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Northwest Power and Conservation Council

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December 6, 2016

DECISION MEMORANDUM

TO: Council members

FROM: Mark Fritsch, project implementation manager

SUBJECT: Step 1 review of the *Snake River Basin Steelhead Kelt Reconditioning Facility Master Plan*, Project # 2007-401-00, *Kelt Reconditioning and Reproductive Success Evaluation Research*.

PROPOSED ACTION: The Fish and Wildlife Committee recommends that the Council approve the *Snake River Basin Steelhead Kelt Reconditioning Facility Master Plan* to proceed with Step 2/3 activities. This recommendation is subject to the requirement that the CRITFC and NPT address the four issues raised by the ISRP as part of the next review.

SIGNIFICANCE: On March 28, 2016, the Nez Perce Tribe (NPT) and Columbia River Inter-Tribal Fish Commission (CRITFC) submitted to the Council as part of the Three-Step Review Process a master plan for the *Snake River Basin Steelhead Kelt Reconditioning Facility*, as part of Project # 2007-401-00, *Kelt Reconditioning and Reproductive Success Evaluation Research*.

This master plan proposes to develop a facility to support kelt reconditioning for the purpose of improving ESA listed steelhead abundance in the Snake River. Upon release, these fish are intended to return to natal populations, thereby increasing escapement. The 2008 Biological Opinion (BiOp) on the Federal Columbia River Power System (FCRPS) and the Columbia

Basin fish Accords recognized the potential for kelt reconditioning to contribute to steelhead populations and the 2008 FCRPS BiOp identified actions in the Reasonable and Prudent Alternative (RPA Actions 33 and 42) to fund reconditioning programs in the upper-Columbia River and Snake River.

The facility proposed is located at Nez Perce Tribal Hatchery (NPTH) and is the most cost-effective and reliable solution. Specifically, the installation of six twenty foot circular tanks and a building to support the long-term reconditioning of up to 750 kelts is proposed, supporting the goal of an annual release of 180 reconditioned B-run kelts.

BUDGETARY/ECONOMIC IMPACTS

The total estimated preliminary construction budget for the facility as outlined in the master plan is \$1,987,100.

Capital and expense funds associated with the proposed kelt reconditioning facility at the NPTH including study implementation, planning and design, construction, and operation and maintenance totaling \$16,261,613¹ are reserved in Accords budgets between the CRITFC and the FCRPS Action Agencies.

Future cost estimates for O&M at the kelt reconditioning facility is estimated to be about \$720,600 annually that includes a \$70,600 amortized cost for anticipated 10-year lifespan for asset replacement (i.e., chillers and pumps). Annual M&E expenses will be developed as part of the next submittal and review.

BACKGROUND

A unique adaption that steelhead have, over the other anadromous salmonids in the Columbia Basin, is their ability to spawn multiple times in their lifetime (*iteroparity*). The abundance of this life history pattern is currently lower than it was historically due the difficulty with downstream passage of adult fish at mainstem hydropower facilities. Efforts to recover declining steelhead stocks within the Columbia River Basin have ranged from harvest reduction, habitat restoration, passage improvements at mainstem Columbia River hydropower facilities, and hatchery propagation. The use of reconditioned post-spawned steelhead (kelts) provides an opportunity to increase total reproductive potential of steelhead populations within the Columbian Basin as well as preserve a unique steelhead life-history trait. Kelt reconditioning consists of the collection of post-spawned steelhead and the administration of disease preventatives and feed for the purpose of improving survival relative to the untreated condition and releasing them back to their natal waters to spawn again. Although kelt reconditioning is classified as hatchery propagation, this is somewhat misleading since there is no hatchery influence until after the initial spawning of the steelhead.

¹ This is for Fiscal Year 2008 - 2017 at \$2,262,816 capital and \$13,998,797 expense funds.

Project #2007-401-00, *Kelt Reconditioning and Reproductive Success Evaluation Research* is a research, monitoring, and evaluation (RM&E) category project funded through the Columbia Basin Fish Accords. The project has been ongoing since 2000 and represents a merger of two projects (Project #2000-017-00 and #2003-06-200) and builds on information that is currently being generated by the only other Program funded kelt Project (Project #2008-458-00, *Steelhead Kelt Reconditioning*²).

The CRITFC and NPT kelt project has studied and evaluated two topics with respect to post-spawn steelhead. First it assessed the ability to collect and recondition steelhead kelts to preserve this life history and protect this diversity, and second, it monitored the reproductive success of the reconditioned steelhead. The federal agencies included the kelt reconditioning effort in the 2008/2014 BiOp as part of the reasonable prudent alternative actions to aid listed Snake River steelhead populations, and NOAA estimated a potential six percent improvement in steelhead escapement from the kelt reconditioning efforts as part of the jeopardy analysis. The project specifically addresses FCRPS BiOp Reasonable and Prudent Alternative Actions 33 and 42³. As one of many rulings in his opinion on the 2014 BiOp, Judge Simon found NOAA's jeopardy conclusion to be "arbitrary and capricious for relying on six percent improvement as a result of the kelt management plan." The judge based this ruling on statements about uncertainties in the benefits from kelt reconditioning described both in NOAA's own analysis of this action and in other reviews, including a review report from the ISRP (ISRP document 2011-25). The kelt reconditioning ruling was one in a sequence in which Judge Simon ruled that NOAA violated the ESA by making relatively certain conclusions about quantitative survival improvements from actions on a record full of uncertainty as to the precise nature of benefits to be achieved from various habitat and predator control actions. The ruling from the court is an important piece of the context for the current review of the kelt reconditioning project. But the court did not rule that there are no benefits or reasons to continue (or not continue) the kelt reconditioning project, only that NOAA acted in an arbitrary manner under the ESA in assigning to that effort a certain quantified survival benefit. In addition, the ruling was based on information through 2012, excluding a large portion of the information now available about the project. Therefore, the project information and independent science reviews are a better guide for the Council in reviewing the status of the project.

² This a Yakama Nation Accord project to enhance the abundance and life history diversity of naturally produced steelhead in the Upper Columbia River. The Council, based on a follow-up review, approved this Project's scope on November 4, 2014 based on Yakama Nation and Bonneville address the questions raised by the ISRP (ISRP document 2014-9) within the current scope and budget of the project as part of annual reports and future reviews. In addition, the Council requested that Bonneville and NOAA provide an update and status review, in 2016, of this kelt project and how it relates to meeting the intent of RPA 42.2 of the 2008 BiOp.

³ RPA Action 33 requires the Action Agencies to develop and implement a Snake River steelhead kelt management plan designed to provide at least a 6% improvement in B-run population productivity. Toward that goal, a variety of approaches are being tested and implemented including passage improvements and reconditioning kelt steelhead. RPA Action 42 focuses on the reconditioning component and seeks to preserve and rebuild genetic resources through safety-net (kelt reconditioning) and mitigation actions to reduce short-term extinction risk and promote recovery.

I. *Kelt Reconditioning and Reproductive Success Evaluation Research*

This *Snake River Basin Steelhead Kelt Reconditioning Facility Master Plan* is intended to assist in the recovery of natural origin Snake River B-run steelhead. If successful this approach provides an immediate boost in freshwater productivity, offsets long and short-term demographic perils, and minimizes loss of genetic and/or life history diversity.

This Master Plan summarizes and builds on nearly two decades of research and implementation that has included hydrosystem passage, transportation, and short/long-term reconditioning. Through these efforts the evidence suggests that long-term kelt reconditioning is a promising kelt enhancement strategy to meet the needs of the natural origin B-run steelhead from the Snake River Basin.

II. *Facilities*

As described in the Master Plan, CRITFC and the NPT are proposing to construct a small facility adjoining the NPTH. The facility will be capable of reconditioning 591 adult kelts, requiring a maximum capacity of 750 kelts to accommodate holding spawners for up to 20 months. Given its location, expansion potential, existing security, and three-phase power, NPTH represents the best opportunity to accommodate the kelt reconditioning facility. Six aluminum 20-foot circular tanks and four 15-foot aluminum circular tanks would be placed inside a large pole building. Each tank would be enclosed with containment curtains. Tank design would allow for reconditioning of up to 750 kelts. The 2,750 square foot structure is proposed for housing the needed infrastructure and access. The building would also include feed, a chemical storage room, a laboratory to provide on site biological analysis and data storage, a small office and a bathroom. In addition an open roof will cover the running length of the north end of the proposed building to protect the recirculation-filter-chiller units.

