Spring Adult and Fall Juvenile Walleye Population Surveys within the 1854 Ceded Territory of Minnesota, 2013

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

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Introduction

Under the Treaty of 30 September 1854, the Fond du Lac, Grand Portage, and Bois Forte Bands of Lake Superior 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 assessments in the Ceded Territory. Walleye have always been a traditional subsistence resource for Fond du Lac and the Lake Superior Chippewa Bands. A 1994 survey conducted by Fond du Lac indicated that walleye were the primary game fish sought by Fond du Lac band members in the 1854 Ceded Territory (Borkholder 1994b).

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 (Ngu and Kmiecik 1993; Goyke et al. 1993 and 1994) and within Northeastern Minnesota for many years (Borkholder 1994a and 1995). In order to maximize the number of fish handled and marked during the 2013 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 following spawning and have an extended 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. Population estimates based solely upon spring electrofishing data alone will be conservative estimates, lower than the true population size. 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. Given time and personnel constraints, we have chosen to accept conservative population estimates as a trade-off to the extra effort required to trap net for additional females.

The first objective of our assessments in 2013 was to obtain adult walleye population estimates (PE) during the spring spawning period using mark - recapture data. Our electrofishing PEs may be biased towards males in the populations, and thus, are presumed conservative estimates of population abundance. However, by cooperating with the MN DNR area offices, a second PE is obtained using the State's summer gill net data, with which to compare to the spring-only 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 2013 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 during meetings between MNDNR Area Managers and Tribal biologists. The objective was to obtain adult walleye (*Sander vitreus*) population estimates using mark-recapture methods and determine the age structure and growth rates of the walleye population. Fin clipped and colored floy-tagged walleye would then be available during the summer gill net assessments conducted by the MNDNR, thus providing a second population estimate.

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 prior to the beginning of each night's assessment activity. Ambient water conductivity measurements were taken using either a Hanna HI8733 conductivity or a Fisher Scientific Digital Conductivity Meter.

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 (male, female, unknown) 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 (> 254 mm) were marked using non-numbered colored floy tags (yellow for 2013) (Super Swiftachment Fasteners available from the Dennison Fastener Division, Framingham, Massachusetts). The reason for this was because of many years of clipping dorsal fin rays would make it impossible to differentiate 2013 marked fish from previously clipped individuals. A dorsal fin spine from five individuals per centimeter group and per sex was removed and placed in a labeled envelope for later aging in the lab. 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.

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 (Borkholder 1996, 1997, and 1998; Borkholder and Edwards 1999, 2000, 2002, 2003, 2004, 2010, & 2011). Sampling stations were repeated from previous years' surveys.

Walleyes were aged by counting annuli on scales viewed under a microfiche reader (Borkholder 1996 and 1997). 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

Tait Lake

Ice-out during spring 2013 was one of the latest ever on record for Minnesota. According to the MN Climatological website (http://climate.umn.edu/doc/journal/ice_out_recap_2013.htm), many lakes within the State set new records for ice-out. Electrofishing activities were conducted on Tait Lake on 19 – 22 May (Figure 1). By the time ice cleared out enough to begin sampling efforts, many of the fish had finished spawning activities. We observed more immature (< 254 mm) individuals than we normally do during ice out surveys, and most observed males were almost spent of milt. 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 66.6 (EF1, 22 May) to 208.2 (EF5, 22 May) adult walleye per hour of sampling (Table 1, Figure 1). At a 95% confidence interval, mean CPUE for Tait Lake, determined using each sampling station, was 134.7 ± 34.8 adult walleye (>254mm) per hour of sampling effort.

The length frequency of the walleye sampled in Tait Lake is presented in Figure 2. Walleye as large as 517 mm (20.4 inches) were observed in the survey. Incidentally, 140 walleyes were observed to have the red floy tag applied in the 2011 survey, and an additional 26 walleye had a dorsal fin clip mark, indicating that they had been sampled during previous surveys. Additional species observed included northern pike, white sucker, and yellow perch.

Walleyes larger than 254 mm were marked with a non-numbered yellow floy tag along the distal portion of the spiny dorsal fin. Table 2 presents the population estimates based upon mark-recapture data. The electrofishing Schumacker and Eschmeyer population estimate is 2027 (Table 2). The electrofishing adjusted Petersen estimate is 2042 ± 647, with a 10.0% CV (Table 2). The population estimates presented in Table 2 represent the population abundance of walleye using the sampled areas for spawning (Figure 1), and are not estimates of the walleye population within the entire lake. During summer 2013, the Minnesota Department of Natural Resources performed a standardized net assessment on Tait Lake (MN DNR, Grand Marais Area Fisheries). Thirty-two (32) walleyes (> 275 mm) were sampled in the gill nets that would have been 254 mm during the May assessments. Twelve individuals were observed to have the yellow floy tag from the spring sampling (Appendix 1). The adjusted Petersen estimate using both the summer and spring data is 1834 ± 1048, with a 20.6% CV (Table 2). The Schumacker and Eschmeyer population estimate from this gill net data is 1912 (Table 2). These estimates compare very closely with the spring PE's calculated (Table 2). When MNDNR trap data is included with the gill net data, 68 walleyes (> 275 mm) were sampled, with 24 individuals observed with the yellow floy tag. An adjusted Petersen estimate of 2056 ± 894 adult walleye (15.7% CV) was calculated using the gill net and trap net samples. The Shumacker and Eschmeyer estimate was 2047. These estimates from our 2013 surveys may be slightly higher than those observed in 2009 and again in 2011 (Table 2) (Borkholder and Edwards 2010 & 2012).

Table 3 presents the age data for the walleye collected from Tait Lake. Of the 971 unique fish sampled, 664 were assigned to ages 2, 3, & 4. Total annual mortality (A) of the Tait Lake population was estimated at 31.4%, 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). This is similar to the estimation made during the 2011 survey of 35.3% (Borkholder and Edwards 2011). Total annual mortality (A) estimated using the MNDNR's gill net data was 30.5% (Figure 3), nearly the same as that estimated from the spring electrofishing assessment. Table 4 presents back-calculated lengths-at-age for walleye collected from Tait Lake, as determined by aging dorsal fin rays.

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 of 44.5 ± 3.3 (Table 5) indicates a balanced population (Anderson and Weithman 1978). Further, there is a large portion of the population less than 15.0 inches (64.7% of sample) that will be growing and recruiting into this “quality” 15 inch category over the next few years. The summer gill net PSD (40.5 ± 15.8) was not significantly different than the PSD estimate from the spring electrofishing survey (χ^2=0.23, P<0.05, critical Chi-square value of 3.841). No significant differences were observed in the RSDS-Q (χ^2= 0.48) or RSDQ-P (χ^2= -0.36) metrics between the electrofishing and gill net assessments during 2013 assessments (P<0.05, critical Chi-square value of - 1.64) (Table 5).

PSD metrics calculated from the 2011 electrofishing assessments are included for comparison (Table 5) (Borkholder and Edwards 2012). Significant differences were observed between the 2013 PSD and the 2011 PSD (χ^2=8.319, P<0.05, critical Chi-square value of 3.841), and between the RSD Q-P metrics of the two assessments (χ^2=-2.884, P<0.05, critical Chi-square value of -1.64). This is largely attributable to many more individuals observed in 2013 between 10.0 and 15.0 inches, than what was observed in our 2011 survey, and may have been a result of the late ice-out and the large number of immature fish observed in 2013.

The relationships between age-0 and age-1 fall electrofishing data and adult walleye gill net data are presented in Figure 5. We do not have many years of data, so caution needs to be exercised when making any interpretations about this relationship.

