Autumn Assessments of Age-0 and Age-1 Walleye in Twenty-Seven Lakes in the Minnesota 1854 Ceded Territory

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 are taking 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 (Newman 1992, Stone 1992, Stone and Slade 1992, Goyke et al. 1993 and 1994, and Ngu and Kmiecik 1993, 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. Fish assessments often target juvenile (age-1) and young-of-the-year (age-0) individuals. The purpose for assessing juvenile and fingerling individuals often is to evaluate recruitment and year-class strength, which was the main objective for the assessments in this study.

Methods

Electrofishing was performed at night using a boom shocking boat equipped with a Smith-Root Type VI-A electrofisher unit and two Smith-Root umbrella anode arrays (Smith-Root, Vancouver, WA). Pulsed direct current (PDC) was used to minimize injuries to the fish. Surface water temperature was taken at each sampling location. Water conductivity measurements were taken at each sampling station using either a Hanna HI8733 conductivity meter (Ben Meadows Co., Atlanta, GA) or a Fisher Scientific Digital Conductivity Meter. The starting and ending points of each sampling station were identified and recorded using a GPS unit and a lake map.

Based upon our temperature data from the assessments in 1996, we at-

tempted to conduct our sampling between 20.0°C and 10.0°C. Catch per unit effort (CPUE) for age-0 walleye was found to be the highest in this range of temperatures (Borkholder and Parsons, 2001). Due to the warm summer and fall, we postponed our start date by 7 days from previous years.

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 (Borkholder 1996, 1997, and 1998; Borkholder and Edwards 1999 and 2000). New sampling stations were established on Tom, Aspen, and Poplar Lakes, all located in Cook County.

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

Table 1 shows a summary of each evening of electrofishing assessments. CPUE for age-0 walleye ranged from 0.6 fish per hour (Prairie Lake) to 1150.8 fish per hour of electrofishing (Shagawa Lake) (Table 1). CPUE for age-1 walleye ranged from 0.00 fish per hour (Ninemile Lake) to 52.4 fish per hour of electrofishing (Lax Lake) (Table 1). Figures 1 - 28 present length frequency data for each of the twenty seven lakes surveyed. Figure 23 shows all fish sampled from Shagawa Lake, while Figure 24 shows only those individuals larger than 140mm sampled from Shagawa Lake. Table 2 presents the mean length for age-0 and age-1 individuals sampled during fall 2001 assessments. Mean lengths for age-0 walleye ranged from 98 mm (3.9 inches, Homer Lake) to 162 mm (6.4 inches, Crooked Lake).

With the exception of Lax and Wild Rice Lakes, catch rates of age-0 walleye this year were higher than those observed last year (Borkholder and Edwards 2001). Additionally, mean lengths of age-0 walleye were observed this year to be higher than those observed last year (Borkholder and Edwards 2001).

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 $CPUE_{Age\text{-}0}$ = 64.3, our mean

$CPUE_{1+}$ = 31.2, and the mean length of age-0 walleye = 130 mm. Using the mean $CPUE_{Age-0}$ as one criteria, average or better 2001 year classes were observed in 14 of the lakes (Table 1). Average or better 2000 year classes (age-1 walleye) were observed in only Lax Lake. 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 2001 year classes may be present in 14 of the lakes surveyed in 2001 (Table 2). 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 once we can combine gill net data for adults from the DNR several years from now.

Using the CPUE data from 1995 through this survey, we regressed $CPUE_{Age-0}$ year 1 to $CPUE_{1+}$ year 2 to further investigate whether there is any utility in our fall assessments in predicting strength (survival) of year classes. Presumably there should be a correlation between the catch rate of age-0 walleye in year 1 to the catch rate of age-1 walleye in year 2, otherwise we should question the utility of these assessments. Figure 29 shows the re-

sults of the regression. The relationship is significant (F=29.86, P<0.0001, R^2 = .2272, 102 *df),* with the slope of the regression equal to 0.198, suggesting that natural mortality for walleye from age-0 to age-1 over the first winter is approximately 80%. However, by forcing the regression through the origin (i.e., when zero age-0 fish are captured in year-1, we would expect zero age-1 fish sampled in year-2), the regression is not nearly as predictive. This might suggest that during some of the surveys, we have not sampled age-0 walleye in proportion to their actual abundance. These walleyes were sampled more efficiently as age-1 individuals. This might indicate that in the future, we should focus on the catch of age-1 individuals as the index to gauge future year class strength. Regardless, there still appears to be utility in using fall electrofishing assessments to evaluate the relative abundance of age-0 and age-1 walleye, and to use this data to make inferences on recruitment and subsequent year class strength. We will be further investigating this relationship in subsequent assessments and as gill net CPUE's by age class are collected.

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.

Acknowledgments

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Table 1. 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 seven lakes within Northeastern Minnesota during Fall 2001.

Lake (County)	Date	Temp (°C)	Conductivity[1]	On Time (sec)	#Age-0[2]	#1+[3]	$CPUE_{Age-0}$[4]	$CPUE_{1+}$[5]
Aspen (Cook)	10 September	17.8	-----[6]	4950	28	41	20.4	29.8
Ball Club (Cook)	6 September	19.4	30.1	4148	223	22	193.5	19.1
Caribou (Cook)	7 September	20.5	63.6	6405	107	4	60.1	2.2
Cascade (Cook)	4 September	19.4	30.1	6143	301	20	176.4	11.7
Crescent (Cook)	7 September	21.1	35.7	3128	14	9	16.1	10.4
Crooked (Lake)	20 September	17.2	-----[6]	5113	161	0	113.4	0.0
Devilfish (Cook)	5 September	18.3	20.2	9802	398	26	146.2	9.6
Dumbbell (Lake)	19 September	17.2	83.1	5254	458	16	313.8	11.0
Eagle (Carlton)	17 September	18.3	156.5	9947	56	69	20.3	25.0
Elbow (Cook)	11 September	17.8	-----[6]	3734	48	31	46.3	29.9
Fourmile (Lake)	21 September	15.5	-----[6]	7873	793	24	362.6	11.0
Homer (Cook)	4 September	21.1	30.6	5154	53	27	37.0	18.9
Island Lake Res. (St. Louis)	12 September	18.9	78.2	11,889	486	78	147.2	23.6

Table 1. Contin-

Lake (County)	Date	Temp (^{o}C)	Conductivity[1]	On Time (sec)	#Age-0[2]	#1+[3]	$CPUE_{Age-0}$[4]	$CPUE_{1+}$[5]
Tom (Cook)	5 September	21.1	39.1	6405	165	43	92.7	24.2
Two Island (Cook)	6 September	21.1	38.1	6177	13	9	7.6	5.2
West Twin (Cook)	10 September	17.2	38.8	4359	253	22	209.0	18.2
Whiteface Res. (St. Louis)	13 September	18.9	62.0	6635	232	34	125.9	18.4
Wild Rice Res. (St. Louis)	14 September	15.5	132.0	5947	82	16	49.6	9.7
Wilson (Lake)	21 September	17.2	54.5	6440	12	6	6.7	3.4
Windy (Lake)	19 September	17.2	37.4	5810	67	9	41.5	5.6

1 Conductivity, measured in μSiemens / 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.
4Indicates the catch rate of age-0 fish (fish per hour, 3600 sec, of electrofishing on time).
5Indicates the catch rate of age-1 fish (fish per hour, 3600 sec, of electrofishing on time).
6 Conductivity meter was broken. No measurements were taken on this night.

