Fishery Data Series No. 16-26

Lake Evaluations in Region III, 2011–2013

by

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and

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July 2016

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

Symbols and Abbreviations

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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

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ABSTRACT

During 2011–2013 we investigated 49 lakes in the North Slope, the Tanana River, and the Upper Copper and Upper Susitna River management areas to obtain information on fish populations, lake morphometry, and water quality. We sampled fish populations in 32 stocked lakes to evaluate species presence, fish length, and health. Native fish species also were captured in 13 of the 32 stocked lakes. Rainbow trout *Oncorhynchus mykiss* populations in 9 out of 19 lakes met length standards for predetermined length categories. Length standards were not established for other stocked species. We visually examined all fish for overall body and fin condition, external parasites, and indications of disease. Based on our findings we recommended adjustments to current stocking schemes for 21 lakes having stocked fisheries.

We used the same sampling protocol for 12 lakes having only native fish populations. Only 1 fish species was captured in each of 6 lakes, multiple fish species were captured in each of 4 lakes, and fish were not captured in 2 lakes. For all captured native fish, we recorded length information and conducted a visual examination for overall body and fin condition, external parasites, and indications of disease. All captured fish were in good overall health.

We collected morphometric information for 20 lakes and measured water quality parameters for 43 lakes. Lakes ranged from 0.5 to 5,995 ha and from 1.4 to 63 m deep. Water temperature during summer sampling exceeded 18°C in 7 lakes. We measured dissolved oxygen (DO) during winter for 21 lakes and values were below 4 mg/L in 8 lakes.

All fish and morphometric information were stored in the Alaska Lake Database[1] and are accessible to the public through the Alaska Department of Fish and Game (ADF&G) website. Water quality data were stored in a database at the ADF&G at 1300 College Road, Fairbanks, Alaska. Resulting information will be used to assess effects of current and proposed changes to fish stockings and regulation changes, land use and development, and to issue permits and monitor changes in aquatic systems over time.

Keywords: lakes, stocked fisheries, water quality, morphometry, bathymetry, rainbow trout *Oncorhynchus mykiss*, 5th Ave Pond, Bathing Beauty Pond, BBB Lake, Bear Lake (DTA), Boot Lake (DTA), Brodie Lake, Buffalo Lake, Bullwinkle Lake, Crescent Lake, Fall Lake (DTA), Fielding Lake, Forrest Lake, Four Mile Lake, Gergie Lake, Grayling Lake, Hidden Lake (EAFB), Itkillik Lake, John Lake, Johnson Pit #2, Josh Lake, Junction Lake, Koole Lake, Lake Minchumina, Little Harding Lake, Manchu Lake, Mentasta Lake, Moose Lake, North Jans Lake, North Pole Pond, North Twin Lake, Paul's Pond, Polaris Lake

INTRODUCTION

Alaska's constitution requires that the state's replenishable resources be managed for utilization, development, and conservation on the sustained yield principle for the maximum benefit of Alaskans. The Alaska Department of Fish and Game (ADF&G) Division of Sport Fish strives to fulfill this requirement by protecting and improving the state's sport fishery resources through responsible fishery management, sound scientific research, and enhancement activities. Accurate and current information on lakes and fish populations is needed to accomplish these goals. Every year, ADF&G collects information on fish populations, lake morphometry, and water quality for both stocked and wild lakes throughout Region III (Figure 1). Although funding sources are different for stocked and wild lakes, the study designs and methods that we use are similar and therefore summarized in 1 report.

STOCKED LAKE EVALUATIONS

The ADF&G currently stocks game fish in 112 lakes throughout Region III, primarily in the Tanana River drainage near Fairbanks and Delta Junction and the Upper Copper and Upper Susitna (UCUS) River drainages in the Glennallen area (Figure 1). The goal of the stocking

[1] http://www.adfg.alaska.gov/index.cfm?adfg=fishingSportStockingHatcheries.lakesdatabase.

program is to provide diverse and dependable angling opportunities near population centers and offer alternatives to the harvest of wild fish stocks.

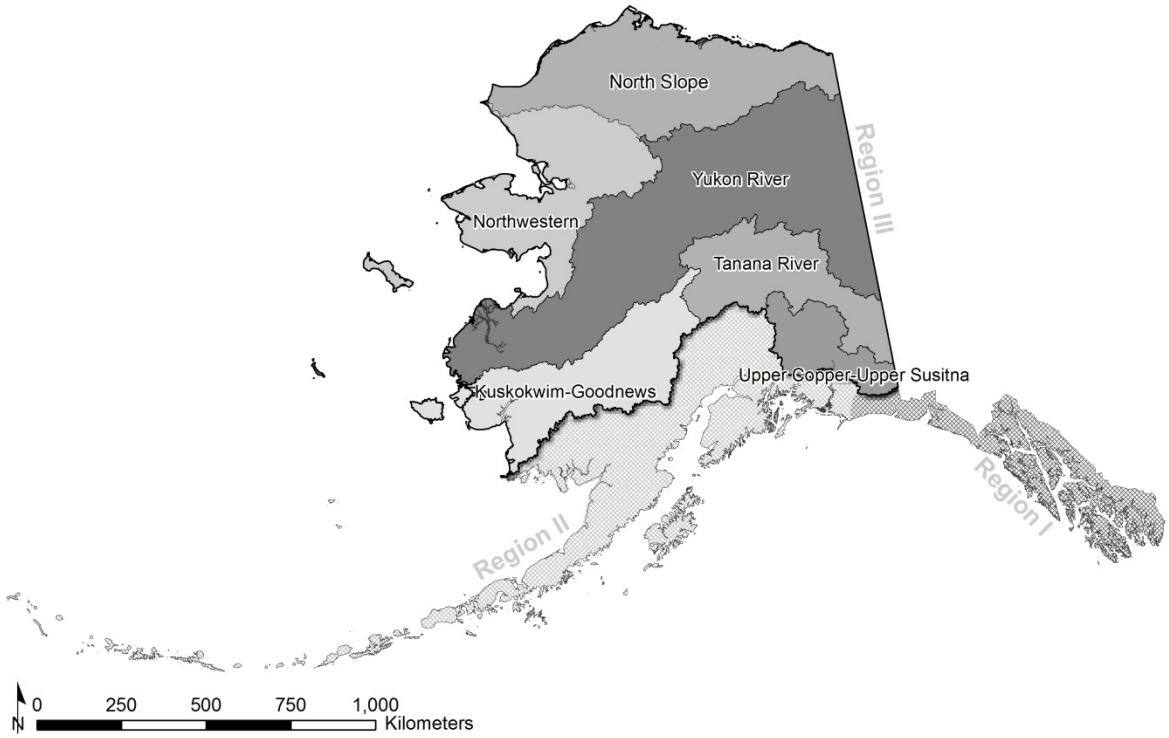


Figure 1.–Region III Sport Fish Management Areas.

Rainbow trout *Oncorhynchus mykiss*, coho salmon *O. kisutch*, Chinook salmon *O. tshawytscha*, Arctic grayling *Thymallus arcticus*, and Arctic char *Salvelinus alpinus* are stocked into lakes to provide year-round sport-fishing opportunity. Managers select lake specific stocking strategies (e.g., species, lifestages, and the number of fish to stock) based on angler preferences, the proximity of a lake to roads or communities, habitat requirements of stocked fish, lake characteristics, and hatchery capabilities.

Typically, fish populations and habitat status is evaluated in each stocked lake at least once every 5 to 10 years. Approximately 10 to 15 lakes are examined each year. These evaluations provide managers with information to assess stocked fish populations and to adjust current stocking strategies and fish hatchery production when necessary, update informational handouts, and provide the public with up to date information regarding fishing opportunities.

Stocked fisheries in Region III are managed according to management plans adopted by the Alaska Board of Fisheries (BOF) for each of the 6 management areas within Region III (Appendix A, Swanton and Taube 2009). The plans for each area are similar and each plan directs ADF&G to meet public demand for diverse fishing opportunities and outlines 3 management approaches to do so (regional, conservative, and special). Each management approach has general objectives for catch rates and sizes of fish; however, objectives are described in terms of "reasonable expectation," "reasonable chance," and "high probability," which are qualitative and difficult to assess.

Skaugstad (*In prep*) developed a general population model to describe the minimum population length-frequency distribution (LFD) that is needed to create fisheries described under each of the 3 management approaches. We used this model to calculate fishery-specific length standards (*m*LS) for predetermined length categories and to quantitatively and visually assess stocked rainbow trout fisheries that are regulated under 1 of the 3 management approaches. If stocked rainbow trout populations met or exceeded the model standards, we considered BOF objectives achieved for fish size.

WILD LAKE EVALUATIONS

For many lakes in Region III, species and habitats have not been investigated, documented, or, in some cases, sampled in over 50 years. Some of these lakes are in areas that are or will be affected by current and proposed resource exploration and development. Exploration and development activities include the extension of the Alaska railroad, proposed roads, resource extraction, and more extensive and intensive use of military training areas. Resource managers need a better understanding of the distribution and habitat use of freshwater fishes in order to maintain healthy aquatic resources that will sustain sport fishing opportunities and provide for other responsible uses and development activities.

Fish information, water quality, and lake morphometric information are used by state and federal agencies when developing management plans, assessing the effects of current or proposed development, issuing permits, and monitoring changes in aquatic systems over time. From these observations, managers can evaluate how natural events or human activity affects fish distribution, size, abundance, and community structure. In addition to documenting species and habitat, these sampling activities help ADF&G Sport Fish area managers identify new angling opportunities and respond to stocking requests.

OBJECTIVES

Objectives for Region III stocked and wild lake evaluations conducted during 2011–2013 were designed to address the specific management needs outlined below.

FISH

Management Need:	Determine if stocked rainbow trout populations were achieving lake-specific management criteria.
Objective 1:	Test for differences between mean rainbow trout lengths and respective management values for defined length categories, with a 90% probability of detecting a difference of at least 10% of the management value with a 10% probability of a Type I error.
Management Need:	Provide fishery managers and anglers with current information about fish species presence, size range, overall health, and document whether fish survived winter.
Objective 2:	Survey selected lakes to determine fish species presence, document the size range of captured fish, and examine all captured fish for body and fin condition, external parasites and indications of disease.

WATER QUALITY

Management Need: Document select physical and chemical properties during fish sampling (typically June, August, or September) and early spring (March or April).

Objective 3: Measure water clarity, temperature, dissolved oxygen (DO), pH, total dissolved solids (TDS), specific conductivity, and alkalinity.

MORPHOMETRY AND OTHER LAKE CHARACTERISTICS

Management Need: Create bathymetric maps and document physical features for select lakes.

Objective 4: Survey the lake bottom to obtain depth, longitude, and latitude data for producing bathymetric maps;

Objective 5: describe the lake watershed and the immediate surroundings, such as tree/shrub cover, and inlets and outlets; and,

Objective 6: photograph the lake and surrounding area from north and south locations and, if flown into a lake, take aerial photographs of the lake and surrounding area.

STUDY AREA

During 2011–2013, we sampled 49 lakes to obtain fishery, morphometric, and water quality data. Thirty-two of these lakes were stocked[2] and 17 were wild. The criteria for selecting lakes for study included 1) the importance of the information for management needs; 2) the number of public inquiries or requests for development of a fishery, or for information about the lake or species present in the lake; and 3) the desire to visit most stocked lakes at least once every 5 to 10 years to assess fish populations and lake habitat. In this section, we briefly describe each water body and discuss specific information requested by area managers, biologists, the public, or other government agencies where applicable. Water bodies are listed as stocked or wild and grouped by Sport Fish management area. A summary of data collected for each location is presented in Table 1 and the locations of study lakes are shown in Figure 2–5. Fish stocking records for the 77 years prior to sampling for each stocked lake are summarized in Appendix B. Unless described otherwise, all trails are accessible by foot, ATV, or snow machine.

STOCKED LAKE EVALUATIONS

Tanana River Management Area

Bathing Beauty Pond is approximately 9 km south of North Pole (Figure 2). Access is along Eielson Farm Road. Surface area is 5.0 ha and maximum depth is 8.0 m. The lake was first stocked with Arctic grayling fry in 1975.

[2] The water body was listed in regulation as stocked at the time of sampling.

Table 1.–Location, size, and information needs for lakes sampled in 2011–2013.

Lake	Hectare	Acre	Latitude (WGS84)	Longitude (WGS84)	Fish	Water quality	Morphometry
Stocked Lake Evaluations							
Tanana River Management Area							
Bathing Beauty Pond	5.0	12	64.714424	-147.19345	yes	yes	no
Brodie Lake	2.1	5	63.71232	-145.83409	yes	yes	no
Bullwinkle Lake	2.0	5	63.906999	-145.82309	yes	yes	no
Forrest Lake	13.6	34	63.474485	-144.02746	yes	yes	yes
Four Mile Lake	49.9	123	63.361098	-142.57192	yes	yes	no
Grayling Lake	4.6	11	64.668073	-147.11732	yes	yes	no
Hidden Lake (EAFB)	6.7	17	64.68721	-147.13696	yes	yes	no
Johnson Pit #2	1.2	3	64.55204	-147.01702	yes	yes	yes
Koole Lake	85.6	212	64.198878	-146.60049	yes	no	no
Little Harding Lake	20.7	51	64.411245	-146.89403	yes	yes	no
Manchu Lake	15.6	39	64.701505	-147.03376	yes	yes	no
Moose Lake	14.1	35	64.6826	-147.07095	yes	yes	no
North Pole Pond	6.9	17	64.753901	-147.33293	yes	yes	no
North Twin Lake	6.4	16	63.864305	-145.83965	yes	yes	no
Paul's Pond	2.2	5	63.706505	-145.82967	yes	yes	no
Polaris Lake	19.3	48	64.68868	-147.0728	yes	yes	no
Quartz Lake	590.0	1,458	64.198617	-145.82454	yes	yes	no
Rainbow Lake	35.0	87	64.128627	-146.09701	yes	yes	no
Rangeview Lake	1.8	5	63.705764	-145.82924	yes	yes	no
Rich 28 Mile Pit	2.9	7	64.609336	-147.06096	yes	yes	no
Sheefish Lake	2.9	7	63.911237	-145.81336	yes	yes	no
Sirlin Drive Pond	1.5	4	64.814807	-147.56651	yes	yes	no
South Twin Lake	5.4	13	63.863328	-145.83851	yes	yes	no
Upper Copper-River and Upper Susitna River Management Area							
Buffalo Lake	2.9	7	62.065145	-146.4507	yes	yes	no
Gergie Lake	31.1	77	62.044634	-146.47429	yes	yes	no
John Lake	56.6	140	62.105142	-146.91788	yes	yes	yes
Junction Lake	4.8	12	62.089549	-146.35207	yes	yes	no
North Jans Lake	25.3	63	62.290129	-146.38554	yes	yes	no

-continued-

Table 1.–Page 2 of 2.

Lake	Hectare	Acre	Latitude (WGS84)	Longitude (WGS84)	Fish	Water quality	Morphometry
Upper Copper River and Upper Susitna River Management Area continued							
Ryan Lake	12.9	32	62.027598	-146.64017	yes	yes	no
Sculpin Lake	48.4	120	61.523386	-144.14605	yes	yes	no
South Jans Lake	34.6	85	62.286656	-146.36555	yes	yes	no
Three Mile Lake	9.7	24	61.565383	-144.44483	yes	yes	no
Wild Lake Evaluations							
North Slope							
BBB Lake	34.4	85	68.60805	-149.77263	yes	yes	yes
Itkillik Lake	438.7	1,084	68.40173	-149.92158	yes	no	yes
Tanana River Management Area							
5th Ave Pond	0.5	1	64.75045	-147.34393	no	yes	yes
Bear Lake (DTA)	50.6	125	64.01209	-146.21511	yes	yes	yes
Boot Lake (DTA)	47.9	118	64.020485	-146.22624	yes	yes	yes
Fall Lake (DTA)	22.5	55	64.052803	-146.2921	yes	yes	yes
Fielding Lake	561.9	1,389	63.17169	-145.68664	no	no	yes
Josh Lake	2.3	6	63.83213	-145.84235	yes	yes	yes
Lake Minchumina	5,995.1	14,814	63.89688	-152.22257	no	no	yes
Skate Lake	23.1	57	62.980077	-141.94615	yes	yes	yes
Spring North Lake (DTA)	28.7	71	64.038124	-146.27005	yes	yes	yes
Summer Lake (DTA)	22.6	56	64.082199	-146.33246	yes	yes	yes
Totek Lake	102.1	252	64.35202	-149.98238	yes	yes	yes
Triangle North Lake (DTA)	11.3	28	64.046852	-146.25803	yes	yes	yes
Upper Copper-River and Upper Susitna River Management Area							
Crescent Lake	15.5	38	63.096094	-145.41343	yes	yes	yes
Mentasta Lake	505.6	1,249	62.917843	-143.82202	no	no	yes
Summit Lake	1,770.1	4,374	63.15242	-145.53726	no	no	yes

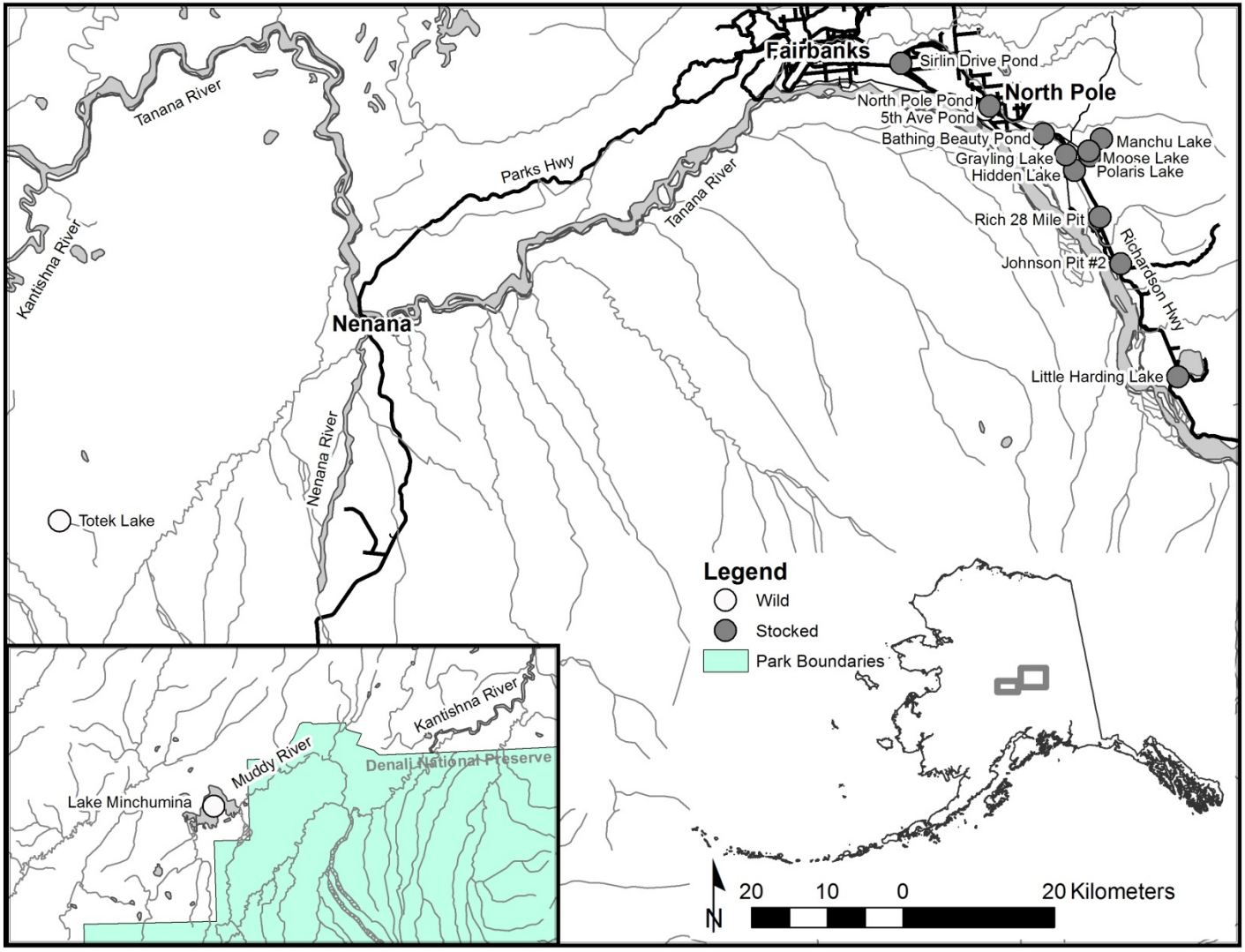


Figure 2.–Location of lakes sampled within the Lower Tanana River Management Area during 2011–2013.

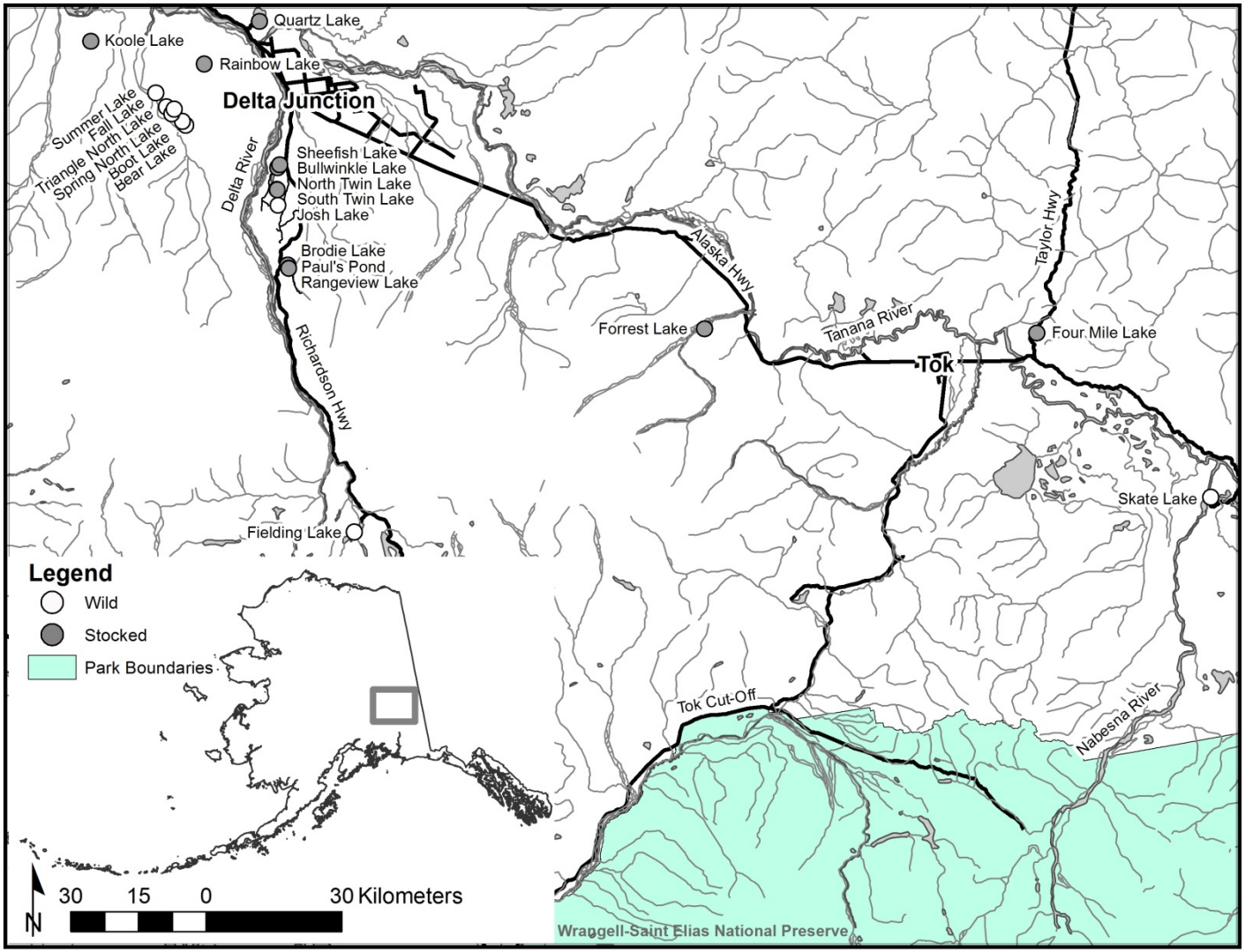


Figure 3.–Location of lakes sampled within the Upper Tanana River Management Area during 2011–2013.

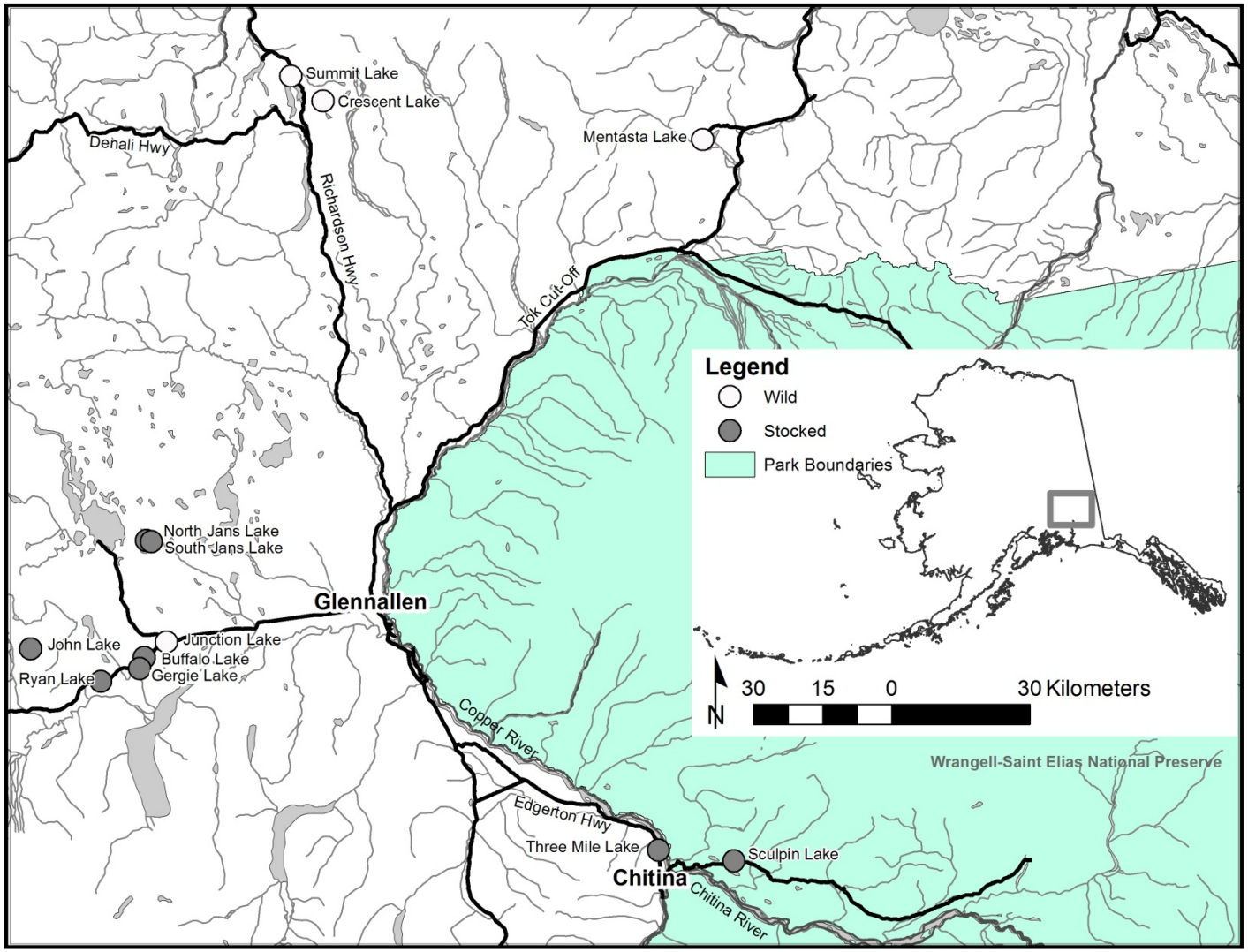


Figure 4.–Location of lakes sampled within the Upper Copper River and Upper Susitna River Management Area during 2011–2013.

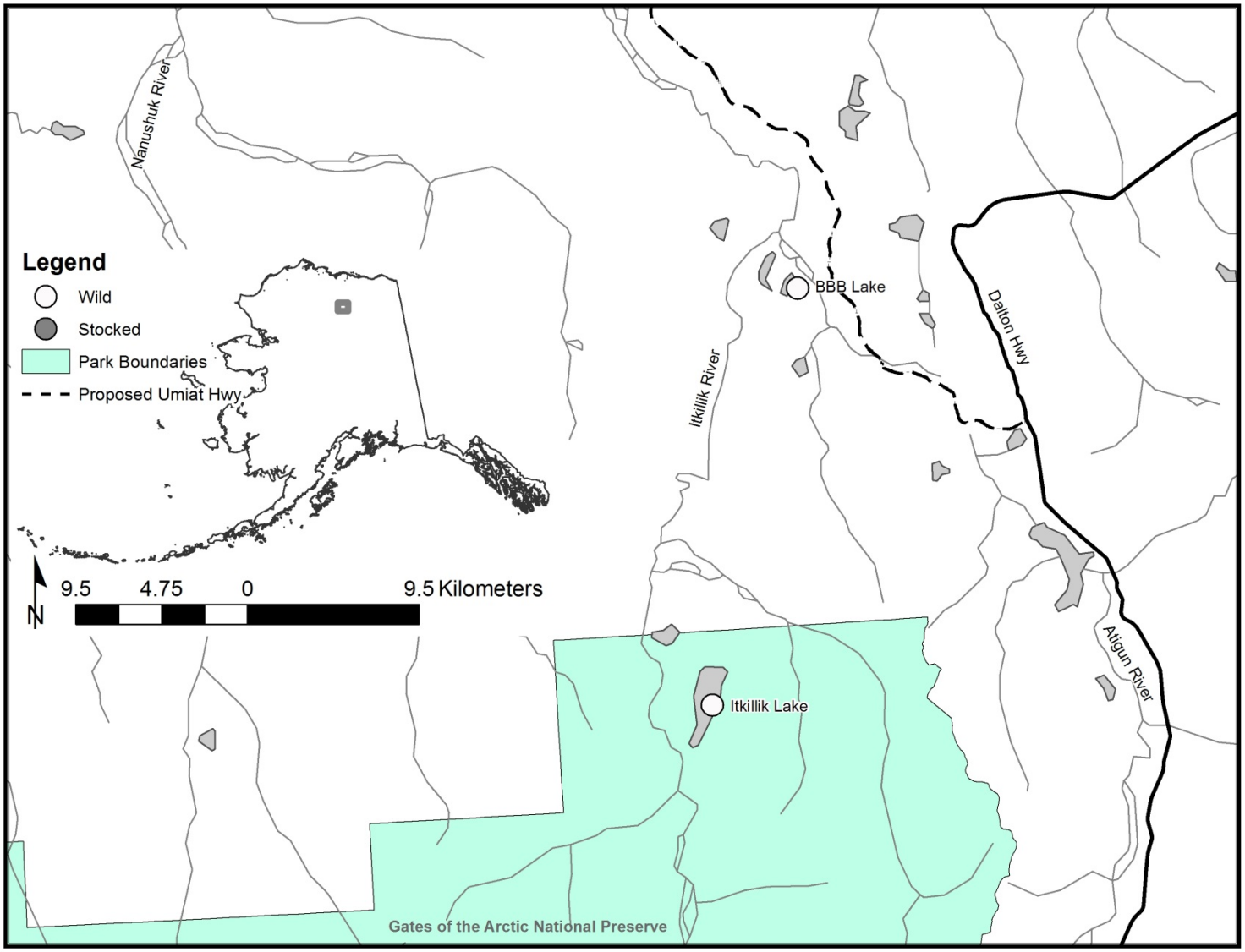


Figure 5.–Location of lakes sampled within the North Slope Management Area sampled during 2011–2013.

ADF&G stocked rainbow trout in 1986 and introduced Arctic char and lake trout *Salvelinus namaycush* in 1988. Currently, catchable Arctic grayling, Chinook salmon, and rainbow trout are stocked annually and catchable Arctic char are stocked on even years. Anglers regularly report catching northern pike *Esox lucius* in Bathing Beauty Pond. Managers wanted to know if stocked fish survived winter and if rainbow trout population length frequency distribution (LFD) met management standards. They also wanted to know the size range of native species and the overall health of stocked fish. Rainbow trout captured during spring 2011 were stocked as catchables in 2010.

Brodie Lake is 3.4 km from the Coal Mine Road parking area, 38 km south of Delta Junction (Figure 3). Access is by trail. Surface area is 2.1 ha and maximum depth is 5.7 m. The lake was first stocked with Arctic char in 1987. Arctic char and Arctic grayling have been consistently stocked since 1992 and Chinook salmon were added in 2004. Fingerling Arctic grayling, catchable Chinook salmon, and subcatchable Arctic char were stocked in the 7 years prior to sampling. Few fish were captured when Brodie Lake was last evaluated in 1999 (Behr et al. 2005). Managers wanted to know if stocked fish survived winter, their population LFD, and overall health. Fish captured in fall 2011 were stocked in 2007, 2008, 2009, or 2010.

Bullwinkle Lake is approximately 13.5 km south of Delta Junction on Meadows Road and lies within the US Army Garrison (USAG) Alaska Donnelly Training Area (DTA) East (Figure 3). Access is by trail and requires a Recreational Access Permit (RAP) from the Army. Surface area is 2.0 ha and maximum depth is 9.0 m. The lake was first stocked in 1984. ADF&G has previously stocked sheefish *Stenodus leucichthys*, lake trout, and Arctic char into Bullwinkle Lake. Currently, fingerling rainbow trout are stocked on even years. No fish were captured when Bullwinkle Lake was last evaluated in 2002 (Behr et al. 2005). Managers wanted to know if stocked fish survived winter, if the rainbow trout population LFD met management standards, and overall health. Rainbow trout captured in spring 2012 were stocked as fingerlings in 2010.

Forrest Lake is 8.8 km west of the Alaska Highway, just south of the Robertson River (Figure 3). Access is at milepost 1,347; there is a small parking area and a 12 km primitive trail that leads to the lake. Surface area is 13.6 ha and maximum depth is 22.5 m. The lake was first stocked with fingerling rainbow trout in 1985 and is currently stocked with the same on even years. The lake was last evaluated in 1994 (ADF&G *unpublished data*[3]). Managers wanted to know if the population LFD of rainbow trout met management standards under the existing stocking regime. Water quality and morphometric information were also requested to update records and to create bathymetric maps. Fish captured in summer 2012 were stocked as fingerlings in 2008 and 2010.

Four Mile Lake is southeast of the Taylor Highway at milepost 4.5 (Figure 3). There is a small parking area adjacent to the highway and lake access is along a 0.8 km trail. Surface area is 49.9 ha and maximum depth is 5.8 m. The lake was first stocked with sheefish fry in 1968. Fingerling rainbow trout and coho salmon were stocked in the 1970s and fingerling lake trout were stocked from 1991 to 2000. Currently, fingerling rainbow trout and subcatchable Arctic char are stocked on odd years. Stockings were changed from odd to even years in 2011 to balance hatchery production schedules. Managers wanted to know the population LFDs of the different stocked species, their overall health, and if the population LFD for rainbow trout met

[3] These data are stored in ALDAT: http://www.adfg.alaska.gov/index.cfm?adfg=fishingSportStockingHatcheries.lakesdatabase.

management standards under the current stocking regime. Rainbow trout captured in summer 2013 were stocked as fingerlings in 2010.

Grayling Lake is west of the Richardson Highway across from Eielson Air Force Base (EAFB) (Figure 2). A Hunt/Trap/Fish (HTF) permit from the EAFB Department of Natural Resources is required to access this lake. Surface area is 4.6 ha and maximum depth is 4.9 m. The lake was first stocked in 1975 with Arctic grayling fry, sheefish were stocked in 1984, rainbow trout were first stocked in 1986, and Arctic char and lake trout were added in 1988. Northern pike are also present. Currently, catchable Arctic grayling and rainbow trout are stocked annually and catchable Arctic char are stocked on even years. Only rainbow trout and Arctic char were stocked in the 7 years prior to sampling and catchable rainbow trout were not available in 2011. Area managers wanted to know if stocked fish survived winter given the presence of northern pike, the population LFDs and overall health of all stocked species, and if the population LFD for rainbow trout met management objectives. Rainbow trout captured in spring 2011 were stocked in 2009 and 2010.

Hidden Lake (EAFB) is west of the Richardson Highway across from EAFB (Figure 2). This lake is on EAFB land and a HTF permit from the EAFB Department of Natural Resources is required to access the lake. Surface area is 6.7 ha and maximum depth is 4.9 m. The lake was first stocked in 1968 with Arctic grayling fry, rainbow trout were first stocked in 1986, and Arctic char and lake trout were added in 1988 and 1989 respectively. Currently, catchable Arctic grayling and rainbow trout are stocked annually and catchable Arctic char are stocked on even years. Northern pike are also present. Area managers wanted to know if stocked fish survived winter given the presence of northern pike, the population LFDs and overall health of all stocked species, and if the population LFD for rainbow trout met management objectives. Rainbow trout captured in spring 2013 were stocked earlier in the year or from 2012 stockings.

Johnson Pit #2 is approximately 50 km south of Fairbanks and east of the Richardson Highway. Access is from Johnson Road at milepost 330.4 of the Richardson Highway (Figure 2). Surface area is 1.2 ha and maximum depth is 3.1 m. The lake was first stocked with Arctic grayling fry in 1975 and rainbow trout stockings began in 1990. Catchable rainbow trout were stocked annually in the 7 years prior to sampling, except for in 2011 when catchables were not available. Currently, catchable Arctic grayling and rainbow trout are stocked annually. There were no ADF&G survey records for this lake and an angler reported catching northern pike in 2012. Sampling was conducted in spring 2012 at the area manager's request to confirm these reports and to assess the overall health of stocked fish.

Koole Lake is between the Little Delta River and Delta Creek, 6.5 km south of the Tanana River (Figure 3). Half of the lake is in the northern tip of the DTA, access is by aircraft or winter trail, and an RAP is required. Surface area is 85.6 ha and maximum depth is 7.0 m. The lake was first stocked with fingerling rainbow trout in 1975. Coho salmon, Arctic grayling, and Arctic char were stocked in the early to mid-2000s. Currently, the lake is stocked with fingerling rainbow trout on odd years and fingerling Arctic grayling and coho salmon on even years. Koole Lake is under conservative management; the daily bag and possession limit is 5 fish, only 1 of which may be 18 inches (457 mm) or longer. In 2013, biologists wanted to compare Chinook and coho salmon to determine which stocking product resulted in the lowest cost-per-catchable. Subcatchable Chinook salmon were marked and stocked in spring 2013, in addition to regular coho salmon stockings, and a two-event mark-recapture experiment was conducted in fall 2013.

Little Harding Lake is next to Harding Lake, 70 km southeast of Fairbanks (Figure 2). Access is from Salcha Drive at milepost 319.3 of the Richardson Highway. Surface area is 20.7 ha and maximum depth is 8.5 m. The lake was first stocked in 1963 with coho salmon. Arctic char, Chinook salmon, and rainbow trout were stocked throughout the 1980s. By the late 1990s, the fishery was supported with annual stockings of catchable rainbow. This stocking regime was maintained until 2013. Little Harding Lake was managed under Special Management from 1994–2013. Fishing was limited to the open water season and the daily bag and possession limit was 1 fish 18 inches (457 mm) or greater in length. These regulations were implemented in response to requests from the public for fisheries with larger rainbow trout. In 2011, area managers and biologists started receiving reports of angler's catching northern pike in the lake. The lake was sampled in spring 2011 to confirm these reports. Rainbow trout captured during sampling were stocked in 2008, 2009, or 2010.

Manchu Lake is approximately 40 km southeast of Fairbanks on Fort Wainwright property and is accessed through EAFB (Figure 2). A RAP from the Army is required to access the lake. Surface area is 15.6 ha and maximum depth is 3.7 m. The lake was first stocked in 1981 with sheefish. Arctic char, coho salmon, and rainbow trout were also stocked in the 1980s and 1990s. Currently, subcatchable Arctic char and catchable rainbow trout are stocked annually. There were no current ADF&G survey records for this lake and northern pike were reported to be present. Area managers wanted to verify the presence of northern pike, to assess population LFDs and overall health of stocked species, and to determine if the population LFD for rainbow trout met management objectives. Rainbow trout captured during spring 2013 were stocked as catchables in 2012.

Moose Lake is approximately 40 km southeast of Fairbanks on EAFB (Figure 2). A HTF permit from the EAFB Department of Natural Resources is required to access the lake. Surface area is 14.1 ha and maximum depth is 18.5 m. The lake was first stocked in 1981 with coho salmon. Rainbow trout were added in 1988, Arctic grayling in 1993, and Arctic char in 1999. Currently, catchable Arctic char are stocked on even years and catchable Arctic grayling and rainbow trout are stocked annually. Northern pike are also present. There were no current ADF&G survey records for this lake. Area managers wanted to know if stocked fish were present given the presence of northern pike, the population LFDs and overall health of stocked species, and if the population LFD for rainbow trout met management objectives. Sampling was conducted in spring 2012.

North Pole Pond is 16 km southeast of Fairbanks in the community of North Pole (Figure 2). Surface area is 6.9 ha and maximum depth is 18.5 m. The lake was first stocked with rainbow trout in 1992. Coho salmon were stocked once in 1995 and the lake is currently stocked with catchable Arctic grayling, Arctic char, and Chinook salmon annually. North Pole Pond does not support fish over winter. Low (<1 mg/L) DO levels were observed during winter sampling in 1999–2001 (ADF&G *unpublished data*[4]). Managers wanted a crude estimate of abundance and size of fish at the end of the summer fishery to know what was available for the winter fishery. Our goal was to stock sufficient numbers of fish to provide for both summer and winter fisheries but not leave too many fish that will likely die from winterkill. Fish captured in fall 2013 were stocked as catchables earlier that summer.

[4] Water quality data are stored in a database at Alaska Department of Fish and Game, 1300 College Road, Fairbanks, Alaska.

North Twin Lake is approximately 13.5 km south of Delta Junction on Meadows Road and lies within the USAG Alaska DTA East (Figure 3). Access is by road and requires a RAP from the Army. Surface area is 6.4 ha and maximum depth is 13.5 m. The lake was first stocked in 1966 with rainbow trout. Coho salmon were first stocked in 1978, Chinook salmon in 1985, and lake trout in 1991. Currently, catchable rainbow trout are stocked annually. North Twin Lake was last evaluated in 1999 (Behr et al. 2005). Managers wanted to know the population LFDs of the different stocked species, their overall health, and if the population LFD for rainbow trout met management standards. Rainbow trout captured during fall 2013 were stocked as fingerlings in 2010 and catchables in 2013.

Paul's Pond is 4.2 km from the Coal Mine Road parking area, 38 km south of Delta Junction (Figure 3). Access is by trail. Surface area is 2.2 ha and maximum depth is 6.5 m. The lake was first stocked with Arctic grayling in 1978. Lake trout were first stocked in 1988, Arctic grayling in 1992, and Arctic char in 1995. Currently, catchable Arctic grayling are stocked on even years. There were no ADF&G survey records available for this lake and managers wanted to know the population LFD and overall health of stocked fish. Arctic grayling captured in fall 2011 were stocked as fingerlings in 2010.

Polaris Lake is approximately 40 km southeast of Fairbanks on EAFB (Figure 2). A HTF permit from the EAFB Department of Natural Resources is required to access the lake. Surface area is 19.3 ha and maximum depth is 11.0 m. The lake was first stocked in 1997 with Arctic char and rainbow trout and in 1998 with Chinook salmon. Currently, catchables of all three species are stocked annually. Anglers frequently report catching large Arctic char and occasionally northern pike (Thomas Slater, Natural Resource Biologist, EAFB Department of Natural Resources, *personal communication*). No ADF&G survey records were available for this lake and DO levels lethal to stocked fish (<1 mg/L) were observed during winter 2005–2010 (ADF&G *unpublished data*[5]). ADF&G managers wanted to know if stocked species were present and their overall health given reports of northern pike and low winter oxygen levels. Fish captured in spring 2013 were stocked in 2010, 2011, or 2012.

Quartz Lake is 16 km north of Delta Junction and approximately 3.4 km east of the Richardson Highway (Figure 3). Surface area is 590.0 ha and maximum depth is 11.5 m. The lake was first stocked in 1971 with rainbow trout, coho salmon stockings began in 1977, Arctic char were introduced in 1992, and Chinook salmon were first stocked in 1993. Currently, subcatchable Arctic char are stocked on odd years and catchable rainbow trout and Chinook salmon and fingerling coho salmon are stocked annually. Stocked fish were found dead along the shore at Quartz Lake in spring 2013 and anglers said they did not see or catch salmon stocked prior to 2013. Managers wanted to know if fish from previous stocking years were present and to assess the growth and overall health of recently stocked fish. Rainbow trout captured in fall 2013 were stocked as catchables earlier in the summer.

Rainbow Lake is a remote lake 106 km southeast of Fairbanks (Figure 3). Access is by aircraft or a 17.2 km winter trail that crosses the Delta River near Delta Junction. Surface area is 35.0 ha and maximum depth is 10.5 m. The lake was first stocked in 1971 with rainbow trout. Currently, fingerling rainbow trout are stocked on even years. Rainbow Lake was under special management at the time of sampling. In 2012, anglers reported catching fewer large fish. Managers wanted to know if the population LFD was meeting management objectives under the

[5] Water quality data are stored in a database at Alaska Department of Fish and Game, 1300 College Road, Fairbanks, Alaska.

current stocking regime for special management regulations. Fish captured in summer 2012 were stocked as fingerlings in 2006, 2008, and 2010.

Rangeview Lake is approximately 4.3 km from the Coal Mine Road parking area, 38 km south of Delta Junction (Figure 3). Access is by trail. Surface area is 1.8 ha and maximum depth is 5.2 m. The lake was first stocked with Arctic char in 1987. Arctic char and Arctic grayling have been consistently stocked since 1992. Lake trout were stocked once in 1994. Wild populations of both Arctic grayling and lake trout existed before stocking. Currently, fingerling Arctic grayling are stocked on even years and subcatchable Arctic char are stocked on odd years. There were no current ADF&G survey records for this lake. Managers wanted to know population LFDs and overall health for stocked species. Most fish captured in fall 2011 were stocked in 2009 or 2010.

