Fishery Management Report No. 14–14

Fishery Management Report for Recreational Fisheries in the Tanana River Management Area, 2012

by

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and

Brandy Baker

March 2014

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)

Mathematics, statistics

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

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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.adfg.alaska.gov/sf/publications/. This publication has undergone regional peer review.

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ABSTRACT

Recreational fisheries season summaries in the Tanana River Management Area (TRMA) for 2012 and preliminary information for 2013 are presented.

The Tanana River drainage is the second-largest tributary system of the Yukon River. 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 about 570 river miles to the Yukon River.

Much of the human population in Region III is located within the Tanana River drainage along the Alaska, Richardson, and Parks highways, and along the road system around Fairbanks. These highways and their secondary roads provide much of the access to TRMA sport fisheries.

The majority of fishing effort in the TRMA occurs on the Chena, Salcha, Chatanika, and Delta Clearwater rivers; Minto Flats; Harding, Fielding, and Tangle Lakes; and various stocked waters. Sport anglers target many species in the TRMA; however, the most commonly targeted species are king salmon, coho salmon, Arctic grayling, burbot, northern pike, lake trout, and stocked rainbow trout.

Key Words: Arctic grayling, burbot, Chatanika River, Chena River, chum, king, coho, Delta Clearwater River, Fielding Lake, Harding Lake, lake trout, TRMA, management, Minto Flats, Nenana River, northern pike, personal use, rainbow trout, recreational, Salcha River, salmon, sport, stocked waters, Tanana River, Tangle Lakes, whitefish, Yukon River.

INTRODUCTION

This area management report provides information regarding the Tanana Management Area (TRMA) 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 (ACs), the general public, and other interested parties. It presents fisheries assessment information and the 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 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 states at a match of up to 3–to–1 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 TRMA and its fisheries for 2012 with preliminary information from the 2013 season. This report is organized into 2 primary sections: a management area overview including a description of the TRMA 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.

The BOF divides the state into 18 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 3 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, and 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 442,500 mi^2 (1,146,000 km^2) of land, some of the state's largest river systems (Yukon, Kuskokwim, Colville, Noatak, and the Upper Copper and Upper Susitna River drainages), thousands of lakes, 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 35,000; the greater Fairbanks North Star Borough population is about 99,000) is the largest community.

For administrative purposes the Division of Sport Fish has divided Region III into 5 fisheries management areas (Figure 1):

- 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);
- Tanana River Management Area (the entire Tanana River drainage);

- Kuskokwim Management Area (the entire Kuskokwim River drainage and Kuskokwim Bay drainages).

Area management biologists for the 5 areas are located in Nome/Fairbanks, Fairbanks, Glennallen, Fairbanks/Delta Junction, and Bethel/Fairbanks, respectively.

ALASKA BOARD OF FISHERIES

The BOF is a 7-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 3-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 ACs, and special interest groups such as fishing associations and clubs. Members of the public provide their input concerning regulation changes and allocation through submitting written proposals and testifying directly to the BOF, by participating in local AC meetings, or by becoming members of local ACs.

ADVISORY COMMITTEES

Local ACs have been established throughout the state to assist the boards of Fisheries and Game in assessing fisheries and wildlife issues and proposed regulation changes. AC meetings allow opportunity for direct public interaction with ADF&G staff attending the meetings, where they are available to answer questions and provide clarification of proposed regulatory changes that affect resource issues of local and statewide concern. The Board Support Section within ADF&G's Division of Administrative Services provides administrative and logistical support for the BOF and ACs. During 2012, ADF&G had direct support responsibilities for 82 ACs in the state.

Within the TRMA there are 6 ACs: Delta Junction, Fairbanks, Minto/Nenana, Middle Nenana River, Lake Minchumina, and Upper Tanana/Forty Mile. In addition, the Paxson AC occasionally comments on proposals concerning TRMA 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 TRMA in January 2013. At that meeting, major changes to the TRMA regulations included the following:

1. Rainbow Lake was moved from special to conservative management, changing the bag limit from 1 fish over 18 in to 5 fish, with only 1 fish over 18 in.
2. Donnelly and Monte lakes were moved from special to regional management and will now have a bag limit of 10 fish, with only 1 fish over 18."
3. Little Harding Lake and Summit Lake were dropped from the stocking program due to northern pike presence (Little Harding Lake) or no public access (Summit Lake). These

lakes will no longer be stocked, and regulations default to the background regulations for the area or special regulations for the specific lake.

4. The northern pike fisheries in the Tanana River drainage lakes were opened year round, with the exception of George and Volkmar lakes, which remain open June 1 through April 20, and the Chatanika River drainage (including Minto Flats and lakes), which is open June 1 through October 14. Harding Lake remained closed to northern pike fishing and Little Harding Lake was closed to northern pike fishing, as a means to rebuild the northern pike population in these adjoining lakes.
5. The large multiple-hook regulation in the Chena River was aligned with the regionwide specifications: a multiple hook must have a gap between point and shank greater than 1/2 inch when taking fish other than salmon.
6. The regulation that closed Fielding Lake to salmon fishing was repealed. Salmon are not present in Fielding Lake, and this action removed misleading language from the regulations.

Further details of the 2013 regulation changes may be found in the individual fisheries sections of this report.

At the 2010 BOF meeting, several changes were made to the sport fish regulations in the TRMA:

1. The spawning closure was removed and the open season extended year round for Arctic grayling in the Chatanika River, Richardson Clearwater River, and Salcha River drainages;
2. The bag and possession limit was changed from 5 Arctic grayling at 12 in or greater in length to 5 Arctic grayling at no size limit in the Chatanika River, Richardson Clearwater River, Salcha River, and Shaw Creek River drainages;
3. In the Chatanika River drainage, the unbaited, single-hook, artificial lure provision was changed to allow only unbaited, artificial lures. In addition, bait was allowed in the Chatanika River drainage only on hooks with a gap size larger than ¾ of an inch;
4. In the Delta Clearwater River and Tok River drainages, Five-Mile Clearwater Creek, Shaw Creek, and Piledriver Slough the unbaited, single-hook, artificial lure regulations were clarified to indicate that only one unbaited, single-hook, artificial lure may be used when fishing for any species in these systems;
5. To simplify the Chena River regulations, the methods and means were applied drainagewide;
6. In the Chatanika River, the regulatory boundary for the sport fishing salmon closure was moved 1 mile downstream from a regulatory marker to the Elliot Highway Bridge;
7. The 5 fish bag and possession limit, open season, and area restrictions for whitefish in the Chatanika River drainage were repealed, which resulted in the regulations reverting back to the area background regulation of 15 whitefish with no size limit and no closed season;
8. The bag and possession limit for northern pike in Volkmar Lake was increased from 1 fish to 2 fish, of which only one may be 30 in or greater;

9. The open season for northern pike was extended by 20 days in Volkmar and George lakes. This change aligned the open season for northern pike in all lakes in the Tanana River drainage to June 1–April 20; and

10. The Tok River drainage was closed to sport fishing for salmon.

For additional TRMA BOF actions from 1986 through 2009, see Arvey 1992; Arvey et al. 1990, 1995; Brase 2006, 2009b; Brase and Baker 2012; Burr et al. 1998; Clark et al. 1992; Doxey 2000, 2007; Parker 2007, 2009a; and Parker and Viavant 2000.

ADF&G EMERGENCY ORDER AUTHORITY

ADF&G has emergency order (EO) authority (5 AAC 75.003) to modify time, area, and bag/possession limit regulations. EOs are implemented to deal with conservation issues for resident species. EOs are also implemented as a tool for inseason management of salmon fisheries. Inseason management is usually carried out in accordance with a fisheries management plan approved by the BOF. EOs issued under this authority for the TRMA from 2012 through 2013 are summarized in Appendix A.

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 has also established a priority for subsistence use of fish and game by Alaskan residents (AS 16.05.258) on all lands and waters 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 nonnavigable waters on public lands. Following the *State of Alaska v. Katie John* decision by the Ninth 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 priority subsistence use by qualified rural residents in nonnavigable waters within federal public lands (including Bureau of Land Management [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.

Development of regulations for subsistence fisheries under the federal subsistence program occurs within the established Federal Subsistence Board (FSB) process. The public provides input concerning regulation changes by testifying in Federal Subsistence Regional Advisory Council (RAC) meetings or by becoming council members. Ten RACs 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 RAC meets twice a year, and subsistence users and other members of the public can comment on subsistence issues at these meetings.

Within the TRMA, the subsistence fisheries for which the federal government asserts management responsibility include those within and adjacent to the Tetlin National Wildlife Refuge, which includes much of the Nabesna and Chisana rivers; the Delta River Wild and

Scenic River Corridor; the Tangle Lakes Archaeological District; the headwaters of the Chisana and Nabesna rivers within the Wrangell-St. Elias National Park and Preserve and adjacent to the Tetlin National Wildlife Refuge; and within the boundaries of Denali National Park and Preserve. The TRMA fisheries fall under the purview of the Eastern Interior RAC (EIRAC). The most recent meeting of the EIRAC was held November 19–20, 2013 in Fairbanks. At this meeting, no federal fisheries proposals for the TRMA were addressed.

REGION III DIVISION OF SPORT FISH 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, a regional management biologist, an area biologist for each of the 5 management areas, 1 or more assistant area management biologists, and 2 stocked water biologists. 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, ACs, and the general public. 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. 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. 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 toward a single species. Species-specific catch-per-unit effort (CPUE) information can seldom be derived from the report. Questionnaires are mailed to a stratified random sample of households containing at least 1 individual with a valid fishing license (resident or nonresident). 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 angler-days of fishing effort expended by sport anglers fishing Alaskan waters, as well as the sport harvest (Mills 1987–1993). Beginning in 1990, the survey was modified to include estimation of catch (release plus harvest) on a site-by-site basis. Survey results for each year are available the following year; hence, the results for 2012 were available fall 2013. 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 inseason management.

The utility of SWHS estimates depends on the number of responses received for a given site (Mills and Howe 1992; Clark 2009). 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.

For purposes of reporting and organizing statistics in the SWHS, the TMRA is designated as survey area U.

SPORT FISH GUIDE LICENSING AND LOGBOOK PROGRAM

Since 1998, the Division of Sport Fish has operated a program to register and/or license both sport fishing guides and sport fishing guide businesses, and to collect information on sport fishing participation, effort, and harvest by saltwater and freshwater guided clients (Sigurdsson and Powers 2009). In 1998, the BOF adopted statewide sport fishing guide regulations (5 AAC 75.075) that required all sport fishing guides and businesses to register annually with ADF&G. At this time, the BOF also adopted statewide regulations that required logbooks for saltwater charter vessels. The logbooks collected information on charter activity (location, effort, and harvest) that was necessary for the BOF for allocation and management decisions specific to king salmon *Oncorhynchus tshawytscha*, rockfish *Sebastes* spp., and lingcod *Ophiodon elongatus*, and for the North Pacific Fishery Management Council (NPFMC) for allocation of Pacific halibut *Hippoglossus stenolepis*.

In 2004, the Alaska Legislature adopted House Bill 452, which established licensing requirements for sport fishing guide business owners and sport fishing guides on a statewide basis (effective 2005). This legislation also required logbook reporting for all freshwater guiding businesses, in addition to the existing saltwater reporting requirements. The logbook data provide location of fishing effort, level of participation, and number of species kept and released by clients. This information is used for the regulation, development, and management of fisheries and has been published annually since 2009 (data since 2006) in a Fishery Data Series report (Sigurdsson and Powers 2009–2013).

SECTION I: MANAGEMENT AREA OVERVIEW

TRMA DESCRIPTION

After the Porcupine River drainage, the Tanana River drainage is the second-largest tributary of the Yukon River (Brabets et al. 1999). The Tanana River basin (Figures 2 and 3) drains an area of approximately 45,918 square miles (73,898 km^2). The mainstem Tanana River is a large glacier-fed drainage 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 about 570 river miles to the Yukon River.

Much of the human population in Region III is located within the Tanana River drainage along the Alaska, Richardson, and Parks highways, and along the road system around Fairbanks. These highways and their secondary roads provide much of the area's access to sport fisheries. The Fairbanks North Star Borough and part of the Denali Borough lie within the TRMA. Approximately 99,000 people live in this area, which encompasses the city of Fairbanks; Fort Wainwright; Eielson Air Force Base; and the communities of Nenana, North Pole, and Salcha

(U.S. Census Data 2010). Other communities and municipalities located within the TRMA include Anderson, Big Delta, Cantwell, Chatanika, Delta Junction, Dot Lake, Ester, Fort Greely, Fox, Healy, Livengood, Manley, Mansfield, Minto, Northway, Nabesna, Tanacross, Tetlin, Tok, and Two Rivers.

The TRMA affords highly varied fishing opportunities ranging from lake trout *Salvelinus namaycush* in the high-elevation lakes along the Denali Highway to some of the highest-quality Arctic grayling *Thymallus arcticus* and coho salmon *O. kisutch* fisheries in Interior Alaska.

FISHERY RESOURCES

Throughout the TRMA, both indigenous (wild stocks) and introduced (produced in hatcheries and stocked) fish are available to anglers. There are 18 fish species indigenous to the Tanana River drainage; 6 of these are commonly targeted by sport anglers. They include king and coho salmon, Arctic grayling, burbot *Lota lota*, lake trout, and northern pike *Esox lucius*. Chum salmon *O. keta*, Dolly Varden, sheefish (inconnu) *Stenodus leucichthys*, least cisco *Coregonus sardinella*, humpback whitefish *C. pidschian*, broad whitefish *C. nasus*, and round whitefish *Prosopium cylindraceum* are taken occasionally by sport anglers.

Longnose suckers *Catostomus catostomus*, Alaska blackfish *Dallia pectoralis*, lake chub *Couesius plumbeus*, slimy sculpin *Cottus cognatus*, and Arctic lamprey *Lampetra japonica* are also present but not targeted by sport anglers.

Rainbow trout *O. mykiss* are not native to the Tanana River drainage, but have been stocked in many lakes. Arctic char *S. alpinus*, coho salmon, king salmon, and Arctic grayling are also stocked in selected lakes of the drainage.

ESTABLISHED MANAGEMENT PLANS AND POLICIES

The regulations governing fisheries in the TRMA in 2012 are found in 5 AAC 74.001 through 5 AAC 74.030 (sport fishing), in 5 AAC 77.171 through 5 AAC 77.190 (personal use), and in 5 AAC 01.200 through 5 AAC 01.249 (subsistence fishing). The specific management plans that affect TRMA sport fisheries are the *Minto Flats Northern Pike Management Plans* (5 AAC 74.044 for the sport fishery and 5 AAC 01.244 for the subsistence fishery), *Tanana River Wild Arctic Grayling Management Plan* (5 AAC 74.055), *Chena and Salcha River King Salmon Sport Harvest Management Plan* (5 AAC 74.060), *Tanana River Area Stocked Waters Management Plan* (5 AAC 74.065), *Tanana River Area Wild Lake Trout Management Plan* (5 AAC 74.040), *Yukon River Drainage Fall Chum Management Plan* (5 AAC 01.249), *Yukon River King Salmon Management Plan* (5 AAC 05.360), and *Yukon River Summer Chum Salmon Management Plan* (5 AAC 05.362).

MAJOR ISSUES

Salmon fisheries are often the most controversial fisheries in Alaska, and those within the TRMA are no exception. In terms of allocation of fish, subsistence salmon fisheries have a priority over commercial, personal use, and sport salmon fisheries during times when runs are low. This priority can lead to regional and/or user group conflicts when commercial fisheries occur in the Lower Yukon River before subsistence users in the upper portion of the drainage have seen any salmon in their fish wheels and nets. In recent years, the Division of Commercial Fisheries has issued emergency orders to reduce harvest of salmon (particularly king salmon) in the Yukon River drainage commercial and subsistence fisheries (JTC 2011, 2012, 2013).

Public Access through Military Lands

There are many stocked lakes located on military lands in the TRMA. In order to access these areas, the public have to acquire a Recreation Access Permit (RAP) for getting on to the military installations (Ft. Wainwright, Ft. Greely, or Eielson Air Force Base) and phone in before entering an area to ensure training exercises are not occurring (Meadows Road, 33 mile loop and Donnelly Training Area [DTA]). Annually, portions of the DTA that contain stocked lakes are closed to public access due to training exercises. These inconveniences may discourage casual anglers from fishing the stocked lakes in these areas.

Invasive Species

In late fall 2010, large mats of an invasive aquatic plant *Elodea sp.* were identified in Chena (Badger) Slough (Amy Larsen, National Park Service Biologist, personal communication). Prior to this discovery, *Elodea* had not been documented in Interior Alaska, although when archival video footage was examined, it was determined that the plant had been in the slough for at least 3 years. This plant has the potential to spread throughout the Chena River drainage and possibly further into the Tanana River drainage, which may degrade fish habitat. In 2013, the U.S. Fish and Wildlife Service (USFWS) assisted with a pilot program to determine the feasibility of using a suction dredge to remove *Elodea* from Chena (Badger) Slough. Preliminary results indicate that although it is possible to remove the plants with the dredge, it is a slow and laborious process (Mitch Osborne, USFWS biologist, personal communication).

ACCESS PROGRAMS

The Wallop-Breaux amendment to the Federal Aid in Sport Fish Restoration Act (Dingell-Johnson or 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 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, restrooms, and parking areas.

In 2012, construction of a new public-use cabin was completed at Coal Mine Lake #5. No other major access projects were constructed in the TRMA. Planning continues on development of the Tanana Lakes Recreation Area in which stocked lakes, river access, and campgrounds are planned adjacent to the Tanana River south of Fairbanks. This project is modeled after the existing Chena Lakes project developed when the Moose Creek Dam was built. Access funds were also used to construct public-use ice houses for Chena and Birch lakes.

INFORMATION AND EDUCATION

Information regarding regulations, publications, stocking and fishing reports, news releases, and EOs for the TRMA can be found from the *Fishing* and *Sport* links at the ADF&G website (http://www.adfg.alaska.gov/index.cfm?adfg=fishingSport.main). From the *Fishing Information*, *Sport Fishing Brochures*, and *Interior* links on this website, anglers interested in fishing the TRMA can read the area descriptions and download several Division of Sport Fish publications, including *Stocked Lakes of the Tanana Valley*, *Fishing the Stocked Lakes of Donnelly Training Area*, *Fishing Quartz Lake*, *Coal Mine Road Lakes*, and *Roadside Salmon Fishing in Interior Alaska*.

There are 3 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, and the regional webpage; and coordinate the Fairbanks Outdoor Show booth, Kid's Fish and Game Fun Day, and the Becoming an Outdoors Woman (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 TRMA is that Delta Clearwater River (DCR) coho salmon provide eggs for schools within the Tanana River drainage 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 to learn about the life cycle of salmon.

SPORT FISHING EFFORT, HARVEST, AND CATCH

Effort, harvest, and catch statistics for TRMA sport fisheries have been estimated from responses to the SWHS since 1977 and reported under the headings of the "Tanana River drainages" (Area U) (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, 2010a-b, 2011a-b, *In prep*). Estimates of angling effort in the TRMA averaged approximately 86,000 angler-days during the last 5 years (2007–2011) (Table 1).

Angling within the TRMA occurs at numerous rivers, lakes, ponds, and streams. Some of these water bodies are accessible directly from the road system and have some type of boat launch accommodating watercraft appropriate to the size and characteristics of the water body. Access to off-road waters may be made by foot (or skis) or overland use of ATVs, snowmachines, and/or dog teams. Access to the most remote sites may require light aircraft equipped with tundra tires, floats, or skis.

Opportunities for sport angling are available year-round in the TRMA. During open-water seasons, sport fishing may occur wherever game fish are present, subject to time and/or area closures. Winter effort focuses on stocked lakes, with some effort directed toward lake and river populations of burbot, lake trout, and northern pike. The majority of fishing effort in the TRMA occurs in the Chena River (Table 1), and the majority of fish species caught and harvested in the TRMA are Arctic grayling, northern pike, burbot, and stocked species (Table 2). On average, Arctic grayling are most commonly caught (58% of the total) and rainbow trout are the most commonly harvested (37% of the total).

Fishing guides, outfitters, and transporters take anglers to areas of higher-quality fishing. Most transport is by aircraft or boat. Some commercial operators provide cabins or some sort of shelter, and/or boats for angler use. In 2012, the majority of guided effort took place on the Upper Chena River. However, the guide logbook data reported in Appendix C have been summed for the entire Tanana River drainage because there are too few guides to separate out the fish released and harvest numbers by individual fishery (department confidentiality policy). Note that the SWHS reports catch (fish harvested and released) and harvest, while the guide logbook reports list fish released and fish kept.

SECTION II: FISHERIES

Recreational angling occurs throughout the TRMA in diverse habitats, where anglers may target a large variety of fish species. This section will focus on the major fisheries of the TRMA that consistently get the highest amount of fishing effort and have had recent changes to the regulations that affect angling opportunity.

KING AND CHUM SALMON

Chena River

Background and Historical Perspective

The Chena River is a rapid-runoff, tannic-stained river that flows slowly through the city of Fairbanks near its mouth with the Tanana River (Figure 4). It is approximately 160 miles long, and in the summer of 1967 it caused severe flooding in downtown Fairbanks. The flood was the impetus to begin construction in 1973 on the Moose Creek Dam at river mile 45 (~72 km; near the city of North Pole) to divert any future high-water events away from populated areas. The dam was completed in 1979 and is operated and maintained by the U.S. Army Corps of Engineers.

The Chena River supports one of the largest king salmon populations in the Alaskan portion of the Yukon River drainage, with average annual returns of over 3,200 fish from 2008 to 2012 (Table 3). Adult king salmon enter the Yukon River during or shortly after breakup and migrate up the Tanana River to enter the Chena River (920 miles from the Bering Sea) between late June and the second week of July. They move up the Chena River to spawning areas which are primarily upriver from the where the fishery occurs (fishing for king salmon is closed above the dam). The run ends in late July or early August.

Chum salmon are primarily available in July and August during and just after the king salmon fishery, and are targeted or caught incidentally while fishing for king salmon. Although chum salmon are generally more abundant than king salmon and are subject to a more liberal bag and possession limit (3 fish per day), average harvest and catch is lower than that for king salmon (Tables 4 and 5). The poor quality of chum salmon flesh for human consumption by the time the fish reach the Chena River is likely a contributing factor. Coho salmon are not present in the Chena River drainage.

