ProjectID: 30008

Instream evaluation of populations, migration timing, individual adult return rates, and wild-hatchery interactions of three naturally produced salmonids

Sponsor: USFWS
Province: Columbia Estuary
Subbasin: Elochoman

Summary:
The following are responses to the preliminary comments from the ISRP on proposal #30008 for the Columbia Estuary Province. There were two major concerns of the ISRP: the proposal seemed to be an aggregate of three different components that may constitute stand-alone proposals and a number of methodological details needed to be expanded and clarified. All concerns are explicitly addressed below. Briefly, the study was designed to consist of three levels of population/biological assessments of salmonids in Abernathy Creek. The first level (Objective 1) is the acquisition of several years of baseline information on the population dynamics of salmonids in the Creek, assessments that were initiated in FY 02. Multiple years of baseline data are necessary to describe variation. The second level of the proposal (Objective 2) is the assessment of the impact of a supplementation program on salmonid populations in Abernathy Creek by referencing the data collected in Objective 1. The third level of the proposal is the verification/control work necessary for the interpretation of Objectives 1 and 2.

ISRP preliminary recommendation, comments (*in italics*) and Sponsor responses:

1. *The proposal is essentially an aggregate of three different components and the connection between them is not clear. Each component could itself constitute the basis of a stand-alone proposal. The proposal needs to be more integrated.*

    a. *The sponsors need to succinctly state the major contribution of the work as a whole.*

    The major contribution of the work outlined in the proposal is identification of baseline and post-manipulation population characteristics for three species of salmonids in Abernathy Creek of the Elochoman subbasin. Two years into the study a hatchery program and riparian zone restoration will be implemented. These two practices impact many populations in the Columbia River Basin, yet the effects on local populations are typically not understood or very difficult to monitor. This study uses new technology to describe current and impacted population levels (and interactions between hatchery and wild fish) subsequent to these activities. Additionally, this study establishes protocols for the use of long-range PIT tag technology to monitor populations.

b. How the component objectives are interrelated and supportive of each other.

The three objectives of the proposal are:

1. Determine abundance and natural production of juvenile, smolt and adult salmonids in Abernathy Creek.
2. Compare biological and ecological interactions and differences between hatchery and wild fish of the same stock
3. Evaluate novel tagging techniques for long-term research, monitoring, and evaluation efforts

Objectives 1 and 2 are intimately related because population characteristics of the three populations monitored in Objective 1 will be used to:

1. determine the release strategies for the hatchery fish being released in Objective 2.
2. determine how population characteristics (population size, juvenile distribution in the creek, density distribution in sections of the creek, juvenile migration timing, adult migration timing, parr-smolt recruitment, relative occurrence of residualization) determined in Objective 1 change post-introduction of hatchery fish (and habitat manipulation).

Perhaps Objective 2 would be better stated as "Evaluate the effects of steelhead trout supplementation efforts on natural population dynamics of steelhead trout, cutthroat trout, and coho salmon." The verbage used in the submitted proposal was used to best address the NMFS RPA on hatchery and wild fish interactions. To adequately address the effects of supplementation efforts on natural populations interactions of wild and hatchery fish need to be quantified. In the literature behavioral interactions have primarily been determined in the laboratory and interactions are then extrapolated to the wild. In the currently proposed study both laboratory and field methodologies will be used to assess behavioral interactions of fish and how these behavioral interactions may affect the physiology of the fish (a parameter rarely monitored in other studies).

Objective 3 explicitly tests questions surrounding the technology applied to address objectives one and two. Several studies have been conducted to preliminarily justify the use of PIT tags for monitoring Pacific salmonids (Prentice and Flagg 1987). The long-term research, monitoring and evaluation efforts are outlined in objectives one and two and supported by PIT tag technology. In order for objectives one and two to be valid a more thorough evaluation of PIT tag effects on fish behavior and physiology (not only migration tendency, as in previous studies) must be conducted.

