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**An Overview of Minto Flats Northern Pike  
Subsistence and Sport Fisheries: A Report to the  
Alaska Board of Fisheries, January 2023**

by

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December 2022

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Alaska Department of Fish and Game

Divisions of Commercial and Sport Fisheries



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Weights and measures (metric)		General		Mathematics, statistics	
centimeter	cm	Alaska Administrative Code		all standard mathematical signs, symbols and abbreviations	
deciliter	dL		AAC		
gram	g	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	alternate hypothesis	H <sub>A</sub>
hectare	ha			base of natural logarithm	<i>e</i>
kilogram	kg			catch per unit effort	CPUE
kilometer	km	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	coefficient of variation	CV
liter	L			common test statistics	(F, t, $\chi^2$ , etc.)
meter	m	at	@	confidence interval	CI
milliliter	mL	compass directions:		correlation coefficient (multiple)	R
millimeter	mm	east	E	correlation coefficient (simple)	r
<b>Weights and measures (English)</b>		north	N	covariance	cov
cubic feet per second	ft <sup>3</sup> /s	south	S	degree (angular)	°
foot	ft	west	W	degrees of freedom	df
gallon	gal	copyright	©	expected value	<i>E</i>
inch	in	corporate suffixes:		greater than	>
mile	mi	Company	Co.	greater than or equal to	≥
nautical mile	nmi	Corporation	Corp.	harvest per unit effort	HPUE
ounce	oz	Incorporated	Inc.	less than	<
pound	lb	Limited	Ltd.	less than or equal to	≤
quart	qt	District of Columbia	D.C.	logarithm (natural)	ln
yard	yd	et alii (and others)	et al.	logarithm (base 10)	log
<b>Time and temperature</b>		et cetera (and so forth)	etc.	logarithm (specify base)	log <sub>2</sub> , etc.
day	d	exempli gratia (for example)	e.g.	minute (angular)	'
degrees Celsius	°C	Federal Information Code	FIC	not significant	NS
degrees Fahrenheit	°F	id est (that is)	i.e.	null hypothesis	H <sub>0</sub>
degrees kelvin	K	latitude or longitude	lat or long	percent	%
hour	h	monetary symbols (U.S.)	\$, ¢	probability	P
minute	min	months (tables and figures): first three letters	Jan,...,Dec	probability of a type I error (rejection of the null hypothesis when true)	$\alpha$
second	s	registered trademark	®	probability of a type II error (acceptance of the null hypothesis when false)	$\beta$
<b>Physics and chemistry</b>		trademark	™	second (angular)	"
all atomic symbols		United States (adjective)	U.S.	standard deviation	SD
alternating current	AC	United States of America (noun)	USA	standard error	SE
ampere	A	U.S.C.	United States Code	variance	
calorie	cal			population sample	Var var
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				

***SPECIAL PUBLICATION NO. 22-18***

**AN OVERVIEW OF MINTO FLATS NORTHERN PIKE SUBSISTENCE  
AND SPORT FISHERIES:  
A REPORT TO THE ALASKA BOARD OF FISHERIES, JANUARY 2023**

by

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Division of Sport Fish, Research and Technical Services  
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December 2022

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## ABSTRACT

This report provides the Alaska Board of Fisheries with an overview of the stock status of Minto Flats northern pike (*Esox lucius*) subsistence and sport fisheries for the January 2023 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.

Keywords: 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), support the largest subsistence fishery for northern pike *Esox lucius* in Yukon River drainage subsistence permit areas, and one of the largest northern pike sport fisheries in the Arctic–Yukon–Kuskokwim Area. The Alaska Department of Fish and Game (hereafter referred to as “the department”) 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 2023 Arctic–Yukon–Kuskokwim Finfish regulatory meeting. This report is organized into 3 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 150; U.S. Census Bureau 2021) is located on the northwest edge of Minto Flats. Minto Flats measures approximately 500,000 acres and consists 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 Creek, Goldstream Creek, 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 2 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 *O. keta*, coho salmon *O. kisutch*, inconnu/sheefish *Stenodorus leucichthys*, longnose suckers *Catostomus catostomus*, Arctic lamprey *Lethenteron camtschaticum*, Alaska blackfish *Dallia pectoralis*, and 4 species of whitefish (broad whitefish *Coregonus nasus*, least cisco *C. sardinella*, humpback whitefish *C. pidschian*, and round whitefish *Prosopium cylindraceum*).

The Minto Lakes is a major northern pike spawning and summer feeding area. The amount of northern pike habitat and presumably production 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 3 primary overwintering areas, including the Chatanika River near its confluence with Goldstream Creek, Swanneck and Grassy Sloughs, and near the confluence of the Tolovana and Tanana Rivers (Burkholder and Bernard 1994; Albert *In prep*). 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 Chatanika River Overwintering Area (CROA). The Minto Lakes stock represents approximately 70% of the northern pike that overwinter in the CROA (Albert 2016).

For management of the subsistence and sport fisheries, there are 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 MLSA; and
  - b. *Area-B*: A subset of the MLSA.
- 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).
- 7) *Chatanika River Overwintering Area (CROA)*: That portion of the Chatanika River between the mouth of Goldstream Creek and the Fairbanks Nonsubsistence Boundary used when referencing population estimates.

## **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 1983, 27 households in Minto harvested an estimated 3,003 northern pike (Andrews 1998). After a positive Customary and Traditional (C&T) use finding for the Yukon River drainage in 1987 by the board, the entire Tolovana River drainage and Chatanika River drainage were opened to subsistence fishing for northern pike. Starting in 1988, it became possible to report northern pike harvest on a household salmon subsistence permit for



Subdistrict 6-B of the Tanana River drainage, and set gillnets were limited to the open water season of April 15 to October 14 for the northern pike fishery. In 1993, the creation of the Fairbanks Nonsubsistence Area restricted subsistence harvest in the Chatanika River drainage within 1 mile of Murphy Dome Road. In that year, the department developed a specific subsistence northern pike permit for the Tolovana River drainage that was separate from the salmon subsistence permits (Table 1).

Since the creation of the Tolovana River drainage northern pike subsistence permit in 1993 until 2017, harvest averaged 722 fish annually (Table 2). Since 1998, a 1,500-fish subsistence harvest limit has been in place for the CHA portion of the drainage. The same year, a 750-fish threshold was put in place in the CHA, where if met, the summer sport fish bag limit is reduced until the end of the calendar year. Subsistence harvest of northern pike in the overall Tolovana River drainage peaked in 2021 at 3,092 fish, and subsistence closures of the CHA were triggered in 2007, 2021, and 2022 (note: 2022 data is preliminary as the summer fishery has not reported yet). Subsistence harvest has been as low as 110 fish in 2011 (Table 2 and Figure 3). Meanwhile, sport fish bag limit reductions were triggered in 2007–2008, 2016, and 2019–2022.

The Tolovana River drainage is a traditional subsistence fishing area, along with other locations in Minto Flats, used by Minto residents (Andrews 1988). Historically, 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). Improvements to fishing location data collection on permits were implemented in 2011 to allow harvest in the CHA to be separated from other harvest in the drainage. From 2018 to 2022, harvest averaged 1,106 northern pike in the CHA annually and 97% of that harvest was taken by FNSB residents (Table 3 and Figure 5). Recent harvest from Minto residents, which can be substantial, typically occurs during ice-free months in parts of the drainage outside of the CHA.

Current legal gear for subsistence fishing for northern pike in the Tolovana River drainage include set gillnets, drift gillnets, beach seines, fish wheels, long lines, fyke nets, dip nets, hook and line attached to a rod or pole (ice fishing only), jigging gear (ice fishing only), and spears. Notably, hook and line attached to a rod or pole has also been allowed through the ice since 1978; prior to this, the gear was outright prohibited. In the CHA, only single hooks may be used. Hook and line (jigging) is the dominant gear type during the winter, and set gillnet is most common in ice-free months. In the Tolovana River drainage, set gillnets may only be used from April 15 to October 14.

Most fishing in the CHA occurs between January and April within a few river miles upstream of Goldstream Creek. Fishers typically use hook and line attached to a rod or pole with bait for jigging. 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. Size limits were established in 2019 and enacted in the 2020 season. The recent 5-year (2018–2022) average subsistence harvest of northern pike was 1,106 fish in the CHA and 875 fish in the remainder of Minto Flats (Table 2).

## **Sport Fishery**

The most notable period of growth in the sport fishery 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 Nonsubsistence Use Area 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 1 or 2 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 fishery harvests from Minto Flats (Doxey *Unpublished*<sup>1</sup>; Table 4). 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.

## MANAGEMENT

### MANAGEMENT PLANS

A complete regulatory history (Table 1) and summary of current management plans for subsistence and sport fisheries of northern pike in Minto Flats (Table 5) are provided. 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 at 20% annually of the recent abundance estimate (Tables 2 and 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 FNSB 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 fishers are required to report their harvests weekly. When cumulative harvest reaches 1,500 fish between January 1 and spring breakup (around May 1), the winter subsistence fishery is closed by emergency order until after breakup of the same calendar year. In the companion sport fish management plan, a cumulative harvest by subsistence users in the CHA between January 1 and spring breakup of 750 fish results in, by emergency order, a reduced bag and possession limit of

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<sup>1</sup> Doxey, M. *Unpublished*. Minto Flats Sport Fish management plan. Alaska Department of Fish and Game, Division of Sport Fish, Fairbanks.

2 fish, of which only 1 fish may be over 30 inches. The order stays in effect for the remainder of the calendar year.

The sport fishery management plan has been amended once since its adoption; in contrast, several modifications have been made to the subsistence management plan. In 2010, the geographic reference of the 20% exploitation rate was changed from Minto Lakes to all lakes and flowing waters within Minto Flats. 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 3 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. Most recently, in 2019, a size restriction for the subsistence fishery in the CHA was adopted to reduce the harvest of large, predominantly female fish.

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

- Permits are required for participation in the subsistence fishery.
- Hook and line gear can only be used through the ice.
- Designation of the CHA (Figure 1) where the following regulations apply:
  - o Contains a 1-mile area closed to subsistence ice fishing;
  - o A subsistence harvest bag limit of 10 fish, 2 of which may be over 30 inches, and a possession limit of 20, 4 of which may be over 30 inches;
  - o Fishers must report weekly catches to the department; and
  - o 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 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 1 may be 30 inches or more in length.
- Once the subsistence harvest within the CHA exceeds 750 fish, bag and possession limit are reduced to 2 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 department office in Fairbanks 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. Historically (1995–2021), 94% of the permits issued were returned to the department, and in the last 5 years (2017–2021), the return rate has increased to an average of 99%.

Between 1988 and 1992, northern pike harvest was probably 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 (Figure 7). 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 department (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, fishers 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 2021, an average of 115 permits were issued annually. The popularity of the CHA has grown significantly since 2017, and a record number of permits, 425, was issued in 2021 (Table 2 and Figure 4). Prior to 2003, most users in this area were Minto residents; however, since 2003, residents of the FNSB have dominated the fishery (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. 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 Minto.

