Regional Operational Plan No. ROP.SF.2A.2023.02

Amendment: Battle Creek Coho Salmon Escapement and Juvenile Assessment, 2023–2024

by

Holly I. Dickson

and

Michael D. Booz

This report is an amendment to an operational plan published as ROP.SF.2A.2022.32. This version includes the text of the original operational plan.

February 2023

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat or long
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	E
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	″
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

REGIONAL OPERATIONAL PLAN NO. ROP.SF.2A.2023.02

AMENDMENT: BATTLE CREEK COHO SALMON ESCAPEMENT AND JUVENILE ASSESSMENT, 2023–2024

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SIGNATURE PAGE

Project Title:	Amendment: Battle Creek Coho Salmon Escapement and Juvenile Assessment, 2023–2024
Project leader(s):	Holly I. Dickson, Fisheries Biologist II, and Michael D. Booz, Fisheries Biologist III
Division, Region and Area	Sport Fish, Region II, Homer
Project Nomenclature:	
Period Covered	FY24 through FY25
Field Dates:	August 1, 2023–October 20, 2024
Plan Type:	Amendment

Approvals

Title	Name	Signature	Date
Project leader	Holly Dickson		
Project Supervisor	Mike Booz		
Research Coordinator	Timothy McKinley		

TABLE OF CONTENTS

Page

LIST OF APPENDICES

Appendix **Page**

PURPOSE

The Battle Creek coho salmon escapement project will provide daily and season-cumulative video weir counts of adult coho salmon (*Oncorhynchus kisutch*), a weekly and annual index of coho salmon escapement, and a catch-per-unit-effort index of the abundance of juvenile coho salmon. These estimates will be used by the Alaska Energy Authority (AEA) to fulfill a Fish and Habitat Management Implementation Plan (FHMIP) ordered by the Federal Energy Regulatory Commission (FERC) to monitor the adult and juvenile coho salmon populations in Battle Creek before and after creek diversion to assess whether a population decline has occurred (FERC 2016). Additionally, the Alaska Department of Fish and Game (ADF&G) Division of Sport Fish (SF) will use these data to better understand the size of coho salmon runs on the south side of Kachemak Bay and how these populations may be able to support sport fishing opportunities.

REASON FOR CHANGE

Due to anticipated continued funding by the Alaska Energy Authority (AEA) through 2024, we want to extend all objectives for ROP.SF.2A.2022.32 for 2 additional years, with some modification. Based on recommendations made by ADF&G SF to AEA following the 2022 video weir operation, coho salmon escapement monitoring will begin earlier and change from 1 September–15 October to 15 August–15 October. The earlier start date will allow the video weir monitoring to capture the entire Battle Creek coho salmon run, which allows a complete census (primary objective 1) as well as the ability to determine cumulative run timing (secondary objective 4). After reviewing the results of foot surveys in 2021 and 2022, the reviewing agencies (ADF&G, NOAA Fisheries, and U.S. Fish and Wildlife Service) recommended to AEA that foot surveys were inadequate as a method for producing an annual index of escapement. Therefore, the foot surveys (secondary objective 1) will be conducted opportunistically, rather than on a required weekly basis. All other methods conducted during the first year of video weir operation at Battle Creek (2022) were successful and will remain unchanged for the final 2 years (2023 and 2024) of the first 5-year monitoring period required by the Federal Energy Regulatory Commission as a condition of the stream diversion license granted to AEA in 2016.

DESCRIPTION OF CHANGE

Battle Creek coho salmon will continue to be censused and sampled as detailed in ROP.SF.2A.2022.032 (Appendix A1) for 2 additional years, with 2 exceptions: 1) for primary objective 1, the dates of video weir operation will be changed from 1 September–15 October to 15 August–15 October and 2) for secondary objective 1, foot surveys in Lower Battle Creek will be conducted opportunistically rather than weekly.

Because of the extension of ROP.SF.2A.2022.32 for 2 additional years, a change in personnel in the responsibilities section was required as well. The 2023 Field Project Leader will be Danielle Siegert, the Fishery Technician III positions will be held by Alissa Cole, Elias Wilson, and Sara Faris. The Fishery Technician II positions will be held by Alexis Bobbitt and “Vacant”, and the Biometrician for this project will be Logan Wendling.

SCHEDULE AND DELIVERABLES

The following will be delivered annually:

Dates	Activity
July 15–August 14	Transport weir materials to Battle Creek and build weir
August 15–October 15	Operate floating video weir, conduct opportunistic foot surveys
Mid-October	Conduct juvenile sampling
Mid-October	Remove, store, and transport weir materials
November	Prepare final report

BUDGET SUMMARY

Projected costs for FY2024. Budget manager Holly Dickson Ninilchik Chinook salmon stock assessment

Line item	Category	Budget ($K)
100	Personal Services	60.0
200	Travel	0.0
300	Contractual	2.2
400	Commodities	3.0
500	Equipment	0.0
Total		65.2

APPENDIX A: ORIGINAL OPERATIONAL PLAN ASSOCIATED WITH THIS AMENDMENT: ROP.SF.2A.2022.32

Appendix A1.–Text of original operational plan associated with this amendment: ROP.SF.2A.2022.32.

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SIGNATURE PAGE

Project Title:	Battle Creek Coho Salmon Escapement and Juvenile Assessment, 2022
Project leader(s):	Holly Dickson, Fisheries Biologist II and Mike Booz, Fisheries Biologist III
Division, Region and Area	Sport Fish, Region II, Homer
Project Nomenclature:	
Period Covered	FY23
Field Dates:	15 August 2022 to 1 November 2022
Plan Type:	Category II

Approval

Title	Name	Signature	Date
Project leader	Holly Dickson		
Project supervisor	Michael Booz		
Biometrician	Logan Wendling		
Research Coordinator	Tim McKinley		

ABSTRACT

In 2022, the Alaska Department of Fish and Game, Division of Sport Fish will operate an instream video weir project to estimate coho salmon (*Oncorhynchus kisutch*) escapement in Battle Creek, located approximately 2 miles southwest of the Bradley Lake Hydroelectric Project on Kachemak Bay in southcentral Alaska. The video weir will be operated at river kilometer 1.7 from late August until mid-October or freeze up, whichever is earlier. Beach seine sampling will be conducted when the weir is installed to determine if any adult coho salmon migrated past the weir site prior to installation. Foot surveys to visually count adult coho salmon will also be conducted such that data are comparable to previous years' survey data. Juvenile coho salmon sampling will occur in mid-October or when the stream flow reaches 75 cfs or less. Baited minnow traps and an analysis of catch-per-unit-effort will be used as an index of juvenile coho salmon abundance between years.

Keywords: Battle Creek, Bradley Lake, coho salmon, *Oncorhynchus kistuch,* escapement, run timing, stock status, video weir

INTRODUCTION

PURPOSE

In 2022, the Battle Creek coho salmon escapement project will provide daily and season cumulative video weir counts of adult coho salmon (*Oncorhynchus kisutch*), a weekly and annual index of coho salmon escapement, and a catch-per-unit-effort index of the abundance of juvenile coho salmon. These estimates will be used by the Alaska Energy Authority (AEA) to fulfill a Fish and Habitat Management Implementation Plan (FHMIP) ordered by the Federal Energy Regulatory Commission (FERC) to monitor the adult and juvenile coho salmon populations in Battle Creek before and after creek diversion to assess whether a population decline has occurred (FERC 2016). Additionally, the Alaska Department of Fish and Game (ADF&G) Division of Sport Fish (SF) will use these data to better understand the size of coho salmon runs on the south side of Kachemak Bay and how these populations may be able to support sport fishing opportunities.

BACKGROUND

Battle Creek is part of a 34.8 km^2 watershed in Kachemak Bay in southcentral Alaska (AEA 2020). The stream is 13.4 river kilometers (RKM) long, most of which is of high-gradient flow, that originates from a small unnamed glacier between Dixon and Nuka glaciers at 2,100 ft elevation and travels through narrow gorges from alpine slopes until it emerges onto the coastal floodplain on the south side of Kachemak Bay (AEA 2020; Figure 1). The headwaters are glacially fed and often high and full of glacial till in the warm summer months. The system is also prone to flash floods and high flooding events, particularly with spring runoff and fall rainstorms. The lower 2.9 RKM of Battle Creek from the confluence of South Fork Battle Creek to the river mouth is a more gradual gradient with pools and runs conducive to holding juvenile and adult salmonids.

South Fork Battle Creek is the largest tributary to the main Battle Creek channel and is not diverted as part of the Bradley Lake Hydroelectric Project (Figure 1). The main Battle Creek channel includes the west fork of upper Battle Creek (the largest tributary to upper Battle Creek), and the smaller middle and east forks. The west fork was diverted into Bradley Lake starting in fall 2020 to supplement the hydroelectric power produced at the Bradley Lake project. AEA began assessing juvenile and adult salmon populations in Battle Creek in 2010 in preparation for the diversion work, but prior to that very little fish or habitat assessment had occurred. The work conducted by AEA concluded that coho salmon were the most numerous adult salmon species in the stream and were also the most likely species to be impacted by the diversion (Brady et al. 2012).

