Spring Adult and Fall Juvenile Walleye Population Surveys within the 1854 Ceded Territory of Minnesota, 2003

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

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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 rights 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 data bases 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 (Newman 1992; Stone 1992; Stone and Slade 1992; Goyke et al. 1993 and 1994; Ngu and Kmiecik 1993; and Borkholder 1994, 1995, and 1996).

The 1854 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 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.

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 the sampling of 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; Borkholder 1994 and 1995). In order to rapidly sample fish populations, Fond du Lac and the 1854 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 in the recapture sample. Accurate estimates are obtained when a large portion of the population are 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 walleye remain in the shallows 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 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 (Frank Stone, U. S.F.W.S., Ashland F.R.O., personal communication).

The first objective of our assessments in 2003 was to obtain adult walleye population estimates (PE) during the spring spawning period using mark - recapture data. Due to personnel and time constraints, trap netting was not used. Thus, our electrofishing PE estimates might be biased towards males in the populations. However, by cooperating with the Area MN DNR offices, we obtain a second PE from the State's summer gill net assessments, with which to compare to the spring only electrofishing PE.

A second benefit of the spring electrofishing surveys is that it allows us to identify and determine key and critical spawning sites, i.e. where catch rates are the highest.

The second part of our 2003 walleye surveys targeted juvenile (age-1) and young-of-the-year (age-0) individuals in the fall. The purpose for assessing juvenile and fingerling individuals often is to evaluate recruitment and year-class strength, which was our objective for the fall assessments.

Methods

Spring Assessments

Eleven lakes within the 1854 Ceded Territory of Minnesota were originally identified by the Area Managers for the MNDNR for electrofishing surveys. These included Island and Cadotte Lakes (Duluth Area); Dumbbell and Silver Island Lakes (Finland Area); and Gunflint, Caribou, Two Island, Holly, Pike, Devil Track, and McFarland Lakes (Grand Marais Area). Due to spring low water conditions, our crews never were able to access Island Lake Reservoir, and time did not permit us to sample lakes other than those identified in Table 1. 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 respective walleye populations. Marked walleye would then be available during the summer gill net assessments conducted by the DNR, thus providing a second population estimate.

Electrofishing was performed at night using two boom shocking boats, both equipped with a Smith-Root Type VI-A electrofisher unit 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 the beginning of each evening. Ambient water conductivity measurements were taken using either a Hanna HI8733 conductivity meter (Ben Meadows Co., Atlanta, GA) or a Fisher Scientific Digital Conductivity Meter.

Electrofishing surveys were planned to begin soon after ice-out, and continue for as long as 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 revive. Walleye were measured to the nearest millimeter (mm), examined for previous marks, and the sex determined (male, female, unknown) based upon visual identification of gametes. Walleye that had been marked during any previous nights' collections were counted as recaptured fish. Unmarked individuals were marked by the removal of the second full dorsal fin spine. On Pike and Caribou Lakes, Cook County, walleye were marked by removal of both a dorsal fin spine and the anal spine, to differentiate 2003 marked individuals from previously marked fish. The dorsal fin spine from five individuals per centimeter group per sex was kept and placed in a labeled envelope for aging. 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). Walleye surveys in Wisconsin have traditionally utilized the adjusted Peterson formula (Goyke et al. 1993 and 1994, and Ngu and Kmiecik 1993). 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 0.3 to 0.5 mm thin sections made using a Buehler Isomet^{TM} 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, as per Duluth Area Fisheries (John Lindgren, MNDNR, personal communication).

Fall Assessments

Catch per unit effort (CPUE) for age-0 walleye was found to be the highest in the fall between 20.0^{o}C and 10.0^{o}C (Borkholder and Parsons, 2001). Warm summer and fall weather required that we postpone our start date by two weeks from previous years. We did, however, run into a few instances where water temperatures were still observed to be greater than 20.0^{o}C. Due to extending our surveys into October, water temperatures did eventually become normal, and we sampled a few lakes below our 10.0°C threshold.

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 revive. Walleye were measured to the nearest mm. Scales were taken for age analysis 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 Authority (Borkholder 1996, 1997, and 1998; Borkholder and Edwards 1999, 2000, and 2003). Sampling stations were repeated from previous years' surveys.

Walleye were aged by counting annuli on scales viewed under a microfiche reader (Borkholder 1996 and 1997). Walleye ages were used to assess CPUE (number of walleye / hour of electrofishing) of juvenile (age-1) and yearling (age-0) individuals.

Results and Discussion

Spring Assessments

Cadotte Lake

Electrofishing activities were conducted on Cadotte Lake from 28 April to 2 May (Figure 1). Dates of electrofishing activities, mean water temperature, mean 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 for each night ranged from 97.8 to 256.3 adults per hour and 128.7 to 260.6 total walleye per hour of sampling (Table 1). At an 80% confidence interval, mean CPUE for Cadotte Lake, determined using each sampling station, was 181.58 ± 31.6 adults per hour and 197.9 ± 29.3 total walleye per hour of sampling effort. The length frequency of the walleye sampled is presented in Figure 2. Additional species observed included yellow perch, white sucker, northern pike, burbot, pumpkinseed, and bluegill.

Catch rates among the sampling stations varied, but were consistently high compared to those of other lakes. Catch rates ranged from 26.8 adult walleye per hour (EF-3, 1 May 2003) to 304.7 adults per hour (EF-2, 30 April 2003) (Figure 1). Catch rates at station EF-3 depended upon the evening, and ranged from 26.8 to 187.4 adults per hour.

Table 2 presents the population estimates based upon mark-recapture data for both the spring electrofishing survey and the summer gill-net assessment. The Schumacker and Eschmeyer population estimate from the electrofishing data is 4044 (Table 2). The adjusted Petersen estimate is 4016 ± 831, with a 6.6% CV (Table 2).

In July 2003 the Minnesota Department of Natural Resources performed a standardized net assessment on Cadotte Lake (Mark Prankus, MN DNR, Duluth Area Fisheries). Of 112 walleye

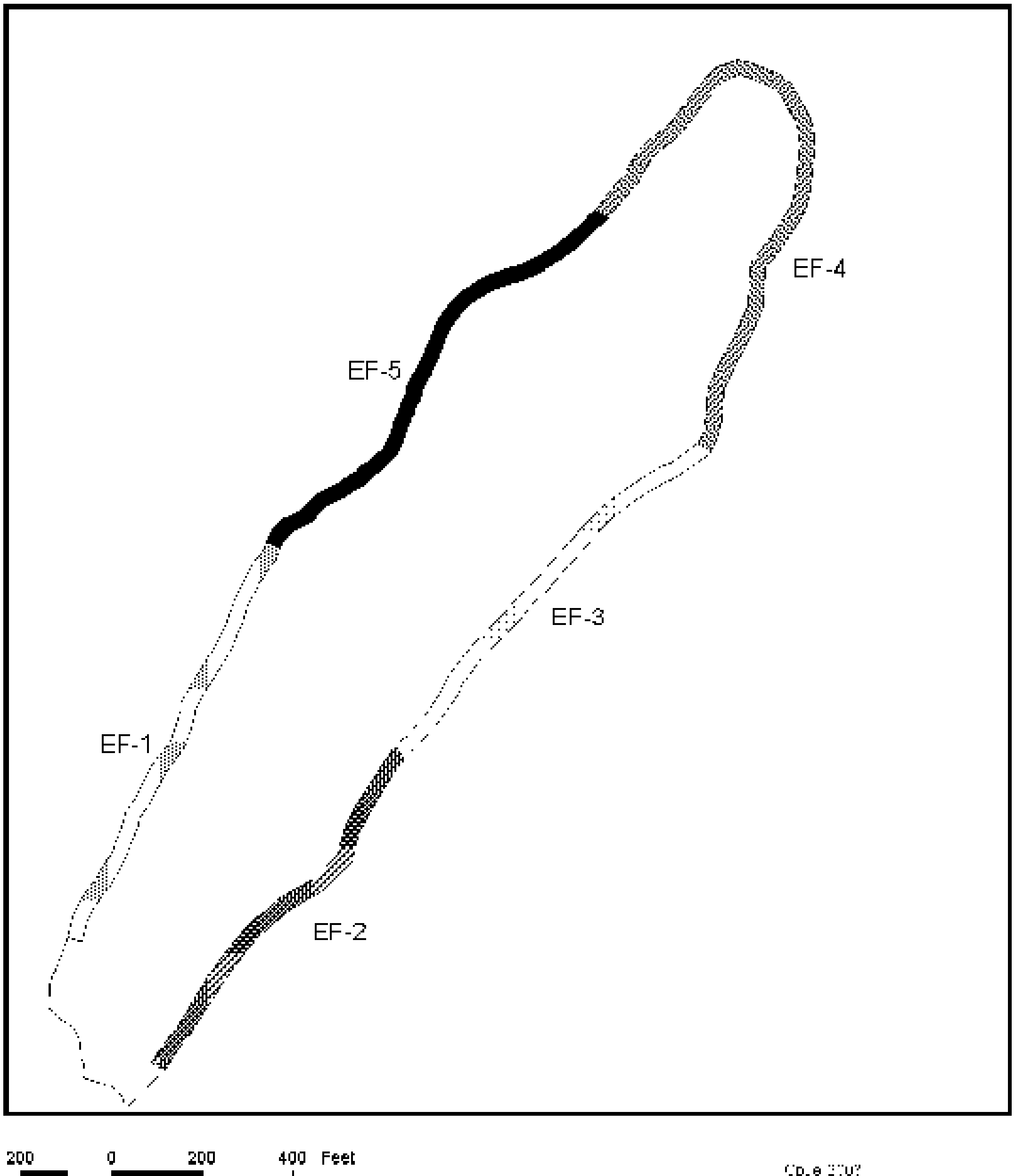


Figure 1: Electrofishing catch-per-unit-effort (CPUE, #/hour) of adult walleye on Cadotte Lake, St. Louis County, Spring 2003.

Table 1. Summary of night time electrofishing activities on three lakes surveyed within the 1854 Ceded Territory, Minnesota, during Spring 2003.

ID #	County	Lake	Area (Acres)	Max Depth	Date	Water Temp (F)	Conductivity[1]	Shocking Time (sec)	Voltage (PDC)	Pulse Width (ms)	Amps Drawn	# WAE[2]	CPUE WAE[3]
69-0114	St. Louis	Cadotte	325.0	18.0	28-Apr-03	44	32.2	7805	1061	5	4	212 / 279	97.8 / 128.7
					29-Apr-03	44	31.8	6230	1061	5	4	220 / 294	126.5 / 169.9
					30-Apr-03	48	38.3	7737	1061	5	3	457 / 477	212.6 / 221.9
					01-May-03	48	30.5	7836	1061	7	4	449 / 456	205.8 / 209.5
					02-May-03	50	31.0	7530	1061	6	4	536 / 545	256.3 / 260.6
38-0219	Lake	Silver Island	1102.0	15.0	03-May-03	47	47.8 / 38.1	20495	1061	5.5	4	305 / 366	53.6 / 64.3
					04-May-03	47	36.8	6657	1061	5.5	4	220 / 227	119.0 / 122.8
16-0360	Cook	Caribou	728.0	30.0	05-May-03	43	63.5	16072	884	4	4	259 / 261	58.0 / 58.5
					06-May-03	45	55.1	10771	884	4	4	238 / 252	79.5 / 84.2
16-0252	Cook	Pike	810.0	45.0	06-May-03	43	64.2	8873	1061	5	3	250 / 250	101.4 / 101.4
					07-May-03	45	45.3	12697	884	4.5	4	297 / 309	84.2 / 87.6
					08-May-03	45	75.0	8764	1061	5	3	292 / 292	119.9 / 119.9

[1] Water conductivity measured in microSiemens / cm

[2] WAE = walleye. Numbers in column represent the number of "stock" sized walleye (>254mm (10 inches)) collected / the total number of walleye collected, including individuals < 10 inches.

[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)) / CPUE of all walleye sampled, including those < 10 inches.

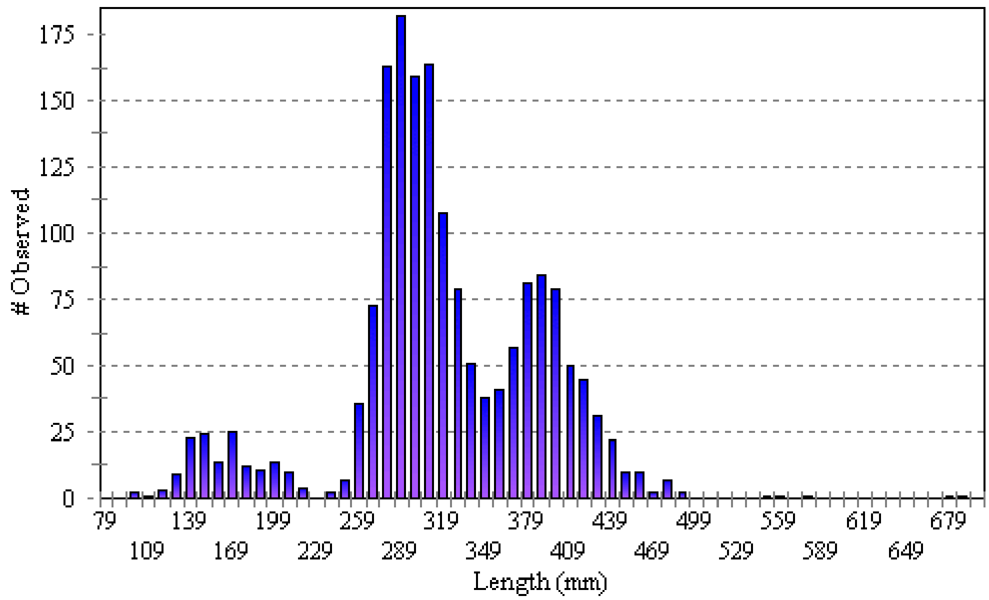


Figure 2. Length frequency distribution of walleye sampled from Cadotte Lake, St. Louis County, MN, during Spring 2003 electrofishing assessments.

