

**Operational Plan: Threemile Lake Complex and
Chuitbuna Lake Invasive Northern Pike Suppression
Project, 2021–2023**

by

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and

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January 2022

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



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Weights and measures (metric)		General		Mathematics, statistics	
centimeter	cm	Alaska Administrative Code	AAC	<i>all standard mathematical signs, symbols and abbreviations</i>	
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	alternate hypothesis	H_A
gram	g	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	base of natural logarithm	e
hectare	ha	at	@	catch per unit effort	CPUE
kilogram	kg	compass directions:		coefficient of variation	CV
kilometer	km	east	E	common test statistics	(F, t, χ^2 , etc.)
liter	L	north	N	confidence interval	CI
meter	m	south	S	correlation coefficient	
milliliter	mL	west	W	(multiple)	R
millimeter	mm	copyright	©	correlation coefficient	
		corporate suffixes:		(simple)	r
Weights and measures (English)		Company	Co.	covariance	cov
cubic feet per second	ft ³ /s	Corporation	Corp.	degree (angular)	°
foot	ft	Incorporated	Inc.	degrees of freedom	df
gallon	gal	Limited	Ltd.	expected value	E
inch	in	District of Columbia	D.C.	greater than	>
mile	mi	et alii (and others)	et al.	greater than or equal to	≥
nautical mile	nmi	et cetera (and so forth)	etc.	harvest per unit effort	HPUE
ounce	oz	exempli gratia		less than	<
pound	lb	(for example)	e.g.	less than or equal to	≤
quart	qt	Federal Information Code	FIC	logarithm (natural)	ln
yard	yd	id est (that is)	i.e.	logarithm (base 10)	log
		latitude or longitude	lat or long	logarithm (specify base)	log ₂ , etc.
Time and temperature		monetary symbols		minute (angular)	'
day	d	(U.S.)	\$, ¢	not significant	NS
degrees Celsius	°C	months (tables and figures): first three letters	Jan, ..., Dec	null hypothesis	H_0
degrees Fahrenheit	°F	registered trademark	®	percent	%
degrees kelvin	K	trademark	™	probability	P
hour	h	United States (adjective)	U.S.	probability of a type I error	
minute	min	United States of America (noun)	USA	(rejection of the null hypothesis when true)	α
second	s	U.S.C.	United States Code	probability of a type II error	
		U.S. state	use two-letter abbreviations (e.g., AK, WA)	(acceptance of the null hypothesis when false)	β
Physics and chemistry				second (angular)	"
all atomic symbols				standard deviation	SD
alternating current	AC			standard error	SE
ampere	A			variance	
calorie	cal			population	Var
direct current	DC			sample	var
hertz	Hz				
horsepower	hp				
hydrogen ion activity	pH				
(negative log of)					
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

REGIONAL OPERATIONAL PLAN NO. ROP.SF.2A.2022.07

**OPERATIONAL PLAN: THREEMILE LAKE COMPLEX AND
CHUITBUNA LAKE INVASIVE NORTHERN PIKE SUPPRESSION
PROJECT, 2021–2023**

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January 2022

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SIGNATURE PAGE

Project Title: Threemile Lake Complex and Chuitbuna Lake Invasive Northern Pike Suppression Project, 2021–2023

Project leader(s): Parker Bradley, Cody Jacobson, and Kristine Dunker

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Plan Type: Category II

Approval

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ABSTRACT

This project will continue progress toward the goal of increasing salmon abundance and restoring fisheries in the Threemile Creek drainage and Chuitbuna Lake by suppression of invasive northern pike populations during field seasons in June 2021, 2022, and 2023. Intensive gill netting will be conducted throughout the Threemile Creek complex and Chuitbuna Lake to remove northern pike.

Keywords: invasive species, northern pike, *Esox lucius*, Threemile Creek, Threemile Lake, Chuitbuna Lake

INTRODUCTION

PURPOSE

The mission of the Alaska Department of Fish and Game (ADF&G), Division of Sport Fish (SF) is “to protect and improve the state’s recreational fisheries resources,” and an objective of the SF strategic plan is to “minimize impacts of invasive species on fish stocks, recreational fisheries, and fish habitat.” Removing northern pike from vital salmon rearing habitat directly addresses this objective. The activities proposed in this project are aligned with several plans and initiatives, and this project will provide ADF&G an important step in assessing the effectiveness of northern pike suppression projects.

BACKGROUND

The northern pike (*Esox lucius*) is an invasive species in Southcentral Alaska that is devastating salmonid populations through juvenile salmon predation in invaded waters (Dunker et al. 2020). The effects of this are most severe in shallow, slow moving, vegetated lakes and streams where northern pike and rearing salmonids (*Oncorhynchus* spp.) share complete habitat overlap (Sepulveda et al. 2013; Sepulveda et al. 2015). Northern pike are native throughout much of the State of Alaska but do not naturally occur south and east of the Alaska Range (Figure 1). Based on anecdotal accounts, they were illegally introduced by anglers to the Yentna River drainage in the late 1950s and subsequently spread throughout the Susitna River basin through natural migration and further illegal stockings (Rutz et al. 2020b). Currently, northern pike have been documented from over 120 lakes and rivers in Southcentral Alaska.

It is hypothesized that recent, smaller scale “secondary” northern pike infestations that have been reported throughout the western coast of Cook Inlet (herein referred to as West Cook Inlet) may have originated from the Susitna River basin infestation.

