Fishery Management Report No. 09-47

Fishery Management Report for Sport Fisheries in the Upper Tanana River Drainage in 2008

by

James F. Parker

December 2009

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

Symbols and Abbreviations

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

Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Measures (fisheries)

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

Mathematics, statistics

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

FISHERY MANAGEMENT REPORT NO. 09-47

FISHERY MANAGEMENT REPORT FOR SPORT FISHERIES IN THE UPPER TANANA RIVER DRAINAGE IN 2008

by

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The Fishery Management Reports series was established in 1989 by the Division of Sport Fish for the publication of an overview of management activities and goals in a specific geographic area, and became a joint divisional series in 2004 with the Division of Commercial Fisheries. Fishery Management Reports are intended for fishery and other technical professionals, as well as lay persons. Fishery Management Reports are available through the Alaska State Library and on the Internet: http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm. This publication has undergone regional peer review.

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PREFACE

This report provides information for the Upper Tanana Management Area (UTMA) and is one in a series of reports annually updating fisheries management information within Region III. The report is provided for the Alaska Board of Fisheries (BOF), Fish and Game Advisory Committees, the general public, and other interested parties. It presents fisheries assessment information and management strategies that are developed from that information. In addition, this report includes a description of the fisheries regulatory process; the geographic, administrative; and regulatory boundaries; funding sources; and other information concerning Division of Sport Fish management programs within the area.

The goals of the Division of Sport Fish of the Alaska Department of Fish and Game (ADF&G) are to protect and improve the state's recreational fisheries resources by managing for sustainable yield of wild stocks of sport fish, providing diverse recreational fishing opportunities, and providing information to assist the BOF in optimizing social and economic benefits from recreational fisheries. In order to implement these goals the division has in place a fisheries management process.

A regional review is conducted annually during which the status of important area fisheries is considered and research needs are identified. Fisheries stock assessment projects are developed, scheduled, and implemented to meet information needs identified by fisheries managers. Projects are planned within a formal operational planning process. Biological information gathered from these research projects is combined with effort information and input from user groups to assess the need for and development of fisheries management plans, and to propose regulatory strategies.

Division of Sport Fish management and research activities are funded by State of Alaska Department of Fish and Game (ADF&G) and federal aid in Fisheries Restoration funds. ADF&G funds are derived from the sale of state fishing licenses. Federal aid funds are derived from federal taxes on fishing tackle and equipment established by the Federal Aid in Sport Fish Restoration Act (also referred to the Dingell-Johnson Act or D-J Act). The D-J funds are provided to the states at a match of up to three-to-one with the ADF&G funds. Additional funding specified for providing, protecting, and managing access to fish and game is provided through a tax on boat gas and equipment established by the Wallop-Breaux (W-B) Act. Other peripheral funding sources may include contracts with various government agencies and the private sector.

This area management report provides information regarding the Upper Tanana Management Area and its fisheries for 2008, with preliminary information from the 2009 season. This report is organized into two primary sections: a management area overview including a description of the UTMA and a summary of effort, harvest and catch for the area, and a section on the significant area fisheries including specific harvest and catch by species and drainage.

ABSTRACT

Summaries of major fisheries within the area are detailed, including descriptions of recent performances, Alaska Board of Fisheries regulatory actions (with emphasis on proposals to be addressed by the Board of Fisheries at its January 2010 meeting), social and biological issues, descriptions of ongoing research and management activities, and fish stocking information within the Upper Tanana River Management Area.

Key Words: Tanana River, Upper Tanana River Management Area, Delta Clearwater River, Tangle Lake system, Fielding Lake, Volkmar Lake, Tok River, sport fisheries, coho salmon, king salmon, burbot, lake trout, Arctic grayling, northern pike, stocked waters.

EXECUTIVE SUMMARY

This document provides a wide array of information specific to the recreational angling opportunities that exist within Region III, specifically those within the Upper Tanana Management Area (UTMA). Information specific to the proposals that the Alaska Board of Fisheries (BOF) will address at its January 26–31, 2010 meeting are contained within numerous sections of this report. As a means to assist BOF members in acquiring information in a timely manner, Appendix A1 is available on page 64. This table guides the reader to specific information contained within the text, tables, and figures that, may be useful in evaluating regulatory proposals.

INTRODUCTION

The BOF divides the state into eighteen regulatory areas to organize the sport fishing regulatory system by drainage and fishery. These areas (different from regional management areas) are described in Title 5 of the Alaska Administrative Code Chapters 47–74. The Division of Sport Fish of ADF&G divides the state into three administrative regions with boundaries roughly corresponding to groups of the BOF regulatory areas. Region I covers Southeast Alaska (the Southeast Alaska regulatory area). Region II covers portions of Southcentral and Southwest Alaska (including the Prince William Sound, Kenai Peninsula, Kenai River Drainage, Cook Inlet-Resurrection Bay Saltwater, Anchorage Bowl Drainages, Knik Arm Drainages, Susitna River Drainage, West Cook Inlet, Kodiak, Bristol Bay, and the Alaska Peninsula and Aleutian Islands regulatory areas). Region III includes the Upper Copper River and Upper Susitna River area and the Arctic-Yukon-Kuskokwim Region (including the North Slope, Northwestern, Yukon River, Tanana River, Kuskokwim-Goodnews regulatory areas).

Region III is the largest geographic region, encompassing the majority of the landmass of the state of Alaska (Figure 1). The region contains over 1,146,000 km^2 (442,500 mi^2) of land, some of the state's largest river systems (the Yukon, the Kuskokwim, the Colville, Noatak, Upper Copper and Upper Susitna River drainages), thousands of lakes and thousands of miles of coastline and streams. Regional coastline boundaries extend from Cape Newenham in the southwest, around all of western, northwestern and northern Alaska to the Canadian border on the Arctic Ocean. Region III as a whole is very sparsely populated, with the most densely populated center located in the Tanana River Valley. Fairbanks (population about 30,000) is the largest community.

For administrative purposes Division of Sport Fish has divided Region III into six fisheries management areas (Figure 1). They are:

- Northwestern/North Slope Management Area (Norton Sound, Seward Peninsula, Kotzebue Sound, and North Slope drainages);
- Yukon Management Area (the Yukon River drainage except for the Tanana River drainage);
- Upper Copper/Upper Susitna Management Area (the Copper River drainage upstream of Canyon Creek and Haley Creek, and the Susitna River drainage above the Oshetna River);
- Upper Tanana River Management Area (the Tanana River drainage upstream from Banner Creek and the Little Delta River; Figure 2);
- Lower Tanana River Management Area (the Tanana River drainage downstream from Banner Creek and the Little Delta River; Figure 2); and,
- Kuskokwim Management Area (the entire Kuskokwim River drainage and Kuskokwim Bay drainages).

Area management biologists for the six areas are located in Nome/Fairbanks, Fairbanks, Glennallen, Delta Junction, Fairbanks, and Bethel/Fairbanks, respectively.

THE ALASKA BOARD OF FISHERIES

The BOF is a seven-member board that sets fishery regulations and harvest levels, allocates fishery resources, and approves or mandates fishery conservation plans for the State of Alaska. BOF members are appointed by the governor for three-year terms and must be confirmed by the legislature.

Under the current operating schedule, the BOF considers fishery issues for regulatory areas or groups of regulatory areas on a 3-year cycle. Proposals to create new or modify existing regulations and management plans are submitted by ADF&G and the public (any individual can submit a proposal to the BOF) for evaluation by the BOF. During its deliberations the BOF receives input and testimony through oral and written reports from ADF&G staff, members of the general public, representatives of local fish and game advisory committees, and special interest groups such as fishermen's associations and clubs. The public provides its input concerning regulation changes and allocation through submission of written proposals and testifying directly to the BOF, by participating in local fish and game advisory committee meetings, or by becoming members of local fish and game advisory committees.

ADVISORY COMMITTEES

Local Fish and Game Advisory Committees have been established throughout the state to assist the Boards of Fish and Game in assessing fisheries and wildlife issues and proposed regulation changes. Advisory committee members are nominated from the local public and voted on by all present during an advisory committee meeting. Most active committees in urban areas meet in the fall and winter on a monthly basis. Rural committees generally have only one fall and one spring meeting due to funding constraints. Advisory meetings allow opportunity for direct public interaction with department staff attending the meetings that answer questions and provide clarification concerning proposed regulatory changes regarding resource issues of local and statewide concerns. The Boards Support Section within the Division of Administration provides

administrative and logistical support for boards (Fisheries and Game) and Fish and Game Advisory Committees. During 2008, the department had direct support responsibilities for 82 advisory committees in the state.

Within the UTMA there are two advisory committees; the Delta Junction and Upper Tanana/Forty Mile. In addition, the Paxson and Fairbanks advisory committees often comment on proposals concerning UTMA fisheries.

RECENT BOARD OF FISHERIES ACTIONS

The BOF meets annually, but deliberates on each individual regulatory area on a 3-year cycle, most recently for the UTMA in 2007. Nine proposals regarding changes to the UTMA sport fisheries were addressed by the BOF at the 2007 meeting. Five of the nine proposals were adopted by the BOF, including; a no bait restriction for Fielding Lake, expanding the harvest dates for Arctic grayling on the Delta Clearwater River, removing the minimum size limit for lake trout in the Tangle Lakes System, allowing catch-and-release (C&R) fishing for king salmon in the Goodpaster River, and modifying the bag limit in Koole Lake (stocked lake) and placing it under the conservative management approach. In addition, a Lake Trout Management Plan was adopted for the all of the AYK Region.

In 2003–2004, BOF actions added two regulatory plans: one for Arctic grayling, and another for the stocked waters in the AYK Region. Under the *Wild Arctic Grayling Management Plan* (5 AAC 70.055), the Delta Clearwater River was classified as a special management water. Under the *Arctic-Yukon-Kuskokwim Region Stocked Waters Management Plan* (5 AAC 70.065), UTMA stocked lakes, specifically Monte, Donnelly, and Rainbow lakes, were classified under the special management approach (bag limit of 1 fish over 18 inches).

Fifty-five proposals regarding changes to the AYK Region subsistence, commercial, personal use, and sport fishing regulations have been submitted to the BOF for the 2009-2010 cycle, fourteen of which are directed at sport fisheries in the Tanana River drainage, nine specific to the UTMA fisheries.

ADF&G EMERGENCY ORDER AUTHORITY

ADF&G has emergency order (EO) authority (5 AAC 75.003, 2009) to modify time, area, and bag/possession limit regulations. Emergency orders are implemented to address conservation issues that are not adequately controlled by existing regulations. Once implemented, an EO is in effect until the situation is resolved or the BOF can formally take up the issue. Emergency orders are also used as a tool for "inseason" management of fisheries. Inseason management is usually in accordance with a fisheries management plan approved by the BOF. There were no EOs issued under this authority for the UTMA during 2008 to 2009.

FEDERAL SUBSISTENCE

The Alaska National Interest Lands Conservation Act (ANILCA) established a priority subsistence use of fish and game for federally qualified rural residents on lands and waters for which the federal government asserts jurisdiction. The state of Alaska also has established a priority for subsistence use of fish and game by Alaskan residents (AS 16.05.258), but cannot discriminate between rural and urban residents (Alaska State Constitution Article VIII, sections 3

and 15). Because of this difference, the federal government asserted authority to ensure a priority subsistence use of fish and game for rural residents on federal lands and certain adjacent waters. On October 1, 1999 the federal government asserted regulatory authority for assuring the rural priority for subsistence fisheries on federal public lands, which includes non-navigable waters on public lands. Following the "Katie John" decision by the 9th Circuit Court in 1995, the federal government expanded the definition of public land to include waters for which the federal agencies assert federal reserved water rights. Under current practice, the federal land management agencies adopt regulations to provide for the priority subsistence use by qualified rural residents in non-navigable waters within federal public lands (including BLM lands) and in navigable waters adjacent to or within federal conservation system units (generally does not include BLM lands). The state retains all other fish and wildlife management authorities, including management on federal land.

The development of regulations for subsistence fisheries under the federal subsistence program occurs within the established Federal Subsistence Board (FSB) process. The public provides its input concerning regulation changes by testifying in Federal Subsistence Regional Advisory Council meetings or by becoming council members. Ten Regional Advisory Councils have been established throughout Alaska to assist the FSB in determining local subsistence issues and providing recommendations on proposed fishing and hunting regulations on the fish and game populations under consideration. Each Regional Council meets twice a year, and subsistence users and other members of the public can comment on subsistence issues at these meetings.

Within the UTMA the subsistence fisheries under federal regulation include those in the: 1) Tetlin Refuge (730,000 acres; Figure 3) which includes much of the Nebesna and Chisana rivers; 2) Delta River Wild and Scenic River Corridor (37,000 acres, 62 river miles); 3) the Tangle Lakes Archaeological District (460,000 acres); and, 4) the headwaters of the Chisana and Nabesna rivers within the Wrangell-St. Elias National Preserve and adjacent to the Tetlin National Refuge. The UTMA fisheries fall under the purview of the Eastern Interior Regional Advisory Council (EIRAC). The most recent meeting was held in October 13–14, 2009 in Fort Yukon.

REGION III SPORT FISH DIVISION RESEARCH AND MANAGEMENT STAFFING

The Region III Division of Sport Fish staff biologists are organized into a research group and a management group. The management group consists of a management supervisor, an area biologist for each of the six management areas, one or more assistant area management biologists, and two stocked water biologists. The area biologists evaluate fisheries and propose and implement management strategies through plans and regulation in order to meet divisional goals. A critical part of these positions is interaction with the BOF, advisory committees, and the general public. The stocked waters biologists plan and implement the regional stocking program for recreational fisheries. The regional management biologist assigned to the Region III headquarters office in Fairbanks also administers the regional fishing and boating access program.

The research group consists of a research supervisor, a salmon research supervisor, a resident species supervisor, research biologists, and various field technicians. The research biologists plan and implement fisheries research projects in order to provide information needed by the

management group to meet divisional goals. The duties of the management and research biologists augment one another.

STATEWIDE HARVEST SURVEY

Sport fishing effort and harvest of sport fish species in Alaska have been estimated and reported annually since 1977 using a mail survey (Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995-1996, 2001a-d, Walker et al. 2003, Jennings et al. 2004, 2006a-b, 2007, 2009a-b, *In prep a-b*). The Statewide Harvest Survey (SWHS) is designed to provide estimates of effort, harvest, and catch on a site-by-site basis. It is not designed to provide estimates of effort directed towards a single species. Species-specific catch-per-unit-effort (CPUE) information can seldom be derived from the report. Two types of questionnaires are mailed to a stratified random sample of households containing at least one individual with a valid fishing license (resident or non-resident). Information gathered from the survey includes participation (number of anglers and days fished), number of fish caught, and number harvested by species and site. These surveys estimate the number of days fished or fishing effort expended by sport anglers fishing Alaskan waters, as well as the sport harvest. Beginning in 1990, the survey was modified to include estimation of catch (release plus harvest) on a site-by-site basis. The survey results for each year are not available until the following year; hence the results for 2008 were not available until fall 2009. Additionally, creel surveys have been selectively used to verify the mail survey for fisheries of interest or for fisheries that require more detailed information or in-season management.

The utility of statewide survey estimates depends on the number of responses received for a given site (Mills and Howe 1992). In general, estimates from smaller fisheries with low participation are less precise than those of larger fisheries with high participation. Therefore the following guidelines were implemented for evaluating survey data:

1. Estimates based on fewer than 12 responses should not be used other than to document that sport fishing occurred;
2. Estimates based on 12 to 29 responses can be useful in indicating relative orders of magnitude and for assessing long-term trends; and,
3. Estimates based on 30 or more responses are generally representative of levels of fishing effort, catch, and harvest.

SECTION I: MANAGEMENT AREA OVERVIEW

After the Porcupine River drainage, the Tanana River drainage is the second largest tributary system of the Yukon River (Brabets et al. 1999). The Tanana River basin (Figure 2) drains an area of approximately 45,918 square miles. The mainstem Tanana River is a large glacial system formed by the confluence of the Chisana and Nabesna rivers near Tok and the Alaska - Canada border which flows in a generally northwest direction for some 570 river miles to the Yukon River.

The Tanana River drainage is divided by Division of Sport Fish into two management areas - the Upper Tanana River Drainage Management Area (UTMA, commonly called the "Delta Management Area"), and the Lower Tanana River Drainage Management Area (LTMA, commonly called the "Fairbanks Management Area"). Management of the Tanana River drainage is split into these two management areas because of the relatively high sport fishery effort and exploitation levels in this region of Interior Alaska.

UPPER TANANA RIVER MANAGEMENT AREA DESCRIPTION

The boundary between the Lower Tanana and Upper Tanana Management areas is at Milepost 295 of the Richardson Highway (Figure 3). The Upper Tanana Management Area is bounded by the Matanuska-Susitna, Denali, and Fairbanks North Star Borough boundaries on the west, the Alaska portion of the White River to the east, the Tangle Lakes System (Delta River) along the Denali Highway, and the headwaters of the Nabesna River at the end of the Nabesna Road to the south. Communities located within the Upper Tanana River drainage include Big Delta, Delta Junction, Fort Greely, Dot Lake, Tanacross, Mansfield, Tok, Tetlin, Northway, and Nabesna.

The UTMA affords highly varied fishing opportunities from lake trout in the high elevation lakes along the Denali Highway to one of the few known Dolly Varden populations in the Tanana River drainage in the streams along the Tok Cutoff. In addition, the UTMA has some of the highest quality Arctic grayling and coho salmon fisheries in the entire Tanana River drainage.

FISHERY RESOURCES

There are 17 fish species known to inhabit the rivers and lakes of the UTMA, of which five are commonly targeted by sport anglers. The native species most commonly targeted include: coho salmon *Oncorhynchus kisutch*, Arctic grayling *Thymallus arcticus*, northern pike *Esox lucius* burbot *Lota lota*, and lake trout *Salvelinus namaycush*. Other native species occasionally targeted include: Chinook (king) salmon *Oncorhynchus tshawytscha*, chum salmon *Oncorhynchus keta*, Dolly Varden *Salvelinus malma*, round whitefish *Coregonus cylindraceum*, least cisco *Coregonus sardinella*, and humpback whitefish *Coregonus pidschian*. Rainbow trout *Oncorhynchus mykiss* are not native to the Tanana River drainage, but have been stocked in numerous lakes and are extremely popular with anglers. Arctic char *Salvelinus alpinus*, coho salmon, Arctic grayling, and lake trout have also been stocked in select lakes of the UTMA.

ESTABLISHED MANAGEMENT PLANS AND POLICIES

Regulations governing fisheries in the UTMA are found in 5 AAC 74.001 through 5 AAC 74.006, 5 AAC 74.010, and 5 AAC 74.030 (sport fishing), 5 AAC 77.001 through 5 AAC 77.190 (personal use), and 5 AAC 01.200 through 5 AAC 01.249 (subsistence fishing). Management plans concerning specific sport fisheries that are in regulation are: the *AYK Region Wild Lake Trout Management Plan* (5 AAC 74.040), the *Wild Arctic Grayling Management Plan* (5 AAC 74.055), and the *AYK Region Stocked Waters Management Plan* (5AAC 74.065).

Management plans not in regulation, but used as annual planning and evaluation tools by the management staff are in place for significant fisheries. The Upper Tanana Management Area fisheries under these plans are as follows: 1) the Delta Clearwater River coho salmon fishery; 2) the Upper Tanana northern pike sport fishery; 3) the Upper Tanana Arctic grayling sport fishery; and, 4) the Fielding Lake sport fishery. These plans are reviewed on a regular basis during the regional area review to determine whether the objectives and management actions are still effective or need to be updated, if the plans are still required, or if other fisheries require management plans.

MAJOR ISSUES

Delta Clearwater River Watershed Project

In 1999, the National Resource Conservation Service (NRCS) implemented a watershed project designed to prevent sediment-bearing waters from the Granite Mountains from entering the DCR (Salcha/Big Delta Soil and Water Conservation District, 1987). In the summer of 2000, the first phase of construction was complete. During 2002 to 2003, construction modifications continued on the project. In 2007, NRCS determined that the Watershed Project was a failure and began looking into future alternatives. In 2009, NRCS decided to make plans for a remedial project to restore the site to as close to pre-project conditions as possible. NRCS has applied for federal stimulus dollars to fund the remediation. Unfortunately, once restored it offers the watershed no protection from future flooding events affecting the DCR. NRSC is adamant that if there is no restoration (remedial project) then the DCR will be subject to conditions much worse than if the project had not be done in the first place.

Range Expansion Projects Donnelly Training Area

The U.S. Army Alaska is performing extensive construction at the Donnelly training area. During the Environmental Impact Study (EIS), the department opposed an option that would select the Meadow Road as a construction/training facility site. ADF&G stocks 14 lakes in this area and these fishing sites are popular with civilian and military anglers. In 2008, extensive construction and fencing closed the 33-mile Loop Road, a trail normally used to access the Upper Jarvis Creek area which includes Kenna Lake (stocked by ADF&G). Alternate trails around the area are being developed to allow recreational use of the area. For the time being, public access to Meadows Road stocked lakes is preserved. These lakes provide recreational opportunities to the public, military personnel, and civilian contractors.

