Fishery Management Report No. 21-28

Fishery Management Report for Recreational Fisheries in the Tanana River Management Area, 2019

by

Heather Scannell

and

Brandy Baker

December 2021

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

Symbols and Abbreviations

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Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

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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by

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ABSTRACT

Season summaries for the sport fisheries and the whitefish personal use spear fishery in the Tanana River Management Area (TRMA) for 2019 and preliminary information for 2020 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 mi (912 km) to the Yukon River.

Much of the population in Division of Sport Fish–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.

Most of the 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 caught species are Arctic grayling, stocked rainbow trout, northern pike, stocked salmon and Arctic char, coho salmon, lake trout, burbot, and Chinook salmon.

Keywords: Arctic grayling, burbot, Chatanika River, Chena River, Chinook, chum, coho, Delta Clearwater River, Fielding Lake, Harding Lake, Quartz Lake, Chinook, 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 annual report provides background and the most recent (i.e., 2019) information on the management of recreational fisheries within the Tanana River Management Area (TRMA). The report is provided for the Alaska Board of Fisheries (BOF), Fish and Game Advisory Committees (ACs), the general public, and other interested parties. Background information includes descriptions of the fisheries; the regulatory process; geographic, administrative, and regulatory boundaries; funding sources; summaries of fisheries assessments; and management objectives with associated rationales. Current information includes: updated summaries of catch, effort, and harvest data; significant issues or developments for particular fisheries; regulatory actions; and future informational needs.

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.

The Division of Sport Fish is primarily funded by the State of Alaska and the Federal Aid in Fisheries Restoration program. ADF&G funds are collected 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. Secondary funding sources may include contracts with government agencies and the private sector.

This area management report provides information regarding the TRMA and its fisheries for 2019 with preliminary information from the 2020 season. This report is organized into 2 primary sections: a management area overview that includes a description of the TRMA and a summary of effort, harvest, and catch for the area; and a section summarizing significant fisheries by species and area.

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 most 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 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 100,000) 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 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 Advisory Committees (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 to answer questions and provide clarification of proposed regulatory changes regarding resource issues of local and statewide concern. The Boards Support Section within ADF&G's Division of Administrative Services provides administrative and logistical support for the BOF and ACs. During 2017, ADF&G had direct support responsibilities for 84 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 2019. At that meeting, major changes to the TRMA regulations included the following:

1. Designated a youth-only fishery for Arctic grayling on the Lower Chena River for 4 consecutive Saturdays and Sundays beginning the 3rd Saturday in June.
2. Extended the period in which Arctic grayling 12 inches or less in size may be retained in the Delta Clearwater River drainage.
3. Increased the bag/possession of northern pike to background regulations (5/day, only 1 can be over 30 inches) in the Chisana River drainage. Established an annual household harvest limit of 10 whitefish for the Chatanika River spear fishery.
4. Extended northern pike season to year-round in George and Volkmar Lakes.
5. Opened Little Harding Lake to fishing for northern pike under background regulations (5/day, only 1 can be over 30 inches).
6. Removed Dune and Koole Lakes from the conservative management approach, defined in the *Tanana River Area Stocked Waters Management Plan* (5 AAC 74.065).

7. Opened the Toklat River drainage to sport fishing year-round for salmon and nonsalmon species; a 3-mile corridor centered near the Kobi–McGrath trail will remain closed.
8. Repealed the Tanana River Area rainbow trout regulations.
9. Updated the Tanana River Management Area stocked waters regulation.

During the 2019 BOF meeting in Anchorage, a restriction of 2 fish, 30 inches or greater in length was imposed on the northern pike winter subsistence ice fishery within the Chatanika River. This restriction was implemented to protect the pre-spawn, larger females known to overwinter in the Chatanika Harvest Area, the same area where under-ice subsistence users target northern pike with hook-and-line gear.

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 address conservation issues for resident species. EOs are also used for inseason management of salmon fisheries. Inseason management is usually in accordance with a fisheries management plan approved by the BOF. EOs issued under this authority for the TRMA from 2016 through 2020 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 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).

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, a management group, and a stocked waters biologist. The management group consists of a management supervisor, an area biologist for each of the 5 management areas, and assistant area management biologists for the Tanana drainage and Upper Copper Upper Susitna drainage. Area biologists evaluate fisheries and propose and implement management strategies through plans and regulations in order to meet divisional goals. A critical part of these positions is interaction with the BOF, ACs, and the general public. The stocked waters biologist plans and implements the regional stocking program for recreational fisheries. The regional management supervisor also supervises the regional fishing and boating access program.

The research group consists of a research coordinator, a salmon research supervisor, a resident species research 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 Alaska Sport Fishing Survey (commonly known as the Statewide Harvest Survey [SWHS]) is designed to provide estimates of effort, harvest, and catch on a site-specific 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. 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 2019 were not available until fall 2020.

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.
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, all TMRA sites are grouped into "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 Chinook 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. Effective May 26, 2019, ADF&G discontinued the freshwater logbook program; however, freshwater guides are still required to register their guide/business and must still register their vessels. Prior to the discontinuation of the freshwater logbook program, and still relevant to the saltwater logbook program, the collected data provides 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 (Sigurdsson and Powers 2009–2014; Powers and Sigurdsson 2016).

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 that drains an area of approximately 45,918 mi^2 (73,898 km^2; Brabets et al. 1999; Figures 2 and 3). The glacial Tanana River is formed by the confluence of the Chisana and Nabesna Rivers near Tok and the Alaska–Canada border, and flows toward the northwest for ~570 mi (970 km) to its terminus at the Yukon River.

Most of the 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 (FNSB) and part of the Denali Borough occur within the TRMA. Approximately 100,000 people live in this area, which encompasses the city of Fairbanks; Fort Wainwright Army Base; Eielson Air Force Base; and the communities of Nenana, North Pole, and Salcha (U.S.

Census Bureau 2010). Other communities and municipalities located within the TRMA include Anderson, Big Delta, Cantwell, Delta Junction, Dot Lake, Dry Creek, Ester, Fort Greely Army Base, Fox, Healy, Lake Minchumina, Livengood, Manley Hot Springs, Minto, Nabesna, Northway, Tanacross, Tetlin, Tok, Two Rivers, and Whitestone.

The TRMA offers various 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. In addition, there are 6 public use cabins that are free to the public although a reservation and permit are required.

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 which are commonly targeted by sport anglers. The common species include Chinook and coho salmon, Arctic grayling, burbot *Lota lota*, lake trout, and northern pike *Esox lucius*. Chum salmon *O. keta*, Dolly Varden *S. malma*, sheefish (inconnu) *Stenodus leucichthys*, least cisco *Coregonus sardinella*, humpback whitefish *C. pidschian*, broad whitefish *C. nasus*, and round whitefish *Prosopium cylindraceum* are caught occasionally by sport anglers.

Longnose suckers *Catostomus catostomus*, Alaska blackfish *Dallia pectoralis*, lake chub *Couesius plumbeus*, slimy sculpin *Cottus cognatus*, and Arctic lamprey *Lampetra camtschatica* 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 and are sterile. Arctic char *S. alpinus*, coho salmon, Chinook salmon, and lake trout are also stocked in selected lakes. Arctic grayling reared from eggs collected in the spring, Chinook salmon reared from eggs collected in the summer, and coho salmon reared from eggs collected in the fall are all stocked the following season. Lake trout eggs collected in the fall are reared for 2 years before being released as juveniles; it takes 3–5 years for those fish to grow to a size that makes them desirable by sport anglers.

ESTABLISHED MANAGEMENT PLANS AND POLICIES

The regulations governing fisheries in the TRMA in 2019 are found in 5 AAC 74.001 through 5 AAC 74.030 (sport fishing), 5 AAC 77.171 through 5 AAC 77.190 (personal use), and 5 AAC 01.200 through 5 AAC 01.249 (subsistence fishing). Specific management plans that affect TRMA sport fisheries include:

- *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

Salmon fisheries are often the most contentious fisheries in Alaska, and those within the TRMA are no exception. In terms of allocation, subsistence salmon fisheries have a regulatory priority over commercial, personal use, and sport fisheries in times of conservation concerns. 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 can harvest 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 Chinook salmon) in the Yukon River drainage commercial and subsistence fisheries.

Public Access through Military Lands

There are many stocked lakes located on military lands in the TRMA. To access these areas, the public must acquire a Recreation Access Permit (RAP) for getting onto the military installations (Fort Wainwright Army Base, Eielson Air Force Base and Donnelly Training Areas) and check-in, either online or by telephone, before entering an area to ensure training exercises are not occurring. Annually, some stocked lakes in portions of the Donnelly Training Area (DTA) near Delta Junction, are temporarily closed to public access due to large scale military training exercises.

Invasive Species

In 2009, the invasive aquatic plant *Elodea* sp. was identified in the Chena River, and in 2011/2012 it was discovered that the lower 10 miles of Chena (Badger) Slough were heavily infested with the aquatic plant. 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 by displacing native vegetation. In 2013, the United States 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, Fairbanks, personal communication). In 2015, *Elodea* was documented in Totchaket Slough (downriver from the Chena River terminus), and it has spread extensively throughout Chena Lakes.

The Fairbanks Soil and Water Conservation District (FSWCD) is coordinating the substantial multiagency effort working towards the eradication of *Elodea* in the Tanana Drainage. Efforts include public outreach, surveys, permitting (e.g., completion of environmental impact statements), monitoring, grant/funding proposals, and eradication. Public outreach has included educating pilots, signage at boat launches, and community meetings with residents concerned with the proposed chemical application of Fluridone (aquatic herbicide manufactured by Alligare). Funding remains a significant challenge and the USFWS has been a major contributor. Survey areas have been expanded to include float ponds and remote lakes accessed by float planes, such as Dune Lake. Mechanical removal of *Elodea* was conducted in the Chena River at several locations using divers in 2016. In 2017, Fluridone was systematically applied to Chena (Badger) Slough, and in 2018 the slough was reassessed, and no *Elodea* was observed. In 2018, Tochaket Slough and Chena Lakes were treated with Fluridone. Most recently, eradication efforts have

focused on Totchaket Slough and for the past 2 summers (2019 and 2020), FSWCD and ADF&F staff have made numerous trips to the slough to apply Fluridone. In 2021, the slough will be reassessed to determine if eradication efforts were successful, and to apply a final treatment.

The potential of *Elodea* to negatively impact fisheries habitat may be significant, even in stocked lakes. *Elodea* has most recently been discovered in Birch, Harding, and Lost Lakes, and Bathing Beauty Pond. A treatment schedule for new water bodies will be developed through the winter and continued eradication and identification efforts will be ongoing pending funding and permits.

In contrast with a true invasive species (i.e., *Elodea*), ADF&G staff often encounter members of the public who believe that northern pike are an invasive species in the Tanana drainage. Northern pike are invasive in Cook Inlet freshwaters (Kenai and Susitna River drainages, Anchorage Bowl lakes), but they are native to the Yukon, Kuskokwim, and Tanana River drainages.

ACCESS PROGRAMS

The Wallop-Breaux Amendment to the 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.

During 2019–2020, these funds were used to complete improvements to the boat launches at the Clearwater Campground in Delta Junction and Fielding Lake. Additionally, the Tanana River boat launch located off Chena Pump Road was hardened. Staff also conducted maintenance of the boat launches in Nenana and Manley Hot Springs, replaced trail and fishing signs, conducted general maintenance of boat launches and public use cabins, installed additional floating docks at the Tanana Lakes recreation area, and constructed an ice fishing house for Chena Lakes Recreation Area.

INFORMATION AND EDUCATION

Information regarding regulations, publications, stocking and fishing reports, news releases, Advisory Announcements, 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). Links on this website (e.g., *Fishing Information*, *Sport Fishing Brochures,* and *Interior*) can be used by anglers to learn about fisheries and download relevant 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, Education Associate II, and a seasonal Fishery Technician respond to questions from the public at the office and via phone and email. In addition, I&E staff distribute and update fishery brochures, fishing regulations, and the regional webpage; and coordinate the Fairbanks Outdoor Show booth, fishing events, and the Becoming an Outdoors Woman (BOW) program.

An Education Associate II provides several essential services for Region III. Primary services include (1) working with regional schools providing hands-on curriculum in sport fishing, fish anatomy, fish biology, and aquatic education via the *Salmon in the Classroom* program; (2)

developing and producing web-based content, especially in the form of "how-to" sport fishing videos, which highlight fisheries, angling techniques, hatchery function, and services; (3) instructing fishing classes and holding fishing events for the *Becoming an Outdoors-Woman* program, UAF Outdoor Adventures, Fairbanks North Star Borough school district, public fishing events at area lakes, and other organizations as requested; (4) assisting in the execution of *Kids Fishing is Fun Day*; and (5) coordinating Region III's social media presence through Facebook and Instagram, which is used to inform the public on an array of topics including regulation changes, lake stocking announcements, and other pertinent sport fishing news.

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).[1] Estimates of angling effort in the TRMA averaged approximately 79,686 angler-days during the 5 years prior to 2019 (2014–2018; Table 1). Recent 5- and 10-year averages are presented to help identify a potential change or trend for the current reporting year (i.e., 2019).

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. Overland transportation to off-road waters includes hiking, off-road recreational vehicles, snowmachines, or dog teams. Access to the many remote sites requires 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.

In the TRMA, stocked lakes (41%) and the Chena River (11%) received the highest percentage of effort in 2019 (Table 1). The most popular fish species caught and harvested in the TRMA were stocked species, followed by Arctic grayling, northern pike, and burbot (Table 2). Arctic grayling was the most popular species caught making up 19% of the total catch; in 2019, it was also the largest catch we have seen since 2013 (148,797 fish; Table 2). Stocked rainbow trout were the most commonly harvested species, which highlights the popularity and importance of stocked lakes to the TRMA. Rainbow trout harvest was 50% of the overall harvest for all species combined.

Information regarding the guided sport fishery for 2019 is not available due the discontinuation of the freshwater guide logbook requirement. Note that the SWHS reports catch, which includes both harvested and released totals, and harvest; whereas the guide logbook historically reported both fish released, and fish kept. Catch and harvest from guided anglers is included in the SWHS estimates.

[1] Alaska Sport Fishing Survey database [Internet]. 1996– . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited April 2021). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/.

SECTION II: FISHERIES

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

CHINOOK AND CHUM SALMON

Chena River

Background and Historical Perspective

The Chena River flows through the city of Fairbanks near its confluence 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 of 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 Chinook salmon populations in the Alaskan portion of the Yukon River drainage, with recent average annual returns of over 5,251 fish from 2015 to 2019 (Table 3). Adult Chinook salmon enter the Yukon River during or shortly after breakup and migrate up the Tanana River to enter the Chena River (920 mi from the Bering Sea) starting late June. They move up the Chena River to spawning areas, which are primarily upriver from the where the fishery occurs (fishing for Chinook salmon is closed above Moose Creek Dam). The run ends in early August.

Chum salmon are primarily available in July and August and are targeted or caught incidentally while fishing for Chinook salmon. Although chum salmon are generally more abundant than Chinook salmon and are subject to a more liberal bag and possession limit (3 fish per day vs. 1 fish per day for Chinook salmon), average harvest and catch is driven by management actions for that season, and typically are less than half that of Chinook salmon (Tables 4 and 5).

Chena River Chinook 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; Skaugstad 1990b, 1994; Evenson 1991a, 1992–1993, 1995, 1996; Evenson and Stuby 1997; Stuby and Evenson 1998; Stuby 1999–2001; Doxey 2004; Doxey et al. 2005; Brase and Doxey 2006; Brase 2012). Counting conditions at the dam can be highly variable depending on water level and turbidity and because of those conditions, sonar technology has been implemented to improve counts during turbid and high-water conditions (Savereide 2012a–b, Stuby and Tyers 2016). Chinook and chum salmon enter the run concurrently, and in the absence of visual identification, sonar methods have improved so that species identification can be adjusted both inseason and postseason based on length metrics from the sonar images. Despite the overlapping run-timing of Chinook and chum salmon, the counting tower is specifically used as an inseason management tool for sport fisheries and the project ends once the Chinook salmon run is over. Therefore, the chum salmon escapement estimates are considered a minimum and not discussed because the chum salmon migration continues into September. In 2005 and 2011, the Chena River was extremely high and turbid throughout most of the Chinook salmon run; therefore, escapement was not estimated. In 2014 and 2016, the Chena River was high

and turbid throughout much of the Chinook salmon run; however, an abundance estimate was produced by using a Dual Frequency Identification Sonar (DIDSON).

In 2018 and 2019, sonar was almost exclusively used to enumerate the entire run; therefore, a more precise estimate of escapement was produced. Advancements in modeling species apportionment, improved sonar technology, and experience in operating the sonar have also allowed for increased precision. Counts from sonar images use a 650 mm threshold to differentiate between chum and Chinook salmon based on size. It is possible that outliers from both species may be counted incorrectly; however, that assumption likely results in a negligible difference to the overall count.

Historically, the Chena River Chinook salmon sport fishery was managed under a management plan with an escapement goal and a guideline harvest allocation for the sport fishery. A guideline annual sport harvest objective of 300–600 Chinook salmon in the Chena River was adopted 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 goal of 6,300 fish, as measured at the counting tower. This point objective was calculated based on averages of available escapement data. 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 ADF&G formed an escapement goal (EG) committee to evaluate and calculate EGs for the Chena and Salcha River Chinook salmon and for some Yukon River drainage chum salmon stocks. The EG process is designed to set escapement ranges that maximize potential yield and is periodically updated as more data is collected and modelling efforts evolve. The current biological escapement goal (BEG) range, that was established in 2001, is 2,800–5,700 Chinook salmon. There is no escapement goal for chum salmon in the Chena River.

A Chinook salmon sport fishery has occurred at the Chena River since before statehood, and the bag and possession limit for Chinook salmon in the Tanana River drainage has remained unchanged since the early 1960s: 1 fish 20 inches (~510 mm) or longer. The river 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 salmon fishery is closed above the Moose Creek Dam.

The Chena River Chinook 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 1,000 or more miles from the Bering Sea (Tables 4 and 5).

Recent Fishery Performance

In 2019, indices of run strength from the Lower Yukon River were below average for years with normal run timing and the run was predicted to come in well below the lower end of the preseason projection range of 144,000 to 220,000 Chinook salmon. Management of Chinook salmon on the Tanana River was driven by tower counts on the Chena and Salcha Rivers. By mid-July tower counts on the Chena River indicated that, based on historical run timing, the run was projected to fall below the lower end of its BEG. In response to the tower counts, the Tanana drainage was restricted to catch-and-release fishing for Chinook salmon on July 17, and ultimately closed

effective July 26. The final estimate on the Chena River was 2,017 fish which was below the lower end of the BEG (2,800–5,700 fish; Table 3).

Estimated annual harvests of Chinook salmon between 1983 and 1992 ranged from 0 to 375 fish, and then increased to 1,280 in the mid-1990s (Brase 2009b). In 2019, zero (0) Chinook salmon were harvested on the Chena River, whereas the 5-year average (2014–2018) harvest was 4 fish (Table 4). Low returns since 2013 resulting in restrictions on the Chinook fishery in the Chena River has led to the decreased harvest trend (Appendix A1). In 2019, the catch was 17 fish, and the 5-year average is 17 fish (Table 5).

Chum salmon harvests and catches in the Chena River have been low and sustainable (Tables 4 and 5), and current trends are anticipated to continue.

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 AYK Region.

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) that mandated all the Tanana River fisheries (commercial, subsistence, personal use, and sport) for Chinook salmon be managed in a manner such that the Chena River Chinook salmon BEG range of 2,800–5,700 fish is achieved at the counting tower. To attain this, BEG, restrictions may be placed on any or all Tanana River fisheries.

Restrictions to the Chinook salmon sport fishery are often dictated by run strength measured by assessment projects in the Lower Yukon River (Pilot Station sonar and test net projects) and restrictions to subsistence users. A poor run and concurrent subsistence restrictions often result in restrictions to the Chena River sport fishery prior to drainage specific information measured by the department's tower and sonar operations at the Moose Creek Dam. For example, the sport fishery was closed preemptively all season in 2014 and 2015 because of low preseason forecasts, restrictions to subsistence users, and low counts at the Lower Yukon River assessment projects. Given all the restrictions, the BEG was ultimately exceeded within the Chena River (Table 3). If preemptive restrictions are not in place, the Chena River sonar/tower operations are used to manage the sport fishery inseason. Counts are monitored daily and research staff are consulted to gauge run timing and strength. To meet the BEG, restrictions (e.g., gear and bag limits) are implemented to appropriately reduce harvest, or more aggressive measures may be taken (e.g., increased bag limits) to provide increased fishing opportunity should the upper end of the BEG be exceeded. Consultations with research and senior staff, and with partnering agencies (e.g., Division of Commercial Fisheries) are made prior to regulatory changes.

Current Issues and Fishery Outlook

Sport fishing opportunities for Chinook salmon in the Tanana River drainage will continue to be closely linked to Yukon River drainage run strength and management of subsistence fisheries. Unfortunately, for the past couple of years (2019 and 2020) both the Yukon and Chena Rivers have had poor returns, resulting in restrictions to all user groups. The Chena River has failed to meet the lower end of the BEG in both those years (2019 and 2020; Table 3).

