Spring Adult and Fall Juvenile Walleye Population Surveys within the 1854 Ceded Territory of Minnesota, 2005

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 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 Authority have been actively involved with fish assessments since 1994 (Borkholder 1994a).

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. 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 more than a decade (Borkholder 1994 and 1995). In order to maximize the number of fish handled and marked during the 2005 spawning season, 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 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 (Frank Stone, U.S.F.W.S., Ashland F.R.O., personal communication).

The first objective of our assessments in 2005 was to obtain adult walleye population estimates (PE) during the spring spawning period using mark - recapture data. Our electrofishing PE estimates may be biased towards males in the populations, and thus, are no doubt conservative estimates. However, by cooperating with the Area MN DNR offices, a second PE is obtained using the State's summer gill net data, with which to compare to the spring only electrofishing PE.

The second objective for our spring 2005 assessments was to address an observed concern amongst Tribal fisheries managers. Past surveys in the Ceded Territory have identified several lakes where the size structure of the resident walleye population indicates an unbalanced population, characterized by smaller adults and periodic recruitment. For example, looking at just two lakes in our data base, and comparing the length frequency distribution for Crescent Lake to that of Elbow Lake, a shift is indicated towards smaller individuals in the Crescent Lake population, with a mean length of 320 mm verses a mean length of 408 mm for the Elbow Lake population (Borkholder and Edwards 2003 and 2001). Back-calculated lengths-at-age studies for both populations have indicated very similar growth curves (Borkholder and Edwards 2003 and 2001). Catch curve analysis indicates that mortality is much higher for the Crescent Lake population, nearly 60%, verses the 26% mortality estimate observed for Elbow Lake (unpublished data). Our objective is to estimate the fishing component of total mortality, i.e. exploitation. Three lakes were chosen for tagging in 2005: Fish Lake (Duluth) as a control representing a balanced walleye population, and Caribou and Crescent Lakes (Grand Marais) representing unbalanced walleye populations. During spring 2005 assessments, numbered floy tags were attached to all walleye larger than 254 mm (10 inches). MN DNR personnel conducted a subsequent creel survey on each of the three lakes. Creel clerks were instructed to look for tags in harvested walleyes. In addition, anglers were able to deposit tags from harvested walleyes in locked boxes at each of the public landings. Tag return data will be used for an additional population estimate, in addition to providing estimates of angler

exploitation. Exploitation data will be reported following the 2006 fishing season, when an additional three lakes will be surveyed.

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 final portion of our 2005 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 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. Lakes chosen for the tagging study for 2005 were Fish Lake Reservoir (Duluth Area), and Crescent and Caribou Lakes (Grand Marais Area). 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. Tagged walleye would then be available during the summer gill net assessments conducted by the DNR, thus providing a second population estimate. Further, creel clerks assigned to each of these three lakes would be looking for tagged walleye in the anglers' creels. The data from tag returns would be used for yet a third population estimate, as well as future estimates of fishing mortality, or exploitation.

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 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 floy tags, and the sex determined (male, female, unknown) based upon visual identification of gametes. Walleye that had been tagged during any previous nights' collections were counted as recaptured fish. Unmarked individuals (> 254 mm) were tagged with a uniquely numbered floy tag. A dorsal fin spine from five individuals per

centimeter group per sex was removed and placed in a labeled envelope for aging. Following tagging 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^{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 has been found to be the highest in the fall when water temperatures are 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 one week from our historical average start date. Fall assessments began in the Grand Marais area on 6 September 2005. Even with the late start, the 20^{o}C threshold was exceeded in seven of the lakes.

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 Authority (Borkholder 1996, 1997, and 1998; Borkholder and Edwards 1999, 2000, 2002, 2003, & 2004). 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

Fish Lake Reservoir

Electrofishing activities were conducted on Fish Lake Reservoir from 16 to 19 April (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 was very high, ranging from 222.9 to 322.1 adult walleye per hour of sampling (Table 1). At an 80% confidence interval, mean CPUE for Fish Lake, determined using each sampling station, was 303.7 ± 27.2 adults per hour and 303.9 ± 27.3 total walleye per hour of sampling effort. Catch rates among the sampling stations were consistently high, as sampling was limited to those areas where spawning walleye had been surveyed in the past. Catch rates ranged from 93.0 adult walleye per hour (EF-A, 19 April 2005) to 602.3 adults per hour (EF-4, 19 April 2005) (Figure 1).

The length frequency of the walleye sampled is presented in Figure 2. Walleye as large as 734 mm (28.9 inches) were observed in the survey. Additional species observed included yellow perch, white sucker, northern pike, pumpkinseed, rock bass, black crappie, and burbot.

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 4798 (Table 2). The adjusted Petersen estimate is 4822 ± 575, with a 3.7% CV (Table 2). These estimates compare quite well with those obtained during a 1999 electrofishing survey, where the adjusted Peterson estimate was 4694 (Table 2). This suggests that the population of spawning adults has not changed significantly since the 1999 survey.

In August 2005 the Minnesota Department of Natural Resources performed a standardized net assessment on Fish Lake Reservoir (Jon Meerbeek, MN DNR, Duluth Area Fisheries). Of 111 walleye (> 264 mm) sampled in the gill nets trap nets that would have been 254 mm during the April assessments (Figure 3), only 8 were observed to have a tag from the spring sampling, though one individual was observed to have a missing dorsal fin ray, and may have either lost a tag or was sampled during the 1999 assessment. This individual was not included as a recaptured fish. The adjusted Petersen estimate using both the summer and spring data is 31,995 ± 26,934, with a 30.3% CV (Table 2). The Schumacker and Eschmeyer population estimate from the gill net data is 8607 (Table 2). The summer net Petersen estimate is much greater than the spring estimate, likely due to relatively few recaptured individuals. The low sample size of recaptured individuals makes this estimate largely unrealistic. This is not nearly as problematic with the Schumacker and Eschmeyer population estimate as this estimate relies upon all

Figure 1. Fish Lake Reservoir, St. Louis Co. Walleye 2005 sampling stations.

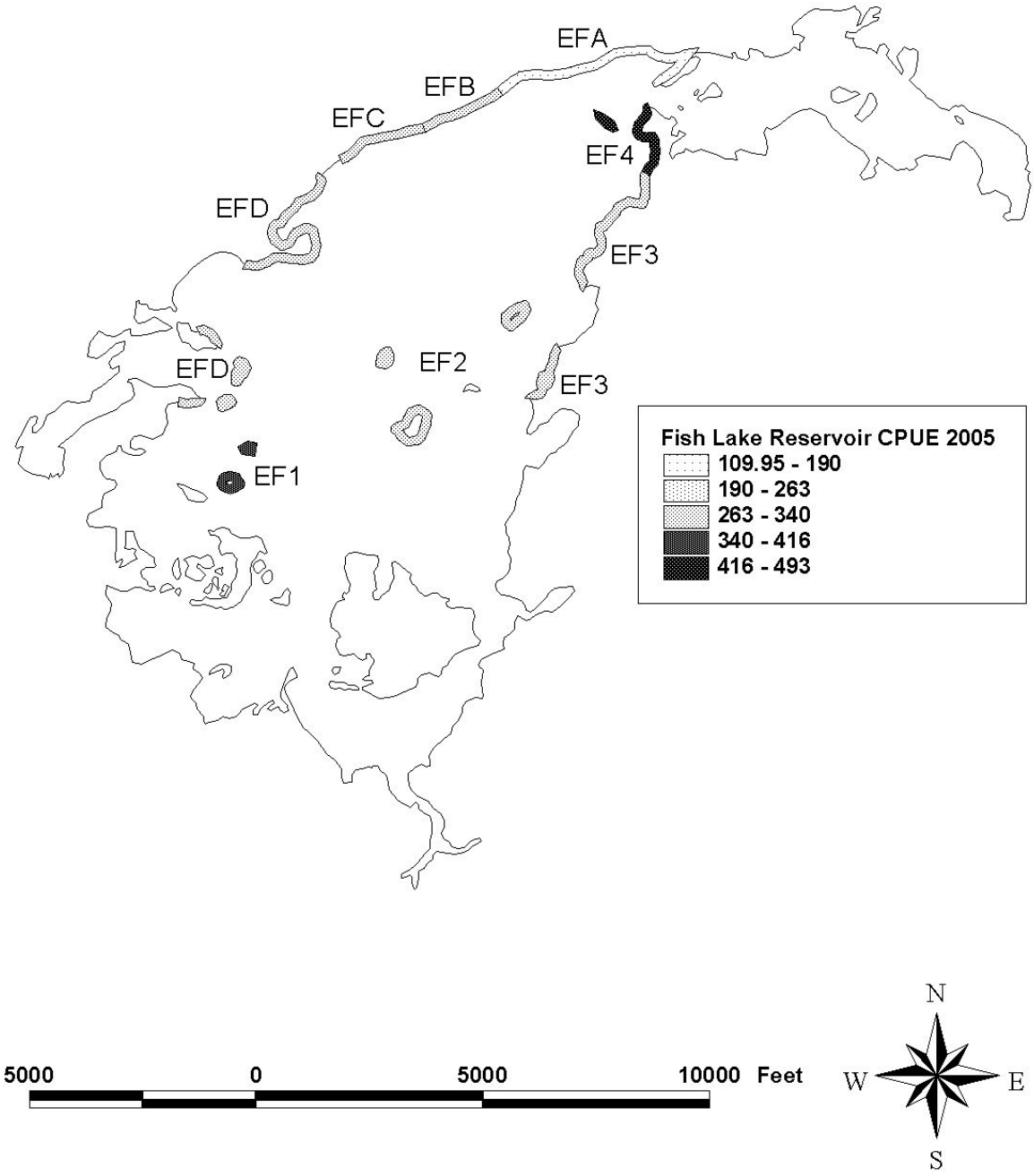


Table 1. Summary of electrofishing activities on three lakes surveyed within the 1854 Ceded Territory, Minnesota, during Spring 2005.

ID #	County	Lake	Area (Acres)	Max Depth	Date	Water Temp (F)	Conductivity[1]	Shocking Time (sec)	Voltage (PDC)	Pulse Width (ms)	Amps	# WAE[2]	CPUE WAE[3]
69-0491	St. Louis	Fish Lake	3260	37	4/16/05	45	122.9	2681	884	3.5	4.0	166	222.9
					4/17/05	49.5	128.8	12331	707	3.0	3.0	1094	319.4
					4/18/05	50.4	128.2	13251	707	2.8	2.5	939	255.1
					4/19/05	50.9	127.6	11803	707	2.8	2.5	1056	322.1
16-0454	Cook	Crescent	744	28	4/20/05	47	30.2	13779	1061	2.5	3.0	120	31.4
					4/21/05	51	28	12909	1061	2.5	3.0	176	49.1
					4/23/05	46.7	29.2	16487	1061	3.0	4.5	353	77.1
					4/25/05	48	27.9	15123	1061	2.5	5.0	347	82.6
16-0360	Cook	Caribou	728	30	4/22/05	46	55.1	18399	884 / 1061	3.5	3.0	166	32.5
					4/24/05	46.7	52.7	16862	884 / 1061	3.5	3.0	199	42.5
					4/26/05	47	51.3	18498	884 / 1061	3.0	3.0	310	60.3

[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 unmarked 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)).