# HARVEST

## SUBSISTENCE HARVEST

The recent 5-year (2017–2021) average subsistence harvest of northern pike is 859 fish in the CHA and 723 fish in the remainder of Minto Flats. The subsistence harvest in the overall Tolovana River drainage has increased from 890 fish on average since 1993 to 1,582 fish over the last 5 years (2017–2021). The largest harvest in the Tolovana River drainage occurred in 2021, when 3,092 northern pike were harvested and 1,908 were released (Table 3 and Figure 3). During that year, there was an equal split of harvest between the CHA and the remainder of Minto Flats (Table 3).

Although residents of the FNSB became the majority participants in the fishery in 2003, Minto residents consistently harvested the majority of northern pike until 2006 (Figure 5). Recently, in 2020 and 2021, Minto residents again harvested the majority of northern pike, despite making up only a fraction of the overall fishery participants.

Prior to the creation of the closed area on the Chatanika River upstream of the Goldstream Creek confluence, the 2011 to 2016 average harvest in the CHA was 362 fish (Table 2). Initially, a 3-mile closed area of the subsistence winter northern pike fishery in the CHA was implemented for 1 season in 2017. During the 3-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 with the 3-mile closure in place compared to previous years. The harvest was the lowest on record in the CHA and third lowest in the Tolovana River drainage. During that winter, a radiotelemetry study found that overwintering northern pike in the Chatanika River were distributed over a much wider area of the river than normal (Albert *In prep*).

After the 3-mile closed area was reduced to a 1-mile area, participation and harvest quickly rebounded. To limit the harvest of large fish, which are almost all female (Gutierrez and Tyers 2020), the bag and possession limits were modified beginning in the 2020 season to reduce the number of fish over 30 inches that could be harvested to 2 fish per day and 4 fish in possession (Table 1).

The number of northern pike released by fishers has been required on subsistence permits since 2017. Between 2018 and 2021, fishers released around half (54%) of the fish they caught ice fishing in the CHA (Figure 3). Mortality after release is assumed to be very low as seen in radiotagged northern pike in the CHA during the winter, due to healthier northern pike body condition in winter compared to any other time of year (Guy and Willis 1991; Albert and Tyers 2020).

In 2021, a record number of 425 household permits were issued for the Tolovana River drainage, resulting in 1,467 northern pike harvested in the CHA by FNSB residents. Inseason reporting indicated 1,423 northern pike had been harvested in the CHA by mid-April. Minto residents harvested 1,526 northern pike in the remainder of Minto Flats. Total subsistence harvest in 2021 was 3,092 northern pike in the Tolovana River drainage on 268 permits fished. This was the largest harvest in the CHA since the bag and possession limits were adopted in 2010 and the largest total northern pike harvest in the Tolovana River drainage since permit records began in 1993 (Table 3).

Inseason reports for 2022 indicated at least 1,259 northern pike were harvested in the CHA by mid-April, which is above the recent 2017–2021 average of 859 fish in the CHA. This was the second consecutive year the 1,500-harvest threshold in the CHA was projected to be reached.

Preliminary data indicate 332 permits were issued for the Tolovana River drainage in 2022, which is above the recent 2017–2021 average of 115 permits. However, participation in the number of households that fished decreased by 14% from 2021 (Table 2). Complete harvest and participation information will not be available until February 2023.

## **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 occur 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 downward, and the recent 4-year average (2018–2021) was 427 fish (Table 4 and Figure 8).

## **RECENT 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 and 2021. In 2022, the subsistence fishery in the CHA was closed based on projected harvest reaching the 1,500-fish threshold. The 750-fish threshold was exceeded 8 times in the past 20 years (2007–2008, 2016, and 2018–2022), resulting in sport fishery restrictions during the summer season of those years except for 2018 (Figures 3 and 8). Sport fishing restrictions for northern pike in the Minto Flats Complex was a bag and possession limit of 2 fish, with 1 over 30 inches in length.

### **2021–2022: CHA Subsistence Fishery Closures**

Recent subsistence fishery closures and sport fishery restrictions followed a similar format to previous years, where weekly inseason reporting was used to direct management actions. However, unlike in 2007 when the fishery passed the 1,500 fish CHA harvest threshold on February 16 (Gleason and Estensen 2018), harvests in 2021 and 2022 increased more slowly and did not approach the 1,500-fish threshold until mid-April. This is probably due to the daily and possession harvest limits established in 2010.

On April 8, 2021, a total of 1,203 northern pike were reported to be harvested in the CHA, prompting a closure of the subsistence fishery in the CHA for the remainder of the spring season effective April 16, 2021. The remainder of Minto Flats remained open to subsistence fishing. Final CHA harvest was reported to be 1,512 from January 1 until spring ice-out. The subsistence harvest in 2021 totaled 3,092 northern pike taken by 268 of the 425 permits issued in the Tolovana River drainage (Table 2 and Figure 3). This was the largest subsistence harvest since permit data began in 1993, but it was not the largest harvest for fish per permit (11 fish per permit in 2021 compared to 70 in 1993). Total harvest in the Minto Flats Complex by all users was 3,404 northern pike, which is the sixth largest harvest since 1993 (Table 2).

On April 8, 2022, a total of 1,059 northern pike were reported to be harvested in the CHA, prompting a closure of the subsistence fishery in the CHA for the remainder of the spring season effective April 17, 2022. The remainder of Minto Flats remained open to subsistence fishing. The subsistence harvest in 2022 is preliminary but totaled 1,259 northern pike by 162 of the 332 permits issued in the Tolovana River drainage (Table 2 and Figure 3). Final subsistence harvest numbers will not be available until February 2023. Harvest per permit decreased slightly from the year

before (8 fish per permit in 2022 compared to 11 in 2021). Estimated sport fishery harvest for 2022 will not be available until late in 2023.

### **2019–2022: Sport Fishery Restrictions**

Sport fishing has been restricted since 2019 due to annual subsistence harvest exceeding 750 fish in the CHA. During this time, subsistence harvest in the Tolovana River drainage ranged from 1,633 to 3,092 fish, and represented 3 of the 5 largest years in terms of reported subsistence harvest (Table 2). In comparison, the sport fishery harvest ranged from 261 to 746 northern pike harvested in 2019–2021. These fish were harvested from the 1,089 to 2,837 northern pike caught over 983 to 2,480 angler-days in the Minto Flats Complex during those years (Table 4).

### **Exploitation Rate**

The Minto Flats Northern Pike Management Plans (5 AAC 01.244, Subsistence; and 5 AAC 74.044, Sport fisheries) manage stocks consistent with the sustained yield principle, provide reasonable opportunity for the subsistence fishery, and provide sport fishing opportunity. The plans contain annual harvest thresholds with attendant regulatory actions to ensure that the overall exploitation rate of northern pike within the lakes and flowing waters of Minto Flats does not exceed 20% by all users. Between 2008 and 2018, the abundance and size of northern pike in the Minto Lakes increased significantly (Table 6). Based on the most recent abundance estimate (2018) of 14,817 (SE = 1,836) northern pike  $\geq 24$  inches in the CHA, the exploitation by all users has ranged from 9–23% since 2018 (Tables 2 and 6). Prior to 2018, the department used Minto Lakes population estimates of northern pike over 16 inches to evaluate the exploitation rates, and exploitation remained under 20% (Tables 2 and 6).

## **STOCK ASSESSMENT**

The department has conducted stock assessment within Minto Flats since the late 1960s (Hallberg 1984). These early efforts were used to collect information on length, sex, and age compositions; seasonal movements; 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. Many data gaps still exist today, such as accurate estimates of population size(s), sex ratios, growth, harvest composition, and movement.

### **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 within the MLSA (Table 6; 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 2008 to compare estimates across all years.

In 2018, a mark–recapture experiment was designed using 3 sampling events to estimate abundance and length composition of northern pike in the CROA during winter, and within the MLSA (Area-A and Area-B) during the open water season (Albert and Tyers 2020). Bayesian techniques were used to combine radiotelemetry information and the traditional two-event Petersen mark–recapture model for closed populations (Seber 1982). Fish were sampled in March within the CROA approximately 1.5 miles upstream of Goldstream Creek. During the following summer, fish were sampled within the MLSA in 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 (Table 6). 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 (Albert and Tyers 2020). For example, based on digitized measurements of satellite imagery, the surface area of lakes within in MLSA was approximately 2 times greater in 2018 as compared to 2010. 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 completed in 2018 and a reexamination of historical abundance estimates in the MLSA, it was determined that previous estimates for fish >400 mm FL are no longer valid. Northern pike 400–600 mm fork length (FL; 16–24 inches total length [TL]) are not fully recruited to the sampling gear, resulting 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 greater than 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 recognized as probably 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 14,675 (95% confidence interval = 12,003–18,462; Albert and Tyers 2020).

## **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 northern pike in the the MLSA during the spring of 1995 and followed their movements for 2 years; however, precise locations (i.e., <500-meter radius) of individual fish were not collected. From 2007 to 2009, 199 fish were radiotagged within the CROA, and 100 fish were tagged in the MLSA (Phil Joy, Fisheries Biologist, Alaska Department of Fish and Game, Fairbanks, memorandum, December 2007; Albert 2016). These fish were surveyed at more regular intervals and more precise locations were attained. During the winters of 2008–2009 and 2009–2010, periodic radiotelemetry surveys of the CHA were completed by snowmachine. 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 1-year period, and to provide additional data to support the 2018 abundance estimation experiments. However, by June 2018, it was determined that these



transmitters were failing due to a manufacturing flaw at a substantial rate, and no fish were recaptured after August (Albert and Tyers 2020).

In 2019, a Minto Flats-wide radiotelemetry study was initiated to provide a comprehensive description of the seasonal distributions and movements of northern pike that inhabit areas outside of the MLSA (Albert *In prep*). The study identified important overwintering, spawning, and summer feeding areas, as well as improved the department's understanding of the relationship between the abundance estimates generated for the index areas in the eastern portion of Minto Flats (i.e., MLSA and CROA) and the Minto Flats-wide northern pike population. During June 2019, 143 northern pike were radiotagged in areas outside of the MLSA in the western portion of Minto Flats (i.e., Tolovana River drainage from the Tanana River to ~30 km upstream of the village of Minto). Using the overwintering locations of those fish, an additional 120 radio tags were deployed in March 2020 into overwintering aggregations of northern pike in Swanneck and Grassy Sloughs. The radiotagged fish were located seasonally with aerial radiotelemetry surveys from August 2019 to April 2022.

The major findings of these studies include:

- Identification of 3 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; Albert *In prep*; Figure 9).
- Northern pike in the MLSA represent 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 2016; Albert *In prep*).
- The migration of northern pike from the CROA to the MLSA occurs over a short (i.e., 5–10 day) window associated with breakup from late April to early May. These fish migrate from the MLSA to the CROA over a protracted period from late October through December (Albert 2016).
- 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 2016; Albert *In prep*; Albert and Tyers 2020).
- Initial data analysis from the 2019–2022 radiotelemetry experiment indicates that the CROA is utilized for overwintering by over 50% of northern pike  $\geq 600$  mm FL that inhabit Minto Flats (Albert *In prep*), indicating that the CROA is a major overwintering area for all northern pike in Minto Flats (Burkholder and Bernard 1994).
- 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 2016; Albert and Tyers 2020).
- The distribution of fish within the CROA can vary across years and within years, probably due to water quality (e.g., dissolved oxygen content) and river morphology.
  - Notable differences were observed in the relative distributions of fish within the CROA between studies (Table 7 and Figures 10–12; Roach 1998a; Albert 2016; Albert *In prep*; Albert and Tyers 2020).

