Susitna-Watana Hydroelectric Project Document
ARLIS Uniform Cover Page

Title: Study of fish distribution and abundance in the upper Susitna River, Study plan Section 9.5 : Initial study report -- Part C: Executive summary and Section 7	**SuWa 223**
Author(s) – Personal:	
Author(s) – Corporate: R2 Resource Consultants, Inc., LGL Alaska Research Associates, Inc.	
AEA-identified category, if specified: Initial study report	
AEA-identified series, if specified:	
Series (ARLIS-assigned report number): Susitna-Watana Hydroelectric Project document number 223	**Existing numbers on document:**
Published by: [Anchorage : Alaska Energy Authority, 2014]	**Date published:** June 2014
Published for: Alaska Energy Authority	**Date or date range of report:**
Volume and/or Part numbers:	**Final or Draft status, as indicated:**
Document type:	**Pagination:** iv, 13 p.
Related work(s): The following parts of Section 9.5 appear in separate files: Part A ; Part A Appendices ; Part B ; Part C.	**Pages added/changed by ARLIS:**
Notes:	

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Susitna-Watana Hydroelectric Project
(FERC No. 14241)

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

Initial Study Report
Part C: Executive Summary and Section 7

Prepared for

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by

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June 2014

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EXECUTIVE SUMMARY

Study of Fish Distribution and Abundance in the Upper Susitna River 9.5	
Purpose	The goal of this study is to characterize the current distribution, relative abundance, run timing, and life history of resident and non-salmon anadromous fish species as well as freshwater rearing life stages of anadromous salmonids in the Upper Susitna River. Seven specific objectives have been developed for this study and include multiple tasks. Data collected as part of this study will be used to provide a baseline characterization of fish assemblages in the Susitna River, to identify and evaluate potential Project-induced effects on fish assemblages, and inform development of any necessary protection, mitigation, and enhancement measures.
Status	Data collection is complete for the first year of this multiyear study. Initial database quality assurance and quality control was completed to compile preliminary summary statistics and preliminary data analysis for the Initial Study Report. Database quality assurance and quality control, data analysis, and coordination with interdependent studies is an ongoing iterative process. A second study year of data collection is planned.
Study Components	Major study components include the following eight objectives: • Objective 1: Describe the seasonal distribution, relative abundance, and fish habitat associations of juvenile anadromous salmonids, non-salmonid anadromous fishes and resident fishes. • Objective 2: Describe seasonal movements of juvenile salmonids and selected fish species such as rainbow trout, Dolly Varden, humpback whitefish, round whitefish, northern pike, Pacific lamprey, Arctic grayling and burbot within the hydrologic zone of influence upstream of the Project. • Objective 3: Describe early life history, timing, and movements of anadromous salmonids. • Objective 4: Characterize the seasonal age class structure, growth, and condition of juvenile anadromous and resident fish by habitat type. • Objective 5: Determine whether Dolly Varden and humpback whitefish residing in the Upper River exhibit anadromous or resident life histories. • Objective 6: Determine baseline metal concentrations in fish tissues for resident fish species in the mainstem Susitna River (see ISR Studies 5.5 and 5.7). • Objective 7: Document the seasonal distribution, relative abundance, and habitat associations of invasive species (northern pike). • Objective 8: Collect tissue samples to support the Genetic Baseline

Study of Fish Distribution and Abundance in the Upper Susitna River 9.5	
	Study for Selected Fish Species (ISR Study 9.14).
2013 Variances	AEA implemented the methods as described in the Study Plan with the exception of the following variances. The significance of these variances is discussed within the ISR sections noted below. • Addition of an early life history study objective (Objective 3 above; Section 4.6.2); • Adjustments to rotary screw trap, PIT array, radio telemetry fixed receiver, and fish distribution and abundance sampling locations (Section 4.1.6); • Adjustments to the number of fixed receiver locations (Section 4.1.6.4); • Adjustments to the timing of fish distribution and sampling efforts (Section 4.2.1); • Adjustments to sample unit lengths (Section 4.1.6.1.1); • Adjustments to gear type applications (e.g., numbers of passes, soak times, minnow trap densities; Section 4.4.4.1); • Refinements to estimating the detection efficiency of PIT tag interrogation systems (Section 4.5.4.1); • Adjustments to the timing of radio-tag implementation and aerial survey methods for tracking resident fish (Sections 4.5.4.2 and 4.5.4.3); • Using size instead of age to evaluate habitat associations of juvenile anadromous and resident fish (Section 4.7.1); and • Adjustments to the timing of fish tissue sample collection for metals and mercury analysis (Section 4.9.1).
Steps to Complete the Study	The Study of Fish Distribution and Abundance in the Upper Susitna River will be completed through a combination of activities in 2014 and 2015. AEA plans to complete the study as described in the Study Plan except for the following modifications: • Continue Salmon Early Life History sampling in select Upper Susitna River tributaries. • Reduce the number of mainstem transects between UR-3 and UR-6 from 20 to 10. • Use remote line mapping and a GRTS approach to select six replicates of side channels, side sloughs, upland sloughs and tributary mouths for sampling in UR-3 to UR-6. • Increase targets for total length of sampled area in Upper River tributaries. • Adjust the location of select rotary screw trap and PIT interrogation

