Special Publication No. 18-20

An Overview of Minto Flats Northern Pike Subsistence and Sport Fisheries: A Report to the Board of Fisheries

by

Christy Gleason

and

Jeffrey Estensen

December 2018

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

Symbols and Abbreviations

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

Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Mathematics, statistics

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

SPECIAL PUBLICATION NO. 18-20

AN OVERVIEW OF MINTO FLATS NORTHERN PIKE SUBSISTENCE AND SPORT FISHERIES: A REPORT TO THE BOARD OF FISHERIES

by
Christy Gleason and Jeffrey Estensen,
Alaska Department of Fish and Game, Division of Commercial Fisheries, Fairbanks

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1565

December 2018

The Special Publication series was established by the Division of Sport Fish in 1991 for the publication of techniques and procedures manuals, informational pamphlets, special subject reports to decision-making bodies, symposia and workshop proceedings, application software documentation, in-house lectures, and became a joint divisional series in 2004 with the Division of Commercial Fisheries. Special Publications are intended for fishery and other technical professionals. Special Publications are available through the Alaska State Library, Alaska Resources Library and Information Services (ARLIS) and on the Internet: http://www.adfg.alaska.gov/sf/publications/. This publication has undergone editorial and peer review

Christy Gleason and Jeffrey Estensen
Alaska Department of Fish and Game, Division of Commercial Fisheries,
1300 College Road, Fairbanks, AK 99701, USA

This document should be cited as follows:
Gleason, C., and J. Estensen. 2018. An overview of Minto Flats northern pike subsistence and sport fisheries: a report to the Board of Fisheries. Alaska Department of Fish and Game, Special Publication No. 18-20, Anchorage.

TABLE OF CONTENTS

LIST OF TABLES

Table **Page**

LIST OF FIGURES

Figure **Page**

ABSTRACT

This report provides the Alaska Board of Fisheries with an overview of the stock status of Minto Flats northern pike (*Esox lucius*) and northern pike subsistence and sport fisheries for the January 2019 Arctic-Yukon-Kuskokwim Finfish regulatory meeting. It includes a review of the regulatory history and management plans, subsistence and sport fish harvests, and stock assessment work.

Key words: Yukon Area, Minto Flats, northern pike (Esox Lucius), subsistence fishing, sport fishing, Alaska Board of Fisheries

INTRODUCTION

Minto Flats, located approximately 50 km west of Fairbanks (Figure 1), supports both a winter subsistence fishery for northern pike *Esox lucius* and one of the largest northern pike sport fisheries in the Division of Sport Fish Region III Northern area. The Alaska Department of Fish and Game (ADF&G) is responsible for managing these stocks for sustained yield and to provide a reasonable opportunity for harvesting northern pike for subsistence uses. This report provides the Alaska Board of Fisheries (board) with information on harvest and abundance estimates for Minto Flats northern pike for the January 2019 Arctic-Yukon-Kuskokwim Finfish regulatory meeting. This report is organized into three major sections: a review of the regulatory history of both fisheries including the management plans and subsistence permit program; a review of both the subsistence and sport fish harvests; and a review of the assessment work completed for these stocks.

AREA DESCRIPTION

Minto Flats is a large wetlands complex located about 50 km west of Fairbanks. The village of Minto (population 210) is located on the northwest edge of Minto Flats. Minto Flats measures approximately 500,000 acres and is comprised of marshes and lakes interconnected by numerous sloughs and several rivers (Figure 1). A group of interconnected lakes in the eastern flats that drain into Goldstream Creek are called the Minto Lakes. The Chatanika, Tolovana, and Tatalina rivers and Washington, Goldstream and numerous smaller creeks flow into Minto Flats, coming together as tributaries to the Tolovana River, itself a tributary to the Tanana River. The glacial Tanana River forms the southern boundary of Minto Flats, and two major sloughs of the Tanana (Swanneck Slough and Grassy Slough) cut into the flats and flow into the Lower Tolovana River. Except for the Tanana River, the waterways of the flats are slow and meandering.

The amount of aquatic habitat suitable to support fish populations in Minto Flats has been estimated at about 15,000 surface acres. The rivers, streams, and sloughs are slow flowing and meandering, and the lakes are shallow, productive, and contain large amounts of aquatic vegetation. Species of fish that reside for at least a portion of their lives in Minto Flats include northern pike, burbot *Lota lota*, Arctic grayling *Thymallus arcticus*, Chinook salmon *Oncorhynchus tshawytscha*, chum salmon *Oncorhynchus keta*, coho salmon *Oncorhynchus kisutch*, sheefish *Stendous leucichthys*, longnose suckers *Catostomus catostomus*, Arctic lamprey *Lethenteron camtschaticum*, Alaska blackfish *Dallia pectoralis*, and four species of whitefish (broad *Coregonus nasus*, least cisco *Coregonus sardinella*, humpback *Coregonus pidschian*, and round *Prosopium cylindraceum*).

For management of the subsistence and sport fisheries, there several overlapping geographic references (Figures 1 and 2):

1) *Minto Flats*: refers to the core wetlands area of interconnected lakes and relates to the Statewide Harvest Survey (SWHS) reporting for sport fisheries (Figure 1);
2) *Minto Flats Complex*: relates to a reporting area for the SWHS and includes Minto Flats, the Tolovana River, the Tatalina River, and the Chatanika River downstream of the Elliott Highway (Figure 1);
3) *Minto Lakes:* a group of interconnected lakes (including Big Minto and Upper Minto lakes) in the eastern flats that drain into Goldstream Creek (Figure 2);
4) *Minto Lakes Study Area (MLSA):* Includes Minto Lakes and the lower portion of Goldstream Creek and used when referencing population estimates (Figure 2):
    a. *Area A:* This includes the entirety of Minto Lakes Study Area; and
    b. *Area B:* A subset of the Minto Lakes Study Area.
5) *Tolovana River Drainage Subsistence Northern Pike Permit Area:* Includes the Tolovana River Drainage not included in the Fairbanks Nonsubsistence Area (Figure 1);
6) *Chatanika River Harvest Area (CHA):* A portion of the Chatanika River between the Fairbanks Nonsubsistence Boundary and a point 1-mile upstream of Goldstream Creek (Figure 1); and
7) *Chatanika River Overwintering Area (CROA)*: That portion of the Chatanika River between the mouth of Goldstream Creek and the Fairbanks Nonsubsistence Boundary.

FISHERIES OVERVIEW

Subsistence Fishery

The Tolovana River drainage has supported a northern pike subsistence fishery throughout this century and earlier (Andrews 1988). Shortly after statehood, the subsistence fishery for northern pike was closed from 1961 to 1978 in the Tanana River drainage upstream of the Kantishna River, which includes the Tolovana River drainage (Minto Flats and Chatanika River). The first formally-adopted subsistence fishing regulation for this area was developed in 1979; this regulation opened subsistence fishing for northern pike in the Tolovana River drainage 2 miles upstream and 2 miles downstream of Minto Village. In 1987, after a positive C&T finding for the Yukon River drainage by the board, the entire Tolovona River drainage and Chatanika River drainage were opened to subsistence fishing for northern pike, this regulation currently remains in place. A complete regulatory history of the subsistence fishery can be found in Table 1. Since 1978, subsistence fishing gear with a rod or pole has been limited to ice fishing only; prior to this, fishing with a rod or pole was prohibited. In 1979, subsistence fishing was allowed for northern pike in the Tolovana River drainage in an area 2 miles upstream and 2 miles downstream of the village of Minto. In 1983, 27 households in Minto harvested an estimated 3,003 northern pike (Andrews 1988). In 1987, the entire Tolovana River drainage opened to subsistence fishing and no permit was required. Starting in 1988, a household subsistence permit was required and set gillnets were limited to the open water season of April 15 to October 14 for this fishery.

Current legal gear for subsistence fishing for northern pike in the Tolovana River drainage is set gillnets, drift gillnets, beach seines, fish wheels, long lines, fyke nets, dip nets, jigging gear (ice fishing only), spears, hook and line attached to a rod or pole (ice fishing only) or leads. In the CHA, only single hooks may be used. In the Tolovana River drainage, set gillnets may only be used from April 15 to October 14.

The Chatanika River drainage was open to subsistence fishing until the nonsubsistence boundary was established 1 mile below the Murphy Dome Road in 1993. In that year, ADF&G developed specific subsistence northern pike permits for the Tolovana River drainage; since then harvest has averaged 694 fish annually (Table 2). Subsistence harvest of northern pike peaked in 2007 at 1,837 fish, which triggered a both a subsistence closure for that spring in the CHA and a sport fish bag limit reduction from 5 to 2 fish from June 1 – October 14, and harvest has been as low as 100 fish in 2011 (Table 2 and Figure 3).

Minto residents primarily subsistence fished for northern pike in the Tolovana River drainage, however since 2003 participation has been dominated by Fairbanks North Star Borough (FNSB) residents (Table 3 and Figure 4). Since 2011, improvements to fishing location data on permits show that on average from 2013 to 2017, 385 northern pike are harvested annually in the CHA and on average 97% of the harvest is taken by FNSB residents (Table 3 and Figure 5). This was a traditional subsistence fishing area, among other locations in Minto Flats, used by Minto residents (Andrews 1988).

Most fishing in the CHA occurs between January and April within a few river miles upstream of Goldstream Creek. Fishermen use hook and line attached to a rod or pole with bait for jigging, which may only be used while ice fishing. Since the Minto Flats Northern Pike Management Plan was developed in 1998, regulations describing bag and possession limits (2010) and closed area (2017 and 2018) to ice fishing were adopted for the CHA to further limit harvest. The recent 5-year average harvest of northern pike in the remainder of Minto Flats is 142 fish and in the CHA is 385 fish (Tables 2 and 3).

Sport Fishery

The sport fishery in Minto Flats has grown since statehood and participation has increased with population growth (Table 4 and Figure 6). The most notable period of growth occurred from the mid-1970s through the early 1980s with improved road access from Fairbanks via the Murphy Dome Road. In the sport fishery, multiple hooks and bait are allowed; however, only single hooks may be used in the Chatanika River between Goldstream Creek and the Fairbanks Non-Subsistence Boundary. Anglers can access Minto Lakes to fish for northern pike either by float planes or by boat from Murphy Dome Road or the community of Minto (Figures 1 and 2). There have typically been one or two guide operations offering overnight fly-in fishing trips into Minto Lakes since the 1970s. There are approximately 34 private or permitted inholdings within Minto Lakes and along Goldstream Creek.

In the winter of 1985–1986, anglers using snowmachines from the Murphy Dome Road located a major overwintering area for northern pike in the Chatanika River near the mouth of Goldstream Creek. A winter sport fishery quickly developed, with a harvest composed mostly of large, prespawning females (about 90%), and nearly doubled annual sport fish harvests from Minto Flats (Doxey 1993). Concern over the number and sex composition of the harvest in the winter sport fishery resulted in a regulation that closed sport fishing throughout the Tolovana Drainage from October 15 through May 31.

The Minto Lakes are a major northern pike spawning and summer feeding area. The amount of northern pike habitat and presumably production and can vary greatly with trending water levels. Since 2012, water levels have risen, and by 2016 shoreline rings of dead birch trees developed suggesting that water levels had not been that high for the last 30–40 years. Radiotelemetry studies within Minto Flats have identified several overwintering areas within Minto Flats, including the

Lower Chatanika River (Burkholder and Bernard 1994). The northern pike that inhabit Minto Lakes during the spring spawning period and the summer and fall represent a unique stock that only overwinters in the CROA. This Minto Lake stock comprises approximately 70% of the northern pike that overwinter in the CROA (Albert et al. 2016).

MANAGEMENT

MANAGEMENT PLANS

Refer to Table 1 for complete regulatory history and Table 5 for a summary of the current management plans of the subsistence and sport fisheries of northern pike in Minto Flats. Subsistence fishing for northern pike in the Minto Flats is managed according to the provisions contained in the *Minto Flats Northern Pike Management Plan* (5 AAC 01.244). Sport fishing is managed according to the provisions contained in the *Minto Flats Northern Pike Management Plan* (5 AAC 74.044). The purpose of both management plans is to provide the department with guidance to achieve the goals of managing these stocks consistent with sustained yield principles, providing reasonable opportunity for the priority subsistence fishery, and providing a sport fishing opportunity. Each plan sets a maximum exploitation rate of northern pike in the lakes and flowing waters of the Minto Flats by all users (Table 2) at 20% annually of the recent abundance estimate (Table 6).

The board adopted both management plans in 1998 in response to a proposal submitted by the department that sought regulatory guidelines relative to the harvest of northern pike during the winter subsistence fishery. There were growing concerns that the increase in the winter subsistence fishery would lead to excessive harvest of northern pike such that the population would not be able to sustain both the customary subsistence fishery and the popular summer sport fishery. There was also concern about the potential effects of the winter subsistence fishery on the overwintering concentration of northern pike stocks in the Tolovana River drainage, particularly in the Chatanika River. Historically subsistence users fishing in the CHA were primarily from the community of Minto. However, there was a rapid increase in participation in the subsistence fishery by Fairbanks North Star Borough residents (Figures 4 and 5).

