WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Lake Michigan Management Reports

WRITTEN BY:
LAKE MICHIGAN FISHERIES TEAM

The 2020 Green Bay yellow perch trawling crew in front of the Research Vessel Coregonus.
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Lake Michigan Committee
2021 LMTC Summer Meeting
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LAKE MICHIGAN

INTRODUCTION

These reports summarize some of the major studies and stock assessment activities by the Wisconsin Department of Natural Resources (DNR) on Lake Michigan and Green Bay in 2020. They provide specific information about the major sport and commercial fisheries and describe trends in some of the major fish populations.

The management of Lake Michigan fisheries is conducted in partnership with other state, federal and tribal agencies and in consultation with sport and commercial fishers. Major issues of shared concern are resolved through the Lake Michigan Committee, which is made up of representatives of Michigan, Indiana, Illinois, Wisconsin and the Chippewa Ottawa Resource Authority. These reports are presented to the Lake Michigan Committee as part of Wisconsin's contribution to that shared management effort.

This compilation is not intended as a comprehensive overview of available information about Lake Michigan fisheries. For additional information, we recommend that you visit the DNR's Lake Michigan webpage at dnr.wi.gov/topic/fishing/lakemichigan.

For further information regarding any individual report, contact the author at the address, phone number or email address shown at the end of the report.

GREEN BAY BROWN TROUT MANAGEMENT AND FALL TRIBUTARY SURVEYS, 2020

This report summarizes assessments and management actions for brown trout in Wisconsin waters of Green Bay/Lake Michigan completed in 2020. Additional information is included for other salmonid species from the Menominee and Peshtigo rivers.

INTRODUCTION

The Wisconsin Department of Natural Resources (DNR) has stocked various salmonid species into Green Bay since the 1960s. 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. Creel survey results indicate that harvest and return rates for Green Bay brown trout were exceptional throughout the late 1980s and 1990s. Since 2000, brown trout harvest has experienced a sharp decline. Stocking numbers for Green Bay have varied somewhat since the 1980s but, in general, have remained fairly consistent until 2010 when fingerling stocking was reduced (Figure 1). Between 2011 and 2015, only yearling brown trout were stocked into Green Bay. Both fall fingerlings and yearlings have been stocked since 2016.

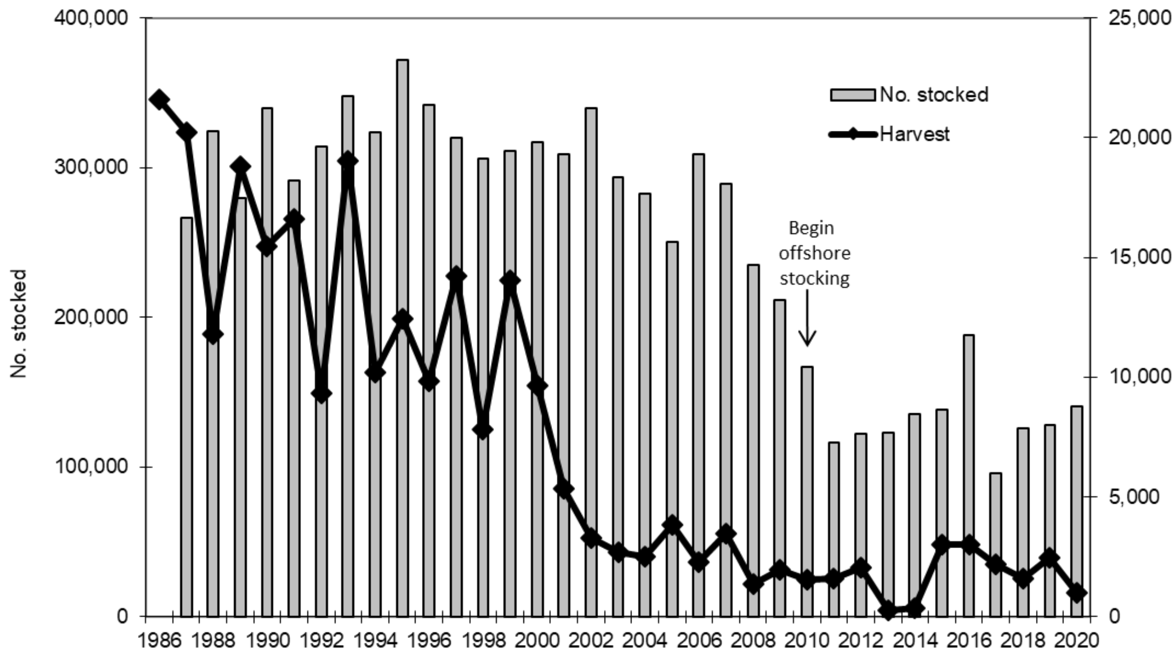

Figure 1. *Number of stocked and harvested brown trout (fingerlings & yearlings combined) in Wisconsin waters of Green Bay by year. Due to COVID-19 concerns, open water creel was not conducted from March to July 2020.*

Historically the DNR has stocked several strains and age classes of brown trout into Green Bay and adjacent rivers. To promote an extended trophy fishery, the Seeforellen (German) brown trout program was initiated in Wisconsin waters of Lake Michigan in the early 1990s. This strain originated from alpine lakes in Germany. Seeforellen generally live longer and grow faster than other strains, thus adding to the trophy element of the fishery[1]. Currently, Seeforellen brown trout are the only strain that Wisconsin routinely stocks into the Great Lakes. Additional background on the Seeforellen strain of brown trout and changes in brown trout stocking strategies for Wisconsin's Lake Michigan can be found in the 2017 report[2].

Following the closure of the Thunder River Hatchery in 2017 and the discontinuation of the Wild Rose (domestic) strain of brown trout that was previously stocked into Lake Michigan by Wisconsin, a stocking allocation strategy for the remaining Seeforellen brown trout was developed. The Lake Michigan Fisheries Forum and the general public provided input at several meetings. This strategy evenly distributes 75% of the entire yearling brown trout quota across each Lake Michigan/Green Bay county.

Next, the strategy incorporates species-specific harvest rates and directed effort for brown trout in each of the counties to allocate the remaining 25% of brown trout. Those parameters are derived from open water creel surveys. Beginning in 2018, an additional 20,000 brown trout were allocated to Green Bay to further boost that local fishery. Throughout 2019, the DNR conducted an extensive stakeholder outreach and engagement process to inform a management strategy for Lake Michigan stocking. As a result, lake-wide brown trout stocking numbers were increased from 376,000 to 450,000 beginning in 2020. A total of 140,168 brown trout were stocked in 2020 in Green Bay by the DNR (Table 1), compared to 128,334 stocked in 2019.

For the previous four years (2016-2019), staff from U.S. Fish and Wildlife Service Green Bay Fishery Resources office (USFWS-GBFRO) utilized their autotrailer to adipose clip all Seeforellen at the Wild Rose Hatchery. These fish were later stocked into Lake Michigan, mostly as spring yearlings in 2017-2020 but some as fall fingerlings in the same year as clipping. Marking all Seeforellen with the autotrailer saved considerable staff time and allowed the DNR to evaluate returns of Seeforellen for several year classes. However, in November 2019, USFWS-GBFRO informed the DNR that the mass marking trailer would not be available to clip brown trout in 2020 and beyond due to scheduling conflicts with the steelhead mass marking project. To ensure that known Seeforellen are collected as future broodstock, Seeforellen that will be stocked in 2021 into the brood rivers (Kewaunee, Milwaukee, Root) were hand-clipped by DNR staff at the Wild Rose Hatchery in the summer of 2020. Approximately 100,000 fish were given an adipose, right ventral (ARV) clip.

In 2010 and 2011, the DNR utilized a pontoon barge and the USFWS *RV Spencer Baird* to stock brown trout offshore in Green Bay. From 2012 to 2019, the DNR used the *RV Coregonus* to stock yearling brown trout offshore in Green Bay. In 2020, due to COVID concerns, the DNR did not stock brown trout offshore but instead fish were stocked directly into tributaries or

[1] Belonger, B. 1996. Brown trout strain evaluation. Pages 55-56 *in* Lake Michigan Management Reports to Great Lakes Fishery Commission, Wisconsin Dept. of Nat. Res., Madison, WI.

[2] Paoli, T. 2018. Green Bay brown trout management and fall tributary surveys, 2017. Lake Michigan Management Reports to Great Lakes Fishery Commission. Wisconsin Dept. of Nat. Res., Madison, WI. https://dnr.wi.gov/topic/fishing/documents/lakemichigan/GreenBayBrownTrout2017.pdf

harbors (Table 1). Plans are to resume offshore stocking in spring 2021. The fall fingerling quotas will continue to be stocked directly into tributaries.

Table 1. *DNR brown trout stocking information for Green Bay in 2020.*

DATE	COUNTY	LOCATION	STRAIN/SIZE	NUMBER	CLIP	# FISH PER LB.	REARING FACILITY
Apr. 2, 2020	Marinette	Menominee River, Menekaunee Harbor	Seeforellen yearling	13,516	AD	9.7	Wild Rose SFH
Apr. 2, 2020	Marinette	Little River mouth	Seeforellen yearling	15,939	AD	9.7	Wild Rose SFH
Apr. 2, 2020	Marinette	Peshtigo River, BB landing	Seeforellen yearling	14,567	AD	9.7	Wild Rose SFH
Apr. 2, 2020	Oconto	Oconto River, harbor	Seeforellen yearling	13,857	AD	9.7	Wild Rose SFH
Apr. 3, 2020	Door	Sturgeon Bay Canal at Stone Quarry	Seeforellen yearling	17,634	AD	9.3	Wild Rose SFH
Apr. 3, 2020	Door	Egg Harbor	Seeforellen yearling	13,798	AD	9.4	Wild Rose SFH
Apr. 3, 2020	Door	Sister Bay	Seeforellen yearling	16,809	AD	9.4	Wild Rose SFH
Sept. 15, 2020	Oconto	Oconto River, Stiles	Seeforellen fingerling	23,998	--	25	Wild Rose SFH
Sept. 15, 2020	Marinette	Little River, Krause Road	Seeforellen fingerling	10,050	--	25	Wild Rose SFH
			Total yearlings **Total fingerlings**	**106,120** **34,048**			

CREEL RESULTS AND DISCUSSION

The harvest estimate for open water Green Bay brown trout in 2020 was 989 fish harvested from mid-July to mid-November. For reference, 2,466 fish were harvested in 2019 from April to mid-November (Figure 1). It is important to note that creel surveys were not conducted from mid-March until mid-July 2020 due to COVID-19 concerns, so the 2020 estimates do not include the spring months when effort and harvest for brown trout is typically high. Green Bay comprised 30% of the total brown trout harvest for Lake Michigan (3,317 fish) in 2020, followed by Milwaukee County at 26%. Brown trout harvest rate for anglers targeting salmonids in Green Bay was 23 hours/fish in 2020. This is worse compared to 12 hours/fish in 2019 but 2020 estimates do not include the spring period when harvest rates are better.

Since offshore stocking began in 2010, harvest rate has generally improved compared to the previous 10 years. Two exceptions are 2013 and 2014, which were late ice-out springs that prevented early season nearshore trolling for brown trout.

MENOMINEE RIVER SURVEY SUMMARY

Electrofishing surveys targeting trout and salmon on the lower Menominee River were completed weekly beginning on Oct. 7 and ending on Dec. 2, 2020. The effort occurs over a half mile section of the river from the Stephenson Island boat landing to the Menominee Dam.

A total of 112 brown trout were captured (59 males; 50 females; 3 unknown) (Table 2), with a mean length of 27 inches. Four brown trout had an adipose, right pectoral clip, indicating yearling Seeforellen stocked in 2016 and now are age-5. Four brown trout had an adipose, left pectoral clip, indicating yearling Seeforellen stocked in 2015 and now age 6. Eighty brown trout had an adipose clip, indicating Seeforellen stocked in 2017 or later. The combined catch per unit of effort (CPUE) for brown trout was 8.5 fish/hour, up from 6.7 fish/hour in 2019 (Figure 2).

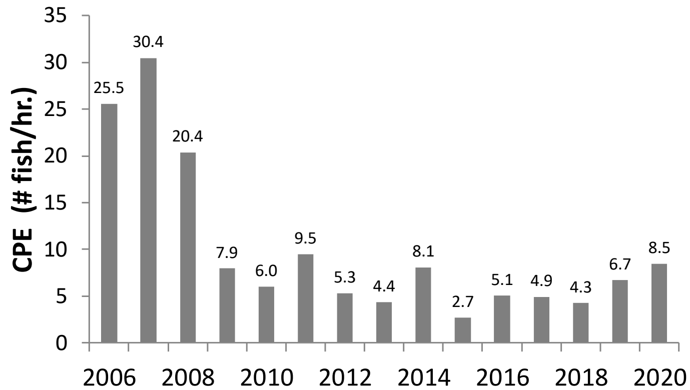

Figure 2. *CPUE (# fish/hour) of brown trout captured during fall electrofishing surveys on the lower Menominee River, 2006-2020.*

Between 2017-2020, the Michigan DNR stocked various genetic strains of brown trout into the Michigan waters of Green Bay. Those strains include: Sturgeon River, Gilchrist Creek and Wild Rose. To investigate whether clipped Seeforellen stocked by the Wisconsin DNR were captured in greater proportions compared to unclipped brown trout of various strains stocked by the Michigan DNR, we considered fish stocked from 2017-2019 that would be age 2-4 at the time of the fall surveys. We excluded fall fingerlings stocked in 2019, as those fish would only be age-1 and not likely to make fall spawning runs and used the following equation derived from Kornis et al. (2017)[3] to calculate a return index,

$$\text{Return index} = CPUE_{k,\ age2\text{-}4} \div \frac{y_k}{10{,}000}$$

where the CPUE of clip type k for ages 2 to 4 and y_k is the number of fish stocked with clip k. The return index for clipped Seeforellen stocked in Green Bay waters in Wisconsin was 0.18, while the return index for unclipped brown trout of various strains stocked in Michigan was slightly less, at 0.11. A caveat to this analysis is that not all brown trout stocked in Green Bay by either state necessarily return to the Menominee River. We will continue to evaluate the contribution of clipped and unclipped fish in 2021. By fall 2022, the Wisconsin age-2 brown trout (yearlings stocked in 2021) will not be clipped, rendering further evaluation difficult.

In addition to brown trout, other salmonids are also collected during the fall surveys. No pink salmon were captured in 2020 (Table 2). Pink salmon typically spawn in September and we sometimes see some pink salmon near the end stages of life during early October. However, pink salmon may have spawned a bit earlier than normal this fall, with some anglers reporting catches of pink salmon in the rivers as early as Labor Day weekend. Eighty-seven Chinook salmon were observed, and this is considerably higher than the previous five years (Table 5). It is possible that one or two cohorts of stocked Chinook had high survival which led to higher numbers observed this fall. Each spring from 2014-2019, approximately half of

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[3] Kornis, M. S., J. L. Webster, A. A. Lane, K. W. Pankow, K. Mann, S. R. Cressman, and C.R. Bronte. 2017. Recovery rates of stocked and wild Chinook salmon in Lake Michigan, 2011-2015. Report #2017-07, USFWS-Green Bay Fish and Wildlife Conservation Office, New Franken, WI.

the Menominee River Chinook salmon quota has been stocked into a net pen as part of a cooperative project with the M&M Great Lakes Sportfishing Club. This is the first year that our fall surveys detected a noticeable increase in Chinook salmon, but it is difficult to determine if net pen use contributed to increased Chinook survival and homing.

Forty-four rainbow trout were captured in 2020, up from 34 in 2019. Thirty-two rainbow trout had an adipose fin clip. Nineteen of those fish were collected and heads were delivered to USFWS-GBFRO for coded-wire tag analysis. An additional five heads were collected during sampling efforts targeting other species on the lower Menominee River. No rainbow trout stocked by the DNR were detected in the samples (Table 3). Additional years of data collection are needed to better determine the relative contribution of stocked rainbow trout by Michigan and Wisconsin in the lower Menominee River.

Table 2. *Number of adult fish captured by species and date on the lower Menominee River, 2020.*

DATE	WATER TEMP	FLOW (CFS)	BROWN TROUT	RAINBOW TROUT	CHINOOK SALMON	PINK SALMON
Oct. 7, 2020	55	4200	5	0	2	0
Oct. 13, 2020	54	4300	4	3	13	0
Oct. 20, 2020	45	4440	13	5	27	0
Oct. 27, 2020	40	6570	11	2	17	0
Nov. 4, 2020	41	4200	10	3	11	0
Nov. 11, 2020	47	5690	9	4	10	0
Nov. 18, 2020	37	8900	21	14	NA	0
Nov. 19, 2020	38	8040	22	10	6	0
Dec. 2, 2020	34	4250	17	3	1	0
TOTAL			**112**	**44**	**87**	**0**

Table 3. *Stocking information from 24 adipose-clipped rainbow trout collected in 2020. All fish were collected in the lower Menominee River. Results courtesy of USFWS-GBFRO mass marking program.*

CAPTURE DATE	LENGTH (INCH)	WEIGHT (LBS.)	SEX	CODED WIRE TAG #	YEAR STOCKED	AGENCY	LAKE	STOCKING LOCATION
Apr. 8, 2020	14.8	1.3	M	No tag detected				
Apr. 8, 2020	13.0	0.7	M	641164	2019	MI DNR	Michigan	Menominee R, Brevoort R, Ford R, East Branch Whitefish R, Days R
Apr. 10, 2020	19.5	3.1	F	641015	2018	MI DNR	Michigan	Menominee R, Cedar R, Brevoort R, Manistique R, Days R
Apr. 10, 2020	15.4	1.3	M	641164	2019	MI DNR	Michigan	Menominee R, Brevoort R, Ford R, East Branch Whitefish R, Days R
Oct. 5, 2020	25.5	7.1	F	641015	2018	MI DNR	Michigan	Menominee R, Cedar R, Brevoort R, Manistique R, Days R
Oct. 13, 2020	22.1	4.9	M	641164	2019	MI DNR	Michigan	Menominee R, Brevoort R, Ford R, East Branch Whitefish R, Days R
Oct. 20, 2020	26.5	7.5	F	641015	2018	MI DNR	Michigan	Menominee R, Cedar R, Brevoort R, Manistique R, Days R

Oct. 20, 2020	23.6	6.1	M	641015	2018	MI DNR	Michigan	Menominee R, Cedar R, Brevoort R, Manistique R, Days R
Oct. 20, 2020	20.5	3.4	F	641164	2019	MI DNR	Michigan	Menominee R, Brevoort R, Ford R, East Branch Whitefish R, Days R
Oct. 27, 2020	25.7	7.3	F	641015	2018	MI DNR	Michigan	Menominee R, Cedar R, Brevoort R, Manistique R, Days R
Oct. 27, 2020	23.8	5.6	M	641015	2018	MI DNR	Michigan	Menominee R, Cedar R, Brevoort R, Manistique R, Days R
Nov. 4, 2020	20.9	4.6	F	No tag detected				
Nov. 4, 2020	23.5	4.9	M	641015	2018	MI DNR	Michigan	Menominee R, Cedar R, Brevoort R, Manistique R, Days R
Nov. 11, 2020	24.9	6.8	F	641015	2018	MI DNR	Michigan	Menominee R, Cedar R, Brevoort R, Manistique R, Days R
Nov. 11, 2020	23.1	5.8	F	641015	2018	MI DNR	Michigan	Menominee R, Cedar R, Brevoort R, Manistique R, Days R
Nov. 11, 2020	22.5	5.3	M	641015	2018	MI DNR	Michigan	Menominee R, Cedar R, Brevoort R, Manistique R, Days R
Nov. 19, 2020	26.9	7.9	F	641015	2018	MI DNR	Michigan	Menominee R, Cedar R, Brevoort R, Manistique R, Days R
Nov. 19, 2020	25.3	8.1	F	641015	2018	MI DNR	Michigan	Menominee R, Cedar R, Brevoort R, Manistique R, Days R
Nov. 19, 2020	25.5	7.5	M	641015	2018	MI DNR	Michigan	Menominee R, Cedar R, Brevoort R, Manistique R, Days R
Nov. 19, 2020	28.7	10.0	M	641015	2018	MI DNR	Michigan	Menominee R, Cedar R, Brevoort R, Manistique R, Days R
Nov. 19, 2020	22.0	4.6	F	641164	2019	MI DNR	Michigan	Menominee R, Brevoort R, Ford R, East Branch Whitefish R, Days R
Nov. 19, 2020	23.8	6.0	F	No tag detected				
Dec. 2, 2020	25.0	6.3	F	641015	2018	MI DNR	Michigan	Menominee R, Cedar R, Brevoort R, Manistique R, Days R
Dec. 2, 2020	20.9	3.1	M	641164	2019	MI DNR	Michigan	Menominee R, Brevoort R, Ford R, East Branch Whitefish R, Days R

PESHTIGO RIVER SURVEY SUMMARY

Prior to 2015, the Peshtigo River was surveyed only periodically in the fall for salmonids. Beginning in 2015, the Peshtigo River has been surveyed on a similar schedule (weekly) as the Menominee River. Electrofishing surveys targeting trout and salmon were completed on the lower Peshtigo River from the city garage landing upstream to the abandoned railroad bridge, which is 0.4 miles upstream. Water levels were too low until the last three survey dates to allow the boat to navigate above the riffle near the island. Surveys were completed weekly from Oct. 7 through Nov. 11, 2020. Additionally, trout and salmon were collected as part of a contaminant fish survey on Sept. 9. Seven brown trout and 24 pink salmon were captured. Only one of the seven brown trout had an adipose fin clip. Five Chinook salmon were observed but not netted (Table 4).

Table 4. *Number of fish captured by species and date on the lower Peshtigo River, 2020.*

DATE	WATER TEMP	FLOW (CFS)	BROWN TROUT	RAINBOW TROUT	CHINOOK SALMON	PINK SALMON
Sept. 9, 2020	63	650	1	0	0	24
Oct. 7, 2020	56	789	0	0	2	0
Oct. 13, 2020	54	944	2	0	0	0
Oct. 20, 2020	46	925	1	0	0	0
Oct. 27, 2020	41	1670	0	0	1	0
Nov. 4, 2020	43	1040	2	0	2	0
Nov. 11, 2020	47	1720	1	0	0	0
TOTAL			**7**	**0**	**5**	**24**

Table 5. *Number of fish by species caught in 2015-2020 in the Menominee and Peshtigo River fall electrofishing surveys.*

	MENOMINEE RIVER						PESHTIGO RIVER					
	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Brown trout	31	76	51	49	75	112	4	9	7	3	5	7
Rainbow trout	9	29	48	17	34	44	2	0	0	0	0	0
Chinook salmon	8	3	5	10	15	87	7	9	10	1	14	5
Pink salmon	0	63	3	42	45	0	28	23	8	18	30	24

SEEFORELLEN GAMETE COLLECTION SUMMARY

Beginning each year in late October or November, DNR crews use electroshocking boats to collect Seeforellen adults that are identified by an adipose fin clip from several locations. Adult Seeforellen are transferred to Besadny Anadromous Fish Facility (BAFF) where they are held in ponds. Once a week from mid-November to early December, propagation staff collect eggs and milt from ripe adults. Fertilized, disinfected eggs are transferred to the Wild Rose Hatchery. Fish that are not yet ripe are returned to the ponds to be spawned at a later date. Enough eggs are collected to fulfill the Lake Michigan (450,000 fish) and Lake Superior (175,000 fish) 2021-22 stocking quotas for brown trout.

In 2020, the DNR sampled the Kewaunee River using one boat for three days (Oct. 20, 27 and Nov. 5). The Root River was sampled on Oct. 27 (one boat) and Nov. 3 and 10, 2020 (two boats). Fish captured at the Root River were given a top caudal clip prior to being transported to BAFF to distinguish each fish as a Root River fish for data analysis purposes. The DNR also sampled the Milwaukee River and harbor on two days (Oct. 28 and Nov. 4) using two electrofishing boats. Total effort for all three locations was 12 electrofishing boat-days. From 2016 to 2019, the Sheboygan River was sampled for brood stock collection, but was not sampled in 2020 due to low returns and high water that reduced effectiveness with the electrofishing boat in recent years.

In 2020, Seeforellen gametes were collected at BAFF during two spawning events: Nov. 18 and 24. Fertilized, disinfected eggs were transported to the Wild Rose Hatchery on each spawning date (Table 6). Sixty fish (30 males; 30 females) were evaluated for fish health on Nov. 30. Virology tests were negative (Dr. Nicole Nietlisbach, DVM, pers. comm). Fish that were not sacrificed for disease testing were transported via stocking truck below the weir and released in the Kewaunee River either the day of gamete collection or on the last day if still green/hard.

Since 2008, the sex ratio of male to female brown trout collected in the Root and Kewaunee Rivers has varied, with fewer males sampled in most years. This trend continued in the Root and Kewaunee rivers in 2020, with 1 male for every 2 females in the Kewaunee River and 1 male for every 1.4 females in the Root River. In contrast, the Milwaukee River and harbor produced 2 males for every female in 2020. The Menominee River brown trout sex ratios continue to be close to 1:1 males to females.

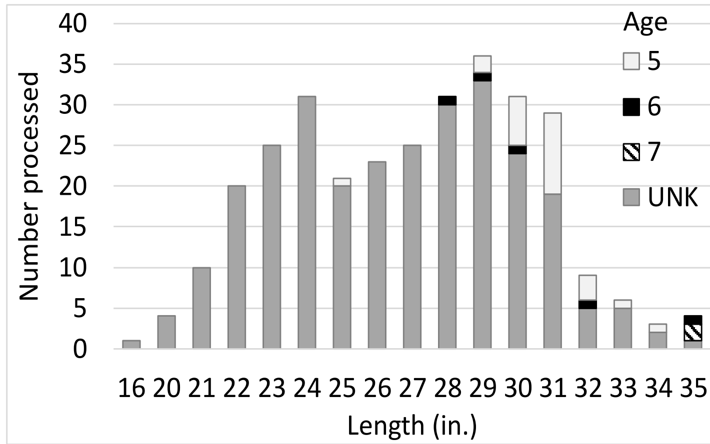


Figure 3. *Length frequency by age of Seeforellen processed at BAFF in 2020. All rivers combined.*

A total of 309 brown trout were processed at BAFF in 2020 (Table 6). Gametes were not collected from every fish as some fish were spent or hard (last day), but biological data was collected from all fish. Age-2, 3, and 4 fish (adipose clip) dominated the sample, with 10% being age-5 or older based on unique fin clips that were given to brood stock prior to mass marking using an adipose only clip (Figure 3). A higher proportion of older fish is encouraging. This indicates improved survival of multiple year classes and allows the genes of larger, older fish to be passed on to the next generation of stocked fish. There was no significant differences between the weight of females collected from the three rivers as determined by one-way ANOVA, $F(2,163) = 0.09$, $p = 0.91$.