West Cook Inlet is off the road system, sparsely populated, and home to hundreds of small, complex, salmon-producing stream systems. Many reports of northern pike presence have come from sport and subsistence anglers; however, most reports lack live or dead specimens, preventing conclusive identification and knowledge of the extent of infestation.

The Tyonek Tribal Conservation District (TTCD) conducted the initial northern pike assessments in the West Cook Inlet drainages between 2015 and 2017 (Swenson and Hagan *Unpublished*¹) and documented northern pike from several area waters (Threemile Lake complex, Chuitbuna Lake, and Second Lake), though much uncertainty remains regarding overall northern pike distribution in the region. Based on those assessments, which documented a low species richness of fish in the lakes, and based on observations by members of the local communities, Threemile Creek drainage

¹ Swenson, N., and J. Hagan. *Unpublished*. Invasive Northern Pike (*Esox lucius*) in the Tyonek Tribal Conservation District: Field Methods Report, 2017.

was prioritized as the salmon-producing system most significantly impacted by northern pike in this area. However, Chuitbuna Lake and Indian Creek drainage (Second Lake) are also of concern for local communities. Control efforts are currently underway in Chuitbuna Lake and are planned for the Indian Creek drainage (Second Lake) as resources become available. Threemile Creek drainage is located between the communities of Beluga and the Native Village of Tyonek and was historically used for subsistence, sport, and commercial harvest of salmon.

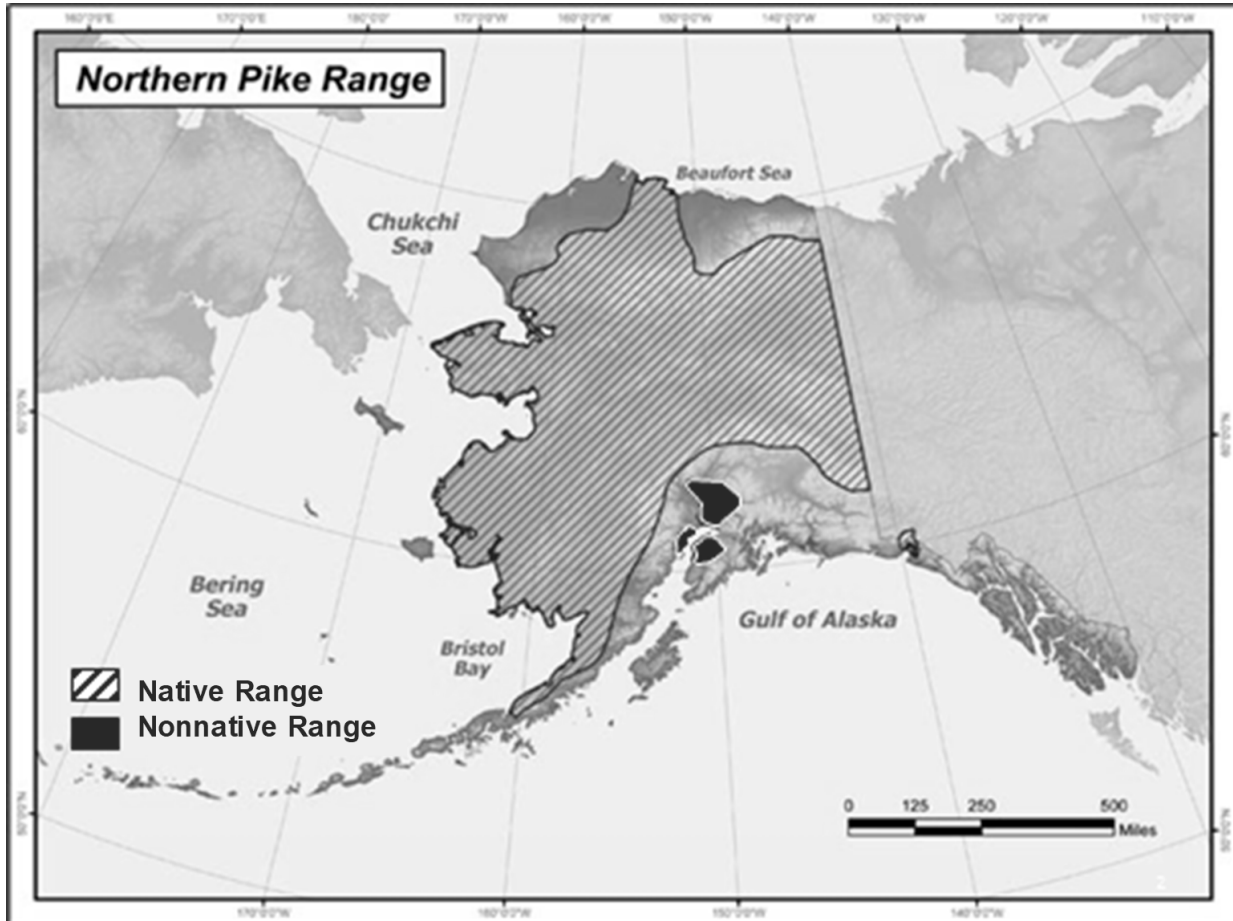


Figure 1.—Distribution of native and nonnative northern pike in Alaska.