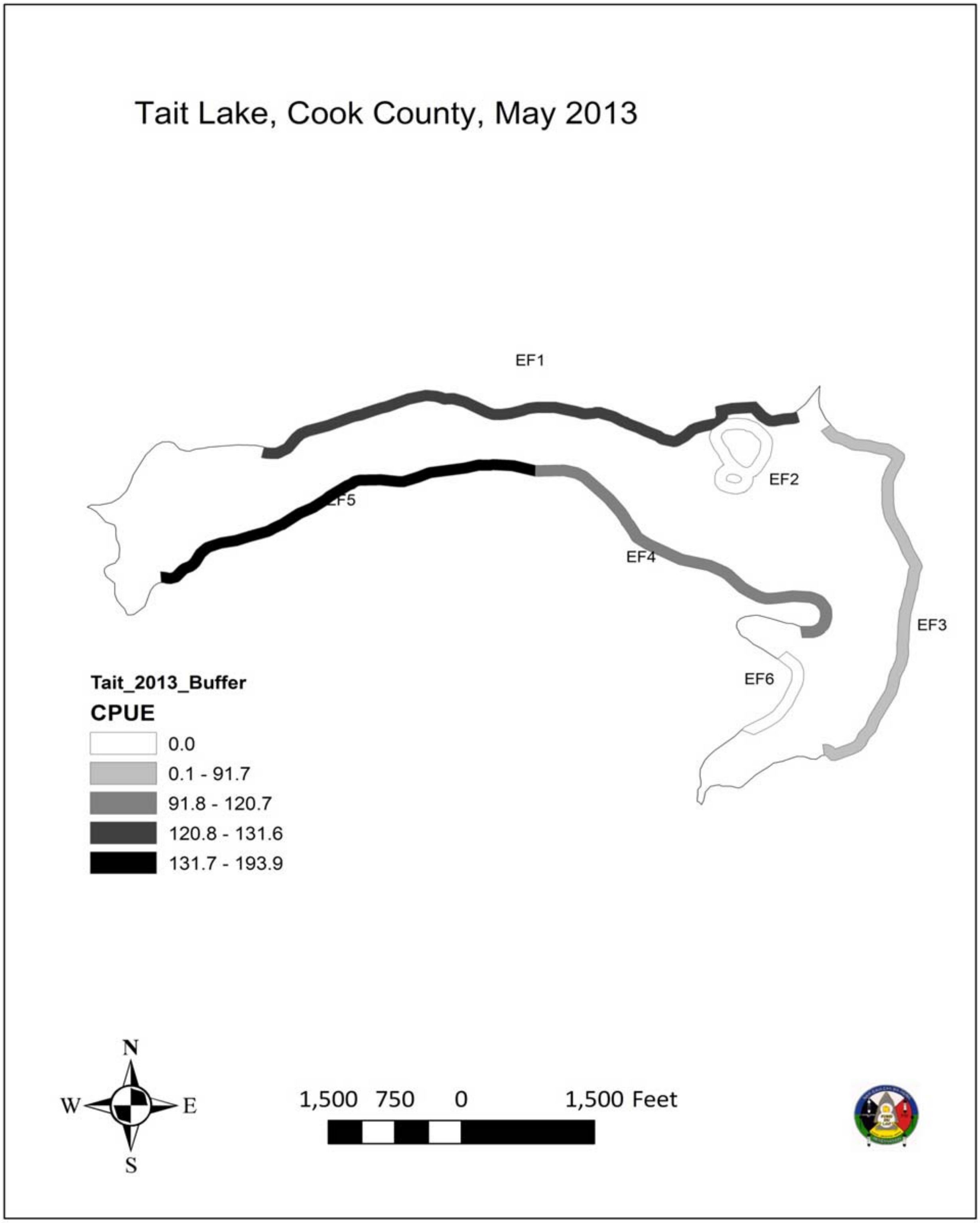

Figure 1. Catch per hour (CPE) of adult walleyes (fish larger than 254 mm) by electrofishing station, on Tait Lake, Cook County, during spring 2013 electrofishing surveys.

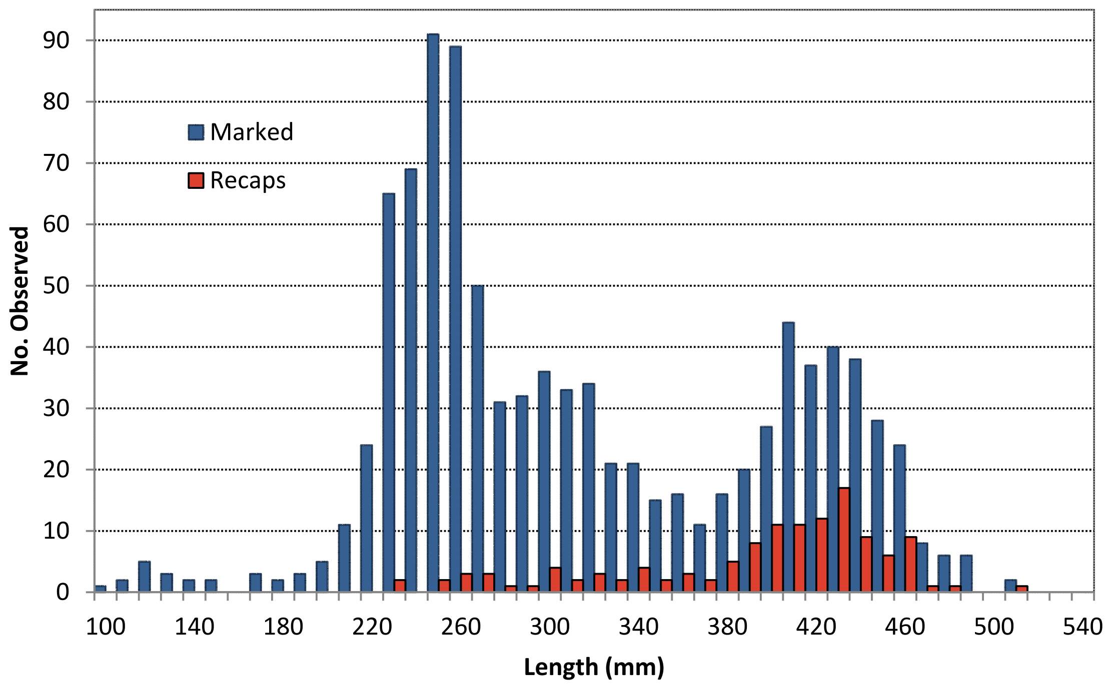

Figure 2. Length frequency distribution of walleye sampled from Tait Lake, Cook County, MN, during spring 2013 electrofishing assessments. Length frequency distribution of recaptured walleyes is shown in red bars.

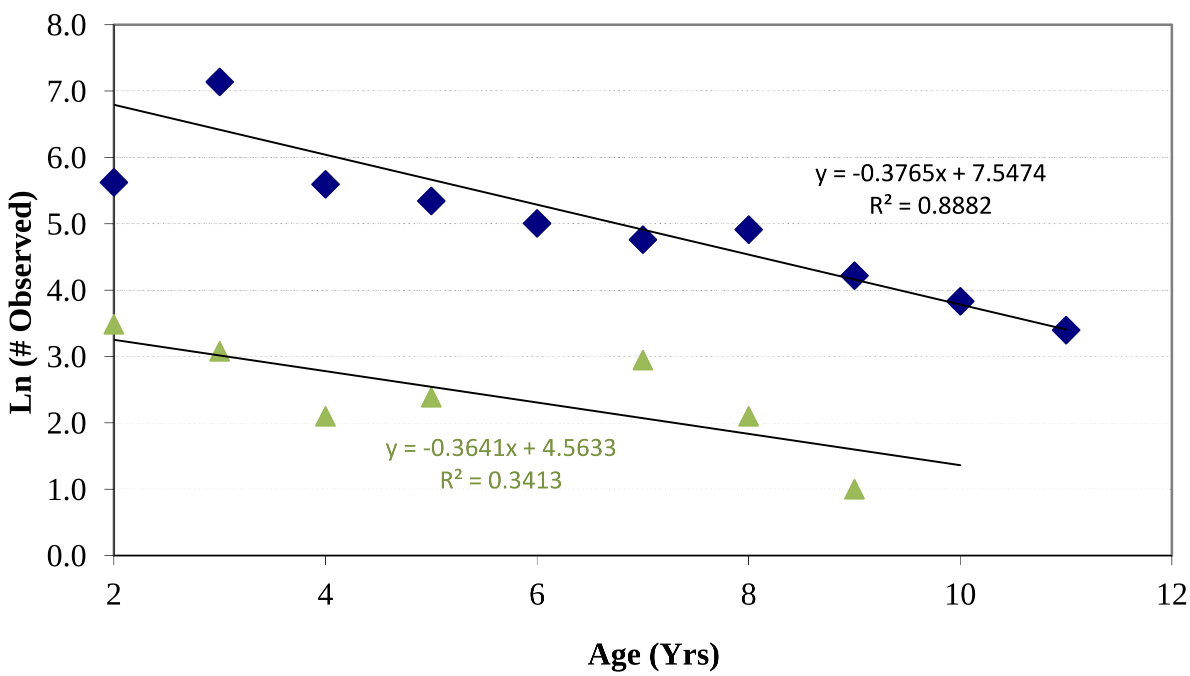

Figure 3. Catch curve analysis of walleyes in Tait Lake, 2013, showing instantaneous mortality (*Z*). Estimates are made from May 2013 electrofishing data (blue diamonds), and from summer 2013 gill net assessments by the MNDNR (green triangles).

Table 1. Summary of electrofishing activities on Tait Lake, Cook County, Minnesota, during Spring 2013.

ID #	County	Lake	Area (Acres)	Max Depth	Date	Water Temp (F)	Conductivity[1]	Shocking Time (sec)	Voltage (PDC)	Amps	# WAE[2]	CPUE WAE[3]
16-0384	Cook	Tait	338	15.0	5/19/2013	49	30	2411	1061	4	92	137.4
					5/20/2013	49.4	33.5	8210	1061	4	280	122.8
					5/21/2013	46	34.8	7645	1061	4	224	105.5
					5/22/2013	48.9	33	9876	1061	4	273	99.5

[1] Water conductivity measured in microSiemens / cm.

[2] WAE = walleye. Numbers in column represent the number of "stock" sized walleye (>254mm (10 inches)) collected. Includes marked and recaptured individuals.

[3] 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 Tait Lake, Spring 2013. 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 determined from gill net samples collected in the summer following marking with the electrofishing surveys. GN/TN includes all of the MNDNR data from both the gill nets and trap nets. Rows of shaded data indicate population estimates from previous surveys, and are presented for comparitive purposes.