State Land Selection-Denali Block/Tangle Lakes Area

The Denali Block is the unofficial name given to about five million acres of largely federal land along the Denali Highway between Paxson and Cantwell. In 2003, the Bureau of Land

Management (BLM) conveyed to the State of Alaska a 235,000 acre block in the Tangle Lakes region, an area north of the Denali Highway between miles 12 and 41. In 2004 the State of Alaska selected a second block of land (117,337 acres) which is located east and west of the Susitna River. The conveyance process for the second block will be completed in 2009. There has been a great deal of mineral exploration in this area in recent years. This exploration has shown the potential for a significant deposit of rare minerals of the platinum group. This area includes the Tangle Lake System which annually averages 5,000 angler-days of use. The Delta River National Wild Scenic River Corridor is excluded from the state's conveyance and will continue to be managed by BLM. BLM and ADF&G began a cooperative research project in 2008 to establish baseline data on Arctic grayling abundance and distribution in the Upper Delta River.

Alaska Railroad

The Alaska Railroad (ARRC) seeks to extend its mainline track from the crossing at Moose Creek/Richardson Hwy, near Eielson Air Force Base, 80 miles southeast to Fort Greely near Delta Junction. ARRC finalized its environmental impact statement (EIS) in 2009. The State of Alaska has been involved with this project since 2003, and has been working closely to develop locations and methods for several river and stream crossings. The State disagrees with the choice of some alternative route proposals in the EIS. The State advocated for alternative routes that put the railroad on a higher southerly bench above the floodplain adjoining streams such as the Richardson Clearwater River. This would minimize effects of the project on anadromous and resident fish populations. Two alternative routes of the EIS have only floodplain options and these are being worked out between the State and ARRC. It is anticipated that phase one of the project will begin in 2010.

ACCESS PROGRAM

The Wallop-Breaux amendment to the Federal Aid in Sport Fish Restoration Act (D-J) mandates that at least 15% of the federal funds collected from taxes on boat gas and sport fishing equipment be used by the states for the development and maintenance of motorized boating access facilities. A broad range of access facilities can be approved for funding if they are constructed to achieve a state fishery management objective. These facilities can include boat ramps and lifts, docking and marina facilities, breakwaters, fish cleaning stations, rest rooms, and parking areas.

Currently, the department is investigating the possibility of acquiring land to provide a boat launch near Shaw Creek and improvements to the Tanana River boat launch at Big Delta. A public access cabin was completed in 2008 for recreational use at Ken's Pond. Past projects include public access cabins on Lisa and George lakes, various trail improvements to stocked lakes, and improvements to the boat ramp at George Lake Landing on the Tanana River. The history of major and small access projects completed in the Tanana drainage from 1988 to 1994 can be found in Burr et al. (1998).

INFORMATION AND EDUCATION

Information regarding regulations, publications, stocking and fishing reports, news releases and emergency orders for the Upper Tanana Management Area can be found at the ADF&G, Division of Sport Fish website (www.sf.adfg.state.ak.us/statewide/index.cfm). The following

informational brochures have been developed to provide information on stocked lakes in the UTMA: "Coal Mine Road Lakes", "Fishing the Stocked Lakes of Donnelly Training Area", "Roadside Fishing of the Eastern Interior Alaska", and "Fishing Quartz Lake." A listing of the addresses, contact numbers, and websites for this and other information sources are found in Appendix A2.

There are three regional information and education (I&E) staff located in the Fairbanks office. An Information Officer II and a seasonal Fisheries Technician III respond to questions from the public at the office and via phone and e-mail. In addition, I&E staff distribute and update fishery brochures, fishing regulations, the regional webpage, coordinate the Fairbanks Outdoor Show booth and Kids' Fish & Game Fun Day, and the Becoming an Outdoorswoman (BOW) program. An Education Associate II coordinates the sport fishing component of the Alaska Conservation Camp and works with schools in various communities throughout the region to provide a curriculum in sport fishing and aquatic education.

A unique I&E feature of the UTMA is that Delta Clearwater River coho salmon provide eggs for school districts from Fairbanks to Tok that participate in the statewide "Salmon in the Classroom" aquatic education program. School children rear the eggs in classroom incubators throughout the winter and release the fry in the spring into local stocked lakes.

SPORT FISHING EFFORT, HARVEST AND CATCH

The proportion of sport fishing effort, harvest, and catch in each of the Tanana River management areas (LTMA and UTMA) has been estimated since 1996. In 2008, 19,374 angler-days of effort were reported from the UTMA (Table 1). This is approximately 69% of the recent five-year average of 28,119 (Table 1). A total of 11,140 fish were harvested and 73,599 fish were caught in the UTMA during 2008 (Table 2 and 3). The 2008 harvest was 65% of the recent five-year average, while 2008 catch represented 73% of the recent five-year average catch.

Angler preferences in the UTMA appear to have shifted to releasing more of their catch. From 1998 to 2007 anglers in the UTMA kept 21% of their catch and from 2003 to 2007 anglers kept 17% of their catch (Table 1). Anglers in the UTMA kept only 15% of their catch in 2008 (Table 1).

In 2008, Arctic grayling was the most commonly caught species in the UTMA, followed by rainbow trout with a total of 50,073 and 14,678 fish caught, respectively (Table 3). In 2008, the harvest rate was much greater for rainbow trout in the UTMA (25%) compared to 9% for Arctic grayling (Table 2 and 3). UTMA burbot which are typically harvested, rather than released, were harvested at a rate of 57% (Table 2 and 3).

SECTION II: FISHERIES

COHO SALMON

DELTA CLEARWATER RIVER

Background and Historical Perspective

Five species of Pacific salmon enter the Yukon River, of these only king, chum, and coho salmon enter the Tanana River drainage and are present in the UTMA. Coho salmon migrate to spawn in small spring-fed tributaries on the south side of the Tanana River drainage. These tributaries near Delta Junction provide critical habitat for the largest known coho salmon spawning concentrations in the Yukon River drainage. Because spring-fed systems do not freeze and coho salmon spawn into the late fall, these fish provide the latest open-water fishing opportunities in the region. Several such spring-fed systems exist throughout the UTMA, the largest of which is the Delta Clearwater River (DCR).

The DCR supports the largest documented spawning concentration of coho salmon in the Yukon River (Parker 1991). The DCR is about 20 miles in length, is road accessible (Figure 4), and supports the largest recreational fishery for coho salmon in the Tanana River drainage (ADF&G 1993). Species-specific effort estimates are not available from the SWHS; however data from a mail-out survey conducted in 1994 and 1995 indicated that 72% of the effort for the Delta Clearwater River was directed at Arctic grayling in 1995 (Howe and Fleischman 2001). From 2003 to 2007, an average of 589 coho salmon were harvested of the 5,890 fish caught annually in the DCR (Table 4). In 2008, the harvest of 65 fish was 11% percent of the 5-year average (Table 4).

Annual escapement index counts of coho salmon are accomplished by a boat survey. Escapement counts are completed on 18 miles of navigable water from an elevated platform on a riverboat. Aerial counts for coho salmon in the non-navigable portions of the DCR were conducted in conjunction with the boat survey from 1994 to 1998. These aerial counts averaged 20.4% of the expanded escapement over this five-year period (Evenson 1995-1996, 1997a; Stuby and Evenson 1998; and Stuby 1999). The results of this study suggest that on average 20.4% of coho salmon escapements to the DCR use the smaller side channels and tributaries. With the assumption that this estimated proportion is representative for the years the boat and aerial surveys were conducted, an escapement estimate for the indexed (boat counted) and non-indexed portions of the DCR can be obtained by increasing the boat counts by 20.4%. The average total escapement based on this expansion of coho salmon in the Delta Clearwater River from 1994 to 1998 is 30,354 fish.

Coho salmon have an overlapping, but somewhat later, run timing with fall chum salmon. Coho salmon are the last of the salmon species to enter the Yukon River and begin to enter the DCR in mid-September. The peak of the run is by mid-October. Property owners living near the river

have reported coho salmon spawning as late as January. The springs provide favorable over-wintering habitat for coho salmon that rear in the river for 1–3 years. Carcass sampling from 1984 to 1990 indicated that an average of 79% of the returning coho salmon were 4-years of age, 14% were 3 years, and the remaining 7% were 5-years of age (Parker 1991). The majority of the coho fingerlings rear in the DCR for 3-years before smolting and spend 1-year in the ocean before returning (Parker 1991).

Coho salmon in the DCR provide the last open-water fishery of the year, attracting both local and non-local anglers who want the opportunity to catch a salmon (ADF&G 1993). Anglers fish from shore or by boat near the State Park campground and boat launch at river mile 8.5. Coho salmon are caught from mid-September through October with rod and reel using various spoons or large spinners.

Recent Fishery Performance

The coho salmon fishery on the DCR has steadily grown in popularity since 1984. Angler effort on the DCR for coho salmon appeared to increase as the Arctic grayling population began to decline (Parker and Viavant 2000) about the same time coho escapements increased. For a number of years angler effort has been observed to be relatively consistent between the two species; however, more effort appeared to be directed on coho salmon when Arctic grayling abundance was at its lowest point. As the Arctic grayling population rebounded, angler effort appears to again be directed primarily at Arctic grayling.

Coho salmon harvests were relatively high from 1986 to 1991, averaging 1,252 fish annually. From 1992 through 2002, coho salmon harvests remained below 1,000 fish. In 2003, 1,272 coho salmon were harvested and 14,665 were caught, the catch being the largest ever recorded. These high harvest and catch numbers corresponded with the record escapement index of 102,800 fish in 2003 (Table 4). The majority of coho salmon are released; the quality of the salmon flesh is not as desirable as fish caught at the mouth of the Tanana River. In 2008, the catch of only 475 coho appears to be an aberration compared to recent years. This may be a combined result of the low escapement of 7,500 fish (Table 4) or a reflection the high cost of fuel, especially for those anglers outside of Delta Junction.

Fisheries Objectives and Management

Coho salmon assessment in the Yukon drainage is quite limited and relies heavily on information from commercial and subsistence harvests because of the expense and/or difficulty running sampling equipment during late fall icing conditions. The only coho salmon escapement goal that is presently in place for the Yukon drainage is the Delta Clearwater River. The current coho salmon escapement goal (5,200–17,000 fish), was established by the BOF in 2004, and replaced the previous minimum goal of 9,000 fish. The goal continues to be based on a boat survey during peak spawning. These boat counts are conducted on the navigable portion of the river from the confluence with the Tanana River upstream approximately 18 river miles. The average count from 1998 to 2007 in the DCR was 40,425 fish (Table 4).

It is unknown what proportion of coho salmon caught in the lower river Yukon are DCR stock. Recent examination of the 29 years of escapement and recruitment data and applying various proportions of harvest, provided an estimated maximum sustained yield for the DCR coho salmon stock of between 9,000 and 12,000 fish (Bue and Hasbrouck 2001). The DCR sport

harvests of coho salmon have remained well below this level and it is assumed that current harvests of the DCR stock in all Yukon River fisheries is sustainable.

The department monitors the DCR coho salmon escapement between mid-September and early October to determine if any inseason management action is necessary. An in-house management plan states that if 2,500 fish are found in the lower eight miles of river between September 15 and October 1, it is likely that the escapement goal will be met and no management actions will occur. However, if less than 1,500 fish are found in the lower eight miles of river during the same time period, the sport fishery will be closed by EO. The present bag and possession limit is three coho salmon per day. Yukon River sonar counts and Nenana test wheel catches may possibly be used as a preliminary index of DCR coho salmon run strength, in conjunction with actions taken by the Division of Commercial Fisheries. With these data and a preliminary escapement estimate, the department has reasonable tools to predict if the coho salmon sport fishery needs to be closed to the retention of coho salmon.

Current Issues and Fishery Outlook

Between 2001 and 2005, large numbers of coho salmon returned to the DCR. However, since 2006 there has been a significant decrease in the run size signaling a change in return per spawner in the DCR (Table 4). The 2008 escapement comes from a high parent year, so perhaps low smolt survival, poor ocean survival, or targeted commercial and subsistence fishing has resulted in the lowest escapement since 1992. Yet, the 2008 escapement was still within the escapement goal range. In 2009, the escapement of 16,840 is only 41% of the recent 5-year average (2003–2007) of 40,425 (Table 4). During the past 10 years, the escapement goal for the DCR has been met or exceeded every year.

Unless there are lower river fisheries that increasingly target coho salmon in the future, additional sport harvests could be sustained in the DCR coho salmon sport fishery. Harvest rates are low and more anglers are practicing catch-and-release. In years of high returns an EO could implement an increase in the bag limit, but few anglers are likely to take advantage of it.

Recent Board of Fisheries Actions

The last BOF action affecting salmon sport fishing in the DCR was in 1998 when a three fish combination bag and possession limit for coho and chum salmon was established drainage-wide.

Current or Recommended Research and Management Activities

The preliminary lower DCR survey (mid-September) and peak DCR coho salmon survey should be conducted annually to assess the coho salmon run in relation to the 5,200–17,000 fish escapement goal.

OTHER UTMA SALMON

Background and Historical Perspective

Several other river systems in the UTMA support spawning populations of salmon. The farthest upriver system in the Tanana River drainage in which significant king salmon spawning occurs is the Goodpaster River.

Within the UTMA, the Tanana River from its confluence with the Gerstle River to the Little Delta River is crucial habitat for returning fall chum salmon. Alluvial aquifers associated with

porous floodplain gravels store water and stabilize winter flows in this area near Delta Junction. All the large aquifers are located on the south side of the Tanana River. Groundwater seeps into the Tanana River, providing spawning habitat for fall chum and coho salmon, which are the last salmon species to spawn during the year.

As previously mentioned, coho salmon migrate to spawn in small spring-fed tributaries in the south side of Tanana River drainage. Several such springs are known to exist throughout the UTMA, including the Richardson Clearwater River, Providence Creek, and Blue Creek.

Recent Fishery Performance

In 2008, no king or chum salmon were harvested or caught (Table 5). In 2008, the harvest of 75 coho salmon was only 12.4% of the 5-year average (Table 5). There are no records or reports of anglers catching coho salmon in the Tok River drainage. However, there are recent observations of coho salmon in the Tok Overflow #1, a spring fed tributary of the Tok River. It is possible that a new spawning stock is developing.

Fisheries Objectives and Management

Teck-Pogo Inc., a mining corporation working within the Goodpaster River drainage, conducted aerial surveys for king salmon from 1998 to 2003 as part of environmental assessment studies (Table 6). In 2004, Teck-Pogo Inc. contracted Tanana Chiefs Conference (TCC) to monitor the Goodpaster River king salmon escapement for 20 years. Since 2004, TCC has operated a counting tower on the North Fork of the Goodpaster River. In 2008, due to poor river conditions restricting the number of days fish could be observed, only 662 king salmon were counted past the tower. In 2009, an estimated 4,251 king salmon passed the counting tower under favorable counting conditions (Table 6); Mike Smith, Fisheries Biologist, Tanana Chiefs Conference, Fairbanks; personal communication).

Current Issues and Fishery Outlook

The department received a report of about 50 spawning coho salmon in the Tok Overflow #1 (30 miles upstream in the Tok River) in October 2008 (Parker 2009). Department staff again surveyed the same area on October 21 and 22, 2009 counting 13 coho salmon. This is the first historical documentation of any coho salmon in these springs and given low numbers of fish, the department has submitted a proposal to the BOF to close the Tok River drainage to sport fishing for salmon to provide protection for this stock (**Proposal 100**). There are similar regulations in other Tanana River tributaries (Delta River drainage, Upper Chatanika, Goodpaster, and Salcha rivers) to protect small salmon stocks or spawning salmon.

Recent Board of Fisheries Actions

In 2007, the BOF adopted a proposal to allow catch-and-release fishing for king salmon in the first 25 miles of river from July 1 through August 31 (Parker 2008).

Current or Recommended Research and Management Activities

Aerial surveys of other important coho salmon producing streams in the area should be conducted. For example, periodic data has been collected by ADF&G on the Richardson Clearwater River. An estimated 265 coho salmon were counted on the Richardson Clearwater River by aerial survey in October 2008 (Mike Parker, Commercial Fish Biologist, ADF&G, Fairbanks; personal communication). Estimates on the Richardson Clearwater River have been

done in 24 of the past 37 years. The average escapement for years in which surveys were conducted is 1,393 fish (Bue 2008).

A foot survey was conducted on Blue Creek for the first time 2007 from the mouth to head of the springs (approximately 1.2 miles). Peak salmon counts in Blue Creek showed 2,200 chums and 102 coho salmon (Parker 2008). In 2008, 31 coho, and 347 chum salmon were counted, and in 2009, 31 coho and 402 chum salmon were counted.

ARCTIC GRAYLING

Arctic grayling are the most widely distributed species of fish sought by anglers in the UTMA and Region III. Arctic grayling are ecologically diverse, and populations vary greatly in abundance, size structure, and productivity. The BOF adopted the *Wild Arctic Grayling Management Plan* (5 AAC 70.055, 2004) at its 2004 meeting. The plan was created to simplify and standardize regulations, establish criteria and thresholds for management decisions, and to direct research needs. The plan is based on three management approaches: *regional, conservative,* and *special*. Under the *regional* approach fisheries are managed under regional background regulations and are the most liberal. The *conservative* approach is a transitional grouping in which fisheries are managed more conservatively in order to maintain certain characteristics of the stock or fishery. Fisheries may be placed in the *conservative* approach while existing regulations are being evaluated or when research findings or public input indicates that more conservative regulations are appropriate. Fisheries under the *special* management approach are managed to maintain, enhance, or develop characteristics of Arctic grayling fisheries most desired by the public, or are managed with the most conservative measures needed to preserve Arctic grayling stocks.

In the UTMA, all Arctic grayling fisheries are managed under the *regional* approach with the exception of the Delta Clearwater River which is managed under the *special* management approach. Arctic grayling fisheries in order of popularity in the UTMA include: Delta Clearwater River, Tangle Lakes system, Fielding Lake, Delta River, Goodpaster River, Tok River drainage, and the Richardson Clearwater River.

DELTA CLEARWATER RIVER

Background and Historical Perspective

The Delta Clearwater River (DCR) is the largest of several spring-fed streams near Delta Junction (Figure 4). In UTMA rivers and streams, Arctic grayling spawn in the Goodpaster, Shaw Creek, Upper Delta River, Healy River, and several other tributaries during the early spring. When spawning is complete, some adults leave for summer feeding waters such as the DCR or the Richardson Clearwater River (RCR). These clear springs maintain cool water temperatures in the summer and provide ideal habitat for adult Arctic grayling. Grayling are not known to spawn in the DCR or the RCR. It is unclear how Arctic grayling recruit to these summer feeding systems; however, fidelity to the DCR and other spring systems is strong (Ridder 1998a). The abundance of Arctic grayling populations within the spawning streams determines how many fish migrate to spring systems. The majority of the DCR Arctic grayling population is fish age-5 and older (Ridder 1998a). Catch-at-age estimates of abundance indicated that the DCR Arctic grayling population declined from 1984 to 1996 (Parker 2006). Abundance declined to a low of 2,490 fish in 1996 (Ridder 1998a). The population has since

increased to 6,891 fish in 2000 and to 14,799 in 2005, likely because of a series of changes to the bag and possession limits (Gryska 2001, Gryska *In prep*; Table 7). Estimates of total catch of Arctic grayling in the DCR have ranged from 4,665 fish in 1997 to 22,112 fish in 2007 (Table 7).

Average exploitation on the DCR Arctic grayling population from 1977 through 1990 was 38% (Parker and Viavant 2000). As indicated by the steady decline in Arctic grayling abundance in the DCR, this high exploitation level probably exceeded sustainability. High exploitation on the DCR was thought to be sustainable because this population was composed of at least eight different stocks of Arctic grayling (Parker and Viavant 2000), the largest contributor being the Goodpaster River at nearly 60% (Ridder 1998b). In 1995, the bag and possession limit was reduced to two fish by EO, resulting in an exploitation rate of 25%. However, the population continued to decline and exploitation in 1996 was up to 49% (Table 7). In 1997, an EO was issued for catch-and-release angling only. The BOF adopted a catch-and-release only regulation in 1998. Because of the catch-and-release restriction, the DCR was essentially transformed into a trophy catch-and-release Arctic grayling fishery. In 2001 the BOF modified the regulations to allow a small level of harvest with a bag limit of one fish, 12 inches or less, from July 10 to August 9. In 2007 the BOF expanded the retention dates to June 1 through December 31. Population models have suggested that a harvest of 900 small fish ($\leq$ 12 inches) would be sustainable on the DCR, but harvests of this magnitude have not occurred.