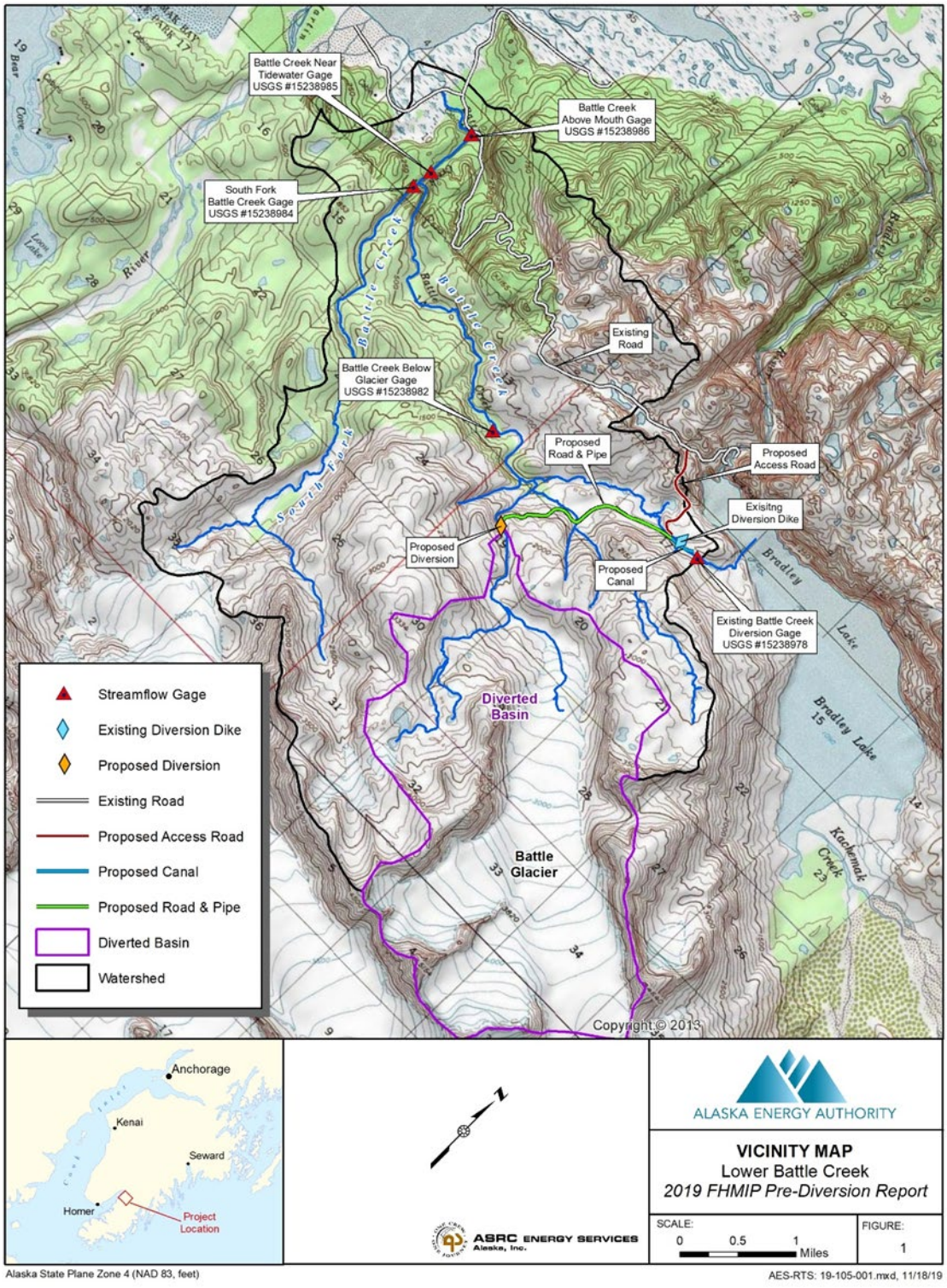

Figure 1.–Map of the Battle Creek Watershed (AEA 2020).

Coho Salmon

Adult coho salmon return to many freshwater systems in the Lower Cook Inlet Management Area, including the roadside streams on the lower Kenai Peninsula, western Cook Inlet streams, and streams on the south side of Kachemak Bay. It is likely the Fox River, located at the head of Kachemak Bay approximately 7.5 km from the mouth of Battle Creek, has the largest naturally occurring coho salmon run in Kachemak Bay. Coho salmon in the Lower Cook Inlet management area typically spend 2 years rearing in freshwater and 1 year at sea before returning to spawn at age 2.1.

In the lower Kenai Peninsula roadside streams, coho salmon begin their freshwater migration in mid-July, with peak run timing in mid- to late August (Hammarstrom 1981; Booz et al. 2019). Coho salmon migrations into freshwater on the south side of Kachemak Bay and the North Gulf Coast are thought to have later run timing than lower Kenai Peninsula roadside streams (Booz et al. 2019). Coho salmon returning to fresh water typically build up in the tidally influenced portions of their natal stream until stream levels rise and then push upstream en masse.

Sport fishing effort directed towards coho salmon in the Lower Cook Inlet management area primarily occurs in the lower Kenai Peninsula roadside streams and on the Homer Spit at the Nick Dudiak Fishing Lagoon. There is also boat-based effort in Kachemak Bay and Lower Cook Inlet, as well as in remote streams in western Cook Inlet. There is very little effort directed at the streams on the south side of Kachemak Bay, but there is some in the Fox River, Silver Creek (a stream in China Poot Bay), Seldovia River, and Port Graham River (Booz et al. 2019). There is likely some sport fishing effort in Battle Creek for coho salmon, but the amount is unknown and likely small.

Regulations for sport fishing in streams on the south side of Kachemak Bay, including Battle Creek, are managed through Kenai Peninsula Area general provisions (Alaska Administrative Code 5 AAC 56.120), which specify seasons, bag and possession limits, and special provisions describing gear and area. Coho salmon are within regulations for salmon other than Chinook salmon (*O. tshawytscha*). There is no annual limit, but there is a bag and possession limit of 2 coho salmon in fresh water.

Historically, coho salmon escapement has been monitored periodically in some systems in Lower Cook Inlet; run size and escapements vary between drainage and years but are generally considered small runs ranging from less than 100 to approximately 25,000. The primary monitoring has been conducted by ADF&G SF in the Anchor River since the late 1980s: 1987–1989, 1992, 2004–2011, and 2020–2021. Coho salmon escapements in the Anchor River have ranged from 1,866 in 2011 to 20,187 in 1989 (Dickson et al. 2020), and as many as 4,000 coho salmon have passed through the Anchor River weir in 1 day (Kerkvliet et al. 2012). From 1996 through 2001, ADF&G SF also monitored coho salmon escapement in Deep Creek, and run size ranged from 3,000 to 8,000 fish (Kerkvliet et al. 2016). Coho salmon escapement in Silver Salmon Creek on the west side of Cook Inlet was monitored by the National Park Service in 2011 through 2013, and annual escapements ranged from approximately 6,000 to 10,000 fish (Dan Young, Lake Clark National Park Service, personal communication, 2021). In recent years, Jakolof Creek on the south side of Kachemak Bay has been monitored by Seldovia Village Tribe for the purpose of starting a coho salmon enhancement program, and run sizes have been less than 200 fish. The ADF&G Division of Commercial Fisheries has monitored coho salmon escapement in several Lower Cook Inlet streams via weirs, aerial surveys, and foot surveys, including Clearwater Creek at the headwaters of Kachemak Bay (Hollowell et al. 2019). In Kamishak Bay, Cook Inlet Aquaculture Association

has monitored coho salmon escapement at their Paint River fish ladder (Glenn Hollowell, ADF&G Division of Commercial Fisheries, Homer, personal communication, 2021). In 2010 and 2011, and again in 2018–2020, coho salmon were monitored by AEA in Battle Creek by conducting foot survey counts. In 2021, ADF&G SF was contracted by AEA to monitor coho salmon via sonar and foot survey count in Battle Creek.

Bradley Lake Hydroelectric Project

The Bradley Lake Hydroelectric Project was first evaluated as an option for power generation by the Army Corps of Engineers in 1955 and was authorized by Congress in 1962, but funding challenges delayed development until the 1980s. The project was issued a FERC license in 1985 and began operating commercially in 1991. The AEA is the licensee for the project and Homer Electric Association (HEA) operates the project. On average, Bradley Lake generates 5 to 10 percent of the total power used annually by the railbelt utilities in Alaska (AEA 2019a). The project includes a 125-foot tall dam, 3 stream diversions, a 3.5-mile long power tunnel, and 20 miles of transmission line to deliver the generated electricity to the main grid.

Battle Creek Diversion

In 2016, AEA received approval from FERC to divert water from the west fork of upper Battle Creek to Bradley Lake. Diverting water from the west fork of Battle Creek to Bradley Lake was estimated to increase electricity production by 37,300 MW, or approximately 10 percent (AEA 2019a). Construction on the diversion began in 2018 and was completed in 2020. A concrete diversion dam was built, as well as 5-foot pipe laid underneath 3 miles of new road to deliver the diverted flows to Bradley Lake.

As part of the amendment to the FERC license for the diversion, AEA was required to file a Fish and Habitat Management Implementation Plan (FHMIP) that included 6 stipulations as follows:

(1) a provision to conduct monitoring of fish and fish habitat in the first 1.8 miles of Battle Creek, during the open water season, at least one year prior to initiation of construction activities that would affect habitat conditions;

(2) a provision to conduct coho salmon foot surveys every year after completion of construction activities, for five years, and then once every five years for the remainder of the license if the initial five-year monitoring indicates a population decline;

(3) a provision to conduct sampling of juvenile salmon at least once before construction of the West Fork UBC diversion and then at least once during the first five years of operation of the diversion, and then once every five years thereafter, for the remainder of the license if initial monitoring indicates a population decline;

(4) a provision to monitor interconnectivity between side-channel juvenile salmon rearing habitat and main-channel habitat;

(5) a description of how and when the licensee would consult with the National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (FWS), and the Alaska Department of Fish and Game (ADFG) to discuss the results of the habitat interconnectivity monitoring; and

(6) a provision to plan and implement, if necessary, based on the monitoring results and in consultation with the agencies, further measures to protect fish and fish habitat, that may include additional monitoring and amending the flow releases required by Article 56 of the license.

