Susitna-Watana Hydroelectric Project

(FERC No. 14241)

Eulachon Run Timing, Distribution, and Spawning in the Susitna River (Study 9.16)

2015 Proposed Eulachon Spawning Habitat Study Modifications Technical Memorandum

Prepared for

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by
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LIST OF ACRONYMS AND SCIENTIFIC LABELS

Abbreviation	Definition
ADF&G	Alaska Department of Fish and Game
AEA	Alaska Energy Authority
cfs	cubic feet per second
CIBW	Cook Inlet Beluga Whale
ISR	Initial Study Report
km	kilometer
m	meter
NMFS	National Marine Fisheries Service
PRM	Project River Mile
RSP	Revised Study Plan
SPD	Study Plan Determination
USR	Updated Study Report

1. INTRODUCTION

In 2013, AEA's study teams conducted the first year of data collection for the Study 9.16 Eulachon Run Timing, Distribution and Spawning in the Susitna River. Sampling and telemetry work in the Lower River supported all four objectives of the study as described in RSP Section 9.16 (AEA 2012). Because eulachon is an important prey species for Cook Inlet Beluga Whale (CIBW) this study has been designed also to support the CIBW study (Study 9.17). After further discussion with National Marine Fisheries Service (NMFS) regarding 2013 and 2014 CIBW study results additional data were deemed necessary focusing on confirming eulachon spawning habitats and evaluating the potential for the Project to affect eulachon spawning habitat. This technical memorandum describes a proposed modification to the Study 9.16 Eulachon Run Timing, Distribution and Spawning in the Susitna River that is intended to fill the identified eulachon habitat data gap in support of Study 9.17 CIBW.

2. APPROACH TO EULACHON SPAWNING HABITAT

2.1. Previous Spawning Data Collection

Previous studies by the Alaska Department of Fish and Game (ADF&G) of eulachon spawning in 1982 and 1983 concluded that the largest concentrations of eulachon migrations in the Susitna River were found downstream of the Yentna River confluence (Barrett et al. 1984). ADF&G researchers documented two separate eulachon runs entering the Susitna River. During 1982, the first run occurred from May 16 to May 30, with the second run occurring from June 1 to June 8. During 1983, the first run occurred from May 10 to May 18, with the second run occurring from May 19 to June 6 (Vincent-Lang and Queral 1984). Approximately 70 percent of the first and second migration spawning areas were located between about PRM 15 and PRM 31.

ADF&G researchers observed eulachon entering the intertidal reach in schools during high tide events. Once through the intertidal reach, eulachon schools migrated upstream along the shore where there was direct flow. When eulachon encountered areas that were stagnant or had low velocity, they moved offshore to stay within the current. In both years, major spawning occurred near cut banks and riffle areas with loose sand and gravel substrates. Eulachon were not observed spawning in clearwater sloughs or tributaries. A total of 61 separate eulachon spawning areas were identified in the Susitna River main channel in 1983. At least six of the areas were used for spawning by fish in both the first and second migrations. In 1983, the first migration eulachon spawning areas were located in moderate velocity areas near cut banks where the riverbed composition was mainly loose sands and gravels. The surface velocity at these sites ranged from 1 to 2 feet per second and depths averaged 4.3 ft. The second eulachon spawning migration had at least seven times as many fish as the first migration and fish used a wider range of habitats. Researchers at the time assumed that the much larger second migration caused crowding and forced second migration fish to use less preferred spawning habitats (Barrett et al. 1984). Several instances of what appeared to be crowding-related mortality were observed with large drifts of carcasses of unspawned eulachon up to 4 ft deep.

During 2013, surveys were conducted at 28 eulachon spawning habitat sites in the mainstem Lower River. Physical characteristics collected to describe spawning habitat included substrate type, velocity and depth. These data were presented in Initial Study Report (ISR) for Study 9.16 in Section 5.3.2. Spawning sites surveyed in 2013 had characteristics similar to spawning habitat previously described by ADF&G (Barrett et al. 1984). These 2013 spawning surveys provide a basis for expansion with the 2015 surveys and habitat model development.