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	antenna sites to improve catch. • Reduce the sample unit length from 500 to 200 meters for main channel and side channel sites when using techniques other than boat electrofishing or drift gillnetting. • Abandon multiple-pass sampling efforts for relative abundance in favor of consistent and rigorous single-pass sampling to generate meaningful CPUE estimates.
Highlighted Results and Achievements	In 2013, nine fish species were captured in the Upper Susitna River, including juvenile Chinook salmon. Over 12,600 fish were observed during three seasonal surveys at over 150 sites representative of 12 tributaries and approximately 47 miles of the Susitna River. Similar to previous studies by ADF&G, juvenile Chinook salmon were rare. They were documented in the Oshetna River and Kosina Creek, and for the first time, in the Black River. Arctic grayling and sculpin were the most widely distributed and abundant species. Watana Creek was notable for relatively high abundance of Dolly Varden and Arctic grayling. No northern pike were observed in the Upper River. Over 1,300 fish were tagged for biotelemetry studies of fish movement. Sampling in 2013 met all first-year study goals and objectives.

7. COMPLETING THE STUDY

7.1. Proposed Methodologies and Modifications

To complete this study, AEA will implement the methodologies in the Study Plan except as described in Section 7.1.2. These activities include:

- Fish distribution and abundance sampling activities in the mainstem Sustina River and select tributaries in the Study Area to support AEA's efforts to:
    - 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 (Study Objective 1);
    - 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 (Study Objective 2);
    - characterize the seasonal age class structure, growth, and condition of juvenile anadromous and resident fish by habitat type (Study Objective 3); and
    - collect tissue samples to support the Genetic Baseline Study for Selected Fish Species (ISR Study 9.14) (Study Objective 7).
- AEA will operate two rotary screw traps in the Upper River Study Area as well as a fyke net in Kosina Creek to support describing seasonal movements of juvenile salmonids and selected fish species within the hydrologic zone of influence upstream of the Project (Study Objective 2).
- Biotelemetry including PIT and radio-tagging, PIT interrogation antenna sites, fixed radio telemetry sites, and aerial surveys will continue to support AEA efforts to:
    - describe seasonal movements of juvenile salmonids and selected fish species within the hydrologic zone of influence upstream of the Project (Study Objective 2);
    - determine whether Dolly Varden and humpback whitefish residing in the Upper River exhibit anadromous or resident life histories (Study Objective 4); and
    - document the seasonal distribution, relative abundance, and habitat associations of invasive species (lake trout and northern pike) (Study Objective 6).
- Fish tissue collection will continue to support AEA's efforts to:
    - determine whether Dolly Varden and humpback whitefish residing in the Upper River exhibit anadromous or resident life histories (Study Objective 5);

- determine baseline metal concentrations in fish tissues for resident fish species in the mainstem Susitna River (see Study 5.7, Mercury Assessment and Potential for Bioaccumulation Study); and

- collect tissue samples to support the Genetic Baseline Study for Selected Fish Species (see Study 9.14).

7.1.1. Decision Points from Study Plan

There were no decision points in the FERC-approved study plan to be evaluated for this study following completion of 2013 work.

7.1.2. Modifications to the Study Plan

AEA will implement the methods as described in the Study Plan with the exception of the following modifications.

7.1.2.1. Early life history

Salmon Early Life History sampling was not in the Study Plan and was added to the Upper River Fish Distribution and Abundance Study program in 2013 (see ISR Section 4.6) and is planned to be continued as a modification. Salmon Early Life History sampling in the Upper River will take place in Upper River tributary basins where Chinook salmon have been documented including the Oshetna River, Black River, Kosina Creek and Tsisi Creek. Sampling will take place biweekly (every two weeks) from ice breakup through the end of June and consist of 10 crew days of effort per biweekly event. Crews will sample at known or likely rearing locations and downstream of spawning areas using gears most effective for capturing juvenile Chinook salmon. Early life history sampling supports the following study objectives:

- Objective 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.
- Objective 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,
    - Task B: Describe seasonal movements using biotelemetry (passive integrated transponders [PIT] and radio-tags),
    - Task C: Describe juvenile Chinook salmon movements.
- Objective 3: Describe early life history of anadromous salmonids. Determine movement patterns and timing of juvenile salmonids from spawning to rearing habitats.
- Objective 4: Characterize the seasonal age class structure, growth, and condition of juvenile anadromous and resident fish by habitat type.
- Objective 8: Collect tissue sampling to support the Genetic Baseline Study for Selected Fish Species (ISR Study 9.14).

