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STOCK ASSESSMENT AND BIOLOGICAL CHARACTERISTICS OF LAKE TROUT POPULATIONS IN INTERIOR ALASKA, 1986

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TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF TABLES

LIST OF TABLES (continued)

LIST OF FIGURES

LIST OF APPENDICES

LIST OF APPENDICES (continued)

ABSTRACT

This study was initiated in 1986 and was designed to evaluate and monitor the structure of lake trout, *Salvelinus namaycush* (Walbaum), populations in interior Alaska and determine the effects of sport fisheries on lake trout stocks. Estimates of catch per unit effort (lake trout caught per hour) from interviews of fishermen ranged from 0.06 to 0.16 fish per hour. Gill nets, fyke nets, and a beach seine were evaluated to determine their relative effectiveness at capturing lake trout unharmed. Small mesh gill nets (25 millimeter and 38 millimeter square measure) were the most effective gear tested. Fyke nets were effective at capturing lake trout less than 200 millimeters fork length in Sevenmile Lake. Beach seining was not effective at capturing lake trout in any of the areas tested. Abundance of lake trout was estimated at Glacier Lake in the upper Delta River System. The density of lake trout over 200 millimeters fork length in this 172 hectare lake was estimated at 15.6 fish per hectare.

Size of lake trout varied widely between sample lakes. The largest fish (maximum fork length greater than 800 millimeters) were found in Paxson and Summit Lakes (Copper River Drainage). Maximum length of fish in each of the other study lakes was generally less than 650 millimeters and all lake trout sampled in Sevenmile and Twobit Lakes were less than 500 millimeters. The oldest lake trout sampled was 36 years old from Summit Lake. Although fish greater than 20 years old were not uncommon, the majority of lake trout sampled were between 4 and 20 years old. Age at maturity (AM_{50}) ranged from 5 for males in Paxson Lake to 12 for females in Twobit Lake. Males typically matured one year earlier than females. Lake trout length at maturity (LM_{50}) ranged from 247 millimeters at Twobit Lake to 425 millimeters at Paxson Lake.

INTRODUCTION

Lake trout, *Salvelinus namaycush* (Walbaum), support important recreational fisheries in both roadside and remote waters. Most fishing for lake trout occurs on easily accessible waters. However, since lake trout are often considered a trophy species, anglers seek guided and other fly-in fishing opportunities in remote areas of the state. Since 1978, the statewide harvest of lake trout has increased at an annual rate of 6.5%. Over half the total harvest comes from lakes located in the Tanana River drainage and the Glennallen area. In the Glennallen area, harvest has increased by 7 percent annually since 1978. In the Tanana drainage and the Arctic-Yukon-Kuskokwim (AYK) region, lake trout harvests have increased 27 percent annually with a catch rate in 1985 five-fold that of the 1978 level.

The lake trout is a popular recreational resource, but may be easily overharvested. This species is long lived and slow growing. Records of fish older than 25 years are not unusual and lake trout older than age 50 have been captured in Alaska. A trophy size lake trout weighing 8.7 kg (20 lbs) in Alaska would typically be 20 or more years old. In interior Alaska, lake trout spawn for the first time at age 5 to 10 at fork lengths

of 350 mm to 500 mm (14 to 20 in). Mature lake trout do not spawn every year. Healey (1978) suggests that average maximum sustainable yield of lake trout populations is less than 0.5 kg of fish per surface hectare of lake per year.

Burr (1987) found that the present knowledge of population abundance, size structure, population dynamic rates, and harvest levels for Alaska lake trout populations is limited. Based on harvest estimates (Mills 1986) and size structure obtained from creel sampling and test netting, he found that the maximum sustainable harvest rate was being exceeded for all populations in the Tanana River drainage and Glennallen area for which harvest estimates were available. Harvest in these waters was as much as seven times the recommended maximum sustainable yield (Healey 1978). Based on this information, the Department reduced bag limits from 12 to 2 fish per day and imposed a length limit of 450 mm total length (TL) (18 in) in all Tanana River drainage and Glennallen area waters. More recently, the Department removed the 450 mm length limit from all but the high use roadside lakes. The Tangle Lakes system, which has sustained the highest harvest rate in recent years was closed to the taking of lake trout by emergency order in January 1987.

The lake trout research project began in 1986 with a long term goal to quantify the population dynamic rates of lake trout so as to provide better estimates of sustainable yield for lake trout fisheries. However, the experience of management for lake trout fisheries in North America is that estimates of sustainable yield are decades in the making. Therefore, the short term goal of this program is to refine our ability to promulgate effective regulations for fisheries in interior Alaska which will keep harvests at levels shown to be sustainable for other lake trout populations (see Healey 1978). In pursuit of this goal, populations were sampled, fisheries monitored, and angler attitudes were surveyed regarding various management options.

The specific objectives of the 1986 field season were:

(1) To estimate population abundance of lake trout larger than 250 mm (FL) in Glacier Lake;

(2) To research non-lethal capture techniques for lake trout;

(3) To estimate age at maturity AM_{50}, length of maturity LM_{50}, sex ratios, Gabelhouse categories and age composition of lake trout populations from area lakes; and

(4) To estimate the catch per unit effort (CPUE) of lake trout in several heavily exploited lakes.

Data were collected from populations of lake trout from seven lakes in central Alaska; Paxson and Summit of the Copper River system and Fielding, Twobit, Sevenmile, Tangles, and Glacier Lakes in the Tanana River drainage. The lakes range widely in size from Sevenmile (surface area 32 ha) to Summit Lake (surface area 1,650 ha) (Figure 1). All lakes are

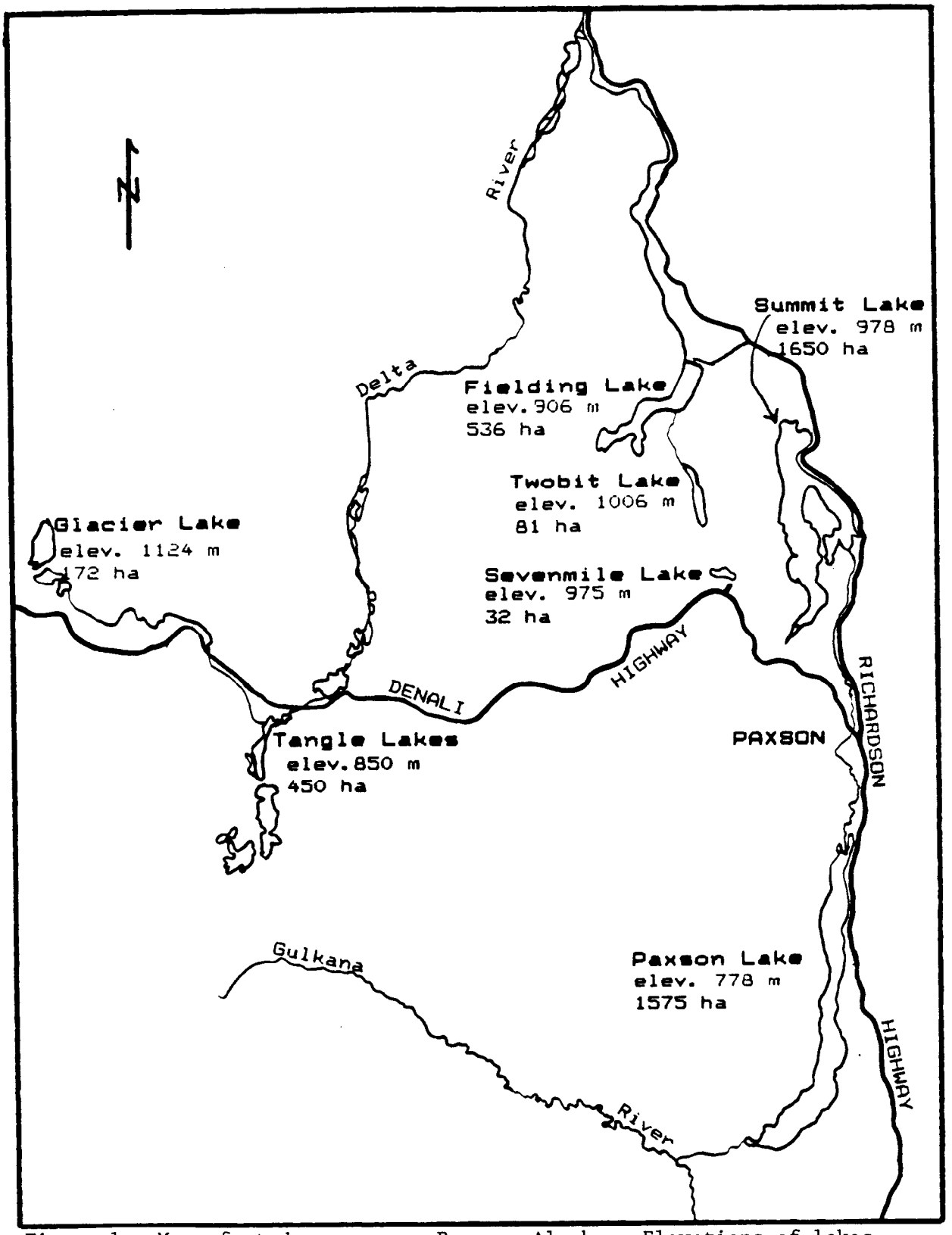

Figure 1. Map of study area near Paxson, Alaska. Elevations of lakes are given in meters, approximate surface areas are in hectares.

located in the Alaska Mountain Range at high elevation, and with the exception of Paxson Lake, within alpine tundra/scrub birch habitat. Paxson Lake is surrounded by a mixed spruce forest.

MATERIALS AND METHODS

Creel Census

Lake trout fishermen were interviewed at Paxson, Summit, Fielding, and Tangle Lakes during 1986 to estimate CPUE (lake trout caught per hour). All anglers were also asked their opinions about possible regulatory changes for lake trout fisheries. All sampling was conducted during the summer except for Paxson Lake where some anglers were contacted during the ice fishing season in May. Specific sampling designs and procedures are given by Clark and Ridder (1987).

Gear Study

Three gear types were evaluated to determine which was the most effective at capturing lake trout unharmed, and which was the most cost effective sampling method. The gear types were: small mesh gill nets 46 m (150 ft) x 1.8 m (6 ft) x 25 mm (1 in) square measure or 38 mm (1.5 in) square measure; a 91 m (300 ft) x 3 m (10 ft) x 9.5 mm (3/8 in) beach seine; and 1.2 m (4 ft) x 1.2 m fyke nets with 30.5 m (100 ft) center leads. Sampling was performed in Paxson Lake, Summit Lake, and Sevenmile Lake.

Sampling was performed during two, nine day periods. The first cycle of fishing was conducted from 25 June to 3 July. Three days were spent at Paxson Lake fishing the central portion of the lake with fyke nets, gill nets, and the beach seine for one day each. The areas that were seined were "chummed" with cut round whitefish, *Prosopium cylindraceum* (Pallas) one day prior to sampling. The gear was next fished in Sevenmile Lake (because of the small size of lake trout in Sevenmile Lake, 38 mm mesh gill nets were not fished in an effort to reduce sampling mortality) and then in Summit Lake. The same sampling procedures were followed in each lake. All captured fish were measured to the nearest millimeter fork length (FL), tagged with a individually numbered Floy anchor tag, and released. In addition, any sampling mortalities were weighed to the nearest gram with a Chatillion spring scale and dissected to obtain otoliths for later age determination and to obtain sex and maturity data.

From 5 to 14 August, the same sampling schedule was followed in different areas of Paxson, Summit, and Sevenmile Lakes. A third sampling cycle was planned for September, but because lake trout catches during all previous sampling had been so low, this sampling event was not conducted.

Since the third sampling cycle was not conducted, we were unable to perform the planned analysis of variance to evaluate gear efficiency. However, effort and catches were compiled, the number of lake trout caught

per hour (CPUE) by each gear type was calculated, and percent mortality of lake trout by gear type was evaluated. Effort for the beach seine was recorded as the number of seine hauls completed. To calculate CPUE for the beach seine in a manner comparable with that of other gear types, the number of seine hauls was multiplied by the average time (0.75 hrs) required to work the gear, thereby providing an estimate of effort in hours.

Glacier Lake Population Estimate

Glacier Lake is estimated to be 172 ha and is located at an elevation of 1,124 meters within the Tangle Lake system (Figure 1). It has numerous small inlets which drain the hillsides around the lake. There is a single outlet on the south end of the lake which becomes discontinuous during summer. Between 15 July and 22 July, "tooth nets" (gill nets with 25 mm or 38 mm square measure mesh) and variable mesh gill nets (13 mm, 25 mm, 38 mm, 50 mm, 64 mm square measure) were fished for a total of 965 net hours. Gill nets were checked at one to three hour intervals except for overnight sets which ran from approximately 2400 hr to 0800 hr. Nets were set in all parts of the lake in various depths from 0.5 to more than 25 meters. In addition, baited hoop nets were fished for a total of 160 net nights of effort.

From 29 August through 5 September, "tooth" and variable mesh gill nets were fished for a total of 653 net hours. In addition, fyke nets were fished for 14 net nights. Again all portions of the lake were netted as were various depths. However, lake trout began spawning during this sampling period, so effort was concentrated on the spawning grounds to maximize catch rates. Lake trout spawned in Glacier Lake in shallow water (0.5 - 2.0 m) over rock and cobble bottom near shore. Lake trout would begin concentrating in the spawning areas at approximately 2100 hr and remain in the area until after 0000 hr. Gill nets were fished in the spawning areas during this time, but the nets were checked every half hour or more frequently.

A modified Petersen mark recapture estimator was selected (Chapman 1951) to estimate the population abundance of lake trout larger than 250 mm FL in Glacier Lake. Population abundance and the approximate variance of this estimate were calculated with the following formulas (Seber 1982):

$$(1) \qquad \hat{N} = \frac{(C+1)(M+1)}{(R+1)} - 1 \qquad (2) \quad \hat{V}[N] = \frac{(M+1)(C+1)(M-R)(C-R)}{(R+1)^2(R+2)}$$

where:

M = the number marked during the first period;

C = the number captured during the second period; and,

R = the number captured during the second period with marks from the first period.

To minimize differential mortality between marked and unmarked fish, only fish which appeared to be in good condition were released. Marked fish were released throughout the lake to enhance mixing of marked fish throughout the population. Also, tagged fish were fin-clipped to ensure that any bias in the abundance estimate due to tag loss was measurable.

