Fishery Data Series No. 05-19

Evaluation of Rainbow Trout in Lisa Lake During 2001, and Fish Population Monitoring in Stocked Waters in the Tanana River and Copper River Drainages, 1999-2003

by

April E. Behr,

James T. Fish

and

Cal Skaugstad

May 2005

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	E
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

FISHERY DATA REPORT NO. 05-19

EVALUATION OF RAINBOW TROUT IN LISA LAKE DURING 2001, AND FISH POPULATION MONITORING IN STOCKED WATERS IN THE TANANA RIVER AND COPPER RIVER DRAINAGES, 1999-2003

By
April E. Behr, James T. Fish, and Cal Skaugstad
Division of Sport Fish, Fairbanks

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1599

May 2005

Development and publication of this manuscript were partially financed by the Federal Aid in Sport fish Restoration Act(16 U.S.C.777-777K) under Projects F-10-16-19, Job No. E-3-1(a).

The Division of Sport Fish Fishery Data Series was established in 1987 for the publication of technically oriented results for a single project or group of closely related projects. Since 2004, the Division of Commercial Fisheries has also used the Fishery Data Series. Fishery Data Series reports are intended for fishery and other technical professionals. Fishery Data Series reports are available through the Alaska State Library and on the Internet: http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm This publication has undergone editorial and peer review.

April E. Behr,
Alaska Department of Fish and Game, Division of Sport Fish,
1300 College Road, Fairbanks, AK 99701-1599, USA
James T. Fish,
Alaska Department of Fish and Game, Division of Sport Fish
1300 College Road, Fairbanks, AK 99701-1599, USA
and
Cal Skaugstad
Alaska Department of Fish and Game, Division of Sport Fish,
1300 College Road, Fairbanks, AK 99701-1599, USA

This document should be cited as:
Behr, A. E., J. T. Fish, and C. Skaugstad. 2005. Evaluation of rainbow trout in Lisa Lake during 2001, and fish population monitoring in stocked waters in the Tanana River and Copper River drainages, 1999-2003. Alaska Department of Fish and Game, Fishery Data Series No. 05-19, Anchorage.

TABLE OF CONTENTS

Page

LIST OF TABLES ii

LIST OF FIGURES ii

LIST OF APPENDICES ii

ABSTRACT 1

INTRODUCTION 1

ABUNDANCE AND COMPOSITION OF RAINBOW TROUT IN LISA AND DONNELLY LAKES, 2001 2

Introduction 2
Objectives 3
Methods 3
  Donnelly Lake 3
  Lisa Lake 3
Results and Discussion 7

FISH POPULATION MONITORING IN STOCKED WATERS, 1999-2003 9

Introduction 9
Objectives 11
Methods 11
Results and Discussion 14

ACKNOWLEDGMENTS 19

REFERENCES CITED 19

APPENDIX A. STOCKING HISTORY FOR LISA LAKE, 1962-2003 21

APPENDIX B. SAMPLING RESULTS FOR FISH POPULATIONS MONITORED IN STOCKED WATERS IN THE TANANA RIVER AND COPPER RIVER DRAINAGES, 1999 23

APPENDIX C. SAMPLING RESULTS FOR FISH POPULATIONS MONITORED IN STOCKED WATERS IN THE TANANA RIVER AND COPPER RIVER DRAINAGES, 2000 35

APPENDIX D. SAMPLING RESULTS FOR FISH POPULATIONS MONITORED IN STOCKED WATERS IN THE TANANA RIVER AND COPPER RIVER DRAINAGES, 2001 43

APPENDIX E. SAMPLING RESULTS FOR FISH POPULATIONS MONITORED IN STOCKED WATERS IN THE TANANA RIVER AND COPPER RIVER DRAINAGES, 2002 47

APPENDIX F. SAMPLING RESULTS FOR FISH POPULATIONS MONITORED IN STOCKED WATERS IN THE TANANA RIVER AND COPPER RIVER DRAINAGES, 2003 49

APPENDIX G. 1998-2003 STOCKING HISTORIES FOR LAKES SAMPLED 1999-2003 53

APPENDIX H. ARCHIVED FILES FOR DATA COLLECTED DURING STUDIES COVERED IN THIS REPORT 59

LIST OF TABLES

Table **Page**

1. Fish population sampling schedule, 1999-2003 11
2. Fish population sampling results summary, 1999-2003 15

LIST OF FIGURES

Figure **Page**

1. The Tanana River and Upper Copper/Upper Susitna River drainages 2
2. Location of Lisa Lake, Donnelly Lake, and other stocked lakes in the Tanana River drainage 4
3. Bathometric map of Lisa Lake 5
4. Lengths of rainbow trout captured during Lisa Lake mark-recapture experiment, 2001 7
5. Cumulative distribution function of lengths from rainbow trout >330 mm FL captured during the mark-recapture experiment at Lisa Lake. 8
6. Location of stocked lakes sampled in the Fairbanks/Nenana area, Tanana River drainage, 1999 - 2003. 12
7. Location of stocked lakes sampled in the Glennallen area, Copper River drainage, 1999 - 2003 13
8. Proportion of fish captured ≥ 300 mm in stocked lakes in the Copper River and Tanana River drainages 1999-2003 17

LIST OF APPENDICES

Appendix **Page**

A. Stocking history for Lisa Lake, 1962-2003. 22
B1. Length frequency distribution of Arctic grayling and rainbow trout in 2-Mile Lake, May 1999 24
B2. Length frequency distribution of Arctic grayling and rainbow trout in 3-Mile Lake, May 1999 24
B3. Length frequency distribution of lake trout and rainbow trout in Backdown Lake, September 1999 25
B4. Length frequency distribution of Arctic char and Arctic grayling in Brodie Lake, September 1999 25
B5. Length frequency distribution of rainbow trout in Buffalo Lake, June 1999 26
B6. Length frequency distribution of coho salmon, lake trout, and rainbow trout in Chet Lake, September 1999 26
B7. Length frequency distribution of lake trout and rainbow trout in Coal Mine 5 Lake, August 1999 27
B8. Length frequency distribution of rainbow trout in Crater Lake, June 1999 27
B9. Length frequency distribution of Arctic grayling and lake trout in Crystal Lake, August 1999 28
B10. Length frequency distribution of lake trout and rainbow trout in Donnelly Lake, September 1999 28
B11. Length frequency distribution of rainbow trout in Forty Foot Lake, June 1999 29
B12. Length frequency distribution of Arctic grayling, coho salmon, and rainbow trout in J Lake, September 1999 29
B13. Length frequency distribution of Arctic grayling in Junction Lake, June 1999 30
B14. Length frequency distribution of rainbow trout in Little Crater Lake, June 1999. 30
B15. Length frequency distribution of Arctic char, coho salmon, and rainbow trout in North Twin Lake, September 1999 31
B16. Average FL of rainbow trout caught in Peanut Lake, June 1999 31
B17. Length frequency distribution of rainbow trout in Ryan Lake, June 1999 32
B18. Length frequency distribution of rainbow trout in Silver Lake, May 1999 32
B19. Length frequency distribution of lake trout and rainbow trout in South Twin Lake, September 1999 33

LIST OF APPENDICES (Continued)

B20. Length frequency distribution of burbot and rainbow trout in Squirrel Creek Pit, June 1999 33
C1. Length frequency distribution of Arctic grayling in Connor Lake, June 2000 36
C2. Average FL of Arctic grayling caught in Dick Lake, June 2000 36
C3. Length frequency distribution of Arctic grayling and burbot in Forgotten Lake, June 2000 37
C4. Length frequency distribution of rainbow trout in Koole Lake, June 2000 37
C5. Length frequency distribution of Arctic grayling in Little Junction Lake, June 2000 38
C6. Length frequency distribution of northern pike in Rich 28 Mile Pond, July 2000 38
C7. Length frequency distribution of rainbow trout in Sculpin Lake, May 2000 39
C8. Length frequency distribution of coho salmon in Strelna Lake, June 2000 39
C9. Length frequency distribution of Arctic char and rainbow trout in Tex Smith Lake, June 2000 40
C10. Length frequency distribution of rainbow trout in Triangle Lake, June 2000 40
C11. Length frequency distribution of rainbow trout in Tschute Lake, June 2000 41
D1. Length frequency distribution of Arctic grayling in Arizona Lake, May 2001 44
D2. Length frequency distribution of Chinook salmon and rainbow trout in Bullwinkle Lake, June 2001 44
D3. Length frequency distribution of Arctic char and rainbow trout in Donnelly Lake, September 2001 45
D4. Length frequency distribution of rainbow trout in Monte Lake, August 2001 45
D5. Length frequency distribution of rainbow trout in Rainbow Lake, June 2001 46
E1. Average FL of fish caught in Bullwinkle Lake, June 2002 48
E2. Average FL of Arctic char and Arctic grayling caught in Sheefish Lake, June 2002 48
E3. Length frequency distribution of Arctic char and rainbow trout in Weasel Lake, June 2002 48
F1. Average FL of fish caught in Doc Lake, August 2003 50
F2. Length frequency distribution of rainbow trout in Little Harding Lake, August 2003 50
F3. Length frequency distribution of rainbow trout in Lost Lake, September 2003 50
F4. Length frequency distribution of Arctic grayling in Luke Lake, August 2003 51
F5. Length frequency distribution of lake trout and rainbow trout in No Mercy Lake, August 2003 51
F6. Length frequency distribution of lake trout and rainbow trout in Rapids Lake, August 2003 52
F7. Length frequency distribution of lake trout and rainbow trout in Rockhound Lake, August 2003 52
G. 1998-2003 Stocking histories for lakes sampled 1999-2003 54
H. Archive files for data collected during studies covered in this report 60

ABSTRACT

The Board of Fish in 2001 assigned ADF&G the task to find lakes that were likely to provide "quality" fisheries for large rainbow trout *Oncorhynchus mykiss* (> 460 mm TL). In 2001, a two-sample mark-recapture experiment was conducted at Lisa Lake to estimate the abundance and size structure of the rainbow trout population. Rainbow trout were stocked every other year since 1995. Age-2 rainbow trout ranged in size from 220 to 310 mm FL (~8-12 inches), and averaged 264 mm FL. Age-4 rainbow trout ranged in size from 310 to 400 mm FL (~12-16 inches), and averaged 327 mm. The estimated abundance of age-2 rainbow trout was 652 (SE = 127). The abundance of age-4 rainbow trout was not estimated because no age-4 fish were captured during the second event. The rainbow trout population in Lisa Lake does not meet the minimum size criteria for a quality fishery.

Fish populations were sampled in 44 lakes in the Tanana River and Copper River drainages during 1999-2003. These data were used to monitor the status of fish populations in stocked waters and provide anglers with up to date information on species composition, size, and relative abundance. Fishery managers apply an arbitrary rule that the current management and stocking strategy was successful when at least 20% of the fish in a sample was ≥ 300 mm FL. Samples from 36 of the lakes contained stocked fish ≥ 300mm. Sixteen of these lakes had samples with 20% (or more) of the fish ≥ 300mm. Samples from 5 other lakes had 10% to <20% of fish ≥ 300mm. No stocking or management changes were made for these lakes, however, they will be monitored more closely in the future. Thirteen of the 36 lakes had samples with less than 10% of fish ≥ 300mm. Stocking schedules and management strategies for these lakes were reviewed and appropriate adjustments were made where feasible. Less than 10 fish were caught in 10 of the 44 lakes sampled. Data from these lakes were insufficient to assess the status of the fish populations. Managers will closely monitor these lakes to determine the cause for small sample sizes and to develop plans to restore the fisheries if needed.

Key words: Lisa Lake, rainbow trout, *Oncorhynchus mykiss*, 2-Mile, 3-Mile, Arizona, Backdown, Brodie, Buffalo, Bullwinkle, Chet, Coal Mine 5, Connor, Crater, Crystal, Dick, Doc, Donnelly, Forgotten, Forty Foot, J, Junction, Koole, Little Crater, Little Harding, Little Junction, Little Lost, Luke, Monte, No Mercy, North Twin, Peanut, Rainbow, Rapids, Rich 28 Mile, Rockhound, Ryan, Sculpin, Sheefish, Silver, South Twin, Squirrel Creek, Strelna, Tex Smith, Triangle, Tschute, Weasel, stocking evaluation, stock assessment, stocking method, length at age, mark-recapture, fish population monitoring.

INTRODUCTION

The Alaska Department of Fish and Game (ADF&G) stocks game fish in approximately 129 lakes and one stream in the Tanana River drainage in Interior Alaska and the Upper Copper/Upper Susitna (UCUS) river drainages in the Glennallen area (Figure 1). The goal of the stocking program is to provide diverse and dependable angling opportunities near population centers and offer alternatives to the harvest of wild fish stocks. The stocking program began in the early 1950s, when lakes along the road system were stocked with rainbow trout *Oncorhynchus mykiss*, or coho salmon *O. kisutch*. Today, the stocking program provides year-round sport-fishing opportunity for rainbow trout, coho salmon, Chinook salmon *O. tshawytscha*, Arctic grayling *Thymallus arcticus*, and Arctic char *Salvelinus alpinus*.

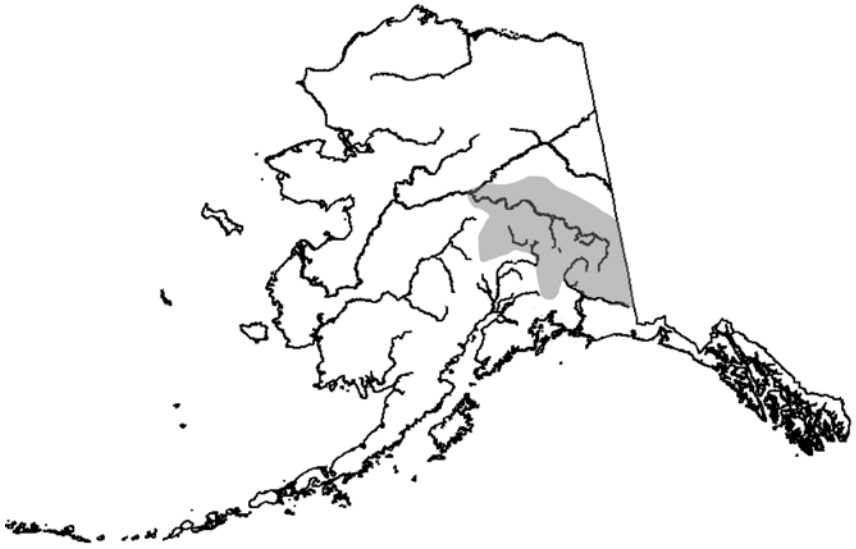


Figure 1.–The Tanana River and Upper Copper/Upper Susitna River drainages (shaded area).

The stocking program supports consumptive fisheries along the road system where potential fishing effort is greatest. As a conservation tool, it serves to divert fishing pressure away from wild populations that cannot support high levels of harvest desired by anglers. Anglers and businesses in the Tanana Valley value the stocking program because it provides angling opportunities that normally would not be present and it benefits local economies through the sales of fishing related sporting goods. Anglers particularly enjoy opportunities to catch highly desired species such as rainbow trout and Arctic char which are not native to the Tanana Valley.

The purpose for monitoring abundance and age-size composition of stocked fish populations was to maintain current information on the status of fish populations in stocked waters throughout the Tanana and UCUS river drainages. This information was used by fisheries managers to assess the status of fish populations, evaluate the effectiveness of the stocking program, and provide information to the public about species composition, size, and abundance of fish in the stocked lakes.

ABUNDANCE AND COMPOSITION OF RAINBOW TROUT IN LISA AND DONNELLY LAKES, 2001

INTRODUCTION

Anglers have requested that ADF&G create fisheries for large rainbow trout in Interior Alaska. All rainbow trout populations in the Tanana River drainage are stocked and anglers can easily access most of the stocked lakes. As a result, these populations receive relatively high fishing pressure (angler effort per lake surface area) and few fish live past age-3 or attain large size (>460 mm TL). To produce and maintain large fish, ADF&G and the public have requested that the Board of Fish restrict fishing seasons and limit the number of fish harvested from certain lakes. ADF&G also has reduced the number of fish stocked in some lakes in an effort to provide

more food resources for fewer fish. The goal of these management actions is to produce larger fish. A growing number of anglers are attracted to such "quality" fisheries and most of these anglers practice catch-and-release, which slows the removal of large fish from the population.

The Board of Fish in 2001 assigned ADF&G the task to find lakes that were likely to grow large rainbow trout to provide quality fisheries. The purpose of this study was to estimate the abundance and size structure of the rainbow trout populations in Lisa and Donnelly lakes in the Upper Tanana Management Area (UTMA) near Delta Junction. Information obtained from anglers suggested that these lakes were capable of producing large fish.

Lisa Lake is located 66 km east of Delta Junction, along the Alaska Highway (Figures 2 and 3). Donnelly Lake is located 28 km south of Delta Junction along the Richardson Highway (Figure 2). Although situated close to the highways, both lakes have trail access requiring anglers to walk or use all-terrain vehicles (ATVs) or snowmachines.

OBJECTIVES

The objectives of this study were to:

1. estimate the abundance ($\hat{N}$) of rainbow trout in Lisa and Donnelly lakes; and,

2. estimate the size composition of rainbow trout in Lisa and Donnelly lakes using size categories: <355 mm, 355 to 460 mm, and >460 mm.

METHODS

Donnelly Lake

At Donnelly Lake, a two-sample mark-recapture experiment was attempted during September 2001. Due to logistic problems, data were collected from only a single multi-day event. These data are summarized in this report in the section *Fish Population Monitoring in Stocked Waters, 1999-2003.*

Lisa Lake

A two-sample mark-recapture experiment was conducted during summer 2001 to estimate the abundance of rainbow trout at Lisa Lake. The marking event (Event 1) occurred 13 to 15 June, 2001, and the recapture event (Event 2) occurred 15 to 17 August, 2001. Capture gear consisted of six fyke nets. All nets were set near shore on the lake bottom in approximately 1 to 2 m of water. The body of each fyke net was positioned parallel to shore. Fyke nets were ~5 m long, the open square end of each fyke net measured either 0.9 or 1.2 m on edge, trailing hoops were 0.9 m diameter, and mesh size was 9 mm^2. Leads (or "wings") were attached to both sides of the open end and measured 7.5 m long by 1.2 m deep. The wings were set to form a "V". One wing was anchored to shore, and a weight was attached to the other wing and positioned offshore. The cod end of each fyke net was pulled taunt and a weight was attached to prevent the fyke net from collapsing.

Each captured fish was marked with a fin clip and measured to the nearest millimeter fork length (FL). Fish captured for the first time during Event 1 were marked with an upper caudal fin clip (UC). Fish captured for the first time during Event 2 were marked with a lower caudal fin clip (LC), whether or not an upper caudal fin clip was present.

