Regional Operational Plan SF.3F.2014.05

Operational Plan: Fish Assemblages and Their Habitat Usage in the Alatna and Koyukuk River Drainages in the Vicinity of the Proposed Ambler Road Crossing

by

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and

Matt Albert

March 2015

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

Symbols and Abbreviations

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Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Mathematics, statistics

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

REGIONAL OPERATIONAL PLAN SF.3F.2014.05

FISH ASSEMBLAGES AND THEIR HABITAT USAGE IN THE ALATNA AND KOYUKUK RIVER DRAINAGES IN THE VICINTIY OF THE PROPOSED AMBLER ROAD CROSSING

by

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Alaska Department of Fish and Game
Division of Sport Fish

March 2015

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SIGNATURE PAGE

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Project leader(s):	Klaus Wuttig and Matt Albert
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Plan Type:	Category II

Approval

Title	Name	Signature	Date
Project leader	Klaus Wuttig		
Biometrician	Pat Hansen		4/30/14
Research Coordinator	Matt Evenson		
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ABSTRACT

The primary goal of this project is to provide information on resident species fish assemblages and their habitat usage relative to those portions of the Alatna and Koyukuk drainages in proximity to the proposed Ambler Road. To date, no rigorous life history studies on resident fish species have been conducted in the Alatna and Koyukuk drainages and spatial information on variables such as range distances, habitat preferences, and residency times in selected seasonal habitats (e.g. overwintering areas) are lacking. These variables will be investigated by deploying radio tags in prevalent resident fishes and monitored over a 14-month period with an emphasis on Arctic grayling *Thymallus arcticus* – other species likely to be radiotagged include northern pike *Esox lucius*, sheefish *Stenodus leucicthyes*, burbot *Lota lota*, Dolly Varden *Salvelinus malma*, whitefish species such as broad *Coregonus nasus* and humpback *Coregonus pidschian*. A boat electrofisher, as well as other sampling gear (e.g. beach seines and baited hoop traps) will be used in the mainstem portions of the Alatna and Koyukuk drainages to provide information on fish assembles present and to capture fish for radio tagging. Periodic aerial surveys will be used to locate radiotagged fish.

Key words: Koyukuk River, Alatna River, radiotelemetry, radio tags, Ambler Road, habitat use, spawning areas, overwintering areas, life history, Northern Pike, *Esox lucius*, sheefish, *Stenodus leucicthyes*, burbot, *Lota lota*, broad whitefish *Coregonus nasus* , humpback whitefish *Coregonus pidschian.*

PURPOSE

This operational plan outlines a study to be conducted by the Alaska Department of Fish and Game, Division of Sport Fish, designed to provide information on resident species fish assemblages and their habitat usage relative to those portions of the Alatna and Koyukuk drainages in proximity to the proposed Ambler Road to Resources Corridor (Figure 1). This information will be used by the Division of Habitat to support the pre-development design and provide for appropriate environmental and mitigation planning for the corridor.

BACKGROUND

Information on fishes inhabiting these waters is minimal because of its remote geography and relatively small consumptive uses by sport, commercial, and subsistence fishers. Data collected to date relates primarily to anadromous salmon and is based on a relatively small number of sampling locations conducted at only a single point of time.

This proposal is primarily directed at freshwater fishes with an emphasis on Arctic grayling *Thymallus arcticus*. This species was selected because it is likely to be the most widespread and prevalent of all freshwater species in these drainages, can be readily sampled, and commonly require a wide range of habitat types. For example, an Arctic grayling may easily travel 70 km over the course of a year by spawning in a small tundra stream during spring, feeding in a first-order mountainous creek during summer, and overwintering in large rivers. Other species of interest include northern pike *Esox lucius*, sheefish *Stenodus leucicthyes*, burbot *Lota lota*, Dolly Varden *Salvelinus malma*, whitefish species such as broad *Coregonus nasus* and humpback *Coregonus pidschian*, and juvenile pacific salmon.

To date, no rigorous life history studies on Arctic grayling or other fish species have been conducted in the Alatna and Koyukuk drainages and spatial information on variables such as range distances, habitat preferences, and residency times in selected seasonal habitats (e.g. overwintering areas) are lacking. To help describe the potential types of seasonal habitat requirements for the defined study areas within the Alatna and Koyukuk drainages, radio tags will be deployed in Arctic grayling and other prevalent fish species, and monitored over a 14-month period. A boat electrofisher, as well as other sampling gear (e.g. beach seines and baited hoop traps) will be used in the mainstem portions of the Alatna and Koyukuk drainages to provide information on fish assembles present.

Although not covered in this operational plan, opportunistic sampling will occur to support the efforts of Division of Habitat, which will have a crew working parallel to this study. For example, additional sampling will include collecting otoliths for aging, examination of stomach contents or gonads, or testing of water chemistry.

OBJECTIVES

This study focuses on two primary drainages, the Alatna and Koyukuk, in the vicinity of the proposed road corridor (Figure 1). All objectives will relate to four study areas, the boundaries that will require minor modifications based on observed fish distributions and boat access. The 4 proposed primary study areas include:

1. **Mainstem Koyukuk**: The mainstem Koyukuk River (~80 km reach), the lower ~20 km of the North Fork Koyukuk and Middlefork Koyukuk rivers, and the lower ~30 km of the mainstem of the John River coinciding with road corridor and including connected slough habitats and creek mouths.
2. **Koyukuk Tributaries:** Tributaries of the mainstem Koyukuk (Area 1) such as the Wild, Jack White, Jane, Timber, Malamute Fork, Timber, and Twelvemile creeks.
3. **Mainstem Alatna:** the mainstem Alatna River (~80-km reach) coinciding with the proposed road corridor and includes connected slough habitats and creek mouths.
4. **Alatna Tributaries:** Tributaries of the mainstem Alatna (Area 3) such as Takahula, Malamute, Rockybottom, and Helpmejack creeks.

The study objectives will be to:

1. Document and characterize the fish assemblages present in the mainstem Alatna River (Study Area 3) during early fall 2014, and in the Koyukuk River mainstem (Study Area 1) during mid-summer and early fall 2014.