A principal provision of the subsistence management plan was the establishment of the CHA (Figure 1), which includes a portion of the Chatanika River from its confluence with Goldstream Creek to the Fairbanks Nonsubsistence Area Boundary. In the CHA, subsistence fishermen are required to report their harvests weekly. When cumulative harvest reaches 1,500 fish between January 1 and spring break-up (~May 1), the winter subsistence fishery is closed by emergency order until break-up (May 1) of the same calendar year. In the companion sport fish management plan, a cumulative harvest between January 1 and spring break-up (~May 1) of 750 fish results in, by emergency order, a reduced bag and possession limit of 2 fish, of which only 1 fish could be over 30 inches. The order stays in effect for the remainder of the calendar year.

The sport fish management plan has been amended once since its adoption. In 2010, the geographic reference of the 20% exploitation rate was changed from Minto Lakes to all lakes and flowing waters within Minto Flats.

Several modifications to the subsistence management plan have been made. In 2010, the board established a subsistence daily limit of 10 fish and a possession limit of 20 fish for the CHA. The change was made in response to large subsistence harvests that closed the winter subsistence fishery in 2007, and triggered reductions to sport fish bag and possession limits in 2007 and 2008.

The subsistence management plan was again modified in 2016 when a portion of the Chatanika River from its confluence with Goldstream Creek to a point three miles upriver was closed to subsistence northern pike ice fishing. A member of the public submitted a proposal in 2016 to reduce the bag and possession limits and to introduce a size restriction for harvested fish in the subsistence fishery. Instead, the board adopted an amendment to create a 3-mile closed area to protect overwintering northern pike. The closed area was adopted because of concerns expressed by the public about the effects on the sport fishery of harvesting of northern pike in the winter subsistence fishery in Minto Lakes (Table 7 and Figure 6). During 2017, the board accepted an Agenda Change Request (ACR) proposal submitted by the Fairbanks Fish and Game Advisory Committee that reduced the closed area from 3 miles to 1 mile, which was adopted by the board. The ACR was submitted because the proponent felt the closed area had the unintended consequence of not providing a reasonable opportunity for subsistence.

The key provisions contained in the current subsistence fishery management plan *Minto Flats Northern Pike Management Plan* (5 AAC 01.244) are as follows:

- Permits required for participation in the subsistence fishery;
- Hook and line gear can only be used through the ice; and
- Designation of the CHA (Figure 1) where the following regulations apply:
    - Contains a 1-mile area closed to subsistence ice fishing;
    - A subsistence harvest bag limit of 10 fish, and a possession limit of 20;
    - Fishermen must report weekly catches to the department; and
    - A subsistence harvest limit of 1,500 fish from January 1 through when the waters are free of ice. After that limit is reached, the subsistence fishery is closed by emergency order.

The key provisions contained in the current sport fishery management plan *Minto Flats Northern Pike Management Plan* (5 AAC 74.044) are as follows:

- An open sport fishing season from June 1 through October 14;
- A bag and possession limit of 5 fish, only one may be 30 inches or more in length; and
- Once the subsistence harvest within the CHA exceeds 750 fish, bag and possession limit are reduced to two fish of which only 1 can be greater than 30 inches.

SUBSISTENCE PERMIT PROGRAM

Since 1988, a household subsistence permit has been required by regulation for taking northern pike in the Tolovana River drainage. The subsistence fishery is open to Alaska residents and a household subsistence fishing permit is required to participate. Permits are free of charge and are available at the Fairbanks office or online at the department website since 2018. The season is open for the calendar year from January 1 through December 31, and permits must be returned to the department 10 days after expiration. In most years, 95% of the permits issued are returned to the department.

Between 1988 and 1992, northern pike harvest was likely documented on a subsistence salmon permit for Subdistrict 6-B of the Tanana River drainage, which includes the Tolovana River drainage. Specific harvest location of northern pike or other fish within Subdistrict 6-B was not required to be documented on the permit. In addition, the subsistence harvest of northern pike in Minto Flats by Minto residents was documented in door-to-door subsistence surveys in 1983 (Andrews 1988) and 1994 (Marcotte 1995). Beginning in 1993, specific subsistence northern pike

permits became available for the Tolovana River drainage (see Figure 7 for the 2018 permit). Since 1993, annual household participation and harvest from subsistence permits have been documented in the Yukon Area Annual Management Report series and Subsistence Report series prepared by the Division of Commercial Fisheries (Table 2).

Since 1994, permit holders fishing in the Chatanika River drainage were required to report their weekly harvest to the department. A catch form was located on the backside of the permit to document the fishing date and the number of fish harvested by species. Catch forms were modified in 1996 to include fishing location. Beginning in 1998, the fishing area for which weekly reporting was required was modified to the Chatanika River between the Goldstream Creek confluence and the Fairbanks Nonsubsistence Area Boundary, now referred to as the CHA. In 2011, a CHA checkbox and "other location" checkbox was added to the catch form to improve fishing location data (Table 2 and Figure 3). Beginning in 2017, fishermen were required to report the number of northern pike released alive on permits and report this information weekly if fishing occurred in the CHA.

Participation

From 1993 to 2018, an average of 86 permits are issued annually (Table 2). A record number of permits, 201, was issued in 2016, likely due to the public attention this small fishery received from discussions of the 2016 board proposal. Prior to 2003, Minto residents composed the majority of users in this area; however, since 2003, residents of the Fairbanks North Star Borough (FNSB) dominate the fishery, accounting for an average of 83% of the permit holders (Table 3 and Figure 4). The majority of FNSB residents subsistence fish in the CHA due to the road accessibility. Rural residents that live remotely on the Chatanika River and urban FNSB residents are both included in the FNSB community grouping of the department permit database.

HARVEST

SUBSISTENCE HARVEST

The recent 5-year average subsistence harvest of northern pike is 385 fish in the CHA and 142 fish in the remainder of Minto Flats. The total 5-, 10-, and 20-year averages of northern pike harvested for subsistence in the Tolovana River drainage are between 526 and 578 fish. The largest harvest of 1,837 fish in the Tolovana River drainage occurred in 2007 (Table 1).

Prior to 2006, the majority of the northern pike harvested in the Tolovana River drainage was taken by Minto residents, while the harvest shifted to FNSB residents dominating the harvest from 2006 to present (Table 3 and Figure 5). Harvest location of northern pike taken from the CHA was not well documented on subsistence permits until 2011. Since 2011, usually over 90% of the harvest in the CHA is by FNSB residents and no harvest occurred by Minto residents in this area (Table 3).

Minto residents have traditionally fished for northern pike in a couple of locations in Minto Flats, including the Chatanika River near the confluence of Goldstream Creek (Marcotte 1995 and Andrews 1988). In recent years, the Minto-Nenana Fish and Game Advisory Committee reported it is too far to travel to the Chatanika River in the winter to catch northern pike and most residents prefer to fish locally next to the village. Several factors suggest that the vast majority of the harvest (94%) by FNSB residents between 2003 and 2010 occurred in the CHA: the noticeable shift in participation of FNSB residents since 2003; road accessibility to the CHA; and zero participation

by Minto residents in the CHA since 2011. Therefore, since 2003 the average harvest has likely been 414 northern pike annually in the CHA (Table 3).

Prior to the establishment of the bag and possession limits in the CHA in 2010, the participation and harvest by FNSB residents had peaked in 2007 at 1,605 fish harvested followed by 1,256 fish harvested in 2008. During those years, Minto residents harvested 231 fish in 2007 and 65 fish in 2008. Following the new regulations, participation and harvest decreased in the subsistence northern pike fishery in the Tolovana River drainage. From 2011 to 2014, harvest in the CHA and the remainder of Minto Flats increased to an average of about 169 fish in each area, for a total average of 334 fish in the Tolovana River drainage. Participation and harvest in the CHA continued to increase through 2016 (Table 3).

In 2016, a record number of 201 household permits were issued for the Tolovana River drainage, resulting in 855 northern pike harvested in the CHA by FNSB residents. Inseason reporting indicated 808 northern pike had been harvested in the CHA by mid-April. Minto residents harvested 54 northern pike in the remainder of Minto Flats. Total subsistence harvest in 2016 was 1,020 northern pike in the Tolovana River drainage. This was the largest harvest in the CHA since the bag and possession limits were adopted in 2010 and 6th largest total northern pike harvest in the Tolovana River drainage since 1993 (Table 3).

Prior to any closed area, the 2012 to 2016 average harvest in the CHA was 395 fish (Table 2). The three-mile closed area of the subsistence winter northern pike fishery in the CHA was implemented for one season in 2017. During the three-mile closure, 93 permits were issued for the Tolovana River drainage resulting in 137 northern pike harvested, of which 21 fish were harvested in the CHA (Table 2). Effort was lower than previous years, with 44% of the permit holders actively fishing in 2017 compared to the recent 5-year average of 55%. The harvest was the lowest on record in the CHA and 3rd lowest in the Tolovana River drainage.

With the closed area modified to one mile in 2018, inseason reports indicated 744 northern pike were harvested in the CHA by mid-April, which is above the recent 5-year average of 385 fish in the CHA (Table 2). Preliminary data indicates 167 permits were issued for the Tolovana River drainage, which is above the recent 5-year average of 119 permits (Table 2). Participation in the number of households that fished increased by 6% from the previous year and fishing success was greater (Table 2). Complete harvest and participation information will not be available until February 2019.

SPORT FISH HARVEST

The Minto Flats Complex still supports the largest sport fishery for northern pike in the Tanana drainage. Within the Minto Flats Complex, most (~85%) effort and harvest occurs within Minto Flats and predominately in the Minto Lakes Study Area (MLSA). Estimated sport catch and harvest of northern pike in the Minto Flats Complex peaked in 1994 with a harvest of 9,489 fish and a catch of 52,191 fish (Figure 8). Since 2007, estimated sport fish harvests have trended downwards, and the recent 5-year average (2013–2017) was 427 fish (Table 4, Figure 4, and Figure 8).

HARVEST LEVELS AND MANAGEMENT ACTIONS

Since the plan was established in 1998, the 1,500-fish threshold to close the subsistence fishery in the CHA was exceeded in 2007 (Figures 3 and 8). The 750-fish threshold was exceeded in 2007,

2008, and 2016, resulting in sport fishery restrictions during the summer season of those years (Figures 3 and 8). Sport fishing restrictions for northern pike in the Minto Flats Complex was a bag and possession limit of two fish, with one over 30 inches in length.

2007 Subsistence Fishery Closure, Sport Fishery Restriction

On February 16, 2007, a total of 1,063 northern pike were reported to be harvested in the CHA. The subsistence fishery in the CHA was closed by emergency order on February 23, 2007, for the remainder of the spring season. The subsistence harvest in 2007 totaled 1,837 northern pike by 54 permits of the 118 permits issued in the Tolovana River drainage (Table 2 and Figure 3). This was the largest subsistence harvest since permit data began in 1993. The remainder of Minto Flats remained open to subsistence fishing. Sport fishing was restricted in the 2007 season, resulting in 1,809 northern pike harvested and 14,077 released by 1,121 anglers (2,595 angler days; Table 4 and Figure 6). Total harvest in the Minto Flats Complex by all users was 3,646 northern pike, which is the 6th largest harvest since 1993 (Table 2).

2008, 2016: Sport Fishery Restrictions

Sport fishing was restricted a second consecutive season in 2008, due to subsistence harvest exceeding 750 fish in the CHA. The sport fishery resulted in 386 northern pike harvested and 3,952 released by 663 anglers (887 angler days; Table 4). The subsistence harvest in 2008 totaled 1,339 northern pike reported on 79 permits of the 146 permits issued in the Tolovana River drainage, which is the 4th largest harvest since 1993 (Table 2). Total harvest in the Minto Flats Complex by all users was 1,725 northern pike, the 11th largest harvest since 1993 (Table 2).

On April 21, 2016, a total of 770 northern pike were reported to be harvested in the CHA. Sport fishing was restricted for the 2016 season, resulting in 196 northern pike harvested and 2,584 released by 1,224 anglers (2,911 angler days; Table 4). The subsistence harvest in 2016 totaled 1,020 northern pike by 129 permits of the 201 permits issued in Tolovana River drainage, which is the 6th largest harvest (Table 2). Total harvest in the Minto Flats Complex by all users was 1,216 northern pike, which is the 14th largest since 1993 (Table 2).

STOCK ASSESSMENT

The department has conducted stock assessment within Minto Flats since the late 1960s (Halberg 1984). These early efforts were used to collect information on length-, sex- and age-composition, movements using Floy[1] tags, angler demographics, and population sizes. Because of the size of Minto Flats, rigorous sampling could not be conducted across all areas, and therefore, the utility of this information was limited. It is acknowledged that many data gaps still exist today relative to accurate estimates of population size(s), sex ratios, growth, harvest composition, and movement.

[1] Product names used in this publication are included for completeness but do not constitute a product endorsement.

ABUNDANCE ESTIMATION

Studies conducted in the late 1980s and early 1990s were designed to estimate the abundance of northern pike in a large area that included most of the Minto Flats: Minto Lakes, Goldstream Creek, the Tolovana River, the lower portions of the Tatalina, and Chatanika rivers, and Swanneck Slough (Burkholder 1989, 1990, 1991; Hansen and Burkholder 1992). These large open-system experiments were fraught with low sample sizes, limited mixing, size and sex biases, too large of a geographic area, and high water during the spring sampling events.