III. *Major Project Review (The Three-Step Process)*

On March 28, 2016 the Council received a Master Plan from the CRITFC and NPT intended to initiate the review process (i.e., Major Project Review) associated with the construction of a small support facility at the NPTH. The Master Plan (Step 1 – conceptual phase) titled *Snake River Basin Steelhead Kelt Reconditioning Facility Master Plan* is a component of Project # 2007-401-00, *Kelt Reconditioning and Reproductive Success Evaluation Research*. This submittal was also guided by the 2014 Council review and recommendation that was based on five issues raised by the ISRP of a closely related kelt project (please see footnote #2).

The Master Plan was submitted to the ISRP for review and on May 13, 2016 the ISRP provided a response requested (ISRP document 2016-8). The ISRP found the Master Plan was well written and summarized the extensive research that had occurred to date including establishing appropriate holding and rearing environments, formulating diets, and developing disease control protocols, but additional information was needed before their review could be completed. The ISRP requested that 9 questions/issues be

addressed before they could complete their review. On July 13, 2016 the Council received a response from CRITFC and NPT intended to address the additional information the requested.

On September 27, 2016, the ISRP provided the Council with their review of the *Snake River Basin Steelhead Kelt Reconditioning Facility Master Plan* (ISRP document 2016-12). The ISRP found that the master plan met scientific review criteria “qualified”. On November 7, 2016 the Council received comment on the ISRP review. The letter was from the CRITFC and provided additional detail on the studies to date and the BiOP ruling (please see Attachment 1).

The ISRP found that the master plan met review requirements for proceeding to Step 2 (progress review/preliminary phase) the panel requested responses to the following four qualifying issues during the next review.

- 1) *Of the proposed locations for the kelt reconditioning facility, the NPTH appears to be the best option. The existing HGMP and Environmental Assessment for the NPTH will need to be modified to account for the reconditioning program.*
- 2) *A comprehensive M&E Plan with an adaptive management component is needed. The M&E plan should describe quantitative objectives, sampling designs, data collection, and an assessment methodology that will be used to evaluate density dependence in B-run steelhead populations.*
- 3) *Biologically based escapement goals that consider density dependence should also be included in the M&E Plan. Such goals will help the proponents assess the contributions that reconditioned kelts are making toward B-run recovery on a population-specific basis.*
- 4) *The M&E plan should also provide more information on the level of effort that will be expended on collecting natural origin B-run kelts and on how they will be identified. How, for example, will the inadvertent inclusion of unclipped B-run hatchery kelts in the program be avoided?*

In addition, it is important to note that the received master plan did not include all Step 1 review elements, as is typical for a master plan⁴, but the CRITFC and NPT submittal was very transparent on the particular elements not included. The sponsors state that the elements are dependent on final site location and approval and that these elements will be completed as part of the anticipated next review (i.e., Step 2/3) associated with this master plan.

ANALYSIS

The ISRP, in their review of the master plan, acknowledged how well the master plan was written in providing detail and addressing the challenges associated with establishing kelt reconditioning as an effective technique in the recovery of these

⁴ For example, environmental review (Step 2/3), final design and value engineering (Step 3).

threatened species. Though the ISRP is not totally convinced that this strategy will increase the abundance of the B-run steelhead population, they see the importance that this life history strategy may play in the recovery of the steelhead in the Snake River Basin. Moreover, the density dependence issues raised in 2 and 3 above appear to apply to any action intended to increase escapement of adult B-run steelhead.

It is important to note that the ISRP has participated in numerous reviews of the kelt projects since 2000. Due to the experimental approach and relationships of these projects, they are currently one of the most reviewed projects in the program. The experimental nature, based largely on past ISRP reviews and input, of this project over the past 16 years is different from most artificial-production projects due to the unique nature of kelt reconditioning. The history of the kelt projects demonstrates clearly how the input received from the ISRP has assisted in the development and shaping of kelt reconditioning efforts in the Basin.

As outlined, in the master plan, the majority of the issues raised by the ISRP will be addressed as part of the next review (i.e., HGMP and M&E). The detail provided by the ISRP in their review will strengthen the responses and the deliverables regarding the remaining review elements needed to meet the Council's review process (i.e., VE and final design). The CRITFC and NPT are hopeful that they will be able to provide the next submittal addressing the ISRP and Step review elements by the end of 2017.

Based on the numerous science reviews and the incorporation of their guidance over time Fish and Wildlife Committee recommends that the Council approve the *SNAKE RIVER BASIN STEELHEAD KELT RECONDITIONING FACILITY MASTER PLAN* to proceed with Step 2/3 activities. This recommendation is subject to the requirement that the CRITFC and NPT addresses the four issues raised by the ISRP as part of the next review.

Attachment 1: Letter received on November 7, 2016 from Columbia River Inter-Tribal Fish Commission regarding Snake River Kelt Reconditioning Program and the ISRP review (ISRP document 2016-12).



COLUMBIA RIVER INTER-TRIBAL FISH COMMISSION

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November 7, 2016

Henry Lorenzen
Chairman
Northwest Power and Conservation Council
851 SW Sixth Ave., Suite 1020
Portland, OR 97204-1347

RE: Snake River Kelt Reconditioning Program

Dear Mr. Lorenzen:

I am writing to express our appreciation for the Northwest Power and Conservation Council's continued support for reconditioning repeat spawning steelhead (kelts) throughout the Columbia Basin, and in particular for Snake River Basin. We are now at the point where it is possible that construction of a production-scale kelt reconditioning facility in the Snake River Basin will be initiated in 2017. This letter broadly describes the biological benefits of this innovative steelhead propagation measure including some of our research results, anticipated project outcomes in terms of Reasonable and Prudent Alternative 33 contained in the 2014 FCRPS Biological Opinion, and a project update based on the most recent project review from the Independent Scientific Review Panel (ISRP).

Steelhead, unlike salmon, do not die after spawning; they can spawn multiple times. A post-spawn steelhead is termed a "kelt." After steelhead spawn in the spring, kelts move downstream and eventually back to the ocean where they remature and return as repeat spawners. The mortality of kelts migrating to the ocean is very high and consequently only a small number of kelts return to repeat spawning. In the Yakima River, repeat spawners make up about 3% of the steelhead run, yet over half of the run is seen moving downstream as kelts. In the Snake River kelts make up about 1% of the steelhead run.

The reconditioning effort only collects wild fish that have already contributed to the spawning population so the potential for negative genetic effects is very low. Based on the 1% return rate in the Snake River, collecting and reconditioning kelt can provide over 100 times greater benefit to the population in terms of fish on the spawning grounds than their potential contribution as natural repeat spawners. Kelt reconditioning not only increases spawners on the spawning grounds, it plays an important role in a spread-the-risk strategy for steelhead; it helps to preserve the diversity of life history pathways in steelhead and can be used as a restoration tool for at-risk steelhead populations. For example, in the Yakima Basin the 2016-17 escapement of steelhead as measured at Prosser Dam is estimated at 2,200 total fish of which 1,320 are females, about half of the normal return. The tribes' kelt reconditioning program in the Yakima Basin will add 192 reconditioned female steelhead

in 2016, effectively increasing the reproductive potential of wild origin Yakima steelhead in 2016 by approximately 14.5%.

Research prerequisites to building a production scale reconditioning facility have been met.

The Snake River Kelt Reconditioning Program began in the middle of 2008 as a response to the FCRPS Biological Opinion (BiOp) Reasonable and Prudent Action (RPA) 33. As agreed upon in the Columbia Basin Fish Accords, funding for the Snake River component was added to an existing project that was successfully reconditioning kelts in the Yakima River. In addition to the increased expense funding, \$2M of capital funds were committed to construct a kelt reconditioning facility in the Snake River to achieve Snake Basin production-scale goals. The project expansion was initially approved by the ISRP at a research scale. Operating at a research scale (i.e. small numbers of fish testing various approaches versus a production scale aimed at meeting a BiOp RPA goal) prevented the project from meeting kelt release goals set in RPA 33 due to limited rearing space. Based on this research phase, we have documented results of our research in a Master Plan to construct a kelt reconditioning production facility and complete the Northwest Power and Conservation Council's (NWPPCC) Three Step Review process for capital construction.