The hypothesis of equal probability of capture for fish of different size was tested with contingency table analysis. The data were grouped by length classes. The test involves the frequencies of tagged fish recaptured versus those not recaptured by size group (Seber 1982).

Population Structure

Age, weight, length, sex, and maturity data were obtained from the lake trout populations from all seven of the lakes previously listed as the study area. When a lake trout was captured in good condition, it was measured to the nearest mm FL and tagged with an individually numbered Floy anchor tag to allow for evaluation of growth over time. When killed, lake trout were weighed then dissected to obtain otoliths for age determination and to obtain information on sex and maturity. These data were obtained from creel census, other projects, the gear study, mark recapture experiments, and test fishing of Twobit Lake.

Creel censuses were conducted at Fielding and the Tangle Lakes. In addition, anglers were interviewed at Paxson Lake during May and during weekends at Paxson and Summit Lakes throughout the summer as manpower allowed.

Personnel on the Burbot Project fished a single 38 m experimental variable mesh (13 mm, 25 mm, 38 mm, 50 mm, 64 mm square measure) monofilament gill net in each lake they sampled that also contained populations of lake trout. This sampling provided data for populations of lake trout from a number of lakes which otherwise could not have been sampled.

Two gill nets (46 m X 1.8 m X 25 mm and 46 m X 1.8 m X 38 mm) were set in Twobit Lake for 20 hours each. This sample provided data on length, weight, age, sex, and maturity for the lake trout population from this lake.

During September lake trout were captured over spawning sites in Summit Lake with monofilament gill nets. Information on length, weight, age, sex, and maturity was obtained from this sample.

Age Determination:

Otoliths (sagitta) were collected from all lake trout dissected during the various field activities. Whole otoliths were prepared by hand grinding surfaces on a carborundum honing stone and were viewed with a compound microscope under reflected light. Sets of opaque and hyaline bands were counted as years of growth with the hyaline bands used as "annuli".

Sex, Age, and Length Composition and Relative Stock Density:

The proportions of the populations corresponding to each sex, age and size category were estimated with the following formulas (Cochran 1977):

$$(3) \qquad \hat{p}_j = \frac{n_j}{n} \qquad (4) \quad V[\hat{p}_j] = \frac{\hat{p}_j(1-\hat{p}_j)}{n-1}$$

where:

n_j = the number in the sample from group j;

n = the sample size; and,

$\hat{p}_j$ = the estimated fraction of the population that is made up of group j.

Relative Stock Density (RSD) was estimated for lake trout from the samples from each lake. The categories of Stock, Quality, Preferred, Memorable, and Trophy were determined as outlined by Gablehouse (1984).

Length at Maturity and Age of Maturity:

To estimate length at maturity, the length and maturity of the sampled lake trout were recorded as percent mature in length categories. Since more than one length category generally has mature and immature fish, probit analysis was used to estimate the LM_{50} (the length at which 50% of the fish are mature) (Finney 1971). The procedure PROBIT from SAS Institute Inc., Cary, NC 27511 was used for this analysis.

The age of maturity, AM_{50}, was estimated using the same procedures as described in the previous paragraph, except that ages rather than lengths were used as variables. The same samples were used for both analyses.

Size at Age:

Estimates of mean length and mean weight at age were generated with standard normal procedures. Simple averages and squared deviations from the means were used to calculate means and variances of the means:

$$(5) \qquad \bar{x}_j = \sum_{i=1}^{n_j} \frac{x_{ij}}{n_j} \qquad (6) \quad V[\bar{x}_j] = \sum_{i=1}^{n_j} \frac{(x_{ij} - \bar{x}_j)^2}{n_j (n_j - 1)}$$

where:

x_{ij} = length of the ith fish in age j;

$\bar{x}_j$ = the estimated mean length of fish in age j; and

n_j = the sample size of age j.

RESULTS

Creel Census

Mean CPUE ranged from 0.16 fish per hour in Summit Lake to 0.06 fish per hour in Fielding Lake (Table 1). Although sample sizes were small, the angler interviews conducted in 1986 indicate that catch rates for lake trout in roadside lakes are very low. On the average it took a fishermen over 10 hours to catch one lake trout.

Fishermen contacted at Fielding and Tangle Lakes of the Tanana River drainage and Summit and Paxson Lakes of the Copper River drainage generally disapproved of closing fishing seasons to allow time for lake trout stocks to recover; anglers at these lakes were neutral or slightly supportive of lower bag limits for lake trout fisheries; and a majority of fishermen favored minimum length limit restrictions on lake trout caught in theses fisheries (Tables 2 and 3).

Gear Study

Catch rates of lake trout in fyke nets ranged from 0 to 0.44 fish per hour (Table 4). No lake trout were caught in fyke nets in Paxson Lake. Only 5 lake trout were caught in Summit Lake and all were less than 200 mm FL. Catches were highest in fyke nets from Sevenmile Lake where 70 fish were caught of which 93% were less than 200 mm (FL). Catches of other species in Paxson and Summit Lakes were very high; particularly humpback whitefish, *Coregonus pidschian* (Gmelin), round whitefish, and juvenile sockeye salmon, *Oncorhynchus nerka* (Walbaum) (Appendix I). In Sevenmile Lake, burbot, *Lota lota* (Linnaeus), were captured in fyke nets, particularly those baited with whitefish.

Table 1. Estimated catch per unit effort and 95% confidence intervals of lake trout caught by anglers from Fielding, the Tangles, Summit, and Paxson Lakes.

		Catch rate (fish/hour)		
Lake/period	n[1]	Mean	SE	±CI
Fielding Lake:				
WD[2] 6/24-7/8	8	0.12	0.07	0.13
WE 6/24-7/8	59	0.05	0.05	0.09
WD 7/9-8/31	14	0.00	0.00	0.00
WE 7/9-8/31	28	0.10	0.05	0.09
June - August	109	0.06	0.04	0.07
Tangle Lakes:				
WD 6/24-8/31	24	0.11	0.11	0.21
WE 6/24-8/31	75	0.11	0.03	0.07
Summit Lake:				
June-August	49	0.16	0.02	0.04
Paxson Lake:				
May	36	0.11	0.05	0.08
June-August	126	0.09	0.02	0.03
May - August	162	0.09	0.02	0.03

[1] Number of angler interviews
[2] WD = weekdays, WE = weekend days

Table 2. Number and percent response of anglers interviewed concerning their opinion of three regulatory options for the lake trout fisheries at Fielding and Tangle Lakes (data for both lakes are combined).

Question	Response		
To improve lake trout fishing would you approve of:			
a: lower bag limits?	Approve	= 36	(25%)
	Disapprove	= 23	(16%)
	No Opinion	= 84	(59%)
	Total	=143	(100%)
b: reduced fishing seasons?	Approve	= 17	(12%)
	Disapprove	= 39	(27%)
	No Opinion	= 87	(61%)
	Total	=143	(100%)
c: size limits?	Approve	= 35	(25%)
	Disapprove	= 24	(17%)
	No Opinion	= 84	(58%)
	Total	=143	(100%)

Table 3. Number and percent response of anglers interviewed concerning their opinion of three regulatory options for the lake trout fisheries at Paxson and Summit Lakes (data for both lakes are combined).

Question	Response		
To improve lake trout fishing would you approve of:			
a: lower bag limits?	Approve	= 45	(51%)
	Disapprove	= 37	(42%)
	No Opinion	= 6	(7%)
	Total	= 88	(100%)
b: reduced fishing seasons?	Approve	= 16	(18%)
	Disapprove	= 67	(75%)
	No Opinion	= 6	(7%)
	Total	= 89	(100%)
c: size limits?	Approve	= 68	(78%)
	Disapprove	= 13	(15%)
	No Opinion	= 6	(7%)
	Total	= 87	(100%)

Table 4. Summary of lake trout catches, sampling effort, and lake trout mortality from sampling conducted with fyke nets in Paxson, Summit, and Sevenmile Lakes, 1986.

		Effort[1]	Lake Trout Captured	% Small[2]	% Mortality	CPUE[3]
Paxson Lake	June:	63.5	0			0.00
	August:	64.5	0			0.00
	Total:	128	0			0.00
Sevenmile Lake	June:	61	27	93	0	0.44
	August:	74	24	87	0	0.32
	August:[4]	144	29	100	0	0.20
	Total:	279	70	93	0	0.25
Summit Lake	July:	65	0	0	0	0.00
	August:	62	1	100	0	0.02
	August:[4]	71	4	100	0	0.06
	Total:	198	5	100	0	0.03
Fyke Net Total:		605	75	96.5	0	0.12

1 Total hours fished
2 Fish less than 200 mm fork length
3 Number of fish caught per hour of fishing
4 Baited with cut whitefish

Lake trout were caught in gill nets in all lakes sampled. The 25 mm mesh gill nets were most effective in Sevenmile Lake, where the CPUE was 0.78 fish per hour (Table 5). In Paxson and Summit Lakes the CPUE for 25 mm mesh nets was 0.07 and 0.25 fish per hour, respectively. The 38 mm mesh nets were most effective in Paxson Lake, where the CPUE was 0.73 fish per hour. In Summit Lake the CPUE of 38 mm nets was 0.16 fish per hour. The catch rates of lake trout from all lakes combined was 0.36 for 25 mm mesh nets and 0.34 for 31 mm mesh nets. No fish smaller than 200 mm FL were captured in these gill nets.

During all 24 seine hauls, only three lake trout were captured for an overall CPUE of 0.17 fish per hour (Table 6). All lake trout were caught in Paxson Lake on the lee of points of land over relatively smooth gravel bottoms. Other species captured in seines included; round whitefish, humpback whitefish, sockeye salmon, and slimy sculpin, *Cottus cognatus* (Richardson) (Appendix I).

Sampling mortality of lake trout caught in gill nets ranged from 0 to 56 percent (Table 5). Overall mortality was higher for 25 mm mesh (38%) than for 38 mm mesh (28%). There were no documented mortalities of lake trout caught in beach seines or fyke nets. However, burbot sampled from fyke nets had been feeding on lake trout that were caught in the net.

Glacier Lake Population Estimate

During July, 242 lake trout were caught in gill nets and 31 in hoop nets; a total of 273 lake trout. One hundred sixty-nine were captured in good condition, tagged and released; the rest (105) were killed by the sampling gear. During the second sampling period in August and September, 234 lake trout were captured in gill nets; only 2 lake trout were caught in fyke nets. Of the 236 lake trout examined during the second sampling period, 14 had Floy tags from the first sampling period; 134 were captured alive, tagged and released; and 86 were captured dead.

No significant difference between capture rates among length categories was found ($\chi^2 = 1.33$, df = 1, $P > 0.05$); hence a nonstratified abundance estimate was calculated for Glacier Lake.

The abundance of lake trout larger than 250 mm FL in Glacier Lake was estimated at 2,686 with an approximate variance of 385,105 and standard error of 621. Since the surface area of Glacier Lake is 172 ha (425 acres), the estimated density of lake tout in the lake was 15.6 lake trout per hectare (6.32 LT/acre).

Population Structure

Data on sex composition, length composition, relative stock density, age composition, and size and age at maturity was obtained from all lake trout populations sampled in 1986.

Table 5. Summary of lake trout catches, sampling effort, and lake trout mortality from sampling conducted with 25 mm and 38 mm mesh gill nets in Paxson, Summit, and Sevenmile Lakes, 1986.

		Effort[1]	Lake Trout Captured	% Small[2]	% Mortality	CPUE[3]
Paxson	June 25 mm:	16	1	0	0	0.06
	June 38mm:	17	8	0	25	0.47
	Total:	33	9	0	22	0.27
	August 25 mm:	25	2	0	50	0.08
	August 38 mm:	16	16	0	56	1.00
	Total:	31	18	0	55	0.58
	25 mm Total:	41	3	0	33	0.07
	38 mm Total:	33	24	0	46	0.73
Sevenmile	June 25 mm:	29	21	0	43	0.72
	August 25 mm:	13	11	0	36	0.85
	25 mm Total:	41	32	0	41	0.78
Summit	June 25 mm:	9	3	0	0	0.33
	June 38 mm:	14	8	0	0	0.57
	Total:	23	11	0	0	0.48
	August 25 mm:	43	10	0	50	0.23
	August 38 mm:	55	3	0	33	0.05
	Total:	98	13	0	46	0.13
	25 mm Total:	52	13	0	39	0.25
	38 mm Total:	69	11	0	9	0.16
25 mm Grand Total:		134	48	0	38	0.36
38 mm Grand Total:		102	35	0	28	0.34

1 Total hours fished
2 Fish less than 200 mm fork length
3 Number of fish caught per hour of fishing

Table 6. Summary of lake trout catches, sampling effort, and lake trout mortality from sampling conducted with beach seine in Paxson, Summit, and Sevenmile Lakes, 1986.

		Effort[1]	Number Captured	% Small[2]	% Mortality	CPUE[3]
Paxson	June:	5	2	0	0	0.43
	August:	5	1	0	0	0.27
	Total:	10	3	0	0	0.40
Sevenmile	June:	3	0	0	0	0.00
	August:	2	0	0	0	0.00
	Total:	5	0	0	0	0.00
Summit	June:	4	0	0	0	0.00
	August:	5	0	0	0	0.00
	Total:	9	0	0	0	0.00
	June Total:	12	2	0	0	0.22
	August Total:	12	1	0	0	0.11
	Beach Seine Total:	24	3	0	0	0.17

1 Number of seine hauls
2 Fish less than 200 mm fork length
3 Number of fish caught per hour of fishing

Sex Composition:

Proportions of males, females, and immature lake trout were estimated from samples collected from seven lakes. In Paxson, the Tangles, and Glacier Lake, the ratio of males to females was essentially even (Table 7). Females were more common than males in Twobit (1.5:1), Sevenmile (1.7:1), and Fielding Lakes (2.5:1). Males were more common in the sample from Summit Lake (2.3:1).

Length Composition:

The sample of 75 lake trout caught by rod and reel from Paxson Lake ranged from 336 to 927 mm FL. An additional sample of 55 fish captured in 25 mm and 38 mm gill nets were within the same size range. In both cases most of the lake trout sampled were 350 to 650 mm FL with relatively few larger fish (Table 8).

Only 17 lake trout were sampled from the creel in Summit Lake. These fish ranged from 320 to 810 mm FL with most fish less than 550 mm. Two hundred thirty-six lake trout were captured in 25 mm, 38 mm and variable mesh gill nets and in fyke nets. The lake trout in this sample ranged from 117 through 872 mm FL (Table 9). All lake trout captured in fyke nets were less than 150 mm FL. The majority of fish (66%) in the test net sample were 400 to 550 mm FL.