All three objectives are specifically connected by the technology being used to answer the biological questions in Objective 1 and 2 with verification of the validity of the technology to be fully answered in Objective 3.

c. *Why they should be grouped together and not be submitted as separate proposals.*

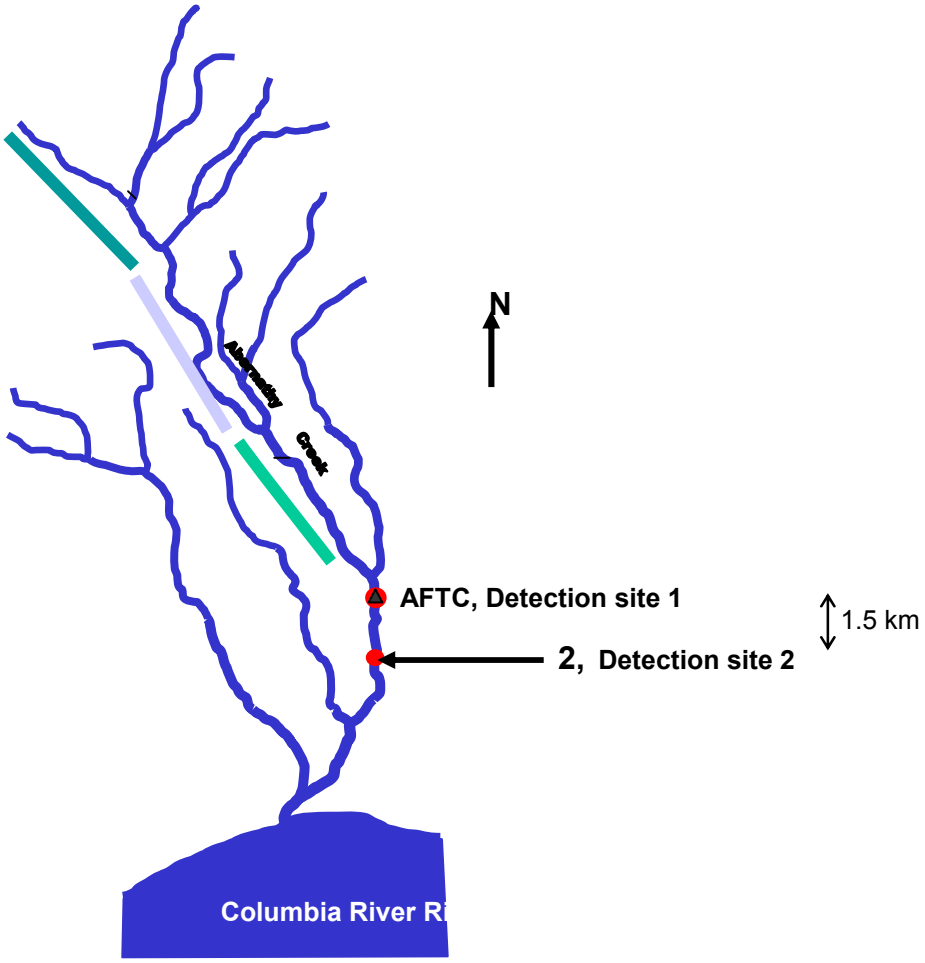
Submission of each objective as a separate proposal would not take full advantage of the infrastructure and established programs at the Abernathy Fish Technology Center. Specifically, the inclusion of all three objectives in one proposal is not only logical for the interpretation of the data but also makes use of prior investments by the Bonneville Power Administration to establish small stream monitoring capabilities on Abernathy Creek.

2. *There are a number of methodological details that need to be expanded and clarified.*

a. *For objective 1*

i. *Where are the detection stations located?*

Detection station 1 is on the grounds of Abernathy Fish Technology Center (AFTC). Detection station 2 is located approximately 1.5 km downstream of station 1.



ii. How will winter survival be quantified?

Winter survival will be quantified by subtracting the number of tagged fish detected at either stationary detection unit plus those detected with the backpack unit after scanning the creek following the spring migration from the total number of fish tagged. There will be some error associated with the number remaining. This will be estimated by conducting controlled assessments of the backpack detection efficiency as follows.

On a monthly basis a reference site (approximately 100 m^2) in Abernathy Creek will be isolated with blocking nets. The site will be electrofished multiple times to deplete the total number of salmonids in the site. All fish > 100mm that are not PIT tagged will be PIT tagged and released back into the Creek. Two hours post-tagging the backpack PIT tag detector will be used to locate all individuals in the stretch. If the block nets can be retained in place the site will be scanned with the backpack unit again 12 hours post-tagging. The efficiency of the unit will be determined as the percentage of fish detected with the backpack unit in reference to the number tagged. Ideally the 2 and 12 h samples will not differ substantially. If so the 12 h estimate will be used as the estimator for all backpack surveys during that month.

iii. How will parr-smolt recruitment be determined?