Richardson Highway 28 Mile Pit is 11 km south of the Richardson Highway EAFB exit. There is a primitive road and parking area at milepost 335.1 of the Richardson Highway (Figure 2). Surface area is 2.9 ha and maximum depth is 6.0 m. The lake was first stocked in 1977 with fingerling coho salmon. Arctic grayling were first stocked in 1985, Arctic char in 1988, and rainbow trout in 1989. Northern pike were captured in 2000 (Behr et al. 2005) and an angler reported catching northern pike in 2012. Currently, catchable Arctic grayling and rainbow trout are stocked annually. Area managers wanted to know population LFDs and overall health for stocked species, if the population LFD for rainbow trout met management objectives, and to confirm the presence of northern pike. Sampling was conducted in spring 2012.

Sheefish Lake is approximately 13.5 km south of the Delta Junction on Meadows Road and lies within the USAG Alaska DTA East (Figure 3). Access is by 1.2 km trail and requires a RAP from the Army. Surface area is 2.9 ha and maximum depth is 12.0 m. The lake was first stocked with sheefish fry in 1977. Arctic grayling were first stocked in 1986, lake trout in 1988, Arctic char in 1992, and Chinook salmon in 2000. Currently, catchable Arctic grayling and subcatchable Arctic char are stocked annually. The lake was last evaluated in 2002 and only 3 fish were captured (Behr et al. 2005). Since this time, we noticed the water level in Sheefish Lake was dropping and managers wanted to know if stocked fish survived winter given this decline. Arctic char captured during spring 2012 were stocked in 2008, 2010, or 2011.

Sirlin Drive Pond is approximately 6 km southeast of Fairbanks, 0.8 km north of the Richardson Highway, and in the community of North Pole (Figure 2). Surface area is 1.5 ha and maximum depth is 3.1 m. The lake was first stocked with catchable rainbow trout in 1996. Currently, catchable rainbow trout are stocked annually. Stocked fish populations in Sirlin Drive Pond had never been evaluated and northern pike were reported to be present in the lake. Sampling was conducted in spring 2011 to determine if stocked fish survived winter and to confirm angler reports of northern pike.

South Twin Lake is approximately 13.5 km south of Delta Junction on Meadows Road and lies within the USAG Alaska DTA East (Figure 3). Access is by road and requires a RAP from the Army. Surface area is 5.4 ha and maximum depth is 5.1 m. The lake was first stocked with fingerling rainbow trout in 1966, coho salmon were initially stocked in 1976, Chinook salmon were stocked once in 1985, and catchable rainbow trout are currently stocked annually. Rainbow trout and lake trout were captured when South Twin Lake was last evaluated in 1999 (Behr et al. 2005). ADF&G mangers wanted to know population LFDs, the overall health of stocked species, and if the population LFD for rainbow trout met management objectives under the current

stocking regime. Most rainbow trout captured in fall 2012 were stocked in 2012 or earlier in 2013.

Upper Copper-Upper Susitna River Management Area

Buffalo Lake is on the north side of the Glenn Highway, 52 km west of Glennallen, at milepost 156.2 (Figure 4). Surface area is 2.9 ha and maximum depth is 5.5 m. The lake was first stocked in 1971 with fingerling rainbow trout. Coho salmon and Arctic grayling were stocked in the 1970s and 1980s respectively. Currently, catchable rainbow trout are stocked annually. Buffalo Lake was last evaluated in 2007 and rainbow trout grew to a satisfactory size (Skaugstad and Behr 2010). Managers wanted to know if the population LFD for rainbow trout was meeting management objectives under the current stocking regime. Fish captured in 2013 were stocked in 2011, 2012, or earlier in 2013.

Gergie Lake is approximately 1.5 km south of the Glenn Highway, 55 km west of Glennallen (Figure 4). Access is by trail. Surface area is 31.1 ha and maximum depth is 5.2 m. The lake was first stocked in 1966 with rainbow trout. Currently, fingerling rainbow trout are stocked on alternate years. Stockings were changed from even to odd years in 2011 to balance hatchery production schedules. Gergie Lake occasionally experiences winterkill events; however, fish stocked in 2004 survived winter and were larger than expected in 2005 (Behr and Skaugstad 2007S). Managers wanted to know if stocked fish survived winter and if population LFD for rainbow trout met management objectives under the current stocking regime. Sampling was conducted in summer 2013.

John Lake is west of Glennallen, 13 km north of the Glenn Highway at milepost 140 (Figure 4). Access is by a 16 km trail. Surface area is 56.6 ha and the maximum depth is 7.0 m. The lake was first stocked in 2004 with fingerling rainbow trout. Rainbow trout stockings were discontinued in 2010 and fingerling Arctic char were stocked in 2011. Cabin owners reported stocked fish did not survive in John Lake. No evaluation records were available and managers wanted to know if stocked rainbow trout were still present in John Lake; and the population LFD and overall health of recently stocked Arctic char. Fish captured in 2011 were stocked earlier in the year.

Junction Lake is east of Lake Louise Road, 0.3 km from the Glenn Highway, and approximately 47 km west of Glennallen (Figure 4). Surface area is 4.8 ha and maximum depth is 5.8 m. The lake was first stocked with fingerling Arctic grayling in 1966. Fingerling stockings continued until 1996. Catchable Arctic grayling were stocked in 2000 and 2003. Stockings were suspended after the 2003 stocking season because ADF&G hatcheries discontinued catchable Arctic grayling production. Hatchery production resumed in 2009 and catchable Arctic grayling were stocked again in 2013. In 2012, prior to reintroducing stocked fish, ADF&G managers wanted to know if previously stocked Arctic grayling were reproducing naturally. Sampling was conducted in fall 2012.

North Jans Lake is a remote lake, approximately 7 km east of Lake Louise (Figure 4). Access is along an 11 km winter trail from Lake Louise Road. Surface area is 25.3 ha and maximum depth is 9.0 m. The lake was first stocked with rainbow trout in 1977. Currently, fingerling rainbow trout are stocked on even years. No evaluation records were available for North Jans Lake and managers wanted to know if stocked fish survived winter and if the rainbow trout population LFD was meeting management objectives under the current stocking regime. Fish captured in 2011 were stocked in 2006, 2008, and 2010.

Ryan Lake is south of the Glenn Highway at milepost 149 (Figure 4). Surface area is 12.9 ha and the maximum depth is 3.7 m. The lake was first stocked in 1952 with rainbow trout. Steelhead *O. mykiss*, coho salmon, Chinook salmon, lake trout, and Arctic grayling were sporadically stocked in 1954–1994. Both fingerling and catchable rainbow trout were stocked into Ryan Lake throughout the 1980s and 1990s. Fingerling rainbow trout stockings were discontinued in 1999 after high catch rates were observed during sampling (n=255 rainbow trout, Behr et al 2005). Currently, catchable rainbow trout are stocked annually and catchable Arctic grayling were added to the annual stocking regime in 2013. Fingerling rainbow trout were released temporarily in 2007 and 2009 because sufficient catchable size fish were not available from ADF&G hatcheries. ADF&G managers wanted to know if the rainbow trout population LFD was meeting management objectives under the current stocking regime. Rainbow trout captured in fall 2012 were stocked in 2009 and 2012.

Sculpin Lake is southeast of Glennallen and south of McCarthy Road at milepost 12.6 (Figure 4). Access is along a 0.4 km foot trail. Surface area is 48.4 ha and maximum depth is 9.0 m. The lake was first stocked in 1968 with fingerling rainbow trout. Arctic char and coho salmon were stocked once in 1994 and 1979 respectively. Currently, fingerling rainbow trout are stocked on alternate years. Sculpin Lake was last evaluated in 2005; prior stockings had been inconsistent due to fluctuations in hatchery production but management objectives were achieved (Behr and Skaugstad 2007). In September 2013, an angler reported a decline in fishing effort and poor growth of stocked fish. ADF&G managers wanted to know if management objectives for the rainbow trout population were still being achieved given recent consistent alternate year stockings and a possible decline in fishing pressure. Rainbow trout captured in spring 2013 were stocked in 2009 and 2011.

South Jans Lake is a remote lake, approximately 7 km east of Lake Louise (Figure 4). Access is along an 11 km winter trail from Lake Louise Road. Surface area is 34.6 ha and maximum depth is 8.5 m. South Jans Lake was first stocked with coho salmon in 1967. Chinook salmon were stocked once in 1984 and rainbow trout were first introduced in 1985. Currently, fingerling coho salmon and rainbow trout are stocked on alternate years. Coho salmon stockings were suspended in 2002–2008 due to reports of overstocking. ADF&G managers wanted to know population LFDs and overall health for stocked species given recent stocking adjustments. Fish captured in spring 2011 were stocked in 2006, 2008, and 2010.

Three Mile Lake is north of Chitina and east of the Edgerton Highway at milepost 29.7 (Figure 4). Surface area is 9.7 ha and the maximum depth is 8.0 m. The lake was first stocked in 1960 with coho salmon. Rainbow trout and Arctic grayling were first released in 1964 and 1984 respectively. Currently, catchable rainbow trout are stocked annually. Fingerling rainbow trout were stocked temporarily in 2007–2011 due to reductions in hatchery production. Managers wanted to know if fingerling rainbow trout survived winter and if the population LFD met management objectives given recent stocking adjustments. Fish captured in fall 2012 were stocked in 2009, 2011, and 2012.

WILD LAKE EVALUATIONS

North Slope Management Area

BBB Lake is 9.4 km west of the Dalton Highway on the north side of the Brooks Range (Figure 5). Access is by aircraft. Surface area is 34.4 ha and maximum depth is 3.2 m. There is a proposed road from the Dalton Highway, at approximately milepost 279, to the community of

Umiat. This road is part of the Foothills West Transportation Project and is intended to improve access to known oil and gas deposits and to encourage development of natural resources within this area. Managers wanted current fish, morphometric, and water quality information on lakes possibly affected by this development. BBB Lake was 1 of 2 lakes selected for sampling in summer 2012; the lake lies 2 km west of the proposed road.

Itkillik Lake is 23 km west of the Dalton Highway and 19 km southwest of the proposed road to Umiat (Figure 5). Access is by aircraft. Surface area is 438.7 ha and maximum depth is 13.5 m. Like BBB Lake, Itkillik Lake was selected for sampling because of its proximity to the Foothills West Transportation Project. Fish, morphometric, and water quality data were collected in summer 2012.

Tanana River Management Area

5th Avenue Pond is adjacent to a tributary of the Chena Slough located in the community of North Pole, approximately 16 km southeast of Fairbanks (Figure 2). Surface area is 0.5 ha and maximum depth is 4.9 m. A member of the public nominated 5th Avenue Pond for stocking in 2011. No survey records exist for this location. Managers requested morphometric and water quality data to determine if lake conditions were acceptable for stocking. Sampling was conducted in fall 2011 and additional water quality sampling was conducted in winter 2012.

Bear Lake (DTA) is approximately 21 km west of the Delta River, 9 km east of Delta Creek, and lies within the USAG Alaska DTA West (Figure 3). Access is by trail and requires a RAP from the Army. Surface area is 50.6 ha and maximum depth is 9.0 m. USAG Alaska requested the support of ADF&G to conduct a planning level survey of aquatic resources on six DTA West lakes. Bear Lake was selected as 1 of the 6 study lakes. Fish, morphometric, and water quality data were collected. Sampling was conducted during March and July 2011.

Boot Lake (DTA) is approximately 21 km west of the Delta River, 8 km east of Delta Creek, and lies within the USAG Alaska DTA West (Figure 3). Access is by trail and requires a RAP from the Army. Surface area is 47.9 ha and maximum depth is 7.0 m. Fish, morphometric, and water quality data were collected in 2011 at the request of USAG Alaska.

Fall Lake (DTA) is 25.5 km west of the Delta River, 3 km east of Delta Creek, and lies within the USAG Alaska DTA West (Figure 3). Access is by trail and requires a RAP from the Army. Surface area is 22.5 ha and maximum depth is 8.0 m. Fish, morphometric, and water quality data were collected in 2011 at the request of USAG Alaska.

Fielding Lake is 2.7 km west of the Richardson Highway at milepost 203.5 (Figure 3). Surface area is 561.9 ha and maximum depth is 23.0 m. Fielding Lake receives a high level of fishing effort and managers requested an updated bathymetric map for anglers. Morphometric data were collected in fall 2013.

Josh Lake (DTA) is approximately 13.5 km south of Delta Junction on Windy Ridge Road (accessed from Meadows Road) and lies within USAG Alaska DTA East (Figure 3). Access is by trail and requires a RAP from the Army. Surface area is 2.3 ha and maximum depth is 10.5 m. An ADF&G manager observed wild Arctic grayling trying to enter J Lake (an adjacent stocked lake) through a small stream that flows from J Lake to Josh Lake. Fish passage between the 2 lakes is currently blocked by a rock gabion. Managers wanted to know what fish species were in Josh Lake, their size range, and to locate potential inlets and outlets to determine if fish could move between the 2 lakes. Sampling was conducted in spring 2012.

Lake Minchumina is 245 km southwest of Fairbanks, south of the Kuskokwim Mountains, in the headwaters of the Kantishna River (Figure 2). Access is by aircraft or winter trail. Surface area is 5,995.1 ha and maximum depth is 16.0 m. Depth data for this lake was last collected by ADF&G in 1974 and managers requested an updated bathymetric map for management needs and for anglers. Lake Minchumina was mapped in spring 2012.

Skate Lake is 267 km southeast of Delta Junction, 0.3 km east of the Nabesna River in the community of Northway (Figure 3). Surface area is 23.1 ha and maximum depth is 3.2 m. The lake was nominated for stocking by the Northway Village Council in April 2012. ADF&G managers wanted to know what fish species were present and their size range, water quality, and lake morphometry to determine stocking feasibility. Sampling was conducted in spring 2013.

Spring North Lake (DTA) is approximately 24 km west of the Delta River, 5 km east of Delta Creek, and lies within the USAG Alaska DTA west (Figure 3). Access is by trail and requires a RAP from the Army. Surface area is 28.7 ha and maximum depth is 4.2 m. Fish, morphometric, and water quality data were collected in 2011 at the request of USAG Alaska.

Summer Lake (DTA) is approximately 27 km west of the Delta River, 0.5 km east of Delta Creek, and lies within the USAG Alaska DTA west (Figure 3). Access is by trail and requires a RAP from the Army. Surface area is 22.6 ha and maximum depth is 2.6 m. Fish, morphometric, and water quality data were collected in 2011 at the request of USAG Alaska.

Totek Lake is approximately 8 km southwest of Dune Lake and 11 km east of the Toklat River. Surface area is 102.1 ha and maximum depth is 1.4 m. There is a Division of Natural Resources (DNR) subdivision surrounding the lake. No survey records exist for this location. Managers wanted fishery, morphometric, and water quality information to identify potential sport fishing opportunities and possible affects resulting from current development. Sampling was conducted in spring 2011.

Triangle North Lake (DTA) is approximately 24 km west of the Delta River, 4.8 km east of Delta Creek, and lies within the USAG Alaska DTA west (Figure 3). Access is by trail and requires a RAP from the Army. Surface area is 11.3 ha and maximum depth is 4.0 m. Fish, morphometric, and water quality data were collected in 2011 at the request of USAG Alaska.

Upper Copper River-Upper Susitna River Management Area

Crescent Lake is 1 km north of the Fish Lakes and 4 km west of the Richardson Highway at Summit Lake (Figure 4). Surface area is 15.5 ha and maximum depth is 5.0 m. There were no ADF&G survey records for this lake and Arctic grayling were reported to be present. Fish, morphometric, and water quality data were collected in summer 2011 at the area manager's request.

Mentasta Lake is located on Mentasta Spur Road (Glenn Highway/Tok cutoff), approximately 130 km northeast of Glennallen (Figure 4). Surface area is 505.6 ha and maximum depth is 5.8 m. The lake was last surveyed by ADF&G in 1960 and managers wanted an updated bathymetric map. Mentasta Lake was mapped in spring 2012.

Summit Lake is 130 km north of Glennallen, east of the Richardson Highway (Figure 4). Surface area is 1,770.1 ha and maximum depth is 63.5 m. Bathymetric data for this lake was last collected in 1963. Area managers wanted an updated bathymetric map for anglers. Summit Lake was mapped in fall 2013.

METHODS

FISH

Fish populations in 44 lakes were selected for sampling in 2011–2013 (Table 1; Figures 2-5). Fishery managers needed information about the population LFD for rainbow trout populations in 19 lakes to determine if current stocking strategies created the desired population LFD. In the other 25 lakes managers were only interested in basic information to determine if stocked or wild species were present, to visually assess their overall health (body robustness and fin condition, presence of external parasites, and indications of disease), or to provide a crude estimate of their length distribution. A less than typical body volume to body length relation is a quick (visual) but subjective indicator that some undetermined factor is adversely affecting growth of individual fish. Summary information about all sampled populations was made available to anglers through the Alaska Lake Database (ALDAT) accessible at http://www.adfg.alaska.gov/index.cfm?adfg=fishingSportStockingHatcheries.lakesdatabase.

Sampling Procedure

Fyke nets and tangle nets were used to sample fish populations in stocked lakes. Fyke nets, tangle nets, and minnow traps were used to sample fish populations in wild lakes. Amount of capture gear and duration of sampling projects was based on lake size (Table 2). More capture gear was used in larger lakes and the project duration was increased. Sampling was stopped at the end of the allotted time regardless of number of fish captured.

Fyke nets were set near shore on lake bottom in 1 to 2 m of water. 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 measuring 7.5 m long by 1.2 m deep were attached to each side of the open end. The net body was positioned parallel to shore and the wings set to form a "V." Each fyke net was pulled taut from the cod end and held in position with a weight.

Table 2.–Amount of capture gear and duration of sampling project by lake size.

Surface area (ha)	Days	Fyke nets	Tangle nets	Minnow traps[a]
0 to 20	1	4	1	5
>20 to 40	2	4	1	5
>40 to 200	3	4	2	8
>200 to 400	3	6	2	10
>400	3	8	2	10

[a] Minnow traps were only used during wild lake evaluations.

Tangle nets were set perpendicular to shore in water deeper than 2 m. 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 fish were captured by entanglement around the mouth and not by gill covers. Two net types were used. One net was a "floater;" the float line buoyancy was greater than the weight of the lead line. The other net was a "sinker;" the lead line was weighted to overcome the buoyancy of the float line. The "floater" had a triple float line and 13.5 kg lead line. The "sinker" had a double float line and a 31.5 kg lead line. Generally, tangle nets were checked every 30

minutes. The field crew leader adjusted the time interval between net checks depending on an immediate assessment of the physiological condition of captured fish.

Minnow traps were used in near shore areas in 1 to 2 m of water. Traps were made of 6 mm wire mesh and were 22 cm in diameter by 42 cm long with an inward pointing funnel at each end. Traps were baited with unsalted salmon row or raw shrimp. A vertical line with a float on one end and a weight on the other was attached to each trap and positioned horizontally in the water column.

Captured fish were measured to the nearest mm FL. Fish captured for the first time regardless of gear type were marked by removing a half circle of tissue from the trailing edge of the upper lobe of the caudal fin. The mark was made with a paper punch that produced a 7 mm diameter circular hole. Subsequent recaptures were recorded but the data were not used for analysis.

Fish were also visually examined for external signs of disease, presence of parasites, and fin condition. Fish were also subjectively judged "thin," "normal," or "robust" by comparing the overall body volume to what an experienced biologist would consider typical for the body length. Unless otherwise noted, all fish were released alive after sampling.

The field crew monitored water temperature daily 1 m beneath the surface near set locations. We tried to conduct all fish sampling when water temperature was <18°C.

Fishery Data Reduction and Analysis

For stocked lakes, we used the population model described by Skaugstad (*In prep*) to estimate minimum length standards (*m*LS) for each stocked rainbow trout fishery.

Sample data were described using standard statistical methods (Cochran 1977) to calculate mean lengths ($\hat{\bar{L}}$) and associated variances within length categories specific to each management approach (>200 mm and ≤350 mm for the regional approach and >350 mm for the conservative and special approaches). LFD plots were generated for both stocked and wild species when 10 or more fish of the same species were captured in a single lake.

Length data were compared to modeled population length distributions *m*LFDs using both visual and statistical methods. For visual comparison, LFDs generated using sample data were plotted with the corresponding *m*LFDs derived from the model. Statistically, we compared observed means ($\hat{\bar{L}}$) to *m*LS using a bootstrap procedure that generated a p-value to evaluate H_0: $\hat{\bar{L}} \geq m\text{LS}$, α=0.05 (Appendix C). A fishery did not meet or exceed its minimum standard when we rejected H_0.

When comparing population means to *m*LS, Skaugstad (*In prep*) found differences were significant even when small (<5%). This occurred when large numbers of fish were captured during population sampling (large sample sizes). Because small differences between sample mean lengths and *m*LS are not meaningful to anglers, we considered management objectives achieved in cases where we rejected H_0 and the difference between sample mean length $\left(\hat{\bar{L}}\right)$ and *m*LS was ≤5% $\left[i.e.\left(\hat{\bar{L}} - mLS\right)/mLS \times 100\% \leq 5\%\right]$.

For wild lakes, sample data were summarized to show fish species present and size range (smallest and largest fish by species). LFD plots were generated when 10 or more fish of the same species were captured. All fish data was archived in the Alaska Lake Database (ALDAT)

and is accessible to the public at http://www.adfg.alaska.gov/index.cfm?adfg=fishingSportStockingHatcheries.lakesdatabase.

Assumptions and Bias

One potential concern using data from one-event capture experiments is inadequate data are collected to evaluate size bias. For our studies, size bias would have the greatest potential affect to statistical tests performed to evaluate stocked fisheries. An accurate estimate of a population LFD requires that all fish in a population have the same probability of capture. In practice, this probably does not happen and this assumption cannot be evaluated with one-event capture experiments. Skaugstad et al. (2010) presented a comprehensive review of the literature and previous work by ADF&G, including an analysis of effect of bias for various scenarios related to this and similar studies.

Lake sampling was also conducted when water temperature was cool to further reduce the risk of size bias in our catch. Our review of other studies has shown that the likelihood of size bias is low when sampling is restricted to periods when water temperature is <18°C (Skaugstad et al. 2010). We anticipate two-event mark-recapture experiments will be conducted periodically for larger lakes, which are stocked annually and support multiple age cohorts. We will continue to use information from these studies to evaluate potential size bias associated with one-event sampling.

WATER QUALITY

When we sample fish populations, we usually collect water temperature and DO data at predetermined depths (Mansfield and Behr 2011). All data are archived in a Water Quality database at ADF&G, 1300 College Road, Fairbanks, Alaska.

Water quality parameters were measured at 43 lakes. Physical and chemical properties were measured at 2 stations in each lake. One station was situated at the maximum depth of each major basin present in the lake. The other station was located equal distance between the maximum depth and shore (along the long axis of the lake; Koenings et al. 1987).

A *YSI Incorporated Environmental Monitoring System 6600 Sonde* or *Hydrolab MiniSonde 4a* was used to measure temperature, pH, DO, percent DO, specific conductivity, and total dissolved solids (TDS). Readings were recorded at 0.5 m intervals from the surface down to 5 m, and then at 1 m intervals until the lake bottom was reached. Instrument accuracy was ± 0.1°C for temperature, ± 0.2 mg/L for DO, and ± 1 µS/cm for specific conductivity.

A 1 L sample of lake water was taken from a depth of 0.3 m and later titrated at room temperature to determine total alkalinity. Subsamples of 100 mL were titrated with sulfuric acid (0.02N) to an endpoint of pH 4.5 and the amount of titrant was recorded (Koenings et al. 1987). Each water sample was analyzed 3 times and the average was taken to determine total alkalinity.

Water transparency was measured using a Secchi disk, following methods outlined by Koenings et al. (1987). Lake type and water color (Table 3), GPS coordinates, date, time, and weather conditions (e.g., cloud cover, air temperature) were also noted at the time of sampling.

Table 3.–Descriptions of lake type and water color.

Code	Description	Definition
Lake Type		
GIS	Glacial Ice Scour	excavations of bedrock to form a depression
GM	Glacial Moraine	glacial deposits of sediment that form a rim; basins
GT	Glacial Thaw/Thermakarst	a depression in permafrost soil that prevents drainage
GK	Glacial Kettle	Stagnant glacier block displaces soil to make a depressions
TFB	Tectonic Fault Block	Fracture, faulting and warping define a depression and rim
TRD	Tectonic Reverse Drainage	Uplift and tilting redirect drainage
FLU	Fluvial	Oxbow or dam – coupled erosion and deposition close a river segment or fluvial sediments barricade a flow
AGQ	Artificial	Gravel, borrow pit, or quarry
AB	Artificial	Beaver dam
AR	Artificial	Reservoir
Water Color		
CLR	Clear	Transparent water, or nearly so.
FER	Ferric	Rust- (orange) stained.
GHT	Glacial, High Turbidity	High turbidity waters (visibility ≤30 cm (12 in) typical of
GLT	Glacial, Low Turbidity	Low turbidity waters (visibility >30 cm) typical of systems
HUM	Humic	Tea-colored water (tannic)
MUD	Muddy	Dark water with high suspended particulate load.

MORPHOMETRY AND OTHER LAKE CHARACTERISTICS

Morphometric and other lake characteristic data were collected at 20 lakes.

Position and depth data were collected using a *Lowrance HDS 5 Lake Insight* sonar unit equipped with a GPS receiver mounted in a small skiff. Location data were recorded in Lowrance Mercator Meter format. Data were collected along multiple transects. The first transect followed the shoreline within 5 m where adequate depth allowed (>0.5 m). When shallow water was encountered (<0.5 m), data were collected further from shore until water depth was adequate to maneuver the skiff. Remaining transects were equally spaced and parallel to the long axis of each lake. The number of transects was determined by lake size. Lakes that were less than 40 ha had a minimum of 6 transects, lakes between 40 and 200 ha had a minimum of 10 transects, and lakes that were 200 to 800 ha had a minimum of 15 transects. If the lake bottom appeared to be highly variable more transects were added after the initial survey was complete. Position and depth data were recorded every 2 s and saved to an internal SD card. Position data were converted to WGS84 (decimal degrees to the fifth decimal place) using methods provided by Lowrance:

$$Longitude=RadDeg*(X/r) \quad (1)$$

and

$$Latitude=RadDeg*(2*\arctan(e^{(Y/r)})-\pi/2) \quad (2)$$

where

X = the X positon recorded in Mercator Meters from the Lowrance unit;

Y = the Y position recorded in Mercator Meters from the Lowrance unit;

RadDeg = the number of degrees in 1 radian (57.2957795132°); and

r = the assumed radius of the earth (6,356,752.3142 m).

This conversion assumes the earth is a sphere with a fixed radius (r) and does not account for the actual ellipsoid shape of the earth.

Position and depth data were imported into ESRI ArcGIS® Desktop 10.3 and used to generate bathymetric maps and to calculate lake morphometric statistics. Reported maximum depth is the maximum depth we observed in our data. We used satellite imagery[6] and the coordinates of our collected depth data to draw lake perimeter polygons. The *Calculate Geometry* tool was used to determine surface area and shoreline length from lake perimeter polygons. The *Create TIN* (triangulated irregular network) and *Surface Contour* 3D Analyst Extension tools were used to create 3-dimensional and line representations of depth data. The *Surface Volume* 3D Analyst Extension tool was used to calculate lake volume from each 3-dimensional rendering. These methods are similar to those outlined in British Columbia Ministry of Environment Ecosystems (2009):

- Surface area was rounded to the nearest 0.1 ha (100 m^2).
- Shoreline length was rounded to the nearest 0.01 km (10 m) for lakes <10 ha and 0.1 km (100 m) for lakes ≥10 ha.
- Maximum depth was rounded to the nearest 0.1 m for lakes <6 m deep and 0.5 m for lakes ≥6 m deep.
- Volume was rounded to the nearest 10,000 m^3.

We recognize this level of implied accuracy may not be appropriate for all lakes, especially for very large or small lakes. We tried to minimize error by exercising consistent data collection and analysis techniques; however, there is likely some level of unknown variation in our measurements due to instrument accuracy, weather, wave action, cloud cover, resolution of satellite imagery, the speed and type of boat used during data collection, and aquatic vegetation.

The immediate surroundings (up to 5 m from shore) of each lake were described through visual observations. This included documenting inlets and outlets and noting the general vegetation cover as tundra, shrub (willow), deciduous, coniferous, or a combination of these types. Lakes were classified into 1 of 5 categories based on lake outlet: landlocked, intermittent, barriered, flood prone, or open.

At each lake, a minimum of 2 digital photographs were taken: 1 photograph was taken from the south shore looking north, and 1 photograph was taken from the north shore looking south. Additional photographs were taken of notable habitat features or other subjects of interest at each lake. Aerial photographs were taken if a lake was accessed by aircraft.

RESULTS & DISCUSSION

In this section, we present our data and observations for lakes sampled within each Sport Fish Management Area.

[6] Best Data Layer Imagery (c. 2010, v1) from the University of Alaska (UA) Geographic Information Network of Alaska (GINA) in Alaska Albers projection.

STOCKED LAKE EVALUATIONS

We sampled both stocked and wild fish species in 32 stocked lakes to evaluate various fishery related attributes, including species presence, size range, and overall health. For each lake, we described our rationale for making recommendations to change stocking regimes or to conduct future research. We based our recommendations on the examination of population LFDs, the use of ancillary limnology information, and our experience to diagnose a probable cause underlying any differences between the observed and expected population LFDs. We recommended suitable adjustments to the stocking scheme with the purpose of eventually achieving the expected population LFD. Occasionally, we discovered for some fisheries the desired population abundance or LFD is not achievable due to natural limits of the system, the number of fish harvested is too high to be sustainable, or both. Depending on circumstances, we recommended that a fishery be moved to a different management category, suggested an alternate species for stocking, or proposed that a lake be removed from the stocked fisheries program. Stocking recommendations for fish size are presented in weight instead of length because ADF&G hatcheries use biomass to plan production schedules. Life stages commonly referred to throughout this report are summarized in Table 4, along with corresponding weights and approximate lengths.

Table 4.–Life stage, target weight, and approximate length of stocked fish produced by ADF&G hatcheries.

Life stage	Weight (g)	Length (mm)	Length (in)
Catchable	120	215	8.5
	180	240	9.5
Subcatchable	40	150	6.0
	60	170	7.0
Fingerling	2	60	2.5

In the Statewide Harvest Survey, when there are 12 or more respondents, statistics for angler effort, catch, and harvest are reported for the individual lake or fishery. When there are fewer than 12 respondents, the lake or fishery is grouped with other lakes and fisheries also having fewer than 12 respondents and statistics are reported for the group. However, the number of respondents for each lake or fishery is available for review. In this report, we note when a lake or fishery is reported individually because we assume this indicates greater popularity compared to lakes and fisheries that receive fewer than 12 respondents.

The Stocked Fisheries Program in Region III has about 100 small lakes < 50 ha that typically receive 1 to 11 respondents in the Statewide Harvest Survey. As a crude surrogate for angler effort we assume a lake having 1 to 11 respondents over multiple years is an indicator of greater angler effort compared to a lake having no respondents over multiple years. We also assume a lake having more years with a higher number of respondents suggests greater angler effort and popularity compared to a lake having the same or fewer years with fewer respondents.

DO measurements for some lakes were unusually high, exceeding 110% saturation. We are confident that most measurements were correct based on using formula to recalculate %DO and density from temperature, salinity, and pressure. But, there were extreme measurements we think

were incorrect due to improper calibration of the instrument or malfunctions with the DO probe. These measurements, however, were archived in a database. We decided to not report these data until we are satisfied that the data can be presented with a proper explanation for the unusual measurements.

Tanana River Management Area

Bathing Beauty Pond: Fish data were collected May 17–18, 2011 and water quality data were collected May 18, 2011 and March 18, 2014 (Table 5, Figure 6). Eighteen rainbow trout, 4 Arctic char, and 1 northern pike were captured. Stocked fish were in good overall health with no external signs of parasites or disease. Examination of the observed LFD and recent stockings indicated rainbow trout were age 2, stocked as catchables in 2010 (Figure 6, Appendix B); however, age structures were not collected to confirm this. All fish fell within the defined length category 200–350 mm but were smaller than *m*LS (Table 6). Objectives for rainbow trout in Bathing Beauty Pond were not achieved.

The manner fish are harvested may explain why rainbow trout were smaller than anticipated. Cunningham and Anderson (1992) found larger stocked rainbow trout were more likely to be harvested and at a higher rate than their smaller counterparts. In a previous study at Lisa Lake, we have observed an entire older cohort disappear between spring and fall sampling events (Behr et al. 2005). Bathing Beauty Pond is located near 2 major population centers, Fairbanks and North Pole, and receives a high level of fishing pressure during both summer and winter months. Fishing is reported annually in the Statewide Harvest Survey.

Inconsistent stockings and the presence of northern pike may also be affecting this fishery. Lakes having native populations of northern pike are not ideal for the stocking program because northern pike prey on the stocked species. We try to minimize predation by encouraging anglers to harvest northern pike in stocked lakes and by stocking larger, catchable size fish. However, availability, number, and size of catchable fish have fluctuated in previous years (Appendix B). Maintaining consistent annual stockings of catchable size fish will improve this fishery.

Recommendations

- Stock 3,600 (120 g) or 2,000 (180 g) catchable rainbow trout annually. Release half in mid-May and half in late June.
- Stock 500 catchable (120 g) Arctic grayling annually, target release date mid-June.
- Stock 950 catchable (120 g) Chinook salmon annually, target release date late September.
- Stock 1,000 catchable (120 g) Arctic char every other year, target release date mid-June.

Table 5.–Bathing Beauty Pond data summary for May 2011 and March 2014 sampling.

Fish	5/17–18/2011		
Species	rainbow trout	Arctic char	northern pike
Count	18	4	1
Mean Length (mm)	281	441	515
Standard Error	6.35	3.43	
Minimum Length (mm)	235	434	515
Maximum Length (mm)	336	449	515
Water Quality			
Date	5/18/2011	3/18/2014	
Secchi Reading (m)	ND	ND	
Alkalinity (mg/L $CaCO_3$)	112	ND	
Temperature (°C)	6.2-8.1	0.9-3.4	
DO (mg/L)	2.7-12.4	0.5-5.9	
DO (%)	19-103	4-43	
pH	8.0-8.5	ND	
Specific Conductivity (µS/cm)	261-395	ND	
TDS (ppm)	0.170-0.256	ND	
Water Color	ND	ND	
Max Depth Sampled (m)	7.00	5.75	

ND = No data. Data collection was not attempted.

Table 6.–Bathing Beauty Pond descriptive statistics and test results by length category for rainbow trout captured in May 2011.

Length category	Observed			Model	Bootstrap	
(mm)	Mean (mm)	SE	N	*m*LS (mm)	Mean (mm)	P-value
>200 & ≤350	281	6.35	18	306	281	0.0001

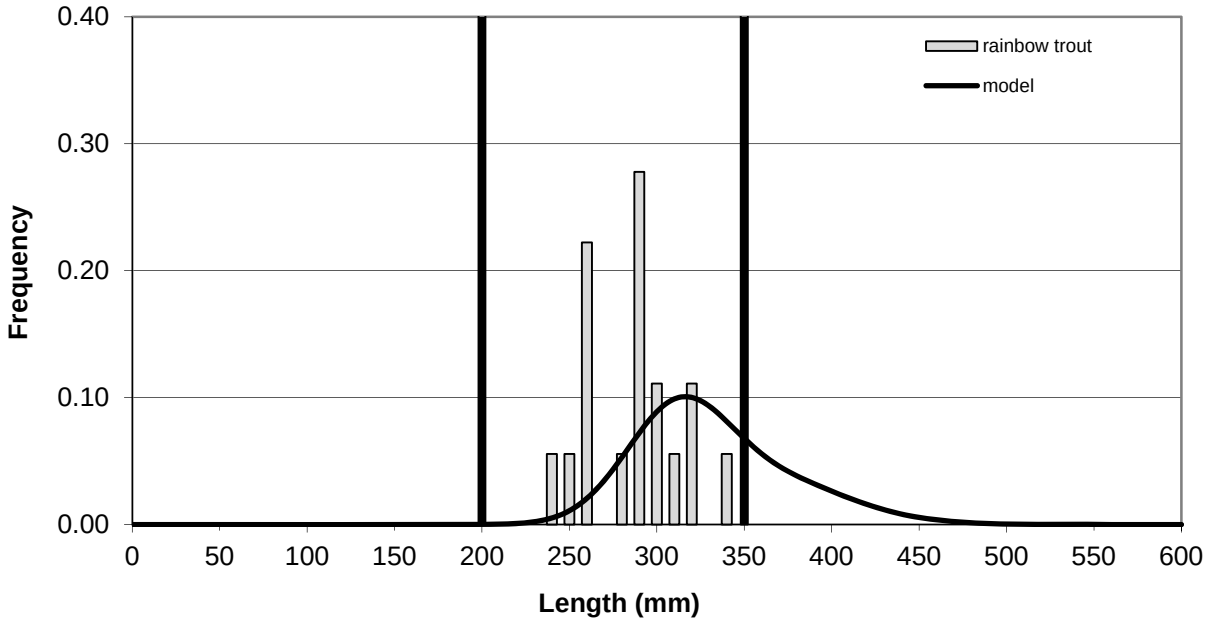


Figure 6.–Bathing Beauty Pond LFD for rainbow trout (n=18) captured May 2011 and plotted with model LFD.

Brodie Lake: Fish and water quality data were collected August 17–18, 2011 (Table 7). Six Arctic char, 1 Arctic grayling, and 1 slimy sculpin *Cottus cognatus* were captured. Age cohorts could not be determined and all fish were in good overall health. Captured Arctic char and Arctic grayling were stocked in 2007, 2008, 2009, and 2010.

Low catch rates were previously observed in Brodie Lake and may be attributed to harvest. Five Arctic char and 8 Arctic grayling were captured when the lake was last evaluated in 1999 (Behr et al. 2005). Brodie Lake is small but supports a popular fishery on Coal Mine Road. Fishing effort as an aggregate of Coal Mine Road lakes is reported annually in the SWHS but could not be evaluated due to too few respondents. Our low catch rates in fall 1999 and 2011, combined with annual reports of harvest, indicate fingerling stockings are not maintaining this fishery. Stockings were not adjusted following 1999 sampling because larger fish were not available. Since then, 2 new hatcheries were constructed in Fairbanks and Anchorage and fingerling Arctic grayling stockings were replaced with catchable stockings in 2013.

The absence of Chinook salmon in our catch is also likely attributed to harvest. Anglers desire Chinook salmon because they are readily caught during both summer and winter months. Anglers have also noted they are more aggressive than other sport fish species. This tendency may result in quick harvest. ADF&G should monitor the SWHS to confirm this species is being harvested and not exhibiting poor in-lake survival.

Recommendations

- Stock 200 subcatchable (20 g) Arctic char every other year, target release date September.

- Stock 300 catchable (120 g) Arctic grayling annually, target release date mid-June.
- Stock 300 catchable (120 g) Chinook salmon annually, target release date late-September.

Table 7.–Brodie Lake data summary for August 2011 sampling.

Fish	8/17–18/2011		
Species	Arctic char	Arctic grayling	slimy sculpin
Count	6	1	1
Mean Length (mm)	312	227	58
Standard Error	23.16		
Minimum Length (mm)	249	227	58
Maximum Length (mm)	400	227	58
Water Quality			
Date	8/18/2011		
Secchi Reading (m)	3.5		
Alkalinity (mg/L $CaCO_3$)	9		
Temperature (°C)	11.1-11.5		
DO (mg/L)	9.6-10.0		
DO (%)	85-91		
pH	6.4-6.5		
Specific Conductivity (µS/cm)	20		
TDS (ppm)	0.013		
Water Color	turbid		
Max Depth Sampled (m)	3.50		

Bullwinkle Lake: Fish and water quality data were collected May 30–31, 2012 (Table 8, Figure 7). Fifty rainbow trout were captured. All fish were in good overall health and had no external signs of parasites or disease. Examination of the observed LFD and recent stockings indicated rainbow trout were age 2, stocked as fingerlings in 2010 (Figure 7, Appendix B). Most fish fell within the defined length category 200-350 mm. Mean length of fish in this category was larger than *m*LS (Table 9). Objectives for rainbow trout in Bullwinkle Lake were achieved.

While fingerling stockings are currently resulting in a satisfactory fishery, winter water quality parameters in Bullwinkle Lake should be monitored to determine how often the lake is likely to experience winterkill events. We have seen the water level in Delta area lakes fluctuate by more than a meter from year to year. This fluctuation, along with the extent of aquatic vegetation and duration of ice cover, influences the amount of DO available to fish during winter months. Water quality parameters measured in Bullwinkle Lake during May 2012 appeared normal (Table 8), but the absence of fish in our catch in 2002 indicated fish do not always survive winter (Behr et al. 2005). If the lake level decreases, Bullwinkle Lake will be more susceptible to a winterkill event. If this occurs, stocking catchable size fish may be needed to support this fishery.

ADF&G hatcheries recently began advance spawning rainbow trout. This procedure produces fingerling size fish available for stocking in spring instead of fall. We expect rainbow trout stocked in spring to have better overwinter survival compared to fish released in fall because fish stocked in spring will have more time to feed and grow prior to winter. This assumption should be verified when time and budgets permit. In anticipation of improved survival, fingerling rainbow trout stockings in Bullwinkle Lake were reduced from 800 to 400 fish in the 2014 Stocking Plan.

Recommendations

- Stock 400 fingerling (2 g) rainbow trout every other year, target release date early June.
- Periodically measure water quality parameters in late March or early April to assess the likelihood of a winterkill event.

Table 8.–Bullwinkle Lake data summary for May 2012 sampling.

Fish	5/30–31/2012
Species	rainbow trout
Count	50
Mean Length (mm)	294
Standard Error	3.94
Minimum Length (mm)	229
Maximum Length (mm)	384
Water Quality	
Date	5/31/2012
Secchi Reading (m)	2.5
Alkalinity (mg/L $CaCO_3$)	47
Temperature (°C)	5.4-13.1
DO (mg/L)	9.2-11.5
DO (%)	79-108
pH	7.7-8.1
Specific Conductivity (µS/cm)	95-99
TDS (ppm)	0.060-0.063
Water Color	clear
Max Depth Sampled (m)	5.00

Table 9.–Bullwinkle Lake descriptive statistics and test results by length category for rainbow trout captured in May 2012.

Length category	Observed			Model	Bootstrap	
(mm)	Mean (mm)	SE	N	*m*LS (mm)	Mean (mm)	P-value
>200 & ≤350	291	3.39	48	237	291	1

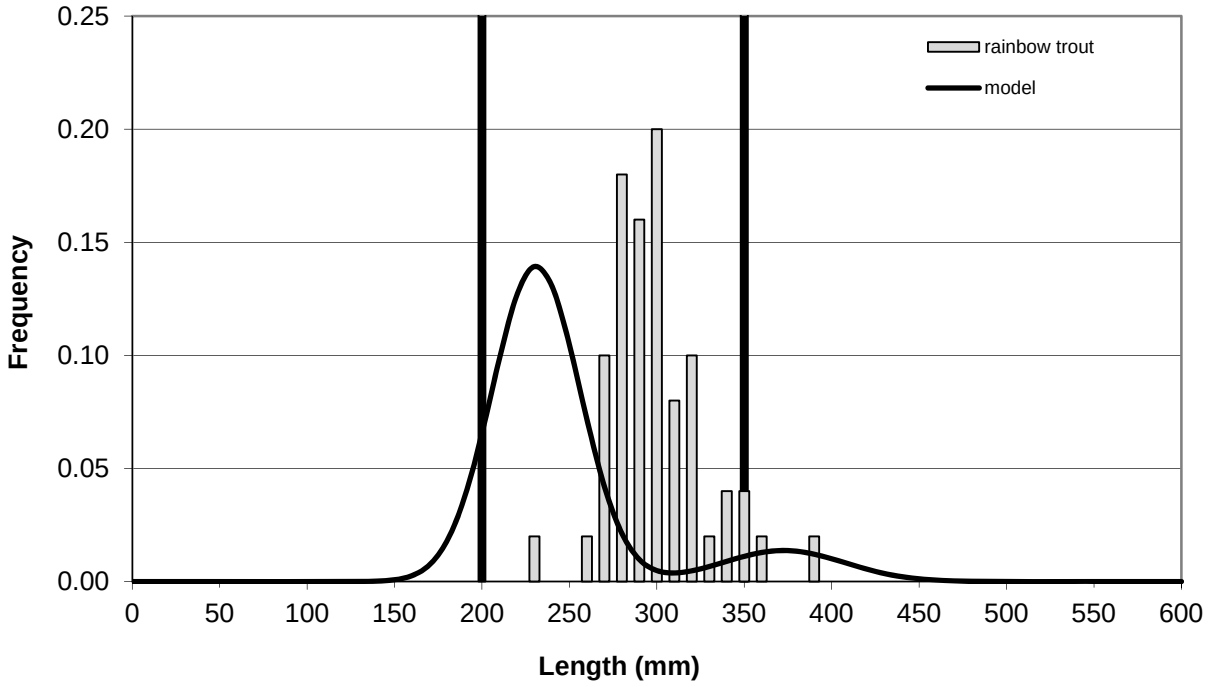


Figure 7.–Bullwinkle Lake LFD for rainbow trout (n=50) captured May 2012 and plotted with model LFD.

Forrest Lake: Fish, water quality, and morphometric data were collected June 18–19, 2012 (Table 10, Figures 8-9). Sixteen rainbow trout and 4 slimy sculpin were captured. Examination of the LFD of captured rainbow trout and recent stockings indicated fish were age 2 and age 4, stocked as fingerlings in 2010 and 2008 respectively (Figure 8, Appendix B). All fish were in good overall health. Mean length of rainbow trout in the length category 200-350 mm was larger than *m*LS (Table 11). While objectives for rainbow trout in Forrest Lake were achieved, more than half of captured fish were dispersed outside the length category and results are likely inconclusive due to the small sample size (n=6).

In spring 2013, an angler reported a possible winterkill event in Forrest Lake. Ice did not break up from the Tanana River (at Nenana) until May 21st in 2013, several weeks later than the May 1st average break-up date for the previous 10 years (NWS 2014). Decaying aquatic vegetation continued to consume DO while extended ice cover delayed the diffusion of atmospheric oxygen into the lake, likely resulting in oxygen levels lethal to stocked fish. Similar conditions were reported in 2013 for other Region III stocked lakes (Quartz Lake near Delta Junction and Tolsona Lake near Glennallen) and ADF&G staff observed dead fish around the perimeters of these lakes just after ice off. ADF&G should monitor date of ice off and winter water quality parameters in Forrest Lake to determine how often lake conditions lead to winterkill events. Stockings should be discontinued if fish routinely die during winter.