Recent Fishery Performance

Angler effort has been increasing in the DCR in recent years, probably a result of the increasing Arctic grayling population. Angler effort over the past ten years (1998 to 2007) averaged 4,190 angler-days and over the last five years (2003 to 2007) averaged 4,659 angler-days. The majority of this effort is probably anglers targeting Arctic grayling. In 2008, effort on the DCR declined for the first time since 2004 (2,248 angler-days) and was only 48% of the five-year average (2003–2007; Table 7).

Harvest in the DCR averaged a modest 62 Arctic grayling from 2003 to 2007 (fish <12 inches; Table 7). Catches of Arctic grayling from 2003 to 2007 (all sizes) averaged 15,433, and in 2007; a record 22,112 Arctic grayling were caught in the DCR. While anglers in the DCR catch small fish (42% in 2008; Table 7), they apparently have little desire to harvest them.

Fisheries Objectives and Management

Current management objectives for the Delta Clearwater River Arctic grayling recreational fishery were updated in 2003 (Parker 2003a). The three objectives of that plan are as follows:

1. **Maintain a fishery in which at least 40% of the measurable population of Arctic grayling exceeds 14 inches in length (TL).**

In 1999, 48% of the estimated population (> 10.5 inches TL) was 14 inches (TL) or greater (Ridder and Gryska 2000). In 2000, 54% of the estimated population (> 10.5 inches TL) was 14 inches or greater (Gryska 2001). Based upon these size compositions in the DCR, the current effort and catch levels, and the public desire to maintain the presence of large fish, the current regulations provide a management strategy that meets the first objective. The goal of regulations passed by the BOF in 2001 was to maintain or increase numbers of large fish in the DCR.

2. **Maintain an annual harvest of 900 fish ($\leq$ 12 inches) or less.**

In addition to maintaining large fish in the DCR, the regulations adopted in 2001 and amended in 2007 were designed to allow a small harvest of fish 12 inches or less. Specifically, the current regulations allow for a harvest of one fish per day, 12 inches or less in length, from June 1 to December 31. Statistical model simulations suggest that a harvest of 900 fish or less is sustainable in the DCR. Simulations also indicate that the current length structure would only be affected minimally by a harvest of 900 fish or less that are less than 12 inches. The number of fish harvested is annually estimated by the SWHS. The largest harvest since the new regulations occurred was in 2008, when 214 Arctic grayling were harvested (Table 7). The average harvest from 2003 to 2007 was 77 Arctic grayling 12 inches or less. In 2008, anglers caught ample numbers of Arctic grayling less than 12 inches (5,173, Table 7) but only harvested 214. This high catch rate but low retention rate may be explained by the evident preference of DCR anglers to release fish.

3. **Prosecute the fishery in such a way as to provide for a minimum catch rate of one Arctic grayling per angler-day.**

Data to determine angler-days of effort, and catch are compiled from the SWHS. Angler-days on the DCR ranged from 2,161 days in 1997 to 10,137 days in 1986 (Table 7). The average from 2003 to 2007 was 4,659 angler-days with an average catch rate of 3.3 fish per angler-day. In the unlikely case that catch rates fall below a threshold level of one fish per day, the department would attempt to determine cause and seek a remedy.

Following the implementation of catch-and-release only regulations in 1997 fishing effort in the DCR initially declined (Parker and Viavant 2000; Clark and Ridder 1994). More recently, fishing effort has increased. Since the harvest of Arctic grayling is very small it is likely that anglers are attracted to the catch-and-release aspect of the fishery and the trophy size fish in the population. The catch in 2008 (8,912 fish) was 52% of the recent 5-year average (15,433 fish; Table 7). Angler effort in 2008 was considerably lower throughout the drainage (Table 1), likely because of higher transportation costs, especially for those outside the local area.

Current Issues and Fishery Outlook

Concerns about enforcement have been raised by the public who feel that violations will increase when harvest is allowed with restrictive bag, size, and season limits. Catch rates are very high in the DCR averaging over 15,000 fish over the past five years (Table 7). The catch is more than the 2006 estimated population size, suggesting that many fish are caught multiple times. The apparent repeated handling of DCR Arctic grayling is likely responsible for some level of mortality, although probably low (McKinley 1993), but even a low hooking mortality rate, e.g. 5% could be significant (750 fish) with such high catch rates.

In 2006, the preliminary abundance of Arctic grayling over 12 inches in the DCR was 14,799 fish (SE=2,204; Gryska *In prep*.). Even the lower end estimate (11,184 fish) suggested by the standard error is significantly larger than the 2000 estimate of 6,891 fish (Table 7). This most recent abundance estimate suggests that current catch rates, and the associated hooking mortality appear to be sustainable.

Recent Board of Fisheries Actions

In 2001, the BOF adopted a proposal to allow a one fish ($\leq$12 inches) bag and possession limit for Arctic grayling in the Delta Clearwater River. The open season for Arctic grayling was July 10–August 9, catch-and-release only from August 10 to July 9. This proposal was adopted due

to large public support to allow some harvest opportunity for Arctic grayling in the Delta Clearwater River. In 2007, the BOF expanded the harvest dates for small Arctic grayling to June 1–December 31, recognizing that the previous narrow harvest window resulted in low harvests and that a higher level of harvest would be sustainable.

In 2004, the BOF adopted a management plan for Arctic grayling fisheries within the Arctic-Yukon-Kuskokwim Region. The management of the DCR falls under the special management approach of the Arctic grayling plan to provide high catch levels and a desired size composition.

Current or Recommended Research and Management Activities

Management activities should ensure protection of aquatic habitat for healthy fish production. Under the "Major Issues" sections of this report, there is a summary of the status of the DCR Watershed Project.

OTHER UTMA ARCTIC GRAYLING WATERS

Background and Historical Perspective

Several other river and or lake systems in the UTMA support Arctic grayling populations; those having popular sport fisheries include the Tangle Lakes System, Fielding Lake, the Goodpaster River, the Tok River drainage, and the Richardson Clearwater River. Stable Arctic grayling fisheries exist in the UTMA because they are either extensive in size or remote enough to accommodate past fishing pressure. One exception is the Tok River, which is somewhat problematic in that proximity to the road system allows fishing close to the spring spawning grounds where a relatively small Arctic grayling population congregates. For this reason, Arctic grayling regulations are restrictive for this system. In some Arctic grayling populations, such as the Goodpaster River, the fish relocate to summer feeding streams and become involved in one or more fisheries. A portion of the Goodpaster River Arctic grayling population can be found in the Delta Clearwater River and portions of the Tanana River that are fished early in the spring before glacial influence clouds the water.

Recent Fishery Performance

In 2008, much of the harvest of Arctic grayling in the UTMA occurred in the Tangle Lakes. The Tangle Lake Arctic grayling harvest was 1,897 fish, 43% of the total UTMA Arctic grayling harvest (4,445; Table 8). UTMA Arctic grayling harvest has declined by 23% based on the 10-year average of 4,436 and the 5-year average of 3,774 fish per year (Table 8). Conversely, catches between the 10- and 5-year averages have remained nearly the same (Table 8).

Fisheries Objectives and Management

All waters in the UTMA, with the exception of the Delta Clearwater River, are managed under the *regional management approach*. With conservation issues associated with the Tok River and restrictions already imposed on the Arctic grayling fishery, the BOF in 2010 will need to consider aligning the Tok River fishery under the *conservative management approach*.

The department has developed a *Fishery Management Plan for the Goodpaster River* (Parker 2003b). This plan has an abundance-based objective for the Goodpaster River Arctic grayling population. The management objective is:

- To maintain the Arctic grayling population such that fish numbers do not fall below 9,000 fish (greater than or equal to 270 mm fork length) in the assessed portion of the river in May.

Current Issues and Fishery Outlook

Recent assessment of the Arctic grayling population in the Goodpaster River in 2006 showed that the population had increased well above the management objective of 9,000 fish. From 1995 to 2002 the assessed portion of the Goodpaster River averaged 12,502 Arctic grayling ≥270 mm FL (Parker 2007), and in 2006 the estimated abundance was 32,907 (SE = 10,363; Gryska *In prep*.).

Recent Board of Fisheries Actions

There have been no actions taken by the BOF concerning Arctic Grayling waters of the UTMA since 2004 when the *Wild Arctic Grayling Management Plan* was established.

Proposals before the 2010 BOF concerning UTMA Arctic grayling include, updating the *Tanana River Area Wild Arctic grayling Management Plan* (5 AAC 74.055) to include the Tok River drainage in the *conservative management* category (**proposal 50**). In addition, the catch-and-release spawning season dates areawide would change by one day (May 30 to May 31) to align the regulations with the dates specified in the management plan.

Proposal 51 brings rivers in the UTMA into compliance with the *Tanana River Area Wild Arctic Grayling Management Plan* (5 AAC 74.055) *regional management approach* by removing spawning closures, length, and gear restrictions in these systems. The proposal removes the Arctic grayling size restrictions on the Richardson Clearwater River, Shaw Creek, and that portion of the Tanana River near the mouth of Shaw Creek. It also removes the Arctic grayling spawning restrictions on the Richardson Clearwater; and it retains the Arctic grayling spawning restriction for Shaw Creek and that portion of the Tanana near Shaw Creek because this is a critical spawning area for Arctic grayling from several systems.

Proposal 53 clarifies method and means in the water bodies in which there are either catch-and-release regulations or exceptions to the general bag and possession limits for Arctic grayling. Systems affected in the UTMA are those under the *conservative management approach* (Tok River drainage) and *special management approach* (Delta Clearwater River), where sport anglers will be restricted to one single-hook, artificial lure, rather than allowing two single hooks or artificial flies per line. Shaw Creek is under the *regional management approach*, but will be treated the same under this proposal because of its unique roadside situation and susceptibility to exploitation.

Current or Recommended Research and Management Activities

In 2008, a cooperative project between ADF&G and BLM was started to estimate abundance of Arctic grayling in a 17-km section (Delta River falls to the mouth of Eureka Creek) of the Delta River. In addition, 100 radio tags were implanted in Arctic grayling to describe the seasonal movements of Arctic grayling in the same study area. Preliminary estimated abundance of Arctic grayling (≥ 270 mm FL) in the 17-km section of the Delta River was 23,152. Tracking the radio tags is ongoing; however, it appears that Arctic grayling have little seasonal movement within the study area (Andy Gryska Sport Fish Biologist, ADF&G–Fairbanks, personal communication).

The Tok River System has a relatively small Arctic grayling population, but is the only roadside fishery in the Tok Area. There are management concerns for this population because of its small size and the amount of fishing effort by the local community. The last stock assessment by ADF&G of the Arctic grayling population was in 1993. To evaluate the current status of the Tok River Arctic grayling population it is recommended to estimate the adult spawning aggregation at the Mineral Lake Outlet. Logistically, the spawning population is easily accessible and an indication of the overall health of the population.

NORTHERN PIKE

Background and Historical Perspective

The major northern pike sport fisheries for the Upper Tanana area occur in George, Volkmar, Deadman, and Healy lakes, and in the Goodpaster and Volkmar rivers (Table 9). George Lake (Figure 5), the largest northern pike fishery in the Upper Tanana area, is accessible by boat, snowmachine, and float or ski equipped airplane, allowing the fishery to occur year-round. Volkmar Lake (Figure 6) is accessible primarily by snowmachine, but also by float and ski equipped airplane, and the fishery there occurs primarily in the winter. There are several lakes and creeks in the Tetlin National Wildlife Refuge that also have abundant northern pike resources, but effort is too low for these fisheries to be included in the SWHS. Scottie and Moose creeks and Deadman Lake near the Canadian Boarder are the only road-accessible northern pike fisheries in the Upper Tanana area. Most remote northern pike fisheries are accessed by plane or boat, and primarily occur during the open water period. Other lakes in the Upper Tanana area with northern pike populations are Sand, "T", Mansfield, Dog, Island, Tetlin, Takomahto, Jatahmund, Island, and Wellesley lakes. Many of these lakes and streams have been lumped together as "Tok Area" lakes in Table 9.

Although effort is not estimated by species targeted, it is thought that the majority of the effort at George and Volkmar lakes is directed toward northern pike. Lately, total fishing effort at George and Volkmar lakes has been more variable, particularly at George Lake (Table 10). Low snowfall, low creek levels, and open water on the Tanana River during the winter make access to these lakes difficult.

Hook-and-line is the predominant gear used to harvest northern pike. Spears, in addition to hook-and-line, are used during the ice cover months. Anglers fishing in lakes are very successful in the spring when northern pike have concentrated for spawning (Hallberg and Bingham 1992). In 1993, 549 households responded to a northern pike survey to gather information on the distribution of participation and harvest, and kinds of gear used by successful northern pike anglers. Results showed that 84% of participation and 82% of the harvest occurred during the open water months (Bingham and Parker 1995). Fishing occurred slightly more often on rivers (51%) than on lakes (49%) during the open water period. Only 14% of the total participation occurred during the ice-covered season, of which 86% of effort was on lakes. Winter anglers harvested 40% of their northern pike using spears (Bingham and Parker 1995). Northern pike stock assessment studies are done periodically for both George and Volkmar lakes (Tables 10& 11; Pearse and Hanson 1993; Scanlon 2001; Wuttig and Reed *In prep*).

George Lake is a semi-remote lake located about 35 miles southeast of Delta Junction and about 5 miles northeast of the Alaska Highway (Figure 5). The lake is large, over 4,500 acres, but shallow, maximum depth is only 35 feet; and the majority of the shoreline is privately owned.

The lake has one major inlet, six smaller inlets, and a navigable outlet, George Creek, which flows to the south into the Tanana River. Nearshore waters are shallow with large beds of aquatic vegetation. George Lake is typically ice-free from late May to mid-October.

In Volkmar Lake (922 acres) fishing effort is directly almost exclusively at northern pike. Volkmar Lake is semi-remote and is relatively close to Delta Junction and Fort Greely (Figure 6); there are numerous private land parcels and cabins around the shoreline, relatively easy wintertime access, and good catch rates of northern pike. Volkmar Lake is situated north of the Tanana River and most of the fishing effort occurs though the ice during spring when temperatures are more moderate and the Tanana River can be crossed safely. During summer Volkmar Lake can only be accessed by float-equipped aircraft.

Recent Fishery Performance

Much of the effort directed towards pike in the UTMA is non-consumptive fishing. In 2008, only 26% of the total catch of northern pike in the Upper Tanana River drainage was harvested (Table 9). Harvests for northern pike in the UTMA have varied greatly since 1996 ranging from 493 to 2,060 fish per year (Table 9). The UTMA 5-year average catch of 6,891 northern pike is consistent with the 10-year average catch of 6,718 fish (Table 9). Harvests in the UTMA have also been consistent; the 5-year average of 1,022 fish is similar to the 10-year average of 1,008 fish (Table 9). The 2008 harvest of northern pike (493) in all UTMA lakes was 48% of the five-year average of 1,022 fish (Table 9). In 2008, fewer anglers fished, especially in more remote areas, perhaps because of higher fuel costs.

George Lake

George Lake recreational fishing effort and harvests have been monitored since 1977 by the SWHS. Fishing effort in George Lake is highly variable, ranging from 377 to 1,939 angler-days in just the past five years (Table 10). This variability is probably due to the water levels in George Creek, which are not always high enough to allow anglers boat access into the lake. In 2000 and 2001, northern pike catches in George Lake increased dramatically as more anglers were able to access the lake via boat, but declined in 2002 because the outlet was nearly dry. In 2007, catches increased substantially at George Lake because the outlet was boat accessible during the spring. Average catch levels of northern pike in George Lake are comparable, averaging 3,649 fish over the past 10 years and 3,930 fish over the past 5 years. In 2008, the catch of 1,286 northern pike was only 33% of the 5-year average (Table 10).

Fishing pressure at George Lake is heaviest from June 1, when the season opens through mid-July. Little ice fishing occurs before late December or early January because poor ice conditions on the Tanana River prevents snow machine access. The ice fishery lasts until March 31 when the northern pike season closes. During the ice fishing season, northern pike and burbot are taken with hook and line gear as well as with spears. ADF&G has annually issued between 1 and 6 ice house permits for George Lake since the early 1980s.

Volkmar Lake

Since 1981, fishing effort on Volkmar Lake has averaged 409 angler-days per year, ranging from 22 in 2000 to 1,263 in 1995 (Table 11). From 2003 to 2007, angler-days averaged 149, which is lower than the 10-year average of 186 angler-days per year (Table 11). Since 1981, harvests of pike ranged from 9 fish in 1996 to 1,084 in 1995. From 2003 to 2007, average harvest and catch of northern pike was 24 and 306 fish, respectively (Table 11).

In 1995, a record 1,263 angler-days occurred on Volkmar Lake with a harvest of 1,084 pike. In 1996, effort and harvest fell to the lowest recorded level (191 angler-days and 9 fish harvested). In 1996, anglers reported that size and abundance of pike in Volkmar Lake had declined. The BOF adopted the current bag and possession limit of one fish, no size limit, at the 1997 meeting as a conservation measure. Stock assessment in 2000 estimated a population of 612 northern pike over 18 inches in Volkmar Lake; it is thought that the large harvest in 1995 was likely responsible for the decline in population and harvests at that level were not sustainable (Table 11).

Fisheries Objectives and Management

George Lake

The management objective since 1993 has been to ensure that harvests and incidental mortality of northern pike by the recreational fishery are sustainable by limiting exploitation to 10%–20% annually. A draft management plan for George and Volkmar Lakes was developed in 2007. The revised management objective for George Lake is to maintain a population size greater than 9,200 northern pike $\geq$ 18 inches (450 mm) in size. An abundance of less than this is the threshold at which a management action to restrict harvest would be taken by the department. The objective is based on the most recent 5-year SWHS reporting period (2003–2007) for fish. This conservative threshold was calculated based upon the highest reported harvest within the past 5 years (862 fish; Table 10), applying a 10% mortality rate on the highest catch within the past 5 years (10% of 6,889 fish or 689) for a total fishing mortality of 1,551 fish.

The department conducted stock assessment for northern pike in George Lake during May 2006 and estimated the population size to be 16,178 fish $\geq$ 18 inches TL (450 mm FL; Table 10) with an additional 4,268 fish between 12 and 18 inches (Wuttig and Reed *In prep*). The population estimate is well above the objective for George Lake at which a management action would need to occur. The abundance is such that additional opportunities to harvest or catch fish are possible.

The sport fishing regulation of only one fish 30 inches or larger in the daily bag and possession limit of five fish potentially affects only about 6% of the northern pike population in George Lake (based on the 2006 abundance estimate). The regulation helps maintain a few large northern pike in the population and prevents anglers from selectively harvesting these large fish, thereby spreading the availability of these large fish among as many anglers as possible.

A substantial level of catch-and-release fishing for northern pike occurs at George Lake. In a 1991 study, ADF&G concluded that catch-and-release mortality of sport caught northern pike was less than 10% (Burkholder 1992). Based on current abundance, harvest, and catch levels of northern pike in George Lake, it appears that catch-and-release fishing practices are not having a negative effect upon the northern pike population.

Volkmar Lake

The management objective for Volkmar Lake is to maintain a population of northern pike $\geq$ 18 inches of 2,000 fish or greater. Although no formal abundance or exploitation-based management plan exists for Volkmar Lake, 2,000 fish were selected as the population size at which any regulatory change would be considered to increase harvest. This corresponds to the maximum sustainable population in Volkmar of 2,000 northern pike spawners (age 5+ or 18 inches or greater) and according to Pearse and Hanson (1993) a 30% natural mortality rate and

850 recruits can be anticipated from a population of this size. An increase in the bag limit is recommended to allow for additional harvest opportunity if the population rises above 2,000 fish.

In 1995, a record 1,263 angler-days occurred on Volkmar Lake with a harvest of 1,085 northern pike, which was not sustainable. Anglers testified that effort in 1996 was high and harvest was poor, with few large fish. In 1996, effort and harvest fell to the lowest recorded level (191 angler-days and 9 fish harvested). During this time, anglers also reported that the size and abundance of northern pike in Volkmar Lake had declined. In 1997, the BOF supported a bag and possession reduction to one fish as a conservation measure. In 2000, the estimated abundance was only 615 fish >450 mm (Scanlon, 2001). Angler effort and harvest have been minimal with the new regulations and angler perception of low northern pike abundance. In 2005, the population of fish >450 mm had increased to 1,630 fish (Wuttig and Reed, *In prep.*). In 2009, the population of fish >450 mm increased to 4,017 fish.

Current Issues and Fishery Outlook

George Lake

Based on recent population estimates, the northern pike population in George Lake is thought to be healthy. Higher lake water levels over the past 2 years has provided access in George Creek for anglers to fish the early season, whereas in the previous 10 years, drought-like conditions left the creek nearly impassable. During the late 1980s and 1990s, George Lake had a reputation of supporting a large population of small fish (e.g., 20 in). Recently, anglers and the local Fish and Game Advisory Committee have expressed their satisfaction in the improved quality of their fishing experience at George Lake because of good catch rates, particularly of larger-sized fish (e.g., >24 in).