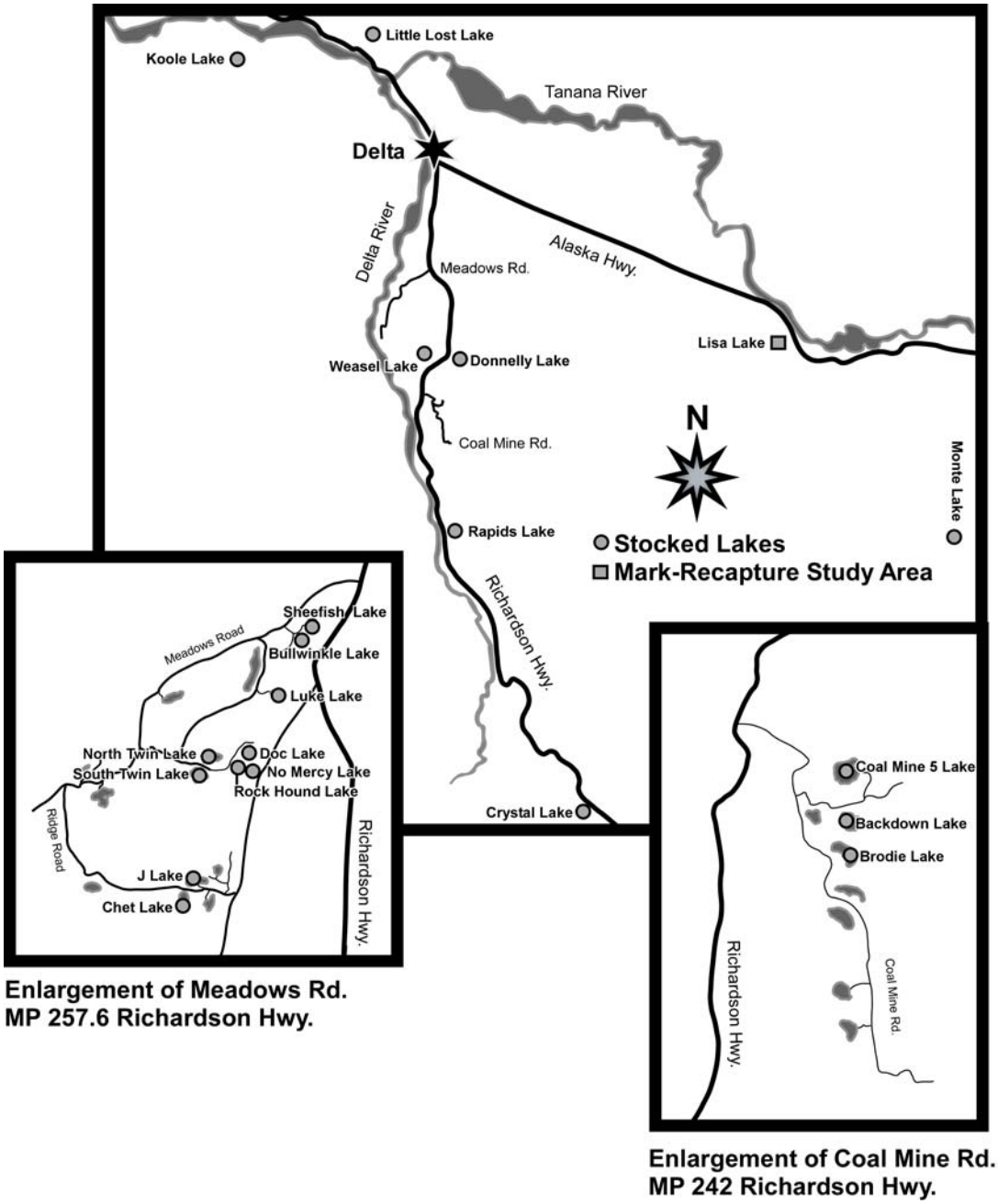


Figure 2.–Location of Lisa Lake, Donnelly Lake, and other stocked lakes in the Tanana River drainage.

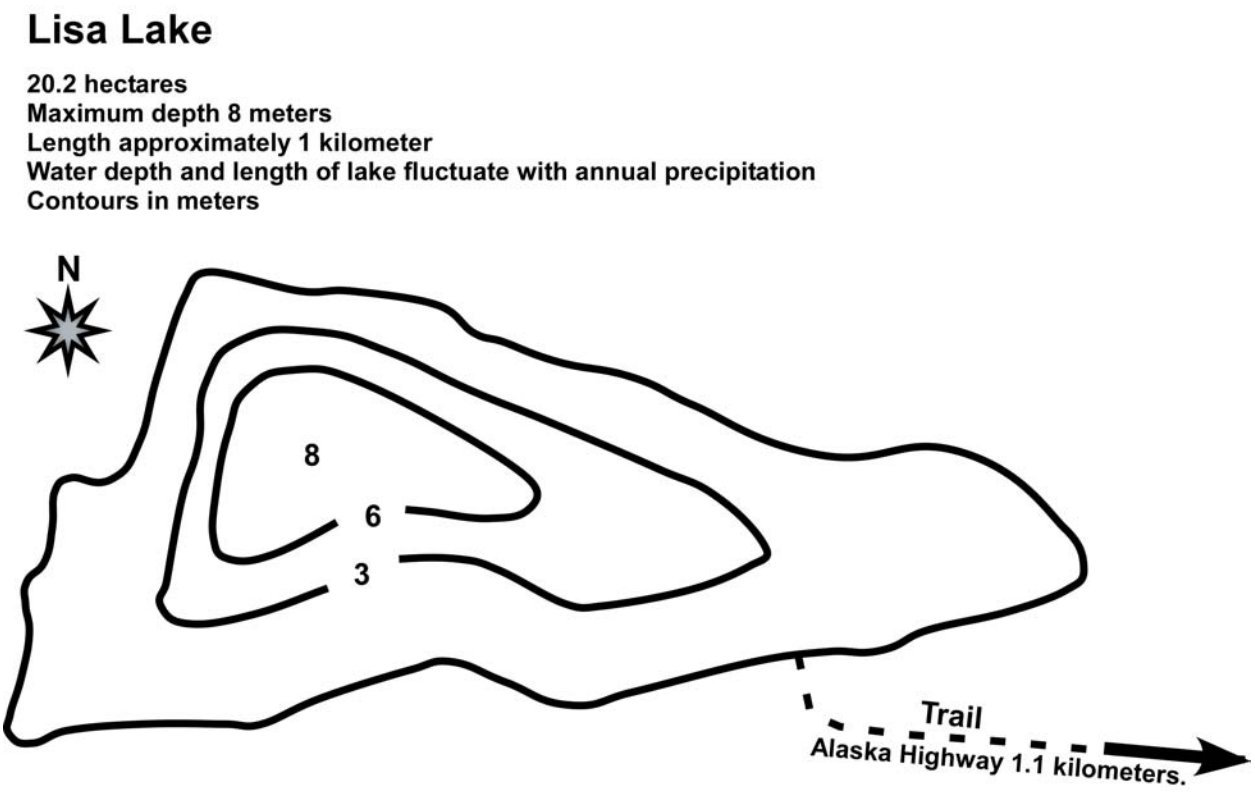


Figure 3.–Bathometric map of Lisa Lake.

Rainbow trout were stocked every other year into Lisa Lake as age-0 fingerlings (~50 mm FL, Appendix A). Length frequency distributions were used to distinguish between age-2 and age-4 cohorts. Therefore, scale samples for age determination were not needed.

The assumptions necessary for accurate estimation of abundance in a closed population were as follows (Seber 1982):

1. the population was closed (no change in the number of rainbow trout in the population during the estimation experiment; i.e., there was no immigration, emigration, births or deaths);
2. all rainbow trout have the same probability of capture in the marking sample or in the recapture sample, or marked and unmarked rainbow trout mix completely between marking and recapture events;
3. marking rainbow trout does not affect their probability of capture in the recapture sample;
4. rainbow trout do not lose their mark between the marking and recapture events; and,
5. all marked rainbow trout were reported when recovered in the recapture sample.

For assumption 1, no immigration or emigration was assured because the lake did not have inlets or outlets. No births occurred because rainbow trout do not reproduce in this lake. Some losses due to natural mortality and harvest likely occurred between sampling events, however marked

and unmarked fish were expected to be subject to similar rates of loss. As such, the abundance estimate was germane to the time of the first (marking) event.

To promote mixing and give each fish an equal probability of being captured (assumption 2) there was a hiatus of 1.5 months between the first and second events, and fish handled during all events were released toward the middle of the lake.

To minimize the likelihood of higher mortality rates for marked fish (assumption 3), all captured fish were handled carefully and any fish that showed signs of severe stress was marked by excising a small portion of a fin that was not used to identify capture method prior to release. Any fish given such a mark was not considered part of the mark-recapture experiment. Additionally, a hiatus of 1.5 months should have been sufficiently long to minimize the effect of previous capture on capture probability.

Validity of assumption 2 was tested with a two sample Kolmogorov-Smirnov (K-S) test (Conover 1980) generated from length data collected during the marking and recapture events (Appendix H). Lengths of fish captured during Event 2 were tested against lengths of fish marked in Event 1 and recaptured during Event 2. If no significant difference was detected between these two samples equal probability of capture in Event 1 was indicated and all data were pooled to calculate one unstratified population estimate. If a significant difference was detected, it was assumed that a size stratified estimator was required because no robust testing procedure is available to evaluate size selective sampling during Event 2. Data from both sampling events would be stratified into two or more size strata such that no significant difference was detectable when the K-S test described above is repeated within strata. Abundance would then be estimated for each size strata and the estimates and variances would be summed for an overall abundance estimate. Size composition parameters would be estimated for each strata, and then combined weighted by estimated abundance in each strata. This decision protocol for stratification is conservative, in that stratification may be used when it is actually unnecessary due to equal probability of sampling during Event 2. However, the loss in precision from using stratified estimation when it is unnecessary is relatively small, and potential bias due to size bias sampling is prevented.

Assumption 4 was assured because there was not sufficient time for excised tissue to grow back and assumption 5 was assured because of rigorous examination of all fish for fin clips.

Chapman's modification of the Petersen estimator (Chapman 1951; Seber 1982) was used to estimate the abundance of the rainbow trout population:

$$\hat{N} = \frac{(n_1 + 1)(n_2 + 1)}{(m_2 + 1)} - 1 \qquad (1)$$

where:

$\hat{N}$ = the abundance of rainbow trout in Lisa Lake;

n_1 = the number of rainbow trout given an UC mark and released during the marking event (Event 1);

n_2 = the number of rainbow trout examined for a UC mark during the recapture event (Event 2); and,

m_2 = the number of rainbow trout captured during Event 2 with an UC mark.

When fish were captured more than once during a sampling event, the subsequent capture(s) was noted but the fish was not measured nor was the subsequent capture(s) used in data analysis or abundance estimation.

Variance of Chapman's modified estimator was calculated using (Seber 1970; Wittes 1972):

$$V\left[\hat{N}\right] = \frac{(n_1+1)(n_2+1)(n_1-m_2)(n_2-m_2)}{(m_2+1)^2(m_2+2)}. \quad (2)$$

Data collected during this study were archived in electronic files cataloged in Appendix H.

Size composition parameters were not estimated because the abundance estimate included only one size composition category identified in objective 2.

RESULTS AND DISCUSSION

During Event 1, 163 rainbow trout were captured, marked, and released (Figure 4a). During Event 2, 75 rainbow trout were captured, 16 of which were recaptured from Event 1 (Figure 4b). Overall, 222 unique fish were handled during the experiment. At least two age cohorts were captured during Event 1, but only one age cohort was captured during Event 2 (Figure 4). Fish from 230 mm to 300 mm captured in Event 1 were likely age-2 and were stocked in 1999.

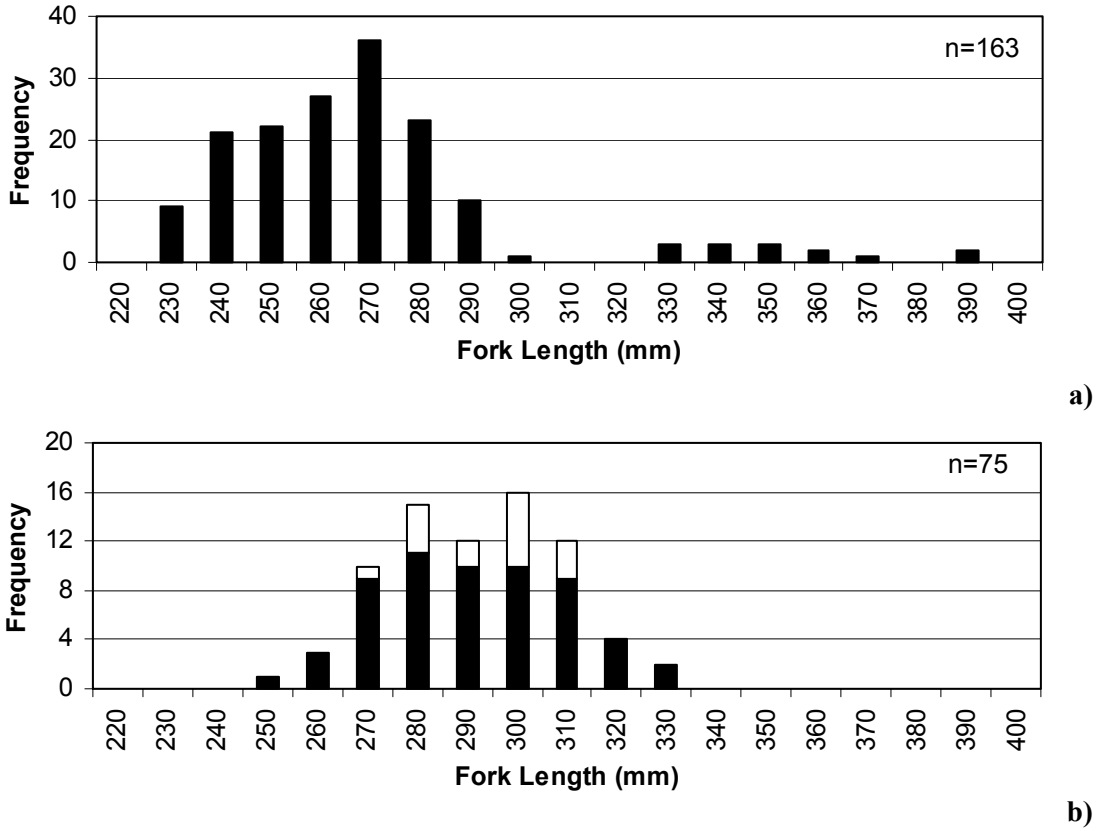


Figure 4.–Lengths of rainbow trout captured during Lisa Lake mark-recapture experiment, 2001; a) Event 1 or Marking Event; b) Event 2 or Recapture Event, with recaptures (n = 16) shown in white.

No fish were stocked in 2000. Fish ≥ 330 mm from Event 1 were likely age-4 or older. In Event 2, fish from 230 mm to 330 mm were from the same age-2 cohort that was captured in Event 1. No fish ≥ 330 mm were caught in Event 2, suggesting that age-4 fish were not available to the gear or very few were left in the lake.

It is likely that age-4 fish were not captured in Event 2 because they were either harvested during the hiatus or they avoided near shore areas where the Fyke nets were set. In either case, the assumption of a closed population was not met during this experiment. Because the age-4 cohort was not sampled in Event 2, only the age-2 cohort (< 330 mm) was used for further analysis.

Plots of the cumulative distribution functions (cdfs) were generated for lengths of fish < 330 mm captured during both events (Figure 5). The shapes of the cdfs for fish captured in Events 1 and 2 were similar but the cdf for Event 2 was shifted to the right compared to that for Event 1.

The most logical explanation for the shift in length distributions (Figures 4 and 5) is that fish grew between Event 1 and Event 2. Fyke nets should not have been size selective; however, they were typically placed near shore in shallow water where part of the population may not frequent.

Results of the two sample K-S test performed on lengths of fish captured during Event 2 versus lengths of fish recaptured during Event 2 indicated that there was no significant difference between the two sample groups (D=0.204; P=0.546). Size selective sampling during the first event was not significant therefore all data were pooled to calculate one population estimate.

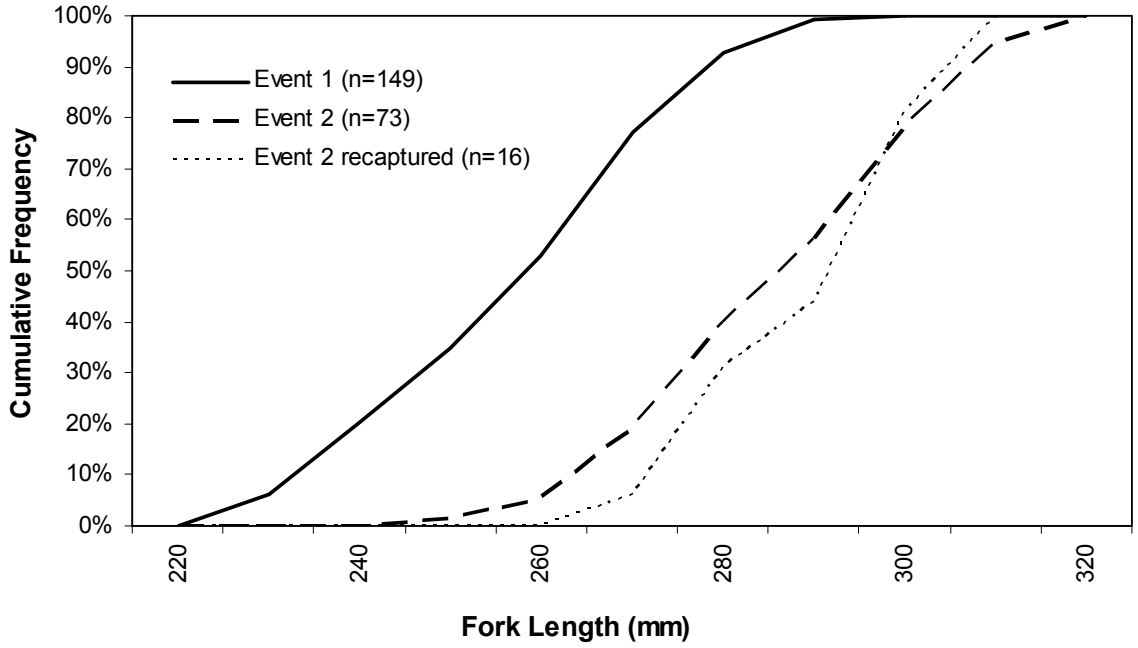


Figure 5.–Cumulative distribution function of lengths from rainbow trout < 330 mm FL captured during the mark-recapture experiment at Lisa Lake (D = 0.204; P=0.546 for fish captured during Event 2 versus fish recaptured during Event 2).

The estimated abundance of fish < 330 mm ($\hat{N}$ = 652, SE = 127) was less precise than desired. In order to meet our planned precision, to estimate abundance such that our estimate was ± 25% of the true value 95% of the time, we needed to sample 161 trout < 330 mm during each sampling event (assuming abundance was approximately 650 fish).

Objective 2 was not meet because too few fish ≥ 330 mm were captured during the experiment to estimate proportions of fish by size category.

Lisa Lake is a popular recreational fishing site, and it was very likely that a number of age-2 fish (along with the age-4 cohort) were harvested during the hiatus. This would not affect the abundance estimate for the age-2 cohort if every fish (marked and unmarked) in this cohort had an equal probability of being harvested during the hiatus. However, because losses occurred between sampling events, the estimate of abundance was only germane to the time of the first event. We do not believe there was sampling induced bias because we carefully handled the fish captured in Event 1 and observed them as they recovered. It was very likely that the marked and unmarked fish behaved the same during the hiatus and during Event 2. So, although the number of fish in the population decreased from Event 1 to Event 2, the ratio of marked to unmarked fish probably did not change.

The current stocking schedule of rainbow trout fingerlings resulted in about one-half of the age-2 cohort exceeding 300 mm TL which is satisfactory for most anglers. The observed results, however, indicated that Lisa Lake was not capable of producing fish greater than 460 mm TL. Stocking subcatchables or catchables may yield more large fish but angling pressure and resource limits would likely prevent most fish from reaching 460 mm TL. In addition, lake location and trail conditions make stocking catchables difficult. Lisa Lake is not a feasible candidate for a ”quality” fishery because it is unlikely that it can produce adequate numbers of large fish to meet angler expectations.

FISH POPULATION MONITORING IN STOCKED WATERS, 1999-2003

INTRODUCTION

The fish stocking program developed by ADF&G uses adaptive management to create and maintain acceptable fisheries in Interior Alaska. Adaptive management enables the stocking program to adapt and change over time in response to what is found when monitoring stocked fisheries. The purpose of monitoring projects is to obtain data that can be used to assess the status of the various stocked fisheries, to identify developing changes, and to determine how effective program actions are in meeting specific management objectives and program goals. Some of the collected data includes fish population abundance and size structure; fishery statistics such as effort, catch, and harvest; angler behaviors and preferences; and lake habitat condition.

