Susitna-Watana Hydroelectric Project
(FERC No. 14241)

Study of Fish Distribution and Abundance in the Upper Susitna River
Study Plan Section 9.5

2014-2015 Study Implementation Report

Prepared for

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by

R2 Resource Consultants, Inc.

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LIST OF ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

Abbreviation	Definition
ADF&G	Alaska Department of Fish and Game
AEA	Alaska Energy Authority
AWC	Anadromous Waters Catalog
BW	Backwater
CIRWG	Cook Inlet Regional Working Group
CPUE	catch-per-unit-effort
CWP	clearwater plume
DIR	direct sample tributary
ELH	early life history
FA	Focus Area
FDA	fish distribution and abundance
FERC	Federal Energy Regulatory Commission
GRTS	generalized random tessellation stratified samples
FL	fork length
ILP	Integrated Licensing Process
in	Inches
IP	Implementation Plan
ISR	Initial Study Report
LR	Lower River
MC	main channel
mm	Millimeters
MR	Middle River
PIT	passive integrated transponder
PRM	Project River Mile
Project	Susitna-Watana Hydroelectric Project
RP	river productivity
RSP	Revised Study Plan
RST	rotary screw trap
SC	side channel
SPD	study plan determination
SS	side slough
TM	tributary mouth
Trib	Tributary
TWG	technical workgroup
US	upland slough
USR	Updated Study Report

1. INTRODUCTION

This Study of Fish Distribution and Abundance in the Upper Susitna River, Section 9.5 of the Revised Study Plan (RSP) approved by the Federal Energy Regulatory Commission (FERC) for the Susitna-Watana Hydroelectric Project, FERC Project No. 14241, focuses on describing the current fish assemblage including spatial and temporal distribution, and relative abundance by species and life stage in the Susitna River upstream of the proposed Watana Dam.

A summary of the development of this study, together with the Alaska Energy Authority's (AEA) implementation of it through the 2013 study season, appears in Part A, Section 1 of the Initial Study Report (ISR) filed with FERC in June 2014. As required under FERC's regulations for the Integrated Licensing Process (ILP), the ISR describes AEA's "overall progress in implementing the study plan and schedule and the data collected, including an explanation of any variance from the study plan and schedule." (18 CFR 5.15(c)(1)).

On October 15, 2014, AEA held an ISR meeting for the Study of Fish Distribution and Abundance in the Upper Susitna River. Since filing the ISR in June 2014 (AEA 2014a), AEA has continued to implement the FERC-approved plan for the Study of Fish Distribution and Abundance in the Upper Susitna River. Study efforts applied to the Study of Fish Distribution and Abundance in the Upper Susitna River subsequent to the ISR include the filing of the following four documents:

- Proposed 2015 Modifications to Fish Distribution and Abundance Study Plan Implementation Technical Memorandum, filed September 17, 2014 (R2 Resource Consultants 2014a);
- Appendix 3. Protocol for Site-Specific Gear Type Selection; Version , filed November 14, 2014 (R2 Resource Consultants 2014b);
- *Draft Chinook and Coho Salmon Identification Protocol*, filed November 14, 2014 (R2 Resource Consultants 2014c);
- Evaluation of 2014 Study Modifications in the Black River Technical Memorandum, filed December 17, 2014 (R2 Resource Consultants2014d).

The 2014 sampling efforts in the Upper River focused on the following steps:

- Completion of the second study year of downstream migrant trapping;
- Completion of the second study year of resident fish radio tagging and tracking;
- Implementation of the tributary sample modification as proposed in Study 9.5 ISR Part C, Section 7.1.2.4, using the Black River as a pilot study per technical memoranda on proposed future sampling modifications (R2 Resource Consultants, 2014a);
- Implementation of the hybrid sampling approach modification proposed in Study 9.5 ISR Part C, Section 7.1.2.5, using habitat mapping to implement a test of this GRTS

sampling approach for off-channel and side channel habitat site selection per the proposed modification technical memorandum (R2 Resource Consultants 2014a);

- Evaluation of the tributary and hybrid sampling approach pilot studies that were implemented in 2014 (R2 Resource Consultants 2014d);
- Fish Distribution and Abundance sampling at sites that were not sampled or partially sampled in 2013 due to land access restrictions.

In furtherance of the next round of ISR meetings and FERC's SPD expected in 2016, this report describes AEA's overall progress in implementing the Study of Fish Distribution and Abundance in the Upper Susitna River during 2014. Rather than a comprehensive reporting of all field work, data collection, and data analysis since the beginning of AEA's study program, this report is intended to supplement and update the information presented in Part A of the ISR for the Study of Fish Distribution and Abundance in the Upper Susitna River through the end of calendar year 2014. It describes the methods and results of the 2014 effort, and includes a discussion of the results achieved.

2. STUDY OBJECTIVES

As established in RSP Section 9.5.1 (Table 2-1), there are eight study objectives, five of which were addressed by activities carried out in 2014:

1) Describe the seasonal distribution, relative abundance (as determined by catch per unit effort [CPUE], fish density, and counts), and fish-habitat associations of resident fishes, juvenile anadromous salmonids, and the freshwater life stages of non-salmon anadromous species.

2) Describe seasonal movements of juvenile salmonids and selected fish species such as Rainbow Trout, Dolly Varden, Humpback Whitefish, Round Whitefish, Northern Pike, Arctic Lamprey, Arctic Grayling and Burbot within the hydrologic zone of influence upstream of the Project.

    a. Document the timing of downstream movement and catch using rotary screw traps.

    b. Describe seasonal movements using biotelemetry (passive integrated transponders [PIT] and radio-tags).

    c. Describe juvenile Chinook Salmon movements.

4) Characterize the seasonal life stage structure, growth, and condition of juvenile anadromous and resident fish by habitat type.

7) Document the seasonal distribution, relative abundance, and habitat associations of invasive species (Lake Trout and Northern Pike).

8) Collect tissue samples to support the Genetic Baseline Study for Selected Fish Species (RSP Section 9.14).

3. STUDY AREA

As established by RSP Section 9.5.3, the study area encompasses the mainstem Susitna River and its tributaries from the proposed Watana Dam site (PRM 187.1) upstream to and including the Oshetna River (PRM 235.1) and its tributary, the Black River (Figure 3-1). The Upper Susitna River is delineated by the location of the proposed Watana Dam because effects of the Project are anticipated to be different upstream and downstream of the proposed dam. The mainstem Susitna River and a portion of its tributaries upstream of the proposed dam will be within the impoundment zone and subject to Project operations that affect daily, seasonal, and annual changes in pool elevation plus the effects of initial reservoir filling. Tributary surveys upstream of the proposed Watana Dam are further delineated by the 3,000-ft elevation contour, which is based on the known extent of juvenile Chinook Salmon distribution. Some study components, such as resident fish life-history studies (e.g., Lake Trout) and juvenile Chinook Salmon distribution sampling may extend beyond the core area.

4. METHODS

This study employed a variety of field methods to build on the existing information related to the distribution and abundance of fish species in the Upper Susitna River consistent with the Study Plan except for specific variances as described below. The following sections provide brief descriptions of study site selection, sampling frequency, the approach, and suite of methods that were used to accomplish each objective of this study.

Fish Distribution and Abundance Sampling Plan

A final sampling scheme was developed as part of the detailed Fish Distribution and Abundance Implementation Plan (IP), for ISR Studies 9.5 and 9.6. Guidance included the Protocol for Site-Specific Gear Type Selection, a working document provided to field crews which summarized the sampling approach used in 2014 (*Appendix 3. Protocol for Site-Specific Gear Type Selection*; Version 5, November 14, 2014). Sampling methods by objective are presented below and in Table 2-1. Brief descriptions of each sampling technique are provided in Section 4.12.

4.1. Study Site Selection

AEA implemented site selection as described in the Study Plan as well as the Study Plan modifications presented in ISR Part C Section 7.1.2, which were further described in two technical memoranda, one on sampling considerations (*Sampling Considerations for Study 9.5 Fish Distribution and Abundance in the Upper Susitna River*; R2 Resource Consultants 2014e). The Upper Susitna River includes the area where the mainstem river will be inundated and tributaries will be partially altered. The sampling effort was tailored to collect information to document fish assemblages, distribution, and abundance generally within the mainstem river and

more intensely within the tributary habitat to be inundated and beyond up to an elevation of 3,000 ft, which was based on the known upper extent of juvenile Chinook Salmon distribution.

4.1.1. Fish Distribution and Abundance Sampling Sites

4.1.1.1. Tributaries

In 2014, five of thirteen tributary streams were selected for sampling in the Upper Susitna River (Figure 4-1; Table 4.1-1). Four tributary streams that were not accessed or were partially accessed in 2013 were sampled using a direct sampling approach. These tributaries included Deadman Creek, Unnamed Tributary 197.7, Unnamed Tributary 204.5, and Unnamed Tributary 206.3 (Table 4.1.2). Two days of sampling effort were applied to each tributary yielding sample lengths of 262-358 meters. The fifth tributary sampled, the Black River, was re-sampled in 2014 using the GRTS approach and modified sampling lengths (R2 Resource Consultants 2014a) as proposed in ISR Part C Section 7.1.2.4. Eight, 400-meter-long GRTS panels were sampled in their entirety for fish distribution and abundance (Table 4.1.3). Additional sampling took place in an unnamed lake in the Tsisi Creek drainage within the Kosina Creek watershed in late August and early September, 2014.

4.1.1.2. Mainstem

Fish distribution and relative abundance sampling in the Upper Susitna River mainstem was conducted to test the proposed hybrid approach modification to the Study Plan, as described in Study 9.5 ISR Part C, Section 7.1.2.5, and in the technical memorandum on sampling considerations (R2 Resource Consultants 2014e). Sampling was conducted from the proposed dam site (PRM 187.1) upstream to the Oshetna River confluence (PRM 235.1). This survey area included Geomorphic Reaches UR-3 (PRM 234.5-224.9), UR-4 (PRM 224.9-208.1), UR-5 (PRM 208.1-203.4), and UR-6 (PRM 203.4-187.1).

The intent of the hybrid approach is to increase sampling of rare habitats in a manner that provides continuity across years and complements the 2013 data set. To do so, rare habitat sample sites were selected using the GRTS approach based on 2013 line mapping in combination with a systematic sub-sampling of 2013 transects (R2 Resource Consultants 2014a). This resulted in selection of three of the 16 transects sampled in 2013 (or 3 of 10 proposed in the modification; Study 9.5 ISR Part C, Section 7.1.2.5) for sampling in 2014 (Table 4.1-4). GRTS site selection of rare mainstem habitats targeted six replicates of side channel, off-channel, and special habitat features.

Implementation of this test design resulted in sampling at 38 macrohabitat locations (Table 4.1-4, Figures A1- A7). In addition to three main channel habitats sampled among transects; replicates of off-channel and side channel habitats were obtained for upland sloughs (6), tributary mouths (7), clearwater plumes (7), side sloughs (6), side channels (6) and backwaters (2). The two backwaters that were sampled were associated with slough samples. Some of the Upper River transects spanned multiple habitat types (e.g., main channel, side channel, upland slough, and side slough); when this occurred, one habitat unit of each type was selected along each transect. When multiple habitat units of the same type were present, one unit was selected at random for sampling.

Main and side channel habitats were sampled with boat electrofishing whenever site conditions and permit stipulations allowed (conductivity, visibility, and absence of adult salmonids). The sampling length for all mainstem habitat units sampled using boat electrofishing and drift gillnetting was equal to 20 times the wetted channel width of the habitat unit, the entire length of the habitat unit, or 500 m (1,640 ft), whichever was less. When site conditions did not allow for boat electrofishing or drift gillnetting, 200 m (328 ft) were sampled using wadeable sampling techniques parallel to the bank. The sampling unit length for off-channel habitat units was 20 times the wetted channel width of the habitat unit, the entire length of the habitat unit, or 200 m (656 ft), whichever was less. If the randomly selected habitat unit was totally inaccessible to field crews, then a second randomly selected habitat unit (GRTS oversample) was sampled.

4.1.2. Rotary Screw Trap Sites

Because of low catch rates at Kosina Creek in 2013, AEA considered alternatives to gather additional information on the seasonal fish movements of anadromous Salmon and resident fish species out of Kosina Creek. In the March 21, 2014 technical team meeting with licensing participants, AEA proposed replacing the rotary screw trap in Kosina Creek with fyke nets near the confluence of Kosina Creek and the Susitna River and siting a rotary screw trap in a mainstem Susitna River location near the proposed dam site. These Study Plan modifications were presented in ISR Part C Section 7.1.2.2 (AEA 2014a).

AEA then implemented these adjustments during 2014 study efforts: setting two fyke nets in lower Kosina Creek and at the associated clear water plume in the Susitna River and operating rotary screw traps at PRM 200.3 on the Susitna River and tributary PRM 0.1 on the Oshetna River (R2 Resource Consultants 2014a). Fyke nets were fished on the same schedule as rotary screw traps (2 days/nights on then three days/nights off).

In 2014, final site selection for Upper River rotary screw traps used the following criteria: 1) position downstream of documented Chinook Salmon; 2) accessibility by helicopter; 3) a minimum depth of 1.25 m (4.1 ft) during low flow periods; and 4) consistent laminar flow with velocities in the range of 0.6 to 2 m/s (2 to 6.6 ft/s). The 2014 Oshetna River trapping location was the same site used successfully in 2013. The 2014 mainstem location at PRM 200.3 was selected after a short list of sites developed using habitat mapping videography upstream of the proposed dam location (PRM 187.1) and downstream of confirmed Chinook Salmon tributaries (PRM 209.1 and 235.1) were visited to assess suitability of conditions. Site selection for fyke nets included the following criteria: 1) position downstream of documented Chinook Salmon in the Kosina Creek drainage near the confluence with the mainstem Susitna River 2) accessibility by helicopter; 3) appropriate depths in the range of 0.5 m (1.6ft) to 1.25 m (4.1 ft); and 4) moderate to low velocity run/glide of pool habitats.

4.1.3. Radio Telemetry Sites and Surveys

In 2014, four fixed radio telemetry stations were installed in the Upper Susitna River per Section 5.8.2.1 of the Final Fish Distribution and Abundance Implementation Plan (IP) filed with FERC on April 1, 2013 (AEA 2013). Stations at the mouths of Kosina Creek (PRM 209.1) and the Oshetna River (PRM 235.1) monitored the movement of radio-tagged fish in the mainstem Susitna River as well as in their respective tributaries with documented Chinook Salmon

spawning. The Watana Creek station (PRM 196.9) was located on the north bank of the Susitna River and monitored the movement of fish in the mainstem of the Susitna River and in Watana Creek, a large accessible tributary within the impoundment zone (Table 4.1-5). An additional station was located at the proposed Watana Dam Site to monitor fish moving upstream or downstream past this location. Aerial tracking of radio-tagged fishes extended into the Lower River down to the mouth of the Susitna River (R2 Resource Consultants 2015) and into the Upper River above Clearwater Creek (PRM 266.6).

4.1.4. Variances from the Study Plan

Several variances occurred in 2014, as described below, some of which were continuations of variances implemented in 2013 (detailed in ISR, Part A, Section 4) or were Study Plan modifications proposed in ISR, Part C, Section 7.1.2 or in the proposed modification TM (R2 Resource Consultants Inc., 2014a).

As was done in 2013 and described in ISR, Part A, Section 4.1.6.1.1 (AEA 2014a), adjustments were made to mainstem sampling unit lengths (500 meters for boat methods and 200 meters for shore-based methods). The level of effort required to effectively cover and gather a representative sample using shore-based techniques including backpack electrofishing, snorkeling, minnow trapping, and seining, was deemed incompatible with the seasonal sampling goals and the number of sites targeted for sampling given the remoteness of the sampling locations. The reduction in sampling length for shore-based techniques is not anticipated to affect AEAs ability to meet study objectives.

In 2013, some tributaries were not sampled or were partially sampled due to land access restrictions. In 2014, these sites were sampled per Section 5.2 of the IP (AEA 2013). Completion of sampling at sites not accessible in 2013 is anticipated to improve AEAs ability to meet study objectives.

The following variances implemented in 2014 were described in ISR Part C Section 7.1.2 as Study Plan modifications, and were further detailed in two technical memoranda filed in 2014, one on sampling considerations (R2 Resource Consultants 2014e) and a second on proposed study modifications (R2 Resource Consultants 2014a). These variances are anticipated to improve AEA's ability to meet the study objectives. Increased sampling of rare mainstem habitats (ISR Part C, Section 7.1.2.5.1; R2 Resource Consultants 2014a) was implemented to better meet the objective of characterizing relative fish abundance by mesohabitat type (RSP Section 9.5.4.3.1 Task C; AEA 2012).

- Increased sampling length in select Upper River tributaries (ISR Part C, Section 7.1.2.4; R2 Resource Consultants 2014a) was proposed and implemented in the Black River to better meet the objective of characterizing relative fish abundance by mesohabitat type (RSP Section 9.5.4.3.1 Task C; AEA 2012).
- The sampling approach for select Upper River tributaries was adjusted and implemented for the Black River from 2013 sub-sampling to entire GRTS panel sampling and increased number of panels, to obtain useful information about habitat associations and increase the number of mesohabitats sampled.

- In 2014, AEA replaced the rotary screw trap in Kosina Creek with fyke netting near the confluence of Kosina Creek to increase catch and operated a rotary screw trap in the mainstem Susitna River location near the proposed dam site (ISR Part C, Section 7.1.2.2; 2014) to better meet the objective of describing seasonal movements (described in Section 5).

The following variance from the Implementation Plan occurred in 2014 as described in the proposed modifications technical memorandum (R2 Resource Consultants 2014a).

- In 2013, four tributaries that were selected for sampling were not sampled or partially sampled due to land access considerations including Deadman Creek and unnamed tributaries 197.7, 204.5, and 206.3. Deadman Creek was proposed as a direct sample tributary and was partially sampled in 2013. After reconnaissance of unnamed tributaries 197.7, 204.5, and 206.3 in 2014, it became clear that the proposed GRTS sampling approach in the Implementation Plan (5.2; Table 5.2-1) was not appropriate because the gradient and forested conditions preclude helicopter landing and access to sample areas in the middle reaches of each of these streams. Thus, the 2014 sampling efforts used a direct sample approach with two days of sampling effort allotted for each of these tributaries targeting a diversity of the mesohabitat types. Stream lengths sampled in 2014 for unnamed tributaries 197.7, 204.5, and 206.3 were less than proposed in the Implementation Plan (5.2, 5.2-2); but exceeded the target lengths proposed in the 2014 technical memorandum on sampling considerations (R2 Resource Consultants 2014e) using an ADF&G sampling sufficiency analysis (Kirsch et al 2014). This variance should not reduce AEAs ability to meet study objectives.

Lake sampling was not proposed as part of the Fish Distribution and Abundance Study Plan. Opportunistic sampling took place in an unnamed lake in the Tsisi Creek drainage August 28-29, 2014. Sampling effort included hoop trapping and angling to target large salmonids based on an anecdotal report. This variance provides supplementary information and is anticipated to improve AEA's ability to meet study objectives.

4.2. Sampling Frequency

Sampling frequency varied among sites based on study objectives. Generally, sampling occurred seasonally during the ice-free period. Fish distribution and abundance sampling was conducted in three seasonal blocks in 2014, early summer (July 11 to July 30), late summer (August 10 to September 5), and fall (September 15 to October 6). During each seasonal sampling event, a portion of mainstem sites were not sampled because habitats were not present (ephemeral features such as clear water plumes), dry, or frozen. In early and late summer, 3 of 36 mainstem locations were not sampled because of dry site conditions. In fall, 11 of 38 sites were not sampled due to low river flows combined with freezing temperatures (Table 4.1-4). Fyke net sampling at Kosina Creek and the installation of rotary screw traps at Susitna River PRM 200.3 and the Oshetna River (RM 0.1) began May 19-20, 2014. Following installation, rotary screw traps and fyke nets were operated on a 48-hours-on/72-hours-off schedule until the Susitna River and Kosina Creek began to freeze-up and the traps were removed on September 28, 2014 (Figure 4.2-1). Stationary radio receivers were installed at the Watana Dam site, Watana Creek, Kosina Creek, and Oshetna River sites between April 28 and July 7 (Table 4.1-5). Fixed radio telemetry

monitoring efficiency was tested on a weekly basis while stations were operable (Table 4.2-2). Aerial radio telemetry surveys were conducted approximately biweekly between January 6 and June 11 (Table 4.2-3), weekly between June 11 and September 15, and continued biweekly thereafter. Flights then occurred approximately every 16 days through June 2015 (Table 4.2-3).