Based on difficulties encountered during these early mark-recapture studies, and on radiotelemetry studies conducted by Burkholder and Bernard (1994) and Roach (1998a), the study area and design for a mark-recapture experiment was modified. Beginning in 1996, the abundance of northern pike was estimated with the Minto Lakes Study Area (MLSA; Table 6 and Figure 2; Roach 1997 and 1998b, Scanlon 2001 and 2006). In 2008, the geographic area of MLSA was expanded to include adjacent waters within the MLSA defined as Area-A (Figure 2). Because Area-B is a subset of Area-A, the abundance of northern pike in area Area-B was also examined in 2018 to compare estimates across all years.

In 2018, an experiment was designed using three sampling events to estimate abundance and length composition of northern pike in the Chatanika River Overwintering Area (CROA) during winter, and within the MLSA (Area-A and Area-B) during the open water season[2]. Bayesian techniques were used to combine telemetry information and traditional two-event Petersen mark-recapture model for closed populations (Seber 1982). Fish were sampled during March within the CROA approximately 1.5 miles upstream of Goldstream Creek. During the following summer, fish were sampled within the MLSA during mid-June and mid-August.

The estimated abundance of northern pike in Minto Lakes has varied, and the largest abundance observed for fish >24 inches occurred in 2018. It is believed that this large increase in abundance is due to a substantial increase in available habitat due to persistent higher water levels observed in Minto Flats since 2012, and a concurrent increase in forage fish. Compared to June 2010, the surface area of lakes within in MLSA was approximately 2 times greater in 2018 based on a digitized measurement of satellite imagery on a typical lake, which also doubles the amount of northern pike habitat available. Prior to 2012, a measurable and prolonged 50-year drying period of the Minto Flats Wildlife Refuge was observed with lowering water tables and fewer ponds (Riordan 2005).

Based on work conducted in 2018, and a reexamination of historical abundance estimates in the MLSA, it was determined that previous estimates for fish >400 mm fork length (FL) are no longer valid. Northern pike 400–600 mm FL (16–24 inches total length (TL)) are not fully recruited to the sampling gear that has resulted in undetected bias (i.e. inaccurate estimates) of an unknown magnitude. For example, in 2008, no marked fish smaller than 500 mm FL (20 inches) were recaptured in the second event.

Relative to the *Minto Flats Northern Pike Management Plans*, evaluating the 20% maximum exploitation rate is problematic because it does not stipulate a population of inference (i.e. northern pike >16 or >24 inches), and the entire area of Minto Flats cannot be assessed. Previous evaluations of exploitation rates were based on fish >16 inches TL (i.e., 400 mm FL) in MLSA, which are now

[2] Matthew Albert, Division of Sport Fish Fisheries Biologist, ADF&G, Fairbanks; personal communication.

recognized as likely biased and invalid. Abundance estimates for northern pike ≥600 mm FL are accurate and can be reliably estimated year-to-year in the CROA. During 2018, the estimated abundance of fish >600 mm FL (24 inches TL) within the CROA was 19,943 (95% C.I. 14,996–24,891)[3].

RADIOTELEMETRY

Several radiotelemetry studies have been conducted in Minto Flats, which were incrementally refined based on past results. In 1987, 98 radio tags were deployed throughout Minto Flats (Burkholder and Bernard 1994). Roach (1998a) deployed 68 radio tags into the MLSA during the spring of 1995 and followed their movements for two years; however, precise locations (i.e. <500 meter radius) of individual fish were not collected. From 2007–2009, 199 fish were radiotagged within the CROA, and 100 fish were tagged in the MLSA (Joy 2009; Albert et al. 2016). These fish were surveyed at more regular intervals and more precise locations were attained. During the winter of 2008–2009 frequent surveys of the CHA were completed by snow machine. In August 2016, 45 radio tags were deployed into northern pike in the MLSA. These fish were tracked during the winter of 2016–2017. In March 2018, 100 radio tags were deployed in the CROA with the intent to precisely monitor northern pike distributions over a one-year period, and to provide additional data to support the 2018 abundance estimation experiments (Albert and Tyers *in prep*). However, these transmitters failed due to a manufacturing flaw, and did not operate after June 1, 2018.

The major findings of these studies include:

- Identification of three major overwintering concentrations, the largest being in the Chatanika River between Goldstream Creek and the Murphy Dome Road access point (CROA) (Holmes and Burkholder 1988; Burkholder and Bernard 1994; Figure 9);
- Northern pike in the MLSA is a discrete stock that migrates annually between the CROA and the MLSA that is used for spawning in spring (~mid to late May) and feeding during summer and fall (Albert et al. 2016);
- The migration of northern pike from the CROA to the MLSA occurs over a short (i.e. 5-10 day) window associated with break-up from late April to early May. These fish migrate from the MLSA to the CROA over a protracted period from late-October through December;
- The overwintering population of northern pike in the CROA is composed of fish from the MLSA, and other areas in Minto Flats (e.g. lakes near the community of Minto, Swanneck Slough, and Lower Tolovana River) but their absolute contribution by individual water body is unknown (Burkholder and Bernard 1994, Albert et al. 2016). However, 52% of fish radiotagged near the community of Minto migrated to the CROA in 1987 indicating that the CROA is a major overwintering area for all northern pike in Minto Flats;
- Approximately 70% of northern pike that overwinter in the CROA migrate to the MLSA for spawning and summer feeding, and the remaining 30% distribute throughout other areas in Minto Flats (Albert et al. 2016); and
- The distribution of fish within the CROA can vary across years and within years, likely due to water quality (i.e. dissolved oxygen) and river morphology:

[3] Matthew Albert, Division of Sport Fish Fisheries Biologist, ADF&G, Fairbanks; personal communication.

- Notable differences were observed in the relative distributions of fish within the CROA between Roach 1998a and Albert et al. 2016 and in research conducted in 2018[4] (Table 7, Figure 10, and Figure 11 and Figure 12);
- Albert et al. (2016) and research conducted in 2018[5] identified that the largest concentrations of radiotagged fish occurred between Mile 1.0 and 3.0 of the CRHA during 2009 and 2017 (Table 7 and Figure 11 and Figure 12); and
- Systematic sampling in the lower 5 miles of the CHA during March of 2018 indicated that fish were largely absent in the 1-mile closed area upstream of Goldstream Creek, and the largest concentrations were between river mile 1.0 and 2.0 where over 1,600 fish were sampled by the department using hook and line, of which ~1,200 were caught from a 100 m reach of river[6].

LENGTH, AGE, AND SEX COMPOSITION

Northern pike have been routinely sampled between the 1960s and early 1990s. However, without an unbiased estimate of abundance, the accuracy of these samples cannot be assessed. Because similar gear types (hook and line, gill nets, and fyke nets) were used during 1997–2018, the lengths of sampled fish provide evidence that the length composition varies slightly year to year (Figure 13). During 1997, 2003, and 2008, the proportions of sampled northern pike >24 inches were similar (~25%). In 2018 the proportion of fish >24 inches increased to ~33%. The proportion of sampled fish greater than 30 inches in 2018 (9.5%), was higher than during 1997 (3.1%), 2003 (4.5%), and 2008 (7.7%).

During the 2018 mark-recapture experiment, hook and line was used to sample fish within the MLSA during summer, was used exclusively in the CROA during March, and is used by subsistence fishers in the CHA. In the spring of 2018, 101 length samples were collected from subsistence harvests by department staff during February and March. All hook and line samples were plotted to illustrate the differences in the size of fish available to sport anglers in the summer and to subsistence fishers during spring, and what is retained by subsistence users. The sample size of subsistence harvest was comparatively small (n = 101) and cannot be interpreted as being truly representative of the all subsistence harvests (Figure 14). However, it does provide evidence that subsistence users still tend to select larger fish from the population and is consistent with historical observations (Doxey 1993).

Sampling of northern pike in Minto Flats has shown that nearly all (i.e., >99%) fish larger than 30 inches are females. This long-standing observation was reaffirmed in 2018 when gonads for 74 fish were inspected and all were females. This is consistent with other circumpolar populations where maximum length (L_∞) for male northern pike approaches 725 mm FL (28.5 inches; Craig 1996). Sex ratios of fish 24–30 inches captured by hook and line in the CHA are disproportionally females. During the 2018 study, 10 out of 32 randomly sampled fish 24–30 inches were males and the probability of this sex ratio with an assumption of equal sex ratios in the population is less than 5%. Female northern pike are more prone to be caught in winter, presumably because they are more aggressive in nature and have greater energetic needs for spawning.

[4] Matthew Albert, Division of Sport Fish Fisheries Biologist, ADF&G, Fairbanks; personal communication.
[5] Matthew Albert, Division of Sport Fish Fisheries Biologist, ADF&G, Fairbanks; personal communication.
[6] Matthew Albert, Division of Sport Fish Fisheries Biologist, ADF&G, Fairbanks; personal communication.

In general, 30-inch female northern pike in Minto Flats are 8–10 years old and will grow approximately 1-2 inches per year thereafter. For males, growth ceases as they approach 30 inches. For example, a 15-year old male (based on a tag recovery) grew to only 28 inches at time of capture in Minto Lakes during 2018[7]. Northern pike become sexually mature between age 4 to 6 years old. Fecundity increases exponentially with body length and a 30-inch female will have ~4 times the number of eggs compared to an 18-inch fish (Craig 1996, Wooton 1998).

Accurate age and growth information on northern pike in Interior Alaska has not been collected because the aging structures (scales and cleithra) underestimate the true age of older fish. Previous studies in Minto lakes have exclusively used scales to assess ages, and unlike northern pike in warmer climates (Laine et al.1991), age determination of Interior Alaska northern pike becomes increasingly difficult after age-5 because growth slows after reaching maturity (Roach 1998b). Using scales and underestimating growth, Burkholder (1991) indicated 16-inch (400 mm FL) fish were ~age-3, 24-in (600 mm FL) fish were ~age 7, and 30-inch were ~age 9, after which annual growth of northern pike slowed markedly after 30 inches growing approximately 1-2 inch thereafter. Cleithra (bony structure of the gill plate) can provide more accurate ages up to age-10, but may still underrepresent true ages thereafter (Laine et al. 1991, Pierce 2012). In 2018, 91 cleithra were collected from northern pike from the CROA and ages were attained from 69 fish (Table 8) and were consistent with ages provided by Burkholder (1991).

Overall, there is limited information available regarding the length, age and sex composition of harvests in sport and subsistence fisheries in Minto Flats, however, relative to sport fisheries, it has been demonstrated that anglers tend to retain fish larger than 24 inches, and these larger fish are often older and disproportionately female (Alt 1968, Hallberg and Bingham 1995). A creel survey conducted in 1994 showed that 82% of fish harvested were 24 inches or greater (Hallberg and Bingham 1995). In 2018, 101 length samples were collected from subsistence harvest in the CHA where nearly all (i.e. 99%) fish greater than 24 inches, and median length of fish harvested was 30 inches (Figure 14).

INFORMATION NEEDS

Several data gaps remain relative to management of northern pike in Minto Flats. Future priority information needs for Minto Flats includes:

1) Monitoring overwintering abundance of northern pike in the CROA,
2) Identification of all major overwintering areas within the Tolovana drainage,
3) Detailed monitoring of overwintering distributions of northern pike within the CROA; and
4) Accurate estimates of the length composition of subsistence harvest in the CHA and the Minto Flats sport fishery.

[7] Matthew Albert, Division of Sport Fish Fisheries Biologist, ADF&G, Fairbanks; personal communication.

REFERENCES CITED

Albert, M. L., T. M. Sutton, M. J. Evenson, F. J. Margraf, and D. Verbyla. 2016. Seasonal movements of northern pike in Minto Flats, Alaska. Thesis (M. S.). University of Alaska Fairbanks, Fairbanks, Alaska.

Alt, K. T. 1968. Sport fish investigations of Alaska: sheefish and pike investigations of the upper Yukon and Kuskokwim drainages with emphasis on Minto Flats drainages. Alaska Department of Fish and Game, Dingell-Johnson Project F-S-R-9 Progress Report 17-B.

Andrews, E. F. 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.

Burkholder, A. 1989. Stock composition, and abundance of northern pike in Minto Flats during 1987 and 1988. Alaska Department of Fish and Game, Fishery Data Series Number 116, Anchorage.

Burkholder, A. 1990. Stock composition of northern pike in Minto Flats during 1989. Alaska Department of Fish and Game, Fishery Data Series Number 90-25, Anchorage.

Burkholder, A. 1991. Abundance and composition of northern pike, Harding Lake, 1990. Alaska Department of Fish and Game, Fishery Data Series Number 91-9, Anchorage.

Burkholder, A., and D. R. Bernard. 1994. Movements and distributions of radio-tagged northern pike in Minto Flats. Alaska Department of Fish and Game, Fishery Manuscript Number 94-1, Anchorage.

Craig, J. F. 1996. Pike: Biology and Exploitation. Chapman & Hall, London, UK.

Doxey, M. 1993. Minto Flats Sport Fish Management Plan. Alaska Department of Fish and Game – Division of Sport Fish, Fairbanks.

Halberg, J. E. 1984. Evaluation of interior Alaska waters and sport fish with emphasis on managed waters – Fairbanks district. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Project F-9-16, Annual Performance Report 1983-1984, Juneau.

Hallberg, J. E., and A. E. Bingham. 1995. Creel surveys conducted in Interior Alaska during 1994. Alaska Department of Fish and Game, Fishery Data Series

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.

