Great Lakes Fishery Commission
Lake Michigan Committee
2000 Annual Meeting
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Lake Michigan Management Reports

Lake Michigan Fisheries Team
Wisconsin Department of Natural Resources

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INTRODUCTION AND SUMMARY

These reports summarize some of the major studies and stock assessment activities of the Department of Natural Resources on Lake Michigan during 1999. They provide specific information about the major sport and commercial fisheries, and they describe trends in some of the major fish populations in Wisconsin waters. 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 COTFMA (the Chippewa/Ottawa Treaty Fishery Management Authority). These reports are presented to the Lake Michigan Committee as part of Wisconsin's contribution to that shared management effort. In addition, the Department and its biologists contribute to a variety of joint information gathering and analysis initiatives that are reported elsewhere. These include a) the development and implementation of lakewide forage assessments methodologies, b) the development and implementation of common creel survey methodologies, c) the development of a lakewide assessment program for chinook salmon, lake trout, and burbot, d) the coordination of yellow perch research and assessment activities, e) the estimation of total predation by stocked salmon and trout, and f) the monitoring of fish health.

Report highlights

Sport fishing was good, and ranged from terrible in the early part of the season to outstanding later in the year. Record breaking coho salmon (26 pounds, 1.2 ounces) and brook trout (10 pounds, 1 ounce) were landed. Anglers again devoted nearly 3,000,000 hours to sport fishing on Lake Michigan and Green Bay during 1999. Anglers harvested 465,000 salmon and trout, up 5% from 1998. The harvests of brown trout, steelhead, coho salmon, and lake trout were up, but the chinook catch was down. This was the first year of reduced stocking under the lakewide stocking reduction plan adopted by all four states, but that could not have affected the sport harvest. Anglers also harvested 26,000 smallmouth bass, 22,000 walleye, and 269,659 yellow perch. Commercial harvest trends were down. The harvest of chubs during the 1999 commercial fishing year (July 1998 through June 1999) was 1.3 million pounds, only 70% of the 1998 harvest, and the commercial harvest of lake whitefish was1.49 million pounds, or 96% of the 1998 harvest. The smelt harvest continued to decline in Green Bay but increased in Lake Michigan.

Spawning runs of all salmon and trout species were adequate to meet egg collection goals, with the exception of the fall run of the Skamania strain of steelhead, which was poor at both the Besadny Anadromous Fisheries Facility, on the Kewaunee River, and the Root River Steelhead Facility. Because of extremely low flow in Strawberry Creek, spawning chinook salmon had difficulty swimming to the collection pond, so only 15% of the 4 million egg quota was obtained from that source. Fortunately, runs were good in the Kewaunee and Root Rivers, so the quota was met.

Population assessments provided both good and bad news. Our assessments show a very strong whitefish population, justifying the recent increase in the annual harvest limit, from 1,770,000 pounds to 2,470,000 pounds. Yellow perch populations in Green Bay and Lake Michigan remain low, and 1999 was not a good year for natural reproduction. The modest but rapidly growing 1998 year class, together with older fish, now protected by the commercial closure and the low sport daily bag limit, were sufficient to provide pretty good fishing late in the late summer in Milwaukee. We have no present plans to change sport or commercial regulations in either Lake Michigan or Green Bay. The bloater chub population remains enormous in Lake Michigan, but our data indicate a continuing decline, reflecting several years of poor recruitment and show an aging population made up increasingly of female fish.

For more information

These reports were written by the fisheries biologists directly involved with the collection and analysis of the data presented. The author's name is listed at the end of each report. If you would like additional information about any topic, please call the author of that report at the phone number listed below:

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WISCONSIN'S 1999 OPEN WATER SPORT FISHING EFFORT AND HARVEST

Overall fishing effort by various angler groups is shown in Table 1. Effort decreased slightly from 2,870,450 hours in 1998 to 2,825,271 hours in 1999. The largest changes present were in the moored boat fishery which decreased by 110,000 hours and the stream fishery which increased by 40,000 hours. Fishing effort has declined by 1.3 million hours since 1986 but has remained relatively constant since 1993.

The salmonid harvest in Wisconsin decreased from 416,521 fish in 1998 to 376,059 in 1999 (Table 3). Rainbow trout and lake trout were responsible for the modest decline. Rainbow trout harvest decreased by 26,000 fish from 1998 (Table 4) while the lake trout harvest declined to 39,819 fish (Table 3). The chinook salmon harvest increased by 21,000 fish in 1999 while the brown trout harvest increased to 37,187 fish. Fishing was good from late July through August but no real good weather pattern set up in 1999 until after July 1st , probably contributing to the lower than average coho salmon and rainbow trout harvest.

The yellow perch harvest increased in 1999. The estimated harvest was 269,005 fish and increase of 11,808 fish from 1998. Northern pike harvests were estimated at 5,324 fish while both smallmouth bass and walleye were at 26,308 and 21,659 fish respectively.

Table 1. Fishing effort (angler hours) by various angler groups in Wisconsin waters of Lake Michigan and Green Bay, 1999.

YEAR	RAMP	MOORED	CHARTER	PIER	SHORE	STREAM	TOTAL
1999	1,418,012	470,888	231,610	123,357	199,410	381,994	2,825,271

Table 2. Sport harvest by fishery type and species for Wisconsin waters of Lake Michigan and Green Bay, 1999.

SPECIES	RAMP	MOORED	CHARTER	PIER	SHORE	STREAM	**TOTAL**
Coho salmon	15,705	21,701	15,569	31	869	2,422	**56,297**
Chinook salmon	60,828	32,038	27,221	2,124	4,820	30,903	**157,934**
Rainbow trout	35,830	25,226	16,272	293	465	6162	**84,248**
Brown trout	18,967	4,600	1,825	2,166	6,531	3,098	**37,187**
Brook trout	0	0	24	0	0	550	**574**
Lake trout	10,573	16,513	12,711	0	0	22	**39,819**
Northern pike	5,134	-	-	84	22	84	**5,324**
Smallmouth bass	6,285	19,119	-	475	166	263	**26,308**
Yellow perch	204,732	38,715	-	6,366	13,008	6,184	**269,005**
Walleye	15,217	2,389	-	460	42	3,551	**21,659**
TOTAL	**373,271**	**160,301**	**73,622**	**11,999**	**25,923**	**53,239**	**698,355**

Table 3. Total number of fish harvested by year 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	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	38,126
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	733,918
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	1,134,256
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	2,430,913
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	1,269,468
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	1,009,813
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	6,616,494

Table 4. Total number of fish harvested by year across all species in Wisconsin waters of Lake Michigan, 1986-1999.

Fisheries Type	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	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	2,469,532
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	1,876,926
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	1,367,425
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	211,441
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	247,948
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	443,222
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	6,616,494

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WISCONSIN'S 1999 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 1999 the projected salmonid egg quotas were: chinook salmon, 4 million; coho salmon, 1.4 million; steelhead 1 million; Seeforellen brown trout .7 million.

During the fall of 1999, 1,934 chinook salmon weighing an estimated 21,081 pounds were processed at SCW (Table 1). Over the last 18 years the average number of chinook salmon processed at SCW has been 4,319. 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. Approximately 0.6 million eggs of a 4.0 million egg quota were collected at SCW in 1999. As a result of the poor return of chinook salmon to SCW, WDNR staff had to rely on the BAFF and RRSF to collect the remainder of the 1999 quota of chinook salmon eggs.

Table 1. Yearly summary of chinook salmon returns at Strawberry Creek, 1981-1999.					
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	633,000	633

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 (1999 average weight was10.9 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.

The chinook salmon return to BAFF during the fall of 1999 was 5,798 (Table 2). This was the largest return of chinook to BAFF since records have been kept. Over the last nine years an average of 2,951 chinook salmon have been processed at BAFF each fall. Approximately 3.3 million chinook salmon eggs were collected at BAFF in the fall of 1999. BAFF figured prominently in the WDNR chinook salmon egg collection during the fall of 1999 because the egg collection at the SCW was a near bust because of low flow conditions in Strawberry Creek.

Table 2. Yearly summary of chinook returns at the Besadny Anadromous Fisheries Facility, 1990-1999.

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

The coho salmon return to BAFF in the fall of 1999 was 1,638 (Table 3). The nine year average coho salmon return prior to 1999 was 2,121. Approximately 1.4 million coho salmon eggs were collected at BAFF in the fall of 1999.

Table 3. Yearly summary of coho salmon returns at the Besadny Anadromous Fisheries Facility, 1990-1999.

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

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

The steelhead return to BAFF in 1999 was 877 (Table 4), with the majority returning in the spring as Chambers Creek and Ganaraska strains. During the previous 7 years an average of 2,528 steelhead have been processed each year. About 608,000 steelhead eggs were collected at BAFF in 1999.

Table 4. Yearly summary of steelhead returns at the Besadny Anadromous Fisheries Facility, 1990-1999.

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		508,00
1999 – Fall		61	7	77	145		100,000

A total of 6,022 chinook salmon were examined at the RRSF in the fall of 1999. The majority of them (5,381 or 89 percent) were passed upstream (Table 5). Approximately 0.8 million chinook salmon eggs were collected at RRSF in the fall of 1999.

A total of 1,150 coho salmon were examined at the RRSF in the fall of 1999 (Table 5). The majority of coho salmon (978 or 85 percent) were passed upstream. Approximately 0.15 million coho eggs were harvested at BAFF in the fall of 1999.

Table 5. Yearly summary of salmon returns at the Root River Steelhead Facility, 1994-1999.

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
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

Steelhead return at RRSF in 1999 was 2,333 (Table 6). Most of these steelhead (2,263 or 97 percent) returned in the spring and were either Chambers Creek and Ganaraska strain. The steelhead returning in fall were primarily the Skamania strain.

Table 6. Yearly summary of steelhead returns at the Root River Steelhead Facility, 1994-1999.

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		

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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.

The study is being repeated in the spring of 2000 except that each of the subgroups of photonic marked fingerlings has a unique CWT lot number for each color being tested.

Photonic marking would appear to be comparable 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, the biggest advantage of photonic marking over CWT application (if it works) comes 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.

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STEELHEAD MANAGEMENT IN WISCONSIN

Wisconsin began its Lake Michigan rainbow/steelhead trout fishery in 1963 when rainbow trout were stocked in a Door County stream. During the years following the original stocking, many changes in the fishery have occurred, including changes in the strains and the age of fish stocked (Figure 1). The early 1980's brought increased stocking, but the number of harvested steelhead remained stable while catch rates declined to near record low levels (Figure 2).

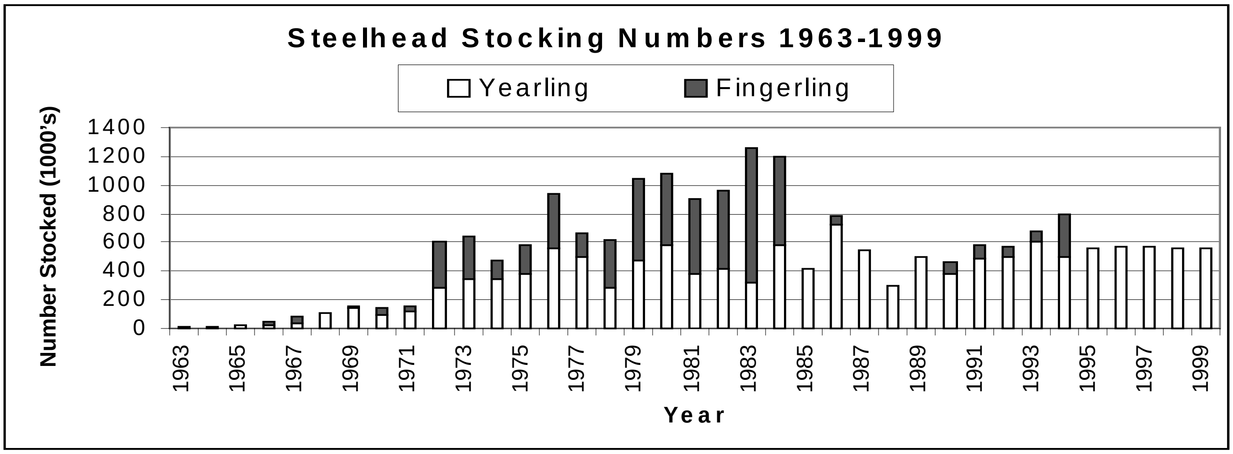

Figure 1. Annual stocking of steelhead into Wisconsin waters of Lake Michigan, 1963-1999.

