# Susitna-Watana Hydroelectric Project Document
# ARLIS Uniform Cover Page

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|---|---|
| **Title:**<br>Genetic baseline study for selected fish species, Study plan Section 9.14 : Initial study report | **SuWa 207** |
| **Author(s) – Personal:** | |
| **Author(s) – Corporate:**<br>Prepared by Gene Conservation Laboratory, Commercial Fisheries Division, Alaska Department of Fish and Game | |
| **AEA-identified category, if specified:**<br>Draft initial study report | |
| **AEA-identified series, if specified:** | |
| **Series (ARLIS-assigned report number):**<br>Susitna-Watana Hydroelectric Project document number 207 | **Existing numbers on document:** |
| **Published by:**<br>[Anchorage : Alaska Energy Authority, 2014] | **Date published:**<br>February 2014 |
| **Published for:**<br>Alaska Energy Authority | **Date or date range of report:** |
| **Volume and/or Part numbers:**<br>Study plan Section 9.14 | **Final or Draft status, as indicated:**<br>Draft |
| **Document type:** | **Pagination:**<br>vi, 40, 2 p. |
| **Related work(s):** | **Pages added/changed by ARLIS:** |
| **Notes:** | |

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SUSITNA-WATANA HYDRO

# Susitna-Watana Hydroelectric Project
# (FERC No. 14241)

# Genetic Baseline Study for Selected Fish Species
# Study Plan Section 9.14

# Initial Study Report

Prepared for

Alaska Energy Authority

SUSITNA-WATANA HYDRO

*Clean, reliable energy for the next 100 years.*

Prepared by

Gene Conservation Laboratory
Commercial Fisheries Division
Alaska Department of Fish and Game

February 2014 Draft

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# APPENDICES

# LIST OF ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

| Abbreviation | Definition |
|---|---|
| ADF&G | Alaska Department of Fish and Game |
| AEA | Alaska Energy Authority |
| CFR | Code of Federal Regulations |
| CIRWG | Cook Inlet Region Working Group |
| DNA | deoxyribonucleic acid |
| FERC | Federal Energy Regulatory Commission |
| GCL | Gene Conservation Laboratory |
| GPS | global positioning system |
| ILP | Integrated Licensing Process |
| IP | Implementation Plan |
| ISR | Initial Study Report |
| ml | milliliter |
| Mm | Millimeter |
| MSA | mixed-stock analyses |
| n/a | not applicable/not available |
| NOAA | National Oceanic and Atmospheric Administration |
| NMFS | National Marine Fisheries Service |
| oz. | ounce |
| PRM | Project River Mile |
| Project | Susitna-Watana Hydroelectric Project |
| RM | River Mile(s) referencing those of the 1980s Project. |
| RSP | Revised Study Plan |
| SPD | Study Plan Determination |
| USFWS | United States Fish and Wildlife Service |

# EXECUTIVE SUMMARY

| Genetic Baseline Study for Selected Fish Species 9.14 | |
|---|---|
| Purpose | The purpose of this study is to collect tissue samples suitable for genetic analyses from Susitna River fish species, conduct genetic analysis of Chinook salmon, and establish tissue repositories for all four other salmon species and 20 non-salmon fish species. Chinook salmon tissue will be used to characterize genetic population structure, examine genetic variation for use in mixed-stock analysis, and, if sufficient variation is found, estimate the contribution of Chinook salmon originating upstream of Devils Canyon to select habitats in the Lower River. Salmon and non-salmon tissue repositories will be used for future studies to characterize the genetic legacy and variation of species and populations of interest. |
| Status | Field collections began in 2012, were expanded in 2013, and will be completed in a final year of study. Chinook salmon analysis began in the fourth quarter of 2013. Collections are on target to meet sampling goals over the 2-year study with two exceptions: 1) odd-year pink salmon were not found spawning in the Chulitna River and were therefore not collected and 2) Chinook salmon from selected tributaries above or near Devils Canyon were not accessible which may impede temporal analyses (Section 4.5). |
| Study Components | Salmon tissue samples were collected via targeted fieldwork conducted by this study. Non-salmon tissue samples were provided via opportunistic collections from this and four other studies conducted for the Project. Sampling dates, sample sizes, and locations targeted by this study vary based on species and study component, but in total represent the most species-comprehensive genetic collections from fresh waters in northern Cook Inlet. All samples were delivered to the Gene Conservation Laboratory operated by the Alaska Department of Fish and Game. Thereafter, some samples were archived for future use and Chinook salmon collections underwent preliminary analysis for genetic variation and mixed stock analysis. |
| 2013 Variances | AEA implemented the methods as described in the Study Plan with the exception of the following variances. The significance of these variances is discussed within the ISR.<br><br>In 2013, there were no variances from the collection, storage and analysis methods described in the Study Plan; however, full access to all of the sampling sites was not available in 2013. Access was not available to collect Chinook salmon samples in tributaries flowing through Cook Inlet Regional Working Group (CIRWG) lands above or near Devils Canyon (Cheechako, Devil, Fog, Tsusena and Watana creeks) in 2013. Lack of land access prevented sampling of coho salmon from Portage and Prairie creeks, and reduced sampling effort for sockeye salmon in Prairie Creek (Genetics IP Section 4.2; see ISR Section 4.5). |

| Genetic Baseline Study for Selected Fish Species 9.14 | |
|---|---|
| Steps to Complete the Study | As explained in the cover letter to this draft ISR, AEA's plan for completing this study will be included in the final ISR filed with FERC on June 3, 2014. |
| Highlighted Results and Achievements | The study made excellent progress towards tissue collections of Susitna River fish species in 2013, with over 4,500 samples collected representing the most species-comprehensive genetic collections from fresh waters in northern Cook Inlet. |

# 1. INTRODUCTION

On December 14, 2012, Alaska Energy Authority (AEA) filed its Revised Study Plan (RSP) with the Federal Energy Regulatory Commission (FERC or Commission) for the Susitna-Watana Hydroelectric Project (FERC Project No. 14241) which included 58 individual study plans (AEA 2012). Included within the RSP was the Genetic Baseline Study for Selected Fish Species, Section 9.14. RSP Section 9.14 focuses on understanding the genetic structure of selected species within the Susitna River.

On February 1, 2013, FERC staff issued its study determination (February 1 SPD) for 44 of the 58 studies, approving 31 studies as filed and 13 with modifications. RSP Section 9.14 was one of the 13 approved with modifications. In its February 1 SPD, FERC recommended the following:

> *AEA consult with the FWS and NMFS prior to preparing the project operational plans; distribute draft project operational plans to the agencies by March 31 of each year of study implementation; allow 15 days for the agencies to provide comments on the draft plans; file the final plans with the Commission by April 30 of each year of study implementation; and include with the final plans, documentation of agency consultation, a description of how agency comments are incorporated into the final plans, and an explanation for why any agency comments are not incorporated into the final plans.*
>
> *To the extent feasible, we recommend that AEA collect tissue samples over a representative proportion of the entire adult Chinook salmon run.*
>
> *We recommend that AEA include in the 2013 project operational plan, a schedule for when the 2012 genetics studies would be available, and include provisions for filing those results with the Commission through either the initial study report, or a supplemental report in 2013. We also recommend that the report on the 2012 preliminary genetics studies clearly describe the criteria, using current scientific literature, to determine whether there is sufficient genetic uniqueness to estimate the percentage of Chinook originating from Upper and Middle River habitats in areas sampled downstream. Finally, we recommend that the report on the 2012 preliminary genetics studies clearly describe whether the study results indicate that sufficient genetic uniqueness is found to characterize the presence and relative proportion of fish originating from the Upper and Middle River in selected Lower River habitats as described in section 9.14.4.7 of the study plan.*

In accordance with the February 1 SPD, AEA provided a draft 2013 Implementation Plan for the Genetic Baseline Study for Selected Fish Species in the Susitna River, Alaska (Genetics Implementation Plan [IP]) for review on March 31, 2013 and filed a final 2013 Genetics IP on April 30, 2013. The 2013 Genetics IP supersedes portions of the Revised Study Plan.

In accordance with the February 1 SPD, AEA has adopted the FERC requested modifications.

Following the first study season, FERC's regulations for the Integrated Licensing Process (ILP) require AEA to "prepare and file with the Commission an initial study report describing its

overall progress in implementing the study plan and schedule and the data collected, including an explanation of any variance from the study plan and schedule." (18 CFR 5.15(c)(1)) This Initial Study Report (ISR) on Genetic Baseline Study has been prepared in accordance with FERC's ILP regulations and details AEA's status in implementing the study, as set forth in the FERC-approved RSP and as modified by FERC's February 1 SPD and the 2013 Implementation Plan (collectively referred to herein as the "Study Plan").

# 2. STUDY OBJECTIVES

The goals of this study are to (1) acquire genetic material from samples of selected fish species within the Susitna River drainage, (2) characterize the genetic structure of Chinook salmon in the Susitna River watershed and (3) assess the use of Lower and Middle River habitat by juvenile Chinook salmon originating in the Middle and Upper Susitna River.

As described in the 2013 Genetics IP Section 3, the objectives of this study are to:

1. Develop a repository of genetic samples for target resident fish species captured within the Lower, Middle, and Upper Susitna River drainage.
2. Contribute to the development of genetic baselines for chum, coho, pink, and sockeye salmon spawning in the Middle and Upper Susitna River drainage.
3. Characterize the genetic population structure of Chinook salmon from Upper Cook Inlet, with emphasis on spawning aggregates in the Middle and Upper Susitna River.
4. Examine the genetic variation among Chinook salmon populations from the Susitna River drainage, with emphasis on Middle and Upper River populations, for mixed-stock analyses (MSA).
5. If sufficient genetic variation is found for MSA, estimate the annual percent of juvenile Chinook salmon in selected Lower River habitats that originated in the Middle and Upper Susitna River in 2013 and 2014 (Figure 2-1).

# 3. STUDY AREA

As established in the 2013 Genetics IP Section 2.2, the study area encompasses the Susitna River and its tributaries from Cook Inlet upstream to the Oshetna River confluence (RM 233.4 [PRM 261.3]; Figure 2). For baseline data related to stock-specific sampling, there was an emphasis on tributaries of the Middle and the Upper Susitna River. For assessing habitat use (juveniles) of fish originating from the Middle (RM 98 – 184 [PRM 102.4 – 187.1]) and Upper Susitna River (RM 184 – 233.4 [PRM 187.1 – 261.3]), tissue from juvenile Chinook salmon was collected in the Lower River (< RM 98 [PRM 102.4]).

# 4. Methods and Variances in 2013

AEA implemented the methods as described in the Study Plan with the exception of variances explained below (Section 4.5).

## 4.1. Sample Collection

For this study fish populations were defined using Waples and Gaggiotti's (2006) definition: a group of individuals of the same species living in close enough proximity that any member of the group can potentially mate with any other member. Functionally, populations were represented by single or pooled collections following the "Pooling Collections into Populations" methods below.

Based on field sampling from previous years (Tables 4-1 to 4-5), information gathered from the Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes ADF&G biologists selected possible sites where fish of each target Pacific salmon species might be spawning and generated idealized sample sizes for each site (Tables 4-1 to 4-5). ADF&G and AEA's contractors made an intensive effort to collect these samples as outlined in the sections below. However, AEA recognized at the inception of this project (2013 Genetics IP) that it was unlikely to obtain the idealized sample size at all sites due to uncontrolled variables (i.e., numbers of fish at a spawning location, number of fish returning in 2013 and 2014, access limitations, water conditions, and catchability of the fish). Therefore, a column was added to Tables 4-1 to 4-5 labeled "Expected" that shows the number of fish that could reasonably be sampled at each site (or group of sites) in two years.