All fish are being tagged as "parr" in the fall before they are expected to undergo the classical springtime smolt migration 7-9 months later. All fish migrating in the spring will be considered smolts. Parr-smolt recruitment will be considered to have occurred for those fish passing both stationary units and not returning back upstream. Certainly those fish captured in the smolt trap in the spring will be considered smolts. At the smolt trap another determination for smolting will be collection of gill tissue for quantification of gill Na^+,K^+ ATPase activity, a physiological indicator of smolting. Another manner for determining recruitment will be monthly monitoring of the creek after the spring migration for individuals that have not left the creek. This will tighten up the estimate of fish that are recruited since they can then be categorized as "residualized" or remaining parr that may recruit in the following year.

iv. How will the number of residualized fish be determined?

The number of residualized fish will be determined using the portable backpack detection unit. Monthly surveys following the springtime smolt migration will be used to determine the number of residualized fish (wild and hatchery). Again, backpack efficiencies will be used to estimate the effectiveness of the sampling protocol. Further, the number of fish

passing the stationary detection units the following spring will be used to adjust the estimates of residualization from the following year.

To further clarify points ii-iv above, there are four possible outcomes for fish after they are PIT tagged in the fall.

1. Fish may undergo the parr-smolt transformation the following spring (smolt). In this case fish will be detected with the stationary detection units.
2. Fish may remain in the creek as parr (residualize) and smolt in the future. In this case they will be detected with the stationary detection units or the backpack unit.
3. Fish may be resident (especially cutthroat trout) and never leave the creek. These fish will be detected with the backpack unit.
4. Fish may die. Mortality will be modeled by subtracting the above three outcomes from the total number tagged.

b. *Objective 2 is broad and vague. This objective needs to be sharpened so that it is clear just what the sponsor is trying to accomplish.*

Perhaps Objective 2 would be better stated as "Evaluate the effects of steelhead trout supplementation efforts on natural population dynamics of steelhead trout, cutthroat trout, and coho salmon."

i. What is "microhabitat"?

Microhabitat in this study is defined as the area to which each individual is located with the backpack detection unit. The backpack unit has been shown to be able to locate an individual fish to within a 15 cm^2 area. Individual areas, or microhabitats, will be mapped and characterized for each fish. Habitat characterization will be completely dependent on the behavior of the detected fish. Two levels of quantification considered will be:

1. For fish that remain in a narrowly identifiable area their microhabitat will be classified at the site specific level by quantifying characteristics such as water depth, wetted width, canopy cover, substrate characteristics, large woody debris, temperature, dissolved oxygen, and pH (habitat assessment adapted from the US Environmental Protection Agency EMAP-Surface Waters Field Operations and Methods for Measuring the Ecological Conditions of Wadeable and Nonwadeable Streams June 1997).

2. For fish that are displaced upon detection habitat will be quantified at the Channel Unit scale (EMAP) where riffle/pool characterization will be used.

Comparisons of habitat preference at both levels will be made for individuals within those levels. Preferences of each species will be made as well as comparisons of hatchery and wild steelhead preferences. Differences in habitat preference will be determined using categorical statistical analyses such as chi-square.

ii. How will microhabitat preferences be determined?

Preferences will be determined as above. Habitat characteristics for each identified fish will be categorized and comparisons will be made among species and the between each species with hatchery steelhead trout.

iii. How will "interactions" between hatchery and naturally produced fish be determined?

Interactions within the natural environment may be difficult to observe, however, when supplementation with hatchery steelhead trout occurs a survey will have already been conducted to determine the location of each wild fish within the area below the release zone for the hatchery fish. Interactions will be characterized as possible displacements as well as proximity of individuals within categorized habitat sites.

Interactions within the laboratory environment is more easily quantified. The observation of hatchery and wild fish moving consecutively down or upstream past antennae within the tank will be quantified as an interaction. It is likely that hatchery and wild fish will move at different times, but as stated above interactions can be quantified based on tag code alone.