Recommendations

- Stock 2,500 fingerling (2 g) rainbow trout every other year, target release date early June.
- Measure water quality parameters periodically in late March or early April when extended ice conditions are expected to occur.

Table 10.–Forrest Lake data summary for June 2012 sampling.

Fish	6/18–19/2012	
Species	rainbow trout	slimy sculpin
Count	16	4
Mean Length (mm)	276	65
Standard Error	25.05	2.12
Minimum Length (mm)	105	61
Maximum Length (mm)	412	70
Water Quality		
Date	6/19/2012	
Secchi Reading (m)	4.8-5.3	
Alkalinity (mg/L $CaCO_3$)	107	
Temperature (°C)	3.6-17.1	
DO (mg/L)	NR	
DO (%)	NR	
pH	7.5-8.8	
Specific Conductivity	230-268	
TDS (ppm)	0.146-0.171	
Water Color	clear	
Max Depth Sampled (m)	19.75	
Morphometry and Other Lake Characteristics		
Surface Area (ha)	13.6	
Shoreline Length (km)	1.7	
Maximum Depth (m)	22.5	
Lake Volume (m^3)	1,570,000	
Outlets	0	
Inlets	0	
Lake Category	landlocked	
Surrounding Vegetation	coniferous	

NR = Measurements were not reported because values were unusually high.

Table 11.–Forrest Lake descriptive statistics and test results by length category for rainbow trout captured in June 2012.

Length category	Observed			Model	Bootstrap	
(mm)	Mean (mm)	SE	N	*m*LS (mm)	Mean (mm)	P-value
>200 & ≤350	267	27.16	6	240	267	0.8627

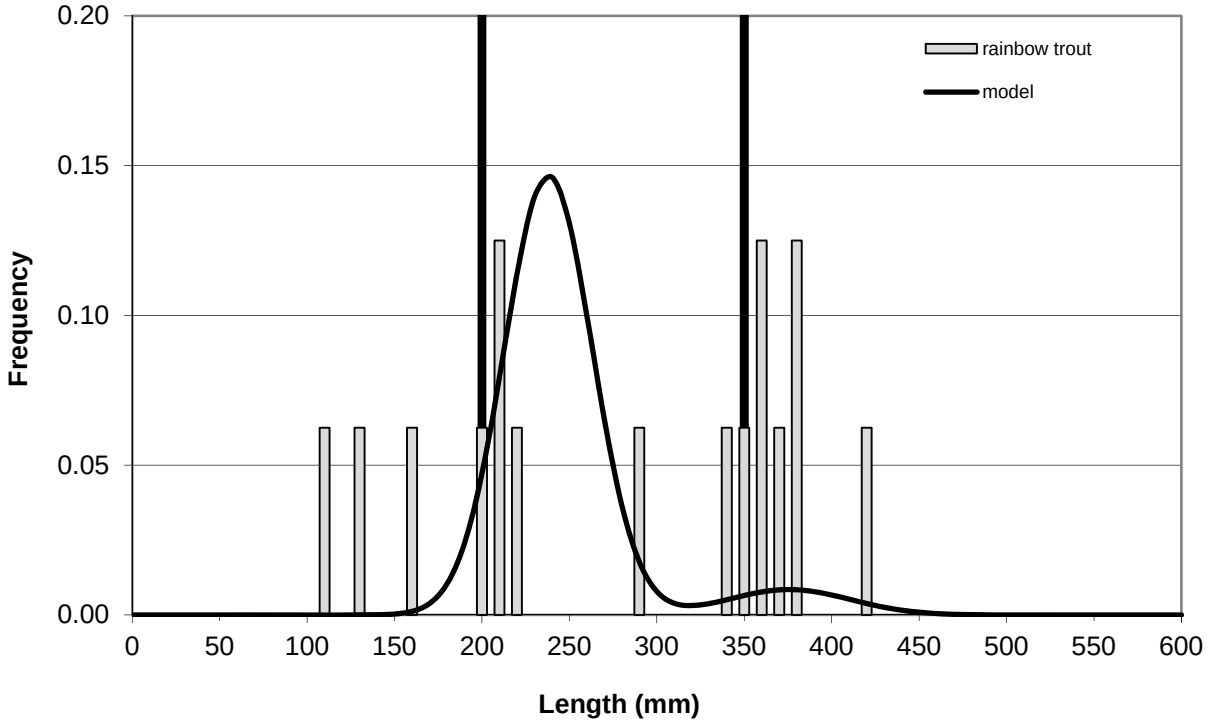


Figure 8.–Forrest Lake LFD for rainbow trout (n=16) captured June 2012 and plotted with model LFD.



Figure 9.–Forrest Lake bathymetric map generated from morphometric data collected June 2012.

Four Mile Lake: Fish and water quality data were collected June 10–12, 2013 (Table 12, Figure 10). Three hundred eighteen rainbow trout, nine Arctic char, and 1 lake trout were captured. All fish were in good overall health. Examination of the observed LFD and recent stockings indicated that most rainbow trout were age 3, stocked as fingerlings in 2010 (Figure 10, Appendix B). Mean length of fish in the length category 200-350 mm was larger than *m*LS (Table 13). Objectives for rainbow trout in Four Mile Lake were achieved.

Although management criteria were achieved, the number of rainbow trout stocked into Four Mile Lake may be too high. Rainbow trout were smaller than management criteria when the lake was last sampled in 2007 (Skaugstad and Behr 2010). Management criteria have since been adjusted to account for sampling date (Skaugstad *in prep*). Using these updated criteria, rainbow trout captured in 2007 would meet management objectives. Nonetheless, subsequent to 2007 findings, ADF&G reduced alternate year fingerling rainbow trout stockings from 20,000 to 10,000. Stockings were also skipped in 2012 when releases were shifted from even to odd years to balance hatchery production. Four Mile Lake is popular with local residents, it is 1 of only 2 stocked fisheries near the community of Tok, and fishing is reported annually in the Statewide Harvest Survey. All of these factors lead us to anticipate lower abundance, fewer fish to harvest, and increased growth in 2011. This is not what we observed. Mean length of rainbow trout in the length category 200-350 mm was similar between sample years (318 mm in 2007 and 313 mm in 2011) and our catch rates increased in 2011 (n=171 in 2007 and n=318 in 2011). Water temperature was greater than 18°C during 2007 sampling and may have influenced catch rates (Skaugstad and Behr 2010), but other factors may also be affecting this fishery.

One possible explanation for seemingly unchanged growth and our increased catch, despite stocking reductions, is a shift in angler habits. Sample results in 2011 may be a reflection of an overall trend of decreasing angler effort, harvest, or both. Fishing effort and the number of fish harvested in the Tanana River management area declined steadily from 2002 through 2011 (Brase and Baker 2014). Similarly, the decline of fishing effort has been observed throughout Region III, the state (Jennings et al. in prep), and the US (Cordell 2012). Rural stocked fisheries, such as Four Mile Lake, may be affected more by this trend as they are further from major population centers and harder to access.

Recommendations

- Stock 10,000 fingerling (2 g) rainbow trout on alternate years, target release date mid-June.
- Stock 3,500 fingerling (2 g) Arctic char on alternate years, target release date mid-June.

Table 12.–Four Mile Lake data summary for June 2013 sampling.

Fish	6/10–12/2013		
Species	rainbow trout	Arctic char	lake trout
Count	318	9	1
Mean Length (mm)	324	262	411
Standard Error	1.97	3.38	-
Minimum Length (mm)	236	240	411
Maximum Length (mm)	477	275	411

Water Quality	
Date	6/11/2013
Secchi Reading (m)	1.3
Alkalinity (mg/L $CaCO_3$)	16
Temperature (°C)	6.7-15.0
DO (mg/L)	1.5-8.7
DO (%)	13-93
pH	5.2-6.3
Specific Conductivity (µS/cm)	40-53
TDS (ppm)	0.026-0.276
Water Color	ferric
Max Depth Sampled (m)	3.50

Table 13.–Four Mile Lake descriptive statistics and test results by length category for rainbow trout captured in June 2013.

Length category	Observed			Model	Bootstrap	
(mm)	Mean (mm)	SE	N	*m*LS (mm)	Mean (mm)	P-value
>200 & ≤350	313	1.29	274	308	313	0.9999

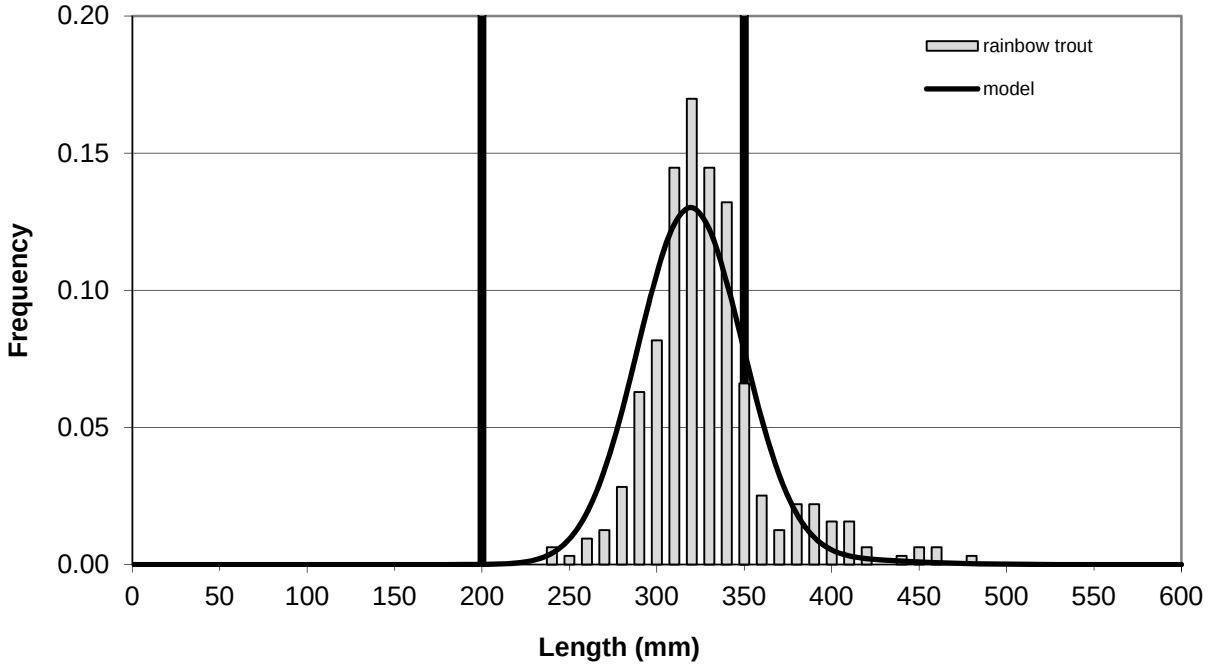


Figure 10.–Four Mile Lake LFD for rainbow trout (n=318) captured June 2013 and plotted with model LFD.

Grayling Lake: Fish data were collected May 24–25, 2011. Water quality data were collected March 25, 2011; March 28, 2012; and April 4, 2013 (Table 14, Figure 11). One hundred thirty-7 rainbow trout and 1 Arctic char were captured in May 2011. Rainbow trout were stocked in 2009 and 2010 (Appendix B). Captured fish were in good overall health but rainbow trout were smaller than *m*LS (Table 15). Objectives for rainbow trout in Grayling Lake were not achieved.

Stocked fish did not meet management objectives because rainbow trout were smaller than the target size at time of stocking. Fish production from ADF&G Sport Fish hatcheries has fluctuated in number, size, and quality (prevalence of body deformities and fin erosion) over the last 10 years. Rainbow trout stocked into Grayling Lake in 2009 and 2010 had an average length of 134 mm (approximately 27 g). Catchable rainbow trout stocked into Region III Lakes in 2014 were much larger, 216 mm (approximately 126 g). This improvement in production is attributed to ADF&G's new hatcheries recently constructed in Fairbanks and Anchorage. Larger Arctic grayling also became available from these facilities and were added to the Grayling Lake fishery in 2013. Maintaining consistent stockings of larger catchable size fish in Grayling Lake will improve this fishery.

Anglers occasionally report catching northern pike in Grayling Lake but none were captured or observed during 2011 sampling. Northern pike were endemic in Grayling Lake prior to stocking in 1975. While northern pike were once eradicated in many Region III roadside ponds to make way for more popular sport fish species such as rainbow trout, we are now seeing an increase in the number of anglers requesting and targeting northern pike fisheries.

Winter oxygen levels in Grayling Lake may occasionally fall below thresholds required to support fish. Salmonid responses to low DO levels have been well documented and include avoidance behavior, changes in activity, growth, overall health, and mortality (Carter 2005, Melony 2001). Asphyxiation of stocked rainbow trout has also been observed at DO levels less than 4 mg/L (Mathias and Barcia 1985). DO was recorded in Grayling Lake in March 2011, March 2012, and April 2013 (Table 14). Levels in the upper 2 meters of the water column were adequate to support fish (4.7-10.6 mg/L at 1-2 m), but lower concentrations lethal to fish were repeatedly observed closer to the lake bottom (0.2-0.8 mg/L at 3-4 m). ADF&G evaluations in the late 1980s also suggested fish may not always survive winter and stocking efforts during this time failed according to historic lake records (ADF&G *unpublished data*[7]).

Recommendations

- Stock 350 catchable (120 g) Arctic char every other year, target release date mid-June.
- Stock 800 catchable (120 g) Arctic grayling annually, target release date mid-June.
- Stock 1,800 catchable (180 g) rainbow trout annually, target release date mid-May.
- Continue to periodically monitor winter DO levels in late March or early April.

Table 14.–Grayling Lake data summary for March and May 2011, March 2012, and April 2013 sampling.

Fish	5/24–25/2011			
Species	rainbow trout	Arctic char		
Count	137	1		
Mean Length (mm)	235	327		
Standard Error	2.44	-		
Minimum Length (mm)	182	327		
Maximum Length (mm)	321	327		
Water Quality				
Date	3/25/2011	5/25/2011	3/28/2012	4/4/2013
Secchi Reading (m)	ND	ND	ND	ND
Alkalinity (mg/L $CaCO_3$)	ND	103	ND	ND
Temperature (°C)	0.5-3.4	9.2-16.2	1.4-2.6	0.3-2.1
DO (mg/L)	0.2-10.6	7.0-9.0	0.4-9.8	0.8-5.9
DO (%)	ND	60-92	ND	ND
pH	ND	8.0-8.2	ND	ND
Specific Conductivity	ND	252-326	ND	ND
TDS (ppm)	ND	0.163-0.212	ND	ND
Water Color	ND	ND	ND	ND
Max Depth Sampled (m)	4.00	3.50	3.00	3.00

ND = No data. Data collection was not attempted.

[7] These records are stored in ALDAT: http://www.adfg.alaska.gov/index.cfm?adfg=fishingSportStockingHatcheries.lakesdatabase.

Table 15.–Grayling Lake descriptive statistics and test results by length category for rainbow trout captured in May 2011.

Length category	Observed			Model	Bootstrap	
(mm)	Mean (mm)	SE	N	*m*LS (mm)	Mean (mm)	P-value
>200 & ≤350	238	2.39	127	307	238	0.0001

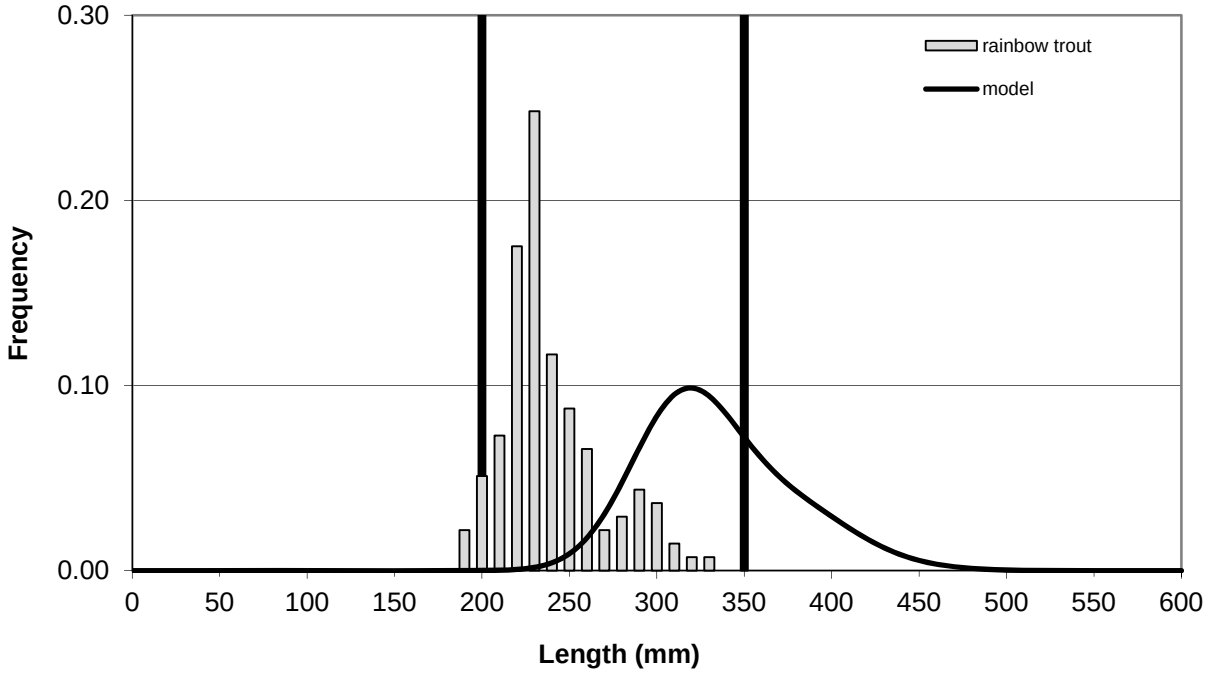


Figure 11.–Grayling Lake LFD for rainbow trout (n=137) captured May 2013 and plotted with model LFD.

Hidden Lake (EAFB): Fish data were collected June 4–5, 2013. Water quality data were collected March 28, 2012; April 4, 2013; and June 4, 2013 (Table 16, Figures 12-13). One hundred thirty 4 rainbow trout and 18 northern pike were captured. All rainbow trout and northern pike were in good overall health. Captured rainbow trout had a mean length of 220 mm (SE=2.90) and the LFD had only 1 mode (Figure 12). We could not determine if these fish were stocked earlier in summer 2013 or sometime in 2012. We suspect most fish were stocked just prior to sampling because this stocking cohort had an average length of 221 mm. The mean length of fish in the length category 200-350 mm was smaller than *m*LS (Table 17). Objectives for rainbow trout in Hidden Lake (EAFB) were not achieved.

It is unclear if harvest, winter water quality, predation by northern pike, or some combination of all 3 factors is affecting this fishery. Hidden Lake (EAFB) is close to Grayling Lake, across the Richardson Highway from EAFB, and fishing effort is reported intermittently in the SWHS. It is possible that large fish in Grayling Lake were harvested. It is also possible that large fish were susceptible to low DO levels during winter and died. DO was recorded in Hidden Lake (EAFB) in March 2012 and April 2013. In both years, oxygen levels were satisfactory to support fish in

the upper 2 m of the water column (3.7-9.3 mg/L) but lethal in the lower 3-4 m (0.1-0.7 mg/L). Lastly, we do not know to what extent northern pike prey on stocked fish. It is likely that predation and angler harvest removed most rainbow trout from the population within a year of stocking.

Recommendations

- Stock 300 catchable (120 g) Arctic char every other year, target release date mid-June.
- Stock 1,500 catchable (120 g) Arctic grayling annually, target release date mid-June.
- Stock 1,900 catchable (180 g) rainbow trout annually, target release date mid-May.

Table 16.–Hidden Lake (EAFB) data summary for June 2013 sampling.

Fish	6/4–5/2013		
Species	rainbow trout	northern pike	
Count	134	18	
Mean Length (mm)	220	336	
Standard Error	2.36	22.26	
Minimum Length (mm)	150	188	
Maximum Length (mm)	285	555	
Water Quality			
Date	3/28/2012	4/4/2013	6/4/2013
Secchi Reading (m)	ND	ND	2.8
Alkalinity (mg/L $CaCO_3$)	ND	ND	94
Temperature (°C)	1.6-4.5	1.1-4.2	6.8-14.4
DO (mg/L)	0.1-9.3	0.7-8.1	1.5-10.0
DO (%)	ND	ND	12-97
pH	ND	ND	7.8-8.3
Specific Conductivity (µS/cm)	ND	ND	210-305
TDS (ppm)	ND	ND	0.136-0.198
Water Color	ND	ND	clear
Max Depth Sampled (m)	4.00	3.00	4.75

ND = No data. Data collection was not attempted.

Table 17.–Hidden Lake descriptive statistics and test results by length category for rainbow trout captured in June 2013.

Length category	Observed			Model	Bootstrap	
(mm)	Mean (mm)	SE	N	*m*LS (mm)	Mean (mm)	P-value
>200 & ≤350	233	1.90	97	273	233	0.0001

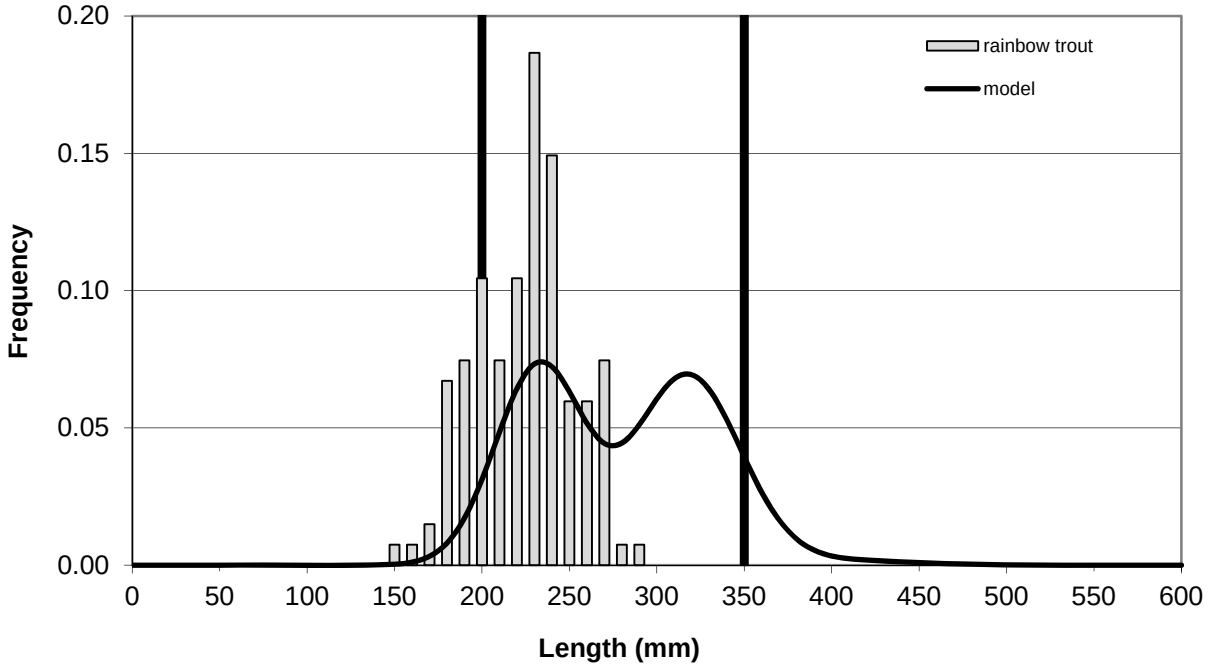


Figure 12.–Hidden Lake (EAFB) LFD for rainbow trout (n=134) captured June 2013 and plotted with model LFD.

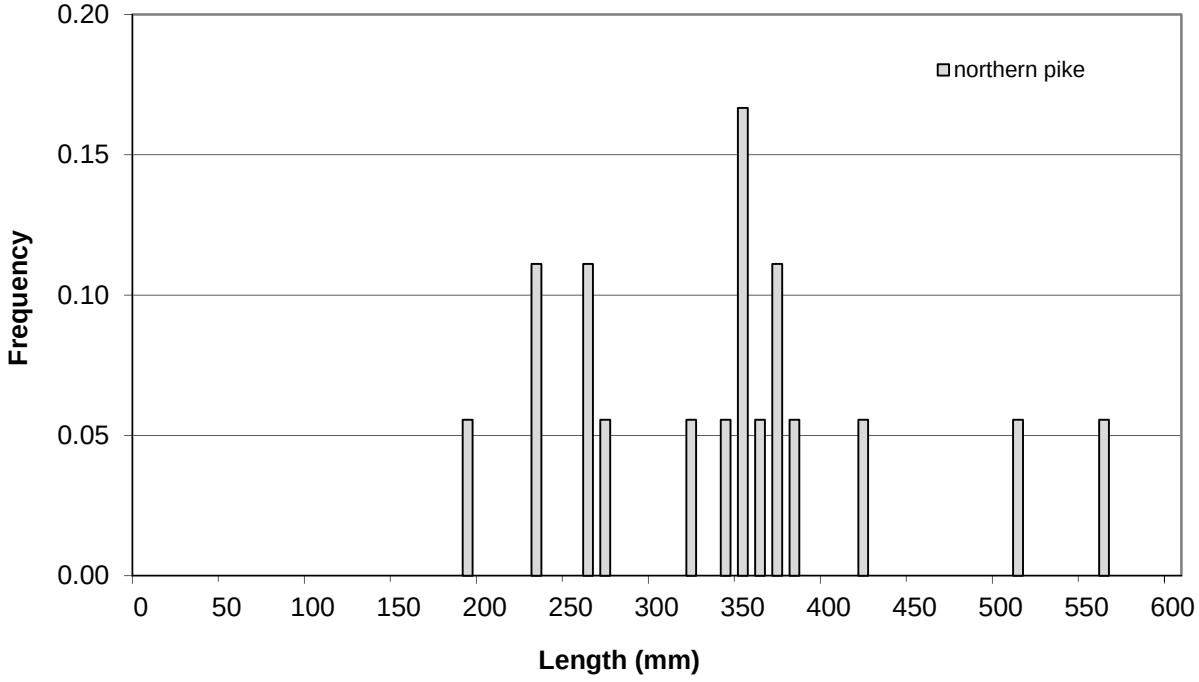


Figure 13.–Hidden Lake (EAFB) LFD for northern pike (n=18) captured June 2013.

Johnson Pit #2: Fish, water quality, and morphometric data were collected May 23–24, 2012 (Table 18, Figure 14). Sampling was conducted soon after ice off and just prior to stockings. Six northern pike and 1 rainbow trout were captured, indicating fish do survive winter and confirming angler reports of northern pike.

Johnson Pit #2 is a high use lake with limited food and habitat resources. It is small (1.2 ha), shallow (3.1 m maximum depth), road accessible, and has no aquatic vegetation. Few insects were observed during sampling, no naturally occurring forage fish species were captured, and northern pike likely prey on stocked fish. Given these conditions, we stock larger, catchable size rainbow trout, and we try to stock enough fish to support consumptive fisheries without taxing food resources necessary to sustain the fish population while maintaining stocking levels that ensure most fish will be harvested before mid-to-late winter (before oxygen levels decline and food resources are exhausted). This can be a moving target as lake conditions and angler's preferences change; however, our low catch rates in 2012 indicate we may be close to achieving this goal.

Recommendations

- Stock 400 catchable (120 g) Arctic grayling annually, target release date mid-June.
- Stock 900 catchable (180 g) rainbow trout annually, target release date early June.

Table 18.–Johnson Pit #2 data summary for May 2012 sampling.

Fish	5/23–24/2012	
Species	northern pike	rainbow trout
Count	6	1
Mean Length (mm)	357	473
Standard Error	33.1	-
Minimum Length (mm)	198	473
Maximum Length (mm)	410	473

Water Quality	
Date	5/23/2012
Secchi Reading (m)	ND
Alkalinity (mg/L $CaCO_3$)	116
Temperature (°C)	11.5-14.1
DO (mg/L)	NR
DO (%)	NR
pH	8.3-8.5
Specific Conductivity (µS/cm)	293-293
TDS (ppm)	0.190-0.204
Water Color	clear
Max Depth Sampled (m)	2.50

Morphometry and Other Lake Characteristics	
Surface Area (ha)	1.2
Shoreline Length (km)	0.52
Maximum Depth (m)	3.1
Lake Volume (m^3)	20,000
Outlets	0
Inlets	0
Lake Category	land locked
Surrounding Vegetation	none

ND = No data. Data collection was not attempted.

NR = Measurements were not reported because values were unusually high.



Figure 14.–Johnson Pit #2 bathymetric map generated from morphometric data collected May 2012.

Koole Lake: Fish data were collected during both capture events of a mark-recapture experiment, August 26–29 and September 9–12, 2013 (Table 19, Figures 15–17). Five Arctic grayling, 375 rainbow trout, 30 coho salmon, and 17 Chinook salmon were captured during the first event. All fish were marked, measured, and released. Two Arctic grayling, 845 rainbow trout, 104 coho salmon, and 45 Chinook salmon were captured and examined for marks during the second event. Of these, 88 rainbow trout and 1 Chinook salmon had marks from the first event. Unique rainbow trout captured during both capture events were compared to population model LFDs for conservative management. Mean length of rainbow trout in the length category >350 mm was significantly smaller than *m*LS (Table 20). Objectives for rainbow trout in Koole Lake were not achieved.

The mark-recapture experiment was conducted at Koole Lake to estimate the abundance of coho and Chinook salmon. These estimates, along with costs to produce and stock each species, were to be used to estimate the cost-per-catchable for each species. Our goal was to compare these costs to determine which species provided a desired number of catchable fish in the fishery for the lowest cost. Abundance estimates were needed because we anticipated unequal probabilities of capture for Chinook and coho salmon. We were not able to reliably estimate abundance because we caught too few fish during the first event. During the mark-recapture experiment we observed 2 distinct Chinook salmon size groups in our catch (Figure 17) and many were in poor overall health. Fish appeared thin, readily lost their scales, and had torn fins. One coho salmon size group was present in our catch and these fish were in better overall health compared to Chinook salmon (Figure 16). We do not know why our recapture rate for salmon was so low or why many Chinook salmon appeared stressed, but higher than normal water temperature in June and July may have been responsible. We decided these conditions (high water temperature and having 1 group in poor overall health) would likely result in biased abundance estimates and unreliable comparisons for cost-per-catchable.

2 distinct size groups were present in the rainbow trout we captured (Figure 15). Fish <240 mm were age 1 stocked as fingerlings in August 2012 and fish ≥240 mm were age 3 and age 5 stocked in 2010 and 2008 respectively (Appendix B). We classified 11 fish in the first event and 6 fish in the second event as thin, and 1 fish in the second event had an unidentified parasite. Rainbow trout in poor overall health ranged in size from 276-405 mm. We believe most of these fish were age 5, near the end of their life; however, we did not collect age structures to confirm this. Age-3 and age-5 fish made up 48% of our catch during event 1 and 24% of our catch during event 2, indicating older fish may have died between capture events.

Several notable weather events occurred during spring and summer 2013. As mentioned previously, ice did not break up or melt from Interior rivers and lakes until several weeks later than usual in 2013. This was followed by a rapid rise in temperature in late May and a protracted warm spell in June. The maximum recorded temperature at the Fairbanks International Airport on June 13th and 14th, when Chinook and coho salmon were stocked, was 26°C and 28°C (79°F and 82°F) respectively (NOAA 2014). Warm weather caused ADF&G to suspend stockings in June after rising water temperatures resulted in the death of several hundred stocked fish in a Fairbanks area lake. Water temperature may have been too warm when Chinook and coho salmon were stocked, causing thermal shock and increased mortality. Additionally, warm water temperatures would have been stressful for older larger rainbow trout already in the lake.

Habitat conditions at Koole Lake have changed since the lake was last evaluated in 2004. The water level has decreased by approximately 1 meter and large patches of former littoral area are

now above the water line. The southern half of Koole Lake was less than 2 meters deep when the lake was last mapped in 2004. Small fluctuations in water level can expose large sections of aquatic vegetation and greatly reduce the habitat available to insects and fish. The thin appearance of many rainbow trout during 2013 indicates stocking levels are likely too high given the current population abundance and available resources.

Recommendations

- Reduce rainbow trout stockings from 24,000 to 11,000 fingerling (2 g) on alternate years, target release date early June.
- Reduce Arctic grayling stockings from 10,000 to 6,000 fingerling (2 g) on alternate years, target release date mid-August.
- Stock 5,000 fingerling (4 g) coho salmon on alternate years, target release date early June.

Table 19.–Koole Lake data summary for August and September 2013 sampling.

Fish	8/26–29/2013			
Species	rainbow trout	coho salmon	Chinook salmon	Arctic grayling
Count	375	30	17	5
Mean Length (mm)	227	103	163	246
Standard Error	4.17	1.02	7.43	27.10
Minimum Length (mm)	89	96	132	155
Maximum Length (mm)	396	112	229	313
Fish	9/9-12/2013			
Species	rainbow trout	coho salmon	Chinook salmon	Arctic grayling
Count	845[a]	104	45[b]	2
Mean Length (mm)	194	108	157	221
Standard Error	2.36	0.97	5.00	64.50
Minimum Length (mm)	92	89	105	156
Maximum Length (mm)	420	150	235	285

[a] Eighty-eight fish were recaptured from August sampling.

[b] One fish was recaptured from August sampling.

Table 20.–Koole Lake descriptive statistics and test results by length category for unique rainbow trout captured in August and September 2013.

Length category	Observed			Model	Bootstrap	
(mm)	Mean (mm)	SE	N	*m*LS (mm)	Mean (mm)	P-value
>200 & ≤350	376	2.88	35	399	376	0.0001

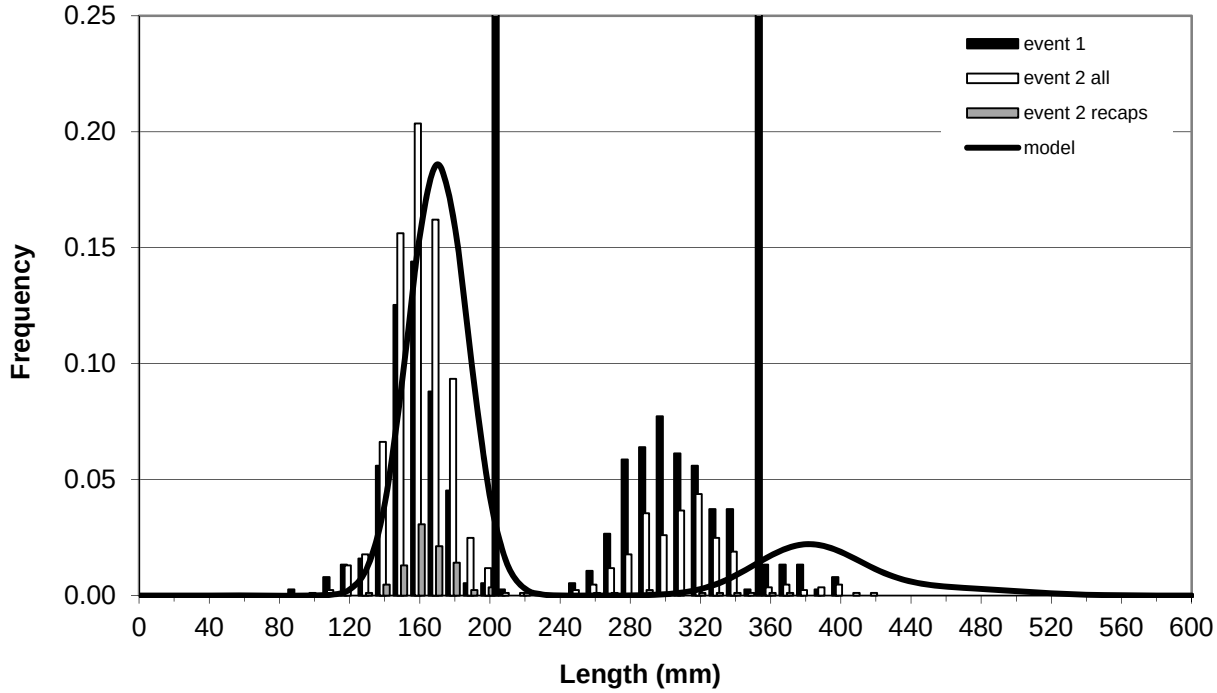


Figure 15.–Koole Lake LFD for rainbow trout (event 1 n=375, event 2 all n=845, event 2 unmarked n= 757, event 2 marked n=88) captured August and September 2013 and plotted with model LFD.

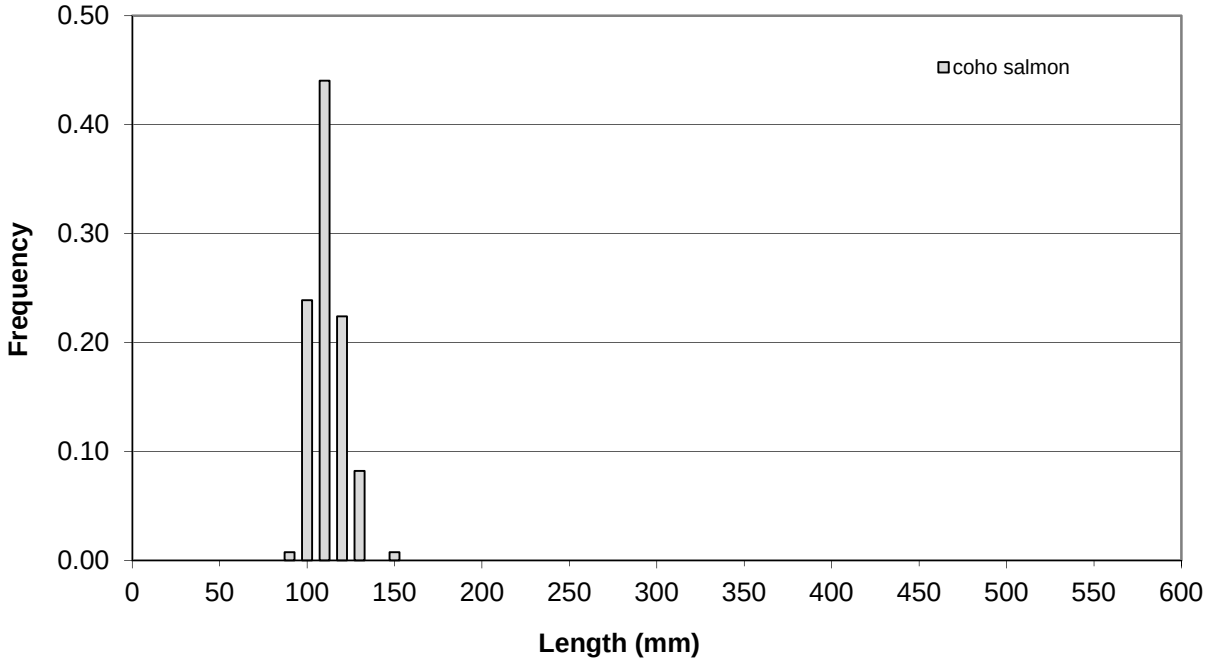


Figure 16.–Koole Lake LFD for coho salmon (n=134) captured August and September 2013.

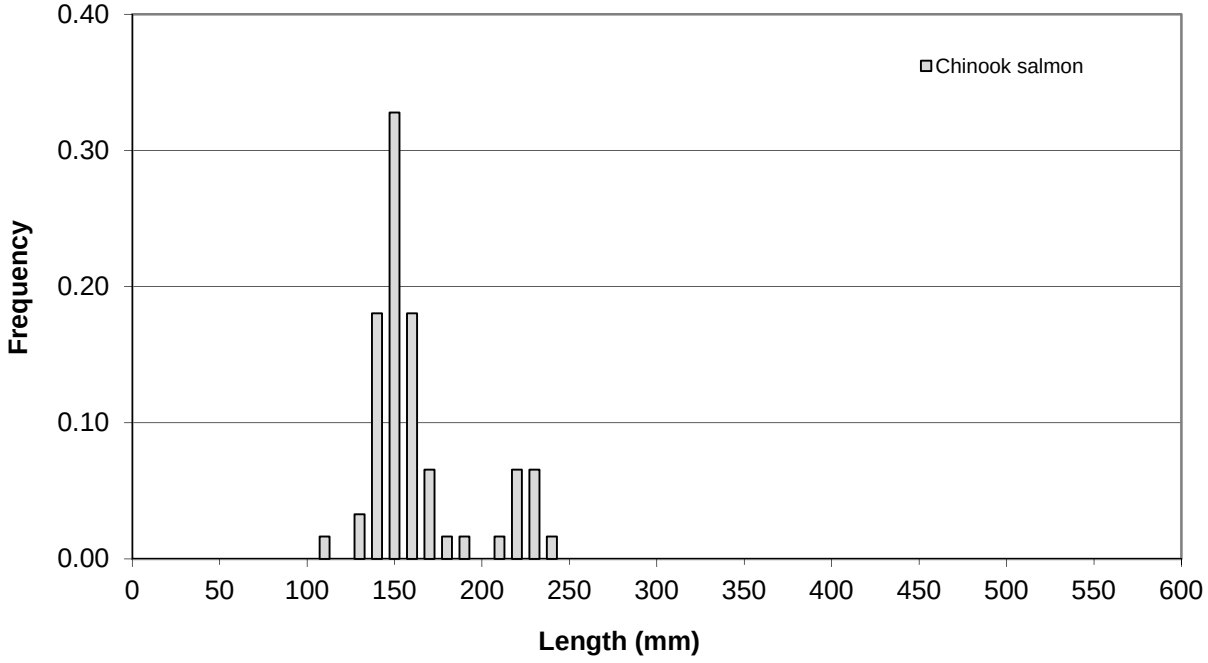


Figure 17.–Koole Lake LFD for Chinook salmon (n=61) captured August and September 2013.

Little Harding Lake: Fish and water quality data were collected May 25–27, 2011 (Table 21, Figure 18). Seventy-three rainbow trout and 2 northern pike were captured. All fish were in good overall health and had no external signs of parasites or disease. One rainbow trout fell within the

length category 200-350 mm and all other rainbow trout were >350 mm. Examination of the observed LFD and recent stockings indicated that most rainbow trout were likely stocked as small catchables in 2009 and 2010 (142 mm on average, Figure 18, Appendix B). Mean length of fish in length category >350 mm was smaller than *m*LS (Table 22). Objectives for rainbow trout in Little Harding Lake were not achieved.

Sampling in 2011 confirmed northern pike presence in Little Harding Lake. A seasonal stream flows east from Little Harding Lake to Harding Lake. ADF&G maintains a culvert with a welded mesh grate to block fish passage between these lakes. Occasionally, during extreme high water events, water bypassed this culvert and flowed directly into Harding Lake. The grate blocking fish passage was also compromised on several occasions.

In 2013, public input and the presence of northern pike resulted in ADF&G changing the management approach for Little Harding Lake. Trout Unlimited (TU - Midnight Sun Chapter Fairbanks, Alaska) submitted a proposal to the BOF in 2013 to remove Little Harding Lake from the special management category, arguing the lake was not suited to this classification and unable to meet objectives (Proposal 90, 2013–2014 BOF cycle, AYK Meeting). Given this input, and recent data from 2011 sampling, ADF&G managers decided to use Little Harding Lake to help rebuild the northern pike population in Harding Lake. Harding Lake once supported the only road accessible quality northern pike fishery in Region III. Fishing for northern pike was closed in 2000 following a decline in abundance attributed to low water levels and the subsequent loss of littoral vegetation (Doxey 2003, Brase 2010). In an effort to increase the lake level, and restore northern pike littoral habitat, a diversion structure was installed in 2007 to reestablish the flow of Rogge Creek into Harding Lake (Brase 2010). Subsequent to these efforts, managers theorized that reestablishing the connection between Little Harding Lake and Harding Lake would further contribute to these rehabilitation efforts by allowing northern pike in Harding Lake access to the spawning and rearing habitat in Little Harding Lake. In 2013, ADF&G submitted a proposal to the BOF to remove Little Harding Lake from the Stocked Fisheries program, stockings were discontinued, the mesh grate blocking fish passage to Harding Lake was removed, and fishing for northern pike was closed (Proposals 89 and 91, 2013-2014 BOF cycle, AYK Meeting).

Recommendations

- Discontinue stockings in Little Harding Lake.

Table 21.–Little Harding Lake data summary for May 2011 sampling.

Fish	5/25–27/2011	
Species	rainbow trout	northern pike[a]
Count	73	2
Mean Length (mm)	415	610
Standard Error	3.35	0
Minimum Length (mm)	289	610
Maximum Length (mm)	468	610
Water Quality		
Date	5/26/2011	5/27/2011
Secchi Reading (m)	2.5-2.5	ND
Alkalinity (mg/L $CaCO_3$)	4	4
Temperature (°C)	4.5-17.7	17.1-18.4
DO (mg/L)	NR	NR
DO (%)	NR	NR
pH	7.9-8.1	7.7
Specific Conductivity (µS/cm)	99-124	97-98
TDS (ppm)	0.064-0.081	0.063-0.068
Water Color	ND	ND
Max Depth Sampled (m)	5.00	1.50

ND = No data. Data collection was not attempted.

NR = Measurements were not reported because values were unusually high.

[a] Fish were larger than the measuring board; length was estimated.

Table 22.–Little Harding Lake: Descriptive statistics and test results by length category for rainbow trout captured in May 2011.