AEA implemented the methods for sampling collection targets as described in the 2013 Genetics IP Section 4.2, with no variances. Collection targets , ranged between 0 and 200 individuals per species per location depending on the number of archived samples and prior knowledge about likely sample collection success (Tables 4-1 through 4-6). Samples were acquired from field collections performed as a part of this Study Plan (Studies 9.14), and from each of four interrelated studies: Study of Fish Distribution and Abundance in the Upper Susitna River (Study 9.5); Study of Fish Distribution and Abundance in the Middle and Lower Susitna River (Study 9.6); Salmon Escapement Study (Study 9.7); and Eulachon Run Timing, Distribution, and Spawning in the Susitna River Study (Study 9.16). All four interrelated studies provided samples from resident fish species collected in the course of their work (Table 4-6). Study 9.5 also provided samples of juvenile Chinook salmon (Table 4-1), and Study 9.7 provided samples from adult salmon from the Indian River and from the Middle River at Curry (detailed in Section 4.1.5). Sampling methods for this Study Plan are described below. Sampling methods for the four interrelated studies are described in those respective Initial Study Reports. Analysis of all samples will be integrated and reported in the Updated Study Report.

### 4.1.1. Adult Chinook salmon collections

To address Objectives 3 and 4, tissue samples were to be collected during the study period from Chinook salmon spawning in drainages within Knik Arm and northwestern Cook Inlet, and within the Susitna River drainage. For drainages within Knik Arm and northwest Cook Inlet, this study was to augment the existing baseline by adding collections of up to 200 Chinook salmon from two tributaries from each area. For the Susitna River drainage, this project was to augment the existing baseline such that all tributaries were represented by at least 50 (and ideally 200) Chinook salmon.

Understanding the population structure of Chinook salmon collected above and below Devils Canyon will inform policymakers regarding the relatedness and isolation of spawning aggregates. Population structure of Chinook salmon will be measured at three different levels: within the set of individuals spawning above the canyon; among the groups of individuals spawning within the Susitna River watershed (with particular emphasis on the Middle River and Upper River); and in relationship to populations from nearby drainages in Upper Cook Inlet. These higher-level analyses will anchor the results and help provide a context for interpretation.

Weekly survey flights were conducted from June 11 to September 15 in 2013 to determine the timing and locations for sampling all five species of salmon (Table 4-7) with the most intensive sampling of adult Chinook salmon occurring between July 15 and August 16 in 2013). Sampling crews were dispatched when and where Chinook salmon were observed in spawning habitats. Because Chinook salmon are generally spread out in streams and in lower abundance compared to other salmon species, multi-day sampling trips were required to get an adequate sample from each location (Table 4-1; Figure 4-5). During this time period, each of the three sampling crews attempted to collect samples from at least two locations per week with an average of 2.5 days per trip. The two extra days each week allowed crews to be relocated and resupplied with sampling gear, food, and other camping supplies, and acquire information from GCL staff for their next sampling location(s).

During the intensive Chinook salmon sampling period, two crews were dedicated to sampling in the Susitna River. One crew was dedicated for sampling the Yentna River and northwestern Cook Inlet during the weeks of July 17 and 24 in 2013. Additional field staff collected Chinook salmon samples from locations along the road system in the Susitna River and Knik Arm from June 24 to July 19, 2013. Crews in the Susitna River had a helicopter (Robinson R-44 II; operated by Alpine Air Alaska, Inc.) on call for transport to and from sampling locations because of the large area to be sampled and short window of opportunity each year to collect Chinook salmon samples. The base of operations for the Alpine Air helicopter was Talkeetna. The Yentna River crew chartered helicopter (Enstrom F28F) flights, as needed, through Talaheim Lodge, based on the Talachulitna River.

Chinook salmon were captured using either hook-and-line, seines, or gillnets depending on the size of the stream and where the fish were located. Upon capture, a single axillary process was clipped from each Chinook salmon and placed in a bottle of ethyl alcohol for preservation. For the two Chinook salmon sampled above Devils Canyon, additional paired samples/data were collected including scales, length (mid-eye to fork, to nearest 5 mm), sex, and GPS information (decimal degrees, to the nearest 0.001). Therefore, for these fish, axillary process and five scale samples were sampled into individually-labeled vials. Scales were sampled at a point along the diagonal line from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin, two rows above the lateral line. Length, sex and GPS information was recorded on Rite-in-the-Rain® notebooks paired with the vial identifier. Fish were held in the water as much as possible while hooks were removed and samples were collected, and released immediately after the sample was placed in the bottle. If necessary, crews held the fish in the water to make sure they could swim before releasing them.

Chinook salmon collections also occurred outside the three-week intensive sampling period as early as the second week of June and as late as the second week of August in 2013 (Table 4-8).

Collection trips during less intensive sampling periods were performed by two crews, but trip lengths were longer (approximately 4 days – one trip per crew per week) due to the lower availability of helicopter charters. Helicopter flights were chartered as needed, through Talaheim Lodge and Alpine Air, to access sites above Devils Canyon and sites not efficiently accessed by jet boat. Jet boats were used to access sites accessible from the road system in the Middle Susitna River.

### 4.1.2. Other adult salmon collections

To address Objective 2, tissue samples were to be collected from 100 individuals (total archived and samples collected during the study period) from at least three spawning aggregates of pink, sockeye, chum, and coho salmon from each of the following drainages: 1) the Susitna River upstream of the Three Rivers Confluence (Middle Susitna River), 2) the Talkeetna River, and 3) the Chulitna River (Tables 4-2 to 4-5; Figures 4-1 to 4-4). Collections from adult pink, sockeye, chum, and coho salmon began on July 29 and continued through August 23, 2013 (Table 4-8). During the intensive Chinook salmon collection period, samples from these other salmon species were collected opportunistically by the two Susitna River crews. During the week of August 19, each of the two sampling crews was assigned to one of the following drainages to collect samples from at least three locations for each species: 1) the Talkeetna River, and 2) the Chulitna River. Collection locations and method of transport to sampling locations were determined after weekly survey flights. Odd-year pink salmon were present in the Middle Susitna River and Talkeetna River, but not in the Chulitna River. From the weeks of August 26 to September 9, poor weather limited the number of these survey flights (Table 4-7) and high water levels and turbid conditions precluded sampling (Table 4-8). Capture and sampling of salmon followed the methods used for adult Chinook salmon.

Previously documented spawning time periods for each species in the Middle Susitna River, indicated below, were used as the general time periods for sampling trips (Thompson et al. 1986).

- Pink salmon – last week of July to third week of August
- Chum salmon – late-August to mid-September
- Sockeye salmon – late-August to mid-September
- Coho salmon – late-August to late-September

### 4.1.3. Juvenile Chinook salmon collections

#### *4.1.3.1. Above Devils Canyon*

To address Objectives 3 and 4, tissue samples were to be collected from a target of 200 juvenile Chinook salmon during the study period at the Oshetna River and in each of Kosina, Fog, and Cheechako creeks. When possible in 2013, collections occurred at the same time as adult salmon collection trips. Collections in 2013 included 71 samples in Kosina Creek and three samples in the Oshetna River (Table 4-1); Cheechako and Fog creeks were not sampled.

Methods for capturing juvenile Chinook salmon in minnow traps followed Magnus et al. (2006). Cured salmon roe was used as bait and several minnow traps were set at each location. Minnow traps were checked at least once per day.

Caudal fin tissue was collected from each juvenile Chinook salmon captured and placed in an individual 2 ml (0.07 oz) vial. Pelvic fins were too small to handle in the field, so caudal fins were sampled instead. Total length (snout-to-fork) was recorded for each sampled juvenile Chinook.

#### *4.1.3.2. Lower River collections*

To address Objective 5, tissue samples were to be collected from 100 juvenile Chinook salmon during the study period from 16 sites across five mainstem habitat types in the Lower Susitna River (1,600 fish total).

Samples of juvenile Chinook salmon collected in the Lower River were classified by habitat type to examine the potential for stock-specific variation in habitat type use. Habitat was classified according to mapping units and categories used in Characterization and Mapping of Aquatic Habitats Study (Study 9.9): main channel, side channel, side slough, backwater, tributary, and tributary mouth. Over the 2-year study, AEA will attempt to collect samples from up to three locations for each habitat type.

Juvenile Chinook salmon in the Lower River were captured using the same methods as described for the juvenile Chinook collections above Devils Canyon. Minnow traps were checked at least once per day. Few new fish were captured between checks and the sampling objective (100 samples per location) was not met in 2013. Multiple locations were selected because the sampling objective could not be met at any of the locations initially selected. Tissue samples were collected using the same methods as described for the juvenile Chinook collections above Devils Canyon.

#### *4.1.3.3. Species identification of juvenile collections*

Species identification was performed in the field using phenotypic characteristics (i.e. Pollard et al. 1997). The eight juvenile putative Chinook salmon collected below Devils Canyon will be analyzed with DNA markers to verify correct field species identification. All Pacific salmon captured above Devils Canyon were sampled and identified in the field as Chinook salmon. Species identification will be confirmed post-season using DNA.

### 4.1.4. Other species collections

To address Objective 1, tissue samples were to be collected from up to 50 representative individuals during the study period from each of the resident fish species listed in Table 4-6, with an emphasis on fish collected in the Lower, Middle and Upper Susitna River. Samples of resident fish species were collected opportunistically while crews were collecting adult and juvenile salmon samples. Resident fish were identified to genus or species with a field key. A small piece of fin tissue was sampled from each fish and placed into a bottle or vial of ethyl alcohol for preservation. Samplers recorded on each bottle, or on datasheets for vial collections, from which of the following areas the samples were collected: 1) Chulitna River, 2) Talkeetna

River, 3) Upper Susitna River, 4) Middle Susitna River below Devils Canyon, 5) Middle Susitna River above Devils Canyon, or 6) Lower River. Tissues were placed in separate bottles for each species and area where they were collected.

### 4.1.5. Sampling coordination with other studies

Tissue samples were also collected by four other studies in 2013: Study of Fish Distribution and Abundance in the Upper Susitna River (Study 9.5); Study of Fish Distribution and Abundance in the Middle and Lower Susitna River (Study 9.6); Salmon Escapement Study (Study 9.7); and Eulachon Run Timing, Distribution, and Spawning in the Susitna River Study (Study 9.16). Sampling kits and collection protocols were distributed to study leads in advance of the field season.

During the 2013 field season, a series of 15 weekly field progress updates (June 28th through October 7th) were distributed to help coordinate sampling. These updates included upcoming sampling activities for each contractor, progress made towards sampling targets for each combination of species and study stratum, and a summary of sample deliveries to the GCL. In season, there was also frequent direct communication among ADF&G, the contractor liaison, and study leads designated for each interrelated study.

Collection progress was updated using a database accessible to leads for studies 9.5, 9.6, 9.7, and 9.16. Once samples were delivered to the GCL, they were entered into ADFG's LOKI database. Most of these samples were resident fish (Table 4-6) or juvenile Chinook salmon from above Devils Canyon (Table 4-1). As part of the Salmon Escapement Study (Study 9.7), AEA also collected samples from salmon at the Indian River weir, salmon radio-tagged at Curry (PRM 124-126), and salmon radio-tagged in the Lower River near the confluence with the Yentna River (PRM 33-34 of the Lower River, and RM 6 of the Yentna River). Sampling methods for all fish tissue samples provided from the interrelated studies are described in the respective ISRs.

### 4.1.6. Collection trip documentation

Detailed notes were kept during each collection trip and then entered into the trip report database in the GCL Oracle database, LOKI, when crews returned to Anchorage (Appendix A). The following information was recorded for each trip: 1) trip logistical information, 2) GPS waypoints where fish were collected, 3) number of fish and species collected at each location, 4) notes on other fish species present, 5) life stage of observed fish, 6) fish habitat information, and 7) recommendations for future collection trips. Collection trip records were used post-season to submit Anadromous Waters Catalog nomination forms.

## 4.2. Tissue Storage

AEA implemented the methods for tissue storage as described in Section 4.3 of the 2013 Genetics IP, with no variances. While in the field, tissue samples were preserved in ethyl alcohol in either a 125–500 ml (4.2-16.9 oz) bulk sample bottle for each location or individual 2 ml (0.07 oz) vials. After samples were received by the GCL, collection information was recorded in LOKI. For long-term storage, samples were preserved as follows: 1) placed into plastic plates and freeze-dried; 2) once dry, moisture-indicating desiccant beads were added and

the plate sealed completely with aluminum foil heat-activated tape; and 3) tissue samples stored at room temperature.

