Spring Adult and Fall Juvenile Walleye Population Surveys within the 1854 Ceded Territory of Minnesota, 2020

A Joint Effort of the Fond du Lac Resource Management Division
and the 1854 Treaty Authority

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Introduction

Under the Treaty of 30 September 1854, the Fond du Lac, Grand Portage, and Bois Forte Bands of Chippewa entered into an agreement with the United States of America. Under this agreement, these three Bands retained certain hunting, fishing, and gathering rights in the land ceded under this treaty.

Along with the right to utilize a resource comes the responsibility to manage and monitor the resource. Bands have assumed an increased responsibility to monitor fish populations and to develop long-term databases to set harvest quotas and to monitor the effects of tribal harvest. Fishery assessment surveys by Native American organizations have been performed for many years in both reservation and ceded territory waters of Wisconsin, Michigan, and Minnesota. Fond du Lac and the 1854 Treaty Authority have been actively involved with fish assessments since 1994 (Borkholder 1994a).

The 1854 Treaty Authority and Fond du Lac Resource Management Division work to protect and enhance the natural resources of the 1854 Ceded Territory for the three Bands. Cooperating with local Minnesota Department of Natural Resources (DNR) offices, the 1854 Treaty Authority and Fond du Lac identify priority natural resource projects for areas within the Ceded Territory. One goal is to assist with walleye (*Sander vitreus*) assessments in the Ceded Territory. Walleye have always been a traditional subsistence resource for the Fond du Lac, Grand Portage, and Bois Forte Bands. Surveys have indicated that walleye are the primary game fish sought after by band members in the 1854 Ceded Territory (Borkholder 1994b; Vogt 2004; Kaeske 2009).

Three techniques are typically utilized for the sampling of adult fish populations from within inland bodies of water; gill nets, trap (fyke) nets, and electrofishing gear. Gill nets are typically set for longer periods of time (10 - 18 hours), and can result in high fish mortality. Trap nets have been used for the sampling of adult walleye populations, but catch rates are low compared to electrofishing (Goyke et al. 1993 and 1994). Electrofishing is an effective and rapid method for sampling large areas, and has been used to sample walleye populations by other Native American agencies within Wisconsin (Ngu and Kmiecik 1993; Goyke et al. 1993 and 1994) and within Northeastern Minnesota since 1994 (Borkholder 1994a). In order to maximize the number of fish handled and marked during the 2020 spawning season, Fond du Lac and the 1854 Treaty Authority chose once again to utilize electrofishing gear for these surveys.

Population estimates can be made using mark - recapture data (Ricker 1975). In this type of assessment, fish are collected, marked (fin clips, tags, etc.), and returned to the water. Population estimates are based upon the ratio of marked fish to unmarked fish within subsequent recapture samples. Accurate estimates are obtained when a large portion of the population is marked, usually 10% to 30% (Meyer 1993).

Surveying adult walleye populations using just electrofishing gear will usually result in conservative estimates of the adult stock. Walleye spawn in shallow water, where they are vulnerable to electrofishing gear. Male walleyes remain in the shallow water throughout the spawning period, while females retreat to deeper water (Meyer 1993). Thus, females are only vulnerable to the sampling gear for a short period of time. The Great Lakes Indian Fish and Wildlife Commission and the U.S. Fish and Wildlife Service utilize trap nets to aid in the sampling of walleye females, thus improving the accuracy of their population estimates.

The first objective of our assessments in 2020 was to obtain adult walleye population estimates (PE) during the spring spawning period using mark - recapture data. Our electrofishing PEs are likely biased towards males in the populations, and thus are presumed conservative estimates of population abundance. However, by cooperating with the MN DNR area offices, another PE is obtained using the State's summer gill net data, with which to compare to the spring electrofishing PE. An additional benefit of the spring electrofishing surveys is that it allows biologists to identify and determine key and critical spawning sites, i.e. where catch rates are the highest.

The second objective of our 2020 walleye surveys targeted juvenile (age-1) and young-of-the-year (age-0) individuals in the fall. The purpose for assessing age-0 and age-1 individuals is to evaluate recruitment and year-class strength, and to continue developing long-term data sets using this data.

Methods

Spring Assessments

Lakes within the 1854 Ceded Territory of Minnesota were identified by MN DNR Area Managers and Tribal biologists. The objective was to obtain adult walleye population estimates using mark-recapture methods and to determine the age structure and growth rates of the walleye population within the lakes surveyed. Tagged walleye would then be available during summer gill net assessments. A second population estimate was obtained by the MN DNR in the course of conducting their standard summer gill net surveys.

Electrofishing was performed at night using boom-shocking boats equipped with Smith-Root electrofisher units and two Smith-Root umbrella anode arrays (Smith-Root, Vancouver, WA). Pulsed direct current was used to minimize injuries to the fish. Surface water temperature was taken at each station. Ambient water conductivity measurements were also taken in order to properly set electrofishing power settings.

Electrofishing surveys were planned to begin soon after ice-out and continue for as long as un-tagged walleye were abundant in the samples or when the percentage of recaptured individuals approached or exceeded 30%. Adult and juvenile walleye immobilized by the electrofishing gear were collected. Collected fish were placed into a 90-gallon tank equipped with an aerator and given time to recover. Walleye were measured to the nearest millimeter (mm), examined for fin clips and / or floy tags, and the sex determined based upon visual identification of gametes. Walleye that had been floy-tagged during any previous nights' collections were counted as recaptured fish (Appendix 1). All individuals larger than 254 mm were marked using non-numbered colored floy tags (light blue color used in 2020) (Super Swiftachment Fasteners available from the Dennison Fastener Division, Framingham, Massachusetts). A dorsal fin spine from five individuals per centimeter group and per sex was removed for age interpretations. Following marking and spine collection, walleyes were released away from the shoreline.

Mark and recapture data were used to calculate adult walleye population estimates using both the Schumacher and Eschmeyer formula for multiple recapture surveys and the adjusted Petersen Method for single census (Ricker 1975). The Schumacher and Eschmeyer formula was used to take advantage of multiple evenings of recapture data. Walleye less than 254 mm (10 inches, “stock” size defined by Anderson 1976 and 1978) were excluded from population estimates.

Spines from adults were cleaned using bleach to remove the layer of skin on the bone. Spines were set in epoxy resin and sectioned (0.3 to 0.5 mm thick) using a Buehler Isomet™ low speed bone saw. Spines were examined using a microfiche reader. Annual rings were counted (McFarlane and Beamish 1987), and marked on overhead transparency sheets. Each spine’s annuli were digitized into a computer using the DisBCal89 program (Frie 1982). DisBCal89 was used to back-calculate length-at-age estimates, using no transformation and a standard intercept of 27.9 mm (MN DNR personal communication).

Fall Assessments

Presumed age-0 and age-1 walleye immobilized by the electrofishing gear were collected. Collected fish were placed into a 90-gallon tank of lake water and given time to recover. Walleye were measured to the nearest mm. Scales were taken for age analysis from five fish per cm group prior to release.

Sampling stations used were either those established during previous electrofishing surveys by the MN DNR or by Fond du Lac and the 1854 Treaty Authority. Sampling stations were repeated from previous years' surveys.

Walleyes were aged by counting annuli on scales viewed under a microfiche reader (Borkholder and Edwards 2001). Walleye ages were used to estimate CPUE (number of walleye / hour of electrofishing) of juvenile (age-1) and young-of-the-year (age-0) individuals.

Results and Discussion

Spring Assessments

Cadotte Lake (DOW 69-0114)

Due to Covid-19 travel restrictions and shutdowns of various businesses and hotels, FDL was only able to survey a single lake this spring. While intentions and plans were in place to survey lakes in both the Finland and Grand Marais areas, hotels were not accepting guests and restaurants were not open to serve meals. FDL was only able to conduct electrofishing activities on Cadotte Lake, St. Louis County, on 29 April thru 2 May (Figure 1). Due to Covid work restrictions, the 1854 Treaty Authority was unable to assist for the spring survey on Cadotte Lake. Dates of electrofishing activities, water temperature, water conductivity, shocking time, the voltage and amps, the number of walleye collected, and the number caught per hour of electrofishing (CPUE) are presented in Table 1. CPUE ranged from 18.0 (EF4, 29 April) to 144.7 (EF3, 2 May) adult walleye per hour of sampling (Figure 1). At a 95% confidence interval, mean CPUE for Cadotte Lake was 102.6 ± 26.5 adult walleye (>254mm) per hour of sampling effort.

The length frequency of the walleye sampled in Cadotte Lake is presented in Figure 2. Walleye as large as 764 mm (30.1 inches) were observed in the survey. Additional species observed included yellow perch, northern pike, white sucker, bluegill, black crappie, and largemouth bass.

Walleyes larger than 254 mm were marked with a non-numbered light blue floy tag along the distal portion of the soft dorsal fin. Table 2 presents the population estimates based upon mark-recapture data. The electrofishing Schumacher and Eschmeyer population estimate is 813 (Table 2). The adjusted Petersen estimate is 630 ± 90, with a 4.5% CV (Table 2). The population estimates presented in Table 2 represent the population abundance of walleye using the spawning habitat sampled (Figure 1), and are not estimates of the walleye population within the entire lake.

During summer 2020, the Minnesota Department of Natural Resources performed a standardized net assessment on Cadotte Lake (MN DNR, Duluth Area Fisheries). Sixty-seven (67) individuals (> 274 mm) were sampled in the gill nets that would have been 254 mm during the May assessments. This 274 mm threshold was determined in previous mark-recapture experiments using unique numbered floy tags (Borkholder et al. 2006). Five (5) individuals were recapture that had the blue floy tag from the spring sampling (Appendix 1). The adjusted Petersen estimate using both the spring and summer data is 6264 ± 5886, with a 33.9% CV (Table 2). The Schumacher and Eschmeyer population estimate from this gill net data is 1103 (Table 2). Eighty-three (83) walleyes in total were sampled between the gill nets and trap nets, with six recaptured individuals observed. Population estimates are included in Table 2.

Table 3 presents the age data for the walleye collected from Cadotte Lake. Of the 853 unique fish sampled, 569 (66.7%) were assigned to ages 3, 4 or 5. Total annual mortality (*A*) of the Cadotte Lake population was estimated using the equation $A = 1 - e^{(Z)}$, where Z is the slope of the catch-curve relationship, and an estimate of instantaneous total annual mortality (Figure 3) (Chapman and Robson 1960). Annual mortality (*A*) was estimated at 40.2% (Figure 3, blue line). Using catch curve analysis assumes that; 1) there are no aging errors; 2) constant recruitment; 3) Z is constant over time, and; 4) above a certain age (sexual maturity for this data set) all individuals within the population are equally vulnerable to the sampling gear (Smith et al., 2012). Total annual mortality (*A*) estimated using the MN DNR's gill net data was 41.5% (Figure 3, green triangles), essentially equivalent to the estimate from the spring electrofishing assessment. Our spring estimate was made using 853 mature walleyes, aged 3 – 15. The estimate from the gill and trap net assessment was made using 75 fish aged 2 – 9.

Table 4 presents back-calculated lengths-at-age for walleye collected from Cadotte Lake, as determined using dorsal fin spines. Figure 4 presents the growth data for Cadotte Lake walleye, for the last three electrofishing surveys. Growth for this population appears to level out at less than 500 mm (19.7 inches) for males, and 600 mm (23.6 inches) for females, although larger individuals are certainly observed.

Stock density indices are used to quantify the size structure of a population. Proportional stock density (PSD) was first proposed by Anderson (1976 and 1978), and is simply a measurement of the proportion of the fish observed larger than a predetermined "quality" length divided by the number of fish observed larger than a predetermined "stock" length. For walleye, "stock" length fish are those larger than 10.0 inches (254 mm), and "quality" length fish are those larger than 15.0 inches (381 mm). Gabelhouse (1984) proposed further separating "quality" fish into "preferred" (walleye > 20.0 inches / 508 mm), "memorable" (walleye > 25.0 inches / 635 mm), and "trophy" length fish (walleye > 30.0 inches / 762 mm), and calculating a relative stock density (RSD), or proportion, for each category. For example, RSD S-Q is the proportion of walleye in the sample between “stock” length (10.0 inches / 254 mm) and “quality” length (> 15.0 inches / 381 mm), divided by the total number of walleye sampled larger than 10.0 inches.

PSD and RSD values determined by our spring electrofishing sampling and summer gillnet survey are presented in Table 5. The electrofishing PSD was 45.3 ± 3.7 (Table 5). 376 of the 717 fish sampled were larger than 10.0 inches (stock sized) and will be growing and recruiting into this “quality” 15-inch category over the next few years, assuming that angling (or natural) mortality doesn’t remove them before this. The summer gill net PSD (38.1 ± 10.4) was not significantly different than the PSD estimate from the spring electrofishing survey (χ^2=1.559, P>0.05, critical Chi-square value of 3.841) (Table 5).

Figure 5 shows historical data from Cadotte Lake. Since 2003, PSDs within Cadotte Lake have been rising in each of the three electrofishing surveys (Figure 5). Observed walleye densities (no. / acre) have been on a steady decline in each of the last three surveys, from 13.7 walleye / acre in 2003 to 2.1 walleye / acre in 2020 (Figure 5). All of the MNDNR gill net data available were processed thru two gill net selectivity models to calculate walleye density within Cadotte Lake (Anderson 2011; Radomski et al. 2019). Comparing the electrofishing data to the MNDNR gill net data, we see similar trends in the data, with all metrics of walleye density declining since 1995 (Figure 4, three colored lines). Most of the population (66.7%) were aged at 5 years or younger (Table 3). The population growth rate levels off at less than 20 inches (“quality length”) for males. A population characterized by young fish, high total mortality (>40%), and a low maximum length suggests that angling exploitation may be too high for the long term. For now, natural reproduction seems strong enough to maintain this population, with no obvious trends in declining juvenile walleye densities over time (see *Fall Assessments* portion of this report beginning on page 15). Cadotte Lake may be a good candidate for future creel surveys and estimates of angling exploitation within this population.