Chena River king salmon escapements have been annually assessed since 1986 using either mark-recapture experiments or a counting tower located above the Moose Creek dam (Table 3; Barton 1987, 1988; Barton and Conrad 1989; Brase 2012; Brase and Doxey 2006; Doxey 2004; Doxey et al. 2005; Evenson 1991a, 1992–1993, 1995, 1996; Evenson and Stuby 1997; Savereide 2012a-b, *In prep* a-b; Skaugstad 1990b, 1994; Stuby and Evenson 1998; Stuby 1999–2001). Counting conditions at the dam can be highly variable depending on water height and river turbidity. In 2005 and 2011, the Chena River was extremely high and turbid for most of the king salmon run; therefore, escapement was not estimated. In contrast, 2013 had good counting conditions throughout the majority of the run and a good estimate of escapement was produced.

Historically, the Chena River king salmon sport fishery was managed under a management plan with an escapement goal and a guideline harvest allocation for the sport fishery. A guideline sport harvest objective of 300–600 king salmon in the Chena River was set by the BOF in 1990. An aerial survey escapement index of 1,700 fish was set by Division of Commercial Fisheries in

1992. In 1993, Division of Sport Fish staff expanded this aerial survey escapement index into an actual escapement abundance goal of 6,300 fish, as measured by the counting tower. This point objective was calculated based on averages of escapement data available at the time. Inseason management for the guideline harvest objectives was impractical because there was no mechanism for day-to-day enumeration of the harvest, and the harvest objectives were repealed in 2001.

In 2000, the department formed an escapement goal (EG) committee to evaluate and calculate EGs for Chena and Salcha rivers king salmon and for some Yukon River drainage chum salmon stocks. The EG process was designed to set escapement ranges that maximize potential yield. The EG committee recommended a biological escapement goal (BEG) range of 2,800–5,700 king salmon, measured by the counting tower, for the Chena River based on an analysis of run reconstruction data related to brood year returns. There is no escapement goal set for chum salmon in the Chena River.

A king salmon sport fishery has occurred at the Chena River since before statehood, and the bag and possession limit for king salmon in the Tanana River drainage has remained unchanged since the early 1960s, at 1 fish ≥ 20 in (~510 mm). The fishery is easily accessible in the lower portion of the Chena River with multiple boat launch and walk-in sites located throughout Fairbanks and North Pole. The fishery is closed above the Moose Creek Dam.

The Chena River king salmon sport fishery continues to be relatively small, especially when compared with fisheries in Southcentral and Southeast Alaska; however, it remains very popular because it provides one of the few opportunities to catch large fish near Fairbanks. Most sport anglers release their catch because the salmon flesh has deteriorated significantly by the time the fish have traveled the 1000 or more miles from the Bering Sea (Tables 4 and 5).

Recent Fishery Performance

The Chena River experienced very high and turbid water conditions during a portion of the 2012 king salmon run. During this portion of the salmon run the counting tower was unusable; however, the DIDSON sonar remained operational and an estimate of king salmon abundance was produced (Savereide *In prep*). The estimate of 2,220 king salmon was below the lower end of the BEG range (2,800 fish).

Estimated harvests of king salmon between 1983 and 1992 ranged from 0 to 375 fish, and then increased in the mid-1990s (Brase 2009b). The 2012 king salmon harvest was 38 fish, which was well below the 5-year average (2007–2011) harvest of 151 fish (Table 4). The 2012 catch of 245 fish was also below the 5-year average catch of 795 fish (Table 5). The 2012 harvest and catch numbers were probably below average due to low escapement and the emergency orders that prohibited retention of king salmon throughout the Tanana drainage (including the Chena River) on July 21 and then closed the Chena River specifically to king salmon fishing on July 30.

The 5-year (2007–2011) average total chum salmon harvest and catch in the Chena River were 28 and 183 fish, respectively (Tables 4 and 5). The Chena River chum salmon harvest and catch has represented less than half of the TRMA's total harvest during this period.

In 2013, the Chena River had good fish-counting conditions throughout the king salmon run, and the preliminary estimate of escapement of 1,859 king salmon was below the lower end of the BEG range (2,800 fish). Similar to 2012, the Tanana drainage was closed to retention and the

use of bait on July 12, and then on July 29 the Chena River itself was closed to king salmon fishing.

Fishery Objectives and Management

In 2001, the BOF adopted policy to manage salmon harvests so that escapements fall within the BEG ranges set by ADF&G. The BEGs are evaluated on a 3-year cycle in synchrony with the BOF meeting cycle for the Yukon River drainage.

Commercial and subsistence salmon harvests occur along almost the entire length of the mainstem Yukon and Tanana rivers (JTC 2011). In 2001, the BOF adopted the *Chena and Salcha River King Salmon Sport Harvest Management Plan* (5 AAC 74.060), which mandated that all the Tanana River fisheries (commercial, subsistence, personal use, and sport) be managed in a manner such that the Chena River king salmon BEG range of 2,800–5,700 fish is achieved at the counting tower. In order to get that number of fish past the counting tower, restrictions may be placed on any or all Tanana River fisheries.

In 2009, an in-house *Sport Fish Management Plan for Chinook Salmon in the Chena and Salcha Rivers* (Brase 2009a) was developed to guide sport fish management of the king salmon sport fishery. The plan provides a prescription for fishery management actions based on projections of final escapement from counting-tower data, on or after Day 20 of the run, relative to the BEG range for each river. The first day king salmon are seen at the counting tower is considered Day 1 of the run and the run typically lasts around 40 days, with the midpoint on Day 20. Historical run-time data suggest that by Day 20, projections accurately predict escapements relative to meeting or not meeting the lower end of the BEG, allowing a sufficient number of days in the run to provide additional harvest opportunity or reduce harvest. Potential management actions include the following: closing the fishery if the lower end of the BEG range will not be met; restricting the fishery to catch-and-release only if there is a small chance of not achieving the lower end of the BEG range; maintaining status quo regulations if projections indicate escapements will fall within the BEG range; liberalizing regulations to allow a bag limit of 2 king salmon (>20 in) if it is likely escapement will exceed the upper end of the BEG range; and liberalizing regulations to allow a bag limit of 3 king salmon (>20 in) if it is likely escapement will exceed the upper end of the BEG range by 30% or greater.

In 2010, 2012, and 2013, the plan indicated that the Chena River king salmon sport fishery should be closed because the run was not projected to meet minimum escapement. The fishery was closed by EO in all three years. These proved to be appropriate management actions, as the run did not meet minimum escapement in any of these years (Table 3).

In 2011, the Chena River king salmon fishery was restricted to catch-and-release only by EO on July 23. This action was taken because the Chena River counting tower was inoperable due to high and turbid water conditions, and lower river indicators suggested that the king salmon run was weak. Restrictions had been placed on subsistence, commercial, and sport users in the Yukon River, and closing the Chena (and all other Tanana River tributaries) to retention of king salmon seemed prudent based on recent years' production and the lack of data from the current year.

Current Issues and Fishery Outlook

While run strength and river conditions can override fishing effort in affecting harvest and catch, the harvest potential of this fishery may be increasing due to a combination of increased public

awareness of its availability and improvements in the gear and fishing techniques used to target king salmon; however, most recent estimates suggest that harvests have declined from the 1990s and exploitation rates remain low (Brase 2009b, Table 4).

There has been some concern raised about the effect that Moose Creek Dam may have on Chena River salmon passage. The dam is designed to allow water to pass freely through 3 floodgates at normal river stages. Fish passage is unimpeded until the river rises, placing property downstream at risk of flooding. When flow exceeds 8,000 ft^3/s, the floodgates are partially closed to maintain that flow rate downstream from the dam. Water is diverted along the floodway to the Tanana River. The floodgates have seldom been lowered while adult king salmon were passing through the structure, and then only for short periods of time. A fishway built into the side of the structure is designed to allow fish passage if a large volume of water is backed up behind the dam. Because the water rarely gets high enough to flow down the fishway, its potential to pass migrating salmon is essentially untested.

Recent Board of Fisheries Actions

The BOF has taken no actions with regards to the Chena River salmon fisheries since 2001 when the *Chena and Salcha River King Salmon Sport Harvest Management Plan* was adopted.

Current or Recommended Research and Management Activities

A DIDSON sonar was deployed downstream of the dam in 2007 to estimate the number of migrating salmon during periods of high water (> 2 consecutive days) when tower counts could not be completed. A mixture model based on length was used to allocate the total count of salmon passing the sonar into numbers of king and chum salmon (Huang 2012). Results were compared to actual tower counts and suggested this methodology is an appropriate means to estimate passage when conditions prohibit tower counts. The project objective is to position 2 sonars so they can record images from each half of the river, 24 hours a day, 7 days a week.

Salcha River

Background and Historical Perspective

The Salcha River is located approximately 40 miles east of Fairbanks via the Richardson Highway. It is a tannic-stained rapid-runoff system approximately 120 miles long, originating in the Tanana Hills to the north (Figure 3). Numerous recreational cabins are located along the lower 70 miles of the river.

The Salcha River supports the largest king salmon escapement in the Tanana River drainage, with average annual returns of over 7,700 fish from 2008 to 2012 (Table 3). Adult king salmon enter the Yukon River during or shortly after breakup and migrate up the Tanana River to enter the mouth of the Salcha River (965 miles from the Bering Sea) between late June and the second week of July before continuing up the Salcha River to spawning areas. The run ends in late July or early August.

Similar to the Chena River salmon sport fishery, chum salmon are caught incidentally to king salmon in the Salcha River. Coho salmon are not present in the Salcha River drainage.

The Salcha River king and chum salmon runs have been annually assessed since 1987 using mark-recapture experiments or by a counting tower located near the Richardson Highway Bridge (Table 3; Brase 2012; Brase and Doxey 2006; Burkholder 1991; Doxey 2004; Doxey et al. 2005; Evenson 1995, 1996; Evenson and Stuby 1997; Savereide 2012a-b, *In prep* a-b; Skaugstad

1988–1990a, 1992–1994; Stuby and Evenson 1998; Stuby 1999–2001). Operation of the Salcha River counting tower is currently contracted to Bering Sea Fishermen's Association (BSFA), with funding from the U.S./Canada Yukon River Pacific Salmon Treaty. BSFA closely follows the project design and methodology established by the Division of Sport Fish (which operated the tower from 1993 to 1998) for this project. Contractor staff report king salmon passage counts to the Division of Commercial Fisheries at the end of each day so that ADF&G can calculate and track cumulative passage. Counting conditions on the Salcha River can be highly variable depending on water height and river turbidity.

There has been a king salmon sport fishery at the Salcha River since before statehood. The salmon fishery is accessible from either a vehicle trail just west of the Richardson Highway Bridge or the nearby Salcha River State Recreation Site (campground). Boaters launch at the campground and travel downstream to fish near the confluence of the Tanana and Salcha rivers. The salmon fishery on the Salcha River is closed above a marker located about 2½ miles upriver from the Richardson Highway Bridge (about 5 miles upstream from the confluence of the Salcha and Tanana rivers). Most of the spawning occurs upstream of this area.

Until 1989, the Salcha River king salmon sport fishery had greater king salmon harvests than were seen on the Chena River. Estimated harvests between 1983 and 1992 ranged from 47 to 871 fish (Brase 2009b). Subsequently, harvest and catch did not increase as dramatically in the Salcha River as in the Chena River, but average harvest continues to be higher on the Salcha River (Table 4), even with a much smaller portion of the river open to salmon fishing. In recent years this is probably due in part to more restrictions being placed on the Chena River king salmon fishery.

The bag and possession limits for king salmon in the Tanana River drainage have remained unchanged since the early 1960s, at 1 fish ≥ 20 in (~510 mm).

Recent Fishery Performance

Similar to the Chena River in 2012, the Salcha River had poor counting conditions throughout a portion of the king salmon run, which limited viewing conditions. However, the missed counts were extrapolated for, and the count of 7,165 king salmon should be considered a good estimate of escapement (Chris Stark, Fisheries Biologist, BSFA, Fairbanks, personal communication).

From 2011–2013, the Salcha River king salmon fishery has been annually restricted to catch-and-release fishing only by EO (Appendix A). These actions were taken because Yukon River indicators suggested that the king salmon run was weak, supported by low numbers at the counting towers in these years. Restrictions had been placed on subsistence, commercial, and sport users in the Yukon River, and closing the Salcha River (and all other Tanana River tributaries) to retention of king salmon seemed prudent based on recent years' production and lack of data from the current year.

The 2012 king salmon harvest was 76 fish, with a catch of 682 fish; these were both below the 5-year average harvest (2007–2011) of 268 fish and average catch of 947 fish (Tables 4 and 5). The harvest and catch numbers were probably below average in 2012 due to low escapement and the emergency order that prohibited retention of king salmon throughout the Tanana (including the Salcha River) on July 21.

The 5-year (2007–2011) average total chum salmon harvest and catch in the Salcha River were 18 and 63 fish, respectively (Tables 4 and 5). The Salcha River chum salmon harvest and catch has represented less than half of the area's total harvests during this period.

In 2013, the Salcha River had good counting conditions throughout the run, and the count of 5,465 king salmon was above the lower end of the BEG range (3,300 fish, Table 3). Similar to 2012, the Tanana drainage was closed to retention and the use of bait on July 12, but because the Salcha River projection was projected to exceed the upper end of the escapement goal, it was reopened to the use of bait and the retention of king salmon on July 29 (Appendix A).

Fishery Objectives and Management

Similar to the process described under the Chena River king salmon section of this report, the EG committee recommended a Salcha River king salmon BEG of 3,300–6,500 fish in 2001. Unlike the Chena River, the Salcha River king salmon BEG range has been met or exceeded every year since 1990.

The Salcha River is also managed under the *Chena and Salcha River King Salmon Sport Harvest Management Plan* (5 AAC 74.060) and an in-house management plan developed in 2009 to guide sport fish management of the Salcha River king salmon fishery (Brase 2009a).

Current Issues and Fishery Outlook

Typically, more sport anglers target king salmon on the Salcha River than on the Chena River, possibly due to better water clarity, larger run size, and ease of access to good fishing locations.

Recent Board of Fisheries Actions

There have been no actions taken by the BOF with regards to the Salcha River king salmon fisheries since 2001 when the *Chena and Salcha River King Salmon Sport Harvest Management Plan* was adopted.

Current or Recommended Research and Management Activities

It is recommended that the department continue to work with BSFA contractors, who operate the Salcha River escapement monitoring project, in order to receive daily updates of the number of salmon passing the counting tower and river conditions.

COHO SALMON

Delta Clearwater River

Background and Historical Perspective

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 these 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 upper portion of the Tanana River drainage, the largest of which is the Delta Clearwater River (DCR) (Figure 5).

The DCR supports the largest documented spawning stock of coho salmon in the Yukon River, with escapements averaging over 8,300 fish/year from 2008–2012 (Table 6). The DCR is about 20 miles in length, is road accessible, and supports the largest recreational fishery for coho

salmon in the Tanana River drainage. From 2007 to 2011, an average of 195 coho salmon were harvested of the almost 3,000 fish caught annually in the DCR (Tables 4 and 5). In 2012, the harvest of 57 fish was below the 5-year average (Table 4).

Annual escapement index counts of coho salmon have been conducted by boat survey since 1972 (Brase 2012; Brase and Doxey 2006; Doxey 2004; Doxey et al. 2005; Evenson 1995, 1996; Evenson and Stuby 1997; Parker 1991; Savereide 2012a-b; Skaugstad 1994; Stuby and Evenson 1998; Stuby 1999–2001). Escapement counts are conducted from an elevated platform on a riverboat during the peak of the coho salmon spawning period (generally mid-October) in that portion of the DCR from its confluence with the Tanana River, upriver to mile 18 (~29 km), or to the uppermost navigable point.

Coho salmon are the last of the salmon species to enter the Yukon River and may be seen in the DCR starting in mid-September. The peak of the run is in mid-October. Property owners living near the river have reported coho salmon spawning as late as January. The springs provide favorable overwintering habitat for juvenile coho salmon that rear in the river. Carcass sampling from 1984 to 1990 indicated that, on average, 14% of returning coho salmon were 3 years old (1.1), 79% were 4 years old (2.1), and the remaining 7% were 5 years old (3.1) (Parker 1991). Therefore, the majority of the coho salmon fingerlings in the DCR rear for 3 winters (including 1 winter rearing in river gravel), then outmigrate and spend 1 winter in the ocean before returning (Parker 1991).

Recent Fishery Performance

Coho salmon in the DCR provide the last open-water fishery of the year, attracting both local and nonlocal anglers who want the opportunity to catch a salmon. Anglers can fish from shore or from boats, which can be launched at the state park campground or at a boat launch at river mile 8.5 (~13.5 km) off Jack Warren Rd. Coho salmon are caught from mid-September through October using various spoons, large spinners, or flies.

The coho salmon fishery on the DCR has steadily grown in popularity since 1984 (Parker 2009b). The majority of coho salmon are released (Tables 4 and 5) because the quality of the salmon flesh in the DCR is not as desirable as fish caught closer to the confluence of the Yukon and Tanana rivers. In 2012, the catch of 2,316 coho salmon was below the 5-year average of 2,994 fish (Table 5).

In 2012, approximately 305 coho salmon were counted on September 28 from the state campground (mile 8 or ~13 km) downriver to mile 1 (~1.6 km). Because this count was below the 1,500 fish trigger the coho salmon fishery was restricted to catch-and-release fishing only. The fishery was not closed completely because there were thought to be fish still holding downriver and an unusually high water event was experienced in the middle Tanana River area in late September. Commercial fishery harvests and assessment projects in the Lower Yukon and Tanana rivers indicated that the coho salmon run was slightly late and below average in size. The final escapement estimate for 2012 was 5,230 coho salmon, which slightly surpassed the lower bound of the SEG.

In 2013, approximately 135 coho salmon were counted on September 27 from the state campground (mile 8 or ~13 km) downriver to mile 1 (~1.6 km). Because this count was below the 1,500 fish trigger, the coho salmon fishery was restricted to catch-and-release fishing only. The fishery was not closed completely because commercial fishery harvests and assessment

projects in the Lower Tanana River indicated that the coho salmon run was slightly late and below average in size and there were thought to be fish still holding downriver. The final escapement estimate for 2013 was 6,222 coho salmon, which surpassed the lower bound of the SEG (5,200 fish).

Fisheries Objectives and Management

Coho salmon assessment in the Yukon River drainage is quite limited and relies heavily on information from commercial and subsistence harvests; icy winter conditions make sampling difficult and expensive. The only coho salmon escapement goal presently in place for the Yukon River drainage is the DCR. The current coho salmon escapement goal (5,200–17,000 fish; sustainable escapement goal [SEG]), was adopted by the department in 2004 and replaced the previous minimum threshold 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 2008 to 2012 in the DCR was 8,325 fish (Table 6).

The department monitors DCR coho salmon escapement between mid-September and early October to determine whether any inseason management action is necessary. Management objectives state that if 2,500 fish are found in the lower 8 miles of river between September 15 and October 1, it is likely that the escapement goal will be met and no management actions to restrict harvest will occur. However, if less than 1,500 fish are found in the lower 8 miles of river during the same time period, the sport fishery may be closed by EO. The present bag and possession limit is 3 coho salmon. Yukon River sonar counts and catch rates from a test fish wheel on the Tanana River near Nenana are used as a preliminary index of DCR coho salmon run strength. With these data and a preliminary escapement estimate, the department has reasonable tools to predict if the coho salmon sport fishery needs to be restricted.

Current Issues and Fishery Outlook

Between 2001 and 2005, large numbers of coho salmon returned to the DCR. However, since 2010, there has been a significant decrease in the return size (Table 6). In 2013, the escapement of 6,222 coho salmon was 75% of the recent 5-year average (2008–2012) of 8,325 fish. During the past 10 years, the escapement goal for the DCR has been met or exceeded every year.

Recent Board of Fisheries Actions

The last BOF action affecting salmon sport fishing in the DCR was in 1998 when a 3-fish bag and possession limit for coho and chum salmon was established drainagewide.

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 SEG.

KING, COHO, AND CHUM SALMON

Other TRMA Fisheries

Background and Historical Perspective

Several other river drainages in the TRMA support spawning populations of salmon; these include the Chatanika (king and chum salmon), Nenana (king, chum, and coho salmon), and

Goodpaster rivers (king and chum salmon). The furthest upstream tributary of the Tanana River drainage in which substantial king salmon spawning occurs is the Goodpaster River.

The Tanana River, from its confluence with the Gerstle River to the Little Delta River, is crucial habitat for returning 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 chum and coho salmon.

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 TRMA, including the Richardson Clearwater River, Providence Creek, and Blue Creek.

The Chatanika River king salmon population was assessed sporadically by boat survey and then annually from a counting tower from 1998 to 2005 (Table 3; Brase and Doxey 2006; Doxey 2004; Doxey et al. 2005; Stuby 1999–2001). The counting tower project was discontinued in 2005 due to consistently annual high water conditions that resulted in poor viewing conditions and low-quality estimates in most years.

The Nenana River drainage is believed to support the second largest coho salmon spawning population in the Tanana River drainage, and it has been surveyed regularly by boat and aerial survey since 1993 (Chris Stark, Bering Sea Fishermen's Association biologist, personal communication). These surveys indicate that the recent 5-year average total Nenana River drainage coho salmon escapements have been approximately 2,500 fish (Table 6).

Teck-Pogo Inc. (now Sumitomo), 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 3). In 2004, Teck-Pogo Inc. contracted BSFA to monitor the Goodpaster River king salmon escapement for 20 years. BSFA subcontracted Tanana Chiefs Conference (TCC) to operate a counting tower. Since 2004, TCC has operated the counting tower on the North Fork of the Goodpaster River. In 2013, an estimated 723 king salmon passed the counting tower under moderately favorable counting conditions (Table 3; Chris Stark, Fisheries Biologist, BSFA, Fairbanks, personal communication).

Fishery Objectives and Management

Due to a lack of a long time series of return data, there are no escapement goals associated with any of the other TRMA salmon populations.

When an EO is implemented restricting fishing regulations for king salmon based on information from the Chena and Salcha rivers or downriver (Yukon and Tanana rivers) run indicators, it typically covers all of the king salmon fisheries in the Tanana drainage. However, EOs relaxing inseason restrictions or liberalizing standard regulations may not apply to the other Tanana River drainage stocks if the information is based only on tower count information from the Chena and Salcha rivers, and if there is not specific information regarding run status in the other streams.

In the last 3 years (2011–2013), all Tanana River tributaries were restricted to king salmon catch-and-release only by EO (Appendix A). This action was taken because downriver indicators suggested that the king salmon run was weak, and in 2011, counting towers on the Chena and Salcha rivers were inoperable. Restrictions had been placed on subsistence, commercial, and sport users in the Yukon River, and closing all Tanana River tributaries to retention of sport-

caught king salmon was prudent and reasonable based on recent years' production and the inseason escapement data.

Current Issues and Fishery Outlook

Although effort and catch rates are currently sporadic and low in these minor salmon systems, this situation may change as more development occurs in the area.