2.2. Eualchon Spawning Locations

In 2013, AEA utilized radio telemetry, visual observations, and multibeam sonar to identify potential eulachon spawning locations (See ISR Section 9.16.4.4.1; AEA 2014) and based on the result of that effort is proposing a modification to eulachon distribution data collection for 2015. After review of the 2013 spawning distribution data, AEA determined that the radio telemetry results identified potential spawning locations (Figure 2.2-1a 7 2.2-1b) within the known distribution of eulachon spawning from the 1980s (Figure 2.2 -2) and consistent with visual and sonar observations in 2013 (Figure 2.2 -2). Thus, the radio telemetry component of the study, which required additional effort, did not provide additional information on potential spawning locations. Further, radio signals are not detectable in saline environments and would not be suitable for detection of potential spawning in the lower, likely intertidal, reach of the Susitna River. Because AEA does not think another year of radio telemetry data will further inform the eulachon study objectives, AEA proposes to eliminate the radio telemetry study component in 2015.

In lieu of radio telemetry, AEA is proposing additional visual and sonar surveys to identify potential spawning locations in the lower, likely intertidal, reach of the eulachon spawning distribution (PRM 6-11) that was not surveyed in 2013. No data is currently available on eulachon spawning in that stretch of the Lower River. However, eulachon spawning and presence below PRM 11 is of interest to help inform the Cook Inlet Beluga Whale Study 9.17 (AEA 2012). AEA proposes to use the visual and sonar methods as described in RSP Section 9.16 (AEA 2012) to complete these surveys in 2015.

2.3. Eulachon Spawning Habitat Model

2.3.1. Previous Eulachon Spawning Habitat Model

During 1983, habitat surveys were conducted at 20 eulachon spawning sites between approximately PRM 13 and PRM 23 to characterize habitat and environmental parameters associated with eulachon spawning (Barrett et al. 1984). A representative sub-sample of the surveyed spawning sites was chosen for additional analysis to determine whether physical habitat conditions that were present at the time of spawning might exist at different mainstem discharges. At each of five study sites, two representative transects were selected for streambank surveys during the spawning run. The transect bed was profiled from a point on the bank above high water out into the channel to a water depth of about 5 ft. The surficial substrate composition along each transect was visually estimated and recorded. Representative measurements of water depth and velocity were then recorded during subsequent site visits to collect data over a range of mainstem flows.

The range of depths and velocities recorded at known Susitna River eulachon spawning areas during active spawning suggested that variations in mainstem flow had little effect on the availability of acceptable depths and velocities at eulachon spawning sites. ADF&G researchers concluded "that acceptable substrates and hydraulic conditions persist along these shoreline margins for mainstem discharges between 35,000 and 105,000 cfs" (Vincent-Lang and Queral 1984). Although the results of their investigations indicated that variations in mainstem discharge between 35,000 and 105,000 cubic feet per second (cfs) had little effect on the suitability of suitable spawning areas, other factors, such as water temperature and shoreline stability, should also be considered.

2.3.2. Proposed Eulachon Spawning Habitat Model

AEA proposes to measure transects at known eulachon spawning areas to determine whether the streambank geometry and substrate provide acceptable spawning conditions at a range of flows in the Lower Susitna River. The 1980s studies used empirical observations and measurements during the 1982 and 1983 eulachon spawning periods. In an effort to extend study results to a range of flows lower than what might be experienced during the 2015 spawning period, a transect-based modeling approach, based on an adaptation of Wetted-Perimeter instream flow methods (Leathe and Nelson 1986), will be used. Four transects will be selected in the Lower River below the Yentna River confluence in eulachon spawning areas. To the extent practical, transects will be co-located at areas where high-density eulachon spawning was observed in 1982, 1983, and 2013 as well.