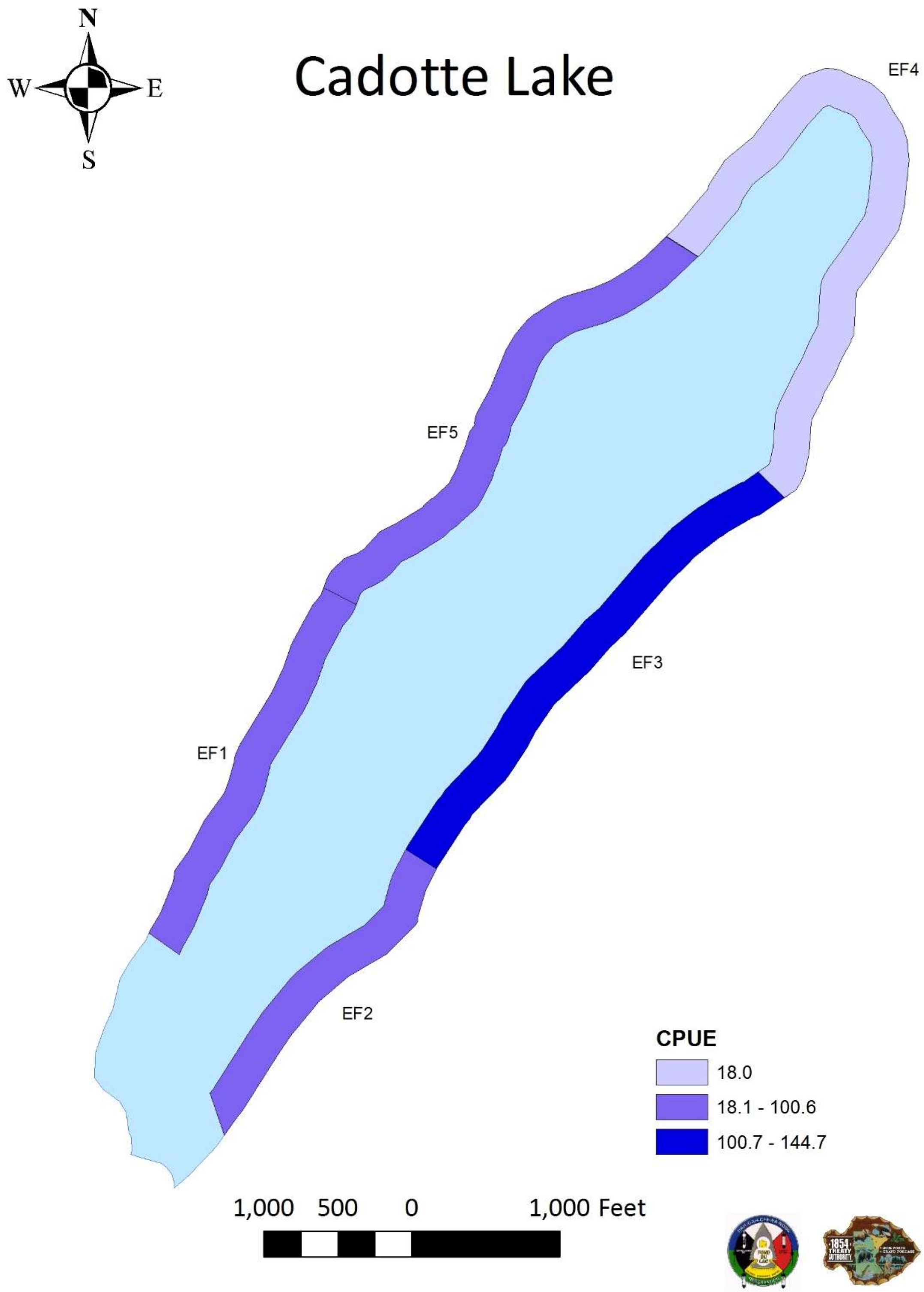

Figure 1. Catch per hour (CPUE) of adult walleyes (fish larger than 254 mm) by electrofishing station, on Cadotte Lake, St. Louis County, during spring 2020 electrofishing surveys.

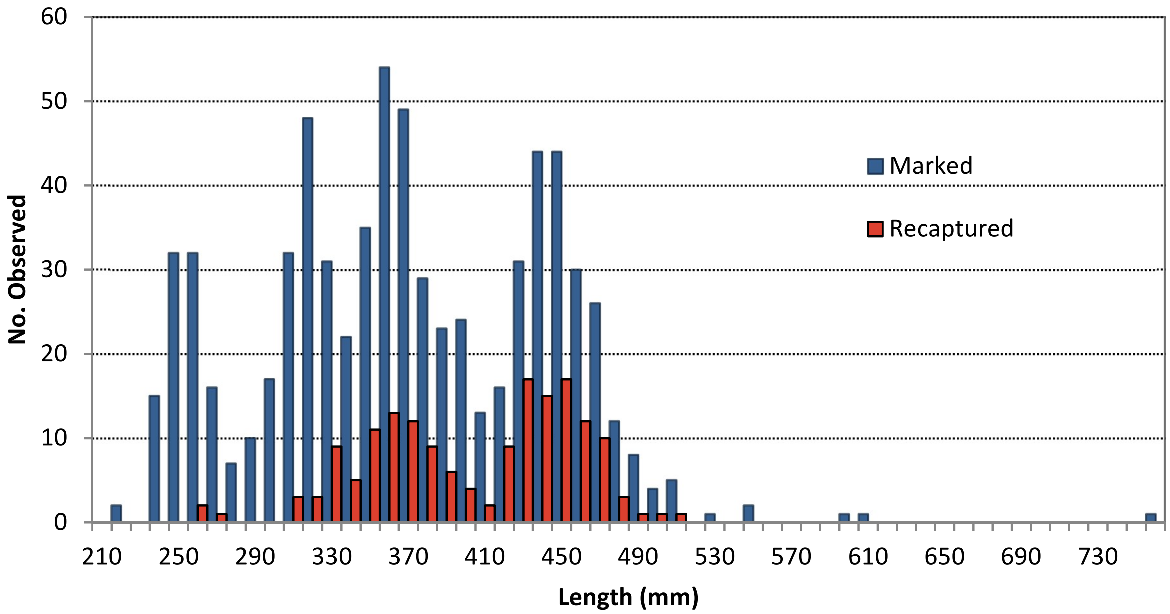

Figure 2. Length frequency distribution of walleye sampled from Cadotte Lake, St. Louis County, during spring 2020 electrofishing assessments. Length frequency distribution of recaptured walleyes is shown in red bars.

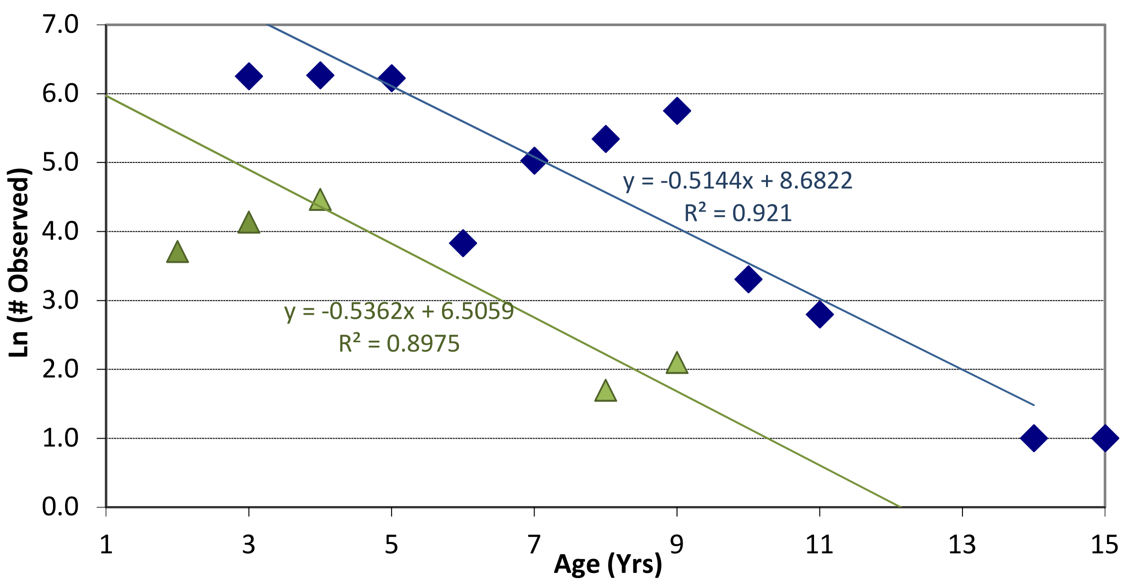

Figure 3. Catch curve analysis of walleyes in Cadotte Lake, 2020, showing instantaneous mortality (*Z*). Estimates are made from spring 2020 electrofishing data (blue diamonds) and summer MN DNR gill net data (green triangles).

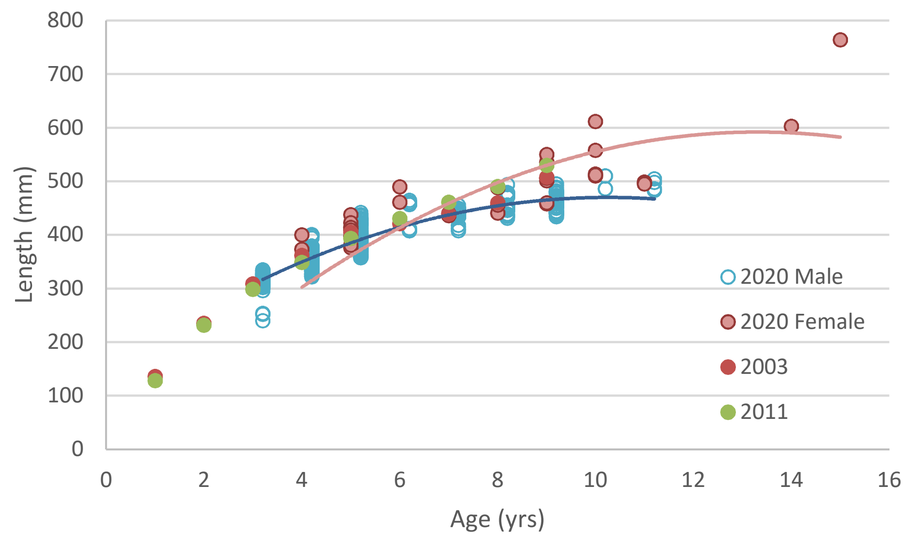

Figure 4. Mean length at age estimates for walleye in Cadotte Lake, St. Louis County, from three different electrofishing surveys, 2003, 2011, and 2020 (males and females separately). The regression lines are fitted only for the 2020 data, and set with a 0 intercept.

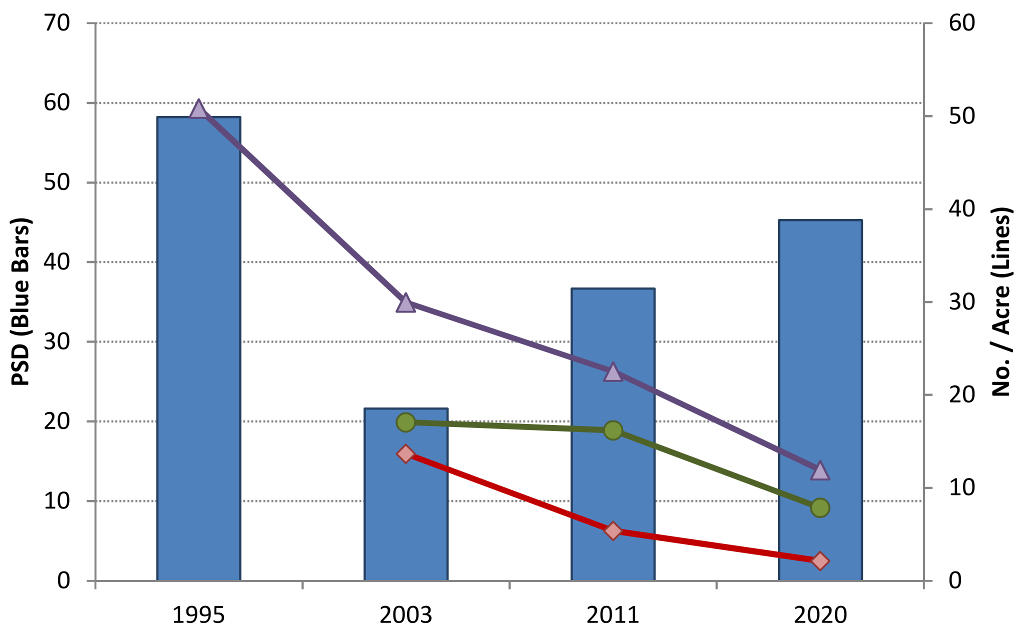

Figure 5. PSDs (blue bars) for walleye and adult walleye densities (no. / acre, colored lines) in Cadotte Lake as estimated during spring electrofishing surveys and MNDNR summer gill net assessments. Red line displays walleye density estimates from spring electrofishing surveys. Green line shows density estimates using MNDNR gill net data processed thru the Radomski et al. (2019) model. The purple line shows estimates from MNDNR gill net data processed thru Anderson's (2011) Q_{abg} gill net selectivity model.

Table 1. Summary of electrofishing activities on Cadotte Lake within the 1854 Ceded Territory of Minnesota during spring 2020.

ID #	County	Lake	Area (Acres)	Max Depth (ft)	Date	Water Temp (F)	Conductivity[1]	Shocking Time (sec)	Voltage (PDC)[2]	Amps[3]	# WAE[4]	CPUE WAE[5]
69-0371	St. Louis	Cadotte	293	18	4/29/2020	44.8	31.5	6964	1061	3	126	65.1
					4/30/2020	46.0	33.1	6841	1061	4	153	80.5
					5/1/2020	47.0	31.8	8996	1061	3	332	132.9
					5/2/2020	48.8	32.3	6481	1061	4	242	134.4

1 Water conductivity measured in microSiemens / cm.
2 Voltage is reported as actual voltage recorded from the SmithRoot Type VI-A, or as Low / High from the SmithRoot 5.0 GPP
3 Amps are reported as from the 1854 Treaty Authority Boat / Fond du Lac Boat.
4 WAE = walleye. Numbers in column represent the number of "stock" sized walleye (>254mm (10 inches)) collected. Includes marked and recaptured individuals.
5 CPUE = catch per unit effort, computed as per hour (3600 sec) of electrofishing. Numbers in column represent CPUE for "stock" sized walleye (>254mm (10 inches)).

Table 2. Walleye population estimates for Cadotte Lake (St. Louis County), spring 2020. Estimates are for walleye larger than 254 mm (10.0 inches). EF denotes population estimates determined from spring electrofishing data. GN refers to population estimates from samples collected during the MN DNR's summer netting assessments. GN/TN includes all of the MN DNR data from both the gill nets and trap nets.

Lake	Population Estimate[1]	No. / Acre	95% Confidence Limits Lower	Upper	Estimate[2]	C.V.[3]
Cadotte – EF_{2020}	813	2.8	486	2476	630 ± 90	4.5 %
Cadotte – GN_{2020}	1048	3.6	554	9540	5916 ± 5927	36.1%
Cadotte – GN/TN_{2020}	1103	3.8	564	25,562	6264 ± 5886	33.9%

1 Schumacher and Eschmeyer population estimate.
2 Adjusted Petersen population estimate, with 95% confidence interval.
3 Coefficient of variation for the Petersen estimate.

Table 3. Age frequency distribution of walleye from Cadotte Lake, St. Louis County, spring 2020, based upon the number of fish sampled and aged per size category.

