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Lake Michigan Management Reports

Lake Michigan Fisheries Team
Wisconsin Department of Natural Resources

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GREEN BAY YELLOW PERCH

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This report summarizes assessments and monitoring of yellow perch in southern Green Bay completed in 2013. Yellow perch abundance in Green Bay increased steadily through the 1980's. The estimated total biomass of yearling and older yellow perch rose from under 1 million pounds in 1978 to nearly 9 million pounds in 1987. The population growth was fueled by the production of strong year classes in 1982, 1985, 1986, and 1988. Following the late 1980's, yellow perch abundance began to decline and the biomass estimate dropped to between 500 and 600 thousand pounds by 2002. The decline in the population during the 1990's and early 2000's can be attributed to poor recruitment. From 1988 to 2002, only two reasonably strong year classes (1991 and 1998) appeared during summer trawling surveys (Figure 1). More recent summer trawling surveys, however, show improved recruitment. Surveys from 2002 to 2013 indicate reasonably strong year classes (Figure 1).

Spawning assessment

The spring spawning assessment on Green Bay near Little Tail Point was not conducted in 2013. Beginning in 2014, plans are for the spring fyke netting survey to be conducted every other year instead of annually.

Water temperature

A HOBO Water Temp Pro v2® templogger U22 (Onset Computer Corporation) was deployed on April 24, 2013 near Little Tail Point to record water temperature every 30 min until August 21, 2013. May 2013 water temperatures averaged 56.7F. The 11-year May average (2003-2013) for this location is 57.5F.

Beach seining

Fifteen index sites along the west and east shores of Green Bay were sampled twice between June 25-27, 2013, and at twelve index sites between July 9-11, 2013 using a beach seine (25ft x 6ft, ¼-in delta mesh with 6x6x6ft bag). At each site, two 50ft hauls were pulled in perpendicular to shore. The number of YOY retained and escaped from the seine bag when it was placed in a tub was recorded. Catch per effort (CPE) was calculated as the mean number of YOY yellow perch per 100ft seine haul. YOY yellow perch were captured at 10 sites (mean CPE=32) during the June sampling and at 9 sites in July (mean CPE=24). The 14-year average CPE is 81. The site with the highest abundance in 2013 was Skoggs Bridge, just north of the Oconto River (CPE=194).

Mean length of YOY yellow perch during the late June survey period was 35 mm (range: 22-49 mm). By the July sampling period, mean length of YOY was 47 mm (range: 30-62 mm). These averages are about 10 mm less than the 2012 averages, presumably because of the early spring in 2012 and late spring in 2013. The wide range of lengths may be the result of several pulses of hatches. As expected, escapement rates decreased with larger fish and all YOY $\geq$ 51 mm were retained in the seine bag. Because many YOY had not yet reached a size where they were effectively captured, our CPE values are probably underestimated. However, a seine with a smaller mesh is difficult to pull in areas with cladophora, which was abundant in several locations in the southern and eastern portions of Green Bay during the sampling periods.

A total of twenty-seven fish species were identified during the survey. Alewife YOY dominated the catches followed by white sucker YOY, yellow perch YOY, common carp YOY, freshwater drum YOY. The majority of alewife YOY were captured in a single haul at Red Banks (Brown County). Of interest were 27 smallmouth bass captured (Little Sturgeon, Pensaukee, Red Arrow Park), 14 northern pike YOY captured (Red Arrow Park, Oconto Park I, Pensaukee), and 8 walleye YOY

captured (Little Tail, Bay Beach). While these gamefish YOY are occasionally captured in seining surveys, the seining surveys suggest strong year classes for those species in Green Bay in 2013.

Trawling survey

Annual late summer trawl surveys continued for the 36th year to monitor trends in yellow perch abundance. Trawling was conducted at 76 index sites at 12 locations: 44 shallow sites (established in 1978-1980) and at 32 deep water sites (added in 1988) using a 25-ft semi-balloon trawl with 1½-in stretch mesh on the body, 1¼-in stretch mesh on the cod end, and a cod end liner with ½-in stretch mesh. The net was towed for 5 minutes at a speed of 2.8 knots, for a total distance of approximately 0.25 miles. Hauls were made during daylight hours on the RV Coregonus. After tearing two nets at two sites earlier in the survey, one site (LIT35a) was omitted in 2013 due to a history of snags on the bottom at that site. At each of the 12 locations, 100 YOY yellow perch were measured. Mean length of YOY was 67 mm (range: 47-108 mm). YOY captured in the southern bay were generally larger than YOY from the northern study sites, presumably due to an earlier hatch, warmer water temperatures, and more productive waters. However, timing of the survey could also be a factor, since the northern sites are surveyed a week or so before the southern sites.

The average number of yellow perch collected per trawl hour was adjusted based on the amount of habitat that standard and deep sites represent, creating a weighted area average value. The trawling surveys indicated that 2013 produced a moderate year class with the relative abundance of YOY yellow perch (843/hr), ranking as the 12th highest since the deep water sites were added in 1988 (Figure 1). For the last three years, greatest abundance of YOY was at Pensaukee (PEN) followed by Little Tail Point (LIT).

While the trawling surveys are designed to assess YOY distribution and abundance, yearling and older yellow perch are also measured, weighed, sexed, and aged. Abundance of age-1 and older fish was 137/hr in 2013 compared to the 26-year average of 505/hr. A majority (76%) of the age-1 and older fish captured were yearlings (2012 year class) with a mean length of 136 mm (range: 92-200 mm) followed by age-2 (18%) with a mean length of 164 mm (range: 108-245 mm). Other common species in decreasing order of abundance captured at shallow sites were gizzard shad, alewife YOY, trout perch, and white perch YOY. Deep water sites were dominated by adult alewife, whitefish YOY, rainbow smelt YOY, and common suckers.

Of particular note was the record high CPE of walleye YOY, recorded at 244/hr near Little Tail Point (LIT). Long Tail Point (LOT) also had high abundances of walleye YOY (214/hr). Two rare species were recorded during the 2013 trawling surveys: 3 sauger YOY captured at Little Tail Point and 3 lake herring captured at East of Youngs Reef (EYR).

At each of the 12 locations, a temperature and dissolved oxygen profile is taken along with a secchi disk reading. Water clarity was highest at the northernmost locations and generally decreased in the southern bay, ranging from 3.8 m at Mouth of Peshtigo River (MPR) to 0.4 m at Longtail Point (LOT) and Point Sable (PS). Beginning in 2013, a GoPro® Hero3 digital camera was attached to the inside body of the net to capture video footage of the net while it was fishing. Footage quality was excellent in clearer water and on sunny days, but footage quality decreased as water clarity decreased at southern sites.

Mussels incidentally caught in the trawl are weighed to the nearest pound and are visually inspected for the relative composition of zebra and quagga mussels. From 1999 to 2011, zebra mussels comprised most of the dreissenid mussels incidentally caught in the trawling survey. However, since 2012, quagga mussels dominated the dreissenid mussels caught.

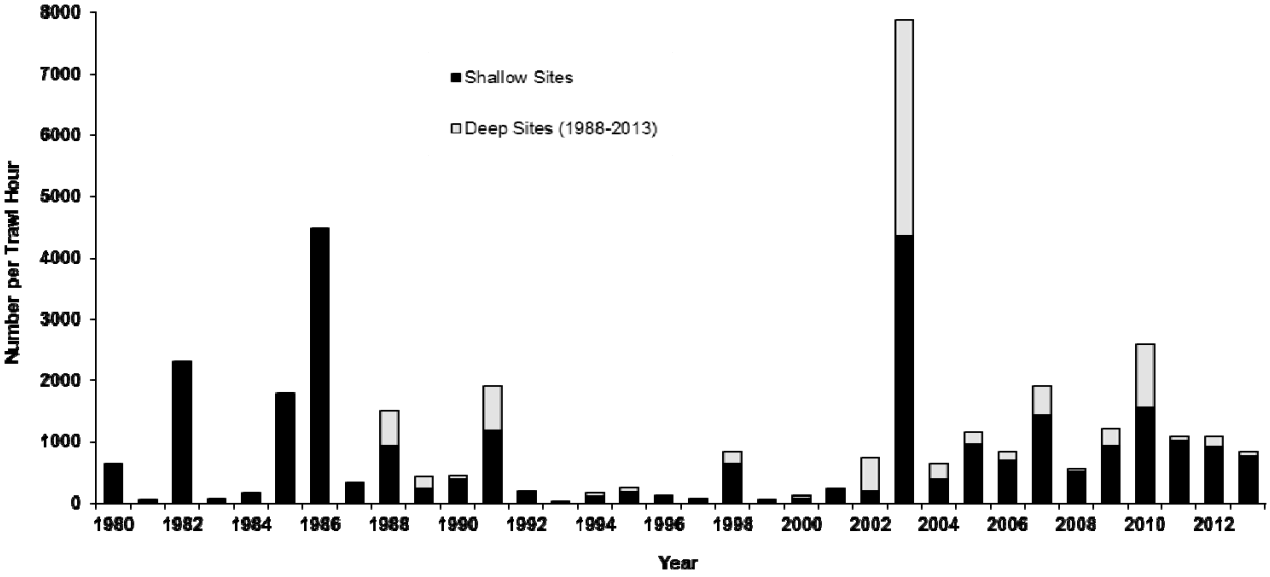

Figure 1. Relative abundance (weighted area average) of young-of-year yellow perch collected during late summer index trawling surveys in Green Bay from 1980 to 2013.

Sport harvest

Sport fishing harvest is estimated from an annual creel survey. Fish obtained through that survey were used to describe the age and size composition of the catch. Open water harvest of yellow perch in 2013 was 215,422 (66,236 lbs) compared to 148,980 (29,752 lbs) in 2012 (Figure 2). The majority of the open water harvest (33%) was by boat anglers launching at ramps at Door and Kewaunee Counties, followed by boat anglers launching in Oconto (21%) and Brown County (16%). The remaining 30% of harvest was by pier, shore, or stream anglers, or by anglers who responded to the moored boat survey. These are fairly similar proportions to the 2011 and 2012 harvest. The open water harvest rate (0.18/hr) and catch rate (0.35/hr) of yellow perch in 2013 was similar to the 2012 rates (0.17/hr and 0.33/hr) (Figure 3). A majority (46%) of the open water harvest was from the 2010 year class, while the 2011 year class comprised 30%. The 2010 year class made up 62% of the open water harvest last year, in 2012, so it is encouraging to see that strong year class continue to be represented in catches. The mean length of open-water harvested yellow perch was 8.5 inches (n = 381), compared to 7.8 inches in 2012.

Winter harvest is influenced largely by ice conditions, daily bag limits, angler effort, and abundance of adult perch. Since the creel survey began in 1986, angler harvest of yellow perch during winter months has ranged from 2 million fish in 1990 to 6,930 in 2002 (Figure 2). Winter (January-March) harvest of yellow perch in 2013 (35,216 fish; 9,159 lbs.) was higher than in 2012 (9,767 fish; 2,165 lbs.) but still below the 16-year harvest average for Green Bay (48,873 fish). Harvest rate for anglers targeting yellow perch in winter 2013 (0.27 fish/hr) was significantly less than in 2012 (0.66 fish/hr). The mean length of yellow perch harvested through the ice was 8.4 inches compared to 8.0 inches in 2012.

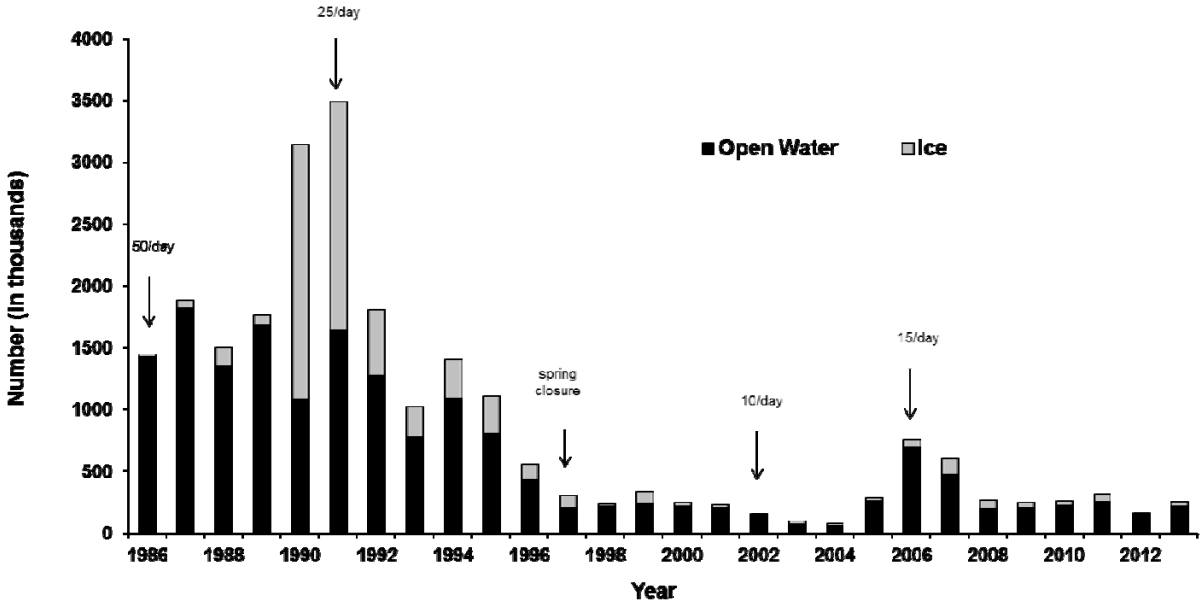

Figure 2. Estimated sport harvest of yellow perch in Green Bay from 1986 to 2013. Regulation changes indicated by arrows.

Figure 3. Estimated sport catch rate and harvest rate of yellow perch in Green Bay from 1986 to 2013.

Commercial harvest

The annual commercial harvest was reported by commercial fishermen who are required to weigh their harvest daily. Fish sampled by WDNR at commercial landings were used to describe the age and size composition of the catch. Since 1983, the yellow perch commercial harvest in Green Bay

has been managed under a quota system. The zone 1 (Green Bay) quota has ranged over the past decade from 20,000 pounds to a high of 475,000 pounds and is currently set at 100,000 pounds.

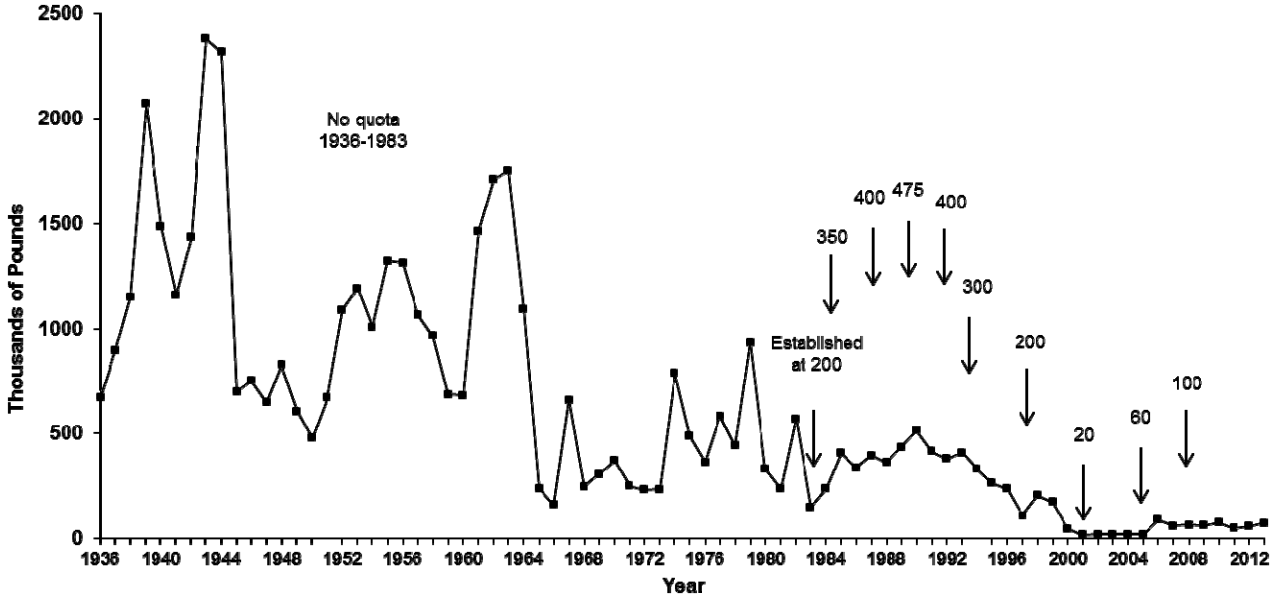

Figure 4. Commercial harvest of yellow perch in Green Bay from 1936 to 2013. Total allowable commercial harvest changes (thousands of pounds) indicated by arrows.

In 2013, commercial fishers harvested a total of 73,452 pounds (223,528 fish) of yellow perch using gill nets and drop nets, compared to 57,845 pounds in 2012 (Figure 4). The total allowable commercial harvest has remained at 100,000 pounds since 2008. The harvest rate (CPE) for gill nets in 2013 was 34 pounds per 1000 ft fished, slightly up from 2012 (23 pounds/1000 ft). Drop net CPE fell to 15 pounds per net in 2013 (Figure 5), but drop nets comprised only 73 pounds of the total catch. Age-3 perch (2010 year class) made up 65% of the total commercial harvest in 2013, while age-2 comprised 29%. The 2010 year class continued to be well represented. In 2012, the 2010 year class made up 63% of the total commercial harvest in 2012.

Discussion and Management Actions

In summary, yellow perch recruitment has been steady for the last decade, with peak year classes occurring in 2003, 2005, and 2010. The relative abundance of YOY yellow perch in 2013 (843/hr) ranks as the 12th highest since 1988. Even with excellent recruitment occurring in Green Bay, commercial and sport harvest has leveled off over the last five years and has not exhibited significant increases.

One possible explanation for lower than expected harvest levels may be because fewer yellow perch are surviving to age-one and beyond. WDNR continues to work with USDA Wildlife Services to achieve the goals for managed double-crested cormorant colonies set forth in the Environmental Assessment "Reducing Double-crested Cormorant Damage in Wisconsin" [a]. The population goals for peak numbers of cormorant nests on Cat and Jack Islands have been reached in 2012 and 2013, and in both of those years Hat Island was slightly above the 500 nest goal set for that colony[b]. In addition, WDNR will continue to monitor the status of the yellow perch fishery and adjust commercial harvest limits and sport bag limits if several years of recruitment failures should occur.

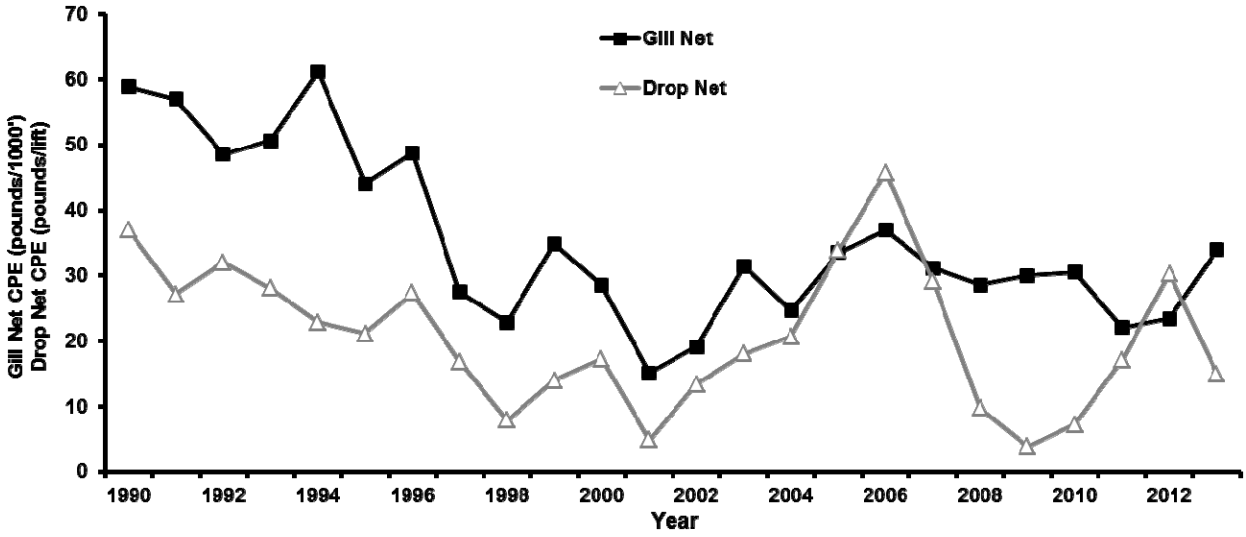

Figure 5. Gill net and drop net catch per unit effort (CPE) of all licensed yellow perch commercial fishers in Green Bay waters, 1990 – 2013. Gill net CPE is in pounds of yellow perch harvested per 1,000 feet lifted. Drop net CPE is in pounds of yellow perch harvested per pot lifted.