Table 2. Mean length for age-0 and age-1 walleye sampled during fall 2001 assessments in Northeastern Minnesota.

Lake (County)	Date	Age-0 Mean Length (mm)	Age-1 Mean Length (mm)
Aspen (Cook)	10 September	124	198
Ball Club (Cook)	6 September	106	205
Caribou (Cook)	7 September	139	227
Cascade (Cook)	4 September	110	199
Crescent (Cook)	7 September	143	221
Crooked (Lake)	20 September	162	---
Devilfish (Cook)	5 September	105	223
Dumbbell (Lake)	19 September	145	218
Eagle (Carlton)	17 September	144	214
Elbow (Cook)	11 September	104	170
Fourmile (Lake)	21 September	147	233
Homer (Cook)	4 September	98	180
Island Lake Res. (St. Louis)	12 September	111	206
Lax (Lake)	19 September	156	195
Ninemile (Lake)	20 September	147	0
North McDougal (Lake)	20 September	119	215
Pike (Cook)	11 September	103	205
Poplar (Cook)	10 September	112	204
Prairie (St. Louis)	17 September	138	192
Shagawa (St. Louis)	18 September	121	233
Tom (Cook)	5 September	122	204
Two Island (Cook)	6 September	114	214
West Twin (Cook)	10 September	130	208
Whiteface Res. (St. Louis)	13 September	143	232
Wild Rice Res. (St. Louis)	14 September	140	216
Wilson (Lake)	21 September	133	223
Windy (Lake)	19 September	141	204

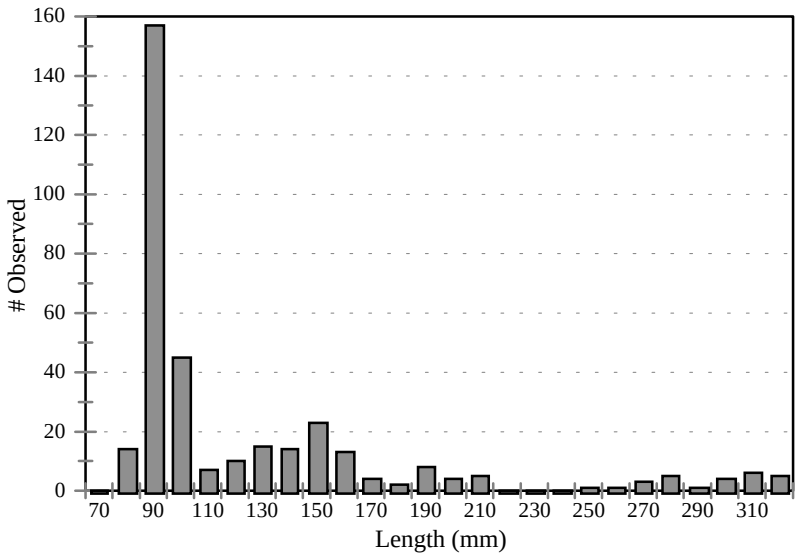

Figure 1. Length frequency distribution of walleye collected from Cascade Lake, Cook County, during fall 2001 electrofishing assessments.

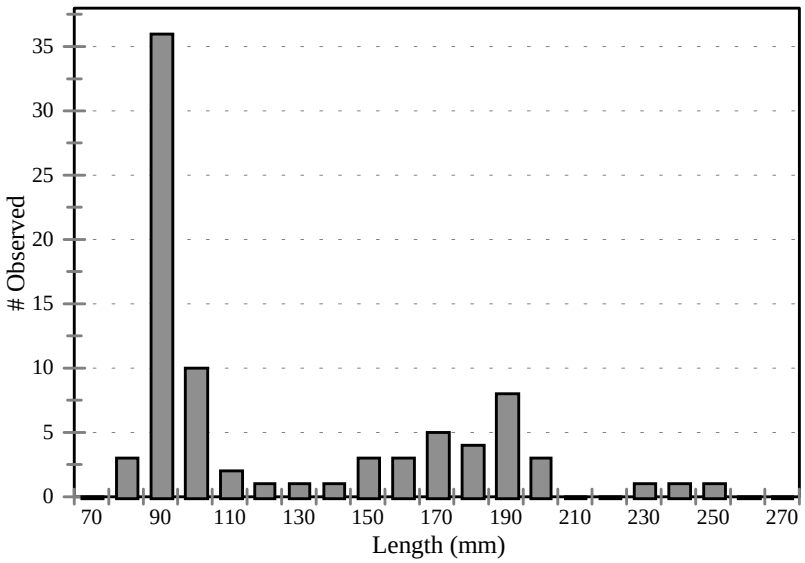

Figure 2. Length frequency distribution of walleye collected from Homer Lake, Cook County, during fall 2001 electrofishing assessments.

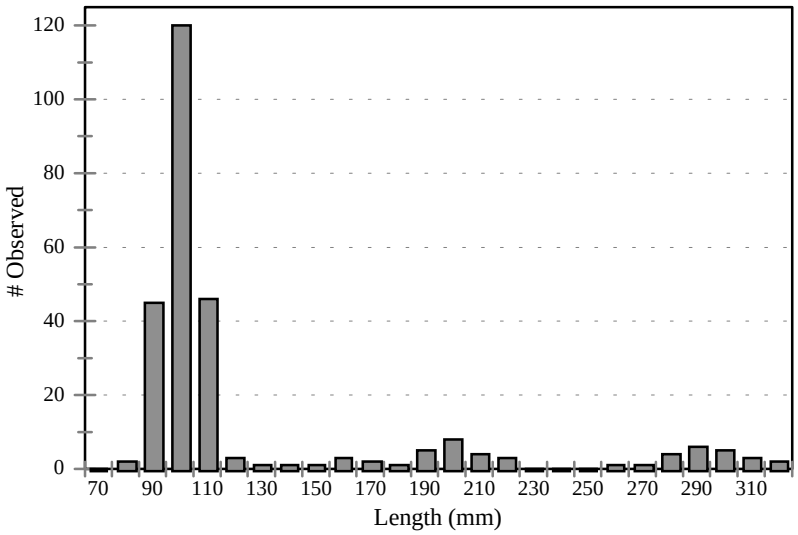

Figure 3. Length frequency distribution of walleye collected from Ball Club Lake, Cook County, during fall 2001 electrofishing assessments.