Table 6. *Number of Seeforellen brown trout processed for biological data at BAFF by river source and gender in 2020. This includes all fish even if no gametes were collected. Mortalities removed from the ponds are not included in this table.*

DATE	MILWAUKEE RIVER & HARBOR		ROOT RIVER		KEWAUNEE RIVER		EGGS COLLECTED
	Males	Females	Males	Females	Males	Females	
18-Nov-2020	34	16	40	38	17	36	916,524
24-Nov-2020	24	13	16	39	12	24	423,936
TOTAL	**58**	**29**	**56**	**77**	**29**	**60**	**1,340,460**

SUMMARY

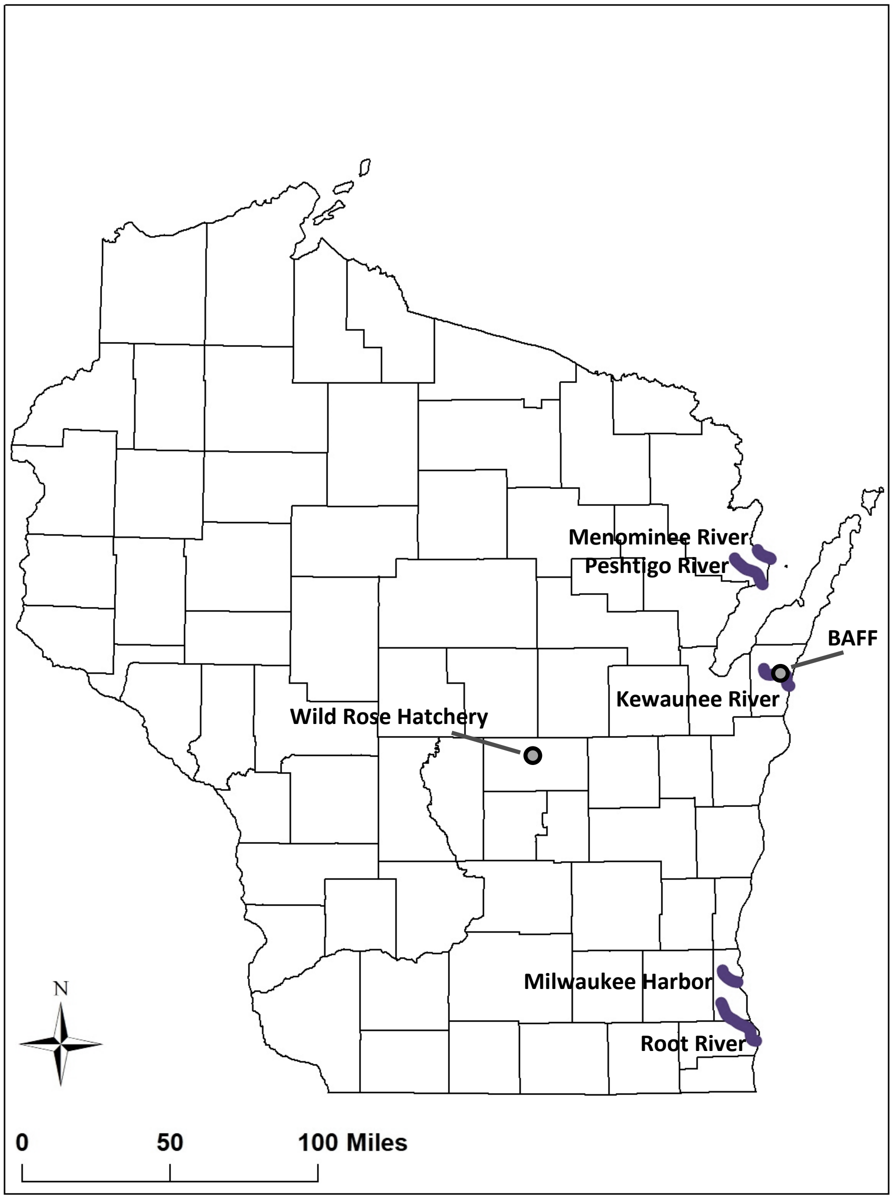
Total estimated harvest of brown trout in Green Bay in 2020 was 989 fish in 2020, but that estimate does not include fish harvested from late March to mid-July 2020 due to COVID-19 work restrictions. Harvest rates for anglers targeting salmonids in Green Bay was 23 hours/fish, compared to 12 hours/fish in 2019 but again, this does not include the spring period when harvest rates are typically better.

All yearling brown trout that Wisconsin stocked into Lake Michigan from 2017 to 2020 received an adipose fin clip through the efforts of the USFWS-GBFRO mass marking trailer. Brown trout captured during weekly fall surveys in 2020 were used to evaluate relative contributions of Wisconsin clipped brown trout compared to unclipped brown trout stocked by the Michigan DNR in northern Green Bay. The return index for clipped Seeforellen stocked in Wisconsin was 0.18, while the return index for unclipped brown trout of various strains stocked in Michigan was slightly less, at 0.11. We will continue to evaluate the contribution of clipped and unclipped fish in 2021. By fall 2022, the Wisconsin age-2 brown trout (fingerlings stocked in 2020 and yearlings stocked in 2021) will not be clipped, rendering further evaluation difficult.

Seeforellen brood stock will continue to be collected in Milwaukee Harbor and the Kewaunee and Root rivers. Fall assessments will continue to be conducted in the Menominee and Peshtigo rivers. Although offshore stocking was not conducted in 2020 due to COVID-19 issues, the DNR plans to continue offshore stocking yearling brown trout into Green Bay in 2021. Since offshore stocking began, the harvest rate has generally improved compared to the previous ten years. Two exceptions are 2013 and 2014, which were late ice-out springs that prevented early season nearshore trolling for brown trout. In 2021, the DNR will continue to stock brown trout, conduct index surveys and evaluate their contributions to the Green Bay fishery.

ACKNOWLEDGEMENTS

Dozens of staff across several agencies and offices made this effort possible. DNR fisheries staff from Peshtigo, Green Bay and Sturgeon Bay offices participated in the Menominee and Peshtigo River surveys targeting trout and salmon. DNR fisheries staff from Green Bay and Besadny Anadromous Fish Facility collected brood fish on the Kewaunee River. DNR fisheries staff from Milwaukee and Eagle collected and transported brood fish from the Root River and Milwaukee harbor and river. DNR staff from the Wild Rose Hatchery and BAFF were involved in various aspects of Seeforellen gamete collection and rearing the fish. DNR fish health staff from Madison collected samples at BAFF. Peshtigo staff collected biological data at BAFF. Data for trout and salmon for all surveys was entered into the DNR Lake Michigan Fish Tracking Database by Peshtigo staff.



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STATUS OF GREAT LAKES MUSKELLUNGE IN WISCONSIN WATERS OF GREEN BAY

The Wisconsin Department of Natural Resources (DNR) in cooperation with several local musky clubs and the Musky Clubs Alliance of Wisconsin initiated a Great Lakes muskellunge reintroduction program in 1989 for the Green Bay waters of Lake Michigan to diversify the predator population of the bay. In 2012, the DNR completed a Green Bay Great Lakes Muskellunge Management Plan. This report highlights our efforts to manage this fishery.

ANNUAL ASSESSMENTS

Annual assessments to determine the status of the Green Bay muskellunge population have been consistently conducted using Fox River fyke nets in the spring and electrofishing in the fall since 2003. However, because of the COVID-19 pandemic, we did not conduct musky spring surveys in 2020.

Nighttime electrofishing surveys have been conducted along the length of the lower Fox River from the river mouth to the DePere Dam during September or October since 2000 to index muskellunge and walleye populations. During the 2020 fall electrofishing survey, we captured seven muskellunge that were greater than 450 mm (17.7”) with only one musky greater than 760 mm (30”) (Figure 1). The 2020 catch per unit of effort (CPUE) sharply decreased to 1.2 muskellunge per hour compared to 6.4 per hour for length greater than 450 mm in 2019. A similar result came from efforts related to muskellunge greater than 760 mm (30”) with 0.2 fish per hour in 2020 compared to 4.2 musky per hour in 2019. The 2020 CPUE indicates a decrease from 2019 but is similar to the previous 10 years.

Since the onset of an earlier survey start date in 2009, fall CPUE has sharply declined through 2020. The exception was in 2019, with factors such as reduced stocking numbers, poor fall water clarity and avoidance of favored fall shoreline holding areas in the Fox River because of dredging activities all contributing to the decline in CPUE. However, the 2019 CPUE was the highest since 2010. Following very low fall catches from 2011 through 2013, increasing catches have been noted recently, except in 2017 and 2020, when warm river water temperatures persisted beyond the end of the survey reducing the catch of musky. Increasing CPUE, noted by the past four of six fall surveys, are likely the result of increased stocking which has occurred since 2010.

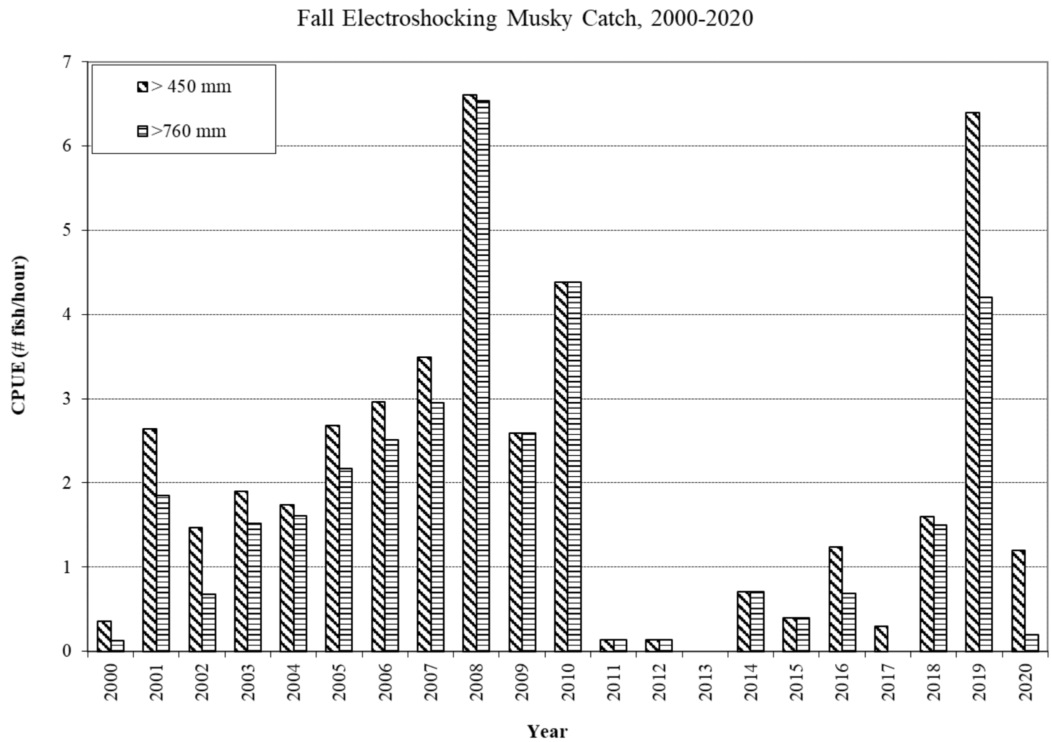

Figure 1. *Catch per Unit Effort (CPUE) from nighttime electrofishing on the Fox River for muskellunge greater than 450mm (17.5 in) and greater than 760mm (30 in) from 2000- 2020.*

STOCKING

In 2020, the DNR stocked 0 fall fingerlings and 7,741 yearlings. The DNR did not rear fall fingerlings at the Besadny Anadromous Fisheries Facility (BAFF) in 2020. In 2019, the DNR stocked 4,838 fall fingerling and 5,006 yearling musky into the Wisconsin waters of Green Bay (Figure 2). Overall, Wisconsin has stocked 170,588 fingerling and 32,647 yearling musky since the start of this project in 1989. The DNR has been able to stock yearling musky in five of the last six years.

Stocking since 2010 has used a combination of fingerling musky raised at BAFF near Kewaunee, WI and yearling musky reared at Wild Rose State Fish Hatchery. Eggs for musky raised at BAFF were obtained from wild fish attempting to spawn in the Fox River that were captured during spring fyke net surveys. Yearling musky raised at Wild Rose were obtained from the Michigan DNR from fish spawning in the Detroit River.

Since 2010, the majority of stocking has focused on locations that have fingerling habitat and are also able to support adult musky. These locations in include the Fox River in Brown County, the Menominee River in Marinette County and Sawyer Harbor and Little Sturgeon Bay in Door County. However, with the availability of musky for stocking since 2010, smaller streams on the west shore of Green Bay including the Peshtigo River, Oconto River, Pensaukee River and Suamico River have been stocked. All stocked fingerling musky receive a left ventral (LV) fin clip and all yearling stocked musky receive a right ventral (RV) clip and 20% of the yearling musky were also PIT tagged near the dorsal fin.

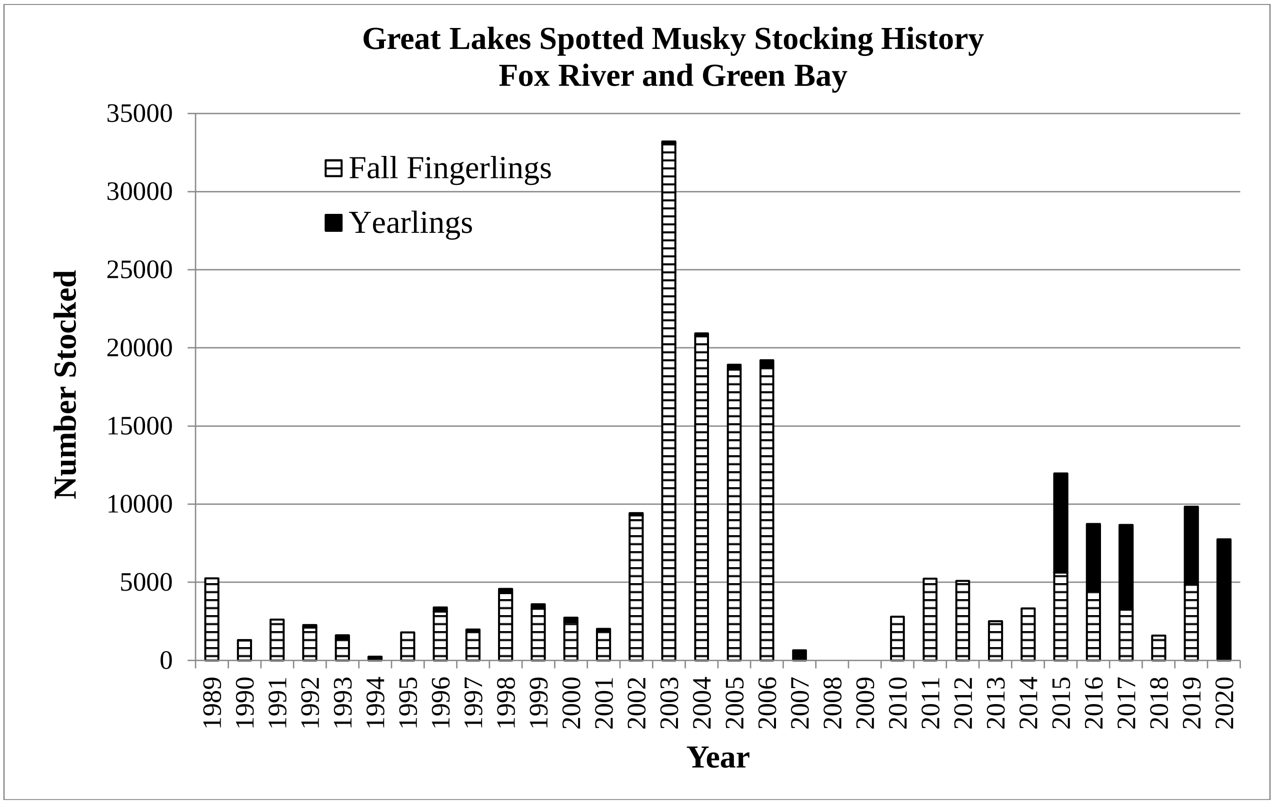

Figure 2. *Great Lakes Spotted muskellunge stocking history for fish that were stocked into Green Bay from 1989 through 2020.*

FISHERY

The Green Bay creel survey estimated that a total of 1,183 muskellunge were caught by anglers in 2020 although the COVID-19 pandemic delayed us from collection of creel data until July (Figure 3). That 2020 estimate was 73% lower than the 2019 estimate and below the average annual catch of 1,600 which has been noted since 2005. The 2019 estimated catch of musky was the highest on record. Harvest of musky is low, and harvest trends should be viewed with caution since they are computer generated estimates. Catch and release fishing and the 1372 mm (54”) minimum size limit will likely limit harvest for the foreseeable future in the Green Bay musky fishery.

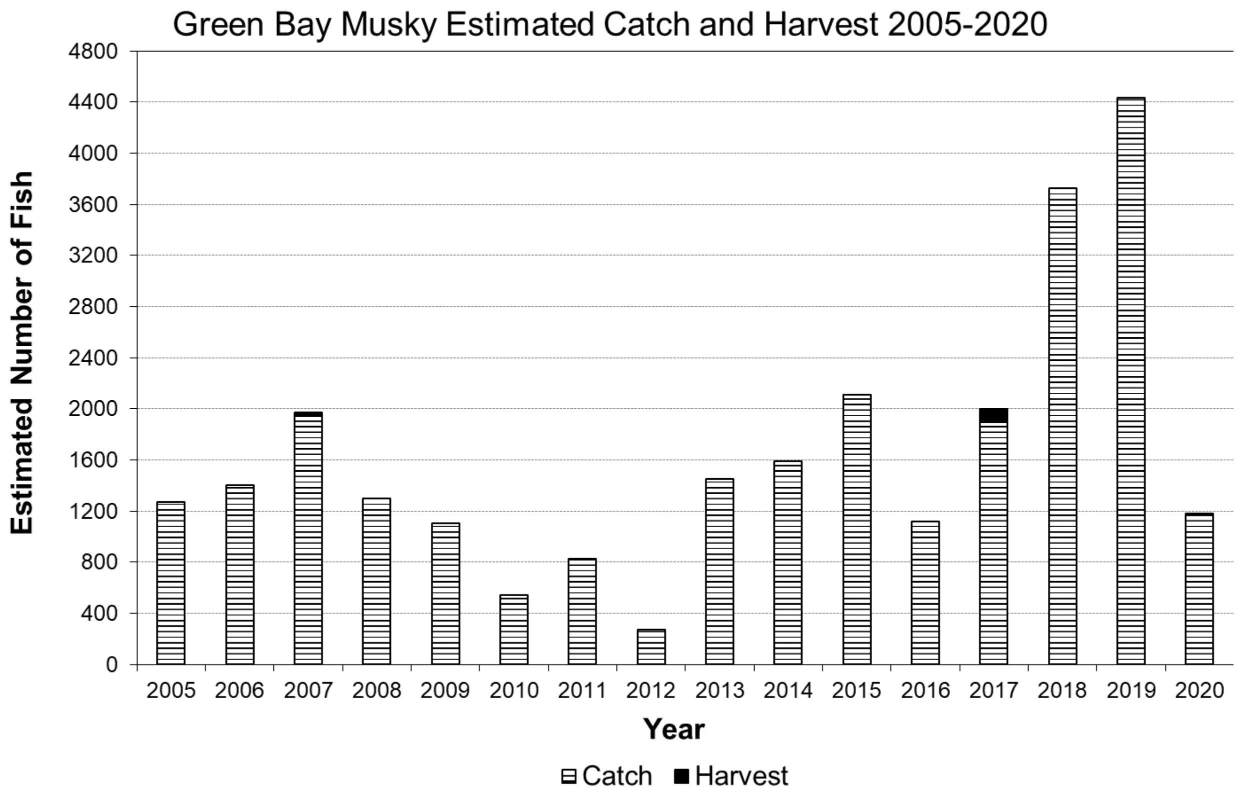

Figure 3. *The estimated catch and harvest of Great Lakes Spotted muskellunge from Green Bay from 2005 through 2020 during the open water fishing season.*

A total of 66.562 hours of directed effort for muskellunge occurred on Green Bay and the lower Fox River from July 1 through Oct. 31, 2020 (Figure 4). Creel interviews did not start until July in 2020 because of the COVID-19 pandemic. This 2020 effort was 32% higher than the 2019 estimate. The higher 2020 directed effort followed a trend of generally increased statewide angler participation in 2020. The creel data estimated that CPUE was 0.018 in 2020 compared 0.089 fish per hour in 2019 or 56.2 hours in 2020 compared to 11.3 hours in 2019 to catch a musky. The number of hours needed to catch a musky has improved every year since 2016 with the exception of 2020.

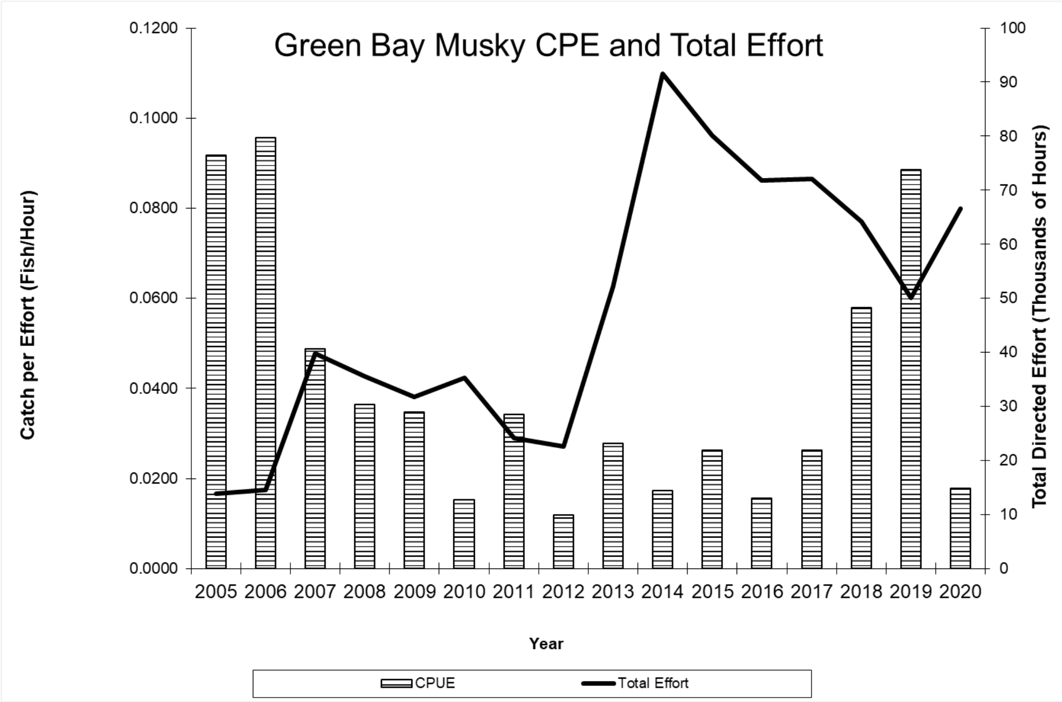

Figure 4. *Total directed fishing effort for muskellunge on Green Bay waters of Lake Michigan from 2005-2020 is displayed by the solid black line on the right axis in thousands of hours fished. The left axis shows catch per effort of muskellunge caught from 2005 through 2020.*

FUTURE

Currently, annual stocking maintains the Green Bay musky population with few natural recruits captured during recent surveys. Increased stocking since 2010, especially since 2015, should increase the number of musky available to anglers in Green Bay waters in upcoming years. Based on DNR surveys, it appears that stocked musky grow rapidly, reach maturity and attempt to spawn. Creel survey results indicate that the Green Bay musky fishery remains popular with anglers. They have begun to target musky throughout Green Bay as the population spreads out from the Fox River and lower Green Bay to more northern waters. Ongoing cooperative projects with UW-Stevens Point and UW- Green Bay are using telemetry to monitor musky movement throughout Green Bay, side scan sonar to evaluate habitat, egg deposition and fry surveys to quantify reproduction and habitat enhancement projects to improve spawning, juvenile and adult musky habitat.

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2020 STATUS OF WALLEYE IN SOUTHERN GREEN BAY AND THE 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 1970s, the Wisconsin Department of Natural Resources (DNR) began to stock fry and fingerling fish to rehabilitate the walleye population. This stocking program was so successful in reestablishing natural reproducing walleye in southern Green Bay and the lower Fox River that stocking was discontinued in 1984 and in the Sturgeon Bay area in 2012. Since 1984, surveys have been conducted to assess adult and young of year (YOY) walleye in the Fox River, Green Bay and other tributaries.

The purpose of this report is to summarize data collected during the 2020 field season on the southern Green Bay/Fox River and Menominee River walleye stocks, and to describe long-term trends in YOY production and angler catch and harvest.

SPRING ELECTROFISHING SURVEYS

From 2013-19, the DNR assessed the magnitude of walleye spawning migrations into the Fox River located in southern Green Bay by using daytime electroshocking. Electrofishing has been conducted just below the dam in De Pere to capture walleye during the estimated peak of the spring spawning run with a goal to tag 500 walleye and to collect biological information from captured walleye. Because of the COVID-19 pandemic and related field work restrictions, spring surveys were not conducted in the lower Fox River. However, DNR staff collected walleye gametes from the Menominee River so that related 2020 survey effort will be reported.

The 2020 Menominee River walleye electroshocking runs were conducted on April 8 and April 10. During this period, weather conditions varied with warm weather followed by cold ambient temperatures and high flows. Maximum ambient temperature was 60° F on April 8 and 42° F on April 10. Water temperatures fell from 43° F on April 8 to 41° F on April 10. During these sampling events, the effort was not recorded but generally was 1-2 hours of electrofishing time per day. Captured walleye ranged in length from 340 mm to 757 mm (13.4” to 29.8”) and had an average length of 551 mm (21.7”).

The 152 male walleye that were captured ranged in length from 340 mm to 625 mm (13.4” to 24.6”) and had an average length of 506 mm (19.9”) (Figure 1). 94% of the captured male walleye were less than 600 mm (24”) in length with few fish greater than 600 mm (24”). The 171 female walleye ranged in length from 480 mm to 757 mm (18.9” to 29.8”) and had an average length of 594 mm (23.4”). The distribution of female walleye length was bimodal with peaks near 533 mm (21”) and 650 mm (25.6”). 41% of the captured female walleye were greater than 600 mm (24”) in length.