Length Group		N	Age											
Inches	mm	Sampled	3	4	5	6	7	8	9	10	11	12	13	14	15
9.5	241	21	21												
10.0	254	42	42												
10.5	267	28	28												
11.0	279	10	10												
11.5	292	15	15												
12.0	305	40	40												
12.5	318	59	44	15											
13.0	330	44	11	33											
13.5	343	39		39											
14.0	356	90		63	27										
14.5	368	68		34	34										
15.0	381	38			38										
15.5	394	46		9	37										
16.0	406	22			12	5	5								
16.5	419	30			30										
17.0	432	76			8		37	8	23						
17.5	445	70					14	42	14						
18.0	457	59				10			49						
18.5	470	41						25	16						
19.0	483	15				2		2	7	2	2				
19.5	495	9							4		4				
20.0	508	6								6					
20.5	521														
21.0	533	1							1						
21.5	546	2							1	1					
22.0	559														
22.5	572														
23.0	584														
23.5	597	1												1	
24.0	610	1								1					
24.5	622														
30.0	762	1													1
TOTAL		853	190	193	185	17	56	77	115	10	6	0	0	1	1

Table 4. Back-calculated lengths-at-age for walleye collected from Cadotte Lake, St. Louis County, Minnesota, spring 2020.

Age Class	N	Length (mm)	Length (in)
1	178	117	4.6
2	178	210	8.3
3	177	285	11.2
4	121	342	13.5
5	98	382	15
6	69	415	16.3
7	64	441	17.4
8	53	464	18.3
9	37	483	19
10	12	516	20.3
11	7	527	20.7
12	5	557	21.9
13	4	585	23
14	2	678	26.7
15	1	764	30.1

Table 5. Proportional Stock Density (PSD) and Relative Stock Densities (RSD) with 95% confidence for Cadotte Lake (St. Louis County). Values are for spring electrofishing (EF) and MN DNR gill netting (GN) and trap netting (TN) surveys conducted during the year indicated.

Lake	PSD	RSD S-Q	RSD Q-P	RSD P-M	RSD M-T
Cadotte – EF_{2020}	45.3 ± 3.7	54.7 ± 3.7	43.7 ± 3.7	1.5 ± 0.9	0.0 ± 0.0
Cadotte – GN_{2020}	29.4 ± 10.8	70.6 ± 10.8	29.4 ± 10.8	0.0 ± 0.0	0.0 ± 0.0
Cadotte – GN/TN_{2020}	38.1 ± 10.4	61.9 ± 10.4	31.0 ± 9.9	6.0 ± 5.1	1.2 ± 2.3

Fall Assessments

Catch per unit effort (CPUE) for age-0 walleye has been found to be the highest in the fall when water temperatures are between 20.0°C and 10.0°C (Borkholder and Parsons 2001). Fall assessments began in the Grand Marais area on 31 August 2020. This 20°C threshold was not exceeded in any of the lakes surveyed this season (Table 6). All of the lakes were surveyed before the lakes cooled to below the 10°C lower threshold.

Table 6 presents a summary of each evening of electrofishing assessments. CPUE for age-0 walleye ranged from 2.6 fish per hour (Wild Rice Lake) to 215.5 fish per hour of electrofishing (Caribou Lake). Of note, Whiteface was surveyed on September 21, but the length data sheets were subsequently lost or misplaced. We had 72 scale samples, but opted to not age these samples given that we wouldn't be able to determine CPEs. Table 6 does not present any data for age-0 or age-1 walleyes for Whiteface in 2020. CPUE for age-1 walleye ranged from 0.0 fish per hour (Wild Rice Lake) to 58.8 fish per hour of electrofishing (Elbow Lake) (Table 6).

Table 7 presents the mean length for age-0 and age-1 individuals sampled during fall 2020 assessments. Mean lengths for age-0 walleye ranged from 111 mm (4.4 inches, Tom Lake) to 164 mm (6.5 inches, Dumbbell Lake). Mean lengths for age-1 walleye ranged from 178 mm (7.0 inches, Two Island Lake) to 245 mm (9.6 inches, Wilson Lake). Figures 6 – 28 present length frequency data for each of the lakes surveyed.

Historical catch rates for all of the lakes in our schedule are presented in figures 29 – 52. These figures present the age-0 and age-1 catch per hour for all years surveyed by both Fond du Lac and the 1854 Treaty Authority. This data is presented mostly for the various MN DNR area office staff to see in a single snapshot how lakes within their areas have historically produced seemingly strong and weak year-classes of walleyes.

Wild Rice Lake Reservoir Largemouth Bass

This year, 62 largemouth bass (*Micropterus salmoides*) were sampled, with lengths ranging from 55 mm (2.2 in) to 361 mm (14.2 in) (Figure 28). Since they were first collected in 2009, the number of largemouth bass in the annual fall assessment shows an increasing trend (Figure 53, displayed immediately following Figure 28). Unless there's a compelling reason to continue this survey in the future, this largemouth bass survey may be terminated beginning in 2021. The Bands will be open to discussion with the State DNR regarding this issue.

Table 6. Total number and catch-per-unit-effort (CPUE) of age-0 and age-1 walleye collected from 25 lakes within the 1854 Ceded Territory of Northeastern Minnesota during fall 2020.

Lake	Date	Temp (F)	Temp (C)	Cond.[1]	Age-0 Total[2]	Age-1 Total[3]	Seconds	CPUE Age-0[4]	CPUE 1+[5]
Ball Club	1-Sep	64.0	17.8	23.0	30	21	5100	21.2	14.8
Cadotte	21-Sep	60.0	15.5	26.0	78	88	7482	37.5	42.3
Caribou	2-Sep	64.4	18.0	69.0	449	56	7500	215.5	26.9
Cascade	8-Sep	57.0	13.9	24.0	45	29	6980	23.2	15.0
Crescent	3-Sep	62.2	16.8	30.0	48	6	3660	47.2	5.9
Crooked	13-Sep	58.3	14.6	48.0	8	20	4205	6.8	17.1
Dumbbell	11-Sep	59.1	15.1	73.3	255	4	6183	148.5	2.3
Elbow	31-Aug	62.1	16.7	29.0	212	95	5820	131.1	58.8
Fourmile	10-Sep	57.5	14.2	47.0	45	75	5411	29.9	49.9
Harriet	10-Sep	58.0	14.4	60.7	73	32	5275	49.8	21.8
Island Reservoir	18-Sep	61.2	16.2	84.2	269	159	11468	84.4	49.9
Ninemile	9-Sep	55.8	13.2	45.6	158	8	5698	99.8	5.1
N. McDougal	11-Sep	58.1	14.5	66.0	63	62	6210	36.5	35.9
Pike	2-Sep	65.8	18.8	57.8	18	3	6180	10.5	1.7
Shagawa	22-Sep	61.6	16.4	92.2	99	85	12512	28.5	24.5
Silver Island	9-Sep	54.8	12.6	42.0	42	13	4373	34.6	10.7
Tait	1-Sep	56.9	13.8	37.5	232	99	9771	85.5	36.5
Tom	1-Sep	64.9	18.3	33.0	17	40	8021	7.6	18.0
Two Island	31-Aug	64.0	17.8	30.4	24	89	5738	15.1	55.8
West Twin	3-Sep	61.4	16.3	31.7	46	31	4840	34.2	23.1
Whiteface Res.	21-Sep	59.9	15.5	59.7	---	---	7819	---	---
Wild Rice	17-Sep	58.1	14.5	140.2	4	0	5579	2.6	0.0
Wilson	10-Sep	59.9	15.5	47.4	52	32	6725	27.8	17.1
Windy	9-Sep	59.3	15.2	28.0	19	13	6162	11.1	7.6

1 Conductivity, measured in MicroSiemens / cm.
2 Indicates the number of age-0, young-of-the-year, walleye collected in each sample.
3 Indicates the number of age-1 juvenile walleye collected in each sample.
4 Indicates the catch rate of age-0 fish (fish per hour, 3600 sec, of electrofishing on time).
5 Indicates the catch rate of age-1 fish (fish per hour, 3600 sec, of electrofishing on time).

Table 7. Mean length for age-0 and age-1 walleye sampled during fall 2020 assessments within the 1854 Ceded Territory of Northeastern Minnesota. Numbers in parentheses indicate sample sizes, and are presented when mean lengths are based upon few individuals (N=<20).

Lake (County)	Date	Age-0 Mean Length (mm)	Age-1 Mean Length (mm)
Ball Club	1-Sep	128	215
Cadotte	21-Sep	162	180
Caribou	2-Sep	125	197
Cascade	8-Sep	131	198
Crescent	3-Sep	139	226 (N=6)
Crooked	13-Sep	144 (N=8)	193 (N=20)
Dumbbell	11-Sep	164	218 (N=4)
Elbow	31-Aug	123	194
Fourmile	10-Sep	156	221
Harriet	10-Sep	122	183
Island Reservoir	18-Sep	122	190
Ninemile	9-Sep	158	231 (N=8)
N. McDougal	11-Sep	147 (N=18)	201 (N=3)
Pike	2-Sep	159	234
Shagawa	22-Sep	145	226
Silver Island	9-Sep	139	209 (N=13)
Tait	1-Sep	117	207
Tom	1-Sep	111 (N=17)	206
Two Island	31-Aug	113	178
West Twin	3-Sep	147	233
Whiteface Res.	21-Sep	Datasheets Lost	Datasheets Lost
Wild Rice	17-Sep	132 (N=4)	N/A
Wilson	10-Sep	145	245
Windy	9-Sep	146 (N=19)	234 (N=13)

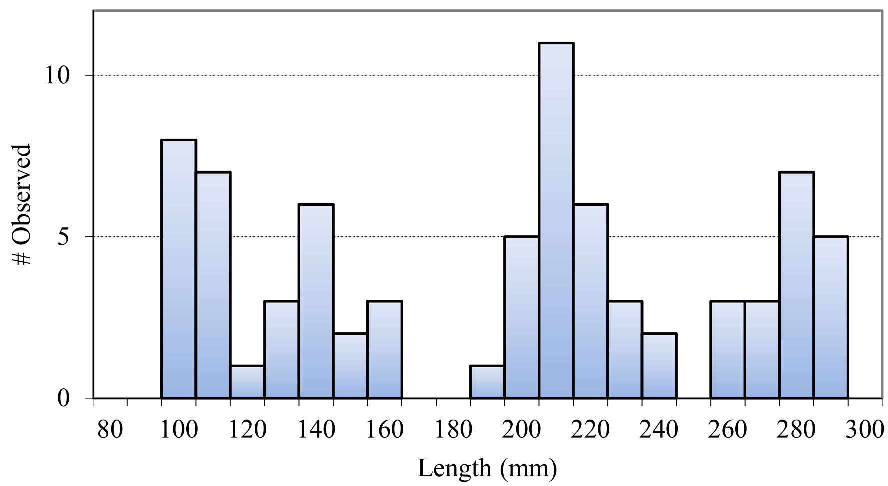

Figure 6. Length frequency distribution of walleye collected from Ball Club Lake, Cook County, during fall 2020 electrofishing assessments.

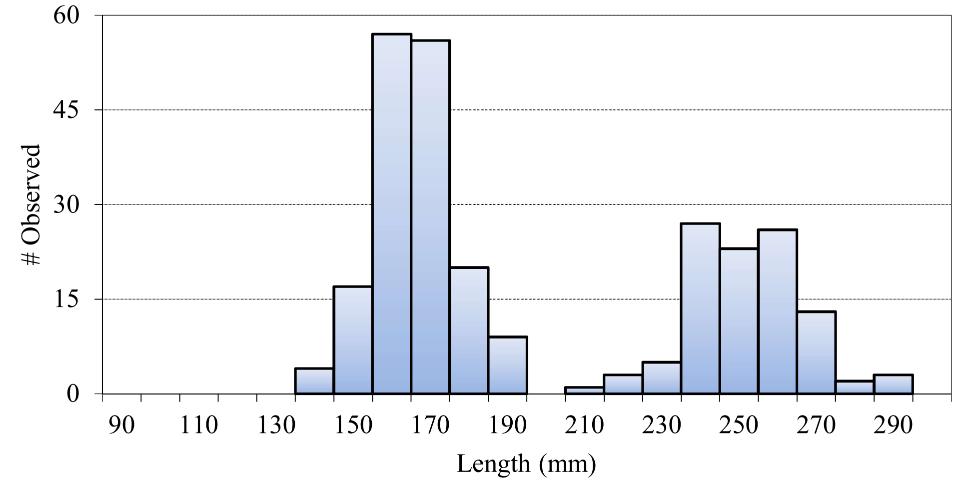

Figure 7. Length frequency distribution of walleye collected from Cadotte Lake, St. Louis County, during fall 2020 electrofishing assessments.

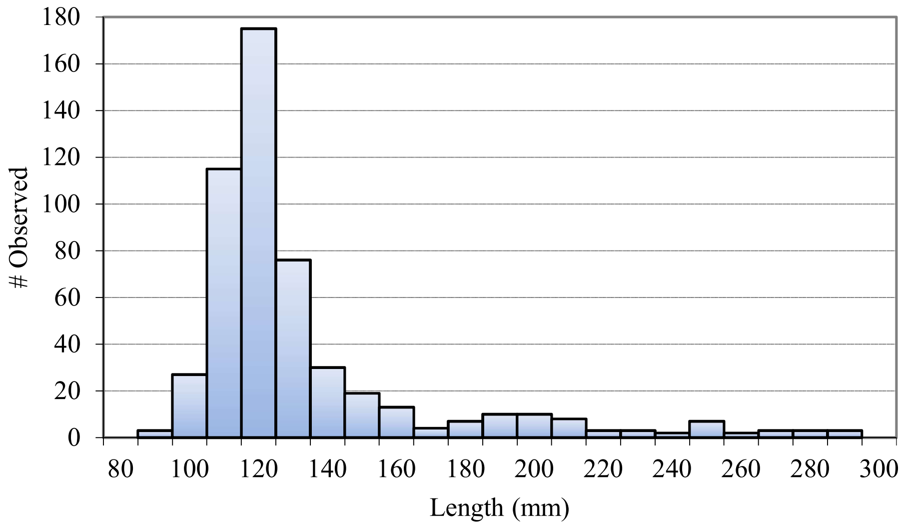

Figure 8. Length frequency distribution of walleye collected from Caribou Lake, Cook County, during fall 2020 electrofishing assessments.

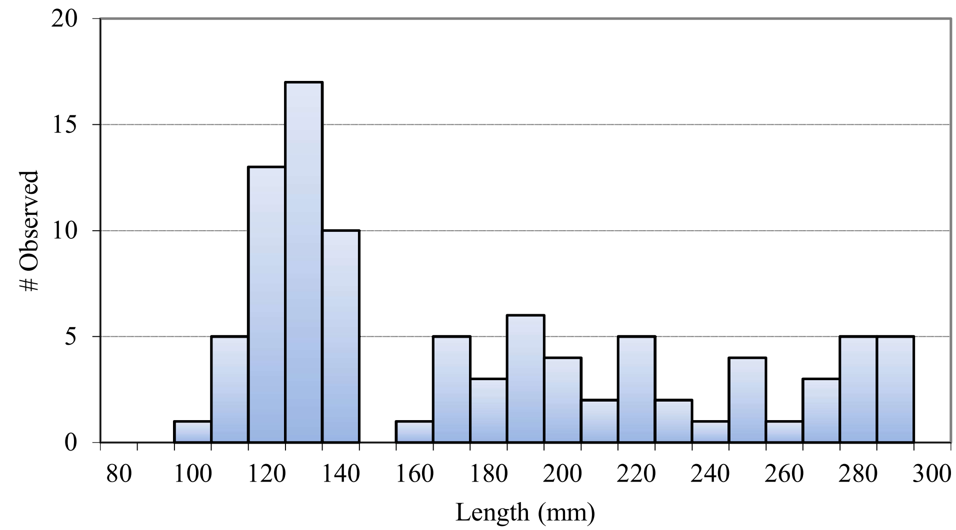

Figure 9. Length frequency distribution of walleye collected from Cascade Lake, Cook County, during fall 2020 electrofishing assessments.