Thirty-five lake trout caught by anglers from all of the Tangle Lakes ranged from 250 to 460 mm FL (Table 10). An additional 44 lake trout were sampled from these lakes with variable mesh gill nets. Fish in the gill net sample ranged from 225 to 655 mm FL although most fish (89%) were between 250 and 500 mm FL (Table 10).

Lengths of 22 lake trout caught on rod and reel from Fielding Lake ranged from 350 to 605 mm FL (Table 11). An additional sample of 19 lake trout from gill nets (variable mesh) and from electro-fishing ranged from 163 through 615 mm FL (Table 11). Most fish (85%) in both samples were less than 500 mm FL.

Fork lengths from 507 lake trout sampled from Glacier Lake ranged from 90 through 678 mm (Table 12). These fish were captured in 25 mm, 38 mm, and variable mesh gill nets. Percentage of fish in size categories increased steadily from 200 to 400 mm with most fish (53%) in the 400 to 450 category. Numbers of fish dropped sharply after 450 mm with relatively few larger fish in the sample. Length composition of male and female lake trout was not significantly different ($\chi^2 = 3.34$, df = 4, $P > 0.05$).

A sample of 118 lake trout captured from Sevenmile Lake ranged from 35 to 460 mm FL (Table 13). Fish in this sample were captured in fyke nets and in 25 mm gill nets. Most fish in the smaller size classes were caught in fyke nets. All but two lake trout in the sample were less than 450 mm.

Table 7. Sex composition of lake trout from Paxson, Summit, Tangles, Fielding, Glacier, Sevenmile, and Twobit Lakes.

Lake			Creel			Netted			Both		
			Males	Females	Immature	Males	Females	Immature	Males	Females	Immature
Paxson	n[1]	99	10	12	0	40	43	0	49	50	0
	%		45	55		48	52		49	50	0
	SE (%)		11	11		7	7		5	5	
Summit	n	197	4	3	0	126	52	12	130	55	12
	%		57	43		66	27	6	66	28	6
	SE (%)		2	2		3	3	2	3	3	2
Tangles	n	34	1	2	0	16	13	2	17	15	2
	%		33	66		52	42	6	50	44	6
	SE (%)		8	8		9	9	4	9	9	4
Fielding	n	7	0	2	0	2	3	0	2	5	0
	%		0	100		40	60	0	29	71	0
	SE (%)					20	20		19	19	
Glacier	n	267				132	115	20	132	115	20
	%		---	---	---	49	43	7	49	43	8
	SE (%)					3	3	2	3	3	2
Sevenmile	n	25				6	10	9	6	10	9
	%		---	---	---	24	40	36	24	40	36
	SE (%)					9	10	10	9	10	10
Twobit	n	77				31	46	0	31	46	0
	%		---	---	---	40	60	0	40	60	0
	SE (%)					6	6		6	6	

[1] Sample Size

Table 8. Estimated length composition of the lake trout population in Paxson Lake, 1986.

	Length Group (mid point, Fork Length mm)																				
	25	75	125	175	225	275	325	375	425	475	525	575	625	675	725	775	825	875	925	975	ALL
CREEL CENSUS																					
Males	0	0	0	0	0	0	1	3	7	1	5	10	2	0	0	1	0	0	0	0	30
Females	0	0	0	0	0	0	2	3	6	4	6	5	3	0	0	1	0	0	1	0	31
both	0	0	0	0	0	0	3	10	14	9	13	17	6	0	0	2	0	0	1	0	75
%	0	0	0	0	0	0	4	13	19	12	17	23	8	0	0	3	0	0	1	0	
SE (%)							2	4	5	4	4	5	3			2			1		
TEST NETTING																					
Males	0	0	0	0	0	0	0	0	4	4	2	0	0	0	0	0	0	0	0	0	10
Females	0	0	0	0	0	0	0	1	2	3	0	2	4	0	0	0	0	0	0	0	12
both	0	0	0	0	0	0	0	2	8	8	2	4	6	1	0	0	0	0	0	0	31
%	0	0	0	0	0	0	0	6	26	26	6	13	19	3	0	0	0	0	0	0	
SE (%)								4	8	8	4	6	7	3							
ALL LAKE TROUT																					
Males	0	0	0	0	0	0	1	5	14	7	7	10	2	0	0	1	0	1	0	0	48
Females	0	0	0	0	0	0	2	4	10	7	6	12	7	0	0	1	0	0	1	0	50
both	0	0	0	0	0	0	4	16	28	20	16	27	13	1	1	2	0	1	1	0	130
%	0	0	0	0	0	0	3	12	22	15	12	21	10	1	1	2	0	1	1	0	
SE (%)							2	3	4	3	3	4	3	1	1	1		1	1		

Table 9. Estimated length composition of the lake trout population in Summit Lake, 1986.

	Length Group (mid point, Fork Length mm)																		
	25	75	125	175	225	275	325	375	425	475	525	575	625	675	725	775	825	875	ALL
CREEL CENSUS																			
Males	0	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0	4
Females	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	3
Both	0	0	0	0	0	0	4	2	5	1	3	1	0	0	0	0	1	0	17
%	0	0	0	0	0	0	24	12	29	6	18	6	0	0	0	0	6	0	
SE (%)							11	8	11	6	10	6					6		
TEST NETTING																			
Males	0	0	0	0	2	5	3	2	12	51	38	7	1	3	1	1	0	0	126
Females	0	0	0	1	2	6	3	2	8	11	13	0	1	2	0	2	0	1	52
Both	0	0	18	1	7	13	8	5	27	70	60	10	5	5	1	3	2	1	236
%	0	0	8	0	3	6	3	2	11	30	25	4	2	2	0	1	1	0	
SE (%)			2		1	1	1	1	2	3	3	1	1	1		1	1		
ALL LAKE TROUT																			
Males	0	0	0	0	2	5	3	2	13	52	40	7	1	3	1	1	0	0	130
Females	0	0	0	1	2	6	3	2	9	11	14	0	1	2	0	2	1	1	55
Both	0	0	18	1	7	13	12	7	32	71	63	11	5	5	1	3	3	1	253
%	0	0	7	0	3	5	5	3	13	28	25	4	2	2	0	1	1	0	
SE (%)			2		1	1	1	1	2	3	1	1	1	1		1	1		

Table 10. Estimated length composition of the lake trout population in the Tangle Lakes, 1986.

	Length Group (mid point, Fork Length mm)														
	25	75	125	175	225	275	325	375	425	475	525	575	625	675	ALL
CREEL CENSUS															
Males	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Females	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
Both	0	0	0	0	1	6	18	5	4	1	0	0	0	0	35
%	0	0	0	0	3	17	51	14	11	3	0	0	0	0	
SE (%)					3	6	9	6	5	3					
TEST NETTING															
Males	0	0	0	0	0	1	7	4	2	1	0	0	0	1	16
Females	0	0	0	0	0	1	3	2	4	1	2	0	0	0	13
Both	0	0	0	0	2	5	11	7	7	6	2	3	0	1	44
%	0	0	0	0	5	11	25	16	16	14	5	7	0	2	
SE (%)					3	5	7	6	6	5	3	4		2	
ALL LAKE TROUT															
Males	0	0	0	0	0	1	7	4	3	1	0	0	0	1	17
Females	0	0	0	0	0	1	3	2	6	1	2	0	0	0	15
Both	0	0	0	0	3	11	29	12	11	7	2	3	0	1	79
%	0	0	0	0	4	14	37	15	14	9	3	4	0	1	
SE (%)					2	4	5	4	4	3	2	2		1	

Table 11. Estimated length composition of the lake trout population in Fielding Lake, 1986.

	Length Group (mid point, Fork Length mm)														
	25	75	125	175	225	275	325	375	425	475	525	575	625	675	ALL
CREEL CENSUS															
Males	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Females	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2
Both	0	0	0	0	0	0	1	6	10	2	1	1	1	0	22
%	0	0	0	0	0	0	5	27	45	9	5	5	5	0	
SE (%)							5	10	11	22					
TEST NETTING															
Males	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
Females	0	0	0	0	0	0	0	0	1	1	1	0	0	0	3
Both	0	0	0	1	0	4	1	3	4	3	1	1	1	0	19
%	0	0	0	5	0	21	5	16	21	16	5	5	5	0	
SE (%)				5		10	5	9	10	9	5	5	5		
ALL LAKE TROUT															
Males	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
Females	0	0	0	0	0	0	0	0	2	1	1	0	1	0	5
Both	0	0	0	1	0	4	2	9	14	5	2	2	2	0	41
%	0	0	0	2	0	10	5	22	34	12	5	5	5	0	
SE (%)				2		5	23	17	17	15	23	23	23		

Table 12. Estimated length composition of the lake trout population in Glacier Lake, 1986.

	Length Group (mid point, Fork Length mm)															
	25	75	125	175	225	275	325	375	425	475	525	575	625	675	725	ALL
ALL LAKE TROUT																
Males	0	0	0	0	2	12	16	19	73	6	0	1	1	1	0	131
Females	0	0	0	0	4	16	18	14	56	4	1	1	1	0	1	116
Both	0	1	3	3	16	51	57	108	214	30	9	5	5	3	2	507
%			1	1	3	10	11	21	42	6	2	1	1	1		
SE (%)					1	1	1	2	2	1	1					

Table 13. Estimated length composition of the lake trout population in Sevenmile Lake, 1986.

	Length Group (mid point, Fork Length mm)														
	25	75	125	175	225	275	325	375	425	475	525	575	625	675	ALL
ALL LAKE TROUT															
Males	0	0	0	1	0	1	1	2	1	0	0	0	0	0	6
Females	0	0	0	1	0	0	2	6	1	0	0	0	0	0	10
Both	1	21	10	28	8	3	5	25	13	2	0	0	0	0	116
%	1	18	9	24	7	3	4	22	11	2					
SE (%)	1	4	3	4	2	1	2	4	3	1					

Seventy-seven lake trout were captured in 25 mm and 38 mm gill nets from Twobit Lake. These fish ranged in fork length from 242 to 455 mm with most fish between 250 and 450 mm (Table 14).

Relative Stock Density:

No lake trout sampled in 1986 fell in the "Trophy" category (FL > 974 mm) (Table 15, Figure 2). Two percent of the lake trout sampled in both Paxson and Summit Lakes were "Memorable" (779-974 mm FL). "Preferred" (595-778 mm FL) lake trout were captured in Fielding, Glacier and Round Tangle Lakes. The highest proportion of larger fish were in Paxson and Summit Lakes where 49% and 44% of the fish were of quality or larger size. Samples from Twobit and Sevenmile Lakes contained no "Quality" (495-594 mm FL) lake trout and all fish were "Stock" (260-494 mm FL) or smaller.

Age Composition:

Seventy-four lake trout taken by anglers from Paxson Lake ranged from age 4-28 (Figure 3, Appendix II). An additional sample of 31 lake trout gill-netted in 25 mm and 38 mm mesh (square measure) were within the same age range. The majority of fish in both samples (52% and 82%) were from age 5 to 7.

Lake trout caught by sport fishermen in Summit Lake (n=16) ranged from age 4 to 18 (Figure 3, Appendix II). Ages 4 through 8 occurred most frequently (70%) in this sample. A total 107 test netted lake trout ranged from age 1 to 36. The age 1 and 2 fish were caught in fyke nets. The other fish in the test sample were caught in 25 mm, 38 mm, and variable mesh gill nets.

Lake trout sampled from the creel from the Tangle Lakes (n=34) ranged from Age 4 to 13 (Figure 4, Appendix II). Age classes 5 through 8 were the most frequently caught (72%) by fishermen. A sample of 12 trout captured in variable mesh gill nets had a similar age range.

Twenty-two lake trout caught on rod and reel in Fielding Lake ranged from age 4 to age 9 with age 7 fish most frequently taken (Figure 4, Appendix II). A variable mesh gill net sample of 8 lake trout extended the range to age 10.

A sample of 189 lake trout from Glacier Lake caught in variable mesh gill nets ranged from age 1 through age 29 (Figure 5, Appendix II). Ages 5 through 7 (30%) and 11 through 13 (37%) occurred most frequently.

Twenty-four lake trout captured in fyke nets and 25 mm mesh gill nets from Sevenmile Lake ranged in age from 1 to 5 (Figure 5, Appendix II). All age 1 through 3 fish were caught in fyke nets.

Table 14. Estimated length composition of the lake trout population in Twobit Lake, 1986.

	Length Group (mid point, Fork Length mm)														
	25	75	125	175	225	275	325	375	425	475	525	575	625	675	ALL
ALL LAKE TROUT															
Males	0	0	0	0	1	3	3	12	11	1	0	0	0	0	31
Females	0	0	0	0	0	4	7	22	11	2	0	0	0	0	46
Both	0	0	0	0	1	7	10	34	22	3	0	0	0	0	77
%					1	9	13	44	29	4					
SE (%)					1	3	4	6	5	2					

Table 15. Relative Stock Density of lake trout from Paxson, Summit, Tangles, Glacier, Fielding, Sevenmile, and Twobit Lakes after Gabelhouse (1984).

