Susitna-Watana Hydroelectric Project
(FERC No. 14241)

2012 Upper Susitna River Fish Distribution and Habitat Study

Fish Distribution Report

Prepared for

Alaska Energy Authority

Prepared by

HDR Alaska, Inc
2525 C Street
Suite 305
Anchorage, AK 99503

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LIST OF ACRONYMS AND SCIENTIFIC LABELS

Abbreviation	Definition
ADF&G	Alaska Department of Fish and Game
AEA	Alaska Energy Authority
AFFI	Alaska Freshwater Fish Inventory
ANOVA	analysis of variance
ARDGA	Aquatic Resources Data Gap Analysis
CPUE	catch-per-unit-effort
DNA	deoxyribonucleic acid
EtOH	Isopropanol/Methanol/Ethanol
FERC	Federal Energy Regulatory Commission
FL	fork length
FRP	Fish Resource Permit
GIS	Geographic Information System
GPP	Gas-Powered Pulsator
GPS	Global Positioning System
ILP	Integrated Licensing Process
km^2	square kilometer
kW	Kilowatt
m	Meter
MANOVA	multivariate analysis of variance
mi^2	square mile
mL	Milliliter
mm	Millimeter
NEPA	National Environmental Policy Act
NHD	National Hydrography Dataset
NMFS	National Marine Fisheries Service
PAD	Pre-Application Document
Project	Susitna-Watana Hydroelectric Project
RM	Susitna River historic river mile
TL	total length
USFS	U.S. Department of Agriculture, Forest Service
YOY	young-of-the-year

SUMMARY

Two study components were conducted to document distribution and relative abundance of adult Chinook salmon and provide information on the distribution of all fish species and aquatic habitats upstream of Devils Canyon.

Adult Salmon Distribution

The 2012 Adult Salmon Distribution Study was initiated to provide information on the distribution and relative abundance of adult Chinook salmon (*Oncorhynchus tshawytscha*) in the Susitna River and its tributaries upstream of Devils Canyon (RM 150-152). This study consisted of aerial surveys in the mainstem Upper Susitna River and 12 major tributaries from Cheechako Creek (RM 152.4) to the Oshetna River (RM 233.5).

Based on available run time information, four aerial spawning ground survey events were scheduled at 5-day intervals from July 24 through August 11, 2012. Overall, weather was favorable throughout the survey period and while variable (from sunny to light rain), did not negatively impact survey confidence and did not prevent or delay survey completion. Surveys were conducted by a two-person crew and covered the Chinook salmon spawning habitat within the 12 major tributaries and the mainstem Upper Susitna River.

Adult salmon surveys conducted in 2012 were the most comprehensive to date within the Upper Susitna River watershed. Adult Chinook salmon distribution observed in this study is similar to that found previously. Chinook salmon was the only Pacific salmon species observed above Devils Canyon. In general, counts of Chinook salmon were low in all tributaries and were fairly consistent across survey dates. Adult Chinook salmon were located in five tributaries, with the highest number (16) observed in Kosina Creek. Other tributaries with Chinook salmon included Cheechako (5), Chinook (4), Devil (7), and Fog (1) creeks.

Meso-habitat type and substrate composition were visually estimated at seven locations where adult Chinook salmon were observed: three locations in Chinook Creek, three locations in Devils Creek, and one location in Kosina Creek. Riffle was the dominant meso-habitat among all sites surveyed, and the dominant substrate was cobble.

This study was challenged by the vast extent of the survey area, water with low visibility due to whitewater and boulder riffles, the relatively small number of fish that return to tributaries above Devils Canyon, and a lack of documented spawning locations. Poor visibility due to white water turbulence was present in approximately 50 percent of all streams surveyed and limited data collection in these areas. As such, visual surveys likely accounted for only a portion of the spawning population and the number of salmon observed should be considered a minimum estimate of the number present in the study area.

Juvenile Chinook Salmon and Other Species Distribution within and above Devils Canyon

The Fish Distribution Study was initiated to provide information on the distribution of all fish species and aquatic habitats within and upstream of Devils Canyon. Information regarding fish distribution, including distribution of juvenile Chinook salmon, is important to define the extent of potential Project effects to fish and aquatic habitat and will inform the planning and design of

future Upper Susitna River fish studies. For this study, locations previously documented with juvenile or adult Chinook salmon presence were identified as the highest priority areas for sampling.

Sampling was conducted during July and August, 2012. Fish distribution sampling in two habitats (tributary and lake) was conducted throughout 27 tributary sub-basins. A total of 233 meso-habitat sample units within 27 tributary streams were sampled. In addition, four lakes located in tributary sub-basins were sampled.

Within tributaries, sampling effort was stratified from the stream mouth to the upper watershed based on channel gradient and valley confinement. However, the availability of helicopter landing zones also played a part in the selection of sites. Fish distribution sampling was also conducted in the mainstem at tributary plumes in the vicinity of 18 tributary mouths and in main channel, side channel, Susitna River and off-channel habitats at 10 locations on the mainstem Susitna River between RM 166.3 – 233.5. Of the 28 sample segments on the mainstem, 15 sample segments were located downstream of the proposed dam site, with the remaining 13 and was located upstream. Where possible, sample sites were selected to be representative of the habitat types present within the study area.

Catch total of 2,787 fish were captured or observed (i.e. snorkeling) in 2012 including at least 11 species. Sample results included 37 juvenile Chinook salmon and one adult Chinook salmon which was observed within tributary plume habitat (RM 181.2) during a boat-based electrofishing survey. Sculpin composed approximately 62 percent of the total catch and were documented in all but two of the 27 drainages sampled. Arctic grayling were documented in all but one drainage and Dolly Varden were captured from 13 of the drainages. A total of 109 fish were captured during fish distribution surveys in mainstem Susitna River habitat; Arctic grayling, round whitefish, burbot, longnose sucker, and sculpin were collected.

Backpack electrofishing was the most effective gear type used for fish species presence sampling in wadeable habitats and accounted for approximately 88 percent of total fish captured; it was also the only gear type that captured juvenile Chinook salmon. As such, this gear type was utilized the majority of sample time. Differences in turbidity, water turbulence, and habitat complexity among streams and habitats were all factors influencing differences in electrofishing results.

Sampling during 2012 provided a qualitative overview of fish species composition, spatial distribution, and localized relative abundance. All fish captured during sampling were known native species. Sculpin were most common, but Arctic grayling were relatively ubiquitous throughout the study area and were captured throughout all major habitats. The 37 juvenile Chinook salmon collected were concentrated in cascade habitat and along margin habitat with boulder pocket water located near tributary mouths.

The 2012 Fish Distribution Study provided helpful insight into planning for 2013-2014 field efforts and a foundation of expanded knowledge of fish distribution and habitat use. The field effort was not without challenges and field activities provided insight into the effectiveness of numerous sampling techniques and provide potential refinements for future data collection.

1. INTRODUCTION

The Alaska Energy Authority (AEA) is preparing a License Application that will be submitted to the Federal Energy Regulatory Commission (FERC) for the proposed Susitna-Watana Hydroelectric Project, FERC No. 14241 (Project) using the Integrated Licensing Process (ILP). The Project will be located on the Susitna River, an approximately 300-mile-long river in Southcentral Alaska. The proposed dam site will be located at historical river mile[1] (RM) 184.

The 2012 Upper Susitna River Fish Distribution and Habitat Study was implemented to collect information on fish distribution and abundance and to characterize aquatic habitat in the Upper Susitna River watershed. The Upper Susitna River is defined as the river reach above the proposed dam site (RM 184).

The 2012 Upper Susitna River Fish Distribution and Habitat Study Plan (AEA 2012) identified three goals:

Goal 1: Characterize aquatic habitat in the Susitna River and its tributaries/lakes above Devils Canyon upstream to and including the Oshetna River.

Goal 2: Determine the distribution and relative abundance of adult Chinook salmon in the Susitna River and its tributaries above Devils Canyon upstream to and including the Oshetna River.

Goal 3: Determine the distribution and relative abundance of juvenile Chinook salmon and other fish species present in the Susitna River and its tributaries and lakes above Devils Canyon upstream to and including the Oshetna River up to 3,000-foot elevation.

To address the objectives of the study, AEA initiated four component studies in 2012 including the Adult Salmon Spawning Ground Surveys, the Distribution of Juvenile Chinook and Other Species in the Upper Susitna River Study (Fish Distribution Study), the Fish Passage Barriers Assessment, and the Aquatic Habitat Mapping Study. This report contains results from the first two of these study components.

This information will inform the 2013–2014 licensing study program, Exhibit E of the License Application, and FERC's National Environmental Policy Act (NEPA) analysis for the Project license.

2. ADULT SALMON SPAWNING GROUND SURVEYS

The 2012 Adult Salmon Spawning Ground Surveys were initiated to provide information on the distribution and relative abundance of adult Chinook salmon (*Oncorhynchus tshawytscha*) in the Susitna River and its tributaries upstream of Devils Canyon (RM 150–152).

[1] River mile (RM) designations used in this document pertaining to the main Susitna River are based on the historic river mile system established in the 1980s. A new, Project river mile system based on modern channel mapping will be adopted in future reporting. River miles were interpolated to the nearest tenth to facilitate spatial referencing of tributary confluences with the Susitna River and other features.

2.1. Study Objectives

Information from the 2012 Adult Salmon Spawning Ground Surveys supports Goal 2 of the Upper Susitna River Fish Distribution and Habitat Study Plan (AEA 2012). The three objectives of the Adult Salmon Spawning Ground Surveys were to (1) determine the distribution and relative abundance of adult Chinook salmon (and any other Pacific salmon present during the peak Chinook salmon spawning period) in the mainstem Susitna River and tributaries above Devils Canyon from Cheechako Creek upstream to and including the Oshetna River; (2) support the Alaska Department of Fish and Game (ADF&G) Chinook salmon stock analysis by collecting tissue samples from individual adult salmon for genetic analysis; and (3) characterize habitats at adult Chinook salmon spawning sites above Devils Canyon.

2.2. Study Area

The Adult Salmon Spawning Ground Surveys consisted of aerial surveys in the mainstem Upper Susitna River and 12 major tributaries between Cheechako Creek (RM 152.4) and the Oshetna River (RM 233.5). The following tributaries were surveyed.

1. Cheechako Creek
2. Chinook Creek
3. Devil Creek
4. Fog Creek
5. Unnamed (RM 181.2)
6. Tsusena Creek
7. Deadman Creek
8. Watana Creek
9. Kosina Creek
10. Jay Creek
11. Goose Creek
12. Oshetna River

Tributary surveys began in tributary mouth habitat at the downstream end of the clear water plume in the mainstem Susitna River that emanated from the tributary and continued upstream to an anadromous barrier or an elevation of 3,000 feet (Buckwalter 2011), whichever came first.

2.3. Methods

2.3.1. Survey Frequency and Data Collection

Surveys conducted in 1983 indicated that peak adult Chinook salmon counts for major tributaries just downstream of Devils Canyon were obtained on July 25, 1983. ADF&G confirmed that surveys for Indian River and Portage Creek were typically conducted in late July, and by that time, some Chinook salmon would likely have migrated through Devils Canyon and into Upper Susitna River tributaries (Ivey, Pers. Comm. 2012).

Based on the available run time information, a total of four aerial spawning ground survey events were scheduled at 5-day intervals from July 24 through August 11, 2012, on the following dates:

1) July 24–25
2) July 30–31
3) August 5–6
4) August 10–11

Surveys were conducted by a two-person crew. Observations were made from low altitudes, approximately 50 to 75 feet when trees and terrain allowed, and at an air speed of up to 25 miles per hour. An experienced survey pilot optimized aircraft positioning and helped minimize the

effects of glare off the water. Polarized sunglasses were also worn to reduce glare effects. The entire survey route was tracked with Global Positioning System (GPS) technology and survey results were mapped in a Geographic Information System (GIS). If adult salmon were observed at 3,000-foot elevation, then surveys continued upstream until no adult salmon were observed or habitat was no longer suitable for spawning.

Fish counts, date, time, tributary stream, and weather conditions were recorded directly on a data form. All fish locations were marked by GPS, representative photographs of fish locations were taken from the air, and fish behavior (actively spawning fish) and habitat (e.g., mesohabitat, dominant substrate) were described. Survey data were entered into a Susitna Project Access database and queried to summarize fish counts by date and stream.

2.3.2. Data Review and Quality Control

Quality control measures included employing two experienced observers on each survey. To maintain consistency in observer efficiency, the lead observer conducted all four survey events from the front seat of the helicopter. The secondary observer varied for all four survey events, but was important in locating fish, confirming fish observations by the lead observer or pilot, operating the GPS, and keeping a waypoint comment log. The helicopter pilot also remained consistent for all surveys, which supported observation consistency and ensured familiarity with the streams being surveyed.

2.3.3. Survey Confidence

To document the level of survey confidence, observers completed a standardized worksheet ranking the following set of criteria that could affect the ability to see fish.

1. Weather: sunny, partly sunny, overcast, light rain, rain
2. Sun/Glare: (good) 1 2 3 4 5 (poor)
3. Water Visibility: (good) 1 2 3 4 5 (poor)
4. Vegetation Cover: (good) 1 2 3 4 5 (poor)
5. Notes: other factors potentially affecting the survey

Following each event, a numerical rating for each survey was calculated and used to provide an index of the observers' confidence in their ability to see fish. However, no precision or accuracy criteria were specified for 2012 because estimates were derived solely from aerial surveys and survey variability was unknown. Observer efficiency trials and expansion factors to account for observation error were not employed during 2012 given the low numbers of salmon expected in the study area.

Additionally, to provide an index of consistency between ADF&G and AEA observers, a one-time paired survey was conducted on the Indian River. The Indian River is a tributary to the Middle Susitna River (RM 13 8.5) that has been surveyed annually by ADF&G and is known to have a relatively abundant number of spawning Chinook salmon. The AEA paired survey was completed on the same day as the annual ADF&G survey.

2.4. Deviations from Study Plan

The 2012 Upper Susitna River Fish Distribution and Habitat Study Plan (AEA 2012) stated that efforts to determine the distribution of adult Chinook salmon would focus on 16 tributaries of the

Upper Susitna River; however, the actual survey focused on only 12 (see Section 2.2). The study plan included Indian River and Portage Creek in the list of planned streams; these were outside of the study area. In addition, two unnamed tributaries located between Kosina Creek and the Oshetna River were not surveyed because an adult salmon passage barrier was identified on one of the streams (HDR 2013) and the other was found to be unsuitable for Chinook salmon spawning due to low flow and high gradient.

In the absence of a passage barrier, surveys were not always completed to an elevation of 3,000 feet. Some surveys ended when observers concluded that the habitat was not suitable for Chinook salmon spawning (e.g., stream was shallow or high gradient). The following lists the exceptions, which are also presented on the maps in Appendix A.

- Fog Creek mainstem surveys ended at 2,660 feet, at which point the stream branches into two tributaries, each lacking sufficient water depth to support adult salmon spawning.
- Watana Creek surveys ended at 2,720 feet where one of several tributaries enters from the left. Additional habitat may lie above the surveyed extent; therefore, it is expected that this creek will be aerially surveyed from helicopter in 2013 to 3,000 ft.
- Jay Creek surveys ended at 2,840 feet at a prominent beaver pond. The stream channel above this point is braided lacking sufficient depth to support adult salmon spawning.
- Oshetna River surveys ended at 2,760 feet, approximately 17 miles upstream from the confluence with the Susitna. This was the most distant point from the field camp and helicopter fuel endurance limited the ability to reach the 3,000-foot elevation.

Habitat at spawning sites was not fully characterized as described in the study plan. Prior to the survey period, instream flow study managers concluded that spawning habitat data would only be incorporated into the habitat suitability criteria dataset if locations occurred in the area of reservoir fluctuation. No redds were observed within the inundation zone in 2012; therefore, no habitat measurements were collected on the ground. Spawning habitat substrate was visually estimated from the helicopter at some locations.

The study plan stated that the aerial survey crew would opportunistically obtain genetics samples from adult Chinook salmon near death (post-spawned) to support the ADF&G Chinook salmon genetic stock identification program; however, during the survey period all observed fish were freely swimming and did not meet the near death criteria. Nevertheless, the ADF&G Gene Conservation Laboratory fielded a sampling team to collect genetic samples from Kosina Creek, where the largest concentration of Chinook salmon spawners were observed.

2.5. Results

The four, peak-season, aerial surveys were completed as scheduled and covered the accessible Chinook salmon spawning habitat evident within the 12 major tributaries and the mainstem Upper Susitna River upstream from the confluence with Cheechako Creek (RM 152.4) to the Oshetna River (RM 233.5). Turbid water within most of the mainstem Upper Susitna River portion of the study area during the survey period precluded data collection. However, mainstem areas were surveyed opportunistically when potential clear water habitat was identified. This resulted in variations in the extent of the survey area for each tributary (Appendix A). For example, the clear water plumes of seven small tributaries between RMs 165.6 and 176.1 were surveyed on July 24 and a clear water slough near RM 171 was surveyed on July 30. Unnamed

tributaries to Fog, Watana, and Jay creeks were routinely included in the survey. Tsisi Creek, a tributary to Kosina Creek, was surveyed on August 11.

2.5.1. Distribution and Relative Abundance

Chinook salmon was the only Pacific salmon species observed within the study area in 2012. Adult Chinook salmon were located in five tributaries (Table 1). In general, counts of Chinook salmon were low in all tributaries and were fairly consistent across survey dates. The highest numbers of Chinook salmon were observed in Kosina Creek during all survey events with a peak count of 16 on the third survey (August 6; Table 1). Peak adult Chinook salmon counts for all five streams occurred during either the second or third surveys (Figure 1). No fish were observed in the clear water portions of the mainstem Susitna River that could be surveyed or within any of the secondary tributaries surveyed. No fish carcasses were observed. All fish observed during this survey were seen below adult fish barriers; Kosina Creek was the only tributary without a barrier (Appendix A).

2.5.2. Genetic Sampling

As described in Section 2.4 above, opportunistic tissue samples were not taken from near death (post-spawned) salmon to support the ADF&G Chinook salmon stock identification program. During the survey period, adult Chinook salmon were freely swimming in open water areas and did not meet the near death criteria. No fish carcasses were observed. ADF&G collected tissue samples from Chinook salmon in Kosina Creek on July 31. ADF&G used hook-and-line gear to capture 10 fish and sample axillary tissue for deoxyribonucleic acid analysis.

2.5.3. Spawning Habitat Characterization

Mesohabitat type and substrate composition were visually estimated from the helicopter at seven locations where adult Chinook salmon were thought to be spawning: three locations in Chinook Creek, three locations in Devil Creek, and one location in Kosina Creek. No active spawning was observed and only one redd was identified. Riffle was the dominant mesohabitat where Chinook salmon were likely spawning (57 percent) followed by run (29 percent) and pool (14 percent). At these same locations cobble was the dominant substrate (44 percent), followed by gravel (30 percent) and boulder (26 percent).

2.5.4. Survey Confidence

Overall, weather was favorable throughout the survey period, and while variable (from sunny to light rain), did not negatively affect survey confidence and did not prevent or delay survey completion. Of the eight survey days, one day was sunny, two were overcast with light rain, and five had variable weather (Table 2). Water visibility was the most influential factor to survey confidence, followed by overhanging vegetation and sun glare (Table 3). The most significant impairment to visibility was whitewater turbulence, which was present in approximately 50 percent of all streams surveyed. Photographs were taken to capture typical whitewater areas and illustrate the difficulty in locating adult salmon within these areas (Appendix B). The effect of turbidity and turbulence within the survey confidence rankings ranged from 1 to 5 with an average of 2.8 and a standard deviation of 1.0 (Table 3).

Most streams surveyed contained reaches of clear water and high visibility. However, in several stream reaches, turbidity from both glacial and erosion sources impaired survey effectiveness. The glacially-influenced Oshetna River was the most turbid stream within the survey area. During the first three survey events, water visibility was estimated at 6 to 12 inches. During the final survey, water clarity had increased so that the substrate was visible in all habitat types except for the deepest pools and runs. In Watana Creek, visibility was severely limited in the lower reach due to erosion produced from an area of historic mudslides. Once upstream of this area, the water was clear. Turbidity in the mainstem Susitna River entirely precluded the ability to visually locate adult salmon.

2.5.5. Paired Surveys

Results of the paired survey of Indian River showed that fish counts from aerial adult salmon surveys can be highly variable between observers. On July 24, ADF&G conducted an aerial survey and counted 338 adult Chinook salmon and approximately one hour later, within the same river reach and under excellent survey conditions, the AEA survey observed only 149 fish.

2.6. Discussion and Conclusion

Adult salmon surveys conducted in 2012 have been the most comprehensive to-date within the Upper Susitna River watershed. The adult Chinook salmon distribution observed in this study was consistent with previous work conducted in these streams that found Chinook in all of the same tributaries, with the exception of Tsusena Creek (Table 4; ADF&G 1984; Buckwalter 2011). The 2012 surveys counted more salmon in total, and more salmon in each tributary compared to the historical surveys. This difference in counts could be due to difference in methods among the studies; the 2012 study comprised four survey periods, whereas the historical studies were merely point estimates.

Visual surveys likely account for only a portion of the spawning population. At the time of any one survey, a proportion of the returning population may not have reached its spawning destination; some may have already spawned and left the area, and some were present but unseen. This study was challenged by the vast extent of the survey area, large areas of turbid water, the relatively small number of fish that return to tributaries above Devils Canyon, and a lack of documented spawning locations. The goal of this study was not to estimate total escapement but only to determine the relative abundance and distribution of Chinook salmon spawning in the Upper Susitna River watershed. The actual number of salmon observed should be considered a minimum estimate of the number of fish present in the study area. This minimum estimate may be used as an indicator of relative abundance comparable to past and future study years, though only if compared to the same time period and locations.

The paired survey results for Indian River showed significant variability between ADF&G and AEA observers. The reason for this discrepancy was not determined in 2012; however, intrinsic characteristics of a stream such as log jams, overhanging trees, and cut banks can make one stream more difficult to count than another. It is possible that Indian River wasn't an ideal system in which to conduct a paired survey because it does contain some areas of complex habitat. On other tributaries, results of individual observers paired counts were more consistent for both ADF&G and AEA. Three AEA surveys completed at 5-day intervals on Kosina Creek had less than 15 percent variability and paired surveys completed by ADF&G within six Middle

River tributaries on a 2-day interval also had low variability averaging 6.8 percent and ranging from 1 to 16 percent. In general, variability was higher when fish abundance was higher (Ivey and Oslund, In Prep.).

To ensure a higher index of consistency in future years, multiple paired surveys should be conducted and results compared immediately so that if major differences in salmon counts are found, the reasons for the discrepancies can be investigated. Radio telemetry may provide another means of assessing the accuracy of aerial counts. If radio-tagged fish are precisely located with telemetry receiving equipment but are not visible to observers, then it is possible that a similar proportion of untagged fish are not visible either, whether it be due to water turbidity, water turbulence, or other factors.

3. DISTRIBUTION OF JUVENILE CHINOOK AND OTHER SPECIES IN THE UPPER SUSITNA RIVER

The Upper Susitna River Fish Distribution Study was initiated to provide detailed information on the distribution of all fish species and aquatic habitats upstream of Devils Canyon (RM 150–152). Information regarding fish distribution, including distribution of juvenile Chinook salmon (*Oncorhynchus tshawytscha*), is important to define the extent of potential Project effects to fish and aquatic habitat and will inform the planning and design of other Upper Susitna River studies related to fish distribution.

3.1. Study Objectives

Information in this report supports Goal 3 of the 2012 Upper Susitna River Fish Distribution and Habitat Study Plan (AEA 2012) (see Section 1, Introduction). Specific study objectives related to Goal 3 were as follows.

Objective 1: Determine the distribution and relative abundance of fish species residing in tributary and lake habitats downstream of barriers, up to 3,000-foot elevation.

Objective 2: Determine the distribution and relative abundance of fish species residing in accessible mainstem Susitna River habitats within the reservoir inundation zone, including the main channel, side channels, side sloughs, upland sloughs, and tributary mouths.

Objective 3: Characterize fish habitat for juvenile Chinook salmon where found in the study area.

Objective 4: Support the ADF&G Chinook salmon genetic stock analysis by collecting tissue samples from individual juvenile salmon.

Objective 5: Determine whether Dolly Varden (*Salvelinus malma*) and humpback whitefish (*Coregonus oidschian*) in the study area have anadromous life histories.

Objective 6: Determine baseline tissue metal content for select fish species in the study area.

3.2. Study Area

The study area included the Susitna River and its tributary stream drainages from Devils Canyon upstream to and including the Oshetna River (Figure 2). The study area encompassed nearly 3,880 square kilometers (km^2) or over 2,400 square miles (mi^2)[2], and roughly 81 miles of the mainstem Susitna River. The study area included 80 tributary streams that drained directly into the Susitna River and roughly 2,500 lakes/ponds[3].

Tributary streams were grouped into three drainage basin size classes. Most tributary streams in the study area are relatively small streams that drain less than 50 km^2 (31 mi^2) [4]. Eight tributary streams drained between 50 km^2 and 200 km^2 (124 mi^2), and nine tributary streams drained at least 200 km^2.

Sampling in 2012 was conducted in 24 accessible tributaries to the mainstem Susitna River, including 14 of 67 that drained less than 50 km^2, 4 of 8 that drained 50 km^2–200 km^2, and 9 of 9 drainage areas exceeding 200 km^2 (Appendix C). Sampling was focused in stream habitats located downstream of adult salmon passage barriers (barriers are described in a companion report) or to an elevation of 3,000 feet in streams where barriers were not identified. Select mainstem Susitna River and lake habitats were also sampled.

3.3. Methods

3.3.1. Sample Site Selection

Historical fish species distribution data (1981–2011) were reviewed to help prioritize 2012 sampling. Locations previously documented with juvenile or adult Chinook salmon presence were identified as the highest priority areas for sampling. The 2012 sample sites were intended to be representative of the habitat types present within the study area and were selected using a tiered approach. At the broadest scale, the study area was broken into four target habitats: (1) tributary streams; (2) tributary plumes, which refers to habitat just downstream of tributary mouths within the mainstem Susitna River (mixing zone of clear water tributaries in turbid mainstem); (3) mainstem Susitna River; and (4) lakes. Specific locations to be sampled were identified based on a number of considerations including spatial distribution throughout the study area, proximity to proposed Project features (e.g., proposed dam site and reservoir inundation zone), relative drainage basin size, and accessibility.

Within tributaries, sampling effort was stratified from the stream mouth to the upper watershed based on channel gradient and valley confinement. Major tributaries to the Upper Susitna River typically exhibit three major zones: (1) tributary mouths characterized by low to moderate gradient in moderately confined valleys, (2) transition zones of primarily high gradient with

[2] The study area, from the headwaters of all tributary streams that enter the Susitna River between RM 152.4 and 233.5, is over 2,400 square miles (calculated using NAD_1983_Alaska_Albers projected coordinate system).

[3] Based on GIS analysis of the National Hydrography Dataset (NHD) Flowline dataset derived from the NHD (downloaded from source website December 2011) and clipped to the Susitna Basin. The "lakes" layer used for this analysis was the NHD_Waterbody feature class where FType = LakePond.

[4] Drainage basin size classes generated by ADF&G (Buckwalter 2012) were used to categorize tributary streams in the NDH Flowline dataset that fall within the study area.

steep-walled canyons, and (3) unconfined plateaus of lower gradient that extend from the tree line to alpine headwaters. Generally, sampling occurred in all three zones, but first priority was placed in the lower portions of stream drainages, as well as within the vicinity of tributary plumes of major tributaries. Lakes located at an elevation below 2,050 feet, which is the current estimate of the maximum pool height of the proposed inundation zone, were also prioritized for sampling in 2012.

Fish presence was previously documented for a number of tributary streams and lakes in the study area during sampling conducted in the1980s and during more recent surveys conducted by the ADF&G (Buckwalter 2011). Tributary drainages that were excluded from previous efforts were also sampled in 2012 to expand baseline data. Priority was placed on sampling a subset of smaller tributary streams (drainage basin less than 50 km^2) for which no data existed. Additionally, two locations recommended by Buckwalter (2011) were sampled that included a tributary near RM 192 and another in the Fog Lakes complex.

Where possible, sample sites were selected to be representative of the habitat types present within the study area; however, site selection was influenced by several logistical challenges. Steep terrain, abundant trees, and vegetation often prohibited helicopter access. Sampling was limited to accessible habitats in wadeable stream channels and side channels. Some accessible streams were also unsafe to sample because of swift water velocity. Sampling in unwadeable streams was limited to shallow stream margins. In addition to influencing site selection, these challenges also limited the ability to sample specific portions of target streams or habitats present within the stream reaches sampled. The distances from field camp to sampling locations varied but in some cases exceeded 79 km (49 mi). The time and fuel required to access these tributaries limited the number and spatial separation of sampling sites. These factors influenced the number and distribution of selected sample locations (Figure 3and Figure 4; Appendix C).

3.3.2. Field Data Collection

Field data collection methods provided in the 2012 Upper Susitna River Fish Distribution and Habitat Study Plan (AEA 2012) were reviewed by ADF&G and a Fish Resource Permit (FRP) SF2012-151 was issued prior to conducting fieldwork. To reduce sample method bias, the field team used a combination of gear types to address variations in fish species size, life history stage, behavior, and habitat preference.

Sampling Gear

Both active and passive fish sampling techniques were used in 2012. Active capture techniques used in 2012 included backpack and boat electrofishing, snorkeling, and angling. Passive sampling techniques included gillnets, minnow traps, and fyke nets. Methods specific to both active and passive sampling gear used in 2012 are described below.

Backpack Electrofishing

Single-pass open system backpack electrofishing (Smith-Root LR-24) was used to sample wadeable stream habitat. Each backpack unit was fitted with a standard Smith-Root cathode and a single anode pole with a steel ring. A two- or three-person crew conducted electrofishing in streams by moving in an upstream direction. Team size was based on helicopter fuel and gear requirements or staff availability. The total linear distance over which fish sampling occurred in

a particular stream reach or general area is referred to as a 'sample segment.' Typically, the total length of a stream's sample segment was equal to or greater than at least 100 meters (m), but where access or safety was a concern it may have been reduced.

A sample segment was delineated into one or more mesohabitat 'sample units.' Aquatic habitat was classified at the mesohabitat level using the habitat classification system developed for Project licensing studies (Appendix D). Mesohabitat types included alcove, cascade, percolation channel, pool, riffle, pocketwater, run, and slough. Pools were further described as backwater or scour pools. A discrete mesohabitat unit was recorded if the distance between adjacent habitats was at least as long as the width of the wetted channel.

The field team recorded a GPS location at the downstream end of each sample segment, and moved upstream to sample discrete mesohabitat sample units separately. The team captured a digital image of each mesohabitat unit sampled using a GPS-enabled camera. Parameters recorded for each mesohabitat sample unit also included a representative wetted channel width (m) and where feasible, the total mesohabitat unit length (m)[5]. If sampling was not conducted throughout the mesohabitat unit's entire length, the length sampled was recorded. In most cases, the team was not able to sample the entire width of each stream. Therefore, the portion of the stream's wetted width that was sampled was visually estimated. The percent substrate composition and the mesohabitat unit's average water depth were visually estimated (Appendix D).

Netting efficiency and visual observation were compromised in units where turbid water conditions limited visibility and swift water prohibited access to the entire channel. Water clarity was noted to provide a measure of confidence in the visual data. Water clarity was recorded in the field using a qualitative scale of 0–3: i.e., poor, estimated < 25 percent of fish presence observed; fair, estimated 25–50 percent of fish presence observed; good, estimated > 50–75 percent of fish presence observed; and excellent, estimated >75 percent of fish presence observed. Data were recorded separately for each mesohabitat sample unit so that fish habitat associations could be considered. These data were not used for analysis purposes.

