Regional Operational Plan SF.1J.2014.09

Situk River Steelhead Stock Assessment, 2014–2015

by

Brian H. Marston

July 2014

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 thw e 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

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Division of Sport Fish

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The Regional Operational Plan Series was established in 2012 to archive and provide public access to operational plans for fisheries projects of the Divisions of Commercial Fisheries and Sport Fish, as per joint-divisional Operational Planning Policy. Documents in this series are planning documents that may contain raw data, preliminary data analyses and results, and describe operational aspects of fisheries projects that may not actually be implemented. All documents in this series are subject to a technical review process and receive varying degrees of regional, divisional, and biometric approval, but do not generally receive editorial review. Results from the implementation of the operational plan described in this series may be subsequently finalized and published in a different department reporting series or in the formal literature. Please contact the author if you have any questions regarding the information provided in this plan. Regional Operational Plans are available on the Internet at: http://www.adfg.alaska.gov/sf/publications/

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SIGNATURE PAGE

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Approval

Title	Name	Signature	Date
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ABSTRACT

Steelhead (*Oncorhynchus mykiss*) are an important sport fishery species in Alaska, and the Situk River hosts the state's largest steelhead sport fishery. The primary purpose of this project is to record abundance and size attributes of steelhead kelts in the Situk River. Observations of abundance and fish size are used to determine if run abundance and size of steelhead kelts is changing across time. Decreasing trends in steelhead kelt abundance or size could require changes to angling regulation in order to help ensure the sustainability of the steelhead fishery. Furthermore, kelt abundance in the Situk River is used in combination with other abundance counts of steelhead in Alaska to assess trends, both regionally and statewide, to help sustain all steelhead fisheries in the state. Additionally, scale ageing of steelhead is complicated by variable freshwater life stages and repeat spawning. The Situk River weir is also used to sample scales from known age steelhead and mortalities to help resolve this issue. Observations of fishery-related wounds are also recorded to assess potential impacts on steelhead.

Keywords: *Oncorhynchus mykiss*, Steelhead, kelt, weir, resistance board, fisheries management, remote video, passive integrated transponder.

PURPOSE

The primary purpose of this project is to record abundance and size attributes of steelhead kelts using a weir on the Situk River. Observations of abundance and fish size are used to determine if run abundance and size of steelhead kelts is changing across time. This plan covers weir operations in 2014 and 2015.

BACKGROUND

The Situk River produces the largest known annual run of steelhead (*Oncorhynchus mykiss*) in Alaska, and supports the largest steelhead sport fishery along with fisheries for five other salmonid (*Oncorhynchus sp*.) species, and char (*Salvelinus malma*). The Situk River drains three lakes and flows 35.2 km into the Gulf of Alaska southeast of the village of Yakutat; the drainage area is about 397 hectares (Figure 1). Steelhead kelts have been counted in the Situk River annually since 1988 by the Alaska Department of Fish and Game (ADF&G), and data have been gathered since 1948 by various other agencies (Bain et al. 2003). Despite restrictive regulations that limit harvest to 2 fish per year over 36 inches, the Situk River steelhead fishery has continued to attract a large number of anglers, many of whom voluntarily practice catch-and-release fishing. Estimates from the Statewide Harvest Survey (SWHS) show that recent catches of steelhead in the Situk River are variable (5,600–16,000), while harvest remains very low (Table 1; Jennings et al. 2010).

Steelhead kelt abundance counts from the Situk River help monitor stock status in light of the intensive sport fishery. The data from this stream are also used as part of an overall regionwide steelhead abundance indexing program. Steelhead abundance in the Situk River is indexed annually by counting downstream migrating steelhead kelts as they pass a weir in the lower river after spawning. A "resistance board" weir was first installed in 1995 after more traditional weirs failed in previous years during periods of high stream flows. The weir was further modified in 1997 and 1998 to improve capture and holding capabilities (Johnson and Jones 1998, 1999), and a video system was installed in 2002 that allowed fish to be counted from a remote station (i.e., cabin). This video system allows unimpeded fish passage through the weir, and helps ease the labor required to obtain sampling goals.

Figure 1.–Location of weir to be used to count emigrating steelhead from the Situk River drainage, Southeast Alaska, 2014-2015.

Downstream counts of steelhead kelts emigrating from the Situk River from 2004 to 2013 (Table 1) have varied from 4,864 to 15,003 fish (average = 9,194). The peak count occurred in 2006, and the low count in 2012. The 2013 count totaled 7,533 kelts and was below average. Like 2012, the 2013 counts of steelhead were hampered by record winter snowfalls that melted abruptly in May, which produced record stream flows that delayed weir installation by approximately 10 days, as well as limiting the effectiveness of counting. The results in 2013 should be seen as a minimum count.

Table 1.–Steelhead catch, harvest, and kelt counts on Situk River in Southeast Alaska, 2004–2013.

