

Field Report

Selawik River Survey 2023

2023 National Rivers & Streams Assessment

July 24 - August 11, 2023



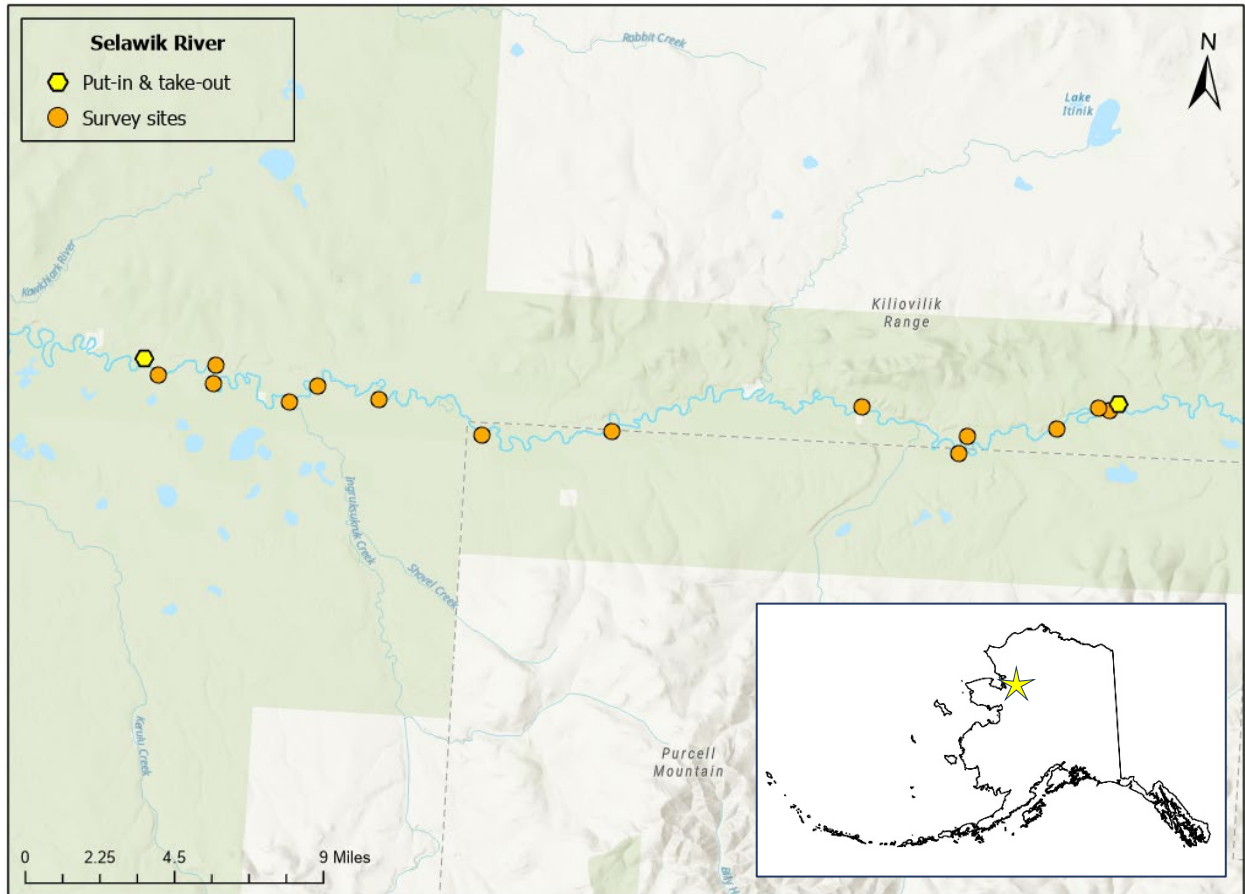


Figure 1. 2023 Selawik River survey sites, and the location of Selawik River in Alaska (inset).

Acknowledgements

This survey was funded by the Environmental Protection Agency’s National Aquatic Resource Surveys. Work was completed by Alaska Department of Environmental Conservation, Division of Water staff in partnership with the U.S. Fish & Wildlife Service, Alaska Department of Fish & Game, and Alaska Department of Natural Resources.

