Application Name: Adult Steelhead Migratory Routes Investigation

Application Number: 219-6035-16666

By: Gilliam SWCD

Offering Type: Open Solicitation

Application Type: Monitoring

OWEB Region: Mid Columbia
County: Gilliam
Coordinates: 45.733562,-120.648963

Applicant:
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Budget Summary:
OWEB Amount Requested: $223,232
Total Project Amount: $626,866

Administrative Information

Abstract

Provide an abstract statement for the project. Include the following information: 1) Identify the project location; 2) Briefly state the project need; 3) Describe the proposed work; 4) Identify project partners.

Approximately 60% of adult steelhead returning to the John Day River "overshoot" the John Day River mouth and are detected 119 km upstream in the Columbia River at McNary Dam. After crossing McNary Dam, John Day adult steelhead must "fallback" in order to return and spawn in the John Day River. Adult overshoot past a hydroelectric dam can directly (via physical injury during fallback) and indirectly (via increased energy expenditure) reduce the survival and reproductive capacity of returning adults. The current proportion of adult steelhead overshooting the John Day River contributes to a 7-year mean Bonneville Dam to South Fork John Day conversion probability of 50%. This means that only half of the adult steelhead arriving at Bonneville Dam survive and return to their natal stream to spawn. Life-cycle models indicate substantial risk of quasi-extinction for a John Day steelhead population if this status quo conversion probability continues. The quasi-extinction risk diminishes to near zero if conversion rate increases to 70%.

A first step toward increasing conversion rate is to map the migratory routes of John Day adult steelhead from the mouth of the river upstream to Tumwater Falls. To do this, we will leverage the existing infrastructure and returning Passive Integrated Transponder tagged adults (originally tagged as parr or smolts in John Day tributaries) by capturing known origin adults in the Bonneville Dam Adult Fish Facility. Recaptured adults will be tagged with acoustic transmitters. An array of acoustic receivers positioned in the Columbia and John Day rivers will detect tagged adults and allow us to map migratory routes to elucidate where and when adult steelhead are migrating. We will compare fate of each tagged individual by migratory route to identify relationships between migration route and population performance. Gilliam SWCD and ODFW will be the lead partners, and will coordinate with other agencies as appropriate.

Location Information

What is the ownership of the project site(s)?

✓ *Public land (any lands owned by the Federal government, the State of Oregon, a city, county, district or municipal or public corporation in Oregon)*

What agency(ies) are involved?

Gilliam SWCD and Oregon Department of Fish and Wildlife are the primary partners on this application. Other agencies that will likely be involved, at least at a consultation and coordination level, include:

- Oregon DSL (for navigable waterways below the ordinary high water mark)

- Columbia River InterTribal Fish Commission (Bonneville Adult Fish Facility coordination).

- U.S. Army Corps of Engineers (Bonneville Adult Fish Facility coordination).

❑ *Private (land owned by non-governmental entities)*

✓ *This grant will take place in more than one county.*

List the counties affected:

Multnomah (location of Bonneville Dam--site of adult steelhead capture and tagging); Gilliam and Sherman counties (locations of tag receiver stations below the ordinary high water mark in the John Day and Columbia rivers in both of these counties).

Permits

Other than the land-use form, do you need a permit, license or other regulatory approval of any of the proposed project activities?

● Yes
❍ No

For Details Go to Permit Page

Racial and Ethnic Impact Statement

Racial and Ethnic Impact Statement

❍ The proposed grant project policies or programs could have a disproportionate or unique POSITIVE impact on the following minority persons. (indicate all that apply)

❍ The proposed grant project policies or programs could have a disproportionate or unique NEGATIVE impact on the following minority persons. (indicate all that apply)

● The proposed grant project policies or programs WILL HAVE NO disproportionate or unique impact on minority persons.

Insurance Information

❑ *Working with hazardous materials (not including materials used in the normal operation of equipment such as hydraulic fluid)*

❑ *Earth moving work around the footprint of a well*

❑ *Aerial application of chemicals*

❑ *Removal or alteration of structures that hold back water on land or instream including dams, levees, dikes, tidegates and other water control devices (this does not include temporary diversion dams used solely to divert water for irrigation)*

❑ *Applicant's staff or volunteers are working with kids related to this project (DAS Risk assessment tool not required, additional insurance is required)*

❑ *Applicant's staff are applying herbicides or pesticides (DAS Risk assessment tool not required, additional insurance is required)*

Additional Information

❑ *This project affects Sage-Grouse.*

Problem Statement

Issue

Provide an overview of the present situation and the key question, specific problem, and/or or watershed issue that this monitoring is intended to inform.

The John Day River, located in Northeastern Oregon, supports a native, naturally reproducing population of summer steelhead (Oncorhynchus mykiss) which are listed as “Threatened” under the Endangered Species Act. Beginning in 2004, many juvenile John Day steelhead have been marked with Passive Integrated Transponder (PIT) tags to estimate population abundance, survival, and migration timing. PIT tags are internally implanted, typically when juvenile steelhead are migrating from rearing areas to the ocean and provide individual identification for the life of each fish. When adult steelhead return to the Columbia River one or two years after emigrating from the John Day River, PIT tagged individuals can be detected in a series of antenna arrays located in the fish ladders of hydropower dams, and also at in-stream antennas in tributaries.

On the Columbia River downstream of the confluence of the Snake and Columbia, adult PIT tag detection now exists at all four dams. Despite being 119 km upstream from the John Day River mouth, in most years a majority of returning John Day steelhead ascend McNary Dam (Figure 1). John Day steelhead exhibit “adult overshoot,” or migration past their natal stream mouth, at a higher proportion than neighboring Mid-Columbia steelhead populations (e.g., Umatilla and Yakima rivers). Adult overshoot contributes to the low "conversion probability" for steelhead originating from the South Fork John Day (Figure 2), and presumably from other areas of the John Day basin. Conversion probability is the product of survival times homing, or, in other words, the percent of adult steelhead crossing Bonneville Dam which survive and return to their smolt tagging site. The current low conversion probability limits the abundance of John Day steelhead escaping to the John Day to support both fisheries and natural production.

Some of the John Day River adult overshoots stray into, and apparently spawn in, non-natal tributaries in the vicinity of McNary Dam. In addition to the risk of straying (and hence complete loss of reproduction in the John Day basin) adult overshoot could also impose additional mortality. Fallback over mainstem dams may increase mortality of adult steelhead. For instance, Keefer et al. (2005) estimated that escapement rates from the mainstem Columbia were 13% lower for steelhead that fallback over a dam as opposed to those that did not fallback. Surface spillway operation at McNary Dam is terminated on August 31 and not resumed until spring, forcing downstream migrating John Day steelhead to pass through the turbines or the juvenile bypass system (which is also out of service for portions of the winter months). The majority of John Day steelhead fallback over McNary Dam after September 1 (Richins and Skalski 2018), increasing risk of mortality during passage through the juvenile bypass system or turbines.

John Day steelhead which overshoot to McNary Dam and then return downstream to the John Day are migrating at least an additional 238 km greater than their direct route migration distance. A steelhead returning to the South Fork John Day (approximately centrally located in the basin) with no detours will have a 692 km migration from the ocean. Adult overshoot to McNary Dam will add at least 34% to this migration distance. Energy and lipid levels in salmonids upon ocean exit are correlated with migration distance to spawning areas (Quinn 2005). A South Fork John Day steelhead (for example) may be physiologically less prepared for a 930 km migration than a 692 km migration. This may result in less successful mating and spawning behavior.

The energy budget impact from overshoot will be compounded by water temperature effects on steelhead which overwinter in the Columbia and/or Snake . Columbia and Snake River winter water temperatures have been artificially elevated in the past five decades through dam construction and are substantially higher than in the John Day. Figure 3 provides an example of temperature differentials between the John Day and Columbia rivers. Our research collaborator on this project, ODFW, has 8 years of temperature monitoring data at these sites, ensuring that we understand the existing inter-annual temperature variation. Adult steelhead metabolism is largely

controlled by water temperature (for review see Quinn 2005). Exposure to warmer winter temperatures in the Columbia may cause consumption of more fat reserves than anticipated. Since steelhead are generally not feeding after return to freshwater, they may not be able to compensate for the extra loss of energy resulting from wintering in warm water areas (Columbia and/or Snake rivers).

Migration timing of Columbia River summer steelhead shifted from the 1950's to the 1990's. Peak arrival at Bonneville Dam was approximately 21 days later in the 1990's than it was in the 1950's (Robards and Quinn 2002). This delay in migration was coincident with delayed peak summer temperature in the mainstem Columbia River. Delays in migration timing may make entry into the John Day River during summer months more difficult, as John Day discharge decreases through the summer months. Mean John Day River August discharge may influence the migratory patterns of John Day steelhead. Analysis of PIT tag data suggests there is correlation between John Day River summer flow levels and the proportion of adults overshooting (Figure 4). However, a PIT tag based investigation of overshoot, while effective at describing the large-scale patterns (e.g., Richins and Skalski 2018), cannot provide fine-scale information on timing or location of migrating adults in the vicinity of the John Day River mouth. These data are necessary to begin elucidating the causal mechanisms driving overshoot.

Poor conversion probability for John Day River steelhead is limiting spawner abundance (Figure 5) and hence recovery. In life cycle model simulations, increasing conversion from 55% to 70 or 80% significantly increases adult spawner abundance (Figure 5), and decreases quasi-extinction risk (Figure 6). Quasi-extinction risk is the predicted probability of the population declining to fewer than 0.5 spawners/km in a given year. The risk in Figure 6 is the percentage of all future years (model runs) which contain estimated spawner escapement below this threshold. This modeling was done with existing habitat capacity, suggesting that if the number of adult spawners can be increased via increased conversion probability, there would be sufficient rearing habitat capacity. This is especially likely given the extensive restoration action planned by the John Day Basin Partnership (through funding from OWEB and other sources), which is targeted at increasing freshwater rearing habitat capacity.

Adult overshoot also has negative implications for recreational fisheries and associated economies in the Lower John Day River. Since the majority of the adult return currently overshoots, many are not available to John Day River fisheries occurring during fall in Gilliam, Sherman, and Wheeler counties. Increased adult abundance during fall would increase in-river fishing participation and associated economic stimulus to these counties.

In conclusion, life-cycle model simulations clearly indicate the potential ecological benefit of increased conversion probability, and the risk to the population of failing to address issues contributing to the low conversion probability. Adult overshoot of the John Day River mouth is a key factor likely to contribute to low conversion; hence it should be targeted for monitoring to understand all aspects of adult overshoot. With improved understanding of adult migratory routes in the John Day Dam pool (specifically at the John Day-Columbia confluence) comes an opportunity for identifying ameliorative actions.

Strategies

Is the proposed monitoring or data need identified as an essential or needed action in a LOCAL assessment or plan at the proposed location?

● Yes
❍ No

Provide the name of local plan, Watershed assessment or other locally relevant document.
John Day Basin Partnership Focused Investment Partnership; Strategic Action Plan.

Additionally, this application is designed to address key adult migration concerns documented in the Mid-Columbia Recovery plan: (https://www.dfw.state.or.us/fish/CRP/docs/mid_columbia_river/Oregon_Mid-C_Recovery_Plan_Feb2010.pdf). For example, p 8-95 demonstrates the need to understand how migration history relates to adult energetics and mortality. Understanding the relationship between migration history and fate (survival or mortality) is a key product of this monitoring proposal and directly addresses this recovery plan need.

Is this project a part of a comprehensive monitoring strategy/program?

● Yes
❍ No

Provide the name of the monitoring strategy/program.
John Day Salmonid Life Cycle Monitoring--ODFW

If the strategy/program is published in a document, report the document name using the Endnote citation format to report the name.
N/A

Are other organizations/entities cooperating with this monitoring project by concurrently conducting field work for other components of a comprehensive monitoring strategy or program that are not also being funded out of this grant?

● Yes
❍ No

How many?
3

List the organizations/entities.
Oregon Department of Fish and Wildlife
Eco Logical Research Inc.
Confederated Tribes of the Warm Springs Reservation of Oregon

These three entities are actively tagging juvenile steelhead in the John Day Basin with PIT tags. This work collectively enables our proposed monitoring of known-origin adults by providing a source of tagged returning adults. Additionally, Eco Logical Research is a key analytical partner responsible for providing life-cycle model simulations about the effect of conversion rate on population viability.