The statistical-catch-at-age model for Green Bay yellow perch was updated and run during the winter of 2013-14. Outputs of that model suggest that the adult (age 1 and older) yellow perch population has remained steady between 2.7 and 3 million fish from 2007 to 2012. The model does not exhibit any increases or decreases in the overall adult yellow perch population in the last six years that would warrant an adjustment to the daily bag limit or commercial quota. Therefore, the recommendation to keep the total allowable commercial harvest, or quota, at 100,000 pounds and the daily bag limit at 15 was approved by the WDNR Fisheries Management Board in July 2014. Plans are for the model to be re-run in winter 2014-15.

[a] USDA (United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services). 2009. Final Environmental Assessment: Reducing Double-crested Cormorant Damage in Wisconsin. 732 Lois Dr., Sun Prairie, WI.
http://www.fws.gov/midwest/MidwestBird/documents/WIeaFinal.pdf

[b] Jones, M., and C. Lovell. 2013. Double-crested cormorant summary report for Wisconsin Department of Natural Resources, 2013. USDA (United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services).

STATUS OF YELLOW PERCH STOCKS - LAKE MICHIGAN

This report is a summary of the status of young and adult perch in Lake Michigan assessed through several annual surveys in Wisconsin waters during 2013-14.

Young-of-the-year Assessment

An annual survey of YOY yellow perch along the Lake Michigan shoreline was conducted from 8/26/13 to 9/12/13. We used a standard 25-foot beach seine which was pulled by two persons in shallow nearshore waters of Lake Michigan. In general, each pull consisted of a 100-foot sweep either parallel to the beach or perpendicular to the beach along piers and jetty's depending on the depth and feasibility of seining. At each station, two 100-foot pulls were conducted – one a parallel and the other perpendicular. Fourteen stations were sampled from Sheboygan to Kenosha (Sheboygan – 3, Ozaukee – 2, Milwaukee – 5, Racine – 2, and Kenosha – 2).

Seining conditions were generally good in the Sheboygan sites in the first round of seining, yet we caught very few fish. Most of the sites south of Sheboygan all the way down to Bender Park beach, Milwaukee Co., were very difficult to seine due to cladophora clogging the net. Further south, Racine and Kenosha sites had good seining conditions with little cladophora and calm waters. The water temperature was 48 ^{0}F at this time. We caught two YOY yellow perch (50mm, 62mm) in Meyers Park in Racine. In the second week of seining, we caught three YOY yellow perch (48mm, 51mm, and 54mm) at Doctors Park. The water temperature was in the 70s. The density of cladophora varied from station to station during much of the season depending on the prevailing winds making conditions unpredictable. A total of 12 species of fish were captured during the seining survey (Table 1). Young-of-the-year and juvenile alewife dominated the catch followed by Spottail shiner and round goby.

We attempted to sample each site (with some exceptions) twice during the sampling season. A total of 4,075 ft of seine hauls were conducted at fourteen sites capturing 5 YOY yellow perch yielding a catch per effort (CPE) of 0.12 YOY yellow perch per 100 foot seine haul which is very low (Figure 1). The average size of the YOY yellow perch in 2013 was smaller (53 mm) than that of 2012 (62.4 mm). An early warming spring in 2012 may have contributed to the faster growth of YOY yellow perch observed last year.

Two index stations, Shoop Park (Racine Co.) and Doctors Park (Milwaukee Co.), have been used for setting micromesh gill net. In 2013, we conducted an additional set at South Shore harbor. The nets were set in nearshore waters using an inflatable boat on a calm day at depths ranging from 5 to 10 feet and fished overnight. We used a 100-foot long and 5--foot deep monofilament net consisting of 12mm stretch mesh. A total of 300 feet of net was fished at each station. Two lifts were conducted off Shoop Park, three lifts were conducted off Doctors Park, and one lift was conducted in South Shore Harbor.

Gill net sampling was conducted from 8/27/13 to 10/8/13. A total of twelve species of fish were captured in these nets with round goby, alewife and spottail shiners dominating the catch (Table 2). Only two YOY yellow perch were caught, one at Doctors Park and the other at Shoop Park. The catch per 100 ft of gillnet was only 0.11 YOY yellow perch (CPE=0.11) (Figure 2). In general, the conditions were very good for sampling. The water off Doctors Park was very clear, and calm, yet some suspended cladophora got on the nets. Similar conditions existed at the other two sites with calm waters, some suspended cladophora and little net fowling. Winds were mild, and the temperature ranged from 49 ^{0}F to 70 ^{0}F. Despite these very good conditions, very few

fish were caught at South Shore Harbor and at Doctors Park. Poor catches in both sites may be due to increased water clarity leading to potential net avoidance.

Table 1. Number of fish caught in YOY yellow perch beach seining assessment (Lake Michigan shoreline from Kenosha to Sheboygan), WDNR - 2013.

Fish species	**Number of fish**
Alewife (YOY)	2403
Rainbow smelt	2
Common shiner	2
Blacknose shiner	6
Spottail shiner	423
Sand shiner	269
Fathead minnow	3
Longnose dace	78
White sucker	2
Banded killifish	4
Yellow perch (juvenile)	2
Yellow perch (YOY)	5
Round goby	354

Table 2. Numbers of fish captured in the YOY yellow perch micromesh gillnet survey at index stations (Lake Michigan nearshore waters), WDNR – 2013.

Species	**Number of fish**
Alewife	312
Gizzard shad	1
Coho salmon	1
Brown trout	1
Longnose dace	23
Rainbow smelt (adult)	4
Spottail shiner	238
Longnose dace	78
White sucker	2
Trout perch	1
Yellow perch (juvenile)	9
Yellow perch (YOY)	2
Round goby	318

Spawning Assessment

This assessment has been conducted since 1990 on the Green Can Reef and in the Milwaukee Harbor (Table 3). The objective is to quantify the relative abundance of mature female perch in previously identified spawning areas. In 2013, the yellow perch spawning assessment (PSA) was conducted on 5/22, 5/29 and 5/30 for a total effort of 2,500 ft. of gill net set around Green Can Reef. Each box of 500 ft gillnet consisted of 2, 2.5, 2.75, 3.0 and 3.25 inch stretch mesh (100 ft each panel). The bottom temperature was still cooler at 44.7F on May 22nd at 39 ft. but went up to 48.6F by May 29. The Secchi disc transparency was 35 ft. The surface water temperature was 49.8 F. The net was set at depth range from 39 to 53ft. We collected biological data and anal spine samples from all 95 (42 male and 53 female) perch. At the end of May nearly 58% females were spent indicating peak

spawning.

Although we caught fewer perch than the previous year, the general health of yellow perch captured appeared to be fine. Unlike the previous years, males were freely expressing milt, and the gonads appeared fully developed. The ripe females had well developed ovaries. There was no pattern in the number of fish caught or the number of spent female with respect to the depth (deep vs. shallow).

We collected anal spine samples from 34 male and 40 female perch to examine age distribution of the spawning population. The catch was composed mainly of ages 3, 6, 7 and 8. The 2010 year-class perch (age 3) were the highest in the catch, though marginally, followed by the 2005 year-class perch (Figure 3). There were multiple other year-classes represented in the sample though in smaller quantities.

Yellow perch egg deposition survey was conducted by the WDNR dive team on June 13th, 2013. The divers surveyed an area of 23,311 square meters at depth ranging from 35-55ft. They counted 9 egg masses resulting in 0.4 egg mass per 1000 square meters (Figure 4).

Graded Mesh Gill Net Assessment

The WDNR conducts standardized graded mesh gill net assessments annually in winter months, in grids 1901 and 1902 off Milwaukee. The mesh sizes used in these assessments run from 1 to 3.25 inches stretch mesh with 1/4 inch increment. In early December 2013, the air and water temperature started dropping very quickly. Hence the captain and the crew tried to move quickly so that the assessment could be completed in a short time. However, due to severe cold temperatures, and for safety of the vessel and the crew, the assessment was cut short with only two lifts, one on 12/6 and the other on 12/7. We lifted six boxes of gill net on 12/6 and eight boxes of gillnet on 12/7. Generally we set a total of 20 boxes of nets on 4-5 nights, each box consisting of 800 ft. High winds, waves and very cold temperatures prevented us from setting any more gill nets. Thus the total effort this year was only 11,200 ft. of gill net. The surface water temperature during the sampling period was around 40 ^{0}F which was similar to previous years of sampling.

The total number of yellow perch caught in this year's survey was an all-time low (10 perch). Only five yellow perch were caught in each lift. The catch per 1000 ft. was 0.89 yellow perch (for all meshes combined). Most perch were caught in the larger size meshes. There were two males, 294mm and 309mm, and eight females which ranged from 239mm to 362mm. The perch ages ranged from 2 to 13, with the majority of them being age 9 (2005 year-class). The sex ratio was 20% males and 80% females.

We maintained our yellow perch graded mesh standard protocol while choosing locations and depths. The cause of extremely low catches of yellow perch in this year assessment is unclear. The nets appeared to be fishing effectively which was evident in the good numbers of other species caught such as round white fish, lake trout and burbot. The nets were not clogged by cladophora which sometimes happens especially in shallow waters.

Since 2000 the sex ratio of the yellow perch population has shifted toward predominantly female and lasted until 2002. This trend was reversed again since 2003 with greater number of males, except for 2007. But recently the female proportion has increased markedly with 71% in 2010, 76% in 2011, 77% in 2012, 76% in 2013 and 80% in 2014.

Harvest

In September 1996, the commercial yellow perch fishery was closed in the Wisconsin waters of Lake Michigan. Hence, the information on commercial harvest is limited up to 1995 catches. Sport harvest is monitored by a contact creel survey. The sport bag limit has been reduced to five fish per day since September 1996, which is reflected in the total harvest (Table 4). The overall harvest in Lake Michigan increased from 20,000 perch in 2008 to 51,000 in 2009. The sport harvest remained the same in 2010 at 51,000 fish while there was a dramatic decline in the sport harvest in 2011 (67% drop) with only 17,000 fish. It further declined to a record low estimated numbers of 9,115 perch in 2012 and 8,830 in 2013. In general, the lakeshore counties – Milwaukee, Racine and Kenosha accounted for most of the sport harvest. The main reason for the decline of the population is poor recruitment. Yellow perch are fully recruited to the fishery at age 3. The 3-year-old yellow perch (2010 year-class) dominated the sport catch in 2013 comprising 55% of the aged perch followed by age 6 yellow perch (16%) from 2008 year-class (Figure 5).

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, in recent years, the 2005 year-class emerged as the strongest year-class supporting the fishery. Interestingly, 2013 sport harvest was dominated by 2010 year-class with 2005 year-class perch comprising only a small proportion. Effective September 1996 commercial fishing was closed in the Wisconsin waters of Lake Michigan and daily sport bag limit was reduced to 5 fish. Effective May 2002, the sport fishery for Lake Michigan yellow perch is closed from May 1 to June 15. These rule changes are implemented to benefit perch population recovery by reducing impact on spawning stocks, and allowing mature adults to spawn multiple years in their life time. Presence of multiple year-classes in the spawning population as well as in the sport harvest is a positive change. However, the overall number and biomass of yellow perch population in the lake is declining further. The current regulation will remain in effect until a detailed analysis is complete on the status of yellow perch population.

Table 3. Yellow perch spawning assessment in Milwaukee waters (Green Can Reef) of Lake Michigan.

Year	Total	Males	Females	Sex-unknown	% Females	Total effort[1]
1995	1,272	1,233	39	0	3	17,000[2]
1996	4,674	4,584	90	0	2	14,400
1997	14,474	14,417	46	11	0.32	5,000[3]
1998	4,514	4,283	231	0	5.1	24,600[4]
1999	5,867	5,635	232	0	4	9,200
2000	855	722	133	0	15.5	3,700
2001	1,431	993	438	0	31	5,400
2002	1,812	1,645	167	0	9.2	2,500
2003	1,609	1,583	26	0	1.6	1,700
2004	1,143	997	144	0	12.6	2,100
2005	1,271	1,207	64	0	5	2,000
2006	1,741	1,580	161	0	9	2,500
2007	2,132	2,076	56	0	3	2,000
2008	326	209	117	0	35.9	4,000
2009	629	465	164	0	26	3,500

Year	Total	Males	Females	Sex-unknown	% Females	Total effort[1]
2010	616	486	130	0	21	3,000
2011	635	200	435	0	68.5	7,000
2012	147	112	35	0	24	2,000
2013	95	42	53	0	56	2,500

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

Year	Commercial harvest (lb. x 1000)	Sport harvest (number x 1000)
1995	128	214
1996	15[a]	41[b]
1997	Closed	27[b]
1998	Closed	36[b]
1999	Closed	23[b]
2000	Closed	16[b]
2001	Closed	121[b]
2002	Closed	88[b]
2003	Closed	66[b]
2004	Closed	42[b]
2005	Closed	33[b]
2006	Closed	68[b]
2007	Closed	66[b]
2008	Closed	20[b]
2009	Closed	51[b]
2010	Closed	51[b]
2011	Closed	17[b]
2012	Closed	9[b]
2013	Closed	9[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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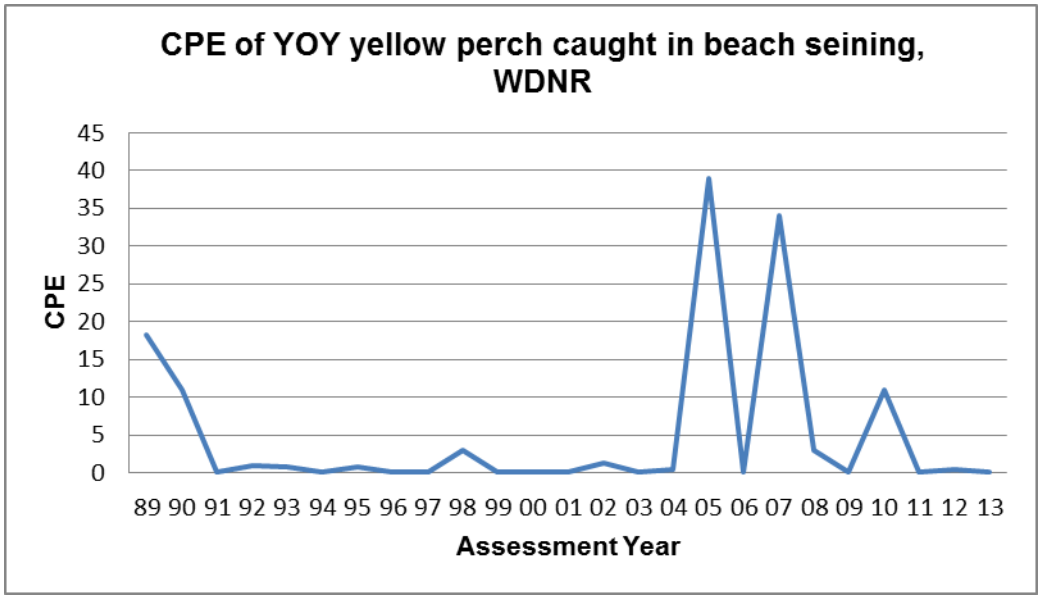

Figure 1. CPE (fish/100') of YOY yellow perch in summer beach seining, WDNR.

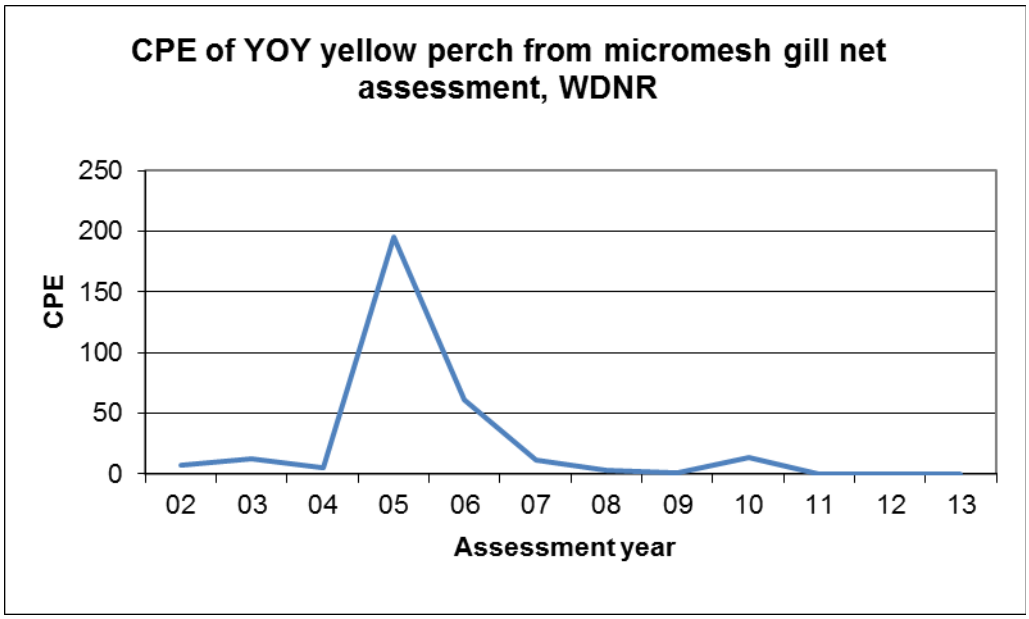

Figure 2. Catch per effort of young-of-the-year yellow perch captured in the micromesh gill net, WDNR, 2013.

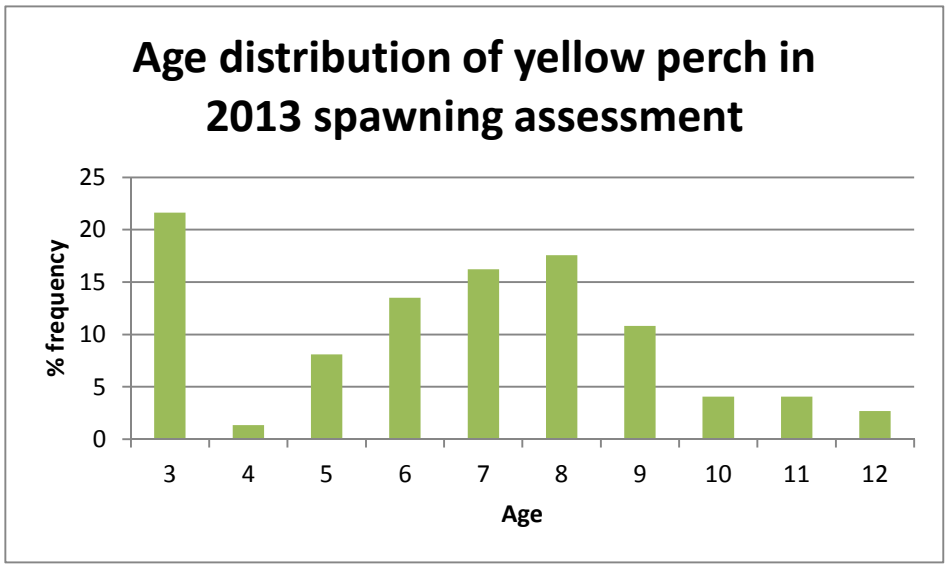

Figure 3. Age distribution of spawning population surveyed near Green Can Reef.