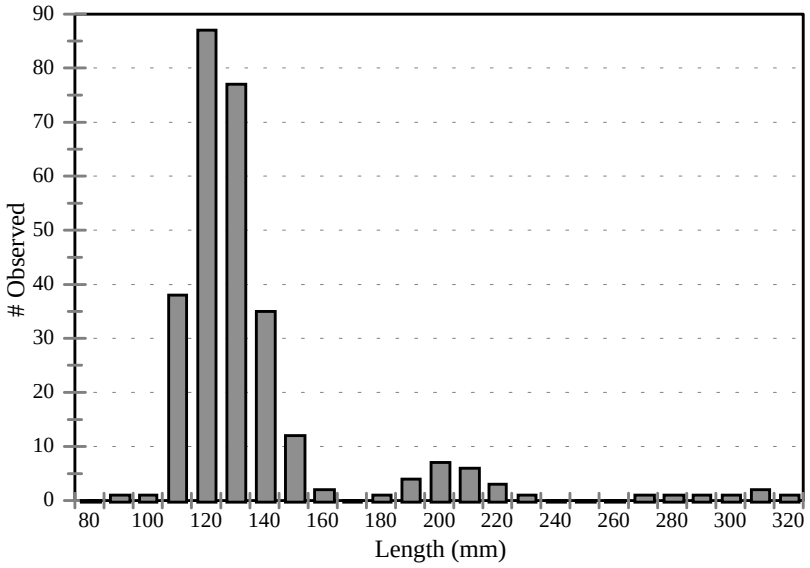

Figure 4. Length frequency distribution of walleye collected from West Twin Lake, Cook County, during fall 2001 electrofishing assessments.

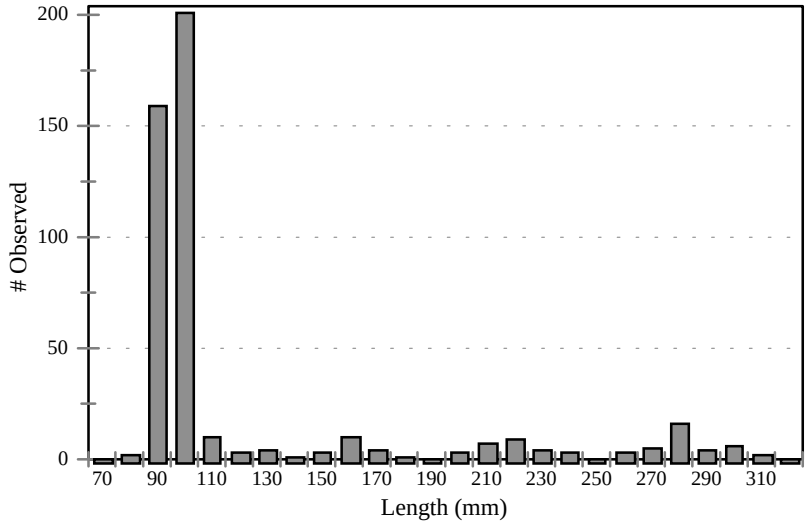

Figure 5. Length frequency distribution of walleye collected from Devilfish Lake, Cook County, during fall 2001 electrofishing assessments.

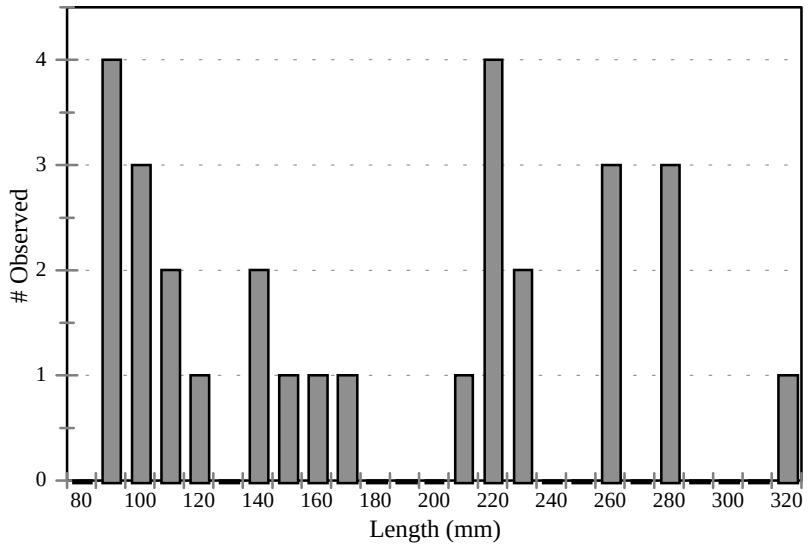

Figure 6. Length frequency distribution of walleye collected from Two Island Lake, Cook County, during fall 2001 electrofishing assessments.

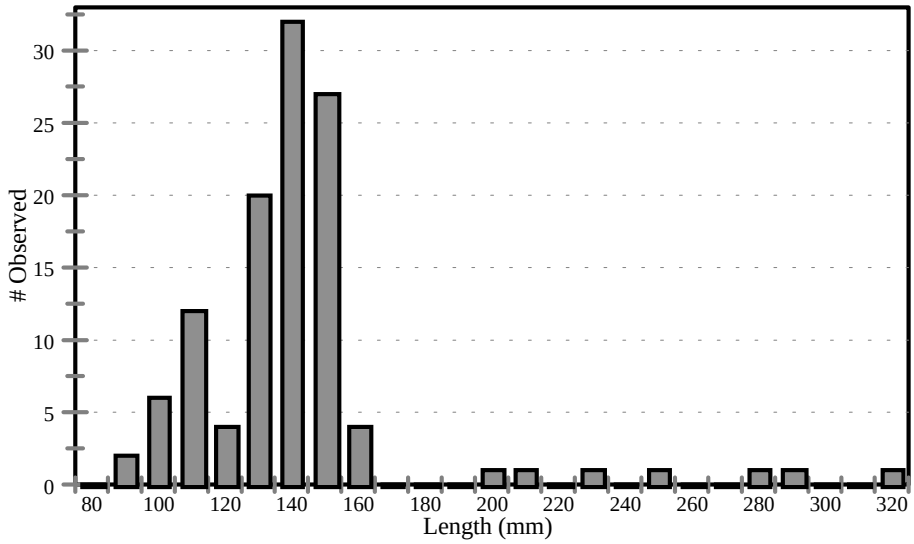

Figure 7. Length frequency distribution of walleye collected from Caribou Lake, Cook County, during fall 2001 electrofishing assessments.

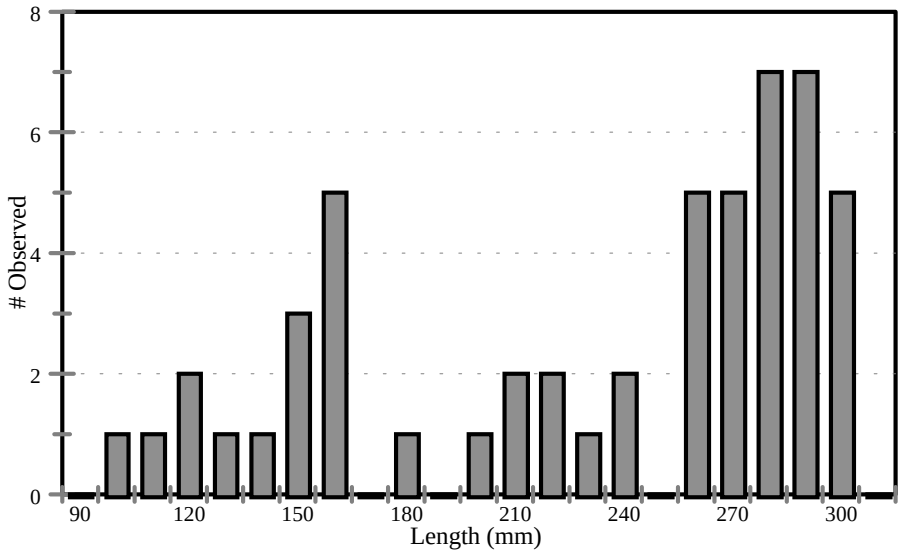

Figure 8. Length frequency distribution of walleye collected from Crescent Lake, Cook County, during fall 2001 electrofishing assessments.