As part of the FHMIP, AEA completed prediversion coho salmon foot surveys in 2018 through 2020, but experienced limited stream visibility from high glacial turbidity during all years. Previous foot surveys conducted by AEA in 2010 and 2011 were also hampered by poor visibility due to glacial runoff, making it difficult to observe adult coho salmon and redds in nearly all water conditions. In 2021, AEA contracted ADF&G SF to conduct the foot surveys and explore the use of a sonar to estimate coho salmon escapement in Battle Creek. Sonar operation had limited success in the small stream channel, but with the diversion operational and the stream visibility good, foot surveys were the most successful of any year. In 2022, AEA is again contracting the ADF&G SF to operate a floating video weir in lieu of a sonar weir, conduct foot surveys, and conduct juvenile sampling as outlined in this operational plan.

HISTORICAL MONITORING IN BATTLE CREEK

Prior to the work in 2010, very little fish stock assessment had been conducted in Battle Creek. The ADF&G Anadromous Waters Catalog had documented coho salmon, sockeye salmon (*O. nerka*), and Dolly Varden (*Salvelinus malma*) in the system (Johnson and Blanche 2011). AEA began conducting initial estimates of the coho salmon population in Battle Creek in 2010 as part of their preparation for the Battle Creek diversion project. The initial assessment determined that coho salmon were both the most numerous salmon species in the stream and the most likely species to be impacted by the diversion (Brady et al. 2012).

Adult Coho Salmon Population Assessment

Foot Surveys

Foot surveys in 2010 and 2011 were used to estimate the adult coho salmon population in Battle Creek. The 2010 survey began in late July, but water clarity was not sufficient to conduct visual counts of adult salmon until late September. In 2010, no adult coho salmon were observed during the 29 July foot survey, and only 1 was observed on the 30 August survey, which was captured in a fyke net fished for 38 hours as a way to detect adult coho salmon due to the poor stream visibility (HDR 2011). On 28 September and 28 October, 230 and 37 adult coho salmon were observed, respectively. Twenty-four redds were also observed during the October survey (Table 1). In 2011, surveys were conducted monthly from May through November except June. No adult coho salmon were observed in the stream until the 9 October survey when 234 were counted (Table 1). An additional 27 coho salmon were observed on 2 November (Brady et al. 2012). The 2010 and 2011 monitoring concluded that the peak coho salmon run was likely in late September, but that the run might continue through mid-November (Waltemyer and Seaberg 2013).

An “area under the curve” estimator and an assumption that Lower Cook Inlet coho salmon have a stream life of 17.5 days (Hollowell et al. 2012) were used to estimate the adult coho salmon population of 421 (range 343–1,084) in 2010 and 398 (range 324–1,024) in 2011 (Waltemyer and Seaberg 2013).

Table 1.–Adult coho salmon foot survey results from 2010, 2011, and 2018–2021.

		Coho salmon count			Other species		
Year	Survey date	Alive	Dead	Active redds	Pink salmon	Dolly Varden	Comments
2010	29 Jul	–	–	–	–	–	Too turbid
	30 Aug	–	–	–	–	–	1 captured in fyke net in Reach 1
	28 Sep	230	0	0	–	–	140 in Reach 2; 90 in Reach 3
	28 Oct	37	0	24	–	–	9 in Reach 3; 28 in Reach 3
	Total	268	0	24	–	–	
2011	17 May	0	0	0	–	–	–
	20 Jul	0	0	0	–	–	–
	2 Aug	0	0	0	–	–	–
	7 Sep	0	0	0	–	–	–
	9 Oct	234	0	0	–	–	144 in Reach 2; 80 in Reach 3; 10 in Skirmish Creek
	2 Nov	27	0	0	–	–	3 in Reach 1; 18 in Reach 3; 6 in Skirmish Creek
	Total	261	0	0	0	0	
2018	17 Sep	0	0	0	0	0	–
	24 Sep	0	0	0	0	0	–
	1 Oct	0	0	0	0	0	–
	8 Oct	0	0	0	0	0	–
	15 Oct	0	0	0	0	0	–
	22 Oct	–	–	–	–	–	Too turbid for survey
	29 Oct	23	0	0	0	0	Most were in spawning pairs
	Total	23	0	0	0	0	
2019	18 Sep	–	–	–	–	–	Too turbid for survey
	26 Sep	2	0	0	12	0	–
	3 Oct	0	0	0	0	0	1 unidentified adult fish and one 6 to 8 inch fish observed
	9 Oct	1	0	0	0	0	–
	16 Oct	0	0	0	0	0	1 unidentified adult fish observed
	22 Oct	2	0	0	0	0	2 in Reach 2
	30 Oct	83	0	0	0	0	83 in Skirmish Creek; too turbid to observe in Reach 2
	Total	88	0	0	12	0	
2020	16 Sep	15	0	0	1	0	In bridge hole; mix of chrome and deep red coho
	23 Sep	5	0	0	0	0	5 in Reach 2; more present in bridge hole but not visible
	30 Sep	–	–	–	–	–	–
	7 Oct	0	0	0	0	0	–
	14 Oct	0	0	0	0	0	–
	21 Oct	0	0	0	0	0	–
	28 Oct	2	0	0	0	0	2 in Reach 2; the fish were in deteriorating condition
	Total	22	0	0	1	0	

-continued-

Table 1.–Page 2 of 2.

Year	Survey date	Coho salmon count			Other species		Comments
		Alive	Dead	Active redds	Pink salmon	Dolly Varden	
2021	7 Sep	27	0	0	17	0	2 sockeye salmon also identified
	14 Sep	0	0	0	9	0	
	21 Sep	2	0	0	15	0	1 sockeye and 1 unidentified salmon
	28 Sep	111	0	0	0	0	
	5 Oct	132	0	0	6	0	
	12 Oct	79	0	0	0	0	
	19 Oct	83	0	0	0	0	
	26 Oct	87	0	20	0	1	
	Total	521	0	20	47	1	
Average		197	0	7	10	0	

Source: Brady et al. 2012; Waltemyer and Seaberg 2013; AEA 2021, 2022.
Note: An en dash means no data.

Foot surveys to count adult coho salmon were also conducted in 2018 through 2021 (Table 1). AEA contracted a private consulting firm to conduct the foot surveys in 2018 through 2020 and contracted ADF&G SF to conduct the foot surveys in 2021. Foot surveys were conducted weekly from mid-September through October in the lower reaches (Reach 1 and Reach 2) in all years (Figure 2). The difficulty with stream visibility continued during the 2018–2020 surveys. In 2018, no coho salmon were observed in Battle Creek until 29 October, when 23 coho salmon were counted (Table 1). No other salmon species were observed in Battle Creek that year (AEA 2019b). In 2019, a small number of coho salmon were observed on most weekly surveys beginning in mid-September (Table 1). Dolly Varden and pink salmon (*O. gorbuscha*) were also observed that year. On the final 2019 survey on 30 October, 83 coho salmon were observed in the Skirmish Creek beaver pond area. In 2020, the largest fish count occurred on the first survey of the season on 15 September with 15 coho and 1 pink salmon observed. It is likely there were coho salmon in the stream in the following weeks, but turbidity and then high flows prevented a count. In 2021, coho salmon were observed on all but 1 weekly survey. Turbidity was very low in 2021, allowing for the highest foot survey counts of any year. In total, 521 coho salmon were counted.

Sonar Assessment

In 2021, ADF&G SF conducted a pilot year Adaptive Resolution Imaging Sonar (ARIS) assessment of the coho salmon escapement in Battle Creek. The flows in Battle Creek were considerably lower than normal during fall 2021, which resulted in very few holding areas for coho salmon and only 1 suitable place for sonar placement, which coincided with the densest coho salmon holding water. Although remote operation of the ARIS was successful, counting the sonar files was problematic because of fish milling at the sonar location throughout the monitoring period, resulting in nearly uncountable files and a biased-high final escapement estimate. Despite the challenging counting conditions, the fall 2021 project resulted in some valuable data, including a better understanding of run timing in Battle Creek and confirmation that foot survey counts are underestimates of the number of coho salmon in Battle Creek.