- o The largest concentrations of radiotagged fish typically occur between Mile 1.0 and 3.0 of the CROA (Table 7 and Figures 11–12; Albert 2016; Albert *In prep*; Albert and Tyers 2020).
- o Systematic sampling in the lower 5 miles of the CHA during March 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 (Albert and Tyers 2020).

## 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, comparisons among years can be made. Although estimated abundances varied substantially between experiments, the length composition of the MLSA northern pike population remained relatively constant (Roach 1997, 1998b; Scanlon 2001, 2006; Joy 2009; Albert and Tyers 2020).

In the spring of 2019, before the 30-inch size restriction was enacted in the CHA subsistence fishery, a study was conducted to assess the size and sex compositions of overwintering northern pike harvested by the winter subsistence fishery (Gutierrez and Tyers 2020). Department staff sampled northern pike harvested by subsistence fishers in the CHA as well as fish caught by staff utilizing hook and line gear (similar to that used by subsistence fishers) to collect a sample representative of the population vulnerable to capture and harvest within the CHA. The study concluded that the fish harvested by the winter subsistence fishery in the CHA tended to be larger and more frequently female than the vulnerable population of fish. Fish larger than 30 inches made up 41% of the subsistence harvest and were 90% female. In contrast, only 18% of the fish in the vulnerable population were larger than 30 inches and were 75% female (Gutierrez and Tyers 2020).

Sampling of northern pike in Minto Flats has shown that a large majority (90%) of fish larger than 30 inches are females. Genetic testing in the Minto Flats population identified 8 males over 30 inches (out of 136 males detected), with the largest being a 36-inch male (Gutierrez and Tyers 2020). The average total lengths in 2019 across the vulnerable population were 27.9 inches for females and 25.4 inches for males (Gutierrez and Tyers 2020; Figure 13). Female northern pike are more prone to being caught in winter. They may be a larger component of the population, more aggressive in nature, or have greater energetic needs for spawning.

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 decreases 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 (personal communication, email, M. Albert, Sport Fish Biologist, department, Fairbanks). Northern pike become sexually mature between at 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; Wootton 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 roughly age-3, 24-inch (600 mm FL) fish were roughly age-7, and 30-inch were roughly age-9, after which annual growth of northern pike slowed markedly after 30 inches, growing approximately 1–2 inch thereafter. Cleithra (a 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 (Figure 13). Observed lengths at age were consistent with ages provided by Burkholder (1991).

## INFORMATION NEEDS

Data gaps remain relative to management of northern pike in Minto Flats. Future priority information needs for Minto Flats include:

- 1) Periodic assessments of abundance, length, and sex composition of the overwintering population of northern pike in the CROA.
- 2) Monitoring length composition of subsistence harvest and the population vulnerable to harvest in the CHA.

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## **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 Customary and Traditional (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 Nonsubsistence 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. <ul style="list-style-type: none"> <li>Only single hooks may be used in the Chatanika River Harvest Area (CHA; between Goldstream Creek and 1 mile downstream of Murphy Dome Road).</li> <li>1,500- and 750-fish thresholds established based on weekly call-ins for CHA.</li> </ul>
	2010	5 ACC 01.244 amended, implemented 2011: Modified bag and possession limits in CHA: <ul style="list-style-type: none"> <li>10 fish per household, 20 fish in possession.</li> </ul> No bag or annual limits in remaining portions of Minto Flats.
	2016	3-mile closed area to ice fishing in CHA upstream Goldstream Creek, implemented in 2017.
	2017	3-mile closed area modified to 1-mile closed area in CHA upstream of Goldstream Creek, implemented in 2018.
	2019	5 AAC 01.244 amended, implemented in 2020: Modified bag and possession limits in CHA for fish >30": <ul style="list-style-type: none"> <li>2 fish &gt;30" per household, 4 fish &gt;30" in possession.</li> </ul>

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Table 1.–Page 2 of 2.

Fishery	Year	Regulation
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 <ul style="list-style-type: none"> <li>• Bag and possession limit 5 fish, only 1 over 30 inches.</li> <li>• Season: June 1 to October 14.</li> <li>• Multiple hooks allowed.</li> </ul>
	1998	Minto Flats Northern Pike Management Plan (5 ACC 74.044) For all lakes and flowing waters <ul style="list-style-type: none"> <li>• Bag and possession limit 5 fish, only 1 over 30 inches.</li> <li>• Season: June 1 to October 14.</li> <li>• Single hook only in Chatanika River between Goldstream Creek and 1 mile downstream of Murphy Dome Road.</li> <li>• If 750 fish are caught in CHA through the ice, sport fish bag limit is reduced to 2 fish, only 1 over 30 inches until end of calendar year.</li> </ul>
	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, 1993–2022.

Year	Subsistence fishery					Sport fishery		Total harvest by all users
	Permits issued	Permits fished	CHA harvest <sup>a</sup>	Tolovana River drainage harvest	Total harvest <sup>b</sup>	Angler-days	Total harvest	
1993	31	35%	—	—	767	—	3,420	4,187
1994	48	52%	—	—	1,193	—	9,489	10,682
1995	57	53%	—	—	1,088	—	4,480	5,568
1996	74	41%	—	—	1,916	7,990	2,716	4,632
1997	88	47%	—	—	1,344	7,655	1,246	2,590
1998	70	44%	—	—	431	3,768	772	1,203
1999	54	43%	—	—	400	7,064	1,098	1,498
2000	34	35%	—	—	352	4,212	390	742
2001	50	36%	—	—	277	2,454	654	931
2002	32	41%	—	—	521	4,815	650	1,171
2003	119	46%	—	—	966	4,555	1,284	2,250
2004	99	42%	—	—	393	4,650	1,390	1,783
2005	80	39%	—	—	386	5,047	2,052	2,438
2006	101	54%	—	—	865	4,050	1,204	2,069
2007	118	47%	—	—	1,837	5,656	1,809	3,646
2008	147	54%	—	—	1,363	2,840	386	1,749
2009	113	46%	—	—	563	4,892	873	1,436
2010	96	43%	—	—	125	3,327	609	734
2011	70	41%	27 <sup>c</sup>	83	110	3,090	422	532
2012	73	48%	243 <sup>c</sup>	282	525	4,036	412	937
2013	77	57%	154 <sup>c</sup>	77	231	3,406	382	613
2014	106	54%	377 <sup>c</sup>	101	478	4,261	597	1,075
2015	120	55%	516 <sup>c</sup>	249	765	2,229	372	1,137
2016	201	64%	855 <sup>c</sup>	165	1,020	2,911	196	1,216
2017	93	44%	21	116	137	5,450	589	726
2018	175	59%	832	208	1,040	2,324	390	1,430
2019	245	63%	937	696	1,633	2,480	746	2,379
2020	329	58%	965	1,040	2,005	998	261	2,266
2021	425	63%	1,538	1,554	3,092	983	312	3,404
2022 <sup>d</sup>	332	49%	1,259	—	1,259	—	—	1,259
Total:	3,657	—	7,724	18,780	27,082	105,143	39,201	66,283
2018–2022 Avg.	301	58%	1,106	875	1,806	1,696	427	2,148
1993–2017 Avg.	86	46%	313	153	722	4,471	1,500	2,222

Note: Minto Flats Complex includes Minto Flats Lakes and flowing waters, Tolovana River drainage, and the Lower Chatanika River. En dash = no data. CHA = Chatanika Harvest Area.

<sup>a</sup> 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.

<sup>b</sup> Includes harvest in CHA and Minto Flats Complex before 2011.

<sup>c</sup> CHA harvest in 2011–2016 was adjusted using residency information and date of harvest.

<sup>d</sup> Data are preliminary and are based on weekly call-ins and returned permits. Permits expire December 31, 2022. Sport Fish information is not available at this time.



Table 3.—Subsistence harvest of northern pike by community in Tolovana River drainage, 1993–2022.

Year	Permits issued	Harvest in CHA			Harvest in Tolovana River drainage (includes CHA)				
		Percentage by FNSB residents <sup>a</sup>	Percentage by Minto residents <sup>a</sup>	CHA Harvest <sup>a</sup>	FNSB residents <sup>a</sup>		Minto residents <sup>a</sup>		Total subsistence harvest <sup>b</sup>
					Number harvested	Percentage of total harvest	Number harvested	Percentage of total harvest	
1993	31	—	—	—	0	0%	767	100%	767
1994	48	—	—	—	84	7%	1,111	93%	1,193
1995	57	—	—	—	165	15%	903	83%	1,088
1996	74	—	—	—	79	4%	1,837	96%	1,916
1997	88	—	—	—	67	5%	1,266	94%	1,344
1998	70	—	—	—	37	9%	309	72%	431
1999	54	—	—	—	25	6%	375	94%	400
2000	34	—	—	—	1	0%	351	100%	352
2001	50	—	—	—	0	0%	277	100%	277
2002	32	—	—	—	14	3%	507	97%	521
2003	119	—	—	—	394	41%	572	59%	966
2004	99	—	—	—	110	28%	283	72%	393
2005	80	—	—	—	160	41%	226	59%	386
2006	101	—	—	—	428	49%	400	46%	865
2007	118	—	—	—	1,605	88%	231	13%	1,837
2008	147	—	—	—	1,256	92%	70	5%	1,363
2009	113	—	—	—	411	73%	149	26%	563
2010	96	—	—	—	44	35%	71	57%	125
2011 <sup>c</sup>	70	74%	0%	27	29	26%	74	67%	110
2012 <sup>c</sup>	73	96%	0%	243	284	54%	232	44%	525
2013 <sup>c</sup>	77	100%	0%	154	225	97%	6	3%	231
2014 <sup>c</sup>	106	100%	0%	377	381	80%	93	19%	478
2015 <sup>c</sup>	120	97%	0%	516	567	74%	172	22%	765
2016 <sup>c</sup>	201	97%	0%	855	914	90%	54	5%	1,020
2017	93	95%	0%	21	29	21%	108	79%	137
2018	175	98%	2%	832	814	78%	226	22%	1,040
2019	245	99%	0%	937	937	57%	685	42%	1,633
2020	329	96%	0%	965	978	49%	982	49%	2,005
2021	425	95%	0%	1,538	1,494	48%	1,526	49%	3,092
2022 <sup>d</sup>	332	98%	0%	1,259	1,236	98%	—	—	1,259

-continued-

Table 3.–Page 2 of 2.

Year	Permits issued	Harvest in CHA			Harvest in Tolovana River drainage (includes CHA)				
		Percentage by FNSB residents <sup>a</sup>	Percentage by Minto residents <sup>a</sup>	CHA harvest <sup>a</sup>	FNSB residents <sup>a</sup>		Minto residents <sup>a</sup>		Total subsistence harvest <sup>b</sup>
					Number harvested	Percentage of total harvest	Number harvested	Percentage of total harvest	
Total:	3,657	–	–	7,724	12,768	–	13,863	–	27,078
2018–2022 Average	301	97%	0%	1,106	1,092	66%	855	40%	1,806
1993–2017 Average	86	94%	0%	313	292	38%	418	60%	722

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

<sup>a</sup> 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.