Electrofisher settings were determined in the field based on water quality conditions, professional judgment, and the overall goal of minimizing impacts to fish health. Prior to electrofishing, the team recorded ambient conductivity (microSiemens) and surface water temperature in Celsius (°C) with a digital meter (Hanna pH/EC/TDS 98129) at the downstream end of sample segments to help determine initial electrofisher settings. An ADF&G-generated table that recommends target voltage settings for juvenile salmonid sampling in cold water was used as a reference at the onset of sampling (Buckwalter 2012). Backpack electrofishing was conducted by trained staff per ADF&G FRP requirements; protocols were consistent with previously established studies and guidelines[6]. For each mesohabitat sample unit, fish capture data and sampling effort (e.g., electrofishing 'power on' recorded in seconds) were documented separately to establish catch-per-unit-effort (CPUE).

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[5] When the mesohabitat unit length exceeded the linear distance over which fish sampling was to occur or extended beyond the rangefinder's view, the total length (TL) was not recorded.

[6] Personal communication regarding electrofishing field protocols (Buckwalter 2012); *Electro-fishing Waters Containing Salmonids Listed under the Endangered Species Act* (NMFS 2000); *Backpack and Drift Boat Design Considerations and Sampling Protocols* (Temple and Pearsons 2007).

The naming convention used to identify each sample segment was linked to the name of the GPS unit and the unit's automatic waypoint identification. The sample unit name included the sample segment and a sequential number. For example, the identification of the sample segment if collected with the first waypoint using the Garmin unit named 'Golf' was 'G001'. The identification of the first mesohabitat unit encountered was sample unit 'G001.01'; the second habitat unit moving in an upstream direction was 'G001.02', etc.

Boat Electrofishing

Boat-based electrofishing was used primarily to sample non-wadeable stream habitat and was conducted from a 16-foot-long cataraft (model Aire Lion) on a break-down aluminum frame (manufactured at Alaska Raft and Kayak in Anchorage) and outfitted with a Honda 9.9 HP 4-stroke engine.

The cataraft was mounted with a Smith-Root 2.5 Gas-Powered Pulsator (GPP) electrofisher. The 2.5 GPP electrofisher was selected because it has sufficient power capabilities for low to medium conductivity water and utilizes a smaller generator (custom wound Honda) than would be required by other models. The 2.5 GPP (ranges in power from 2.5 to 9 kilowatt [kW]) includes five pulse settings and a percent-of-range selector to shape the waveform. A pulsed-DC waveform was used during boat-based operations. As standard practice, low frequency pulse settings were selected initially to avoid exposing fish to more harmful higher pulse frequencies. Settings were adjusted according to sampling conditions encountered.

Boat-based electrofishing was conducted by an experienced two-person crew. During sampling operations, the rower controlled the electrofisher settings and maneuvered the boat with either the oars or the motor while the netter collected fish with a long-handled fiberglass dip net from the bow. The forward netting platform was outfitted with a foot switch to initiate or cease electrofishing, and a lean bar for increased safety. In tributary streams, the boat operator typically moved the boat laterally across the current with the oars while moving downstream. In the mainstem Susitna River, the boat operator used either the oars or the motor to access suitable habitats.

The field team recorded a GPS location at the upstream start of each stream or sample segment prior to moving downstream to sample. Habitat measurements associated with distinct mesohabitat types were not recorded during the boat-based surveys in tributaries due primarily to the difficulty of stopping at habitat breaks while floating downstream. The team captured a digital image using a GPS-enabled camera and recorded electrofish 'power on' seconds for each area or stream segment sampled to establish CPUE. The naming convention to identify sample segments and water clarity qualifiers were consistent with that described in the Backpack Electrofishing section above.

Minnow Traps

Minnow traps baited with commercially-processed salmon eggs were soaked in low velocity areas of both lacustrine and riverine habitats for varying periods of time. Minnow traps were roughly 17 inches long and 9 inches in diameter, and were made of galvanized wire mesh. Both 1/4-inch and 1/8-inch mesh size traps were used in 2012. In most cases, traps were set for just a few hours while teams sampled nearby habitat using other capture gear. However, soak times varied from roughly 1 hour to several days because of helicopter logistics and inclement weather.

The field team recorded general characteristics of the habitat in which traps were placed, such as mesohabitat type, and captured representative photographs. Fish captures were recorded separately for each trap. Minnow trap soak times were recorded to establish CPUE for each species captured. The naming convention to identify sample sites was consistent with that described in the Backpack Electrofishing section above.

Fyke Nets

Fyke nets used in 2012 were constructed of 0.25-inch (44-pound) green treated netting with two metal rectangular entrance frames (27 inches by 39 inches), a vertical net throat, and four metal hoops with a single 6-inch diameter throat. The cod end (fish containment) was 8 feet long and each net included attached wings and detachable center leads with floats and weighted line. The maximum depth fished with this configuration was approximately 33 inches. These comparatively small fyke nets were selected because they are relatively lightweight and fit in the back seat of an R-44 helicopter. Fyke nets were placed in lacustrine and relatively slow-moving riverine habitats for varying periods of time and were not baited. Soak times varied from less than 1 hour to several days, due primarily to helicopter logistics and inclement weather. Fyke nets used in lakes were situated along the lake margin and typically placed close to a lake's outlet channel. The field team recorded the mesohabitat type in which fyke nets were placed and captured representative photographs of fyke net sets using a GPS-enabled camera. Fyke net set and pull times were recorded so that a total sampling effort for each net could be calculated. Fish captures were recorded separately for each net to establish CPUE. The naming convention to identify sample sites was consistent with that described in the Backpack Electrofishing section above.

Gillnets

The only gillnet deployed in 2012 measured 30 m (98 feet) long and 2 m (6 feet) deep with a mesh size of 1.75 inches. The net was placed in slow moving riverine habitat by affixing the net to riparian vegetation. Gillnets soaked for varying periods of time while other sampling methods were used in nearby habitats. Soak times were recorded for each net set. The naming convention to identify sample sites was consistent with that described in the Backpack Electrofishing section above. The field team recorded mesohabitat types where gillnets were used and captured representative photographs.

Angling

Angling surveys were conducted opportunistically in streams where electrofishing techniques were considered ineffective because of excessive water depth or water velocity. Angling was also performed in areas where field crews concluded that larger fish may have moved to avoid an electrofishing team. Angling was commonly conducted within relatively deep areas of larger streams, at tributary mouths of small streams, and at clear water plumes from major tributaries to the Susitna River. Lakes were also sampled from shorelines. The field team recorded mesohabitat types where angling was performed.

Collapsible pack rods with spinning reels and lightweight fishing line were used for angling efforts. Terminal tackle consisted of spinners and spoons; however, if these were ineffective, imitation fly patterns were used with a bobber indicator. Hooks were rendered barbless to reduce

the likelihood of fish injury. Fish were landed carefully and managed with a net when possible. Collected fish were identified to species and measured to nearest millimeter (mm). Fish were either retained for tissue sample collection or released near the point of capture.

Snorkeling

Single-pass open system snorkel surveys supplemented other methods and specifically targeted areas where conditions were not suitable for either backpack or boat-based electrofishing. The number of snorkelers used was based on stream width to ensure that the entire channel was surveyed during a single pass. When multiple snorkelers were used, snorkelers moved simultaneously within distinct lanes to view the entire stream width in a single pass. Snorkeling was used only on a limited basis, and when conducted, it was implemented by a single technician. The snorkeler moved in an upstream direction and identified fish species and estimated fish lengths in 20-mm increments (e.g. 0–20 mm, 21–40 mm, etc.). Fish observations were recorded separately for each mesohabitat unit sampled. Habitat parameters were recorded within each mesohabitat sample unit following methods used by backpack electrofish teams. The length and estimated sample width within each mesohabitat unit were recorded

Fish Handling and Biological Data Collection

Captured fish were identified to species, or the lowest taxonomic level possible, and enumerated. Fork length (FL [i.e., fork of the tail to the nose]) was recorded to the nearest mm for captured salmonids. Total length (TL) was recorded for species with caudal fins that are not forked. When many individual species with a similar size range were captured, the total catch was recorded and a subset was measured; each Chinook salmon captured was measured. Fish observed but not captured were recorded as visual observations. Where possible, fish length was estimated. Fish life-stage was estimated in the field based on fish species and length. Standardized fork-length threshold values developed by ADF&G were used to assign measured fish to selected life-stage classes (Buckwalter 2012).

Fish were returned near the point of capture, except for those retained as specimens for further identification or analysis. Fish inadvertently killed during sampling were either discarded on-site or retained for further analysis, when appropriate. The final disposition (e.g., unintended mortality, voucher specimen, injury) was recorded for each fish handled. Representative photographs were cataloged for each species captured.

Fish identification reference material was available on-site and consulted when species identification was in question. Hand lenses were used to aide in the identification of sculpin (*Cottidae*). Sculpin that could not be identified to species were recorded as ‘sculpin-spp’. Other species that could not be confidently identified in the field were photographed and identified at the lowest taxonomic level possible (e.g., genus or family) at a later date. Voucher specimens were retained for further identification.

Codes used to report fish species, disposition, and life-stage were consistent with those used during recent ADF&G studies (Buckwalter 2012) and FRP requirements. All data were recorded on a standardized datasheet. All fish capture data were submitted to ADF&G, following standard data submission form guidelines, per FRP requirements.

Genetics

Genetic samples were collected from juvenile Chinook salmon to support ADF&G's genetic baseline development for Chinook stocks of the Upper Susitna River. Samples from all other fish species encountered were also collected on an opportunistic basis during the 2012 fish distribution surveys to supplement ADF&G's Statewide DNA sampling program.

A 2-mm non-lethal fin clip was taken from the upper caudal fin of juvenile Chinook salmon. Each fin clip was preserved in a separate 2.0 milliliter (mL) vial filled with Isopropanol/Methanol/Ethanol (EtOH).

For other fish species except slimy sculpins (*Cottus cognatus*), genetic samples consisted of an approximate 2-mm non-lethal fin clip from either the caudal fin or axillary process. The anal fin was determined to be a more suitable fin to clip from slimy sculpin. Samples for other target fish species were preserved in species-specific bulk sample bottles filled with EtOH. Length measurements and capture location (GPS coordinates) were recorded for each fish sampled.

All fins were clipped using scissors; effort was made to minimize contact with human skin. The ADF&G genetics laboratory provided the field team with sample collection protocols (Appendix E), bulk sample bottles, and 2.0-mL vials.

Tissue Metals Content

Tissue samples were collected from target species to evaluate baseline metal levels in fish that may be used for human consumption. Target fish included Dolly Varden, Arctic grayling (*Thymallus arcticus*), lake trout (*Salvelinus namaycush*), rainbow trout (*Oncorhynchus mykiss*), burbot (*Lota lota*), and whitefish species. Up to seven whole body specimens of each species were identified as the target sample size. This effort was intended to support the water quality study; data may also be used to support wildlife investigations of metals in prey for piscivorous furbearers.

Fish samples were collected opportunistically throughout the study area in 2012. Angling and gillnets were the primary collection method; however, adult resident fish captured during electrofishing surveys were also retained for analysis. Samples were kept cool for several hours before freezing.

Otolith Microchemistry

The goal during 2012 was to collect up to 30 adult Dolly Varden and adult humpback whitefish (*Coregonus pidschian*) to extract and analyze otoliths for strontium distribution. Otoliths were extracted to document whether life histories exhibited by these fish populations in the Upper Susitna River exhibit anadromy. Strontium distribution within otoliths has been used to describe fish migrations between marine and freshwater environments (Brown et al. 2007). The strontium-to-calcium ratio can be used to reconstruct the chronology of migration between salinity environments for diadromous salmonids (Zimmerman 2005). Predetermined thresholds from known anadromous and non-anadromous fish standards in published literature are used as the reference.

Due to the expected low probability of anadromy above Devils Canyon, a large sample size was considered necessary to achieve the study objective. For example, a sample size of 10 fish has a

97 percent probability of selecting one anadromous fish when the actual proportion of anadromous fish in the population is 30 percent or greater (Brown et al. 2007).

3.3.3. Data Analysis

Fish distribution and habitat data were summarized into tables, charts, and figures. Data were first presented by gear type to characterize individual gear type effectiveness and to highlight gear bias where possible. Results were then presented according to sample location and by the broad target habitats. Data are presented relative to spatial location along the Susitna River and organized from downstream to upstream. Fish distribution and habitat information were generally characterized with a range of observed data and mean values where pertinent. Individual catch by species and overall composition were reported. CPUE was determined by dividing the catch by the sampling effort (e.g., seconds electrofished). For each stream sampled with a backpack electrofisher, CPUE was determined for each fish species captured. CPUE was not calculated for other methods, although effort is provided where possible.

Fish species populations were also analyzed by age class. Length-frequency histograms were reviewed and age class determined based on professional review and opinion.

3.3.4. Data Review and Quality Control

All gathered data were maintained through a strict quality control program developed for all studies within the Project. Entered data were independently reviewed to ensure that entry was correct. Where errors were found, field technicians were consulted to identify appropriate revisions. Summarized data, figures, and tables were reviewed for consistency and accuracy. Final reported information was reviewed by an independent senior biologist to ensure appropriate scientific reporting.

3.3.5. Deviations from Study Plan

Field Data Collection

The following study plan deviations occurred during field data collection:

- Study locations were marked with a GPS coordinate. Monumenting locations did not occur.
- Habitat characteristics were recorded for all areas sampled, in addition to habitats where juvenile Chinook salmon were found.
- Estimated thalweg depth, bankfull width, and dominant in-water cover type were not recorded in 2012 for all sites because of safety and logistical constraints associated with wading the entire channel.
- Estimates of the percent of each substrate type present were recorded in lieu of recording only the dominant and sub-dominant substrate types where substrate determination was possible.
- Habitat measurements associated with distinct mesohabitat types were not recorded during boat-based surveys. This omission was due to logistical constraints and safety concerns to maintain the boat at specific habitat breaks in swift current.
- Seine nets were not used in 2012; snorkeling methodology was included in 2012.

- Sampling was not conducted in Devils Creek downstream of the adult fish passage barrier because of the lack of a helicopter landing zone.
- The 2012 study plan indicated that the length of stream sampled at each site would be equal to or greater than 40 wetted channel widths based on the mean wetted width at the site (Buckwalter et al. 2010). However, it was evident during the initial field event in July 2012 that sampling a distance of 40 wetted channel widths for the majority of the streams surveyed was not attainable given the large size of the study area, difficult sampling conditions, access limitations, and small team size. Sampling a pre-determined segment length allowed for sampling two to three sample segments per day and therefore for 2012 sampling to cover a greater distribution of habitats.
- The study plan indicated that the 2012 sampling effort would target lakes that fall within the proposed inundation zone as well as 10 other lakes in the study area. In 2012, four lakes were sampled for fish presence. Priority was placed on lakes that are close to the proposed reservoir footprint; therefore, sampling was conducted in Sally Lake (Watana Creek drainage) and in a small, unnamed lake with an outlet stream that enters the Susitna River near RM 203.5. Sampling occurred on one of the five lakes that were identified for sampling in the Fog Creek drainage, and one of two lakes identified in the Deadman Creek drainage. Due to helicopter scheduling conflicts and weather delays, not all lakes could be sampled, but a list of prioritized lakes was completed. Existing fish species presence data were available for Clarence Lake, Watana Lake, and Deadman Lake. As a result, these lakes were given low priority and not sampled.
- The 2012 study plan indicated that a minimum of two transects running in a north/south and east/west pattern would be recorded in lakes sampled for fish, and that transects would be established so that they intersect at what is believed to be the deepest part of each lake sampled, if possible. Depth data are available for many lakes in the study area. Weather delays and helicopter scheduling conflicts limited the field team's ability to effectively sample lakes using this approach.
- No otoliths were collected for micro-chemistry analysis of anadromy due to the limited number of captures of adult-sized fish. The study plan indicated that CPUE would be compared between reaches using analysis of variance (ANOVA) to establish statistically significant differences. Comparisons between basins were not made because of other biasing factors that can alter the potential success of collecting fish. Biasing factors can include habitat complexity, turbidity, water quality, and stream size.

Data Analysis

ANOVA statistical testing assumes no correlation between independent variables and error. This assumption was violated by the influence of stream complexity, water quality, turbidity, stream size, and other biasing factors that varied among sampling sites. Sufficient data were not available to perform multivariate analysis of variance (MANOVA), which would be necessary to address biasing factors. Therefore, no additional ANOVA or MANOVA testing was completed.

3.4. Results

The 2012 effort focused on stream habitats (Table 5) with sampling limited primarily to wadeable stream channels and side channels, and along the margins of larger, unwadeable streams. The majority of sampling was conducted in main channel followed by side channel

habitat; off-channel habitat was sampled less frequently (Table 6). Fish distribution sampling was conducted in 27 tributary streams and 4 lakes located within tributaries of the study area. Sampling also occurred in the mainstem river within18 tributary plume habitats and within 10 mainstem Susitna River sites.

Catch diversity was representative of fish species known or assumed to be present in the Upper Susitna River drainage (Table 7). A total of 2,406 fish were captured in 2012 from at least 11 species, including 37 juvenile Chinook salmon (Appendix F, Photo 1) that were captured from two locations in the study area (Figure 5 and Figure 6). One adult Chinook was observed within tributary plume habitat (RM 181.2) during a boat-based electrofishing survey on July 27, 2012. Sampling activities were suspended as soon as the adult Chinook salmon was observed. No other Chinook salmon were observed during ground-based surveys.

Sculpin composed 62.0 percent of the total catch and were documented in all but two drainages sampled. Sculpin species, including slimy sculpin, are referred to as sculpin within the report unless otherwise noted. Arctic grayling (Appendix F, Photo 4) were the second most frequently captured species, composing 23.2 percent of the total catch followed by Dolly Varden (10.2 percent). Arctic grayling were documented in all but one drainage sampled; Dolly Varden were captured from 13 of the 27 tributary stream drainages sampled.

3.4.1. Sampling Gear

Backpack Electrofishing

Backpack electrofishing was the primary gear type used in 2012 (Table 5) and accounted for 87.6 percent of total fish captured. Sampling was conducted in stream habitat within 24 tributaries, 12 tributary plumes sampled from the mainstem Susitna River, and 9 mainstem Susitna River locations (Table 8). Only one lake was sampled using a backpack electrofisher.

A total of 2,108 fish were captured using the backpack electrofisher, including 37 juvenile Chinook salmon and 15 unidentified salmonids (Table 8). Backpack electrofishing was the only gear type that captured Chinook salmon in 2012. Sculpin most often dominated the catch, followed by Arctic grayling and Dolly Varden. Catch of other species was considerably lower. Sampling effort was recorded for 209 of the 215 discrete sample units electrofished. A total of 2,067 fish were captured during the 929.15 minutes (55,749 seconds or 15.48 hours) of backpack electrofishing effort. This equates to a CPUE of 2.2 fish per minute for all species captured during the 2012 study season.

Boat Electrofishing

Boat-based electrofishing surveys were conducted within three tributary streams, seven tributary plumes accessed from the mainstem Susitna River, one location in the mainstem Susitna River, and in one lake.

A total of 121 fish were captured using the boat-based electrofisher during 141.43 minutes (8,486 seconds) of effort (Table 9). Arctic grayling and sculpin were the most frequently captured fish. Boat-based electrofishing accounted for 5.0 percent of total fish captured.

Many fish were observed but not captured during boat-based surveys (Table 9). The field team recorded the presence of 59 fish, including Arctic grayling, whitefish species, and longnose

sucker; however, additional fish were observed but not recorded. Diversity of fish species observed was consistent with captured fish.

Minnow Traps

A total of 41 minnow traps were used in 2012, including 18 traps set throughout two tributary stream drainages and 23 traps set in four lakes (Table 10; Figure 3 and Figure 4). Minnow traps were not used in the mainstem Susitna River or tributary plume habitats.

Traps captured 46 fish over a total effort of 31,679 minutes (572.98 hours; Table 10). Catch was limited to sculpin, Dolly Varden, and Arctic grayling. Minnow traps accounted for 1.7 percent of the total fish captured.

Fyke Nets

Fyke nets were used on eight occasions in 2012; seven nets were set in four lakes and in one tributary plume (Table 11). Lakes sampled included an unnamed lake in the Deadman Creek drainage, an unnamed lake in the Fog Creek drainage, Sally Lake in the Watana Creek drainage, and an unnamed lake that drains into the Susitna River at RM 203.4. Fyke nets were not used in tributary or mainstem Susitna River habitats. Fyke nets captured 75 fish in 12,521 minutes (208.68 hours, Table 11). Catch was limited to sculpin, Arctic grayling, and Dolly Varden. Fyke nets accounted for 3.1 percent of the total fish captured.

Gillnets

Gillnets were used on two occasions in 2012, both in the Kosina Creek drainage. One gillnet was set in a side channel of Kosina Creek on July 28, 2012, and soaked for 2.5 hours. The other gillnet was deployed in a side channel of Gilbert Creek, a tributary to Kosina Creek, on August 1, 2012. The net soaked for less than 1 hour during an electrofishing survey. No fish were captured from either set. The field team recorded the presence of young-of-the-year (YOY) grayling and sculpin in the nets' proximity, and captured grayling and sculpin during an electrofishing survey in adjacent habitat.

The field team planned to use a gillnet in Sally Lake to target lake trout for tissue collection. However, the team used alternative methods because of the presence of loons close to the sampling area.

Angling

Limited angling was conducted in tributary, tributary plume, and lake habitats in 2012 (Table 12). A total of 49 fish were captured, including Arctic grayling, Dolly Varden, and lake trout. Angling accounted for 2.0 percent of the total fish captured.

Snorkeling

Snorkeling was conducted along a portion of one unwadeable tributary stream by a two-person team on August 10, 2012. The entire width of the stream could not be sampled by one snorkeler, and velocity and depth precluded movement throughout certain portions of the stream channel.

The snorkelers observed a total of 40 fish, including Arctic grayling, round whitefish, sculpin, and Dolly Varden (Table 13).

3.4.2. Spatial Distribution

Tributary Stream Drainages

Field sampling of tributary streams resulted in collection of 1,791 fish comprising six species. Composition of fish collected within tributary habitat was dominated by sculpin (slimy sculpin and unclassified sculpin, 67.6 percent), Arctic grayling (15.7 percent), and Dolly Varden (13.6 percent); Chinook salmon accounted for 2.1 percent, with longnose suckers and round white fish accounting for 1.0 percent. The field team incidentally observed over 290 additional fish that avoided collection. In addition, 40 fish were observed during snorkeling (Table 13).

Lake sampling resulted in collection of 112 fish from the 4 lakes sampled; no fish were captured or observed in the unnamed lake within the unnamed tributary drainage at RM 203.4 (Table 14). Four species were documented in lakes; catch was dominated by sculpin (68.1 percent) and Arctic grayling (24.8 percent). Lake trout and Dolly Varden were also collected.Backpack electrofishing surveys were conducted in 184 mesohabitat sample units in tributaries, or 79.0 percent of the sites sampled in tributary habitats (Table 5). Catch (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonmy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 166) and CPUE (Table 17) were dominated by sculpin, Arctic grayling, and Dolly Varden. Fish distribution sampling using seven different gear types resulted in collection of 2,787 fish (Table 14)

Downstream of Proposed Dam Site

Fish sampling was successfully conducted in 14 tributaries downstream of the proposed Susitna –Watana Dam site.

RM 152.4-Cheechako Creek

Fish distribution sampling was conducted in one sample segment, which was located downstream of the fish barrier located 3.4 km (2.1miles) from the mouth. Backpack electrofishing was conducted from the mouth to a point approximately 175 m (574 feet) upstream. The entire sample segment was characterized as cascade mesohabitat (Table 6). No other sampling methods were attempted.

A total of 51 fish were captured during 16.75 minutes (1,005 seconds) of effort on August 2012. Juvenile Chinook salmon dominated the catch (68.6 percent), followed by Dolly Varden (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). Arctic grayling and sculpin were also collected. Fork lengths of juvenile Chinook salmon ranged from 54 mm to 72 mm (Appendix G). Water clarity in this clearwater stream was considered good to excellent during the survey.

Cheechako Creek was one of only two tributary streams where juvenile Chinook were captured, and was the only location where Chinook salmon dominated the catch. Chinook salmon were captured primarily from behind boulders and on the margins of the left bank. The stream channel sampled was approximately 12 m (39 feet) wide and mean depth was 0.45 m (1.5 feet). Boulders (70 percent) dominated the substrate; the presence of cobble (20 percent) and gravel (10 percent) was also documented. Minimal overhanging vegetation was noted in the sample area.

Adult Chinook salmon were observed in Cheechako Creek downstream of the barrier during an aerial salmon spawning survey in 2012. The presence of adult Chinook salmon was also documented in the 1980s (ADF&G 1985).

RM 157.0-Chinook Creek

Fish distribution sampling occurred in Chinook Creek on July 24, 2012. Backpack electrofishing was conducted in three spatially separate segments over a combined total distance of 180 m (591 feet), and angling was conducted in the segment near the mouth. Mesohabitat sampled was classified as riffle, pocket-water, and cascade (Table 6).

A total of 29 fish were captured from Chinook Creek during 16.33 minutes (980 seconds) of backpack electrofishing effort (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). Dolly Varden dominated the catch (70.0 percent); sculpin were also captured. No fish were captured during angling. Chinook Creek was 1 of 13 streams where Dolly Varden were captured and was 1 of 3 streams where backpack electrofishing catch was dominated by Dolly Varden. Water clarity in Chinook Creek was considered excellent during the survey.

Adult Chinook salmon were observed in the main channel during an aerial salmon spawning survey in 2012. The presence of adult Chinook salmon in this stream was also documented in the 1980s (ADF&G 1985).

RM 161.5-Devil Creek

Fish distribution sampling occurred on August 16, 2012, in Devil Creek. Sampling was not conducted in Devil Creek downstream of the adult salmon passage barrier located 2.3 km (1.4

miles) upstream of the mouth because of the lack of a landing zone. Backpack electrofishing was conducted in one area located upstream of the barrier on August 16, 2012, to catalog fish species presence. Sampling was conducted over a distance of 200 m (656 feet). Mesohabitat sampled was classified as 100 percent pocket-water riffle (Table 6).

A total of 42 fish were captured from Devil Creek during 9.05 minutes (543 seconds) of backpack electrofishing effort. Catch was dominated by Dolly Varden (90.5 percent); were also captured (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). Devil Creek was 1 of 13 streams where Dolly Varden were captured and was 1 of 3 streams where backpack electrofishing catch was dominated by Dolly Varden. Water clarity was considered excellent during the survey.

The presence of adult Chinook salmon has been previously documented downstream of the barrier (ADF&G 1985); adult Chinook were observed downstream of the barrier during all four aerial surveys in 2012.

RM 166.3-Unnamed Tributary

Fish distribution sampling occurred on July 31 and August 16, 2012. Backpack electrofishing was the only sampling method used in this tributary. Sampling was conducted in two segments over a total distance of 169 m (554 ft). Mesohabitat sampled was primarily cascade, with some classified as run (Table 6).

A total of 29 fish were captured during 15.52 minutes (931 seconds) of backpack effort (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). Catch was dominated by sculpin (37.9 percent) and Dolly Varden (34.5 percent); Arctic grayling and a single unidentified salmonid were also recorded. Water clarity was considered excellent during the surveys.

RM 168.7-Unnamed Tributary

Fish distribution sampling occurred on July 31, 2012. Backpack electrofishing was conducted in two sample segments over a total distance of 74 m (243 ft). The sites were located downstream of the barrier located 0.6 km (0.4 mi) above of the confluence. Mesohabitat sampled was 100 percent riffle (Table 6).

A total of 57 fish were captured during 10.73 minutes (644 seconds) of backpack effort. Catch was dominated by sculpin (80.7 percent); Arctic grayling and Dolly Varden also collected (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). Additional sculpin were observed but not captured. Water clarity was considered excellent during sampling.

RM 171.0-Unnamed Tributary

Fish distribution sampling occurred on August 6, 2012. Backpack electrofishing and angling were conducted in one sample segment downstream of the barriers located 2.3 km (1.4 mi) upstream of the confluence. A distance of 142 m (466 ft) was sampled with the backpack electrofisher; mesohabitat was 100 percent riffle (Table 6).

A total of 13 fish were captured during 3.07 minutes (184 seconds) of backpack electrofishing effort. Arctic grayling (n=8) were captured by angling and all sculpin (n=5) were captured by electrofishing (Table 14). Water clarity was considered excellent.

RM 173.0-Unnamed Tributary

Fish distribution sampling occurred on July 30, 2012. Backpack electrofishing was conducted in two sample segments, both located downstream of the barrier 0.3 km (0.2 mi) upstream of the confluence. Sampling was conducted over a total distance of 77 m (253 ft). No other sampling methods were used in this stream. The mesohabitat sampled was primarily cascade and run, with some riffle (Table 6).

A total of 7 fish were captured during 8.27 minutes (496 seconds) of backpack electrofishing effort. Sculpin dominated the catch (71.4 percent); Dolly Varden and Arctic grayling were also caught (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). Additional sculpin were observed, but not collected. Water clarity was considered excellent.

RM 174.0-Unnamed Tributary

Fish distribution sampling occurred on July 30, 2012. Backpack electrofishing was conducted in one sample segment just upstream from the mouth, over a distance of 46 m (151 ft). The mesohabitat sampled was classified as run and riffle (Table 6).

A total of 53 fish were captured during 12.43 minutes (746 seconds) of backpack effort. Catch was dominated by sculpin (66.0 percent) followed by Arctic grayling (Table

15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). Dolly Varden, longnose sucker, and YOY unidentified salmonids were also collected. Water clarity was considered excellent.

RM 174.2-Unnamed Tributary

Fish distribution sampling occurred on July 30, 2012. Backpack electrofishing was conducted in the main channel over a total distance of 74 m (243 ft), working upstream from the tributary mouth. The mesohabitat sampled was classified as 100 percent riffle (Table 6).

A total of 58 fish were captured or observed; catch was dominated by sculpin (65.2 percent), followed by Arctic grayling. Dolly Varden and unidentified salmonids were also captured in fewer numbers (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). Backpack electrofishing effort was not recorded from one sample segment. In the unit where effort was recorded, fifteen fish were captured during 3.48 minutes (209 seconds) of backpack electrofishing effort. Water clarity was considered excellent.

RM 176.6-Fog Creek

Fish distribution sampling was conducted throughout Fog Creek, within 3 secondary tributary streams, and 1 lake in the Fog Lakes complex (Figure 3 and Figure 4) on July 18, July 21-23, and August 9, 2012. Backpack electrofishing was the primary sample method used in stream habitats; angling and minnow traps were used at a subset of sample segments. Backpack electrofishing was conducted in 39 stream mesohabitat units over a total distance of 1,123 m

(3,685 ft) in the Fog Creek drainage (Table 6). Effort was concentrated in side channel and main channel habitats; off channel habitats were also sampled. Most mesohabitat was defined as riffle (n=13, 42.1 percent), run (n=14, 27.0 percent), or percolation channel (n=4, 14.1 percent). Cascade, scour pool, pocket-water riffle, and slough were also sampled.

A total of 258 fish were collected or observed within Fog Creek and its tributaries using all aforementioned methods (Table 14). Backpack electrofishing resulted in capture and/or observation of 194 fish during 141.70 minutes (1,123 seconds) of effort (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). The total catch by all methods was dominated by sculpin (66.3 percent) followed by Dolly Varden; only four Arctic grayling were captured. Over half of the sculpin were identified as slimy sculpin (Table 14). Dolly Varden FL ranged from 32 mm to 366 mm (Appendix G). The Fog Creek drainage was one of two drainages where FL of Dolly Varden exceeded 200 mm. In general, water clarity was good to excellent.

On July 21, 2012, five adult Dolly Varden (FL between 300 mm and 366 mm) were collected from a percolation channel near the outlet of the Fog Lake system by angling. Dolly Varden were also captured from minnow traps placed in the lake's outlet channel.

One lake in the Fog Lakes complex was sampled by boat-based electrofishing, minnow traps, and a fyke net. A total of 25 fish were captured from the lake, mostly sculpin (Table 14). Dolly Varden were also collected. Water clarity was during boat-based electrofishing was good.

One adult Chinook salmon was observed in Fog Creek on July 30, 2012, during an aerial salmon spawning survey. The presence of both adult and juvenile Chinook salmon in Fog Creek has been previously documented (Buckwalter 2012). Juvenile Chinook salmon were captured from two locations in the Fog Creek drainage by ADF&G in 2003 and 2011 (Buckwalter 2011). Sampling in 2012 occurred in close proximity to both locations; however, juvenile Chinook were not captured or observed.