The Wetted-Perimeter method assumes that there is a direct relation between the wetted perimeter along a transect and fish habitat. The wetted perimeter of a stream, defined as the width of the streambed and stream banks in contact with water for an individual cross section, is used as a measure of the availability of aquatic habitat over a range of discharges (Leathe and Nelson 1986). Wetted perimeter transect lengths, transect water depths, and discharge data are collected at a site over a range of flow conditions to generate a wetted-perimeter - discharge curve. Typical application of the method involves plotting the wetted perimeter of a riffle over a range of flows and determining the inflection point. The flow represented by the inflection point is assumed to protect the food-producing riffle habitats at a level sufficient to maintain the existing fish population at some acceptable level of sustained production. Instead of assuming that an inflection point provides an acceptable level of protection, the results of the proposed analysis will be used to compare flows during the May and June eulachon spawning period under pre- and post-Project conditions.

Two types of data collection are necessary for the proposed analysis. The first includes transect-specific measurements collected at high, medium, and low flow conditions to cover the range of flows observed during the May and June eulachon spawning period. The second includes installation of pressure transducers recording stage in 15-minute increments over the length of the field effort. Transect measurements will include bed, bank, and water surface elevations tied into the Project datum, and characterization of surficial substrate at each transect near eulachon spawning areas. The following three field efforts are proposed:

1. During May and June, efforts will include transect selection, installation of the pressure transducers, and site specific transect measurements of bathymetry, water surface elevation, and surficial substrate;
2. July field efforts will collect water surface elevation data under assumed moderate flow conditions; and
3. September low-flow field efforts will include collection of water surface elevation data, verification of substrate data collected during the May and June field effort, and removal of the pressure transducers. Measurement of low-flow conditions during September is expected to provide information on stage changes in the Lower River that may occur under proposed Project operations in May and June.

The pressure transducer data, coupled with stage information available for the Susitna River at Susitna station (USGS No. 15294350), will be used to identify flow travel times between the Susitna Station location and the selected transects. This travel time information will be used to adjust the pre- and post-Project streamflow modeling results estimated using the Open-water Flow Routing model results available at PRM 29.9, downstream to the location of the selected transects (see ISR Study 8.5, Appendix K). Streamflow data at the transects of interest under pre- and post-Project conditions will be coupled with the transect bathymetry data to develop wetted perimeter-discharge relationships for each transect.

To evaluate potential Project-related effects, the transect-based method will be used to quantify and compare the availability of water depths and spawning-sized substrate along the banks of each transect during the May and June eulachon spawning period under pre- and post-Project conditions. In addition, changes in wetted perimeter that maintain a minimum water depth over areas of suitable spawning-sized substrates will be plotted against mainstem flow to identify a breakpoint or threshold (CDFW 2013). The breakpoint will define the flow below which aquatic habitat conditions for spawning eulachon rapidly decline and will represent the minimum mainstem flow needed to protect suitable spawning habitat. The results of the 2015 eulachon spawning habitat study will be presented in the Updated Study Report (USR).

3. LITERATURE CITED

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CDFW (California Department of Fish and Wildlife). 2013. Standard Operating Procedure for the Wetted Perimeter Method in California. California Department of Fish and Wildlife Instream Flow Program Standard Operating Procedure DFG-IFP-004**,** 19 p.

