

Assessment of Bull Trout, Summer Steelhead, and Spring Chinook Salmon Passage during Operation of the Tucannon River Adult Weir/Trap

2020 Annual Progress Report



Joseph D. Bumgarner

*Washington Department of Fish and Wildlife, Snake River Lab, 401 S. Cottonwood Street,
Dayton, WA 99328*

On the cover: Tucannon Fish Hatchery Adult Trap and Weir. *Photograph by WDFW*

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Joseph D. Bumgarner

Washington Department of Fish and Wildlife
Snake River Lab
401 S. Cottonwood
Dayton, WA 99328

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Assessment of Bull Trout, Summer Steelhead, and Spring Chinook Salmon Passage during Operation of the Tucannon River Adult Weir/Trap: 2020 Annual Progress Report

Joseph D. Bumgarner
Washington Department of Fish and Wildlife
Snake River Lab
401 S. Cottonwood
Dayton, WA 99328

Abstract – Bull Trout are listed across their entire range in the U.S. (conterminously) under the Endangered Species Act (ESA) as a threatened species. Summer steelhead and spring Chinook salmon are also listed under the ESA (Snake River Summer Steelhead DPS, Snake River spring/summer Chinook ESU). A potential threat to all species that has recently received considerable attention is the operation of weirs/traps and the resulting influence on each species' migration. All of these species are captured annually at the Washington Department of Fish and Wildlife's (WDFW) Tucannon River adult weir/trap, with all Bull Trout passed upstream following capture, while a portion of the annual summer steelhead and spring Chinook salmon runs are held for broodstock for the Lower Snake River Compensation Plan (LSRCP) hatchery program. A team of biologists investigated whether the operation of the Tucannon River adult weir/trap impacted Bull Trout, summer steelhead, or spring Chinook salmon during their spawning migration in 2020. A portion of the annual return of each species contain Passive Integrated Transponders (PIT) tags which were used to monitor migratory behavior at instream PIT arrays in the Tucannon River, but more specifically around the adult weir/trap when in operation.

A new trap fyke was installed prior to the summer steelhead return. Fourteen steelhead were detected entering the trap, with six (42%) detected escaping the trap during the steelhead return. Following the steelhead return, modifications to the new fyke were made on three separate occasions during the Bull Trout and spring Chinook runs to improve capture. These modifications were based on steelhead results and input from the workgroup, and not based on Bull Trout or spring Chinook returns as they were limited in 2020.

Only one previously PIT tagged Bull Trout returned in 2020. This fish converted through the trap (100%) with a passage delay of 1.4 days. This one Bull Trout did not escape the trap. Only two previously PIT tagged spring Chinook returned to the trap in 2020. The percentage of spring Chinook salmon that converted through the adult trap in 2020 was 50%, with one fish escaping after being detected in the trap. Median delay of these two fish was 4 days.

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Preface

This report is intended to document annual work and activities associated with Bull Trout, summer steelhead, and spring Chinook salmon passing the Tucannon River adult weir/trap, in the Tucannon River (Washington), which is operated for both the capture, collection and propagation of summer steelhead and spring Chinook salmon under the Lower Snake River Compensation Program hatchery mitigation program. This report primarily focuses on activities/monitoring in calendar year 2020, but also includes information gathered on Bull Trout and spring Chinook salmon migration/passage from 2015-2019 run years where available.

This report is generally technical in nature and, for context, references and discusses operations and benchmarks that were previously established by co-managers. This report is not a policy document and, while its contents may inform the process, is not for the direct purpose of establishing final policy.

Introduction

Bull Trout (*Salvelinus confluentus*) are listed under the Endangered Species Act (ESA) as a threatened species. Bull Trout were listed across their entire range in the U.S. (coterminously) on November 1, 1999 (see USFWS 2015a). Factors contributing to the listing of Bull Trout included range-wide declines in distribution, abundance, and habitat quality. Land and water use that alter or disrupt the habitat requirements of Bull Trout can be a threat to the persistence of Bull Trout. Commonly considered examples of such threats include dams and timber harvest (USFWS 2015a). A potential threat from the operation of weirs/traps and the resulting influence on Bull Trout migrations has recently received considerable attention (Kelly Ringel 2014). The operation of weirs/traps are prevalent throughout the part of the Columbia River basin that is accessible to anadromous fish and where anadromous fish management occurs.

The Mid-Columbia Recovery Unit (MCRU) is one component of the coterminous Distinct Population Segment (DPS). The MCRU has numerous core areas, one of which is the Tucannon Core Area (Figure 1). Bull Trout still occupy most of their historic range in the Tucannon River watershed, and prior to 2000 the population of the core area was considered relatively large (USFWS 2010). Genetic analyses indicate that there are currently five local populations of Bull Trout, and possibly a sixth, within the core area of the Tucannon River watershed (USFWS 2008; Kassler et al. 2013). Both resident and migratory forms of Bull Trout still occur in the Tucannon River watershed (Martin et al. 1992; WDFW 1997) and recent data indicate that migratory Bull Trout regularly use the mainstem of the Snake River on a seasonal basis (Underwood et al. 1995; WDFW 1997; Faler et al. 2008; Bretz 2010; D. Wills, pers. comm. 2014). Spawning and early rearing for the Tucannon population is focused in the upper Tucannon River (generally considered above its confluence with Panjab Creek [rkm 75], ~16 rkm upstream from the Tucannon adult weir/trap), small tributaries to the upper mainstem, and in Panjab Creek and its tributaries.

Summer steelhead (*Oncorhynchus mykiss*) are also present in the Tucannon River and include both natural- and hatchery- origin spawners from a hatchery program which began in 1982 (Schuck 1985) under the Lower Snake River Compensation Plan (LSRCP) and has been operated by the Washington Department of Fish and Wildlife (WDFW). Summer steelhead in the Tucannon River were listed as threatened in 1997 under the ESA and are part of the Snake River summer steelhead DPS.

Spring Chinook (*Oncorhynchus tshawytscha*) salmon are also present in the Tucannon River and include both natural- and hatchery- origin spawners from a hatchery program which began in 1985 (Bugert et al, 1986) under the Lower Snake River Compensation Plan (LSRCP) and has been operated by the Washington Department of Fish and Wildlife (WDFW). The Tucannon spring Chinook salmon population was listed as threatened in 1993 under the ESA and is part of the Snake River spring/summer Chinook ESU.

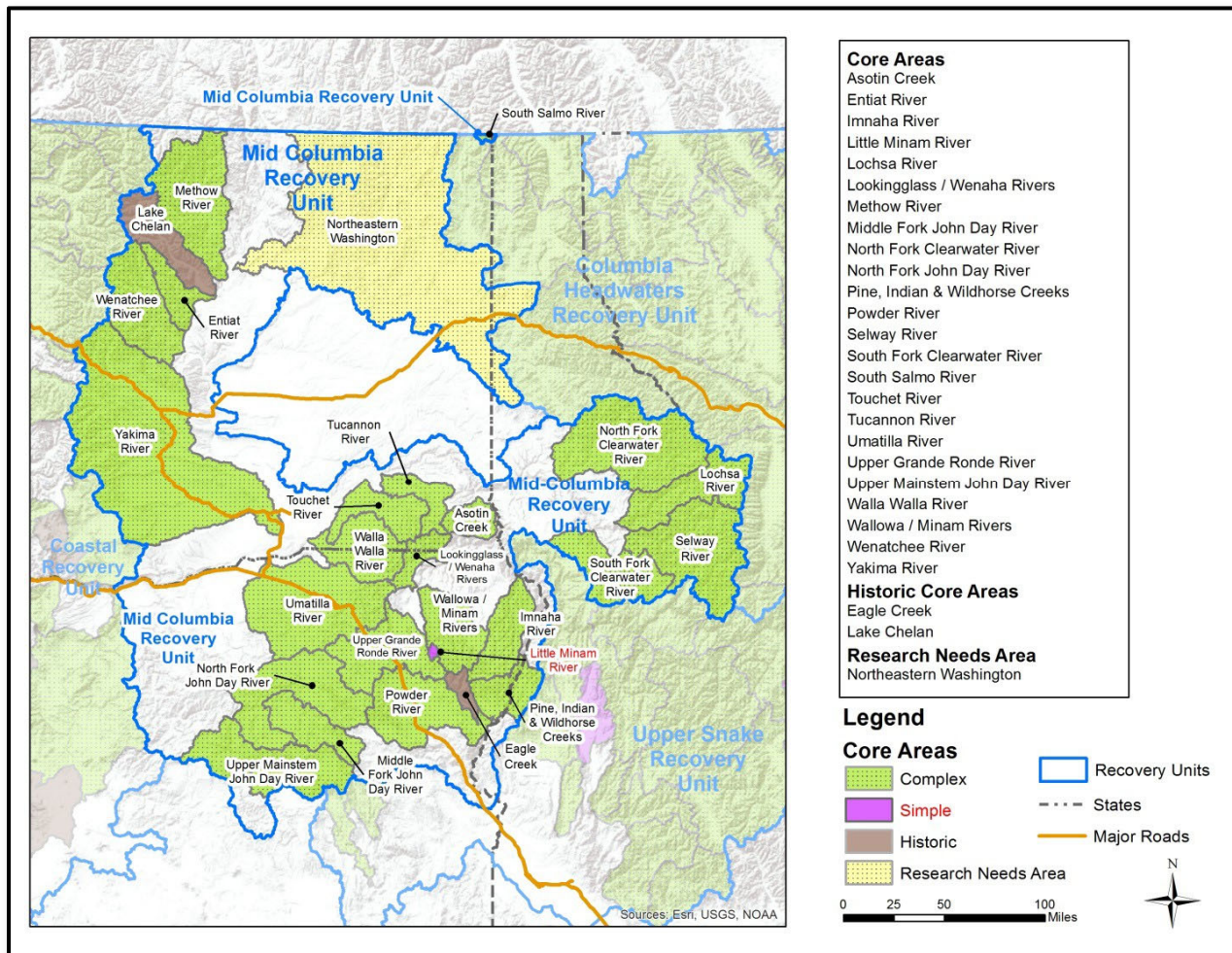


Figure 1. Populations of Bull Trout in the Mid-Columbia Recovery Unit are numerous and provided above. In the Tucannon River Bull Trout can be found primarily in the upper Tucannon River in the mainstem and the following small tributaries: Bear Creek, Cold Creek and Sheep Creek, Panjab Creek, Meadow Creek, Turkey Creek and Turkey Tail Creek. Bull trout are also known to exist in Cummings Creek, a small tributary that enters the Tucannon River mainstem about 1.6 km below Tucannon FH.

