Technical Report No. 22-05

Ambler Road Corridor (Mile 0-55) Fish Investigations in Koyukuk River Tributaries, 2021

by

Chad E. Bear

February 2022

Alaska Department of Fish and Game **Habitat Section**

Symbols and Abbreviations

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Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Mathematics, statistics

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

TECHNICAL REPORT NO. 22-05

AMBLER ROAD CORRIDOR (MILE 0-55) FISH INVESTIGATIONS IN KOYUKUK RIVER TRIBUTARIES, 2021

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February 2022

Cover: Unnamed Ninemile Creek Tributary, August 2021, Photograph by Chad Bear.

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Executive Summary

This report summarizes the results of fish presence survey work performed from August 23-27, 2021, at waterbody crossings within the first 55 miles of the proposed Ambler Mining District Industrial Access Project (AMDIAP or Ambler Road) Route-A corridor. Specific focus was given to small streams where fish presence was unknown. Aerial observations also were conducted in the larger drainages to locate salmonid spawning areas. Streams in this area vary considerably in physical characteristics. Some are wetland complexes with low gradient incised meandering streams and slow water velocity. Many creeks are fast flowing and transitioning rapidly from steep upland hillsides into larger rivers.

Survey efforts included visual observations of waterbody characteristics upriver and downriver of the proposed road crossing locations for natural barriers to fish passage. Fish presence was determined by visual observations, minnow traps, angling and backpack electrofishing in 23 crossing locations of tributaries to the Middle Fork Koyukuk, Wild and John rivers. Captured fish were identified, counted, measured, and released unharmed.

Fish presence was documented at 16 of the 23 sites sampled during 2021. Fish populations varied depending on stream characteristics, consisting primarily of Arctic grayling with mixed communities of other resident fish species. Abundant large beaver dam complexes in these drainages have altered fish distribution on a decades-long timescale with some years allowing fish access to sections of river blocked during past years.

Introduction

The Ambler Mining District Industrial Access Project (AMDIAP or Ambler Road) is located along the south side of the Brooks Range in the Koyukuk and Kobuk river drainages. The proposed 211-mile-long road will travel west from the Dalton Highway at MP 161, near Coldfoot, and end at the south bank of the Ambler River. The proposed two-lane gravel road crosses primarily state lands (61%), Alaska Native corporation lands (15%), Gates of the Arctic National Park lands (12%) and the Bureau of Land Management (BLM) managed lands (12%). The Department of Natural Resources (DNR) manages all state-owned lands, water, and mineral resources. The Department of Fish and Game, Habitat Section reviews and authorizes activities proposed in all fish bearing water bodies under Alaska Statute Title 16, These activities may include bridges, culverts, gravel mining, water withdrawals, and/or other road construction related activities.

In 2009 the state of Alaska began studying the feasibility of the Ambler Access Road following the Brooks East Corridor. This Route-A corridor will cross several rivers including the Koyukuk and Alatna rivers on the eastern end near Bettles/Evansville and Kobuk River tributaries on the western end. In 2014 both the ADF&G Habitat and Sport Fish Divisions conducted systematic sampling of fish within the larger waterways of the Koyukuk, John, Alatna and Wild rivers, and various other smaller waterbodies. (Scannell 2015 and Wuttig et al. 2015). In 2012, ABR, Inc. conducted research and fish sampling throughout the proposed corridor (Lemke et al. 2013). Other fisheries inventories or assessment studies in waters within the road corridor are limited or outdated

The 2021 fish inventory focused on smaller tributaries of the Koyukuk, Wild, and John rivers within the first 55 miles of the corridor. These road crossing's locations were wholly unsampled or undocumented for fish presence but were near known fish populations from the past inventory research. The goals of the 2021 project were to: 1) survey 23 stream crossing sites along the first 55 road miles of the proposed Ambler Road, starting at the Dalton Highway MP 161 heading west (Figure 1); 2) document whether each waterbody contained fish, then determine the fish species and life stage; and 3) if there were no fish present, determine if there was a permanent barrier that limits their use of the waterbody.

AIDEA has committed to ensuring fish passage design crossing structures for all anadromous and resident fish rivers and streams in the Ambler Road Final EIS (USDOI BLM 2020). AIDEA assumes that all perennial river and streams provide fish habitat and would therefore require fish passage structures (USDOI BLM 2020). AIDEA also assumes that some well-defined ephemeral streams may provide fish habitat and will maintain connectivity and fish passage at all road crossings (USDOI BLM 2020).

ADF&G requires surveys be conducted at stream crossing where fish data is lacking to inform culvert designs during permitting. AIDEA has committed to proper design and installation of all culverts placed in streams according to U.S Forestry Service stream simulation design standards

(USDA FS 2008) and the Culvert Design Guidelines for Ecological Function (USDOI – FWS 2021). All fish passage culvert designs would additionally comply with the State of Washington Stream Simulations culvert standards (Barnard et al. 2013) to reduce impacts to fish passage from winter icing or blockage by woody debris. Proper design, installation, regular inspections, and maintenance of crossing structures will reduce impacts to fish passage and the likelihood and severity of potential impacts to aquatic life.

The Alaska Statute Fishway Act (AS 16.05.841) requires authorization from ADF&G Habitat Section for activities within or across a stream (which could include ephemeral streams) used by fish if such an activity may impede the efficient passage of fish, regardless of fish species or land ownership status. ADF&G has committed to surveying undocumented streams and compiling information on fish presence to aid road crossing structure designs and issuing required authorizations for in-water work during road construction and the life of the fish passage structures.