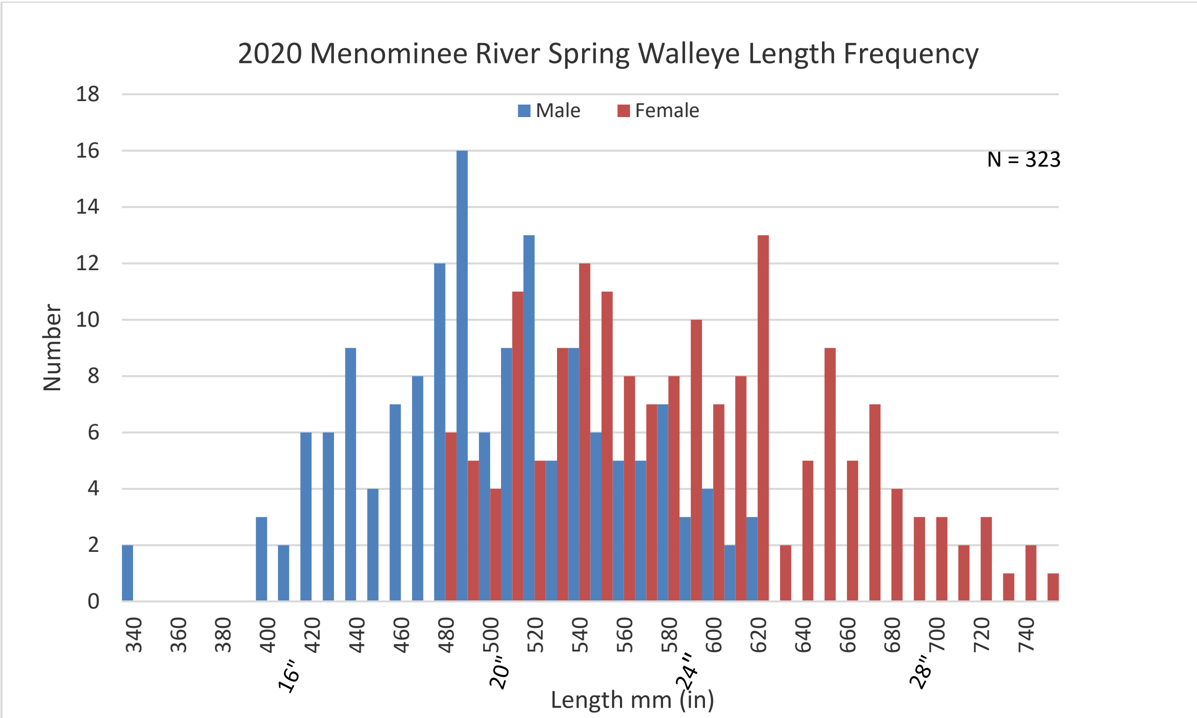

Figure 1. *The length distribution of walleye captured during 2020 spring electroshocking on the Menominee River.*

During the 2020 spring Menominee River survey, a dorsal spine was removed from all captured walleye for age analysis with up to ten spines per centimeter length interval for male and female walleye collected. In 2020, 323 spines (152 male and 171 female) were analyzed to develop our Year Class (YC) distribution table (Figure 2). YC 2015 (age 5) was the most common YC, with YC 2016 (age 4) also present in a higher percent. In 2020, 2015 YC walleye represented 21.4% of the run.

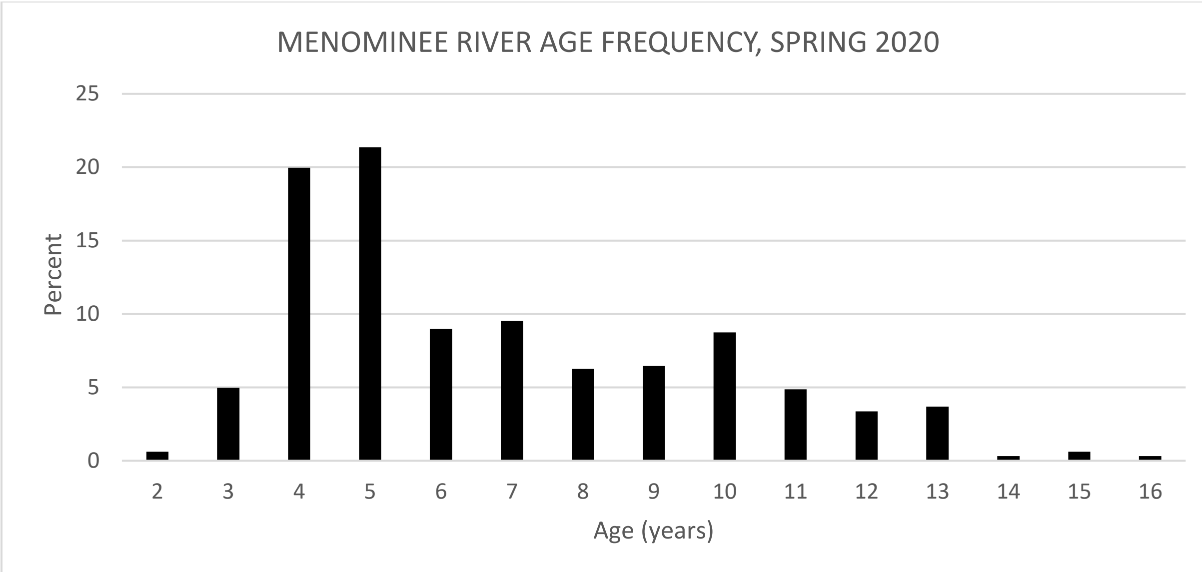

Figure 2. *The year class distribution of walleye captured during the spring spawning run from the Menominee River in 2020. Male and female ages are pooled to determine the percentage of the run represented by each year class.*

FALL ELECTROFISHING INDEX SURVEYS

In 2020, during the nighttime YOY walleye index electroshocking survey on the Fox River, staff surveyed a total of 8.5 miles of shoreline and actual time shocking was six hours. We captured 562 walleye that had average length of 372 mm (14.6”) and ranged in length from 162 mm to 614 mm (6.4” to 24.2”) (Figure 3). 540 (96%) of the captured walleye were classified as adult walleye. The adult CPUE was 92 fish per mile of shoreline and 65 fish per hour. The YOY walleye were caught at 0.8 fish/mile and 1.2 fish/hour which was 90% less than 2019.

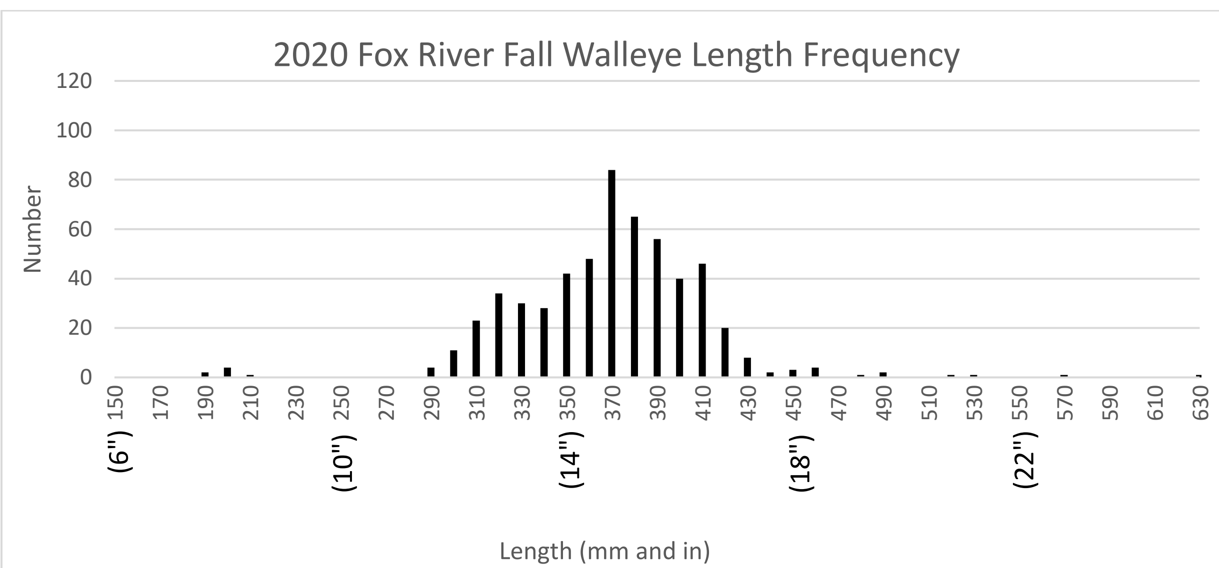

Figure 3. *Length-frequency distribution of walleye from the lower Fox River during fall 2020.*

RECRUITMENT OF YOY WALLEYE

Results of our 2020 fall electrofishing index surveys indicated that the CPUE of YOY caught on the Fox River and southern Green Bay were far below average when compared with the period of 1993 through 2019 (Figure 4). Fox River YOY walleye CPUE was 1.2 per hour shocked, which was well below the 1993-2019 average CPUE of 17.6 YOY per hour. The southern Green Bay catch was even lower at zero YOY per hour shocked, which was much lower than the 1993-2019 average of 11.5 per hour. Since 2007, except for 2012 and 2019, walleye YOY assessments have found above average YC production in either the Fox River or Green Bay or in both locations. Consecutive poor YC's were last noted at both locations during the falls of 2004-06 and 2019-20. It's interesting to note apparent predictable strong year classes from the fall Fox River surveys every five years (1993, 1998, 2003, 2008, 2013 and 2018). The lower Green Bay fall surveys indicated a similar but not always consistent pattern.

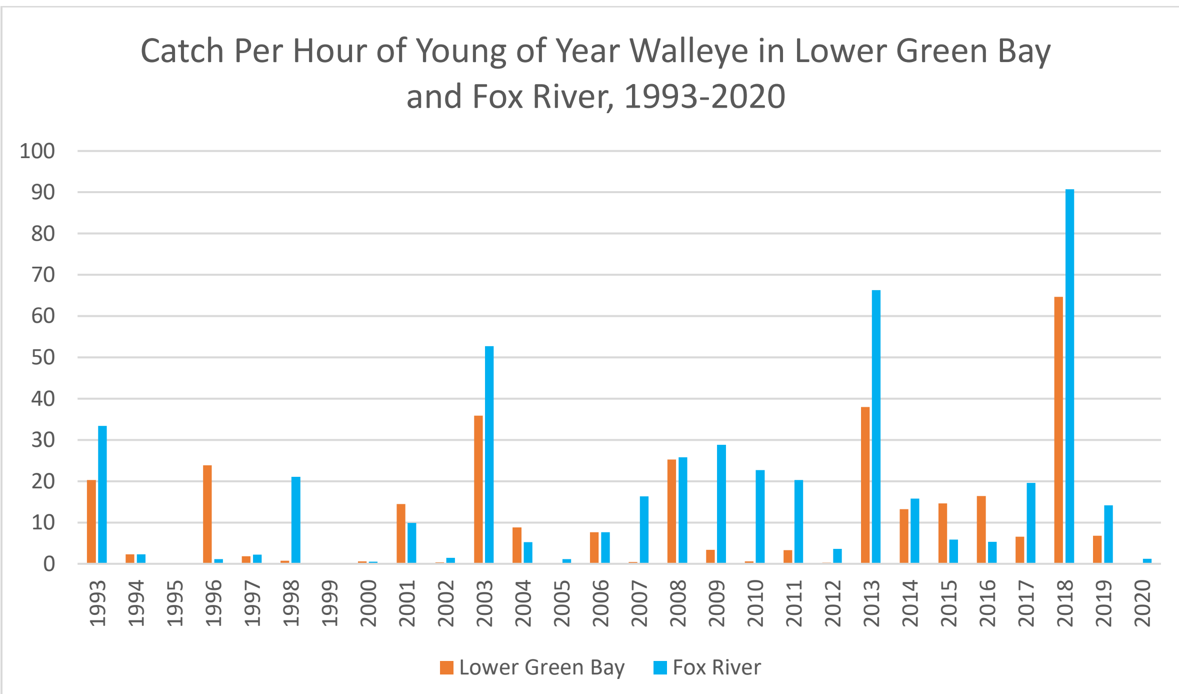

Figure 4. *CPUE of young-of-year walleye in the lower Fox River (DePere Dam to mouth), lower Green Bay (south of a line drawn from Longtail Point to Point Sable), as measured by catch per unit effort (CPUE; number per hour) from data collected in electrofishing index surveys during 1993-2020.*

CATCH AND HARVEST

2020 catch and harvest only collected from July-October because of the COVID-19 pandemic. The total catch of walleye from Wisconsin waters of Green Bay was estimated by DNR creel surveys at 182,270 fish during the 2020 open water fishing season (July–October 31) (Figure 5). This was a 16% decrease from the estimated 217,097 walleye that were caught during the 2019 open water fishing season. The 2020 walleye catch was far above the 1986-2019 average catch of 127,640 walleye but lower than the previous ten-year average catch of 197,562.

The total open water fishing season harvest of walleye from Wisconsin waters of Green Bay decreased by 11% from 98,358 harvested in 2019 to 87,197 in 2020 (Figure 5). However, the 2020 harvest of walleye was much higher than the 1986-2019 average harvest of 44,365 and only slightly lower than the previous ten-year average harvest of 87,376.

Although there have been yearly fluctuations in catch and harvest, the general trend for catch and harvest has been steadily increasing since the early 2000s. Since 2012, the estimated walleye catch has been above 150,000 fish each year. It is likely that the increases in catch are directly related to average to above average YOY production since 2007. Likewise, the estimated harvest has been above 75,000 walleye since 2012 due to strong walleye production. The larger than average catch and harvest noted in 2020 were likely due to the 2013-year class fully entering the fishery.

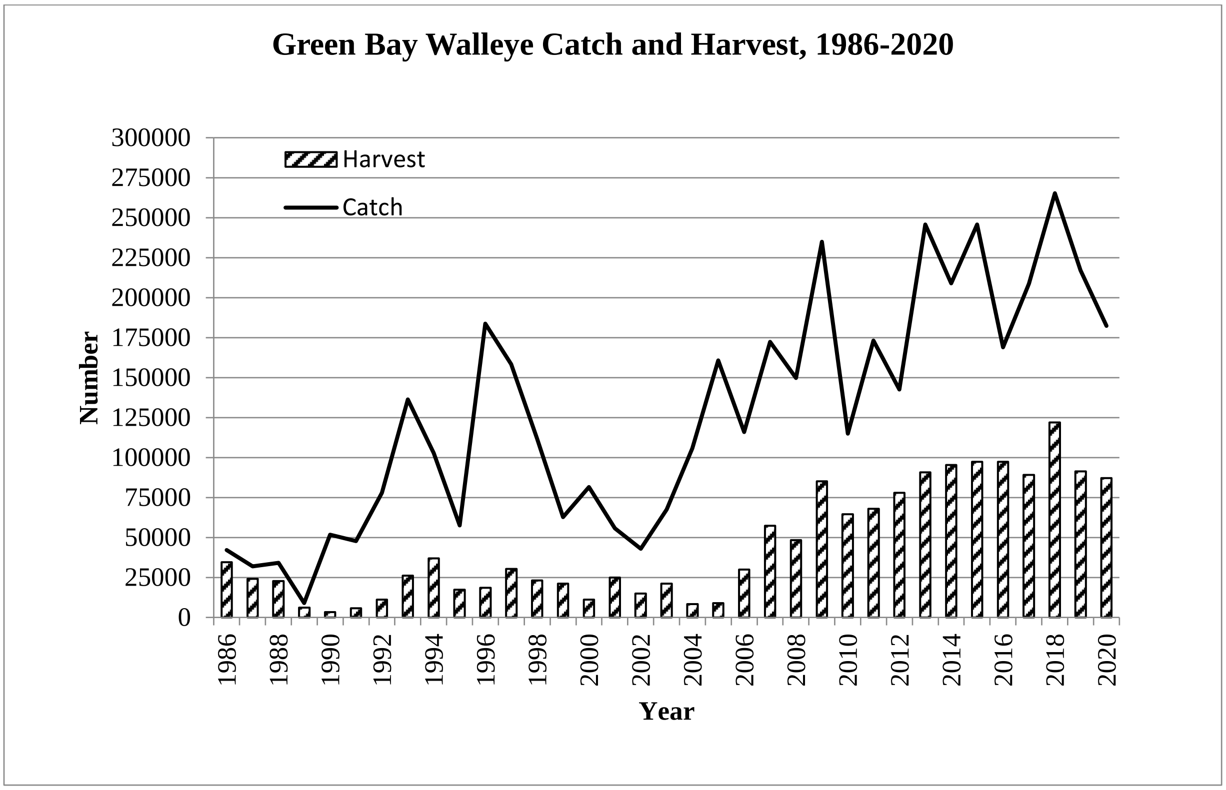

Figure 5. *Estimated total open water season (March-October) walleye catch and harvest from Wisconsin waters of Green Bay and the lower Fox River during 1986 through 2019. 2020 data reflects only July-October data because of reduced creel effort due to the COVID-19 pandemic.*

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 ten of the past twelve years during electroshocking surveys with the 2018 cohort being the strongest year class measured since the onset of fall index shocking. In general, year classes since 2013 have been rated as average or slightly above average with 2013 and 2018 the largest measured. The 2013 YC has fully entered the fishery and as the 2015 through 2018-year classes fully recruit to the fishery, annual catch and harvest are likely to increase because these fish will obtain a size desired by anglers. In fact, comments from interviewed anglers in 2020 was that most of the fish caught were less than 15 inches in length. The Green Bay creel survey continues to play a vital role in the management of the walleye fishery. Additionally, as contaminant levels continue to decrease from the Fox River PCB clean-up, walleye harvest will also likely continue to indicate a general increasing trend.

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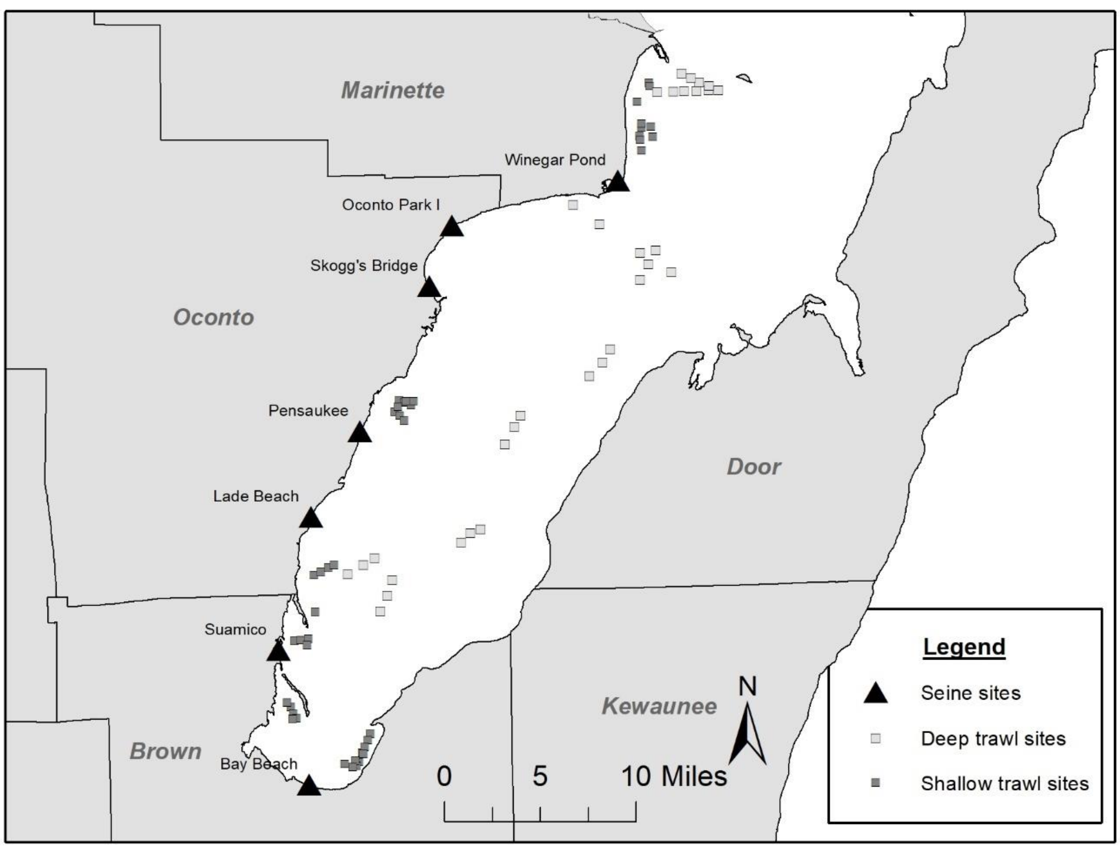
GREEN BAY YELLOW PERCH

This report summarizes assessments and monitoring of yellow perch in southern Green Bay completed in 2020 by the Wisconsin Department of Natural Resources (DNR). Data obtained from various surveys are used as inputs for a statistical catch at age model that estimates the abundance of adult yellow perch. These surveys include spring fyke netting, water temperature monitoring, shoreline seining, commercial monitoring, bottom trawling and recreational harvest creel surveys. Details of methods are described within each survey section.

Yellow perch abundance in Green Bay increased steadily through the 1980s. 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. Beginning in the late 1980s, yellow perch abundance began to decline, primarily due to poor recruitment. From 1988 to 2002, only two reasonably strong year classes (1991 and 1998) appeared during summer trawling surveys (Figure 1). Since 2002, reasonably strong year classes were measured annually, with the exception of 2014, 2019 and 2020 (Figure 1). The trawling surveys indicated that 2020 produced a poor year class, with the relative abundance of YOY yellow perch estimated at 75/hr. The average number of YOY per trawl hour is 901/hr, since deep water trawl sites were added in 1988.

MAP OF 2020 SAMPLING LOCATIONS



SPAWNING ASSESSMENT

The spring spawning assessment inside of Little Tail Point is currently completed every 2 to 3 years. Since that survey was completed in 2019, it was not planned for 2020.

WATER TEMPERATURE

Annual spring and summer temperature monitoring has been ongoing since 2003. Temploggers were not deployed in 2020 due to COVID-19 work restrictions in April and May.

BEACH SEINING

Seven long-term index sites along the west shore of Green Bay were sampled once using a beach seine (25ft wide x 6ft high, ¼-inch delta mesh with 6 x 6 x 6ft bag) between July 28 and Aug. 5, 2020. Due to high Lake Michigan water levels and difficult wading conditions, sites along the east shore of Green Bay and Red Arrow Park near Marinette were not surveyed in 2020. June sampling was not completed in 2020 due to COVID-19 work restrictions.

At each site, a rope tied to a steel rod was driven into the bottom sediment to measure a 50ft transect perpendicular to shore. Two people walked alongside the rope and completed two hauls, one on each side of the 50ft rope. A third person held a tub and supplies. After each 50ft haul, the number of YOY both retained and escaped from the seine bag when it was placed in a tub was recorded. Catch per effort (CPUE) was calculated as the mean number of YOY yellow perch per 100ft seine haul. YOY yellow perch were captured at 3 of 7 sites (mean CPUE=7; Table 1) during the sampling period. The previous 22-year average CPUE is 70. The site with the highest abundance in 2020 was at Oconto Park I (CPUE=23).

Mean length of YOY yellow perch during the late July-early August survey period was 54 mm (range: 42-75). A total of 21 fish species were identified during the survey. Bluegill YOY dominated the catches followed by gizzard shad YOY, round goby and alewife YOY. Of interest were 4 YOY northern pike and 1 YOY largemouth bass captured at Winegar Pond, 6 YOY largemouth bass and 1 YOY smallmouth bass captured at Oconto Park I.

Table 1. *Yellow Perch mean CPUE of June and July sampling periods, 2011-2020.*

	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
June CPUE	N/A	17	44	163	51	37	46	32	30	115
July CPUE	7	7	45	14	12	N/A	7	24	27	38

TRAWLING SURVEY

Annual late summer trawl surveys continued for the 43rd year to monitor trends in yellow perch abundance. Trawling was conducted at 75 index sites at 12 locations: 43 shallow sites (established in 1978-1980) and at 32 deep water sites (added in 1988) using a 25-ft semi-balloon trawl with 1½-inch stretch mesh on the body, 1¼-inch stretch mesh on the cod end, and a cod end liner with ½-inch stretch mesh. The net was towed for five 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.

At each of the 12 locations, 100 YOY yellow perch were measured if captured and yearling and older perch were subsampled for age, length and weight. All species were counted, with additional biological data recorded for gamefish and lake whitefish.

For all locations, mean length of yellow perch YOY was 67 mm (range: 47-111 mm). 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 2020 produced a poor year class with the relative abundance of YOY yellow perch (75/hr), ranking as the 4th lowest since the deep-water sites were added in 1988 (Figure 1). Greatest abundance of YOY yellow perch was at Longtail Point (LOT), where 418/hour were captured.

While the trawling surveys are designed to assess YOY distribution and abundance, yearling and older yellow perch were also measured, weighed, sexed and aged. Abundance of age-1 and older fish was 70/hr in 2019 compared to the 33-year average of 411/hr. A majority (73%) of the age-1 and older fish captured were yearlings (2019 year class) with a mean length of 137 mm (range: 110-174 mm) followed by age-2 (25%) with a mean length of 185 mm (range: 130-228 mm). White perch YOY were the dominant species captured at shallow sites, followed by alewife YOY, gizzard shad, trout perch and spottail shiners. At deep sites, alewife YOY were the most abundant species sampled. Other common species in decreasing order of abundance captured at deep sites were rainbow smelt YOY, adult alewife, adult smelt and juvenile lake whitefish.

At each of the 12 locations, a temperature and dissolved oxygen profile was taken along with a secchi disk reading. In 2018 and 2019, the “Green Bay Dead Zone,” an area of hypoxic water in the bottom layer, was recorded during trawling surveys. However, oxygen readings were sufficient at all locations in 2020.

Water clarity was highest at the northernmost locations and decreased farther to the south, ranging from 3.4 m at Little River Deep (LRD) off of Marinette to 0.6 m at Longtail Point (LOT) in the southern bay.

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 have dominated the dreissenid mussels caught. Only 3.5 pounds of mussels were collected in 2020, which is the lowest over the 17 years that mussels were consistently weighed at each drag. The highest weight of dreissenid mussels recorded was 778 pounds in 2005.