7.1.2.2. Rotary Screw Trap Locations

FERC's April 1, 2013 Study Plan Determination (SPD) provided for rotary screw traps to be operated in the Oshetna River, Kosina Creek, and in the Susitna River near the proposed dam site (B-133). In 2013, the trap in the Susitna River near the proposed dam site was not operated due to a lack of access to CIRWG lands (Section 4.1.6.2). In 2014, AEA plans to operate a trap in this location to comply with the SPD.

AEA plans to replace the Kosina Creek rotary screw trap with fyke netting near the mouth of Kosina Creek. AEA sought the input of the Fisheries Technical Workgroup (TWG) with respect to this modification on March 20, 2014 (AEA 2014). The clear, swift water, and infrequent pools and glides in Kosina Creek make siting a rotary screw trap challenging. Screw trapping in Kosina Creek in 2013 only captured 153 fish between mid-June and early October; considerably less than the trap in the Oshetna River, which captured 1,001 fish in the same period. Visual observations of fish in the pool underneath the trap indicated the trap was not effectively capturing fish. The habitat in Kosina Creek lends itself to fyke netting more than screw trapping. Fyke net sampling near the mouth of Kosina Creek was productive during the 2013 Salmon Early Life History Sampling and Fish Distribution and Abundance Sampling. The Kosina Creek fyke net would operate on the same schedule as the rotary screw traps in the Upper River (two days on/three days off). Replacing this rotary screw trap with a fyke net is expected to increase fish catch and thereby improve AEA's ability to meet study objectives.

7.1.2.3. Biotelemetry

7.1.2.3.1. Fixed Radio Receiver Sites

Specific telemetry sites were discussed in Section 5.8.2.1 of the Implementation Plan. Lack of access to CIRWG land in 2013 necessitated a number of changes to the quantity and location of telemetry fixed stations in the Upper River as described in ISR Section 4.1.6.4. In 2013, the fixed receiver station planned for the proposed Watana Dam site (PRM 187.1) was relocated to Deadman Creek (PRM 191.2) and the station at Watana Creek (PRM 196.9) was not installed due to a lack of land access. In 2014, fixed receiver stations will include a station near the Watana Dam site, Watana Creek (PRM 196.9), Kosina Creek (PRM 209.2) and the Oshetna River (PRM 235.1). Pending attainment of study tagging goals, radio telemetry efforts are anticipated to be completed in 2014.

7.1.2.3.2. PIT Interrogation Antenna Sites

The Implementation Plan provided that PIT tag antenna arrays be deployed at two sites in the Upper River during the open-water period: in the Oshetna River near its confluence with the Susitna River and in Kosina Creek near its confluence with Tsisi Creek (IP Section 5.6.5). Based on the results from the first study season, AEA plans to change the Passive integrated transponder [PIT] antenna locations. The Kosina Creek antenna location performed poorly with very few fish detections. AEA plans to relocate the antenna to either a smaller body of water where the antenna can be designed to have better channel coverage (Tsisi, Goose, or Jay Creeks) or higher up in the Kosina Creek watershed above Tsisi Creek. PIT antenna arrays will be placed within 10 miles of a downstream migrant sampling location (rotary screw trap or Kosina

Creek fyke net). A change in location to improve array detection efficiency will improve AEA's ability to document the presence of tagged fishes and thereby meet study objectives.

7.1.2.3.3. PIT Tagging

The Study Plan provided that up to 1,000 fish per target species be PIT-tagged in proximity to each PIT interrogation antenna and rotary screw trap site (RSP Section 9.5.4.3.2). Cumulative tagging goals of 1,000 fish per target species in proximity to an interrogation antenna may be reached in 2015. However, AEA will continue to PIT-tag fish until 2,000 tags (1,000 tags x two PIT antennas) have been allocated per target species in the Upper River Segment instead of capping the number of fish tagged at 1,000 in proximity to each antenna site. Using a segment-wide target will allow for the tagging of more individuals if they are not evenly distributed among antenna sites. Increasing the number of tags deployed will improve AEA's ability to meet study objectives.