All three ESA listed species are routinely handled during annual operations of the Tucannon adult weir/trap. A “new” fish ladder/trap was constructed in 1998 adjacent to the existing Tucannon FH water intake facility. The water intake facility uses a sheet pile dam placed in the river as a backwater for the hatchery water supply. The fish ladder and trap allow passage upstream of the sheet pile dam (i.e. now considered or referred to as the “weir”) and selective capture of upstream migrants when the trap is operated. Overall, the Tucannon adult weir/trap generally operates from late February through early October each year. Summer steelhead are the first to arrive, with most steelhead arriving at the trap in March and April. Most of the upstream migration for Bull Trout and spring Chinook occurs between May and July. Generally, Bull Trout that move from the lower Tucannon River to their spawning areas are believed to pass through the entire area where summer steelhead and spring Chinook salmon spawn.

Endangered Species Act Consultation

Starting in 2015, the USFWS-LSRCP and its cooperators initiated consultation with NOAA-Fisheries on continued operation of spring/summer Chinook salmon, steelhead and rainbow trout programs in NE Oregon and SE Washington. In 2016, a Biological Opinion was issued (USFWS 2016) that identified with the following Terms and Conditions (Section 8.4.1c-d) for the Tucannon River spring Chinook salmon program:

- c. Upon signature of this Opinion, the LSRCP and WDFW will continue to develop an evaluation of Bull Trout passage and delay at the Tucannon River Hatchery fish ladder/trap during periods of operation; initial discussions have already been initiated. As with the Imnaha study, it is understood that the Tucannon study design will use existing and improved PIT tag arrays and opportunistic PIT tagging efforts for completion. A monitoring group will be established to address Bull Trout passage and delay issues similar to that already described for the Imnaha weir (see T&C 1b of this Opinion and T&Cs in the associated Imnaha Weir Biological Opinion, incorporated here by reference) such that information from both the Tucannon and Imnaha studies may be used to more broadly answer the extent of passage and delay impacts in the action area. Progress reports will be submitted by WDFW and LSRCP after the second full year of data collection, and annual meetings will be convened between the monitoring group, co-managers, and cooperators to review the data and discuss potential operational changes to minimize adverse effects and reduce take associated with Tucannon facility operations. If proposed weir modifications are identified within the study period, those modifications must be implemented within a timeframe agreed to by the Service, LSRCP, and the co-managers in the Tucannon basin; follow-up actions, if needed, will be included in a final report following the study. If study results indicate that passage delays are not significantly impacting Bull Trout migration, co-managers and the Eastern Washington Field Office will determine whether continued PIT tagging and data collection are desired as a means of better understanding Bull Trout life history within the Tucannon River system; continuation of agreed upon aspects of the study will not be the responsibility of the LSRCP.*
- d. Include the Service (Ecological Services Field Office or Fisheries Office staff) in meetings to deal with weir issues and lessening impacts to Bull Trout.*

Starting in late 2016, a monitoring workgroup including program staff from WDFW, Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation and the USFWS was formed, held meetings, analyzed, and reviewed existing data for the Tucannon River Bull Trout population. The workgroup developed an initial project goal and project objectives that specifically addressed the Tucannon adult weir/trap facility operations and potential passage and delay issues similar to the operations of the Imnaha River adult weir/trap in NE Oregon. Project implementation was initially attempted in run year 2017 but due to spring flooding events in the Tucannon River was delayed until 2018. This document meets the stated Term and Condition obligation for WDFW and LSRCP to provide a report after the third full year of data collection (2020).

Tucannon River Project Goal

To provide information that can be used to minimize the incidental “take” of ESA-listed Bull Trout, summer steelhead, spring Chinook salmon, and other ESA or sensitive species in the Tucannon River during operation and management of the Tucannon River adult weir/trap for broodstock collection of summer steelhead and spring Chinook salmon.

2020 Tucannon River Project Objectives

Following the assessments for Bull Trout and spring Chinook in 2018 and 2019 (Bumgarner and Engle, 2019), it was confirmed that fish escaping the trap was high and lead to poor conversion rates for spring Chinook, and increased passage delay in both spring Chinook and Bull Trout. It was also suspected that steelhead have escaped the trap in the past as well. When these evaluations started back in 2015, summer steelhead were not included because the temporary antennas located below the trap could not be installed/maintained during high spring flow events. Once the TFH PIT Array was upgraded in 2017, it was more feasible to include steelhead, but then high spring flows have generally disabled some of the antennas, making it more difficult to evaluate the run of steelhead at the trap. In addition, many of the steelhead are known to bypass the weir during the higher spring flows. Determining the escape rate of summer steelhead are now also part of the annual evaluations for the trap.

Based on the finding for Bull Trout and spring Chinook within the 2019 assessment report, the plan was to design a new trap fyke entrance prior to the 2020 trapping season. Expecting that some PIT tagged summer steelhead would arrive at the trap in the spring of 2020, the temporary antenna inside the trap was installed to evaluate if steelhead could escape the newly designed fyke. This would allow time for additional modifications to the fyke before the Bull Trout or spring Chinook runs arrived. Objectives for the 2020 season were:

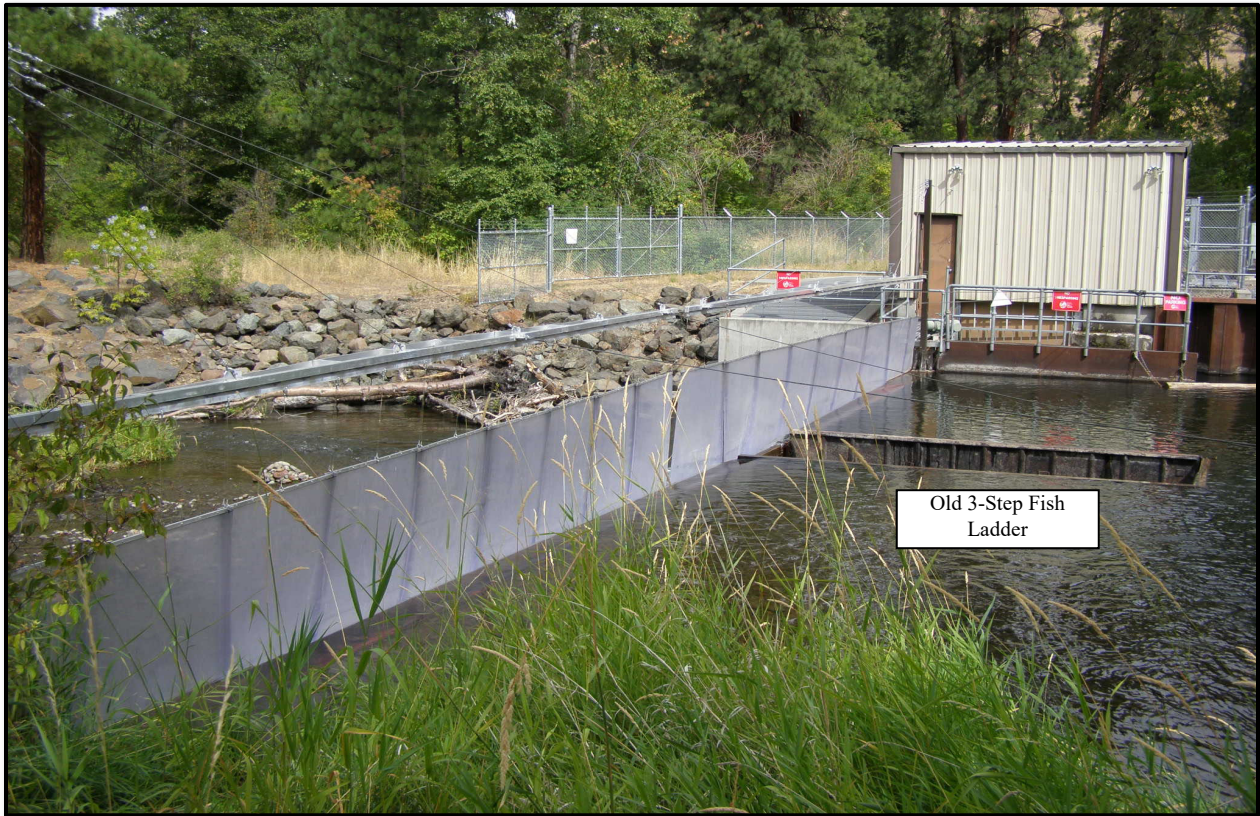
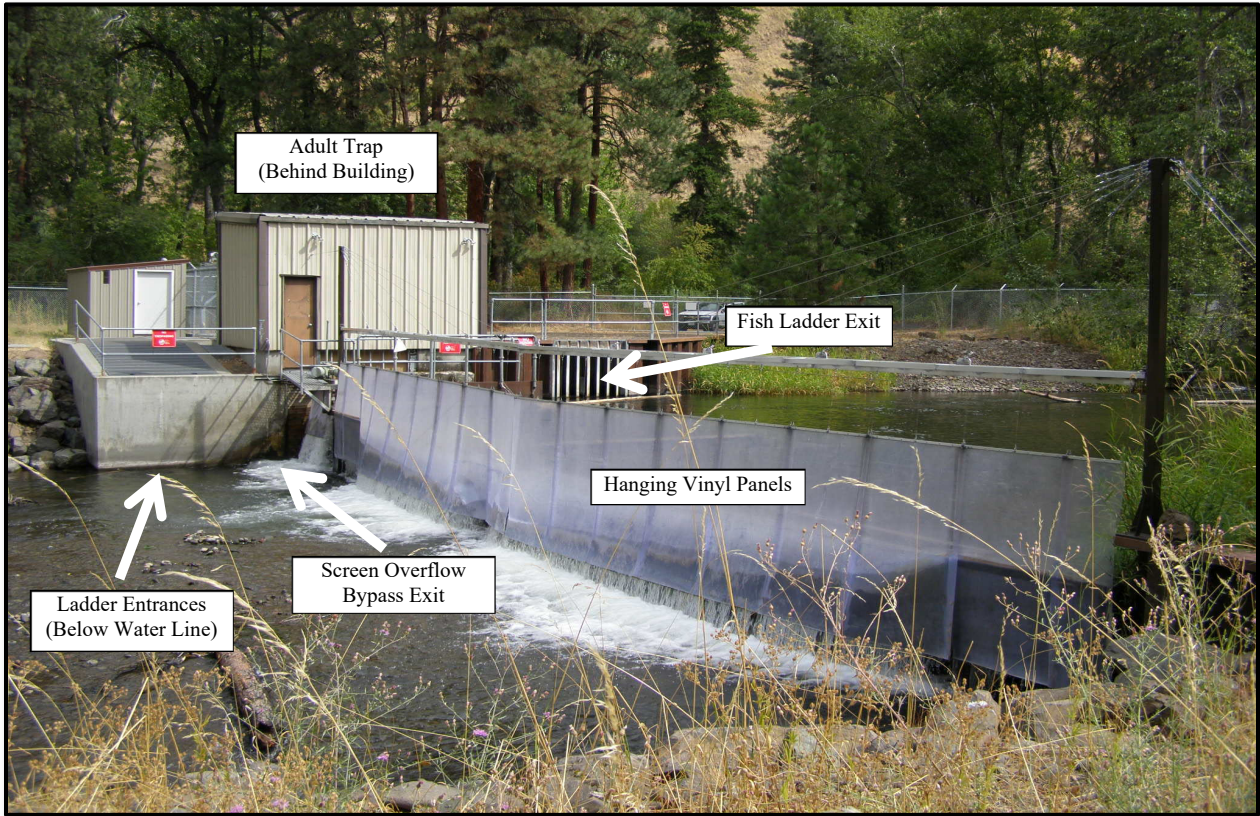
1. Determine the escape rate of summer steelhead from the adult trap. Make fyke modifications as needed to improve capture and conversion rate of all three species.
2. From 2018-2022, assess the passage rate (conversion) of Bull Trout that is associated with the operation of the Tucannon River adult weir/trap for collection and enumeration of spring Chinook salmon for the hatchery program. Target benchmarks for Bull Trout conversions are an average across the five study years of at least 95%, with no less than 75% in any given year (point estimates). This criterion will be re-examined annually by the workgroup.
3. From 2018-2022, assess the migration delay (delay) of Bull Trout that is associated with the operation of the Tucannon River adult weir/trap for collection and enumeration of spring Chinook salmon for the hatchery program. Target benchmarks for delay (of Bull Trout that pass the adult weir/trap) are median passage times (between lower [TC1] and upper [TC3 and/or TC4] antenna arrays) of no longer than 8 days for May, 6 days for June, 4 days for July and 2 days for August and September, with no individual taking longer than 8 days in any month.
4. From 2018-2022, assess the passage rate (conversion) of spring Chinook salmon during standard broodstock collection and enumeration of the spring Chinook salmon run in the Tucannon River.

5. From 2018-2022, assess the migration delay (delay) of spring Chinook salmon during standard broodstock collection and enumeration of the spring Chinook salmon run in the Tucannon River.
6. Minimize and standardize impacts to Bull Trout and spring Chinook salmon during operation of the Tucannon River adult weir/trap through adaptive management during planned monitoring activities of passage and delay. This will be done through ongoing and continued discussions and coordination between the USFWS, NOAA-Fisheries, co-managers, and cooperators, and may involve revising benchmarks, implementing operational changes or modification of structures.

Study Area and Adult Weir/Trap Operation

The Tucannon River adult weir/trap is located at approximately rkm 59. The facility is located on WDFW property within the W.T. Wooten Wildlife Area and serves as the adult collection facility for the Tucannon River spring Chinook salmon and Tucannon River summer steelhead hatchery programs under the USFWS-LSRCP Program. From 1985 to 1996, a floating weir attached to a sheet pile dam adjacent to the Tucannon FH (rkm 58) was installed for broodstock collection with a target installation period in late-April or early-May. After major floods destroyed this adult weir/trap location in 1996, a new fish ladder and trap was placed around the current Tucannon FH water intake facility and sheet pile dam (Photo 1). The original water intake sheet pile dam had a center 3-step ladder section which allowed unimpeded fish passage through the dam. In 1998, when the new facility was completed, the 3-step ladder section had to be closed off for broodstock collections for each of the hatchery programs. Hanging vinyl picket panels (first installed in 2008) are installed manually prior to the summer steelhead return each year and kept in place throughout the spring Chinook salmon run. The objective of the panels are to prevent or lessen the number of fish that could jump over the dam (Photos 1 and 2), which during certain flow conditions many fish can pass unimpeded.

The adult weir/trap is operated by WDFW, with spawning, incubation and early rearing for spring Chinook salmon and steelhead hatchery programs occurring at Lyons Ferry FH, also operated by WDFW. Lead management entities identified in the current 2018 – 2027 U.S. v. Oregon Management Agreement include WDFW, the Nez Perce Tribe, and the Confederated Tribes of the Umatilla Indian Reservation.



Photos 1 and 2. Photos of the Tucannon River adult weir/trap. Photos by WDFW hatchery evaluation staff.

Methods

Per the USFWS Biological Opinion (2016), and as part of ongoing investigations by co-managers and cooperating agencies, Bull Trout have been PIT-tagged annually at the Tucannon River adult weir/trap for several years. Upon capture and determining a Bull Trout doesn't contain a PIT tag, a new PIT tag is inserted into the dorsal sinus (anterior edge of the dorsal fin) per Bouwens and Jakubowski (2015). Bull Trout which have been previously PIT tagged in other monitoring efforts within or outside the Tucannon River are opportunistically included in the analysis if they are detected in the Tucannon River and attempt passage at the Tucannon River adult weir/trap. In addition, summer steelhead and spring Chinook salmon adults/jacks returning with PIT tags, either from juvenile tagging in the Tucannon River (hatchery or natural origin), or from adult tagging efforts at Bonneville or Lower Granite dams, were used to address the objectives for spring Chinook salmon (Objectives 4 and 5), and to assess the escapement of steelhead from the newly designed trap entrance (Objective 1). Documentation of all three species that move throughout the entire Tucannon River is possible through a series of instream PIT tag detection arrays (Figure 2). Detection data can be queried from these PIT-detection arrays through the PIT tag information system (www.ptagis.org).