The Native Village of Tyonek (NVT) is a Dena’ina Athabascan village located 43 miles southwest of Anchorage along Cook Inlet and is home to approximately 200 people. There are no roads to Tyonek, so access is via boat or small aircraft. The remote setting and cultural heritage of NVT makes subsistence activities of paramount importance, and many of these activities focus on salmon. The total subsistence harvest for Tyonek in 2013 was 16,766 pounds of salmon or 118 pounds per capita (Jones et al. 2015). Although Threemile Creek is located about 3 miles north of Tyonek, northern pike in that system are suspected of reducing salmon populations in Threemile Creek and therefore decreasing the number of salmon returning along the West Cook Inlet beaches where Tyonek’s subsistence fishing occurs. Additionally, the outlet creek of Chuitbuna Lake provides rearing habitat for juvenile coho salmon. With northern pike thriving in the Threemile Creek and Chuitbuna Lake drainages without established containment or control, their potential to

continue spreading into surrounding waterbodies in and around Tyonek and into vulnerable drainages along West Cook Inlet remains high without management intervention.

Survey data collected to date by TTCD suggest the Threemile Creek drainage has been the most severely affected of the surveyed waters. As a result, ADF&G partnered with TTCD and Cook Inlet Aquaculture Association (CIAA) beginning in 2018 to conduct an initial population assessment and suppression event in the Threemile Lake complex, which includes Threemile Lake, West Threemile Lake, Lower Lily Pad Lake, and Upper Lily Pad Lake. This lake complex is slated for annual invasive northern pike suppression efforts like those ongoing in Alexander Creek (Rutz et al. 2020a). This effort will directly benefit salmon populations and both subsistence and sport fisheries in the Tyonek region. Most importantly, management of this invasive northern pike population might also hinder expansion of northern pike to other vulnerable drainages along West Cook Inlet.

The long-range goal of the partnership between TTCD, NVT, and ADF&G (hereafter referred to as “the partnership” or “the partners”) is to reduce the impact of invasive northern pike on rearing salmonids by removing as many northern pike from Chuitbuna Lake and the Threemile Lake complex as possible. Relieving some of the predation pressure on salmon fry and smolt should increase their abundance by contributing to greater survival (Muhlfeld et al. 2008; Courtney et al. 2018). Over time, greater survival of juvenile salmon may result in larger annual returns of adult salmon that support sport and subsistence fisheries in the TTCD. Increased salmon productivity in the Threemile Creek drainage and Chuitbuna Lake coupled with reductions in the northern pike population could eventually allow salmonids to recover. In other parts of Alaska where northern pike are native, and even in other drainages in Southcentral Alaska where they are not (e.g., the Deshka River), northern pike and salmonids can coexist; however, habitat complexity that allows salmonids opportunities to avoid these predators is hypothesized to be a strong factor in mitigating predator-prey interactions within these fish communities (Sepulveda et al. 2013). In the Threemile Lake complex, where the habitat is relatively homogenous, providing ideal conditions for northern pike, salmonids are unable to avoid predation and hence their populations can drastically decline (Dunker et al. 2018). Through annual suppression of northern pike in this area, the partnership hopes to eventually restore salmonid production to sustainable levels in the Threemile Creek drainage and Chuitbuna Lake.

To effectively design and implement an annual northern pike suppression program, it is necessary to begin with a baseline estimate of the size of the northern pike population (e.g., Baxter and Neufeld 2015). In 2018, a population estimate was performed by the partnership in combination with a suppression event that doubled as a recapture event in the Threemile Creek drainage. In Threemile Lake, including Lower Lily Pad Lake, it was estimated there were $1,063 \pm 102$ (95% CI) northern pike ≥ 300 mm prior to suppression. The suppression efforts reduced that population by 57%. In West Threemile Lake, it was estimated there were 45 ± 11 northern pike ≥ 300 mm prior to suppression. The suppression efforts reduced that population by 49%. Finally, in Upper Lily Pad Lake, it was estimated there were 221 ± 70 northern pike ≥ 300 mm prior to suppression. Suppression efforts reduced that population by 56%. Additionally, in 2019, the partnership performed a population estimate in combination with a suppression event that doubled as a recapture event in Chuitbuna Lake. In Chuitbuna Lake, it was estimated there were 150 ± 13 northern pike ≥ 300 mm prior to suppression. The suppression efforts reduced that population by 78%. Northern pike suppression in the Threemile Lake Complex continued in 2019. In 2020, suppression in both areas was greatly limited because the COVID-19 pandemic prevented ADF&G

from joining TTCD and NVT in the field. That year, TTCD and NVT removed a total of 160 northern pike (135 from Threemile Lake and 25 from Chuitbuna Lake). Northern pike suppression at planned levels is expected to resume during the 2021 field season. Despite the unintended interruption by the pandemic, the baseline data acquired in 2018 and 2019 will facilitate future evaluation of the suppression program because direct comparisons can be made between this initial baseline and northern pike population levels following extended periods of suppression. Furthermore, the abundance estimate can be used to model annual removal targets to increase the effectiveness of the suppression program and determine, on an annual basis, if suppression activities are successfully meeting those targets.

OBJECTIVES

This project will continue to advance ADF&G's long-term goal of increasing salmon abundance and restoring fisheries by suppressing northern pike populations in the Threemile Creek drainage and Chuitbuna Lake.

PRIMARY OBJECTIVES

- 1) Suppress the northern pike population in the Threemile Lake complex and Chuitbuna Lake by setting 20 gillnets in each predesignated section (6 in the Threemile Lake complex and 2 in Chuitbuna Lake) for two 24-hour periods each year.

SECONDARY OBJECTIVES

- 1) Calculate the quartiles of the distribution of fork lengths (FL) of northern pike captured by gillnets in the Chuitbuna Lake and the Threemile Lake complex.
- 2) Document stomach contents, sex, weights, and ages of northern pike captured by gillnets in the Chuitbuna Lake and the Threemile Lake complex.