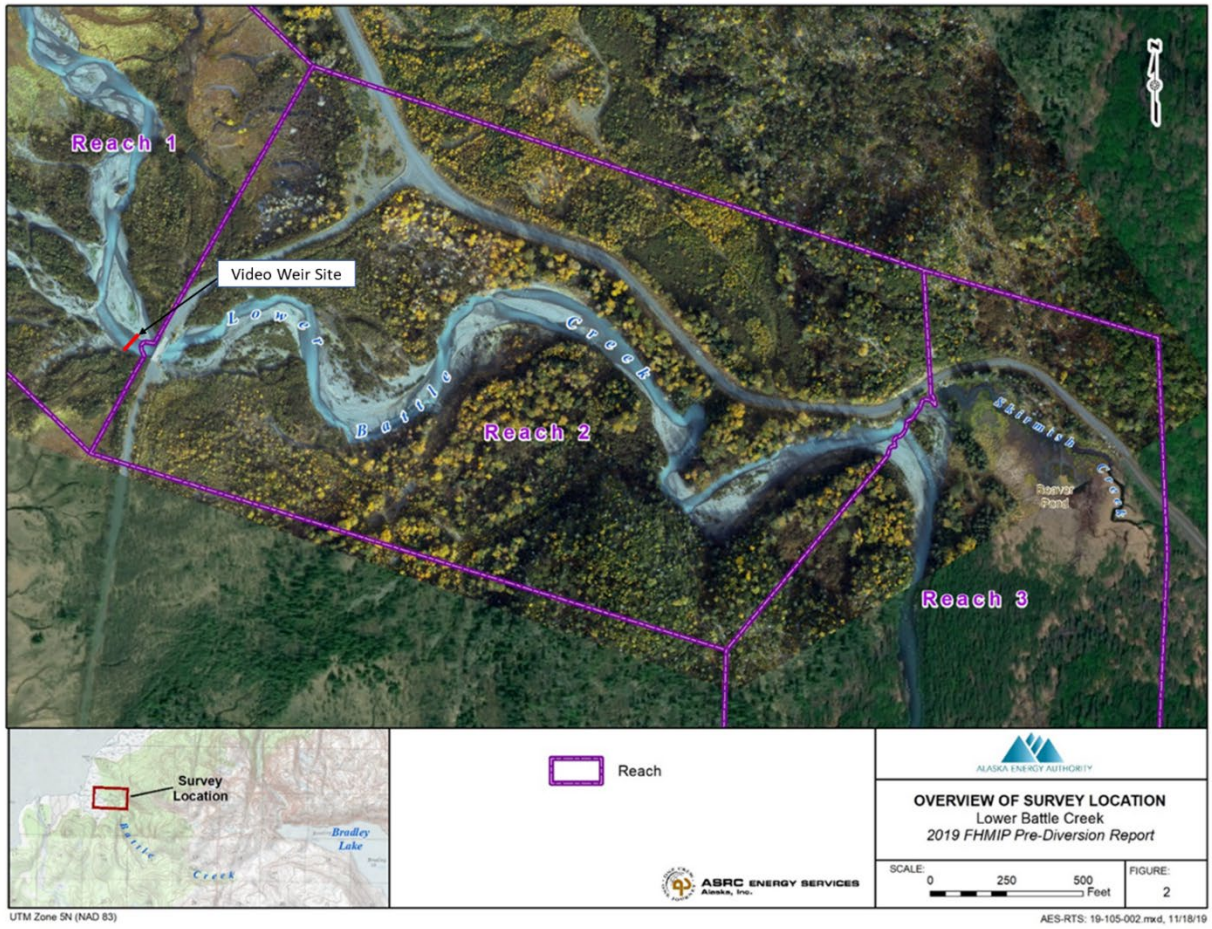

Figure 2.–Aerial imagery of lower Battle Creek, including Reaches 1, 2, and 3 (downstream to upstream), and the weir site (AEA 2020).

Juvenile Salmon Assessment

In 2010, AEA began assessing the presence and distribution of juvenile salmonids in Battle Creek. Baited minnow traps and beach seining were used for capturing juvenile salmonids throughout the entire watershed. Very few juvenile salmonids were captured in uppermost Reach 3 and no juvenile salmon were captured upstream of Reach 3 (Table 2), which supports the idea that the velocity and gradient of Reaches 4 and 5 are not suitable fish habitat (Brady et al. 2012). Juvenile sampling efforts in subsequent years were focused on Reaches 1 and 2, where adequate juvenile habitat exists.

In 2010, Dolly Varden were the most prevalent species (396), followed by sticklebacks (Gasterosteidae; 117), sockeye salmon (81), and coho salmon (36). Coho salmon juveniles were caught most frequently in Reach 1 and in Skirmish Creek (Table 2). The length distribution of captured juvenile coho salmon was bimodal, with fish 80 mm or less assumed to be young of the year, and the 81–120-mm size category assumed to be age 1+ fish (HDR 2011). Sockeye salmon juveniles were only captured with the beach seine method in Skirmish Creek and in slow water pools in Reach 2.

Table 2.–Juvenile sampling results from Battle Creek in 2010, 2018, 2020, and 2021.

Year	Month	Area	Coho salmon	Dolly Varden	Sockeye salmon	Stickleback spp.	Sculpin spp.
2010	Jul	Reach 1	11	68	3	67	
		Reach 2	1	74	0	0	1
		Reach 3	0	10	0	0	0
		Reach 4	0	0	0	0	0
		Reach 5	0	0	0	0	0
		Skirmish Creek	0	18	51	0	0
		South fork	–	–	–	–	–
		Total	12	170	54	67	1
	Aug	Reach 1	14	83	0	17	0
		Reach 2	3	33	27	6	0
		Reach 3	0	17	0	0	0
		Reach 4	0	0	0	0	0
		Reach 5	–	–	–	–	–
		Skirmish Creek	20	29	0	26	1
		South fork	–	–	–	–	–
		Total	37	162	27	49	1
	Sep	Reach 1	2	22	0	1	0
		Reach 2	0	10	0	0	0
		Reach 3	2	23	0	0	0
		Reach 4	–	–	–	–	–
		Reach 5	–	–	–	–	–
		Skirmish Creek	–	–	–	–	–
		South Fork	0	9	0	0	0
		Total	4	64	0	1	0
2018	Oct	Reach 1	15	28	0	144	0
		Reach 2	37	497	0	1	1
		Skirmish Creek	38	276	0	0	1
		Total	90	801	0	145	2
2020	Oct	Reach 1	67	119	0	57	1
		Reach 2	85	254	0	0	10
		Skirmish Creek	34	313	0	2	1
		Total	186	686	0	59	12
2021	Oct	Reach 1	43	19	0	116	0
		Reach 2	160	274	0	1	12
		Skirmish Creek	125	0	0	22	0
		Total	328	293	0	139	12

Source: Brady et al. 2012; AEA 2021; AEA 2022.

Note: An en dash means not sampled.

Juvenile sampling was conducted again in 2018, 2020, and 2021 in Reaches 1 and 2 using baited minnow traps. Overall, coho salmon CPUE increased over the 3 years (1.78, 4.30, and 6.96, respectively), whereas Dolly Varden CPUE declined over the same period (AEA 2022). In 2019, a total of 801 juvenile Dolly Varden and 90 juvenile coho salmon were captured from both reaches (AEA 2019b). Dolly Varden were again the most numerous juvenile species caught, with a total of 686 captured from both reaches; a total of 186 juvenile coho salmon were captured as well (AEA 2020). In 2021, a total of 329 juvenile coho salmon and 295 Dolly Varden were captured (AEA 2022).

OBJECTIVES

PRIMARY OBJECTIVES

1) Census the coho salmon escapement upstream of RKM 1.7 in Battle Creek from 1 September through 15 October.
2) Estimate the catch per unit effort (CPUE) of juvenile coho salmon between RKM 1.7 and 2.9 (Reach 2) of Battle Creek such that a 40 percent change in CPUE between years can be detected at the significance level of $\alpha = 0.1$.

SECONDARY OBJECTIVES

1) Conduct foot surveys in Lower Battle Creek to provide weekly and annual index counts of adult salmon in a manner comparable to previous surveys.
2) Conduct a beach seine survey in Battle Creek to assess if adult coho salmon passed the weir site prior to video monitoring.
3) Document the occurrence of juvenile salmonids between RKM 0.0 and 2.9 (Reach 1 and 2) of Battle Creek.
4) Determine the cumulative run timing of the coho salmon run in Battle Creek.

METHODS

ADULT COHO SALMON ESCAPEMENT MONITORING

There will be 2 components to coho salmon escapement monitoring: video weir counts and foot survey counts. The coho salmon escapement will be primarily counted with a video weir located at the Martin River Access Road bridge (RKM 1.7; Figure 3). The weir will be operated from 1 September until 15 October. These operation dates were chosen after observing peak coho salmon run timing on 29 September 2021 via sonar weir operation and from beach seine surveys detecting coho salmon in the stream in late August. A beach seine survey will be conducted upstream of the weir at the time it is installed to assess if any coho salmon have already migrated upstream. A weekly foot survey will also be conducted in Reach 2 throughout weir operation.