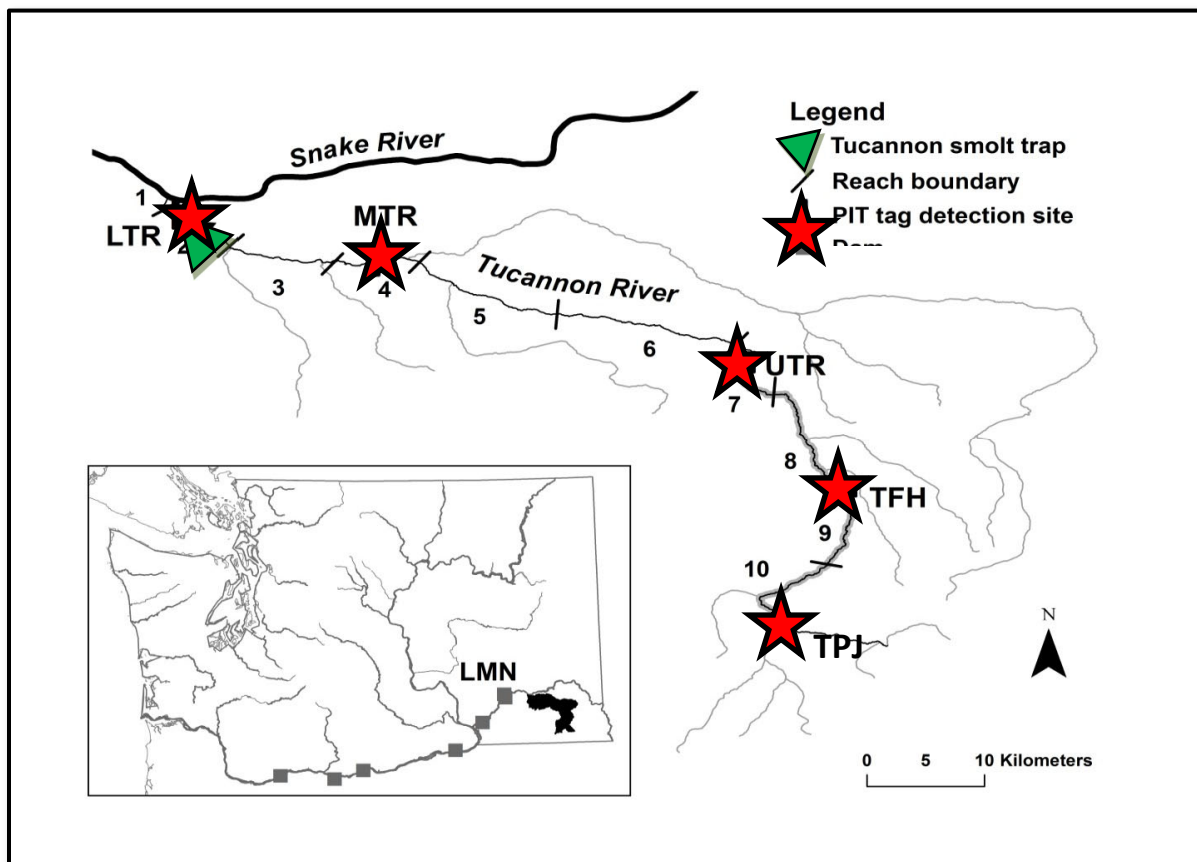


Figure 2. Tucannon River Basin and location of the adult trap/weir, PIT Tag Arrays, and smolt trap. Lower Monumental Dam (LMN), 2nd of the lower four Snake River Dams, is identified in the inset of Washington.

In previous analyses PIT tag detections were examined from PIT antennas located ~100 m downstream of the weir/trap (TC1), in the fish ladder (TC2), in the adult trap (TC3), and upstream (TC4) of the Tucannon River adult weir/trap (Photo 3) to achieve the objectives of the study. However, for 2020, all antennas at TC4 were non-functional the entire season. In addition to antennas at TC1 and TC2, an additional temporary PIT antenna was again added to the floor of the trap (Photo 4) in 2020 to assess if fish were escaping the newly designed fyke entrance.

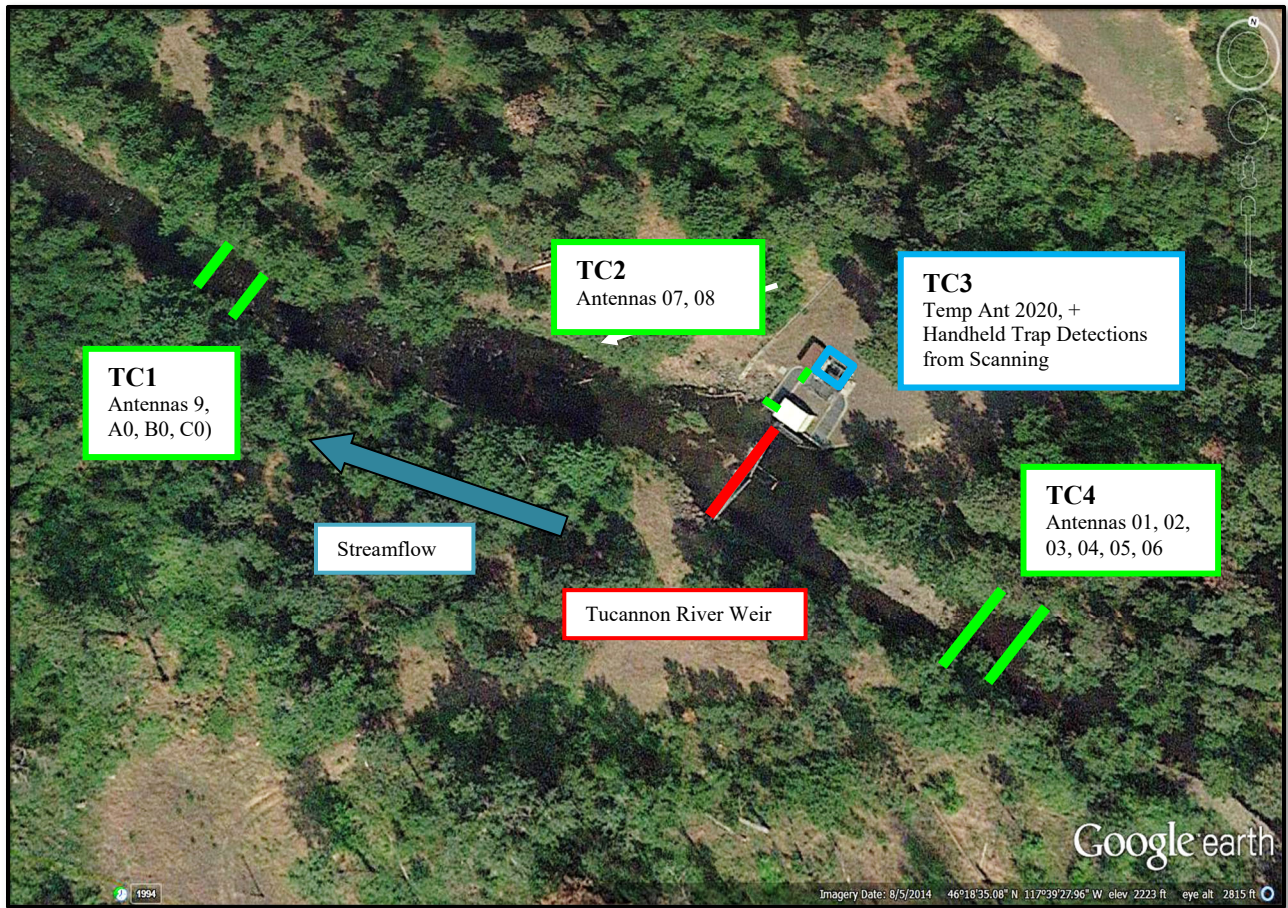


Photo 3. Location of the Passive Integrated Transponder (PIT) tag detection arrays around the Tucannon River adult weir/trap site. The TC1 (4 antennas) and TC4 (6 antennas) are within the bank full area of the Tucannon River, while TC2 (2 permanent antennas) are in the fish ladder. In 2020, one additional temporary antenna was installed on the trap floor (included in TC3). All locations are approximations.



Photo 4. Photo of the new trap fyke and temporary antenna (secured to the floor of the trap) 2020.

For the 2020 season, detection histories for the PIT-tagged summer steelhead, Bull Trout and spring Chinook salmon were compiled to determine whether they exhibited a pattern reflective of the behavior of interest, specifically:

- 1) Detections occurred during adult weir/trap operation, not pre- or post-operation
- 2) Detections showed the fish moving upstream rather than only downstream.
- 3) Detections were of fish tagged prior to year of capture at the adult weir/trap.

Detection histories for both Bull Trout and spring Chinook from 2015-2020 were included in some analyses to provide additional background on movement and detection patterns and have been include in this year’s report where applicable. The first year temporary PIT tag detection equipment was installed below the adult trap was 2015.

Calculations for Objective 1: *Determine the escape rate of summer steelhead from the adult trap.*

Escapement rate on steelhead (and later for Bull Trout and spring Chinook) was calculated as:

$$TC3_{\text{Temporary Antenna}} / (\text{Sum } TC1 + TC2_{\text{Detected at a later date}})$$

Where:

$TC1_{\text{Detected at a later date}}$ = the number of PIT-tagged steelhead, Bull Trout or spring Chinook salmon that were detected at the set of antennas below the trap **after** that particular fish was detected inside the adult trap.

$TC2_{\text{Detected at a later date}}$ = the number of PIT-tagged steelhead, Bull Trout or spring Chinook salmon that were detected at the set of antennas in the fish ladder **after** that particular fish was detected inside the adult trap.

$TC3_{\text{Temporary Antenna}}$ = the number of PIT-tagged steelhead, Bull Trout or spring Chinook salmon that were detected in the adult trap on the temporary trap antenna

Calculations for Objectives 2 and 4: *From 2018-2022, assess the passage rate (conversion) of Bull Trout and spring Chinook salmon that is associated with the operation of the Tucannon River adult weir/trap for broodstock collection and enumeration of spring Chinook salmon for the hatchery program.*

In 2020, adult weir/trap operations were similar to previous years and detections of PIT-tagged Bull Trout and Chinook salmon were summarized and analyzed as outlined in the Methods

section. In 2020, all antennas at TC4 (upstream of the adult weir/trap) were inoperable/missing during the entire season due to a catastrophic flood in February. Only with some luck did the four antennas below the weir (TC1 remained operational). The Panjab Array site was also disabled for the entire season. As such, the calculations to assess passage rate (conversion) was again modified for 2020, and capture/detection in the adult trap was the upper most detection location. From previous evaluations only a small percentage of the Bull Trout and spring Chinook salmon have been detected passing over the sheet pile dam under certain flow conditions, even with the hanging vinyl panels in place based on historical data. Without the upstream arrays in 2020, how many fish passed over could not be assessed, hence some calculations of overall upstream passage could be in error.