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4. FIGURES

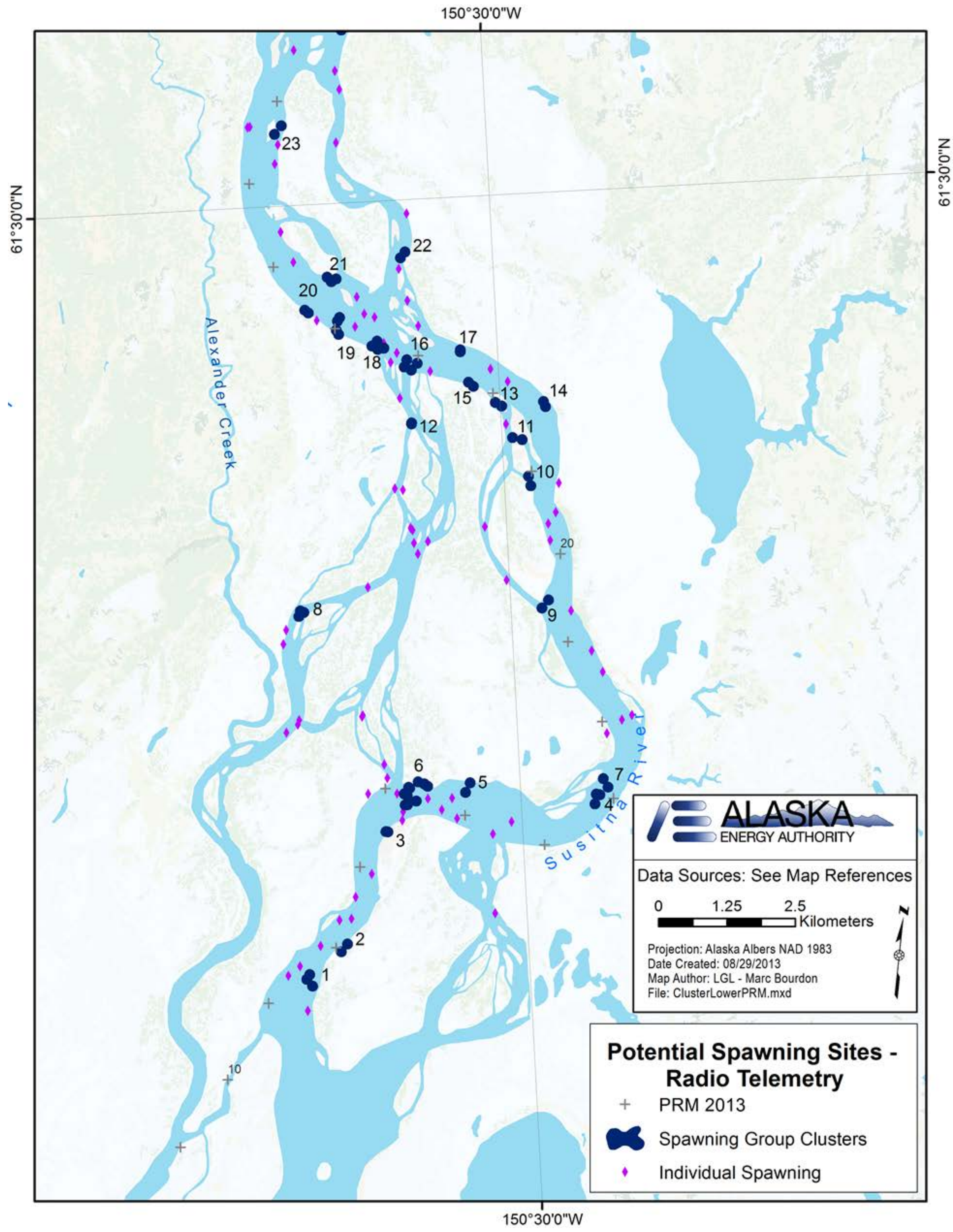

Figure 2.2 – 1a. Potential spawning sites of eulachon in the Susitna River in 2013, based on radio telemetry detections, Map 1 of 2 (from ISR 9.16).