Project History

Continuation - Are you requesting funds to continue work on a monitoring project previously funded by OWEB?
❍ Yes
● No

Resubmit - Have you submitted, but were not awarded an OWEB application for this project before?
❍ Yes
● No

Phased - Is proposed work in this application a phase of a comprehensive monitoring plan or project?
❍ Yes
● No

Plans and Salmon

Will this project benefit salmon or steelhead?
● Yes
❍ No

✓Middle Columbia River - Steelhead

How will the resulting monitoring project benefit salmon or steelhead or their habitat?

The baseline monitoring proposed by this application will inform our understanding of the migration routes used by adult steelhead which overshoot versus those which home to the John Day River. These data will provide an initial description of the problem, and inform possible avenues for future monitoring and/or management actions.

Understanding migratory routes and their relationship to survival will identify possible factors influencing conversion probability. The status quo conversion probability (estimated at 50% for the South Fork John Day population), when coupled with current in-stream habitat conditions for John Day steelhead, creates a substantial risk of quasi-extinction (McHugh et al. 2017). We currently have limited understanding of adult steelhead migration through the John Day River - Columbia River confluence area. Baseline data regarding adult migratory routes in this area are a prerequisite for development of an adaptive management plan to address John Day tributary overshoot. Ultimately, an adaptive management-monitoring plan will likely be needed to successfully reduce the proportion of adults overshooting the John Day River mouth. Successful reduction of overshoot will increase conversion probability which will in turn increase fishery benefits and reduce the probability of quasi-extinction for these populations.

Reducing overshoot and ultimately increasing conversion would directly benefit each of the five steelhead populations in the John Day Basin via a reduction of quasi-extinction risk. This is a unique aspect of this monitoring proposal -- the data and results will influence all five populations within the John Day Major Population Group. We will have the potential to recapture known-origin adults from each population and follow their migration patterns with dual acoustic-radio tags. The data resulting from this proposal will be applicable to the entire Major Population Group, rather than to only a specific population or component of a population. Hence, there is a large potential uplift from the initial learning and then eventual management actions resulting from this monitoring proposal.

Does the project address either a problem or data need identified in a REGIONAL assessment or recovery plan at the proposed location?
● Yes
❍ No

Regional Assessments or Recovery Plans

Middle Columbia River Steelhead Distinct Population Segment ESA Recovery Plan

Proposed Solution

Monitoring Activity

What are you proposing to do? Choose only one.

- ●*Status and Trend Monitoring -- Details will follow.*
- ❍*Effectiveness Monitoring of a Restoration Project(s)*
- ❍*Landscape Scale Effectiveness Monitoring*
- ❍*Rapid Bioassessment Monitoring*

Goal, Objectives, and Activities

State your project goal. A goal statement should articulate desired outcomes (the vision for desired future conditions) and the watershed benefit.

Our goal is to achieve 70% conversion probability for adult steelhead from Bonneville Dam to the John Day River. This project contributes to the ultimate goal by quantitatively describing, both spatially and temporally, the migration patterns of individually tagged John Day adult steelhead. We seek to describe migratory routes in the Columbia River at rkm 351 - rkm 352 (at and 1km upstream of the John Day River confluence), and in the John Day River from rkm 0-16. These data will create management ability to ameliorate tributary overshoot and boost conversion toward the ultimate goal of a 70% conversion probability. Achieving this goal will reduce quasi-extinction risk and support in-river fisheries.

List specific and measurable objectives. Objectives support and refine the goal by breaking it down to steps for achieving the goal. (NOTE: If you quantify your objectives, ensure all numbers match the metrics listed in your selected habitat types.) Provide up to 7 objectives.

Objective #1

Objective

Accomplish the pre-sampling coordination and permitting necessary to participate in trapping of adult steelhead in the Bonneville Dam adult fish facility. Accomplish pre-sampling coordination and identification of acoustic receiver locations in the vicinity of the John Day-Columbia River confluence.

Describe the project activities. Activities explain how the objective will be implemented.

Successful implementation of this project will require partnership development and extensive pre-project planning. To accomplish this, we will sub-contract with ODFW to hire an NRS-1 (the implementation lead for this project) in September 2019. This will provide ample time to coordinate with critical state and federal agencies and their contractors. Coordination will help identify efficiencies, such as existing acoustic receiver locations, and any possible unused acoustic or telemetry receivers that can be applied to this project. Through this coordination, we hope to identify juvenile salmon acoustic telemetry system (JSATS- the type of acoustic tags which we propose to purchase and track) compatible acoustic receivers (most receivers used in the Columbia are JSATS-compatible) that will be unused during summer-fall 2020. If 'loaner' JSATS receivers can be applied to this project, we can reduce the largest upfront materials cost to OWEB, which would make the pre-project contract staffing cost-effective.

Prior to field sampling and tagging, the ODFW NRS-1 will also scout and map proposed acoustic receiver locations in the John Day pool. Feedback on the proposed receiver array will be sought during the winter of 2019; leading to refinement and improvement of receiver array functionality.

Pre-sampling work will also encompass product research and design, specifically of acoustic receivers and tags. Identifying the critical tag specifications through a thorough analysis and coordination process during winter 2019 will ensure that we deploy the best possible products into the field during 2020.

The 2019 work will additionally include ESA permitting for 2020. The ODFW NRS-1 will (in collaboration with other ODFW and GSWCD staff) develop and submit a 4(d) take permit application to cover research and sampling activities in 2020.

Objective #2

Objective

Capture known origin John Day River steelhead in the adult fish facility (AFF) at Bonneville Dam. Trapping will run from July 1 to September 15, 2020 during daylight hours (water temperature permitting). Known origin recaptures (from PIT tag code) will be implanted with an acoustic transmitter with a minimum 300 day lifespan.

Describe the project activities. Activities explain how the objective will be implemented.

ODFW contract staff (NRS-1 and EBA), with occasional backfill from Gilliam SWCD, will staff the Adult Fish Facility (AFF) at Bonneville Dam to capture returning John Day origin adult steelhead. Extensive pre-sampling coordination with the Corps of Engineers (access and safety), Pacific States Marine Fisheries Commission (PTAGIS--for sort by code data upload and operation), and Columbia River Intertribal Fish Commission (CRITFC also uses the AFF, coordination can help identify sampling efficiencies) will be conducted during winter 2019 and spring 2020. The coordination needed here is part of the rationale for the extensive pre-sampling contract with the ODFW NRS-1.

The ODFW staff will use prior years of detection data at the Bonneville Dam fish ladders to predict the key monthly and diel periods of adult steelhead movement into the fish ladders. Current data suggest July 1 - September 15 will be the key sampling period (Figure 7 and Figure 8). ODFW staff will be stationed at the dam during this key period, and prepared to use the selective diversion capabilities of the AFF to capture tagged steelhead.

To accomplish the selective diversion, ODFW staff will 'flag' all possible returning PIT tag codes (i.e., all steelhead PIT tagged in the John Day River basin in the prior 1-5 years which have not already returned to an adult detection site; smolts will have been PIT tagged, in part, at the rotary screw trap sites identified in the John Day basin map). When a flagged tag arrives, the separator gate will be closed, diverting the tagged adult, plus non-tagged 'bycatch', into the sampling facility. Staff will then use a handheld PIT tag transceiver to identify and release the bycatch, while securing the PIT tag recapture for acoustic tag insertion.

The PIT tag recaptures will be anesthetized and measured for length. Surgical implant of a dual acoustic-radio transmitter with trailing antenna will occur when fish are fully anesthetized and deemed healthy enough for surgery. The acoustic tag data will be entered into P4 (field front end for the PTAGIS database) in the conditional and text comments associated with the recapture record for that PIT tag code. These data will all be uploaded to the publicly accessible PTAGIS database for storage and subsequent retrieval/analysis. During recovery, tag operation will be confirmed with a handheld radio receiver. Following recovery from anesthesia, tagged adult steelhead will be released immediately upstream of the adult fish trap and allowed to proceed up the fish ladder to cross Bonneville Dam. We propose a goal of tagging 50 known origin adult steelhead with dual acoustic-radio tags. This will provide a reasonable sample size at our acoustic array near and in the lower John Day River. This sample size should be achievable given an adult return near the long-term mean abundance.

Objective #3

Objective

Install and operate a series of acoustic detection nodes and companion water temperature loggers in the Columbia and John Day rivers from July 5 through April 1.

Conduct companion radio-telemetry surveys to supplement the acoustic detection array as needed, and to ensure detection of adult steelhead in the John Day River to identify fate and relate that to migratory routes in the acoustic array.

Describe the project activities. Activities explain how the objective will be implemented.

We will solicit input and make appropriate adjustments to our acoustic array design (an example draft layout is provided in the attached 'Project Design' document) during winter 2019 and spring 2020. We will also use this time period to coordinate with potential project collaborators (USACE and contractors) and identify possible loaner acoustic receivers that could be integrated into our study design and provide additional points of detection in the Columbia River.

We will gather and construct acoustic receiver nodes and associated deployment hardware during spring 2020. Deployment of the nodes will commence on approximately July 1, 2020, coincident with the start of acoustic tagging at Bonneville Dam. We will maintain the array with weekly or bi-weekly (as indicated by battery life) checks for functionality, data download, and battery switch-out. We may adjust the acoustic arrays as needed in-season to optimize detection efficiency and migratory route mapping. The acoustic receiver arrays will be maintained until the last tagged adult has exited the project area, or during April of 2021, whichever comes first.

An advantage of the dual acoustic-radio tags we propose to use is that they can also be tracked with radio telemetry receivers. In the event of tags that are 'missed' on the acoustic array, we can use aerial telemetry flights to relocate missing tags. Additionally, we can use aerial telemetry to confirm migration upstream past the acoustic array in the John Day River in the event that adults are not detected at the PIT arrays in the John Day. The dual methods of secondary detection (radio telemetry and PIT arrays), ensure that we will have a high probability of detection for tagged adults in the John Day River. This will enable us to determine the ultimate fate of tagged individuals in the John Day and relate fate back to migratory route through the acoustic array in the lower John Day River and the John Day-Columbia confluence.

Objective #4

Objective

Manage and assimilate adult steelhead detection data (both acoustic and PIT detections), stream temperature, and stream discharge data.

Describe the project activities. Activities explain how the objective will be implemented.

The initial recapture (at Bonneville) and tagging data will be submitted to PTAGIS in order to facilitate tracking of individual fish. Subsequent PIT detections (The Dalles Dam, John Day Dam, McNary Dam, JD1 etc.) will also be available at, and retrieved from PTAGIS. The acoustic and radio tag location data will be stored and retrieved from a parallel Access database. PIT tag code will be a common field between our Access database for acoustic/radio detection data, and the PIT detection data housed in PTAGIS. Hence, PIT code will allow collation of all detection history for an individual fish. All detection data will be geo-referenced, allowing later incorporation into GIS for migratory route development.

Detection events will be date and time stamped. This will allow matching to an array of stream temperature data, as well as stream discharge data for the John Day and Columbia rivers. We will maintain stream temperature loggers at or near acoustic receiver nodes that are greater than 400 m distant from another receiver node with a temperature logger. The pre-project water temperature collected by ODFW was collected at approximately 2 m depth near the shorelines. We propose to continue that depth monitoring of the shoreline, but conduct temperature monitoring at approximately 5 m depth (when receivers are located in areas at least that deep) at the acoustic receiver nodes. This is a typical maximum travel depth for adult steelhead, hence it is a logical depth for temperature measurement in deep water areas. Temperature data will be initially housed in an Access database, and ultimately transferred to the ODEQ temperature database.

Objective #5

Objective

The overarching goal of this objective is to quantitatively describe the patterns of use and migration in the John Day-Columbia confluence area by returning adult steelhead, and how those patterns influence the fate of each fish. Within this umbrella, the sub-objectives are to:

-Map migration routes

-Analyze migration routes and look for areas of higher and lower than expected usage or travel

-Classify each acoustic tagged adult into migratory route categories for ease of dissemination and discuss with managers

-Relate migration history to ultimate fate of individuals

Describe the project activities. Activities explain how the objective will be implemented.

We will collate all possible data (PIT, radio, acoustic) for each individual fish. These three data streams will be used to build a spatio-temporal migratory route from Bonneville Dam upstream to the last known detection site. While acoustic tag detections near the mouth of the John Day River will be our primary tool for mapping migration, we can also use aerial telemetry flights and PIT tag detections at upstream sites (primarily McNary Dam adult ladders and juvenile bypass system, and the "JD1" array at John Day rm 20) to estimate the efficiency of the acoustic arrays at detecting migrating adults.