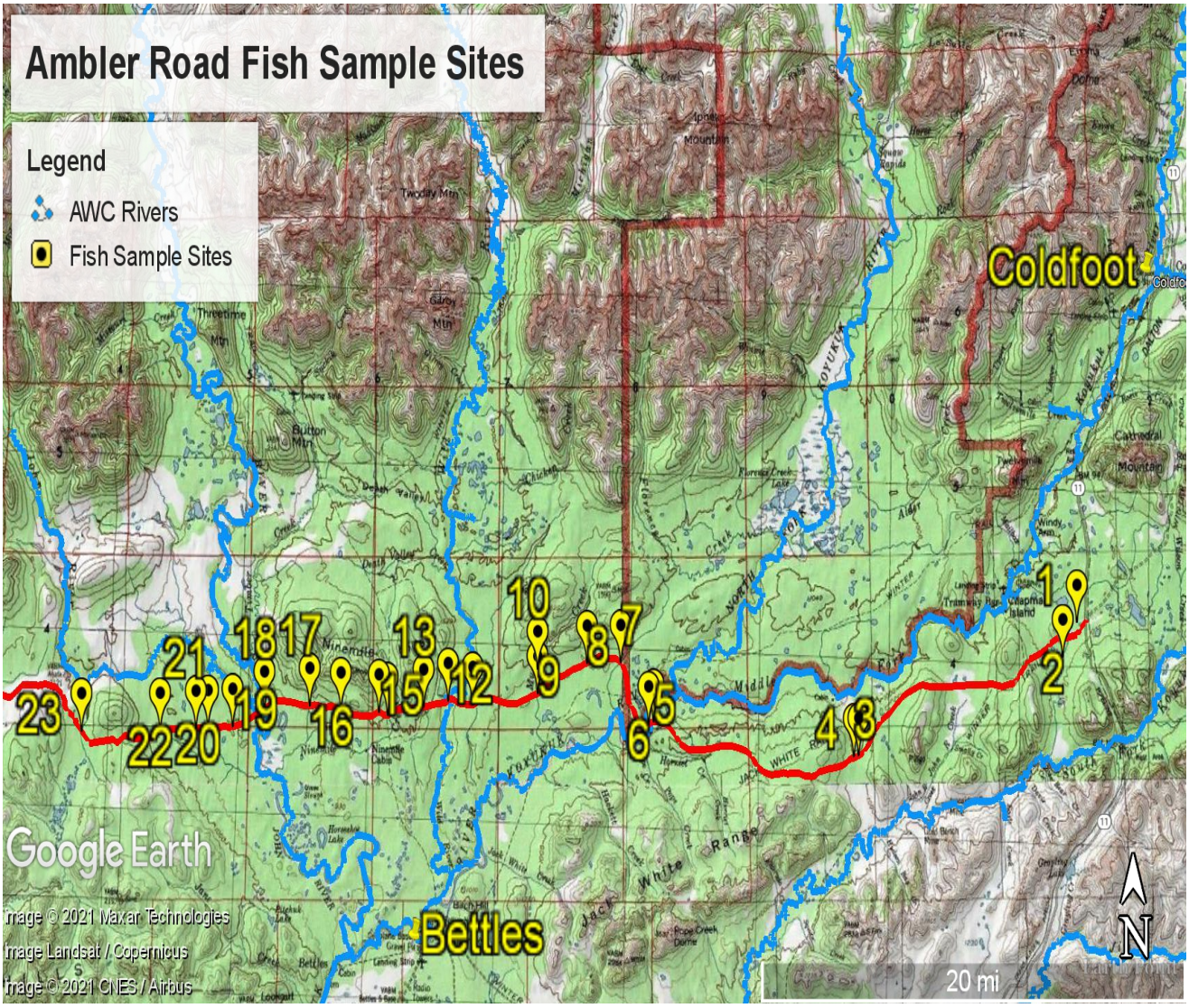

Figure 1. Ambler Road Alignment Fish Survey Sites, August 2021.

Methods

Survey Site Selection

Within the surveyed 55 road miles there are three large river crossings: the Koyukuk, Wild, and John rivers. Fish distribution and species assemblage data already exist for these larger rivers and is contained in the ADF&G Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes (AWC). The Alaska Fresh Water Fish Inventory (AFFI) has documentation of resident fish species in the lakes and rivers surveyed by ADF&G and other environmental agencies. The AWC, AFFI and Technical Reports produced by ADF&G, ABR and DOWL identify fish species and habitat use in the larger rivers and creeks as well as some of their tributaries, but most of the remaining small unnamed tributaries have not been sampled, specifically at the headwaters where many of the proposed road crossing and culverts are intended.

During winter of 2020, 23 sites were selected for the 2021 field season based on available satellite imagery, GIS watershed maps, and United State Geological Survey (USGS) topographic maps. There was limited baseline data regarding the presence of fish species in the small streams, creeks, and drainages that are crossed by the proposed Ambler Road through this section of the Brooks Range foothills. The sites selected and surveyed in were small tributaries of the three larger rivers that were not sampled during the 2014 ADF&G field work or previous AFFI fish surveys. These creeks were all connected to fish bearing tributaries but had no fish survey data.

Creek Characteristics

From August 23-27, each of the 23 survey sites were accessed by a Bell 407 helicopter departing from the community of Coldfoot. The sites were sampled as close to the road crossing alignment as possible when landing areas were available. During flight each creek was surveyed upriver and downriver of the crossing coordinates for obstructions to fish passage such as waterfalls or subsurface water flow. Some creeks were flown to their confluence with their mainstem rivers when within reasonable distance. Beaver dams did block several of the creeks, but these are not considered permanent barriers to fish passage as they may wash out with high water or allow fish passage during seasonal water levels. Each creek was observed, photographed, and fish passage blockages noted. Observations and fish species captured are presented in the results section.

Fish Presence

Fish presence was determined by angling, visual observations, minnow traps, and electrofishing. For minnow traps, 10 traps baited with cured salmon roe were used at 20 of the sites. Baited minnow traps were fished for 24 hours at each location before they were checked and captured fish documented. All fish captured were identified, measured to fork length, and released (Figure 2). Large drainages were also examined for the presence of mature fish by angling and/or visual survey from the helicopter. Survey timing of late August was intended to target potential juvenile salmon rearing in small creeks and tributaries. Juvenile Chinook salmon will emerge from

spawning bed gravel in the spring and move into rearing habitat during the summer months before moving to overwintering habitats prior to freeze-up. Juvenile salmon respond to baited minnow traps and are relatively easy to capture. Resident fish species inhabit small creeks and tributaries during the summer months and are still typically present in high densities during August.

Figure 2. Arctic grayling (age-0) captured at Site 23, Malamute Fork Tributary August, 2021.

Results and Discussion

Overview of Survey

Fish were captured or were previously documented at 16 of the 23 surveyed sites. Of the 16 sites with documented fish presence, three of the sites are listed in the Anadromous Waters Catalog (AWC) and large bridges (>140 feet) are currently proposed for their crossings. Six sites are proposed to be crossed by small bridges (<50 feet). Two sites had fish documented in the AFFI. Nine of these 16 sites were previously undocumented as fish bearing and resident fish species were captured, these tributaries will be added to the AFFI.