To move from the research-scale to production-scale phase, the ISRP asked that the following questions be addressed (ISRP 2014-9): 1) Establish methods to assess how kelt reconditioning may benefit population growth, abundance, spatial structure, and diversity; 2) Conduct modeling and power analysis to clarify how many juvenile and F1 adults should be sampled to detect meaningful differences in the breeding and reproductive success; 3) Determine methods to assess the fat levels, maturation timing, fecundity, egg size, and gamete viability of the project's reconditioned kelts, including consecutive skip spawners; 4) Monitor the homing and straying rates of reconditioned kelts released by the project; and 5) Identify geographic locations and times of year for release of the project's reconditioned fish. The Snake River Kelt Steelhead Master Plan document summarizes our research addressing these questions. The Master Plan was submitted to the ISRP for review on March 28, 2016. The ISRP favorably reviewed the Master Plan (ISRP 2016-8) on May 13, 2016:

“The Master Plan is well written and contains an excellent summary of the extensive steelhead reconditioning work that has occurred in the Basin. Moreover, we compliment the proponents for investigating and addressing the many difficulties associated with steelhead reconditioning. Numerous challenges associated with fish culture had to be addressed, including establishing appropriate holding and rearing environments, formulating diets, and developing disease control protocols. The effects of long-term reconditioning on gamete viability, fidelity to natal streams, and ability to reproduce in nature were investigated. Comparisons that evaluated the potential benefits of various kelt treatments that ranged from simple direct transportation past downstream dams to long-term reconditioning lasting from 6 to 20 months were also conducted. In general, the results of these assessments indicated that long-term reconditioning of kelts appears to be a promising approach that might lead to a viable conservation strategy for steelhead.”

The ISRP's May 2016 review of the Master Plan was not a part of the record that Judge Simon reviewed with the 2014 BiOp. The May ISRP review also included additional questions that we addressed in a submission on July 13, 2016. On September 27, 2016, we received a second ISRP review (ISRP 2016-12), with its recommendation, “Meets Scientific Review Criteria (qualified).”

We anticipate completing the Council’s Three Step Review process in 2017 and beginning construction of a production-scale kelt reconditioning facility capable of meeting or exceeding the BiOp RPA 33 goal of increasing the Lower Granite Dam ladder count of Snake River Group B steelhead by 180 fish. If delays are minimal, a new facility could be on-line for the 2018 kelt run.

Reconditioned kelt releases have increased since the 2014 BiOp.

As part of its research-scale operation, the Kelt Reconditioning and Reproductive Success Evaluation Research Project reconditioned and released Snake River kelts to address the intent of RPA 33. The 2014 BiOp considered the reconditioned kelt releases in 2011 and 2012 and itself raised questions about the viability of this RPA. Unfortunately, these first two years of the Snake River study – the only ones available for the 2014 BiOp - met with water supply issues at the research facility in use that caused significant fish losses. The water supply issues were successfully addressed and subsequent kelt releases in 2013, 2014, and 2015 were significantly greater (Table 1). The program has over 140 fish on-site for release in 2016 and 2017, depending on individual maturation rates. We are currently assessing the maturation status of these fish, and based on previous data, we anticipate a release of 50 to 70 reconditioned kelts in November, 2016. We will collect additional kelts next spring and recondition them in 2017. As discussed below, these increased kelt releases support the continued development of a dedicated production-scale reconditioning facility that would allow the RPA goals to be met or exceeded and improve Snake River kelts.

Table 1. Summary of fish collections and releases in the Snake River associated with RPA 33.

Year	Number of Fish Collected	Survived Reconditioning	% Survival	Total Release
2011*	111	2	1.8%	2
2012*	124	10	8.1%	10
2013	134	69	51.5%	69
2014	122	37	30.3%	35
2015	140	43	30.7%	24
2016	225	142	62.7%	TBD
* Water issues at Dworshak NFH caused catastrophic losses to project fish (Hatch et al, 2012 and 2013).				

The BiOp’s goal is achievable alongside additional benefits.

Kelt reconditioning using collection at Lower Granite Dam offers a broad-based steelhead restoration approach for most of the Snake River ESU. Kelt reconditioning may benefit all wild steelhead populations in the Snake River above Lower Granite Dam with benefits scaled for specific populations or at the ESU level depending on where kelts are collected. Reconditioning could be particularly useful in a year like 2016 where wild steelhead counts are running about half the size of

recent years. In addition to directly increasing spawners, the reconditioning program offers a spread-the-risk strategy that can provide potential benefits not possible through any other existing or proposed action.

The Snake River Basin Steelhead Kelt Reconditioning Facility Master Plan includes a pathway to achieve the intent of RPA 33 and increase spawners contributing to the entire Snake River ESA-listed steelhead population. Table (2) describes reasonable estimates for the number of B-run steelhead kelts that could be collected and reconditioned to meet the goal of RPA 33 and additional fish from non-target MPGs. The proposed reconditioning facility is sized appropriately to accommodate at least these numbers of fish.

Using Table 2 as an example, if we collect wild steelhead that are 60 cm and larger at Lower Granite Dam, we would expect to transport 667 fish on average to the reconditioning facility. Applying survival and productivity rates observed in our research to these kelts yields 356 fish for release. Estimating the proportion from the Clearwater and Salmon MPGs (Target MPGs) we would have 224 Target MPG fish (B-Run) and additional 124 fish from non-target MPGs. Additional collection opportunities exist at Little Goose Dam as well as from utilizing local broodstock collections in the South Fork Clearwater River. These possible collections are also presented in Table 2.

Table 2. Estimated Snake River kelt steelhead collections, survival, association with Major Population Groups, and release numbers.

	collection criteria	transferred to NPTH	end of season holding (0.40)	Consecutive spawners (0.34)	Skip spawners (0.66)	2nd year Recondition survival (0.9)	1st year productivity credit (1.29)	2nd year productivity credit (1.51)	Total Fish Released	MPG credit at MPG level	Level fish credit	Non target fish increase
Lower Granite Dam Kelt Collection	> 60 cm	667	267	91	176	158	117	239	356	0.63	224	124
Little Goose Dam Kelt	all	390	156	53	103	93	68	140	208	0.62	129	74
South Fork Clearwater	localized broodsto	50	20	7	13	12	9	18	27	1	27	0
Total		1107	443	150.54	292	263	194	397	591		380	198

We urge the Northwest Power and Conservation Council to continue its support of the Snake River Steelhead Kelt Reconditioning Program and the Master Plan for the Snake River Basin Steelhead Kelt Reconditioning Facility. The Snake River Kelt Reconditioning Program has the ability to attain the goals of RPA 33 with the completion of this production-scale kelt reconditioning facility. The concerns for the Program described in the 2014 BiOp and reflected in Judge Simon’s May 5, 2016 Opinion do not accurately characterize the advancement of the program. We believe that kelt reconditioning will increase wild steelhead abundance and productivity with very low impacts to the natural population.