RM 179.1-Unnamed Tributary

Backpack electrofishing was conducted on July 29, 2012 in one sample segment downstream of the barrier located 4.5 km (2.8 mi) upstream of the confluence. The sample segment started at the mouth and extended 137 m (450 ft) upstream, encompassing six mesohabitat sample units. Mesohabitat within the segment was classified as predominately run, with some cascade (Table 6).

A total of 54 fish were captured during 23.70 minutes (1,442 seconds) of backpack electrofishing effort, including two juvenile Chinook salmon (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). Catch was dominated by Arctic grayling (50.0 percent). Sculpin and Dolly Varden were also captured in fewer numbers. Water clarity was considered excellent during the survey.

This unnamed stream was 1 of only 2 streams where juvenile Chinook salmon were captured in 2012. Chinook salmon had not previously been documented in this stream drainage. The juvenile Chinook salmon had FL of 60 mm and 64 mm. Both were captured in run habitat 12 m (39 ft) upstream from the Susitna River confluence. The habitat unit was 11 m (36 ft) long and averaged 2.6 m wide and 0.25 m (8.5 ft and 0.8 ft respectively) deep. Substrate consisted of 10 percent boulder, 40 percent cobble, 40 percent gravel, and 10 percent fines. Visibility was considered excellent in this clearwater stream; overhanging vegetation was prevalent. The fish were holding, under cover, along a velocity break between slow and fast water.

RM 179.4-Unnamed Tributary

Fish distribution sampling occurred on August 10, 2012. Backpack electrofishing was conducted over a 100 m (328 ft) sample segment. Mesohabitat sampled was defined as 100 percent cascade (Table 6).

A total of 14 fish were captured during 6.22 minutes (373 seconds) of backpack effort. Catch including Arctic grayling (64.3 percent) and Dolly Varden (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). Water clarity was considered excellent.

RM 181.2-Unnamed Tributary

Fish distribution sampling occurred on July 23, July 27, and August 10, 2012. A distributary channel flows from the primary channel into the Susitna River approximately 300 m (984 ft)

upstream from the Susitna River confluence. All fish distribution sampling was conducted within the lower portion of the primary (west) channel, downstream of the bifurcation.

Backpack electrofishing was conducted on July 23, 2012 in the lower 35 m (115 ft) of habitat in the west channel beginning at the mouth. High velocities precluded the team's to sample throughout the entire channel. Sampling was limited to habitats along the stream margin and behind boulders where slower velocities were encountered. A total of six were captured during 3.53 minutes (212 seconds) of backpack electrofishing effort (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). Water clarity was excellent during sampling.

The team returned on August 10, 2012 to snorkel additional habitats. A total distance of 249 m (817 ft) was sampled. Mesohabitat composition was primarily run, run-pocketwater, and riffle-pocketwater, with cascade and pool habitat also present (Table 6). The snorkeler observed 40 fish, primarily Arctic grayling. Round whitefish, sculpin, and Dolly Varden were also observed. The entire width of the stream could not be sampled by one snorkeler, and velocity and depth

precluded movement throughout portions of the stream channel. In total, 46 fish were observed by snorkeling or captured by backpack electrofishing (Table 14).

RM 181.8-Tsusena Creek

Fish distribution sampling occurred on July 25, July 27, and August 10, 2012. The channel bifurcates in its lower 0.5 km (0.3 mi) and enters the Susitna River as two channels. An adult salmon barrier is located approximately 6.1 km (3.8 mi) upstream of the confluence. Backpack electrofishing was conducted in the west channel, downstream of the bifurcation. Total distance sampled was 107 m (351 ft); mesohabitat included riffle and run (Table 6).

A total of 50 fish were captured during 10.28 minutes (617 seconds) of backpack effort. Sculpin dominated the catch (86.0 percent) and Arctic grayling and longnose sucker also captured (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). Some of the sculpin were identified as slimy sculpin. Visibility during backpack electrofish was considered excellent.

The presence of adult Chinook salmon was documented in the 1980s (ADF&G 1985). Aerial surveys to document the adult salmon presence were conducted downstream of the barrier in 2012; no salmon were observed.

Upstream of Proposed Dam Site

RM 186.6-Deadman Creek

Fish distribution sampling occurred on July 24, July 26, and August 15, 2012. Fish distribution sampling was conducted at one location downstream of the barrier located 1.0 km (0.6 mi) upstream of the confluence, and two locations upstream from the barrier, including an unnamed lake.

Both boat-based electrofishing and angling were conducted upstream of the barrier (upstream of the 2,050-ft elevation). The boat-based electrofishing survey was conducted over a distance of roughly 1 km (0.6 mi). The upstream start was located roughly 4.3 km (2.7 mi) downstream of Deadman Lake. Velocities were extremely low throughout the area sampled. Mesohabitat included primarily long, slow runs and deep pools; few riffles were encountered (Table 6). Many large fish were observed swimming outside of the electrical field multiple times throughout the survey; however, capture was limited to three sculpin and one juvenile Arctic grayling. The juvenile Arctic grayling was captured from an aggregate of juveniles visible along the margin of the stream. Visibility was good during boat-based electrofishing.

Angling was more effective for capturing adult fish in these conditions. Ten Arctic grayling were captured with angling gear for a total of 12 captured or observed (Table 14).

One unnamed lake in this drainage was sampled in 2012 using angling gear, fyke nets, and minnow traps. Catch was comprised of Arctic grayling and lake trout (Table 14).

Aerial surveys to document the adult salmon presence were conducted downstream of the barrier in 2012; no salmon were observed. Chinook salmon have not been documented in Deadman Creek by previous investigators (ADF&G 1985; Buckwalter 2011).

RM 186.9-Unnamed Tributary

Fish distribution sampling occurred on August 5, 2012. The stream channel in the vicinity of the mouth is high gradient cascade, with boulders present. Less than 2 m (6.6 ft) of limited backpack electrofishing was attempted at the mouth of the stream. Water clarity was poor; no fish were captured or observed. Habitat throughout this stream does not appear suitable for adult salmon.

RM 192.0-Unnamed Tributary

Fish distribution sampling occurred on July 17-18, and July 26, 2012. Backpack electrofishing was conducted in two discrete segments, over a total distance of 205 m (673 ft). Runs were the dominant mesohabitat sampled (Table 6). The remaining mesohabitat sample units were riffle, pocket-water riffle, backwater pool, and scour pool.

A total of 34 fish were captured or observed during 23.60 minutes (1,416 seconds) of backpack electrofishing effort. Sculpin (slimy and unclassified) dominated the catch (85.7 percent); Arctic grayling and Dolly Varden were also captured (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). Water clarity was excellent during the sampling.

One sample segment was located downstream of the proposed inundation zone (approximately 2,050-foot elevation) and the other was located upstream. Arctic grayling and sculpin were present in both segments; Dolly Varden were documented only in the upstream segment.

RM 194.1-Watana Creek

Fish distribution sampling occurred July 19-20, July 26, August 3, August 6, and August 11, 2012. Sampling was conducted in Watana Creek, within 5 tributary streams, and in Sally Lake, which is located below the proposed reservoir elevation of 2,050 ft. Backpack and boat-mounted

electrofishing were the primary capture methods used in stream habitat. Angling gear and minnow traps were used at a subset of the stream segments sampled.

A total of 414 fish were captured or observed from stream habitat sampled throughout the Watana Creek drainage; catch was dominated by sculpin (slimy and unclassified) and Arctic grayling (Table 14). Catch also included Dolly Varden and round whitefish. Backpack electrofishing was conducted in main channel (73.6 percent), side channel (21.8 percent), and off channel (4.6 percent) over a total distance of 1,202 m (3,944 ft, Table 6). Mesohabitat in most sample units was defined as run or riffle, with smaller amounts of cascade, backwater pool, scour pool, pocket-water riffle, pocket-water run, and slough.

Backpack electrofishing effort was relatively well distributed throughout Watana Creek. Of the 1,202 m of stream habitat sampled, approximately 471 m (1,545 ft) was located below an elevation of 2,050 ft, and the remaining 731 m (2,398 ft) was located above an elevation of 2,050 ft.

A total of 320 fish were captured or observed during 84.20 minutes (1,202 seconds) of backpack electrofishing effort. Sculpin were caught or observed most often (85.3 percent), Arctic grayling were found often in habitats sampled downstream of 2,050-ft and caught less frequently farther upstream. Dolly Varden were captured from only two locations on Watana Creek. One Dolly Varden was captured from riffle habitat in a side channel located roughly 14 km (8.7 mi) upstream from the mouth, and another six were captured farther upstream. In general, water clarity was good to excellent.

A boat-electrofishing survey was conducted over a distance of approximately 4.9 km (3.0 mi) on July 20, 2012. The upstream start was located approximately 12.6 km (7.9 mi) upstream of the Susitna River confluence. Mesohabitat within the stream segment sampled was dominated by riffles and runs (Table 6). Boat-based electrofishing resulted in the capture of 16 fish, predominantly Arctic grayling; round whitefish were also collected. Approximately 15 additional Arctic grayling were observed but not captured.

Backpack electrofishing, angling, minnow traps, and a fyke net were used to sample Sally Lake. Fish captures and observations were dominated by sculpin and Arctic grayling (Table 14). Lake trout were also captured.

RM 194.9-Unnamed Tributary

Fish distribution sampling was conducted on July 18-19, and July 26, 2012. Two segments were sampled in this tributary, one located near the mouth and the other located farther upstream above an elevation of 2,050 ft on the east channel. Sampling did not occur upstream of the suspected barrier in the west channel located 1.3 km (0.8 mi) upstream of the confluence.

Backpack electrofishing was conducted over a total combined distance of 149 m (489 ft). Sampling occurred at nine discrete mesohabitat units; mesohabitat was primarily run or riffle, with some scour pools present (Table 6). Additionally, two minnow traps were used at the upper segment.

Backpack electrofishing effort in the tributary was 13.63 minutes (818 seconds). A total of fish were captured at the downstream site. Sculpin (slimy and unclassified) were the fish captured (84.6 percent); Arctic grayling were also caught (Table 15. Fish captured and

observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). No fish were captured or observed at the upstream segment. Water quality during tributary sampling was fair.

RM 200.7-Unnamed Tributary

Fish distribution sampling occurred August 1, 2012. Backpack electrofishing was conducted over 45 m downstream from the barrier located 0.3 km (0.2 mi) upstream of the confluence. Mesohabitat sampled was limited to pocket-water riffle and cascade (Table 6).

A total of 24 fish were captured or observed. The majority of fish were sculpin (87.5 percent); Arctic grayling were also captured (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). Fifteen fish were captured during 5.82 minutes (349 seconds) of backpack electrofishing effort in one unit. Backpack electrofishing effort was not recorded from one sample segment. Water clarity was fair.

RM 201.8-Unnamed Tributary

Fish distribution sampling occurred on August 3, 2012. Backpack electrofishing was conducted in the main channel of the stream over a total distance of 10 m (33 ft), downstream from the barrier located 0.6 km (0.4 mi) upstream of the confluence. Mesohabitat sampled was documented as 100 percent riffle (Table 6). Backpack electrofishing effort was abbreviated in this short section (0.6 minutes); no fish were captured or observed. Water clarity was poor.

RM 203.4-Unnamed Tributary

Fish distribution sampling occurred on August 14, 2012. Sampling did not occur in the stream; the unnamed lake was sampled with fyke nets and minnow traps. No fish were caught or observed (Table 14). The lake is below an elevation of 2,050-ft.

RM 203.7-Unnamed Tributary

Fish distribution sampling occurred on August 2, 2012. Backpack electrofishing was conducted in the main channel over a distance of 30 m (98 ft). Mesohabitat sampled was defined as cascade and pocket-water run (Table 6).

A total of 29 fish were captured or observed during 4.63 minutes (278 seconds) of backpack electrofishing effort; all fish were sculpin (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). Water clarity was fair to good.

RM 206.8-Kosina Creek

Fish distribution sampling within the Kosina Creek drainage occurred on July 19, July 28, August 1, and August 12, 2012. Sampling was conducted throughout Kosina Creek and within two secondary tributaries: Gilbert Creek and Tsisi Creek. Backpack and boat-mounted electrofishing were the primary capture methods. Angling gear and gill nets were used at a subset of the segments sampled.

A total of 412 fish were captured or observed throughout the Kosina Creek drainage. Catch was dominated by sculpin (79.4 percent) followed by Arctic grayling. Dolly Varden and round whitefish were also captured (Table 14). Additionally, the presence of unspecified whitefish and salmonids was recorded. Chinook salmon were not captured or observed during the ground-based surveys. However, adult Chinook salmon were observed in Kosina Creek during the adult salmon aerial surveys conducted in July and August, 2012.

Backpack electrofishing was conducted over a total distance of 1,541 m (5,056 ft) within the Kosina Creek basin. Sampling occurred in main channel (30.9 percent), side channel (62.1 percent), and off channel (7.0 percent) habitat throughout eight spatially distinct areas, which included 19 mesohabitat sample units (Table 6). Most mesohabitat was defined as run, pocket-water riffle, and slough. Cascade, scour pool, riffle, and pocket-water run were also sampled.

Sample segments were relatively well distributed spatially throughout Kosina Creek. Sampling occurred in segments located throughout the mouth to roughly 23.7 km (14.7 mi) upstream from the Susitna River. The majority of stream habitat sampled was located upstream of the 2,050-foot elevation. Backpack electrofishing was conducted at two sample segments downstream of the 2,050-foot elevation in slough and main channel habitats over a total distance of 276 m (906 ft).

Fish composition was relatively consistent throughout the areas sampled. A total of 247 fish were captured during 151.58 minutes (1,541 seconds) of backpack electrofishing effort (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 166). Catch and observation was dominated by sculpin (87.4 percent). Artic grayling were only captured upstream of 2050-ft; round whitefish were also present. In general, water clarity was good to excellent; few sample segments were classified as fair.

A boat-based electrofishing survey was conducted over a distance of approximately 5.7 km (3.6 mi) on July 19, 2012. The upstream start was located approximately 23.2 km (14.4 mi) upstream of the Susitna River confluence. Mesohabitat within the stream segment sampled was dominated by riffles and runs (Table 6). Boat-based electrofishing resulted in the capture of Arctic grayling, round whitefish, and sculpin (Table 14). Adult Arctic grayling and whitefish were observed swimming outside of the electrical field multiple times throughout the survey.

Angling was found to be an effective method for capturing adult grayling in Kosina Creek. Five adult Arctic grayling were landed with angling gear.

The presence of adult and juvenile Chinook salmon in Kosina Creek was recently documented by ADF&G (Buckwalter 2011; ADF&G 2011). Adult Chinook salmon were observed in Kosina Creek during an aerial salmon spawning survey in 2012. However, no juvenile Chinook salmon were captured from Kosina Creek in 2012.

RM 208.6-Jay Creek

Fish distribution sampling occurred on July 25 and August 14, 2012. Backpack electrofishing was the primary method used to sample Jay Creek; angling was conducted at a subset of segments sampled. Backpack electrofishing was conducted over a total distance of 754 m (2,474 ft). Six stream segments were sampled, which included 19 discrete mesohabitat sample units. Backpack electrofishing occurred in main channel (80.0 percent), side channel (12.6 percent), and off channel (7.4 percent) habitats (Table 6). Most mesohabitat sampled were defined as riffle, run, or scour pool. Alcove, percolation channel, and slough habitats were also sampled.

Access to stream habitats within the lower portion of Jay Creek is limited. Jay Creek is confined by steep canyon walls for roughly 5.3 km (3.3 mi), starting at a point approximately 6.8 km (4.2 mi) upstream from its confluence with the Susitna River. The channel is less confined and more accessible within the lower 1.4 km (0.9 mi). Sampling was not conducted within the canyon reaches. Backpack electrofishing was conducted in five spatially distinct areas in Jay Creek, including one segment near the mouth. The upstream-most sample segment was located approximately 15.1 km (9.4 mi) upstream from the confluence.

Backpack electrofishing was conducted at just one segment downstream of the 2,050-foot elevation, over a distance of 84 m (276 ft). The remainder of the stream was sampled upstream of the 2,050-foot elevation. Fish species presence was relatively consistent throughout the areas sampled.

A total of 102 fish were captured during 55.97 minutes (3,358 seconds) of backpack electrofishing effort throughout Jay Creek (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). Catch was dominated by Dolly Varden (63.7 percent), followed by Arctic grayling and sculpin. An additional Arctic grayling was captured by angling roughly 9.5 km (5.9 m) upstream from the confluence. Water clarity was good to excellent in 18 of the 19 sample units; one unit was classified as fair.

Jay Creek was 1 of 13 streams where Dolly Varden were captured and was 1 of 3 streams where backpack electrofishing catch was dominated by Dolly Varden. Arctic grayling were captured from most segments sampled. Dolly Varden were captured from four of the five segments located upstream of 2,050-foot elevation, but were not captured from the downstream backpack electrofishing segment. Dolly Varden dominated the catch at the two upstream-most segments.

RM 231.0-Goose Creek

Fish distribution sampling occurred on July 29 and August 13, 2012. Backpack electrofishing was conducted over 637 m (2,090 ft) of stream. Sampling occurred in main channel (42.5 percent) and side channel (57.5 percent) habitat, over six stream segments (Table 6). Mesohabitat was dominated by pocket-water riffle and run, with riffle also present.

A total of 123 fish were captured during 50.78 minutes (3,047 second) of backpack electrofishing effort. Catch was dominated by sculpin (64.2 percent) and Arctic grayling (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). One additional Arctic grayling was observed but not captured. Water clarity was good to excellent during sampling.

Backpack electrofishing was conducted in three spatially distinct areas in Goose Creek, each with two sample segments. Distinct sample areas were located at approximately 1.9 km, 4.2 km, and 5.1 km upstream of the confluence (1.1 mi, 2.6 mi, and 3.2 mi, respectively). Sculpin and

Arctic grayling were captured in each of the three distinct areas; however, the majority of fish (74.8 percent) were from the two stream segments closest to the confluence.

RM 233.5-Oshetna River

Fish distribution sampling occurred on July 26-27, and August 13, 2012. Backpack electrofishing occurred in main channel (28.6 percent), side channel (36.7 percent), and off channel (34.7 percent) habitat over five sample segments (Table 6). A total of 608 m (1,995 ft) of stream were sampled including two segments totaling 220 m (722 ft) in the Black River. Overall, eleven mesohabitat units of stream were sampled (Table 6). Most mesohabitat was defined as percolation channel, riffle, or run, with scour pool habitat also present. No lake habitats were sampled in the Oshetna River drainage.

Backpack electrofishing was conducted in four spatially distinct areas of the Oshetna River drainage. Segments were located at the mouth and upstream of the confluence at 3.1 km and 12.4 km (1.9 mi and 7.7 mi, respectively). Two additional segments were located in the Black River approximately 20.2 km (12.6 mi) upstream of the confluence.

A total of 168 fish were captured during 42.67 minutes (2,560 seconds) of backpack electrofishing effort. Most fish captured were sculpin (93.4 percent); Arctic grayling and a single longnose sucker were also captured (Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonomy
166.3-Unnamed Trib Plume	BP, Fyk				39								10	
171.0-Unnamed Trib Plume	BP				18								6	
173.0-Unnamed Trib Plume	BP				8								5	
174.0-Unnamed Trib Plume	BP				21				1				32	
174.2-Unnamed Trib Plume	BP				33				1				30	
179.1-Unnamed Trib Plume	BP				24								19	
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32	
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5	
186.6-Deadman Creek Trib Plume	GPP				2									
186.9-Unnamed Trib Plume	BP													
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1	
194.1-Watana Cr Trib Plume	GPP				2				1		1			
194.9-Unnamed Trib Plume	GPP				1				2					
201.8-Unnamed Trib Plume	BP				21					1			13	
203.7-Unnamed Trib Plume	BP				15								7	
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2			
208.6-Jay Cr Trib Plume	GPP				6				4	1				
233.5-Oshetna River Trib Plume	BP				3							2	14	
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16). A significant amount of the catch (42.8 percent) was collected within the Black River. Sculpin were captured in each of the four distinct areas; however, the majority of sculpin were from the Black River. Arctic grayling were distributed from the mouth up to the uppermost segment located in the Black River; however, they were not captured in all segments. The majority were captured in the segment located at the mouth. The single longnose sucker was located in the segment 12.4 km (7.7 mi) from the confluence. Water clarity was variable throughout the backpack electrofishing effort; 6 of the 11 habitat units sampled had excellent water clarity, the remaining were classified as poor (n=1) or fair (n=4).

The presence of adult and juvenile Chinook salmon in the Oshetna River was recently documented by ADF&G (Buckwalter 2011; ADF&G 2011). Chinook salmon were not captured or observed in the Oshetna River in 2012.

Mainstem Susitna River

Fish distribution sampling was conducted in the mainstem Susitna River at tributary plumes in the vicinity of 18 tributary mouths. Sampling also took place in main channel, side channel, and off-channel habitats at 10 locations on the mainstem Susitna River. Sampling in the mainstem occurred between RM 166.3 – 233.5. Of the 28 sample segments located on the mainstem, 15 sample segments were located downstream of the proposed dam site, with the remaining 13 located upstream.

In the 10 sample sites not located at tributary plumes, the field team sampled a total of 1,409 m[7] (4,623 ft) of stream habitat at 18 individual sample units consisting of isolated pond, backwater pool, riffle, run, and slough mesohabitats. Riffle mesohabitat (n=5, 40.0 percent) was the most common sample unit, followed by slough (n=6, 31.5 percent). Backpack electrofishing was the primary sampling method; one unit, a slough, was sampled with a boat-mounted electrofishing unit.

A total of 109 fish were captured during fish distribution surveys in the 10 mainstem sample sites (Table 18). Arctic grayling, round whitefish, burbot, longnose sucker, and sculpin were collected. The field team recorded over 114 additional fish that were observed but not captured during capture-based surveys; no additional species were noted.

In the 18 tributary plumes sampled, backpack electrofishing was the primary method utilized (n=12 plumes). Boat-based electrofishing (n=6 plumes) or a combination of both boat and backpack electrofishing (n= 2 plumes) were utilized less often. Angling and a fyke net were utilized in only one plume each. In all, the field team sampled over 875 m (2,871 ft) of plume habitat utilizing backpack electrofishing. The length of plume sampled by boat-based electrofishing was not available due to logistical constraints.

Sampling in tributary plumes collected 391 fish with over 150 additional fish observed but not netted. Six species were documented in tributary plumes, with catch dominated by Arctic grayling (53.5 percent) and sculpin (slimy sculpin and unclassified sculpin, 40.7 percent). Round whitefish, longnose suckers, burbot, and humpback whitefish were captured in far fewer numbers (5.8 percent); two unidentified salmonids were also captured (Table 15).

Downstream of Proposed Dam Site

RM 166.3-Unnamed Tributary

On July 31, 2012, fish distribution sampling by backpack electrofishing and fyke net occurred in the mainstem Susitna River in the tributary plume of the unnamed tributary at RM 166.3. The fyke net was set for 23 minutes and captured a single Arctic grayling. Backpack electrofishing effort was 7.8 minutes (468 seconds) and occurred over a distance of 37 m (121 ft). A total of 49 fish were captured consisting of Arctic grayling (79.6 percent) and sculpin (Table 15).

[7] Length sampled was not recorded for two mainstem sample units.

RM 168.8, Susitna River

Susitna River off-channel habitat at RM 168.8 was sampled by backpack electrofishing on July 31. Three mesohabitat types were sampled, including backwater pool, slough, and an isolated pond. Total sample distance was 260 m (853 ft). Sampling effort was greatest in the slough mesohabitat (49.0 percent), followed by the back-water pool (43.0 percent) and the isolated pond (8.0 percent).

A total of 22 fish were captured during 24.90 minutes (1,493 seconds) of backpack electrofishing effort. Catch consisted entirely of sculpin with the exception of one Arctic grayling (Table 18). In addition, approximately 20 Arctic grayling were observed but not captured. Water clarity ranged from fair to good.

RM 171.0-Unnamed Tributary

Fish distribution sampling by backpack electrofishing occurred on August 6, 2012 in the mainstem Susitna River in the tributary plume of the unnamed tributary at RM 171.0. Backpack electrofishing effort was 4.28 minutes (257 seconds) over a distance of 53 m (174 ft). A total of 18 Arctic grayling were captured and six sculpin were observed in the plume (Table 15).

RM 173.0-Unnamed Tributary

Backpack electrofishing was conducted in the mainstem Susitna River in the tributary plume of the Unnamed Tributary at RM 173.0 on July 30, 2012. Backpack electrofishing effort was 3.8 minute (228 seconds) over a distance of 20 m (66 ft). A total of 13 fish were captured composed of Arctic grayling and sculpin (Table 15).

RM 174.0-Unnamed Tributary

Sampling by backpack electrofishing occurred on July 30, 2012 in the tributary plume of the unnamed tributary at RM 174.0. Backpack electrofishing effort was 7.90 minutes (474 seconds) over a distance of 39 m (128 ft). A total of 54 fish were collected. Sculpin dominated the catch (59.3 percent), Arctic grayling and a single unidentified salmonid were also captured (Table 145).

RM 174.1, Susitna River

Backpack electrofishing occurred in off-channel habitat on the mainstem Susitna River at RM 174.1 on July 30, 2012. Mesohabitat was backwater pool approximately 105 m (344 ft) long and 17 m (56 ft) wide; sampling was only completed on the shore margin covering an area approximately 90 m (295 ft) long by 2 m (6.6 ft) wide because deep mud limited mobility within the habitat unit.

A total of 30 fish were captured during 8.70 minutes (524 seconds) of backpack electrofishing effort. Catch consisting primarily of Arctic grayling (73.3 percent); longnose sucker and sculpin were also captured (Table 18). Water clarity was poor.

RM 174.2-Unnamed Tributary

Backpack electrofishing occurred on July 30, 2012 in the mainstem Susitna River within the vicinity of the tributary plume. Backpack electrofishing effort was 11.75 minutes (705 seconds) over a distance of 46 m (151 ft). A total of 37 fish were captured with an additional 27 observed. Species composition of captured and/or observed fish consisted of Arctic grayling, sculpin, and a single unidentified salmon (Table 14).

RM 178.2, Susitna River

Backpack electrofishing occurred in side channel habitat on the mainstem Susitna River at RM 178.2 on August 10, 2012. Sampling occurred at a shallow riffle located within a main channel island complex. Sampling was conducted over a distance of 121 m (397 ft).

A total of 8 fish were captured during 5.30 minutes (315 seconds) of backpack electrofishing effort. Catch consisted of sculpin and longnose sucker (Table 18). Water clarity was poor.

RM 179.1-Unnamed Tributary

On July 29, 2012, backpack electrofishing was conducted in the plume associated with the unnamed tributary at RM 179.1 in the mainstem Susitna River. Electrofishing effort was 11.72 minutes (703 seconds) over a distance of 55 m (180ft). A total of 43 fish were captured; Arctic grayling dominated the catch (55.8 percent) and the remaining fish were sculpin (Table 14).

RM 181.2-Unnamed Tributary

Fish distribution sampling using backpack and boat-based electrofishing was conducted on the mainstem Susitna in the plume of the unnamed tributary at RM 181.2. On August 10, 2012, backpack electrofishing was conducted over a total distance of 181 m (594 ft) with an effort of 33.08 minutes (1,985 seconds). A total of 43 fish were captured. Sculpin were the dominant fish caught (primarily identified as slimy sculpin). Arctic grayling and round whitefish were also collected in fewer numbers (Table 145). The netter observed but was unable to capture other fish (sculpin and unidentified salmonids).

A single adult Chinook salmon was observed in the clearwater plume during a boat-based electrofishing survey on July 27, 2012. The Chinook salmon was in spawning colors. Sampling activities ceased as soon as the adult Chinook salmon was observed. Total sample effort was 19 seconds.

RM 181.8-Tsusena Creek

Fish distribution sampling in the mainstem Susitna River at the Tsusena Creek plume was conducted using angling, boat-based electrofishing, and back-pack electrofishing during two separate events. Angling and backback electrofishing was conducted on August 10, 2012. Boat-based electrofishing took place on July 27, 2012. The majority of fish were captured by boat-based electrofishing (n=34) with fewer numbers captured by angling (n=4) and backpack electrofishing (n=5). Boat-based electrofishing effort was 6.58 minutes (395 seconds). Backpack electrofishing effort was 6.98 minutes (419 seconds) over a distance of 175 m (574 ft).

A total of 43 fish were captured. Fish captured included Arctic grayling (60.5 percent), sculpin, round whitefish, humpback whitefish, and longnose sucker (Table 145). This was the only location where a humpback whitefish was identified.

Upstream of Proposed Dam Site

Fish Distribution sampling was successfully conducted in 12 of 13 tributary upstream of the proposed Dam sight. Sampling in the firat tributary was not successful due to high gradient, high velocity habitat.

RM 186.0, Susitna River

Backpack electrofishing occurred over 95 m (312 ft) of off-channel slough habitat on the mainstem Susitna River at RM 186.0 on July 27, 2012. Visibility was poor in the portion of slough habitat adjacent to the Susitna River and improved as the water cleared toward the top of the slough.

A total of 17 fish were captured during 8.50 minutes (508 seconds) of backpack electrofishing effort. Sculpin were the most abundant species captured (52.9 percent), followed by Arctic grayling and longnose sucker (Table 18).

RM 186.6-Deadman Creek

Fish distribution sampling in the mainstem Susitna River at the Deadman Creek plume was conducted using boat-based electrofishing on July 26, 2012. Effort totaled 2.77 minutes (166 seconds) and resulted in the capture of two Arctic grayling (Table 145).

RM 186.8, Susitna River

Backpack electrofishing occurred in the main channel of the mainstem Susitna River at RM 186.8 on August 5, 2012. A total of 55 m (180 ft) of shallow back eddy habitat were sampled upstream and downstream from a small tributary.

A total of four fish were captured during 13.80 minutes (828 seconds) of backpack electrofishing effort. Arctic grayling, round whitefish, sculpin, and burbot were collected (Table 18). In addition, 2 sculpin were observed but not captured. Water clarity was poor.

RM 186.9-Unnamed Tributary

Backpack electrofishing in the mainstem Susitna River at the small plume associated with the unnamed tributary at RM 186.9 occurred on August 5, 2012. Water clarity was poor and a limited effort of 0.75 minutes (45 seconds) over 6 m (6.5 ft) resulted in no fish captured or observed.

RM 192.0-Unnamed Tributary

Fish distribution sampling by boat-mounted electrofishing occurred on July 26, 2012 in the plume created by the unnamed tributary at RM 192. A total of 21 fish were captured over an effort of 3.40 minutes (204 seconds). The catch included Arctic grayling, longnose sucker, round

whitefish, and sculpin. The netter reported an additional 35 Arctic grayling that were affected by the electrical field but not captured (Table 145).

RM 192.6, Susitna River

Backpack electrofishing occurred in the main channel of the mainstem Susitna River at RM 192.6 on August 5, 2012. Several hundred meters of shallow riffle along the island shoreline were sampled; precise survey distance is not available.

Four fish were captured including adult and juvenile Arctic grayling, longnose sucker, and sculpin (Table 18). In addition, approximately four Arctic grayling were observed but not captured. Backpack electrofishing effort is not available. Poor water clarity and swift current made capturing fish difficult.

RM 194.0, Susitna River

Backpack electrofishing occurred On August 6, 2012, in main channel and off-channel habitat of the mainstem Susitna River at RM 194.0 over a total distance of 261 m (856 ft). Main channel sampling occurred in run (58.6 percent) and riffle (18.4 percent) mesohabitat types. Off-channel mesohabitat was slough (23.0 percent).

A total of 14 fish were captured at this site within the main channel habitat (Table 18). Catch was limited to longnose sucker and sculpin. Numerous additional fish were observed but not captured during backpack electrofishing surveys; these species included 14 longnose sucker and 15 sculpin. Backpack electrofishing effort was greater than 11.70 minutes (704 seconds) but is not unavailable at all sites. Water clarity was poor in the main channel; water clarity in the slough varied from poor near the Susitna River to good in the clear water near the top of the slough.