Concerns about a declining steelhead fishery prompted the Wisconsin Department of Natural Resources to form a steelhead committee to evaluate the program and make recommendations to improve the fishery. The 1988 Lake Michigan Steelhead Fishery Management Plan (LMSFMP) made recommendations in three areas: developing new stocking strategies, improving rearing facilities and increasing stream access for anglers.

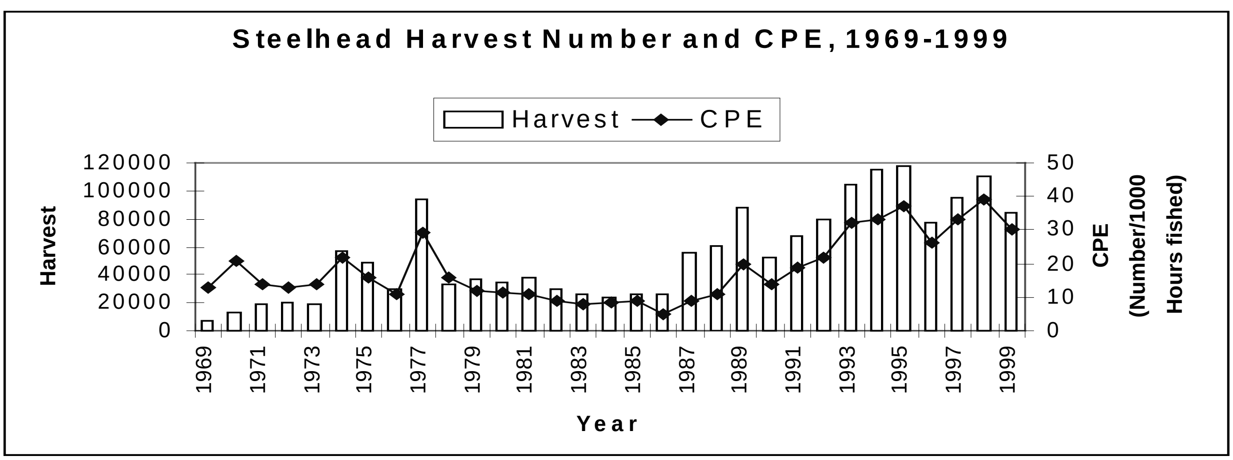

Figure 2. Steelhead harvest number and CPE for Wisconsin waters of Lake Michigan, 1969-1999. CPE is the number of steelhead caught per 1000 angling hours.

Goals and accomplishments of the 1988 Steelhead Management Plan

The primary goal of the LMSFMP was to improve steelhead fishing in Lake Michigan and its tributaries and to sustain an annual steelhead harvest of 50,000 fish. To achieve this goal, several key tactics were identified.

<u>Tactic 1:</u> Stock the proper strains of steelhead

Three steelhead strains, Skamania, Chambers Creek, and Ganaraska were chosen by Wisconsin for its Lake Michigan steelhead program. Although similar in appearance, each strain has unique characteristics that make it important to the overall steelhead program. It was hoped that these strains would provide a good return to the creel and provide more fishing opportunities throughout the year for anglers in tributary streams.

Skamania are summer/fall run steelhead with spawning migrations that begin in early summer and peak in September. Chambers Creek strain steelhead were chosen because they begin their migration into streams in late fall and are available to stream anglers until early May. The Ganaraska strain was chosen because it is a spring run strain that would be available in streams until late May.

The three strains chosen for Wisconsin's steelhead program have performed as expected by increasing return to the creel. Angler harvest of steelhead since the inception of LMSFMP has ranged from a low of 51,711 in 1990, to a high of 117,508 in 1995. Harvest has greatly exceeded the annual goal of 50,000 steelhead.

The other goal of this tactic was to improve the stream fishery for anglers by increasing angling opportunities. We hoped that by stocking three strains of steelhead that migrated at different times, fish would be available to stream anglers for many more months of the year. Run time data collected indicates that steelhead return at distinct times during the year providing anglers with many steelhead fishing opportunities.

<u>Tactic 2:</u> Stock the proper size of smolts, at the proper time, in the proper streams

Research on steelhead indicate the critical size for stocking steelhead is 75 g to 113 g (4 to 6 fish/pound) and 191 mm (7.5 inches) in length. The LMSFMP set these sizes as goals for Wisconsin's steelhead program. Stocking size has not approached the goals set by the LMSFMP. Skamania were the closest to LMSFMP goals with an average length of 161 mm (6.4 inches) and weight of 33 g (13.8 fish/ pound) when stocked. Chambers Creek yearlings were stocked with an average length and weight of 159 mm (6.3 inches) and 32 g (14.2 fish/pound) respectively. Ganaraska were stocked at the smallest size with an average length of 142 mm (5.6 inches) and a weight of 20 g (22.7 fish/pound). Harvest numbers indicate that despite stocking fish at a smaller than goal size, returns have exceeded the goals of the LMSFMP.

Stocking time has been more variable than stocking size. Stocking time depends greatly on growth rates of fish (water temperature and feeding rate), space availability at the hatchery (crowding), and stream conditions (ice, flow, and temperature). Steelhead have been stocked as early as January and as late as May. Average stocking time (the time between the first and last stockings) for each strain is generally between the last week of March and the second week of April. Skamania are stocked first because of their larger size, followed by Chambers Creek and Ganaraska.

The LMSFMP set a stocking goal of 500,000 yearling steelhead to improve the steelhead fishery and enhance the overall Lake Michigan salmonid fishery. Since 1988 when all three strains were introduced, Wisconsin has stocked approximately 500,000 yearling steelhead per year. Shortfalls of yearlings in one strain were replaced if possible by yearlings of the other strains. Additional steelhead have been stocked as fingerlings and yearlings because of the availability of surplus fish in the hatchery system.

The tactic outlined in the LMSFMP called for Skamania and Chambers Creek strain steelhead to be stocked in Class I streams that provided over winter habitat and remained open to Lake Michigan throughout the year. Typically these are large river systems and include the Oconto, Manitowoc, Menominee, Milwaukee, East and West Twin, Ahnapee, and Sheboygan Rivers. Each river was allocated 11,100 Skamania and 11,100 Chambers Creek strain steelhead.

Class II streams lack over-wintering habitat, or become sand blocked at their mouths. These streams include the Pigeon River, Stoney Creek, Oak Creek, Heins Creek, Sauk Creek, Little River, Whitefish Bay Creek, Pike River, Fischer Creek, Hibbards Creek, Silver Creek, Reibolts Creek, Menomonee River and Kinnickinnic River. Each Class II tributary is stocked with 6,500 Ganaraska.

The third class of streams were the designated broodstock waters. The Root and Kewaunee Rivers were to be stocked at a higher rate than other streams to insure enough steelhead returned to provide eggs and a fishery in the stream. The brood rivers were to receive 35,000 fish of each strain.

<u>Tactic 3:</u> Improve production practices of all species to optimize total rearing efficiency

The following production practices were initiated toward meeting the goal of 500,000 steelhead smolts for spring stockings: (1) The Kettle Moraine Springs Fish Hatchery transfers coho salmon production to Lake Mills Fish Hatchery as 1 to 2 million eyed eggs each fall. (2) An upgraded boiler system accelerates growth of Ganaraska strain fish to enable spring stocking during the first year of life. (3) The use of higher fat, protein and moist salmon diets improves the health of the fish. (4) Automated timed feeding systems for fish from the fry through smolt stages preserves their wild characteristics. (5) Natural lighting is used except during handling and cleaning. (6) Reduced rearing densities improve the growth and health of steelhead. (7) Pond coverings over outdoor facilities cut direct sunlight and reduce avian predation. (8) Oxygen injection systems stabilize dissolved oxygen levels in raceways.

<u>Tactic 4:</u> Expand or improve existing facilities to meet production goals

To achieve this tactic, several projects have been completed at Kettle Moraine to improve steelhead production. (1) Earthen ponds have been converted to 600 linear feet of raceway and feral brood stock holding space. (2) A groundwater study was conducted to determine the feasibility of developing a third high capacity well. (3) A recirculation water line has been constructed to provide increased water velocities to reduce stress in spring smolts.

In addition to the work completed at Kettle Moraine, two facilities, the Root River Steelhead Facility and Besadny Anadromous Fisheries Facility have been constructed to assist in the collection of eggs and adult broodstock from returning steelhead.

Tactic 5: Improve access to available habitat

Land purchases and easements have been pursued to improve access to many miles of streams. In the Northeast Region access has been improved at Fischer Creek (Fischer Creek Park), Manitowoc River (Old Oslo Dam Site), Kewaunee River (Besadny Fish and Wildlife Area-boat landing and handicap accessible trails), Whitefish Dunes State Park (proposed handicap trails), Little River (Marinette County), Oconto River (boat ramps) and the Menominee River (boat ramps).

In the Southeast Region the removal of the North Avenue dam and the Menomonee drop structure has improved access to many stream miles for increased fishing opportunities on the Milwaukee River. Additional access was created on Sauk Creek (fishing easements) and on the Sheboygan River (boat ramps).

Tactic 6: Improve habitat accessible to existing access

The Plan recognized the need for trout habitat and stream improvement that focused on providing cover for recently stocked juveniles and providing cover and holding areas for returning adults. To date, five projects have been completed, with several other projects underway.

Tactic 7: Develop fish passage facilities to currently unavailable upstream river reaches

Since development of the LMSFMP, only two dams, the North Avenue dam and Menomonee drop structure have been removed. Other dams have been considered for removal, but local communities have decided to maintain, repair or replace those dams.

Summary of the 1988 Lake Michigan Steelhead Fishery Management Plan

The goal of the LMSFMP was to improve steelhead fishing on Lake Michigan and its tributaries. The measure of success was a harvest target of 50,000 steelhead per year. This goal has been surpassed every year since 1991 (Figure 2). In the years 1993 through 1995 the number of steelhead harvested has been more than twice the harvest target. We recognize that a portion of the steelhead harvested might be stocked by other states or produced by natural reproduction in many Michigan streams, which may inflate harvest totals.

This dramatic turn-around in the fishery may be credited to a management plan that clearly gave direction to the steelhead program. The strains selected, improved hatchery practices, and many management activities have made steelhead an important component of the Lake Michigan fishery. Despite the success of the past decade of steelhead management, an updated Steelhead Management Plan is needed as a guide to continue the successes of the current program and to continue to make improvements in the fishery.

The 1999 Lake Michigan Steelhead Fishery Management Plan

The goal of this plan is to improve angling opportunities for steelhead in Lake Michigan and its tributaries and to maintain the annual steelhead harvest to between 75,000 and 100,000 fish.

The first five tactics are a continuation of the 1988 LMSFMP. These tactics reflect the success of the current program. Areas that need improvement or new opportunities to improve the rainbow/steelhead fishery are identified in later tactics.