Lake	Population Estimate[1]	95% Confidence Limits Lower	Upper	Estimate[2]	C.V.[3]
Tait – EF_{2013}	2027	1902	2170	2042 ± 647	10.0 %
Tait – GN_{2013}	2013	1912	2125	1834 ± 1048	20.6 %
Tait – GN/TN_{2013}	2047	1951	2153	2056 ± 894	15.7%
Tait – EF_{2011}	1216	1029	1488	1253 ± 386	7.2%
Tait – GN_{2011}	1325	961	2135	2226 ± 1581	22.3%
Tait – EF_{2009}	1593	1544	1645	1584 ± 416	6.4%
Tait – GN_{2009}	1720	1372	2303	2212 ± 983	14.0%

[1] Schumacher and Eschmeyer population estimate.
[2] Adjusted Petersen population estimate, with 95% confidence interval.
[3] Coefficient of variation for the Petersen estimate.
[4] Unable to calculate upper and lower confidence limits with one degree of freedom (1 *df*)

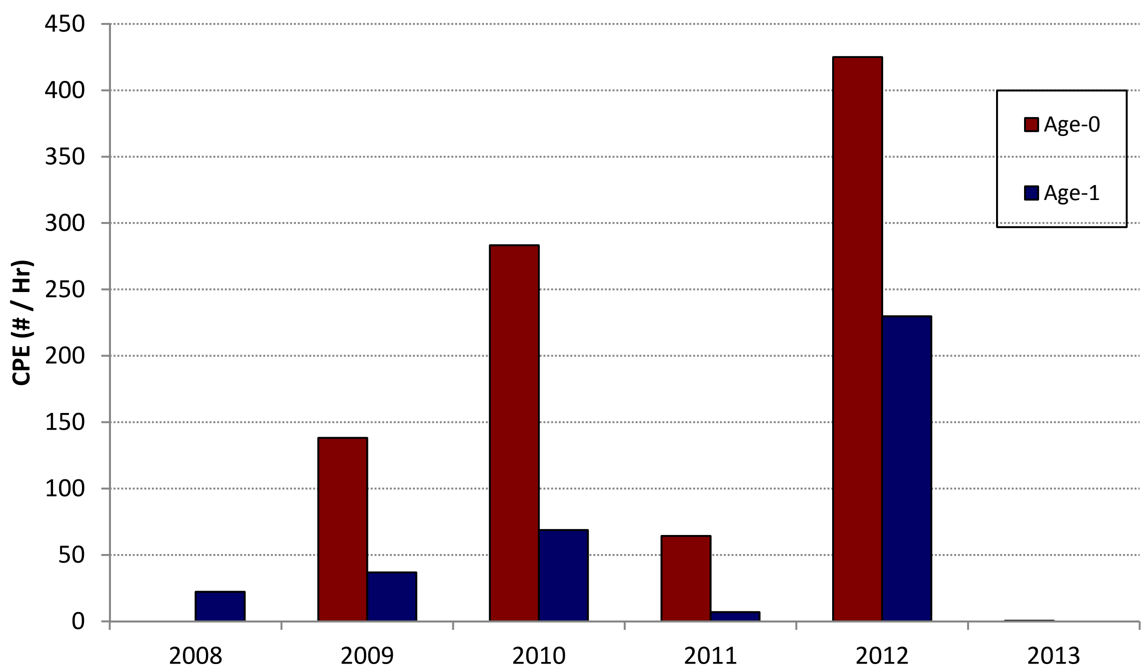

Figure 4. Age-0 and age-1 fall electrofishing catch-per-hour (CPE) data from Tait Lake, since 2008.

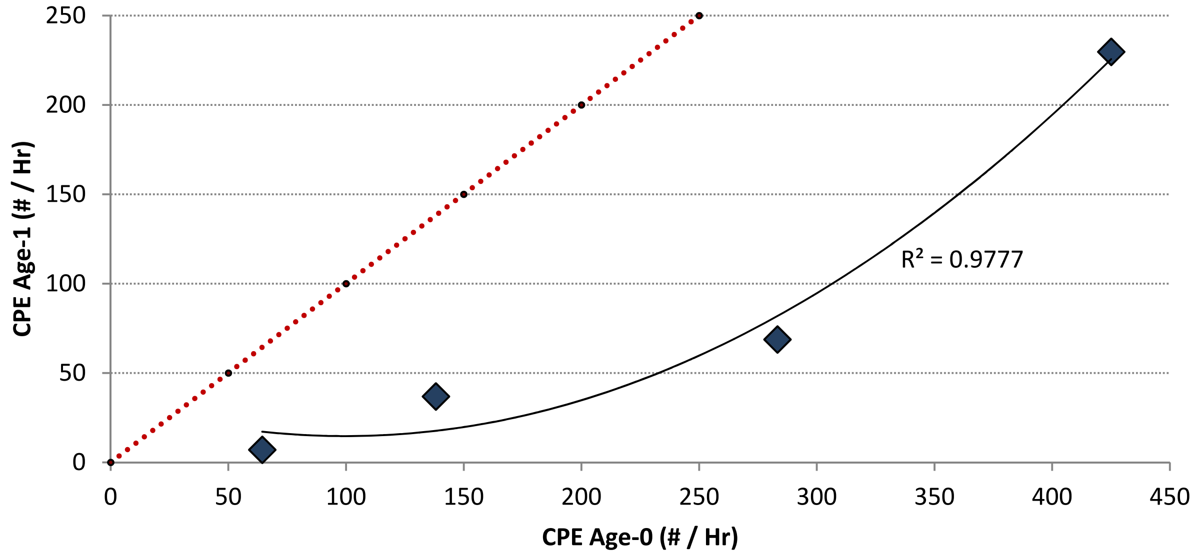

Figure 5. The relationship between age-0 fall electrofishing catch-per-hour (CPE) data in year$_i$, and fall CPE data of the same cohort as age-1 in year$_{i+1}$, from Tait Lake since 2008. The red dotted line is a 1:1 line.

Table 4. Back-calculated lengths-at-age for walleye collected from Tait Lake, Cook County, Minnesota, May 2013.

Age Class	N	Length (mm)	Length (in)
1	191	108	4.3
2	191	190	7.5
3	166	270	10.6
4	111	331	13.0
5	81	368	14.5
6	66	396	15.6
7	56	420	16.5
8	42	435	17.1
9	29	451	17.8
10	19	457	18.0
11	13	467	18.4
12	6	473	18.6
13	4	483	19.0
14	3	496	19.5
15	2	504	19.8

Table 3. Age frequency distribution of walleye from Tait Lake, Cook County, spring 2013, based upon the number of fish sampled and aged per size category.

Length Group		N	Age													
Inches	mm	Sampled	2	3	4	5	6	7	8	9	10	11	12	13	14	15
4.0	102	2														
4.5	114	6														
5.0	127	3														
5.5	140	2														
6.0	152	2														
6.5	165	3	3													
7.0	178	3	3													
7.5	191	4	4													
8.0	203	8	8													
8.5	216	27	27													
9.0	229	80	57	23												
9.5	241	87		87												
10	254	108		108												
10.5	267	92		92												
11	279	39		33	6											
11.5	292	45		45												
12	305	44		37	7											
12.5	318	38		22	16											
13	330	24		16												
13.5	343	26			26											
14	356	20			14	6										
14.5	368	12			12											
15	381	26			11	11	4									
15.5	394	28			7	7	7		7							
16	406	53				45			8							
16.5	419	46					20	20	5							
17	432	48				8	24	8		8						
17.5	445	44						6	28		6	6				
18	457	29						8		12	8					
18.5	470	10							1	1	2	4	2			
19	483	8						1	1	2	1	1		1		1
19.5	495	2								1					1	
20.0	508	2								1						1
TOTAL		971	102	463	99	77	55	43	50	25	17	11	2	1	1	2
			10.5%	47.7%	10.2%	7.9%	5.7%	4.4%	5.1%	2.6%	1.8%	1.1%	0.2%	0.1%	0.1%	0.2%

Table 5. Proportional Stock Density (PSD) and Relative Stock Densities (RSD) with 95% confidence intervals for walleye sampled from Tait Lake, Cook County, Minnesota. Values are for spring electrofishing (EF) and MN DNR gill netting (GN) surveys conducted during the year indicated.

Lake	PSD	RSD S-Q	RSD Q-P	RSD P-M	RSD M-T
Tait – EF_{2013}	44.5 ± 3.3	55.5 ± 3.3	44.2 ± 3.3	0.3 ± 0.4	0.0 ± 0.0
Tait – GN_{2013}	40.5 ± 15.8	59.4 ± 15.8	40.5 ± 15.8	0.0 ± 0.0	0.0 ± 0.0
Tait -- EF_{2009}	47.8 ± 3.3	52.2 ± 3.3	46.7± 3.3	1.0 ± 0.7	0.1 ± 0.2
Tait -- GN_{2009}	57.9 ± 11.1	42.1 ± 11.1	55.3 ± 11.2	2.6 ± 3.6	0.0 ± 0.0
Tait -- EF_{2011}	51.9 ± 3.8	48.1 ± 3.8	51.5 ± 3.8	0.4 ± 0.5	0.0 ± 0.0
Tait -- GN_{2011}	50.0 ± 14.8	50.0 ± 14.8	45.4 ± 14.7	4.6 ± 6.2	0.0 ± 0.0

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 3 September 2013. This 20°C threshold was exceeded in three lakes (Table 6). All of the lakes were surveyed before the lakes cooled to below the 10°C lower threshold (Borkholder and Parsons, 2001).