Length category	Observed			Model	Bootstrap	
(mm)	Mean (mm)	SE	N	*m*LS (mm)	Mean (mm)	P-value
>350	417	2.90	72	442	417	0.0001

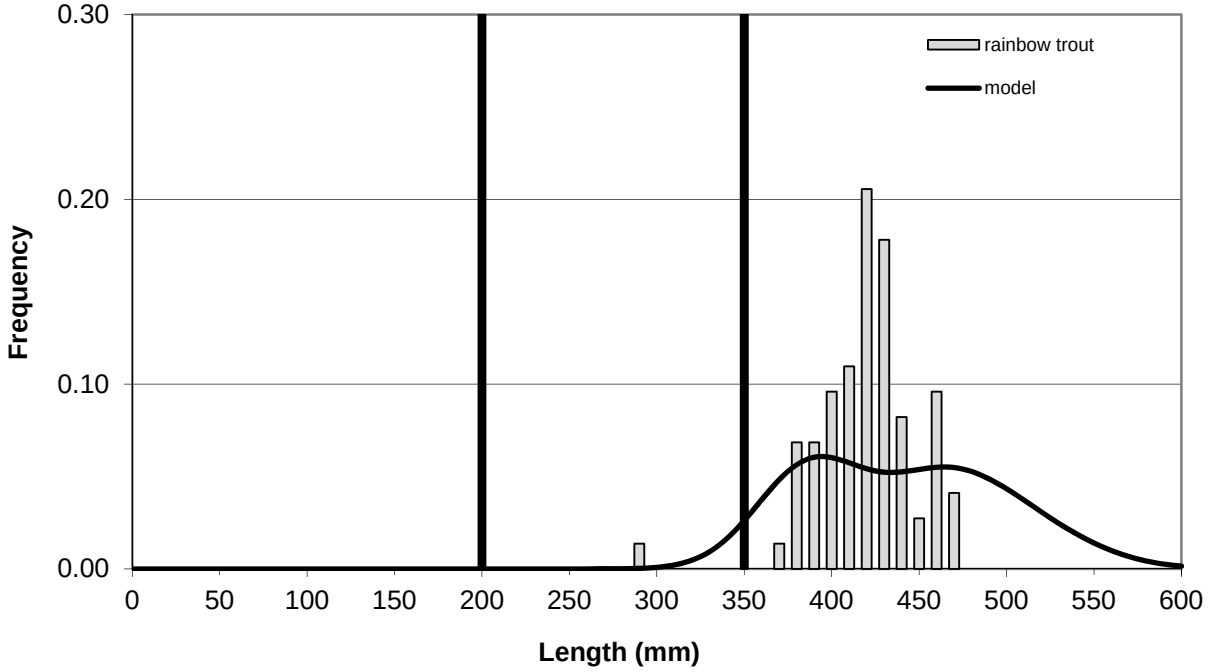


Figure 18.–Little Harding Lake LFD for rainbow trout (n=73) captured May 2011 and plotted with model LFD.

Manchu Lake: Fish data were collected June 4–5, 2013. Water quality data were collected March 22, 2011, March 27, 2012, April 2, 2013, and June 4, 2013 (Table 23, Figure 19). DO levels measured during winter 2011, 2012, and 2013 were adequate to support fish (Table 23). One hundred sixteen rainbow trout were captured and all fish were in good overall health. One prominent mode was visible in the LFD of captured fish (Figure 19). Examination of recent stockings indicated fish were age 2 stocked as catchables in June 2012 (Appendix B). Mean length of rainbow trout in length category 200-350 mm was similar to *m*LS (Table 24). Objectives for rainbow trout in Manchu Lake were achieved. We could not confirm angler reports of northern pike. We captured no Arctic char.

Managers reallocated fish production in the Tanana River Management Area in 2014 and replaced rainbow trout and Arctic char stockings in Manchu Lake with Arctic grayling. These changes were implemented because several other lakes in the immediate vicinity (Moose Lake, Polaris Lake, and Bear Lake on EAFB) are stocked with rainbow trout.

Recommendations

- Stock 720 catchable (120 g) Arctic grayling annually, target release date mid-June.

Table 23.–Manchu Lake data summary for June 2014 sampling.

Fish	6/4–5/2013			
Species	rainbow trout			
Count	116			
Mean Length (mm)	304			
Standard Error	3.52			
Minimum Length (mm)	170			
Maximum Length (mm)	390			
Water Quality				
Date	3/22/2011	3/27/2012	4/2/2013	6/4/2013
Secchi Reading (m)	ND	ND	ND	1.6
Alkalinity (mg/L $CaCO_3$)	ND	ND	ND	17
Temperature (°C)	1.3-4.7	1.2-4.7	1.1-4.3	5.5-15.2
DO (mg/L)	0.3-6.3	0.2-7.3	0.3-8.0	0.5-9.2
DO (%)	ND	ND	ND	4-90
pH	ND	ND	ND	7.0-7.7
Specific Conductivity (µS/cm)	ND	ND	ND	58-111
TDS (ppm)	ND	ND	ND	0.037-0.072
Water Color	ND	ND	ND	humic
Max Depth Sampled (m)	3.00	3.00	3.00	3.20

ND = No data. Data collection was not attempted.

Table 24.–Manchu Lake descriptive statistics and test results by length category for rainbow trout captured in June 2013.

Length category	Observed			Model	Bootstrap	
(mm)	Mean (mm)	SE	N	*m*LS (mm)	Mean (mm)	P-value
>200 & ≤350	303	3.28	109	307	303	0.0872

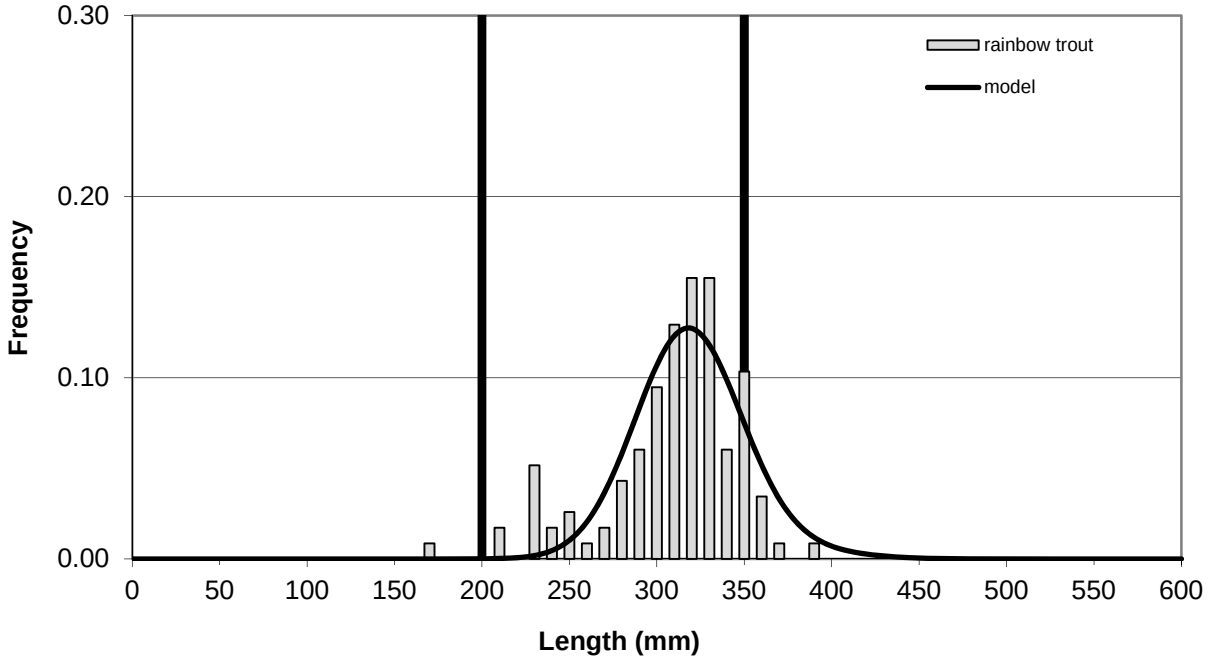


Figure 19.–Manchu Lake LFD for rainbow trout (n=116) captured June 2013 and plotted with model LFD.

Moose Lake: Fish data were collected May 22–23, 2012. Water quality data were collected March 22, 2011, March 27, 2012, May 22, 2012, and March 28, 2013 (Table 25). No fish were captured during May 2012 sampling and we could not confirm angler reports of northern pike. Low DO levels measured during winter 2011, 2012, and 2013 were lethal to stocked fish (Table 25). These results are consistent with angler reports of declining catch rates after January (Thomas Slater, Outdoor Recreation Planner, EAFB Department of Natural Resources, EAFB *personal communication*). Our goal is to stock sufficient numbers of fish to support consumptive summer and early winter fisheries while ensuring most fish will be harvested before mid-to-late winter after which winter-kill events likely occur. We may need to adjust the number of fish stocked with this goal in mind.

Recommendations

- Stock 1,000 catchable (120 g) Arctic grayling annually, target release date early June.
- Stock 250 catchable (120 g) Arctic char annually, target release date mid-June.
- Stock 3,600 catchable (120 g) rainbow trout annually, half in mid-May and half in mid-June.

Table 25.–Moose Lake data summary for March 2011, March and May 2012, and March 2013 sampling.

Fish	5/22–23/2014			
Species				
Count	0			
Mean Length (mm)				
Standard Error				
Minimum Length (mm)				
Maximum Length (mm)				
Water Quality				
Date	3/22/2011	3/27/2012	5/22/2012	3/28/2013
Secchi Reading (m)	ND	ND	4.0	ND
Alkalinity (mg/L $CaCO_3$)	ND	ND	142	ND
Temperature (°C)	3.3-5.0	3.0-5.0	7.9-14.8	3.4-4.9
DO (mg/L)	0.1-0.3	0.0-0.2	5.9-10.1	0.1-0.5
DO (%)	ND	ND	50-104	ND
pH	ND	ND	7.4-7.9	ND
Specific Conductivity (µS/cm)	ND	ND	270-287	ND
TDS (ppm)	ND	ND	0.173-0.184	ND
Water Color	ND	ND	clear	ND
Max Depth Sampled (m)	9.00	10.00	3.50	10.00

ND = No data. Data collection was not attempted.

North Pole Pond: Fish and water quality data were collected September 17–18, 2013 (Table 26, Figure 20). One hundred forty rainbow trout and 3 Arctic grayling were captured. All fish were in good overall health. Captured rainbow trout were age 1, stocked earlier in 2013. Mean length of rainbow trout in length category 200-350 mm was smaller than *m*LS (Table 27). Objectives for rainbow trout in North Pole Pond were not achieved.

North Pole pond is located in a residential neighborhood south of Fairbanks, in the community of North Pole. The lake receives a high level of fishing pressure during summer months and fishing is reported annually in the Statewide Harvest Survey. North Pole Pond is managed as a put and take fishery. Fish are released intermittently throughout summer to provide consistent fishing opportunity. The last stocking of rainbow trout prior to sampling was in mid-June and fish were approximately 211 mm at time of release. Fish did not appear to grow much from June 18 to September 18, 2013; mean length of captured rainbow trout was 212 mm (SE=2.28) in September.

We know North Pole Pond usually does not support fish overwinter-low DO levels (<1 mg/L) were observed during winter 1999–2001 (ADF&G *unpublished data*[8]) and age-2 rainbow trout from stockings in 2012 were not present in the sample LFD. We do not know when during winter oxygen levels become lethal to stocked fish. Because the fishery is popular, ADF&G should continue managing North Pole Pond as a seasonal put and take fishery, expecting

[8] Water quality data are stored in a database at Alaska Department of Fish and Game, 1300 College Road, Fairbanks, Alaska.

minimal growth and a winter-kill event sometime during December through mid-May. North Pole Pond likely failed to meet management objectives due to minimal growth of age-1 catchables and absence of age-2 catchables due to annual winter-kill events.

Recommendations

- Reduce rainbow trout stockings from 3,600 to 3,000 catchables (180 g) annually. Stock half in mid-May and half in mid-June.
- Stock 800 catchable (120 g) Chinook salmon annually, target release date early October.
- Stock 700 catchable (120 g) Arctic grayling annually, target release date mid-May.

Table 26.–North Pole Pond data summary for September 2013 sampling.

Fish	9/17–18/2013	
Species	rainbow trout	Arctic grayling
Count	140	3
Mean Length (mm)	212	272
Standard Error	2.28	11.67
Minimum Length (mm)	131	260
Maximum Length (mm)	276	295
Water Quality		
Date	9/17/2013	
Secchi Reading (m)	ND	
Alkalinity (mg/L $CaCO_3$)	ND	
Temperature (°C)	9.6-9.8	
DO (mg/L)	5.0-10.7	
DO (%)	46-98	
pH	6.4-7.7	
Specific Conductivity (µS/cm)	291-335	
TDS (ppm)	0.187-0.207	
Water Color	clear	
Max Depth Sampled (m)	3.00	

ND = No data. Data collection was not attempted.

Table 27.–North Pole Pond descriptive statistics and test results by length category for rainbow trout captured in September 2013.

Length category	Observed			Model	Bootstrap	
(mm)	Mean (mm)	SE	N	*m*LS (mm)	Mean (mm)	P-value
>200 & ≤350	226	1.81	95	278	226	0.0001

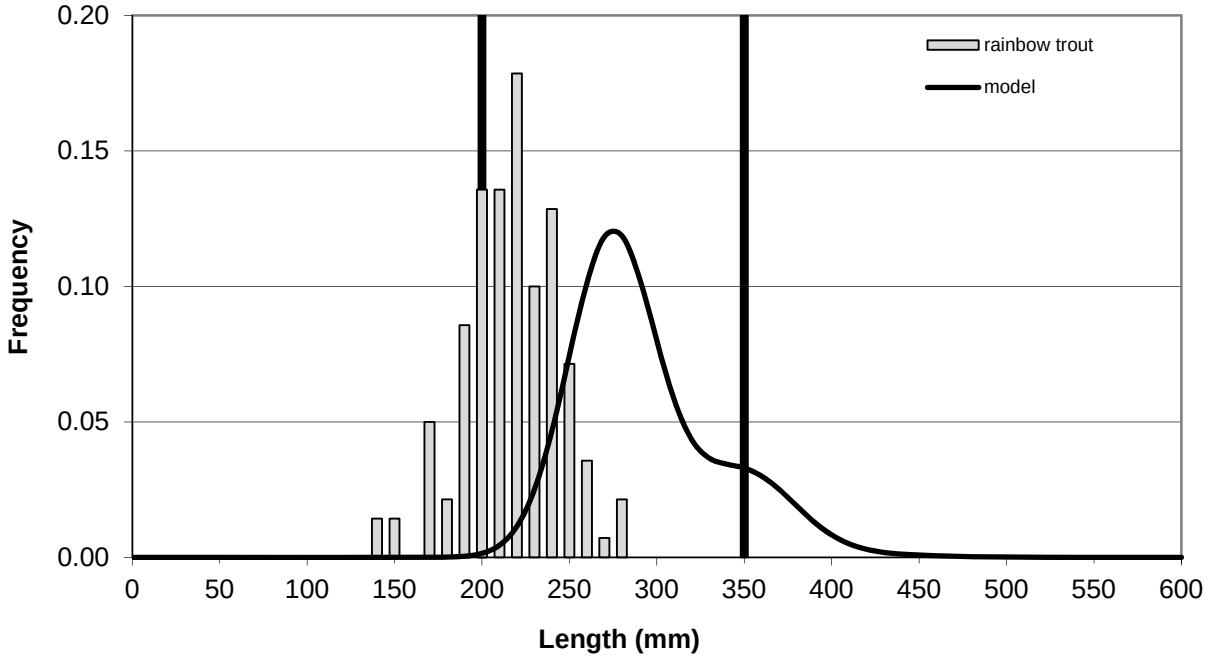


Figure 20.–North Pole Pond LFD for rainbow trout (n=140) captured September 2013 and plotted with model LFD.

North Twin Lake: Fish and water quality data were collected August 12–13, 2013 (Table 28, Figures 21–22). Thirty-one rainbow trout and 13 slimy sculpin were captured. All fish were in good overall health and 2 modes were present in the LFD of captured rainbow trout (Figure 21). Recent stocking records indicated rainbow trout 143-280 mm were age 1 and stocked as small catchables earlier in 2013; fish >300 mm were most likely age 2 stocked as small (169 mm) catchables in 2012 (Appendix B). Mean length of rainbow trout in length category 200-350 mm was significantly smaller than *m*LS (Table 29). Objectives for rainbow trout in North Twin Lake were not achieved.

Lake trout were not present in our catch but are likely still present in North Twin Lake. Anglers last reported catching lake trout in the SWHS in 2009 (Jennings et al. 2011). Lake trout production from ADF&G hatcheries was discontinued after 2001 (ADF&G 2014). In 2009, lake trout were raised in the Fairbanks Experimental Hatchery and released into North Twin Lake (Appendix B). Lake trout can live up to 50 years and prefer deep water habitat in lakes (Burr 1987). Although we sampled both near and off shore areas during sampling, our gear may not have been set deep enough to capture lake trout. The maximum set depth recorded for tangle nets during 2013 sampling was 4.9 m. The maximum depth of North Twin Lake is 13.5 m.

North Twin Lake is a popular recreational site and sufficient numbers of anglers visit the lake for it to appear annually in the Statewide Harvest Survey. Larger rainbow trout are quickly harvested by anglers and few fish survive to age 3. Only 2 rainbow trout >400 mm were captured when the lake was last evaluated in 1999 (Behr et al. 2005). Given the limited growth observed during 2013 sampling, larger (180 g instead of 120 g) catchable rainbow trout may be needed to maintain a satisfactory fishery in North Twin Lake.

North Twin Lake likely failed to meet management objectives due to the small size of age-1 catchables when stocked.

Recommendations

- Stock 500 catchable (180 g) rainbow trout annually, target release date early June.

Table 28.–North Twin Lake data summary for August 2013 sampling.

Fish	8/12–13/2013	
Species	rainbow trout	slimy sculpin
Count	31	13
Mean Length (mm)	231	67
Standard Error	10.46	3.29
Minimum Length (mm)	143	49
Maximum Length (mm)	362	86
Water Quality		
Date	8/13/2013	
Secchi Reading (m)	6.8	
Alkalinity (mg/L $CaCO_3$)	60	
Temperature (°C)	14.6-16.7	
DO (mg/L)	NR	
DO (%)	NR	
pH	7.6-10.0	
Specific Conductivity (µS/cm)	128-130	
TDS (ppm)	0.082-0.083	
Water Color	clear	
Max Depth Sampled (m)	6.50	

NR = Measurements were not reported because values were unusually high.

Table 29.–North Twin Lake descriptive statistics and test results by length category for rainbow trout captured in August 2013.

Length category	Observed			Model	Bootstrap	
(mm)	Mean (mm)	SE	N	*m*LS (mm)	Mean (mm)	P-value
>200 & ≤350	248	8.88	19	272	248	0.0056

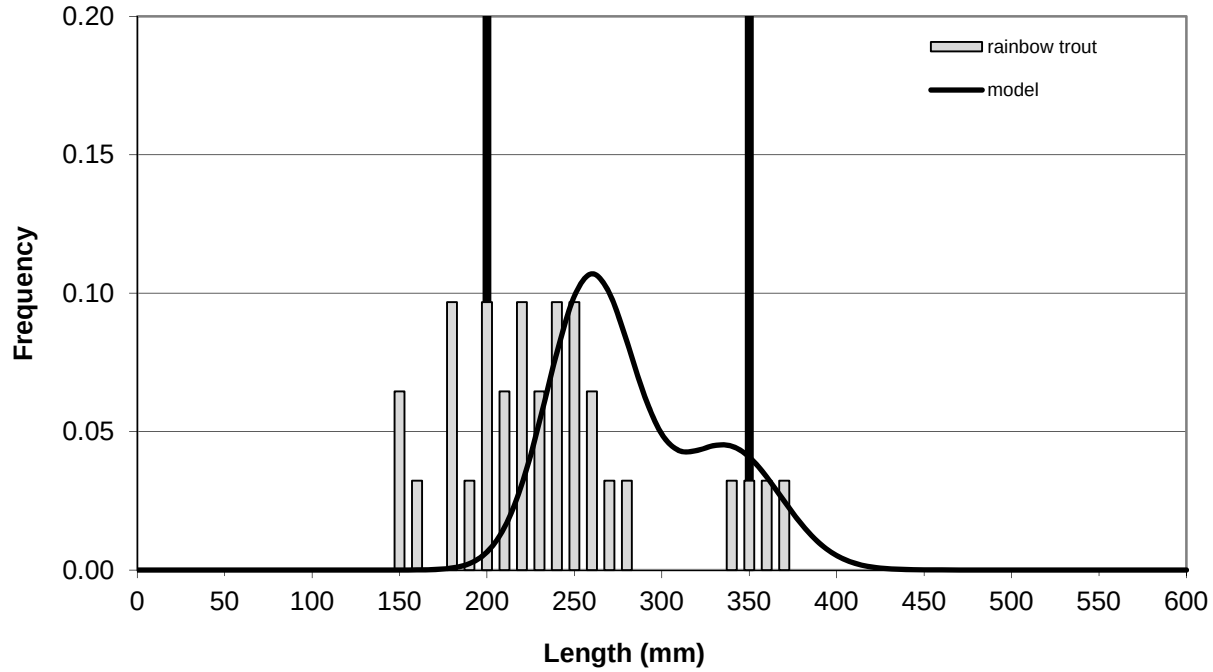


Figure 21.–North Twin Lake LFD for rainbow trout (n=31) captured August 2013 and plotted with model LFD.

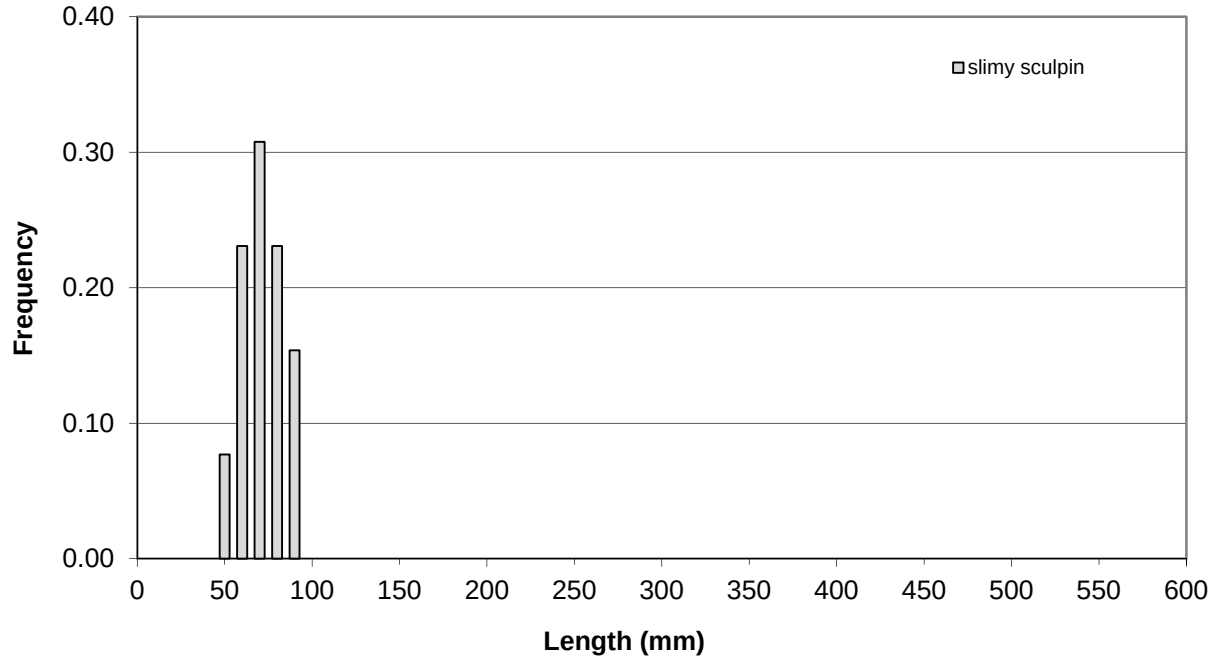


Figure 22.–North Twin Lake LFD for slimy sculpin (n=13) captured August 2013.

Paul's Pond: Fish and water quality data were collected August 16–17, 2011 (Table 30, Figure 23). Thirty-seven Arctic grayling, 3 lake trout, and 7 slimy sculpin were captured. All fish were in good overall health and had no external signs of parasite or disease. Examination of the observed LFD and recent stockings indicated that Arctic grayling were age 1, stocked as large fingerlings (130 mm, 24 g) in 2010 (Figure 23, Appendix B). Lake trout are no longer produced by ADF&G Sport Fish hatcheries and were last stocked into Paul's Pond in 2000. Catchable Arctic grayling production was suspended in 2003 due to limited capacity at ADF&G hatcheries in Anchorage (ADF&G 2004). Production resumed following the construction of 2 new hatcheries in Fairbanks and Anchorage and Arctic grayling fingerling stockings in Paul's Pond were replaced with catchable stockings in 2013.

Recommendations

- Stock 200 catchable (120 g) Arctic grayling annually, target release date mid-June.

Table 30.–Paul's Pond data summary for August 2011 sampling.

Fish	8/16–17/2011		
Species	Arctic grayling	lake trout	slimy sculpin
Count	37	3	7
Mean Length (mm)	217	437	93
Standard Error	4.38	7.00	5.56
Minimum Length (mm)	164	426	67
Maximum Length (mm)	274	450	106
Water Quality			
Date	8/17/2011		
Secchi Reading (m)	3.0		
Alkalinity (mg/L $CaCO_3$)	8		
Temperature (°C)	10.0-12.5		
DO (mg/L)	8.2-10.2		
DO (%)	71-96		
pH	6.5-6.8		
Specific Conductivity (µS/cm)	17-19		
TDS (ppm)	0.011-0.013		
Water Color	turbid		
Max Depth Sampled (m)	3.70		

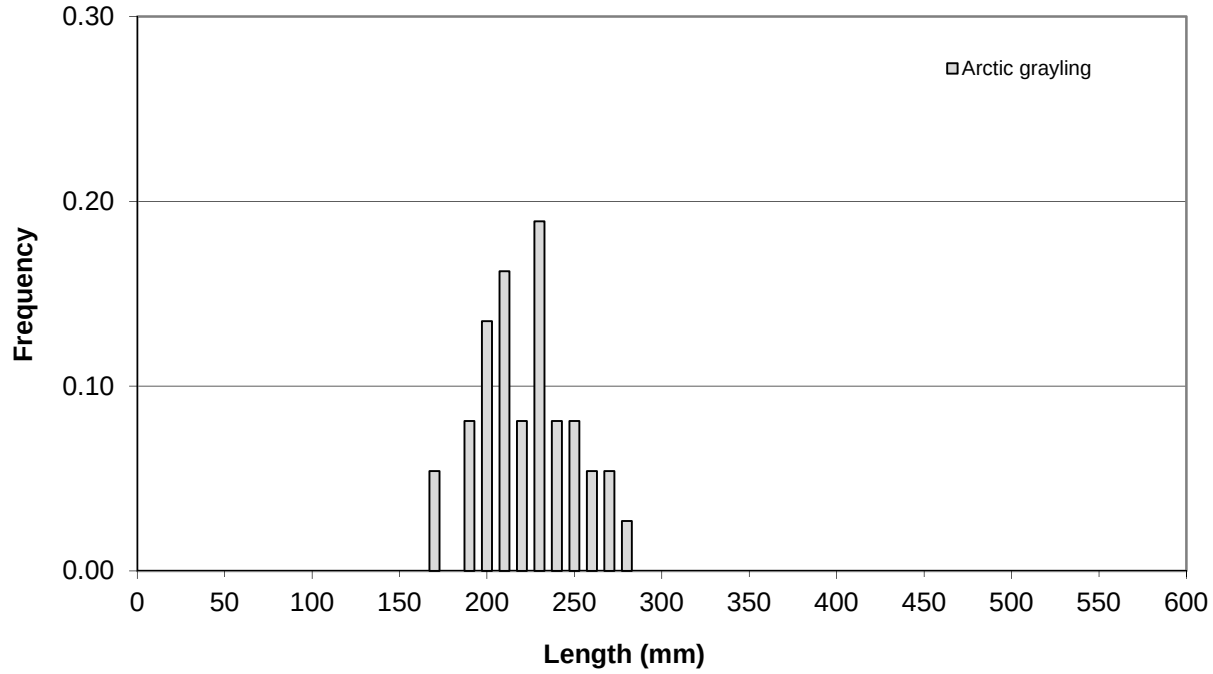


Figure 23.–Paul's Pond LFD for Arctic grayling (n=37) captured August 2011.

Polaris Lake: Fish data were collected May 14–15, 2012. Water quality data were collected March 22, 2011, March 27, 2012, May 14, 2012, and March 28, 2013 (Table 31). Sampling in May 2012 was conducted soon after ice off and just prior to spring stockings to determine if stocked fish survived winter and to crudely assess their overall health. Three Arctic char were captured and all were in good overall health. The absence of rainbow trout and Chinook salmon in our catch is not surprising given low oxygen levels observed in March 2012 (Table 31). We could not confirm angler reports of northern pike; none were present in our catch or observed during sampling. Our goal in Polaris Lake is to stock sufficient numbers of fish to support consumptive summer and early winter fisheries while ensuring most fish will be harvested before mid-to-late winter after which winter-kill events likely occur. Future evaluations should be conducted in late summer to estimate the number of fish remaining in the lake after open water fishing season. We will use this information in the future to adjust numbers of fish stocked to achieve our goal.

Recommendations

- Stock 1,500 catchable (120 g) Arctic char on alternate years, target release date mid-June.
- Stock 1,500 catchable (120 g) Chinook salmon annually, target release date early October.
- Stock 5,400 catchable (180 g) rainbow trout annually, target release date early June.

Table 31.–Polaris Lake data summary for March 2011, March and May 2012, and March 2013 sampling.

Fish	5/14–15/2012			
Species	Arctic char			
Count	3			
Mean Length (mm)	405			
Standard Error	9.68			
Minimum Length (mm)	394			
Maximum Length (mm)	424			
Water Quality				
Date	3/22/2011	3/27/2012	5/14/2012	3/28/2013
Secchi Reading (m)	ND	ND	1.0	ND
Alkalinity (mg/L $CaCO_3$)	ND	ND	128	ND
Temperature (°C)	0.4-3.7	0.1-3.8	6.8-9.0	0.7-3.6
DO (mg/L)	0.1-1.3	0.1-2.2	NR	0.2-1.3
DO (%)	ND	ND	NR	ND
pH	ND	ND	7.6-7.9	ND
Specific Conductivity (µS/cm)	ND	ND	248-250	ND
TDS (ppm)	ND	ND	0.158-0.219	ND
Water Color	ND	ND	cloudy	ND
Max Depth Sampled (m)	6.00	6.00	3.50	6

ND = No data. Data collection was not attempted.

NR = Measurements were not reported because values were unusually high.

Quartz Lake: Fish data were collected October 29, 2013. Water quality data were collected March 31, 2012 and October 29, 2013 (Table 32, Figure 24). Four hundred seventy-four rainbow trout were captured and 193 were measured. Two distinct size categories were present in the LFD of captured rainbow trout, corresponding to fish stocked in June and August 2013 (Figure 24, Appendix B). No fish from previous stocking years were present in our catch. Coho salmon stocked in June 2013 and Chinook salmon stocked in September 2013 were also absent. Rainbow trout in the length category 200-350 mm had a mean length of 262 mm (SE=3.91) and were smaller than *m*LS (Table 33). Objectives for rainbow trout in Quartz Lake were not achieved.

Low oxygen levels affected overwinter survival of rainbow trout stocked in 2012. In late winter and early spring 2013, Anglers reported poor fishing in Quartz Lake. Water quality data were collected at 2 sampling stations in March 2013; DO measured 0.4-1.4 mg/L at the first station and 0.7-3.1 mg/L at the second. Oxygen levels <1 mg/L are usually lethal to rainbow trout. In early June, as ice began to recede from shore, over 100 dead rainbow trout were observed around the perimeter of Quartz Lake. Fish stockings occurred soon after these reports and continued through June, August, and September (Appendix B). ADF&G should periodically measure water quality parameters in Quartz Lake in late March or early April to determine how often the lake is likely to experience a winterkill event.

Following the delayed break up of 2013, temperature increased rapidly in June and stayed high. This rapid onset of unseasonably hot weather may have affected the survival of coho salmon stocked in 2013. The maximum recorded temperature at the Fairbanks International Airport was >21°C (70°F) for 23 of the 30 days in June (NOAA 2014). Coho salmon were stocked in the middle of this warm spell on June 21, 2013 (Appendix B).

We do not know why Chinook salmon were absent from our catch. Temperatures had cooled by late September when fish were released. One possible explanation is that Chinook salmon were located off shore and not available to our gear. Tangle nets were not used during 2013 sampling because ice was forming on the lake. Instead, we attached center leads to each fyke net. Center leads consisted of an additional net (1 m deep by 33 m long) attached to the opening of each fyke. Nets were set perpendicular to shore with the center lead extending to shore. This sampling method was previously used at Quartz Lake and resulted in satisfactory catch rates with limited capture bias for rainbow trout (Fish and Skaugstad 2004). We know some Chinook salmon survived after stocking because ADF&G received 1 confirmed report of an angler catching a Chinook salmon in March 2014.

Fish usually grow well in Quartz Lake. Examination of the LFD of captured rainbow trout suggests fish stocked in June had grown and exceeded management expectations, while fish stocked in August and September did not (Figure 24). The later stocking group had less time in the lake during summer to grow.

Given the unusual weather conditions of 2013, no changes to stockings are recommended at this time.

Recommendations

- Stock 9,500 subcatchable (40 g) Arctic char on alternate years, target release date early September.
- Stock 8,000 catchable (120 g) Chinook salmon annually, target release date early October.
- Stock 30,000-77,000 fingerling (4 g) coho salmon annually, target release date early June.
- Stock 20,000 catchable (120 g) rainbow trout annually. Release half in mid-May and half in early August.

Table 32.–Quartz Lake data summary for March 2012 and October 2013 sampling.

Fish	10/29–31/2013	
Species	rainbow trout	
Count	193[a]	
Mean Length (mm)	279	
Standard Error	4.75	
Minimum Length (mm)	147	
Maximum Length (mm)	436	
Water Quality		
Date	3/31/2012	10/30/2013
Secchi Reading (m)	ND	ND
Alkalinity (mg/L $CaCO_3$)	ND	ND
Temperature (°C)	1.9-3.2	1.4-2.7
DO (mg/L)	0.4-3.1	0.3-12.5
DO (%)	5-24	ND
pH	ND	ND
Specific Conductivity (µS/cm)	ND	ND
TDS (ppm)	ND	ND
Water Color	ND	ND
Max Depth Sampled (m)	5.00	12.00

[a]An additional 281 rainbow trout were captured, counted, and released. No lengths were taken for these fish.
ND = No data. Data collection was not attempted.

Table 33.–Quartz Lake descriptive statistics and test results by length category for rainbow trout captured in October 2013.

Length category	Observed			Model	Bootstrap	
(mm)	Mean (mm)	SE	N	*m*LS (mm)	Mean (mm)	P-value
>200 & ≤350	262	3.91	135	288	262	0.0001

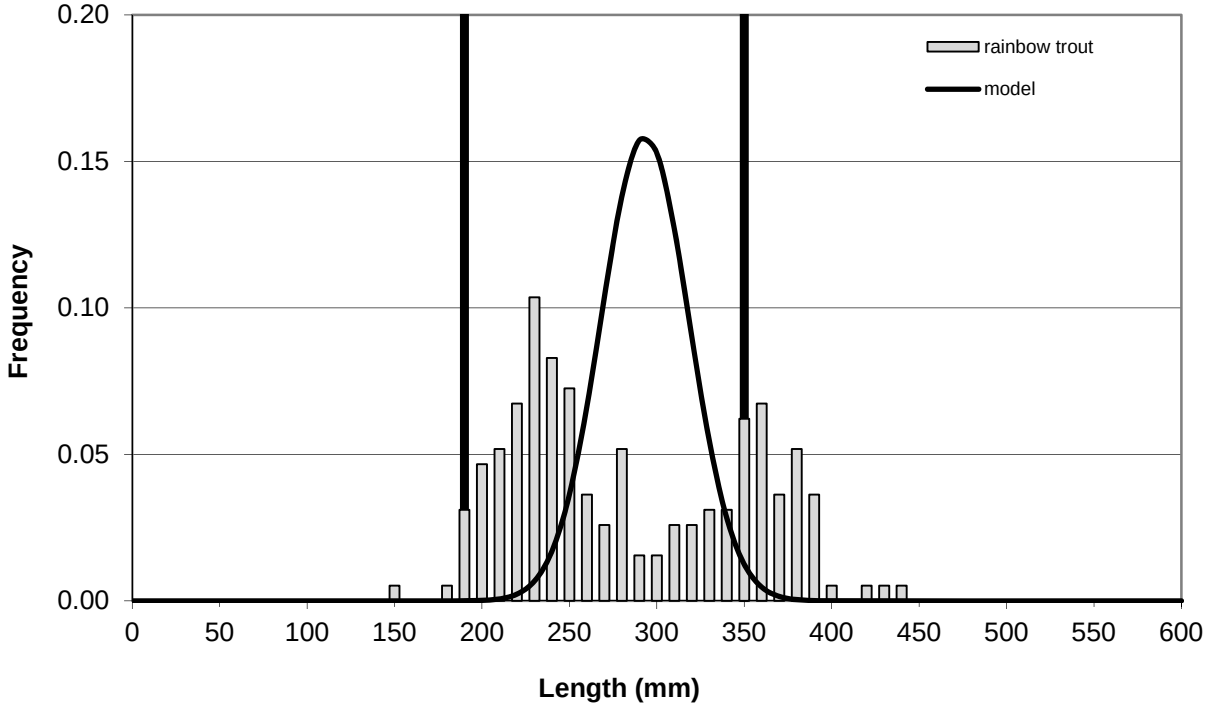


Figure 24.–Quartz Lake LFD for rainbow trout (n=193) captured October 2013 and plotted with model LFD.

Rainbow Lake: Fish data were collected June 6–8, 2012. Water quality data were collected March 25, 2011 and June 7, 2012 (Table 34, Figure 25). Seventy-four rainbow trout were captured. Two fish appeared thin. Examination of the observed LFD and recent stockings indicated that rainbow trout were age 2 and age 4 stocked as fingerlings in 2010 and 2008 (Figure 25, Appendix B). Age-2 fish were 146-296 mm and age-4 fish were 345-432 mm. Thin rainbow trout were 376 mm and 422 mm and fell within the age-4 cohort. Rainbow trout >350 mm did not meet *m*LS for special management (Table 35). Special management objectives for rainbow trout in Rainbow Lake were not achieved.

Rainbow Lake was classified as a special management lake by the BOF in 2004 and corresponding bag restrictions were implemented in 2005. Daily bag and possession limit for a special management lake is 1 fish over 18 inches (457 mm) (Appendix A). Evaluations conducted in 2004 and 2005 indicated rainbow trout were meeting management objectives (Behr and Skaugstad 2006, 2007). In 2012, ADF&G received reports from anglers that few large rainbow trout were present in the lake, and, under special management regulation, few fish were available for harvest. Subsequent to these reports, the public submitted a BOF proposal to change the category of Rainbow Lake from special to regional management (Proposal 237, 2013–2014 BOF cycle, AYK Meeting). This action would have increased the daily bag and possession limit to 10 fish, 1 over 18 inches (457 mm). ADF&G opposed this proposal because there were already multiple existing fisheries under regional management and because this action limited the diversity of fishing opportunity in the Tanana River management area. A compromise was

reached during the 2013–2014 AYK BOF meeting and Rainbow Lake was moved to the conservative management category, allowing a harvest of 5 fish, 1 over 18 inches (457 mm).

The sample distribution for the age-2 cohort matched the model LFD for conservative management but the age-4 cohort was smaller than the model LFD (Figure 25). Rainbow trout >350 mm did not met *m*LS for conservative management (Table 35). Conservative management objectives for rainbow trout in Rainbow Lake were not achieved.

With other populations we have increased the mean length of all age cohorts by reducing the abundance of fish, which reduces competition for limited food resources. Abundance reduction may be accomplished by increasing harvest or reducing the number of fish stocked. Shifting from special management to conservative management will allow anglers to harvest more fish, which may have the desired effect of reducing abundance and increasing fish size. If this strategy does not provide a population structure that meets conservative management objectives after 5 years then we have the option of adjusting the number of fish stocked.

Recommendations

- Stock 8,000 fingerling (2 g) rainbow trout on alternate years, target release date early June.

Table 34.–Rainbow Lake data summary for June 2012 sampling.

Fish	6/6–8/2012	
Species	rainbow trout	
Count	74	
Mean Length (mm)	312	
Standard Error	9.02	
Minimum Length (mm)	147	
Maximum Length (mm)	432	
Water Quality		
Date	3/25/2011	6/7/2012
Secchi Reading (m)	ND	3.5
Alkalinity (mg/L $CaCO_3$)	ND	26
Temperature (°C)	0.7-3.6	5.5-17.2
DO (mg/L)	0.2-2.9	8.9-9.9
DO (%)	ND	73-104
pH	ND	7.3-7.8
Specific Conductivity (µS/cm)	ND	64-67
TDS (ppm)	ND	0.042-0.043
Water Color	ND	clear
Max Depth Sampled (m)	4.00	7.00

ND = No data. Data collection was not attempted.

Table 35.–Rainbow Lake descriptive statistics and test results by length category for rainbow trout captured in June 2012.

Length category (mm)	Observed			Model	Bootstrap	
(Management Category)	Mean (mm)	SE	N	*m*LS (mm)	Mean	P-value
<350 (Special)	385	3.67	36	454	385	0.0001
<350 (Conservative)	385	3.67	36	414	385	0.0001

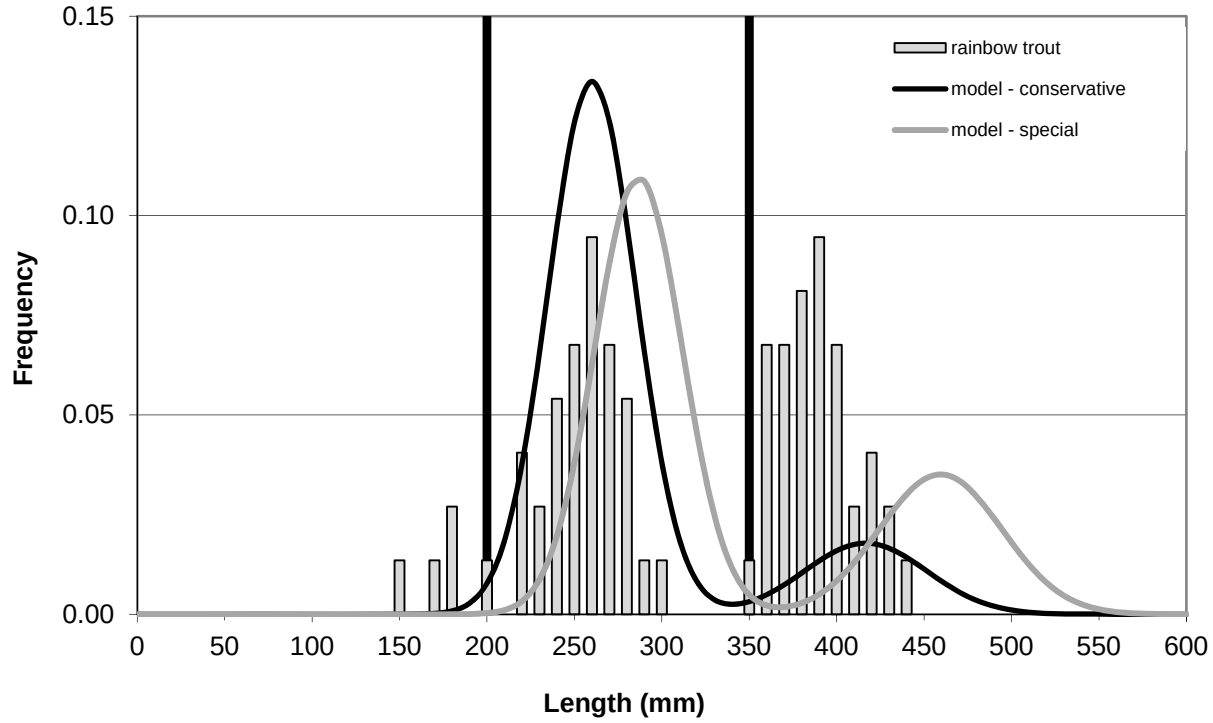


Figure 25.–Rainbow Lake LFD for rainbow trout (n=74) captured June 2012 and plotted with model LFDs for conservative and special management standards.

Rangeview Lake: Fish and water quality data were collected August 15–16, 2011 (Table 36, Figure 26). Nine Arctic char, 14 Arctic grayling, 2 slimy sculpin, and 1 lake trout were captured. All fish were in good overall health and had no external signs of parasite or disease. Examination of the observed LFD and recent stockings indicated that Arctic grayling were likely age 1, stocked as large fingerlings (130 mm, 24 g) in 2010 (Figure 26, Appendix B). Arctic char were last stocked in Rangeview Lake in 2009. Lake trout were stocked once in 1994. Arctic grayling were captured in Rangeview Lake in 1990, prior to ADF&G stocking the species (ADF&G *unpublished data*[9]). Arctic grayling scheduled for stocking into Paul's Pond may have been mistakenly stocked into Rangeview Lake. All stocked fish captured in August 2011 fell within length category 200-350 mm. Water quality parameters indicate conditions were adequate to support fish.

[9] These data are stored in ALDAT: http://www.adfg.alaska.gov/index.cfm?adfg=fishingSportStockingHatcheries.lakesdatabase.

Stocking fingerling size fish in a lake containing lake trout is not ideal; lake trout undoubtedly prey on small stocked fish. Catchable Arctic grayling production was suspended in 2003 due to limited capacity at ADF&G Sport Fish hatcheries in Anchorage (ADF&G 2004). Production resumed in 2009 following the construction of 2 new hatcheries in Fairbanks and Anchorage and Arctic grayling fingerling stockings in Rangeview Lake were replaced with catchable stockings in 2013.

Recommendations

- Stock 190 subcatchable (40 g) Arctic char on alternate years, target release date early September.
- Stock 160 catchable (120 g) Arctic grayling annually, target release date mid-June.

Table 36.–Rangeview Lake data summary for August 2011 sampling.