There is an extensive suite of in-stream PIT tag arrays in the John Day River (see John Day PIT Arrays Map).

These sites are coupled with locations where ODFW and others will be tagging steelhead smolts to provide the known origin adults for this acoustic telemetry monitoring. Prior data indicates the homing probability of steelhead, once they have returned to the John Day River, is very high (see Steelhead Homing Patterns map). Hence, there is a high probability of detection for the known-origin adults when they return to where they were tagged as juveniles. This provides good certainty in identifying the final fate of acoustic tagged adults; which is important for determining how migratory routes in the Columbia and lower John Day rivers may influence conversion probability.

We will evaluate correlations among explanatory variables such as date of passage, water temperature, and stream flow. Initial exploratory analysis will consist of relating adult fates to the areas and water temperatures where adults were observed via acoustic telemetry. Temperature probes on a subset of acoustic receivers will allow us to match the temperature with fish detections (or absence of detections) in the circular detection area around each acoustic receiver.

We will answer initial questions such as:

-Were mortalities in areas of warmer water?
-Did survivors avoid warm water areas?
-Were there John Day river entry timing differences between mortalities and survivors?

In the process of answering exploratory questions such as these, we will classify individual fish routes into three initial categories (we may develop more categories as we learn about individual migration routes:

Route 1) Enter the John Day River without overshooting

Route 2) Enter the John Day River without overshooting, but exit and proceed upstream in the Columbia prior to reaching Tumwater Falls.

Route 3) Initially overshoot the John Day River mouth (no detections inside the John Day River) and continue up the Columbia (fish in this group may later fall-back and enter the John Day).

The current PIT tag detection data have insufficient spatial precision to place adults into these categories. Hence, we can't effectively identify physical or environmental correlates which are influencing conversion probability. This proposed acoustic monitoring provides the needed fine spatial scale data necessary to complement the larger spatial scale PIT detection data to fully address the adult conversion probability issue.

Ultimately, ODFW staff will construct logistic regression models which will relate fate of each individual (e.g., die, survive and home, survive and stray, unknown fate are all possibilities) to environmental correlates and key detection times/locations. We will evaluate if significant patterns emerge from the regression model. Emergent patterns can identify areas that are critical for successful migration, or conversely, areas and times that are correlated with higher than expected mortality rates.

Objective #6

Objective

Disseminate final results and knowledge gained about adult steelhead migratory routes and ultimate fate through a completion report, oral presentation, and technical publications.

Describe the project activities. Activities explain how the objective will be implemented.

Data collection will initially be focused on one run-year (July 2020 to April 2021) to limit the overall expense and ensure sufficient time for analysis. While a one-year 'snapshot' will miss potential migratory route changes resulting from inter-annual environmental variability, we propose to use prior years water temperature, air temperature, and stream flow data to nest the one-year snapshot into the longer-term picture.

We intend to make data analysis a flexible, living objective--that is, it will be occurring continuously through fall and winter 2020 as detection data are accrued. With that in mind, if valuable migratory route data emerge, we may consider submitting an application during the fall 2020 grant cycle for additional monitoring funding using 'proof of concept' data collected during 2020.

Initial public presentation of project data and results will occur at the Oregon Chapter American Fisheries Society meeting in March 2021. Following this initial presentation and informal peer-review, work on the OWEB completion report will continue through spring 2021, with time budgeted for ODFW's NRS-1 to conduct these analyses. Finalized water temperature data will be submitted to ODEQ in spring 2021. The final completion report for OWEB will be primarily assembled by the ODFW NRS-1, with assistance from GSWCD (data entry, proofing, and possibly geo-spatial support) and other ODFW staff as needed.

Describe the benefit to watershed planning, project implementation, and/or public education efforts that will be provided by the monitoring work proposed in this application.

Identifying migratory routes and their relationship to the outcome of individual adults can ultimately guide habitat or fishery management actions to improve the conversion probability of John Day River adult steelhead. We recognize that these are initial baseline data however, and while they may not be immediately applicable toward the goal of improved conversion probability; they will move us incrementally closer to that target. If migratory route data can identify projects or areas to target with reasonable possibility of improving conversion, the John Day Partnership could ultimately help guide resources in this direction, given the substantial improvement in population viability likely to occur with improved adult conversion.

Furthermore, these data will provide an initial assessment of how realistic it may (or may not) be to improve conversion probability. If we can identify no opportunities for improvement of adult conversion from our migratory route monitoring, planning will have to assume that the current conversion probability extends into the foreseeable future. This outcome would indicate that a substantial uplift in freshwater productivity must be accomplished to move John Day steelhead toward de-listing and eventual broad-sense recovery.

List the major activities of the monitoring project and time schedule you will use to complete the monitoring. Schedule should relate to budget.

Element	Description	Start Date	End Date
Coordination and sampling gear preparation.	Coordinate logistics of sampling at Bonneville AFF, procure acoustic tags and receivers. Coordinate for deployment of acoustic receivers.	9/2019	7/2020
Acoustic Tagging	Capture and Tag adult John Day steelhead at Bonneville AFF.	7/2020	9/2020
Acoustic Receiver Operation	Deploy, maintain, download acoustic receivers.	7/2020	3/2021
Periodic Telemetry Relocation of Tagged Adults	Conduct periodic telemetry flights to locate tagged adults and search for adults missed at the acoustic arrays.	8/2020	3/2021
Data management and analysis	Build and analyze individual steelhead migratory route tracks.	10/2020	3/2021
Analyze Migration Routes and Outcomes	Compare outcomes of individual steelhead to migratory routes observed at the Columbia-John Day River confluence.	3/2021	5/2021
Final Reporting	Final reporting of data and analysis to OWEB, submit temperature data to ODEQ, and disseminate analyses through public presentations (e.g., Oregon AFS meeting).	4/2021	6/2021

Element	Q3 2019	Q4 2019	Q1 2020	Q2 2020	Q3 2020	Q4 2020	Q1 2021	Q2 2021
Coordination and sampling gear preparation.								
Acoustic Tagging								
Acoustic Receiver Operation								
Periodic Telemetry Relocation of Tagged Adults								
Data management and analysis								
Analyze Migration Routes and Outcomes								
Final Reporting								

Habitat Types

What habitat type(s) are you proposing to work in?

- ✓ *Instream Habitat*
- ❑ *Riparian Habitat*
- ❑ *Upland Habitat*
- ❑ *Wetland and/or Estuary Habitat*

Status and Trend

Select all of the activities you will be implementing for status and trend monitoring in this application.

- ❑ *Habitat Surveys*
- ❑ *Instream surveys*
- ❑ *Vegetation*
- ❑ *Macroinvertebrates*
- ❑ *Juvenile Fish*
- ✓ *Adult Fish*
  - ❑ *Presence*
  - ❑ *Absence*
  - ❑ *Abundance*
  - ✓ *Distribution survey*
  - ❑ *Carcass counts*
  - ❑ *Redd counts*
  - ❑ *Genetic sampling*
- ❑ *Other Biological Monitoring*
- ❑ *Invasive Species*
- ❑ *Soil Surveys*
- ❑ *Water Quantity*
- ✓ *Water Quality*
  - ✓ *Surface Water*
  - ❑ *Ground Water*
  - ❑ *Sediment*
  - ❑ *Salinity*
  - ❑ *Conductivity*
  - ❑ *Bacteria*
  - ❑ *Oxygen*
  - ❑ *pH*
  - ✓ *Temperature*
  - ❑ *Toxins*
  - ❑ *Turbidity*
  - ❑ *Nutrients*
  - ❑ *Water Clarity*

Methods and Design

Describe in detail the monitoring methods that will be followed and provide the citation for the protocols that will be used.

We propose to use Advanced Telemetry System's Dual Acoustic-Radio Tags (DART) for tracking of adult steelhead. These tags are built on the Juvenile Salmon Acoustic Telemetry System (JSATS) platform, and hence would be compatible with existing receivers used by other Columbia River basin monitoring agencies; creating the possibility of detection data and transceiver equipment sharing and collaboration. While the JSATS tag platform was primarily developed for smolt out-migration monitoring, it has also been applied to and studied at adult fishways on the Columbia River with an observed high detection efficiency (Jung et al. 2015), suggesting that it is an appropriate tool for our proposed application.

Surgical implantation of JSATS acoustic transmitters into juvenile salmon and steelhead (smolts) is a common monitoring technique in the Columbia River. We propose to simply scale this technique up, with larger, longer battery life tags that will be inserted into larger returning adults. While the tags will be larger, the tag-to-body length and tag-to-body weight ratios will be maintained at less than the ratios studied on juvenile salmonids, ensuring no tag burden effects on migratory route selection. We will conduct surgical implantation of DART tags into the peritoneal cavity of adult steelhead at Bonneville Dam. An extensive body of research has been conducted on surgical implantation of acoustic tags in to juvenile salmon (e.g., Deters et al. 2012). Overall, the literature suggest high tag retention and low mortality for salmon smolts, even in warm (17 C) water temperatures. Hence, we expect successful application of surgical tagging techniques when scaled up to larger, more robust adult steelhead.

Adult steelhead will be anesthetized, measured for fork length, and scanned to record PIT tag code prior to surgery. Once the recaptured PIT tag code is confirmed and DART tag functionality is also confirmed, tag insertion surgery will begin. Fish will be horizontal and upside down in a padded, damp holding cradle during surgery, with constant gravity feed water irrigating their gills via a tube placed in the mouth. An incision slightly dorsal of the mid-ventral line, and anterior to the pelvic girdle will be made with a sterile scalpel. A sterilized, shielded cannulated needle will be inserted through this incision and advanced posteriorly to the rear of the body cavity. The shield will be removed and the needle will penetrate the body wall in an outward direction near the posterior extent of the body cavity. The radio antenna from the tag will be threaded through the needle, and then out the posterior insertion. The needle will then be removed in the posterior direction, and the tag will be simultaneously pushed and pulled through the incision into the body cavity. The incision will then be closed with sterile sutures (approximately 1 suture per 5.5 mm of incision length; Brown et al. 2013) and swabbed with disinfectant.

Tagged adults will be recovered in oxygenated holding tanks post anesthesia. During recovery, the fish will be scanned again to ensure integrity of the PIT tag. Once fully recovered from anesthesia, tagged fish will then be released at the nearest practical upstream point in the fish ladders to continue upstream migration.

References (for all sections):

Brown R.S., K.A. Deters, K.V. Cook, and M.B. Eppard. 2013. "A comparison of single-suture and double-suture incision closures in seaward-migrating juvenile Chinook salmon implanted with acoustic transmitters: implications for research in river basins containing hydropower structures." Animal Biotelemetry 1. PNNL-SA-92173. . doi:10.1186/2050-3385-1-10

Deters K.A., R.S. Brown, J.W. Boyd, M.B. Eppard, and A. Seaburg. 2012. "Optimal Suturing Technique and Number of Sutures for Surgical Implantation of Acoustic Transmitters in Juvenile Salmonids." Transactions of the American Fisheries Society 141. PNNL-SA-76729. . doi:10.1080/00028487.2011.638594

Jung K., Z. Deng, J.J. Martinez, D.R. Geist, G.A. Mcmichael, J.R. Stephenson, and P. Graf. 2015. "Performance of an Acoustic Telemetry System in a Large Fishway." Animal Biotelemetry 3. PNWD-SA-10429. . doi:10.1186/s40317-015-0052-9

Keefer, M. L., C. A. Peery, W. R. Daigle, M. A. Jepson, S. R. Lee, C. T. Boggs, K. R. Tolotti, and B. J. Burke. 2005. Escapement, harvest, and unknown loss of radio-tagged adult salmonids in the Columbia River-Snake River hydrosystem. Canadian Journal of Fisheries and Aquatic Sciences 62:930–949.

McHugh, P. A., W. C. Saunders, N. Bouwes, C. E. Wall, S. Bangen, J. M. Wheaton, M. Nahorniak, J. R. Ruzycki, I. A. Tattam, and C. E. Jordan. 2017. Linking models across scales to assess the viability and restoration potential of a threatened population of steelhead (Oncorhynchus mykiss) in the Middle Fork John Day River, Oregon, USA. Ecological Modelling 355:24–38.

Richins, S. M. and J. R. Skalski. 2018. Steelhead overshoot and fallback rates in the Columbia-Snake River basin and the influence of hatchery and hydrosystem operations. North American Journal of Fisheries Management 38:1122-1137.