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.

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

Laine, A. O., W. T. Momot, and P. A. Ryan. 1991. Accuracy of using scales and cleithra for aging northern pike from an oligotrophic Ontario lake. North American Journal of Fisheries Management 11:220-225.

Marcotte, J. R. 1995. Minto Subsistence Pike and Whitefish Harvest Assessment, 1995 [DRAFT]. Alaska Department of Fish and Game, Special Publication No. SP1995-002, Juneau.

Pierce, R. B. 2012. Northern Pike: Ecology, Conservation, and Management History. University of Minnesota Press, Minneapolis, MN.

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 Number 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 Number 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.

Riordan, B. A. 2005. Using remote sensing to examine changes of closed-basin surface water area in interior Alaska from 1950-2002. Master's Thesis, University of Alaska Fairbanks.

REFERENCES CITED (Continued)

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. 2006. Abundance and composition of the northern pike population in Minto Lakes, 2003. Alaska Department of Fish and Game, Fishery Data Series No. 06-74, Anchorage.

Seber, G. A. F. 1982. The estimation of animal abundance and related parameters. Macmillan, New York.

Wooton, R. J. 1998. Ecology of Teleost Fishes, second edition. Chapman and Hall, London, UK.

TABLES AND FIGURES

Table 1.–Chronology of subsistence and sport fishing regulations for northern pike in the Minto Flats Complex.

Fishery	Year	Regulation
Subsistence	Prior to 1961	No state regulatory subsistence restrictions to local residents.
	1961 to 1978	Closed subsistence fishing for northern pike in the Tanana River drainage upstream of Kantishna River, which includes Tolovana River drainage.
	1978	Rod and reel subsistence gear legal by ice fishing only in Yukon Area.
	1979	Open subsistence fishing for northern pike in Tolovana River drainage in an area 2 miles upstream and 2 miles downstream of Minto Village.
	1987	Positive C&T finding by board (5 AAC 01.236) Open subsistence fishing for northern pike in entire Tolovana River drainage, including Chatanika River drainage.
	1988	Permit required for northern pike in Tolovana River drainage. Set gillnets limited to April 15 to October 14.
	1993	Limited subsistence fishing on Chatanika River to area below Fairbanks Non-Subsistence Boundary (1 mile below Murphy Dome Road). Specific Tolovana Drainage Northern Pike Permits developed by Division of Commercial Fisheries.
	1994	Weekly call-in required for harvest in Chatanika River drainage.
	1998	Minto Flats Northern Pike Management Plan (5 ACC 01.244) established. • Only single hooks may be used in the Chatanika River Harvest Area (CHA; between Goldstream Creek and 1 mile downstream of Murphy Dome Road). • 1,500 and 750 fish thresholds established based on weekly call-ins for CHA.
	2010	5 ACC 01.244 amended: Modified bag and possession limits in CHA: • 10 fish per household, 20 fish in possession. No bag or annual limits in remaining portions of Minto Flats.
	2017	3-mile closed area to ice fishing in CHA upstream Goldstream Creek.
	2018	3-mile closed area modified to 1-mile closed area in CHA upstream of Goldstream Creek.
Sport	1961	Bag and possession limit 10 fish
	1970	Bag and possession limit 10 fish, only 2 greater than greater than 30 inches.
	1987	For all lakes and flowing waters • Bag and possession limit 5 fish, only 1 over 30 inches. • Season: June 1 to October 14 • Multiple hooks allowed.
	1998	Minto Flats Northern Pike Management Plan (5 ACC 74.044) For all lakes and flowing waters • Bag and possession limit 5 fish, only 1 over 30 inches. • Season: June 1 to October 14 • Single hook only in Chatanika River between Goldstream Creek and 1 mile downstream of Murphy Dome Road.
	2010	5 ACC 74.044 amended: Area modified to align with 5 ACC 01.244 to determine exploitation rates of all lakes and flowing waters of Minto Flats.

Table 2.–Subsistence and sport fisheries harvest of northern pike in Minto Flats Complex[a], 1993–2018.

	Subsistence fishery					Sport fishery		
Year	Permits issued	Permits fished	CHA harvest[b]	Tolovana R. drainage harvest[c]	Total harvest	Angler days	Total harvest	Total harvest by all users
1993	31	32%	–	767	767	–	3,420	4,187
1994	48	50%	–	995	995	–	9,489	10,484
1995	55	36%	–	1,068	1,068	–	4,480	5,548
1996	74	32%	–	1,616	1,616	7,990	2,716	4,332
1997	88	45%	–	1,344	1,344	7,655	1,246	2,590
1998	70	44%	–	431	431	3,768	772	1,203
1999	54	44%	–	400	400	7,064	1,098	1,498
2000	34	38%	–	352	352	4,212	390	742
2001	50	34%	–	214	214	2,454	654	868
2002	32	44%	–	521	521	4,815	650	1,171
2003	119	48%	–	966	966	4,555	1,284	2,250
2004	99	42%	–	393	393	4,650	1,390	1,783
2005	79	39%	–	386	386	5,047	2,052	2,438
2006	101	55%	–	788	788	4,050	1,204	1,992
2007	118	46%	–	1,837	1,837	5,656	1,809	3,646
2008	146	54%	–	1,339	1,339	2,840	386	1,725
2009	113	45%	–	560	560	4,892	873	1,433
2010	96	44%	–	115	115	3,327	609	724
2011	70	39%	–	30	100	3,090	422	522
2012	73	48%	73	452	525	4,036	412	937
2013	77	58%	154	77	231	3,406	382	613
2014	106	54%	377	101	478	4,261	597	1,075
2015	120	55%	516	249	765	2,229	372	1,137
2016	201	64%	855	165	1,020	2,911	196	1,216
2017	93	44%	21	116	137	5,426	586	723
2018[c]	167[c]	50%[c]	744[c]	–	744[c]	–	–	–
Total:	2,314	–	2,740	15,282	18,092	98,334	37,489	54,837
2013-2017 Average	119	55%	385	142	526	3,647	427	953
2008-2017 Average	110	50%	333	320	527	3,642	484	1,011

Note: En dash = no data, CHA = Chatanika Harvest Area.

[a] Minto Flats Complex includes Minto Flats lakes and flowing waters, Tolovana River drainage, and the Lower Chatanika River.

[b] Chatanika Harvest Area (CHA) fishing location has been documented on permits since 2011. Prior to 2011, fishing occurred in the CHA but fishing location was not specified on permits.

[c] Data are preliminary and are based on weekly call-ins and returned permits. Permits expire 12/31/2018. Sport Fish information is not available at this time.

Table 3.–Subsistence harvest of northern pike by community in Tolovana River drainage, 1993–2018.

		Harvest in CHA			Harvest in Tolovana River drainage (includes CHA)				
Year	Permits issued	Percentage by FNSB residents[b]	Percentage by Minto residents[b]	CHA harvest[b]	FNSB residents[b]	Percentage of total harvest	Minto residents[b]	Percentage of total harvest	Total subsistence harvest
1993	31	–	–	–	0	0%	767	100%	767
1994	48	–	–	–	84	8%	911	92%	995
1995	55	–	–	–	165	15%	903	85%	1,068
1996	74	–	–	–	79	5%	1,537	95%	1,616
1997	88	–	–	–	67	5%	1,266	94%	1,344
1998	70	–	–	–	37	9%	394	91%	431
1999	54	–	–	–	25	6%	375	94%	400
2000	34	–	–	–	1	0%	351	100%	352
2001	50	–	–	–	0	0%	214	100%	214
2002	32	–	–	–	14	3%	507	97%	521
2003	119	–	–	–	394	41%	572	59%	966
2004	99	–	–	–	110	28%	283	72%	393
2005	79	–	–	–	160	41%	226	59%	386
2006	101	–	–	–	428	54%	360	46%	788
2007	118	–	–	–	1,605	87%	231	13%	1,837
2008	146	–	–	–	1,256	94%	65	5%	1,339
2009	113	–	–	–	411	73%	149	27%	560
2010	96	–	–	–	44	38%	71	62%	115
2011	70	–	–	70	29	29%	64	64%	100
2012	73	74%	0%	73	284	54%	232	44%	525
2013	77	96%	0%	154	225	97%	4	2%	231
2014	106	100%	0%	377	381	80%	93	19%	478
2015	120	99%	0%	516	567	74%	172	22%	765
2016	201	97%	0%	855	914	90%	54	5%	1,020
2017	93	95%	0%	21	29	21%	108	79%	137
2018[c]	167[c]	100%[c]	0%[c]	744[c]	744[c]	100%[c]	–	–	744[c]
Total:	2,314	–	–	2,810	8,053	–	9,909	–	18,092
2013-2017 Average	119	97%	0%	385	423	72%	86	26%	526
2008-2017 Average	110	94%	0%	295	414	65%	101	33%	527

Note: En dash = no data available, CHA = Chatanika Harvest Area, FNSB = Fairbanks North Star Borough

[a] Minto Flats Complex includes Minto Flats lakes and flowing waters, Tolovana River drainage, and the Lower Chatanika River.

[b] Chatanika Harvest Area (CHA) fishing location has been documented on permits since 2011. Prior to 2011, fishing occurred in the CHA but fishing location was not specified on permits.

[c] Data are preliminary and based on weekly call-ins and returned permits. Permits expire 12/31/2018.

Table 4.–Sport Fish angler effort (days fished, DF), harvest, and catch for northern pike in the Minto Flats area, and the Minto Flats Complex[a], 1983–2017.

	Minto Flats			Minto Flats Complex[a]		
Year	DF	Harvest	Catch	DF	Harvest	Catch
1983	NA	2,748	N/A	NA	3,461	N/A
1984	NA	2,453	N/A	NA	3,128	N/A
1985	NA	4,146	N/A	NA	5,256	N/A
1986	NA	4,927	N/A	NA	6,488	N/A
1987	NA	1,781	N/A	NA	2,401	N/A
1988	NA	1,492	N/A	NA	1,965	N/A
1989	NA	1,734	N/A	NA	2,596	N/A
1990	NA	1,570	4,946	NA	2,009	6,060
1991	NA	2,155	5,427	NA	2,586	6,111
1992	NA	1,299	6,175	NA	1,325	6,585
1993	NA	2,076	19,536	NA	3,420	24,378
1994	NA	8,438	47,248	NA	9,489	52,191
1995	NA	3,126	21,823	NA	4,480	29,193
1996	3,051	2,078	12,495	7,990	2,716	16,479
1997	3,334	1,074	9,932	7,655	1,246	11,253
1998	1,413	731	4,136	3,768	772	4,704
1999	2,431	908	3,261	7,064	1,098	3,636
2000	1,230	266	1,402	4,212	390	1,784
2001	1,118	641	2,849	2,454	654	1,916
2002	2,349	483	8,806	4,815	650	10,085
2003	2,023	1,260	8,707	4,555	1,248	12,997
2004	1,892	1,199	19,205	4,650	1,390	21,159
2005	3,124	1,880	14,839	5,047	2,052	16,768
2006	2,416	935	7,284	4,050	1,204	8,447
2007	2,695	1,712	11,526	5,656	1,809	14,077
2008	887	258	2,925	2,840	386	3,951
2009	2,984	765	6,622	4,892	873	7,913
2010	1,424	569	6,477	3,327	609	8,073
2011	1,460	396	3,362	3,090	422	3,911
2012	964	303	4,113	4,036	412	4,481
2013	1,197	350	3,101	3,406	382	3,273
2014	1,996	485	1,947	4,261	597	2,204
2015	1,074	360	4,395	2,229	372	4,417
2016	400	75	1,986	2,911	196	2,584
2017	2,450	520	7,853	5,426	586	8,509
Average 2013–2017	1,423	358	3,856	3,647	427	4,197
Average 2008–2017	1,484	408	4,278	3,642	484	4,932
Average 1998–2017	1,776	705	6,240	4,134	805	7,244

Note: 2018 is not available at this time.

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

Table 5.–2018 Minto Flats Northern Pike Management Plans for Subsistence and Sport Fisheries.

	Subsistence fishing (5 AAC 01.244)	Sport fishing (5 AAC 74.044)
Area:	Tolovana River Drainage (includes lakes and flowing water of Minto Flats). Fairbanks Non-Subsistence Boundary marks the upper boundary on the Chatanika River.	Lakes and flowing waters of Minto Flats, Tolovana River drainage, and Lower Chatanika River.
Requirement to Participate in Fishery:	Subsistence Household Permit, Alaska Residency	Sport Fishing License, Alaska Resident or Nonresident
Season:	January 1–December 31	June 1–October 14
Harvest Limit:	Chatanika HA: 10 northern pike/day, 20 in possession Remainder of Minto Flats: no limit	All lakes and flowing waters of Minto Flats: 5 northern pike/day, 5 in possession
Size Restriction:	None	All lakes and flowing waters of Minto Flats: Retain only 1 northern pike 30″ or longer
Gear:	Set gillnet, drift gillnet, beach seine, fish wheel, long line, fyke net, dip net, jigging gear, spear, hook and line attached to a rod or pole, or lead	Hook and line attached to a rod or pole
Gear Restrictions:	Ice fishing only: jigging and hook and line attached to a rod or pole Set gillnets: April 15–October 14 Chatanika HA: only single hooks	Chatanika HA: only single hooks
Closed Area:	Ice fishing only: 1 river mile of Chatanika upstream of Goldstream Creek confluence.	None
Inseason Reporting:	Chatanika HA: weekly catch report required to the department by 4:30 pm on Thursdays.	None
Postseason Harvest Report:	Permits expire December 31, due back to department January 10.	Statewide Sport Fishing Survey
Harvest Thresholds and Management Actions:	If 1,500 northern pike are harvested in the Chatanika HA from January 1 and spring ice out, the winter fishery in the Chatanika HA will be closed for the remainder of the winter season.	If 750 or more northern pike are harvested from the Chatanika HA subsistence fishery after January 1 until water are free of ice, the sport fishery bag and possession limit will be reduced to two fish (in the lakes and flowing waters in Minto Flats) for the remainder of the calendar year.
Management Actions Taken:	February 23, 2007 Subsistence Closure in Chatanika HA	Sport Fishing Reductions 2007, 2008, 2016

Table 6.–Estimated northern pike abundance in the Minto Lakes Study Area during 1996–2018, and with the Chatanika River Overwintering Area in 2018.