Table 6 presents a summary of each evening of electrofishing assessments. CPUE for age-0 walleye ranged from 0.4 fish per hour (Devilfish Lake) to 480.7 fish per hour of electrofishing (Shagawa Lake) (Table 6). Shagawa Lake was stocked with 2.3 million fry in 2013, which seemingly contributed to the high catch rates. Interestingly, Ninemile was also stocked, with 150,000 fry, but these were not observed during fall sampling. CPUE for age-1 walleye ranged from 0.0 fish per hour (Devilfish, Ninemile, and Wild Rice Lakes) to 240.6 fish per hour of electrofishing (Tait Lake) (Table 6). Figures 6 – 29 present length frequency data for each of the lakes surveyed. Table 7 presents the mean length for age-0 and age-1 individuals sampled during fall 2013 assessments. Mean lengths for age-0 walleye ranged from 96 mm (3.8 inches, Pike Lake) to 151 mm (5.9 inches, Cadotte Lake). Mean lengths for age-1 walleye ranged from 165 mm (6.5 inches, Tait Lake) to 252 mm (9.9 inches, Cadotte Lake).

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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 September 2013.

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	3-Sep	68	20.0	29.4	19	131	5706	12.0	82.6
Cadotte	23-Sep	60	15.6	----	245	74	6617	133.3	40.3
Caribou	20-Sep	61	16.1	----	159	21	7528	76.0	10.0
Cascade	5-Sep	70	21.1	27.8	184	81	7268	91.1	40.1
Crescent	16-Sep	61	16.1	33.6	1	14	3157	1.1	16.0
Crooked	17-Sep	62	16.7	50.9	136	64	5612	87.2	41.1
Devilfish	4-Sep	67	19.4	19.7	1	0	9612	0.4	0.0
Dumbbell	17-Sep	62	16.7	75.8	423	27	5528	275.5	17.6
Elbow	6-Sep	72	22.2	34.4	48	101	4430	39.0	82.1
Fourmile	19-Sep	62	16.7	50.0	142	50	8417	60.7	21.4
Harriet	17-Sep	62	16.7	52.7	5	36	6145	2.9	21.1
Island Reservoir	24-Sep	63	17.2	75.3	72	100	10293	25.2	35.0
Ninemile	17-Sep	61	16.1	64.8	2	0	3909	1.8	0.0
N. McDougal	16-Sep	66	18.9	63.6	59	25	6917	30.7	13.0
Pike	5-Sep	69	20.6	57.4	100	35	6501	55.4	19.4
Shagawa	25-Sep	62	16.7	89.9	1535	16	11496	480.7	5.0
Silver Island	18-Sep	61	16.1	39.9	46	29	8368	19.8	12.5
Tait	16-Sep	62	16.7	41.6	1	533	7976	0.5	240.6
Tom	4-Sep	69	20.6	33.9	11	228	8379	4.7	98.0
Two Island	3-Sep	70	21.1	30.4	119	175	5383	79.6	117.0
West Twin	6-Sep	71	21.7	32.0	137	106	4615	106.9	82.7
Whiteface Res.	23-Sep	62	16.7	61.1	57	101	6912	30.2	53.1
Wild Rice	9-Sep	68	20.0	124.3	1	0	4925	0.7	0.0
Wilson	18-Sep	61	16.1	46.9	60	111	5969	36.2	70.0
Windy	18-Sep	62	16.7	32.1	3	26	5155	2.1	18.2

[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 2013 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.

Lake (County)	Date	Age-0 Mean Length (mm)	Age-1 Mean Length (mm)
Ball Club	3-Sep	109	204
Cadotte	23-Sep	151	252
Caribou	20-Sep	137	232
Cascade	5-Sep	112	188
Crescent	16-Sep	102	200
Crooked	17-Sep	126	212
Devilfish	4-Sep	97	----
Dumbbell	17-Sep	146	210
Elbow	6-Sep	110	175
Fourmile	19-Sep	128	223
Harriet	17-Sep	124	170
Island Reservoir	24-Sep	117	190
Ninemile	17-Sep	146	----
N. McDougal	16-Sep	110	192
Pike	5-Sep	96	198
Shagawa	25-Sep	106	208
Silver Island	18-Sep	123	216
Tait	16-Sep	135	165
Tom	4-Sep	113	198
Two Island	3-Sep	114	181
West Twin	6-Sep	105	210
Whiteface Res.	23-Sep	126	202
Wild Rice	9-Sep	142	----
Wilson	18-Sep	124	201
Windy	18-Sep	127	205

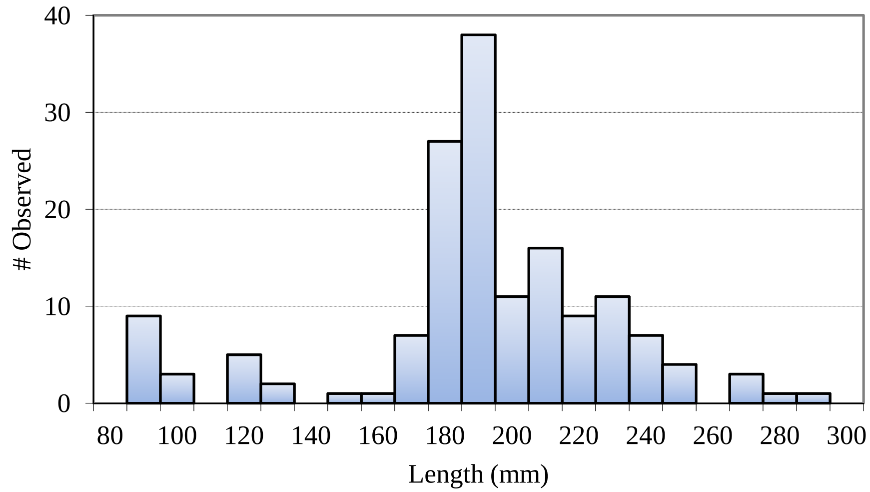

Figure 6. Length frequency distribution of walleye collected from Ball Club Lake, Cook County, during fall 2013 electrofishing assessments.

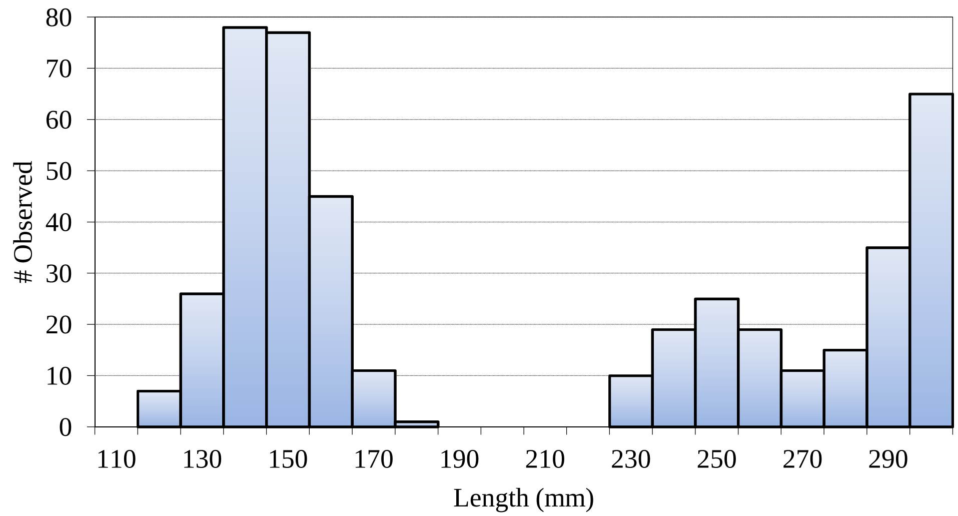

Figure 7. Length frequency distribution of walleye collected from Cadotte Lake, St. Louis County, during fall 2013 electrofishing assessments.

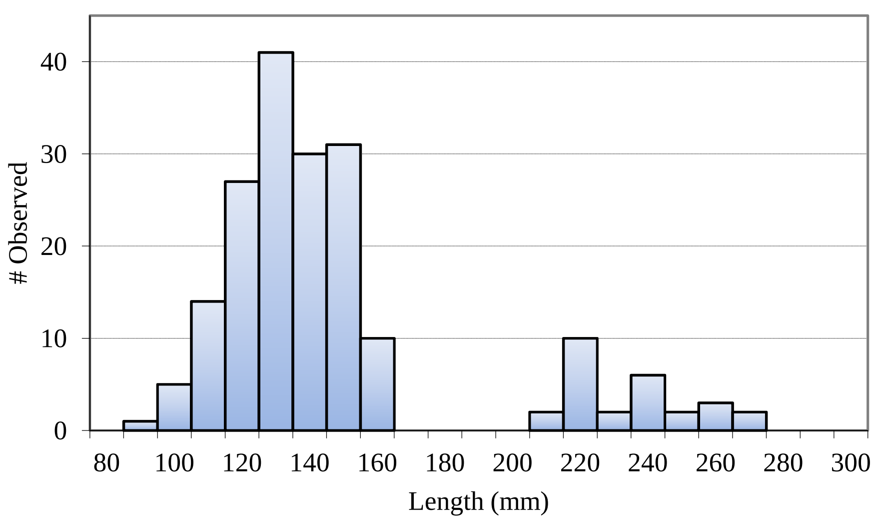

Figure 8. Length frequency distribution of walleye collected from Caribou Lake, Cook County, during fall 2013 electrofishing assessments.