Robards, M. D. and T. P. Quinn. 2002. The migratory timing of adult summer-run steelhead in the Columbia River over six decades of environmental change. Transactions of the American Fisheries Society. 131:523–536.

Quinn, T.P. 2005. The behavior and ecology of Pacific Salmon and trout. University of Washington Press, Seattle.

Describe in detail the sampling design used to choose sampling locations, sample parameters, and sampling frequency.

We chose the adult steelhead capture and sampling point (Bonneville AFF) opportunistically based on the presence of fish capture equipment at this location. This site represents the only feasible point in the Columbia River to target and recapture known-origin steelhead returning to the John Day River. The primary acoustic receiver sampling location (Columbia River at the mouth of the John Day River, and the John Day River upstream to Tumwater Falls at rm 10) was selected based on the extensive PIT tag detection data indicating overshoot past the confluence.

At the John Day-Columbia confluence sampling location, we present an initial plan for acoustic receiver locations (see attachment for proposed acoustic receiver array map). However, the final locations of this component of the sampling will be determined during Objective 1 as part of the initial coordination phase. We propose to operate a line of acoustic receivers across the Columbia River upstream of the John Day River mouth at the narrowest nearby point. This will allow us to detect tagged adults which overshoot the John Day, and where in the Columbia they are located during overshoot. The acoustic receivers spread up the John Day River will create detection of tagged steelhead entering, and exiting the river to identify if fish enter the river before overshooting, and secondly identify return paths for fish that did overshoot.

We will aim to tag 50 returning John Day adult steelhead in summer 2020. The target of tagging 50 adults is a realistic goal based on prior years of PIT tag detection and return data at Bonneville Dam. With 50 tagged adults released at Bonneville Dam, and assuming a mean PIT-based conversion estimate from Bonneville to The Dalles Dam of 87%, it is likely that more than 40 tagged adults will arrive to the John Day - Columbia confluence. When paired with the proposed acoustic array, this will provide a reasonable initial sample size for mapping of migratory routes and comparison with survival tracking. Our proposed acoustic tag sample size is supported by the high homing fidelity observed from PIT tag detection data once John Day adult steelhead return to the basin (see attached Steelhead Homing Patterns map and matrix). Nearly all sites where PIT tagged smolts and/or parr will be released will have PIT tag detection arrays (e.g., South Fork, Middle Fork, Upper Mainstem, Bridge Creek, Thirtymile Creek, Cottonwood Creek, Rock Creek). This pairing of release and detection sites, coupled with the high homing fidelity indicates that most of the PIT tag recaptures which we tag with an acoustic tag will, if successful at returning to the John Day, cross PIT arrays upstream from the JD1 array. This will create an extensive 'encounter' history for each fish, and create a high probability of accurately assigning fish to Fate 0 or Fate 1.

We propose to initially sample one run-year, given the high start up cost of this project. Acoustic receiver nodes are the largest Materials and Supplies line item we are requesting OWEB funding for. Since these are usable in multiple years; we hope to use the baseline data from 2020 as a 'proof of concept' and apply for subsequent years of funding. We recognize that this project is a new extension of monitoring actions OWEB has funded in the past. We feel the data and life-cycle models clearly indicate that this is a necessary extension to learn about a life-history stage of John Day steelhead that is limiting return on other restoration investments in throughout the John Day basin. However, we acknowledge our obligation to demonstrate proof of concept for this new monitoring approach through an initial year of data collection before proposing a multi-year funding commitment by OWEB.

Since the acoustic receiver nodes can be reused for multiple sampling seasons, cost of additional years of sampling would be reduced from this initial proposal. Follow-on funding would be needed primarily for more acoustic tags and personnel/contractor time. This would allow continued monitoring if the information gained in 2020 warrants follow-on data collection.

Information

Will the monitoring activities proposed in this application consist of gathering baseline data?

● Yes
❍ No

Wrap-Up

Outcomes

Report the total number of stream miles that will be monitored under this application.
11

Report the total number of acres that will be monitored under this application.
0

Provide a brief description explaining how you calculated totals for stream miles or total acres monitored.
We plan to monitor the Columbia River for approximately 1 km upstream from the mouth of the John Day River. We will also monitor within the first 10 mi of the John Day River, for a total of approximately 11 mi. Acres monitored were set to 0 to indicate no land based monitoring is associated with this application.

Quality Control/Assurance

If necessary, do you have an EPA or ODEQ approved Quality Assurance Project Plan or Sampling and Analysis Plan?

- ❍ Yes
- ● No
- ❍ N/A

Project Management

List the key individuals, their roles, and qualifications relevant for monitoring implementation.

Role	Name	Affiliation	Qualifications	Email	Phone
Project Management	Herb Winters	Gilliam SWCD	Ten years of experience with SWCDs.	herb.gilliamswcd@gmail.com	(541) 701-8580
Technician - Assist ODFW	Norie Wright	Gilliam SWCD	Two years experience with East John Day Watershed Council.	norie.gilliamswcd@gmail.com	(541) 384-2281
Project Design / Oversight	Ian Tattam	ODFW	Fifteen years of research and monitoring experience with salmonids in the John Day Basin. Extensive experience with communication and scientific publication of research and monitoring results.	Ian.A.Tattam@state.or.us	(541) 962-3027
Project Implementation, Lead Data Collector, Data Analysis	NRS-1 (To Be Hired)	ODFW			

Data

Describe the grantee's, collaborator's and/or contractor's past experience in applying watershed monitoring data.

Program manager for the Gilliam SWCD. Herb has been working with landowners to implement restoration projects for 10 years. In 2012, Herb was recognized as the District employee of the year for the state of Oregon. He became the District's project manager for the district in 2014. To date, Herb has enrolled almost 1,300 acres of Wheeler County lands into the CREP program, including acreage on the proposed Property. He has presented several times at regional OWEB CREP trainings to help new technicians excel in implementing the program. Mr. Winters is also recognized statewide as a pioneer in juniper restoration and Beaver Dam Analog (BDAs) implementation projects. Since 2013 Mr. Winters has personally submitted nine successful OWEB restoration applications requesting approximately $715,000 and in doing so leveraged over $1,238,000 in match funds.

Herb currently serves on the John Day Basin Partnership Steering Committee and is the lead for the John Day Basin Partnership Technical Working Group. He also serves on the Oregon Conservation Education and Assistance Network (OCEAN) board as the Columbia Plateau representative. OCEAN provides a statewide network for education, resources, partnerships, and professional development making better employees and stronger districts. He has presented several times at the OCEAN CONNECT conference to provide GIS and riparian planting technical training.

He helped plan the NRCS North Slope Ochoco Holistic Restoration Project ($4,200,000) where his expertise provided innovative Geographic Information Systems (GIS) technology to address priority natural resource concerns in a ridge to ridge manner. NRCS has recognized Mr. Winters as an exceptional conservation planner and has asked him to be one of two representatives for the state of Oregon to join NRCS's partners on a national committee to discuss and evaluate partner's reservations . ODFW will utilize Herb's project management experience for this project.

Ian Tattam has been studying John Day salmonids for 15 years; seven of those years were spent studying exclusively steelhead with Oregon State University in the South Fork John Day watershed, and as an initial collaborator in the Bridge Creek IMW. For the past eight years, Ian has split effort between steelhead and Chinook salmon research and monitoring, as Research Project Leader for ODFW's John Day Life Cycle Monitoring efforts. Ian has been lead author or contributor to numerous technical reports and presentations, and six peer-reviewed journal articles documenting research/monitoring results from the John Day basin.

Describe how the resulting data will be managed, analyzed, and interpreted. Explain the relationship between the data collection and final report to ensure a thorough analysis.

Data Management:

The recapture records for PIT tagged adults, and the subsequent dual acoustic-radio tagging event will be entered into the PTAGIS database (www.ptagis.org) via the data entry program P4 on a daily basis. The PTAGIS database, which is publicly accessible, will provide the link between the juvenile PIT tagging, and the acoustic tagging at recapture in the Bonneville AFF. The PTAGIS database also receives and houses our in-stream array detections of PIT tagged adult steelhead from the network of in-stream PIT detection arrays in the Columbia and John Day rivers. The juvenile tagging, adult tagging, and adult detection records can be easily merged for each individual fish via the "complete tag history" function in PTAGIS, which shows all detections and recaptures. These data are backed up by PTAGIS, and also available on the independent Columbia River DART website (funded by BPA) to ensure functionality and accessibility to all interested parties. The redundancy of two servers ensures data security, and provides remote access for a large number of potential data users. Both sites also require and provide appropriate metadata, ensuring the data are searchable and understandable to all potential project collaborators.

We will store acoustic-radio tag detection data in both GIS and Access. Both databases will be backed up, and the GIS data can be stored in an Arc-GIS Online (AGOL) account maintained by the John Day Basin Partnership (currently managed by Oregon Department of Fish and Wildlife). Again, the AGOL account facilitates multi-user

sharing of the spatial detection data. Links to the AGOL account can be distributed to partners and subject matter experts (e.g., university faculty), for additional input on spatial data analysis.

Water temperature data will be initially stored in Access and summarized in excel. At the end of the project, temperature data will be uploaded to the ODEQ database for long-term storage and public accessibility. To facilitate seamless upload of these data, the ODFW NRS-1 will devote some of the pre-sampling coordination portion of the grant (Objective 1) to completion of an ODEQ Quality Assurance Project Plan. This will ensure the full suite of necessary metrics are collected and organized in a fashion that will ensure successful upload and utilization of these water temperature data.

Data Analysis:

We will build individual fish migratory route histories by collating detections among PIT, acoustic, and radio telemetry detection sites and/or events. The PTAGIS Complete Tag History will provide all PIT tag data for an individual fish, to which we will append acoustic and radio telemetry detections. These data can be used to create a spatial-temporal migratory route for each fish. Within this migratory route, we will create finer scale two-dimensional tracks in the vicinity of acoustic receiver arrays in the John Day Pool and lower John Day River to determine if there are migratory routes that are common among many individuals. Migratory route maps will be visually interpreted for common patterns and groupings. An initial approach we have outlined is to categorize fish by migratory route:

Route 1) Enter the John Day River without overshooting, no detections at the acoustic array or other sites in the Columbia upstream from the mouth of the John Day.

Route 2) Enter the John Day River without overshooting, but subsequently exit and proceed upstream in the Columbia.

Route 3) Initially overshoot the John Day River mouth (no detection inside the John Day River temporally between PIT detection at John Day Dam and detection at the acoustic receiver line upstream from the John Day River mouth) and continue up the Columbia (fish in this group may later fall-back and enter the John Day).

In the absence of a priori data on migratory routes in the John Day-Columbia confluence area, we present categorical analysis as an initial approach to communicating part of the spatial data we propose to collect. Categories can be refined and either expanded or condensed with individual migratory tracks in hand. Once movement patterns at the John Day-Columbia confluence are mapped and categorized, we will also categorize the ultimate fate of each individual. Fates could be initially clustered into 2 groups, with the JD1 PIT array being a key point of reference, as it is the first detection point encountered upstream of Tumwater Falls (see PIT array map in attachments).

Fate 1)- Survive past JD

Fate 0)- Unsuccessful at reaching JD1 (mortality or stray to another river)

Data Interpretation:

We will use individual fish histories to determine the ultimate fate of each individual. The key metric for evaluation will be: did the fish survive to reach the JD1 array (John Day River rm 20). We will use the extensive network of upstream PIT arrays, potentially coupled with telemetry flights to verify that tagged adults successfully migrated past the JD1 array. The ultimate fate of individuals within each migration category will be expressed through both a matrix approach (for visual representation--an estimate of the survival probability for each of the migratory route categories) and binomial or multinomial regression modelling.

As an example, a 3 x 2 matrix could summarize results as:

	Fate 1	Fate 0
Route 1	n (%)	n (%)
Route 2	n (%)	n (%)
Route 3	n (%)	n (%)

We anticipate that a regression model will be constrained by sample size in the first year. However, interpreting these data in this fashion provides an initial framework for relating survival probability (i.e., whether fish fall into categories 1 or 2) to potential explanatory variables. These could include temperature, streamflow, or date of detection at certain array sites. Multiple regression models with different explanatory variables (or combinations of variables) will be constructed. We will use information theoretic selection and multi-model inference to select the models which provide the best explanation of the relationship between observed survival patterns and migratory route history. If we opt, and are successful with additional monitoring proposals, this regression approach becomes more powerful with multiple years of data. This approach also provides a way to test for inter-annual differences, as 'year' can be used as an explanatory variable in the model comparison and selection process.