		≥ 400mm (~16 in)[a]		≥ 600mm (~24 in)		≥ 720 mm (~30 in)	
Year	Area	Abundance	SE	Abundance	SE	Abundance	SE
1996	MLSA-B	23,850	7,799	7,616	883	-	-
1997		16,547	1,754	3,251	174	672	48
2000	MLSA-B	-	–	5,331	1,152	-	-
2003	MLSA-B	25,227	4,529	7,683	2,347	1,405	288
2008[a]	MLSA-A[b]	16,045	3,132	2,219	397	958	362
	MLSA-B	9,854	1,701	2,092	448	635	635
2018[c]	CROA			19,943	2537	3,098	510
	MLSA-A			14,569	2034	2,380	432

Source: Roach 1997, 1998; Scanlon 2001, 2006; Joy 2009; Albert and Tyers *in prep*.

Note: SE = standard error.

[a] Estimated abundance of northern pike 400–600 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.

[c] 2018 data is preliminary.

Table 7. Estimated number of radio-tagged northern pike in the Chatanika River between Goldstream Creek and the Fairbanks Nonsubsistence Boundary (~15 river miles) relative to the current 1-mile and the previous3-mile closed areas.

Survey	Closed	Open	Closed	Open
month	River mile 0–1	River mile 1–15	River mile 0–3	River mile 3–15
March 1988	1 (4%)	26 (96%)	1 (4%)	26 (96%)
March 1996	N/A	N/A	3 (11%)	25 (89%)
March 1997	N/A	N/A	3 (11%)	17 (85%)
February 2009	2 (4%)	43 (96%)	26 (58%)	19 (42%)
April 2009	2 (4%)	43 (96%)	26 (58%)	19 (42%)
February 2017	9 (41%)	13 (59%)	15 (68%)	7 (32%)
March 2017	11 (55%)	9 (45%)	13 (65%)	7 (35%)

Table 8.–Estimated length-at-age for northern pike in Minto Lakes using cleithra, 2018.

Age	Sex	Sample size	Average length (mm FL)
5	F	4	567
	M	3	546
6	F	16	634
	M	4	589
7	F	8	682
	M	4	632
8	F	4	737
	M	2	683
9	F	7	752
10	F	5	775
	M	1	725
11	F	5	807
	M	1	705
12	F	2	874
14	F	2	927
15	F	1	920

Figure 1.–Map of Minto Flats Complex, Tolovana River drainage subsistence permit area, and location of the Minto Lakes Study Area.

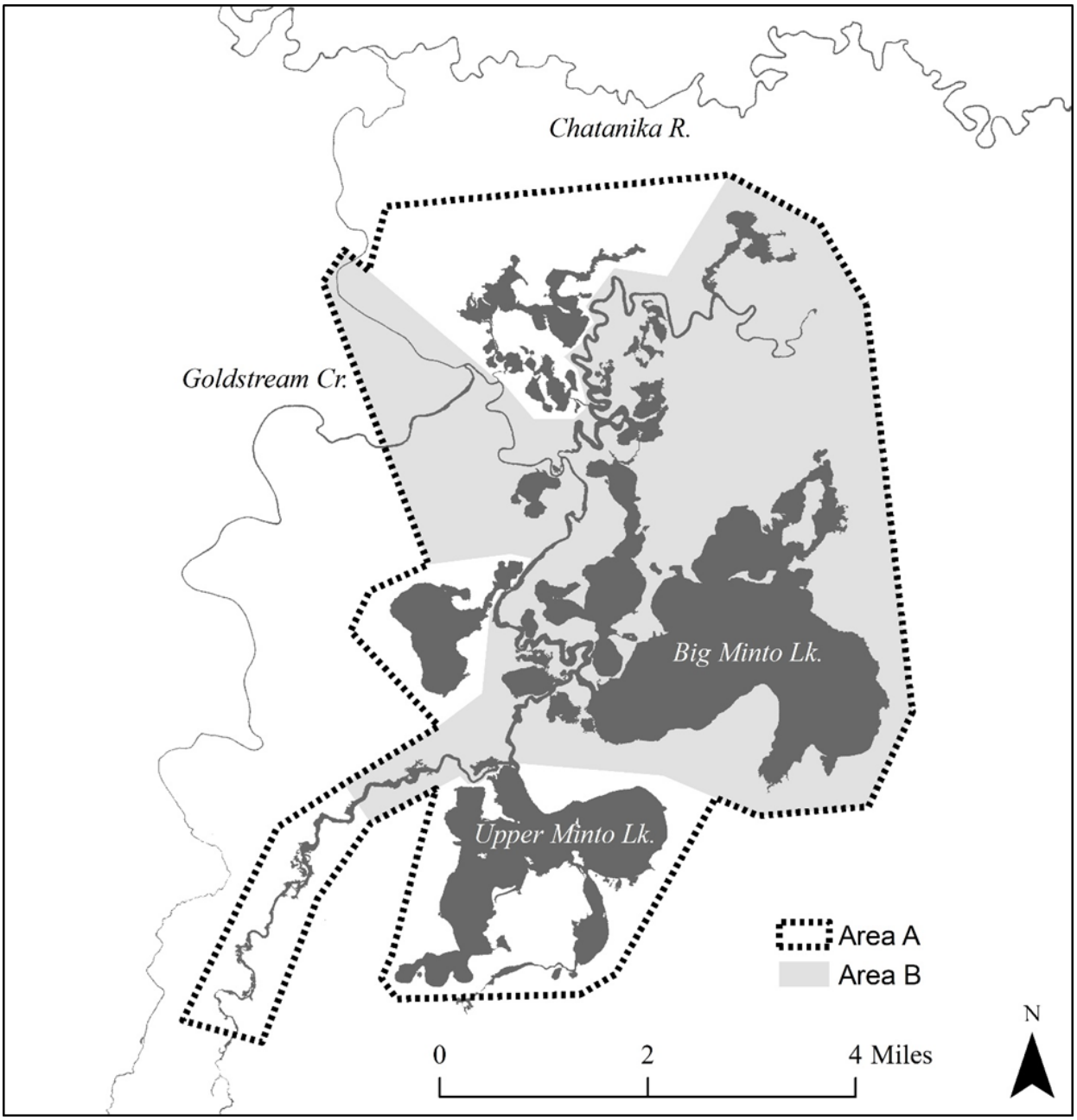


Figure 2.–Demarcation of Minto Lakes Study Area; Area-A and Area-B.

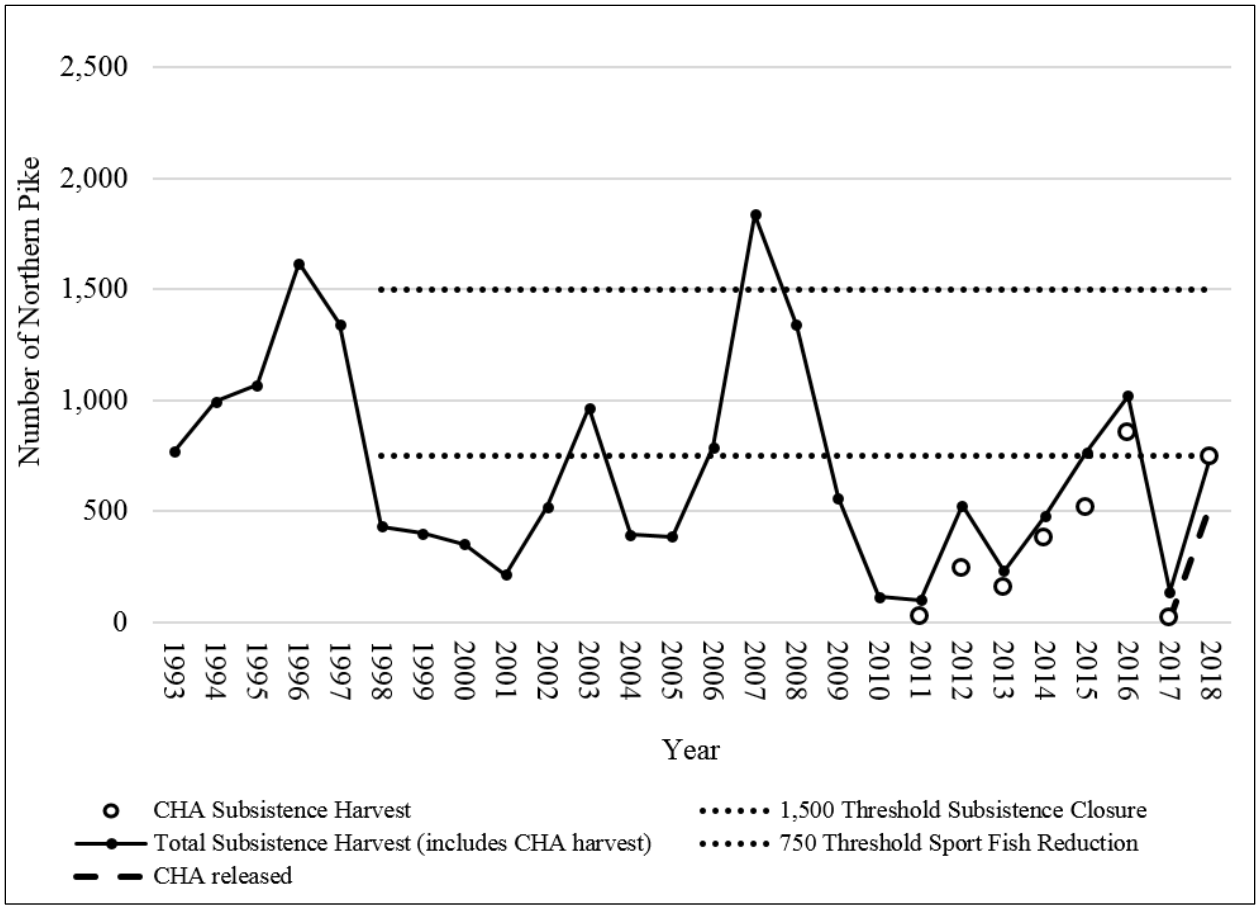


Figure 3.–Subsistence harvest and release of northern pike in Tolovana River drainage.

Note: Chatanika Harvest Area (CHA) fishing location has been documented on permits since 2011. Prior to 2011, fishing occurred in the CHA but fishing location was not specified on permits. 2018 data is preliminary.

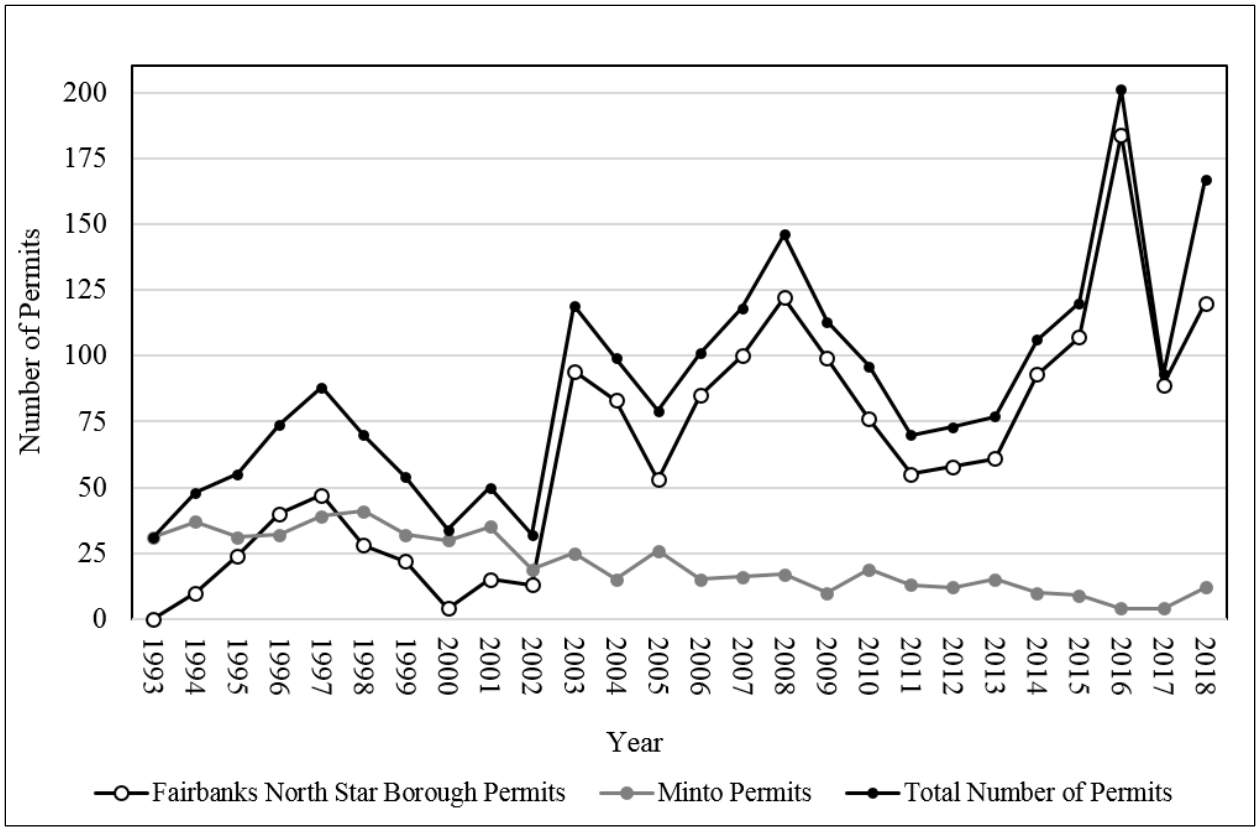


Figure 4.–Subsistence household participation by community for northern pike in the Tolovana River drainage, 1993–2018.