Sincerely,



Robert C. Lothrop
Interim Executive Director

Cc: Jennifer Anders, Chair, Fish and Wildlife Committee, Northwest Power and
Conservation Council
Lorri Bodi, Vice-President, Environment, Fish and Wildlife, Bonneville Power
Administration
Bruce Suzumoto, Senior Policy Advisor, Interior Columbia Basin Office, NOAA Fisheries
Dave Johnson, Fisheries Program Manager, Nez Perce Tribe
Paul Ward, Fisheries Program Manager, Yakama Nation
Mel Sampson, YKFP Program Manager, Yakama Nation

Snake River Basin Steelhead Kelt Reconditioning Facility Master Plan

Hatch,¹ D.R., A.L. Pierce,^{1,2} S.R. Everett³, R. Branstetter¹, J. Stephenson¹, A.P. Matala¹, N. Graham¹, Z.L. Penney¹, and Chris Beasley⁴

¹ Columbia River Inter-Tribal Fish Commission, Portland, OR

² University of Idaho, Moscow, ID

³ Nez Perce Tribe, Lapwai, ID

⁴ Quantitative Consultants, Boise, ID



Columbia River Inter-Tribal Fish Commission



Presentation Outline

Project Goal: Attempt to enhance repeat spawner rates (iteroparity) in steelhead and address the following issues:

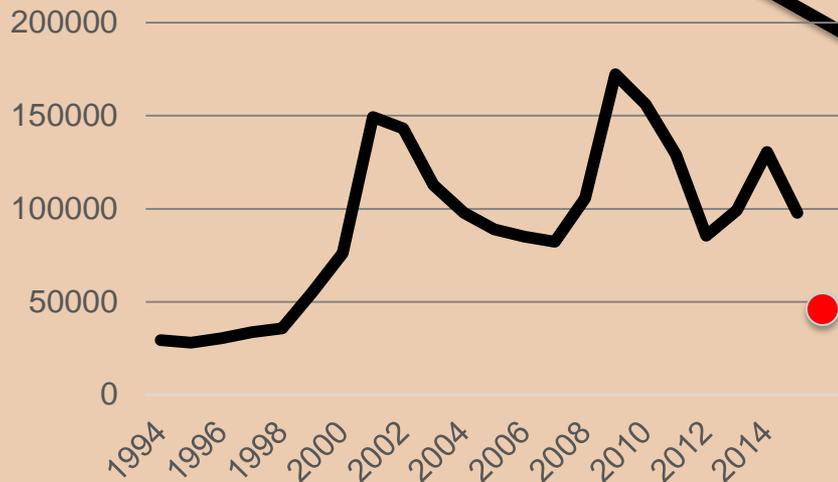
1. Define the problem / rationale for this effort
2. Summary of kelt reconditioning efforts in the Columbia Basin
3. Summary of physiology studies
4. Evaluations of reproductive success of reconditioned kelt steelhead
5. Effects of artificial reconditioning on homing of kelt steelhead
6. Genetic Stock Identification of the Snake River kelt steelhead population
7. Summary of kelt project performance to date
8. Planned Snake River kelt production scale facility



1. Define the Problem

All steelhead upstream of Bonneville Dam in the Columbia River are listed Under the Endangered Species Act

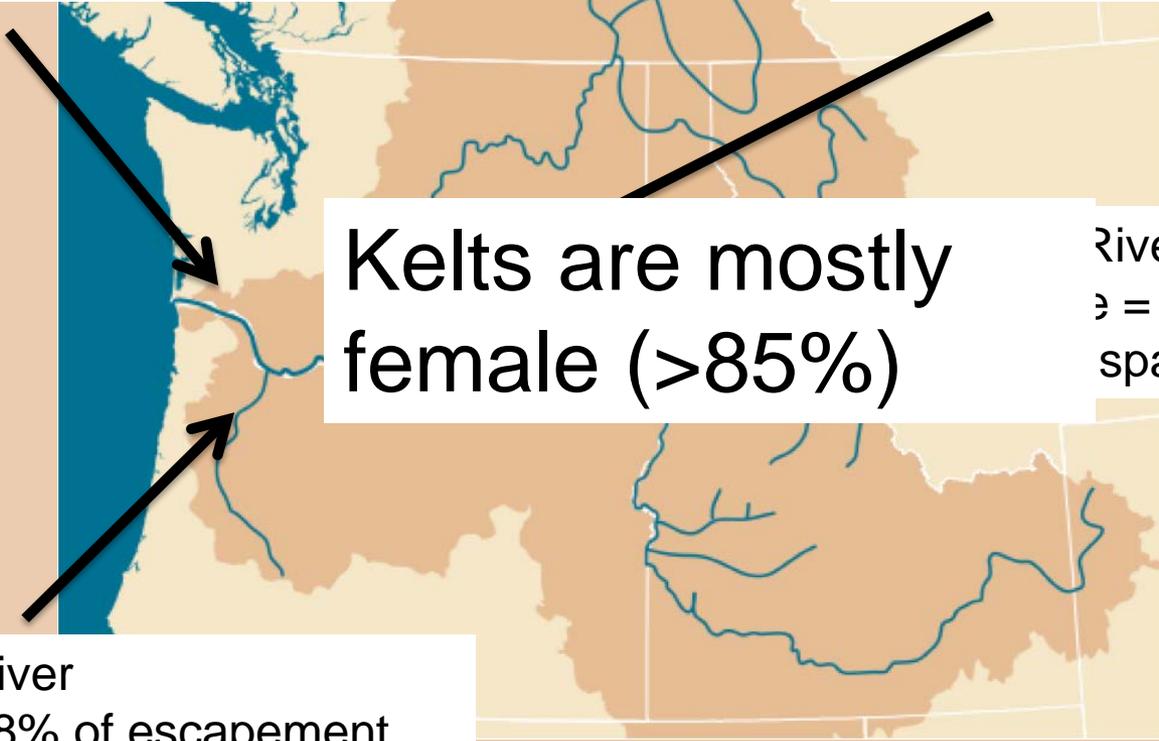
Bonneville Dam Wild Steelhead Count



1. Kelt steelhead availability (% of escapement) and repeat spawner rates (% of the run) in the Columbia Basin

Kalama River
Kelt rate is unknown
Repeat spawner rate = 17%

Yakima River
Kelt rate = 70% of escapement
Repeat spawner rate = 3.4%



Kelts are mostly female (>85%)

River
Kelt rate = 45% of escapement
Repeat spawner rate = 0.4%

Willamette River
Kelt rate is 58% of escapement
Repeat spawner rate = 1.3-12.4%



1. Approach / Rationale

This project wants to leverage the iteroparous nature of steelhead into increasing the lifetime reproductive success of wild steelhead and assist with recovery. Kelt stage steelhead are abundant in the Columbia River, but repeat spawners are rare.

Abundant kelts are a no-take opportunity to increase natural steelhead production.

Successful iteroparity can increase individual lifetime reproductive success by two to three times relative to individuals adopting a semelparous strategy

NOAA Biological Opinion for the Operating the Columbia River Hydro system calls for a 6% improvement in B-run steelhead population productivity by artificially reconditioning kelt steelhead and / or improving in-stream passage through the hydro system



2. Kelt Reconditioning Process

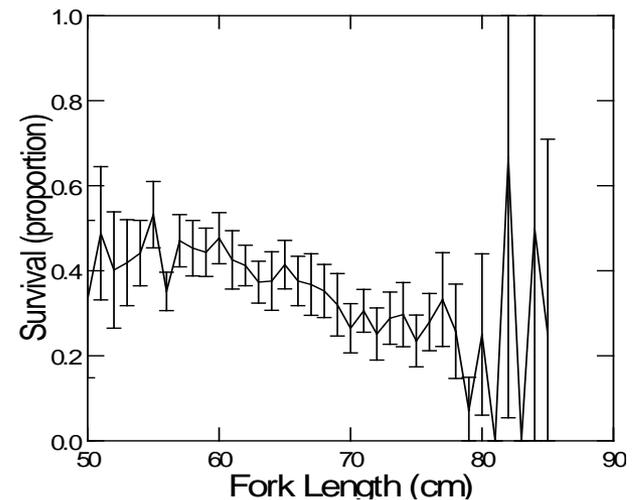
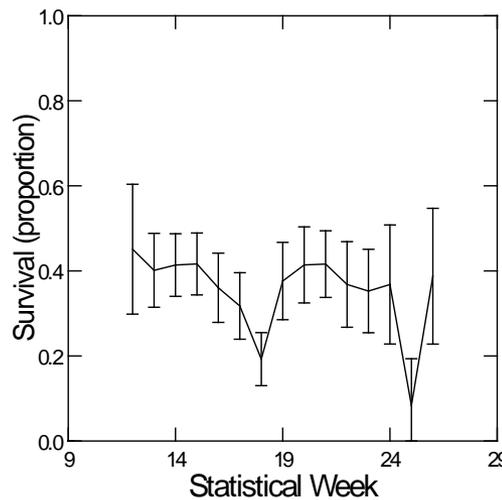
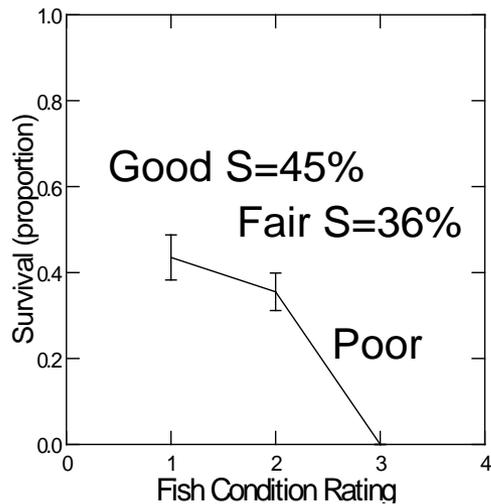