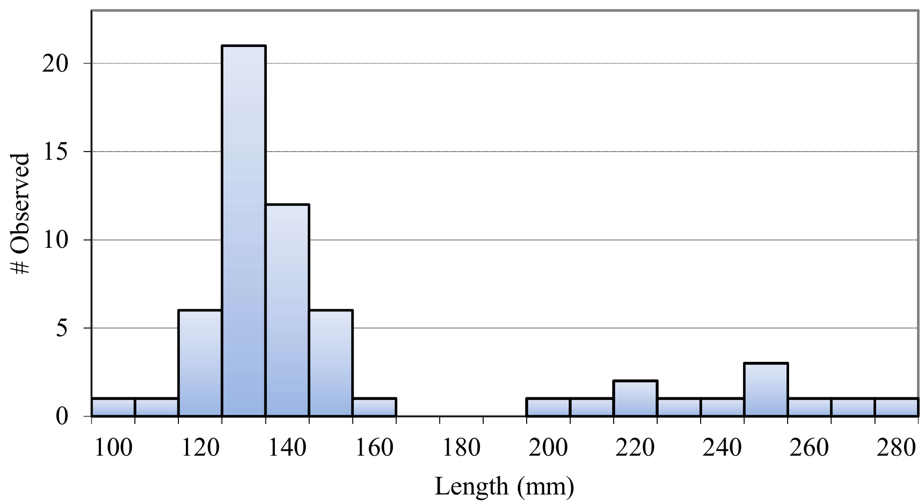

Figure 10. Length frequency distribution of walleye collected from Crescent Lake, Cook County, during fall 2020 electrofishing assessments.

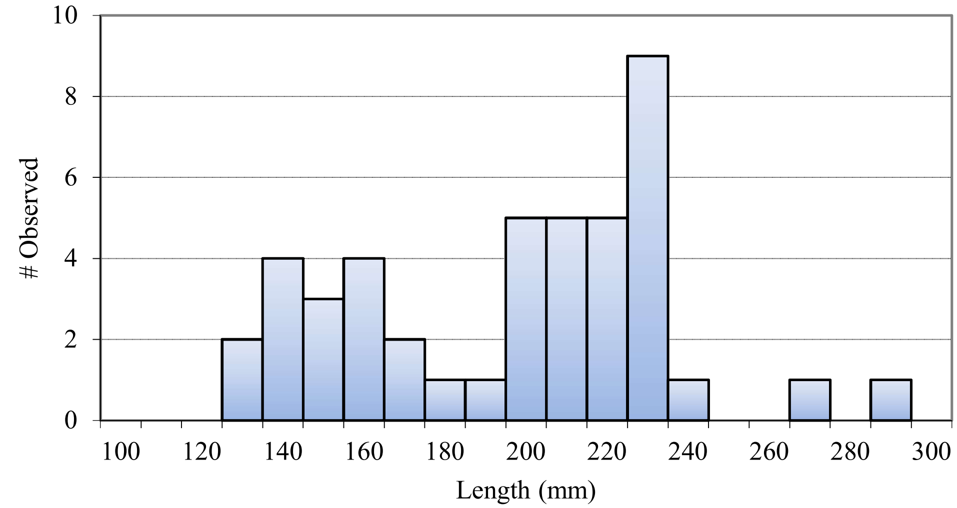

Figure 11. Length frequency distribution of walleye collected from Crooked Lake, Lake County, during fall 2020 electrofishing assessments.

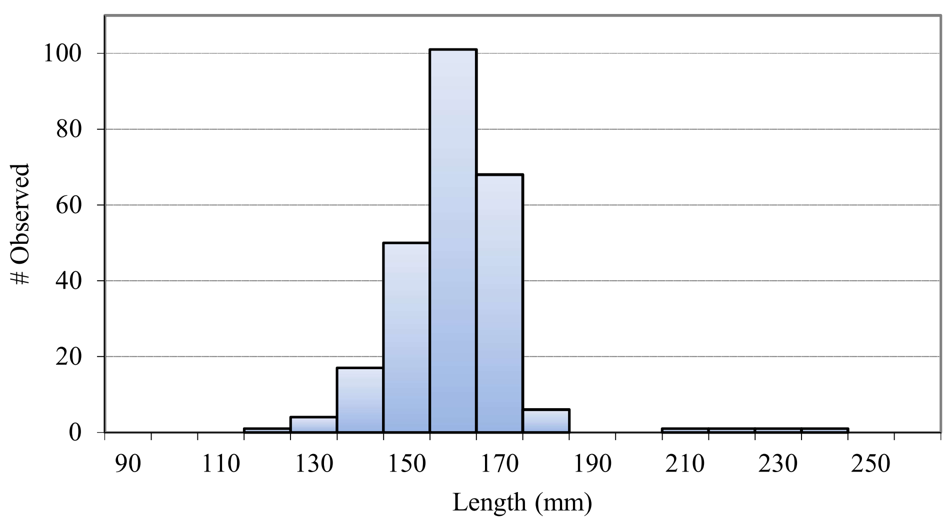

Figure 12. Length frequency distribution of walleye collected from Dumbbell Lake, Lake County, during fall 2020 electrofishing assessments.

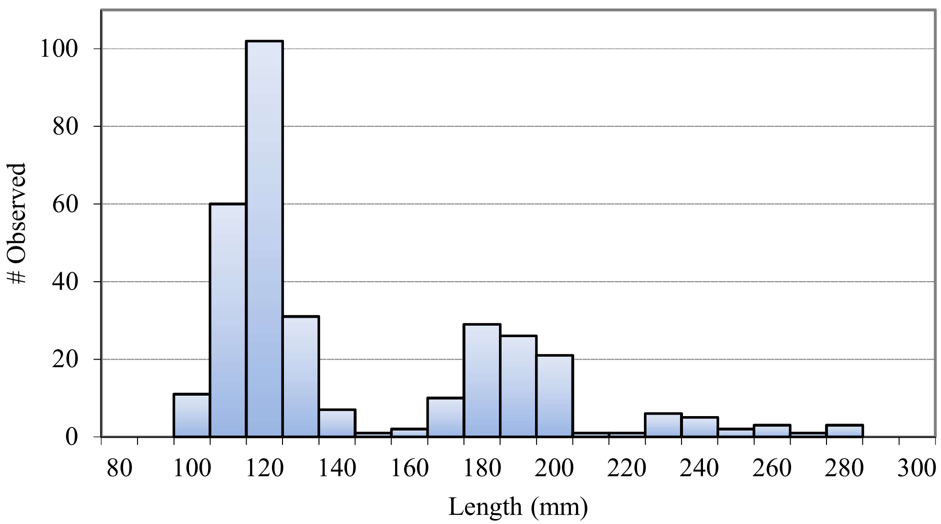

Figure 13. Length frequency distribution of walleye collected from Elbow Lake, Cook County, during fall 2020 electrofishing assessments.

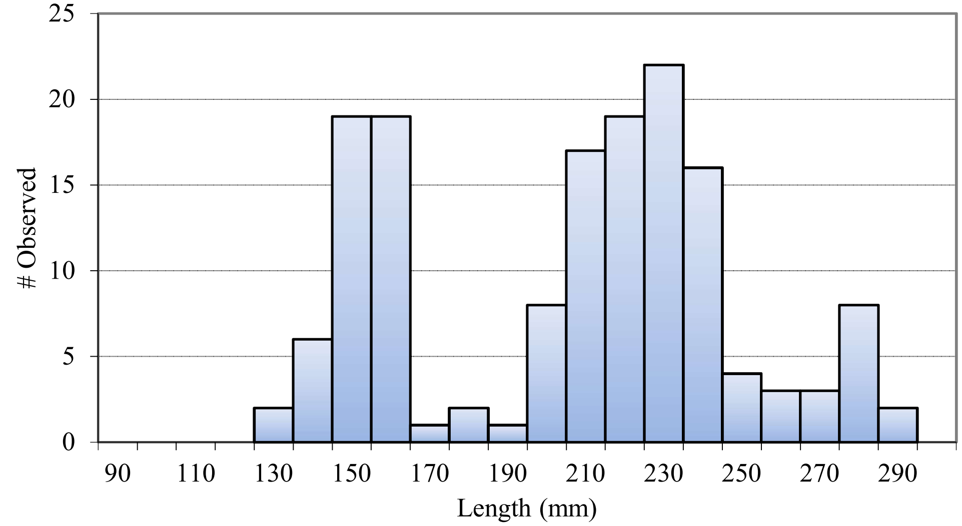

Figure 14. Length frequency distribution of walleye collected from Fourmile Lake, Cook County, during fall 2020 electrofishing assessments.

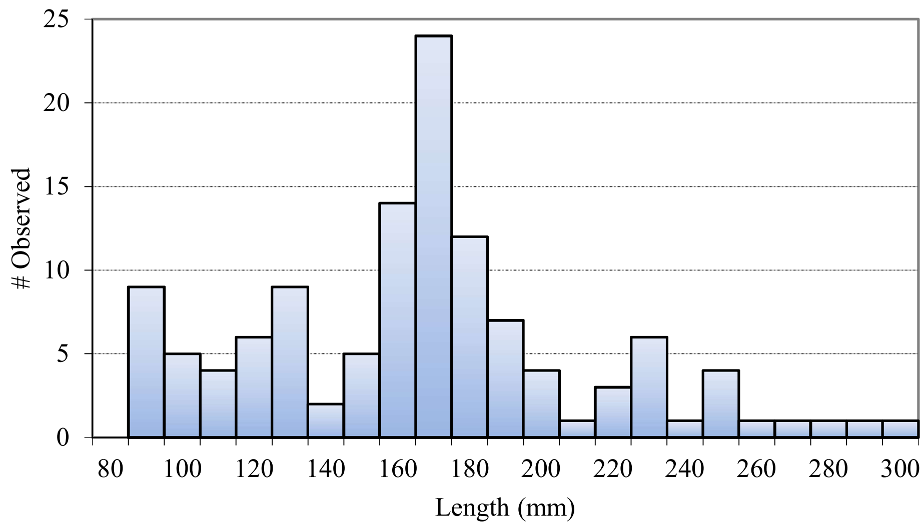

Figure 15. Length frequency distribution of walleye collected from Harriet Lake, Lake County, during fall 2020 electrofishing assessments.

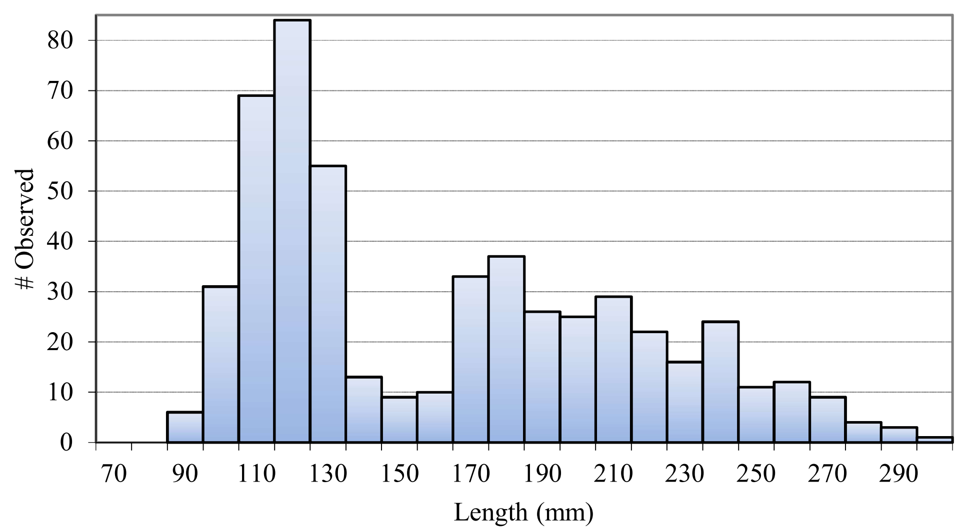

Figure 16. Length frequency distribution of walleye collected from Island Lake Reservoir, St. Louis County, during fall 2020 electrofishing assessments.

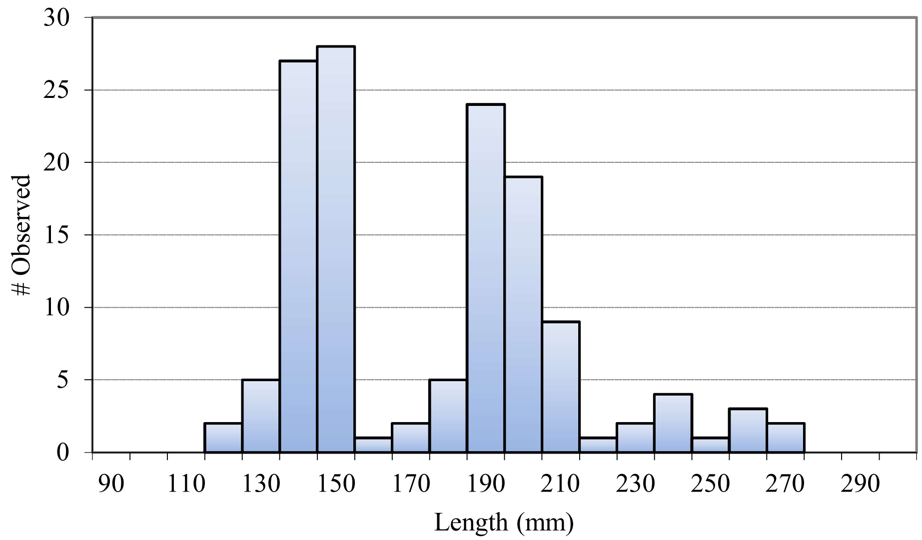

Figure 17. Length frequency distribution of walleye collected from North McDougal Lake, Lake County, during fall 2020 electrofishing assessments.

