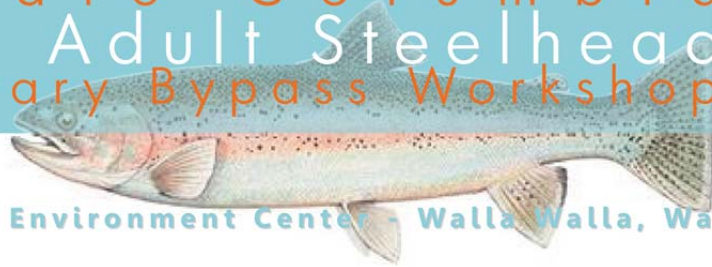


Middle Columbia
Wild Adult Steelhead
Tributary Bypass Workshop

NOV
19
2014



Water and Environment Center - Walla Walla, Washington

ABSTRACTS

Columbia River Mainstem Research

Fallback of Overwintering Adult Steelhead at Lower Columbia River Dams with a McNary Case Study

Brad Trumbo, U.S. Army Corps of Engineers

Abstract: A portion of adult steelhead entering the Columbia River Basin overwinter within Federal Columbia River Power System (FCRPS) and may experience “fallback” downstream over or through a dam subsequent to successful passage through adult fish ladders. Fallback is not unique to overwintering fish, but is a concern of fishery managers as the powerhouse is typically the only passage route available in the winter. Fish that fallback generally experience lower escapement from fisheries and the hydrosystem. Early radio-telemetry studies estimated fallback rates up to 50% at lower Columbia River dams, but more recent estimates are generally < 10%. Fallback estimates at McNary Dam have been among the highest of the 4 lower Columbia River dams. In recent years a large number of steelhead adults have been observed overwintering in the McNary Dam forebay. It has been estimated that up to 50% of John Day River overshoots pass McNary and must fall back to spawn in the John Day. Hydroacoustic studies at McNary in 2010-2011 and 2011-2012 estimated up to approximately 2,300 adults fell back between December and April. Kelt passage studies employing acoustic telemetry showed a higher proportion of fish passing the spillway weir (SW) and with higher survival compared to turbine routes. Considering these results, the Corps conducted a direct survival study in 2014 with adult steelhead (mean total length 591mm) to further evaluate the potential benefit of SW passage for adults. Turbine survival (N=130) was estimated at 90.7% ($\pm 5.0\%$; 95% CI) and SW survival (N=88) was 97.7% ($\pm 3.2\%$; 95% CI). A current hydroacoustic study is underway to evaluate adult steelhead SW passage efficiency to determine how winter SW operation will affect fallback. Similar studies at Bonneville and The Dalles have resulted in operating surface passage routes for adults and McNary may soon follow.

Adult Steelhead Overshoot (Bypass) in the Snake River: Status of the Available Information

Chris Pinney, U.S. Army Corps of Engineers

Abstract: A relatively high portion of adult steelhead overwinter near the lower Snake River dams of the Federal Columbia River Power System (FCRPS) where “fallback” downstream and re-ascension confound pre-spawner counts and conversion between dams. The population of particular concern in the lower Snake River hydrosystem is the proportion of Tucannon River-origin adult steelhead that overshoot the Tucannon River to continue migration, straying, or wandering upriver past Little Goose and Lower Granite dams that fail to pass back downriver to their natal Tucannon River. As part of the larger adult passage and survival studies within the Corps’ Anadromous Fish Evaluation Program, the Walla Walla District has attempted to evaluate the magnitude and mechanisms of Tucannon River steelhead overshoot in our efforts to manage for FCRPS Biological Opinion standard conversion rates. Results from additional adult PIT tag detection, radio-tracking, and acoustic-tracking studies on both adults and kelt steelhead will be presented with the objective of elucidating warrant for possible winter operations that could allow higher connectivity for overshoot Tucannon River steelhead between the upstream Little Goose and Lower Granite dams, such as some focused surface weir spill.

Pattern and Process in Upstream Migration of Steelhead in the Columbia and Snake Rivers

Chris Caudill, University of Idaho

Co-Author: Matt Keefer (UI)

Abstract: Steelhead are strongly philopatric, with adults returning to their natal streams with high precision after ocean-scale foraging migrations and freshwater migrations exceeding 1,000 km in some cases. Here, I will provide an overview of steelhead upstream migration behavior in the mainstem Columbia and Snake rivers

highlighting major results from large-scale radio-telemetry and PIT studies over the past 15 years. I will focus on known and hypothesized route orientation and finding behaviors, carry-over effects of juvenile experience on adult behavior and fate, behavioral thermoregulation, patterns of mainstem overwintering, and potential causes and consequences of overshoot, fallback, and straying behaviors. I will provide recommendations for a more standardized terminology and will attempt to identify major current challenges and critical uncertainties.