Data from the various monitoring projects are used to identify and evaluate underlying reasons for any differences between actual and desired results. This information is then used to adjust program actions such as stocking schemes, regulations, and habitat manipulations so that program goals and management objectives are accomplished. For some situations, monitoring projects may show that management objectives are not reasonable or can’t be met due to natural

limitations associated with lake habitat and productivity. When such conditions occur, fishery management plans and objectives will need to be rewritten within the constraints imposed by natural limits.

There are about 129 lakes in the stocking program in Interior Alaska. Because research and management resources are limited, only 15 to 20 lakes can be examined each year. A goal for the Stocked Waters Program is to visit each lake and evaluate its fish populations and habitat status at least once every five years. Single-sample capture events are typically used to sample fish populations and the results provide satisfactory basic information to assess the general status of fish populations. This approach allows ADF&G to monitor a large number of lakes each year. However, when a potential problem is identified (i.e., inadequate growth, poor survival, etc…) and more detailed information about a fish population is required, then two-sample mark-recapture experiments are generally conducted. The cost of a two-sample mark-recapture experiment is much higher compared to the cost for a single-sample capture event because more resources are required for a longer time. Consequently, two-sample mark-recapture experiments are used to examine fish populations in only two to four lakes each year. This approach is efficient for monitoring fish populations because it uses limited resources to monitor a number of stocked fisheries. It is effective because it collects sufficient data to manage the fisheries and it identifies potential problems where additional resources can be directed to obtain more detailed information.

Over the last 10 years there have been noticeable changes to the stocked fisheries in Interior Alaska. The transformation of these fisheries can be attributed mainly to changes in habitat, angler behavior, and fish hatchery production along with an increase in the number of anglers such as military and their support personnel. Consequently, ADF&G is modifying management and research practices for the stocked waters program so that important indicators for fish populations, angler preferences, and habitat are monitored for change. When changes are identified the department can adapt management strategies, modify stocking schemes, or take other necessary actions to take advantage of new situations, mitigate impacts, or to adjust to new angler behaviors.

Monitoring projects also are beneficial because biologists are able to directly observe fish populations and habitat conditions. From these observations biologists can judge if potential problems exist and work with fishery managers to design studies to obtain additional information that will be used to assess problems and to develop suitable solutions.

Data collected from the monitoring projects will be summarized and made available to anglers. ADF&G receives numerous requests from anglers for information on the species, size, and abundance of fish in lakes in the Tanana River and Copper River drainages. Anglers use this information to plan fishing trips and the department uses the information to update the pamphlet *Guide to Stocked Waters*, the Fish and Game internet web site, and to provide other informational handouts.

Results of fish population monitoring projects presented in this report were from studies conducted from1999 through 2003.

OBJECTIVES

Survey fish populations in lakes in the Fairbanks, Delta Junction, and Glennallen areas (Table 1; Figures 2, 6, and 7) to determine the size range of fish captured in fyke nets with 48 hours of sampling effort and tangle nets with six hours of sampling effort per lake.

Table 1.–Fish population sampling schedule, 1999-2003.

Year	Lake
1999	2-Mile, 3-Mile, Backdown, Brodie, Buffalo, Chet, Coal Mine 5, Crater, Crystal, Donnelly, Forty Foot, J, Junction, Little Crater, North Twin, Peanut, Ryan, Silver, South Twin, and Squirrel Creek Pit
2000	Connor, Dick, Forgotten, Koole, Little Junction, Rich 28 Mile, Sculpin, Strelna, Tex Smith, Triangle, and Tschute
2001	Arizona, Bullwinkle, Donnelly, Monte, and Rainbow
2002	Bullwinkle, Sheefish, and Weasel
2003	Doc, Little Harding, Little Lost, Luke, No Mercy, Rapids, and Rockhound

METHODS

Fyke nets, tangle nets, and typical sport fishing gear (hook-and-line, bait, and artificial fly) were used to sample fish populations in small lakes near Fairbanks, Delta Junction, and Glennallen. Fyke nets were set for at least two 24 hour or one 48 hour sampling period in each lake. Sampling was constrained by time; therefore, sample sizes were not predetermined. At least one fyke net was used per 10 surface ha. However, a minimum of two fyke nets were used per lake. The location and spacing of the nets was difficult to standardize and was determined by the crew leader based on several factors including lake morphology, presence or absence of aquatic vegetation, knowledge of past netting activities, knowledge of fish behavior, limnology information, and weather. The crew leader selected sites that would likely maximize catches of fish and sample representative habitats within the littoral zone of a given lake.

Fyke nets had openings that were either 0.9 or 1.2 m^2, body length from opening to cod end was about 5 m, hoop size was 0.9 m diameter, and mesh size was 9 mm^2. Wings were 7.5 m long by 1.2 m deep and were attached to each side of the open end. Fyke nets were typically set near shore on the lake bottom in 1 to 2 m of water. The net body was positioned parallel to shore with the wings on both sides of the open end set to form a "V". One wing was anchored to shore and a weight was attached to the other wing and positioned offshore. Each fyke net was pulled taut from the cod end and held in position with a weight.

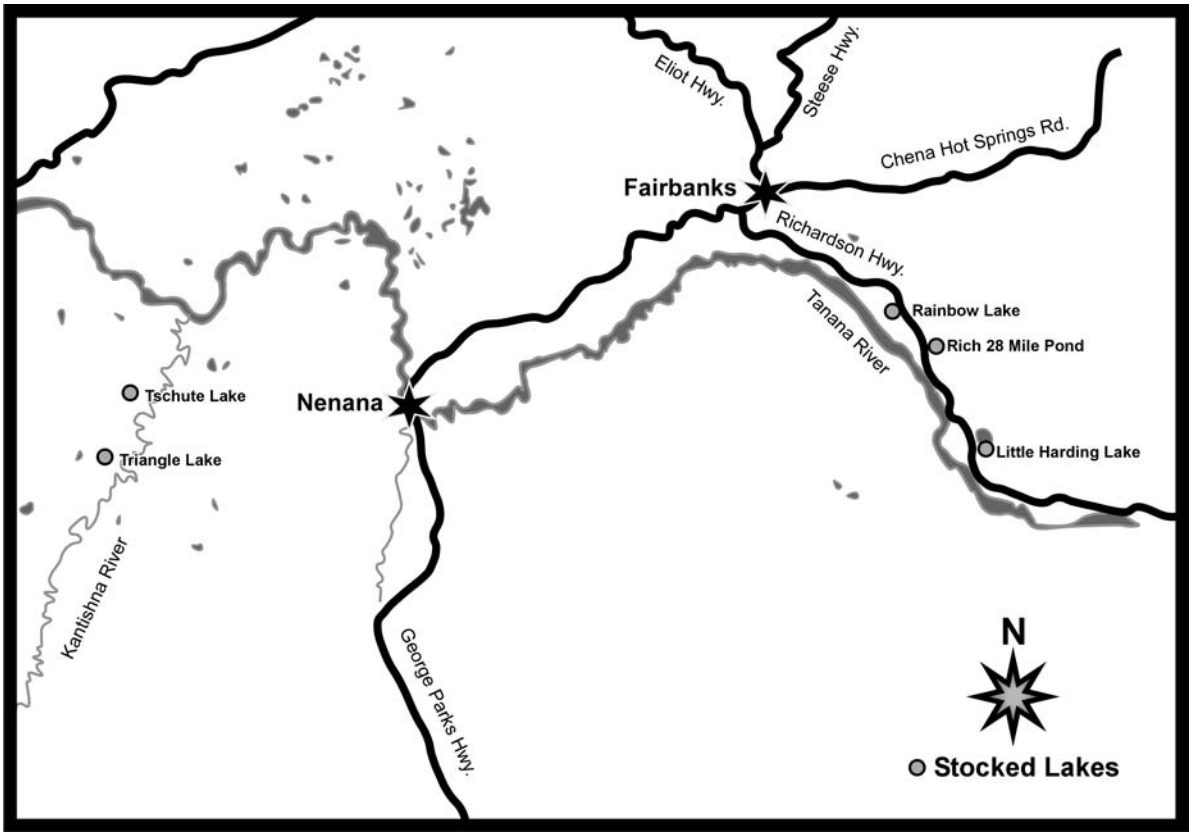


Figure 6.–Location of stocked lakes sampled in the Fairbanks/Nenana area, Tanana River drainage, 1999 - 2003.

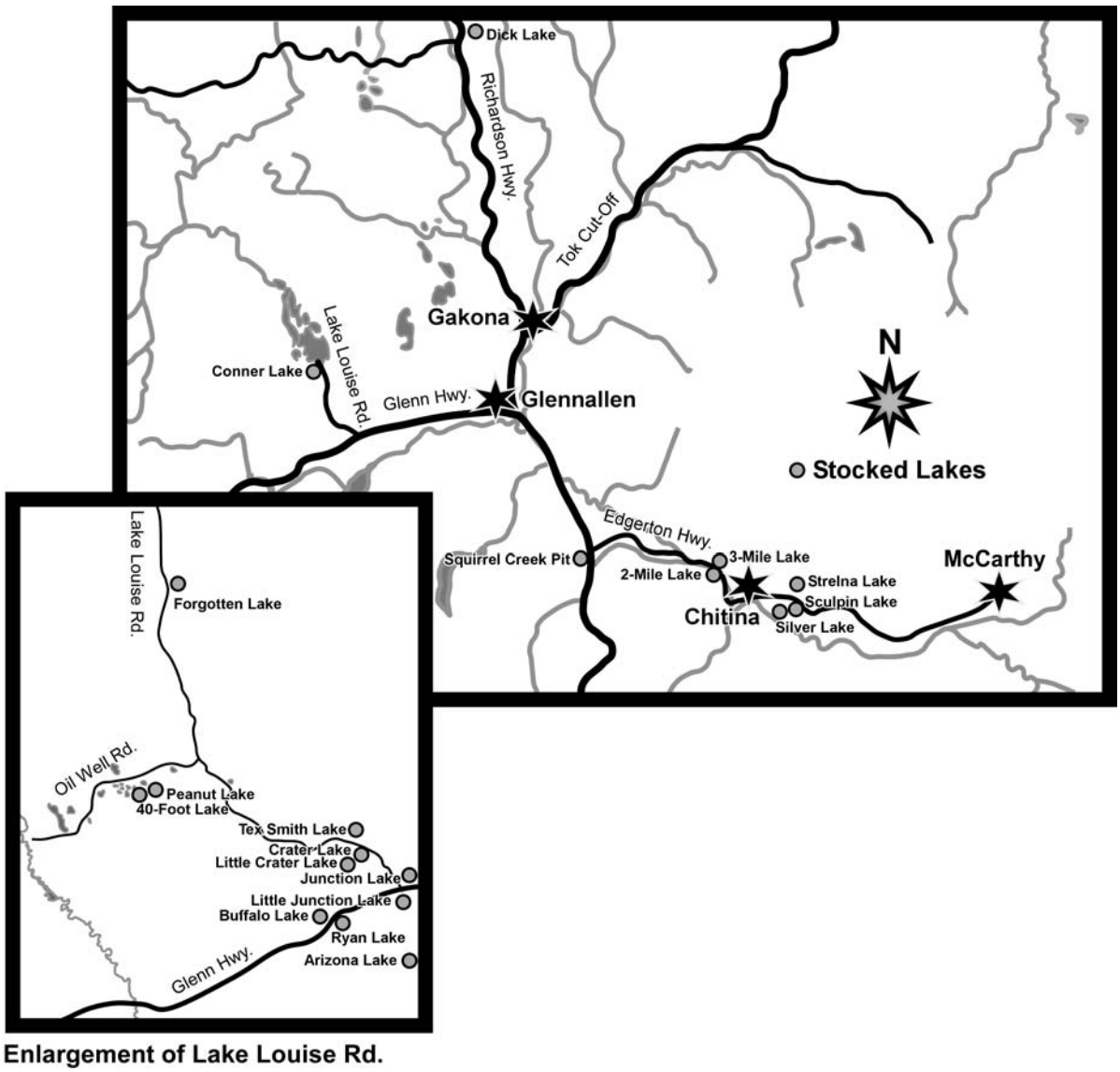


Figure 7.–Location of stocked lakes sampled in the Glennallen area, Copper River drainage, 1999 - 2003.

Tangle nets, in addition to fyke nets, were used in some lakes to capture fish in water deeper than 2 m. Tangle nets were set perpendicular to shore in water deeper than 2 meters. Tangle nets measured 45 m long by 5.4 m deep and were made of 13 mm bar fine thread monofilament. Mesh size was small to ensure that fish were captured by entanglement around the mouth and not by the gill covers. One tangle net had a triple float line and a 13.6 kg lead line. This net was a "floater," because its buoyancy kept it from sinking. The other net was a "sinker" and had a double float line and a 31.8 kg lead line; the heaver lead line caused this net to sink. The amount of time that the nets were set depended on the number of fish caught along with injury and mortality rates. Generally, tangle nets were checked every 20 minutes. The time was shortened or extended depending on an immediate assessment of the condition of the fish.

Sport fishing gear was used to catch fish in areas that were not accessible or suitable for sampling with fyke nets or tangle nets.

RESULTS AND DISCUSSION

Both wild and stocked fish were present in lakes sampled during 1999-2003. Catches consisted primarily of stocked fish (Arctic char, Arctic grayling, coho salmon, Chinook salmon, lake trout, and rainbow trout). Wild fish captured included burbot *Lota lota*, lake chub *Couesius plumbeus,* northern pike *Esox lucius*, and slimy sculpin *Cottus cognatus*. Catches from 1999 through 2003 are summarized in Table 2 and Appendices D1 through H7. Corresponding stocking histories (1998-2003) are summarized in Appendix G.

Fishery managers used this information to assess the status of the fisheries and the effectiveness of the stocking program. The number of fish caught, their age and length, along with ancillary information from anglers were used as gross indicators of lake productivity, population status, harvest, and angler satisfaction. This information showed that a portion of fish populations exceeded 300 mm in 36 of the 44 lakes sampled (Figure 8). This was an arbitrary size that was used to indicate if a fishery was producing adequate size fish that would satisfy most anglers. Most fish were stocked at "fingerling" (~60 mm) or "catchable" (130 – 250 mm) size.

Sculpin Lake (Appendix C7), Koole Lake (Appendix C4), and Rainbow Lake (Appendix D5) were three examples of productive fisheries. Fish were stocked as fingerlings and 60-97% of the population grew larger than 300 mm.

In contrast, Donnelly Lake (Appendix B10) had very few fish ≥ 300 mm (1-2%). Anglers who fished Donnelly Lake reported catching fish larger than 300 mm but most of these large fish were less abundant by the end of summer. This information indicated the lake produced large rainbow trout but they were quickly harvested. Increasing the number of fingerlings stocked so more fish grow to catchable size was not a reasonable solution. Growth rates would likely slow if additional fish were competing for limited resources. Stocking catchables may have solved the problem but it would cost more to maintain the fishery because catchable fish cost more to produce and to stock. In 1998 it cost $2 to produce a catchable size fish compared to $0.17 to rear a fish to fingerling size at the Fort Richardson hatchery. Because sampling results indicated that Donnelly Lake could grow fingerling rainbow trout to a large size, and the stocking of catchable fish was not economically feasible, a harvest restriction of one fish over 18" was proposed and adopted by the Board of Fish in 2003.

Table 2.–Fish population sampling results summary, 1999-2003. All lengths listed are fork length unless otherwise noted.

Lake	Species	Number Caught	Min Length (mm)	Max Length (mm)
1999				
2-Mile Lake	GR	59	160	291
	RT	180	122	336
3-Mile Lake	GR	9	194	265
	RT	99	112	380
Backdown Lake	LT	25	144	269
	RT	21	136	321
Brodie Lake	AC	5	227	397
	GR	8	140	188
Buffalo Lake	RT	241	63	279
Chet Lake	LT	2	175	300
	RT	11	266	304
	SS	4	172	246
Coal Mine #5 Lake	LT	5	340	610
	RT	46	80	530
Crater Lake	RT	46	188	363
Crystal Lake	GR	25	104	300
	LT	10	355	386
Donnelly Lake	LT	76	124	295
	RT	155	40	322
Forty Foot Lake	RT	9	149	460
J Lake	GR	14	209	327
	RT	11	243	352
	SS	75	136	293
Junction Lake	GR	10	255	311
Little Crater Lake	RT	28	205	299
North Twin Lake	AC	1	205	205
	RT	6	171	436
	SS	35	122	450
Peanut Lake	RT	3	532	663
Ryan Lake	RT	255	53	451
Silver Lake	RT	272	210	552
South Twin Lake	LT	19	127	219
	RT	21	168	377
Squirrel Creek Pit	BB*	15	242	580
	RT	12	211	282

-continued-

Table 2.–Page 2 of 2.

Lake	Species	Number Caught	Min Length (mm)	Max Length (mm)
2000				
Connor Lake	GR	6	155	362
Dick Lake	GR	2	220	286
Forgotten Lake	GR	10	155	340
	BB*	8	310	430
Koole Lake	RT	84	96	390
Little Junction Lake	GR	69	110	320
Rich 28 Mile Pond	NP	7	325	662
Sculpin Lake	RT	713	80	448
Strelna Lake	SS	1,366	135	290
Tex Smith Lake	AC	3	420	460
	RT	210	80	434
Triangle Lake	RT	38	214	325
Tschute Lake	RT	53	119	206
2001				
Arizona Lake	GR	305	149	394
Bullwinkle Lake	KS	24	200	262
	RT	33	210	460
Donnelly Lake	AC	12	120	268
	RT	280	89	315
Monte Lake	RT	6	250	473
Rainbow Lake	RT	110	230	403
2002				
Bullwinkle Lake	none	-	-	-
Sheefish Lake	AC	1	595	595
	GR	2	271	320
Weasel Lake	AC	1	311	311
	RT	105	125	275
2003				
Doc Lake	none	-	-	-
Little Harding Lake	RT	32	255	373
Little Lost Lake	RT	35	235	315
Luke Lake	GR	30	244	316
No Mercy Lake	LT	23	86	380
	RT	4	93	342
Rapids Lake	LT	28	293	365
	RT	6	268	301
Rockhound Lake	LT	4	357	379
	RT	16	247	330

AC – Arctic char (*Salvelinus alpinus*)
GR – Arctic grayling (*Thymallus articus*)
RT – Rainbow trout (*Oncorhynchus mykiss*)
KS – King / Chinook salmon (*Oncorhynchus*
BB – Burbot (*Lota lota*)
LT – Lake trout (*Salvelinus namaycush*)
SS – Silver / Coho salmon (*Oncorhynchus*
* Total length listed.