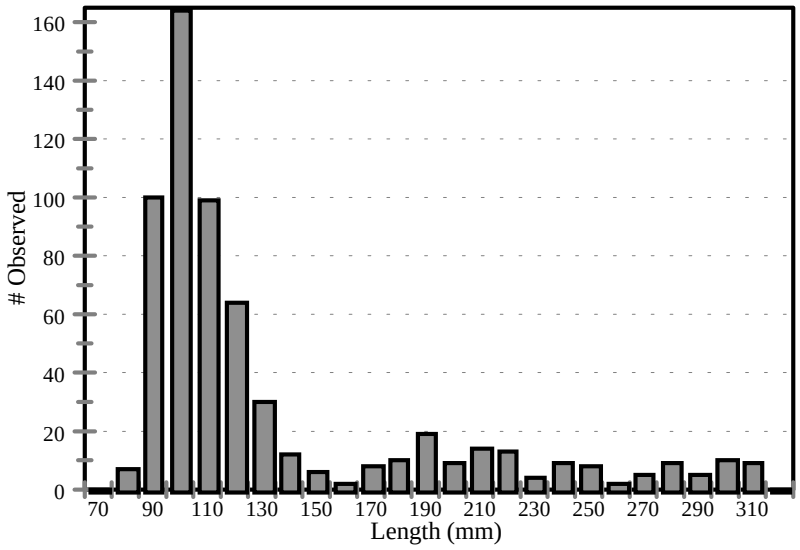

Figure 9. Length frequency distribution of walleye collected from Island Lake Reservoir, St. Louis County, during fall 2001 electrofishing assessments.

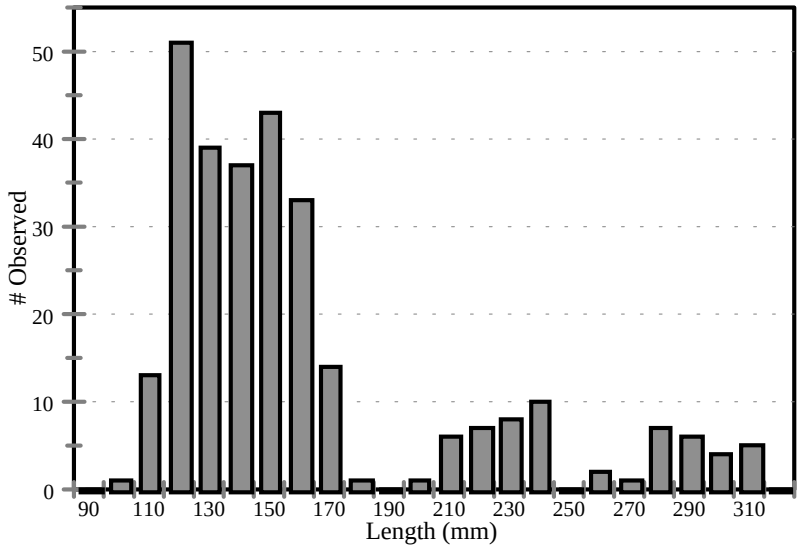

Figure 10. Length frequency distribution of walleye collected from Whiteface Reservoir, St. Louis County, during fall 2001 electrofishing assessments.

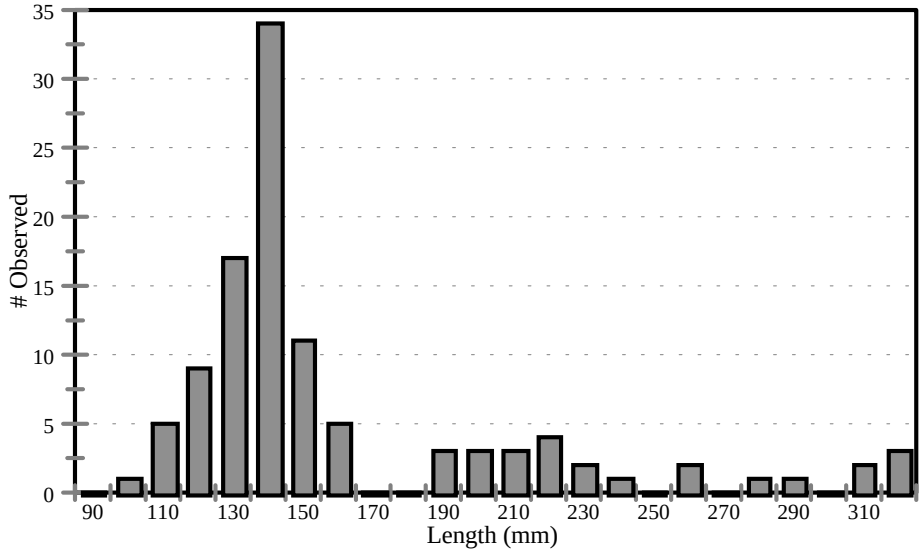

Figure 11. Length frequency distribution of walleye collected from Wild Rice Lake Reservoir, St. Louis County, during fall 2001 electrofishing assessments.

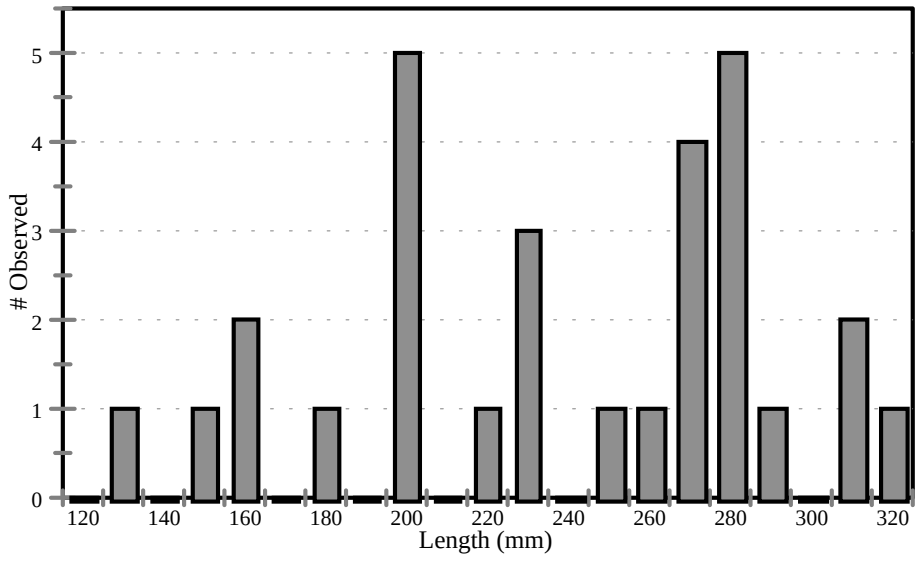

Figure 12. Length frequency distribution of walleye collected from Prairie Lake, Carlton County, during fall 2001 electrofishing assessments.