4.2.1. Variances from the Study Plan

Two variances related to sampling frequency of downstream migrant traps (Study 9.5 ISR Part A, Section 4.12.10) and the pilot test of the hybrid approach (Study 9.5 ISR Part C, Section 7.2) occurred in 2014.

- Operation of downstream traps was planned for a 48h on and 72h off continuously from ice out to freeze up (Study 9.5 ISR Part A, Section 4.2). However, a high flow event in early July damaged the Oshetna River rotary screw trap; consequently the trap was not operated July 8-10 and July 12 as scheduled (Figure 4.2-1) while a replacement trap was transported to the site, assembled, and installed. The replacement trap began fishing July 13 (Table 4.2-1). The gap in trap operation occurred after the period when the majority of juvenile Chinook Salmon had out-migrated from Upper River tributaries (May-June). This variance should not reduce AEA's ability to meet study objectives as the Kosina Creek fyke nets and mainstem rotary screw trap at PRM 200.3 were operated as scheduled.

- The tributary sampling modification (Study 9.5 ISR Part C, Section 7.2) called for three seasonal samples during 2014 pilot study. However, one Upper River GRTS panel site, a tributary mouth at PRM 204.5 was inadvertently not sampled during the fall sampling event (Table 4.1-4). Replicates of each mainstem habitat type are sampled on a seasonal basis and the loss of one seasonal sample is not anticipated to reduce AEA's ability to meet the study objective of characterization of seasonal distribution, relative abundance and habitat associations.

4.3. Objective 1: Fish Distribution, Relative Abundance, and Habitat Associations

AEA implemented the methods as described in the Study Plan with the exception of variances explained below (Section 4.3.3). The general sampling approach was to gather data on relative abundance as determined by CPUE and density; complementary data on fish size, life stage, and condition factor were also collected. For all sampling, main channel, off-channel, and tributary habitats were further characterized in the field to the mesohabitat level (pool, riffle, glide, etc.) for sampling purposes and for study of fish-habitat associations. The sampling locations and fish capture methods (e.g., number of passes, amount of soak time, use of block nets when feasible) were standardized such that they were repeatable on subsequent sampling occasions.

4.3.1. Tasks A&B: Fish Distribution and Relative Abundance Surveys

4.3.1.1. Field Methods

Fish distribution surveys included three seasonal sampling events during the ice-free seasons. Methods were selected based on target species, life stages, and water conditions. Snorkeling and

electrofishing were preferred methods for juvenile fishes in clear water areas where velocities were safe. Minnow traps, beach seines, and fyke nets were employed as alternatives in deeper waters and in habitats with limited access, low visibility, or high velocities. For larger fishes, gillnets, seines, hoop traps, and angling were used. Whereas snorkeling, minnow trapping, backpack electrofishing, and beach seines were applicable to sloughs and other slow-moving waters, gillnetting, boat electrofishing, hoop traps, and trot lines were more applicable to the mainstem. Two or more survey methods were selected for each site based on target species and life stages (R2 Resource Consultants 2014b). The decisions about what methods to apply were made by field crews after initial site selection following guidance outlined in the gear selection protocol (R2 Resource Consultants 2014b) and in accordance with state and federal fish sampling permit requirements. All methods were conducted with a level of effort consistent with generating estimates of CPUE that facilitated comparison of counts or densities of fish over space and time. Basic site and habitat information was collected for each mesohabitat sampled and detailed records were kept on the level of sampling effort including soak times, sampling duration, number of units, and specifications of gear used. This included calibration and quality control of methods and documentation of conditions that affected sampling efficiency, such as visibility, water temperature, and conductivity, to ensure that consistent effort was applied within and among sampling units and events. Lake sampling, not anticipated in the implementation plan or gear selection protocol (R2 Resource Consultants 2014b), and supplemental sampling for Lake Trout in an unnamed lake in the Tsisi Creek basin in 2014 included the use of fyke nets set in littoral areas and angling from shore and kayak.

4.3.2. Task C: Fish-Habitat Associations

In conjunction with Tasks A, data was collected for fish distribution and abundance by macro and mesohabitat type.

4.3.3. Variances from Study Plan

4.3.3.1. Sampling Approach

The following variances from the Study Plan in 2014 for Objective 1 were consistent with 2013 variances to Study Plan methods as described in the Study 9.5 ISR, Part A, Section 4.4.4. In summary:

- single pass sampling, limited use of block nets, overnight soak duration for fyke nets and hoop traps, soak times for drift gill net sets were less than 30 minutes; use of one gear type in 3 percent of mesohabitats where additional gears were not appropriate (Study 9.5 ISR Part A, Section 4.4.4.1);
- no sonar techniques were specifically used in the Upper River for FDA (Study 9.5 ISR Part A, Section 4.4.4.2);
- because of the high gradient nature of the Upper River, minnow traps were sometimes placed in pocket water at densities lower than described in the IP (Study 9.5 ISR Part A, Section 4.4.4.1); however, because of increased sampling of lower gradient mainstem sites, densities of 1-2 traps per 10 m (33 ft) of sample length were met in most locations.

These variances did not impact AEAs ability to meet study objectives.

The following variances implemented in 2014 were presented as Study Plan modifications in ISR Part C, Sections 7.1.2.4 and 7.1.2.5, the sampling considerations technical memorandum (R2 Resource Consultants 2014e), and the proposed modifications technical memorandum (R2 Resource Consultants 2014a) except as noted. In 2014, sampling of the Black River varied from the IP. Sampling followed proposed modifications to tributary target lengths based on width measurements. In order to meet adjusted target lengths, two GRTS panels were added to the Black River and the panel length was completely sampled (Table 4.1-2). Sampling of the mainstem in 2014 using a "hybrid" approach was a variance from the IP (IP Section 5.4). This included mainstem sampling of rare habitat features using habitat mapping and a GRTS based approach for site selection (Table 4.1-4). An additional variance in 2014 was the supplemental sampling of three mainstem transects. These variances will improve AEA's ability to meet Objective 1 and result in improved estimates of fish abundance by habitat type while maintaining a spatially balanced and efficient sampling approach for analyzing habitat associations of fishes in the Upper River (R2 Resource Consultants 2014a).

4.4. Objective 2: Seasonal Movements

AEA implemented the methods for Objective 2 as described in the Study Plan with the exception of the variances explained in Section 4.4.4.

4.4.1. Task A: Document the timing of downstream movement and catch for all fish species using out-migrant traps.

As described in Section 4.1.2 and Section 4.2, two rotary screw traps and two fyke nets were deployed in the Upper River study area shortly after ice break-up. In addition to collecting data on migratory timing, size-at-migration, and growth, these traps also served as a source of fish to PIT tag (Objective 2, Task B), a way to recapture previously PIT-tagged fish, collect fish for radio tagging (Objective 2, Task B), and to support other studies including the Genetic Baseline Study for Selected Fish Species (Study 9.14).

4.4.2. Task B: Describe seasonal movements using biotelemetry.

Biotelemetry techniques included radio telemetry and Passive Integrated Transponder (PIT) technology. Half duplex PIT tags (12 and 23 mm [0.5 to 0.9 in]) were surgically implanted in fish greater than 60 mm (2.4 in) to monitor movement and growth. Fish for PIT tagging were captured opportunistically during fish distribution and abundance sampling and out-migrant trapping.

In 2014, AEA PIT tagged 1,466 fish in the Upper River as discussed in Study 9.5 ISR Part C, Section 7.1.2.3. PIT tags were implanted in 6 of 9 target species including: juvenile Chinook Salmon, Arctic Grayling, Burbot, Dolly Varden, Humpback Whitefish, and Round Whitefish (Table 4.5-1). Thus, progress continued towards meeting PIT tagging goals as discussed in Study 9.5 ISR Part C, Section 7.1.2.3 and targets were met in 2014 for Arctic Grayling (Table 4.4-1). Recaptured fish provided information on the time and distance travelled since the fish was last

handled and growth. No Arctic Lamprey, Northern Pike, or Rainbow Trout were observed or collected in the Upper River.

Radio tagging goals (30) were met or exceeded for Arctic Grayling (111), Burbot (40), Longnose Sucker (44) and Round Whitefish (41). Targeted efforts to tag Lake Trout (12) also took place in a headwater lake in the Tsisi Creek drainage (Table 4.4-2). Radio transmitters were surgically implanted in adult fish of sufficient body size distributed temporally and longitudinally in the Upper River to monitor movement patterns. Radio-tagged fish were relocated during aerial surveys with flights approximately every sixteen days and more frequently (weekly) during implementation of the Salmon Escapement Study (Study 9.7) to describe seasonal movements within the hydrologic zone of influence upstream of the Project (Table 4.2-3). Stationary radio receivers were installed and operated at the Watana Dam site, Watana Creek, Kosina Creek, and Oshetna River sites between late April and early November, 2014 (Table 4.1-5). Fixed radio telemetry monitoring efficiency was tested on a weekly basis (Table 4.2-2). Average radio tag life is 450, 652, and 901 days depending on tag size. Summary information for tags at large (Table 4.4-3) indicates the number of fish with valid tags that were actively tracked by month in the Upper River in 2014 and 2015.

4.4.3. Task C: Describe juvenile Chinook Salmon movements.

Juvenile Chinook Salmon movement within the Upper River was described using the rotary screw traps and biotelemetry methods outlined in Objective 2, Tasks A and B. Juvenile Chinook Salmon greater than 60 mm (2.4 in) fork length were evaluated for PIT tagging. Fish deemed to be suitable for tagging based on size and condition were implanted with a PIT tag. Rotary screw traps were also used to document juvenile Chinook Salmon migratory timing and size-at-migration from natal tributaries and in the mainstem Susitna River.

4.4.4. Variances from Study Plan

Several variances related to seasonal movements occurred in 2014, as described below, some of which were continuations of variances implemented in 2013 (detailed in ISR, Part A, Section 4) or resulted from implementation of Study Plan modifications proposed in ISR, Part C, Section 7.1.2 and the proposed modifications TM (R2 Resource Consultants, Inc. 2014a).

The Study Plan provided that up to 1,000 fish per target species would be PIT-tagged in proximity to each PIT interrogation antenna (RSP Section 9.5.4.3.2). In ISR Part C, Section 7.1.2.3.3, AEA proposed to tag up to 2,000 fish across their distribution in the Upper River rather than in proximity to an antenna as a Study Plan modification. In 2014, AEA implemented the proposed Study Plan modification and increased the number of tags implanted in six fish species. This variance improved AEA's ability to meet Objective 2 by increasing the number of total tags deployed. It also capitalized on the fact that field crews were conducting repeat sampling in specific areas and allowed for collection of additional information of local movements through in hand recaptures in those areas sampled in 2014.

The Study Plan proposed implanting 30 radio tags into individuals from nine fish species in the Upper River and indicated the spatial and temporal distribution of tagging would be determined by the availability of target species (IP Section 5.8.1). In 2014, that goal was met or exceeded for 4 species (Arctic Grayling, Round Whitefish, Burbot, and Longnose Sucker) and progress was

made for one more (Lake Trout). These tags provided information on seasonal movements and habitat use of these fish; however, the targets were not met for all species. Consistent with what was reported in the Study 9.5 ISR, Part A, Section 4.5.2, two species were rare (Humpack Whitefish and Lake Trout) in Upper River streams in 2014 and two species were not detected in any of the Upper River sampling (Rainbow Trout and Northern Pike). In addition, while Dolly Varden were reasonably abundant in the Upper River, they were small bodied. Of the approximately 500 Dolly Varden measured during fish distribution and abundance sampling in the Upper River study area, only 3 (6%) of these char met the minimum tagging size of 277 mm with the smallest sized radio tag, indicating the low occurrence of larger bodied char in Upper River streams. This variance will affect AEA's ability to address all species targeted under Objective 2b, but will not detract from AEA's ability to meet the study objective of describing seasonal movements of selected fish species within the zone of hydrologic influence upstream of the Project, as two years of sampling in over 270 habitats indicate these species are not using this area except in very low abundance. Furthermore there is some data available from fish distribution and abundance sampling, downstream migrant trapping and PIT tagging field efforts will help describe the seasonal use of habitats for these species.

In 2014, AEA replaced the rotary screw trap in Kosina Creek with fyke netting near the confluence of Kosina Creek (ISR Part C, Section 7.1.2.2; R2 Resource Consultants, Inc 2014a). This variance was in response to low catch by the trap in Kosina Creek in 2013 and was implemented in an attempt to improve catch of multiple species. As described in the 2014 technical memorandum evaluating proposed modification (R2 Resource Consultants 2014d). The operation of fyke nets in the mouth of Kosina Creek and in the Kosina Creek clear water plume was effective at increasing both the total number of fish caught and the CPUE as compare to the 2013 rotary screw trap. The results of this variance will enhance AEA's ability to meet objective 2, describing seasonal movements in the Upper River.

In 2014, AEA radio tagged most fish in the summer or fall; the time when they are at an energetic maximum and likely to be most resilient to the stresses associated with handling. This was consistent with the variance implement in 2013 (9.5 ISR Part A, Section 4.5.4.2). Tagging fish with tags capable of transmitting for 450-901 days when fish are best able to cope with handling stress will enhance AEA's ability to document seasonal movements and meet study objective 2.

Survey methods for radio-tagged resident fish were modified from the IP (Section 5.8.2.2) to accommodate the high number of frequencies that needed to be scanned for salmon and resident fish. This was consistent with the tracking methods used and 2013 and described as a variance in 9.5 ISR Part A, Section 4.5.4.3. In summary, no manual tracking, directed searching, or identification of habitat type was conducted during the period when adult salmon were being tracked. However, resident tag frequencies were tracked manually during the period when adult salmon tags were not present. This variance in aerial telemetry survey method likely did not have a negative effect on meeting the objectives of the radio-telemetry component of the study because the accuracy of the geographic positions of the tags were sufficient to characterize the seasonal distribution and timing of resident fish. Range testing of the mobile telemetry antenna array demonstrated that all sections of river would be scanned during a survey for each frequency. Further, the increased occurrence of surveys during both periods of when salmon were present and not present (relative to that proposed in the IP), provided a higher likelihood to

detect tags. However, the accuracy (recorded within 300 meters [1000 ft]) may make habitat use inferences less accurate if habitat delineations were smaller than the resolution of the tag positions.

4.5. Objective 4: Characterize the seasonal life stage, growth, and condition of juvenile anadromous and resident fish by habitat type.

AEA implemented the methods for Objective 4 as described in the Study Plan. In conjunction with Objectives 1 and 2, captured fish were identified to species and classified to life stage or smolt index when possible. A summary of fish length-at-maturation for the region was used as a basis for assigning life stages (Table 4.5.1). Each time a gear was used for sampling, a random sample of 25 individuals per species, life stage, and site were measured for fork length (FL) in millimeters and measured in grams. For species without a forked tail (e.g., sculpin and Burbot), total length was measured laterally along the mid-line from the anterior edge of the snout to the posterior edge of the tail. The total sample size of fishes measured for length and weight in 2014 was nearly 6,000 individuals (Table 4.5-2). Recaptured PIT-tagged fish (Objective 2, Task B) provided growth rate information. Parameters recorded in each habitat unit included the number of fish by species and life stage, fork length, weight, global positioning system (GPS) location of sampling unit, length, width, and depths of sampling unit, time of sampling, weather conditions, substrate type, water temperature, dissolved oxygen, conductivity.

4.5.1. Variances from Study Plan

As described in Study 9.5 ISR Part A, Section 4.7.1 and Study 9.5 ISR Part C, Section 7.1.2, the Study Plan stated that each time sampling gear was checked, 25 individuals of each species and life stage were randomly selected to be measured for length and weighed (IP Section 5.1.5). However, the FERC Study Plan Determination interpreted AEA's study plan as proposing measurement of all fish collected. AEA implemented the method consistent with the Study Plan in 2013 and 2014 resulting in a variance that was described in Study 9.5 ISR Part A, Section 4.7.1 and as a study modification proposed in Study 9.5 ISR Part C, Section 7.1.2.7. The sample size of 25 measurements per species per life stage per site was consistent with collecting the data necessary to evaluate length frequency distributions and condition factor for sampled fish and will not affect AEA's ability to meet objective 5 (Study 9.6 ISR Part C, Section 7.1.2.6.3).

The Study Plan called for documenting the seasonal age class structure of fish by habitat type (RSP Section 9.6.4.3.5). However, fish age could not be assigned based on fish length, so AEA proposed the use of seasonal size structure by habitat type instead as described in Study 9.5 ISR Part A, Section 4.7.1.2. Evaluating habitat associations by size instead of age will continue to meet the objective of documenting the seasonal life stage use, growth, and condition of species by habitat type and will not affect AEA's ability to meet objective 5.

4.6. Objective 7: Document the seasonal distribution, relative abundance, and habitat associations of invasive species (Northern Pike).

AEA implemented the methods for Objective 7 as described in the Study Plan with no variances. Northern Pike were likely established in the Susitna River drainage in the 1950s through a series of illegal introductions (Rutz 1999). The proliferation of this predatory species is of concern owing to the negative effect of Northern Pike on salmonids and other species such as stickleback. At this time, Northern Pike have not been documented in the Upper River, so no targeted collection effort for pike was made. However, the presence and habitat associations of Northern Pike have been documented as a component of all fish capture and observation sampling events associated with Objectives 1 and 2.

4.7. Objective 8: Collect tissue samples from juvenile salmon and resident and non-salmon anadromous fish.

AEA implemented the methods for Objective 8 as described in the Study Plan with no variances. In support of the Genetic Baseline Study for Selected Fish Species (ISR Study 9.14) and fish identification protocol (R2 Resource Consultants 2014c), fish tissues were collected opportunistically in conjunction with all fish capture events. The target species, number of samples, and protocols are outlined in the ISR for Study 9.14. Tissue samples included an axillary process from adult salmon, caudal fin clips or mucus swabs from fish greater than 60 mm (2.4 in). Genetics samples were collected from a total of 36 juvenile Chinook Salmon during the 2014 Study Year (Table 4.7-1).

4.8. Fish Sampling Techniques

A combination of gillnetting, electrofishing, angling, minnow trapping, hoop trapping, snorkeling, seining, and fyke netting, and rotary screw trapping techniques were used to sample or observe fish in the Upper River and its tributaries. Techniques selected varied based on habitat characteristics, season, and target species/life stage. All fish sampling and handling techniques described within this study were selected in consultation with state and federal regulatory agencies and sampling has been conducted under state and federal biological collection permits. Limitations on the use of some methods during particular time periods or locations (e.g. no electrofishing when adult salmon are present) played a role in the selection of sampling techniques.

4.8.1. Fish Handling

Fish handling was done as described in the IP (AEA 2013) with the exception of the fish handling variance, measuring a random sample of 25 individuals per species, per life stage, and per gear described in section 4.5.5 of this SIR. This sample size is consistent with collecting the data necessary to evaluate length frequency distribution and condition factor for fish by species, by gear type and macrohabitat and, thus, will be sufficient to meet the study objectives.

4.8.2. Variances from Study Plan

Study efforts in 2014 followed the gear specifications and descriptions of field application outlined in the IP (AEA 2013) with variances described in the Study 9.5 ISR Part A, Section 4.4, and summarized above in Section 4.3.3.1 of this SIR. These variances were incorporated into an updated version of IP Appendix 3, guidance for gear selection (R2 Resource Consultants 2014b). These variances are not anticipated to reduce AEA's ability to meet the study objectives.