A comparison of lengths collected during 2006 to lengths collected in 1987 indicates a higher proportion of larger fish in the population. In 1987, 48% (8,495) fish were over 18 inches and in 2006, 79% were over 18 inches in size (Clark et al, 1988). In 2006, it was estimated there were approximately 1,013 northern pike over 30 inches in length or about 6% of the estimated population. In 1987, only 3.4% of the population, or 300 fish were estimated at 30 inches or more in length.

Volkmar Lake

The guidelines for managing the Volkmar Lake northern pike sport fishery are such that if the population reaches 2,000 fish (18 inches or larger), the bag limit may be increased to allow additional harvest opportunity. A five fish bag limit is probably not sustainable due to the size of the lake and how prone the population to excessive exploitation. A bag and possession limit of 3 fish per day, of which only 1 fish may be 30 inches or greater in length, is believed to be sustainable while maintaining a population above 2,000 fish greater than 18 inches.

Recent Board of Fisheries Actions

During the 1997 meeting the BOF reduced the northern pike bag and possession limit in Volkmar Lake to one fish with no size limit. The intent of this bag limit reduction was to reduce effort and harvest and allow the population to rebuild to previous levels. Population abundance of northern pike has increased under this regulation (4,017 fish > 450 mm FL) as of 2009.

In 1997, the BOF adopted a department proposal to remove the areawide spring spawning closure for flowing waters (except the Tolovana drainage) and reduce the Tanana River

drainagewide spawning closure for lakes by 20 days (from April 1 – May 31 to April 21 – May 31). The exceptions to liberalizing the spring spawning closure were the popular northern pike fisheries: Harding, George (including its outlet), and Volkmar lakes.

In 2001, the BOF adopted a proposal for the Chisana River drainage upstream from the Northway Bridge that reduced the northern pike bag and possession limit to two fish, only one of which could be over 30 inches. This regulation will provide protection to stocks of fish in streams that cross the Alaska Highway from the Canadian border to Northway.

In January 2010, the BOF will address **proposal 61** which proposes to increase the bag and possession limit in Volkmar Lake from one fish (no size limit) to three fish, of which only one can be over 30" in length. Recent population studies estimate over 4,000 northern pike over 18 inches in length in Volkmar Lake. A population of 2,000 fish is the management threshold in which regulatory action can be taken to increase harvest.

In addition, **proposal 62** requests the spring spawning closure for northern pike in Volkmar Lake be reduced by 20 days. All other lakes in the Tanana River drainage, with the exception of Volkmar Lake, George Lake, and the George Lake outlet, have a June 1–April 20 open season.

Current or Recommended Research and Management Activities

In 2006, a creel census was conducted at George Lake from February 9 through March 31. The survey provided information on the timing of the winter fishery and the size and sex composition of the northern pike catch (Parker 2006). A majority (75%) of the anglers interviewed approved of the current regulations (Parker 2006).

LAKE TROUT

Background and Historical Perspective

Since 1986, the department has conducted research on lake trout populations due to high harvest rates and perceived declines in lake trout abundance that had occurred in many UTMA lakes. Today, lake trout regulations region-wide are conservative to protect existing lake trout populations. Specific life history features of lake trout (slow growth, delayed maturity, and non-consecutive spawning), combined with the short growing season at higher altitudes, increases the vulnerability of the species to overharvest (Burr 1987, 2006). The impact of even modest fishing pressure can be significant.

Lakes containing lake trout in the UTMA include Fielding, Two Bit, Landmark Gap, Glacier, Sevenmile, 14-Mile, and the Tangle lakes system.

Recent Fishery Performance

In 2008, there was a harvest of 431 lake trout in the UTMA (Table 12). In 2008, only 25% of the total catch of lake trout (1,735) in the UTMA were harvested (Table 12). The Tangle Lakes system has consistently produced the highest lake trout harvest in the UTMA. In 2008, the number of lake trout harvested from this system was 232 fish with a catch of 1,119 fish (Table 12). The 2008 lake trout harvest in the Tangle Lakes system was only 70% of the recent 5-year average harvest of 331 fish. In Fielding Lake (Figure 6), the recent 5-year average (2003–2007) harvest was 89 lake trout; seven lake trout were harvested in 2008 and this was 8% of the 5-year average (Table 13), probably the result of new regulations enacted in 2007. Total catch of

lake trout in Fielding Lake has followed the same trend, with the 2008 catch of 103 fish being 19% of the recent 5-year average of 533 fish (Table 13).

Fishery Objectives and Management

In 2007, the BOF adopted the *AYK Region Wild Lake Trout Management Plan* (5 AAC 74.040) which provides guidelines for regulations based upon current effort and harvest levels, specific population data, and biological characteristics of the water body (Burr 2006). The *AYK Wild Lake Trout Management Plan* provides criteria for the BOF, public, and department to address in future proposals directed towards lake trout fisheries. The lake area model (LA model) is the primary tool for determining if fishing mortality estimated by the SWHS for specific lakes is acceptable. The LA model estimates yield for a water body based on area and regulatory actions will be introduced when harvests and an estimated 10% hooking mortality of the released fish have exceeded the yield for two consecutive years.

In the Tangle Lakes system, average harvest from 2003–2007 was 331 lake trout (Table 12). A 10% hooking mortality of the catch is combined with harvest to determine total mortality. Catch over the past 5 years has averaged 1,544 fish. When the harvest of 331 fish is combined with an additional 10% hooking mortality of 121 fish, a total estimated fishing mortality of lake trout from the Tangle lakes system is 452 fish per year. The sustainable lake trout yield for the Tangle Lakes system is 731 fish per year based on the LA model (Burr 2006).

A sustainable lake trout harvest for Fielding Lake is about 78 fish (for fish over 26 inches) per year based upon the LA model (Burr 2006). From 2003 to 2007, the harvest of lake trout from Fielding Lake averaged 89 fish per year (Table 13). Catch of lake trout averaged 533 fish from 2003 to 2007 with a high catch in 2005 of 862 fish (Table 13). The estimated harvest combined with estimated hooking mortality of 44 fish gives annual average total fishing mortality of 133 fish. Given the low abundance of lake trout and the high proportion that are caught and released, the continued use of bait in this fishery would probably result in total lake trout fishing mortality exceeding the estimated sustained yield.

Current Issues and Fishery Outlook

During the 2001 BOF meeting, the department did not support a bait restriction in Fielding Lake because this would reduce the opportunity to catch burbot and lake trout harvests were considered sustainable at that time. In 2007, the BOF adopted a department proposal to eliminate the use of bait in Fielding Lake because lake trout harvests had exceeded estimates of yield from 2004-2006.

Recent Board of Fisheries Actions

The BOF in January 2001, increased the minimum size limit to 26 inches for retention of lake trout in Fielding Lake. In addition, the open season for lake trout in Fielding Lake was restricted from October 1 to August 31 to reduce harvests and protect spawning fish. In 2007, a single-hook restriction was established on Fielding Lake and bait was eliminated to further reduce lake trout harvests.

Also at the 2007 BOF meeting, the minimum size limit of 18 inches for lake trout retention in the Tangles Lakes system was removed from regulation since harvests were below the sustainable yield of 521 fish over 18 inches per year. Without the length limit, the sustainable yield for the

Tangle Lakes system increased to 731 fish because all lake trout in the system are available for harvest.

In January 2010, the BOF will address **proposal 58** to allow the use of bait during the winter fishery (November 1–March 31) in Fielding Lake. Since the bait restriction went into effect in 2007, harvest of lake trout have been below the sustainable level (Table 13).

The BOF will also address **proposal 59**, which would prohibit the use of a second line during the winter fishery in Fielding Lake. The author of this proposal believes allowing one less line in conjunction with proposal 58 (allowing bait during the winter fishery) would reduce harvest, yet increase opportunity to catch lake trout and burbot.

Ongoing or Recommended Research and Management Activities

The last population estimate for lake trout in Fielding Lake was in 1999 when 264 adults ≥550 mm FL, or 22 inches were estimated (Parker et al. 2001). Recent harvests from 2003–2007 indicate that higher than sustainable harvests still occur. Estimated total fishing mortality of lake trout in Fielding Lake will continue to be monitored by the SWHS.

BURBOT

Background and Historical Perspective

Before restrictive regulations were put into effect, burbot fishing in UTMA lakes occurred primarily in Fielding and the Tangle Lakes system. Now very little harvest occurs in these lakes. In 1987, bag limits in these lakes were reduced from five to two fish and the use of setlines was eliminated, due to concerns of overharvest. The majority of the burbot harvest in the Tanana River occurs near communities such as Fairbanks, Delta Junction, and Northway. Burbot movements within the Tanana River tend to minimize effects of concentrated local fishing effort, and stocks in the Tanana River appear to be lightly exploited (Evenson 1997b).

Harvest from UTMA lakes has declined since 1987 when reduced bag limits, restrictions on the number of hooks, and prohibition of setlines were adopted for many lakes. From 1981 to 1984, harvests of burbot at Fielding Lake averaged 330 fish per year which is believed to have caused a decline in the adult population. Due to low recruitment, a cycle of high and low abundance has occurred thereafter (Parker 2001). In 1994 the department issued an EO to close the Fielding Lake burbot fishery until further notice. The population increased under the closure and in 2001 the burbot fishery was reopened. At the 2001 meeting, the BOF adopted a proposal reducing the bag limit from two to one burbot. Harvest in Fielding Lake was not reported immediately after the fishery was opened, but in 2003, the SWHS reported 11 fish harvested and since then harvest has been as high as 51 fish in 2006 (Table 14).

Recent Fishery Performance

In 2008, the estimated harvest of burbot in the UTMA by sport anglers was 207 fish (Table 14). The harvest in 2008 was only 21% of the 5-year average of 989 fish from 2003 to 2007 (Table 14). Harvests for burbot in the UTMA have varied since 1996 ranging from 207 fish in 2008 to 2,432 fish in 1997 (Table 14). The SWHS splits the Tanana River into three statistical areas; Lower, Middle, and Upper Tanana River. A portion of the Middle Tanana River and the entire Upper Tanana River is included in the UTMA. For reporting purposes, 33% of the harvest and catch of the Middle Tanana River is attributable to the UTMA. The middle section begins in

Nenana, ends at Delta Junction and includes popular areas near the mouths of the Chena River and Shaw Creek. It was estimated based on the relative size of the respective fisheries, that about 70% of the burbot harvest is taken in the Fairbanks area, while 30% occurs in the Upper Tanana area (Parker and Viavant 2000). In 2008, the Tanana River component of burbot harvest attributed to the UTMA was 173 fish (Table 14). In 2008, anglers fishing burbot in the UTMA harvested 207 or 57% of the burbot they caught (Table 14). In 2008, the SWHS reported 17 burbot harvested in Tangle Lakes system and 17 in George Lake, but no burbot were reported harvested in Fielding Lake (Table 14).

Fishery Objectives and Management

Fielding Lake is a popular angling destination that has had restrictive regulations put in place over the years to prevent overharvest. Burbot regulations on Fielding Lake have changed from a 10 fish bag limit, to total closure, and to a very conservative bag limit of one fish.

Statistical simulations of the Fielding Lake burbot population show that a 10% exploitation rate can be sustained on an optimum population size of about 1,000 burbot (>18 inches). Therefore, the management objectives for the Fielding Lake burbot fishery are to: 1) maintain a population size of 1,000 burbot > 18 inches in size; and, 2) ensure that the harvest plus incidental mortality of burbot is less than 10% of the population size.

Sustainable levels of harvest in small, high elevation lakes such as Fielding and the Tangle Lakes system are thought to be low and if harvests should reach 100 fish per year, impacts upon the population should be investigated. The number of burbot annually harvested from Fielding Lake is obtained from the SWHS, these numbers will be continue to be monitored and if the annual harvest exceeds 100 fish, further restrictions may be required.

Current Issues and Fishery Outlook

From 1985 to 2000, ADF&G collected burbot abundance data from Fielding Lake (Table 13). The burbot population has increased from overfishing in the 1980s, was estimated to be 598 fish (TL > 18 inches (450mm)) in 1999 and 759 fish in 2000 (Parker 2001). In 2008, the estimate for Fielding Lake burbot (TL> 18 inches) was 894 (Parker *In prep*).

The Fielding Lake burbot population currently can sustain a total fishing mortality of about 90 fish. In the past 5 years anglers have reported harvesting from 0 to 51 burbot in Fielding Lake, averaging 23 burbot per year (Table 12). This number is unlikely to increase, as opportunity to harvest burbot is now limited due to the bait restriction adopted by the BOF in 2007.

Recent Board of Fisheries Actions

In 2001, the BOF adopted a daily bag and possession limit of one burbot in Fielding Lake. In addition, when fishing for burbot or lake trout, bait could only be used on a single hook, and fishing for burbot or lake trout was closed from September 1 to 30. In 2007, the BOF further restricted the regulations for Fielding Lake by prohibiting the use of bait to protect the lake trout population. This directly impacts the burbot fishery as most anglers use bait for burbot fishing.

Current or Recommended Research and Management Activities

Exploitation rates of burbot in the Upper Tanana River are not considered excessive. Burbot stock assessments carried out by ADF&G during the late 1980s indicated that the uppermost river section near Northway supported the lowest density of large burbot among the river

sections sampled (Evenson 1991). Subsistence and personal use fisheries for burbot are known to occur in the Upper Tanana, but harvests in these fisheries may be underreported. Current estimates of stock status or of total harvest for the Upper Tanana drainage are unavailable. However, since this part of the river showed low relative abundance of burbot compared to other river sections and has seasonally intense effort and harvest, there is concern for local depletion.

Low productivity of burbot in most UTMA lakes combined with relatively high harvest levels may result in overexploitation. Population density of burbot in lakes declined dramatically in the early 1980s due to unsustainable exploitation rates in the sport fisheries. Stock assessment studies in the 1980s conducted in lakes of the Tanana River drainage (Lafferty et al. 1992), confirmed that several lake stocks in the drainage showed evidence of high exploitation. More recent stock assessment studies conducted in lakes of the Tanana River drainage demonstrate the detrimental effects of long-term high exploitation rates (Parker 2001). Periodic stock assessment, such as occurred in Fielding Lake in 2008, demonstrated that this once depleted burbot population has increased in abundance and appears to be healthy.

STOCKED WATERS

Background and Historical Perspective

The ADF&G stocks rainbow trout, Arctic char, Arctic grayling, and landlocked salmon into 48 lakes in the UTMA. The stocking program is designed to provide additional fishing opportunities near communities and at popular recreational destinations where fish resources and angling opportunity are limited and where fishing effort and harvest are highest. Remote lakes are stocked to provide opportunities for anglers who want a more challenging experience or those who want to enjoy more remote settings. Lakes in the stocking program range in size from a few acres to several hundred acres and are accessible by road, trail, ATV, or aircraft. Most of the fisheries are year-round and half of the angling effort on some lakes probably occurs during the winter months due to easier accessibility. State hatcheries at Fort Richardson and Elmendorf AFB located near Anchorage provide most of the fish for the UTMA. An experimental hatchery in Fairbanks was producing small numbers of fish through 2009. A new hatchery located in Fairbanks is due to be completed in 2011.

Recent Fishery Performance

From 1999 through 2008, anglers fishing the stocked lakes in the UTMA generated from 8,729 to 23,126 angler-days annually and averaged 12,886 angler-days (Table 15). From 1999 to 2008, harvests of stocked fish ranged from 5,861 to 32,199 fish averaging 15,849 fish (Table 15). From 1999 to 2009, catches of stocked fished ranged from 23,374 to 91,946 fish averaging 50,045 fish (Table 15). In 2008, effort (angler-days) on stocked waters was 45% of the total estimated fishing effort for both stocked and wild species in the UTMA. From 1999 to 2008, the number of stocked fish harvested averaged 69% and ranged from 49% to 82% of the total annual harvest in the UTMA. Effort, harvest, and catch in stocked waters have generally declined over the past 10 years (Table 15).

Rainbow trout are the most commonly caught stocked fish in the UTMA over the past ten years, followed by coho and king salmon, Arctic char, Arctic grayling, and lake trout in decreasing order. These catch rates correspond to the numbers of these fish that are stocked (at catchable size), with rainbow trout being the most commonly stocked fish and Arctic grayling the least

(Table 16). Lake trout have not been stocked in UTMA lakes since 2000; however, eggs were taken from Sevenmile Lake in 2008, to be raised in the Fairbanks pilot hatchery and resulting fingerlings were stocked in 2009.

In 2007, the average catch rate per angler-day of effort for stocked fish in the UTMA was 2.8 fish and the recent 10-year average was 3.9 fish (Table 16). Fish stockings for 2006 through 2008 are summarized in Table 17.

Fisheries Objectives and Management

In January 2004, the BOF adopted the *Arctic-Yukon-Kuskokwim Region Stocked Waters Management Plan* (5 AAC 70.065, 2004; SWMP). The SWMP created three management approaches: regional (high yield), conservative, and special management. Almost all stocked lakes in Region III are categorized under the regional approach. The BOF directs the department to manage the stocked waters according to a framework designed to meet public demand and provide diversity of opportunity. The department may manage specific fisheries to provide or maintain qualities desired by the angling public.

The regulations adopted by the board are designed to maintain the characteristics of each fishery category. All waters stocked in the UTMA are classified as high yield or under the regional management category with four exceptions. Koole Lake is the only lake in the UTMA that is categorized under the SWMP as conservative yield. There are three lakes in the UTMA, Monte Lake, Donnelly Lake, and Rainbow Lake under the special management category.

Stocked waters may be reclassified into a different category only through proposals from the public, department, or Board of Fisheries, and only if the proposals meet the criteria established for the proposed category. Requests for reclassification and special management will be submitted to the BOF during the appropriate cycle.

Currently, ADF&G provides diverse year-round sport fishing in the UTMA for rainbow trout, coho salmon, Arctic grayling, and Arctic char. Goals of the fish-stocking program in the UTMA are to:

- reduce harvest pressure on wild stocks;
- provide angling opportunity for increasing numbers of anglers;
- diversify angling opportunity by stocking popular species and species not typically found along the road system; stock a variety of lakes; and improve access; and,
- rehabilitate depleted wild stocks when required.

Meeting public demand for recreational fishing opportunities in Alaska while at the same time maintaining and protecting the wild fishery resources has become increasingly complex. Today, Alaska is experiencing increased tourism and continued forest, mineral, and petroleum development. All of these activities impact Alaska's wild fish stocks and the fisheries that depend on them.

The *Statewide Stocking Plan for Recreation Fisheries* (SSP) is updated annually. The SSP is a comprehensive list of the species, life stage, stocking frequencies, maximum numbers of fish that can be stocked for lakes, and projected numbers of fish to be stocked for a five-year period in the UTMA. Comments received from the public and current policies are reviewed to determine what changes will be required to update the stocking plan each year. The updated stocking plan

for Region III is submitted to the Sport Fish regional office in Anchorage in November for inclusion into the draft SSP. After a comment period the finalized plan is usually published and available by 1 February. The SSP can be accessed via the ADF&G website.

Current Issues and Fishery Outlook

The two Anchorage hatcheries (Ft. Richardson and Elmendorf Air Force Base (AFB)) are no longer producing as many fish as they once did due to changes to the electrical generation systems that they were linked to. These changes resulted in less hot water, which is necessary for accelerating growth rates in fish. The catchable rainbow trout program at the Elmendorf AFB hatchery has been curtailed due to parasite contamination concerns. In 2005, the Alaska Legislature approved the construction of new hatcheries in both Fairbanks and Anchorage to replace the outdated Anchorage facilities. Funding was been secured and above ground construction on the Fairbanks facility began in 2008. Once the Fairbanks hatchery becomes operational, the biomass of fish stocked in the UTMA is predicted to double. The first catchable rainbow trout from the Fairbanks hatchery are expected in 2011.

ADF&G will continue to stock lakes that provide fishing opportunities and where stocked fish exhibit good survival and growth, or provide put and take fisheries. New lakes will be evaluated as candidates in the stocking program based on public requests for new fisheries.

Recent Board of Fisheries Actions

In January 2004, the BOF adopted the *Arctic-Yukon-Kuskokwim Region Stocked Waters Management Plan* (Swanton and Taube 2009).

In 2007, the BOF adopted a proposal to change the management approach for Koole Lake from the regional to conservative under the SWMP. This change reduced the bag and possession limit from 10 fish (all species combined), of which only one may be 18 inches or greater in length to 5 fish (all species combined), of which only one may be 18 inches or greater in length.