Patterns of Migration, Holding, Overshoot and Fallback of Summer Steelhead in the Columbia Basin Derived from PIT Tag Data

Blane Bellerud, NOAA-National Marine Fisheries Service

Cascades Eastern Slope Tributaries MPG Research

Hood River, Fifteenmile Creek, and Deschutes Eastside Tributaries Tributary Bypass

Derrek Faber, Oregon Department of Fish & Wildlife

Co-Authors: Phil Simpson, Rob Reagan, Tom Nelson, Steve Springston, Wayne Wilson, Brian Poxon, Rod French, James Ruzycski, and Richard W. Carmichael (ODFW)

Abstract: We examined the extent of tributary bypass for Steelhead originating from the Hood River, Mill Creek, Fifteenmile Creek, and the Deschutes River Eastside Tributaries (Buck Hollow Creek, Bakeoven Creek and Trout Creek). Tributary bypass was defined as having a PIT-tag detection of a steelhead at a location upstream of the tributary of origin prior to spawning. Fish were initially tagged with PIT tags as outmigrating smolts to provide natural-origin abundance estimates, smolt-to-adult return rates, migration timing, and migration routes for fish in these watersheds. Tributary bypass for steelhead originating from the Hood River and the Deschutes River Eastside Tributaries was very limited, and generally less than 5% of the total run that were initially detected as adults at the Bonneville Dam fish ladders. However, the tributary bypass for steelhead originating from Mill Creek and Fifteenmile Creek was extensive, attributing 60-70% of the total run and included prolonged residence in the Deschutes River. Fish passing upstream of The Dalles Dam must navigate downstream of the dam prior to spawning in their natal tributaries, which necessitates further examination of the winter operation of fish passage routes at that dam.

Modeling Wind River Steelhead Life Cycle Survival Based on Capture-Mark-Recapture Studies

Dan Rawding, Washington Department of Fish & Wildlife

Co-Authors: Thomas Buehrens and Charlie Cochran (WDFW)

Abstract: Empirical life stage and reach scale estimates of steelhead survival are currently lacking but are needed to develop Columbia River hydro-system biological opinions, evaluate ESA recovery actions, and to report on population status. We used a Cormack-Jolly-Seber model to estimate the survival from parr to adult steelhead on their second spawning run for 8 different spatial reaches over 9 cohorts for an ESA listed population of summer steelhead in the Lower Columbia Recovery region based on Passive Integrated Transponder (PIT) tagging, recapture, and detection in the Wind and Columbia rivers. Smolt to adult returns had the most annual variability and based on correlation analysis ocean survival explains much of the variation for this population. On average only 63% of the PIT steelhead passing Bonneville Dam arrive at the Wind River, which is low for this 24 km reach. These fish were not detected at The Dalles Dam or other tributary sites between these dams suggesting losses are likely to occur in the Bonneville pool and may be due to poor environmental conditions or indirect effects of harvest. First time repeat spawners increased population

productivity by 17%. Iteroparity resulted in increased life history diversity and population resilience for this population. Our estimates rates of iteroparity were more than double previous published rates of Columbia River summer steelhead above BON and our literature review suggest the lower repeat spawner rates for other Columbia River steelhead populations may be influenced by the hydro-system.

Steelhead Wanderings Prior to Spawning in Rock Creek, Washington

Brady Allen, U.S. Geological Survey-Columbia River Research Laboratory

Co-Authors: Elaine Harvey (Yakama Nation Fisheries Program), Ian Jezorek (USGS), and Patrick Connolly (USGS)

Abstract: The U.S. Geological Survey collaborated with the Yakama Nation starting in 2009 to study the fish populations in Rock Creek, a Washington tributary of the Columbia River 21 kilometers upstream of John Day Dam. Prior to this study, very little was known about the threatened steelhead (*Oncorhynchus mykiss*) population in this arid watershed with intermittent stream flow. The objectives of the study were to survey the habitat conditions, learn where and how fish currently inhabit the system, and which areas are most productive for steelhead. We built, installed, and operated two passive integrated transponder (PIT)-tag interrogation systems at rkm 5 and at the confluence with Squaw Creek (rkm 13). From fall of 2009 to fall 2012, we PIT-tagged 3,088 *O. mykiss* during electrofishing efforts. About 27% of the PIT-tagged *O. mykiss* migrated out of Rock Creek as smolts in March and April. As of November 2014, 26 adult fish that we tagged as juveniles in Rock Creek have passed Bonneville Dam. Adult fish ladders at The Dalles Dam detected 22 of these fish. To date, 50% (n=11) of these fish have traveled passed the mouth of Rock Creek and passed over McNary Dam, which is about 100 km farther upstream than Rock Creek. Most of these fish passed McNary Dam from September through November. In addition, a total of 43 steelhead that were PIT-tagged by others outside of Rock Creek (as adults at Bonneville Dam or as juveniles in other systems) have been detected entering Rock Creek during the spawning season. Twenty-seven (63%) of these had fish passed McNary Dam and seven had passed Ice Harbor Dam, another 68 km upstream, before traveling back downstream and entering Rock Creek.