Year	SWHS catch	SWHS harvest	Weir kelt count
2004	7,811	0	12,462
2005	14,301	0	12,265
2006	10,592	0	15,003
2007	11,844	0	12,438
2008	16,418	53	7,312
2009	5,947	26	7,302
2010	5,630	0	5,335
2011	6,075	0	7,424
2012	10,611	87	4,864
2013	– [a]	– [a]	7,533

Note: SWHS = Statewide Harvest Survey;

[a] Not available at time of publication.

Aging steelhead from scale patterns is problematic due to difficulties determining estuary versus saltwater growth, complexities as a result of repeated spawning events, and split-differential (fall and spring) migration timing. No known-age validation of steelhead scales exists (Bain et al. 2003). The ability to accurately estimate the saltwater age of Situk River steelhead from scale samples is important, and may eventually provide data necessary to reconstruct the age composition of prior returns. Verification of our aging techniques will be enhanced greatly by collecting scale samples from known-age increment (changes in scale pattern between 2 known reference points, i.e., initial capture and recapture) steelhead.

The Situk River weir is a fish capturing platform. Fish are trapped with a box trap behind the weir that can be remotely closed. Age-sex-length (ASL) information is collected from steelhead kelts captured with this trap. These data are used to monitor the size attributes of the Situk River steelhead stock, and to compare to other steelhead populations in the region that may have different management strategies. An antenna mounted at the trap entrance is also used to detect fish tagged with passive integrated transponder (PIT) tags, which allows the capture and sampling of known-age increment fish. Passive integrated transponder tags were injected into a subsample of kelts from 2000 to 2011 with the objective that these fish would be captured in subsequent years, thus providing a second scale sample from the same fish after a known number of years. The uniquely numbered PIT tags allow the collection and analysis of a sample of known-age scales with the objectives of improving scale aging techniques and population modeling. To date (through 2013), a total of 829 steelhead have been PIT tagged, and 82 have been recaptured for a second scale sample.

The Situk River steelhead weir will be operated in 2014 and 2015 to count emigrating steelhead kelts; sample and measure fish to estimate sex and length composition; detect PIT tags; and sample scales from fish (all PIT recaptures) for archiving.

OBJECTIVES

PRIMARY OBJECTIVES

1. Count steelhead kelts emigrating through the Situk River weir.
2. Detect and capture previously PIT-tagged steelhead kelts, and sample each recaptured fish for sex, length (fork length (FL) and total length (TL) to nearest 5 mm), and scales.
3. Estimate the length composition per each sex of steelhead kelts emigrating past the Situk River weir such that the estimated proportions are within 0.075 of the true values 95% of the time.

SECONDARY OBJECTIVES

1) Sample steelhead mortalities (collected from the stream and weir, or provided by anglers) for scales and otoliths so that ages determined from scale pattern analysis can be compared to ages determined by reading otoliths.

2) Develop a database of scale images collected from recaptured PIT-tagged fish during successive years to document changes in scale structure over time. Information gained from these known-increment steelhead scales will provide insights that can improve aging techniques for scales collected on the Situk River and possibly throughout Southeast Alaska. This information will also contribute to what was learned from a research project on Sitkoh Creek that collected known-age increment steelhead scales. Collectively these two projects should improve the ability to decipher life history information from steelhead scale patterns.

3) Collect observations of scarring on immigrant and emigrant steelhead trout to determine effects of subsistence, commercial, and sport fishing activities on adult steelhead returning to the Situk River.

METHODS

STUDY DESIGN

Steelhead Kelt Weir

A “resistance board” weir (Figure 2) will be constructed on the Situk River approximately 2.4 km (1.5 miles) upstream from salt water and will be functional for fish passage by early May in 2014 and 2015. Prior to installation of the weir, the kelt outmigration will be monitored with periodic boat counts beginning on April 1, or as soon as ice conditions allow, to ensure the outmigration is not occurring early. The weir will be operated to capture and count steelhead kelts migrating downstream until approximately June 10, when the weir will be reconfigured to count immigrating salmon. Average run timing from past years indicates that normal kelt emigration timing is between early May and early June (Johnson and Jones 1998–2001, 2003; Marston et al. 2012), although this can be variable. The weir will be attended 24 hours per day and all emigrant steelhead will be visually counted passing through the weir with the aid of an underwater video system (Primary Objective 1); if any steelhead immigrants are observed passing upstream they will also be recorded. Additionally, after June 10, migrant steelhead will continue to be recorded and sampled as necessary by ADF&G, Division of Commercial Fisheries personnel until the weir is dismantled in mid August.

Figure 2.–Situk weir trap box section in center with trap gates (A and B) and sampling platform (tent). The sloped resistance board section (left of trap) floats at the surface and allows water flows and boats to pass through weir. The direction of stream flow is downstream, from top to bottom of photo.

Fish will be counted primarily between the hours of 2200 and 0300 hours (Alaska Daylight time). This time frame matches the peak emigration timing seen in past years (Johnson and Jones 1998–2001, 2003; Marston et al. 2012). During other hours the weir gate is closed so fish cannot pass, but weir attendants will open the weir gate and begin counting if fish buildup occurs.