Seven sites did not have fish captured or were not surveyed due to no or low water flow during the survey time, however fish may still use these locations at least seasonally (Gryska 2006). Of the seven sites that did not have fish presence, two sites had ephemeral character during our site visit despite the large amount of precipitation received in the Brooks Range the proceeding weeks. Four sites were surveyed but no fish were captured during our survey time window and efforts. One site, Site 10, was an alternative crossing location across Mud Creek and was not surveyed as fish were captured within the drainage at Site 9. A summary of fish species, numbers and location are

presented in Table 1. A detailed account of creek characteristics and fish passage recommendations at each site follows the table.

Table 1. Ambler Road Corridor Sample Sites, August 2021.

Site #	Proposed Crossing Structure	Creek / River Name	Fish Captured / Documented	Road Crossing Latitude	Road Crossing Longitude
1	Small Bridge #15	Unnamed Tributary, Chapman Creek	Northern Pike Documented in 2010	67.078729	-150.353876
2	Small Bridge #12	Unnamed Tributary, Chapman Creek	Northern Pike Documented in 2010	67.071533	-150.384681
3	Fish Passage Culvert	Unnamed Tributary, Middle Fork Koyukuk	5 Arctic Grayling, 2021	67.012801	-150.767113
4	Fish Passage Culvert	Unnamed Tributary, Middle Fork Koyukuk	2 Arctic Grayling, 2021	67.012748	-150.767975
5	Small Bridge #10	Side Channel, Mainstem Koyukuk River	1 Burbot, 2021	67.031602	-151.121988
6	Large Bridge #5	Koyukuk River	AWC 334-40-11000-2125	67.030408	-151.130660
7	Small Bridge #21	Unnamed Tributary, Koyukuk River	1 Arctic Grayling, 2021	67.061473	-151.179731
8	Cross Drain Culvert	Ephemeral creek during 2021 Survey	Not Surveyed. Ephemeral Creek	67.061207	-151.239492
9	Small Bridge #17	Mud Creek, Koyukuk River Tributary	2 Arctic Grayling, 2021	67.045826	-151.327040
10	Small Bridge #17	Mud Creek, Koyukuk River Tributary	Not Surveyed, Same as Site 9	67.058333	-151.327040
11	Cross Drain Culvert	Ephemeral creek during 2021 Survey	Not Surveyed. Ephemeral Creek	67.040229	-151.441893
12	Large Bridge #3	Wild River	AWC 334-40-11000-2125-3871	67.042204	-151.485376
13	Cross Drain Culvert	Unnamed Tributary, Wild River	No Fish Captured	67.038958	-151.528395

14	Fish Passage Culvert	Ninemile Creek	1 Arctic Grayling, 2021	67.034805	-151.591843
15	Cross Drain Culvert	Unnamed Tributary, Ninemile Creek	No Fish Captured	67.036353	-151.607385
16	Cross Drain Culvert	Unnamed Tributary, Ninemile Creek	No Fish Captured	67.037142	-151.674688
17	Fish Passage Culvert	Unnamed Tributary, Ninemile Creek	2 Arctic Grayling, 2021	67.039242	-151.730228
18	Large Bridge #11	John River	AWC 334-40-11000-2125-3841	67.037190	-151.810827
19	Cross Drain Culvert	Unnamed Tributary, John River	No Fish Captured	67.028282	-151.866419
20	Cross Drain Culvert	Unnamed Tributary, John River	No Fish Captured	67.027463	-151.909963
21	Fish Passage Culvert	Unnamed Tributary, John River	2 Arctic Grayling, 2021	67.027081	-151.931310
22	Fish Passage Culvert	Unnamed Tributary, John River	11 Arctic Grayling, 2021	67.025761	-151.994501
23	Small Bridge #9	Unnamed Tributary, Malamute Fork John River	8 Arctic Grayling, 2021	67.024959	-152.133195
NRC 1	No Road Crossing	Timber Creek, John River Tributary	2 Slimy Sculpin, 2021	67.069146	-151.832137
NRC 2	No Road Crossing	Harriet Creek, Koyukuk River Tributary	1 Arctic Grayling, 2021	67.019786	-151.136473
NRC 3	No Road Crossing	Florence Creek, North Fork Koyukuk Tributary	No Fish Captured	67.128132	-150.900876
NRC 4	No Road Crossing	Winnie Creek, North Fork Koyukuk Tributary	2 Slimy Sculpin, 1 Arctic Grayling, 2021	67.196835	-150.826595

Site 1, (Unnamed Tributary, Chapman Creek):

Unnamed tributary of Chapman Creek (Figure 3). Crossing location GPS coordinates 67.078729 N, -150.353876 W. Small bridge #15 is planned for construction by AIDEA. Northern pike were documented in the lake directly downriver from this crossing by ADF&G in 2010. AFFI site number FSK1020C07. No northern pike or fish were captured during this 2020 survey effort, but northern pike do not regularly respond to baited minnow traps. Resident fish including Arctic grayling are documented in Chapman Creek and are most likely present at this crossing. There are two culverts in this unnamed tributary between the sample location and the lake (Figure 4). Both were unobstructed by debris and openly flowing during this survey but had fast water velocities due to precipitation during August. The culverts are in an access road to mining claims near the confluence of Chapman Creek and the Middle Fork Koyukuk River. These two culverts are not in the Ambler Road Alignment corridor or current scope of work but may need to be upgraded to Fish Passage culverts as a mitigation measure if this access road is used for Ambler Road related construction activities.

Figure 3. Site 1. Unnamed tributary of Chapman Creek, August 2021.

Figure 4. Culverts downriver of Site 1 in unnamed tributary of Chapman Creek, August 2021.

Site 2, (Unnamed Tributary, Chapman Creek):

Unnamed tributary of Chapman Creek (Figure 5). Crossing location GPS coordinates 67.071533 N, -150.384681 W. Small bridge #12 is planned for construction by AIDEA. Northern pike were documented in the lake directly downriver from this crossing in 2010 by ADF&G. AFFI site number FSK1020C07. No northern pike or fish were captured during this 2020 survey effort, but northern pike do not regularly respond to baited minnow traps. Resident fish including Arctic grayling are documented in Chapman Creek and are likely present at this crossing. This crossing site is a different tributary to Chapman Creek than the Site 1 tributary but is upriver of the two culverts in the mining access road. Replacement or upgrading the two culverts in the access road (Figure 4) would improve fish passage connectivity to these two tributaries.