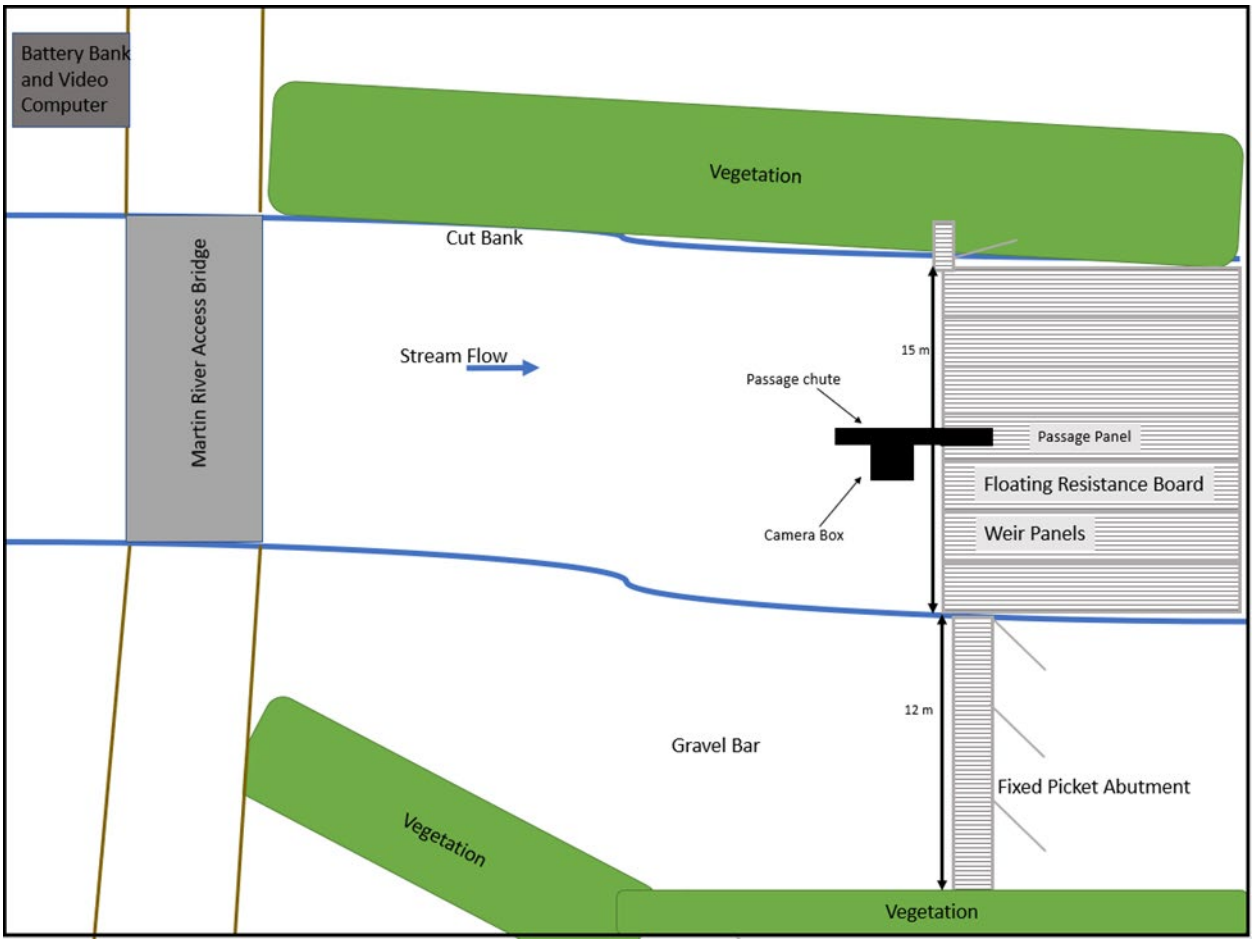

Figure 3.–Location and layout of the Battle Creek video weir in 2022.

Video Weir Operation

Weir Design

A video weir will be installed by attaching a rail to the river-bottom substrate using upstream duckbill earth anchors pounded into the river bottom with a rock hammer. All attachment eyes on the rails will be connected to a duckbill earth anchor (Stewart 2003). The gaps between the weir pickets will be approximately 3.8 cm (about 1.5 inches) to block the passage of adult salmon. Stewart (2002) will be used as a guide for weir material construction and repairs. A fish passage chute with an underwater video system will be attached to the upstream edge of the weir at the most optimal site for both fish passage and camera box placement (Figure 3).

The underwater video system is composed of an underwater camera mounted in a sealed box (camera box), fish passage chute, 12 V DC power system, and video recording system. The camera box is roughly 80 cm by 90 cm and is constructed with 3.2 mm aluminum. The camera mounts in the rear and at the bottom of the camera box and is pointed towards the front through the 45 cm by 80 cm and 9.5 mm thick safety glass. At least 6 LED lights will be installed within the camera box for consistent illumination throughout the day. After the camera and lights are installed, the camera box will be filled with dechlorinated tap water through a hatch for increased video quality, protection from silt, and to maintain negative buoyancy. The hatch is located on the top of the box

above the camera and sealed with a rubber gasket and bolts to prevent any river water from entering the box. A small amount of algaecide will be added to the water to help prevent algae growth inside the box. The camera and light cords are fed through a sealed tube on top of the camera box that extends well above the water line.

The camera box attaches to the fish passage chute by fitting into welded pins. The fish passage chute is roughly 1 m long, has a removable lid to block out most light, and restricts passage down to roughly 13 cm. The fish passage chute is attached to a fence that sits against the rail on the substrate and has an opening that aligns with the opening at the upstream end of the floating fish passage chute panel. The passage chute is attached to the fence by threading half inch metal rods through sleeve fittings on the chute and fence. The removable lid on the passage chute allows the outside of the camera box glass and the inside of the fish passage chute to be cleaned.

Operation

All video images will be recorded on a 2-terabyte internal hard drive that is specialized for recording video at 30 frames-per-second. Motion detection software provided by the DVR manufacturer will be used to record video on 3 channels. One channel will only record motion triggers, a second channel will record the full 0300 hour, and the third channel will record video 24 hours each day. To minimize the amount of blank video footage and review time, the motion detection software will be used to customize the areas of the frame that trigger motion.

A MiFi portable router will be used to create a wireless internet connection and allow remote access to the computer via the GoToMyPC program for remote check-ins and video data review. Remote access to the computer will also allow crew to monitor the physical condition of the weir via a security camera feed that will run on a fourth DVR channel. All motion-triggered video and the full 0300-hour video will be uploaded to a cloud-based service, such as Microsoft OneDrive, each day so the files can be reviewed at the Homer office. The computer used for most of the video review will be programmed to automatically sync all video from the Battle Creek weir via the cloud.

Data Collection

The full 0300 hour and the 0300 hour of just motion triggers will be the first video footage reviewed daily. Accumulated motion triggers will be examined for the hour and compared to the actual number of fish observed during the full hour. In the event a coho salmon did not create a motion trigger during that hour, the technician will immediately alter the motion trigger detection areas and (or) sensitivity in the DVR software to remedy the problem. Then, the technician will discuss with their crew and project leaders which additional hours may require review of the full record footage. After reviewing the 0300-hour full record and motion files, all motion-recorded files will be reviewed sequentially, beginning with the 0000 hour.

The DVR software Remote ViewLog has numerous file review features that assist in identification and counting of passing fish. The image can be played forwards or backwards at various speeds or paused and zoomed to assist in counting or species identification. Coho salmon counts will be tallied hourly. All other species counts will be tallied as daily totals.

All escapement counts will be collected on video data sheets (Appendix A1) and then entered in the Access database using the data entry structure detailed in Appendix B1. Daily fish counts will be summarized in the database and will also be summarized in season automatically using a database query. During each new shift, crewmembers will review the data collected during the

prior shift for completeness. Postseason, all data will be imported into a master Access database at the Homer office.

To prevent data loss, the DVR software will be set to record video files to a folder synced to upload to Microsoft OneDrive. The folder will be located on an internal hard drive that is formatted to accommodate constant recording of video files. In the event of a software or cloud malfunction, the video files will be available on the internal hard drive and the motion-detected video files will be available on both the cloud and the internal hard drive. Recording video to 2 locations should significantly reduce the possibility of video data loss.

Homer ADF&G staff will visit the weir once per week or more if water conditions necessitate. During weir visits, Homer staff will clean the weir and camera box glass, run the generator if needed, and perform other maintenance on the gear as needed, including generator maintenance. During weir visits, Homer staff will also conduct foot surveys to visually count adult coho salmon (see *Foot Surveys* section below).

Interpolating Video Counts

If any video files are lost, unusable, or not recorded, the missing period will be documented in the Access field database in the "missing video" table. The table will be referenced inseason and postseason to determine if interpolation is needed. This table is very important because it is difficult to discern which periods of video were not recorded without detailed notes.

In the event interpolation is required for 1–2 consecutive hours of video files, 2 countable hours, 1 immediately before and 1 following the uncounted period will be counted completely (i.e., the full 60 minutes of each of the 2 hours will be counted) to help mitigate any increased variance or bias that the interpolation incurred. Interpolated full-hour counts for hour j (24-hour system) will be made according to the following:

$$\hat{I}_j = C_k + \left[\frac{C_m - C_k}{m - k}\right][j - k] \qquad (1)$$

where

C_x = count in hour x, where x is either m or k,

k = last full hour (24-hour system, e.g., 1500) for which a count is available ($j > k$),

m = next full hour (e,g, 1700) for which a count is available ($j < m$).

It is likely this method will be used rarely because short periods of missing video (such as 1–2 hours) may often not require interpolation. However, if it is determined that the short missing period was in the middle of a period of high fish passage, then this method may be appropriate.

Should data be missing for 3 hours or more, such that diel timing begins to affect the interpolation, then the counts from the same time of day on the day prior and day after the day in which the missing period occurs will be used. For example, if the missing data are from 0300 through 1100 hours on Tuesday, then the missing data will be interpolated as the average of the counts from 0300 through 1100 hours from Monday and Wednesday. Other factors may be taken into consideration to produce the most accurate interpolation, including rising or falling stream levels, tidal influence, and water temperatures.

Finalizing Escapement Data

As the season progresses, weir crew and crew leaders will proof the datasheets against the field database. When mistakes are found, they will be modified in the field database immediately. This will help keep the records of the counts consistent and reduce confusion.

Postseason, the counts will be imported into the master Access database at the Homer office. Counts will be further proofed by hourly totals.