Tactic 1: Continue stocking the current strains

Tactic 2: Stock the proper size of smolts, at the proper time in the proper streams

Tactic 3: Update facilities and rearing techniques to improve steelhead production

Tactic 4: Continue to improve access to habitat

Tactic 5: Continue to improve in stream habitat

Tactic 6: Improve nearshore fishing opportunities by stocking domestic rainbow trout

Near shore harvest has declined since the beginning of current stocking program. Shore and pier anglers now only account for 3% of the steelhead harvest and 4.7% of the total harvest of Lake Michigan salmonids.

Rainbow Trout may be the most desirable salmonid to use as a nearshore species for several reasons. First, many strains of rainbow are available through various sources and several are already found in the Great Lakes drainage. A strain could be selected that provided the desired traits of good growth, disease resistance, adaptation to large lakes and remaining nearshore. Second, a strain could be selected that provides the type of nearshore fishing that is desired, be it summer, fall, winter, or spring. Finally, rainbows have the ability to utilize all types of forage present. Rainbow diet is broad and could consist of other organisms, including insects, and would not rely exclusively on alewife for their primary food source.

Tactic 7: Reduce angler crowding on broodstock streams

Steelhead that are stocked into the two brood streams, the Root and Kewaunee Rivers, serve two purposes: first, to provide eggs for the continuation of the steelhead program, and second, to provide a local stream fishery for anglers. Because these streams receive a greater number of stocked fish than other streams, anglers tend to congregate on them. Biologists should determine if a portion of the fish stocked into these two rivers could be reallocated to other rivers to reduce fishing pressure on the brood streams.

It has been have determined that the excellent return rates of Chambers Creek and Ganaraska steelhead to the Root River will allow biologists to reallocate a portion of the stocking quota for the Root River into other regional streams.

<u>Tactic 8:</u> Optimize stream fishing opportunities

Reallocating stocking numbers and strain distribution would improve the steelhead fishing in smaller tributaries. This can be accomplished by reducing broodstock stream numbers, or by reallocating the strains and number per strain that are currently stocked in Class I and II streams. Because current data suggests that Chambers Creek strain fish return mostly in spring, it is recommended that Class I streams be stocked with 6,000 Chambers Creek, 5,100 Ganaraska, and 11,110 Skamania. In Class II streams it is recommended to stock equal numbers of Ganaraska and Chambers Creek steelhead while maintaining current stocking number. This reallocation will increase fishing opportunities in Class I and II streams by lengthening the time steelhead are present in the stream. To this base allocation level for Class I and II streams additional steelhead could be added if reallocation from broodstock river occurs.

<u>Tactic 9:</u> Design and implement studies on the Kewaunee River to (1) determine the affect of stocking location on return rate, and (2) determine if other factors in the lower Kewaunee River contribute to low return number of adult fish

Currently, steelhead are stocked approximately 4 miles above the dam at the Besadny Facility. During their downstream migration, steelhead are exposed to predation, warm stream temperatures and low water which may trap them above the dam. This study would include all three strains for three years using marked fish. Each year, one lot would be stocked above the dam and another stocked below the dam for each strain to determine if return rate is affected by stocking location on the Kewaunee River.

Shallow areas in the Kewaunee River below the Besadny Weir may expose fish to higher levels of bird predation than deeper sections. If return rate is not affected by stocking location, then a habitat project should be designed that would deepen several shallow, featureless areas of the lower Kewaunee River. These deeper areas would have increased flow and depth reducing the number of stocked salmonids lost to bird predation.

<u>Tactic 10:</u> Develop and follow a well-defined spawning protocol for steelhead

To have healthy fish and maintain our goal of August through May steelhead angling in Lake Michigan tributaries it is critical to maintain the genetic diversity of each strain. Wisconsin’s Anadromous Feral Broodstock Protocol will be the goal for steelhead spawning. Keystones of the protocol include, one to one matings, a minimum number of spawning pairs (250 pairs of adults) and spawning throughout the run to maintain the genetic diversity of stocked steelhead.

Environmental factors may vary between the Root and Kewaunee Rivers causing migrations during different time periods making gamete collection difficult. During typical years, spring migrations at the Root River begin two weeks earlier than at Kewaunee and summer rain events can be local causing migrations at one facility and not the other. The ability to hold adults, and collect and raise small batches of fish would make the goals of the Anadromous Feral Broodstock Protocol achievable, but because of current hatchery space limitations a modified operational protocol must be followed. This protocol would include: (1) collection of extra eggs at the Root River Facility to insure that quotas are met would be allowed, but these eggs should be discarded if the Besadny Facility is able to collect 50% of the quota; (2) that every effort should be made to spawn throughout the migratory run; and (3) collection of Skamania adults to be held at Kettle Moraine until ripe should occur at whatever facility has returning fish. If runs are adequate at both facilities, then 50% should come from each facility.

Acknowledgements

Team Steelhead consisted of the following WDNR Fisheries and Habitat Protection Staff: Mike Baumgartner, Matt Coffaro, Brad Eggold, Steve Fajfer, Steve Hogler, Randy Link, Sue Marcquenski, m Moore and Steve Surendonk.

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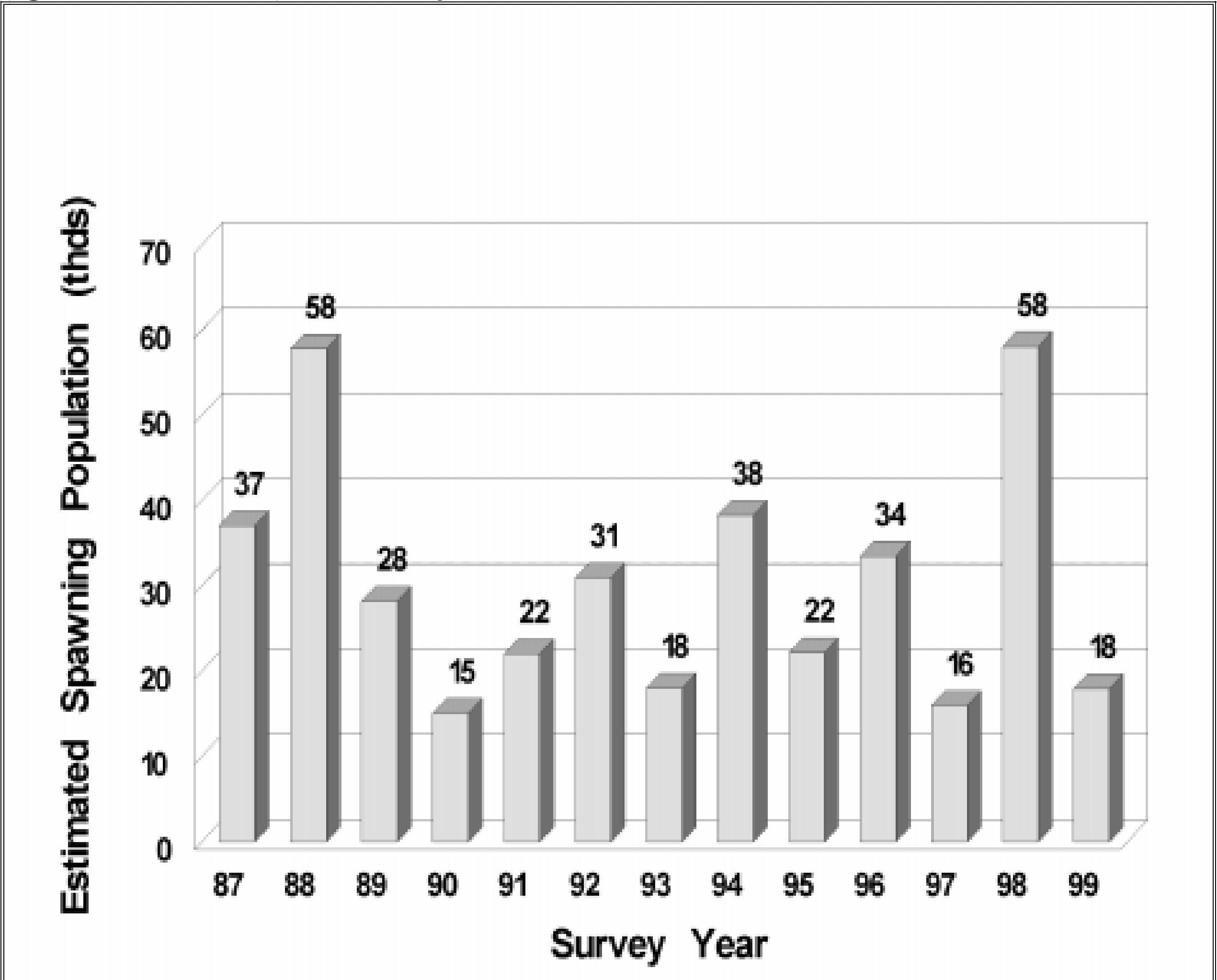
STATUS OF WALLEYE STOCKS - GREEN BAY

Fox River

The estimated adult walleye spawning population (age3 and older, greater than 370mm) in the Fox River dropped from the twelve year high of 58,109 reached in 1998 to an estimated 17,981 adult fish (95% C.I. 12,663-26,442) (Figure 1). Unless extraordinary abundance of walleye is achieved in the year 2000 the decrease will end the general trend of increasing walleye abundance that had been observed over a seven-year period. Low water levels may be affecting the effectiveness of sampling gear and low flows may not be have attracted as many walleye into the river. Last years estimated harvest of approximately 1,800 walleye from the Brown County area does little to support an argument of overexploitation.

Figure 1. Spawning population estimates of adult walleye greater than 370mm in length (ages three and older) from surveys conducted between 1987 and 1999.



Recruitment of males to the spawning population by the 1996 year-class was moderately strong compared to previous years, with an estimated 5,328 males entering the adult population (Figure 2). In contrast to 1998 when females represented 68.4% of the population, in 1999 males were in greater abundance and represented 55.7%, females 32.7% and undetermined 11.6%. The male age three cohort (1996 year-class) comprised 53.2% of the male population. Both age four and six were weakly represented (Table 1). The age five cohorts in the female component were the most abundant (Table 2).

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 1987-1999.