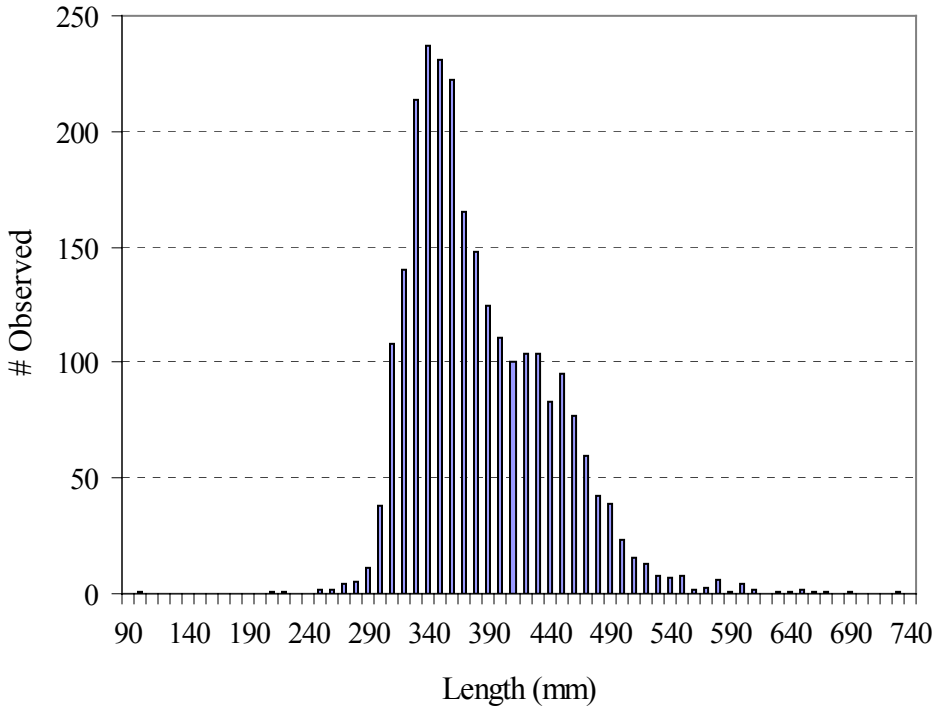


Figure 2. Length frequency distribution of walleye sampled from Fish Lake Reservoir, St. Louis County, MN, during Spring 2005 electrofishing assessments. Bars do not represent counts of recaptured individuals.

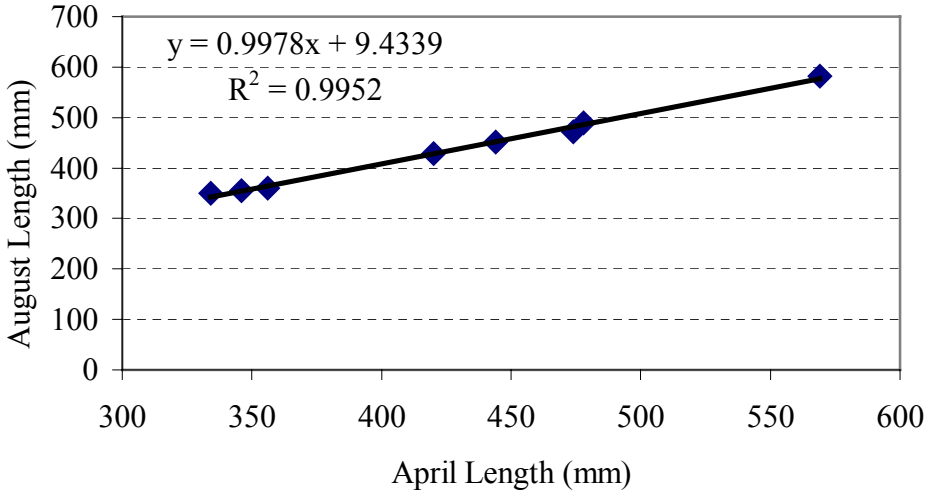


Figure 3. Growth of individually tagged walleye from Fish Lake, 2005. Lengths are those observed during tagging in April 2005, compared to those observed from the MN DNR gill nets in August 2005.

Table 2. Walleye population estimates for Fish Lake Reservoir (St. Louis County), and Crescent and Caribou Lakes (Cook County), April 2005. Estimates are for walleye larger than 254 mm (10.0 inches) in April. 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]	95% Confidence Limits Lower	Upper	Population Estimate[2]	C.V.[3]
Fish Lake – EF_{2005}	4798	4313	5405	4822 ± 575	3.7%
Fish Lake – GN_{2005}	8607	5951	15544	31,995 ± 26,934	30.3%
Fish Lake – EF_{1999}	4918	4435	5518	4694	5.1%
Crescent – EF_{2005}	1409	1334	1494	1385 ± 282	6.4%
Crescent – GN_{2005}	1737	1115	3926	5225 ± 3713	25.6%
Crescent – EF_{2002}	1919	1564	2484	1789 ± 444	8.9%
Caribou – EF_{2005}	574	509	658	585 ± 137	5.5%
Caribou – GN_{2005}	840[4]	461[4]	4777[4]	3700 ± 2262	26.0%
Caribou – EF_{2003}	1027	Not Calculated due to a single *df*		1019 ± 1419	11.0%

1 Schumacher and Eschmeyer population estimate.
2 Adjusted Petersen population estimate, with 95% confidence interval.
3 Coefficient of variation for the Petersen estimate.
4 Due to low recapture sample , 90% Confidence Limits had to be calculated.

sampling dates, and thus may be a better estimate of the true population size. We will be investigating this further as we combine angler tag-return data in the future.

Table 3 presents the age data for the walleye collected from Fish Lake. Of the 2571 unique fish sampled, 2108 were assigned to ages 4 through 7. This suggests that a few very strong year classes may be pulsing through the fishery. As fish were observed up to 16 years old (Table 3), it does not appear that fishing mortality is too high. Future analysis of the angler data will partition mortality estimates into angling and natural mortality rates. Table 4 presents back-calculated lengths at each age class for walleye collected from Fish 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

Table 3. Age frequency distribution of walleye from Fish Lake, St. Louis County, April 2005, based upon the number of fish sampled and aged per size category.

Length Group			AGE													
Inches	mm	N Sampled	3	4	5	6	7	8	9	10	11	12	13	14	15	16
8	203	1														
8.5	216	1														
9	229	0														
9.5	241	1														
10	254	0														
10.5	267	8	5	3												
11	279	5		5												
11.5	292	18	2	16												
12	305	94	6	77	11											
12.5	318	185		145	40											
13	330	254		212	42											
13.5	343	314		52	127	85										
14	356	290		145	116	29										
14.5	368	211		79	79	53										
15	381	189		27	54	81	27									
15.5	394	142				71	47	24								
16	406	141			26	77	13	26								
16.5	419	123		15	15	62	15	15								
17	432	124			16	39	31	23	16							
17.5	445	111			17	43	17		9	9	17					
18	457	107				36	24	24	12	12						
18.5	470	80				7	15	7	15	0	36					
19	483	45				3	3	11	6	11	11					
19.5	495	45					6	11		11	11		3		3	
20	508	20						1	3	4	9	3				
20.5	521	15					4		1	2	3	1	1	1	1	
21	533	13					1	1	4		3	2			1	1
21.5	546	6					1	1	2		1				1	
22	559	4							1	1	1		1			
22.5	572	4						1	1	1	1					
23	584	6						2		1	3					
23.5	597	3								1	1				1	
24	610	3								1	2					
24.5	622	0														
25	635	2							1		1					
25.5	648	2									2					
26	660	1									1					
26.5	673	1									1					
27	686	0														
27.5	699	1										1				
28	711	0														
28.5	724	1													1	
29	737	0														
TOTALS		2571	13	777	543	584	204	148	69	54	105	7	5	1	8	1

Table 4. Back-calculated lengths at each age class for walleye collected from Fish Lake Reservoir, St, Louis County, Minnesota, April 2005.

Age Class	N	Length (mm)	Length (in)
1	265	110	4.3
2	265	189	7.4
3	265	264	10.4
4	260	331	13.0
5	206	386	15.2
6	180	426	16.8
7	145	457	18.0
8	123	482	19.0
9	96	502	19.8
10	77	518	20.4
11	56	533	21.0
12	17	530	20.9
13	11	534	21.0
14	8	550	21.6
15	5	570	22.4

Table 5. Proportional Stock Density (PSD) and Relative Stock Densities (RSD) with 95% confidence intervals for walleye sampled from Fish Lake Reservoir, St. Louis County, and Caribou and Crescent Lakes, 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
Fish Lake – EF_{2005}	46.3 ± 1.9	53.7 ± 1.9	43.1 ± 1.9	2.9 ± 0.6	0.3 ± 0.2
Fish Lake – GN_{2005}	45.3 ± 8.6	54.7 ± 8.6	32.8 ± 8.1	12.5 ± 5.7	0.0 ± 0.0
Crescent Lake – EF_{2005}	67.5 ± 3.3	32.5 ± 3.3	63.3 ± 3.4	3.5 ± 1.3	0.8 ± 0.6
Crescent Lake – GN_{2005}	44.6 ± 10.7	55.4 ± 10.7	37.4 ± 10.4	6.0 ± 5.1	1.2 ± 2.4
Caribou Lake – EF_{2005}	54.2 ± 4.6	45.8 ± 4.6	46.0 ± 4.6	7.5 ± 2.4	0.7 ± 0.8
Caribou Lake – GN_{2005}	11.3 ± 6.0	88.7 ± 6.0	9.4 ± 5.6	1.9 ± 2.6	0.0 ± 0.0

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 46.3 ± 1.9 (Table 5) suggests the population is balanced (Anderson and Weithman 1978). The summer gill net PSD (45.3 ± 8.6) is not significantly different than the PSD estimate from the spring electrofishing survey (χ^2=0.049, 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 during 2005 assessments (Table 5). PSD metrics between 1999 (PSD = 46.1) and 2005 (PSD = 46.3) electrofishing surveys were nearly identical (χ^2=0.017 P>0.05, critical Chi-square value of 3.841). This data suggests that little has changed with the size structure of the Fish Lake walleye population from 1999 to 2005.