Recent Board of Fisheries Actions

At the 2010 BOF meeting, a proposal was adopted that relocated the regulatory boundary marker in the Chatanika River, above which is closed to salmon fishing. The former regulatory boundary was located 1 mile (~1.6 km) upstream from the Elliott Highway Bridge and was originally put in place for the whitefish spear sport fishery that occurred in the area through 1993. Other regulations used this point as a reference in order to maintain consistency. The new boundary is the Elliott Highway Bridge itself. This new location provides a more permanent and recognizable boundary.

The BOF also adopted a proposal that closed the Tok River drainage to sport fishing for salmon to provide protection for a developing stock. In 2008, the department received a report of about 50 spawning coho salmon in the Tok Overflow #1 (30 miles upstream in the Tok River) (Parker 2009b). In October 2009, department staff again surveyed the same area and counted 13 coho salmon. These were the first historical documentations of any coho salmon in these springs, and given low numbers of fish, the BOF supported providing protection to this small salmon stock.

Current or Recommended Research and Management Activities

The Chatanika River drainage was an important mining area from the 1920s through 1950s. In 1926, the Davidson Ditch Diversion Dam was built. It was used to support industrial activity in the area until it became inoperable in 1967 due to flood damage. In 2002, the dam was removed through a cooperative partnership among several state, federal, and private nonprofit organizations. This project restored fish passage to more than 65 miles (105 km) of upstream habitat for king and chum salmon. Staff from BSFA annually monitor the watershed above the old dam site for recolonization by salmon adults and/or juveniles. Juvenile salmon have been observed from the former dam site to approximately 6.2 miles (10 km) upriver every year since the dam was removed, except in 2009, when no juveniles were observed, despite extensive trapping and survey efforts (Chris Stark, Fisheries Biologist, BSFA, Fairbanks, personal communication).

Aerial surveys are conducted on other coho salmon-producing streams in the area. For example, since 2000, aerial surveys have been performed consistently by the Division of Commercial Fisheries to count Richardson Clearwater River (RCR) coho salmon. In 2012, an estimated 515 coho salmon were counted on the RCR, and in 2013 an estimated 647 coho salmon were counted (A. Padilla, Commercial Fish biologist, ADF&G, Fairbanks, personal communication). The average escapement for 2008–2012 was 500 fish (Table 6).

A foot survey was conducted on Blue Creek for the first time in 2007 from the mouth to head of the springs (approximately 1.2 miles). Peak salmon counts in Blue Creek showed 2,200 chum and 102 coho salmon (Parker 2007). In 2012, 53 coho and 6 chum salmon were counted, and in 2013, 23 coho and 53 chum salmon were counted in the same area by aerial survey.

ARCTIC GRAYLING

Chena River

Background and Historical Perspective

Due to its accessibility, the Chena River Arctic grayling stock offers high-quality angling opportunity to anglers across a broad socioeconomic and age spectrum. There is road access from Eielson Air Force Base and the river flows through Fort Wainwright Army Base, giving military personnel direct access. The Chena River State Recreation Area is a popular boating, camping, and fishing destination for residents and nonresident visitors traveling along the road system.

From the late 1970s through the mid-1980s, the Arctic grayling fishery on the Chena River was the largest Arctic grayling fishery in Alaska. The average annual fishing effort (for all species) for the 10-year period (1977–1986) was about 30,500 angler-days (Brase 2009c). Between 1986 and 1987, estimates of abundance declined (Table 7; Clark and Ridder 1987a, 1988). Although there was no stock assessment performed on Chena River Arctic grayling prior to 1985, the decline in average harvest from 1977 to 1984 (28,440 fish; Brase 2009c) compared to the 1985–1986 average harvest (7,051 fish; Brase 2009c) was a reasonable indicator of the decline in the Arctic grayling population. Therefore, in 1988 the bag limit was reduced from 10 per day to 5 per day, fishing was restricted to catch-and-release during the spring spawning period (April 1 through the first Saturday in June), and the use of bait was eliminated.

Although harvest decreased for 2 years after the imposition of these restrictions and abundance estimates increased after 1989, both harvest and effort increased substantially in 1989 (Brase 2009c), prompting the lowering of the bag limit from 5 per day to 2 per day. This additional restriction was not sufficient to reduce harvest to a sustainable level, and in 1991 the fishery was further restricted by EO to catch-and-release only (Brase 2009c). The BOF made this a permanent regulatory change in 1994. After the change in fishing regulations, catches and effort dropped off; however, they have remained relatively stable in recent years, averaging approximately 33,700 fish and 18,500 angler-days between 2002 and 2011 (Tables 1, 8).

In addition to eliminating sport harvest through regulation changes, the department initiated a program of Chena River stock enhancement by stocking hatchery and pond-reared Arctic grayling that were spawned from Chena River stock. In 1993 and 1994, approximately 61,000 fish/year were stocked into the Chena River. Survival of these fish was estimated as part of the ongoing stock assessment efforts during 1993–1995 and determined to be too low to justify the cost of the enhancement effort. Stocking was discontinued after 1994 (Clark 1994–1996).

The Chena River Arctic grayling population continued to be assessed with mark-recapture experiments from 1991 to 1998 and then again in 2005 (Table 7; Clark et al. 1991; Clark 1994–1996; Ridder 1998b, 1999; Ridder and Fleming 1997; Wuttig and Stroka 2007). These surveys illustrate an Arctic grayling population that is stable with a large proportion of quality-sized fish but probably cannot sustain a large annual harvest that would be similar to historic levels.

The Chena River Arctic grayling fishery has been popular since before statehood, and it has increased in popularity as Fairbanks and the surrounding area have been developed and access has improved. The Arctic grayling fishery is almost entirely an open-water fishery, occurring from April through October. Anglers target Arctic grayling throughout the road- and boat-accessible sections of the river and its tributaries, and some are transported to the headwaters by

aircraft to begin float trips during which they fish for Arctic grayling. Chena (Badger) and Piledriver sloughs are important components of the Chena River Arctic grayling fishery because they provide rearing areas for lower river Arctic grayling and are easily accessible fishing locations.

Prior to 2007, the SWHS divided the Chena River into the "upper river" and "lower river" at the South Fork (river mile 77 or ~124 km). Since 2007, the Chena River was divided into the upper and lower sections at the Moose Creek Dam (river mile 45 or ~72 km) (Figure 4). The SWHS provides separate estimates of effort, catch, and harvest of all species for each section. Species distributions and regulations that close salmon fishing and prohibit the use of bait above the dam suggest that almost all of the effort in the SWHS-designated upper river is directed toward Arctic grayling. The lower river supports a multi-species fishery, including king salmon, burbot, and northern pike fisheries. Although the majority of the effort in the Chena River is probably directed toward Arctic grayling, effort is not apportioned between species, and the multi-species fishery confounds attempts to describe the total effort targeting Arctic grayling within the Chena River fisheries.

Recent Fishery Performance

Much like salmon, catch rates of Arctic grayling are highly dependent on river conditions. In years of high turbid flow, catch rates will be low, and in years of low rainfall, catches will often be good. However, if water temperatures are too warm, fish may not be active feeders. These weather fluctuations may explain some of the variability seen in the SWHS catch reports: in 2004, water levels were low in the Chena River and grayling catches were higher than average; in 2005, 2008, 2011, and 2012 water levels were high throughout much of July and grayling catches were lower than average. The 2012 catch of Arctic grayling in the Chena River was 18,776 fish, which was below the 5-year average (2007–2011) catch of 28,709 fish (Table 7).

Fishery Objectives and Management

In 2004, the BOF adopted the *Tanana River Area Wild Arctic Grayling Management Plan* (5 AAC 74.055), which directed ADF&G to manage Arctic grayling fisheries for long-term sustained yield while providing and/or maintaining fishery qualities that anglers desire. The *Tanana River Area Wild Arctic Grayling Management Plan* has 3 management approaches: regional, conservative, and special. Each of these approaches has different means of achieving the goals of sustained yield (reduce bag and possession limits, reduce fishing season, only allow catch-and-release, modify other methods and means). The Chena River is in the special management category.

In addition, ADF&G has drafted an in-house *Fishery Management Plan for the Chena River Arctic Grayling Sport Fishery* (Doxey and Brase *In prep*). After this plan has gone through a full review, it will be used to manage the Chena River Arctic grayling population. The management objectives in the draft plan are as follows:

- In the upper river (river-miles 45–90), maintain a minimum abundance of 8,500 Arctic grayling ≥ 12 in (~305 mm) in total length.
- In the lower river (downriver from river mile 45 or ~72 km at the Moose Creek dam), maintain a minimum abundance of 2,200 Arctic grayling ≥ 12 in (~305 mm) in total length.

Current Issues and Fishery Outlook

The 2005 Chena River Arctic grayling assessment showed that the numbers of large (~11 in or ≥ 270 mm) Arctic grayling in the upper portion of the drainage (5,203 fish, SE = 543) had dropped from the 1998 estimate of 12,519 fish, SE = 2,051 (Table 7). The number of large Arctic grayling in the lower river was estimated at 2,190 fish (SE = 268). Both of these estimates are below the draft management objective; however, estimates of total abundance (fish ~6 in or ≥ 150 mm) for both years were nearly identical at approximately 27,500 fish (Table 7).

Recent Board of Fisheries Actions

At the 2010 meeting, the BOF clarified that Chena Slough (also known as Badger Slough) is part of the Chena River and therefore falls under the same regulations. The BOF also modified the gear regulations on the Chena River so that the same gear (1 unbaited single-hook artificial lure; 1 unbaited treble hook with a gap between hook and shank of ½ inch or greater; or 1 baited single hook with a gap between hook and shank larger than ¾ inch) may be used throughout the drainage (previously there were differences in hook size regulations between the upper and lower portions of the river).

Current or Recommended Research and Management Activities

The Chena River Arctic grayling population should continue to be assessed on a regular basis to determine whether additional actions should be taken in order to meet management objectives.

Delta Clearwater River

Background and Historical Perspective

The Delta Clearwater River (DCR) is the largest of several spring-fed streams near Delta Junction (Figure 5). Arctic grayling spawn in Goodpaster River, 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 feeding habitat for adult Arctic grayling. Arctic grayling are not known to spawn or overwinter in the DCR or the RCR. It is unclear how Arctic grayling recruit to these summer feeding streams; however, fidelity to the DCR and other spring-fed streams is strong (Ridder 1998a). The abundance of Arctic grayling populations within the spawning streams in part determines how many fish migrate to these spring-fed streams.

Arctic grayling larger than 10 in (240mm), were at a low of 3,000 fish in 1996 (Ridder 1998a). The population later increased to 7,991 fish in 2000 and to 14,799 in 2006, probably because of a series of changes to the bag and possession limits (Gryska 2001; Wuttig and Gryska 2010; Table 10). In the last 10 years, estimates of total catch of Arctic grayling in the DCR have ranged from 8,912 fish in 2008 to 22,112 fish in 2007 (Table 8).

Recent Fishery Performance

Angler effort in the DCR over the last 5 years (2007 to 2011) averaged 4,331 angler-days (Table 1). 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). In 2012, the angler effort on the DCR was 3,870 days, slightly below the 5-year average (Table 1).

Harvest in the DCR averaged 80 Arctic grayling from 2007 to 2011 (Table 9). Catches of Arctic grayling from 2007 to 2011 averaged 14,715 fish (Table 7). Population models have suggested that a harvest of 900 Arctic grayling ≤ 12 in (~305 mm) would be sustainable on the DCR (Clark and Ridder 1994), but harvests of this magnitude have not occurred.

Fisheries Objectives and Management

In 2004, the BOF adopted the *Tanana River Area Wild Arctic Grayling Management Plan* (5 AAC 74.055) that stated that ADF&G would manage Arctic grayling fisheries for long-term sustained yield while providing and/or maintaining fishery qualities that anglers desire. The *Tanana River Area Wild Arctic Grayling Management Plan* has 3 management approaches: regional, conservative, and special. Each of these approaches has different means of achieving the goals of sustained yield (reduce bag and possession limits, reduce fishing season, only allow catch-and-release, modify other methods and means). DCR Arctic grayling are managed under the special management approach.

Specific management objectives for the Delta Clearwater River Arctic grayling recreational fishery were updated in 2003 (Parker 2003a). The 3 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 in (~355 mm) in length.
2. Maintain an annual harvest of 900 fish ≤ 12 in (~305 mm) or less.
3. Prosecute the fishery in such a way as to provide for a minimum catch rate of 1 Arctic grayling per angler-day.

Current Issues and Fishery Outlook

Catch levels are very high in the DCR, averaging over 15,000 fish annually over the past 10 years (Table 8). The catch is more than the 2006 estimated population size, suggesting that at least some fish are caught multiple times. The apparent repeated handling of DCR Arctic grayling is likely responsible for some level of mortality, although catch-and-release mortality is probably low (5%, McKinley 1993). However, even a low hooking mortality rate of 5% could be significant with such high catch levels.

In 2006, the abundance of Arctic grayling over 12 in (~270 mm fork length [FL]) in the DCR was estimated at 14,799 fish (Table 9; Wuttig and Gryska 2010), which is significantly larger than the 2000 estimate, even when the 95% confidence intervals are compared, rather than just the point estimates. Therefore, current catch rates and the associated hooking mortality appear to be sustainable.

Recent Board of Fisheries Actions

At the 2010 meeting, the BOF adopted a proposal that clarified method and means in waters that had either catch-and-release regulations or exceptions to the general bag and possession limits for Arctic grayling. This affected the DCR, which is managed under the special management approach. Sport anglers in the DCR are now restricted to 1 single-hook artificial lure, rather than allowed 2 single hooks or artificial flies per line.

Current or Recommended Research and Management Activities

The DCR Arctic grayling population should continue to be assessed on a regular basis to determine whether additional actions should be taken in order to meet management objectives.

Tangle Lakes System

Background and Historical Perspective

The Tangle Lakes system is located in the upper portion of the Tanana River drainage near the Denali Highway and is made up of several high-elevation lakes including Lower, Shallow, Round, and Upper Tangle lakes, which are connected by the Tangle River that flows into the Delta River. The Delta River drains north through the Alaska Range, eventually joining the Tanana River and emptying into the Yukon River. The watershed includes 150,000 acres of land, 160 miles of streams, and 21 lakes.

The Delta River Corridor is managed by the BLM as a Wild and Scenic Waterway and is a popular area in the summer and fall. There is a BLM campground located on Round Tangle Lake, and it is relatively easy to canoe from the Tangle Lakes to the Delta River and then to a takeout on the Richardson Highway near Phelan Creek.

Recent Fishery Performance

In 2012, the Tangle Lakes system accounted for the largest number of Arctic grayling caught and harvested in any water body within the TRMA. The Tangle Lakes Arctic grayling catch was 19,281 fish (23% of TRMA total), and the harvest was 1,245 fish or 27% of the total TRMA Arctic grayling harvest (Tables 8 and 9).

Fishery Objectives and Management

The Arctic grayling fisheries in the Tangle Lakes system fall under the *Tanana River Area Wild Arctic Grayling Management Plan* regional management approach and the background bag and possession limit that was instituted in 1975 for Arctic grayling in the Tanana River drainage (5 fish/day with no size limit and no closed seasons).

Current Issues and Fishery Outlook

In 2003, the BLM conveyed to the State of Alaska a 235,000-acre block (Denali Block 1) in the Tangle Lakes region, an area north of the Denali Highway between miles 12 and 41. 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 portion of the Delta River that is federally designated as a National Wild and Scenic River Corridor was excluded from the state's conveyance and will continue to be managed by BLM.

In 2008 and 2009, BLM and ADF&G coordinated and conducted a cooperative research project collecting baseline data on Arctic grayling abundance and distribution in the Upper Delta River. The abundance of Arctic grayling in the 10.5 mile (17 km) section of the Delta River that is designated as Wild and Scenic was estimated at 44,212 fish (SE = 9,108) ≥9.5 in (240 mm FL) and 23,152 fish (SE = 3,189) ≥10.5 in (270 mm FL). These densities are the greatest ever observed among published estimates for Alaskan Arctic grayling populations (Gryska 2011a).

Recent Board of Fisheries Actions

There have been no actions taken by the BOF with regards to the Tangle Lakes area Arctic grayling fishery since 2004 when the *Wild Arctic Grayling Management Plan* was adopted.

Other TRMA Arctic Grayling Fisheries

Background and Historical Perspective

Arctic grayling are popular with recreational anglers, are generally abundant, and occur in many TRMA rivers and streams besides the major fisheries previously detailed:

The **Chatanika River** is located approximately 30 miles north of Fairbanks and is accessible via both the Elliot and Steese Highways (Figure 3). The Chatanika River is a clear or lightly tannic-stained rapid-runoff stream, and it flows through valleys between summits and uplands for about 80% of its length before it enters Minto Flats. At that point the character of the river changes from one typical of rapid-runoff upland streams with pools, riffles, cutbanks and gravel bars, and a substrate consisting largely of gravel or broken rock; to a slower stream with an incised channel with high, fairly stable banks and a bottom substrate consisting primarily of sand and organic material. Mining activity dominated the Upper Chatanika River drainage during the first half of the 20th century. Today, recreational cabins are scattered along the river's length, with a few small mining claims still in operation.

In the upper river, anglers focus almost entirely on Arctic grayling; in the lower river, Arctic grayling, northern pike, burbot, sheefish, salmon, and whitefish are all targeted by anglers. Prior to 1992, the Chatanika River Arctic grayling bag and possession limit fell under the background regulations of 5 fish/day with no size limit. From 1992 to 2009 regulations allowed for a daily bag and possession limit of 5 fish, all $\geq$ 12 in (~305 mm) in length, and Arctic grayling could not be retained during the spawning closure from April 1 through May 31. In 2010, the regulations changed to allow retention year-round (no closed seasons) and no length limits on the 5-fish bag and possession limit.

Arctic grayling have been assessed intermittently in the Chatanika River since 1972 (Clark et al. 1991; Fish 1996; Fleming et al. 1992; Holmes 1983, 1985; Holmes et al. 1986; Ridder et al. 1993; Roach 1994, 1995; Tack 1973; Wuttig 2004; Wuttig and Gryska 2011). The Chatanika River is difficult to survey due to its length and shallow depth, so abundance has often been reported as a density index rather than a point estimate (Brase 2009c). In 1995 and 2002, researchers reported no immediate conservation problems for Chatanika River Arctic grayling, but stream productivity may be low (Fleming 1998; Wuttig 2004). Arctic grayling densities were lower in the upper river (between Perhaps and Sourdough creeks), and concerns were expressed about the potential for stock depletion in the upper river should fishing mortality increase. An extensive population assessment was performed in 2007, and it indicated a significant increase in the number of large Arctic grayling in the Chatanika River since the last assessment in 2002 (Table 11).

The **Nenana River** drainage is a turbid, glacier-fed tributary located approximately 45 miles south of Fairbanks. The lower portion of the drainage is accessible via the Parks Highway, and the upper portion of the drainage is accessible via the Denali Highway (Figure 3). Most angling effort occurs in the clearwater tributaries of the Nenana River, such as the Brushkana River, as well as Julius and Clear creeks. Recreational cabins are scattered throughout this area, and there is some sport fish guide activity in the area.

A radiotelemetry study performed in 2001–2002 demonstrated the importance of the Brushkana River as a spawning stream within the upper portion of the Nenana River drainage. Radiotagged Arctic grayling that spawned in the Brushkana River overwintered in the mainstem Nenana River or other large tributaries (Gryska 2006). As a result of this work, the Nenana River Arctic grayling stocks are considered 1 stock for management purposes.

The **Salcha River** (Figure 3) Arctic grayling fishery has supported increasing catch and consistent harvest over recent years and provides a substantial proportion of the harvest opportunity for Arctic grayling in the TRMA (Tables 8 and 9). The majority of the Arctic grayling fishing opportunity is accessible only by boat, and a high proportion of the effort is from property owners along the river and their visitors. Some sport fish guiding for Salcha River Arctic grayling also occurs.

Effort on this multi-species fishery may be affected by many factors, including the following: the strength of the king salmon run, high-water events that can make Arctic grayling fishing very difficult, low-water events that can limit boat access to fishing areas, weather, and timing of breakup and freeze-up (Table 1).

Prior to 1987, the Salcha River Arctic grayling bag and possession limit was 5 fish per day, 10 fish in possession, with no size limit and no seasonal closures. From 1987 through 2009, the Salcha River Arctic grayling regulations were a bag and possession limit of 5 fish $\geq$12 in (~305 mm) per day and Arctic grayling could not be kept during the spawning period (April 1–May 31). In 2010, the regulations were amended to allow retention year-round (no spawning closure) and no length limit.

The Salcha River Arctic grayling population was annually assessed from 1988 to 1994 and appeared to be stable or possibly increasing (Table 12; Clark and Ridder 1987b, 1988, 1990; Clark et al. 1991; Ridder et al. 1993; Roach 1994, 1995). It is difficult to make direct population comparisons from year to year because different sizes of study areas were assessed, sampling occurred at different times of year, and different size classes were available. The Salcha River Arctic grayling population was most recently assessed in 2004. The summer index population of 2,042 fish (SE = 434) $\geq$ 10.5 in (270 mm) in a 24-mile (39 km) reach of the river is similar to the 1994 index estimate of 2,767 fish $\geq$ 10.5 in (270 mm; Table 12; Gryska 2011b).

Other waters that support Arctic grayling sport fisheries include Fielding Lake, the Goodpaster River, the Tok River drainage, Shaw Creek and the Richardson Clearwater River. Access ranges from roadside fisheries to those accessible only by boat along major rivers to the mouth of the tributary. As with almost all Arctic grayling fisheries in the Tanana River drainage, these fisheries primarily take place during the open-water season.

Recent Fishery Performance

In terms of harvest and catch, the Chatanika River Arctic grayling fishery had remained relatively stable since 2003. In 2012, the harvest of 291 fish was below the 5-year average (2007–2011) of 610 fish (Table 9), and the catch of 4,855 fish was well below the 5-year average of 8,084 fish (Table 8). The Salcha River Arctic grayling fishery had a recent 5-year average (2007–2011) catch of 8,109 and harvest of 1,294 fish (Tables 8 and 9). The 2012 catch of 6,182 Arctic grayling on the Salcha River was below the 5-year average, as was the harvest of 709 fish.

Fishery Objectives and Management

In 2004, the BOF adopted the *Tanana River Area Wild Arctic Grayling Management Plan* (5 AAC 74.055) that directed ADF&G to manage Arctic grayling fisheries for long-term sustained yield while providing and/or maintaining fishery qualities that anglers desire. The *Wild Arctic Grayling Management Plan* has 3 management approaches: regional, conservative, and special. Each of these approaches have different ways of meeting the goals of sustained yield (reduce bag and possession limits, reduce fishing season, only allow catch-and-release, modify other methods and means).