5. RESULTS

Analysis of data collected in 2014 is not a component of this Study Implementation Report. Some very general results in terms of counts and observations are presented in this section. Data developed in support of the 2014 SIR is available for download at: http://gis.suhydro.org/SIR/09-Fish_and_Aquatics/9.5-Fish_Dist_and_Abund_Upper_Susitna/

Nearly 9,000 fish were collected and/or observed in the Upper River in 2014 (Table 5-1). Nine species were collected with sculpin being the most abundant fish sampled followed by: Arctic Grayling, Longnose Sucker, Burbot, Round Whitefish, Chinook Salmon, Humpback Whitefish, Dolly Varden, and Lake Trout (Tables 5-1 and 5-2). Among gear types, electrofishing resulted in the highest overall catch; collected seven species; and was particularly effective with sculpin, Longnose Sucker, Arctic Grayling, Burbot, and whitefishes (Table 5-3). Rotary screw traps collected over fourteen hundred fish with large catches of Arctic Grayling, Longnose Sucker, and whitefishes. Eighteen of 36 juvenile Chinook Salmon observations were at rotary screw traps. Fyke netting captured just fewer than one thousand fish, the catch consisting mostly of Arctic Grayling, Longnose Sucker, and sculpin (Table 5-3). Fyke netting collected the second most Chinook Salmon after rotary screw traps. Other gear types caught lesser numbers of fish. Lake Trout were only taken by angling in 2014 (Table 5-3).

5.1. Objective 1: Fish Distribution, Relative Abundance, and Habitat Associations

5.1.1. Task A: Fish Distribution and Relative Abundance Sampling

Table 5-2 describes the species distribution within the Upper River study area, including the mainstem Susitna River geomorphic reaches (UR-3, UR-4, UR-5, and UR-6), tributaries, and lakes, as documented during 2012 through 2014 field studies. Additionally, the table incorporates historic fish distribution information from ADF&G (1981 & 1984), Saunter and Stratton 1983, 1984), Buckwalter (2011), and Kirsch et al. (2014).

Nine fish species are known to inhabit the Upper Susitna River study area. These include one anadromous species, Chinook Salmon, as well as Arctic Grayling, Burbot, Lake Trout, Longnose Sucker, Slimy Sculpin, Humpback Whitefish, and Round Whitefish (Table 5-2). During field surveys sculpin were not always identified to the species level; therefore, they are reported herein as sculpin spp. When sculpin were identified to species, identifications included only Slimy Sculpin. Each of these nine species was documented in the Upper River study area in 2012 (HDR 2013), 2013 (AEA 2014A), and 2014. With the exception of Lake Trout, all species

in the Upper River also have been documented in the Middle River study area (ISR Study 9.6; R2 Resource Consultants 2015).

Overall, the 2014 distribution patterns varied among species, particularly with regard to differences between the mainstem Susitna River and tributary habitats. Only Arctic Grayling and sculpin were widely distributed in both the mainstem river and its tributaries (Table 5-2). Chinook Salmon, Burbot, Longnose Sucker, and Round Whitefish were also widespread in the Susitna River, but their distribution within tributaries was limited primarily to larger streams such as Kosina Creek and the Oshetna River (Table 5-2). Dolly Varden were found almost exclusively in tributary streams, and Lake Trout were found primarily in lakes although small numbers were observed in Watana Creek and the mouth of Watana Creek (Tables 5-1 and 5.2). A more detailed description of Chinook Salmon distribution is provided below in Section 5.1.1.1.

5.1.1.1. Chinook Salmon

In 2014, Chinook Salmon were distributed in the Upper River between the lower reaches of Deadman Creek (PRM 189.4) to the lower reaches of the Oshetna River (PRM 235.1; Table 5-1); Chinook Salmon were not collected or observed in the Black River despite intensive sampling of over 3,600 meters of tributary and off-channel habitats three times (R2 Resource Consultants 2014c; Table 5-1). Increased sampling effort in off-channel habitats and operation of a rotary screw on the mainstem Susitna River facilitated detection of Chinook Salmon juveniles in mainstem reaches (UR-4 through UR-6) and in the lower reaches of several tributaries downstream of the primary spawning tributaries (Table 5-2). Juvenile Chinook Salmon were found in tributary mouth and side channel habitats but not in side sloughs or upland sloughs of the Upper River (Table 5-1). No juvenile Chinook Salmon were observed in the mainstem Susitna River upstream of PRM 210, including reach UR-3 (Table 5-1). One adult Chinook Salmon was observed boat electrofishing the main channel habitat at Transect PRM 209.9, just upstream of Kosina Creek. The fish was rolled but not netted and electrofishing stopped in accordance with the ADF&G Fish Resource Permit.

5.1.1.2. Other Species

Arctic Grayling were widely distributed throughout the mainstem Susitna River (PRM 187.1 to 235.1), tributaries, and lakes. No new occurrences outside of the known range of Arctic Grayling were documented in 2014 (Table 5.2). Burbot were present throughout the mainstem river and in the largest tributary streams including: Deadman Creek, Unnamed Tributary 197.7, Kosina Creek, Jay Creek, and the Oshetna and Black river system (Table 5-1). Dolly Varden were found in very low numbers in a clear water plume in UR-6 and tributaries of varying sizes (Table 5-1). In 2014, Dolly Varden were found in the lower reaches of one tributary stream where they had been previously undocumented, Unnamed Tributary 204.5 (Table 5-2). Although lake sampling is not a specific objective of study 9.5, four lakes in the Upper Susitna River have been found to support Lake Trout (Table 5-2). These lakes include Deadman Lake in the Deadman Basin, an unnamed lake also in the Deadman Basin, Sally Lake in the Watana Basin, and an unnamed lake in the Tsisi Creek basin. Within riverine habitats, small numbers of juvenile Lake Trout have been observed in an unnamed tributary to Watana Creek draining Big Lake and Watana Creek near its mouth (Table 5-2). Longnose suckers were distributed throughout the

mainstem Susitna River geomorphic reaches UR-6, UR-5, UR-4, and UR-3, and in five of the larger tributary streams: Watana Creek, Unnamed Tributary 197.7, Kosina Creek, Goose Creek, and the Oshetna/Black river system (Table 5-2). Whitefishes were distributed throughout the mainstem study area and in tributaries of varying sizes.

5.2. Objective 2: Seasonal Movements

5.2.1. Task A: Document the timing of downstream movement and catch for all fish species using out-migrant traps.

Rotary screw traps (RST) were operated at PRM 200.3 and near the mouth of the Oshetna River (PRM 235.1), while fyke nets were fished near the confluence of Kosina Creek and the Susitna River (PRM 209.1). These traps were used to document seasonal fish movements of anadromous salmon and resident fish species out of these Upper River tributaries and down the mainstem between mid-May and late September (R2 Resource Consultants 2014a). During this period, the Oshetna River RST caught 919 fish, the mainstem RST caught 497 fish, and the Kosina Creek fyke nets 223 fish (Table 5.-1). Juvenile Chinook Salmon, and six species of resident fish including Arctic Grayling, Burbot, Longnose Sucker, sculpin, Humpback Whitefish, and Round Whitefish were collected. The Oshetna River and mainstem RSTs caught seven species, while the Kosina Creek fyke nets tallied six species. Juvenile Chinook Salmon were caught at all locations; the highest catch of fifteen fish was at the mainstem RST at PRM 200.3 followed by Kosina fyke nets (11) and the Oshetna RST (3) (Table 5-1). Most juvenile Chinook Salmon were collected in late May (trapping began May 19) and June at all trapping locations; catches then declined in July, and no Chinook Salmon were collected in August or September. Higher catches in the first six to eight weeks of the trapping season was consistent among locations. Seasonally, catch of other fishes in the Oshetna River trap increased from May (64 fish in six trapping nights) to September (387 fish), driven by increasing numbers of juvenile/adult Arctic Grayling. Catches of Longnose Sucker, the second most abundant species caught in the Oshetna River trap (Table 5-1), were consistent throughout the trapping period. Overall catch at the mainstem RST were highest in July (249 fish) driven by high catch of juvenile Arctic Grayling, Burbot, and whitefishes. Following this July pulse, catch declined and were low in August (44 fish) and September (38 fish). Collection numbers at the Kosina fyke nets followed a similar pattern to the Oshetna River RST, increasing throughout the trapping season. This trend was driven by increased catch of juvenile Arctic Grayling in August (62) and September (52). Catches of juvenile burbot in the Kosina Creek fyke nets remained low and consistent each month.

5.3. Objective 4: Characterize the seasonal life stage, growth, and condition of juvenile anadromous and resident fish by habitat type.

Sampling in 2014 will inform future analysis of growth and condition by habitat for the Updated Study Report. Below are some general findings from 2014.

5.3.1. Juvenile Chinook Salmon

In 2014, juvenile Chinook Salmon measured for fork length in the Upper River ranged from 46 to 114 mm with average and median lengths of 87 and 90.5 mm, respectively (Figure 5- 1). Fish collected in 2014 were generally larger than those collected in 2013; median lengths by year were 90.5 and 61 mm, respectively (Figure 5-1).

5.3.2. Other Species

Juvenile and juvenile/adult Arctic Grayling were most abundant in tributaries (Deadman Creek and Black River), clear water plume, side channel, and side slough habitats (Table 5-1). Adult Arctic Grayling were most abundant at the mouth of the Oshetna River (RST) and the Deadman Creek mouth and clear water plume. Juvenile Burbot were associated with a wide variety of habitat types including tributary (namely the Black River), main channel, side channel, side slough and upland slough (Table 5-1). Dolly Varden were rare in the Upper River study area in 2014, and were only observed in Deadman Creek, the clear water plume of Deadman Creek and Unnamed Tributary 204.5. Lake Trout were documented during opportunistic sampling of an unnmaed lake in the Tsisi Creek basin. Juvenile and juvenile/adult Longnose Sucker were found to be most abundant in side slough habitats (Table 5-1). Juvenile whitefishes were most abundant in side slough and side channel habitats while adults were mostly associated with side channel and main channel habitats.

5.4. Objective 7: Document the seasonal distribution, relative abundance, and habitat associations of invasive species (Northern Pike).

No Northern Pike were collected in the Upper River in 2014 (Table 5-1) or during any sampling to date (Table 5-2).

5.5. Objective 8: Collect tissue samples from juvenile salmon and resident and non-salmon anadromous fish.

Fish tissue samples in the Upper River were collected opportunistically from juvenile salmon and resident fish species in conjunction with all fish capture events in support of the Genetic Baseline Study for Selected Fish Species (Study 9.14). The Genetic Baseline Study for Selected Fish Species Study Implementation Report provides a complete summary of sample collection.

In addition, 228 genetics samples have been collected from juvenile Chinook Salmon in the Upper River including 36 samples during the 2014 study season (Table 5-4). These samples were sent to ADF&G genetics laboratory for species verification. All samples of juvenile salmon from the Upper River have resulted in positive species identifications as Chinook Salmon (Table 5-4).

6. DISCUSSION

The study of Fish Distribution and Abundance in the Upper Susitna River is ongoing. As indicated in Section 4, tasks associated with five study objectives were conducted in 2014. The discussion below includes a summary of key findings in 2014 and an assessment of the adequacy of the data collected in 2014 to meet the study objectives and a summary of proposed modifications. Where applicable, a comparison between 2014 results and previously collected data in the Upper River study area is also provided (R2 Resource Consultants 2014c).

6.1. Juvenile Chinook Salmon

6.1.1. Occurrence in the Upper River

Initial documentation of juvenile Chinook Salmon in the Upper River study area occurred in 2003 when ADF&G collected several individuals from the Oshetna River and Kosina Creek during fish inventories (Buckwalter 2011, Kirsch et al 2014). Since that time, through AEA's licensing efforts, nearly 300 juvenile Chinook Salmon have also been documented in Kosina Creek, Oshetna River, Black River (tributary to the Oshetna River), lower Deadman Creek, lower Unnamed Tributary 197.7, and the mainstem Susitna River reaches UR-4, UR-5, and UR-6 (Buckwalter 2011, AEA 2014a, Kirsch et al. 2014, Table 5-2; Figure 6-1). Based on 2013 and 2014 surveys Kosina Creek and the Black River appear to be the primary rearing areas for the Chinook Salmon in the Upper River (Figure 6-1).

Fish collection effort and juvenile Chinook Salmon catch has been variable between sampling years. In 2012, no juvenile Chinook Salmon were collected in the Upper River despite widespread sampling efforts including Kosina Creek and the Oshetna River (HDR 2013). In 2013, AEA study teams collected 281 juvenile Chinook Salon in three tributaries: the Oshetna River, Black River and Kosina Creek with 70% of the catch from Kosina Creek and 28% from the Black River. In 2014, the Kosina Creek catch was reduced by an order of magnitude, the Oshetna was low but stable, and no juvenile salmon were observed in the Black River despite intensive sampling effort in that tributary (Table 5-1). In addition in 2014, juvenile Chinook were collected in the mainstem Susitna River as well as in two undocumented tributary streams: the lower reaches of Deadman Creek (PRM 189.4) and Unnamed Tributary 197.7 (Table 5-2).It remains unclear whether Deadman Creek and Unnamed Tributary 197.7 are natal tributaries for these fish or whether the fish entered from the mainstem Susitna during their downstream migration.

Results of genetic analysis verified the species field identification for all juvenile Chinook Salmon from the Upper River that were typed from 2012, 2013, and 2014 collections. No other species of juvenile Pacific salmon have been collected in the Upper River or the Middle River above Devils Canyon Impediment 1 (PRM 155.1, R2 Resource Consultants 2015).

6.1.2. Occurrence in the Middle River Within and Above Devils Canyon

In addition to collections in the Upper River study area (above PRM 187.1), since 2003, over 100 juvenile Chinook Salmon have been observed in the Middle River and its tributaries upstream of Devils Canyon Impediment 3 (PRM 164.7, Buckwalter 2011, HDR 2013, AEA

2014a, Kirsch et al. 2014, R2 Resource Consultants 2015). The collections have primarily occurred in Devils Creek, Fog Creek and tributaries, and Tsusena Creek. More than 400 juvenile Chinook Salmon have been collected in Cheechako (PRM 155.9) and Chinook (PRM 160.5) Creeks, tributaries to Devils Canyon between Impediments 1 and 3 (PRM 155.1-164.7; Buckwalter 2011; HDR 2013; AEA 2014A; Kirsch et al 2014; and R2 Resource Consultants 2015). Results of genetic analysis verified the species field identification and all juvenile Chinook Salmon from the Middle River above Impediment 1 (PRM 155.1) that were typed from 2012, 2013, and 2014 collections (R2 Resource Consultants 2015).

6.1.3. Size

Juvenile Chinook Salmon collected in the Upper River from 2003 through 2014 have ranged in size from 38 to 114 mm FL with a median and mean of 63 and 65 mm, respectively (Figure 6-2). The size distribution of juvenile Chinook Salmon in the Upper River has varied by collection year and season (Figure 5-1 and 6-3). In 2003, median length was 68.5 mm, in 2013 61 mm, and in 2014 90.5 mm (Figure 5-1). In late May and June juvenile Chinook Salmon sizes followed a bi-modal distribution with small fish 38-50 mm and larger fish 81-110 mm (Figure 6-3). In July, the majority of fish collected were 41-65 mm, in August 50-75 mm, and September 51-80 mm (Figure 6-3). Juvenile Chinook Salmon collected in tributary streams were smaller (median 60.5 mm FL) than fish collected in tributary mouths or the mainstem Susitna River (87 mm FL) presumably dispersing or out-migrating (Figure 6-4).

The bimodal length-frequency distribution of juvenile fish collected in 2013 and 2014 (Figures 5-1 and 6-2) suggests that two age classes may be present, i.e., a portion of 2013 year class out-migrated in 2013 while other parr reared in the Upper River over the 2013-14 winter and out-migrated as larger 1+ fish. The few numbers of fish less than 70 mm in 2014, may also be indicative of the year-to-year variability in spawning and/or juvenile survival for Upper River Chinook Salmon. This is consistent with adult fish estimates, where 2012 Upper River counts and the number of tagged fish moving into the Upper River were both greater than respective 2013 counts (AEA 2014c).

6.1.4. Timing

In 2013 and 2014, 38 of 52 juvenile Chinook Salmon collected in mainstem Upper Susitna River habitats (including tributary mouths) occurred in late late-May through mid-July, within six to nine weeks of river breakup (Figure 6-5). Similar to the Middle River (AEA 2014A; Schmidt et al. 1985), the primary outmigration period for juvenile Upper River Chinook Salmon appears to be May and June shortly after ice breakup. Collection numbers in mainstem habitats declined each month through the summer and into the fall; only two juvenile Chinook Salmon were collected in September and early October despite intensive sampling and downstream migrant trapping.

6.2. Lake Trout

In 2014 sampling took place in an Unnamed Lake in the Tsisi Creek drainage within the Kosina Creek drainage to follow up on anecdotal accounts of aggregations of large salmonids in this lake. Aerial reconnaissance by field staff confirmed an abundance of large fish in this lake in late

August 2014. Efforts were made to sample these fish in late August and early September using hoop trapping and angling. Thirteen fish were collected in the size range of 372-456 mm fork length; all were confirmed to be Lake Trout (Table 5-1). A portion of these fish received radio tags and their movements were monitored through June 2015 (Table 4.4-2).

6.3. Proposed Additional Sampling Modifications

In 2014, AEA implemented variances proposed as modifications in Section 7.1 of the Initial Study Report (ISR), and a 2014 technical memorandum on sampling considerations (R2 Resource Consultants 2014e). AEA then evaluated the merit of the proposed variances in further addressing study objectives and developed recommendations for further study efforts in a technical memorandum on proposed modifications (R2 Resource Consultants 2014a). A summary of these recommendations follows.

6.3.1. 2014 Pilot Test of Tributary Sampling Approach

Sampling full GRTS panels in the Black River resulted in more mesohabitat units (19 vs 11) and increased sampling length (2,274 m vs 1,050 m). For many species and life stages, the full sampling approach resulted in increased accuracy and precision of relative abundance estimates (R2 Resource Consultants 2014a) and increased replicates of fish counts across habitats, including rarer habitats. This increased replication will better support a full evaluation of fish-habitat associations for the USR.

AEA proposed to adopt the tributary sampling modifications and targets from ISR, Part C, 7.1.2.4, and summarized in Proposed 2015 Modifications to Fish Distribution and Abundance Study Plan Implementation Technical Memorandum (R2 Resource Consultants 2014a). By applying this modified approach, the sampling length in all but one tributary would be maintained or increased beyond that accomplished in 2013 (R2 Resource Consultants 2014a). The sample length for each tributary would be developed for the length of main-channel to be sampled and would be accomplished by sampling the fewest number of GRTS panels possible to accommodate the target length. The use of the GRTS panel process for selection would ensure that survey sites are spatially balanced throughout the tributary. In addition, because the target lengths are based on main channel GRTS panels, the length of tributary off-channel habitat surveyed would be in addition to the length of sample targets, as was evident for the Black River in 2014 (target 3,200 m, total 3,600 m). As the application of this modification in the Black River has shown, this modified approach would allow for inclusion of additional mesohabitat replicates and would improve AEA's ability to discuss fish use of habitats for rare species and habitats in Upper River tributaries.

6.3.2. 2014 Test of the Mainstem Hybrid Sampling Approach

Implementing the hybrid approach as described in the proposed modification TM (R2 Resource Consultants, Inc. 2014a) has been demonstrated to increase both the types of habitat as well as the overall length/area of habitat sampled in the Upper River, and thereby improve AEA's ability to characterize fish-habitat associations in the Upper Susitna River (R2 Resource Consultants 2014a). The hybrid approach allows for the random and spatially balanced (GRTS) selection of rare habitats in the Upper River while maintaining repeated sampling of main channel transect

locations established in 2013. AEA proposes that ten transects be selected for repeat sampling supplemented with GRTS-based selection of off-channel and side channel sampling locations (R2 Resource Consultants 2014a) based on habitat mapping results (Study 9.9).