## 4.3. Laboratory Analysis

Laboratory analysis began during the fourth quarter of 2013 (Figure 7.1), and methods were described in detail in the 2013 Genetics IP Section 4.4.

## 4.4. Data Retrieval and Quality Control

Data retrieval and quality control will be accomplished as part of different ongoing activities, the first of which began in the fourth quarter of 2013. The 2013 Genetics IP Section 4.5 contains detailed descriptions of data retrieval and quality control methods.

## 4.5. Variances from Study Plan

In 2013, there were no variances from the collection, storage and analysis methods described in the Genetic Baseline Study Plan; however, full access to all of the sampling sites in the 2013 Genetics IP was not available in 2013. The Study Plan for 2013 included sampling on streams that required access to Cook Inlet Regional Working Group (CIRWG) lands. Access was not granted to CIRWG lands in 2013, thereby fully or partially restricting sampling on some streams. Lack of access to CIRWG lands above or near Devils Canyon prevented potential sampling of Chinook salmon on Cheechako, Devil, Fog, Tsusena, and Watana creeks. Lack of access to CIRWG lands also prevented potential sampling at Portage and Prairie creeks for coho salmon, and reduced sampling at Prairie Creek for sockeye salmon. The study was designed to collect the target number of samples over multiple years. AEA will attempt to meet sampling targets for the locations on CIRWG lands in the next year of study if permission is granted to access these sites. Analysis of 2013 and 2014 collections will provide insight into whether there is a loss in power to test for stability in allele frequencies across years for Chinook salmon (testing between hypotheses 1a, 1b; Figure 2-1) and, if there is, the magnitude of this loss in power.

# 5. RESULTS

## 5.1. Sample Collection

Sample collection results include all collections delivered to the GCL by September 15, 2013.

### 5.1.1. Adult Chinook salmon collections

Survey flights to determine distribution and availability of Chinook salmon for sampling occurred from the week of June 8 to August 19 (Table 4-8). Fifty sites were surveyed from the air. AEA attempted to sample at 30 sites and successfully sampled at 27 sites (Table 4-1). Samples from 1,131 adult Chinook salmon were collected. Most of these samples were taken from the Susitna River drainage (1,073). Two of these samples were from above Devils Canyon. The remaining samples came from other drainages within upper Cook Inlet.

### 5.1.2. Other adult salmon collections

Survey flights to determine distribution and availability of other adult salmon species for sampling occurred from the week of July 29 to August 19 (Table 4-8). Of the 85 sites visited, 25 sites were surveyed from the air but sampling was not attempted (no fish or too few fish observed to justify sampling), 34 sites were sampled but no fish were captured, and 26 sites were successfully sampled for at least one adult salmon. Samples from 295 sockeye salmon were collected from 13 streams (Table 4-2). Samples from 641 chum salmon were collected from 14 streams (Table 4-3). Samples from 68 coho salmon were collected from 5 streams (Table 4-4). Samples from 1,041 pink salmon were collected from 12 streams (Table 4-5).

### 5.1.3. Juvenile Chinook salmon collections

#### *5.1.3.1. Above Devils Canyon*

Sampling trips to collect juvenile Chinook salmon above Devils Canyon were conducted seven times in 2013. A total of 138 samples from juvenile Chinook salmon collected above Devils Canyon are available for analysis. Samples from 103 juvenile Chinook salmon were collected in 2013 from two tributaries above Devils Canyon (Oshetna River, n=32; Kosina Creek, n=71; Table 4-1). Of the 32 samples collected in the Oshetna River, 29 were acquired by ISR Study 9.5 (Study of Fish Distribution and Abundance in the Upper Susitna River). No samples were collected in Fog or Cheechako creeks in 2013. Archived tissues collected in 2012 are also available from Fog Creek (n=35).

#### *5.1.3.2. Lower River collections*

Sampling trips to collect juvenile Chinook salmon in the Lower River were conducted four times in 2013. Samples from eight juvenile Chinook salmon were collected from the Lower River (Table 4-1). These samples were all collected from slough habitat on July 5, 2013 (Table 4-9).

### 5.1.4. Other species collections

In 2013, opportunistic sampling for other (resident) species was conducted during all sampling trips and by the four interrelated AEA studies. In total, samples were collected from 1,255 fish, with sampling sites further broken into one of six potential strata (Table 4-6). The target sample size of 50 total fish per species reached for nine species (burbot, Dolly Varden, eulachon, Arctic grayling, slimy sculpin, three-spine stickleback, longnose sucker, rainbow trout, and round whitefish). No samples were collected for eight species (Alaska blackfish, Pacific lamprey, coastrange sculpin, Pacific staghorn sculpin, prickly sculpin, lake trout, Bering cisco, and lake whitefish).

### 5.1.5. Pacific salmon sampling coordination with other studies

As part of the Salmon Escapement Study (Study 9.7), Pacific salmon were collected by AEA at the Indian River weir and from salmon radio-tagged at Curry. The 9 Chinook, 2 pink, 1 sockeye, and 13 chum salmon samples collected at the Indian River weir will be added to the baseline if needed. The 609 Chinook (including jacks), 232 coho, 201 chum, 199 pink, and 139 sockeye salmon samples taken from salmon radio-tagged at Curry will be used if the final spawning

locations can be determined from telemetry and sampling targets have not been met. Because of uncertainty about whether these samples will be added to the baseline, these collections are not reported in Tables 4-1 and 4-5.

In addition, samples of Pacific salmon were collected at fishwheel sites as part of AEA-funded projects administered by the ADF&G Division of Sport Fish, but those samples were not delivered to GCL by September 15, 2013.

### 5.1.6. Collection trip documentation

A total of 11 entries were made into the GCL Oracle database to document survey trips and 61 entries were made to document collection trips.

## 5.2. Tissue Storage

For most of the collections (75 percent), samples were placed into bottles (multiple fish per container). In the remaining collections, samples were placed into vials (one fish per container).

## 5.3. Laboratory Analysis

Laboratory and statistical analyses are ongoing and no results are available for inclusion in this Initial Study Report. Preliminary analyses will be used to inform consultations with USFWS and NMFS. Final analysis methods will be informed by these consultations.

## 5.4. Data Retrieval and Quality Control

Data retrieval and quality control are ongoing and no results are available for inclusion in this Initial Study Report.

# 6. DISCUSSION

The study was designed to achieve the target number of samples over the course of multiple years. With a few exceptions, sample collections of Pacific salmon species delivered to GCL through September 15, 2013 were sufficient to maintain progress toward study objectives ("Expected" columns in Tables 4-1 to 4-5). AEA will attempt to meet sampling targets for the locations on CIRWG lands in the next year of study if permission is granted to access these sites. However, even if sampling targets are met, limited access to these sites in 2013 may have reduced the power to test for stability in allele frequencies across years for Chinook salmon (testing between hypotheses 1a, 1b; Figure 2-1). Analysis of collections from 2013 and subsequent years will provide insight into whether there is a loss in power and, if there is, the magnitude of this loss in power.

## 6.1. Chinook Salmon Adults and Juveniles Above Devils Canyon

Section 4.2 of the 2013 Genetics IP outlined sample collection in locations across the Susitna River basin. In 2013, Alaska Energy Authority was not granted access to Cook Inlet Regional

Working Group (CIRWG) lands to collect samples associated with this study. As a result AEA did not collect samples of adult salmon where they were observed on CIRWG lands from the air or through radio-tag tracking. For adult Chinook salmon, tributaries not accessed included Watana, Tsusena, Fog, Devil, and Cheechako creeks (all above or within Devils Canyon on the Susitna River). In addition, Portage Creek (below Devils Canyon on the Susitna River) and Prairie Creek (a Talkeetna River tributary) received a reduced sampling intensity due to lack of land access. Coho salmon adults were not sampled in Prairie and Portage creeks, and sampling effort for adult sockeye salmon was reduced.

## 6.2. Chinook Salmon Adults in the Middle River Below Devils Canyon

Major strides were made toward collecting Chinook salmon in the Susitna drainage below Devils Canyon in 2013. Overall, 1,071 fish were collected from 23 sites. These numbers are close to what was anticipated for 2013 and 2014 combined (1,032 fish from 20 to 29 sites), although the geographic distribution of the collections differs. In the Yentna River, 202 fish were collected from three sites (project expected 390 fish from 9 sites over two years). In the Chulitna River, 444 fish were collected from 9 sites; (project expected 218 fish from 2 to 8 sites over two years). In the Middle River, below Devils Canyon, 95 fish were collected from 2 sites (project expected 134 fish from 2 to 6 sites over two years). In Talkeetna River, 246 fish were collected from 6 sites (project expected 131 fish from 2 to 6 sites over two years). Finally, from the Lower River, 84 fish were collected from 3 sites (project expected 159 fish from 5 to 9 sites over two years).

## 6.3. Chinook Salmon Adults Elsewhere

Progress was made toward collecting Chinook salmon in the other drainages from Upper Cook Inlet in 2013. In the western side of Cook Inlet, 42 fish were collected from one site (study expected 235 fish from 4 sites over two years). In the Knik Arm, 16 fish were collected from two sites (study expected 181 fish from 5 to 7 sites over two years). Additional samples collected in 2013 are expected to arrive at the GCL from ADF&G Division of Sport Fish from weirs at three of these sites.

## 6.4. Chinook Salmon Juveniles – Lower River

Despite four trips to collect juvenile Chinook salmon in the Lower River, only eight fish were sampled; all were from slough habitat on one sampling day (Table 4-9). Therefore, additional ADF&G staff, with vast experience annually capturing thousands of juvenile Chinook salmon from Southeast Alaska rivers, were invited to conduct a four-day training course on the Lower River during the week of September 23, 2013. This course was intended to train field crews on how to cure bait and bait traps and how to identify appropriate locations for setting traps and pulling seines following the methods outlined in Magnus et al. (2006). These techniques were applied late in the season in 2013 and will be applied during the next year of study. Results from these sampling efforts will be used to guide future sampling for juvenile Chinook salmon in the Lower River.

## 6.5. Other Salmon Adults

Fish were sometimes not found in sublocations where ADF&G expected to find them, but the study teams were able to capture fish in other sublocations within the targeted location. This was especially the case for pink and chum salmon, where less was known about the spawning distribution at the beginning of this study (Tables 4-3 and 4-5).

For odd-year pink salmon, AEA sampled fewer than the targeted 300 fish within the Chulitna River (one fish), but met target sample numbers in the Middle Susitna River and Talkeetna River. These odd-year pink salmon do not appear to utilize spawning habitats in the Chulitna River. Odd-year pink salmon will not be available in 2014, so AEA's ability to meet the target sample sizes for odd-year pink salmon in the Chulitna River will depend on the schedule of future sampling.

Section 4.2.2 of the 2013 Genetics IP described a schedule of weekly survey flights between June 8 and September 23, and Section 4.2.3 described the plan for three sampling crews between late July and late September for adult salmon species other than Chinook salmon. Poor weather between August 19 and September 15, 2013 resulted in four fewer survey flights (Table 4-7) than planned. These cancelled survey flights represent 18 percent (4/22) of the survey flights planned for the season. This poor weather period also kept crews out of the field for three of the eight weeks (Table 4-8) called for in the 2013 Implementation Plan. This reduced survey effort came during the expected run timing of chum, sockeye, and coho salmon to their spawning grounds. For these three species, less progress was made towards achieving the sampling targets than expected in 2013, but it is anticipated that the sample targets can be achieved during the next year of study to meet study objectives (Table 4-5).

## 6.6. Other Fish Species

Sample collections through September 15, 2013 were sufficient to attain or make progress towards study objectives for some resident species (Objective 1). Although the target sample size for each species was 50 fish for the entire Susitna River drainage, ADF&G also wanted to know roughly what part of the drainage the samples came from, and so asked field crews to reference each collection to one of six location "strata" in the drainage. ADF&G asked each field crew to collect up to 50 specimens from their strata to ensure the minimum for the drainage was met. Because crews worked concurrently in different strata, this meant 50 samples were able to be collected in multiple places for some species, and caused the drainage-wide target to be exceeded (e.g., rainbow trout; Table 4-6).