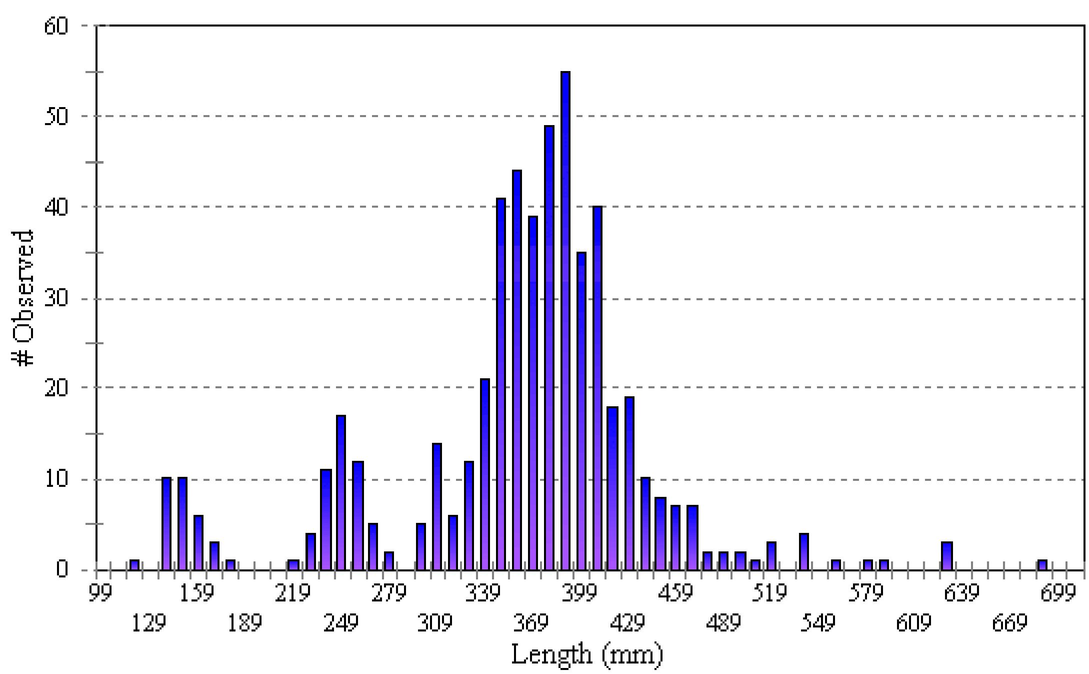


Figure 4. Length frequency distribution of walleye sampled from Silver Island Lake, Lake County, MN, during Spring 2003 electrofishing assessments.

sampled in the gill nets larger than 254mm, 21 were observed to have the mark from the spring sampling. The adjusted Petersen estimate using both the summer and spring data is 8049 ± 3872, with a 18.7% CV (Table 2). The Schumacker and Eschmeyer population estimate from the gill net data is 4487 (Table 2), which is closer to the spring estimate. The Petersen estimate is likely greater than the spring estimate due to relatively few recaptured individuals. This is not nearly as problematic with the Schumacker and Eschmeyer population estimate as this estimate relies upon all sampling dates.

Table 3 presents the age data for the walleye collected from Cadotte Lake. Of the 1735 fish sampled, 1052 were assigned to ages 2 and 3. Only 212 fish were assigned ages 5 or older. This suggests that either fishing pressure may be excessive, or a few very strong year classes are recruiting into the fishery. Table 4 presents back-calculated lengths at each age class for walleye collected from Cadotte Lake.

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 21.6 ± 2.0 (Table 5) suggests the population is unbalanced (Anderson and Weithman 1978), characterized by small individuals (RSD S-Q = 78.4 ± 2.0) (Table 5). The summer gill net PSD (27.7 ± 8.3) also suggests that the Cadotte Lake walleye population is unbalanced, characterized by small individuals (RSD S-Q = 72.3 ± 8.3) (Table 5), and is not significantly different than the PSD estimate from the spring electrofishing survey (χ^2=2.21, P>0.05, critical Chi-square value of 3.841). No significant differences were observed in any of the RSD metrics between the electrofishing and gill net assessments.

Table 2. Walleye population estimates for Cadotte Lake (St. Louis County), Silver Island (Lake County), and Caribou and Pike Lakes (Cook County), Spring 2003. 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.

Lake	Population Estimate #1[1]	95% Confidence Limits Upper	Lower	Population Estimate #2[2]	C.V.[3]
Cadotte - EF	4044	4309	3809	4016 ± 831	6.6 %
Cadotte - GN	4487	6097	3550	8049 ± 3872	18.7 %
Silver Island - EF	1137	1137[4]	1137	1127 ± 1565	10.9 %
Silver Island - GN	2063	49342[5]	1054	5179 ± 6137	27.5%
Caribou - EF	1027	1027[4]	1027	1019 ± 1419	11.0 %
Pike - EF	1229	2789	788	1124 ± 332	6.4%
Pike - GN	1444	4458	862	3159 ± 2303	22.9%

1 Schumacher and Eschmeyer population estimate.
2 Adjusted Petersen population estimate.
3 Coefficient of variation for the Petersen estimate.
4 Upper and Lower 95% Confidence Limits are the same due to only 1 degree of freedom.
5 Due to low sample size of only 12 recaptured individuals, 80% Confidence Limits had to be calculated for the Silver Island gill net assessment.

Table 4. Back-calculated lengths at each age class for walleye collected from Cadotte Lake, St, Louis County, Minnesota, Spring 2003.

Age Class	N	Length (mm)	Length (in)
1	192	136	5.4
2	147	235	9.3
3	125	309	12.2
4	102	362	14.2
5	75	405	15.9
6	44	421	16.6
7	29	439	17.3
8	16	460	18.1
9	8	508	20.0
10	4	559	22.0
11	3	617	24.3
12	1	671	26.4

Table 3. Age frequency distribution of walleye from Cadotte Lake, St. Louis County, spring 2003, based upon the number of fish sampled and aged per size category.

Length Group Inches	mm	N Sampled	Ages	1	2	3	4	5	6	7	8	9	10	11	12
3	89	1	1-1	1											
4	101	3		3											
4.5	114	5	3-1	5											
5	127	28	7-1	28											
5.5	140	26	6-1	26											
6	152	23	6-1	23											
6.5	165	25	7-1	25											
7	178	14	5-1, 1-2	12	2										
7.5	191	14	4-1	14											
8	203	12	6-1, 1-2	10	2										
8.5	216	0													
9	229	3	1-2		3										
9.5	241	17	4-2		17										
10	254	74	6-2		74										
10.5	267	171	5-2		171										
11	279	236	4-2		236										
11.5	292	212	1-2, 5-3		35	177									
12	305	161	6-3			161									
12.5	318	99	6-3			99									
13	330	60	4-3			60									
13.5	343	51	2-3, 5-4			15	36								
14	356	66	6-4				66								
14.5	368	97	6-4				97								
15	381	118	7-4, 1-5				103	15							
15.5	394	67	2-4, 4-5, 1-6				19	38	10						
16	406	63	7-5, 1-6, 3-7, 2-8					34	5	14	10				
16.5	419	36	1-4, 8-5, 1-6, 1-7				3	26	3	3					
17	432	29	4-5, 7-6, 6-7, 2-8, 2-9					5	10	8	3	3			
17.5	445	9	2-5, 2-6, 1-7, 3-8					2	2	1	3				
18	457	5	1-5, 1-6, 1-8, 1-10					1	1		1		1		
18.5	470	8	3-5, 1-6, 1-7, 1-9					4	1	1		1			
19	483	1	1-5					1							
19.5	495	0													
20	508	0													
20.5	521	0													
21	533	0													
21.5	546	2	1-7, 1-11							1				1	
22	559	0										1			
22.5	572	1	1-9												
23.0	584	0													
23.5	597	0													
26	660	1	1-12												1
26.5	673	1	1-11											1	
TOTAL		1735		147	540	512	324	126	32	28	17	5	1	2	1

Table 5. Proportional Stock Density (PSD) and Relative Stock Densities (RSD) with 95% confidence intervals for walleye sampled from Cadotte Lake, St. Louis County; Silver Island Lake, Lake County; and Caribou, and Pike Lakes, Cook County, Minnesota. Values are for spring electrofishing (EF) in 2003 and MN DNR gill netting (GN) during summer 2003, except for the 1999 electrofishing (EF) sample from Pike Lake and the 1998 electrofishing and gill net samples from Caribou Lake.

Lake	PSD	RSD S-Q	RSD Q-P	RSD P-M	RSD M-T
Cadotte - EF_{2003}	21.6 ± 2.0	78.4 ± 2.0	21.3 ± 2.0	0.2 ± 0.2	0.1 ± 0.2
Cadotte - GN_{2003}	27.7 ± 8.3	72.3 ± 8.3	26.8 ± 8.2	0.9 ± 1.7	0.0 ± 0.0
S. Island - EF_{2003}	45.4 ± 4.5	54.6 ± 4.6	42.8 ± 4.5	2.4 ± 1.4	0.2 ± 0.4
S. Island - GN_{2003}	33.8 ± 8.4	66.1 ± 8.4	30.6 ± 8.2	2.5 ± 2.8	0.8 ± 1.6
Caribou - EF_{2003}	67.7 ± 4.4	32.3 ± 4.4	66.1 ± 4.4	1.4 ± 1.1	0.2 ± 0.4
Caribou - GN_{2003}	28.6 ± 15.0	71.4 ± 15.0	25.7 ± 14.5	2.9 ± 5.5	0.0 ± 0.0
Caribou - EF_{1998}	41.1 ± 4.2	58.9 ± 4.2	36.5 ± 4.1	4.3 ± 1.7	0.4 ± 0.5
Caribou - GN_{1998}	8.9 ± 4.4	91.1 ± 4.4	8.9 ± 4.4	0.0 ± 0.0	0.0 ± 0.0
Pike - EF_{2003}	68.6 ± 3.8	31.4 ± 3.8	58.4 ± 4.0	9.5 ± 2.4	0.7 ± 0.7
Pike - GN_{2003}	41.5 ± 12.0	58.5 ± 12.0	35.4 ± 11.6	6.2 ± 5.8	0.0 ± 0.0
Pike - EF_{1999}	60.3 ± 3.1	39.7 ± 3.1	50.5 ± 3.2	7.9 ± 1.7	2.0 ± 0.9

Silver Island Lake

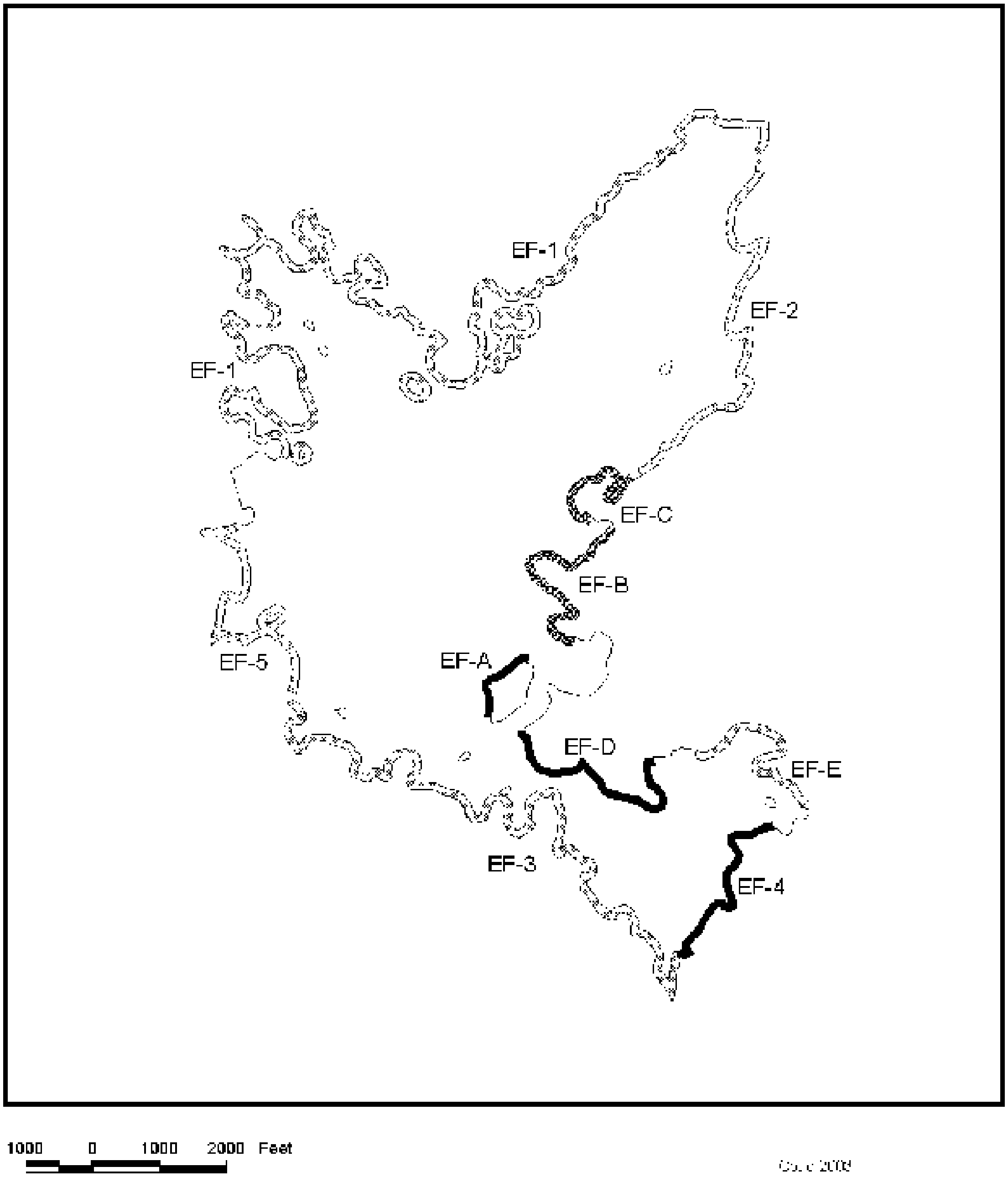
Electrofishing activities were conducted on Silver Island Lake on 3 and 4 May (Figure 3). Dates of electrofishing activities, mean water temperature, mean water conductivity, shocking time, the voltage and amps, the number of walleye collected, and the number caught per hour of electrofishing (CPUE) are presented in Table 1. CPUE for each night ranged from 53.6 to 119.0 adults per hour and 64.3 to 122.8 total walleye per hour of sampling (Table 1). At an 80% confidence interval, mean CPUE for Silver Island Lake, determined using each sampling station, was 92.9 ± 29.4 adults per hour and 102.5 ± 31.6 total walleye per hour of sampling effort. Additional species observed included yellow perch, white sucker, northern pike, burbot, black crappie, and rock bass. Of note, one walleye was collected with a healed dorsal fin clip. We assume this fish came from a previous survey conducted on Windy Lake, via T Lake.

The length frequency of the walleye sampled is presented in Figure 4.

Catch rates among the sampling stations varied. Catch rates were highest along stations EF-4, EF-A, EF-C, and EF-D, and were lowest along stations EF-2, EF-5, and EF-E (Figure 3).