With the exception of Five-Mile Clearwater (located on the south side of the Tanana River between Fairbanks and Delta Junction), Shaw Creek and its confluence with the Tanana River, the Tok River, and Piledriver Slough, the Arctic grayling fisheries in these other waters fall under the *Tanana River Area Wild Arctic Grayling Management Plan* regional management approach and the background bag and possession limit that was instituted in 1975 for Arctic grayling in the Tanana River drainage (5 fish/day with no size limit and no spawning closure).

Five-Mile Clearwater Creek and the Tok River are both in the *Tanana River Area Wild Arctic Grayling Management Plan* conservative management approach, with a bag and possession limit of 2 fish, only 1 of which may be over 12 in long (~305 mm; size limit in the Five-Mile Clearwater only). Piledriver Slough is managed under the conservative management approach and is open to catch-and-release fishing only.

The ADF&G 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 10.5 in (270 mm) fork length) in the assessed portion of the river in May."

Recent Board of Fisheries Actions

At the 2010 meeting, the BOF adopted several proposals specific to the Arctic grayling fisheries in the TRMA. A proposal was adopted that aligned the end dates for Arctic grayling spawning catch-and-release limitations in the *Tanana River Wild Arctic Grayling Management Plan* (May 30) with those dates in the specific area regulations (May 31). A second proposal was adopted that clarified the methods and means in the water bodies where there are either catch-and-release regulations or exceptions to the general bag and possession limits for Arctic grayling, and are under the conservative or special management approach of the *Tanana River Area Wild Arctic Grayling Management Plan*. The Piledriver Slough Arctic grayling fishery is managed under the special management approach to maintain current population characteristics or levels or rebuild the population to previous population characteristics or levels. The Five-Mile Clearwater Creek and Tok River are managed under the conservative management approach to maintain a high-quality Arctic grayling fishing experience (a higher percentage of large fish) or to provide additional conservation measures. Under either the conservative or special management approach of the management plan, it is appropriate to restrict gear to 1 single-hook artificial lure rather than allowing 2 single hooks or artificial flies per line. Shaw Creek is under the regional management approach, but this BOF action was applied to Shaw Creek because of its unique roadside situation and susceptibility to exploitation.

Finally, a proposal was adopted that brought several small Arctic grayling waters in the TRMA into compliance with the *Tanana River Area Wild Arctic Grayling Management Plan* regional management approach by removing spawning closures and length and gear restrictions. The action removed the Arctic grayling size restrictions on the Chatanika River, Salcha River, Richardson Clearwater River, Shaw Creek, and that portion of the Tanana River near the mouth of Shaw Creek. It also removed the Arctic grayling spawning restrictions on the Chatanika, Salcha, and Richardson Clearwater rivers but retained 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 streams.

Current or Recommended Research and Management Activities

Arctic grayling populations should be assessed through the SWHS and stock assessment (when feasible), and regulations should align with 1 of the 3 management approaches of the *Tanana River Area Wild Arctic Grayling Management Plan*.

NORTHERN PIKE

Minto Flats

Background and historic perspective

The Minto Flats wetlands complex is located about 35 miles west of Fairbanks between the communities of Nenana and Minto (Figure 6). It is an approximately 500,000-acre area of marsh and lakes, interconnected by numerous sloughs and rivers. Most of the area is included in the Minto Flats State Game Refuge, which was established by the Alaska Legislature in 1988 to ensure protection and enhancement of habitat, conservation of fish and wildlife, and continuation of public uses within the area. The Chatanika, Tolovana, and Tatalina rivers, as well as Washington, Goldstream, and numerous smaller creeks, flow into Minto Flats. These flowing waters come together as tributaries to the Tolovana River, itself a tributary to the Tanana River at its mouth at the southwestern end of Minto Flats. The waterways of Minto Flats are slow and meandering.

The Minto Lakes, a group of large interconnected, generally shallow, and heavily vegetated lakes in the eastern Minto Flats, are a popular northern pike fishing and waterfowl hunting area. In addition to those who use boats to access this area, there are both guiding services and private pilots that travel to the lakes in floatplanes. Guides and private individuals have cabins on some of the sparse areas of higher ground that are not regularly flooded. Minto Lakes are thought to support the majority of the northern pike sport fishery within the Tolovana River drainage, although the SWHS does not separate the lakes' harvest and catch data from the rest of Minto Flats.

Minto Lakes are a major northern pike spawning and summer feeding area. In winter, much of the flowing and standing water within Minto Flats becomes anoxic, forcing fish to move to waters of the Chatanika and Tolovana rivers or up tributary rivers to oxygenated areas. Partial winterkills are thought to be common and can be a confounding factor in attempts to predict fish population dynamics and assess angler impact. Northern pike are typically the only fish targeted by sport anglers in the Minto Flats area. These large piscivores are located throughout Minto Flats and can be readily taken on many types of lures.

The northern pike fishery of the Lower Chatanika River is included in this section because northern pike move between Minto Lakes and Chatanika River, and the lower 35 miles of the Chatanika River is within Minto Flats. Similarly, because effort, catch, and harvest estimates for the Tolovana River appear occasionally in the SWHS data, and because Minto Flats and all of its waters are within the Tolovana River drainage, general references in this section to the Minto Flats complex and/or Tolovana River drainage should be considered a summation of effort/harvest or catch of northern pike in the Tolovana River, Minto Flats, and the Lower Chatanika River drainage.

The Tolovana River drainage/Minto Flats complex northern pike population has supported a major proportion of the TRMA northern pike sport fishery for many years (Table 13). It was primarily a summer fishery until the mid-1980s, when an intensive sport fishery developed on concentrations of northern pike overwintering in the Chatanika River just upstream from the mouth of Goldstream Creek. A subsistence fishery for northern pike (and whitefish) occurs near the village of Minto and at historically used sites in the eastern portions of Minto Flats (Andrews 1988). Gillnets are used throughout the open-water period, and northern pike are taken through the ice with hook-and-line.

From 1984 to 1986, total harvest of northern pike from the Minto Flats complex doubled from 3,128 fish to 6,488 fish (Brase 2009c). It was believed, and later demonstrated by radiotelemetry studies (Roach 1998), that these fish were the spawning stock for the Minto Lakes. After 1987, regulations were implemented that closed sport fishing for northern pike at Minto Flats between October 15 and May 31, and the bag limit was reduced from 10 to 5 fish per day, only 1 of which may be ≥ 30 in long (~760 mm).

Estimated sport catch and harvest of northern pike in the Minto Flats complex peaked in 1994 with a harvest of 9,489 fish and a catch of 52,191 fish. Estimated sport harvest and catch continued to decline until 2001, when reported catches started to increase (Brase 2009b). A significant increase in the recent years' catch and harvest began in 2003, when harvest in the Minto Flats complex went from 650 fish to 1,284 fish (Table 13). Harvests stayed at that higher level through 2007, dropped in 2008, and have remained at a lower level since then.

Currently, Minto Flats is closed to sport fishing for northern pike from October 15–May 31; the bag and possession limit is 5 fish, only 1 of which may be ≥ 30 in long (~760 mm).

Northern pike population assessments have been performed in the Minto Lakes area every 3 to 5 years from 1987 through 2008 (Table 14). As a surrogate for abundance estimates of northern pike in the entire Minto Flats (200,000 ha), the department estimates abundance of northern pike in the Minto Lakes Study Area, which contains an estimated 15,000 acres of summer habitat for northern pike (Roach 1998). The 2008 estimate of 9,854 northern pike ≥ 400mm (~16 in) was significantly less than estimates from either 2003 or 1997 (25,227 and 16,546 fish, respectively; Table 14; Scanlon 2006; Roach 1998). Similar results were also observed for pike ≥ 600mm (~24 in), with the 2008 estimate of 2,092 fish being significantly smaller than the 2000 and 1997 estimates (5,331 and 3,251 fish, respectively; Scanlon 2001; Joy 2009).

Recent Fishery Performance

The 2012 catch of northern pike in the Minto Flats was 4,113 fish, which was lower than the recent 5-year average (2007–2011) of 6,147 fish (Table 13). In 2012, fishing effort in Minto Flats was below average, with an estimated 964 angler-days compared to the 5-year average of

1,870 days (Table 1). The majority of the effort at Minto Flats is probably directed toward northern pike, even though effort is not estimated by target species in the SWHS.

Although Minto Flats is closed to northern pike sport fishing from October 15 through May 31, a subsistence fishery occurs throughout the winter. To participate in any subsistence fishery, fishers need to be Alaska residents. Residents must acquire a Tolovana Subsistence Northern Pike Permit from ADF&G Division of Commercial Fisheries in Fairbanks. Subsistence fishers commonly harvest northern pike near the confluence of the Chatanika River and Goldstream Creek (Figure 6) late in the winter/early in the spring. The winter subsistence northern pike harvest has averaged 790 fish over the past 5 years (2007–2011) from an average number of 51 permit holders (Table 15).

Fishery Objectives and Management

The Minto Flats northern pike population is managed under the sport and subsistence Minto Flats Northern Pike Management plans (5 AAC 74.044 and 5 AAC 01.244), which stipulate that the maximum exploitation rate of northern pike by all users in the Lower Chatanika River and Minto Lakes/Goldstream Creek area may not exceed 20% of the northern pike population annually.

The sport fishing plan establishes the open season for the sport fishery from June 1 to October 14 and a bag and possession limit of 5 fish, only 1 of which may be ≥ 30 in (~750 mm). Additionally, if subsistence harvest in the Chatanika River drainage upstream of the confluence of the Chatanika River and Goldstream Creek is ≥ 750 northern pike from January 1 to the ice-free period, the sport bag and possession limit will be reduced by EO to 2 fish, of which only 1 may be ≥ 30 in (~750 mm) in the lakes and all flowing waters of Minto Flats for the remainder of the calendar year.

The subsistence management plan is slightly different:

1. Subsistence fishing for northern pike is open year-round; however, a permit is required (Alaska residents only);
2. Prior to 2010 there were no daily and/or annual limits; however, in 2010, the BOF established a 10-fish bag, 20-fish possession limit for the fishery that occurs in that portion of the Chatanika River upstream from its confluence with Goldstream Creek;
3. Gillnets may be used only April 15–October 14; and
4. A hook-and-line may be used only if fishing through the ice.

If subsistence harvest in the Chatanika River drainage upstream of the confluence of the Chatanika River and Goldstream Creek is greater than 1,500 northern pike from January 1 to the ice-free period, these waters will be closed by EO to fishing for northern pike through the ice.

Finally, both the sport and subsistence management plans for northern pike require use of single hooks in that portion of the Chatanika River drainage upstream of the confluence of the Chatanika River and Goldstream Creek, to the Fairbanks Nonsubsistence Area boundary (approximately 1 mi [~1.6 km] below the boat launch).

Current Issues and Fishery Outlook

Harvest of northern pike in the lakes and flowing waters of the Minto Flats area appears to be less than the maximum 20% exploitation rate specified in regulation. The 2002–2011 (10-year) average sport fish harvest of northern pike in the Minto Flats was 946 fish (Table 13), and the

2002–2011 (10-year) average subsistence harvest was 701 fish (Table 15); the total of these 2 harvest estimates is 1,646 northern pike. The 2008 abundance estimate in the Minto Flats index area was 9,854 northern pike larger than ~16 in (400 mm; Table 13); 20% of this abundance is 1,971 fish. Therefore, if sport and subsistence harvests continue to maintain current levels and the population of northern pike in Minto Flats does not decrease, there should be no need for restrictions to the sport fishery.

Recent Board of Fisheries Actions

In 2010, the BOF adopted a proposal that aligned the language in the subsistence and sport fish versions of the *Minto Flats Northern Pike Management Plan* (5 AAC 01.244 and 5 AAC 74.044). The description of the area used to estimate the exploitation rate of northern pike in the 2 versions of the plan was not the same, even though the intent of the plans were to include the same area and fish stocks. The adopted proposal aligned the description of the area for which the exploitation rate is calculated.

Current or Recommended Research and Management Activities

Performing a northern pike population estimate in the Minto Flats is a priority before the next BOF meeting to assess whether the population has rebounded from the low population estimated in 2008.

TRMA Lakes

Background and Historical Perspective

Northern pike sport fisheries occur in several lakes in the TRMA, including George, Volkmar, Deadman, Healy, and Mineral lakes. Of these lakes, George Lake has the largest amount of fishing effort and harvest. Hook-and-line is the predominant gear used to harvest northern pike, although spears are also used during the winter months. 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. Much of the effort directed towards northern pike in the TRMA is nonconsumptive fishing (catch-and-release). In 2012, only 12% of the total sport catch of northern pike in the Tanana River drainage was harvested (Table 13).

George Lake is a remote lake located about 35 miles southeast of Delta Junction and about 5 miles northeast of the Alaska Highway (Figure 2). The lake is large (4,500 acres) but shallow, with a maximum depth of only 35 feet (~10 m), and the majority of the shoreline is privately owned. The lake has 1 major inlet 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 and is seasonally accessible by boat, snowmachine, and airplane (equipped with floats or skis). During the open-water season, fishing pressure is believed to be highest 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 prevent snowmachine access. Year-to-year total fishing effort at George Lake can be variable due to poor snowmachine conditions (low snowfall and open water on the

Tanana) and difficult boat access (low creek levels). During the ice-fishing season, northern pike and burbot are taken by hook-and-line, as well as with spears. The department has annually issued between 1 to 6 ice house permits for George Lake since the early 1980s.

Based on recent population estimates, the northern pike population in George Lake appears healthy and current harvests sustainable. During the late 1980s and 1990s, George Lake supported a large population of relatively small northern pike (~20 in [510 mm]; (Clark et al 1988; Pearse and Hanson 1993). Recently, anglers and some members of the local Fish and Game AC have expressed satisfaction with their summer fishing experiences at George Lake because of good catch rates, particularly of larger-sized fish (e.g., > 24 in [~610 mm]).

Stock assessment conducted during 2006 indicated a higher proportion of larger fish in the population compared to 1987. In 1987, 48% of the northern pike population was estimated to be over 18 in (~450 mm; Clark et al. 1988). In 2006, 79% of the northern pike population was estimated to be ≥ 18 in (~450 mm; Wuttig and Reed 2010). In 2006, it was estimated that there were approximately 1,013 northern pike ≥ 30 in (~750 mm) or about 6% of the estimated population (Table 16). In 1987, only 3.4% of the population, or 300 fish, were estimated at 30 in (~750 mm) or more in length.

Volkmar Lake is remote but relatively close to Delta Junction and Fort Greely (Figure 2). 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 is thought to occur through 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. Northern pike stock assessment studies are done periodically for both George and Volkmar lakes (Table 16; Pearse and Hanson 1993; Pearse 1994; Scanlon 2001; Wuttig and Reed 2010).

In 1995, a record 1,263 angler-days occurred on Volkmar Lake, with a harvest of 1,084 pike (Parker 2009a). 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. At the 1997 BOF meeting, the BOF adopted a bag and possession limit of 1 fish, no size limit, as a conservation measure. It is thought that the large harvest in 1995 was responsible for the decline in population and harvests at that level were not sustainable (Parker 2009a).

In 2000, the estimated abundance of northern pike ≥ 18 in (~450 mm) in Volkmar Lake was 615 fish (Scanlon 2001). Angler effort and harvest were minimal after 1997, presumably due to the reduced bag and possession limit and angler perceptions of low northern pike abundance. In 2005, the population of northern pike > 450 mm (~18 in) had increased to 1,814 fish (Wuttig and Reed 2010), and in 2009 the population had increased to 4,017 fish (Table 16) (Wuttig 2010).

Recent Fishery Performance

The 5- and 10-year average catches and harvests of northern pike in both George and Volkmar lakes have remained very similar, although there is annual variability (Table 13). This annual variability can be attributed to ice conditions on the Tanana River crossings during the winter and the water-level fluctuations in George Creek during the summers. Both these lakes are almost exclusively northern pike fisheries; therefore, estimates of effort may be applied to these lakes more readily than for other multi-species fisheries.

Fishing effort in George Lake is highly variable, ranging from 249 to 1,645 angler-days in just the past 5 years (Table 1). The 2012 catch of 8,463 pike from George Lake was the highest recorded in the past 11 years and the highest catch in the entire Tanana drainage, whereas the harvest of 653 fish was above the 5-year average of 474 fish, but it was not as high as harvests in 2003, 2005, 2007, and 2010 (Table 13).

Since 2002, fishing effort on Volkmar Lake has averaged 163 angler-days per year (Table 1), and harvests of northern pike at Volkmar Lake ranged from 0 fish in 2007 to 127 in 2002 (Table 13). From 2007 to 2011, average harvest and catch of northern pike was 30 and 219 fish, respectively.

Fisheries Objectives and Management

George Lake

The management objective for George Lake is to maintain a population size greater than 9,200 northern pike $\geq$ 18 in (~450 mm) in size. An abundance less than this is the threshold at which a management action to restrict harvest would be taken by the department.

Volkmar Lake

The management objective for Volkmar Lake is to maintain a population of northern pike $\geq$ 18 in (~450 mm) of 2,000 fish or greater; although no formal abundance or exploitation-based management objective exists for Volkmar Lake, this was selected as the population size at which any regulatory change would be considered to increase harvest.

Current Issues and Fishery Outlook

George Lake

There are occasional reports of George Lake experiencing isolated winter and/or summer fish kills. In the late winter/early spring of 2012, fishermen complained of a large algal bloom. Department staff took oxygen readings at several points around the lake, and even though there were dead algae floating in the water, the oxygen levels were sufficient for fish survival. The algae probably lead to decreased catch rates because of poor underwater visibility for the northern pike. There were also reports of dead fish in the shallows in the early summer of 2013; however, those reports were never confirmed.

Recent Board of Fisheries Actions

In January 2010, the BOF adopted a proposal that increased the bag and possession limit in Volkmar Lake from 1 fish (no size limit) to 2 fish, of which only 1 can be over 30 in (~750 mm) in length. The BOF also adopted a proposal that reduced the spring spawning closure for northern pike in Volkmar and George lakes by 20 days. This change aligned the open season for all the lakes in the TRMA, with the exception of the Tolovana drainage and Harding Lake, to June 1–April 20.

Current or Recommended Research and Management Activities

Northern pike populations should continue to be monitored in George and Volkmar lakes to assess possible fisheries impacts from the recent regulation changes.

Other TRMA Northern Pike Fisheries

Harding Lake is located about 45 road miles southeast of Fairbanks along the Richardson Highway and is the largest roadside lake north of the Alaska Range (Figure 3). Northern pike were a high-profile game fish in Harding Lake because they were readily caught and their preference for shallow water habitats made them highly vulnerable to anglers. In 2000, northern pike fishing at Harding Lake was closed due to low abundance; for details about the closure and habitat rehabilitation efforts, see Brase (2009c).

Northern pike are common in many smaller lakes and in sloughs and tributaries of the Tanana River, and small harvests are reported annually from many locations throughout the TRMA. The Lower Chena, Zitziana, and Salcha rivers; Piledriver Slough; and gravel pits in south Fairbanks and on Eielson Air Force Base are examples of the types of areas that produce northern pike for anglers. Other fisheries occur in lakes in the Kantishna River drainage (such as East Twin and Mucha lakes) and in clear boat-accessible sloughs, backwaters, and small tributaries off of the Tanana River. Other lakes in the Upper Tanana River drainage with northern pike populations are Sand, "T," Mansfield, Dog, Island, Tetlin, Takomahto, Jatahmund, Island, and American Wellesley lakes.

Northern pike colonize suitable gravel pits and other ponds when the river floods into them and the pits become connected to the river, or when people illegally introduce northern pike into those waters. Many of these areas are road-accessible and rarely produce large numbers of fish or many large fish. It is not presently possible to develop a direct estimate of effort because of the mixed-stock fisheries of which these northern pike fisheries are a part.

Angler interest in road-accessible northern pike fisheries is high. However, the nature of the northern pike as a piscivore that takes the hook readily, but requires many years to grow to the larger sizes valued by anglers, makes it difficult to manage northern pike fisheries in roadside situations.

Studies on abundance and age and sex composition were conducted in East Twin Lake in 1993 (Pearse 1994) and Deadman Lake in 1994 (Hansen and Pearse 1995). In both cases, populations were judged to be healthy and capable of sustaining existing harvest levels. A radiotelemetry study done in 1993 and 1994 in the Chena River suggested that adult northern pike in that river move little during the year (Pearse 1994).

Providing harvest opportunity at sustainable levels is an overriding management responsibility. However, in roadside ponds stocked with salmonids, such as rainbow trout, and where northern pike have been illegally introduced, maximum harvest rate (in excess of sustainability) is beneficial to the put-and-take fishery for stocked species.

ADF&G will continue to monitor these small northern pike fisheries through the SWHS and assess trends that may indicate a fishery is getting higher use and may, therefore, warrant further research and/or management activities.

In January 2013, the BOF adopted a proposal that increased the northern pike sport fishing season to year-round in all lakes of the TRMA, *except* Harding, Little Harding, George, and Volkmar lakes; and all the lakes of the Tolovana River drainage (Minto Flats).

BURBOT

Tanana River

Background and Historical Perspective

The Tanana River is the second largest tributary of the Yukon River; it is approximately 570 miles long and is highly turbid in the summer due to glacial runoff. The largest Tanana River mainstem sport fishery, based on harvest, is the burbot fishery. Burbot are the only freshwater members of the cod family (*Gadidae*), and they are unique among freshwater fishes in the fact that they are active and spawn in the coldest part of winter when most other fish are generally inactive.

Burbot are commonly caught through the ice using set lines where up to a total of 15 hooks may be used. In flowing waters of the Tanana River drainage, the bag and possession limit for burbot is 15 fish, no size limit. Burbot stocks in the Tanana River are harvested most heavily near population centers such as Fairbanks, North Pole, and Nenana.

Population assessments were conducted annually from the late 1980s through 1998 in the Lower Chena River and the Tanana River near Fairbanks, and they showed a population that was stable and possibly increasing (Table 17; Evenson 1988, 1994, 1997; Stuby and Evenson 1999). Radiotelemetry studies on burbot have also been conducted. Extensive movements and exchange of burbot within the Tanana River drainage tends to minimize effects of concentrated local fishing effort, and overall, stocks in the Tanana River appear to be lightly exploited (Evenson 1997).

Although most of the effort in the Tanana River fishery is probably directed toward burbot, it can be difficult to make inferences about burbot fisheries because the SWHS bases its estimates on calendar years, which divide the winter fishery into 2 segments, and assigns the first portion to the end of 1 year and the second portion to the beginning of the next. Anglers fish for burbot all winter. Casual observations indicate that effort increases as the ice becomes safer for surface travel in November. Effort declines in late December and then climbs again after mid-January. This decline coincides with the darkest, coldest time of the year and with the general timing of burbot spawning in the rivers.