Fish	8/15–16/2011			
Species	Arctic char	Arctic grayling	slimy sculpin	lake trout
Count	9	14	2	1
Mean Length (mm)	223	243	80	205
Standard Error	9.33	7.48	9.50	-
Minimum Length (mm)	202	208	70	205
Maximum Length (mm)	275	305	89	205
Water Quality				
Date	8/16/2011			
Secchi Reading (m)	2.5			
Alkalinity (mg/L $CaCO_3$)	9			
Temperature (°C)	10.2-11.2			
DO (mg/L)	7.4-11.3			
DO (%)	71-103			
pH	7.6-8.1			
Specific Conductivity (µS/cm)	19-28			
TDS (ppm)	0.012-0.018			
Water Color	turbid			
Max Depth Sampled (m)	3.70			

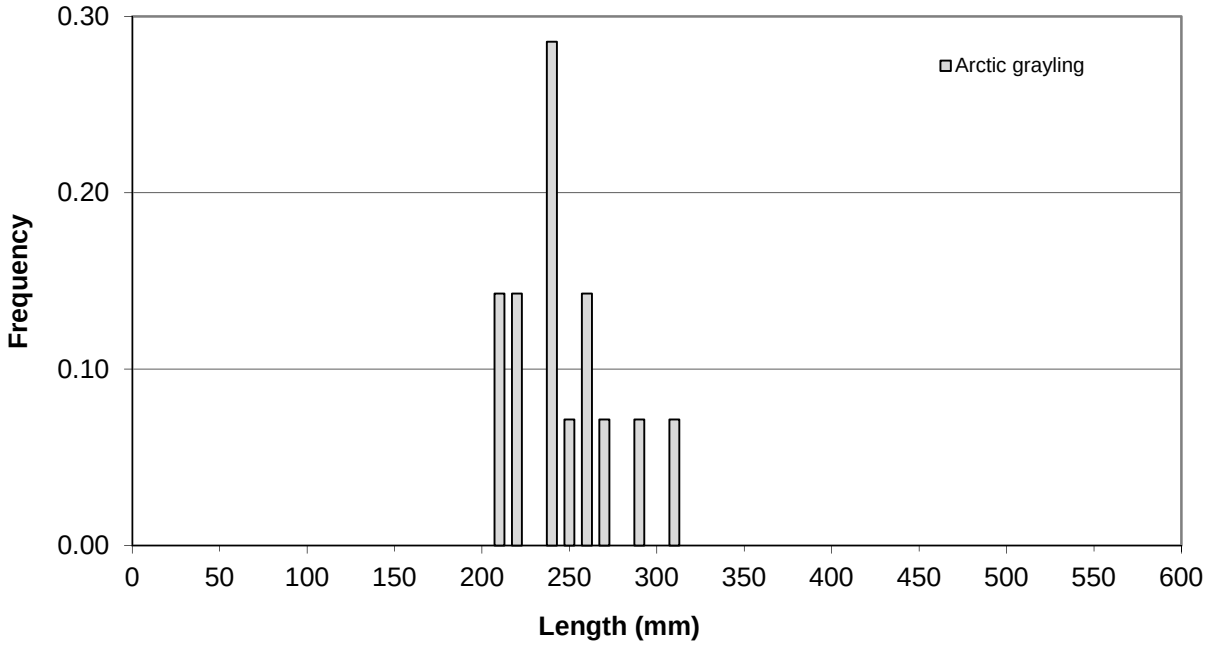


Figure 26.–Rangeview Lake LFD for Arctic grayling (n=14) captured August 2011.

Richardson Highway 28 Mile Pit: Fish data were collected May 24–25, 2012. Water quality data were collected March 28, 2012, May 25, 2012, and April 4, 2013 (Table 37). Sampling was conducted soon after ice off and just prior to spring stocking. One northern pike and no stocked fish were captured. Water quality parameters indicate conditions were adequate to support fish.

ADF&G survey records from the 1970s indicated lake chub *Couesius plumbeus* were present in the lake prior to stocking but there was no indication that northern pike were captured or observed (ADF&G *unpublished data*[10]). Richardson Highway 28 Mile Pit is a category 1, landlocked, gravel pit. It has no inlets or outlets and the Richardson Highway separates the pit from Piledriver Slough and the Tanana River.

We do not know why Arctic char were absent from our catch. Arctic char were last stocked in 2010 (Appendix B). Richardson Highway 28 Mile Pit has a maximum depth of 6.0 m and both near and off shore areas were sampled in 2012. Tangle nets were set at depths up to 5.5 m. Arctic char should have been susceptible to this gear. Additionally, we collected winter water quality data in March and April 2001, 2002, 2003, 2005, 2006, and 2007, and, in every year, the majority of the water column contained DO levels adequate to support fish (ADF&G *unpublished data*[11]). Arctic char stockings were discontinued in 2012.

Our goal is to stock enough fish in Richardson Highway 28 Mile Pit to support consumptive summer and early winter fisheries while maintaining stocking levels that ensure most fish will be harvested before mid-to-late winter. Given the presence of northern pike, only catchable size fish should be stocked into Richardson Highway 28 Mile Pit. ADF&G should conduct future

[10] These data are stored in ALDAT: http://www.adfg.alaska.gov/index.cfm?adfg=fishingSportStockingHatcheries.lakesdatabase.
[11] Water quality data are stored in a database at Alaska Department of Fish and Game, 1300 College Road, Fairbanks, Alaska.

evaluation work in the fall, just prior to freeze up, to more accurately gauge the size, overall health, and relative abundance of stocked fish after the open water fishery.

Recommendations

- Stock 100 catchable (120 g) Arctic grayling annually, target release date early June.
- Stock 540 catchable (180 g) rainbow trout annually, target release date early June.

Table 37.–Rich 28 Mile Pit data summary for May 2012 sampling.

Fish	5/24–25/2012
Species	northern pike
Count	1
Mean Length (mm)	800
Standard Error	-
Minimum Length (mm)	800
Maximum Length (mm)	800

Water Quality			
Date	3/28/2012	5/25/2012	4/4/2013
Secchi Reading (m)	ND	4.5	ND
Alkalinity (mg/L $CaCO_3$)	ND	91	ND
Temperature (°C)	1.5-4.3	7.5-15.6	0.8-3.9
DO (mg/L)	0.3-9.6	5.0-10.1	0.4-8.5
DO (%)	ND	13-103	ND
pH	ND	7.8-8.2	ND
Specific Conductivity (µS/cm)	ND	192-231	ND
TDS (ppm)	ND	0.123-2125	ND
Water Color	ND	clear	ND
Max Depth Sampled (m)	4.00	4.00	4.00

ND = No data. Data collection was not attempted.

Sheefish Lake: Fish and water quality data were collected May 30–31, 2012 (Table 38, Figure 27). Forty-two Arctic char were captured and all fish were in good overall health. Examination of the observed LFD and recent stockings indicated fish from at least 2 previous stockings were present in the lake (Arctic char were stocked in 2010 and 2011; Figure 27, Appendix B). Thirty-one percent of captured fish were satisfactory size (>200 mm). Water level at Sheefish Lake in May 2012 was similar to the water level observed when the lake was last evaluated in 2002. Water quality parameters indicate conditions were adequate to support fish.

Catchable Arctic grayling were last stocked in Sheefish Lake in 2001. Catchable Arctic grayling production was suspended in 2003 due to limited capacity at ADF&G Sport Fish hatcheries in Anchorage (ADF&G 2004). Arctic grayling stockings in Sheefish Lake were restored in 2013 following the construction of 2 new ADF&G hatcheries.

Recommendations

- Stock 350 subcatchable (40 g) Arctic char on alternate years, target release date early September.
- Stock 400 catchable (120 g) Arctic grayling annually, target release date mid-June.

Table 38.–Sheefish Lake data summary for May 2012 sampling.

Fish	5/30–31/2012
Species	Arctic char
Count	42
Mean Length (mm)	213
Standard Error	18.51
Minimum Length (mm)	112
Maximum Length (mm)	490
Water Quality	
Date	5/31/2012
Secchi Reading (m)	2.5
Alkalinity (mg/L $CaCO_3$)	41
Temperature (°C)	5.0-13.1
DO (mg/L)	9.0-11.0
DO (%)	76-107
pH	7.5-8.0
Specific Conductivity (µS/cm)	87-89
TDS (ppm)	0.056-0.057
Water Color	clear
Max Depth Sampled (m)	6.00

ND = No data. Data collection was not attempted.

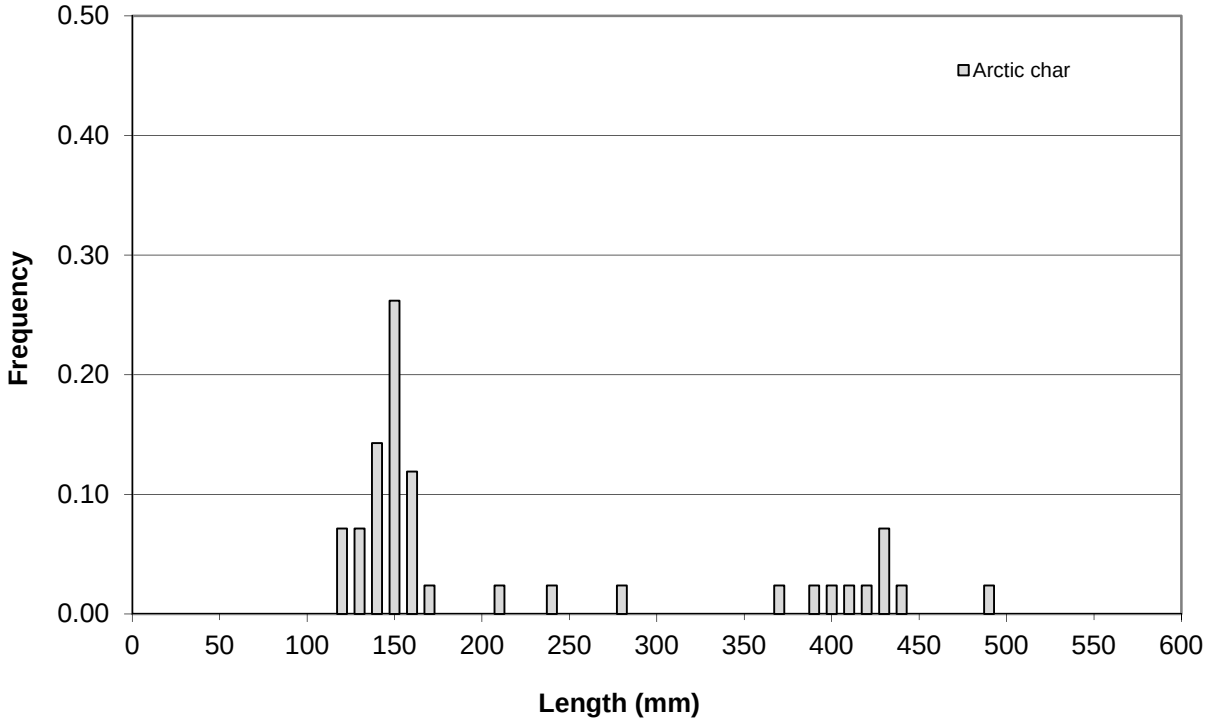


Figure 27.–Sheefish Lake LFD for Arctic char (n=42) captured May 2012.

Sirlin Drive Pond: Fish and water quality data were collected May 18–19, 2011, soon after ice off and just prior to spring stockings (Table 39). No fish were captured and field personnel observed over 45 dead rainbow trout on the lake bottom near shore. We could not confirm angler reports of northern pike. Stocked fish did not survive winter.

Like other small urban lakes, our goal is stock enough fish in Sirlin Drive Pond to support consumptive summer and early winter fisheries while maintaining stocking levels that ensure most fish will be harvested before mid-to-late winter. The dead rainbow trout we observed in spring 2011 is an indication that many fish in Sirlin Drive Pond were not harvested. Catchable rainbow trout stockings were reduced from 400 to 180 fish annually in the 2012 Stocking Plan. ADF&G should consider conducting future sampling at Sirlin Drive Pond during late summer, just prior to freezing, to assess abundance, health, and overall health of stocked fish.

Recommendations

- Stock 180 catchable (180 g) rainbow trout annually, target release date mid-June.

Table 39.–Sirlin Drive Pond data summary for May 2011 sampling.

Fish	5/18–19/2011
Species	
Count	0[a]
Mean Length (mm)	
Standard Error	
Minimum Length (mm)	
Maximum Length (mm)	
Water Quality	
Date	5/19/2011
Secchi Reading (m)	ND
Alkalinity (mg/L $CaCO_3$)	46
Temperature (°C)	8.9-10.0
DO (mg/L)	10.5-11.0
DO (%)	92-97
pH	9.0-9.4
Specific Conductivity (µS/cm)	138-140
TDS (ppm)	0.089-0.091
Water Color	ND
Max Depth Sampled (m)	1.00

[a]No fish were captured; however, approximately 45 dead rainbow trout were observed.
ND = No data. Data collection was not attempted.

South Twin Lake: Fish and water quality data were collected 12–13, 2013 (Table 40-41, Figure 28). Thirty-eight rainbow trout, 2 slimy sculpin, and 1 lake trout were captured. All fish were in good overall health and had no external signs of parasite or disease. Lake trout were not stocked in South Twin Lake but may have migrated from North Twin Lake during high water. Two modes were present in the LFD of captured rainbow trout (Figure 28). Stocking records indicated most captured fish were likely stocked in 2012 or 2013 (Appendix B). Mean length of rainbow trout in length category 200-350 mm was smaller than mLS. Objectives for rainbow trout in South Twin Lake were not achieved.

Similar to North Twin Lake, South Twin Lake is a popular recreational site and harvest is reported annually in the Statewide Harvest Survey. Larger rainbow trout are quickly harvested by anglers and few fish survive to age 3. While the fishery failed to meet management objectives most of the population is within the target category 200-350 mm. This is acceptable because in 2014 most of the population will exceed 300 mm.

Recommendations

- Stock 500 catchable (180 g) rainbow trout annually, target release date early June.

Table 40.–South Twin Lake data summary for August 2013 sampling.

Fish	8/12–13/2013		
Species	rainbow trout	slimy sculpin	lake trout
Count	38	2	1
Mean Length (mm)	252	84	500
Standard Error	7.70	18.50	
Minimum Length (mm)	150	65	500
Maximum Length (mm)	359	102	500

Water Quality	
Date	8/13/2013
Secchi Reading (m)	4.8
Alkalinity (mg/L $CaCO_3$)	44
Temperature (°C)	14.0-15.3
DO (mg/L)	4.8-9.6
DO (%)	42-103
pH	6.9-7.7
Specific Conductivity (µS/cm)	93-99
TDS (ppm)	0.060-0.063
Water Color	clear
Max Depth Sampled (m)	5.7

ND = No data. Data collection was not attempted.

Table 41.–South Twin Lake descriptive statistics and test results by length category for rainbow trout captured in August 2013.

Length category	Observed			Model	Bootstrap	
(mm)	Mean (mm)	SE	N	*m*LS (mm)	Mean (mm)	P-value
>200 & ≤350	258	6.43	33	273	258	0.0119

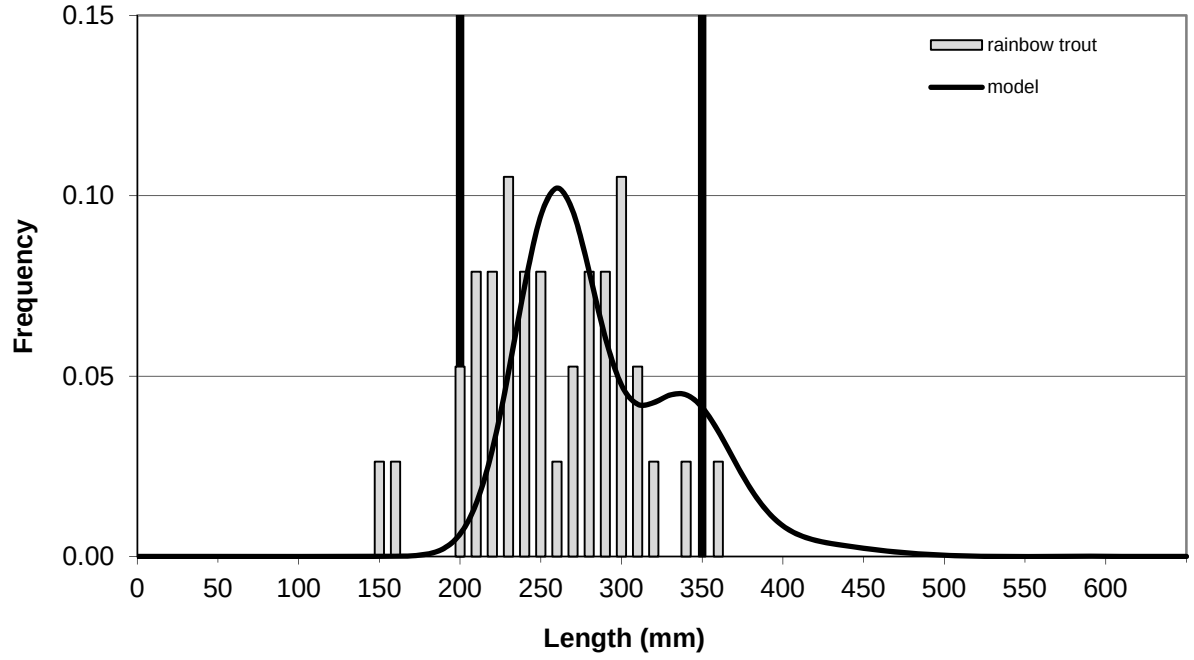


Figure 28.–South Twin Lake length-frequency distribution for rainbow trout (n=38) captured August 2013 and plotted with model LFD.

Upper Copper-Upper Susitna River Management Area

Buffalo Lake: Fish data were collected June 25–26, 2013. Water quality data were collected April 14, 2011, April 9, 2012, April 4, 2013, and June 25, 2013 (Table 42). Nine rainbow trout were captured in 2013. Age cohorts could not be identified. All captured fish were a satisfactory size (>200 mm) and were in good overall health. Water quality parameters recorded in 2011, 2012, and 2013 indicate conditions were adequate to support fish; however, water temperature in the upper portion of the water column exceeded 18°C during fish sampling in June 2013.

Buffalo Lake is reported regularly in the Statewide Harvest Survey and we believe most stocked fish are harvested. Arctic char catchables were added to the 2014 Stocking Plan at the area manager's request. Additional catchable size fish are not available at this time but will be stocked when fish become available.

Recommendations

- Stock 540 catchable (180 g) rainbow trout annually, 370 in late May or early June and 170 in late August.
- Stock 500 catchable (120 g) Arctic char on alternate years, target release date mid-June.

Table 42.–Buffalo Lake data summary for April 2011, April 2012, and April and June 2013 sampling.

Fish	6/25–26/2013
Species	rainbow trout
Count	9
Mean Length (mm)	265
Standard Error	11.77
Minimum Length (mm)	227
Maximum Length (mm)	346

Water Quality				
Date	4/14/2011	4/9/2012	4/4/2013	6/25/2013
Secchi Reading (m)	ND	ND	ND	1.8
Alkalinity (mg/L $CaCO_3$)	ND	ND	ND	17
Temperature (°C)	1.2-4.4	0.5-4.4	0.2-4.1	4.4-21.7
DO (mg/L)	0.3-8.6	0.4-9.2	0.3-9.5	0.2-8.0
DO (%)	3-61	3-64	3-64	1-100
pH	6.2-6.7	6.3-11.5	ND	5.7-7.1
Specific Conductivity (µS/cm)	76-116	39-71	34-74	44-77
TDS (ppm)	ND	ND	ND	0.028-0.047
Water Color	ND	ND	ND	ND
Max Depth Sampled (m)	4.00	4.50	4.50	3.50

ND = No data. Data collection was not attempted.

Gergie Lake: Fish data were collected June 25–27, 2013. Water quality data were collected April 14, 2011, April 9, 2012, April 5, 2013, and June 25, 2013 (Table 43). No fish were captured during June 2013 sampling. DO levels typically lethal to stocked fish (<1 mg/L) were observed throughout most, and in one case all, of the water column during winter 2011, 2012, and 2013. Similar winterkill conditions were previously observed in Gergie Lake. Low DO levels were recorded in April 2001, no fish were captured when sampling was conducted the following spring, and age-4 fish were absent from the catch when sampling was again conducted in 2005 (Behr and Skaugstad 2007). Water quality parameters recorded in June 2013 indicate conditions were adequate to support fish; however, water temperature in the upper portion of the water column exceeded 18°C.

Fingerling rainbow trout stockings in Gergie Lake should be replaced with catchable stockings when larger fish become available. Arctic char were added to the 2014 Stocking Plan at the area manager's request. Additional Arctic char are not available at this time but will be stocked when fish become available.

Recommendations

- Stock 500 catchable (120 g) rainbow trout annually, target release date early June.
- Stock 500 catchable (120 g) Arctic char on alternate years, target release date early September.

Table 43.–Gergie Lake data summary for April 2011, April 2012, April 2013, and June 2014 sampling.

Fish	6/25–27/2013			
Species				
Count	0			
Mean Length (mm)				
Standard Error				
Minimum Length (mm)				
Maximum Length (mm)				
Water Quality				
Date	4/14/2011	4/9/2012	4/5/2013	6/25/2013
Secchi Reading (m)	ND	ND	ND	2.8
Alkalinity (mg/L $CaCO_3$)	ND	ND	ND	77
Temperature (°C)	0.2-4.4	0.2-4.5	0.3-4.1	10.7-19.8
DO (mg/L)	0.3-1.9	0.5-5.6	0.5-2.4	-
DO (%)	2-13	4-38	4-16	-
pH	6.7-7.0	7.4-8.1	6.3-7.1	6.6-8.3
Specific Conductivity (µS/cm)	224-256	108-145	113-133	166-180
TDS (ppm)	ND	ND	ND	0.106-0.115
Water Color	ND	ND	ND	ND
Max Depth Sampled (m)	3.50	4.00	4.00	4.00

ND = No data. Data collection was not attempted.

John Lake: Fish and morphometric data were collected June 14–17, 2011. Water quality data were collected April 18, 2011, April 9, 2012, April 4, 2013, and June 17, 2011 (Table 44, Figures 29-32). Nine Arctic char, 10 Arctic grayling, 10 burbot *Lota lota*, 16 longnose suckers *Catostomus catostomus*, and 6 slimy sculpin were captured. Captured fish were in good overall health and had no external signs of parasite or disease. Captured Arctic char had a mean length of 52 mm (SE=0.84) and were stocked earlier in the year. These fish were stocked in mid-June at 0.63 g (approximately 43 mm) (Appendix B). Rainbow trout stocked in 2008 were not present in our catch and future stockings were discontinued. Water quality parameters recorded in 2011, 2012, and 2013 indicate conditions were adequate to support fish.

John Lake is a remote lake. Stocked fish are transported using a floatplane and fishing effort has not been reported in the Statewide Harvest Survey. Rainbow trout from previous year's stockings were not present in our catch and 2 native sport fish species (burbot and Arctic grayling) were present in this lake. If Arctic char also perform poorly, and angling effort does not increase, ADF&G may discontinue stockings in John Lake.

Recommendations

- Stock 2,000 fingerling (4 g) Arctic char on alternate years, target release date mid-June.

Table 44.–John Lake data summary for April and June 2011, April 2012 and April 2013 sampling.

Fish	6/14–17/2011				
Species	Arctic char	Arctic grayling	burbot	longnose sucker	slimy sculpin
Count	9	10	10	16	6
Mean Length (mm)	52	229	232	339	46
Standard Error	0.84	24.95	14.04	16.98	4.34
Minimum Length (mm)	47	120	94	175	38
Maximum Length (mm)	55	278	311	399	64

Water Quality				
Date	4/18/2011	6/17/2011	4/9/2012	4/4/2013
Secchi Reading (m)	ND	2.5-3.0	ND	ND
Alkalinity (mg/L $CaCO_3$)	ND	10	ND	ND
Temperature (°C)	0.2-4.3	8.7-12.9	0.4-5.05	0.3-4.4
DO (mg/L)	1.2-12.3	7.3-10.0	0.3-10.4	1.7-11.8
DO (%)	9-85	63-93	3-71	12-81
pH	6.0-8.9	7.7-7.8	5.8-6.6	5.1-6.6
Specific Conductivity (µS/cm)	42-48	35-36	23-55	15-30
TDS (ppm)	ND	0.023-0.024	ND	ND
Water Color	ND	humic	ND	ND
Max Depth Sampled (m)	4.00	5.00	6.00	5.00

Morphometry and Other Lake Characteristics	
Surface Area (ha)	56.6
Shoreline Length (km)	6.4
Maximum Depth (m)	7.0
Lake Volume (m^3)	1,150,000
Outlets	1
Inlets	0
Lake Category	intermittent outlet
Surrounding Vegetation	grass, shrub, coniferous

ND = No data. Data collection was not attempted.

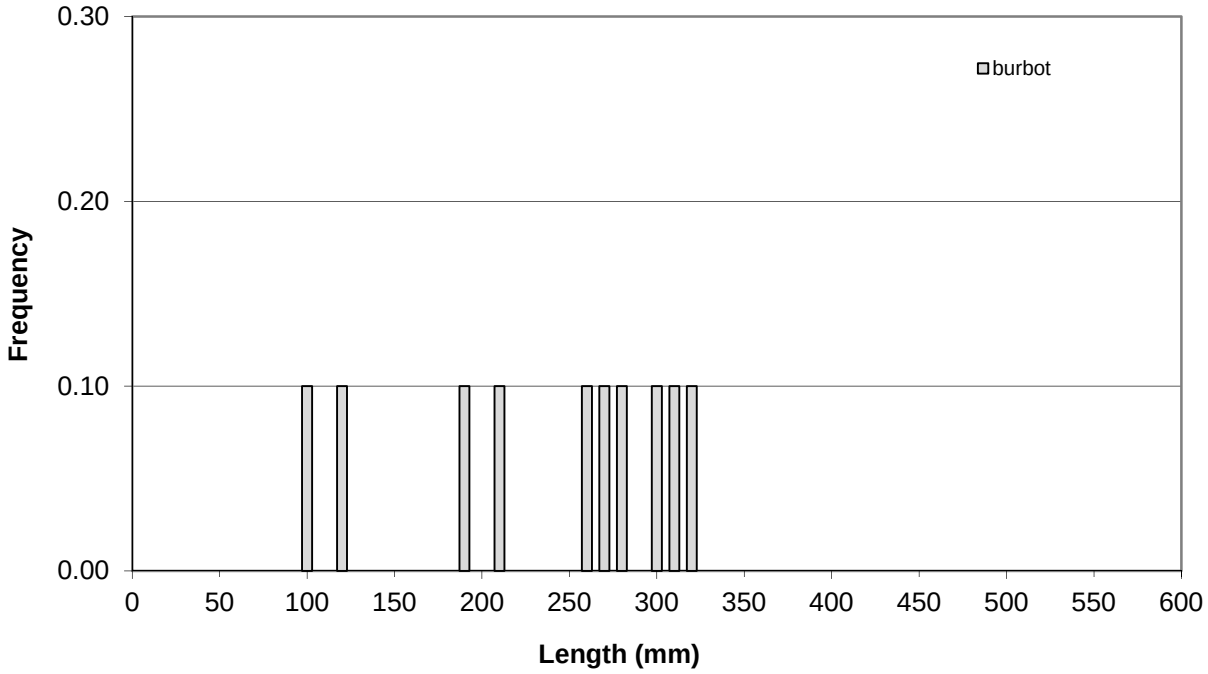


Figure 29.–John Lake LFD for burbot (n=10) captured June 2011.

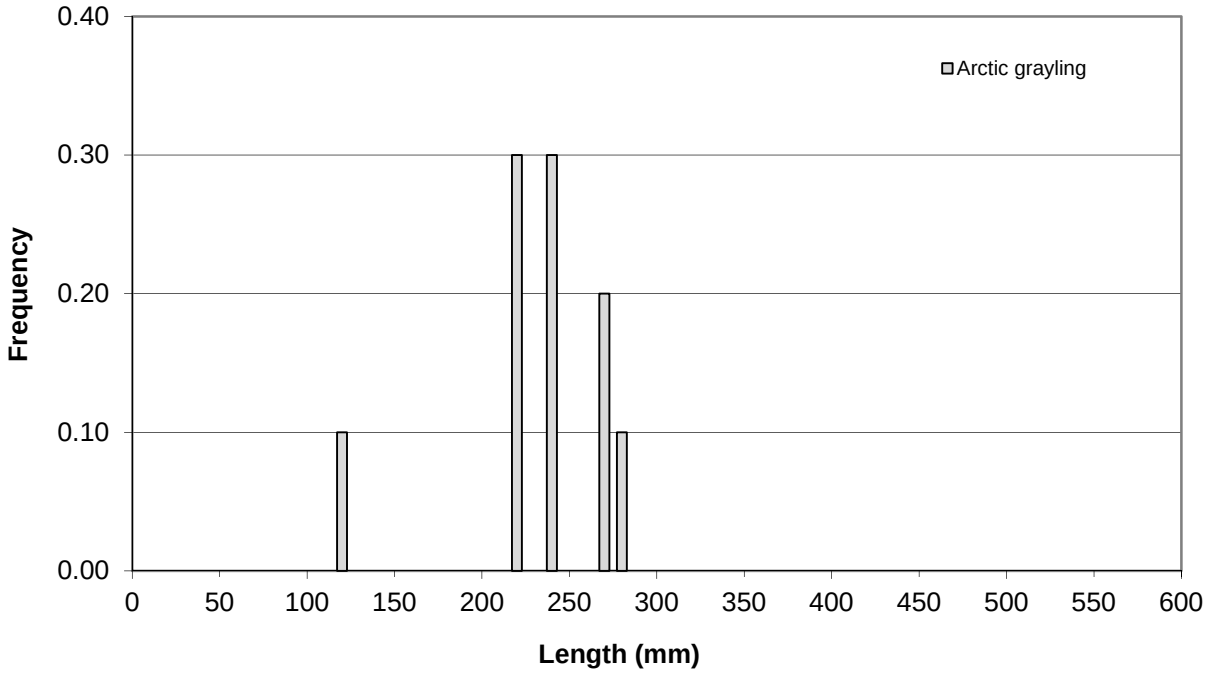


Figure 30.–John Lake LFD for Arctic grayling (n=10) captured June 2011.

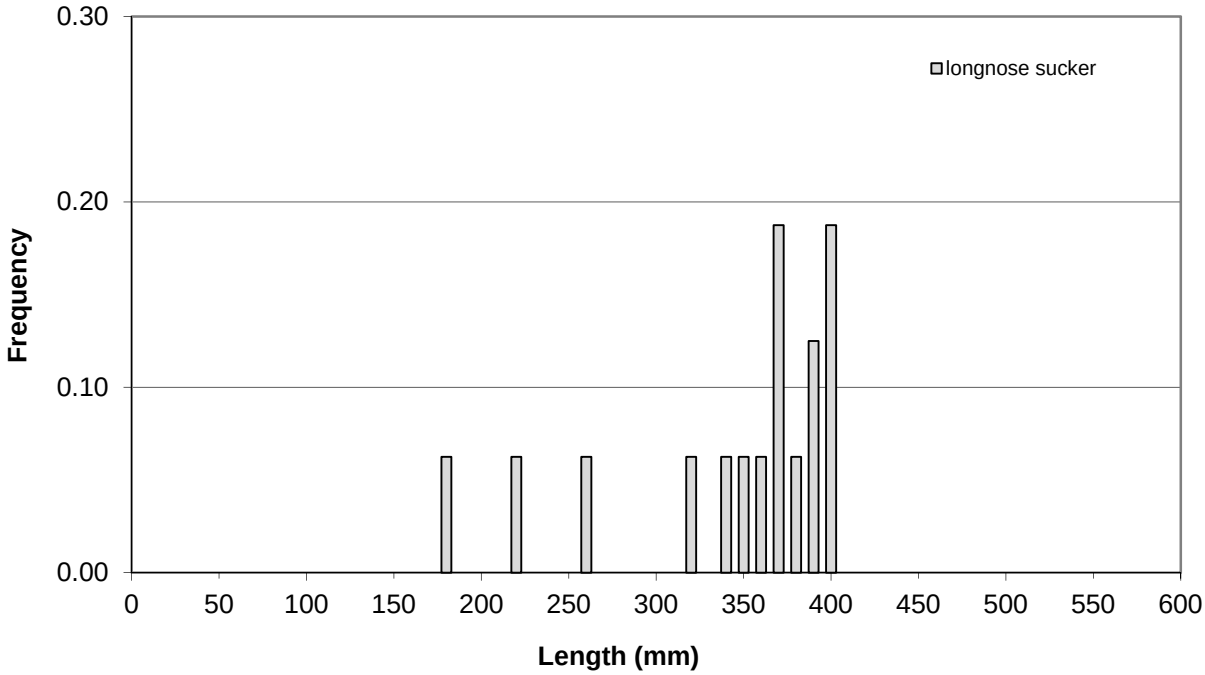


Figure 31.–John Lake LFD for longnose sucker (n=16) captured June 2011.



Figure 32.–John Lake bathymetric map generated from morphometric data collected in June 2011.

Junction Lake: Fish and water quality data were collected August 15–16, 2012. Water quality data were collected April 12, 2011, April 10, 2012, August 16, 2012, and April 4, 2013 (Table 45). Six Arctic grayling were captured during August 2012 sampling. Captured fish had a mean length of 265 mm (SE=55.03) and 2 size groups were present, 325-380 mm and 90-96 mm. The presence of smaller (90-96 mm) fish in Junction Lake confirmed natural reproduction of Arctic grayling. Larger (325-380 mm) fish likely originated from previous stockings; however, no age structures were collected to confirm this. ADF&G survey records from 1960 indicate no fish were observed in Junction Lake prior to initial stockings in 1966 (ADF&G *unpublished data*[12]). Stockings were discontinued in 2003 when hatchery production of catchable Arctic graying was suspended due to limited capacity at ADF&G Sport Fish hatcheries in Anchorage (ADF&G 2004). Production resumed following the construction of 2 new hatcheries in Fairbanks and Anchorage and catchable Arctic grayling were stocked in 2013. Water quality parameters recorded in 2011, 2012, and 2013 indicate conditions were adequate to support fish. Fishing effort is reported frequently (7 of the last 10 years) in the SWHS but could not be evaluated due to too few respondents. Anglers reported catching no fish in Junction Lake in 2005 and 2008–2011. Arctic grayling were reported again in the Statewide Harvest Survey after stockings resumed in 2013 (Romberg et al. *In prep*).

Recommendations

- Stock 900 catchable (120 g) Arctic grayling annually, target release date mid-June.

[12] These data are stored in ALDAT: http://www.adfg.alaska.gov/index.cfm?adfg=fishingSportStockingHatcheries.lakesdatabase.

Table 45.–Junction Lake data summary for April 2011, April and August 2012, and April 2013 sampling.

Fish	8/15–16/2012			
Species	Arctic grayling			
Count	6			
Mean Length (mm)	266			
Standard Error	55.04			
Minimum Length (mm)	90			
Maximum Length (mm)	380			
Water Quality				
Date	4/12/2011	4/10/2012	8/16/2012	4/4/2013
Secchi Reading (m)	ND	ND	2.0	ND
Alkalinity (mg/L $CaCO_3$)	ND	ND	40	ND
Temperature (°C)	0.3-3.9	0.2-3.9	7.6-17.0	0.2
DO (mg/L)	0.7-7.5	0.8-9.2	0.0-8.7	9.2
DO (%)	5-51	6-63	0-99	63
pH	6.1-6.4	NR	6.9-8.0	NR
Specific Conductivity (µS/cm)	108-154	65-79	100-143	70-70
TDS (ppm)	ND	ND	0.064-0.091	ND
Water Color	ND	ND	clear	ND
Max Depth Sampled (m)	4.00	4.00	5.00	0.50

NR = Measurements were not reported because pH probe was not functional.

North Jans Lake: Fish and water quality data were collected June 22–23, 2011 (Table 46, Figure 33). One hundred forty-nine rainbow trout and 3 coho salmon were captured. All fish were in good overall health and had no external signs of parasite or disease. Coho salmon have not been stocked in North Jans Lake; fish likely migrated from South Jans Lake during high water. One mode was present in the LFD of captured rainbow trout (Figure 33). These fish were <200 mm, age 1, and stocked as fingerlings in 2010 (Appendix B). Two rainbow trout were in the length category 200-350 mm and 5 fish were >350 mm. Age cohorts for fish >200 mm could not be identified; however, stocking records indicated these fish were stocked in 2006 and 2008 (Appendix B). Mean length of rainbow trout in the length category 200-350 mm was similar to *m*LS (Table 47). Objectives for rainbow trout in North Jans Lake were achieved.

DO levels in North Jans Lake were lower than levels we typically see in June in Region III lakes. DO was 5.6-3.2 mg/L from 0-4 m and then dropped to <1 mg/L throughout the remainder of the water column, down to 7.1 m. Summer DO levels ≥8 mg/L near the surface are common during summer in Interior lakes. DO was recorded in June at 12 lakes during 2011–2013; 3 lakes had maximum values below 8 mg/L, North Jans Lake, South Jans Lake, and Crescent Lake (Tables 46, 52, and 70 respectively). Examination of DO and temperature profiles showed these lakes were isothermal throughout most of the water column. This is indicative of mixing and likely explains low DO readings near the surface.

Recommendations

- Stock 9,500 fingerling (2 g) rainbow trout on alternate years, target release date early June.

Table 46.–North Jans Lake data summary for June 2011 sampling.

Fish	6/22–24/2011	
Species	rainbow trout	coho salmon
Count	149	3
Mean Length (mm)	145	157
Standard Error	6.77	2.96
Minimum Length (mm)	89	151
Maximum Length (mm)	701	161

Water Quality	
Date	6/22/2011
Secchi Reading (m)	5-7
Alkalinity (mg/L $CaCO_3$)	46
Temperature (°C)	7.9-16.0
DO (mg/L)	0.0-5.6
DO (%)	0-64
pH	6.7-8.0
Specific Conductivity (µS/cm)	86-120
TDS (ppm)	0.056-0.076
Water Color	clear
Max Depth Sampled (m)	7.10

Table 47.–North Jans Lake descriptive statistics and test results by length category for rainbow trout captured in June 2011.

Length category	Observed			Model	Bootstrap	
(mm)	Mean (mm)	SE	N	*m*LS (mm)	Mean (mm)	P-value
>200 & ≤350	303	12.00	2	310	303	0.2531

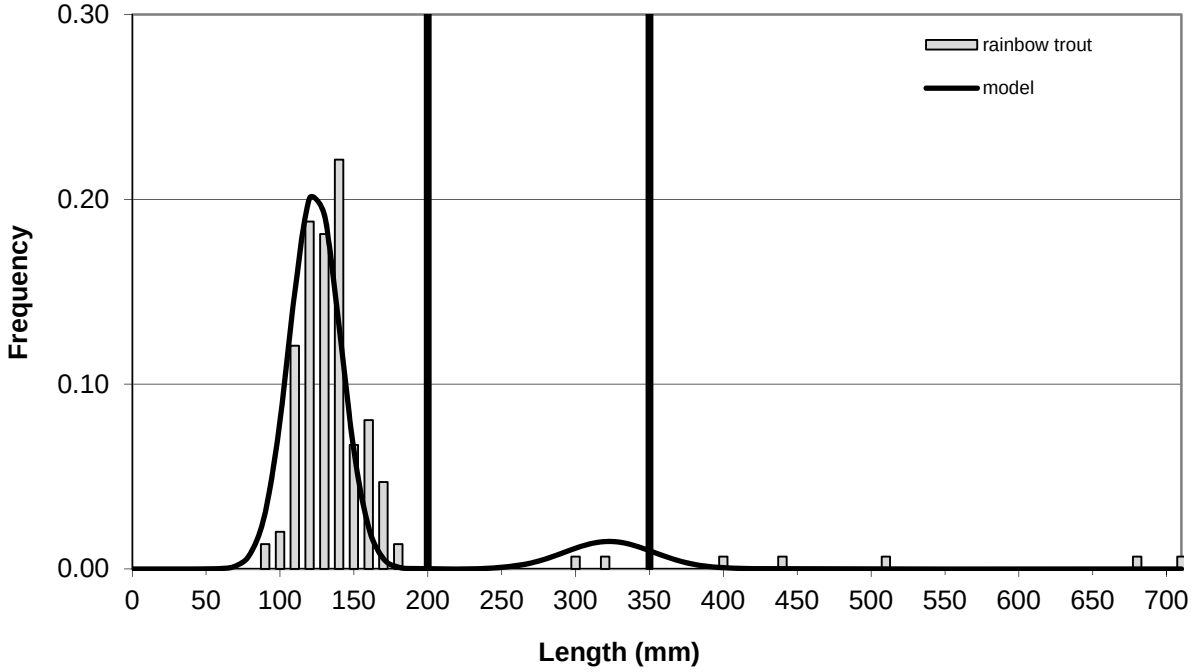


Figure 33.–North Jans Lake LFD for rainbow trout (n=149) captured June 2011 and plotted with model LFD.

Ryan Lake: Fish data were collected August 15–16, 2012. Water quality data were collected April 19, 2011, April 9, 2012, August 16, 2012, and April 4, 2013 (Table 48, Figure 34). Twelve rainbow trout were captured and all fish were in good overall health. Two distinct modes were present in the LFD of captured fish (Figure 34). Stocking records indicated rainbow trout 168-225 mm were stocked as catchables earlier in 2012 and fish >350 mm were stocked as fingerlings in 2009 (Appendix B). Four fish fell within the defined length category 200-350 mm. Mean length of fish in this category was smaller than *m*LS (Table 49). Objectives for rainbow trout in Ryan Lake were not achieved. Water quality parameters indicate conditions were adequate to support fish.

Rainbow trout in Ryan Lake did not meet management objectives because stocked fish were small at the time of release. Fish released into Ryan Lake in June 2012 were 61 g (173 mm), substantially smaller than the 120 g target for catchable rainbow trout. In 2012, ADF&G fish production was transitioned from Fort Richardson to 2 new hatcheries in Anchorage and Fairbanks. This transition resulted in fish releases from 3 separate hatcheries and drastic fluctuations in size and number of fish available for stocking. By 2013, the transition was completed and fish production stabilized. Catchable rainbow trout released from the Fairbanks Ruth Burnett Sport Fish Hatchery (RBSFH) in 2013 had an average weight of 130 g (approximately 218 mm) and 180 g fish are scheduled to be released in 2015. Catchable Arctic grayling from the RBSFH were also released in 2013. Maintaining consistent annual stockings of catchable size fish will improve this fishery.

Recommendations

- Stock 540 (180 g) catchable rainbow trout annually, target release date early June.
- Stock 500 catchable (120 g) Arctic grayling annually, target release date mid-June.

Table 48.–Ryan Lake data summary for April 2011, April and August 2012, and April 2013 sampling.

Fish	6/15–16/2012			
Species	rainbow trout			
Count	12			
Mean Length (mm)	264			
Standard Error	28.85			
Minimum Length (mm)	168			
Maximum Length (mm)	421			
Water Quality				
Date	4/19/2011	4/9/2012	8/16/2012	4/4/2013
Secchi Reading (m)	ND	ND	2.5	ND
Alkalinity (mg/L $CaCO_3$)	ND	ND	17	ND
Temperature (°C)	0.7-3.8	0.2-4.1	15.1-16.6	0.3
DO (mg/L)	0.6-7.2	0.5-8.1	8.9-9.3	12.3
DO (%)	5-49	4-55	98-103	85
pH	6.1-6.2	8.4-8.8	7.8-8.1	NR
Specific Conductivity (µS/cm)	80-82	40-94	45-47	34-34
TDS (ppm)	ND	ND	0.029-0.030	ND
Water Color	ND	ND	clear	ND
Max Depth Sampled (m)	2.00	2.50	3.00	0.50

ND = No data. Data collection was not attempted.

NR = Measurements were not reported because pH probe was not functional.

Table 49.–Ryan Lake: Test results by length category for rainbow trout captured in August 2012.

Length category	Observed			Model	Bootstrap	
(mm)	Mean (mm)	SE	N	*m*LS (mm)	Mean (mm)	P-value
>200 & ≤350	216	3.77	4	258	216	0.0001

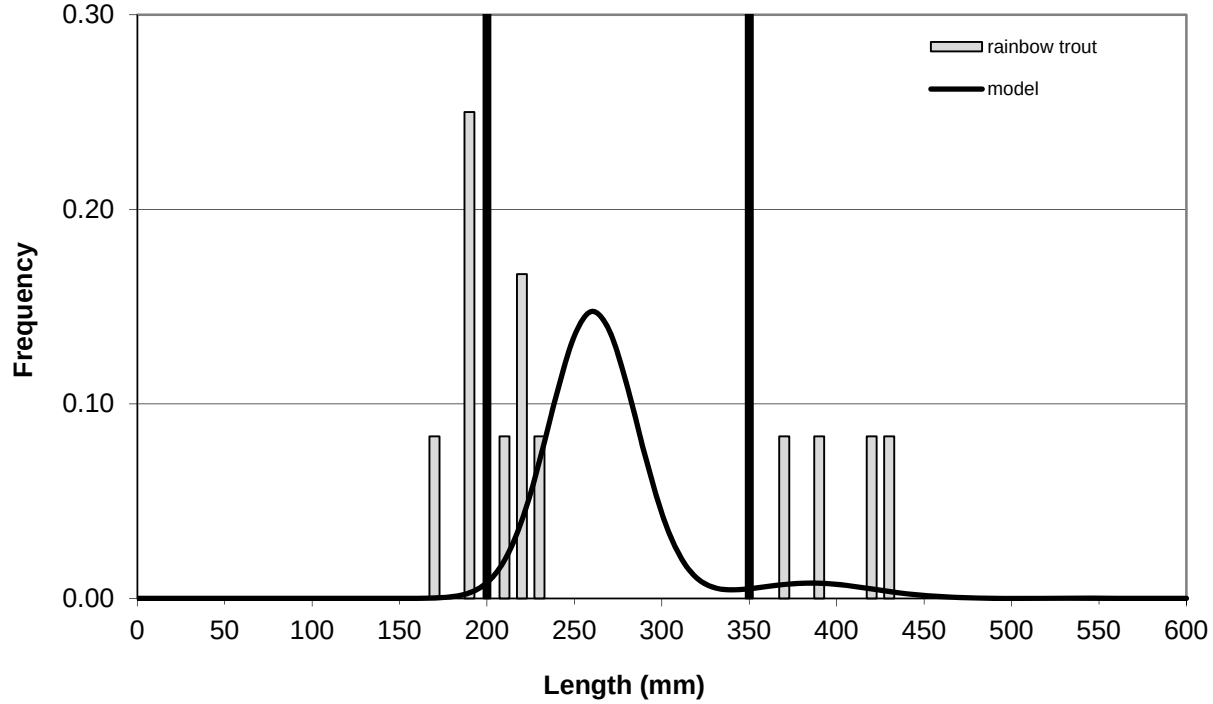


Figure 34.–Ryan Lake LFD for rainbow trout (n=12) captured August 2012 and plotted with model LFD.