Crescent Lake

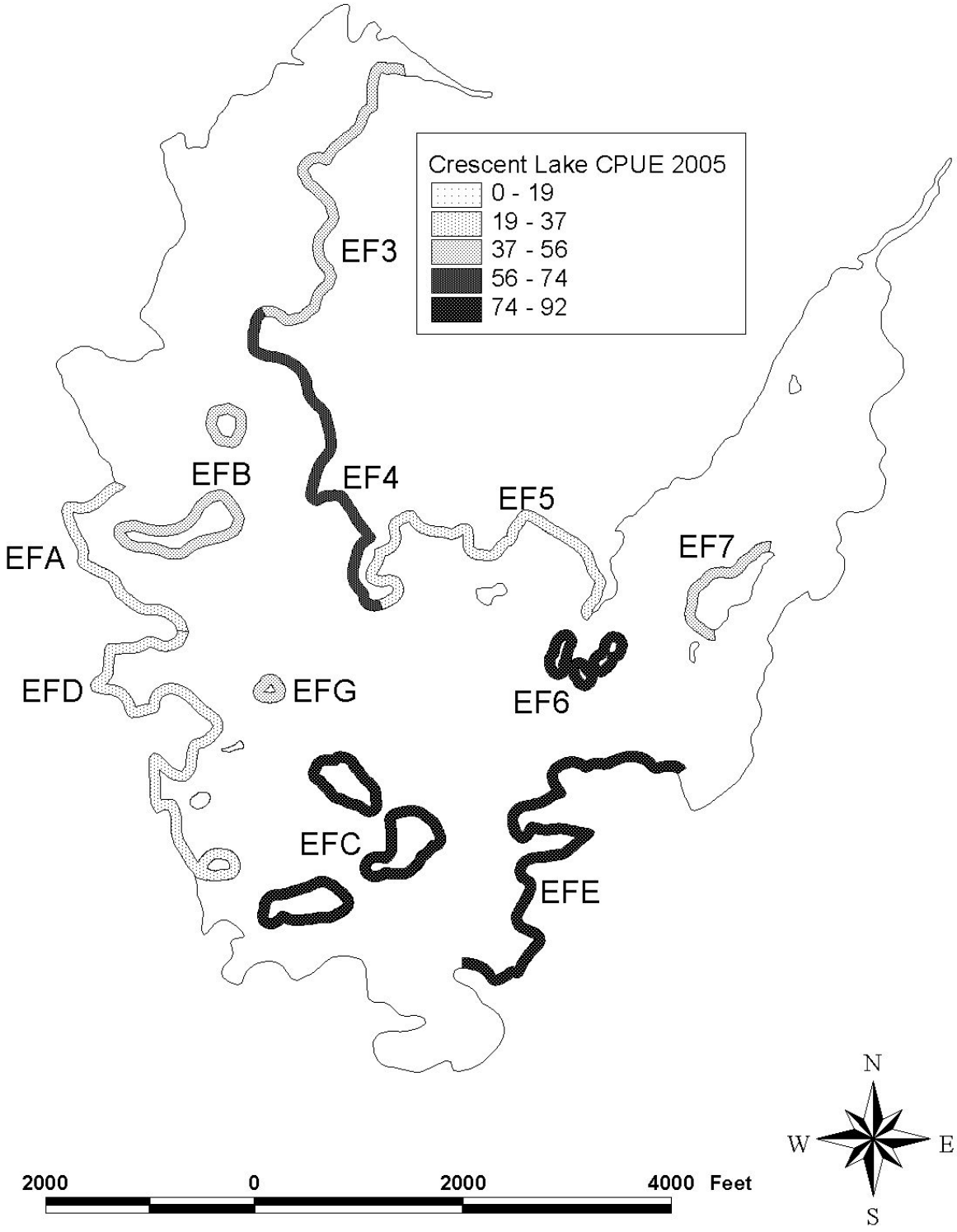
Electrofishing activities were conducted on Crescent Lake on 20 through 25 April (Figure 4). Dates of electrofishing activities, mean water temperature, mean water conductivity, shocking time, the voltage and amps, the number of walleye collected, and the number caught per hour of electrofishing (CPUE) are presented in Table 1. CPUE for each night ranged from 31.4 to 82.6 adult walleye per hour of sampling (Table 1). At an 80% confidence interval, mean CPUE for Crescent Lake, determined using each sampling station, was 57.9 ± 8.2 adults per hour and 58.0 ± 8.2 total walleye per hour of sampling effort. Additional species observed included yellow perch, white sucker, smallmouth bass, and muskellunge.

Catch rates among the sampling stations varied. Catch rates were highest around the islands (EF-6 and EF-C) and along the southernmost shoreline (EF-E). Catch per hour was moderately high at EF-4. Areas characterized by soft bottom substrates were not surveyed in 2005, and are not labeled on Figure 4. We did not sample these stations since our last survey in 2002 found that walleyes were not using these areas of the lake for spawning activities.

The length frequency of the walleye sampled from Crescent Lake is presented in Figure 5. Table 6 presents the age data for the walleye collected from Crescent Lake. Table 7 presents back-calculated lengths at each age class for walleye collected from Crescent Lake.

Table 2 presents the population estimates based upon mark-recapture data. The electrofishing Schumacker and Eschmeyer population estimate is 1409 (Table 2). The electrofishing adjusted Petersen estimate is 1385 ± 282, with a 6.4% CV (Table 2). The 2005 estimates are a little lower than those

Figure 4. Crescent Lake, Cook Co. Walleye 2005 sampling stations.



obtained in 2002 (Table 2) (Borkholder and Edwards 2003). While we did sample Bouder Lake in 2002, there were not many individuals observed using Bouder for spawning activities. Our sampling did not cover any of Bouder Lake in 2005.

In July 2005, the Minnesota Department of Natural Resources performed a standardized net assessment on Crescent Lake (Steve Persons, MN DNR, Grand Marais Area Fisheries). Of the 80 walleye larger than 276 mm sampled (individuals that would have been at least 254 mm in April, Figure 6) in both the gill nets and trap nets, 11 were observed to have a tag. The adjusted Petersen estimate from the summer data is 5225 ± 3713, with a 25.6% CV, and the Schumacher and Eschmeyer estimate is 1737 (Table 2). The 2005 gill net estimates are likewise lower than the gill net population estimates from 2002 (N = 3130) (Borkholder and Edwards 2003).

PSD and RSD values determined by our spring electrofishing sampling are presented in Table 5. The electrofishing PSD of 67.5 ± 3.3 (Table 5) suggests the population is balanced (Anderson and Weithman 1978), with a significant portion of quality-length fish (RSD Q-P = 63.3 ± 3.4). In 2005, significant differences in the PSD estimates were observed between the electrofishing and gill net

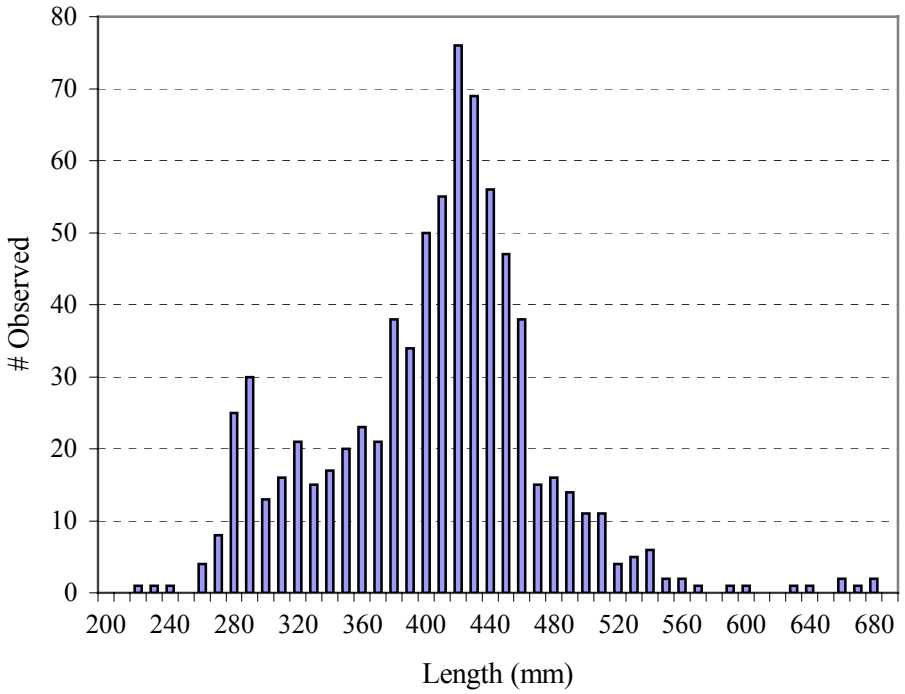


Figure 5. Length frequency distribution of walleye sampled from Crescent Lake, Cook County, MN, during Spring 2005 electrofishing assessments. Bars do not represent counts of recaptured individuals.

Table 6. Age frequency distribution of walleye from Crescent Lake, Cook County, spring 2005, based upon the number of fish sampled per size category.

Length Group			AGE												
Inches	mm	N Sampled	3	4	5	6	7	8	9	10	11	12	13	14	15
8	203	1													
8.5	216	0													
9	229	2													
9.5	241	0													
10	254	7	5	2											
10.5	267	35	23	4		4	4								
11	279	36	36												
11.5	292	16	11	5											
12	305	27	18	9											
12.5	318	18	10	8											
13	330	20	8	8	4										
13.5	343	26	6	14	6										
14	356	30		11	11	8									
14.5	368	43		11	22		11								
15	381	46		13		7	20	7							
15.5	394	71		9	14	19	24	5							
16	406	79		7	7	26	26	13							
16.5	419	90			14	18	45	14							
17	432	64				15	44	5							
17.5	445	63			3	17	32	11							
18	457	22				7	7	2	2	2					
18.5	470	17				8	6	4							
19	483	13					6	6						1	
19.5	495	17			1	1	6	1	1	4		1		1	
20	508	7				1	1	1				2	1		1
20.5	521	8						2			1	2	2	1	
21	533	6					3			1	1			1	
21.5	546	1							1						
22	559	2						1		1					
22.5	572	1													
23	584														
23.5	597	1								1					
24	610	1											1		
24.5	622	0													
25	635	1											1		
25.5	648	2									2				
26	660	1												1	
26.5	673	2								1				1	
27	686														
TOTAL		776	117	101	81	131	234	72	5	10	4	5	5	7	1

Table 7. Back-calculated lengths at each age class for walleye collected from Crescent Lake, Cook County, Minnesota, April 2005.

Age Class	N	Length (mm)	Length (in)
1	241	106	4.2
2	241	190	7.5
3	241	261	10.3
4	206	318	12.5
5	175	367	14.5
6	155	412	16.2
7	120	443	17.4
8	54	468	18.4
9	33	495	19.5
10	30	516	20.3
11	21	526	20.7
12	17	530	20.9
13	13	550	21.7
14	7	558	22.0
15	1	514	20.2

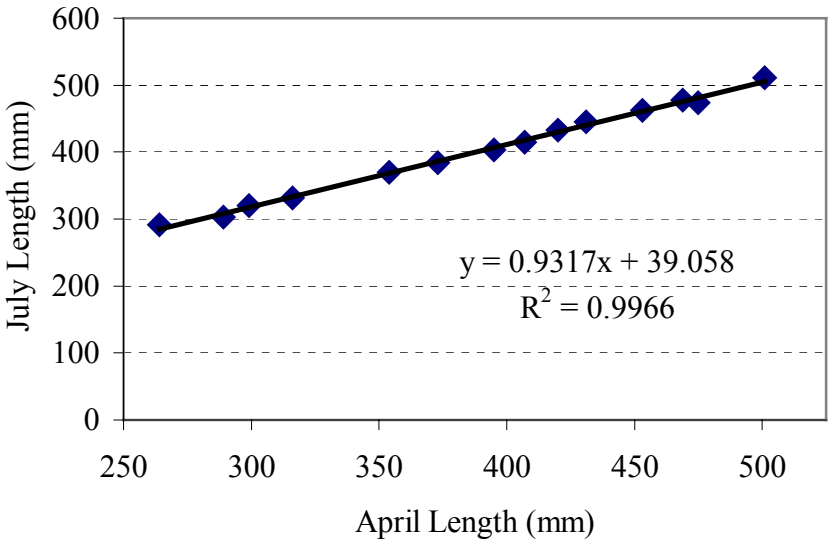


Figure 6. Growth of individually tagged walleye from Crescent Lake, 2005. Lengths are those observed during tagging in April 2005, compared to those observed from the MN DNR gill nets in July 2005.

assessments (χ^2=17.4, P<0.05, Table 5). The gill net data (RSD S-Q = 55.4) suggests that there is a larger proportion of 10 - 15 inch walleye recruiting into the fishery than is suggested by the electrofishing data (RSD S-Q = 32.5) (χ^2= -4.17, P<0.05, Table 5). Presumably many of these smaller fish may not have been mature and spawning in April, and thus were not vulnerable to our electrofishing gear.