At the 2007 meeting the BOF updated the stocked waters list. This is a housekeeping action that is performed at each AYK BOF meeting due to new lakes being added and old lakes being removed from the list. Lakes are removed from the list if they are unable to sustain fish and/or public access is no longer allowed.

In 2009, the BOF will address **proposal 49**, which updates the stocked waters list with lake deletions and additions to the SSP.

Current or Recommended Research and Management Activities

The ongoing strategy is to stock species most suited to a particular lake's physical characteristics and at a size to account for lake productivity, harvest pressure, and to minimize transport costs. Rainbow trout and Arctic grayling do well in most lakes in the UTMA and support summer fisheries. Coho and king salmon also do well in most lakes and provide an aggressive fish during winter when other species are less active. Arctic char and lake trout are long lived and grow to large size which makes them attractive to anglers. In some lakes more than one species is stocked to provide diversity and to take advantage of different seasonal behavior. The most popular combination is rainbow trout and coho salmon. In the UTMA several lakes are suitable habitat for lake trout. It is recommended that once the new hatchery in Fairbanks is operational that a lake trout egg take be added to the stocking program.

Fingerling coho salmon are stocked in Quartz Lake because the lake produces sufficient numbers of catchable fish from fingerling stockings. However, recent population assessments in Quartz Lake have shown that the survival of rainbow trout fingerlings from August through June appears to be much lower. For this reason, ADF&G is now stocking sub-catchable rainbow trout into Quartz Lake. This problem with survival can be averted if stocking of fingerlings can occur earlier in the summer.

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REFERENCES CITED

ADF&G. 1993. Recreational Fishery Management Plan for Coho Salmon in the Delta Clearwater River. Alaska Department of Fish and Game, Division of Sport Fish, Fairbanks.

Bingham, A. E., and J. F. Parker. 1995. Assessment of harvest and participation characteristics in the northern pike fisheries of the Tanana River drainage, Alaska. Alaska Department of Fish and Game, Fishery Data Series No. 95-16, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds95-16.pdf.

Brabets, T.P., B. Wang, and R.H. Meade. 1999. Environmental and Hydrologic Overview of the Yukon River Basin, Alaska and Canada. USGS Water-Resources Investigations Report 99-4204.

Bue, F. 2008. 2007 Yukon River Fall Season Summary. Alaska Department of Fish and Game Commercial Fisheries, News Release. March 18, 2008, Fairbanks.

Bue, B. G., and J. J. Hasbrouck. *Unpublished*. Escapement goal review of salmon stocks of Upper Cook Inlet. Alaska Department of Fish and Game, Report to the Alaska Board of Fisheries, November 2001 (and February 2002), Anchorage.

Burkholder, A. 1992. Mortality of northern pike captured and released with sport fishing gear. Alaska Department of Fish and Game, Fishery Data Series No. 92-03, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds92-03.pdf

Burr, J. M. 1987. Synopsis and bibliography of lake trout (*Salvelinus namaycush*) in Alaska. Alaska Department of Fish and Game, Fishery Manuscript No. 5, Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/fms-005.pdf

Burr, J. M. 2006. AYK Lake Trout Management Plan. Alaska Department of Fish and Game, Fishery Management Report No. 06-52, Anchorage. http://www.sf.adfg.state.ak.us/FedAidpdfs/fmr06-52.pdf

Burr J., F. DeCicco, J. Hallberg, and J. Parker. 1998. Fishery Management Report for Sport Fisheries in the Arctic-Yukon-Kuskokwim, Tanana River, and Northwest Alaska Regulatory Areas, 1993-1994. Alaska Department of Fish and Game, Fishery Management Report No. 98-5, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fmr98-05.pdf

Clark, J. H., D. R. Bernard, and G. A Pearse. 1988. Abundance of the George Lake Northern pike population in 1987 and various life history features of the population since 1972. Alaska Department of Fish and Game, Fishery Data Series No. 58. Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds-058.pdf

Clark, R. A., and W. P. Ridder. 1994. An age-structured stock analysis of Arctic grayling in the Delta Clearwater River, 1977 to 1990. Alaska Department of Fish and Game, Fishery Manuscript No. 94-04, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fms94-04.pdf

Evenson, M. J. 1991. Abundance and Size Composition of Burbot in Rivers of Interior Alaska during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-33, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds91-33.pdf

Evenson, M. J. 1995. Salmon Studies in interior Alaska, 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-05, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds95-05.pdf

Evenson, M. J. 1996. Salmon Studies in interior Alaska, 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-17, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds96-17.pdf

Evenson, M. J. 1997a. Salmon Studies in interior Alaska, 1996. Alaska Department of Fish and Game, Fishery Data Series No. 97-31, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds97-31.pdf

Evenson, M. J. 1997b. Burbot research in rivers of the Tanana River drainage, 1996. Alaska Department of Fish and Game, Fishery Data Series No. 97-34, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds97-34.pdf

Gryska, A. D. 2001. Abundance and Composition of Arctic grayling in the Delta Clearwater River, 2000. Alaska Department of Fish and Game, Fishery Data Series No. 01-27, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds01-27.pdf

REFERENCES CITED (Continued)

Gryska, A. D. *In prep.* Abundance and composition of Arctic grayling in the Delta Clearwater River, 2006. Alaska Department of Fish and Game, Fisheries Date Series, Anchorage.

Hallberg, J. E., and A. E. Bingham. 1992. Evaluation of Interior Alaska waters and sport fish with emphasis on managed waters – Fairbanks District. Alaska Department of Fish and Game, Fishery Management Report No. 92-07. Anchorage.

Howe, A. L., G. Fidler, and M. J. Mills. 1995. Harvest, catch, and participation in Alaska sport fisheries during 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-24, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds95-24.pdf

Howe, A. L., G. Fidler, A. E. Bingham, and M. J. Mills. 1996. Harvest, catch, and participation in Alaska sport fisheries during 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-32, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds96-32.pdf

Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001a. Revised edition. Harvest, catch, and participation in Alaska sport fisheries during 1996. Alaska Department of Fish and Game, Fishery Data Series 97-29 (Revised), Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds97-29(revised).pdf

Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001. Revised Edition. Harvest, catch, and participation in Alaska sport fisheries during 1997. Alaska Department of Fish and Game, Fishery Data Series No. 98-25 (revised), Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds98-25(revised).pdf

Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001c. Revised Edition. Participation catch, and harvest in Alaska sport fisheries during 1998. Alaska Department of Fish and Game, Fishery Data Series 99-41 (Revised), Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds99-41(revised).pdf

Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001. Participation, catch, and harvest in Alaska sport fisheries during 1999. Alaska Department of Fish and Game, Fishery Data Series No. 01-08, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds01-08.pdf

Howe, A. L., and S. Fleischman. 2001. Targeted angler-days fished for selected Alaska sport fisheries, 1994 and 1995. Alaska Department of Fish and Game, Fishery Data Series No. 01-07, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds01-07.pdf

Jennings, G. B., K. Sundet, A. E. Bingham, and D. Sigurdsson. 2004. Participation, catch, and harvest in Alaska sport fisheries during 2001. Alaska Department of Fish and Game, Fishery Data Series No. 04-11, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds04-11.pdf

Jennings, G. B., K. Sundet, A. E. Bingham, and D. Sigurdsson. 2006. Participation, catch, and harvest in Alaska sport fisheries during 2002. Alaska Department of Fish and Game, Fishery Data Series No. 06-34, Anchorage. http://www.sf.adfg.state.ak.us/FedAidpdfs/fds06-34.pdf

Jennings, G. B., K. Sundet, A. E. Bingham, and D. Sigurdsson. 2006. Participation, catch, and harvest in Alaska sport fisheries during 2003. Alaska Department of Fish and Game, Fishery Data Series No. 06-44, Anchorage. http://www.sf.adfg.state.ak.us/FedAidpdfs/fds06-44.pdf

Jennings, G. B., K. Sundet, and A. E. Bingham. 2007. Participation, catch, and harvest in Alaska sport fisheries during 2004. Alaska Department of Fish and Game, Fishery Data Series No. 07-40, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds07-40.pdf

Jennings, G. B., K. Sundet, and A. E. Bingham. 2009. Estimates of participation, catch, and harvest in Alaska sport fisheries during 2005. Alaska Department of Fish and Game, Fishery Data Series No. 09-47, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/FDS09-47.pdf

Jennings, G. B., K. Sundet, and A. E. Bingham. 2009b. Estimates of participation, catch, and harvest in Alaska sport fisheries during 2006. Alaska Department of Fish and Game, Fishery Data Series No. 09-54, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/FDS09-54.pdf

Jennings, G. B., K. Sundet, and A. E. Bingham. *In prep a.* Estimates of participation, catch and harvest in Alaska sport fisheries during 2007. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

REFERENCES CITED (Continued)

Jennings, G. B., K. Sundet, and A. E. Bingham. *In prep b.* Estimates of participation, catch and harvest in Alaska sport fisheries during 2008. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

Lafferty, R., J. F. Parker, and D. R. Bernard. 1992. Stock assessment and biological characteristics of burbot in lakes of Interior Alaska during 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-20, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds92-20.pdf

McKinley, T. 1993. Mortality of Arctic char and large Arctic grayling captured and released with sport fishing gear. Alaska Department of Fish and Game, Fishery Data Series No. 93-01, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds93-01.pdf

Mills, M. J. 1979. Alaska statewide sport fish harvest studies, 1977 data. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1978-1979, Project F-9-11, 20 (SW-I-A), Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/FREDf-9-11(20)SW-I-A.pdf

Mills, M. J. 1980. Alaska statewide sport fish harvest studies, 1978 data. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1979-1980, Project F-9-12, 21 (SW-I-A), Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/FREDf-9-12(21)SW-I-A.pdf

Mills, M. J. 1981a. Alaska statewide sport fish harvest studies, 1979 data. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1980-1981, Project F-9-13, 22 (SW-I-A), Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/FREDf-9-13(22a)SW-I-A.pdf

Mills, M. J. 1981b. Alaska statewide sport fish harvest studies, 1980 data. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1980-1981, Project F-9-13, 22 (SW-I-A), Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/FREDf-9-13(22b)SW-I-A.pdf

Mills, M. J. 1982. Alaska statewide sport fish harvest studies, 1981 data. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1981-1982, Project F-9-14, 23 (SW-I-A), Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/FREDf-9-14(23)SW-I-A.pdf

Mills, M. J. 1983. Alaska statewide sport fish harvest studies, 1982 data. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1982-1983, Project F-9-15, 24 (SW-I-A), Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/FREDf-9-15(24)SW-I-A.pdf

Mills, M. J. 1984. Alaska statewide sport fish harvest studies, 1983 data. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1983-1984, Project F-9-16, 25 (SW-I-A), Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/FREDf-9-16(25)SW-I-A.pdf

Mills, M. J. 1985. Alaska statewide sport fish harvest studies, 1984 data. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1984-1985, Project F-9-17, 26 (SW-I-A), Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/FREDf-9-17(26)SW-I-A.pdf

Mills, M. J. 1986. Alaska statewide sport fish harvest studies, 1985 data. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1985-1986, Project F-10-1, 27 (RT-2), Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/FREDf-10-1(27)RT-2.pdf

Mills, M. J. 1987. Alaska statewide sport fisheries harvest report, 1986 data. Alaska Department of Fish and Game, Fishery Data Series No. 2, Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds-002.pdf

Mills, M. J. 1988. Alaska statewide sport fisheries harvest report, 1987 data. Alaska Department of Fish and Game, Fishery Data Series No. 52, Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds-052.pdf

Mills, M. J. 1989. Alaska statewide sport fisheries harvest report, 1988. Alaska Department of Fish and Game, Fishery Data Series No. 122, Juneau. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds-122.pdf

Mills, M. J. 1990. Harvest and participation in Alaska sport fisheries during 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-44, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds90-44.pdf

REFERENCES CITED (Continued)

Mills, M. J. 1991. Harvest, catch, and participation in Alaska sport fisheries during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-58, Anchorage.
http://www.sf.adfg.state.ak.us/FedAidPDFs/fds91-58.pdf

Mills, M. J. 1992. Harvest, catch, and participation in Alaska sport fisheries during 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-40, Anchorage.
http://www.sf.adfg.state.ak.us/FedAidPDFs/fds92-40.pdf

Mills, M. J. 1993. Harvest, catch, and participation in Alaska sport fisheries during 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-42, Anchorage.
http://www.sf.adfg.state.ak.us/FedAidPDFs/fds93-42.pdf

Mills, M. J. 1994. Harvest, catch, and participation in Alaska sport fisheries during 1993. Alaska Department of Fish and Game, Fishery Data Series Number 94-28, Anchorage.
http://www.sf.adfg.state.ak.us/FedAidPDFs/fds94-28.pdf

Mills, M. J. and Howe, A. L. 1992. An Evaluation of Estimates of Sport Fish harvest from the Statewide Mail Survey. Alaska Department of Fish and Game, Special Publication No. 92-02. Anchorage.
http://www.sf.adfg.state.ak.us/FedAidPDFs/sp92-02.pdf

Parker, J. F. 1991. Status of Coho Salmon in the Delta Clearwater River of Interior Alaska. Alaska Department of Fish and Game, Fishery Data Series 91-04, Anchorage.
http://www.sf.adfg.state.ak.us/FedAidPDFs/fds91-04.pdf

Parker, J. F., and T. Viavant. 2000. Fishery Management Report for Sport Fisheries in the Tanana River Drainage from 1995 to 1997. Alaska Dept. of Fish and Game, Fishery Management Series No. 00-06, Anchorage.
http://www.sf.adfg.state.ak.us/FedAidPDFs/fmr00-06.pdf

Parker, J. F., B. Scanlon, and K. Wuttig. 2001. Abundance and Composition of Lake Trout in Fielding (1999) and Island (2000) Lakes, Alaska. Alaska Department of Fish and Game, Fishery Data Series No. 01-31. Anchorage.
http://www.sf.adfg.state.ak.us/FedAidPDFs/fds01-31.pdf

Parker, J. F. 2001. Stock assessment and biological characteristics of burbot in Fielding Lake during 2000. Alaska Dept. of Fish and Game, Fishery Data Series No. 01-23, Anchorage.
http://www.sf.adfg.state.ak.us/FedAidPDFs/fds01-23.pdf

Parker, J. F. 2003. Fishery Management Plan for Arctic grayling in the Delta Clearwater River, 2001–2004. Alaska Department of Fish and Game, Sport Fishery Management Report No. 03-02, Fairbanks.
http://www.sf.adfg.state.ak.us/FedAidPDFs/fmr03-02.pdf

Parker, J. F. 2003b. Fishery Management Plan for Arctic grayling in the Goodpaster River, 2001–2004. Alaska Department of Fish and Game, Sport Fishery Management Report No. 03-03, Fairbanks.
http://www.sf.adfg.state.ak.us/FedAidPDFs/fmr03-03.pdf

Parker, J. F. 2006. Fishery Management Report for Sport Fisheries in the Upper Tanana River Drainage in 2005. Alaska Dept. of Fish and Game, Fishery Management Report No. 06-67, Anchorage.
http://www.sf.adfg.state.ak.us/FedAidpdfs/fmr06-67.pdf

Parker, J. F. 2007. Fishery Management Report for Sport Fisheries in the Upper Tanana River Drainage in 2003. Alaska Dept. of Fish and Game, Fishery Management Report No. 07-05, Anchorage.
http://www.sf.adfg.state.ak.us/FedAidpdfs/fmr07-05.pdf

Parker, J. F. 2008. Fishery Management Report for Sport Fisheries in the Upper Tanana River Drainage in 2006. Alaska Dept. of Fish and Game, Fishery Management Report No. 08-56, Anchorage.
http://www.sf.adfg.state.ak.us/FedAidPDFs/fmr08-56.pdf

Parker, J. F. 2009. Fishery Management Report for Sport Fisheries in the Upper Tanana River Drainage in 2007. Alaska Dept. of Fish and Game, Fishery Management Report No. 09-38, Anchorage.
http://www.sf.adfg.state.ak.us/FedAidPDFs/FMR09-38.pdf

REFERENCES CITED (Continued)

Parker, J. F. *In prep*. Stock assessment and biological characteristics of burbot in Fielding Lake during 2008. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

Pearse, G. A. and P. A. Hanson. 1993. Estimates of Sustainable Yield for the Northern Pike Populations in George, Volkmar, T, and Harding Lakes. Alaska Department of Fish and Game, Fishery Manuscript No. 93-01, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fms93-01.pdf

Ridder, W. P. 1998a. Abundance and Composition of Arctic grayling in the Delta Clearwater River 1996 and 1997. Alaska Dept. of Fish and Game, Fishery Data Series No. 98-35, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds98-35.pdf

Ridder, W. P. 1998b. Abundance, Composition and emigration of Arctic grayling in the Goodpaster River, 1995-1997. Alaska Dept. of Fish and Game, Fishery Data Series No. 98-36, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds98-36.pdf

Ridder, W. P. and A. D. Gryska. 2000. Abundance and Composition of Arctic grayling in the Delta Clearwater River, 1999. Alaska Dept. of Fish and Game, Fishery Data Series No. 00-38, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds00-38.pdf

Scanlon, B. P. 2001. Abundance and Composition of Northern Pike in Volkmar Lake and Minto Lakes, 2000. Alaska Dept. of Fish and Game, Fishery Data Series No. 01-29, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds01-29.pdf

Salcha/Big Delta Soil and Water Conservation District. 1987. Granite Mountain/Clearwater Creek Water Quality Planning Project, Final Report and Recommendations. P.O. Box 547, Delta Junction, Alaska.

Stuby, L., and M. J. Evenson. 1998. Salmon Studies in interior Alaska, 1997. Alaska Department of Fish and Game, Fishery Data Series No. 98-11, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds98-11.pdf

Stuby, L. 1999. Salmon studies in interior Alaska, 1998. Alaska Department of Fish and Game, Fishery Data Series No. 99-13, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds99-13.pdf

Swanton, C. O. and T. T. Taube. 2009. A Management Plan for stocked waters fisheries within Sport Fish Region III. Alaska Department of Fish and Game, Fishery Management Report No. 09-03, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fmr09-03.pdf

Walker, R. J., C. Olnes, K. Sundet, A. L. Howe, and A. E. Bingham. 2003. Participation, catch, and harvest in Alaska sport fisheries during 2000. Alaska Department of Fish and Game, Fishery Data Series No. 03-05, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds03-05.pdf

Wuttig, K. G., and D. J. Reed. *In prep*. Abundance and composition of northern pike in Volkmar Lake, 2005, and George Lake, 2006. Alaska Dept. of Fish and Game, Fishery Data Series No., Anchorage.

TABLES AND FIGURES

Table 1.–Number of angler-days, harvest, and catch in the UTMA, 1998–2008.

Year	Number of angler-days (effort)	Total harvest	Total catch	Percent of fish harvested
1998	31,412	37,561	148,258	25%
1999	46,809	38,103	161,328	24%
2000	34,956	39,316	138,658	28%
2001	28,150	23,112	94,747	24%
2002	31,145	31,941	141,838	23%
2003	29,036	22,267	121,585	18%
2004	25,523	16,040	90,254	18%
2005	29,309	16,631	95,358	17%
2006	26,271	13,850	78,815	18%
2007	30,454	16,979	119,784	14%
2008	19,374	11,140	73,599	15%
10-year Average 1998–2007	31,307	25,580	119,063	21%
5-year Average 2003–2007	28,119	17,153	101,159	17%
2008 as % of 5-year Average	69%	65%	73%	89%

Source: Howe et al. 2001a-d, Walker et al. 2003, Jennings et al. 2004, 2006a-b, 2007, 2009a-b, *In prep a-b*.

Table 2.–Number of fish by species harvested by recreational anglers fishing UTMA waters, 1998–2008.

	SALMON				NON SALMON									
Year	Chinook	Coho[a]	Coho[b]	Chum	Rainbow Trout	Lake Trout	Arctic Char	Arctic Grayling	Northern Pike	Whitefish	Burbot	Sheefish	Other	Total
1998	6	479	7,228	5	19,463	426	1,594	5,944	857	362	1,189	9	78	37,640
1999	21	322	6,016	85	21,178	818	2,332	5,225	1,016	16	1,074	0	0	38,103
2000	0	272	10,720	12	19,854	619	1,510	3,824	704	79	1,672	29	22	39,317
2001	0	940	5,118	0	8,384	267	1,787	4,527	1,012	563	515	0	0	23,113
2002	0	517	5,625	0	14,937	624	2,270	4,972	1,380	280	1,289	48	0	31,942
2003	17	1,306	2,017	17	9,731	793	1,732	4,532	924	0	1,189	0	9	22,267
2004	4	532	1,939	56	8,046	457	799	2,602	636	241	675	39	15	16,041
2005	25	267	1,002	0	6,336	569	463	5,242	1,646	60	1,021	0	0	16,631
2006	0	586	828	52	7,132	612	753	2,602	587	57	598	0	43	13,850
2007	0	335	1,662	0	6,912	613	274	3,892	1,338	492	1,461	0	0	16,979
2008	0	75	934	0	3,733	431	797	4,445	493	20	207	7	0	11,140
10-year Average 1998–2007	7	556	4,216	23	12,197	580	1,351	4,336	1,010	215	1,068	13	17	25,588
5-year Average 2003–2007	9	605	1,490	25	7,631	609	804	3,774	1,026	170	989	8	13	17,154
2008 as % of 5-year Average	0%	12%	63%	0%	49%	71%	99%	118%	48%	12%	21%	90%	0%	65%

Source: Howe et al. 2001c-d, Walker et al. 2003, Jennings et al. 2004, 2006a-b, 2007, 2009a-b, *In prep a-b*.