Note: 2018 data is preliminary.

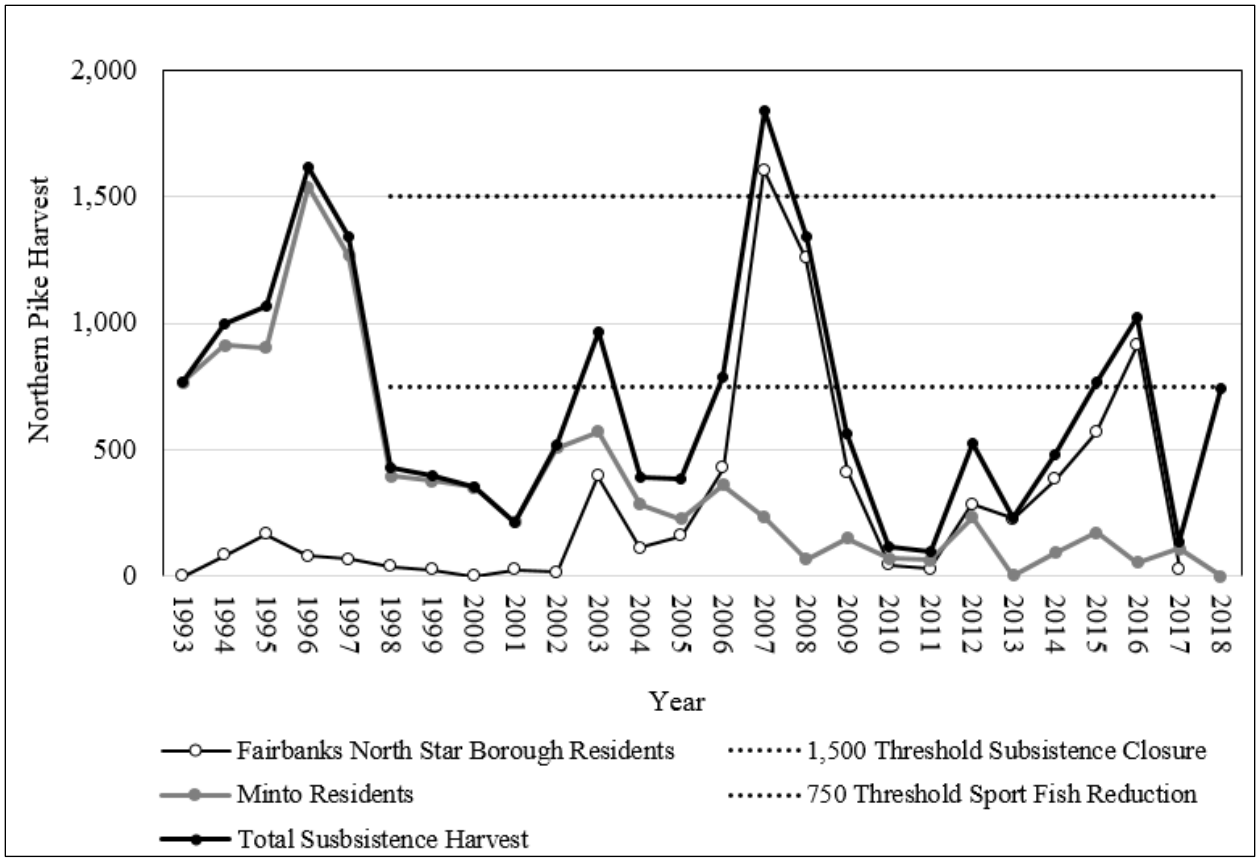


Figure 5.–Subsistence harvest by community for northern pike in the Tolovana River drainage, 1993–2018.

Note: 2018 data is preliminary.

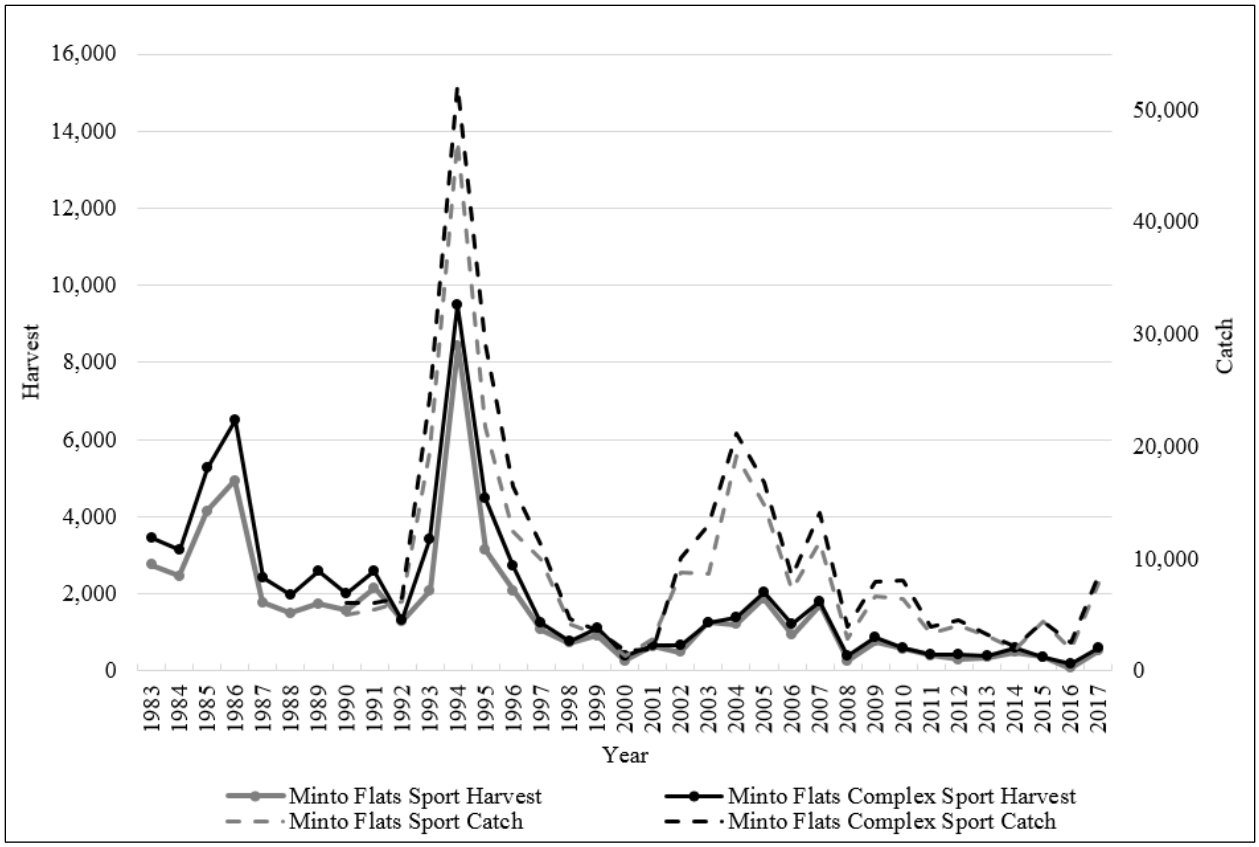


Figure 6.–Sport fishing harvest and catch of northern pike in Minto Flats and Minto Flats Complex, 1983–2017.

Date Issued:_____ Permit Number: ST-_____

Household Subsistence Fishing Permit
Tolovana River Drainage – Northern Pike

Alaska Department of Fish and Game, Division of Commercial Fisheries
1300 College Road, Fairbanks, AK 99701 Telephone (907) 459-7274

Name _____ Telephone _____

Mailing Address _____

Email _____ Number in your Household _____
(Include yourself)

Other Household Member(s)_____

You have selected the following primary gear type: _____

You have selected the following secondary gear type: _____

Conditions of Permit: All regulations pertaining to subsistence fishing in the area to be fished are to be followed. Anyone fishing this household's gear must be named above as a household member and carry this permit on their person during any fishing activity. An accurate record of fish taken under authority of this permit must be recorded on the catch form provided before leaving the fishing site on the same day the fish are landed.

This permit is for the subsistence harvest of northern pike in the Tolovana River drainage, including the Chatanika Harvest Area (HA). Chatanika HA is the Chatanika River, from an ADF&G regulatory marker located one river mile upstream from the confluence of Goldstream Creek to an ADF&G regulatory marker located at the boundary of the Fairbanks Nonsubsistence Area (approximately one mile downstream from the Murphy Dome Road). **Subsistence fishing through the ice is CLOSED** in the Chatanika River from the confluence of Goldstream Creek to an ADF&G regulatory marker approximately one river mile upstream of the confluence.

In the **Chatanika HA**:

- Each household permit has a daily bag limit of 10 pike with a possession limit of 20 pike and only single hooks may be used.
- You are required to report your catch online at www.adfg.alaska.gov/sf/PU/ or by calling ADF&G at **(907) 459-7388 by 4:30 P.M. every Thursday, if fishing activity has occurred.**

At the end of the season your completed catch information must be submitted online at www.adfg.alaska.gov/sf/PU/ or may be submitted to ADF&G Fairbanks office, within 10 days after permit expiration date. **FAILURE TO REPORT CATCH AND HARVEST LOCATION INFORMATION MAY RESULT IN DENIAL OF A HOUSEHOLD PERMIT NEXT YEAR.**

Under authority of this permit, pike may be taken for subsistence within the legal waters of the Tolovana River drainage for the calendar year the permit is issued (as noted in the last two digits of the permit number). This permit expires December 31 annually, unless otherwise noted by an ADF&G official.

This permit is not valid unless signed and dated. By completing this permit application I am agreeing to allow ADF&G to publish the number of fish reported using this permit. No names or addresses will be published.

I hereby claim I am a resident of Alaska and that the information I have provided on this permit is true as witnessed by my signature. I have read and will abide by all conditions of this permit.

X_____ Date_____ Date of Birth _____
Signature of Permittee

Revised 2/2018 RECORD HARVEST ON CATCH FORM

Figure 7.–Copy of 2018 Tolovana River Drainage Subsistence Pike Permit.

Date Issued:___________ Permit Number: ST-_____________

TOLOVANA RIVER DRAINAGE SUBSISTENCE FISHERY CATCH FORM

ADF&G is conducting a research project to estimate northern pike abundance in Minto Flats. If you harvest a tagged pike, please report the number listed on the tag (dorsal fin) and return radio tags (with long metal antennae) to Matt Albert 459-7359 or matthew.albert@alaska.gov. It is preferable to release tagged fish alive, but not required.

If permit is on Rite-in-Rain water resistant paper please use pencil not ink.

DATE	FISHING LOCATION		NUMBER HARVESTED		PIKE RELEASED
	Chatanika HA	Other	PIKE	OTHER (Specify Species)	
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			
	☐	☐			

Report harvests online at www.adfg.alaska.gov/sf/PU/ or return a permit to ADF&G

RETURN TO:
Alaska Department of Fish and Game
Division of Commercial Fisheries
1300 College Road
Fairbanks, AK 99701
Telephone: (907) 459-7274

PLEASE CHECK THIS BOX IF YOU DID NOT FISH THIS YEAR ☐

_____________________________ Sign this Catch Report when you return it.

_______________ Date

Revised 2/2018

Figure 7.–Page 2 of 2.