1. Collect downstream migrating kelts at weirs, or juvenile bypass systems in the spring.
2. Place kelt steelhead in large circular tanks. Apply standard fish culture practices.
3. Release reconditioned kelts in the fall.
4. Reconditioned kelts return to spawn with the natural run either the following spring (consecutive), or wait a year (skip).
5. Reproductive success is tested using genetic parentage analysis.



2. Summary of Reconditioning efforts in the Yakima and Snake rivers

Location	Years	N	S	Potential Benefit relative to fish left in river (survival/return rate)
Yakima	16	9,208	40%	14 x
Snake	6	856	35%	113 x



2. Evaluation of Management Scenarios

Collect downstream migrating kelts:

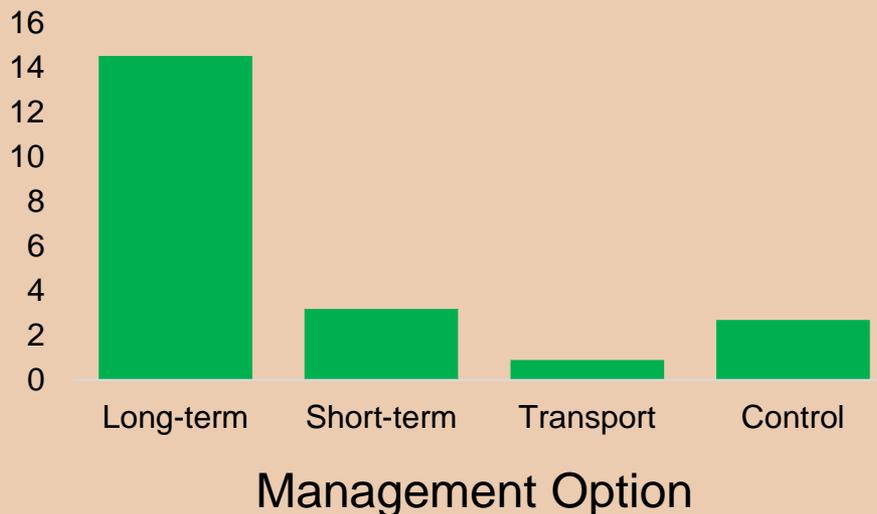
Control – PIT tag and release and systematic sample.

Transport – PIT tag, transport and release below Bonneville Dam. Timed with kelt run.

Short-term – PIT tag, place in tanks and feed for 6-8 weeks, then transport below Bonneville Dam. Timed with kelt run.

Long-term – PIT tag, place in tanks and feed for 5-6 months, then release back in river. Timed with the returning run.

Return Rate



3. Summary of Physiology Studies

- Steelhead first deplete lipids, then muscle protein to fuel migration, gonadal development, and kelt emigration. Penney and Moffitt 2013; Penney and Moffitt 2014a; Penney and Moffitt 2014b
- Consecutive and skip spawning life histories are found in reconditioned kelts. These are normal steelhead life histories. Pierce et al. 2016.
- Consecutive or skip spawning trajectory is determined during the initial 5 to 10 week period after spawning. Caldwell et al. 2013; Caldwell et al. 2014; Pierce et al. in review
- Reconditioned kelts have greater energy reserves than maiden spawners.

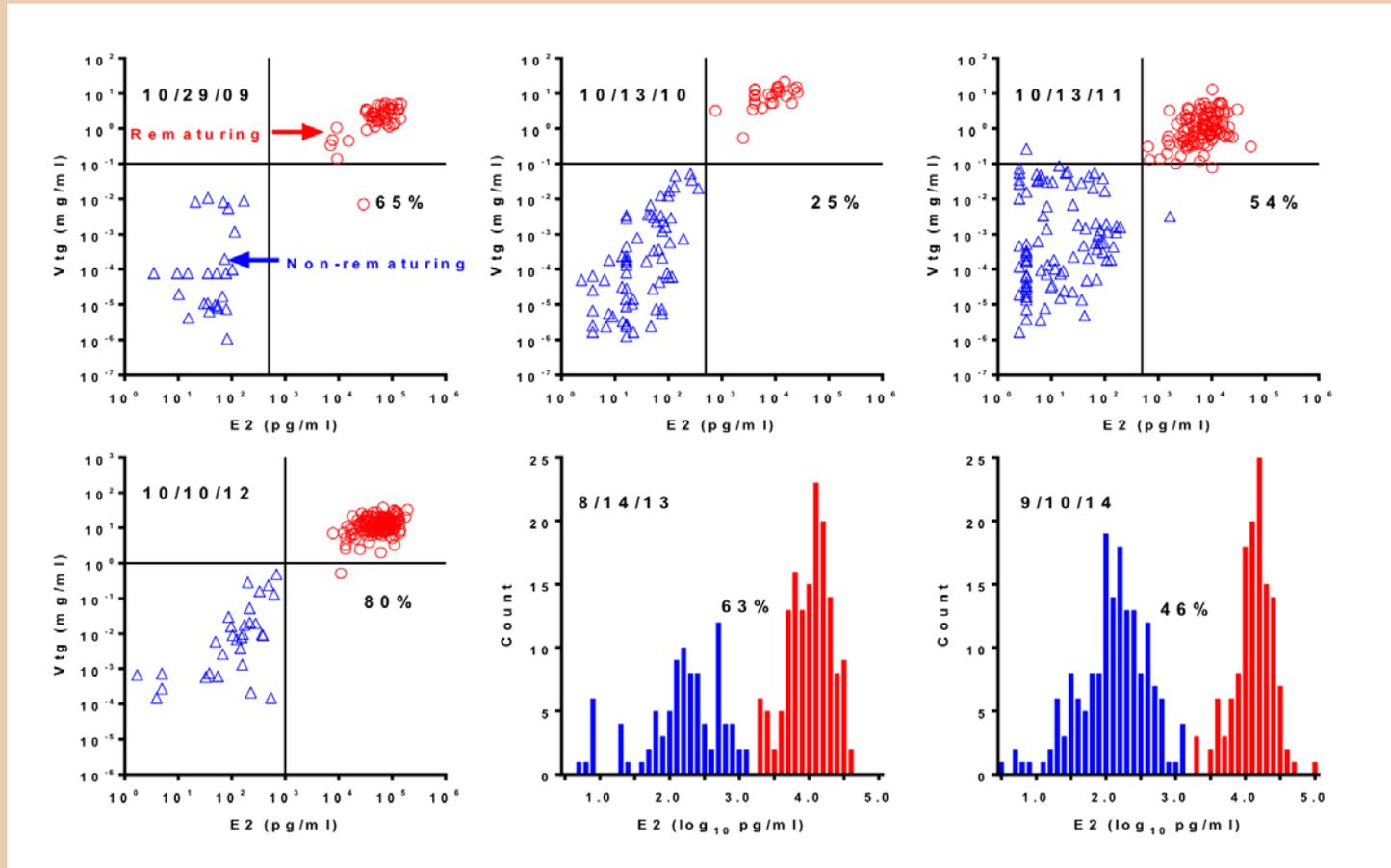


3. Summary of Physiology Studies

Alternative Life Histories

Maturation status of female kelts based on a release or earlier blood sample.