2. Use radiotelemetry to document seasonal locations of mature-sized Arctic grayling (≥330 mm FL) captured in the mainstem Alatna River and its tributaries (Study Areas 3 and 4) during late summer/early fall 2014, and in the mainstem Koyukuk River and its

tributaries (Study Areas 1 and 2) during summer and early fall 2014 with an emphasis on documenting overwintering and spawning areas.

3. Use radiotelemetry to document seasonal locations of other fish species that may be prevalent (northern pike, sheefish, burbot or whitefish spp.) in the mainstem Alatna River during fall 2014 and in the mainstem Koyukuk River during 2014 (summer and fall) with an emphasis on documenting overwintering and spawning areas.
4. Document the presence of anadromous juvenile salmon in tributaries during Arctic grayling radiotagging effort using baited minnow traps.

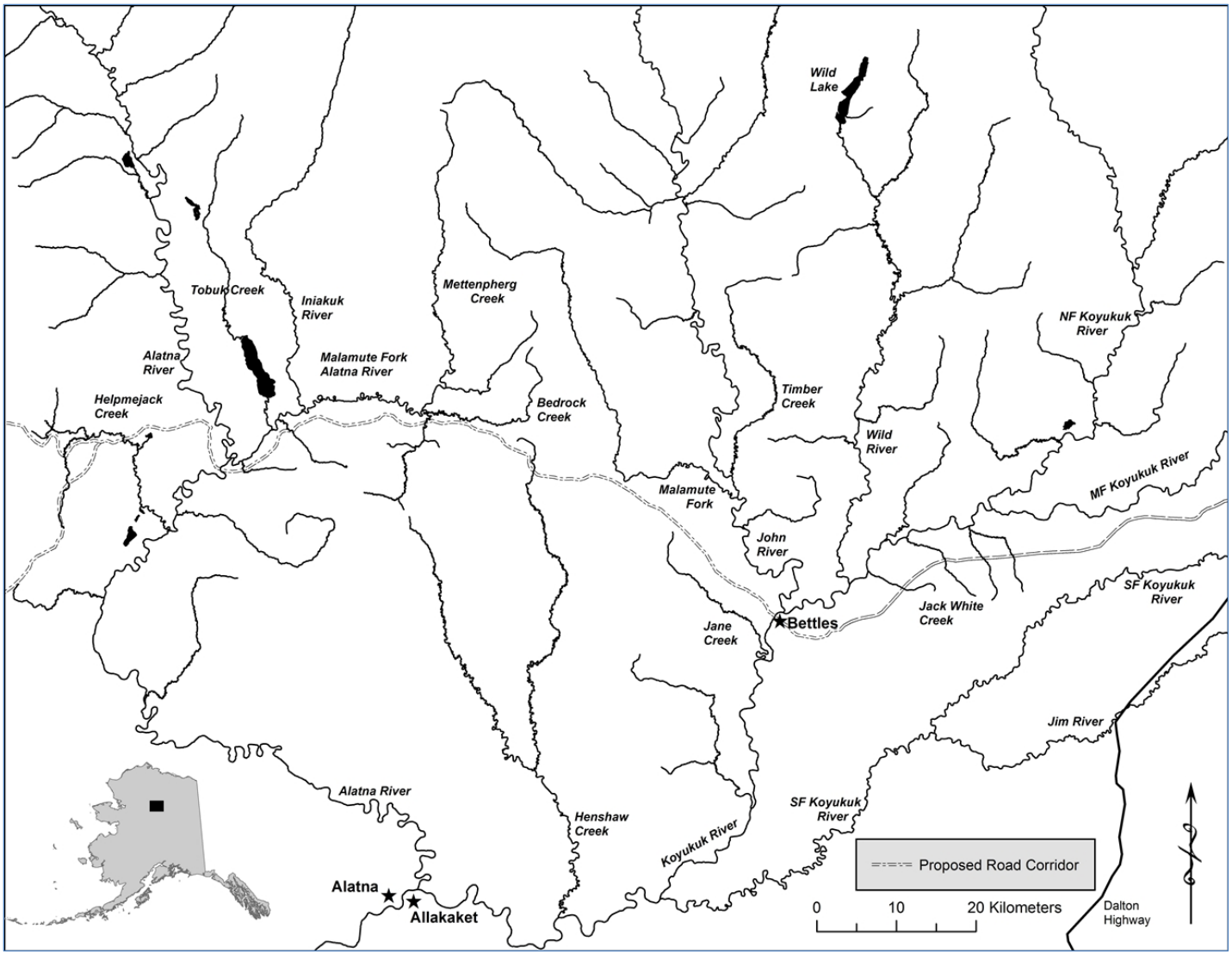

Figure 1.–Koyukuk and Alatna river drainages. Road corridor depicted by dashed line.

METHODS

For both the Alatna and Koyukuk drainages, there will be two interrelated components to the field work, sampling fish assemblages in the mainstem portions and deploying radio tags in both the mainstem and tributaries (See Schedule and Deliverables). The generalized field schedule for 2014 will consist of:

1. June 9–12, prepping and testing equipment and methods near Bettles.
2. July 1–21, sampling mainstem Koyukuk (Area 1) including deployment of radio tags in prevelant resident fishes;
3. July 29–Aug 10, deploying Arctic grayling radio tags and setting baited minnow traps in Alatna and Koyukuk River tributaries (Areas 2 and 4);
4. Aug 26–Sept 10, sampling of Mainstem Koyukuk (Area 1) including deployment of radio tags in resident fishes.
5. Aug 26–Sept 10, sampling of Mainstem Alatna River (Area 3) including deployment of radio tags in resident fishes.

DESCRIPTION OF STUDY AREAS

Mainstem Koyukuk–fish assemblages

The Koyukuk River study area includes 9 study sections; each 10 km in length, distributed across portions of the Koyukuk River, Middle and North Fork Koyukuk rivers, and the John River (Figure 2). In general, the area includes ~170 river kilometers (rkm) and approximately every other 10 km of river will be sampled. This division of the sampling area will help ensure that a large geographic area is sampled, that the amount of area (i.e. a 10-km section) can be reasonably sampled in a given day, and that all habitat types are encountered and sampled. Slight modifications to a section will be made in the field to maximize fish captures and species diversity by, for example, shifting an upper boundary to include a stream mouth or large side channel. Time permitting, additional areas will be sampled if there appears to be productive habitats available, such as a large slough complex. Similarly, some sections may need to be shortened because of time constraints or poor sampling conditions (low or high water) occur.