Table 2 presents the population estimates based upon mark-recapture data. The electrofishing Schumacker and Eschmeyer population estimate is 1137 (Table 2). The electrofishing adjusted Petersen estimate is 1127 ± 1565, with an 10.9% CV (Table 2). Our sampling covered most of the habitat available for use by spawning walleyes.

In July 2003, the Minnesota Department of Natural Resources performed a standardized net assessment on Silver Island Lake (Don Smith and Ron Van Bergen, MN DNR, Finland Area



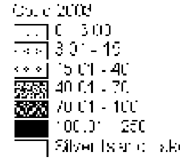


Figure 3: Electrofishing catch-per-unit-effort (CPUE, #/hour) of adult walleye on Silver Island Lake, Lake County, Spring 2003.

Fisheries). Of 121 walleye sampled in the gill nets larger than 254mm, 10 were observed to have the mark from the spring sampling. The adjusted Petersen estimate from the summer data is 5179 ± 6137, with a 27.5% CV (Table 2). Not much weight should be placed on this estimate because of the large confidence interval, due to the relatively few recaptured individuals.

Table 6 presents the age data for the walleye collected from Silver Island Lake. Table 7 presents back-calculated lengths at each age class for walleye collected from Silver Island Lake.

PSD and RSD values determined by our spring electrofishing sampling are presented in Table 5. The electrofishing PSD of 45.4 ± 4.6 (Table 5) suggests the population is balanced (Anderson and Weithman 1978), with a significant portion of stock-length fish (RSD S-Q = 54.6 ± 4.6) recruiting to the fishery.

Comparing the two gear types in 2003, i.e. gill nets and electrofishing, significant differences in the proportion of "quality" length fish were observed (Table 5). The 2003 spring electrofishing survey ($PSD_{EF\ 2003}$ = 45.4) sampled walleye larger than 381 mm (15.0 inches) in a greater proportion than did the 2003 summer gill net assessments ($PSD_{GN\ 2003}$ = 33.8) (χ^2=5.21, P>0.05, critical Chi-square value of 3.841). Both gear types suggest that there is a large proportion of 10 - 15 inch walleye either recruiting into the fishery, or angling pressure is harvesting a large proportion of the walleye that have fully recruited into the fishery. As we do not have any fall data from Silver Island, we know nothing about year classes and recruitment patterns on this lake. Further study will help managers better understand this walleye population.

Table 7. Back-calculated lengths at each age class for walleye collected from Silver Island Lake, Lake County, Minnesota, Spring 2003.

Age Class	N	Length (mm)	Length (in)
1	161	121	4.8
2	161	206	8.1
3	146	278	10.9
4	114	336	13.2
5	88	380	15.0
6	53	414	16.3
7	36	443	17.4
8	25	472	18.6
9	14	487	19.2
10	10	523	20.6
11	6	537	21.1
12	5	561	22.1
13	3	563	22.2
14	2	557	21.9
15	2	581	22.9

Table 6. Age frequency distribution of walleye from Silver Island Lake, Lake County, spring 2003, based upon the number of fish sampled and aged per size category.

Length Group Inches	Length Group mm	N Sampled	Ages	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
4.5	114	1		1														
5	127	10	4-1	10														
5.5	140	11	5-1	11														
6	152	7	5-1	7														
6.5	165	2	1-1	2														
7	178	0																
7.5	191	0																
8	203	0																
8.5	216	5	1-2		5													
9	229	12	1-2		12													
9.5	241	20	11-2, 1-3		18	2												
10	254	12	2-2, 7-3		3	9												
10.5	267	3	3-3			3												
11	279	1	1-3			1												
11.5	292	9	7-3			9												
12	305	14	11-3			14												
12.5	318	13	3-4				13											
13	330	35	2-3, 6-4			9	26											
13.5	343	50	10-4, 1-5				45	5										
14	356	49	5-4, 6-5				22	27										
14.5	368	68	1-4, 9-5				7	61										
15	381	57	4-5, 1-6					46	11									
15.5	394	49	11-5, 2-6					41	8									
16	406	34	1-5, 6-6, 1-7					4	26	4								
16.5	419	21	3-5, 4-6, 3-7					6	9	6								
17	432	11	1-6, 2-7, 1-8, 1-9						2	5	2	2						
17.5	445	11	1-4, 3-6, 2-7, 1-8				1		5	4	1							
18	457	8	2-7, 2-8, 1-9							3	3	2						
18.5	470	3	1-8, 1-9, 1-10								1	1	1					
19	483	3	2-8, 1-9								2	1						
19.5	495	1	1-8								1							
20	508	3	1-7, 1-8, 1-10							1	1		1					
20.5	521	2	1-12												2			
21	533	2	1-8, 1-15								1							1
21.5	546	1	1-11											1				
22	559	1	1-8								1							
22.5	572	0																
23.0	584	1	1-10										1					
23.5	597	0																
24	610	0																
24.5	622	3	1-13, 1-15													1		1
26.5	673	1	1-12												1			
TOTAL		534		31	21	47	114	190	61	23	13	6	3	1	3	1	0	2

Caribou Lake

Electrofishing activities were conducted on Caribou Lake on 5 and 6 May (Figure 5). Table 1 presents mean water temperature, conductivity, number of walleye sampled, and CPUE for walleye. CPUE for each night ranged from 58.0 to 79.5 adults per hour and 58.5 to 84.2 total walleye per hour of sampling (Table 1). At an 80% confidence interval, mean CPUE for Caribou Lake, determined using catch data from each sampling station, was 67.7 ± 15.2 adults per hour and 67.7 ± 15.4 total walleye per hour of sampling effort. Length frequency data of walleye collected is presented in Figure 6. Additional species observed included smallmouth bass, yellow perch, white sucker, northern pike, and black crappie.

Catch rates among the sampling stations varied. Catch rates for walleye of all sizes were high among the stations sampled (Figure 5). Catch rates were highest along stations EF-1, EF-2, EF-A, and EF-C, and were lowest along stations EF-3, EF-4, and EF-4' (Figure 5).

Table 8 presents the age frequency distribution. Back-calculated length-at-age estimates are presented in Table 9.

Table 2 presents the two population estimates based upon mark-recapture data. The electrofishing Schumacker and Eschmeyer population estimate is 1027 (Table 2). The electrofishing adjusted Petersen estimate is 1019 ± 1419, with a 11.0% CV (Table 2).

In July 2003, the Minnesota Department of Natural Resources performed a standardized net assessment on Caribou Lake (Paul Eiler and Steve Persons, MN DNR, Finland Area Fisheries). Unfortunately, no recaptured individuals were noted in the field sheets, and it was unclear as to whether data simply wasn't recorded or no recaptured individuals were sampled.

In 1998, we performed similar spring electrofishing assessments on Caribou Lake (Borkholder and Edwards 1999). The Schumacker and Eschmeyer population estimate we calculated in 1998 was 874, with upper and lower 95% confidence limits of 1631 and 597, respectively, and the Petersen estimate of 937 (CV 7.1%) (Borkholder and Edwards 1999). Comparing our 1998 estimates with those from this year's assessments, it appears that the abundance of spawning adult walleye has not changed noticeably since 1998. Our fall age-0 and age-1 walleye survey results suggest that recruitment has been inconsistent recently, with relatively few strong year classes observed over the last 6 years. Strong age-0 cohorts were observed in 1998, 1999, 2001, and 2002, but were not subsequently observed as age-1 individuals.

PSD and RSD values determined by our spring electrofishing sampling are presented in Table 5. Samples collected by electrofishing during spring 1998 and again in 2003 (PSD_{1998} = 41.1 ± 4.2, PSD_{2003} = 67.7 ± 4.4) showed significant differences in PSD values between the two

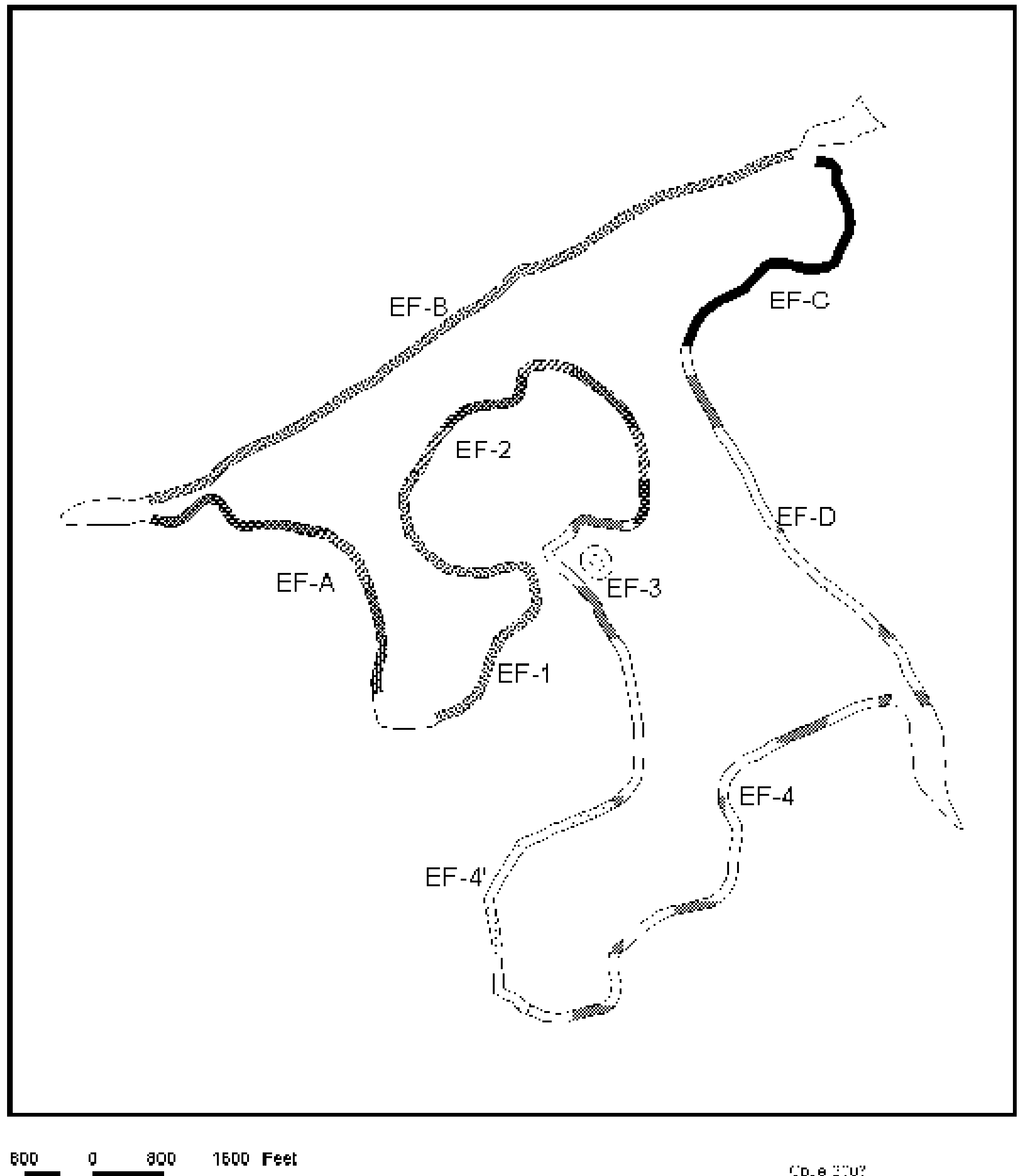


Figure 5: Electrofishing catch-per-unit-effort (CPUE, #/hour) of adult walleye on Caribou Lake, Cook County, Spring 2003.

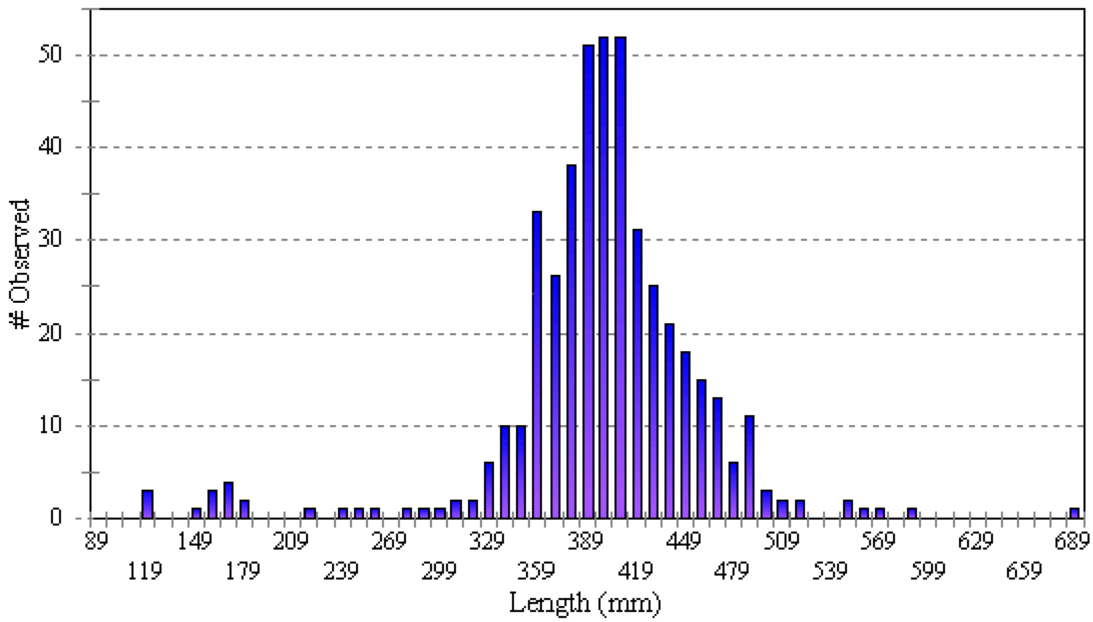


Figure 6. Length frequency distribution of walleye sampled from Caribou Lake, Cook County, MN, during Spring 2003 electrofishing assessments.