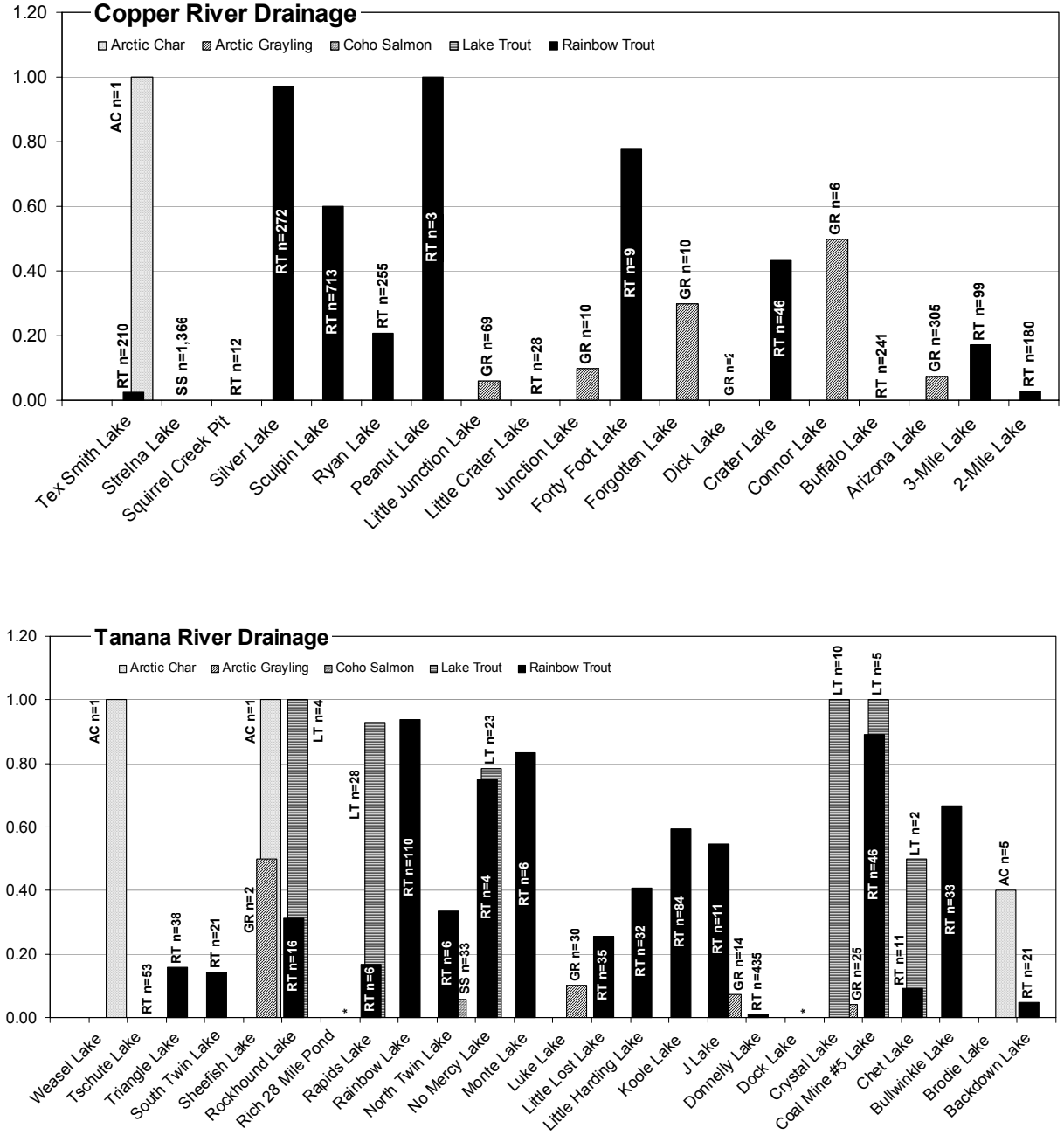


Figure 8.-Proportion of fish captured ≥ 300 mm in stocked lakes in the Copper River and Tanana River drainages 1999-2003.* No stocked fish caught during sample period.

Tex Smith Lake (Appendix C9) was another lake with few fish ≥ 300 mm (2%). Tex Smith Lake was stocked with fingerling and catchable rainbow trout in 1999. Sampling results in 2000 indicated that few catchable fish survived to the following year. The lake is next to a main road and is popular with local residents and tourists. Due to its popularity and high harvest rate, Tex Smith Lake is now stocked twice a year with catchable size fish. It is now managed as a put-and-take fishery because the lake can not produce enough catchable fish from stocked fingerlings to meet angler demand.

Popular small lakes such as Brodie Lake (Appendix B4) may be quickly fished out, potentially explaining why fewer than ten fish were captured during the sampling period. Stocking fingerlings probably will not maintain a desirable fishery. Stocking catchable fish is an unlikely option because the fish will have to be reallocated from another popular fishery. The fish hatcheries at Fort Richardson and Elmendorf Air Force Base can not produce additional catchable rainbow trout without impacting other popular programs such as the anadromous salmon fisheries in the Anchorage area that rely on hatchery produced salmon smolts. The periodic inspection and assessment of these fisheries will continue, however, stocking changes can not be made until more fish become available.

In general, if 20% (or more) of a stocked population exceeded 300 mm managers assumed that the stocking density (number of fish per ha) was sufficient to provide a fishery that was generally acceptable to a majority of anglers. Sixteen of the 44 lakes sampled fell into this category. These lakes appeared productive with sufficient forage for growth. No management changes or stocking adjustments were necessary.

If 10-19% of fish grew greater than 300 mm the fishery was considered to be marginal. Five lakes fell into this category. Current stocking plans were continued, however, managers will pay more attention to these fisheries to ensure objectives are met.

If less than 10% of fish exceeded 300 mm managers considered the fishery to be poor. Thirteen lakes fell into this category. For these lakes managers reassessed current stocking plans and management strategies, changed the size of fish stocked, proposed harvest restrictions, or discontinued stocking.

Less then 10 fish caught during a sampling event was considered to be insufficient data. These lakes were looked at on an individual bases and will likely be resampled when time and personnel allow. Ten of the 44 lakes sampled fell into this category.

Information obtained from these monitoring projects was also used to develop new management objectives and stocking schemes for the stocked fisheries in Region III. A recent reduction in hatchery production has made implementation of preferred stocking schedules difficult. However, the department will continue to monitor stocked lakes and strive to maintain fisheries acceptable to anglers.

ACKNOWLEDGMENTS

Cal Skaugstad, Holly Carroll, Anne Peniston, Shannon Spring, Dave Stoller, Michael "Wolf" Cartusciello, Rick Queen, Tony Roof, Samantha Strom, Lynn Perry-Plake, John Stadtmiller, and Tim Stadtmiller, assisted with the field work. Sara Case provided editorial and formatting assistance. The U.S. Fish and Wildlife Service provided partial funding for this study through the Federal Aid in Sport Fish Restoration Act (16 U.S.C. 777-777K) under Projects F-10-16-19, Job No. E-3-1(a).

REFERENCES CITED

Chapman, D. G. 1951. Some properties of the hypergeometric distribution with applications to Zoological censuses. University of California Public. Stat. 1, 131-160.

Conover, W. J. 1980. Practical nonparametric statistics 2nd ed. John Wiley & Sons, New York. 493pp.

Seber, G. A. F. 1970. The effects of trap response on tag-recapture estimates. Biometrika 26, 13-22.

Seber, G. A. F. 1982. On the estimation of animal abundance and related parameters, Second edition, MacMillan and Company, New York.

Wittes, J. T. 1972. On the bias and estimated variance of Chapman's two-sample capture-recapture population estimate. Biometrics 28, 592-597.

APPENDIX A
STOCKING HISTORY FOR LISA LAKE, 1962-2003

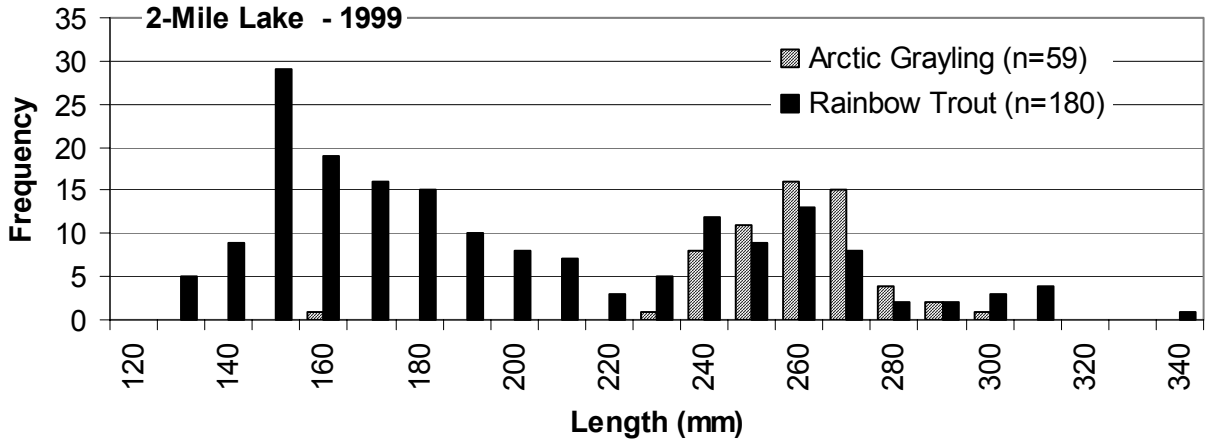
Appendix A.-Stocking history for Lisa Lake, 1962-2003.

Species	Stocking Date	Number Stocked	Age[a]	Sex[b]	Average Length (inches)	Brood Year
Rainbow Trout	8-Sep-62	5,000	F	MF		1962
Rainbow Trout	14-Aug-63	5,000	F	MF		1963
Coho Salmon	23-Jul-64	7,500	F	MF		1964
Rainbow Trout	12-Aug-64	4,000	F	MF		1964
Rainbow Trout	4-Aug-65	6,000	F	MF		1965
Coho Salmon	4-Aug-65	5,000	F	MF		1965
Rainbow Trout	2-Aug-66	6,000	F	MF		1966
Coho Salmon	8-Jul-68	9,500	F	MF		1968
Rainbow Trout	31-Jul-69	20,000	F	MF		1969
Rainbow Trout	24-Jun-71	39,500	F	MF		1971
Coho Salmon	29-Aug-72	10,200	F	MF		1972
Rainbow Trout	18-Jul-73	9,500	F	MF		1973
Coho Salmon	23-Jul-74	9,900	F	MF		1974
Rainbow Trout	2-Aug-76	10,000	F	MF		1976
Coho Salmon	15-Aug-78	15,000	F	MF		1978
Rainbow Trout	23-Jul-80	4,533	F	MF		1980
Coho Salmon	17-Jun-82	8,490	F	MF		1982
Rainbow Trout	16-Aug-84	9,000	F	MF		1984
Coho Salmon	30-May-85	10,000	F	MF		1985
Rainbow Trout	18-Aug-86	1,000	F	MF		1986
Rainbow Trout	26-Aug-87	10,000	F	MF		1987
Rainbow Trout	10-Aug-89	10,000	F	MF		1989
Rainbow Trout	6-Aug-91	10,000	F	MF		1991
Rainbow Trout	20-Jul-93	10,125	F	MF		1993
Rainbow Trout	27-Jul-94	1,067	F	MF		1994
Rainbow Trout	19-Jul-95	10,000	F	MF		1995
Rainbow Trout	13-Aug-97	10,000	F	MF	2.4	1997
Rainbow Trout	26-Jul-99	10,000	F	MF	2.1	1999
Rainbow Trout	3-Aug-01	10,000	F	MF	1.7	2001
Rainbow Trout	20-Aug-03	10,000	F	MF	2	2002

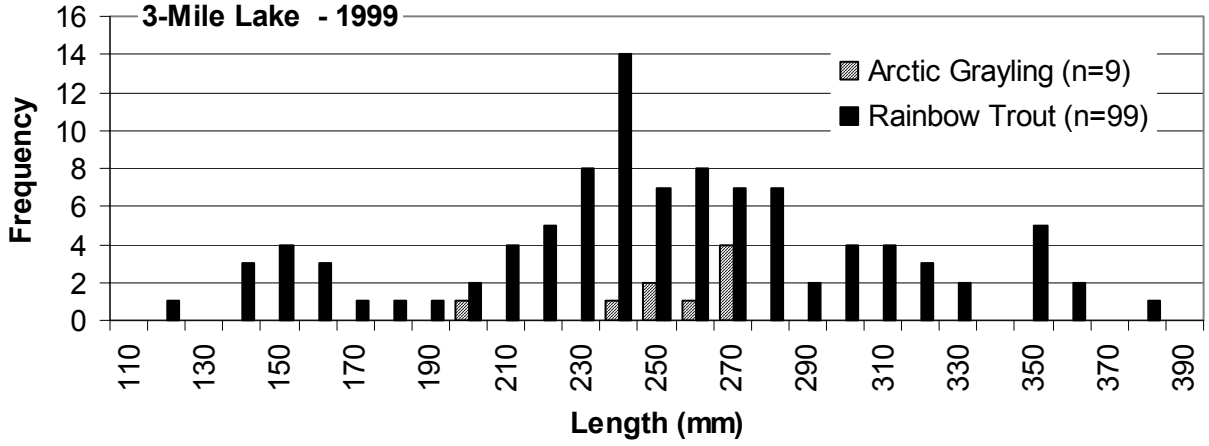
[a] E = eyed eggs, F = fingerling, S = subcatchable, C= catchable.

[b] MF = male and female diploid, AF = all female triploid.

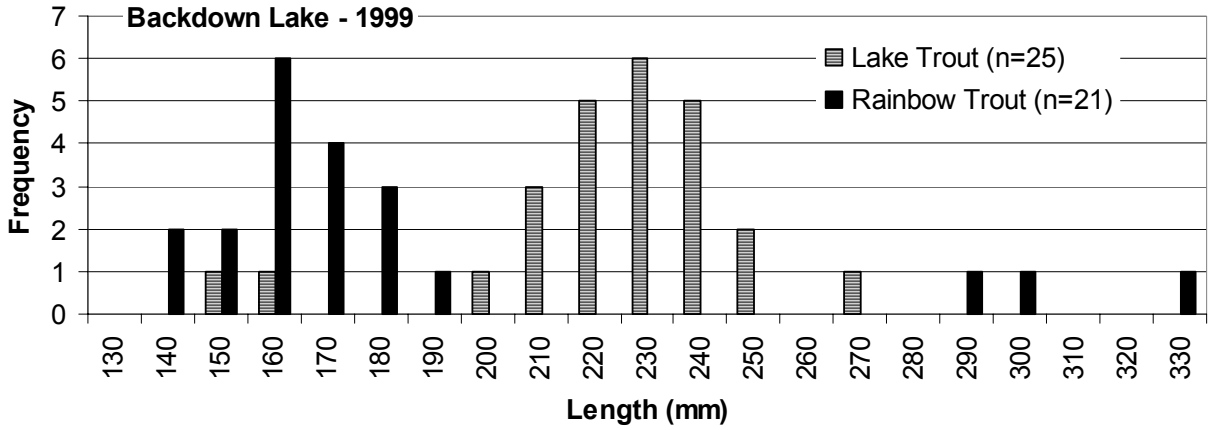
APPENDIX B
SAMPLING RESULTS FOR FISH POPULATIONS MONITORED IN STOCKED WATERS IN THE TANANA RIVER AND COPPER RIVER DRAINAGES, 1999



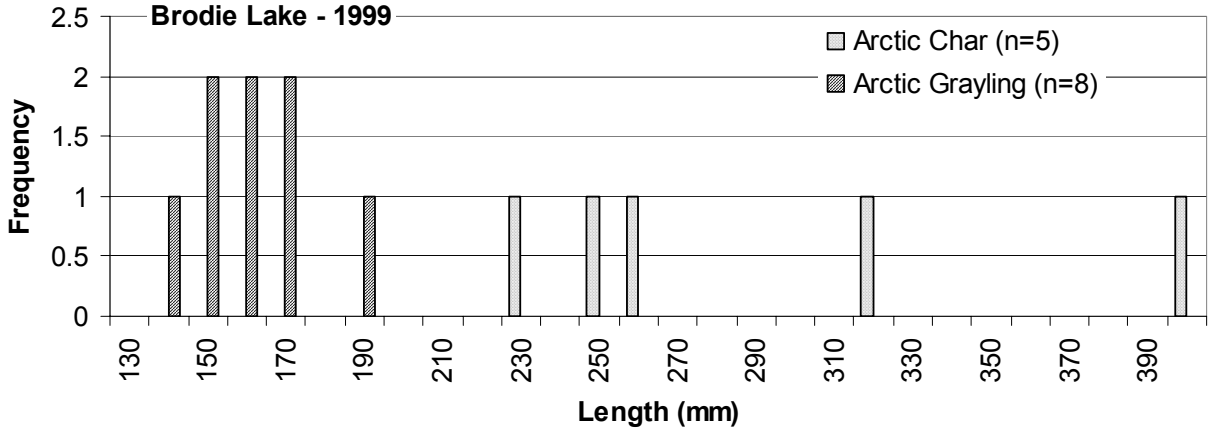
Appendix B1.–Length frequency distribution of Arctic grayling and rainbow trout in 2-Mile Lake, May 1999.



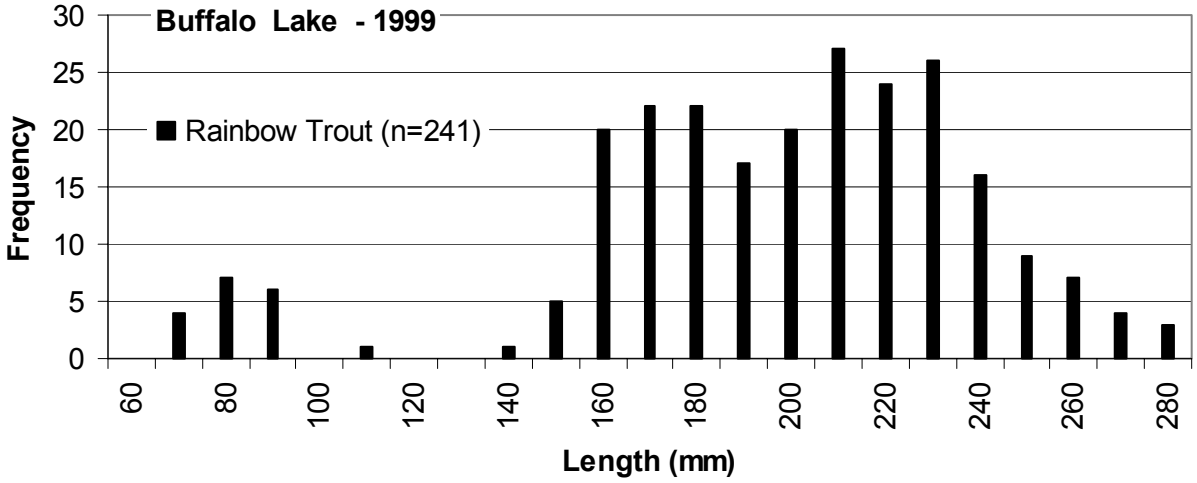
Appendix B2.–Length frequency distribution of Arctic grayling and rainbow trout in 3-Mile Lake, May 1999.



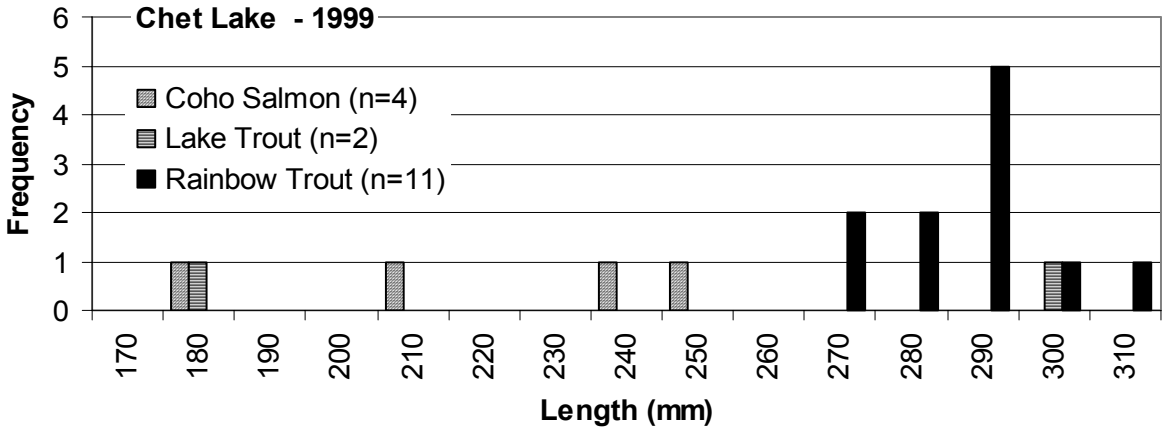
Appendix B3.–Length frequency distribution of lake trout and rainbow trout in Backdown Lake, September 1999.