Prior to 1988 there was no bag and possession limit for burbot if taken by hook-and-line. There was a limit of 10 fish per day if the fish were taken by spear or bow and arrow. In 1988, the current bag and possession limits of 15 fish in flowing waters and 5 fish in lakes were adopted.

Recent Fishery Performance

The estimated catch and harvest of burbot in the TRMA varies from year to year within a range of about 1,000 to 5,000 fish. The recent 5-year average total harvest of 1,953 burbot is 62% of the total catch of 3,132 fish (Table 18), which is a higher retention rate than any other fish species in the Tanana River drainage, indicating the consumptive value of this fishery to Interior Alaska residents. The Middle Tanana River and the Lower Chena River fisheries provide most of the catch and harvest in the TRMA. These fisheries are on the same stock of burbot, which could be characterized as a "Middle Tanana" stock.

Fishery Objectives and Management

There are no specific management plans or fishery objectives in place for Tanana River burbot.

Current Issues and Fishery Outlook

Residents of Fairbanks typically target specific winter fishery locations near the mouth of the Chena River and nearby, on the Tanana River. These targeted areas may be experiencing some localized depletion of the larger Middle Tanana River stock.

Recent Board of Fisheries Actions

There have been no recent actions taken by the BOF with regards to the Tanana River burbot fishery.

Current or Recommended Research and Management Activities

Exploitation rates of burbot in the Upper Tanana River drainage are not considered excessive; however, 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 1991b). Subsistence fisheries for burbot are known to occur in the Upper Tanana River drainage, but harvests in these fisheries may be underreported because subsistence permits for non-salmon species are not required throughout the area. Current estimates of stock status or of total harvest for the Upper Tanana River drainage are unavailable. However, because this part of the river showed low relative abundance of burbot compared to other river sections and may have seasonally intense effort and harvest, there is concern for local depletion.

ADF&G will continue to monitor these small burbot fisheries through the SWHS and assess trends that may indicate a fishery is getting higher use and may therefore warrant further research and/or management activities.

Tanana River Drainage Lakes

Background and Historical Perspective

Burbot also inhabit deep lakes of the TRMA and may colonize suitable ponds and gravel pits when flooded by nearby rivers. Sport fishing for burbot occurs year-round, but the majority of the effort in the TRMA appears to occur in the fall and winter. Closely-attended fishing lines are most commonly used when fishing for burbot in lakes.

Although current exploitation rates of burbot in TRMA lakes are not considered excessive, studies suggest there is low burbot abundance in most of the easily accessible lakes examined within the Tanana River drainage. Population density of burbot in many lakes declined dramatically in the early 1980s due to unsustainable rates of sport fishing exploitation. Stock assessment studies conducted in lakes of the Tanana River drainage have demonstrated the detrimental effects of long-term high exploitation rates on stocks (Lafferty et al. 1992).

Before restrictive regulations were put into effect, burbot fishing in TRMA lakes occurred primarily in Fielding Lake and the Tangle Lakes system (Parker 2009a). 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 1987, bag limits in these lakes were reduced from 5 to 2 fish and the use of setlines was prohibited, due to concerns of overharvest. In 1994, the department issued an EO to close the Fielding Lake burbot fishery until further notice.

In 1999, the Fielding Lake burbot population was estimated to be 598 fish (TL > 18 in [~450 mm]); in 2000 it had increased to 759 fish (Parker 2001). Because of these increases, the Fielding Lake burbot fishery was reopened in 2001 with a bag and possession limit of 1 fish per day. Harvest in Fielding Lake was not reported immediately after the fishery reopened, but 11 fish were harvested in 2003, with an increase to 67 fish in 2012 (Table 18). The reduced bag limit appears to be sustainable because the most recent abundance in 2008 was 894 burbot (Parker 2013).

The burbot bag and possession limit in all lakes of the TRMA (except Harding, Fielding, and T lakes; and the Tangle Lakes system) is 5 fish per day.

Recent Fishery Performance

In 2012, no burbot were reported harvested in the Tangle Lakes system, but 67 were harvested from Fielding Lake, and 217 burbot were harvested from George Lake (Table 18).

Fishery Objectives and Management

Statistical simulations of the Fielding Lake burbot population suggest that a 10% exploitation rate can be sustained on an optimum population size of about 1,000 burbot (>18 in [~450 mm]). Therefore, the management objectives for the Fielding Lake burbot fishery are to 1) maintain a population size of 1,000 burbot > 18 in in size (~450 mm) and 2) ensure that the harvest-plus-hooking mortality of released burbot is less than 10% of the population size.

Current Issues and Fishery Outlook

The Fielding Lake burbot population can currently sustain a total fishing mortality of about 90 fish. In the past 5 years, anglers have reported harvesting from 0 to 67 burbot in Fielding Lake (Table 18). This number is unlikely to substantially increase, because opportunity to harvest burbot is now limited due to the bait prohibition adopted by the BOF in 2007 to protect the lake trout population.

Recent Board of Fisheries Actions

There have been no recent actions taken by the BOF with regards to the TRMA burbot fisheries that occur in lakes.

Current or Recommended Research and Management Activities

Levels of harvest in small, high elevation lakes such as Fielding Lake and the Tangle Lakes system are thought to be sustainable, and if harvests should reach 100 fish per year, effects on the population should be investigated. The number of burbot annually harvested from Fielding and the Tangle lakes is obtained from the SWHS. These numbers will continue to be monitored. If the annual harvest exceeds 100 fish in each population, further restrictions may be required.

WHITEFISH

Chatanika River

Background and Historical Perspective

The Chatanika River supports a large spawning population of whitefish (primarily humpback and least cisco). During late summer and fall, humpback whitefish and least cisco migrate up the Chatanika River to spawn in the middle section of the river between Hard Luck Creek and a few miles upstream of the Elliot Highway Bridge. They then move downriver to as yet undefined

overwintering areas. It is quite possible that some of the overwintering areas are outside of the Minto Flats complex. Fleming (1999) described the potential compound life history of the stocks, which might include long migrations in the Tanana and Yukon rivers. During the course of northern pike research, humpback whitefish and least cisco have been observed moving into the Minto Lakes immediately after breakup, where they feed during the summer before moving upriver to spawning areas.

Historically, the only major sport fishery for whitefish in the TRMA was the spear fishery on the Chatanika River in the vicinity of the Elliot Highway Bridge. This fishery traditionally took place in September, while least cisco and humpback whitefish were migrating upstream to spawn. Both of these species were harvested, as were a small percentage of round whitefish. The fishery became very popular during the 1980s, and harvests had increased to 25,000 fish by 1987 (Brase 2009b).

This fishery had no bag limit until 1988, when a 15-fish bag limit was implemented. Harvest decreased in 1988 after the bag limit was imposed but increased again in 1989. The decline in humpback whitefish abundance from 41,211 fish in 1988 to 17,322 fish in 1989 (Table 19; Hallberg 1989; Timmons 1990), combined with harvest estimates that were considered unsustainable, prompted the department to close the fishery by EO in October 1990 and again in September 1991 (Brase 2009c). In 1992, the BOF adopted an ADF&G proposal to limit the fishery to the month of September and to limit the area where the fishery took place to downstream of a point 1 mile (~1.6 km) above the Elliot Highway Bridge. During 1992, ADF&G also adopted an in-house Chatanika River whitefish management plan that set threshold abundance levels required to allow harvest. The threshold abundance level for humpback whitefish was 10,000 spawners, and the threshold abundance level for least cisco was 40,000 spawners.

Stock assessments done in 1992 and 1993 (Table 19; Fleming 1993, 1994) indicated abundance levels above the threshold levels in the management plan. However, harvest rates in those years were very low and attributed to poor weather conditions that reduced fishing success during the peak of migration (Burr et al. 1998).

Stock assessment during 1994 (Fleming 1996) indicated that the abundance of least cisco was below the management plan threshold allowing harvest; therefore, the fishery was closed by EO in September 1994. The fishery remained closed by EO through 2001, when the BOF prohibited the use of spears in the Chatanika River whitefish sport fishery by regulation.

In 2007, the BOF added spears as a legal gear type in the personal use whitefish fishery. Separate permits, specific to the Chatanika River, were designed that designated the dates, fishing area, and household limits for this fishery. In that first year, the department issued 100 household permits with a household limit of 10 whitefish. After 2007, because of high demand for permits, the low number of participants, and the low level of harvest (Brase and Baker 2012; Table 20), the number of issued permits was doubled to 200.

Recent Fishery Performance

When the BOF prohibited the use of spears in the sport fishery, it reduced the bag and possession limit to 5 whitefish for hook-and-line gear and prohibited the retention of least cisco. There is little participation in this sport fishery due to the difficulty in catching whitefish by hook-and-line.

Alaska residents holding a sport fishing license may obtain a *Personal Use Whitefish and Sucker Permit* (5 AAC 77.190) that allows them to harvest whitefish with dip nets, fyke nets, beach seines, or fish wheels in the Fairbanks Nonsubsistence Area (5 AAC 99.015(a)(4)). Permits for this fishery are available at the ADF&G office in Fairbanks.

In general the results from the personal use spear fishery seem to indicate increasing participation and success (Table 20). This may be due to people improving their spearing technique and finding a good location to harvest whitefish. Preliminary results from 2013 indicate higher-than-average harvest rates (Table 20), which may have been caused by the unusually warm weather experienced in October. In 2011, lower success rates may have been due to unusually high water throughout the spearing season.

Fishery Objectives and Management

An unpublished *Chatanika River Personal Use Whitefish Spear Fishery Management Plan* was developed in 2007. This plan outlines a history of the Chatanika River whitefish fishery and the fishery's current management objectives.

The draft management objectives are as follows:

1) To maintain an orderly fishery that produces a sustainable harvest; and

2) To stay within these permit guidelines:

- Permits will be issued starting in mid-August;
- Permits will be only issued to Alaska residents who hold a sport fish license, and only 1 permit will be issued per household;
- Permits will be issued from the Fairbanks ADF&G office;
- Permits must be filled out and returned after fishing is complete or October 31;
- If a permit is not returned, the permittee may not be eligible to receive another the following year;
- Permit will specify fishery area and fishery dates; and
- Maximum total fishery harvest level of 1,000 whitefish (any species).

Current Issues and Fishery Outlook

Overall there appears to be satisfaction from the participants in the personal use spear fishery. They report enjoying the opportunity to participate in the fishery and are satisfied with the 10-fish household limit. In 2009 and 2010, the total numbers of permits were issued in 3 days or less, and since 2011, all 200 permits have been issued in less than 5 hours each year, an indication of the popularity of the spear fishery.

Anglers interested in spearing whitefish are encouraged to look for other stocks that might provide opportunity for fall spear fishing. Because of ongoing interest, it is possible that new spear fisheries may emerge on small stocks of whitefish in some of the clearwater tributaries of the Tanana River, and reported harvest levels should be watched in future years, especially from those streams that are easily accessible. To date there has been little success at developing spear fisheries on other stocks.

Recent Board of Fisheries Actions

At the 2010 meeting, the BOF adopted an ADF&G proposal that repealed the exceptions to the general sport bag and possession limits and seasonal closures for whitefish in the Chatanika River. There was not a conservation concern in opening the hook-and-line sport fishery for whitefish year-round, because whitefish are difficult to catch using hook-and-line gear compared to personal use gear (spear). This change reduced the complexity of the regulations for the Chatanika River as the sport fishing regulations for whitefish reverted back to the areawide season (year-round) and bag and possession limits (15 fish).

Current or Recommended Research and Management Activities

In 2008, separate abundance estimates were obtained for Chatanika River populations of least cisco and humpback whitefish (Table 19; Wuttig 2009). The humpback whitefish estimate was 22,490 fish (SE = 2,777); the estimate of least cisco was 15,870 fish 10 in or more in length (≥ 250mm; SE = 1,429). These results suggest that the humpback whitefish population is at or slightly above the historical average, whereas the least cisco population remains below the historical average. The lack of recovery in the least cisco population indicates that continued conservative management of the Chatanika River personal use whitefish spear fishery is prudent.

In 2012, the estimated abundance of humpback whitefish was 12,755 fish (Table 18). The abundance of humpback whitefish was within the range of most previous estimates. The proportion of the whitefish population composed of large fish (≥ 440 mm FL [~18 in]) increased from 60% (2008) to 72%. Correspondingly, few smaller-sized fish (i.e., 360-439 mm FL [~15-18 in]) were present in the sample, indicating short-term recruitment may be relatively small in subsequent years (Gryska, *In prep*)

LAKE TROUT

Background and Historical Perspective

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

Lakes containing wild lake trout in the TRMA include Harding, Fielding, Two Bit, Landmark Gap, Glacier, Sevenmile, and the Tangle lakes system. The bag and possession limit for wild lake trout in most areas of the TRMA is 2 fish with no size limit; exceptions are the Tangle Lakes system (bag and possession limit of 1 fish with no size limit), Fielding Lake (bag and possession limit of 1 fish, and the fish must be ≥ 26 in in length [~660 mm]), and Harding Lake (bag and possession limit of 1 fish, and the fish must be ≥ 30 in in length [~760 mm]).

The lake trout population in Harding Lake is unique in that although it was originally stocked, it now has a naturally reproducing lake trout population. Between 1981 and 1984 a total of 16 individuals ranging in age from 2 to 11 years old were captured during lake surveys. This was the first solid evidence that the Harding Lake stocked lake trout were reproducing (Doxey 1985). In 1998, artificial spawning substrate was placed in Harding Lake to enhance lake trout

spawning habitat (Viavant 1996). Fish were observed to be using the substrate, although it is unclear what the success rate has been. For more details about the history of lake trout in Harding Lake see Brase (2009c).

Prior to 2001, lake trout were stocked in various lakes throughout the TRMA. Stocked lakes that may still contain lake trout in the TRMA include Craig, Four Mile, Fourteen Mile, Moose, Crystal #1, Kenna, Lost, Rapids, Coal Mine #5, Paul's Pond, Chet, Ghost, Nickel, and North Twin lakes. Lake trout have not been stocked in the TRMA since 2001, although the Fairbanks experimental hatchery did produce and stock a small number of lake trout into North Twin Lake in 2009.

Recent Fishery Performance

In 2012, there was a harvest of 319 lake trout in the TRMA (Table 20). The Tangle Lakes system has consistently produced the highest wild lake trout harvest in the TRMA. In 2012, the number of lake trout harvested from this system was 161 fish with a catch of 1,286 fish (Table 21). The 2012 lake trout harvest in the Tangle Lakes system was below the recent 5-year average harvest of 388 fish.

Fishery Objectives and Management

In 2007, the BOF adopted the *Tanana River Area 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 *Tanana River Area Wild Lake Trout Management Plan* provides criteria for the BOF, public, and department to address in future proposals directed toward lake trout fisheries. The lake area model (LA model) is the primary tool for determining whether fishing mortality estimated by the SWHS for specific lakes is likely sustainable. The LA model estimates yield potential of lake trout from a water body using lake surface area as a surrogate for available habitat volume, and regulatory actions will be introduced when harvests combined with an estimated 10% hooking mortality of the released fish have exceeded the yield potential for 2 consecutive years.

Harding Lake is managed under the special management categories of both the *Tanana River Area Stocked Waters Management Plan* (5 AAC 74.065) and the *Tanana River Area Wild Lake Trout Management Plan* (5 AAC 74.040).

Current Issues and Fishery Outlook

The Harding Lake annual lake trout yield estimate from the LA model is 90 fish with a 30-inch minimum size (~760 mm; John Burr, ADF&G, Sport Fish Biologist, Fairbanks, personal communication). Since this 30-inch minimum size regulation was changed in 2007, catch and harvest of lake trout has decreased, indicating that this regulation change may be resulting in a sustainable lake trout fishery in Harding Lake.

In the Tangle Lakes system, average harvest from 2007–2011 was 388 lake trout (Table 21). A 10% hooking mortality of the catch that is released (catch less harvest) is combined with harvest to determine total mortality. Catch over the past 5 years has averaged 1,833 fish. When the harvest of 388 fish is combined with the 10% hooking mortality of 145 fish, a total estimated fishing mortality of lake trout from the Tangle lakes system is 533 fish per year. The sustainable yield for the Tangle Lakes system is 731 lake trout per year based on the LA model (Burr 2006).

The sustainable yield for Fielding Lake is about 78 lake trout (for fish over 26 in [~660 mm]) per year based upon the LA model (Burr 2006). From 2007 to 2011, the harvest of lake trout from Fielding Lake averaged 23 fish per year (Table 21). Catch of lake trout averaged 265 fish from 2007 to 2011. The estimated harvest combined with estimated hooking mortality of 24 fish gives annual average total fishing mortality of 47 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 have probably resulted in total lake trout fishing mortality exceeding the estimated sustained yield.

Recent Board of Fisheries Actions

There have been no proposals adopted regarding lake trout in the TRMA since 2007.

Current or Recommended Research and Management Activities

A multiyear mark-recapture population study was initiated in 2010 for lake trout in Fielding Lake (Schwanke, *In prep*). Abundance was estimated to be 299 (SE=25; 95% CI = 250–347) mature male lake trout (approximately 20 in and greater). Information gathered from this study suggest that the prior estimate of 193 (SE = 35; 95% CI = 124–262) mature male lake trout from 1999 (Parker et al. 2001) was biased low.

STOCKED WATERS

Background and Historical Perspective

The program of stocking hatchery-produced fish to augment angling opportunity in Alaska began in 1952 when lakes along the road system near Fairbanks were stocked with rainbow trout and coho salmon. The first sport fish hatchery in Alaska (then the Territory of Alaska) was constructed at Birch Lake in 1952 and remained in operation until the 1960s. Subsequently hatcheries at Fire Lake, Ft. Richardson, Elmendorf AFB, Clear Air Force Station, and other locations have supplied fish to TRMA waters.

Some initial stocking events were “bucket-biology” experiments where fish were simply transported from 1 lake to another, often without good documentation. Stocking Alaska's waterways has changed over the years, and now there are restrictive policies in place that outline criteria determining where fish can be stocked, what species may be stocked, and what brood source can be used. In addition, all potential brood source and hatchery-raised fish must undergo pathology testing to ensure they are disease-free before being used as broodstock or outstocked into any water bodies.

At present, over 90 lakes may be stocked in the TRMA. They range in size from Harding Lake, at about 2,500 acres, to small urban ponds less than 1 acre in surface area. Piledriver Slough is the only stream that has been stocked with (sterile) rainbow trout; however, this practice ended in 2010. These stocked waters offer a range of fishing opportunities, including neighborhood urban ponds, large and small roadside lakes, remote lakes that are only trail-accessible and sometimes only in winter, and a few remote lakes only accessible by airplane. They function within the spectrum of fisheries management to provide diverse angling opportunities, shift pressure from wild stocks, and provide harvest alternatives. Diversity also provides an opportunity for winter fishing.

A variety of fish may be currently stocked in the TRMA, including rainbow trout, Arctic grayling, Arctic char, king, and coho salmon. These fish are produced at state hatcheries and

then transported by truck to Fairbanks and/or Delta Junction area lakes in the early summer and late fall. Occasionally, lakes are stocked in the winter.

Fish have been stocked at 4 sizes: 1) fingerling (2 grams, ~3 in); 2) subcatchables (20–60 grams, ~ 5 in); 3) catchables (100–200 grams, ~9-10 in); and 4) surplus broodstock (up to 1,500 grams, ~15 in). Size-at-stocking depends on management needs at a particular stocking location, lake characteristics (e.g., productivity, prone to winterkill), and hatchery production capability. For example, catchables are stocked in roadside and urban ponds because frequent angler use exceeds the pond's ability to sustain the fishery with fingerling stockings. Conversely, fingerlings are stocked into remote lakes because those lakes have the ability to meet the lower demand, and it is too expensive to transport larger fish with aircraft.

Recent Fishery Performance

Fishing the stocked waters of the TRMA is very popular because the bag and possession limits are typically very liberal (10 fish, only 1 fish 18 in or larger [~460 mm]) and most of the lakes/ponds are easily accessible. Approximately 56% of the recent 5-year average annual TRMA sport harvest comes from stocked lakes in the area, although catch of stocked species has been in a general decline since 2002, likely a result of reduced hatchery production (Table 22).

Fishery Objectives and Management

In 2004, the BOF adopted the *Tanana River Area Stocked Waters Management Plan* (5 AAC 74.065) into regulation. This plan defines how the department should meet public demand for diverse fishing opportunities. The plan defines 3 management approaches: regional, conservative, and special. Special management lakes are managed to produce larger fish, although anglers may have a lower probability of catching those fish. The only lake in the TRMA that is currently in the special management category is Harding Lake. Dune, Koole, and Rainbow lakes are managed under the conservative management approach. All remaining lakes in the TRMA fall under the regional management approach.

The Region III general stocking plan, a component of the Statewide Stocking Plan, is annually updated by stocked waters staff. The stocking plan is a comprehensive list of species, life stage, stocking frequencies, and maximum numbers of fish that can be stocked for all lakes in the stocking program. The projected numbers of fish to be stocked annually for a 5-year period are also listed in this report. The Statewide Stocking Plan, including the Region III stocking component, may be accessed electronically via the department's website.

Current Issues and Fishery Outlook

In 2013, there were several winter and summer fish kills in the TRMA, likely due to the extended winter season (there was still ice on many Interior lakes in early June) and then the extreme speed at which the lakes did warm up once the ice went out (this did not occur in 2012, which was a more typical winter and spring breakup). Quartz Lake was the highest-profile lake that winter-killed. ADF&G biologists performed surveys in October and captured no fish that had been stocked prior to 2013, so the department believes the lake had a total die-off. It will take several years for Quartz Lake to recover to the high densities of fish seen prior to the winter-kill event, providing future winterkills do not occur.

The new William Jack Hernandez (Anchorage) and Ruth Burnett (Fairbanks) Sport Fish hatcheries are currently in operation and began producing catchable-sized fish in 2012. Once

these hatcheries have the funds to become fully operational, the biomass of fish stocked in the TRMA is predicted to double.

A major issue in the TRMA is a lack of public access to many small ponds/gravel pits in the Fairbanks area. Without guaranteed public access, the department is unable to stock a water body; therefore, an opportunity is lost for small neighborhood fisheries to develop.

Recent Board of Fisheries Actions

At the 2013 BOF meeting, the BOF moved several lakes into different management categories within the *Tanana River Area Stocked Waters Management Plan*: Rainbow Lake was moved from the special to the conservative management category; and Little Harding, Summit, Monte, and Donnelly lakes were moved from the special to the regional management category. After Little Harding was moved to the regional management category, it was removed from the stocked waters list and closed to northern pike fishing. Subsequently, Summit Lake was dropped from the stocked waters program due to lack of public access.