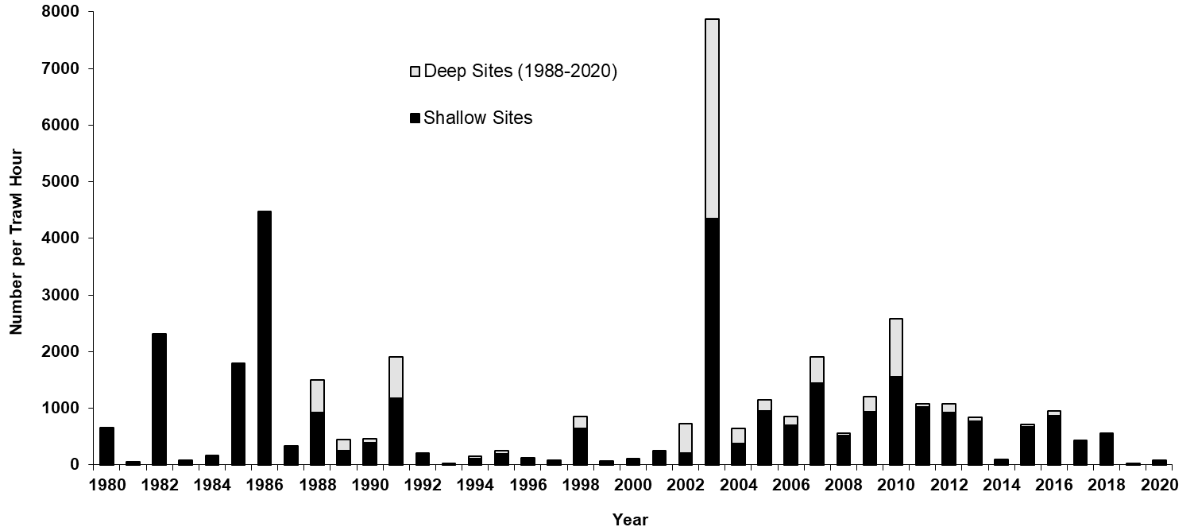


Figure 1. *Relative abundance (weighted area average) of young-of-year yellow perch collected during late summer index trawling surveys in Green Bay from 1980 to 2020.*

RECREATIONAL HARVEST

Since 2006, recreational fishing regulations for yellow perch in Wisconsin waters of Green Bay include a 15 fish daily bag limit during the open season from May 20 to March 15. Recreational harvest is estimated from an annual creel survey. Winter harvest is influenced largely by ice conditions, daily bag limits, angler effort and abundance of adult perch. Harvest of perch through the ice continues to be a minor component of the overall harvest. Much of the targeted ice fishing effort on Green Bay has focused on lake whitefish for the past decade. An estimated 19,094 perch were harvested between January and March 15, 2020. The 2020 ice harvest was down compared to the 2019 ice harvest of 25,844 perch.

Due to COVID-19 work restrictions, open water creel was conducted from only July to November in 2020. Open water harvest estimates of yellow perch increased significantly from last year. In 2020, an estimated 248,485 yellow perch were harvested in open water, up from 82,052 fish in 2019 (Figure 2). The 2020 estimates do not include harvest from the May 20 opener to July so the true harvest was even higher in 2020. Some of this increase may be attributed to more angler interest in 2020 due to the COVID-19 pandemic, but much of the increase is likely due to improved catch and harvest rates as documented during the creel survey. The majority of the open water harvest was by boat anglers launching at ramps in Door and Kewaunee counties (37%) and Brown county (27%). Age and length data were not collected by open water creel clerks in 2020.

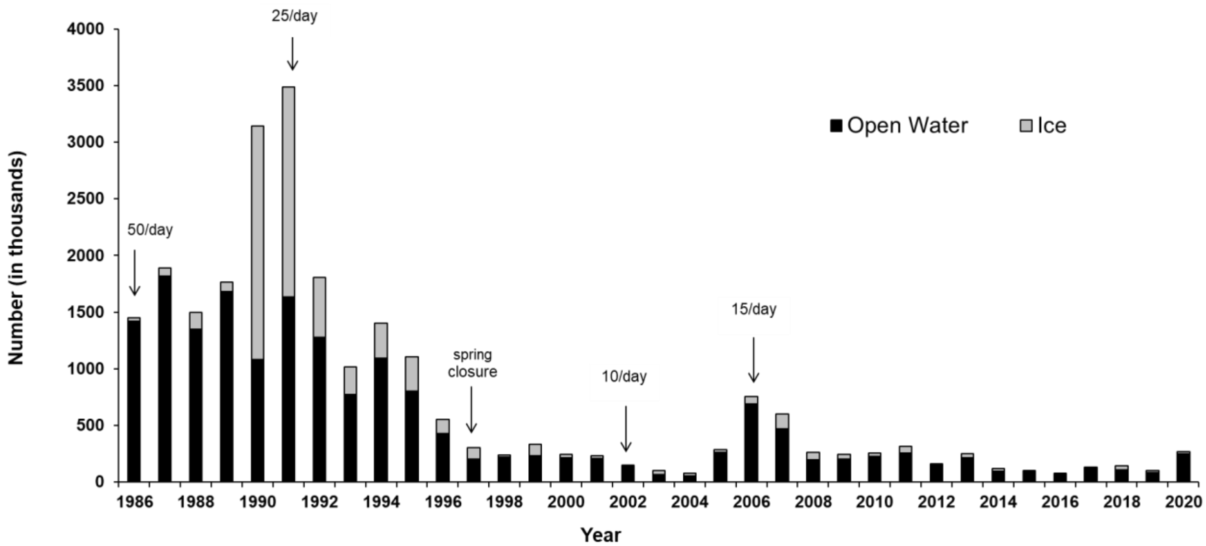


Figure 2. *Estimated recreational harvest of yellow perch in Green Bay from 1986 to 2020. Regulation changes indicated by arrows. Open water creel estimates for 2020 are from July-November only.*

COMMERCIAL HARVEST

The annual commercial harvest was reported by commercial fishermen who are required to weigh and report their harvest daily. Fish sampled by the DNR 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 from 20,000 pounds to a high of 475,000 pounds. The total allowable commercial harvest has remained at 100,000 pounds since 2008.

In 2020, commercial fishers harvested a total of 41,812 pounds of yellow perch (an estimated 140,030 fish), compared to 33,499 pounds in 2019. The majority of commercial harvest is with gill nets (98%), while drop nets comprised 2% of the total harvest in 2020. The average harvest rate (CPUE) for gill nets in 2020 was 34 pounds per 1000 ft fished, up from 25 pounds per 1000 ft fished in 2019. Drop net CPUE was 8 pounds per lift in 2020. Age-2 perch (2018 year class) made up 85% of the total commercial harvest in 2020 while age-3 comprised 12%.

DISCUSSION AND MANAGEMENT ACTIONS

Data collected in 2020 was incorporated into the statistical-catch-at-age model for Wisconsin waters of Green Bay yellow perch. The model was updated and run during the spring of 2021. Those inputs included harvest, effort and age composition from commercial and sport fisheries and YOY data from trawling surveys. Outputs of that model estimate that the adult (age 1 and older) yellow perch population has ranged between 1 million and 2.5 million fish from 2012 to 2020. The yellow perch (age 1 and older) abundance was estimated around 1.0 million fish in 2020. The trawling surveys indicated that 2020 produced a poor year class with the relative abundance of YOY yellow perch (75/hr), ranking as the 4th lowest since the deep-water sites were added in 1988.

In summary, despite many strong year classes occurring since 2003, the adult yellow perch population has not increased as expected. A research project by University Wisconsin-Stevens Point investigated the diet composition of walleye, lake whitefish and yellow perch. Results from that study suggest that yellow perch may be experiencing high mortality due to predation[4].

Despite these concerns, open water harvest of yellow perch by sport anglers in Green Bay increased by 67% in 2020 compared to the previous year. It is likely that higher harvest by sport anglers was partially due to an increase in fishing license sales in 2020 compared to the past five years (K. Scheidegger, DNR data), but was also fueled by higher angler success rate that was documented during the open water creel survey. Total commercial harvest in 2020 increased by 20% and harvest rate improved to 34 pounds per 1000 feet of gill nets compared to 25 pounds in 2019. Age-2 and age-3 yellow perch continue to provide a majority of the harvest opportunities for sport and commercial fishers. The DNR will continue to monitor the status of the yellow perch fishery and adjust commercial harvest limits and sport bag limits as needed.

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[4] Koenig, L. 2020. Food web interactions among walleye, lake whitefish, and yellow perch in Green Bay, Lake Michigan. Master’s thesis. University of Wisconsin, Stevens Point.

SPORTFISHING EFFORT AND HARVEST

Due to the COVID-19 pandemic, the creel season was shortened in 2020. Charter fishing trips and the moored-boater surveys began in May, and creel surveys of ramp, pier, shore and stream anglers began in July. Therefore, the 2020 results discussed below are for May-November only, whereas in a typical year results are for March-November. In addition, no biological data was collected from sport-caught fish in 2020.

Wisconsin's Lake Michigan open water fishing effort was 1,951,303 hours during 2020, 18% below the five-year average of 2,386,268 hours (Table 1). However, it is important to consider the shortened creel season in this estimate. Effort was below the average for all fishery types, although charter and shore effort were less than 2% below the five-year average.

The 2020 season was more successful for Wisconsin's Lake Michigan trout and salmon anglers than the 2019 season. Overall harvest was higher, with 216,820 salmonids harvested (Table 4). The harvest rate increased from 2019 to 0.1111 fish per hour, which was only slightly below the five-year average. Total harvest for coho salmon, Chinook salmon, rainbow trout and lake trout was up from the 2019 harvest numbers. Harvest remained below the 5-year average for all these species except for lake trout, which was 38% above the 5-year average with 38,271 fish harvested. The 2020 lake trout harvest was the highest lake trout harvest on record since 2002. Brown trout harvest decreased from 2019, with 3,317 fish harvested. Because biological data was not collected from sport-caught fish in 2020, standard weights could not be calculated (Table 5).

The open-water yellow perch harvest in 2020 was 250,498 fish (Table 2). This was an increase in harvest from 2018 and the highest harvest on record since 2013. Lake Michigan yellow perch harvest was 2,013 fish and the Green Bay harvest was 248,485 fish.

Table 1. *Fishing effort (angler hours) by various angler groups in Wisconsin waters of Lake Michigan and Green Bay during 2020 and percent change from the 5-year average (2016-20).*

YEAR	RAMP	MOORED	CHARTER	PIER	SHORE	STREAM	TOTAL
2020	1,081,248	227,887	293,226	81,437	109,117	158,388	1,951,303
% change	-21.92%	-11.25%	-1.73%	-29.79%	-1.46%	-27.88%	-18.23%

Table 2. *Sport harvest by fishery type and species for Wisconsin waters of Lake Michigan and Green Bay during 2020.*

SPECIES	RAMP	MOORED	CHARTER	PIER	SHORE	STREAM	**TOTAL**
Coho salmon	6,973	9,653	21,899	42	794	988	**40,349**
Chinook salmon	22,716	14,252	21,715	685	3,316	17,769	**80,453**
Rainbow trout	12,343	14,628	26,992	181	245	41	**54,430**
Brown trout	928	932	783	158	105	411	**3,317**
Brook trout	0	0	0	0	0	0	**0**
Lake trout	8,817	7,998	21,456	0	0	0	**38,271**
Northern pike	1,179	0	0	65	159	89	**1,492**
Smallmouth bass	4,099	2,603	0	96	216	1,003	**8,017**
Yellow Perch	225,315	3,931	0	6,461	9,549	5,242	**250,498**
Walleye	82,092	4,217	0	38	0	2,352	**88,699**
TOTAL	**364,462**	**58,214**	**92,845**	**7,726**	**14,384**	**27,895**	**565,526**

Table 3. *Total number of fish harvested by species across all angler groups in Wisconsin waters of Lake Michigan, 2011-2020.*

SPECIES	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020*	TOTAL (SINCE 1986)
Brook trout	26	18	0	0	0	0	0	0	0	0	39,040
Brown trout	9,936	21,337	17,094	23,324	20,174	23,879	20,398	12,529	7,985	3,317	1,176,859
Rainbow trout	75,442	75,981	58,311	73,105	59,106	76,846	66,441	57,095	50,254	54,430	2,370,419
Chinook salmon	169,752	390,385	145,301	130,698	113,973	139,082	83,873	84,142	62,916	80,453	7,148,986
Coho salmon	157,367	73,395	89,061	52,297	41,010	125,964	119,686	85,411	32,197	40,349	2,772,133
Lake trout	17,788	29,094	27,240	25,425	35,715	19,137	20,345	26,747	34,197	38,271	1,522,536
TOTAL	430,311	590,210	337,007	304,849	269,978	384,908	310,743	265,924	187,549	216,820	15,029,973
Harvest Per Hour	0.1693	0.2337	0.1213	0.1163	0.0990	0.1464	0.1222	0.1086	0.0795	0.1111	0.1412

Table 4. *Total number of salmonids harvested by year by angler group in Wisconsin waters of Lake Michigan, 2011-2020.*

FISHERIES TYPE	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020*	TOTAL (SINCE 1986)
Ramp	172,438	261,944	112,150	115,239	102,749	164,540	135,787	103,310	59,786	51,777	5,788,892
Moored	103,547	122,008	77,929	57,004	53,182	74,000	46,638	50,785	43,816	47,463	3,814,039
Charter	121,043	174,776	105,427	97,186	91,255	112,150	100,333	89,446	73,521	92,845	3,707,342
Pier	4,432	9,023	5,961	7,834	8,159	10,089	4,963	2,493	695	1,066	364,531
Shore	8,544	6,900	10,205	9,949	4,931	9,477	7,119	4,242	2,946	4,460	458,812
Stream	20,307	15,559	25,335	17,637	9,702	14,652	15,903	15,648	6,785	19,209	896,357
TOTAL	**430,311**	**590,210**	**337,007**	**304,849**	**269,978**	**384,908**	**310,743**	**265,924**	**187,549**	**216,820**	**15,029,973**

**Note: Creel estimates for 2020 are from May-November only. Final column in Tables 3 and 4 represents total number of salmonids harvested from 1986-2020.*

Table 5. *Standard weight (lbs) for salmonids from Wisconsin waters of Lake Michigan and Green Bay from 2015-2019 and percent change from the 5-year average.*

SPECIES	2015	2016	2017	2018	2019	% CHANGE
Brook trout	-	-	-	-	-	-
Brown trout	3.86	3.96	3.97	3.45	5.48	32.34%
Rainbow trout	3.90	4.29	4.05	3.74	4.35	7.10%
Chinook salmon	9.19	10.31	10.41	10.01	10.94	7.53%
Coho salmon	3.85	3.93	3.65	4.29	4.45	10.40%
Lake trout	5.61	5.83	5.67	6.08	6.35	7.46%

** Note - No brook trout were harvested during this time period.*

Walleye harvest was estimated at 88,699 fish. This was a slight decrease from 2019, where 91,358 fish were harvested. The 2020 northern pike harvest was 1,492 fish. Smallmouth bass harvest was 8,017 fish, an increase from 2019.

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

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THE STATUS OF THE COMMERCIAL CHUB FISHERY AND CHUB STOCKS IN WISCONSIN WATERS OF LAKE MICHIGAN, 2020

The total bloater chub harvest from commercial gill nets was 2,393 pounds for calendar year 2020. This was an increase from last year in the southern zone. Although there were 16 permits in the northern zone and 25 permits in the southern zone, no fishermen reported fishing for chubs in the North and only two in the South (Tables 1 and 2). There was no reported chub harvest in the commercial smelt trawlers as incidental to the targeted smelt harvest.

Table 1. *Harvest, quota, number of fishers and effort (feet) for the Wisconsin Southern Zone gill net chub fishery, 1982-2020.*

YEAR	HARVEST	QUOTA	FISHERS	EFFORT (X 1,000 ft)	CPUE
1982	1,538,657	1,300,000		16,032.6	96
1983	1,730,281	1,850,000		19,490.0	88.8
1984	1,697,787	2,400,000		30,868.7	55
1985	1,625,018	2,550,000		32,791.1	49.6
1986	1,610,834	2,700,000		34,606.1	46.5
1987	1,411,742	3,000,000	59	32,373.9	43.6
1988	1,381,693	3,000,000	60	58,439.0	23.6
1989	1,368,945	3,000,000	64	48,218.1	27.6
1990	1,709,109	3,000,000	54	41,397.4	41.3
1991	1,946,793	3,000,000	58	45,288.3	43
1992	1,636,113	3,000,000	53	40,483.7	40.4
1993	1,520,923	3,000,000	58	42,669.8	35.6
1994	1,698,757	3,000,000	65	35,085.5	48.4
1995	1,810,953	3,000,000	59	28,844.9	62.8
1996	1,642,722	3,000,000	56	27,616.6	59.5
1997	2,094,397	3,000,000	53	28,441.8	73.6
1998	1,665,286	3,000,000	49	23,921.1	69.6
1999	1,192,590	3,000,000	46	25,253.2	47.2
2000	878,066	3,000,000	41	22,394.7	39.2
2001	1,041,066	3,000,000	44	26,922.8	38.7
2002	1,270,456	3,000,000	47	24,940.5	50.9
2003	1,069,148	3,000,000	43	22,613.0	47.3
2004	1,057,905	3,000,000	43	21,468.9	49.3
2005	1,213,345	3,000,000	43	24,119.8	50.3
2006	807,031	3,000,000	40	19,110.4	42.2
2007	410,025	3,000,000	43	13,837.4	29.6
2008	227,026	3,000,000	39	9,823.2	23.1
2009	165,158	3,000,000	37	7,960.8	20.7
2010	90,879	3,000,000	38	5,645.6	16.1
2011	34,262	3,000,000	35	2,169.6	15.8
2012	8,583	3,000,000	32	784.0	11
2013	10,146	3,000,000	31	867.0	11.7

2014	25,436	3,000,000	31	1,267.0	20.08
2015	51,351	3,000,000	29	2,722.0	18.86
2016	32,140	3,000,000	31	1,944.0	16.53
2017	9,644	3,000,000	28	688.9	14
2018	7,301	3,000,000	25	424.0	17.2
2019	742	3,000,000	25	83.0	8.9
2020	2,393	3,000,000	25	167.0	14.3

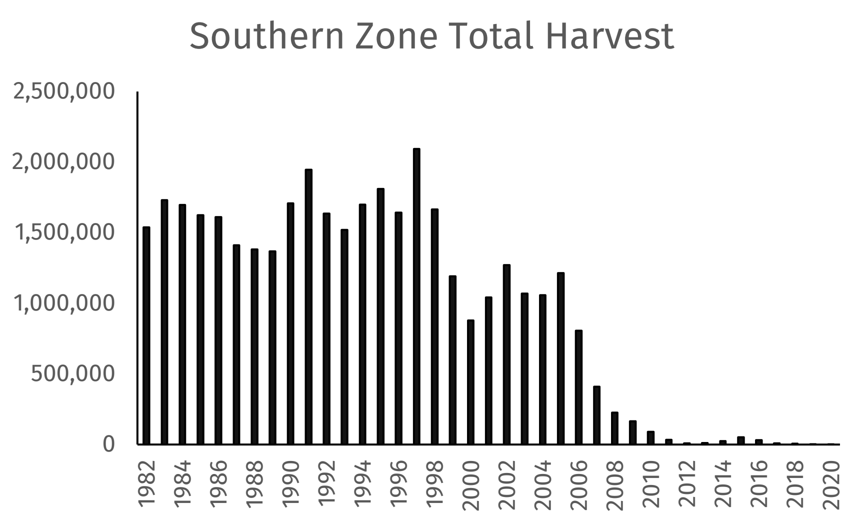
Table 2. *Harvest, quota, number of fishers and effort (feet) for the Wisconsin Northern Zone gill net chub fishery, 1982-2020.*

YEAR	HARVEST	QUOTA	FISHERS	EFFORT (x 1,000 ft)	CPUE
1982	251,832	200,000		3,469.80	72.5[a]
1983	342,627	300,000		6,924.70	49.5
1984	192,149	350,000		6,148.40	31.2
1985	183,587	350,000		3,210.00	57.2
1986	360,118	400,000		7,037.20	51.2[b]
1987	400,663	400,000	23	6,968.60	57.5
1988	412,493	400,000	23	8,382.30	49.2
1989	329,058	400,000	25	8,280.80	39.7
1990	440,818	400,000	23	8,226.40	53.6
1991	526,312	400,000	22	9,453.50	55.7
1992	594,544	500,000	24	11,453.10	51.9
1993	533,709	500,000	24	15,973.60	33.4
1994	342,137	500,000	24	8,176.20	41.8
1995	350,435	600,000	24	5,326.40	65.8
1996	332,757	600,000	24	4,589.70	72.5
1997	315,375	600,000	23	4,365.60	72.2
1998	266,119	600,000	23	3,029.00	87.9
1999	134,139	600,000	23	1,669.70	80.3
2000	77,811	600,000	21	2,199.50	35.4
2001	36,637	600,000	21	972.4	37.7
2002	63,846	600,000	21	1,098.60	58.1
2003	102,692	600,000	21	2,326.50	44.1
2004	50,029	600,000	21	1,354.00	36.9
2005	50,831	600,000	21	1,376.80	36.9
2006	36,285	600,000	19	1,011.10	35.9
2007	6,590	600,000	18	216	30.5
2008	23,942	600,000	18	845	28.3
2009	17,091	600,000	18	831.4	20.6
2010	5,551	600,000	18	474.2	11.7
2011	5,368	600,000	17	313	17.1
2012	6,633	600,000	16	497	13.3
2013	8,813	600,000	17	492.5	17.89
2014	6,807	600,000	17	393	17.32

2015	3,163	600,000	14	171	18.49
2016	7,850	600,000	17	159	49.37
2017	828	600,000	17	72	11.5
2018	200	600,000	17	12	16.7
2019	0	600,000	16	0	0
2020	0	600,000	16	0	0

[a] *for the years 81-85, 90 & 91, 98-17 totals were by calendar year.*
[b] *for the years 86-89 & 92-97 the totals were through Jan. 15 of the following year.*

Harvest in the southern zone, which essentially includes waters from Algoma south to Illinois, was 2,393 pounds in 2020. Total catch in the southern zone was up from 2019 but remains at less than 1% of the allowed quota of 3 million pounds for the southern zone. In the northern zone, essentially waters from Baileys Harbor to Michigan, no fish were reported. The southern zone CPUE was up compared to 2019. Total gill net effort was up slightly in the southern zone compared to 2019. In the south, 25 permits were issued with 2 reporting harvesting chubs in 2020, while in the north 0 of 16 permit holders reported harvesting chubs.



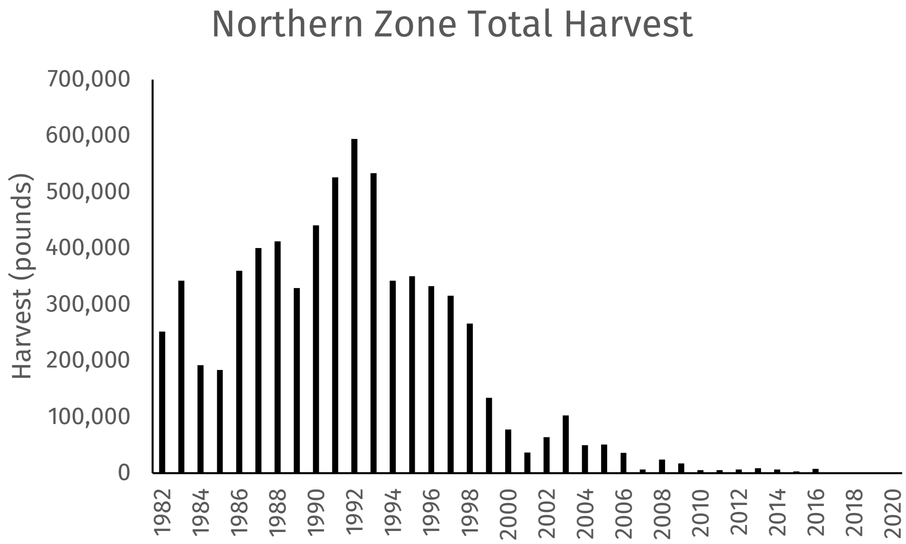


Figure 1. *Total harvest (pounds) by year and zone for the Wisconsin gill net chub fishery, 1982-2020.*

Population assessments off Baileys Harbor were not conducted in 2020 due to budget constraints.

We were unable to sample catches from the commercial fishery in 2020 due to the lack of active fishers.

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STATUS OF LAKE STURGEON IN LAKE MICHIGAN WATERS

INTRODUCTION

Lake sturgeon populations were decimated by the early 1900s through overfishing 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 rivers). 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 four populations (Fox-Wolf, Peshtigo-Oconto, Menominee and Manistee rivers) that reside in Green Bay. The Menominee River contains the largest population in Lake Michigan waters with a majority of those fish (69%) genetically assigned to the Menominee River population and also containing representation from the other three population stocks. The lower Menominee River supported a hook and line fishery from 1946-2005. The exploitation rate (16%) was highest in 2005 when the harvest was 136 fish. That hook and line fishery has been a catch and release fishery since 2006. Lake sturgeon stocking occurs on the Milwaukee and Kewaunee rivers and recovering is dependent on the survival and growth of those stocked sturgeon and continued habitat improvements.

GREEN BAY POPULATIONS

In 2015-2020, data collected from lake sturgeon stemmed from fish passage efforts at the Menominee Dam on the Menominee River. Those efforts produced data from 743 lake sturgeon in the fish lift and 399 of those fish were passed upstream of the lower two dams. The goal is to increase the spawning success of Menominee River adult sturgeon and increase the population size in the lower river and Green Bay. To date, over 90% of the passed upstream sturgeon remained upstream in good spawning habitat for a spawning opportunity and nearly all of those fish return downstream to Green Bay.

We'll continue with our movement study through acoustic transmitters implanted in lake sturgeon from the Menominee, Peshtigo, Oconto and Fox rivers. From 2011-2020, we surgically inserted acoustic passive integrated transponder (PIT) tags into 354 adults (Menominee (71%), Peshtigo (10%), Oconto (11%) and Fox (8%)). Their movements are monitored continuously with 3-6 stationary receivers in each of those four rivers and several receivers in Green Bay. Recent movement information supports the genetic analysis which described a mixed population. Southern Green Bay tagged sturgeon have been documented at receivers in northern Green Bay and a few strays were detected on Lake Huron receivers. The sex distribution from all project sturgeon was 33% female and 67% male. The average length of the females was 156.5 cm and males were 140.1 cm. The movements will be documented in Green Bay until 2021 and between the four major Green Bay rivers through 2025.

In August 2020, we installed two partial PIT tag antenna arrays in the Peshtigo River about halfway downstream of the Peshtigo Dam. Our objective is that these arrays will detect previously PIT tagged sturgeon. The antennas were functional in the fall of 2020 and detected a few sturgeon, but we anticipate more sturgeon will be detected in the spring of 2021 when Green Bay sturgeon migrate to the Peshtigo dam tailwater for spawning. We plan to install the remaining antenna nodes in the summer of 2021.

MILWAUKEE UPDATE

Sturgeon work was limited in 2020. The Milwaukee Streamside Rearing Facility (SRF) was not utilized in 2020 but underwent major repairs. Limited juvenile sampling occurred on three occasions. Some adults were captured in the Milwaukee River in the spring of 2021.