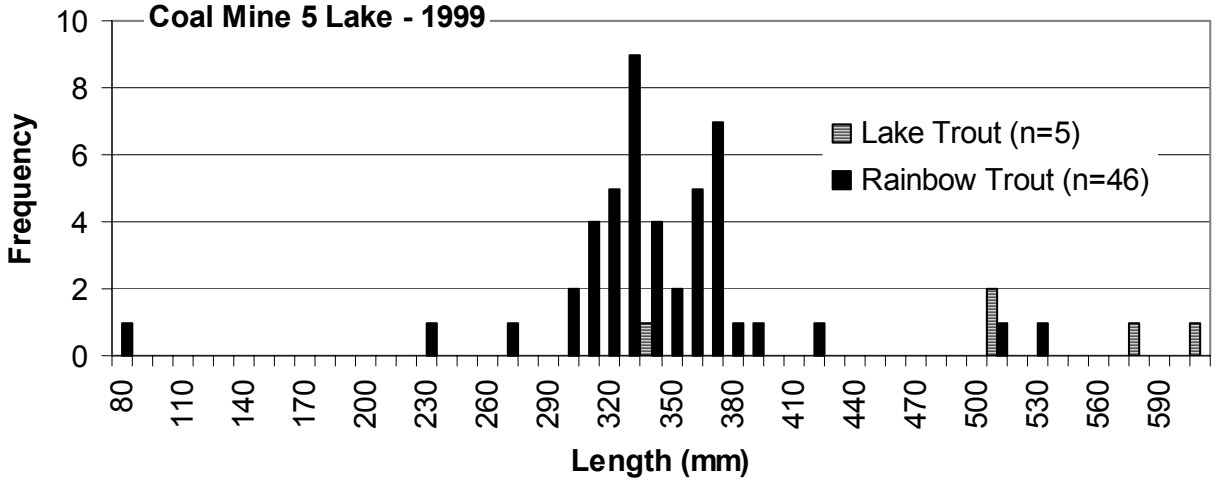
Appendix B4.–Length frequency distribution of Arctic char and Arctic grayling in Brodie Lake, September 1999.



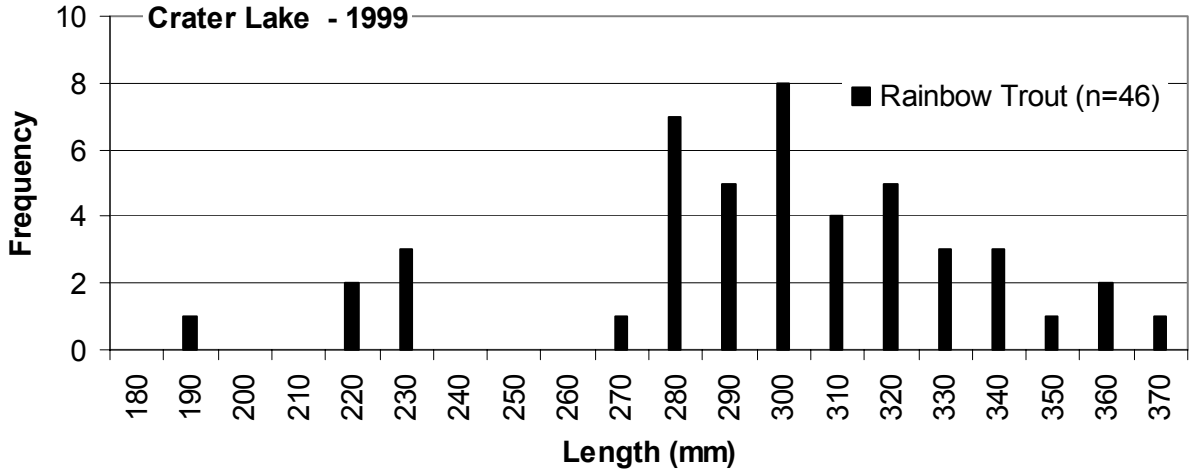
Appendix B5.–Length frequency distribution of rainbow trout in Buffalo Lake, June 1999.



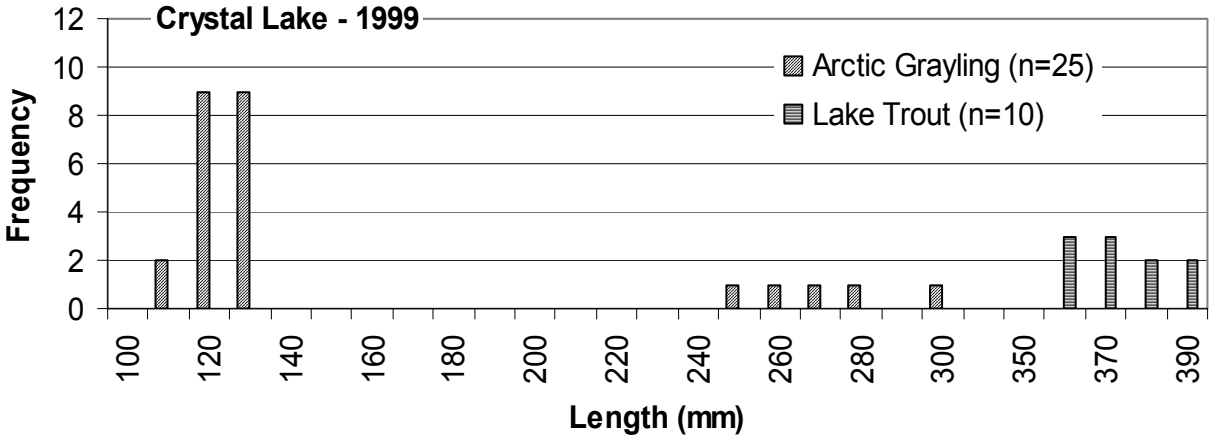
Appendix B6.–Length frequency distribution of coho salmon, lake trout, and rainbow trout in Chet Lake, September 1999.



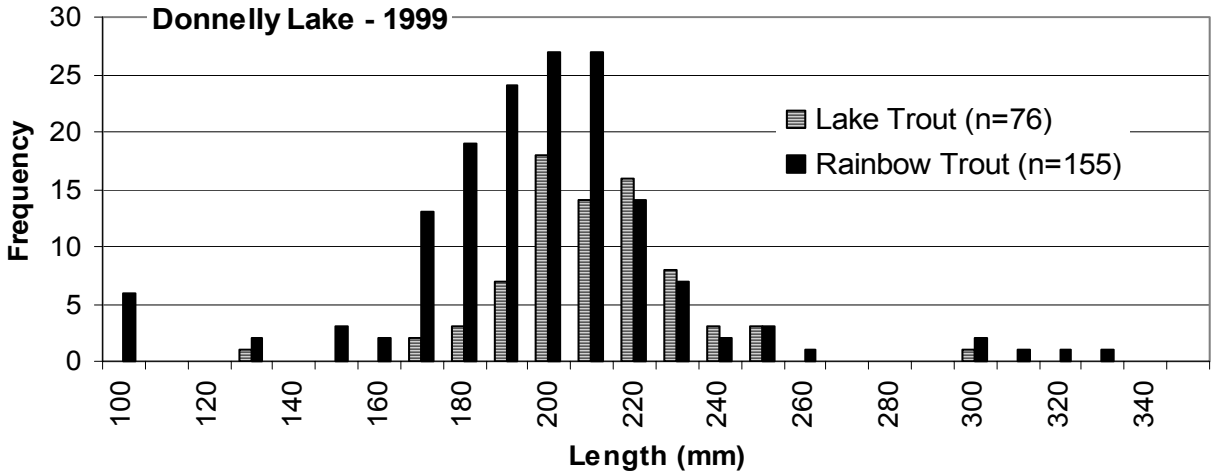
Appendix B7.–Length frequency distribution of lake trout and rainbow trout in Coal Mine 5 Lake, August 1999.



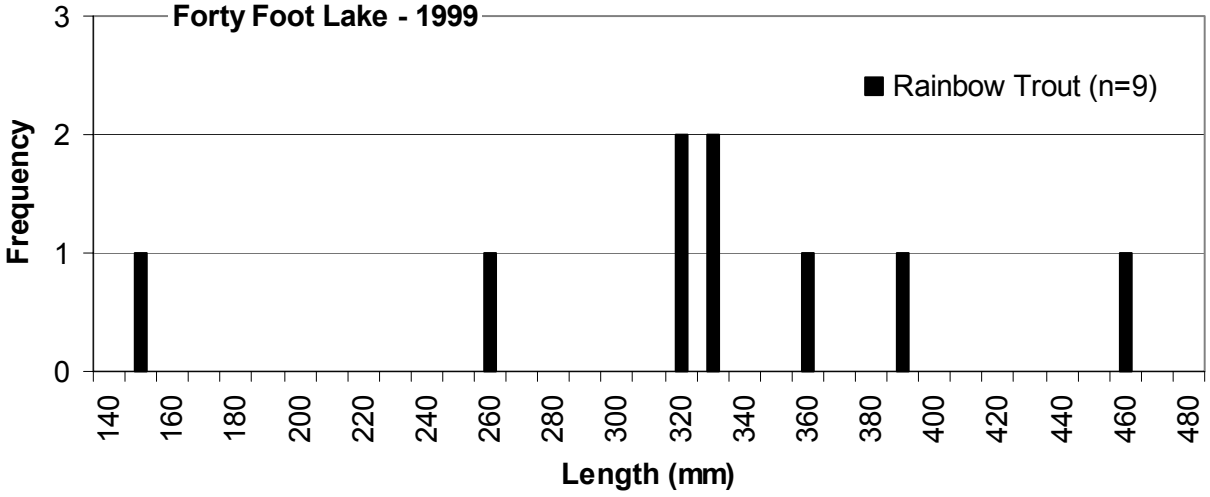
Appendix B8.–Length frequency distribution of rainbow trout in Crater Lake, June 1999.



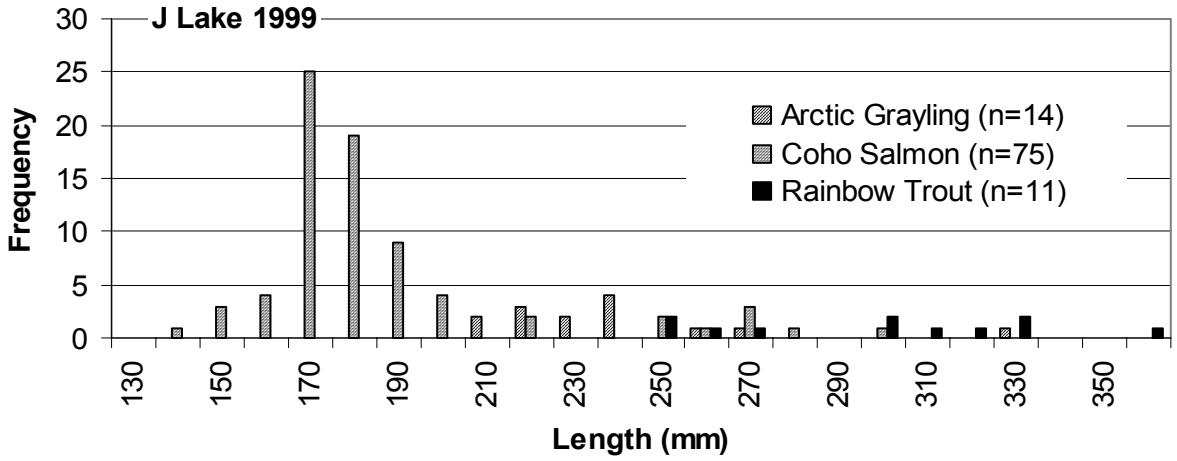
Appendix B9.–Length frequency distribution of Arctic grayling and lake trout in Crystal Lake, August 1999.



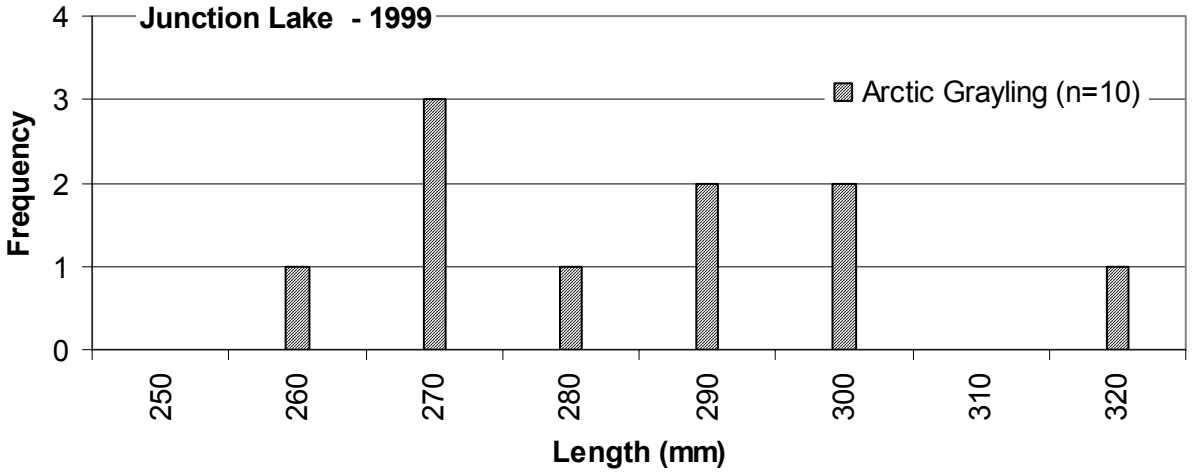
Appendix B10.–Length frequency distribution of lake trout and rainbow trout in Donnelly Lake, September 1999.



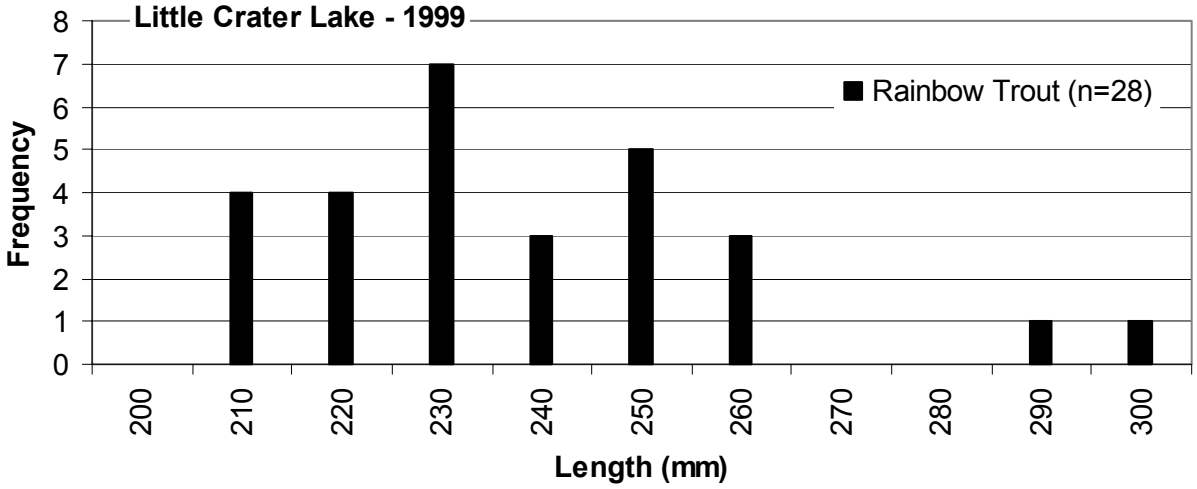
Appendix B11.–Length frequency distribution of rainbow trout in Forty Foot Lake, June 1999.



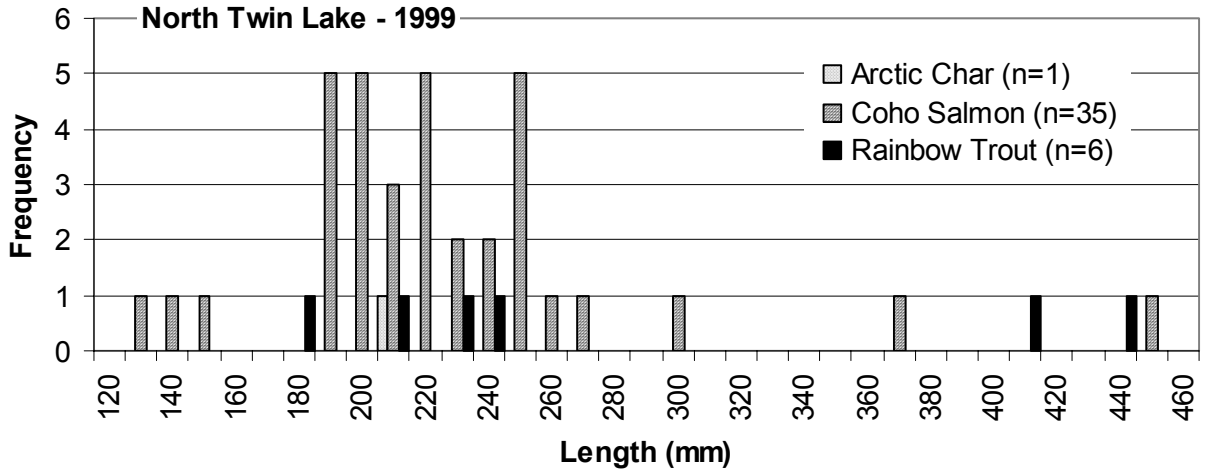
Appendix B12.–Length frequency distribution of Arctic grayling, coho salmon, and rainbow trout in J Lake, September 1999.



Appendix B13.–Length frequency distribution of Arctic grayling in Junction Lake, June 1999.



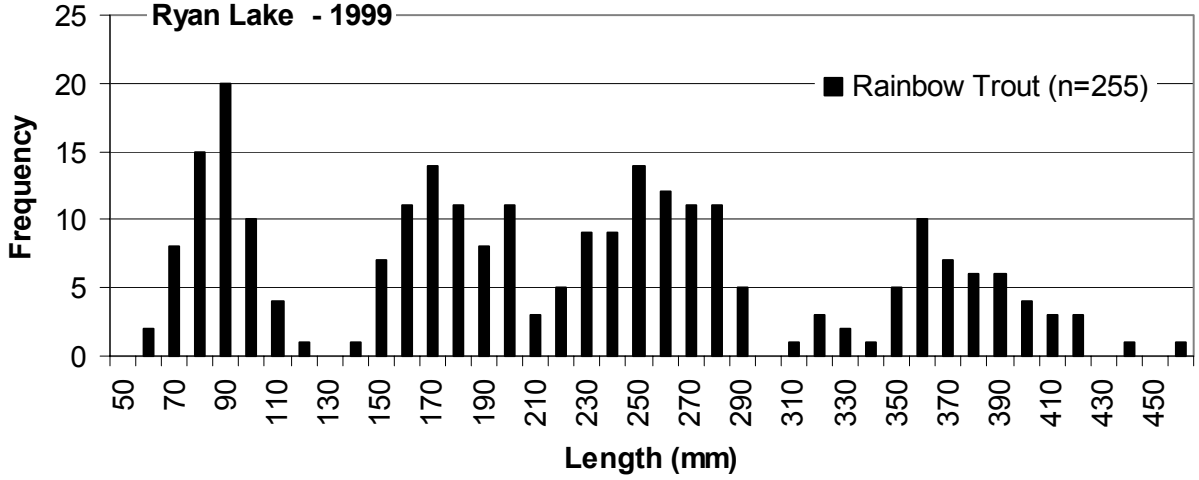
Appendix B14.–Length frequency distribution of rainbow trout in Little Crater Lake, June 1999. Slimy sculpin also present.