Koyukuk River tributaries–Arctic grayling telemetry

Using aerial images, 22 tagging locations across 16 tributary streams have been preliminarily identified for the deployment of radio tags in Arctic grayling during August (Figure 3). These were selected based on their proximity to the proposed road and detecting a broad range of possible movements. For example, Arctic grayling within the Malamute River may reside there year round displaying little seasonal movements. In contrast, Arctic grayling summering in Timber Creek may display a large range of movements by using the mainstem Koyukuk River

for overwintering and the Jane Creek for spawning. Some tagging locations and number of radio tags per location will likely be adjusted as sampling progress.

Mainstem Alatna–fish assemblages

The Alatna River study area encompasses an ~80 km reach of the mainstem Alatna River extending downstream from Takahula Creek, and a 10-km portion of Malamute Fork. Within this area six 10-km sampling sections have been selected for sampling, 5 along the Alatna mainstem and 1 in the Malamute Fork (Figure 2). This division of the sampling area will help ensure that a large geographic area is sampled, that the amount of area (i.e. 6 sections) can be reasonably sampled in a given day, and that all habitat types are encountered and sampled. Time permitting, additional reaches will be sampled if there appears to be productive habitats available, such as a large slough complex.

Alatna River tributaries–Arctic grayling telemetry

Using aerial images, 21 tagging locations across 12 tributary streams have been preliminarily identified for the deployment of radio tags in Arctic grayling during August (Figure 3). These were selected based on their proximity to the proposed road, detecting a broad range of possible movements, and knowledge that Arctic grayling generally overwinter in downriver areas. For example, Arctic grayling summering in Takahula Creek may display a large range of movements by using the mainstem Alatna River for overwintering and the Malamute River for spawning. In contrast, Arctic grayling summering within the Malamute River may reside there year round displaying little seasonal movements.

SAMPLING OF FISH ASSEMBLAGES

Sampling of fish assemblages in the mainstem Koyukuk River will be conducted during two distinct periods, midsummer and fall, because it is anticipated that the composition of species present will differ. For example, during fall spawning sheefish, coho *Oncorhynchus kisutch* or humpback whitefish may be present. Within the Alatna River drainage sampling during two distinct time periods is preferable, but to due constraints, it will only be sampled in the fall. It is anticipated that fall will provide the greatest diversity of fish with the potential for coho, sheefish, and whitefish species migrating to or staging at fall spawning areas.

Sampling effort will be approximately distributed at the scale of a subsection. A subsection is the 10-km section divided into five 1.6-km (1-mi) reaches. To aid distribution of fishing effort laminated aerial maps of each section will be provided in sampling kits with the boundaries of the sections and subsections labeled with corresponding coordinates (Figures 4 and 5).

Within each section, a combination of gear will be used and should reliably capture all prevalent fish species, juvenile and adult. Gear will consist of an electrofishing boat, 5 large-mesh hoop traps, 5 small-mesh hoop traps, 10 minnow traps, and 1 beach seine. A gillnet (25-mm mesh, 2

m deep, and 30 m long) and hook-and-line will be used opportunistically, for example, at creek mouths, at slough entrances, or in backwater eddies. The large mesh (25 mm) hoop traps are 3.05 m long, with seven 6.35 mm steel hoops and taper from 0.61 m at the entrance to 0.46 m at the cod end. These will be baited with cut Pacific herring *Clupea harengus* placed in perforated plastic containers. The smaller meshed hoop traps (9 mm) are approximately 1.2 m long with 100 mm throats. The minnow traps are made of 6-mm galvanized steel wire mesh, are 44 cm long, and 23 cm in diameter. The smaller hoop traps and minnow traps will be baited with cured salmon eggs. The beach seine is ~15 m long, 1.2 m deep, and has a 9-mm mesh.

A crew of three persons will operate the 20-ft electrofishing river boat in the mainstem portions as described by (Fleming 1994). This gear will reliably capture most non-juvenile lotic species (i.e. ≥150 mm FL) if they are present in any appreciable numbers with the exception of Arctic lamprey *Lethenteron japonicum*. The boat will fish downstream focusing on the river margins, mouths of tributaries, slack water areas, and slough mouths. The boat will be operated until the sampling tote is full or the end of a 1.6-km subsection is reached.