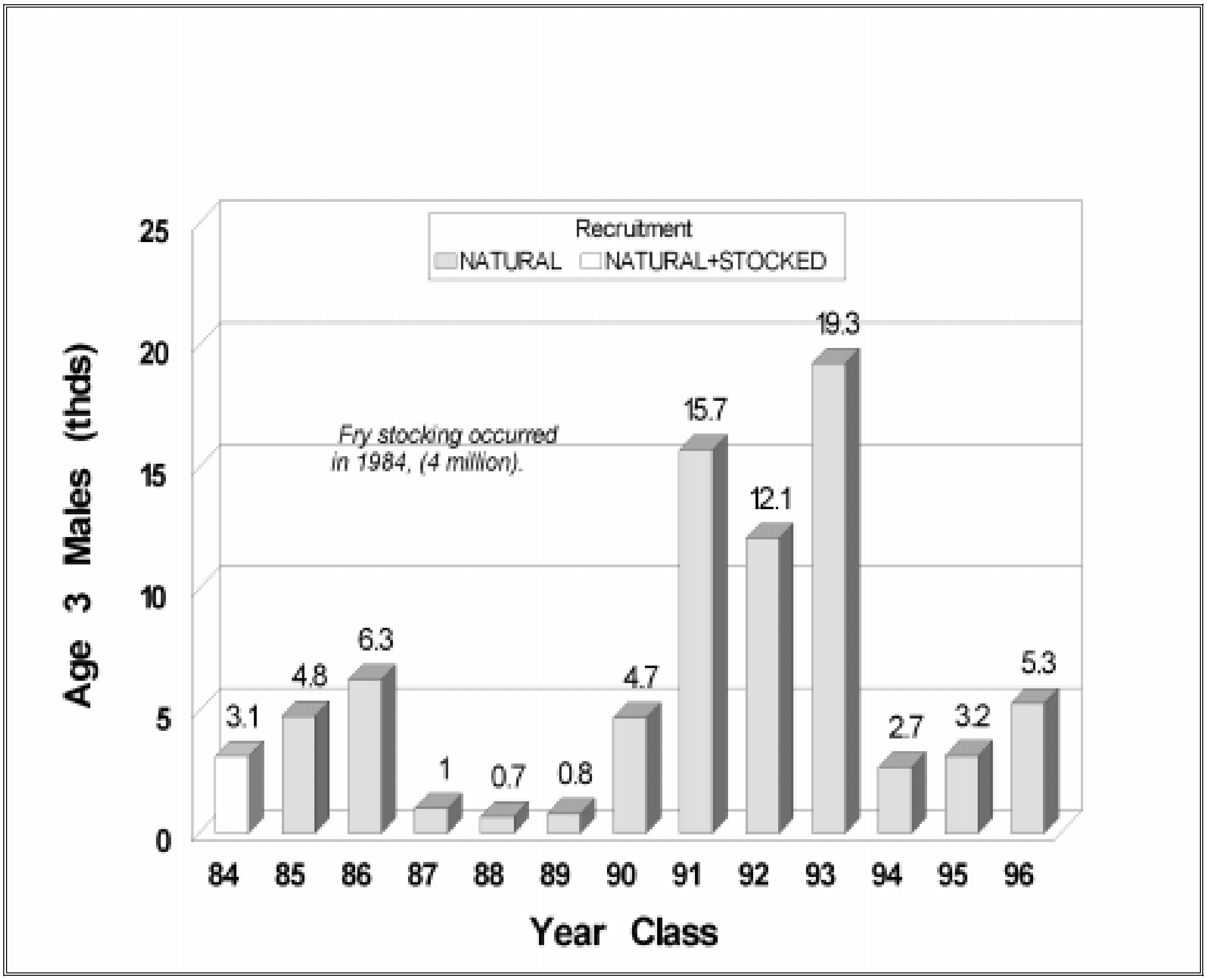


Table 1. Age Distribution of Male Spawning Walleye – Fox River 1998-1999 (%)

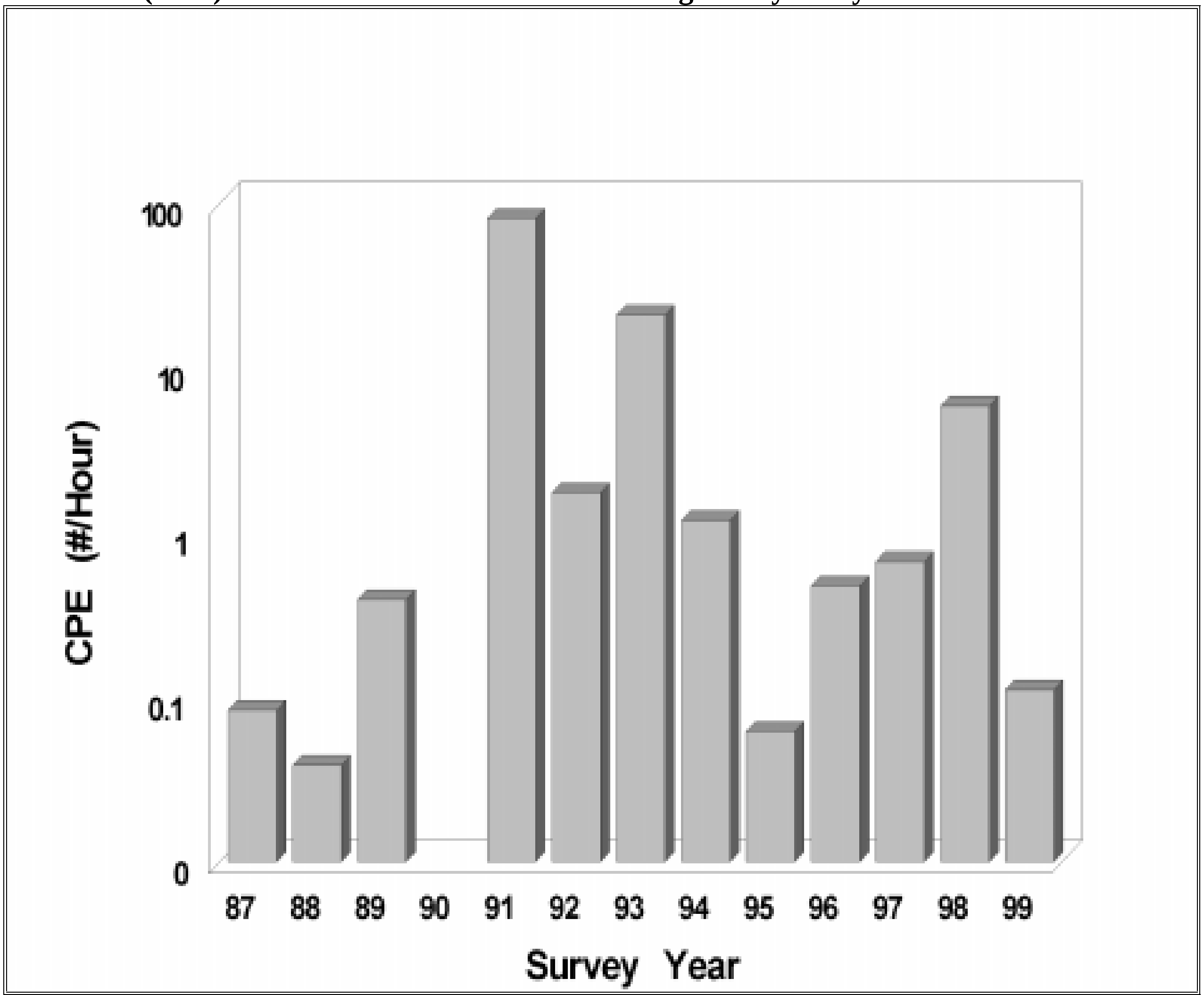
Age	**2+**	**3+**	**4+**	**5+**	**6+**	**7+**	**8+**	**9+**	**10+**	**11+**	**12+**	**13+**
1998	**2.0**	**16.8**	**35.5**	**37.2**	**6.2**	**1.6**	**0.4**	**0.0**	**0.1**	**0.1**		
1999	**3.3**	**53.2**	**10.4**	**20.5**	**9.5**	**2.0**	**1.0**					

Table 2. Age Distribution of Female Spawning Walleye – Fox River 1998-1999 (%)

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

Results of fall electrofishing surveys on the Fox River were less than encouraging. The catch per unit effort (CPE) of young-of-year walleye at 0.11 per hour was the poorest in the last four years (Figure 3). And while numbers were low, the average length at 250mm should allow for good over-winter survival for this modest year class.

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 1987-1999.



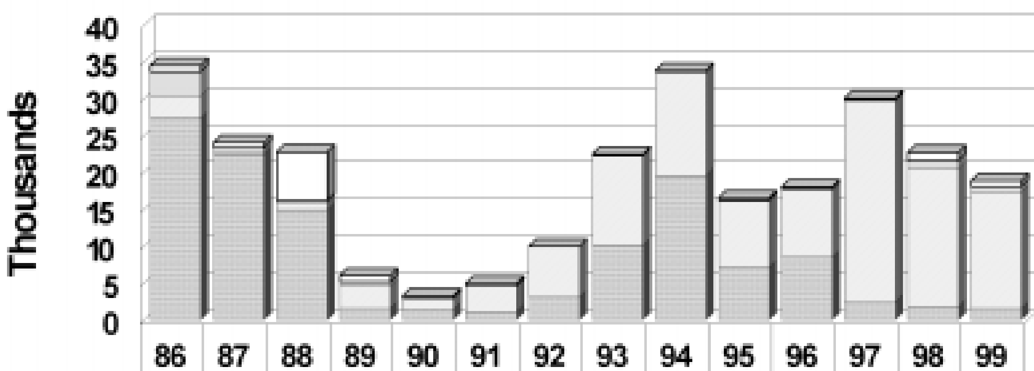
Catch and Harvest

Walleye harvest in Wisconsin waters of Green Bay dropped to the lowest level in three years. Total angler harvest was 18,877 walleye, representing a 21% reduction from the 22,919 walleye harvested in 1998 (Figure 4). Marinette and Brown Counties, as in the past, accounted for the vast majority of the harvest (91.5%) with Marinette County accounting for 84.6% of the total harvest. However, the reduction in harvest occurred across all regions of the Bay. Brown, Marinette, Oconto, and Door/Kewaunee showed fairly proportional reductions at 17%, 20%, 20%, and 27%, respectively.

As in the harvest figures, a decrease in total walleye catch for Green Bay occurred during 1999. The catch decreased by 44% from 111,656 in 1998 to 62,682 in 1999 (Figure 5). Similar to the harvest, Brown and Marinette Counties accounted for 92.5% of the catch.

In contrast to the harvest, however, the decrease in catch did not occur bay-wide. Oconto and Brown Counties had increases of 13% and 83%, respectively, while Marinette and Door/Kewaunee Counties showed decreases of 60% and 51%, respectively.

Figure 4. Total walleye harvest for Wisconsin waters of Green Bay by County for the years 1986-1999.

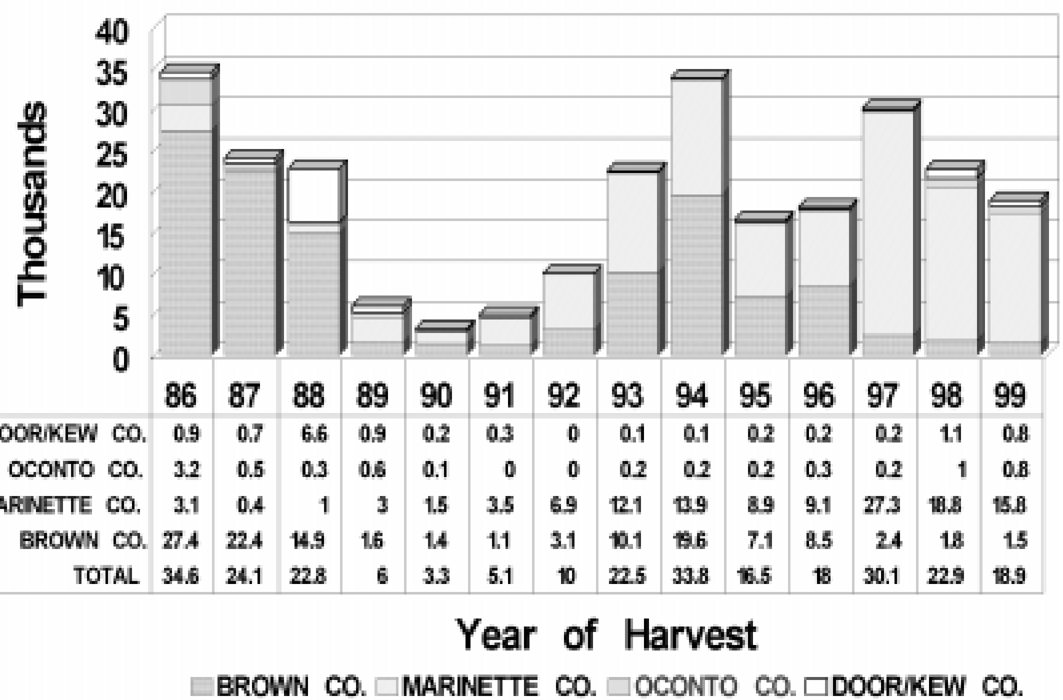


	86	87	88	89	90	91	92	93	94	95	96	97	98	99
DOOR/KEW CO.	0.9	0.7	6.6	0.9	0.2	0.3	0	0.1	0.1	0.2	0.2	0.2	1.1	0.8
OCONTO CO.	3.2	0.5	0.3	0.6	0.1	0	0	0.2	0.2	0.2	0.3	0.2	1	0.8
MARINETTE CO.	3.1	0.4	1	3	1.5	3.5	6.9	12.1	13.9	8.9	9.1	27.3	18.8	15.8
BROWN CO.	27.4	22.4	14.9	1.6	1.4	1.1	3.1	10.1	19.6	7.1	8.5	2.4	1.8	1.5
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

Year of Harvest

BROWN CO. MARINETTE CO. OCONTO CO. DOOR/KEW CO.