7.1.2.4. Tributary Sampling Approach

The April 2013 FERC Study Plan Determination adopted a sampling approach in which tributary sampling was scaled in proportion to stream size (p. B-124). To achieve a spatially-balanced and random sample of fish habitats within Upper River tributaries, each tributary was divided into GRTS panels that were 200, 400, or 800 m long, depending on the tributary drainage area. However, in 2013, 100 m-long units were sub-sampled within these GRTS panels in 2013. Specifically, within a selected GRTS panel fish sampling occurred in either a complete mesohabitat unit or up to 100 m per mesohabitat for each mesohabitat type present. Post-season analysis indicated that 2013 tributary sampling was effective at documenting fish distribution (Task A; see species accumulation curve in Figure 7.1-1). Relative abundance estimates were effectively generated for all sampled habitats (Task B). However, analysis of habitat associations were limited by the small number of rare habitat types sampled in the tributaries. Increased sampling of rare habitat types would better meet the objectives of characterizing fish abundance by mesohabitat type and fish usage of habitat types (RSP Section 9.5.4.3.1, Task C).

The 2013 sub-sampling resulted in a sampling effort that differed from the FERC SPD with smaller basins receiving proportionally more sampling effort and larger basins receiving proportionally less sampling effort (Table 7.1-1). In addition, a post-season review of the remote video within each GRTS panel indicated that there were some habitat types (pools, alcoves, percolation channels) that were under-represented in 2013 fish sampling and would benefit from additional sampling. These two findings have prompted AEA to modify the Upper River study by increasing the number of sub-sampling units within the GRTS panels using an approach that increases sampling proportional to stream width and increases the number of under-represented fish habitats. During the Fisheries Technical Workgroup on March 20, 2014, AEA presented these post-season analyses and modifications to the target sample length of Upper River tributaries with licensing participants (R2 Resources Consultants 2014b).

When considering modifications to the sampling approach, it is important to consider the ability to compare data across years. Thus, AEA's plan is to repeat sampling at all 2013 sampling units while allocating increased effort strategically among tributaries. AEA has reviewed a number of sampling sufficiency analyses based on stream size including a recent publication by ADF&G

for sampling in Alaska streams (Kirsch et al. 2014). AEA plans to apply the recommendation from the ADF&G analysis to Upper River tributaries and will use this approach as described below to generate increased total sample lengths by tributary. One caveat in applying the ADF&G approach is that in most tributaries AEA will maintain or increase sample length beyond that accomplished in 2013, to allow for inclusion of additional mesohabitat replicates. The stream-specific sample length changes are presented in Table 7.1-1.

Sampling sufficiency for characterizing fish distribution is often evaluated in relation to channel width (Paller 1995, Patton et al. 2000, Hughes et al. 2002, Maret and Ott 2003, Reynolds et al. 2003, Kirsch et al. 2014). Fish sampling and habitat surveys (see Study 9.9) completed in 2013 provide channel width information that was not available to incorporate into the Implementation Plan. AEA has reviewed the 2013 sampling effort in the context of field measurements of channel width in order to prioritize additional sampling. Kirsch et al. (2014) recommended sampling lengths of 40 wetted channel widths for wadeable streams, 120 channel widths for nonwadeable streams in basins with a watershed area of 100-300 km, and more than 140 channel widths in nonwadeable streams in larger drainage basins. Applying these recommendations to Upper River tributaries, AEA has developed revised distance targets for future sampling. AEA plans to maintain the spatial configuration of the original GRTS panel sampling and apportion the additional sampling length within the existing panels by increasing the number of replicates of mesohabitat units sampled per panel. Due to access and logistical sampling considerations, final sampling locations will be determined in the field. This approach will improve AEA's ability to evaluate fish abundance by habitat type while maintaining a spatially balanced and efficient sampling approach.

7.1.2.5. Mainstem Sampling approach

The Study Plan provided that mainstem sampling be conducted along 20 transects placed regularly along the Upper River segment (IP Section 5.4). A hybrid approach using transects for main channel sampling and GRTS based on 2013 remote line mapping for off-channel habitats is planned for future sampling. Sampling in 2013 was effective at documenting fish distribution (Task A). Relative abundance estimates were effectively generated for all sampled habitats (Task B). However, analysis of habitat associations was limited by the low number of off-channel habitats in the mainstem. Increased sampling of off-channel habitats would better meet the objective of characterizing fish abundance by macrohabitat type (RSP Section 9.5.4.3.1, Task C). Sufficient characterization of main channel fish distribution, abundance, and habitat associations was achieved in the first study season. A species accumulation curve based on 2013 sampling indicates that 92 percent of Upper River mainstem fish species were encountered by the 6th transect (Figure 7.1-2). AEA plans to reduce the number of target mainstem transects from 20 to 10 (Table 7.1-2, Figure 7.1-3) in order to increase sampling in rare and off-channel habitat types using a GRTS approach. Ten of the sixteen transects sampled in 2013 were randomly selected for sampling. Following an approach consistent with the Middle River, sampling units for fish distribution and abundance will be 500 meters for main channel sites when using boat electrofishing and drift gillnetting and 200 meters when using other sampling techniques.