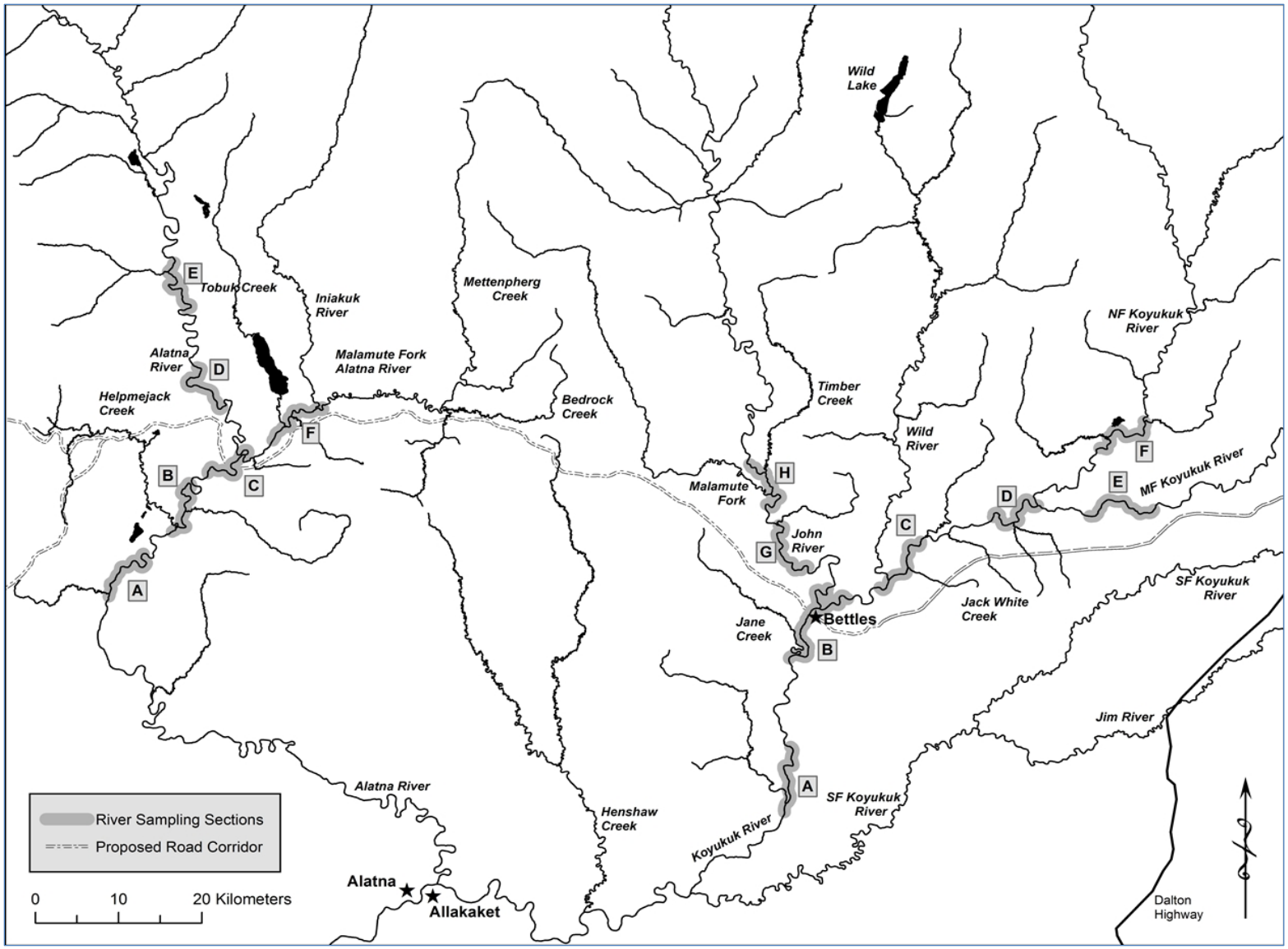

Figure 2.–Koyukuk and Alatna drainages depicting 10-km sampling sections.

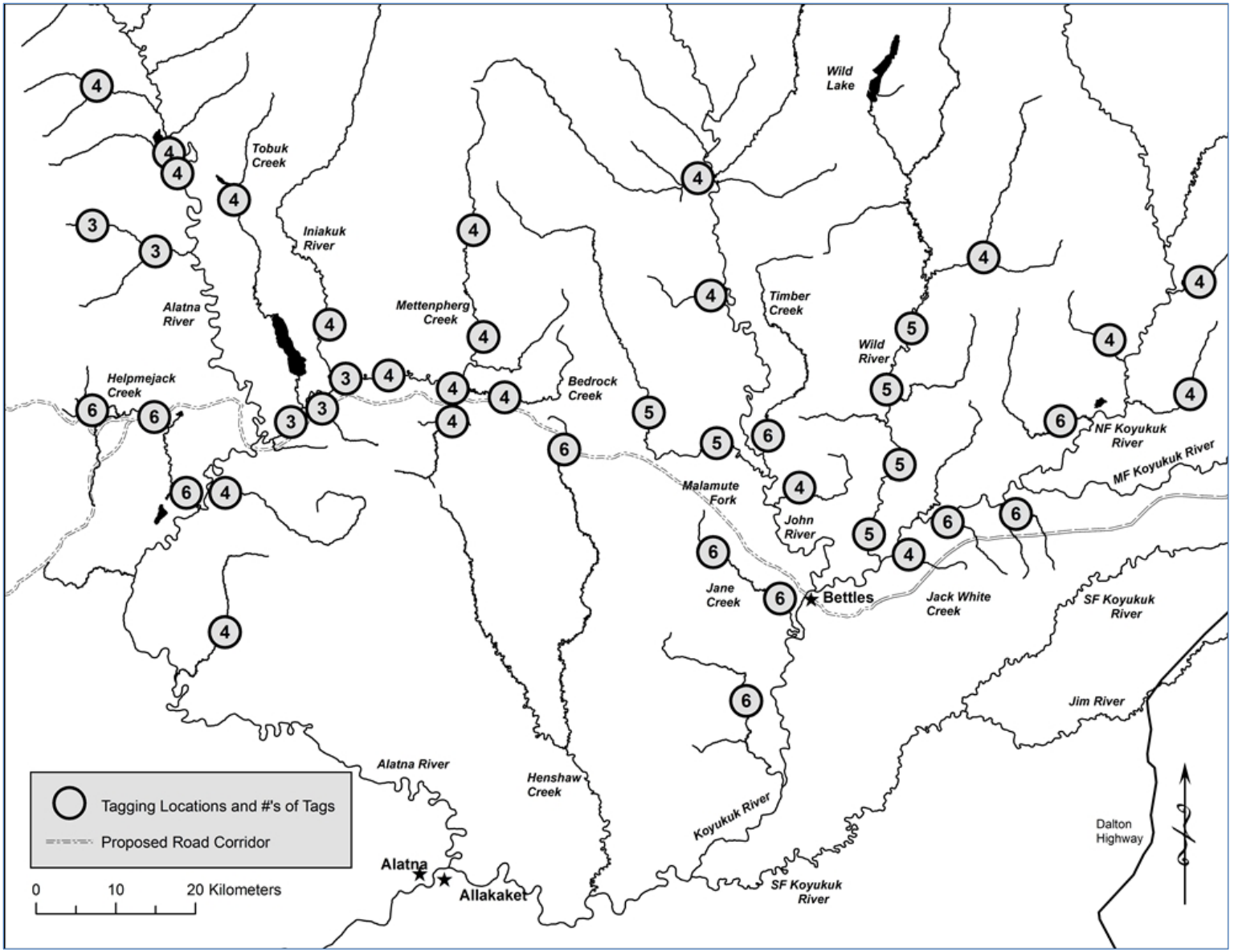

Figure 3.–Alatna and Koyukuk drainages depicting tributary streams and preliminary distribution of Arctic grayling radio tags, 2014