Selawik River Survey 2023

July 24 – August 11, 2023

The Alaska Department of Environmental Conservation (ADEC) completed a survey on the Selawik River in 2023, alongside the Environmental Protection Agency's (EPA) 2023-2024 National Rivers and Streams Assessment (NRSA). EPA partners with states and Tribes to complete NRSA as part of their National Aquatic Resource Surveys. NRSA assess the quality of the nation's waters based on a variety of indicators including habitat characteristics, biological community structure, and water chemistry. National Aquatic Resource Surveys, including NRSA, use a randomized design that selects sites that are representative of the larger population or area, and therefore provide scientifically defensible assessments of the nation's waters that can be used to track changes in condition over time. Environmental managers use this information to support the protection and restoration of water resources and mitigate damage to these ecosystems.

Site selection and survey design

The Selawik River, located within the Selawik National Wildlife Refuge (Figure 1), was selected based on several factors including state and federal partnership capacity and a lack of baseline water quality data in the region. The Selawik River is a highly sinuous, low gradient river in the Kobuk Ridges and Valleys and Kotzebue Sound Lowlands ecoregions, surrounded by wetlands.

Sites for this survey were selected using a randomized design to provide a snapshot of the overall condition of the water. As part of the design, randomly generated locations were categorized as "base" sites or "oversample" sites. If a base site could not be sampled (e.g., because it was inaccessible or unsafe), oversample sites could be sampled in their place in a systemic way to maintain the integrity of the design. All base sites were sampled, and oversample sites were not needed for this survey.

This survey was designed using EPA's Survey Design Tool (Dumelle et al. 2023), which uses the Generalized Random-Tessellation Stratified algorithm to create a spatially balanced design. It was designed to cover 35 base sites over two years, but logistical constraints required canceling the second season of sampling. 14 sites were sampled across approximately 60 miles of river in 2023. The sample frame was created using the National Hydrography Dataset, and excluded an upstream reach that was not boatable (Bill Carter, Selawik National Wildlife Refuge Biologist, personal communication, June 29, 2022) and a section downstream where flow rates were less than 1 mph. The accessible portion of river was divided into two strata based on assumed accessibility: Float and Jetboat (Table 1).

Table 1. Selawik River survey design summary.

Section of Selawik River	Base sites	River miles	Percent of total length of Selawik River	Percent of accessible length of Selawik River
Upstream of Float	-	44.2	17.2	-
Float	13	54.9	21.4	38.2
Jetboat	22	89.1	34.7	61.8
Downstream of Jetboat	-	68.8	26.8	-

Data collection

Data were collected based on non-wadable NRSA protocols (USEPA 2023) at the 14 upstream sites. Sampling reach lengths were calculated based on estimated wetted widths at the site coordinates, known as the X-site (Figure 2, transect F). Aerial imagery and ArcGIS Pro were used to estimate wetted width and reach lengths, and to map each sampling reach. Eleven transects were spaced evenly along each reach and labeled A through K (Figure 2). When two X-sites were too close to one another, reaches were slid up or downstream to avoid reach overlap. Due to the remote location and inability to meet sample preservation requirements, water quality and physical habitat portions of the survey were collected during separate sampling events (Table 2).