At both the 2013 and 2010 meetings, the BOF adopted the updated stocked waters list.

Current or Recommended Research and Management Activities

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 survival of rainbow trout fingerlings from August through June appears to be much lower. For this reason, the department is now stocking subcatchable rainbow trout into Quartz Lake. This problem with survival can be averted if stocking of fingerlings can occur earlier in the summer when water temperatures are cooler.

The ongoing strategy is to stock species most suited to a particular lake's physical characteristics at a size to account for lake productivity and harvest pressure and to minimize transport costs. Rainbow trout and Arctic grayling do well in most lakes in the TRMA 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 are long-lived and can grow to a large size, which makes them attractive to anglers. In some lakes, more than 1 species is stocked to provide diversity and to take advantage of different seasonal behavior. The most popular combination is rainbow trout and coho salmon.

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TABLES AND FIGURES

Table 1.–Estimates of effort (angler-days) for select areas of the Tanana River drainage, 2002–2012.

	Year											5-year Average	10-year Average
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2007–2011	2002–2011
Chena River Total	18,869	21,828	31,485	17,491	13,372	24,026	14,802	16,804	15,408	10,401	8,296	16,288	18,449
Upper Chena	6,243	7,374	11,320	8,773	4,257	9,507	5,688	6,017	8,007	3,921	4,047	6,628	7,111
Lower Chena [a]	12,626	14,454	20,165	8,718	9,115	14,519	9,114	10,787	7,401	6,480	4,249	9,660	11,338
Piledriver Slough	4,246	2,317	2,546	1,079	1,293	1,519	1,900	4,695	2,338	1,768	1,585	2,444	2,370
Chatanika River Total	3,844	4,223	5,487	4,605	3,947	5,312	3,558	3,526	4,137	3,401	6,200	3,987	4,204
Upper Chatanika	1,907	1,834	2,917	2,711	2,520	2,352	1,966	1,897	2,438	1,796	3,199	2,090	2,234
Lower Chatanika [a]	1,937	2,389	2,570	1,894	1,427	2,960	1,592	1,629	1,699	1,605	3,001	1,897	1,970
Salcha River	5,954	5,032	4,859	4,851	4,866	5,656	3,394	6,124	6,567	2,821	3,264	4,912	5,012
Minto Flats	2,349	2,023	1,892	3,124	2,416	2,595	887	2,984	1,424	1,460	964	1,870	2,115
Nenana Drainage [b]	2,061	1,834	1,801	2,086	1,296	979	1,721	2,699	2,401	5,947	6,550	2,749	2,283
Delta Clearwater River	4,580	6,006	3,357	4,507	4,850	5,149	2,248	5,018	4,193	5,048	3,870	4,331	4,496
Tangle Lakes Drainage above Wildhorse Creek	4,994	5,820	3,737	4,299	3,600	5,463	3,443	4,065	7,050	4,478	4,402	4,900	4,695
George Lake	700	716	377	1,939	601	705	526	1,645	1,256	249	1,553	876	871
Fielding Lake	826	840	1,010	1,248	1,065	1,139	1,203	788	1,548	422	1,163	1,020	1,009
Volkmar Lake	372	313	193	44	139	57	145	134	184	50	143	114	163
Goodpaster River	912	925	612	1,402	892	1,305	823	1,949	1,132	993	879	1,240	1,095
Stocked Lakes Total	49,508	41,897	51,606	35,001	32,693	37,303	34,091	38,870	43,513	24,776	25,885	35,711	38,926
Quartz Lake	9,795	7,169	7,852	5,696	6,281	5,522	4,860	6,905	8,214	4,532	3,988	6,007	6,683
Coal Mine Road Lakes	1,023	425	481	102	507	503	971	586	872	929	152	772	640
Harding Lake [c]	2,094	2,246	2,675	1,118	1,913	749	1,504	1,068	2,336	1,540	1,309	1,439	1,724
Other Stocked Lakes	36,596	32,057	40,598	28,085	23,992	30,529	26,756	30,311	32,091	17,775	20,435	27,492	29,879
Other Tanana	9,247	6,160	7,524	11,722	8,647	9,748	3,594	3,196	5,708	5,564	4,937	5,562	7,111
Total Tanana	108,462	99,934	116,486	93,398	79,677	100,956	72,335	92,497	96,859	67,378	69,691	86,005	92,798

Source: Jennings et al. 2006a–b, 2009a-b, 2010a-b, 2011a-b, *In prep*; Romberg et al. *In prep.*

[a] Includes unspecified reaches.

[b] Includes Brushkana Creek.

[c] Harding Lake was closed to northern pike fishing in the summer of 2000.

Table 2.–Number of fish harvested and caught by recreational anglers fishing in the Tanana River drainage (includes stocked waters), 2002–2012.

	Year	King Salmon	Chum Salmon	Coho Salmon	Landlocked Salmon	Rainbow Trout	Dolly Varden / Arctic Char	Lake Trout	Arctic Grayling	Northern Pike	Burbot	Sheefish	Whitefish	Other Species
Harvest														
	2002	478	307	541	17,693	38,562	6,645	709	12,987	3,436	4,009	92	1,086	251
	2003	2,153	63	1,317	6,680	26,292	4,854	860	10,084	2,947	2,561	59	167	18
	2004	1,319	98	716	8,459	25,554	4,111	646	6,773	4,895	3,446	177	1,485	239
	2005	483	144	267	3,056	17,829	2,752	1,082	10,061	4,624	2,487	129	114	168
	2006	638	315	629	2,499	16,998	1,818	791	5,982	3,276	1,903	53	252	94
	2007	549	41	339	4,289	17,841	2,038	648	6,739	3,900	3,623	37	656	17
	2008	254	61	170	5,352	10,576	2,990	506	8,122	1,381	1,227	83	227	0
	2009	836	71	115	2,540	10,053	2,733	1,193	8,134	3,016	1,879	23	96	0
	2010	313	62	369	2,832	11,056	1,965	1,086	8,298	2,652	2,010	0	1,300	106
	2011	372	77	284	1,227	7,663	1,189	443	5,179	1,209	1,024	16	641	24
	2012	114	63	84	800	6,069	539	319	4,971	2,300	1,128	7	369	84
	5-year Average 2007–2011	465	62	255	3,248	11,438	2,183	775	7,294	2,432	1,953	32	584	29
	10-year Average 2002–2011	740	124	475	5,463	18,242	3,110	796	8,236	3,134	2,417	67	602	92
Catch														
	2002	3,227	1,109	5,694	47,019	108,597	15,147	4,816	177,070	25,146	4,869	98	1,597	278
	2003	7,000	1,791	15,377	19,880	80,447	13,224	3,595	144,505	26,591	3,332	415	1,018	994
	2004	6,339	1,196	5,796	23,785	73,299	14,855	3,816	142,373	36,710	4,591	518	1,831	732
	2005	1,633	1,372	2,844	11,972	46,646	7,904	5,164	128,377	33,900	3,226	454	682	537
	2006	2,619	1,445	5,230	7,102	50,484	9,980	3,678	93,276	18,866	3,296	73	969	135
	2007	2,463	305	3,343	13,450	53,861	7,147	2,523	149,388	31,577	5,427	37	1,181	82
	2008	915	636	1,739	9,593	41,522	7,172	2,000	116,973	10,330	1,590	195	1,418	0
	2009	2,632	526	4,330	8,795	42,664	6,161	4,526	146,575	18,881	4,256	38	1,539	43
	2010	1,859	158	3,679	7,276	49,225	5,800	5,034	122,898	20,076	3,164	300	1,760	268
	2011	1,432	620	3,761	2,980	35,547	4,806	2,296	87,411	13,672	1,224	158	1,023	47
	2012	1,142	411	2,623	5,189	31,385	3,731	1,773	91,019	19,524	1,299	36	523	84
	5-year Average 2007–2011	1,860	449	3,370	8,419	44,564	6,217	3,276	124,649	18,907	3,132	146	1,384	88
	10-year Average 2002–2011	3,012	916	5,179	15,185	58,229	9,220	3,745	130,885	23,575	3,498	229	1,302	312

Source: Jennings et al. 2006a–b, 2009a-b, 2010a-b, 2011a-b, *In prep*; Romberg et al. *In prep*.

Table 3.–Abundance estimates and methods of estimation for king salmon in the Chena, Salcha, Chatanika, and Goodpaster rivers, 2002–2013.

	Chena		Salcha		Chatanika		Goodpaster	
Year	Abundance	Method	Abundance	Method	Abundance	Method	Abundance	Method
2002	6,967	M-R[a]	4,644 [b]	Tower	719	Tower	1,440	Helicopter
2003	8,739[c]	Tower	11,758 [d]	Tower	1,008	Tower	3,004	Helicopter
2004	9,645	Tower	15,761	Tower	2,444	Tower	3,673	Tower
2005	no estimate [e]	Tower	5,988	Tower	no estimate [e]	Tower	1,184	Tower
2006	2,936	Tower	10,400	Tower	ND	ND	2,479	Tower
2007	3,564	Tower	5,631 [b]	Tower	ND	ND	1,581	Tower
2008	3,212	Tower	5,300 [b]	Tower	ND	ND	1,880	Tower
2009	5,253	Tower	12,788	Tower	ND	ND	4,280	Tower
2010	2,382	Tower	6,135	Tower	ND	ND	1,125	Tower
2011[f]	no estimate [c]	Tower	7,200	Tower +Aerial	ND	ND	1,325	Tower
2012[f]	2,220	Tower	7,165	Tower	ND	ND	778	Tower
2013	1,859	Tower	5,465	Tower	ND	ND	723	Tower
BEG Range	2,800–5,700		3,300–6,500		No escapement goal		No escapement goal	
10-year Average 2003–2012	4,745		8,821				2,131	
5-year Average 2008–2012	3,267		7,718				1,878	

Source: Brase 2012; Brase and Doxey 2006; Doxey 2004; Doxey et al. 2005; Savereide 2012a-b; Stuby 2000 and 2001.

[a] M-R = Mark-recapture experiment.
[b] Should be considered a minimum count due to high- and/or turbid-water conditions.
[c] 11,100 king salmon when expanded for noncounting days.
[d] 15,500 king salmon when expanded for noncounting days.
[e] No estimates were produced due to extreme high-water events throughout the run. Chena River king salmon escapement was probably within the BEG range.
[f] Preliminary results.

Table 4.–Sport harvest of king, coho, and chum salmon in the Tanana River drainage, 2002–2012.

	Year											5-year average	10-year average
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2007–2011	2002–2011
King Salmon													
Chena River	178	976	762	57	265	78	150	413	32	84	38	151	300
Salcha River	269	1,127	481	351	317	471	74	397	143	256	76	268	389
Chatanika River	0	13	37	0	0	0	30	0	16	0	0	9	10
Goodpaster River[a]	ND	ND	ND	ND	ND	0	0	0	0	0	0	0	0
Other Tanana	31	37	39	75	56	0	0	26	122	32	0	36	42
Total Tanana Drainage	478	2,153	1,319	483	638	549	254	836	313	372	114	465	740
Coho Salmon													
Nenana River drainage	24	11	78	0	37	0	86	10	160	0	27	51	41
Delta Clearwater River	517	1,272	511	267	580	311	65	105	209	284	57	195	412
Other Tanana	0	34	127	0	12	28	19	0	0	0	0	9	22
Total Tanana Drainage	541	1,317	716	267	629	339	170	115	369	284	84	255	475
Chum Salmon													
Chena River	167	0	28	32	118	0	15	0	50	77	0	28	49
Minto Flats	117	0	0	32	130	0	0	53	0	0	0	11	33
Salcha River	23	25	14	64	15	32	46	0	12	0	0	18	23
Delta Clearwater River	0	0	0	0	52	0	0	0	0	0	0	0	5
Other Tanana	0	38	56	16	0	9	0	18	0	0	63	5	14
Total Tanana Drainage	307	63	98	144	315	41	61	71	62	77	63	62	119

Source: Jennings et al. 2006a–b, 2009a-b, 2010a-b, 2011a-b, *In prep*; Romberg et al. *In prep*.

ND = No data.

[a] Prior to 2007, the Goodpaster River was closed to salmon fishing. In 2007, the Goodpaster River was open to catch-and-release only.

Table 5.–Sport catch of king, coho, and chum salmon in the Tanana River drainage, 2002–2012.

	Year											5-year Average	10-year Average
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2007–2011	2002–2011
King Salmon													
Chena River	1,920	3,012	4,571	503	1,208	824	530	1,506	515	599	245	795	1,519
Salcha River	1,157	3,752	1,514	582	747	1,575	299	982	1,108	769	682	947	1,249
Chatanika River	86	13	168	12	0	0	86	0	16	32	215	27	41
Goodpaster River[a]	ND	ND	ND	ND	ND	0	0	104	0	0	0	21	21
Other Tanana	55	223	86	536	568	64	0	40	220	32	0	71	182
Total Tanana Drainage	3,227	7,000	6,339	1,633	2,619	2,463	915	2,632	1,859	1,432	1,142	1,860	3,012
Coho Salmon													
Nenana River drainage	98	461	1,046	0	97	15	298	19	410	0	212	148	244
Delta Clearwater River	5,311	14,665	4,061	2,640	4,864	3,210	475	4,311	3,214	3,761	2,316	2,994	4,651
Other Tanana	285	251	689	204	269	118	966	0	55	0	95	228	284
Total Tanana Drainage	5,694	15,377	5,796	2,844	5,230	3,343	1,739	4,330	3,679	3,761	2,623	3,370	5,179
Chum Salmon													
Chena River	779	189	505	398	292	26	185	101	50	551	118	183	308
Minto Flats	117	25	28	95	130	0	0	70	0	0	0	14	47
Salcha River	38	1,047	355	82	166	165	46	35	24	44	42	63	200
Delta Clearwater River	23	50	42	0	533	105	0	0	11	14	0	26	78
Other Tanana	152	480	266	797	324	9	405	320	73	11	251	164	284
Total Tanana Drainage	1,109	1,791	1,196	1,372	1,445	305	636	526	158	620	411	614	916

Source: Jennings et al. 2006a–b, 2009a-b, 2010a-b, 2011a-b, *In prep*; Romberg et al. *In prep*.

ND = No data.

[a] Prior to 2007, the Goodpaster River was closed to salmon fishing. In 2007, the Goodpaster River was open to catch-and-release for king salmon only.

Table 6.–Coho salmon escapement estimates from the Tanana River drainage, 2003–2013.

Surveyed Stream	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	5-year Average 2008–2012	10-year Average 2003–2012
Delta Clearwater River	102,800	37,550	31,175	15,950	14,650	7,500	16,850	5,867	6,180	5,230	6,222	8,325	24,375
Richardson Clearwater River	6,232	8,626	2,024	271	553	265	155	1,002	575	515	647	502	2,022
Nenana River													
Lost Slough	85	220	430	194	ND	1,342	410	1,110	ND	ND	721[a]	954	542
Teklanika River	658	450	325[b]	160[b]	ND	1,539[c]	ND	280	ND	0	225	140	347
Otter Creek	4,535	3,370	3,890	1,916	ND	1,652	680	720	ND	ND	425	1,017	2,395
Julius Creek	1	280	280	0	ND	0	2	0	ND	ND	0	1	80
*Wood Creek	3,055	840	1,030	634	ND	578	470	340	ND	0	55	347	868
*Clear Creek	884	140[d]	35[d]	972	ND	292	0[e]	130	ND	0	2	141	456
*Glacier Creek	62[d]	90[d]	70[d]	14[d]	ND	0[e]	0[e]	0[e]	ND	0	30	0	0
Lignite Creek	67	91	378	168	ND	343	113	234	ND	ND	1	230	199
June Creek	74[c]	85[c]	201[c]	66[c]	ND	42[c]	18	ND	ND	ND	ND	18	18

Source: U.S./Canada Yukon River Panel Joint Technical Committee (JTC 2012); C. Stark, biologist, BSFA, Fairbanks, personal communication.
ND = No data.

[a] Incomplete; section surveyed was Julius creek to a mile downstream of Anderson.
[b] Silty; poor visibility.
[c] Incomplete survey (access to private property issue).
[d] Numerous beaver dams; stream out of bank in places; fair visibility.
[e] Beaver dam blocking stream mouth.
* Tributaries to Julius Creek.

Table 7.–Estimated abundance of Arctic grayling by size and by river section of the Chena River, 1985–1998, 2005.

	Lower River (below RM 45)				Upper River (RM 45–90)					
	Stock size		Quality size		Stock size		Quality size			
Year	150–269 mm (~6-10.5 in)	(SE)	≥270mm (~10.5 in)	(SE)	150–269 mm (~6-10.5 in)	(SE)	≥270mm (~10.5 in)	(SE)	Total Abundance[a]	(SE)
1985	ND		ND		ND		ND		112,391	ND
1986	ND		ND		ND		ND		61,581	(26,987)
1987	ND		ND		ND		ND		31,502	(3,500)
1988	ND		ND		ND		ND		22,204	(2,092)
1989	ND		ND		ND		ND		19,028	(1,542)
1990	ND		ND		ND		ND		31,815	(4,880)
1991	5,100	(561)	1,426	(188)	14,513	(2,328)	5,717	(846)	26,756	(2,547)
1992	9,394	(1,108)	1,921	(338)	13,495	(1,570)	4,538	(647)	29,348	(2,055)
1993	10,514	(1,492)	1,533	(311)	20,694	(3,627)	6,877	(1,486)	39,618	(4,289)
1994	14,200	(1,085)	2,335	(274)	21,239	(3,350)	6,601	(1,228)	44,375	(2,647)
1995	14,150	(1,450)	2,059	(294)	21,660	(3,209)	7,276	(1,292)	45,145	(3,852)
1996	11,863	(962)	2,780	(245)	15,611	(2,970)	11,209	(1,229)	41,463	(3,363)
1997[b]	10,205	(2,348)	2,044	(374)	ND	ND	9,458	(1,688)	≥21,707[c]	(2,916)
1998[b]	7,212	(1,520)	1,804	(427)	6,028	(1,161)	12,519	(2,051)	27,563	(2,459)
2005	5,541	—[d]	2,190	(268)	14,764	—[d]	5,203	(543)	27,698	(3,661)
Management Objectives			2,200				8,500			

Source: Clark 1989, 1990, 1991, 1993, 1994, 1995, 1996; Clark and Ridder 1987a, 1988; Holmes et al. 1986; Ridder 1998b, 1999; Ridder and Fleming 1997; Wuttig and Stroka 2007.

[a] Total abundance is for fish ≥ 150 mm (~6 in) FL unless otherwise indicated.

[b] One boat used to fish the upper section.

[c] Abundance estimate does not include fish 150 to 239 mm (~6-10 in) FL for the upper section.

[d] In 2005 standard errors were not calculated for Arctic grayling 150–269mm (~6-10.5 in).

Table 8.–Sport catch of Arctic grayling in the Tanana River drainage, 2002–2012.

	Year											5-year Average	10-year Average
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2007-2011	2002-2011
Chatanika River Total	15,313	13,178	8,729	9,326	7,885	10,394	11,229	6,990	4,659	7,150	4,855	8,084	9,485
Upper Chatanika	10,065	7241	5,771	6,394	5,861	6,642	9,243	2,253	3,428	4,210	2,958	5,155	6,120
Lower Chatanika	5,248	5,937	2,958	2,932	2,024	3,752	1,986	4,737	1,231	2,940	1,897	2,929	3,365
Nenana River Total	7,113	4,425	6,197	9,284	2,110	3,120	10,159	9,494	8,679	12,543	8,987	8,799	7,312
Nenana River (excluding Brushkana)	2,387	2,488	3,367	4,487	833	2,081	2,789	5,157	1,977	3,908	998	3,182	2,947
Brushkana Creek	4,726	1,937	2,830	4,797	1,277	1,039	7,370	4,337	2,574	3,674	1,236	3,799	3,456
Chena River Total	44,508	36,098	55,376	31,026	26,322	45,673	28,909	26,316	27,067	15,579	18,776	28,709	33,687
Upper Chena	21,488	20,667	34,710	20,367	15,485	31,366	20,315	14,356	18,274	9,820	13,722	18,826	20,685
Lower Chena	23,020	15,431	20,666	10,659	10,837	14,307	8,594	11,960	8,793	5,759	5,054	9,883	13,003
Piledriver Slough	8,199	6,037	4,789	3,962	2,972	3,316	5,030	5,295	6,717	3,475	2,291	4,767	4,979
Salcha River	7,532	6,756	7,355	6,525	2,391	11,759	4,531	14,811	5,670	3,775	6,182	8,109	7,111
Goodpaster River	1,346	1,499	1,735	2,464	1,467	2,947	3,116	3,417	1,574	1,444	1,274	2,500	2,101
Delta Clearwater River	12,913	17,576	14,212	19,922	12,542	22,112	8,912	20,714	12,081	9,758	11,063	14,715	15,074
Fielding Lake	2,932	1,989	2,802	4,437	952	5,199	4,589	3,605	14,095	424	2,445	5,582	4,102
Tangle Lakes	25,768	23,931	15,007	18,695	11,103	32,491	20,166	30,536	27,682	18,653	19,281	25,906	22,403
Other Tanana	32,663	15,722	15,768	11,749	15,290	7,160	12,104	14,814	7,769	7,273	8,042	9,824	14,031
Total Tanana	158,287	127,211	131,970	117,390	83,034	144,171	108,745	135,992	115,993	80,074	83,196	116,995	122,138

Source: Jennings et al. 2006a–b, 2009a-b, 2010a-b, 2011a-b, *In prep*; Romberg et al. *In prep*.

Table 9.–Sport harvest of Arctic grayling in the Tanana River drainage, 2002-2012.