In general, a second crew of two persons will operate an 18-ft jet powered skiff and will fish the remainder of the gear. Within each subsection, 1 large hoop trap, 1 small hoop trap and 2 minnow traps will be set and fished overnight, and a minimum of 1 seine haul will be completed. The placement of this gear will be left to the discretion of the crew and waters more likely to hold fish. Creek mouths and slough entrances (if present) will be targeted to maximize detection of species present. The hoop traps will primarily catch burbot and longnose suckers *Catostomus catostomus* and will be set overnight before being moved and reset the following day. Similarly, the minnow traps will be fished overnight, but will target juvenile fish, presumably Dolly Varden and salmon spp. The beach seine will target juvenile fishes along the stream margins. Sampling efforts with the gillnet and angling will be more opportunistic and will be conducted when time and water conditions allow. One or two gillnets will be fished each day and the duration of the set will vary, but will not be fished overnight. Typically, these will be set near the beginning of the day and pulled when returning to camp.

The sequence and manner in which the sections are sampled will depend on the number of crews, the type of gear to be used, weather, and logistical considerations, such as travel distances and staffing, and aircraft availability. Daily crew assignments and the order in which the sections are sampled will be developed at the start of each event/trip, and likely adjusted as sampling proceeds. Examples of sampling schedules are provided (Appendix A).

Data collection–fish assemblages

As appropriate for each gear type, data collected will include: GPS location (decimal degrees, WGS84 datum), date, time set, time pulled, duration fished, general description of habitat type, and number of fish captured by species.

1. Examples of general habitat type include: main channel, side channel, side slough (side channel not connected on upstream side), backwater, clearwater tributary mouth.
2. Additional habitat descriptors could include, inside gravel bar, outside cut bank, beaver dam complex, and point bar.

For Electrofishing, GPS locations for the start and end point of all runs will be recorded, regardless of duration, and individual fish by gear type, additional data will include fish length (mm FL).

All data will be collected on a gear specific field data forms (Appendix B) or in Rite-in-the-Rain™ notebooks that will be entered into an Excel spreadsheet.

Data collected for each fish captured will include: species, measurement of fish length, location (name of waterbody, section, subsection, and GPS coordinate), gear type and date.

RADIOTELEMERTY

A total of 380 radio tags will be deployed across both drainages (the Alatna and Koyukuk) (Table 1). Within the Koyukuk drainage area, three groups of fish will be targeted: 1) prevalent resident species in the mainstem during mid-July; 2) Arctic grayling in the tributaries to the Koyukuk River; and, 3) prevalent resident species in the mainstem during early fall (Table 1). In the Alatna River, Arctic grayling in the tributaries will be radiotagged in early August and prevalent resident species in the mainstem will be targeted early fall.

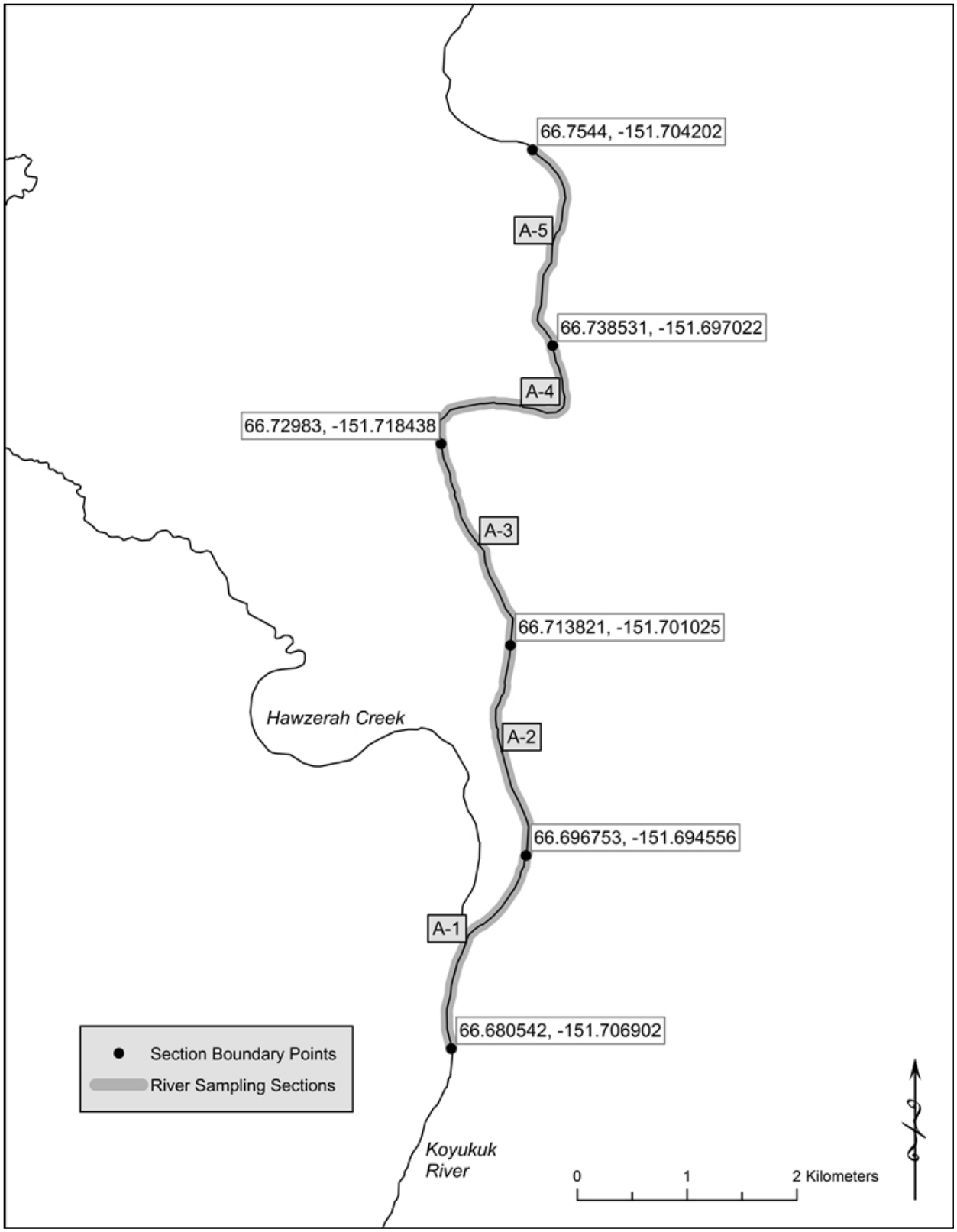

Figure 4.–Example map of sampling section A and corresponding subsections.