Beach Seine Survey

A beach seine survey will be used to assess whether adult coho salmon passed upstream of the weir site prior to operation. The seine will only be deployed in pools that are possible to set the net in. The pool at the Martin River Access Road bridge is the most easily seined pool in Reach 1 and Reach 2 and will be used for an initial assessment of the presence of other species in the stream. If it is suspected that coho salmon are upstream of the weir at the install date but are holding in water that a beach seine cannot be set in, other methods such as hook-and-line sampling may be explored. If it's determined that coho salmon passed the weir site prior to installation, the operation date may be adjusted earlier for future years.

Survey Methods and Data Collection

Prior to deploying the beach seine from the raft, crew members will be assigned tasks so that the sampling occurs efficiently once the net is set. One crew member will be designated to record data onto data sheets (Appendix A2) and secure the net on the beach while other crew members work up the fish. The remaining crew will work to quickly process fish out of the net. Two to 3 crew members wearing dry suits will work the beach seine through pools (Figure 4).

As crew members work quickly to process fish out of the net, fish will not be removed from the water unless necessary. Each fish captured in the seine will be identified by species and recorded on the data sheet. A crew member will give the caudal fin a clip on the upper lobe so that the fish will not be counted a second time if it is recaptured.

Finalizing Survey Data

The raw beach seine survey data will be entered into an Excel spreadsheet saved on Microsoft OneDrive. Data entry will occur within 1 week of a sampling event. These data will be proofed to match data sheets, and then summarized in table form for a final report.

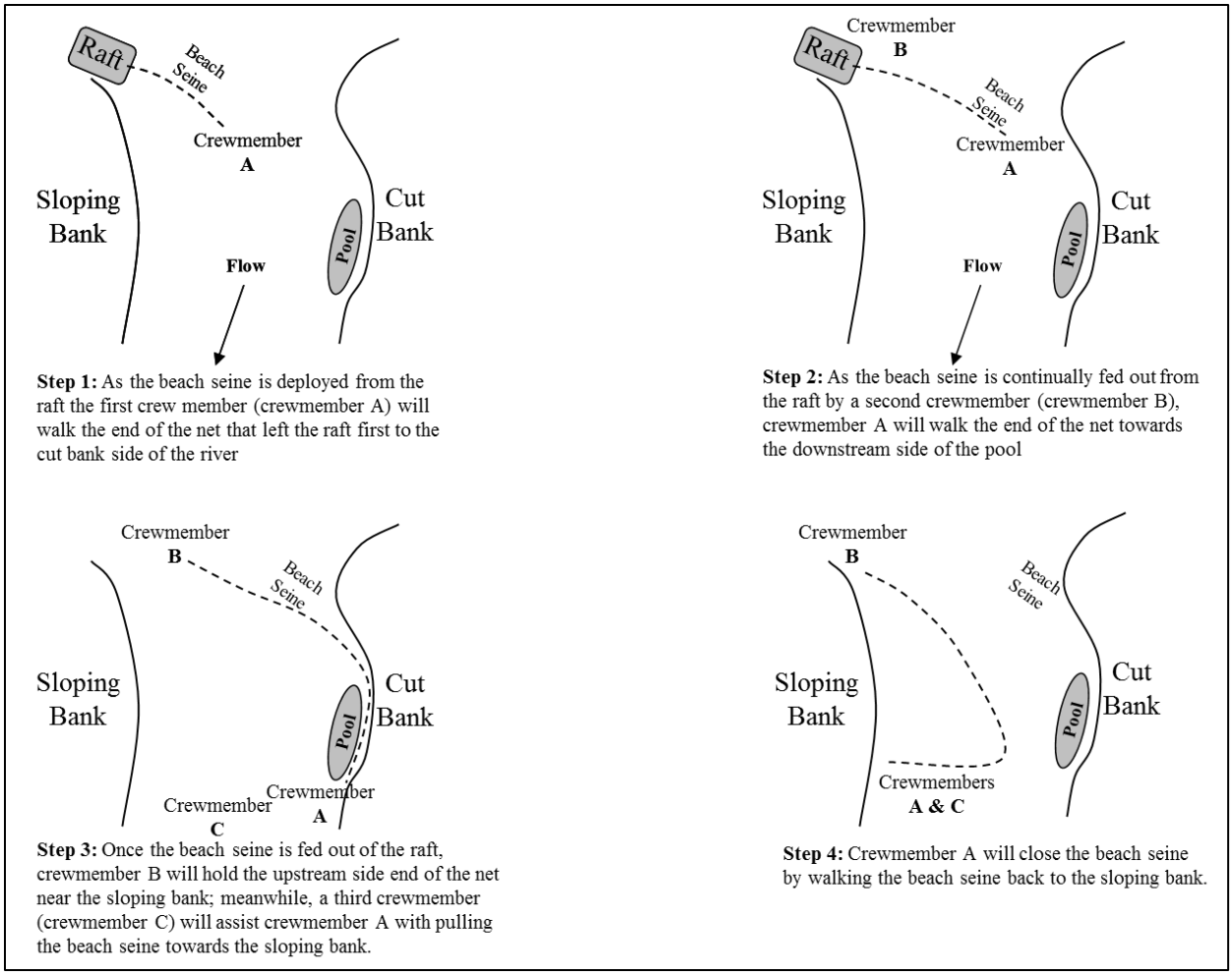

Figure 4.–Beach seining method for sampling Battle Creek.

Foot Surveys

Foot surveys to visually count adult coho salmon will be conducted when ADF&G SF staff are on site once per week. The surveys will follow the same methods that were used in previous years so that the counts are comparable. The objective of the foot surveys in past years was to provide weekly and annual index counts of spawning adult salmon and document active redd numbers in Reach 2 of Battle Creek (AEA 2021).

Survey Methods and Data Collection

Surveys will be conducted from the beginning of September to mid-October or until weir operation ceases. ADF&G SF staff will begin the foot surveys at the Martin River Access Road bridge (Figure 5) and continue upstream to the confluence of Skirmish Creek. The lower portion of Skirmish Creek, from the mouth upstream to the Bradley Lake Access Road bridge, will also be surveyed. Wind, rain, and flow from the U. S. Geological Survey gage will be evaluated prior to each foot survey to decide whether the survey will be conducted; surveys will only be conducted with the best visibility conditions.

ADF&G SF staff will wear polarized glasses to maximize fish viewing ability and will look for live fish, carcasses, and active redds. Observed adult salmon will be identified to species, counted,

and a GPS location will be taken (Appendix A3). Water clarity will also be measured with a 20 cm Secchi disk at 4 locations along the survey, which will be used as a relative measure of fish visibility. The Secchi disk will be lowered in the water column until it is no longer visible. The Secchi measurement will be recorded as the average of 2 depths: the depth the disk is no longer visible as it is lowered into the water and the depth it first becomes visible as it is raised in the water. If the disk is visible on the stream bottom, then the two recorded depths will be the same. The 4 locations for the Secchi disk measurements are as follows (Figure 5):

1. Boundary of Reach 1 and 2 (downstream end of Reach 2)
2. Midstream sampling location (59°45′45″N, 150°57′55″W)
3. Boundary of Reach 2 and 3 (upstream end of Reach 2)
4. Skirmish Creek at inlet to beaver pond

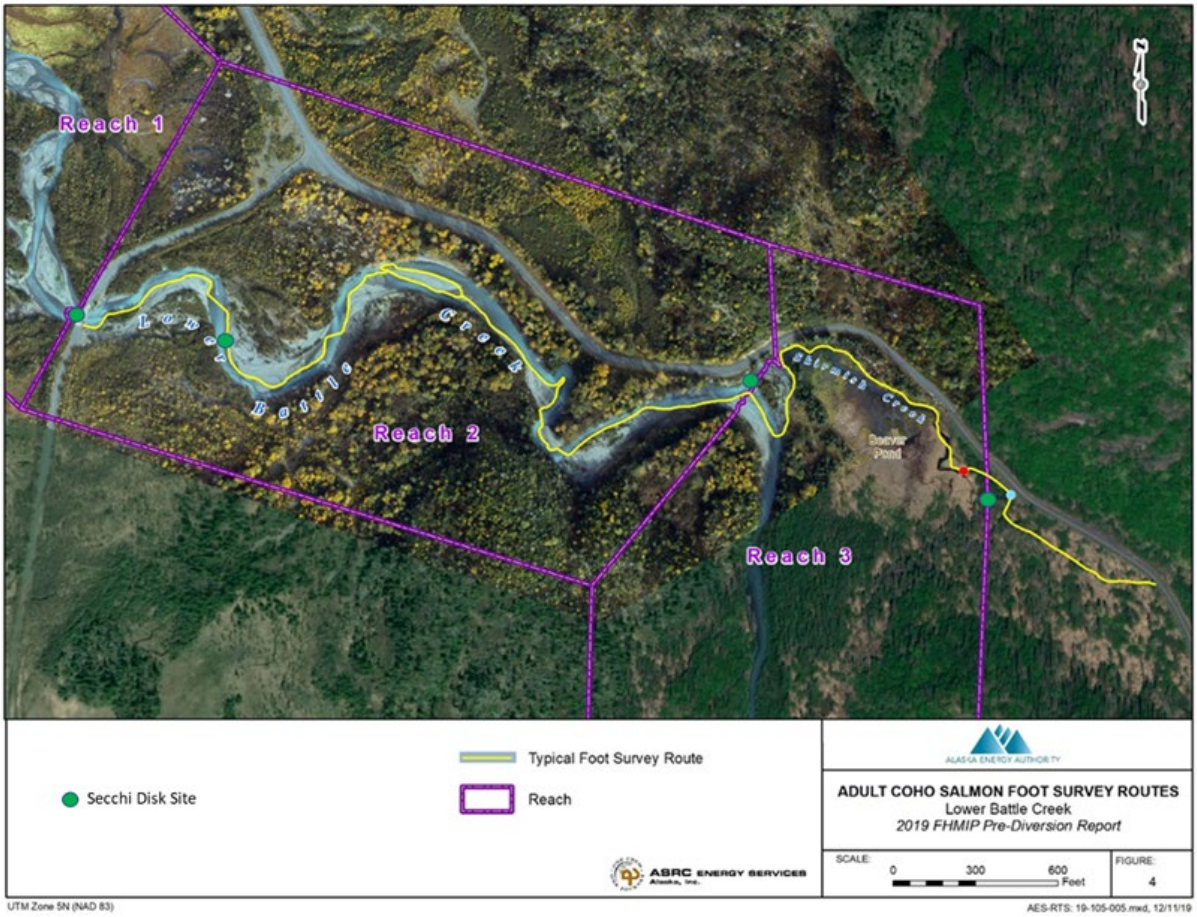

Figure 5.–Foot survey route (yellow line) and Secchi disk sampling locations (green dots) in Battle Creek (AEA 2020).