MILWAUKEE JUVENILE SAMPLING

Each year a summer gill net survey targeting juvenile lake sturgeon in the Milwaukee Harbor area is conducted. This survey began in 2013 and is designed to evaluate the survival of stocked lake sturgeon as well as monitor the retention of marks, both PIT tags and clips. It also establishes an index of relative abundance for juvenile lake sturgeon in the Milwaukee estuary under the current stocking plan. Two gangs of gill nets are tied together to create a 1000 foot long set including 600 feet of 4.5 inch, 200 feet of 8 inch and 200 feet of 10 inch stretch mesh panels. One net gang per day is set in a random location within or just outside of the Milwaukee Harbor and soaked for less than 24 hours. Nets are set opportunistically with the target of at least one set per week beginning in May and ending in September. When a juvenile sturgeon is captured, the fish is scanned for tags and checked for clips. If it does not have a PIT tag a new one is implanted underneath the second scute. The weight, length and girth are recorded, and a genetic sample is taken and often some pictures are snapped before release. Bycatch species are identified and numbers/species are recorded and all fish are released.

Since 2013, 70 lake sturgeon from the Milwaukee River SRF have been captured during this survey. Five more from the Kewaunee SRF have also been captured in the Milwaukee general juvenile survey. Of the 75 recaptures, 21 were missing PIT tags but had visible clips. Only one sturgeon was captured without a visible fin clip and it also did not have a PIT tag. This fish was removed from any graphs or analysis. The age of the recaptured SRF sturgeon ranged from 1-6 years old and the size ranged from 12 inches-34.3 inches (Figure 1). When compared to growth of stocked lake sturgeon in the upper Menominee River (Marinette County), the SRF sturgeon are growing at a faster rate (Figure 2). On average, the lake sturgeon from the Milwaukee SRF are growing more than 4.5 inches per year after release.

Cohort was assigned to juvenile sturgeon captured that were missing a PIT tag by using the range of lengths at age from known age fish. With consistent juvenile surveys, it is possible to estimate the relative success or survival of a given year class. Information for year classes pre-2012 is limited but more than twice as many from the 2012 cohort were captured compared to the 2013-2017-year classes (Figure 3). It is possible that the stocking location change in 2012 and again in 2013 has influenced the survival or habitat use of the stocked lake sturgeon. It is also possible that there is no change in the survival of the sturgeon but rather the conditions in the harbor in 2013-2018 were less suitable for sampling. This preliminary data has highlighted the stocking location as potential impact factor in the success of the program and will be researched further.

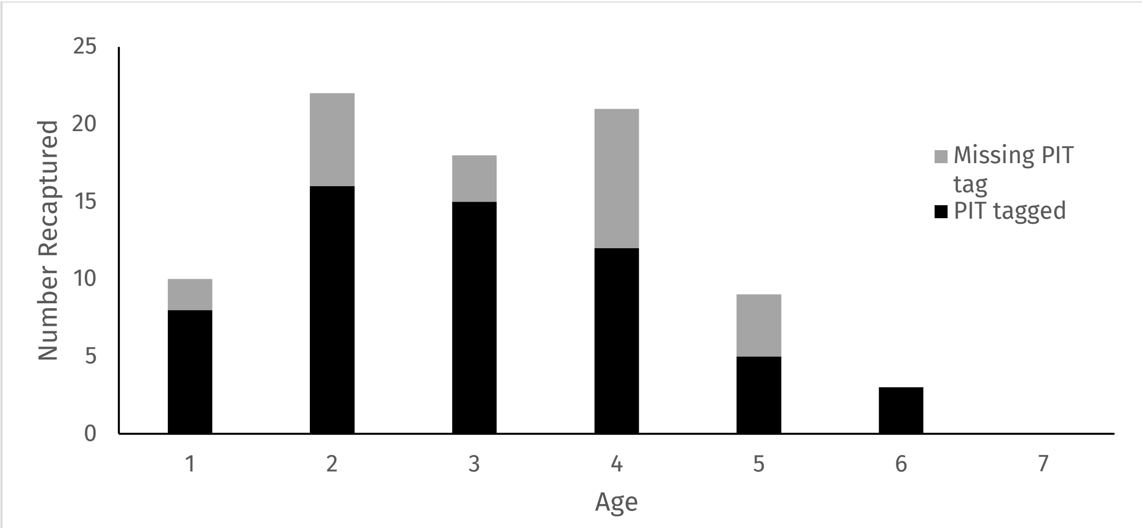

Figure 1. *Age of recaptures during the Milwaukee juvenile lake sturgeon survey 2013-2019. Cohort was assigned to juvenile sturgeon captured that were missing a PIT tag by using the average length at age from known age fish.*

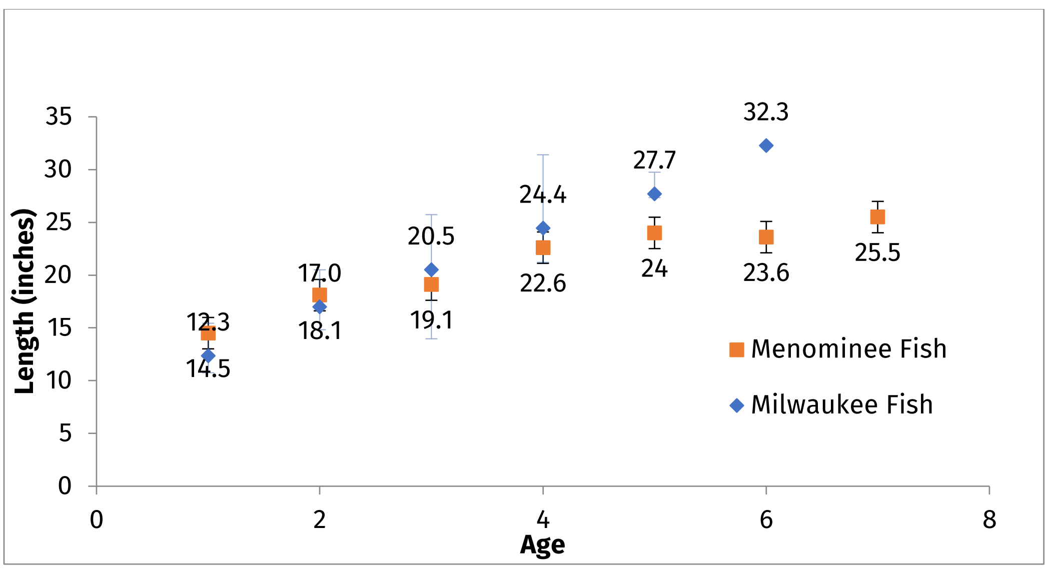

Figure 2. *Average length at age of stocked lake sturgeon in the Milwaukee River and the Menominee River.*

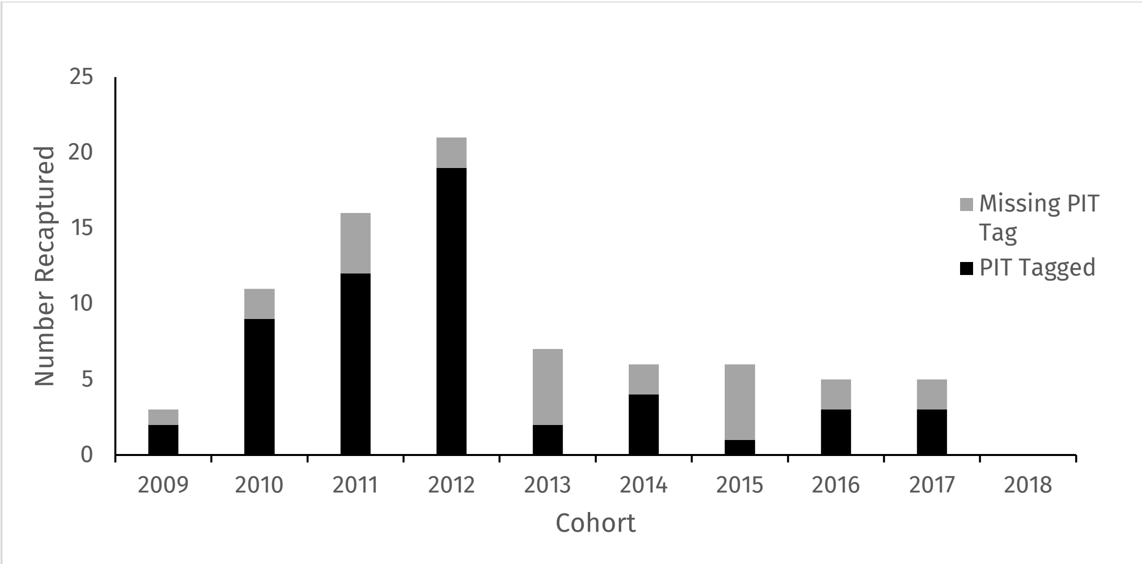

Figure 3. *Cohorts of juvenile sturgeon captured in the Milwaukee juvenile gill netting survey. Cohort was assigned to juvenile sturgeon captured that were missing a PIT tag by using the average length at age from known age fish.*

MILWAUKEE RIVER ADULT SAMPLING

In spring of 2020 about a dozen sturgeon were observed in the Milwaukee River. Unfortunately, we were unable to capture these fish to scan for PIT tags or check for clips. We came into 2021 with a plan and captured four adult lake sturgeon. Three of those sturgeon had PIT tags and RV fin clips that indicated that they were stocked in the Milwaukee River as a part of our reintroduction. Two of those adults were from the SRF stocked in 2007 and 2010 and the third tagged fish was stocked in 2005 from Wild Rose State Fish Hatchery. The fish with RV clips ranged from 46 inches - 55 inches and appear to be growing quickly. We expect to see many more fish in the near future and are installing a PIT array this summer to passively monitor for the tagged fish to return.

KEWAUNEE RIVER STREAMSIDE REARING FACILITY (SRF)

The SRF originally located on the Manitowoc River was moved to the Kewaunee River, at the Besadny Anadromous Fishery Facility (BAFF) beginning in 2009. Sturgeon work was limited in 2020, and the Kewaunee SRF was not used in 2020.

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2020 STATUS OF LAKE TROUT IN SOUTHERN LAKE MICHIGAN

BACKGROUND

The purpose of this report is to summarize data collected during the 2020 field season and to describe long term trends in relative abundance, catch-at-age, natural recruitment and spawning populations of lake trout in Southern Wisconsin waters of Lake Michigan. For changes in sport harvest, please refer to the Sportfishing Effort and Harvest report.

The rehabilitation goals and objectives referenced in this report are outlined in more detail in "A Fisheries Management Implementation Strategy for the Rehabilitation of Lake Trout in Lake Michigan" (Dexter et al. 2011; referred to in this document as "Strategy"). The Strategy document summarizes technical recommendations for lake trout rehabilitation, including a series of evaluation benchmarks for rehabilitation. Not every objective outlined in the implementation Strategy was addressed in this report.

SPRING LAKEWIDE ASSESSMENT SURVEYS

Spring assessment surveys were not conducted in 2020 due to restrictions on work because of the COVID-19 pandemic. Spring assessment surveys are scheduled to resume in 2021. Objective 1 of the Strategy is evaluated through spring stock assessments and thus will be addressed in 2021.

FALL SPAWNING ASSESSMENT

The Wisconsin Department of Natural Resources (DNR) annually conducts lake trout spawning surveys on both nearshore and offshore reefs. Two nearshore reefs off Milwaukee (Green Can Reef, South Milwaukee Reef) have been sampled annually since the late 1980s. The Northeast Reef within the Southern Refuge has been sampled annually since 2009.

Both nearshore reefs were sampled on Oct. 27, 2020. The Northeast Reef was sampled on Nov. 4. Each reef was set with two 800-foot gangs of graded-mesh gill net with 200 foot panels each of 4.5 inch, 5.0 inch, 5.5 inch and 6.0 inch mesh. Nets were lifted after 24 hours. Bycatch is typically minimal. Of 175 fish caught on the nearshore reefs, 12 were species other than lake trout (eight burbot, one brown trout, one white sucker and two longnose suckers). No bycatch occurred on the Northeast Reef.

Overall catch-per-unit effort (CPUE) on the nearshore reefs has remained relatively consistent since 2012 (Figure 1). In 2020, CPUE of lake trout on the South Milwaukee Reef was 51.3 lake trout/1000 feet of net, while CPUE on the Green Can Reef was 51.9 lake trout/1000 feet of net. Catch in 2020 was slightly below the 9-year average CPUE, which was 73 lake trout/1000 feet of net on the South Milwaukee Reef and 72 lake trout/1000 feet of net on the Green Can Reef.

Overall CPUE on the Northeast Reef has also remained relatively consistent since 2012 (Figure 2). In addition, catch has consistently been higher than on the nearshore reefs. In 2020, CPUE on the Northeast Reef was 114 lake trout/1000 feet of net, only slightly below the 9-year average CPUE of 123 lake trout/1000 feet of net. Strong winds offshore in the fall of 2020 could have affected catch.

The age structure of lake trout captured during fall assessments is shown in Figures 3 and 4. The mean age of lake trout captured on the nearshore reefs for all years combined was 13.5 years (n = 350, Figure 3). The mean age of lake trout captured on the offshore reefs for all years combined was 14.5 years (n = 964, Figure 4). In 2020, the mean age of lake trout captured on the nearshore reefs was 10 years and on the Northeast Reef was 12 years. Ages shown in Figures 3 and 4 are primarily from coded wire tagged lake trout (91 otolith ages, 47 scale ages, and 1,174 coded wire tag (CWT) ages), and there are likely older lake trout in the population not represented here. Collecting otoliths from non-CWT lake trout (including both wild and fin-clipped fish) in future years should provide further insight into age structure, in addition to the large overlap between size-at-age observed from CWT-fish (Figures 11 and 12).

The strain composition of CWT-fish caught in fall assessments is shown in Figures 5 and 6. For both offshore and nearshore reefs, the Seneca Lake and Green Lake strains make up the majority of returns. Seneca Lake fish are still stocked in Wisconsin waters. For 2020, 80% of CWT-fish caught nearshore were the Seneca Lake strain (Figure 5).

Offshore strain composition varied in 2020, with 61% of the return being Klondike Reef fish (Figure 6). The Klondike Reef strain are a deep-water strain stocked only on the Southern Refuge that are likely to remain on the offshore reefs, while other strains stocked into Lake Michigan make use of a variety of habitat. Klondike Reef fish have been stocked on the Southern Refuge since 2012, and the age distribution of Klondikes caught on the Northeast Reef in 2020 was ages 5-9. We expect to see more Klondike Reef fish in the coming years on the Southern Refuge.

From 2012-2020, an average of 8% of lake trout caught on nearshore reefs were wild (both reefs combined, Figure 7). In 2020, 18.5% of lake trout caught on the South Milwaukee Reef and 28.1% caught on the Green Can Reef were wild, which was significantly higher than the average. This marked the second year on the Green Can Reef where the number of wild lake trout caught increased from previous years.

Overall, the proportion of wild lake trout caught on the offshore reefs is significantly higher than on the nearshore reefs. From 2012-2020, an average of 25.4% of lake trout caught on the Northeast Reef were wild. In 2020, 16% of lake trout caught on the Northeast Reef were wild (Figure 8). Although this number is lower than has been observed in the past few years, it could be an anomaly.

Objective 2 outlined in the implementation Strategy is to increase the abundance of adults in fall surveys to a minimum CPUE of 50 lake trout/1000 feet of graded-mesh gillnet, which has been met consistently (Figures 1 and 2).

Objective 3 outlined in the Strategy addresses achieving progress towards attaining spawning populations; specifically, spawning populations in targeted rehabilitation areas should be at least 25% female and contain 10 or more age groups older than age 7. Although we do observe 10 or more age groups older than age 7 (Figures 3 and 4), we are not consistently observing spawning populations that are at least 25% female in the Southern Refuge. The average proportion of females captured on the offshore reefs from 2012-2020 is 20.4% (Figure 10). In 2020, 18.1% of lake trout captured on the Northeast Reef were female.

Not every objective outlined in the implementation Strategy was addressed in this report. Objective 4 relates to detecting a minimum density of 500 viable eggs/m^2 in targeted rehabilitation areas by 2021. We have collected eggs in spawning surveys for thiamine analysis, but do not have results at this time.

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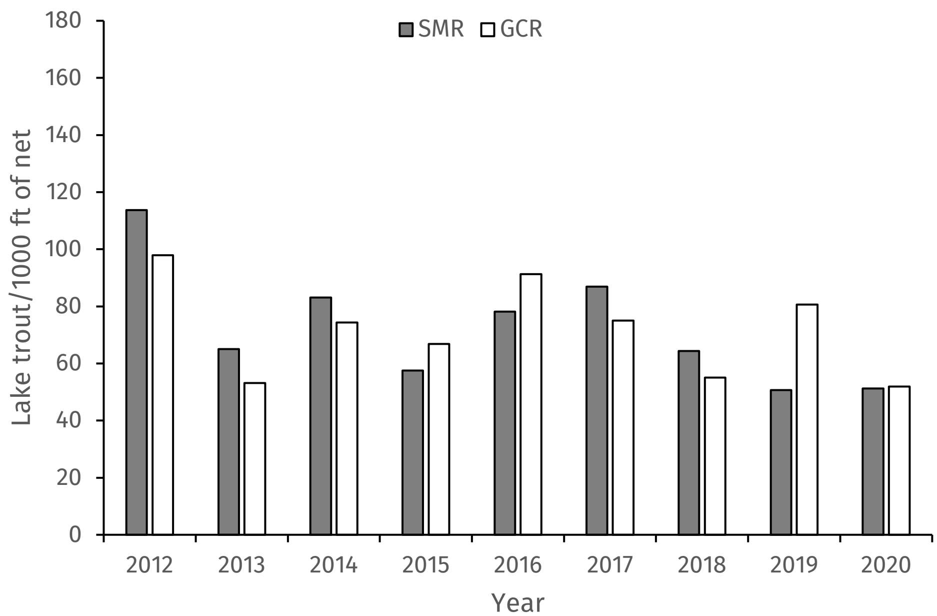

Figure 1. *Fall catch-per-unit effort of lake trout by year for nearshore reefs. Note: SMR = South Milwaukee Reef; GCR = Green Can Reef.*

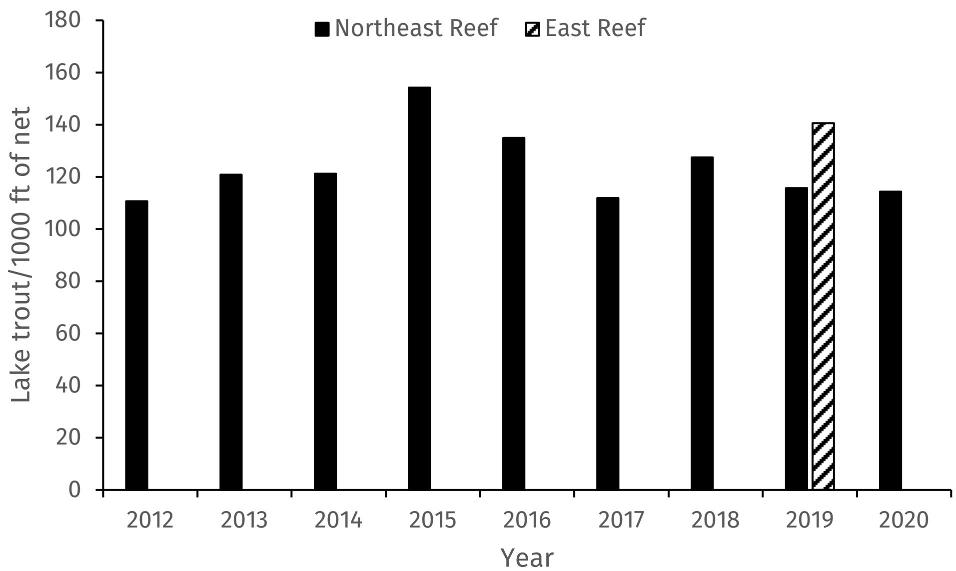

Figure 2. *Fall catch-per-unit effort of lake trout by year for offshore reefs.*

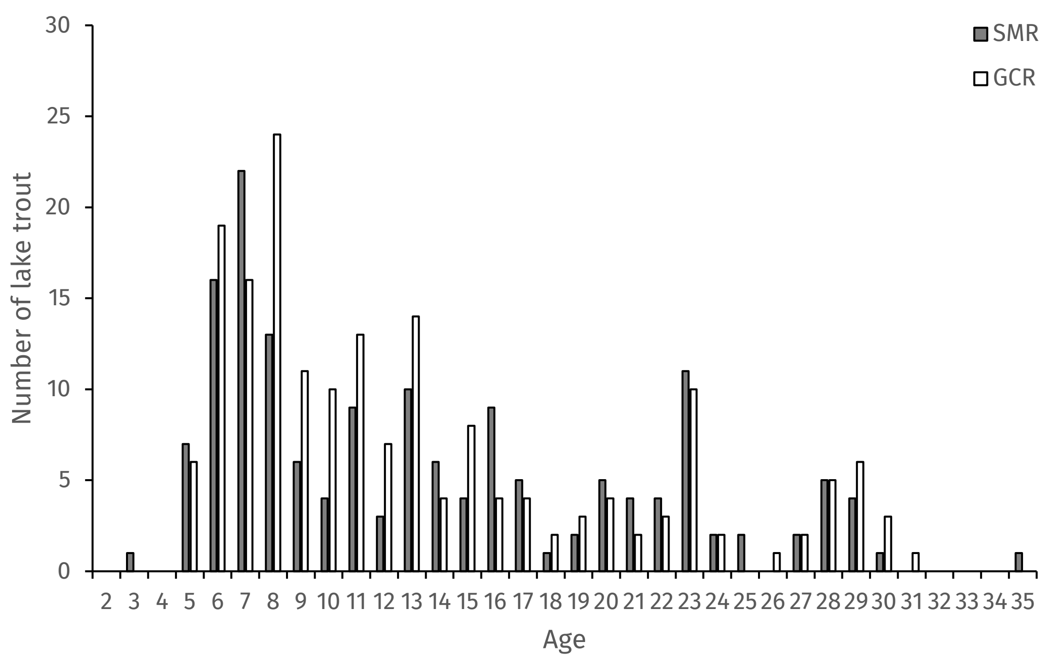

Figure 3. *Age distribution of stocked lake trout caught in fall assessment surveys on nearshore reefs from 2012-2020. Note: SMR = South Milwaukee Reef; GCR = Green Can Reef.*

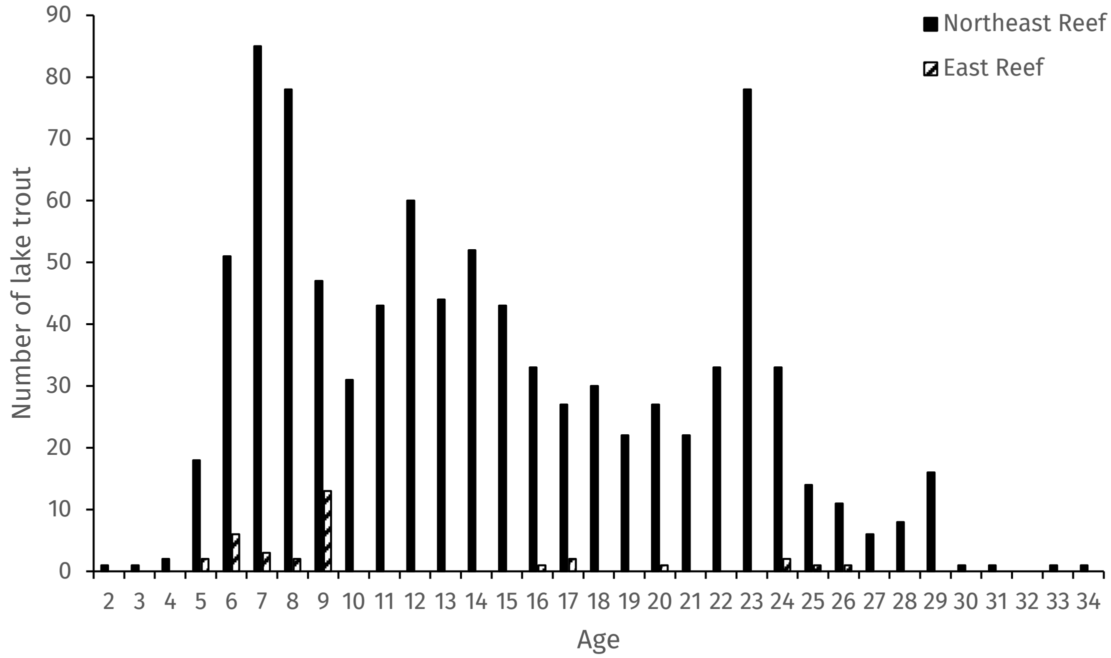

Figure 4. *Age distribution of stocked lake trout caught in fall assessment surveys on offshore reefs from 2012-2020. Note: East Reef results are from 2019 only.*

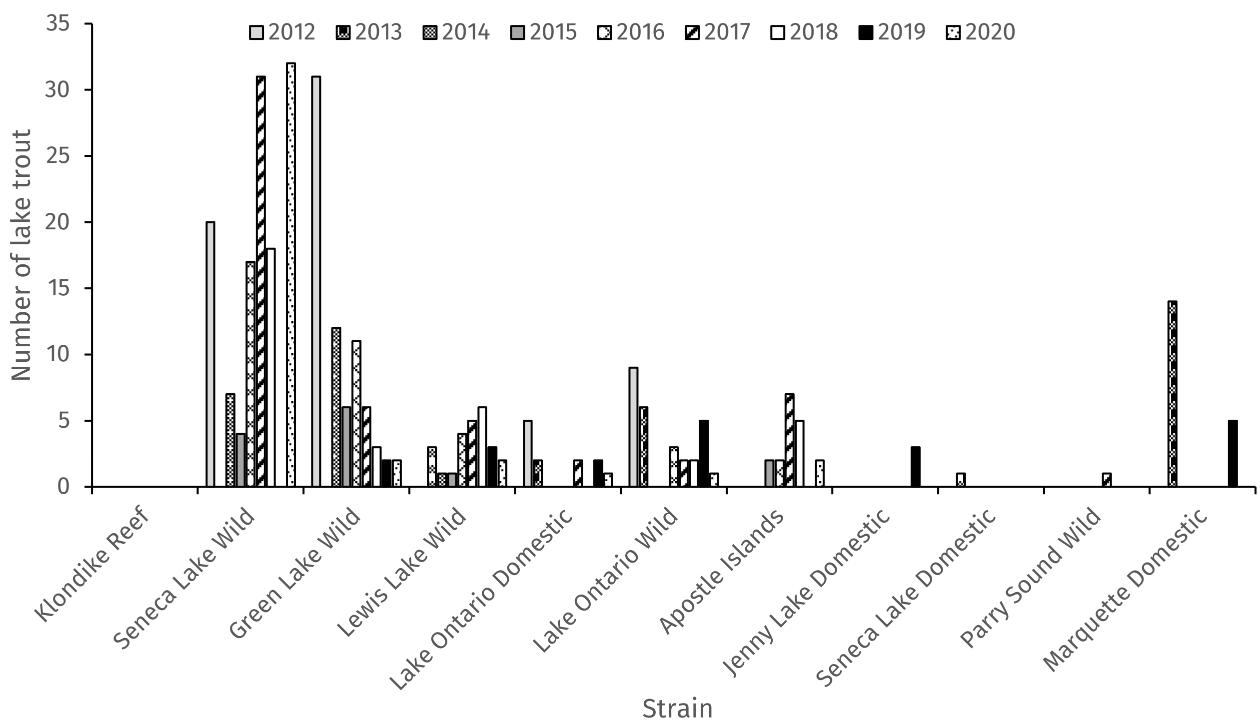

Figure 5. *Strain composition of coded wire tagged lake trout caught in fall assessment surveys on nearshore reefs from 2012-2020.*