Age data (Table 6) and length data (Figure 5) suggest that either angling pressure may be a bit high, or there have been some weak year classes over the last decade. In the spring survey, of 776 fish sampled, only 37 individuals were older than 9 years, and only 32 individuals were larger than 20.0 inches (RSD P-M = 3.5, RSD M-T = 0.8, Table 5). The last strong year classes observed during fall assessments were the two in 1997 and 1998 (Borkholder 1997 and 1998). As we started our monitoring in 1997, we have no data to suggest whether there were several poor year classes prior to 1997. This issue will be addressed once all of the angler tag return data has been analyzed.

Caribou Lake

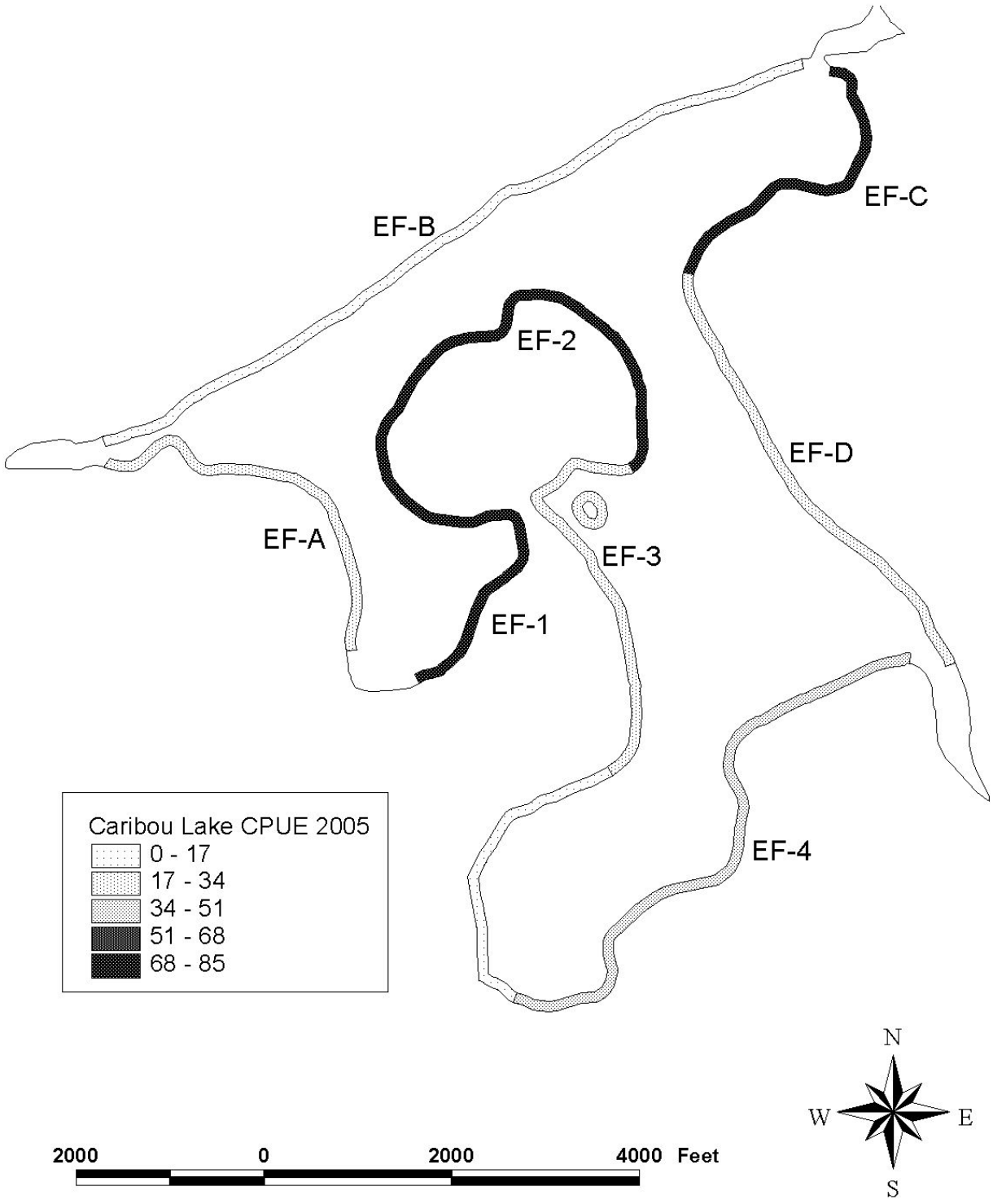
Electrofishing activities were conducted on Caribou Lake on 22 through 26 April (Figure 7). Table 1 presents mean water temperature, conductivity, number of walleye sampled, and CPUE for walleye. CPUEs for each night ranged from 32.5 to 60.3 adult walleyes per hour of on-time. At an 80% confidence interval, mean CPUE for Caribou Lake, determined using catch data from each sampling station, was 44.8 ± 9.1 adults per hour and 45.1 ± 9.2 total walleye per hour of sampling effort. Length frequency data of walleye collected is presented in Figure 8. Additional species observed included yellow perch, white sucker, northern pike, black crappie, and trout perch.

Table 8 presents the age frequency distribution for Caribou Lake in April 2005. The larger number of age-6 walleye observed, versus age-5 and age-7, corresponds well to a strong year-class observed in 1999 (Borkholder and Edwards 2000). Back-calculated length-at-age estimates are presented in Table 9.

Table 2 presents the two population estimates based upon electrofishing mark-recapture data. The electrofishing Schumacker and Eschmeyer population estimate is 574 (Table 2). The electrofishing adjusted Petersen estimate is 585 ± 137, with a 5.5% CV (Table 2).

In August 2005, the Minnesota Department of Natural Resources performed a standardized net assessment on Caribou Lake (Steve Persons, MN DNR, Grand Marais Area Fisheries). Of the 97 walleye larger than 279 mm sampled (individuals that would have been 254 mm in April, Figure 9) in both the gill nets and trap nets, 11 were observed to have a tag. The adjusted Petersen estimate from the summer data is 3700 ± 2262, with a 26.0% CV, and the Schumacher and Eschmeyer estimate is 840 (Table 2).

Figure 7. Caribou Lake, Cook Co. Walleye 2005 sampling stations.



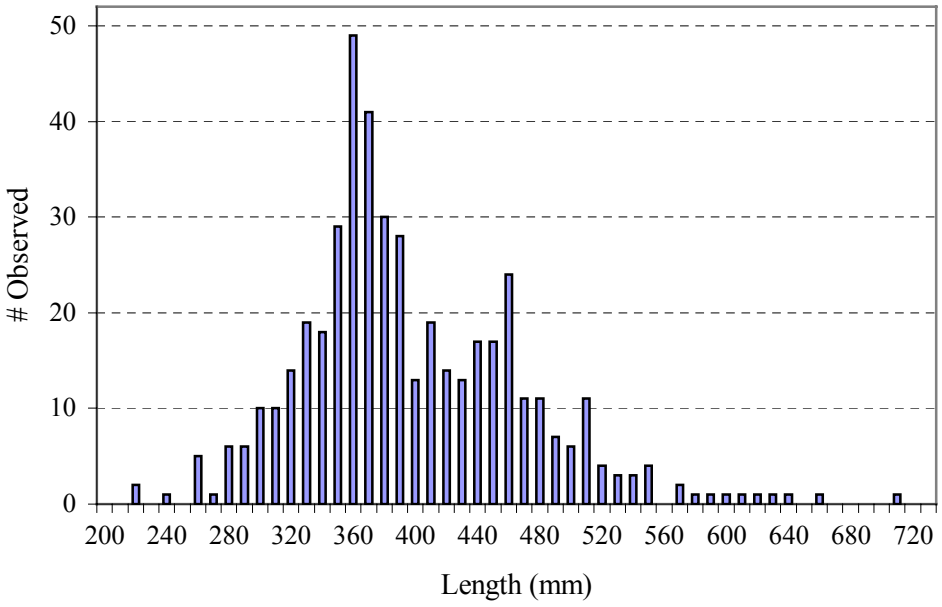


Figure 8. Length frequency distribution of walleye sampled from Caribou Lake, Cook County, MN, during Spring 2005 electrofishing assessments. Bars do not represent counts of recaptured individuals.

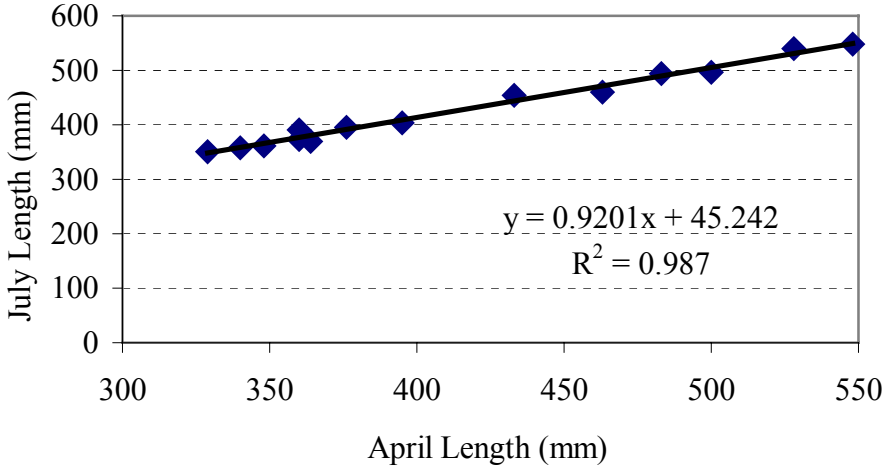


Figure 9. Growth of individually tagged walleye from Caribou Lake, 2005. Lengths are those observed during tagging in April 2005, compared to those observed from the MN DNR gill nets in July 2005.

Table 8. Age frequency distribution of walleye from Caribou Lake, Cook County, spring 2005, based upon the number of fish sampled and aged per size category.