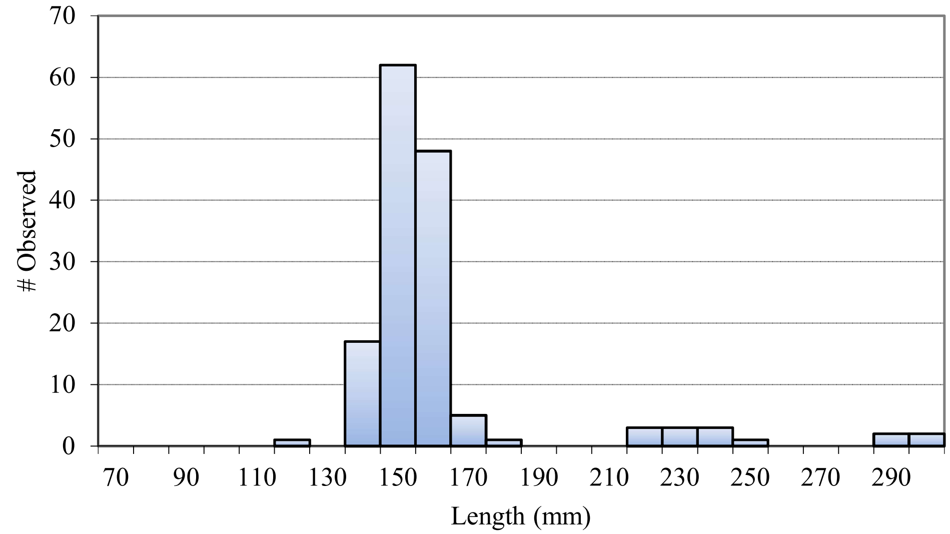

Figure 18. Length frequency distribution of walleye collected from Ninemile Lake, Lake County, during fall 2020 electrofishing assessments.

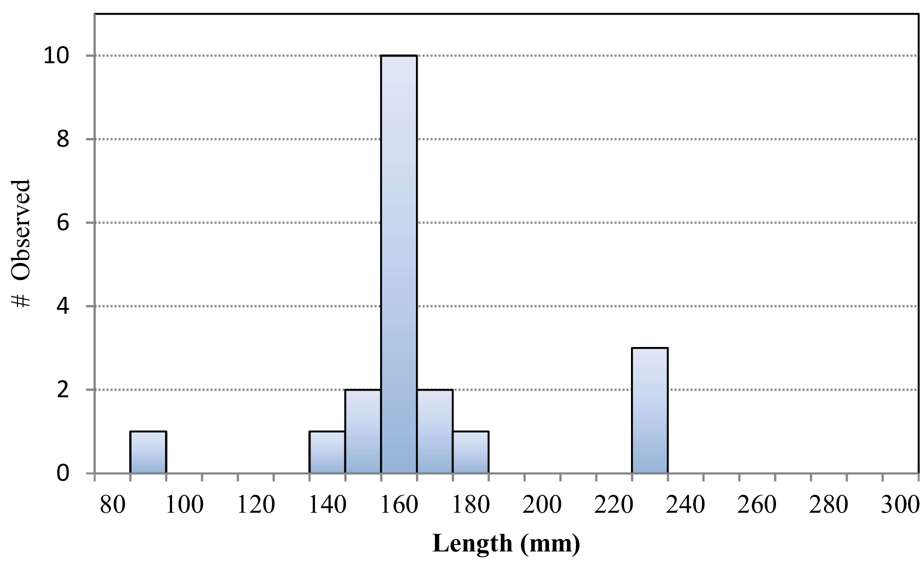

Figure 19. Length frequency distribution of walleye collected from Pike Lake, Cook County, during fall 2020 electrofishing assessments.

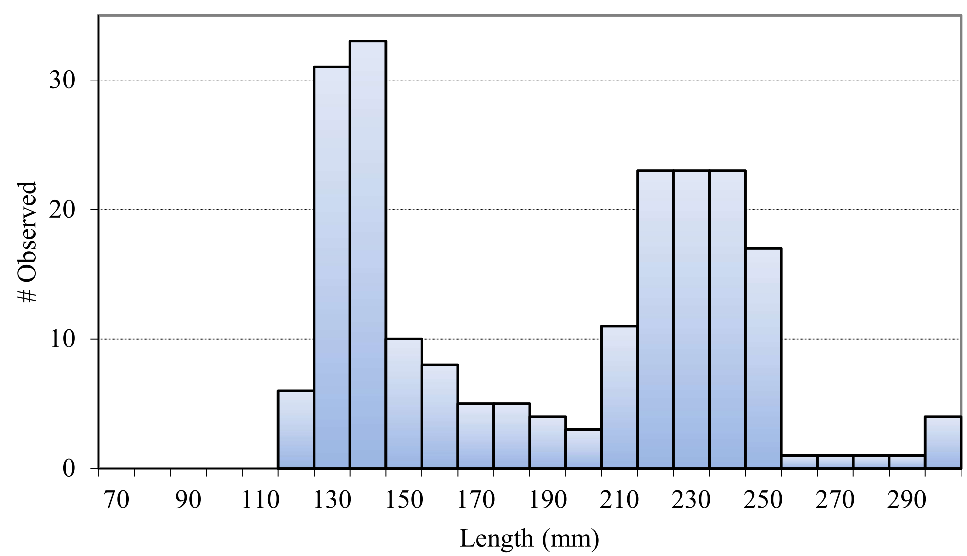

Figure 20. Length frequency distribution of walleye collected from Shagawa Lake, St. Louis County, during fall 2020 electrofishing assessments.

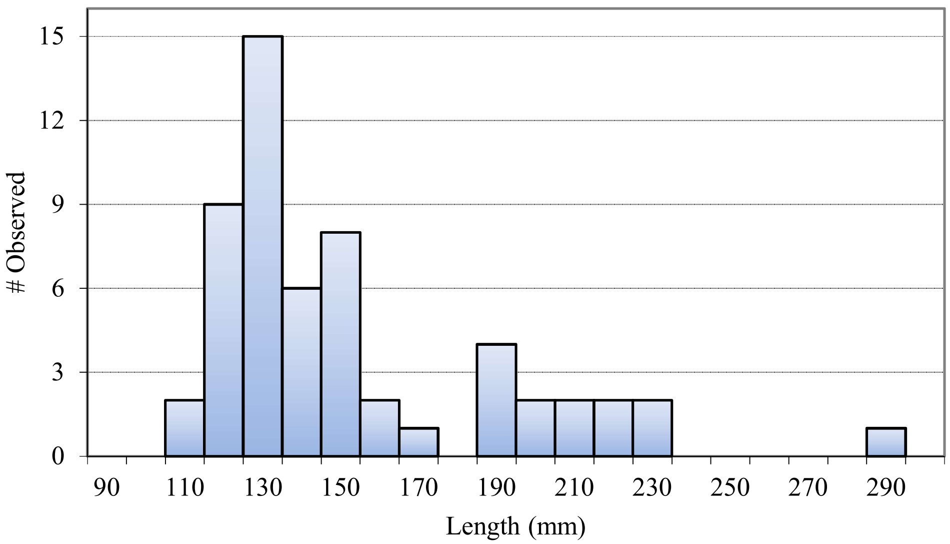

Figure 21. Length frequency distribution of walleye collected from Silver Island Lake, Lake County, during fall 2020 electrofishing assessments.

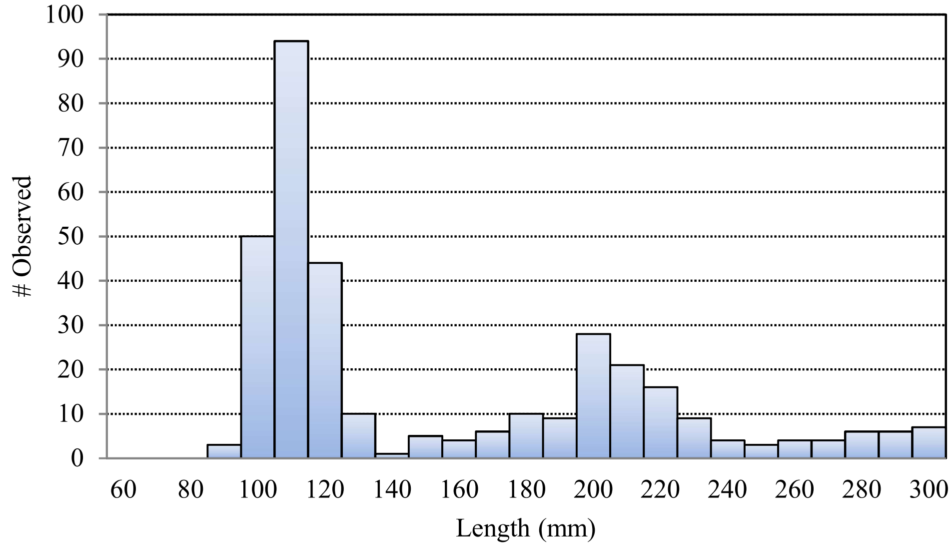

Figure 22. Length frequency distribution of walleye collected from Tait Lake, Cook County, during fall 2020 electrofishing assessments.

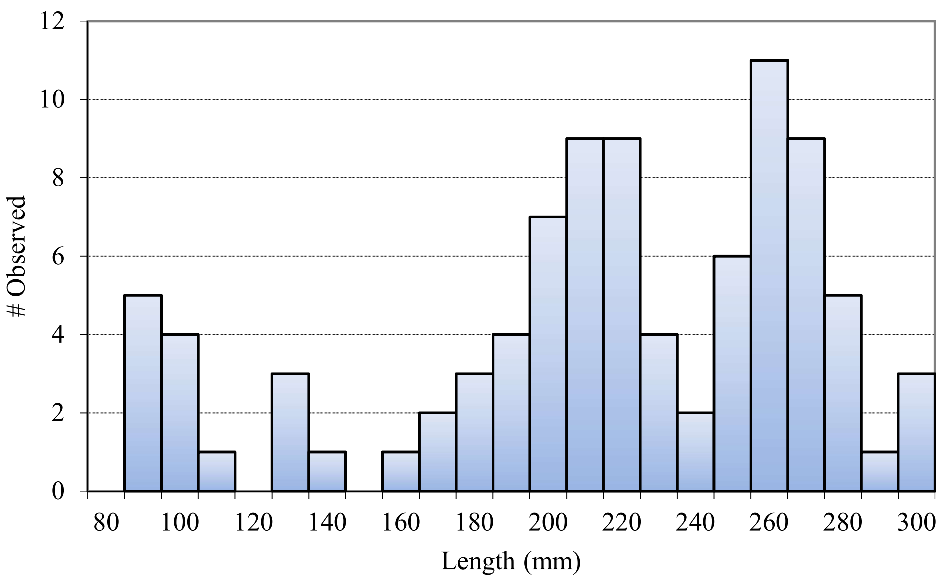

Figure 23. Length frequency distribution of walleye collected from Tom Lake Cook County, during fall 2020 electrofishing assessments.

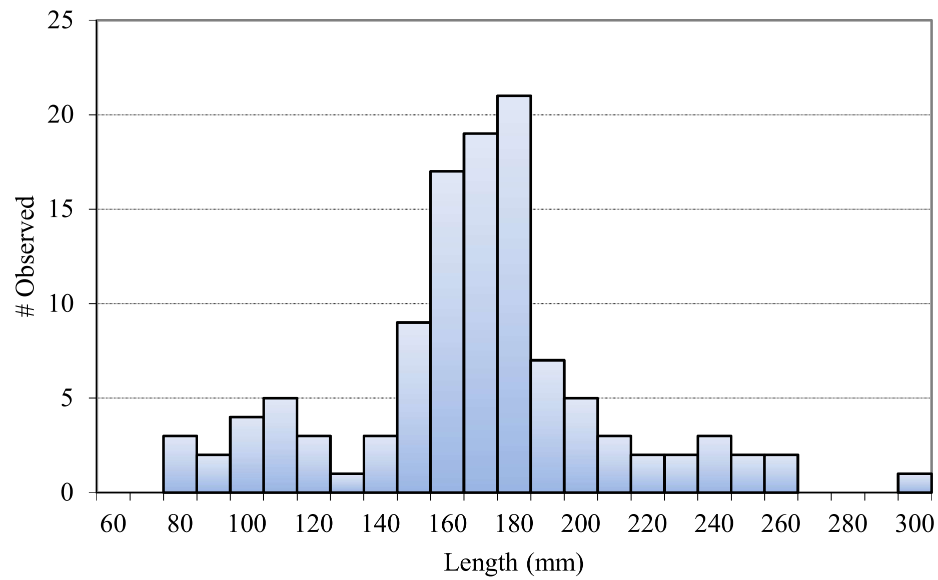

Figure 24. Length frequency distribution of walleye collected from Two Island Lake, Cook County, during fall 2020 electrofishing assessments.

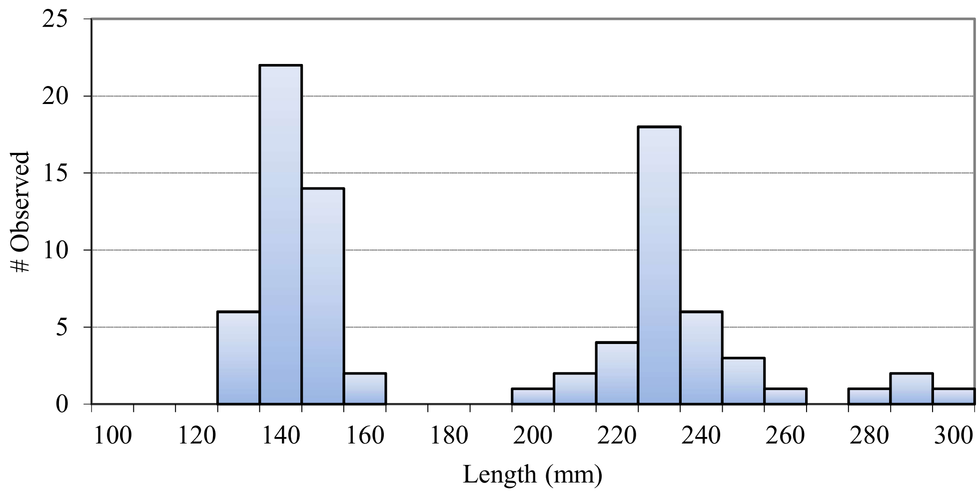

Figure 25. Length frequency distribution of walleye collected from West Twin Lake, Cook County, during fall 2020 electrofishing assessments.

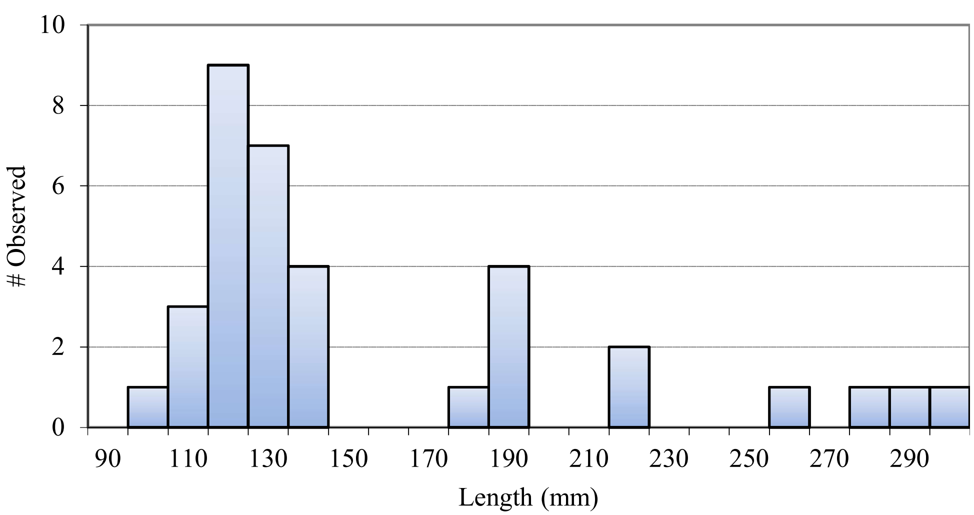

Figure 26. Length frequency distribution of walleye collected from Wilson Lake, Lake County, during fall 2020 electrofishing assessments.