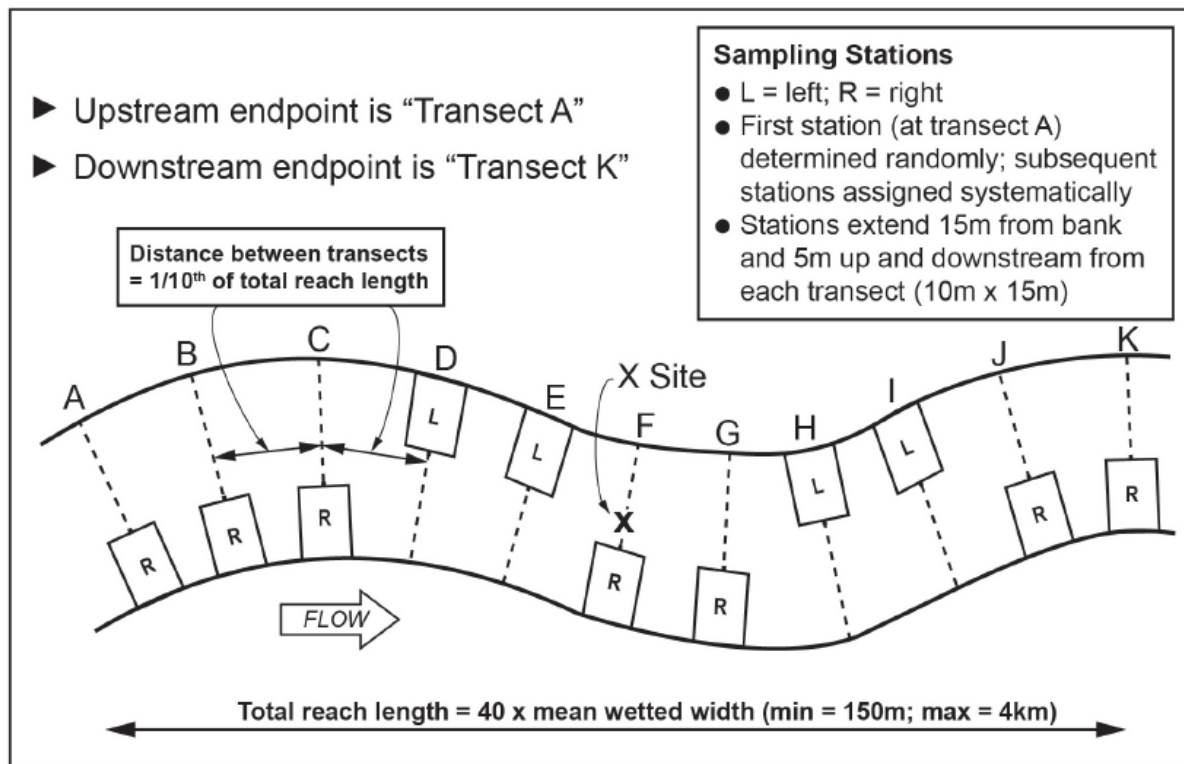


Figure 2. Reach layout for non-wadable rivers and streams surveys.

Water quality samples were collected from one transect along each sampling reach from July 24 – 26, 2023 (Tables 2 & 3). Indicators included metals, major cations and anions, dissolved organic carbon, total dissolved solids, total suspended solids, nutrients, and in situ parameters. These included supplemental indicators for ADEC water quality standards development, in addition to NRSA indicators.

Benthic macroinvertebrate sampling, periphyton sampling, and physical habitat surveys were completed July 31 – August 10. The upstream starting point (Figure 1) was accessed via helicopter, and two crews floated approximately 60 miles while surveying the 14 sites (Table 2; Figure 3). All base sites were surveyed; thus, oversample sites were not surveyed.

Physical habitat characteristics were surveyed at the 11 transects of each sampling reach (Fig. 2). They included visual assessments of riparian habitat, instream fish habitat, canopy cover, river substrate, and human impacts. Composite benthic macroinvertebrate and periphyton samples were collected at each sampling transect and preserved in the field with ethanol and formalin, respectively, until shipment to the laboratory for enumeration and identification.



Figure 3. ADEC crew floating Selawik River (top), collecting water quality measurements (middle), and measuring canopy density (bottom).

Table 2. Selawik River sampling and survey schedule.