RM 194.1-Watana Creek

The small plume of Watana Creek in the mainstem Susitna River was sampled on July 26, 2012. An effort of 1.10 minutes (66 seconds) by the boat-mounted electrofisher resulted in no successfully netted fish; however, Arctic grayling, longnose sucker, and an unidentified salmonid were observed (Table 14).

RM 194.9-Unnamed Tributary

The boat-mounted electrofisher was used to sample habitat in the tributary plume within the Susitna River on July 26, 2012. The size of the plume was very small. An effort of 0.90 minutes (54 seconds) captured one Arctic grayling and 2 unidentified salmonids were observed (Table 145).

RM 197.7, Susitna River

Backpack electrofishing occurred on August 2, 2012, in main channel and side-channel habitat of the mainstem Susitna River at RM 197.7 over 387 m (1,270 ft) of stream. Main channel sampling consisted mostly of riffle (77.5 percent) mesohabitat. Side-channel mesohabitat was classified as slough (22.5 percent).

Nine fish were captured during 18.60 minutes (1,117 seconds) of backpack electrofishing effort (Table 18). Arctic grayling and longnose sucker were captured in the side-channel habitat; one burbot was captured in the main channel. Additional Arctic grayling, sculpin, and longnose sucker were observed but not captured in the side channel. Water clarity was poor in the main channel and improved within the slough.

RM 201.7, Susitna River

Backpack electrofishing occurred on August 1, 2012 in the main channel of the mainstem Susitna River at RM 201.7 over 70 m (230 ft) of stream. Mesohabitat was classified as riffle over one sample unit.

No fish were captured at this site during 6.10 minutes (366 second) of backpack electrofishing effort. Four unidentified fish were observed in the main channel, but not captured (Table 18). Water clarity was poor.

RM 201.8-Unnamed Tributary

Fish distribution sampling in the plume of the unnamed tributary at RM 201.8 occurred on August 3, 2012 by backpack electrofishing. Effort was 8.42 minutes (505 seconds) over 91 m (299 ft). A total of 15 fish were captured, composed primarily of Arctic grayling with fewer numbers of sculpin and one burbot. In addition, 20 Arctic grayling and sculpin were observed but not captured (Table 145).

RM 203.7-Unnamed Tributary

Fish distribution sampling in the plume of the unnamed tributary at RM 203.7 occurred on August 2, 2012 by backpack electrofishing. Backpack electrofishing occurred over a distance of 56 m (184 ft) with an effort of 3.45 minutes (207 seconds). A total of 22 fish comprised of Arctic grayling and sculpin were captured (Table 145).

RM 205.7, Susitna River

Boat-mounted electrofishing occurred on July 25, 2012, in off-channel slough habitat on the mainstem Susitna River at RM 205.7 over 70 m (230 ft) of stream. The slough, approximately 50 m (164 ft) wide and 239 m (784 ft) long, was located near the downstream end of the Kosina Creek clearwater plume.

No fish were caught during 1.40 minutes (81 seconds) of boat electrofishing effort (Table 18). The team visually observed a school of small fish during the effort and was able to capture a fish from the school using a small hand net. The fish was identified as YOY Arctic grayling. Approximately 20 Arctic grayling were observed but not captured. Water clarity in the portion of the slough closest to the Susitna River was fair. Water clarity improved to good towards the upstream extent of the slough but the upstream extent became too shallow to effectively sample with the boat unit.

RM 206.8-Kosina Creek

Kosina Creek's extensive clearwater plume within the mainstem Susitna River was sampled on July 25, 2012 using a boat-mounted electrofisher. The survey effort totaled 8.05 minutes (483 seconds) and extended nearly 1.6 km (1.0 mi) downstream of the mouth of Kosina Creek. A total of 12 fish were captured, including Arctic grayling and longnose sucker. In addition, 16 unidentified salmonids were observed but not captured (Table 145).

RM 208.6-Jay Creek

The small plume at the mouth of Jay Creek was sampled in the mainstem Susitna River on July 25, 2012, using a boat-mounted electrofisher. Flow from Jay Creek enters the Susitna River in three small channels. The mixing zone of clear and turbid water at the base of each channel was estimated to be approximately 2 m by 2 m (6.5 ft by 6.5 ft). Electrofishing effort was 2.18 minutes (131 seconds). A total of 3 fish comprised of Arctic grayling and one burbot were captured. In addition, four unidentified salmonids and four Arctic grayling were observed but not captured (Table 14).

RM 233.5-Oshetna River

Backpack electrofishing was conducted within the mainstem Susitna River in the tributary plume of the Oshetna River on July 26, 2012. A total distance of 120 m (394 ft) was sampled during 5.07 minutes (304 seconds) of backpack electrofishing. Catch comprised of 16 sculpin and 3 Arctic grayling (Table 14).

3.4.3. Genetics

Fin clips were collected for genetic sampling from 35 juvenile Chinook salmon (FL 54 mm-72 mm) captured in Cheechako Creek. Fin clips were also taken throughout the study area from 69 Arctic grayling (FL 43-384), 29 Dolly Varden (FL 78mm-366mm), 20 longnose sucker (TL 68mm-404), 3 burbot (TL 380mm-410mm), 3 round whitefish (FL 179mm-305mm), and 2 slimy sculpin (TL 54mm-88mm). Samples were submitted to the ADF&G Genetics Laboratory in Anchorage on October 4, 2012.

3.4.4. Tissue Metals Content

Nineteen fish were collected as voucher specimens for metals analysis, including 7 Arctic grayling, 5 round whitefish, 1 humpback whitefish, 4 burbot, and 2 lake trout. However, 13 of the original 19 samples became unusable and were discarded after a freezer power malfunction at Stephan Lake Lodge. Tissue samples from 6 fish, including 2 lake trout, 2 burbot, and 2 Arctic grayling were not affected by the freezer malfunction and were submitted to Rand Brooks Laboratory for metals analysis. Results of the laboratory analysis will be presented in the Water Quality report.

All 6 samples analyzed were collected from upstream of the proposed dam site. Five fish were collected from habitat within the proposed inundation zone; and 1 fish was captured in a tributary stream just upstream from the proposed inundation zone elevation. The burbot were captured from the mainstem Susitna River. Lake trout were captured from Sally Lake, which is located in the Watana Creek drainage. Arctic grayling were captured from Watana Creek.

3.4.5. Otolith Microchemistry

Otoliths were not extracted from fish in 2012. One humpback whitefish was retained but the sample was discarded as a result of a freezer malfunction at Stephan Lake Lodge. The field team captured 5 adult Dolly Varden (FL ranged between 300 mm and 366 mm) from a percolation channel in the Fog Creek drainage, near the outlet of the Fog Creek system on July 21, 2012. However, none were retained for otolith analysis at that time. The team intended to resample near the initial point of capture to collect adult Dolly Varden, but was unable to return due to time constraints.

In 2011, ADF&G biologists collected otoliths from humpback whitefish and Dolly Varden from several reaches upstream of Devils Canyon. The otoliths are being tested for saltwater residency in an effort to determine whether anadromy may be a component of these species life history in the Upper Susitna River. Results are pending (Buckwalter 2011).

3.5. Discussion and Conclusion

3.5.1. Existing Fish Species Distribution Data Summary

Information regarding resident species, anadromous non-salmon species, and freshwater life stages of anadromous salmon throughout the Susitna River basin was collected during studies in connection with the historical proposed Susitna Hydroelectric Project in the 1980s. Historical data includes the spatial and temporal distribution of fish species and their relative abundance. To varying degrees, the relative abundance and distribution of resident fish species were determined during the early 1980s studies. For several species data included classifying dominant age classes and sex ratios, tracking movements, and identifying spawning and overwintering habitats. The Pre-Application Document (PAD) (AEA 2011a) and Aquatic Resources Data Gap Analysis (ARDGA; AEA 2011b) summarized this existing information and also identified data gaps for resident and rearing anadromous fish.

More recently, the ADF&G conducted fish presence sampling in the Upper Susitna River subbasin as part of their Alaska Freshwater Fish Inventory (AFFI) program[8]. In August 2003, the ADF&G sampled 19 reaches upstream of Devils Canyon with a backpack electrofisher during a reconnaissance inventory (Buckwalter 2011). In August 2011, ADF&G biologists returned to sample an additional 60 reaches using backpack and boat-based electrofishing, with an emphasis on anadromous fish, as part of their standard AFFI fish inventory practices (Buckwalter 2011). ADF&G recorded aquatic and riparian habitat characteristics at each fish sampling site and conducted a total of three aerial surveys to identify locations of spawning salmon (Buckwalter 2011). Between both study years, 75 reaches were sampled for fish presence within or upstream of Devils Canyon. Of these, 38 reaches fall within the study area of the Fish Distribution Study (Buckwalter 2011).

To date, eight fish species have been documented inhabiting riverine habitats within the Susitna River basin upstream of Devils Canyon, including Chinook salmon, Arctic grayling, Dolly Varden, humpback whitefish, round whitefish, burbot, longnose sucker, and slimy sculpin

[8] The ADF&G Fishery Data Series (FDS) report that will describe these efforts in detail is currently being prepared. The ADF&G prepared a synopsis of the 2011 fish inventory in November 2011 (Buckwalter 2011).

(Sautner and Stratton 1983; Buckwalter 2011). Two additional species, lake trout and rainbow trout, have been documented exclusively in lacustrine habitats (Schmidt et. al 1985). Lake trout were documented in Sally Lake, located in the Watana Creek drainage, and Deadman Lake in the Deadman Creek drainage (Delaney et al. 1981). Rainbow trout presence was documented in High Lake and Little High Lake within the Devils Creek drainage in the 1980s (Schmidt et. al 1985) (Table 19). All of these species except rainbow trout were found in 2012.

3.5.2. Fish Species Distribution in the Upper Susitna River Study Area

Sampling in 2012 provided a qualitative overview of fish species composition, spatial distribution, and localized relative abundance. Collected species were generally representative of species known to be present in the Upper Susitna River drainage based on historical information.

All fish captured during sampling were known native species. Sculpin were most common and composed 62 percent of the total catch for the entire study. Sculpin are common native demersal riverine species that have little recreational importance.

Arctic grayling were relatively ubiquitous throughout the study area and were captured throughout all major habitats. In tributary streams, catch appeared to be higher in downstream sites relative to sites farther upstream. Historically, Arctic grayling were captured from all tributary habitat evaluation locations, with the exception of Chinook Creek (Delaney et al. 1981; ADF&G 1982). The majority of Arctic grayling were captured by angling, but other methods were used (Delaney et al. 1981; Sautner and Stratton 1983). Arctic grayling were identified as the most abundant fish species throughout the proposed inundation zone (Delaney et al. 1981; Sautner and Stratton 1983).

Dolly Varden were captured in tributary streams, but were absent from tributary plumes and mainstem Susitna River sites. Catch appeared higher at upstream sites relative to sites farther downstream. Sampling in 2012 captured more individual Dolly Varden than the 1980s effort; distribution was wide.

Burbot and longnose suckers were documented in the vicinity of tributary plumes that extend into the Susitna River, and within sloughs and along margins of the Susitna River. Although these two species were observed in the vicinity of tributary mouths, neither was observed in sampling locations farther upstream. This trend is generally consistent with catch in the 1980s (Sautner and Stratton 1983).

Sampling in 2012 confirmed the presence of anadromous Chinook salmon above Devils Canyon. Biologists from the ADF&G recently collected otoliths from optionally-anadromous species, including humpback whitefish and Dolly Varden, from several reaches upstream of Devils Canyon. The otoliths are being tested for the presence of saltwater residency in an effort to determine the migration history of the collected fish (Buckwalter 2011).

Length frequency histograms for Arctic grayling and Dolly Varden captured from Fog, Watana, Jay, and Kosina creeks and the Oshenta River showed that Age-0 size classes were well represented for each stream (Appendix F), which suggests successful spawning, hatching and rearing of the most sensitive early life stages. In most streams, multiple age-classes were present for these two species.

3.5.3. Chinook Salmon in the Upper Susitna River Study Area

Juvenile Chinook salmon were captured in only two streams in 2012. Cheechako Creek is a clearwater stream located near the base of Devils Canyon. Historical observations identified the presence of 25 adult salmon in Cheechako Creek (ADF&G 1985). The 35 juvenile Chinook salmon collected in 2012 were concentrated in cascade habitat and along margin habitat with boulder pocket water located near the mouth of the confluence. The unnamed tributary (RM 179.1) where the remaining two juveniles were collected is a relatively small, clearwater drainage. Salmon were not previously documented in the stream. The close proximity of the collected fish to the confluence of the mainstem Susitna River for both Cheechako Creek and the unnamed tributary suggest that proximal rearing is occurring in tributaries outside of the mainstem Susitna River. Chinook spawn in tributary habitat and juvenile rearing in tributaries can be common due to available velocity refugia and lower predator density.

Although no juvenile Chinook salmon were collected or observed, adults were recently observed during aerial surveys of Cheechako, Chinook, Devil, Fog, and Kosina creeks. Previous data identified salmon in all five of these drainages, in addition to Tsusena Creek and the Oshetna River (Buckwalter 2011) (Figure 7; Table 20).

ADF&G also collected fish tissue samples from Chinook in Kosina Creek on July 31, 2012 using hook-and-line gear. The single-day effort resulted in collecting 10 Chinook and subsequent tissue samples.

Information on the extent of Chinook salmon distribution and run size in the Upper Susitna River basin is limited. Historical data indicate that Susitna River Chinook salmon spawn exclusively in tributary streams (Thompson et al. 1986; Barrett et al. 1983; ADF&G 1984; ADF&G 1985), and that nearly all Chinook salmon juveniles in this system outmigrate to the ocean as age-1+ fish. Little is known about the density and distribution of juvenile salmon in the Susitna River upstream of the proposed dam site at RM 184.

In 2012, a radio-telemetry study titled, *Adult Salmon Distribution and Habitat Utilization,* was conducted in which five species of Pacific salmon (*Oncorhynchus* spp. including Chinook salmon) were radio-tagged and tracked in the mainstem Susitna River to describe salmon migration behavior, identify salmon spawning locations, and evaluate techniques for future studies of salmon in turbid water. The study design was meant to enable comparisons to salmon distribution and habitat use in the 1980s, when similar studies were conducted for the Alaska Power Authority Hydroelectric Project.

Radio telemetry detection was used to assign final destination of Chinook salmon in either the mainstem Susitna River or tributaries. Results found that only two salmon tagged from the Lower River (1.1 percent) and four salmon tagged from the Middle River had final destinations upstream of the proposed Project dam site. Chinook salmon was the only species identified migrating upstream of any of the three high velocity impediments in Devils Canyon (RM 150–161). Most Chinook salmon migrated through the Devils Canyon impediments in mid-July, when discharge in the Susitna River was between 17,000 and 21,000 cfs at the Gold Creek gage. Run timing at Curry peaked in early July.

3.5.4. Fish Collection Methodologies Influencing Success

The collection and representation of fish species and size classes was influenced by sampling methodologies employed. Backpack electrofishing equipment used in 2012 was reliable and, given the two-person crew size, easily transported in the R-44 helicopter. Backpack electrofishing was the most effective gear for fish species presence sampling in wadeable habitats and composed the majority of sample time. Seven of nine species were collected by backpack electrofishing; however, effort was limited to wadeable streams or shallower stream margins that did not possess excessively swift water. Less than 10 percent of electrofished habitat occurred in tributary plumes, mainstem habitat, or lakes. The two species not collected by backpack electrofishing, lake trout and whitefish, are commonly associated with deep unwadeable habitat.

Differences in turbidity, water turbulence, and habitat complexity among streams and habitats were additional factors influencing differences in electrofishing results. Electrofishing was successful at immobilizing fish in most areas sampled; however, netting efficiency was considered poor at many sample sites due primarily to turbidity and velocity. Tributary streams were typically flowing very swiftly and white water turbulence severely limited the ability to see fish in many streams. Turbid water habitats, particularly in the mainstem Susitna River, were especially challenging for netting fish. In some cases, the team would see a stunned fish at the surface (or see evidence of its movement as surface turbulence), but would not be able to react quickly enough to capture the fish before it was no longer visible in the turbid water. Information for fish observed, but not captured, was recorded. It is likely that other fish had been stunned but not observed, especially bottom dwelling species such as sculpin.

Boat-based electrofishing allowed sampling to occur in habitat areas that would otherwise be inaccessible, and in some habitat areas, unsuitable for other gear types. The effectiveness of boat-based electrofishing was challenged by low conductivity, high turbidity, and swift water. Sampling with the boat electrofisher was not possible in high velocity areas because of the prevalence of boulders and whitewater. Many fish were observed, but not collected. Refinement to the boat electrofisher configuration (e.g., altered anode array, more powerful control unit, etc) may incrementally improve the range of the electrical field, but challenges with turbidity, conductivity, and swift water are notable limitations.

Angling was opportunistically applied to lake, tributary plume, and tributary habitat. Collected fish were all equal or greater than 148 mm in length, representing a sampling bias to adult lifestages. Success appeared similar among habitat types and catch was related to the number of units sampled.

Fyke nets are typically an effective gear type at capturing a wide range of fish species and sizes in still or slow water habitats. Fyke nets selected for use in 2012 were relatively lightweight and fit in the backseat of an R-44 helicopter; however, transport of multiple fyke nets required multiple trips using a single R-44, so use in 2012 was limited. Fyke nets and minnow traps both collected Dolly Varden, Arctic grayling, and slimy sculpin. Minnow traps were placed primarily in lacustrine habitat and predominantly collected Dolly Varden. Fyke nets were also placed in tributary plume habitat and primarily collected slimy sculpin and Arctic grayling. Fyke nets collected more fish than minnow traps with less effort. Nonetheless, both methods were effective in their respective applications.

Snorkeling was not often utilized because of logistical challenges and safety requirements. Implementing snorkel surveys in swift water and larger streams would require a larger team to ensure safe protocol implementation. Snorkeling may still be effective, but would require additional logistical resources than were planned for 2012.

3.5.5. Conclusion

The 2012 Fish Distribution Study provided helpful insight into planning for 2013–2014 field efforts and a foundation of expanded knowledge of fish distribution and habitat use. The field effort was not without challenges and field activity provided insight into the effectiveness of numerous sampling techniques and how best to refine future data collection. Sampling gear effectiveness will be critical for planning upcoming field activity (2013–2014).

As field researchers garnered first-hand field experience in implementing the numerous methodologies, they also gathered information on fish distribution and habitat use that extended beyond historical data. Chinook salmon were not collected at many locations, but were found in one new location. Expected species composition has been validated to date; however, much additional information is yet to be collected. Additional data will help refine habitat use by focus species, bolster characterization of species relative abundance, and better document multiple life stages over time. Many drainages were sampled only once. Multiple sample events over time will increase confidence in species composition and habitat use data. Overall, the study provided a solid foundation to execute a well-planned research effort in 2013–2014.

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5. TABLES

Table 1. 2012 Upper Susitna River aerial spawning surveys results summary.

		Numbers of Adult Chinook Salmon Observed During Tributary Surveys			
Stream Name	**Historic River Mile**	**Survey 1 (7/24-7/25)**	**Survey 2 (7/30-7/31)**	**Survey 3 (8/5-8/6)**	**Survey 4 (8/10-8/11)**
Cheechako	152.4	0	5	0	2
Chinook	157.0	0	2	4	0
Devils	161.4	2	6	7	1
Fog	176.6	0	1	0	0
Unnamed	181.2	0	0	0	0
Tsusena	181.8	0	0	0	0
Deadman	186.6	0	0	0	0
Watana	194.1	0	0	0	0
Kosina	206.8	15	8	16	14
Jay	208.6	0	0	0	0
Goose	231.0	0	0	0	0
Oshetna	233.5	0	0	0	0

Table 2. Summary of weather variability survey confidence criteria during aerial spawning surveys.

Date	Weather				
	Sunny	Partly Cloudy	Overcast	Light Rain	Rain
July 24	✓	✓	✓	✓	
July 25	✓	✓	✓		
July 30	✓	✓	✓	✓	
July 31	✓				
August 5			✓	✓	
August 6			✓	✓	
August 10	✓	✓	✓		
August 11	✓	✓	✓		

Table 3. Summary of survey confidence criteria during aerial spawning surveys.

Variable	Average Rank	Range	Standard Deviation
Sun Glare	2.0	1 to 3	0.32
Water Visibility	2.8	1 to 5	1.02
Vegetation Cover	2.3	1 to 4	0.66

Note: Variables ranked from 1 to 5 with 1 being good and 5 being poor.

Table 4. Summary of previous adult Chinook salmon observations upstream of Devils Canyon.

Stream Name	Count	Lifestage	Date
Cheechako Creek	25	Adult	8/1/1983[1]
Chinook Creek	8	Adult	8/1/1983[1]
Devils Creek	1	Adult	8/2/1983[1]
Fog Creek	2	Adult	8/1/2003[2]
Tsusena Creek	1	Adult	8/1/2003[2]
Kosina Creek	1	Adult	7/27/2011[2]

[1] ADF&G 1984, Susitna Hydro Aquatic Studies Report No. 1

[2] Buckwalter 2011, Synopsis of ADF&G's Upper Susitna Drainage Fish Inventory

Table 5. Number of surveys, or sample units, by gear type in tributary, tributary plume, mainstem Susitna River, and lake habitats in the Upper Susitna River study area, July-August 2012.

Habitat Type	Backpack Electrofisher	Boat-Mounted Electrofisher	Minnow Trap	Fyke Net	Gillnet	Angling	Snorkel
Tributary	184	14	18		2	9	6
Tributary Plume	12	8		1		1	
Mainstem Susitna	18	2					
Lake	1	2	23	7		2	
TOTALS	**215**	**26**	**41**	**8**	**2**	**12**	**6**

Table 6. Summary of mesohabitats sampled in tributary streams during backpack electrofishing surveys in the Upper Susitna River study area, July-August 2012.

Susitna Historic River Mile and Stream Name	Number of Sampled Units	Secondary Tributaries Sampled	Total Sampled Length (m)	% Composition of Sampled Channel Type			% Composition of Sampled Mesohabitat Units									Wetted Width Range (m)[1]	Range of Average Depth (m)[2]	Percent Substrate Composition of Sampled Units						Water Clarity
				Main Channel	Side Channel	Off Channel	Alcove	Cascade	Percolation Channel	Pool (Backwater)	Pool (Scour)	Riffle (Pocket Water)	Riffle	Run (Pocket Water)	Run	Slough			Bed Rock	Boulder	Cobble	Gravel	Fines	Organic	
152.4-Cheechako Creek	1	None	175	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	12	0.45	0.0%	70.0%	20.0%	10.0%	0.0%	0.0%	clear
157.0-Chinook Creek	3	None	180	100.0%	0.0%	0.0%	0.0%	16.7%	0.0%	0.0%	0.0%	0.0%	50.0%	33.3%	0.0%	0.0%	4–14	0.3–0.45	0.0%	43.3%	33.3%	23.3%	0.0%	0.0%	clear
161.5-Devils Creek	1	None	75	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	22	0.55	0.0%	60.0%	30.0%	10.0%	0.0%	0.0%	clear
166.3-Unnamed Tributary	4	None	169	100.0%	0.0%	0.0%	0.0%	88.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	11.2%	0.0%	5–8	0.25–0.4	0.0%	45.7%	34.4%	18.8%	1.1%	0.0%	clear
168.7-Unnamed Tributary	2	None	74	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0 %	0.0%	0.0%	0.0%	1.5–8	0.1	0.0%	0.0%	50.0%	45.4%	4.6%	0.0%	clear
171.0-Unnamed Tributary	1	None	142	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0 %	0.0%	0.0%	0.0%	2–3	NA	0.0%	0.0%	70.0%	30.0%	0.0%	0.0%	clear
173.0-Unnamed Tributary	3	None	77	100.0%	0.0%	0.0%	0.0%	58.4%	0.0%	0.0%	0.0%	0.0%	7.8%	0.0%	33.8%	0.0%	2–6	0.1–0.21	0.0%	15.8%	40.8%	43.4%	0.0%	0.0%	clear
174.0-Unnamed Tributary	2	None	46	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	26.1%	0.0%	73.9%	0.0%	2–17	0.1–0.25	0.0%	20.0%	40.0%	22.6%	17.4%	0.0%	clear
174.2-Unnamed Tributary	2	None	72	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0 %	0.0%	0.0%	0.0%	1–12	0.15–0.4	0.0%	9.7%	53.0%	26.2%	8.4%	0.0%	clear
176.6-Fog Creek	39	Tributary L1 Tributary R2 Tributary R6	1122.6	27.8%	54.6%	17.6%	0.0%	0.9%	14.1%	0.0%	3.4%	8.9%	42.1%	0.0%	27.0%	3.6%	1.5–19	0.12–0.43	0.0%	14.8%	42.9%	31.1%	9.0%	2.2%	clear
179.1-Unnamed Tributary	6	None	137	100.0%	0.0%	0.0%	0.0%	13.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	86.9%	0.0%	1.1–9	0.1–0.6	0.0%	19.3%	45.5%	25.6%	9.5%	0.0%	clear
179.4-Unnamed Tributary	1	None	100	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4	0.2	0.0%	40.0%	30.0%	30.0%	0.0%	0.0%	clear
181.2-Unnamed Tributary	1	None	35	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	9–23	0.45	0.0%	40.0%	60.0%	0.0%	0.0%	0.0%	clear
181.8-Tsusena Creek	3	None	107	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	74.8%	0.0%	25.2%	0.0%	7–16	0.3–0.4	0.0%	20.0%	42.5%	32.8%	4.7%	0.0%	clear
192.0-Unnamed Tributary	12	None	205	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	8.3%	8.3%	14.1%	15.1%	0.0%	54.1%	0.0%	1.9–12	0.22–0.66	0.0%	21.8%	30.8%	27.5%	17.7%	2.1%	clear
194.1-Watana Creek	33	Tributary L1 Tributary R3 Tributary R5 Delusion Creek	1202	73.6%	21.8%	4.6%	0.0%	1.0%	0.0%	0.7%	3.2%	6.7%	27.0%	6.4%	50.5%	4.6%	21	0.15–0.6	0.9%	16.3%	35.9%	25.0%	17.6%	4.3%	mostly clear[3]
194.9-Unnamed Tributary	9	None	148.5	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	9.1%	0.0%	26.9%	0.0%	64.0%	0.0%	1.4–8	0.14–0.8	0.0%	23.1%	28.3%	29.1%	17.7%	1.8%	humic
200.7-Unnamed Tributary	2	None	45	100.0%	0.0%	0.0%	0.0%	44.4%	0.0%	0.0%	0.0%	55.6%	0.0%	0.0%	0.0%	0.0%	3–19	0.35	0.0%	35.6%	40.0%	24.4%	0.0%	0.0%	clear
201.8-Unnamed Tributary	1	None	10	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0 %	0.0%	0.0%	0.0%	11	0.2	0.0%	80.0%	10.0%	10.0%	0.0%	0.0%	clear
203.7-Unnamed Tributary	2	None	30	100.0%	0.0%	0.0%	0.0%	60.0%	0.0%	0.0%	0.0%	0.0%	0.0%	40.0%	0.0%	0.0%	3–19	0.05–0.15	0.0%	30.0%	48.0%	22.0%	0.0%	0.0%	clear
206.8-Kosina Creek	19	Tsisi Creek Gilbert Creek	1541	30.9%	62.1%	7.0%	0.0%	3.0%	0.0%	0.0%	2.9%	20.8%	1.5%	4.2%	52.7%	14.9%	2–25	0.1–0.8	0.0%	21.7%	21.2%	23.7%	32.4%	1.0%	clear

Susitna Historic River Mile and Stream Name	Number of Sampled Units	Secondary Tributaries Sampled	Total Sampled Length (m)	% Composition of Sampled Channel Type			% Composition of Sampled Mesohabitat Units									Wetted Width Range (m)[1]	Range of Average Depth (m)[2]	Percent Substrate Composition of Sampled Units						Water Clarity
				Main Channel	Side Channel	Off Channel	Alcove	Cascade	Percolation Channel	Pool (Backwater)	Pool (Scour)	Riffle (Pocket Water)	Riffle	Run (Pocket Water)	Run	Slough			Bed Rock	Boulder	Cobble	Gravel	Fines	Organic	
208.6-Jay Creek	19	None	754	80.0%	12.6%	7.4%	0.5%	0.0%	6.9%	0.0%	13.5%	0.0%	41.2%	0.0%	32.8%	5.0%	0.6–54	0.05–1	0.0%	5.8%	41.6%	43.0%	9.2%	0.4%	clear
231.0-Goose Creek	7	None	637	42.5%	57.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	63.3%	6.8%	0.0%	30.0%	0.0%	1.8–2	0.2–0.45	0.0%	34.4%	45.7%	18.9%	1.0%	0.0%	clear
233.5-Oshetna River	11	Black River	608	28.6%	36.7%	34.7%	0.0%	0.0%	34.7%	0.0%	10.9%	0.0%	28.6%	0.0%	25.8%	0.0%	4–49	0.1–0.8	0.0%	10.1%	35.9%	45.8%	8.2%	0.0%	mostly clear[4]

[1] The range of wetted widths varied greatly for some tributaries because side channel and/or secondary tributaries were sampled in addition to the mainstem of the tributary. Where only one habitat unit was sampled a range was not available and only a single value was given.
[2] Where only one habitat unit was sampled, a range was not available and only a single value was given.
[3] Site was mostly clear with 10% of the units having low glacial turbidity due to tributary inflows.
[4] Site was mostly clear with 18% of the units having high glacial turbidity and 18% having low glacial turbidity due to tributary inflows.

Table 7. Total number and size range of fish captured by backpack electrofishing, boat-based electrofishing, fyke nets, minnow traps, and angling in the Upper Susitna River study area, July-August 2012.

Fish Species Latin Name[1]	Fish Species Common Name	Total Number Captured	Minimum Length[2] (mm)	Maximum Length[2] (mm)
Salvelinus malma	Dolly Varden	246	26	366
S. namaycush	Lake trout	5	320	510
Thymallus arcticus	Arctic grayling	559	22	500
Coregonus pidschian	Humpback whitefish	1	231	231
Prosopium cylindraceum	Round whitefish	14	119	420
Salmonidae	Salmonid-unspecified	15	18	52
Oncorhynchus tshawytscha	Chinook salmon	37	54	72
Lota lota	Burbot	5	372	410
Catostomus catostomus	Longnose sucker	32	20	404
Cottus cognatus	Slimy sculpin	366	25	175
Cottidae	Sculpin-unspecified	1126	22	124

Notes:
[1] Fish identified to the lowest taxonomic level possible (family, genus, or species).
[2] Fork length was measured for fish with forked caudal fins; otherwise TL was measured.

Table 8. Fish captured and observed during backpack electrofish surveys, by target habitat, in the Upper Susitna River study area, July-August 2012.

8a. Effort at and fish species captured from each habitat type

Habitat Type	No. of Sample Units[1]	Effort (minutes)[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonmy[2]	Totals
Mainstem Susitna	18	97.60				36	1				3	21	8	39		**104**
Tributary	184	714.55	37	210		241				13		3	285	902		**1691**
Tributary Plume	12	105.00				159	3			2	1		36	112		**313**
Lake	1	12.00														**0**
TOTALS	**215**	**929.15**	**37**	**210**	**0**	**436**	**4**	**0**	**0**	**15**	**4**	**24**	**329**	**1053**	0	**2122**

8b. Minimum and Maximum Fish Lengths (mm)

minimum size	54	26		27	119			18	380	20	25	23		
maximum size	72	249		350	290			52	410	395	175	124		

8c. Fish observed but not captured

Habitat Type	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonmy[2]	Totals
Mainstem Susitna				38						26		30	4	**98**
Tributary		5		51				3				195	1	**255**
Tributary Plume				29				3				58		**90**
Lake														**0**
TOTALS	**0**	**5**	**0**	**118**	**0**	**0**	**0**	**6**	**0**	**26**	**0**	**283**	**5**	**443**

Notes:

[1] Effort was not recorded for 4 sample units in Mainstem Susitna and 2 units in Tributary habitats; a total of 41 fish were captured, including Dolly Varden (n=2), arctic grayling (n=10), Sculpin (n=27), burbot (n=1) and longnose sucker (n=1).