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

The enumeration project at the Moose Creek Dam has evolved and currently entails a counting tower paired with an Adaptive Resolution Imaging Sonar (ARIS) positioned on each bank. This dual system combined with the refined mixture model to better apportion Chinook and chum salmon (Stuby and Tyers 2016) is highly accurate and robust to the dynamic counting conditions and high water that occurs in the Chena River. For example, out of the past 5 years the sonar was used exclusively for calculating 4 estimates of escapement (2015–2019). This approach should continue.

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, groundwater-fed system approximately 120 miles long, originating from the Tanana Hills to the north (Figure 3). Numerous recreational, privately owned, cabins are located along the lower 70 miles of the river.

The Salcha River supports the largest Chinook salmon escapement in the Tanana River drainage, with annual returns that average larger than those from the Chena River (Table 3). Run timing is essentially the same as the Chena River stock. In the Salcha River, chum salmon are caught incidentally to Chinook salmon and coho salmon are not present.

The Salcha River Chinook and chum salmon runs have been assessed annually since 1987 using mark-recapture experiments or by a counting tower located near the Richardson Highway Bridge (Table 3; Skaugstad 1988–1990a, 1992–1994; Burkholder 1991a; Evenson 1995, 1996; Evenson and Stuby 1997; Stuby and Evenson 1998; Stuby 1999–2001; Doxey 2004; Doxey et al. 2005; Brase and Doxey 2006; Brase 2012; Savereide 2012a–b, 2014; Stuby and Tyers 2016). In 2014, the Salcha River counting tower was contracted out to Bering Sea Fishermen's Association (BSFA) for operation, with funding from the U.S./Canada Yukon River Pacific Salmon Treaty. BSFA closely followed the project design and methodology established by the Division of Sport Fish who operated the tower from 1993 to 1998. Chinook and chum salmon counts were reported daily to the Division of Commercial Fisheries. In 2016, Division of Sport Fish reassumed responsibility of operating the counting tower and integrated sonar to ensure enumeration during periods of high water. Beginning in 2016, ARIS was used in addition to the counting tower. The ARIS operates similarly to the DIDSON sonar that is typically used on the Chena River; however, because the ARIS has a larger detection zone, it is more appropriate for the wider Salcha River.

There has been a salmon sport fishery on 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. 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 3 mi (4.8 km) upriver from the Richardson Highway Bridge (5 mi or 8 km upstream from the confluence of the Salcha and Tanana Rivers). All spawning occurs upstream of the marker.

Until 1989, the Salcha River Chinook salmon sport fishery had greater harvests than were seen on the Chena River. Estimated annual harvests between 1983 and 1992 ranged from 47 to 871 fish (Brase 2009b). In the past 10 years, harvest and catch in the Salcha River have been substantially higher than the Chena River (Table 4). This disparity in angling metrics occurs despite a much smaller portion of the river being open to salmon fishing.

The bag and possession limits for Chinook salmon (1 fish 20 in or longer) in the Tanana River drainage have remained unchanged since the early 1960s.

Recent Fishery Performance

In 2019, indices of run strength from the Lower Yukon River were below average for years with normal run timing and the run was predicted to come in well below the lower end of the preseason projection range of 144,000 to 220,000 Chinook salmon. Management of Chinook salmon on the Tanana River was driven by tower counts on the Chena and Salcha Rivers. By mid-July tower counts on the Salcha River indicated that, based on historical run timing, spawning escapement was projected to fall below its BEG. In response to that tower count, the Tanana drainage was restricted to catch-and-release fishing for Chinook salmon on July 17 and closed effective July 26. On the Salcha River, the final estimate was 4,768 fish, which was above the lower end of the BEG (3,300–6,500).

Fishery Objectives and Management

The current BEG for Salcha River Chinook salmon (3,300–6,500 fish) was established in 2001. Unlike the Chena River, the Salcha River Chinook salmon BEG range has been met or exceeded every year since 1990, except for 2016. Sonars (ARIS and DIDSON) were operated in 2016 for the first time and with the addition of this technology we were able to provide an escapement estimate despite high water inhibiting visual counts. It was believed that a significant portion of the run passed undetected in 2016 and the estimate (2,675) produced is considered a minimum, but still does not indicate that the BEG was not achieved. In 2019, the visual tower count was used exclusively to provide an accurate estimate of Chinook salmon (4,863) and the lower end of the BEG was achieved (Table 3).

Current Issues and Fishery Outlook

Typically, more Chinook salmon are caught and harvested from the Salcha River than from the Chena River, likely due to better water clarity and larger run size. In recent years, Chinook salmon escapement has been made on the Salcha River, while the Chena River has not. This has occasionally resulted in differing regulations between the 2 systems (e.g., Salcha River is open to Chinook salmon sport fishing, while the Chena River is closed), which can be confusing to anglers.

Recent Board of Fisheries Actions

There have been no actions taken by the BOF with regards to Salcha River Chinook 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

The Alaska Sustainable Salmon Fund (AKSSF) provided funding for the Salcha River counting tower from 2017–2019. In 2020, funding was not available and we were unable to produce an estimate of escapement for 2020. Division of Sport Fish will continue to look for secure funding for both counting towers. We would like both rivers to have paired sonar and tower counts to

improve the accuracy and reliability of the mixture model parameter outputs during periods of poor visibility.

COHO SALMON

Delta Clearwater River

Background and Historical Perspective

Coho salmon spawn in small spring-fed tributaries on the south side of the Tanana River drainage, and in the mainstem Tanana River. These waters, particularly near Delta Junction, provide critical habitat for the largest known aggregations of coho salmon in the Yukon River drainage. Because these spring-fed tributaries do not freeze and coho salmon spawn into the late fall, these fish provide the last open-water fishing opportunities for salmon 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 drainage, with escapements averaging over 8,173 fish/year during 2015–2019 (Table 6). The DCR is about 20 mi (32 km) in length, is road accessible, and supports the largest recreational fishery for coho salmon in the Tanana River drainage. Coho salmon are the last of the salmon species to enter the Yukon River and arrive in the DCR starting in mid-September. The peak of the run is in late October; however, property owners living along the river have reported coho salmon spawning as late as January.

Annual escapement index counts of coho salmon have been conducted by boat survey since 1972. Counts are conducted from an elevated platform on a river boat during the peak of the coho salmon spawning period (generally late October or early November). The index section encompasses most of the spawning area of the run (>95%) and extends 18 river mi (29 km) upstream from its confluence with the Tanana River.

Recent Fishery Performance

Coho salmon in the DCR attract both local and nonlocal anglers who want the opportunity to catch salmon late into the fall/early winter. Anglers can fish from shore or from boats that can be launched at the state park campground or at a boat launch at river mile 8.5 (~13.5 km) off Remington Road. Coho salmon are caught from mid-September through October using various spoons, large spinners, or flies.

The coho salmon fishery on the DCR has grown in popularity since 1984 (Parker 2009). The majority of coho salmon caught are released (Tables 4 and 5) likely 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 2019, the harvest of 72 fish and catch of 1,063 fish were below the most recent 5-year averages of 315 fish and 4,171 fish, respectively (2014–2018; Tables 4 and 5).

Fisheries Objectives and Management

The DCR is the only river in the entire Yukon River drainage for which there is a coho salmon escapement goal. The sustainable escapement goal (SEG) for coho salmon (5,200–17,000 fish) for the DCR was adopted by the BOF in 2004, which replaced the previous minimum threshold of 9,000 fish within the index area. In 2019, the lower bound of the SEG was not met with a count of 2,043 coho salmon (Table 6).

ADF&G monitors DCR coho salmon escapement between mid-September and early October to determine whether any inseason management action is necessary. The background daily bag and possession is 3 salmon in combination other than Chinook salmon (i.e., chum and coho salmon). Yukon River sonar counts and catch rates from fish wheels in the Tanana River are used as preliminary indices of DCR coho salmon run strength. In general, these indices are poor predictors and if the return to the DCR appears marginal, then early season boat surveys in the DCR are relied on more heavily.

Current Issues and Fishery Outlook

Coho salmon returns to the DCR have varied considerably with escapements ranging between 2,043 and 19,553 since 2009 (Table 6). This level of variability is expected to continue and the probability of restrictions to the fishery each year appears to be increasing. In 2019, the initial count conducted on September 25th was 215 coho salmon in the lower 8 mi (13 km). Despite that initial count, an EO was not issued due to the run timing being later than average and index projects in the Lower Yukon River predicting an above average run. Ultimately, when counts did not improve, the fishery was closed on October 11, 2019. The peak count of 2,043 fish did not meet the lower bound of the SEG (Table 6). Likewise, in 2020, when counts did not improve, the fishery was closed on October 17 and the final estimate was 2,555 fish (Table 6).

Recent Board of Fisheries Actions

The last BOF action germane to the DCR coho salmon sport fishery was in 1998, when a bag and possession limit of 3 fish for coho and chum salmon, in combination, was established for the entire Tanana River drainage. During the 2013, 2016, and 2019 BOF meetings the DCR escapement goal was reviewed, and no changes were recommended by the committee.

Current or Recommended Research and Management Activities

Despite increased assessment effort (i.e., multiple boat surveys) and restrictions to the fishery, the lower bound of the escapement goal has not been reached for past 3 years (2018–2020). The preliminary survey in the lower river (8 mi or 13 km) during mid-September, and the entire 18-mile (29 km) survey area during peak spawning will continue to be conducted annually. The early survey is important for predicting potential run strength and the peak surveys are needed to assess the run to determine if the SEG of 5,200–17,000 coho salmon will be met.

CHINOOK, 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 River (Chinook and chum salmon), tributary streams of the Nenana River (Chinook, chum, and coho salmon), and Goodpaster River (Chinook and chum salmon). The furthest upstream tributary of the Tanana River drainage in which substantial Chinook salmon spawning occurs is the Goodpaster River.

The Tanana River, from its confluence with the Gerstle River to the Little Delta River, provides habitat for returning chum salmon. Alluvial aquifers, located on the south side of the Tanana River, are associated with porous floodplain gravels that store water and stabilize winter flows in this

area near Delta Junction. Groundwater from these aquifers seep into the Tanana River, providing optimal spawning habitat for chum and coho salmon.

Coho salmon migrate to spawn in small spring-fed tributaries on 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, to name a few.

The Nenana River drainage is believed to support the second largest coho salmon spawning population in the Tanana River drainage after the DCR and has been surveyed regularly by boat and aerial survey since 1993 (Table 6).

The Chatanika River Chinook salmon population was assessed periodically 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 annual high-water events that resulted in poor viewing conditions and low-quality estimates in most years.

Teck-Pogo Inc. (now owned by Northern Star), a gold mining corporation working a large ore body within the Goodpaster River drainage, conducted aerial surveys for Chinook salmon from 1998 to 2003 as part of environmental assessment studies. In 2004, Teck-Pogo Inc. contracted BSFA to monitor the Goodpaster River Chinook salmon escapement for 20 years. BSFA operated a counting tower on the North Fork of the Goodpaster River annually until the project was discontinued after the 2018 season.

Fishery Objectives and Management

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

When an EO is implemented that restricts fishing regulations for Chinook salmon, it typically covers all Chinook salmon fisheries in the Tanana drainage. However, exceptions may apply for the Chena and Salcha Rivers where there are reliable in-season metrics of run strength (i.e., counting towers and sonars) as well as a management plan in regulation. For example, harvests may be permitted in the Salcha River, whereas the Chena River and the remaining portions of the Tanana Drainage are restricted to catch-and-release.

In 2019, early indices of run strength for Chinook salmon projected an average-sized run and downriver subsistence fisheries were permitted but restricted to time and mesh to help ensure that escapement goals were met. Based on tower counts from both the Chena and Salcha Rivers, the sport fishery was restricted to catch-and-release fishing only and bait was restricted, effective July 17. When tower counts continued to project that one or both rivers may not meet the lower end of their respective BEGs, the sport fishery was closed for the remainder of the season, effective July 26.

Current Issues and Fishery Outlook

There are no significant fisheries issues and management of these tertiary systems will continue to be managed in accordance with the run strength into the Yukon River and Tanana River tributaries.

Recent Board of Fisheries Actions

At the most recent BOF meeting in 2019, the Toklat River drainage was opened to sport fishing year-round for salmon and nonsalmon species, with the exception of a 3-mile corridor centered near the Kobi-McGrath trail, which will remain closed to protect spawning habitat.

Current or Recommended Research and Management Activities

The only other current research project related to salmon within the Tanana River Drainage are the annual aerial or foot surveys of coho salmon performed by Division of Commercial Fisheries in select tributaries such as the Richardson Clearwater River or Julius Creek (Table 6). These counts can be highly variable due to production or survey conditions. The counts for 2019 were delayed due to the late season, unusually mild fall weather, and subsequent late run timing of coho salmon. Consequently, some survey data were not available (Table 6).

ARCTIC GRAYLING

Chena River

Background and Historical Perspective

Due to its ease of access and high proportion of large fish, the Chena River Arctic grayling population offers high-quality opportunities to anglers. There is road access for nearly the entire length of the river from its outlet to mi 57 (91 km) of Chena Hot Springs Road. It flows through Fairbanks, North Pole, Eielson Air Force Base, Fort Wainwright Army Base, the Chena River State Recreation Area, and affords anglers several options for access. The Chena River State Recreation Area, in particular, is a popular boating, camping, and fishing destination for residents and nonresident visitors traveling along the road system.

The Chena River Arctic grayling fishery has been popular since before statehood and has increased in popularity as Fairbanks and the surrounding area have been developed and access has improved. The fishery occurs almost entirely during open water from April through October. Anglers target Arctic grayling throughout the road- and boat-accessible sections of the river and its tributaries, and some anglers fly into the headwaters to begin float trips for fishing. Badger Slough (historically referred to as Chena Slough) is a particularly important tributary because it provides significant spawning and rearing habitat, as well as easily accessible fishing locations.

From the late 1970s through the mid-1980s, the Chena River supported 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, with most of this effort thought to be targeting Arctic grayling (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/year; Brase 2009c) compared to the 1985–1986 average harvest (7,051 fish/year; Brase 2009c) suggested a decline in the Arctic grayling population. Therefore, in 1988 the daily bag and possession 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 prohibited.

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, and in 1991, the fishery was restricted by EO to catch-and-release only (Brase 2009c). The BOF made this a permanent regulatory change in 1994. After this change, catches declined and have remained relatively stable at about 20,000 fish/year in recent years (Table 8).

In addition to eliminating sport harvest through regulatory changes, the department initiated a program of enhancement by stocking hatchery- and pond-reared Arctic grayling spawned from the Chena River stock. In 1993 and 1994, approximately 61,000 catchable fish 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. This program was discontinued after 1994 (Clark 1994–1996).

The Chena River Arctic grayling population assessments were conducted using 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 like historic harvest levels.

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 the effort in the SWHS-designated upper river is directed toward Arctic grayling. The lower river supports a multispecies fishery that includes Chinook salmon, burbot, and northern pike. Although most of the effort in the Chena River is probably directed toward Arctic grayling, effort is not apportioned between species, and the multispecies fishery confounds attempts to describe the total effort targeting Arctic grayling within the Chena River sport fishery.

Recent Fishery Performance

Much like salmon, catch rates of Arctic grayling are highly dependent on river conditions, with lower rates in years dominated by high turbid flow and higher in years dominated by clear water. Lower flow allows grayling to easily see a lure or a fly. For example, in years with lower water levels, Arctic grayling catches were higher than average, and in years with higher water throughout the summer season Arctic grayling catches were lower than average. The 2019 catch of Arctic grayling in the Chena River was 26,164 fish, which is above the 5-year average (20,310 fish; Table 8).

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 *Unpublished*)[2] to provide guidance. The management objectives are abundance based that may be refined as angler preferences change and more abundance-based information is collected. The objectives are as follows:

1. Maintain a minimum abundance of 8,500 Arctic grayling ≥12 in (~305 mm) in total length in the upper river (river miles 45–90, or river km 72–144).
2. Maintain a minimum abundance of 2,200 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).

Current Issues and Fishery Outlook

The Chena River remains popular as a destination for Arctic grayling fishing, and in general angler reports are good.

Recent Board of Fisheries Actions

During the most recent AYK BOF meeting in 2019, there was a proposal submitted by the Fairbanks AC that would allow harvest of Arctic grayling less than 12 inches from June 1–July 15 in the Chena River, from 500 yards downstream of the Nordale Road Bridge to the Chena River confluence with the Tanana River, and in Piledriver Slough. From June 1–July 15, the remainder of the Chena River would remain closed to Arctic grayling retention. From July 16–May 31, the entire Chena River would be closed to all Arctic grayling retention. This regulation would terminate after 3 years under the assumption that during this time ADF&G would conduct a stock assessment. In order to conserve the Chena River/Piledriver Slough Arctic grayling population, the BOF and ADF&G agreed to create a youth-only fishery. This youth-only fishery allows for the retention of 1 Arctic grayling of any size for 4 consecutive weekends beginning the 3rd Saturday in June.

Current or Recommended Research and Management Activities

The Chena River Arctic grayling population should be assessed prior to the 2022 BOF meeting. The most recent abundance estimate was in 2005 (Table 7). Proposals to open the Chena River Arctic grayling fishery to harvest predictably occur for nearly every BOF meeting and current information is desired to adequately address anticipated proposals.

Questions remain regarding fish that spawn in the 90-mile mainstem assessment area during May and their contribution to the summer fishery within the assessment area. An integrated study that assesses the spring and summer populations together with a rigorous telemetry study would permit a drainagewide assessment of abundance and better address the effects of proposed regulatory changes.

Delta Clearwater River

Background and Historical Perspective

Arctic grayling spawn in the Goodpaster River, Shaw Creek, Upper Delta River, Healy River, and several other tributaries during the early spring. When spawning is complete, adults leave for summer feeding locations in other nearby rivers such as the Delta Clearwater River (DCR) or the

[2] Doxey, M., and A. L. J. Brase. *Unpublished*. Fishery management plan for the Chena River Arctic grayling sport fishery. Alaska Department of Fish and Game, Division of Sport Fish, Fairbanks.

Richardson Clearwater River (RCR). These clear springs maintain cool water temperatures in the summer and provide ideal feeding habitat for adult Arctic grayling. The DCR is the largest of several spring-fed streams near Delta Junction (Figure 5). Arctic grayling are not known to spawn or overwinter in the DCR or RCR. It is unclear how Arctic grayling recruit to these summer feeding streams; however, summer 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.

The abundance of Arctic grayling larger than ~9.5 in (240 mm) in the DCR was at a low of 3,000 fish in 1996 (Ridder 1998a). The population later increased to 7,991 fish in 2000 and 14,799 in 2006, probably because of a series of changes to the bag and possession limits that reduced harvests (Gryska 2001; Wuttig and Gryska 2010; Table 10).

Recent Fishery Performance

Species-specific estimates of effort 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 2019, the angler effort on the DCR was 4,417 angler/days, which is below the 5-year average of 5,267 angler/days (Table 1). Harvests remain negligible and catches of Arctic grayling appear stable (Tables 8 and 9). Population models suggest 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 (Table 9).

In the last 10 years, estimates of total catch of Arctic grayling in the DCR have ranged from 9,758 fish in 2011 to 20,714 in 2009. The most recent estimate of 15,322 fish in 2019 is above the 5-year average of 12,320 fish (Table 8).

Fisheries Objectives and Management

In 2004, the BOF adopted the *Tanana River Area Wild Arctic Grayling Management Plan* (5 AAC 74.055) that states 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, or 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).

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 12,000 fish annually over the past 10 years, and harvest remains minimal with a 5-year average of 175 fish (Tables 8 and 9). The catch is near the 2006 estimated population size, suggesting that at least some fish are caught multiple times. The apparent repeated handling is responsible for some level of mortality, although catch-and-release mortality is probably low (<5%; McKinley 1993). In 2006, the abundance of Arctic grayling over 12 in total length (270 mm FL) in the DCR was estimated at 14,799 fish (Table 10; Wuttig and Gryska 2010), nearly doubling the 2000 estimate, which was germane to fish 240 mm FL. This notable increase in abundance, particularly those ≥14 in (~355 mm), suggests that low hooking mortality rates coupled with healthy Arctic grayling spawning populations in nearby rivers and streams are both contributing to the continued success of the fishery.

Recent Board of Fisheries Actions

During the most recent AYK BOF meeting in 2019, the season for retaining 1 Arctic grayling 12 inches or less in length was extended. Previously retention was prohibited from January 1 through May 31.

Current or Recommended Research and Management Activities

The DCR Arctic grayling population should be periodically assessed to determine whether additional actions should be taken to meet management objectives.

Tangle Lakes System

Background and Historical Perspective

The Tangle Lakes system is in the upper portion of the Tanana River drainage near the Denali Highway and includes several lakes near tree line (~3,000 ft or 915 m) 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. The watershed includes 150,000 acres of land, 160 miles of streams, and 21 lakes.

The Delta River Corridor is managed by 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

The Tangle Lakes system consistently accounts for the highest number of Arctic grayling caught and the second highest for Arctic grayling harvested for any water body within the TRMA. This performance is in part due to some the highest observed densities of Arctic grayling within the state (Gryska 2011a) and ease of access. In 2019, the catch of Arctic grayling was 31,160 fish and the harvest was 1,100 (Tables 8 and 9).