Figure 5. Site 2. Unnamed Tributary of Chapman Creek, August 2021.

Site 3, (Unnamed Tributary, Middle Fork Koyukuk River):

Unnamed tributary of the Middle Fork Koyukuk River (Figure 6). Crossing location GPS coordinates 67.012801 N, -150.767113 W. Fish passage structure is required by ADF&G Habitat Section. During this 2021 survey five juvenile Arctic grayling were captured in the 10 minnow traps. Four of the Arctic grayling were 60 mm, one was 152 mm. The 60 mm grayling were young-of-the-year (age-0) from successful spawning in this system during spring of 2021. The creek and terrain occur on a shallow gradient with slow water velocity during this August sampling despite high precipitation during the preceding weeks. This site is directly adjacent to Site 4 and the two tributaries combine into one before flowing into Middle Fork Koyukuk River.

Figure 6. Site 3. Unnamed tributary of Middle Fork Koyukuk River, August 2021.

Site 4, (Unnamed Tributary, Middle Fork Koyukuk River):

Unnamed tributary of the Middle Fork Koyukuk River (Figure 7). Crossing location GPS coordinates 67.012748 N, -150.767975 W. Fish passage structure is required by ADF&G Habitat Section. During this 2021 survey two juvenile Arctic grayling were captured in the 10 minnow traps. The juvenile Arctic grayling captured were between 60 mm and 65 mm and were young of the year (age-0) from successful spawning in this system during spring of 2021. The creek and terrain are on a shallow gradient with slow water velocity during this August sampling despite high precipitation during the preceding weeks This site is directly adjacent to site 3 and the two tributaries combine into one before flowing into Middle Fork Koyukuk River.

Figure 7. Site 4. Unnamed tributary of Middle Fork Koyukuk River, August 2021.

Site 5, (Side Channel, Mainstem Koyukuk River):

Mainstem Koyukuk River side channel in floodplain along the east riverbank (Figure 8). Crossing location GPS coordinates 67.031602 N, -151.121988 W. Small bridge #10 is planned for construction by AIDEA. During this 2021 survey, one Burbot (152 mm) was captured in the 10 minnow traps. Adult Arctic grayling were observed swimming in the creek but not captured. During high water this channel would contain substantial water flow. Both riverbanks were about 10 feet tall in some sections of the channel. The channel is in the floodplain of the Mainstem Koyukuk River and the embankments contained a mixture of willow, coniferous trees, black spruce, and white spruce. Most trees in the flood plain were most likely less than 50 years old with many areas containing willow between five to ten years old. This channel may change in the future during high water events and require improved channelization beginning at its upriver departure from the Koyukuk River to maintain its current path. After the 2021 field season a similar side channel was noted in the floodplain to the west of the Mainstem Koyukuk River that the Ambler Road Alignment will cross (Figure 9). No picture or sampling was done of this similar side channel, but it appears to have connectivity to the main Koyukuk River from reviewing available satellite imagery. The road crossing coordinates are 67.029411 N, -151.142065 W, Site 6.1 for reference (Figure 9). A fish passage crossing structure is recommended by ADF&G.

Figure 8. Site 5. Unnamed side channel along east riverbank of Mainstem Koyukuk River, August 2021.