	Year											5-year Average	10-year Average
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2007-2011	2002-2011
Chatanika River Total	1,357	955	583	607	644	461	989	208	774	616	291	610	719
Upper Chatanika	694	303	311	424	514	231	518	105	491	496	89	368	409
Lower Chatanika	663	652	272	183	130	230	471	103	283	120	202	241	311
Nenana River Total	982	697	716	2,268	464	577	928	468	538	756	1,022	653	839
Nenana River (excluding Brushkana)	306	455	156	1,619	245	440	587	203	120	473	298	365	460
Brushkana River	676	242	560	649	219	137	341	265	418	283	194	289	379
Chena River Total	0	0	0	0	0	0	0	0	0	0	0	0	0
Upper Chena	0	0	0	0	0	0	0	0	0	0	0	0	0
Lower Chena	0	0	0	0	0	0	0	0	0	0	0	0	0
Piledriver Slough	32	0	0	0	0	0	0	211	0	0	0	42	24
Salcha River	1,287	1,225	1,501	806	703	1,365	576	2,165	1,556	806	709	1,294	1,199
Goodpaster River	229	56	176	617	212	676	528	640	443	71	202	472	365
Delta Clearwater River	51	0	111	140	85	172	214	0	14	0	86	80	79
Fielding Lake	587	351	491	623	56	636	738	33	585	70	460	412	417
Tangle Lakes	2,686	2,438	1,251	1,825	1,181	1,131	1,897	2,125	2,656	2,031	1,245	1,968	1,922
Other Tanana	3,815	2,541	1,640	2,353	1,548	1,223	1,655	1,993	899	563	563	1,267	1,823
Total Tanana	11,026	8,263	6,469	9,239	4,893	6,241	7,525	7,843	7,465	4,913	4,578	6,797	7,388

Source: Jennings et al. 2006a–b, 2009a-b, 2010a-b, 2011a-b, *In prep*; Romberg et al. *In prep.*

Table 10.–Estimated abundance of Arctic grayling ≥ 240 mm FL in a 14-mile (23 km) long index section of the Delta Clearwater River, 1996–2000, 2006.

Year	Abundance	SE
1996	3,000	370
1997	7,420	920
1998	5,570	780
1999	6,977	401
2000	7,991	940
2006[a]	14,799	2,204

Source: Gryska 2001; Ridder 1998a, 1999; Ridder and Gryska 2000; Wuttig and Gryska 2010.

[a] The 2006 estimate is for Arctic grayling ≥ 270 mm FL.

Table 11.–Abundance of select size classes of Arctic grayling in an ~18-mile (29.6 km) section of the Chatanika River from ~2 mi (3.2 km) above the Elliott Hwy Bridge downstream to the mouth of Any Creek, 1995, 2002, 2007.

Year	Capture Method	>250 mm	SE	>270mm	SE	>330 mm	SE
1995	electrofishing	–	–	3,027	–	267	–
2002	hook & line	–	–	205	36	124	–
2007	electrofishing	–	–	2,132	526	407	172
	hook & line	1,026	190	–	–	363	82

Source: Fish 1996; Wuttig 2004; Wuttig and Gryska 2011.

Table 12.–Abundance estimates of Arctic grayling (N) for the Lower Salcha River (bridge to river mile 25 [~40 km]) during mid-to-late June, 1988–1994, 2004.

Year	N (SE)	Size (mm FL)	Date	N (SE) [a]	Size (mm FL)
1988[b]	2,181 (542)	≥150	May 24–June 8	1,182	≥270
1989	6,935 (766)	≥150	June 12–20	2,081	≥270
1990	5,792 (659)	≥150	June 19–27	1,564	≥270
1991	4,182 (907)	≥200	June 18–July 2	1,756	≥270
1992	7,076 (2,555)	≥200	June 15–25	2,235	≥270
1993	15,950 (2,442)	≥150	June 7–17	3,031	≥270
1994	14,562 (1,762)	≥150	June 13–30	2,767	≥270
2004	–	–	June 29–July 15	2,042 (434)	≥270

Source: Clark et al. 1991; Clark and Ridder 1987b, 1988, 1990; Gryska 2011b; Ridder et al. 1993; Roach 1994, 1995.

[a] Standard errors (SE) for fish $\geq$ 270mm could not be calculated for the 1988–1994 estimates (Roach 1995).

[b] Sample section in 1988 was ~10 mi (16 km) long.

Table 13.–Sport harvest and catch of northern pike in the Tanana River drainage, 2002–2012.

	Year											5-year Average	10-year Average
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2007–2011	2002–2011
Harvest													
Minto Flats	483	1,260	1,199	1,880	935	1,712	258	765	569	396	303	740	946
Minto Flats complex [a]	650	1,284	1,390	2,052	1,204	1,809	386	873	609	422	412	820	1,068
George Lake	223	738	149	853	217	776	264	567	681	82	653	474	455
Healy Lake	39	0	45	0	9	0	0	88	0	0	0	18	18
Deadman Lake	35	0	76	24	42	0	72	13	0	0	23	17	26
Volkmar Lake	127	24	30	12	55	0	51	26	59	16	31	30	40
Mineral Lake (into Station Creek)	0	57	0	177	41	45	0	170	168	0	0	77	66
Other Tanana	2,362	844	3,205	1,506	1,708	1,270	608	1,279	1,135	689	1,181	996	1,461
Total Tanana Harvest	3,436	2,947	4,895	4,624	3,276	3,900	1,381	3,016	2,652	1,209	2,300	2,432	3,134
Catch													
Minto Flats	8,806	8,706	19,205	14,839	7,284	11,346	2,926	6,623	6,477	3,362	4,113	6,147	8,957
Minto Flats complex[a]	10,085	12,997	21,159	16,768	8,447	14,077	3,988	7,915	8,088	3,911	4,481	7,589	10,740
George Lake	2,149	4,097	2,723	4,484	2,958	6,889	1,442	3,152	4,010	1,574	8,463	3,413	3,348
Healy Lake	255	449	151	0	27	0	0	704	0	0	0	141	159
Deadman Lake	571	546	754	1,091	179	345	180	707	0	0	1,570	246	437
Volkmar Lake	304	339	603	280	186	174	51	244	381	244	188	219	281
Mineral Lake (into Station Creek)	666	244	0	977	122	465	0	440	309	0	0	243	322
Other Tanana	11,116	6,919	11,320	10,300	6,947	9,627	4,669	5,719	7,288	7,943	4,822	7,056	8,188
Total Tanana Catch	25,146	25,591	36,710	33,900	18,866	31,577	10,330	18,881	20,076	13,672	19,524	18,907	23,475

Source: Jennings et al. 2006a–b, 2009a-b, 2010a-b, 2011a-b, *In prep*; Romberg et al. *In prep*.

[a] Includes Minto Flats, Tolovana River, and the Lower Chatanika River.

Table 14.–Estimated northern pike abundance in the Minto Lakes Study Area, 1987–1988, 1990–1991, 1996–1997, 2000, 2003, and 2008.

	≥ 400mm (~16 in)		≥ 525 mm (~20 in)		≥ 600mm (~24 in)	
Year	Abundance	SE	Abundance	SE	Abundance	SE
1987	–	–	11,257	3,075	–	–
1988	–	–	13,233	3,143	–	–
1990	–	–	27,418	6,800	–	–
1991	–	–	17,633	5,480	–	–
1996	23,850	7,799	20,695	6,765	7,616	883
1997	16,547	1,754	14,639	1,552	3,251	174
2000	–	–	–	–	5,331	1,152
2003	25,227	4,529	13,900	2,918	7,683	2,347
2008	9,854	1,701	–	–	2,092	448

Source: Burkholder 1989, 1990; Hansen and Burkholder 1992; Joy 2009; Roach 1997, 1998; Scanlon 2001, 2006.

SE = standard error.

Table 15.–Number of subsistence permits issued, returned, and reported fished, and total subsistence harvest of northern pike in the Tolovana River drainage, 1995–2013.

Year	Permits			Total Harvest
	Issued	Returned	Fished	
1995	55	52	20	1,023
1996	70	61	24	1,616
1997	86	73	40	1,333
1998	69	65	32	431
1999	54	50	24	400
2000	34	29	13	352
2001	49	43	19	214
2002	32	31	13	521
2003	119	105	57	966
2004	98	90	42	393
2005	79	69	31	386
2006	101	97	56	788
2007	118	109	54	1,837
2008	146	136	79	1,339
2009	113	108	51	560
2010	96	90	42	115
2011	70	69	27	100
2012	73	68	35	525
2013	67	65	45	231
5-Year Average 2007–2011	109	102	51	790
10-Year Average [a] 2002–2011	97	90	45	701

Source: ADF&G, Commercial Fisheries Division, Fairbanks, unpublished data.

[a] These years are used to compare and summarize with the SWHS estimates.

Table 16.–Estimates of abundance of northern pike >18 in (~450 mm) in George and Volkmar lakes, 1985–2009.

	Volkmar Lake		George Lake	
Year	Abundance	SE	Abundance	SE
1985	4,020	250	No Survey	
1986	4,028	587	No Survey	
1987	4,230	634	8,495	1,086
1988	2,196	148	15,117	4,086
1989	1,115	179	12,354	1,473
1990	2,019	349	8,107	892
1991	2,509	289	10,939	959
1992	2,542	369	7,001	540
1993	No Survey		No Survey	
1994	No Survey		No Survey	
1995	No Survey		No Survey	
1996	No Survey		No Survey	
1997	No Survey		No Survey	
1998	No Survey		No Survey	
1999	No Survey		No Survey	
2000	615	161	No Survey	
2001	No Survey		No Survey	
2002	No Survey		No Survey	
2003	No Survey		No Survey	
2004	No Survey		No Survey	
2005	1,814	449	No Survey	
2006	No Survey		16,204	3,293
2007	No Survey		No Survey	
2008	No Survey		No Survey	
2009	4,017	307	No Survey	

Source: Timmons and Pearse 1989; Clark and Gregory 1988; Clark et al. 1988; Pearse 1990; Pearse 1991; Pearse and Burkholder 1993; Pearse 1994; Hansen and Pearse 1995; Scanlon 2001; Wuttig and Reed 2010; Wuttig 2010.

SE = standard error.

Table 17.–Catch-age estimates of total and exploitable abundances, with coefficients of variation (CV), of Tanana River burbot, 1987–1998.

Year	Total Abundance [a]	CV	Total Exploitable Abundance [b]	CV
1987	281,255	0.155	77,877	0.168
1988	262,542	0.161	74,591	0.167
1989	242,706	0.170	73,246	0.163
1990	226,347	0.175	70,345	0.162
1991	198,666	0.178	67,714	0.164
1992	157,388	0.177	62,774	0.163
1993	153,969	0.206	56,227	0.173
1994	148,921	0.239	48,976	0.179
1995	176,044	0.308	43,420	0.194
1996	273,975	0.430	41,514	0.213
1997	402,186	0.489	52,168	0.244
1998	578,153	0.563	69,024	0.282

Source: Evenson 1988, 1994; Stuby and Evenson 1999.

[a] Total abundance is defined as the number of fish at large prior to harvest, without consideration of the gear selectivity adjustment.

[b] Total exploitable abundance is the number of fish that are potentially vulnerable to the fishery (a portion of 5-, 6-, 7-, and 8-year-old fish plus all fish 9 years or older).

Table 18.–Sport harvest and catch of burbot in the Tanana River drainage, 2002–2012.

	Year											5-year Average	10-year Average
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2007–2011	2002–2011
Harvest													
Lower Tanana River and tributaries	13	87	160	149	140	90	365	0	0	0	50	91	100
Middle Tanana River and tributaries	1,895	1,001	1,594	1,685	698	1,636	519	361	968	450	406	787	1,081
Chena River	58	487	1,433	248	311	960	202	262	125	26	84	315	411
Salcha River	77	0	0	9	0	60	0	361	110	0	0	106	62
Upper Tanana River and tributaries	199	749	119	136	225	495	0	658	82	0	243	247	266
Fielding Lake	0	11	30	25	51	0	0	0	0	0	67	0	12
Tangle Lakes	22	9	0	0	0	12	17	0	37	0	0	13	10
George Lake	0	47	0	149	76	0	17	52	220	12	217	60	57
Other Tanana	1,745	170	110	86	402	370	107	185	468	536	61	333	418
Total Tanana Harvest	4,009	2,561	3,446	2,487	1,903	3,623	1,227	1,879	2,010	1,024	1,128	1,953	2,417
Catch													
Lower Tanana River and tributaries	26	87	218	335	149	180	365	0	0	6	50	110	137
Middle Tanana River and tributaries	2,397	1,500	2,087	1,872	1,541	1,735	777	465	1,548	632	456	1,031	1,455
Chena River	83	573	1,977	310	539	1,290	227	287	157	38	84	400	548
Salcha River	77	0	0	9	0	60	0	361	110	0	0	106	62
Upper Tanana River and tributaries	268	860	129	211	354	1,695	0	2,859	330	0	340	977	671
Fielding Lake	0	11	30	50	89	0	0	34	0	0	67	7	21
Tangle Lakes	22	19	0	34	0	54	17	0	37	0	0	22	18
George Lake	0	47	0	248	76	0	84	52	220	12	217	74	74
Other Tanana	1,996	235	150	157	548	413	120	198	762	536	85	406	512
Total Tanana Catch	4,869	3,332	4,591	3,226	3,296	5,427	1,590	4,256	3,164	1,224	1,299	3,132	3,498

Source: Jennings et al. 2006a–b, 2009a-b, 2010a-b, 2011a-b, *In prep*; Romberg et al. *In prep.*

Table 19.–Humpback whitefish and least cisco abundance estimates from the Chatanika River, 1988–1997, 2008, and 2012.

Year	Humpback Whitefish	Least Cisco
1988	41,211 (SE = 5,155)	ND
1989	17,322 (SE = 1,655)	53,409 (SE = 5,110)
1990	No Survey	
1991[a]	15,313 (SE = 2,078)	135,065 (SE = 24,513)
1992	19,187 (SE = 1,617)	75,035 (SE = 8,555)
1993	13,112 (SE = 1,096)	46,562 (SE = 5,971)
1994	12,700 (SE = 1,138)	27,639 (SE = 3,211)
1995	No Survey	
1996	No Survey	
1997	16,107 (SE = 1,260)	22,811 (SE = 4,496)
1998–2007	No Survey	
2008	22,490 (SE = 2,777)	15,345 (SE = 1,350)[b]
2012	12,755 (SE = 1,405)	No Survey

Source: Fleming 1993, 1994, 1996, 1997; Hallberg 1989; Timmons 1990, 1991; Wuttig 2009.

[a] Estimates are for humpback whitefish > 359 mm FL (~14 in), and least cisco > 289 mm FL (~11 in).

[b] Estimates for least cisco $\geq$ 250 mm FL (~10 in).

Table 20.–Chatanika River personal use whitefish spear fishery permit results, 2007–2013.

Year	Permits		Number of Households that Fished	Whitefish Species				Total Whitefish Harvest	Average Harvest/ Permit
	Issued	Returned		Least Cisco	Humpback	Round	Unknown		
2007	100	97	52	47	158	9	53	267	5.13
2008	200	191	92	53	367	37	65	522	5.67
2009	200	194	124	104	501	77	68	750	6.05
2010	200	198	141	103	657	94	100	954	6.77
2011	200	196	129	172	284	66	22	583	4.52
2012	200	198	123	318	372	136	41	867	7.05
2013	200	199	153	324	495	139	147	1,105	7.22

Table 21.–Sport harvest and catch of wild lake trout in the Tanana River drainage, 2002–2012.

	Year											5-year Average	10-year Average
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2007-2011	2002-2011
Harvest													
Harding Lake	48	41	72	48	171	28	23	0	192	28	32	54	65
Fielding Lake	0	83	101	112	108	40	7	18	48	2	64	23	52
Tangle Lakes	414	505	270	224	272	383	232	333	657	337	161	388	363
Other Tanana	247	231	203	698	240	197	244	842	51	76	62	282	303
Total Tanana Harvest	709	860	646	1,082	791	648	506	1,193	948	443	319	748	783
Catch													
Harding Lake	597	518	479	707	1,140	263	104	303	845	255	79	354	521
Fielding Lake	137	423	520	862	634	227	226	552	309	12	299	265	390
Tangle Lakes	2,464	1,631	976	2,327	895	1,890	1,119	1,559	3,317	1,278	1,286	1,833	1,746
Other Tanana	1,618	1,023	1,841	1,268	1,009	143	551	2,112	220	91	109	623	988
Total Tanana Catch	4,816	3,595	3,816	5,164	3,678	2,523	2,000	4,526	4,691	1,636	1,773	3,075	3,645

Source: Jennings et al. 2006a–b, 2009a-b, 2010a-b, 2011a-b, *In prep*; Romberg et al. *In prep.*

Table 22.–Contribution of stocked fish to the Tanana River drainage total harvest and catch, 2002– 2012.

	Year											5-year Average	10-year Average
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2007–2011	2002–2011
Effort													
Effort on Stocked Waters	49,508	41,897	51,606	35,001	32,693	37,303	34,091	38,870	43,513	24,776	25,885	35,711	38,926
Total TRMA Effort	108,617	99,934	116,486	93,398	79,677	100,956	72,335	92,497	96,859	67,378	69,691	86,005	92,814
Percent Stocked Waters Effort	46%	42%	44%	37%	41%	37%	47%	42%	45%	37%	37%	42%	42%
Harvest													
Rainbow trout	38,516	26,292	25,344	17,791	16,878	17,841	10,576	9,909	10,910	7,663	6,069	11,380	18,165
Landlocked salmon	17,693	6,680	8,459	3,056	2,551	4,289	5,352	2,540	2,832	1,227	800	3,248	5,468
Arctic grayling	1,884	1,704	296	806	1,068	498	546	292	786	181	243	461	806
Arctic char	6,452	4,595	3,796	2,617	1,631	1,967	2,780	2,721	1,667	1,178	528	2,063	2,940
Lake trout	180	178	115	328	378	84	214	413	138	0	32	170	203
Other	244	0	192	0	43	0	0	0	19	0	84	4	50
Total stocked fish harvest	64,969	39,449	38,202	24,526	22,549	24,679	19,468	15,875	16,352	10,249	7,756	17,325	27,632
Total TRMA Harvest (stocked + wild)	86,886	58,055	57,918	43,196	35,248	40,717	30,949	30,689	32,152	19,348	16,847	30,771	43,516
Percent Stocked Waters Harvest	75%	68%	66%	57%	64%	61%	63%	52%	51%	53%	46%	56%	63%
Catch													
Rainbow trout	108,551	80,372	72,867	46,425	50,306	53,744	41,522	42,612	48,609	35,547	31,385	44,407	58,056
Landlocked salmon	47,084	19,880	23,797	11,972	7,352	13,450	9,593	8,795	7,276	2,980	5,189	8,419	15,218
Arctic grayling	15,692	16,465	10,338	11,212	10,028	5,095	11,312	10,583	6,720	6,938	7,042	8,130	10,438
Arctic char	14,244	12,470	13,127	7,417	9,476	6,968	6,130	5,695	4,714	4,000	3,010	5,501	8,424
Lake trout	1,213	998	1,020	1,241	1,814	84	444	1,123	343	497	79	498	878
Other	271	0	343	0	43	6	0	0	31	0	84	7	69
Total stocked fish catch	187,054	130,185	121,492	78,267	79,019	79,347	69,001	68,808	67,693	49,962	46,789	66,962	93,083
Total TRMA Catch (stocked + wild)	394,814	318,169	315,841	244,711	197,153	270,784	194,083	240,966	221,497	154,977	158,739	216,461	255,300
Percent Stocked Waters Catch	47%	41%	38%	32%	40%	29%	36%	29%	31%	32%	29%	31%	36%

Source: A. Behr, Stocked Waters biologist, ADF&G, Fairbanks, personal communication; catch and harvest data, Jennings et al. (2006a–b, 2009a-b, 2010a-b, 2011a-b, *In prep*; Romberg et al. *In prep*.)

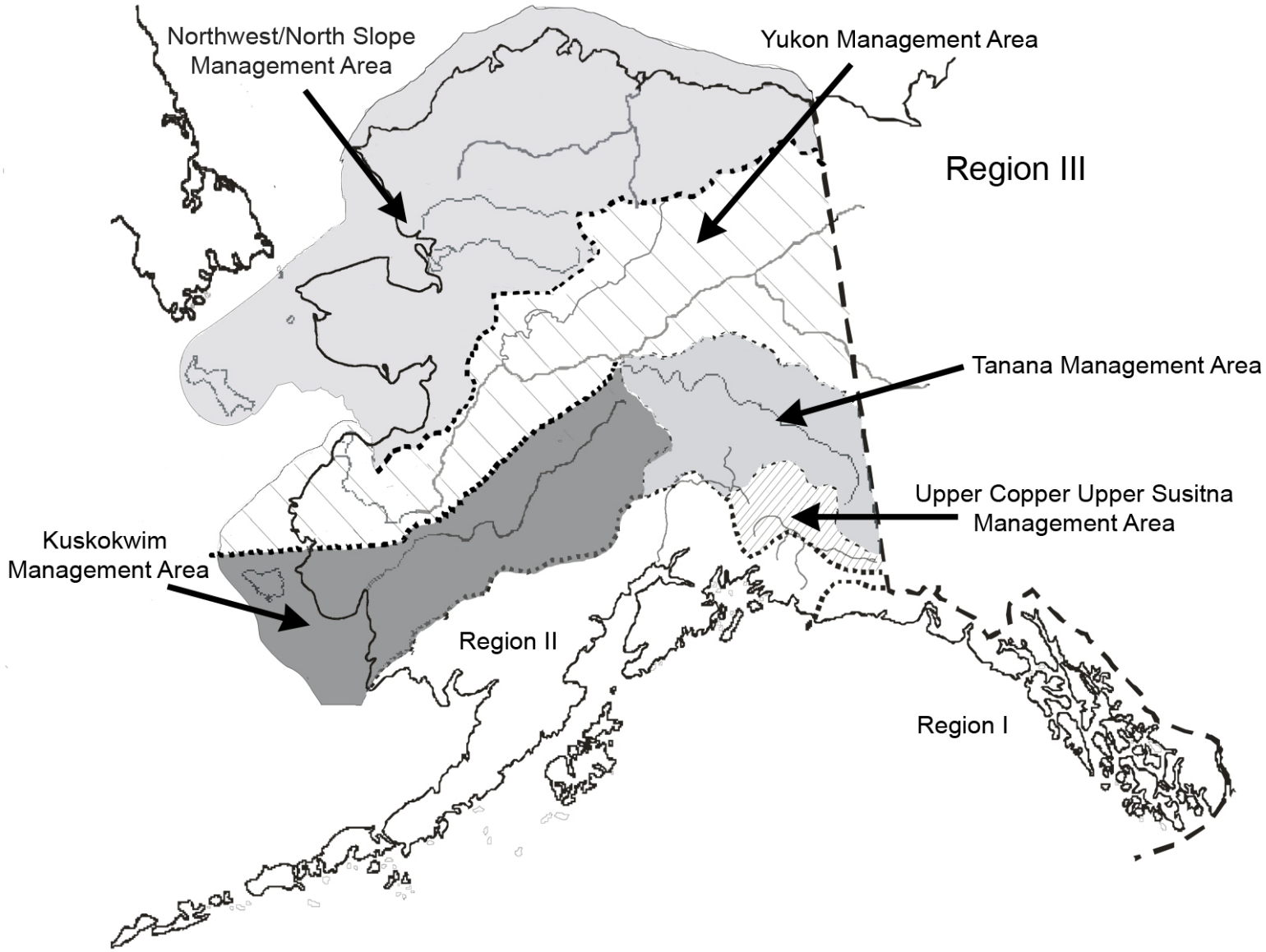

Figure 1.–Map of the sport fish regions in Alaska and the five Region III management areas.