METHODS

STUDY AREA

This project will take place in the TTCD. The TTCD shares its boundaries with Alaska Game Management Unit 16B. The District's eastern edge is the Susitna River, its northern and western boundaries are the divide of the Alaska Range, and its southern border is Cook Inlet. Population and infrastructure in the region are limited but centered on the Tyonek–Beluga corridor. The Tyonek–Beluga corridor hosts a population of roughly 200 people and has over 80 miles of unimproved roads and 3 airstrips. Waterbodies in proximity to this small population corridor are classified as the Tyonek Area Watershed (Figure 2). The watershed has 378 lakes and approximately 1,624 river miles of lotic waters and is home to all 5 species of Pacific salmon. Juvenile salmonids are preferred prey for northern pike and the negative effects of northern pike infestations on salmonid populations in the region is well documented (e.g., Sepulveda et al. 2013).

Waterbodies with direct access to the Tyonek–Beluga road system are the most heavily used for sport and subsistence fishing activities. The Threemile Lake complex has several access points including a motorized watercraft launch accessible by all-terrain vehicle (ATV) and is the most heavily used area for sport fishing activities in the region, and Chuitbuna Lake is accessible from the road system (Figure 3). The Threemile Creek drainage is a complex stream system covering 20.4 square miles. There are more than 20 interconnected lakes and several more ephemeral lakes

within the drainage. Due to the low-gradient landscape, flooding can connect closed lakes for periods of time and connect off-channel habitat and oxbows. The system is groundwater dominated.

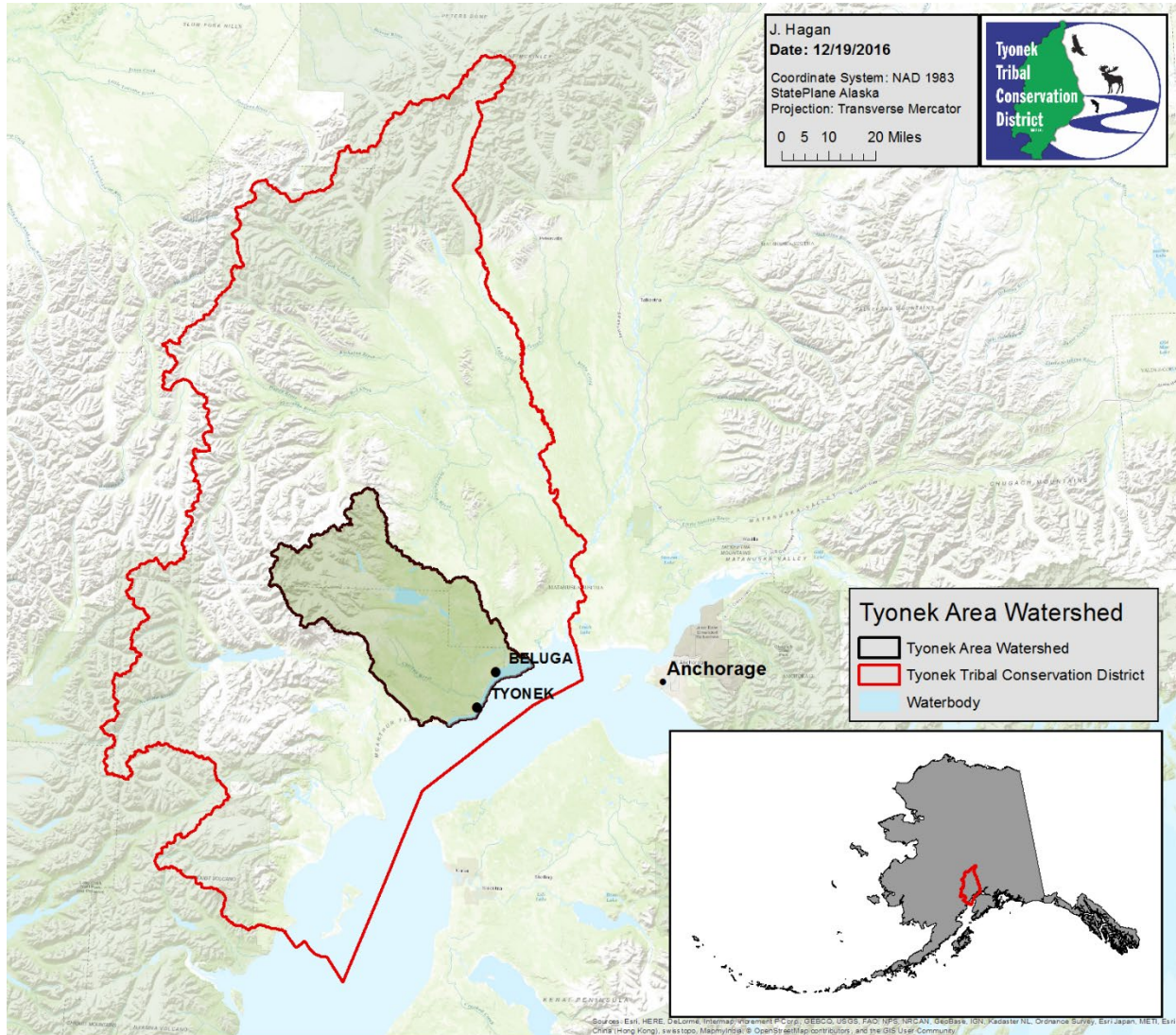


Figure 2.—Map of the Tyonek Area Watershed.