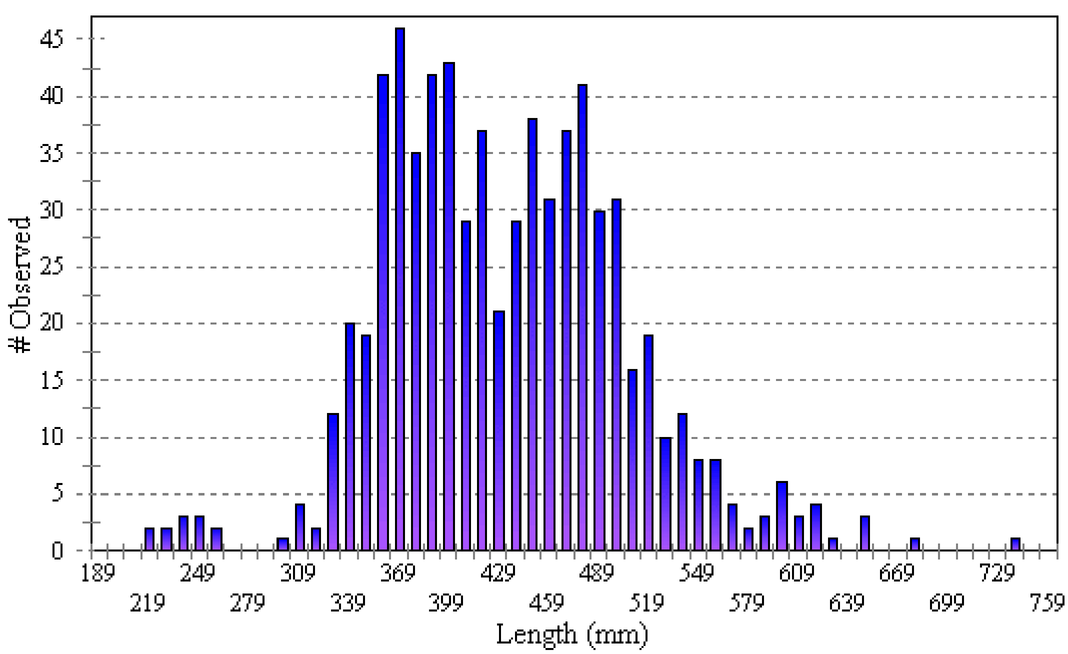


Figure 8. Length frequency distribution of walleye sampled from Pike Lake, Cook County, MN, during Spring 2003 electrofishing assessments.

Table 3. Age frequency distribution of walleye from Caribou Lake, Cook County, spring 2003, based upon the number of fish sampled and aged per size category.

Length Group Inches	mm	N Sampled	Ages	1	2	3	4	5	6	7	8	9	10	11	16
4.5	114	3	3-1	3											
5.0	127	0													
5.5	140	1	1-1	1											
6.0	152	4	4-1	4											
6.5	165	4	4-1	4											
7.0	178	1	1-1	1											
7.5	191	0													
8.0	203	0													
8.5	216	1	1-2		1										
9.0	229	1	1-2		1										
9.5	241	2	1-2, 1-3		1	1									
10.0	254	0													
10.5	267	1	1-2		1										
11.0	279	1	1-3			1									
11.5	292	1	1-3			1									
12.0	305	3	2-3			3									
12.5	318	7	2-3, 3-4			3	4								
13.0	330	14	6-3, 1-4			12	2								
13.5	343	19	2-3, 5-4, 1-5			5	12	2							
14.0	356	41	1-3, 7-4			5	36								
14.5	368	54	6-4, 3-5				36	18							
15.0	381	68	5-4, 1-5				57	11							
15.5	394	59	5-4, 3-5				37	11							
16.0	406	47	1-4, 9-5, 1-6				4	39	4						
16.5	419	32	1-4, 9-5, 3-6				3	22	7						
17.0	432	26	1-4, 2-5, 2-6, 1-8, 1-9				4	7	7		4	4			
17.5	445	18	1-5, 2-6, 3-7, 1-8					3	4	8	3				
18.0	457	17	2-6, 2-7, 1-8, 1-9, 1-10						5	5	2	2	2		
18.5	470	9	2-7, 3-8							4	5				
19.0	483	9	2-7, 2-8, 1-11						1		2	2			
19.5	495	5	1-6, 2-8, 2-9						1		2	2			
20.0	508	2	2-8								2				
20.5	521	0													
21.0	533	1	1-7							1					
21.5	546	2	2-9									2			
22.0	559	1	1-9									1			
22.5	572	1	1-10										1		
23.0	584	0													
23.5	597	0													
26.5	673	1	1-16												1
TOTAL		453		9	4	31	195	113	29	18	20	13	3	0	1

Table 9. Back-calculated lengths at each age class for walleye collected from Caribou Lake, Cook County, Minnesota, Spring 2003.

Age Class	N	Length (mm)	Length (in)
1	124	113	4.4
2	124	204	8.0
3	123	287	11.3
4	107	355	14.0
5	72	400	15.7
6	43	434	17.1
7	32	463	18.2
8	23	485	19.1
9	11	511	20.1
10	4	530	20.9
11	2	547	21.5
12	1	617	24.3
13	1	635	25.0
14	1	647	25.5
15	1	666	26.2
16	1	680	26.8

years (χ^2 = 68.50, P<0.05, critical Chi-square value of 3.841) (Table 5). While significantly different, both spring samples suggest well-balanced walleye populations, with the 2003 sample having a higher proportion of "quality" length walleye than the 1998 sample.

Significant differences in PSD metrics were observed between the two gear types, gill nets and electrofishing (χ^2 = 21.58, P<0.05, critical Chi-square value of 3.841) (Table 5). Between the two gear types in 2003, only 8 individuals were sampled larger than 508 mm (20.0 inches). In 1998, we observed 25 individuals larger than 508 mm in the electrofishing sample. In both spring surveys, all of the available walleye spawning habitat was sampled, and large numbers of spawning walleye were collected during both assessments. This may reflect a situation where either mortality (angling harvest) is cropping out the larger individuals from the population, or food resources are limited. Many small yellow perch and shiners were observed, suggesting that food resources may not be limiting growth of walleye. Growth rates at the earliest ages do not appear to be too slow, thus suggesting that angling mortality might be limiting this population. Future studies are being planned to address this situation, e.g. a tagging study beginning in 2005.

Pike Lake

Electrofishing activities were conducted on Pike Lake on 6, 7, and 8 May (Figure 7). Table 1 presents mean water temperature, conductivity, number of walleye sampled, and CPUE for walleye. CPUE for each night ranged from 84.2 to 119.9 adults per hour and 87.6 to 119.9 total walleye per hour of sampling (Table 1). At an 80% confidence interval, mean CPUE for Pike Lake, determined using catch data from each sampling station, was 98.7 ± 17.6 adults per hour and 99.8 ± 17.4 total walleye per hour of sampling effort. Additional species observed included smallmouth bass, northern pike, and white sucker.

Catch rates among the sampling stations varied, but were all consistently higher than average. We did not sample the shallow, muck-bottomed bay at the far west end of the lake (EF-0, Figure 7).

Length frequency data of walleye collected is presented in Figure 8. Age frequency data is in Table 10. Back-calculated length at age estimates are presented in Table 11.

Table 2 presents the two population estimates based upon mark-recapture data. The electrofishing Schumacker and Eschmeyer population estimate is 1229 (Table 2). The electrofishing adjusted Petersen estimate is comparable at 1124 ± 332, with a 6.4% CV (Table 2).

In July 2003, the Minnesota Department of Natural Resources performed a standardized net assessment on Pike Lake (Paul Eiler and Steve Persons, MN DNR, Finland Area Fisheries). Using just the gill net data, of 65 sampled walleye larger than 254mm (10.0 inches), 13 were observed to have a clipped anal spine. Two individuals were also noted with the 1999 dorsal fin clip. These data provided an adjusted Petersen estimate of 3159 ± 2303 (22.9% CV, Table 2) and a Schumacker and Eschmeyer population estimate of 1444 (Table 2).

PSD and RSD values determined by our spring electrofishing sampling are presented in Table 5. Samples collected by electrofishing during spring 1999 and again in 2003 (PSD_{1999} = 60.3 ± 3.1, PSD_{2003} = 68.6 ± 3.8) did show a significant difference in PSD values between the two years (χ^2 = 8.53, P<0.05, critical Chi-square value of 3.841) (Table 5). While significant, these differences are not great, and suggest that there has not been a real change in the population structure of Pike Lake in the past four years.

Comparing the two gear types in 2003, significant differences in the proportion of "quality" length fish were observed between the electrofishing collection and the gill net surveys (χ^2 = 19.06, P<0.05, Chi-square value of 3.841) (Table 5). Differences between the two gear types were noted only in the RSD Q-P metric (χ^2 = -4.37, P<0.05, Chi-square value of -1.645). The gill net assessment suggests that there were significantly higher proportion of walleye in the 10 to 15 inch group, relative to all walleye larger than 10 inches, than was observed in the electrofishing assessment.

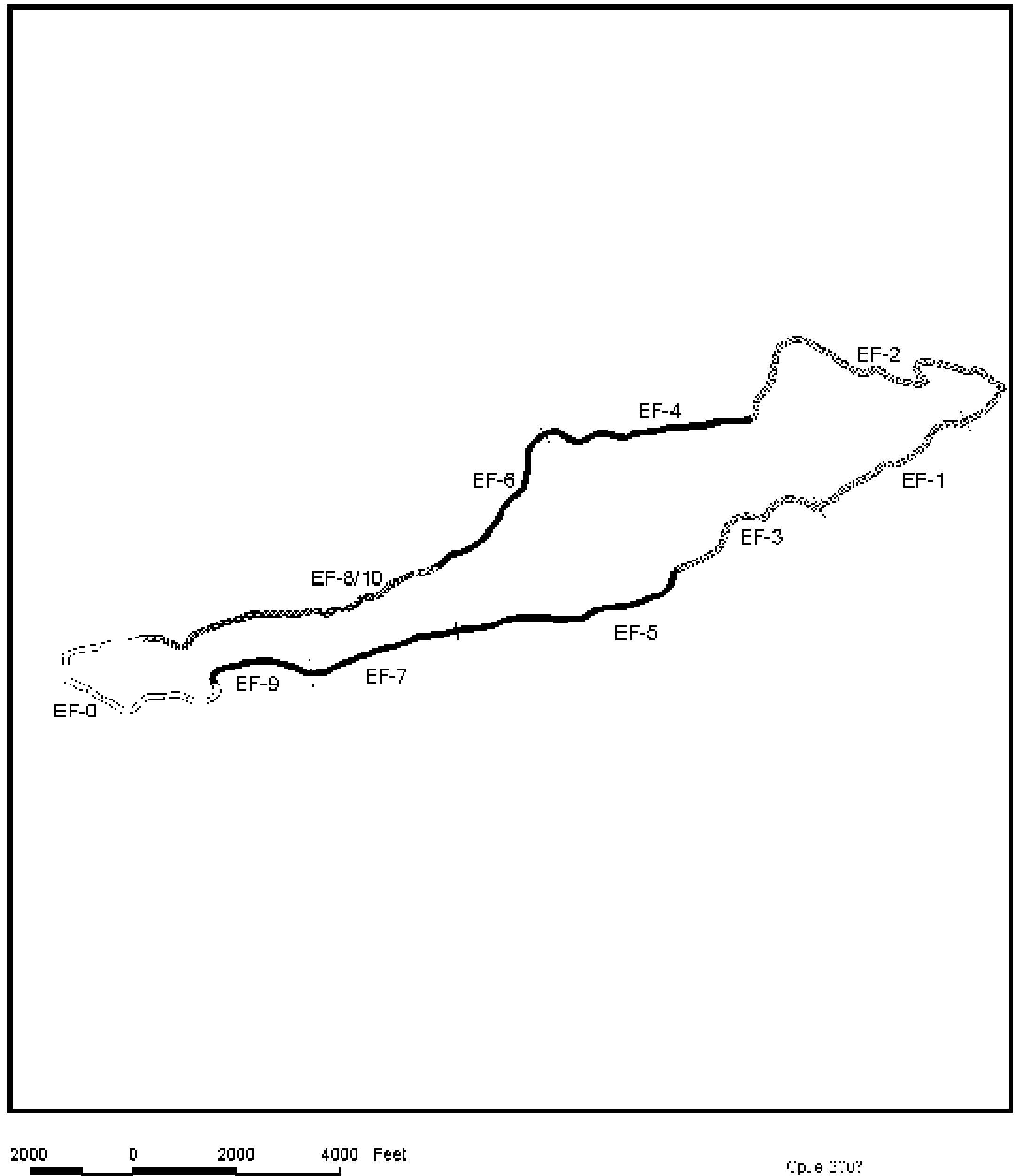


Figure 7: Electrofishing catch-per-unit-effort (CPUE, #/hour) of adult walleye on Pike Lake, Cook County, Spring 2003.

Table 10. Age frequency distribution of walleye from Pike Lake, Cook County, spring 2003, based upon the number of fish sampled and aged per size category.

Length Group Inches	mm	N Sampled	Ages	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
8	203	0																		
8.5	216	4			4															
9	229	3			3															
9.5	241	5	1-2		5															
10	254	0																		
10.5	267	0																		
11	279	0																		
11.5	292	2	1-3			2														
12	305	5	1-3, 3-4			1	4													
12.5	318	12	1-3, 4-4			2	10													
13	330	26	3-4, 1-5				20	6												
13.5	343	39	8-4, 2-5				31	8												
14	356	56	5-4, 4-5				31	25												
14.5	368	41	3-4, 6-5				14	27												
15	381	58	2-4, 3-5				23	35												
15.5	394	46	1-4, 6-5, 1-6				6	34	6											
16	406	43	7-5, 2-6					33	10											
16.5	419	29	4-5, 1-6					23	6											
17	432	40	1-5, 1-6, 2-7, 5-8, 1-11					4	4	8	20	4								
17.5	445	41	1-6, 1-7, 7-8, 2-9						4	4	25	8								
18	457	47	1-5, 2-7, 7-8, 1-12					4		9	30				4					
18.5	470	52	1-7, 6-8, 4-9, 1-11, 1-12							4	24	16		4	4					
19	483	36	2-7, 7-8, 2-9, 2-10, 3-11, 1-12							4	15	4	4	6	3					
19.5	495	27	1-6, 2-7, 3-8, 3-9, 4-10, 2-11, 2-12						2	3	5	5	6	3	3					
20	508	25	1-6, 5-8, 4-9, 1-11, 1-12						2		10	8		2	2					
20.5	521	12	4-8, 1-10, 1-11, 3-12, 1-15, 1-17								4		1	1	3			1		1
21	533	16	1-7, 2-8, 3-9, 2-11, 8-12							1	2	3		2	8					
21.5	546	13	1-7, 3-8, 2-9, 1-12, 1-15							1	5	3			1			1		
22	559	5	2-8, 1-9, 2-12								2	1			2					
22.5	572	2	1-12												2					
23.0	584	8	1-8, 4-9, 1-10, 2-11								1	4	1	2						
23.5	597	4	1-11, 3-12											1	3					
24	610	4	1-10, 1-12, 2-14										1		1		1			
24.5	622	1	1-12												1					
25	635	3	3-12												3					
25.5	648	1	1-14														1			
26	660	1	1-17																	1
26.5	673	0																		
TOTAL		703			12	5	139	199	34	34	143	56	13	21	40	0	2	2	0	2

Table 11. Back-calculated lengths at each age class for walleye collected from Pike Lake, Cook County, Minnesota, Spring 2003.