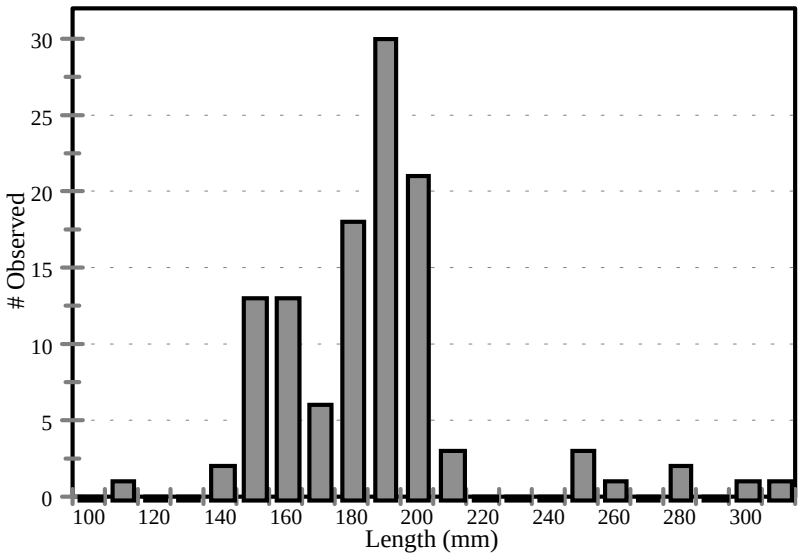

Figure 13. Length frequency distribution of walleye collected from Lax Lake, Lake County, during fall 2001 electrofishing assessments.

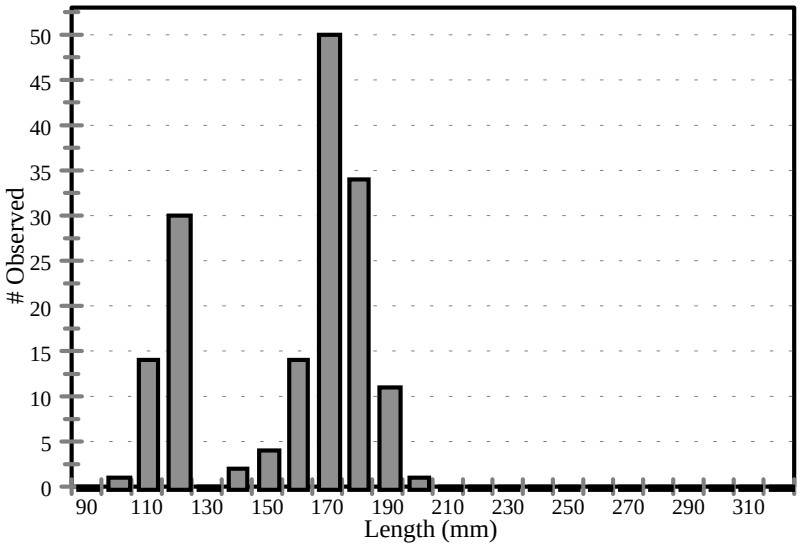

Figure 14. Length frequency distribution of walleye collected from Crooked Lake, Lake County, during fall 2001 electrofishing assessments.

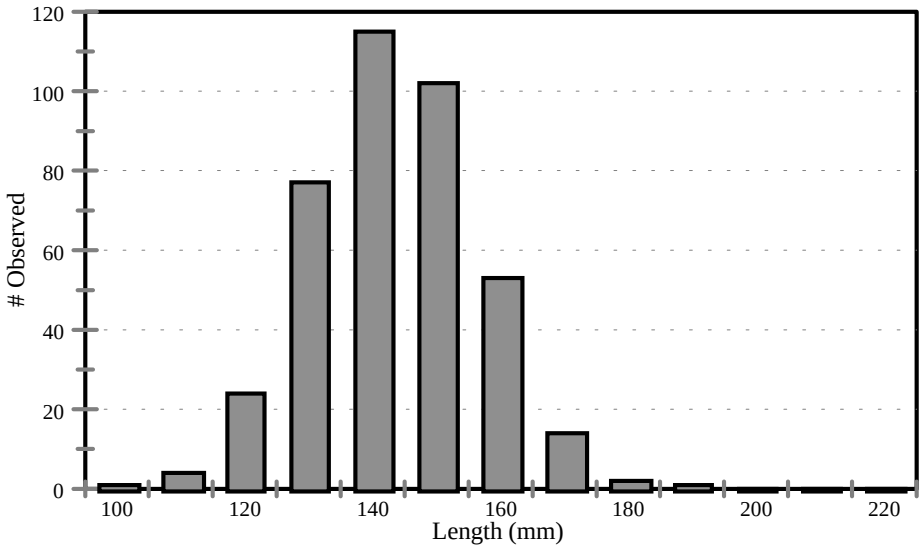

Figure 15. Length frequency distribution of walleye collected from Ninemile Lake, Lake County, during fall 2001 electrofishing assessments.

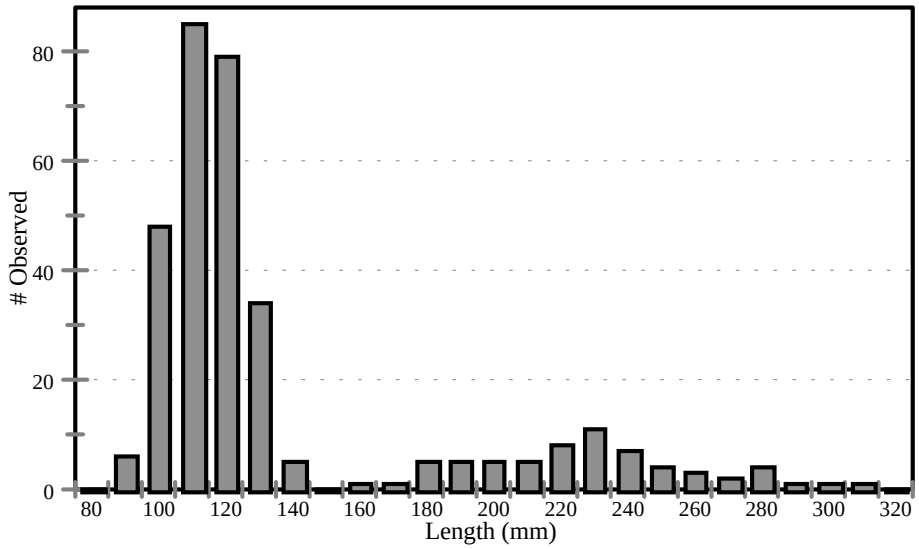

Figure 16. Length frequency distribution of walleye collected from North McDougal Lake, Lake County, during fall 2001 electrofishing assessments.