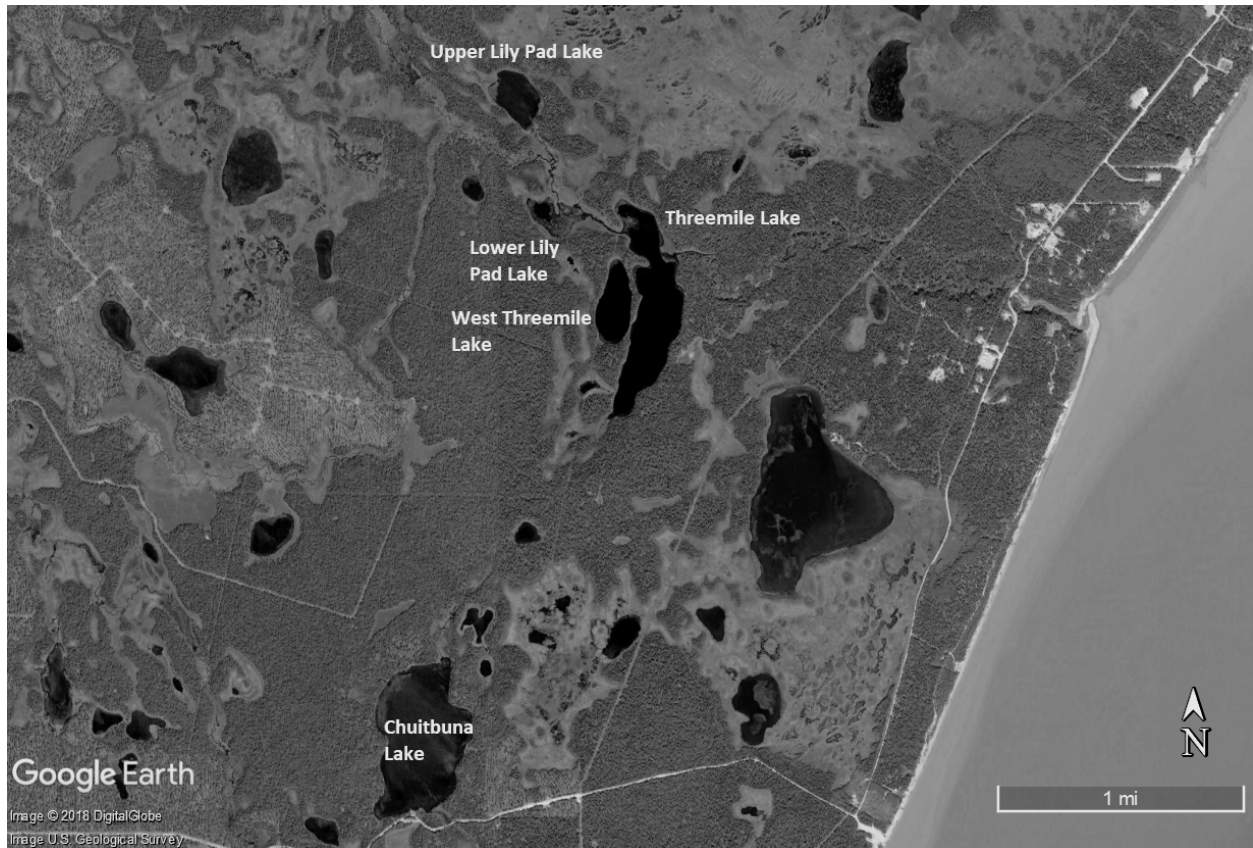


Figure 3.—Map of the study area.

STUDY DESIGN

Chuitbuna Lake Northern Pike Suppression

Results² from the partnership’s initial suppression in 2019 showed a substantial portion (78%) of the population from Chuitbuna Lake could be removed in 4 days of netting effort using 20 nets per day. Similar effort will be employed moving forward with an attempt to maintain a level of mortality in the population that exceeds recruitment so the population will decline over time.

Sampling

The Chuitbuna Lake sample area was divided into 2 sections, with each section containing approximately 1 mile of shoreline, which is both manageable by a 2-person crew and provides heavy netting density with 20 nets (Figure 4). A total of 20 gillnets will be utilized in this suppression event. All 20 gillnets will be deployed first in Section 1, fished overnight for 2 consecutive days, and then moved to Section 2 and fished overnight an additional 2 consecutive days for a total of 4 days.

All captured northern pike will be immediately dispatched and enumerated. Presence of tags from the 2019 mark–recapture study will be noted if present, along with tag number. These data will be recorded on the Northern Pike Catch Form (Appendix A1). Periodically throughout the day, dispatched northern pike will be brought to a processing station where 2 crew members will

² Results presented from the partnership’s suppression efforts are unpublished and archived with ADF&G, Division of Sport Fish, Palmer.

measure each northern pike for fork length and weight, remove the otoliths and cleithra, and dissect each northern pike to document stomach contents and sex. These data will be recorded on the Northern Pike Stomach Sampling Form (Appendix A2).