The underwater video camera system (first used in 2002; Ocean Systems™ Deep Blue[1]) will be used to count fish in a climate protected viewing area, and to avoid delaying downstream or upstream passage of fish. As fish pass through the weir gate, they will be recorded by the underwater camera and projected to a screen, where they will be counted by observers in the counting cabin on the eastern shore. In this way, observers are in a protected viewing environment that is not hindered by rain or wind, and can accurately count fish as they pass the

[1] This and subsequent product names are included for a complete description of the process and do not constitute product endorsement.

weir. The low light requirements of the black and white camera and the absence of personnel on the weir have also markedly reduced the trap shyness exhibited by steelhead during previous years (Bob Johnson, former ADF&G Yakutat Area Management Biologist, personal observation). The camera head will be positioned to observe the entire trap opening. If any part of the opening becomes obscured from camera view, the trap gate can be shut immediately via a remote trigger, and the camera can be repositioned. Illumination for the underwater camera will be provided via a dim light array placed over the trap opening. Additionally, a video recorder will be run simultaneously during "live" counting events to provide the ability to permanently record passage and check date accuracy.

As a backup procedure, if the video system becomes inoperable, emigrant steelhead will be counted by direct observation through an opening by pulling a dozen or so consecutive pickets in the weir face near the eastern shore. When directly counting fish, lights will be set to provide the minimum illumination necessary to see all steelhead.

Sex and Length Composition and Sample Size

The weir opening gate through which fish are passed and counted leads into a fish trap that can be closed to capture emigrating fish (Figure 2). The trap (a box trap) sits behind (downstream of) the weir and functions as a chute for counting and passage of fish, but can be closed if a sample of fish is needed, or PIT-tagged fish are detected. Fish with PIT tags are detected by an antenna placed at the trap opening gate. The downstream trap can be closed from the weir, or from the remote counting station (cabin) with a wire trigger, when a previously PIT-tagged steelhead is detected by the PIT tag antenna. This downstream trap will be used on the weir to systematically capture a representative sample of steelhead for subsequent sex and length (SL) sampling as well as capture and collect scales from previously PIT-tagged steelhead (Primary Objectives 2 and 3).

Capturing steelhead kelts is somewhat problematic because the Situk River is relatively shallow and clear and kelts do not readily pass into the downstream trap. It is impossible to capture all the kelts in the downstream trap at the weir without affecting run timing or inducing mortality. The weir is designed so that kelts can either pass through the weir unimpeded and simply be counted via the remote video feed, or the trap can be closed and the steelhead can be captured for sampling. Groups of fish for sampling are captured by periodically closing the lower gate, allowing fish to enter, then closing the upper gate to trap a subsample. Subsamples can be penned into a small side section of the trap and more fish can be allowed to enter to attain sampling goals. Once the required number of fish is trapped, they are crowded and enclosed in the side section of the trap, and the weir trap can then be opened to pass and count other fish. Processing and measurement of the sample can then occur. Proportional sampling of the entire emigration over time is desired and efforts will be made to capture and sample (for SL) a representative subsample of the steelhead kelts throughout the entire emigration. If proportional sampling is not achieved, estimates will be stratified over time (see Data Analysis section).

A fixed sampling fraction for SL data collection will be obtained. Fish will be sampled twice weekly (Monday and Thursday), and the number sampled will be a fixed proportion of the number of fish counted passing the weir since the previous sampling event. A daily sampling goal will be calculated by subtracting the cumulative weir count at the completion of the previous event from the current cumulative count, and multiplying by 0.05 (5% x sum of daily run since last event required sample size; see below). Because previous investigations (Johnson and Jones 1998, 1999) showed differences in sex composition between fish emigrating during early evening versus late evening, sampling periods will alternate between "early" and "late" evening (Mondays: early; Thursdays: late).

Sampling of the total run of 7,533 fish in 2013 yielded an SL sample of 228 fish that were successfully measured. Run size was smaller and later than expected but sufficient to achieve sample size goals. The expected sample size for the 2014 steelhead SL sample was obtained by multiplying the 10-year (2004–2013) average emigration of 9,194 kelts by 0.05, yielding an expected sample size of 459 steelhead in 2014. This exceeds the 226 needed (Thompson 2002; A. Bingham unpublished data) to achieve the stated criterion (Primary Objective 3, within 0.075 95% of the time) for multinomial proportions. Because this is a fixed sampling fraction rather than a fixed sample size goal, if more than the expected 9,194kelts emigrate in 2014, more steelhead will be sampled, and less will be sampled if run size is smaller. Sampling 5% of as few as 4,530 emigrating steelhead will still allow us to meet the Primary Objective 3 criterion. The expected sample size in 2015 will be calculated based on an updated 10-year emigration average (2005–2014), which will be revised upwards or downwards depending on run strength.

Techniques to estimate fish age from scale patterns will be developed using scales collected in the PIT-tagging study. Methods to be used to estimate fish age will be described in an aging manual that is under development.