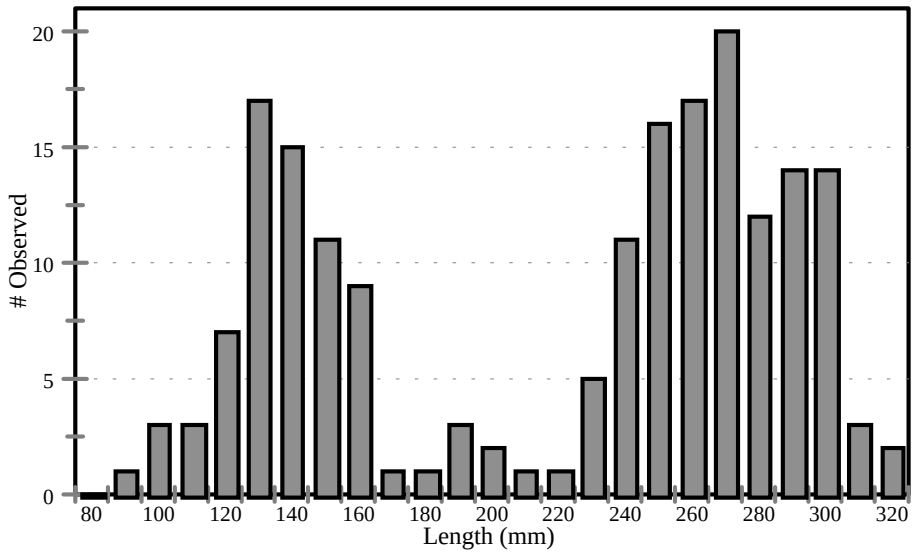

Figure 17. Length frequency distribution of walleye collected from Windy Lake, Lake County, during fall 2001 electrofishing assessments.

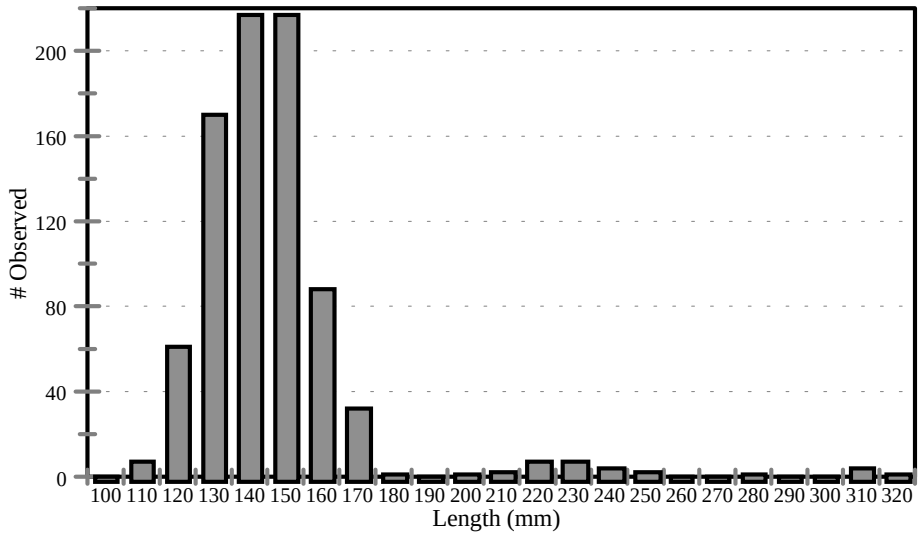

Figure 18. Length frequency distribution of walleye collected from Four Mile Lake, Cook County, during fall 2001 electrofishing assessments.

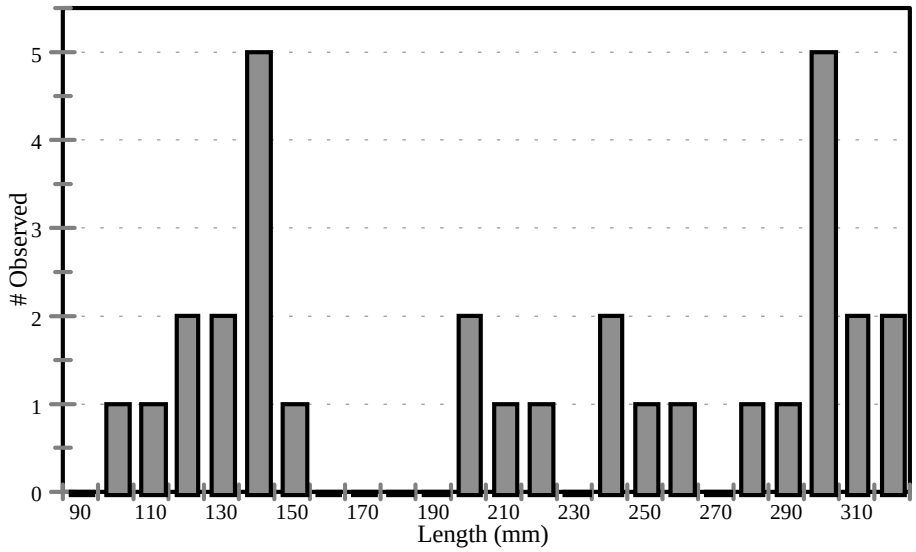

Figure 19. Length frequency distribution of walleye collected from Wilson Lake, Lake County, during fall 2001 electrofishing assessments.

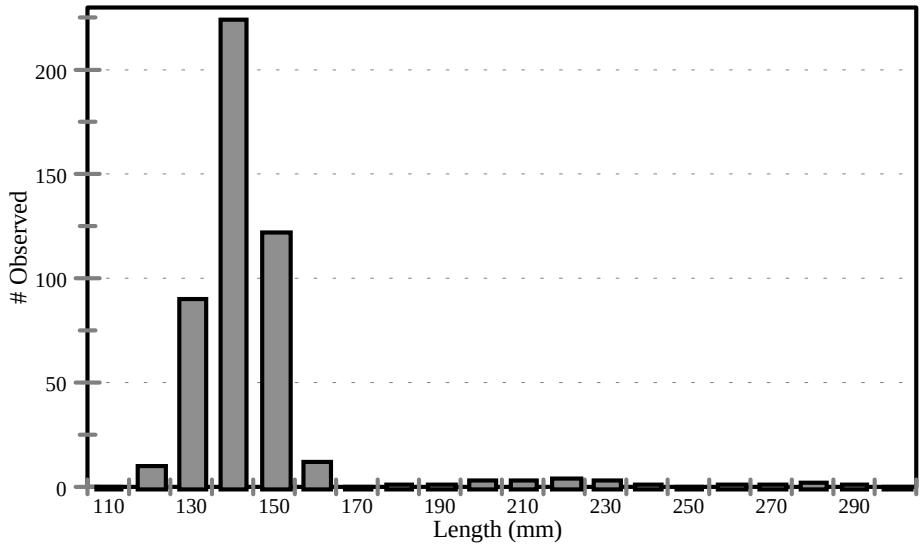

Figure 20. Length frequency distribution of walleye collected from Dumbbell Lake, Lake County, during fall 2001 electrofishing assessments.