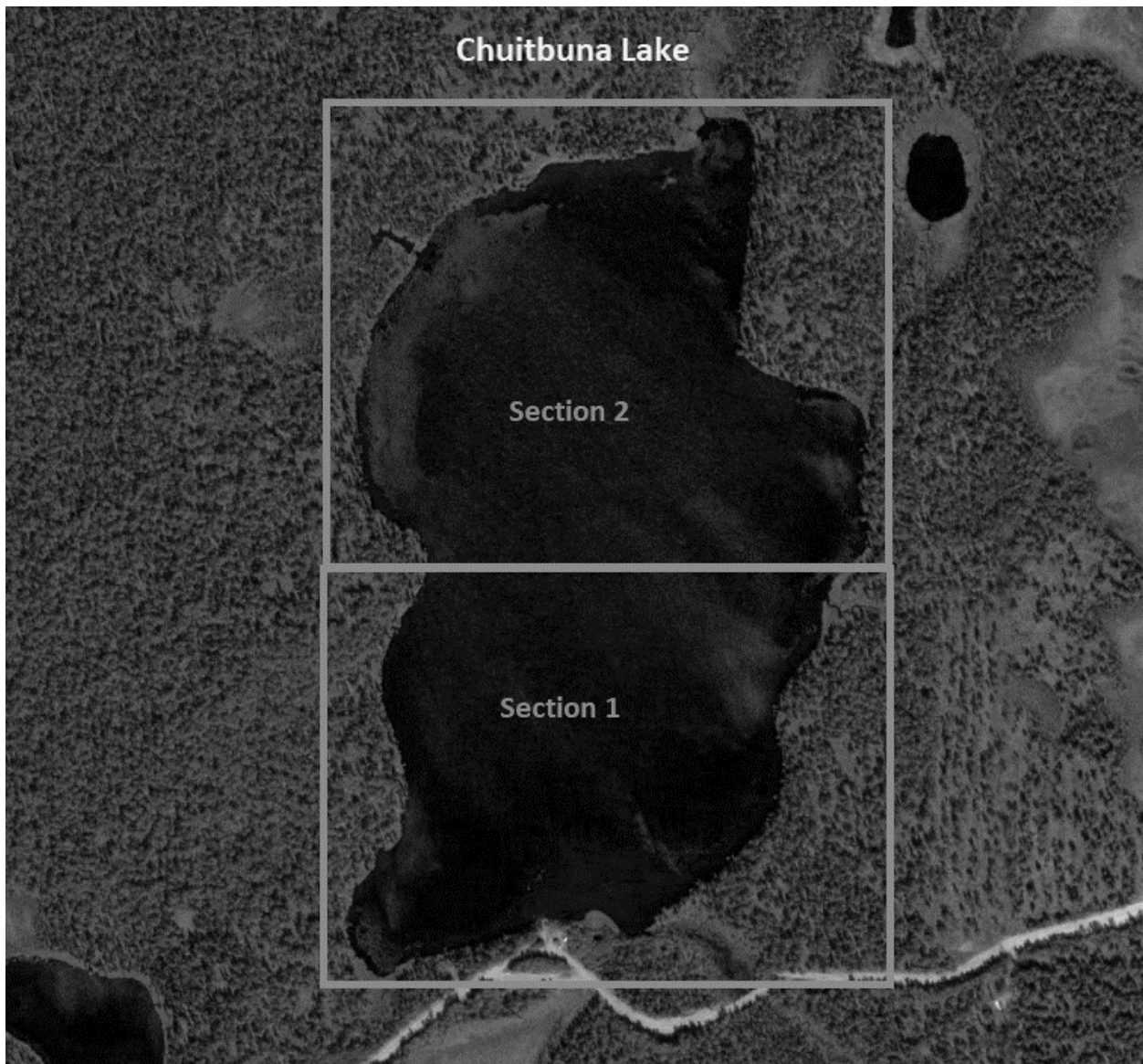


Figure 4.–Chuitbuna Lake divided into 2 sections for suppression netting.

Threemile Lake Complex Northern Pike Suppression

Results from initial suppression in 2018 showed a substantial portion (54%) of the population ≥ 300 mm from the Threemile Lake complex could be removed in 10 days of netting (720 captured out of an estimated 1,329). In 2019, with similar netting effort employed as 2018, 761 northern pike ≥ 300 mm were removed, which is similar to the number removed in 2018. This may be partly because young fish ≤ 300 mm in 2018 had reached a recruitable size to the gillnets in 2019 (Figure 5). Similar effort will be employed moving forward with an attempt to maintain a level of mortality in the population that exceeds recruitment so the population will decline over time.