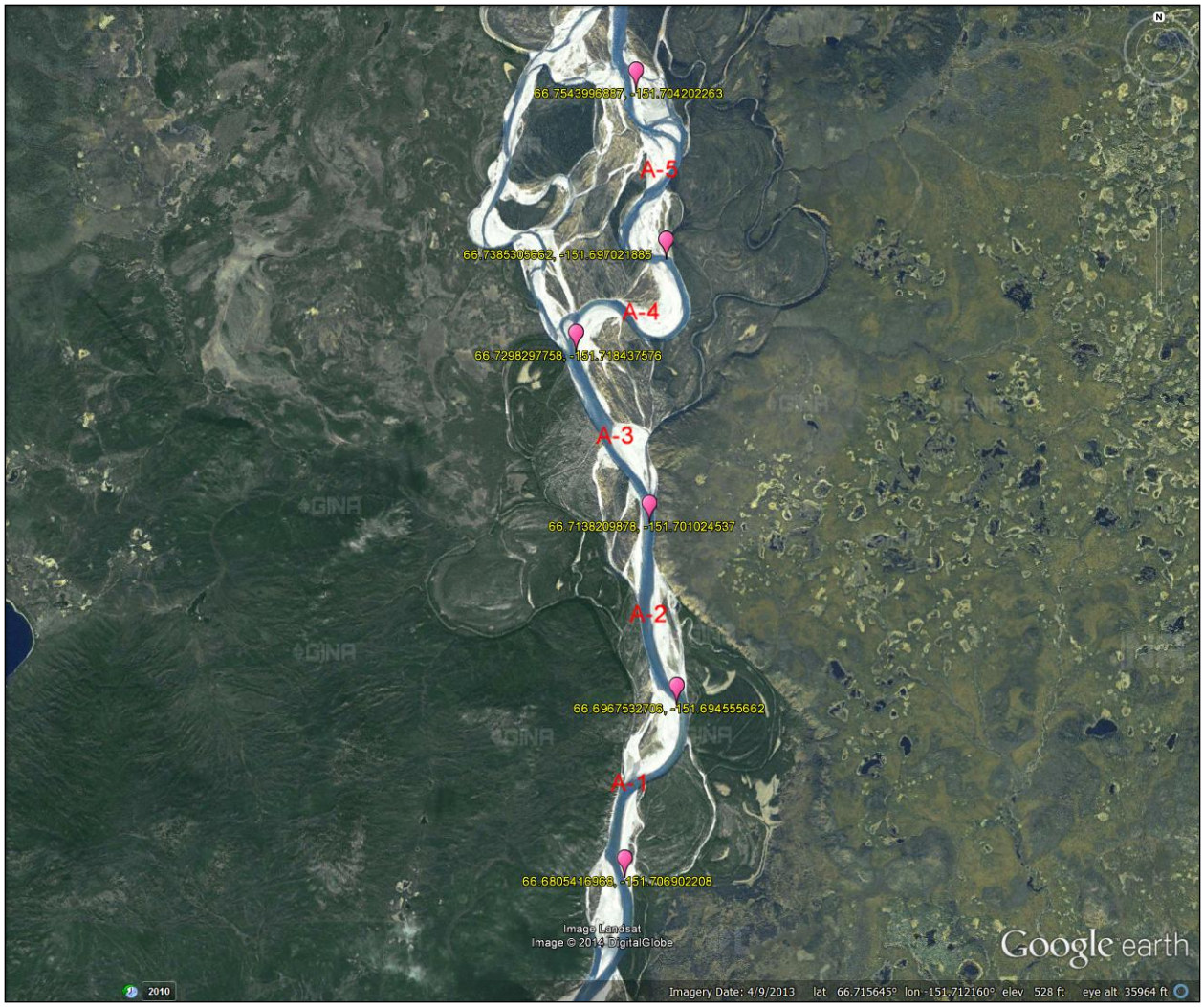

Figure 5.–Example map using aerial imagery of sampling section A and corresponding subsections.

Within the mainstem Alatna and Koyukuk study areas, the exact allocation of radio tags by section and species cannot be firmly apportioned prior to sampling because little is known about the area. The intent is to focus on those areas where fish appear to be most abundant and to target fish that have a reasonable probability of inhabiting waters near the proposed road crossing at some point during their annual cycle, therefore Arctic grayling will be the primary species sampled. The decision to radio tag a fish species other than Arctic grayling will be made as sampling progresses. For example, if catches of burbot and northern pike are relatively high, 5 of each will be radiotagged in a section on a given day. A portion (e.g. 20%) of the tags will be withheld toward the end of the sampling effort so that crew(s) can return to a section and radiotag species that may have been under represented, such as sheefish. Fish of a mature size will be targeted because they will be large enough to bear a radio tag (i.e. ≥ 330 mm FL) and potential spawning areas can be identified. To maximize our ability to radio tag multiple species, all radio tags will be of the same size and weight and will accommodate any species ≥330 mm FL.

Table 1.–Approximate allocation of radio tags.