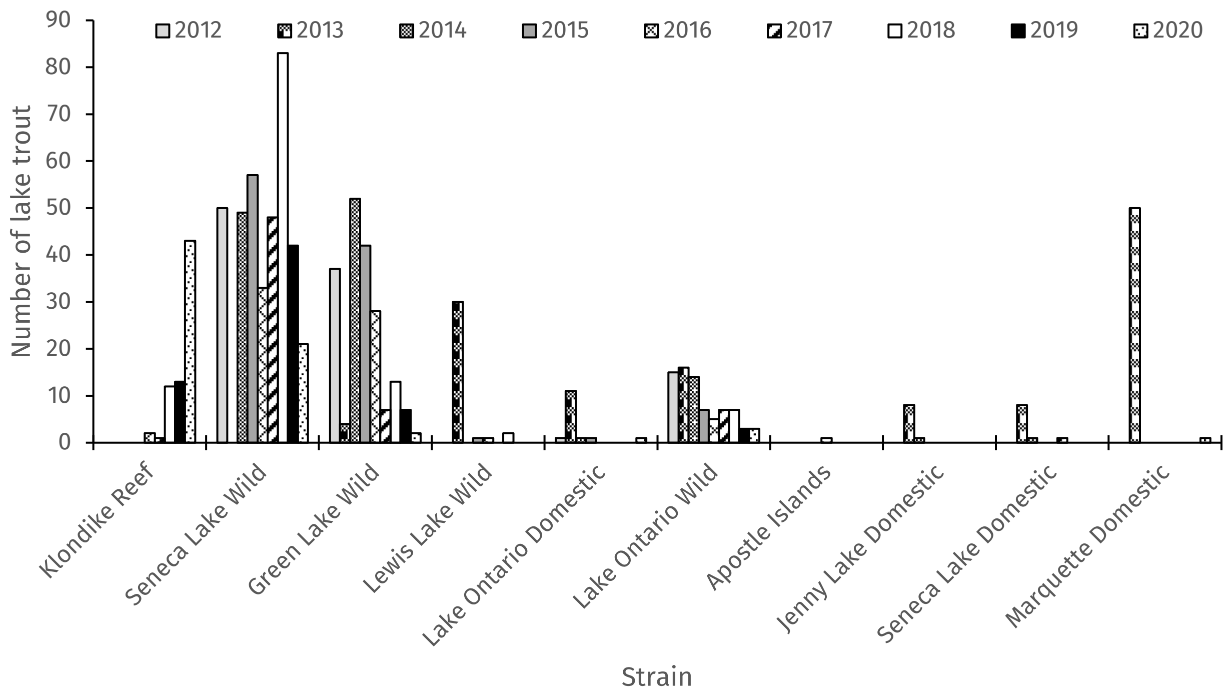

Figure 6. *Strain composition of coded wire tagged lake trout caught in fall assessment surveys on offshore reefs from 2012-2020.*

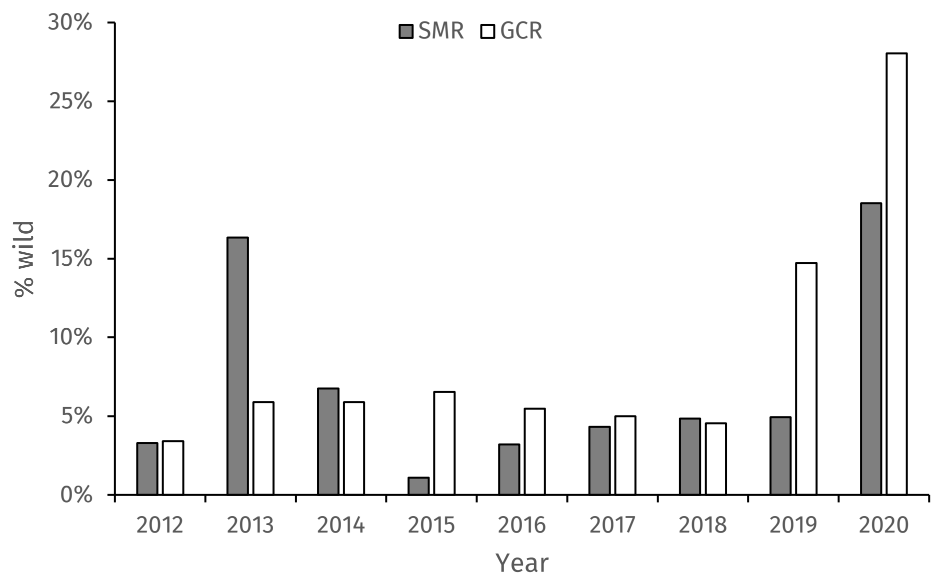

Figure 7. *Proportion of wild lake trout captured in fall assessment surveys on nearshore reefs from 2012-2020. Note: SMR = South Milwaukee Reef; GCR = Green Can Reef.*

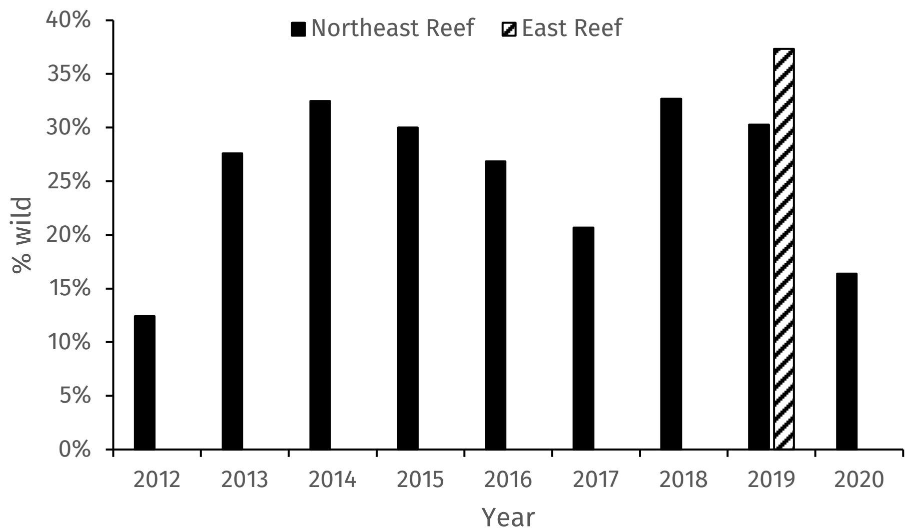

Figure 8. *Proportion of wild lake trout captured in fall assessment surveys on offshore reefs from 2012-2020.*

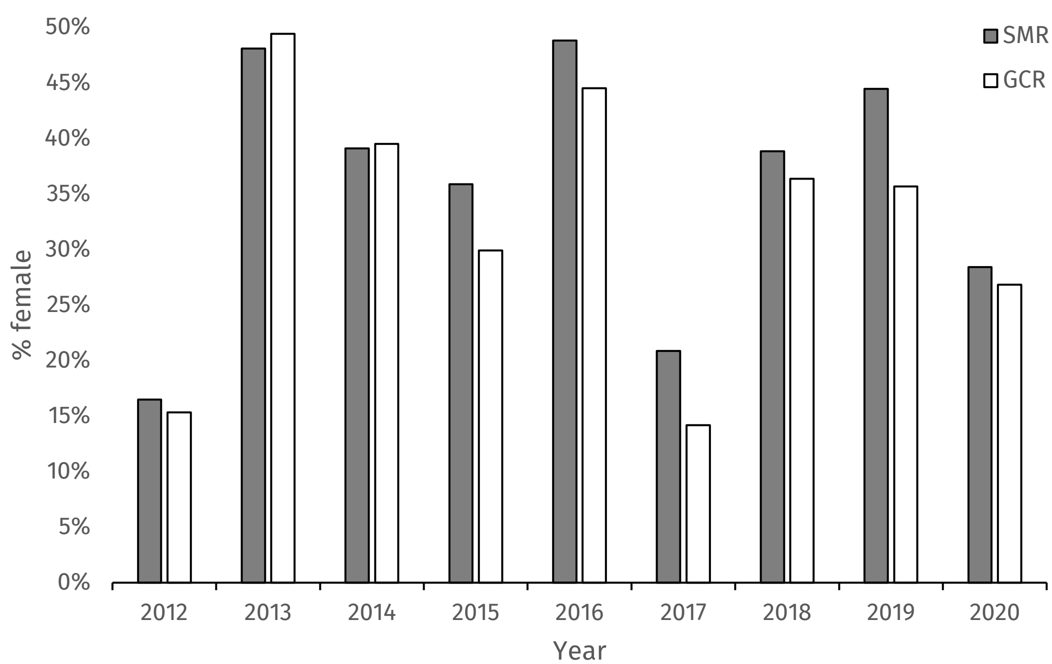

Figure 9. *Proportion of female lake trout caught in fall assessment surveys on nearshore reefs from 2012-2020. Note: SMR = South Milwaukee Reef; GCR = Green Can Reef.*

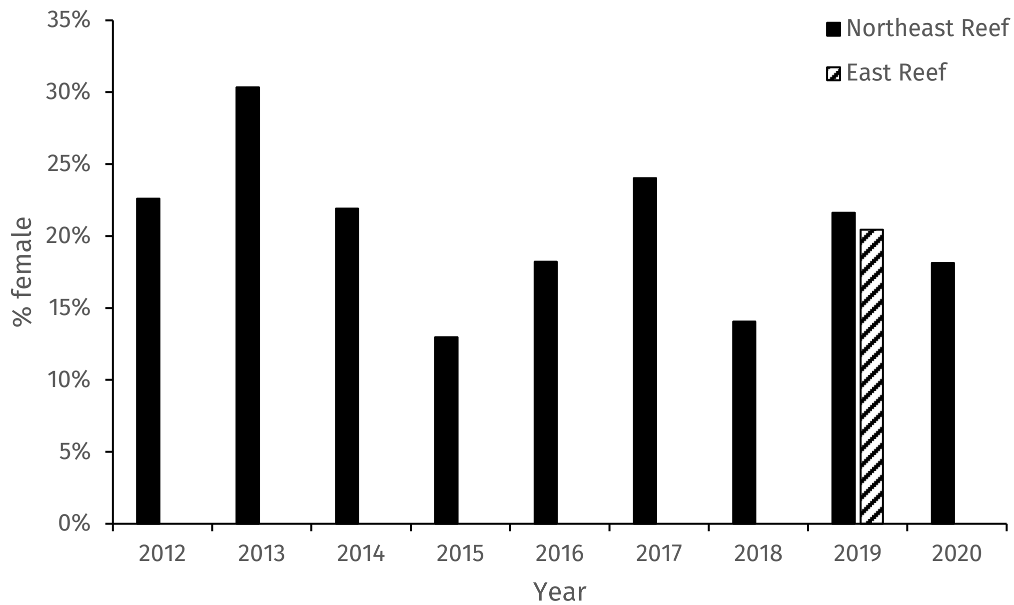

Figure 10. *Proportion of female lake trout caught in fall assessment surveys on offshore reefs from 2012-2020.*

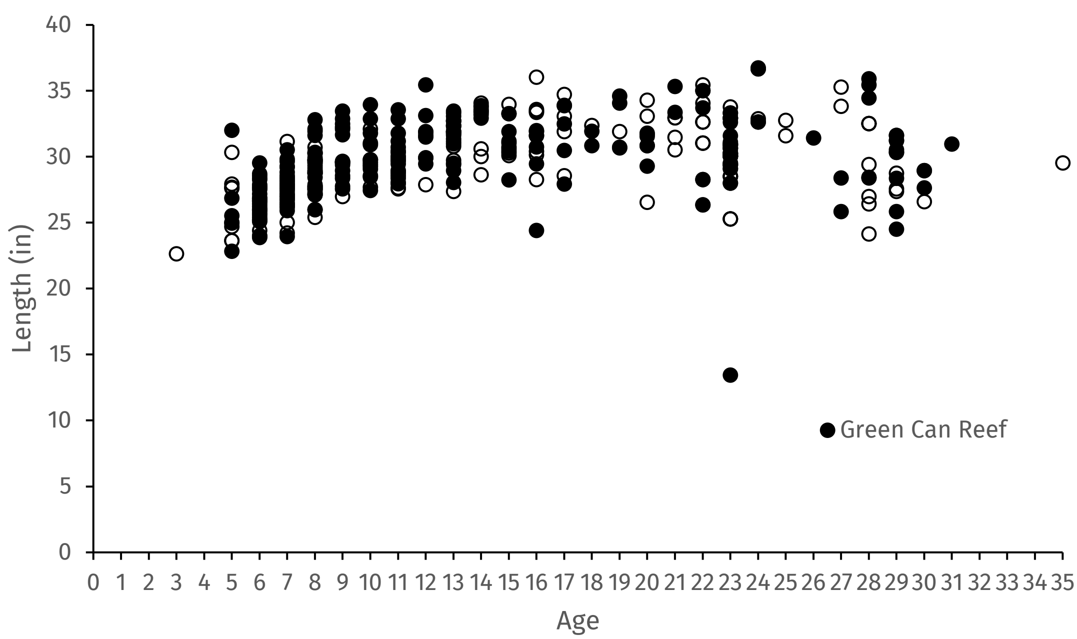

Figure 11. *Length-at-age of known-age lake trout captured in fall assessment surveys on nearshore reefs from 2012-2020.*

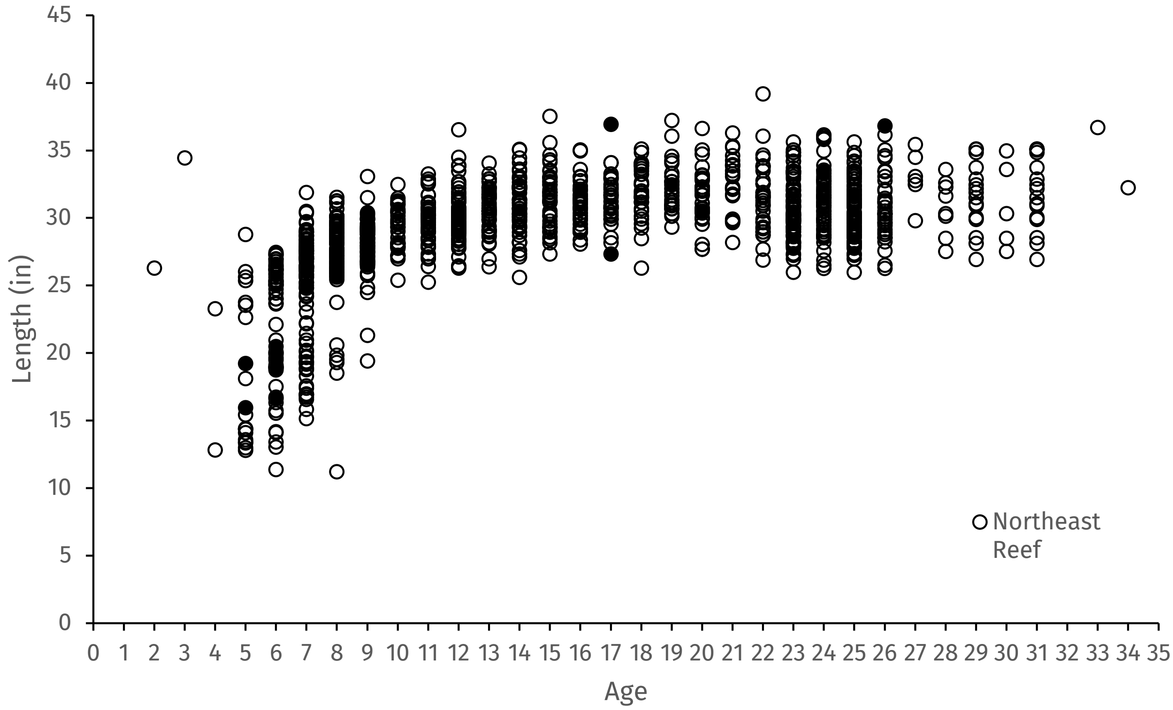

Figure 12. *Length-at-age of known-age lake trout captured in fall assessment surveys on offshore reefs from 2012-2020.*

LAKE WHITEFISH

COMMERCIAL HARVEST

Lake whitefish *Coregonus clupeaformis* harvest in Wisconsin waters of Lake Michigan and Green Bay was approximately 935,000 pounds in 2020, a decrease of approximately 160,000 pounds from 2019 (Figure 1). Harvest in 2020 was the lowest since the quotas were established in 1989-90. The annual harvest was likely hampered by the effects of the COVID-19 pandemic in 2020, to an extent.

The commercial whitefish harvest in Wisconsin was previously 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. In 2012, the quota season began operating on a “calendar year” with the same November closed period. The initial quota established in 1989-90 was 1.15 million pounds. It increased several times thereafter and reached 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 2009-10 quota increase of approximately 410,000 pounds was treated as a “Special Increase” and split equally among the zones (Table 1).

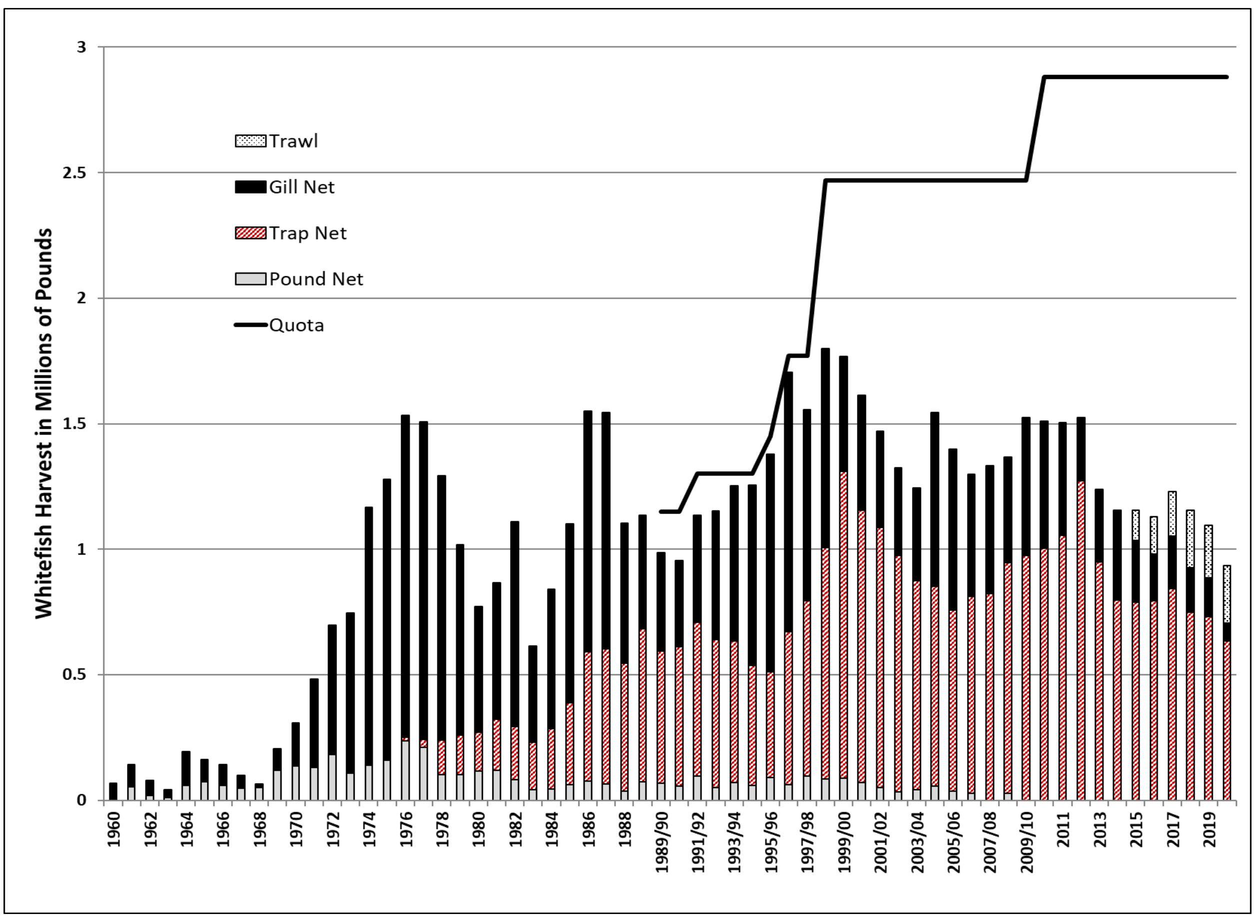

Figure 1. *Lake whitefish reported commercial harvest by gear in pounds (dressed weight) from Wisconsin waters of Lake Michigan including Green Bay, from 1952 through 2020. (Calendar years 1949 through 1989 and 2010-2020; quota years 1989-90 through 2008-09). Years in which there was a transition (1989, 2010) are reported both in quota and calendar year harvest.*

Trap and gill nets have been the primary gear types used to harvest lake whitefish in Wisconsin waters of Lake Michigan. Pound nets were used historically but have not been employed since 2009. In May 2020 a bottom trawl fishery for lake whitefish was implemented; but it is restricted to only the Manitowoc/Two Rivers area of Lake Michigan. Commercial fishers have used trap nets as a legal gear to harvest lake whitefish from Lake Michigan since 1976 and has long been the primary gear for lake whitefish (Figure 1).

Table 1. *Lake whitefish harvest by zone in dressed weight in Wisconsin since the quota increase to 2.47 million pounds. Data are presented by quota year through mid-2011 and by calendar year between 2012-2020.*

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
2014	336,564	543,256	276,034	1,155,854
2015	314,003	586,115	253,858	1,153,976
2016	254,685	610,191	264,521	1,129,397
2017	283,784	711,130	234,891	1,229,755
2018	352,470	535,907	265,632	1,154,009
2019	330,209	494,987	269,251	1,094,447
2020	349,054	327,542	255,694	932,290

[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.

Trap net effort continues to decline since reaching its third highest level in 2010; effort declined by 217 pots lifted between 2019 and 2020 (Figure 2). Meanwhile, gillnet effort has followed a longer-term decline. The 1.74 million feet of gill net fished in 2020 is nearly 1.2

million feet less than was fished in 2019. Preference for trap net caught fish is largely responsible for the overall decline in gill net use, although the decline in gill net efficiency brought on by ecological perturbations (increased water clarity, algae fouling) from invasive species is also a major contributor. Commercial trawl effort increased nearly 150 hours between 2019 and 2020. However, because the trawl fishery is still relatively new, it's difficult to interpret any effort trend data at this time.

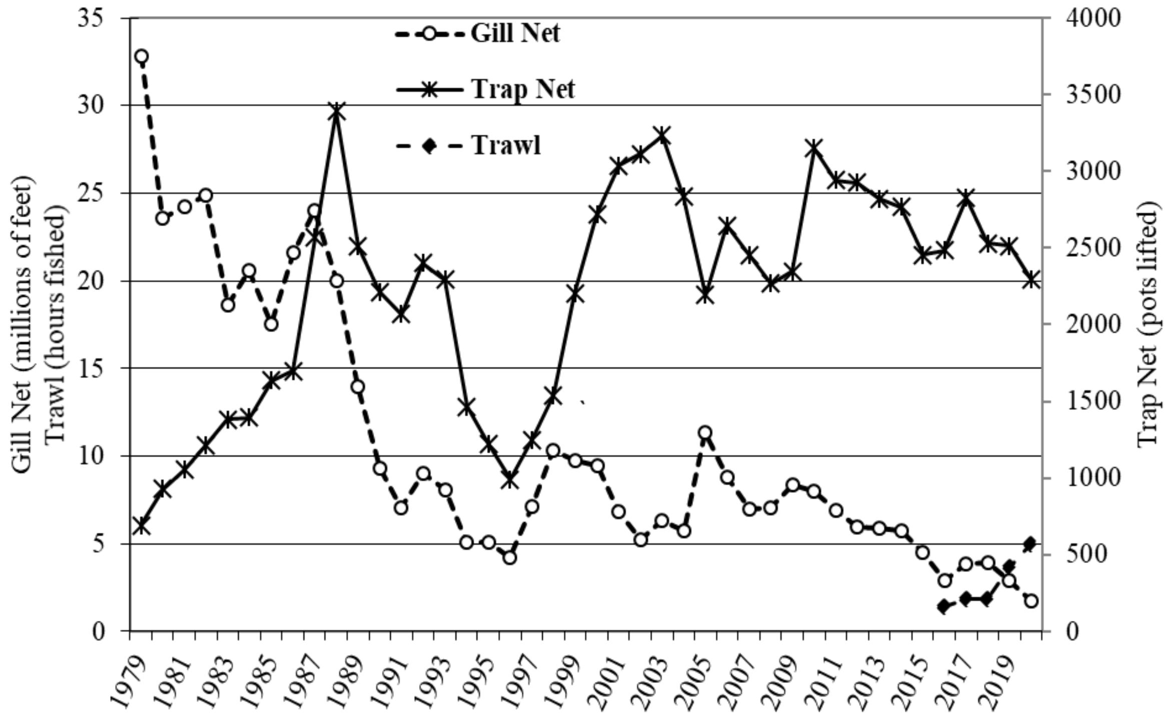

Figure 2. *Trends in commercial fishing effort for lake whitefish in Wisconsin waters of Lake Michigan including Green Bay, 1979 – 2020. The first three years of data from the trawl fisher should be interpreted with caution as they were part of an experimental study.*

Trap net catch per unit of effort (CPUE) has shown a steady decline over the past 5 years (Figure 3). Catch per trap net lift dropped somewhat between 2019 and 2020 by around 14 pounds per lift. Gillnet CPUE has remained relatively steady over the past 15-20 years but decreased by around 12 pounds per 1000 ft fished between 2018 and 2019. Trawl CPUE declined considerably between 2019 and 2020 by around 140 pounds per hour fished. However, because the trawl fishery is still relatively new, it's difficult to interpret any CPUE trend data at this time.