<sup>b</sup> Includes harvest from fishers residing outside FNSB and Minto.

<sup>c</sup> CHA harvest in 2011–2016 was adjusted using residency information and date of harvest.

<sup>d</sup> Data are preliminary and based on weekly call-ins and returned permits. Permits expire December 31, 2022.

Table 4.—Sport Fish angler effort (angler-days), harvest, and catch for northern pike in the Minto Flats area, and the Minto Flats Complex, 1983–2021.

Year	Minto Flats			Minto Flats Complex <sup>a</sup>		
	Angler-days	Harvest	Catch	Angler-days	Harvest	Catch
1983	NA	2,748	NA	NA	3,461	NA
1984	NA	2,453	NA	NA	3,128	NA
1985	NA	4,146	NA	NA	5,256	NA
1986	NA	4,927	NA	NA	6,488	NA
1987	NA	1,781	NA	NA	2,401	NA
1988	NA	1,492	NA	NA	1,965	NA
1989	NA	1,734	NA	NA	2,596	NA
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	2,570	523	7,918	5,450	589	8,578
2018	728	219	1,415	2,324	390	1,968
2019	1,283	170	1,519	2,480	746	1,579
2020	310	25	244	998	261	1,089
2021	316	156	764	983	312	2,837
2018–2021 Average	659	143	986	1,696	427	1,868
1996–2017 Average	1,911	784	6,695	4,471	912	7,850

Note: Minto Flats Complex includes Lower Chatanika River, Tolovana River, and Minto Flats. 2022 is not available at this time.

Table 5.–2022 Minto Flats Northern Pike Management Plans for subsistence and sport Fisheries.

	<b>Subsistence fishing (5 AAC 01.244)</b>	<b>Sport fishing (5 AAC 74.044)</b>
Area:	Tolovana River drainage (includes lakes and flowing water of Minto Flats). Fairbanks Nonsubsistence 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 Harvest Area (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:	Chatanika HA: only 2 northern pike 30" or longer per day, only 4 over 30" in possession	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 River 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 and are 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, <u>the winter fishery in the Chatanika HA</u> 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 2 fish ( <u>in the lakes and flowing waters in Minto Flats</u> ) for the remainder of the calendar year.
Management actions taken:	Subsistence closure in Chatanika HA in 2007, 2021, and 2022	Sport fishing reductions in 2007–2008, 2016, and 2019–2022

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

Year	Area	$\geq 400$ mm (~16 in) <sup>a</sup>		$\geq 600$ mm (~24 in)		$\geq 720$ mm (~30 in)	
		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 <sup>b</sup>	MLSA-A	16,045	3,132	2,219	397	958	362
	MLSA-B	9,854	1,701	2,092	448	635	635
2018	CROA	—	—	14,675	1,631	—	—
	MLSA-A	—	—	11,443	1,651	—	—

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

Note: SE = standard error.

<sup>a</sup> Estimated abundance of northern pike 400–600 mm fork length (FL) are biased, and the magnitude of this is unknown.

<sup>b</sup> 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 7. Estimated number of radiotagged 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 previous 3-mile closed areas.

Survey month	Closed	Open	Closed	Open
	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	NA	NA	3 (11%)	25 (89%)
March 1997	NA	NA	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%)

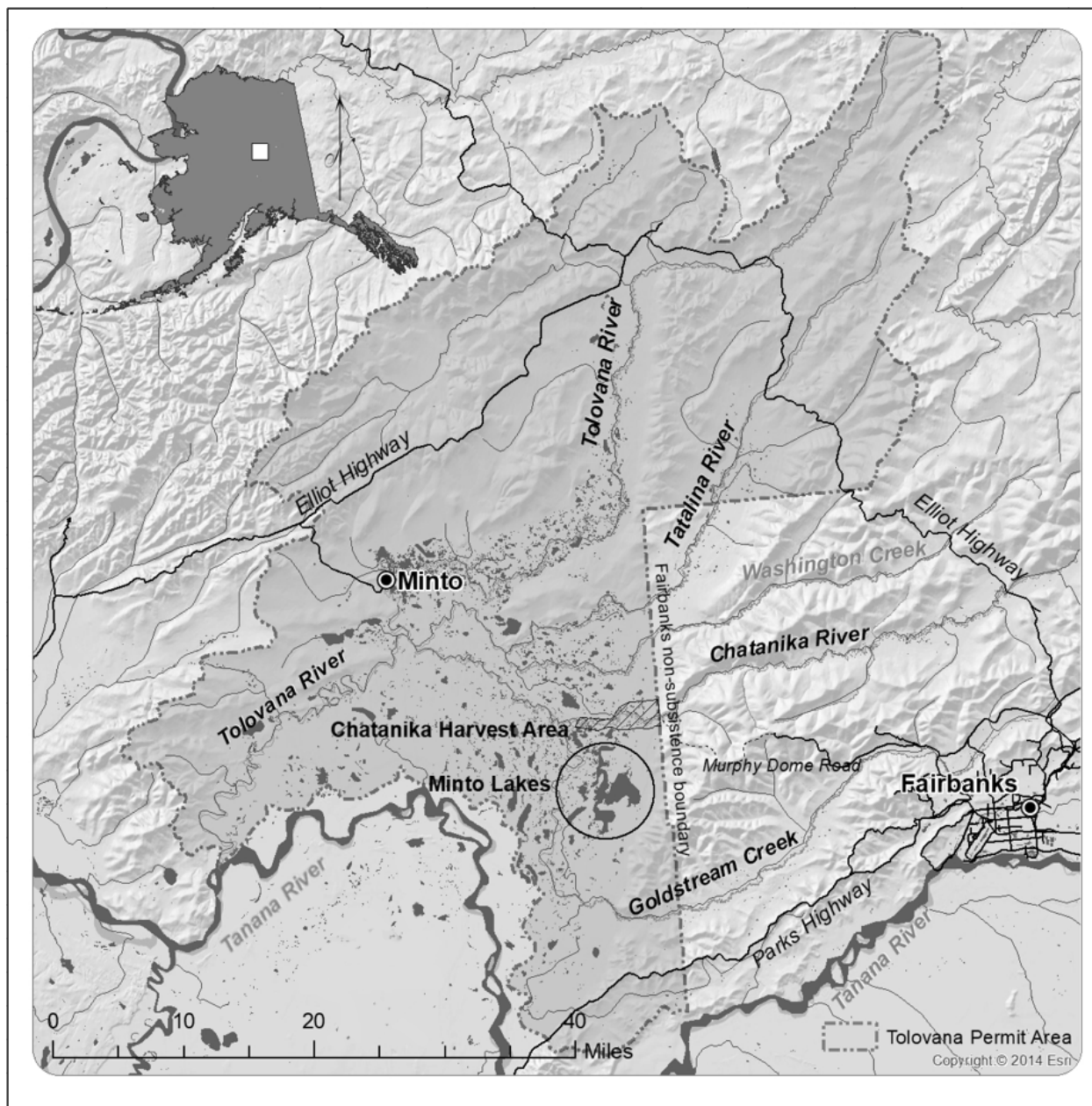


Figure 1.—Map of Minto Flats Complex, Tolovana River drainage subsistence permit area, and location of the Minto Lakes Study Area (MLSA).

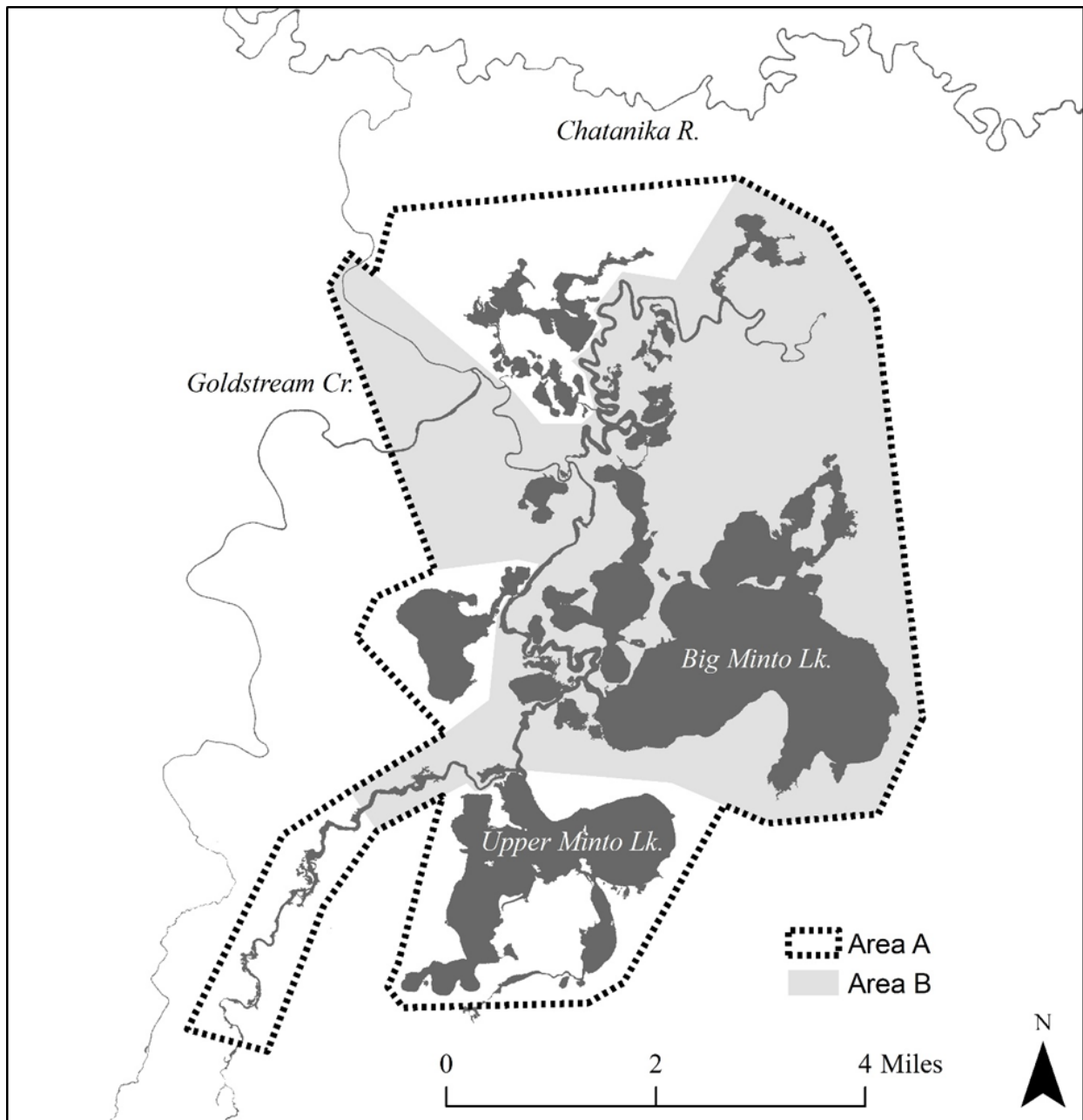


Figure 2.—Demarcation of Minto Lakes Study Area (MLSA): Area-A and Area-B.