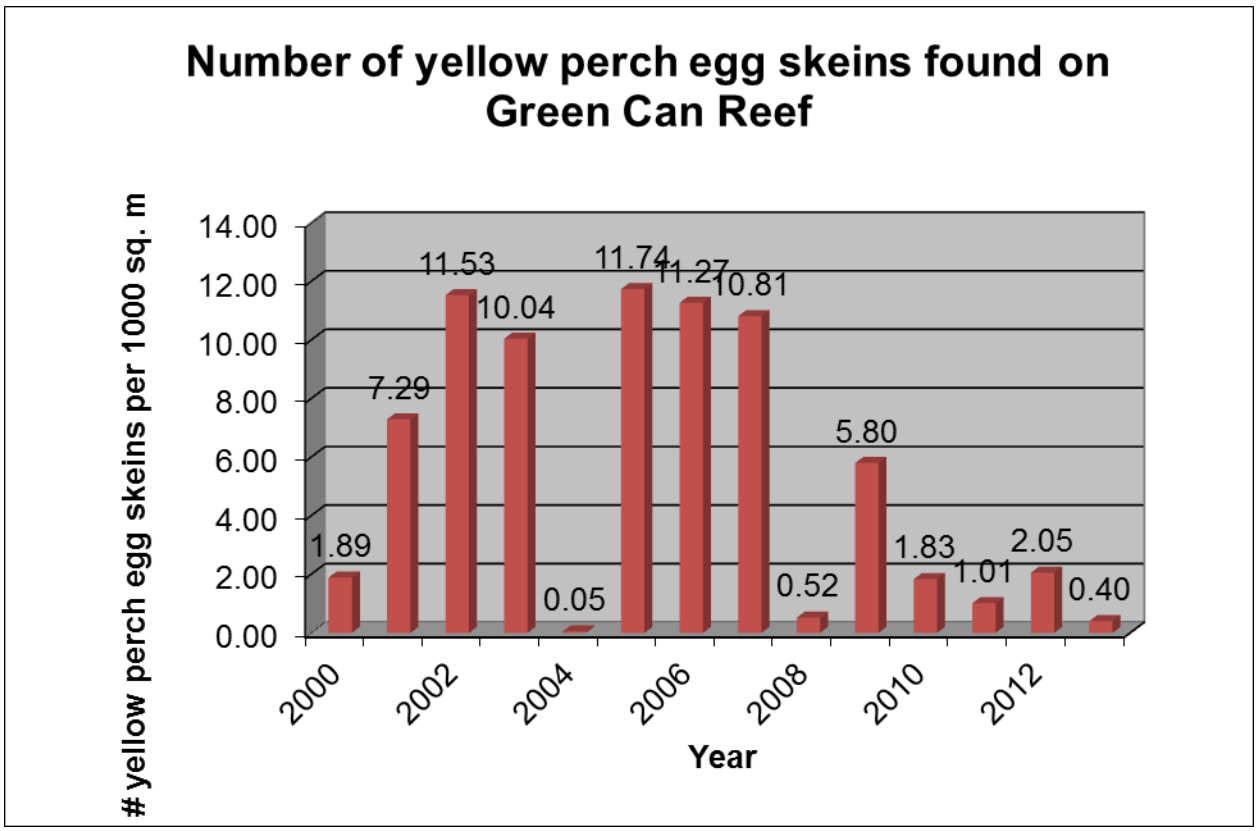

Figure 4. Yellow perch egg deposition survey in Lake Michigan near Green Can Reef, WDNR.

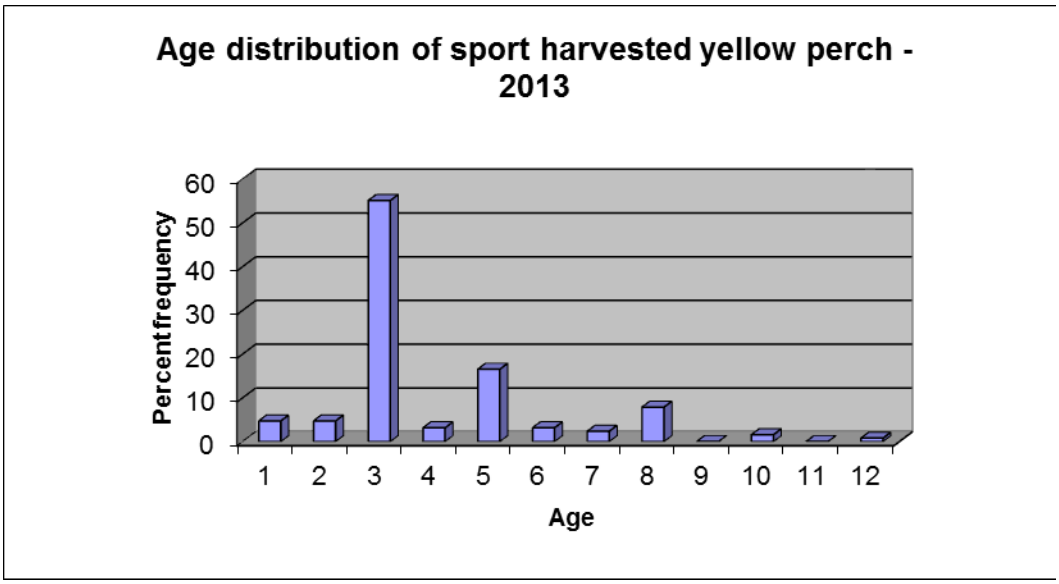

Figure 5. Age distribution of yellow perch in the winter graded mesh gillnetting assessment (GMA) in Lake Michigan, 2013.

SPORTFISHING EFFORT AND HARVEST

Wisconsin's Lake Michigan open water fishing effort was 2,779,161 hours during 2013, 2.59% above the five-year average of 2,708,890 (Table 1). Effort was well above the five-year average for some fishery types despite the modest overall increase. Most notable the charter boat effort increased by 11.9% and the stream fishery effort increased by 23.22% during 2013.

Wisconsin Lake Michigan trout and salmon anglers had a challenging season in 2013. Overall harvest was down, with 337,007 salmonids harvested; the harvest rate decreased to 0.1213, fish per hour (Table 3). Chinook again comprised the majority of the catch, with a harvest of 145,301. Fishing for Coho salmon started early and strong in 2013, with 89,061 fish harvested.

The open-water Yellow Perch harvest was 224,252 fish (Table 2), up considerably from 2012. The majority of the catch was comprised of the 2012 and 2010 year classes.

Walleye harvest was estimated at 91,524 fish, an increase from 2012. The Northern Pike catch was slightly lower in 2013 with 1,463814 fish caught. Smallmouth Bass harvest was 7,206 fish, a slight decrease from 2012.

For more summaries, check out Wisconsin's Lake Michigan website at:
http://dnr.wi.gov/topic/fishing/lakemichigan/ManagementReports.html

Table 1. Fishing effort (angler hours) by various angler groups in Wisconsin waters of Lake Michigan and Green Bay during 2013 and percent change from the 5-year average (2009-2013).

YEAR	RAMP	MOORED	CHARTER	PIER	SHORE	STREAM	TOTAL
2013	1,483,258	366,843	325,033	161,609	147,289	295,129	**2,779,161**
% change	-0.12%	-3.39%	11.90%	-2.96%	-0.25%	23.22%	**2.59%**

Table 2. Sport harvest by fishery type and species for Wisconsin waters of Lake Michigan and Green Bay during 2013

SPECIES	RAMP	MOORED	CHARTER	PIER	SHORE	STREAM	**TOTAL**
Coho salmon	39,348	13,771	29,478	1,573	1,118	3,773	**89,061**
Chinook salmon	41,021	41,346	42,111	1,790	5,177	13,856	**145,301**
Rainbow trout	16,771	14,729	19,714	444	997	5,656	**58,311**
Brown trout	6,208	1,947	2,009	2,154	2,739	2,037	**17,094**
Brook trout	0	0	0	0	0	0	**0**
Lake trout	8,802	6,136	12,115	0	174	13	**27,240**
Northern pike	1,187	0	0	51	71	154	**1,463**
Smallmouth bass	3,869	2,128	0	466	532	211	**7,206**
Yellow perch	179,532	25,650	0	2,560	6,449	10,061	**224,252**
Walleye	81,888	826	0	91	0	8,719	**91,524**
TOTAL	**378,626**	**106,533**	**105,427**	**9,129**	**17,257**	**44,480**	**661,452**

Table 3. Total number of fish harvested by year by species across all angler groups in Wisconsin waters of Lake Michigan, 1998-2013.

Species	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL (SINCE 1986)
Brook Trout	159	574	199	263	144	126	1	18	17	62	13	27	0	26	18	0	39,040
Brown Trout	27,371	37,187	40,966	26,421	35,220	23,654	20,918	27,489	17,769	37,947	23,763	15,792	13,029	9,936	21,337	17,094	1,065,253
Rainbow Trout	110,888	84,248	71,829	72,854	74,031	48,548	25,529	48,490	48,420	62,249	41,552	46,529	49,121	75,442	75,981	58,311	1,933,142
Chinook Salmon	136,653	157,934	136,379	191,378	275,454	317,619	360,991	418,918	398,905	431,143	256,796	214,621	315,294	169,752	390,385	145,301	6,453,849
Coho Salmon	59,203	56,297	87,927	47,474	102,313	50,625	76,944	59,244	56,136	94,677	25,453	42,690	42,445	157,367	73,395	89,061	2,275,219
Lake Trout	82,247	39,819	31,151	40,408	39,865	23,881	14,209	14,139	10,638	19,281	12,763	14,946	17,483	17,788	29,094	27,240	1,322,699
TOTAL	**416,521**	**376,059**	**368,451**	**378,798**	**527,027**	**464,453**	**498,592**	**568,298**	**531,885**	**645,359**	**360,340**	**334,605**	**437,372**	**430,311**	**590,210**	**337,007**	**13,089,202**
Harvest Per Hour	0.1451	0.1331	0.1614	0.1382	0.1789	0.1719	0.1904	0.2036	0.1916	0.2108	0.1443	0.1171	0.1539	0.1693	0.2337	0.1213	0.1468

Table 4. Total number of salmonids harvested by year by angler group in Wisconsin waters of Lake Michigan, 1998-2013.

Fisheries Type	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL (SINCE 1986)
Ramp	155,953	141,903	170,081	156,470	236,241	196,235	195,953	241,535	197,833	254,231	115,698	113,446	161,917	172,438	261,944	112,150	5,055,704
Moored	141,538	100,078	68,872	85,435	110,094	111,148	130,418	149,845	128,666	164,286	92,635	91,986	127,356	103,547	122,008	77,929	3,441,151
Charter	84,867	73,622	91,665	76,868	106,631	100,037	123,995	137,922	152,749	173,250	110,481	91,333	117,004	121,043	174,776	105,427	3,050,606
Pier	4,200	4,614	4,402	7,327	10,629	8,464	11,329	9,284	8,835	15,440	6,487	7,975	8,203	4,432	9,023	5,961	329,232
Shore	8,997	12,685	13,971	18,308	20,111	14,995	11,175	8,557	13,472	16,394	10,191	8,519	6,398	8,544	6,900	10,205	415,688
Stream	20,966	43,157	19,460	34,390	43,321	33,574	25,722	21,155	30,330	21,758	24,848	21,346	16,494	20,307	15,559	25,335	796,821
TOTAL	**416,521**	**376,059**	**368,451**	**378,798**	**527,027**	**464,453**	**498,592**	**568,298**	**531,885**	**645,359**	**360,340**	**334,605**	**437,372**	**430,311**	**590,210**	**337,007**	**13,089,202**

* Totals represent total number of salmonids harvested from 1986 – 2013.

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GREEN BAY BROWN TROUT

Tammie Paoli

This report summarizes assessments and management actions for brown trout in Green Bay waters of Lake Michigan completed in 2013.

Background

The Wisconsin Department of Natural Resources has stocked various salmonid species into Green Bay since the 1960's. The initial intent of that stocking effort was to control introduced prey species like alewives and rainbow smelt while providing a quality near shore and offshore fishery for Green Bay anglers. Brown trout provided a consistent early season nearshore and summer trolling fishery, along with other stocked salmonines. Creel survey results indicate that harvest and return rates for Green Bay brown trout were exceptional throughout the late 1980's and 1990's. Since 2000, brown trout fishing has experienced a sharp decline. Stocking numbers for Green Bay have varied somewhat since the 1980's but, in general, remain fairly consistent until 2010 when fingerling stocking was greatly reduced. Beginning in 2011, fingerling stocking was eliminated, and only yearling brown trout are currently stocked into Green Bay (Figure 1). This change was made because of the assumed low survival of small fall fingerling trout, combined with several fall stocking events where bird predation was evident.

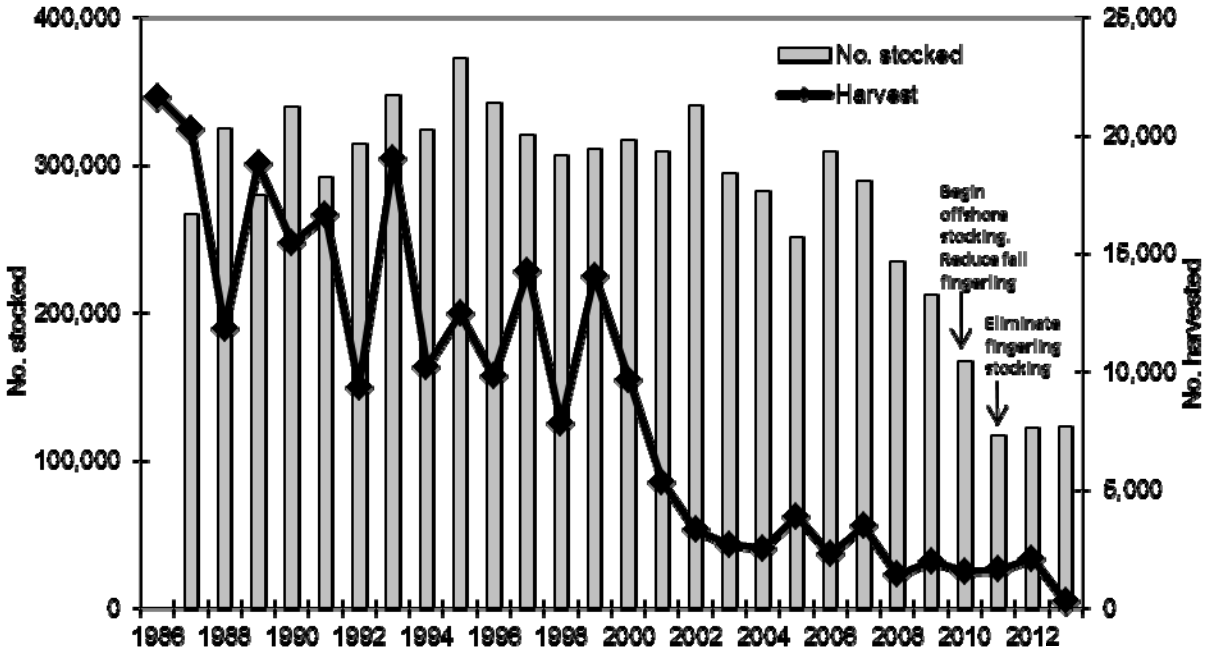


Figure 1. Number of stocked and harvested brown trout in Wisconsin waters of Green Bay by year. Fingerling stocking was reduced in 2010 and eliminated in 2011. Only yearling brown trout are currently stocked into Green Bay waters.

Return to creel of brown trout in Green Bay has fallen from an average of 4% prior to 2000 to 1% or less from 2001 to present. A comprehensive review of brown trout data and related fisheries information was completed in 2009. The problem was discussed at several meetings of the Lake Michigan Fisheries Team throughout 2009 and forwarded to the Fisheries Management Board. In January 2010, the FM Board adopted a plan to stock fish offshore to avoid nearshore predators and to discontinue stocking fall fingerlings into Green Bay. That plan seeks an integrated

approach to adjust stocking strategies with the following management objective:
Two indices measured by creel surveys for Green Bay waters (% return and total harvest of brown trout) will trend towards the targets within five years of implementation of the plan. Results should indicate consistent returns from stocking levels. Fishing pressure will be considered in the analyses to determine if changes in harvest or return rate are associated with changes in effort. Lastly, catch per unit effort of fall electrofishing surveys in the lower Menominee River will continue to serve as a fishery-independent index of brown trout abundance in Green Bay.

The target indices are:

a) Total harvest greater than or equal to 4% of number stocked BNT. This return rate is comparable to return rates for Green Bay prior to 2000; OR
b) Total harvest of 5,000 or more fish based on 126,000 yearlings stocked annually into Green Bay, AND
c) Brown trout harvest rate less than or equal to 23 hours per fish based on targeted total salmonid fishing effort.

Management Actions
Sharp reductions in fall fingerling stocking and implementation of offshore stocking began in 2010 using the U.S. Fish and Wildlife Service vessel RV Spencer Baird, and complete implementation (discontinue fall fingerlings; maintain offshore stocking) began in 2011 using a WDNR pontoon cage. The newly acquired WDNR vessel RV Coregonus was first used in 2012 to haul fish offshore, and continued in 2013 (Table 1).

Creel Results and Discussion
The harvest estimate for Green Bay brown trout in 2013 reached an all-time low of 270 fish, down from 2,060 fish in 2012. Annual harvest remains well below the target of 5,000 fish. Harvest rates were also dismal in 2013 (123 hours/fish), considerably up from 2012 (20 hours/fish). The fishing effort for salmonids in Green Bay was at an all-time low in 2013 at 33,107 angler hours, down from 42,119 angler hours in 2012. The previous 26-year average (1986-2011) is 163,099 angler hours per year.

Table 1. Green Bay brown trout stocking information for 2013.

Date	***Location***	***Strain/Size***	***Number***	***Clip***	***# fish/lb.***	***Rearing Facility***	***Vessel Used***
6-Feb-2013	Under ice Grid 804	Seeforellen yearling	19,504	ALM	7.2	Wild Rose SFH	--
8-Feb-2013	Under ice Grid 804	Seeforellen yearling	10,572	ALM	7.5	Wild Rose SFH	--
6-May-2013	Offshore Grid 804	Seeforellen yearling	37,639	--	6.1	Wild Rose SFH	RV Coregonus
8-May-2013	Offshore Grid 703	Wild Rose yearling	52,685	--	3.8	Thunder River	RV Coregonus
8-May-2013	Menominee River	Wild Rose yearling	2,561	--	4.4	Thunder River	--
		Total yearlings	**122,961**				

Brown Trout Derby
The Marinette-Menominee Great Lakes Sportfishing Club has sponsored a summer Brown Trout Derby for over 30 years. Data sets from this derby indicate that upwards of a thousand brown trout were typically harvested during the 2-day event. However, from 2001 to 2011, the number

of brown trout registered in the derby was much lower than the previous two decades. In 2012, The number of brown trout registered increased to 211 fish, but then fell to 16 in 2013 (Table 2).

Table 2. Number and mean weights of fish harvested during the two-day MMGLSF Brown Trout Derby.

	BROWN TROUT		*CHINOOK*		*RAINBOW TROUT*		*WALLEYE*	
	#	**Avg lb.**	**#**	**Avg lb.**	**#**	**Avg lb.**	**#**	**Avg lb.**
2006	28	5.4	693	10	10	4.1	44	2.3
2007	143	5.9	969	8.5	54	6	22	2.9
2008	102	8.4	730	8.4	47	5.6	30	3.1
2009	26	7.8	444	8.7	18	6.5	21	3.1
2010	89	8	818	9.6	39	4.9	55	3.8
2011	13	8.5	87	9.6	10	5.5	231	2.8
2012*	211	6.9	344	10.4	165	4.5	23	3.8
2013*	16	7.9	60	9.8	7	9.0	13	4.5

*Participants allowed to register only one fish per species per day in 2012 and 2013. Past rules allowed for all legal-size fish to be registered.