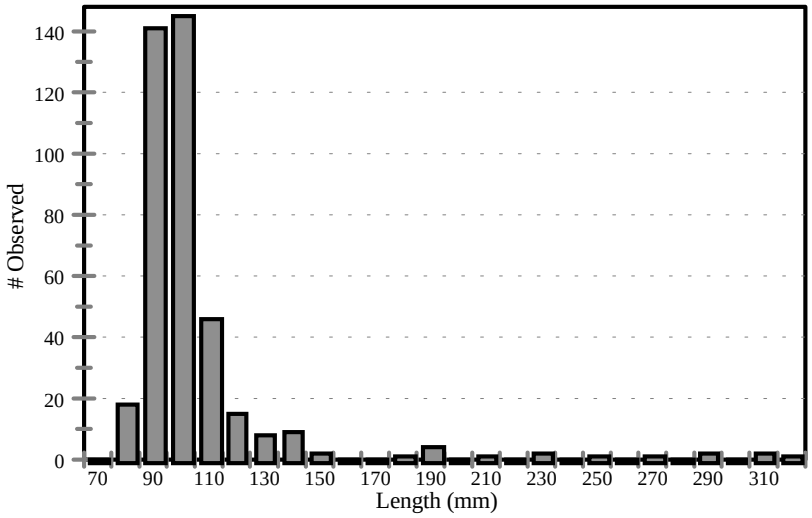

Figure 21. Length frequency distribution of walleye collected from Pike Lake, Cook County, during fall 2001 electrofishing assessments.

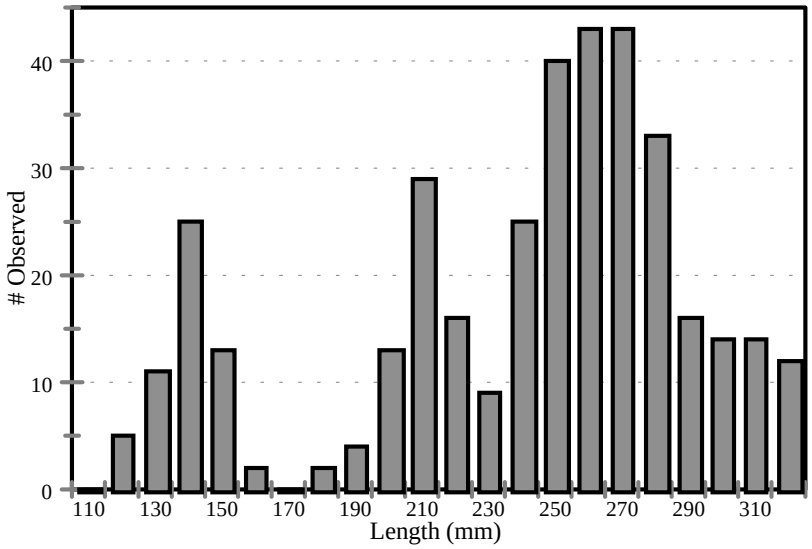

Figure 22. Length frequency distribution of walleye collected from Eagle Lake, Carlton County, during fall 2001 electrofishing assessments.

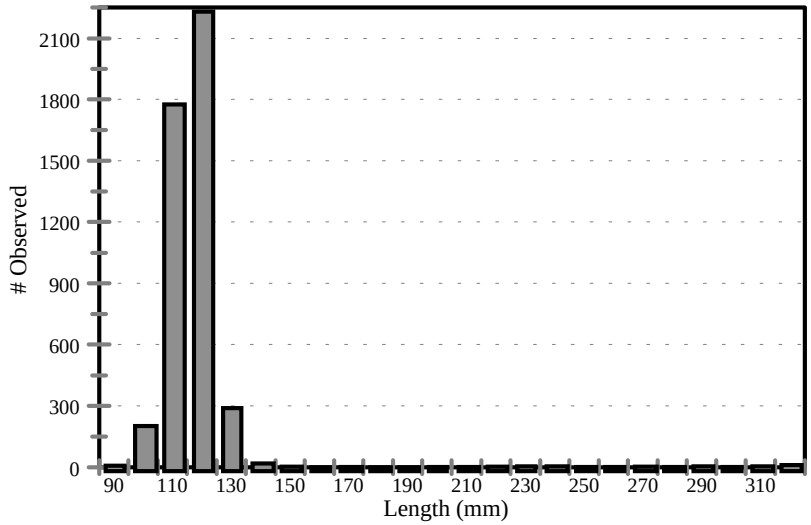

Figure 23. Length frequency distribution of walleye collected from Shagawa Lake, St. Louis County, during fall 2001 electrofishing assessments.

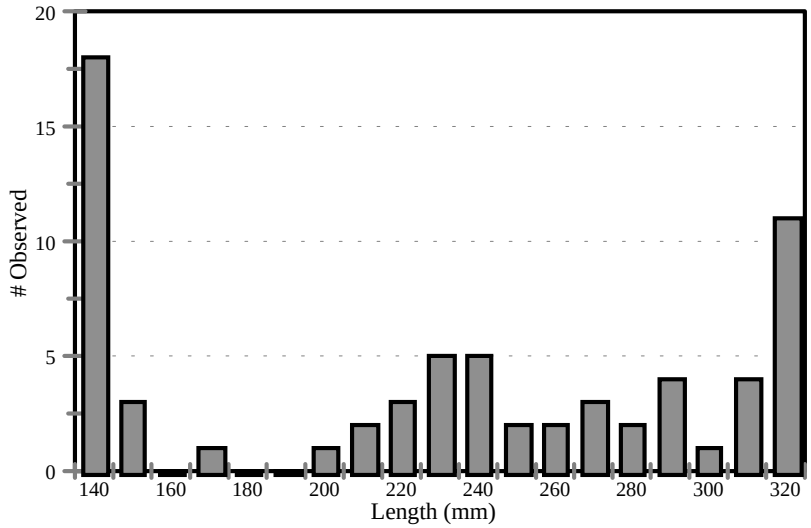

Figure 24. Length frequency distribution of walleye larger than 140 mm collected from Shagawa Lake, St. Louis County, during fall 2001 electrofishing assessments.

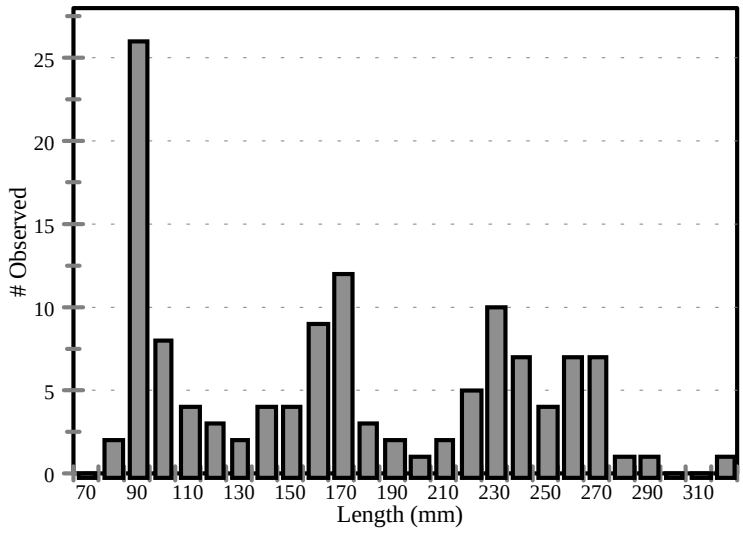

Figure 25. Length frequency distribution of walleye collected from Elbow Lake, Cook County, during fall 2001 electrofishing assessments.