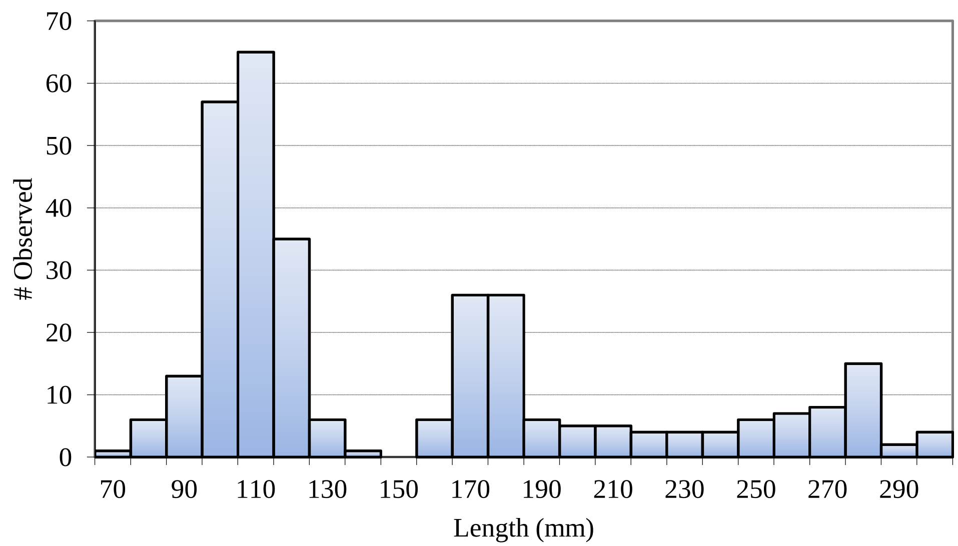

Figure 9. Length frequency distribution of walleye collected from Cascade Lake, Cook County, during fall 2013 electrofishing assessments.

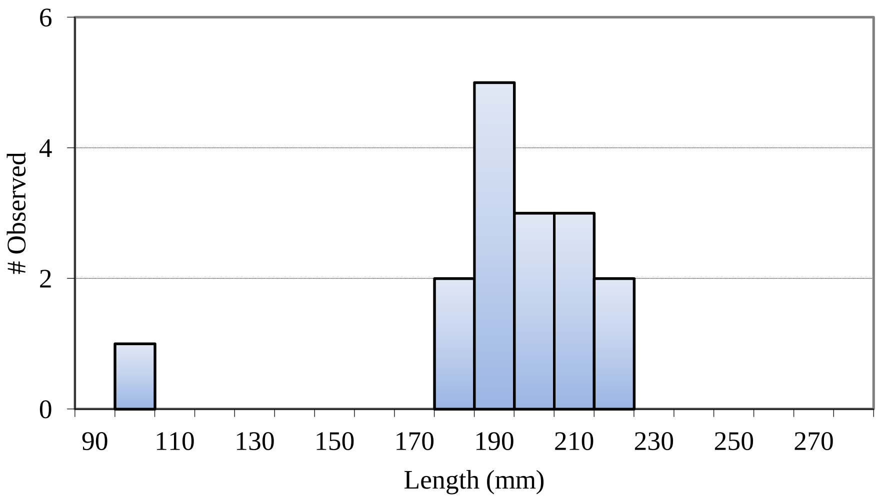

Figure 10. Length frequency distribution of walleye collected from Crescent Lake, Cook County, during fall 2013 electrofishing assessments.

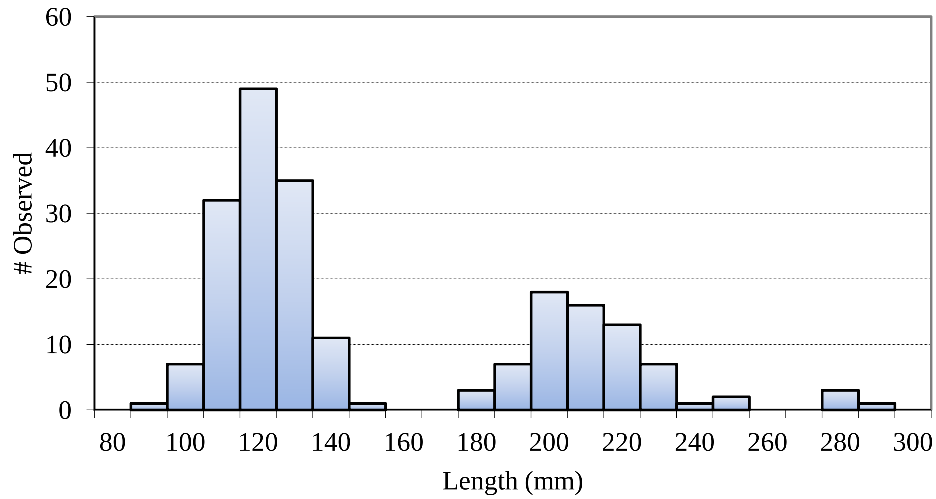

Figure 11. Length frequency distribution of walleye collected from Crooked Lake, Lake County, during fall 2013 electrofishing assessments.

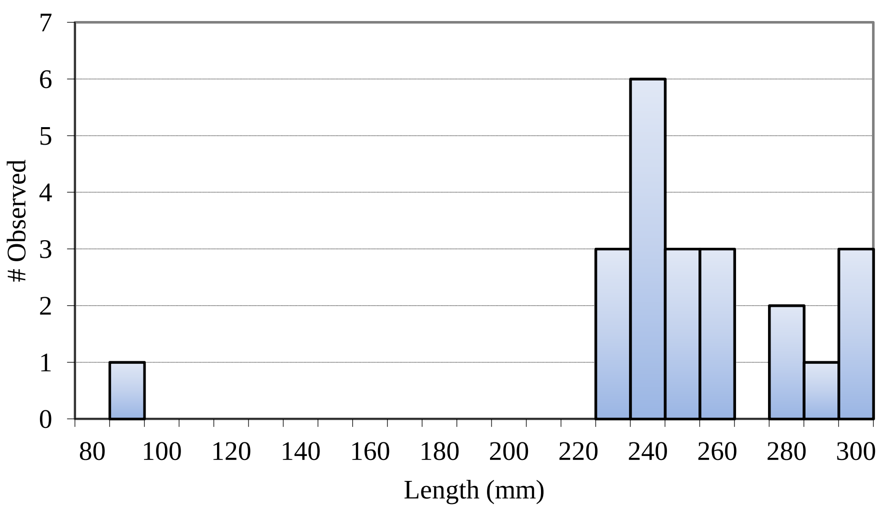

Figure 12. Length frequency distribution of walleye collected from Devilfish Lake, Cook County, during fall 2013 electrofishing assessments.

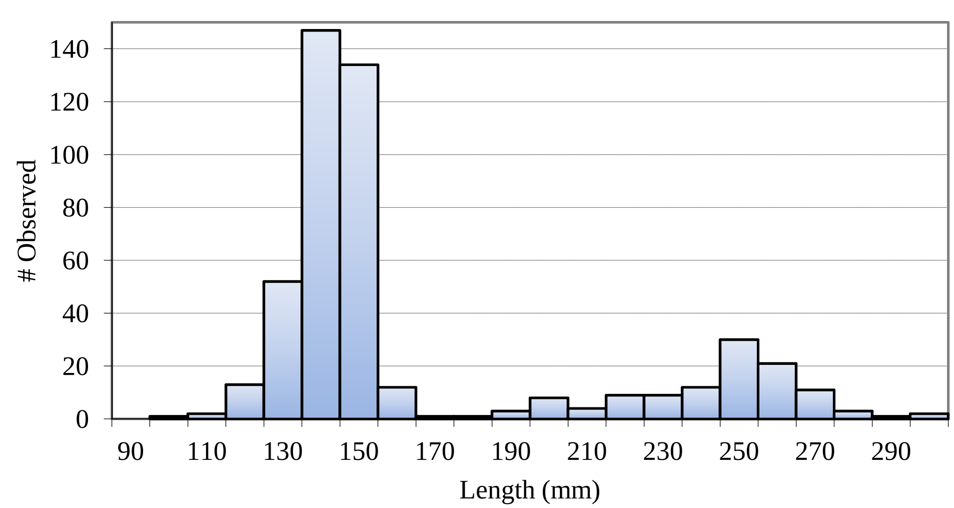

Figure 13. Length frequency distribution of walleye collected from Dumbbell Lake, Lake County, during fall 2013 electrofishing assessments.