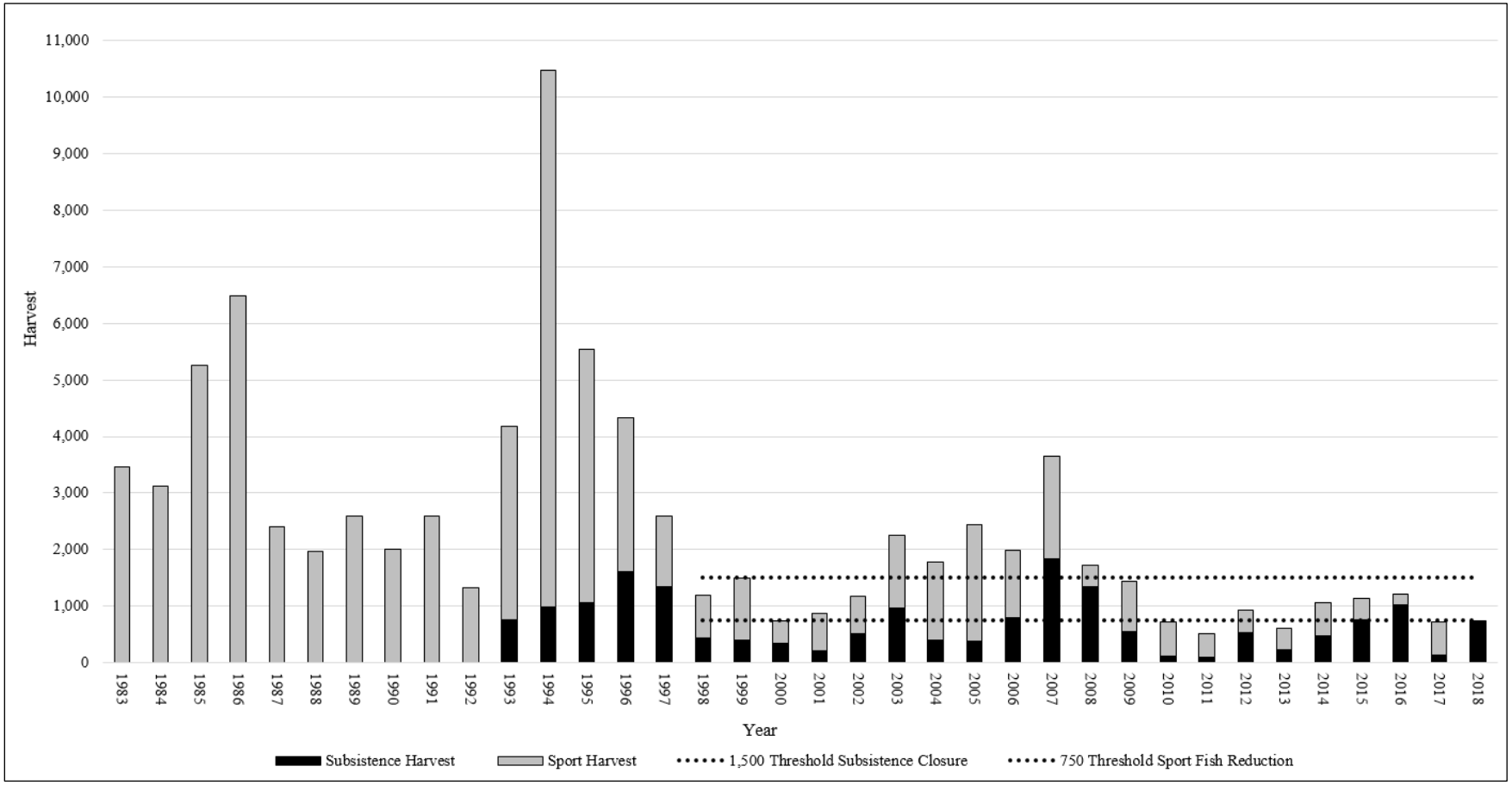


Figure 8.–Subsistence harvest and sport harvest of northern pike in Minto Flats Complex, 1983–2018.

Note: 2018 data is preliminary.

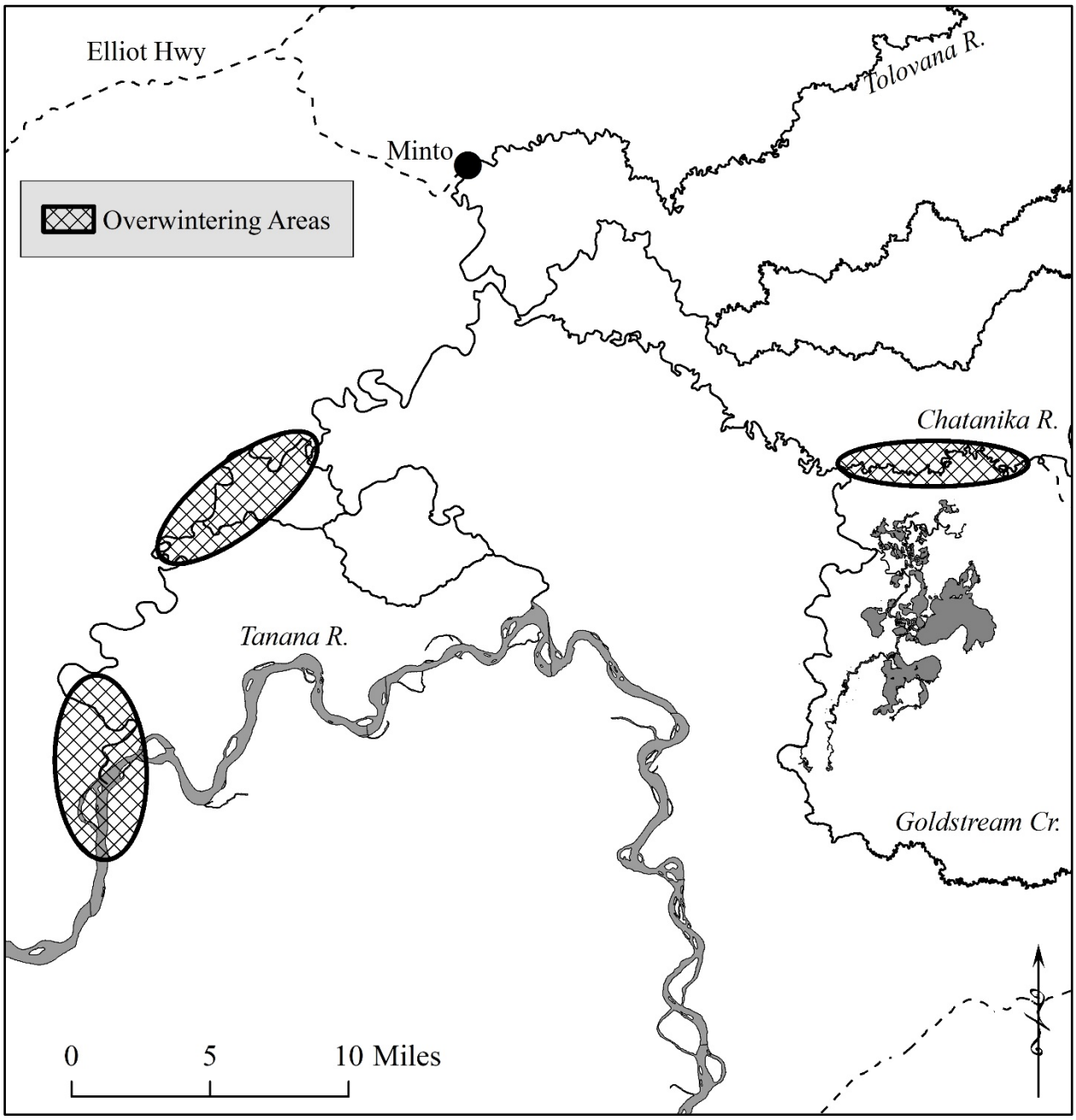


Figure 9.–Major overwintering aggregations of northern pike in Minto Flats identified by Burkholder and Bernard (1994).

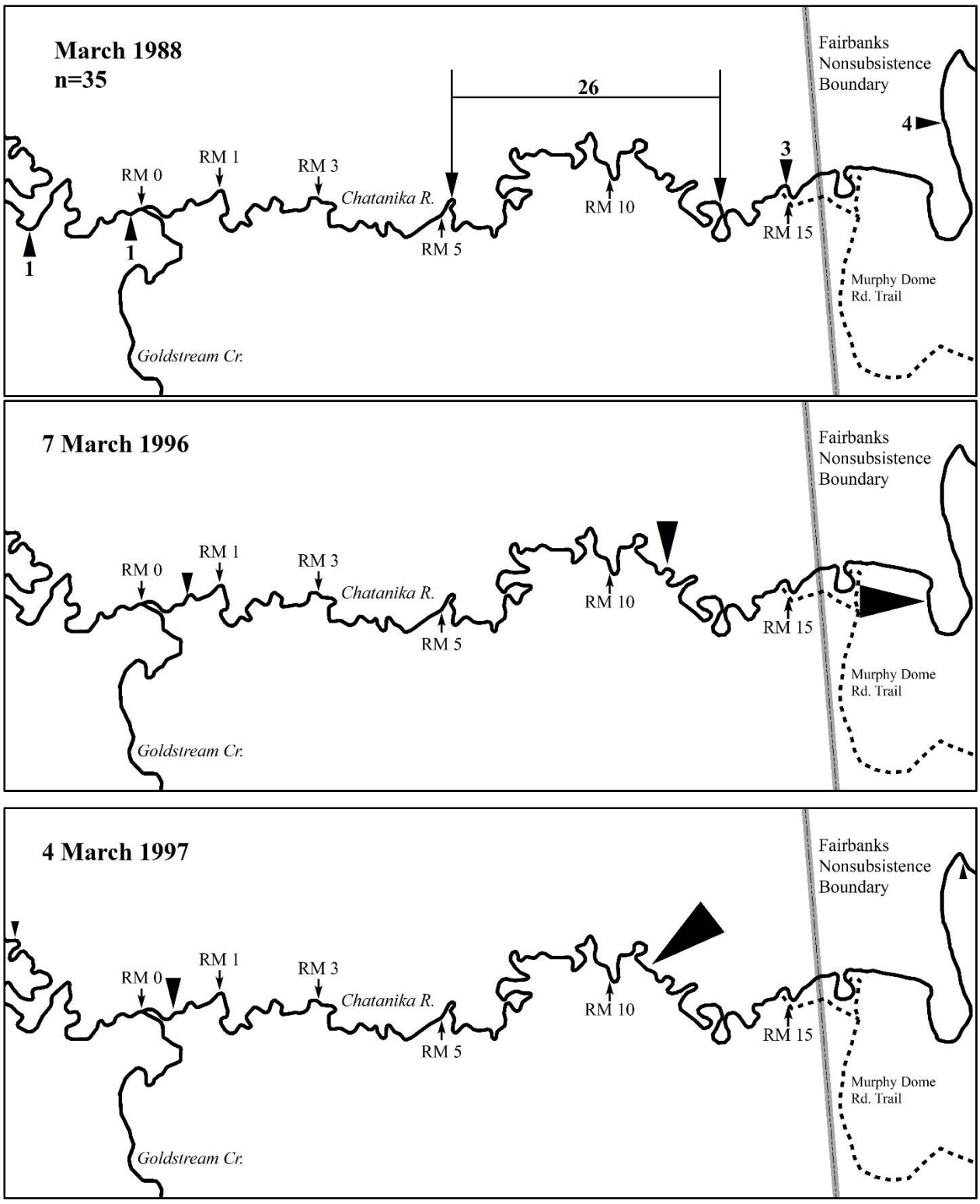
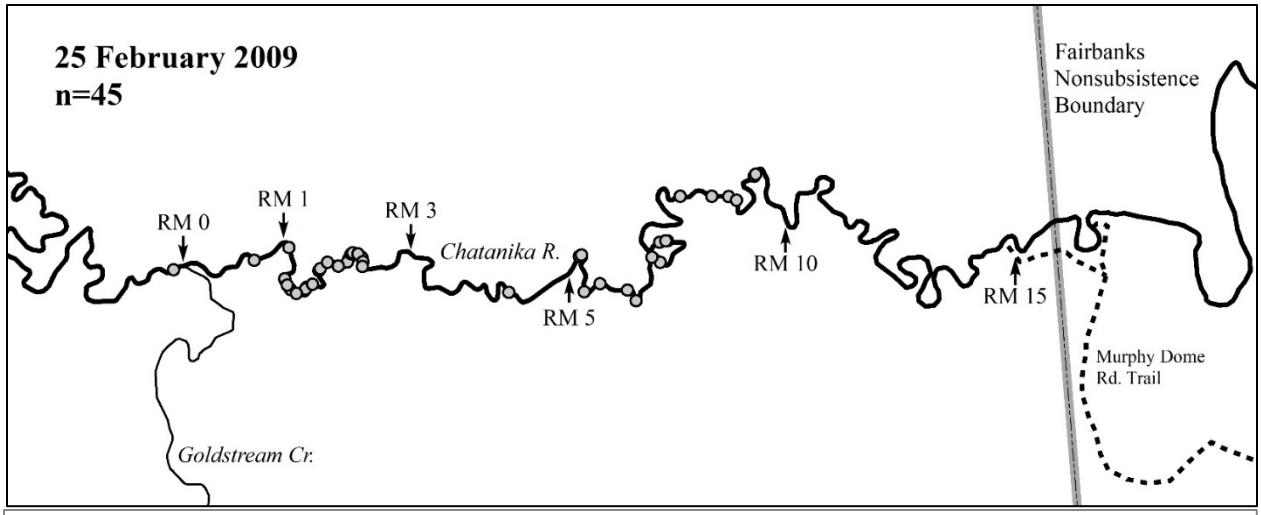


Figure 10.–Overwintering aggregations by survey date of northern pike in CROA presented by Roach (1998a). The relative number of radiotagged fish in a specific area is depicted by arrow size or are directly labeled.