The approved study methods include only opportunistic collection of resident fish species. Targets of 50 fish per species may not be met for those species that were not present during sampling, or were not susceptible to the sampling gear. No laboratory or statistical analyses are planned for genetic samples from resident species in this study.

## 6.7. Coordination with Other Studies

Tissue samples from salmon radio-tagged by interrelated Study 9.7 provided a relatively high number of backup salmon samples in 2013. These samples will continue to be archived at the

GCL in the winter of 2013/2014; those fish whose final destinations can be determined will then be used to help fill any incomplete baselines at the end of this study. For resident fish species, the coordination with studies 9.5, 9.6, 9.7, and 9.16 allowed considerable success in 2013 (full or partial collection of samples for 12 of 20 species identified in the 2013 Study Plan). Species with no collections were likely either not in the study areas or were not vulnerable to the capture gear, making it unlikely that their collection targets can be reached with opportunistic sampling.

# 7. PLANS FOR COMPLETING THE STUDY

[As explained in the cover letter to this draft ISR, AEA's plan for completing this study will be included in the final ISR filed with FERC on June 3, 2014.]

# 8. LITERATURE CITED

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# 9. TABLES

**Table 4-1. Area, location, and sublocation of baseline samples of adult and juvenile Chinook salmon spawning aggregates for genetic analysis. Sample sizes show number of samples and sample years for collections already in the Gene Conservation Laboratory archives (Archived), number of samples to obtain the ideal archived sample size (Ideal), the anticipated number to be collected over the two years of this project based on past sampling effort and success and information from the Anadromous Waters Catalog and local biologists (Expected), progress made toward sampling targets this year (2013), and the resulting total sample size after combining the amount archived with the 2013 samples (Total). An "S" in the 2013 column indicates that a survey was performed but sampling was not attempted, a "-" indicates that no survey was performed. Some of the expected numbers are for groups of locations. Sampling locations originally not included in the implementation plan have been included, and are indicated by an "n/a" ideal and expected value. New locations that are now included in grouped locations are sharing the expected value for their group. Map numbers (Map No.) correspond to location numbers on Figure 4-5.**

| | | | | | Sample sizes | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | This project | | | |
| Area | Location | Sublocation | Map No. | Year(s) Collected (# archived) | Ideal | Expected (all years) | 2013 | Total |
| Adult Chinook salmon | | | | | | | | |
| West Side Cook Inlet | Chuitna River | | 1 | 2008, 2009 (142) | 200 | 58 | - | 142 |
| | Beluga River | Coal Creek | 2 | 2009, 2010, 2011 (120) | 200 | 80 | - | 120 |
| | Theodore River | | 3 | 2010, 2011, 2012 (189) | 200 | 11 | 42 | **231** |
| | Lewis River | | 4 | 2011, 2012 (86) | 200 | 86 | 0 | 86 |
| Yentna Drainage | Clearwater Creek | | 5 | 2012 (25) | 200 | 50 | - | 25 |
| | Red Creek | | 6 | 2012 (29) | 200 | 58 | 82 | 111 |
| | Happy River | | 7 | 2012 (19) | 200 | 38 | S | 19 |
| | Red Salmon Creek | | 8 | 2012 (12) | 200 | 24 | S | 12 |
| | Hayes River | | 9 | 2012 (5) | 200 | 10 | 45 | 50 |
| | Canyon Creek | | 10 | 2012 (32) | 200 | 64 | 75 | 107 |
| | Talachulitna River | | 11 | 1995, 2008, 2010 (180) | 200 | 20 | - | 180 |
| | Lake Creek | Sunflower Creek | 12 | 2009, 2011 (127) | 200 | 71 | S | 127 |
| | Kahiltna River | Peters Creek | 13 | 2009, 2010, 2011, 2012 (110) | 200 | 55 | - | 110 |

| | | | | | Sample sizes | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | This project | | | |
| Area | Location | Sublocation | Map No. | Year(s) Collected (# archived) | Ideal | Expected (all years) | 2013 | Total |
| Susitna Drainage | Chulitna River | Middle Fork | 14 | 2009, 2010, 2011 (182) | 200 | 18 | 29 | **211** |
| | | East Fork | 15 | | 200 | | 63 | |
| | | West Fork | 16 | | 200 | | S | |
| | | Honolulu Creek | 17 | | 200 | | 31 | |
| | | Pass Creek | 18 | | n/a | | 33 | |
| | | Spink Creek | 21 | | 200 | 200 | 56 | **415** |
| | | Byers Creek | 19 | | 200 | | 54 | |
| | | Troublesome Creek | 20 | | 200 | | 71 | |
| | | Tokositna River (Bunco Creek) | 22 | | 200 | | 104 | |
| | | Tokosina River (Bunco Lake inlet stream) | 23 | | n/a | | 3 | |
| | Upper Susitna River | Oshetna River | 24 | | 200 | | 0 | |
| | | Kosina Creek | 25 | 2012 (10) | 200 | | 2 | |
| | | Watana Creek | 26 | | 200 | | S | |
| | Middle Susitna River above Devils Canyon | Tsusena Creek | 27 | | 200 | 50 | S | 12 |
| | | Fog Creek | 28 | | 200 | | 0 | |
| | | Devil Creek | 30 | | 200 | | S | |
| | | Chinook Creek | 32 | | 200 | | S | |

| | | | | | Sample sizes | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | This project | | | |
| Area | Location | Sublocation | Map No. | Year(s) Collected (# archived) | Ideal | Expected (all years) | 2013 | Total |
| | Middle Susitna River below Devils Canyon | Portage Creek | 31 | 2009, 2010, 2011 (141) | 200 | 59 | 25 | 166 |
| | | Indian River | 33 | 2012 (1) | 200 | 75 | 70 | 71 |
| | | Gold Creek | 34 | | 200 | | S | |
| | | Lane Creek | 35 | | 200 | | S | |
| | | Chase Creek | 36 | | 200 | | S | |
| | Talkeetna River | Prairie Creek | 37 | 1995, 2008 (169) | 200 | 31 | 33 | **202** |
| | | no name creek #2 | 40 | | n/a | 100 | 25 | **207** |
| | | no name creek #1 | 39 | | n/a | | 71 | |
| | | upper mainstem | 38 | | 200 | | S | |
| | | Iron Creek | 41 | | 200 | | 47 | |
| | | Disappointment Creek | 42 | | 200 | | 64 | |
| | | Sheep River | 43 | | 200 | | S | |
| | | Larson Creek | 44 | | 200 | | S | |
| | | Chunilna Creek (Clear Creek) | 45 | 2009, 2012 (130) | 200 | 65 | 6 | 136 |

| | | | | | Sample sizes | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | This project | | | |
| Area | Location | Sublocation | Map No. | Year(s) Collected (# archived) | Ideal | Expected (all years) | 2013 | Total |
| | Lower Susitna River, upstream of Deshka River | Montana Creek | 46 | 2008, 2009, 2010 (218) | 200 | 0 | - | **218** |
| | | Birch Creek | 47 | | 200 | 50 | S | **84** |
| | | Sheep Creek | 48 | | 200 | | 22 | |
| | | North Fork Kashwitna River | 49 | | 200 | | 12 | |
| | | Little Willow Creek | 50 | | 200 | | 50 | |
| | | Willow Creek | 51 | 1991,1997, 2005, 2009 (309) | 200 | 0 | - | **309** |
| | Deshka River | Moose Creek | 52 | 1995, 2012 (103) | 200 | 52 | - | 103 |
| | | Deshka River weir | 53 | 2005 (200) | 200 | 0 | - | **200** |
| | Alexander Creek | Sucker Creek | 54 | 2011, 2012 (143) | 200 | 57 | - | 143 |
| Knik Arm | Matanuska River | Kings River | 55 | | 200 | 25 | 4 | 16 |
| | | Granite Creek | 56 | | 200 | | 12 | |
| | | Moose Creek | 57 | 1995, 2008, 2009, 2012 (155) | 200 | 45 | - | 155 |
| | Eagle River | South Fork | 58 | 2009, 2011, 2012 (73) | 200 | 24 | - | 73 |
| | | Meadow Creek | 59 | 2009 (6) | 200 | 12 | - | 6 |
| | Ship Creek | | 60 | 2009 (311) | 200 | 0 | - | **311** |
| | Little Susitna River | | 61 | 2009, 2010 (125) | 200 | 75 | - | 125 |

| Area | Location | Sublocation | Map No. | Year(s) Collected (for Archive) | Sample size | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | This project | | | |
| | | | | | Ideal | Expected (all years) | 2013 | Total |
| **Juvenile Chinook salmon** | | | | | | | | |
| Susitna Drainage | Above Devils Canyon | Oshetna River | 24 | 2012 (35) | 200 | 70 | 32* | **138** |
| | | Kosina Creek | 25 | | 200 | | 71 | |
| | | Fog Creek | 28 | | 200 | | 0 | |
| | | Cheechako Creek | 29 | | 200 | | - | |
| Susitna Drainage | Lower River | 5 habitat types (100 fish/habitat type times 3 or 4 collections) | n/a | | 1,600 | 1,600 | 8 | 8 |

*29 juvenile Chinook salmon samples acquired by ISR Study 9.5 Fish Distribution and Abundance in the Upper Susitna River

**Table 4-2. Location and sublocation of baseline samples of adult sockeye salmon spawning aggregates for genetic analysis. Sample sizes show number of samples and sample years for collections already in the Gene Conservation Laboratory archives (Archived), number of samples to obtain the ideal archived sample size (Ideal), the anticipated number to be collected over the two years of this project based on past sampling effort and success and information from the Anadromous Waters Catalog and local biologists (Expected), progress made toward sampling targets this year (2013), and the resulting total sample size after combining the amount archived with the new samples (Total). An "S" in the 2013 column indicates that a survey was performed but sampling was not attempted, a "-" indicates that no survey was performed. Some of the expected numbers are for groups of locations. Sampling locations originally not included in the implementation plan have been included, and are indicated by an "n/a" ideal and expected value. New locations that are now included in grouped locations are sharing the expected value for their group. Map numbers (Map No.) correspond to location numbers on Figure 4-1.**

| | | | | | Sample sizes | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | This project | | |
| Area | Location | Sublocation | Map No. | Year(s) Collected (# archived) | Ideal | Expected (all years) | 2013 | Total |
| Susitna River above three rivers confluence | Chulitna River | Middle Fork | 2 | | 100 | 100 | 0 | 0 |
| | | East Fork | 1 | | 100 | | 0 | |
| | | Pass Creek | 5 | | n/a | n/a | 2 | 2 |
| | | Spink Creek | 4 | 2007, 2008 (126) | 100 | 0 | 0 | **126** |
| | | Byers Lake | 3 | 1993, 2006, 2007 (243) | 100 | 0 | 23 | **266** |
| | | (Tokositna River) Sloughs | 7 | | 100 | 100 | S | 0 |
| | | (Tokositna River) Swan Lake | 8 | 2006, 2007, 2009 (109) | 100 | 0 | 0 | **109** |
| | | no-name creek | 6 | | n/a | n/a | 6 | 6 |
| | Middle Susitna River below Devils Canyon | Portage Creek | 9 | | n/a | 100 | 8 | 10 |
| | | 5th of July Creek | 10 | | n/a | | 2 | |
| | | McKenzie Creek | 11 | | 100 | | 0 | |
| | | Chase Creek | 12 | | 100 | | 0 | |
| | Mainstem sloughs above Three Rivers Confluence | sloughs 8A,11, and 21 | 13 | 1995, 1996, 1997 (156) | 100 | 0 | 80 | **236** |
| | | slough 9 | 14 | | n/a | | 64 | 64 |

| | | | | | Sample sizes | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | This project | | | |
| Area | Location | Sublocation | Map No. | Year(s) Collected (# archived) | Ideal | Expected (all years) | 2013 | Total |
| Susitna River above three rivers confluence | Talkeetna River | no-name creek | 15 | | n/a | 0 | 1 | 1 |
| | | Stephan Lake | 16 | 1993, 1994, 2007 (346) | 100 | 0 | - | **346** |
| | | Prairie Creek | 17 | | n/a | 0 | 2 | 2 |
| | | Iron Creek | 18 | | 100 | 50 | 0 | 0 |
| | | Disappointment Creek | 19 | | n/a | 0 | 11 | 11 |
| | | Sloughs | 20 | 1997 (79) | 100 | 21 | 0 | 79 |
| | | Sheep River | 21 | 2008 (190) | 100 | 0 | S | **190** |
| | | Larson Lake - Eastern shore | 23 | 2011 (90) | 100 | 10 | S | 90 |
| | | Larson Creek | 22 | 1992, 1993 (200) | 100 | 0 | S | **200** |
| | | Larson Lake - outlet stream | 24 | 2011 (126) | 100 | 0 | S | **126** |
| | | Chunilna Creek | 25 | | 100 | 100 | 18 | 18 |
| | | Mama and Papa Bear Lakes | 26 | 1997, 2007 (106) | 100 | 0 | 75 | **181** |
| | | Fish Creek | 27 | | n/a | 0 | 3 | 3 |