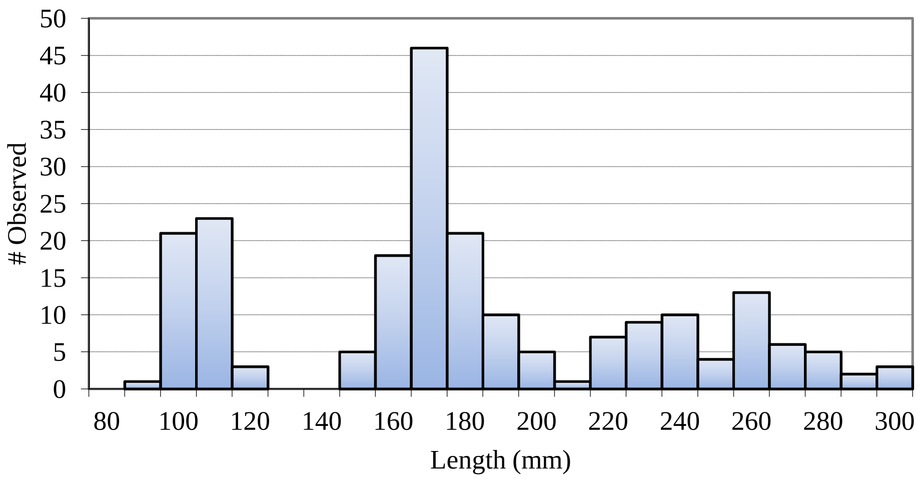

Figure 14. Length frequency distribution of walleye collected from Elbow Lake, Cook County, during fall 2013 electrofishing assessments.

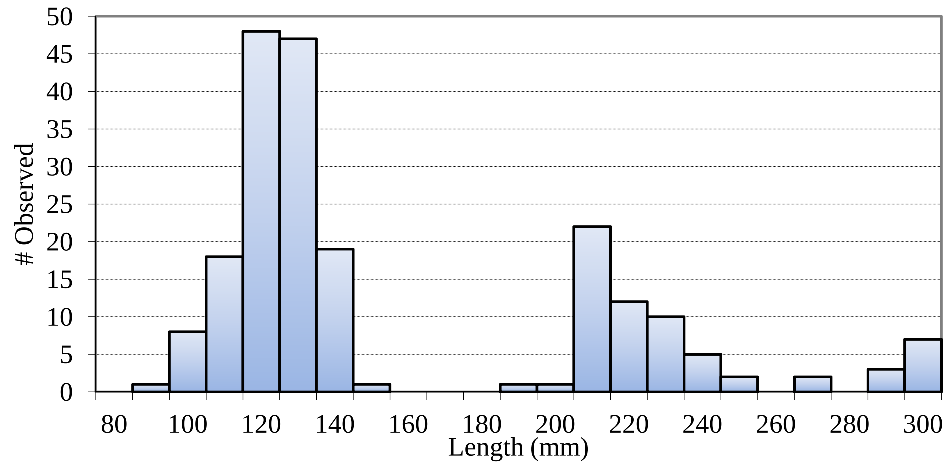

Figure 15. Length frequency distribution of walleye collected from Fourmile Lake, Cook County, during fall 2013 electrofishing assessments.

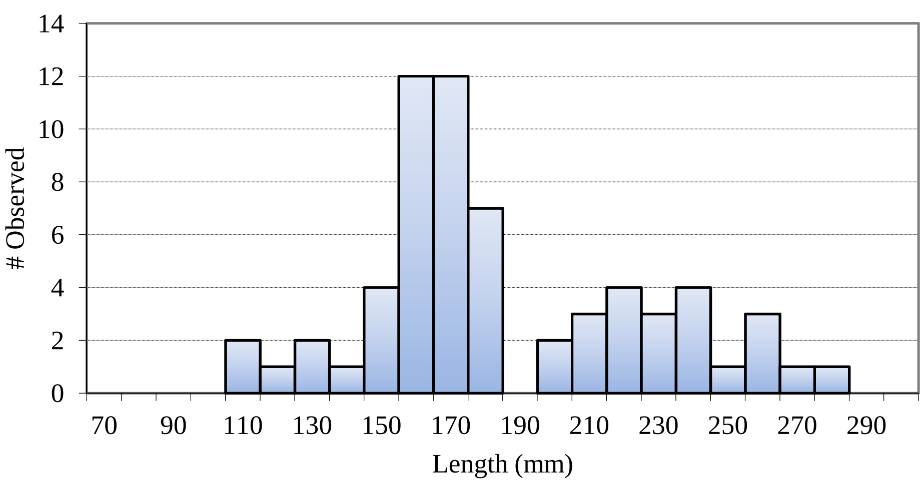

Figure 16. Length frequency distribution of walleye collected from Harriet Lake, Lake County, during fall 2013 electrofishing assessments.

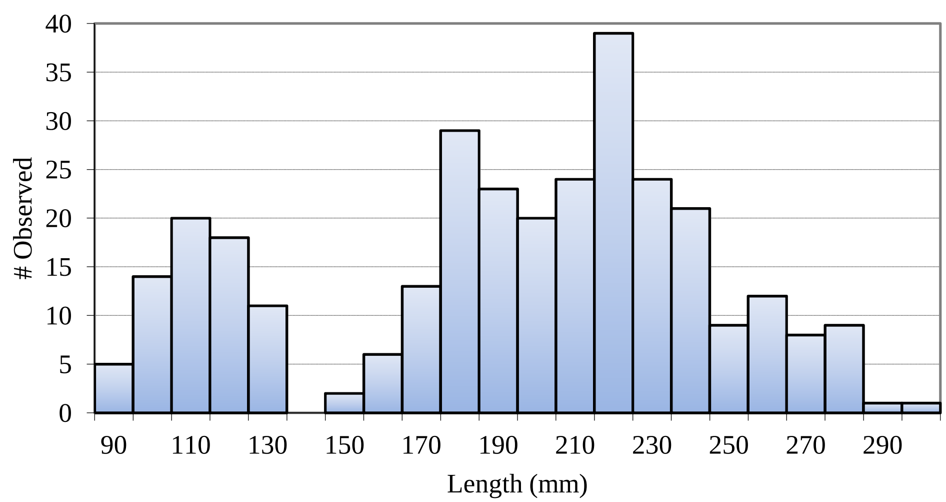

Figure 17. Length frequency distribution of walleye collected from Island Lake Reservoir, St. Louis County, during fall 2013 electrofishing assessments.

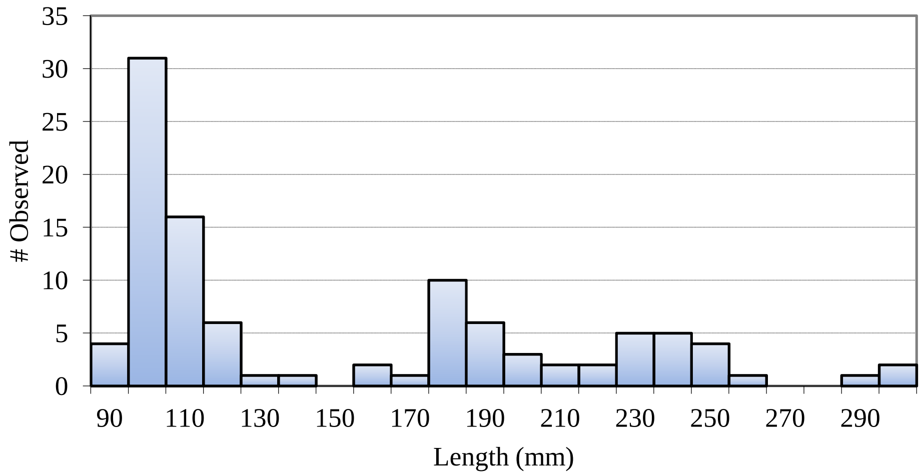

Figure 18. Length frequency distribution of walleye collected from North McDougal Lake, Lake County, during fall 2013 electrofishing assessments.

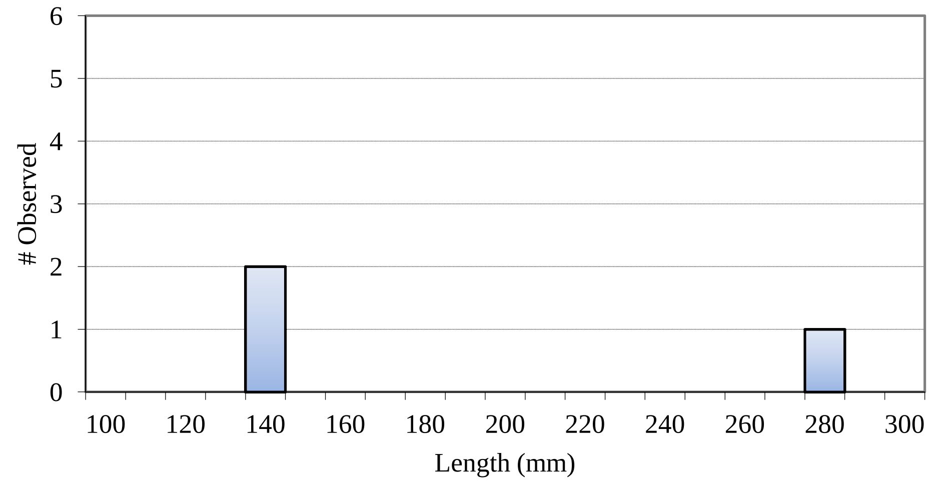

Figure 19. Length frequency distribution of walleye collected from Ninemile Lake, Lake County, during fall 2013 electrofishing assessments.