Relative to Objectives 2 and 4, the *observed percent* of Bull Trout and spring Chinook salmon that passed the adult weir/trap in 2020 was calculated as: $(TC3)/TC1 \times 100$

Where:

$TC1$ = the number of PIT-tagged Bull Trout or spring Chinook salmon that were detected at the set of antennas below the trap

$TC3$ = the number of PIT-tagged Bull Trout or spring Chinook salmon that were captured/handled in the adult trap (with confirmation from the temporary trap antenna)

Calculations for Objectives 3 and 5: *During 2018-2022, assess the migration delay (delay) of Bull Trout and spring Chinook salmon associated with the operation of the Tucannon River adult weir/trap for brood stock collection and enumeration of spring Chinook salmon for the hatchery program.*

As in Objectives 2 and 4, for 2020 we specifically used previously PIT-tagged fish and the date of first detection at the lower array (TC1) along with the capture date in the adult trap (TC3). Target days of delay benchmarks used in this evaluation are identical to those developed for the Imnaha River (as data to inform benchmarks for the Tucannon River was lacking). Relative to Objective 3 and 5, the time (in days) for an individual Bull Trout or spring Chinook salmon to pass the adult weir/trap site in 2020 was calculated by: $Capture\ date_{[TC3]} - 1^{st}\ detection\ date_{[TC1]}$

Where:

$1^{st}\ detection\ date_{[TC1]}$ = the date and time a PIT-tagged Bull Trout or spring Chinook salmon was first detected at the row of antennas immediately below the adult trap

$Capture\ date_{[TC3]}$ = the date and time a PIT-tagged Bull Trout or spring Chinook salmon was captured in the adult trap by hatchery staff

Results and Discussion

Infrastructure and Specific Adult Weir/Trap Operations in 2020

In 2020, adult weir/trap operations were identical to prior years. However, as previously mentioned, all antennas upstream of the weir/trap (TC4) were non-functional due to the flood in early February. A total of 19 summer steelhead that were previously PIT tagged returned in 2020, but only 14 were used to assess the effectiveness of the new trap fyke (Appendix A). All previously PIT-tagged Bull Trout (1) and spring Chinook (2) salmon arriving below the adult weir/trap in 2020 were included to assess the effectiveness of the new fyke.

Summer Steelhead Escapement (Objective 1)

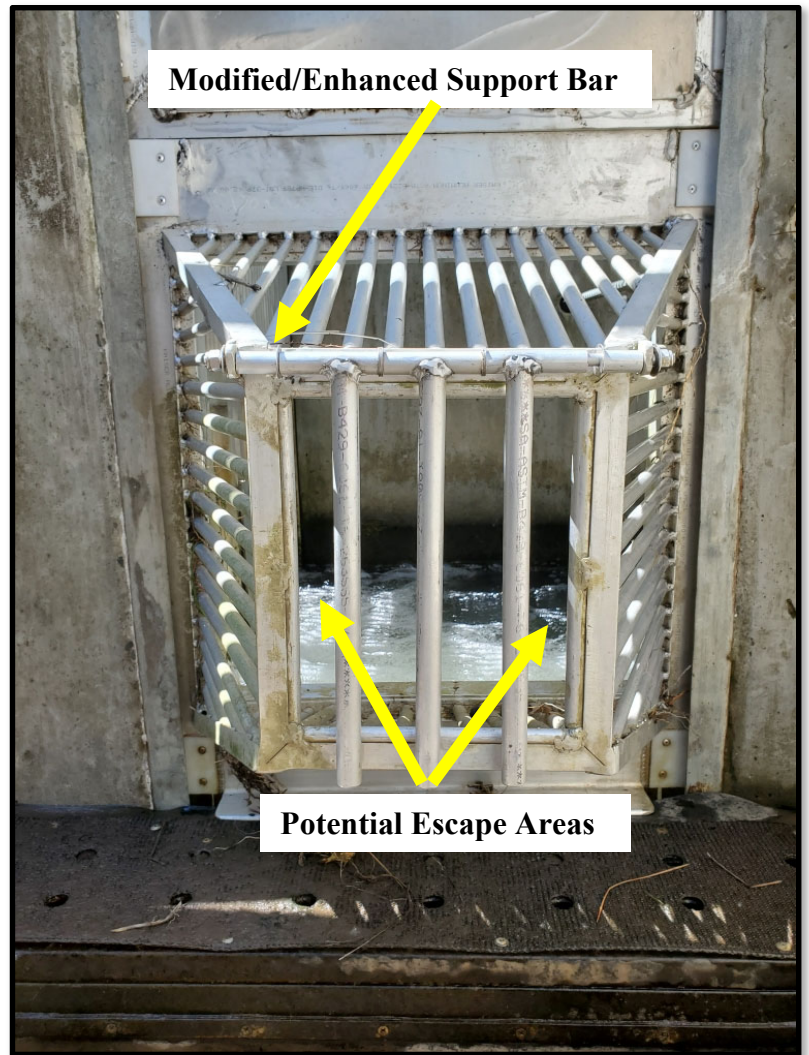
Prior to the steelhead return, TFH hatchery staff constructed a new fyke entrance (Photo 4) based on a similar design used at the Imnaha River trap. Nineteen total steelhead with PIT tags were detected at TC1, but only 14 of those were detected inside the fish ladder (TC2) and by the temporary antenna in the adult trap box (TC3). Of the 14 detected inside the trap, only 8 (57.1%) were captured by hatchery staff. Six fish (42.9%) escaped the trap at least once (Appendix B).

Modifications to the trap fyke

Based on these results, the new trap fyke was not working as anticipated. It was determined that some damage to the fyke was caused by the 30-year flood event in February (a fair amount of debris did enter the fish ladder/trap). This damaged caused the moveable vertical bars (Photo 4) to have more “play” in them which allowed them to be easily spread apart, which would allow fish a greater chance to escape. The support bar for the vertical bars was fixed and strengthened (Photo 5), and the fyke was put back in place on 28 May, just as the spring Chinook and Bull Trout were starting to arrive.

Photo 5. Fyke after support bar was enhanced.

After the new fyke was installed, hatchery staff noted that they thought some fish (bull trout) were observed in the trap late in the evening, but were then not present the next morning. Hatchery staff thought that fish were able to find the corners of the new fyke (photo 4 - indicated by arrows) and able to move the bars out enough to escape the trap. Based on that observation, hatchery staff added crab pot fingers that have been used in the past to extend out beyond the fyke opening, but not to hinder the movement of the vertical bars meant to keep fish in the trap (Photos 6 and 76). The crab pot fingers were added on June 4th.





Photos 6 and 7. Addition of crab pot fingers to fyke to reduce the chance of escapement.

At this time (June 4), the current spacing of the movable vertical bars was 2 inches. Additional bars could be added to reduce the spacing, but there was some concern that more closely spaced bars might inhibit spring Chinook from entering the trap.

On June 15, a summary report of the findings on steelhead escapement was sent out to the coordination group. Mike Mclean (CTUIR) was provided a copy of the summary report and reached out to TFH hatchery staff about additional modifications that should be made to the fyke to keep fish from escaping. The biggest issue in his mind was the spacing of the moveable vertical bars. Based on his experience with similar fykes in the Grande Ronde Basin, the vertical bars needed to be much closer ($3/4$ to one inch) to prevent fish from escaping. Further, he indicated with this spacing he has never observed any avoidance of fish from entering the traps. The TFH staff took those assurances and again modified the trap fyke (addition of three more vertical bars – Photo 8), with re-installment of the new fyke on 17 June. The vertical spacing between the bars is currently $\sim 3/4$ inch. These modifications were the last made to the new fyke for the remainder of the season.



Photo 8. Modified trap fyke as of 17 June, 2020.

Bull Trout Conversion Rates and Delay (Objectives 2 and 3)

Objective 2 – Conversion

For the 2020 migration period, only one previously PIT-tagged Bull Trout was detected moving upstream at TC1 (Appendix A). This fish was captured and passed upstream, so total conversion was 100% for the season (Figure 3). The detection history of this fish indicates it did not escape the trap either (Appendix C).

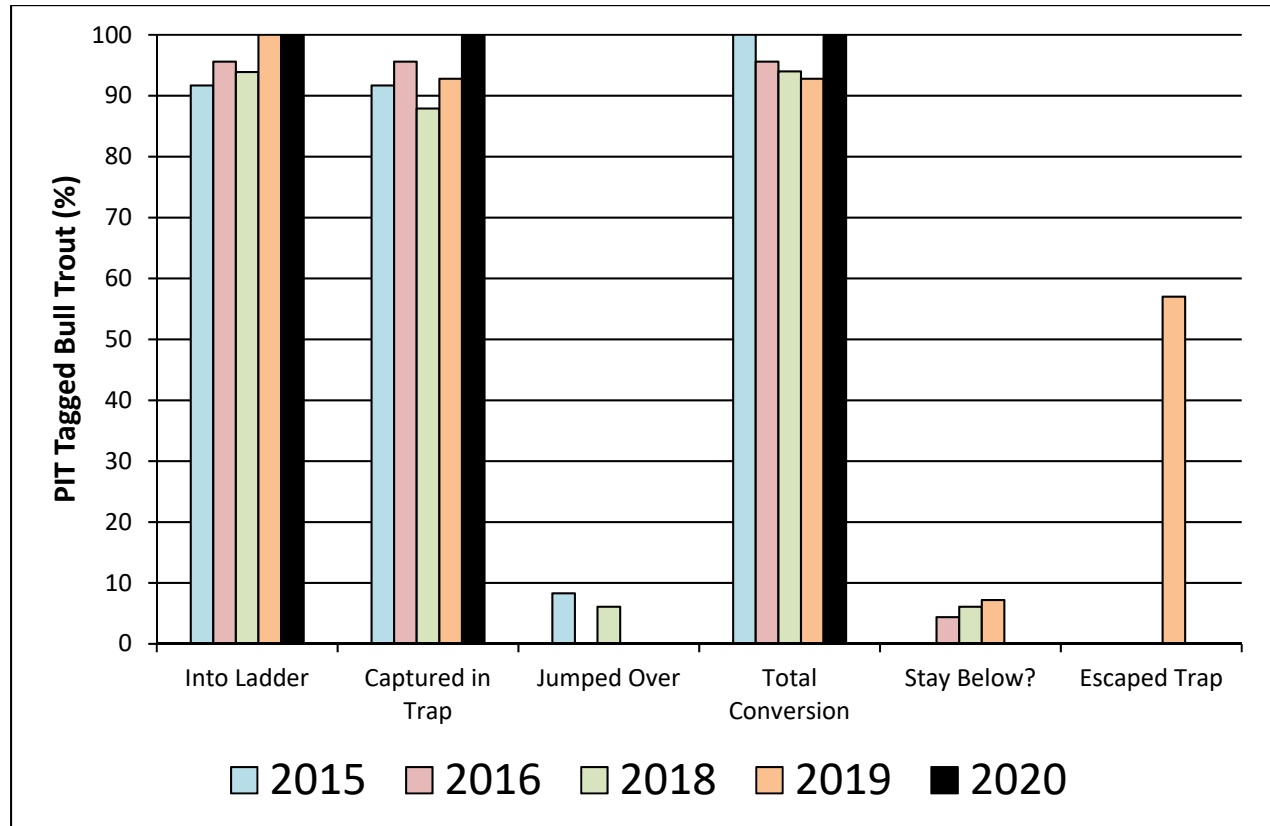


Figure 3. Tucannon River Bull Trout passage (conversion) through the Tucannon adult weir/trap, 2015, 2016, 2018, 2019 and 2020.