An example binomial regression model structure can be simply expressed as:

Fate (0, 1) ~ Route + Maximum Temperature Experienced + Day of Detection at Receiver r + Streamflow on Detection at r + Year

This is an example of a potential 'full' model, where the fate of each individual fish is related to many possible explanatory variables. Simpler, reduced models will also be fitted, wherein the fate of each fish is related to a reduced number of explanatory variables. The models can then be compared with an information theoretic framework that ranks models based on their relative ability to explain which fate individual fish are assigned to. Analyzing the data in this format can quantitatively link migratory routes to adult fate. This will extend our migratory route data beyond simply lines on a map to an understanding of the ultimate effect of migratory routes on population productivity.

Describe how the data will be reported and made available to natural resource professionals and the public.

Adult steelhead tagging and recapture data will be available at www.PTAGIS.org. This publicly accessible online database will provide a link from the known origin (juvenile tagging site), to the adult recapture at Bonneville Dam, and the subsequent acoustic tag codes implanted into the adult. Adult PIT tag detection data from in-stream detection arrays are stored and retrievable from ptagis.org as well, allowing access to the full life-cycle data. Summarized acoustic and radio telemetry detection data will be provided in appendices of the final OWEB report.

Raw temperature data will be uploaded to and made available in the ODEQ database. Summarized temperature data will be provided in the analyses and appendices of the final report to OWEB. We will also use the John Day Partnership AGOL account as a vehicle for sharing these temperature data with collaborators as requested.

The analyses and final OWEB report will be made available to key natural resource agencies and the public via our participation in the John Day Basin Partnership. In addition, final results can be disseminated through our existing informal collaboration and discussion with project partners and the public. Several examples of this dissemination are: a keynote presentation and summary of results at Gilliam SWCD's Annual Meeting, presentations at meetings of the Oregon Chapter American Fisheries Society and/or River Restoration Northwest, and presentation by ODFW to the Mid-Columbia Steelhead ESU Steering Committee (collaboration of federal, state and local entities working for recovery of Mid-Columbia summer steelhead).

How will this data be applied to inform future actions?

These are baseline data which are necessary to collect before we can begin an informed process dealing with a key factor limiting the long-term persistence of John Day River steelhead. While one year of sampling will not cover

the full suite of environmental conditions experienced by migrating adults, we can leverage the pre-existing temperature data to ameliorate this problem. The multi-year data set on temperature in the Lower John Day and Columbia River near the John Day mouth will be maintained during this proposed sampling (in addition to expanded temperature monitoring at acoustic receivers). These data hence provide an expected range of variation into which we can fold the 2020 data to provide a quantitative perspective on whether temperatures in 2020 were average, below average, or above average. This comparison will help place our migratory route maps and adult steelhead fates into a larger context; and also provide quantitative hypothesis generation about how these routes and fates would change concomitant with changes in temperature.

Ultimately, we hope to identify key migration routes and locations where management agencies could consider habitat (e.g., are there key holding or migration areas in the John Day River downstream of Tumwater Falls where spring development would benefit migrating adult steelhead) or fishery management actions (e.g., what is the mean and range of residence times for adult steelhead in the John Day River downstream of Tumwater Falls?) to improve the conversion probability of John Day River adult steelhead. We realize that this is a first step, and not a solution, to this critical problem. However, we believe that the existing PIT tag and temperature data, provide critical quantitative background context for this proposed monitoring. These data will ensure this project's applicability to both help explain past years large-scale conversion probability monitoring results (e.g., PIT tag based estimates, such as those provided by Richins and Skalski 2018), and provide monitoring and management direction moving forward to address the conversion probability problem.

Budget

Item	Unit Type	Unit Number	Unit Cost	OWEB Funds	External Cash	External In-Kind	Total Costs
Salaries, Wages and Benefits							
Gilliam SWCD Technician (Wright)	Hours	550	$25.35	$13,943	$0	$0	$13,943
Gilliam SWCD Project Manager (Kirwan)	Hours	80	$35.35	$0	$0	$2,828	$2,828
Gilliam SWCD Project Lead (Winters)	Hours	160	$35.35	$0	$0	$5,656	$5,656
			Category Sub-total	**$13,943**	$0	$8,484	$22,427
Contracted Services							
ODFW Biologist	Months	21	$5,280.00	$110,880	$0	$0	$110,880
ODFW- Technician	Months	2.5	$3,740.00	$9,350	$0	$0	$9,350
ODFW-OSP Flight-time for periodic aerial telemetry to locate missing dual acoustic-radio tagged steelhead.	Hours	20	$165.00	$0	$0	$3,300	$3,300
ODFW Mileage	Miles	3600	$0.55	$1,962	$0	$0	$1,962
ODFW Screw Trap Operation to Tag Known Origin Steelhead Smolts which will be the focus of Recapture Effort at Bonneville AFF.	Years	2	$170,000.00	$0	$0	$340,000	$340,000
			Category Sub-total	**$122,192**	$0	$343,300	$465,492
Travel							
Accomodations at ODFW Hatchery near Bonneville	Days	75	$182.00	$0	$0	$13,650	$13,650
Gilliam SWCD Mileage	Miles	5280	$0.55	$2,878	$0	$0	$2,878
			Category Sub-total	**$2,878**	$0	$13,650	$16,528
Materials and Supplies							
PIT Tags applied to Steelhead Smolts at Rotary Screw Traps in the South Fork, Middle Fork, and Upper Mainstem John Day during 2018 and 2019. These tags will create the opportunity to conduct known-origin recaptures at Bonneville AFF.	Each	10000	$1.97	$0	$0	$19,700	$19,700
PIT Tag Transceiver and Sampling Supplies for Adult Steelhead Tagging	Each	1	$3,500.00	$0	$0	$3,500	$3,500
Dual Acoustic-Radio Tags	Each	50	$275.00	$13,750	$0	$0	$13,750
Acoustic Receiver Nodes	Each	15	$3,245.00	$48,675	$0	$0	$48,675
Acoustic Receiver Anchoring Supplies	Each	15	$100.00	$1,500	$0	$0	$1,500
Telemetry Receiver	Each	1	$3,000.00	$0	$0	$3,000	$3,000
			Category Sub-total	**$63,925**	$0	$26,200	$90,125
Equipment and Software							
Jet Boat for use in John Day Pool/Arm	Each	1	$12,000.00	$0	$0	$12,000	$12,000
			Category Sub-total	**$0**	$0	$12,000	$12,000
Other							

			$0	$0	$0	$0	$0
Category Sub-total				$0	$0	$0	$0
Modified Total Direct Cost Amounts				$202,938	$0	$403,634	$606,572
Indirect Costs							
Federally Accepted 'de minimis' Indirect Cost Rate (up to 10%)		10%			Indirect Cost Total: $20,294		
Total				$223,232	$0	$403,634	$626,866

If the budget includes unusually high costs and/or rates, provide justification for those costs and/or rates.

If the budget identifies a contingency amount for specific line item(s) within the Contracted Services and Materials and Supplies budget categories, explain the specific reasons a contingency is needed for each line item. Contingencies are line-item specific and cannot be used for other costs.

Funding and Match

Fund Sources and Amounts

Organization Type	Name	Source Note	Contribution Type	Amount	Description	Status
State	Oregon Department of Fish and Wildlife	Sampling equipment and accomodations near Bonneville Dam.	In-Kind - Materials	$13,650	Housing/storage area near Bonneville Dam sampling site.	Secured
State	Oregon Department of Fish and Wildlife	Sampling equipment and accomodations near Bonneville Dam.	In-Kind - Materials	$3,500	PIT Tag Transceiver and Components	Secured
State	Oregon Department of Fish and Wildlife	Sampling equipment and accomodations near Bonneville Dam.	In-Kind - Materials	$3,000	Telemetry Transceiver and Antennas	Secured
State	Oregon Department of Fish and Wildlife	Sampling equipment and accomodations near Bonneville Dam.	In-Kind - Materials	$3,300	Telemetry Flight Time	Pending
State	Gilliam Soil and Water Conservation District		In-Kind - Labor	$8,484	Administrative and professional support.	Secured
Federal	Bonneville Power Administration	Contract funds to ODFW for screw trap operation and PIT tag purchase.	In-Kind - Materials	$19,700	PIT tag purchase price, tags will be applied to steelhead smolts to facilitate capture of known origin adults at Bonneville Dam.	Secured
Federal	Bonneville Power Administration	Contract funds to ODFW for screw trap operation and PIT tag purchase.	In-Kind - Materials	$12,000	Jet boat for acoustic receiver operation and maintenance.	Secured
Federal	Bonneville Power Administration	Contract funds to ODFW for screw trap operation and PIT tag purchase.	In-Kind - Labor	$340,000	Labor for screw trap operation and tagging of John Day steelhead smolts to ensure known-origin adults for capture at Bonneville Dam.	Secured

Fund Source Cash Total	$0	Fund Source In-Kind Total	$403,634

Match

Contribution Source-Type: Description	Amount
Oregon Department of Fish and Wildlife-In-Kind - Materials: Housing/storage area near Bonneville Dam sampling site.	$13,650
Oregon Department of Fish and Wildlife-In-Kind - Materials: PIT Tag Transceiver and Components	$3,500
Oregon Department of Fish and Wildlife-In-Kind - Materials: Telemetry Transceiver and Antennas	$3,000
Oregon Department of Fish and Wildlife-In-Kind - Materials: Telemetry Flight Time	$3,300
Gilliam Soil and Water Conservation District-In-Kind - Labor: Administrative and professional support.	$8,484
Bonneville Power Administration-In-Kind - Materials: PIT tag purchase price, tags will be applied to steelhead smolts to facilitate capture of known origin adults at Bonneville Dam.	$19,700
Bonneville Power Administration-In-Kind - Materials: Jet boat for acoustic receiver operation and maintenance.	$12,000
Bonneville Power Administration-In-Kind - Labor: Labor for screw trap operation and tagging of John Day steelhead smolts to ensure known-origin adults for capture at Bonneville Dam.	$340,000

Match Total	$403,634

Do match funding sources have any restrictions on how funds are used, timelines or other limitations that would impact the portion of the project proposed for OWEB funding?

❍ Yes
● No

Do you need state OWEB dollars (not Federal) to match the requirements of any other federal funding you will be using to complete this project?

❍ Yes
● No

Does the non-OWEB funding include NOAA/PCSRF funds?

❍ Yes
● No

Uploads

Figures and Tables: Figures.pdf **- Figures referenced in the Problem Statement.**

Project Design: Receiver Locations.pdf **- Map of proposed acoustic receiver locations.**

Map: John Day River Basin Screw Trap Site Map.pdf **- Overview and map of sites where smolts will be PIT tagged.**

Map: John Day PIT Arrays Map.pdf **- Map of John Day Basin PIT detection sites.**

Figures and Tables: Steelhead Homing Patterns.pdf **- Sub-basin scale homing patterns of adult steelhead in the John Day Basin.**

Secured Match Forms: Match Funding Form.pdf **- Match Funding Form.**

Secured Match Forms: Match Funding Form.pdf **- Match Funding Form.**

Support Letters: ODFW Support and Match Funding Documentation.pdf **- Letter of support and match funding documentation.**

Permit Page

Project Activity Requiring a Permit or License	Name of Permit or License	Entity Issuing Permit or License	Status
Capture/handle/mark/release of adult steelhead.	4(d) Scientific Take Permit.	NOAA Fisheries and ODFW.	Application to be submitted in 2019 for 2020 work.