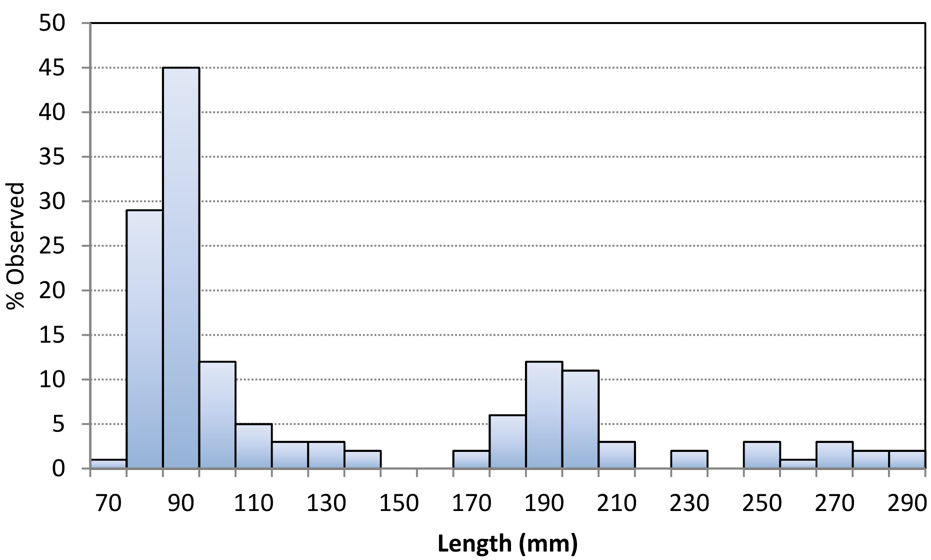

Figure 20. Length frequency distribution of walleye collected from Pike Lake, Cook County, during fall 2013 electrofishing assessments. Note y-axis is % observed.

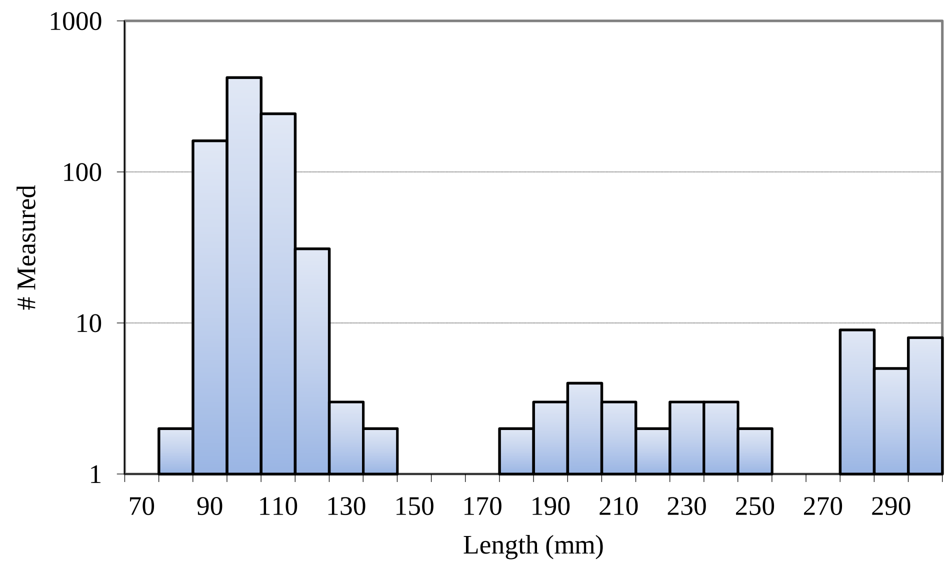

Figure 21. Length frequency distribution of walleye collected from Shagawa Lake, St. Louis County, during fall 2013 electrofishing assessments. Note y-axis is log scale.

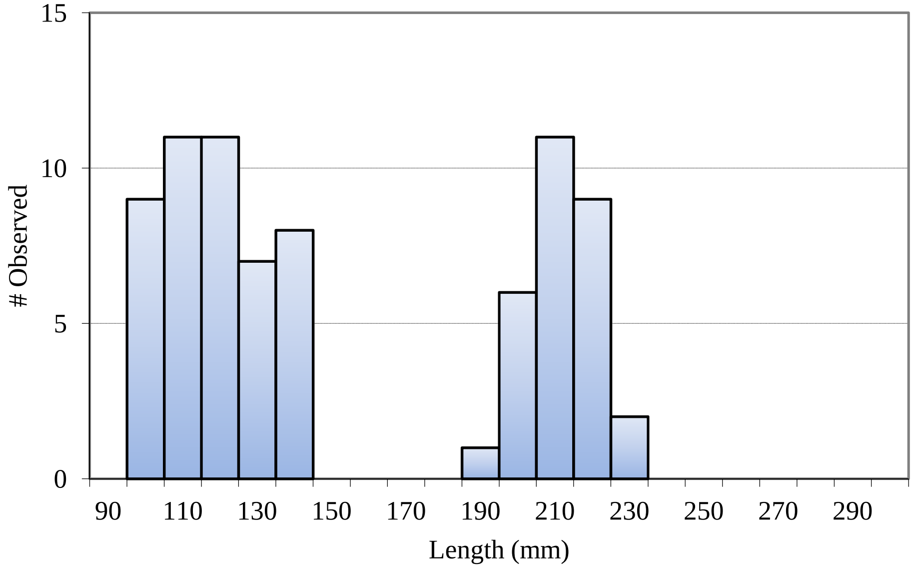

Figure 22. Length frequency distribution of walleye collected from Silver Island Lake, Lake County, during fall 2013 electrofishing assessments.

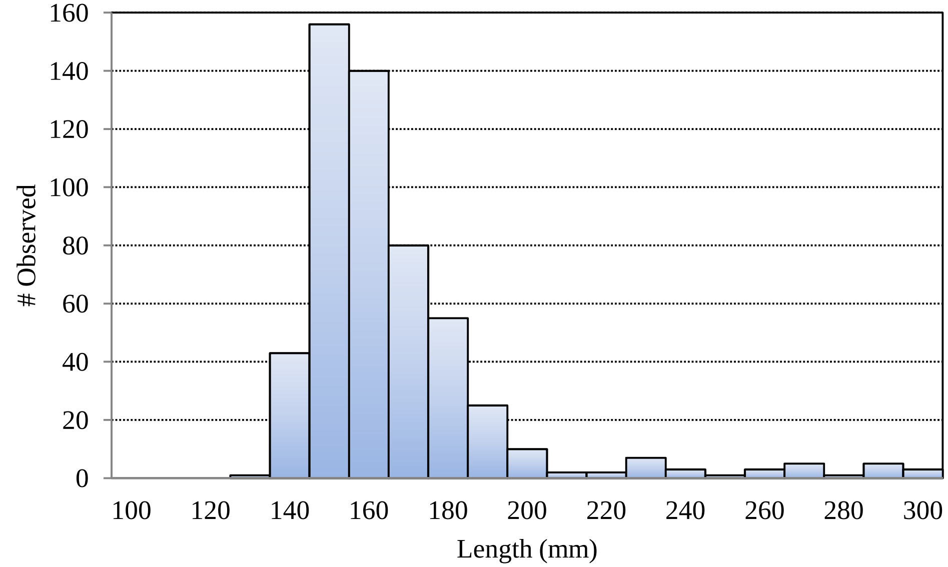

Figure 23. Length frequency distribution of walleye collected from Tait Lake, Cook County, during fall 2013 electrofishing assessments.

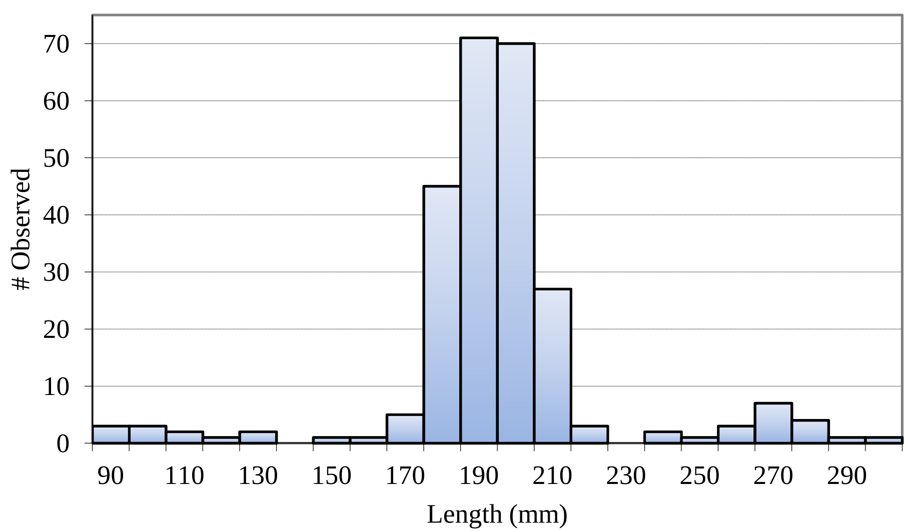

Figure 24. Length frequency distribution of walleye collected from Tom Lake Cook County, during fall 2013 electrofishing assessments.