The planned reduction in transects and their associated main channel sample sites in the Upper River should not affect study inference as transect data will be aggregated across Geomorphic

Reaches for UR-3 through UR-6. A geomorphic-reach based approach is helpful in the Middle River where impacts will likely decrease longitudinally downstream from the dam and the impacts of flow changes are dependent on channel form. A reach-based approach is not as helpful in the Upper River where the scale of inference will be the future inundation zone, which spans four Geomorphic Reaches from the upper extent of UR-3 (PRM 234.5) to the downstream extent of UR-6 (PRM 187.1). Within the inundation zone, impacts will be relatively uniform and independent of channel form. The hybrid approach that AEA plans for the next year of sampling will include an additional four side channel sites and six sites of each off-channel habitat type within the future reservoir inundation zone as well as repeating 20 mainstem and two side channel transect sites. This will increase the total number of sampling sites from 22 to 34, and an additional 12 special feature habitat sites will also be sampled. Increasing the number and diversity of habitats sampled in the Upper Susitna River will improve AEA's ability to meet the objective of analyzing habitat associations of fishes in the Upper River.

7.1.2.5.1. Rare Habitats

The Study Plan provided that mainstem sampling be conducted along 20 transects placed regularly along the Upper River segment (IP Section 5.4). However, side channels, upland sloughs, side sloughs, as well as tributary mouths, clearwater plumes and backwaters all are relatively rare in the Upper River. The original 20 Upper River transect placements resulted in targets of 8 side channels, 3 side sloughs, and 3 tributary mouths. However, only 2 side channels, 1 side slough, and 3 tributary mouths were sampled. A review of remote line mapping after the 2013 field season indicated that additional habitats of these types were available for sampling as were other unsampled habitat types including upland sloughs, clearwater plumes and backwaters. Using the remote line mapping, a GRTS sampling approach was applied to side channel, side slough, upland slough, and tributary mouth habitats. Six replicates of each habitat type, as well as oversample sites to be used as alternatives if initial sites are found to be dry or inaccessible, were randomly selected for sampling within the Upper Susitna mainstem study area (Geomorphic Reaches UR-3 to UR-6). Tributary mouths and sloughs will be inspected for special mesohabitat types including clearwater plumes and backwaters, and they will be sampled when encountered. Following an approach consistent with the Middle River (see Study 9.6), sampling units for fish distribution and abundance will be 500 meters for side channel and 200 meters or 20 times the wetted channel width, whichever is less for off-channel habitat types.

7.1.2.6. Multiple-pass sampling

In the Revised Study Plan (Section 9.5.4.3.1), AEA proposed that relative abundance sampling would include multiple-pass sampling when electrofishing, snorkeling, and minnow trapping were employed. However due to permit restrictions limiting electrofishing efforts to one pass, the April 2013 FERC SPD recommendation that minnow traps be set for 24-hrs, and the extensive level of effort involved in three-pass snorkeling 200 m (656 ft) long sampling units, single-pass sampling was conducted. AEA plans to continue to use a single-pass sampling approach for both fish distribution and abundance sampling. Limiting sampling duration facilitates sampling a larger number of sites across seasonal sampling periods and supports AEA's ability to characterize fish distribution and abundance. Sufficiency analysis of fish distribution and abundance sampling using species accumulation curves, as described in Sections

7.1.2.4 and 7.1.2.5, supports the adequacy of the single-pass methods used in 2013 for characterizing fish assemblages.

7.1.2.7. Fish Handling

The Study Plan stated that each time sampling gear was checked, a random sample of 25 individuals per species, life stage, and site would be measured for fork length (FL) and weighed (IP Section 5.1.5). However, the FERC SPD interpreted AEA's study plan as proposing to measure and weigh all fish and no modifications were recommended (SPD p. B-130). The sample size of 25 measurements per species, per life stage, per gear was consistent with collecting the data necessary to evaluate length frequency distributions and condition factor for sampled fish. Future fish handling is proposed to occur as it did in 2013; 25 fish, per species, per life stage, per gear will be weighed, measured for length and PIT tagged if appropriate. AEA plans to randomly select and measure the first 25 sculpin for length (no weight) regardless of lifestage.

7.2. Schedule

In general, the schedule for completing the FERC-approved Study Plan is dependent upon several factors, including Project funding levels authorized by the Alaska State Legislature, availability of required data inputs from one individual study to another, unexpected weather delays, the short duration of the summer field season in Alaska, and other events outside the reasonable control of AEA. For these reasons, the Study Plan implementation schedule is subject to change, although at this time AEA expects to complete the FERC-approved Study Plan through the filing of the Updated Study Report by February 1, 2016, in accordance with the ILP schedule issued by FERC on January 28, 2014.