[2] Fish were identified to the lowest taxonomic level possible.

Table 9. Fish captured and observed during boat-based electrofish surveys, by target habitat, in the Upper Susitna River study area, July-August 2012.

9a. Effort at and fish species captured from each habitat type

Habitat Type	No. of surveys	Gear effort (minutes)	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[1]	Salmonid spp.[1]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[1]	Fish, no taxonmy	Totals
Mainstem Susitna	2	1.35				1										1
Tributary	14	79.85				16	3						6			25
Tributary Plume	8	28.38				45	7	1			1	8	7	4		73
Lake	2	31.85											15	7		22
TOTALS	**26**	**141.43**	0	0	0	**62**	**10**	**1**	0	0	**1**	**8**	**28**	**11**	0	**121**

9b. Minimum and maximum fish lengths (mm)

minimum size				22	124	231			372	134	34	22		
maximum size				356	420	231			372	404	103	63		

9c. Fish observed but not captured

Habitat Type	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[1]	Salmonid spp.[1]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[1]	Fish, no taxonmy	Totals
Mainstem Susitna				20										20
Tributary				18			3	4						25
Tributary Plume	1			6				7		1				15
Lake														0
TOTALS	**1**	0	0	**44**	0	0	**3**	**11**	0	**1**	0	0	0	**60**

Notes:
[1] Fish were identified to the lowest taxonomic level possible.

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Table 10. Fish captured by minnow traps, by target habitat, in the Upper Susitna River study area, July-August 2012.

10a. Effort at and fish species captured from habitat type																
Habitat Type	**No. of Traps**	**Gear effort (minutes)**	**Chinook salmon**	**Dolly Varden**	**Lake trout**	**Arctic grayling**	**Round whitefish**	**Humpback whitefish**	**Whitefish spp.[1]**	**Salmonid spp.[1]**	**Burbot**	**Longnose sucker**	**Slimy sculpin**	**Sculpin spp.[1]**	**Fish, no taxonmy**	**Totals**
Mainstem Susitna	0															0
Tributary	18	11,660		20		1							9	9		39
Tributary Plume	0															0
Lake	23	20,019		1										6		7
TOTALS	**41**	**31679**	0	**21**	0	**1**	0	0	0	0	0	0	**9**	**15**	0	46
10b. Minimum and maximum fish lengths (mm)																
		minimum size		45		56							77	60		
		maximum size		156		56							103	80		

Notes:
[1] Fish were identified to the lowest taxonomic level possible.

Table 11. Fish captured by fyke nets, by target habitat, in the Upper Susitna River study area, July-August 2012.

11a. Effort at and fish species captured from habitat type																
Habitat Type	**No. of Nets**	**Gear effort (minutes)**	**Chinook salmon**	**Dolly Varden**	**Lake trout**	**Arctic grayling**	**Round whitefish**	**Humpback whitefish**	**Whitefish spp.[1]**	**Salmonid spp.[1]**	**Burbot**	**Longnose sucker**	**Slimy sculpin**	**Sculpin spp.[1]**	**Fish, no taxonmy**	**Totals**
Mainstem Susitna																0
Tributary																0
Tributary Plume	1	23				1										1
Lake	7	12498		2		23								49		74
TOTALS	**8**	**12521**	0	**2**	0	**24**	0	0	0	0	0	0	**0**	**49**	0	75
11b. Minimum and maximum fish lengths (mm)																
		minimum size		116		62								40		
		maximum size		169		165								83		

Notes:
1 Fish were identified to the lowest taxonomic level possible.

Table 12. Fish captured by angling, by target habitat, in the Upper Susitna River study area, July-August 2012.

12a. Effort at and fish species captured from habitat type																
Habitat Type	**No. of Sample Units**	**No. of Anglers**	**Chinook salmon**	**Dolly Varden**	**Lake trout**	**Arctic grayling**	**Round whitefish**	**Humpback whitefish**	**Whitefish spp.[1]**	**Salmonid spp.[1]**	**Burbot**	**Longnose sucker**	**Slimy sculpin**	**Sculpin spp.[1]**	**Fish, no taxonmy**	**Totals**
Mainstem Susitna																0
Tributary	9	1		13		23										36
Tributary Plume	1	1				4										4
Lake	2	1			**5**	4										9
TOTALS	**12**	**3**	0	**13**	**5**	**31**	0	0	0	0	0	0	0	0	0	**49**
12b. Minimum and maximum fish lengths (mm)																
minimum size				148	320	204										
maximum size				366	510	500										

Notes:
[1] Fish were identified to the lowest taxonomic level possible.

Table 13. Fish observed during snorkel surveys, by target habitat, in the Upper Susitna River study area, July-August 2012.

13a. Fish species observed in each target area.																
Habitat Type	**No. of Sample Units**	**No. of Snorkelers**	**Chinook salmon**	**Dolly Varden**	**Lake trout**	**Arctic grayling**	**Round whitefish**	**Humpback whitefish**	**Whitefish spp.[1]**	**Salmonid spp.[1]**	**Burbot**	**Longnose sucker**	**Slimy sculpin**	**Sculpin spp.[1]**	**Fish, no taxonmy**	**Totals**
Mainstem Susitna																0
Tributary	6	2		2		32	3							3		40
Tributary Plume																0
Lake																0
TOTALS	**6**	**2**	0	**2**	0	**32**	**3**	0	0	0	0	0	0	**3**	0	40
13b. Minimum and maximum fish lengths (mm)																
estimated minimum size				60		80	300							100		
estimated maximum size				200		400	320							120		

Notes:
[1] Fish were identified to the lowest taxonomic level possible.

Table 14. Fish captured and observed and gear types used in tributary and lake habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Stream Name	Target Area	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonmy	No fish captured	Totals
152.4-Cheechako Cr	Tributary	BP	35	12		3								1			**51**
157.0-Chinook Cr	Tributary	A, BP		20									2	7			**29**
161.5-Devils Cr	Tributary	BP		38									1	3			**42**
166.3-Unnamed Trib	Tributary	BP		10		7				1				11			**29**
168.7-Unnamed Trib	Tributary	BP		3		8								66			**77**
171.0-Unnamed Trib	Tributary	A, BP				8							5				**13**
173.0-Unnamed Trib	Tributary	BP		1		1							1	7			**10**
174.0-Unnamed Trib	Tributary	BP		3		11				3		1		35			**53**
174.2-Unnamed Trib	Tributary	BP		2		10				4				42			**58**
176.6-Fog Cr	Tributary	A, BP, MT, VOG		75		9				3			85	86			**258**
	Unnamed Lake	GPP, Fyk, MT		3									15	7			**25**
179.1-Unnamed Trib	Tributary	BP	2	5		27							1	19			**54**
179.4-Unnamed Trib	Tributary	BP		5		9											**14**
181.2-Unnamed Trib	Tributary	BP, Snrk		2		32	3							9			**46**
181.8-Tsusena Cr	Tributary	BP				6						1	13	30			**50**
186.6-Deadman Creek	Tributary	A, GPP, VOG				12							3				**15**
	Unnamed Lake	A, Fyk, MT, VOG			1	6											**7**
186.9-Unnamed Trib	Tributary	*Not Sampled*															X
192.0-Unnamed Trib	Tributary	BP		2		3				1			9	19			**34**

Historic River Mile and Stream Name	Target Area	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonmy	No fish captured	Totals
194.1-Watana Cr	Tributary	A, BP, GPP, MT, VOG		7		85	2			4			80	236			**414**
	Sally Lake	A, BP, Fyk, MT			4	22								55			**81**
194.9-Unnamed Trib	Tributary	BP, MT				3							2	12			**17**
200.7-Unnamed Trib	Tributary	BP				3								21			**24**
201.8-Unnamed Trib	Tributary	BP														X	**0**
203.4-Unnamed Trib	Tributary	*Not Sampled*															X
	Unnamed Lake	Fyk, MT														X	**0**
203.7-Unnamed Trib	Tributary	BP												29			**29**
206.8-Kosina Cr	Tributary	A, BP, GPP, Gill		1		75	1		3	4			36	291	1		**412**
208.6-Jay Cr	Tributary	A, BP		65		29							4	7			**105**
231.0-Goose Cr	Tributary	BP				45							11	68			**124**
233.5-Oshetna River	Tributary	BP, VOG				11						1	47	110			**169**
		Total:	**37**	**254**	**5**	**425**	**6**	**0**	**3**	**20**	**0**	**3**	**315**	**1,171**	**1**	0	**2,787**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; Gill=Gillnet; MT=Minnow trap; Snrk=Snorkel; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 15. Fish captured and observed and gear types used in the mainstem Susitna River at tributary plume habitats, Upper Susitna River study area, July-August 2012.

Historic River Mile and Tributary Plume Source	Gear Types Used[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonmy	No fish captured	Totals
166.3-Unnamed Trib Plume	BP, Fyk				39								10			**49**
171.0-Unnamed Trib Plume	BP				18								6			**24**
173.0-Unnamed Trib Plume	BP				8								5			**13**
174.0-Unnamed Trib Plume	BP				21				1				32			**54**
174.2-Unnamed Trib Plume	BP				33				1				30			**64**
179.1-Unnamed Trib Plume	BP				24								19			**43**
181.2-Unnamed Trib Plume	BP, GPP	1			6	3			3			32	32			**77**
181.8-Tsusena Cr Trib Plume	A, BP, GPP				26	3	1				1	7	5			**43**
186.6-Deadman Creek Trib Plume	GPP				2											**2**
186.9-Unnamed Trib Plume	BP														X	**0**
192.0-Unnamed Trib Plume	GPP, VOG				44	4					5	2	1			**56**
194.1-Watana Cr Trib Plume	GPP				2				1		1					**4**
194.9-Unnamed Trib Plume	GPP				1				2							**3**
201.8-Unnamed Trib Plume	BP				21					1			13			**35**
203.7-Unnamed Trib Plume	BP				15								7			**22**
206.8-Kosina Cr Trib Plume	GPP, VOG				10				16		2					**28**
208.6-Jay Cr Trib Plume	GPP				6				4	1						**11**
233.5-Oshetna River Trib Plume	BP				3							2	14			**19**
	Total:	**1**	**0**	**0**	**279**	**10**	**1**	**0**	**28**	**2**	**9**	**43**	**174**	**0**	0	**547**

Notes:
[1] Gear types: A=Angling; BP=Backpack electrofish; Fyk=Fyke net; GPP=Boat electrofish; VOG=Visual observation
[2] Fish were identified to the lowest taxonomic level possible.

Table 16. Fish captured and observed during backpack electrofish surveys, by stream, in the Upper Susitna River study area, July-August 2012.

16a. Effort at and fish species captured from each tributary sampled

Historic River Mile and Stream Name	No. of Sample Units[1]	Length Sampled (Meters)	Gear Effort (minutes)[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonmy	No fish captured	Totals
152.4-Cheechako Cr	1	175	16.75	35	12		3								1			51
157.0-Chinook Cr	3	180	16.33		20									2	7			29
161.5-Devils Cr	1	75	9.05		38									1	3			42
166.3-Unnamed Trib	4	169	15.52		10		7				1				11			29
168.7-Unnamed Trib	2	74	10.73		3		8								46			57
171.0-Unnamed Trib	1	142	3.07											5				5
173.0-Unnamed Trib	3	77	8.27		1		1							1	4			7
174.0-Unnamed Trib	2	46	12.43		3		11				3		1		35			53
174.2-Unnamed Trib	1	10	3.48				1				4				11			16
176.6-Fog Cr	39	1123	141.70		39		3				1			76	75			194
179.1-Unnamed Trib	6	137	23.70	2	5		27							1	19			54
179.4-Unnamed Trib	1	100	6.22		5		9											14
181.2-Unnamed Trib	1	35	3.53												6			6
181.8-Tsusena Cr	3	107	10.28				6						1	13	30			50
192.0-Unnamed Trib	12	205	23.60		2		2							9	15			28
194.1-Watana Cr	33	1202	84.20		5		42							80	193			320
194.9-Unnamed Trib	9	149	13.63				2							2	9			13
200.7-Unnamed Trib	1	20	5.82				2								13			15
201.8-Unnamed Trib	1	10	0.60														x	0
203.7-Unnamed Trib	2	30	4.63												29			29
206.8-Kosina Cr	19	1541	151.58				27				4			33	183			247

16a. Effort at and fish species captured from each tributary sampled

Historic River Mile and Stream Name	No. of Sample Units[1]	Length Sampled (Meters)	Gear Effort (minutes)[1]	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.[2]	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Fish, no taxonmy	No fish captured	Totals
208.6-Jay Cr	19	754	55.97		65		26							4	7			102
231.0-Goose Cr	7	637	50.78				44							11	68			123
233.5-Oshetna River	11	608	42.67				10						1	47	110			168
TOTALS	**182**	**7605**	**714.55**	**37**	**208**	**0**	**231**	**0**	**0**	**0**	**13**	**0**	**3**	**285**	**875**	**0**	**0**	1652
16b. Minimum and maximum fish lengths (mm)																		
minimum size (mm)				54	26		27				18		68	25	23			
maximum size (mm)				72	249		330				52		395	175	115			

[1] Effort was not recorded for 2 sample units in Tributary habitats. Dolly Varden (n=2), Arctic grayling (n=9), and sculpin (n=8) were captured from one sample unit in Stream 174.2-Unnamed Trib. Arctic grayling (n=1), and sculpin (n=8) were captured from one sample unit in Stream 200.7-Unnamed Trib. Data collected at the 2 sample units were excluded from this table.

[2.] Fish were identified to the lowest taxonomic level possible.

Table 17. Catch-per-unit time (CPUE) (fish captured/minute) by stream for fish captured during backpack electrofish surveys, in the Upper Susitna River study area, July-August 2012.

Historic River Mile and Stream Name	No. of Sample Units1	Length Sampled (Meters)	Gear Effort (minutes)1	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Totals
152.4-Cheechako Cr	1	175	16.75	**2.09**	**0.72**	0.00	**0.18**	0.00	0.00	0.00	0.00	0.00	0.00	**0.06**	3.04
157.0-Chinook Cr	3	180	16.33	0.00	**1.22**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.12**	**0.43**	1.78
161.5-Devils Cr	1	75	9.05	0.00	**4.20**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.11**	**0.33**	4.64
166.3-Unnamed Trib	4	169	15.52	0.00	**0.64**	0.00	**0.45**	0.00	0.00	**0.06**	0.00	0.00	0.00	**0.71**	1.87
168.7-Unnamed Trib	2	74	10.73	0.00	**0.28**	0.00	**0.75**	0.00	0.00	0.00	0.00	0.00	0.00	**4.29**	5.31
171.0-Unnamed Trib	1	142	3.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.63**	0.00	1.63
173.0-Unnamed Trib	3	77	8.27	0.00	**0.12**	0.00	**0.12**	0.00	0.00	0.00	0.00	0.00	**0.12**	**0.48**	0.85
174.0-Unnamed Trib	2	46	12.43	0.00	**0.24**	0.00	**0.88**	0.00	0.00	**0.24**	0.00	**0.08**	0.00	**2.82**	4.26
174.2-Unnamed Trib	1	10	3.48	0.00	0.00	0.00	**0.29**	0.00	0.00	**1.15**	0.00	0.00	0.00	**3.16**	4.59
176.6-Fog Cr	39	1123	141.70	0.00	**0.28**	0.00	**0.02**	0.00	0.00	**0.01**	0.00	0.00	**0.54**	**0.53**	1.37
179.1-Unnamed Trib	6	137	23.70	**0.08**	**0.21**	0.00	**1.14**	0.00	0.00	0.00	0.00	0.00	**0.04**	**0.80**	2.28
179.4-Unnamed Trib	1	100	6.22	0.00	**0.80**	0.00	**1.45**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.25
181.2-Unnamed Trib	1	35	3.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.70**	1.70
181.8-Tsusena Cr	3	107	10.28	0.00	0.00	0.00	**0.58**	0.00	0.00	0.00	0.00	**0.10**	**1.26**	**2.92**	4.86
192.0-Unnamed Trib	12	205	23.60	0.00	**0.08**	0.00	**0.08**	0.00	0.00	0.00	0.00	0.00	**0.38**	**0.64**	1.19
194.1-Watana Cr	33	1202	84.20	0.00	**0.06**	0.00	**0.50**	0.00	0.00	0.00	0.00	0.00	**0.95**	**2.29**	3.80

Historic River Mile and Stream Name	No. of Sample Units1	Length Sampled (Meters)	Gear Effort (minutes)1	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Salmonid spp.[2]	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.[2]	Totals
194.9-Unnamed Trib	9	149	13.63	0.00	0.00	0.00	**0.15**	0.00	0.00	0.00	0.00	0.00	**0.15**	**0.66**	0.95
200.7-Unnamed Trib	1	20	5.82	0.00	0.00	0.00	**0.34**	0.00	0.00	0.00	0.00	0.00	0.00	**2.23**	2.58
201.8-Unnamed Trib	1	10	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
203.7-Unnamed Trib	2	30	4.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**6.26**	6.26
206.8-Kosina Cr	19	1541	151.58	0.00	0.00	0.00	**0.18**	0.00	0.00	**0.03**	0.00	0.00	**0.22**	**1.21**	1.63
208.6-Jay Cr	19	754	55.97	0.00	**1.16**	0.00	**0.46**	0.00	0.00	0.00	0.00	0.00	**0.07**	**0.13**	1.82
231.0-Goose Cr	7	637	50.78	0.00	0.00	0.00	**0.87**	0.00	0.00	0.00	0.00	0.00	**0.22**	**1.34**	2.42
233.5-Oshetna River	11	608	42.67	0.00	0.00	0.00	**0.23**	0.00	0.00	0.00	0.00	**0.02**	**1.10**	**2.58**	3.94
TOTALS	**182**	**7605**	**714.55**	**0.052**	**0.291**	**0.000**	**0.323**	**0.000**	**0.000**	**0.000**	**0.018**	**0.000**	**0.004**	**0.399**	1.09

[1] Effort was not recorded for 2 sample units in Tributary habitats. Dolly Varden (n=2), Arctic grayling (n=9), and sculpin (n=8) were captured from one sample unit in Stream 174.2-Unnamed Trib. Arctic grayling (n=1), and sculpin (n=8) were captured from one sample unit in Stream 200.7-Unnamed Trib. Data collected at the 2 sample units were excluded from this table.

[2] Fish were identified to the lowest taxonomic level possible.

Table 18. Fish captured from the mainstem Susitna River by electrofishing, Upper Susitna River study area, July-August 2012.

18a. Effort at and fish species captured from each mainstem sampling area																	
Historic River Mile	**Sample Length (m)[1]**	**Gear Effort (minutes)[2]**	**Chinook salmon**	**Dolly Varden**	**Lake trout**	**Arctic grayling**	**Round whitefish**	**Humpback whitefish**	**Whitefish spp.[3]**	**Salmonid spp.[3]**	**Burbot**	**Longnose sucker**	**Slimy sculpin**	**Sculpin spp.[3]**	**Fish, no taxonmy**	**No fish captured**	**Totals**
Downstream of proposed dam site																	
168.8	260	24.90				1								21			22
174.1	90	8.70				22						4		4			30
178.2	121	5.30										2	5	1			8
Upstream of proposed dam site																	
186.0	95	8.50				7						1	3	6			17
186.8	55	13.80				1	1				1			1			4
192.6	NA	NA				1					1	1		1			4
194.0	261	NA										9		5			14
197.7	387	18.60				4					1	4					9
201.7	70	6.10														x	0
205.7	70	1.40				1											1
TOTALS	**1409**	**87.30**	**0**	**0**	**0**	**37**	**1**	**0**	**0**	**0**	**3**	**21**	**8**	**39**	**0**		**109**
18b. Minimum and maximum fish lengths (mm)																	
	minimum size (mm)					37	290				410	20	57	32			
	maximum size (mm)					142	290				410	310	94	124			

[1] Sample length was not recorded for electrofish sampling that took place at RM 192.6.
[2] Sample effort was not recorded for electrofishing that took place at RM 192.6; or for a portion of partial of sample effort at RM 194.
[3] Fish were identified to the lowest taxonomic level possible.

Table 19. Fish species presence in tributary and lake habitats in the Upper Susitna study area, combining historic data, and data collected from July-August 2012.

Historic River Mile and Stream Name	Target Habitat/ Name	Sampled in 2012 (yes/No)	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.	Salmonid spp.	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.	Rainbow Trout
152.4-Cheechako Cr	Tributary habitat	Yes	•[1]	•[2]											
157.0-Chinook Cr	Tributary habitat	Yes	•[1]												
161.5-Devils Cr	Tributary habitat	Yes		•[1]		•[1]									
	High Lake	No													•[1]
	Little High Lake	No													•[1]
166.3-Unnamed Trib	Tributary habitat	Yes													
168.7-Unnamed Trib	Tributary habitat	Yes													
171.0-Unnamed Trib	Tributary habitat	Yes													
173.0-Unnamed Trib	Tributary habitat	Yes													
174.0-Unnamed Trib	Tributary habitat	Yes													
174.2-Unnamed Trib	Tributary habitat	Yes													
176.6-Fog Cr	Fog Creek Sub Basin	Yes	•[2]	•[2]		•[1]	•[1]		•[1]		•[1]		•[2]	•[1]	
	Unnamed Lake	Yes													
179.1-Unnamed Trib	Tributary habitat	Yes													
179.4-Unnamed Trib	Tributary habitat	Yes													
181.2-Unnamed Trib	Tributary habitat	Yes													
181.8-Tsusena Cr	Tributary habitat	Yes	•[1]			•[1]	•[1]				•[1]	•[1]		•[1]	
186.6-Deadman Creek	Tributary habitat	Yes		•[1]		•[1]					•[1]	•[1]			
	Deadman Lake	No		•[1]	•[1,4]	•[1,4]	•[1]	•[1]			•[1]			•[1]	
	Lake N62.921, W148.508	Yes													
186.9-Unnamed Trib	Tributary habitat	No													

Historic River Mile and Stream Name	Target Habitat/ Name	Sampled in 2012 (yes/No)	Chinook salmon	Dolly Varden	Lake trout	Arctic grayling	Round whitefish	Humpback whitefish	Whitefish spp.	Salmonid spp.	Burbot	Longnose sucker	Slimy sculpin	Sculpin spp.	Rainbow Trout
192.0-Unnamed Trib	Tributary habitat	Yes													
194.1-Watana Cr	Wantana Creek Sub Basin	Yes		•[2]		•[2]	•[2]				•[1]	•[1]	•[2]		
	Sally Lake	Yes			•[1]	•[1]								•[1]	
	Big Lake	No													
194.9-Unnamed Trib	Tributary habitat	Yes													
200.7-Unnamed Trib	Tributary habitat	Yes													
201.8-Unnamed Trib	Tributary habitat	Yes													
203.4-Unnamed Trib	Tributary habitat	No													
	Unnamed Lake	Yes													
203.6-Unnamed Trib	Watana Lake	No			•[4]	•[4]									
203.7-Unnamed Trib	Tributary habitat	Yes													
206.8-Kosina Cr	Tributary habitat	Yes	•[1,2]			•[2]	•[2]				•[1]	•[1]	•[2]		
	Gilbert Creek	Yes				•[2]									
	Tsisi Creek	Yes													
	Clarence Lake	No			•[3,4]	•[3,4]			•[3]						
208.6-Jay Cr	Tributary habitat	Yes		•[1]		•[2]	•[1]				•[1]	•[1]			
221.5-Unnamed Tributary	Tributary habitat	No													
226.7-Unnamed Tributary	Tributary habitat	No											•[2]		
231.0-Goose Cr	Tributary habitat	Yes				•[2]					•[1]	•[1]	•[2]	•[1]	
233.5-Oshetna River	Tributary habitat	Yes	•[2]	•[2]		•[2]	•[2]				•[1]	•[2]	•[2]	•[1]	
	Black River	Yes													

1. ADF&G 1981, 1983, 1984; 2=Buckwalter 2011; 3=ADF&G 2012; 4=Three Rivers Fly & Tackle 2012.

● Historical Record

Grey highlighted cells represent fish species that were captured or observed during the July-August 2012 fish distribution sampling effort.

Table 20. Summary of Chinook salmon observations based on historical data and July-August 2012 sampling effort, Upper Susitna River study.

Historic River Mile and Stream Name	Historical Record			July–August 2012 Sampling Effort		
	Record Available (Yes/No)	Date	Description	Sampling occured (Yes/No)	Date	Description
152.4-Cheechako Cr	Yes[1]	8/1/1983	Habitat: NA Count: 25 Lifestage: Adult	Yes[3]	8/16/2012	Habitat: cascade, mainstem margin in boulders. Count: 35 Lifestage: Juvenile (FL:55–75 mm)
				Yes[4]	2012 (7/30–8/11)	Habitat: NA Count: 7 Lifestage: Adult
157.0-Chinook Cr	Yes[1]	8/1/1983	Habitat: NA Count: 8 Lifestage: Adult	Yes[4]	2012 (7/24–8/06)	Habitat: NA Count: 6 Lifestage: Adult
161.5-Devils Cr	Yes[1]	8/1/1983	Habitat: NA Count: 1 Lifestage: Adult	Yes[4]	2012 (7/24–8/11)	Habitat: NA Count: 16 Lifestage: Adult
176.6-Fog Cr	Yes[2]	8/1/2003	Habitat: NA Count: 2 Lifestage: Adult	Yes[3]	8/9/2012	Habitat: mainstem riffle (close proximity to historic sampling 8/1/2003 and 8/13/2003) Count: 0 Lifestage: --
	Yes[2]	8/13/2003	Habitat: mainstem and side channel margin Count: 5 Lifestage: Juvenile (FL:56–91 mm)	Yes[3]	7/22/2012	Habitat: sub-tributary mainstem and side channel (close proximity to historic sampling 8/6/2011) Count: 0 Lifestage: --
	Yes[2]	8/6/2011	Habitat: sub-tributary mainstem margin Count: 8 Lifestage: Juvenile (FL:49–61 mm)	Yes[4]	2012 (7/30–7/31)	Habitat: NA Count: 1 Lifestage: Adult

Historic River Mile and Stream Name	Historical Record			July–August 2012 Sampling Effort		
	Record Available (Yes/No)	Date	Description	Sampling occured (Yes/No)	Date	Description
179.1-Unnamed Tributary	No	--	--	Yes[3]	7/29/2012	Habitat: run, mainstem Count: 2 Lifestage: Juvenile (FL:60–64 mm)
181.8-Tsusena Cr	Yes[2]	8/1/2003	Habitat: NA Count: 1 Lifestage: Adult	No	--	--
206.8-Kosina Cr	Yes[2]	8/13/2003	Habitat: mainstem, riffle Count: 1 Lifestage: Juvenile (73 mm)	Yes[3]	8/12/2012	Habitat: mainstem run (close proximity to historic sampling 8/15/2003 and 8/13/2003) Count: 0 Lifestage: --
	Yes[2]	8/14/2003	Habitat: NA Count: 1 Lifestage: Juvenile			
	Yes[2]	8/15/2003	Habitat: mainstem Count: 2 Lifestage: Juvenile (FL:70–75 mm)	Yes[4]	2012 (7/24–8/11)	Habitat: NA Count: 53 Lifestage: Adult
	Yes[2]	7/27/2011	Habitat: NA Count: 1 Lifestage: Adult			
233.5-Oshetna River	Yes[2]	8/14/2003	Habitat: side channel Count: 3 Lifestage: Juvenile (FL:52–67 mm)	Yes[3]	8/12/2012	Habitat: side channel (close proximity to historic sampling 8/14/2003) Count: 0 Lifestage: --

1. ADF&G 1984, Susitna Hydro Aquatic Studies Report No. 1.
2. ADF&G 2012, Synopsis of ADF&G's Upper Susitna Drainage Fish Inventory
3. Backpack electrofishing results
4. Aerial spawning survey results

6. FIGURES

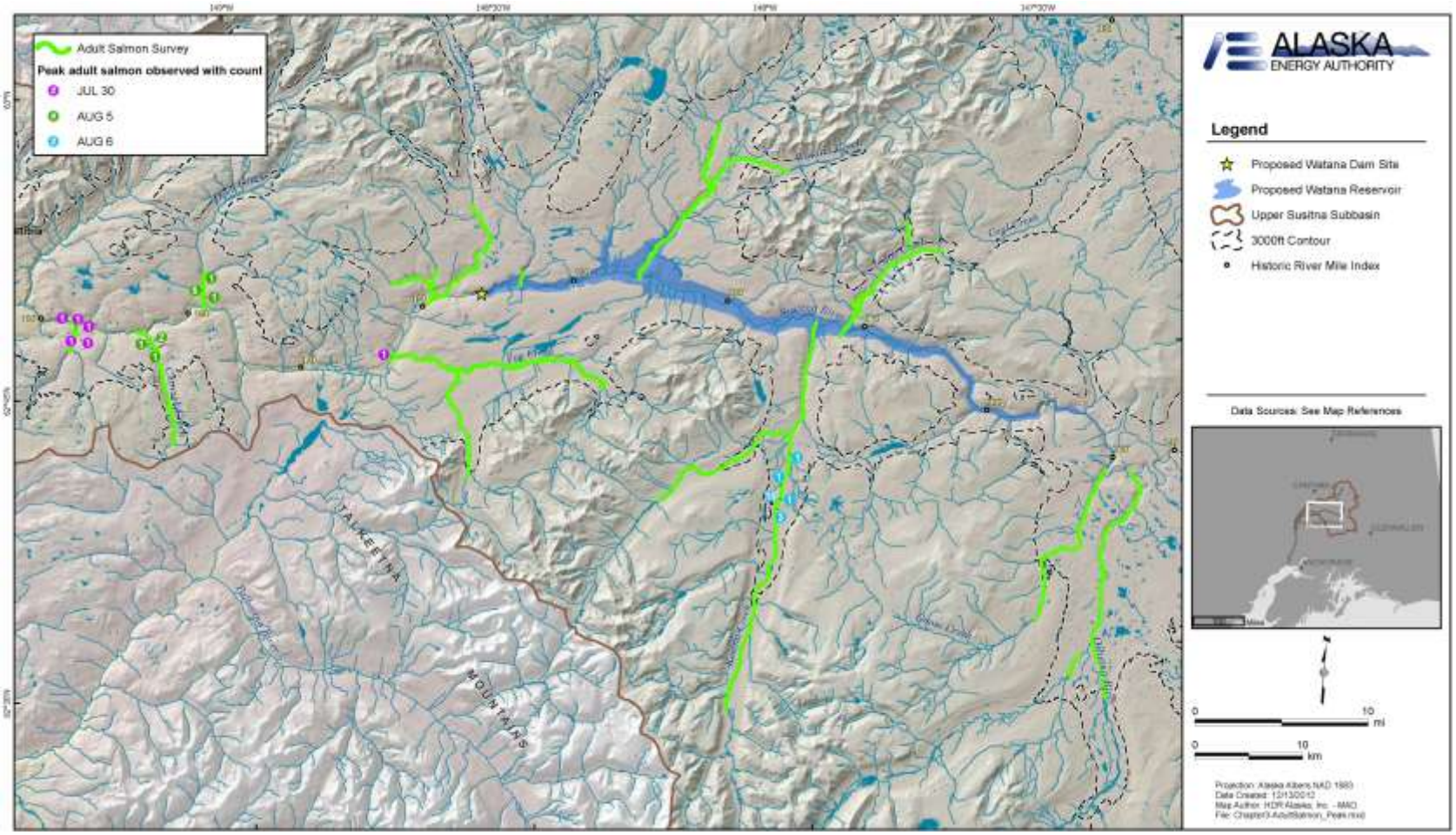


Figure 1. Upper Susitna River Adult Salmon Spawning Ground Survey Extent Showing the Peak 2012 Chinook salmon Counts.