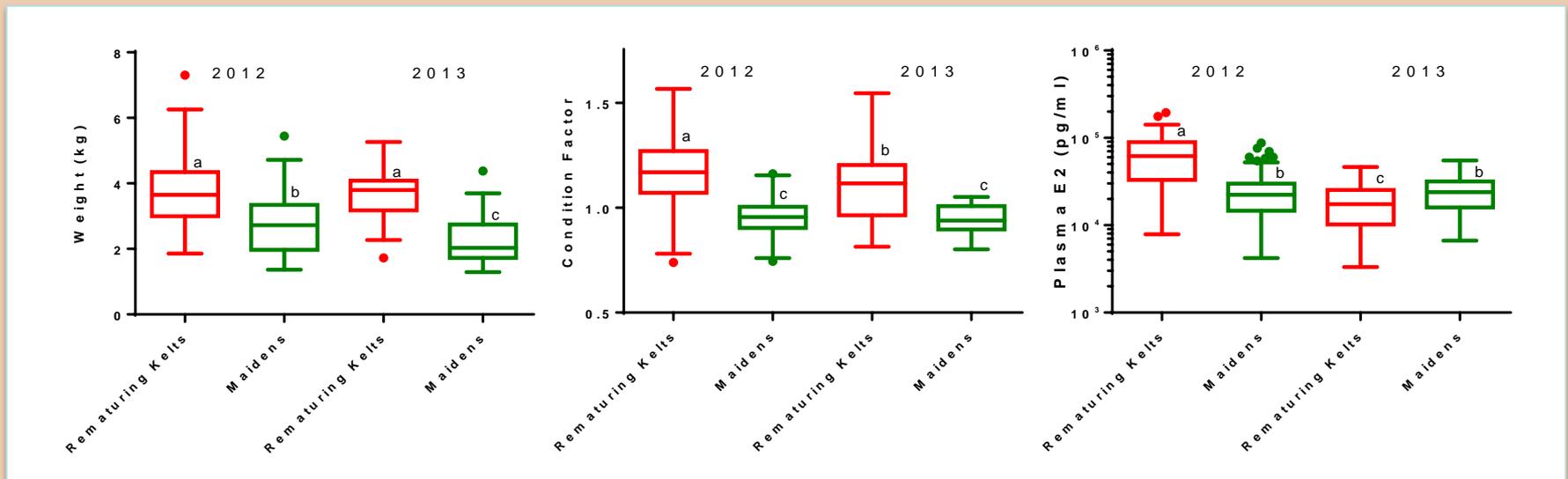
E2: estradiol; Vtg: vitellogenin



3. Summary of Physiology Studies

Reproductive Performance of Maiden and Reconditioned Kelts (wild fish)

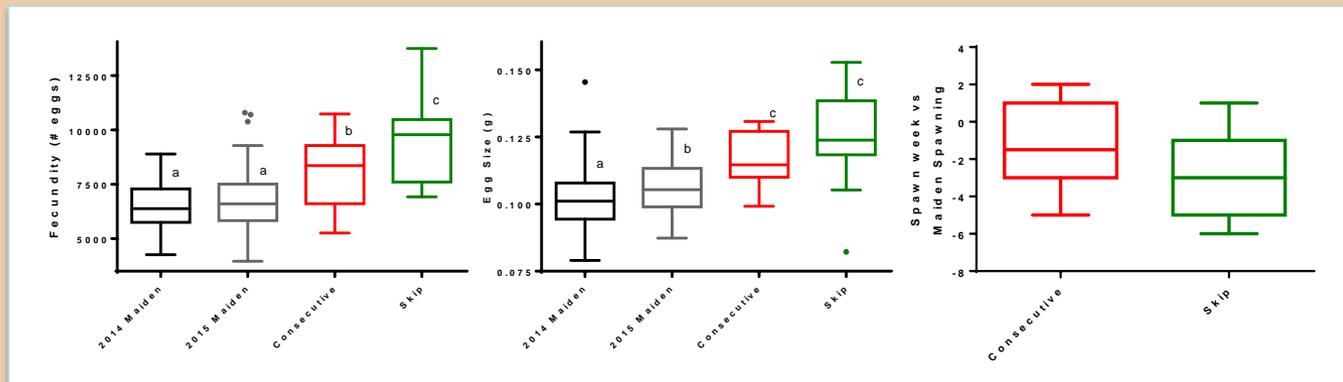
Body size, Fulton's condition factor, and plasma estradiol levels in rematuring reconditioned female Prosser Fish Hatchery steelhead kelts and maiden females sampled during upstream migration at the Prosser Denil ladder in October (Yakima River).



4. Evaluations of Reproductive Success of Reconditioned Kelt Steelhead

We have evaluated reproductive success of reconditioned kelt steelhead at a variety of scales due in part to the difficulty in obtaining these types of data in natural streams.

1. In a hatchery setting: evaluate reproductive performance of maiden fish, recondition them and compare performance as repeat spawners. Results to date show that fecundity and egg size were greater in reconditioned consecutive spawners versus maidens, and increased further in skip spawners, indicating that kelts should produce more offspring that survive at a higher rate than maidens.



4. Evaluations of Reproductive Success of Reconditioned Kelt Steelhead

We have evaluated reproductive success of reconditioned kelt steelhead at a variety of scales due in part to the difficult in obtaining these types of data in natural streams.

2. In a river setting, we are evaluating reproductive performance of maiden and reconditioned kelt steelhead using parentage analysis to identify juveniles produced by each group. Results to date are encouraging and indicate that lifetime reproductive success of reconditioned kelt steelhead is about double that of maiden fish.
3. Over the last two years, we utilized the Cle Elum Hatchery spawning channel to determine the feasibility of evaluating steelhead reproductive success. Thousands of juveniles were produced both years and we will begin more rigorous experiments in the future.