[a] Coho salmon returning to natural systems.

[b] Coho salmon stocked in UTMA lakes.

Table 3.–Number of fish by species caught by recreational anglers fishing UTMA waters, 1998–2008.

	SALMON				NON SALMON									
Year	Chinook	Coho[a]	Coho[b]	Chum	Rainbow Trout	Lake Trout	Arctic Char	Arctic Grayling	Northern Pike	Whitefish	Burbot	Sheefish	Other	Total
1998	19	1,980	15,924	5	48,838	2,225	4,195	66,844	5,419	585	1,719	26	480	148,259
1999	45	1,941	16,960	588	61,372	3,424	9,475	58,671	7,044	377	1,431	0	0	161,328
2000	11	2,124	29,026	12	48,893	2,806	3,802	42,314	7,134	93	2,366	44	36	138,659
2001	13	5,892	11,420	575	22,538	1,150	2,621	41,175	7,584	914	699	0	168	94,749
2002	9	5,442	16,079	102	39,330	3,840	6,073	63,422	5,542	387	1,565	48	0	141,839
2003	157	14,744	7,059	278	26,341	2,946	5,126	56,064	6,611	283	1,475	0	501	121,585
2004	21	4,390	4,862	154	25,057	2,265	4,197	42,359	5,538	316	848	68	183	90,258
2005	25	2,830	2,973	686	17,355	3,651	1,453	55,943	8,299	455	1,370	0	321	95,361
2006	96	4,876	2,487	533	18,670	2,514	3,125	40,233	4,604	436	1,191	7	43	78,815
2007	5	3,320	5,856	105	18,795	2,259	975	75,394	9,503	771	2,801	0	2	119,786
2008	0	641	1,960	61	14,678	1,735	1,975	50,073	1,910	175	360	32	0	73,600
10-year Average 1998–2007	40	4,754	11,265	304	32,719	2,708	4,104	54,242	6,728	462	1,546	19	173	119,063
5-year Average 2003–2007	61	6,032	4,647	351	21,244	2,727	2,975	53,999	6,911	452	1,537	15	210	101,159
2008 as % of 5-year Average	0%	11%	42%	17%	69%	64%	66%	93%	28%	39%	23%	213%	0%	73%

Source: Howe et al. 2001c-d, Walker et al. 2003, Jennings et al. 2004, 2006a-b, 2007, 2009a-b, *In prep a-b*.

[a] Coho salmon returning to natural systems.

[b] Coho salmon stocked in UTMA lakes.

Table 4.–Estimates of coho salmon escapement, effort, harvest, and catch in the Delta Clearwater River 1977–2008.

Year	Coho Escapement[a]	DCR Angler-Days	Coho Harvest	Coho Catch	% Released
1977	4,793	6,881	31		
1978	4,798	7,210	126		
1979	8,970	8,398	0		
1980	3,946	4,240	25		
1981	8,563	4,673	45		
1982	8,365	4,231	21		
1983	8,019	5,867	63		
1984	11,061	5,139	571		
1985	5,358	8,722	722		
1986	10,857	10,137	1,005		
1987	22,300	5,397	1,068		
1988	21,600	5,184	1,291		
1989	12,600	5,368	1,049		
1990	8,325	4,853	1,375	3,271	58%
1991	23,900	5,594	1,721	4,382	61%
1992	3,963	3,756	615	1,555	60%
1993	10,875	4,909	48	1,695	97%
1994	62,675	3,984	509	3,009	83%
1995	20,100	6,261	463	5,195	91%
1996	14,070	3,424	983	2,435	60%
1997	11,525	2,161	866	4,174	79%
1998	11,100	3,415	603	2,350	74%
1999	10,975	5,705	76	1,634	95%
2000	9,225	2,647	255	1,911	87%
2001	46,875	4,670	816	5,393	85%
2002	38,625	4,580	517	5,311	90%
2003	102,800	6,006	1,272	14,665	91%
2004	37,550	3,357	511	4,061	87%
2005	31,175	4,504	267	2,639	90%
2006	15,950	4,850	580	4,864	88%
2007	14,650	5,116	313	3,223	90%
2008	7,500	2,248	65	475	86%
2009	16,850				
Average					
10-year Average 1998–2007	31,893	4,485	521	4,605	88%
5-year Average 2003–2007	40,425	4,767	589	5,890	89%
2008 as % 5-year average	19%	47%	11%	8%	

Source: Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995-1996, 2001a-d, Walker et al. 2003, Jennings et al. 2004, 2006a-b, 2007, 2009a-b, *In prep a-b*.

a Estimates of escapement from river boat only.

Table 5.–Sport harvest and catch for salmon by species within the Upper Tanana River Drainage Management Area, 1998–2008.

	Salmon Harvest			Salmon Catch		
Year	Chinook	Coho[a]	Chum	Chinook	Coho[a]	Chum
1998	6	479	5	19	1,980	5
1999	21	322	85	45	1,941	588
2000	0	272	12	11	2,124	12
2001	0	940	0	13	5,892	575
2002	0	517	0	9	5,442	102
2003	17	1,306	17	157	14,744	278
2004	4	532	56	21	4,390	154
2005	25	267	0	25	2,830	686
2006	0	586	52	96	4,876	533
2007	0	335	0	5	3,320	105
2008	0	75	0	0	641	0
10-year average 1998–2007	7	556	23	40	4,754	304
5-year Average 2003–2007	9	605	25	61	6,032	351
2008 as % of 5-year Average	0.0%	12.4%	0.0%	0.0%	10.6%	0.0%

Source: Howe et al. 2001c-d, Walker et al. 2003, Jennings et al. 2004, 2006a-b, 2007, 2009a-b, *In prep a-b*.

a Wild coho stocks caught in UTMA fisheries.

b Hatchery produced coho, stocked and caught in UTMA lakes.

Table 6.–Estimated king salmon escapement, aerial survey indices, and survey conditions in the Goodpaster River, 1998–2009.

Year	Counting Tower Counts[a]	SE	Estimation Method[b]	Aerial Survey Index[a]	Condition[c]	Survey Conducted by
1998			Helicopter	477	Good	Teck-Pogo
1999			Helicopter	1,743	Good	Teck-Pogo
2000			Helicopter	2,175	Good	Teck-Pogo
2001			Helicopter	1,457	Good	Teck-Pogo
2002			Helicopter	1,440	Excellent	Teck-Pogo
2003			Helicopter	3,004	Fair	Teck-Pogo
2004	3,674	106	Tower	480	-	Tanana Chiefs and Teck-Pogo
2005	1,113	54	Tower	-	-	Tanana Chiefs
2006	2,440	98	Tower	884	Good	Tanana Chiefs and ADF&G
2007	1,113	54	Tower	-	-	Tanana Chiefs
2008	662	-	Tower	-	-	Tanana Chiefs
2009	4,251	-	Tower	-	-	Tanana Chiefs
Average	1,962					

[a] Details of aerial survey estimates can be found in memos from John Morsell of Northern Ecological Services to Teck Resources, Inc., 3520 International Street, Fairbanks, AK 99701 and tower counts are from email communications with Mike Smith of Tanana Chiefs Conference, Fairbanks, AK.

[b] Helicopter indicated aerial surveys using helicopter, Tower indicates tower-counts.

[c] During these aerial surveys, conditions were judged on a scale of "poor, fair, good, excellent" unless otherwise noted.

Table 7.–Estimated harvest, catch, and abundance of Arctic grayling in the Delta Clearwater River, 1977–2008.

Year	Angler-days	Harvest <12"	Harvest >12"	Total Harvest	Catch <12"	Catch >12"	Total Catch	Abundance[a]	SE
1977	6,881	...	...	6,118	...	...	...	9,702	1,234
1978	7,210	...	...	7,657	...	...	...	8,826	1,279
1979	8,398	...	...	6,492	...	...	...	6,258	885
1980	4,240	...	...	5,680	...	...	...	6,175	832
1981	4,673	...	...	7,362	...	...	...	9,829	1,461
1982	4,231	...	...	4,779	...	...	...	9,369	1,159
1983	5,867	...	...	6,546	...	...	...	12,760	1,746
1984	5,139	...	...	4,193	...	...	...	11,063	1,276
1985	8,722	...	...	5,809	...	...	...	10,767	1,388
1986	10,137	...	...	2,343	...	...	...	7,840	1,148
1987	5,397	...	...	2,005	...	...	...	7,684	1,289
1988	5,184	...	...	2,910	...	...	...	8,845	1,962
1989	5,368	...	...	3,016	...	...	...	6,482	1,751
1990	4,853	...	...	1,772	...	...	12,424	4,477	1,766
1991	5,594	0	2,165	2,165	3,033	4,965	7,998	4,420	---
1992	3,756	0	797	797	2,669	3,417	6,086	4,210	---
1993	4,909	0	437	437	3,074	2,638	5,712	3,972	---
1994	3,984	375	1,036	1,411	4,269	5,037	9,306	4,059	---
1995	6,261	0	926	926	1,620	4,354	5,974	3,700	---
1996	3,424	0	1,218	1,218	3,354	5,624	8,978	2,490	310
1997	2,161	0	54	54	2,980	1,685	4,665	4,600	590
1998	3,415	0	0	0	4,842	11,293	16,135	4,500	630
1999	5,705	0	0	0	2,444	9,328	11,772	6,271	369
2000	2,647	0	0	0	2,339	6,351	8,690	6,891	821
2001	4,670	47	44	91	3,554	9,020	12,574		
2002	4,580	51	0	51	3,180	9,733	12,913		
2003	6,006	0	0	0	3,729	13,847	17,576		
2004	3,357	111	0	111	5,805	8,407	14,212		
2005	4,504	65	75	140	2,985	16,987	19,922	14,799	2,204
2006	4,850	85	0	85	3,189	9,353	12,542		
2007	5,116	172	0	172	4,757	17,355	22,112		
2008	2,248	214	0	214	3,749	5,163	8,912		
10-year Average 1998–2007	4,190	36	17	53	3,505	9,600	13,100		
5-year Average 2003–2007	4,659	62	15	77	3,778	11,665	15,433		
2008 as % of 5-year	48%	247%	0%	211%	92%	39%	52%		

Source: Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995-1996, 2001a-d, Walker et al. 2003, Jennings et al. 2004, 2006a-b, 2007, 2009a-b, *In prep a-b*.

[a] Arctic grayling population of fish 5 years and older from 1977 to 2000 (Parker 2003a) and for 2005, (Gryska *In prep*).

Table 8.–Estimated harvest and catch of Arctic grayling in selected UTMA waters, 1997–2008.

	Harvest					Catch				
Year	Tangle Lakes	Goodpaster River	Fielding Lake	Other waters	UTMA Total	Tangle Lakes	Goodpaster River	Fielding Lake	Other waters	UTMA Total
1996	3,213	595	599	3,935	8,342	21,061	2,921	3,114	32,581	59,677
1997	4,152	532	1,133	2,456	8,273	29,041	4,448	1,612	27,441	62,542
1998	3,045	668	851	1,380	5,944	19,180	4,705	2,165	40,794	66,844
1999	1,804	852	645	1,924	5,225	15,683	3,882	3,050	36,056	58,671
2000	2,020	63	705	1,036	3,824	18,574	1,290	2,594	19,856	42,314
2001	1,738	873	424	1,492	4,527	12,970	1,815	2,028	24,362	41,175
2002	2,686	229	587	1,470	4,972	25,768	1,346	2,932	33,376	63,422
2003	2,438	56	351	1,687	4,532	23,931	1,499	1,989	28,645	56,064
2004	1,251	176	491	684	2,602	15,007	1,735	2,802	22,815	42,359
2005	1,825	617	623	2,177	5,242	18,695	2,464	4,437	30,347	55,943
2006	1,181	212	56	1,153	2,602	11,103	1,467	952	26,711	40,233
2007	1,131	676	636	1,449	3,892	32,491	2,947	5,199	34,757	75,394
2008	1,897	528	738	1,282	4,445	20,166	3,116	4,589	22,202	50,073
10-year average 1998–2007	1,912	442	537	1,445	4,336	19,340	2,315	2,815	29,772	54,242
5-year Average 2003–2007	1,565	347	431	1,430	3,774	20,245	2,022	3,076	28,655	53,999
2008 as % of 5-year Average	121.2%	152.0%	171.1%	89.7%	117.8%	99.6%	154.1%	149.2%	77.5%	92.7%

Source: Howe et al. 2001a-d, Walker et al. 2003, Jennings et al. 2004, 2006a-b, 2007, 2009a-b, *In prep a-b*.

Table 9.–Estimated sport harvest and catch of northern pike in selected waters within the Upper Tanana River Drainage Management Area, 1996–2007.

Year	George Lake		Healy Lake		Deadman Lake		Volkmar		Tanana River		Tok Area [a]		Other lakes/streams		Total	
	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch
1996	1,289	4,487	0	355	129	268	9	280	131	237	323	3,031	179	1,965	2,060	10,623
1997	302	1,940	41	117	153	599	82	239	133	239	222	905	102	926	1,035	4,965
1998	418	2,995	27	449	121	350	34	384	27	237	119	329	111	675	857	5,419
1999	344	3,380	0	330	122	424	18	85	78	448	404	1,985	50	392	1,016	7,044
2000	259	4,957	86	248	123	432	10	10	88	353	59	634	79	500	704	7,134
2001	610	5,146	0	0	28	379	40	390	51	193	158	907	125	569	1,012	7,584
2002	223	2,149	39	255	35	571	127	304	18	218	128	1,071	810	974	1,380	5,542
2003	738	4,097	0	449	0	546	24	339	16	124	81	290	65	766	924	6,611
2004	149	2,723	45	151	76	754	30	603	119	254	151	151	66	902	636	5,538
2005	853	4,484	0	0	23	1,079	12	280	121	243	594	1,728	19	384	1,622	8,198
2006	217	2,958	9	27	42	179	55	186	104	244	133	586	28	424	588	4,604
2007	775	6,889	0	0	0	344	0	174	120	302	321	1,309	122	485	1,338	9,503
2008	264	1,442	-	-	72	180	51	51	13	79	0	0	60	126	493	1,910
10-year Average 1998–2007	459	3,978	21	191	57	506	35	276	74	262	215	899	148	607	1,008	6,718
5-year Average 2003–2007	546	4,230	11	125	28	580	24	316	96	233	256	813	60	592	1,022	6,891
2008 as % of 5-year	48%	34%	0%	0%	255%	31%	211%	16%	14%	34%	0%	0%	100%	21%	48%	28%

Source: Howe et al. 2001a-d, Walker et al. 2003, Jennings et al. 2004, 2006a-b, 2007, 2009a-b, *In prep a-b*.

[a] Tok Area: includes lakes and streams such as Mineral Lake, Tok River, Fish Creek, Moose Creek, Mansfield Lake, Wellesley Lakes, and Island Lake.

Table 10.–Estimates of effort, harvest, catch, and abundance of northern pike in George Lake, 1977–2007.

Year	Angler Days	Total Harvest	Harvest		Total Catch	Catch		Abundance[a]
			<30 "	>30 "		<30"	>30"	>18"
1977	854	1,227						
1978	1,271	1,392						
1979	903	2,018						
1980	1,057	1,395						
1981	1,351	2,236						
1982	989	1,635						
1983	860	1,322						
1984	1,254	1,700						
1985	1,127	2,670						
1986	1957	3,076						
1987	1,467	2,229						8,495
1988	964	1,837						16,680
1989	610	882						12,354
1990	1,540	945			3,950			8,107
1991	1,931	1,264	1,086	178	5,096	4,684	312	10,939
1992	1,067	529	446	83	2,861	2,657	204	7,001
1993	772	442	316	126	2,620	2,339	281	
1994	594	948	835	113	4,377	3,962	415	
1995	708	531	415	116	1,582	1,360	222	
1996	577	1,289	1,093	196	4,487	4,203	284	
1997	629	302	254	48	1,940	1,665	275	
1998	829	603	344	74	2,995	2,661	334	
1999	1,417	344	307	37	3,380	3,195	185	
2000	734	259	168	91	4,957	4,015	942	
2001	1,128	610	584	26	5,146	5,067	79	
2002	700	223	203	20	2,149	1,897	252	
2003	716	738	516	222	4,097	3,781	316	
2004	377	149	149	0	2,723	2,512	211	
2005	1,939	862	762	100	4,527	4,236	291	
2006	601	217	182	35	2,958	2,877	81	16,178
2007	704	775	624	151	6,889	6,245	644	
2008	526	264	228	36	1,442	1,286	156	
10-year Average 1998–2007	915	478	384	76	3,982	3,649	334	
5-year Average 2003–2007	867	548	447	102	4,239	3,930	309	
2008 as % of 5-year	61%	48%	51%	35%	34%	33%	51%	

Source: Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995-1996, 2001a-d, Walker et al. 2003, Jennings et al. 2004, 2006a-b, 2007, 2009a-b, *In prep a-b.*

[a] Spring abundance for George Lake for fish > 18 inches using the Darroch estimator in 1987–1988; the Peterson estimator in 1989–1991; and using the unstratified Program Capture estimator from 1992 to 1993, and in 2006 a Peterson estimator (Wuttig, K. G. and D. R. Reed. *In prep*).

Table 11.–Estimates of angler days, harvest, catch, and abundance of northern pike in Volkmar Lake, 1981–2008.

Year	Angler-days	Harvest	Catch	Harvest		Catch		Abundance
				< 30 inches	> 30 inches	< 30 inches	> 30 inches	>18 inches
1981	458	648						
1982	546	777						
1983	270	430						
1984	436	428						
1985	711	503						4,020
1986	596	657						4,028
1987	472	224						4,229
1988	186	255						2,196
1989	466	180						1,115
1990	129	84						2,019
1991	1,052	565	1,011	461	104	907	104	2,509
1992	608	231	1,256	158	73	1182	74	2,542
1993	579	320	432	207	113	302	130	3,097
1994	722	323	1,928	278	45	1794	134	2,318
1995	1,263	1,084	1,801	901	183	1454	347	
1996	191	9	230	9	0	230	0	
1997	768	84	598	21	63	535	63	
1998	224	34	480	34	0	480	0	
1999	311	18	85	9	9	19	66	
2000	22	10	10	0	10	0	10	612
2001	188	40	390	40	0	209	181	
2002	372	127	304	127	0	304	0	
2003	313	24	339	0	24	291	48	
2004	193	30	603	30	0	362	241	
2005	44	12	228	12	0	235	47	1,630
2006	139	55	186	22	33	131	55	
2007	57	0	174	0	0	149	25	
2008	145	51	51	38	13	38	13	4,017
10-year Average 1998–2007	186	35	280	27	8	218	67	
5-year Average 2003–2007	149	24	306	13	11	234	83	
2008 as % of 5-year	97.2%	210.7%	16.7%	296.9%	114.0%	16.3%	15.6%	

Source: Mills 1981 b, 1982-1994; Howe et al. 1995-1996, 2001a-d, Walker et al. 2003, Jennings et al. 2004, 2006a-b, 2007, 2009a-b, *In prep a-b.*

Table 12.–Estimated sport harvest and catch of wild lake trout in selected areas within the Upper Tanana River Drainage Management Area , 1998–2008.

	Fielding Lake Drainage[a]		Tangle Lakes System[b]		Delta River		Other UTMA Lakes		UTMA waters	
Year	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch
1998	19	302	305	1,574	0	0	102	571	426	2,225
1999	43	293	519	2,202	14	81	242	1,111	818	3,424
2000	36	313	394	1,930	0	0	189	959	619	2,806
2001	17	129	149	716	0	0	101	453	267	1,150
2002	13	521	414	2,464	48	157	149	1,082	624	3,840
2003	83	423	516	2,037	68	90	126	802	793	2,946
2004	101	520	270	976	30	91	56	677	457	2,264
2005	112	862	224	2,327	0	0	233	462	569	3,651
2006	108	634	272	895	0	125	232	860	612	2,514
2007	40	227	482	1,890	0	0	91	142	613	2,259
2008	7	226	232	1,119	8	8	184	382	431	1,735
10-year Average 1998–2007	53	405	345	1,665	15	50	153	500	566	2,619
5-year Average 2003–2007	89	533	557	1,661	20	61	143	471	609	2,727
2008 as % of 5-year	8%	42%	65%	67%	41%	13%	128%	81%	71%	64%

Source: Howe et al. 2001c-d, Walker et al. 2003, Jennings et al. 2004, 2006a-b, 2007, 2009a-b, *In prep a-b*.