Figure 5. Total walleye catch for Wisconsin waters of Green Bay by County for the years 1986-1999.



	86	87	88	89	90	91	92	93	94	95	96	97	98	99
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
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
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
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
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

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STATUS OF YELLOW PERCH STOCKS - SOUTHERN GREEN BAY

Population Assessment

In 1999, young of the year (yoy) yellow perch assessment continued at the intensified level begun in 1997 with the participation and funding from the Wisconsin Sea Grant Program. Sampling was conducted at least weekly at Little Tail Point from prior to spawning on April 1, through September 1. In 1999 peak spawning occurred on April 19 one day later than 1998 (April 18), compared to April 27, in 1997. The date of first larval y. perch capture was also one day latter in 1999 (April 30) than 1998 (April 29) and earlier than 1997 (May13). In 1999, pelagic yoy perch ranging from 3.5 to 17 mm. total length were sampled by High Speed Miller Sampler, and Neuston Net. In 1999 peak larval abundance measured by Miller Sampler was 12.6 % lower and 3 days later and larval fish were 23.9 % smaller in mean length than in 1998. In 1997 peak larval abundance was much lower (34.6%) and later (26 days), but the mean length was only 3.2 % less than 1998. In 1999 the peak catch occurred on May 17, and was 437 per ½ mile transect, compared to 500 on May 14, in 1998 and 327 on June 9, in 1997. Mean lengths were 7.0, 9.2 and 8.9 mm respectively. . Demersal yoy perch ranging from 8 to 111 mm. total length were sampled by survey seine and trawl. **Demersal yoy yellow perch abundance was much lower in 1999 than 1998 in both seine and trawl samples indicating a problem with survival in 1999 between peak pelagic larval abundance and the demersal life stage.** Peak seine abundance in 1999 was 9 per haul compared to 1,084 in 1998 and 268 in 1997, while peak trawl abundance was 493 per trawl hr. compared to 7,911 and 803 respectively.

Index station seining, continued for the 18th consecutive year at 15 sites spread over 130 miles of Green Bay shoreline, also indicated low abundance of demersal yoy yellow perch. 3.6 yoy y. perch per seine haul in 1999 was the third lowest value for the 18-year period.

Between May 8 and July 1, 1999, gill net and trawl sampling for potential yoy yellow perch predators was under taken in close proximity to where the yoy perch were located. Stomach contents from 1,059 fish of 17 species were examined. Included were 545 alewife and 324 white perch, the two species which most frequently contained yoy y. perch last year. This year yellow perch were only positively identified from two white perch and one smelt. Last year stomach contents of 526 fish of 16 species were examined. 115 stomachs from 7 species contained identifiable yoy yellow perch. Stomachs from 56 white perch (206 mm. mean length) contained up to 35 yellow perch ranging from 10 to 55 mm total length. Stomachs from 40 alewife (195 mm. mean length) contained up to 258 yellow perch ranging from 6 to 16 mm total length. Stomachs from 8 sheepshead (370 mm. mean length) contained up to 7 yellow perch ranging from 22 to 37 mm. total length. YoY yellow perch were also found in 4 walleyes, 3 black bullheads, 2 short nose gar, and 1 yellow perch. Because of the difficulty of catching predators in shallow set gill nets during day light hours all most all predators were caught after dark. Yellow perch were more frequently found in white perch stomachs in sets after mid-night (31.6 %) then in sets ½ hour after sunset (14.7%).

In 1994, 1997, and 1998 high numbers of yoy yellow perch survived beyond the size of alewife predation (5-to16 mm. long), as demonstrated by post alewife predation shoreline seining abundance. However, since 1991 the positive correlation between June / July index seining abundance and August index trawling abundance has deteriorated. In 1998, predator sampling described above pointed to white perch as the major predator on yellow perch between 20 and 50 mm. long and the probable cause for the poorer correlation between seine and trawl yellow perch abundance since 1991. The reason the correlation was some what better in 1998 than 1994 or 1997 may be due to the earlier spring which allowed the yoy to grow through the predation size window sooner, and also several recent weak year classes of white perch has resulted in a decrease in abundance. However, yoy white perch in 1998 and yearling white perch in 1999 were extremely abundant in August index trawl catches indicating potential increased future predation.

In 1999, the yoy y. perch did not survive long enough in large enough numbers to show up significantly in white perch stomachs at 20 to 50 mm. long. Both seine and trawl samples indicated a problem with survival in 1999 between peak pelagic larval abundance and the demersal life stage, a period when alewife predation was occurring in 1998. Gill nets set for potential predators indicated alewife abundance was at least as high in 1999 as 1998 however, there weren't any larval y. perch found in alewife stomachs in 1999 using the same sampling technique as 1998. It has been suggested that darkness of the night, timing of the full moon and cloud cover, may affect prey susceptibility. As previously reported, the larval y. perch growth rate appeared to be slower in 1999 than 98 or 97. Lower water temperatures during larval development probably account for at least some of the apparent slower growth. If predation was cropping the larger fish it could cause the appearance of slower growth. However, again over 1,000 stomachs of 17 species of potential predators were examined and few y. perch were found. Slower growth may indicate that starvation has played a role in this years poor survival. Larval y. perch gut content analysis, RNA/DNA ratio as a measure of condition, otolith aging, and analysis of plankton available to the larval y. perch may shed light on this. The analysis of those data are in progress at several universities as part of the Sea Grant funded study. It is apparent that many factors affect yellow perch year class strength in Green Bay and the importance of each factor varies from year to year.

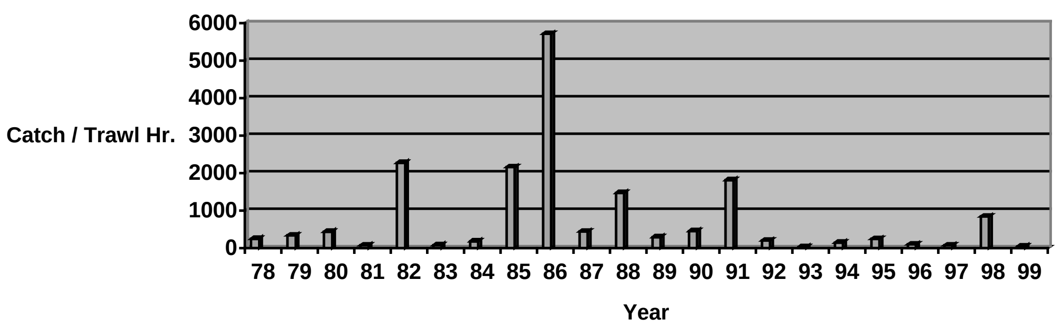

Figure 1. Index Trawl Rel. Abundance , YoY Yellow Perch (Weighted Area Avg.)

Index station trawling continued in 1999 at the standard sites established in 1978 and the deep sites established in 1988. The deeper sites were developed as a result of a trend of increasing abundance of yellow perch observed at a single deep site (off Marinette) established in 1985. Standard and deep site information has been combined based on the amount of habitat they represent and an adjustment made for standard site information prior to 1988 to account for the increasing area of occupancy, creating a weighted area average value. The number of yoy yellow perch caught per trawl hour (50) ranked it second lowest in the past 22 years since index sites were established in 1978. 1999 was below the median of 277 and mean of 806. Figure 1. shows the catch per trawl hour for yoy from 1978 to 1999.

Yearling and older yellow perch abundance increased at index sites in 1999 (Figure 2). The weighted area average was 545.7, up from 97.5 in 1998. The continued good showing of the 1998 year class accounted for 94.9 per cent of the average. The average number caught per trawl hour was lower at standard sites (93.5) than at deep sites (452.1).

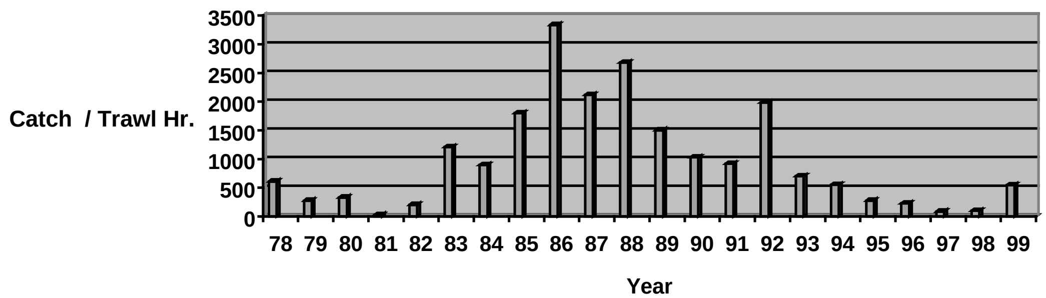

Figure 2. Index Trawl Rel. Abundance, Ylg. & Older Y. Perch (Weighted Area Avg.)

Table 1 shows the average length by year class for ages 1+ through 3+ at standard and deep sites. Average length at age decreased in 1999 at both standard and deep sites for age 1+ and remain the same or increased for ages 2+ and 3+.

Table 1. Yellow Perch Average Length (mm) at Age from Index Station Trawling

	Year Class – Average Length in mm													
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Std. Sites														
Age 1+	143	137	138	1398	136	140	128	132	137	140	143	131	145	138
Age 2+	175	169	170	169	168	165	159	171	173	175	166	187	187	
Age 3+	195	191	194	194	194	191	187	195	193	191	223	230		
Deep Sites														
Age 1+			137	137	134	134	122	126	134	141	133	135	137	128
Age 2+		162	171	166	166	158	154	166	168	170	163	166	175	
Age 3+	187	189	188	187	184	183	179	184	187	184	191	213		

As a measure of condition, the average weight of a 203 mm (8 inch) yellow perch has been followed. In general the average weight was highest during the very low population abundance of the early 1980's and was lowest during the high population abundance of the late 1980's. In 1999, it decreased to 92.9 grams from 97.7 grams in 1998 (Table 2).

Table 2. Average Weight of a 203 mm Yellow Perch From Index Station Trawling

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Wt. Gr.	98.4	93.5	93.9	93.2	97.9	99.0	99.3	101.9	101.3	102.2	98.2	101.1	91.3	97.7	92.9

Harvest Assessment

Since the 1983-1984 commercial fishing license year, the yellow perch harvest in Green Bay has been managed under a quota system. Quota shares are allocated to individual licensees based on their harvest for four years prior to establishment of the quota. The license year quotas run from July 1 to June 30. The zone 1 quota has changed from 200,000 pounds the first year; to 350,000 pounds for 1984-85 and 1985-86; to 400,000 pounds in 1986-87, 1987-88 and 1988-89; to 475,000 pounds in 1989-90 and 1990-91; to 400,000 pounds in 1991-92 through 1993-94; to 300,000 pounds in 1994-95 through 1996-97. The 1997-1998 quota was reduced to 200,000 pounds, were it remains in 1999-2000. The number of licenses with quota shares has declined from 105 to 35 since 1983. The number remained at 35 in the current license year.

Both a gill net and entrapment net fishery exists. From 1998 to 1999 the catch rate in gill nets increased from 29.4 pounds to 37.1 pounds per 1,000 feet of gill net lifted, still below the ten-year average of 43.7 pounds per 1,000 feet. Effort decreased from 5.7 million feet to 4.1 million feet fished. The catch rate in entrapment nets increased from 14.0 pounds to 17.3 pounds per pot lift, also still below the ten-year average of 21.3 pounds per pot lift. Effort decreased from 2,648 pots lifted in 1998 to 1,279 pots lifted in 1999.