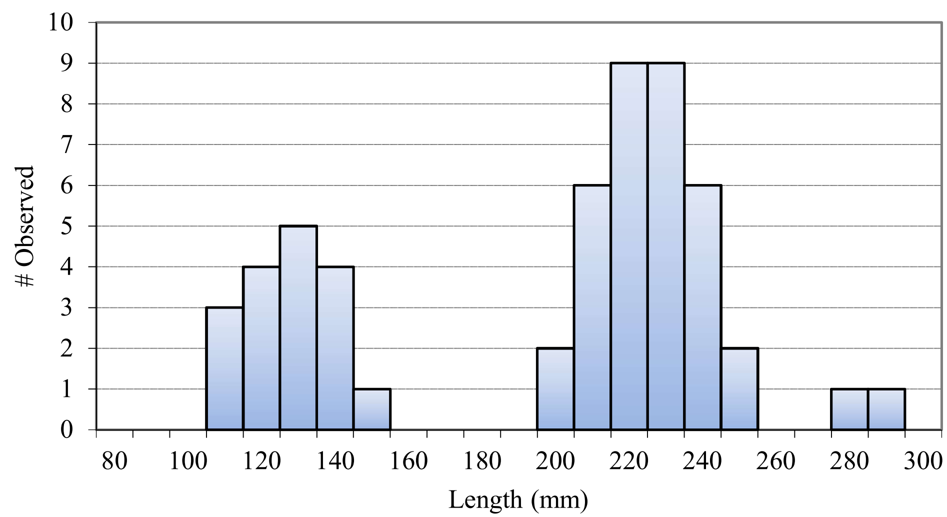

Figure 27. Length frequency distribution of walleye collected from Windy Lake, Lake County, during fall 2020 electrofishing assessments.

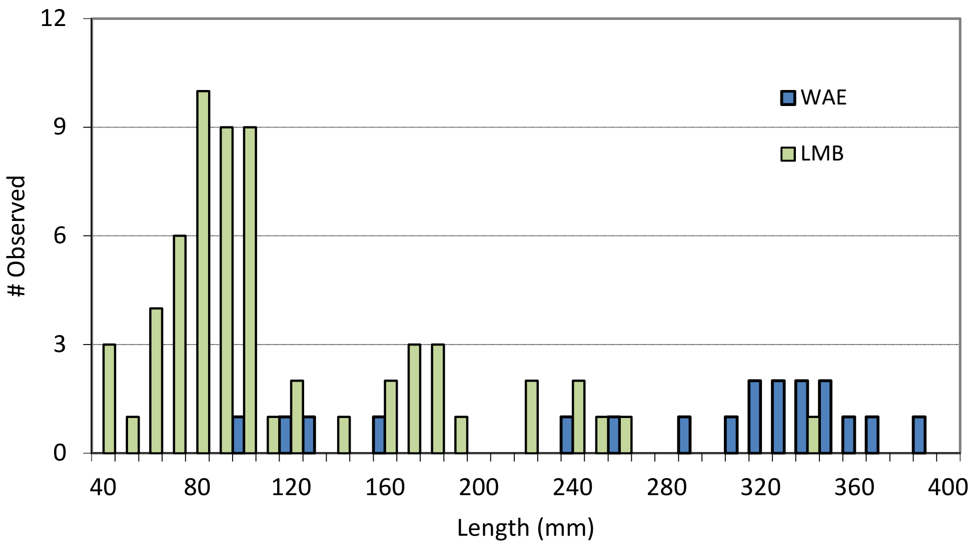

Figure 28. Length frequency distribution of walleye & largemouth bass collected from Wild Rice Lake Reservoir, St. Louis County, during fall 2020 electrofishing assessments. Blue bars represent the walleye sampled while the green bars represent largemouth bass sampled.

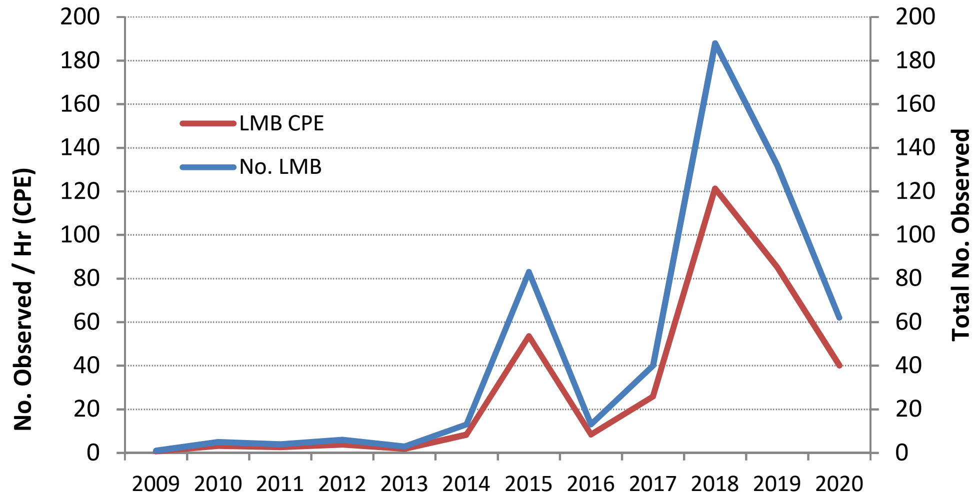

Figure 53. Largemouth bass collected (Total and CPE) from Wild Rice Lake Reservoir, St. Louis County, during fall electrofishing assessments since they were first observed in 2009.

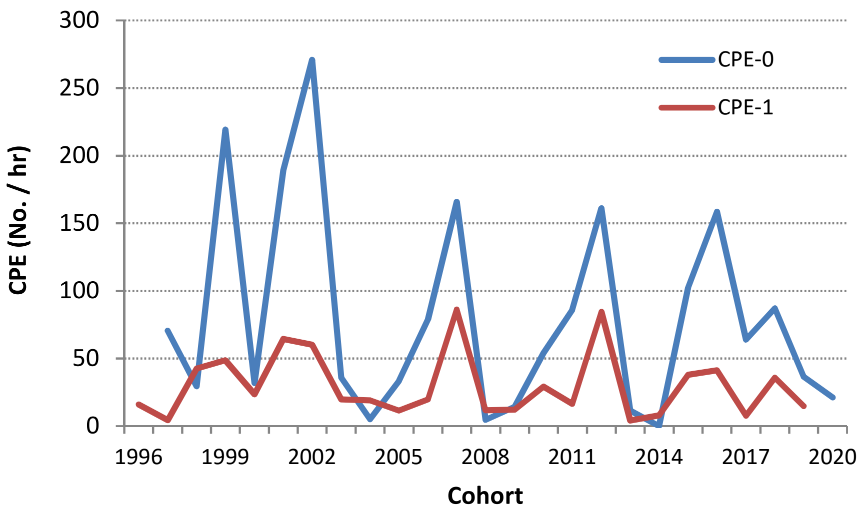

Figure 29. Walleye age-0 and age-1 electrofishing CPE, Ball Club Lake, Cook County, 1997-2020.

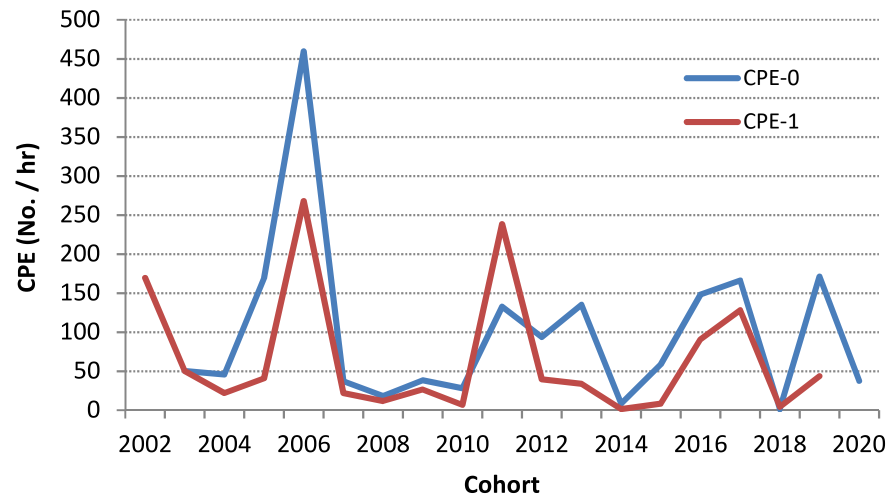

Figure 30. Walleye age-0 and age-1 electrofishing CPE, Cadotte Lake, St. Louis County, 2003-2020.

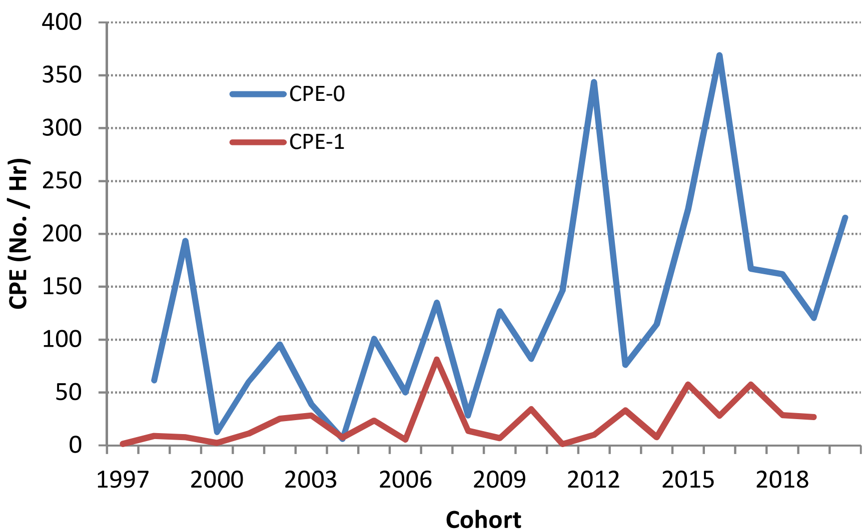

Figure 31. Walleye age-0 and age-1 electrofishing CPE, Caribou Lake, Cook County, 1998-2020.

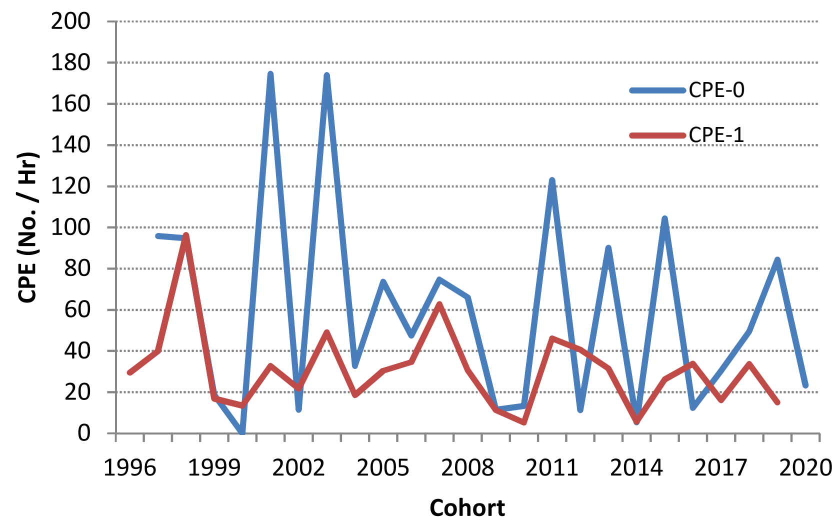

Figure 32. Walleye age-0 and age-1 electrofishing CPE, Cascade Lake, Cook County, 1997-2020.

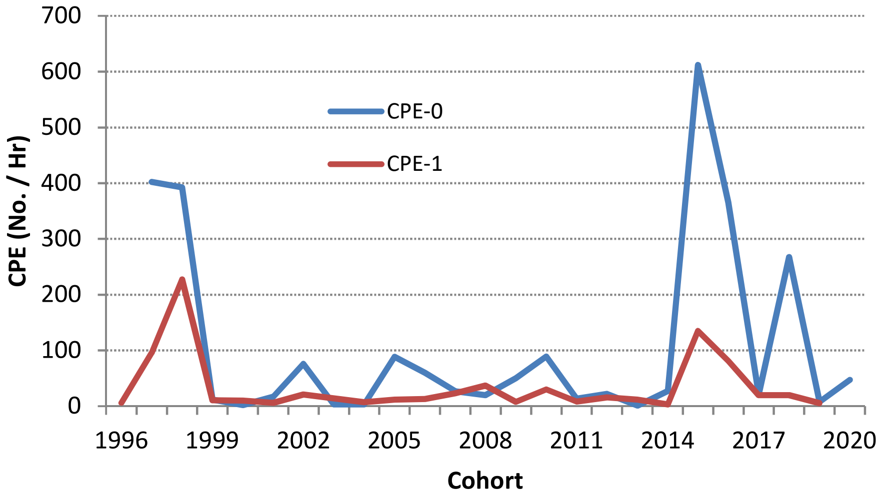

Figure 33. Walleye age-0 and age-1 electrofishing CPE, Crescent Lake, Cook County, 1997-2020.

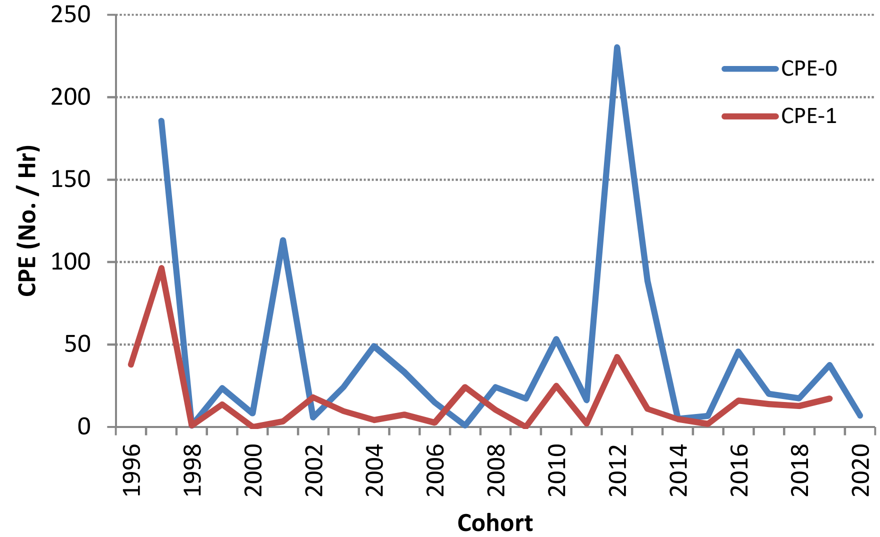

Figure 34. Walleye age-0 and age-1 electrofishing CPE, Crooked Lake, Lake County, 1997-2020.