Length Group			AGE												
Inches	mm	N Sampled	2	3	4	5	6	7	8	9	10	11	12	13	16
8	203	1													
8.5	216	1													
9	229	1	1												
9.5	241	0													
10	254	2		2											
10.5	267	5		5											
11	279	6		6											
11.5	292	10		8	2										
12	305	14		12	2										
12.5	318	16		9	7										
13	330	21		2	19										
13.5	343	30			30										
14	356	55			47	8									
14.5	368	50			40	10									
15	381	41			28	13									
15.5	394	26			12	7	7								
16	406	20					16	4							
16.5	419	17			2	2	11	2							
17	432	19				3	12	3							
17.5	445	22			2		6	12	2						
18	457	30					10	10	3	7					
18.5	470	15					8	5			1				
19	483	9					1	1	1	3	3				
19.5	495	9						2	2	3	1				
20	508	12					1	4			4	3			
20.5	521	6							2	1	1	1		1	
21	533	3							1	1	1				
21.5	546	5						1	1		1	1			
22	559														
22.5	572	2									1	1			
23	584	2									1				1
23.5	597														
24	610	2							1			1			
24.5	622	2										1	1		
25	635														
25.5	648	1										1			
26	660	1									1				
28	711	1										1			
TOTAL		457	1	44	191	43	72	44	13	15	15	10	1	1	1

Table 9. Back-calculated lengths at each age class for walleye collected from Caribou Lake, Cook County, Minnesota, April 2005.

Age Class	N	Length (mm)	Length (in)
1	200	107	4.2
2	200	205	8.1
3	200	286	11.2
4	171	351	13.8
5	116	399	15.7
6	101	437	17.2
7	70	465	18.3
8	45	497	19.6
9	34	512	20.2
10	26	542	21.3
11	12	581	22.9
12	3	578	22.8
13	2	542	21.3
14	2	568	22.3
15	2	578	22.8
16	1	590	23.2

In 2003, we performed similar spring electrofishing assessments on Caribou Lake. The Schumacker and Eschmeyer population estimate calculated in 2003 was 1027, and the Petersen estimate of 1019 (CV 11.0%) (Borkholder and Edwards 2004). Comparing our 2003 estimates with those from this year's assessments, it appears that the abundance of spawning adult walleye may have declined. Catch curve analysis indicates that total mortality may be as high as 52.5% (R^2 = .872). Future analysis of the angler data collected this past summer will partition estimates of total mortality into angling and natural mortality rates.

PSD and RSD values determined by our spring electrofishing sampling are presented in Table 5. Samples collected by electrofishing during spring 2003 (PSD_{2003}= 67.6 ± 4.4) (Borkholder and Edwards 2004) and again in 2005 (PSD_{2005} = 54.2 ± 4.6) showed significant differences in PSD values between the two years (χ^2 = 16.7, P<0.05, critical Chi-square value of 3.841) (Table 5). The 2003 sample appeared to have a higher proportion of "quality" length walleye than the 2005 sample. Only 37 walleye were sampled in 2005 larger than 20 inches (Table 8). We have fall age-0 data going back as far as 1998. We

have no way of knowing whether the lack of these older year classes observed in the 2005 sample (Table 8) is due to poor spawning and recruitment during the years preceding 1998, or due to excessive angling mortality recently.

The 2005 metrics illustrate that there are a lot more fish in the 10.0 to 14.9 inch range (RSD_{2005} S-Q = 45.8) this year than what was observed in 2003 (RSD_{2003} S-Q = 32.3, Borkholder and Edwards 2004). This corresponds well to the relatively strong 2001 and 2002 year classes observed during fall recruitment surveys (Borkholder and Edwards 2002 & 2003). PSD values will no doubt increase in the future as walleye continue growing and recruit to the larger size classes.

Significant differences in PSD between the two gear types, gill nets (PSD = 11.3) and electrofishing (PSD = 54.2), were noted in 2005 ($\chi^2 = 63.5$, $P>0.05$, critical Chi-square value of 3.841) (Table 5). Within the gill net sample of 106 fish larger than 10 inches, 94 of these were smaller than 15 inches (RSD S-Q = 88.1, Table 5). The majority of these fish are no doubt from the strong 2001 and 2002 year classes discussed above, and will soon be recruiting to "quality" sized individuals (> 15.0 inches).

Between both of the two gear types in 2005, only 39 individuals ($N_{total} = 582$) sampled were larger than 508 mm (20.0 inches). This may reflect a situation where either mortality (angling harvest) is cropping out the larger individuals from the population, or food resources are limited. Growth rates at the earliest ages do not appear to be too slow, relative to other area populations, thus suggesting that angling mortality might be limiting this population. This will be addressed using the tag return and creel survey data from 2005, to be analyzed when the study is completely finished following the 2006 angling year.

Fall Assessments

Table 10 presents a summary of each evening of electrofishing assessments. CPUE for age-0 walleye ranged from 1.7 fish per hour (Poplar Lake) to 193.1 fish per hour of electrofishing (Cadotte Lake) (Table 10). CPUE for age-1 walleye ranged from 1.2 fish per hour (Homer and Poplar Lakes) to 90.4 fish per hour of electrofishing (Shagawa Lake) (Table 10). Figures 10 - 29 present length frequency data for each of the 24 lakes surveyed. Table 11 presents the mean length for age-0 and age-1 individuals sampled during fall 2005 assessments. Mean lengths for age-0 walleye ranged from 104 mm (4.1 inches, Elbow Lake) to 158 mm (6.2 inches, Crooked Lake). Mean lengths for age-1 walleye ranged from 172 mm (6.8 inches, Devilfish Lake) to 242 mm (9.5 inches, Cadotte 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 78.4, and our mean $CPUE_{1+}$ is 35.2. Using the mean $CPUE_{Age-0}$ as one criterion, average or better 2005 year classes were observed in eight of the lakes (Table 10). Average or better 2004 year

classes (age-1 walleye) were observed in one of the lakes (Table 10). 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.

Overall, mean lengths observed in 2005 were larger than those observed during previous years' surveys. This is no doubt a result of the warmer than average summer experienced in northern Minnesota. 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 over-winter 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.

The mean length of age-0 walleye observed since 1995 in our electrofishing assessments is 125 mm in lakes not stocked by the DNR with fingerling walleye prior to our assessments. Using the mean length criteria of 125 mm for average year classes, average or better 2005 year classes may be present in all but five of the lakes surveyed (Table 11), although sample sizes were low in four of the lakes with mean lengths greater than 125mm. In the future, we will be further investigating the predictive power mean length and CPUE of age-0 have 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 our electrofishing data with the State's gill net data for adults. Continued monitoring of walleye young-of-the-year and year-1 fish will give a better picture of recruitment patterns of walleye over time in these lakes, and give managers a better understanding of these walleye populations.

Acknowledgments

The Fond du Lac Division of Resource Management and the 1854 Authority wish to acknowledge and thank the Fond du Lac Fishery Technicians; and Sonny Myers, Darren Vogt, and Carlye Olson, 1854 Authority, for their hard work in the field. Carlye Olson, 1854 GIS expert extraordinaire, provided the GIS maps with the walleye CPUE data. Steve Persons and Paul Eiler (Grand Marais Area Office), and Deserae Hendrickson and Jon Meerbeek (Duluth Area Office) provided gill net data from the Minnesota Department of Natural Resources.

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Table 10. Total number and catch-per-unit-effort (CPUE) of age-0 and age-1 walleye collected by the 1854 Authority and the Fond du Lac Resource Management Division from 24 lakes within the 1854 Ceded Territory of Northeastern Minnesota during fall 2005.

Lake	Date	Temp (F)	Temp (C)	Cond.[1]	YOY Total[2]	Age-1 Total[3]	Total Both	Seconds	CPUE YOY[4]	CPUE 1+[5]
Ball Club	7 Sept	62	16.7	30.8	40	29	69	4340	33.2	24.1
Cadotte	16 Sept	66	18.9	33.7	420	42	462	7832	193.1	19.3
Caribou	8 Sept	65	18.3	63.4	190	14	204	6775	101.0	7.4
Cascade	12 Sept	68	20	26.9	139	35	174	6792	73.7	18.6
Crescent	10 Sept	67	19.4	25.7	129	11	140	5227	88.8	7.6
Crooked	27-Sept	60	15.6	51.4	33	4	37	3567	33.3	4.0
Devilfish	6-Sept	67	19.4	13.7	106	66	172	8913	42.8	26.7
Dumbbell	20 Sept	63	17.2	73.8	193	21	214	4939	140.7	15.3
Elbow	8 Sept	64	17.8	42.1	149	10	159	4293	124.9	8.4
Fourmile	26 Sept	59	15	51.4	367	35	402	7405	178.4	17.0
Homer	12 Sept	71	21.7	28.3	5	2	7	5865	3.1	1.2
Island Reservoir	14 Sept	67	19.4	78.4	206	38	244	11,133	66.6	12.3
Ninemile	21 Sept	65	18.3	61.6	185	23	208	5042	132.1	16.4
N. McDougal	25 Sept	57	13.9	84.6	119	41	160	6724	63.7	22.0
Pike	11 Sept	73	22.8	55.5	54	22	76	6274	31.0	12.6
Poplar	8 Sept	69	20.6	37.4	3	2	5	6219	1.7	1.2
Shagawa	13 Sept	68.5	20.3	88.8	50	310	360	12,344	14.6	90.4
Silver Island	11 Sept	66	18.9	37.7	19	11	30	4473	15.3	8.9
Tom	6 Sept	69	20.6	35.7	42	70	112	7985	18.9	31.6
Two Island	7 Sept	68	20.0	30.6	70	4	74	6582	38.3	2.2
West Twin	8 Sept	----		33.6	79	33	112	4010	70.9	29.6
Whiteface Res.	15 Sept	66.5	19.2	57.3	227	40	267	7449	109.7	19.3
Wilson	18 Sept	66	18.9	46.9	54	4	58	6459	30.1	2.2
Windy	19 Sept	64	17.8	32.2	14	37	51	6030	8.4	22.1

[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 11. Mean length for age-0 and age-1 walleye sampled during fall 2005 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 (Cook)	9 Sept	118	225
Cadotte (St. Louis)	16 Sept	132	242
Caribou (Cook)	8 Sept	143	200 (N=14)
Cascade (Cook)	12 Sept	140	209
Crescent (Cook)	10 Sept	144	219 (N=11)
Crooked (Lake)	27 Sept	158	236 (N=4)
Devilfish (Cook)	6 Sept	108	172
Dumbbell (Lake)	20 Sept	146	204 (N=21)
Elbow (Cook)	8 Sept	104	187 (N=10)
Fourmile (Cook)	26 Sept	134	194
Homer (Cook)	12 Sept	144 (N=5)	226 (N=2)
Island Lake Reservoir (St. Louis)	14 Sept	122	186
Ninemile (Lake)	21 Sept	149	234 (N=23)
N. McDougal (Lake)	25 Sept	126	188
Pike (Cook)	11 Sept	111	197
Poplar (Cook)	8 Sept	144 (N=3)	216 (N=2)
Shagawa (St. Louis)	13 Sept	135	176
Silver Island (Cook)	11 Sept	144 (N=19)	195 (N=11)
Tom (Cook)	6 Sept	150	192
Two Island (Cook)	7 Sept	131	195 (N=4)
West Twin (Cook)	8 Sept	134	191
Whiteface Res. (St. Louis)	15 Sept	132	206
Wilson (Lake)	18 Sept	135	193 (N=4)
Windy (Lake)	19 Sept	154 (N=14)	213

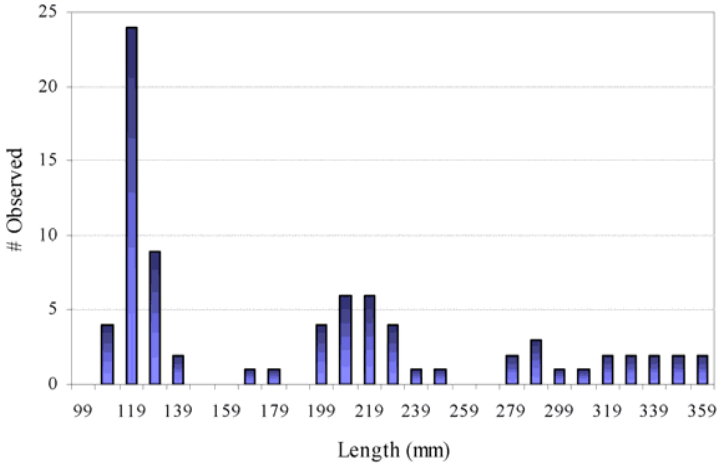

Figure 10. Length frequency distribution of walleye collected from Ball Club Lake, Cook County, during fall 2005 electrofishing assessments.