Lake		Length Group				
		260 mm[1] Stock	495 mm Quality	595 mm Preferred	779 mm Memorable	975 mm Trophy
Paxson	n	68	37	23	2	0
	%	52	29	18	2	0
	SE(%)	4	4	3	1	--
Summit	n	125	82	14	5	0
	%	55	36	6	2	0
	SE(%)	4	5	7	1	--
Tangles	n	67	7	1	0	0
	%	89	9	1	0	0
	SE(%)	4	3	1	--	--
Glacier	n	446	12	13	0	0
	%	95	3	3	0	0
	SE(%)	1	1	1	--	--
Fielding	n	60	5	3	0	0
	%	88	7	4	0	0
	SE(%)	4	3	2	--	--
Sevenmile	n	47	0	0	0	0
	%	100	0	0	0	0
	SE(%)	--	--	--	--	--
Twobit	n	75	0	0	0	0
	%	100	0	0	0	0
	SE(%)	--	--	--	--	--

[1] Lower limit of length category

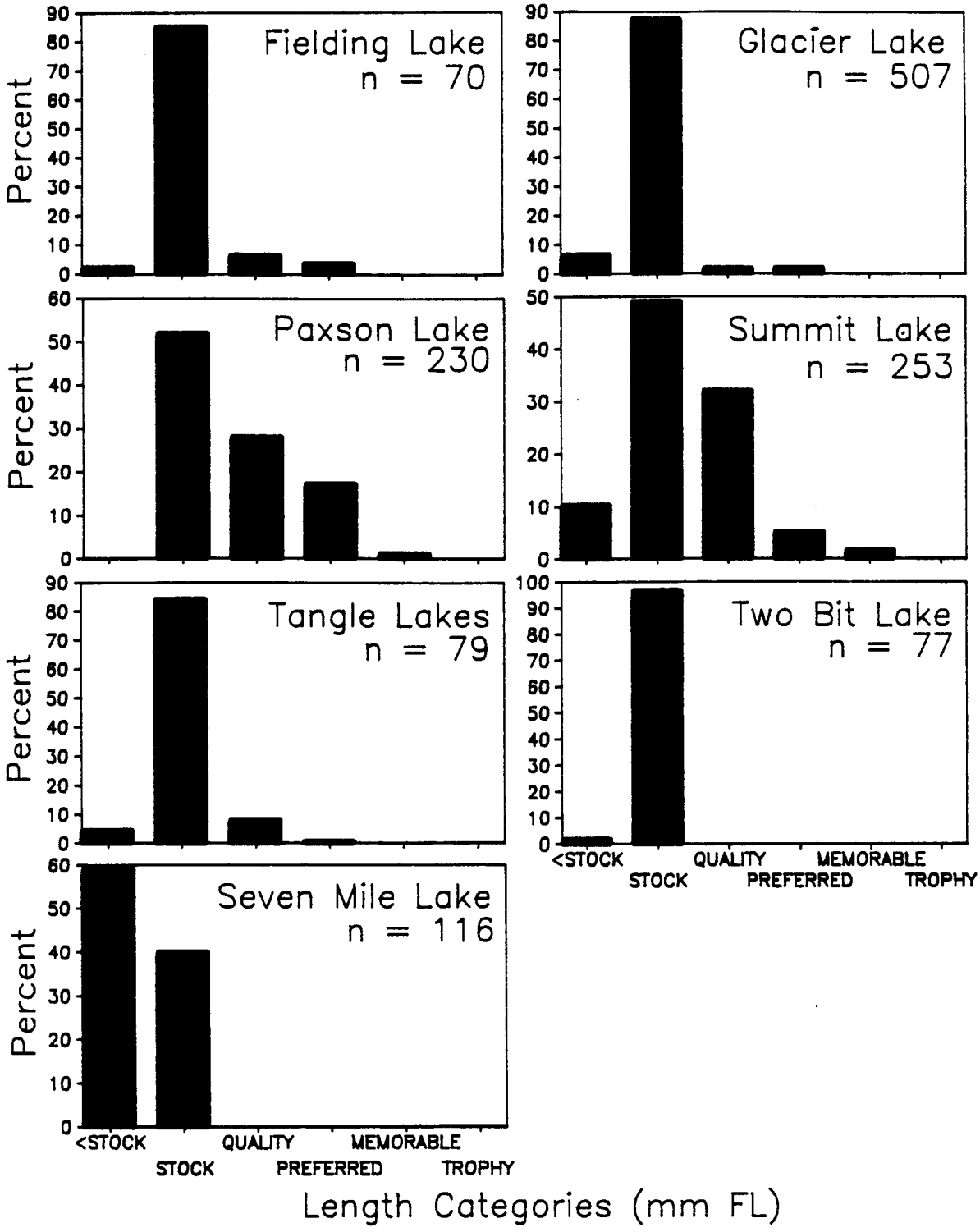

Figure 2. Relative Stock Density of lake trout in Paxson, Summit, Fielding, Glacier, Tangle, Twobit, and Sevenmile Lakes, 1986.

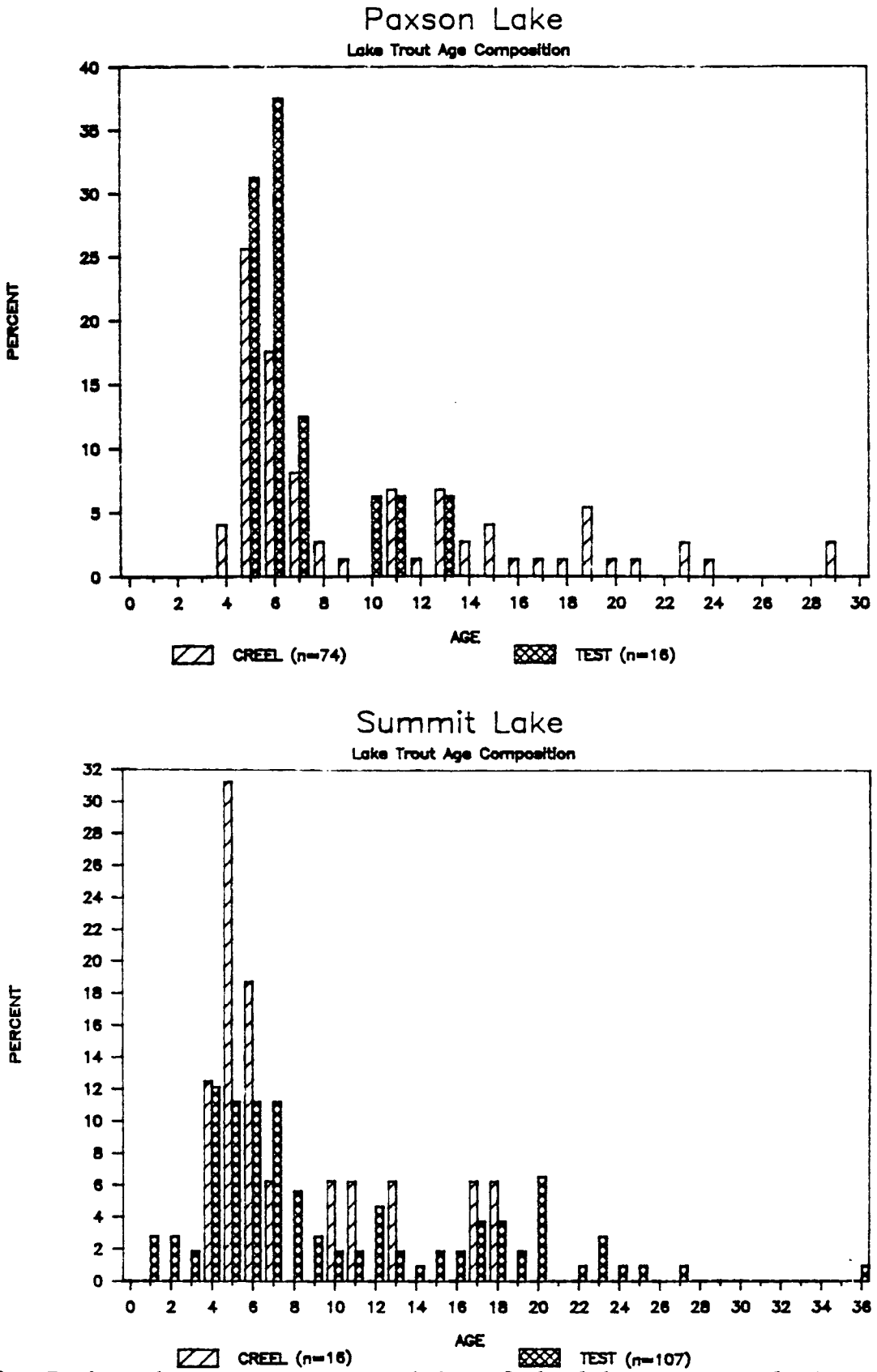

Figure 3. Estimated percent age composition of the lake trout populations from Paxson and Summit Lakes, 1986.

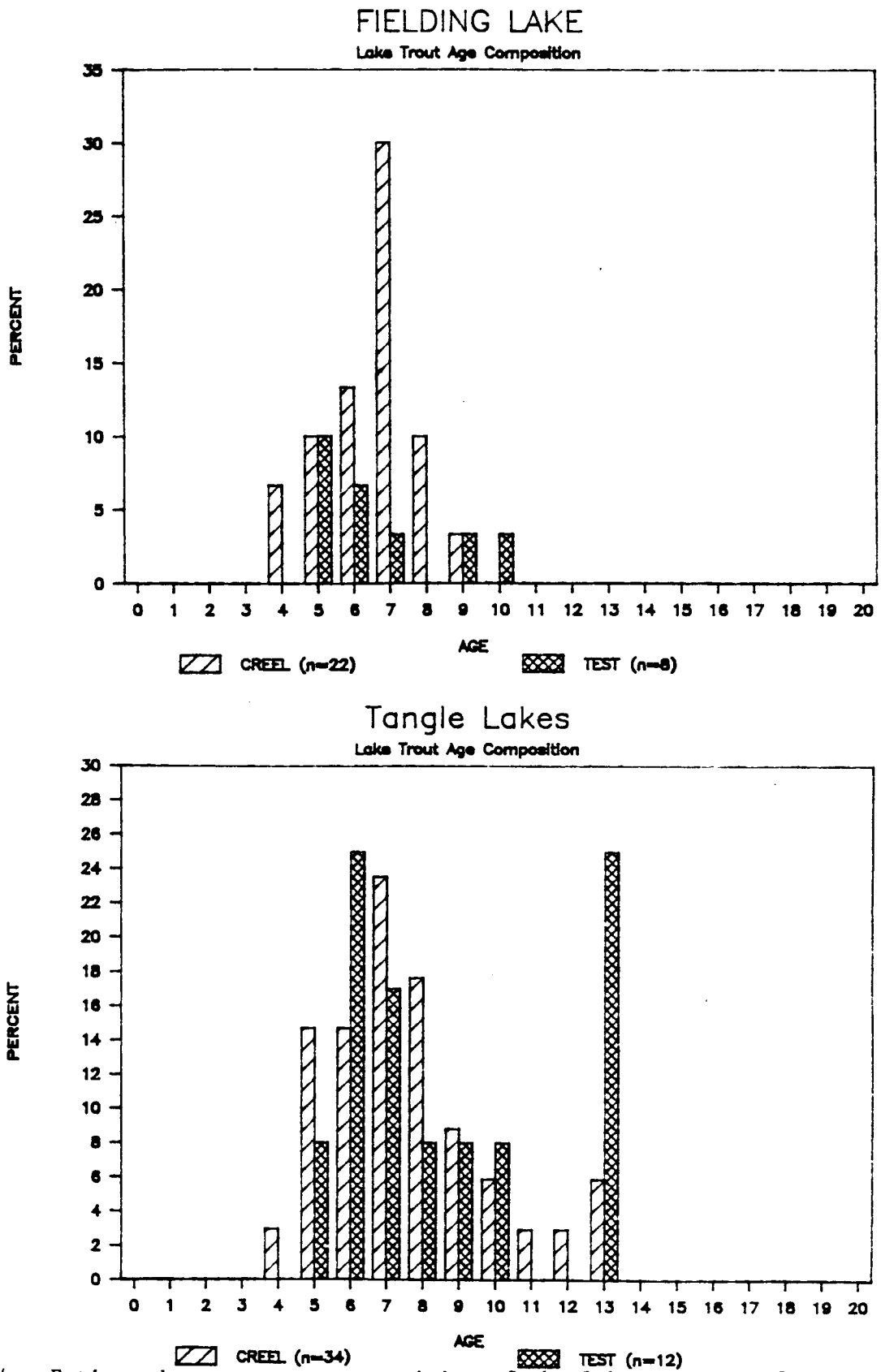

Figure 4. Estimated percent age composition of the lake trout populations from Fielding and Tangle Lakes, 1986.

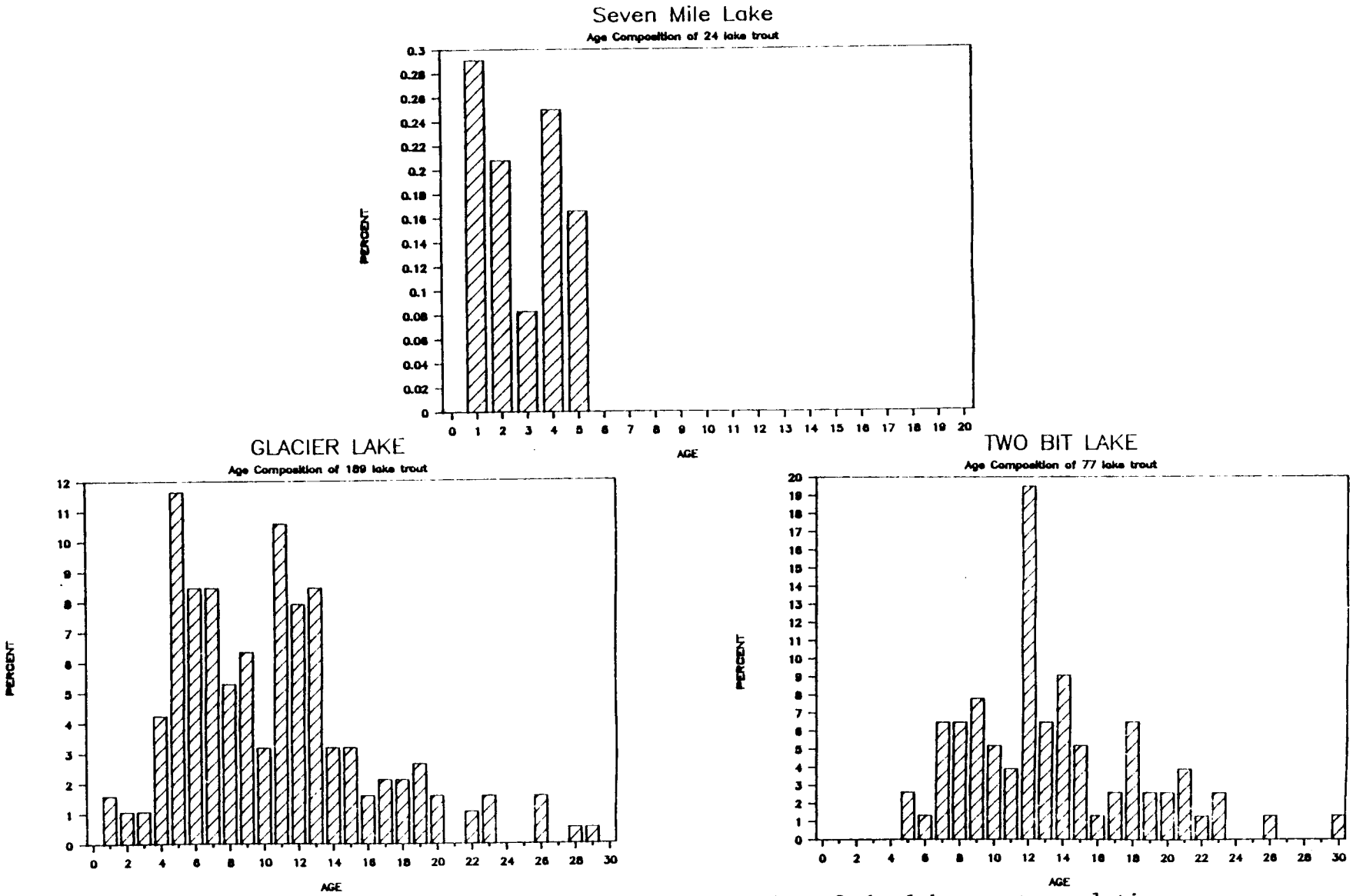

Figure 5. Estimated percent age composition of the lake trout populations from Sevenmile, Glacier, and Twobit Lakes, 1986.