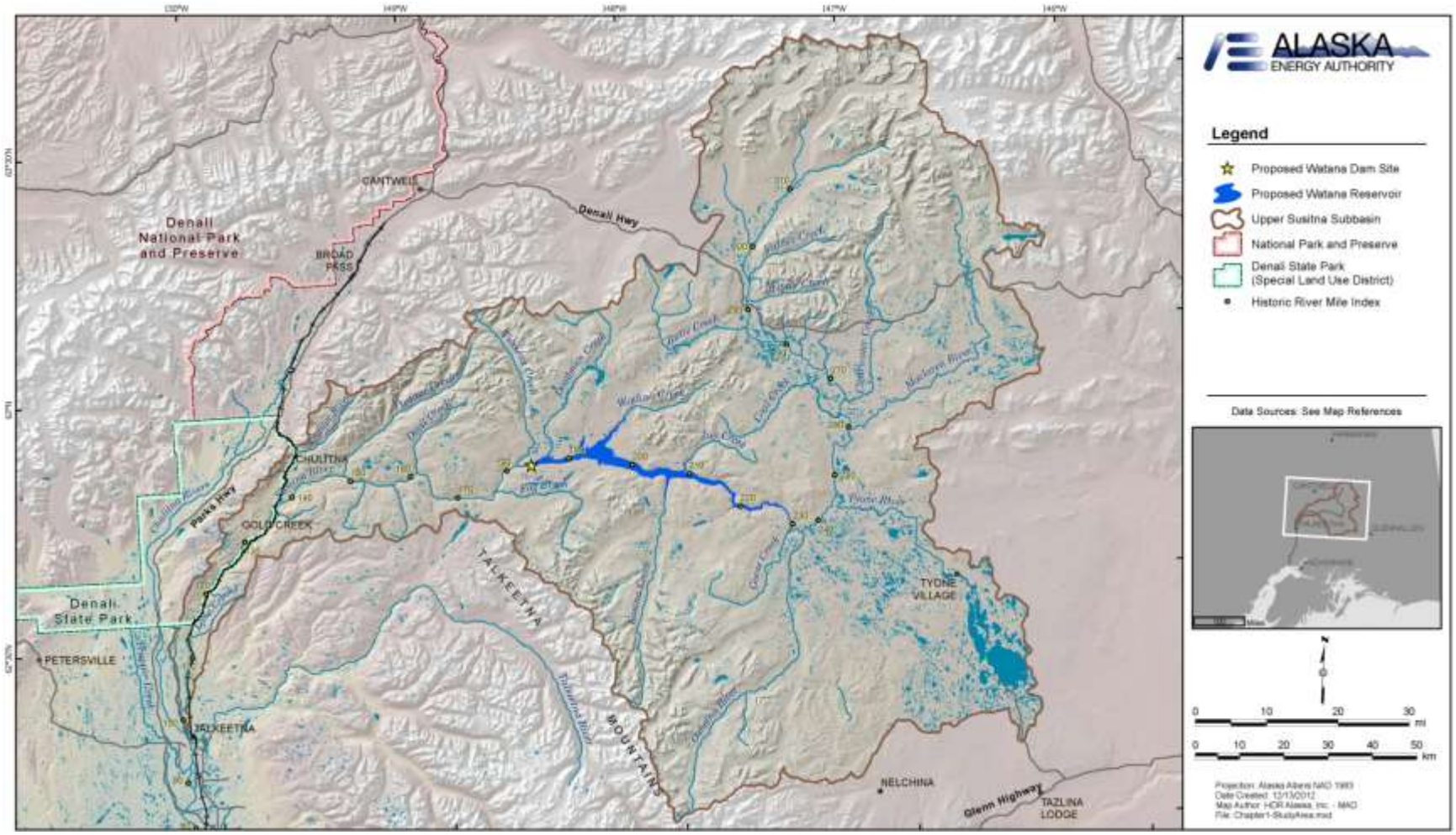


Figure 2. Study area for fish distribution sampling in the Upper Susitna River, July-August 2012.

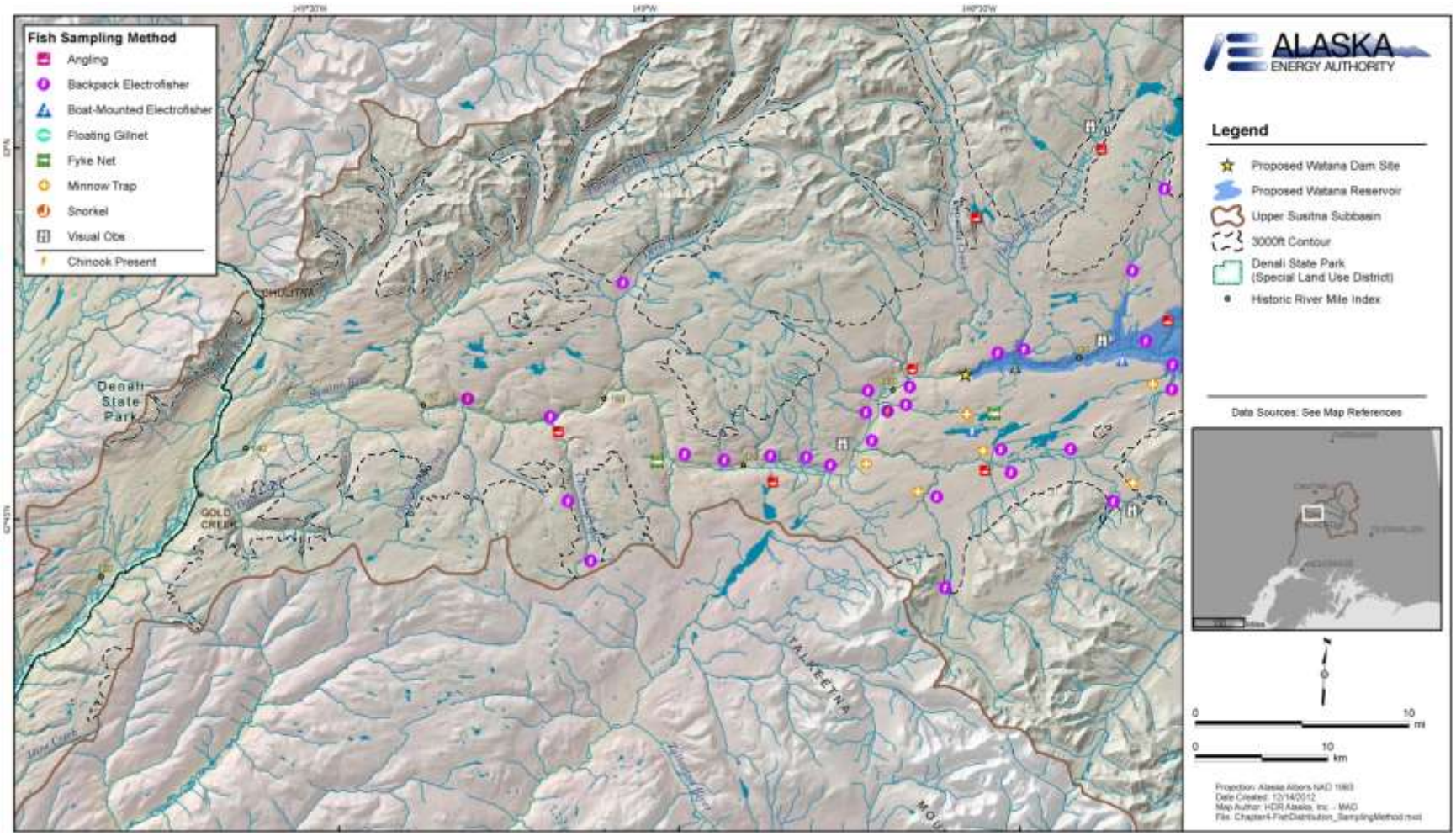


Figure 3. Gear types used during fish species distribution sampling in the Upper Susitna River study area, July-August 2012, 1 of 2.

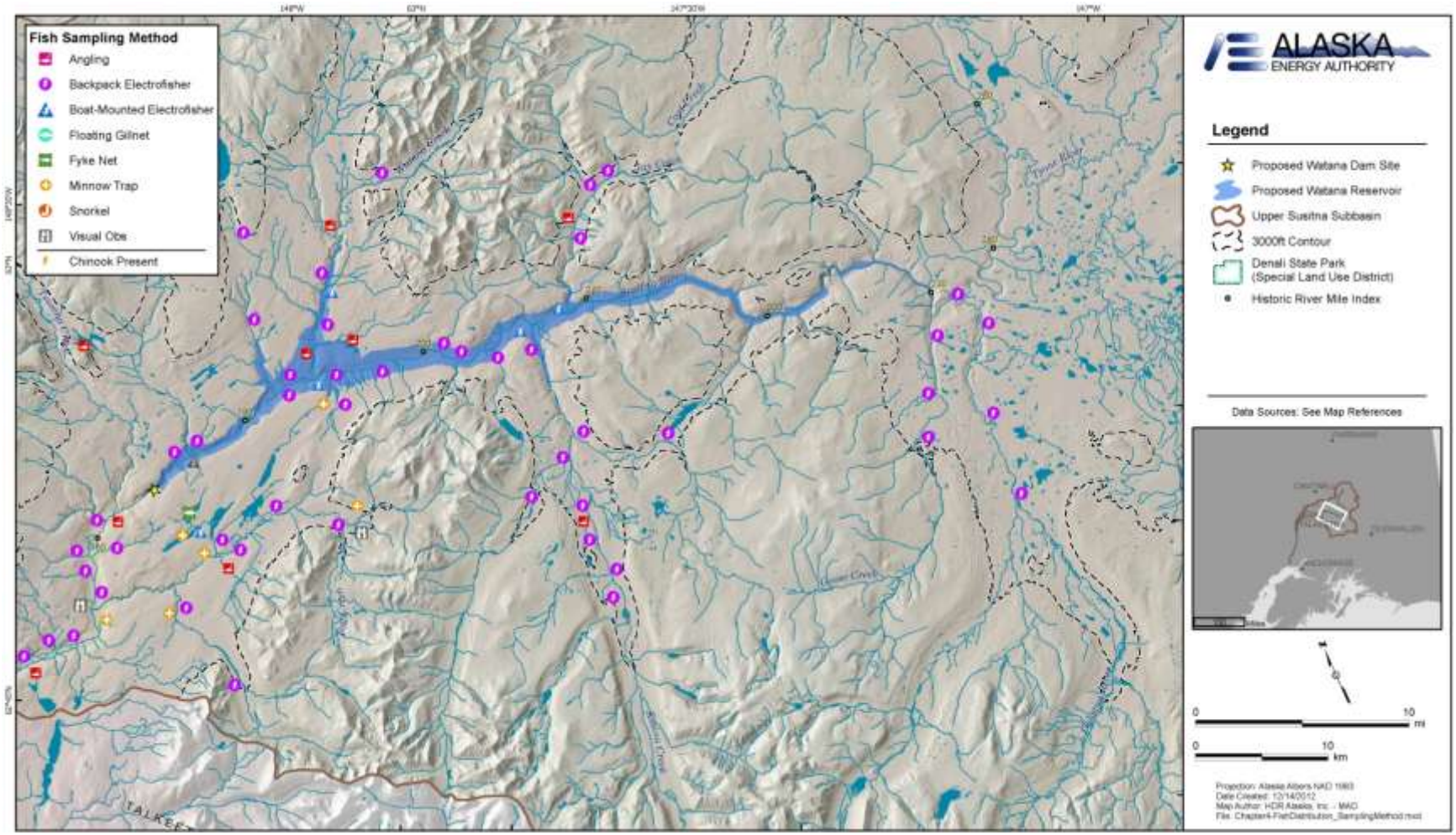


Figure 4. Gear types used during fish species distribution sampling in the Upper Susitna River study area, July-August 2012, 2 of 2.

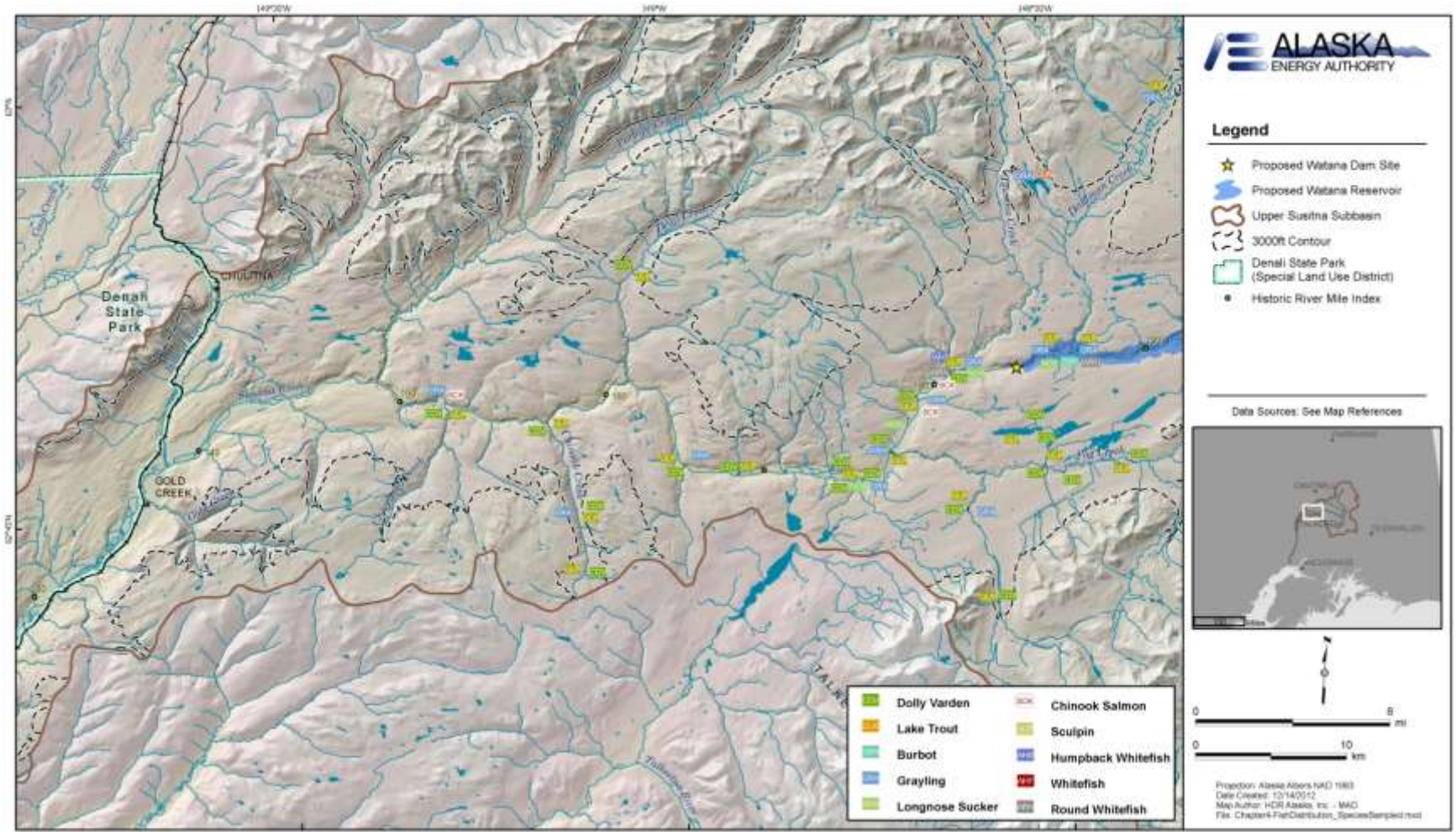


Figure 5. Fish species distribution for areas sampled in the Upper Susitna River study area, July-August 2012, 1 of 2.

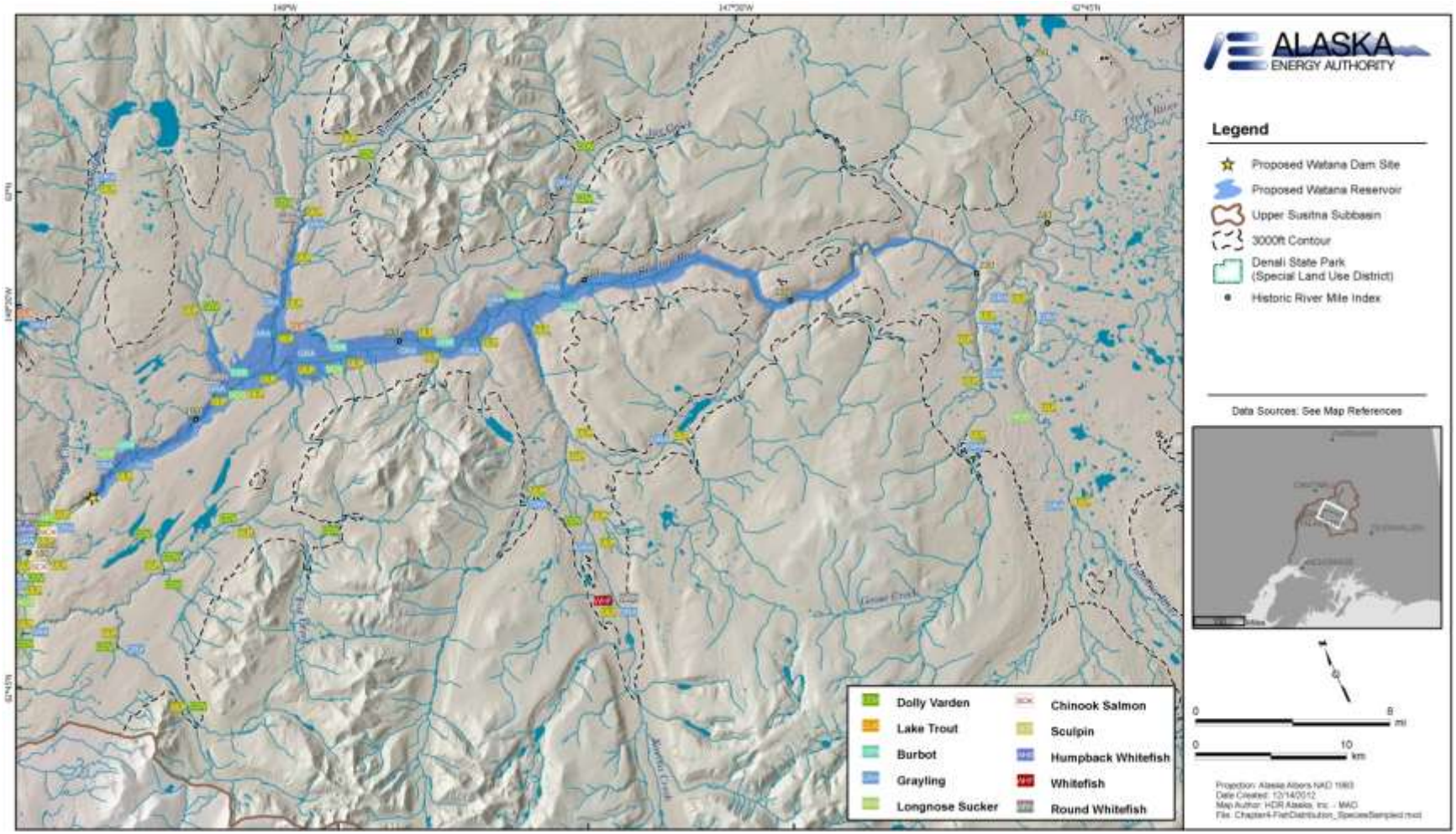


Figure 6. Fish species distribution for areas sampled in the Upper Susitna River study area, July-August 2012, 2 of 2.

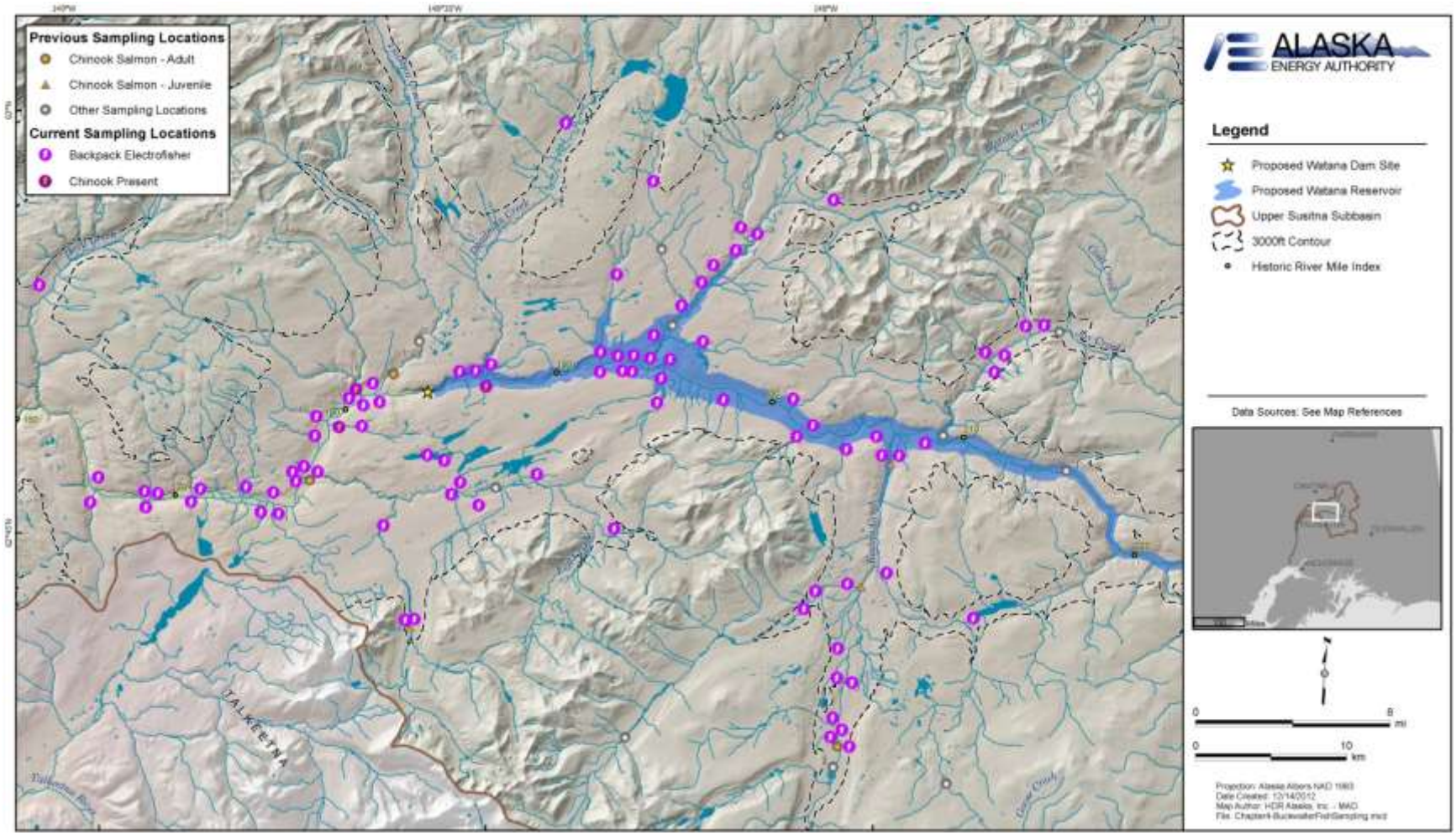
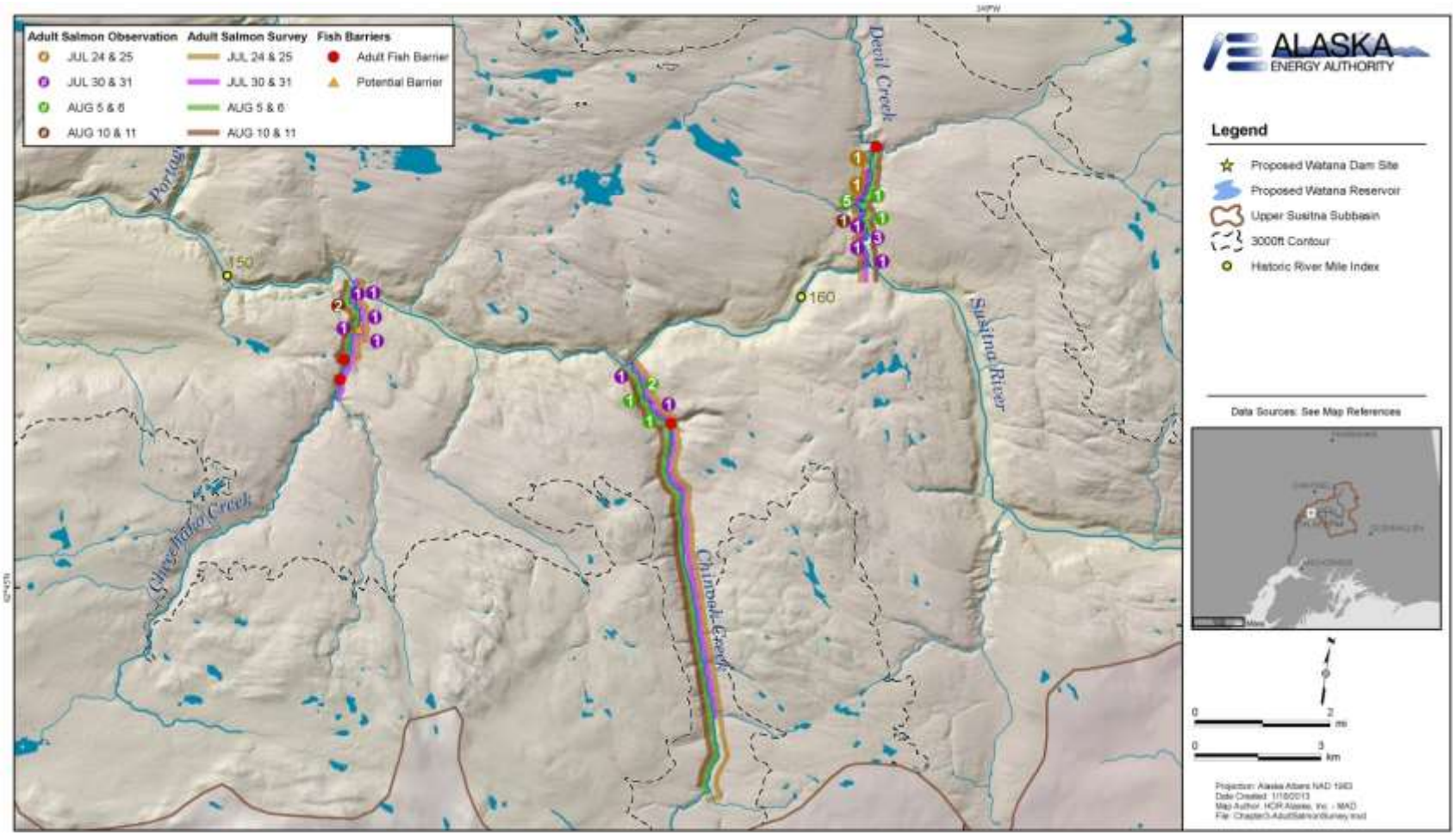
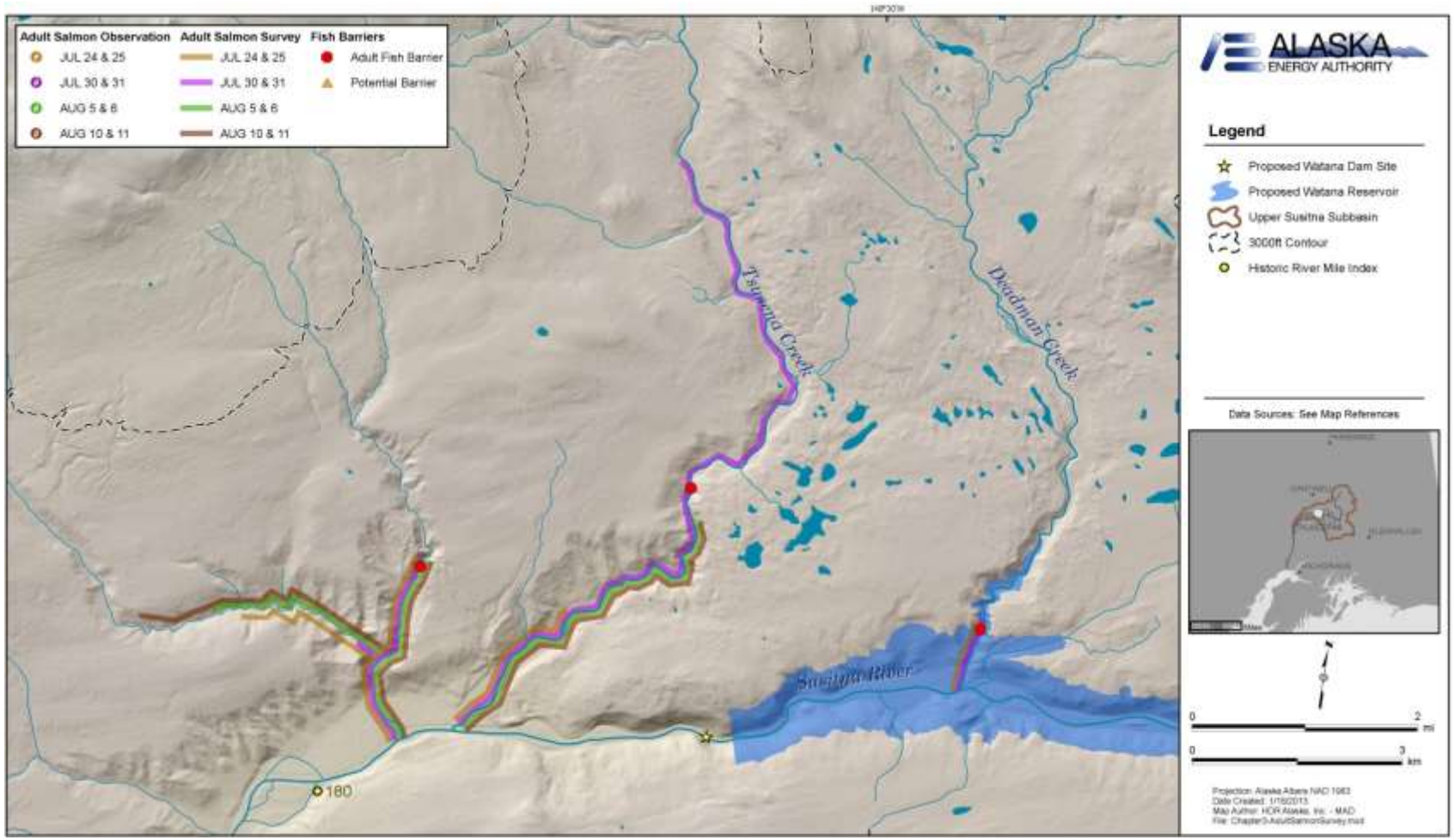


Figure 7. Chinook salmon observations from recent fish distribution surveys throughout the Upper Susitna River drainage (ADF&G 2011).