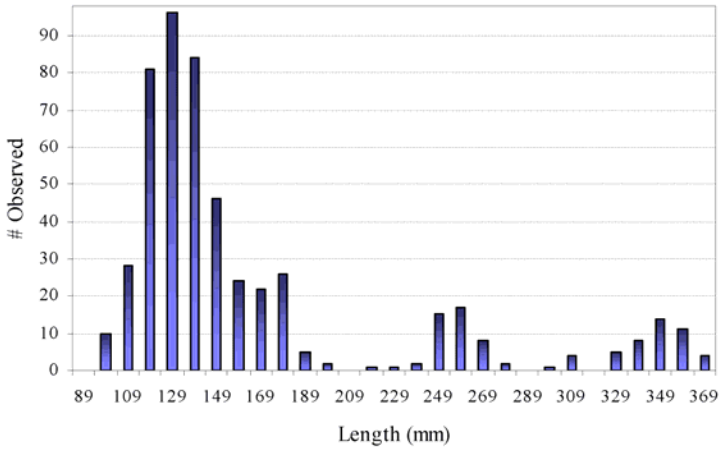

Figure 11. Length frequency distribution of walleye collected from Cadotte Lake, St. Louis County, during fall 2005 electrofishing assessments.

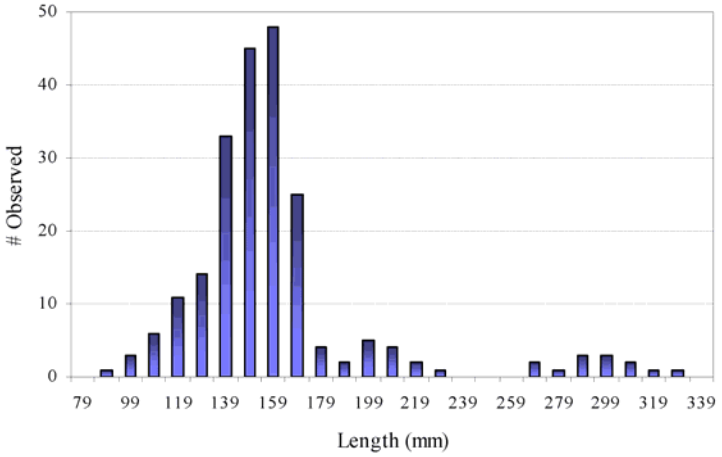

Figure 12. Length frequency distribution of walleye collected from Caribou Lake, Cook County, during fall 2005 electrofishing assessments.

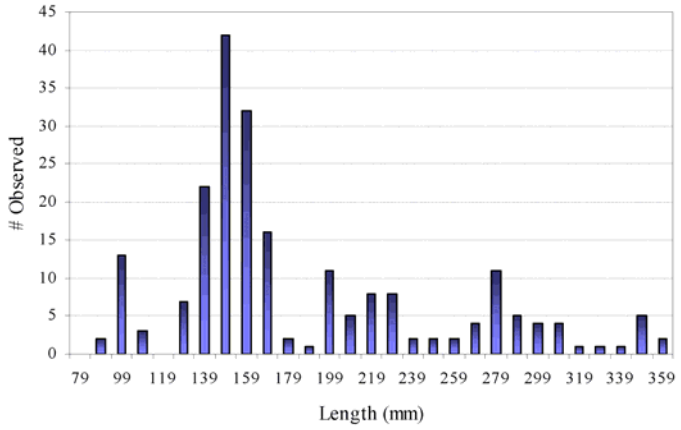

Figure 13. Length frequency distribution of walleye collected from Cascade Lake, Cook County, during fall 2005 electrofishing assessments.

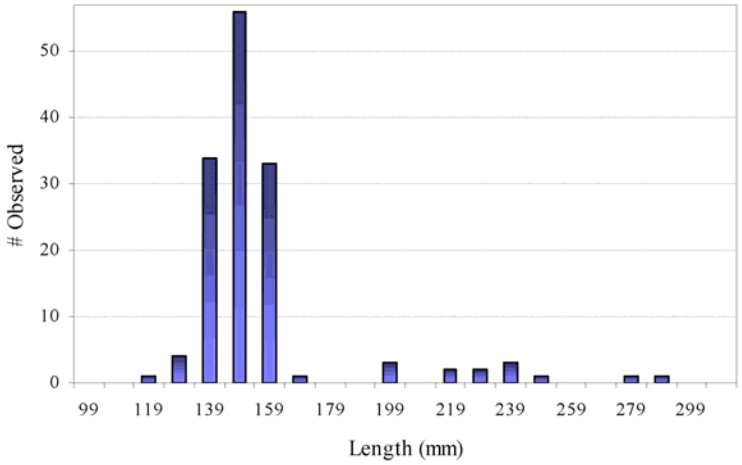

Figure 14. Length frequency distribution of walleye collected from Crescent Lake, Cook County, during fall 2005 electrofishing assessments.

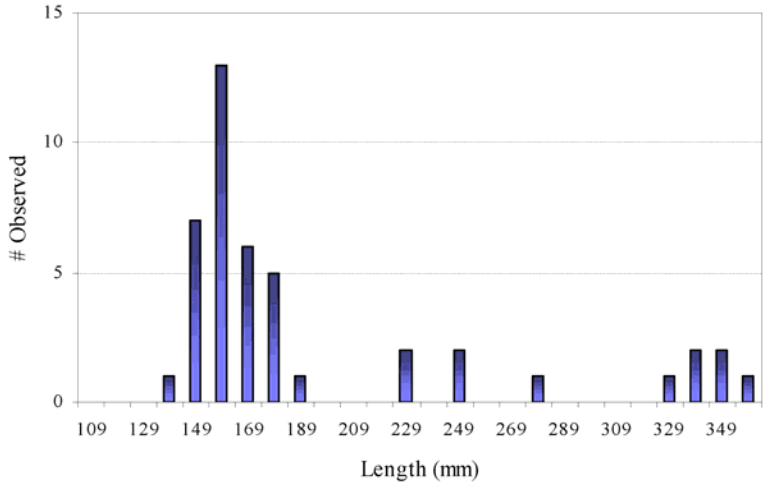

Figure 15. Length frequency distribution of walleye collected from Crooked Lake, Lake County, during fall 2005 electrofishing assessments.

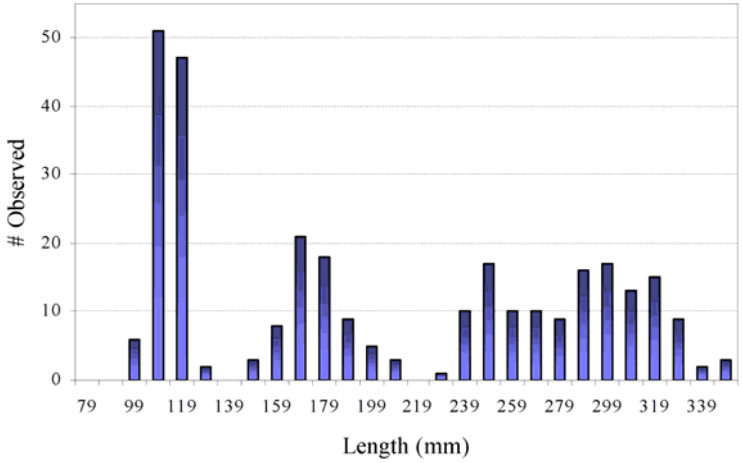

Figure 16. Length frequency distribution of walleye collected from Devilfish Lake, Cook County, during fall 2005 electrofishing assessments.

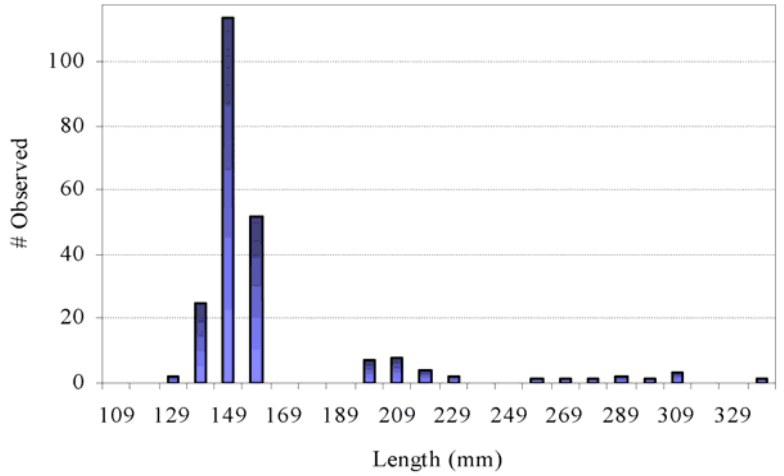

Figure 17. Length frequency distribution of walleye collected from Dumbbell Lake, Lake County, during fall 2005 electrofishing assessments.

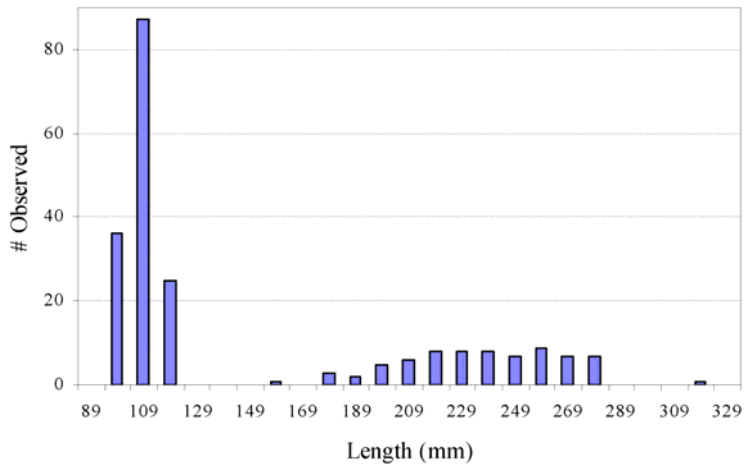

Figure 18. Length frequency distribution of walleye collected from Elbow Lake, Cook County, during fall 2005 electrofishing assessments.