With regard to this specific study, AEA is planning the following activities for 2014:

- Fish distribution and abundance sampling activities in the mainstem Sustina River and select tributaries in the Study Area. Sampling will include three seasonal sampling events in the following locations:
    - Under-represented mainstem habitats in Susitna River (Section 7.1.2.5)
    - Three mainstem transect locations to facilitate comparison of 2014 data with 2013 and 2015 sampling.
    - Tributaries on CIRWG lands that were not sampled in 2013 including Deadman Creek and Unnamed Tributaries 197.7, 204.5, and 206.3.
    - Rare habitats in the Black River to evaluate the tributary sampling modification detailed in Section 7.1.2.4.
- Rotary screw traps: AEA will continue to operate two rotary screw traps in the Upper River Study Area with additional migrant monitoring using a fyke net in Kosina Creek as described in Section 7.1.2.2.
- Biotelemetry: Radio-tagging, fixed radio telemetry sites, and aerial surveys

- Fish tissue collection will continue.

In 2015, AEA plans to complete all remaining data collection and analysis for this study.

7.3. Conclusion

The combination of 2013 study efforts including variances (as described in ISR Section 4), the planned work for 2014 and 2015 including modifications (as described in ISR Section 7.1.2), and the integration with other studies will fully achieve the proposed Study Plan objectives (described in ISR Section 2).

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7.5. Tables

Table 7.1-1. 2013 tributary sampling summary and proposed future sampling length targets for Study 9.5

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 Meso-habitats Sampled 2013	Meters sampled 2013	% Sampled	Average Wetted Width (m)	Average bankful width (m)	CWs Sampled (wetted)	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	41.9	73	140	5,026	12%	2,422
Black River	NA	no	400	24	6	11	1,050	11%	23	24.5	46	*140*	3,178	33%	2,128
Goose Creek (PRM 232.8)	269.1	*no*	200	81	20	38	3,107	19%	14	16.8	219	120	1,704	11%	(1,403)
Kosina Creek (PRM 209.1)	1036.5	yes	800	24	6	10	1,000	5%	32	34.7	31	140	4,522	24%	3,522
Tsisi Creek	NA	no	400	23	6	10	980	11%	14	15.2	69	*140*	1,988	22%	1,008
Unnamed Tributary 206.3	<80.3	no	200	29	0	0	-	0%	3	4.8	0	40	124	2%	124
Unnamed Tributary 204.5	<80.3	no	200	21	0	0	-	0%	5 (est)	5 (est)	0	40	200	5%	200
Unnamed Tributary 197.7	<80.3	no	200	41	0	0	-	0%	5 (est)	5 (est)	0	40	200	2%	200
Watana Creek (PRM 196.9)	452.7	yes	400	60	15	30	2,561	11%	11	15.5	231	140	1,554	6%	-
Watana Creek Tributary	NA	no	200	67	13	18	1,459	11%	10	13.3	154	*140*	1,330	10%	-
Unnamed Tributary 194.8	321.2	no	400	32	2	4	300	2%	3	5.5	88	140	476	4%	176
Total	**--**	**--**	**--**	**454**	**81**	**149**	**13,061**	**8%**					**20,302**	**12%**	**8,377**

Table 7.1-2. Main channel sampling locations, n=10, proposed for 2015.

Geomorphic Reach	PRM	Sample Type	Sampled in 2013	Sample in 2015
Proposed Watana Dam PRM 187.1				
UR-6	188.3	Distribution	No: Land Access	
UR-6	190.7	Distribution	Y	Y
UR-6	193.1	Distribution	Y	
UR-6	195.5	Distribution	Y	Y
UR-6	197.9	Distribution	Y	
UR-6	200.3	Distribution	Y	Y
UR-6	202.7	Relative Abundance	Y	
UR-5	205.1	Relative Abundance	Y	Y
UR-5	207.5	Distribution	Y	
UR-4	209.9	Distribution	Y	Y
UR-4	212.3	Distribution	Y	
UR-4	214.7	Distribution	Y	Y
UR-4	217.1	Relative Abundance	Y	
UR-4	219.5	Distribution	Y	Y
UR-4	221.9	Distribution	No: Unsafe	
Proposed Reservoir Inundation Zone at Low Pool 222.5				
UR-4	224.3	Relative Abundance	Y	Y
UR-3	226.7	Distribution	No: Unsafe	
UR-3	229.1	Distribution	No: Unsafe	
UR-3	231.5	Distribution	Y	Y
Proposed Reservoir Inundation Zone at Maximum Pool 232.5				
UR-3	233.9	Distribution	Y	Y
Total			**16**	**10**