Objective 3. Delay

In order to assess migration delay we previously provided context by determining how quickly fish were migrating upstream before they reached the adult weir/trap area (Bumgarner and Engle 2019). Based on multiple years of Bull Trout detections in the Tucannon River, median migration speeds (rkm/day) at detection sites below the adult weir/trap ranged from about 0.8-1.7 rkm/day. Median migration speeds (2015-2019) around the adult weir/trap area (when starting from the antennas immediately downstream of the trap) have been estimated at <0.1 rkm/day. Based on this information, the adult weir/trap area does appear to influence the migration rate of Bull Trout in the Tucannon River.

2020 Specific Delay at the TFH Adult Weir/Trap

One previously PIT tagged Bull Trout was detected at both TC1, TC2, and TC3 and had a detection history indicating it was suitable for calculating days of delay specifically in the adult weir/trap area. Overall delay of this one fish from first detection through captured in the trap was 1.4 days.

Lack of Previously PIT Tagged Bull Trout in 2020

Unfortunately, only one previously PIT tagged Bull Trout returned in 2020, greatly limiting the ability to assess passage conversion and delay. From 2015 to 2019, previously PIT tagged Bull Trout have ranged from 12-46 individuals, providing an adequate number of fish annually for the assessment. Generally, most of the previously PIT tagged fish returning are the larger/older age classes (likely repeat spawners). Curiously, in 2020, the Bull Trout captured were absent of these larger/older age classes, with the largest Bull Trout captured measuring 43 cm. The one previously PIT tagged Bull Trout measured 40 cm. Compared to previous years (2016-2019), about 25% of the annual Bull Trout return measure >45 cm (Figure 4). While not absolutely known, it's possible that the 30-year flood event which occurred in February 2020 affected the larger/older age fish to a greater degree than the smaller fish.

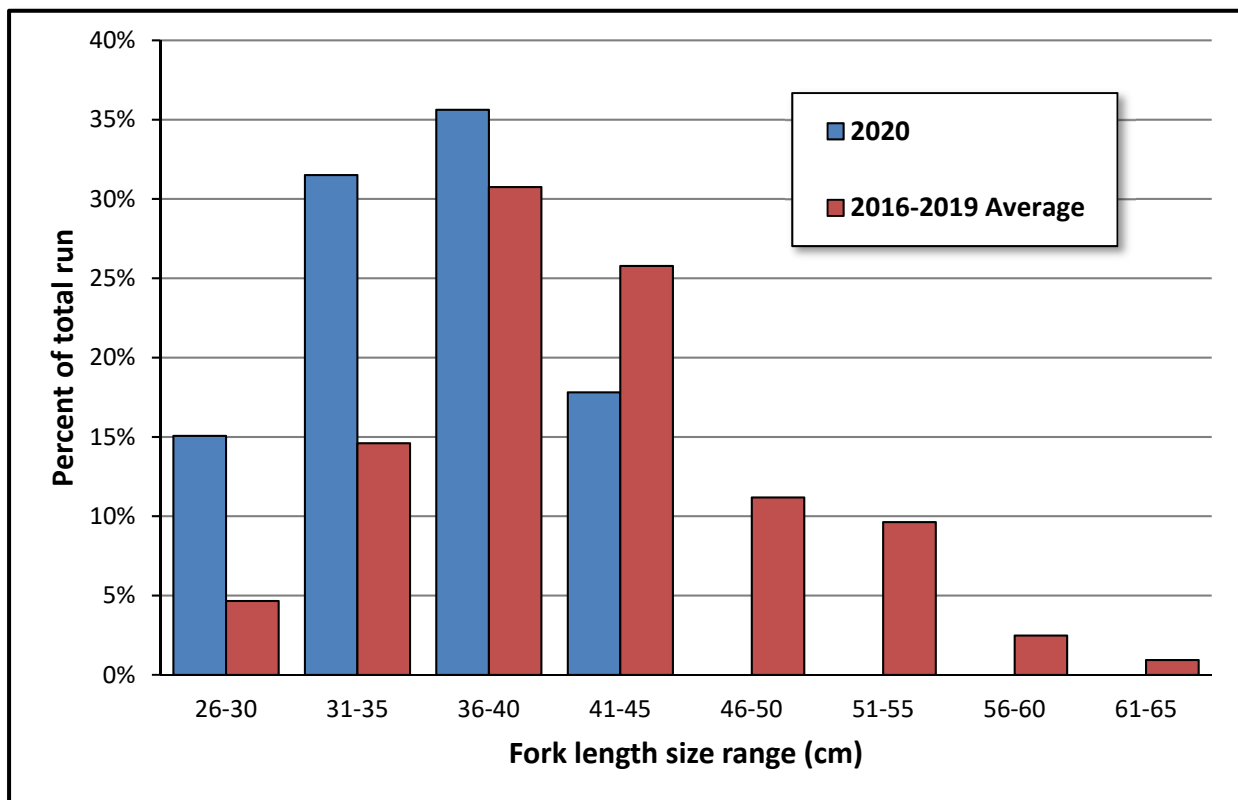


Figure 4. Size distribution of Bull Trout captured in 2020 compared to the average size of Bull Trout captured from 2016-2019.

Spring Chinook Salmon Conversion Rates and Delay (Objectives 4 and 5).

Objective 4: Conversion

During the 2020 migration, only two previously PIT-tagged spring Chinook salmon were detected moving upstream towards the trap (Appendix D). One was captured and hauled for broodstock, the other was detected inside the trap but never captured (escaped the trap), and it either remained below or jumped the weir and went upstream. Thus, the conversion rate from below the adult weir/trap to capture/passage was 50% (Figure 5), with a 50% escapement rate. Both spring Chinook arrived at the trap prior to final trap fyke modifications were complete.

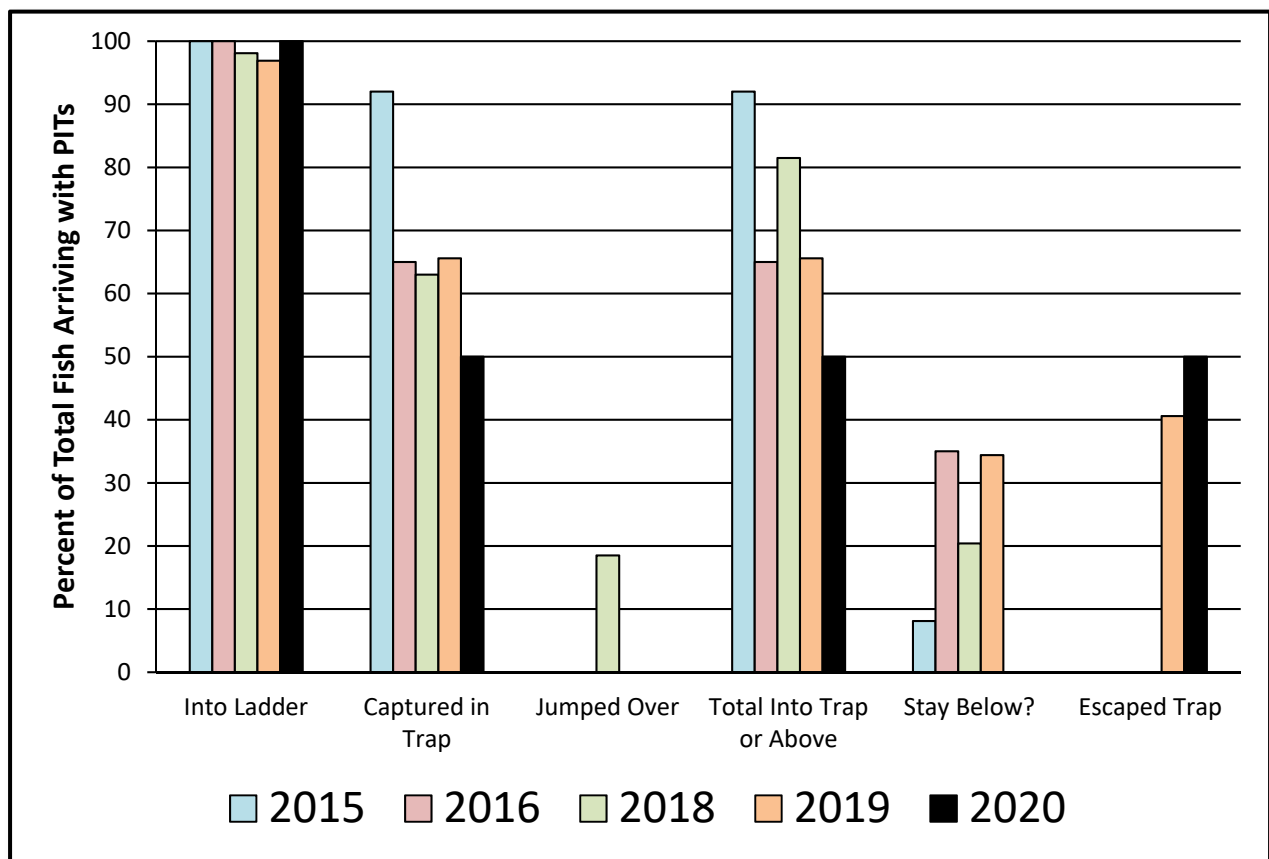


Figure 5. Tucannon River spring Chinook salmon passage (conversion) through the Tucannon adult weir/trap, 2015, 2016, 2018, 2019 and 2020.