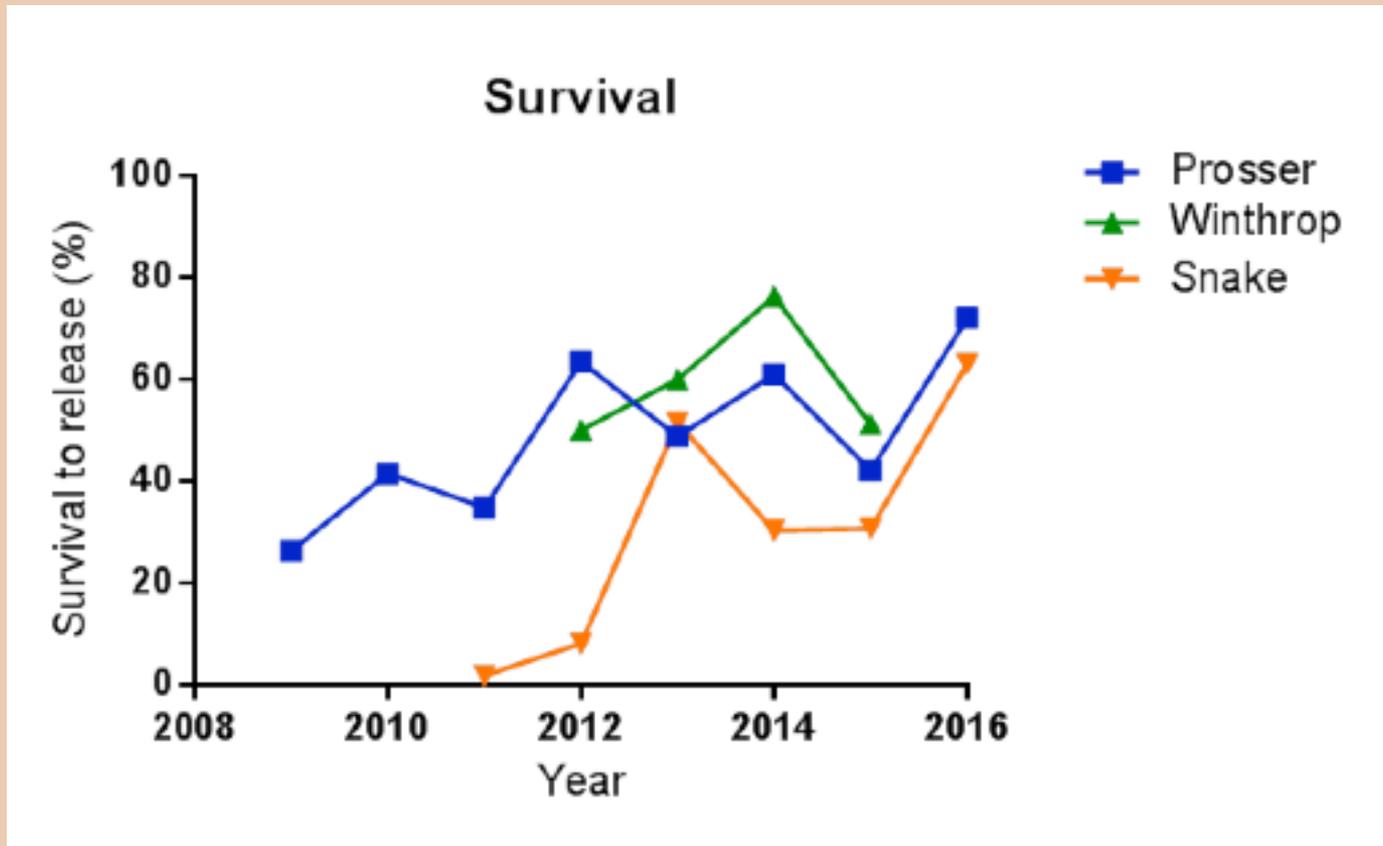


5. Effects of Artificial Reconditioning on Homing of Kelt Steelhead

A number of data sources provide details of spawning locations of maiden steelhead. Sources include In-stream PIT arrays, radio tracking, trap capture, and fish ladder PIT detection. Conclusive evidence for homing was found in fish histories with both maiden and repeat spawning events located.



7. Summary of Kelt Project Performance



Summary

1. Columbia River steelhead populations are listed under ESA and need novel recovery strategies
2. There is a relatively large abundance of kelt steelhead in the Columbia River even in the upper most areas
3. In general, repeat spawning steelhead make up a very small proportion of the spawning run
4. Increasing repeat spawners in steelhead populations can have many positive effects on populations including increasing; genetic diversity, lifetime fecundity, and fitness since genes are distributed across generations
5. Long-term reconditioning kelt steelhead provides 5 to over 100 times more repeat spawners than leaving the fish in the river
6. Physiology studies have provided us with a much better understanding of energetic and physiological status of kelts, improved our understanding of alternative life histories in post-spawning fish, and improved survival and health of reconditioned fish.



Summary

7. Blood hormone assays are useful to classify consecutive and skip spawner steelhead.
8. Reproductive success studies are underway at a variety of scales: hatchery analog, spawning channel, and natural river. Results are encouraging
9. Artificially reconditioned kelt steelhead appear to repeat home with high fidelity.



Estimated Snake River kelt steelhead collections, survival, association with Major Population Groups, and release numbers

	collection criteria	transferred to NPTH	end of season holding (0.40)	Consecutive spawners (0.34)	Skip spawners (0.66)	2nd year Recondition survival (0.9)	1st year productivity credit (1.29)	2nd year productivity credit (1.51)	Total Fish Released	credit at MPG level	MPG Level credit	Non target fish increase
Lower Granite Dam Kelt Collection	> 60 cm	667	267	91	176	158	117	239	356	0.63	224	124
RPA 33 Goal = Increase the Lower Granite Dam ladder count of wild B-run steelhead by 6% of the base period = 180 reconditioned kelts												



Nez Perce Tribal Hatchery

Pole Building
Concrete floor
6 large (20 ft) circular tanks
4 smaller circular tanks
Necessary piping
Cost \$2,000,000

Main
Headtank

Hatchery
Building

Headtank

S - Channels

Acclimation
Ponds

100'
Raceways

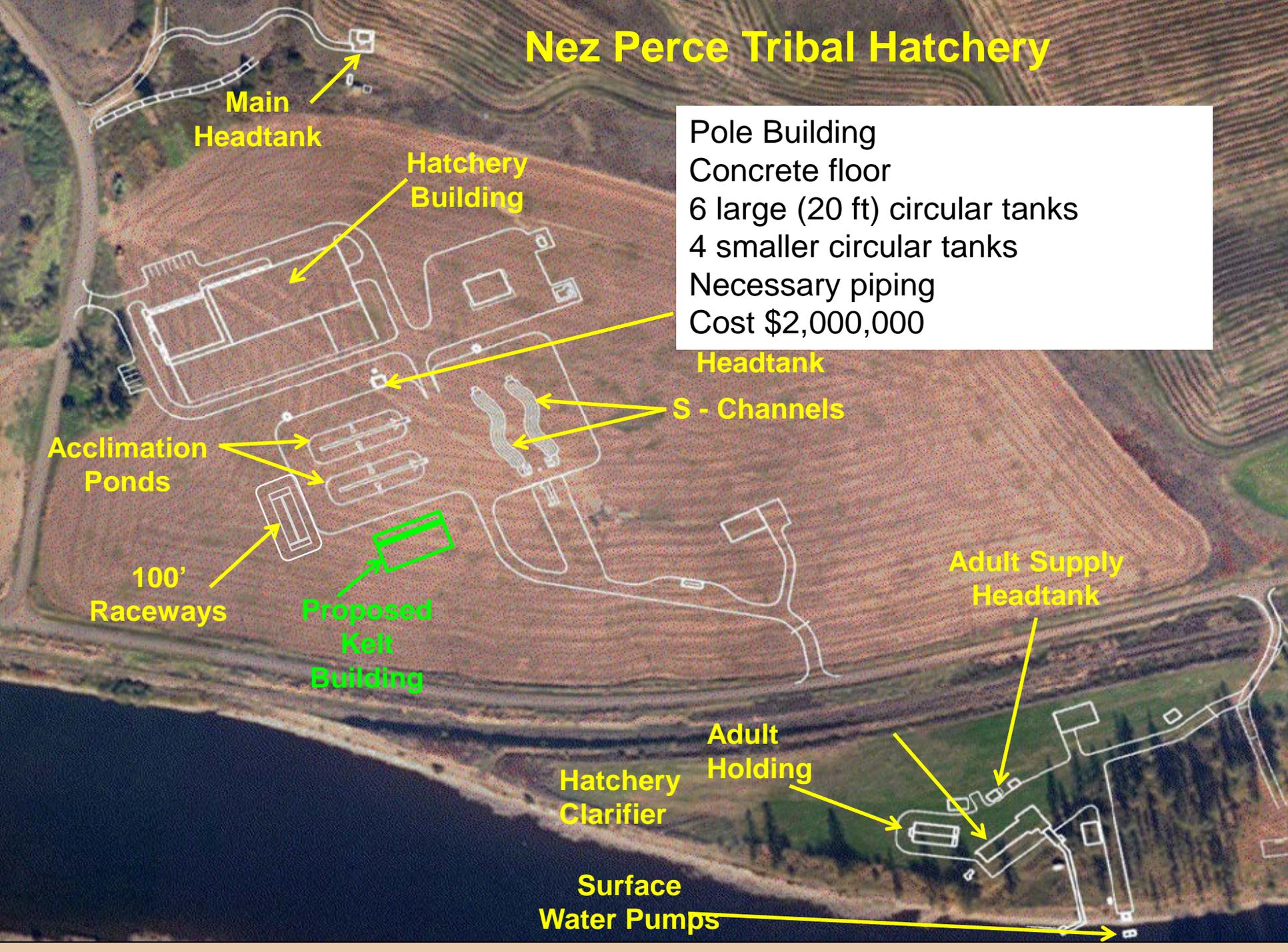
Proposed
Kelt
Building

Adult Supply
Headtank

Hatchery
Clarifier

Adult
Holding

Surface
Water Pumps



ISRP Recommendation

- “The ISRP acknowledges that even if density dependence is currently limiting abundance, ongoing habitat and fish passage restoration work may help alleviate some population bottlenecks and lead to increased productivity.
- Also, reconditioned adults are buffered from environmental conditions that affect survival rates in mainstem and ocean habitats. Thus, these fish may become an important conservation resource when the survival of maiden steelhead is impacted by poor marine and river conditions.
- The project also directly addresses the issue of declining iteroparity in Snake River steelhead.
- Additionally, it provides an opportunity to assess the viability of using reconditioned kelts in population recovery.
- Consequently, the program offers a “spread-the-risk” strategy that can **provide potential benefits not possible through any other existing or proposed action.**”