JUVENILE SAMPLING

Juvenile sampling will be conducted to fulfill FERC's order (FERC 2016) and ADF&G Section 10(j) Recommendation (ADF&G 2015) in the FHMIP:

> *1) relative numbers and species of juvenile salmon must be documented to assess spawning success pre- and post-diversion by confirming that recruitment is occurring; and*

2) document the occurrence of salmon species other than coho salmon.

This will be done by sampling juveniles with the same methods that were used by AEA to complete the pre- and postdiversion juvenile sampling in previous years. Methods used in previous years must be followed as closely as possible to produce results that are comparable between years. Sampling in Reach 1 will be conducted to document the species and distribution of juvenile salmonids in that area of stream. Sampling in Reach 2 will be conducted to also estimate catch-per-unit-effort of juvenile coho salmon in that stream section, as well as document the distribution and catch-per-unit-effort of other juvenile salmonid species.

Sample Size

The number of traps needed to detect a change in catch-per-unit effort (CPUE) as an index of juvenile abundance was estimated by conducting a power analysis (AEA 2021). These methods are cited from the *Lower Battle Creek Fish and Habitat Management Implementation Plan Final 2020 Post-Diversion Interim Annual Report* (AEA 2021). Reach 2 is a relatively small area of stream, and the need to detect change in CPUE must be balanced with appropriate sampling effort in a small area. The ability to detect a 40% change in mean log(CPUE) was determined to be sufficient power for this analysis, meaning approximately 28 traps set in Reach 2 is adequate. A normal distribution on the logarithmic transformation of the 2010 and 2011 coho salmon minnow trapping data was used to determine this sample size as follows (AEA 2021):

$$n = 2(z_a + z_\beta)^2 \left(\frac{s^2}{(\text{CPUE} \times d)^2}\right) \quad (2)$$

where

n = number of samples (traps) needed

z_a = 1.28 (significance level $\alpha = 10\%$ [Snedecor and Cochran 1989])

z_β = 0.84 ($\beta = 20\%$, power = 80% [Snedecor and Cochran 1989])

s = standard deviation = 0.4296 (logarithmic transformation fish/24 hours [ADF&G Fish Collection Report for Brady et al. [2012])

$CPUE$ = 0.6128 (logarithmic transformation of fish/24 hours [ADF&G Fish Collection Report for Brady et al. [2012]

d = level to detect a change in (CPUE)

Various levels of confidence (d) were calculated based on this analysis:

20 percent change with 110 traps
30 percent change with 49 traps
40 percent change with 28 traps
50 percent change with 18 traps

Sampling and Data Collection

Juvenile salmonid sampling will be conducted in Reaches 1 and 2 of Battle Creek, beginning at RKM 0.0 and continuing into Skirmish Creek at RKM 2.9. Reach 2 is identified as the primary focus of juvenile sampling effort because it includes the most juvenile salmonid habitat. The FHMIP stipulates that the trapping of juvenile salmon in Reach 2 and Skirmish Creek be used to develop an index of juvenile coho salmon abundance and to document the use and availability of

side-channel habitat to juvenile salmonids. Juvenile trapping in Reach 1 is to be used to document species distribution and the use of Reach 1 main- and off-channel areas by juvenile salmonids.

Because standardized sampling methods across all years is critical for comparison of relative abundance, the minnow traps will be set in the same locations as previous years, to the extent practicable (Figure 6). Sampling will occur when the flows are at 75 cfs or less and will be delayed if a storm event has created higher flows or poor water clarity.

Minnow traps baited with cured salmon roe will be fished in Reach 1 and 2 of Battle Creek in mid-October, which is when flows are most likely to reach the target of 75 cfs or less. Traps will be placed in the stream overnight so that they all have an approximate 20–24 h soak time.

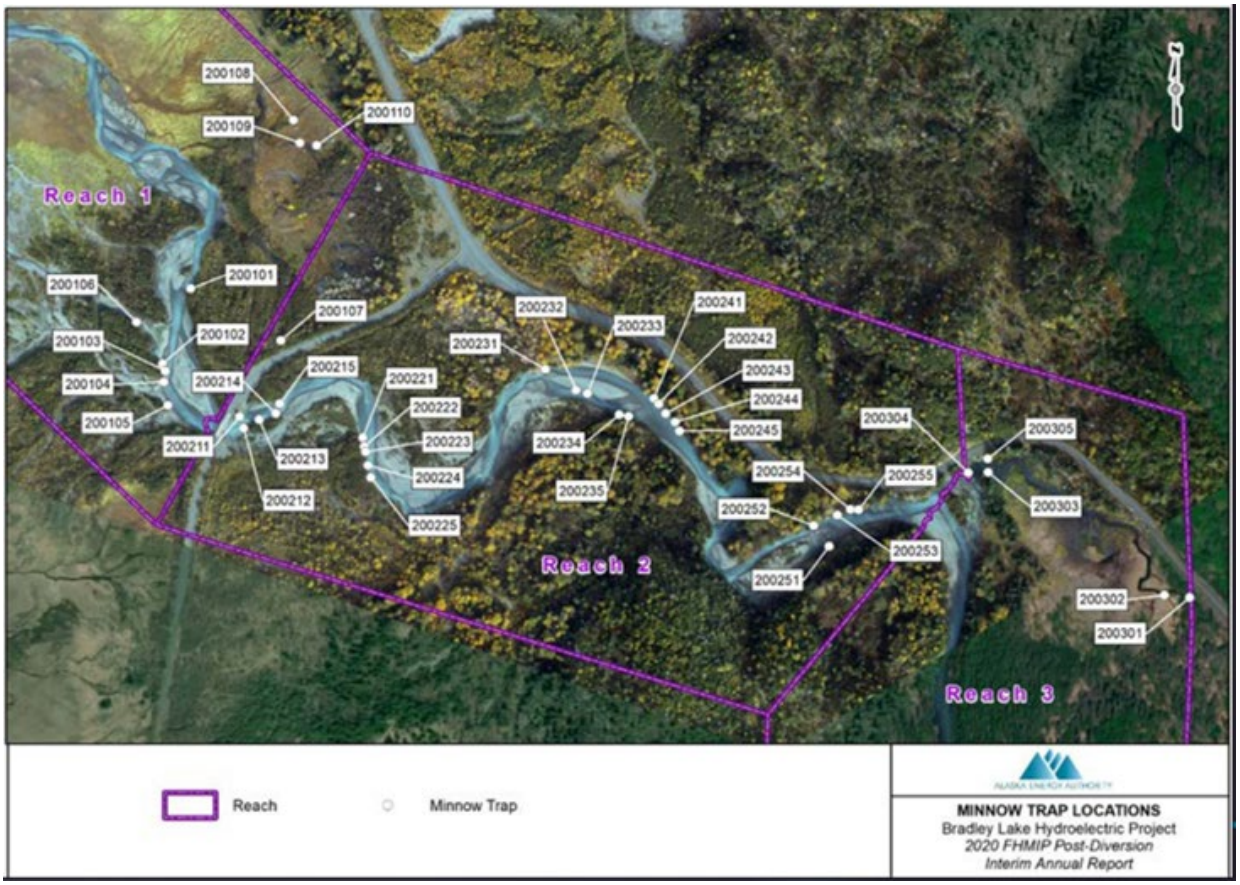

Figure 6.–Locations of baited minnow traps for juvenile sampling in Reaches 1 and 2 (AEA 2020).

A total of 10 traps will be deployed in Reach 1. Five will be set in in the mainstem and 5 in off-channel habitats (Figure 6). In Reach 2, a total of 30 traps will be set in 6 groups of 5 (the sixth group of 5 is not shown in Figure 6). Each trap will be placed in habitat suitable for holding juvenile salmon as close as possible to the previous locations used (Figure 6). Each group of 5 will cover a length of stream approximately 50 m long, and the traps within that group will be approximately 9–18 m apart from each other. Five additional traps will be placed in Skirmish Creek.

Each trap will have several rocks placed inside it to weight the trap and provide cover for trapped juvenile salmon. Each trap will have a piece of bright parachute cord tied to it to attach it to a nearby fixed object. After placing each trap, GPS coordinates will be recorded as well as the time each trap was deployed and the water depth (Appendix A4).