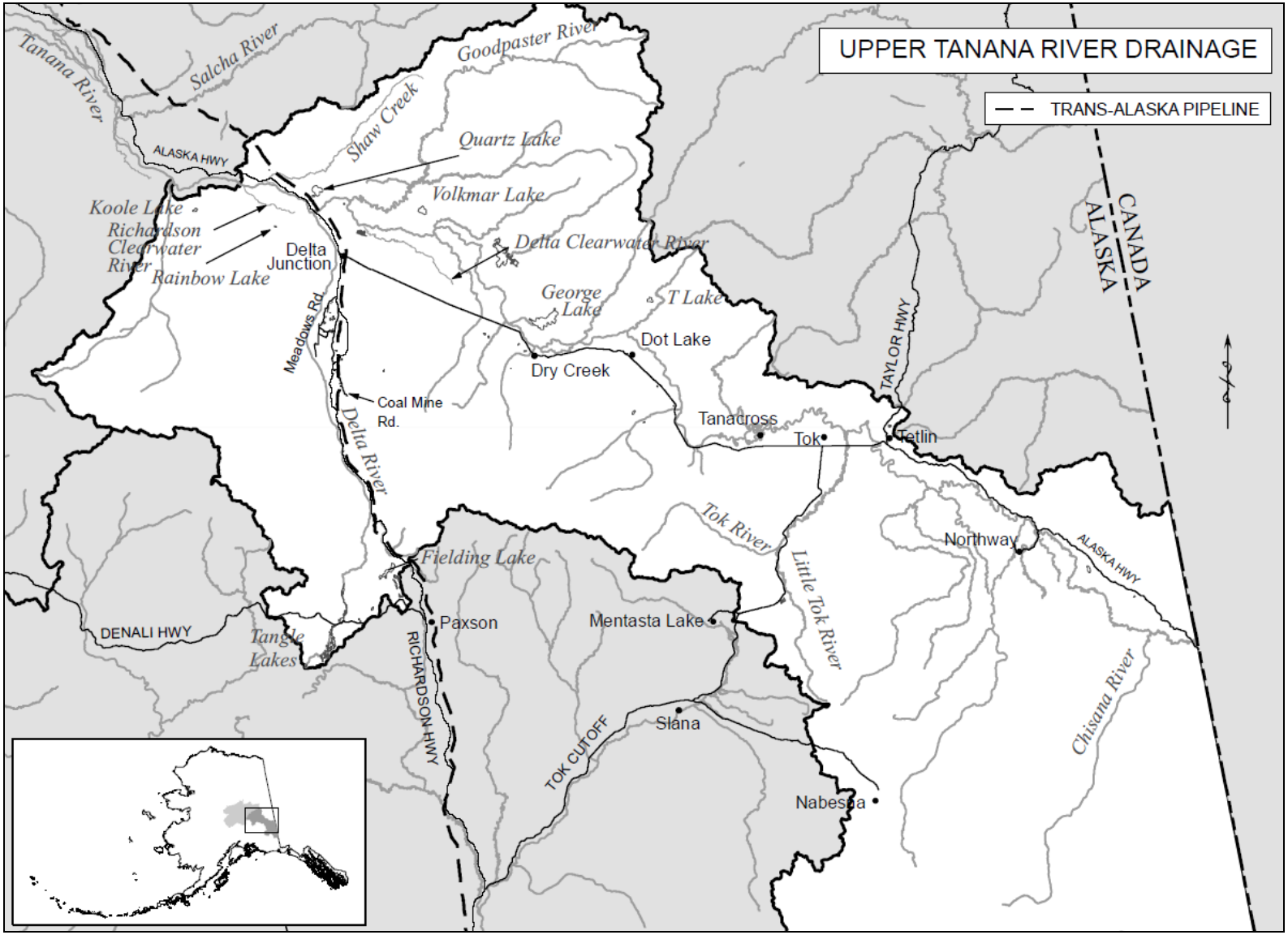

Figure 2.–Map of that portion of the Tanana River drainage located upriver from the Salcha River.

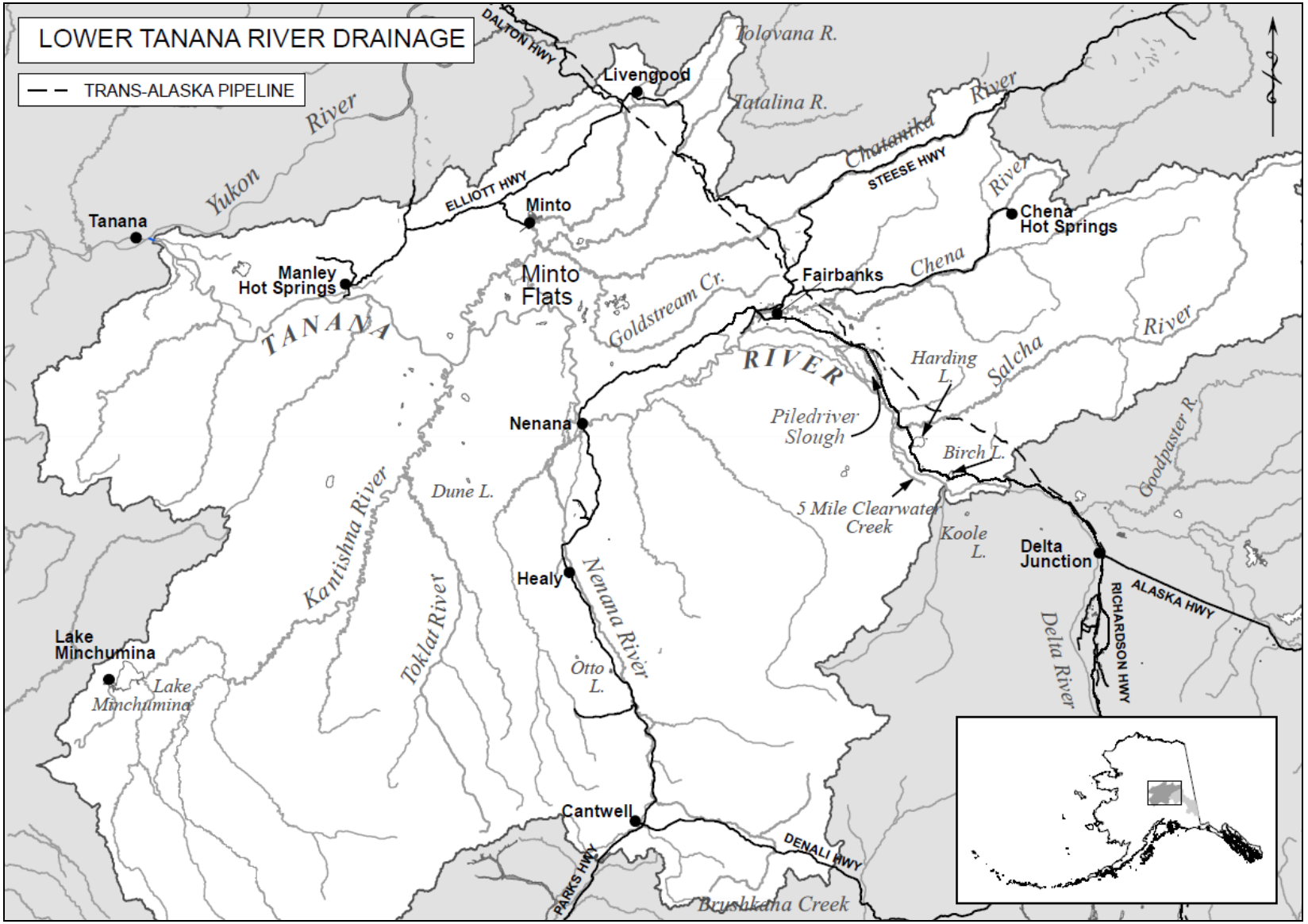

Figure 3.–Map of that portion of the Tanana River drainage located downriver from Shaw Creek.

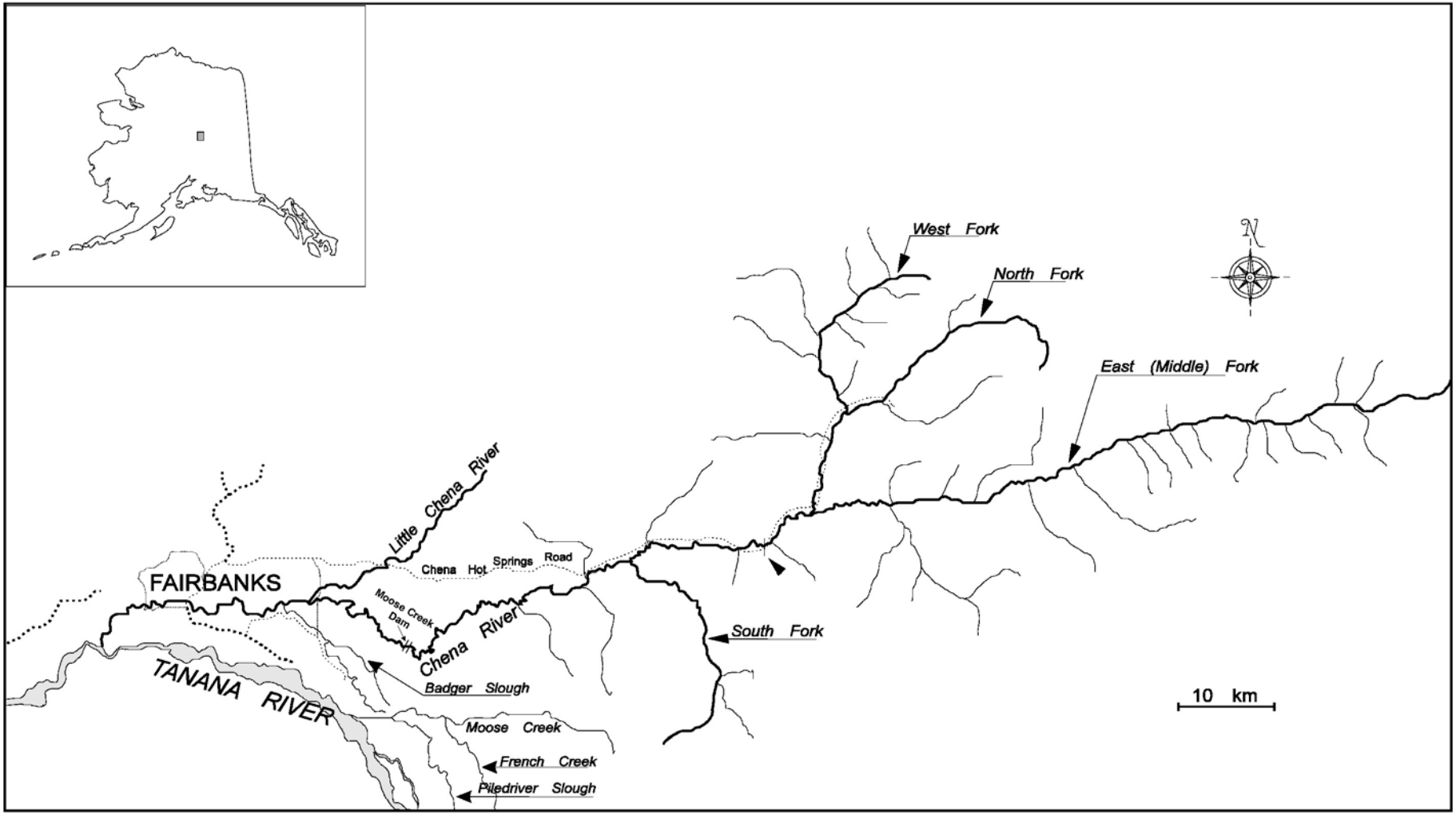

Figure 4.–The Chena River drainage.

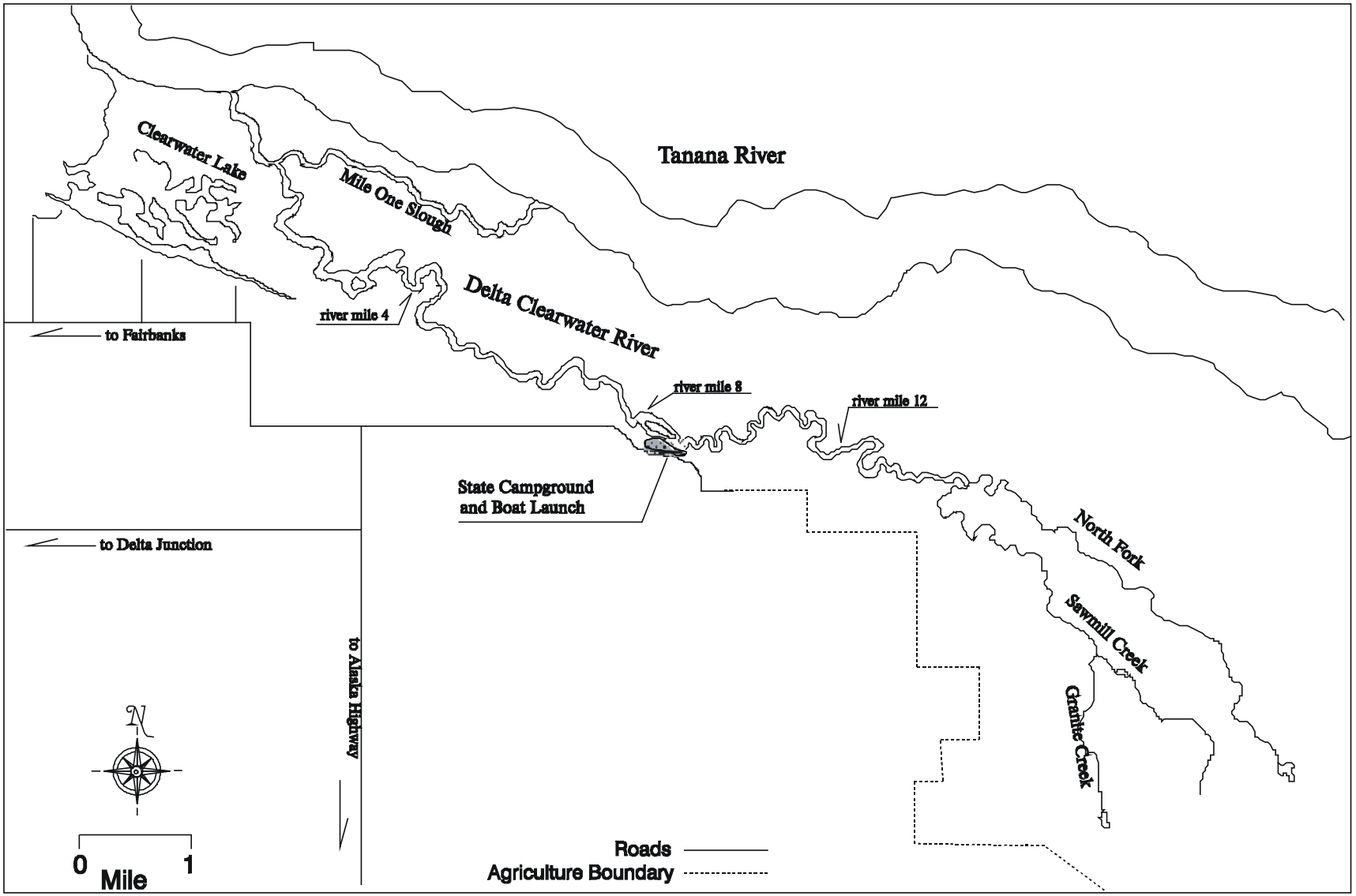

Figure 5.–Map of the Delta Clearwater River.

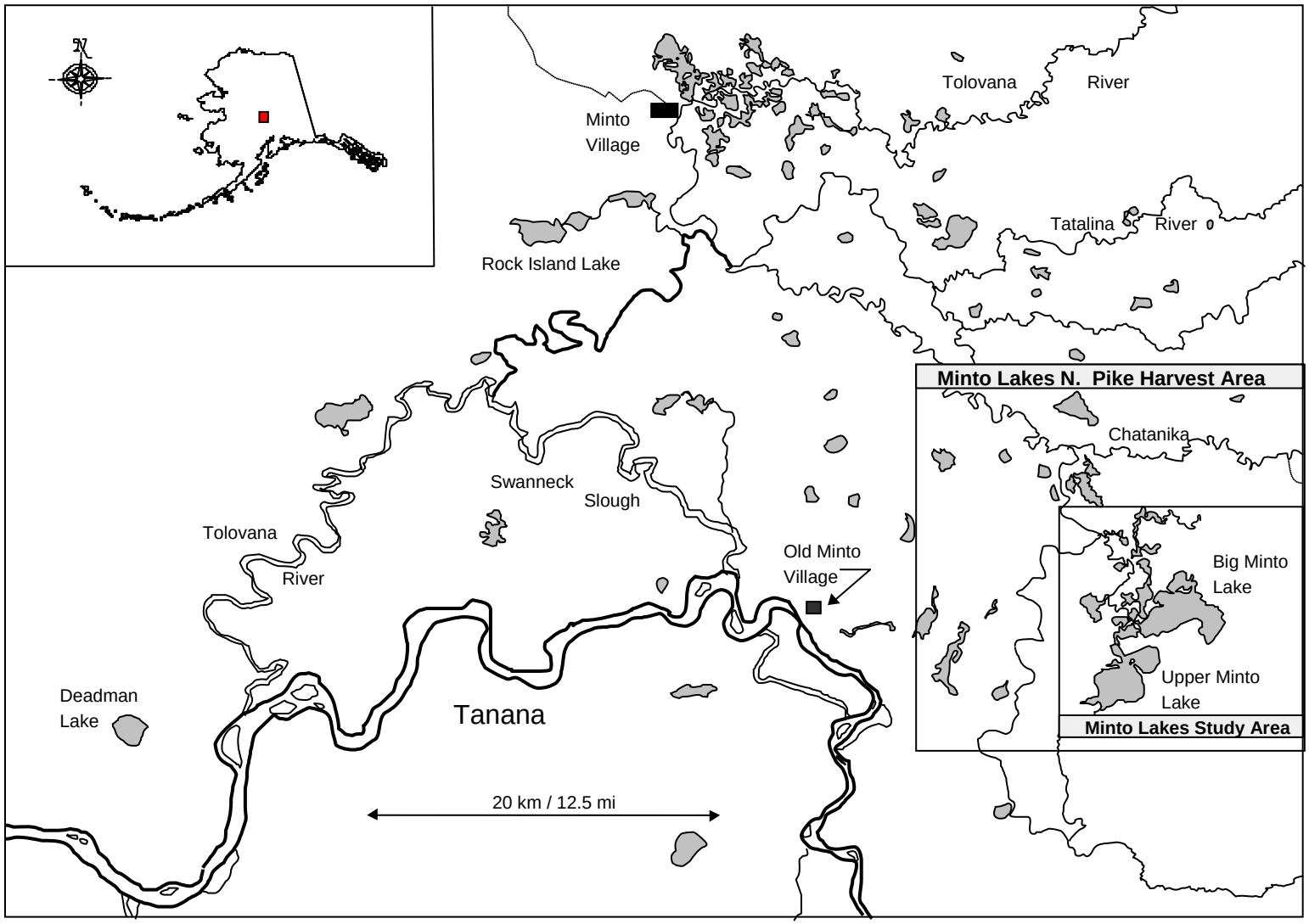

Figure 6.–Minto Flats wetland complex with demarcation of harvest reporting area and the northern pike population assessment area.

APPENDIX A

Appendix A1.–Emergency orders issued for Tanana River Management Area sport fisheries, 2012–2013.

Year	E. O. Number	Explanation
2012	3-KS-07-12	Prohibited retention of king salmon in all flowing waters of the Tanana River drainage effective 12:01 a.m. Saturday, July 21, 2012. Use of bait in all tributaries of the Tanana River drainage was also prohibited.
	3-KS-09-12	Closed sport fishing for king salmon in all waters of the Chena River drainage and the Tanana River within a half-mile radius of the mouth of the Chena River effective 12:01 a.m., effective Monday, July 30, 2012.
	3-SS-01-12	Prohibited retention of coho salmon in all waters of the Delta Clearwater River drainage, including the Clearwater Lake drainage, effective 12:01 a.m. Saturday, October 6, 2012.
2013	3-KS-10-13	Prohibited the retention of sport caught king salmon in all flowing waters of the Tanana River drainage effective 12:01 a.m. Friday, July 12, 2013. The use of bait in all tributaries of the Tanana River drainage was also prohibited.
	3-KS-12-13	Closed the Chena River and the Tanana River within a half-mile radius of the mouth of the Chena River to king salmon fishing and the use of bait and reopened the Salcha River to king salmon retention and the use of bait. The retention of sport caught king salmon in all other flowing waters of the Tanana River drainage remained prohibited, and the use of bait in all tributaries of the Tanana River drainage (excluding the Salcha River) remained prohibited, effective 12:01 a.m. Monday, July 29, 2013.
	3-SS-01-13	Prohibited retention of coho salmon in all waters of the Delta Clearwater River, including the Clearwater Lake drainage, effective 12:01 a.m. Saturday, October 5, 2013.

APPENDIX B

Appendix B1.–Angler effort (angler-days) and fish species kept and released in the Tanana River Area, as reported in the freshwater guide logbooks, 2006–2012.

Year	Angler Effort	King Salmon	Coho Salmon	Dolly Varden	Lake Trout	Rainbow Trout	Arctic Grayling	Northern Pike	Sheefish
Fish Kept (Harvested)									
2006	676	10	58	0	ND	1	68	ND	ND
2007	1,555	17	274	2	0	101	78	23	0
2008	1,156	10	153	4	0	68	12	20	0
2009	1,290	31	75	9	0	349	7	57	1
2010	1,101	6	95	1	0	10	43	124	0
2011	1,683	2	85	30	0	115	34	133	0
2012	1,811	0	29	68	0	250	42	0	0
Fish Released									
2006	676	13	144	38	ND	629	2,338	ND	ND
2007	1,555	29	169	0	0	961	3,167	160	0
2008	1,156	3	59	16	0	773	1,477	154	4
2009	1,290	28	133	8	2	148	5,353	135	5
2010	1,101	31	54	0	3	12	6,072	318	0
2011	1,683	4	65	42	1	103	8,758	406	0
2012	1,811	0	67	58	0	77	8,396	65	0

Source: Sigurdsson and Powers (2009–2012).
ND = No data.