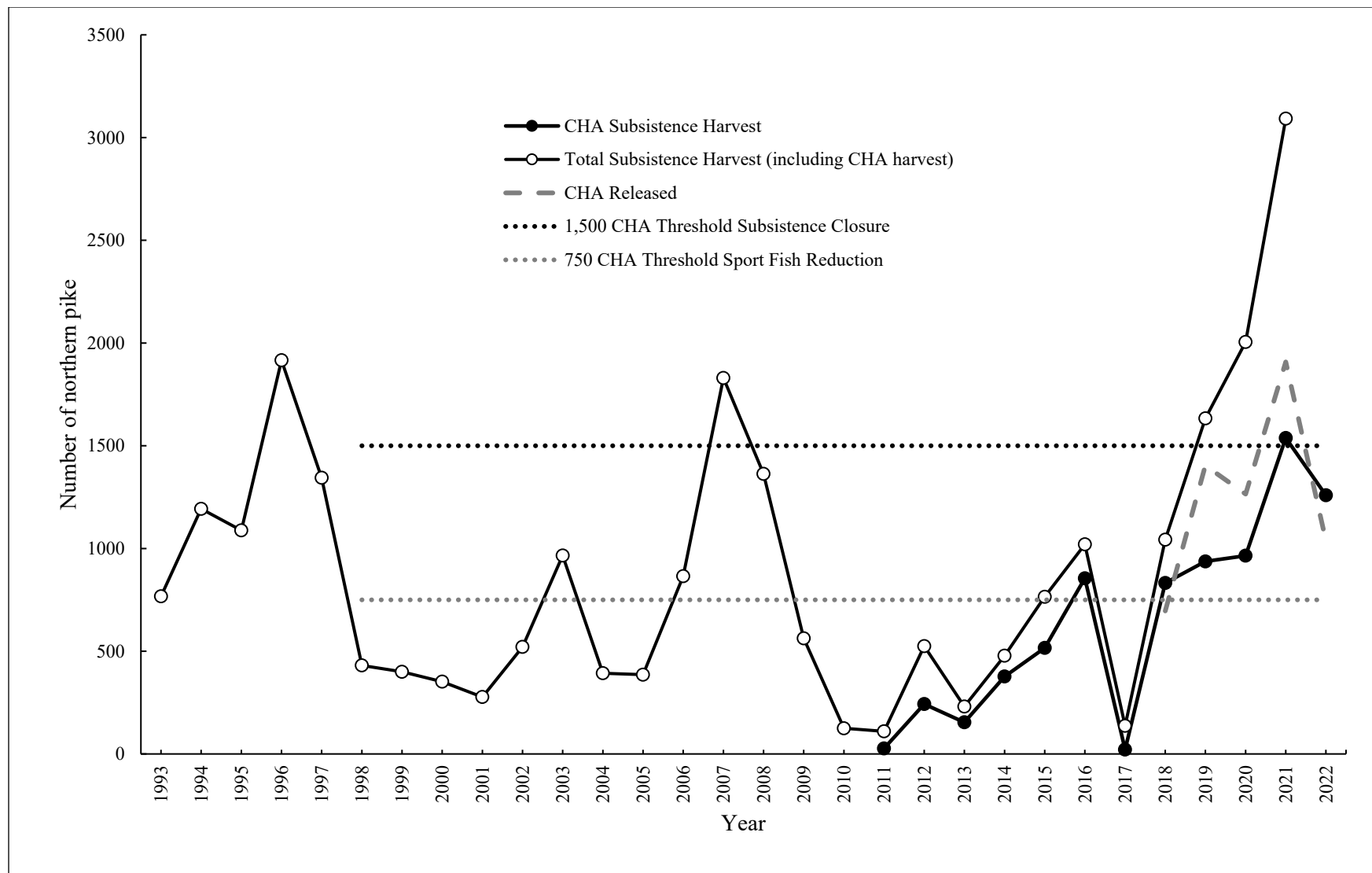


Figure 3.—Subsistence harvest and release of northern pike in Tolovana River drainage.

*Note:* Chatanika Harvest Area (CHA) fishing location has been documented since 2011, with harvest estimated from 2011–2016 based on residency of the permits and harvest date. Prior to 2011, fishing occurred in the CHA but fishing location was not specified on permits. 2022 data is preliminary.

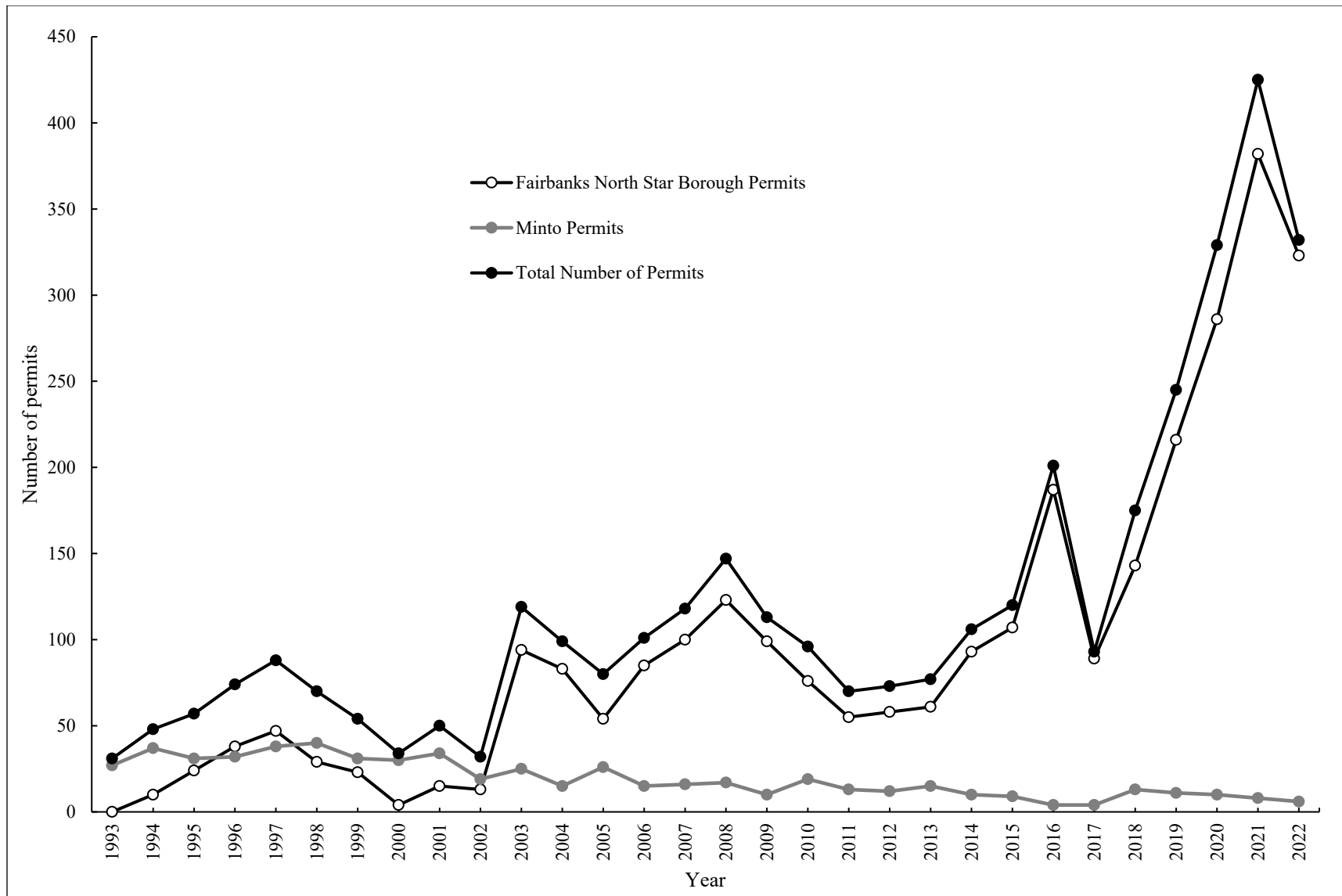


Figure 4.—Subsistence household participation by community for northern pike in the Tolovana River drainage, 1993–2022.

*Note:* 2022 data is preliminary.

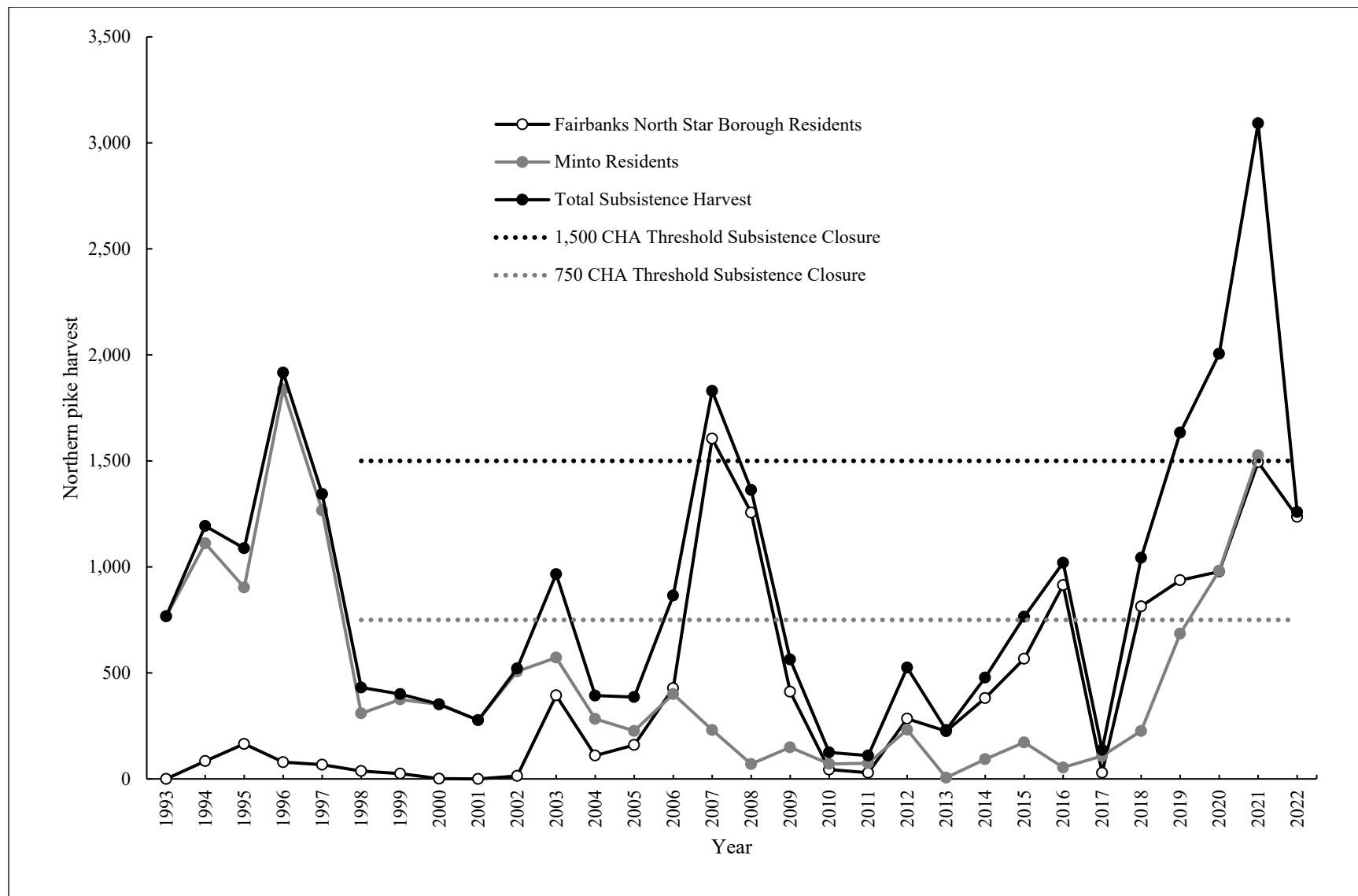


Figure 5.—Subsistence harvest by community for northern pike in the Tolovana River drainage, 1993–2022.