Detection and Recapture of Passive Integrated Transponder-tagged Fish

Detection and recapture of tagged fish is accomplished with the fish trap, a tag reader, and an antenna (Biomark™) mounted on the trap opening gate (Figure 2; antenna mounted at gate A). Every fish that passes the weir is automatically scanned by the reader's antenna. When a tag is detected as the fish passes the upper weir-trap gate during normal fish counting procedures, an audible signal (loud tone) will alert the weir crew, and both trap doors will then be shut via a remote trigger. This will capture the fish in the trap below the weir along with any that may be holding in the trap. The tagged fish will then be netted and selected from the other fish by using a hand-held antenna and tag detector to examine each fish. Scale sampling will then be done on the tagged fish. Additionally, tagged fish may also be captured during SL sampling. All fish will be scanned with a hand-held reader during SL sampling to determine if tags are present.

DATA COLLECTION

Steelhead Kelt Weir

The number of steelhead passing upstream and downstream through the weir will be recorded by date and time on the "Situk weir daily observations" form (Appendix A1). Water level (nearest 1 cm, measured at a staff gauge located upstream of the weir) and water temperature (nearest 0.1°C) will also be recorded on this form each morning at approximately 0900 hours, along with daily and cumulative totals of steelhead sampled for sex and length. Typically few if any steelhead are passed upstream during the weir operations.

Sex and Length Composition Sampling

The ultimate goal of the fixed proportion sampling strategy is to spread SL sampling proportionally over the entire emigrating population. A sex and length sampling "day" encompasses all times from late evening to sunrise the next day. "Early" evening samples are defined here as fish trapped from 2000 to 2400 hours (Alaska Daylight time). "Late" evening samples are defined as fish trapped between the hours of 0100 and 0430. Daily sampling goals will be determined by multiplying the weir passage since the last sampling event by 5%. The daily sample goal will be attained by allowing the required number of fish to enter the trap each "early" or "late" sampling period while operating the weir to count and pass fish with the lower gate closed.. If an insufficient number of fish pass in a given night to fill the sample goal, the remaining balance will be sampled the following night.

To avoid selectivity within the trap, all fish in the trap will be sampled (except any weak fish that have accumulated during the day above the weir prior to the early sample). An exception to this rule might occur if, by accident, a large number of extra fish are inadvertently captured, and time does not allow for complete processing. It is not critical that the exact sampling goal be captured and sampled because data analysis procedures are available to adjust for non-proportional weekly sampling. However, obtaining approximately proportional samples is the goal.

Biological data for each fish sampled will be recorded on the "biological sampling" form (Appendix A2) and includes: date, time of passage through weir (noted under "PIT Number/Miscellaneous"), sex, total length (from tip of snout to tip of tail, nearest 5 mm), presence or absence of an adipose fin (i.e., look for steelhead "strays" as other projects in Southeast Alaska use adipose fin clips to designate a fish has been PIT tagged), color (codes = 1 for bright; 2 for medium or dusky colored; and 3 for dark), presence or absence of fungus (codes = Y or N for present or absent), PIT number, and miscellaneous comments. The code designation for scars observed is listed in Appendix A3 and is adopted from Seibel et al. (*unpublished*)[2] and Taylor (1985). All sampled fish will be scanned for PIT tags using a hand-held detector (Biomark™).

Passive Integrated Transponder Detection, and Recapture

The detection and capture of previously PIT-tagged steelhead (Figure 3) during non-sampling time periods will be performed in 2014 and 2015 similar to other years. The antenna is a square portal that fits over the upper weir gate, and is designed to detect all tags that pass through that square space (approximately 61 x 61 cm). As before the antenna is connected to a data logger via wires. The data logger produces an audible beep when a tag is detected. A wireless microphone will be installed at the data logger and routed to an amplified speaker inside the cabin. When a "beep" is heard (indicating that the fish bears a PIT tag), a technician will release the gates that will entrap that fish in the trap, along with any other fish that may be passively in the trap. To locate the tagged fish, a hand-held PIT tag wand will then be used to scan the tag-bearing area of all the fish that are captured at that time. The PIT number will be entered in the "PIT Number/Miscellaneous" field of the sampling form (Appendix A2) to identify it as a recaptured fish sample.

Scale Sampling Fish Tagged with Passive Integrated Transponders

All recaptured PIT-tagged fish will be sampled for scales. Scales will be taken from the area 2 to 4 rows above or below the lateral line and along a line from the posterior end of the dorsal fin to

[2] Seibel, M., A. Davis, J. Kelly, L. Talley and P. Skannes. *Unpublished*. Observations on externally scarred and marked Chinook and coho salmon in the Southeast Alaska commercial troll fishery 1982. Located at: Alaska Department of Fish and Game, Juneau.

the anterior end of the anal fin. A minimum of 4 scales will be taken from each fish. The goal of getting a readable scale may be hindered by taking scales over multiple years. In order to confront that issue and get a good scale the first year, scales will be taken from the right side above the lateral line, the second capture event right side below the lateral line, the third recapture left side above the lateral line, the fourth year left side below the lateral line. This broadened collection area increases the possibility of collecting readable scales. All slime, grit, and skin will be removed from the scales.