6.3.3. Downstream Migrant Trap Locations

The mainstem trapping location implemented in 2014 (PRM 200.3) is approximately thirteen river miles upstream of the proposed Watana Dam location. This site provided good hydraulic conditions for downstream migrant trapping, produced good catch numbers, and has a large landing zone for site access. Site reconnaissance prior to the 2014 open water season using habitat mapping videography followed up with site visits in May 2014 identified this location as the best option of very few potential locations in the mainstem above the Watana Dam site.. Fyke netting in the mouth and clear water plume of Kosina Creek in 2014 was more effective than operating a rotary screw trap at tributary PRM 2.2, especially for juvenile Chinook Salmon (Sampling Considerations for Study 9.5 Fish Distribution and Abundance in the Upper Susitna River, March 2014; Table 5-1). Based on data collection in 2014, AEA intend to rely upon rotary screw trap operation at the mouth of the Oshetna River and the PRM 200 mainstem location as well as fyke netting in the mouth and clear water plume of Kosina Creek. This operation would be consistent with the modifications proposed in ISR, Part C, Section 7.1.2.2 and the proposed modification TM (R2 Resource Consultants, Inc, 2014a).

7. CONCLUSION

In 2014, AEA conducted tasks associated with five of the eight study objectives. The radio-telemetry potion of Objective 2b, describing seasonal movements of resident fishes in the Upper River has been completed. Target tagging goals have been met for all target fish species that are present and abundant in the Upper River as determined by fish distribution and sampling in 2013 and 2014 with the exception of Dolly Varden. Dolly Varden are present and abundant in the Upper River but are not large enough for even the smallest radio tags. Northern Pike and Rainbow Trout have not been documented as present in the Upper River. Humpback Whitefish and Lake Trout although present but have been rare in river and stream samples with only 27 and 10 fish observed over two years of surveys. For the four fish species where tags targets have been met or exceeded, the fish have been tracked continuously from July 2, 2013 through July 6, 2015. The tagging data are undergoing analysis.

For all other objectives addressed in 2014, the combination of 2013 and 2014 study efforts including variances (as described in ISR Section 4), and the planned work for the second complete study year including modifications (as described in ISR, Part C, Section 7.1.2 and R2 Resource Consultants 2014a), and the integration with other studies will fully achieve the proposed Study Plan objectives described in Study 9.5 ISR, Part A, Section 2 (AEA 2014a).

In 2014, AEA continued baseline documentation studies of fish distribution and abundance in the Upper Susitna River and collected data that supports study modifications proposed in Study 9.5 ISR Part C Section 7.1.2 (AEA 2014a). The results described in this report demonstrate the successful implementation of a first year of data collection for all Study 9.5 study objectives and two years of data collection for the radio telemetry effort implemented under Objective 2b. This

field work, data collection, data analysis, and reporting for the Study of Fish Distribution and Abundance in the Upper Susitna River demonstrate that AEA is on track to meet all study objectives in the FERC-approved Study Plan.

7.1. Modifications to Study Plan

AEA plans to implement the modification identified in the Study 9.5 ISR Part C, Section 7.1.2. In addition, AEA proposes the following three modifications to the 9.5 Study Plan.

1. Implementation of the variances proposed as tributary sampling modifications and targets from the Initial Study Report 7.1.2.4, as summarized in Proposed 2015 Modifications to Fish Distribution and Abundance Study Plan Implementation Technical Memorandum (R2 Resource Consultants 2014a). *See Supra* Section 6.3.1.
2. Implementation of the hybrid approach to mainstem sampling in the Upper River. *See Supra* Section 6.3.2.
3. Implementation of the direct sampling approach to unnamed tributaries 197.7, 204.5, and 206.3. *See Supra* Section 6.3.3.

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9. TABLES

Table 2-1. Study objectives for the Study of Fish Distribution and Abundance in the Upper Susitna River from the Revised Study Plan.
Note that the Revised Study Plan was succeeded by the Final Susitna River Fish Distribution and Abundance Implementation Plan (March 2013).

Obj	Task	Species/ Life stage	Study Sites	Proposed Methods by Season
1A	Distribution and Relative Abundance	Juvenile salmon, non-salmon anadromous, resident	Representative habitat types	Single pass sampling Selection of methods will be site-specific, species-specific, and life-stage-specific. For juvenile and small fish sampling, electrofishing, snorkeling, seining, fyke nets, angling, DIDSON and video camera where feasible and appropriate. For adults, directed efforts with seines, gill nets, trot lines, and angling. To the extent possible, the selected transects will be standardized and the methods will be repeated during each sampling period at a specific site to evaluate temporal changes in fish distribution. Additional info from radio telemetry studies (Objective #2).
1B	Fish habitat associations	Juvenile salmon, non-salmon anadromous, resident	Representative habitat types	Analysis of data collected under Objective 1: Distribution. Combination of fish presence, distribution, and density by mesohabitat type by season.
2A	Timing of downstream movement and catch using out-migrant traps	All species; juveniles	At selected out-migrant trap & PIT tag array sites	Rotary Screw Traps: Maximum of 2. One near the proposed dam site; one near the mouth of a known Chinook Salmon spawning tributary. Combine with fyke net sampling to identify key site-specific differences. Sampling in mainstem lateral habitats downstream of tributaries with fyke nets, seines, and out-migrant traps
2B	Describe seasonal movements using biotelemetry (PIT and radio-tags)	Multiple species	River-wide aerial tracking surveys	PIT tags: tags opportunistically implanted from a variety of capture techniques. Radio-tags surgically implanted in up to 30 fish of sufficient body size of each species distributed temporally & longitudinally.
2C	Describe juvenile Chinook Salmon movements	Juvenile Chinook Salmon	Representative habitat types	Rotary screw trap in known Chinook spawning tributaries Monthly measurements of fish size/ growth
3	Document life stage, growth, and condition by season	Juvenile anadromous and resident fish	All study sites for Obj 1A	Stock biology measurements – length from captured fish up to 100 individuals per season per species per life stage. Emphasis placed on juvenile Chinook Salmon.

Obj	Task	Species/ Life stage	Study Sites	Proposed Methods by Season
4	Seasonal presence/absence and habitat associations of invasive species	Northern Pike	All study sites	Same methods as #1 and #2 above. The presence of Northern Pike and other invasive fish species will be documented in all samples Additional direct efforts with angling as necessary
5	Collect tissue samples to support the Genetic Baseline Study	All	All study sites in which fish are handled	Opportunistic collections in conjunction with all capture methods listed above. Tissue samples include axillary process from all adult salmon, caudal fin clips from fish >60 mm, and whole fish <60 mm.

Table 4.1-1. Tributaries selected for fish distribution and abundance sampling in the Upper Susitna River.

Tributary	Susitna River Mainstem PRM	Listed in AWC Catalog	Stream Access-ibility	Average Wetted Width[1] (m)	Drainage Basin Area (km^2)	Average Channel Width[2] (m)	GRTS Sampling Unit Size (m)
Oshetna River	235.1	yes	yes	17	1424.5	34	800
Black River	NA	no	yes	14	NA	NA	400
Goose Creek	232.8	yes	yes	10	269.1	12	200
Proposed Reservoir Inundation Zone PRM 232.5							
Jay Creek	211	no	no	8	160.1	14	DIR
Kosina Creek	209.1	yes	partial	33	1036.5	45	800
Tsisi Creek	NA	no	yes	58	NA	NA	400
Unnamed Tributary	206.3	no	unknown	NA	<80.3	NA	DIR
Unnamed Tributary	204.5	no	unknown	NA	<80.3	NA	DIR
Unnamed Tributary	197.7	no	unknown	NA	<80.3	NA	DIR
Watana Creek	196.9	yes	partial	11	452.7	16	400
Watana Creek Tributary	NA	no	yes	NA	NA	13	200
Unnamed Tributary	194.8	no	unknown	NA	321.2	NA	400
Deadman Creek	189.4	no	no	32	453.5	27	DIR
Proposed Watana Dam Site PRM 187.1							

Notes:
1 Data taken from AEA (unpublished 2012 data).
2 Data taken from Saunter and Stratton (1983).
DIR = tributary subject to direct rather than statistical sampling due to accessibility issues.
NA = data not available or applicable

Table 4.1-2. 2013-2014 tributary sampling summary and proposed future Upper River tributary sampling length targets.

GRTS Sampled Tributaries	Drainage Basin Area (km^2)	Chinook salmon presence	GRTS Sampling Unit Size (m)	Number of GRTS Population Sample Units	Number of 2013 Sample Sites	Number of mesohabitats sampled 2013	Meters Sampled 2013	% Sampled 2013	Number of mesohabitats sampled 2014	Main Channel Meters sampled 2014	Average Wetted width (m)	Channel Widths Sampled 2013	Kirsch et al. 2014 target (CW)	Kirsch et al. 2014 target (m)	Kirsch et al. 2014 target (%)	Proposed Change (m)
Oshetna River (PRM 235.1)	1424.5	yes	800	52	13	28	2,604	6%	--	--	36	73	140	5,026	12%	**2,422**
Black River	NA	no	400	24	6	11	1,050	11%	28	3,217	23	46	140	3,178	33%	**2,128**
Goose Creek (PRM 232.8)	269.1	no	200	81	20	38	3,107	19%	--	--	14	219	120	1,704	11%	**-1,403**
Kosina Creek (PRM 209.1)	1036.5	yes	800	24	6	10	1,000	5%	--	--	32	31	120	4,522	24%	**3,522**
Tsisi Creek	NA	no	400	23	6	10	980	11%	--	--	14	69	140	1,988	22%	**1,008**
Watana Creek (PRM 196.9)	452.7	yes	400	60	15	30	2,561	11%	--	--	11	231	140	1,554	6%	**--**
Watana Creek Tributary	NA	no	200	67	13	18	1,459	11%	--	--	10	154	140	1,330	10%	**--**
Unnamed Tributary (PRM 194.8)	321.2	no	400	32	2	4	300	2%	--	--	3	88	140	476	4%	**176**
GRTS Total	**--**	**--**	**--**	**454**	**81**	**149**	**13,061**	**8%**	**28**	**3,217**	**--**	**--**	**--**	**19,778**	**12%**	**7,853**
Direct sample Tributaries																
Jay Creek (PRM 211)	160.1	no	NA	--	NA	8	324	--			14	--	--	--	--	**--**
Unnamed Tributary (PRM 206.3)	<80.3	no	NA	--	NA	--	--	--	3	263	6.9	--	--	--	--	**Direct**
Unnamed Tributary (PRM 204.5)	<80.3	no	NA	--	NA	--	--	--	2	330	4.5	--	--	--	--	**Direct**
Unnamed Tributary (PRM 197.7)	<80.3	no	NA	--	NA	--	--	--	5	358	7.1	--	--	--	--	**Direct**
Deadman Creek (PRM 189.4)	453.5	no	NA	--	NA	--	--	--	5	357	28.4	--	--	--	--	**--**
Direct Sample Total	**--**	**--**	**--**	**--**	**--**	**8**	**324**	**--**	**15**	**1,308**	**--**	**--**	**--**	**--**	**--**	**--**

Table 4.1-3. Back River GRTS tributary habitat classification and mesohabitat sampling, 2013 & 2014.

Year	Macrohabitat	Single Main Channel			Single Main Total	Split Main Channel			Split Main Total	Multi-Split Main Channel			Multi-Split Main Channel Total	Main Channel Total	Tributary[b]		Off-Channel[b]	Grand Total (m)
	Mesohabitat	Boulder riffle	Rapid	Run/Glide		Boulder riffle	Riffle	Run/Glide		Boulder riffle	Riffle	Run/Glide			Run/Glide	Boulder Riffle	Percolation Channel	
2013	Black River: Panel 01			100	**100**									**100**			100	**200**
	Black River: Panel 02										100	100	**200**	**200**			100	**300**
	Black River: Panel 04	100			**100**									**100**				**100**
	Black River: Panel 06					100		150	**250**					**250**				**250**
	Black River: Panel 07	100			**100**									**100**				**100**
	Black River: Panel 09	100			**100**									**100**				**100**
2013 Total[a]		**300**	**-**	**100**	**400**	**100**	**-**	**150**	**250**	**-**	**100**	**100**	**200**	**850**	**-**	**-**	**100**	**1,050**
2014	Black River: Panel 01	104		296	**400**									**400**			127	**527**
	Black River: Panel 02						100	245	**345**		55		**55**	**400**			140	**540**
	Black River: Panel 03	43	282	75	**400**									**400**	51	44		**495**
	Black River: Panel 04		90		**90**			310	**310**					**400**			40	**440**
	Black River: Panel 05									400			**400**	**400**				**400**
	Black River: Panel 06	150		100	**250**	100			**100**			50	**50**	**400**				**400**
	Black River: Panel 07	210	190		**400**			17	**17**					**417**				**417**
	Black River: Panel 09	280			**280**					120			**120**	**400**				**400**
2014 Total		**787**	**562**	**471**	**1,820**	**100**	**100**	**572**	**772**	**520**	**55**	**50**	**625**	**3,217**	**51**	**44**	**127**	**3,619**

[a]: 2013 main channel totals may included parrallel mesohabitats

[b]: when encoutered, tributaries and off-channel habitats were sampled upstream of the confluence for 200 meters or 20x channel widths, whichever was smaller

Table 4.1-4. Sample effort for hybrid mainstem GRTS and transect sampling in the Upper River, 2014.

Site ID	Sample Type	Project River Mile	Mainstem Habitat	Macrohabitat/ Special Mesohabitat	Event 1	Event 2	Event 3	Site Length (m)
Proposed Dam Site PRM 187.1								
FDA-UR6-189.4-68-CWP	GRTS	189.4	Main Channel	Clearwater Plume- Deadman Creek	X	X	X	200
FDA-UR6-189.4-68-TM	GRTS	189.4	Main Channel	Tributary Mouth- Deadman Creek	X	X	X	38
FDA-UR6-193.1-72-CWP	GRTS	193.1	Main Channel	Clearwater Plume- Unnamed Tributary	X	Dry	Dry	16
FDA-UR6-193.1-72-TM	GRTS	193.1	Main Channel	Tributary Mouth- Unnamed Tributary	X	Dry	Dry	14
FDA-UR6-P48-SS	GRTS	194.5	Off-Channel	Side Slough	X	X	Frozen	200
FDA-UR6-P51-SS	GRTS	197.1	Off-Channel	Side Slough	X	X	Frozen	200
FDA-UR6-P51-SS	GRTS	197.1	Off-Channel	Side Slough-Backwater	NP	X	NP	23
FDA-UR6-200.3-SC	Transect	200.3	Main Channel	Side Channel	X	X	X	270
FDA-UR6-200.3-MC	Transect	200.3	Main Channel	Split Main Channel	X	X	X	500
FDA-UR6-P4-SC	GRTS	202.1	Main Channel	Side Channel	X	X	Frozen	200
FDA-UR6-203.4-71-CWP	GRTS	203.4	Main Channel	Clearwater Plume- Unnamed Tributary	X	X	X	91
FDA-UR6-203.4-71-TM	GRTS	203.4	Main Channel	Tributary Mouth- Unnamed Tributary	X	X	X	25
FDA-UR5-204.5-67-CWP	GRTS	204.5	Main Channel	Clearwater Plume- Unnamed Tributary	X	X	X	35
FDA-UR5-204.5-67-TM	GRTS	204.5	Main Channel	Tributary Mouth-Unnamed Tributary	X	X	NS	19
FDA-UR5-P2-SC	GRTS	206.4	Main Channel	Side Channel	X	X	X	500
FDA-UR4-P46-SS	GRTS	208.1	Off-Channel	Side Slough-Backwater	X	X	Frozen	200
FDA-UR4-209-69-CWP	GRTS	209	Main Channel	Clearwater Plume- Kosina Creek	X	X	X	262
FDA-UR4-209-69-TM	GRTS	209	Main Channel	Tributary Mouth- Kosina Creek	X	X	X	50
FDA-UR4-P50-SS	GRTS	209.7	Off-Channel	Side Slough Backwater	X	NP	NP	70
FDA-UR4-P50-SS	GRTS	209.7	Off-Channel	Side Slough	X	X	X	129
FDA-UR4-209.9-MC	Transect	209.9	Main Channel	Single Main Channel	X	X	X	500
FDA-UR4-P47-SS	GRTS	210	Off-Channel	Side Slough	X	X	X	200
FDA-UR4-210.5-93-US	GRTS	210.5	Off-Channel	Upland Slough	X	X	X	160
FDA-UR4-099-US	GRTS	211.2	Off-Channel	Upland Slough	X	X	X	120
FDA-UR4-214-90-US	GRTS	214	Off-Channel	Upland Slough	X	X	X	120
FDA-UR4-214-94-US	GRTS	214	Off-Channel	Upland Slough	X	X	X	120
FDA-UR4-214.4-91-US	GRTS	214.4	Off-Channel	Upland Slough	X	X	X	200
FDA-UR4-098-US	GRTS	214.4	Off-Channel	Upland Slough	X	X	X	160
FDA-UR4-O6-SC	GRTS	215.9	Main Channel	Side Channel	X	X	X	200
FDA-UR4-P49-SS	GRTS	216.9	Off-Channel	Side Slough	X	X	X	145
FDA-UR4-219.9-CWP	Transect	219.9	Main Channel	Clearwater Plume- Unnamed Tributary	X	X	X	112
FDA-UR4-219.9-MC	Transect	219.9	Main Channel	Single Main Channel	X	X	X	500
FDA-UR4-219.9-TM	Transect	219.9	Main Channel	Tributary Mouth- Unnamed Tributary	X	X	Dry	87
FDA-UR4-P10-SC	GRTS	223.5	Main Channel	Side Channel	NS	X	X	200
Proposed Reservoir Inundation Zone at Low Pool 222.5								
FDA-UR3-P1-SC	GRTS	231	Main Channel	Side Channel	X	X	X	200
FDA-UR3-P1-SC	GRTS	231	Main Channel	Side Channel-Backwater	NP	X	NP	66
FDA-UR3-P70-CWP	GRTS	232	Main Channel	Clearwater Plume- Goose Creek	X	X	X	200
FDA-UR3-P70-TM	GRTS	232	Main Channel	Tributary Mouth- Goose Creek	X	X	X	61
Proposed Reservoir Inundation Zone at Maximum Pool 232.5								
Total					**35**	**35**	**27**	**6,304**

Dry: site dewatered not sampled, Frozen: site frozen to substrate not sampled, NP: habitat not present, NS: site not sampled

Table 4.1-5. Operation schedule and antenna orientation for fixed-station receiver locations in the Middle and Upper Susitna River, 2014.Fixed stations receivers were not deployed in 2015.

Station	PRM	Install Date	Removal Date	Antenna Orientation			Rationale
				Antenna 1	Antenna 2	Antenna 3	
Middle River							
Lane Creek	116.8	10-May	3-Oct	Down Susitna	Up Susitna	Across Susitna	Monitor for Curry tagged fish moving downstream; Monitor for Lower River tagged fish moving into Middle River
Gateway	130.1	14-Jun	23-Sep	Down Susitna	Up Susitna		Monitor for Curry tagged fish moving upstream
Indian River	142.1	2-May	28-Oct	Down Susitna	Up Susitna	Up Indian River	Salmon spawning stream
Downstream extent Devils Canyon PRM 153.9							
Cheechako Creek	157.4	13-Jun	9-Oct	Down Susitna	Up Susitna		Monitor site for fish passing above Impediment 1
Chinook Creek	160.5	13-Jun	2-Oct	Down Susitna	Up Susitna		Monitor site for fish passing above Impediment 2
Devils Island	166.9	13-Jun	3-Dec	Down Susitna	Up Susitna		Monitor site for fish passing above Impediment 3
Upper Extent Devils Canyon PRM169.6							
Watana Dam Site	186.8	8-Jul	5-Nov	Down Susitna	Up Susitna		Monitor fish moving past proposed dam site
Proposed Dam Site PRM 187.1/Upper River Boundary							
Watana Creek	196.9	14-Jun	10-Oct	Down Susitna	Up Susitna	Up Watana Creek	Large accessible tributary within impoundment zone
Kosina Creek	209.1	30-Apr	4-Nov	Down Susitna	Up Susitna	Up Kosina Creek	Salmon spawning stream
Watana Reservoir Low Pool 222.5							
Watana Reservoir Full Pool 232.5							
Oshetna River	235.1	20-May	9-Oct	Down Susitna	Up Susitna	Up Oshetna River	Monitor site for fish in mainstem Susitna River and entering Oshetna River

Table 4.2-2. Monitoring efficiency (percent operational) of Upper Susitna fixed-station receivers, by week, 2014. Percentages were calculated as the number of hours of recorded receiver activity divided by the number of hours in the week; "-" = 'not deployed'. Receivers were considered active in a given hour if at least one fish detection, beacon-tag hit, or noise event was recorded during the hour.