A sample of 77 lake trout captured in 25 mm and 38 mm mesh gill nets from Twobit Lake ranged in age from 5 through 30. Age 12 was the most common age class (19%) in our sample (Figure 5, Appendix II).

Maturity:

Length at Maturity. Lake trout from Paxson Lake mature at the largest size of any of the lakes sampled (LM_{50} = 425 mm FL, Figure 6). Lake trout from Twobit Lake mature at a smaller size (LM_{50} = 347 mm FL) than in the other lakes. The LM_{50}'s for Summit Lake and Glacier Lake were 396 mm and 373 mm FL, respectively. In each instance, males matured at somewhat smaller sizes than females (Table 16). Data from populations in Fielding Lake and Sevenmile Lake were too few for similar analysis.

Age at Maturity. The age at which 50% of the lake trout were mature in our sample from Paxson Lake is 5.4 years (Figure 6). For males, all samples age 4 and younger were immature; all samples age 6 and older were mature. For females, all samples age 5 and younger were immature; all samples age 7 and older were mature (Table 17). In Summit Lake, the AM_{50} was 6.1 years (males 5.7, females 6.5). The AM_{50} for lake trout in Glacier Lake was 9.9 years (males 9.6, females 10.1) and for Twobit Lake the AM_{50} was 9.0 years for males and 11.8 years for females (Figure 6).

Size at Age:

Mean Length at Age. The mean length at age for lake trout from Paxson, Summit, Glacier, Tangles, Sevenmile, Twobit, and Fielding Lakes are given in Appendix III. Lake trout in the samples grew fastest and attained the largest size in Paxson Lake and were the smallest at age in the samples from Twobit Lake. Sample sizes from Sevenmile and Fielding Lakes are very small and many age groups are not represented. No lake trout older than age 5 were sampled in Sevenmile Lake. The Tangle Lakes sample is a pool of lake trout from four of the Tangle Lakes and is composed primarily of lake trout from Round and Upper Tangle Lakes.

Mean Weight at Age. The mean weight at age for lake trout from these lakes is given in Appendix IV. Though sample sizes are smaller than the samples for length at age, the same trends described for length can be seen in weight at age. Lake trout from Paxson and Summit Lakes were in better condition than were those from Twobit or Glacier Lakes. Sample sizes from the Tangles, Sevenmile, and Fielding Lakes are extremely small.

DISCUSSION

Gear Study

Due to the small sampling effort and very low catch rates, extensive interpretation of the gear study results is not possible. Day to day variability and site selection within the lakes probably affected catches as much as the actual efficiency of the gear. However, some obvious

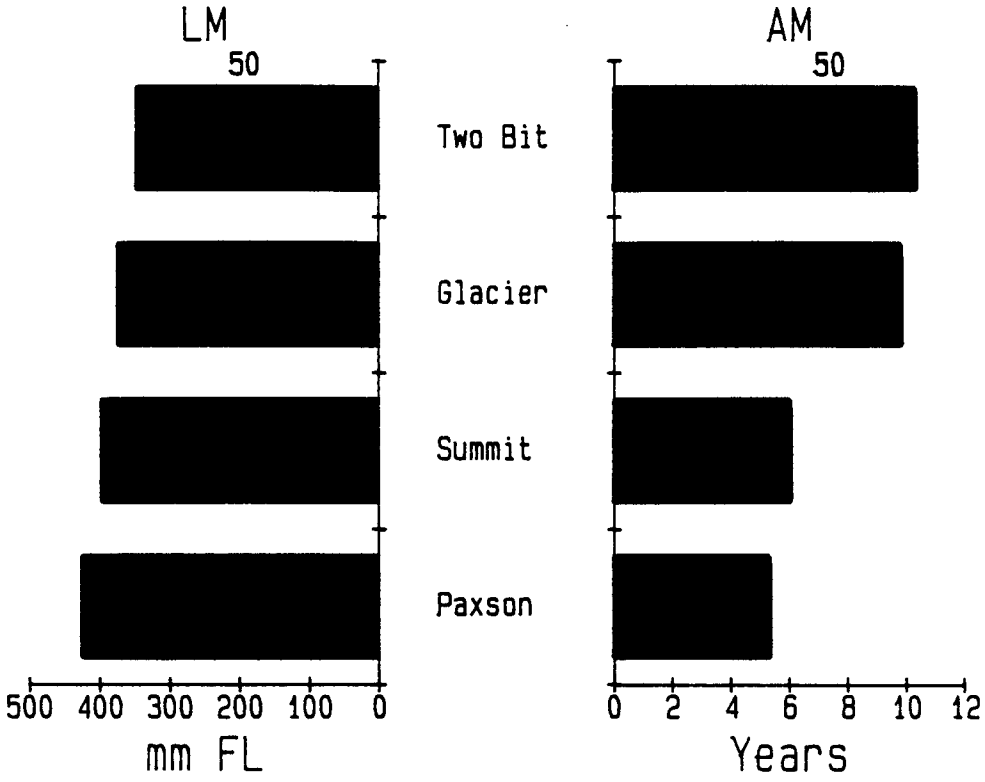

Figure 6. Estimated length at maturity (LM_{50}) and age at maturity (AM_{50}) of lake trout from Twobit, Glacier, Summit, and Paxson Lakes, 1986.

Table 16. The LM_{50}, LM_{1}, and LM_{99} and their fiducial limits for lake trout sampled from Glacier, Paxson, Summit, and Twobit Lakes in 1986.

Lake	Sample Size	LM_{50}	95% Fiducial Limits		LM_{1}	95% Fiducial Limits		LM_{99}	95% Fiducial Limits	
			Lower	Upper		Lower	Upper		Lower	Upper
PAXSON										
Both	95	425	404	444	330	267	361	547	506	656
Females	48	460	438	492	401	316	426	528	493	699
Males	46	396	327	420	310	127	354	505	459	917
SUMMIT										
Both	193	396	328	429	294	168	346	532	484	702
Females	53	452	429	470	400	323	424	511	485	611
Males	127	361	318	389	258	188	300	506	468	580
GLACIER										
Both	238	373	363	381	315	292	330	441	428	462
Females	106	384	368	394	335	298	354	439	424	471
Males	110	362	345	375	298	261	320	439	420	476
TWOBIT										
Both	77	347	311	368	225	133	268	536	470	782
Females	46	363	289	406	Lower limit = 0			Upper Limit > 1000		
Males	31	328	257	357	245	112	291	438	396	648

Table 17. The AM_{50}, AM_1, and AM_{99} and their fiducial limits for lake trout sampled from Glacier, Paxson, Summit, and Twobit Lakes in 1986.

Lake	Sample Size	AM_{50}	95% Fiducial Limits		AM_1	95% Fiducial Limits		AM_{99}	95% Fiducial Limits	
			Lower	Upper		Lower	Upper		Lower	Upper
PAXSON										
Both	88	5.4	5.0	5.9	3.6	2.1	4.2	8.2	7.1	13.8
Females	42	6 (All samples Age 5 and younger were immature; all samples Age 7 and older were mature)								
Males	45	5 (All samples Age 4 and younger were immature; all samples Age 6 and older were mature)								
SUMMIT										
Both	110	6.1	5.7	6.6	4.3	3.2	4.9	8.8	7.7	12.0
Females	43	6.5	6.0	7.2	5.5	3.5	6.0	7.7	7.1	12.6
Males	60	5.7	4.9	6.5	3.8	1.9	4.5	8.6	7.2	16.6
GLACIER										
Both	191	9.9	9.1	10.6	7.3	5.5	8.3	13.4	12.2	16.8
Females	87	10.1	9.4	10.7	8.3	6.2	9.0	12.4	11.5	15.5
Males	82	9.6	8.0	10.7	6.4	3.5	7.8	14.2	12.2	22.3
TWOBIT										
Both	77	Lower limit < 1			Lower limit = 0			Upper Limit > 100		
Females	46	11.8	5.1	18.0	Lower limit < 1			Upper Limit > 100		
Males	31	9.0	6.3	10.5	5.6	1.4	7.3	14.5	11.9	37.2

conclusions can be made about the relative success of the gear types tested. Lake trout were caught in all lakes sampled using gill nets, and gill nets were by far the most efficient gear tested for capturing mature lake trout. About three times more lake trout were caught per hour in gill nets than in the next most efficient gear, fyke nets. Fyke nets were only reasonably efficient in Sevenmile Lake (CPUE = 0.25 fish per hour) and over 95% of lake trout caught in fyke nets were juveniles. The beach seine was the least effective gear type tested. However, the small seine mesh size (9.5 mm) and the bottom composition of the lakes (mud or large boulders) often made sampling with the seine difficult and probably contributed to the inefficiency of the gear. In areas with a firm smooth bottom, a deeper seine with larger mesh could prove to be an effective sampling tool. This type of seine would probably be most effective in early summer and fall when light intensity is less and surface waters are cooler or when lake trout are concentrated for spawning.

The high mortality rate of lake trout caught in gill nets was the major disadvantage of this gear. Efforts to decrease gill net mortality rates should include; checking nets more frequently (maximum time between checks should not be over 30 minutes), evaluating mortality between multifilament and monofilament nets, comparing mortality rates between various mesh sizes, and reducing the use of gill nets during warm water periods. Attempts to develop other efficient sampling tools should continue.

Glacier Lake Population Estimate

Conditions for the accurate use of the mark recapture estimator are: a closed population, complete mixing of tagged and untagged fish (and equal probability of capture of all fish), no loss of marks, and equal mortality between marked and unmarked fish. Since the outlet stream becomes discontinuous during mid summer, it is unlikely that lake trout immigrated into or emigrated from the lake. Marked fish were released throughout the lake to enhance mixing. Also, the length of time between the capture events should have been sufficient to ensure complete mixing of marked and unmarked fish. No loss of tags was observed. Recruitment through growth may have occurred but since lake trout grow slowly and since the time between marking and recapture was only four weeks it is assumed that growth recruitment was minimal. There is some concern over the issue of equal mortality between marked and unmarked fish. Although only fish which appeared to be in good condition were released, two tagged lake trout (264 and 330 mm FL) were found in the stomach of a 595 mm lake trout. This is the only case where tagged fish were found in stomach contents. Only three other large lake trout (>500 mm) were killed and dissected and these contained only round whitefish so the rate of occurrence of cannibalism of marked fish is unknown.

Population Structure

Data collected in 1986 from the populations of lake trout from the seven lakes in the study area have provided estimates of the population structure (sex, size, and age composition, and maturity) for each lake trout population. However, in many cases the sample sizes were too small

to allow meaningful comparisons or conclusions, particularly for estimates of age composition and size at age. We will continue to collect data from the populations in each of these lakes from creel census contacts and from test netting. These data will be accumulated across years and added to the existing data base to improve the accuracy and precision of the estimates of population structure.

Lake trout stocks usually exhibit balanced sex ratios (Martin and Olver 1980) as was observed in our samples from Paxson, Tangles, and Glacier Lakes. Samples from the populations in these lakes were small, particularly from Fielding Lake (n=7). Males were more common in the sample from Summit Lake. However, most of this sample was collected from the spawning grounds where a preponderance of males has been found in most other studies (Martin and Olver 1980) and hence may not reflect the sex composition of the population in general.

The length compositions of lake trout from Sevenmile and Twobit Lakes are similar for fish from 250 to 500 mm. Neither lake contained any fish larger than 500 mm. Fish smaller than 250 mm are present in the Sevenmile Lake sample but are absent from the Twobit Lake sample. This is probably a result of fyke nets selecting for smaller fish since nearly all small lake trout in the sample from Sevenmile Lake were captured in fyke nets and fyke nets were not fished in Twobit Lake. The samples from Glacier, Fielding, and the Tangle Lakes contained larger lake trout than did those from Twobit and Sevenmile Lakes (all lakes of the Tanana River drainage). In Glacier, Fielding, and Tangle Lakes, from 5% to 18% of the lake trout were larger than 500 mm. Lake trout sampled from Summit and Paxson Lakes of the Copper River system were generally larger than those sampled from Tanana River drainage lakes. In Paxson Lake 49% of all lake trout sampled were larger than 500 mm, and in Summit Lake 35% were larger than 500 mm.

Relatively old lake trout (age 28-30) were sampled from Paxson and Summit lakes of the Copper River system and from the relatively remote Twobit and Glacier Lakes of the Tanana River system. In contrast, no lake trout older than age 13 were captured from the other three Tanana River lakes which all have good road access. It is important to note however, that the sample sizes from these three lakes is much smaller than those from the other four lakes.

The age at maturity (AM_{50}) of lake trout from Paxson and Summit Lakes is much lower than that of lake trout from the two Tanana River Lakes for which we have data. Of particular interest, is the abruptness with which maturity occurred in our sample from Paxson Lake. Such "knife edge" maturity is not common particularly with long lived species like lake trout.

Lake trout from the Copper River system lakes are relatively large and mature at a larger size and at a younger age than do lake trout from lakes of the Tanana river system. The faster growth of lake trout in Paxson Lake and Summit lake can probably be attributed to the presence of large numbers of sockeye salmon fry and smolt and, to a lesser degree, round and humpback whitefish for forage. In contrast, lake trout are essentially

the only species in Twobit Lake where their diet is composed primarily of snails and aquatic invertebrates. Whitefish and other species are present in the other Tanana River lakes but sockeye salmon are absent.