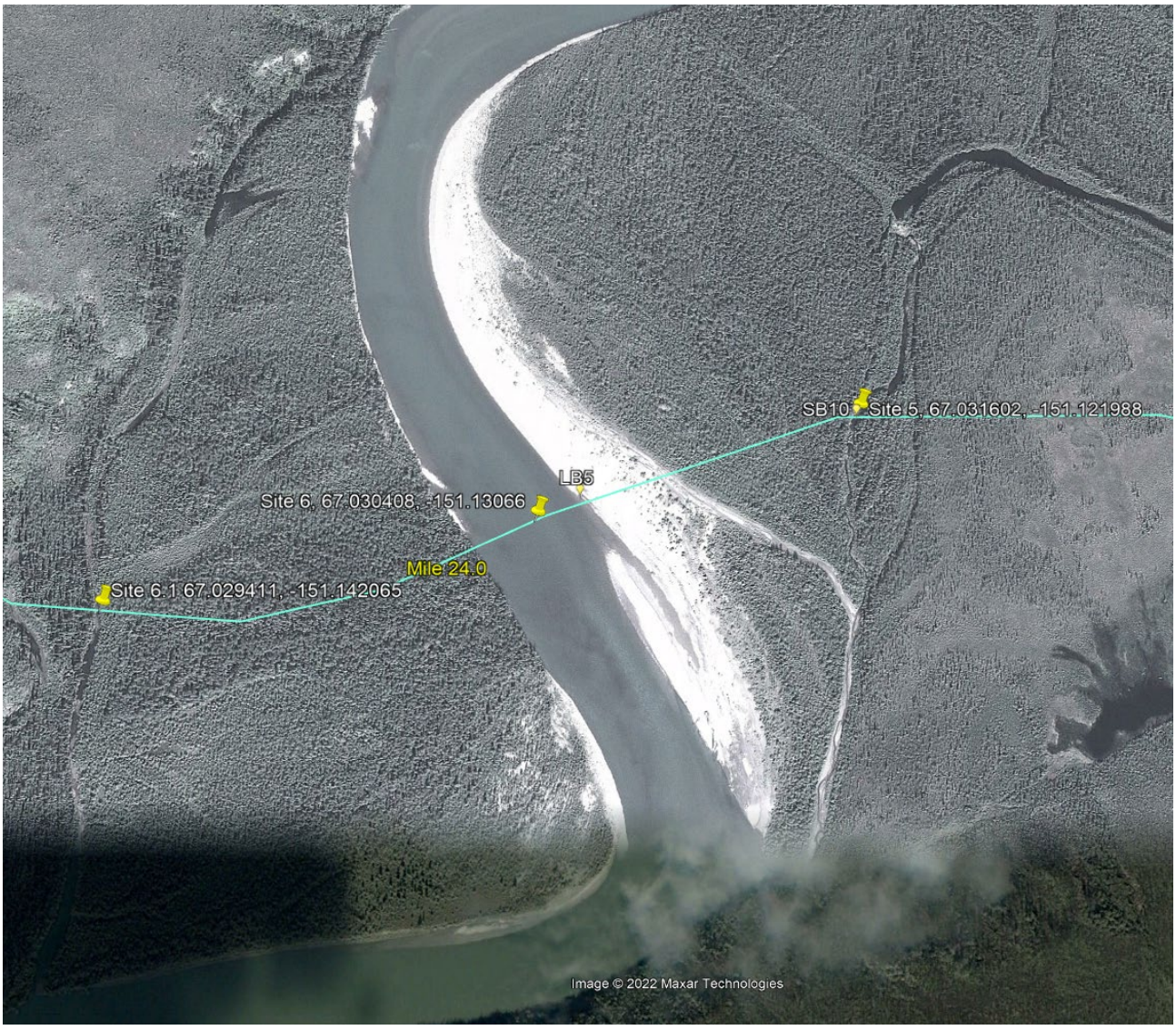

Figure 9. Site 6.1. Unnamed side channel along west riverbank of Mainstem Koyukuk River, August 2021.

Site 6, (Mainstem Koyukuk River):

Mainstem Koyukuk River, AWC 334-40-11000-2125 (Figure 10). Crossing location GPS coordinates 67.030408 N, -151.13066 W. Large bridge #5 is planned for construction by AIDEA. Fish presence and abundance were documented in the 2014 ADF&G survey work (Wuttig, et al). Chum and Chinook salmon spawn upriver of this crossing in the North Fork and Middle Fork Koyukuk River. Sheefish and whitefish also travel through this section of river as well as resident species including Arctic grayling, burbot, northern pike, and Dolly Varden. We did not set minnow traps or sample the Mainstem Koyukuk River as fish species and abundance previously were documented and a bridge is planned for construction.

Figure 10. Site 6. Mainstem Koyukuk River crossing location, August 2021.

Site 7, (Unnamed Tributary, Mainstem Koyukuk River):

Unnamed tributary of the Mainstem Koyukuk River (Figure 11). Crossing location GPS coordinates 67.061473 N, -151.179731 W. Small Bridge #21 is planned for construction by AIDEA. During this 2021 survey, one adult Arctic grayling (240 mm) was captured by rod and reel fishing. No fish were captured with the minnow traps or with the LR-24 Electro fisher.

Figure 11. Site 7. Unnamed tributary of Mainstem Koyukuk River, August 2021.

Site 8, (Unnamed Tributary, Mainstem Koyukuk River):

Unnamed tributary of the Mainstem Koyukuk River (Figure 12). Crossing location GPS coordinates 67.061207 N, -151.239492 W. A fish passage structure is not required by ADF&G Habitat Section for Site 8 but may still be considered at AIDEA's discretion. This creek had a small and undefined channel at the crossing location. Further downriver it appeared to be overgrown with aquatic and terrestrial vegetation and the channel was obscured from view. We landed and attempted to set minnow traps in the open sections of water but there was not sufficient depth or flow. This does not exclude the possibility of fish presence as this sampling effort was a single event conducted in August. Fish may seasonally pass through this section to utilize habitat

upriver near the headwaters during spring or high-water events. However, it cannot be determined if fish use occurs without more sampling. Fish passage structure can be determined by hydraulic sizing at AIDEA's discretion.

Figure 12. Site 8. Unnamed tributary of Mainstem Koyukuk River, August 2021.

Site 9, (Mud Creek, Koyukuk River Tributary):

Mud Creek, a tributary of the Mainstem Koyukuk River (Figure 13). Crossing location GPS coordinates 67.045826 N, -151.32704 W. Small Bridge #17 is planned for construction by AIDEA. During this 2021 survey, two juvenile Arctic grayling were captured with minnow traps. The juvenile Arctic grayling captured were between 60 mm and 65 mm and were young-of-the-year from successful spawning in this system during spring of 2021. No adult grayling was captured with 30 minutes of rod and reel fishing effort. Mud Creek was three to five feet deep on average and approximately 15 to 20 feet wide at this crossing.

Figure 13. Site 9. Mud Creek, tributary of Mainstem Koyukuk River, August 2021.

Site 10, (Mud Creek, Koyukuk River Tributary):

Mud Creek, a tributary of the Mainstem Koyukuk River (Figure 14). Crossing location GPS coordinates 67.058333 N, -151.32704 W. Small Bridge #17 is planned for construction by AIDEA at Site 9 across Mud Creek. We did not sample Site 10 as it is an alternative crossing location across Mud Creek and in very close proximity to Site 9 that was sampled. No blockage to fish passage was observed between Site 9 and Site 10 and fish presence would be assumed given the short distance between the two sites.

Figure 14. Site 10. Alternative crossing of Mud Creek, tributary of Mainstem Koyukuk River, August 2021.

Site 11, (Unnamed Tributary, Mainstem Koyukuk River):

Unnamed tributary of the Mainstem Koyukuk River (Figure 15). Crossing location GPS coordinates 67.040229 N, -151.441893 W. A fish passage structure is not required by ADF&G Habitat Section for Site 11. This creek had no defined channel at the crossing location and it appeared to be overgrown with aquatic and terrestrial vegetation. No sampling was conducted as there was no defined channel or reasonable assumption of fish passage through the disconnected standing water in the crossing alignment. This does not exclude the possibility of fish presence as this sampling attempt was a single event conducted in August. Fish may seasonally pass through this section to utilize habitat upriver near the headwaters during spring or high-water events. However, it cannot be determined without more sampling effort. Fish passage structure can be determined by hydraulic sizing at AIDEA's discretion.

Figure 15. Site 11. Unnamed tributary to Mainstem Koyukuk River, August 2021.

Site 12, (Wild River):

Wild River, AWC 334-40-11000-2125-3871 (Figure 16). Crossing location GPS coordinates 67.042204 N, -151.485376 W. Large bridge #3 is planned for construction by AIDEA. Fish presence and abundance were documented in the 2014 ADF&G survey work (Wuttig, et al). Chum and Chinook salmon spawn upriver of this crossing between Chicken Creek and Michigan Creek. Broad and humpback whitefish also travel through this section of river as well as resident species including Arctic grayling, burbot, northern pike, and Dolly Varden. We did not set minnow traps in the Wild River as fish species and abundance were previously documented and a bridge is planned for construction. No fish were caught by rod and reel effort in 30 minutes of fishing effort. We flew an aerial survey upriver from the crossing alignment to Wild Lake for spawning adult Chinook or Chum salmon. Water was clear and levels were relatively low at the time of the survey. No adult salmon were observed in the known spawning reaches. No salmon carcasses were observed washed up on gravel bars or in eddies. This may be from the high-water events prior to the survey washing carcasses down river or a low number of salmon returning to spawn in 2021.