7.6. Figures

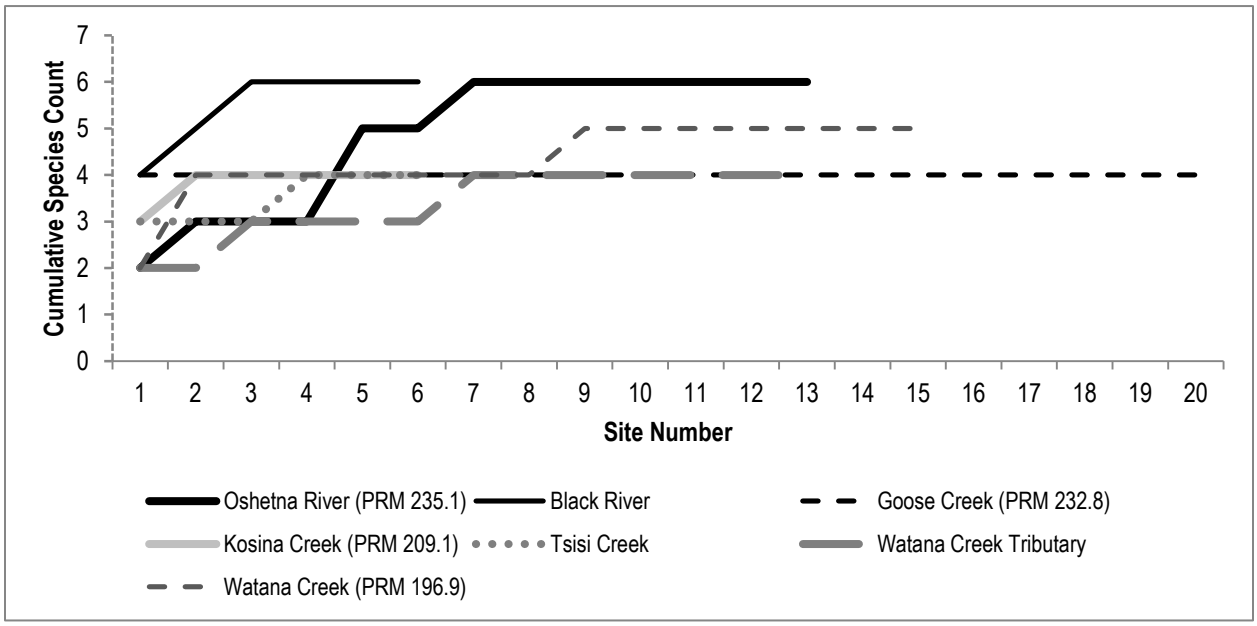

Figure 7.1-1. Species accumulation across Upper River tributary GRTS sampling sites in 2013.