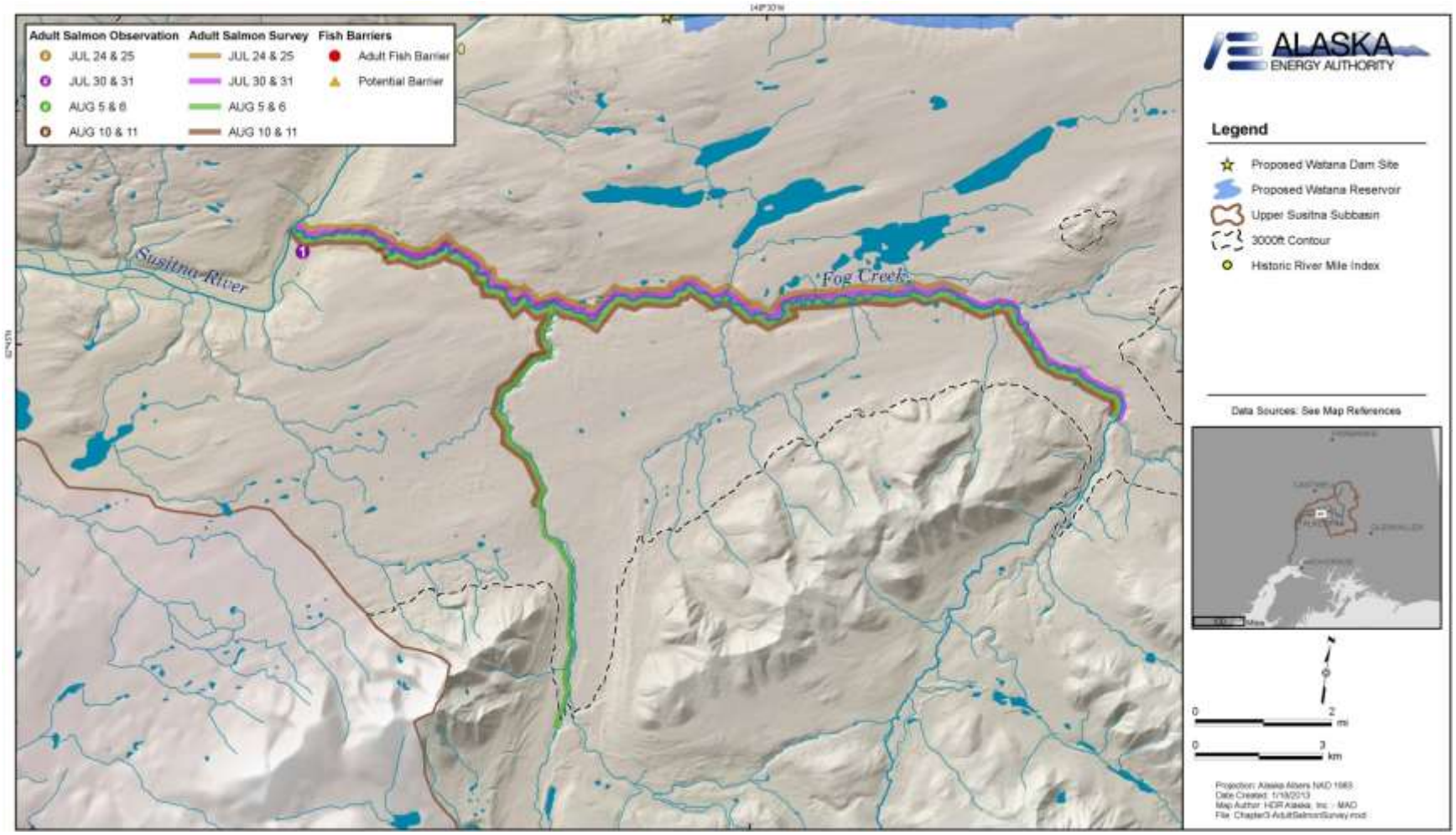
Appendix A. Adult Salmon Aerial Survey Detail Map



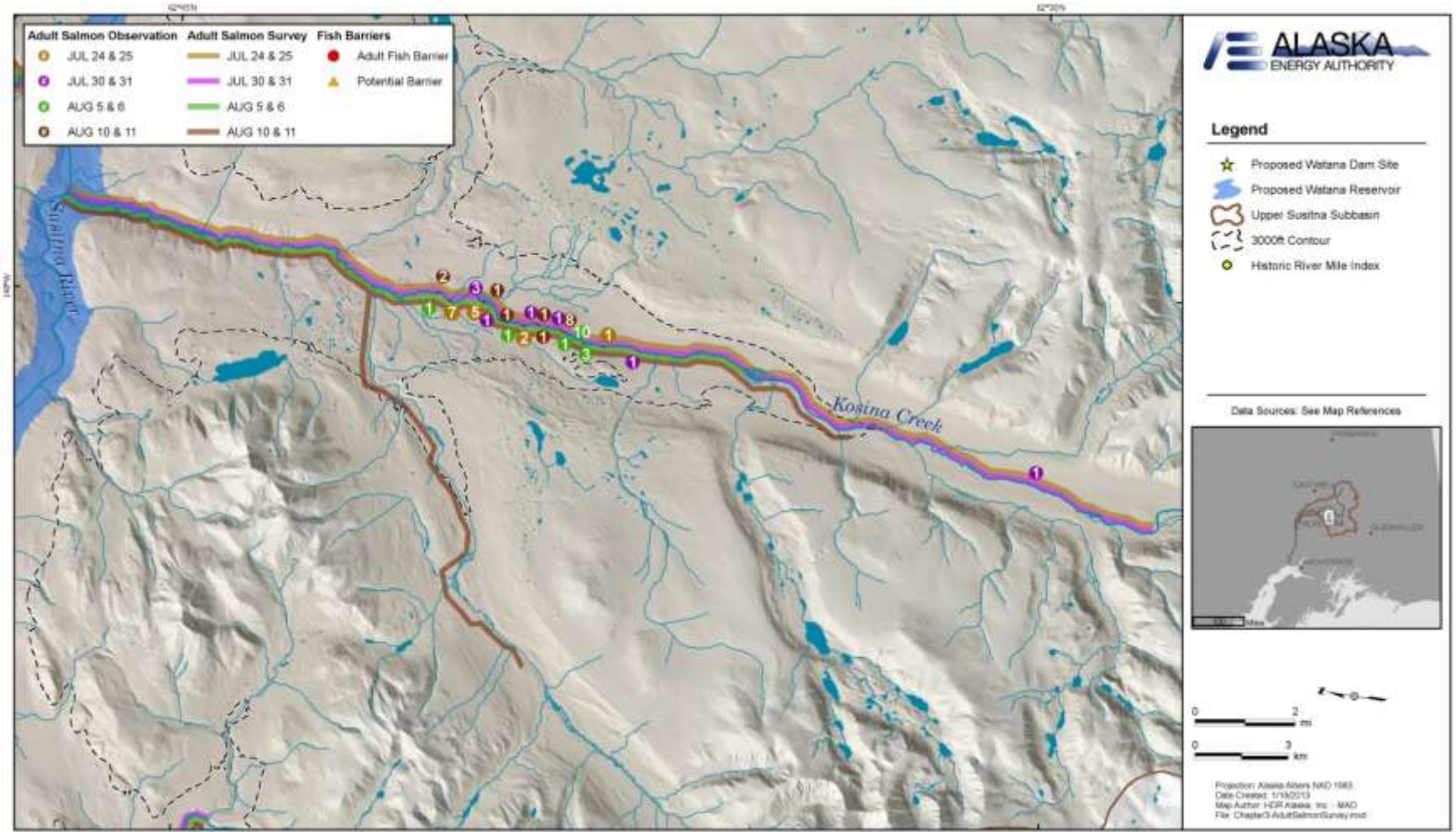
Map 1. Chinook salmon counts in the East half of the survey area during all four surveys.



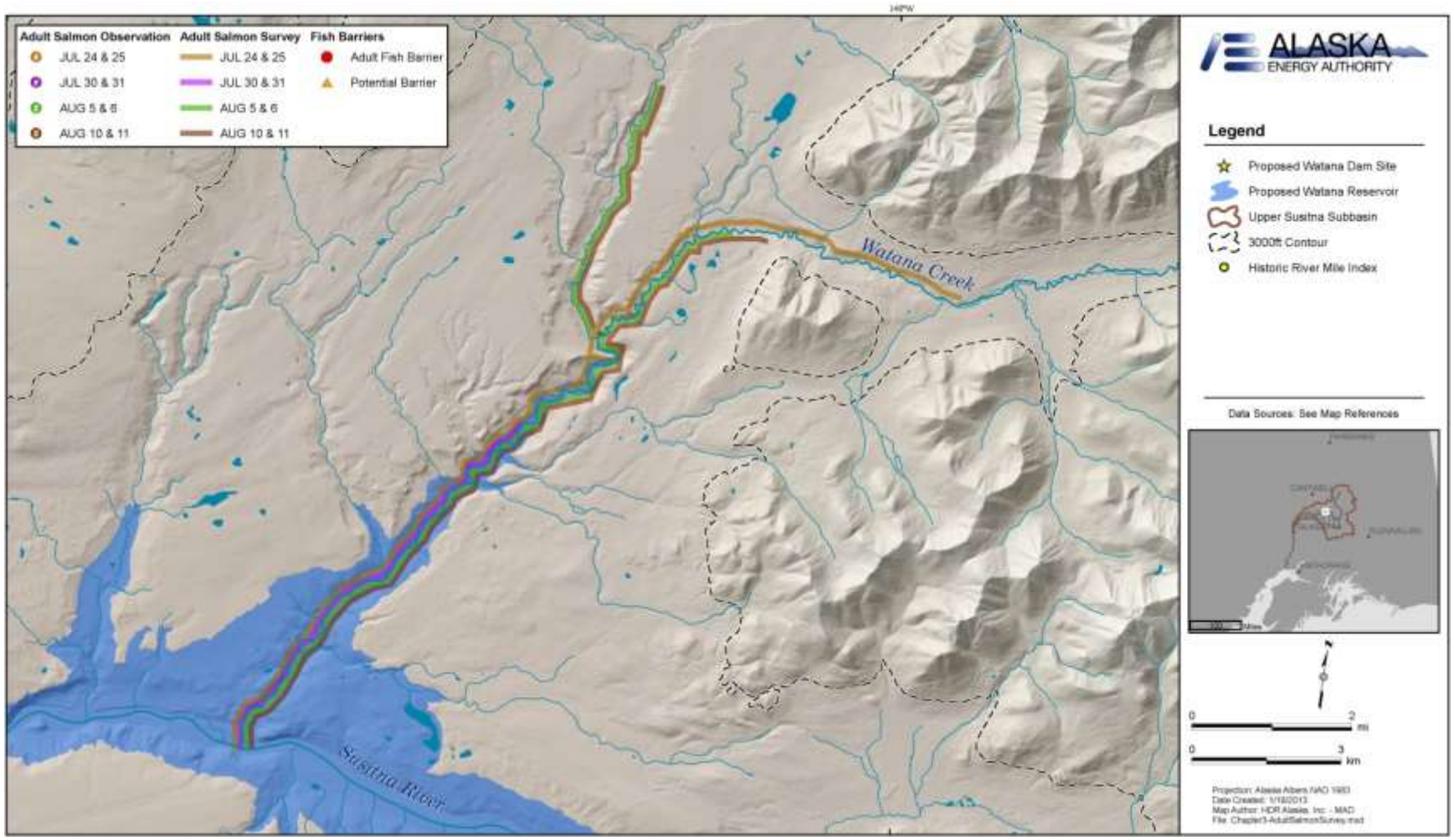
Map 2. Chinook salmon counts near the proposed dam site and RM 180.



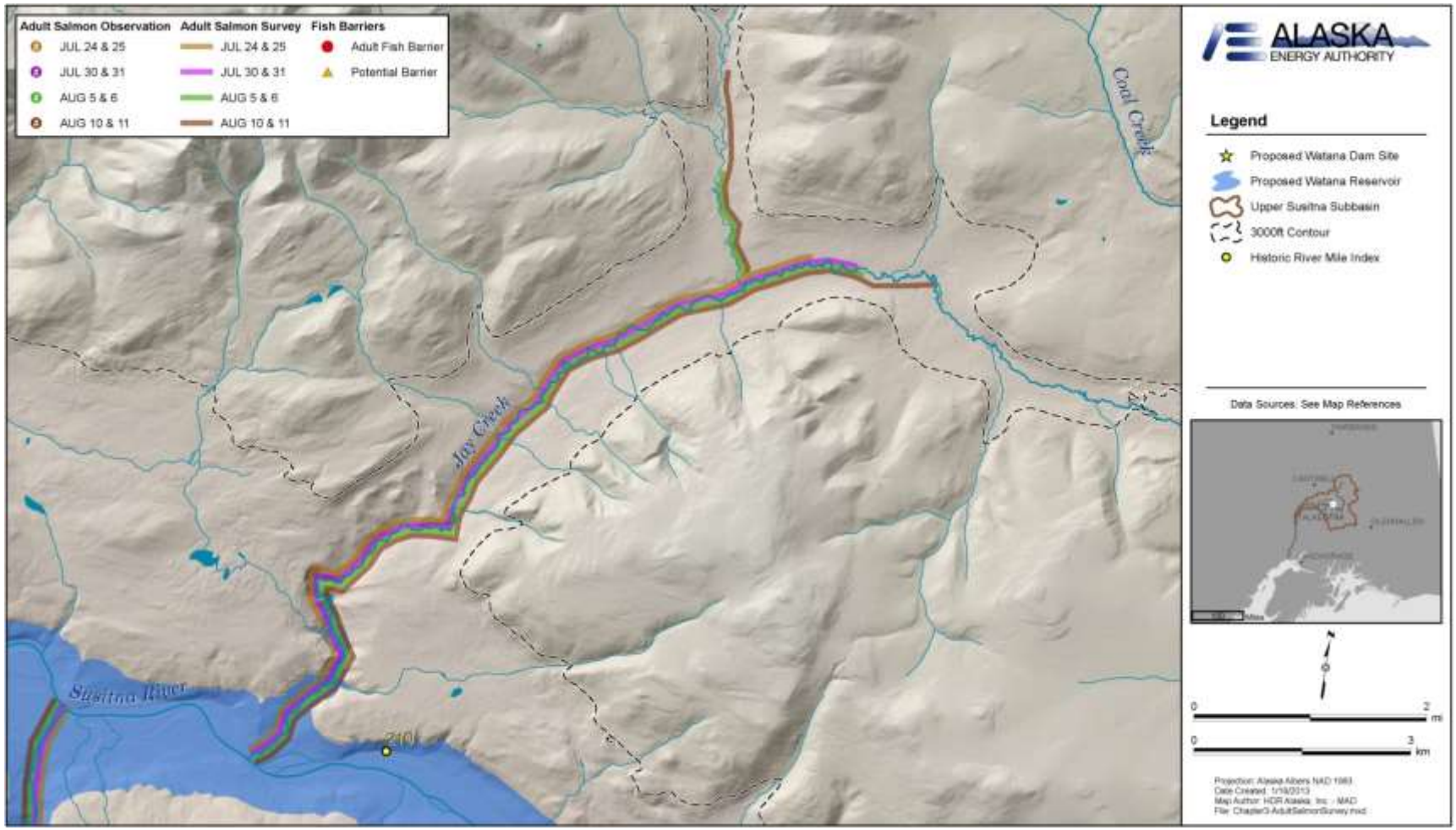
Map 3. Chinook salmon counts in the central portion of the survey area for all four surveys.



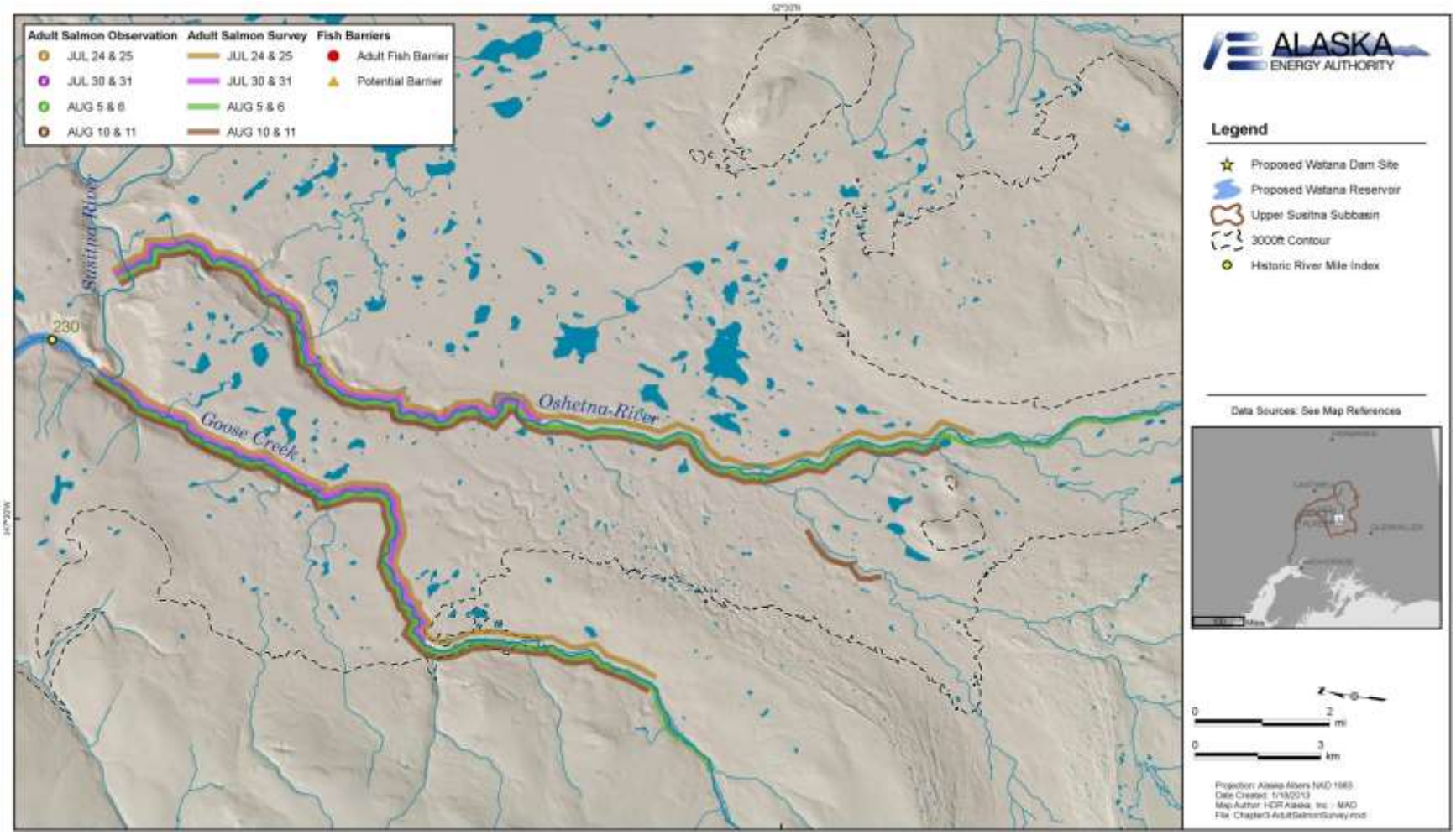
Map 4. Chinook salmon counts in Kosina Creek for all surveys.



Map 5. Chinook salmon counts in Watana Creek for all surveys.



Map 6. Chinook salmon counts in Jay Creek for all surveys.



Map 7. Chinook salmon counts in the southern portion of the survey area during all surveys.

Appendix B. Adult Salmon Aerial Survey Representative Photographs

Photo 1. Typical whitewater section of Kosina Creek on July 25, 2012.

Photo 2. Typical whitewater section of Chinook Creek showing an adult Chinook salmon as observed from the helicopter on August 5, 2012.

Photo 3. Chinook salmon in a typical cascade and pool complex in Devil Creek on August 5, 2012.

Appendix C. Descriptions of Tributary Streams in the Study Area Surveyed for Fish Distribution

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Stream	RM Confluence	Drainage Size (km^2)	Characteristics
Cheechako Creek	152.4	94.3	Flows into the Susitna River from the south. Main channel is approximately 17.2 km (10.7 mi) in length. Multiple falls located roughly 3.4 km (2.1 mi) upstream from mouth prevent the upstream movement of adult salmon. Upstream from the falls, the drainage includes a few tributary streams and small lakes.
Chinook Creek	157.0	58.0	Flows into the Susitna River from the south. Main channel is roughly 17.1 km (10.6 mi). Assessed for the presence of adult salmon passage barriers in 2012; no barriers were identified. A small secondary channel flows into Chinook Creek roughly 2.1 km (1.3 mi) upstream from mouth. A waterfall prevents upstream adult salmon movement into the secondary channel.
Devils Creek	161.5	190.6	Flows into the Susitna River from the north. Includes a number of tributaries and lakes, including High Lake and Little High Lake. Main channel is roughly 25.4 km (15.8 mi). Two large waterfalls located roughly 2.3 km (1.4 mi) upstream from mouth prevent the upstream movement of adult salmon.
Unnamed	166.3	<50	Flows into the Susitna River from the south. Main channel is roughly 8.7 km (5.4 mi). Assessed for the presence of adult salmon passage barriers in 2012; no barriers were identified.
Unnamed	168.7	<50	Flows into the Susitna River from the north. Main channel is roughly 4.2 km (2.6 mi). Multiple boulder cascades and complex chutes located roughly 0.6 km (0.4 mi) upstream from mouth were identified as barriers to adult salmon.
Unnamed	171.0	<50	Flows into the Susitna River from the north. Main channel is roughly 5.5 km (3.4 mi). Multiple complex chutes identified as barriers to adult salmon in the main channel, starting at roughly 2.3 km (1.4 mi) upstream from mouth. Drainage includes a number of secondary tributaries, of which only one is located downstream of the first barrier.
Unnamed	173.0	<50	Flows into the Susitna River from the north. Main channel is roughly 8.7 km (5.4 mi). A set of multiple falls located at a point roughly 0.3 km (0.2 mi) upstream from mouth was identified as a barrier to adult salmon.
Unnamed	174.0	<50	Flows into the Susitna River from the south. Includes a number of tributaries and lakes. Main channel is approximately 8.9 km (5.5mi). Assessed for the presence of adult salmon passage barriers in 2012; no barriers were identified.
Unnamed	174.2	<50	Flows into the Susitna River from the south. Includes a number of tributaries and lakes. Main channel is approximately 13.8 km (8.6 mi). Assessed for the presence of adult salmon passage barriers; no barriers were identified.
Fog Creek	176.6	381.2	Flows into the Susitna River from the east. Includes a number of tributaries and lakes (including the Fog Lakes complex). Main channel of the stream is roughly 44.7 km (27.8 mi) in length. Assessed for the presence of adult salmon passage barriers in 2012; no barriers were identified.
Unnamed	179.1	<50	Flows into the Susitna River from the east. Main channel is roughly 6.1 km (3.8 mi) in length. Forks at a point

Stream	RM Confluence	Drainage Size (km^2)	Characteristics
			roughly 3.6 km (2.2 mi) upstream from mouth. On the north (river right) channel, a waterfall located roughly 4.5 km (2.8 mi) upstream from the mouth is a barrier to adult salmon. No barriers were identified on the south (river left) channel.
Unnamed	179.4	<50	Flows into the Susitna River from the west. Includes several tributaries. Main channel is roughly 8.1 km (5 mi). Assessed for the presence of adult salmon passage barriers in 2012; no barriers were identified.
Unnamed	181.2	>200	Flows into the Susitna River from the north. Main channel is roughly 16.7 km (10.4 mi). A large tributary on the stream's right bank joins the main channel at a point roughly 1.3 km (0.8 mi) upstream from the mouth. Upstream from this confluence, both channels flow through relatively steep canyons. A large, single waterfall located on the main channel roughly 2.9 km (1.8 mi) upstream from the mouth is a barrier to adult salmon. Barriers were not identified on the secondary channel.
Tsusena Creek	181.8	374.3	Flows into the Susitna River from the north. Includes many tributaries and lakes, including Clark Creek. Main channel is roughly 49.4 km (30.7 mi). A large waterfall located roughly 6.1 km (3.8 mi) upstream from the mouth is a barrier to adult salmon.
Deadman Creek	186.6	453.5	Flows into the Susitna River from the north. Includes a number of tributaries and lakes, including Deadman Lake. Mainstem is roughly 67.4 km (41.9 mi) in length. A large waterfall located roughly 1.0 km (0.6 mi) from the mouth is a barrier to adult salmon. The barrier falls is located below the proposed reservoir elevation of 2,050-ft.
Unnamed	186.9	<50	Flows into the Susitna River from the north. Mainstem is roughly 2.9 km (1.8 mi) in length. High gradient cascades and bedrock chutes located roughly 0.6 km (0.4 mi) upstream from the mouth are considered potential barriers to adult salmon. This habitat is located below the proposed reservoir elevation of 2,050-ft.
Unnamed	192.0	>200	Flows into the Susitna River from the north. Includes a few tributaries and many lakes. Main channel is roughly 11.4 km (7.1 mi) long. Assessed for the presence of adult salmon passage barriers in 2012; no barriers were identified.
Watana Creek	194.1	452.7	Flows into the Susitna River from the north. Includes a number of tributaries and lakes, including Sally Lake and Big Lake. Main channel is roughly 43.3 km (26.9 mi). Melting permafrost and other unstable soils create turbid conditions throughout portions of this drainage. Assessed for the presence of adult salmon passage barriers in 2012; barriers were not identified.
Unnamed	194.9	<50	Flows into the Susitna River from the south. Includes a number of tributaries. Main channel is roughly 8.7 km (5.4 mi). The channel forks at a point roughly 1.2 km (0.75 mi) upstream from the mouth. Multiple falls located on the main (west) channel roughly 2.1 km (1.3 mi) upstream from the mouth likely present a barrier to adult salmon. This habitat is located below the proposed reservoir elevation of 2,050-ft.
Unnamed	200.7	<50	Flows into the Susitna River from the northeast. Includes a few secondary tributaries and lakes. Main channel

Stream	RM Confluence	Drainage Size (km^2)	Characteristics
			is roughly 16.1 km (10.0 mi). A series of five permanent falls located roughly 0.3 km (0.2 mi) upstream from the mouth present a barrier to adult salmon. The falls are located below an elevation of 2,050 ft.
Unnamed	201.8	<50	Flows into the Susitna River from the southwest. Includes a few tributaries and lakes. Main channel is roughly 10.0 km (6.2 mi) long. High gradient cascades and falls located roughly 0.6 and 1.0 km (0.4 and 0.6 mi) upstream from the mouth were identified as potential barriers to adult salmon. These habitats are located below an elevation of 2,050 ft.
Unnamed	203.4	<50	Flows into the Susitna River from the north. Originates from a small lake. Main channel is roughly 0.8 km (0.5 mi) in length. Free of adult salmon passage barriers to the unnamed lake.
Unnamed	203.7	<50	Flows into the Susitna River from the south. Includes a few tributaries and lakes, including Watana Lake. Main channel is roughly 11.9 km (7.4 mi) long. Assessed for the presence of adult salmon passage barriers in 2012; no barriers were identified.
Kosina Creek	206.8	1,036.5	Flows into the Susitna River from the south. Includes numerous tributaries and lakes. Named secondary tributaries include Tsisi Creek, Gilbert Creek, Terrace Creek, John Creek, and George Creek. Main channel is roughly 47.5 km (29.5 mi). Assessed for the presence of adult salmon passage barriers in 2012; no barriers were identified.
Jay Creek	208.6	160.1	Flows into the Susitna River from the northeast. Includes numerous tributaries; beaver pond complexes are present in its upper reaches. Main channel is roughly 31.5 km (19.6 mi). Splits into multiple channels just upstream from mouth. Assessed for the presence of adult salmon passage barriers in 2012; no barriers were identified.
Goose Creek	231.0	269.1	Flows into the Susitna River from the southwest. Includes a few small tributaries, including Busch Creek. Main channel is roughly 40.6 km (25.2 mi). Assessed for the presence of adult salmon passage barriers in 2012; no barriers were identified.
Oshetna River	233.5	1,424.5	Flows into the Susitna River from the south. Includes numerous tributaries, including Black River, Little Oshetna River, Conglomerate Creek, Roaring Creek, Landslide Creek, and Nowhere Creek. The basin contains several hundred lakes including Black Lake, Crater Lake, and Square Lake. Main channel is roughly 89.5 km (55.6 mi). Assessed for the presence of adult salmon passage barriers in 2012; no barriers were identified.

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Appendix D. Susitna River Mainstem and Mesohabitat Type Descriptions and Substrate Size Classes

Classification Level	Type	Description
Mainstem Habitat Type	Main Channel	Channels of the river that convey streamflow throughout the year. Can include single or multiple channels. In the Susitna River, they are visually recognizable during summer months by turbid, glacial water and high velocities. In general, they convey more than 10 percent (approximate) of the total flow passing a given location. [2,3]
	Side Channel	Channels that contain streamflows during open water periods but may be dewatered in a portion of the channel or entirely at low flows.[1] These channels carry mainstem water so also may be characterized by turbid, glacial water. Velocities often appear lower than in mainstem sites. In general, they convey less than 10 percent (approximate) of the total flow passing a given location. [1] Side channel habitat may exist in well-defined channels or in areas possessing numerous islands and submerged gravel bars.
	Tributary Mouth	Clear water areas that exist where tributaries flow into Susitna River mainstem or side channel habitats.[1] The flow of this habitat type often manifests as a clear water plume extending out into the turbid receiving water of the mainstem Susitna River. Tributary mouth habitat also extends upstream into the tributary to the upper extent of any backwater influence that might exist. The surface area of tributary mouth habitat is affected both by tributary discharge and mainstem stage. [3]
	Tributary	Those reaches of tributary streams upstream of the tributary mouth habitats. Tributary habitat may contain distinct mainstem channel types, off-channel waterbodies, and mesohabitat types.
	Off-Channel	Aquatic habitats located beyond a river's active channel, yet still within the river's active valley. Off-channel habitats lack an upstream surface water connection to the main channel at intermediate or low flows, although downstream surface water connections may exist. Off-channel habitats convey water or contain water from small tributaries, upwelling groundwater, and/or local surface runoff.
Off-Channel Type	Side Slough (Low flow slough)	Overflow channels contained within the Susitna River floodplain that are separated from the mainstem at the upstream end by exposed alluvial berm.[1] These channels generally contain clear water from small tributaries, upwelling groundwater, and local surface runoff. Side sloughs have non-vegetated bars at their upstream ends that are overtopped during periods of moderate to high mainstem discharge. The water surface elevation of the mainstem Susitna River at the downstream end of a side slough generally causes a backwater effect in the lower portion of the slough. Overtopping from mainstem flows occurs multiple times for short durations June through August. [2] Except during periods of overtopping the temperature of side sloughs is independent of the mainstem water temperature.
	Upland Slough (Slough)	Similar to side sloughs except they are separated from the mainstem channel or a side channel by a well vegetated berm. Upland sloughs contain clear water from small streams, upwelling, and/or local surface runoff. Upland sloughs are rarely overtopped by mainstem discharge. [2,3]
	Backwater	Found along channel margins and created by mainstem flow eddies around obstructions such as boulders, root wads, or in-channel wood. Part of active channel at most flows; scoured at high flow. Substrate typically sand, gravel, and cobble. Generally not as long as the full channel width. [4]
	Isolated Pond	A self-contained off-channel waterbody that lacks a surface water connection to the river when the main channel flow is less than bankfull. Substrate is highly variable.
	Relic Channel	An abandoned channel lacking active flow. [6]
Mesohabitat Type	Cascade	A fast water habitat with turbulent flow; many hydraulic jumps, strong chutes, and eddies and between 30-80 percent white water. High gradient; usually greater than 4 percent slope. Much of the exposed substrate composed of boulders organized into clusters, partial bars, or step-pool sequences. [4]
	Pocketwater	A stream section intermediate in slope to the slopes observed for cascades and riffles in the subject stream, but absent clear cross-channel steps characteristic of a cascade, and the flow patterns are more complex and not characteristic of riffles (where turbulence is visibly distributed more or less evenly across the channel). There are multiple, prominent pockets of velocity refuges distributed across and along the channel that are downstream of flow obstructions. The obstructions are mostly small boulders that are of a size scaling with mid- to high-flow depth. The unit should be at least 1 channel width long to be classified separately, otherwise lump in with most similar adjacent mesohabitat type.
	Riffle	A fast water habitat with turbulent, shallow flow over submerged or partially submerged gravel and cobble substrates. [4] Gradients are approximately 2 to less than 4 percent.