Figure 16. Site 12. Wild River, Large Bridge #3 proposed for construction, August 2021.

Site 13, (Unnamed Tributary of the Wild River):
Unnamed tributary of the Wild River (Figure 17). Crossing location GPS coordinates 67.038958 N, -151.528395 W. A fish passage structure is not required by ADF&G Habitat Section for Site 13 but may still be considered at AIDEA's discretion. This creek had a small but defined channel at the crossing location. Further downriver it appeared to be overgrown with aquatic and terrestrial vegetation and the channel was obscured from view. We landed and set ten minnow traps in the open sections of water. No fish were captured during this 2021 sampling. This does not exclude the possibility of fish presence as this sampling effort was a single event conducted in August. Fish may seasonally pass through this section to utilize habitat upriver near the headwaters during spring or high-water events. However, it cannot be determined without more sampling effort at this time. Fish passage structure can be determined by hydraulic sizing at AIDEA's discretion.

Figure 17. Site 13. Unnamed tributary of Wild River, August 2021.

Site 14, (Ninemile Creek, John River Tributary):
Ninemile Creek, tributary of the John River (Figure 18). Crossing location GPS coordinates 67.034805 N, -151.591843 W. Fish passage structure is required by ADF&G Habitat Section. During this 2021 survey one juvenile Arctic grayling was captured in the 10 minnow traps. The juvenile Arctic grayling captured was 61 mm and a young-of-the-year from successful spawning in this system during spring of 2021. The creek and terrain are on a moderate gradient with moderate water velocity during this August sampling despite high precipitation during the preceding weeks. There were small beaver dams in this section of Ninemile Creek but there was adequate water flow over and through the small dams to allow fish passage. Beaver damns are not considered permeant blockages to fish passage by the ADF&G Habitat Section as they can seasonally wash out or the beaver removed at a future date.

Figure 18. Site 14. Ninemile Creek, tributary of John River, small beaver dams present at time of fish survey but not permanent blockages to fish passage, August 2021.

Site 15, (Unnamed Tributary, Ninemile Creek):

Unnamed tributary of Ninemile Creek (Figure 19). Crossing location GPS coordinates 67.036353 N, -151.607385 W. A fish passage structure is not required by ADF&G Habitat Section for Site 15 but may still be considered at AIDEA's discretion. This creek had a small but defined channel at the crossing location. Further downriver it appeared to be overgrown with aquatic and terrestrial vegetation and the channel was obscured from view before it's confluence with Ninemile Creek. We landed and set ten minnow traps in the open sections of water. No fish were captured in this 2021 sampling. This does not exclude the possibility of fish presence as this sampling effort was a single event conducted in August. Fish may seasonally pass through this section to utilize habitat upriver near the headwaters during spring or high-water events. However, it cannot be determined without more sampling effort at this time. Fish passage structure can be determined by hydraulic sizing at AIDEA's discretion.

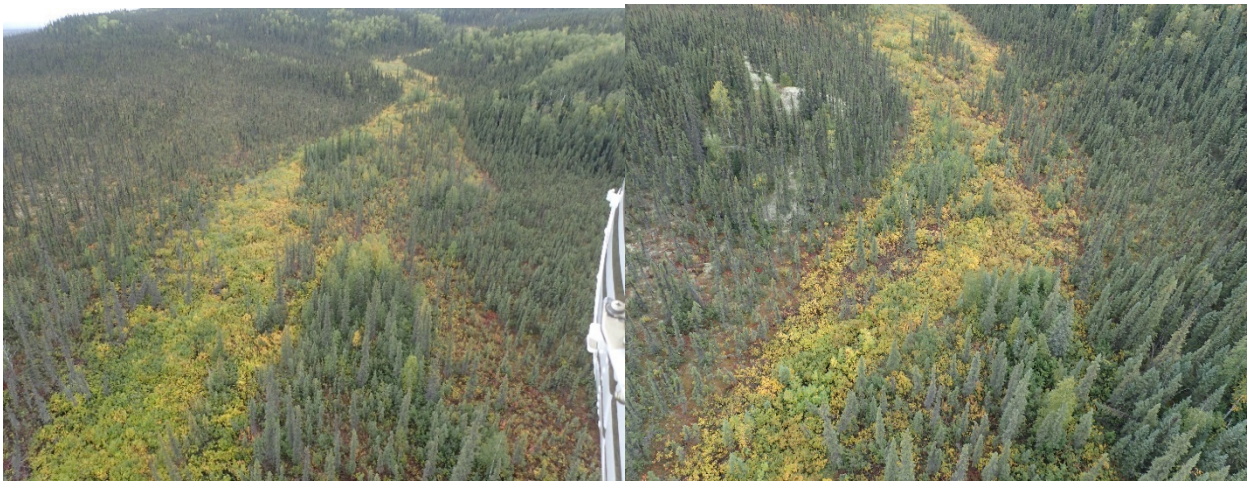

Figure 19. Site 15. Unnamed tributary of Ninemile Creek, August 2021.

Site 16, (Unnamed Tributary, Ninemile Creek):

Unnamed tributary of Ninemile (Figure 20). Crossing location GPS coordinates 67.037142 N, -151.674688 W. A fish passage structure is not required by ADF&G Habitat Section for Site 16 but may still be considered at AIDEA's discretion. This creek had a small but defined channel at the crossing location. Further downriver it appeared to be overgrown with aquatic and terrestrial vegetation and the channel was obscured from view before it's confluence with Ninemile Creek. We landed and set ten minnow traps in the open sections of water. No fish were captured in this 2021 sampling. This does not exclude the possibility of fish presence as this sampling effort was a single event conducted in August. Fish may seasonally pass through this section to utilize habitat upriver near the headwaters during spring or high-water events. However, it cannot be determined without more sampling effort at this time. Fish passage structure can be determined by hydraulic sizing at AIDEA's discretion.