Age Class	N	Length (mm)	Length (in)
1	224	100	3.9
2	224	183	7.2
3	223	254	10.0
4	220	321	12.6
5	191	378	14.9
6	155	421	16.6
7	147	454	17.9
8	135	482	19.0
9	83	504	19.8
10	58	517	20.4
11	49	532	20.9
12	35	553	21.8
13	7	578	22.8
14	7	593	23.3
15	4	574	22.6
16	2	620	24.4
17	2	631	24.8

Fall Assessments

Table 12 shows a summary of each evening of electrofishing assessments. CPUE for age-0 walleye ranged from 0.0 fish per hour (Poplar and Prairie Lake) to 245.7 fish per hour of electrofishing (Ninemile Lake) (Table 12). CPUE for age-1 walleye ranged from 0.0 fish per hour (Poplar Lake) to 256.0 fish per hour of electrofishing (Ninemile Lake) (Table 12). Figures 9 - 35 present length frequency data for each of the twenty-seven lakes surveyed. Table 13 presents the mean length for age-0 and age-1 individuals sampled during fall 2003 assessments. Mean lengths for age-0 walleye ranged from 97 mm (3.8 inches, Homer Lake) to 169 mm (6.6 inches, Crooked Lake). Mean lengths for age-1 walleye ranged from 172 mm (6.8 inches, Homer Lake) to 250 mm (9.8 inches, Ninemile Lake).

Since initiating a regular fall electrofishing program for age-0 and age-1 walleye in 1995, and excluding lakes in years of stocking by the MN DNR and results from this year's assessments, our mean $CPUE_{Age-0}$ is 64.3, and our mean $CPUE_{1+}$ is 31.2. Using the mean $CPUE_{Age-0}$ as one criteria, average or better 2003 year classes were observed in 5 of the lakes (Table 12). Average or better 2002 year classes (age-1 walleye) were observed in approximately 11 lakes, including Windy Lake at a $CPUE_{1+}$ of 31.0 (Table 12). As data is collected in future MN DNR standard gill net surveys, we should gain further insight as to whether these presumed strong year classes are in fact well represented as adults.

Several studies have suggested that age-0 walleye need to reach a certain critical size to have a chance at surviving their first winter (Forney 1976; Madenjian et al. 1991). Both Forney (1976) and Madenjian et al. (1991) attributed overwinter size-selected mortality of age-0 walleye to cannibalism. Forney (1976) suggested that this critical size is 175 mm (6.9 inches) in Oneida Lake, New York. If the bulk of the age-0 cohort exceeded this total length by the end of the growing season, the duration of their exposure to cannibalism would be reduced, and recruitment would be relatively high (Forney 1976). If first year growth was slower, age-0 walleye would be exposed to cannibalism by older walleye for longer periods of time. In Mille Lacs Lake, MN, year classes with mean lengths greater than 140 mm (5.5 inches) have typically led to strong year classes (R. Bruesewitz, personal communication). The 1988 year class was 160 mm (6.3 inches) going into the first winter, and has been an exceptional year class, while the 1985 year class, 93 mm (3.7 inches) at the end of the fall, was essentially non-existent in subsequent years (R. Bruesewitz, personal communication).

The average mean length of age-0 walleye observed since 1995 in our electrofishing assessments is 130 mm in lakes not stocked by the DNR with fingerling walleye prior to our assessments. Using the mean length criteria of 130 mm for average year classes, average or better 2003 year classes may only be present in 7 of the lakes surveyed in 2003 (Table 13). In the future, we will be further investigating the predictive power mean length and CPUE of age-0 has on CPUE of 1+ the following sampling season in northern Minnesota lakes, with the goal of determining mean length and CPUE thresholds that can be used to predict year class strength. This will be possible as we continue to combine gill net data for adults from the DNR.

Continued monitoring of walleye young-of-the-year and year-1 fish will give a better picture over time as to the nature of the walleye populations in these lakes. Monitoring these lakes over time will give managers a better understanding of walleye population dynamics and recruitment, and the relationship between year-1 age-0 walleye abundance and year-2 age-1 walleye abundance.

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Table 12. Total number and catch-per-unit-effort of age-0 and age-1 walleye collected by the 1854 Authority and the Fond du Lac Division of Resource Management from twenty five lakes within the 1854 Ceded Territory of Northeastern Minnesota during Fall 2003.

Lake (County)	Date	Temp (^oC)	Conductivity[1]	On Time (sec)	#Age-0[2]	#1+[3]	$CPUE_{Age-0}$[4]	$CPUE_{1+}$[5]
Aspen (Cook)	16 September	18.9	55.3	3584	9	11	9.0	11.1
Ball Club (Cook)	10 September	20.0	33.0	4317	43	72	35.9	60.0
Cadotte (St. Louis)	17 September	20.0	41.4	8080	118	352	52.6	156.8
Caribou (Cook)	11 September	21.7	68.6	6582	71	46	38.8	25.2
Cascade (Cook)	8 September	18.3	29.8	5793	280	38	174.0	23.6
Crescent (Cook)	11 September	20.3	39.1	3392	3	20	3.2	21.2
Crooked (Lake)	1 October	9.4	52.1	4112	47	7	41.2	6.1
Devilfish (Cook)	9 September	18.3	20.2	10689	34	45	11.5	15.2
Dumbbell (Lake)	30 September	10.6	60.2	4680	89	31	68.5	23.9
Eagle (Carlton)	18 September	18.9	167.1	8916	10	74	4.0	29.9
Elbow (Cook)	10 September	18.9	38.9	3913	54	87	49.7	80.0
Fourmile (Lake)	2 October	7.8	56.6	7016	117	130	60.0	66.7
Homer (Cook)	8 September	20.0	36.1	5478	2	12	1.3	7.9
Island Lake Res. (St. Louis)	19 September	17.2	110.4 / 90.1	10384	169	141	58.6	48.9
Ninemile (Lake)	1 October	6.7	58.5	7018	479	20	245.7	10.3
North McDougal (Lake)	30 September	6.7	38.5	5015	39	57	28.0	37.3
Pike (Cook)	15 September	20.6	71.1	6012	6	55	3.6	32.9
Poplar (Cook)	16 September	19.2	45.0	5775	0	0	0.0	0.0
Prairie (St. Louis)	13 September	17.8	120.4	4549	0	14	0.0	11.1
Shagawa (St. Louis)	29 September	11.7	106.3	7744	15	84	7.0	39.1

Table 12. Continued.

Lake (County)	Date	Temp (^oC)	Conductivity[1]	On Time (sec)	#Age-0[2]	#1+[3]	$CPUE_{Age-0}$[4]	$CPUE_{1+}$[5]
Silver Island (Lake)	15 September	18.3	42.8	4245	47	47	39.9	39.9
Tom (Cook)	9 September	20.8	45.6	76566	50	48	23.5	22.6
Two Island (Cook)	10 September	21.1	44.8	6533	5	50	2.8	27.6
West Twin (Cook)	16 September	18.9	40.9	4097	134	20	117.7	17.6
Whiteface Res. (St. Louis)	12 September	20.6	66.0	6978	185	107	96.0	52.6
Wilson (Lake)	2 October	8.3	58.2	5249	6	25	4.1	17.2
Windy (Lake)	3 October	9.4	31.6	5347	28	45	18.2	31.0

[1] Conductivity, measured in FSiemens / 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 13. Mean length for age-0 and age-1 walleye sampled during fall 2003 assessments within the 1854 Ceded Territory of Northeastern Minnesota.

Lake (County)	Date	Age-0 Mean Length (mm)	Age-1 Mean Length (mm)
Aspen (Cook)	16 September	130	247
Ball Club (Cook)	10 September	116	214
Cadotte (St. Louis)	17 September	138	228
Caribou (Cook)	11 September	116	229
Cascade (Cook)	8 September	110	208
Crescent (Cook)	11 September	129	213
Crooked (Lake)	1 October	169	242
Devilfish (Cook)	9 September	109	201
Dumbbell (Lake)	30 September	125	213
Eagle (Carlton)	18 September	145	227
Elbow (Cook)	10 September	107	186
Fourmile (Lake)	2 October	130	231
Homer (Cook)	8 September	97	172
Island Lake (St. Louis)	19 September	125	198
Ninemile (Lake)	1 October	145	250
North McDougal (Lake)	30 September	123	192
Pike (Cook)	15 September	124	193
Poplar (Cook)	16 September	---	---
Prairie (St. Louis)	13 September	---	188
Shagawa (St. Louis)	29 September	145	182
Silver Island (Lake)	15 September	125	200
Tom (Cook)	9 September	108	200
Two Island (Cook)	10 September	120	197
West Twin (Cook)	16 September	123	222
Whiteface (St. Louis)	12 September	140	209
Wilson (Lake)	2 October	116	228
Windy (Lake)	3 October	127	214

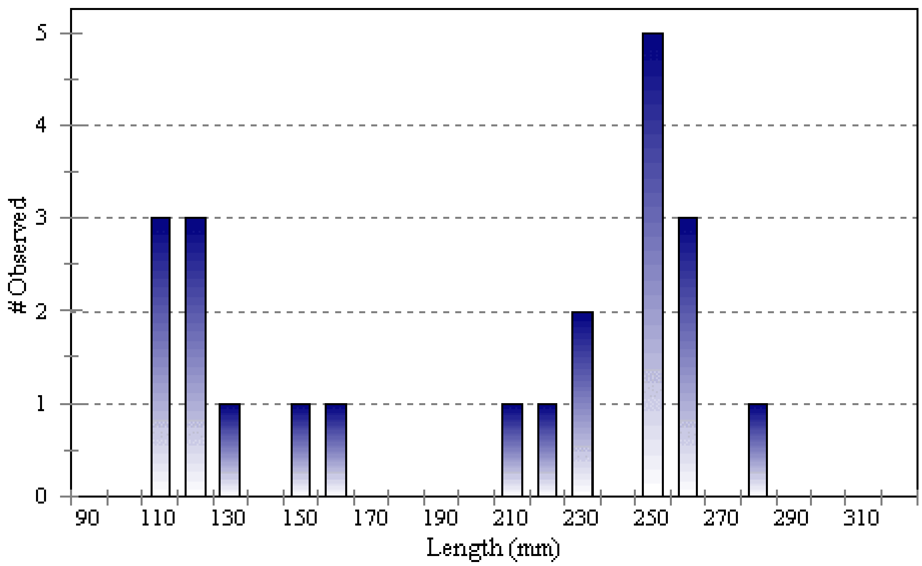

Figure 9. Length frequency distribution of walleye collected from Aspen Lake, Cook County, during fall 2003 electrofishing assessments.

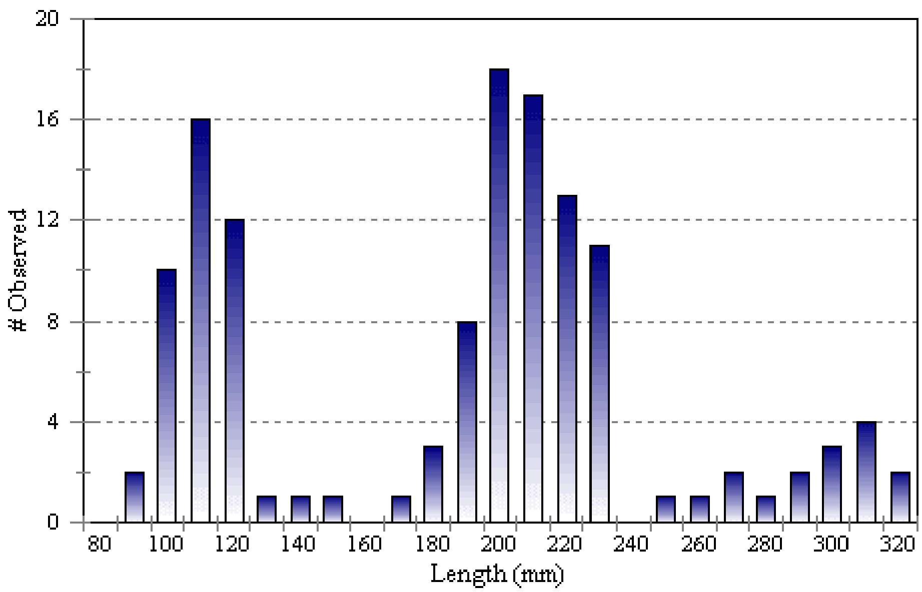

Figure 10. Length frequency distribution of walleye collected from Ball Club Lake, Cook County, during fall 2003 electrofishing assessments.

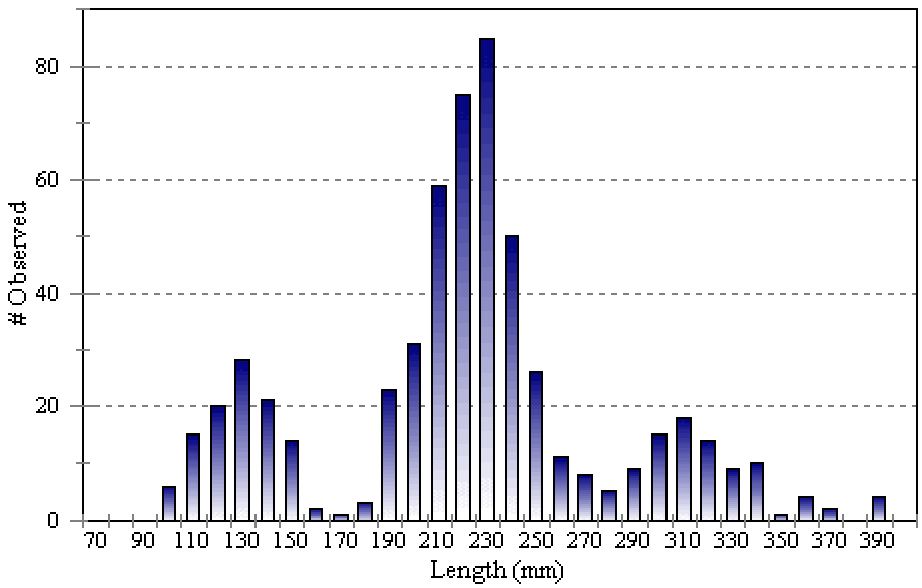

Figure 11. Length frequency distribution of walleye collected from Cadotte Lake, St. Louis County, during fall 2003 electrofishing assessments.