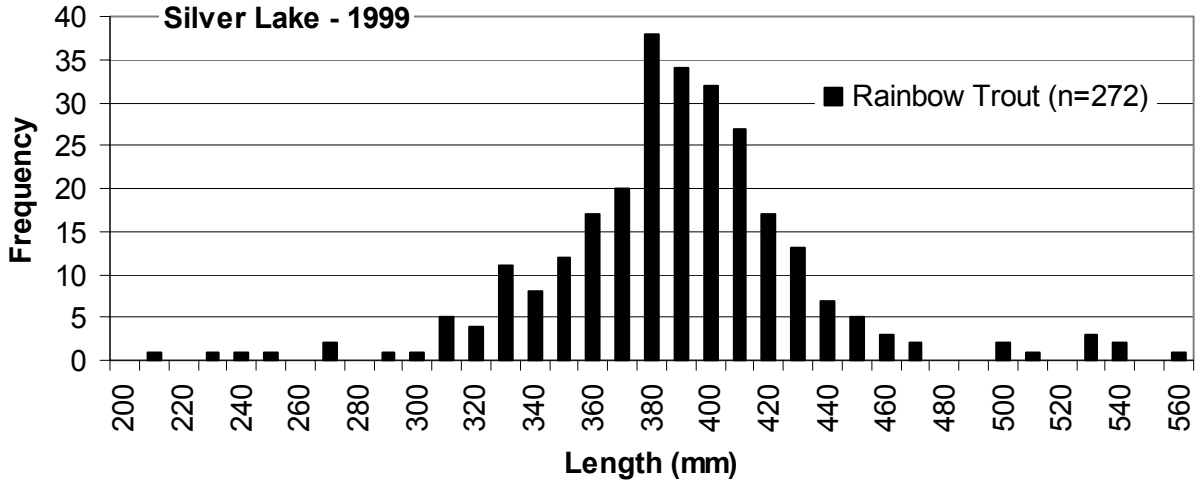
Appendix B15.–Length frequency distribution of Arctic char, coho salmon, and rainbow trout in North Twin Lake, September 1999.

Appendix B16.–Average FL of rainbow trout caught in Peanut Lake, June 1999.

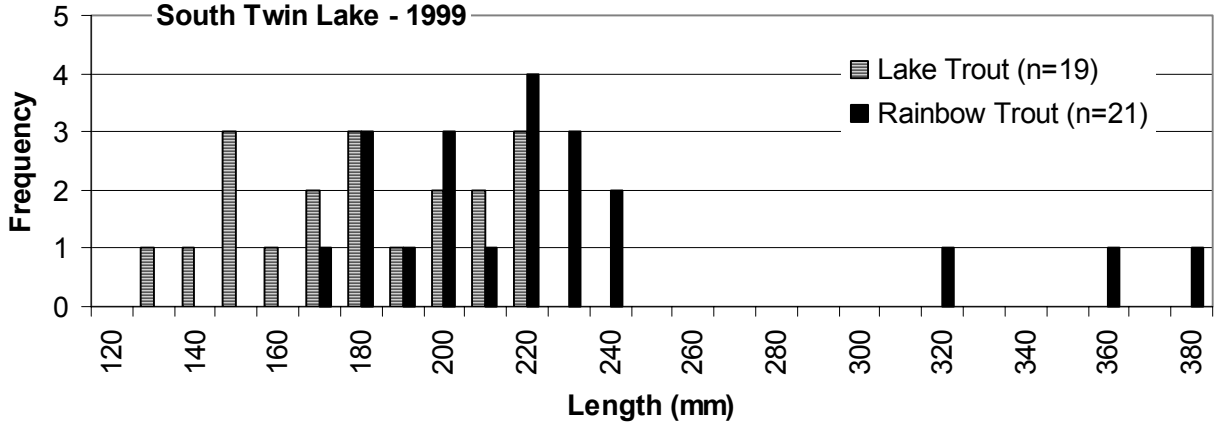
Lake	Date	Species	# Caught	Ave. FL (mm)
Peanut Lake	6/17/99	RT	3	599



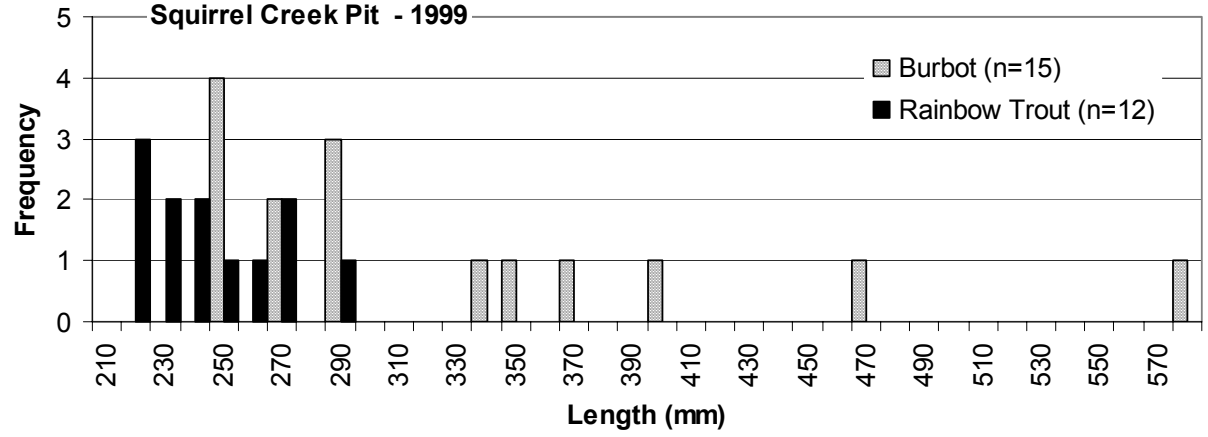
Appendix B17.–Length frequency distribution of rainbow trout in Ryan Lake, June 1999.



Appendix B18.–Length frequency distribution of rainbow trout in Silver Lake, May 1999.

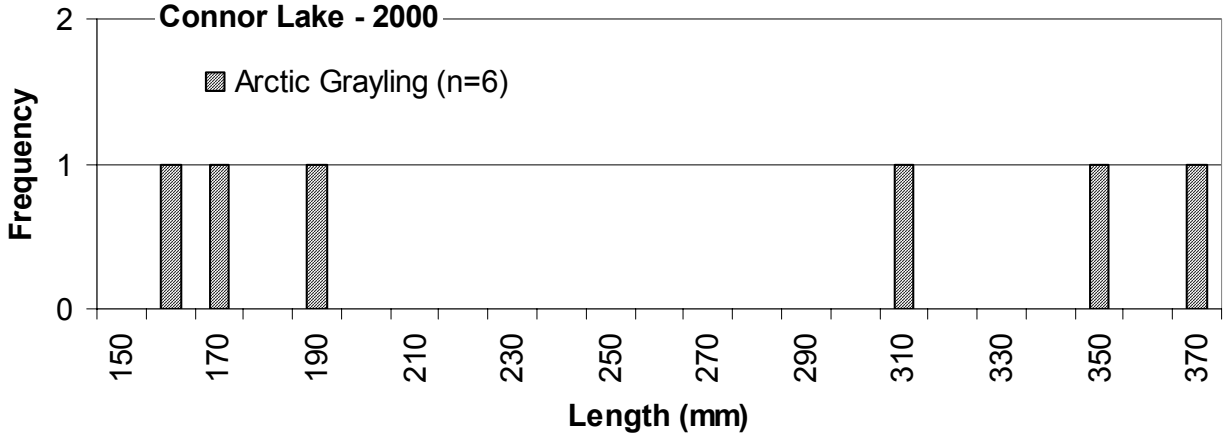


Appendix B19.–Length frequency distribution of lake trout and rainbow trout in South Twin Lake, September 1999.



Appendix B20.–Length frequency distribution of burbot and rainbow trout in Squirrel Creek Pit, June 1999. Burbot data reported in TL. Rainbow trout data reported in FL.

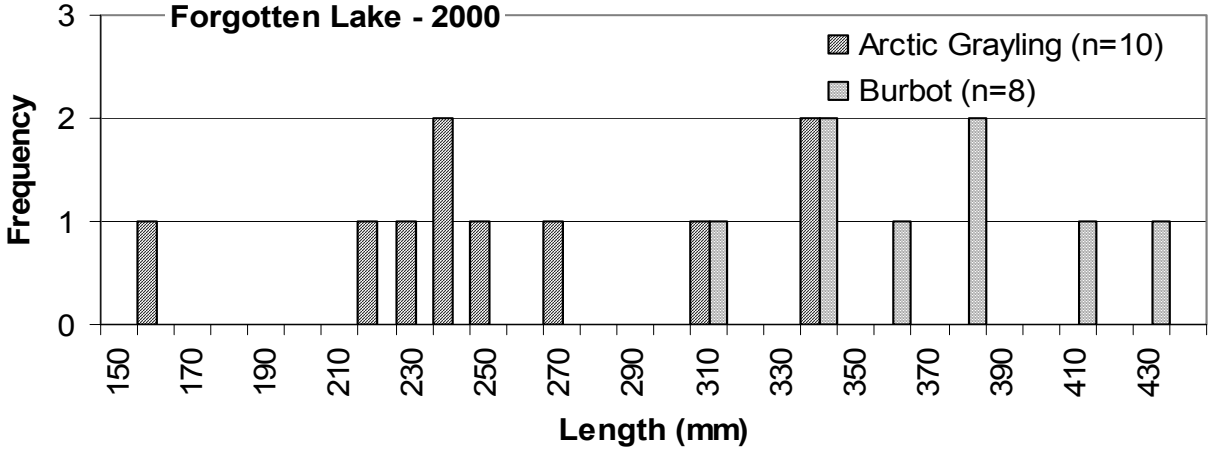
APPENDIX C
SAMPLING RESULTS FOR FISH POPULATIONS MONITORED IN STOCKED WATERS IN THE TANANA RIVER AND COPPER RIVER DRAINAGES, 2000



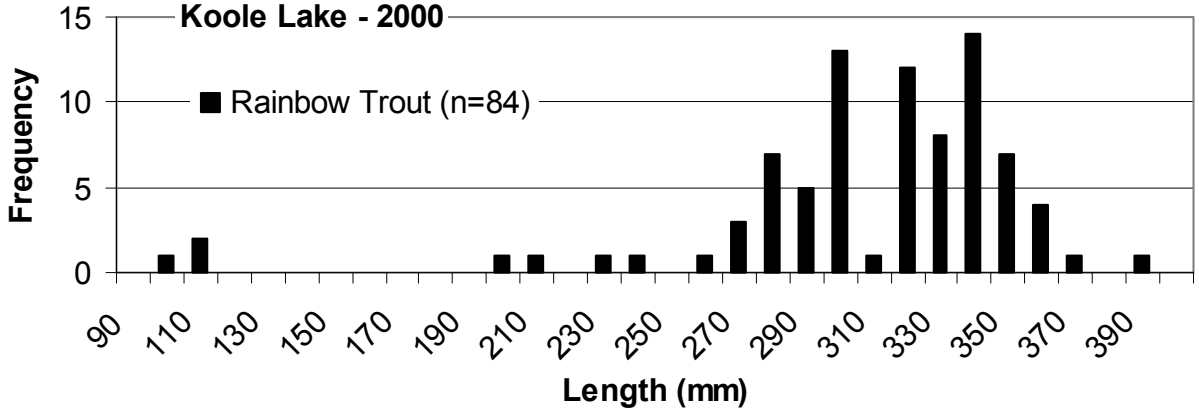
Appendix C1.–Length frequency distribution of Arctic grayling in Connor Lake, June 2000.

Appendix C2.–Average FL of Arctic grayling caught in Dick Lake, June 2000.

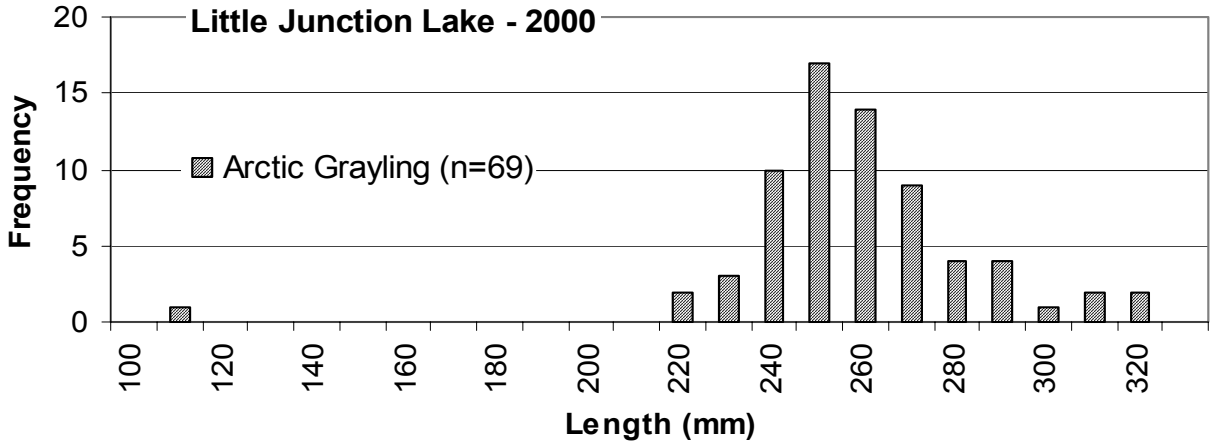
Lake	Date	Species	# Caught	Average FL (mm)
Dick Lake	6/5/00	AG	2	253



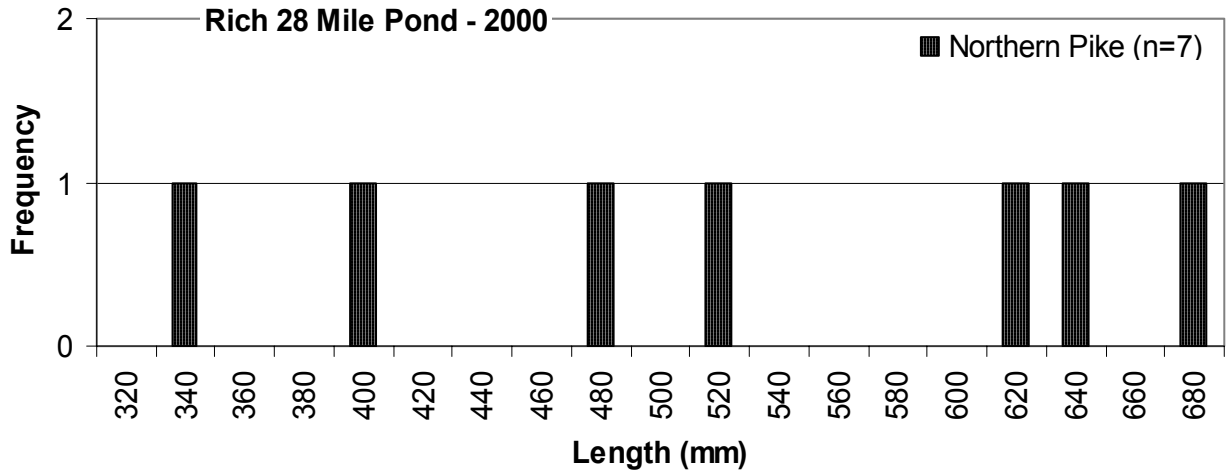
Appendix C3.–Length frequency distribution of Arctic grayling and burbot in Forgotten Lake, June 2000.



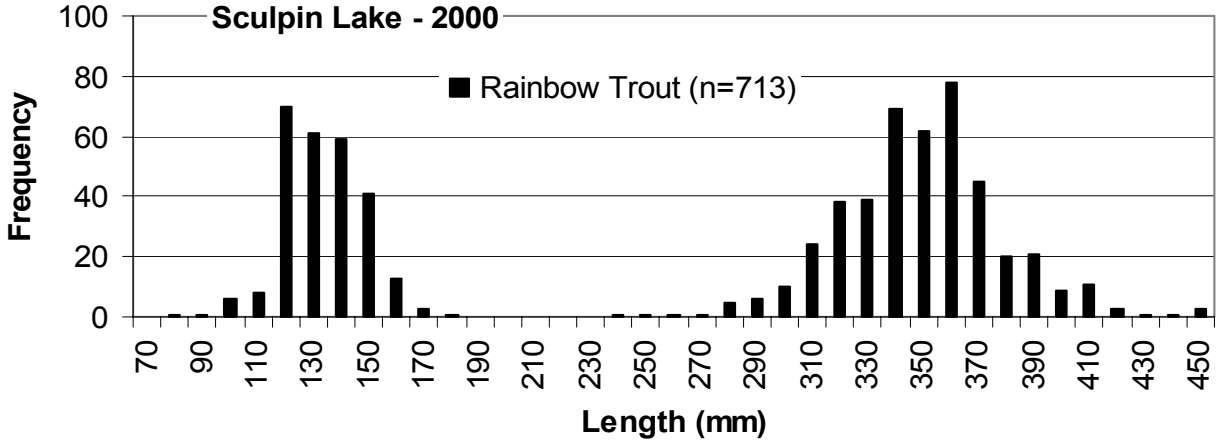
Appendix C4.–Length frequency distribution of rainbow trout in Koole Lake, June 2000.



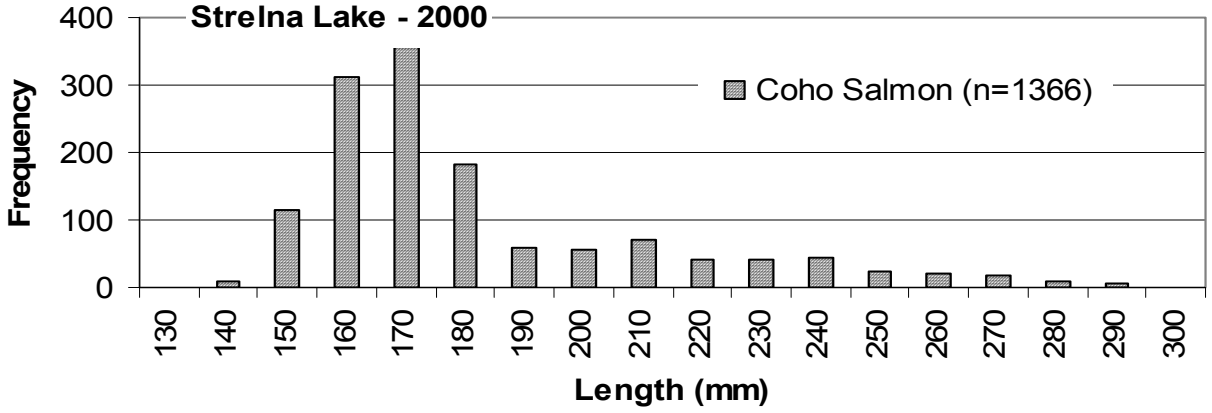
Appendix C5.–Length frequency distribution of Arctic grayling in Little Junction Lake, June 2000.



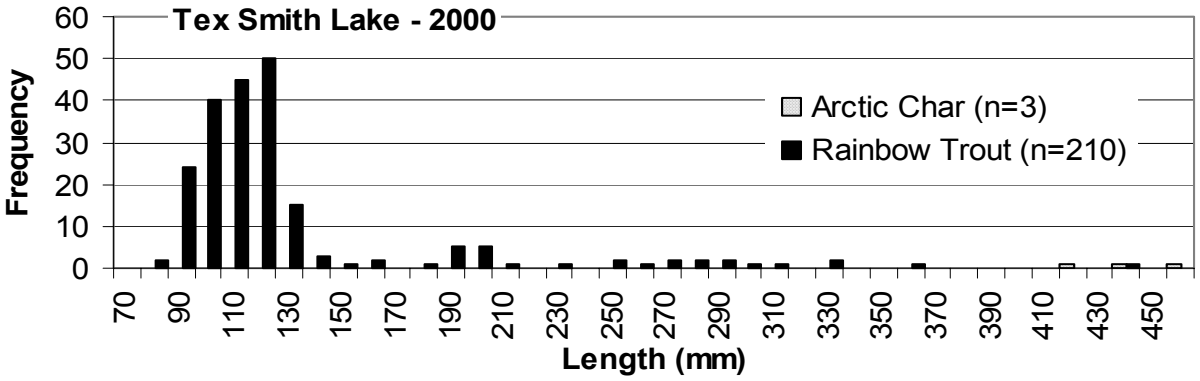
Appendix C6.–Length frequency distribution of northern pike in Rich 28 Mile Pond, July 2000.