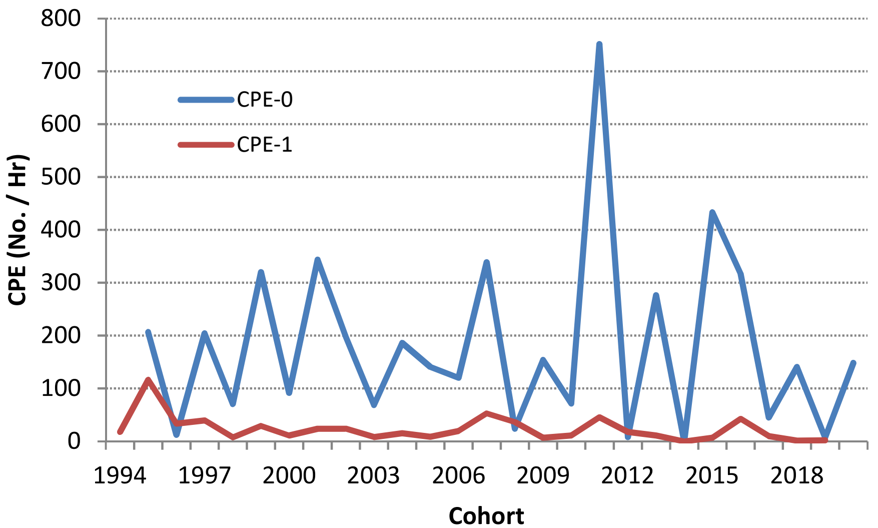

Figure 35. Walleye age-0 and age-1 electrofishing CPE, Dumbbell Lake, Lake County, 1995-2020.

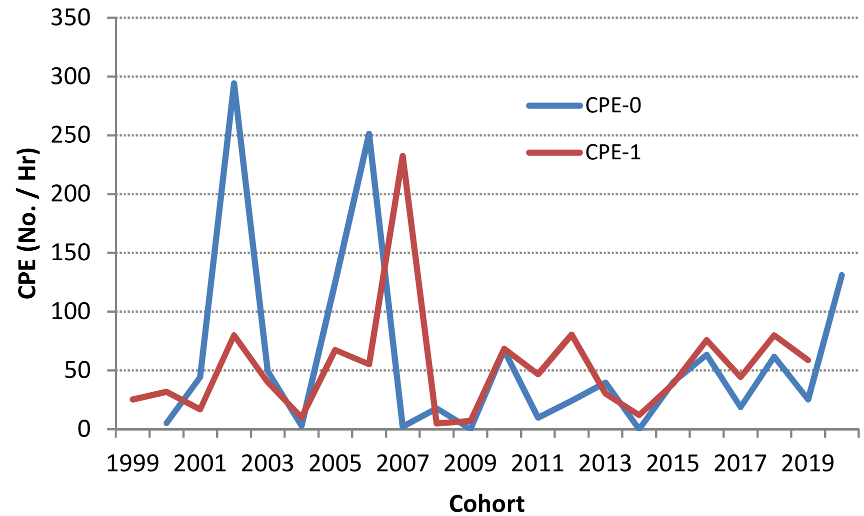

Figure 36. Walleye age-0 and age-1 electrofishing CPE, Elbow Lake, Cook County, 2000-2020.

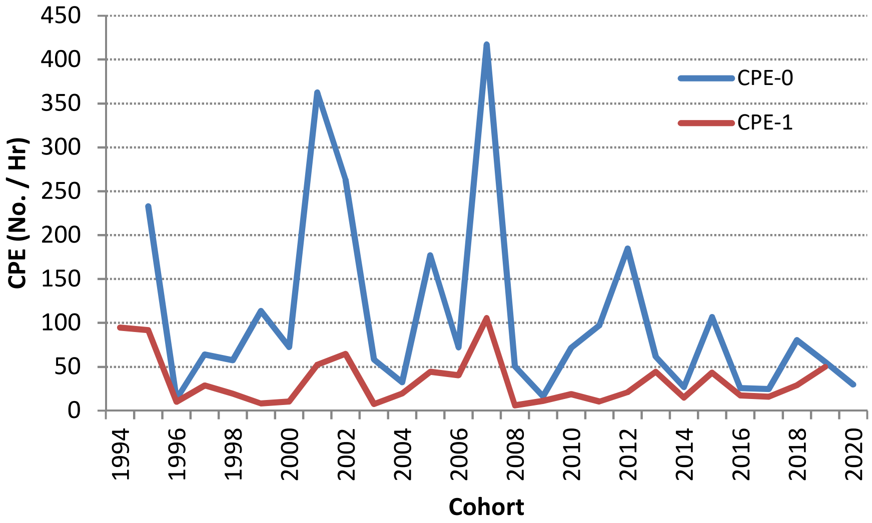

Figure 37. Walleye age-0 and age-1 electrofishing CPE, Four Mile Lake, Lake County, 1995-2020.

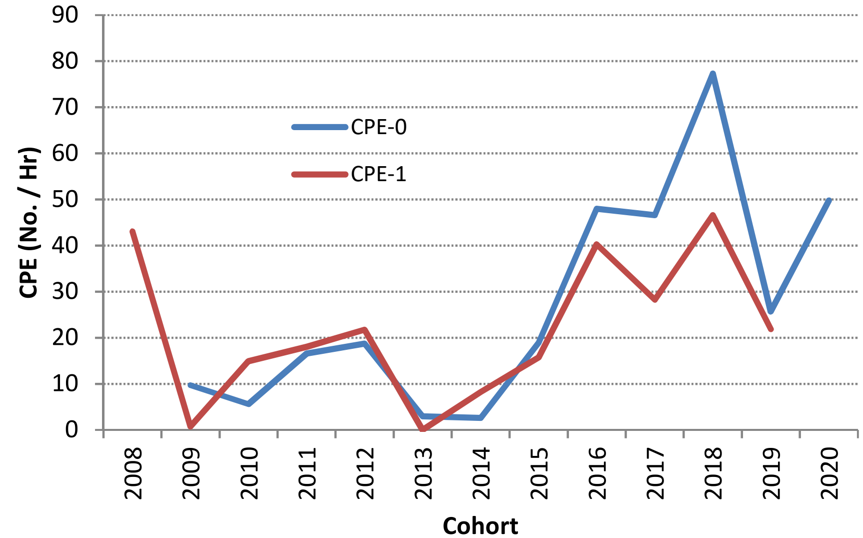

Figure 38. Walleye age-0 and age-1 electrofishing CPE, Harriet Lake, Lake County, 2009-2020.

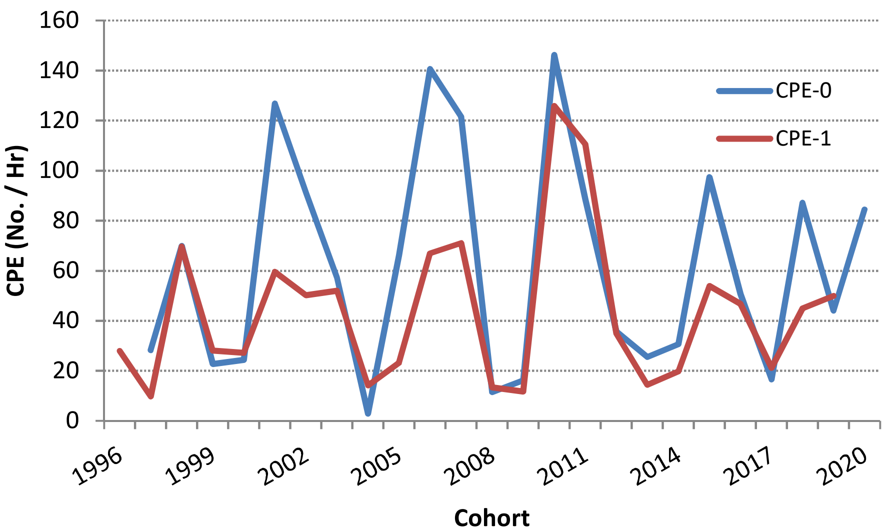

Figure 39. Walleye age-0 and age-1 electrofishing CPE, Island Lake, St. Louis County, 1997-2020.

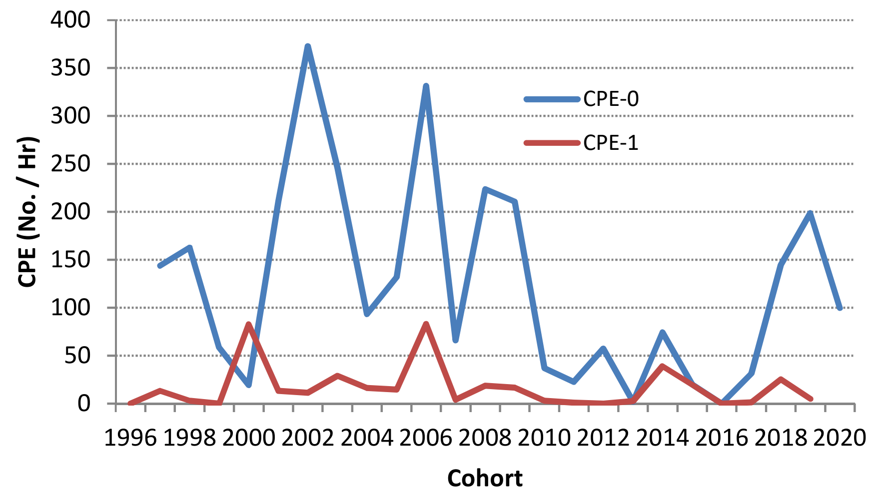

Figure 40. Walleye age-0 and age-1 electrofishing CPE, Ninemile Lake, Lake County, 1997-2020.

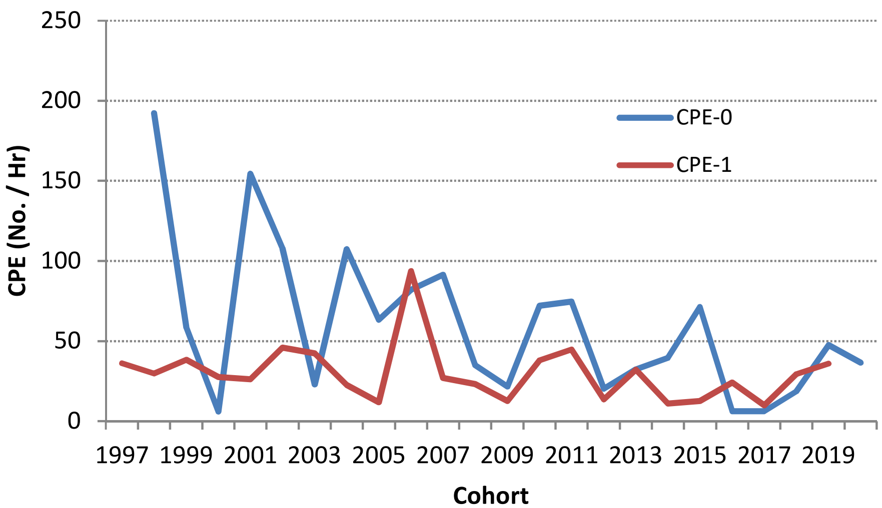

Figure 41. Walleye age-0 and age-1 electrofishing CPE, North McDougal Lake, Lake County, 1998-2020.

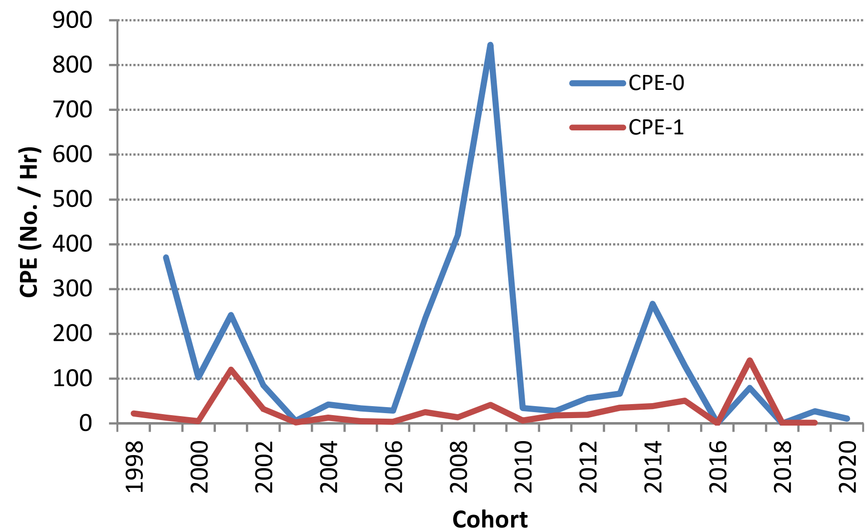

Figure 42. Walleye age-0 and age-1 electrofishing CPE, Pike Lake, Cook County, 1999-2020.

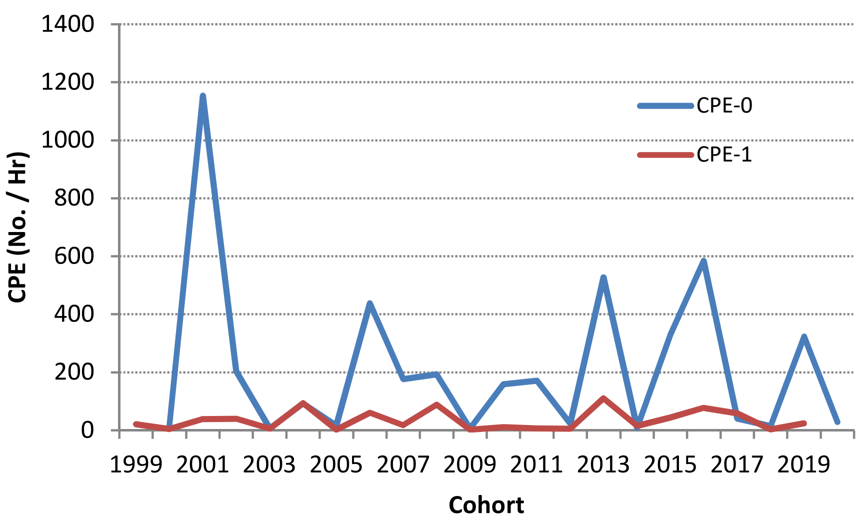

Figure 43. Walleye age-0 and age-1 electrofishing CPE, Shagawa Lake, St. Louis County, 2000-2020.