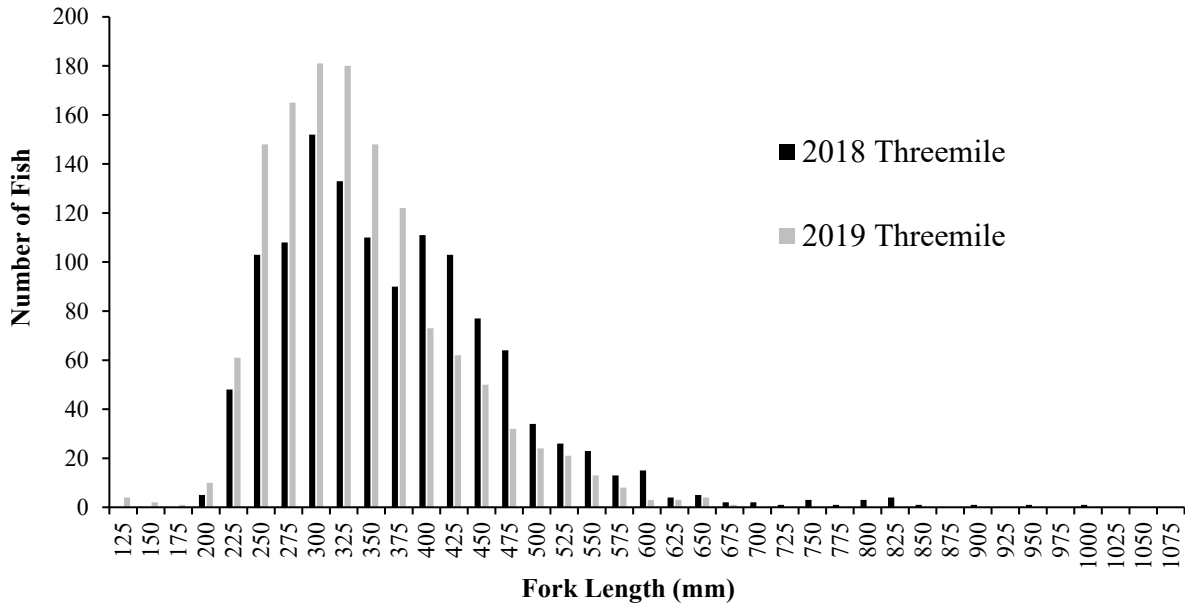


Figure 5.—Length frequency distribution of northern pike captured from the Threemile Lake complex in 2018 (black) and 2019 (grey).

Sampling

The Threemile Lake complex study area was divided into 6 sections, each containing approximately 0.75 miles of shoreline (Figure 6). A total of 21 gillnets will be used in this suppression event. For Sections 1–4, 20 gillnets will be deployed beginning in Section 1, fished overnight for 2 consecutive days, and then moved to the next section the following day. For Sections 5 and 6, gillnetting effort will be split between the two, with each section receiving 10 gillnets that will be set overnight for 2 consecutive days on the same days. One gillnet will be left at the lake outlet (the dividing line between Sections 2 and 3) for the duration of the suppression event and checked daily. In 2018 and 2019, the lake outlet is where catch rates were highest and where most of the predation on juvenile salmonids was occurring.

All captured northern pike will be immediately dispatched and enumerated. Presence of tags from the 2018 mark–recapture study will be noted if present, along with tag number. These data will be recorded on the Northern Pike Catch Form (Appendix A1). Periodically throughout the day, dispatched northern pike will be brought to a processing station where 2 crew members will measure each northern pike for fork length and weight, remove the otoliths, and dissect each northern pike to document stomach contents and sex. Cleithra will be removed from a maximum of 20 northern pike in each 100 mm size class (100–199 mm, 200–299 mm, etc.). Additionally, any northern pike with a floy tag will have the cleithra collected as well. These data will be recorded on the Northern Pike Stomach Sampling Form (Appendix A2).