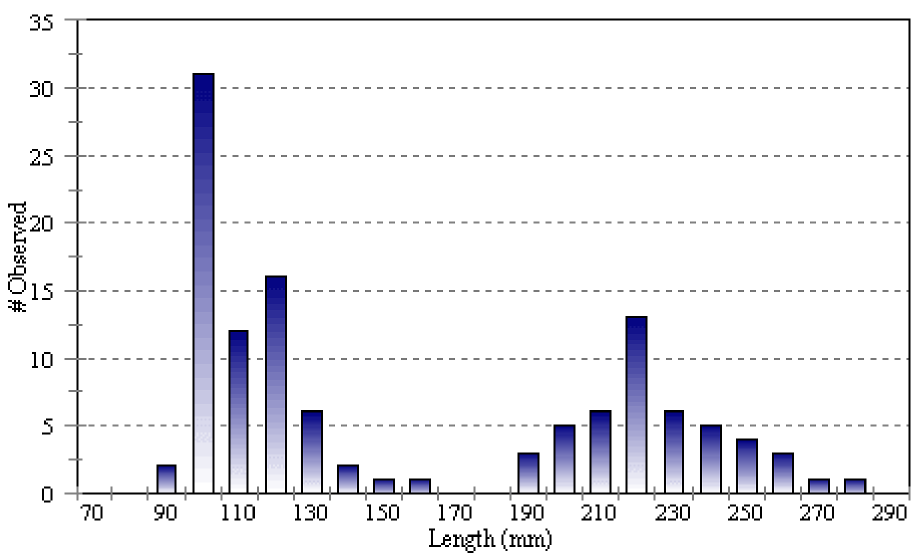

Figure 12. Length frequency distribution of walleye collected from Caribou Lake, Cook County, during fall 2003 electrofishing assessments.

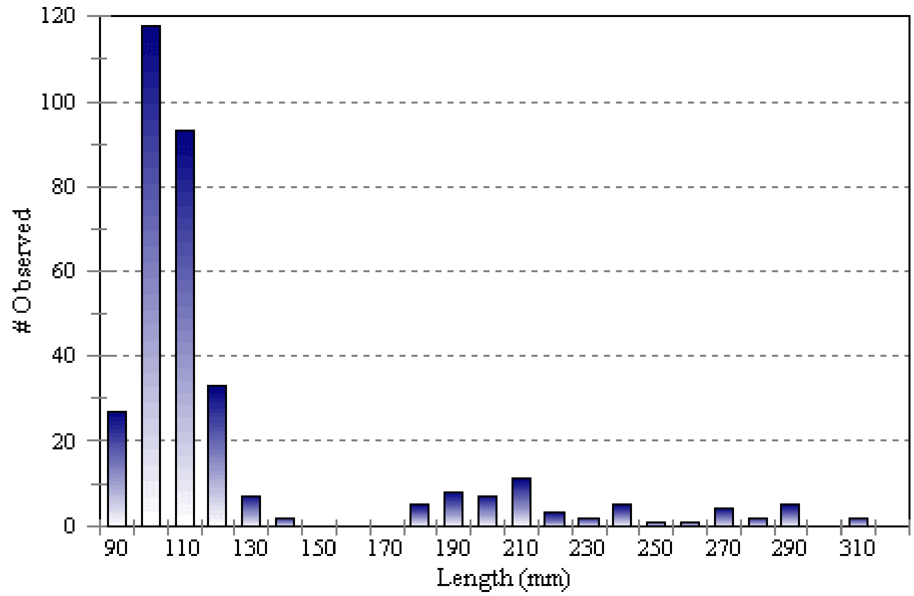

Figure 13. Length frequency distribution of walleye collected from Cascade Lake, Cook County, during fall 2003 electrofishing assessments.

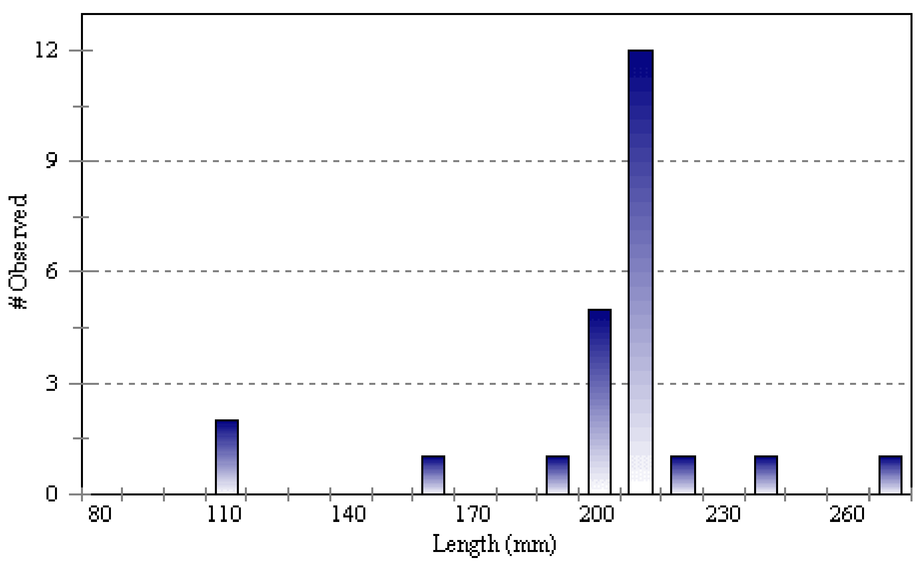

Figure 14. Length frequency distribution of walleye collected from Crescent Lake, Cook County, during fall 2003 electrofishing assessments.

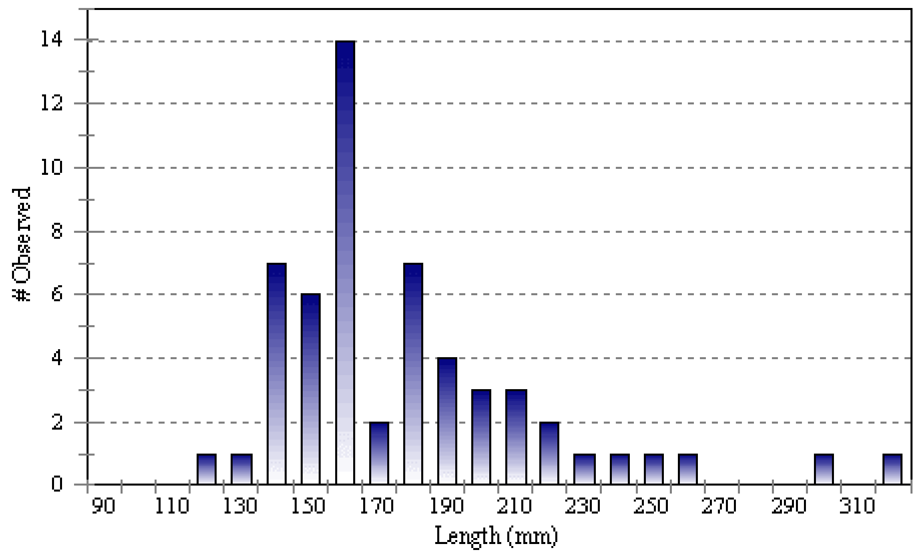

Figure 15. Length frequency distribution of walleye collected from Crooked Lake, Lake County, during fall 2003 electrofishing assessments.

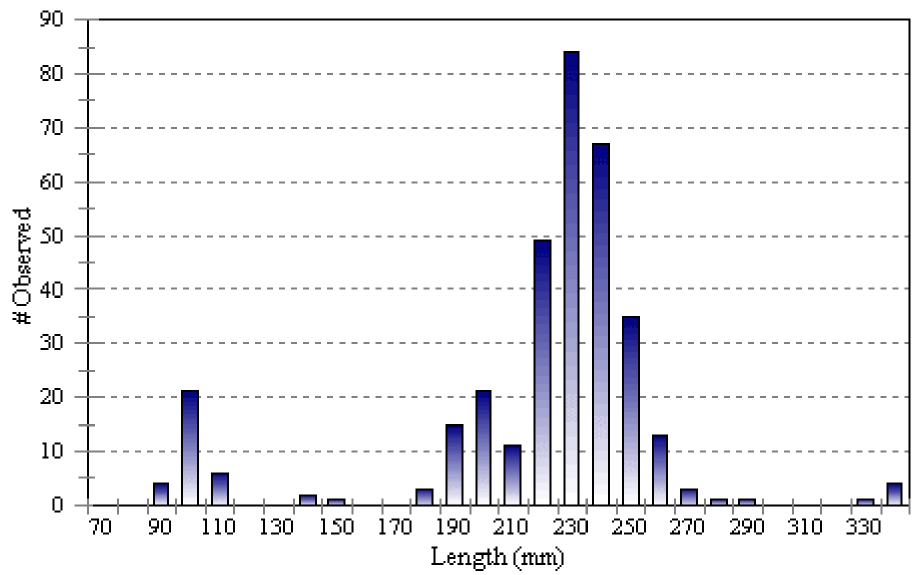

Figure 16. Length frequency distribution of walleye collected from Devilfish Lake, Cook County, during fall 2003 electrofishing assessments.

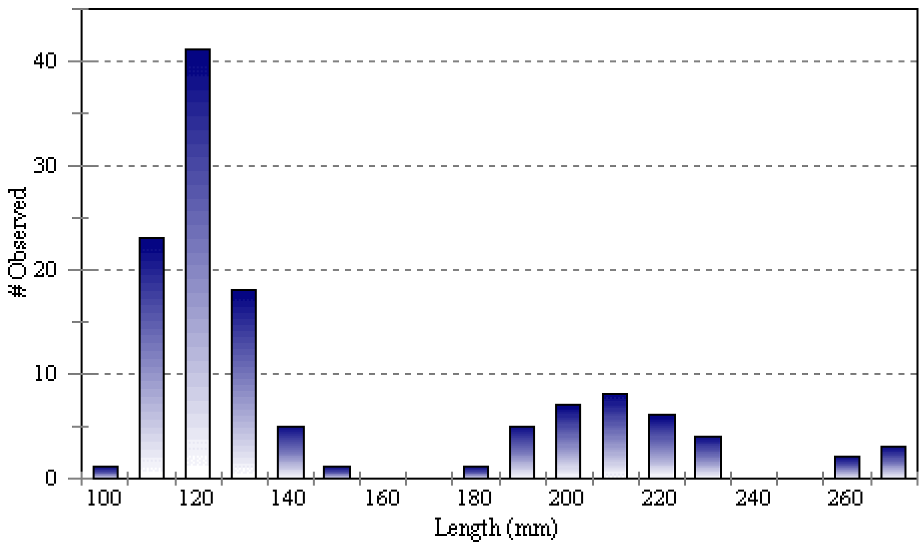

Figure 17. Length frequency distribution of walleye collected from Dumbbell Lake, Lake County, during fall 2003 electrofishing assessments.

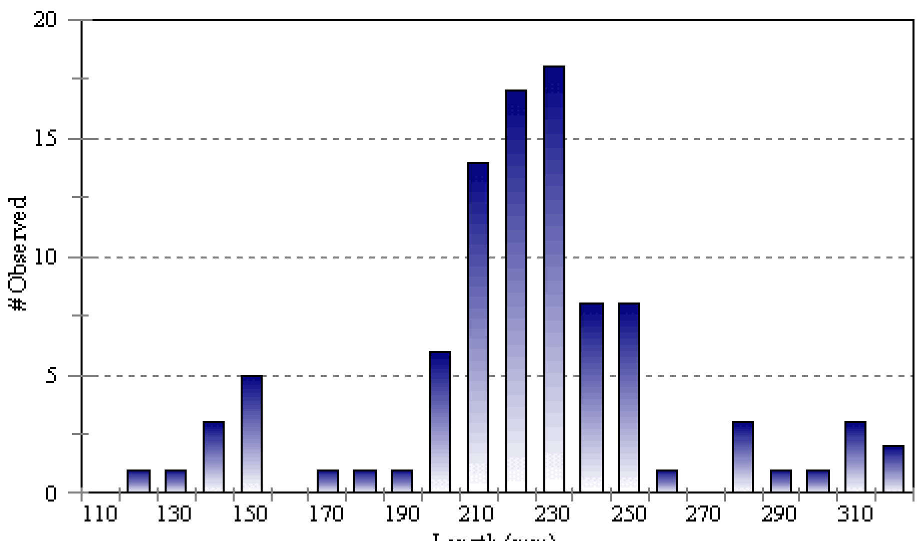

Figure 18. Length frequency distribution of walleye collected from Eagle Lake, Carlton County, during fall 2003 electrofishing assessments.

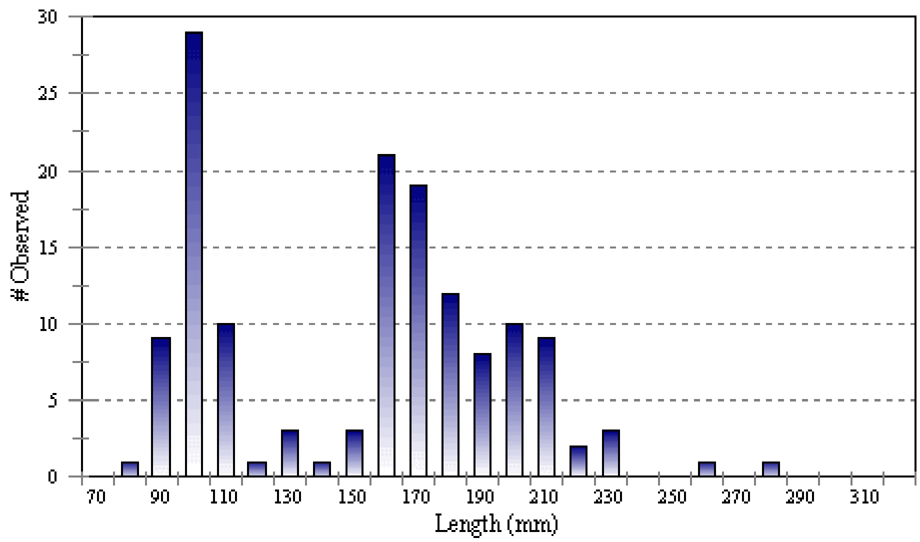

Figure 19. Length frequency distribution of walleye collected from Elbow Lake, Cook County, during fall 2003 electrofishing assessments.