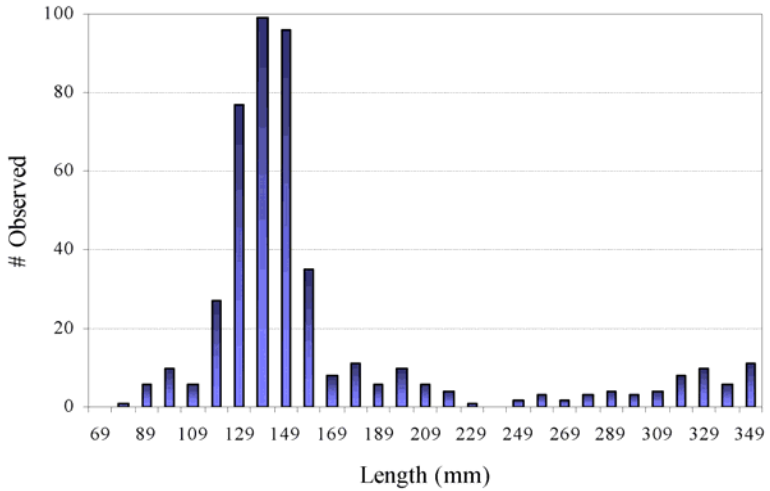

Figure 19. Length frequency distribution of walleye collected from Fourmile Lake, Cook County, during fall 2005 electrofishing assessments.

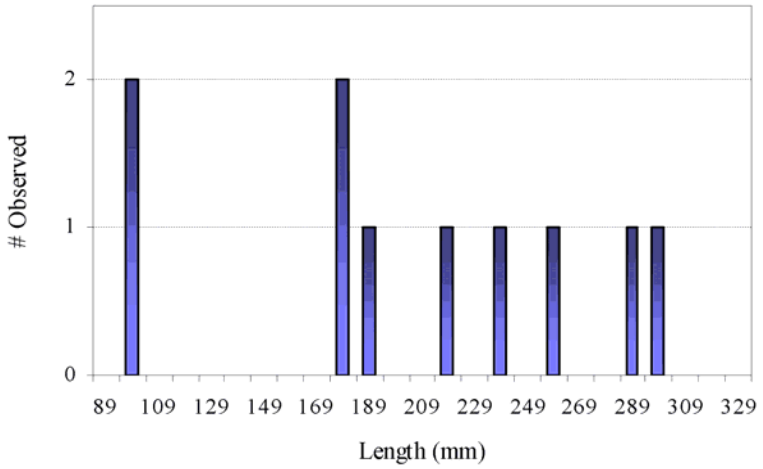

Figure 20. Length frequency distribution of walleye collected from Homer Lake, Cook County, during fall 2005 electrofishing assessments.

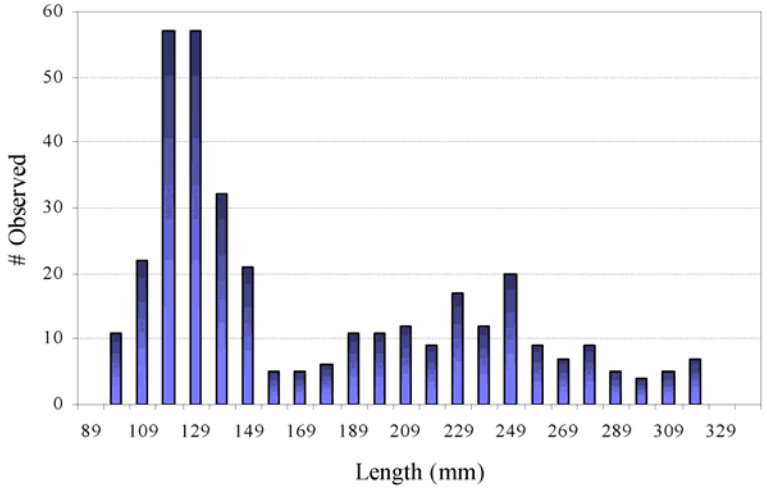

Figure 21. Length frequency distribution of walleye collected from Island Lake, St. Louis County, during fall 2005 electrofishing assessments.

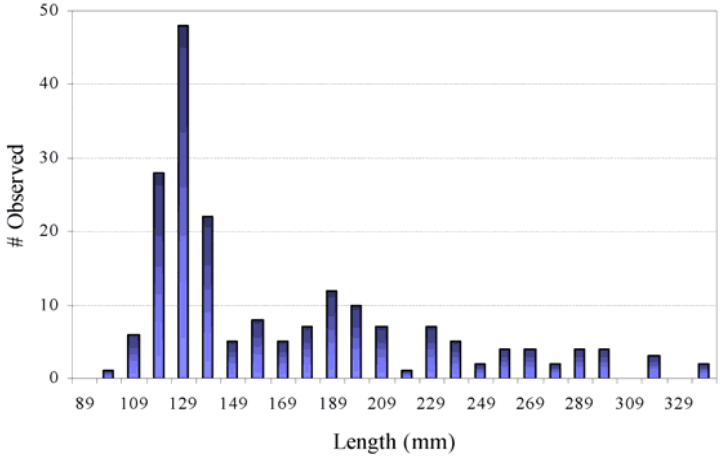

Figure 22. Length frequency distribution of walleye collected from North McDougal Lake, Lake County, during fall 2005 electrofishing assessments.

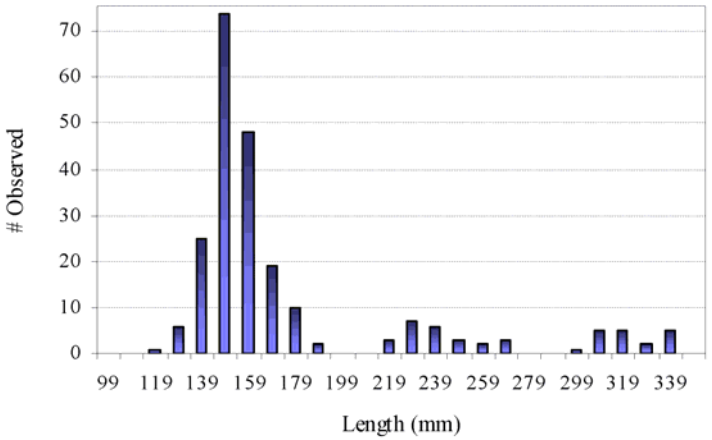

Figure 23. Length frequency distribution of walleye collected from Ninemile Lake, Lake County, during fall 2005 electrofishing assessments.

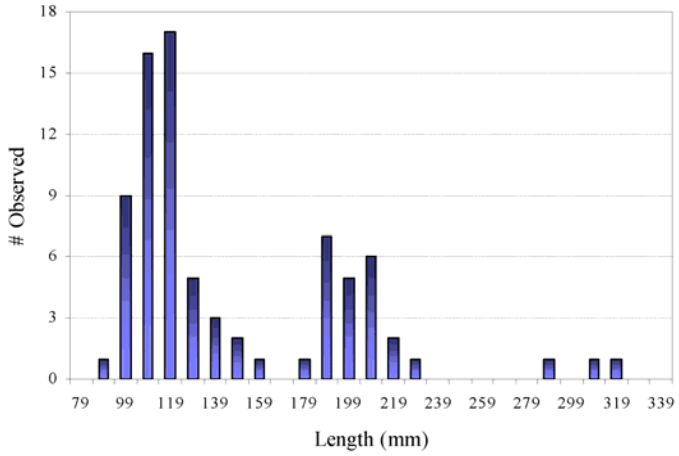

Figure 24. Length frequency distribution of walleye collected from Pike Lake, Cook County, during fall 2005 electrofishing assessments.

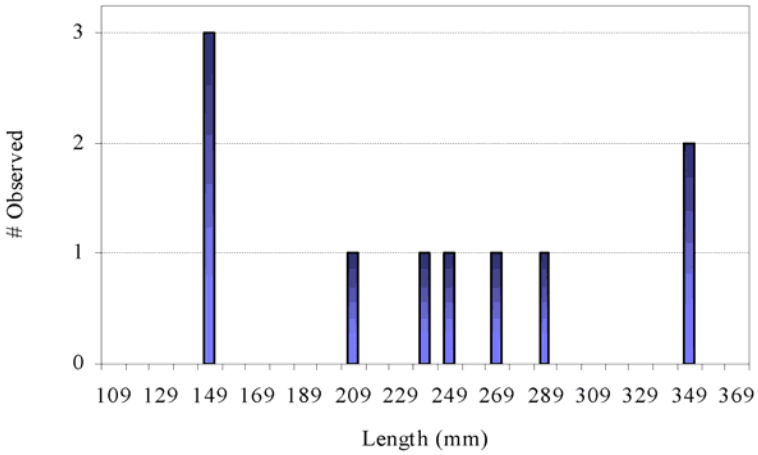

Figure 25. Length frequency distribution of walleye collected from Poplar Lake, Cook County, during fall 2005 electrofishing assessments.

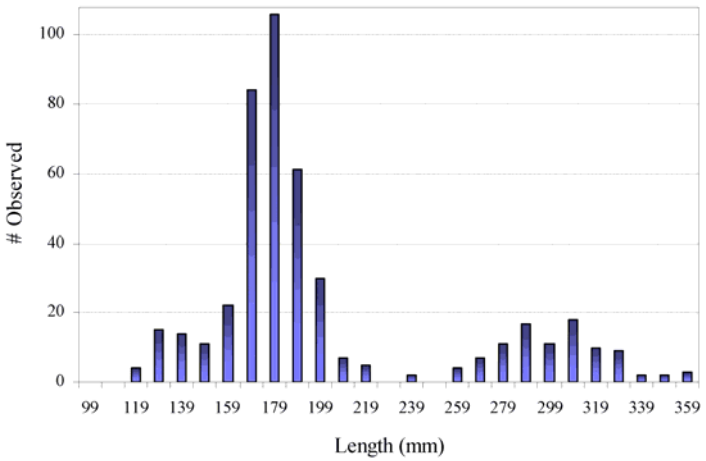

Figure 26. Length frequency distribution of walleye collected from Shagawa Lake, St. Louis County, during fall 2005 electrofishing assessments.

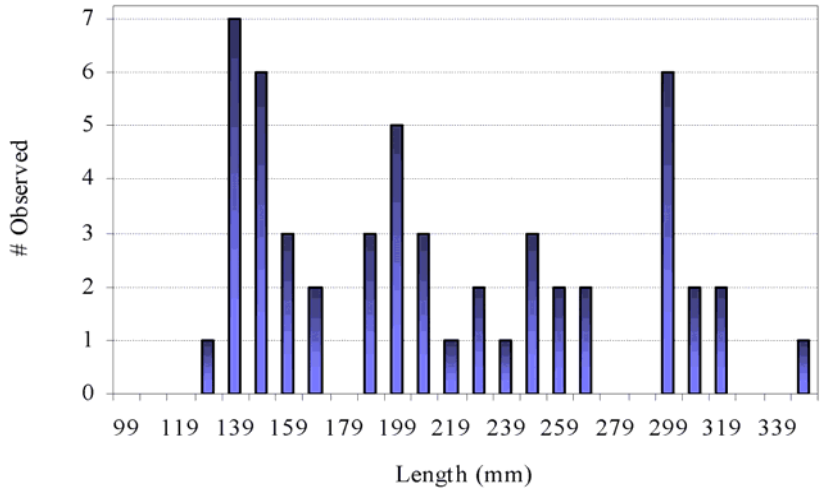

Figure 27. Length frequency distribution of walleye collected from Silver Island Lake, Cook County, during fall 2005 electrofishing assessments.