Fishery Objectives and Management

The Arctic grayling fishery in the Tangle Lakes system falls under the *Tanana River Area Wild Arctic Grayling Management Plan* regional management approach, and the background bag and possession limit 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, 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. Mineral exploration in recent years 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 effort (Table 1). The portion of the Delta River that is federally designated as a 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 mi (17 km) section of the Delta River that is designated as Wild and Scenic was estimated at 44,212 fish (SE = 9,108) ≥240 mm FL (10 inch TL) and 23,152 fish (SE = 3,189) ≥270 mm FL (12 inch TL; Gryska 2011a). These densities are the 2nd highest observed among published estimates for Arctic grayling populations in Alaska.

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

Numerous smaller Arctic grayling fisheries occur throughout the Tanana Drainage. 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 stream, flowing through upland hills of the White Mountains for about 80% of its length before it enters Minto Flats wetlands complex. In the uplands, the river has a mix of pools, riffles, and gravel bars, and in the flats, the channel is incised with high 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 reaches of the tributaries.

In the upper river, Arctic grayling are primarily targeted by anglers, and downstream it transitions to more of a northern pike, burbot, sheefish, salmon, and whitefish fishery. Prior to 1992, the Chatanika River Arctic grayling bag and possession limit was 5 fish/day with no size limit. From 1992 to 2009, regulations allowed for a daily bag and possession limit of 5 fish ≥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 (Tack 1973; Holmes 1983, 1985; Holmes et al. 1986; Clark and Ridder 1990; Clark et.al 1991; Fleming et al. 1992; Ridder et al. 1993; Roach 1994, 1995; 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 if fishing mortality increased. An extensive population assessment was performed in 2007, and it indicated a significant increase in the number of large Arctic grayling (≥270 mm FL) in the Chatanika River since the last assessment in 2002 (Table 11).

The Nenana River is a turbid, glacier-fed tributary of the Tanana River 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 and Fish Creeks. Recreational cabins are scattered throughout this area, and there is some sport fish guide activity in the area. Catches of Arctic grayling have averaged 13,597 fish/year and harvests have averaged 919 fish/year between 2014 and 2018 in the Nenana River drainage streams; the 2019 estimates of catch and harvest were 12,376, and 104 fish, respectively (Tables 8 and 9).

A radiotelemetry study performed in 2001–2002 demonstrated the importance of Brushkana Creek as a spawning stream within the upper portion of the Nenana River drainage. Radiotagged Arctic grayling that spawned in Brushkana Creek 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 a single stock for management purposes.

The Salcha River Arctic grayling fishery has supported consistent catch and harvest over recent years (Tables 8 and 9). Most of the Arctic grayling fishery is accessible only by boat, and a high proportion of the effort is from property owners along the river and their visitors.

Effort on the Salcha River (Table 1) may be affected by many factors, including the strength of the Chinook 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.

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 ≥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 the minimum length limit for harvest was removed.

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 and the estimated population of fish ≥270 mm (13,407; SE = 1,643) within the index area was sufficient to support current harvest levels (Gryska 2011*b*).

Other waters that support important 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

For these fisheries, there are no concerning trends in catch and harvest, and exploitation rates appear sustainable.

Fishery Objectives and Management

5 AAC 74.055 directed ADF&G to manage Arctic grayling fisheries to meet a 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).

Except for the Five-Mile Clearwater (located on the south side of the Tanana River between Fairbanks and Delta Junction), the Tok River, and Piledriver Slough, the Arctic grayling fisheries in other waters fall under the *Tanana River Area Wild Arctic Grayling Management Plan* regional management approach. The background bag and possession limit that was instituted in 1975 for Arctic grayling in the Tanana River drainage is 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.

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 a minimum abundance of 9,000 fish (greater than or equal to 270 mm [~11 in] FL) in the assessed portion of the river in May. The most recent abundance estimate of Arctic grayling ≥270 mm FL during May 2006 was 32,907 (SE = 10,363), which far exceeded the management objective (Gryska 2010).

Recent Board of Fisheries Actions

There have been no actions taken by the BOF with regards to the other TRMA Arctic grayling fisheries since 2010 when the BOF adopted several proposals specific to the Arctic grayling fisheries in the TRMA. A proposal was adopted that restricted gear to 1 single-hook, artificial lure rather than allowing 2 single hooks or artificial flies per line in TRMA waters where there were 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.* Additionally, 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.

Current or Recommended Research and Management Activities

Arctic grayling populations should be assessed when needed to evaluate sustainability, identify discrete stocks, or identify unknown population traits that may affect management. Future regulations should be consistent with *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; Washington, and Goldstream Creeks; and numerous other smaller creeks flow into Minto Flats. These flowing waters come together as tributaries to the Tolovana River, which is a tributary to the Tanana River at its terminus at the southwestern end of Minto Flats. The waterways of Minto Flats are slow and meandering.

Minto Lakes is a group of large interconnected, generally shallow, and heavily vegetated lakes located in the eastern portion of Minto Flats. The lakes are a popular area for northern pike fishing and hunting for waterfowl and moose. Access to the area is primarily by boat or floatplane, and the area is utilized by guides and private individuals. Some private individuals and guides have cabins on the few sparse areas of higher ground that are not regularly flooded. Minto Lakes is thought to support the majority (i.e., >90%) of the northern pike sport fishery within the Tolovana River drainage (Table 13).

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 discrete oxygenated areas of the Chatanika and Tolovana Rivers. Partial winterkills are thought to occur, which can confound modeling of population dynamics to assess angler impacts. 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 Minto Flats northern pike fishery includes the Tolovana River, the Lower Chatanika River and numerous sloughs and creeks, such as Goldstream Creek. Northern pike seasonally move between all these water bodies. Because of this, SWHS effort, catch, and harvest estimates for all of these water bodies are summed and presented under the general heading of Minto Flats (Figure 6).

The Minto Flats 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, which was also a traditional subsistence area. A subsistence fishery for northern pike (and whitefish) also occurs near the village of Minto and other historic 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.

Northern pike overwintering in the Chatanika River are composed mostly (~75–90%) of fish that utilize Minto Lakes during the open water period (i.e., for spawning and feeding). This overwintering area has been termed the Chatanika River Overwintering Area (CROA; Roach 1998a; Albert 2016). After 1987, regulations were implemented that closed sport fishing for northern pike in Minto Flats between October 15 and May 31, and the bag limit was reduced from 10 fish to the current regulation of 5 fish per day, only 1 of which may be ≥30 in long.

Estimated sport catch and harvest of northern pike in Minto Flats peaked in 1994 with a harvest of 9,489 fish and a catch of 52,191 fish (Brase 2009b). Since 2009, harvests have trended down, and the most recent 5-year average of harvest is 429 fish (Table 13). Catches have followed a similar pattern. Since 2012, there have been high-water events in the Chatanika River drainage, resulting in prolonged periods of high water throughout Minto Flats (Albert and Tyers 2020). These consistent high-water events could be impacting levels of effort, harvest, and catch.

Northern pike population assessments were performed in Minto Flats annually from 1987–1991 (Holmes and Burkholder 1988; Burkholder 1989, 1990, 1991b; Hansen and Burkholder 1992). However, obtaining accurate and unbiased abundance estimates was difficult to achieve because experimental assumptions were often not met (Roach 1997, 1998a). These large open-system experiments were fraught with low sample sizes, limited mixing of marked and unmarked fish, size and sex biases, and high-water during spring sampling events. Based on difficulties encountered during these early mark–recapture experiments and radiotelemetry studies conducted by Burkholder (1989), Burkholder and Bernard (1994), and Roach (1998a), the assessment area and study design was modified. Beginning in 1996 through 2008, northern pike abundance estimation experiments were done within an assessment area termed the Minto Lakes Study Area (MLSA; Figure 6). The resulting estimates were used as an index of abundance of northern pike for the entire Minto Flats wetland complex (Table 14). In 2018, the population assessment study design was again modified. A 3-event mark–recapture experiment was conducted to estimate the overwintering population of northern pike in the CROA and the summer population in the MLSA. The 2018 estimate of overwintering northern pike ≥600 mm (~24 in) in the CROA was 14,675 (SE = 1,631) fish and the summer abundance of northern pike ≥600 mm in the MLSA was 11,443 (SE = 1,651; Albert and Tyers 2020). The 2018 MLSA summer estimate was well above the previous 2008 estimate of 2,219 (SE = 397) fish (Joy 2009; Albert and Tyers 2020).

Recent Fishery Performance

The 2019 catch of northern pike in Minto Flats was 1,579 fish, which was well below the recent 5-year average (2014–2018) of 3,953 (Table 13). In 2019, fishing effort in Minto Flats was below average, with an estimated 527 angler-days compared to the 5-year average of 1,354 angler-days (Table 1). Fishing effort is not estimated by target species in the SWHS; however, fishing effort in Minto Flats is assumed to be directed at northern pike.

Although Minto Flats is closed to northern pike sport fishing from October 15 through May 31, a state-managed subsistence fishery occurs throughout the winter. To participate in any state subsistence fishery in Alaska, users must be Alaska residents. Residents must acquire a Tolovana River Drainage Northern Pike Subsistence Permit from ADF&G Division of Commercial Fisheries (DCF) in Fairbanks or online. Subsistence users commonly harvest northern pike through the ice in the CROA (Figure 6) late in the winter and early in the spring. The subsistence northern

pike preliminary harvest for the entire Tolovana River drainage recently averaged 688 fish over the past 5 years (2014–2018) from an average number of 139 permits issued (Table 15). For 2019, the harvest was ~1,633 northern pike with 245 permits issued, this substantial increase was likely due to the growing popularity of the subsistence fishery that is specific to CROA. Prior to 2016, the DCF did not break out harvest specific to the CROA and it was instead assumed that permits issued to Fairbanks North Star Borough (FNSB) residents were indicative of CROA effort and harvest since the fishery is typically dominated by Fairbanks residents. For additional information specific to subsistence harvest please contact DCF, Fairbanks.

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 "lakes and flowing waters water of Minto Flats" 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 (762 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 within the lakes and all flowing waters of Minto Flats for the remainder of the calendar year.

The subsistence management plan is as follows:

1. Subsistence fishing for northern pike is open year-round to Alaskan residents; however, a permit is required.
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. In 2019, the BOF amended the bag and possession limit to include a size restriction where only 2 fish of the 10-fish bag limit may be 30 inches or greater in length.
4. Starting January 1, 2018, the portion of the Chatanika River from an ADF&G regulatory marker located at the confluence of the Chatanika River and Goldstream Creek upstream approximately 1 mile to another ADF&G regulatory marker was closed to subsistence fishing through the ice.
5. Gillnets may be used only April 15–October 14.
6. 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

Recent harvests of northern pike in the lakes and flowing waters of the Minto Flats area have been below the maximum 20% exploitation rate specified in regulation. Since 2005, subsistence harvests have been appreciable, primarily by residents of the FNSB, and there has been a downward trend in sport fish harvest (Tables 13 and 15). The assessment area used to manage the fisheries and calculate the 20% exploitation rate has changed multiple times in the past few decades (Table 14). Most recently, in 2018, the assessment area consisted of the MLSA and the CROA. The MLSA is more consistent with the historical assessment area and the CROA was a "new" assessment area aimed at estimating the abundance and length composition of the overwintering population in the CROA.

The 2018 abundance estimates for the MLSA and CROA was 11,956, and 14,675 northern pike larger than ~24 in (600 mm), respectively (Table 14). It is unclear as to what these abundance estimates mean to management since the 20% threshold exploitation rate is applied to the entirety of Minto Flats and studies conducted in the MLSA and CROA are relative to those specific areas. If sport and subsistence harvests continue to maintain current levels and the population of northern pike in the assessed areas (MLSA and CROA) are indicative of the overall Minto Flats population, there should be no need for restrictions to the sport fishery relative to the 20% exploitation threshold. Additionally, recent high-water events throughout the Minto Flats are providing optimal rearing habitat for northern pike but also negatively impacting the sport fishery due to accessing fishing spots when the water is high.

Recent Board of Fisheries Actions

The *Minto Flats Northern Pike Management Plans* regarding the sport and subsistence fisheries (5 AAC 74.044 and 5 AAC 01.244) were amended during the 2016 BOF. These amendments closed ice fishing (sport and subsistence) from the confluence of the Chatanika River and Goldstream Creek to an ADF&G regulatory marker approximately 3 river miles upstream. Shortly thereafter, an Agenda Change Request was submitted to change the 3-mile closed area in the Chatanika River to a 1-mile closed area, also with the lower boundary at the mouth of Goldstream Creek. This proposal was adopted at the 2017 BOF meeting.

At the 2019 AYK BOF meeting, the *Minto Flats Northern Pike Management Plan* (5 AAC 01.244) regarding subsistence harvest was amended to restrict the 10 fish bag limit/20 fish in possession to only allow 2 of the 10 fish bag limit or 4 of the 20 fish possession to be 30 inches or greater in length.

Current or Recommended Research and Management Activities

Depending on what "assessed" population is used, the combined harvest between sport and subsistence fisheries was ~2,400 fish, which is right at a 20% exploitation rate for the MLSA population but below that same threshold for the CROA population (16%). A better understanding of the relative importance of all overwintering areas within the Minto Flats is needed to assess relative exploitation of discrete summer or spring spawning populations.

Given the growing popularity of the subsistence fishery in the CROA, it is likely that harvest will continue to exceed the 750 fish management trigger and sport fish anglers will continue to see summer restrictions. In the absence of a Minto Flats-wide abundance estimate, the true exploitation rate will be unknown but the assumption is that is well below 20%.

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 and Volkmar Lakes receive the largest amount of fishing effort, harvest, and catch (Tables 1 and 13). Hook and line is the predominant gear used to harvest northern pike in these lakes, 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. It is unknown whether these use patterns are still valid assumptions. Much of the hook-and-line effort directed towards northern pike in the TRMA is nonconsumptive fishing (no retention).

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 much 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 during the ice-free period, particularly right after spawning in early to mid-June. 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 winter trail conditions (low snowfall and open water on the Tanana River) and difficult boat access (low creek levels). During the ice-fishing season, northern pike are taken by hook and line, as well as with spears.

Based on the most recent population estimate of 16,204 fish ≥450 mm FL, 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 Hansen 1993). Recently, anglers and 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]).

A stock assessment conducted during 2006 indicated a higher proportion of larger fish in the population compared to 1987. 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 (~760 mm), or about 6% of the estimated population (Wuttig and Reed 2010). In 1987, only 3.4% of the population, or 300 fish, were estimated at 30 in (~760 mm) or more in length (Clark et al. 1988). In 1987, 48% of the northern pike population was estimated to be ≥18 in (~450 mm; Clark et al. 1988).

Volkmar Lake is situated north of the Tanana River, remote but relatively close to Delta Junction and Fort Greely (Figure 2). Volkmar Lake can be accessed in winter months via a ~30-mile trail following the Goodpaster River starting at Quartz Lake or ~11-mile trail starting from Rapeseed

Way north of the Alaska Highway. Summer access is by float-equipped aircraft. There are numerous private land parcels and cabins around the shoreline, relatively easy wintertime access, and good catch rates of northern pike. Most of the fishing effort is thought to occur through the ice during spring when temperatures are more moderate, and the Tanana River can still be crossed safely.

Northern pike stock assessment studies are done periodically for both George and Volkmar Lakes (Table 16; Pearse 1991; Pearse and Burkholder 1993; Pearse and Hansen 1993; Pearse 1994; Scanlon 2001; Wuttig 2010; Wuttig and Reed 2010).

In 1995, a record 1,263 angler-days occurred on Volkmar Lake, with a harvest of 1,084 northern pike (Parker 2009). In 1996, effort and harvest fell to the lowest recorded level (191 angler-days and 9 fish harvested (Parker and Viavant 2000). In 1996, anglers reported that size and abundance of northern 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 2009). 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 2000, the estimated abundance of northern pike ≥450 mm (~18 in) in Volkmar Lake was 615 fish (Scanlon 2001). In 2005, the population of northern pike ≥450 mm had increased to 1,814 fish (Wuttig and Reed 2010), and in 2009 the population had increased to 4,017 fish ≥450 mm (Table 16; Wuttig 2010).

Annual catch and harvest estimates of northern pike in both George and Volkmar Lakes can vary considerably from year to year (Table 13). This variation is in part 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 multispecies fisheries. Fishing effort in George Lake ranged from 249 to 1,645 angler-days in the past 10 years (2009–2018; Table 1), and in 2019, effort was 401 days, which is close to the most recent 5-year average (2014–2018) of 494 angler-days. For 2019, the catch (2,785 fish) was well above the 5-year average of 1,883 fish and harvest (365 fish) was like the recent 5- and 10-year averages (Table 13).

Fishing effort in Volkmar Lake ranged from 0 to 369 angler-days in in the past 10 years (2009–2018; Table 1), and in 2019, effort was 199 days. For 2019, catch (314 fish) and harvest (24 fish) were average (Table 13).

Fisheries Objectives and Management

George Lake

The interim management objective for George Lake is to maintain a population size greater than 7,300 northern pike ≥18 in (~450 mm) in size. An abundance less than this is the threshold at which a management action to restrict harvest would be considered by ADF&G (Wuttig and Reed 2010).

Volkmar Lake

The management objective for Volkmar Lake is to maintain a population of northern pike ≥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 or decrease 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, anglers complained of a large algal bloom. ADF&G staff took dissolved 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 led to decreased catch rates because of poor underwater visibility for the northern pike. There were also reports of dead fish in July of 2017. ADG&G staff investigated and counted over 1,000 whitefish floating in the lake. Since 2018, there were reports of increased water clarity and improved catch rates of northern pike.

Recent Board of Fisheries Actions

At the most recent AYK BOF meeting in 2019, the northern pike season was extended to year-round in both George and Volkmar Lakes.

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 recent regulation changes. Currently, both lakes are on the research priority list. Updated stock assessment information will aid managers in assessing potential impacts from recent regulation changes and evaluating the angling quality of the fisheries.

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 are a high-profile game fish in Harding Lake because they can readily be caught around the lake's shoreline, ~75% of which is developed with residential houses or recreational cabins. In 2000, northern pike fishing at Harding Lake was closed due to low abundance; details about the closure, population changes, and habitat rehabilitation efforts are discussed by Brase (2009c). In summary, rehabilitation of the northern pike population is dependent on reestablishing vegetated littoral habitat. From 2016–2019, the lake elevation goal of 717 ft was nearly achieved every spring and has remained close to that threshold level. In 2012, the estimated abundance of northern pike ≥450 mm FL was 567, which was still below the level of 1,000 fish ≥450 mm FL needed to open the fishery to catch-and-release (Doxey 2003). In 2020, a stock assessment was conducted to see if the population was responding to the increased water levels. The estimated population of ~700 fish ≥450 mm is still below the management objective level of 1,000 fish.

In Little Harding Lake, northern pike were captured for the first time in 2011 since it was last chemically treated with rotenone during the 1970s to create a trophy stocked rainbow trout fishery. The mechanism by which these fish were reintroduced is unknown, but the illegal transfer of fish from nearby Harding Lake is suspected. Little Harding Lake is currently stocked with rainbow trout. In 2016, a stock assessment of the northern pike population in Little Harding Lake was conducted to determine if stocking efforts should continue. Only 37 fish were captured, and an estimate could not be produced. However, the catch information indicated that the northern pike population and rainbow trout were coexisting and that stocking catchable-sized (i.e., 8–10 in)

rainbow trout should continue. To mitigate northern pike predation on stocked rainbow trout, Little Harding Lake was opened to background regulation for northern pike (5/day, only 1 can be 30 inches or greater in length; regulations set at the 2019 AYK BOF meeting).

Northern pike are also 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 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 of the Tanana River. Other lakes in the Upper Tanana River drainage with northern pike populations are Sand, "T," Mansfield, Dog, Tetlin, Takomahto, Jatahmund, Island, and American Wellesley Lakes.

Northern pike colonize suitable gravel pits and other ponds when rivers 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 in which these northern pike fisheries are a part.

Angler interest in road-accessible northern pike fisheries is high. However, the nature of 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.

Providing harvest opportunity at sustainable levels is the primary 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.

BURBOT

Tanana River

Background and Historical Perspective

The Tanana River, the second largest tributary of the Yukon River, 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 Lotidae and 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, 1991b, 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 tend 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 one 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 harvest and catch of burbot in the TRMA varies annually from 60–4,000 caught versus 600–2,000 harvested in the past 10 years (Table 18). The recent 5-year average of annual harvest (2014–2018) is 1,384 burbot, compared to 1,078 during 2019 (Table 18). The Middle Tanana River and the Lower Chena River fisheries provide for 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 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; however, extensive movements and exchange of burbot within the Tanana River drainage tend to minimize effects of concentrated local fishing effort.

Recent Board of Fisheries Actions

In 2016, the regulations for Jack and Grizzly Lakes (in the Upper Tanana River drainage near the Wrangell mountains) were changed, and consequently, the use of set lines are no longer permitted.

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 nonsalmon 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 localized depletion.

To build upon historical telemetry data and to address burbot stocks throughout the drainage, research staff is currently conducting a more comprehensive telemetry study of burbot. In 2018 and 2019, 300 radio tags were deployed in the upper, middle, and lower sections of the Tanana River. The results from this study will help managers describe seasonal distribution, identify spawning areas, and estimate mean travel distances. This information will help to answer questions about upriver fish movements and whether managers should be concerned about discrete stocks potentially being overexploited.