Klickitat River Steelhead Bypass and Passage Monitoring

Joe Zendt, Yakama Nation Fisheries Program

Abstract: Recent monitoring activities for Klickitat River subbasin steelhead populations have included PIT tagging and radio telemetry monitoring, which provide information on a variety of passage issues and life history questions. To date, returning numbers of adult natural-origin steelhead that were PIT tagged and released as juveniles in the Klickitat subbasin are very low (<20 from tag releases of approximately 2000-3000 wild *O. mykiss* per year in recent years). Approximately 11% of these returning fish were detected at mainstem Columbia detection sites upstream of the Klickitat River; half of these eventually returned to the Klickitat River (with detection at the Lyle Falls fishway on the lower Klickitat R.) while half had a last detection upstream of the Klickitat River. Returning numbers of adult hatchery-origin steelhead PIT tagged and released as juveniles in the Klickitat River are higher (885 from tag releases of approximately 10,000 per year in recent years). A small percentage (2.7%) of these returning fish were detected at mainstem Columbia detection sites upstream of the Klickitat River. At least 21% of those that initially bypassed the Klickitat River eventually returned to the Lyle Falls fishway, with the remainder having a last detection upstream of the Klickitat River. PIT-tagged returns to the Klickitat River can go also undetected as fish can ascend Lyle Falls without using the fishway. The data that exist to date suggest that bypass does not ultimately prevent a large percentage of Klickitat subbasin steelhead from returning to their natal stream. Small returning sample sizes prevent a robust analysis currently, and continued monitoring should occur. In addition, radio telemetry monitoring around the Lyle Falls fishway suggest that unimpaired upstream and downstream passage is an important feature for steelhead migration behavior. Approximately 25% of natural-origin steelhead that entered the Lyle Falls fishway and were radio-tagged left the Klickitat subbasin and many were later detected at other mid-Columbia or Snake River sites. Significant percentages of fish re-ascended Lyle Falls after falling back, and kelting behavior in wild spawners

was prevalent, indicating that upstream and downstream passage throughout the migration and post-spawning period are utilized when available.

Yakima River MPG Research

Yakima River Steelhead: A Summary of Columbia & Snake River Adult PIT-Tag Detections

Chris Frederiksen, Yakama Nation Fisheries Program

Co-Author: David Lind (YN)

John Day River MPG Research

Potential Demographic Consequences of Straying on Donor and Recipient Populations in the Columbia-Snake Basin: Case Studies from the John Day and Deschutes Basins

Chris Caudill, University of Idaho

Co-Author: Matt Keefer (UI)

Abstract: We recently completed a comprehensive review of straying by adult salmon and steelhead (*Oncorhynchus spp*), with an emphasis on Columbia River populations and the role of the smolt transport program (Keefer and Caudill 2013; Keefer and Caudill 2014). Strays can have positive, negative, or neutral effects on recipient populations, depending on the source and relative abundance of the strays versus the recipient population(s).

Few studies have explicitly considered the effects of net movement from donor populations to recipient populations when the populations' sizes differ. As part of the review, we developed a simple demographic model to estimate the number of adult steelhead strays from the Snake River (i.e., the donor population) and the number straying into specific non-natal sites (i.e., into recipient populations). Users input data from recent empirical estimates of Snake River smolt abundance, juvenile transportation rates, smolt-to-adult returns (SARs), and adult straying rates. The model demonstrates that strays from large donor populations can numerically overwhelm native fish in small recipient populations, even at low (~1%) stray rates. The model results are consistent with empirical observations from the John Day and Deschutes rivers.

These results imply that high immigration rates into small recipient populations mask true recipient population size and changes in native population growth rate. The genetic effects likely depend on the degree of local adaptation and evolutionary history within the metapopulation, but are unlikely to be beneficial for recovery efforts.