Week	Near Watana Dam Site (PRM 186.8)	Watana Creek (PRM 196.9)	Kosina Creek (PRM 209.1)	Oshetna River (PRM 235.1)
4/28 - 5/4	nd	nd	100	nd
5/5 - 5/11	nd	nd	100	nd
5/12 - 5/18	nd	nd	94	nd
5/19 - 5/25	nd	nd	78	100
5/26 - 6/1	nd	nd	100	100
6/2 - 6/8	nd	nd	100	100
6/9 - 6/15	nd	62	100	100
6/16 - 6/22	nd	91	100	100
6/23 - 6/29	nd	24	100	100
6/30 - 7/6	nd	79	100	100
7/7 - 7/13	100	100	100	100
7/14 - 7/20	100	100	100	100
7/21 - 7/27	100	100	100	100
7/28 - 8/3	100	100	100	100
8/4 - 8/10	100	100	100	100
8/11 - 8/17	100	100	100	100
8/18 - 8/24	100	100	100	100
8/25 - 8/31	100	100	100	100
9/1 - 9/7	30	100	100	100
9/8 - 9/14	94	100	100	100
9/15 - 9/21	100	100	100	100
9/22 - 9/28	100	100	100	100
9/29 - 10/5	100	100	100	100
10/6 - 10/12	100	100	100	100
10/13 - 10/19	100	nd	99	nd
10/20 - 10/26	100	nd	100	nd
10/27 - 11/2	39	nd	100	nd
11/3 - 11/9	0	nd	100	nd
2015: fixed station receivers were not deployed				

Light Grey: Low power/dead battery; Grey: Receiver not scanning; Dark Gray: station damaged by wildlife.

Table 4.2-3. Summary of aerial surveys of radio-tagged fish in the Upper Susitna River, 2014-2015 (Table 1 of 2).

Zone Number	201	203	205	207	212	215	222	223	224	225	228	229	232		233	236
Waterbody	Susitna River	Deadman Creek	Susitna River	Unnamed Tributary	Watana Creek	Susitna River	Kosina Creek	Susitna River	Jay Creek	Susitna River	Goose Creek	Susitna River	Oshetna River		Susitna River	Tyone River
Begin	Dam Site PRM 187.1	PRM 189.4	Deadman Creek PRM 189.4	PRM 194.8	PRM 196.9	Wantana Creek PRM 196.9	PRM 209.1	Kosina Creek PRM 209.1	PRM 211	Jay Creek PRM 211	PRM 232.9	Goose Creek PRM 232.9	PRM 235.1		Oshetna River PRM 235.1	PRM 247.3
End	Deadman Creek PRM 189.4		Watana Creek PRM 196.9			Kosina Creek PRM 209.1		Jay Creek PRM 211		Goose Creek PRM 232.9		Oshetna River PRM 235.1			Tyone River PRM 247.3	
Jan-6	H		H		H	H	H	H		H						
Jan-28,29	H	H	H		H	H	H	H		H		H			H	H
Feb-17	H		H		H	H	H	H	H	H	H	H	H		H	H
Mar-18	H	H	H		H	H	H	H	H	H	H	H	H		H	H
Apr-9	H		H		H	H	H	H	H	H	H	H	H		H	H
Apr-30	H		H		H	H	H	H		H	H	H	H		H	H
May-20	H	H	H	H	H	H	H	H	H	H	H	H	H		H	H
Jun-11	H	H	H		H	H	H	H	H	H	H	H	H		H	H
Jun-16	H	H	H		H	H	H	H	H	H	H	H	H			
Jun-21	H	H	H		H	H	H	H	H	H	H	H	H			
Jun-24,25	H	H	H		H	H	H	H	H	H	H	H	H			
Jun-28	H		H		H	H	H									
Jul-10	H	H	H	H	H	H	H	H	H	H	H	H	H			
Jul-14															H[a]	H
Jul-17	H	H	H	H	H	H	H	H	H							
Jul-25	H	H	H		H	H	H	H	H	H	H	H	H			
Aug-1	H	H	H		H	H										
Aug-3	H	H	H		H	H	H	H	H	H	H	H	H			
Aug-6,9,12	H	H	H		H	H	H	H		H	H	H	H		H[b]	
Aug-15	H	H	H	H	H	H	H									
Aug-18	H	H	H		H	H	H									
Aug-21	H	H	H	H	H	H	H	H	H	H	H	H	H			
Aug-30	H	H	H		H	H	H	H	H	H	H	H	H			
Sep-5	H	H	H		H	H	H	H	H	H	H	H	H			
Sep-17	H	H	H	H	H	H	H	H	H	H	H	H	H		H	H
Oct-2	H	H	H		H	H	H	H	H	H	H	H	H		H	H
Oct-14	H	H	H		H	H	H	H	H	H	H	H	H		H	H
Nov-4,5	H	H	H		H	H	H	H	H	H	H	H	H		H	H
Dec-4,5	H		H			H		H		H		H	H		H[b]	H
Dec-16	H		H		H	H	H	H	H	H		H	H		H[b]	H

Reservoir Inundation Zone Full Pool PRM 232.5

H=Helicopter Survey, [a] = Includes survey of Susitna River PRM 247.3 to PRM 266.6 and Clearwater Creek (PRM 266.6), [b] = Includes survey of Susitna River PRM 247.3 to PRM 266.6

Table 4.2-3. Summary of aerial surveys of radio-tagged fish in the Upper Susitna River, 2015 (Table 2 of 2).

Zone Number	201	203	205	207	212	215	222	223	224	225	228	229	232	Reservoir Inundation Zone Full Pool PRM 232.5	233	236
Waterbody	Susitna River	Deadman Creek PRM 189.4	Susitna River	Unnamed Tributary PRM 194.8	Watana Creek PRM 196.9	Susitna River	Kosina Creek PRM 209.1	Susitna River	Jay Creek PRM 211	Susitna River	Goose Creek PRM 232.9	Susitna River	Oshetna River PRM 235.1		Susitna River	Tyone River PRM 247.3
Begin	Dam Site PRM 187.1		Deadman Creek PRM 189.4			Wantana Creek PRM 196.9		Kosina Creek PRM 209.1		Jay Creek PRM 211		Goose Creek PRM 232.9			Oshetna River PRM 235.1	
End	Deadman Creek PRM 189.4		Watana Creek PRM 196.9			Kosina Creek PRM 209.1		Jay Creek PRM 211		Goose Creek PRM 232.9		Oshetna River PRM 235.1			Tyone River PRM 247.3	
Jan-6	H		H		H	H	H	H	H	H		H	H		H	H
Feb-3	H	H	H		H	H	H	H	H	H	H	H	H		H	H
Feb-19	H		H		H	H	H	H	H	H	H	H	H		H	H
Mar-10	H		H		H	H	H	H	H	H	H	H	H		H	H
Mar-25	H		H		H	H	H	H	H	H		H	H		H	H
Apr-14	H		H		H	H	H	H	H	H	H	H	H		H	H
Apr-23	H		H		H	H	H	H	H	H	H	H	H		H	H
May-20	H	H	H		H	H	H	H	H	H	H	H	H		H	H
Jun-4	H		H		H	H	H	H	H	H	H	H	H		H	H
Jun-23	H	H	H	H	H	H	H	H		H	H	H	H		H	H

H=Helicopter Survey

Table 4.4-1. PIT-tagged fish in the Upper Susitna River, 2013-2014.

Study Component	Chinook salmon		Arctic grayling		burbot		Dolly Varden		humpback whitefish		Lake Trout	round whitefish		whitefish, undifferentiated	**implant total**	**recapture (PIT array and in-hand) total**
	implant	recapture	implant	recapture	implant	recapture	implant	recapture	implant	recapture	implant	implant	recapture	implant		
2014 FDA, UP Downstream Migrant Trapping	12	1	443	10	22				1			37		31	**546**	**11**
2014 FDA, UP Seasonal Sampling	1		542	16	308	13	4		3			55		7	**920**	**29**
2014 Upper River Total	**13**	**1**	**985**	**26**	**330**	**13**	**4**		**4**			**92**		**38**	**1,466**	**40**
2013 Upper River Total	**22**		**913**	**35**	**31**	**1**	**109**	**2**	**9**		**1**	**98**	**3**	**21**	**1,204**	**41**
Upper River Total	**35**	**1**	**1,898**	**61**	**361**	**14**	**113**	**2**	**13**	**0**	**1**	**190**	**3**	**59**	**2,670**	**81**

Table 4.4-2. Radio tag allocation by season Upper Susitna River, 2013-2014.

Species	Upper Susitna River					
	May/June	July	August	Sept	Total	Grand Total
Arctic Grayling	53 (0)	0 (31)	0 (1)	0 (26)	53 (58)	111
Burbot	14 (0)	0 (0)	0 (0)	19 (7)	33 (7)	40
Dolly Varden	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
Humpback Whitefish	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
Lake Trout	0 (0)	0 (0)	0 (0)	12 (0)	12 (0)	12
Longnose Sucker	17 (0)	0 (5)	0 (0)	17(5)	34 (10)	44
Northern Pike	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
Rainbow Trout	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
Round Whitefish	7 (0)	0 (0)	0 (0)	16 (18)	23 (18)	41

Format: tags applied in 2014 (tags applied in 2013). No tags were applied in 2015. Tagging during spawning periods conducted at the discretion of the surgeon as based on fish condition.

Table 4.4-3. Radio tag Upper-Susitna-released resident fish at large, by study month, 2014-2015.

Target Species	Jan '14	Feb '14	Mar '14	Apr '14	May '14	Jun '14	Jul '14	Aug '14	Sep '14	Oct '14	Nov '14	Dec '14	Jan '15	Feb '15	Mar '15	Apr '15	May '15	Jun '15
Arctic Grayling	25	23	22	21	17	68	50	43	40	35	31	28	27	23	23	22	20	17
Burbot	5	5	5	4	4	16	14	13	29	25	23	20	20	20	19	19	19	17
Dolly Varden	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Humpback Whitefish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lake Trout	0	0	0	0	0	0	0	0	12	12	12	11	11	11	11	11	11	11
Longnose Sucker	3	3	3	3	3	19	17	15	27	25	22	17	15	15	14	14	13	13
Northern Pike	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rainbow Trout	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Round Whitefish	7	6	5	5	4	11	11	10	25	23	19	18	18	17	16	16	16	16

Table 4.5-1. Summary of size-at-life stage index used to classify Susitna River fish species, 2014.

Species	Life stage			Source
	Juvenile	Juvenile-or-adult	Adult	
Chinook Salmon	alevin, fry, parr, smolt index			
Chum Salmon	alevin, fry, parr, smolt index			
Coho Salmon	alevin, fry, parr, smolt index			
Pink Salmon	alevin, fry, parr, smolt index			
Sockeye Salmon	alevin, fry, parr, smolt index			
Alaska Blackfish	<42	42–113	>113	Kirsch et al. (2014)
Arctic Grayling	<190	190–328	>328	Kirsch et al. (2014)
Arctic Lamprey	<125	125-219	>219	Heard 1966; Docker 2009; Vladykov and Kott 1978
Burbot	<280	280–498	>498	Kirsch et al. (2014)
Dolly Varden	<83	≥83	-	Kirsch et al. (2014)
Eulachon	<165		>165	HDR and LGL (2014)
Longnose Sucker	<188	188–348	>348	Kirsch et al. (2014)
Northern Pike	<330	330–448	>448	Kirsch et al. (2014)
Sculpin (slimy)	<51	51–68	>68	Kirsch et al. (2014)
Threespine Stickleback	<40	40-70	>70	ADFG 1981
Lake Trout	<300	300-430	430	Burr 1993
Rainbow Trout	<200	200-325	>325	Russell 1977, Adams 1999
Bering Cisco	Not Applicable			
Whitefish, Humpback	<280	280–363	>363	Kirsch et al. (2014)
Whitefish, Round	<199	199–318	>318	Kirsch et al. (2014)
Whitefish, Unspecified	<199	199-363	>363	

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Table 4.5-2. Summary of fish with length and weight measurements collected in the Upper Susitna River, 2014.

Study Component	Chinook salmon	Arctic grayling	burbot	Dolly Varden	humpback whitefish	longnose sucker	round whitefish	sculpin, undifferentiated	whitefish, undifferentiated	Grand Total
FDA, UP Downstream Migrant Trapping	16	702	42		5	374	60	31	90	1,320
FDA, UP Seasonal Sampling	4	779	356	5	4	658	187	2,587	12	4,592
2014 Upper River Total	**20**	**1,481**	**398**	**5**	**9**	**1,032**	**247**	**2,618**	**102**	**5,912**

Table 4.7-1. Summary of tissue collection for genetic baseline development and species identification, 2014.

Study Component	Location	Chinook Salmon	Total
FDA, UP Downstream Migrant Trapping	Oshetna River	3	3
FDA, UP Downstream Migrant Trapping	Kosina Creek	10	10
ADF&G Genetics (Study 9.14)	Kosina Creek	1	1
FDA, UP Downstream Migrant Trapping	PRM 200.3	14	14
FDA, UP Seasonal Sampling	PRM 189-206	4	4
FDAL, UP Radio Tagging Catch	PRM 203	4	4
Upper River Total 2014		**36**	**36**

Table 5-1. Upper Susitna fish distribution and abundance observations, 2014. Page 1 of 2

Waterbody	Site ID	Project River Mile	Chinook salmon					Arctic grayling					burbot				Dolly Varden		lake trout	Fish observation-species not available
			fry	parr	smolt	juvenile	adult	juvenile	juvenile/adult	adult	carcass	not recorded	juvenile	juvenile/adult	adult	not recorded	juvenile/adult	not recorded	juvenile/adult	
Proposed Watana Dam Location PRM 187.1																				
Deadman Creek	FDA-UR6-DEA	189		1				8	48	4				4			2			1
Susitna River	FDA-UR6-189-P68-CWP	189						8	46	8	1		1				1			
Susitna River	FDA-UR6-189-P68-TM	189		2		1		7	11	7			2							
Susitna River	FDA-UR6-193-P72-CWP	193											1							
Susitna River	FDA-UR6-193-P72-TM	193																		
Susitna River	FDA-UR6-194-P48-SS	194						14					6							
Unnamed Tributary 197.7	FDA-UR6-197.7	197		1				2	3				6	1		1				
Susitna River	FDA-UR6-197-P51-SS	197						7					12	3	1	1				
Susitna River	FDA-UR6-200.3-SC	200						31	6			5	3		1					2
Susitna River	PRM 200 RST	200		4	11			116	62	8			26							
Susitna River	FDA-UR6-202-P4-SC	202			1			3					6							
Susitna River	FDA-UR6-203-P71-CWP	203						9												
Susitna River	FDA-UR6-203-P71-TM	203											2							
Susitna River	FDA-UR5-204-P67-CWP	204																		
Susitna River	FDA-UR5-204-P67-TM	204																		
Unnamed Tributary 204.5	FDA-UR5-204.5	204															3	1		
Susitna River	FDA-UR5-206-P2-SC	206			1			15	19	1		22	20	4		7				20
Unnamed Tributary 206.3	FDA-UR5-206.3	206																		
Susitna River	FDA-UR4-208-P46-SS	208						17	8	1		2	10							
Susitna River	FDA-UR4-209.9-MC	209					1	17	1			7	4			4				
Susitna River	FDA-UR4-209-P50-SS	209						83					24	2						2
Susitna River	FDA-UR4-209-P69-CWP	209						13	61	3			8							
Susitna River	Kosina Fyke-CWP	209	1	1	7			138	6	1	1		13	1	1					
Susitna River	FDA-UR4-209-P69-TM	209						4	2				1	1						1
Kosina Creek	Kosina Fyke-Trib	209		1	1															1
Tsisi Lake	TSI Lake1	209																	2	
Susitna River	FDA-UR4-210-P47-SS	210						18	1				8							6
Susitna River	FDA-UR4-210-P93-US	210																		
Susitna River	FDA-UR4-211-P99-US	211						6					13							
Susitna River	FDA-UR4-214-P90-US	214											22							
Susitna River	FDA-UR4-214-P91-US	214																		
Susitna River	FDA-UR4-214-P94-US	214						8					15							
Susitna River	FDA-UR4-214-P98-US	214																		
Susitna River	FDA-UR4-215-P6-SC	215						21	3			3	12	1						
Susitna River	FDA-UR4-216-P49-SS	216						17				3	29			5				5
Susitna River	FDA-UR4-219.9-CWP	219						2					3	1						
Susitna River	FDA-UR4-219.9-MC	219						16				2	23	6		9				
Susitna River	FDA-UR4-219.9-TM	219																		
Proposed Reservoir Inundation Zone at Minimum Pool 222.5																				
Susitna River	FDA-UR4-223-P10-SC	223						36				4	3			3				
Susitna River	FDA-UR3-231-P1-SC	231						51	2			12	9			6				5
Susitna River	FDA-UR3-232-P70-CWP	232						7	9	1		1	10			2				
Susitna River	FDA-UR3-232-P70-TM	232						4					1							
Proposed Reservoir Inundation Zone at Maximum Pool 232.5																				
Oshetna River	Oshetna RST	235		1	2			219	245	25	2	1	3	1						
Black River	FDA-BLA-1	235						35	12			1	16	3						2
Black River	FDA-BLA-2	235						39	9	1		10	9			1				1
Black River	FDA-BLA-3	235						40	29	3		3	8	1						
Black River	FDA-BLA-4	235						19	7			8	15			1				
Black River	FDA-BLA-5	235						49	10			21	7	1		3				
Black River	FDA-BLA-6	235						40	7			16	10			3				
Black River	FDA-BLA-7	235						35	8			6	13			4				
Black River	FDA-BLA-9	235						49	7	1		19	9	1		8				2
Total			1	11	23	1	1	1203	622	64	4	146	383	31	3	58	6	1	2	48