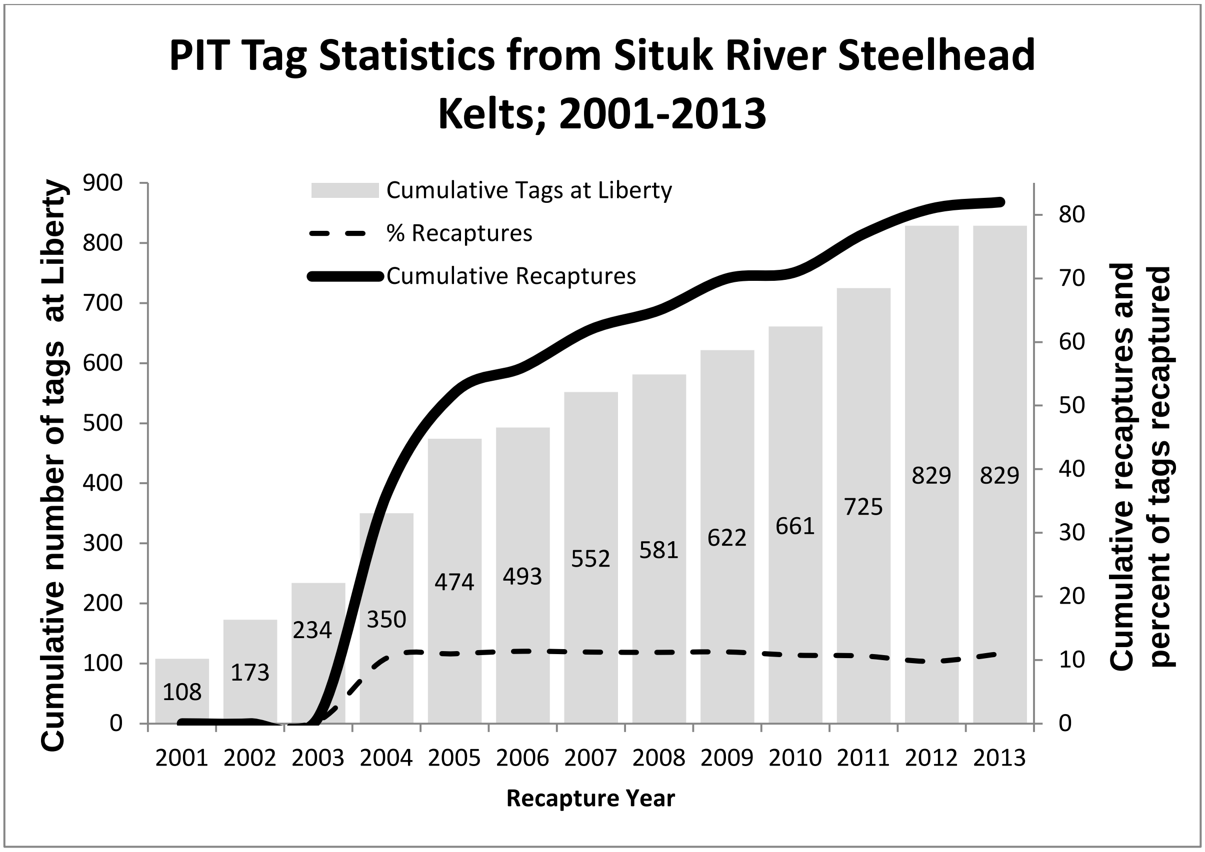

Figure 3.–Passive integrated transponder tag implant and return numbers from the Situk River kelt weir 2001–2013.

Scales will then be placed on gum cards using 2 columns per fish: i.e., scales from fish #1 will be mounted over card numbers 1, 11, 21, 31 and 2, 12, 22, 32; scales from fish #2 go over card numbers 3, 13, 23, 33, and 4, 14, 24, 34, and so on. Scales will be moistened and mounted on the gum card directly over the appropriate scale numbers. The side of the scale facing out on the gum card will be the same as the side facing out when the scale was adhered to the fish. This outward facing side is referred to as the "sculptured" side of the scale. Ridges on this (outward) side can be felt with a fingernail or forceps. Scales will be placed in a uniform direction on the gum card, e.g., anterior side up, and sculptured side out. Gum cards will be stored in coin envelopes marked with the sample number, the date, and the fish lengths. Sample number(s) will also be written on the gum card, in the "Remarks" section, to eliminate possible mixing of the cards at a later date.

Mortality Data Collection

All steelhead mortalities collected from the stream, weir, or provided by anglers will be sampled for scales and otoliths so that ages determined from scale pattern analysis can be compared to ages determined by reading otoliths. Any otoliths collected will be placed in pill capsules (dry), and stored in coin envelopes with the scales. Age from otoliths will be estimated according to procedures currently being developed. Data from steelhead mortalities will be recorded on a separate "biological sampling" form (Appendix A4).