The preliminary yellow perch harvest estimate for the Jan. through Dec.1999 commercial fishery in WM-1 is 173,145 pounds, or 535,222 fish. Figure 3 shows the harvest in pounds since 1983.Both open water and ice sport fisheries exist on Green Bay. The preliminary creel survey harvest estimate for yellow perch in 1999 is 332,980 fish weighing 67,244 pounds compared to 235,566 fish weighing 52,906 pounds in 1998. Figure 4 shows the sport harvest in numbers since 1983. Combining the sport and commercial harvest estimates, 240,684 pounds were harvested in 1999 (257,067 in 1998) totaling 868,203 fish (967,590 in 1998).

Table 3 shows the relative age distribution of the harvest in 1992 through 1999. In 1999 age 2+ through 4+ dominated the harvest. The high proportion of the harvest spread over these ages reflects the lack of domination by a strong year class. The relatively high showing of the age 1+ 1998 year class fish substantiates good abundance's seen in surveys.

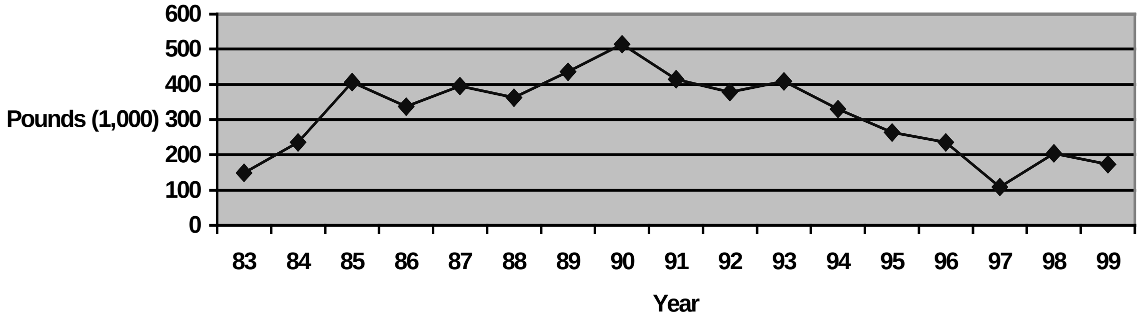

Figure 3. Commercial Yellow Perch Harvest

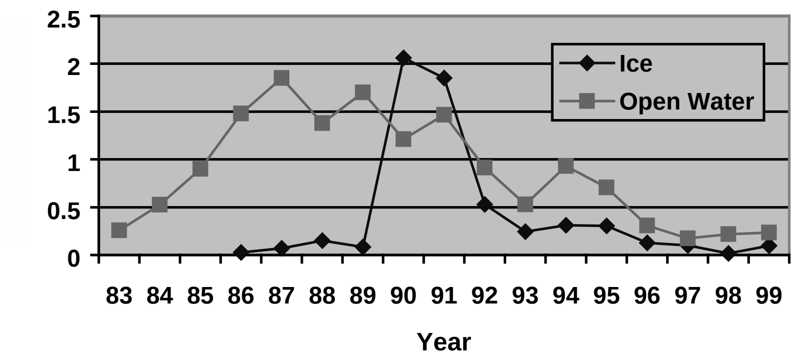

Figure 4. Yellow Perch Sport Creel Survey Harvest Estimate

Table 3. Age Distribution of the Combined Sport and Commercial Harvest (% by No.)

Year	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+
1992	.0	7.22	30.06	37.82	12.41	10.99	1.36	.10	.03	.00
1993	.04	13.23	21.55	27.19	23.66	9.17	4.16	.87	.11	.02
1994	.0	5.27	62.56	19.56	7.59	3.34	1.18	.48	.02	.00
1995	.57	5.19	10.73	72.21	8.3	1.53	1.19	.48	.02	.00
1996	.84	38.09	13.42	7.60	36.62	2.18	.88	.28	.05	.04
1997	2.87	29.44	58.64	3.41	1.16	4.11	.18	.11	.08	.00
1998	2.61	19.27	58.14	17.70	.87	.62	.70	.06	.01	.02
1999	4.97	32.78	31.78	26.73	3.15	.28	.18	.13	.01	.00

Management Plans

Although the 1999 year class appears to be very weak, the moderate 1998 year class continuing to be well-represented at age 1. As a result of that and because of the increased protection for the population instituted in the past several years, no changes in regulations are being proposed at this time.

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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; commercial fishing remains closed and the daily sport bag limit remains 5 fish, with the month of June closed for fishing. Research work as identified by the Yellow Perch Task Group is progressing to understand the cause of perch decline. This report is a summary of status of young and adult perch in Lake Michigan assessed through several annual assessments in Wisconsin waters during 1999.

Seining

In southeastern Wisconsin, beach seining was done for young of the year (YOY) yellow perch at 19 sites between Kenosha and Sheboygan from August 16 to September 7, 1999 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. 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 SED since 1989. No YOY perch were captured in 1994 sampling as well as 1999 sampling. Although the 1998 data indicated a slight improvement compared to the previous years of recruitment of young perch, the 1999 data was not encouraging at all.

Spawning Assessment

This assessment has been conducted on Black Can Reef and in the harbor at Milwaukee since 1990. The objective is to quantify the relative abundance of mature female perch in previously identified spawning areas. In 1999, in order to meet the sampling needs for research objectives of the yellow perch task group, the WDNR used graded mesh gill net to capture spawning individuals. The sampling effort lasted from May 20 to June 8, 1999 in which a total of 5,867 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. Ripe male yellow perch dominated the catch, while the females comprised 4 per cent of the catch in 1999 compared 0.32 percent in 1997 (Table 1). Majority of the females was green and some were spent. The females should begin to recruit to this assessment, as sexually mature fish at age 3. However, poor catches of younger mature females may be due to the lack of recruitment of the early 90's year classes to the spawning population.

Graded Mesh Gill Net Assessment

The WDNR conducts standardized graded mesh gill net assessments annually in January, in grids 1901 and 1902 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.

Table 2 shows the relative abundance as catch per effort of perch, by age, for this assessment from 1988 through January of 2000. (Please note that this table has been slightly modified from previous reports due to clerical error for 1997-1999.) The data show variability in catch rates by calendar year. These data show, for the most part, very low CPEs of younger fish while the CPEs of the older year classes remains consistently high. Thus the low CPE's of the younger year classes can not be explained by sampling variability and these year classes are extremely weak. The dominant age-groups in 1992 were age 3 and 4, which got shifted to age 4 and 5 in 1993, age 5 and 6 in 1994, age 6 and 7 in 1995, and age 7 and 8 in 1996. Although ages 1 to 5 were not represented in 1996 samples at all, the samples from 1997 onwards had fair number of 2-5 year old perch. Data on the age and size distribution of yellow perch from the 1999 and 2000 winter survey indicated that smaller and younger perch (ages 2 to 5) were represented in these samples in significant proportions (Table 2). The sex ratio for the entire sample in 1999 was somewhat of a balanced nature consisting of 58% males and 42% females, and in winter 2000 sample it was skewed towards female with 64% females and 36% males.

Harvest

The commercial yellow perch fishing was closed in the Wisconsin waters of Lake Michigan effective September 1996. 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 tremendously reduced in recent years, which reflects 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 3,142 yellow perch were tagged off Milwaukee as part of the lake-wide yellow perch movement study during the 1999 spawning season. 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. We surpassed our target number to tag, which was 3,000 perch during the 1999 field season.

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Table 1. Yellow perch spawning assessment in Milwaukee waters (Black Can Reef) of Lake Michigan - 1990-1999.

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	< 1	5,000[3]
1998	4,514	4,283	231	0	5	24,600[4]
1999	5,867	5,635	232	0	4	9,200

[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 trapnet and 4 lifts of fyke nets were taken

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
1	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	39
3	453	1854	1037	865	276	98	25	0	0	4	2	57	108
4	386	1012	938	323	715	402	58	28	0	14	6	215	90
5	701	1563	394	327	281	757	218	65	0	11	29	93	88
6	324	1880	381	83	181	165	141	120	19	18	35	57	41
7	12	155	90	82	126	49	48	76	51	77	20	45	32
8	3	1	0	32	73	16	11	65	71	251	43	63	22
9	0	0	0	0	14	0	0	24	31	109	110	44	9
10	0	0	0	0	0	0	0	2	12	15	60	33	11
11	0	0	0	0	0	0	0	0	3	0	15	9	7
12	0	0	0	0	0	0	0	0	0	0	4	7	5
%Male	56	69	61	72	82	86	89	90	95.2	89	80	58	36
%Female	44	31	39	28	18	14	11	10	4.8	11	20	42	64

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
1990	256	615
1991	326	841
1992	282	844
1993	267	496
1994	254	258
1995	128	237
1996	15[a]	85[b]
1997	closed	22[b]
1998	closed	24[b]
1999	closed	32[b]

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

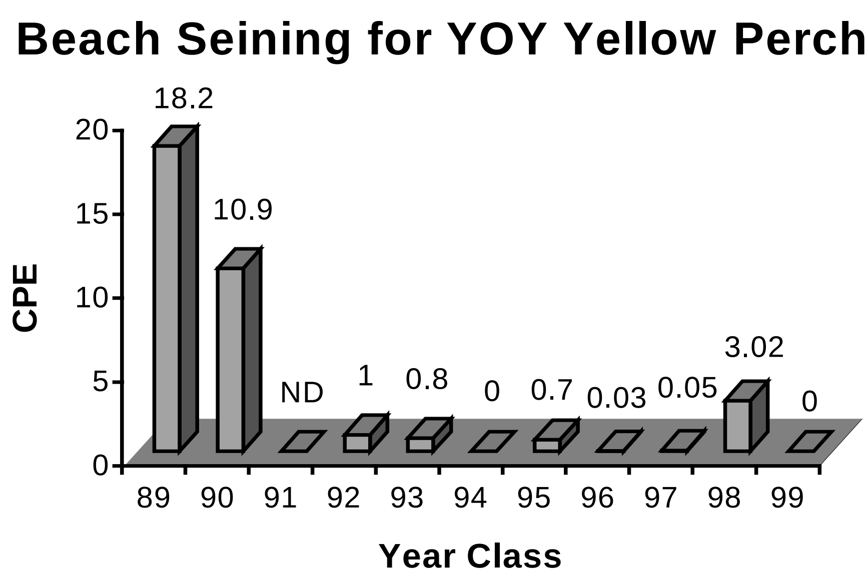

Figure 1. CPE (fish/100' seine haul) of YOY yellow perch in WDNR sum beach seining.

BLOATER CHUBS IN WISCONSIN WATERS

The total reported chub harvest from commercial gill nets was 1,326,729 pounds for calendar year 1999, a decrease of 31% from 1998 (Tables 1 and 2). Commercial smelt trawlers harvested an additional 169,522 pounds incidental to the targeted smelt harvest.

By zone, the harvest in the south was 1,192,590 pounds, a 28% decrease compared to the 1998 harvest, while in the north 134,139 pounds were reported caught, an approximate 50 % decrease compared to 1998. The harvest in the south in 1999 represented about 40 % of that zone's quota while the harvest in the north amounted to about 22% of that zone's quota. CPE decreased significantly in the South by 32% from 1998, while in the north CPE remained high and was the second highest catch rate (surpassed only in 1998) since chub fishing re-opened there in 1981. Effort for the year in the north was the lowest since fishing re-opened in 1981, while in the south effort increased about 5%. In the south, 32 of the 46 chub permit holders reported harvesting chubs while in the north 11 of 23 reported chubs.