**Table 4-3. Location and sublocation of baseline samples of adult chum salmon spawning aggregates for genetic analysis. Sample sizes show number of samples and sample years for collections already in the Gene Conservation Laboratory archives (Archived), number of samples to obtain the ideal archived sample size (Ideal), the anticipated number to be collected over the two years of this project based on past sampling effort and success and information from the Anadromous Waters Catalog and local biologists (Expected), progress made toward sampling targets this year (2013), and the resulting total sample size after combining the amount archived with the new samples (Total). An "S" in the 2013 column indicates that a survey was performed but sampling was not attempted, a "-" indicates that no survey was performed. Some of the expected numbers are for groups of locations. Sampling locations originally not included in the implementation plan have been included, and are indicated by an "n/a" ideal and expected value. New locations that are now included in grouped locations are sharing the expected value for their group. Map numbers (Map No.) correspond to location numbers on Figure 4-2.**

| | | | | | Sample sizes | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | This project | | | |
| Area | Location | Sublocation | Map No. | Year(s) Collected (# archived) | Ideal | Expected (all years) | 2013 | Total |
| Susitna River above Three Rivers Confluence | Chulitna River | Middle Fork | 1 | | 100 | 200 | 0 | 43 |
| | | West Fork | 2 | | 100 | | S | |
| | | Byers Creek | 3 | | 100 | | 18 | |
| | | Troublesome Creek | 4 | | 100 | | 25 | |
| | | Spink Creek | 5 | 2007, 2008 (45) | 100 | 55 | 2 | 47 |
| | | Tokositna River mainstem | 6 | | 100 | 50 | S | 0 |
| | Middle Susitna River below Devils Canyon | Portage Creek | 7 | | 100 | 100 | 147 | **147** |
| | | Indian River | 8 | | 100 | 100 | 123 | **123** |
| | | Gold Creek | 9 | | n/a | n/a | 5 | 5 |
| | | sloughs above Three Rivers Confluence | 10 | 1996 (103) | 0 | 0 | 70 | **173** |
| | | 5th of July Creek | 11 | | n/a | n/a | 34 | 34 |
| | | 4th of July Creek | 12 | | n/a | n/a | 56 | 56 |
| | | Lane Creek | 13 | | n/a | n/a | 1 | 1 |
| | | Whiskers Creek | 14 | | n/a | n/a | 3 | 3 |

| | | | | | Sample sizes | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | This project | | | |
| Area | Location | Sublocation | Map No. | Year(s) Collected (# archived) | Ideal | Expected (all years) | 2013 | Total |
| | Talkeetna River | upper mainstem | 16 | | 100 | | S | |
| | | Disappointment Creek | 17 | | 100 | | S | |
| | | Sheep River | 18 | | 100 | 200 | S | 1 |
| | | Larson Creek | 20 | | 100 | | S | |
| | | Fish Creek | 19 | | 100 | | 1 | |
| | | Sloughs | 15 | 1995 (50) | 100 | 50 | 20 | 70 |
| | | Chunilna Creek | 21 | 1993 (87) | 100 | 13 | 136 | **223** |

**Table 4-4. Location and sublocation of baseline samples of adult coho salmon spawning aggregates for genetic analysis. Sample sizes show number of samples and sample years for collections already in the Gene Conservation Laboratory archives (Archived), number of samples to obtain the ideal archived sample size (Ideal), the anticipated number to be collected over the two years of this project based on past sampling effort and success and information from the Anadromous Waters Catalog and local biologists (Expected), progress made toward sampling targets this year (2013), and the resulting total sample size after combining the amount archived with the new samples (Total). An "S" in the 2013 column indicates that a survey was performed but sampling was not attempted, a "-" indicates that no survey was performed. Some of the expected numbers are for groups of locations. Sampling locations originally not included in the implementation plan have been included, and are indicated by an "n/a" ideal and expected value. New locations that are now included in grouped locations are sharing the expected value for their group. Map numbers (Map No.) correspond to location numbers on Figure 4-3.**

| | | | | | Sample sizes | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | This project | | | |
| Area | Location | Sublocation | Map No. | Year(s) Collected (# archived) | Ideal | Expected (all years) | 2013 | Total |
| Susitna River above three rivers confluence | Chulitna River | Middle Fork | 2 | | 100 | | 0 | |
| | | East Fork | 1 | | 100 | | 0 | |
| | | Honolulu Creek | 3 | | 100 | 200 | 0 | 0 |
| | | Byers Creek | 4 | | 100 | | 0 | |
| | | Troublesome Creek | 5 | | 100 | | 0 | |
| | | Spink Creek | 6 | 2008 (38) | 100 | 62 | 0 | 38 |
| | | Tokositna River mainstem | 7 | | 100 | 100 | S | 0 |
| | | Tokositna River (Bunco Creek) | 8 | | 100 | | 0 | |
| | | Tokositna River (Swan Lake) | 9 | 2009 (20) | 100 | 80 | 0 | 20 |
| | Middle Susitna River below Devils Canyon | Portage Creek | 10 | | 100 | 200 | 0 | 1 |
| | | Indian River | 11 | | 100 | | 1 | |
| | | Gold Creek | 12 | | 100 | | S | |
| | | McKenzie Creek | 13 | | 100 | | S | |
| | | Lane Creek | 14 | | 100 | | S | |
| | | Sloughs | 15 | | 100 | 75 | 2 | 2 |
| | | Chase Creek | 16 | | 100 | 75 | S | 0 |
| | | Whiskers Creek | 17 | | 100 | 75 | 62 | 62 |

| | | | | | Sample sizes | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | This project | | | |
| Area | Location | Sublocation | Map No. | Year(s) Collected (# archived) | Ideal | Expected (all years) | 2013 | Total |
| Susitna River above three rivers confluence | Talkeetna River | upper mainstem | 18 | | 100 | 25 | S | 0 |
| | | Prairie Creek | 19 | | 100 | 75 | S | 0 |
| | | Sheep River | 20 | | 100 | 50 | S | 0 |
| | | Larson Lake - outlet | 21 | 2011 (84) | 100 | 16 | S | 84 |
| | | Chunilna Creek | 22 | | 100 | 75 | 2 | 2 |
| | | Fish Creek | 23 | | n/a | n/a | 1 | 1 |

**Table 4-5. Location and sublocation of baseline samples of adult pink salmon spawning aggregates for genetic analysis. Sample sizes show number of samples and sample years for collections already in the Gene Conservation Laboratory archives (Archived), number of samples to obtain the ideal archived sample size (Ideal), the anticipated number to be collected over the two years of this project based on past sampling effort and success and information from the Anadromous Waters Catalog and local biologists (Expected), progress made toward sampling targets this year (2013), and the resulting total sample size after combining the amount archived with the new samples (Total). An "S" in the 2013 column indicates that a survey was performed but sampling was not attempted, a "-" indicates that no survey was performed. Some of the expected numbers are for groups of locations. Sampling locations originally not included in the implementation plan have been included, and are indicated by an "n/a" ideal and expected value. New locations that are now included in grouped locations are sharing the expected value for their group. Map numbers (Map No.) correspond to location numbers on Figure 4-4.**

| | | | | | Sample sizes | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | This project | | | |
| Area | Location | Sublocation | Map No. | Year(s) Collected (for Archive) | Ideal | Expected (all years) | 2013 | Total |
| Susitna River above three rivers confluence | Chulitna River | Middle Fork | 1 | | 100 | 100 | 0 | 1 |
| | | Spink Creek | 3 | | 100 | | 0 | |
| | | Troublesome Creek | 2 | | 100 | | 0 | |
| | | no name creek | 4 | | n/a | | 1 | |
| | Middle Susitna River below Devils Canyon | Portage Creek | 5 | | 100 | 50 | 136 | **136** |
| | | Indian River | 6 | | 100 | 100 | 114 | **114** |
| | | Gold Creek | 7 | | 100 | 50 | 106 | **446** |
| | | 5th of July Creek | 8 | | n/a | | 2 | |
| | | 4th of July Creek | 9 | | n/a | | 107 | |
| | | slough 9 | 10 | | n/a | | 116 | |
| | | McKenzie Creek | 11 | | 100 | | 0 | |
| | | Lane Creek | 12 | | 100 | | 115 | |
| | | Chase Creek | 13 | | 100 | | 0 | |
| | | Whiskers Creek | 14 | | 100 | | 15 | |

| | | | | | Sample sizes | | |
|---|---|---|---|---|---|---|---|
| | | | | | This project | | |
| Area | Location | Sublocation | Map No. | Year(s) Collected (for Archive) | Ideal | Expected (all years) | 2013 | Total |
| | Talkeetna River | upper mainstem | 15 | | 100 | 25 | 0 | 0 |
| | | Disappointment Creek | 16 | | n/a | 0 | 127 | **127** |
| | | Sheep River | 17 | | 100 | 25 | 0 | 0 |
| | | Larson Creek | 18 | | 100 | 100 | 0 | 0 |
| | | Chunilna Creek | 19 | | 100 | 100 | 101 | **101** |
| | | Fish Creek | 20 | | n/a | 0 | 101 | **101** |

**Table 4-6. Resident and non-salmon anadromous fish species targeted for genetic tissue sampling in the Susitna River and samples sizes collected in 2013. Sample collections are reported for the Gene Conservation Laboratory (GCL), interrelated studies (other), and the combined total (N).**

| Species | Target sample size (total) | Collection Strata | | | | | | | | | | | | | | | | | | Total Collected |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Upper Susitna River | | | Middle Susitna River above Devils Canyon | | | Middle Susitna River below Devils Canyon | | | Lower Susitna River | | | Talkeetna River | | | Chulitna River | | | |
| | | GCL | other studies | N | GCL | other studies | N | GCL | other studies | N | GCL | other studies | N | GCL | other studies | N | GCL | other studies | N | |
| Blackfish, Alaska | 50 | | | 0 | | | 0 | | | 0 | | | 0 | | | 0 | | | 0 | 0 |
| Burbot | 50 | | | 0 | | | 0 | 4 | | 4 | 2 | 102 | 104 | | | 0 | | | 0 | 108 |
| Dolly Varden | 50 | 1 | | 1 | 3 | | 3 | 5 | | 5 | 4 | 3 | 7 | 35 | | 35 | | | 0 | 51 |
| Eulachon | 50 | | | 0 | | | 0 | | | 0 | | 283 | 283 | | | 0 | | | 0 | 283 |
| Grayling, Arctic | 50 | 17 | | 17 | 21 | | 21 | 45 | 14 | 59 | 7 | 4 | 11 | 5 | | 5 | 3 | | 3 | 116 |
| Lamprey, Arctic* | n/a | | | | | | | | | | | 9 | 9 | | | | | | | 9 |
| Lamprey, Pacific | 50 | | | 0 | | | 0 | | | 0 | | | 0 | | | 0 | | | 0 | 0 |
| Pike, northern | 50 | | | 0 | | | 0 | | | 0 | | 16 | 16 | | | 0 | | | 0 | 16 |
| Sculpin, coastrange | 50 | | | 0 | | | 0 | | | 0 | | | 0 | | | 0 | | | 0 | 0 |
| Sculpin, Pacific staghorn | 50 | | | 0 | | | 0 | | | 0 | | | 0 | | | 0 | | | 0 | 0 |
| Sculpin, prickly | 50 | | | 0 | | | 0 | | | 0 | | | 0 | | | 0 | | | 0 | 0 |
| Sculpin, slimy | 50 | 15 | | 15 | 40 | 100 | 140 | | | 0 | | 52 | 52 | | | 0 | | | 0 | 207 |
| Stickleback, ninespine | 50 | | | 0 | | | 0 | | | 0 | | 7 | 7 | | | 0 | | | 0 | 7 |