Note: 2022 data is preliminary.

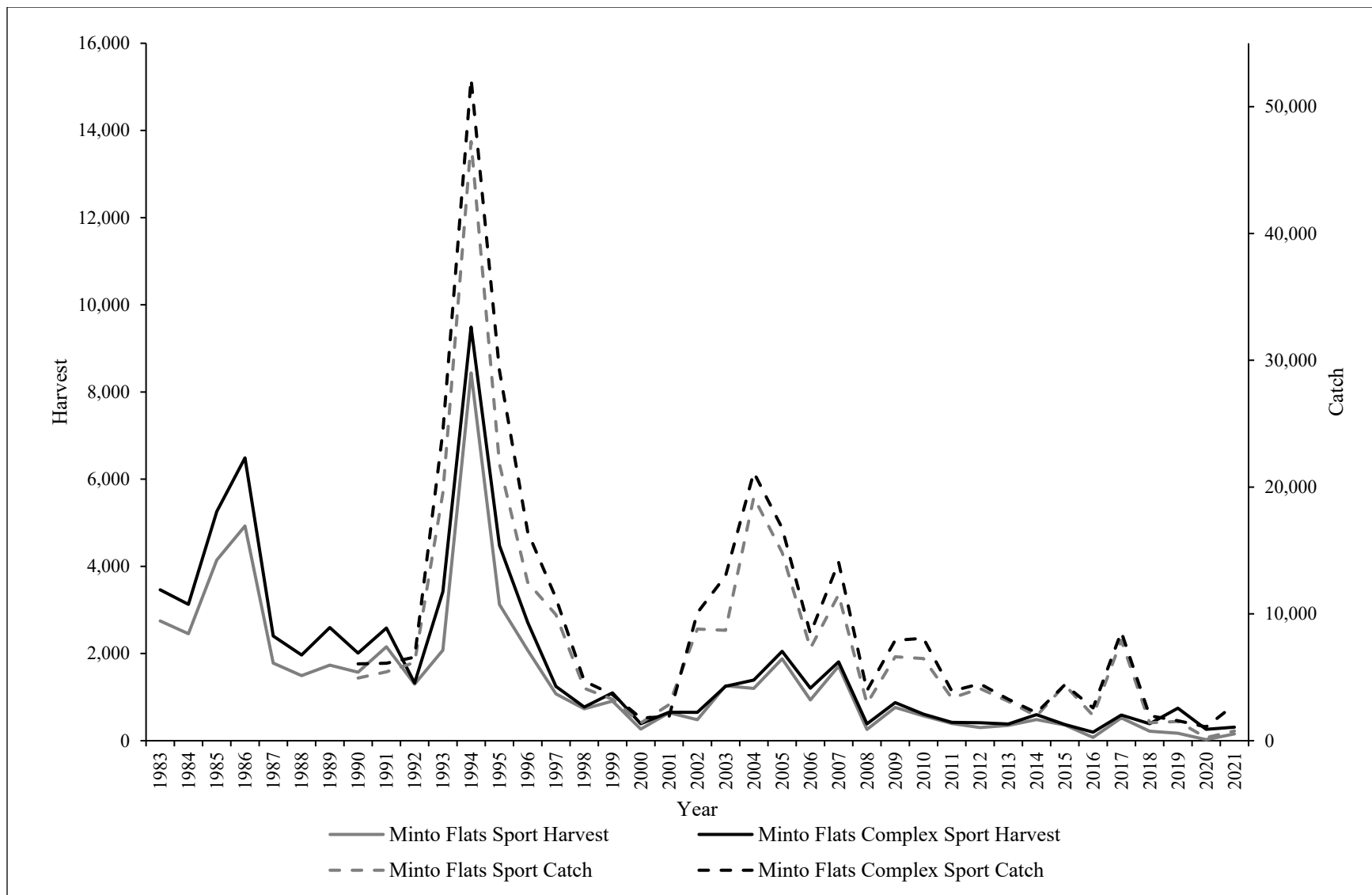


Figure 6.—Sport fishing harvest and catch of northern pike in Minto Flats and Minto Flats Complex, 1983–2021.



Alaska Department of Fish & Game  
2022 Household Subsistence Fishing Permit  
Northern Pike - Tolovana River drainage

This permit is valid through  
December 31<sup>st</sup>, 2022

Permit Number

Last Name		First Name	M.I.	<input type="checkbox"/> Alaska Resident	Sport Fishing License #
<input type="text"/>		<input type="text"/>	<input type="text"/>		<input type="text"/>
Mailing Address					
<input type="text"/>					
City	State	Zip Code	Phone Number	Driver's License #	State
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
E-Mail Address					
<input type="text"/>					

Names of other household members authorized to fish this permit:

**Subsistence Permit Area:** Tolovana River drainage, including the Chatanika Harvest Area (HA) located in the Chatanika River from an ADF&G regulatory marker located one river mile upstream (N 64° 59.186 W 148° 52.304) from the confluence of Goldstream Creek to an ADF&G regulatory marker located at the boundary of the Fairbanks Nonsubsistence Area (N 64° 58.930 W 148° 39.611). **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.

**Gear restriction:** A hook and a line attached to a rod or pole (jigging) may only be used when subsistence fishing through the ice. Gillnets may be used only from April 15 through October 14.

**Permit Conditions:**

- All regulations pertaining to subsistence fishing in the area must be followed. See regulation summary.
- Anyone fishing this household's gear must be named above and carry this permit on their person during fishing activity. Household members participating in fishing must be Alaska Residents.
- 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.
- **In the Chatanika Harvest Area:**
  - **Weekly reporting required for each week you fish (even if catch is zero). Report catch by 4:30 P.M. Thursdays at [www.adfg.alaska.gov/harvest](http://www.adfg.alaska.gov/harvest) or call 459-7388.**
  - **Household Harvest Limit:** Daily limit 10 pike, only 2 may be 30 inches or greater in length; possession limit 10 pike, only 4 may be 30 inches or greater in length.
  - Only single hooks allowed.

**Permit expires December 31. Final harvest must be reported within 10 days after expiration.** Even if you did not fish, you must complete a report. Reporting can be completed by returning permit to ADF&G 1300 College Road, Fairbanks, AK 99701. You may also visit [www.adfg.alaska.gov/harvest](http://www.adfg.alaska.gov/harvest) to report final catch and indicate you are **done fishing**, or select 'mark permit as not fished'. Failure to report this household's harvest information may result in denial of a household permit next year.

For questions, call the Fairbanks office (907) 459-7274

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.*

Signature of Permittee


Date

Revised 11/2021

RECORD CATCH ON PAGE 2

Figure 7.—Copy of 2022 Tolovana River drainage subsistence northern pike permit.

**Alaska Department of Fish & Game**  
**2022 Household Subsistence Fishing Permit**  
**Northern Pike - Tolovana River drainage**



Permit Number \_\_\_\_\_

Total Length  
(tip of snout to tip of tail)

DATE	FISHING LOCATION		NUMBER HARVESTED		PIKE RELEASED
	Chatanika HA	Other	PIKE	OTHER (Specify Species)	
	<input type="checkbox"/>	<input type="checkbox"/>			
	<input type="checkbox"/>	<input type="checkbox"/>			
	<input type="checkbox"/>	<input type="checkbox"/>			
	<input type="checkbox"/>	<input type="checkbox"/>			
	<input type="checkbox"/>	<input type="checkbox"/>			
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	<input type="checkbox"/>	<input type="checkbox"/>			

**Weekly reporting required**  
**for each week you fish in the Chatanika HA**

Report catch (even if catch is zero) by 4:30 P.M. Thursdays at  
[www.adfg.alaska.gov/harvest](http://www.adfg.alaska.gov/harvest) or call 459-7388.

**At end of season, visit [www.adfg.alaska.gov/harvest](http://www.adfg.alaska.gov/harvest) to report final catch and indicate you are done fishing, or select 'mark permit as not fished'.**