Objective 5. Delay

Similar to the Bull Trout, in order to assess migration delay we previously provided context by determining how quickly fish were migrating upstream before they reached the adult weir/trap area (Bumgarner and Engle 2019). Based on data from 2016-2019 spring Chinook salmon detections in the Tucannon River, median migration speeds (rkm/day) at detection sites below the adult weir/trap ranged from about 2-8 rkm/day. Median migration speeds around the adult

weir/trap area (when starting from the antennas immediately downstream of the trap) have been estimated at <0.05 rkm/day. Based on this information, the adult weir/trap area does appear to influence the migration rate of spring Chinook salmon in the Tucannon River.

2020 Specific Delay at the TFH Adult Weir/Trap

Only two previously PIT tagged spring Chinook salmon were detected in the adult trap/weir area. One was only detected inside the trap (for some unknown reason it was not detected at TC1 or TC2) and then captured and hauled for broodstock. The other fish was detected at both TC1, TC2, and TC3 (temporary antenna), but escaped and was never detected again. Overall delay of the two spring Chinook salmon ranged from 0.5-8.5 days (Figure 6).

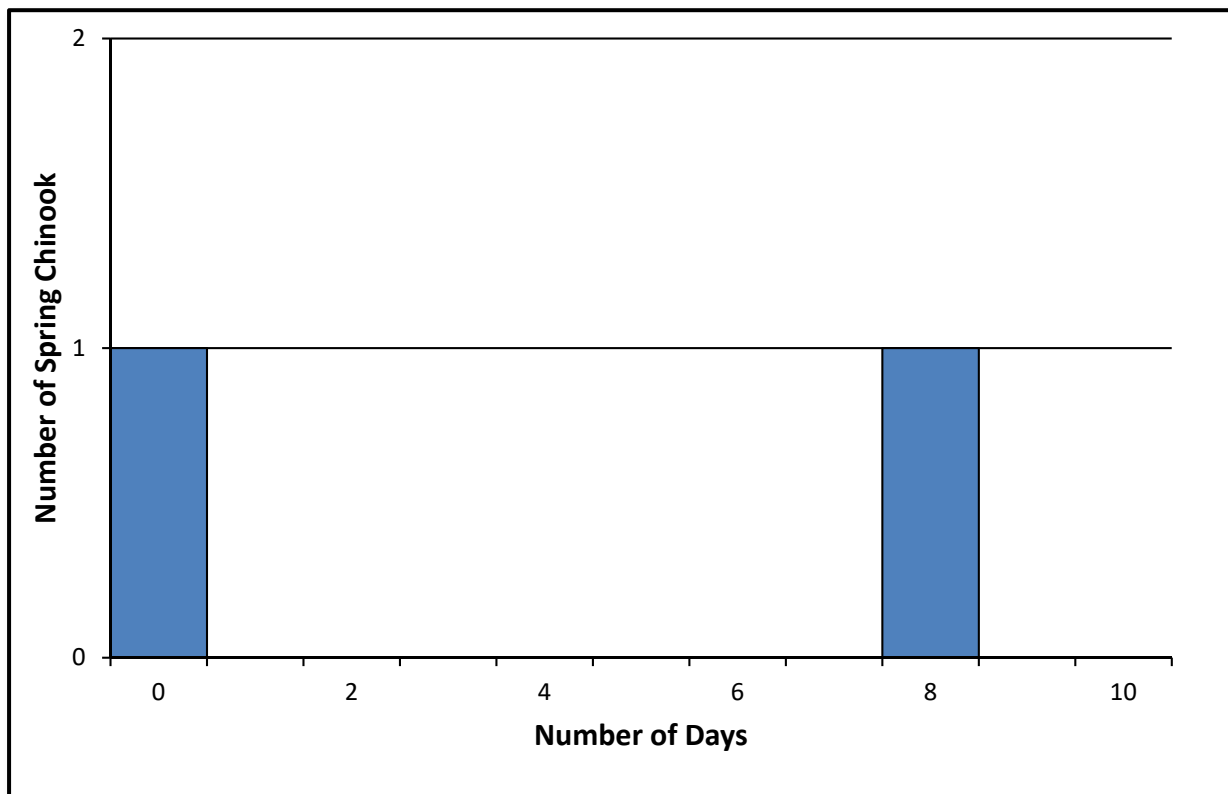


Figure 6. The actual number of days in 2020 it took spring Chinook salmon to move from TC1 to TC3 (adult trap detection/capture by hatchery staff).

Conclusions and Future Actions

This is the second progress report of a multi-year effort evaluating the effects of the adult weir/trap operated for the LSRCP Tucannon River spring Chinook salmon program and its potential impacts to Bull Trout migration and delay. While not the main focus of the study, passage conversion and delay for spring Chinook salmon have also been summarized, along with adult trap escapement rates for summer steelhead, Bull Trout, and spring Chinook. This progress report presents specific findings for the 2020 migration year, but prior year's information (2015-2019) have been included where useful to better describe what has been observed for both Bull Trout and spring Chinook salmon migration and delay.

In 2020, the Bull Trout conversion rate was 100% (benchmark >95%) through the weir/trap area but based only on one fish that was previously tagged. For spring Chinook salmon, conversion through the trap area was 50%, but was based only on two previously tagged spring Chinook.

Migration rate of both Bull Trout and spring Chinook from the lower Tucannon River upstream to the adult weir/trap is generally about 0.5-2.0 rkm/day (Bull Trout) to ~6.0 rkm/day (spring Chinook). Migration rate of both species slows considerably once they reach the trap area. Median delay of Bull Trout and spring Chinook to navigate past the weir/trap in 2020 was 1.4 and 4 days, respectively.

The low number of returning previously PIT tagged Bull Trout and spring Chinook greatly limited the ability to assess passage conversion and delay in 2020. However, because of the evaluation of steelhead adult trap escapement, modifications to the new trap fyke were made, and will likely increase overall conversion rates and decrease passage delay of all three species in the future.

The only additional modification to the trap fyke planned prior to 2021 returns will be a horizontal bar placed slightly in front of the movable vertical bars on the fyke entrance. This addition will prevent the vertical bars from getting “flipped” on top of the trap fyke. This happened a couple of times during the spring Chinook/Bull Trout trapping period when fish pushed their way through the fyke opening (likely at high speed). When this was happened, it left a larger gap between the bars allowing fish to escape more easily.

For the spring of 2021, similar returns of previously PIT tagged summer steelhead at the trap are expected. These fish should provide a good evaluation of the modified fyke entrance, where modifications can again be made prior to the Bull Trout or spring Chinook runs if necessary. Unfortunately, the spring Chinook run is again predicted low for 2021 so it's doubtful that more than a few previously PIT tagged fish will return. Slightly more than 70 Bull Trout were PIT tagged in 2020, which based on previous years tagging efforts will likely result in 10-20 Bull Trout returning in 2021 that can be assessed. To date, there have been 11 Bull Trout detected on

the LTR, MTR, and UTR arrays since the fall of 2020, all of which were tagged at the adult trap during the 2020 migration season. Hopefully all of these, along with some others that haven't been detected will return to the adult trap in 2021.

Current Antenna Status: Unfortunately, the February 2020 flood not only scoured out many of the antennas upstream of the adult trap, but altered the river in such a way that installing more antennas in the same area would not work, or again could be easily taken out by moderate flow events. The area further upstream (within relatively close distance [100-200m]) of the trap has become largely braided making logistically challenging to install antennas and cables that wouldn't also get easily scoured out by higher flows. An option to install some temporary antennas (battery powered) once the anticipated high spring flows have passed is possible, but it will depend on how much the stream is altered this spring. For future evaluations, the workgroup should discuss the importance of having these upstream antennas as part of the evaluation.

Acknowledgements

Thanks to the Lower Snake River Compensation Plan Office for funding the analysis of this work. Thanks to all those who improved this report through their review of earlier drafts. Thanks to the Tucannon FH staff (Doug Maxey, Daniel Pounds, Chris Highley, and Daniel Byington) for the daily operation of the adult trap, scanning and PIT tagging the Bull Trout and Spring Chinook salmon captured in the trap. I am grateful to co-managers (the Nez Perce Tribe and the Confederated Tribes of the Umatilla Indian Reservation) for their support of and participation in this work as well as the U.S. Fish and Wildlife staff contributions to the Tucannon River workgroup.