DATA REDUCTION

The electronic data file(s) will be checked for mistakes and omissions before analysis. A final edited copy of the data, along with a data map, will be sent to Division of Sport Fish, Research and Technical Services (RTS) in Anchorage electronically for archiving. The data map will include a description of all electronic files contained in the data archive, all data fields and details of where hard copies of any associated data are to be archived, if not in RTS. For this project, data will be archived in Excel™ workbooks (presently in Office 2007). The original hard copies of all data forms, scale gum cards and acetates, will be logged and stored in the Region 1 age-sex-length data archives, located in file cabinets in the Douglas regional office.

DATA ANALYSIS

Steelhead Kelt Weir

The numbers of steelhead moving upstream and downstream will be summed, and the daily counts, temperature, and depth will be plotted. The median date of kelt emigration and daily proportion of the run passing the weir will be calculated and compared to the average of daily proportions from 2004 to 2013 (Appendix B1). The timing of scheduled commercial fishery openings, water temperature, and stream level will be superimposed on the plot of daily emigration.

Sex and Length Composition

If required, sex and length compositions for the season will be estimated after stratifying the data into k weekly strata $(h = 1, 2, \ldots, k)$.

For length *(y)*:

$$\hat{\bar{y}}_h = \frac{1}{n_h} \sum_i y_{h,i} \quad (1)$$

$$\operatorname{var}\left(\hat{\bar{y}}_h\right) = \left(1 - \frac{n_h}{N_h}\right) \frac{\sum_i \left(y_{h,i} - \hat{\bar{y}}_h\right)^2}{n_h \left(n_h - 1\right)} \quad (2)$$

$$\hat{\bar{y}} = \frac{1}{N} \sum N_h \, \hat{\bar{y}}_h \quad (3)$$

$$\operatorname{var}\left(\hat{\bar{y}}\right) = \sum W_h^2 \operatorname{var}\left(\hat{\bar{y}}_h\right) \quad (4)$$

where i denotes an individual fish, n_h is the weekly sample measured for length, N_h is the weekly emigration total, $N = \sum N_h$, and W_h is the weight N_h/N derived from the weekly emigration totals.

For composition-proportions:

$$\hat{p}_{a,h} = \frac{n_{a,h}}{n_h} \tag{5}$$

$$\text{var}(\hat{p}_{a,h}) = \left(1 - \frac{n_h}{N_h}\right) \frac{\hat{p}_{a,h}(1 - \hat{p}_{a,h})}{n_h - 1} \tag{6}$$

$$\hat{p}_a = \frac{1}{N} \sum_h N_h \ \hat{p}_{a,h} \tag{7}$$

$$\text{var}(\hat{p}_a) = \sum_h W_h^2 \text{var}(\hat{p}_{a,h}) \tag{8}$$

where $\hat{p}_{a,h}$ is the estimated proportion of the population in length (or sex) group a and temporal strata h, n_h is the number of fish successfully measured in strata h, and $n_{a,h}$ is the subset of n_h that belongs to group a. If the weir washes out or is otherwise unsuccessful at counting the entire emigration, the $fpc = (1\text{-}n/N)$ term will not be included in either of the estimators.

Passive Integrated Transponder Detection and Recapture

A database of scale images collected from recaptured, previously PIT-tagged steelhead will be developed. This database will help document changes in scale structure over time. Information gained from these known-increment steelhead scales will provide insights that can be applied to age scales collected on the Situk River since 1994, and assist other steelhead research projects throughout Southeast Alaska.

SCHEDULE AND DELIVERABLES

The following work schedules are planned:

April 15, 2014	Begin weir assembly and repair, weir site preparation
May 4, 2014	Install weir
June 10, 2014	Transfer weir operation to Division of Commercial Fisheries staff for salmon
August 15, 2014	Assist with weir removal
October 15, 2014	Complete data input and checking

Deliverables:

A draft Fishery Data Series report covering 2012–2015 will be submitted by March 2016.

RESPONSIBILITIES

Brian Marston, Fishery Biologist III, Project Leader.

Duties: Supervise all field work; edit, analyze and report data, assist with field work.

Anton Antonovich, Biometrician III.

Duties: Provide input to sampling design and evaluation. Assist in data analysis and report writing. Review operational plan, data analysis, and final report.

Chet Woods, Fishery Technician III.

Duties: Acts as crew leader during installation and early operation of weir until transfer to Division of Commercial Fisheries. Works closely with the project leader, supervising construction and operation of the weir according to operational plan. Responsible for completion and error checking of weir data forms. Schedules crew to ensure days off and minimize overtime. Ensures timely submission and completion of crew time sheets.