| Species | Target sample size (total) | Collection Strata | | | | | | | | | | | | | | | | | | Total Collected |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Upper Susitna River | | | Middle Susitna River above Devils Canyon | | | Middle Susitna River below Devils Canyon | | | Lower Susitna River | | | Talkeetna River | | | Chulitna River | | | |
| | | GCL | other studies | N | GCL | other studies | N | GCL | other studies | N | GCL | other studies | N | GCL | other studies | N | GCL | other studies | N | |
| Stickleback, threespine | 50 | | | 0 | | | 0 | | | 0 | 50 | 92 | 142 | | | 0 | | | 0 | 142 |
| Sucker, longnose | 50 | | | 0 | | | 0 | 5 | | 5 | 1 | 102 | 103 | | | 0 | | | 0 | 108 |
| Trout, lake | 50 | | | 0 | | | 0 | | | 0 | | | 0 | | | 0 | | | 0 | 0 |
| Trout, rainbow | 50 | | | 0 | 1 | | 1 | 40 | | 40 | 40 | 7 | 47 | 19 | | 19 | 23 | | 23 | 130 |
| Whitefish, Bering cisco | 50 | | | 0 | | | 0 | | | 0 | | | 0 | | | 0 | | | 0 | 0 |
| Whitefish, humpback | 50 | 3 | | 3 | | | 0 | | | 0 | | | 0 | | | 0 | | | 0 | 3 |
| Whitefish, lake | 50 | | | 0 | | | 0 | | | 0 | | | 0 | | | 0 | | | 0 | 0 |
| Whitefish, round | 50 | 2 | | 2 | | | 0 | 57 | 9 | 66 | | | 0 | 1 | | 1 | 6 | | 6 | 75 |
| * Collected, but not on original list of target species | | | | | | | | | | | | | | | | | | | | |

**Table 4-7. Summary of survey flights conducted during 2013. Surveys were performed throughout the summer of 2013 in order to determine potential sampling locations for five salmon species (Chinook, sockeye, pink, chum, and coho salmon). X's indicate the occurrence of a survey flight in a given collection strata (Figure 3-1) on a certain date. Survey flight number 17 shows no X's because the survey was cancelled due to poor survey conditions.**

| | | Collection strata | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Survey # | Date | Upper Susitna River | Middle Susitna above Devils Canyon | Middle Susitna below Devils Canyon | Lower Susitna River | Talkeetna River | Chulitna River | West Side Cook Inlet | Yentna Drainage | Knik Arm |
| 1 | 6/11/2013 | X | X | X | | | X | | | X |
| 2 | 7/8/2013 | | | X | X | X | | | | |
| 3 | 7/9/2013 | X | X | X | | | X | | | |
| 5 | 7/15/2013 | X | | | | X | | | | X |
| 6 | 7/16/2013 | | | X | | | X | | | |
| 7 | 7/17/2013 | | | | | | | | X | |
| 8 | 7/22/2013 | X | X | X | | X | | | | |
| 9 | 7/23/2013 | | | | X | | X | | | |
| 10 | 7/24/2013 | | | | | | | | X | |
| 11 | 7/29/2013 | X | X | X | | X | | | | |
| 12 | 7/30/2013 | | | | X | | X | | | |
| 13 | 8/5/2013 | X | | | | X | X | | | |
| 14 | 8/6/2013 | | X | X | X | X | X | | | |
| 15 | 8/12/2013 | | | | | X | | | | |
| 16 | 8/13/2013 | | X | X | | | X | | | |
| 17 | 8/19/2013 | | | | | | | | | |
| 18 | 8/26/2013 | | | | X | | | | | X |
| 19 | 9/15/2013 | | | X | | | X | | | |

**Table 4-8. Genetic sampling effort through time by river area for adult salmon species in 2013. Salmon species sampled are reported by week and strata. X's indicate where sampling occurred in each week of the Project field season for all salmon species, and for sampling locations where Chinook salmon were the only target species. Species sampled: Chinook (K), sockeye (S), pink (P), chum (Ch), and coho (Co) salmon. Sampling occurred from 6/8/2013 through 9/15/2013.**

| | | Collection Strata | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Area sampled (all salmon species) | | | Area sampled (Chinook salmon only) | | | | |
| Week of | Species sampled | Talkeetna | Chulitna | Middle Susitna below Devils Canyon | Lower Susitna | Middle Susitna above Devils Canyon | Yentna | Knik | West |
| 6/8-25/2013 | K | | | | | | | | x |
| 6/24/2013 | K | | | | x | | | | x |
| 7/1/2013 | K | x | | | x | | | | x |
| 7/8/2013 | K | | | x | x | | | | x |
| 7/15/2013 | K | x | x | | | | | x | |
| 7/22/2013 | K | x | x | | | x | x | | |
| 7/29/2013 | K, S, Ch, P, Co, | x | x | x | | x | | | |
| 8/5/2013 | K,S, Ch, P,Co | x | x | x | | x | | | |
| 8/12/2013 | K, S, Ch, P, Co | x | x | x | | x | | | |
| 8/19/2013 | S, Ch, P | x | | x | | | | | |
| 8/26/2013 | * | | | | | | | | |
| 9/2/2013 | * | | | | | | | | |
| 9/9/2013 | * | | | | | | | | |

* Sampling efforts disrupted by adverse weather conditions.

**Table 4-9. Juvenile Chinook salmon tissue collections across five habitat types in the Lower Susitna River, through September 15, 2013. Collection numbers of juvenile Chinook salmon tissues are reported for 16 collection sites over 5 different habitat types (main channel, backwater, braid, channel edge, and slough) in the Lower Susitna River. Totals per stratum are reported (totals).**

| | Habitat Type | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Main channel | | | Braid | | | Channel edge | | | | Slough | | | Backwater | | |
| | collection site number | | | collection site number | | | collection site number | | | | collection site number | | | collection site number | | |
| DATE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 7/5/2013 | | | | | | | | | | | 8 | | | | | |
| Totals: | | | | | | | | | | | 8 | | | | | |

**Table 4-10. Metadata and location of Chinook salmon samples collected above Devils Canyon. Length (in millimeters) and sex were determined for Chinook salmon sampled above Devils Canyon on August 6, 2013. Creek name, latitude, and longitude are also reported for these data.**

| Fish # | Date | Length | Sex | Creek | Latitude/Longitude |
|---|---|---|---|---|---|
| 1 | 8/6/2013 | 980 | M | Kosina | 62.701/ -147.986 |
| 2 | 8/6/2013 | 575 | F | Kosina | 62.633/ -148.031 |

# 10. FIGURES

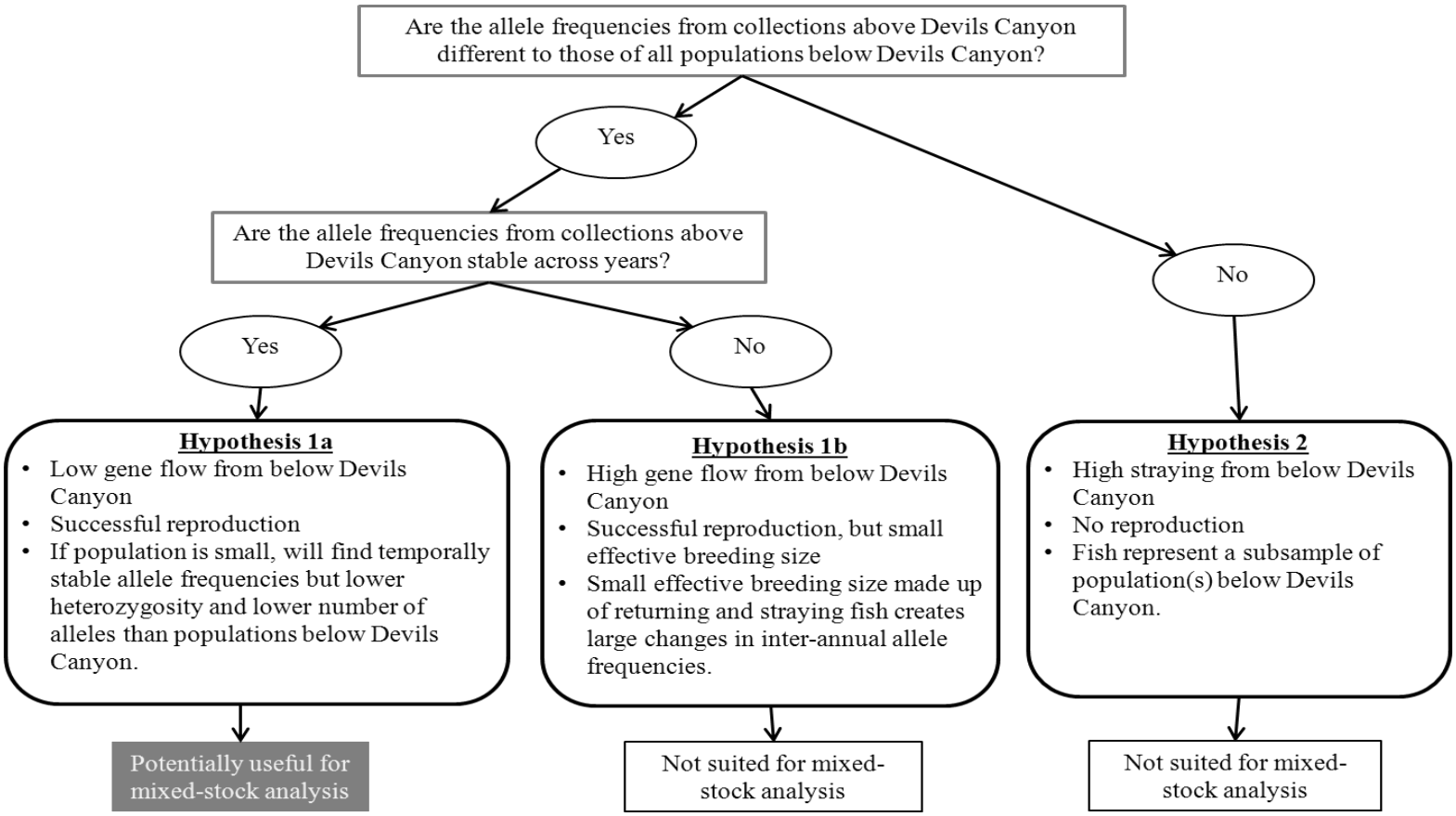


**Figure 2-1. A generalized flow chart to distinguish among hypotheses of population structure for Chinook salmon collected over spawning habitat above Devils Canyon in the Middle and Upper Susitna River. Only a self-sustaining population (Hypothesis 1a) will potentially result in genetic variation suitable for mixed-stock analysis for estimating the proportion of juvenile Chinook salmon mixtures collected in the Middle and Lower Susitna River that originate from above Devils Canyon.**