[a] Fielding Lake drainage includes, Crystal, Two-bit, and Sevenmile Lakes.

[b] Tangle Lakes System includes, Glacier, and Landmark Gap lakes.

Table 13.–Estimated sport harvest, catch, and abundance of lake trout and burbot in Fielding Lake, 1981–2008.

Year	Angler-days	Lake Trout Harvest	Lake Trout Catch	Lake Trout Abundance[a]	Burbot Harvest	Burbot Catch	Burbot Abundance[b]
1981	1,369	295			249		
1982	2,764	346			365		
1983	1,737	294			367		
1984	871	169			0		
1985	1,023	347			0		325
1986	1,682	136			32		334
1987	1,032	127			12		234
1988	1,728	364			36		426
1989	1,664	195			0		581
1990	1,255	186	321		0	0	698
1991	1,572	295	870		0	0	617
1992	1,910	170	247		51	51	347
1993	1,827	276	939		32	32	337
1994	2,129	52	213		73	73	445
1995	3,575	44	486		0	0	447
1996	960	42	222		0	0	483
1997	1,259	55	245		0	0	405
1998	1,602	19	302		0	25	421
1999	1,154	43	279	264	0	15	598
2000	827	18	221		0	48	759
2001	525	12	106		0	0	
2002	826	0	137		0	0	
2003	840	83	423		11	11	
2004	1,010	101	520		30	30	
2005	1,248	112	862		25	50	
2006	1,034	108	634		51	85	
2007	1,139	40	227		0	0	
2008	1,203	7	103		0	0	894
10-year Average 1998– 2007	1,021	54	371		12	26	
5-year Average 2003– 2007	1,054	89	533		23	35	
2008 as % of 5-year	114%	8%	19%		0%	0%	

Source: Mills 1981a-b, 1982-1994; Howe et al. 1995-1996, 2001a-d, Walker et al. 2003, Jennings et al. 2004, 2006a-b, 2007, 2009a-b, *In prep a-b*.

[a] Population estimate of abundance of lake trout 22 inches and larger (Parker et al. 2001).

[b] Population estimates of abundance of burbot 18 inches total length and larger (Parker 2001).

Table 14.–Estimated sport harvest and catch of burbot in selected waters of the UTMA, from 1998–2008.

	Fielding Lake		Tangle Lakes		George Lake		Shaw Creek		Tanana River		Other waters		UTMA waters	
Year	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch
1996	0	0	0	0	0	0	24	81	720	1,241	228	353	972	1,675
1997	0	0	52	52	64	90	52	180	2,058	2,458	206	515	2,432	3,295
1998	0	25	0	0	8	8	71	79	863	1,292	247	316	1,189	1,720
1999	0	15	8	28	0	13	127	127	761	994	178	254	1,074	1,431
2000	0	48	0	0	0	0	557	582	867	1,305	248	431	1,672	2,366
2001	0	0	29	29	0	0	72	72	378	562	36	36	515	699
2002	0	0	22	22	0	0	168	183	824	1,059	275	323	1,289	1,565
2003	11	11	9	19	47	47	32	32	1,079	1,355	11	11	1,189	1,475
2004	30	30	0	0	0	0	0	0	645	818	0	0	675	848
2005	25	50	0	34	149	248	50	62	773	905	24	71	1,021	1,370
2006	51	89	0	0	76	76	20	20	451	860	0	146	598	1,191
2007	0	0	12	54	0	0	464	564	940	2,138	45	45	1,461	2,801
2008	0	0	17	17	17	84	0	0	173	259	0	0	207	360
10-year Average 1998–2007	12	27	8	19	28	39	156	172	758	1,129	106	163	1,068	1,547
5-year Average 2003–2007	23	36	4	21	54	74	113	136	778	1,215	16	55	989	1,537
2008 as % of 5-year	0%	0%	405%	79%	31%	113%	0%	0%	22%	21%	0%	0%	21%	23%

Source: Howe et al. 2001a-d, Walker et al. 2003, Jennings et al. 2004, 2006a-b, 2007, 2009a-b, *In prep a-b*.

Table 15.–Effort, harvest, and catch statistics by species for stocked waters in the UTMA 1998–2008.

	Year										Average
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	1999-2008
Effort											
Effort on Stocked Waters	23,126	17,243	12,642	15,800	10,528	12,065	9,390	9,816	9,524	8,729	12,886
Total UTMA Effort	46,809	34,956	28,150	31,145	29,036	25,523	24,141	26,271	30,454	19,374	29,586
Percent of Stocked Waters Effort	49%	49%	45%	51%	36%	47%	39%	37%	31%	45%	44%
Harvest											
Rainbow trout	21,178	19,854	8,384	14,937	9,731	8,046	6,336	7,132	6,912	3,733	10,624
Coho/Chinook salmon	6,016	10,720	5,118	5,625	2,017	1,939	1,002	828	1,662	934	3,586
Arctic grayling	135	33	720	387	175	97	193	94	260	259	235
Arctic char	2,332	1,510	1,787	2,270	1,732	799	463	753	274	751	1,267
Lake trout	300	82	37	144	126	56	128	212	91	184	136
Total	29,961	32,199	16,046	23,363	13,781	10,937	8,122	9,019	9,199	5,861	15,849
Harvest/effort	1.3	1.9	1.3	1.5	1.3	0.9	0.9	0.9	1.0	0.7	1.2
UTMA harvest all species	38,103	39,317	23,113	31,942	22,267	16,041	16,631	13,850	16,979	11,140	22,938
Percent of stocked waters harvest	79%	82%	69%	73%	62%	68%	49%	65%	54%	53%	69%
Catch											
Rainbow trout	61,372	48,893	22,538	39,330	36,341	25,057	17,355	18,670	18,795	14,678	30,303
Coho/Chinook salmon	16,960	11,420	11,420	16,079	7,059	4,862	2,973	2,487	5,856	1,960	8,108
Arctic grayling	3,145	1,059	3,333	3,294	991	1,833	1,262	2,238	810	4,970	2,294
Arctic char	9,475	3,802	2,621	6,073	5,126	4,197	1,453	3,125	975	1,830	3,868
Lake trout	994	340	218	886	390	677	331	679	114	382	501
Total	91,946	65,514	40,130	65,662	49,907	36,625	23,374	27,199	26,550	23,820	50,045
Catch rate (catch / effort)	4.0	3.8	3.2	4.2	4.7	3.0	2.5	2.8	2.8	2.7	3.9
UTMA catch all species	161,328	138,659	94,749	141,839	121,585	90,258	95,361	78,815	119,786	73,599	111,598
Percent of stocked waters catch	57%	47%	42%	46%	41%	41%	25%	35%	22%	32%	45%

Source: Howe et al. 2001c-d, Walker et al. 2003, Jennings et al. 2004, 2006a-b, 2007, 2009a-b, *In prep a-b*.

Table 16.–Summary of stocking activities for the UTMA, 2007–2009.

Species	Broodstock	Catchable	Subcatchable	Fingerling	Total
2007					
Arctic grayling				2,016	2,016
Arctic char		2,925	15,223		18,148
King salmon		9,334			9,334
Coho salmon				105,956	105,956
Rainbow trout		32,981	30,523	302,487	365,991
Total		45,240	45,746	410,459	501,445
2008					
Arctic grayling				17,564	17,564
Arctic char			2,047		2,047
King salmon			9,465		9,465
Coho salmon				14,800	14,800
Rainbow trout			74,941	140,974	215,915
Total	0	0	86,453	173,338	259,791
2009					
Arctic grayling				2,000	2,000
Arctic char				12,899	12,899
King salmon			18,155		18,155
Coho salmon				86,500	86,500
Rainbow trout			35,955	19,000	54,955
Lake trout				600	600
Total	0	0	54,110	120,999	175,109

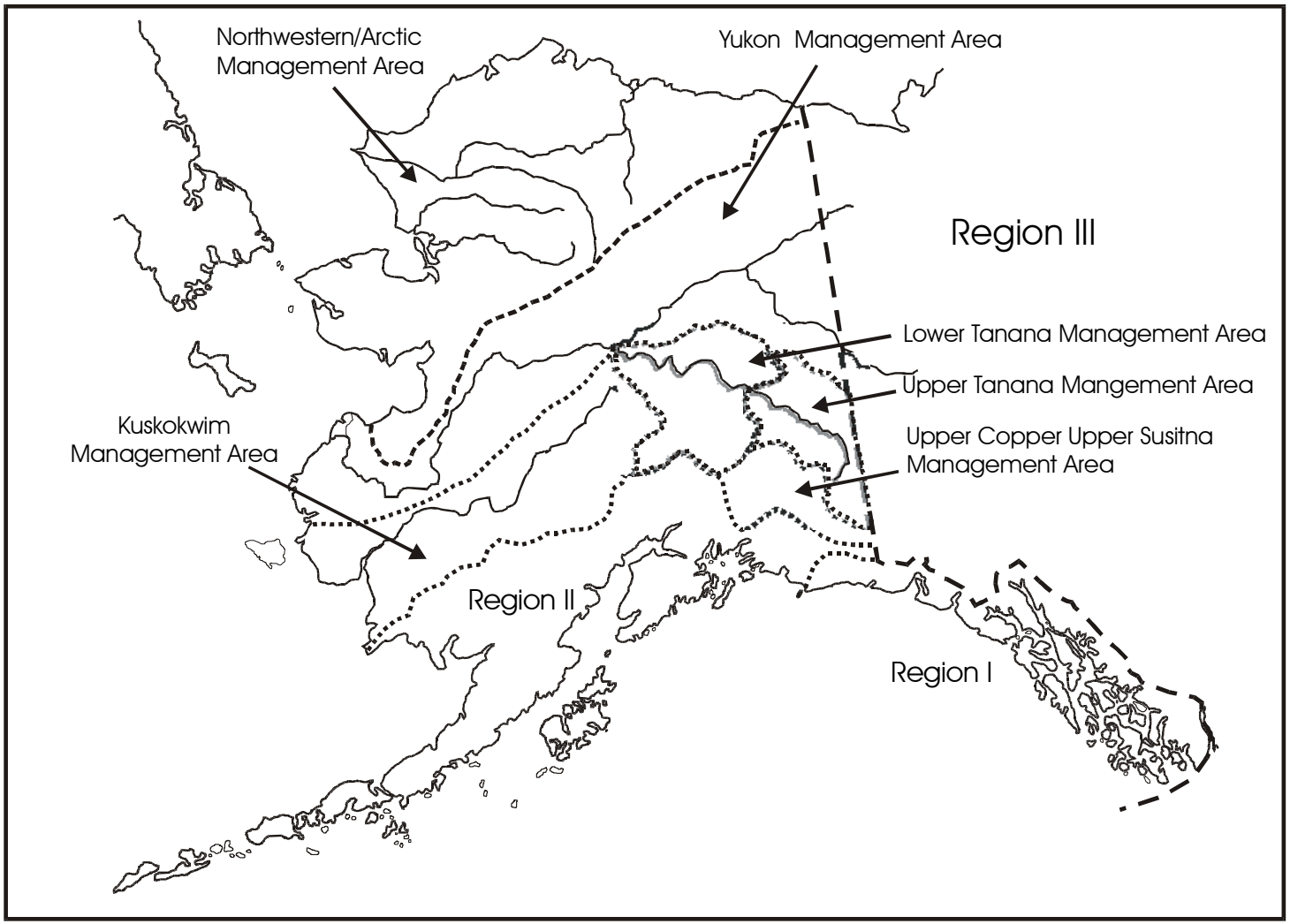

Figure 1.–Map of the sport fish regions in Alaska and the six Region III management areas.

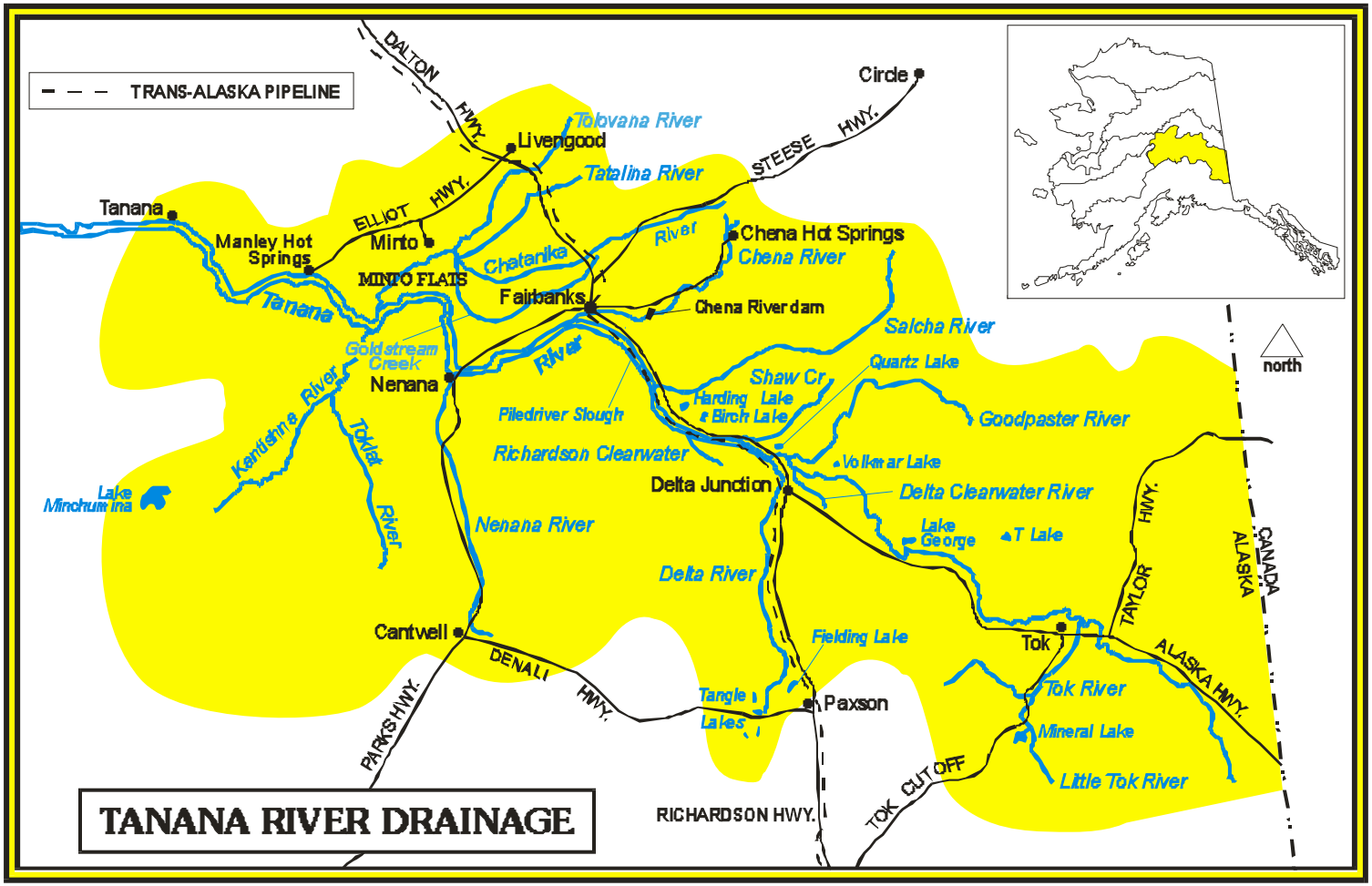

Figure 2.–Map of the Tanana River drainage.

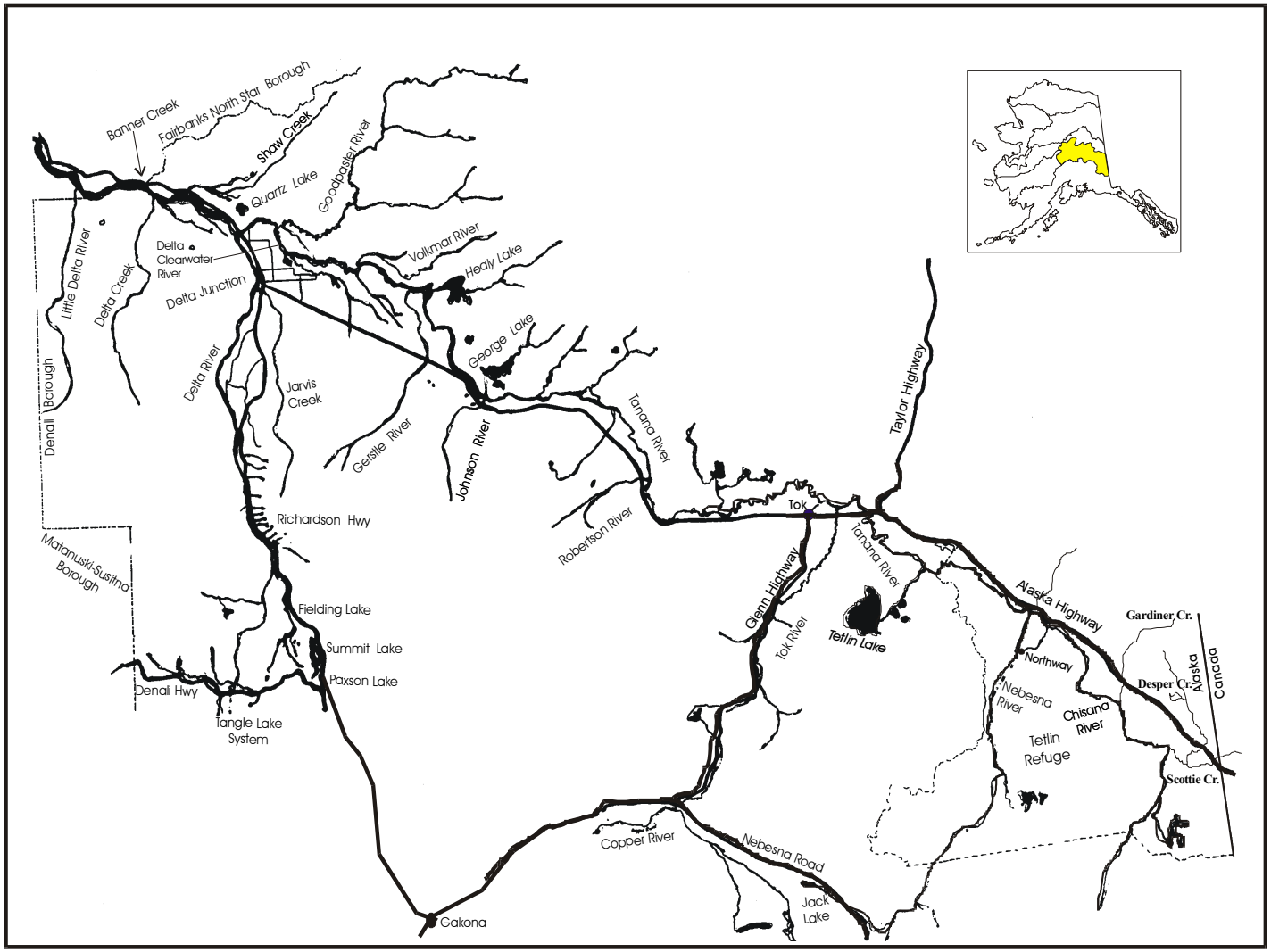

Figure 3.–Map of the Upper Tanana River Drainage Management Area within the Tanana River drainage.