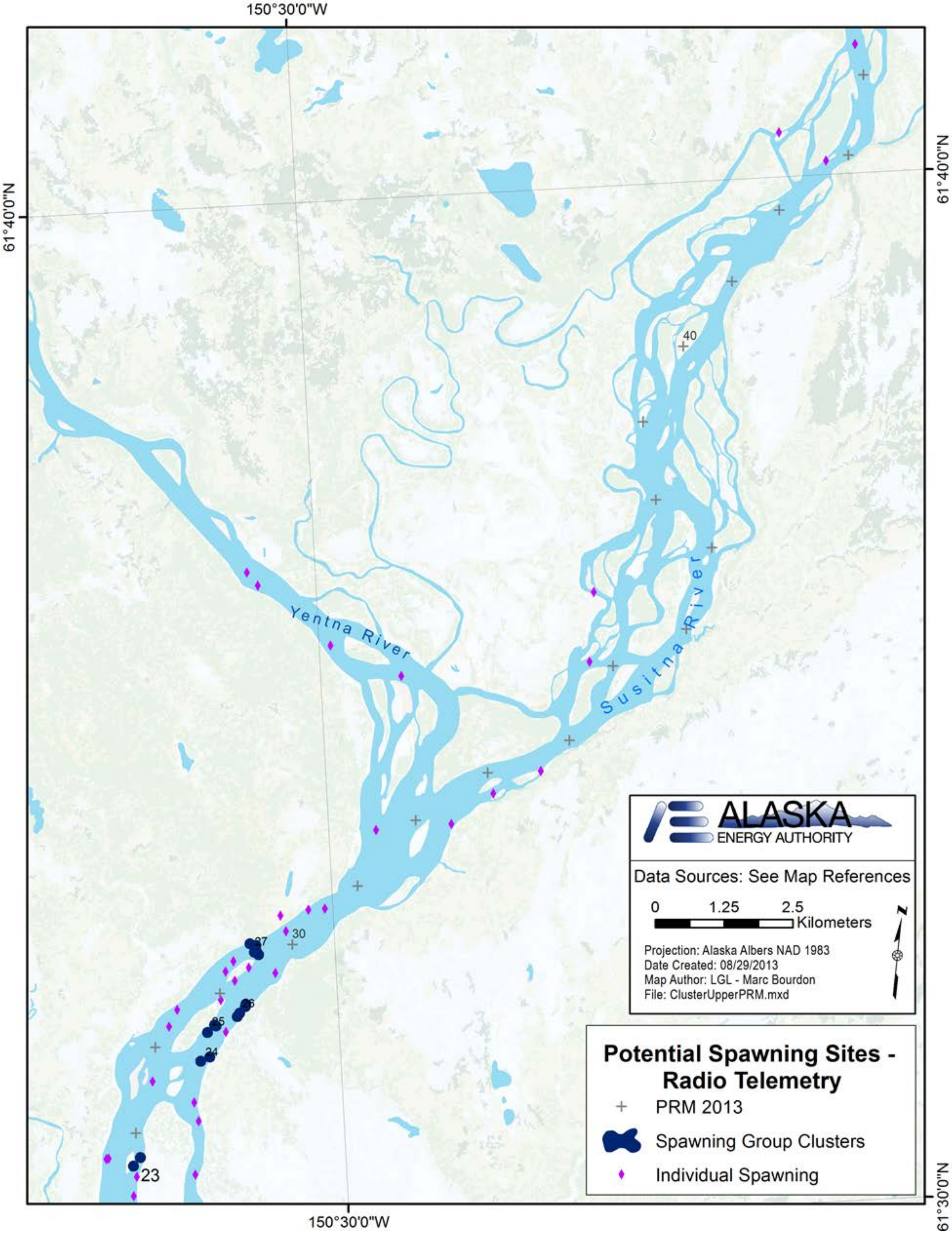

Figure 2.2 – 1b. Potential spawning sites of eulachon in the Susitna River in 2013, based on radio telemetry detections, Map 2 of 2 (from ISR 9.16).