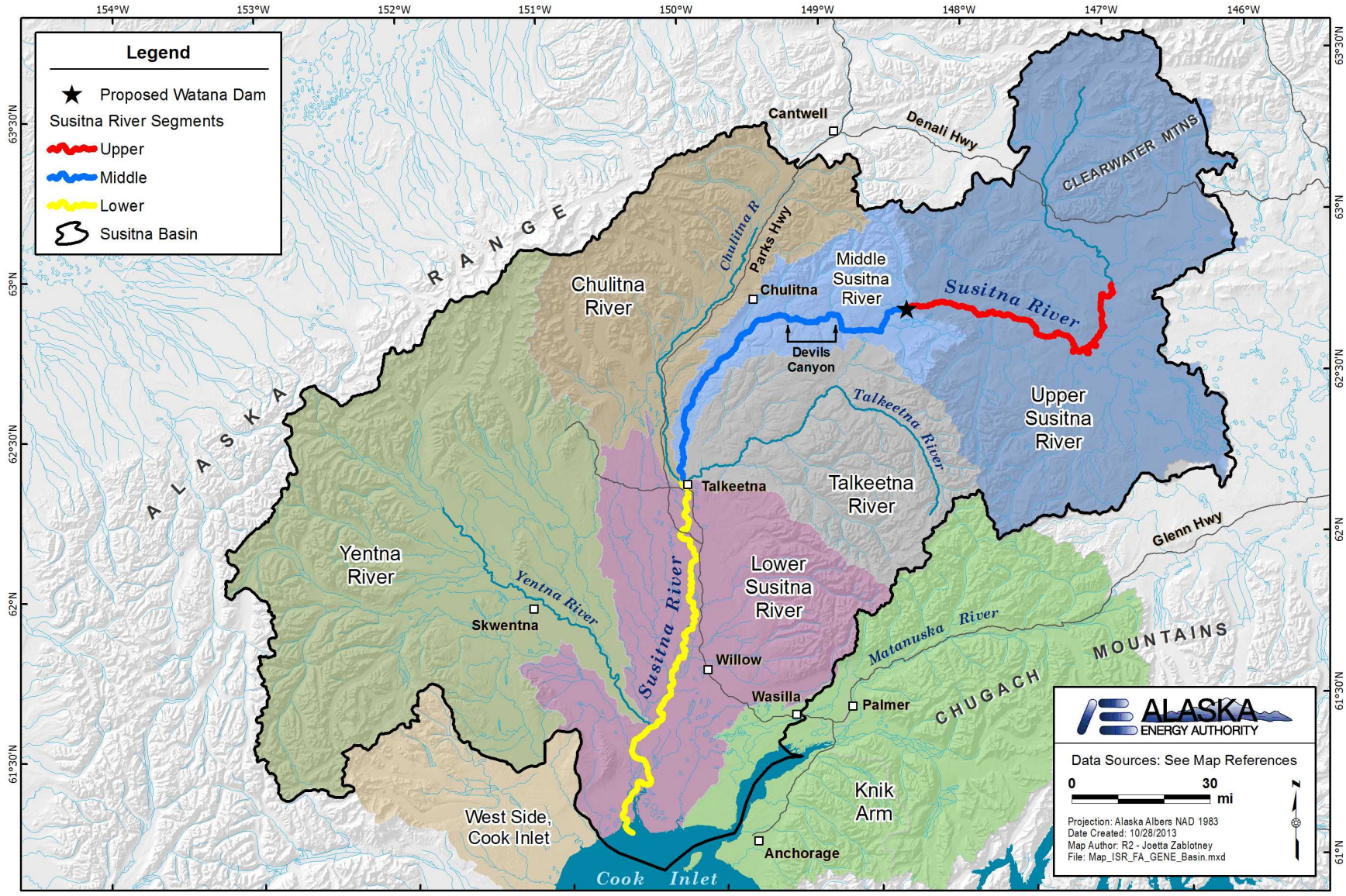


**Figure 3-1. Collection strata for samples collected for genetic archive and/or analysis.**

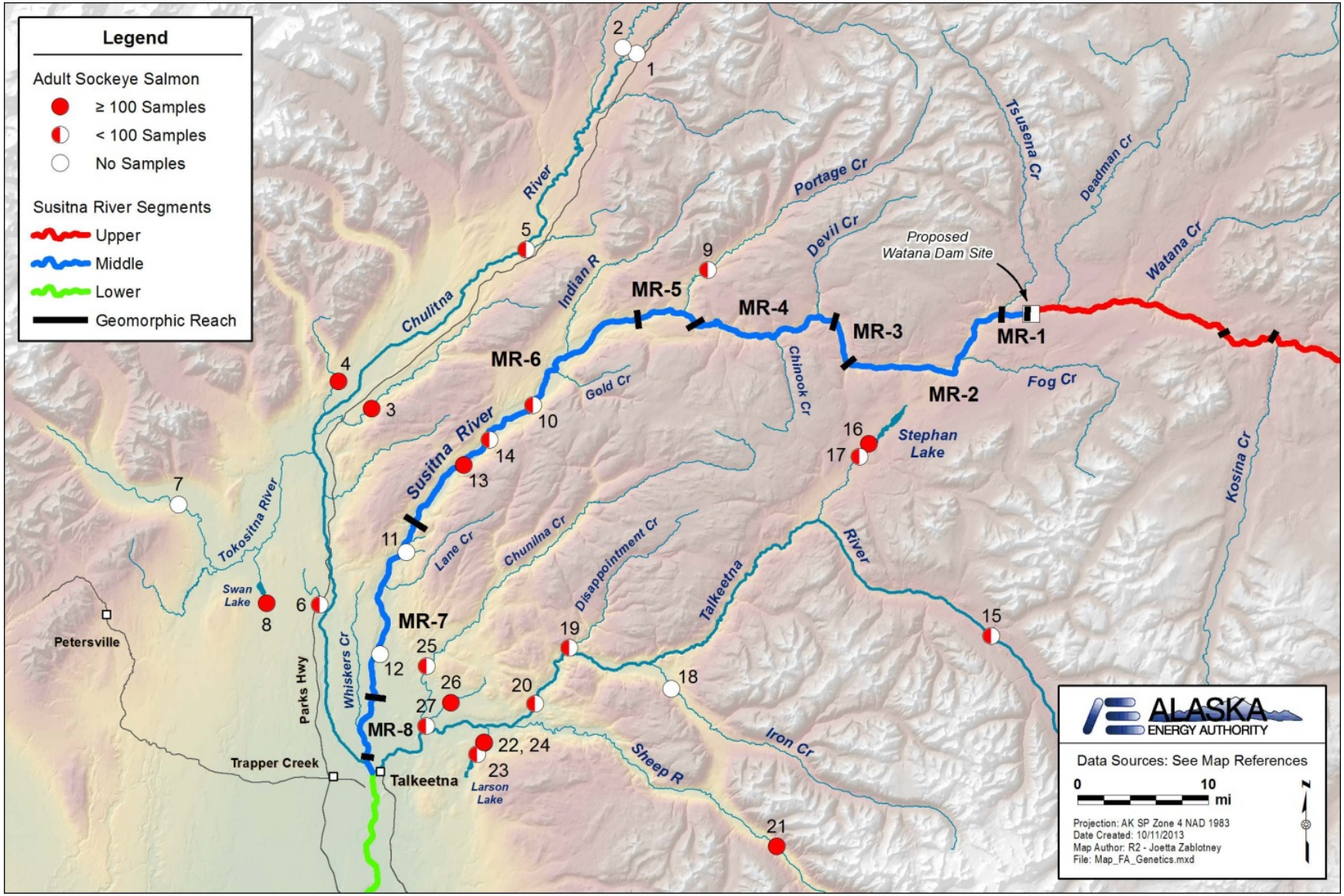


**Figure 4-1. Baseline sampling locations for adult sockeye salmon. Circles indicate the number of samples in the Gene Conservation Laboratory archives. Numbers correspond to map numbers on Table 4-3.**

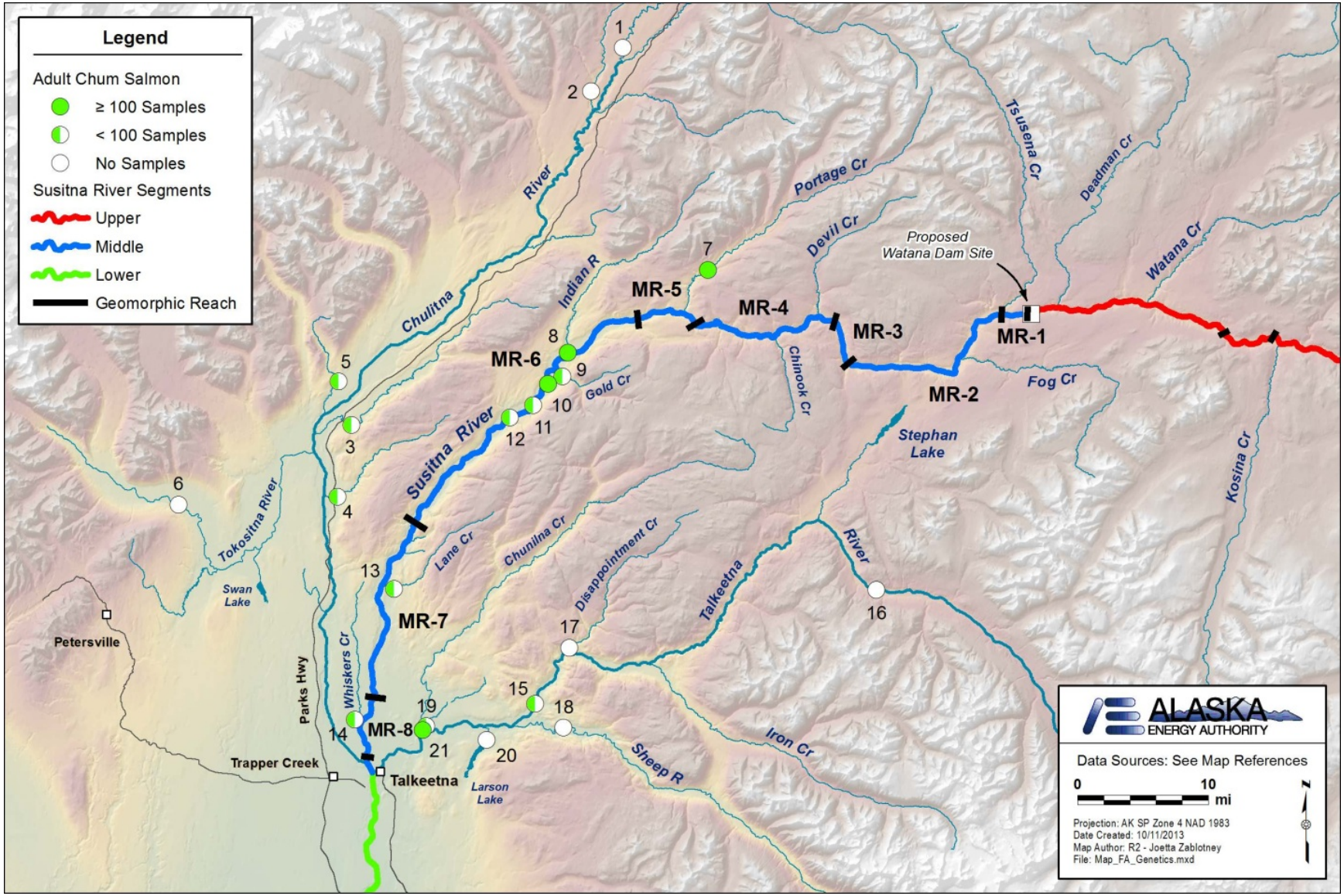


**Figure 4-2. Baseline sampling locations for adult chum salmon. Circles indicate the number of samples in the Gene Conservation Laboratory archives. Numbers correspond to map numbers on Table 4-4.**