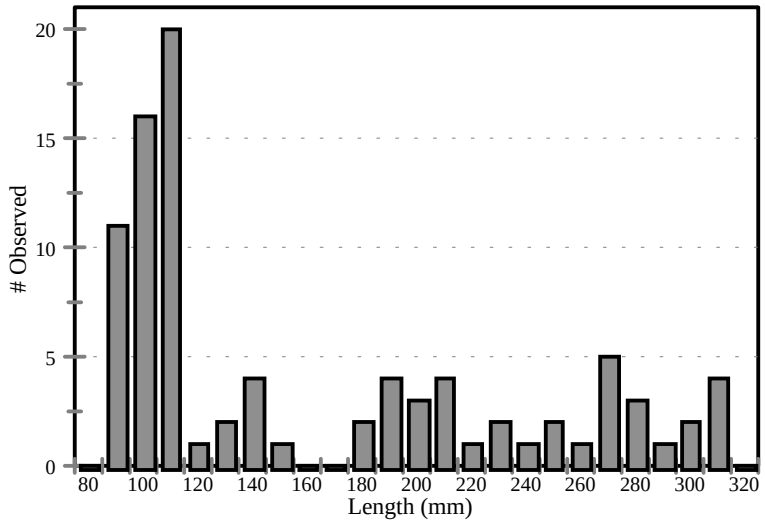

Figure 26. Length frequency distribution of walleye collected from Poplar Lake, Cook County, during fall 2001 electrofishing assessments.

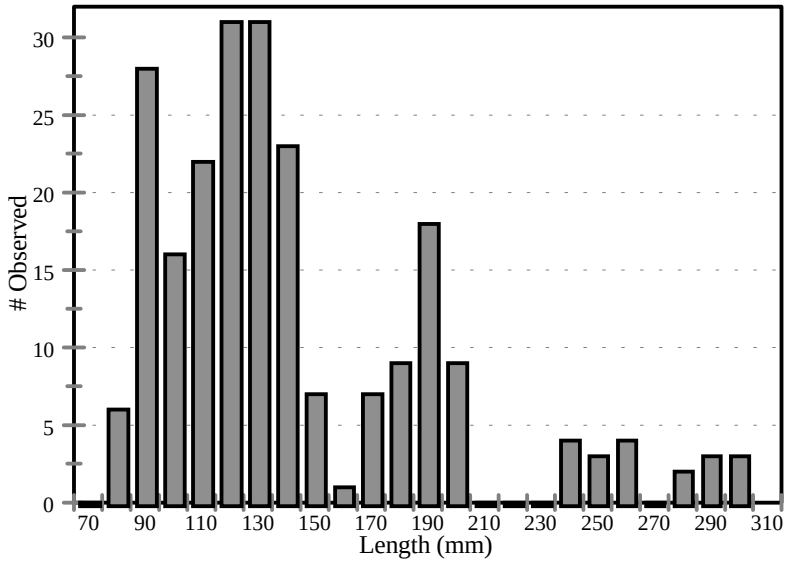

Figure 27. Length frequency distribution of walleye collected from Tom Lake, Cook County, during fall 2001 electrofishing assessments.

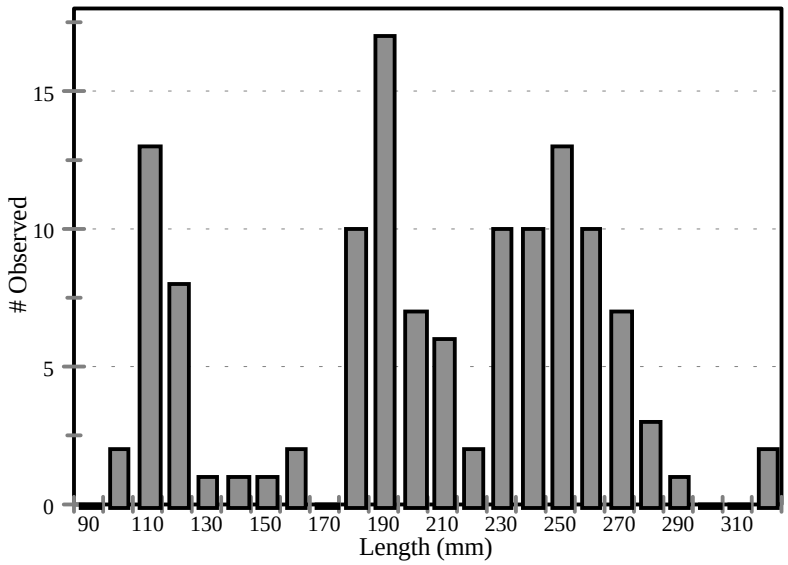

Figure 28. Length frequency distribution of walleye collected from Aspen Lake, Cook County, during fall 2001 electrofishing assessments.

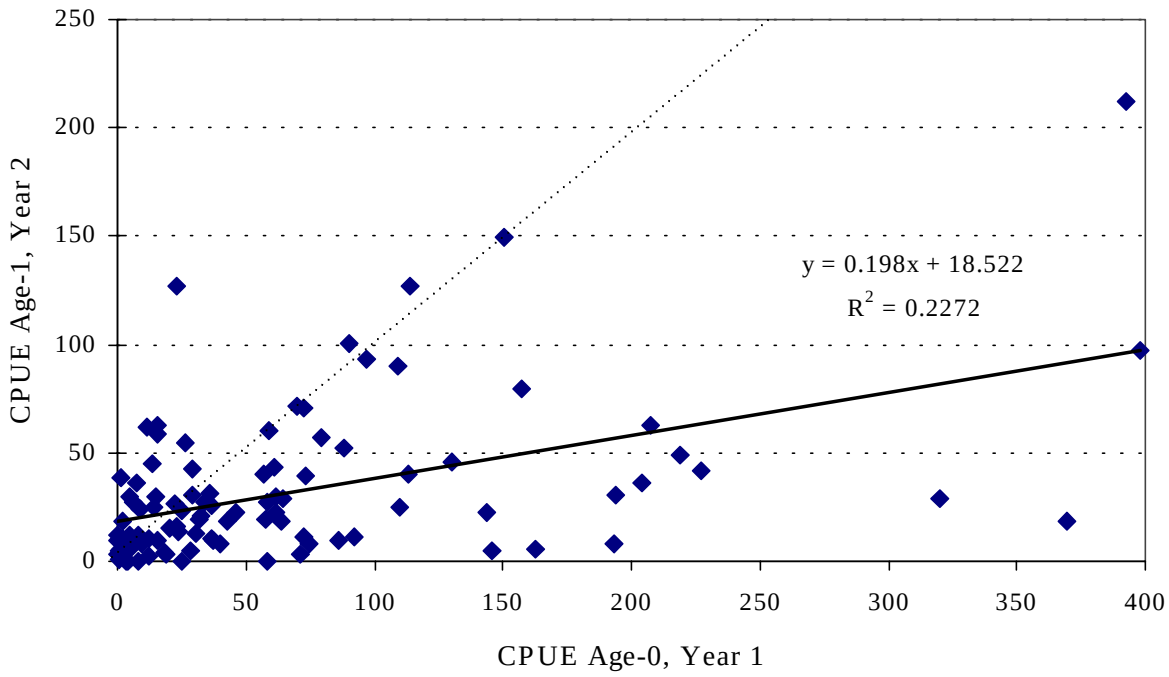

Figure 29. Catch per effort (# / Hour) of age-0 walleye during year 1 electrofishing assessments plotted against catch per effort of age-1 walleye during year 2 assessments. The equation describing the relationship is shown in the solid line. The 1:1 dashed line is included as a reference.