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 or illegally transported. Sport fishing for burbot occurs year-round, but most of the effort in the TRMA appears to occur in the fall and winter. Closely attended fishing lines and setlines are most used when fishing for burbot in lakes.

Although current exploitation rates of burbot in TRMA lakes are not considered excessive, past studies suggest there was 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 2009). 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 and possession limits in these lakes were reduced from 5 to 2 fish and the use of setlines was prohibited, due to concerns of overharvest.

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. Catch and harvest had remained low and decreased to zero after a bait restriction was established in 2007. Since the bait restriction in 2007, no burbot have been harvested except for 67 burbot in 2012 (Table 18).

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. Currently, the regulation for Fielding Lake is the most restrictive with no set lines or bait allowed, and a bag and possession limit of 1 burbot.

Recent Fishery Performance

In 2019, no burbot were reported harvested from Fielding Lake, 35 were harvested from Tangle Lakes, and 69 were harvested from George Lake (Table 18). Burbot harvests in George Lake have varied in the last 10 years with a range of 0 to 312. Ice conditions on the Tanana River for access, the popularity of the burbot fishery, private ownership around the lake, and a public use cabin have all contributed to the varied harvest levels. The harvest of 0 burbot in 2017 was probably due to

the lake ice thickness (over 55 in thick) and the cold temperatures in the spring that limited participation (Table 18).

Fishery Objectives and Management

Statistical simulations of 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 total fishing mortality (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 harvest of about 90 fish. Since 2007, the harvest of burbot has been 0 for every year except 2012 when 67 burbot were harvested (Table 18). Harvests will remain minimal because of the bait restriction adopted by the BOF in 2007 to protect the lake trout population.

Public reports of limited burbot catches and harvest in 2016 and 2017 (Table 18) prompted a 2018 burbot stock assessment in George Lake to assess the current harvest regulations were sustainable. The mean CPUE of fully recruited burbot (≥450 mm total length [TL]) per 48-h set was 0.69 (SE = 0.15) and mean length of all burbot sampled was 647 mm TL (SE = 5.65; Baker and Tyers 2019). The estimated mean CPUE was like the previous CPUE in 1995 (0.72; SE = 0.07; Parker 1996), indicating recent harvest levels are sustainable and no regulatory action is needed.

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

Liberalizing the Fielding Lake burbot fishery is largely dependent on management of the lake trout fishery. A scheduled stock assessment in 2021 for lake trout will provide an updated assessment of the lake trout population, and if that population is stable enough to allow for the bait restriction to be lifted, a burbot stock assessment should be conducted to evaluate the current population.

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 primarily between Murphy Creek and the Elliot Highway Bridge. They then move downriver to undefined overwintering areas. It is suspected that some of the overwintering areas are outside of the Minto Flats complex within the mainstem Tanana River. Fleming (1999) described the potential complex life history of these 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 near the Elliot Highway Bridge. This fishery traditionally took place in September, while least cisco and humpback whitefish were migrating upstream to spawn. Both 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/year 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 (SE = 5,155) in 1988 to 17,322 (SE = 1,655) fish in 1989 (Table 19; Hallberg 1989; Timmons 1990), combined with harvest estimates that were considered unsustainable, prompted ADF&G 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 (Hallberg and Bingham 1994).

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, designated the dates, fishing area, and household limits for this fishery. In that first year, ADF&G issued 100 household permits with a household limit of 10 whitefish. In 2007, there was a high demand for the 100 permits; however, participation and harvest were low with only half the participants reported fishing. Brase and Baker (2012a–b) reported the number of issued permits doubled to 200 in 2008, and then raised again to 225 permits in 2016 (Table 20). Based on past abundance estimates, a harvest level of 1,000 whitefish (humpback whitefish, round whitefish, and least cisco combined) was deemed sustainable. Factoring past abundance estimates, this ensures a very conservative annual exploitation of <5% for a given species.

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) ≥360 mm FL; the estimate of least cisco was 15,345 fish ≥10 in (≥250 mm; SE = 1,350). These results suggest that the humpback whitefish population was slightly below 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 ≥360 mm FL (SE = 1,405; Table 19). The abundance of humpback whitefish was within the range of most previous estimates. The percentage 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 2014).

Recent Fishery Performance

In 2019, only 177 humpback whitefish were harvested compared to the most recent abundance estimates of 22,290 in 2008 (Wuttig 2009), and 12,755 fish in 2012 (Gryska 2014).

In general, the results from the personal use spear fishery seem to be relatively stable with regards to participation and success (Table 20). Participation and success are dependent on water conditions and weather, and are greater when the river is clear. In 2019, total reported harvests were 493 fish composed of 177 humpback whitefish, 197 least cisco, 101 round whitefish, and 18 unknown whitefish (Table 20). Several permit holders (n = 11), or 4.9%, failed to report after 2 email reminders, and 1 phone call.

From 2007–2013, the ratio of least cisco to humpback whitefish harvested in the Chatanika River was 0:4, and from 2017–2019 it changed to 2:1. This may indicate strong recruitment of least cisco into the personal use fishery.

There is little participation in this sport fishery due to the difficulty in catching whitefish by hook and line.

Fishery Objectives and Management

The *Chatanika River Personal Use Whitefish Spear Fishery Management Plan* (Brase *Unpublished*)[3] 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.
2. To stay within these permit guidelines:
    a. Permits will be issued starting in mid-August.
    b. Permits will be only issued to Alaska residents who hold a sport fish license, and only 1 permit will be issued per household.
    c. Permits will be issued from the Fairbanks ADF&G office.
    d. Permits must be filled out and returned after fishing is complete or by October 31.
    e. If a permit is not returned, the permittee may not be eligible to receive another the following year.
    f. Permit will specify fishery area and fishery dates.
    g. Maximum total fishery harvest level of 1,000 whitefish (any species).

[3] Brase, L. J. *Unpublished*. Chatanika River personal use whitefish spear fishery management plan. Alaska Department of Fish and Game, Division of Sport Fish, Fairbanks.

Current Issues and Fishery Outlook

Overall, there appears to be satisfaction from the participants in the personal use spear fishery. People report enjoying the opportunity to participate in the fishery and are satisfied with the 10-fish household limit. In 2009 and 2010, all permits were issued in 3 days or less. In 2019, it took 3 hours to issue all the permits and in 2020, due to the Covid-19 pandemic, the permit system was moved to an online lottery; it will likely remain an online lottery and online reporting should be available by 2021.

Anglers interested in spearing whitefish are encouraged to look for other stocks that might provide opportunity for fall spear fishing. Because of ongoing interest, other spear fisheries may emerge on small stocks of whitefish in some of the clearwater tributaries of the Tanana River. There is an unknown level of spearfishing effort at the Fielding Lake outlet and the potential for the same kind of effort at the George Lake outlet; harvest levels at these locations may need to be monitored if popularity increases.

Recent Board of Fisheries Actions

There have been no actions taken by the BOF with regards to the Chatanika River whitefish fishery since 2010 when 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. During 2016, the BOF permanently set into regulation a seasonal household limit of 10 whitefish for all species combined.

Current or Recommended Research and Management Activities

The population dynamics of least cisco can be highly variable because they are relatively short lived (e.g., 5–7 years) and more responsive to changing environmental factors. The last abundance estimate was in 2008 and a more recent stock assessment is recommended. The increasing ratio in harvests of least cisco to humpback whitefish since 2013 suggests a growing least cisco population (Table 20).

Current research efforts have focused on least cisco seasonal movements throughout Minto Flats and the Chatanika River using radiotelemetry and sonar. Telemetry data will aid management in understanding where least cisco that spawn in the Chatanika River and reside in the winter and summer months. It will also describe the upstream and downstream migrations and spatial distributions of least cisco.

A feasibility study that used sonar operated downstream of the fishery and main spawning area attempted to enumerate outmigrating least cisco after they have spawned. Preliminary data suggests that due to species apportionment issues (i.e., multiple fish species being of similar size), and upstream/downstream movement, a sonar system is currently not beneficial in enumerating least cisco. Both telemetry and sonar projects are currently being drafted and results will be reflected in future Fishery Management Reports.

The online lottery for permits is also likely to continue. Historically, permits were given out at the Fairbanks ADF&G office on a first-come/first-serve basis. It is assumed that the people who typically stand in line outside the office are more likely to participate in the fishery and be successful at harvesting fish. In 2020, the preliminary harvest/permit was 2.8 fish (Table 20). It is unknown if this decline is due to water levels, the number of "new" users, fewer fish on the spawning grounds, or the Covid-19 pandemic; however, it is likely a combination of those factors.

LAKE TROUT

Background and Historical Perspective

Since 1986, ADF&G 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 spawning in nonconsecutive years) combined with the short growing season at higher altitudes increase the vulnerability of the species to overharvest (Burr 1987, 2006). Even modest fishing pressure can have a significant impact.

Lakes containing wild lake trout in the TRMA include Fielding, Monte, Two Bit, Landmark Gap, Glacier Gap, 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, which includes Glacier Gap and Landmark Gaps Lakes (bag and possession limit of 1 fish with no size limit), Fielding Lake (bag and possession limit of 1 fish >26 inches in length), and Harding Lake (bag and possession limit of 1 fish $\geq$30 inches in length).

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, because these fish were spawned in years when no stocking of lake trout occurred (Doxey 1985). In 1998, an artificial spawning substrate was placed in Harding Lake to enhance 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, Donnelly, 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.

In Fourteen Mile Lake, a self-sustaining population of rainbow trout was established from stocking that occurred in 1961. Lake trout were stocked in 1991 and are also self-reproducing. Based on sampling in June of 2017, rainbow trout are still present (4 captured) but at much lower densities. Far more lake trout (n = 33) were sampled and their lengths were 28–500 mm FL.

Recent Fishery Performance

In 2019, there was a harvest of 428 lake trout in the TRMA (Table 21). The Tangle Lakes system has consistently produced the highest wild lake trout harvest in the TRMA. In 2019, the number of lake trout harvested from this system was 316 fish with a catch of 798 fish (Table 21). Based on SWHS estimates for both Fielding and Harding Lakes, effort, harvest, and catch in both lakes remains low; however, managers are confident that both lakes are more popular and receive more effort than what is reflected in the SWHS. The continued harvests in Harding Lake indicate some proportion of the population are still growing above 30 in and the catches indicate that a sustainable fishery exists; this is probably the case at Fielding Lake as well.

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 ADF&G 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 3 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). Fielding Lake is managed under the special management category *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, which factors in a 10% hooking mortality (Burr 2006). The status of the population is unknown. Regular requests from the public indicate a desire to supplement the number of lake trout to improve catch rates and ensure future production of harvestable fish. Supplemental stockings are a priority and have been added to the region's stocking plan. In 2019, the lake trout stocking program was reinstated and 10,000 subcatchables (~5 in) were introduced into Harding Lake; those fish will grow large enough to recruit into the sport fishery in 5–7 years.

The sustainable yield estimate for the Tangle Lakes complex is 235 lake trout per year based on the LA model (Burr 2006). Harvest has exceeded that threshold 6 out of the last 10 years (Table 21).

In Fielding Lake, the sustainable yield is set at 78 lake trout ≥26 inches. Accounting for 10% hooking mortality, the 5-year average of total fishing mortality was 36 fish (Table 21). Removal of the 26-inch length limit would increase the sustainable yield to 203 lake trout. The benefits of this action would be to simplify the regulations and provide more opportunity for anglers to harvest fish. Based on fishing effort and the tendency for anglers to not harvest fish, it is believed that this would not significantly increase harvest.

Recent Board of Fisheries Actions

There have been no proposals adopted regarding lake trout in the TRMA since 2007. At the 2019 AYK BOF meeting, there were 2 proposals related to Fielding Lake. The first proposal aimed to modify the size limit for lake trout to a maximum of 28 inches or less, and the second proposal looked to repeal the size limit altogether.

Current or Recommended Research and Management Activities

A multiyear mark–recapture population study was initiated in 2010 for lake trout in Fielding Lake (Schwanke 2013). Spawning abundance was estimated to be 299 (SE = 25; 95% CI = 250–347) mature male lake trout (≥20 in). 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.

An updated stock assessment of Fielding Lake was scheduled for the summer/fall of 2020/2021, but due to the Covid-19 pandemic that project has been delayed a year. This project will use hook-and-line sampling in the summer and beach seining on the spawning grounds for 2 consecutive years. The hope is that we will have a more robust estimate and not simply an estimate of the male spawning population.

Harding Lake is the only local lake that provides a highly valued and popular lake trout fishery near Fairbanks. These fish are difficult to catch probably because of their relatively low densities and/or restricted productivity related to their limited spawning areas. The public demand for lake trout fishing in Harding Lake is high. In fall 2020, stocking efforts were reinstated into Harding Lake, once those fish are recruited to the sport fishery, they should increase catch rates, and hopefully, angler participation and satisfaction.

The Tangle Lakes Complex consistently receives the most effort, catch, and harvest rates when compared to other lake trout fisheries in the TRMA (Tables 1 and 21). Minimal information has been collected on the lake trout within this complex, and the last time a stock assessment was conducted it was in 1988 and did not include many of the lakes. Additionally, a radiotelemetry project was conducted but due to a small size the data was inconclusive in determining if the complex represented a single population. An updated radiotelemetry project followed by a complex-wide abundance estimate is scheduled for 2022.

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, Fort Richardson, Elmendorf Air Force Base, Clear Air Force Station, and other locations have supplied fish to TRMA waters.

Initial stocking events were often “bucket-biology” experiments when fish were simply transported from one lake to another, often without good documentation. Stocking Alaska’s waterways has changed over the years, and now there are science-based 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 stocked into any water bodies.

At present, over 91 lakes are 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 rainbow trout (sterile); however, this practice ended in 2010. These stocked waters offer a range of both summer and winter 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. These lakes function to provide diverse angling opportunities, shift pressure from wild stocks, and provide harvest alternatives.

A variety of fish are stocked in the TRMA, including rainbow trout, Arctic grayling, Arctic char, lake trout, and landlocked salmon (Chinook and coho). These fish are produced at the Ruth Burnett Sport Fish Hatchery in Fairbanks and then transported by truck to Fairbanks and/or Delta Junction area lakes in the early summer and late fall. Some brood stock or eggs (e.g., rainbow trout) are provided by the William Jack Hernandez Sport Fish Hatchery in Anchorage. Occasionally, lakes, particularly Chena Lake and Cushman Lake are stocked just prior to ice-up to supplement the winter fisheries at these locations.

Fish are stocked at 4 size categories: (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 can meet the lower demand, and it is too expensive to transport the same numbers of larger fish with aircraft.

Additionally, to promote public participation and angling success, 6 public use cabins are available for free with a reservation and permit. All of these cabins, except the one at George Lake, are on popular stocked lakes in the Delta Junction area.

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), catch rates can be high, and most of the lakes/ponds are easily accessible. Approximately 38% of all effort and 60% of all harvest within the TRMA between 2009–2018 were supported by stocked lakes (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 ADF&G 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. Rainbow Lake is only lake currently managed under the conservative management approach, and Harding Lake is managed under the special 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 hatchery and management 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 on the ADF&G website at http://www.adfg.alaska.gov/index.cfm%3Fadfg%3DfishingSportStockingHatcheries.stockingPlan.

Current Issues and Fishery Outlook

The William Jack Hernandez (Anchorage) and Ruth Burnett (Fairbanks) Sport Fish hatcheries began producing catchable-sized fish in 2012. The increase harvest of stocked fish observed since 2013 is attributed to this production. The Ruth Burnett hatchery continues to perform at optimal production, and in 2019, the first lake trout eggs since 2000 were reared. In the fall of 2020, the

lake trout stocking program was reinstated and subcatchables were stocked in a select TRMA and Southcentral lakes. In 2020, the Arctic grayling egg take did not occur due to budget cuts and the Covid-19 pandemic. It is anticipated that the Arctic grayling stocking program will resume in 2022. The Chinook salmon egg take on the Chena River did not happen in 2020 dues to escapement concerns, Chinook salmon were instead provided by the William Jack Hernandez Hatchery.

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, the ability to provide fishing opportunity within the Fairbanks city limits and surrounding area is lost until legal access to these water bodies is provided.

Another issue that has recently emerged is per- and polyfluoroalkyl substances (PFAS) contamination around Eielson Air force Base and North Pole. Local wells and several stocked lakes are known to be contaminated with PFAS. Out of an abundance of caution, ADF&G has restricted water bodies with PFAS contamination to catch-and-release only, and those lakes are currently not being stocked.

Recent Board of Fisheries Actions

At the 2019 BOF meeting, the BOF adopted the updated *Tanana River Area Stocked Waters Management Plan* (5 AAC 74.065) and removed Koole and Dune Lakes from the conservative management approach due to insufficient 18-inch fish during the 2013 sampling, a decreasing trend in harvest, and decreased water levels to support the conservative management approach. Koole and Dune Lakes are currently managed under the regional management approach. Stocked waters are removed or reclassified from the stocking plan when there is a loss of public access, poor fish growth or survival, or insufficient effort. Lakes are added if new opportunities arise.

Current or Recommended Research and Management Activities

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 Chinook salmon also do well in most lakes and provide an aggressive fish during winter when other species are less active. Arctic char and lake trout are long-lived and can grow to a large size (≥18 in), which makes them attractive to anglers; however, they generally need deeper, cooler lakes to survive. In some lakes, more than 1 species are stocked to provide diversity and to take advantage of different seasonal behavior of the fish. The most popular combination is rainbow trout and coho salmon. Every season selected stocked lakes are assessed to ensure they are meeting public demand and that lake productivity is consistent with the current stocking regime for that particular lake. The assessments of stocked lake should be continued.

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REFERENCES CITED

Albert, M. L. 2016. Seasonal movements of northern pike in Minto Flats, Alaska. Master of Science thesis, University of Alaska Fairbanks, Fairbanks.

Albert, M. L., and M. Tyers. 2020. Estimated abundance of northern pike in the Chatanika River and Minto Lakes, 2018. Alaska Department of Fish and Game, Fishery Data Series No. 20-10, Anchorage.

Andrews, E. 1988. The harvest of fish and wildlife for subsistence by residents of Minto, Alaska. Alaska Department of Fish and Game, Technical Paper No. 137, Juneau.

Baker, B., and M. Tyers. 2019. Stock assessment of Burbot in George Lake, 2018. Alaska Department of Fish and Game, Fishery Data Series No. 19-34, Anchorage.

Barton, L. H. 1987. Population estimate of Chinook salmon escapement in the Chena River in 1986 based upon mark and recapture techniques. Arctic, Yukon, and Kuskokwim Region, Yukon River Salmon Escapement Report No. 31. Alaska Department of Fish and Game, Division of Commercial Fisheries, Fairbanks.

Barton, L. H. 1988. Population estimate of Chinook salmon escapement in the Chena River in 1987 based upon mark and recapture techniques. Alaska Department of Fish and Game, Regional Informational Report No. 3F88-05, Fairbanks.

Barton, L. H., and R. Conrad. 1989. Population estimate of Chinook salmon escapement in the Chena River in 1988 based upon mark and recapture techniques. Alaska Department of Fish and Game, Regional Informational Report No. 3F89-13, Fairbanks.

Bingham, A. E., and J. F. Parker. 1995. Assessment of harvest and participation characteristics in the northern pike fisheries of the Tanana River Drainage, Alaska. Alaska Department of Fish and Game, Fishery Data Series No. 95-16, Anchorage.

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

Brase, A. L. J. 2006. Fishery management report for sport fisheries in the Lower Tanana River management area, 2003–2005. Alaska Department of Fish and Game, Fishery Management Report No. 06-62, Anchorage.

Brase, A. L. J. 2009a. Sport fishery management plan for Chinook salmon in the Chena and Salcha Rivers. Alaska Department of Fish and Game, Fishery Management Report No. 09-11, Anchorage.

Brase, A. L. J. 2009b. Fishery management report for recreational fisheries in the Lower Tanana River management area, 2007. Alaska Department of Fish and Game, Fishery Management Report No. 09-23, Anchorage.

Brase, A. L. J. 2009c. Fishery management report for recreational fisheries in the Lower Tanana River management area, 2008. Alaska Department of Fish and Game, Fishery Management Report No. 09-46, Anchorage.

Brase, A. L. J. 2012. Salmon studies in the Chena, Delta Clearwater, Goodpaster and Salcha Rivers, 2006. Alaska Department of Fish and Game, Fishery Data Series No. 12-01, Anchorage.

Brase, A. L. J., and B. Baker. 2012a. Fishery management report for recreational fisheries in the Lower Tanana River management area, 2010. Alaska Department of Fish and Game, Fishery Management Report No. 12-32, Anchorage.

Brase, A. L. J., and B. Baker. 2012b. Fishery management report for recreational fisheries in the Lower Tanana River management area, 2011. Alaska Department of Fish and Game, Fishery Management Report No. 12-46, Anchorage.

Brase, A. L. J, and M. Doxey. 2006. Salmon studies in the Chena, Chatanika, Delta Clearwater and Salcha Rivers, 2004 and 2005. Alaska Department of Fish and Game, Fishery Data Series No. 06-61, Anchorage.

Burkholder, A. 1989. Movements, stock composition, and abundance of northern pike in Minto Flats during 1987 and 1988. Alaska Department of Fish and Game, Fishery Data Series No. 116, Juneau.

Burkholder, A. 1990. Stock composition of northern pike in Minto Flats during 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-25, Anchorage.