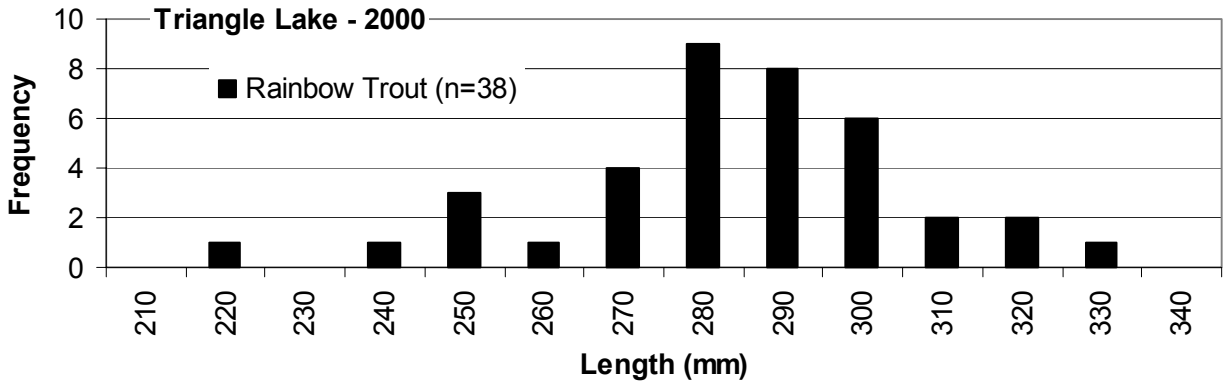
Appendix C7.–Length frequency distribution of rainbow trout in Sculpin Lake, May 2000.



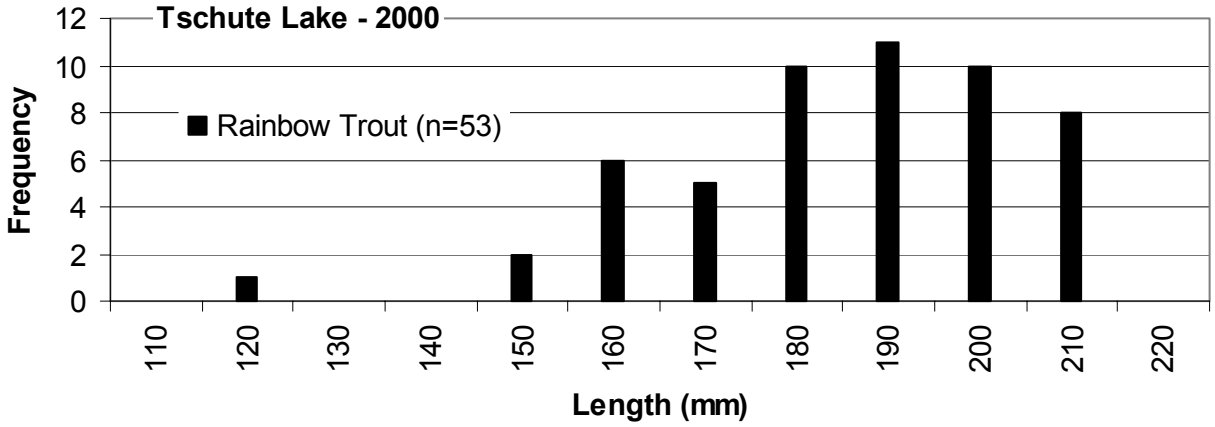
Appendix C8.–Length frequency distribution of coho salmon in Strelna Lake, June 2000.



Appendix C9.–Length frequency distribution of Arctic char and rainbow trout in Tex Smith Lake, June 2000.

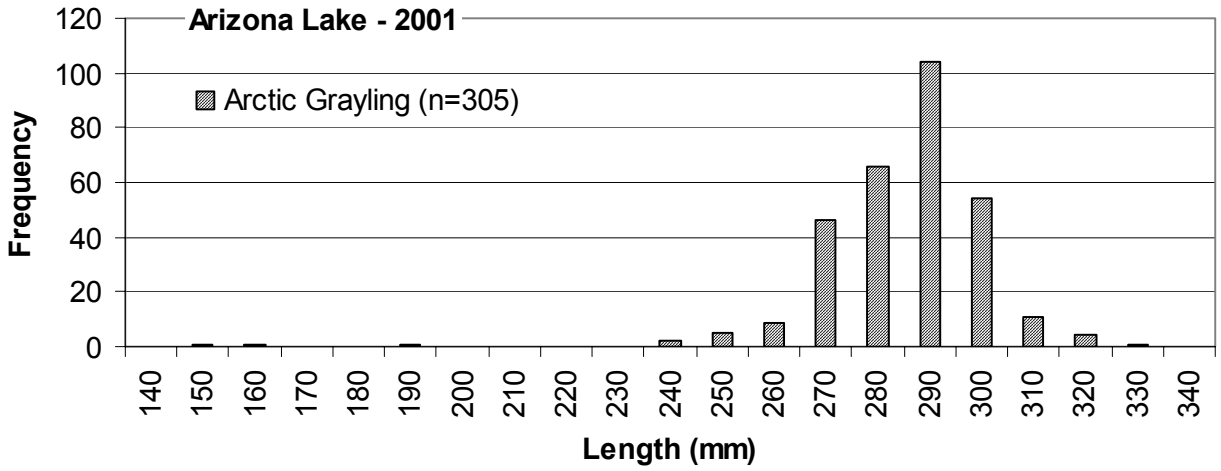


Appendix C10.–Length frequency distribution of rainbow trout in Triangle Lake, June 2000.

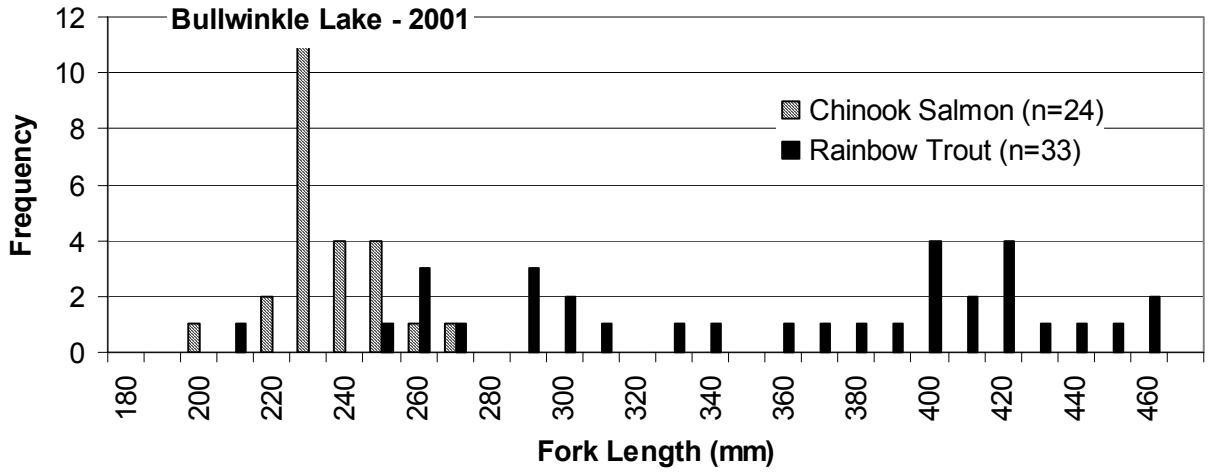


Appendix C11.–Length frequency distribution of rainbow trout in Tschute Lake, June 2000.

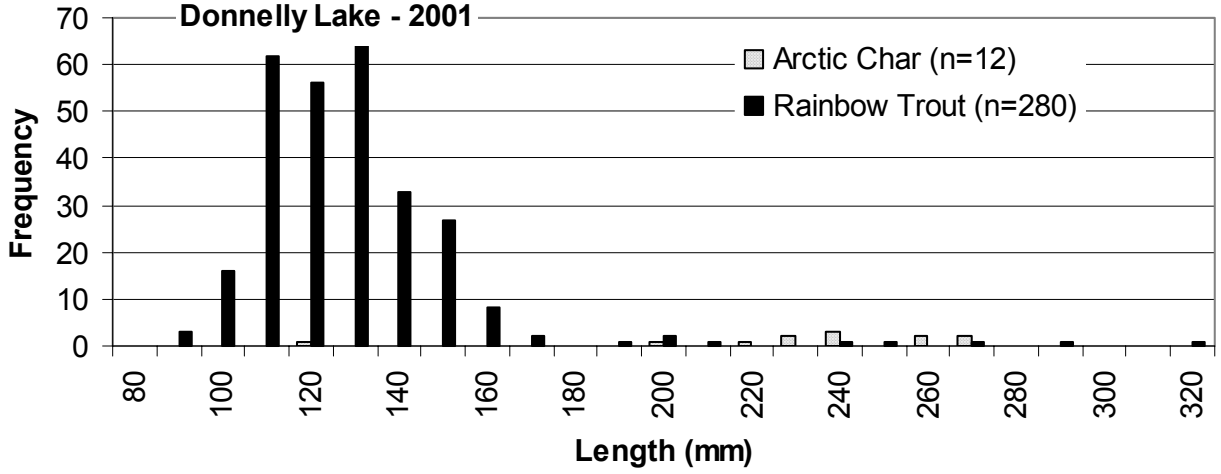
APPENDIX D
SAMPLING RESULTS FOR FISH POPULATIONS MONITORED IN STOCKED WATERS IN THE TANANA RIVER AND COPPER RIVER DRAINAGES, 2001



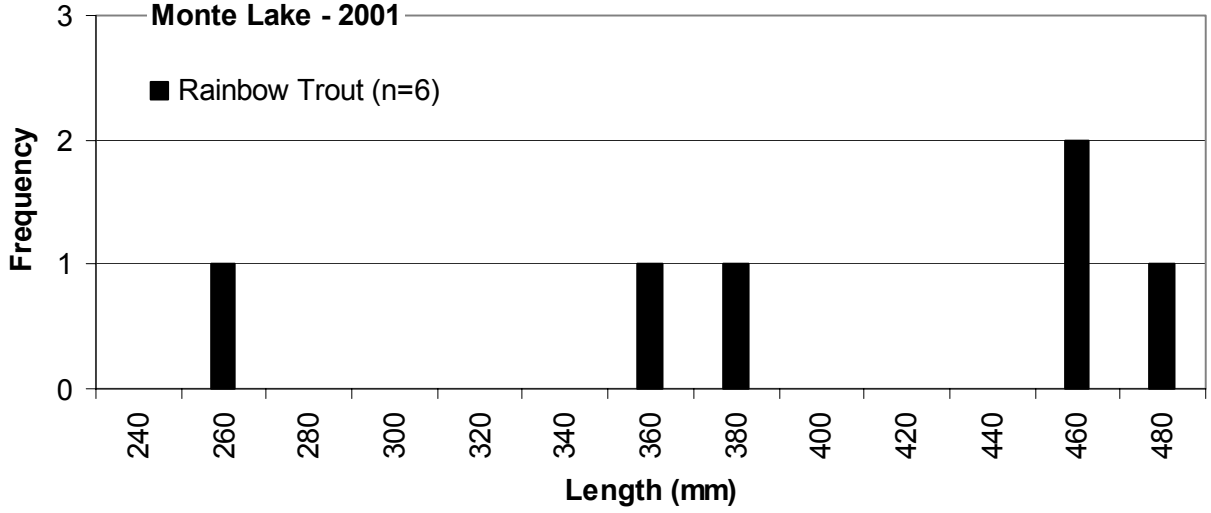
Appendix D1.–Length frequency distribution of Arctic grayling in Arizona Lake, May 2001.



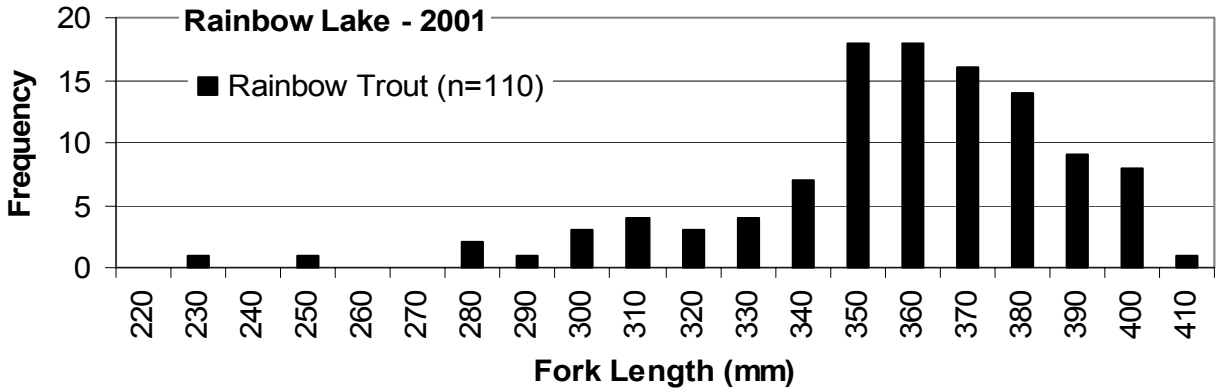
Appendix D2.–Length frequency distribution of Chinook salmon and rainbow trout in Bullwinkle Lake, June 2001.



Appendix D3.–Length frequency distribution of Arctic char and rainbow trout in Donnelly Lake, September 2001. Slimy sculpin also present.



Appendix D4.–Length frequency distribution of rainbow trout in Monte Lake, August 2001.



Appendix D5.–Length frequency distribution of rainbow trout in Rainbow Lake, June 2001.

APPENDIX E
SAMPLING RESULTS FOR FISH POPULATIONS MONITORED IN STOCKED WATERS IN THE TANANA RIVER AND COPPER RIVER DRAINAGES, 2002

Appendix E1.–Average FL of fish caught in Bullwinkle Lake, June 2002.

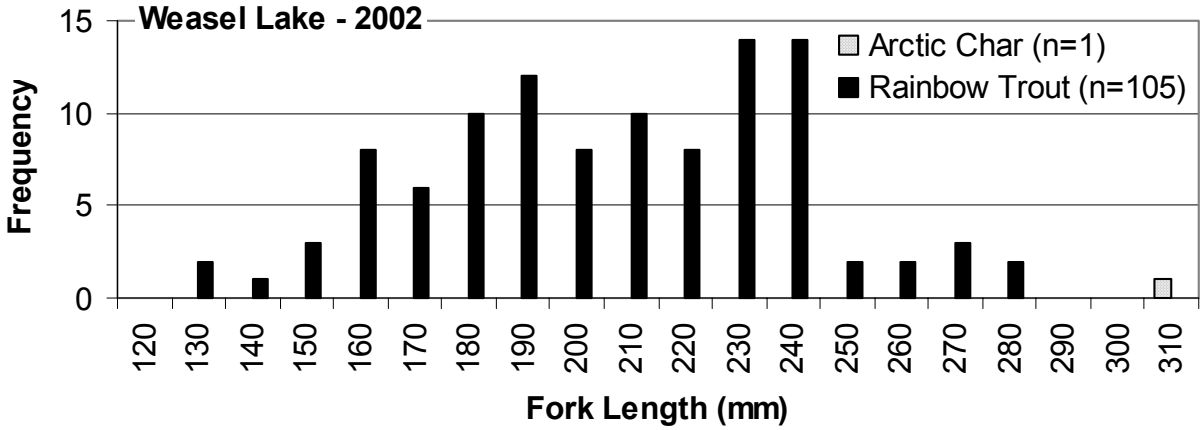
Lake	Date	Species	# Caught	Average FL (mm)
Bullwinkle Lake	6/2/2002	*		

* 3 nets set – 24 hour soak – no fish caught

Appendix E2.–Average FL of Arctic char and Arctic grayling caught in Sheefish Lake, June 2002.

Lake	Date	Species	# Caught	Average FL (mm)
Sheefish Lake	6/2/2002	AC	1	595
		AG	2	296

Slimy sculpin also present.



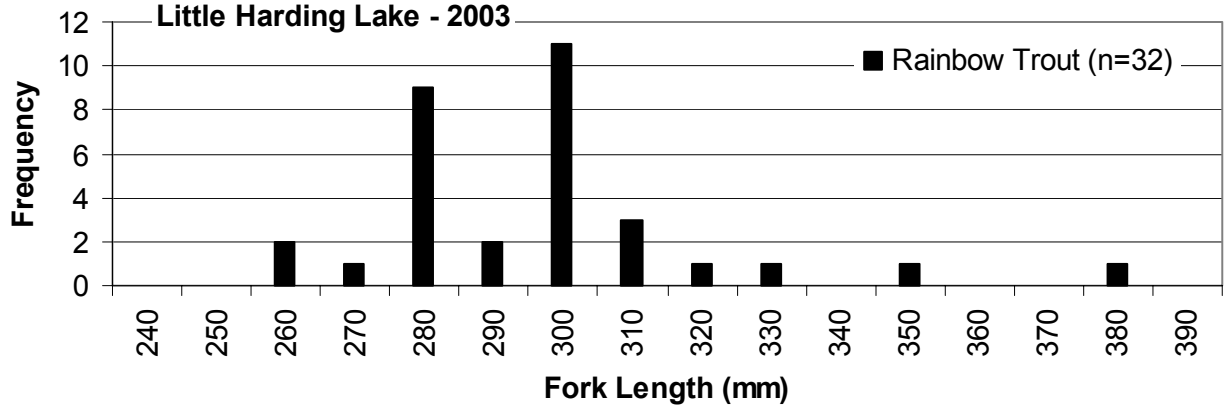
Appendix E3.–Length frequency distribution of Arctic char and rainbow trout in Weasel Lake, June 2002.

APPENDIX F
SAMPLING RESULTS FOR FISH POPULATIONS MONITORED IN STOCKED WATERS IN THE TANANA RIVER AND COPPER RIVER DRAINAGES, 2003

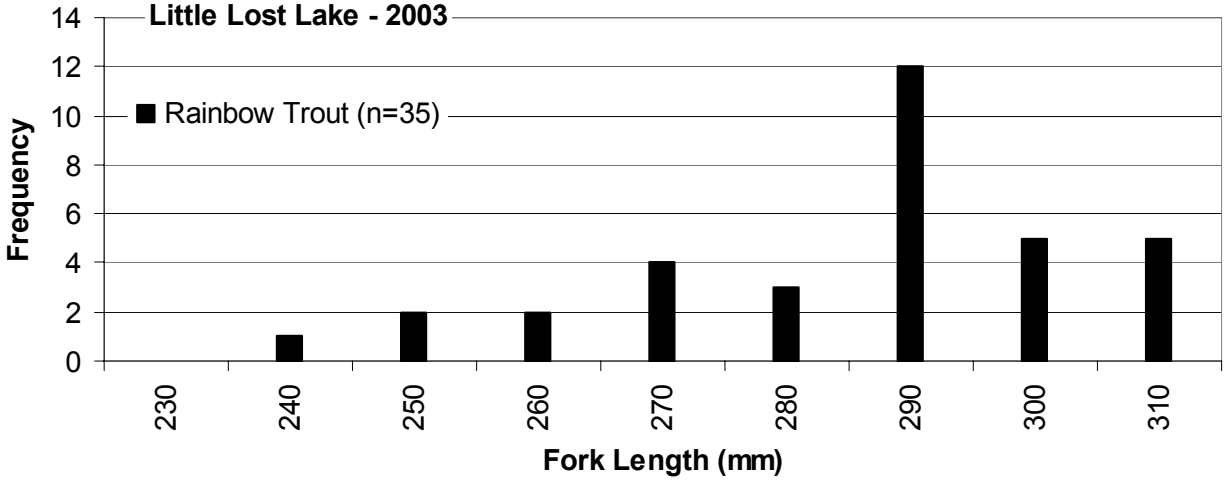
Appendix F1.–Average FL of fish caught in Doc Lake, August 2003.