**If returning the paper permit to ADF&G, complete the following:**

CHECK THIS BOX IF YOU DID NOT FISH THIS YEAR ☐

---

Sign this Catch Report when you return it. \_\_\_\_\_ Date \_\_\_\_\_

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

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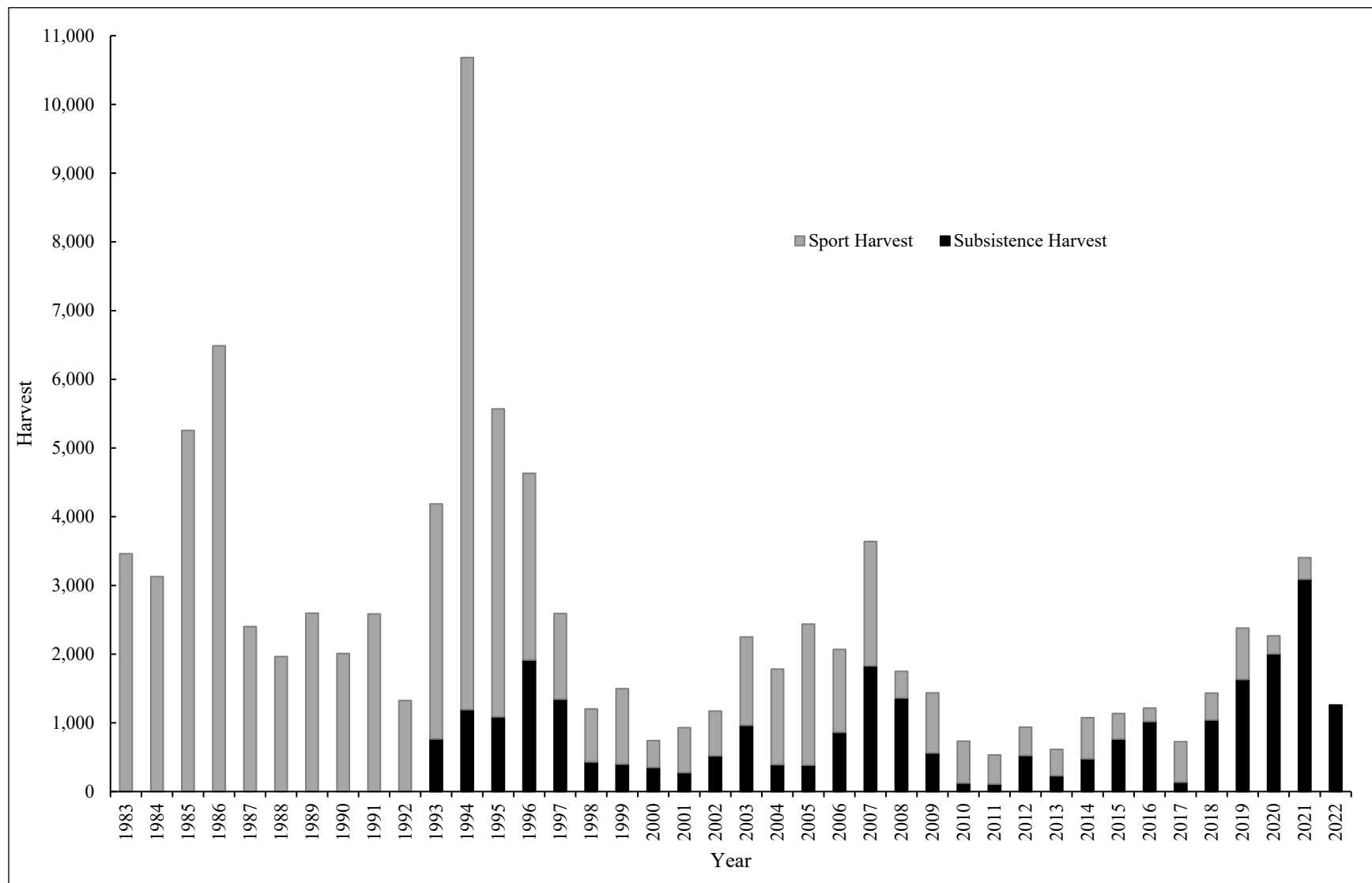


Figure 8.—Subsistence harvest and sport harvest of northern pike in Minto Flats Complex, 1983–2022.

Note: 2022 data is preliminary.

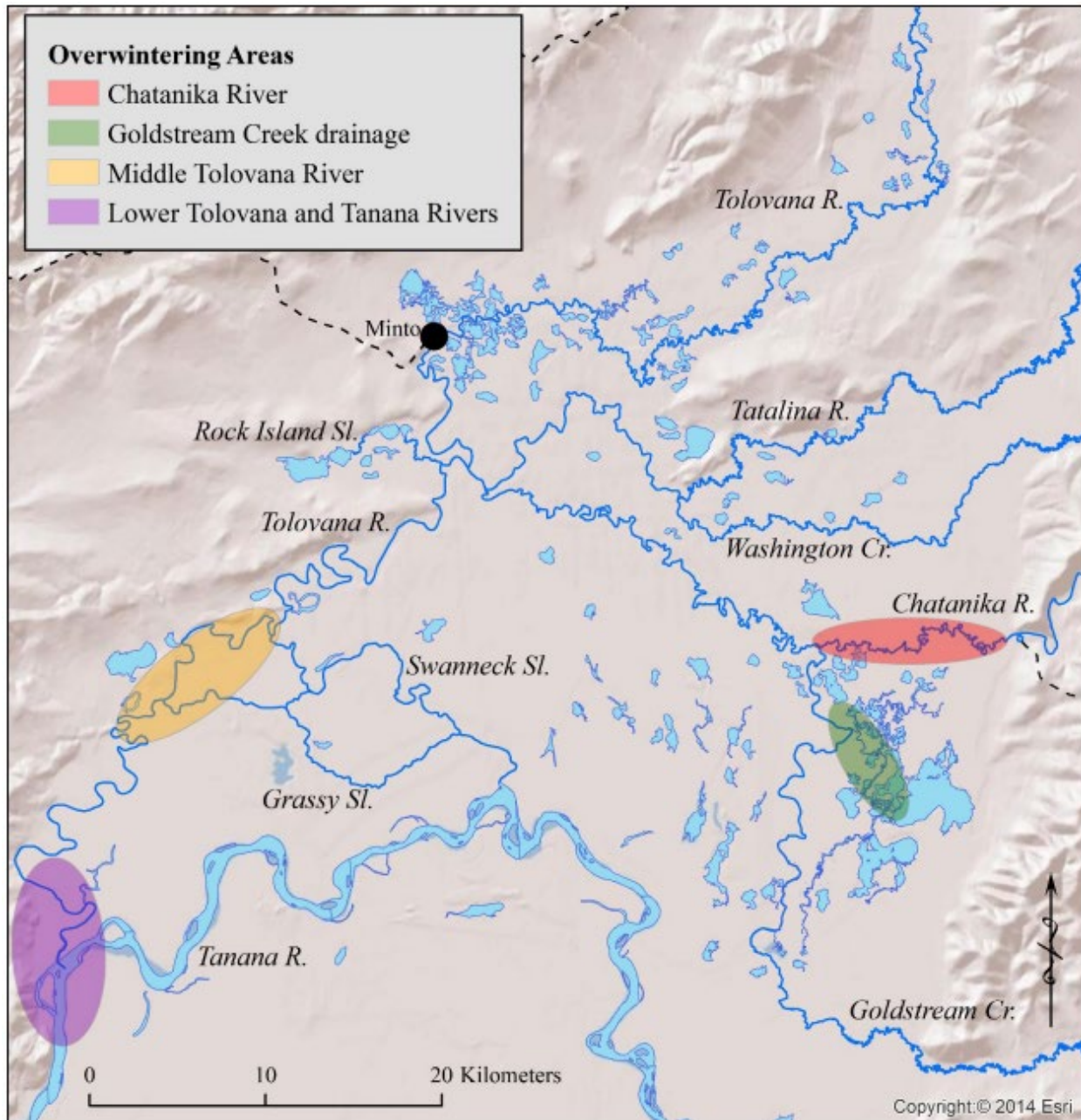


Figure 9.—Major overwintering aggregations of northern pike in Minto Flats identified by Burkholder and Bernard (1994).



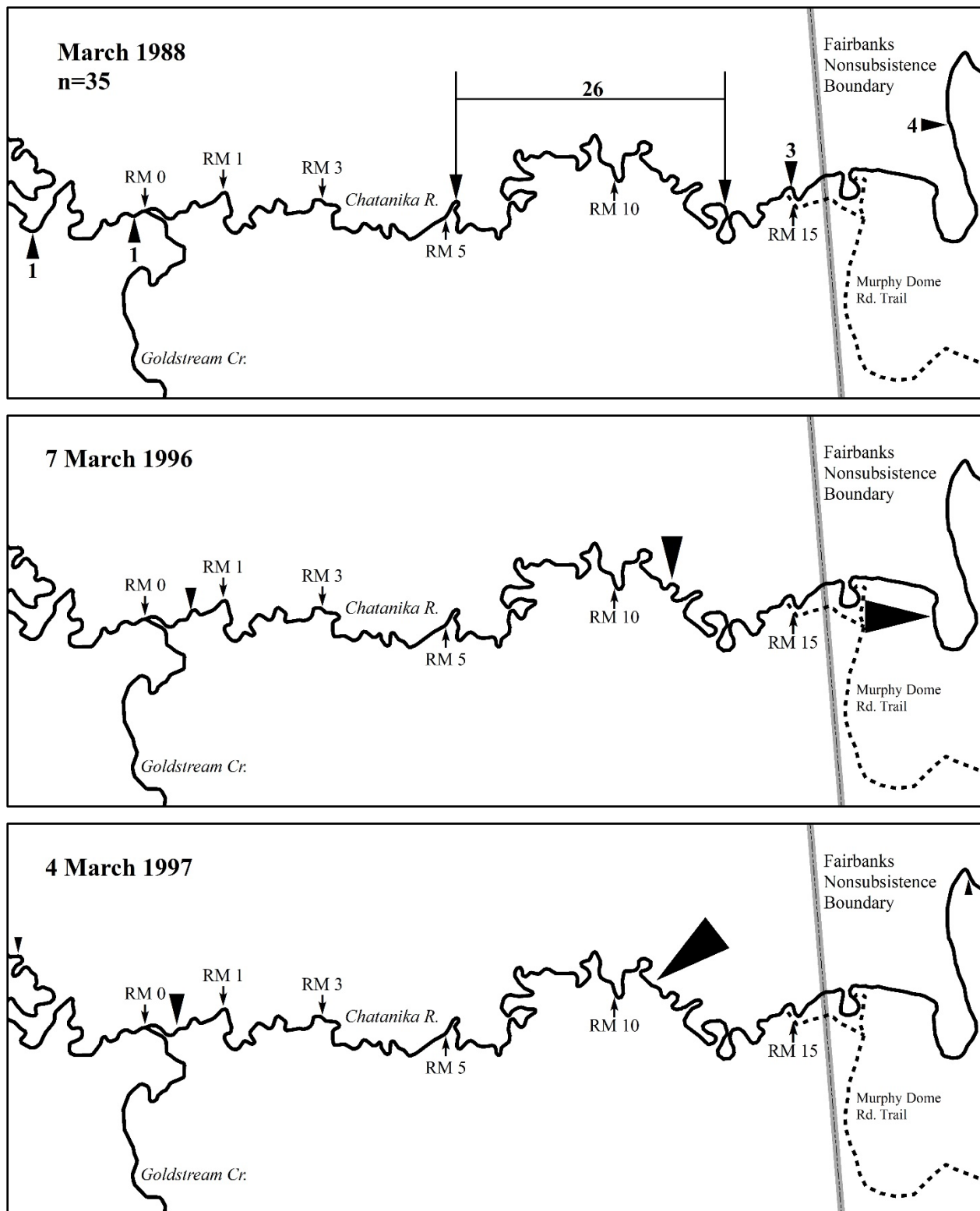


Figure 10.—Overwintering aggregations by survey date of northern pike in Chatanika River Overwintering Area (CROA) presented by Roach (1998a). The relative number of radiotagged fish in a specific area is depicted by arrow-size or is directly labeled.