Fisheries

From creel census interviews and catch sampling, the lake trout fisheries of interior Alaska can generally be characterized as poor. Catch rates are very low (on average 0.1 fish per hour) and the majority of fish harvested are smaller than quality size (especially in lakes of the Tanana River drainage). Overexploitation of the major lake trout fisheries in interior Alaska (Burr 1987) is the probable cause of the low catch rates and small average size of lake trout harvested. Based largely on the findings of this study (including angler opinions), new regulations affecting lake trout fisheries were instituted in 1987. The new length limit (450 mm minimum) and the reduced bag limit (2 fish per day) will hopefully reduce fishery exploitation to a level which will allow stocks to recover.

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Appendix Table I.1. Catch of fish by species and gear type from Paxson Lake, 25-27 June 1986.

PAXSON LAKE	Catch by Species[1]											
	RWF	HWF	RS(A)	RS(J)	GR	SSC	BB	TOTAL LT	TAGGED LT	KILLED LT	%SMALL LT	EFFORT hrs:min
	110	6	1	315	6	2	2	0	0	0	0	
FYKE NET	40	0	0	136	0	0	0	0	0	0	0	
	51	9	7	451	0	0	0	0	0	0	0	
Total	201	15	8	902	6	2	2	0	0	0	0	63:25
TOOTH NET 25 mm	10	35	0	0	0	0	0	1	1	0	0	
	17	53	0	0	0	0	0	0	0	0	0	
Total	27	88	0	0	0	0	0	1	1	0	0	16:08
TOOTH NET 38 mm	0	40	0	0	0	0	0	3	3	0	0	
	21	76	0	0	0	0	0	5	3	2	0	
Total	21	116	0	0	0	0	0	8	6	2	0	16:53
Total	48	204	0	0	0	0	0	9	7	2	0	33:00
SEINE	1	3	2	23	0	4	0	0	0	0	0	
	2	6	0	1	0	0	0	2	2	0	0	
	13	1	0	1	0	12	0	0	0	0	0	
	1	0	0	37	0	0	0	0	0	0	0	
	0	6	0	0	0	0	0	0	0	0	0	
Total	17	15	2	61	0	16	0	2	2	0	0	5 hauls

[1] RWF, roundwhite fish; HWF, humpback whitefish; RS(A), adult sockeye salmon; RS(J), juvenile sockeye salmon ; GR, grayling; SSC, slimy sculpin; BB, burbot; LT, lake trout; %SMALL, lake trout less than 200 mm FL.

Appendix Table I.2. Catch of fish by species and gear type from Summit Lake, 1-3 July, 1986.

SUMMIT LAKE	Catch by Species[1]									
	RWF	RS(A)	RS(J)	SSC	BB	TOTAL LT	TAGGED LT	KILLED LT	%SMALL LT	EFFORT hrs:min
FYKE NET	30	0	0	2	0	0	0	0	0	23:42
	43	1	300+	0	1	0	0	0	0	18:28
	9	0	1	0	0	0	0	0	0	23:10
Total	82	1	300+	2	1	0	0	0	0	65:20
TOOTH NET 25 mm	6	0	0	0	0	2	2	0	0	3:15
	12	0	0	0	0	1	1	0	0	3:27
	31	0	0	0	0	0	0	0	0	2:17
Total	49	0	0	0	0	3	3	0	0	8:59
TOOTH NET 38 mm										
Total	2	0	0	0	0	0	5	0		4:51
Total	51	0	0	0	0	8	8	0	0	13:50
SEINE	2	0	0	0	0	0	0	0	0	
	0	0	200+	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	
Total	2	0	200+	0	0	0	0	0	0	4 HAULS

[1] RWF, round whitefish; RS(A), adult sockeye salmon; RS(J), juvenile sockeye salmon; SSC, slimy sculpin; BB, burbot; LT, lake trout; %SMALL, lake trout < 200 mm FL.

Appendix Table I.3. Catch of fish by species and gear type from Sevenmile Lake, 28-30 June 1986.

SEVENMILE LAKE	Catch by Species[1]							
	SSC	BB	TOTAL LT	TAGGED LT	KILLED LT	POSTED LT	%SMALL LT	EFFORT hrs:min
FYKE NET	0	1	20	15	0	5	90	20:00
	1	0	3	3	0	0	100	21:00
	2	0	4	1	0	3	100	20:00
Total	3	1	27	19	0	8	93	61:00
TOOTH NET 25 mm	0	0	1	1	0	0	0	6:00
	0	0	0	0	0	0	0	6:00
	0	0	20	11	9	0	0	17:00
Total	0	0	21	12	9	0	0	29:00
SEINE	17	0	0	0	0	0	0	
	0	0	0	0	0	0	0	
	1	0	0	0	0	0	0	
Total	18	0	0	0	0	0	0	3 hauls

[1] SSC, slimy sculpin; BB, burbot; LT, lake trout;
KILLED, fish killed by the sampling gear;
POSTED, captured alive and killed for age sample; %SMALL, < 200 mm FL.

Appendix Table I.4. Catch of fish by species and gear type from Paxson Lake, 6-8 August, 1986.

PAXSON LAKE	Catch by Species[1]											
	RWF	HWF	RS(A)	RS(J)	GR	SSC	BB	TOTAL LT	TAGGED LT	KILLED LT	%SMALL LT	EFFORT hrs:min
	36	3	4	0	1	0	4	0	0	0		23:11
FYKE NET	43	4	6	12	0	0	0	0	0	0		23:45
	22	1	6	28	1	0	6	0	0	0		23:45
Total	101	8	16	40	2	0	10	0	0	0	0	70:41
	69	5	7	23	0	0	0	0	0	0		21:35
FYKE NET	17	8	0	25	0	0	1	0	0	0		21:25
(chummed)	19	6	4	22	0	0	2	0	0	0		21:30
Total	105	19	11	70	0	0	3	0	0	0	0	64:30
TOOTH NET 25 mm	0	5	0	0	0	0	0	0	0	0		3:10
	2	15	0	0	0	0	0	0	0	0		2:20
	3	11	0	0	0	0	0	1	0	0		3:00
	0	3	0	0	0	0	0	0	0	0		3:10
	0	3	0	0	0	0	0	0	0	0		2:10
	0	3	0	0	0	0	0	0	0	0		1:45
	3	0	0	0	0	0	0	0	0	0		2:30
	2	1	0	0	0	0	0	0	0	0		3:40
	1	4	1	0	0	0	0	1	0	1		3:25
Total	11	45	1	0	0	0	0	2	0	1	0	25:10
TOOTH NET 38 mm	0	37	0	0	0	0	0	1	0	1		3:20
	0	17	0	0	0	0	0	0	0	0		2:45
	0	14	0	0	0	0	0	3	1	2		3:15
	0	12	0	0	0	0	0	12	6	6		3:15
	0	18	0	0	0	0	0	0	0	0		1:35
	0	23	0	0	0	0	0	0	0	0		1:30
Total	0	121	0	0	0	0	0	16	7	9		15:40
Total	11	166	1	0	0	0	0	18	7	10	0	40:50
SEINE	27	3	0	0	0	0	0	0	0	0		
	24	1	1	0	0	0	0	0	0	0		
	3	0	0	0	0	0	0	0	0	0		
	36	0	0	0	0	0	0	0	0	0		
	5	1	0	0	0	0	0	1	1	0		
Total	95	5	1	0	0	0	0	1	1	0	0	5 hauls

[1] RWF, roundwhite fish; HWF, humpback whitefish; RS(A), adult sockeye salmon; RS(J), juvenile sockeye salmon ; GR, grayling; SSC, slimy sculpin; BB, burbot; LT, lake trout; %SMALL, lake trout less than 200 mm FL.

Appendix Table I.5. Catch of fish by species and gear type from Summit Lake, 9-11 August 1986.

SUMMIT LAKE	Catch by Species[1]											
	RWF	RS(A)	RS(J)	SSC	BB	TOTAL LT	TAGGED LT	KILLED LT	%SMALL LT	SET TIME	PULL TIME	EFFORT hrs:min
FYKE NET	2	1	3	0	0	0	0	0	0	2140	1600	21:40
	42	0	3	0	0	1	0	0	100	2025	1540	20:25
	0	0	12	0	0	0	0	0	0	1920	1500	19:20
Total	44	1	18	0	0	1	0	0	100	6125		61:25
	4	4	6	0	0	0	0	0	0	2340	1540	23:40
	27	5	26	0	0	0	0	0	0	2350	1520	23:50
	1	17	8	0	1	4	0	0	100	2400	1500	24:00
Total	32	26	40	0	1	4	0	0	100	7130		71:30
TOOTH NET 25 mm	1	0	0	0	0	1	1	0	0	200	1600	2:00
	11	0	0	0	0	0	0	0	0	200	1620	2:00
	13	0	0	0	0	1	0	1	0	340	1950	3:40
	10	0	0	0	0	0	0	0	0	340	2000	3:40
	6	0	0	0	0	1	1	0	0	110	2100	1:10
	4	0	0	0	0	0	0	0	0	120	2120	1:20
	2	0	0	0	0	1	1	0	0	320	1830	3:20
	6	4	0	0	0	6	2	4	0	2610	1740	26:10
Total	53	4	0	0	0	10	5	5	0	4320		43:20
TOOTH NET 38 mm	0	0	0	0	0	0	0	0	0	210	1640	2:10
	0	0	0	0	0	1	0	1	0	200	1650	2:00
	0	0	0	0	0	2	2	0	0	340	2020	3:40
	0	0	0	0	0	0	0	0	0	340	2030	3:40
Total	0	0	0	0	0	3	2	1	0	1130		11:30
Total	53	4	0	0	0	13	7	6	0	5450		54:50
SEINE	2	0	0	0	0	0	0	0	0			
	0	0	0	0	0	0	0	0	0			
	3	1	0	0	0	0	0	0	0			
	0	0	0	0	0	0	0	0	0			
	0	0	0	0	0	0	0	0	0			
Total	5	1	0	0	0	0	0	0	0	5 HAULS		5 HAULS

[1] RWF, round whitefish; RS(A), adult sockeye salmon; RS(J), juvenile sockeye salmon; SSC, slimy sculpin; BB, burbot; LT, lake trout; %SMALL, lake trout < 200 mm FL.

Appendix Table I.6. Catch of fish by species and gear type from Sevenmile Lake, 12-14 August, 1986.

SEVENMILE LAKE	Catch by Species[1]							
	SSC	BB	TOTAL LT	TAGGED LT	CLIPPED LT	KILLED LT	%SMALL LT	EFFORT hrs:min
FYKE NET	0	?	8		8	0	100	25:00
	0	?	12	3	9	0	75	24:45
	0	?	4		4	0	100	24:30
Total	0	?	24	3	21	0	87	74:15
FYKE NET (chummed)	0	2	8	0	8	0	100	23:30
	0	3	4	0	4	0	100	23:45
	0	4	1	0	1	0	100	23:50
Total	0	9	13	0	13	0	100	71:05
FYKE NET (chummed)	0	8	4	0	4	0	100	24:10
	0	3	0	0	0	0	0	24:20
	0	4	2	0	2	0	100	24:15
Total	0	15	6	0	6	0	100	72:45
Total	0	24	43	3	40	0	93	
TOOTH NET 25 mm	0	0	4	3	0	1	0	2:35
	0	0	3	2	0	1	0	2:20
	0	0	0	0	0	0	0	2:10
	0	0	1	0	0	1	0	2:00
	0	0	0	0	0	0	0	1:35
	0	0	2	1	0	1	0	1:45
	0	0	1	1	0	0	0	0:20
Total	0	0	11	7	0	4	0	12:45
SEINE	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	
Total	0	0	0	0	0	0	0	2 hauls

[1] SSC, slimy sculpin; BB, burbot; LT, lake trout; %SMALL, < 200 mm FL.

Appendix Table II.1. Estimated age composition of the lake trout population in Paxson Lake, 1986.

AGE (years)	CREEL CENSUS					TEST NETTING					ALL LAKE TROUT				
	Males	Females	Both Sexes			Males	Females	Both Sexes			Males	Females	Both Sexes		
	n[1]	n	n	%	SE[2]	n	n	n	%	SE	n	n	n	%	SE
0	0	0	0	0		0	0	0	0		0	0	0	0	
1	0	0	0	0		0	0	0	0		0	0	0	0	
2	0	0	0	0		0	0	0	0		0	0	0	0	
3	0	0	0	0		0	0	0	0		0	0	0	0	
4	2	1	3	4	2	0	0	0	0		2	1	3	3	2
5	8	6	19	26	5	4	1	5	31	12	16	8	29	28	4
6	2	7	13	18	4	1	5	6	38	13	5	13	22	21	4
7	2	4	6	8	3	2	0	2	13	9	5	4	9	9	3
8	1	0	2	3	2	0	0	0	0		1	0	2	2	1
9	1	0	1	1	1	0	0	0	0		1	0	1	1	1
10	0	0	0	0		0	1	1	6	6	0	1	1	1	1
11	3	1	5	7	3	0	1	1	6	6	3	3	7	7	2
12	1	0	1	1	1	0	0	0	0		1	1	2	2	1
13	3	2	5	7	3	0	1	1	6	6	3	3	7	7	2
14	0	2	2	3	2	0	0	0	0		2	2	2	2	1
15	2	1	3	4	2	0	0	0	0		2	2	4	4	2
16	1	0	1	1	1	0	0	0	0		1	0	1	1	1
17	1	0	1	1	1	0	0	0	0		1	0	1	1	1
18	0	1	1	1	1	0	0	0	0		0	1	1	1	1
19	2	0	4	5	3	0	0	0	0		2	1	5	5	2
20	0	1	1	1	1	0	0	0	0		0	1	1	1	1
21	1	0	1	1	1	0	0	0	0		1	0	1	1	1
22	0	0	0	0		0	0	0	0		0	0	0	0	
23	0	2	2	3	2	0	0	0	0		0	2	2	2	1
24	0	1	1	1	1	0	0	0	0		0	1	2	2	1
25	0	0	0	0		0	0	0	0		0	0	0	0	
26	0	0	0	0		0	0	0	0		0	0	0	0	
27	0	0	0	0		0	0	0	0		0	0	0	0	
28	0	0	0	0		0	0	0	0		0	0	0	0	
29	0	1	2	3	2	0	0	0	0		0	1	2	2	1
30	0	0	0	0		0	0	0	0		0	0	0	0	
ALL	30	30	74			7	9	16			46	45	105		

[1] n = sample size

[2] SE = standard error (percent)

Appendix Table II.2. Estimated age composition of the lake trout population in Summit Lake, 1986.