Alexandria Paton-Romero, Fishery Technician II

Duties: The responsibilities of this position will be to work as assistant crew leader under the supervision of the crew leader and project biologist, assisting with the construction, maintenance, and operation of the weir and field camp, and procurement of services and goods. Other duties will include assisting with the capture and scientific sampling of steelhead, assisting with the operation and maintenance of generators, firearms, radios, small boats, outboard motors, and other field and research equipment, and assisting with counting adult steelhead through the weir

Stephanie Sanguinetti, Fishery Technician III

Duties: Assists with weir construction, maintenance, and operation. Other duties will include assisting with the capture and scientific sampling of steelhead, and assisting with counting adult steelhead through the weir on selected sampling nights.

Clayton Hamilton, Fishery Technician III (if needed)

Duties: Assists with weir construction, maintenance, and operation. Other duties will include assisting with the capture and scientific sampling of steelhead, and assisting with counting adult steelhead through the weir on selected sampling nights.

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APPENDIX A

Appendix A1.–Situk weir daily observations and cumulative steelhead sampled recording form.

			STEELHEAD							SAMPLING			
	Water		Down	Up	Down	Up	Morts	Morts	REMARKS	STEELHEAD		PIT TAGS	
DATE	Level	Temp	Daily	Daily	*Cumulative*	*Cumulative*	*Daily*	*Cumulative*		Daily	*Cumulative*	Daily	*Cumulative*
DATE													
5/1/2014													
5/2/2014													
5/3/2014													
5/4/2014													
5/5/2014													
5/6/2014													
5/7/2014													
5/8/2014													
5/9/2014													
5/10/2014													
5/11/2014													
5/12/2014													
5/13/2014													
5/14/2014													
5/15/2014													
5/16/2014													
5/17/2014													
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5/25/2014													
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5/27/2014													
5/28/2014													
5/29/2014													
5/30/2014													
5/31/2014													
6/1/2014													
6/2/2014													
6/3/2014													
6/4/2014													
6/5/2014													
6/6/2014													
6/7/2014													
6/8/2014													

Appendix A2.–Biological sampling form for Situk River steelhead. See key below for codes

DATE	**Sex**	**Total Length**	**Card**	**Scale 1**	**Scale 2**	**CWT?**	**Color**	**Scar**	**Fungus**	**SELECT**	**PIT Number/Miscellaneous**

Key. Color: 1=Bright, 2=Medium or "Dusky" 3=Dark, Fungus: Y= yes, present, N = no, absent

Appendix A3.–Scar code descriptions for weir sampling form, Situk River steelhead.

CATEGORY	*DESCRIPTION*
1	*One or more fairly well delineated linear marks between the head and the dorsal fins, approximately perpendicular to the longitudinal body axis and encircling or partially encircling the body.*
2	A series of approximately parallel marks or scrape lines over a substantial portion of the body; two or more series of such marks occurring at different angles may give the appearance of crosshatch marks.
3	A fairly well delineated scrape band generally occurring between the head and dorsal fins approximately perpendicular to the longitudinal body axis or angled slightly backward from the top to the bottom of the body and containing a nearly oval shape open wound, normally in the upper portion of the body.
4	Extensive descaling of at least 25% or more of one or both sides of the body but with marks or wounds not well delineated.
5	Open, gaping wounds or puncture marks located anywhere on the body, either with no other marks and scrapes or with adjacent irregular 'scratch' or 'claw' marks, but none of the marks described in categories 1 through 4.
6	Any scars/marks not fitting descriptions in categories 1 – 5 and 7.
7	A fresh or healed appearing wound on either side of the body-usually a couple of inches in length, and angled dorsally and forward toward the head of the fish, from the anterior insertion of the dorsal fin to the front of anal fin and behind the ventral fin. May also occur elsewhere on the fish, but the angle of cut is usually consistent with the ones described above. The fresh wound will have flesh exposed the whole length of the cut. The healed scar will have an 'indentation or pucker' type scar wherever it is located.

Category 8 – Sport fishing related - hook mark on body, torn mouthparts, hook in body/fin

Category 9 – Torn dorsal or caudal fin

Category 10 – Torn gill-plate(s)