Fall Electrofishing Surveys

Electrofishing surveys targeting brown trout on the lower Menominee River were completed on September 23, October 10, 14, 23, 30, and November 5 and 12, 2013, with a combined CPE of 4.4 fish/hour (Figure 2). Forty-eight brown trout were captured (29 males; 19 females), with a mean length of 23.6 inches. The majority (27) of the fish were captured on October 23. High flows in excess of 3000 cubic feet per second in November prevented the shocking boat from surveying the area immediately below the dam, which is where many trout are typically captured. Beginning in 2010 as a result of offshore stocking, no brown trout have been stocked by WDNR into the Menominee River. Michigan DNR annually stocks approximately 28,000 brown trout yearlings into the Menominee River. Those fish receive a unique fin clip. WDNR fall surveys have only captured one fish with a MDNR clip since 2010.

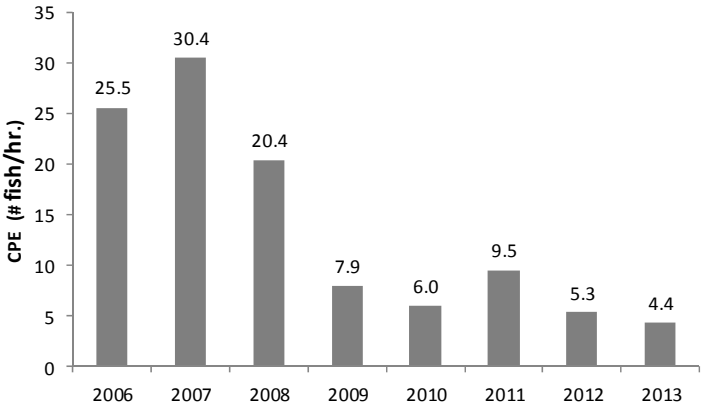


Figure 2. CPE (# fish/hour) of brown trout captured during fall electrofishing surveys on the lower Menominee River, 2006-2013.

Floy-tagging Studies and Voluntary Fishing Logs

Since 2009, WDNR and the Marinette-Menominee Great Lakes Sportfishing Club have cooperatively floy-tagged yearling trout that are stocked into the Menominee Marina for the club-sponsored annual Kid's Fishing Day. The goal of this tagging project is to gain information on harvest return and movement of fish. Excluding the fish that were harvested for the Kid's Fishing Day, the percent return from fish stocked in each year is listed in Table 3.

Table 3. Trout floy-tagged at Menominee Marina for Kid's Fishing Day by MMGLSF Club, June 2009-2013.

Year	Species	# tagged	mean size (inches)	% return[a]
2009	Brown trout	392	11.1	4.6%
2010	Brown trout	772	8.6	0
2011	Brown trout	22	8.0	0
2011	Rainbow trout	415	10.1	1.9%
2012	Brown trout	1118	10.1	2.3%
2013	Brown trout	947	10.6	1.2%

[a]As of Oct 2014. Fish caught during Kid's Derby were excluded and fish captured and released during surveys were included in % return calculations.

WDNR distributed voluntary fishing logbooks to anglers who frequently target brown trout on Green Bay. Data obtained from those logbooks is summarized in Table 4. The number of brown trout caught increased substantially in 2012. A total of five anglers who turned in logbooks reported catching only 9 brown trout in 2013 (Table 4).

Table 4. Information from voluntary fishing logbooks, 2010-2013.

	2010	2011	2012	2013
# logbooks turned in	12	5	17	5
# brown trout caught	32	48	412	9
Average of Catch per Effort (hours per fish)	6.7	4.1	4.5	3.1
Average of length (in.)	24.4	21.7	22.1	20.0

Summary

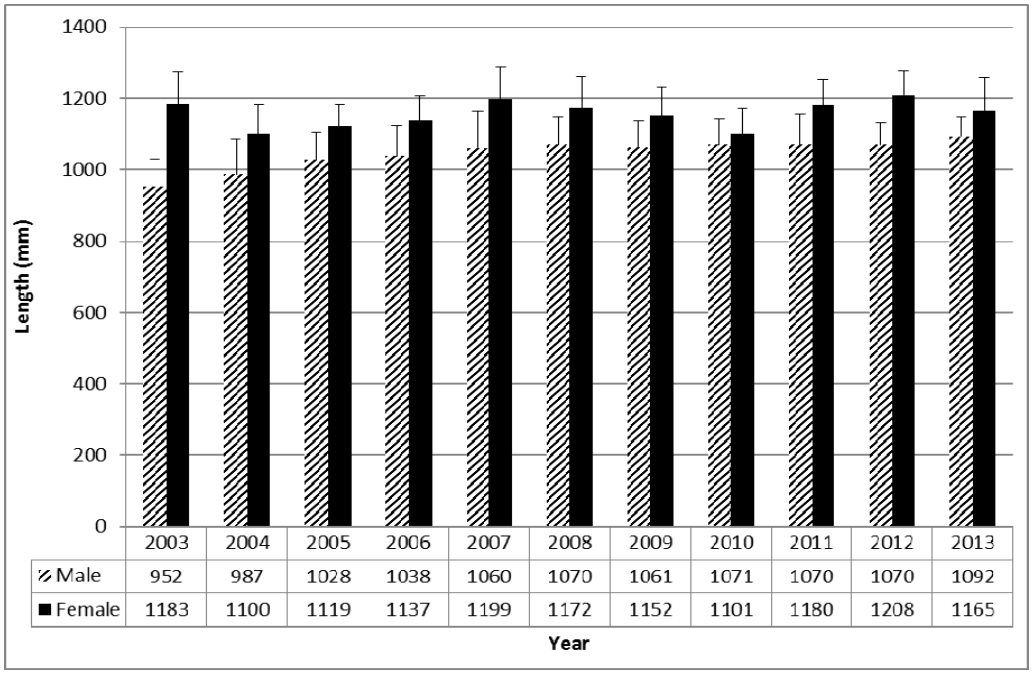
In 2011 and 2012, low harvest rates are near or below the target of 23 hours/fish were encouraging. However, this trend did not continue in 2013 when total harvest and harvest rate of Green Bay brown trout was dismal. One explanation may be reduced fishing effort by anglers targeting salmonids in 2013. Salmon and trout sport trolling in Green Bay and much of Lake Michigan was not ideal throughout most of 2013, with a late spring coupled with many strong wind events that affected stratification of Green Bay. Sudden water temperature fluctuations affect prey distribution, particularly round goby and alewife, which in turn affects predator behavior and catchability. Over the next few years, WDNR will continue to closely monitor total harvest and harvest rates of brown trout in Green Bay to determine if those indices are responding over the long term to the new stocking strategy that began in 2010.

STATUS OF GREAT LAKES MUSKELLUNGE IN WISCONSIN WATERS OF GREEN BAY, LAKE MICHIGAN

The Wisconsin Department of Natural Resources (WDNR) in cooperation with several local musky clubs and the Musky Clubs Alliance of Wisconsin initiated a Great Lakes strain muskellunge reintroduction program in 1989 in the Green Bay waters of Lake Michigan. A three-phase plan was drafted by WDNR biologists to re-establish a self-sustaining population of muskellunge in Green Bay: (1) identify an appropriate egg source, obtain eggs, and successfully hatch, rear and stock fish, (2) establish an inland lake broodstock population, and (3) develop a self sustaining population in Green Bay (Kapuscinski 2007).

Annual Assessments

Nearly annual assessments to determine the status of the Green Bay muskellunge population have been conducted using fyke nets in spring and electrofishing in fall since 2003. In 2013, the average length of the fifteen males captured in fyke nets was 1092 mm (43.0") (Figure 1). The average size of male musky captured during the spring sampling period has trended slightly upward since 2004. The average length of the eight females captured during spring fyke netting in 2013 was 1165 mm (45.9"). The 2013 average length was the near the average length of female musky captured since 2003.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Male	952	987	1028	1038	1060	1070	1061	1071	1070	1070	1092
Female	1183	1100	1119	1137	1199	1172	1152	1101	1180	1208	1165

Figure 1. Average length distributions of male and female muskellunge captured during spring netting surveys of the lower Fox River from 2003-2013.

Nighttime electrofishing surveys have been conducted along the length of the Fox River from the mouth to the DePere dam during October since 2000 to index muskellunge and walleye

populations. However since 2009, these surveys have been generally conducted two weeks earlier than in previous years to better sample walleye. During the 2013 fall electrofishing survey we did not capture any musky although several were observed. Since the onset of the earlier start date in 2009, fall CPUE has sharply declined. Other factors such as reduced stocking number and avoidance of favored fall shoreline holding areas in the Fox River because of dredging activities may have contributed to the decline as well.

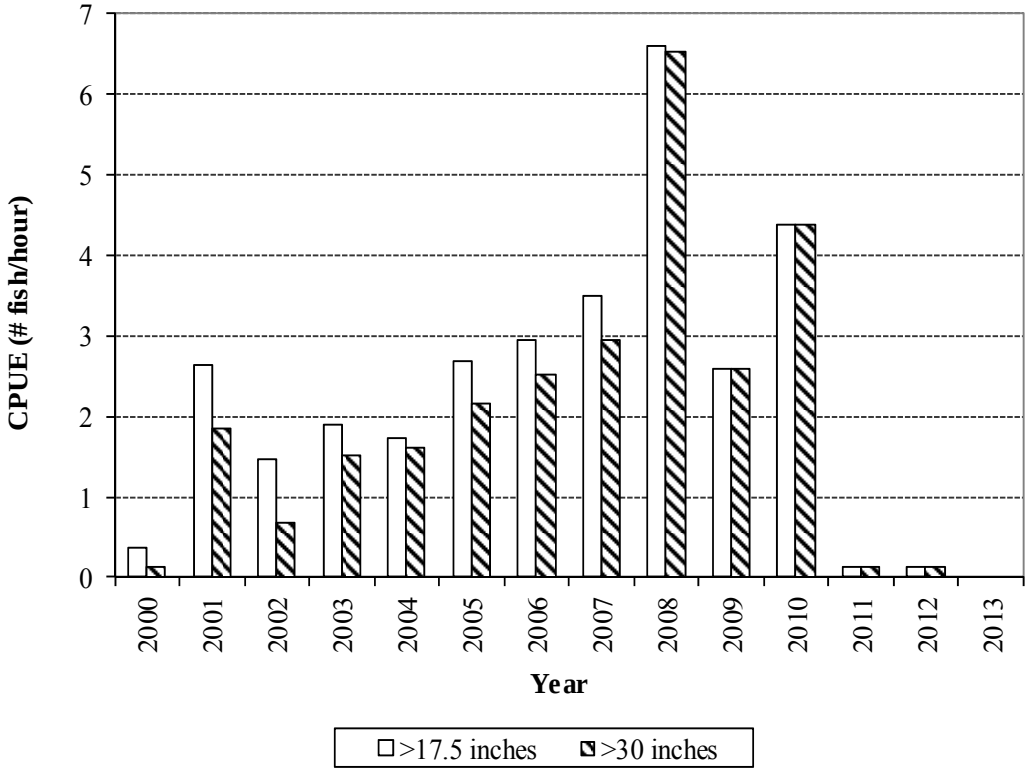


Figure 2. Catch per Unit Effort (CPUE) from night time electrofishing on the Fox River for muskellunge greater than 450mm (17.5in) and greater than 762mm (30in) from 2000- 2013.

Stocking

Since the beginning of the restoration project, stocking numbers have varied greatly. During the first thirteen years of the program (1989-2001), hatchery production averaged 2,600 fingerling and yearling musky per year (Table 1). Average annual stocking number increased to 20,500 from 2002 to 2006 as eggs from multiple sources were raised at Wild Rose Hatchery. After VHS was found in the Wisconsin waters of Lake Michigan, musky stocking dropped to less than 1,000 fish stocked between 2007 and 2009. Stocking resumed in 2010 when Department policy allowed for eggs to be collected from ripe musky from the Fox River with fertilized eggs and fingerlines raised at the Besadny Anadromous Fisheries Facility (BAFF) near Kewaunee, WI. From 2010 through 2013, the average annual stocking of musky averaged 3,900 fall fingerling. Since the onset of the program fingerling and yearling musky have been stocked throughout southern Green Bay including the Fox River (Figure 3).

Table. 1. Stocking numbers of Great Lakes Spotted Musky from 1989 through 2012 by age class.

Stocking	Fingerlings	Yearlings
1989	5261	0
1990	1274	9
1991	2624	0
1992	2107	152
1993	1394	215
1994	0	237
1995	1803	0
1996	3135	247
1997	1842	130
1998	4311	278
1999	3305	294
2000	2451	295
2001	1854	176
2002	9281	140
2003	33107	103
2004	20772	161
2005	18609	325
2006	18785	421
2007	0	640
2008	0	0
2009	0	0
2010	2791	0
2011	5242	0
2012	5100	0
2013	2522	0

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

Fishery

The Lake Michigan creel survey estimated that a total of 52,266 hours of directed effort for muskellunge occurred on Green Bay and the lower Fox River from March 15th through October 31st, 2013 (Figure 4). This was a substantial increase in directed fishing effort over the 2012 total of 22,595 hours and is the greatest amount of directed effort measured since 2005. It is likely that this value underestimates total effort since a substantial amount of angling goes on in November after the creel survey ends. The creel survey estimated that CPUE was 0.028 fish per hour in 2013 which was an increase over the 2012 CPUE of 0.012 but still was much less than CPUE recorded in 2005 and 2006. In 2013 the creel survey estimated that anglers caught 1,454 musky with an estimated harvest of zero. Similar to CPUE, catch in 2013 was up substantially from the estimated catch in 2012.

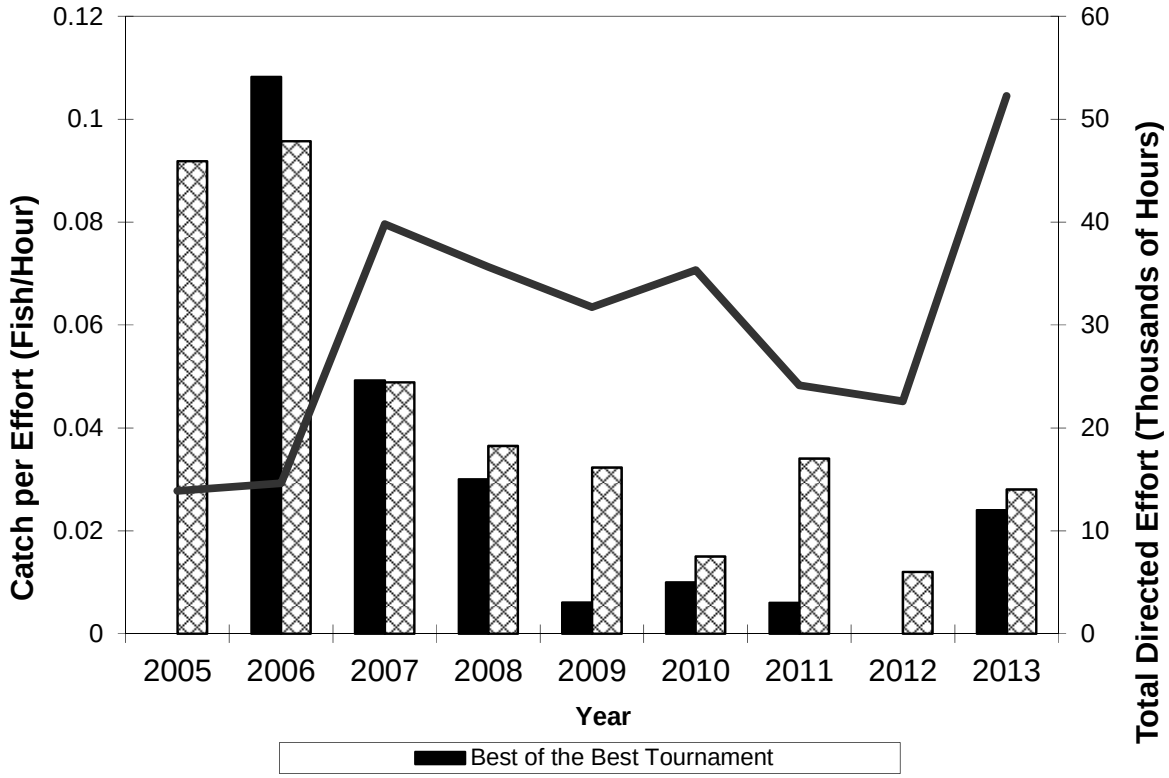


Figure 4. Total directed fishing effort for muskellunge on Green Bay waters of Lake Michigan from 2005-2012 is displayed by the solid black line and on the right axis. The left axis shows catch rate in number of muskellunge caught per hour of directed fishing, the estimated catch rate from creel surveys is displayed by hatched bars, and the catch rate from the Muskies Inc. "Best of the Best Tournament" is shown by the black bars.

Figure 4 also shows the catch rates from a Muskies Inc. tournament that has been held annually on the lower part of the Bay and the Fox River since 2006. This tournament is conducted over 2 days but during the most active period of muskellunge angling. The similarity in values of the tournament census data and the creel estimates from 2006 through 2008 indicates that that creel survey estimates were doing a good job at estimating CPUE despite the lack of coverage during November. However, recently this relationship has not been as strong as creel estimates of CPUE have been higher than tournament CPUE. In 2012, anglers fishing in this tournament did not report any musky being captured. Catch improved in 2013 with tournament anglers registering seventeen musky. It is likely that a combination of factors including poor fishing conditions during the Best of the Bay Tournament, changes in musky movement patterns caused by warmer water temperatures and the decline in the number of available musky are responsible for much of the decline in CPUE noted the past several years.

Future

The population trend of adult Great Lakes strain muskellunge in Green Bay waters is unknown. Stocking currently maintains the population with only a few natural recruits captured during recent surveys on the Menominee River and Little Sturgeon Bay. Increased stocking the past four years should increase the number of musky available to anglers in Green Bay waters in upcoming years. Based on creel survey results, it appears that the population is spreading out from the Fox River and lower Green Bay to more northern waters as creel surveys have found good numbers of musky in the Menominee, Peshtigo Rivers and the Sturgeon Bay area.

Fishing effort has sharply increased since 2005 prompting concern among musky anglers regarding overharvest despite low harvest estimates from the creel survey. This concern has lead to development of a new management plan and anglers at a 2013 Conservation Congress spring meeting voted to increase the minimum size limit for Great Lakes Muskellunge in the Wisconsin waters of Green Bay from 1270 mm (50") to 1372 mm (54") beginning April 1, 2014. Other ongoing projects will focus on increasing hatchery production and on spawning habitat restoration.

References

Kapuscinski, K. L., B.J. Belonger, S. Fajfer, and T.J. Lychwick. 2007. Population Dynamics of muskellunge in Wisconsin waters of Green Bay, Lake Michigan, 1989-2005. Environmental Biology of Fishes 79:27-36.

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2013 STATUS OF WALLEYE IN GREEN BAY AND THE LOWER FOX RIVER

Background

Walleye stocks in southern Green Bay were decimated during the early to mid 1900s by habitat destruction, pollution, interactions with invasive species, and from over-exploitation. Following water quality improvements in the early 1970's, the Wisconsin Department of Natural Resources began to stock fry and fingerlings to rehabilitate the walleye population (Schneider et al 1991). Stocking began in the Sturgeon Bay area and later expanded to include the lower Fox River (downstream from the DePere Dam). This stocking (fingerlings and fry) was so successful in southern Green Bay and the lower Fox River that it was discontinued in 1984 to allow surveys to determine if substantial natural reproduction and recruitment was occurring. However, stocking in the Sturgeon Bay area resumed in 1994 and continues with a mix of fry and fingerling being stocked to augment the population. The total number of number of walleye stocked in Wisconsin waters of Green Bay has varied by location and year with over 70,000,000 fry and 4,500,000 fingerling stocked into Green Bay and the Fox River since 1973. Kapuscinski et al (2010) provides a detailed description of walleye stocking across the entire bay covering the years of 1973 to 2005 that show the numbers and mix of ages stocked by Wisconsin and Michigan.

Table 1. Walleye stocking in Wisconsin's Green Bay waters since 1972. Walleye totals are in millions of fish stocked and are divided into two time periods: 1972 to 1984 (Rehabilitation phase) and 1994-2012 (Augmentation phase). No walleye were stocked from 1985 to 1993 and walleye stocked during the 1994 to 2012 period were all stocked in the Sturgeon Bay area.