Waterbody	Site ID	Project River Mile	longnose sucker					salmonid-unspecified	sculpin-unspecified	whitefish, humpback			whitefish, round				whitefish-unspecified					Total
			juvenile	juvenile/adult	adult	carcass	not recorded			juvenile	juvenile/adult	adult	juvenile	juvenile/adult	adult	not recorded	juvenile	juvenile/adult	adult	carcass	not recorded	
Proposed Watana Dam Location PRM 187.1																						
Deadman Creek	FDA-UR6-DEA	189							39													107
Susitna River	FDA-UR6-189-P68-CWP	189							20				5	2								92
Susitna River	FDA-UR6-189-P68-TM	189							6				2	1								39
Susitna River	FDA-UR6-193-P72-CWP	193																				1
Susitna River	FDA-UR6-193-P72-TM	193																				0
Susitna River	FDA-UR6-194-P48-SS	194	74					3	80				17				3	1				198
Unnamed Tributary 197.7	FDA-UR6-197.7	197	9					1	60													84
Susitna River	FDA-UR6-197-P51-SS	197	153	63	3		1		25				56	1			15	1				342
Susitna River	FDA-UR6-200.3-SC	200	37	5			8	3	106				27	4	2			1			3	244
Susitna River	PRM 200 RST	200	110	3				1	9	3	1		24	6	2		109	2				497
Susitna River	FDA-UR6-202-P4-SC	202	9	1					189				4				1					214
Susitna River	FDA-UR6-203-P71-CWP	203	1						19				1									30
Susitna River	FDA-UR6-203-P71-TM	203							5													7
Susitna River	FDA-UR5-204-P67-CWP	204							16						1			2				19
Susitna River	FDA-UR5-204-P67-TM	204							2													2
Unnamed Tributary 204.5	FDA-UR5-204.5	204						1														5
Susitna River	FDA-UR5-206-P2-SC	206		2			3	2	103		1	1	10	4	8		2				19	264
Unnamed Tributary 206.3	FDA-UR5-206.3	206																				0
Susitna River	FDA-UR4-208-P46-SS	208	60						36	1	1		1		1						3	141
Susitna River	FDA-UR4-209.9-MC	209	3	1				1	60				23	3		2	2				11	140
Susitna River	FDA-UR4-209-P50-SS	209	90	2			1		116				12				1	1				334
Susitna River	FDA-UR4-209-P69-CWP	209							107				1									193
Susitna River	Kosina Fyke-CWP	209	27	1					11				10				1					220
Susitna River	FDA-UR4-209-P69-TM	209							21													30
Kosina Creek	Kosina Fyke-Trib	209																				3
Tsisi Lake	TSI Lake1	209																				2
Susitna River	FDA-UR4-210-P47-SS	210	183	1			3		70				15				7					312
Susitna River	FDA-UR4-210-P93-US	210																				0
Susitna River	FDA-UR4-211-P99-US	211	17						53													89
Susitna River	FDA-UR4-214-P90-US	214	21																			43
Susitna River	FDA-UR4-214-P91-US	214																				0
Susitna River	FDA-UR4-214-P94-US	214	102			4																129
Susitna River	FDA-UR4-214-P98-US	214																				0
Susitna River	FDA-UR4-215-P6-SC	215	5					6	41					1			1					94
Susitna River	FDA-UR4-216-P49-SS	216	416				26		24				1									526
Susitna River	FDA-UR4-219.9-CWP	219							49													55
Susitna River	FDA-UR4-219.9-MC	219	5				1	2	36				2					1		1	4	108
Susitna River	FDA-UR4-219.9-TM	219																				0
Proposed Reservoir Inundation Zone at Minimum Pool 222.5																						
Susitna River	FDA-UR4-223-P10-SC	223	4					1	11				1									63
Susitna River	FDA-UR3-231-P1-SC	231	8	1					30				1									125
Susitna River	FDA-UR3-232-P70-CWP	232	1						17													48
Susitna River	FDA-UR3-232-P70-TM	232							29													34
Proposed Reservoir Inundation Zone at Maximum Pool 232.5																						
Oshetna River	Oshetna RST	235	343	23	6				15		1		3	12	9			6	2			919
Black River	FDA-BLA-1	235			1			2	492													564
Black River	FDA-BLA-2	235						2	413					1								486
Black River	FDA-BLA-3	235						1	360													445
Black River	FDA-BLA-4	235							217									1				268
Black River	FDA-BLA-5	235						1	290									1				383
Black River	FDA-BLA-6	235						4	352													432
Black River	FDA-BLA-7	235							166													232
Black River	FDA-BLA-9	235						4	300					1	1							402
Total			1678	103	10	4	43	35	3995	4	4	1	216	36	24	2	142	17	2	1	40	8965

Table 5-2. Fish Distribution in the Upper Susitna River 2012--2014 and select historical records.

Location	Poject River Mile	Drainage Basin Size (km^2)	Chinook salmon (juvenile)	Arctic grayling	Burbot	Dolly Varden	Lake trout	Longnose sucker	Sculpin	Whitefish, humpback	Whitefish, round	Whitefish, unspecified
Susita River Devils Canyon to Watana Dam 2013	166.1-187.1		X	X	X	X		X	X		X	X
Proposed Watana Dam Location PRM 187.1												
Susitna River UR-6	187.1-203.4		X	X	X	◊	◊	X	X	X	X	◊
Susitna River UR-5	203.4-208.1		◊	X	X			X	X	◊	X	◊
Susitna River UR-4	208.1-224.9		◊	X	X			X	X	◊	X	◊
Susitna River UR-3	224.9-234.5			X	X			X	X		X	
Watana Reservoir at Full Pool PRM 232.5												
Susitna River above Oshetna	>234.5			X								
Aerial Mainstem - Dam site to Oshetna	N/A			X				X				
Deadman Creek	189.4	453.5	◊	X, □	◊, □	◊, □		□	X			
Unnamed Tributary 194.8	194.8	321.2		X		X			X			
Watana Creek	196.9	452.7		X, O	□	X, O	◊	X, □	X, O		X, O	
Watana Creek Tributary: Unnamed L1	N/A			X					X			
Watana Creek Tributary: Unnamed L3	N/A								X			
Watana Creek Tributary: Unnamed R3	N/A			X					X			
Watana Creek Tributary: Unnamed R5	N/A			X			X		X		X	
Unnamed Tributary 197.7	197.7	<80.3	◊	X	◊			◊	X			
Unnamed Tributary 198.4	198.4					X						
Unnamed Tributary 203.4	203.4			X					X			
Unnamed Tributary 204.5						◊						
Unnamed Tributary 206.3	206.3	<80.3							X			
Kosina Creek	209.1	1036.5	X, O	X	X, □	X, O		X, □	X, O	X, O	X	X
Kosina Creek Tributary: Tsisi Creek	N/A			X					X		X	X
Kosina Creek Tributary: Gilbert Creek	N/A			X					X, O			
Kosina Creek Tributary: Unnamed	N/A								X			
Jay Creek	211	106.1		X, O	X, □	X, □		□	X		□	
Goose Creek	232.8	269.1		X, O	□			X	X, O		X	
Oshetna River	235.1	1424.5	X, O	X, O	X			X	X	X	X	X
Oshetna River Tributary: Black River	N/A		X	X	X, □	O		X, O	X, O		X, O	
Tyone River	247.3							X				
Clearwater Creek	266.6			X								
Deadman Basin Lake: Deadman Lake	N/A			□	□	□	X, □			□	□	
Deadman Basin Lake: Unnamed Lake	N/A						X					
Watana Basin Lake: Sally Lake	196.9			X, □			X, □		X, □			
Kosina Basin Lake: Tsisi Lake	N/A			X			◊					

X: Fish Distribution and Abudance 2012-2013 ◊: Fish Distribution and Abudance 2014

□: ADF&G 1981, 1983a, 1984

O: Buckwalter 2011

Table 5-3. Upper Susitna River fish observations by gear type, 2014.

Gear Type	Chinook Salmon	Arctic Grayling	Burbot	Dolly Varden	Fish, No Species Recorded	Lake Trout	Longnose Sucker	Salmonid	Sculpin	Whitefish, Humpback	Whitefish, Round	Whitefish, Undifferentiated	**Grand Total**
Angle		60				2							**62**
Backpack Electrofish	2	434	235	2			757		2,569		104	16	**4,119**
Boat Electrofish		36	2				3			2	22		**65**
Dip Net	1	1	1										**3**
Fyke Net- Kosina	11	146	15		1		28		11		10	1	**223**
Fyke Net- FDA		192	72				210		227		25	4	**730**
Gill Net, Drift													**0**
Hoop Trap		14	11				8		6		1	2	**42**
Minnow Trap	1	6	37	1			31		121		2		**199**
Rotary Screw Trap	18	679	30				485		24	5	56	119	**1,416**
Seine		60	4				138		20	2	45	8	**277**
Snorkel	2	216	4	3	6		80	1	20		10	7	**349**
Visual Observation	2	195	65	1	41		98	33	997		3	45	**1,480**
Grand Total	**37**	**2,039**	**476**	**7**	**48**	**2**	**1,838**	**34**	**3,995**	**9**	**278**	**202**	**8,965**

Table 5-4. Summary of results for juvenile Chinook Salmon samples collected for genetic baseline development and species identification, 2013-2014.

Year	Hydrologic Segment	Upper River		
	Species	Chinook Salmon		
		# Samples	# Extracted	Field Identification (% Correct)
2013		192	192	100%
2014		36	36	100%
Total		228	228	100%

10. FIGURES

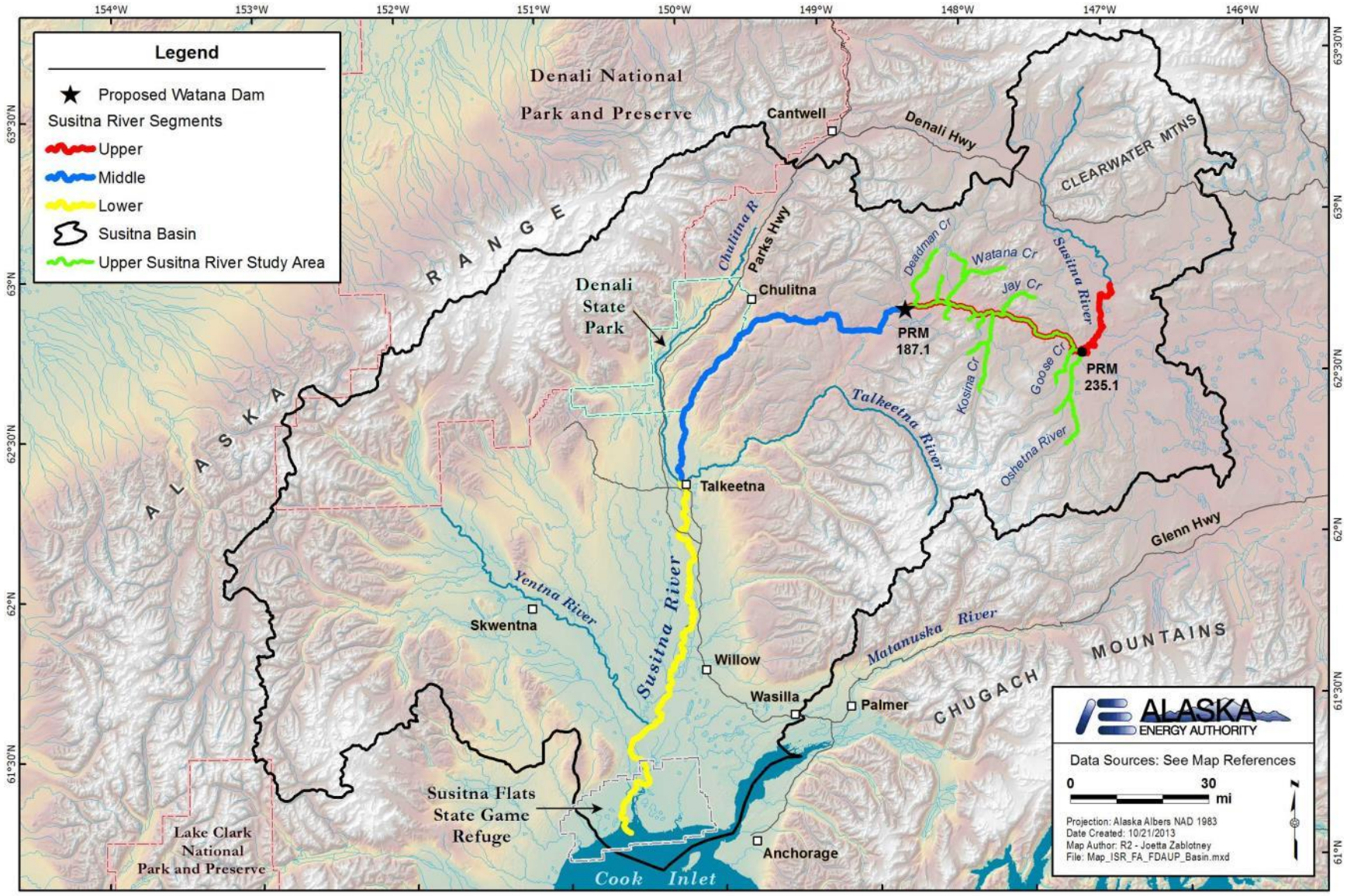

Figure 3-1. Upper Susitna River fish distribution and abundance study area.

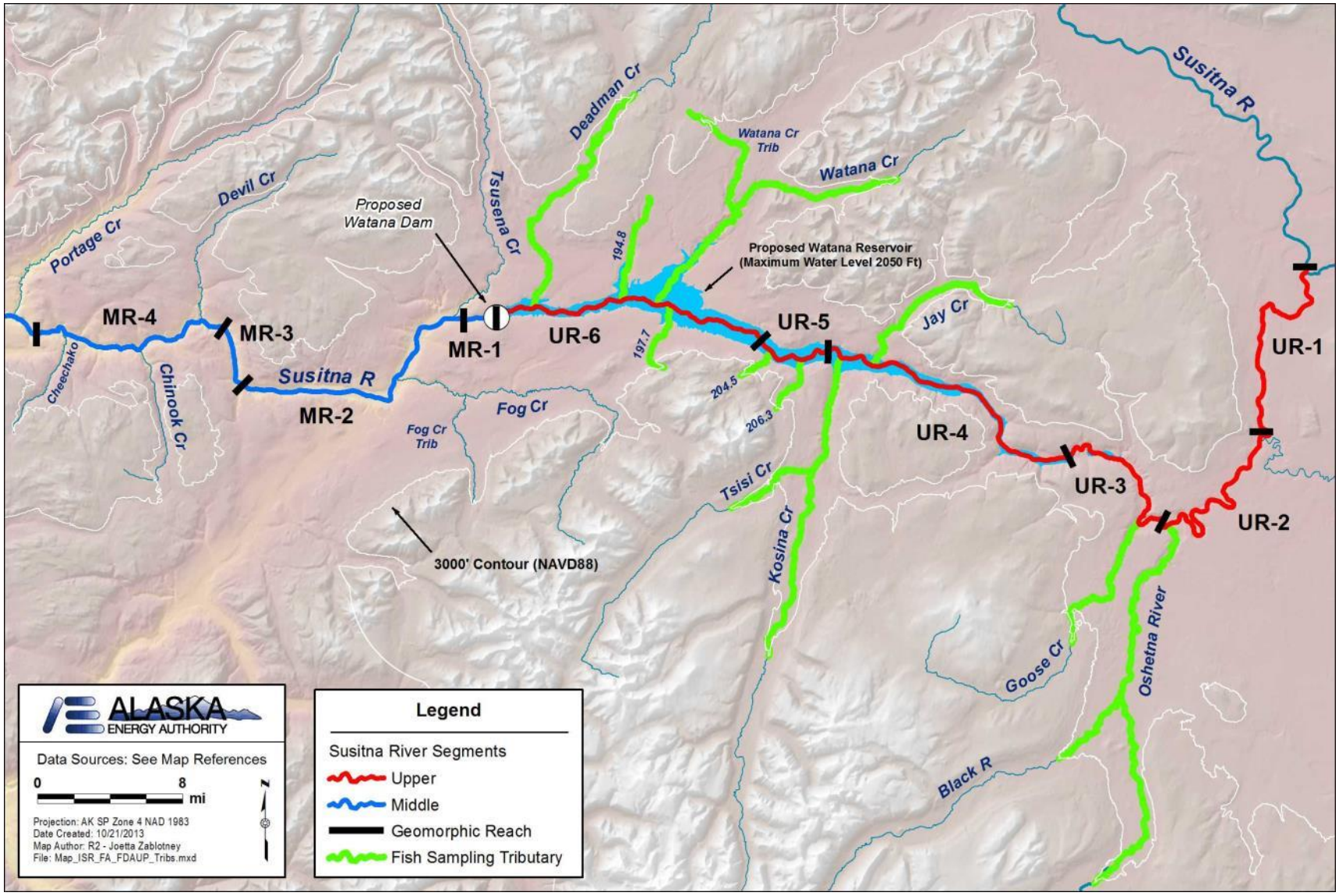

Figure 4-1. Locations of 13 tributaries upstream of the proposed Watana Dam location selected for sampling up to the 3,000 ft contour.

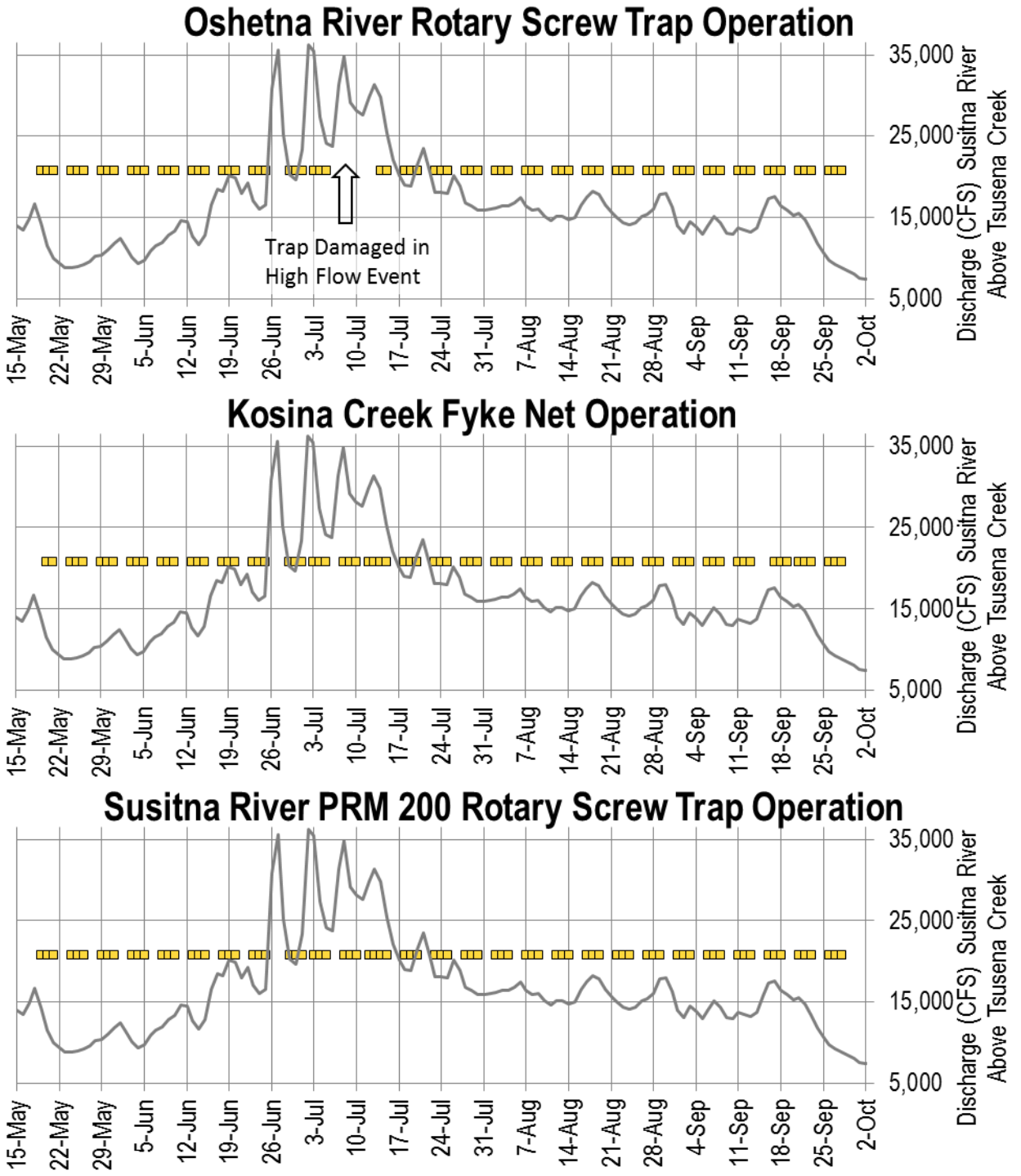

Figure 4.2-1. Downstream migrant trapping operation schedule for rotary screw traps at Oshetna River RM 0.1, Susitna River at PRM 200.3, and Kosina Creek fyke netting, 2014. Yellow boxes indicate trap operation days.