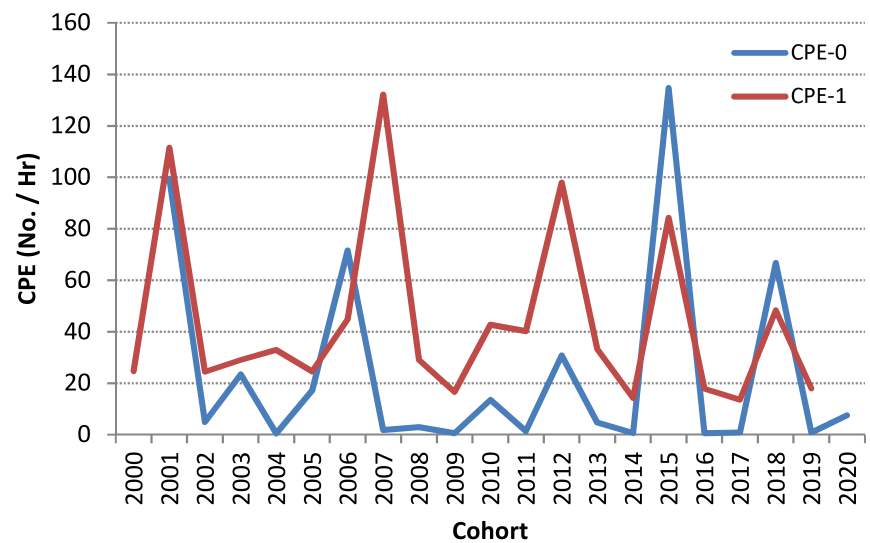

Figure 44. Walleye age-0 and age-1 electrofishing CPE, Silver Island Lake, Lake County, 2003-2020.

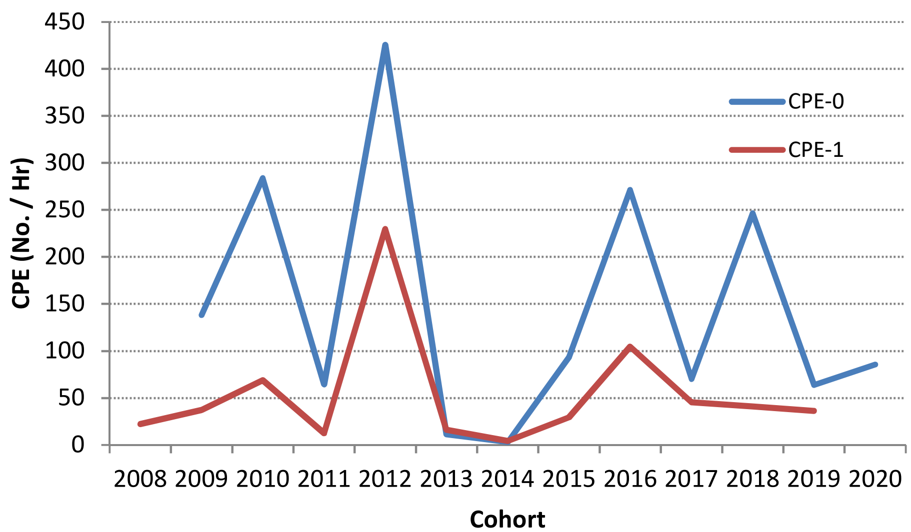

Figure 45. Walleye age-0 and age-1 electrofishing CPE, Tait Lake, Cook County, 2009-2020.

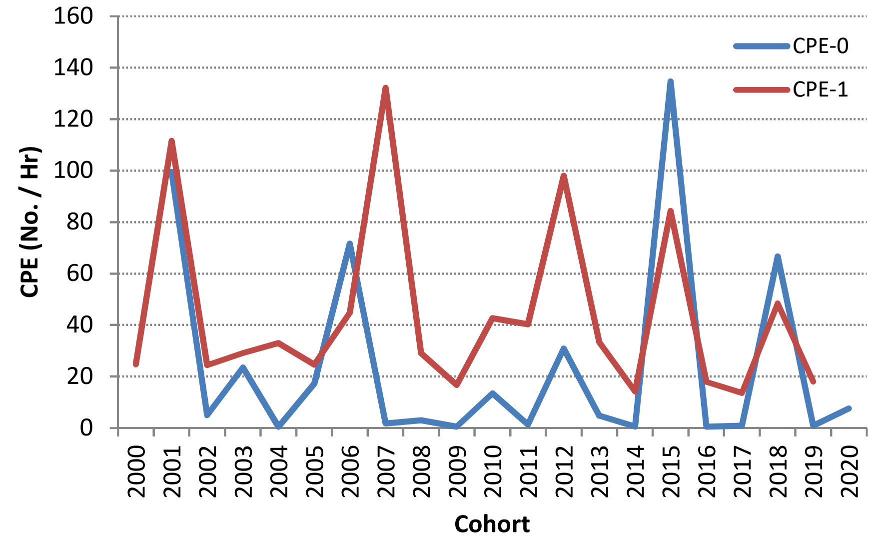

Figure 46. Walleye age-0 and age-1 electrofishing CPE, Tom Lake, Cook County, 2001-2020.

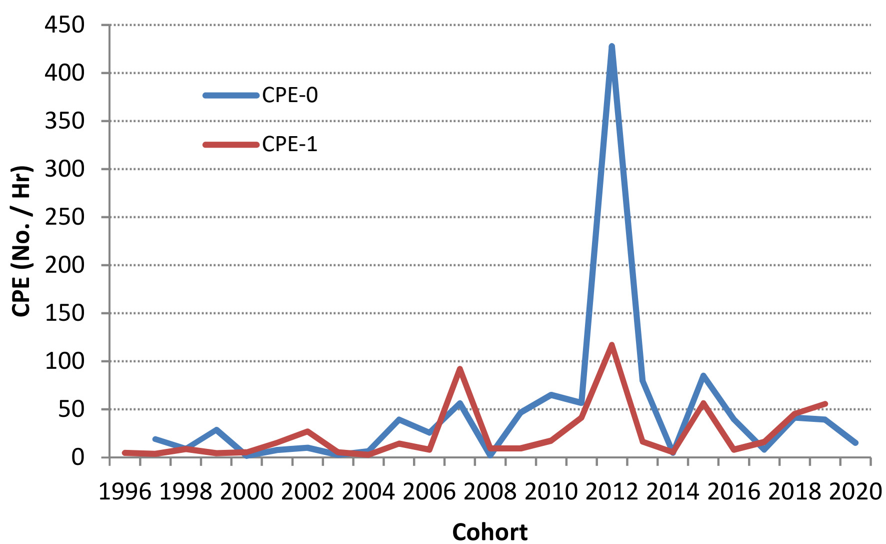

Figure 47. Walleye age-0 and age-1 electrofishing CPE, Two Island Lake, Cook County, 1997-2020.

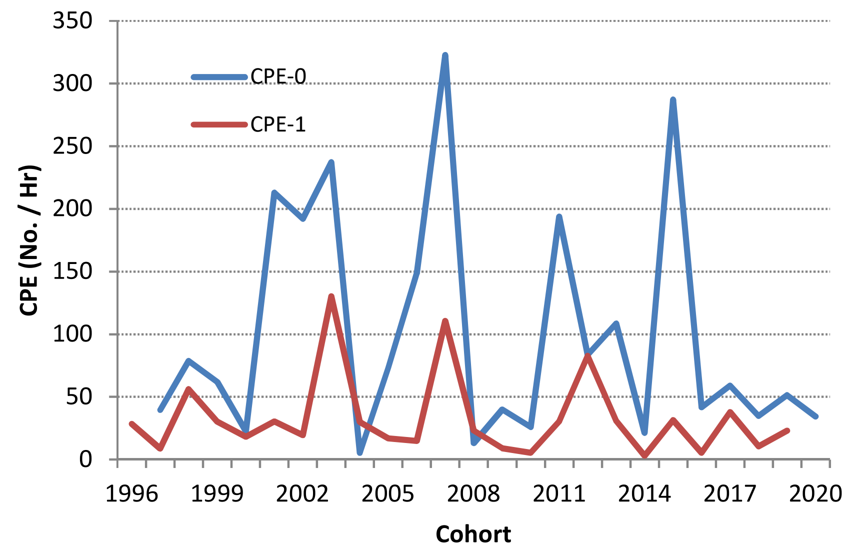

Figure 48. Walleye age-0 and age-1 electrofishing CPE, West Twin Lake, Cook County, 1997-2020.

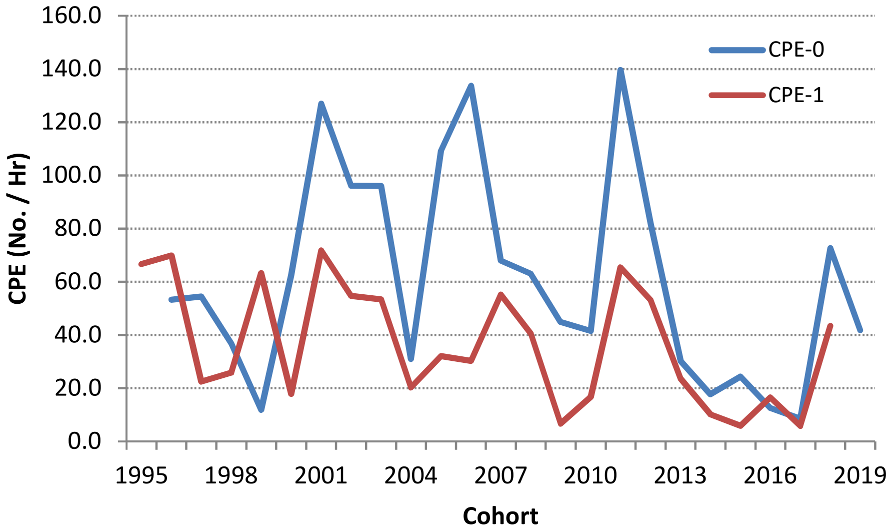

Figure 49. Walleye age-0 and age-1 electrofishing CPE, Whiteface Reservoir, St. Louis County, 1996-2019. Note that 2020 data is not presented here.

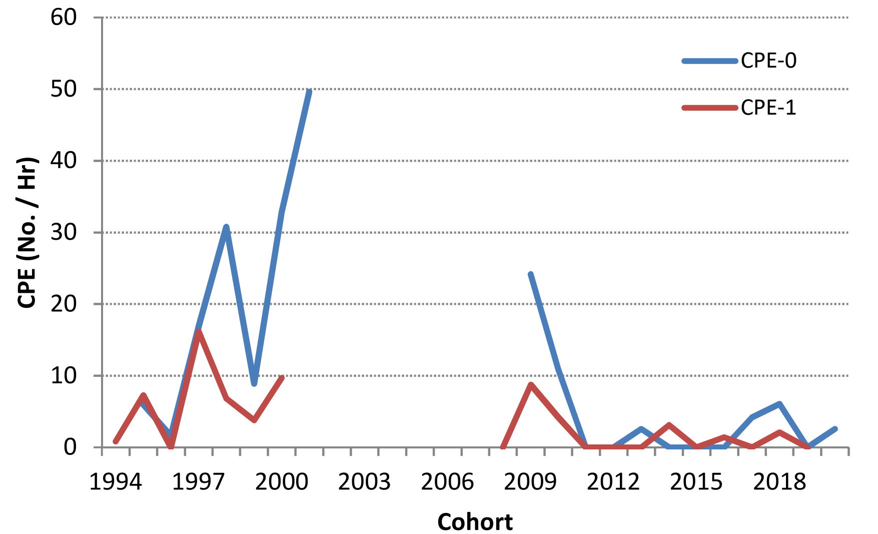

Figure 50. Walleye age-0 and age-1 electrofishing CPE, Wild Rice Lake, St. Louis County, 1995-2020.

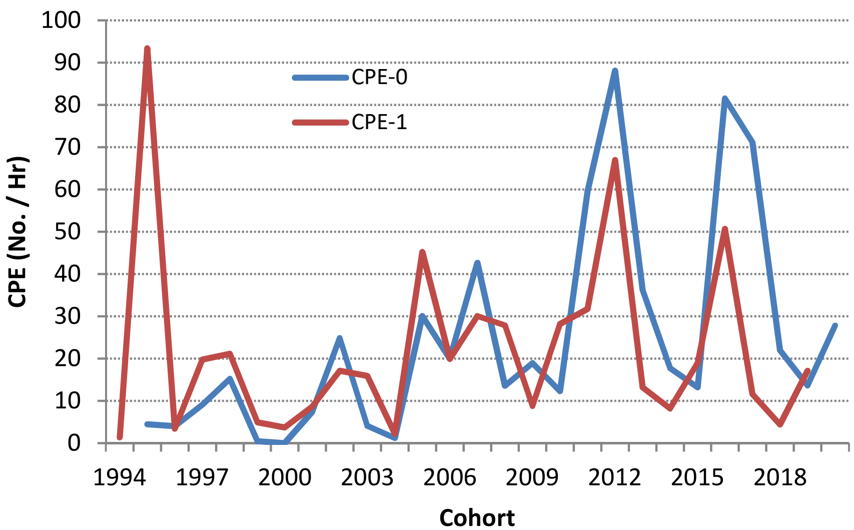

Figure 51. Walleye age-0 and age-1 electrofishing CPE, Wilson Lake, Lake County, 1995-2020.

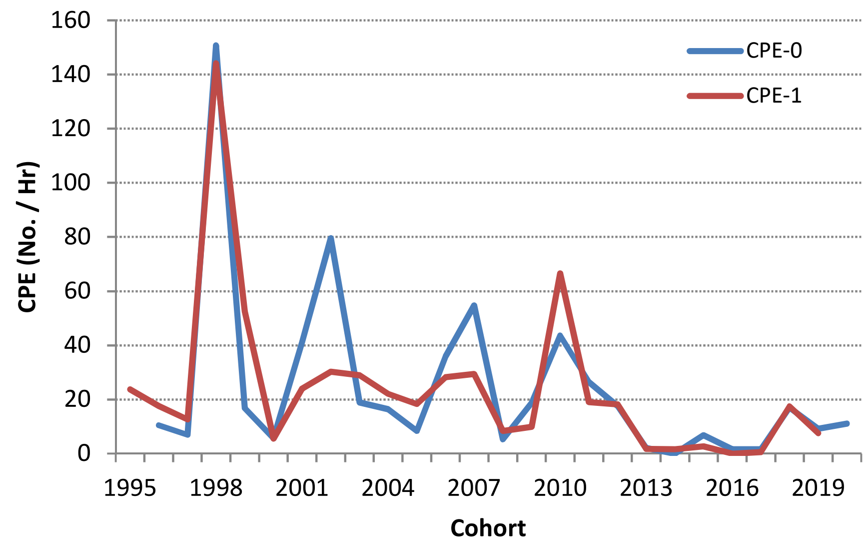

Figure 52. Walleye age-0 and age-1 electrofishing CPE, Windy Lake, Lake County, 1996-2020.

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Appendix 1. Nightly Mark / Recapture Data for walleye > 254 mm sampled during spring 2020 assessments in the 1854 Ceded Territory, and for walleye > 274mm observed in MN DNR summer gill net assessments.

Lake	Date	Marked in Population	Daily Catch	Daily Recap
Cadotte	29 April	---	126	0
	30 April	126	141	12
	1 May	255	284	48
	2 May	491	136	106
	MN DNR GN	521	67	5
	MN DNR GN / TN	521	83	6