The implications of the COVID-19 pandemic likely had a negative impact on commercial fishing effort, and potentially CPUE, at least in the first half of 2020. However, the steady drop in CPUE for all gears suggests a declining lake whitefish population; most likely driven by catch data from areas that are primarily harvesting fish from the Lake Michigan stock(s). Most

Lake Michigan stocks have been in decline for the past 5-10 years and future safe harvest levels for the commercial fishery will reflect this trend.

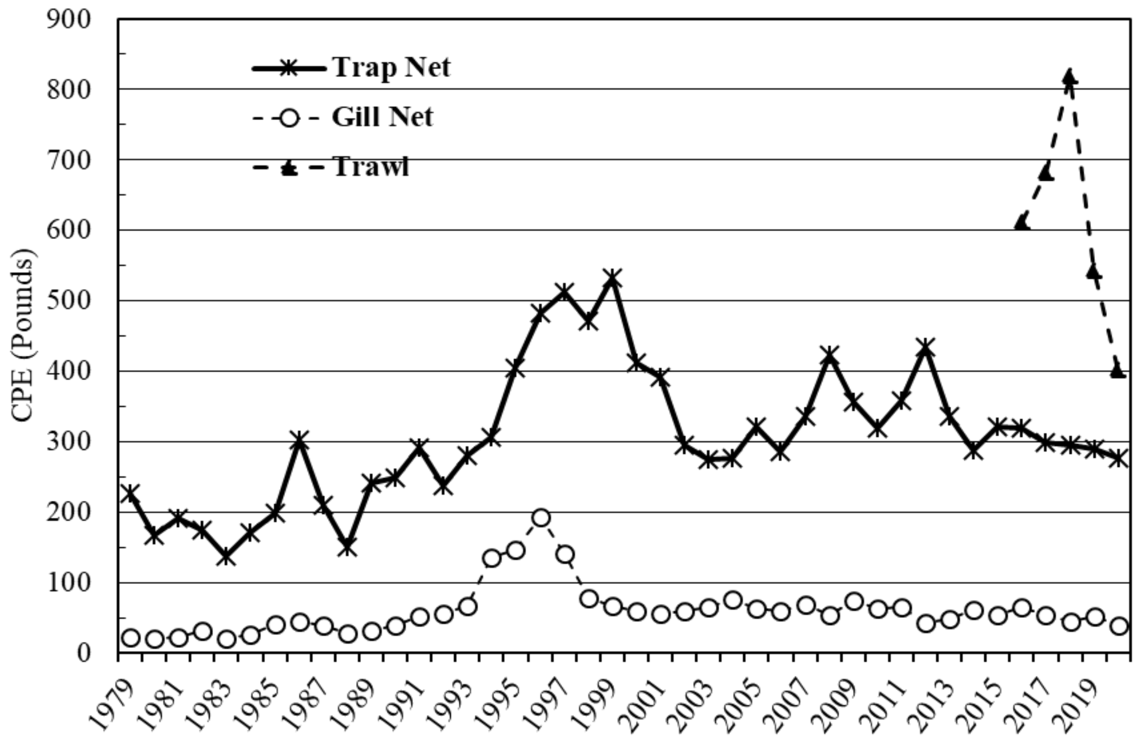

Figure 3. *Trends in commercial dressed weight catch per unit of effort (CPUE) for lake whitefish in Wisconsin waters of Lake Michigan including Green Bay, 1979 – 2020. Gill net is pounds harvested per 1,000 feet lifted, trap net is pounds harvested per pot lifted, and trawl is in pounds harvested per hour fished. The first three years of data from the trawl fisher should be interpreted with caution as they were part of an experimental study.*

SPORT ANGLER HARVEST

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. The advent of the whitefish fishing is largely responsible for the resurgence of overall ice fishing effort on Wisconsin waters of Green Bay (Figure 4). A formal Guide Reporting Program was implemented in 2017, although a portion of the guided trip harvest is still estimated because of cases of non-reporting. Previous to the reporting program, guide harvest was included as part of standard creel interviews.

Winter creel surveys for Green Bay are conducted during the months of January, February and March. For winter 2020, the estimated whitefish harvest was 101,145 fish, an increase of 20,000 from the previous year (Figure 4). Angler effort directed toward whitefish increased also from 187,742 in 2019 to 255,877 in 2020. Effort for lake whitefish made up 74% of the total ice fishing effort on Green Bay in 2020. Fishing effort data submitted in the formal Guide

Reports are not directly included in the direct effort estimates for the overall creel harvest. However, some effort data are likely collected from guided trips indicentally during creel surveys. Catch per effort, measured in lake whitefish caught per hour of fishing specifically for that species, has been considerably lower during the last two ice seasons than in previous years (Figure 5). The catch rate for 2020 increased slightly from that of 2019; but was still substantially lower than 2018.

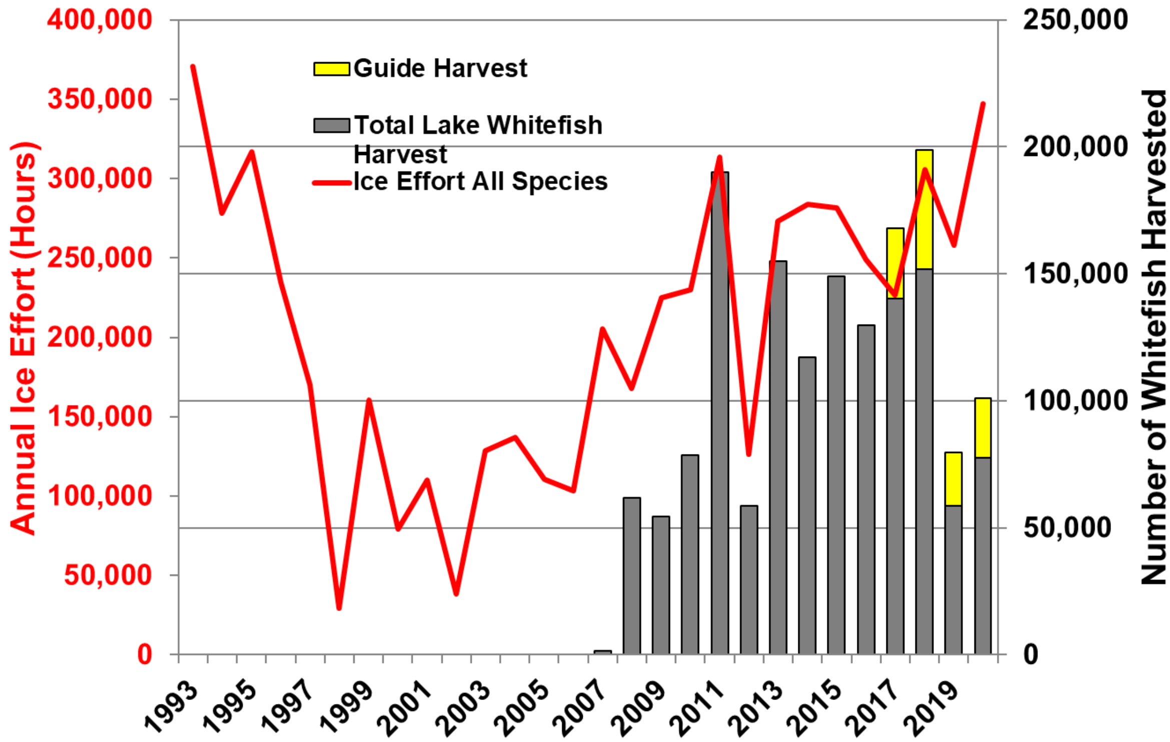

Figure 4. *Estimated number of lake whitefish harvested and total effort for all species in Wisconsin waters of Green Bay during the winter creel season (January- March) for 2007-2020.*

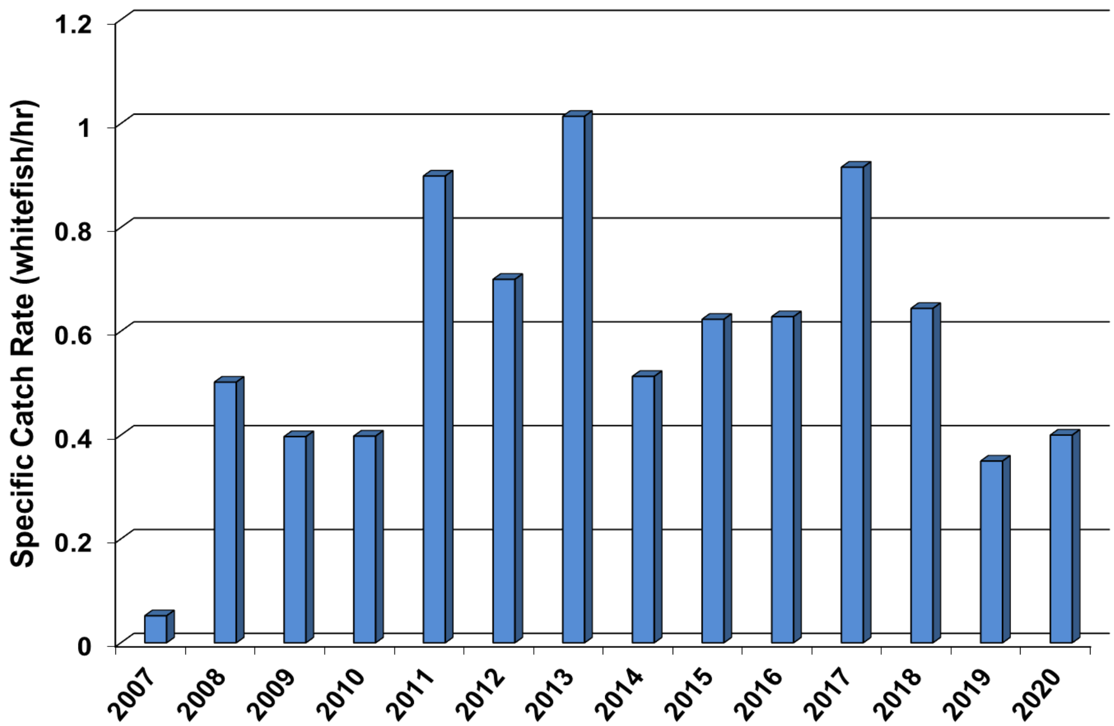

Figure 5. *Specific catch rates of lake whitefish caught per hour for anglers targeting lake whitefish in Wisconsin waters of Green Bay during the winter creel season (January-March) for 2007-2020.*

WEST SHORE GREEN BAY TRIBUTARY POPULATIONS

During the mid-1990s, lake whitefish began a recolonization of the Menominee River (Belonger, 1995). The whitefish population gradually increased and by the mid-2000s the number during the November spawning period was estimated to be in the thousands. Beginning in 2013, DNR staff began assessing other major west shore Wisconsin rivers in Green Bay for lake whitefish during November. These surveys revealed that lake whitefish were also making spawning migrations into the Fox, Peshtigo and Oconto Rivers to varying degrees of relative abundance. The ability to accurately estimate these individual populations has been confounded by the influence of the dams artificially concentrating fish on most rivers. While several tagging studies have occurred, the relatively low number of recaptured fish relative to the total number tagged constrains accurate population estimates as well.

Strong young-of-year recruitment events have been measured for some time in the waters of southern Green Bay. Bottom trawling assessments, conducted annually during August targeting juvenile yellow perch, have captured lake whitefish in increasing numbers beginning in the mid-1990s (Figure 6). This survey is particularly successful at catching the young-of-year and yearling stages of lake whitefish while adult catches are likely limited due to gear avoidance. Initial occurrence of large year classes of young-of-year whitefish generally follow trends of adults colonizing the tributaries suggesting these river populations are major sources for lake whitefish recruitment into the Green Bay fishery. However, emerging evidence suggests that some recruitment of lake whitefish is occurring from the open waters of Green Bay proper as well. After some relatively strong recruitment events over the previous five years, recruitment was measured to be relatively low in 2019 and 2020.

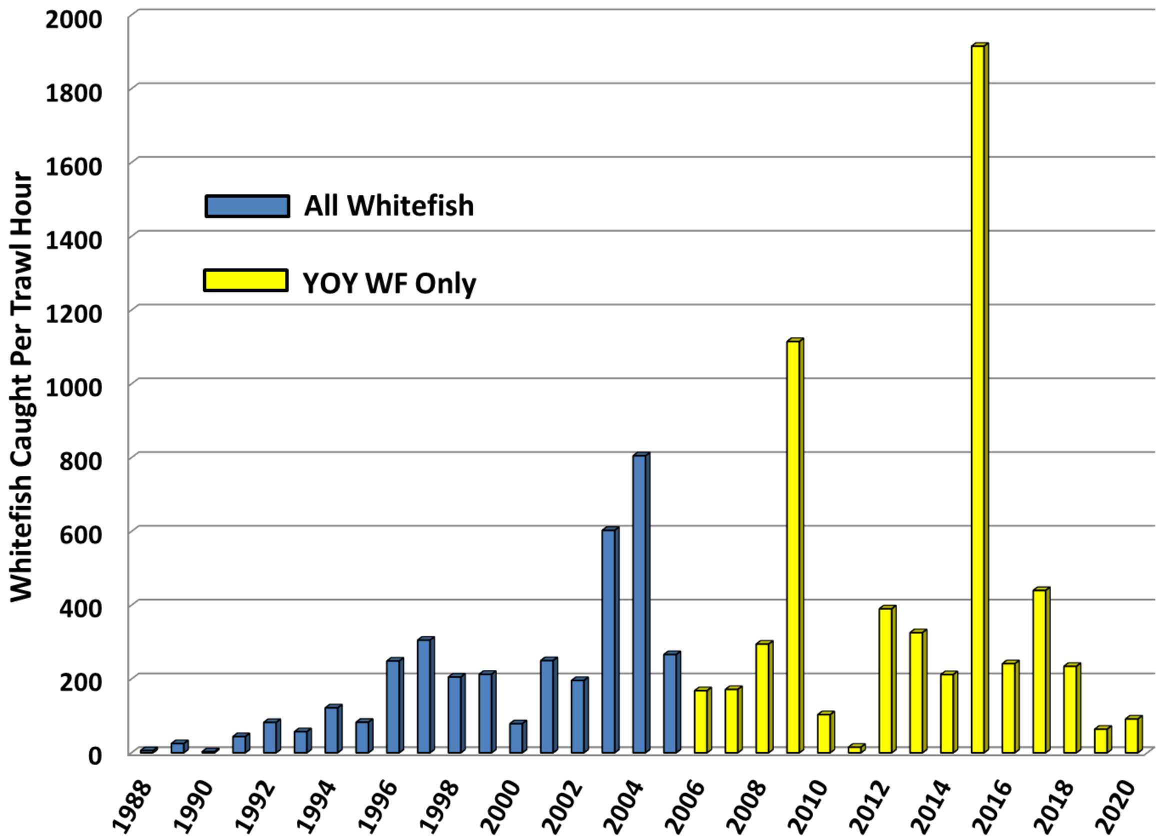

Figure 6. *Lake whitefish captured during August bottom trawling assessments in Green Bay between 1988 and 2020. Young-of-year (YOY) whitefish were not separated in counts until 2006; therefore, blue bars represent all whitefish combined in the catch while yellow bars represent only YOY whitefish.*

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2020 LAKE MICHIGAN WEIR REPORT

GENERAL WEIR OVERVIEW

The Wisconsin Department of Natural Resources (DNR) operates three salmon and trout egg collection facilities on Lake Michigan tributaries. The Strawberry Creek Salmon Spawning Facility or weir (SCW) is located in Sturgeon Bay, WI of Door County and has been operated since the early 1970s. SCW is the DNR's primary egg collection facility for Chinook salmon (*Oncorhynchus tshawytscha)* and typically provides the entire egg supply needed by the DNR to produce Chinook salmon for stocking into Lake Michigan. The Besadny Anadromous Fisheries Facility (BAFF) has been operated since 1990 and is located on the Kewaunee River, in Kewaunee County. BAFF is a co-primary egg collection facility for steelhead (*Oncorhynchus mykiss),* coho salmon (*Oncorhynchus kisutch*), and brown trout (*Salmo trutta*). The Root River Steelhead Facility (RRSF), operated since 1994, is located on the Root River in Racine County. RRSF is also a co-primary egg collection facility for steelhead, coho, and brown trout. BAFF and RRSF both serve as backup egg collection facilities for Chinook salmon.

This report summarizes the number of fish processed at each weir during 2020, but please note reported values aren't absolute numbers of fish returned to each river. Many variables impact spawning runs including stream flow, lake level, water temperature, stocking numbers, survival, harvest, dates of operation for each weir, etc. These factors vary from year to year and impact numbers of fish available and processed at each egg collection facility. Egg collection goals also vary from year to year, depending on projected stocking quotas, the DNR's production needs and egg requests from other states or agencies.

Overall for 2020, sufficient numbers of salmon and trout eggs were collected to meet planned future stocking levels by the DNR for Wisconsin waters of Lake Michigan. Due to the COVID-19 pandemic, operations were adjusted at all DNR weirs during 2020.

STRAWBERRY CREEK SALMON SPAWNING FACILITY

AUTUMN 2020 STRAWBERRY CREEK SUMMARY

During fall 2020, the DNR collected eggs at facilities in Kewaunee and Racine, but the Strawberry Creek Salmon Spawning Facility (SCW) in Sturgeon Bay was not operated due to high water (operational challenges) and the COVID-19 pandemic (streamlined workload to two of three facilities). Numbers and weights of Chinook salmon through 2019 (not 2020) are provided (Figures 1 and 2).

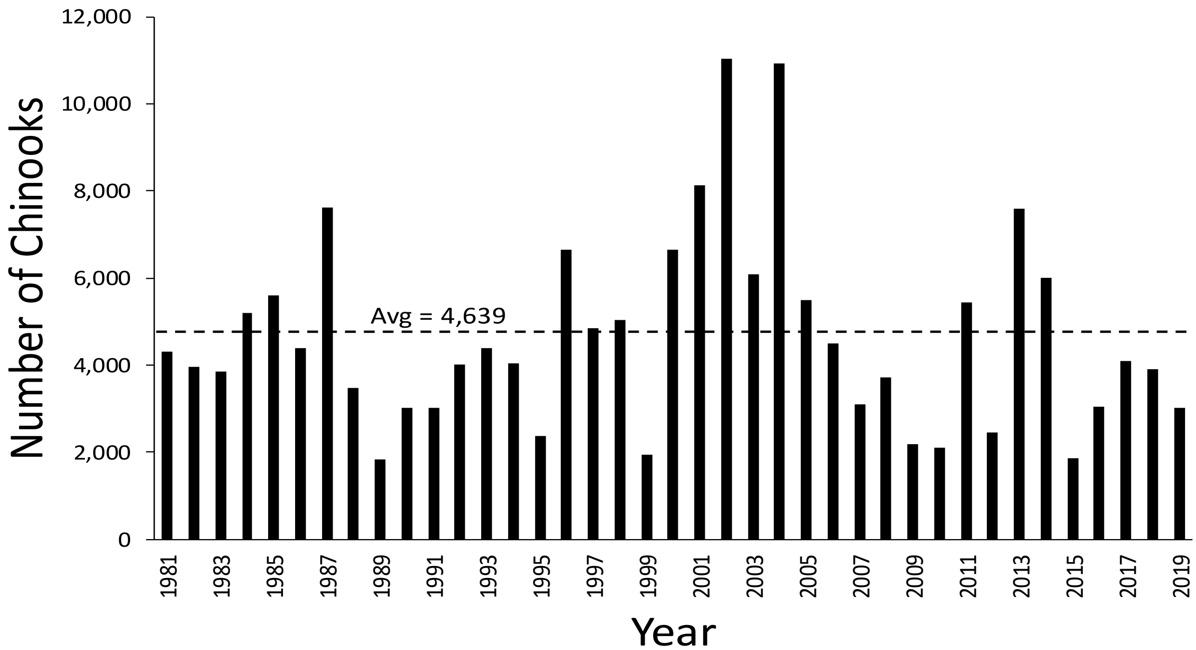

Figure 1. *Numbers of Chinook salmon handled during autumn spawning operations at Strawberry Creek weir per year from 1981-2019 (2020 data not available). The long-term average is 4,639 (dotted line). Several factors impact these numbers including: stream flow from rainfall and supplemental water pumping, lake level, water temperature, stocking numbers, survival rates, dates of operation for the weir, etc.*

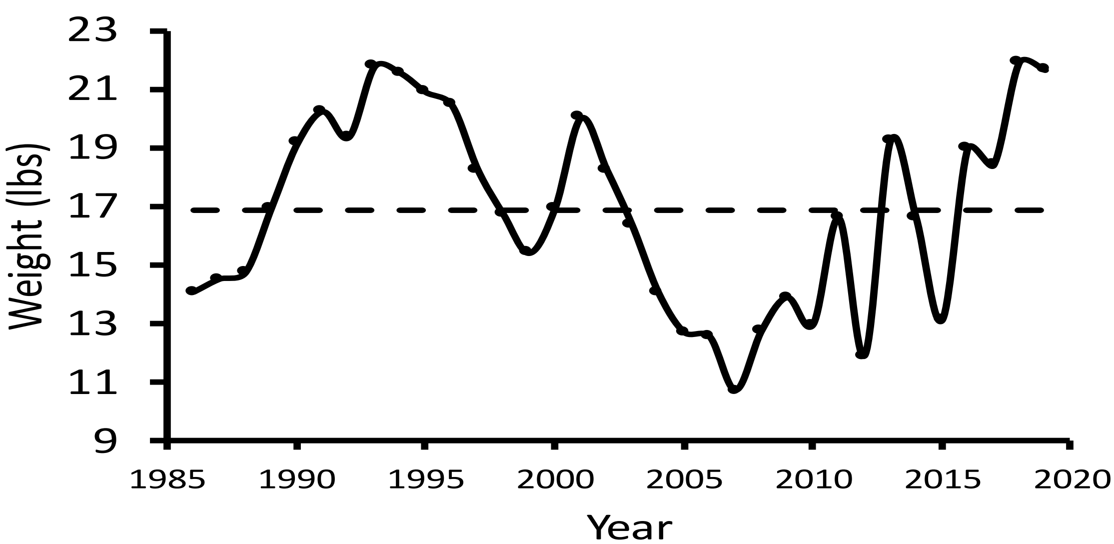

Figure 2. *Average weight of age-3 female Chinook salmon processed at the Strawberry Creek weir per year from 1986-2019 (2020 data not available). The long-term average is 16.9 pounds (dotted line). Many factors impact Chinook size including alewife biomass, Chinook abundance and the ratio of predator/prey, etc.*

BESADNY ANADROMOUS FISHERIES FACILITY (BAFF)

SPRING 2020 BAFF SUMMARY

Due to the COVID-19 public health emergency and the Governor's Executive Order #12, steelhead spawning activities at BAFF were modified this spring. Restrictions were placed on the number of staff present at the facility, and therefore no biological data were collected on spring steelhead at BAFF but eggs were collected. At total of 140 female steelhead were spawned at BAFF during spring 2020.

AUTUMN 2020 BAFF SUMMARY

A total of 709 Chinook and 1,857 coho salmon were processed for data at BAFF during autumn 2020 from Oct. 2 to Nov. 10 (Table 1). These salmon were sacrificed and processed for data including length (mm), weight (kg), gender, lamprey wounds and fin clips. CWTs were also collected from Chinooks. Eggs and fish health samples were collected from both Chinook and coho. A summary of Chinooks processed at BAFF by year from 1990-2020 is provided below (Figures 3 & 4). Coho processed at BAFF during recent years include: 1,298 (2012), 2,286 (2013), 786 (2014), 689 (2015), 861 (2016), 1,044 (2017), 1,480 (2018), 602 (2019) and 1,857 (2020) with an average of 1,211.