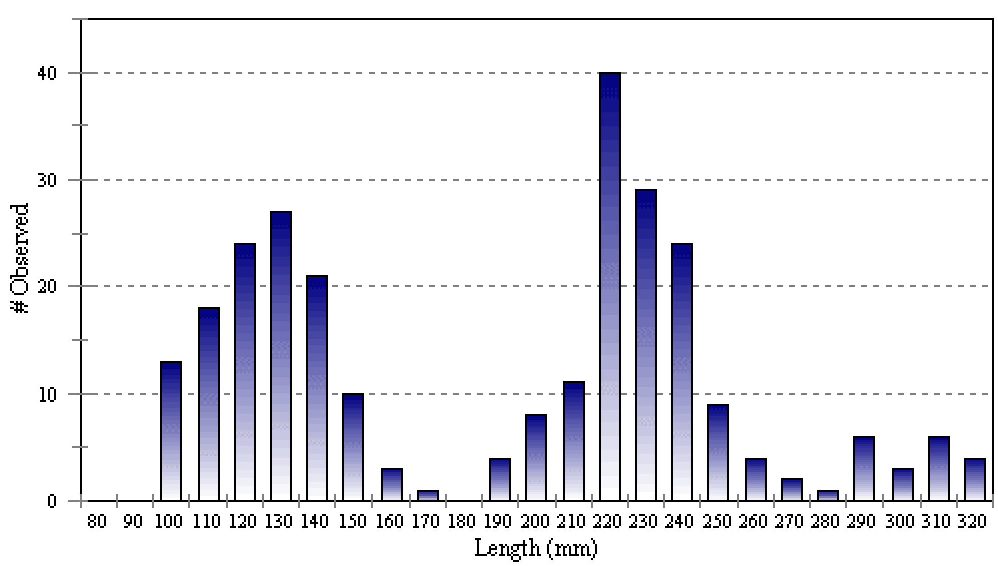

Figure 20. Length frequency distribution of walleye collected from Four Mile Lake, Cook County, during fall 2003 electrofishing assessments.

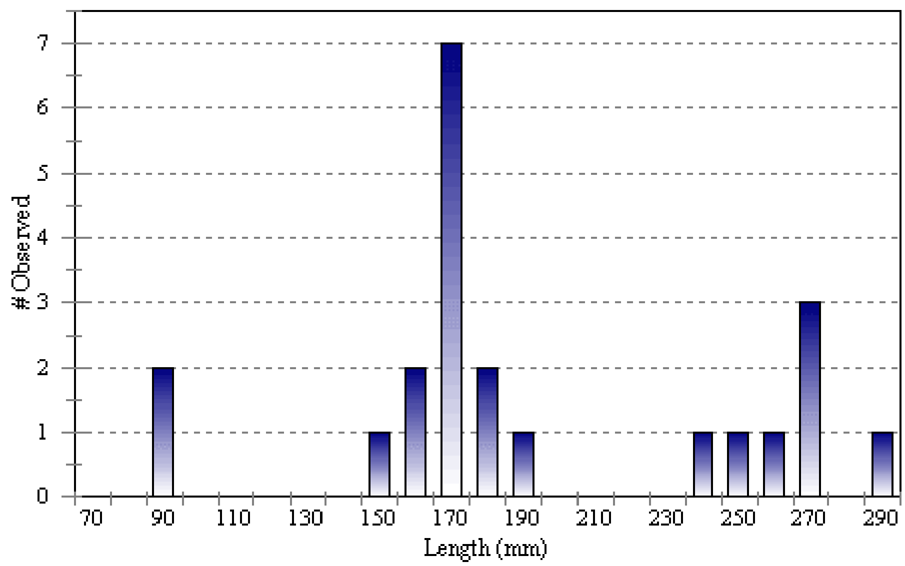

Figure 21. Length frequency distribution of walleye collected from Homer Lake, Cook County, during fall 2003 electrofishing assessments.

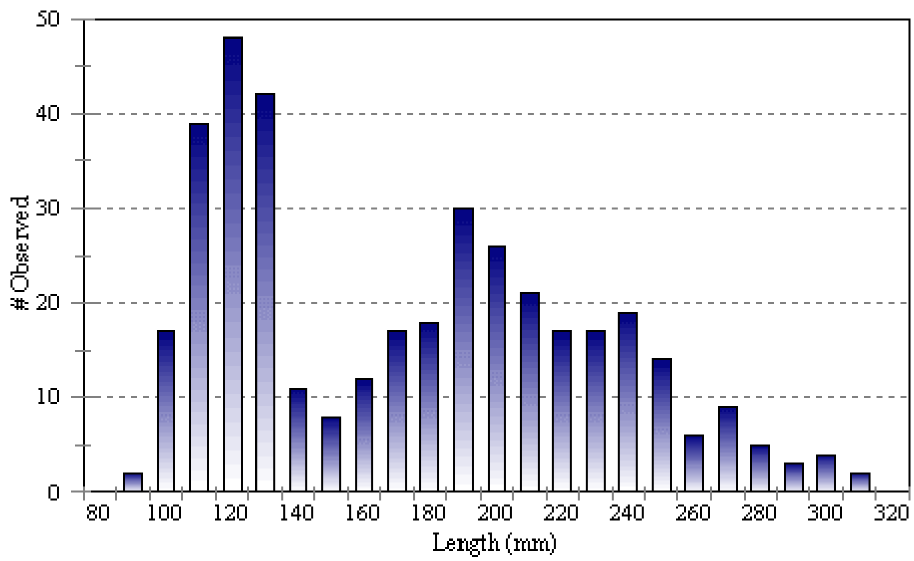

Figure 22. Length frequency distribution of walleye collected from Island Lake Reservoir, St. Louis County, during fall 2003 electrofishing assessments.

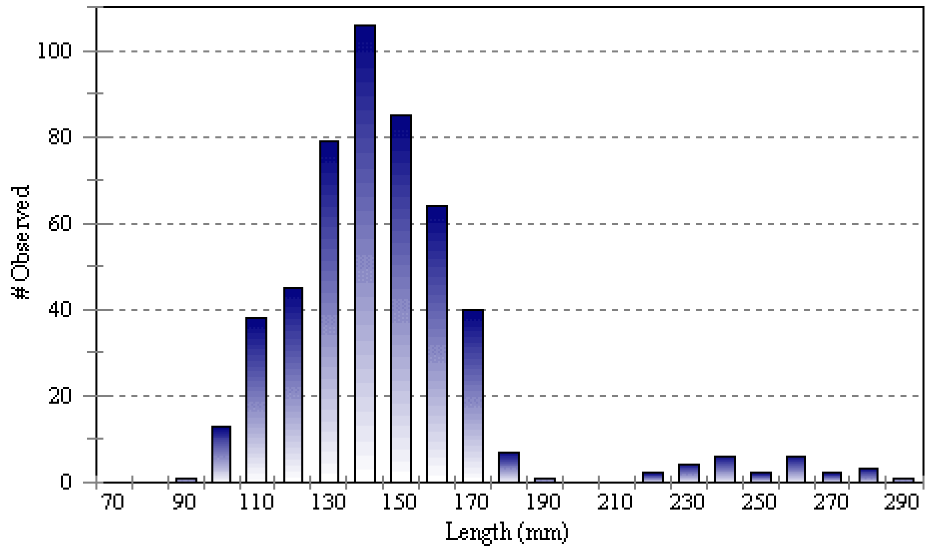

Figure 23. Length frequency distribution of walleye collected from Ninemile Lake, Lake County, during fall 2003 electrofishing assessments.

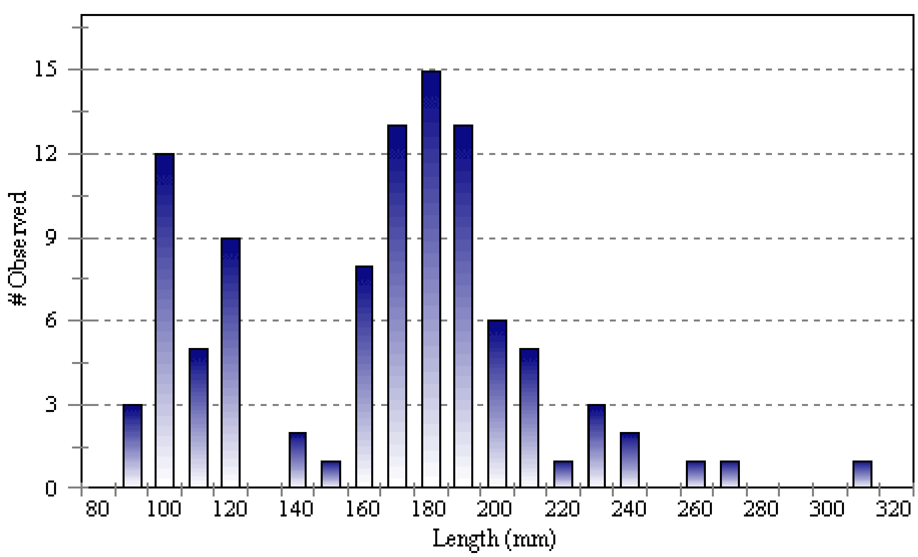

Figure 24. Length frequency distribution of walleye collected from North McDougal Lake, Lake County, during fall 2003 electrofishing assessments.

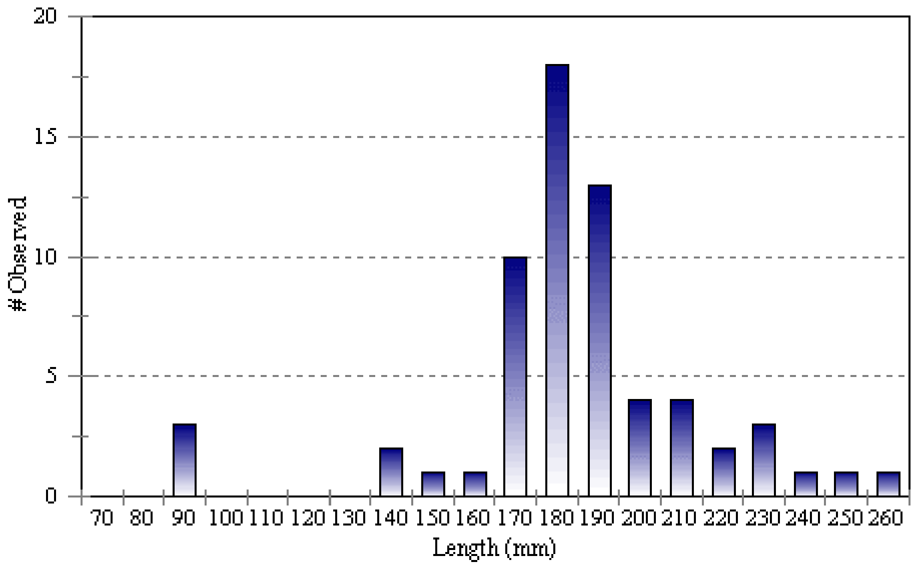

Figure 25. Length frequency distribution of walleye collected from Pike Lake, Cook County, during fall 2003 electrofishing assessments.

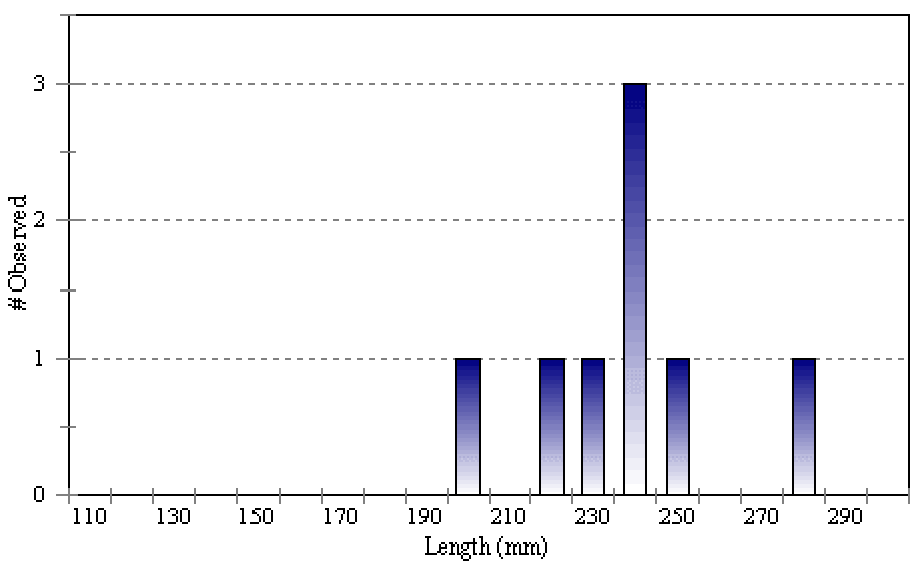

Figure 26. Length frequency distribution of walleye collected from Poplar Lake, Cook County, during fall 2003 electrofishing assessments.

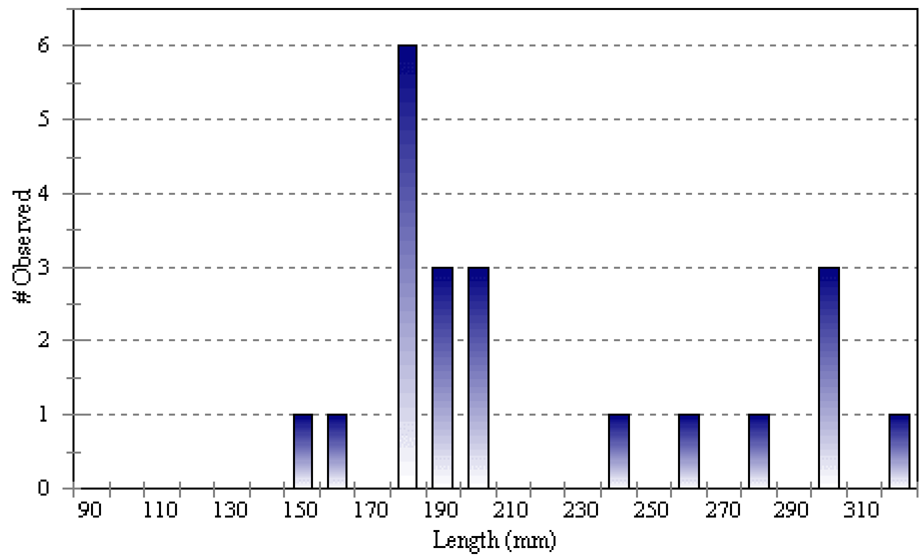

Figure 27. Length frequency distribution of walleye collected from Prairie Lake, Carlton County, during fall 2003 electrofishing assessments.