	Fry		Fingerling	
Year	Green Bay	Fox River	Green Bay	Fox River
1973-1984	29.0	44.0	3.06	0.058
1994-2012	1	0.0	1.46	0.0

Although spawning abundance and young of year (YOY) production have been variable since monitoring began, the stock has not been augmented through stocking in southern Green Bay or the Fox River since 1984 and the walleye population is considered to be self-sustaining. The purpose of this report is to summarize data collected during the 2013 field season on the southern Green Bay / lower Fox River walleye stock, and to describe long-term trends in YOY production and angler catch and harvest.

Fall electrofishing index surveys

Recruitment of YOY walleye

Results of our 2013 electrofishing index surveys show that the relative abundance of young of the year (YOY) walleye at the fall fingerling stage was the highest measured for the Fox River since

1993 (Figure 1) and indicates that 2013 will likely be a strong year class. The 2013 age 0 catch per unit effort (CPUE) from the Fox River was 66.3 YOY/hour of electrofishing which is well above the 1993-2012 average of 12.9 YOY/hour. The southern Green Bay catch was 38.0 YOY/hour, which is above the 1993-2012 average of 8.1 YOY/hour. The difference between the bay and river catch rates may be attributed either to differences in spawning success or to differences in water temperatures that were noted between Green Bay and the Fox River at the time each was surveyed. The average length of YOY walleye in 2013 was 190 mm as compared to the 2012 average length of 238 mm. A short growing season and large numbers of YOY walleye likely contributed to smaller Age 0 fish in 2013 than seen in previous years. Year-class failures have not been observed in more than two consecutive years from the Fox River and Green Bay since the springs of 1999 and 2000 (Figure 1).

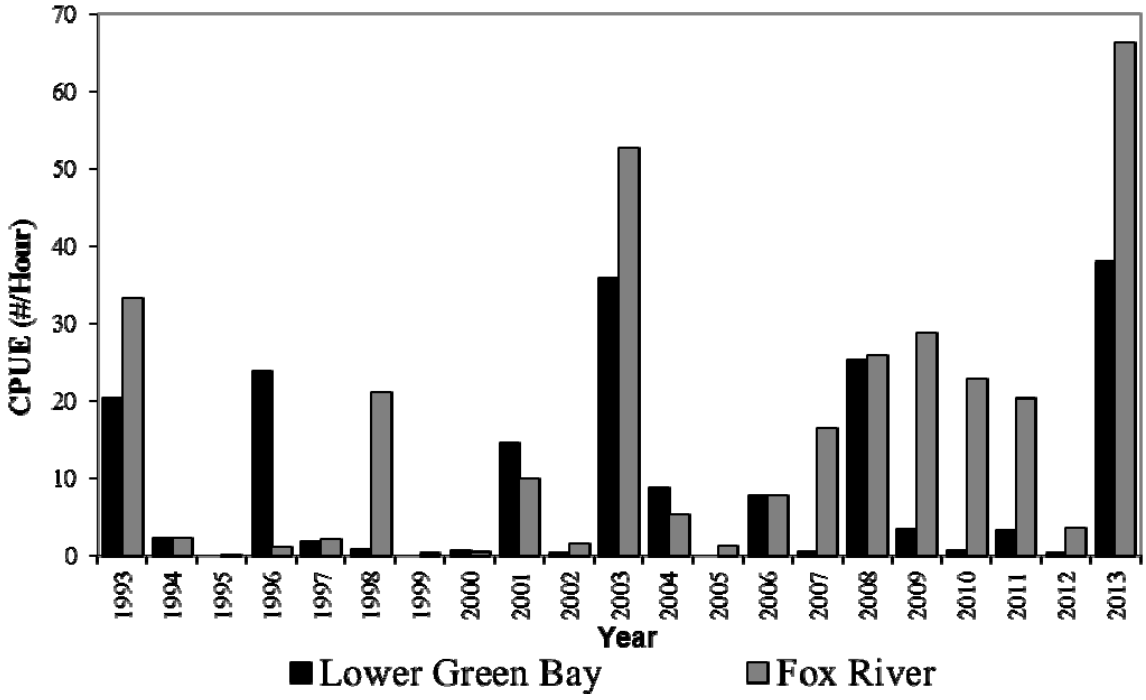


Figure 1. Relative abundance of young-of-year walleye in the lower Fox River (DePere Dam to mouth), lower Green Bay (south of a line drawn from Longtail Point to Point Sable), as measured by catch per unit effort (CPUE; number per hour) from data collected in electrofishing index surveys during 1993-2013.

Walleye stock size and age structure

In 2013, during our nighttime index electroshocking surveys on the lower Fox River, we captured 425 walleye that had average length of 256 mm (range 140 mm to 625 mm). The length-frequency distribution of captured walleye indicates that the stock's size structure is dominated by young walleye and that year-class failures, low recruitment, slow growth, or excessive mortality have not greatly impacted the population (Figure 2). Spines were collected from a stratified subsample (n=140) of walleye during electrofishing during the spring run and ages were estimated by cross sectioning and counting annuli. An age-length key was used to assign ages to un-aged individual fish by proportion of known aged fish at length from the sub-sample

(Isermann and Knight 2005). Fish from the 2013 year class (YOY) and from the strong year classes of 2007 through 2010 and to a lesser extent 2003 dominated our catch. It was notable that poor year classes prior to 2003 and from 2004 to 2006 were rarely caught in our surveys.

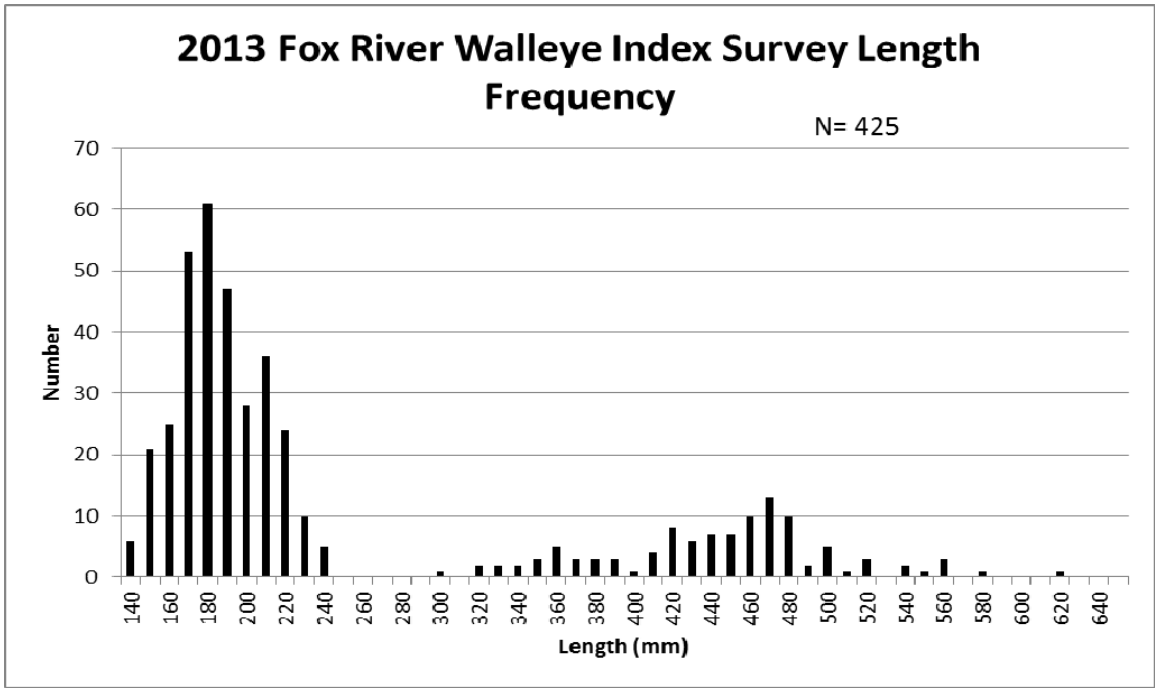


Figure 2. Length-frequency distribution of walleye sampled while electrofishing the lower Fox River during fall 2013.

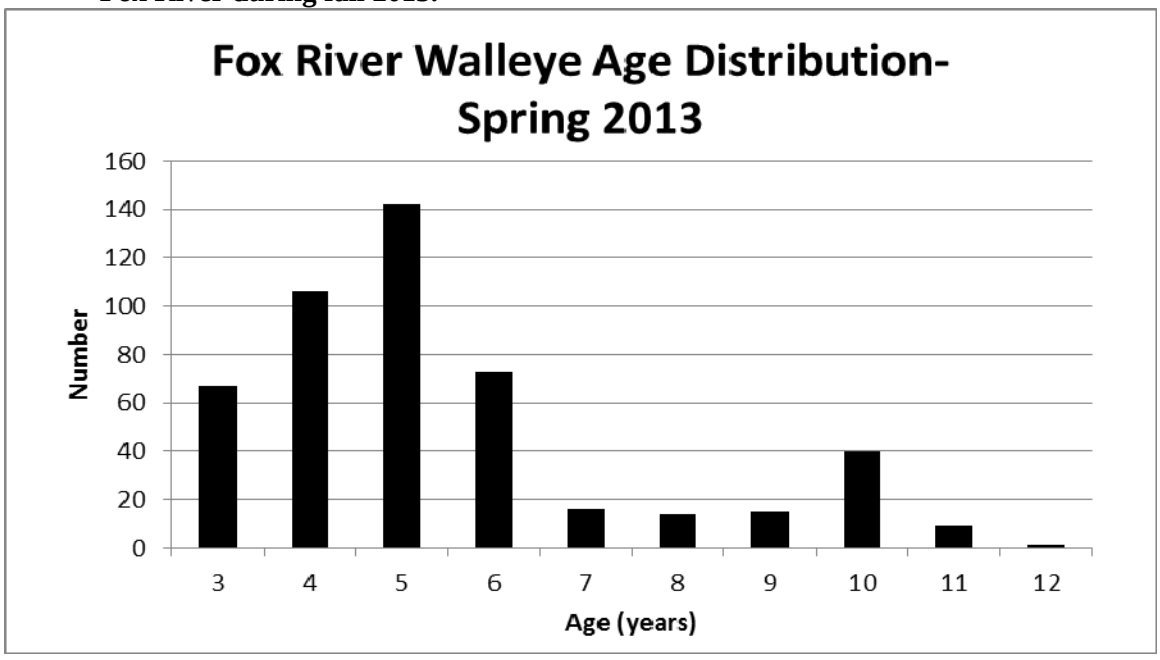


Figure 3. Estimated age-frequency distribution of walleye sampled while electrofishing on the lower Fox River during the spring of 2013.

On Green Bay, we captured 227 walleye that averaged 293 mm in length (range 126 mm to 672 mm) during fall index electroshocking (Figure 4). The size distribution of captured walleye from Green Bay was similar to the length frequency from the Fox River. Based on the age frequency (Table 3) from the Fox River, it is likely our Green Bay catch had a high proportion of age 5 (2008 year class) walleye in it.

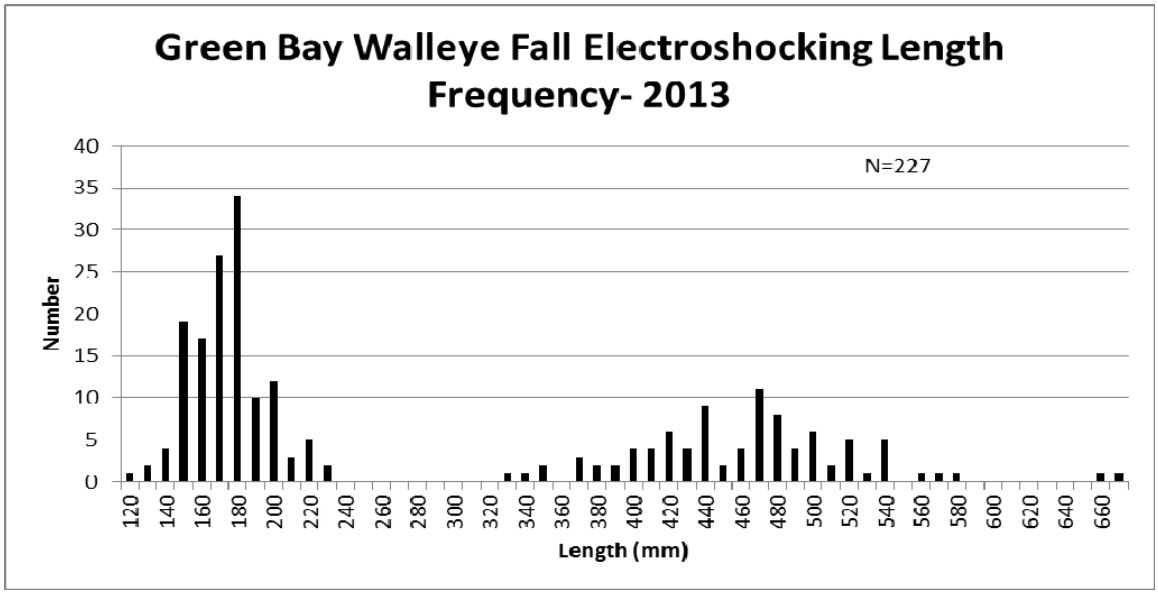


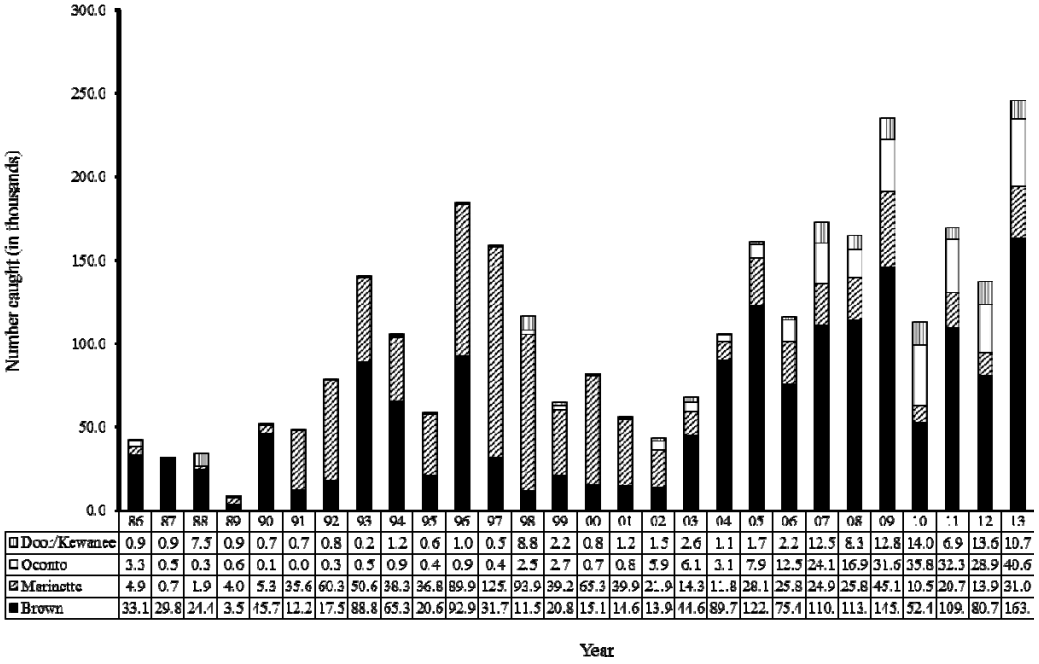
Figure 4. Length-frequency distribution of walleye sampled while electrofishing lower Green Bay during 2013.

Catch and Harvest

Total catch of walleye from Wisconsin waters of Green Bay was estimated by creel survey at 245,373 during the 2013 open water season (March–October 31) (Figure 5). This was a 79.1% increase from the estimated 137,042 walleye that were caught during the 2012 open water season. The 2013 walleye catch was highest measured since 1986 with increased catch measured in Brown, Oconto and Marinette Counties. The Door/Kewaunee catch slightly decreased in 2013 from the 2012 level.

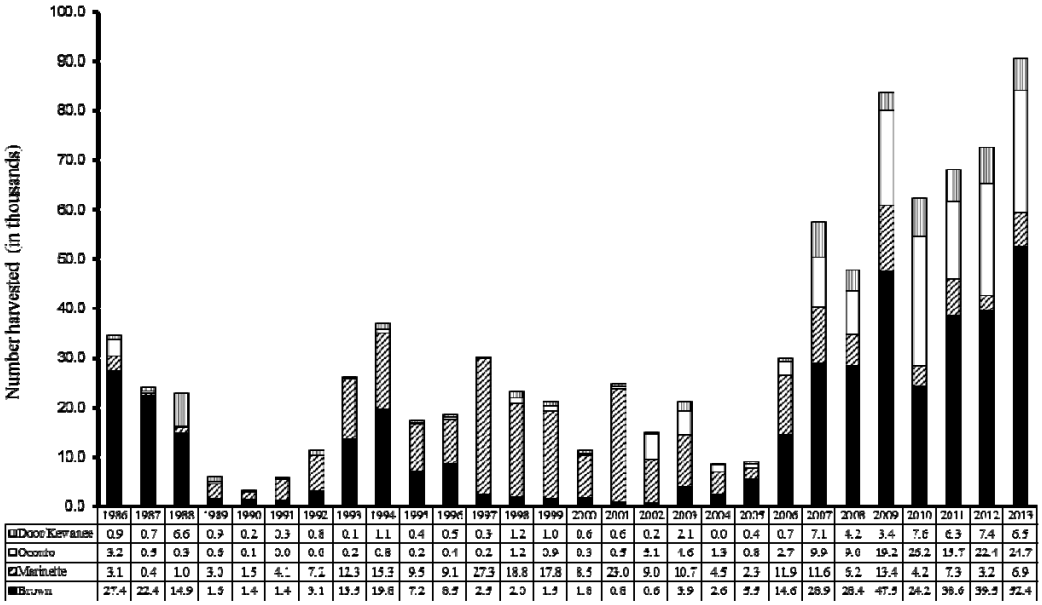
The total open water season harvest of walleye from Wisconsin waters of Green Bay increased by 24.9% from 72,481 harvested in 2012 to 90,498 in 2013 (Figure 6). The 2013 harvest of walleye was the highest measured since 1986 and was well above the average annual harvest from 1986 to 2012 of 29,340 walleye. In 2013, harvest increased in Brown, Oconto and Marinette Counties and decreased Door/Kewaunee Counties when compared 2012 harvest estimates.

Walleye catch and harvest has been relatively high since 2006, with the greatest contribution to the fishery from the lower Fox River, lower Green Bay and Oconto County. Increases in catch are likely due to strong year classes in 2003, and from 2008 to 2010. Walleye catch increased at a faster rate in 2013 than did harvest likely due to sublegal length fish being caught from an abundant 2011 year class and to lesser extent a poor 2012 year class.



	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13
Door/Kewaunee	0.9	0.9	7.5	0.9	0.7	0.7	0.8	0.2	1.2	0.6	1.0	0.5	8.8	2.2	0.8	1.2	1.5	2.6	1.1	1.7	2.2	12.5	8.3	12.8	14.0	6.9	13.6	10.7
Oconto	3.3	0.5	0.3	0.6	0.1	0.0	0.3	0.5	0.9	0.4	0.9	0.4	2.5	2.7	0.7	0.8	5.9	6.1	3.1	7.9	12.5	24.1	16.9	31.6	35.8	32.3	28.9	40.6
Marinette	4.9	0.7	1.9	4.0	5.3	35.6	60.3	50.6	38.3	36.8	89.9	125.	93.9	39.2	65.3	39.9	21..9	14.3	11..8	28.1	25.8	24.9	25.8	45.1	10.5	20.7	13.9	31.0
Brown	33.1	29.8	21.1	3.5	15.7	12.2	17.5	88.8	65.3	20.6	92.9	31.7	11.5	20.8	15.1	14.6	13.9	41.6	89.7	122.	75.1	110.	113.	145.	52.1	109.	80.7	163.

Figure 5. Estimated total open water season (March-October) walleye catch from Wisconsin waters of Green Bay and the lower Fox River by county during 1986-2013.