Lake	Date	Species	# Caught	Average FL (mm)
Doc Lake	8/27/03	*		

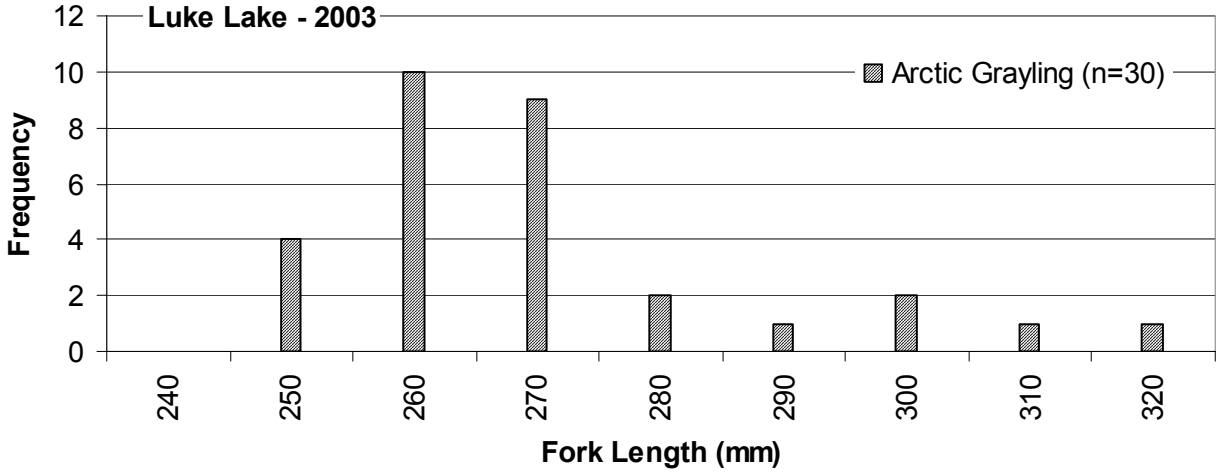
* 48 hour soak – no fish caught



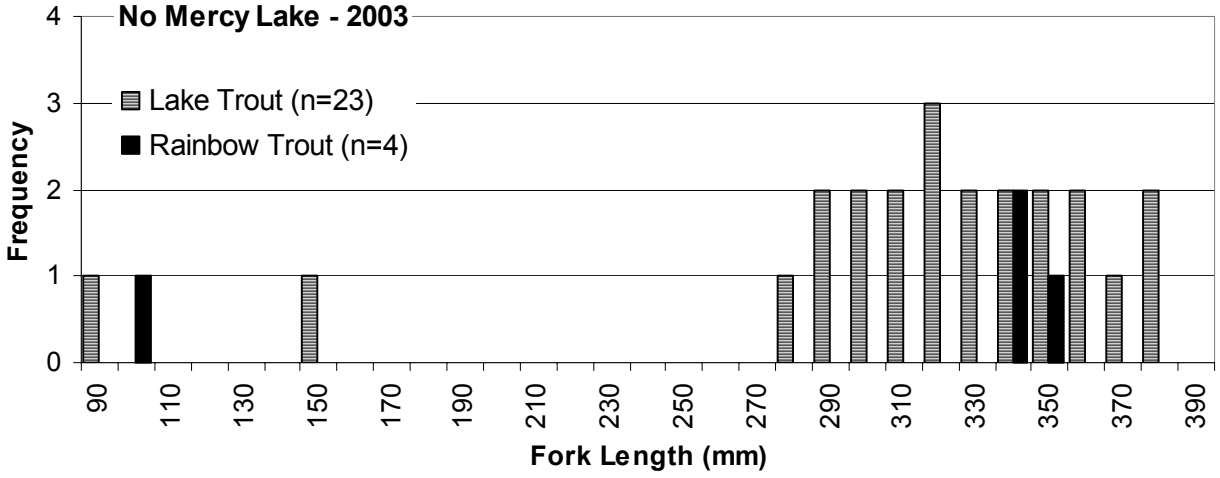
Appendix F2.–Length frequency distribution of rainbow trout in Little Harding Lake, August 2003. Lake chubs also present.



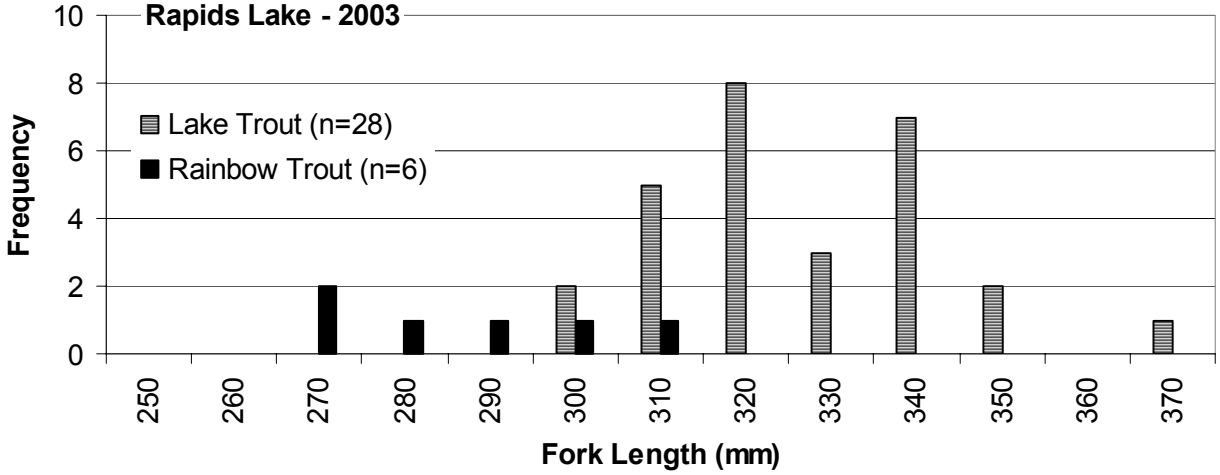
Appendix F3.–Length frequency distribution of rainbow trout in Lost Lake, September 2003.



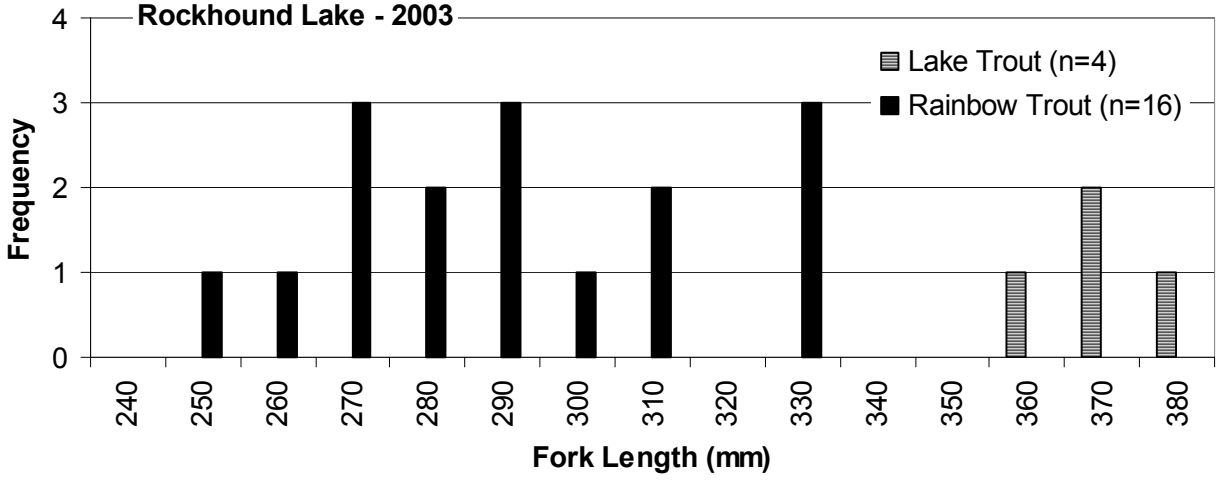
Appendix F4.–Length frequency distribution of Arctic grayling in Luke Lake, August 2003.



Appendix F5.–Length frequency distribution of lake trout and rainbow trout in No Mercy Lake, August 2003.



Appendix F6.–Length frequency distribution of lake trout and rainbow trout in Rapids Lake, August 2003.



Appendix F7.–Length frequency distribution of lake trout and rainbow trout in Rockhound Lake, August 2003. Slimy sculpin also present.

APPENDIX G
1998-2003 STOCKING HISTORIES FOR LAKES SAMPLED 1999-2003

Appendix G.-1998-2003 Stocking histories for lakes sampled 1999-2003.

Lake	Date	Species	Lifestage	Number
Arizona L	08/18/03	GR	F	800
Backdown L	08/19/98	RT	F	1,200
Backdown L	09/22/99	AC	S	503
Backdown L	08/01/00	RT	F	1,227
Backdown L	08/14/02	RT	F	992
Backdown L	09/04/02	AC	S	663
Brodie L	06/07/99	GR	C	275
Brodie L	06/07/99	GR	C	45
Brodie L	09/22/99	AC	S	434
Brodie L	06/28/01	GR	C	275
Brodie L	09/04/02	AC	S	588
Brodie L	08/20/03	GR	F	500
Buffalo L	06/08/98	RT	C	434
Buffalo L	08/13/98	RT	F	806
Buffalo L	05/26/99	RT	C	499
Buffalo L	05/30/00	RT	C	493
Buffalo L	05/24/01	RT	C	500
Buffalo L	05/24/02	RT	C	450
Buffalo L	05/27/03	RT	C	475
Bullwinkle L	08/09/99	RT	F	833
Bullwinkle L	08/08/01	RT	F	800
Chet L	10/08/98	LT	S	299
Chet L	08/09/99	RT	F	1,667
Coal Mine #5	07/08/98	RT	C	546
Coal Mine #5	07/22/98	RT	C	217
Coal Mine #5	06/07/99	RT	C	333
Coal Mine #5	08/08/01	RT	F	2,000
Connor L	07/07/00	GR	C	486
Connor L	08/18/03	GR	F	775
Crater L	08/05/99	RT	F	3,600
Crater L	08/22/01	RT	F	3,200
Crater L	08/12/03	RT	F	2,517
Crystal Lake*	1988-2003	none	-	-
Dick L	06/16/00	AC	C	1,521
Dick L	06/16/00	GR	C	346
Dick L	08/14/02	AC	F	4,000
Dick L	06/16/03	AC	C	1,971
Dick L	06/16/03	AC	C	191
Donnelly L	08/09/99	RT	F	13,278
Donnelly L	09/22/99	AC	S	4,939
Donnelly L	08/01/00	RT	F	13,000
Donnelly L	08/14/02	RT	F	11,522
Forgotten L	07/06/00	GR	C	500
Forty Foot L	07/16/73	SS	F	2,000
Forty Foot L	06/04/83	GR	E	3,000
J L	06/07/99	GR	C	536
J L	08/20/03	GR	F	500
Junction L	07/07/00	GR	C	540
Junction L	08/18/03	GR	F	793

-continued-

Appendix G.-Page 2 of 4.

Lake	Date	Species	Lifestage	Number
Koole L	08/04/98	RT	F	16,000
Koole L	08/25/99	RT	F	16,550
Koole L	08/08/01	RT	F	20,000
Little Crater L	08/18/99	RT	F	420
Little Crater L	08/22/01	RT	F	400
Little Harding L	07/13/98	RT	S	1,497
Little Harding L	08/25/99	RT	S	1,385
Little Harding L	09/08/99	RT	B	57
Little Harding L	06/26/00	RT	B	102
Little Harding L	06/26/00	RT	C	1,021
Little Harding L	05/23/01	RT	C	800
Little Harding L	05/29/01	RT	B	150
Little Harding L	06/19/02	RT	C	800
Little Harding L	06/05/03	RT	C	764
Little Junction L	07/07/00	GR	C	200
Little Lost L	05/26/99	RT	C	500
Little Lost L	06/12/00	RT	C	1,075
Little Lost L	07/06/00	RT	B	25
Little Lost L	06/11/01	RT	C	2,110
Little Lost L	06/11/01	RT	B	40
Little Lost L	06/03/02	RT	C	1,061
Little Lost L	06/23/03	RT	C	2,689
Luke L	06/07/99	GR	C	300
Luke L	06/28/01	GR	C	440
Monte L	07/26/99	RT	F	18,000
Monte L	08/03/01	RT	F	18,000
No Mercy L	08/09/99	RT	F	666
No Mercy L	08/08/01	RT	F	600
North Twin L	08/19/98	RT	F	2,000
North Twin L	10/08/98	LT	S	554
North Twin L	08/09/99	RT	F	2,000
North Twin L	08/01/00	RT	F	2,181
North Twin L	09/22/00	LT	S	1,002
North Twin L	08/08/01	RT	F	2,000
Peanut L	08/05/99	RT	F	2,400
Peanut L	08/22/01	RT	F	2,400
Rainbow L	07/26/99	RT	F	7,000
Rainbow L	08/08/01	RT	F	8,600
Rapids L	10/08/98	LT	S	355
Rapids L	08/09/99	RT	F	1,000
Rapids L	09/22/00	LT	S	200
Rapids L	08/08/01	RT	F	740
Rich 28	05/21/98	RT	C	814
Rich 28	06/05/98	SS	S	781
Rich 28	06/01/99	SS	S	400
Rich 28	06/30/99	RT	C	700
Rich 28	09/08/99	SS	S	400
Rich 28	06/08/00	RT	C	1,999
Rich 28	07/20/00	SS	F	800

-continued-

Appendix G.-Page 3 of 4.

Lake	Date	Species	Lifestage	Number
Rich 28	07/20/00	SS	F	800
Rich 28	07/05/01	RT	C	800
Rich 28	06/06/02	AC	C	525
Rich 28	06/06/02	RT	C	760
Rich 28	06/16/03	AC	C	201
Rich 28	06/24/03	RT	C	800
Rockhound L	08/09/99	RT	F	666
Rockhound L	08/08/01	RT	F	600
Ryan L	06/08/98	RT	C	505
Ryan L	08/13/98	RT	F	8,128
Ryan L	06/29/99	RT	C	468
Ryan L	05/30/00	RT	C	493
Ryan L	06/13/01	RT	C	1,815
Ryan L	05/24/02	RT	C	450
Ryan L	05/27/03	RT	C	515
Sculpin L	07/29/99	RT	F	28,000
Sculpin L	08/22/01	RT	F	14,000
Sheefish L	10/17/00	KS	C	438
Sheefish L	10/17/00	PSxKS	C	469
Sheefish L	06/28/01	GR	C	440
Sheefish L	09/04/02	AC	S	913
Silver L	06/06/99	RT	S	3,685
Silver L	07/29/99	RT	F	80,517
Silver L	08/22/01	RT	F	80,000
Silver L	08/12/03	RT	F	49,019
South Twin L	08/19/98	RT	F	4,000
South Twin L	08/09/99	RT	F	4,444
South Twin L	06/28/01	RT	C	500
South Twin L	06/23/03	RT	C	526
Squirrel Creek Pit	06/08/98	RT	C	836
Squirrel Creek Pit	05/26/99	RT	C	505
Squirrel Creek Pit	06/26/99	GR	C	512
Squirrel Creek Pit	06/29/99	RT	C	429
Squirrel Creek Pit	06/16/00	RT	C	1,000
Squirrel Creek Pit	06/16/00	GR	C	865
Squirrel Creek Pit	05/24/01	RT	C	1,000
Squirrel Creek Pit	06/13/01	GR	C	800
Squirrel Creek Pit	05/24/02	RT	C	1,152
Squirrel Creek Pit	05/27/03	RT	C	991
Strelna L	06/13/99	SS	F	33,190
Strelna L	07/29/99	RT	F	15,101
Strelna L	07/18/00	SS	F	15,955
Strelna L	08/22/01	RT	F	15,000
Strelna L	06/17/02	SS	F	34,000
Strelna L	08/12/03	RT	F	15,006
Tex Smith L	06/05/98	RT	C	500
Tex Smith L	05/26/99	RT	C	487
Tex Smith L	06/28/99	RT	C	500
Tex Smith L	08/05/99	RT	F	4,246

-continued-

Appendix G.-Page 4 of 4.

Lake	Date	Species	Lifestage	Number
Tex Smith L	10/20/99	RT	F	1,000
Tex Smith L	05/30/00	RT	C	504
Tex Smith L	07/18/00	RT	C	492
Tex Smith L	06/13/01	RT	C	1,000
Tex Smith L	07/18/01	RT	C	521
Tex Smith L	05/24/02	RT	C	510
Tex Smith L	06/27/02	RT	C	529
Tex Smith L	05/27/03	RT	C	776
Tex Smith L	06/18/03	RT	C	556
Three Mile L	09/09/98	RT	F	6,013
Three Mile L	07/29/99	RT	F	4,000
Three Mile L	07/18/00	RT	C	1,972
Three Mile L	06/13/01	RT	C	2,000
Three Mile L	05/24/02	RT	C	1,471
Three Mile L	05/27/03	RT	C	1,475
Triangle L	08/04/98	RT	F	10,000
Triangle L	07/22/99	RT	F	10,133
Triangle L	08/06/01	RT	F	10,000
Triangle L	08/06/03	RT	F	10,001
Tschute L	07/22/99	RT	F	10,000
Two Mile L	07/29/99	RT	F	3,400
Two Mile L	07/18/00	RT	C	1,166
Two Mile L	06/13/01	RT	C	2,045
Two Mile L	05/24/02	RT	C	1,511
Two Mile L	05/27/03	RT	C	1,475
Weasel L	08/19/98	RT	F	1,600
Weasel L	07/26/99	RT	F	1,600
Weasel L	08/01/00	RT	F	1,590
Weasel L	08/14/02	RT	F	1,255

AC – Arctic char (Salvelinus alpinus)
GR – Arctic grayling (Thymallus articus)
KS – King / Chinook salmon (Oncorhynchus tshawytscha)
LT – Lake trout (Salvelinus namaycush)
PS / KS – Pink / King salmon hybrid (Oncorhynchus gorbuscha / tshawytscha)
RT – Rainbow trout (Oncorhynchus mykiss)
SS – Silver / Coho salmon (Oncorhynchus kisutch)

* Lake trout stocked in 1994.

APPENDIX H
ARCHIVED FILES FOR DATA COLLECTED DURING STUDIES COVERED IN THIS REPORT

Appendix H.-Archive files for data collected during studies covered in this report.

File Name	Description
Archived Lisa Lake Mark Recap Data 2001	Lisa Lake mark-recapture data 2001.
1999 Archived Lake Monitoring Data	Lake monitoring data 1999.
2000 Archived Lake Monitoring Data	Lake monitoring data 2000.
2001 Archived Lake Monitoring Data	Lake monitoring data 2001.
2002 Archived Lake Monitoring Data	Lake monitoring data 2002.
2003 Archived Lake Monitoring Data	Lake monitoring data 2003.

Data files are available from the Alaska Department of Fish and Game, Sport Fish Division, Research and Technical Services, 333 Raspberry Road, Anchorage, Alaska, 99518-1599.