REFERENCES CITED (Continued)

Burkholder, A. 1991a. Abundance, egg production, and age-sex-size composition of the Chinook salmon escapement in the Salcha River, 1990. Alaska Department of Fish and Game, Fishery Data No. 91-5, Anchorage.

Burkholder, A. 1991b. Stock composition of northern pike captured in Minto Flats during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-23, Anchorage.

Burkholder, A., and D. R. Bernard. 1994. Movements and distribution of radio-tagged northern pike in Minto Flats. Alaska Department of Fish and Game, Fishery Data Series No. 94-1, Anchorage.

Burr, J. M. 1987. Synopsis and bibliography of lake trout, *Salvelinus namaycush* in Alaska. Alaska Department of Fish and Game, Fishery Manuscript No. 5, Juneau.

Burr, J. M. 2006. AYK Lake trout management plan. Alaska Department of Fish and Game, Fishery Management Report No. 06-52, Anchorage.

Clark, J. H., and S. L. Gregory. 1988. Abundance estimates of the Volkmar Lake northern pike population with estimates of age, sex, and length composition, 1985 through 1987. Alaska Department of Fish and Game, Fishery Data Series No. 57, Juneau.

Clark, J. H., D. R. Bernard, and G. A Pearse. 1988. Abundance of the George Lake northern pike population in 1987 and various life history features of the population since 1972. Alaska Department of Fish and Game, Fishery Data Series No. 58. Juneau.

Clark, R. A. 1989. Stock status of Chena River Arctic grayling. Alaska Department of Fish and Game, Fishery Data Series No. 97, Juneau.

Clark, R. A. 1990. Stock status of Chena River Arctic grayling. Alaska Department of Fish and Game, Fishery Data Series No. 90-4, Anchorage.

Clark, R. A. 1991. Stock status of Chena River Arctic grayling during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-35, Anchorage.

Clark, R. A. 1993. Stock status and rehabilitation of Chena River Arctic grayling during 1991 and 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-5, Anchorage.

Clark, R. A. 1994. Stock status and rehabilitation of Chena River Arctic grayling during 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-5**,** Anchorage.

Clark, R. A. 1995. Stock status and rehabilitation of Chena River Arctic grayling during 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-8, Anchorage.

Clark, R. A. 1996. Stock status and rehabilitation of Chena River Arctic grayling during 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-2, Anchorage.

Clark, R. A. 2009. An evaluation of estimates of sport fish harvest from the Alaska statewide harvest survey, 1996–2006. Alaska Department of Fish and Game, Special Publication No. 09-12, Anchorage.

Clark, R. A., D. F. Fleming, and W. P. Ridder. 1991. Stock assessment of Arctic grayling in the Salcha, Chatanika, and Goodpaster Rivers. Alaska Department of Fish and Game, Fishery Data Series No. 91-15, Anchorage.

Clark, R. A., and W. P. Ridder. 1987a. Abundance and length composition of selected grayling stocks in the Tanana drainage during 1986. Alaska Department of Fish and Game, Fishery Data Series No. 26, Juneau.

Clark, R. A., and W. P. Ridder. 1987b. Stock assessment of Arctic grayling in the Salcha and Chatanika Rivers. Alaska Department of Fish and Game, Fishery Data Series No. 74, Juneau.

Clark, R. A., and W. P. Ridder. 1988. Stock assessment of Arctic grayling in the Tanana River drainage. Alaska Department of Fish and Game, Fishery Data Series No. 54, Juneau.

Clark, R. A., and W. P. Ridder. 1990. Stock assessment of Arctic grayling in the Salcha, Chatanika, and Goodpaster Rivers. Alaska Department of Fish and Game, Fishery Data Series No. 90-7, Anchorage.

REFERENCES CITED (Continued)

Clark, R. A., and W. P. Ridder. 1994. An age-structured stock analysis of Arctic grayling in the Delta Clearwater River, 1977 to 1990. Alaska Department of Fish and Game, Fishery Manuscript No. 94-4, Anchorage.

Doxey, M. 1985. Population studies of game fish and evaluation of managed lakes in the Salcha District with emphasis on Birch and Harding Lakes. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Report of Progress, 1984-1985, Project F-9-17, 26(GIII-K).

Doxey, M. 2003. Fishery management plan and restoration plan for the Harding Lake northern pike sport fishery, 2000–2004. Alaska Department of Fish and Game, Fishery Management Report No. 03-01, Fairbanks.

Doxey, M. 2004. Salmon studies in the Chena, Chatanika, Delta Clearwater and Salcha Rivers, 2001. Alaska Department of Fish and Game, Fishery Data Series No. 04-01, Anchorage.

Doxey, M, A. L. J. Brase, and D. J. Reed. 2005. Salmon studies in the Chena, Chatanika, Delta Clearwater and Salcha Rivers, 2002 and 2003. Alaska Department of Fish and Game, Fishery Data Series No. 05-65, Anchorage.

Evenson, M. J. 1988. Movement, abundance and length composition of Tanana River burbot stocks during 1987. Alaska Department of Fish and Game, Fishery Data Series No. 56, Juneau.

Evenson, M. J. 1991a. Abundance, egg production, and age-sex-size composition of the Chinook salmon escapement in the Chena River, 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-6, Anchorage.

Evenson, M. J. 1991b. Abundance and size composition of burbot in rivers of Interior Alaska during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-33, Anchorage.

Evenson, M. J. 1992. Abundance, egg production, and age-sex-size composition of the Chinook salmon escapement in the Chena River, 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-4, Anchorage.

Evenson, M. J. 1993. Abundance, egg production, and age-sex-length composition of the Chinook salmon escapement in the Chena River, 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-6, Anchorage.

Evenson, M. J. 1994. Stock assessment of burbot in the Tanana and Chena Rivers, 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-11, Anchorage.

Evenson, M. J. 1995. Salmon studies in Interior Alaska, 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-5, Anchorage.

Evenson, M. J. 1996. Salmon studies in Interior Alaska, 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-17, Anchorage.

Evenson, M. J. 1997. Burbot research in rivers of the Tanana River drainage, 1996. Alaska Department of Fish and Game, Fishery Data Series No. 97-34, Anchorage.

Evenson, M. J., and L. Stuby. 1997. Salmon studies in Interior Alaska, 1996. Alaska Department of Fish and Game, Fishery Data Series No. 97-31, Anchorage.

Fleming, D. F. 1993. Stock assessment of humpback whitefish and least cisco in the Chatanika River during 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-25, Anchorage.

Fleming, D. F. 1994. Stock assessment and relative age validation of humpback whitefish and least cisco in the Chatanika River during 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-41, Anchorage.

Fleming, D. F. 1996. Stock assessment and life history studies of whitefish in the Chatanika River during 1994 and 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-19, Anchorage.

Fleming, D. F. 1997. Stock assessment of whitefish in the Chatanika River during 1996 and 1997. Alaska Department of Fish and Game, Fishery Data Series No. 97-36, Anchorage.

Fleming, D. F. 1998. Status of the Arctic grayling fishery in the Upper Chatanika River during 1997. Alaska Department of Fish and Game, Fishery Data Series No. 98-29, Anchorage.

Fleming, D. F. 1999. Stock monitoring of whitefish in the Chatanika River during 1998. Alaska Department of Fish and Game, Fishery Data Series No. 99-18, Anchorage.

REFERENCES CITED (Continued)

Fleming, D. F., R. A. Clark, and W. P. Ridder. 1992. Stock assessment of Arctic grayling in the Salcha, Chatanika, Goodpaster, and Delta Clearwater Rivers during 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-17, Anchorage.

Gryska, A. D. 2001. Abundance and composition of Arctic grayling in the Delta Clearwater River, 2000. Alaska Department of Fish and Game, Fishery Data Series No. 01-27, Anchorage.

Gryska, A. D. 2006. Vulnerability of Arctic grayling to the Brushkana Creek sport fishery. Alaska Department of Fish and Game, Fishery Data Series No. 06-73, Anchorage.

Gryska, A. D. 2010. Goodpaster River Arctic grayling stock assessment, 2006. Alaska Department of Fish and Game, Fishery Data Series No. 10-28, Anchorage.

Gryska, A. D. 2011a. Stock assessment Arctic grayling in the Delta River, 2008. Alaska Department of Fish and Game, Fishery Data Series No. 11-01, Anchorage.

Gryska, A. D. 2011b. Salcha River Arctic grayling stock assessment, 2003–2004. Alaska Department of Fish and Game, Fishery Data Series 11-42, Anchorage.

Gryska, A. D. 2014. Stock assessment of humpback whitefish in the Chatanika River, 2012. Alaska Department of Fish and Game, Fishery Data Series 14-12, Anchorage.

Hallberg, J. E. 1989. Abundance and size composition of Chatanika River least cisco and humpback whitefish with estimates of exploitation by recreational anglers. Alaska Department of Fish and Game, Fishery Data Series No. 108, Juneau.

Hallberg, J. E., and A. E. Bingham. 1994. Creel surveys conducted in interior Alaska during 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-27, Anchorage.

Hansen, P. A., and A. Burkholder. 1992. Abundance and stock composition of northern pike in Minto Flats, 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-48, Anchorage, Alaska, USA.

Hansen, P. A., and G. A. Pearse. 1995. Abundance and composition of northern pike in Volkmar and Deadman Lakes, 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-7, Anchorage.

Holmes R. A. 1983. Distribution, abundance and natural history of the Arctic grayling in the Tanana River drainage. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1982–1983, Project F-9-15, 24 (R-1), Juneau.

Holmes, R. A. 1985. Population structure and dynamics of the Arctic grayling with emphasis on heavily fished stocks. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1984–1985, Project F-9-17(26) R-I-A, Juneau.

Holmes, R. A., and A. Burkholder. 1988. Movements and stock composition of northern pike in Minto Flats. Alaska Department of Fish and Game, Fishery Data Series No. 53, Juneau, Alaska, USA.

Holmes, R. A., W. Ridder, and R. Clark. 1986. Tanana drainage Arctic grayling. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1985-1986, Project F-10-1, 27 (G-8-1), Juneau.

Howe, A. L., and S. Fleischman. 2001. Targeted angler-days fished for selected Alaska sport fisheries, 1994 and 1995. Alaska Department of Fish and Game, Fishery Data Series No. 01-7, Anchorage.

JTC (Joint Technical Committee of the Yukon River U.S./Canada Panel). 2011. Yukon River salmon 2010 season summary and 2011 season outlook. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A11-01, Anchorage.

Joy, P. 2009. Estimated abundance of northern pike in Minto Lakes, 2008. Alaska Department of Fish and Game, Fishery Data Series No. 09-79, Anchorage.

Lafferty, R., J. F. Parker, and D. R. Bernard. 1992. Stock assessment and biological characteristics of burbot in lakes of Interior Alaska during 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-20, Anchorage.

REFERENCES CITED (Continued)

Matter, A. N., and M. Tyers. 2019. Chinook salmon escapement in the Chena and Salcha Rivers and coho salmon escapement in the Delta Clearwater River, 2017. Alaska Department of Fish and Game, Fishery Data Series No. 20-01, Anchorage.

Matter, A. N., and M. Tyers. 2020. Chinook salmon escapement in the Chena and Salcha rivers and coho salmon escapement in the Delta Clearwater River, 2017. Alaska Department of Fish and Game, Fishery Data Series No. 20-01, Anchorage.

McKinley, T. R. 1993. Mortality of Arctic char and large Arctic grayling captured and released with sport fishing gear. Alaska Department of Fish and Game, Fishery Data Series No. 93-1, Anchorage.

Mills, M. J., and A. L. Howe. 1992. An evaluation of estimates of sport fish harvest from the Alaska statewide mail survey. Alaska Department of Fish and Game, Special Publication No. 92-2, Anchorage.

Parker, J. F. 1996. Stock assessment and biological characteristics of burbot in Fielding and George Lakes during 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-13, Anchorage.

Parker, J. F. 2001. Stock assessment and biological characteristics of burbot in Fielding Lake during 2000. Alaska Department of Fish and Game, Fishery Data Series No. 01-23, Anchorage.

Parker, J. F. 2003a. Fishery management plan for Arctic grayling in the Delta Clearwater River, 2001–2004. Alaska Department of Fish and Game, Sport Fishery Management Plan No. 03-02, Fairbanks.

Parker, J. F. 2003b. Fishery management plan for Arctic grayling in the Goodpaster River, 2001–2004. Alaska Department of Fish and Game, Fishery Management Report No. 03-03, Fairbanks.

Parker, J. F. 2009. Fishery management report for sport fisheries in the Upper Tanana River Drainage in 2007. Alaska Department of Fish and Game, Fishery Management Series No. 09-38, Anchorage.

Parker, J. F., and T. Viavant. 2000. Fishery management report for sport fisheries in the Tanana River Drainage from 1995 to 1997. Alaska Department of Fish and Game, Fishery Management Series No. 00-06, Anchorage.

Parker, J. F., B. Scanlon, and K. Wuttig. 2001. Abundance and composition of lake trout in Fielding (1999) and Island (2000) Lakes, Alaska. Alaska Department of Fish and Game, Fishery Data Series No. 01-31. Anchorage.

Pearse, G. A. 1990. Abundance and age, sex, and length composition of the northern pike populations of George, Volkmar, and T Lakes, 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-42, Anchorage.

Pearse, G. A. 1991. Stock assessment of the northern pike populations in Volkmar, George, and T Lakes, 1990 and 1991, and a historical review of research conducted since 1985. Alaska Department of Fish and Game, Fishery Data Series No. 91-63, Anchorage.

Pearse, G. A. 1994. Movements of northern pike in the lower Chena River, 1993–1994. Alaska Department of Fish and Game, Fishery Data Series No. 94-40, Anchorage.

Pearse, G. A., and A. Burkholder. 1993. Abundance and composition of the northern pike populations in Volkmar, George, T, and East Twin Lakes, 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-10, Anchorage.

Pearse, G. A., and P. A. Hansen. 1993. Estimates of sustainable yield for the northern pike populations in George, Volkmar, T, and Harding lakes. Alaska Department of Fish and Game, Fishery Manuscript No. 93-1, Anchorage.

Powers, B., and D. Sigurdsson. 2016. Participation, effort, and harvest in the sport fish business/guide licensing and logbook programs, 2014. Alaska Department of Fish and Game, Fishery Data Series No. 16-02, Anchorage.

Ridder, W. P. 1998a. Abundance and composition of Arctic grayling in the Delta Clearwater River 1996 and 1997. Alaska Department of Fish and Game, Fishery Data Series No. 98-35, Anchorage.

Ridder, W. P. 1998b. Stock status of Chena River Arctic grayling in 1997, and radiotelemetry studies, 1997–1998. Alaska Department of Fish and Game, Fishery Data Series No. 98-39, Anchorage.

Ridder, W. P. 1999. Stock status of Chena River Arctic grayling in 1998. Alaska Department of Fish and Game, Fishery Data Series No. 99-35, Anchorage.

REFERENCES CITED (Continued)

Ridder, W. P., and A. D. Gryska. 2000. Abundance and Composition of Arctic grayling in the Delta Clearwater River, 1999. Alaska Department of Fish and Game, Fishery Data Series No. 00-38, Anchorage.

Ridder, W. P., and D. F. Fleming. 1997. Stock status of Arctic grayling in the Chena River and Badger Slough during 1996. Alaska Department of Fish and Game, Fishery Data Series No. 97-30, Anchorage.

Ridder, W. P., T. R. McKinley, and R. A. Clark. 1993. Stock assessment of Arctic grayling in the Salcha, Chatanika, and Goodpaster Rivers during 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-11, Anchorage.

Roach, S. M. 1994. Stock assessment of Arctic grayling in the Salcha, Chatanika, and Goodpaster Rivers during 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-13, Anchorage.

Roach, S. M. 1995. Stock assessment of Arctic grayling in the Salcha, Chatanika, and Goodpaster Rivers during 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-9, Anchorage.

Roach, S. M. 1997. Abundance and composition of the northern pike population in Minto lakes, 1996. Alaska Department of Fish and Game, Fishery Data Series No. 97-17, Anchorage.

Roach, S. M. 1998a. Site fidelity, dispersal, and movements of radio-implanted northern pike in Minto Lakes, 1995–1997. Alaska Department of Fish and Game, Fishery Manuscript No. 98-1, Anchorage.

Roach, S. M. 1998b. Abundance and composition of the northern pike population in Minto Lakes, 1997. Alaska Department of Fish and Game, Fishery Data Series No. 98-12, Anchorage.

Savereide, J. W. 2012a. Salmon studies in the Chena, Delta Clearwater, Goodpaster, and Salcha Rivers, 2007–2009. Alaska Department of Fish and Game, Fishery Data Series 12-3, Anchorage.

Savereide, J. W. 2012b. Salmon studies in the Chena, Delta Clearwater, Goodpaster, and Salcha Rivers, 2010. Alaska Department of Fish and Game, Fishery Data Series 12-5, Anchorage.

Savereide, J. W. 2014. Salmon studies in the Chena, Delta Clearwater, Goodpaster, and Salcha Rivers, 2011–2012. Alaska Department of Fish and Game, Fishery Data Series 14-16, Anchorage.

Scanlon, B. P. 2001. Abundance and composition of the northern pike populations in Volkmar Lake and Minto Lakes, 2000. Alaska Department of Fish and Game, Fishery Data Series No. 01-29, Anchorage.

Scanlon, B. P. 2006. Abundance and composition of the northern pike population in Minto Lakes, 2003. Alaska Department of Fish and Game, Fishery Data Series 06-74, Anchorage.

Schwanke, C. J. 2013. Stock assessment of lake trout in Fielding Lake, 2010–2011. Alaska Department of Fish and Game, Fishery Data Series 13-55, Anchorage.

Sigurdsson, D., and B. Powers. 2009. Participation, effort, and harvest in the sport fish business/guide licensing and logbook programs, 2006–2008. Alaska Department of Fish and Game, Special Publication No. 09-11, Anchorage.

Sigurdsson, D., and B. Powers. 2010. Participation, effort, and harvest in the sport fish business/guide licensing and logbook programs, 2009. Alaska Department of Fish and Game, Fishery Data Series No. 10-65, Anchorage.

Sigurdsson, D., and B. Powers. 2011. Participation, effort, and harvest in the sport fish business/guide licensing and logbook programs, 2010. Alaska Department of Fish and Game, Fishery Data Series No. 11-31 Anchorage.

Sigurdsson, D., and B. Powers. 2012. Participation, effort, and harvest in the sport fish business/guide licensing and logbook programs, 2011. Alaska Department of Fish and Game, Fishery Data Series No. 12-27, Anchorage.

Sigurdsson, D., and B. Powers. 2013. Participation, effort, and harvest in the sport fish business/guide licensing and logbook programs, 2012. Alaska Department of Fish and Game, Fishery Data Series No. 13-37, Anchorage.

Sigurdsson, D., and B. Powers. 2014. Participation, effort, and harvest in the sport fish business/guide licensing and logbook programs, 2013. Alaska Department of Fish and Game, Fishery Data Series No. 14-23, Anchorage.

Skaugstad, C. L. 1988. Abundance and age-sex-size composition of the 1987 Salcha River Chinook salmon escapement. Alaska Department of Fish and Game, Fishery Data Series No. 37, Juneau.

REFERENCES CITED (Continued)

Skaugstad, C. L. 1989. Abundance and age-sex-size composition of the 1988 Salcha River Chinook salmon escapement. Alaska Department of Fish and Game, Fishery Data Series No. 75, Juneau.

Skaugstad, C. L. 1990a. Abundance, egg production, and age-sex-size composition of the Chinook salmon escapement in the Salcha River, 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-23, Anchorage.

Skaugstad, C. L. 1990b. Abundance, egg production, and age-sex-size composition of the 1989 Chena River Chinook salmon escapement. Alaska Department of Fish and Game, Fishery Data Series No. 90-13, Anchorage.

Skaugstad, C. L. 1992. Abundance, egg production, and age-sex-length composition of the Chinook salmon escapement in the Salcha River, 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-2, Anchorage.

Skaugstad, C. L. 1993. Abundance, egg production, and age-sex-length composition of the Chinook salmon escapement in the Salcha River, 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-23, Anchorage.

Skaugstad, C. L. 1994. Salmon studies in Interior Alaska, 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-14, Anchorage.

Stuby, L. 1999. Salmon studies in Interior Alaska, 1998. Alaska Department of Fish and Game, Fishery Data Series No. 99-31, Anchorage.

Stuby, L. 2000. Salmon studies in Interior Alaska, 1999. Alaska Department of Fish and Game, Fishery Data Series No. 00-4, Anchorage.

Stuby, L. 2001. Salmon studies in Interior Alaska, 2000. Alaska Department of Fish and Game, Fishery Data Series No. 01-24, Anchorage.

Stuby, L., and M. J. Evenson. 1998. Salmon studies in interior Alaska, 1997. Alaska Department of Fish and Game, Fishery Data Series No. 98-11, Anchorage.

Stuby, L., and M. J. Evenson. 1999. Burbot research in rivers of the Tanana River drainage, 1998. Alaska Department of Fish and Game, Fishery Data Series No. 99-36, Anchorage.

Stuby, L., and M. Tyers. 2016. Chinook salmon escapement in the Chena, Salcha, and Goodpaster Rivers and coho salmon escapement in the Delta Clearwater River, 2015. Alaska Department of Fish and Game, Fishery Data Series No. 16-45, Anchorage.