Figure 20. Site 16. Unnamed tributary of Ninemile Creek. August 2021.

Site 17, (Unnamed Tributary, Ninemile Creek):

Unnamed tributary of Ninemile Creek (Figure 21). Crossing location GPS coordinates 67.039242 N, -151.730228 W. Fish passage structure is required by ADF&G Habitat Section. During the 2021 survey, two adult Arctic grayling were captured in 30 minutes of rod and reel fishing effort. Several small Arctic graylings were observed swimming in the pools but not captured. This creek was large and well defined with two- to three-foot-deep water in the sample area at the current precipitation levels. A small bridge may be needed to handle the water flow and provide fish passage.

Figure 21. Site 17. Unnamed tributary of Ninemile Creek, August 2021.

Site 18, (John River):

John River, AWC 334-40-11000-2125-3841 (Figure 22). Crossing location GPS coordinates 67.037190 N, -151.810827 W. Large bridge #11 is planned for construction by AIDEA. Fish presence and abundance were documented in the 2014 ADF&G survey work (Wuttig, et al). Chum salmon spawn upriver of this crossing location in the Malamute Fork John River. Chinook salmon spawn upriver of this crossing location between Timber Creek and Missouri Creek. Broad and humpback whitefish travel through this section of river as well as resident species including Arctic grayling, burbot, northern pike, and Dolly Varden. We did not set minnow traps in the John River as fish species and abundance were documented and a bridge is planned for construction. No fish were caught by rod and reel effort in 30 minutes of fishing effort.

Figure 22. Site 18. John River below confluence with Malamute Fork John River, August 2021.

Site 19, (Unnamed Tributary, John River):

Unnamed tributary of John River (Figure 23). Crossing location GPS coordinates 67.028282 N, -151.866419 W. A fish passage structure is not required by ADF&G Habitat Section for Site 19 but

may still be considered at AIDEA's discretion. This creek had a small but defined channel at the crossing location. Further downriver it appeared to be overgrown with aquatic and terrestrial vegetation and the channel was obscured from view before it's confluence with the John River. We landed and set ten minnow traps in the open sections of water. No fish were captured in this 2021 sampling. This does not exclude the possibility of fish presence as this sampling effort was a single event conducted in August. Fish may seasonally pass through this section to utilize Habitat upriver near the headwaters during spring or high-water events. However, it cannot be determined without more sampling effort at this time. Fish passage structure can be determined by hydraulic sizing at AIDEA's discretion.

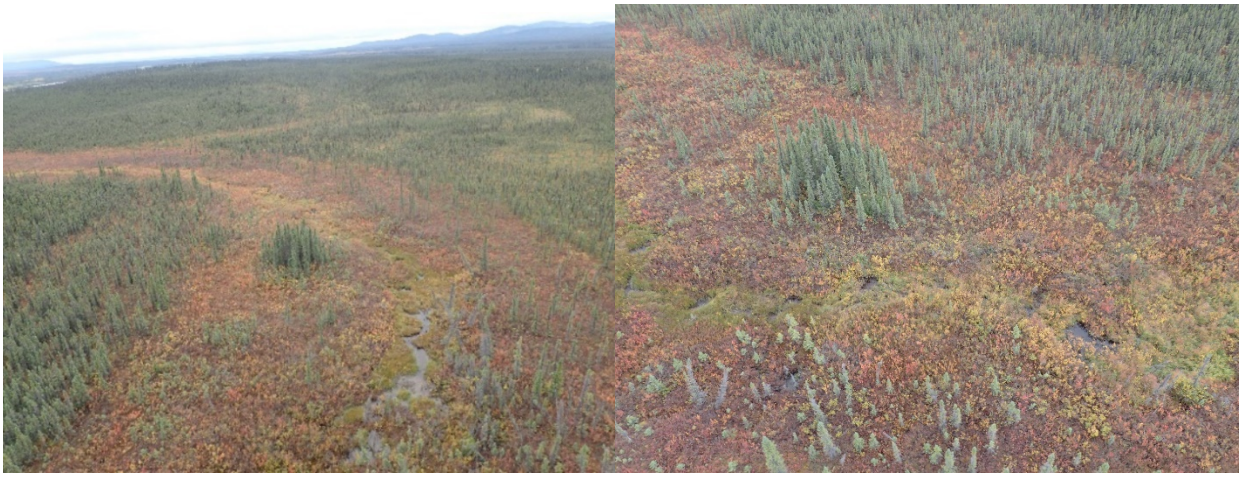

Figure 23. Site 19. Unnamed tributary of John River, August 2021.

Site 20, (Unnamed Tributary, John River):

Unnamed tributary of John River (Figure 24). Crossing location GPS coordinates 67.027463 N, -151.909963 W. A fish passage structure is not required by ADF&G Habitat Section for Site 20 but may still be considered at AIDEA's discretion. This creek had a small but defined channel at the crossing location. Further downriver it appeared to be overgrown with aquatic and terrestrial vegetation and the channel was obscured from view before it's confluence with the John River. We landed and set ten minnow traps in the open sections of water. No fish were captured in this 2021 sampling. This does not exclude the possibility of fish presence as this sampling effort was a single event conducted in August. Fish may seasonally pass through this section to utilize habitat upriver near the headwaters during spring or high-water events. However, it cannot be determined without more sampling effort at this time. Fish passage structure can be determined by hydraulic sizing at AIDEA's discretion.

Figure 24. Site 20. Unnamed tributary of John River, August 2021.

Site 21, (Unnamed Tributary, John River):

Unnamed tributary of John River (Figure 25). Crossing location GPS coordinates 67.027081 N, -151.93131 W. Fish passage structure is required by ADF&G Habitat Section. During the 2021 survey, two juvenile Arctic grayling were captured in the 10 minnow traps. The juvenile Arctic grayling captured were between 60 mm and 65 mm and were young of the year (age-0) from successful spawning in this system during spring of 2021. The creek and terrain are on a moderate gradient with moderate water velocity during this August sampling despite high precipitation during the preceding weeks. There were small beaver dams in this section of the creek but had adequate water flow over and through the small dams to allow fish passage. Beaver damns are not considered permeant blockages to fish passage by the ADF&G Habitat Section as they can be seasonally washed out or the beaver removed at a future date.

Figure 25. Site 21. Unnamed tributary of John River, August 2021.