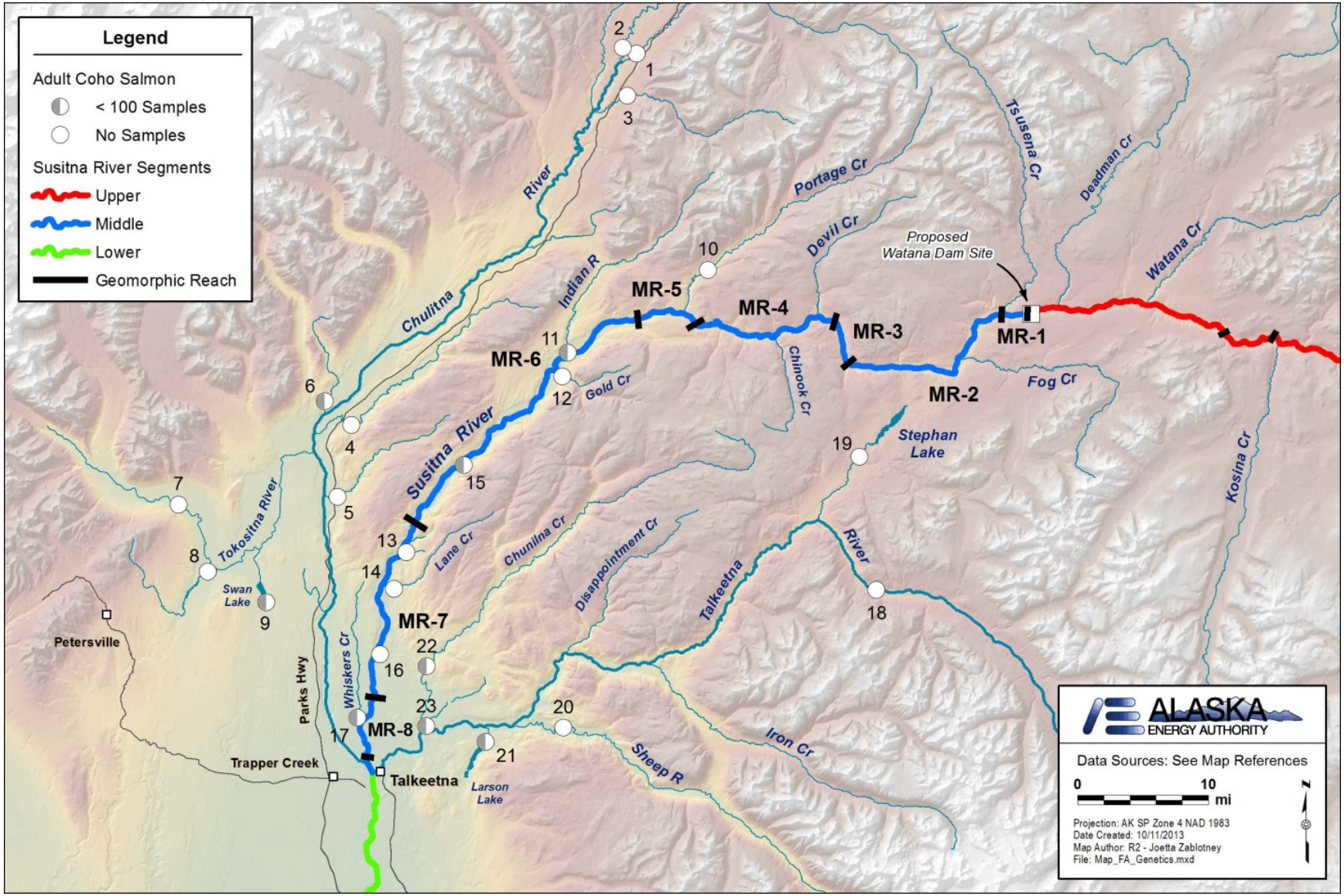


**Figure 4-3. Baseline sampling locations for adult coho salmon. Circles indicate the number of samples in the Gene Conservation Laboratory archives. Numbers correspond to map numbers on Table 4-5.**

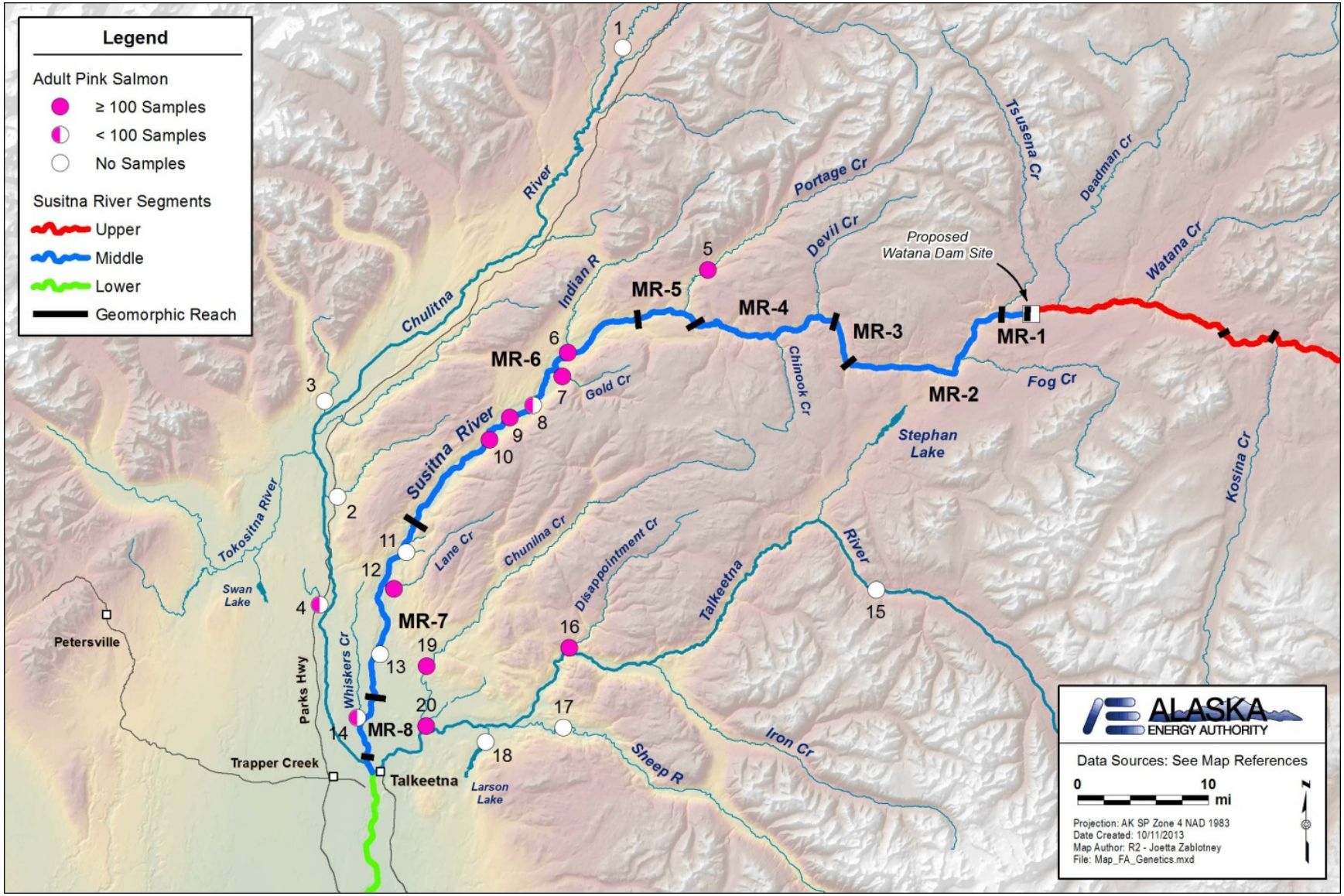


**Figure 4-4. Baseline sampling locations for adult pink salmon. Circles indicate the number of samples in the Gene Conservation Laboratory archives. Numbers correspond to map numbers on Table 4-6.**

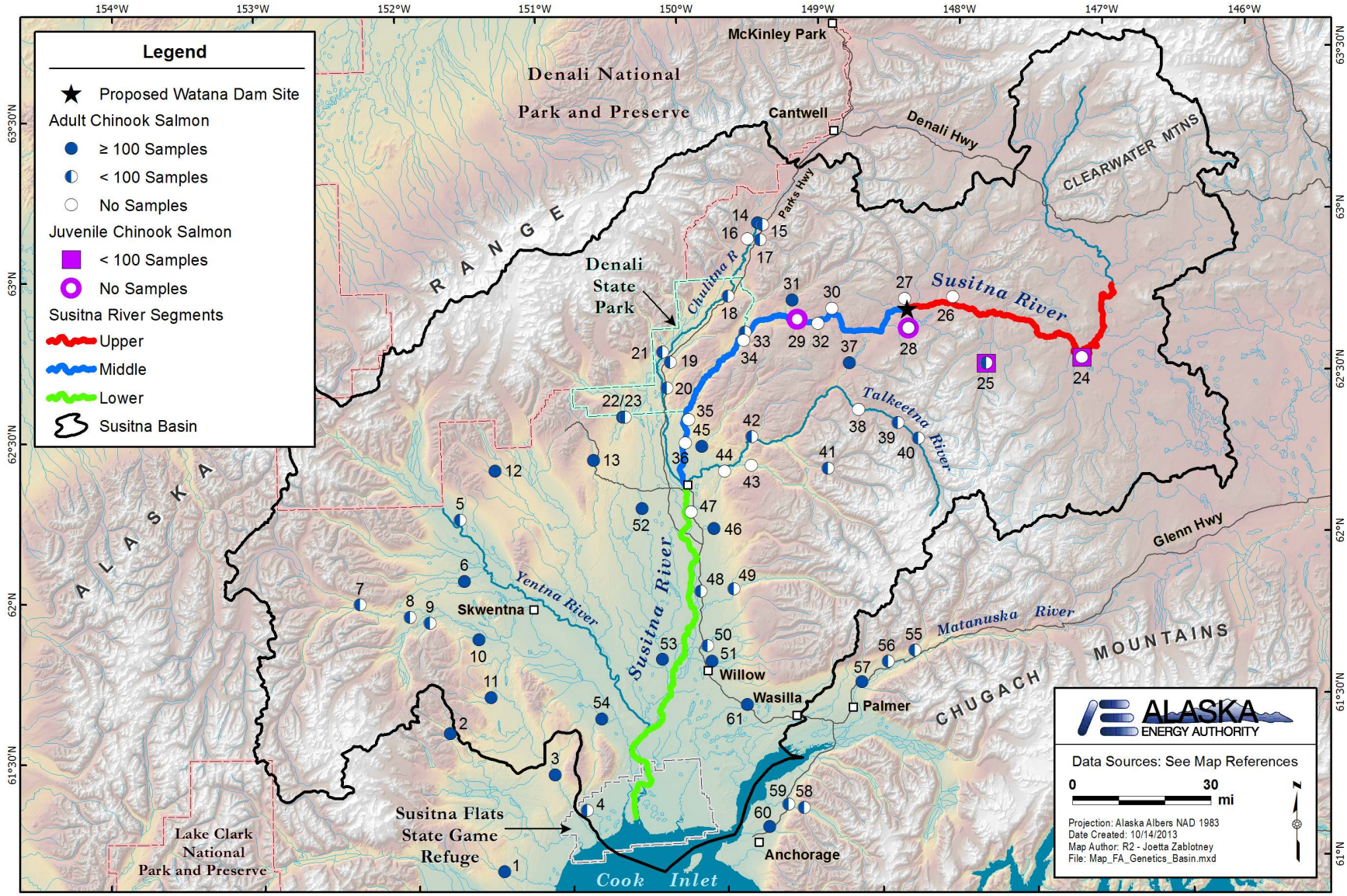


**Figure 4-5. Baseline sampling locations for adult and juvenile (inset) Chinook salmon. Circles indicate the number of samples in the Gene Conservation Laboratory archives. Numbers correspond to map numbers in Table 4-2. The Lower Susitna River (below project river mile (PRM) 102.4), Middle River (RM 102.4-187.1) and Upper River (RM 187.1-235.1) segments are highlighted with the proposed dam at PRM 187.1.**

# APPENDIX A: TEMPLATE FOR COLLECTION TRIP REPORTS

# LOKI Trip Report Form

| Trip Start Date | Trip End Date | Trip Name |
|---|---|---|
| Charter | | Transportation |
| Lodging | Report Date | Report Author |

| Waypoint Name: | | Potential Access: | |
|---|---|---|---|
| camp/survey/collection | latitude | longitude | |
| waypoint comments | | | |
| Waypoint Name: | | Potential Access: | |
| camp/survey/collection | latitude | longitude | |
| waypoint comments | | | |
| Waypoint Name: | | Potential Access: | |
| camp/survey/collection | latitude | longitude | |
| waypoint comments | | | |
| Waypoint Name: | | Potential Access: | |
| camp/survey/collection | latitude | longitude | |
| waypoint comments | | | |
| Waypoint Name: | | Potential Access: | |
| camp/survey/collection | latitude | longitude | |
| waypoint comments | | | |
| Waypoint Name: | | Potential Access: | |

| camp/survey/collection | latitude | longitude |
|---|---|---|
| waypoint comments | | |
| TRIP COMMENTS ON REVERSE SIDE | | |
| TRIP COMMENTS | | |
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