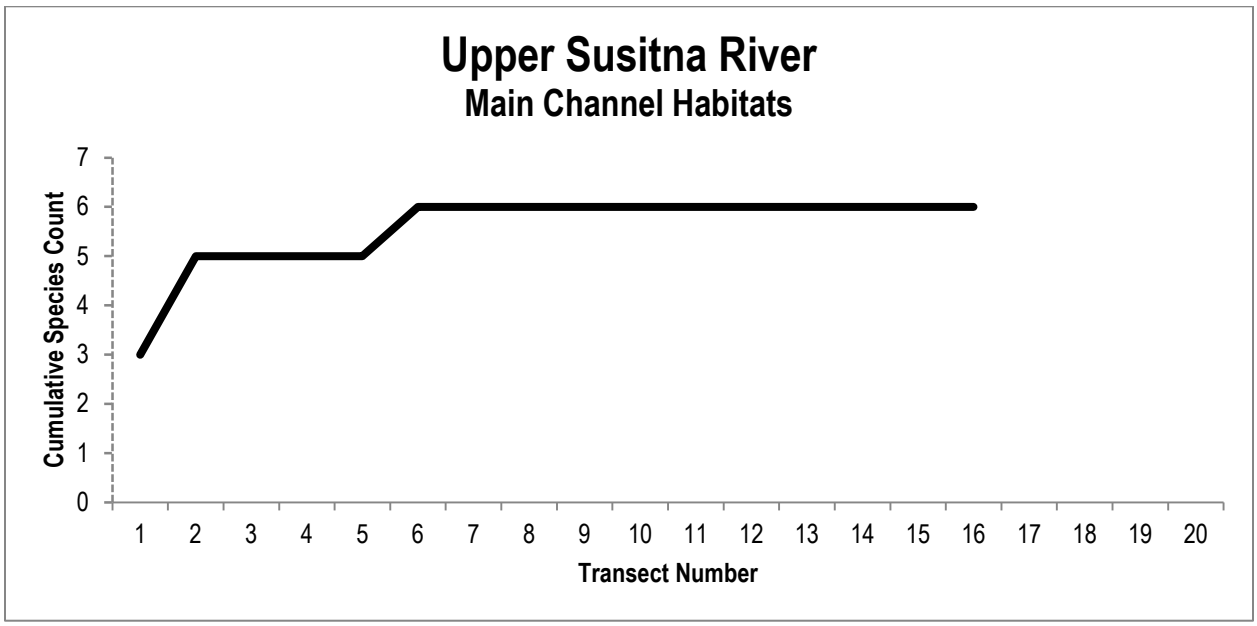

Figure 7.1-2. Species accumulation across Upper River main channel sampling transects in 2013.

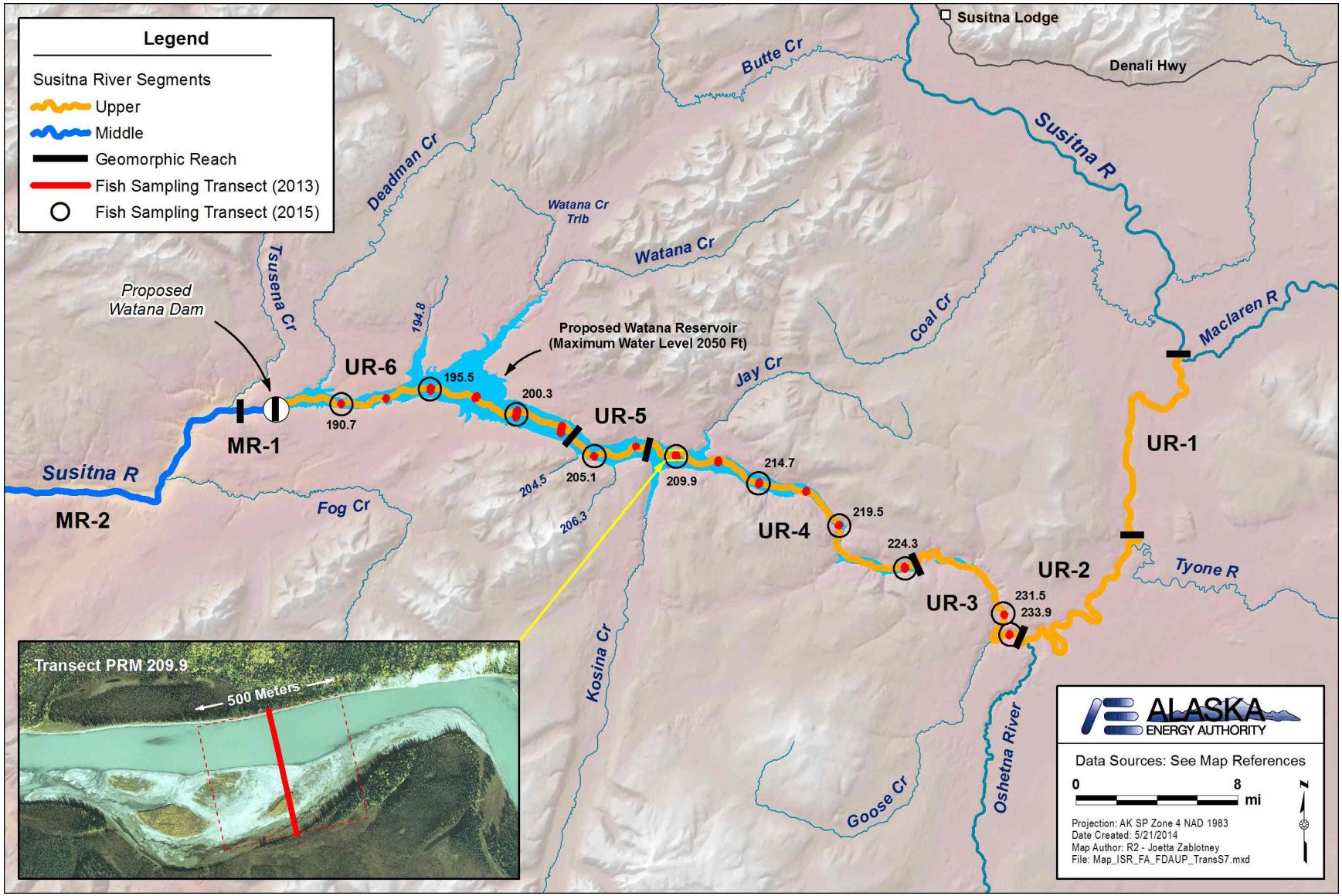

Figure 7.1-3. Fish distribution and abundance transect sampling locations in the Upper Susitna River.