Classification Level	Type	Description
	Run	A fast water habitat with little surface turbulence. A run has generally uniform depth that is greater than the maximum substrate size. [4] Gradients are approximately 0 to less than 2 percent.
	Pool	A slow water habitat with a flat surface slope and low water velocity that is deeper than the average channel depth. Substrate is highly variable. [4]
	Beaver Complex	A complex waterbody created by beaver dams that includes one or more ponded areas, connecting channels, and outlet channel to the mainstem, side or a tributary channel. Substrate is generally fine grained sand, silt and organic debris.
Pool Subtypes	Scour Pool	Formed by mid-channel scour or flow impinging against one stream bank or partial obstruction (logs, root wad, or bedrock). Generally with a broad scour hole. Includes corner pools in meandering lowland or valley bottom streams. [4]
	Backwater Pool	Found along channel margins; created by eddies around obstructions such as boulders, root wads, or woody debris. Part of active channel at most flows; scoured at high flow. Substrate typically sand, gravel, and cobble. Generally not as long as the full channel width. [4]
	Beaver Pond	Water impounded by the creation of a beaver dam. Maybe within main, side, or off-channel habitats. [4]
Other	Alcove	An off-channel habitat that is laterally displaced from the general bounds of the active channel and formed during extreme flow events or by beaver activity; not scoured during typical high flows. Substrate is typically sand and organic matter. Generally not as long as the full channel width. [4]
	Percolation Channel	A slough habitat type that is characterized by groundwater percolation from the floodplain through gravel bars. Its upstream surface water connection to the active river channel has been cut off due to an accumulation of sediment and debris at the head of the formerly open channel, yet main river flows continue to provide a groundwater source of flow to the percolation channel. At high or overbank flows, an upstream surface water connection to the active river channel may be present. [5]
	Isolated Pond	A self-contained off-channel waterbody that lacks a surface water connection to the main channel when flow is less than bankfull. Substrate is highly variable. An isolated pond may occur within the off-channel slough habitats or elsewhere in the off-channel portion of the river valley. [3]

Notes:

1. Table agreed upon by the ATWG for mesohabitat classifications
2. Source: Trihey (1982).
3. Source: Schmidt et al. (1984).
4. Source: Adapted from Moore et al. (2006).
5. Source: Adapted from Peterson and Reid (1984).
6. Source: Adapted from Washington Department of Ecology (2012).

Substrate Classification

Substrate Type	Size Range (mm)
Organic	Organic
Sand/Silt	< 2.0
Gravel	2.0-63.9
Small Cobble	64.0-127.9
Large Cobble	128.0-255.9
Small Boulder	256-512
Large/Med Boulder	> 512
Bedrock	Bedrock

Notes:
1. Appended from the USFS (2001) classification.

Appendix E. Genetics Tissue Sampling Guidance

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Appendix F. Representative Photographs, 2012

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List of Photos

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Photo 1. Juvenile Chinook salmon captured from Cheechako Creek (RM 152.4), August 16, 2012. PhotoBP1020676

Photo 2 Dolly Varden captured from stream connecting Fog lakes (RM 176.6), July 18, 2012. PhotoRP1010722

Photo 3. Juvenile round whitefish captured from tributary plume (RM 181.2), August 10, 2012. PhotoRP1020333

Photo 4. Juvenile Arctic grayling captured from tributary stream (RM 192), July 17, 2012. PhotoJI0081

Photo 5. Longnose sucker captured from tributary plume at Jay Creek (RM 208.6), July 25 2012. PhotoRP1010892

Photo 6. Burbot captured from tributary plume at Jay Creek (RM 208.6), July 25 2012. PhotoRP1010885

Photo 7. Lake trout captured from Sally Lake in Watana Creek basin (RM 194.1), August 5, 2012. PhotoRP1020245

Photo 8. Round whitefish captured from tributary plume at Tsusena Creek (RM 181.8), July 27, 2012. PhotoRP102004

Photo 9. RM 152.4-Cheechako Creek, near mouth, 35 juvenile Chinook salmon captured August 16, 2012. PhotoBP1020673

Photo 10. RM 157-Chinook Creek, upper site, sampled July 24, 2012. PhotoBP1020580

Photo 11. RM 161.5-Devils Creek, sampled upstream of waterfall on August 16, 2012. PhotoBP1020679

Photo 12. RM 166.3-Unnamed trib., sampled July 31, 2012. PhotoRP1020101

Photo 13. 168.7-Unnamed trib., sampled July 31, 2012. PhotoRP1020114

Photo 14. 168.8-Susitna River, off-channel habitat sampled July 31, 2012. PhotoRP1020116

Photo 15. 171.0-Unnamed trib., sampled August 6, 2012. PhotoRP1020192

Photo 16. 173.0-Unnamed trib., sampled July 30, 2012. PhotoRP1020097

Photo 17. 174.0-Unnamed trib., sampled July 30, 2012. PhotoRP1020090

Photo 18. 174.1-Susitna River, off-channel habitat sampled July 30, 2012. PhotoRP1020295

Photo 19. 174.2-Unnamed trib., sampled July 30, 2012. PhotoRP1020087

Photo 20. 176.6-Fog Creek, at mouth (channel, river left). PhotoRP1010866

Photo 21. 176.6-Fog Creek, secondary trib., near previous Chinook salmon capture site (Buckwalter 2011). PhotoRP1010831

Photo 22. 176.6-Fog Creek, side channel sampled on July 23, 2012. PhotoBP1020575

Photo 23. 176.6-Fog Creek, fyke net set in lake on July 23, 2012. PhotoRP1010717

Photo 24. 178.2-Susitna River, habitat sampled, looking upstream. PhotoBP1020621.

Photo 25. 179.1-Unnamed trib., two juvenile Chinook salmon captured on July 29, 2012. PhotoRP1020059

Photo 26. 179.1-Unnamed trib., sampled July 29, 2012, upstream of Chinook salmon capture site, PhotoRP1020071.

Photo 27. 179.4-Unnamed trib., sampled August 10, 2012. PhotoBP1020620

Photo 28. 181.2-Unnamed trib., snorkel survey on August 10, 2012. PhotoRP1020325

Photo 29. 181.8-Tsusena Creek, looking upstream, on July 27, 2012. PhotoBP1020609

Photo 30. 186.0-Susitna River, slough habitat sampled on July 27, 2012. PhotoBP1020606

Photo 31. 186.6-Deadman Creek, upper stream during boat-electrofishing on July 2012. PhotoRP1010869

Photo 32. 186.8-Susitna River, main channel backwater eddy, sampled August 5, 2012. PhotoRP1020265

Photo 33. 186.9-Unnamed trib., sampled August 5, 2012. PhotoRP1020258

Photo 34. 192.0-Unnamed trib., sampled July 17, 2012. PhotoJI0083

Photo 35. 192.6-Susitna River habitat sampled August 5, 2012. PhotoRP1020249

Photo 36. 194.1-Watana Creek, clearwater plume at mouth, sampled July 26, 2012. PhotoRP101032

Photo 37. 194.1-Watana Creek, boat-electrofishing on July 20, 2012. PhotoRP1010787

Photo 38. 194.1-Watana Creek, flooded channel in large mud-slide area, July 20, 2012. PhotoRP1010797

Photo 39. 194.1-Watana Creek, Sally Lake, sampled August 3, 2012. PhotoRP1020174

Photo 40. 194.1-Watana Creek, secondary tributary that drains Sally Lake, July 20, 2012. PhotoBP1020550

Photo 41. 194.9-Unnamed trib., sampled July 19, 2012. PhotoBP1020539

Photo 42. 194.9-Unnamed trib., mouth, sampled July 26, 2012. PhotoRP1010928

Photo 43. 200.7-Unnamed trib., sampled August 1, 2012. PhotoRP1020118

Photo 44. 201.7-Susitna River, margin sampled on August 3, 2012. PhotoRP1020203

Photo 45. 201.8-Unnamed trib., sampled August 3, 2012. PhotoRP1020199

Photo 46. 203.4-Unnamed trib. basin, Lake below 2050-ft. PhotoBP1020650

Photo 47. 203.7-Unnamed trib., at mouth, sampled August 2, 2012. PhotoRP1020153

Photo 48. 205.7-Susitna River, slough downstream of Kosina Creek extensive plume, sampled July 25, 2012. PhotoRP1010898

Photo 49. 206.8-Kosina Creek's extensive clearwater plume, slough at RM 205.7 visible, August 6, 2012. PhotoJB1589

Photo 50. 206.8-Kosina Creek side channel, sampled on August 12, 2012. PhotoBP1020636

Photo 51. 206.8-Kosina Creek, July 17, 2012. PhotoJM0550

Photo 52. 206.8-Kosina Creek, sampled by boat-electrofisher on July 19, 2012. PhotoRP1010748

Photo 53. 208.6-Jay Creek. Small plumes, multiple channels sampled by boat-electrofisher July 25, 2012. PhotoRP1010882

Photo 54. 231.0-Goose Creek, July 29, 2012. PhotoRP1020051

Photo 55. 233.5-Oshetna River at the Black River confluence, June 22, 2012. PhotoJB1411

Photo 56. 233.5-Oshetna River, sampled July 26, 2012. PhotoBP1020601

Appendix G. Length-frequency Histograms for Select Fish Species and Locations, 2012

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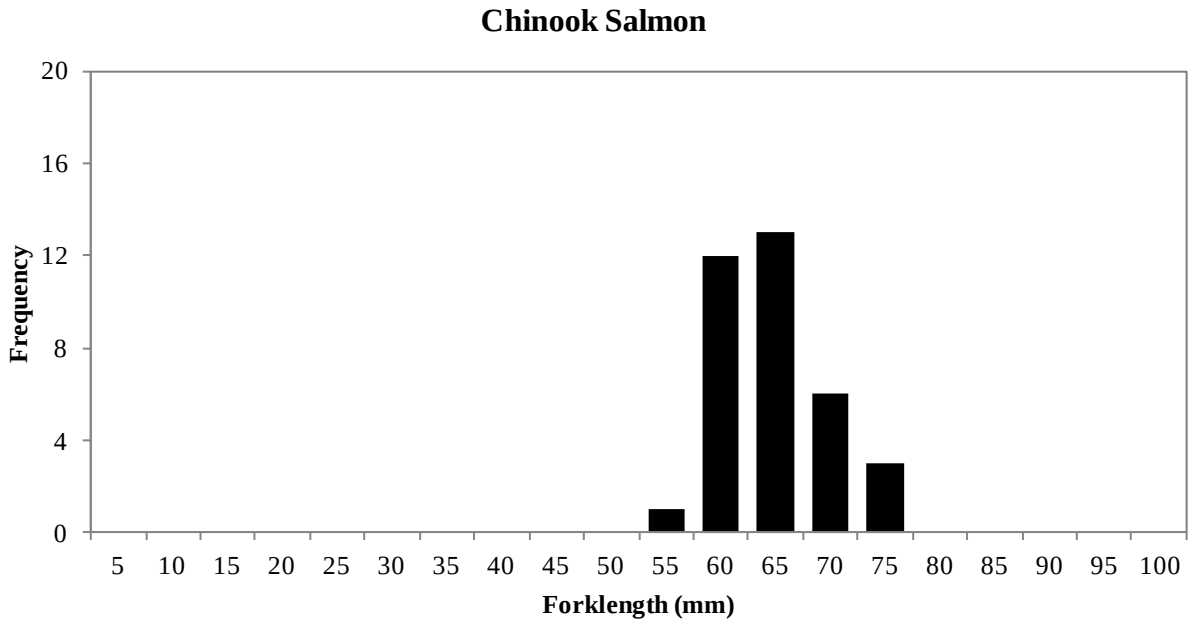

Figure G-1. Length Frequencies for Chinook salmon (n=35) captured in the RM 152.4 –Cheechako Creek drainage, Upper Susitna River study area, July-August, 2012. Fish were captured by backpack electrofishing.

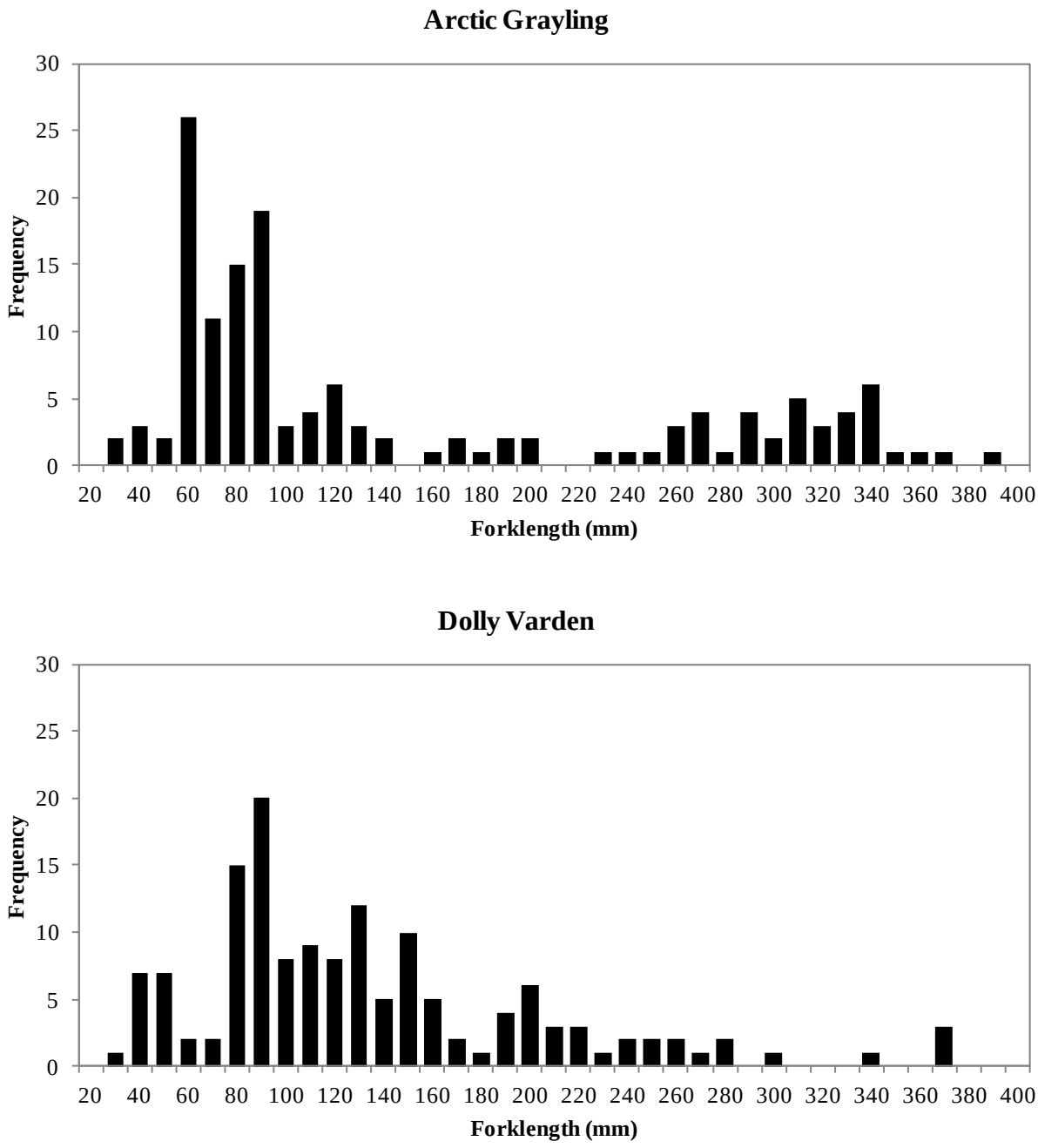

Figure G-2. Length Frequencies for Arctic Grayling (n=143) and Dolly Varden (n=145) captured in tributary, tributary plume, and lake habitats in the Upper Susitna River study area, July-August, 2012. Fish were captured by boat-mounted electrofisher, backpack electrofishing, minnow traps, angling, and fyke nets.

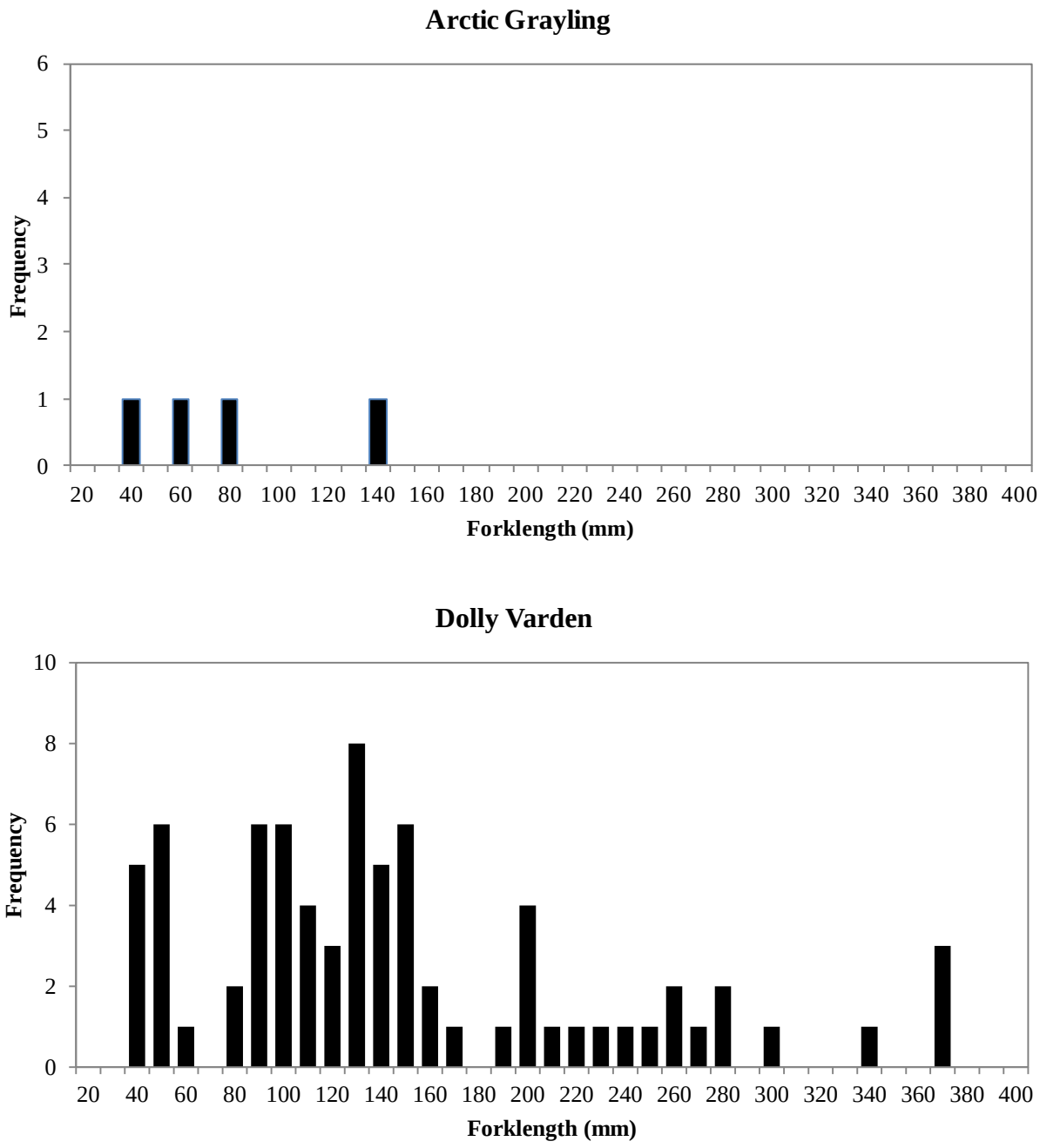

Figure G-3. Length Frequencies for Arctic Grayling (n=4) and Dolly Varden (n=75) captured in the RM 176.6 – Fog Creek drainage, Upper Susitna River study area, July-August, 2012. Fish were captured by backpack electrofishing, minnow traps, angling, and fyke nets.

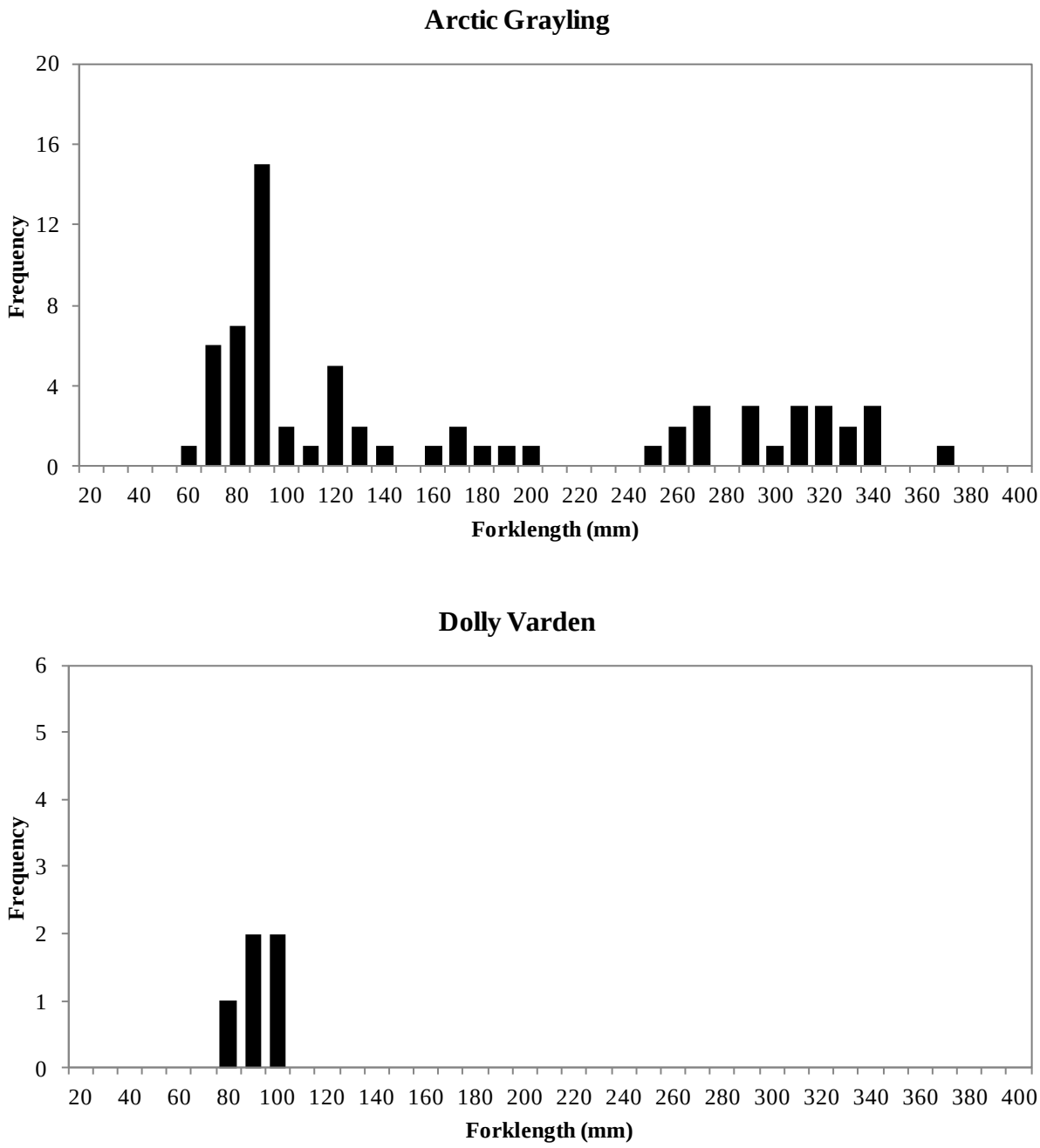

Figure G-4. Length Frequencies for Arctic Grayling (n=68) and Dolly Varden (n=5) captured in the RM 194.1 – Watana Creek drainage, Upper Susitna River study area, July-August, 2012. Fish were captured by boat-mounted electrofisher, backpack electrofishing, angling, and fyke nets.

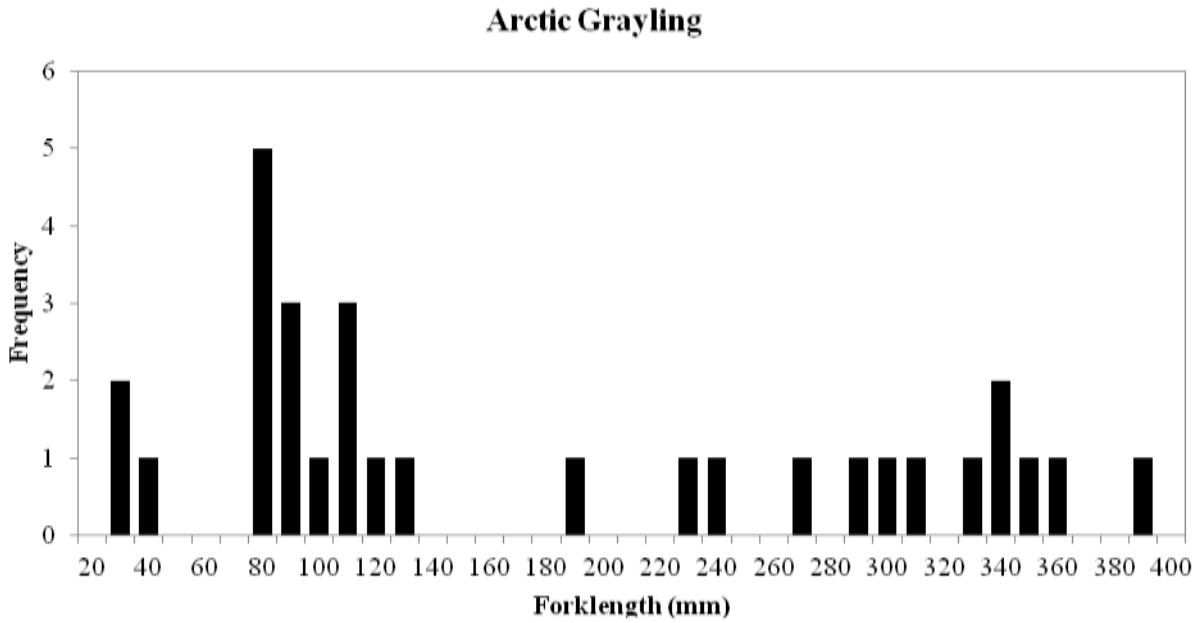

Figure G-5. Length Frequencies for Arctic Grayling (n=30) and captured in the RM 206.8 –Kosina Creek drainage, Upper Susitna River study area, July-August, 2012. Fish were captured by boat-mounted electrofisher, backpack electrofishing, and angling.

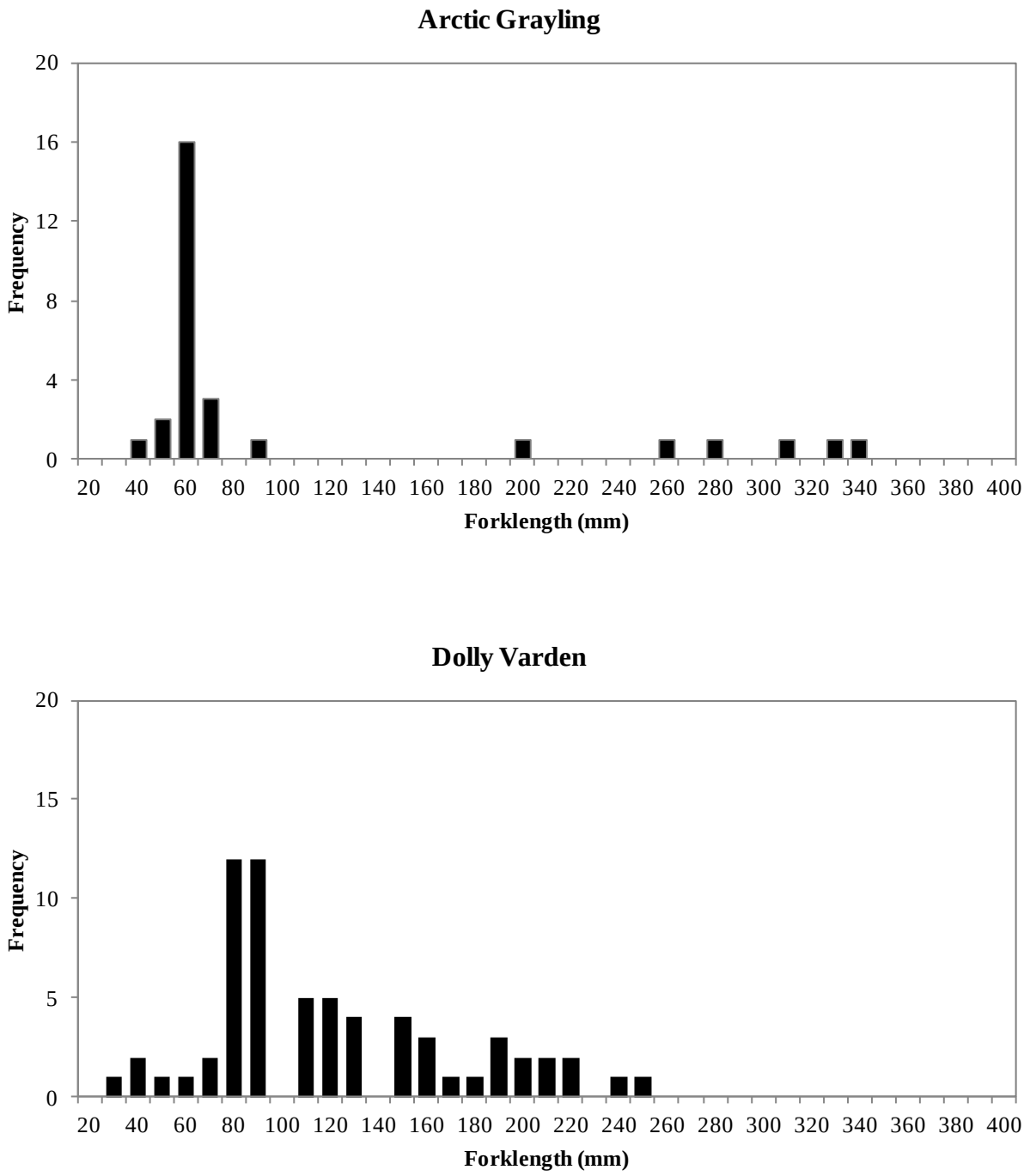

Figure G-6. Length Frequencies for Arctic Grayling (n=29) and Dolly Varden (n=65) captured in the RM 208.6 – Jay Creek drainage, Upper Susitna River study area, July-August, 2012. Fish were captured by boat-mounted electrofisher, backpack electrofishing, and angling.

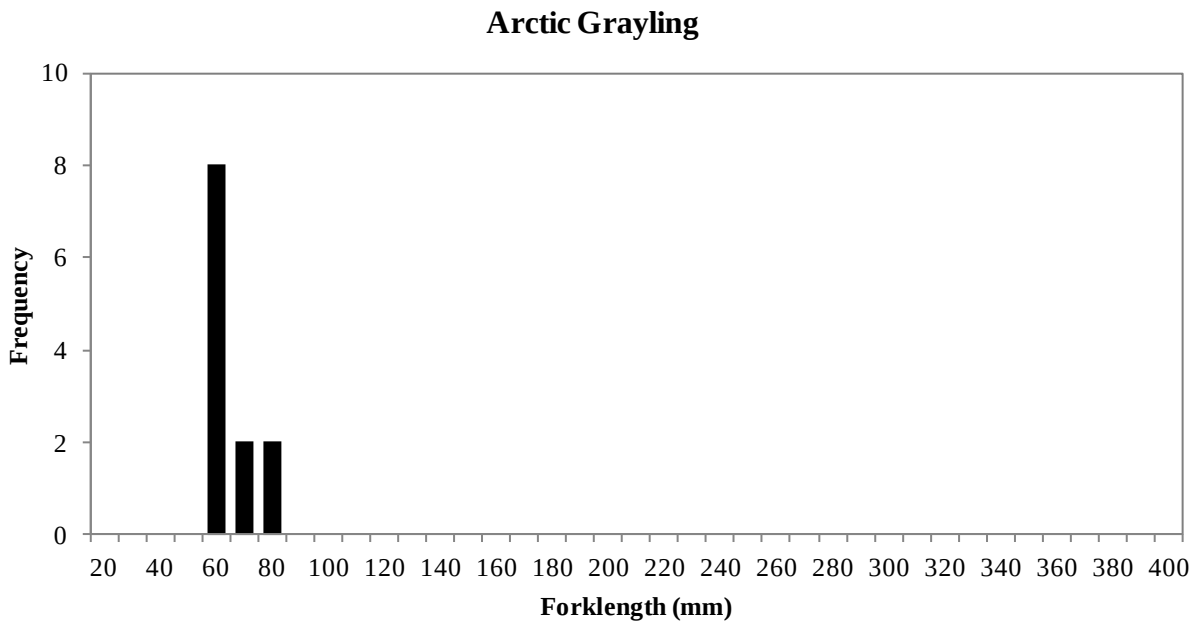

Figure G-7. Length Frequencies for Arctic Grayling (n=12) captured in the RM 233.5 –Oshetna Creek drainage, Upper Susitna River study area, July-August, 2012. Fish were captured by backpack electrofishing.

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