Migration and Survival of Adult John Day River Steelhead

James Ruzycki, Oregon Department of Fish & Wildlife

Co-Author: Ian Tattam (ODFW)

Abstract: We investigated the migratory behavior and apparent mortality of adult steelhead by monitoring detections of returning adults previously PIT-tagged as juveniles. Natural-origin John Day River steelhead appear to incur significant losses as they return to freshwater to spawn. Losses occur throughout the migration corridor before they reach their natal tributary. Forty five percent of the adult steelhead detected at Bonneville Dam were not detected migrating into the John Day River and significant losses appear to have occurred in the Columbia River downstream of the John Day River. Since 2007, 52% of returning adults have also bypassed the

mouth of the John Day River and ascended McNary Dam. Conversion of these adults back to the John Day River has averaged 60% during this period. This behavior is not unique to the John Day River populations. We have documented similar behavior and losses for natural-origin Umatilla River steelhead. Estimates of conversion and survival of PIT-tagged fish are dependent on adequate detection facilities within the FCRPS and in tributaries. Detection efficiencies of in-stream arrays are needed to quantitatively determine entry of adults into natal tributaries and straying into neighboring populations and watersheds.

Umatilla/Walla Walla Rivers MPG Research

Migration and Survival of Adult Umatilla River Steelhead

James Ruzycki, Oregon Department of Fish & Wildlife

Co-Author: Josh Hanson (ODFW)

Abstract: See *Migration and Survival of Adult John Day River Steelhead* abstract.

Walla Walla Bypass Monitoring

Rey Weldert, Confederated Tribe of the Umatilla Indian Reservation

Abstract: The Walla Walla Basin historically supported a strong steelhead (*Oncorhynchus mykiss*) population. The Walla Walla Salmonid Monitoring and Evaluation project has been in existence since 2000. With increased use of Passive Integrated Transponders and remote instream antenna arrays, our knowledge of upstream migrating adults is more widely understood. The Touchet and Walla Walla projects tag about 5000 juvenile natural production steelhead each year which gives an average return to McNary Dam of 72 adults per year since 2009. 43% of these returning fish fail to enter the Walla Walla River and are detected further upstream. Of the 362 adults crossing McNary only 221 are detected in the Walla Walla River, a 39% stray rate. Of the fish entering the Walla Walla, 88% are returning to their natal stream and 12% are coming from other Mid-Columbia tributaries. We will continue to monitor Mid-Columbia steelhead movements into the Walla Walla River and update this research when necessary.

Lower Snake and Clearwater Rivers MPGs Research

Tucannon River Summer Steelhead

Joe Bumgarner, Washington Department of Fish & Wildlife

Abstract: Recently, WDFW has used Passive Integrated Transponder (PIT) tags to estimate adult returns and smolt-to-adult survival of hatchery and natural origin summer steelhead to SE Washington. Through PIT tag detections at Ice Harbor and Lower Granite dams, and more recently in the Tucannon River, we have documented a high bypass rate (~60%) of Tucannon River origin steelhead when they return as adults. While some of the steelhead that bypass eventually fall back through the hydro-system and return to the Tucannon River (~20%), nearly half of the population is believed to remain above Lower Granite Dam. Overall, we estimate only 40-50% of the fish that cross Ice Harbor return to the Tucannon River. In addition, with the PIT tag array at the mouth of the Tucannon River, we have documented many other natural origin steelhead in the Tucannon River, primarily populations from the Mid-Columbia River. Approximately 80% of these fish enter the Tucannon River after March 1. These other steelhead represent about 40% of the natural origin steelhead in the Tucannon River annually. Run timing, stream temperature and stream flows were examined as possible factors that could be related to the high rate of bypass. The majority of the adults return when Snake River and Tucannon River temperatures are high, and stream flows in the Tucannon are at their seasonal lows. Rate of bypass was positively correlated with mean monthly stream temperatures, and negatively correlated with stream flow.

Representative tagging of natural origin steelhead populations, and maintenance/improvements to instream PIT Arrays should be a priority in all basins that exhibit this bypass behavior.

Mid-Columbia Steelhead PIT Tag Observations At and Above Lower Granite Dam

Rick Orme, Nez Perce Tribe Department of Fisheries Resource Management

Genetic Stock Research

Genetic Characterization of Steelhead Population Dynamics in the Columbia River

Jon Hess, Columbia River Inter-Tribal Fish Commission

Co-Authors: Andrew P. Matala (CRITFC), Joseph S. Zandt (Yakama Nation Fisheries Program), and Shawn R. Narum (CRITFC)

Abstract: Characterization of population structure of steelhead in the Columbia River has revealed two main highly diverged lineages (coastal versus interior), and within each lineage multiple populations can be differentiated. However, a broad region that includes the middle Columbia River and lower Snake River basin appears to be relatively poorly differentiated and may indicate a high level of gene-flow that maintains similarity among steelhead that spawn in this region. This presentation will include an overview of the genetic tools that are available to identify the likely genetic stock of origin and even the hatchery broodstock parents of steelhead in the Columbia River. Further, results from various ongoing projects will be used to demonstrate our ability to detect and document straying and by-pass behavior of Columbia River steelhead.