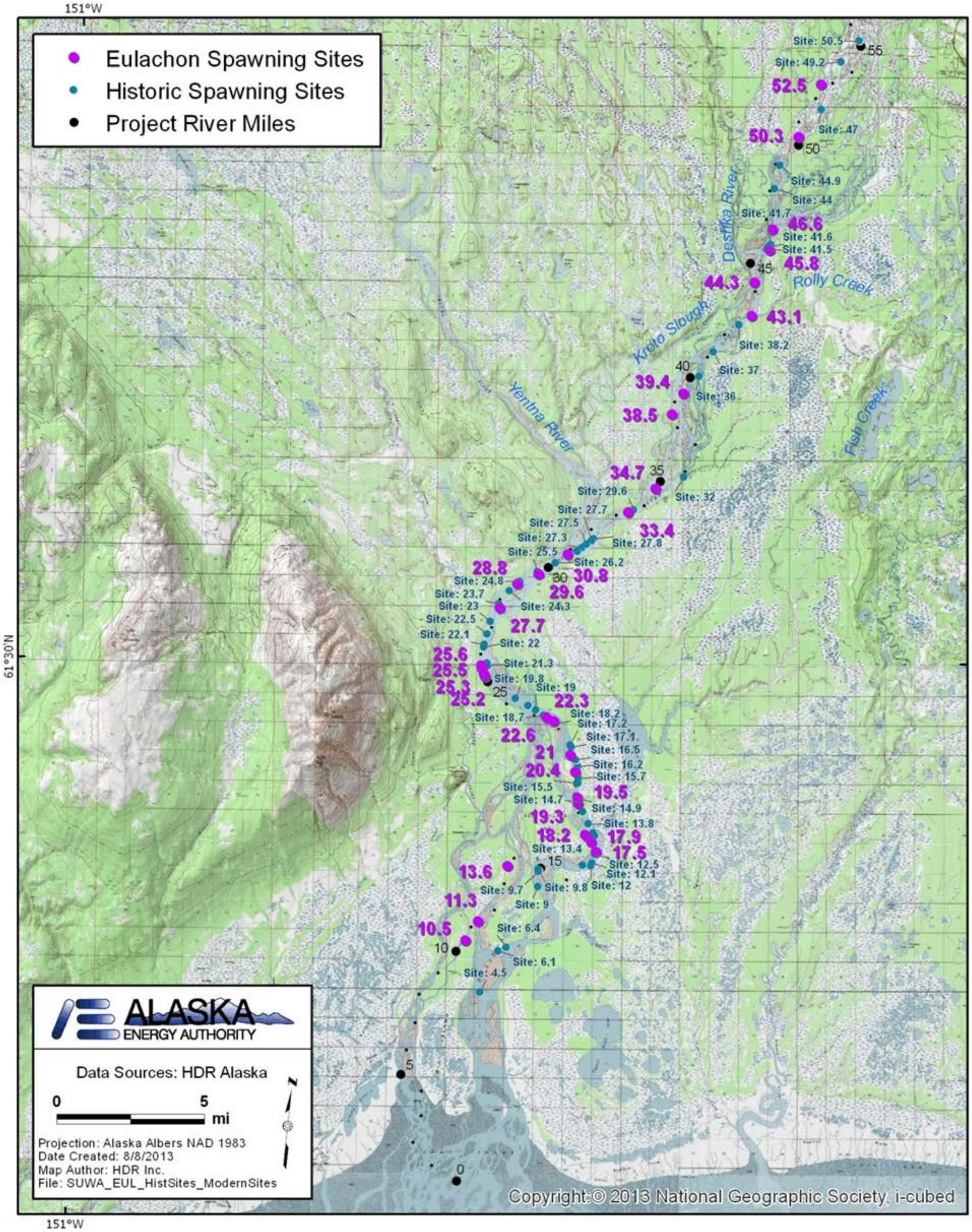

Figure 2.2-2. Location of historic eulachon spawning sites (blue) and spawning sites surveyed in 2013 (purple) by Project River Mile (from ISR 9.16).