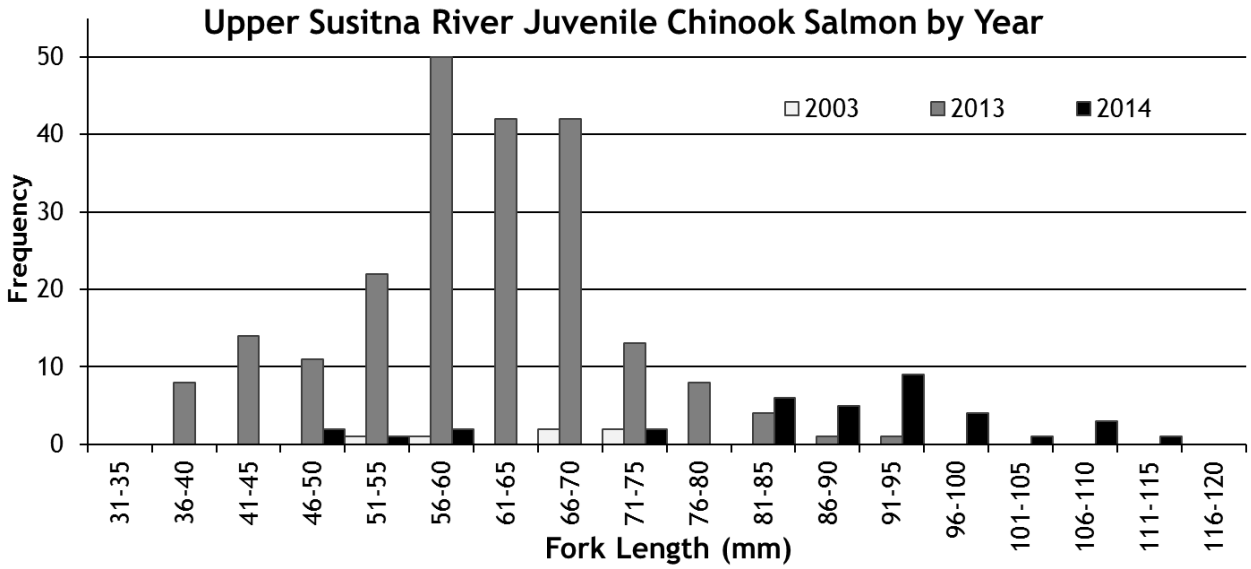

Figure 5-1. Juvenile Chinook Salmon length-frequency distribution by survey year in the Upper Susitna River, 2003-2014(Buckwalter 2011; AEA 2014A; Kirsch et al 2014; Table 5-1).

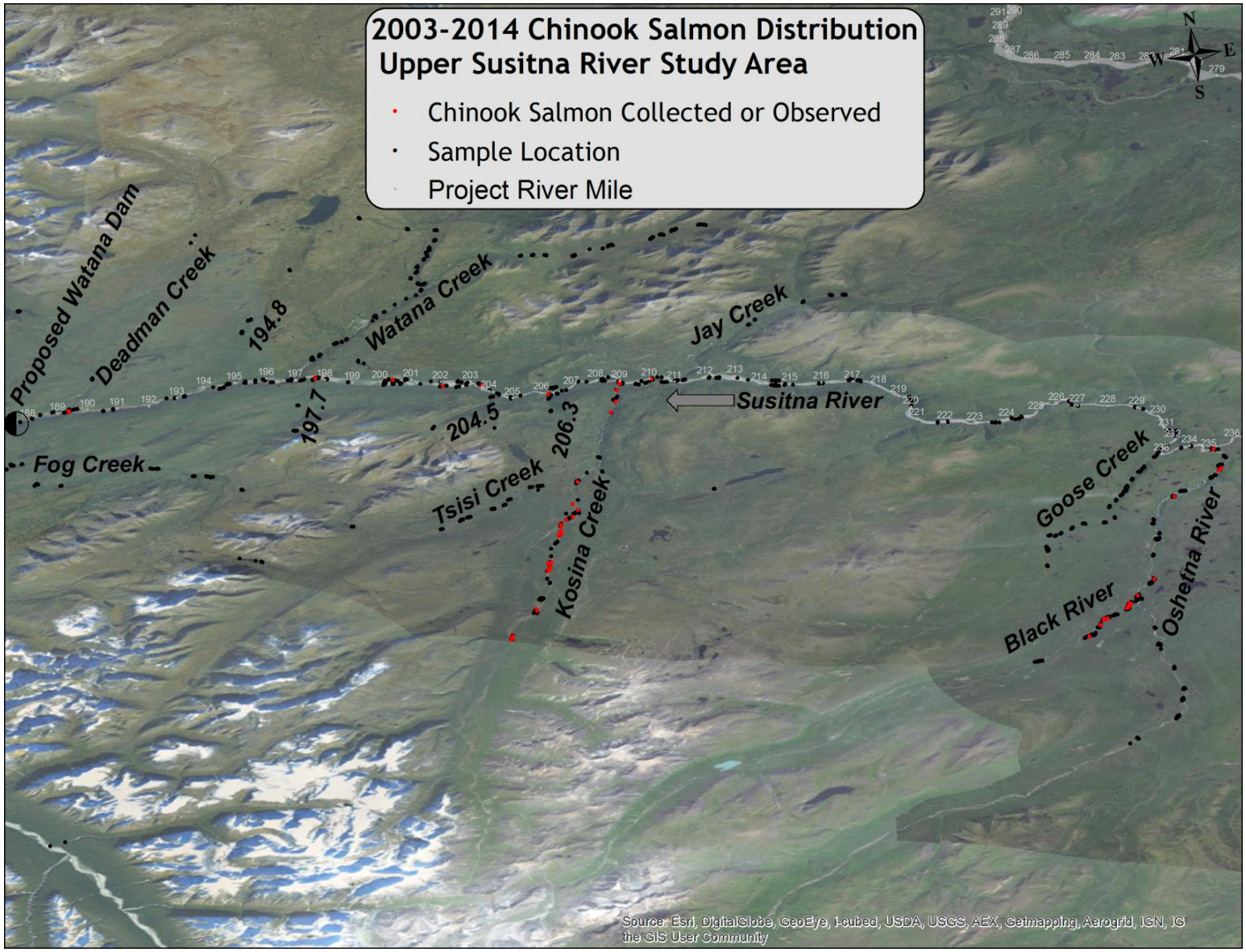

Figure 6-1. Juvenile Chinook Salmon distribution in the Upper Susitna River, 2003-2014 (Buckwalter 2011; AEA 2014A; Kirsch et al 2014;Table 5-1).

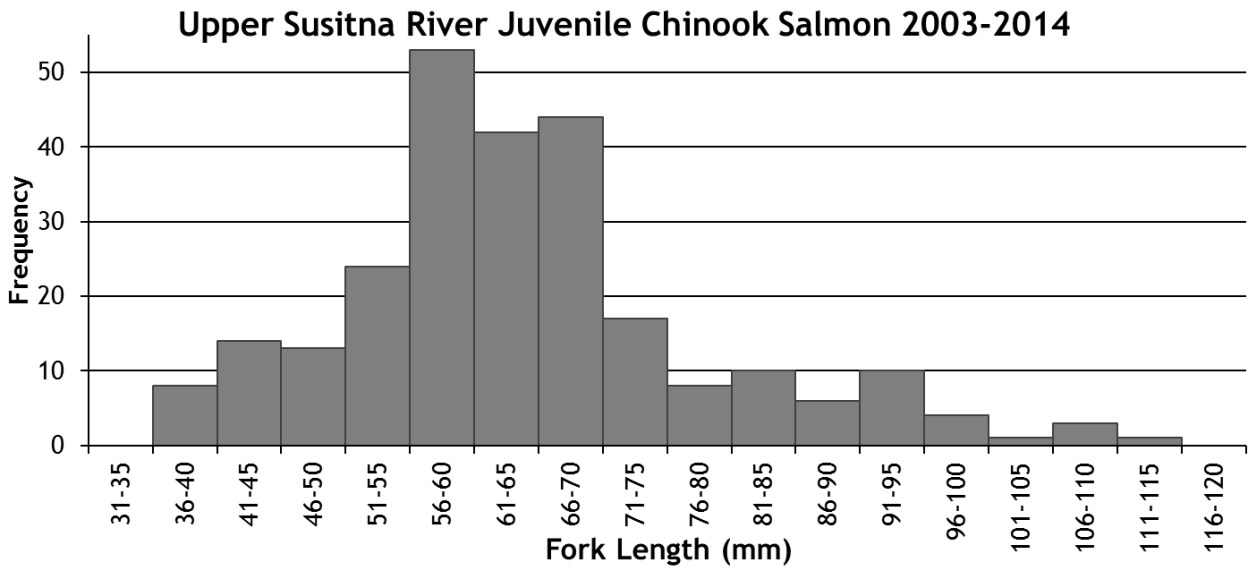

Figure 6-2. Juvenile Chinook Salmon length-frequency distribution in the Upper Susitna River, 2003-2014 (Buckwalter 2011; AEA 2014A; Kirsch et al 2014; Table 5-1).

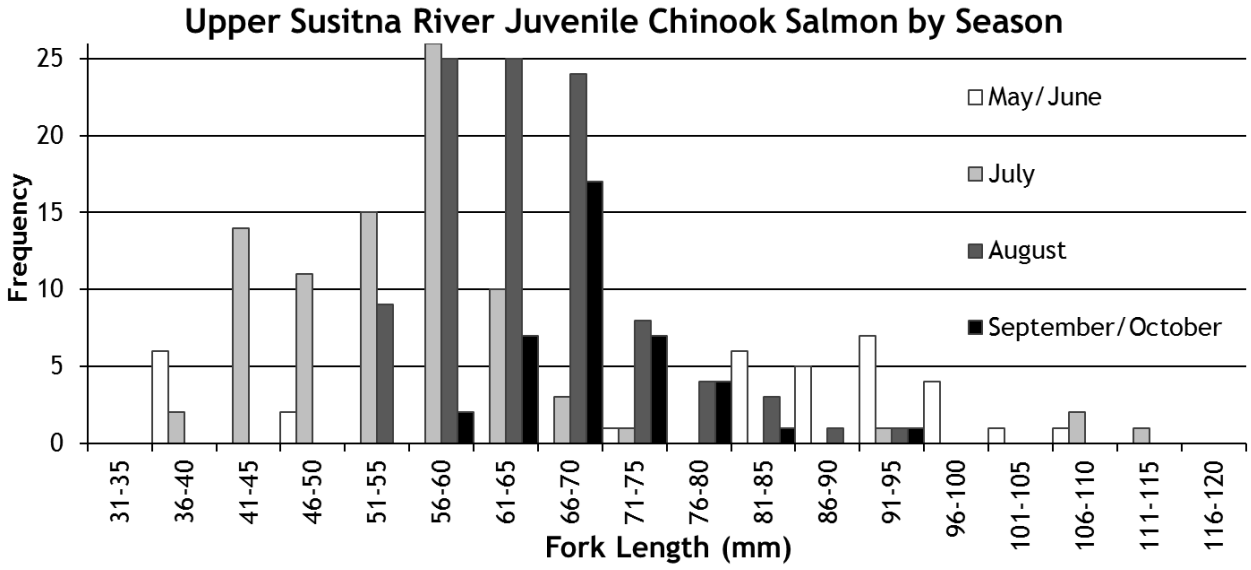

Figure 6-3. Juvenile Chinook Salmon length-frequency distribution by season Upper Susitna River, 2003-2014 (Buckwalter 2011; AEA 2014A; Kirsch et al 2014; Table 5-1).

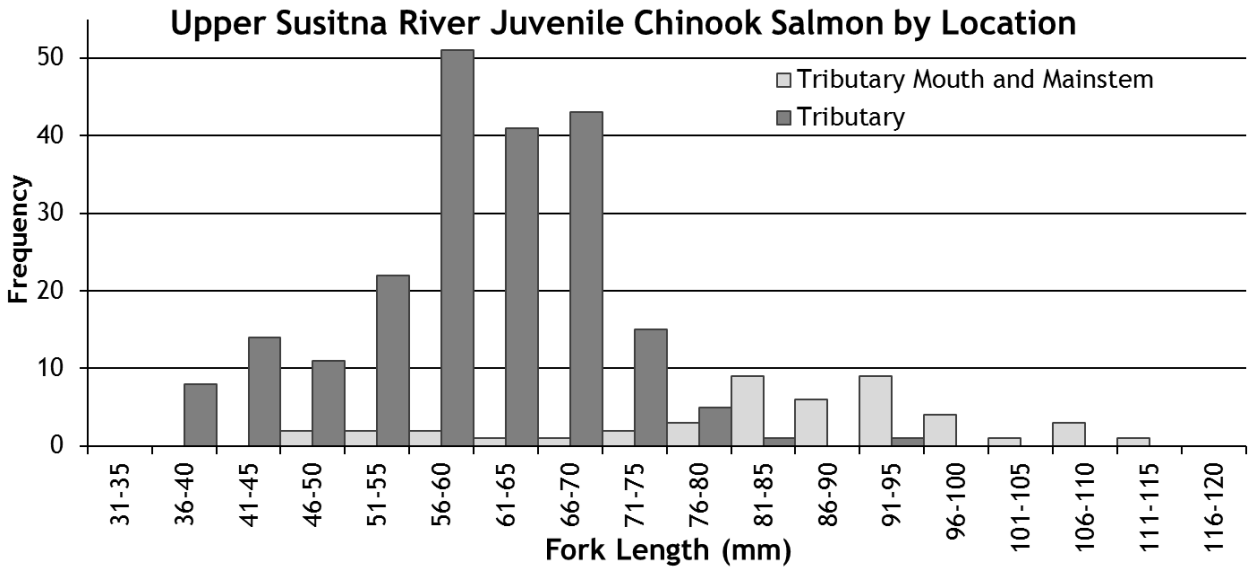

Figure 6-4. Juvenile Chinook Salmon length-frequency distribution by location Upper Susitna River, 2003-2014 (Buckwalter 2011; AEA 2014A; Kirsch et al 2014; Table 5-1).

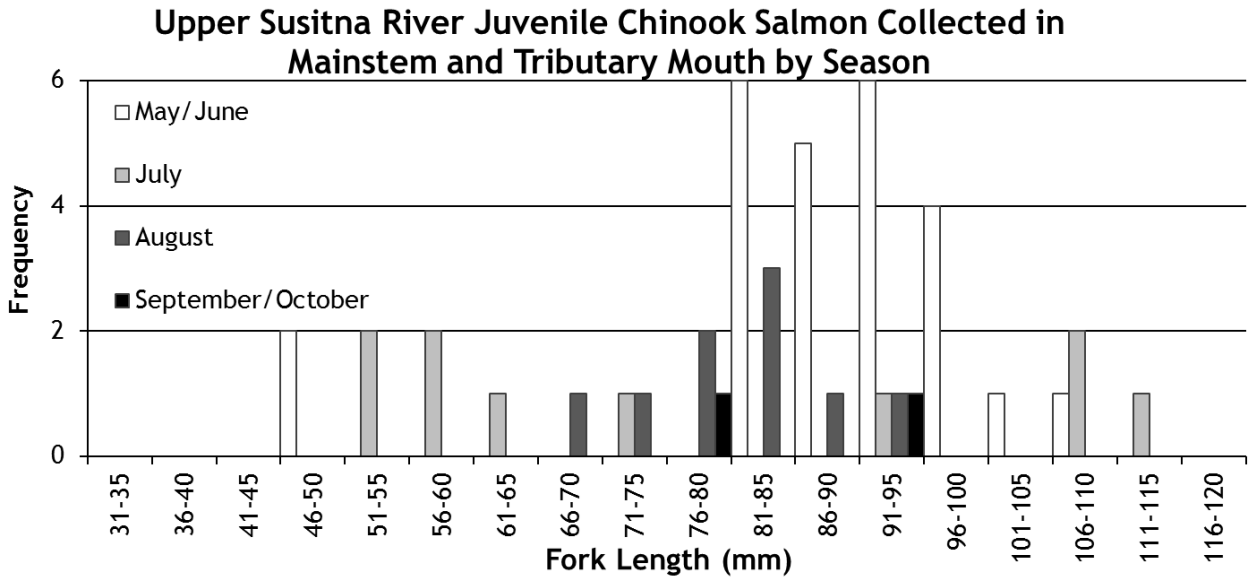

Figure 6-5. Juvenile Chinook Salmon length-frequency distribution season for fish collect in tributary mouths or the mainstem Upper Susitna River, 2003-2014 (Buckwalter 2011; AEA 2014A; Kirsch et al 2014; Table 5-1).

APPENDIX A: 2014 SAMPLING SITE MAPS

TABLE OF FIGURES

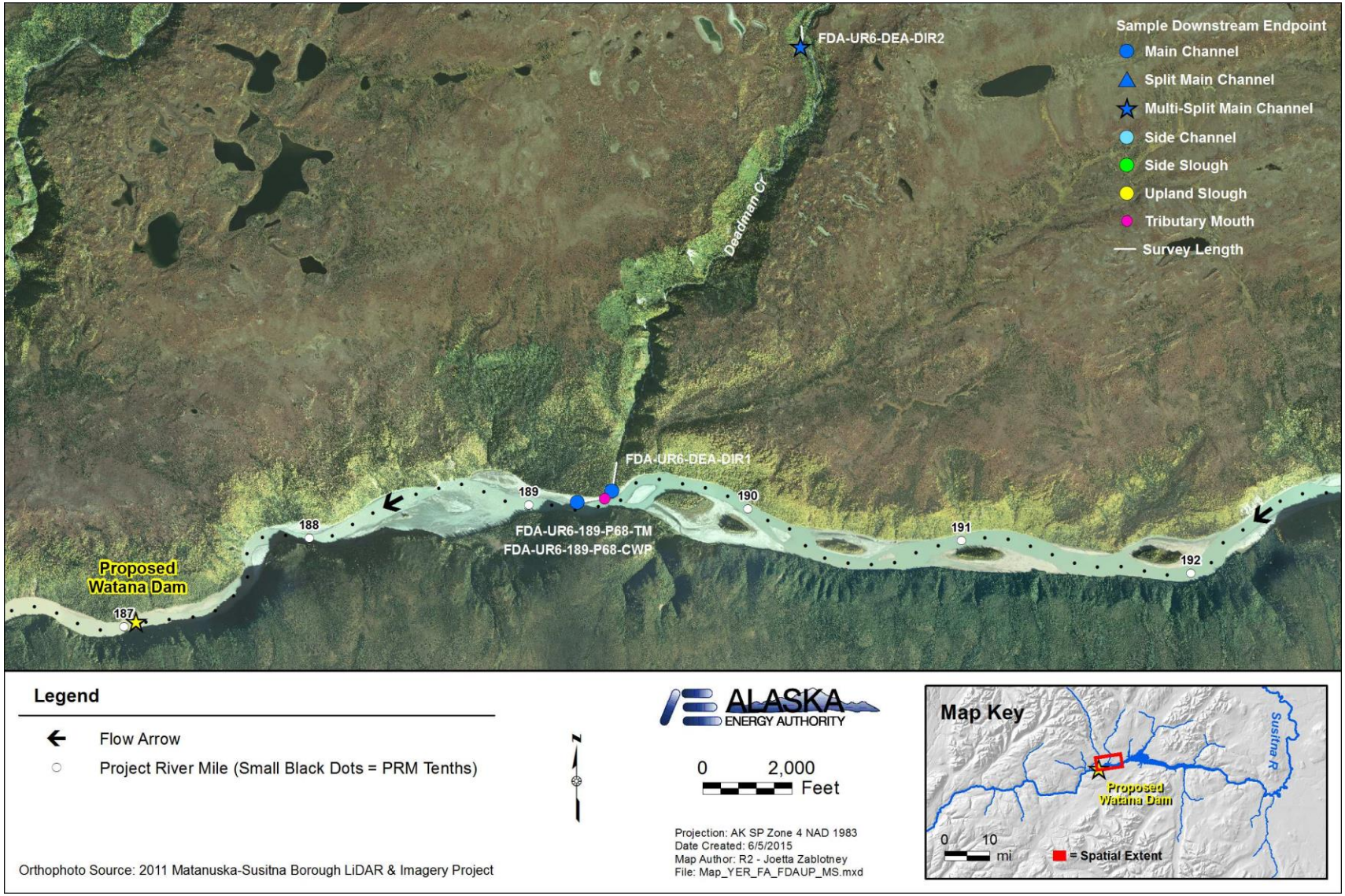

Figure A1. Seasonal GRTS and opportunistic fish distribution and abundance sampling locations PRM 187-193 and tributary direct sampling locations for Deadman Creek, 2014.