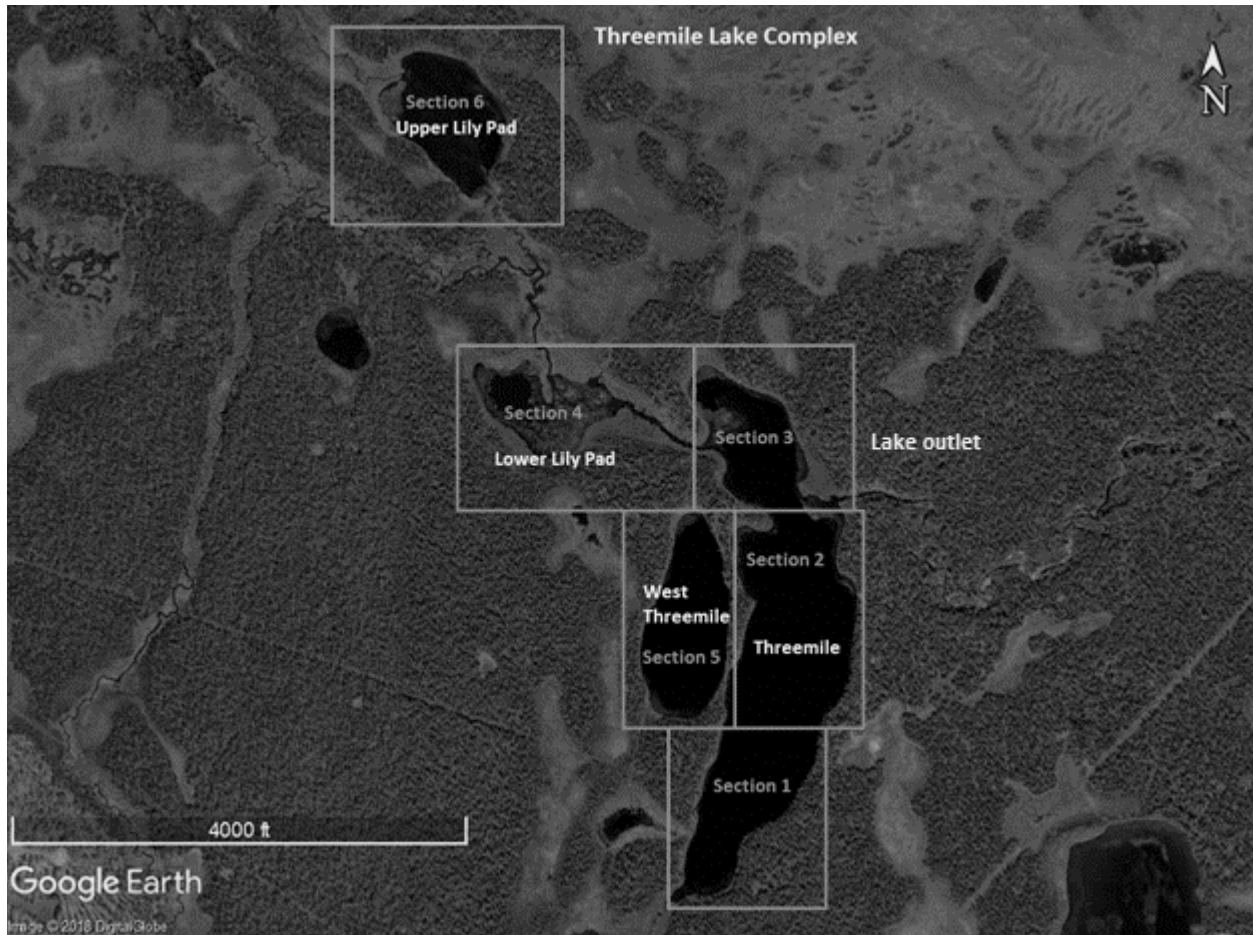


Figure 6.—Threemile Lake complex. Lake sections delineated in grey.

DATA COLLECTION

Chuitbuna Lake Northern Pike Suppression

All capture data will be recorded on water resistant paper following the format in Appendix A1. Additionally, all captured northern pike will be dispatched and processed for fork lengths, weight, sex, stomach contents, and have otoliths and cleithra removed. Presence of tags from the 2019 mark–recapture study will be noted if present, along with tag number. All data will be recorded on data sheets (Appendix A2).

Threemile Lake Northern Pike Suppression

All capture data will be recorded on water resistant paper following the format in Appendix A1. Additionally, all captured northern pike will be dispatched and processed for fork lengths, weight, sex, stomach contents, and have otoliths removed. Cleithra will be removed from representative fish and any fish with tags. Presence of tags from the 2018 mark–recapture study will be noted if present, along with tag number. All data will be recorded on data sheets (Appendix A2).

DATA REDUCTION

Data will be transferred from data sheets to Microsoft Excel worksheets which will be stored on a computer hard drive and the state network.

DATA ANALYSIS

Length frequency distributions will be calculated for each year and the quartiles of the distribution will be compared across years to see the effect heavy suppression has on sizes of northern pike. Catch-per-unit-effort (CPUE) will be calculated each year and compared directly with previous years. Additionally, age-at-length and length-weight comparisons will be made among years to see what changes, if any, have occurred in relation to the northern pike body condition or individual growth rates. Depending on results, future suppression efforts may be adjusted to cause an effective decrease in the northern pike population and ultimately reduce the predation on native fish in the area.

SCHEDULE AND DELIVERABLES

Dates	Activity
May 2021, 2022, 2023	Purchase equipment and field camp gear Confirm field crews Transfer equipment
June 2–12 2021, 2022, 2023	Threemile Lake complex northern pike suppression Collect northern pike length, weight, sex, stomach data, otoliths and cleithra
June 13–17 2021, 2022, 2023	Chuitbuna Lake northern pike suppression Collect northern pike length, weight, sex, stomach data, and otoliths
Fall 2021, 2022, 2023	Data entry
Winter 2023	Analyze data and write project report for the Fishery Data Series Plan future northern pike suppression

RESPONSIBILITIES

Kristine Dunker, Fishery Biologist III, ADF&G

Duties: Provide oversight and make recommendations on study designs and project plans; assist with field work, data analysis, and project reporting; coordinate and assist with the completion of project deliverables.

Parker Bradley, Fishery Biologist II, ADF&G

Duties: Serve as the lead project biologist; assist with planning and coordinating field logistics; author project report and presentations to the public.

Cody Jacobson, Fishery Biologist I, ADF&G

Duties: Assist with planning and coordinating field logistics and equipment procurement; supervise field activities and technicians.

Ben Buzzee, Biometrician IV, ADF&G

Duties: Provide guidance on study design; assist with postseason data analysis; review project operational plans and reports.

Nicole Swenson, Biologist, Tyonek Tribal Conservation District

Duties: Provide guidance on study design; coordinate field logistics and equipment procurement.

Jillian Jablonski, Biologist, Tyonek Tribal Conservation District

Duties: Provide guidance on study design; coordinate field logistics and equipment procurement.

Crystal Jones, Environmental Director, Native Village of Tyonek

Duties: Community outreach, reporting, and equipment procurement.

Brian Peter, Environmental Technician, Native Village of Tyonek

Duties: Community outreach, field work, and equipment procurement.

Fish and Wildlife Technicians, ADF&G

Duties: Assist with field activities.

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APPENDIX A: SAMPLING FORMS

Appendix A1.–Northern pike capture form.

Northern Pike Capture Form 2021							
Lake:			Section #		Start Date:		
Samplers:					Stop Date:		
Net #	GPS		Start Time	Stop Time	# NP	# other Sp.	Comments
1	61.	-151.					
2	61.	-151.					
3	61.	-151.					
4	61.	-151.					
5	61.	-151.					
6	61.	-151.					
7	61.	-151.					
8	61.	-151.					
9	61.	-151.					
10	61.	-151.					
11	61.	-151.					
12	61.	-151.					
13	61.	-151.					
14	61.	-151.					
15	61.	-151.					
16	61.	-151.					
17	61.	-151.					
18	61.	-151.					
19	61.	-151.					
20	61.	-151.					
21	61.	-151.					