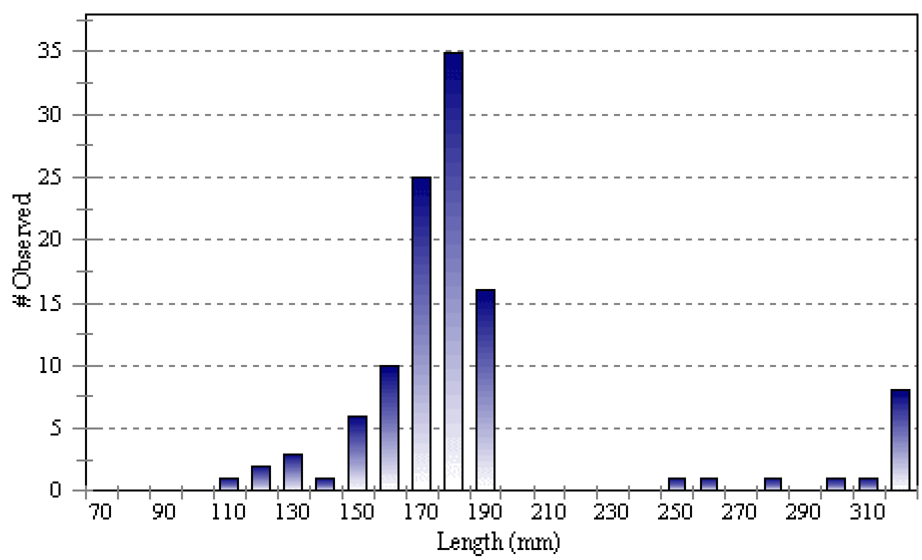

Figure 28. Length frequency distribution of walleye collected from Shagawa Lake, St. Louis County, during fall 2003 electrofishing assessments.

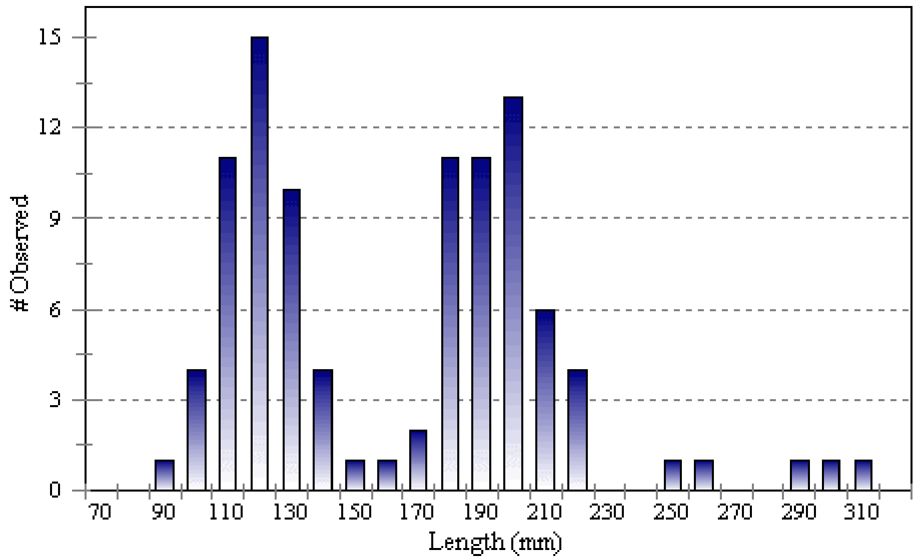

Figure 29. Length frequency distribution of walleye collected from Silver Island Lake, Lake County, during fall 2003 electrofishing assessments.

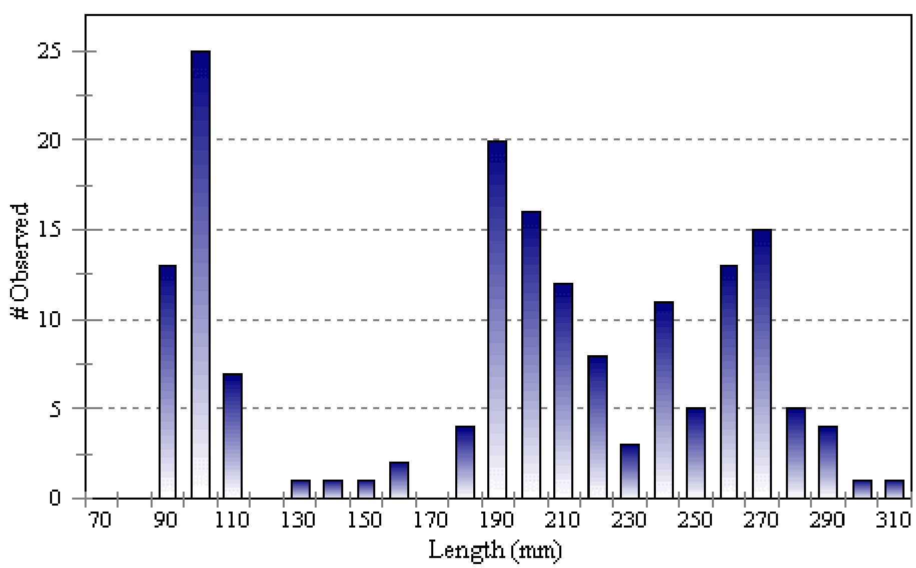

Figure 30. Length frequency distribution of walleye collected from Tom Lake, Cook County, during fall 2003 electrofishing assessments.

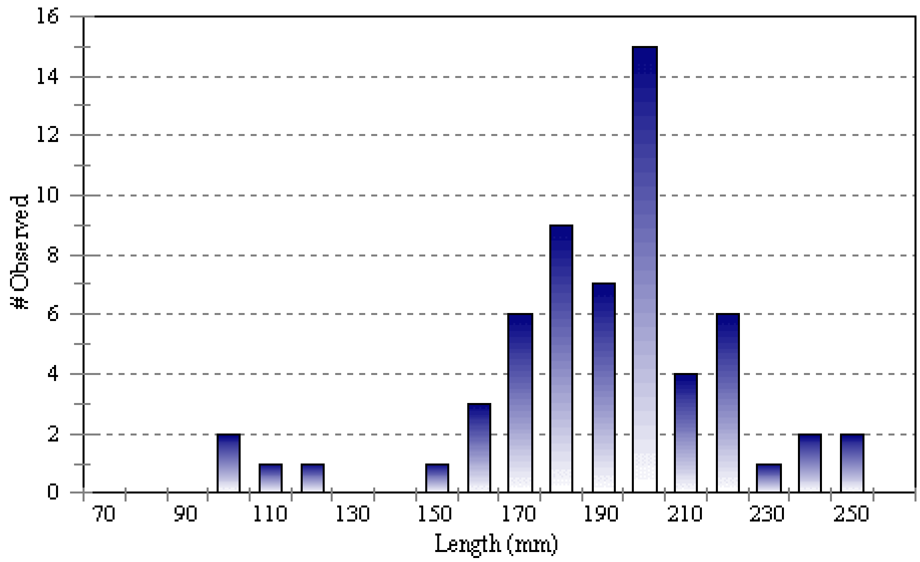

Figure 31. Length frequency distribution of walleye collected from Two Island Lake, Cook County, during fall 2003 electrofishing assessments.

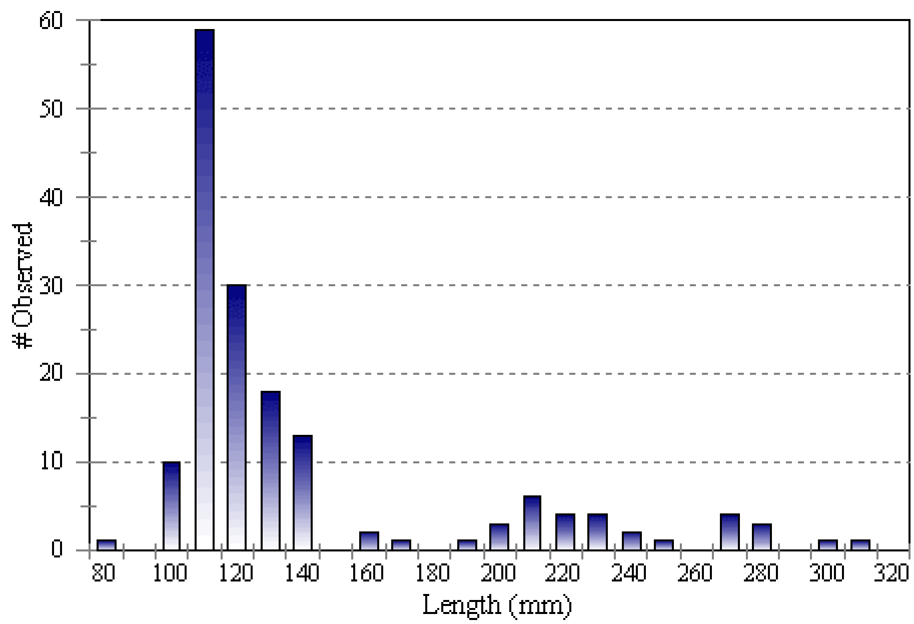

Figure 32. Length frequency distribution of walleye collected from West Twin Lake, Cook County, during fall 2003 electrofishing assessments.

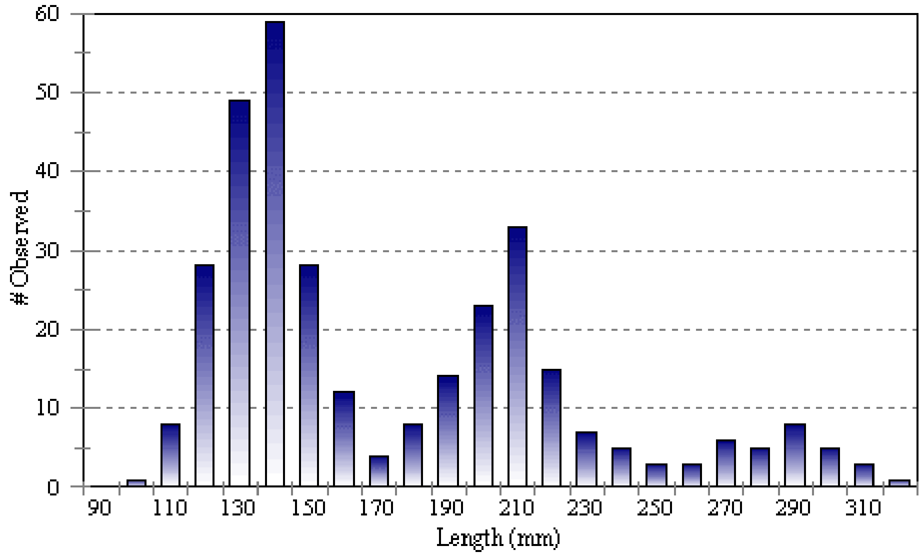

Figure 33. Length frequency distribution of walleye collected from Whiteface Reservoir, St. Louis County, during fall 2003 electrofishing assessments.

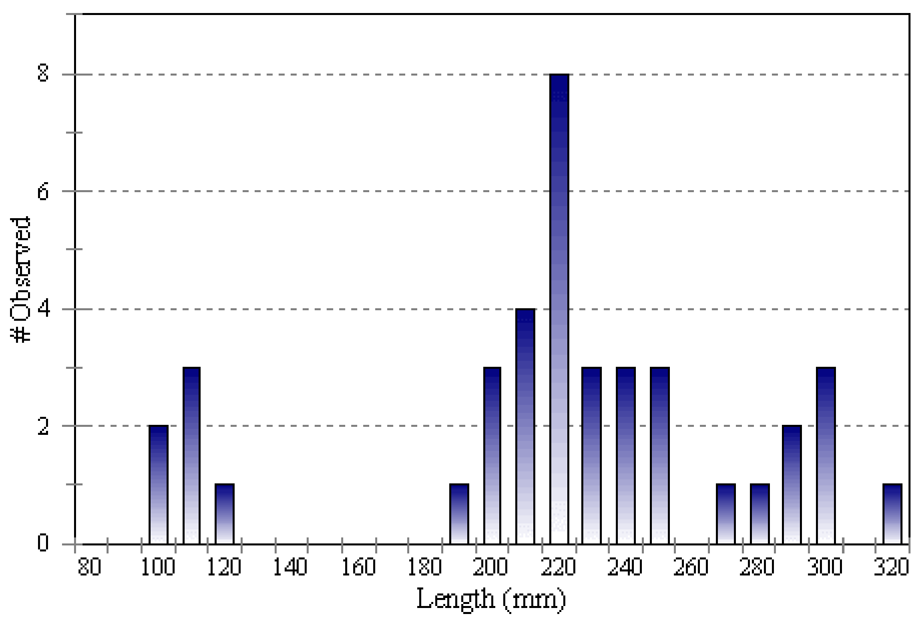

Figure 34. Length frequency distribution of walleye collected from Wilson Lake, Lake County, during fall 2003 electrofishing assessments.

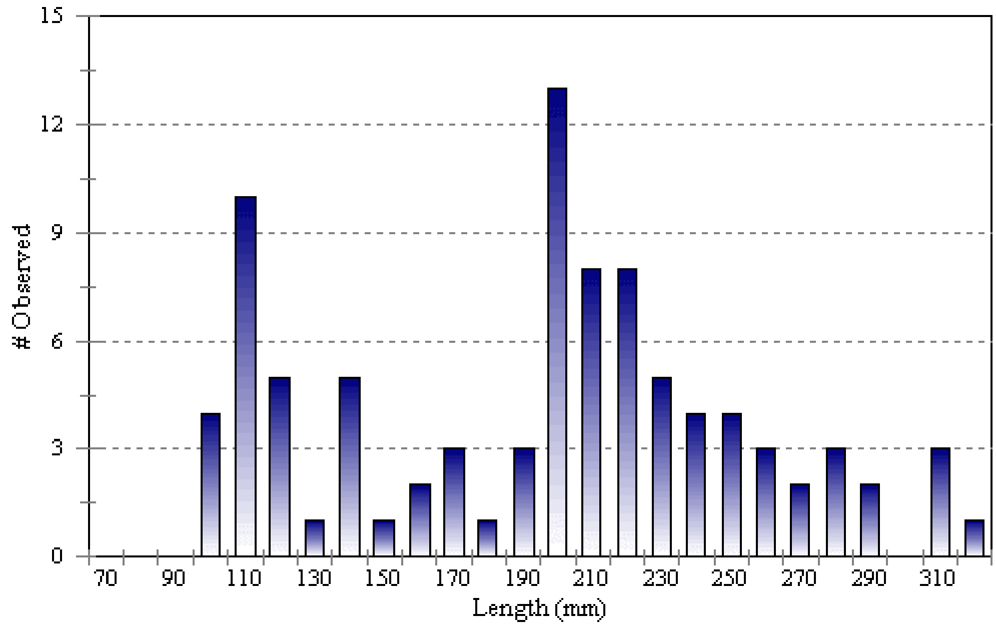

Figure 35. Length frequency distribution of walleye collected from Windy Lake, Lake County, during fall 2003 electrofishing assessments.