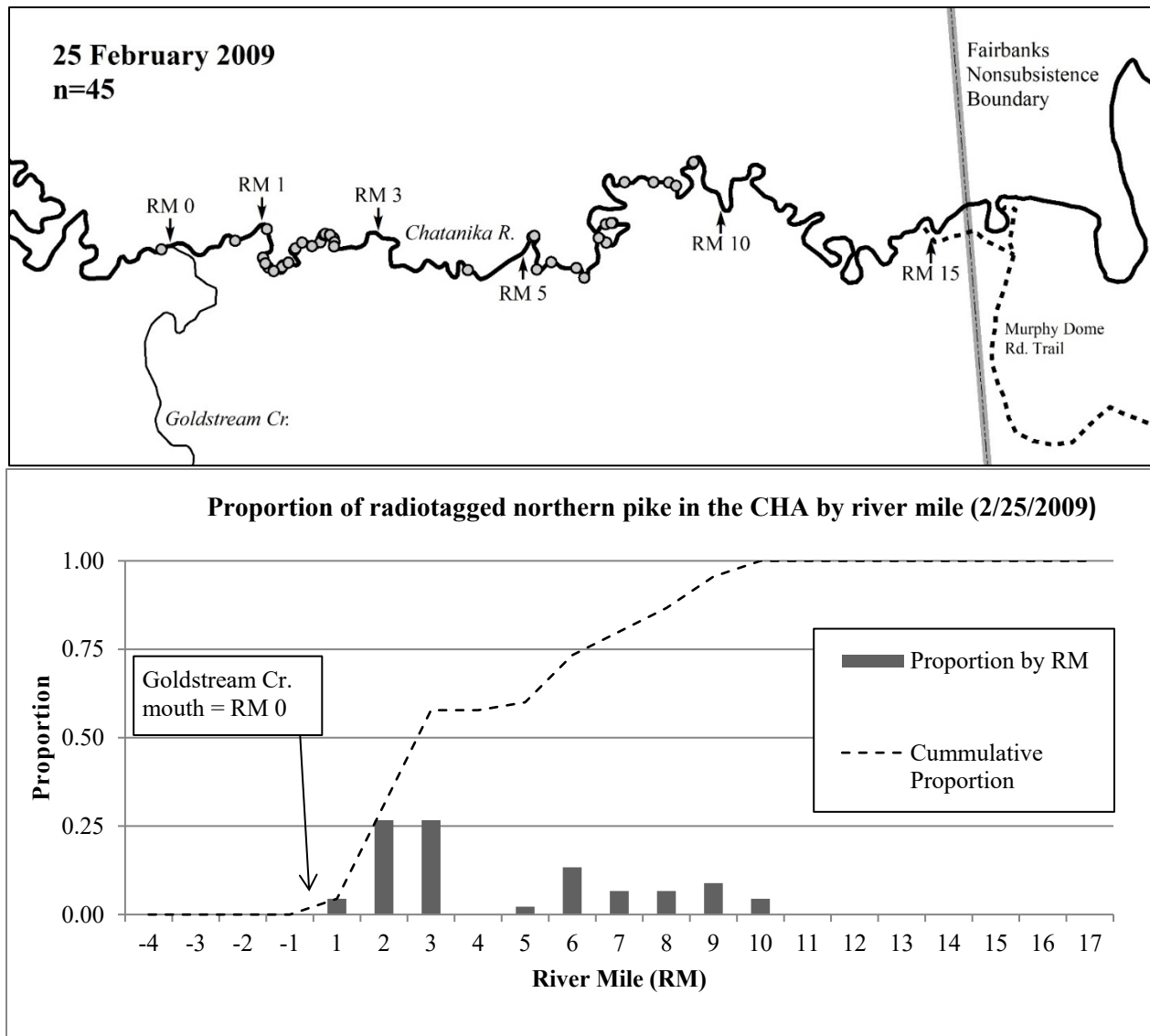


Figure 11.—Distributions of radiotagged northern pike in in the Chatanika Harvest Area (CHA) relative to river mile (RM) during February 2009.

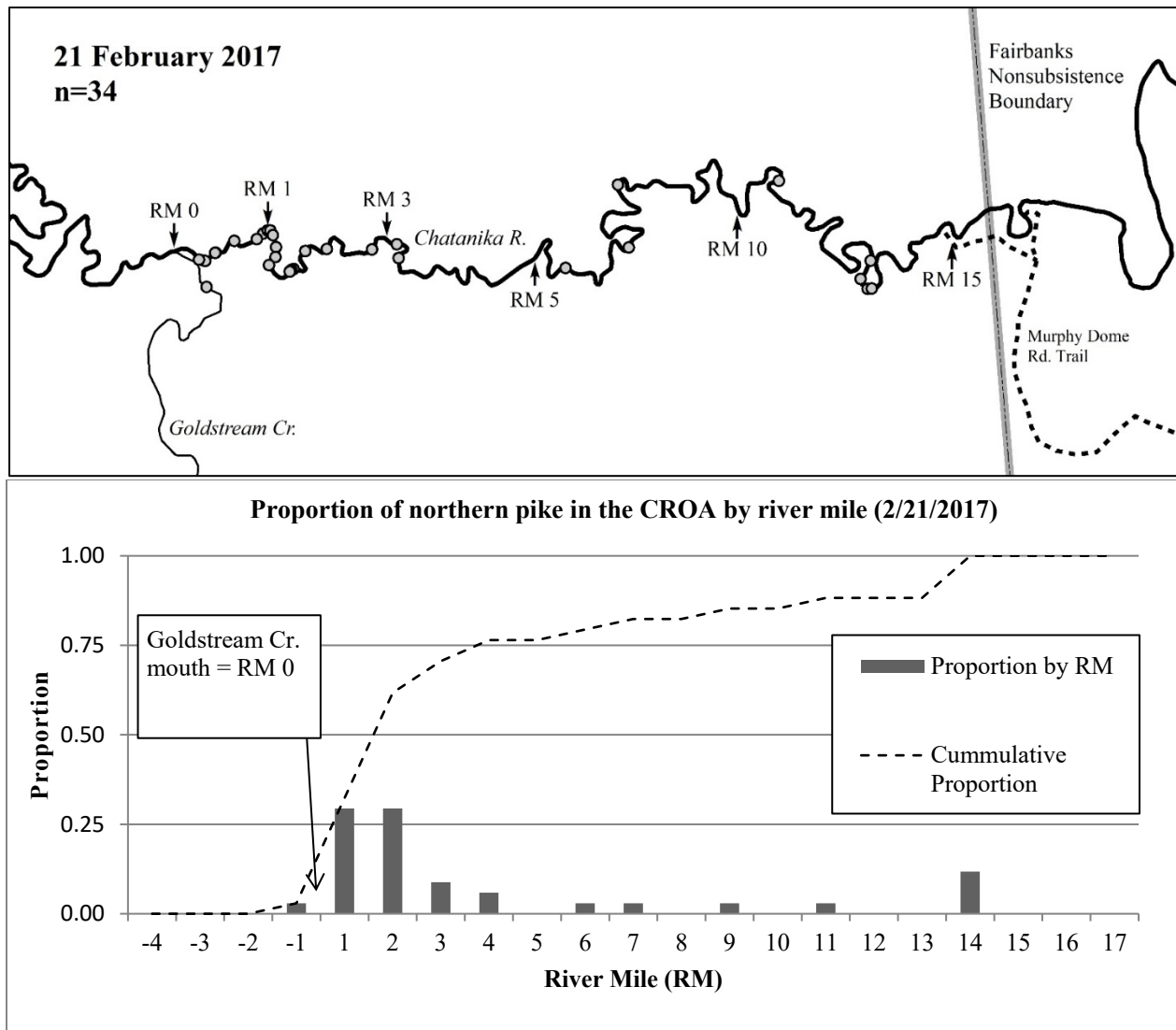


Figure 12.—Distributions of radiotagged northern pike in in the Chatanika Harvest Area (CHA) relative to RM during February 2017.

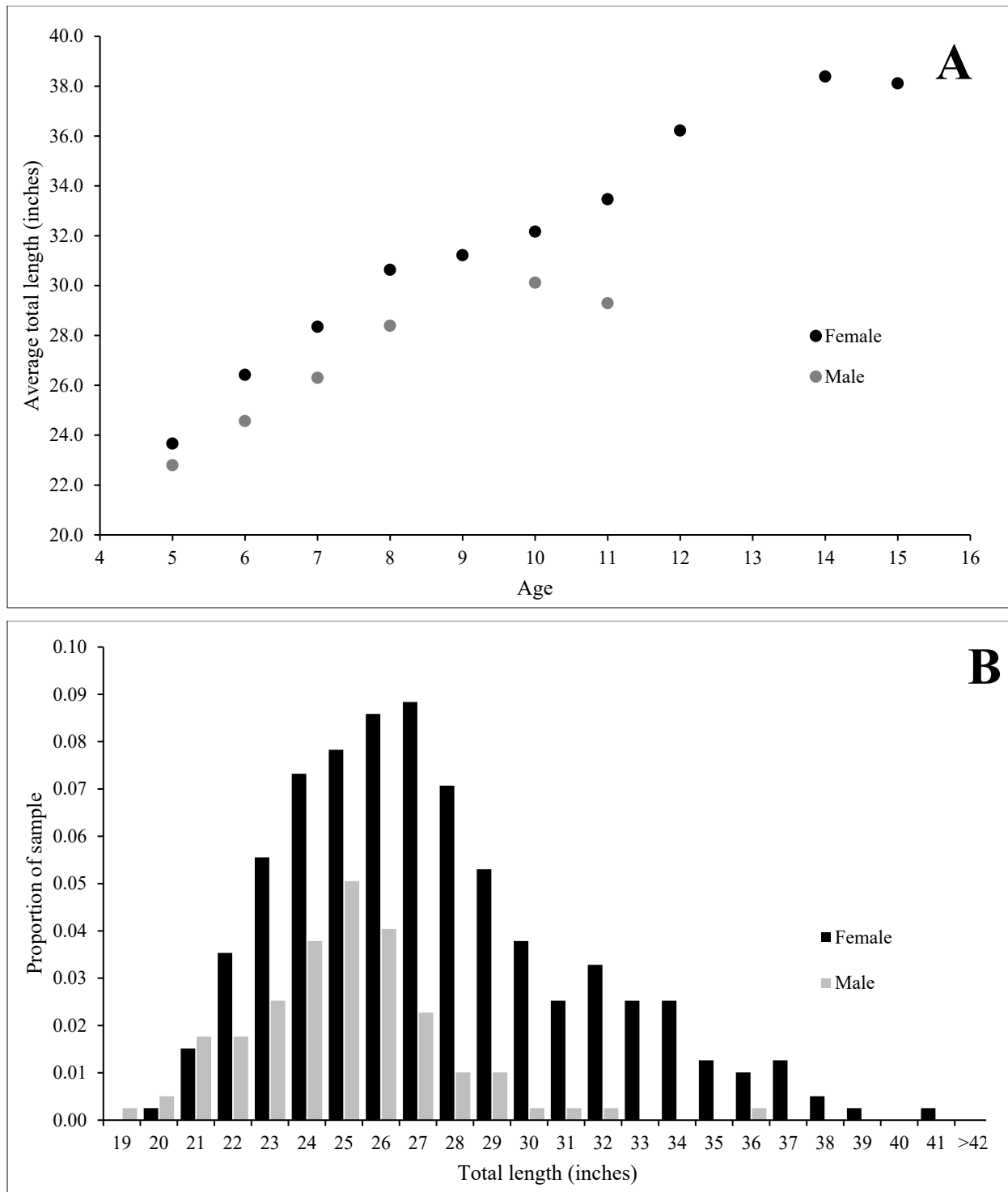


Figure 13.—(A) Estimated length-at-age for northern pike in Minto Lakes using cleithra ( $n = 69$ ), 2018; and (B) proportional total length by sex ( $n = 770$ ), 2019 (Gutierrez and Tyers 2020).

*Note:* Total lengths are estimated from fork length (FL) based on the equation from Gutierrez and Tyers (2020).