	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Door/Kewaunee	0.9	0.7	6.6	0.9	0.2	0.3	0.8	0.1	1.1	0.4	0.5	0.3	1.2	1.0	0.6	0.6	0.2	2.1	0.0	0.4	0.7	7.1	4.2	3.4	7.6	6.3	7.4	6.5
Oconto	3.2	0.5	0.3	0.6	0.1	0.0	0.0	0.2	0.8	0.2	0.4	0.2	1.2	0.9	0.3	0.5	5.1	4.6	1.3	0.8	2.7	9.9	9.0	19.2	25.2	15.7	22.1	21.7
Marinette	3.1	0.4	1.0	3.3	1.5	4.1	7.1	11.3	15.3	9.5	9.1	27.3	18.8	17.8	8.5	23.0	9.0	10.7	4.5	2.3	11.9	11.6	5.2	13.4	4.2	7.3	3.2	6.9
Brown	27.4	22.4	14.9	1.5	1.4	1.4	3.1	13.5	19.8	7.2	8.5	2.5	2.0	1.5	1.8	0.8	0.6	3.9	2.6	5.5	14.6	28.9	28.4	47.5	24.2	38.6	39.5	52.4

Figure 6. Estimated total open water season (March-October) walleye harvest from Wisconsin waters of Green Bay and the lower Fox River by county during 1986-2013.

The Future of the Sport Fishery

The future of the southern Green Bay/lower Fox River walleye stock and sport fishery appears to be very promising. Substantial walleye year classes have been measured the past six of seven falls during electroshocking with 2013 cohort being the strongest year class measured since 1993. Furthermore, year-class failures have not been observed in more than two consecutive years since 1999-2000 indicating strong recruitment on a regular basis. As the 2011 and 2013 year classes fully recruit to the fishery in the next couple of years, yearly harvest is likely to increase because these fish will obtain a size desired by anglers. Additionally, as contaminant levels continue to decrease from Fox River PCB clean-up, walleye harvest will likely continue to increase.

References

Isermann, D. A. and C. T. Knight. 2005. A computer program for age length keys incorporating age assignment to individual fish. North American Journal of Fisheries Management 25:1153-1160.

Kapuscinski, K., T.G. Zorn, P.J. Schneeberger, R.P. O'Neal, B.T. Eggold. 2010. The Status of Lake Michigan Walleye Stocks. *In* Status of walleye in the Great Lakes: proceedings of the 2006 Symposium. Great Lakes Fish. Comm. Tech. Rep. 69. pp 15-69.

Schneider, J. C., and five coauthors. 1991. Walleye rehabilitation in Lake Michigan, 1969-1989, p. 23-61. *In* P.J. Colby, C. A. Lewis, and R. L. Eshenroder [ed.]. Status of walleye in the Great Lakes: case studies prepared for the 1989 workshop. Great Lakes Fisheries Commission Special Publication 91-1.

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LAKE WHITEFISH

Scott Hansen

Commercial Harvest

Lake whitefish *Coregonus clupeaformis* harvest in Wisconsin waters of Lake Michigan and Green Bay was approximately 1.239 million pounds in 2013 and decreased by approximately 285,000 lbs. from 2012 resulting in the lowest annual harvest since 2002 (Figure 1). This is below the 20 year average of approximately 1.46 million pounds and is considerably different from the 2012 harvest that was the highest since 2001.

The commercial whitefish harvest in Wisconsin was formerly regulated on a "quota year" basis beginning in July and running through June of the following year, with a closed period during spawning in November. Beginning in 2012 the quota season now operates on a "calendar year" with the same closed period. The initial quota established in 1989-90 was 1.15 million pounds. It increased to 2.47 million pounds during the 1998-99 quota year. The quota was again increased during the 2009-10 quota year resulting in the current total allowable catch limit of 2.88 million pounds. The Wisconsin quota is allocated to three zones at roughly 9% of the quota for zones 1 and 3, and 82% for zone 2. However, the 2009-2010 quota increase of approximately 410,000 pounds was treated as a "Special Increase" and split equally among the zones (Table 1).

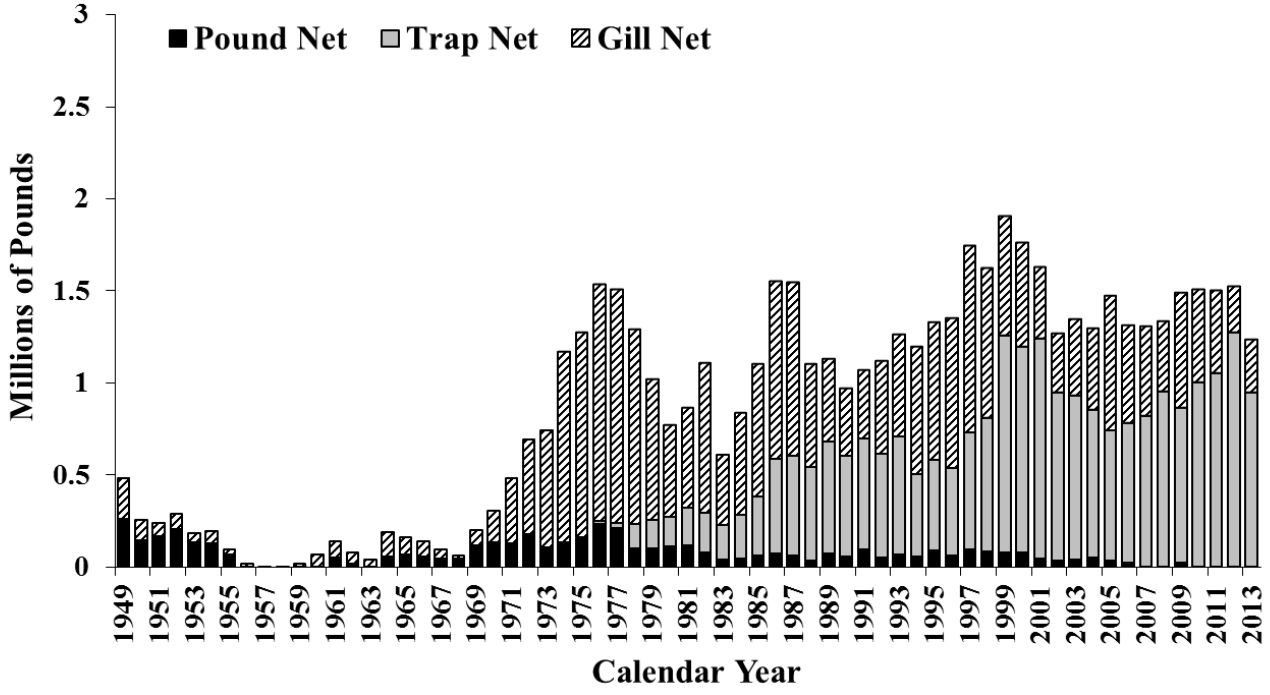


Figure 1. Lake whitefish calendar year commercial harvest reported by gear type in pounds (dressed weight) from Wisconsin waters of Lake Michigan including Green Bay from 1949 through 2013.

Wisconsin commercial fishermen have used trap nets as a legal gear to harvest lake whitefish from Lake Michigan since 1976. The trend in use of trap nets has generally increased over the time since their implementation and over the last two decades has on average accounted for nearly 60% of the whitefish harvested annually. The total proportion of whitefish harvested by trap nets decreased substantially between 2012 and 2013 dropping from 84% to 76% of the harvest (Figure 1). Pound nets were not fished in 2013.

Table 1. Lake whitefish harvest in dressed weight in Wisconsin by quota year broken down by zone through the 2010-2011 quota year and 2012-2013 calendar years.

Quota Year [a,b]	Zone 1 Harvest	Zone 2 Harvest	Zone 3 Harvest	Total Harvest
1998-99	143,225	1,474,605	182,486	1,800,316
1999-00	57,659	1,516,187	193,592	1,767,438
2000-01	72,496	1,330,107	210,604	1,613,207
2001-02	39,333	1,301,209	129,084	1,469,626
2002-03	107,827	1,085,599	131,344	1,324,770
2003-04	81,525	1,050,697	111,389	1,243,611
2004-05	129,081	1,248,689	166,319	1,544,089
2005-06	173,563	1,104,843	118,823	1,397,229
2006-07	181,289	901,935	214,909	1,298,133
2007-08	180,835	938,005	215,228	1,334,068
2008-09	182,614	944,580	211,614	1,338,808
2009-10	317,140	922,533	286,066	1,525,739
2010-11	263,389	1,030,042	270,370	1,563,801
2012[c]	205,244	985,408	333,209	1,523,861
2013	338,563	630,764	270,204	1,239,531

[a] Between quota years 1998/99 and 2008/09 the quota was 2.47 million pounds and quotas for zones 1 thru 3 were 225,518, 2,029,662, and 214,820, respectively

[b] Beginning April, 2010 the WI quota was increased to 2.88 million pounds and quotas for zones 1 thru 3 were changed to 362,185, 2,166,629, and 351,487 pounds respectively.

[C] Beginning in January 2012, the WI commercial whitefish fishery began quota administration on a calendar year basis.

Although the trap net effort has been variable since 2003, there has been a steady decline since 2009 (Figure 2). Between 2012 and 2013, the amount of trap net effort declined by 107 pots lifted. Meanwhile, after a spike in 2005, gillnet effort has also generally declined; the effort of 5.8 million feet of net fished in 2013 was nearly identical to that of 2012. The steady decline in the amount of net fished in recent years has resulted in gillnet effort dropping by nearly 2.5 million feet of net fished between 2009 and 2013, a decline of around 40%. The trap net catch per unit of effort (CPE) declined sharply from 2012 decreasing by almost 100 pounds per pot lifted (Figure 3). Gillnet CPE has remained relatively steady over the past decade and it increased slightly between 2012 and 2013 by about 7 pounds 1000 ft. fished.

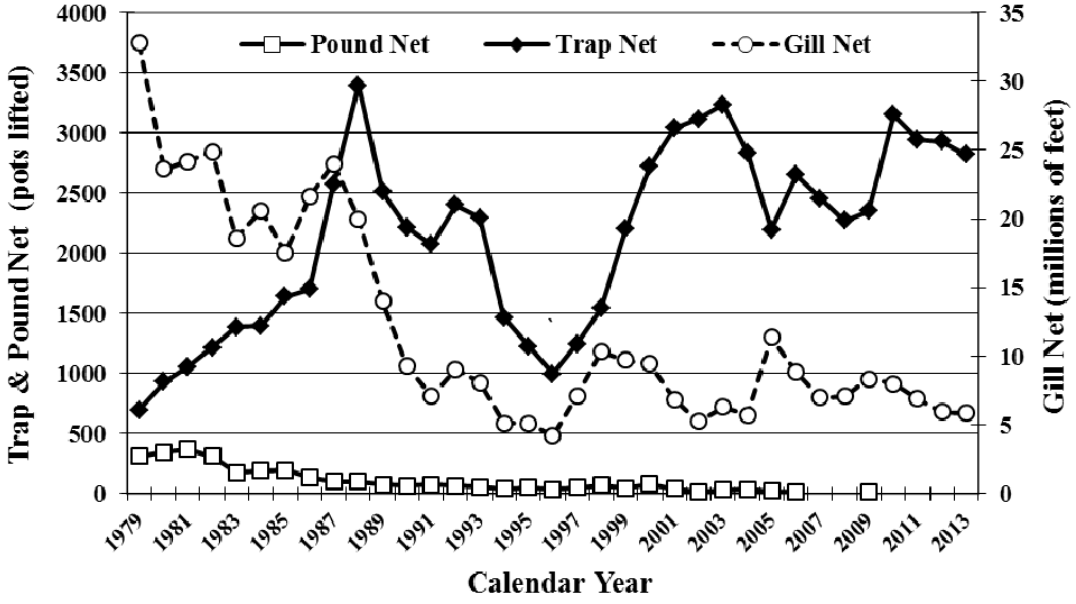


Figure 2. Trends in gill net, trap net, and pound net effort fished for lake whitefish in Wisconsin waters of Lake Michigan including Green Bay, 1979 – 2013. Gill net effort is in millions of feet; trap and pound net effort is number of pots lifted.

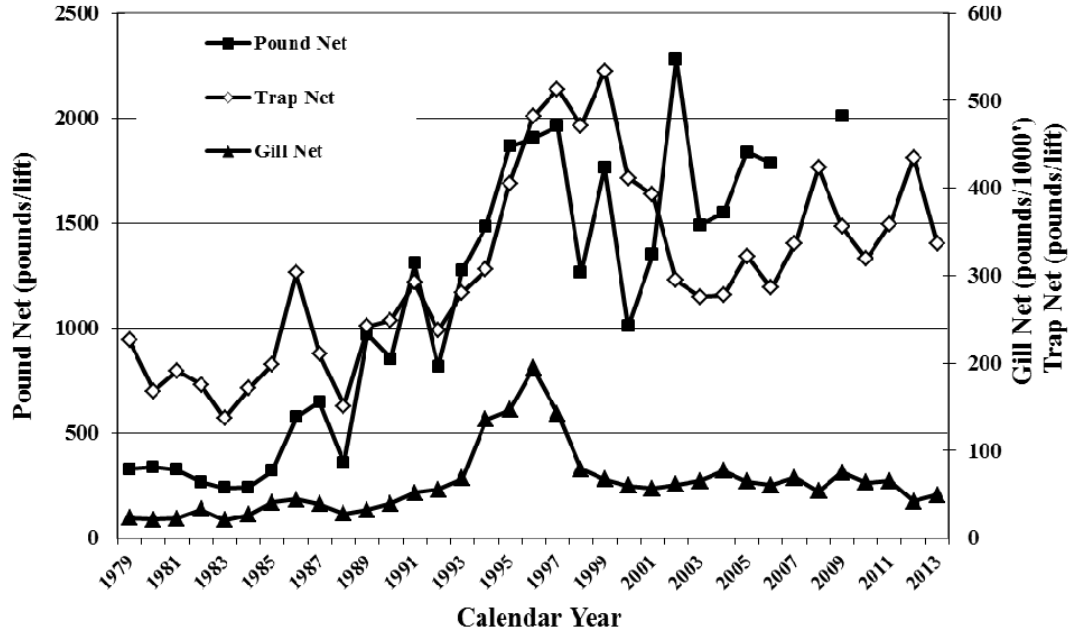


Figure 3. Trends in gill net, trap net, and pound net catch per unit of effort (CPE) in the Wisconsin waters of Lake Michigan including Green Bay, 1979 – 2013. Gill net CPE is pounds of whitefish harvested per 1,000 feet lifted; trap and pound net CPE is pounds of whitefish harvested per pot lifted.

Growth

Mean lengths and weights-at-age of lake whitefish measured during the spring in Wisconsin waters demonstrated a precipitous decline during the late 1990s. This downward trend then generally continued more gradually (with some variation) into the early 2000s until leveling off somewhat over the last few years (Figures 4 and 5). Mean length at age either declined or remained relatively static in 2013 (Figure 4). The average length-at-age for 7 year old fish continues to dip below the commercial harvest limit (432 mm). The average length for this age class over the last five years has hovered around the harvest length limit making at least a portion of age-7 fish available to the commercial fishery. Whitefish weight-at-age levels during 2013 continue to struggle near or even below (e.g. age-9) historic lows for most age classes but changed relatively little between 2012 and 2013 (Figure 5).

Within the past 5 -10 years, obtaining a viable sample size of younger whitefish age classes near the North/Moonlight Bay (NMB) spawning grounds, our historical spring assessment area, has become difficult to impossible. In the spring of 2007 we began sampling for juveniles in Green Bay and the samples from this area now constitute all of the spring assessment data. Studies have shown a certain level of whitefish stock mixing likely occurs in Green Bay depending on the time of year (Andvik 2012). Therefore, the consistency in measuring growth of NMB-stock fish over the time series has likely been compromised as a result of mixing and the influence of stocks with different specific growth rates.

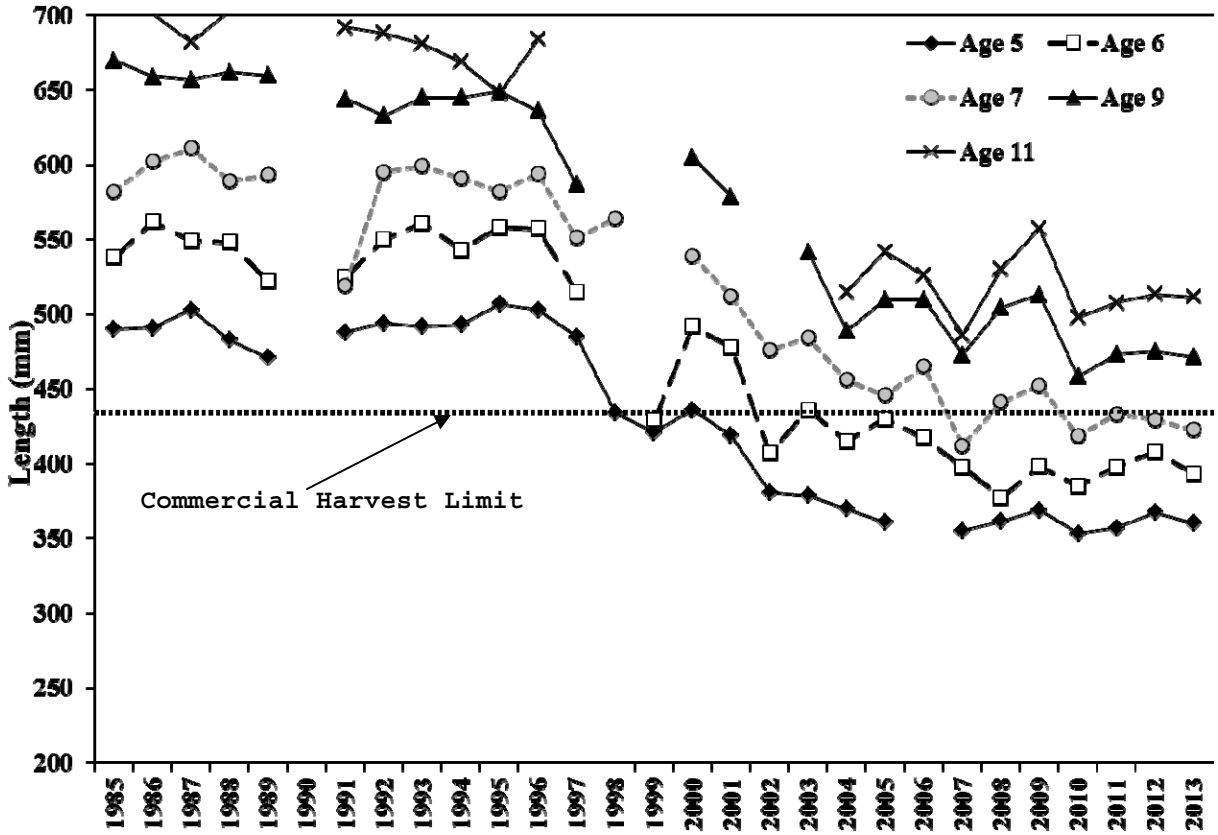


Figure 4. Mean length at age of spring sampled lake whitefish from 1985 thru 2013.