Site 22, (Unnamed Tributary, John River):
Unnamed tributary of John River (Figure 26). Crossing location GPS coordinates 67.025761 N, -151.994501 W. Fish passage structure is required by ADF&G Habitat Section. During the 2021 survey, 11 juvenile Arctic grayling were captured in the 10 minnow traps. The juvenile Arctic grayling captured were between 60 mm and 65 mm and were young of the year (age-0) from successful spawning in this system during spring of 2021. The creek and terrain are on a moderate gradient with moderate water velocity during this August sampling despite high precipitation during the preceding weeks. There were small beaver dams in this section of the creek but had adequate water flow over and through the small dams to allow fish passage. Beaver damns are not considered permeant blockages to fish passage by the ADF&G Habitat Section as they can seasonally wash out or the beaver removed at a future date.

Figure 26. Site 22. Unnamed tributary of John River, August 2021.

Site 23, (Unnamed Tributary, Malamute Fork John River):
Unnamed tributary of Malamute Fork John River (Figure 27). Crossing location GPS coordinates 67.024959 N, -152.133195 W. Small bridge #9 is planned for construction by AIDEA. During the 2021 survey, eight juvenile Arctic grayling were captured in the 10 minnow traps. The juvenile Arctic grayling captured were between 60 mm and 65 mm and were young of the year (age-0) from successful spawning in this system during spring of 2021. The creek and terrain are on a moderate gradient with moderate water velocity during this August sampling despite high precipitation during the preceding weeks.

Figure 27. Site 23. Unnamed tributary of Malamute Fork John River, August 2021.

After sampling the 23 Ambler Road alignment crossing locations, four additional creeks were selected for juvenile salmon surveys to increase the regional data set. These four creeks were in the flight path between Coldfoot and the required sample sites and passed over daily while traveling. We sampled the lowest one mile of these creeks directly before their confluences with larger rivers. Juvenile Chinook salmon from documented spawning locations in the main rivers will move into small tributaries to use the food and nutrient rich waters for rearing habitat (Cunjak 1996). We sampled Timber Creek, Harriet Creek, Florence Creek, and Winnie Creek. These larger tributaries would have resident fish presence but are not listed in the Anadromous Waters Catalog (AWC) as salmon rearing or spawning habitat.

No Road Crossing Sample Site 1, (Timber Creek):

Timber Creek, John River tributary (Figure 28). GPS sampling location coordinates 67.069146 N, -151.832137 W. Chinook salmon spawning and rearing has been documented in the John River near the confluence of Timber Creek by ADF&G in 2014 (Wuttig et al). There was reasonable assumption juvenile Chinook would move into Timber Creek for rearing. Two slimy sculpin and two juvenile Arctic grayling were captured during the 2021 sampling. No juvenile salmon were captured, and Timber Creek will not be added to the AWC at this time.

Figure 28. No Road Crossing Sample Site 1. Timber Creek, John River tributary, August 2021.

No Road Crossing Sample Site 2, (Harriet Creek):

Harriet Creek, Mainstem Koyukuk River tributary (Figure 29). GPS sampling location coordinates 67.019786 N, -151.136473 W. Chum and Chinook salmon migration, spawning and rearing has been documented in the Koyukuk River near the confluence of Harriet Creek by ADF&G. There was reasonable assumption juvenile salmon would move into Harriet Creek for rearing. One juvenile Arctic Grayling was captured during the 2021 sampling. No juvenile salmon were captured, and Harriet Creek will not be added to the AWC at this time.

Figure 29. No Road Crossing Sample Site 2. Harriet Creek, Mainstem Koyukuk River tributary, August 2021.

No Road Crossing Sample Site 3, (Florence Creek):

Florence Creek, North Fork Koyukuk River tributary (Figure 30). GPS sampling location coordinates 67.128132 N, -150.900876 W. Chinook salmon migration, spawning and rearing has been documented in the North Fork Koyukuk River upriver of the confluence of Florence Creek by ADF&G. There was reasonable assumption juvenile salmon would move into Florence Creek for rearing. No juvenile salmon were captured during this 2021 survey and Florence Creek will not be added to the AWC at this time.

Figure 30. No Road Crossing Sample Site 3. Florence Creek, North Fork Koyukuk River Tributary, August 2021.

No Road Crossing Sample Site 4, (Winnie Creek):

Winnie Creek, North Fork Koyukuk River tributary (Figure 31). GPS sampling location coordinates 67.196835 N, -150.826595 W. Chinook salmon migration, spawning and rearing has been documented in the North Fork Koyukuk River upriver of the confluence of Winnie Creek by ADF&G. There was reasonable assumption juvenile salmon would move into Winnie Creek for rearing. Two slimy sculpin and one juvenile Arctic grayling were captured in 20 minnow traps set for 24 hours. No juvenile salmon were captured during this 2021 survey and Winnie Creek will not be added to the AWC at this time.

Figure 31. No Road Crossing Sample Site 4. Winnie Creek, North Fork Koyukuk River Tributary, August 2021.

CONCLUSION

No anadromous fish were captured during the 2021 sampling and none of the sampled creeks, tributaries or rivers will be added to the Anadromous Waters Catalog (AWC). Nine new creeks and tributaries of the Koyukuk, John and Wild rivers (Site 3, 4, 7, 9, 14, 17, 21, 22, 23) will be added to the Alaska Fresh Water Fish Inventory database (AFFI) from this 2021 survey work. No undocumented species of fish for the drainages were observed or captured. Arctic grayling was the most commonly captured fish during this 2021 fisheries investigation work and the capture of age-0 Arctic grayling in several tributaries strongly suggests that Arctic grayling successfully spawned in those systems during spring of 2021. In future surveys more effort and specific gear types will be used to capture Arctic grayling, such as fyke nets and hook and line fishing efforts. Survey timing for 2022 and 2023 may be adjusted to early August to better observe potential adult Chinook salmon spawning timing in these Koyukuk and Kobuk River drainages. Future survey work should continue with the same design standards in 2022 and 2023 for the remaining 156 miles of the Ambler Road corridor to its terminus at the Ambler River. This survey and fish data will identify fish habitat crossed by the Ambler Road and will expand our understanding of the fish species utilizing these waterways. As found in past projects, multiple field inspections at different times of the year are essential to documenting fish presence and species assemblages. Regular updates to the baseline fish data sets will be necessary in future years as progress on the Ambler Road continues.

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