Table 1. *Numbers of Chinook and coho salmon processed for data and removed from ponds each day at the Besadny Anadromous Fisheries Facility (BAFF) during autumn 2020. Tallies of dead fish routinely removed from holding ponds are not included in this table.*

DATE	CHINOOK PROCESSED FOR DATA	FEMALE CHINOOK SPAWNED	CHINOOK EGGS COLLECTED	COHO PROCESSED FOR DATA	FEMALE COHO SPAWNED	COHO EGGS COLLECTED
Oct .2, 2020	200	40	211,600	2		
Oct. 6, 2020	100	19	102,974	7		
Oct. 9, 2020	217	85	475,409	12		
Oct. 13, 2020	126	37	215,252	12		
Oct. 16, 2020	44			15		
Oct. 21, 2020	5			22		
Oct. 28, 2020	4			421	160	459,667
Oct. 29, 2020	9			112		
Nov. 4, 2020	2			1,203	80	247,265
Nov. 10, 2020	2			51		
TOTALS	**709**	**181**	**1,005,235**	**1,857**	**240**	**706,932**

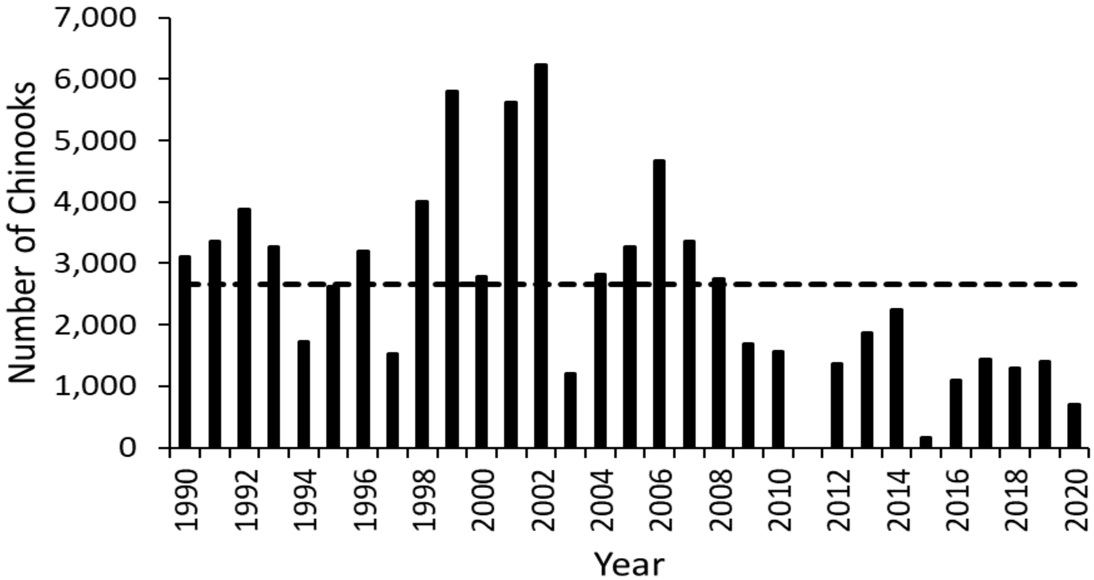

Figure 3. *Number of Chinook salmon handled during autumn spawning operations at the Besadny Anadromous Fisheries Facility (BAFF) per year from 1990-2020. The long-term average is 2,664 (dotted line). Several factors impact these numbers including stream flow, water temperature, stocking numbers, survival rates, dates of operation for the weir, etc.*

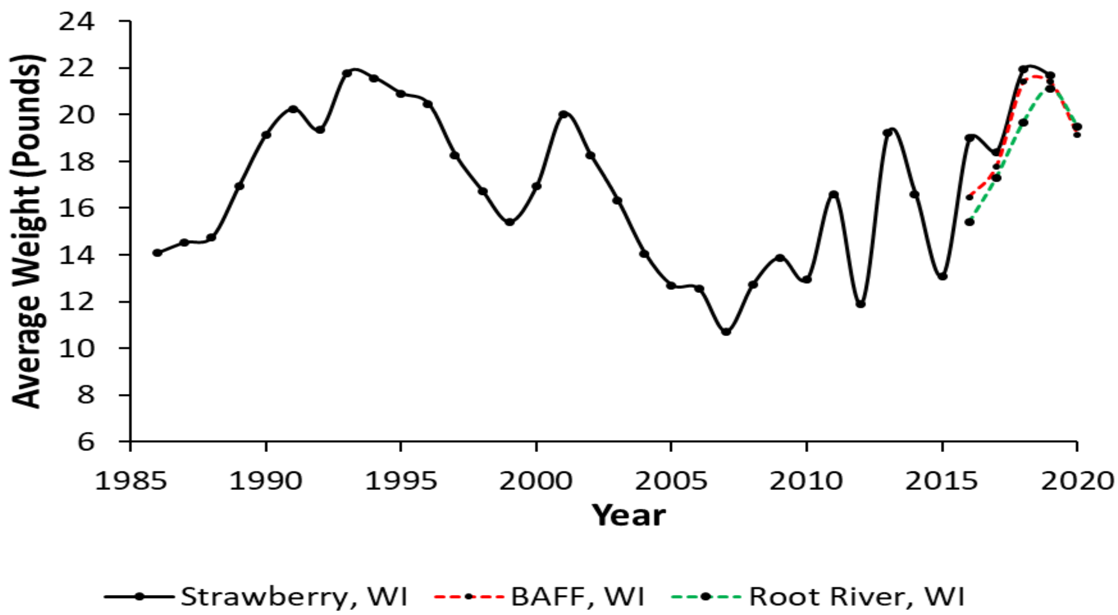

Figure 4. *Average weight of age-3 female Chinook salmon processed at the Strawberry Creek weir per year from 1986-2019 (black), the Besadny Anadromous Fisheries Facility from 2016-2020 (red), and the Root River from 2016-2020 (green). Many factors impact Chinook size including alewife biomass, Chinook abundance, and the ratio of predator/prey, etc.*

ROOT RIVER STEELHEAD FACILITY

SPRING 2020 ROOT RIVER SUMMARY

Due to the COVID-19 public health emergency and the Governor's Executive Order #12, steelhead spawning activities at the Root River Steelhead Facility (RRSF) were modified this spring. Restrictions were placed on the number of staff present at the facility, and therefore no biological data was collected from fish after March 23. The focus of our effort was egg collection for our hatchery system to provide steelhead for stocking in the future.

The RRSF was in operation for two processing dates this spring prior to the Governor's Executive Order #12. We captured 128 steelhead between March 16 and March 23. Steelhead were processed on March 19 and March 23.

A total of 108 female steelhead were spawned at the Root River, and 140 females were spawned at the Besadny Anadromous Fisheries Facility (BAFF). With the eggs collected at both of our spawning facilities, we expect to meet our egg collection goals for the year.

AUTUMN 2020 ROOT RIVER SUMMARY

The RRSF was in operation for eleven processing dates during the Fall 2020 migration. We captured and processed 5,404 fish between Sept. 21 and Nov. 2. In conjunction with the BAFF in Kewaunee, we met our egg collection and biological sampling goals and fish health inspections were conducted on coho and Chinook.

The Fall 2020 Root River effort is summarized below.

	Captured	Spawned	Eggs taken	Passed Upstream
Chinook	3,845	601	2,289,731	2,887
Coho	1,547	422	501,835	1,508
Rainbow	10	0	0	2
Brown	2	0	0	2
Totals	5,404	1,023	2,791,566	4,399

Water levels in the Root River were very low for much of this fall season due to a lack of precipitation. Despite the low water levels, both coho and Chinook salmon moved upstream in large numbers throughout October. The Fall 2020 return of 3,845 Chinooks was the highest return at RRSF since 2006.

Throughout the fall season, Chinooks were sampled as part of two ongoing studies: The multiagency mass marking program designated to evaluate salmonid wild production, movements, age and stocking practices, and the DNR's net pen study. Chinook salmon were adipose-clipped and tagged with coded wire tags (CWTs) lake-wide from 2011 through 2016, and analysis of these tags will provide fish managers with more information on movement patterns of Chinooks in the lake, growth rates and the occurrence of “straying,” or when a mature fish returns to a stream other than the one where it was originally stocked. Chinook salmon in the Kewaunee (BAFF) and Root (RRSF) rivers were differentially marked with coded wire tags from 2015-2018. Chinook stocked directly into the rivers and into net pens received different CWT numbers, and analysis of these tags will help evaluate whether Wisconsin’s collaborative net pen projects are having a positive impact on post stocking survival. Tags were recovered from 692 chinook salmon at RRSF this fall.

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YELLOW PERCH ASSESSMENTS IN WISCONSIN WATERS OF LAKE MICHIGAN 2020

2020 SPAWNING SURVEY

In 2020, no spawning surveys were conducted by the Wisconsin Department of Natural Resources (DNR). The Green Can Reef area off Milwaukee is the established index site for the annual yellow perch spawning assessment. Typically, a range of gill nets are set on the Green Can Reef targeting spawning yellow perch. Protocols for this survey are more clearly defined in Standard Operating Procedures for the Southern Lake Michigan Fisheries Work Unit (DNR 2014). Graphical results of previous data is available below. Overall, there has been poor adult spawning numbers since the late 1990s and early 2000s.

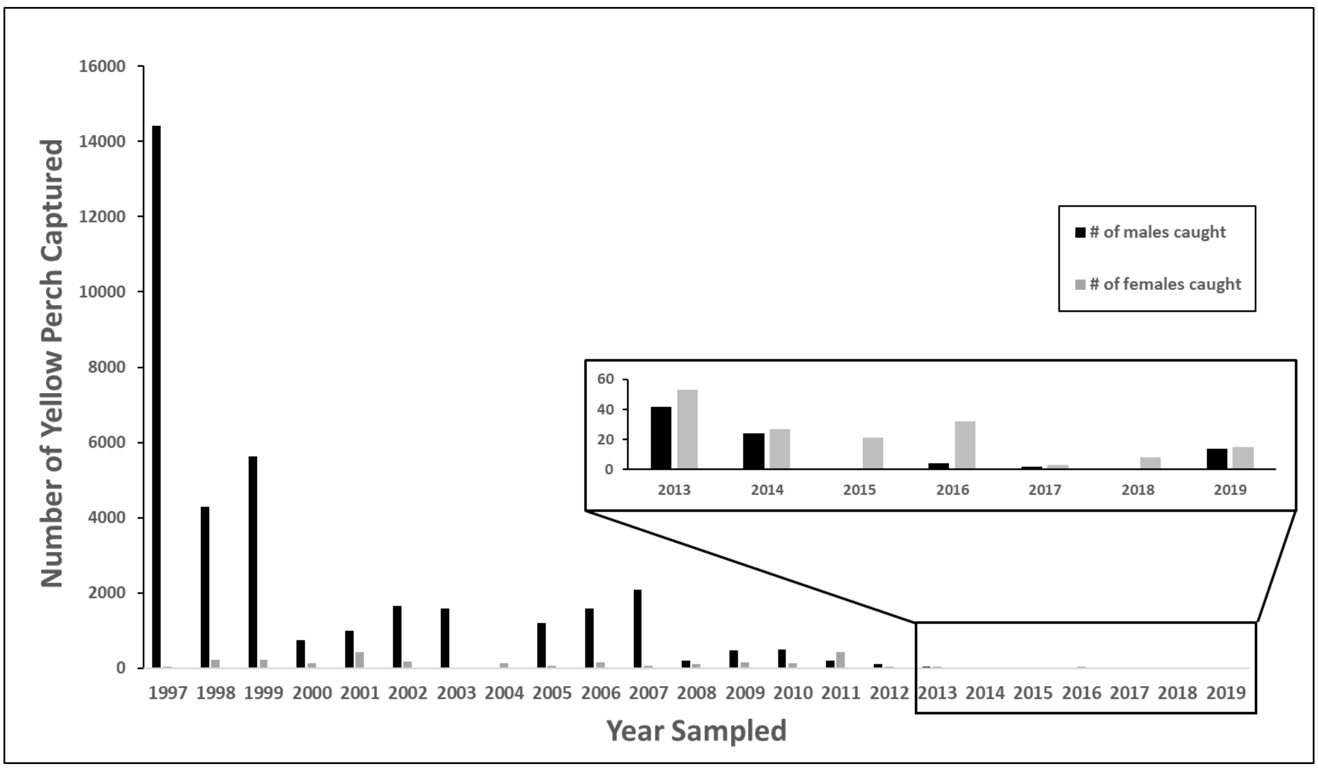

Figure 1. *Yellow Perch Spawning Assessment Green Can Reef, Lake Michigan, Milwaukee, DNR 1997-2019.*

2020 YOUNG OF YEAR SURVEY

An annual survey of young-of-the-year (YOY) yellow perch along the Lake Michigan shoreline typically consists of both seining and micromesh gill netting efforts. The YOY survey encompassed sampling sites from Sheboygan to Kenosha.

SEINING ASSESSMENT

The seining survey was carried out from Aug. 27 to Sept. 16, 2020. A standard 25-foot beach seine which was pulled by two persons in shallow nearshore waters of Lake Michigan. Each pull consisted of a 100-foot sweep either parallel to the beach or perpendicular to the beach or along piers and jetties depending on the depth and feasibility of seining. At each station, depending on conditions, two 100-foot pulls were attempted unless algae bloom limited our ability to effectively pull the net, especially when sampling around jetties and windward shores.

A total of 15 stations were sampled from Sheboygan to Kenosha (Sheboygan – 3, Ozaukee – 3, Milwaukee – 5, Racine – 2 and Kenosha – 2). Each site was sampled twice, approximately one week apart. Seining conditions during the sampling period varied among different sites on different days depending on wind direction. Some sites were difficult to seine due to Cladophora clogging the net while others were clear and easy to sample. In general, seining conditions this year were favorable for this assessment. A total of 60 seine hauls were taken in the 15 sites for a total 6,000 ft of seine haul. The water temperature during the survey was in the low to mid 60s for most sites in the survey this year.

A total of 50 YOY perch were caught in the seining effort in 2020. This yielded a catch per effort (CPUE) of 0.83 YOY yellow perch per 100 foot of seine haul (Figure 2). A total of 19 species of fish were captured during the survey (Table 1). Young-of-the-year alewife dominated the catch followed by spottail shiner, longnose dace then yellow perch.

Table 1. *Numbers of fish captured in the YOY yellow perch seining survey at index stations, DNR – 2020.*

SPECIES	NUMBER CAPTURED
Yellow perch	50
Alewife	10,768
Bloater	9
Chinook salmon	1
Rainbow trout	8
Rainbow smelt	12
Golden shiner	2
Emerald shiner	2
Spottail shiner	497
Fathead minnow	10
Longnose dace	75

Quillback	6
White sucker	11
Banded killifish	40
Brook silverside	13
White perch	1
Bluegill	2
Largemouth bass	10
Round goby	7

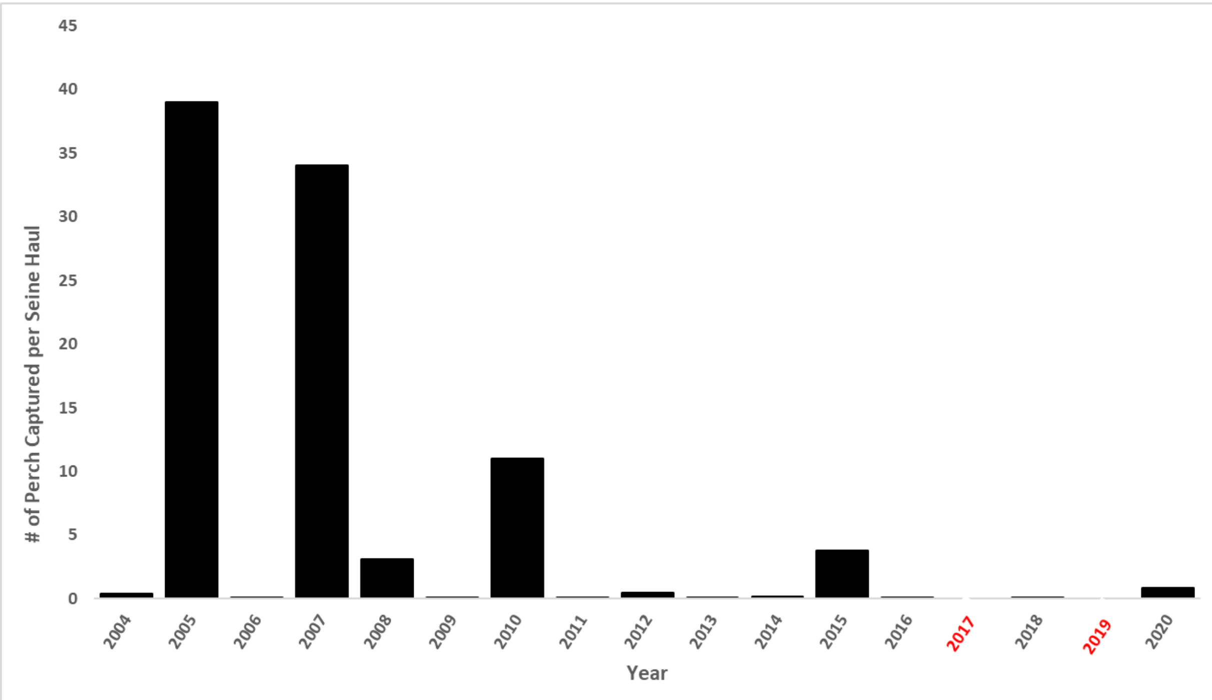

Figure 2. *Number of yellow perch captured in annual beach seining surveys at index sites from Kenosha to Sheboygan on Lake Michigan from 2004-2020. 2017 and 2019 are in red to show that the survey was not conducted on those years.*

MICROMESH

Beginning in 2016, three index stations are used for the annual micromesh gillnet survey targeting YOY yellow perch, Shoop Park (Racine Co.), Doctors Park (Milwaukee Co.) and Bradford Beach (Milwaukee Co.). In 2020, we used our 20 ft work boat to set and lift nets at all sites. At each site the nets are set in nearshore waters at depths ranging from 5 ft to 6 ft and fished overnight. In 2020, we had three sets using two 200-foot long and 5-foot deep monofilament net panels consisting of 12mm stretch mesh. A total of 1 YOY and 3 juvenile yellow perch were caught in our micromesh nets in 2020.

On Sept. 23, 2020 we lifted 400 ft of micromesh gill net off Bradford Beach. The water temperature was 51° F, and no yellow perch were captured. These nets had considerable

Cladophora on the lift. On Sept. 24, 2020 we set 400 ft of net off Shoop Park that was fished for one night. The water temperature was 58° F and four yellow perch were caught. On Sept. 29, 2020 we set the final 400 ft in front of Doctors Park with 44° F water temp and did not capture any yellow perch.

Micromesh gill net surveys were conducted at index sites like the previous years of sampling. Overall, the conditions for sampling were moderate as one net did encounter significant Cladophora. The water was cooler on the two sets that we did not catch perch in. We met our goal for amount of net set and covering the area of Milwaukee and Racine for micromesh, however, we did not set each site twice like we usually do. Instead, we simply set twice the amount of net out at one time. The nets were effective in capturing multiple species of fish although YOY Yellow Perch catch was low (Table 2). 2020 follows poor catches in the previous couple years and continually shows poor recruitment (Figure 3). The YOY and juvenile alewife numbers in this survey as well as the seining survey are much higher than in recent years and may be available as a food source for larger perch in the lake.

Table 2. *Numbers of fish captured in the YOY yellow perch micromesh gillnet survey at index stations (Lake Michigan nearshore waters), DNR – 2020.*

SPECIES	NUMBER OF FISH
Alewife	3,723
Lake trout	1
Coho salmon	1
Spottail shiner	18
Rainbow smelt	139
Yellow perch (YOY)	1
Yellow perch juvenile	3
Round goby	11

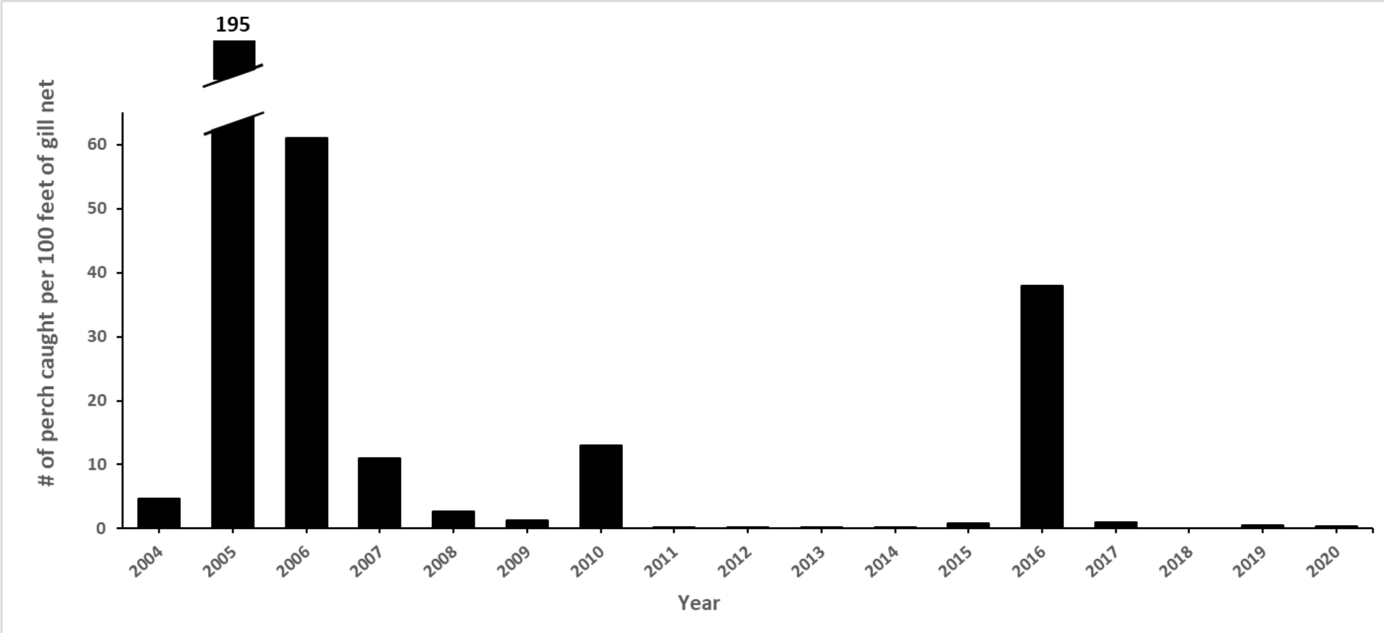

Figure 3. *Micromesh gill net catch per 100 feet of young-of-the-year yellow perch in the nearshore waters of Lake Michigan, DNR 2004-2020.*

WINTER GRADED MESH ASSESSMENT

Our annual winter graded mesh assessment of the yellow perch population in Lake Michigan was conducted between Dec. 3, 2020 and Dec. 9, 2020. Historically, this survey would be conducted January 2021 and labeled as the winter of 2021 survey. However, due to availability of the boat and marina space, this survey was conducted in December when yellow perch should be schooled in similar locations. This survey will be conducted in early December or late November for the foreseeable future.

For the winter graded mesh survey, we try to set 20 boxes of net. Each box of gill net contains one 50 ft panel of each 1.0 inch, 1.25 inches, 1.5 inches, 1.75 inches and one 100 ft panel of each 2.0 inches, 2.25 inches, 2.5 inches, 2.75 inches, 3.0 inches and 3.25 inches stretch monofilament mesh, totaling 800 ft per box. Two or three boxes of net are then attached at the ends to create a gang. The survey was conducted off the near shore waters of Milwaukee to the north, middle and south using the DNR research vessel *R/V Coregonus*.

We lifted three 1600 ft gangs on Dec. 3 to the north of the harbor at depths ranging from 60 to 77-ft. No perch were caught. We reset those three gangs to the north of the Green Can Reef in 60 to 80-foot depths and lifted on Dec. 4. No perch were captured in these sets either. The same three gangs were set to the south of the harbor on Dec. 7 covering depths of 73 to 82 ft and lifted on Dec. 8, also capturing no perch. For the final set we set one 800 ft box in the Milwaukee Harbor in front of the War Memorial and Art Center, one 1600 ft gang south of the Green Can Reef on the shallow side and one 1600 ft gang from 68 to 72 ft also near Green Can

Reef. The only net that captured any perch during this survey was the net set from 46 to 52 ft on the nearshore side of the Green Can Reef where four perch were captured. All lifts combined we were able to surpass our goal of 20 boxes by successfully completing 19,200 ft of gill net effort (24 boxes) over four nights. The surface water temperature during the sampling period was 42-44^{0}F, similar to previous years of sampling. Our catch of yellow perch consisted of three, 5-year-old females (2016 cohort) and one, 7-year-old female (2014 cohort) (Table 3). For standardization purposes, graded mesh assessment data is often reported as catch rate per 10,000 ft of equal length mesh panels. In these terms, our adjusted catch was less than two yellow perch per 10,000 ft of standardized mesh gill net in the December 2020 graded mesh assessment.

Table 3. *Number of yellow perch caught by mesh size in the December 2020 graded mesh assessment.*

MESH SIZE (IN)	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3	3.25
# OF YELLOW PERCH									2	2

Table 4. *Number of yellow perch caught by age in the December 2020 graded mesh assessment.*

AGE	2	3	4	5	6	7	8	9	10	11	12	13	14
# OF YELLOW PERCH				3		1							
AVERAGE LENGTH (MM)				311		314							

We maintained our yellow perch graded mesh standard protocol while choosing locations and depths, however, the perch may have been slightly shallower than most of our sets. Low catches and few cohorts of yellow perch in this assessment highlight a lack of recruitment and low overall population (Figure 4). The nets appeared to be fishing effectively, which was evident by the good numbers of round whitefish (254) caught in the nets. Other species included lake trout (28) and burbot (3). The nets were not clogged by Cladophora which occasionally occurs in shallower waters.

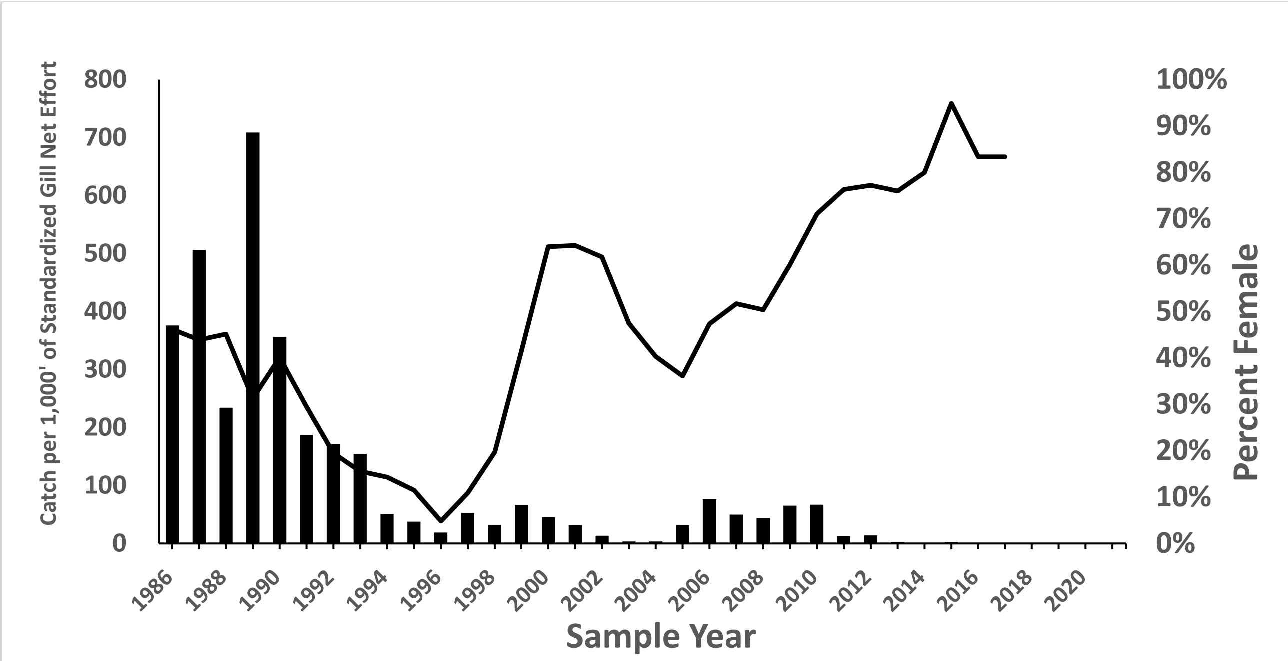

Figure 4. *Adult yellow perch standardized catch per unit of effort (CPUE) (bars) and percent female (line) in the Wisconsin waters of Lake Michigan winter gill net assessment, Milwaukee, WI, 1986-2020. Percent Female calculation ends in 2018 due to insufficient sample size.*

2020 SURVEY YEAR SUMMARY

Yellow perch populations remain low and struggle to produce significant year classes. Even when YOY classes are detected in targeted surveys (2005-2007, 2010 and 2016) (Figures 2 & 3) they rarely are detected in spawning or graded mesh surveys. Yellow perch from the 2016 cohort were captured during the spawning survey in 2019 and in the graded mesh assessment in December 2020 and are showing up in the creel. Although these numbers are low, the 2016 cohort is the most recent somewhat successful cohort in the last nine years. Many factors contributed to the decrease in yellow perch populations in Southen Lake Michigan. For more details see the Lake Michigan Yellow Perch Summit Summary Report: https://dnr.wi.gov/topic/fishing/Documents/LakeMichigan/LakeMichiganYellowPerchSummitReport.pdf.

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