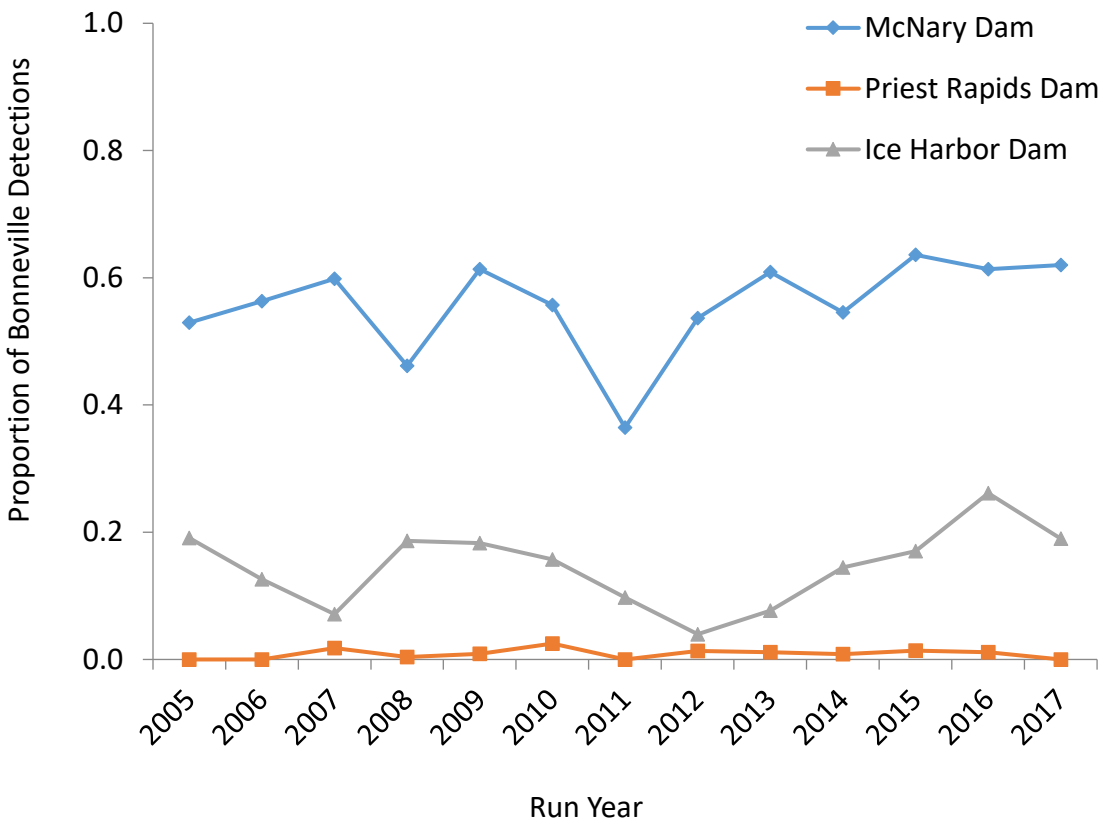


Figure 1. The annual proportion of John Day origin (known from Passive Integrated Transponder tags) adult steelhead detected at Bonneville Dam that were detected at dams upstream from the mouth of the John Day River. This line-graph summarizes inter-annual trends in John Day steelhead overshooting the river mouth and arriving at McNary Dam or Priest Rapids Dam (Columbia River), or Ice Harbor Dam on the Snake River.

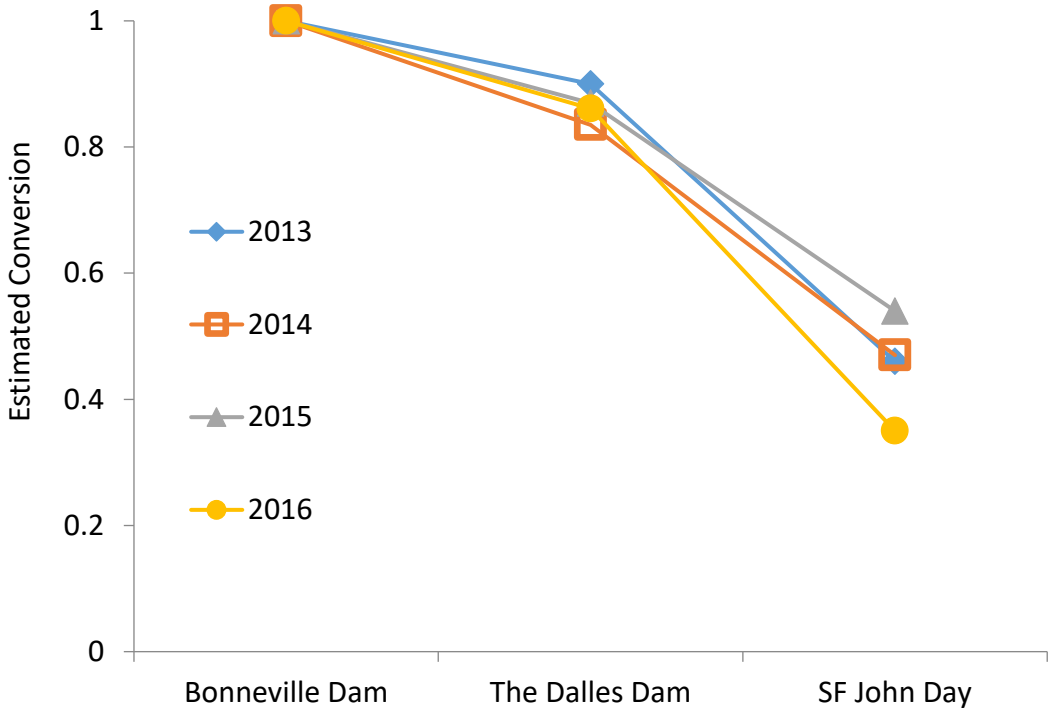


Figure 2. Estimated conversion probability (conversion probability equals the product of survival probability times probability of homing back to the South Fork John Day) for adult steelhead originally PIT tagged in the South Fork John Day River. On average, 87% of adults converted to The Dalles Dam, but only 50% of adults both survived and arrived back to the South Fork John Day.

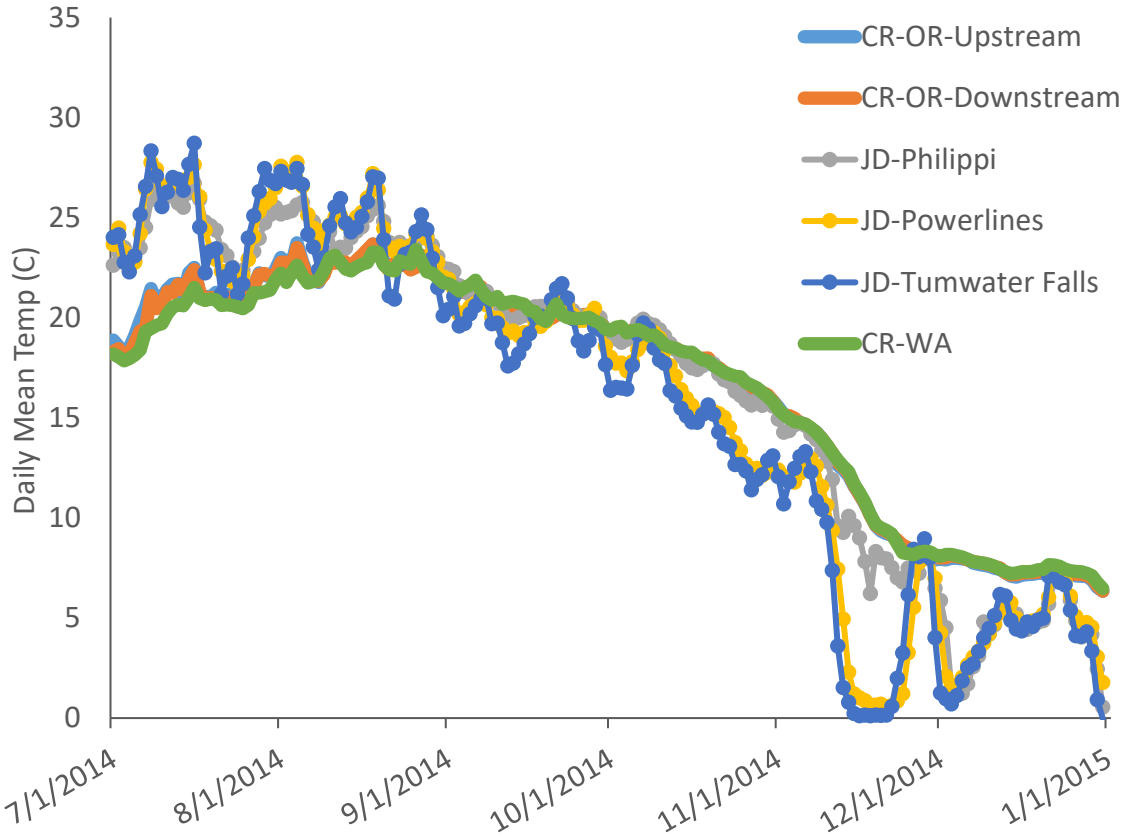


Figure 3. Daily water temperatures, collected hourly at approximately 2m depth, near the John Day - Columbia River confluence. Lines labeled "CR…" denote temperatures in the Columbia River, while lines labeled "JD…" indicate temperature in the John Day River. John Day River temperatures exceeded Columbia temperatures during July and August, but declined rapidly beginning September 1 and were thereafter lower than Columbia temperatures on the majority of days. November-December temperatures in the John Day were markedly lower than in the Columbia, potentially creating energy budget differences for steelhead based on wintering location.

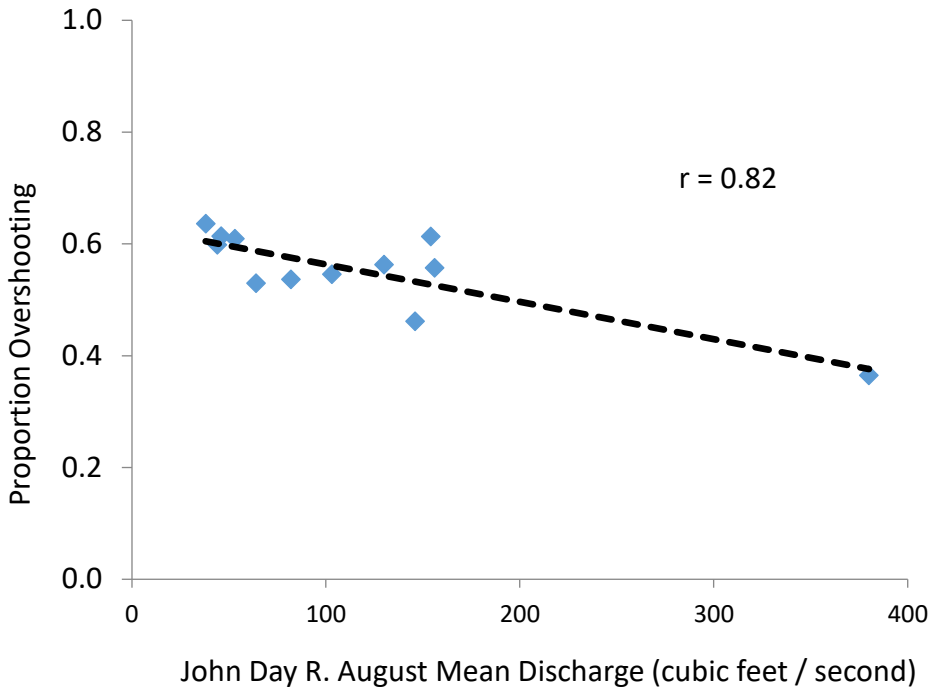


Figure 4. Correlation between the mean John Day river flow during August and the proportion of returning adult John Day steelhead overshooting the John Day River mouth (based on detection at McNary Dam). While driven by one point, this correlation suggests increased John Day River flow is inversely related to the probability of river mouth overshoot.

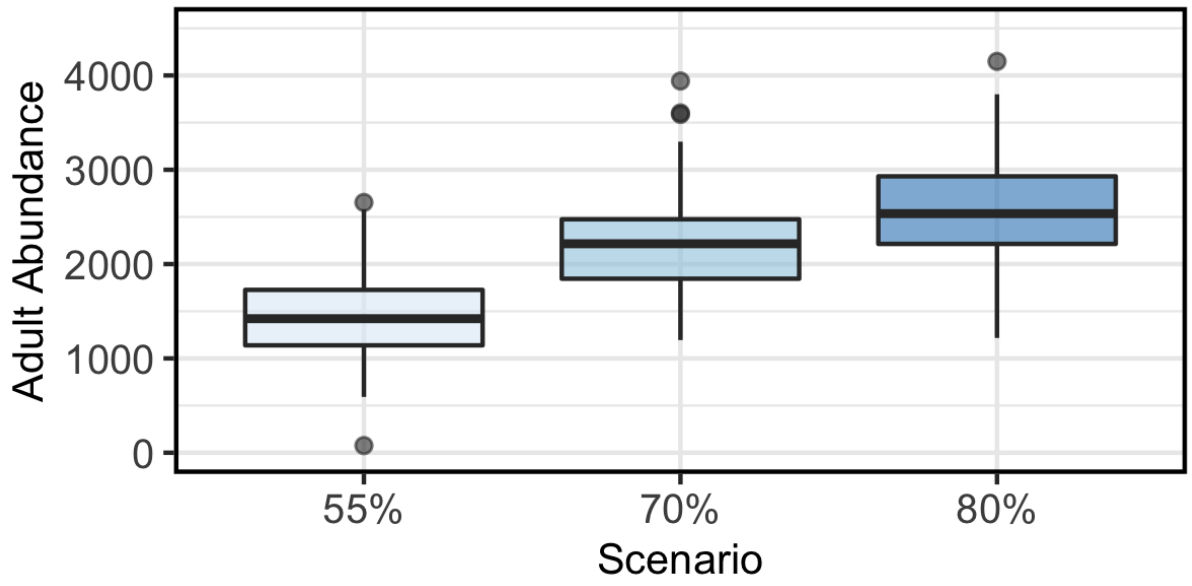


Figure 5. Life cycle model simulations of the impact of three different Bonneville Dam-to-Middle Fork John Day River conversion probability scenarios on mean predicted spawner escapement of Middle Fork John Day River steelhead. Increasing conversion probability by 15% provides a significant increase in adult spawner escapement into the Middle Fork John Day.