Drainage	Period	Section / subsection	Species	~ number of tags
Alatna				
	August	Tributaries	Arctic grayling	80
	Early Fall	Mainstem Alatna	Arctic grayling	10
			Other species	50
			Subtotal	140
Koyukuk				
	July	Mainstem Koyukuk	Arctic grayling	10
			Other species	80
	August	Tributaries	Arctic grayling	100

Early fall	Mainstem Koyukuk	Arctic grayling	10
		Other species	40
		Subtotal	240

For Arctic grayling in tributary streams, a preliminary distribution map of radio tags was developed by examining likely habitat from aerial images (Figure 3). This apportionment will likely require minor refinement after initial field inspections and as sampling progresses. The tributary tags will be deployed during July 29–August 10 using four 2-person crews. There are a total of 43 sites, which will require 10 days of favorable weather and water conditions. The sites will be accessed by helicopter; the Koyukuk sites will be based out of Bettles, and the Alatna sites based out of a field camp near the mouth of Malamute Creek. Hook-and-line gear will be used to capture fish. At least three photos of the sampling location with surrounding riparian vegetation will be taken.

Standardized telemetry practices will be employed. For all fish species a radio tag will be surgically implanted using Aqui-S 20E™ for anesthesia and following the basic surgical methods detailed by Brown (2006) and Morris (2003). The transmitters selected for this project are Lotek™ coded tags with motion sensors and will operate for ~14 months. Radio tags will operate on 4 frequencies between 149.500 and 149.999 MHz with individual transmitters digitally coded for identification.

Tracking flights will be conducted using a fixed wing aircraft and a Lotek SRX 600 receiver with an internal GPS that will record time and location data. Over a 14-month period, a minimum of 6 surveys will be conducted and the timing of the flights will coincide with periods before and after major movements to spawning, overwintering, and summer feeding areas. For a given drainage, the flights will occur in late September, mid-November, early March, late May, early June, and early August.

Relative to Objective 4, baited minnow traps will be fished while deploying tributary radio tags to assist in detecting the presence of anadromous juvenile salmon species. Based on the department's anadromous waters catalog, many of the tributaries have not been sampled. Therefore, 2–3 minnow traps baited with cured salmon roe will be set in the stream near the landing zone upon arrival and checked before leaving the area, which will result in approximately 2–4 hours of fishing time. Although the minnow traps will not prove absence, any catches of juvenile will be used to document an anadromous water. If any adult salmon are observed, photos of adult salmon will be taken as evidence as well.

Data collection – Radiotelemetry

For those fish receiving a radio tag, additional data will include their radio tag frequency and code. During each aerial survey, data collected for each fish will include frequency, code, latitude, longitude, and a general description of its location (e.g. approximately 1 km upstream from Malamute Creek).

SAMPLE SIZE

The number of radio tags was determined primarily by funding and what could be reasonably be accomplished in one summer. In the initial study design in 2013 proposed that 500+ radio tags be deployed over a two year period, working in the Alatna drainage during year 1, and in the Koyukuk Drainage during year 2 (2014). However, a delay in funding and an expedited need for the data, both years work have been compressed into one year and concessions relative to sampling effort and radio tags were necessary. It is believed that the current allocation and number of tags across species and the drainages will help to maximize information relative to habitat requirements for species present and needed for mitigation and planning.

DATA ANALYSIS

Fish assembles

Catch data (number of fish and length information) will be summarized by date, section, subsection, gear type, and species. All attendant data, including photos of tributary sampling sites, will be catalogued in the Alaska Fish Resource Monitor database cataloging system as appropriate (http://extra.sf.adfg.state.ak.us/FishResourceMonitor/?mode=awc).

Radiotelemetry

To facilitate data analyses and interpretation, fish implanted with a radio transmitter will be assigned fates at the end of the study. Fish that were known to have died prior to the completion of the tagging period and those that are never located will be removed from the experiment. The fates are as follows:

1. Tagging Mortality (TM) - a fish that dies in response to tag implantation (either within or outside of study area) between tagging and the first aerial survey. Fish with this fate will not be used for calculating proportions.
2. Post-Tagging Mortality (PTM) – a fish that was known to be alive during at least one prior survey, but was judged to be dead at the time of the survey being conducted. Such tags could be located in the water or out of the water away from the river. Fish with this fate will not be used for tracking surveys subsequent to the survey it was known to be dead.

3. Unknown (U) – a fish that is not located during an aerial survey and is never detected again because of tag failure or it migrated too far from the study area to be located again.
4. At large (AL) – A fish that was not located during an aerial survey, but was located again during one or more subsequent surveys. The AL fate is a temporary assignment and is not used during the period it was not located. It is expected that ~10% of fish will not be found in a given survey and is assumed to be a random occurrence.

Fate assignments will be tallied by survey.

Descriptions of seasonal distributions of fish will be presented and summarized by plotting coordinates of all located fish deemed to be alive at the time of the survey onto a digitized map of the drainage using the program ArcGIS®. Variables to be measured include:

1. net distance traveled between tracking events;
2. direction traveled between tracking events;
3. maximum distances traveled between seasonal habitats (i.e. range); and,
4. number of radiotagged fish within 0.5, 1.0, and 2.0 kilometers.

Patterns in transmitter locations will be used to infer fish behavior and habitat use, and aggregations of fish will be used to characterize significant spawning and overwintering habitats. For example, an aggregation of two or more fish, which were tagged in the mainstem, within a 2-kilometer radius in Helpmejack Creek during late May would signify a potential spawning habitat.

SCHEDULE AND DELIVERABLES

Timeline of major project activities.