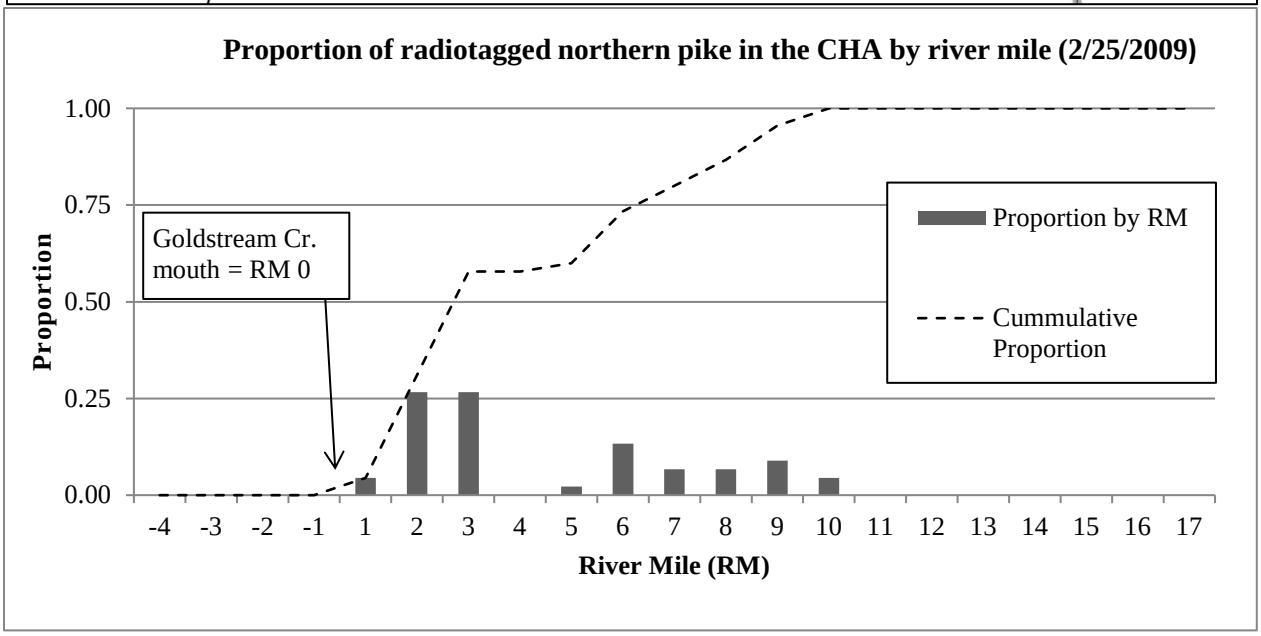


Figure 11.–Distributions of radiotagged northern pike in in the Chatanika Harvest Area (CHA) relative to river mile (RM) during February 2009.

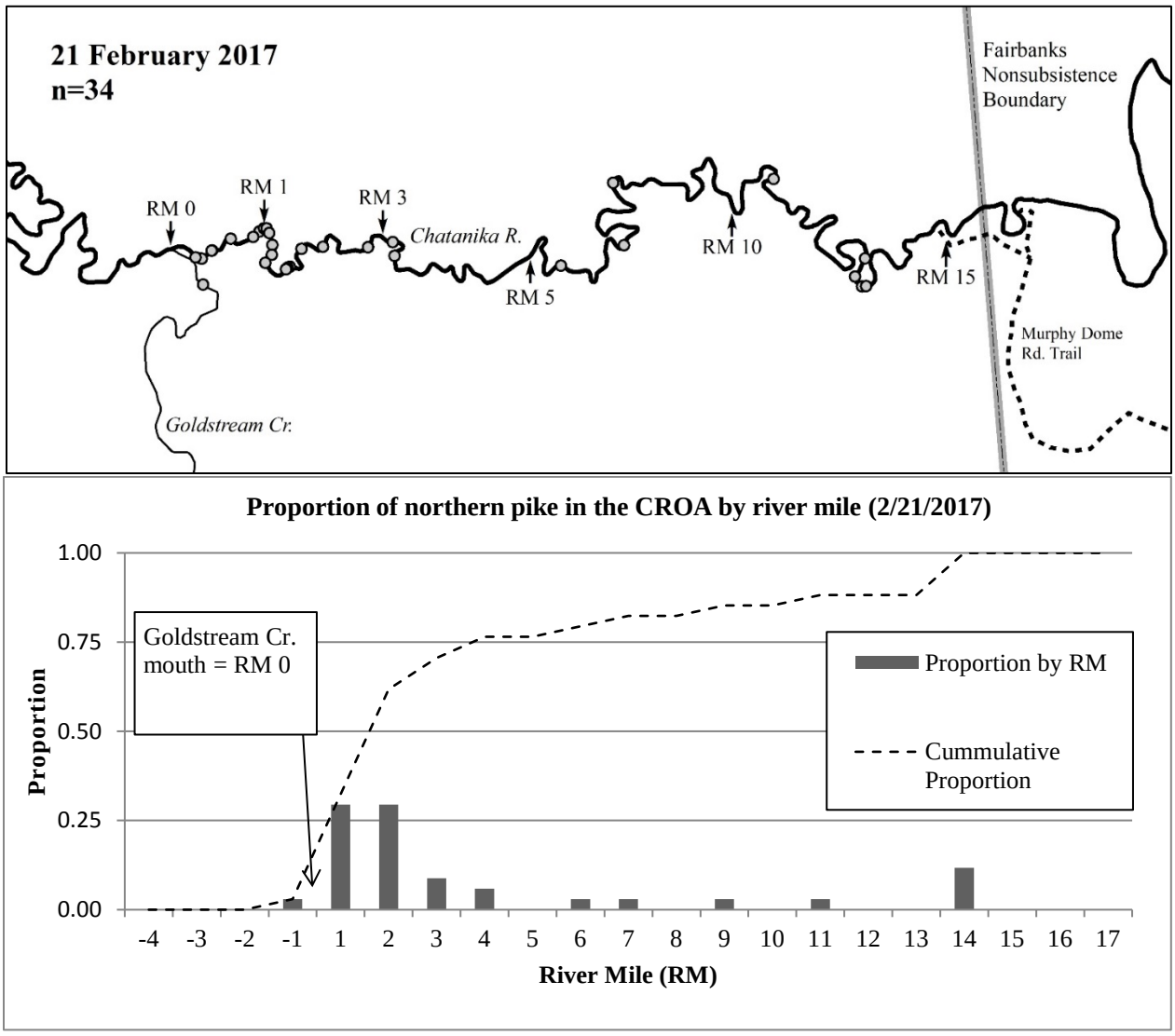


Figure 12.–Distributions of radiotagged northern pike in in the Chatanika Harvest Area (CHA) relative to river mile (RM) during February 2017.

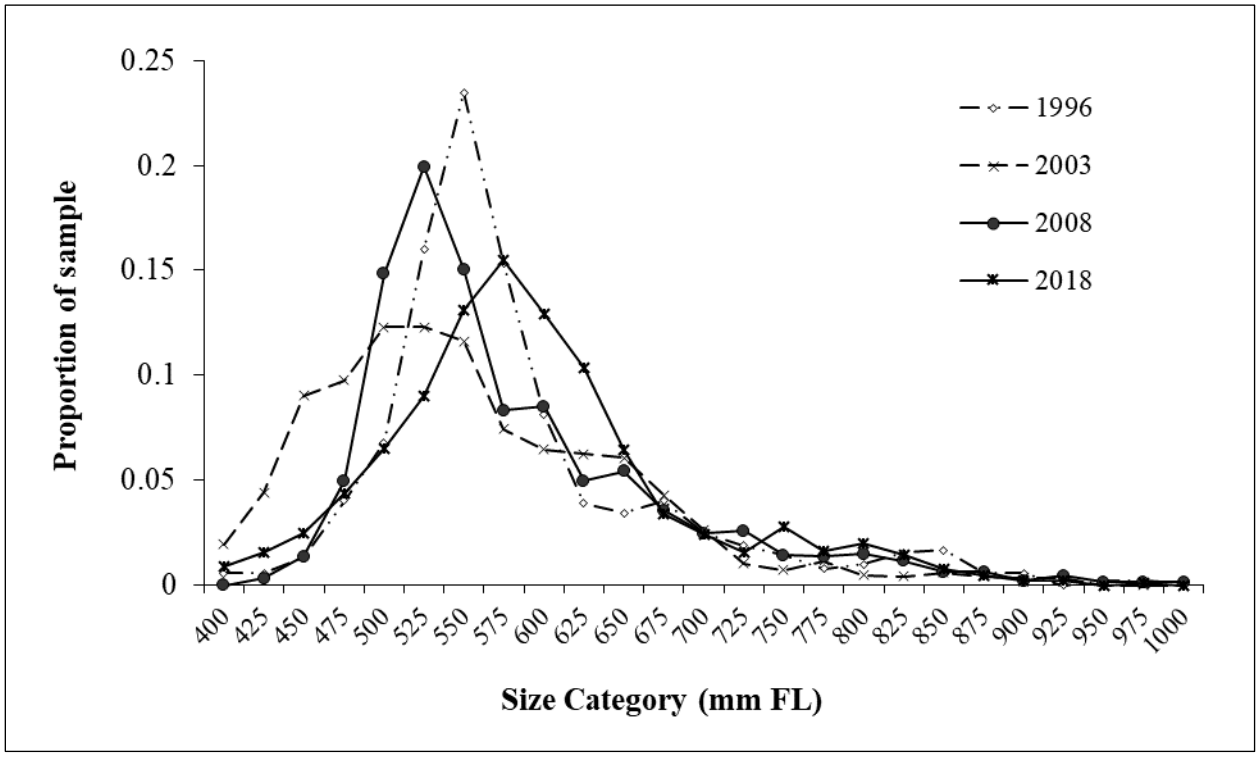


Figure 13.–Length compositions of northern pike sampled in the MLSA during summer of 1996, 2003, 2008, and 2018.

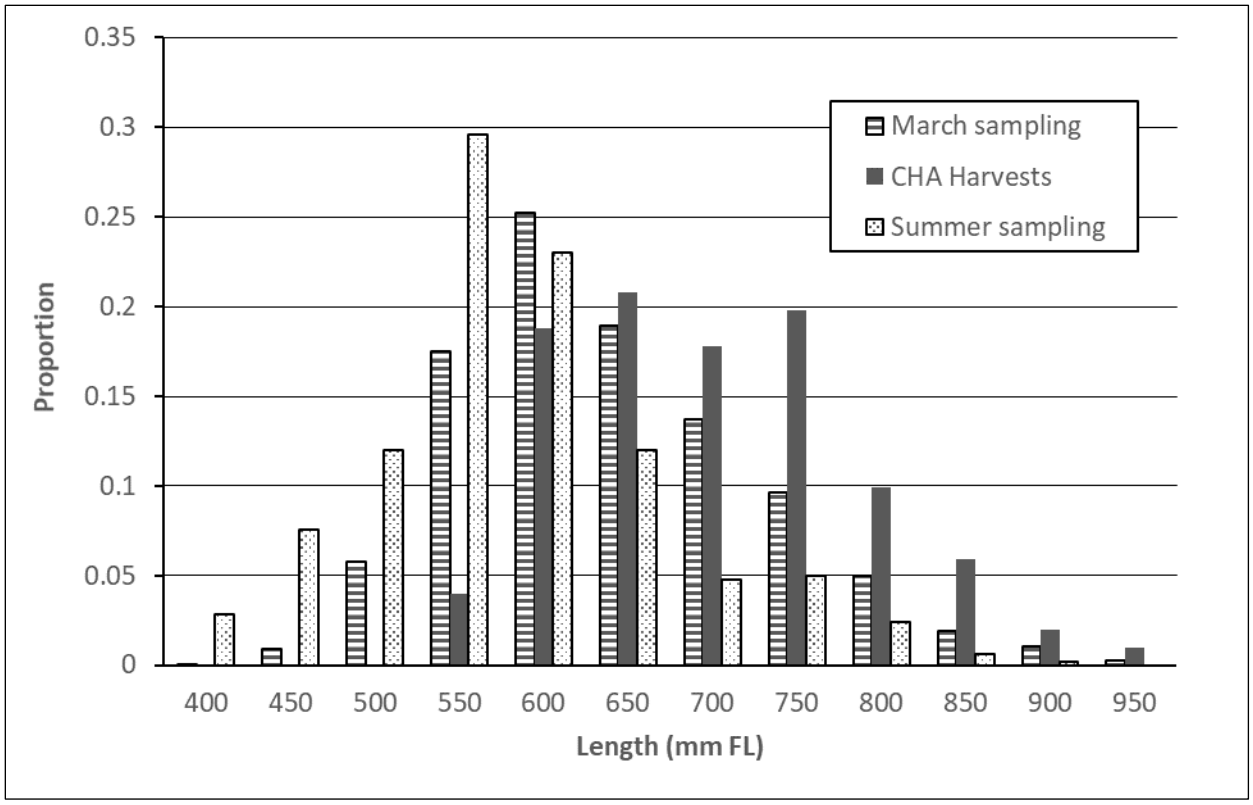


Figure 14.–Length composition of northern pike captured by hook and line in the MLSA during summer (n = 1,734), in the CHA during March (n = 943), and harvested by subsistence users during February and March (n = 101) in the CHA during 2018.