Tack, S. L. 1973. Distribution, abundance and natural history of the Arctic grayling in the Tanana River drainage. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1972–1973, Project F-9-5, 14 (R-1), Juneau.

Timmons, L. S. 1990. Abundance and length, age, and sex composition of Chatanika River humpback whitefish and least cisco. Alaska Department of Fish and Game, Fishery Data Series No. 90-2, Anchorage.

Timmons, L. S. 1991. Stock assessment of humpback whitefish and least cisco in the Chatanika River in 1990 and 1991. Alaska Department of Fish and Game, Fishery Data Series No. 91-70.

Timmons, L. S., and G. A. Pearse. 1989. Abundance of the northern pike populations of George, Volkmar, and T Lakes with estimates of age, sex, and length composition, 1988. Alaska Department of Fish and Game, Fishery Data Series No. 115, Juneau.

United States Census Bureau. 2010. US Census Data. www.census.gov (accessed February 23, 2011).

Viavant, T. 1996. Observations of fish attraction devices in Hidden and Harding Lakes, Alaska. Alaska Department of Fish and Game, Fishery Data Series No. 96-41, Anchorage.

Wuttig, K. G. 2004. Stock assessment of Arctic grayling in the headwaters of the Chatanika and Chena Rivers during 2002. Alaska Department of Fish and Game, Fishery Data Series No. 04-22, Anchorage.

Wuttig, K. G. 2009. Stock assessment of humpback whitefish and least cisco in the Chatanika River, 2008. Alaska Department of Fish and Game, Fishery Data Series No. 09-55, Anchorage.

REFERENCES CITED (Continued)

Wuttig, K. G. 2010. Abundance and composition of northern pike in Volkmar Lake, 2009. Alaska Department of Fish and Game, Fishery Data Series No. 10-41, Anchorage.

Wuttig, K., and A. D. Gryska. 2010. Abundance and length composition of Arctic grayling in the Delta Clearwater River, 2006. Alaska Department of Fish and Game, Fishery Data Series No. 10-84, Anchorage.

Wuttig, K., and A. D. Gryska. 2011. Stock assessment of Arctic grayling in the Chatanika River between Faith and Any Creeks, 2007. Alaska Department of Fish and Game, Fishery Data Series 11-55, Anchorage.

Wuttig, K. G., and D. J. Reed. 2010. Abundance and composition of northern pike in Volkmar Lake, 2005, and George Lake, 2006. Alaska Department of Fish and Game, Fishery Data Series No. 10-69, Anchorage.

Wuttig, K., and S. Stroka. 2007. Summer abundance of Arctic grayling in the Chena River, 2005. Alaska Department of Fish and Game, Fishery Data Series No. 07-21, Anchorage.

TABLES AND FIGURES

Table 1.–Estimates of effort (angler-days) for select areas of the Tanana River drainage, 2009–2019.

	Year											5-year Average	10-year Average
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2014–2018	2009–2018
Chena total[a]	16,804	15,408	10,401	8,296	19,219	20,293	11,210	8,021	8,460	5,370	6,675	10,671	12,348
Upper Chena	6,017	8,007	3,921	4,047	6,206	5,666	4,294	3,024	3,807	3,476	3,071	4,053	4,847
Lower Chena	10,787	7,401	6,480	4,249	13,013	14,627	6,916	4,997	4,653	1,894	3,604	6,617	7,502
Piledriver Slough	4,695	2,338	1,768	1,585	2,119	1,167	**644**	**250**	1,004	**1,124**	**935**	838	1,669
Chatanika total[a]	3,526	4,137	3,401	6,200	6,665	5,144	4,060	4,168	6,439	3,699	4,061	4,702	4,744
Upper Chatanika	1,897	2,438	1,796	3,199	4,767	2,903	2,528	1,344	3,559	2,103	3,200	2,487	2,653
Lower Chatanika	1,629	1,699	1,605	3,001	1,898	2,241	1,532	2,824	2,880	1,596	861	2,215	2,091
Salcha River	6,124	6,567	2,821	3,264	3,492	1,406	2,042	2,629	1,371	2,252	**747**	1,940	3,197
Minto Flats	2,984	1,424	1,460	964	1,197	1,996	1,074	**400**	2,570	728	527	1,354	1,480
Nenana Drainage[b]	2,699	2,401	5,947	5,494	3,369	2,373	5,916	6,359	4,291	4,318	2,895	4,651	4,317
Delta Clearwater River	5,018	4,193	5,048	3,870	3,158	5,366	4,330	6,191	5,263	5,184	4,417	5,267	4,762
Tangle Lakes drainage	4,065	7,050	4,478	4,326	6,199	5,519	3,999	4,619	4,696	4,431	4,732	4,653	4,938
George Lake	1,645	1,256	**249**	1,553	**474**	**641**	**289**	**256**	**148**	**1,135**	**401**	494	765
Fielding Lake	788	1,548	**422**	1,163	**1,545**	**714**	1,732	992	**1,108**	**551**	**805**	1,019	1,056
Volkmar Lake	**134**	**184**	**50**	**143**	ND	**53**	**360**	ND	**36**	**369**	**199**	**205**	166
Goodpaster River	1,949	1,132	993	**879**	**694**	**1,169**	**789**	**996**	**266**	**349**	**3,238**	714	922
Stocked Lakes total	38,870	43,513	24,776	25,885	29,722	43,082	30,819	28,949	20,815	27,840	25,812	30,301	31,427
Quartz Lake	6,905	8,214	4,532	3,988	1,347	4,114	4,593	5,865	4,203	6,350	3,153	5,025	5,011
Coal Mine Rd Lakes	4,294	7,325	3,957	2,311	4,385	7,072	2,745	3,249	3,116	2,714	3,780	3,779	4,117
Harding Lake	1,068	2,336	1,540	1,309	1,961	1,096	1,323	**843**	**590**	**717**	**644**	914	1,278
Other stocked lakes	7,774	10,152	2,962	4,373	8,820	11,827	5,885	6,733	5,986	4,504	7,524	6,987	6,902
Other Tanana	26,603	25,638	14,747	18,277	22,029	30,800	22,158	18,992	12,906	18,059	10,711	20,583	21,021
Total Tanana	3,196	5,708	5,564	6,069	7,448	7,217	8,977	7,225	10,430	8,011	7,861	8,372	6,985

Source: Alaska Sport Fishing Survey database [Internet]. 1996– . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited January 4, 2021). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/.

Note: Although data are presented for all years, data in bold result from fewer than 12 respondents and are subject to high variance and as presented only indicate that sport fishing occurred in these waters.

[a] Includes unspecified reaches.

[b] Includes Brushkana Creek, Fish Creek.

Table 2.–Number of fish harvested and caught by recreational anglers fishing in the Tanana River drainage (includes stocked waters), 2009–2019.

	Year	Chinook 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														
	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
	2013	11	8	139	1,179	9,067	835	799	5,952	2,087	1,436	7	810	21
	2014	0	54	216	4,126	10,254	1,015	418	8,010	1,867	1,745	37	1,165	0
	2015	13	0	180	1,753	22,119	610	484	5,591	1,838	1,877	0	193	261
	2016	20	0	641	7,980	18,834	3,038	480	6,680	1,707	1,689	20	370	0
	2017	18	23	236	3,655	11,286	942	375	4,449	1,096	1,032	7	745	189
	2018	200	15	482	2,018	9,973	1,375	117	3,176	1,586	578	35	444	17
	2019	19	0	72	1,234	12,661	606	428	3,008	2,524	1,078	15	135	0
5-year Average 2014–2018		50	18	351	3,906	14,493	1,396	375	5,581	1,619	1,384	20	583	93
10-year Average 2009–2018		190	37	275	2,811	11,637	1,424	571	6,044	1,936	1,440	15	613	70
Catch														
	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
	2013	129	580	1,952	3,947	31,462	5,050	1,472	148,797	15,293	1,693	79	1,647	99
	2014	10	171	6,655	14,589	37,250	3,249	1,752	109,152	14,651	1,932	186	1,744	48
	2015	48	189	4,393	3,323	60,475	4,937	4,330	108,078	14,743	2,929	69	422	586
	2016	1,532	117	4,853	19,280	46,584	8,880	1,829	91,319	12,450	3,385	49	612	202
	2017	138	627	3,218	8,642	30,366	1,971	4,924	99,450	11,807	1,200	7	822	436
	2018	538	57	2,830	7,696	29,919	3,629	589	83,847	6,898	614	75	533	114
	2019	36	24	1,579	8,824	42,292	3,556	1,226	124,653	16,880	1,265	15	314	232
5-year Average 2014–2018		453	232	4,390	10,706	40,919	4,533	2,685	98,369	12,110	2,012	77	827	277
10-year Average 2009–2018		946	346	3,829	8,172	39,488	4,821	2,849	108,853	14,799	2,170	100	1,063	193

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited January 4, 2021). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/.

Table 3.–Abundance estimates and methods of estimation for Chinook salmon in the Chena and Salcha Rivers, 2005–2020.

	Chena		Salcha	
Year	Abundance	Method	Abundance	Method
2005	No estimate[b]	Tower	5,988	Tower
2006	2,936	Tower	10,400	Tower
2007	3,564	Tower	5,631[a]	Tower
2008	3,212	Tower	5,300[a]	Tower
2009	5,253	Tower	12,788	Tower
2010	2,382	Tower	6,135	Tower
2011	No estimate[b]	Tower	7,200	Tower and aerial
2012	2,220	Tower	7,165	Tower
2013	1,859	Tower	5,465	Tower
2014	7,192	Sonar	No estimate[b]	Tower
2015	6,291	Tower	9,000	Tower
2016	6,665	Sonar	2,675	Tower and sonar
2017	4,949	Sonar	4,195	Sonar
2018	5,947	Sonar	5,021	Sonar
2019	2,404	Tower	4,863	Tower
2020[c]	306[c]	Sonar	No estimate[d]	
BEG Range	2,800–5,700		3,300–6,500	
10-year Average (2009–2018)	4,751		6,391	
5-year Average (2014–2018)	6,209		4,693	

Source: Brase and Doxey 2006; Brase 2012; Savereide 2012a–b, 2014; Stuby and Tyers 2016; Matter and Tyers 2019, 2020.

[a] Should be considered a minimum count due to high- and/or turbid-water conditions.

[b] No estimates were produced due to extreme high-water events throughout the run. Chena River Chinook salmon escapement was likely within the BEG range, based on results from the Salcha River escapement estimate.

[c] An incomplete count due to high water events and significant data gaps.

[d] The Salcha River tower did not operate due to insufficient funding.

Table 4.–Sport harvest of Chinook, coho, and chum salmon in the Tanana River drainage, 2009–2019.

	Year											5-year Average	10-year Average
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2014–2018	2009–2018
Chinook salmon													
Chena River	413	32	84	38	0	0	0	0	18	0	0	4	59
Salcha River	397	143	256	76	0	0	13	20	0	200	**0**	47	111
Chatanika River	0	16	0	0	0	0	0	0	0	0	19	0	2
Goodpaster River	0	0	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0	0
Other Tanana	26	122	32	0	11	0	0	0	0	0	0	0	19
Total	836	313	372	114	11	0	13	20	18	200	19	50	190
Coho Salmon													
Nenana River drainage	10	160	0	27	0	0	0	0	21	141	0	32	36
Delta Clearwater River	105	209	284	57	81	216	180	641	215	325	72	315	231
Other Tanana	0	0	0	0	58	0	0	0	0	16	0	3	7
Total	115	369	284	84	139	216	180	641	236	482	72	351	275
Chum Salmon													
Chena River	0	50	77	0	0	0	0	0	0	0	0	0	13
Minto Flats	0	12	0	0	0	0	0	0	0	15	**0**	3	3
Salcha River	0	0	0	0	0	0	0	0	23	0	0	5	2
Delta Clearwater River	71	0	0	63	8	54	0	0	0	0	0	11	20
Other Tanana	71	62	77	63	8	54	0	0	23	15	0	18	37
Total	0	50	77	0	0	0	0	0	0	0	0	0	13

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited January 4, 2021). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/.

Note: Although data are presented for all years, data in bold result from fewer than 12 respondents and are subject to high variance and as presented only indicate that sport fishing occurred in these waters.

Table 5.–Sport catch of Chinook, coho, and chum salmon in the Tanana River drainage, 2009–2019.

	Year											5-year Average	10-year Average
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2014–2018	2009–2018
Chinook Salmon													
Chena River	1,506	515	599	245	95	10	0	0	57	20	17	17	305
Salcha River	982	1,108	769	682	23	0	13	1,425	20	518	**0**	395	554
Chatanika River	0	16	32	215	0	0	0	0	20	0	19	4	28
Goodpaster River	104	0	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0	10
Other Tanana	40	220	32	0	11	0	15	107	41	0	0	33	47
Total	2,632	1,859	1,432	1,142	129	10	28	1,532	138	538	36	449	944
Coho Salmon													
Nenana River drainage	19	410	0	212	130	357	0	0	258	141	283	151	153
Delta Clearwater River	4,311	3,214	3,761	2,316	1,747	6,278	4,378	4,853	2,844	2,503	1,063	4,171	3,621
Other Tanana	0	55	0	95	75	20	15	0	179	186	233	80	63
Total	4,330	3,679	3,761	2,623	1,952	6,655	4,393	4,853	3,281	2,830	1,579	4,402	3,836
Chum Salmon													
Chena River	101	50	551	118	0	38	19	27	415	0	0	100	132
Minto Flats	35	24	44	42	290	0	118	0	18	15	**0**	30	59
Salcha River	0	11	14	0	130	24	52	21	182	0	0	56	43
Delta Clearwater River	390	73	11	251	160	109	0	69	12	42	24	46	112
Other Tanana	526	158	620	411	580	171	189	117	627	57	24	232	346
Total	101	50	551	118	0	38	19	27	415	0	0	100	132

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited January 4, 2021). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/.

Note: Although data are presented for all years, data in bold result from fewer than 12 respondents and are subject to high variance and as presented only indicate that sport fishing occurred in these waters.

Table 6.–Coho salmon survey counts from the Tanana River drainage, 2009–2020.

Surveyed Stream	Year												5-year Average	10-year Average
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2015–2019	2010–2019
Delta Clearwater R.	16,850	5,867	6,180	5,230	6,222	4,285	19,553	6,767	9,616	2,884	2,043	2,555	8,173	6,865
Richardson Clearwater R.	155	1,002	575	515	647	1,941	3,742	1,350	ND	976	ND	475	2,023	1,344
Lost Slough	410	1,110	369	ND	721[a]	333	242	334	1,278	1,822	ND	28	919	784
Nenana River mainstem	ND	280	ND	106	225	ND	1,789	1,680	862	241	749	206	921	682
Otter Creek (17-Mile Slough)	680	720	912	405	425	886	3,890	2,746	1,942	347	424	507	1,870	1,270
Julius Creek	2	0	0	ND	0	0	ND	0	0	0	0	ND	0	0
Wood Creek[b]	470	340	0	0	55	649	1,419	1,327	2,025	361	184	231	1,063	636
Clear Creek[b]	0[c]	130	516	0	2	25	164	27	9	0	5	3	41	88
Glacier Creek[b]	0[c]	0[c]	156	0	30	0	6	20	0	11	0	0	7	25
Lignite Creek	113	234	ND	ND	1	37	26	ND	ND	ND	ND	ND	26	75
June Creek	18	ND	ND	ND	ND	3	ND	ND	ND	ND	ND	ND	ND	3

Source: A. Padilla, biologist, ADF&G, Division of Commercial Fisheries, Fairbanks, personal communication, 2021.

ND = No data.

[a] Incomplete survey (lack of daylight).

[b] Tributaries to Julius Creek.

[c] Silty, poor visibility.

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

	Lower river (below RM 45)				Upper river (RM 45–90)					
Year	Stock size 150–269 mm FL (~6–12 in TL)	(SE)	Quality size ≥270mm FL (~12 in TL)	(SE)	Stock size 150–269 mm FL (~6–12 in TL)	(SE)	Quality size ≥270mm FL (~12 in TL)	(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: Holmes et al. 1986; Clark and Ridder 1987a, 1988; Clark 1989, 1990, 1991, 1993, 1994, 1995, 1996; Ridder and Fleming 1997; Ridder 1998b, 1999; Wuttig and Stroka 2007.

Note: RM = river mile; FL = fork length; TL = total length.

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

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

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

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

Table 8.–Sport catch of Arctic grayling in the Tanana River drainage, 2009–2019.

	Year											5-year Average	10-year Average
Water Body	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2014–2018	2009–2018
Chatanika River total	6,992	4,659	7,150	4,855	10,362	18,102	6,086	8,791	8,702	4,686	3,952	9,273	8,039
Upper Chatanika	4,738	3,427	4,210	2,958	5,338	11,611	4,302	1,916	6,694	3,099	3,188	5,524	4,829
Lower Chatanika	2,254	1,231	2,940	1,897	5,024	6,491	1,784	6,875	2,008	1,587	0*	3,749	3,209
Nenana River Drainage total	9,491	8,678	12,543	7,751	9,099	6,519	22,506	14,475	12,212	12,271	12,376	13,597	11,555
Fish Creek	**5,155**	4,127	4,961	6,753	3,693	3,352	8,786	6,307	5,815	7,392	8,138	6,330	5,634
Brushkana Creek	4,336	2,574	3,674	**1,236**	3,167	**731**	**1,377**	**1,013**	**1,226**	2,157	**2,190**	1,301	2,149
Chena River Total	26,316	27,166	15,579	18,776	53,034	24,234	24,836	12,920	25,594	13,968	26,164	20,310	24,242
Upper Chena	14,356	18,373	9,820	13,722	22,262	16,303	11,006	7,905	11,228	9,475	15,678	11,183	13,445
Lower Chena	11,960	8,793	5,759	5,054	30,772	7,931	13,830	5,015	14,366	4,493	10,486	9,127	10,797
Piledriver Slough	5,294	6,717	3,475	2,291	3,202	2,939	**1,395**	**451**	381	**636**	**5,612**	1,160	2,678
Salcha River	14,811	5,670	3,775	6,182	8,276	2,360	5,268	3,555	4,668	3,836	**1,331**	3,937	5,840
Goodpaster River	3,415	1,574	1,444	**1,274**	**236**	**1,895**	**1,041**	**2,576**	**338**	**431**	**2,900**	1,256	1,422
Delta Clearwater River	20,714	12,081	9,758	11,063	11,551	10,778	14,066	12,065	14,717	9,974	15,322	12,320	12,677
Fielding Lake	3,605	14,095	**424**	2,445	**2,027**	**903**	1,910	1,683	**7,618**	**895**	**1,171**	2,602	3,561
Tangle Lakes	30,535	27,682	18,653	19,281	30,820	24,806	16,813	19,927	16,908	25,545	31,160	20,800	23,097
Other Tanana	25,390	14,570	14,610	17,101	20,190	16,616	14,157	14,876	8,312	11,605	24,665	13,113	15,743
Total	146,563	122,892	87,411	91,019	148,797	109,152	108,078	91,319	99,450	83,847	124,653	98,369	108,853

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited January 4, 2021). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/.

Note: Although data are presented for all years, data in bold result from fewer than 12 respondents and are subject to high variance and as presented only indicate that sport fishing occurred in these waters.

Table 9.–Sport harvest of Arctic grayling in the Tanana River drainage, 2009–2019.

	Year											5-year Average	10-year Average
Water Body	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2014–2018	2009–2018
Chatanika River Total	209	773	616	291	690	3,491	231	1,202	1,288	378	244	1,318	917
Upper Chatanika	106	491	496	89	417	765	193	400	934	287	244	516	418
Lower Chatanika	103	282	120	202	273	2,726	38	802	354	91	0*	802	499
Nenana River Drainage Total	469	538	756	828	473	600	1,410	1,532	656	398	104	919	766
Fish Creek	**203**	0	0	530	0	59	33	968	200	147	0	281	214
Brushkana Creek	266	418	283	**194**	357	**189**	**272**	**53**	**184**	169	**20**	173	239
Chena River Total	0	0	0	0	0	0	0	0	0	0	138	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	101	0	0
Piledriver Slough	211	0	0	0	0	0	**0**	**0**	0	**0**	**0**	0	21
Salcha River	2,165	1,555	806	709	1,547	504	265	228	336	423	**74**	351	854
Goodpaster River	640	444	71	**202**	**17**	**302**	**19**	**214**	**87**	**143**	**616**	153	214
Delta Clearwater River	0	14	0	86	0	266	244	99	0	264	21	175	97
Fielding Lake	33	585	**70**	460	**381**	**139**	457	232	**116**	**0**	**39**	189	247
Tangle Lakes	2,125	2,656	2,031	1,245	1,482	1,271	1,502	1,309	1,274	867	1,100	1,245	1,576
Other Tanana	2,286	1,730	829	1,150	1,362	1,437	1,463	1,864	692	703	672	1,232	1,352
Total	8,138	8,295	5,179	4,971	5,952	8,010	5,591	6,680	4,449	3,176	3,008	5,581	6,044

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited January 4, 2021). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/.

Note: Although data are presented for all years, data in bold result from fewer than 12 respondents and are subject to high variance and as presented only indicate that sport fishing occurred in these waters.