ISRFP

Columbia River Inter-Tribal Fish Commission



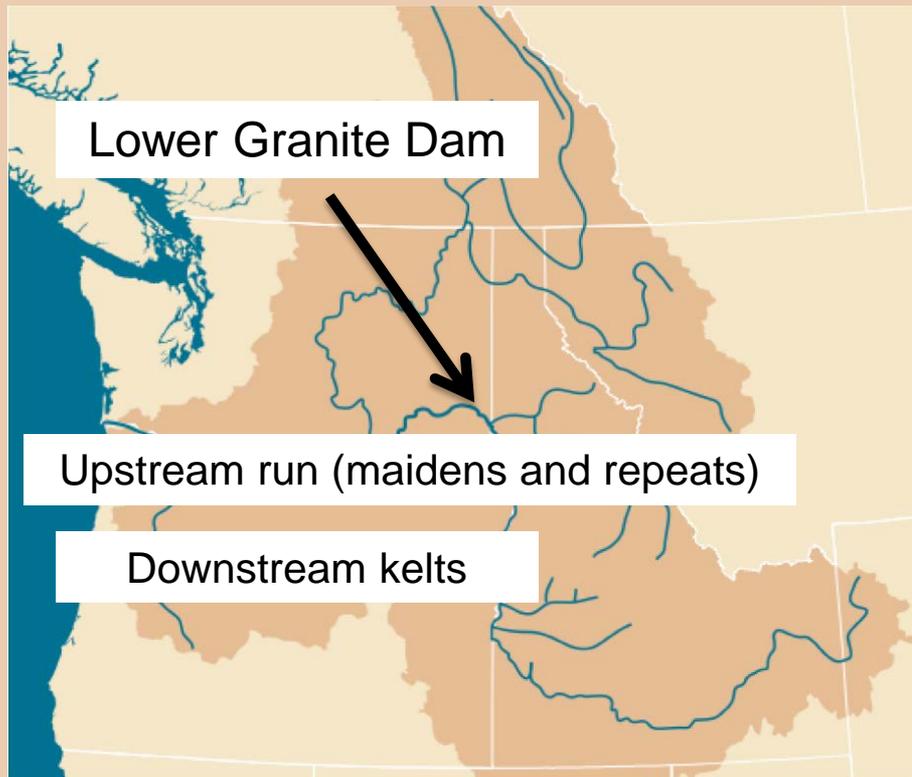
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Lower Granite Dam Kelt Collection	> 60 cm	667	267	91	176	158	117	239	356	0.63	224	124
Little Goose Dam Kelt Collection	all	390	156	53	103	93	68	140	208	0.62	129	74
South Fork Clearwater River	localized broodstock	50	20	7	13	12	9	18	27	1	27	0
Total		1107	443	150.54	292	263	194	397	591		380	198



4. Genetic Stock Identification of Snake River Origin Kelts

We conducted GSI monitoring of kelt steelhead in the Snake River Basin of Washington, Oregon and Idaho from 2009 to 2014 in order to evaluate kelt stock proportions by region-of-origin and compared to other work with maiden and repeat spawners.



Assignments made to the highest ranked reporting group regardless of probability score.

Reporting groups included:

Grande Ronde

Imnaha

Lower Clearwater

Lower Salmon

Lower Snake

Upper Snake

A run groups

Middle Fork Salmon

South Fork Salmon

Upper Clearwater

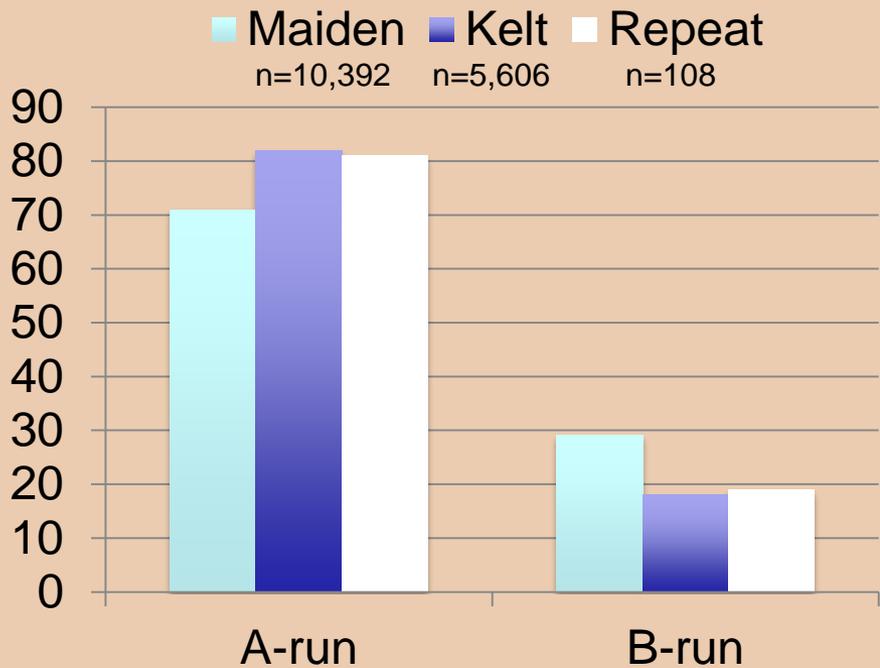
South Fork Clearwater

B run groups



4. Genetic Stock Identification of Snake River Origin Kelts

Run composition of maiden, kelt, and repeat spawner steelhead determined with GSI at Lower Granite Dam



Assignments made to the highest ranked reporting group regardless of probability score.

Reporting groups included:

- Grande Ronde
 - Imnaha
 - Lower Clearwater
 - Lower Salmon
 - Lower Snake
 - Upper Snake
- A run groups
-
- Middle Fork Salmon
 - South Fork Salmon
 - Upper Clearwater
 - South Fork Clearwater
- B run groups

Matala, A.P., D.R. Hatch, S. Everett, M. Ackerman, B. Bowersox, and S. Narum. In review. Genetic stock identification reveals regional distinctions in the biology and repeat spawning potential of emigrating kelt steelhead in the Snake River. ICES Special Addition.



4. Evaluations of Reproductive Success of Reconditioned Kelt Steelhead

Number and percentage of parents detected in each class, average number of progeny assigned to an individual, relative reproductive success (RRS), and lifetime reproductive success (LRS) for each group of individuals. Data collected in 2013 and 2014 in Yakima River tributaries. This is an index due to incomplete sampling.



Class	Parents			Progeny				RRS	LRS
	Genotyped N	Detected		Genotyped N	Assigned				
		N	%		N	Per			
♂	●	312	16	5.1%	312	33	0.11	1.00	
	●	78	10	12.8%	78	27	0.35	3.27	
	●	24	4	16.7%	24	9	0.38	3.55	6.82
♀	●	905	33	5.6%	905	101	0.17	1.00	
	●	625	55	10.1%	625	128	0.23	1.37	
	●	321	17	6.0%	321	33	0.12	0.69	2.06



5. Effects of Artificial Reconditioning on Homing of Kelt Steelhead

Location	Conclusive Evidence for Homing				Consistent with Homing		
	A. Maiden/ Repeat Spawner Tag Detection	B. Repeat Spawner Tag Detection + GSI conformation	C. Conclusive Homing total A+B		D. Repeat spawner PIT Detection at Prosser	E. Post Spawn Repeat Spawner Recaptured at CJFF	F. Consistent with homing, some fish are in both D and E
Yakima R	27	200	227		561	103	629
Omak Cr	11	-	11		-	-	-
Total	38	200	238		561	103	629