After the soak time, captured fish from each minnow trap will be placed in a 5-gallon bucket and processed. Each fish will be identified and fork length (or total length as appropriate; Appendix A5) will be measured to the nearest millimeter. A photograph will be taken of representative captured fish species to confirm identification.

Finalizing Data

The juvenile sampling data will be entered into an Excel spreadsheet and proofed to match the field data sheets. Photos, GPS coordinates, and species and length data will all be matched and proofed.

DATA ANALYSIS

Coho Salmon Escapement (Primary Objective 1)

The daily net upstream passage censused during video operation at RKM 1.7 on day i will be calculated as the sum of hourly upstream counts minus the sum of hourly downstream counts:

$$n_i = \sum_{j=1}^{24} (u_{ij} - d_{ij}) \tag{3}$$

where u_{ij} is the upstream count for the period counted in hour j within day i, and d_{ij} is the downstream count for the period counted in hour j within day i.

The annual count for the period covered by the video weir will be calculated as the sum of the daily counts:

$$N = \sum_{i=1}^{L} n_i \tag{4}$$

where L is the number of days in the season covered by the video weir counting process.

Catch-Per-Unit-Effort of Juvenile Salmon (Primary Objective 2)

Catch per unit effort (CPUE) will be used to index the abundance of juvenile salmonids.

$$\widehat{CPUE}_k = \frac{\sum_{l=1}^{L_k} c_{kl}}{\sum_{l=1}^{L_k} e_{kl}} \tag{5}$$

with variance

$$\text{var}\left(\widehat{CPUE}_k\right) = \frac{\sum_{l}^{L_k} \left(c_{kl} - \widehat{CPUE}_k e_{kl}\right)^2}{\overline{e_k}^2 L_k (L_k - 1)} \tag{6}$$

where

c_{kl} = number of fish caught in the lth minnow trap at location k,

e_{kl} = unit of effort in hours of lth minnow trap deployed in the water at location k,

$\overline{e_k}$ = the mean of e_{kl} across all sets of minnow traps l on at location k;

L_k = the total number of minnow traps set at location k.

To detect change in CPUE over time, the CPUE data will need to be evaluated for a normal distribution. However, CPUE data from minnow traps are frequently not normally distributed (Wayne and Fabrizio 2007). If the data are not normally distributed, a Kruskal-Wallis test ($\alpha = 10$) will be appropriate to compare the means of the distribution of each year's CPUE data (AEA 2019b). A significant result from this test would indicate at least 1 year's population is not like the others, and additional analyses would be conducted to illustrate the trend.

CUMULATIVE RUN TIMING (SECONDARY OBJECTIVE 4)

The cumulative percent of the escapement will be used to determine run timing of coho salmon by using the daily escapement count by date over the cumulative escapement count.

SCHEDULE AND DELIVERABLES

Results of this study will be reported by ADF&G SF to the Alaska Energy Authority and published in a final report to the Federal Energy Regulatory Commission to fulfill the Fish and Habitat Management Implementation Plan. The FHMIP report is also provided to ADF&G.

Dates	Activity
20 July–31 August	Move weir materials, build weir.
1 September–15 October	Weir operation
September and October	Conduct approximately weekly foot surveys to visually count adult coho salmon.
Mid-October	Conduct juvenile sampling.
Mid-October	Remove weir and transport materials.
Mid-November–December	Prepare final report.

RESPONSIBILITIES

Holly Dickson, Fishery Biologist II, Project Supervisor
Duties: Manages budget and overall project supervision. Writes project operational plan and supervises daily activities of field crews and data management. Hires seasonal field staff. Coordinates crew schedules as needed with the project field leader. Participates in field activities and supervises the installation and removal of the video weir, beach seine surveys, foot surveys, and juvenile sampling. Assists with weekly maintenance of the weir. Conducts data analyses and summarizes results. Prepares final report.

Mike Booz, Fishery Biologist III, Project Supervisor
Duties: Assists with overall project supervision. Collects timesheets and leave slips for submission. Assists with installations, removals, beach seine surveys, foot surveys, and juvenile sampling. Makes discretionary decisions concerning safety, methodology, and collection of field samples. Reviews final report.

Danielle Siegert Fishery Biologist I, Project Field Leader
Duties: Works under the supervision of the project leader and supervisor. Responsible for leading technicians with the daily operation video weir and processing files. Troubleshoots computer system, instructs field crew, procures equipment, and assists with leading the installation of the weir, beach seine surveys, foot surveys, and juvenile sampling. Leads weekly maintenance of the weir. Ensures data are collected and recorded as outlined in the operational plan. Ensures data are reviewed for completeness and error checking in season. Coordinates weir crew schedules and

communicates field needs with project supervisor and leader. Conducts data analyses and summarizes results.

Eli Wilson and Alissa Cole, Fishery Technician III
Duties: Works under the general supervision of the project leaders and field leader. Supports the crew with daily video weir operation. Assists with the installation, operation, and removal of the weir; beach seine surveys; foot surveys; juvenile sampling; and counting video files. Assists with finalizing data after the season has ended and finalizing report edits.

Sara Faris and Alexis Bobbitt, Fishery Technician IIs
Duties: Works under the general supervision of the project leader. Responsible for counting video files. Collects and records data as outlined in the operational plan. Assists with weekly weir maintenance, weir installation and removal, beach seine surveys, foot surveys, and juvenile sampling.

Logan Wendling, Biometrician I
Duties: Provides technical assistance with statistical procedures and sample designs. Reviews and recommends procedures for data analysis.

BUDGET SUMMARY

Projected costs for FY2023. Funding to operate this project is provided to ADF&G, SF through an RSA from AEA.

Line item	Category	Budget ($K)
100	Personal Services	60.1
200	Travel	0.0
300	Contractual	2.2
400	Commodities	3.0
500	Equipment	0.0
Total		65.3

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APPENDIX A: DATA SHEETS

Appendix A2.–Data sheet for recording video counts at Battle Creek.

Video Weir Data Entry Form

Location: Battle Date: Crew:

	Coho	Sockeye	Pink	Dolly Varden	Other
0000					
0100					
0200					
0300					
0400					
0500					
0600					
0700					
0800					
0900					
1000					
1100					
1200					
1300					
1400					
1500					
1600					
1700					
1800					
1900					
2000					
2100					
2200					
2300					
Total					

3AM reviewed?

If full record needed, note which hours:_____ and when completed:_____ by:_____

Video uploaded to OneDrive? _____

Counts posted to Teams? _____

Counts entered in database & projections? _____

	Initial Check		Final Check	
	Date	Staff	Date	Staff
Sheet:				
Access:				

Appendix A3.–Data sheet for beach seine surveys at Battle Creek.

Beach Seine Data Form **Date:**

Location: **Page _____of_____**

Set #	Sampler	Species	Number of Fish	Comments

Appendix A4.–Data sheet for foot surveys at Battle Creek.

Battle Creek Foot Survey

Date _____ Crew: _____

Location	Species	# of Fish	Lat	Long	Fish Behavior	Comments

Secchi Disk Measurements

	Last visible	First non-visible	Average
Location 1			
Location 2			
Location 3			
Location 4			

% Cloud Cover: _____

Stream Height: _____

Other comments: _____

Appendix A5.–Data sheet for minnow trapping at Battle Creek.

Battle Creek Minnow Trap Datasheet						
Date:			Crew:			
Trap #	Lat	Long	Soak Start	Soak End	Habitat Type	Depth

Appendix A6.–Data sheet for juvenile sampling at Battle Creek.

Battle Creek Juvenile Sampling Datasheets				
Date:		Crew:		
Trap #	Species	Length (mm)	Type of Length(fork or total)	Picture #

APPENDIX B: DATA ENTRY

Appendix B1.– Battle Creek field database.

Fish Table		
HeaderDataTbl		
Field Name	**Data Type**	**Description**
ID	AutoNumber	Unique number assigned for each day
Date	Date/Year	
Comments	Text	Comments that would affect counts for the day, i.e. interpolations needed, or no chinook salmon counted but all video reviewed
Crew	Text	Tech on duty that day
FishDataTbl		
Hour Counted	Number	Hour the fish was counted through the weir
Year	Number	Auto filled
Date	Date/Time	Date of sampling
Hour	Number	Hour fish passed through the weir (0000 = midnight; 0100 = 1am…1200 = noon etc).
Species	Number	430=coho salmon
NoFish	Number	Number of fish counted
HourComments	Text	Notes related to the hour counted
OtherSpecies Table		
Species	Number	420=Sockeye salmon 410=Chinook salmon 440=Pink salmon 450=Chum salmon 530=Dolly Varden 540=Steelhead 541=Rainbow trout 600=Pacific lamprey 900=Unknown or other (if "900" is entered, an explanation should be included in the comments.
Date	Date/Year	Date counted
Steelhead Up	Number	Number of steelhead moving upstream
Steelhead Down	Number	Number of steelhead moving downstream
Dolly Varden	Number	Number of Dolly Varden moving upstream
Pink salmon	Number	Number of pink salmon moving upstream
Rainbow trout	Number	Number of rainbow trout moving upstream
Coho salmon	Number	Number of coho salmon moving upstream
Sockeye salmon	Number	Number of sockeye salmon moving upstream
Chum salmon	Number	Number of chum salmon moving upstream
Lamprey	Number	Number of lamprey moving upstream
Other	Number	Number of other moving upstream