Table 10.–Estimated abundance of Arctic grayling ≥240 mm fork length (FL) in a 14-mile (23 km) long index section of the Delta Clearwater River, 1996–2000 and 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: Ridder 1998a, 1999; Ridder and Gryska 2000; Gryska 2001; Wuttig and Gryska 2010.

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

Table 11.–Abundance estimates (SE) of Arctic grayling within the Chatanika River.

		Length (mm FL)	
Year	Index area	≥270	≥330
1995	3.2 upstream of Elliot Bridge to Any Creek (29.6 km)	3,027 (ND)	267 (ND)
2002	Sourdough Creek to Perhaps Creek (18.3 km)	205 (36)	ND
2007	Sourdough Creek to Perhaps Creek (18.3 km)	775 (152)	91(37)
2007	Faith to Any Creek(122.6 km)	11,934 (1,881)	1,416 (1,076)
2007	3.2 upstream of Elliot Bridge to Any Creek (29.6 km)	2,132 (562)	407 (172)

Source: Fleming 1998; Wuttig 2004; Wuttig and Gryska 2011.

Note: FL = fork length; ND = no data.

Table 12.–Abundance estimates of Arctic grayling (N) for the Lower Salcha River (Richardson Highway bridge to river mile 25, ~40 km), 1988–1994 and 2004.

Year	N (SE)	Length (mm FL)	Date	N (SE)[a]	Length (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 and Ridder 1988, 1990; Clark et al. 1991; Ridder et al. 1993; Roach 1994, 1995; Gryska 2011b.

Note: FL = fork length; en dash = no data.

[a] Standard error (SE) for fish ≥270 mm 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, 2009–2019.

	Year											5-year Average	10-year Average
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2014–2018	2009–2018
Harvest													
Minto Lakes[a]	765	568	396	303	350	485	360	75	523	219	**170**	332	404
Minto Flats[b]	873	608	422	412	382	597	372	**196**	589	390	746	429	484
George Lake	567	681	**82**	653	**67**	**431**	**433**	**102**	**0**	**559**	**365**	305	358
Healy Lake	**88**	**0**	ND	ND	**142**	**0**	**25**	**60**	**16**	**0**	ND	20	41
Deadman Lake (Alaska Highway)	**13**	ND	**0**	**23**	ND	ND	ND	**0**	**32**	**0**	**77**	11	11
Deadman Lake (Tolovana River)	ND	ND	ND	ND	**57**	ND	ND	**91**	ND	ND	**39**	91	74
Volkmar Lake	**26**	**59**	**16**	**31**	ND	**58**	**37**	ND	**11**	**72**	**24**	45	39
Mineral Lake (into Station Creek)	**170**	**168**	**0**	ND	**66**	**40**	**41**	**0**	**8**	**15**	**18**	21	56
Other Tanana	1,279	1,135	689	1,181	1,373	741	930	1,258	440	550	1,255	784	958
Total Tanana harvest	3,016	2,651	1,209	2,300	2,087	1,867	1,838	1,707	1,096	1,586	2,524	1,619	1,936
Catch													
Minto Lakes[a]	6,622	6,477	3,362	4,113	3,101	1,947	4,395	1,986	7,918	1,415	**1,519**	3,532	4,134
Minto Flats[b]	7,915	8,088	3,911	4,481	3,284	2,218	4,417	2,584	8,578	1,968	1,579	3,953	4,744
George Lake	3,152	4,009	**1,574**	8,463	**1,255**	**4,830**	**470**	**2,606**	**494**	**1,014**	**2,785**	1,883	2,787
Healy Lake	**704**	**0**	ND	ND	**1,480**	**29**	**371**	**196**	**183**	**143**	ND	184	388
Deadman Lake (Alaska Highway)	**707**	ND	**0**	**1,570**	ND	ND	ND	**112**	**32**	**10**	**97**	51	405
Deadman Lake (Tolovana River)	ND	ND	ND	ND	**57**	ND	ND	**181**	ND	ND	**2,242**	181	119
Volkmar Lake	**244**	**381**	**244**	**188**	ND	**145**	**817**	ND	**11**	**255**	**314**	307	286
Mineral Lake (into Station Creek)	**440**	**309**	**0**	ND	**196**	**259**	**104**	**145**	**49**	**15**	**252**	114	169
Other Tanana	5,718	7,286	7,943	4,822	9,021	7,170	8,564	6,626	2,460	3,493	9,611	5,663	6,310
Total Tanana catch	18,880	20,073	13,672	19,524	15,293	14,651	14,743	12,450	11,807	6,898	16,880	12,110	14,799

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited January 4, 2021). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/.

Note: Although data are presented for all years, data in bold result from fewer than 12 respondents and are subject to high variance and as presented only indicate that sport fishing occurred in these waters.

[a] In 2019, Minto Lakes was added as a location to the SWHS.

[b] Includes Minto Lakes, Lower Chatanika River, Tolovana River, and Goldstream Creek.

Table 14.–Estimated northern pike abundance in the Minto Lakes Study Area (MLSA) during 1996–2018, and with the Chatanika River Overwintering Area (CROA) in 2018.

		≥400mm (~16 in)[a]		≥600mm (~24 in)		≥720 mm (~30 in)	
Year	Area	Abundance	SE	Abundance	SE	Abundance	SE
1996	MSLA-B	23,850	7,799	7,616	883	–	–
1997		16,547	1,754	3,251	174	672	48
2000	MSLA-B	–	–	5,331	1,152	–	–
2003	MSLA-B	25,227	4,529	7,683	2,347	1,405	288
2008[b]	MSLA-A[b]	16,045	3,132	2,219	397	958	362
	MSLA-B	9,854	1,701	2,092	448	635	635
2018	CROA	–	–	14,675	1,631	3,207	549
	MSLA-A	–	–	11,443	1,651	–	–

Source: Roach 1997, 1998b; Scanlon 2001, 2006; Joy 2009; Albert and Tyers 2020.

Note: SE = standard error; en dash = no data.

[a] Estimated abundance of northern pike 400–599 mm FL are biased, and the magnitude of this is unknown.

[b] In 2008, the geographical size of the study area was expanded and is referred to as "Area-A". "Area-B" is the same study area that was used during 1996–2003.

Table 15.–Number of subsistence permits issued, returned, and reported fished, and total subsistence harvest of northern pike in the Tolovana River drainage, 1995–2020.

	Permits			
Year	Issued	Returned	Fished	Total harvest
1995	57	54	30	1,088
1996	74	68	30	1,916
1997	88	74	41	1,344
1998	70	66	31	431
1999	54	50	23	400
2000	34	29	12	352
2001	50	43	18	277
2002	32	31	13	521
2003	119	105	55	966
2004	99	91	42	393
2005	80	69	31	386
2006	101	98	55	865
2007	118	110	55	1,830
2008	147	138	80	1,363
2009	113	108	52	563
2010	96	91	41	125
2011	70	70	29	110
2012	73	68	35	525
2013	77	74	44	231
2014	106	105	57	478
2015	120	119	66	765
2016	201	196	129	1,020
2017	93	93	41	137
2018	175	175	103	1,040
2019	245	243	155	1,633
2020[a]	329	323	191	2,005
5-year Average 2014–2018	139	138	79	688
10-year Average 2009–2018	112	110	60	499

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

[a] Preliminary data based on permits returned and telephone harvest reporting as of 12/31/2020. Permits expire at the end of the calendar year.

Table 16.–Estimates of abundance of northern pike >18 inches (~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: Clark and Gregory 1988; Clark et al. 1988; Pearse 1990; Pearse 1991; Pearse and Burkholder 1993; Pearse 1994; Hansen and Pearse 1995; Timmons and Pearse 1989; Scanlon 2001; Wuttig and Reed 2010; Wuttig 2010.

Note: 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) and are usually ≥450 mm FL.

Table 18.–Sport harvest and catch of burbot in the Tanana River drainage, 2009–2019.

	Year											5-year Average	10-year Average
Harvest	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2014–2018	2009–2018
Lower Tanana River and tributaries	0	0	0	**50**	**17**	**20**	**41**	**0**	**22**	**60**	**17**	29	21
Middle Tanana River and tributaries	361	968	450	406	**722**	**487**	794	843	820	**160**	278	621	601
Chena River	262	125	26	84	12	884	58	27	110	15	277	219	160
Salcha River	361	110	0	0	44	61	0	0	0	0	**0**	12	58
Upper Tanana River and tributaries	658	82	**0**	**243**	382	**32**	**501**	**388**	**0**	**270**	**190**	238	256
Fielding Lake	0	0	**0**	67	**0**	**0**	0	0	**0**	**0**	**0**	0	7
Tangle Lakes	0	37	0	0	0	99	0	14	0	13	35	25	16
George Lake	52	220	**12**	217	**97**	**162**	**312**	**37**	**0**	**30**	**69**	108	114
Other Tanana	185	468	536	61	162	0	171	380	80	30	212	132	207
Total Tanana harvest	1,879	2,010	1,024	1,128	1,436	1,745	1,877	1,689	1,032	578	1,078	1,384	1,440
Catch													
Lower Tanana River and tributaries	0	0	6	**50**	**17**	**20**	**0**	**0**	**44**	**60**	**17**	25	20
Middle Tanana River and tributaries	465	1,548	632	456	**817**	**607**	911	988	856	**169**	295	706	745
Chena River	287	157	38	84	36	891	117	27	141	15	347	238	179
Salcha River	361	110	0	0	62	61	0	0	0	15	**0**	15	61
Upper Tanana River and tributaries	2,859	330	**0**	**340**	415	**32**	**1,338**	**1,939**	**46**	**282**	**190**	727	758
Fielding Lake	34	0	**0**	67	**0**	**0**	0	0	**0**	**0**	**0**	0	10
Tangle Lakes	0	37	0	0	0	99	0	14	0	13	35	25	16
George Lake	52	220	**12**	217	**130**	**182**	**312**	**37**	**0**	**30**	**69**	112	119
Other Tanana	198	762	536	85	216	40	251	380	113	30	312	163	261
Total Tanana catch	4,256	3,164	1,224	1,299	1,693	1,932	2,929	3,385	1,200	614	1,265	2,012	2,170

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited January 4, 2021). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/.

Note: Although data are presented for all years, data in bold result from fewer than 12 respondents and are subject to high variance and as presented only indicate that sport fishing occurred in these waters.

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	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	No Survey
1996	No Survey	No Survey
1997	16,107 (SE = 1,260)	22,811 (SE = 4,496)
1998–2007	No Survey	No Survey
2008	22,490 (SE = 2,777)	15,345 (SE = 1,350)[b]
2012	12,755 (SE = 1,405)	No Survey

Source: Hallberg 1989; Timmons 1990, 1991; Fleming 1993, 1994, 1996, 1997; Wuttig 2009; Gryska 2014.

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

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

Table 20.–Chatanika River personal use whitefish spear fishery permit results, 2007–2020.

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	544	4.22
2012	200	198	123	318	372	136	41	867	7.05
2013	200	199	153	324	495	139	147	1,105	7.22
2014	200	198	141	220	206	141	23	590	4.18
2015	200	196	115	330	105	107	23	565	4.91
2016	224	219	148	403	198	177	77	855	5.78
2017	227	203	134	481	237	181	63	962	7.18
2018	225	213	123	318	108	151	46	623	5.07
2019	225	214	113	197	177	101	18	493	4.36
2020[a]	225	196	124	125	147	79	15	366	2.98

Source: ADF&G, Sport Fish Division, Fairbanks, unpublished data.

[a] Preliminary data.

Table 21.–Sport harvest and catch of lake trout in the Tanana River drainage, 2009–2019.

	Year											5-year Average	10-year Average
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2014–2018	2009–2018
Harvest													
Harding Lake	0	192	28	32	0	0	20	**21**	**13**	**19**	**24**	15	33
Fielding Lake	18	48	**2**	64	**161**	**0**	32	21	**29**	**0**	**0**	16	38
Tangle Lakes	333	657	337	161	444	206	72	374	228	16	316	179	283
Other Tanana	842	189	76	62	194	212	360	64	105	82	88	165	219
Total Tanana harvest	1,193	1,086	443	319	799	418	484	480	375	117	428	375	571
Catch													
Harding Lake	303	845	255	79	171	109	531	**343**	**104**	**46**	**24**	227	279
Fielding Lake	552	309	**12**	299	**335**	**145**	291	117	**286**	**165**	**134**	201	251
Tangle Lakes	1,159	3,317	1,278	1,254	761	801	1,121	1,049	3,932	214	798	1,423	1,529
Other Tanana	2,112	563	751	109	205	697	2,387	320	602	164	270	834	791
Total Tanana catch	4,526	5,034	2,296	1,741	1,472	1,752	4,330	1,829	4,924	589	1,226	2,685	2,849

Source: Alaska Sport Fishing Survey database [Internet]. 1996– . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited January 4, 2021). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/.

Note: Although data are presented for all years, data in bold result from fewer than 12 respondents and are subject to high variance and as presented only indicate that sport fishing occurred in these waters.

Table 22.–Contribution of stocked fish to the Tanana River drainage total effort, harvest, and catch, 2009–2019.

	Year											5-year Average	10-year Average
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2014–2018	2009–2018
Effort													
Effort on stocked waters	38,870	43,513	24,776	25,885	29,722	44,830	32,125	29,465	25,474	27,840	25,168	31,142	30,508
Total TRMA effort (stocked + wild)	92,497	96,859	67,378	69,691	85,301	96,140	76,241	71,055	66,897	65,361	63,305	75,139	78,734
Percent stocked waters effort	42%	45%	37%	37%	35%	47%	42%	41%	38%	43%	40%	41%	38%
Harvest													
Rainbow trout	9,909	10,910	7,663	6,069	9,067	10,254	22,086	18,834	11,082	9540	12446	14,359	11,541
Landlocked salmon	2,540	2,832	1,227	800	1,179	4,126	1,753	7,980	3,655	2,018	1,234	3,906	2,811
Arctic grayling	292	786	181	243	182	955	538	983	82	311	156	574	455
Arctic char	2,721	1,667	1,178	528	620	846	473	2,373	927	1100	533	1,144	1,243
Lake trout	413	138	0	32	43	25	80	0	0	57	63	32	79
Other	0	19	0	84	0	0	213	0	30	256	0	100	60
Total stocked fish harvest	15,875	16,352	10,249	7,756	11,091	16,206	25,143	30,170	15,776	13,282	14,432	20,115	16,190
Total TRMA harvest (stocked + wild)	30,689	32,152	19,348	16,847	22,351	28,907	34,919	41,459	24,053	20,016	21,780	29,871	27,074
Percent stocked waters harvest	52%	51%	53%	46%	50%	56%	72%	73%	66%	66%	66%	67%	60%
Catch													
Rainbow trout	42,612	48,609	35,547	31,385	31,462	37,250	60,442	45,812	29,218	28,255	41,591	40,195	39,059
Landlocked salmon	8,795	7,276	2,980	5,189	3,947	14,589	3,323	19,280	8,642	7,696	8,824	10,706	8,172
Arctic grayling	10,583	6,720	6,938	7,042	7,415	8,211	4,662	5,498	3,934	4,139	9,249	5,289	6,507
Arctic char	5,695	4,714	4,000	3,010	3,839	2,570	2,325	5,745	1,482	2,389	2,677	2,902	3,577
Lake trout	1,123	343	497	79	43	25	300	0	0	84	75	82	249
Other	0	31	0	84	0	48	384	0	30	892	0	271	147
Total stocked fish catch	68,808	67,693	49,962	46,789	46,706	62,693	71,436	76,335	43,306	43,455	62,416	59,445	57,711
Total TRMA catch (stocked + wild)	240,966	221,497	154,977	158,739	212,200	191,389	204,522	191,092	163,608	137,339	200,896	177,590	187,630
Percent stocked waters catch	29%	31%	32%	29%	22%	33%	35%	40%	26%	32%	31%	33%	31%

Source: Alaska Sport Fishing Survey database [Internet]. 1996– . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited January 4, 2021). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/

Note: The numbers presented in this table may vary slightly from year to year. Estimates of catch, harvest, and effort on stocked waters were generated using separate annual data exports form the internal ADF&G Statewide Harvest Survey Database (https://intra.sf.adfg.state.ak.us/swhs_est/presearch.cfm). Estimates in this database are often revised and summaries compiled from more recent data exports may be slightly different. Additionally, occasionally errors in previous year's estimates are found and corrected.

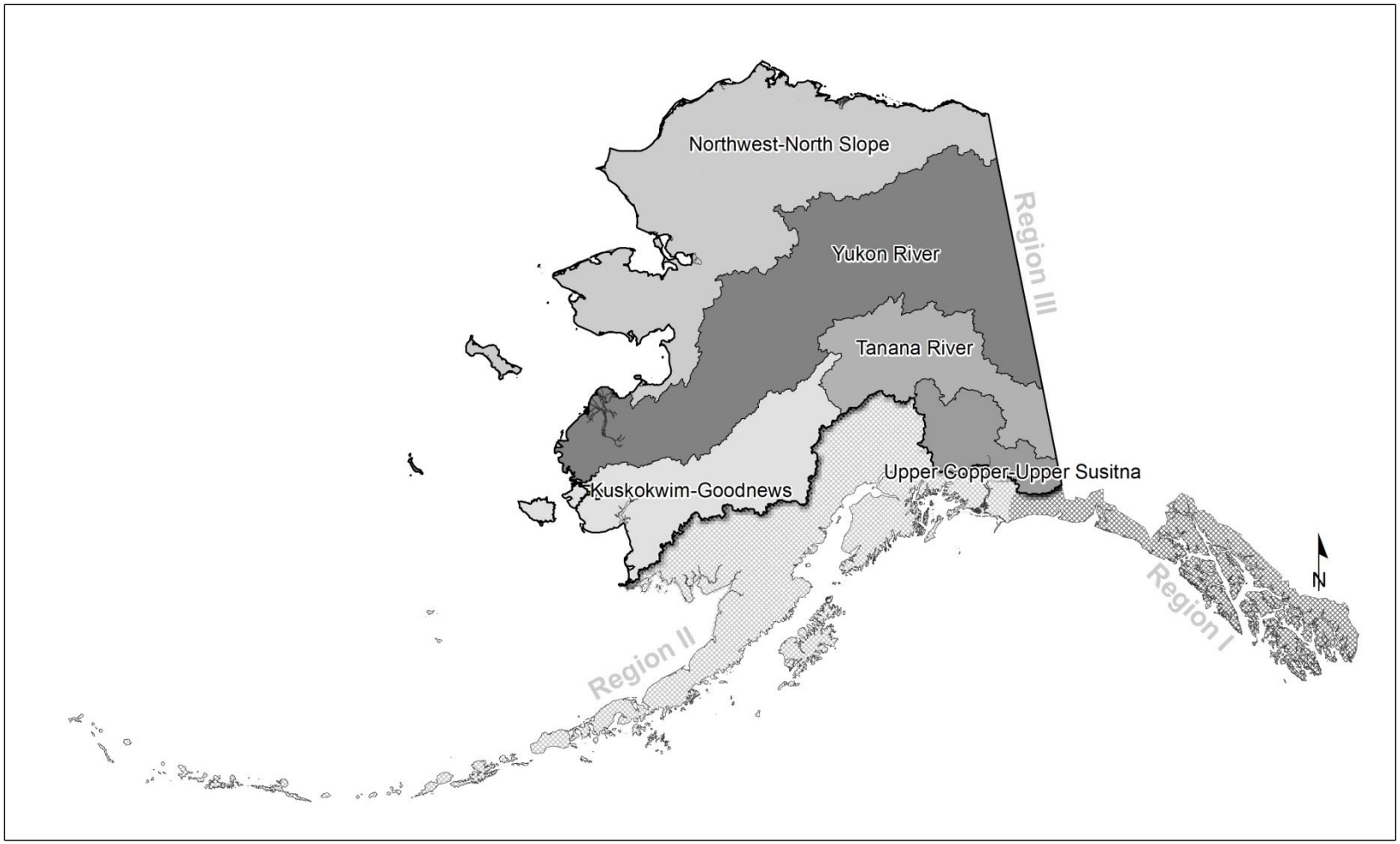

Figure 1.–The regional divisions (I-III) for ADF&G Division of Sport Fish, and the 5 management areas within Region III.