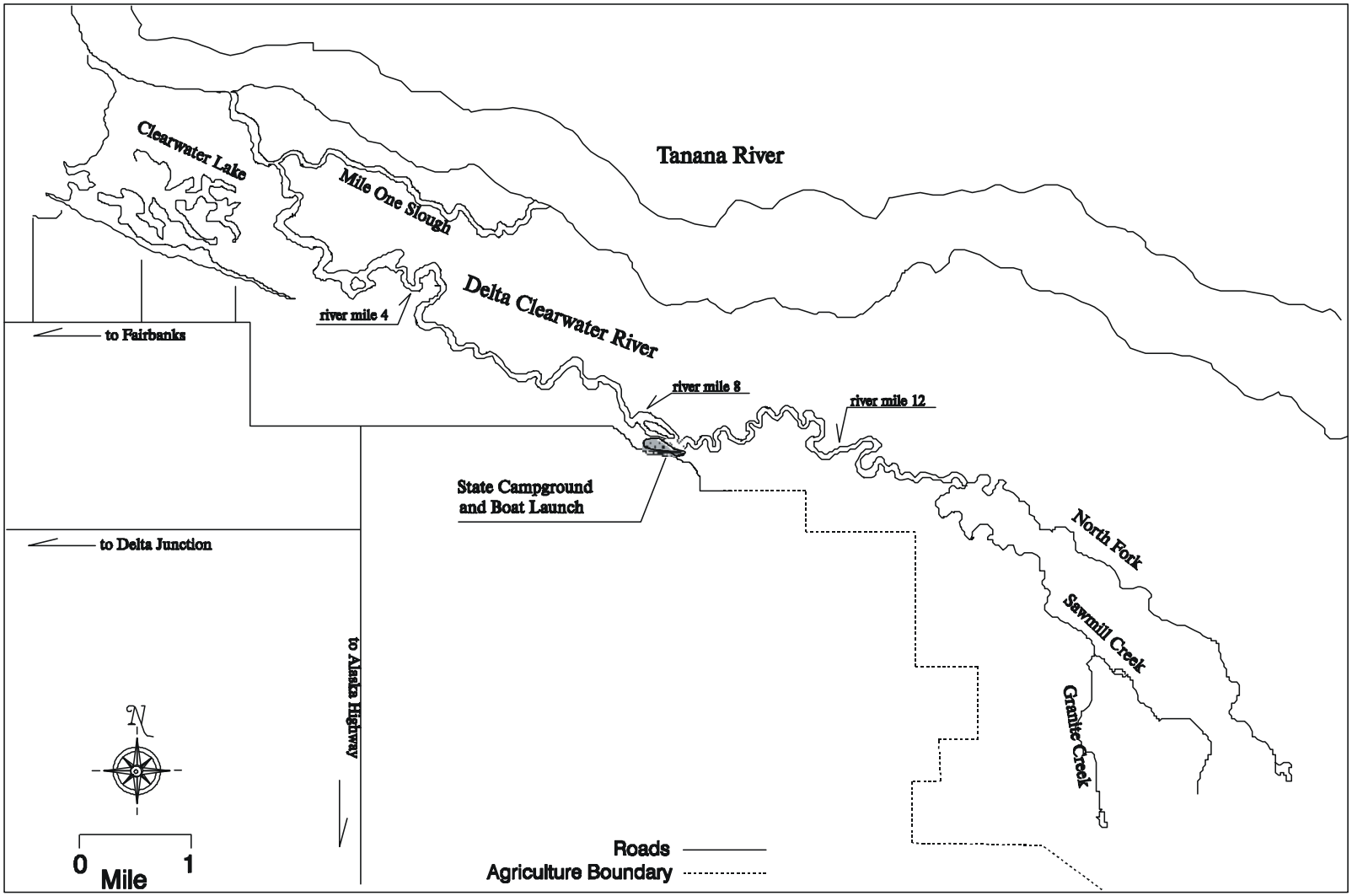

Figure 4.–Map of the Delta Clearwater River.

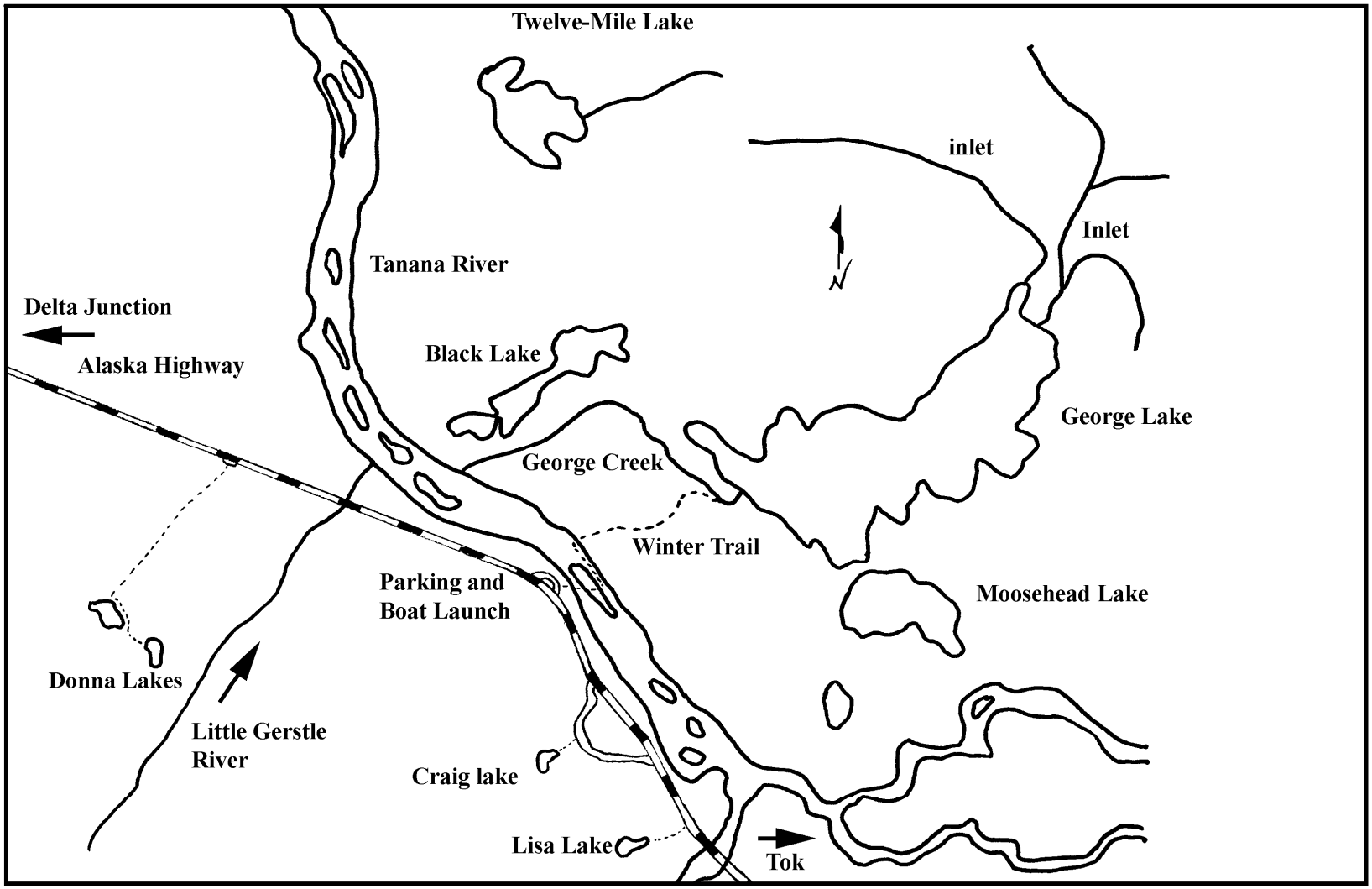

Figure 5.–Map of the George Lake.

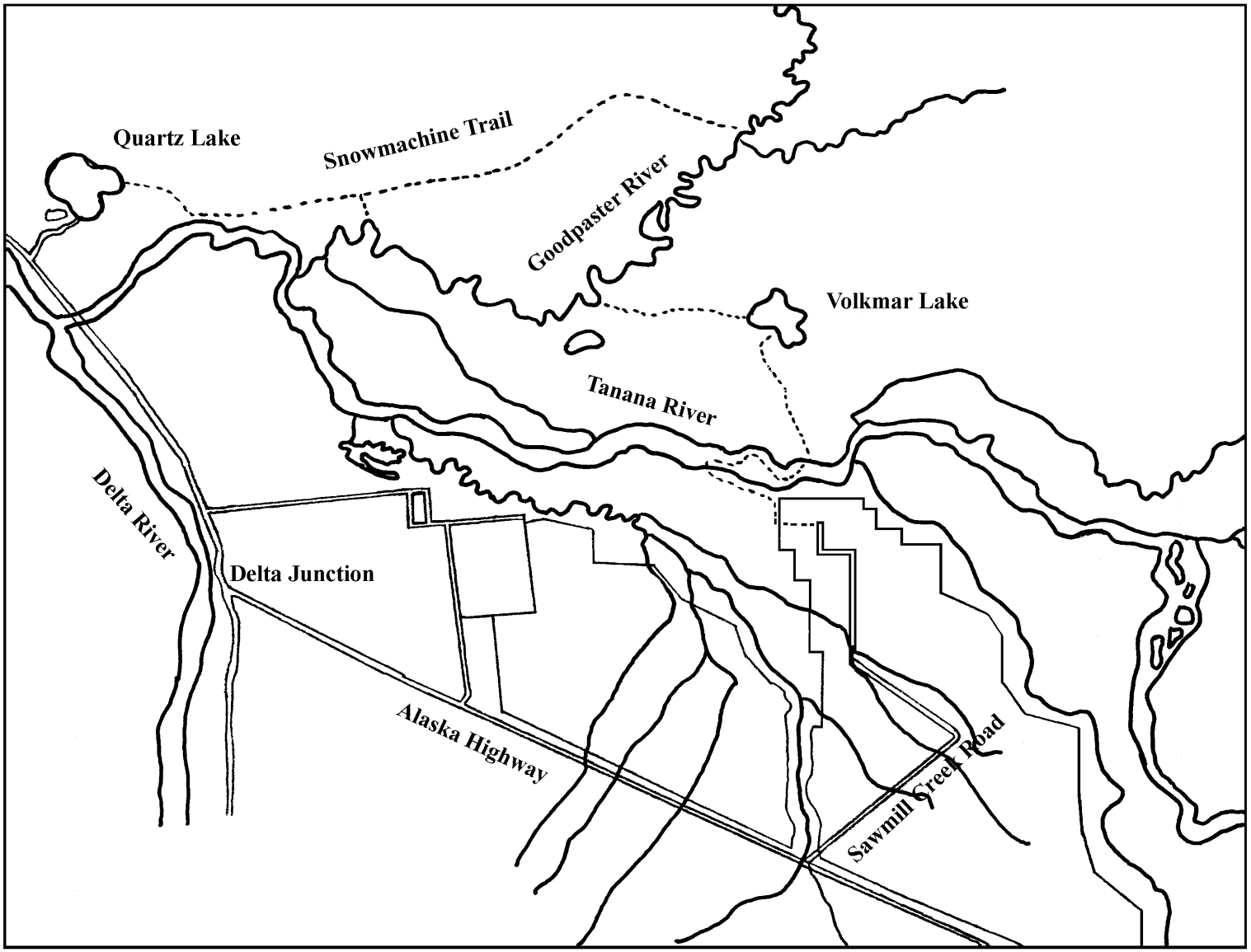

Figure 6.–Map of Volkmar Lake.

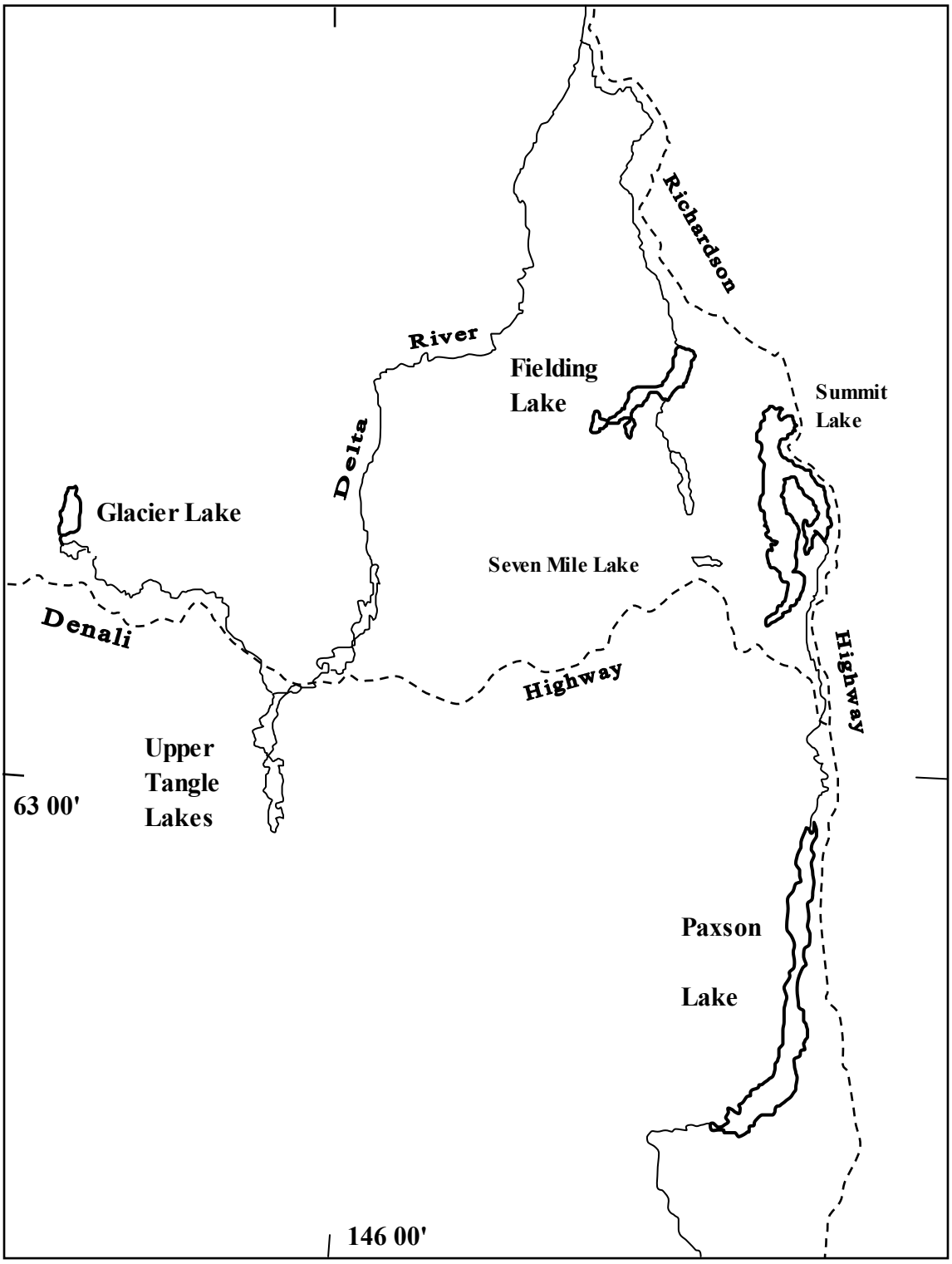

Figure 7.–Location of Fielding Lake.

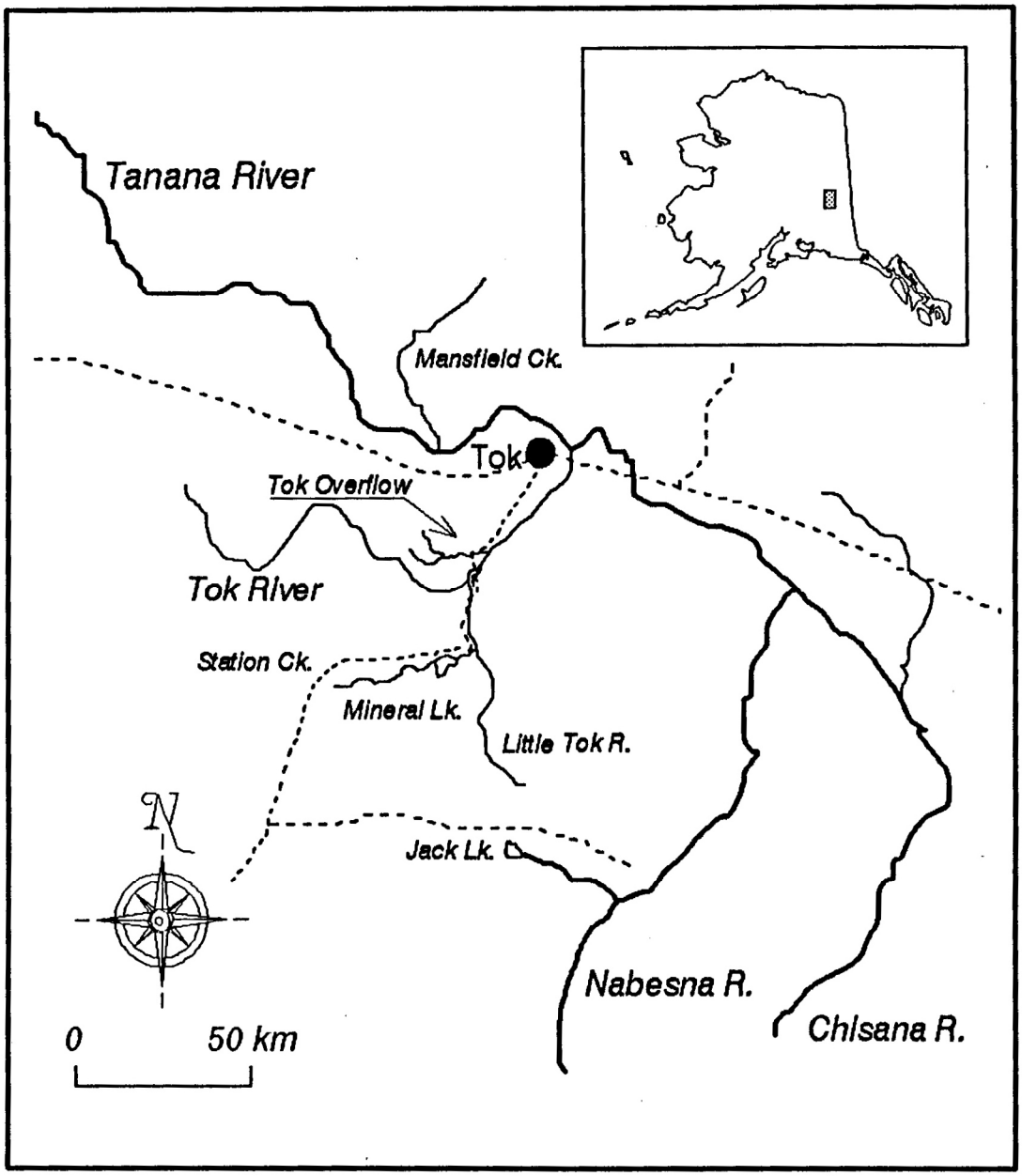

Figure 8.–Map of the Tok River drainage.

APPENDIX A

Appendix A1.–Reference information specific to 2009 Alaska Board of Fisheries proposals pertaining to the UTMA.

Proposal	Proposal Subject	Text (page number)	Table #	Figure #
49	Update Area Stocked Waters list	29	..	..
50	Align Tanana River Area Wild Arctic Grayling Management Plan with Area Regulations	16 - 18	..	..
51	Align UTMA Rivers in compliance with the Wild Arctic Grayling Management plan.	16 - 18	..	..
53	Clarifies Arctic Grayling method and means in the C&R waters.	16 - 19	..	..
58	Allow Seasonal use of Bait in Fielding Lake	23 - 25	12, 13, 14	7
59	Gear Restriction Fielding Lake	23 - 25	12, 13, 14	7
61	Increase Bag Limit in Volkmar Lake	19 - 23	9, 11	6
62	Increase Open Season in Volkmar Lake	19 - 23	9, 11	6
100	Close Salmon fishing in Tok River drainage.	13	..	8

Appendix A2.–Listing of contact information for state and government agencies in the Upper Tanana River drainage.

Organization	Address	Phone	Website
Alaska Department of Fish and Game, Delta Area Office	PO Box 605 Delta Junction, AK 99737-0605	(907) 895-4632	http://www.sf.adfg.state.ak.us/Management/Areas.cfm/FA/upperTananaOverview.overview
Fairbanks Regional Office	1300 College Road Fairbanks, AK 99701-1599	(907) 459-7207	http://www.sf.adfg.state.ak.us/region3/index.cfm
Alaska Department of Natural Resources – Delta Junction Area State Parks		(907) 895-4599	http://dnr.alaska.gov/parks/units/deltajct/index.htm
Alaska Public Lands Information Office	PO Box 359 Tok, AK 99780	(907) 883-5667	http://www.nps.gov/aplic
U.S. Bureau of Land Management – Delta National Wild, Scenic & Recreational River	PO Box 147 Glennallen, AK 99588-0147	(907) 822-3217	http://www.blm.gov/ak/st/en/fo/gdo.html
National Park Service Wrangell-St. Elias National Park & Preserve	PO Box 439 Copper Center, AK 99573	(907) 822-5234	http://www.nps.gov/wrst
U.S. Fish & Wildlife Service – Tetlin National Wildlife Refuge	1.3 mile Borealis Avenue PO Box 779 Tok, AK 99780	(907) 883-5312	http://tetlin.fws.gov/
City of Delta Junction	PO Box 229 Delta Junction, AK 99737-0229	(907) 895-4656	http://www.ci.delta-junction.ak.us/
Tok Chamber of Commerce	P.O. Box 389 Tok, Alaska 99780	(907) 883-5775	http://www.tokalaskainfo.com/chamber.html
Doyon, Limited	1 Doyon Place, Suite 300 Fairbanks, AK 99701-2941	(907) 459-2000	http://www.doyon.com/