Age (years)	CREEL CENSUS					TEST NETTING					ALL LAKE TROUT				
	Males	Females	Both Sexes			Males	Females	Both Sexes			Males	Females	Both Sexes		
	n[1]	n	n	%	SE[2]	n	n	n	%	SE	n	n	n	%	SE
0	0	0	0	0		0	0	0	0		0	0	0	0	
1	0	0	0	0		0	0	3	3	2	0	0	3	2	1
2	0	0	0	0		0	1	3	3	2	0	1	3	2	1
3	0	0	0	0		0	1	2	2	1	0	1	2	2	1
4	0	0	2	13	9	5	8	13	12	3	5	8	15	12	3
5	1	0	5	31	12	7	4	12	11	3	8	4	17	14	3
6	1	1	3	19	10	5	7	12	11	3	6	8	15	12	3
7	0	0	1	6		6	6	12	11	3	6	6	13	11	3
8	0	0	0	0		3	3	6	6	2	3	3	6	5	2
9	0	0	0	0		3	0	3	3	2	3	0	3	2	1
10	1	0	1	6	6	1	1	2	2	1	2	1	3	2	1
11	0	1	1	6	6	2	0	2	2	1	2	1	3	2	1
12	0	0	0	0		5	0	5	5	2	5	0	5	4	2
13	0	0	1	6	6	2	0	2	2	1	2	0	3	2	1
14	0	0	0	0		1	0	1	1	1	1	0	1	1	1
15	0	0	0	0		1	1	2	2	1	1	1	2	2	1
16	0	0	0	0		1	1	2	2	1	1	1	2	2	1
17	0	0	1	6	6	2	2	4	4	2	2	2	5	4	2
18	0	1	1	6	6	2	2	4	4	2	2	3	5	4	2
19	0	0	0	0		2	0	2	2	1	2	0	2	2	1
20	0	0	0	0		6	1	7	7	2	6	1	7	6	2
21	0	0	0	0		0	0	0	0		0	0	0	0	
22	0	0	0	0		1	0	1	1	1	1	0	1	1	1
23	0	0	0	0		2	1	3	3	2	2	1	3	2	1
24	0	0	0	0		1	0	1	1	1	1	0	1	1	1
25	0	0	0	0		0	1	1	1	1	0	1	1	1	1
26	0	0	0	0		0	0	0	0		0	0	0	0	
27	0	0	0	0		0	1	1	1	1	0	1	1	1	1
28	0	0	0	0		0	0	0	0		0	0	0	0	
29	0	0	0	0		0	0	0	0		0	0	0	0	
30	0	0	0	0		0	0	0	0		0	0	0	0	
31	0	0	0	0		0	0	0	0		0	0	0	0	
32	0	0	0	0		0	0	0	0		0	0	0	0	
33	0	0	0	0		0	0	0	0		0	0	0	0	
34	0	0	0	0		0	0	0	0		0	0	0	0	
35	0	0	0	0		0	0	0	0		0	0	0	0	
36	0	0	0	0		1	0	1	1	1	1	0	1	1	1
ALL	3	3	16			59	41	107			62	44	123		

[1] n = sample size

[2] SE = standard error (percent)

Appendix Table II.3. Estimated age composition of the lake trout population in the Tangle Lakes, 1986.

Age (years)	CREEL CENSUS					TEST NETTING					ALL LAKE TROUT				
	Males	Females	Both Sexes			Males	Females	Both Sexes			Males	Females	Both Sexes		
	n[1]	n	n	%	SE[2]	n	n	n	%	SE	n	n	n	%	SE
0	0	0	0	0		0	0	0	0		0	0	0	0	
1	0	0	0	0		0	0	0	0		0	0	0	0	
2	0	0	0	0		0	0	0	0		0	0	0	0	
3	0	0	0	0		0	0	0	0		0	0	0	0	
4	0	0	1	3	3	0	0	0	0		0	0	1	2	2
5	0	0	5	15	6	0	1	1	8	8	0	1	6	13	5
6	0	0	5	15	6	2	1	3	25	13	2	1	8	17	6
7	0	0	8	24	7	2	0	2	17	11	2	0	10	22	6
8	0	0	6	18	7	1	0	1	8	8	1	0	7	15	5
9	0	0	3	9	5	0	1	1	8	8	0	1	4	9	4
10	1	0	2	6	4	0	1	1	8	8	1	1	3	7	4
11	0	0	1	3	3	0	0	0	0		0	0	1	2	2
12	0	0	1	3	3	0	0	0	0		0	0	1	2	2
13	0	1	2	6	4	2	1	3	25	13	2	2	5	11	5
ALL	1	1	34			7	5	12			8	6	46		

[1] n = sample size

[2] SE = standard error (percent)

Appendix Table II.4. Estimated age composition of the lake trout population in Fielding Lake, 1986.

Age (years)	CREEL CENSUS					TEST NETTING					ALL LAKE TROUT				
	Males	Females	Both Sexes			Males	Females	Both Sexes			Males	Females	Both Sexes		
	n[1]	n	n	%	SE[2]	n	n	n	%	SE	n	n	n	%	SE
0	0	0	0			0	0	0			0	0	0		
1	0	0	0			0	0	0			0	0	0		
2	0	0	0			0	0	0			0	0	0		
3	0	0	0			0	0	0			0	0	0		
4	0	0	2	9	6	0	0	0			0	0	2	7	5
5	0	0	3	14	7	0	0	3	38	18	0	0	6	20	7
6	0	0	4	18	8	1	1	2	25	16	1	1	6	20	7
7	0	1	9	41	11	0	1	1	13	13	0	2	10	33	9
8	0	0	3	14	7	0	0	0	0		0	0	3	10	6
9	0	0	1	5	5	0	1	1	13	13	0	1	2	7	5
10	0	0	0			1	0	1	13	13	1	0	1	3	3
ALL	0	1	22			2	3	8			2	4	30		

[1] n = sample size

[2] SE = standard error (percent)

Appendix Table II.5. Estimated age composition of the lake trout population in Glacier Lake, 1986.

AGE (years)	TEST NETTING				
	Males	Females	Both Sexes		
	n[1]	n	n	%	SE[2]
0	0	0	0		
1	0	0	3	2	1
2	0	0	2	1	1
3	0	0	2	1	1
4	3	4	8	4	1
5	6	9	22	12	2
6	8	7	16	8	2
7	7	9	16	8	2
8	5	5	10	5	2
9	5	6	12	6	2
10	2	4	6	3	1
11	8	12	20	11	2
12	8	6	15	8	2
13	8	8	16	8	2
14	3	2	6	3	1
15	4	2	6	3	1
16	1	2	3	2	1
17	2	2	4	2	1
18	1	3	4	2	1
19	4	0	5	3	1
20	1	2	3	2	1
21	0	0	0		
22	1	1	2	1	1
23	2	1	3	2	1
24	0	0	0		
25	0	0	0		
26	2	1	3	2	1
27	0	0	0		
28	0	1	1	1	1
29	1	0	1	1	1
30	0	0	0		
ALL	82	87	189		

[1] n = sample size
[2] SE = standard error (percent)

Appendix Table II. 6. Estimated age composition of the lake trout population in Sevenmile Lake, 1986.

AGE (years)	TEST NETTING				
	Males	Females	Both Sexes		
	n[1]	n	n	%	SE[2]
0	0	0	0		
1	0	0	7	29	9
2	2	1	5	21	8
3	0	2	2	8	6
4	2	4	6	25	9
5	2	2	4	17	8
6	0	0	0		
7	0	0	0		
8	0	0	0		
9	0	0	0		
10	0	0	0		
ALL	6	9	24		

[1] n = sample size
[2] SE = standard error (percent)

Appendix Table II.7. Estimated age composition of the lake trout population in Twobit Lake, 1986.

AGE (years)	TEST NETTING				
	Males	Females	Both Sexes		
	n[1]	n	n	%	SE[2]
0	0	0	0		
1	0	0	0		
2	0	0	0		
3	0	0	0		
4	0	0	0		
5	1	1	2	3	2
6	1	0	1	1	1
7	1	4	5	6	3
8	3	2	5	6	3
9	2	4	6	8	3
10	1	3	4	5	3
11	0	3	3	4	2
12	8	7	15	19	5
13	1	4	5	6	3
14	4	3	7	9	3
15	0	4	4	5	3
16	0	1	1	1	1
17	2	0	2	3	2
18	2	3	5	6	3
19	0	2	2	3	2
20	1	1	2	3	2
21	2	1	3	4	2
22	1	0	1	1	1
23	0	2	2	3	2
24	0	0	0		
25	0	0	0		
26	0	1	1	1	1
27	0	0	0		
28	0	0	0		
29	0	0	0		
30	1	0	1	1	1
ALL	31	46	77		

[1] n = sample size
[2] SE = standard error (percent)

Appendix Table III.1. Estimated length (mm FL) at age of lake trout sampled from Paxson Lake, 1986.

AGE	CREEL CENSUS			TEST NETTING			MALE LAKE TROUT			FEMALE LAKE TROUT			ALL LAKE TROUT		
	mean length	sample size	SE[1]	mean length	sample size	SE	mean length	sample size	SE	mean length	sample size	SE	mean length	sample size	SE
0		0			0			0			0			0	
1		0			0			0			0			0	
2		0			0			0			0			0	
3		0			0			0			0			0	
4	373	3	12		0		364	2	14	390	1		373	3	12
5	407	19	6	439	5	9	424	16	6	400	8	9	413	29	5
6	453	13	13	438	6	14	443	5	13	441	13	14	447	22	9
7	522	6	13	513	2	23	516	5	14	515	4	19	515	9	10
8	534	2	19		0		553	1			0		534	2	19
9	518	1			0		518	1			0		518	1	
10		0		605	1			0		605	1		605	1	
11	552	5	12	650	1		542	3	9	604	3	24	568	7	16
12	570	1			0		570	1		586	1		578	2	8
13	615	5	42	562	1		707	4	66	557	3	17	642	7	47
14	686	2	77		0			0		686	2	77	686	2	77
15	563	3	9		0		570	2	11	565	2	15	567	4	8
16	572	1			0		572	1			0		572	1	
17	561	1			0		561	1			0		561	1	
18	580	1			0			0		580	1		580	1	
19	601	4	4		0		603	2	3	571	1		595	5	7
20	609	1			0			0		609	1		609	1	
21	530	1			0		530	1			0		530	1	
22		0			0			0			0			0	
23	598	2	5		0			0		598	2	5	598	2	5
24	927	1			0			0		758	2	170	758	2	170
25		0			0			0			0			0	
26		0			0			0			0			0	
27		0			0			0			0			0	
28		0			0			0			0			0	
29	583	2	13		0			0		465	1		583	2	13
30		0			0			0			0				
ALL	506	74	12	479	16	18	498	45	15	513	46	16	502	105	10

[1] SE = Standard Error

Appendix Table III.2. Estimated length (mm FL) at age of lake trout sampled from Summit Lake, 1986.

AGE	CREEL CENSUS			TEST NETTING			MALE LAKE TROUT			FEMALE LAKE TROUT			ALL LAKE TROUT		
	mean length	sample size	SE[1]	mean length	sample size	SE	mean length	sample size	SE	mean length	sample size	SE	mean length	sample size	SE
0		0			0			0			0			0	
1		0		118	3	4		0			0		118	3	4
2		0		135	3	8		0		151	1		135	3	8
3		0		267	2	25		0		242	1		267	2	25
4	335	2	15	284	13	12	266	5	11	296	8	16	291	15	11
5	383	5	14	335	12	17	353	8	23	314	4	20	349	17	14
6	428	3	19	436	12	10	444	6	14	431	8	11	434	15	9
7	450	1		466	12	9	469	6	14	463	6	10	464	13	9
8		0		499	6	16	480	3	21	518	3	15	499	6	16
9		0		498	3	7	498	3	5		0		498	3	7
10	523	1		498	2	18	502	2	15	515	1		506	3	13
11	530	1		494	2	15	494	2	10	530	1		506	3	15
12		0		546	5	32	546	5	29		0		546	5	32
13	450	1		491	2	12	491	2	9		0		477	3	15
14		0		494	1		494	1			0		494	1	
15		0		524	2	21	545	1		503	1		524	2	21
16		0		574	2	74	500	1		648	1		574	2	74
17	600	1		541	4	51	579	2	79	503	2	9	553	5	41
18	810	1		551	4	71	478	2	1	686	3	84	603	5	76
19		0		531	2	8	531	2	6		0		531	2	8
20		0		569	7	31	550	6	26	686	1		569	7	31
21		0			0			0			0			0	
22		0		490	1		490	1			0		490	1	0
23		0		508	3	17	493	2		539	1		508	3	17
24		0		497	1		497	1			0		497	1	
25		0		872	1			0		872	1		872	1	
26		0			0			0			0			0	
27		0		503	1			0		503	1		503	1	
28		0			0			0			0			0	
29		0			0			0			0			0	
30		0			0			0			0			0	
31		0			0			0			0			0	
32		0			0			0			0			0	
33		0			0			0			0			0	
34		0			0			0			0			0	
35		0			0			0			0			0	
36		0		505	1		505	1			0		505	1	
ALL	457	16	30	435	107	13	469	62	12	452	44	22	437	123	12

[1] SE = Standard Error

Appendix Table III.3. Estimated length (mm FL) at age of lake trout sampled from the Tangle lakes, 1986.

AGE	CREEL CENSUS			TEST NETTING			MALE LAKE TROUT			FEMALE LAKE TROUT			ALL LAKE TROUT		
	mean length	sample size	SE[1]	mean length	sample size	SE	mean length	sample size	SE	mean length	sample size	SE	mean length	sample size	SE
0		0			0			0			0			0	
1		0			0			0			0			0	
2		0			0			0			0			0	
3		0			0			0			0			0	
4	315	1			0			0			0		315	1	
5	293	5	20	318	1			0		318	1		297	6	17
6	296	5	13	337	3	18	324	2	12	364	1		312	8	12
7	322	8	9	374	2	74	374	2	74		0		332	10	13
8	338	6	20	375	1		375	1			0		344	7	17
9	369	3	20	500	1			0		500	1		402	4	40
10	384	2	87	510	1		445	1		510	1		426	3	68
11	460	1			0			0			0		460	1	
12	354	1			0			0			0		354	1	
13	400	2	28	500	3	108	576	2	112	385	1		460	5	61
14		0			0			0			0				
15		0			0			0			0				
16		0			0			0			0				
17		0			0			0			0				
18		0			0			0			0				
19		0			0			0			0				
20		0			0			0			0				
ALL	334	34	9	414	12	31	421	8	41	410	6	32.85	355	46	11

[1] SE = Standard Error

Appendix Table III.4. Estimated length (mm FL) at age of lake trout sampled from Glacier Lake, 1986.