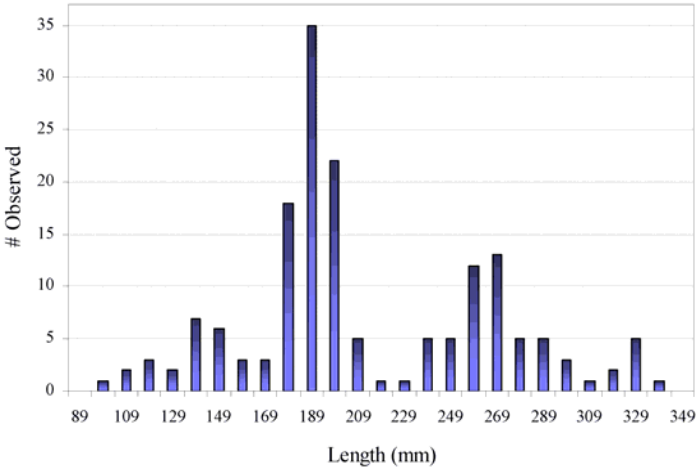

Figure 28. Length frequency distribution of walleye collected from Tom Lake, Cook County, during fall 2005 electrofishing assessments.

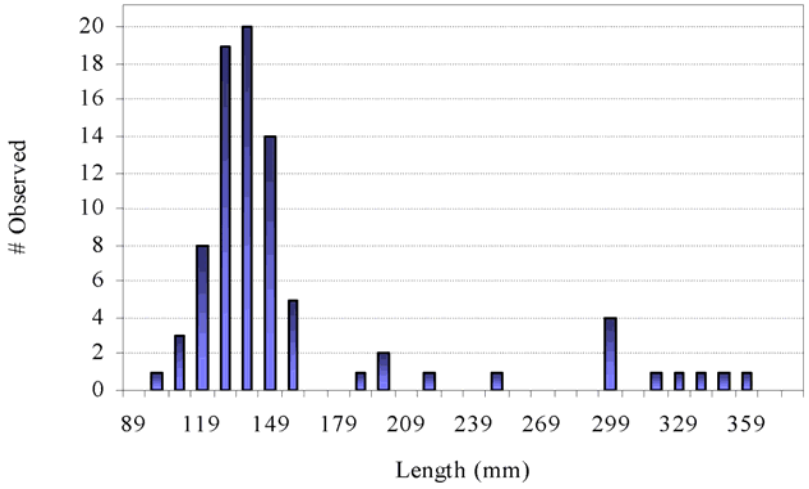

Figure 29. Length frequency distribution of walleye collected from Two Island Lake, Cook County, during fall 2005 electrofishing assessments.

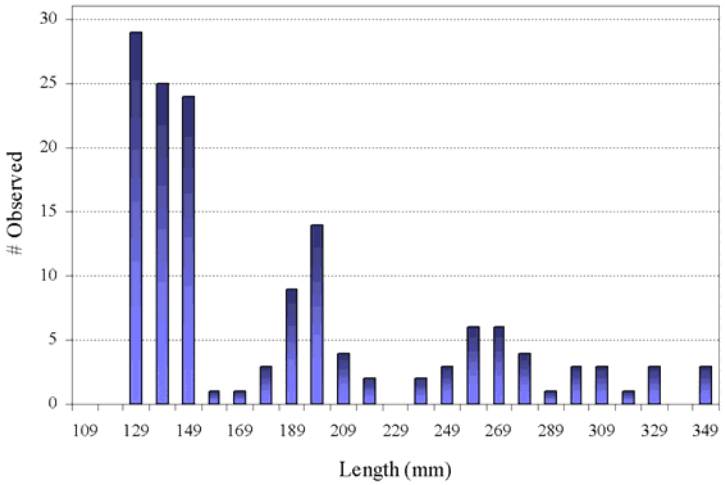

Figure 28. Length frequency distribution of walleye collected from West Twin Lake, Cook County, during fall 2005 electrofishing assessments.

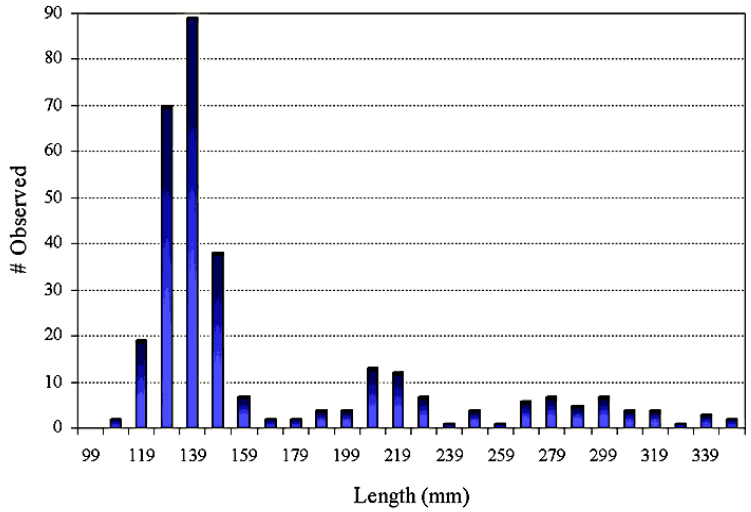

Figure 29. Length frequency distribution of walleye collected from Whiteface Reservoir, St. Louis County, during fall 2005 electrofishing assessments.

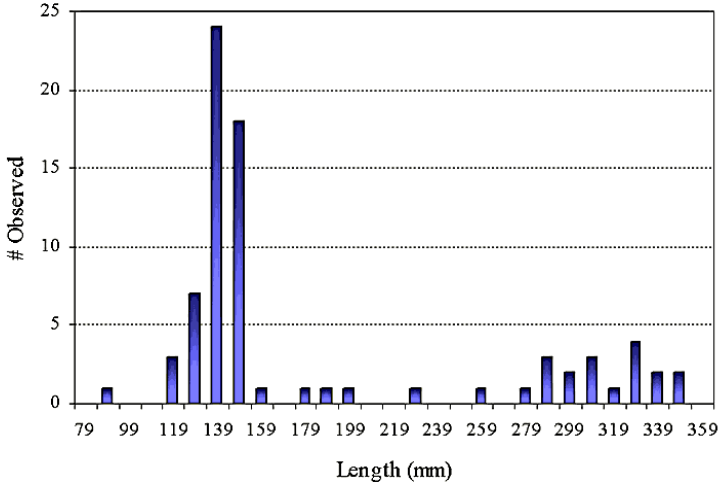

Figure 28. Length frequency distribution of walleye collected from Wilson Lake, Lake County, during fall 2005 electrofishing assessments.

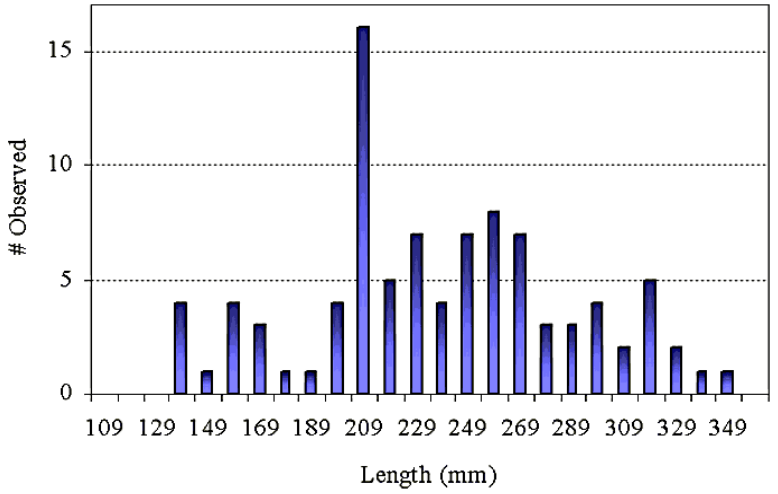

Figure 29. Length frequency distribution of walleye collected from Windy Lake, Lake County, during fall 2005 electrofishing assessments.

Appendix 1. Length frequency distributions for the marked and recaptured walleye sampled during spring 2005 assessments in Fish Lake (St. Louis County), and Crescent and Caribou Lakes (Cook County). Numbers represent all fish marked and recaptured throughout the entire survey, i.e. multiple nights.

Fish Lake, St. Louis County			Crescent Lake, Cook County	
Length (mm)	# Marked	# Recaptured	# Marked	# Recaptured
250	2	0	4	0
260	2	0	8	0
270	4	1	25	0
280	5	1	30	1
290	11	2	13	0
300	38	11	16	1
310	108	29	21	0
320	140	37	15	0
330	214	47	17	3
340	237	66	20	1
350	231	67	23	4
360	222	49	21	3
370	165	54	38	11
380	148	44	34	13
390	125	40	50	22
400	111	35	55	16
410	100	31	76	35
420	104	21	69	30
430	104	36	56	30
440	83	28	47	21
450	95	25	38	17
460	77	22	15	4
470	60	11	16	6
480	42	6	14	3
490	39	9	11	3
500	23	3	11	2
510	16	5	4	2
520	13	3	5	2
530	8	2	6	3
540	7	0	2	0
550	8	1	2	0
560	2	0	1	0
570	3	0	0	0
580	6	0	1	0
590	1	0	1	0
600	4	0	0	0
610	2	0	0	0
620	0	0	1	0
630	1	0	1	1
640	1	0	0	0
650	2	0	2	0
660	1	0	1	0
670	1	0	2	0
680	0	0	0	0
690	1	0	0	0
700	0	0	0	0
710	0	0	0	0
720	0	0	0	0
730	1	0	0	0
740	0	0	0	0

Appendix 1. Continued.

Caribou Lake, Cook County

Length (mm)	# Marked	# Recaptured
250	0	0
260	5	0
270	1	0
280	6	0
290	6	0
300	10	1
310	10	3
320	14	5
330	19	5
340	18	5
350	29	15
360	49	38
370	41	24
380	30	16
390	28	22
400	13	6
410	19	10
420	14	9
430	13	6
440	17	11
450	17	10
460	24	12
470	11	7
480	11	4
490	7	2
500	6	3
510	11	6
520	4	0
530	3	2
540	3	0
550	4	1
560	0	0
570	2	0
580	1	1
590	1	1
600	1	0
610	1	0
620	1	0
630	1	1
640	1	0
650	0	0
660	1	0
670	0	0
680	0	0
690	0	0
700	0	0
710	1	0
720	0	0
730	0	0

Appendix 2. Nightly Mark / Recapture Data for walleye > 254 mm sampled during spring 2005 assessments in Fish Lake (St. Louis County), and Crescent and Caribou Lakes (Cook County).

Lake	Date	Marked in Population	Daily Catch	Daily Recap
Fish	16-Apr-05	--	166	--
	17-Apr-05	166	1094	8
	18-Apr-05	1252	939	253
	19-Apr-05	1938	1056	424
	TOTALS	2570	3255	685
Caribou	22-Apr-05	--	166	--
	24-Apr-05	166	199	63
	26-Apr-05	302	310	160
	TOTALS	452	675	223
Crescent	20-Apr-05	--	120	--
	21-Apr-05	120	176	15
	23-Apr-05	281	353	66
	25-Apr-05	568	347	142
	TOTALS	773	996	223