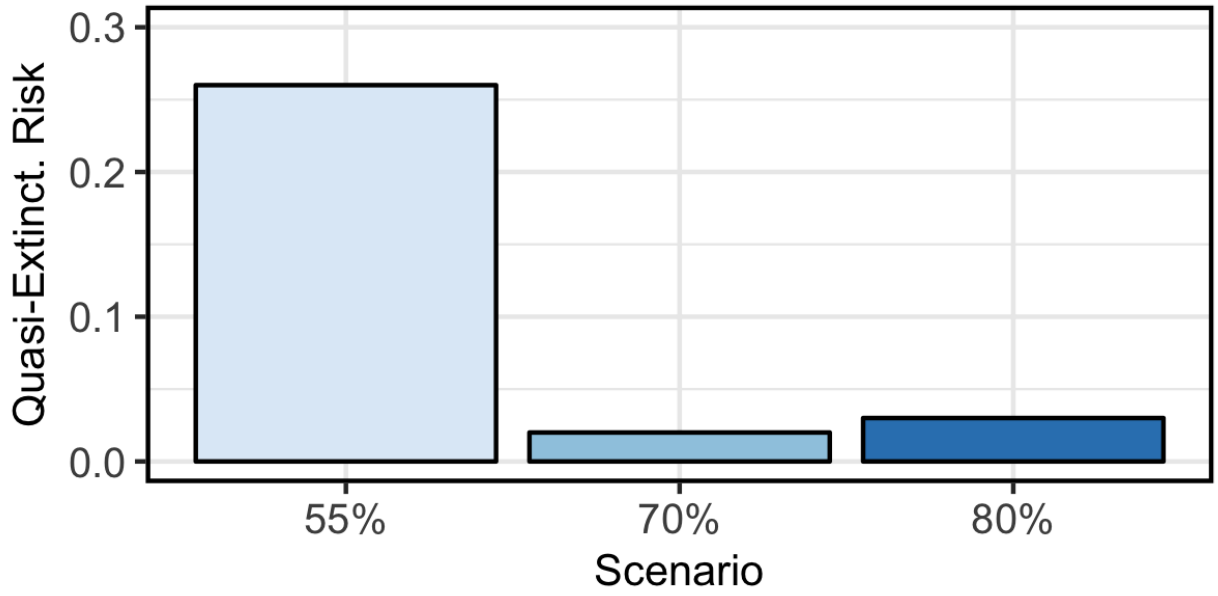


Figure 6. Life cycle model simulations of the impact of three different conversion probability scenarios on quasi-extinction risk for Middle Fork John Day River steelhead. Quasi-extinction risk is the predicted probability of the population declining to less than 0.5 spawners/km. Under a status-quo scenario of 55% conversion probability, the model predicts that the Middle Fork population reaches quasi-extinction in approximately 26% of future years. Increasing conversion probability to 70% or 80% decreases the proportion of future years reaching quasi-extinction to < 5%.

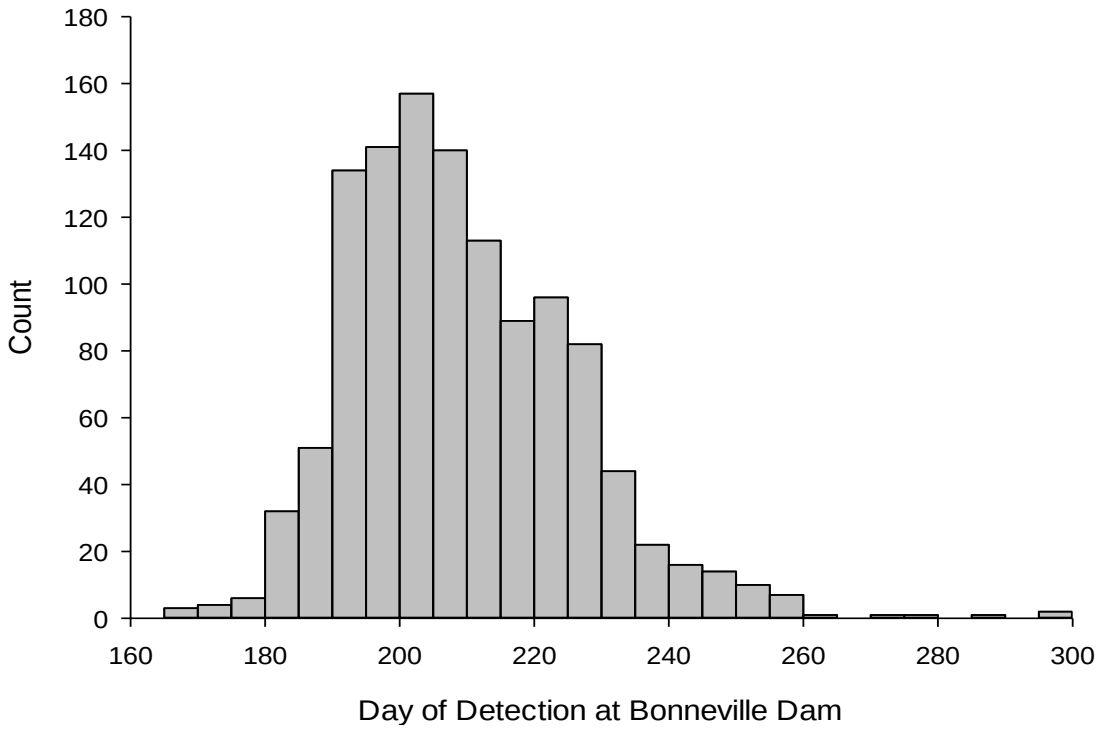


Figure 7. The annual timing of Passive Integrated Transponder tagged John Day adult steelhead detections at Bonneville Dam. This histogram indicates a need to staff the Adult Fish Facility at Bonneville Dam from the 180th day of the year (approximately July 1) through the 250th day of the year (mid-September) to maximize the probability of recapturing John Day origin adult steelhead.

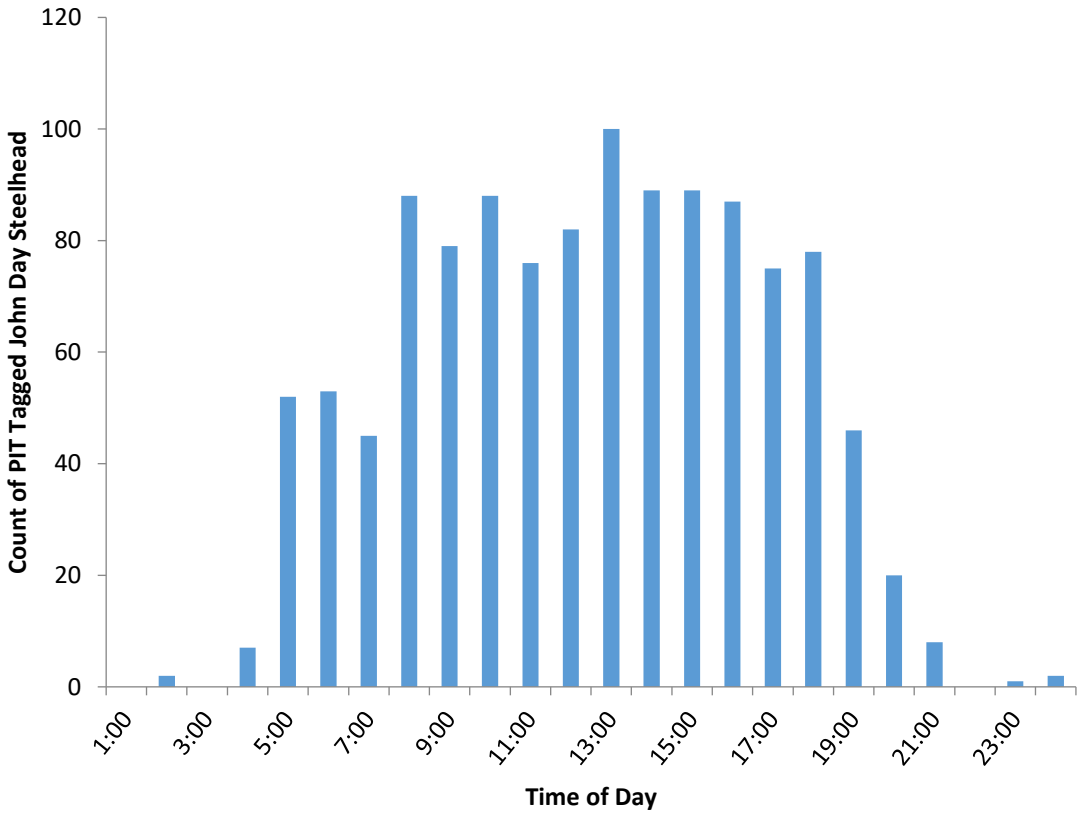
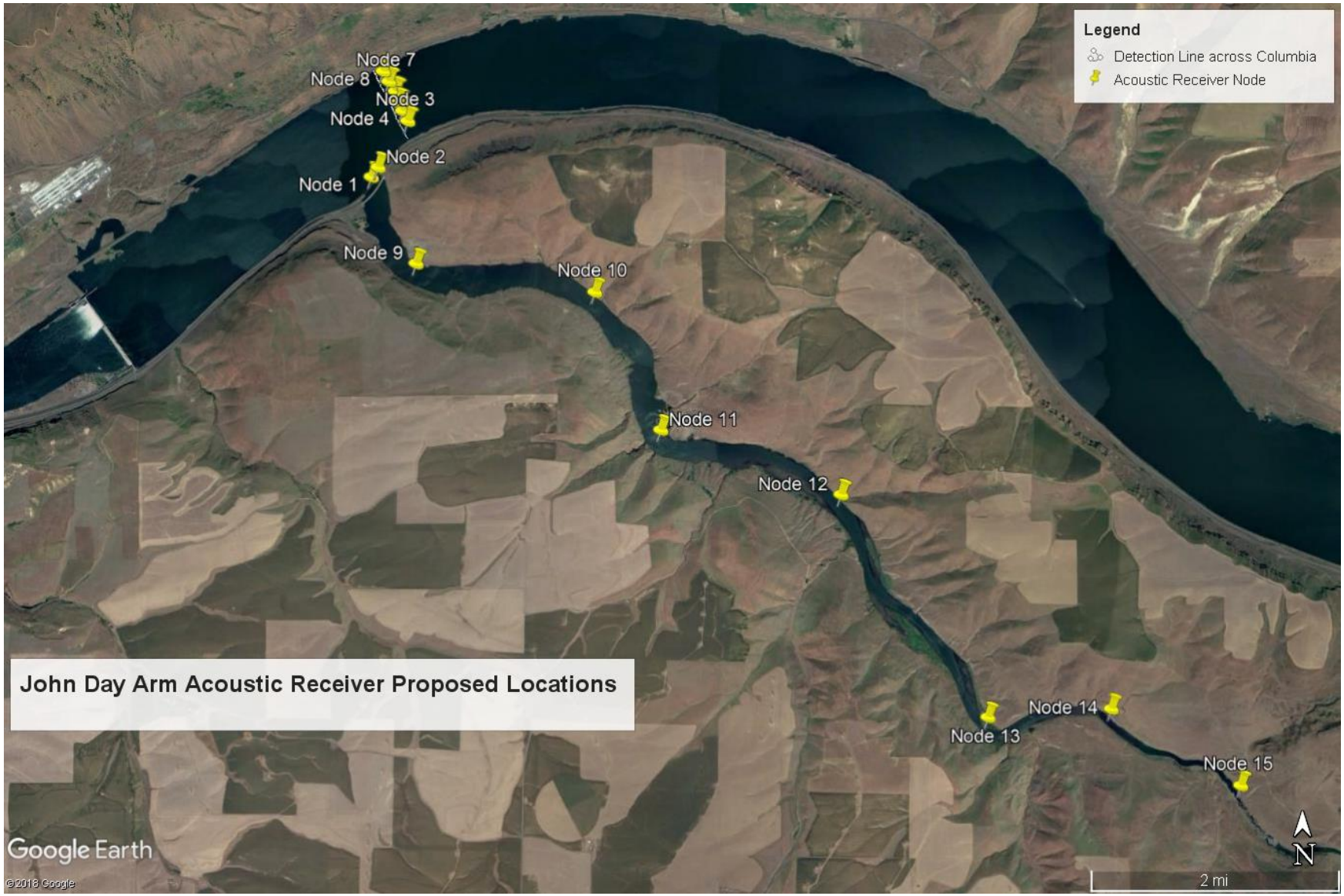


Figure 8. Diel time of detection for John Day PIT tagged adult steelhead at Bonneville Dam. Very few detections occur between midnight and 5 AM (left side of the histogram); or between 8 PM and midnight (right side of the histogram). Staffing the Bonneville Dam Adult Fish Facility during the 6 AM to 2 PM window (to minimize water temperature during fish handling and tagging) will provide opportunity to catch the majority of John Day steelhead migrating through the ladders leading into the Adult Fish Facility.