Date(s)	Sampling Activity
Alatna River	
February 1, 2014	Detailed operational plan completed
April 1–June 15, 2014	Logistical preparations
Early August, 2014	Deploy Arctic grayling radio tags in Alatna tributary section
Late August–mid-September	Sample fish assembles and deploy radio tags (all species) in mainstem Alatna study section
Nov. 2014–Feb. 2015	Aerial tracking surveys of Alatna River fish

Koyukuk River

April 1–June 15, 2014	Logistical preparations
Mid-July, 2014	Sample fish assembles and deploy radio tags (all species) in mainstem Koyukuk study section
Early August, 2014	Deploy Arctic grayling radio tags in Koyukuk tributary section
Late August–mid-September, 2014	Sample fish assembles and deploy radio tags (all species) in mainstem Koyukuk study section
Nov. 2014–Feb. 2015	Aerial tracking surveys of Koyukuk River fish
December 1, 2015	Data analysis completed
April 1, 2016	Final report completed

RESPONSIBILITIES

Matt Albert:	Fisheries Biologist I, serve as project leader, coordinate logistics, data collection, data analysis, draft report.
Klaus Wuttig	Fishery Biologist III; write operational plan, supervise and assist with field preparations, data analysis, and review of final report.
Pat Hansen:	Biometrician IV; review operational plan.
Brian Collyard:	Fish and Wildlife Technician III, assist with field preparations, serve as crew leader during data collection, assist with aerial surveys.
Matt Robinson:	Fish and Wildlife Technician III, assist with field operations.
Rick Queen:	Fish and Wildlife Technician IV, assist with field operations.
Loren St Amand:	Fish and Wildlife Technician III, assist with field operations.
Chad Bear:	Fish and Wildlife Technician III, assist with field operations.
College Intern II:	Vacant
John Burr:	Fisheries Biologist III– Area manager, assist with filed operations.
Matt Evenson:	Research Supervisor, review operational plan

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Morris, W. 2003. Seasonal movements and habitat use of Arctic grayling (Thymallus arcticus), burbot (Lota lota), and broad whitefish (Coregonus nasus) within the Fish Creek drainage of the National Petroleum Reserve-Alaska, 2001-2002. Technical Report No. 03-02, Alaska Department of Natural Resources, Fairbanks.

APPENDIX A

Appendix A1.–Examples of sampling schedule for Koyukuk mainstem during July.

Day	Crew	Area	Task
1			
	1	A	Electrofish, deploy radio tags, set baited hoop traps and minnow traps.
	2	B	Electrofish, set baited hoop traps and minnow traps gear.
	3	A	Sample habitat, assist in radiotag deployment.
2			
	1	A	Pull traps, beach seine, radio tag fish from traps, opportunistically H&L and gill net.
	2	B	Pull traps, beach seine, radio tag fish from traps, opportunistically H&L and gill net.
	3	B	Sample habitat, assist in radio tag deployment, assist in CPUE sampling.
3			
	1	-	Travel to Confluence of North Fork and Middle Fork Koyukuk, fish opportunistically en route or near camp.
	2	-	-same-
	3	-	-same-
4			
	1	F	Electrofish, deploy radio tags, set baited hoop traps and minnow traps.
	2	G	Electrofish, set baited hoop traps and minnow traps gear.
	3	G	Sample habitat, assist in radio tag deployment.
5	1	F	Pull traps, beach seine, radio tag fish from traps, opportunistically H&L and gill net.
	2	G	Pull traps, beach seine, radio tag fish from traps, opportunistically H&L and gill net.
	3	F	Sample habitat, assist in radio tag deployment, assist in CPUE sampling.
6			
	1	E	Electrofish, deploy radio tags, set baited hoop traps and minnow traps.
	2	D	Electrofish, set baited hoop traps and minnow traps.
	3	E	Sample habitat, assist in radio tag deployment.
7	1	E	Pull traps, beach seine, radio tag fish from traps, opportunistically H&L and gill net.
	2	E	Pull traps, beach seine, radio tag fish from traps, opportunistically H&L and gill net.
	3	D	Sample habitat, assist in radio tag deployment, assist in CPUE sampling.
8			
	1	-	Travel to Bettles.
	2	-	-same-
	3	-	-same-

Appendix A2.–Example of crew sampling schedule for mainstem Alatna during early fall 2014.

Day	Crew	Area	Task
1			
	1	F	Electrofish, deploy radio tags, set baited hoop traps and minnow traps.
	2	C	Set hoop and minnow traps, seine, sample habitat.
2			
	1	F	Pull traps, beach seine, radio tag fish from traps, opportunistically H&L and gill net.
	2	C	-same-
3			
	1	E	Electrofish , deploy radio tags.
	2	E	Set hoop and minnow traps, seine, sample habitat.
4			
	1	D	Electrofish, deploy radio tags,
	2	E	Pull traps, beach seine, radio tag fish from traps, opportunistically H&L and gill net.
5			
	1	C	Electrofish, depoly radio tags.
	2	D	Set hoop and minnow traps, seine, sample habitat.
6	1	B	Electrofish, deploy radio tags.
	2	D	Pull traps, beach seine, sample habitat, opportunistically H&L and gill net.
7			
	1	A	Set hoop and minnow traps, seine, sample habitat.
	2	B	Set hoop and minnow traps, seine, sample habitat.
8			
	1	A	Electrofish, deploy radio tags, pull gear.
	2	B	Pull traps, beach seine, sample habitat, opportunistically H&L and gill net.

APPENDIX B

Appendix B1.–Boat electrofishing data collection form.

2014	**Date:**	**Crew:**	**Page #:**
Mainstem	**Section:**	**Subsection:**	**Run #:**
Electrofishing Form	**GPS run start:**	**GPS run end:**	

#	Species	Length	Comment	#	Species	Length	Comment
1				31			
2				32			
3				34			
4				34			
5				35			
6				36			
7				37			
8				38			
9				39			
10				40			
11				41			
12				42			
13				43			
14				44			
15				45			
16				46			
17				47			
18				48			
19				49			
20				50			
21				51			
22				52			
23				53			
24				54			
25				55			
26				56			
27				57			
28				58			
29				59			
30				60			

Appendix B2.–Alatna River sampling data form, 2014. This form includes fish not radiotagged.

2014 Mainstem Sampling form:	**Crew**

Gear:	**River/section/Subsection**	**Lat./Long.**	**Date/ time set:**
	_____		**Date/time pulled:**

Species	Length		Species	Length		Species	Length		Species	Length

Gear:	**River/section/Subsection**	**Lat./Long.**	**Date/ time set:**
	_____		**Date/time pulled:**

Gear:	**River/section/Subsection**	**Lat./Long.**	**Date/ time set:**
	_____		**Date/time pulled:**

Appendix B3.–Data form for radiotagged fish.

Alatna Radiotagging form 2014 **Date _____** **Page #:_____**

Fish #	Section/tributary	Sub section	Lat.	Long.	Length (FL)	Freq / code	Comments
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							