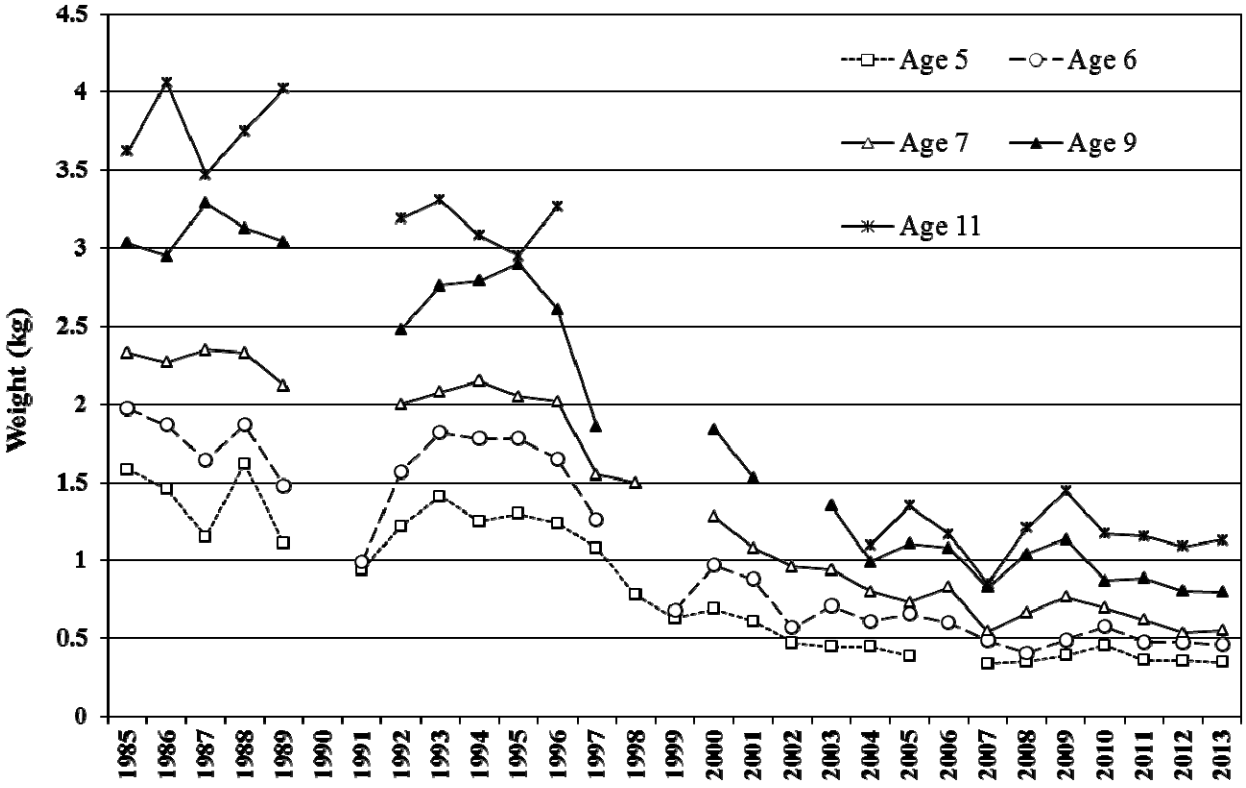


Figure 5. Mean weight at age of spring sampled Lake Whitefish from 1985 thru 2013.

Sport Angler Harvest

Beginning in the winter of 2007, a sport fishery for lake whitefish developed on the bay of Green Bay at levels unprecedented in recent history. The winter creel season of 2007 recorded the first significant lake whitefish harvest of an estimated 1,559 fish. The harvest increased substantially during the winter of 2008 and has remained relatively high ever since.

Winter creel surveys for Green Bay are conducted during the months of January, February, and March. For the winter of 2013 the estimated whitefish harvest was 155,120, a substantial increase from the 2012 harvest (Figure 6). Angler effort directed toward whitefish increased considerably as well, from 91,090 hours fished in 2012 to 161,480 hours in 2013. Harvest rates specific to whitefish in 2013 were 1.045, 0.668, and 0.879 whitefish harvested per hour of fishing for January, February, and March, respectively. For the winter of 2013 the overall average whitefish specific harvest rate was 0.763 fish per hour of fishing, increasing from the 0.595 fish per hour in 2012 (Figure 7).

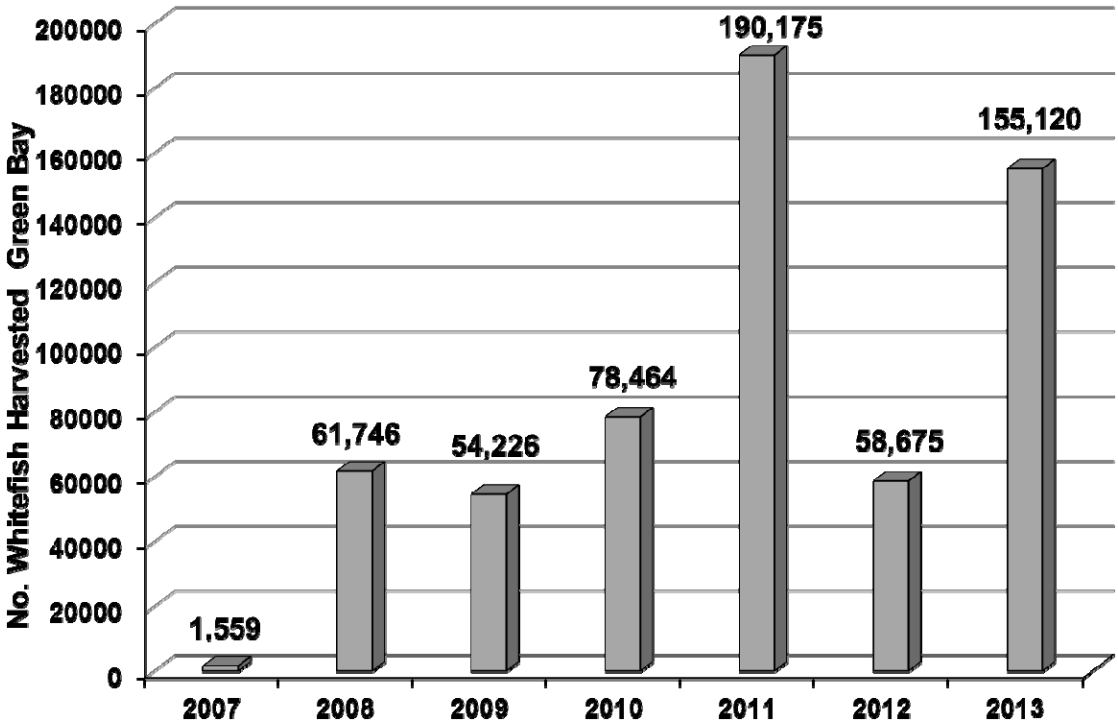


Figure 6. Estimated number of lake whitefish harvested in Wisconsin waters of Green Bay during the winter creel season (January- March) for 2007-2013.

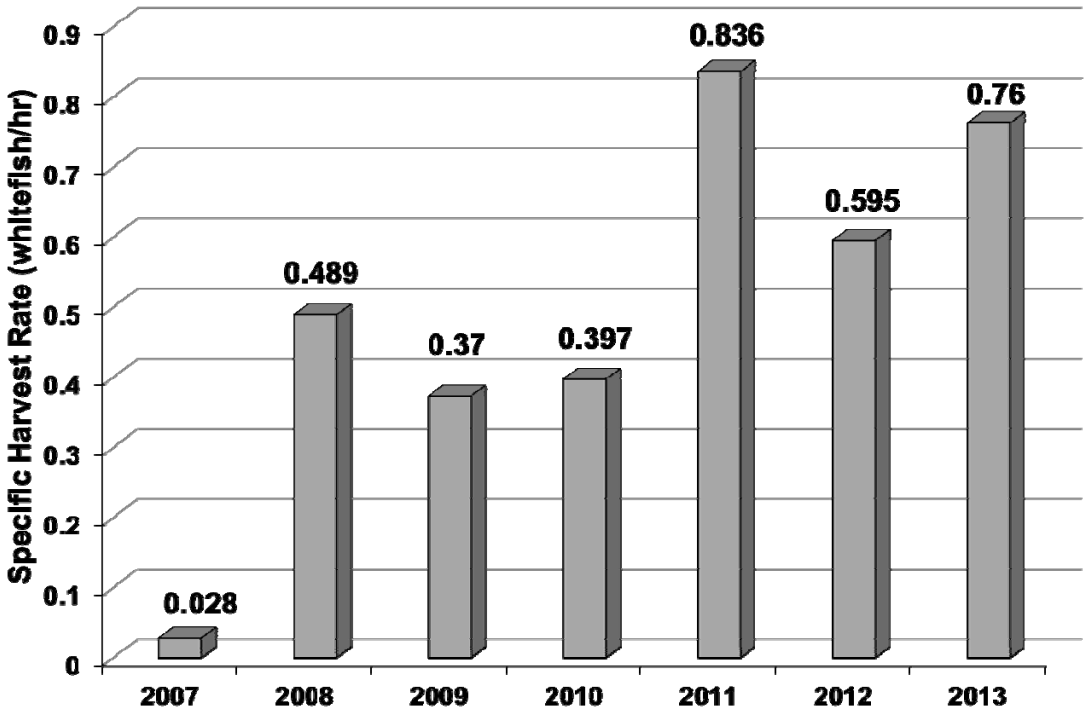


Figure 7. Harvest rate in number of whitefish per hour of fishing specifically for whitefish in Wisconsin waters of Green Bay during the winter creel season (January - March) for 2007-2013.

References:

Andvik, R.T. 2012. Mixed-stock analysis of Lake Michigan's lake whitefish (*Coregonus clupeaformis*) commercial fishery. Master's Thesis. College of Natural Resources, University ofWisconsin-Stevens Point, Stevens Point, WI.

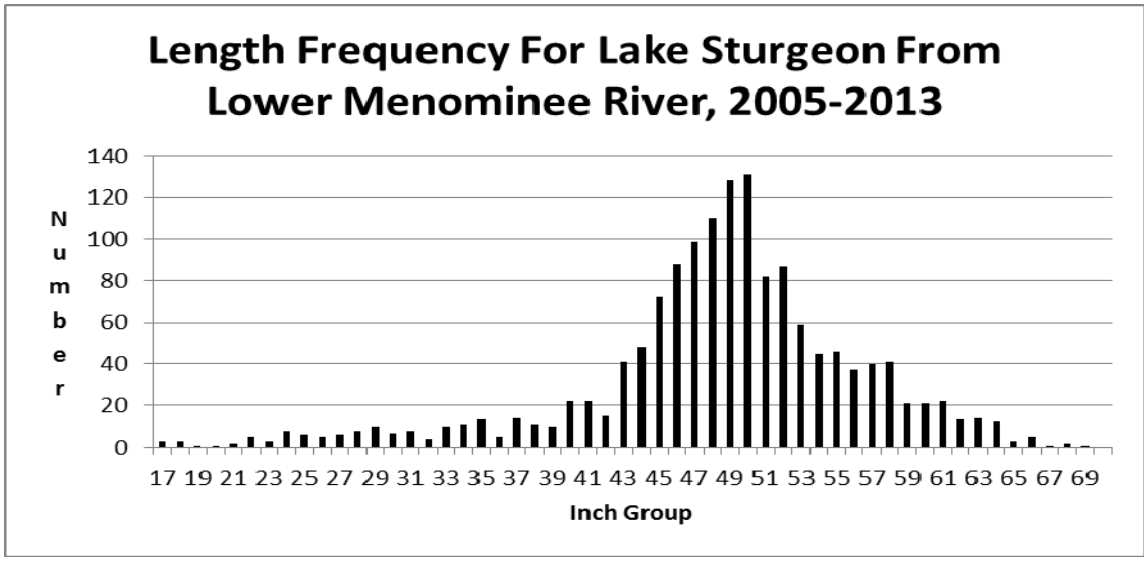
STATUS OF LAKE STURGEON IN LAKE MICHIGAN WATERS

Introduction

Lake sturgeon populations were decimated by the early 1900s through over fishing by commercial fishermen, altered stream flows, interruption of migration routes with dams and water quality degradation in Wisconsin's Lake Michigan's major rivers (Milwaukee, Manitowoc, Kewaunee, Menominee, Peshtigo, Oconto, and Fox). Passage of the Clean Water Act with associated permits for industry and implementation of new Federal Energy Regulatory Commission licenses have improved conditions for fisheries in general. Lake Sturgeon populations have also benefited in the last 25 years and natural reproduction currently occurs on the Menominee, Peshtigo, Oconto, and Fox Rivers. These populations are self sustaining without benefit of stocking. The results of tagging studies and genetic analysis indicate a distinction between the Fox and Oconto River sturgeon and another population on the northern tributaries of Green Bay (Menominee and Peshtigo). The Menominee River contains the largest population in Lake Michigan waters with contributions from stocks of Wisconsin's Peshtigo, Oconto, and Fox Rivers and Michigan's Cedar and Whitefish rivers. The Menominee River has supported a hook and line fishery since 1946. The exploitation was highest in 2005 at 172, although recent regulation restrictions reduced the total harvest to 8 from 2006-13 fall seasons. Lake sturgeon stocking is occurring on the Milwaukee and Manitowoc/ Kewaunee rivers and recovering is dependent on those stocking efforts and continued habitat improvements.

Menominee River Population Assessment

Field sampling, 2 day electrofishing surveys with 2 electrofishing boats, in 2013 produced 122 lake sturgeon from the lower Menominee River. Similar results yielded a total of 1,454 lake sturgeon from 2005-2012. From 2005-13, most of the fish (85%) were subjectively labeled as adults (>107 cm in total length), but several sub-adults sturgeon were observed during the surveys. The overall average total length during these sampling events was 124 cm. From 2005-13, the smallest sturgeon recorded was 44 cm and several fish were over 173 cm in length. Based on 1999-2013 tagging data, the population estimate for the 50 inch and larger segment of the population was 823 in 2013.



The Lake Michigan agencies continue to participate in genetic analysis research of Lake

Michigan's lake sturgeon performed by Michigan State University through Great Lakes Fishery Trust and USFWS grants. That research indicates that adult spawning lake sturgeon from the Fox, Oconto, Peshtigo and Menominee rivers are represented by fish that were genetically assigned to the Fox-Wolf, Peshtigo- Oconto, Menominee or Manistee-Kalamazoo populations. However, a significant degree adult sturgeon fidelity appears to exist for most of the spawning sturgeon. For example, a subsample of 56 adult spawning sturgeon from the Peshtigo River were genetically assigned to several populations (Peshtigo- Oconto River (52%), Fox- Wolf River (22%), Manistee- Kalamazoo (8%) and Menominee (18%).

We proceeded with our movement study through ultrasonic transmitters implanted in lake sturgeon at the Menominee, Peshtigo Oconto and Fox rivers. From 2005-2013, we inserted have sonic tags in 177 adults (Menominee (33%), Peshtigo (34%), Oconto (27%), and Fox 6%). Their movements are monitored continuously through 2-4 stationery receivers in each of those 4 rivers. The sex distribution from that sample was 34% female and 66% male. The average length of the females was 61.3 inches and males were 55.1 inches. The movements between rivers will be monitored through 2024.

Milwaukee River SRF

The Milwaukee SRF was deployed in 2013 on April 11, 2013 and put into service on May 1, 2013. Wisconsin DNR personnel artificially spawned 8 females from the Wolf River and transferred those fertilized eggs to the trailer on May 1, 2013. Approximately 35,000 eggs from seven females were transferred to the trailers. Eggs from each female were placed into a separate hatching jar.

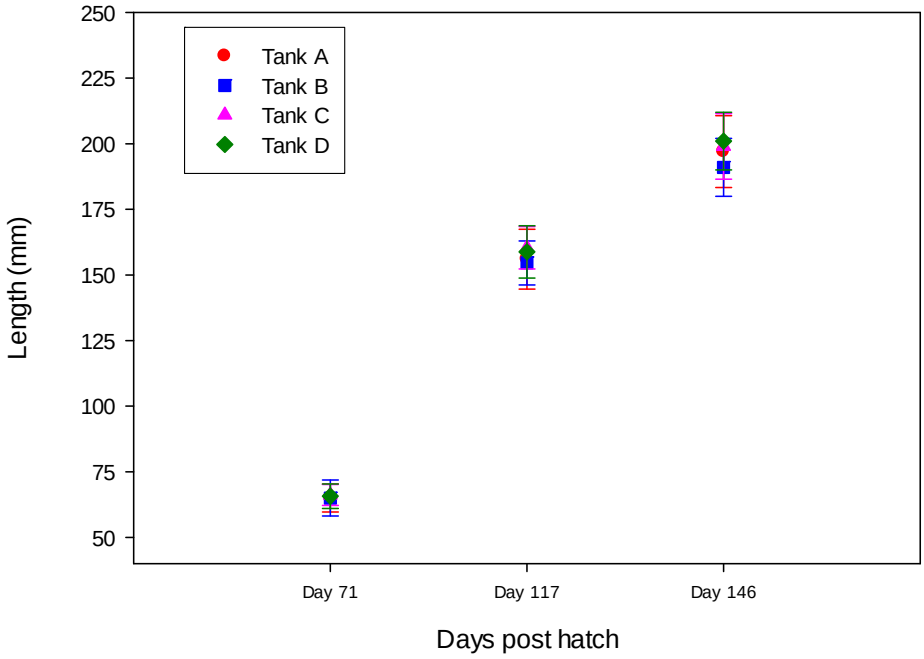
By May 9, lake sturgeon larvae began to hatch and could be seen in the incubation jars. Over the course of the next four days hatching continued until all larvae were in the smaller fry tanks. During the month of May and into June, sturgeon were fed brine shrimp followed by grated blood worms and finally whole blood worms.

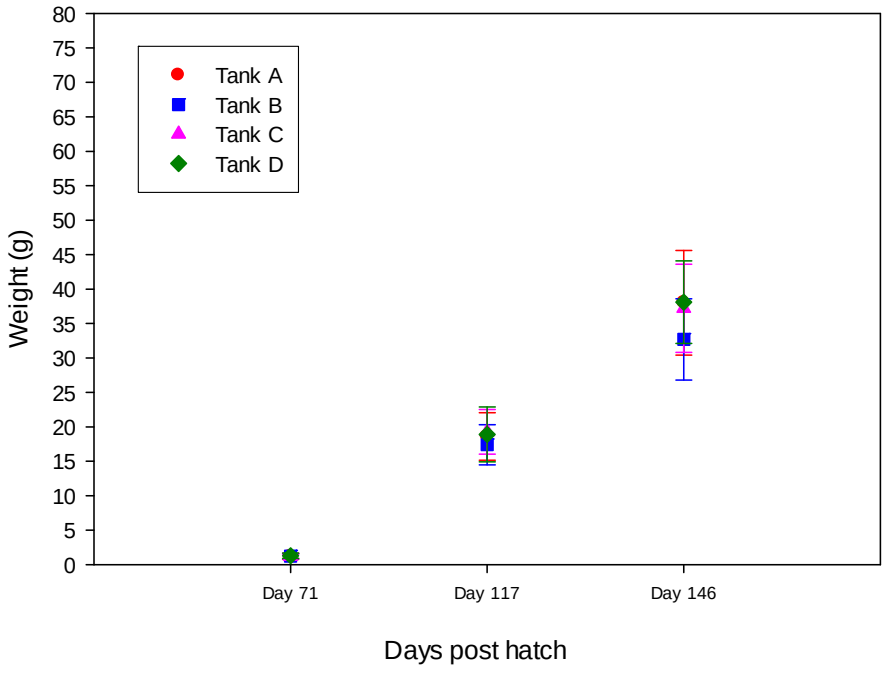
It was estimated that following hatching, there were approximately 2,000 – 4,000 larvae per fry tank. Numbers of larvae were lowered to 1,200 fish in all 4 tanks. The number of lake sturgeon in each tank was set at 1,200 because of issues encountered with high densities in the tanks which caused excessive mortalities. However, once again we did see some high mortalities of fish in the tanks that started around June 11 and subsided by June 24.

From August 1 until the fish were stocked on September 28 only a few more fish died. Testing for VHSv in conjunction with our normal fish health screening process was conducted well prior to stocking. We stocked 1,679 lake sturgeon on September 28, 2013 at Lakeshore State Park.

Total length and weight has been measured biweekly for the fish in the Milwaukee River SRF and are summarized below. Lake Sturgeon in the four tanks (A – D) exhibited similar growth patterns for the entire time they were raised in the facility. Starting from our first measurement at day 71 and continuing until the fish were stocked, both the weigh and length of the sturgeon in all the tanks were very similar. In addition, since the sturgeon eggs were obtained May 1, about two weeks later than normal, the average size and weight was significantly lower than previous years. Fish stocked in September averaged a 197 mm in length and 36 grams in weight.