Sculpin Lake: Fish and water quality data were collected June 18–20, 2013 (Table 50, Figure 35). Fifty-three rainbow trout were captured and 4 fish were in poor overall health; 1 appeared thin, 2 had an unknown fungus, and 1 had a skin ulcer. Distinct age cohorts were not apparent in the LFD of captured fish but stocking records indicate rainbow trout were released in 2009 and 2011 (Figure 35, Appendix B). Fish stocked in 2011 were age 1 at time of release and would have been age 3 during 2013 sampling. Fish stocked in 2009 were age 0 at time of release and would have been age 4 during sampling. Mean length of fish in length category 200-350 mm was greater than *m*LS (Table 51). Objectives for rainbow trout in Sculpin Lake were achieved. Water quality parameters indicate conditions were adequate to support fish.

Poor overall health of rainbow trout in Sculpin Lake could be the result of disease. In 2003, rainbow trout collected at Silver Lake (0.5 km SW of Sculpin Lake) had *Gyrodactylus* sp. and *Trichophrya* sp. on gills, *Gyrodactylus* sp. on skin and fins, and some fungal hyphae typical of *Saprolegnia* sp. on skin (ADF&G Pathology 2003-0085). All these fish parasites are commonly found in fresh water lakes and streams in Alaska. If environmental conditions in Silver Lake were conducive to outbreaks of these parasites then similar conditions likely existed at Sculpin Lake. Similar parasite outbreaks have been reported at Silver Lake in years before and after 2003. For now, we don't know if poor overall health for rainbow trout in Sculpin Lake was caused by disease or something else.

Recommendations

- Stock 10,000 (4 g) fingerling rainbow trout on alternate years, target release date early June.

Table 50.–Sculpin Lake data summary for June 2013 sampling.

Fish	6/18–21/2013
Species	rainbow trout
Count	53
Mean Length (mm)	343
Standard Error	9.13
Minimum Length (mm)	219
Maximum Length (mm)	493
Water Quality	
Date	6/19/2013
Secchi Reading (m)	4.5
Alkalinity (mg/L $CaCO_3$)	89
Temperature (°C)	7.6-21.4
DO (mg/L)	NR
DO (%)	NR
pH	6.8-8.0
Specific Conductivity (µS/cm)	180-222
TDS (ppm)	0.115-0.142
Water Color	clear
Max Depth Sampled (m)	6.00

NR = Measurements were not reported because values were unusually high.

Table 51.–Sculpin Lake: Test results by length category for rainbow trout captured in June 2013.

Length category	Observed			Model	Bootstrap	
(mm)	Mean (mm)	SE	N	*m*LS (mm)	Mean (mm)	P-value
>200 & ≤350	299	6.86	31	239	299	1

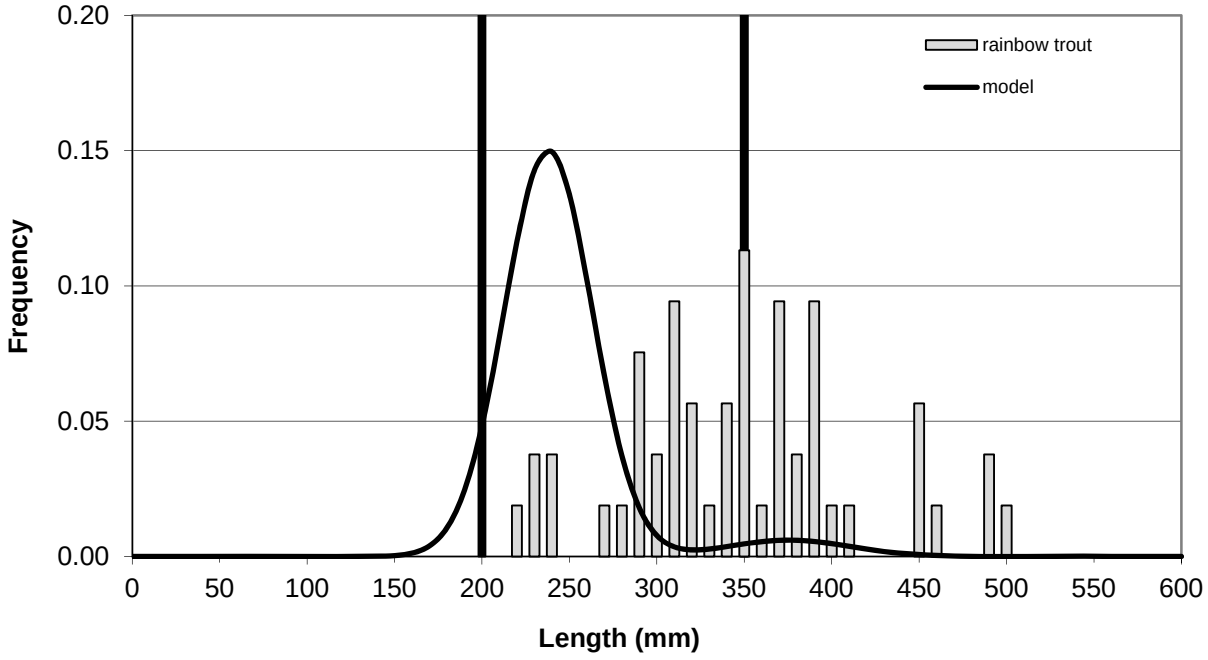


Figure 35.–Sculpin Lake LFD for rainbow trout (n=53) captured June 2013 and plotted with model LFD.

South Jans Lake was evaluated June 20–22, 2011 to collect fish and water quality data (Table 52, Figures 36-37). Seventy-five rainbow trout and 139 coho salmon were captured and measured. Approximately 7,000 additional coho salmon were captured and released. Lengths for these fish were not recorded. Ten captured rainbow trout were in poor overall health; 7 of 10 had cloudy eyes and 6 of 10 had an unknown fungus. Coho salmon were in good overall health. Examination of the observed LFD for rainbow trout and recent stockings indicated 3 age cohorts were present in our catch: age 1, age 3, and age 5; fish were stocked as fingerlings in 2010, 2008, and 2006 respectively (Figure 36, Appendix B). Coho salmon were stocked as fingerlings in 2010. Rainbow trout in poor overall health were 260-501 mm and likely age 3 or age 5; however, age structures were not collected to confirm this. Mean length of rainbow trout in the length category 200-350 mm was similar to *m*LS (Table 53). Objectives for rainbow trout in South Jans Lake were achieved.

The combined stocking density for fingerling rainbow trout and coho salmon in South Jans Lake was approximately 730 fish/ha in 2010. Generally, we keep stocking density ≤ 500 fingerling/ha. Following this evaluation, rainbow trout stockings were reduced from 10,000 to 8,000 fish and coho salmon stockings were reduced from 10,000 to 5,000 fish. While we don't know if poor overall health for some rainbow trout was due to excessive numbers of fish stocked per ha or some other cause it is prudent to reduce the combined number of fish stocked per ha.

Similar to North Jans Lake, DO in South Jans Lake was lower than levels we typically see in June in Region III. The highest recorded value in June 2011 was 5.6 mg/L at the surface. DO and temperature fell gradually with depth until the bottom 2 meters, where temperature rapidly decreased and DO fell to <1 mg/L.

Recommendations

- Stock 8,000 fingerling (2 g) rainbow trout on alternate years, target release date early June.
- Stock 5,000 fingerling (4 g) coho salmon on alternate years, target release date early June.

Table 52.–South Jans Lake data summary for June 2011 sampling.

Fish	6/20–22/2011	
Species	rainbow trout	coho salmon[a]
Count	75	139
Mean Length (mm)	151	154
Standard Error	11.50	0.66
Minimum Length (mm)	82	106
Maximum Length (mm)	501	170
Water Quality		
Date	6/21/2011	
Secchi Reading (m)	3-5.5	
Alkalinity (mg/L $CaCO_3$)	45	
Temperature (°C)	10.2-15.7	
DO (mg/L)	0-5.8	
DO (%)	0-62	
pH	7.0-7.9	
Specific Conductivity (µS/cm)	91-116	
TDS (ppm)	0.058-0.075	
Water Color	clear	
Max Depth Sampled (m)	6.00	

[a] Approximately 7,000 additional coho salmon were captured and released during sampling. Lengths for these fish were not recorded.

Table 53.–South Jans Lake descriptive statistics and test results by length category for rainbow trout captured in June 2011.

Length category	Observed			Model	Bootstrap	
(mm)	Mean (mm)	SE	N	*m*LS (mm)	Mean (mm)	P-value
>200 & ≤350	315	11.47	7	310	315	0.6784

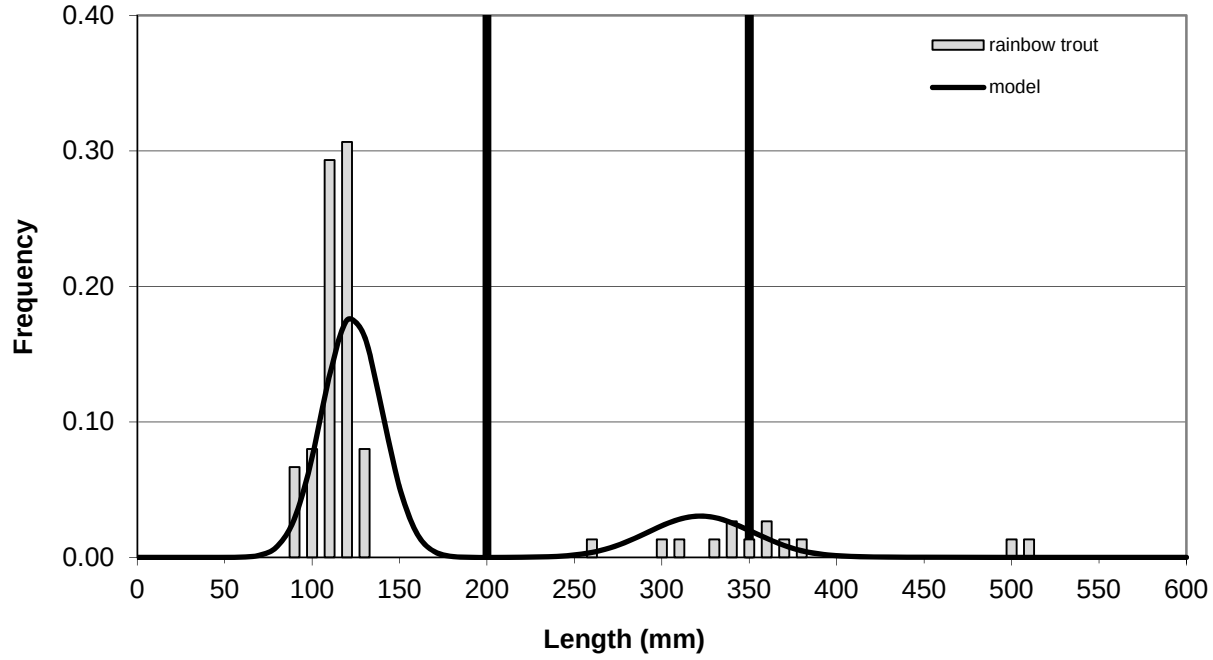


Figure 36.–South Jans Lake LFD for rainbow trout (n=75) captured June 2011 and plotted with model LFD.

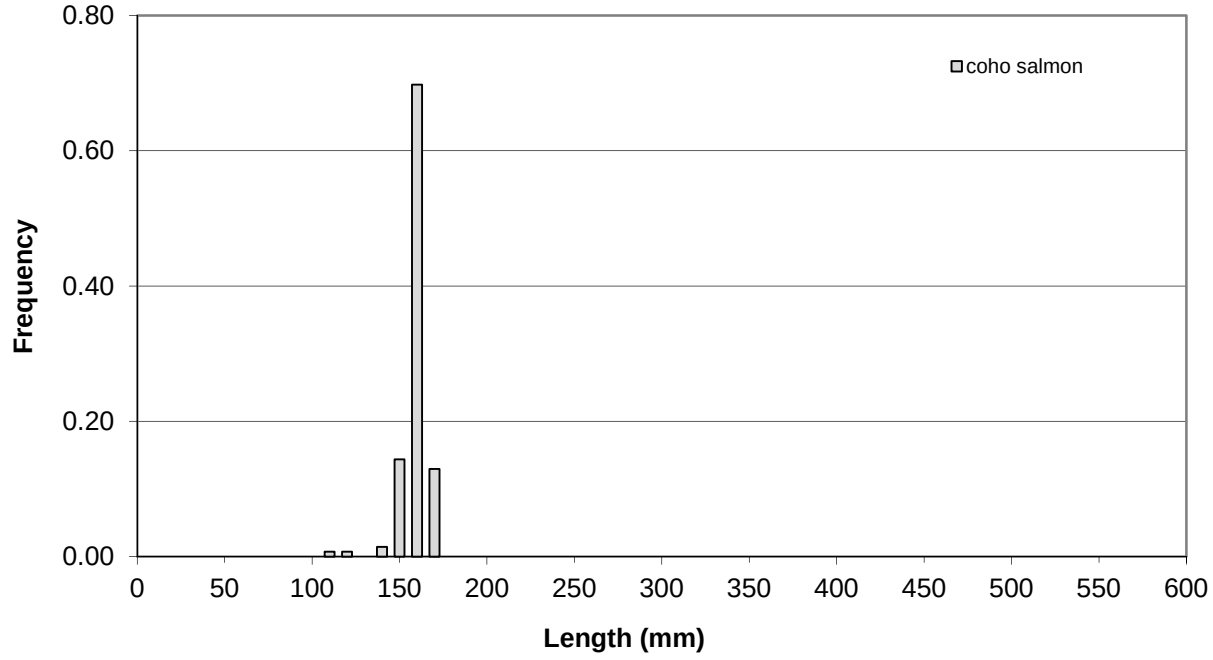


Figure 37.–South Jans Lake LFD for coho salmon (n=139) captured June 2011.

Three Mile Lake: Fish data were collected August 14-15, 2012. Water quality data were collected April 5, 2011, April 2, 2012, August 15, 2012, and April 3, 2013 (Table 54, Figures 38-39). Seventy eight rainbow trout, 20 Arctic grayling, and 1 slimy sculpin were captured. Arctic grayling were last stocked in 1994 and occurred naturally in Three Mile Lake prior to stocking. All fish were in good overall health and had no external signs of parasite or disease. Examination of the observed LFD of captured rainbow trout and recent stockings indicated fish from previous years were present in the lake. Age cohorts could not be determined but 1 prominent mode was apparent in the LFD of captured rainbow trout (150-220 mm, Figure 38). These fish were likely stocked August 2012, just prior to sampling (Appendix B). Mean length of rainbow trout in length category 200-350 mm was larger than *m*LS (Table 55). Objectives for rainbow trout in Three Mile Lake were achieved.

The rainbow trout sample and model LFDs diverged because the model does not account for different size fish stocked at different times during the same year. The 2012 rainbow trout population was comprised of different size fingerlings stocked in spring or fall in different years (2011, 2009, and 2007) and similar size catchables stocked at different times during summer 2012 (Appendix B).

Winter DO levels recorded in April 2011, 2012, and 2013 were marginal to support stocked fish (1.4-4.8 mg/L, Table 54).

Catchable rainbow trout were stocked in 2013 and 2014 and are now the preferred stocking product for this fishery. Catchable Arctic grayling were added at the area manager's request and are scheduled to be released in 2015.

Recommendations

- Stock 1,440 catchable (120 g) rainbow trout annually, target release date early June.
- Stock 1,000 catchable (120 g) Arctic grayling annually, target release date early June.

Table 54.–Three Mile Lake data summary for April 2011, April and August 2012, and April 2013 sampling.

Fish	8/14–15/2012			
Species	rainbow trout	Arctic grayling	slimy sculpin	
Count	78	20	1	
Mean Length (mm)	217	214	91	
Standard Error	6.25	2.48	-	
Minimum Length (mm)	142	192	91	
Maximum Length (mm)	366	233	91	
Water Quality				
Date	4/5/2011	4/2/2012	8/15/2012	4/3/2013
Secchi Reading (m)	ND	ND	bottom	ND
Alkalinity (mg/L $CaCO_3$)	ND	ND	136	ND
Temperature (°C)	1.4-3.5	0.2-3.9	12.9-14.7	0.3-3.8
DO (mg/L)	0.8-2.3	0.5-4.8	7.6-10.7	0.4-3.8
DO (%)	6-16	4-33	71-106	3-25
pH	7.5-7.7	5.9-6.6	7.9-8.2	6.4-7.0
Specific Conductivity (µS/cm)	621-627	288-336	367-379	265-308
TDS (ppm)	ND	ND	0.237-0.242	ND
Water Color	ND	ND	clear	ND
Max Depth Sampled (m)	5.00	6.00	2.50	6.00

Table 55.–Three Mile Lake descriptive statistics and test results by length category for rainbow trout captured in August 2012.

Length category	Observed			Model	Bootstrap	
(mm)	Mean (mm)	SE	N	*m*LS (mm)	Mean (mm)	P-value
>200 & ≤350	262	8.01	34	257	262	0.7385

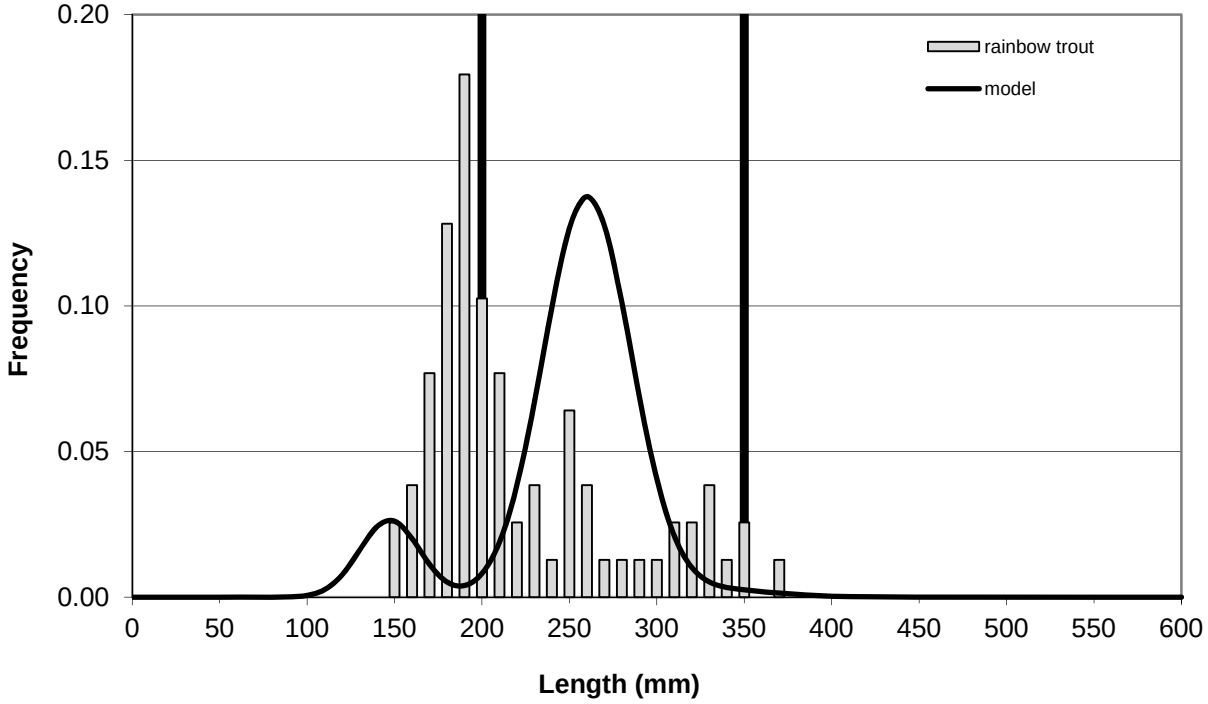


Figure 38.–Three Mile Lake LFD for rainbow trout (n=78) captured in August 2012 and plotted with model LFD.

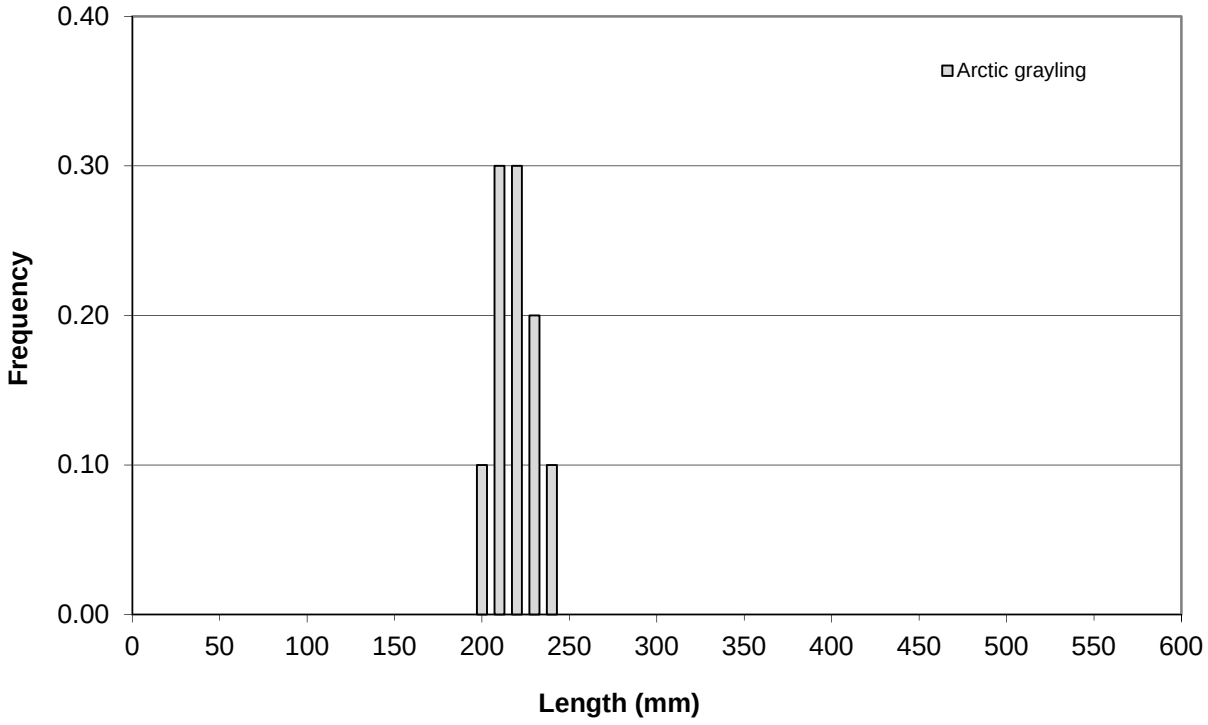


Figure 39.–Three Mile Lake LFD for Arctic grayling (n=20) captured in August 2012.

WILD LAKE EVALUATIONS

We sampled 17 wild lakes to evaluate various fish and lake attributes. We collected information on fish species presence and length at 12 lakes, morphometric data on all 17 lakes, and water quality data in 12 lakes. For these wild lake evaluations, we summarize and present collected information and note unique observations. Captured fish were in good overall health unless noted otherwise.

North Slope Management Area

BBB Lake: Fish, water quality, and morphometric data were collected July 31–August 1, 2012 (Table 56, Figures 40–41).

Table 56.–BBB Lake data summary for July–August 2012 sampling.

Fish	7/31–8/1/2012		
Species	Arctic	slimy sculpin	burbot
Count	35	5	3
Mean Length (mm)	197	72	56
Standard Error	13.14	6.48	2.19
Minimum Length (mm)	57	58	53
Maximum Length (mm)	297	95	60

Water Quality	
Date	8/1/2012
Secchi Reading (m)	-[a]
Alkalinity (mg/L $CaCO_3$)	29
Temperature (°C)	15.0-15.3
DO (mg/L)	3.3-9.0
DO (%)	30-89
pH	6.9-8.4
Specific Conductivity	64-108
TDS (ppm)	0.041-0.070
Water Color	clear
Max Depth Sampled (m)	1.75

Morphometry and Other Lake Characteristics	
Surface Area (ha)	34.4
Shoreline Length (km)	3.4
Maximum Depth (m)	3.2
Lake Volume (m^3)	460,000
Outlets	1
Inlets	1
Lake Category	open
Surrounding Vegetation	tundra

[a] The Secchi disk was still visible when resting on the lake bottom.

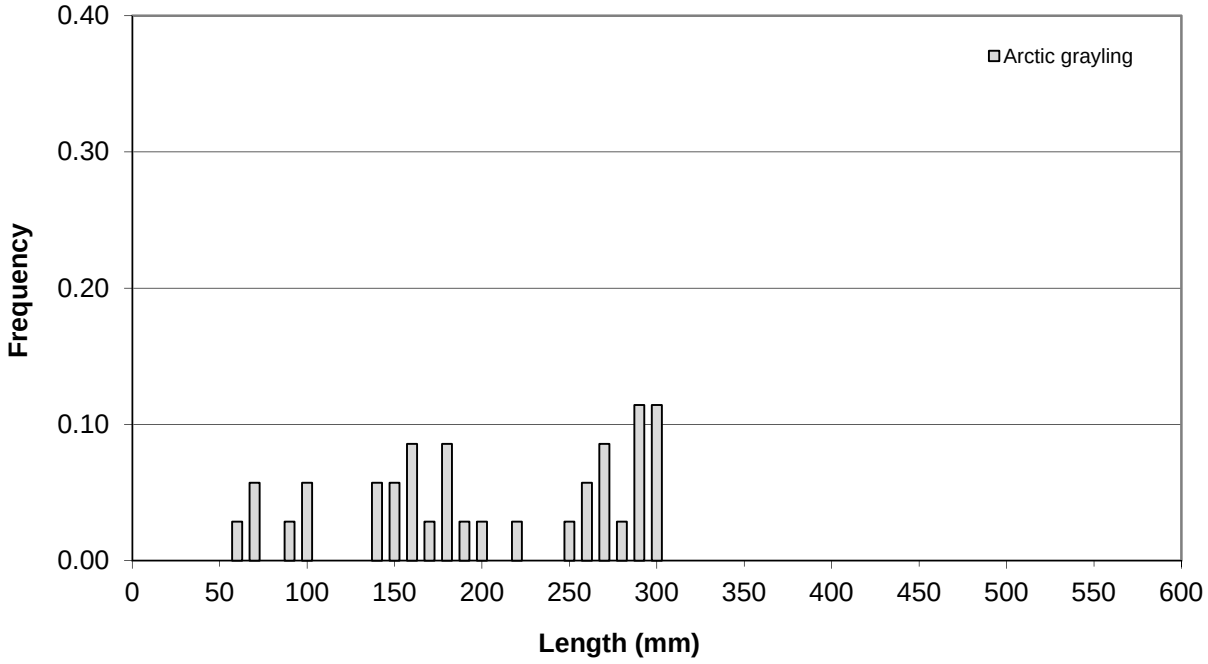


Figure 40.–BBB Lake LFD for Arctic grayling (n=35) captured in July and August 2012.

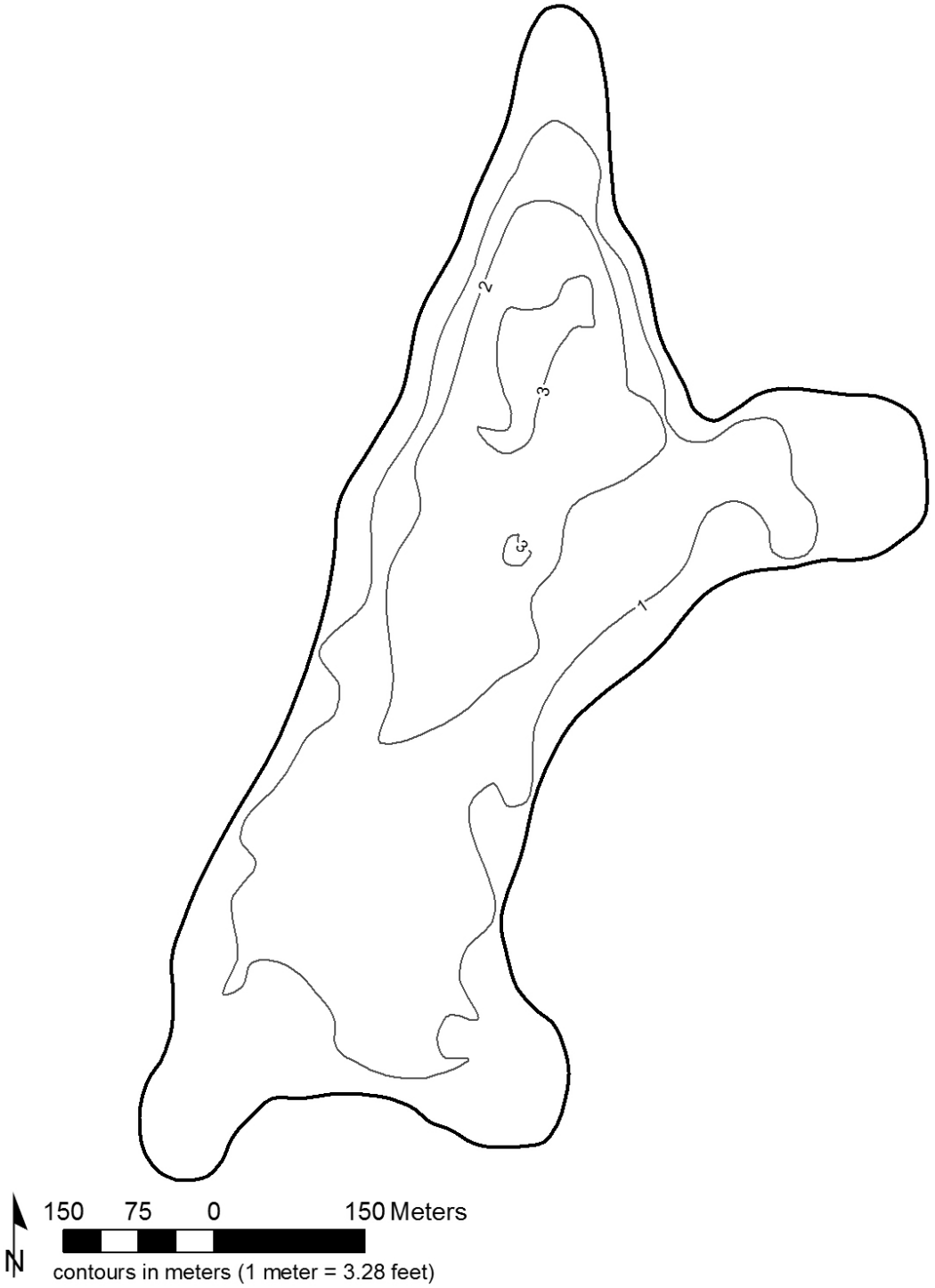


Figure 41.–BBB Lake bathymetric map generated from morphometric data collected July 2012.

Itkillik Lake: **Fish and morphometric** data were collected July 31–August 1, 2012 (Table 57, Figure 42).

Table 57.–Itkillik Lake data summary for July–August 2012 sampling.

Fish	7/31–8/1/2012			
Species	Arctic	slimy sculpin	lake trout	round whitefish
Count	1	1	3	7
Mean Length (mm)	50	50	617	380
Standard Error			121.05	20.73
Minimum Length (mm)	50	50	375	289
Maximum Length (mm)	50	50	750	432

Morphometry and Other Lake Characteristics	
Surface Area (ha)	438.7
Shoreline Length (km)	11.4
Maximum Depth (m)	13.5
Lake Volume (m^3)	21,620,000
Outlets	1
Inlets	multiple
Lake Category	open
Surrounding Vegetation	tundra

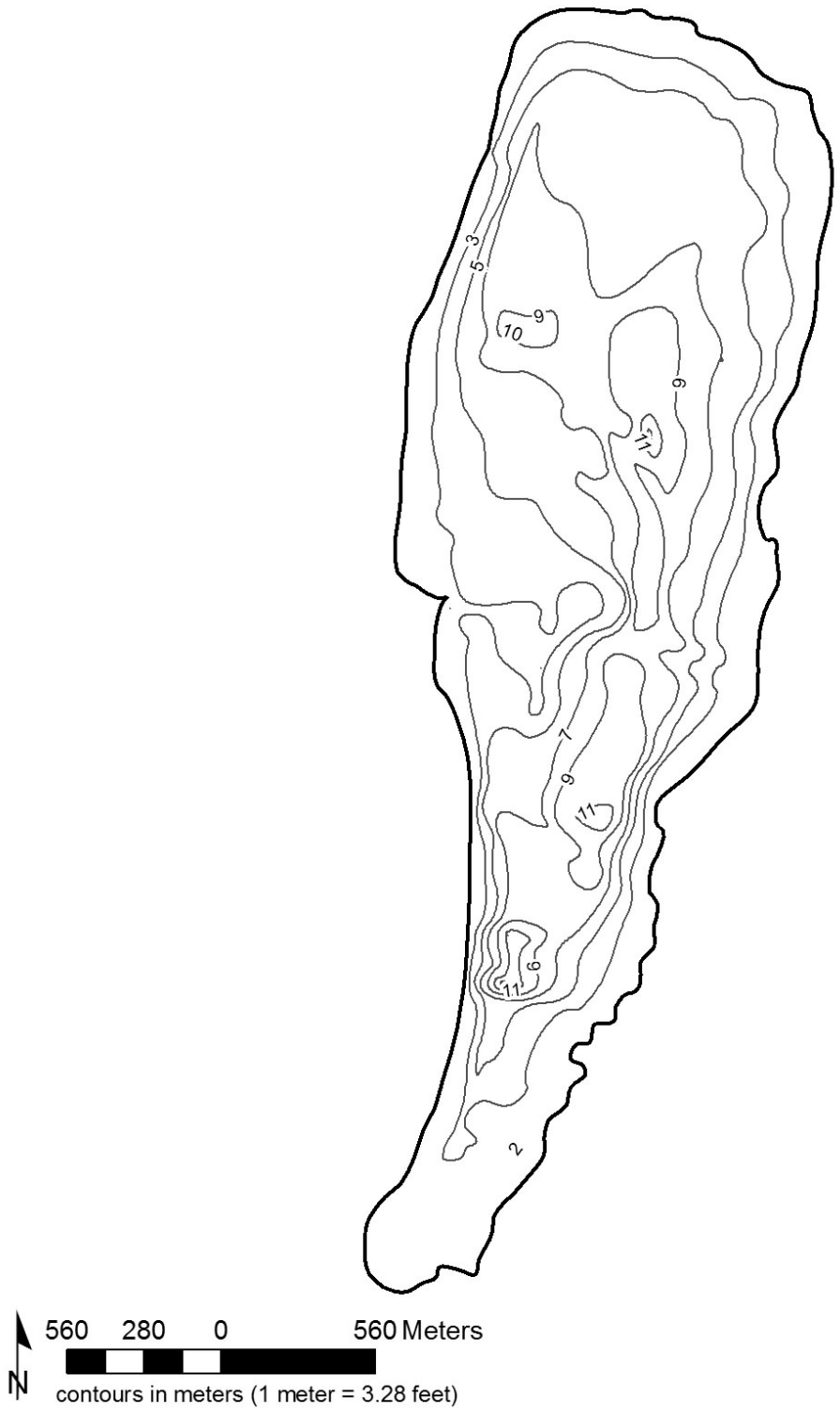


Figure 42.–Itkillik Lake bathymetric map generated from morphometric data collected August 2012.

Tanana River Management Area

5th Ave Pond: Water quality and morphometric data were collected September 27, 2011 and April 12, 2012 (Table 58, Figure 43).

Table 58.–5th Ave Pond data summary for September 2011 and April 2012 sampling.

Water Quality		
Date	4/12/2012	9/27/2011
Secchi Reading (m)	ND	bottom
Alkalinity (mg/L $CaCO_3$)	ND	ND
Temperature (°C)	0.4-2.1	5.6-6.4
DO (mg/L)	0.2-1.1	NR
DO (%)	1-8	NR
pH	ND	7.6
Specific Conductivity	ND	354-356
TDS (ppm)	ND	0.226-0.227
Water Color	ND	ND
Max Depth Sampled (m)	4.00	4.00

Morphometry and Other Lake Characteristics	
Surface Area (ha)	0.5
Shoreline Length (km)	0.29
Maximum Depth (m)	4.9
Lake Volume (m^3)	10,000
Outlets	1
Inlets	0
Lake Category	open
Surrounding Vegetation	shrub

ND = No data. Data collection was not attempted.

NR = Measurements were not reported because values were unusually high.

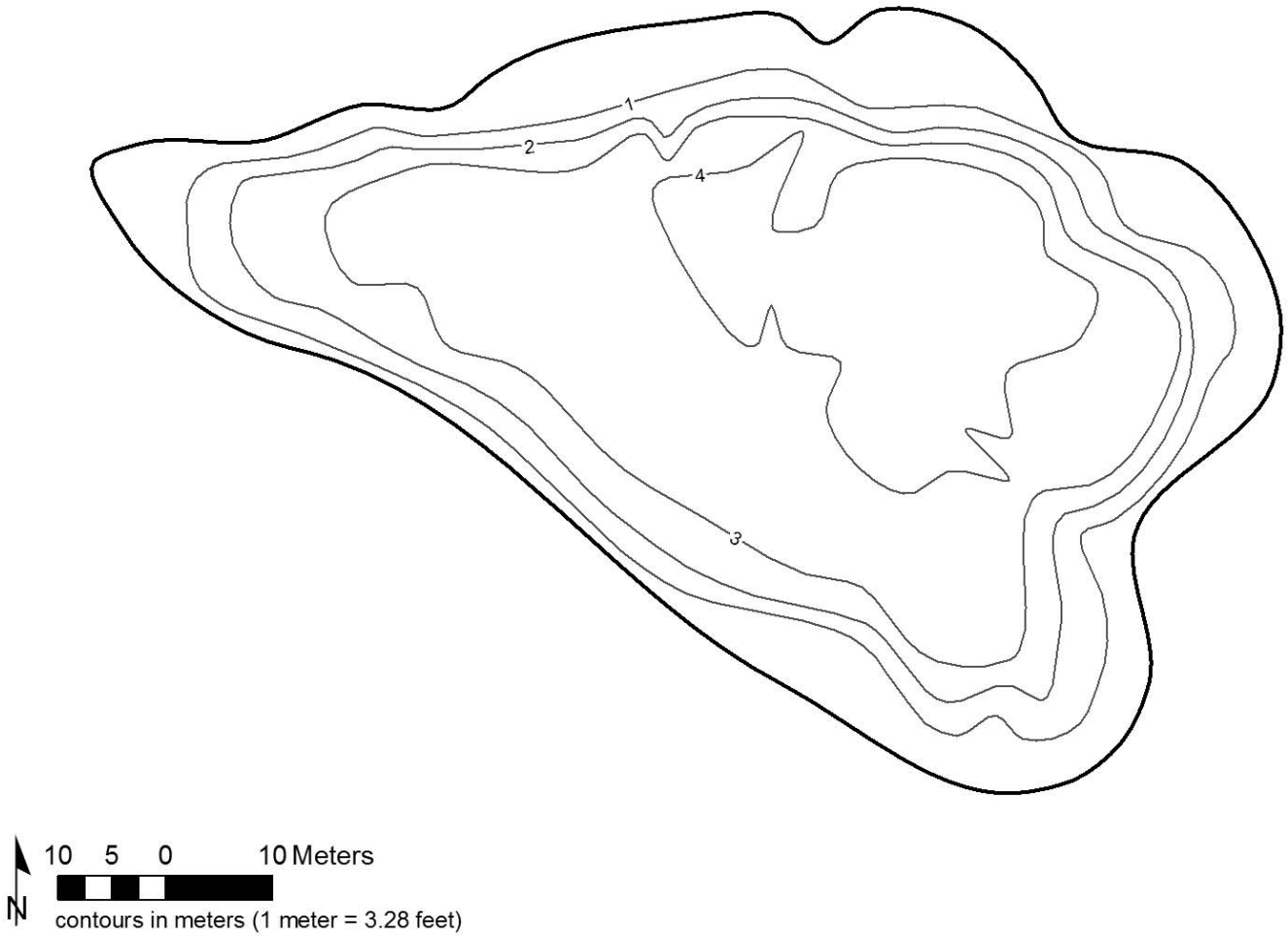


Figure 43.–5th Ave Pond bathymetric map generated from morphometric data collected September 2011.

Bear Lake (DTA): Fish, water quality, and morphometric data were collected March 3, 2011 and July 25–27, 2011 (Table 59, Figures 44-45).

Table 59.–Bear Lake (DTA) data summary for March and July 2011 sampling.

Fish	7/25–26/2011		
Species	lake chub		
Count	86[a]		
Mean Length (mm)	84		
Standard Error	1.77		
Minimum Length (mm)	45		
Maximum Length (mm)	120		
Water Quality			
Date	3/3/2011	7/26/2011	7/27/2011
Secchi Reading (m)	ND	-[b]	3.0
Alkalinity (mg/L $CaCO_3$)	ND	18	18
Temperature (°C)	0.8-4.3	17.9-18.0	16.9-17.6
DO (mg/L)	0.1-7.4	9.2-9.5	7.8-9.5
DO (%)	1-55	97-100	81-99
pH	ND	8.2-8.3	6.8-7.2
Specific Conductivity (µS/cm)	ND	46-46	43-44
TDS (ppm)	ND	0.030	0.028-0.029
Water Color	ND	clear	clear
Max Depth Sampled (m)	5.00	2.50	6.00
Morphometry and Other Lake Characteristics			
Surface Area (ha)	50.6		
Shoreline Length (km)	3.1		
Maximum Depth (m)	9.0		
Lake Volume (m^3)	1,340,000		
Outlets	0		
Inlets	0		
Lake Category	land locked		
Surrounding Vegetation	grass, deciduous, coniferous		

[a]An additional 3,425 lake chub were captured, counted, and released. No lengths were taken for these fish.

[b]The Secchi disk was still visible when resting on the lake bottom.

ND = No data. Data collection was not attempted.

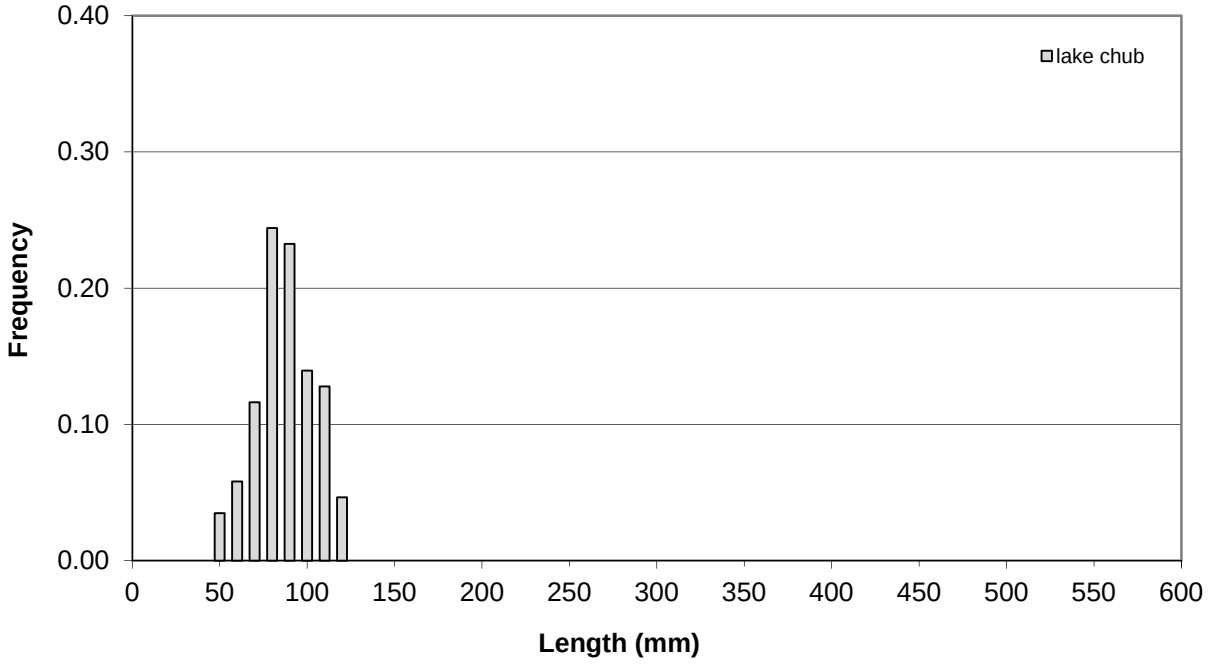


Figure 44.–Bear Lake (DTA) LFD for lake chub (n=86) captured in July 2011.

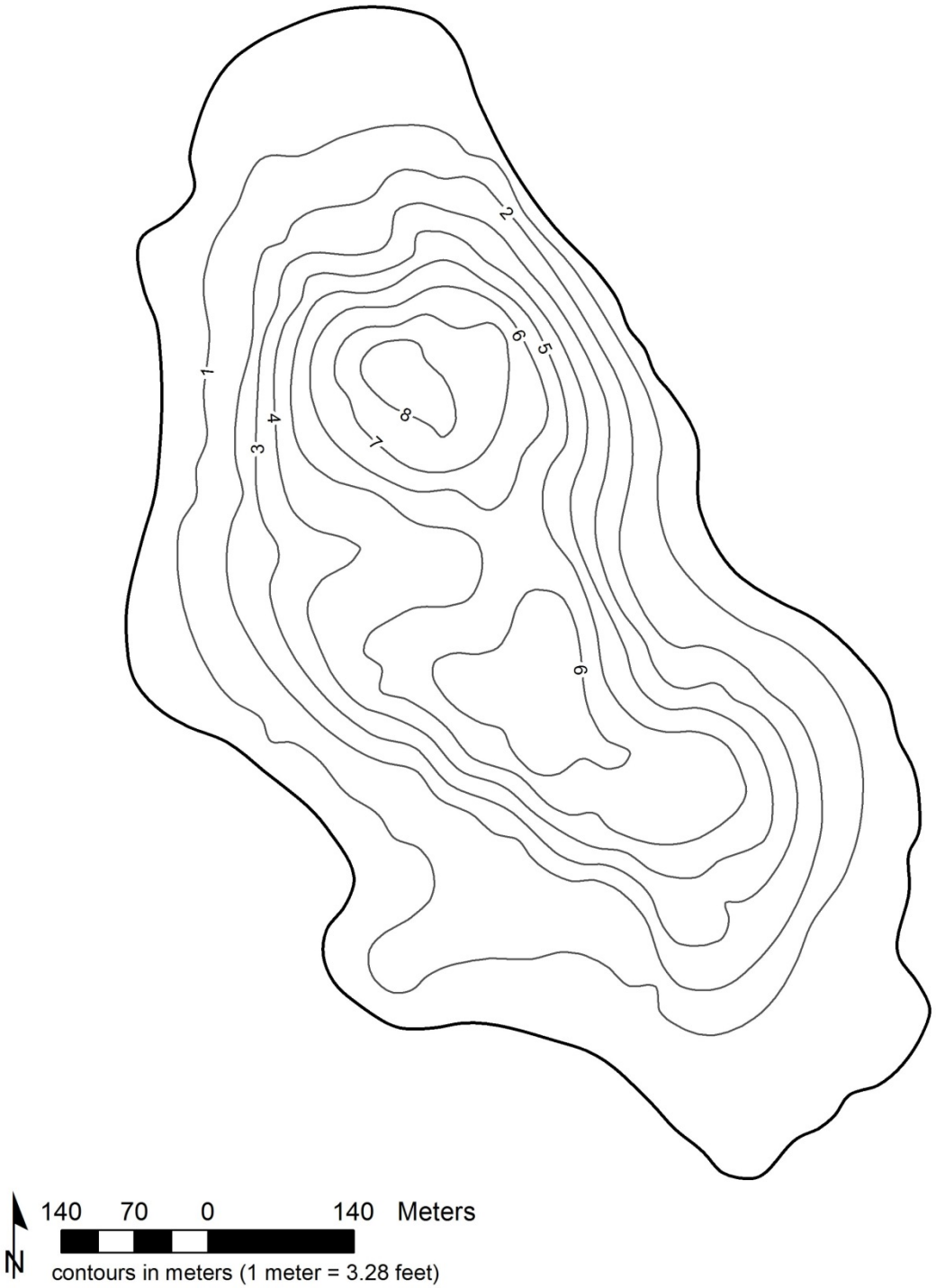


Figure 45.–Bear Lake (DTA) bathymetric map generated from morphometric data collected July 2011.