Site ID	Longitude	Latitude	Water quality sampling	Physical habitat survey
NRS23-Selawik-10	-157.19576	66.49906	7/24/2023	8/3/2023
NRS23-Selawik-04	-157.20305	66.49771	7/24/2023	8/3/2023
NRS23-Selawik-06	-157.24821	66.49438	7/24/2023	8/4/2023
NRS23-Selawik-03	-157.36392	66.47837	7/24/2023	8/4/2023
NRS23-Selawik-07	-157.37076	66.47449	7/24/2023	8/5/2023
NRS23-Selawik-11	-157.46913	66.49113	7/25/2023	8/5/2023
NRS23-Selawik-08	-157.75090	66.48294	7/25/2023	8/6/2023
NRS23-Selawik-12	-157.87680	66.47481	7/25/2023	8/6/2023
NRS23-Selawik-09	-157.98944	66.48815	7/25/2023	8/7/2023
NRS23-Selawik-02	-157.06587	66.49132	7/26/2023	8/7/2023
NRS23-Selawik-13	-158.08047	66.48347	7/26/2023	8/8/2023
NRS23-Selawik-05	-158.17061	66.48940	7/26/2023	8/8/2023
NRS23-Selawik-01	-158.18822	66.49439	7/26/2023	8/8/2023
NRS23-Selawik-25	-158.23401	66.48991	7/26/2023	8/9/2023

Table 3. Selawik River survey indicators.

NRSA water quality indicators	Supplemental water quality indicators	NRSA physical habitat indicators
<ul style="list-style-type: none"> • Temperature (in situ) • pH (in situ) • Specific conductivity (in situ) • Turbidity (in situ) • Dissolved oxygen (in situ) • Total suspended solids • Dissolved organic carbon • Nitrate + Nitrite, as N • Ammonia, as N • Total nitrogen • Total phosphorus • Major dissolved anions: chloride, sulfate • Major dissolved cations: calcium, sodium, potassium, magnesium • Chlorophyll-a 	<ul style="list-style-type: none"> • Hardness as CaCO₃ • Fluoride • Total dissolved solids • Dissolved metals • Total metals 	<ul style="list-style-type: none"> • Benthic macroinvertebrates • Periphyton • Shore bottom and substrate classes • Littoral depths • Woody debris counts • Bank characteristics (wetted, bankfull, and bar widths; bankfull and incised heights) • Visual riparian estimates and canopy densities • Visual fish habitat cover estimates • Thalweg depth measurements • Channel constraint characteristics • Torrent evidence characteristics

Results

Mean (\pm standard deviation) wetted and bankfull widths were 39.7 ± 14.0 m and 53.2 ± 18.3 meters, respectively, and mean thalweg depth was 1.13 ± 0.49 meters. Water quality parameter means, standard deviations, minimums, maximums, and number of results not detected are summarized in Appendix A.

The success of this project is attributed to the following personnel:

- Morgan Brown, ADEC
- Amber Crawford, ADEC
- Olivia Edwards, ADF&G
- Maryann Fidel, ADEC
- Chandra McGee, ADEC
- Brock Tabor, ADEC
- Kaia Victorino, ADEC



This project would not have been possible without the generous support of U.S. Fish & Wildlife Service staff, including Bill Carter, who provided extensive logistical support.

References

Dumelle, Michael, Tom Kincaid, Anthony R. Olsen, Marc Weber (2023). Spsurvey: Spatial Sampling Design and Analysis in R. *Journal of Statistical Software*, 105(3), 1-29.

Doi:10.18637/jss.v105.i03

USEPA (2023). National Rivers and Streams Assessment 2023/24: Field Operations Manual – Non-Wadable. *EPA-841-B-22-007*. U.S. Environmental Protection Agency, Office of Water. Washington, D.C.

Appendix A.

Table A1. Selawik River basic water quality summary for in situ parameters (n = 14).

Parameter	Unit	Mean	Standard deviation	Minimum	Maximum
Dissolved oxygen (DO)	mg/l	9.39	0.5	8.7	9.96
Specific conductance	uS/cm	75.09	6.28	66.73	83.61
Temperature, water	deg C	14.11	1	11.56	15.39
pH	None	8.11	0.31	7.7	8.58

Table A2. Selawik River nutrient results (n = 14).

Parameter	Mean	Detection Limit (mg/l)
Ammonia-nitrogen	Not detected	0.031
Nitrate-Nitrite	Not detected	0.05
Total Kjeldahl nitrogen	Not detected	0.31
Total Phosphorus, mixed forms	Not detected	0.012

Table A3. Selawik River anions/cations summary (n = 14).