Average length and weight of Lake Sturgeon at the Milwaukee Streamside Rearing Facility, 2013





Kewaunee River SRF

Sturgeon eggs were collected from the Wolf river at Shawano on May 5th, 10 days later than the average collection day (April 25 during 8 years of this project). Facilities were prepared to incubate eggs and rear fish from 8 females/families using scaled down versions of a McDonald jar. Table 1 shows the number of eggs and fry for each of the adult females used for egg collection. During incubation the eggs were treated 3 times with Formalin starting on day 3 before they started to hatch on day 9 with hatching completed on day 12.

Table 1. 2013 lake sturgeon egg and fry numbers for each female/family

Female	Number of eggs	Volume(ml) of eggs	Number of Fry kept	Number of Fry tossed	Wt(g) of fish tossed	Total Number of fry	Approx % Hatch
F1	10,343	250	900	696	24.00	1,596	15.4
F2	35,784	1,050	900	5,226	180.20	6,126	17.1
F3	51,136	1,500	900	5,998	206.81	6,898	13.5
F4	30,683	900	900	75	2.59	975	3.2
F5	21,114	510	900	3,147	108.52	4,047	19.2
F6	18,314	500	900	554	19.10	1,454	7.9
F7	16,561	400	900	1,192	41.10	2,092	12.6
F8	13,063	300	900	1,494	51.50	2,394	18.3
Totals	196,998	5,110	6,300	18,382	633.82	23,188	11.8

Note -Number of Fry tossed are estimates from 29 fish/gm taken on 5/22/13

Fry began to feed on brine shrimp about 12 days after hatching. Fry were counted individually into the larger rearing tanks at 20 Days Post Hatch (DPH) with tank numbers set to about 1,800 per tank (900 per female). Fry began to respond favorably to chopped bloodworms at about 28 (DPH). On June 12 (29 DPH) staff began to reduce fish numbers in each tank by removing the smallest fish. Approximately 4 weeks later (7/9) fish began eating krill which meant they were growing extremely well. Warm water temperatures around July 15 necessitated the addition of well water to reduce rearing water temperatures. The addition of well water typically reduced max water temps in the tanks by 6°-9°F.

On August 9, as part of the need to reduce fish densities in each tank, 494 fish (approx. 125/tank) were PIT tagged, left vent clipped and stocked into the river. Fish continued to grow very well and in early October a total of 1,087 large fingerlings were stocked into the river just below the dam at BAFF with about 150 being part of the 2nd annual adopt a sturgeon program at our annual open house event. A total of 1,581 (quota=up to 1,500) small and large fingerling lake sturgeon were stocked into the Kewaunee River in 2013.

Figures 1 and 2 shown below, compare growth of sturgeon fingerlings in each tank from seven separate sample dates of July 8, 24, August 7,14,27, September 11 and October 1.

Figure 1. Comparison of mean lengths of sturgeon from Kewaunee River SRF 2013.

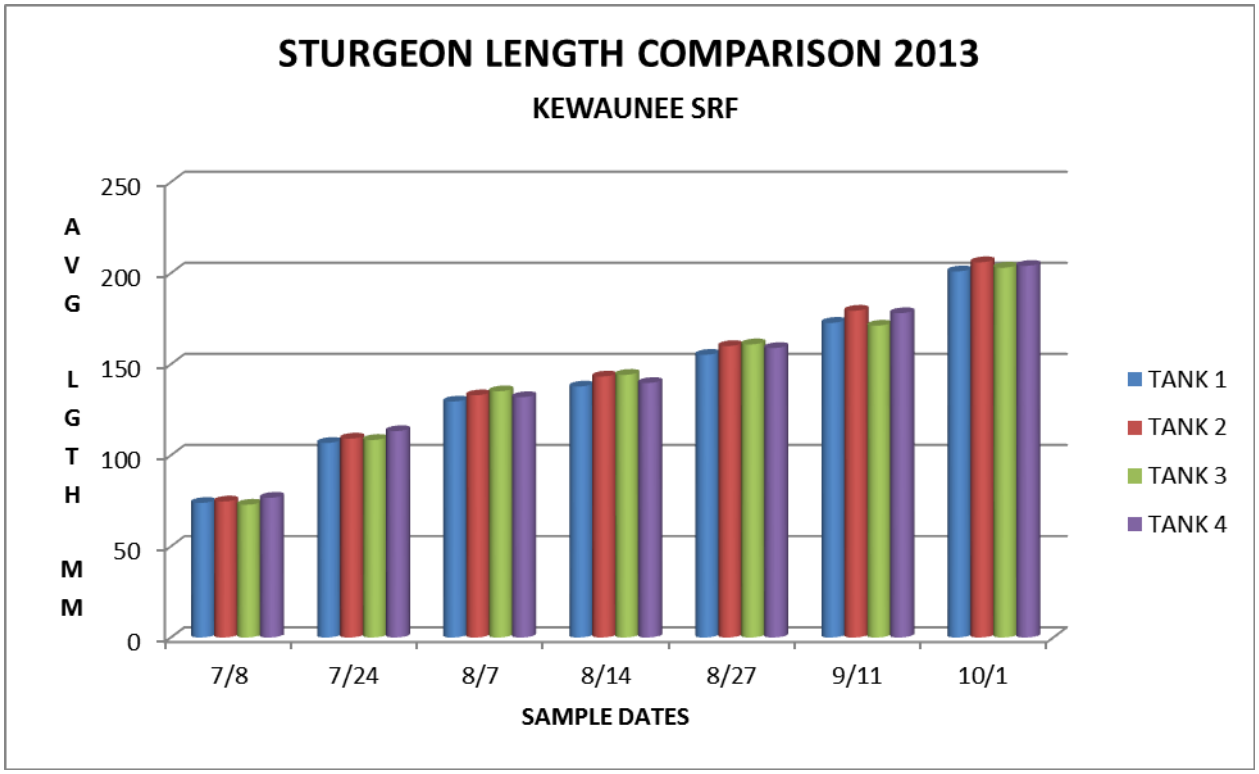
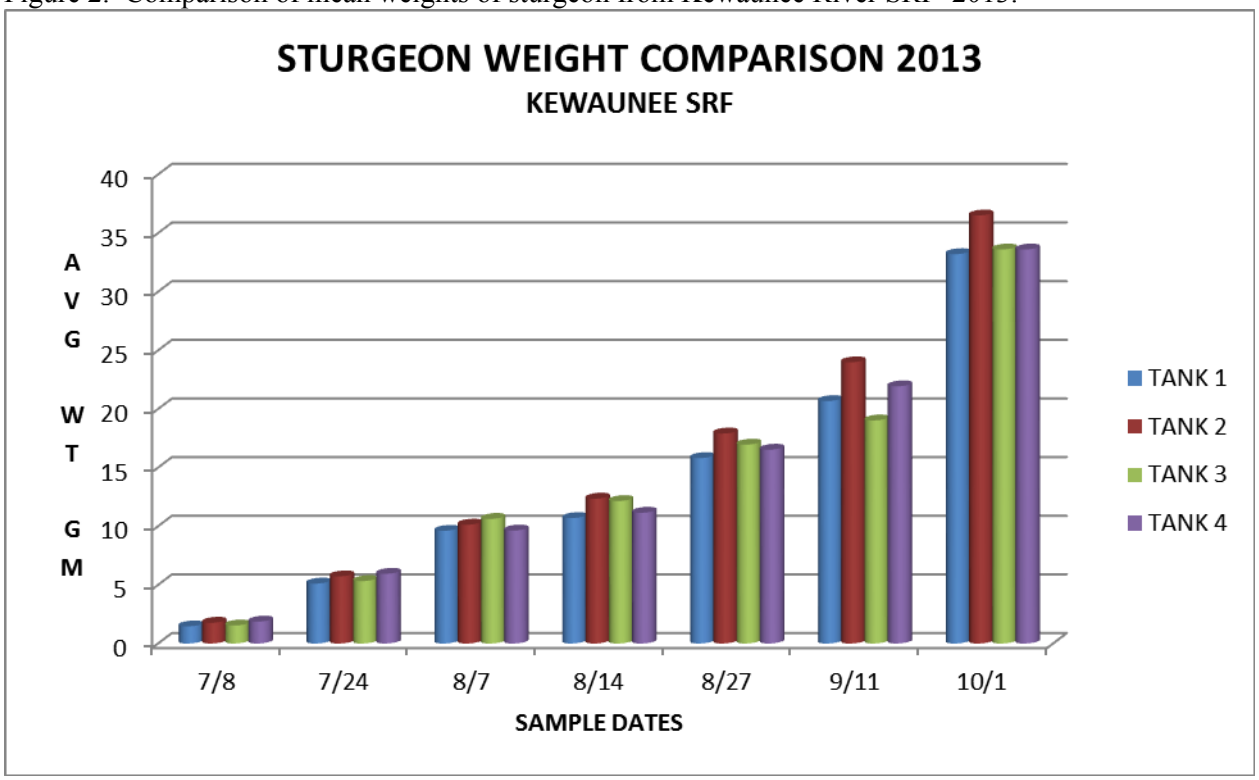


Figure 2. Comparison of mean weights of sturgeon from Kewaunee River SRF 2013.



Menominee River Sport Fishery

The Menominee River is the only river open to sport harvest in Lake Michigan waters. Licensed, modern day harvest of lake sturgeon on the Menominee River has occurred since 1946. A mandatory registration system was enacted in 1983. The harvest in that year was 19 sturgeon and the minimum size limit was 50". The bag limit was reduced from 2 to 1 fish per season in 1992. In 1997, Tom Thuemler of WDNR wrote, "An alternative (regulation approach) would be complete closure of the season every other year. This would halve the exploitation rates and yet still allow some harvest, and might be acceptable if catch and release only season operated in the year when harvest was prohibited".

In 2000, the minimum size limit differed in alternating years with a 70" limit in even years and a 50" limit in odd years. The hook and line harvest of lake sturgeon from the Menominee River increased to the following in selected years: 80 in 1989, 109 in 1998, 167 in 1999, 185 in 2001, and 210 in 2003. The harvest in the three 70" size limit years (2000, 2002, and 2004) averaged at 0 fish. While the alternating year's size limits reduced the overall harvest, the average harvest for the last 6 years (1999- 2004) was 94 fish. Fishing pressure since 1999 has increased by 12%/ harvest year. The harvest in 2005 was recorded as 172 lake sturgeon with 136 stemming from waters below the Menominee Dam. Wisconsin DNR manages their sturgeon fisheries at a 5% exploitation rate and that rate was measured at 16% in 2005.

The Menominee River is jointly managed with the State of Michigan. The agencies decided that current harvest extractions were negatively impacting the recovery of lake sturgeon in the Menominee River and Green Bay. The State of Michigan adopted the following regulation for the 2006 hook and line season: catch and release only below the Menominee Dam, 1 lake sturgeon per angler with a minimum size limit of sixty inches above that dam and open season from first Saturday in September to September 30. Wisconsin Department of Natural Resources adopted the same regulations in 2006. The Menominee River regulation changes reduced the harvest to one lake sturgeon in 2006, 0 in 2007, 1 in 2008, 3 in 2009, 0 in 2010, and 1 each in 2011 and 2012, 2 in 2013 and 0 in 2014.

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WEIR HARVEST

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The Wisconsin Department of Natural Resources (WDNR) operates three salmonine 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 egg collection 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. BAFF is a co-primary egg collection station for two strains of steelhead *O. mykiss*, and coho salmon *O. kisutch.* BAFF also serves as a backup for chinook salmon egg collection. The Root River Steelhead facility (RRSF) has been in operation since 1994 and is located on the Root River in Racine County. RRSF is a co-primary egg collection station for the two strains of steelhead, and coho, and serves as a backup for chinook salmon egg collection.

Historically, RRSF and BAFF began operating in late summer when the Skamania strain of steelhead appeared in the rivers. Skamania brood stock were collected at the weirs and overwintered at the Kettle Moraine Springs Hatchery until they were ready to spawn the following January/February. However, since 2007 VHS concerns have prompted the disease protocol which prohibits the transfer of live adult fish from the weir to the hatcheries. Therefore, we no longer collect Skamania at RRSF or BAFF and have consequently discontinued stocking that strain until a viable alternative source arises.

Total numbers of fish returning as reported here cannot necessarily be interpreted strictly as the absolute number of fish returning to Wisconsin weirs. Returns can vary depending upon several variables including the timeframe the weir was operated during a particular season, whether fish were passed upstream, and the number of smolts previously released at these sites. The salmonine egg harvest quota varies from one year to the next for each species or strain based on the projected needs of WDNR hatcheries and egg requests from other agencies. In 2012, all Lake Michigan salmon and trout egg quotas for Wisconsin waters were met.

Strawberry Creek Weir

Over 1.9 million Chinook salmon eggs were collected at the Strawberry Creek weir in Sturgeon Bay during the fall of 2013. More than 7,000 Chinook salmon returned to Strawberry Creek and a total of 5,401 Chinooks were processed for eggs and/or for biological data (Table 1). Data collected were lengths, weights, gender, lamprey scars, and fin clips. Coded wire tags and fish health samples were also collected from subsamples. The average weight of an age-3 female Chinook salmon at Strawberry Creek during 2013 was 8.74 kg (19.3 lbs.) which was up from 5.4 kg (11.9 lbs.) during 2012. Sufficient numbers of eggs were collected from Strawberry Creek during 2013 to meet WI DNR's Chinook hatchery production goals for stocking in 2014. For a simple comparison, the number of Chinooks processed at Strawberry Creek during 2012 was 2,453.

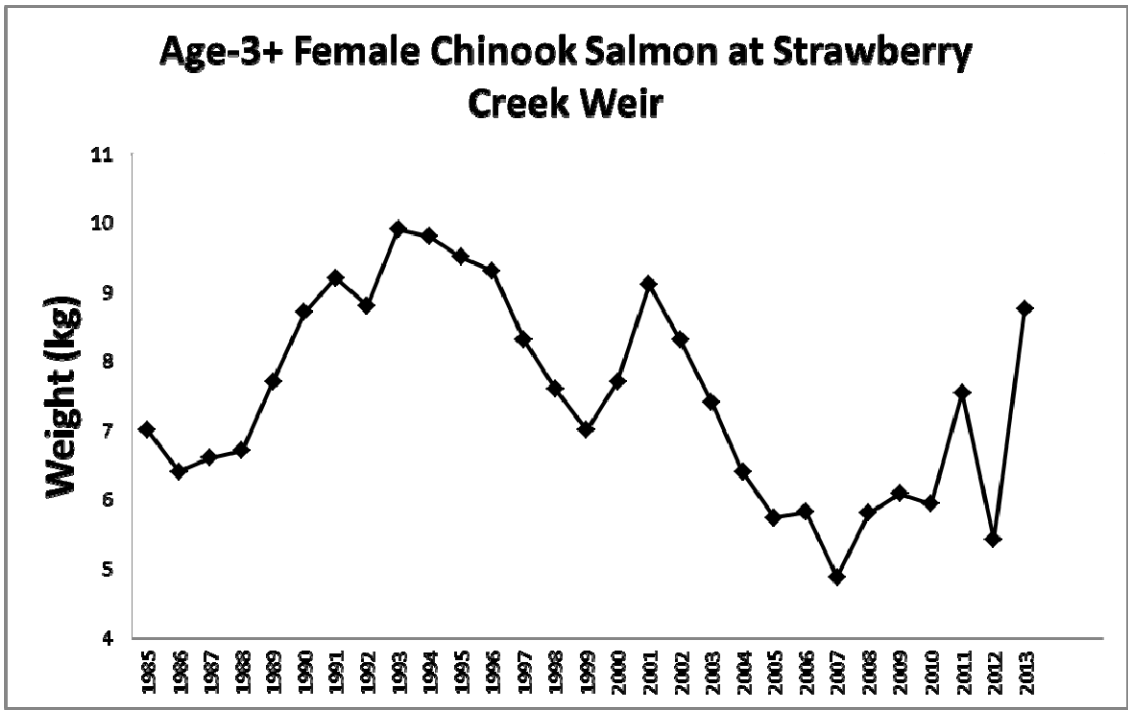
Table 1. Summary of Chinook salmon processed for data and eggs at Strawberry Creek during fall 2013.

Date	Eggs Collected	Chinooks Processed
Mon Sept 30, 2013	298,155	603
Thurs Oct 3, 2013	504,037	839

Mon Oct 7, 2013	378,802	1,256
Thurs Oct 10, 2013	325,771	922
Monday Oct 14, 2013	224,616	1,126
Thursday Oct 17, 2013	175,302	655
Totals	1,906,683	5,401*

*This does not include an additional >1,700 Chinooks removed from the Strawberry Creek pond during 2013 without being processed for data.

Figure 1. Average weight for age-3 female Chinook salmon collected at the Strawberry Creek weir in Sturgeon Bay from 1985-2013.



Besadny Anadromous Fisheries Facility

A total of 878 steelhead were processed at the Besadny Anadromous Fishery Facility (BAFF) on the Kewaunee River during the spring of 2013. These steelhead were processed on April 8, 11, 15, 17, 22, and 29 of 2013. Data collected were lengths, weights, gender, lamprey scars and fin clips. Eggs and fish health samples were also collected from Ganaraska and Chambers Creek strains.

A total of 4,159 Chinook and Coho salmon were processed (for data and/or just counted) at BAFF during the fall of 2013, including 1,873 Chinooks and 2,286 Coho. These fish were processed between October 5, 2013 and November 6, 2013. Data collected were lengths, weights, gender, lamprey scars and fin clips. Coded wire tags were also collected from some adipose clipped Chinooks. Eggs and fish health samples were collected only from Coho.

Root River Steelhead Facility

Spring 2013 Root River Weir Summary:

The Root River Steelhead Facility (RRSF) was in operation for five processing dates during the spring 2013 migration, and we captured 301 steelhead between March 21 and April 29. This was the third lowest spring return to the facility since it opened. Collection efforts were hampered by unusually high stream flows throughout the spring, including two separate flooding events.

The number of fish captured at RRSF is a small subset of the 2013 steelhead run in the Root River. We do not stop every fish in the river, as they are able to move upstream past the facility before it is operational in early spring, and some fish are able to bypass the facility during the sampling season when the river is at high flows. Therefore, any comparison to past year's processing numbers will not provide a meaningful measure of the overall return of steelhead back to the Root River.

In conjunction with the Besadny Anadromous Fisheries Facility in Kewaunee, we met our egg collection quotas for Chambers Creek and Ganaraska strains of steelhead. Our biological sampling goals were fulfilled, and fish health sampling was conducted. Fish sacrificed for health checks were donated to the Racine County Food Bank for local distribution.

The spring 2013 RRSF steelhead effort is summarized below.

Captured	Spawned	Eggs Taken	Passed Upstream
301	175 total (73 Chambers and 102 Ganaraska)	108,500 Chambers 206,000 Ganaraska	179

Fall 2013 Root River Weir Summary:

The Root River Steelhead Facility (RRSF) was in operation for 12 processing days during the Fall 2013 fish migration. We were able to capture and process 3,788 fish between September 16 and November 4. Due to extremely low flows in the Root River, the facility was run sporadically until September 30 and was actively capturing fish for a total of 46 days during the fall season. Our egg-take and biological sampling goals were met, and coho health inspections were conducted. The Fall 2013 Root River effort is summarized below.

	Captured	Spawned	Eggs taken	Passed Upstream
Chinook	1,948	0	0	1,070
Coho	1,666	538	583,000*	1,281
Rainbow	7	0	0	7
Brown	167	0	0	166
Totals	3,788	538	583,000	2,524

* Additional coho eggs were obtained at the Besadny Anadromous Fish Facility in Kewaunee to meet our quota.

The number of fish captured at RRSF is a subset of the Fall 2013 migration in the Root River.

Low flows in the river all season hampered the Chinook return to the facility. Late in the season some much needed rain fell, allowing for a strong coho return. Our egg collection goals were met relatively early in November, therefore when we shut down for the season, there were still significant numbers of coho in the river downstream of the facility.

Throughout the fall season, Chinooks were sampled as part of an ongoing multi-agency, lakewide study on natural reproduction. Stocked Chinooks were implanted with small coded wire tags prior to release, and tags were recovered from 486 fish at RRSF. Analysis of the tags will provide fish managers with more information on movement patterns of Chinooks in the lake, growth rates, and the occurrence of "straying," when a mature fish returns to a stream other than the one where it was originally stocked.