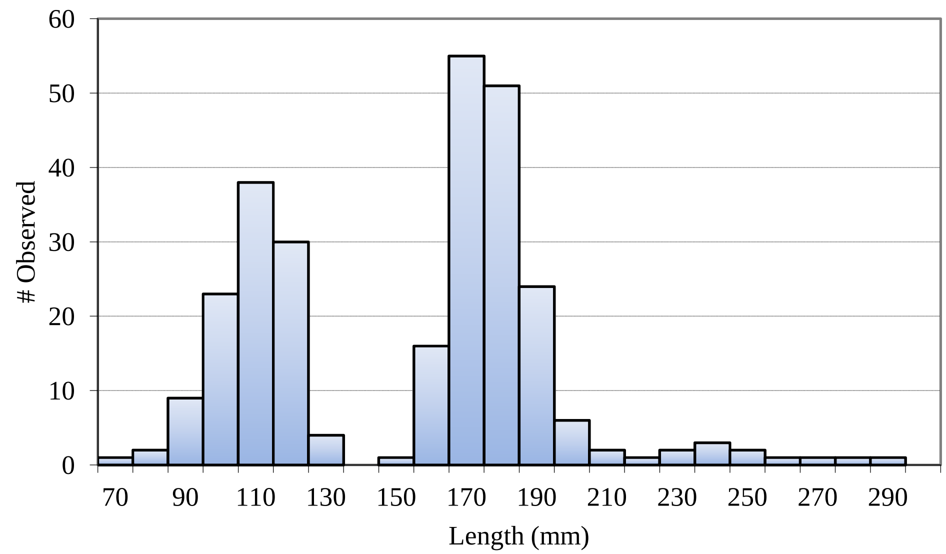

Figure 25. Length frequency distribution of walleye collected from Two Island Lake, Cook County, during fall 2013 electrofishing assessments.

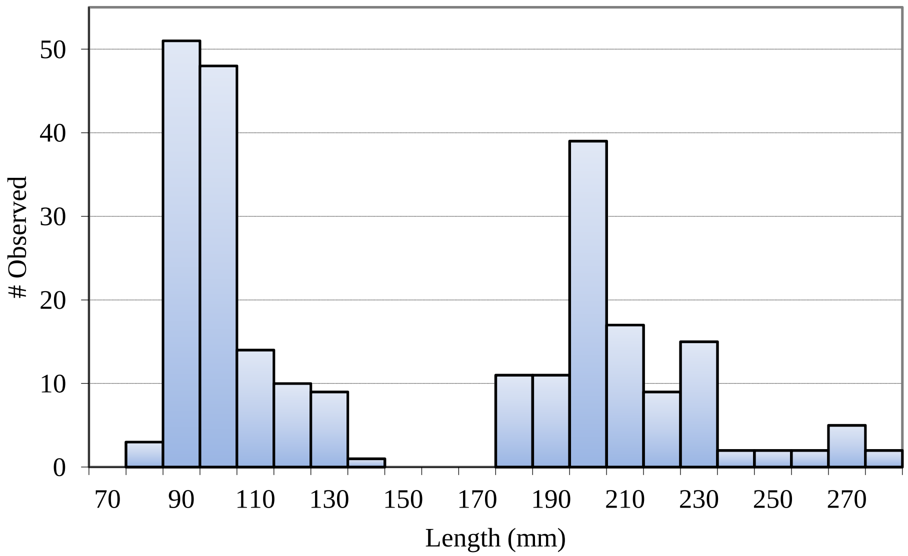

Figure 26. Length frequency distribution of walleye collected from West Twin Lake, Cook County, during fall 2013 electrofishing assessments.

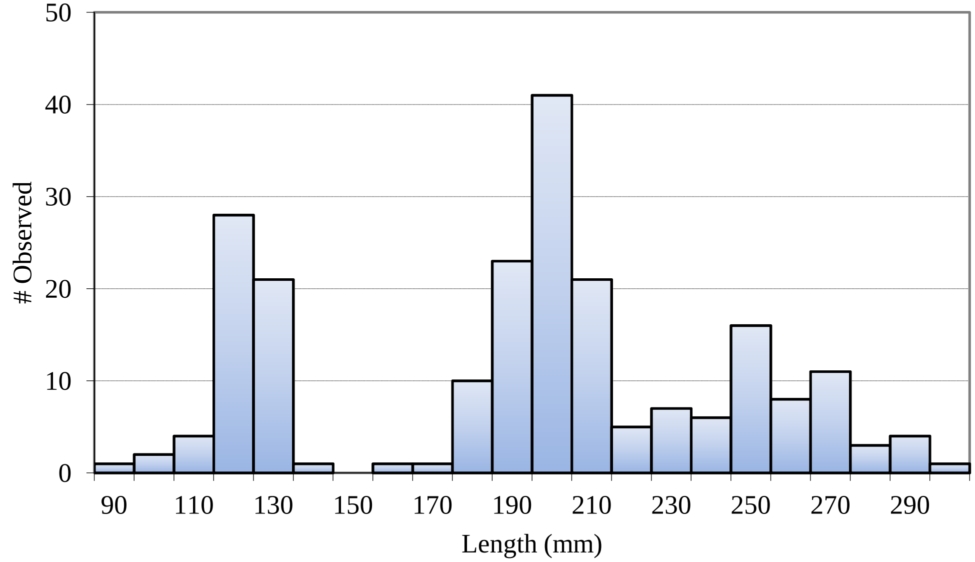

Figure 27. Length frequency distribution of walleye collected from Whiteface Reservoir, St. Louis County, during fall 2013 electrofishing assessments.

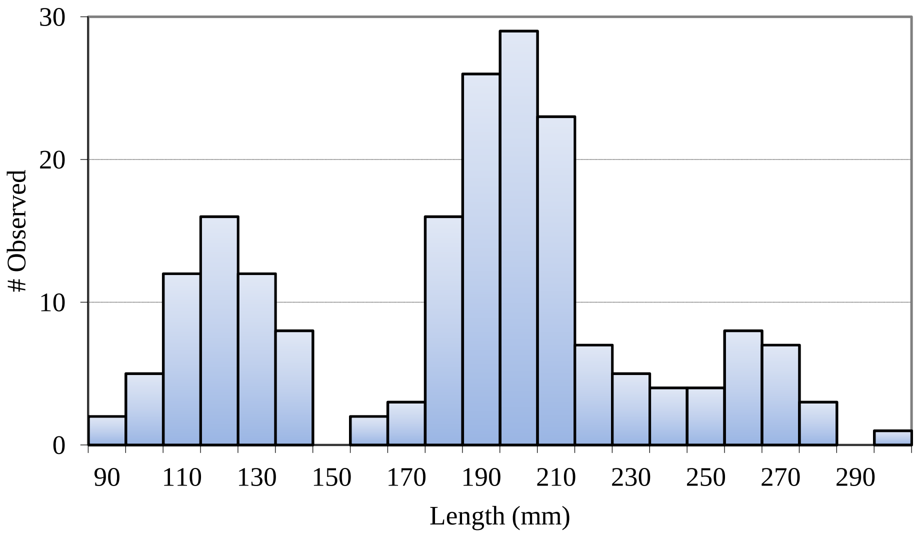

Figure 28. Length frequency distribution of walleye collected from Wilson Lake, Lake County, during fall 2013 electrofishing assessments.

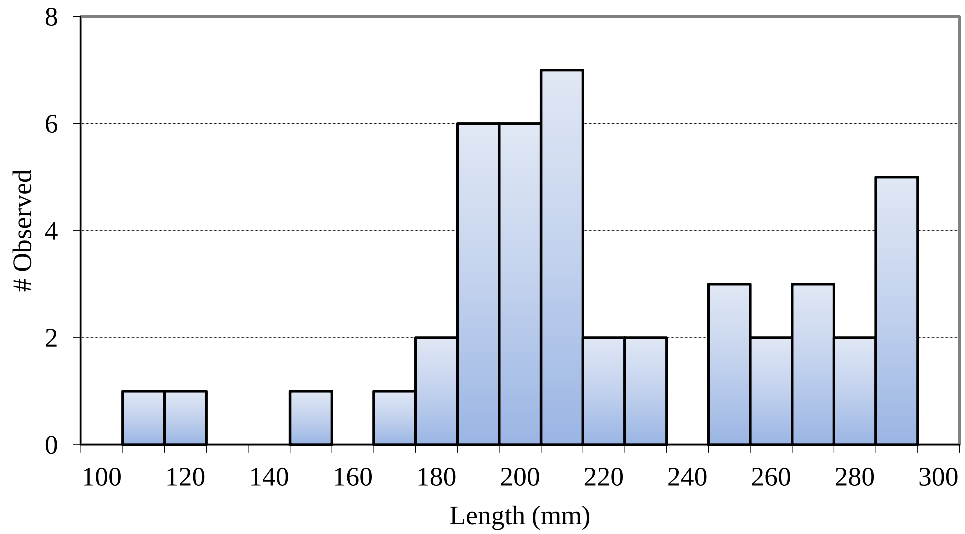

Figure 29. Length frequency distribution of walleye collected from Windy Lake, Lake County, during fall 2013 electrofishing assessments.

Appendix 1. Nightly Mark / Recapture Data for walleye > 254 mm sampled during spring 2013 assessments in Tait Lake, and observed in MN DNR summer gill net assessments.

Lake	Date	Marked in Population	Daily Catch	Daily Recap
Tait	19 May	---	92	---
	20 May	92	280	11
	21 May	361	224	42
	22 May	543	273	72
	MNDNR GN	744	32	12
	MNDNR GN / TN	744	68	24