Table 1. Harvest, quota, number of fishers, effort, and catch per unit of effort (CPE) for Wisconsin's southern chub fishing zone, 1979-1999. 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.

YEAR	HARVEST	QUOTA	FISHERS	EFFORT	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	25,253.1	47.2

Table 2. Harvest, quota, number of fishers, effort, and catch per unit of effort (CPE) for Wisconsin's northern chub fishing zone, 1981-1999.

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

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

In 1999, population assessments using graded-mesh gill nets (GMGN) were conducted off Baileys Harbor (Grid 707) and Algoma (1004) from mid to late September (Table 3). Chub catches by year class were better off Baileys Harbor than Algoma during the GMGN survey in 1999. 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 (Figure 1). Based on declining catch rates of especially younger ages and the increasing mean age of the population, we predict that the commercial harvest will continue to decline along with CPE.

The substantial shift in sex ratios that began about 1980 continued in the chub population sampled during 1999 (Figure 2). 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.

Table 3. Catch rate by age group for chubs from graded-mesh gill nets fished in the Northern and Middle (Central) areas* of Wisconsin waters of Lake Michigan during 1980-87, Baileys Harbor (706) and Algoma (1004) during 1998-99, northern Green bay (507) during 1994-96, Milwaukee (2002, 1802) during 1995-98, and Sheboygan during 1997-98.

YEAR	AGE:	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	-	-	-
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	212.0	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	2 9.2	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	-	-	3.2	19.3	41.8	135.8	167.1	151.9	27.5	12.0	-
	Baileys Harbor	-	-	-	23.6	100.8	234.5	250.6	207.7	56.7	14.6	-

* 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.

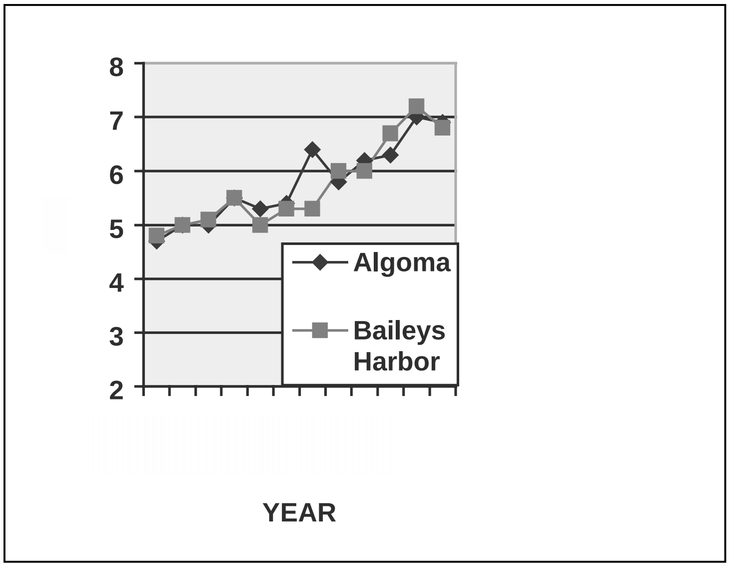

Figure 1. Mean age of chubs caught in GMGN off Algoma and Baileys Harbor during 1988-1999.

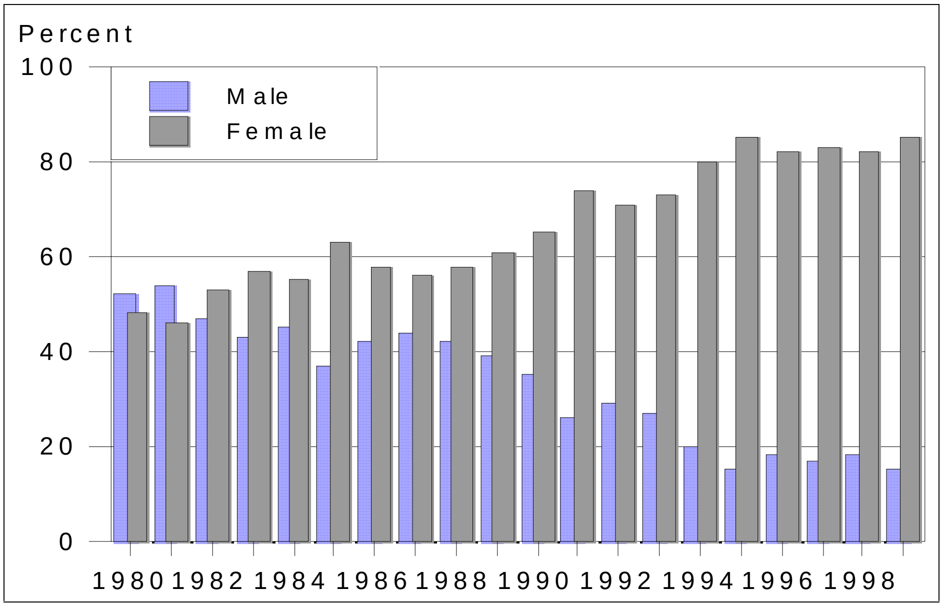

Figure 2.Sex ratio trends of chubs caught in GMGN from Algoma and Baileys Harbor during 1980-1999 and combined chubs from southern Lake Michigan surveys in 1996-1998.

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LAKE WHITEFISH IN WISCONSIN WATERS

Lake whitefish *Coregonus clupeaformis* (whitefish) continues to rank economically as one of the most important species in Wisconsin's Great Lakes commercial fishery. Most of the whitefish harvested from Lake Michigan by Wisconsin commercial fisherman belong to the North/Moonlight Bay (NMB) stock, whose major spawning grounds are concentrated along the eastern shore of Door County. Since July 1989 the commercial harvest of whitefish in Wisconsin waters has been under enforced quota control. This stock is also heavily exploited by state of Michigan commercial fisherman in the waters of Green Bay, but their harvest is not currently under enforced quota control.

In order to maintain current data on this whitefish stock and quota fishery in Wisconsin waters of Lake Michigan including Green Bay, catch statistics are summarized and lifts of commercial fishing gear are sampled by Wisconsin Department of Natural Resources (WDNR) personnel. The WDNR also conducts whitefish sampling from the research vessel Barney Devine (RVBD) with graded mesh gill nets (GMGN) in the spring for juvenile whitefish and in the fall near the spawning grounds for mature whitefish. Similar data has been collected and reported annually by WDNR since the late 1970's.

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 for quota year 1989-90. It was increased to 1.3 million pounds in quota year 1991-92, up to 1.45 million pounds for quota year 1995-96, up to 1.77 million pounds in quota year 1996-97, and up to 2.47 million pounds in quota year 1998-1999 (Figure 1).

Whitefish harvest has dropped for the last two years after peaking at 1.69 million pounds in quota year 1996/97 (Figure 1). In quota year 1997/98 the whitefish harvest dropped to 1.56 million pounds and in quota year 1998/99 the harvest dropped to 1.49 million pounds. During quota years 1994/95 through quota year 1996/97 an average of 5 percent of the whitefish harvest occurred in pound net, 35 percent in trap net, and 60 percent in gill net. During the last two quota years an average of 6 percent of the harvest occurred in pound net, 43 percent in trap net, and 51 percent in gill net. This represents a 9 percent increase in the percent of whitefish caught in entrapment gear.

Although pound net effort has remained relatively stable over the last several years the trap net and gill net effort directed at whitefish has increased over the last three years (Figure 2).

As a result of the increasing effort and decreasing catch the catch per effort (CPE) has decreased in pound and gill nets over the last three years (Figure 3). Trap net reported harvest shows an apparent increase in CPE, but this may be an apparition of the data. Commercial fishermen are required to report only those whitefish harvested during their operations. During several previous years, commercial fishermen were observed high grading their whitefish catch from trap nets. At times hundreds of legal sized but smaller whitefish were released during trap net operations.

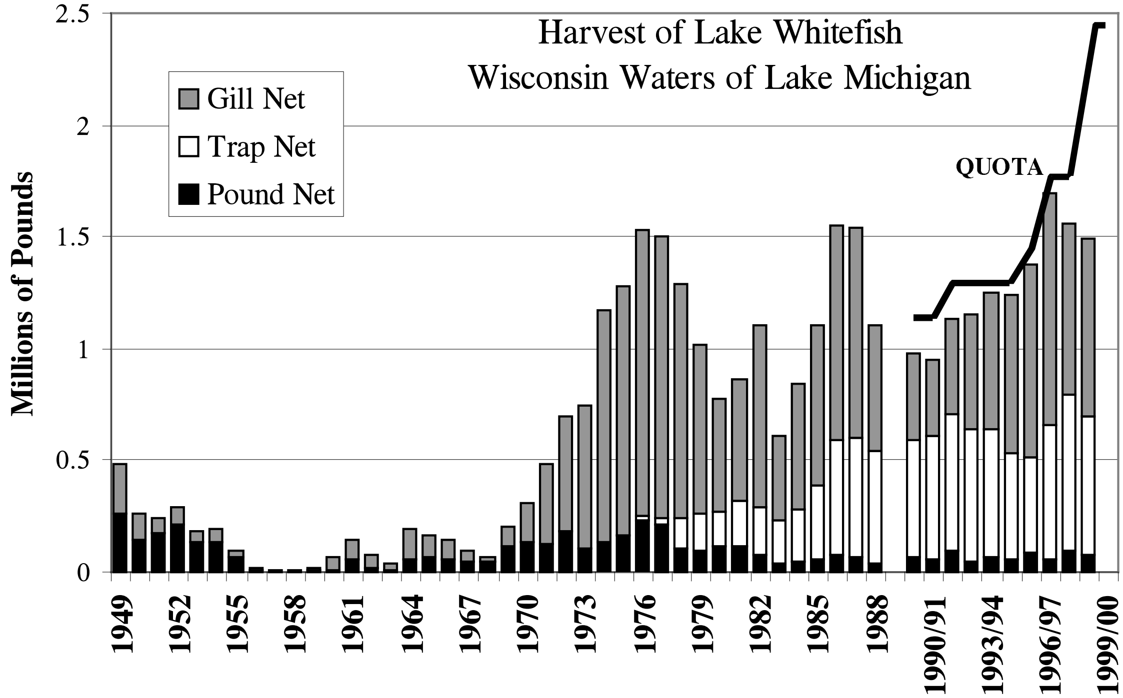

Figure 1.-Reported commercial harvest of lake whitefish, in pounds (dressed weight), by gear, for the Wisconsin waters of Lake Michigan including Green Bay, for calendar years 1949 through 1988, and quota years 1989/1990 through 1998/99.

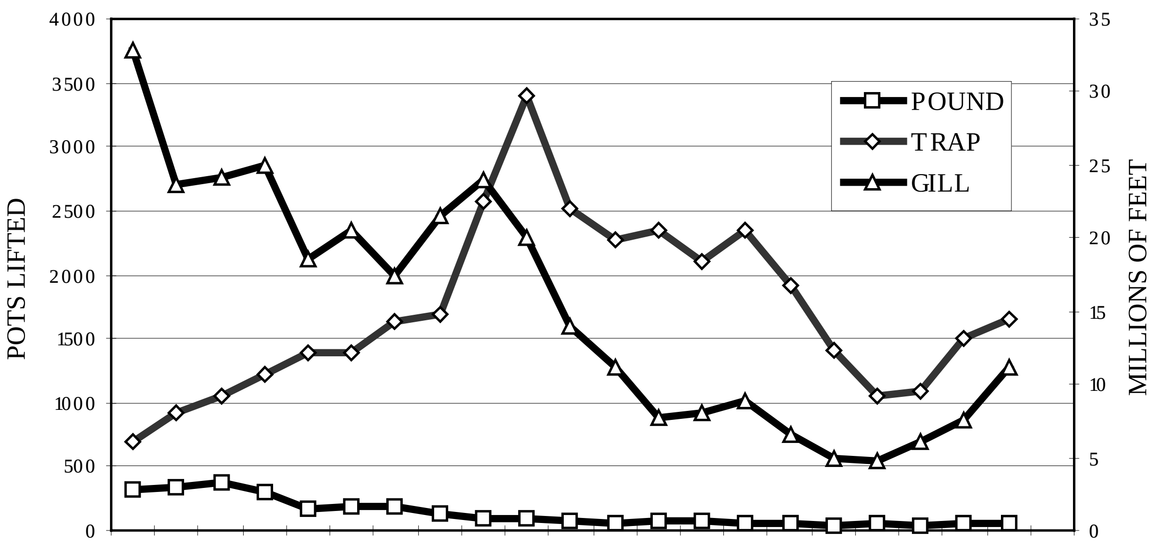

Figure 2.-Trends in gill, trap, and pound net effort for lake whitefish in the Wisconsin waters of Lake Michigan including Green Bay, from 1979 through quota year 1998/99. Gill net effort reported in millions of feet lifted, trap and pound nets reported in number of pots lifted.