Boot Lake (DTA): Fish, water quality, and morphometric data were collected March 3, 2011 and July 25–27, 2011 (Table 60, Figures 46-47).

Table 60.–Boot Lake (DTA) data summary for March and July 2011 sampling.

Fish	7/25–27/2011	
Species	lake chub	
Count	56	
Mean Length (mm)	60	
Standard Error	2.12	
Minimum Length (mm)	30	
Maximum Length (mm)	85	
Water Quality		
Date	3/3/2001	7/25/2011
Secchi Reading (m)	ND	2.5-3.0
Alkalinity (mg/L $CaCO_3$)	ND	11
Temperature (°C)	0.4-4.4	14.2-19.2
DO (mg/L)	2.6-10.1	1.9-6.6
DO (%)	21-73	20-77
pH	ND	6.5-7.3
Specific Conductivity	ND	21-28
TDS (ppm)	ND	0.013-0.018
Water Color	ND	clear
Max Depth Sampled (m)	5.00	6.00
Morphometry and Other Lake Characteristics		
Surface Area (ha)	47.9	
Shoreline Length (km)	6.2	
Maximum Depth (m)	7.0	
Lake Volume (m^3)	720,000	
Outlets	0	
Inlets	0	
Lake Category	land locked	
Surrounding Vegetation	grass, deciduous, coniferous (evidence of an old burn)	

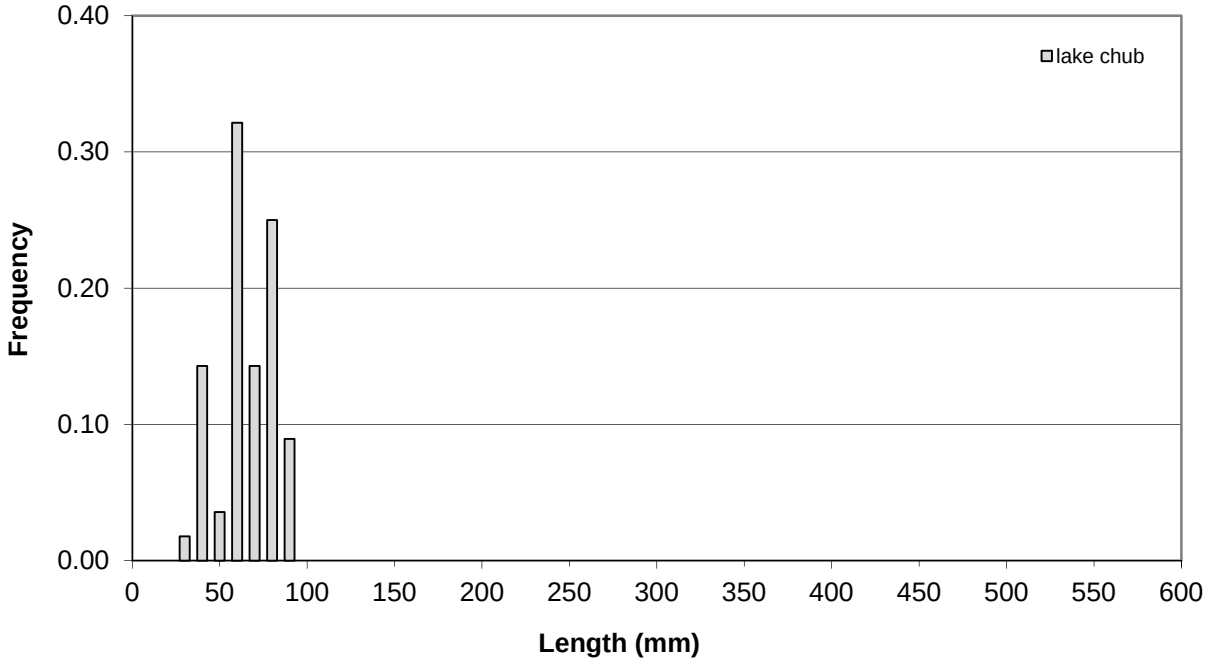


Figure 46.–Boot Lake (DTA) LFD for lake chub (n=56) captured in July 2011.

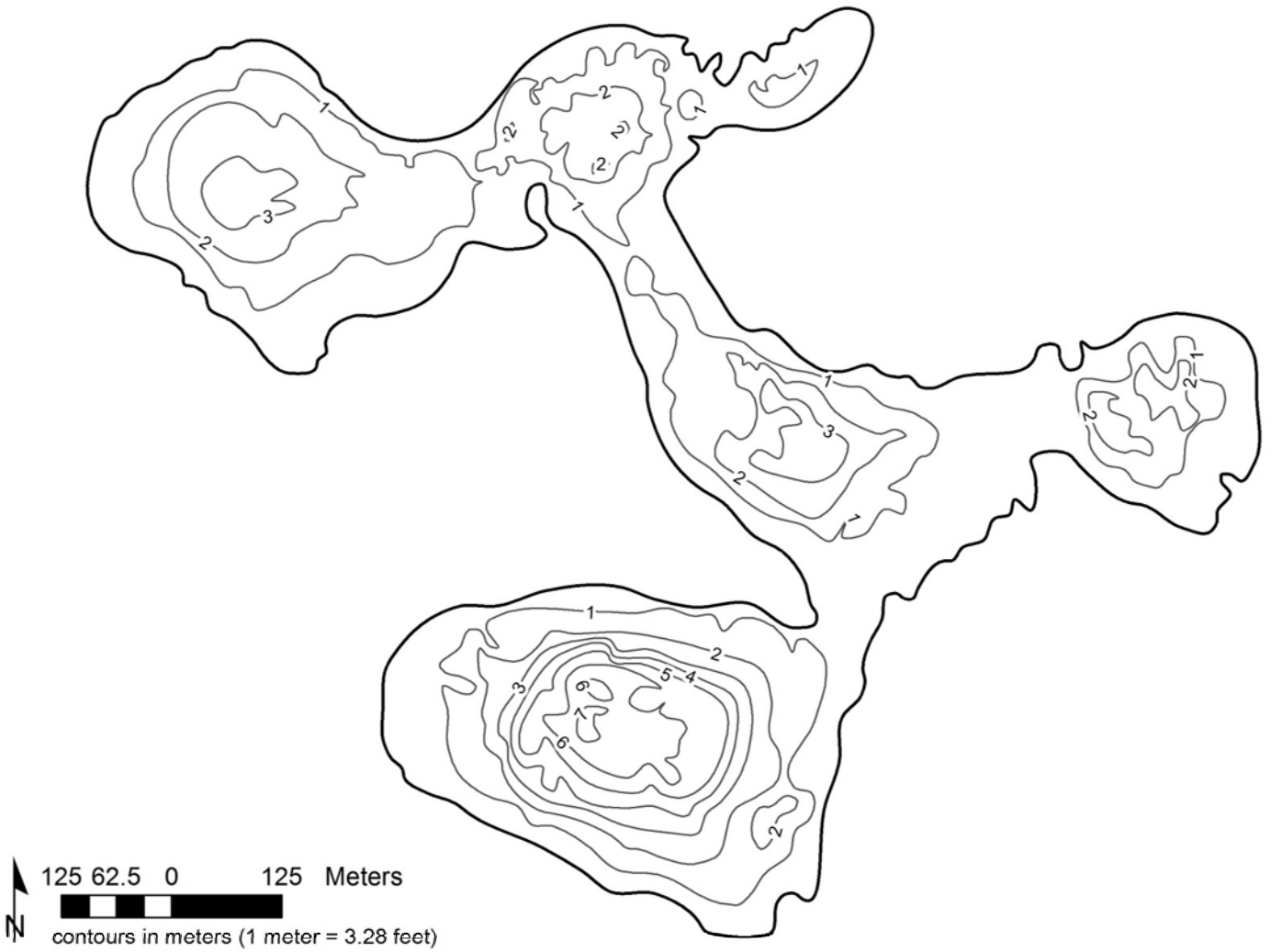


Figure 47.–Boot Lake (DTA) bathymetric map generated from morphometric data collected July 2011.

Fall Lake (DTA): Fish, water quality, and morphometric data were collected March 3, 2011 and July 26–27, 2011 (Table 61, Figures 48-49).

Table 61.–Fall Lake (DTA) data summary for March and July 2011 sampling.

Fish	6/26–27/2011
Species	lake chub
Mean Length (mm)	75
Standard Error	2.46
Median (mm)	75
Mode (mm)	66
Minimum Length (mm)	45
Maximum Length (mm)	126
Count	56

Water Quality		
Date	3/3/2011	7/27/2011
Secchi Reading (m)	ND	1.5-2.5
Alkalinity (mg/L $CaCO_3$)	ND	14
Temperature (°C)	1.0-4.2	14.1-17.3
DO (mg/L)	NR	NR
DO (%)	NR	NR
pH	7.8-8.1	6.6-7.4
Specific Conductivity	41-49	30-33
TDS (ppm)	0.028-0.032	0.019-0.021
Water Color	ND	clear
Max Depth Sampled (m)	3.50	6.75

Morphometry and Other Lake Characteristics	
Surface Area (ha)	22.5
Shoreline Length (km)	1.9
Maximum Depth (m)	8.0
Lake Volume (m^3)	650,000
Outlets	1
Inlets	0
Lake Category	intermittent outlet
Surrounding Vegetation	grass, coniferous

ND = No data. Data collection was not attempted.

NR = Measurements were not reported because values were unusually high.

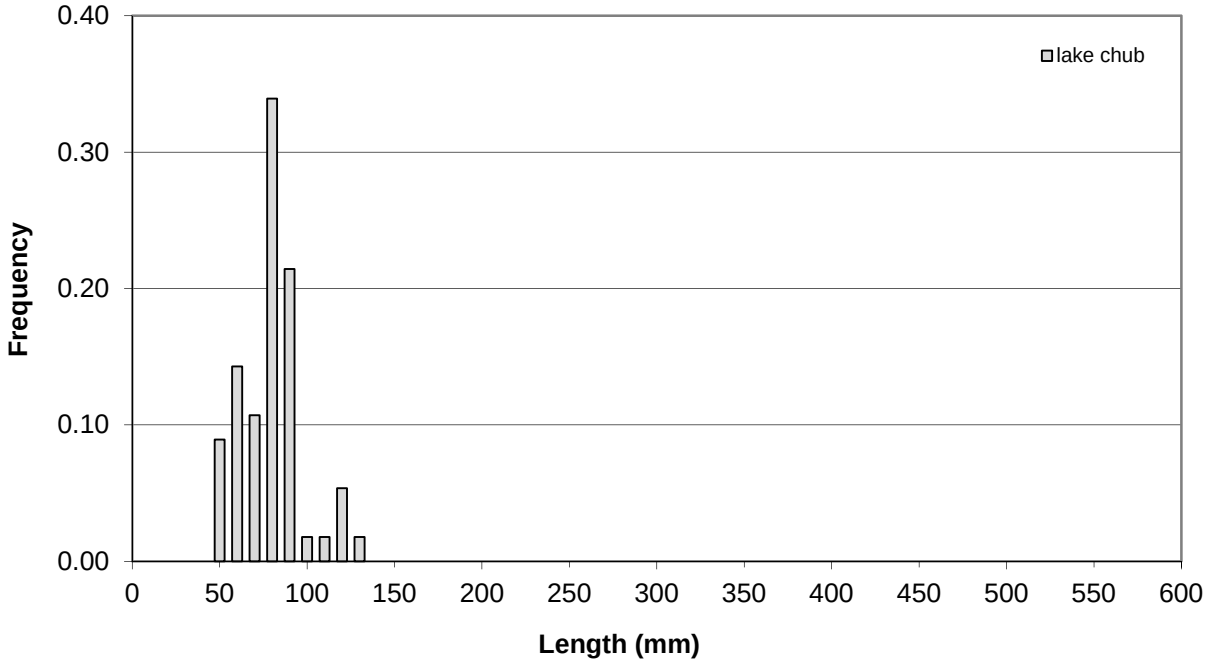


Figure 48.–Fall Lake (DTA) LFD for lake chub (n=56) captured in July 2011.

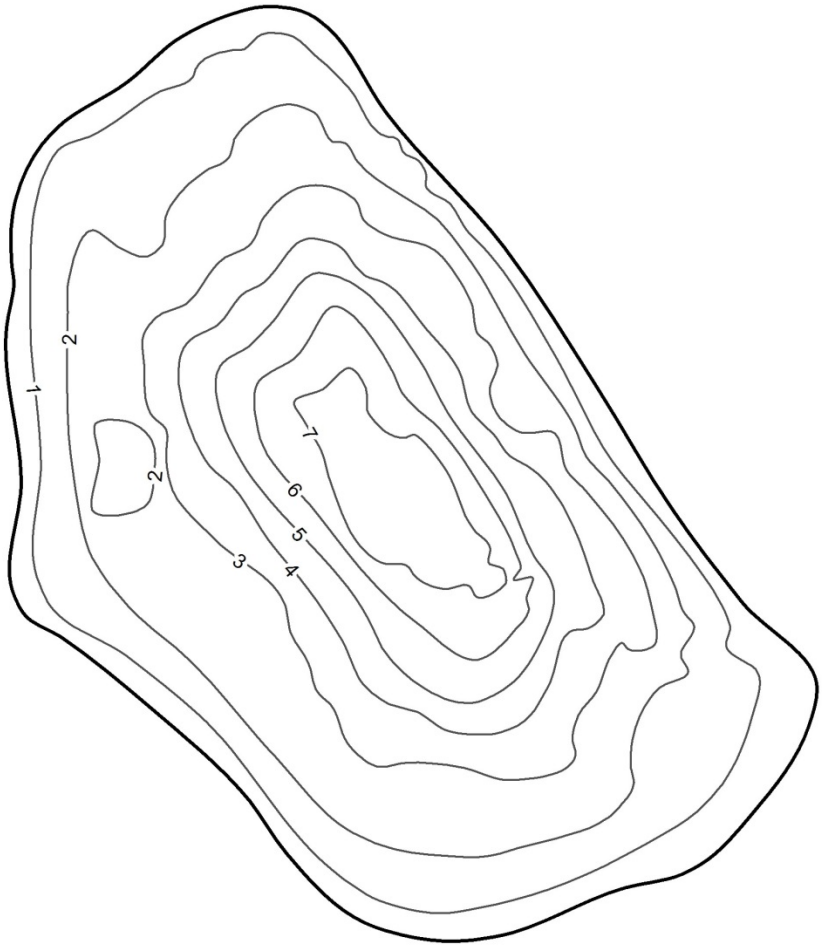


Figure 49.–Fall Lake (DTA) bathymetric map generated from morphometric data collected July 2011.

Fielding Lake. Morphometric data were collected August 19–20, 2013 (Table 62, Figure 50).

Table 62.–Fielding Lake data summary for August 2013 sampling.

Morphometry and Other Lake Characteristics	
Surface Area (ha)	561.9
Shoreline Length (km)	20.3
Maximum Depth (m)	23.0
Lake Volume (m^3)	49,040,000
Outlets	1
Inlets	multiple
Lake Category	open
Surrounding Vegetation	tundra, shrub

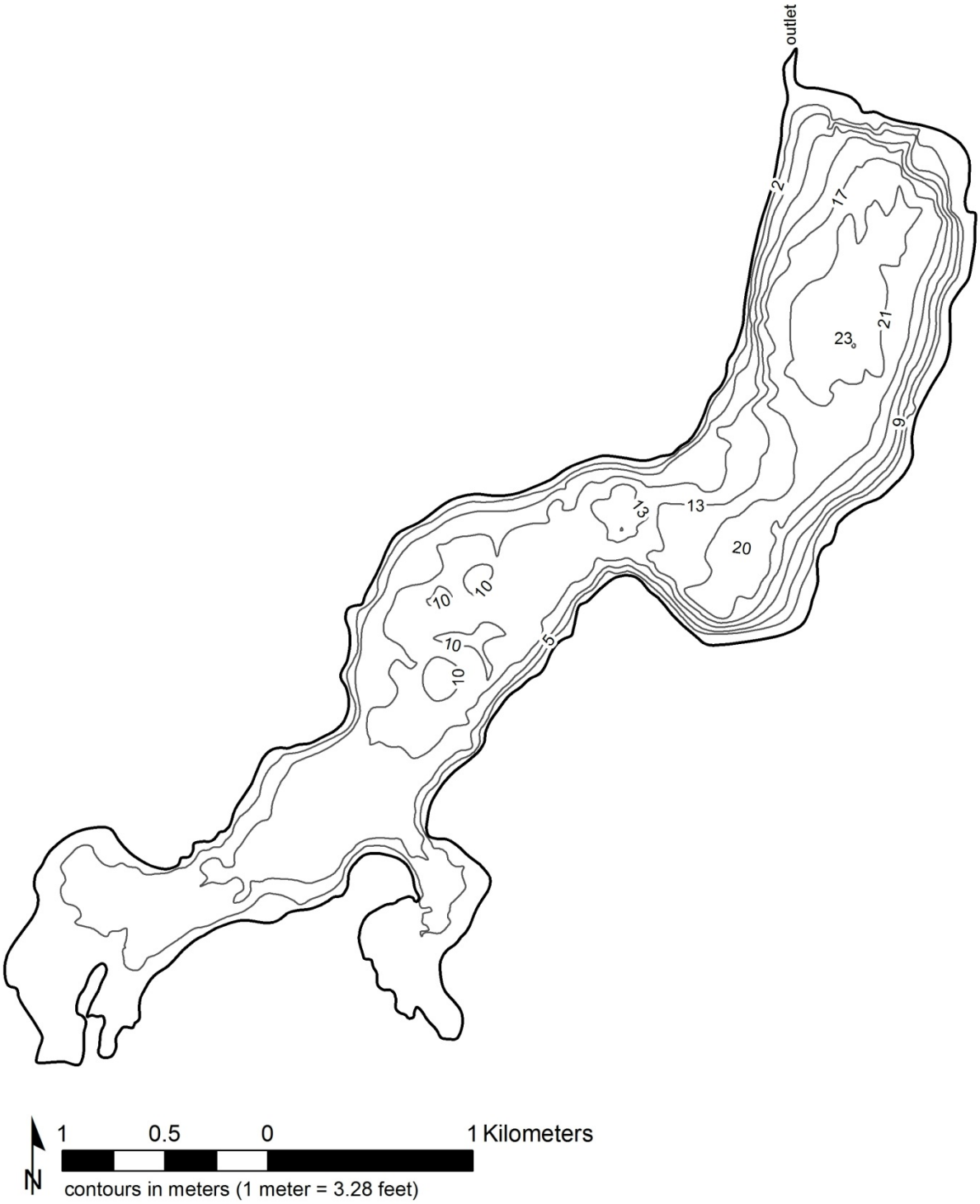


Figure 50.–Fielding Lake bathymetric map generated from morphometric data collected August 2013.

Josh Lake: Fish, water quality, and morphometric data were collected May 31–June 1, 2012 (Table 63, Figures 51-52).

Table 63.–Josh Lake data summary for May–June 2012 sampling.

Fish	5/31–6/1/2012			
Species	Arctic grayling	rainbow trout	slimy sculpin	longnose sucker
Count	35	1	1	122
Mean Length (mm)	219	260	80	ND
Standard Error	3.48			ND
Minimum Length (mm)	134	260	80	ND
Maximum Length (mm)	274	260	80	ND

Water Quality	
Date	6/1/2012
Secchi Reading (m)	2.5
Alkalinity (mg/L $CaCO_3$)	29
Temperature (°C)	9.3-9.5
DO (mg/L)	9.8-10.3
DO (%)	93-100
pH	7.8-7.9
Specific Conductivity	67-71
TDS (ppm)	0.045
Water Color	clear
Max Depth Sampled (m)	6.00

Morphometry and Other Lake Characteristics	
Surface Area (ha)	2.3
Shoreline Length (km)	0.57
Maximum Depth (m)	10.5
Lake Volume (m^3)	90,000
Outlets	1
Inlets	1
Lake Category	intermittent outlet
Surrounding Vegetation	shrub

ND = No data. Data collection was not attempted.

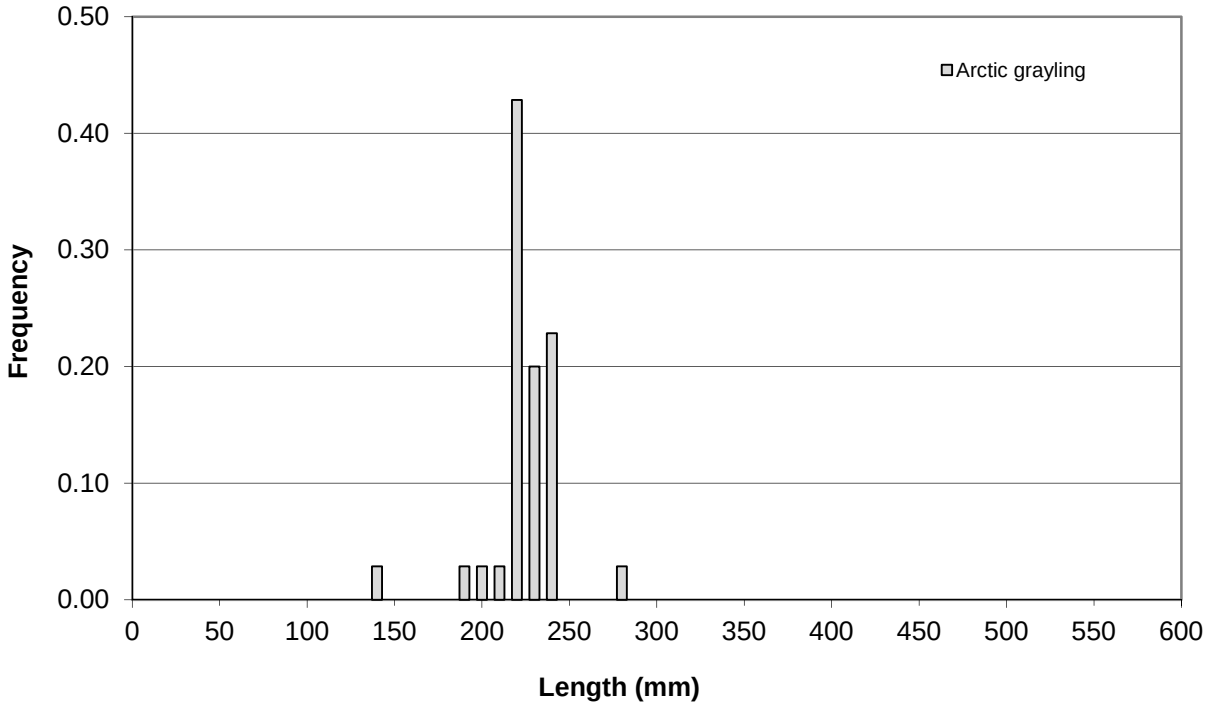


Figure 51.–Josh Lake LFD for Arctic grayling (n=35) captured in May and June 2012.

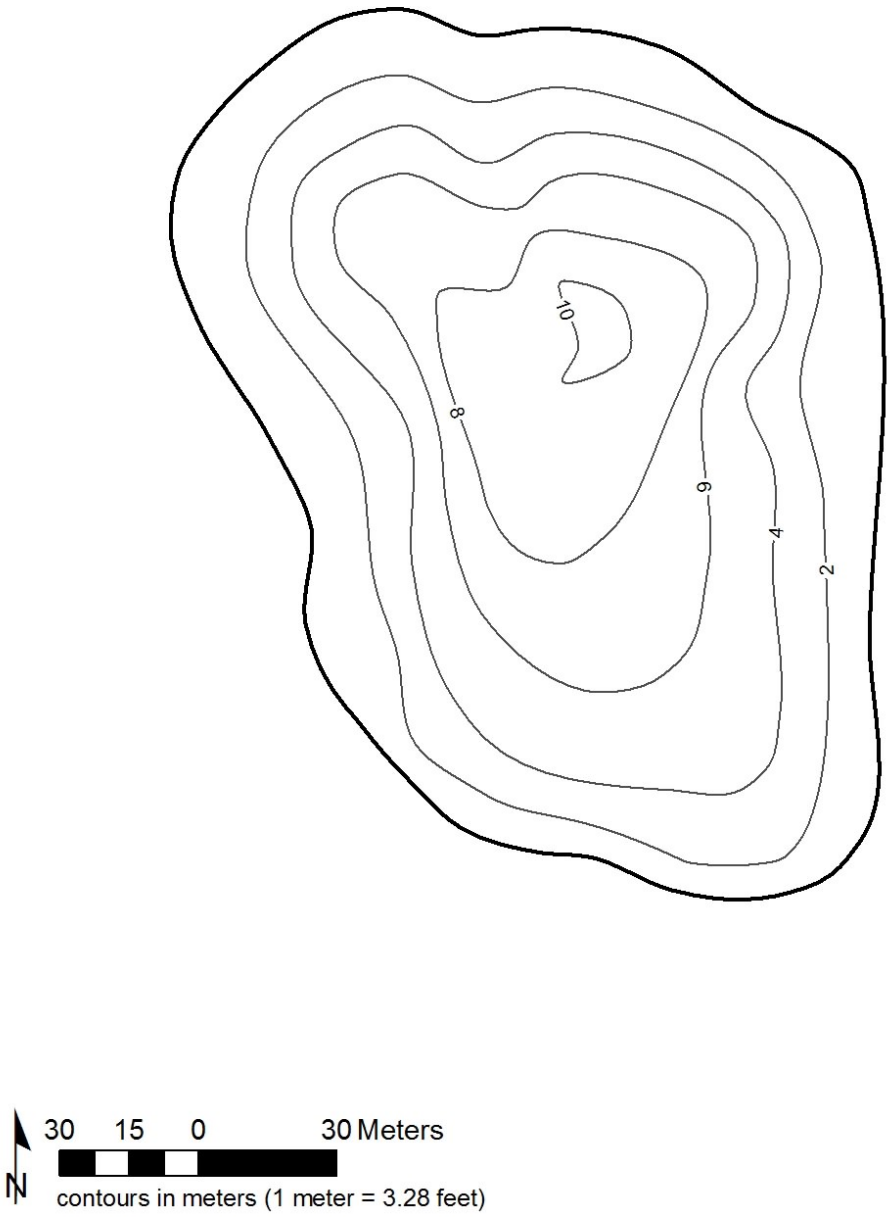


Figure 52.–Josh Lake bathymetric map generated from morphometric data collected June 2012.

Lake Minchumina: Morphometric data were collected June 5–7, 2012 (Table 64, Figure 53).

Table 64.–Lake Minchumina data summary for June 2012 sampling.

Morphometry and Other Lake Characteristics	
Surface Area (ha)	5,995.1
Shoreline Length (km)	67.2
Maximum Depth (m)	16.0
Lake Volume (m^3)	282,000,000
Outlets	1
Inlets	multiple
Lake Category	open
Surrounding Vegetation	grass, shrub, deciduous, coniferous



Figure 53.–Lake Minchumina bathymetric map generated from morphometric data collected June 2012.

Skate Lake: Fish, water quality, and morphometric data were collected June 4–6, 2013 (Table 65, Figure 54).

Table 65.–Skate Lake data summary for June 2013 sampling.

Fish	6/4–6/2013
Species	
Count	0
Mean Length (mm)	
Standard Error	
Minimum Length (mm)	
Maximum Length (mm)	
Water Quality	
Date	6/5/2013
Secchi Reading (m)	1.8
Alkalinity (mg/L $CaCO_3$)	154
Temperature (°C)	6.7-12.5
DO (mg/L)	7.0-9.2
DO (%)	61-93
pH	6.5-7.3
Specific Conductivity (µS/cm)	293-522
TDS (ppm)	0.183-0.332
Water Color	muddy
Max Depth Sampled (m)	2.50
Morphometry and Other Lake Characteristics	
Surface Area (ha)	23.1
Shoreline Length (km)	2.7
Maximum Depth (m)	3.2
Lake Volume (m^3)	370,000
Outlets	0
Inlets	0
Lake Category	land locked
Surrounding Vegetation	grass, shrub, coniferous, deciduous



Figure 54.–Skate Lake bathymetric map generated from morphometric data collected June 2013.

Spring North Lake (DTA): Fish, water quality, and morphometric data were collected March 3, 2011 and July 25–27, 2011 (Table 66, Figures 55-56).

Table 66.–Spring North Lake (DTA) data summary for March and July 2011 sampling.

Fish	7/25–27/2011	
Species	lake chub	
Count	90	
Mean Length (mm)	54	
Standard Error	1.64	
Minimum Length (mm)	30	
Maximum Length (mm)	103	
Water Quality		
Date	3/3/2011	7/26/2011
Secchi Reading (m)	ND	3.7
Alkalinity (mg/L $CaCO_3$)	ND	11
Temperature (°C)	1.3-5.1	15.2-18.1
DO (mg/L)	0.1-4.0	NR
DO (%)	0.9-27	NR
pH	7.5-8.3	6.6-7.0
Specific Conductivity	57-109	23-25
TDS (ppm)	0.037-0.071	0.015-0.016
Water Color	ND	humic
Max Depth Sampled (m)	3.00	4.00
Morphometry and Other Lake Characteristics		
Surface Area (ha)	28.7	
Shoreline Length (km)	2.3	
Maximum Depth (m)	4.2	
Lake Volume (m^3)	370,000	
Outlets	1	
Inlets	0	
Lake Category	intermittent outlet	
Surrounding Vegetation	grass, coniferous	

ND = No data. Data collection was not attempted.

NR = Measurements were not reported because values were unusually high.

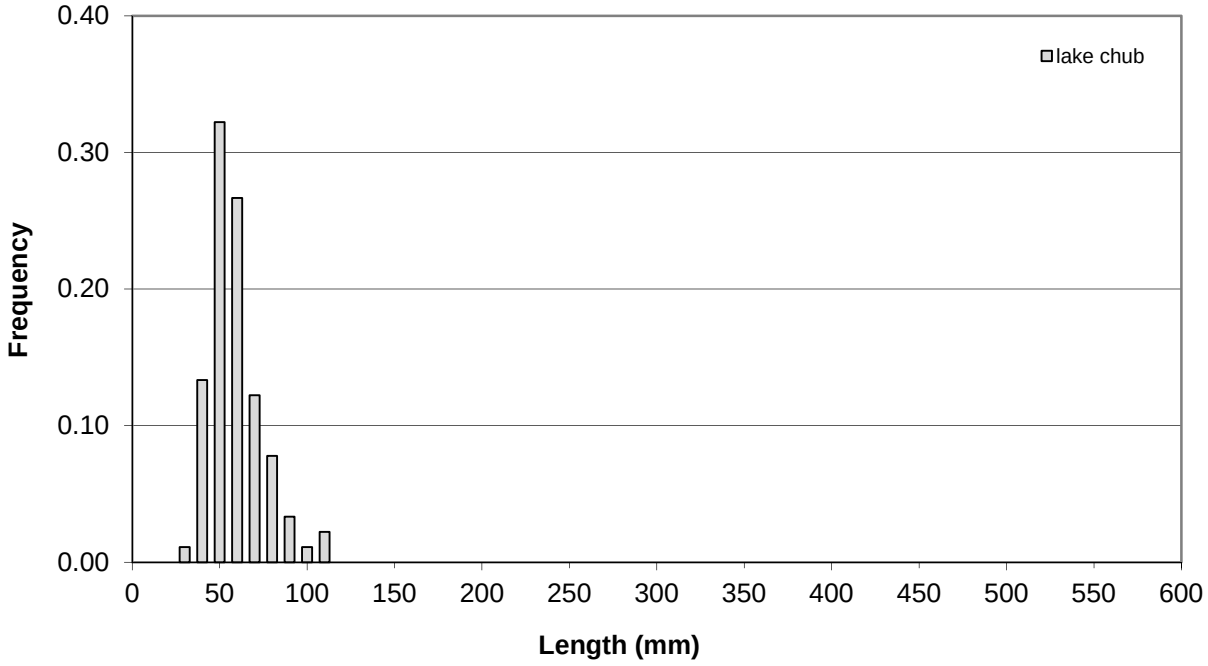


Figure 55.–Spring North Lake (DTA) LFD for lake chub (n=90) captured in July 2011.

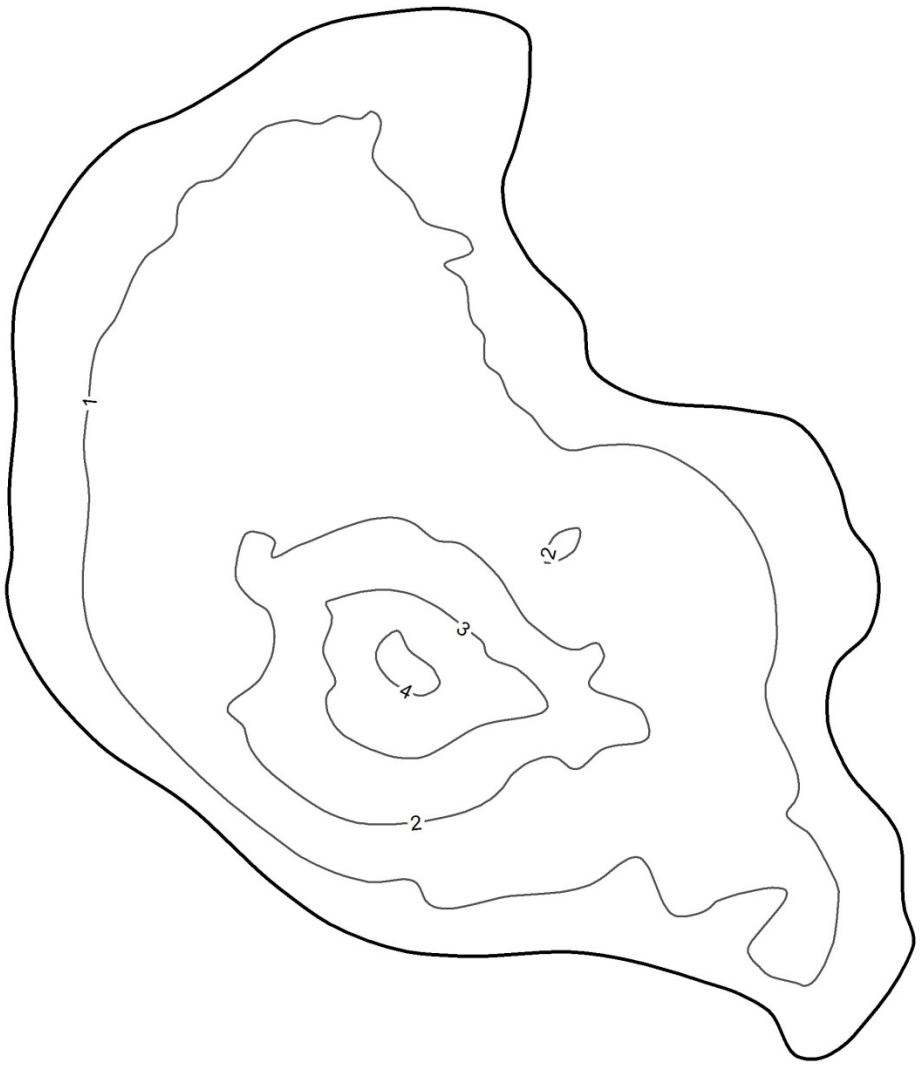


Figure 56.–Spring North Lake (DTA) bathymetric map generated from morphometric data collected July 2011.

Summer Lake (DTA): Fish, water quality, and morphometric data were collected March 3, 2011 and July 26–28, 2011 (Table 67, Figure 57).

Table 67.–Summer Lake (DTA) data summary for March and July 2011 sampling.

Fish	7/26–28/2011		
Species			
Count	0		
Mean Length (mm)			
Standard Error			
Minimum Length (mm)			
Maximum Length (mm)			
Water Quality			
Date	3/3/2011	7/27/2011	7/28/2011
Secchi Reading (m)	ND	bottom	ND
Alkalinity (mg/L $CaCO_3$)	ND	9	ND
Temperature (°C)	0.2-5.0	17.4-17.6	17.1-17.2
DO (mg/L)	0.1-3.8	8.5-9.3	8.7-9.9
DO (%)	1-27	89-96	90-100
pH	6.9-7.4	7.2-7.2	7.3-7.4
Specific Conductivity	65-139	29-29	29-29
TDS (ppm)	0.043-0.091	0.019	0.019
Water Color	ND	clear	clear
Max Depth Sampled (m)	2.75	1.50	1.50
Morphometry and Other Lake Characteristics			
Surface Area (ha)	22.6		
Shoreline Length (km)	2.0		
Maximum Depth (m)	2.6		
Lake Volume (m^3)	260,000		
Outlets	0		
Inlets	0		
Lake Category	land locked		
Surrounding Vegetation	grass, deciduous, coniferous		

ND = No data. Data collection was not attempted.

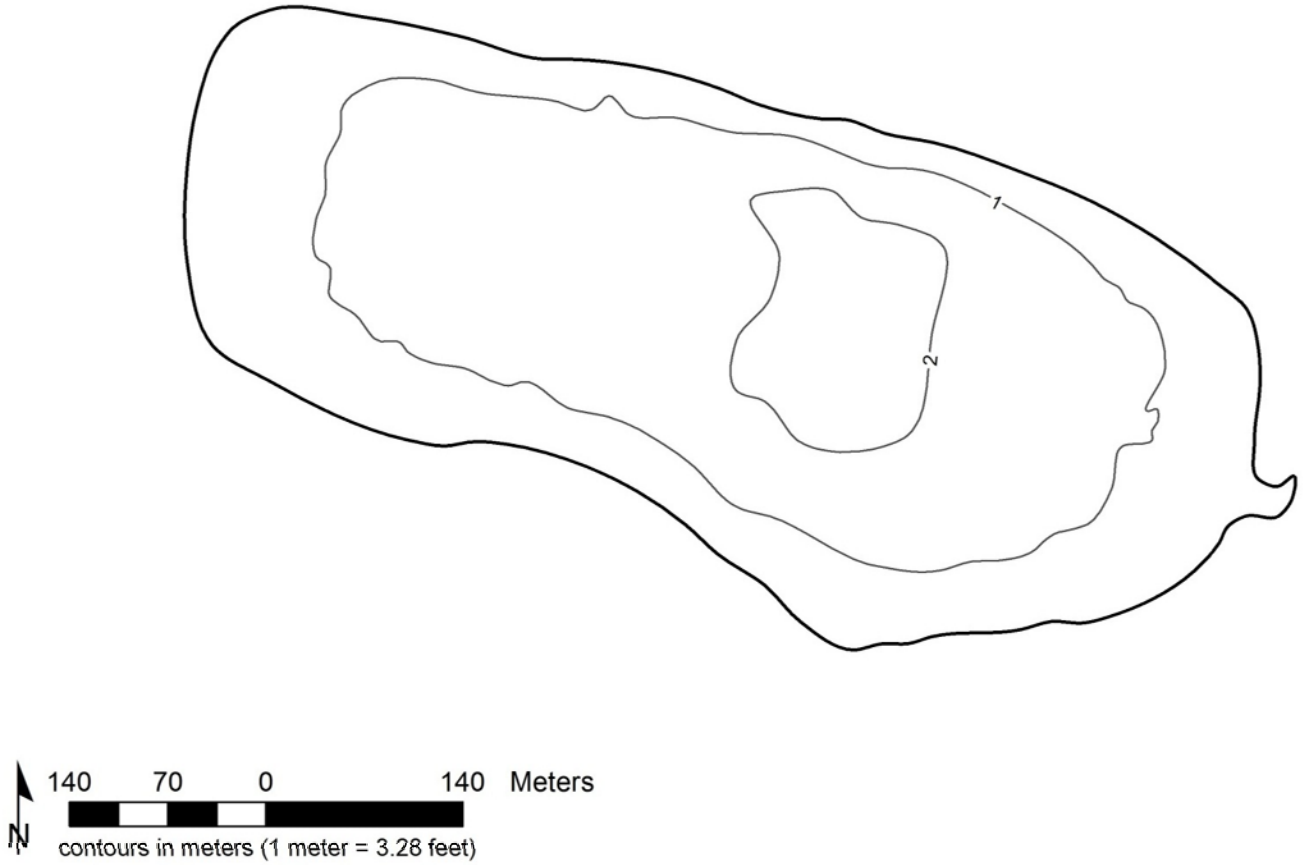


Figure 57.–Summer Lake (DTA) bathymetric map generated from morphometric data collected July 2011.

Totek Lake: Fish, water quality, and morphometric data were collected June 13–14, 2011 (Table 68, Figure 58).

Table 68.–Totek Lake data summary for June 2011 sampling.

Fish	6/13–14/2011
Species	Alaska blackfish
Count	4
Mean Length (mm)	104
Standard Error	5.04
Minimum Length (mm)	89
Maximum Length (mm)	112
Water Quality	
Date	6/14/2011
Secchi Reading (m)	-[a]
Alkalinity (mg/L $CaCO_3$)	22
Temperature (°C)	15.9-16.0
DO (mg/L)	9.5-9.8
DO (%)	99-103
pH	7.4-7.5
Specific Conductivity	80
TDS (ppm)	0.051
Water Color	humic
Max Depth Sampled (m)	1.00
Morphometry and Other Lake Characteristics	
Surface Area (ha)	102.1
Shoreline Length (km)	6.6
Maximum Depth (m)	1.4
Lake Volume (m^3)	820,000
Outlets	1
Inlets	0
Lake Category	intermittent outlet
Surrounding Vegetation	grass, coniferous

[a]The Secchi disk was still visible when resting on the lake bottom.

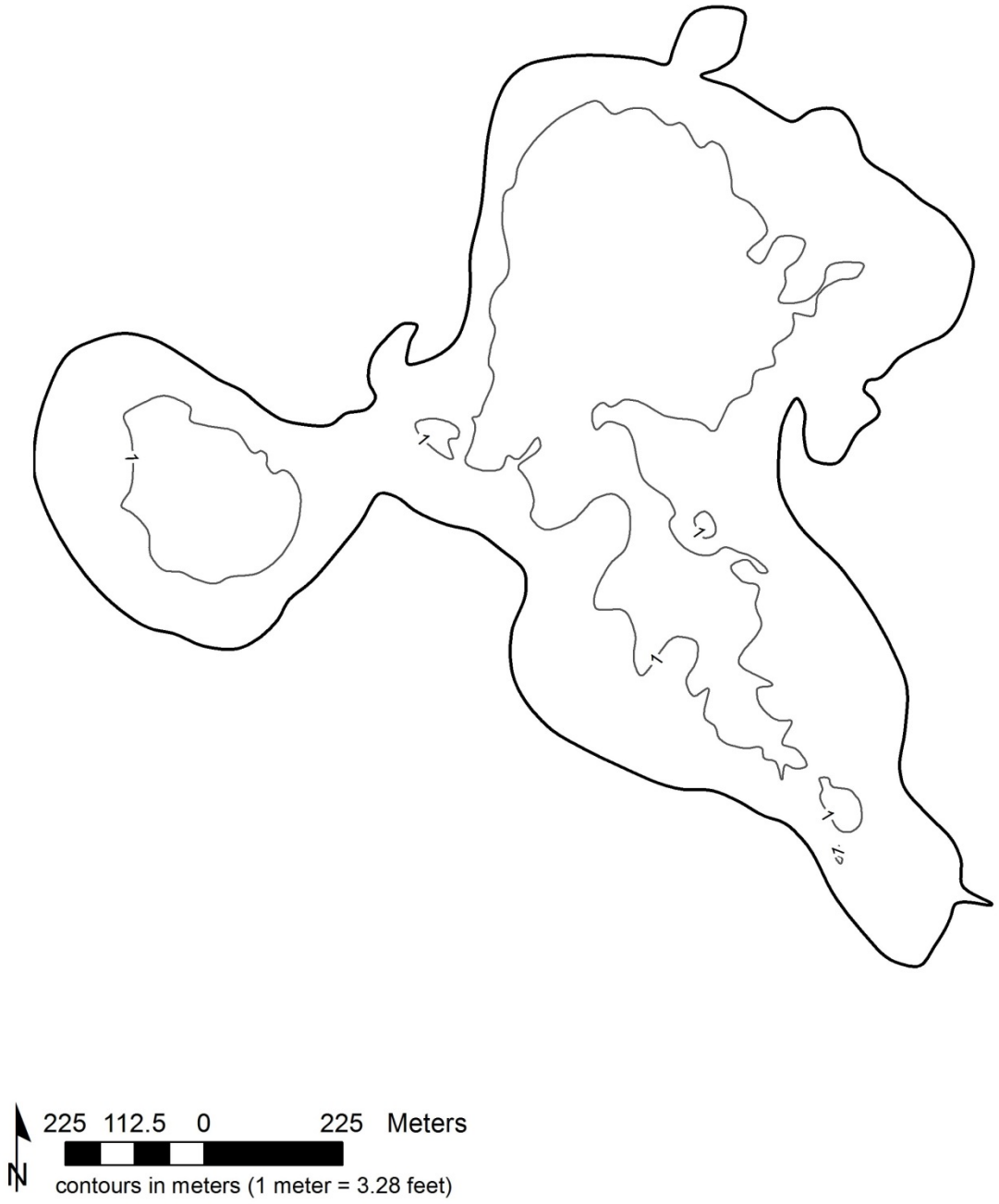


Figure 58.–Totek Lake bathymetric map generated from morphometric data collected June 2011.