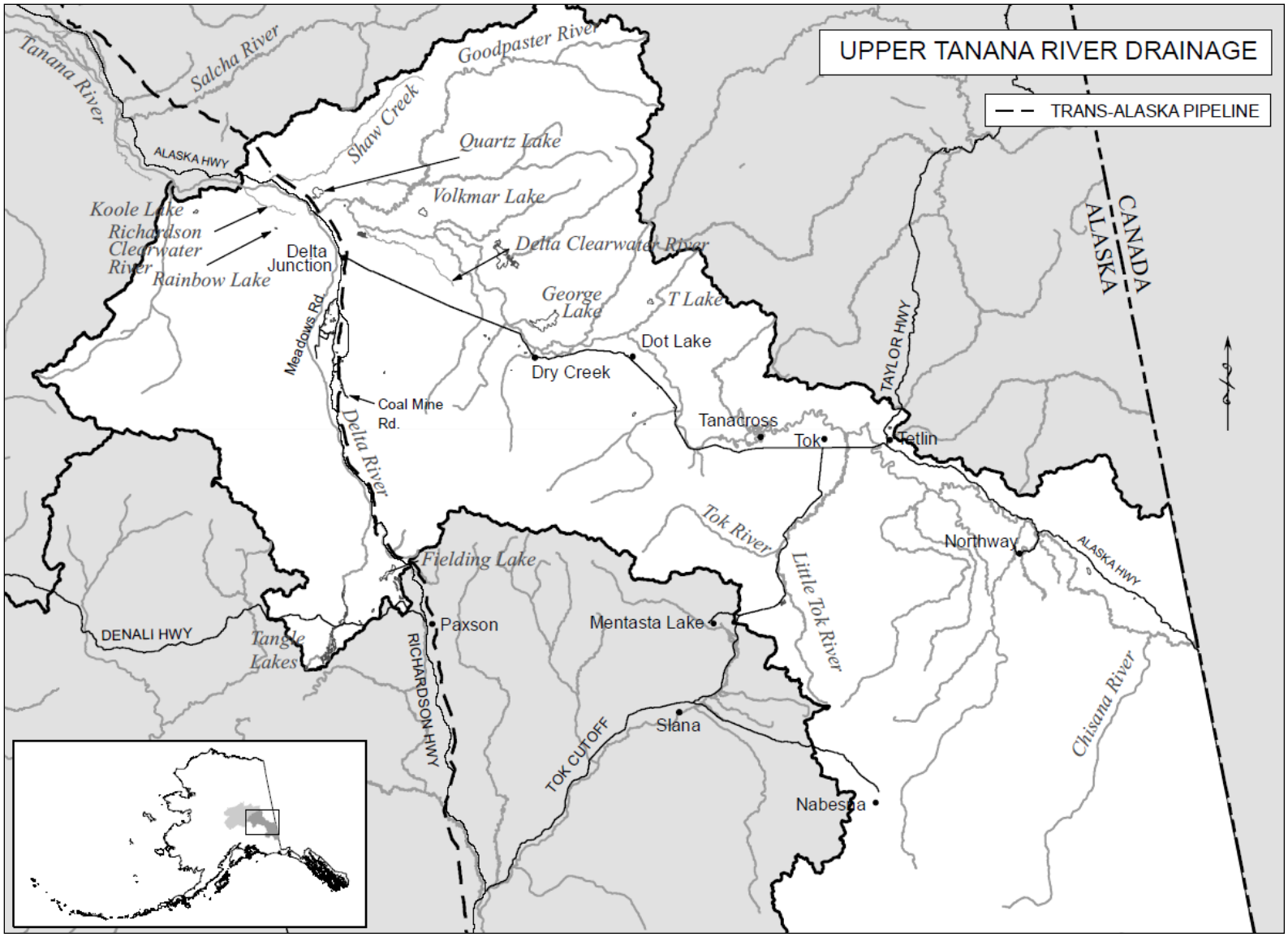

Figure 2.–The portion of the Tanana River drainage located upriver from the Salcha River.

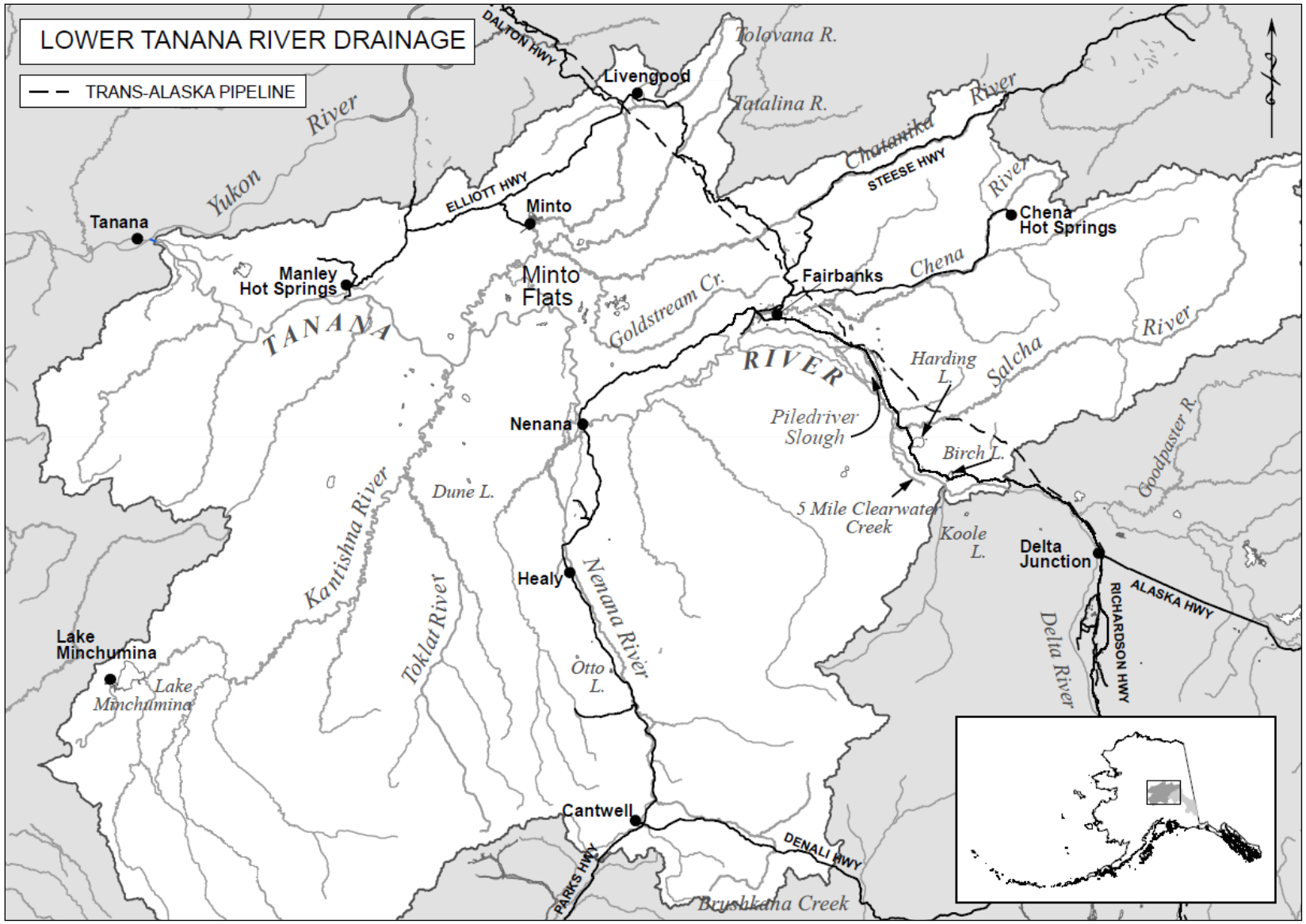

Figure 3.–The portion of the Tanana River drainage located downriver from Shaw Creek.

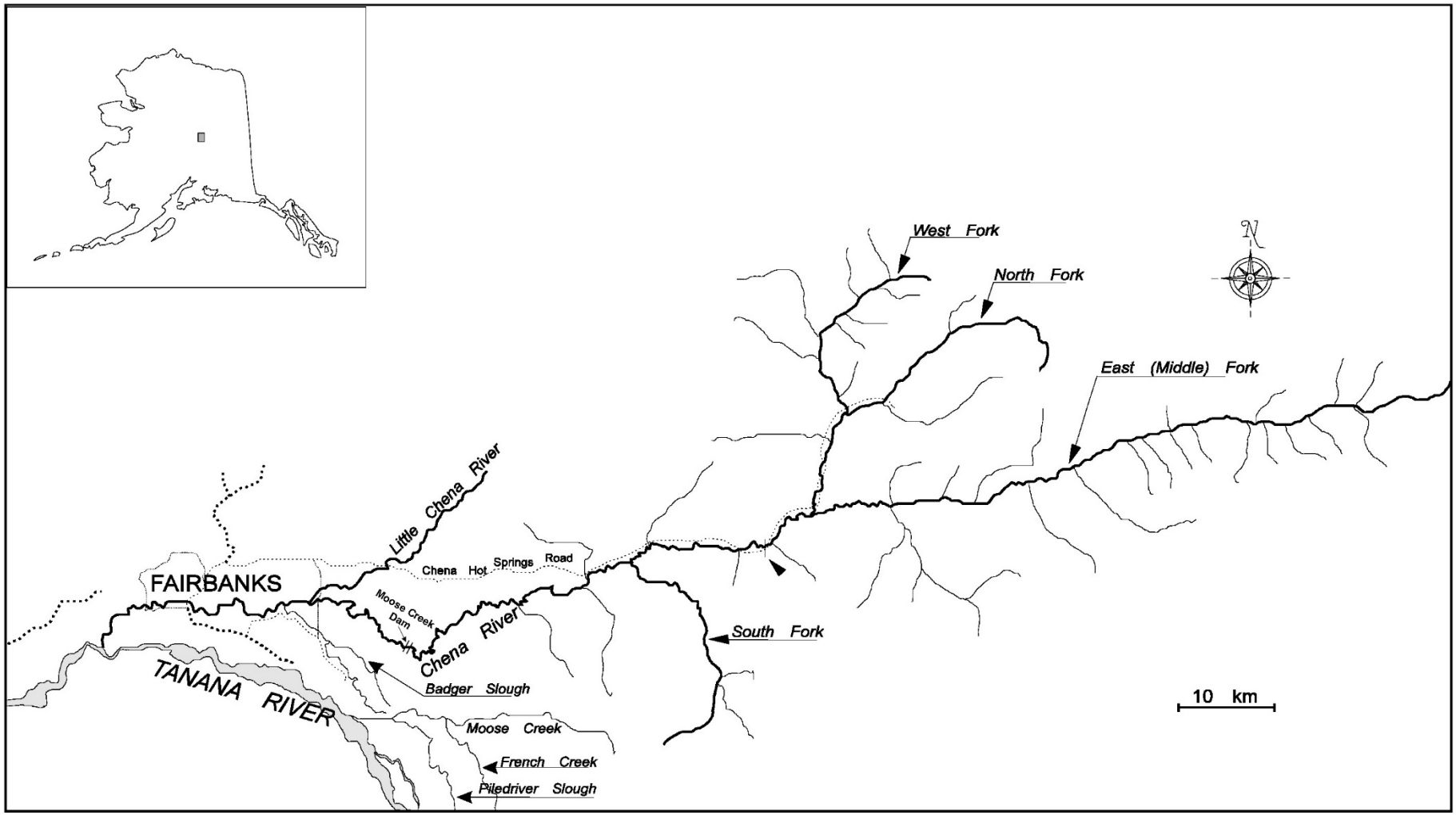

Figure 4.–The Chena River drainage.

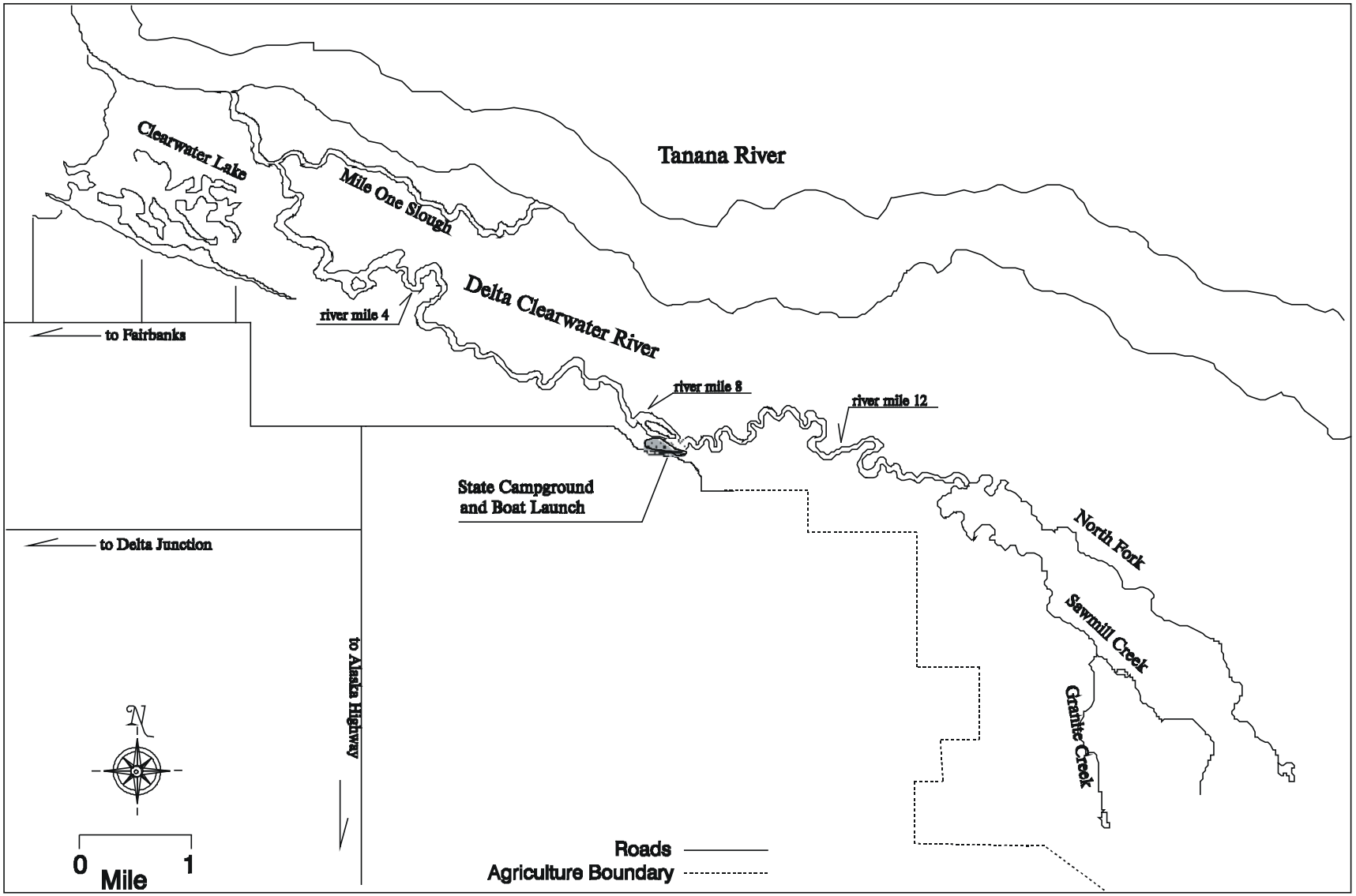

Figure 5.–The Delta Clearwater River.

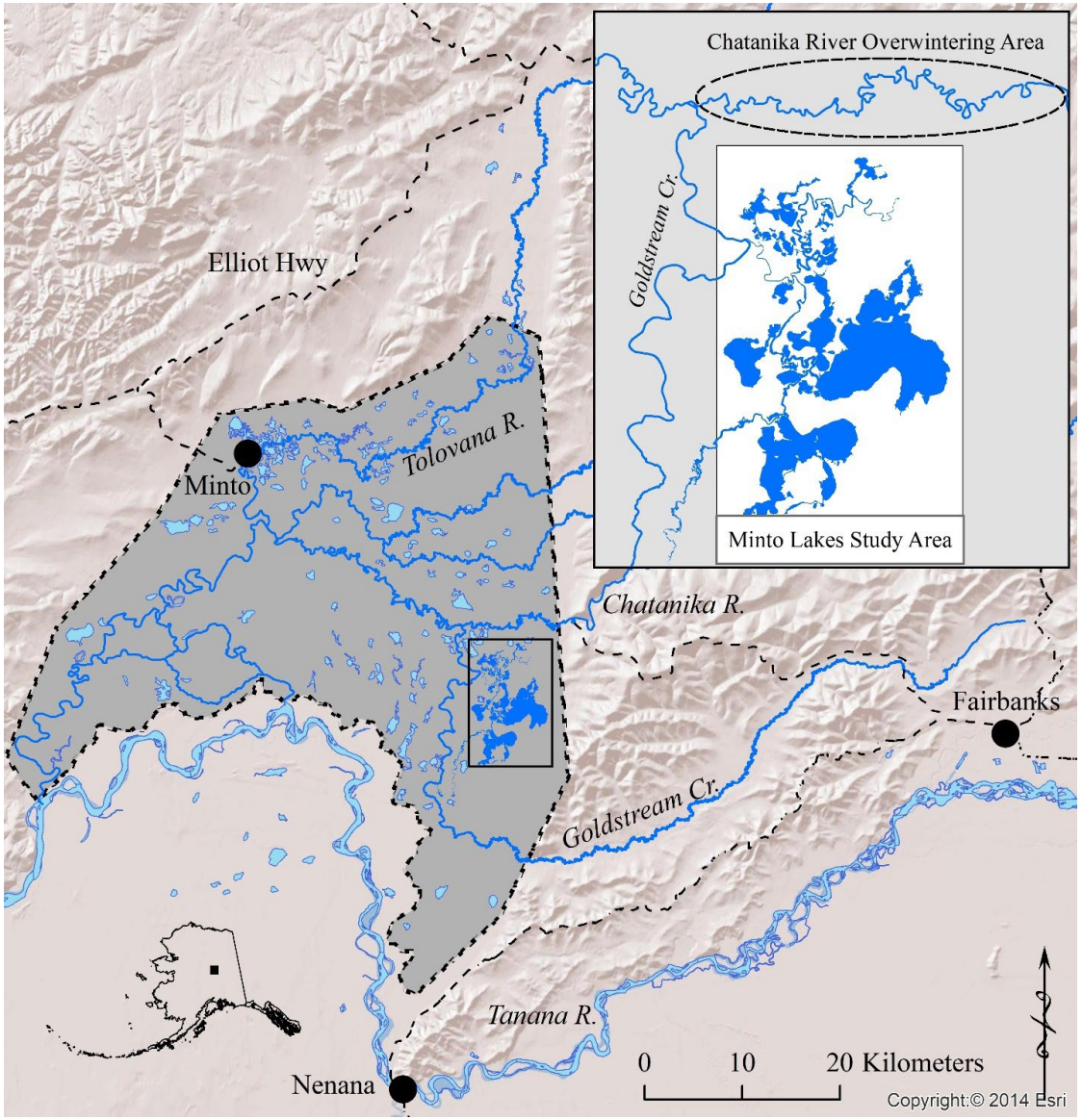

Figure 6.–Minto Flats with demarcation of harvest reporting area and the northern pike population assessment area.

APPENDIX A: EMERGENCY ORDERS

Appendix A1.–Emergency orders (EO) issued for Tanana River Management Area sport fisheries, 2016–2020.

Year	EO Number	Explanation
2016	3-NP-04-16	Reduced the bag and possession limit for northern pike in all lakes and flowing waters of the Minto Flats area to 2 fish, only 1 of which may be 30 in or greater in length, effective, 12:01 AM, Wednesday, June 1, 2016.
	3-KS-08-16	Prohibited the use of bait while sport fishing in all tributaries of the Tanana River drainage effective 12:01 AM, Saturday, July 2, 2016, and suspended August 10, 2016.
2017		No Emergency Orders issued.
2018	3-KS-U-4-18	Reduced the bag limit to one Chinook salmon and prohibited the use of bait in the Tanana River Drainage.
2019	3-R-U-01-19	Closed Kimberly Lake and Polaris Lake to sport fishing, effective 12:01 AM, Friday, April 5, 2019.
	3-NP-U-1-19	Reduced the bag and possession limit for northern pike in all lakes and flowing waters of the Minto Flats area to two fish, only one of which may be 30 in or greater in length, effective, 12:01 AM, Saturday, June 1, 2019.
	3-KS-U-6-19	Prohibited the retention of sport caught Chinook salmon in all flowing waters of the Tanana River drainage effective 12:01 AM, Wednesday, July 17, 2019. The use of bait in all tributaries of the Tanana River drainage was also prohibited.
	3-KS-U-7-19	Closed all waters of the Tanana River drainage to sport fishing for Chinook salmon effective 12:01 AM, Friday, July 26, 2019.
	3-SS-U-01-19	Closed all waters of the Delta Clearwater River, including the Clearwater Lake drainage to sport fishing for coho salmon, effective 12:01 AM, Friday, October 11, 2019. Additionally, only unbaited, single-hook, artificial lures were allowed.
2020	3-R-U-01-20	Closed Kimberly Lake and Polaris Lake to sport fishing, effective 12:01AM, Saturday, January 11, 2020.
	3-R-U-02-20	Opened Polaris Lake to catch-and -release sport fishing, and closed Kimberly Lake to sport fishing effective 12:01AM, Saturday, April 11, 2020.
	3-KS-U-05-20	Closed all waters of the Tanana River drainage to sport fishing for Chinook salmon effective 12:01 AM, Saturday, June 27, 2020.
	3-CS-U-02-20	Closed all waters of the Tanana River drainage to sport fishing for chum salmon effective 12:01 AM, Friday, August 14, 2020.
	3-R-U-03-20	Restricted Bear and Moose lakes to catch-and-release fishing for all fish species effective 12:01 AM, Saturday, September 26, 2020.
	3-R-U-04-20	Restricted Bathing Beauty Pond to catch-and-release fishing for all fish species effective 12:01 AM, Wednesday, October 7, 2020.
	3-SS-U-01-20	Closed all waters of the Delta Clearwater River, including the Clearwater Lake drainage to sport fishing for coho salmon, effective 12:01 AM, Saturday, October 17, 2020. Additionally, only unbaited, single-hook, artificial lures were allowed.