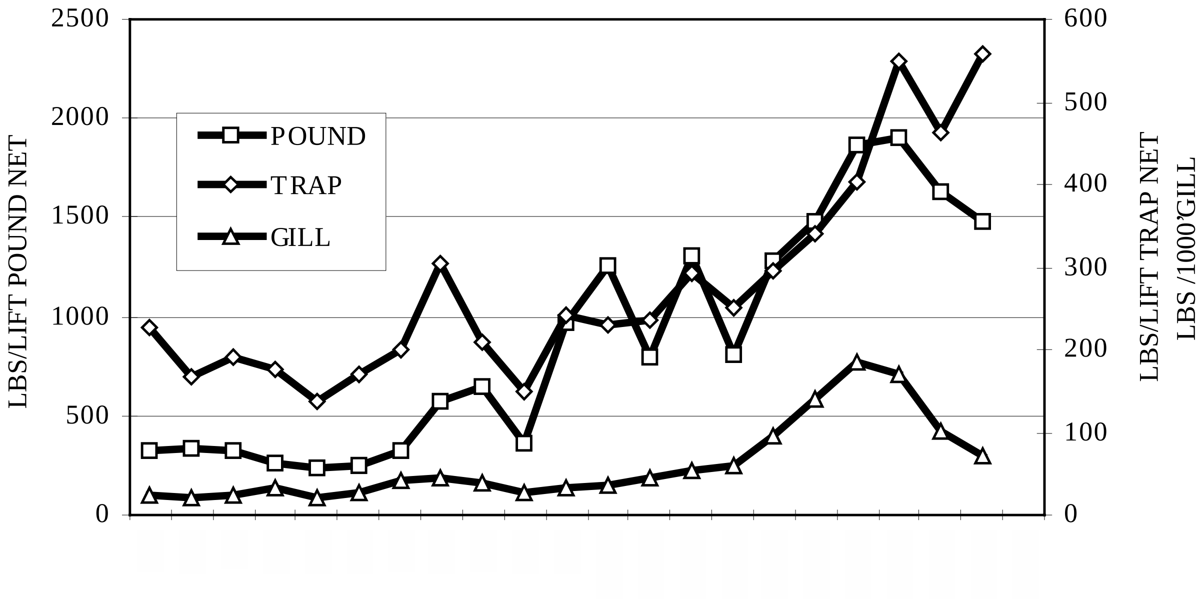

Figure 3.-Trends in catch per effort (CPE) for gill, trap, and pound nets fished for lake whitefish in the Wisconsin waters of Lake Michigan including Green Bay for the years 1979 through quota year 1998/99. CPE in gill net reported as pounds of whitefish harvested per 1,000 feet lifted; trap and pound net CPE reported in pounds of whitefish harvested per pot lifted. All weights are reported as dressed weight.

Aging of last years whitefish samples has not been completed however, over the previous three years there had been a distinct downward trend in length and weight at age. There had been enough of a change in recent years that it has affected the age at which whitefish are recruited to the commercial fishery. In the spring fishery, mean age of whitefish captured has gone from 4.5 in 1995 to 5.4 in 1998. The same trend shows up in the fall fishery where the mean age has gone from 4.5 in 1994 to 5.3 in 1997.

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SMELT WITHDRAWAL BY THE COMMERCIAL TRAWL FISHERY

Historically, commercial trawling has 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. During 1991, additional rules regulating trawling in the waters of Lake Michigan and Green Bay were adopted. These rules were designed to maximize the harvest of rainbow smelt, and minimize the catch of alewife and bloater chub. The commercial rainbow smelt harvest was set at 2.358 million pounds, of which no more than 830,000 pounds could be caught in Green Bay. The regulations also restricted the areas, dates, and times fished, to establish a daylight, deep water (depths greater than 60 feet) Lake Michigan fishery from November 15 to April 20, and a nighttime, deep water (depths greater than 65 feet) Green Bay fishery from June 15 to September 30. 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 844,739 pounds of rainbow smelt during 1999 (Figure 1). This was an increase of greater than 200 % over the 1998 harvest level. Although the 1999 harvest reversed a five year trend of declining catch, harvest is still less than 50% of the catch of the early 1990’s.

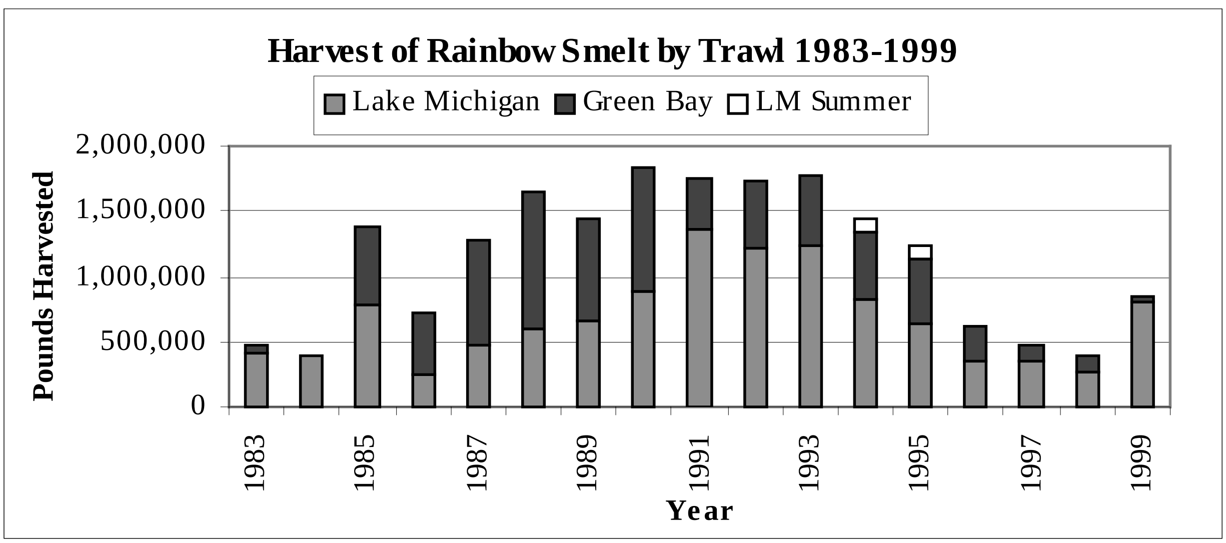

Figure 1. Reported rainbow smelt harvest by trawl from the Wisconsin waters of Lake Michigan for the years 1983 through 1999.

The harvest of rainbow smelt from Lake Michigan was 794,151 pounds (Figure 1), with an average CPE of 429 pounds per hour trawled (Figure 2). The Lake Michigan rainbow smelt harvest in 1999 was the highest harvest since 1994, and reversed the trend of declining harvest. Lake Michigan CPE also rebounded from the 1998 low.

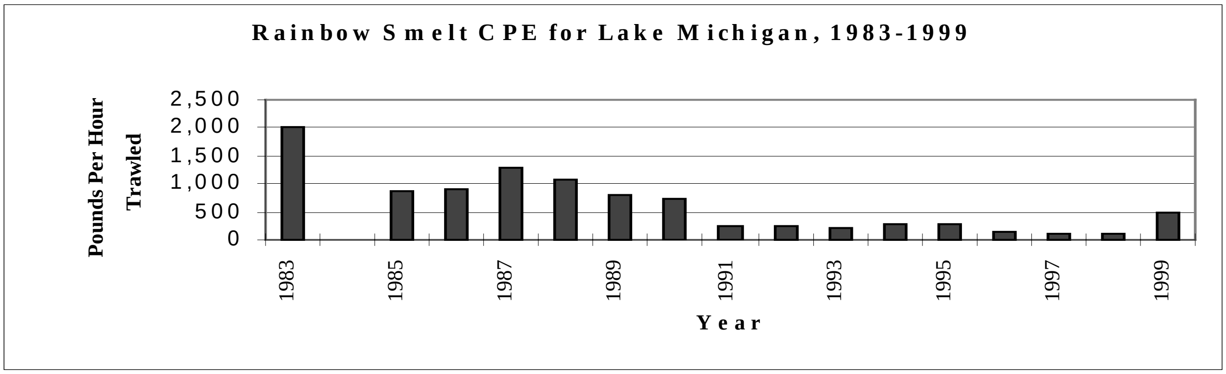

Figure 2. Rainbow smelt CPE in pounds per hour trawled on Lake Michigan during the years 1983 through 1999.

Commercial trawlers on Green Bay reported a rainbow smelt catch of 50,588 pounds (Figure 1), with a CPE of 489 pounds per hour trawled (Figure 3). The 1999 rainbow smelt harvest on Green Bay has declined to their lowest reported level. CPE on Green Bay, which had remained stable through 1995, then decreased markedly, increased in 1999. An increase in CPE with declining harvest may be an indication of reduced effort by commercial trawlers on Green Bay.

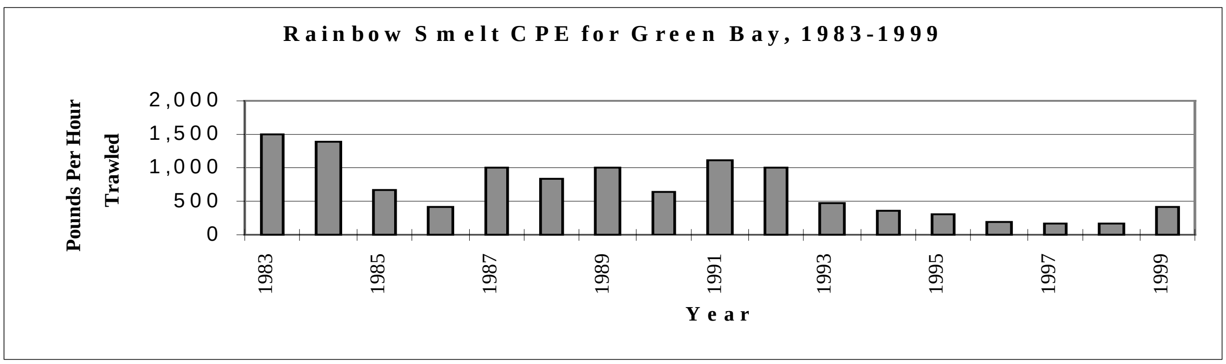

Figure 3. Rainbow smelt CPE in pounds per hour trawled on Green Bay during the years 1983 through 1999.

Generally, the harvest of rainbow smelt by commercial trawlers is 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 is unknown if increased harvest by commercial trawlers is an indication of an increase in rainbow smelt numbers, if trawlers were fishing a localized concentration of fish not indicative of lakewide populations or due to U.S.G.S. sampling difficulties in 1998.

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