Legend
Detection Line across Columbia
Acoustic Receiver Node
Node 7
Node 8
Node 3
Node 4
Node 2
Node 1
Node 9
Node 10
Node 11
Node 12
Node 13
Node 14
Node 15
John Day Arm Acoustic Receiver Proposed Locations
Google Earth
©2018 Google
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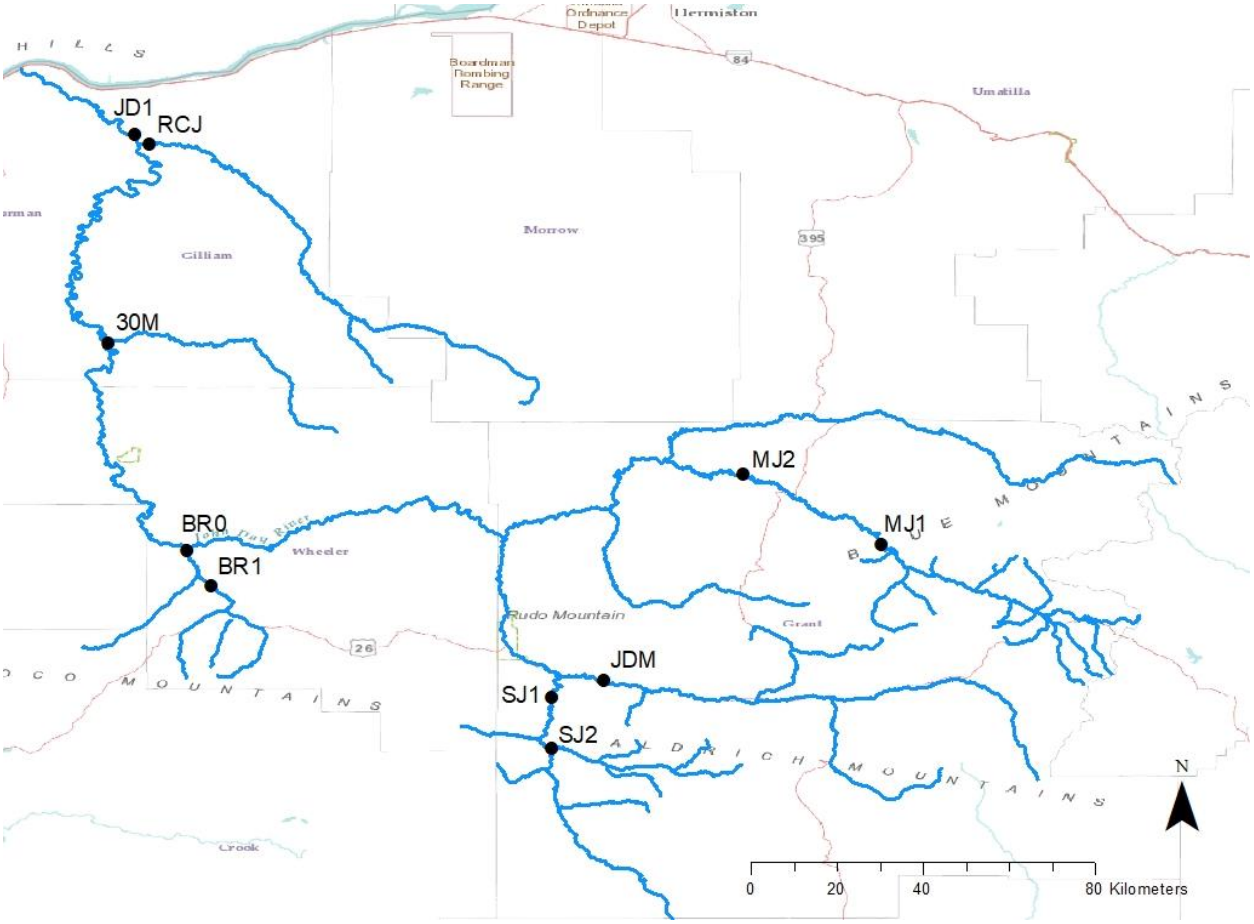
This map depicts the four rotary screw trap sites used by ODFW in the John Day River basin. During 2018 and 2019 the South Fork, Middle Fork and Upper Mainstem trap sites will be operated to tag emigrating smolts with Passive Integrated Transponder (PIT) tags to ensure a suitable abundance of know-origin returning adults for recapture and acoustic tagging at Bonneville Dam during summer 2020. All three trap sites planned for operation in the coming year are paired with instream PIT tag detection arrays, ensuring high probability of detecting returning adults in-river.



Continuously operated Passive Integrated Transponder (PIT) instream detection arrays in the John Day River basin (the “MJ2” array is under construction and expected to be operational by spring 2019). Detection data from each site is uploaded and stored at www.ptagis.org. The “JD1” array located in the John Day River (rm 20) will be a key point for survival analysis of acoustic and PIT tagged adult steelhead. The extensive upstream network of arrays provides opportunities for detection in most areas where juvenile steelhead are PIT tagged. This network, coupled with the high homing fidelity of adults once within the basin creates a high PIT tag detection probability, and a means to calibrate the detection efficiency of the JD1 array.

Homing Patterns in the John Day River Basin

	Adult Detection Location		
Juvenile Tag Location	South Fork	Middle Fork	Bridge Creek
South Fork	154	0	4
Middle Fork	0	80	0
Bridge Creek	0	0	158

A comparison of homing versus straying by Passive Integrated Transponder (PIT) tagged steelhead which were originally tagged in three locations in the John Day River basin. The juvenile tag locations (South Fork John Day, Middle Fork John Day and Bridge Creek) were coupled with in-stream PIT tag detection antennas and are denoted by red stars on the basin map. The matrix indicates that, with the exception of 4 steelhead originally tagged in the South Fork that strayed into Bridge Creek upon adult return, all other in-basin tag detections occurred within the basin of juvenile tagging, suggesting high homing fidelity.

MATCH FUNDING FORM

Document here the match funding shown on the budget page of your grant application

OWEB accepts all non-OWEB funds as match. An applicant may not use *another OWEB grant* to match an OWEB grant; this includes ODA Weed Board projects because they are funded through OWEB grants. However, an applicant who benefits from a pass-through OWEB agreement with another state agency, by receiving either staff expertise or a grant from that state agency, may use those benefits as match for an OWEB grant. (Example: A grantee may use as match the effort provided by ODFW restoration biologists because OWEB funding for those positions is the result of a pass-through agreement).

At the time of application, match funding for OWEB funds requested does not have to be *secured*, but you must show that at least 25% of match funding has been *sought*. On this form, you do not necessarily need to show authorized signatures ("secured match"), but the more match that is secured, the stronger the application. Identify the type of match (cash or in-kind), the status of the match (secured or pending), and either a dollar amount or a dollar value (based on local market rates) of the in-kind contribution.

If you have questions about whether your proposed match is eligible or not, see Allowable Match document in OGMS http://apps.wrd.state.or.us/apps/oweb/fiscal/nologin.aspx under Technical Assistance application or contact your local OWEB regional program representative (contact information available in the instructions to this application).

Project Name: Adult Steelhead Migratory Routes Investigation Applicant: Gilliam SWCD

Match Funding Source	Type (√ one)	Status (√ one)*	Dollar Value	Match Funding Source Signature/Date*
ODFW- BPA Contract Funds	☐ cash ☒ in kind	☒ secured ☐ pending	$340,000.00	R Tatr 10/29/18
ODFW-Boat	☐ cash ☒ in kind	☒ secured ☐ pending	$12,000.00	R Tatr 10/29/18
ODFW-Housing/storage	☐ cash ☒ in kind	☒ secured ☐ pending	$13,650.00	R Tatr 10/29/18
ODFW-PIT Tags	☐ cash ☒ in kind	☒ secured ☐ pending	$19,700.00	R Tatr 10/29/18
ODFW-OSP Telemetry Flights	☐ cash ☒ in kind	☐ secured ☒ pending	$3,300.00	
ODFW-PIT Tag Transceiver	☐ cash ☒ in kind	☒ secured ☐ pending	$3,500.00	R Tatr 10/29/18
ODFW-Telemetry Transceiver	☐ cash ☒ in kind	☒ secured ☐ pending	$3,000.00	R Tatr 10/29/18
Gilliam SWCD	☐ cash ☒ in kind	☒ secured ☐ pending	$8,484.00	Jacob Winters 10/29/18
	☐ cash ☐ in kind	☐ secured ☐ pending		

* **IMPORTANT:** If you checked the "Secured" box in the Status Column for any match funding source, you must provide either the signature of an authorized representative of the match source in the final Column, or attach a letter of support from the match funding source that specifically mentions the dollar amount you show in the Dollar Value Column.

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Oregon
Kate Brown., Governor

Department of Fish and Wildlife
Eastern Oregon Fish Research
203 Badgley Hall, EOU
La Grande, OR 97850
(541) 962-3777
FAX (541) 962-3067
www.dfw.state.or.us/

Monday, October 29, 2018

Oregon Watershed Enhancement Board
775 Summer Street, NE, Suite 360
Salem, OR 97301

Dear OWEB Grant Review Team:

This letter is in support of an OWEB Monitoring Grant Application submitted by the Gilliam Soil and Water Conservation District (GSWCD) entitled: "Adult Steelhead Migratory Routes Investigation."

I have been working in partnership with Herb Winters (Project Manager) and Christina Kirwan of the GSWCD and assisting their submission of the above grant. The monitoring project proposed by GSWCD fills a gap in our current knowledge about John Day River steelhead overshoot. We have extensive evidence (primarily from Passive Integrated Transponder (PIT) tag detections) that most John Day steelhead overshoot the river mouth, with negative implications for the population. However, we do not understand the fine-scale migration patterns of these fish at the John Day-Columbia River confluence, where the overshoot actually begins. This proposal by GSWCD targets that gap with the use of acoustic tags in John Day origin steelhead to map migration patterns at the confluence. Mapping the fine-scale migration patterns here will help identify a course of action to address adult overshoot.

The John Day River Life Cycle Monitoring Project can provide in-kind match funding of $395,150 to support this monitoring proposal. The in-kind match will consist of equipment (rotary screw traps, PIT tags and transceivers, boat, housing accommodation, etc.), and personnel costs to operate rotary screw traps, PIT tag out-migrating smolts, and upload tagging data to web-accessible databases. This monitoring proposal by GSWCD is an important first step towards reducing adult overshoot by mapping migratory routes at the John Day-Columbia River confluence. I look forward to assisting with implementation in any way possible. Please contact me if I can provide any additional information.

Sincerely,

I Tatt

Ian Tattam
Supervisory Fish and Wildlife Biologist
John Day River Salmonid Life Cycle Monitoring
Email: Ian.A.Tattam@state.or.us