Category 11 – Any scars/marks not fitting the descriptions in Categories 1–7

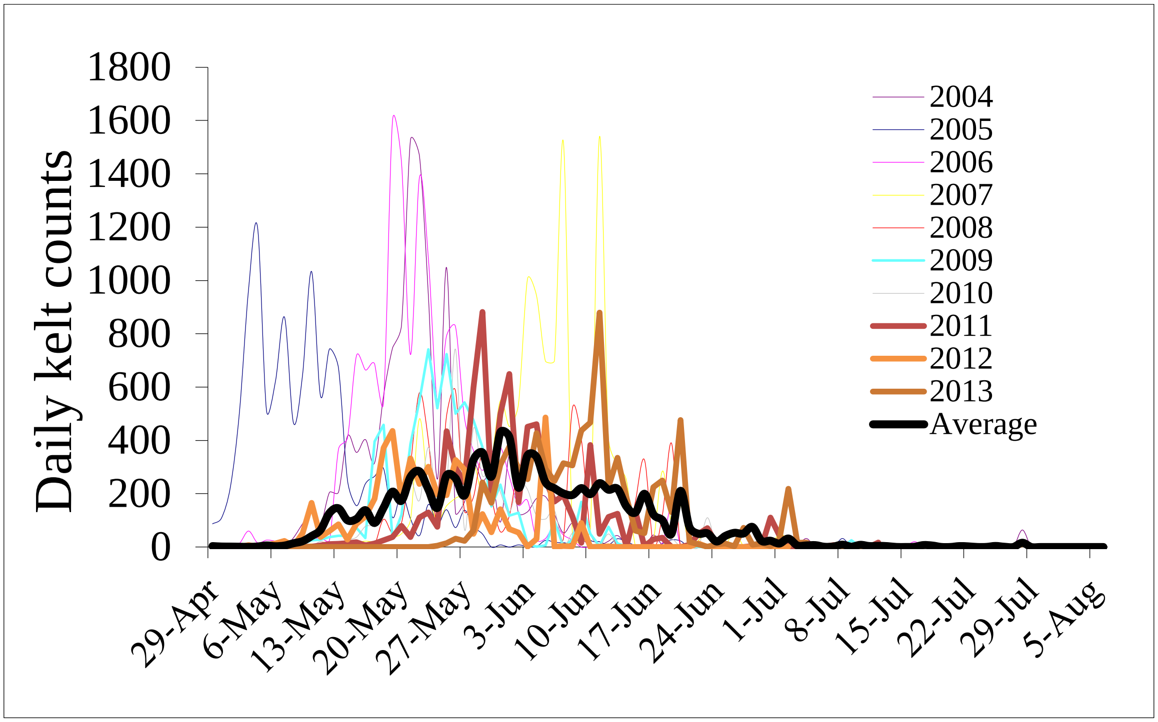
Category 12 – Healed scar of any kind except as described in category 4

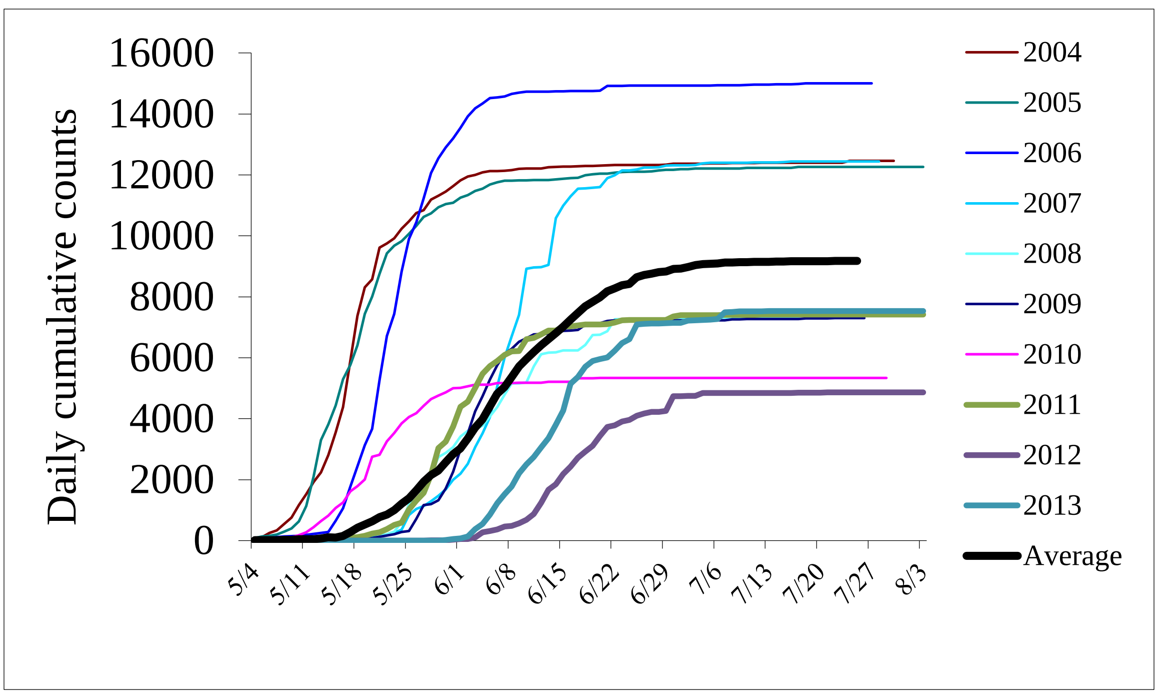
Appendix A4.–Biological sampling form for Situk River steelhead mortalities.

2014 Mort Sampling Form										
DATE	Sex	Total Length	Card	Scale 1	Scale 2	CWT?	Color	Scar	Fungus	Comments

APPENDIX B

Appendix B1.–Historical daily counts, daily cumulative counts, and cumulative proportions of emigrating steelhead at the Situk River weir 2003–2013.





Appendix B1.–Page 2 of 2.