Triangle North Lake (DTA): Fish, water quality, and morphometric data were collected March 3, 2011 and July 26–27, 2011 (Table 69, Figures 59–60).

Table 69.–Triangle North Lake (DTA) data summary for March and July 2011 sampling.

Fish	7/26–27/2011	
Species	lake chub	
Count	68	
Mean Length (mm)	80	
Standard Error	2.75	
Minimum Length (mm)	30	
Maximum Length (mm)	134	
Water Quality		
Date	3/3/2011	7/16/2011
Secchi Reading (m)	ND	3.4
Alkalinity (mg/L $CaCO_3$)	ND	13
Temperature (°C)	0.6-2.2	15.5-18.0
DO (mg/L)	5.9-6.5	NR
DO (%)	42-45	NR
pH	7.6-7.6	6.8-7.2
Specific Conductivity	68-70	34-35
TDS (ppm)	0.045-0.046	0.022-0.023
Water Color	ND	humic
Max Depth Sampled (m)	1.50	3.50
Morphometry and Other Lake Characteristics		
Surface Area (ha)	11.3	
Shoreline Length (km)	1.2	
Maximum Depth (m)	4.0	
Lake Volume (m^3)	160,000	
Outlets	1	
Inlets	0	
Lake Category	intermittent outlet	
Surrounding Vegetation	grass, coniferous	

ND = No data. Data collection was not attempted.

NR = Measurements were not reported because values were unusually high.

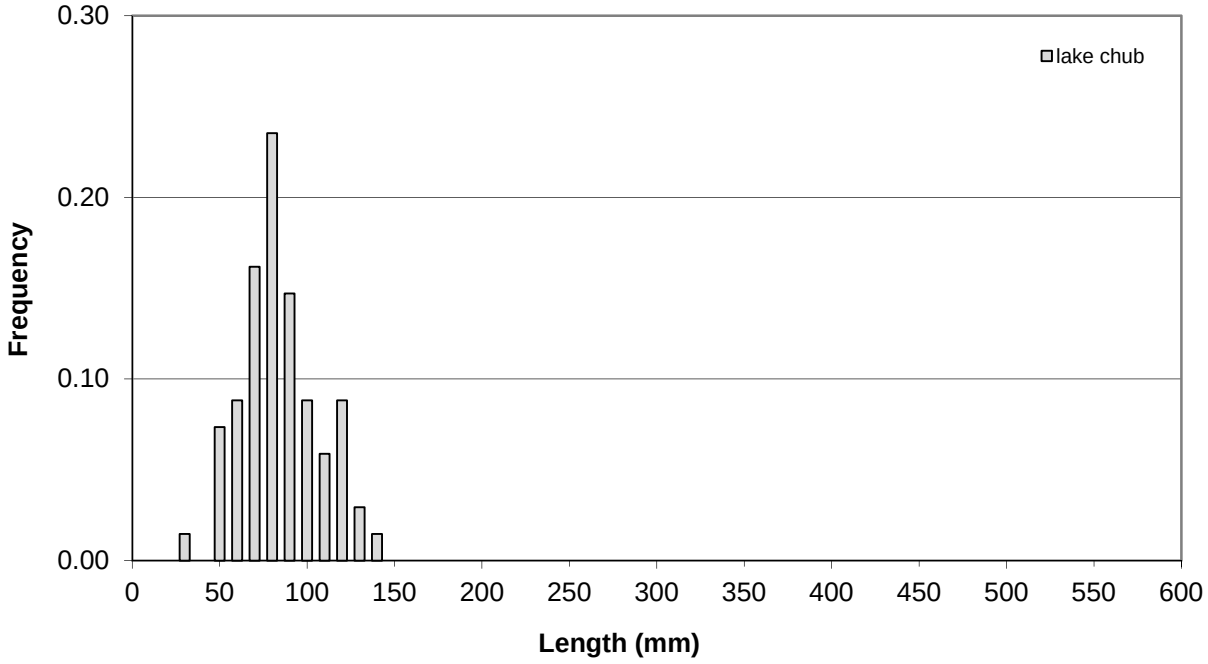


Figure 59.–Triangle North Lake (DTA) LFD for lake chub (n=68) captured in July 2011.

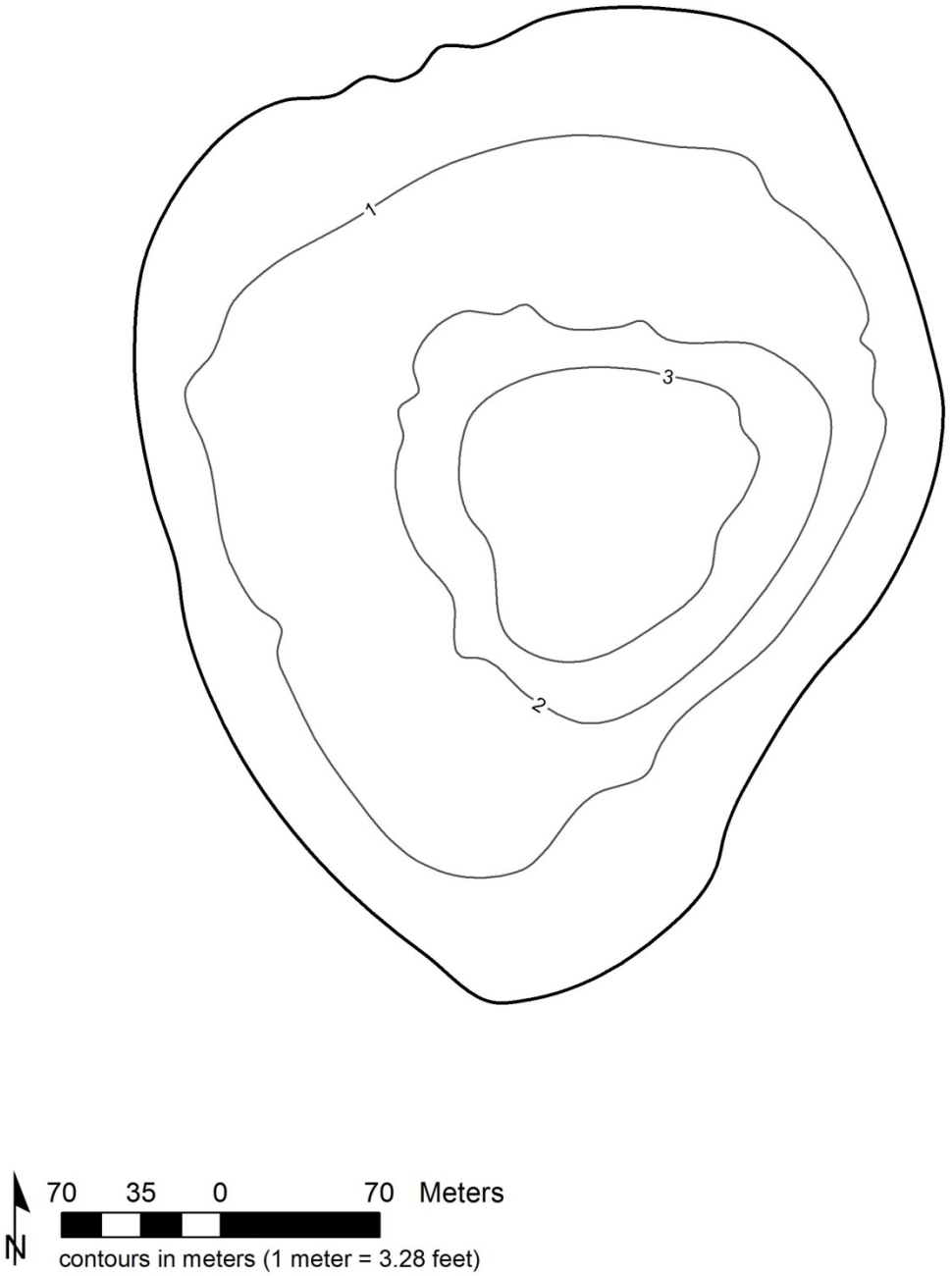


Figure 60.–Triangle North Lake (DTA) bathymetric map generated from morphometric data collected July 2011.

Upper Copper-Upper Susitna River Management Area

Crescent Lake: Fish, water quality, and morphometric data were collected June 6–8, 2011 (Table 70, Figures 61–62).

Table 70.–Crescent Lake data summary for June 2011 sampling.

Fish	6/6–8/2011	
Species	slimy sculpin	burbot
Count	20	2
Mean Length (mm)	80	147
Standard Error	3.51	57.50
Minimum Length (mm)	45	89
Maximum Length (mm)	96	204

Water Quality	
Date	6/7/2011
Secchi Reading (m)	2.5
Alkalinity (mg/L $CaCO_3$)	8
Temperature (°C)	8.3-9.4
DO (mg/L)	4.2-4.3
DO (%)	38
pH	8.2-8.6
Specific Conductivity	15-15
TDS (ppm)	0.01
Water Color	clear
Max Depth Sampled (m)	3.50

Morphometry and Other Lake Characteristics	
Surface Area (ha)	15.5
Shoreline Length (km)	3.0
Maximum Depth (m)	5.0
Lake Volume (m^3)	230,000
Outlets	1
Inlets	0
Lake Category	open
Surrounding Vegetation	shrub

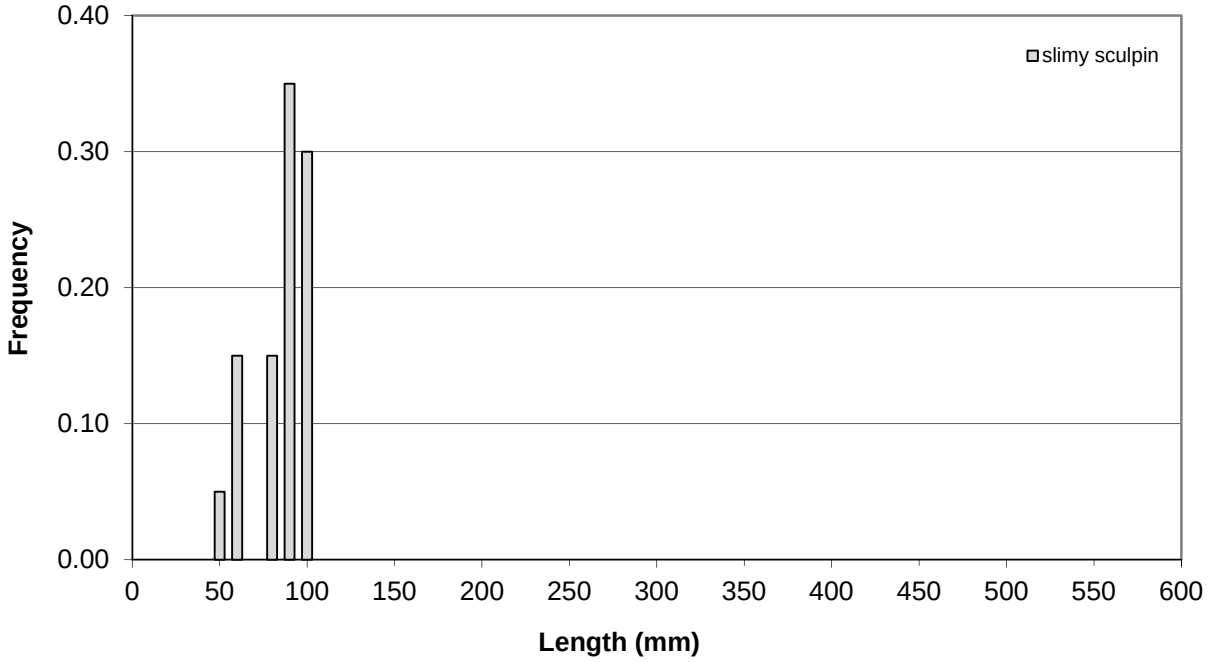


Figure 61.–Crescent Lake LFD for slimy sculpin (n=20) captured in June 2011.

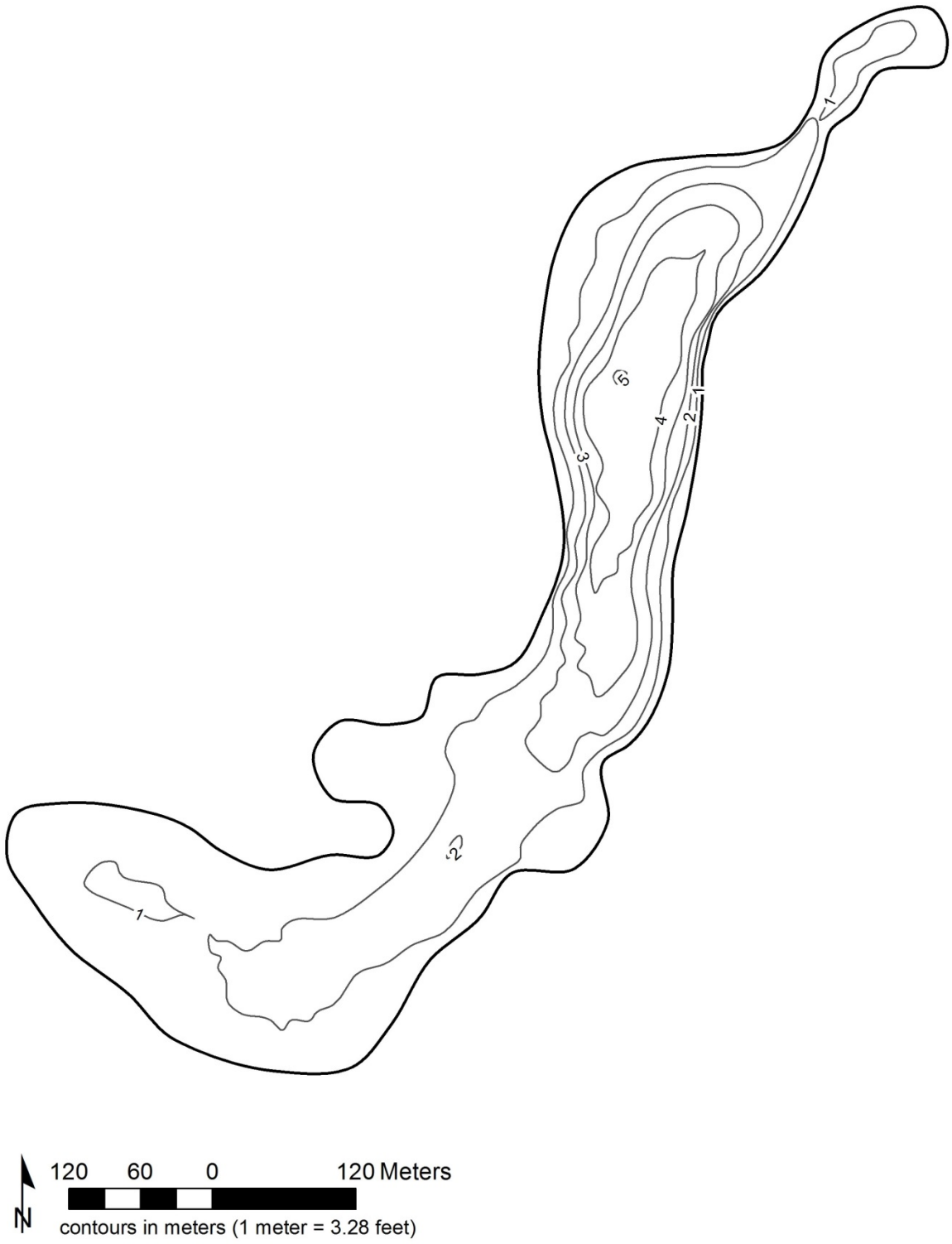


Figure 62.–Crescent Lake bathymetric map generated from morphometric data collected June 2011.

Mentasta Lake: Morphometric data were collected June 19–20, 2012 (Table 71, Figure 63).

Table 71.–Mentasta Lake data summary for June 2012 sampling.

Morphometry and Other Lake Characteristics	
Surface Area (ha)	505.6
Shoreline Length (km)	29.9
Maximum Depth (m)	5.8
Lake Volume (m^3)	8,390,000
Outlets	1
Inlets	2
Lake Category	open
Surrounding Vegetation	coniferous

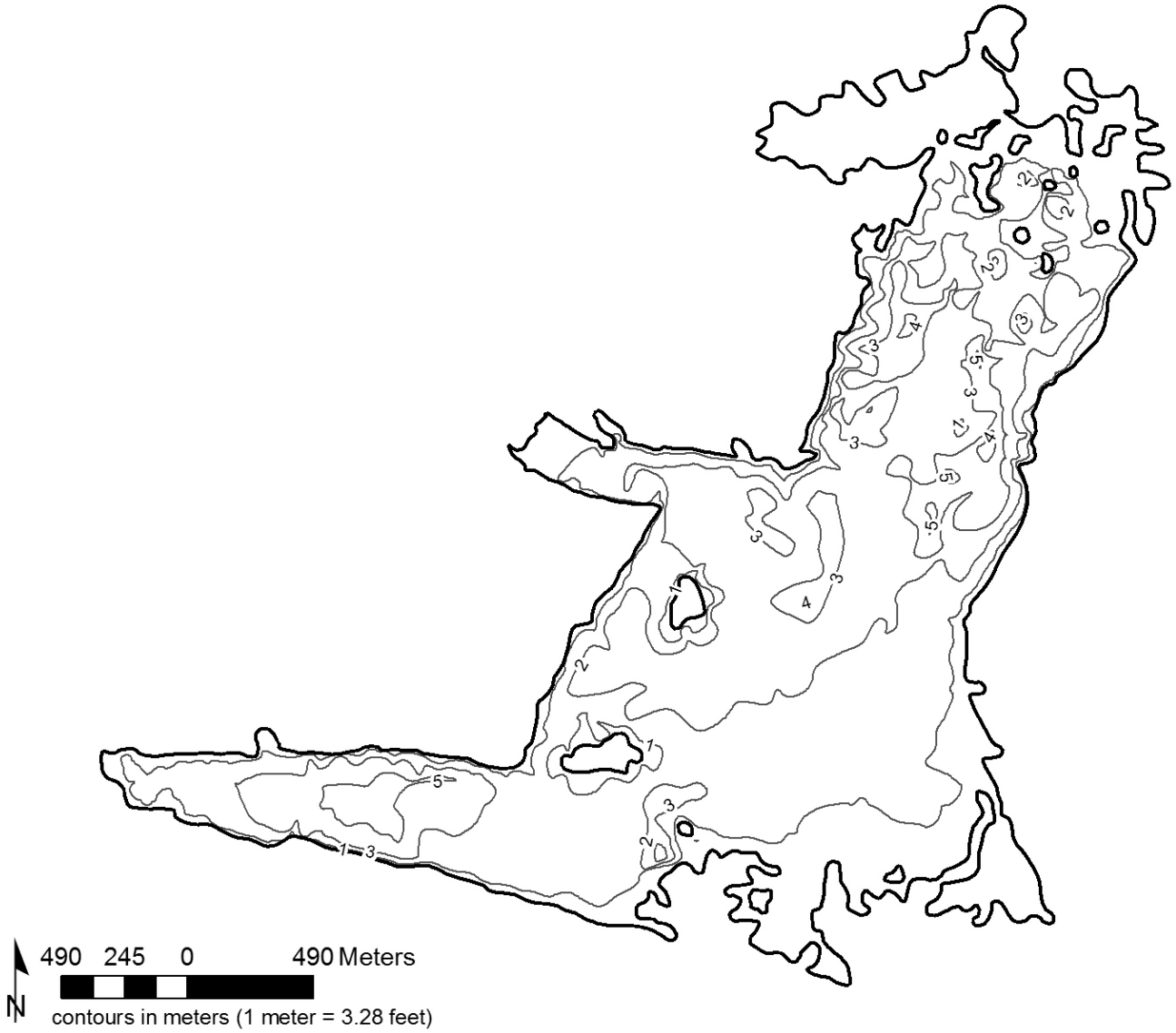


Figure 63.–Mentasta Lake bathymetric map generated from morphometric data collected June 2012.

Summit Lake: Morphometric data were collected August 21–22, 2013 (Table 72, Figure 64).

Table 72.–Summit Lake data summary for August 2013 sampling.

Morphometry and Other Lake Characteristics	
Surface Area (ha)	1770.1
Shoreline Length (km)	48.6
Maximum Depth (m)	63.5
Lake Volume (m^3)	276,090,000
Outlets	1
Inlets	multiple
Lake Category	open
Surrounding Vegetation	tundra, shrub



Figure 64.–Summit Lake bathymetric map generated from morphometric data collected August 2013.

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Virgil Davis and Thomas Redington assisted with the field work. Rachael Kvapil 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. 77-777K) under Projects F-1027-29, Job No. E-3-1.

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APPENDIX A

STOCKED FISHERIES MANAGEMENT PLAN FOR REGION III

Appendix A.–Stocked fisheries management plan for Region III as found in regulations 5AAC 52.065 (Upper Copper River Upper Susitna River), 5AAC 69.165 (North Slope), 5AAC 70.065 (Northwestern), 5AAC 71.065 (Kuskokwim-Goodnews), 5AAC 73.065 (Yukon River), and 5AAC 74.065 (Tanana River).

(a) The department shall manage stocked waters in the "[s]pecified management area" in order to meet public demand for diverse fishing opportunities. The department may manage fisheries to provide or maintain qualities that are desired by sport anglers. The department shall manage the stocked waters according to 1 of 3 management approaches. The management approaches are the

(1) regional management approach;

(2) conservative management approach; and

(3) special management approach.

(b) The board's regulations that govern stocked waters in the "[s]pecified management area" shall be consistent with the applicable management approach specified in (a) of this section.

(c) When a water body in the "[s]pecified management area" is first stocked, it shall be placed under the regional management approach category. After receiving a proposal from the public, the department, or from the board to reclassify a water body, and when the proposal meets the criteria for a different classification, the board may reclassify the water body. The board may act on a proposal to reclassify a water body or to designate a water body for special management only if the proposal has been submitted according to the procedures set out in 5 AAC 96.610 and is consistent with the board's regular meeting cycle schedule.

(d) Regional management approach. Under the regional management approach, stocked waters will be managed so that there will be a reasonable expectation of high catch rates and harvesting a daily bag limit. The bag and possession limit is 10 fish in combination of all stocked species, and only 1 of those fish may be 18 inches or greater in length. The fishing season is open year round and bait may be used.

(e) Conservative management approach. Under the conservative management approach, stocked waters will be managed so that there will be a reasonable expectation to catch a daily bag limit with a reasonable chance of catching fish 18 inches or greater in length. The bag and possession limit is 5 fish in combination of all stocked species, and only 1 of those fish may be 18 inches or greater in length. The fishing season is open year round and bait may be used.

(f) Special management approach. Under the special management approach, stocked waters will be managed so that there will be a high probability of an angler catching more than 1 fish a day that is 18 inches or greater in length. When considering a proposal regarding this management approach, the board should consider taking the following actions:

(1) limit fishing to

(A) catch-and-release fishing;

(B) fly fishing;

(C) trophy fishing, which means that a fish retained must be 18 inches or greater in length;

(2) establish seasonal periods when fishing is closed or is restricted to catch-and-release fishing; or

(3) establish a bag limit of 1 fish, 18 inches or greater in length, or another appropriate bag and size limit.

(g) During times of low hatchery output, the commissioner may, by emergency order, modify methods and means, reduce bag limits, or institute a catch-and-release only fishery.

APPENDIX B

STOCKINGS

Appendix B.–Stocking histories for fish populations sampled in 2011–2013.

Lake	Date	Species	Length (mm)	Length (in)	Lifestage	Number
Bathing Beauty Pond	5/12/2005	RT	216	8.50	C	1,095
Bathing Beauty Pond	9/22/2005	KS	206	8.11	C	700
Bathing Beauty Pond	5/17/2006	RT	267	10.51	C	569
Bathing Beauty Pond	5/25/2006	AC	208	8.19	C	2,226
Bathing Beauty Pond	5/22/2007	RT	143	5.63	C	3,000
Bathing Beauty Pond	6/7/2007	RT	145	5.71	C	630
Bathing Beauty Pond	6/7/2007	AC	192	7.56	C	700
Bathing Beauty Pond	9/6/2007	KS	173	6.81	C	980
Bathing Beauty Pond	11/28/2007	RT	74	2.91	F	3,000
Bathing Beauty Pond	5/16/2008	RT	158	6.22	C	1,617
Bathing Beauty Pond	5/22/2008	RT	161	6.34	C	553
Bathing Beauty Pond	6/10/2008	RT	161	6.34	C	1,350
Bathing Beauty Pond	9/3/2008	AC	211	8.31	C	2,222
Bathing Beauty Pond	9/10/2008	KS	165	6.50	C	1,000
Bathing Beauty Pond	5/15/2009	RT	143	5.63	C	1,500
Bathing Beauty Pond	5/26/2009	RT	138	5.43	C	1,500
Bathing Beauty Pond	6/5/2009	AC	165	6.50	C	700
Bathing Beauty Pond	8/18/2009	KS	135	5.31	C	1,000
Bathing Beauty Pond	5/13/2010	RT	123	4.84	S	1,500
Bathing Beauty Pond	5/13/2010	AC	168	6.61	C	2,100
Bathing Beauty Pond	5/20/2010	RT	125	4.92	S	1,900
Bathing Beauty Pond	5/25/2010	RT	244	9.61	B	200
Bathing Beauty Pond	5/20/2011	AC	174	6.85	C	1,022
Bathing Beauty Pond	6/14/2011	RT	85	3.35	F	1,270
Brodie Lake	8/16/2005	GR	62	2.44	F	1,000
Brodie Lake	8/24/2005	AC	93	3.66	S	375
Brodie Lake	9/26/2005	KS	201	7.91	C	918
Brodie Lake	9/5/2006	GR	62	2.44	F	850
Brodie Lake	9/5/2006	GR	63	2.48	F	65
Brodie Lake	8/28/2007	AC	77	3.03	S	375
Brodie Lake	9/6/2007	KS	173	6.81	C	1,492
Brodie Lake	8/26/2008	KS	154	6.06	C	1,500
Brodie Lake	8/26/2008	GR	63	2.48	F	1,000
Brodie Lake	8/14/2009	AC	72	2.83	F	388
Brodie Lake	8/14/2009	KS	135	5.31	C	1,000
Brodie Lake	6/7/2010	GR	130	5.12	F	475
Brodie Lake	6/3/2011	KS	62	2.44	F	200
Brodie Lake	8/23/2011	AC	100	3.94	S	191
Buffalo Lake	8/29/2007	RT	55	2.17	F	4,000
Buffalo Lake	8/26/2009	RT	50	1.97	F	1,000
Buffalo Lake	6/2/2011	RT	86	3.39	F	1,000

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Lake	Date	Species	Length (mm)	Length (in)	Lifestage	Number
Buffalo Lake	6/7/2012	RT	195	7.68	C	540
Buffalo Lake	6/12/2013	RT	222	8.74	C	540
Bullwinkle Lake	8/30/2006	RT	52	2.05	F	800
Bullwinkle Lake	8/14/2008	RT	56	2.20	F	800
Bullwinkle Lake	6/7/2010	RT	85	3.35	F	466
Bullwinkle Lake	8/22/2012	RT	56	2.20	F	805
Forrest Lake	8/12/2008	RT	47	1.85	F	2,500
Forrest Lake	8/10/2010	RT	50	1.97	F	2,476
Forrest Lake	8/30/2012	RT	63	2.48	F	2,500
Four Mile Lake	9/5/2007	AC	82	3.23	S	3,219
Four Mile Lake	8/12/2008	RT	47	1.85	F	18,000
Four Mile Lake	8/14/2009	AC	72	2.83	F	1,575
Four Mile Lake	8/10/2010	RT	50	1.97	F	19,809
Four Mile Lake	8/23/2011	AC	100	3.94	S	1,600
Four Mile Lake	8/28/2013	AC	110	4.33	F	500
Four Mile Lake	8/28/2013	RT	67	2.64	F	10,000
Gergie Lake	8/20/2008	RT	50	1.97	F	9,300
Gergie Lake	8/17/2010	RT	51	2.01	F	11,964
Gergie Lake	9/10/2013	RT	73	2.87	F	9,000
Grayling Lake	5/12/2005	AC	222	8.74	C	700
Grayling Lake	6/30/2005	RT	216	8.50	C	1,404
Grayling Lake	5/25/2006	AC	208	8.19	C	700
Grayling Lake	5/22/2007	RT	143	5.63	C	1,350
Grayling Lake	5/16/2008	RT	158	6.22	C	1,100
Grayling Lake	6/10/2008	RT	161	6.34	C	900
Grayling Lake	9/3/2008	AC	211	8.31	C	711
Grayling Lake	5/15/2009	RT	143	5.63	C	1,000
Grayling Lake	5/26/2009	RT	138	5.43	C	1,000
Grayling Lake	5/13/2010	RT	123	4.84	S	2,000
Grayling Lake	5/13/2010	AC	168	6.61	C	700
Hidden Lake (EAFB)	5/22/2007	RT	143	5.63	C	1,350
Hidden Lake (EAFB)	5/16/2008	RT	158	6.22	C	1,100
Hidden Lake (EAFB)	6/10/2008	RT	161	6.34	C	900
Hidden Lake (EAFB)	9/3/2008	AC	211	8.31	C	711
Hidden Lake (EAFB)	5/15/2009	RT	143	5.63	C	1,000
Hidden Lake (EAFB)	5/26/2009	RT	138	5.43	C	1,000
Hidden Lake (EAFB)	5/13/2010	RT	123	4.84	S	2,000
Hidden Lake (EAFB)	5/13/2010	AC	168	6.61	C	700
Hidden Lake (EAFB)	6/1/2011	AC	172	6.77	C	945
Hidden Lake (EAFB)	6/1/2012	AC	263	10.35	C	75
Hidden Lake (EAFB)	6/18/2012	RT	168	6.61	C	1,800

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Lake	Date	Species	Length (mm)	Length (in)	Lifestage	Number
Hidden Lake (EAFB)	10/4/2012	RT	79	3.11	F	3,394
Hidden Lake (EAFB)	6/3/2013	RT	221	8.70	C	1,822
Hidden Lake (EAFB)	6/8/2013	RT	215	8.46	C	158
Hidden Lake (EAFB)	6/19/2013	GR	222	8.74	C	500
John Lake	9/8/2006	RT	57	2.24	F	6,832
John Lake	8/26/2008	RT	55	2.17	F	7,100
John Lake	6/2/2011	AC	43	1.69	F	2,000
Johnson Pit #2	5/24/2007	RT	142	5.59	C	720
Johnson Pit #2	5/22/2008	RT	161	6.34	C	812
Johnson Pit #2	5/15/2009	RT	138	5.43	C	800
Johnson Pit #2	5/17/2010	RT	125	4.92	S	800
Johnson Pit #2	6/12/2012	RT	187	7.36	C	858
Junction Lake[a]	-	-	-	-	-	-
Koole Lake	8/2/2007	SS	87	3.43	F	3,290
Koole Lake	8/2/2007	SS	85	3.35	F	3,305
Koole Lake	8/2/2007	AC	74	2.91	S	201
Koole Lake	8/6/2008	GR	51	2.01	F	8,546
Koole Lake	8/6/2008	RT	43	1.69	F	24,483
Koole Lake	6/11/2009	SS	57	2.24	F	5,000
Koole Lake	9/22/2010	GR	70	2.76	F	6,794
Koole Lake	9/22/2010	RT	64	2.52	F	20,014
Koole Lake	8/14/2012	RT	52	2.05	F	24,532
Koole Lake	8/14/2012	GR	60	2.36	F	4,695
Koole Lake	6/13/2013	KS	165	6.50	S	3,507
Koole Lake	6/14/2013	SS	74	2.91	F	11,675
Little Harding Lake	5/19/2005	RT	211	8.31	C	400
Little Harding Lake	5/19/2005	RT	209	8.23	C	400
Little Harding Lake	5/25/2006	RT	255	10.04	C	468
Little Harding Lake	5/24/2007	RT	151	5.94	C	630
Little Harding Lake	6/7/2007	RT	145	5.71	C	630
Little Harding Lake	5/22/2008	RT	161	6.34	C	704
Little Harding Lake	5/22/2008	RT	152	5.98	C	683
Little Harding Lake	5/26/2009	RT	138	5.43	C	665
Little Harding Lake	6/11/2009	RT	151	5.94	C	700
Little Harding Lake	5/25/2010	RT	139	5.47	S	1,386
Manchu Lake	9/3/2008	AC	101	3.98	S	3,200
Manchu Lake	8/14/2009	AC	72	2.83	F	1,275
Manchu Lake	9/1/2009	RT	52	2.05	F	8,533
Manchu Lake	8/23/2010	AC	72	2.83	S	1,281
Manchu Lake	9/1/2011	AC	104	4.09	S	1,275

[a] No stockings occurred 7 years prior to sampling.

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Lake	Date	Species	Length (mm)	Length (in)	Lifestage	Number
Manchu Lake	6/14/2012	RT	183	7.20	C	675
Manchu Lake	6/19/2013	RT	213	8.39	C	720
Moose Lake	5/25/2006	AC	208	8.19	C	629
Moose Lake	5/22/2007	RT	142	5.59	C	900
Moose Lake	5/16/2008	RT	158	6.22	C	1,386
Moose Lake	9/3/2008	AC	211	8.31	C	689
Moose Lake	5/26/2009	RT	138	5.43	C	1,300
Moose Lake	5/13/2010	RT	123	4.84	S	1,300
Moose Lake	5/13/2010	AC	168	6.61	C	700
Moose Lake	6/1/2011	AC	172	6.77	C	945
Moose Lake	6/1/2012	AC	263	10.35	C	100
Moose Lake	6/14/2012	RT	183	7.20	C	1,973
Moose Lake	6/28/2012	RT	176	6.93	C	1,609
North Jans Lake	9/8/2006	RT	57	2.24	F	1,636
North Jans Lake	9/8/2006	RT	54	2.13	F	2,388
North Jans Lake	8/26/2008	RT	55	2.17	F	9,100
North Jans Lake	8/24/2010	RT	54	2.13	F	11,496
North Pole Pond	6/7/2007	RT	145	5.71	C	1,350
North Pole Pond	9/11/2007	KS	172	6.77	C	997
North Pole Pond	6/4/2008	RT	157	6.18	C	1,500
North Pole Pond	9/10/2008	KS	165	6.50	C	1,000
North Pole Pond	5/19/2009	AC	201	7.91	C	50
North Pole Pond	5/19/2009	GR	201	7.91	C	150
North Pole Pond	5/20/2009	GR	201	7.91	C	1
North Pole Pond	5/20/2009	AC	201	7.91	C	12
North Pole Pond	5/26/2009	RT	138	5.43	C	1,500
North Pole Pond	8/18/2009	KS	135	5.31	C	1,000
North Pole Pond	5/13/2010	AC	378	14.88	B	50
North Pole Pond	5/13/2010	RT	123	4.84	S	1,500
North Pole Pond	5/13/2010	RT	343	13.50	B	100
North Pole Pond	5/24/2011	AC	385	15.16	B	9
North Pole Pond	5/24/2011	AC	463	18.23	B	2
North Pole Pond	5/24/2011	AC	535	21.06	B	1
North Pole Pond	5/9/2012	RT	368	14.49	B	150
North Pole Pond	6/5/2012	RT	201	7.91	C	1,690
North Pole Pond	6/26/2012	RT	180	7.09	C	1,209
North Pole Pond	10/1/2012	KS	210	8.27	C	1,932
North Pole Pond	5/29/2013	RT	225	8.86	C	117
North Pole Pond	5/29/2013	AC	263	10.35	C	4
North Pole Pond	6/3/2013	RT	221	8.70	C	1,794
North Pole Pond	6/7/2013	RT	323	12.72	B	147

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Lake	Date	Species	Length (mm)	Length (in)	Lifestage	Number
North Pole Pond	6/18/2013	RT	211	8.31	C	1,806
North Pole Pond	8/27/2013	GR	230	9.06	C	700
North Pole Pond	9/25/2013	KS	211	8.31	C	407
North Twin Lake	8/14/2008	RT	56	2.20	F	2,251
North Twin Lake	3/11/2009	LT	61	2.40	F	600
North Twin Lake	6/7/2010	RT	85	3.35	F	1,283
North Twin Lake	6/20/2012	RT	169	6.65	C	603
North Twin Lake	6/26/2013	RT	212	8.35	C	500
Paul's Pond	8/16/2005	GR	63	2.48	F	1,000
Paul's Pond	9/5/2006	GR	63	2.48	F	901
Paul's Pond	8/26/2008	GR	63	2.48	F	1,000
Paul's Pond	6/7/2010	GR	130	5.12	F	454
Polaris Lake	5/25/2006	AC	208	8.19	C	2,805
Polaris Lake	6/7/2007	RT	145	5.71	C	1,350
Polaris Lake	6/7/2007	AC	192	7.56	C	2,000
Polaris Lake	9/11/2007	KS	172	6.77	C	4,506
Polaris Lake	5/16/2008	RT	158	6.22	C	1,100
Polaris Lake	6/10/2008	RT	161	6.34	C	1,000
Polaris Lake	9/3/2008	AC	211	8.31	C	3,555
Polaris Lake	9/10/2008	KS	165	6.50	C	4,500
Polaris Lake	5/26/2009	RT	138	5.43	C	2,233
Polaris Lake	6/5/2009	AC	165	6.50	C	2,500
Polaris Lake	8/18/2009	KS	135	5.31	C	4,700
Polaris Lake	5/13/2010	RT	123	4.84	S	2,390
Polaris Lake	5/13/2010	AC	168	6.61	C	3,469
Polaris Lake	6/1/2011	AC	172	6.77	C	2,610
Polaris Lake	6/1/2011	KS	62	2.44	F	500
Polaris Lake	6/1/2012	AC	263	10.35	C	200
Polaris Lake	6/14/2012	RT	183	7.20	C	2,431
Polaris Lake	6/28/2012	RT	176	6.93	C	1,488
Quartz Lake	3/23/2007	RT	156	6.14	S	1,420
Quartz Lake	3/23/2007	RT	123	4.84	S	3,339
Quartz Lake	3/28/2007	RT	123	4.84	S	4,145
Quartz Lake	3/29/2007	RT	123	4.84	S	4,099
Quartz Lake	3/30/2007	RT	123	4.84	S	4,147
Quartz Lake	4/2/2007	RT	156	6.14	S	1,202
Quartz Lake	4/2/2007	RT	123	4.84	S	2,857
Quartz Lake	4/3/2007	RT	123	4.84	S	3,422
Quartz Lake	4/25/2007	RT	156	6.14	S	12,670
Quartz Lake	5/24/2007	RT	151	5.94	C	9,370
Quartz Lake	5/30/2007	RT	139	5.47	C	15,750

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Lake	Date	Species	Length (mm)	Length (in)	Lifestage	Number
Quartz Lake	6/12/2007	AC	188	7.40	C	2,925
Quartz Lake	6/18/2007	SS	54	2.13	F	35,555
Quartz Lake	6/19/2007	SS	62	2.44	F	53,161
Quartz Lake	8/23/2007	AC	74	2.91	S	9,586
Quartz Lake	9/13/2007	RT	60	2.36	F	30,968
Quartz Lake	9/13/2007	RT	55	2.17	F	120,170
Quartz Lake	9/13/2007	RT	55	2.17	F	142,349
Quartz Lake	2/13/2008	RT	120	4.72		5,655
Quartz Lake	2/14/2008	RT	121	4.76		5,680
Quartz Lake	4/3/2008	SS	69	2.72		22,751
Quartz Lake	5/28/2008	RT	161	6.34	C	16,437
Quartz Lake	5/28/2008	RT	158	6.22	C	8,862
Quartz Lake	6/27/2008	RT	129	5.08	C	41,075
Quartz Lake	8/6/2008	SS	66	2.60	F	14,800
Quartz Lake	3/11/2009	KS	102	4.02	S	9,561
Quartz Lake	5/28/2009	RT	138	5.43	C	27,355
Quartz Lake	5/28/2009	SS	53	2.09	F	77,000
Quartz Lake	8/14/2009	AC	72	2.83	F	9,006
Quartz Lake	9/3/2009	RT	57	2.24	F	6,000
Quartz Lake	5/17/2010	RT	141	5.55	S	9,674
Quartz Lake	5/17/2010	RT	125	4.92	S	20,220
Quartz Lake	6/18/2010	SS	52	2.05	F	29,500
Quartz Lake	8/10/2010	RT	50	1.97	F	3,360
Quartz Lake	6/3/2011	RT	87	3.43	F	20,137
Quartz Lake	6/14/2011	RT	85	3.35	F	33,444
Quartz Lake	8/23/2011	SS	70	2.76	F	2,000
Quartz Lake	8/23/2011	AC	100	3.94	S	4,845
Quartz Lake	6/13/2012	RT	177	6.97	C	8,900
Quartz Lake	6/15/2012	SS	82	3.23	F	43,690
Quartz Lake	6/19/2012	RT	180	7.09	C	15,449
Quartz Lake	6/26/2012	RT	95	3.74	F	1,597
Quartz Lake	9/4/2012	RT	68	2.68	F	19,600
Quartz Lake	6/4/2013	RT	221	8.70	C	4,973
Quartz Lake	6/10/2013	RT	221	8.70	C	1,526
Quartz Lake	6/11/2013	RT	229	9.02	C	4,487
Quartz Lake	6/13/2013	RT	323	12.72	B	325
Quartz Lake	6/18/2013	RT	211	8.31	C	2,078
Quartz Lake	6/21/2013	SS	78	3.07	F	22,030
Quartz Lake	8/26/2013	AC	113	4.45	S	6,800
Quartz Lake	8/27/2013	RT	214	8.43	C	3,837
Quartz Lake	8/29/2013	RT	210	8.27	C	4,070

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Lake	Date	Species	Length (mm)	Length (in)	Lifestage	Number
Quartz Lake	9/12/2013	RT	222	8.74	C	3,113
Quartz Lake	9/25/2013	KS	211	8.31	C	3,069
Rainbow Lake	7/6/2006	RT	100	3.94	F	2,000
Rainbow Lake	9/5/2006	RT	52	2.05	F	12,500
Rainbow Lake	8/6/2008	RT	43	1.69	F	8,012
Rainbow Lake	9/22/2010	RT	64	2.52	F	8,605
Rainbow Lake	8/14/2012	RT	52	2.05	F	8,016
Rangeview Lake	8/16/2005	GR	63	2.48	F	1,000
Rangeview Lake	8/24/2005	AC	93	3.66	S	375
Rangeview Lake	9/5/2006	GR	63	2.48	F	901
Rangeview Lake	8/28/2007	AC	77	3.03	S	375
Rangeview Lake	8/26/2008	GR	63	2.48	F	1,000
Rangeview Lake	8/14/2009	AC	72	2.83	F	377
Rangeview Lake	6/7/2010	GR	130	5.12	F	479
Rangeview Lake	8/23/2011	AC	100	3.94	S	191
Rich 28 Mile Pit	6/1/2006	AC	208	8.19	C	404
Rich 28 Mile Pit	6/7/2007	RT	145	5.71	C	900
Rich 28 Mile Pit	6/4/2008	RT	157	6.18	C	982
Rich 28 Mile Pit	8/6/2008	AC	193	7.60	C	400
Rich 28 Mile Pit	5/15/2009	RT	143	5.63	C	1,000
Rich 28 Mile Pit	5/17/2010	AC	170	6.69	C	400
Rich 28 Mile Pit	5/17/2010	RT	125	4.92	S	1,000
Rich 28 Mile Pit	5/29/2012	RT	179	7.05	C	540
Ryan Lake	5/31/2006	RT	259	10.20	C	300
Ryan Lake	8/29/2007	RT	49	1.93	F	2,000
Ryan Lake	8/26/2009	RT	50	1.97	F	1,000
Ryan Lake	6/25/2012	RT	173	6.81	C	520
Sculpin Lake	9/5/2007	RT	60	2.36	F	20,000
Sculpin Lake	6/1/2008	RT	201	7.91	S/C	3,000
Sculpin Lake	8/26/2009	RT	50	1.97	F	10,000
Sculpin Lake	6/2/2011	RT	86	3.39	F	14,246
Sculpin Lake	9/10/2013	RT	73	2.87	F	14,000
Sheefish Lake	8/30/2006	AC	89	3.50	S	700
Sheefish Lake	8/14/2008	AC	86	3.39	S	700
Sheefish Lake	8/23/2010	AC	72	2.83	S	395
Sheefish Lake	9/1/2011	AC	104	4.09	S	357
Sirlin Drive Pond	6/7/2007	RT	145	5.71	C	360
Sirlin Drive Pond	6/4/2008	RT	157	6.18	C	400
Sirlin Drive Pond	5/26/2009	RT	138	5.43	C	400
Sirlin Drive Pond	5/17/2010	RT	141	5.55	S	400
South Jans Lake	9/8/2006	RT	54	2.13	F	8,059

-continued-

Lake	Date	Species	Length (mm)	Length (in)	Lifestage	Number
South Jans Lake	8/26/2008	RT	50	1.97	F	19,000
South Jans Lake	8/24/2010	RT	54	2.13	F	10,141
South Jans Lake	8/24/2010	SS	69	2.72	F	19,603
South Twin Lake	5/30/2007	RT	139	5.47	C	720
South Twin Lake	6/4/2008	RT	157	6.18	C	800
South Twin Lake	5/28/2009	RT	138	5.43	C	800
South Twin Lake	5/25/2010	RT	123	4.84	S	800
South Twin Lake	6/20/2012	RT	169	6.65	C	650
South Twin Lake	6/26/2013	RT	212	8.35	C	500
Three Mile Lake	8/29/2007	RT	55	2.17	F	4,000
Three Mile Lake	8/26/2009	RT	50	1.97	F	4,000
Three Mile Lake	6/2/2011	RT	86	3.39	F	4,000
Three Mile Lake	6/25/2012	RT	173	6.81	C	675
Three Mile Lake	8/8/2012	RT	181	7.13	C	841

Species Codes:

RT	Rainbow Trout
SS	Coho Salmon
AC	Arctic Char
GR	Arctic Grayling
KS	Chinook Salmon
LT	Lake Trout

Lifestage Codes:

F	Fingerling
S	Subcatchable
C	Catchable
B	Broodstock

APPENDIX C

2011–2013 DATA

Appendix C.–Capture data for fish populations sampled in 2011–2013.

Data File	Description
2011–2013 SFP Data[a]	Lake, gear type, location, soak time, depth, species, fish length, water temperature, DO, pH, specific conductivity, alkalinity, and TDS.

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