Parameter	Unit	Mean	Standard deviation	Minimum	Maximum
Calcium	ug/l	11460.71	1130.04	9550	13100
Chloride	mg/l	0.31	0.05	0.25	0.43
Fluoride	mg/l	Not detected (< 0.05)	0	0.03	0.03
Magnesium	ug/l	2455.00	140.53	2040	2600
Sulfate	mg/l	3.53	0.49	2.75	4.32

Table A4. Selawik River other water quality indicators summary (n = 14).

Parameter	Unit	Mean	Standard deviation	Minimum	Maximum
Alkalinity	mg/l	26.64	2.5	22.6	30.2
Hardness, carbonate	mg/l	38.72	3.19	32.2	43.4
Dissolved organic carbon	mg/l	6.94	0.61	5.73	7.86
Total dissolved solids	mg/l	57.43	3.72	52	63
Total suspended solids	mg/l	3.19	1.53	1.68	6.0

Table A5. Selawik River dissolved and total metals summary (n = 14).

Parameter	Dissolved (ug/l)					Total (ug/l)				
	Mean	Standard deviation	Minimum	Maximum	Results not detected*	Mean	Standard deviation	Minimum	Maximum	Results not detected*
Aluminum	31.93	2.67	28.20	37.40	0	277.86	128.77	154.00	512.00	0
Antimony	0.07	0.04	0.03	0.18	0	0.10	0.09	0.05	0.40	0
Arsenic	0.40	0.03	0.33	0.48	0	0.51	0.05	0.42	0.59	0
Barium	17.74	1.02	16.20	19.50	0	21.26	1.89	19.20	24.80	0
Beryllium	0.49	0.00	0.49	0.49	14 (0.974)	0.48	0.01	0.44	0.49	14 (0.974)
Boron	5.00	0.00	5.00	5.00	14 (10)	4.96	0.13	4.50	5.00	14 (10)
Cadmium	0.03	0.00	0.03	0.03	14 (0.0689)	0.05	0.04	0.03	0.15	12 (0.0689)
Calcium	9817.14	1365.87	7900.00	11600.00	0	9987.14	1064.99	7700.00	11100.00	0
Cobalt	0.08	0.02	0.06	0.14	0	0.27	0.19	0.15	0.89	0
Copper	1.57	0.27	1.28	2.42	0	2.12	0.93	1.64	5.27	0
Iron	293.00	22.67	255.00	331.00	0	720.86	200.67	564.00	1030.00	0
Lead	0.25	0.00	0.25	0.25	14 (0.5)	0.25	0.01	0.22	0.25	14 (0.5)
Magnesium	2431.43	190.18	1980.00	2690.00	0	2587.86	199.24	1940.00	2730.00	0
Manganese	13.79	6.17	6.04	28.40	0	24.54	6.69	13.40	36.90	0
Molybdenum	1.05	0.12	0.88	1.22	0	1.10	0.15	0.91	1.35	0
Nickel	0.72	0.06	0.59	0.86	0	1.09	0.35	0.80	2.17	0
Potassium	204.07	33.86	161.00	251.00	0	247.93	19.37	209.00	276.00	0
Selenium	0.05	0.02	0.02	0.07	5 (0.046)	0.07	0.01	0.05	0.08	0
Silver	0.06	0.00	0.06	0.06	14 (0.12)	0.07	0.04	0.05	0.21	13 (0.12)
Sodium	2401.43	171.28	2190.00	2680.00	0	2483.57	126.16	2240.00	2660.00	0
Thallium	0.01	0.00	0.01	0.01	14 (0.0201)	0.01	0.00	0.01	0.01	14 (0.0201)
Vanadium	0.66	0.08	0.57	0.78	0	1.44	0.50	1.01	2.21	0
Zinc	1.32	2.96	0.53	11.60	13 (1.06)	1.99	1.73	0.53	7.09	3 (1.06)

*Method Detection Limits are shown in parentheses for results that were not detected.