AGE	MALE LAKE TROUT			FEMALE LAKE TROUT			ALL LAKE TROUT		
	mean length	sample size	SE[1]	mean length	sample size	SE	mean length	sample size	SE
0		0			0			0	
1		0			0		127	3	2
2		0			0		160	2	3
3		0			0		203	2	1
4	263	3	12	249	4	14	260	8	10
5	264	6	6	284	9	5	269	22	4
6	303	8	18	293	7	10	296	16	10
7	331	7	2	333	9	13	332	16	7
8	352	5	7	340	5	8	346	10	5
9	364	5	17	367	6	10	364	12	8
10	388	2	32	395	4	9	392	6	10
11	406	8	6	410	12	6	408	20	4
12	404	8	6	414	6	7	409	15	4
13	442	8	24	455	8	26	449	16	17
14	414	3	11	432	2	3	423	6	7
15	430	4	9	450	2	10	437	6	7
16	430	1		437	2	14	435	3	8
17	423	2	7	438	2	8	431	4	6
18	410	1		482	3	58	464	4	44
19	426	4	8		0		426	5	6
20	410	1		416	2	6	414	3	4
21		0			0			0	
22	430	1		423	1		427	2	4
23	416	2	2	443	1		425	3	9
24		0			0			0	
25		0			0			0	
26	421	2	1	437	1		426	3	5
27		0			0			0	
28		0		430	1		430	1	
29	435	1			0		435	1	
30		0			0			0	
ALL	375	82	7	375	87	8	362	189	6

[1] SE = Standard Error

Appendix Table III.5. Estimated length (mm FL) at age of lake trout sampled from Sevenmile Lake, 1986.

AGE	MALE LAKE TROUT			FEMALE LAKE TROUT			ALL LAKE TROUT		
	mean length	sample size	SE[1]	mean length	sample size	SE	mean length	sample size	SE
0		0			0			0	
1		0			0		84	7	3
2	218	2	52	170	1		177	5	22
3		0		344	2	2	344	2	4
4	365	2	25	365	4	3	365	6	5
5	400	2	35	387	2	1	394	4	11
6		0			0			0	
7		0			0			0	
8		0			0			0	
9		0			0			0	
10		0			0			0	
11		0			0			0	
12		0			0			0	
13		0			0			0	
14		0			0			0	
15		0			0			0	
ALL	327	6	41	343	9	24	247	24	3

[1] SE = Standard Error

Appendix Table III.6. Estimated length (mm FL) at age of lake trout sampled from Twobit Lake, 1986.

AGE	MALE LAKE TROUT			FEMALE LAKE TROUT			ALL LAKE TROUT		
	mean length	sample size	SE[1]	mean length	sample size	SE	mean length	sample size	SE
0		0			0			0	
1		0			0			0	
2		0			0			0	
3		0			0			0	
4		0			0			0	
5	278	1		252	1		265	2	13
6	283	1			0		283	1	
7	242	1		312	4	13	298	5	17
8	321	3	17	316	2	40	319	5	16
9	348	2	8	331	4	20	337	6	13
10	342	1		367	3	5	361	4	7
11		0		385	3	13	385	3	13
12	392	8	10	381	7	10	387	15	7
13	366	1		374	4	20	372	5	15
14	391	4	8	407	3	12	398	7	7
15		0		391	4	5	391	4	5
16		0		388	1		388	1	
17	433	2	25		0		433	2	25
18	403	2	10	414	3	21	410	5	12
19		0		402	2	2	402	2	2
20	381	1		455	1		418	2	37
21	421	2	7	377	1		406	3	15
22	405	1			0		405	1	
23		0		435	2	5	435	2	5
24		0			0			0	
25		0			0			0	
26		0		413	1		413	1	
27		0			0			0	
28		0			0			0	
29		0			0			0	
30	422	1			0		422	1	
ALL	374	31	9	374	46	7	374	77	5

[1] SE = Standard Error

Appendix Table III.7. Estimated length (mm FL) at age of lake trout sampled from Fielding Lake, 1986.

AGE	CREEL CENSUS			TEST NETTING			MALE LAKE TROUT			FEMALE LAKE TROUT			ALL LAKE TROUT		
	mean length	sample Size	SE[1]	mean length	sample Size	SE	mean length	sample Size	SE	mean length	sample Size	SE	mean length	sample Size	SE
0		0			0			0			0			0	
1		0			0			0			0			0	
2		0			0			0			0			0	
3		0			0			0			0			0	
4		0			0			0			0			0	
5	366	2	8		0			0			0		366	2	8
6	404	4	29	446	2	35	471	1		421	1		418	6	21
7	443	8	12	446	1			0		564	2	23	446	9	11
8	427	3	5		0			0			0		427	3	5
9	580	1		547	1			0		547	1		564	2	23
10		0		482	1		482	1					482	1	
ALL	431	18	13	477	5	20	477	2	8	465	4	34	441	23	11

[1] SE = Standard Error

Appendix Table IV.1. Estimated weight (grams) at age of lake trout sampled from Paxson Lake, 1986.

AGE	CREEL CENSUS			TEST NETTING			MALE LAKE TROUT			FEMALE LAKE TROUT			ALL LAKE TROUT		
	mean weight	sample size	SE[1]	mean weight	sample size	SE	mean weight	sample size	SE	mean weight	sample size	SE	mean weight	sample size	SE
0		0			0			0			0			0	
1		0			0			0			0			0	
2		0			0			0			0			0	
3		0			0			0			0			0	
4	450	1			0		450	1			0		450	1	
5	758	4	50	1060	5	190	938	8	131	744	4	21	873	12	90
6	996	6	162	925	6	75	875	4	103	952	10	97	948	15	71
7	1667	3	101	1480	2	120	1480	2	120	1667	3	101	1592	5	81
8	1600	1			0		1600	1			0		1600	1	0
9	1450	1			0		1450	1			0		1450	1	0
10		0		2580	1			0		2580	1		2580	1	0
11	1938	4	138	3700	1		1817	3	93	3000	2	700	2290	5	368
12		0			0			0		2350	1		2350	1	0
13	3420	5	1078	2540	1		5250	4	1563	2280	3	194	3977	7	1031
14	2250	2	250		0			0		4820	2	2220	4820	2	2220
15	2250	2	250		0		2250	2	250		0		2250	2	250
16	2350	1			0		2350	1			0		2350	1	0
17	2100	1			0		2100	1			0		2100	1	0
18		0			0			0			0			0	
19	2250	1			0		2250	1			0		2250	1	0
20	2800	1			0			0		2800	1		2800	1	0
21	1700	1			0		1700	1			0		1700	1	0
22		0			0			0			0			0	
23	2500	2	100		0			0		2500	2	100	598	2	5
24	12200	1			0			0		12200	1		758	1	0
25		0			0			0			0			0	
26		0			0			0			0			0	
27		0			0			0			0			0	
28		0			0			0			0			0	
29		0			0			0			0			0	
30		0			0			0			0			0	
ALL	2294	37	366	1414	16	213	1894	30	323	1818	29	244	2015	61	257

[1] SE = Standard Error

Appendix Table IV.2. Estimated weight (grams) at age of lake trout sampled from Summit Lake, 1986.

AGE	MALE LAKE TROUT			FEMALE LAKE TROUT			ALL LAKE TROUT		
	mean weight	sample size	SE[1]	mean weight	sample size	SE	mean weight	sample size	SE
0		0			0			0	
1		0			0			0	
2		0		151	1			0	
3		0		242	1		275	2	25
4	266	5	12	296	8	17	414	11	37
5	353	8	24	314	4	23	608	12	82
6	444	6	15	431	8	11	1123	12	87
7	469	6	15	463	6	11	1463	12	92
8	480	3	25	518	3	18	1696	6	152
9	498	3	7		0		1733	3	118
10	502	2	22	515	1		1613	2	88
11	494	2	15	530	1		1688	2	138
12	546	5	32		0		2245	5	304
13	491	2	12		0		1625	2	125
14	494	1			0		1722	1	
15	545	1		503	1		1850	2	350
16	500	1		648	1		2900	2	900
17	579	2	112	503	2	12	2494	4	839
18	478	2	2	686	3	102	2900	4	1268
19	531	2	8		0		2173	2	148
20	550	6	28	686	1		3050	7	480
21		0			0			0	
22	490	1			0		1775	1	
23	493	2	12	539	1		1888	3	193
24	497	1			0		1925	1	
25		0		872	1		9500	1	
26		0			0			0	
27		0		503	1		1650	1	
28		0			0			0	
29		0			0			0	
30		0			0			0	
31		0			0			0	
32		0			0			0	
33		0			0			0	
34		0			0			0	
35		0			0			0	
36	505	1			0		1575	1	
ALL	464	62	12	447	44	23	1621	99	134

[1] SE = Standard Error

Appendix Table IV.3. Estimated weight (grams) at age of lake trout sampled from the Tangle Lakes, 1986.

AGE	MALE LAKE TROUT			FEMALE LAKE TROUT			ALL LAKE TROUT		
	mean weight	sample size	SE[1]	mean weight	sample size	SE	mean weight	sample size	SE
0		0			0			0	
1		0			0			0	
2		0			0			0	
3		0			0			0	
4		0			0			0	
5		0			0			0	
6	328	2	39		0		328	2	39
7	660	2	339		0		660	2	339
8	550	1			0		550	1	
9		0		1290	1		1290	1	
10		0		1800	1		1800	1	
11		0			0			0	
12		0			0			0	
13	4000	1		400	1		2200	2	2546
14		0			0			0	
15		0			0			0	
16		0			0			0	
17		0			0			0	
18		0			0			0	
19		0			0			0	
20		0			0			0	
ALL	421	8	41	1163	3	33	1113	9	423

[1] SE = Standard Error

Appendix Table IV.4. Estimated weight (grams) at age of lake trout sampled from Glacier Lake, 1986.

AGE	MALE LAKE TROUT			FEMALE LAKE TROUT			ALL LAKE TROUT		
	mean weight	sample size	SE[1]	mean weight	sample size	SE	mean weight	sample size	SE
0		0			0			0	
1		0			0			0	
2		0			0			0	
3		0			0		75	1	
4	160	3	31	163	4	39	173	8	23
5	215	6	32	261	9	22	240	22	15
6	356	8	68	354	7	34	352	16	36
7	396	7	28	380	9	31	387	16	21
8	505	5	54	466	4	49	488	9	35
9	490	4	59	580	6	53	544	10	40
10	763	2	88	756	4	87	758	6	59
11	784	8	39	877	11	37	408	19	29
12	796	7	39	867	6	81	836	14	39
13	1099	8	349	1025	7	109	1064	15	187
14	925	3	90	963	2	63	971	6	54
15	1019	4	62	1025	2	125	1021	6	51
16	950	1		950	2	150	950	3	87
17	1038	2	88	1100	1		1058	4	45
18	1075	1		1800	3	851	1619	4	628
19	913	4	85		2		940	5	71
20	850	1		1025	2	50	967	3	65
21		0			0			0	
22	1100	1		950	1		1025	2	75
23	975	2	125	1050	1		425	3	9
24		0			0			0	
25		0			0			0	
26	825	2	75	1150	1		933	3	117
27		0			0			0	
28		0		900	1		900	1	
29		0			0		900	1	
ALL	690	80	49	696	83	50	672	177	33

[1] SE = Standard Error

Appendix Table IV.5. Estimated weight (grams) at age of lake trout sampled from Sevenmile Lake, 1986.

AGE	MALE LAKE TROUT			FEMALE LAKE TROUT			ALL LAKE TROUT		
	mean weight	sample size	SE[1]	mean weight	sample size	SE	mean weight	sample size	SE
0		0			0			0	
1		0			0			0	
2	150	1			0		150	1	
3		0		425	2	6	425	2	25
4	800	1		592	3	6	644	4	88
5	863	2	38	650	2	12	756	4	93
6		0			0			0	
7		0			0			0	
8		0			0			0	
9		0			0			0	
10		0			0			0	
11		0			0			0	
12		0			0			0	
13		0			0			0	
14		0			0			0	
15		0			0			0	
ALL	669	4	61	561	7	17	600	11	68

[1] SE = Standard Error

Appendix Table IV.6. Estimated weight (grams) at age of lake trout sampled from Twobit Lake, 1986.

AGE	MALE LAKE TROUT			FEMALE LAKE TROUT			ALL LAKE TROUT		
	mean weight	sample size	SE[1]	mean weight	sample size	SE	mean weight	sample size	SE
0		0			0			0	
1		0			0			0	
2		0			0			0	
3		0			0			0	
4		0			0			0	
5	280	1		220	1		250	2	30
6	300	1			0		300	1	
7	180	1		360	4	53	324	5	55
8	410	3	46	395	2	105	404	5	42
9	510	2	10	453	4	62	472	6	41
10	480	1		560	3	31	540	4	29
11		0		483	3	44	483	3	44
12	678	8	63	626	7	37	653	15	37
13	600	1	0	590	4	103	592	5	80
14	605	4	41	650	3	50	624	7	30
15		0		725	4	49	725	4	49
16		0		700	1		700	1	
17	880	2	20		0		880	2	20
18	720	2	20	807	3	121	772	5	70
19		0		725	2	25	725	2	25
20	640	1		1000	1		820	2	180
21	625	2	25	500	1		583	3	44
22	740	1		1040	2	40	740	1	
23		0			0		1040	2	40
24		0			0			0	
25		0			0			0	
26		0		850	1		850	1	
27		0			0			0	
28		0			0			0	
29		0			0			0	
30	700	1			0		700	1	
ALL	595	31	33	608	46	30	603	77	22

[1] SE = Standard Error

Appendix Table IV.7. Estimated weight (grams) at age of lake trout sampled from Fielding Lake, 1986.

AGE	MALE LAKE TROUT			FEMALE LAKE TROUT			ALL LAKE TROUT		
	mean weitht	sample size	SE[1]	mean weight	sample size	SE	mean weight	sample size	SE
0		0			0			0	
1		0			0			0	
2		0			0			0	
3		0			0			0	
4		0			0			0	
5		0			0			0	
6	1390	1		790	1		1090	2	424
7		0		1240	1		1240	1	
8		0			0			0	
9		0		1820	1		1820	1	
10	1310	1			0		1310	1	
ALL	1350	2	57	1283	3	365	1310	5	184

[1] SE = Standard Error