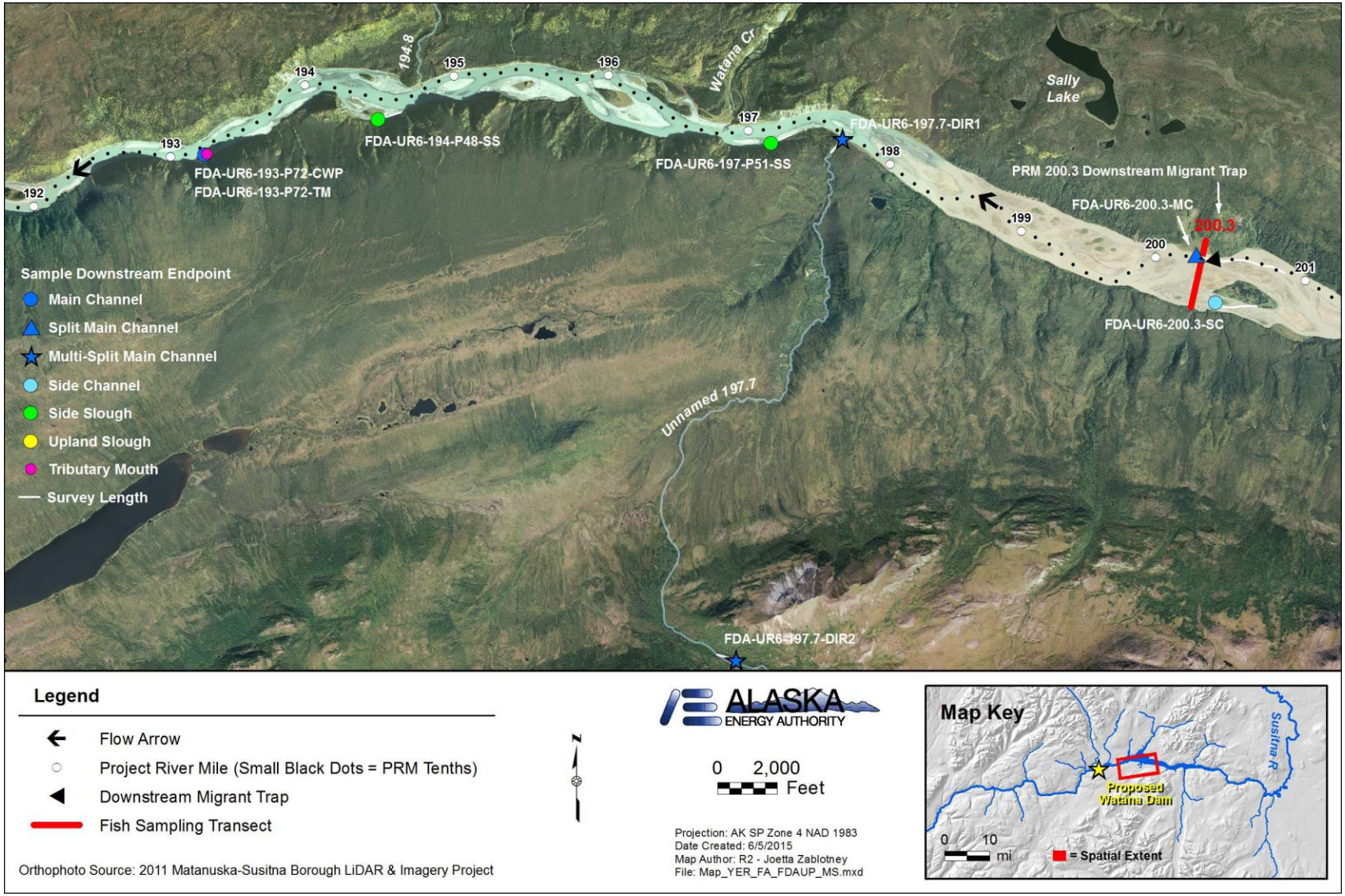

Figure A2. Seasonal GRTS, transect, and opportunistic fish distribution and abundance sampling locations PRM 192-201, downstream migrant trap location at PRM 200.3, and tributary direct sampling locations for Unnamed Tributary 197.7, 2014.

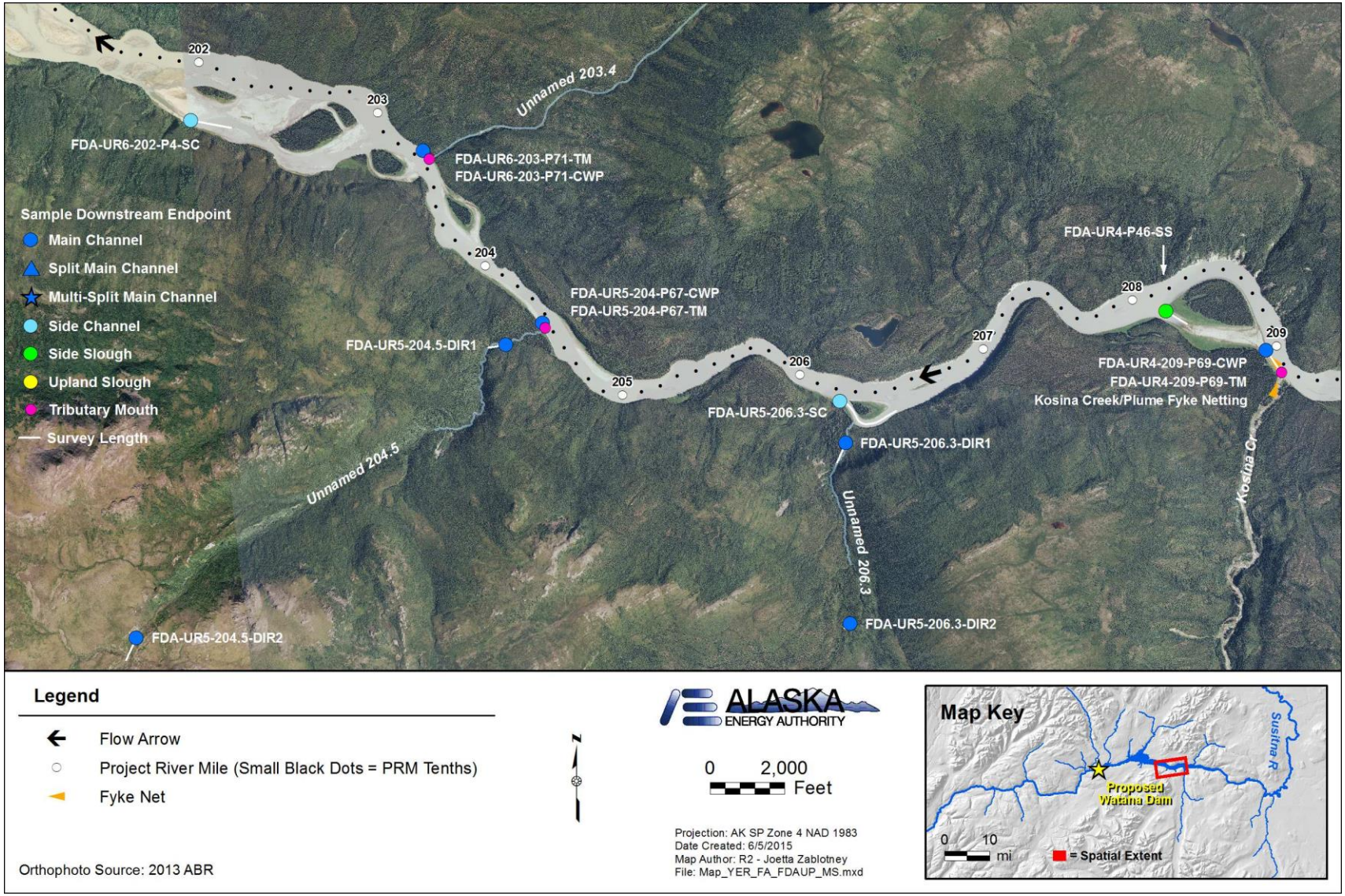

Figure A3. Seasonal GRTS, transect, and opportunistic fish distribution and abundance sampling locations PRM 202-209, Kosina Creek fyke net location, and tributary direct sampling locations for Unnamed Tributaries 204.5 and 206.3, 2014.

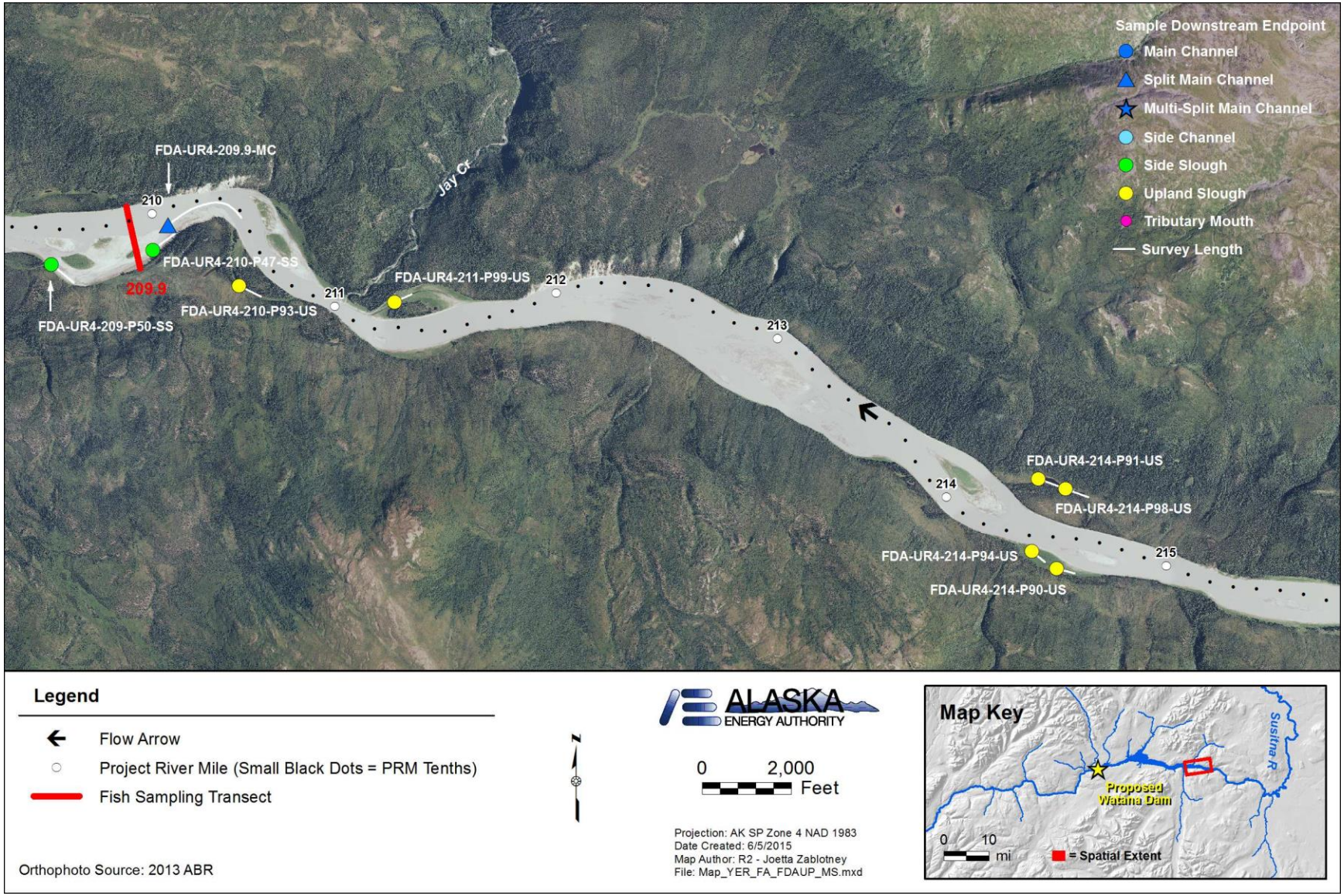

Figure A4. Seasonal GRTS, transect, and opportunistic fish distribution and abundance sampling locations PRM 209-215, 2014.

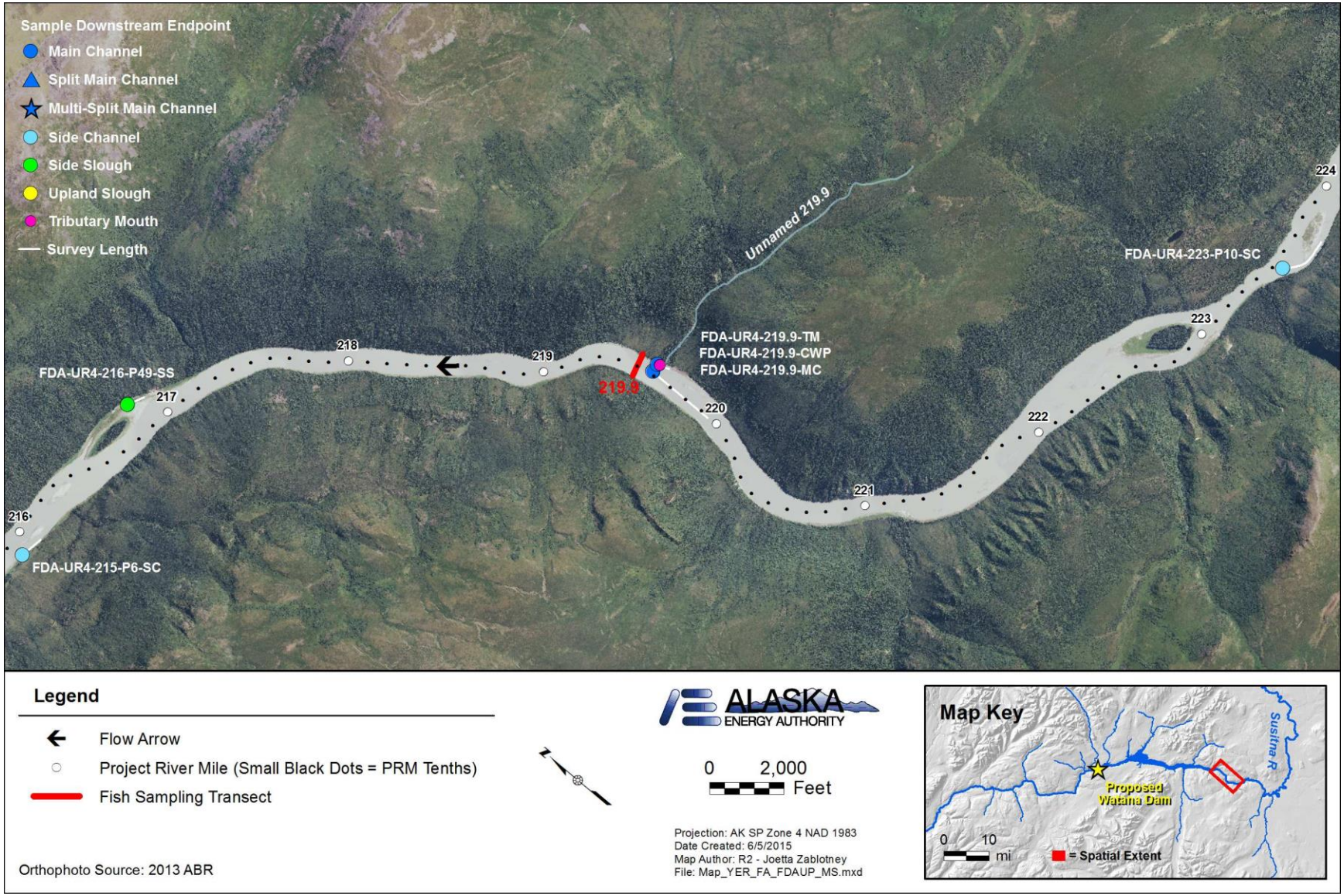

Figure A5. Seasonal GRTS, transect, and opportunistic fish distribution and abundance sampling locations PRM 216-224, 2014.

Figure A6. Seasonal GRTS, transect, and opportunistic fish distribution and abundance sampling locations and Oshetna River downstream migrant trap location PRM 231-235, 2014.

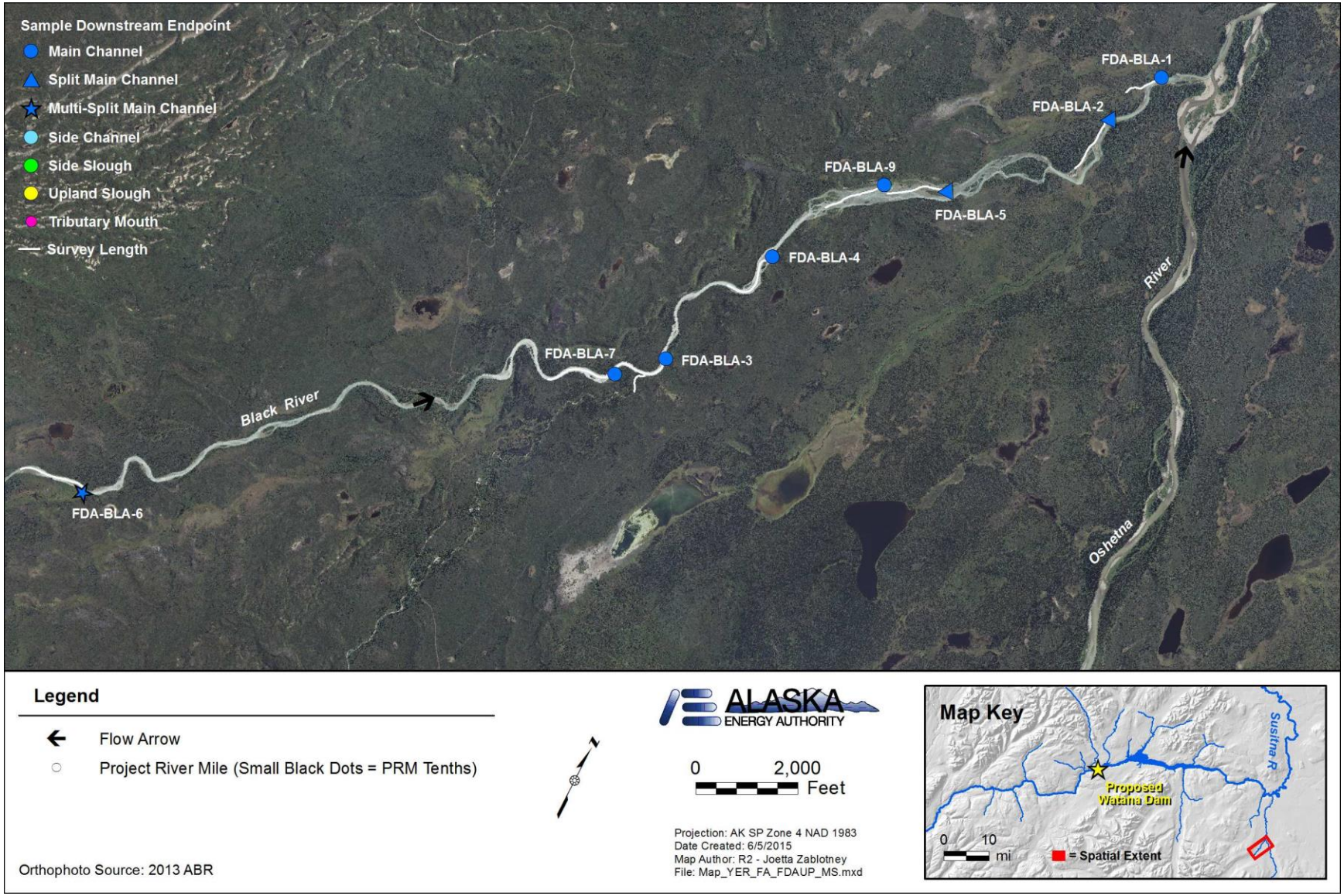

Figure A7. Seasonal GRTS, sampling locations Black River, 2014.