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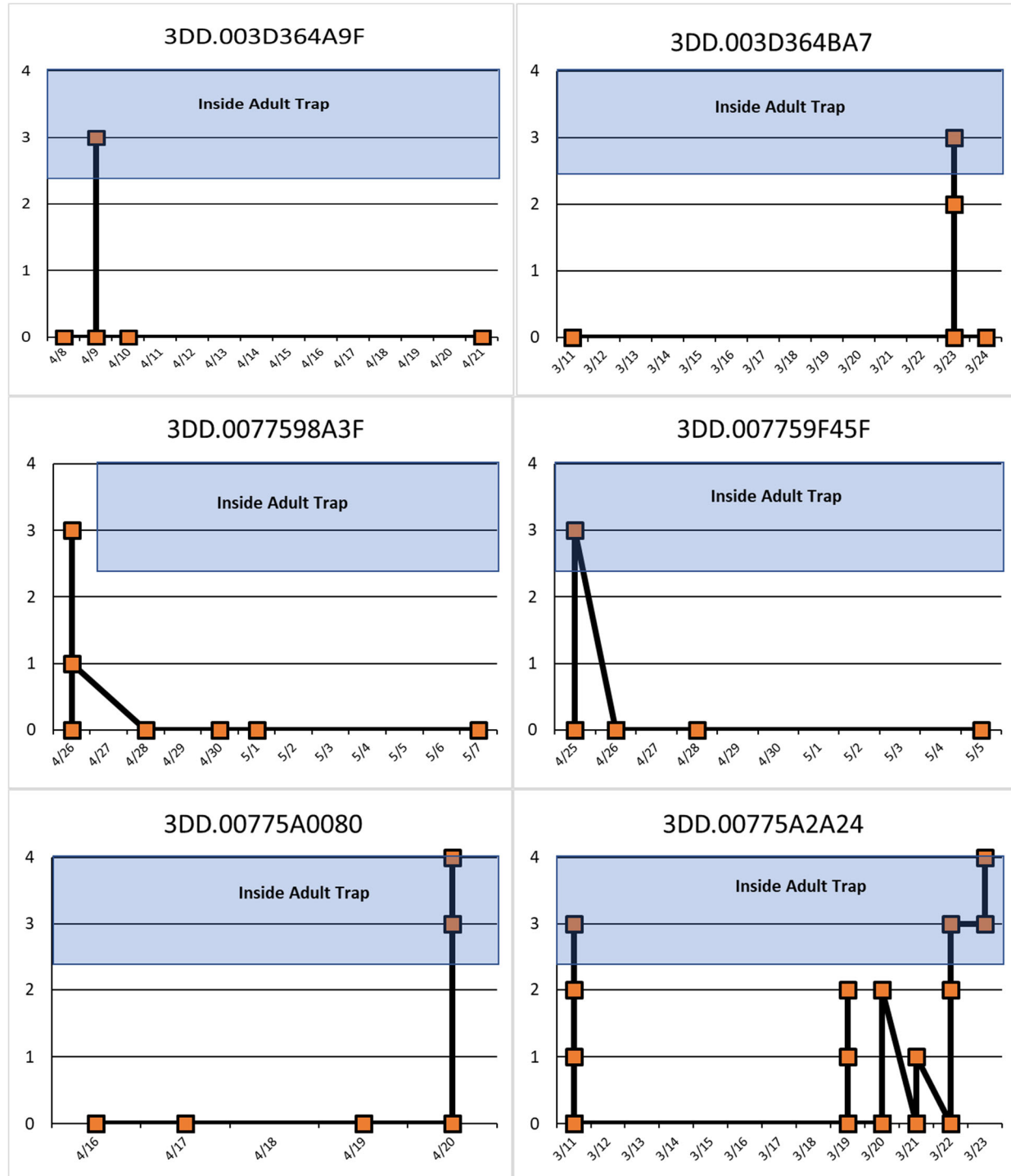
Appendix A

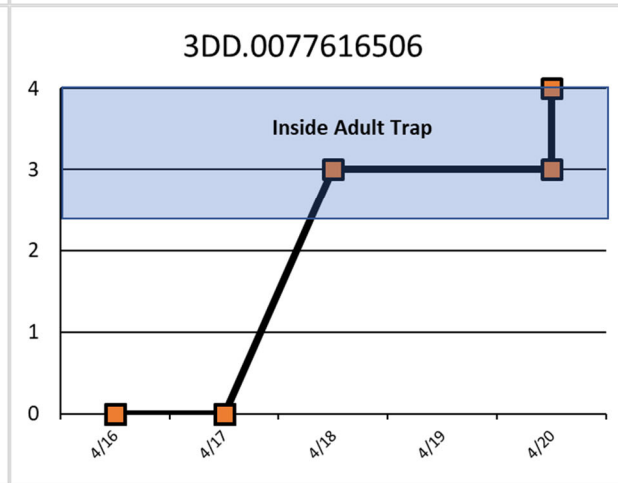
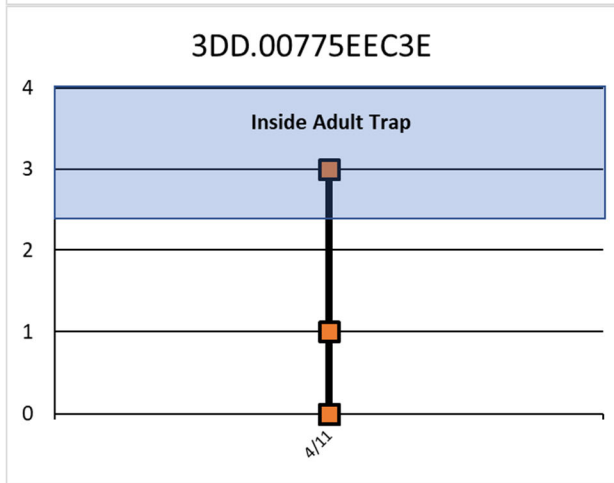
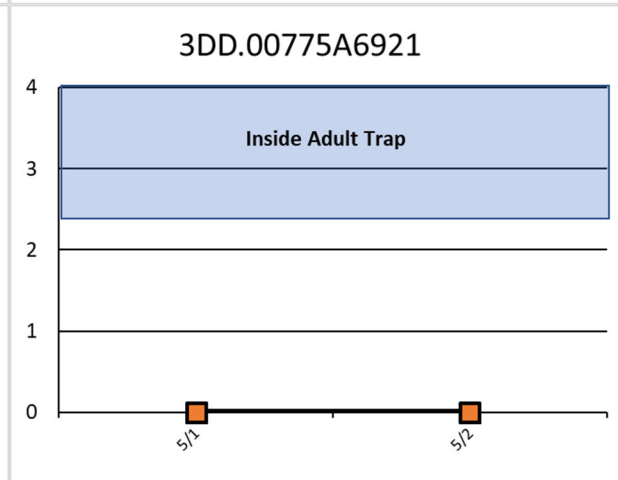
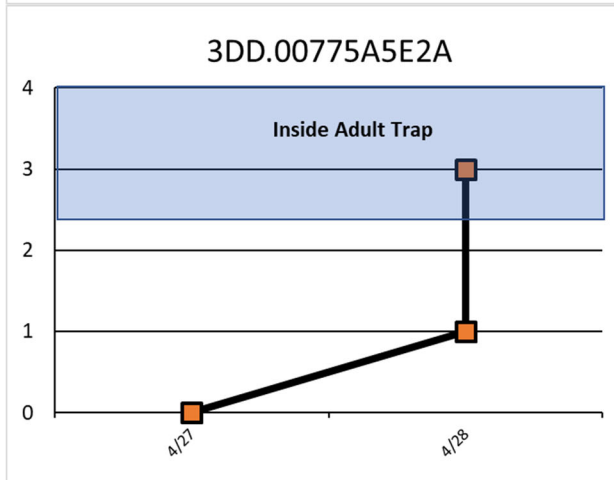
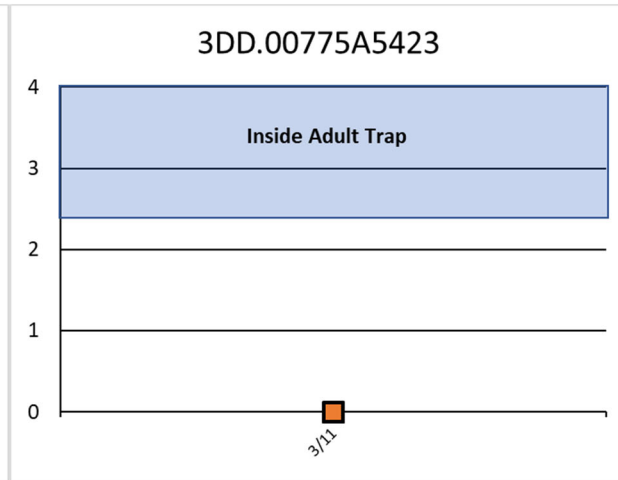
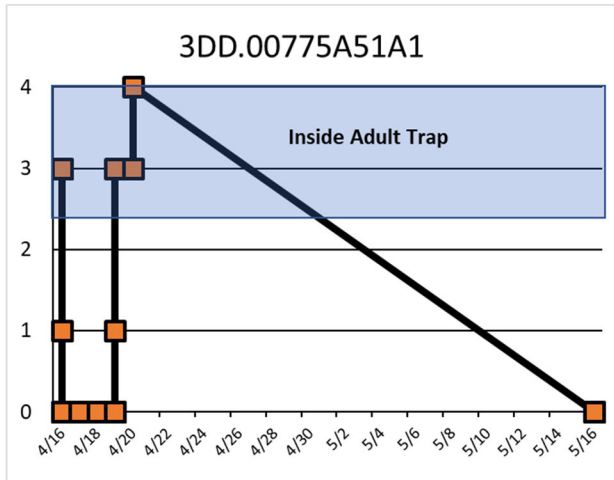
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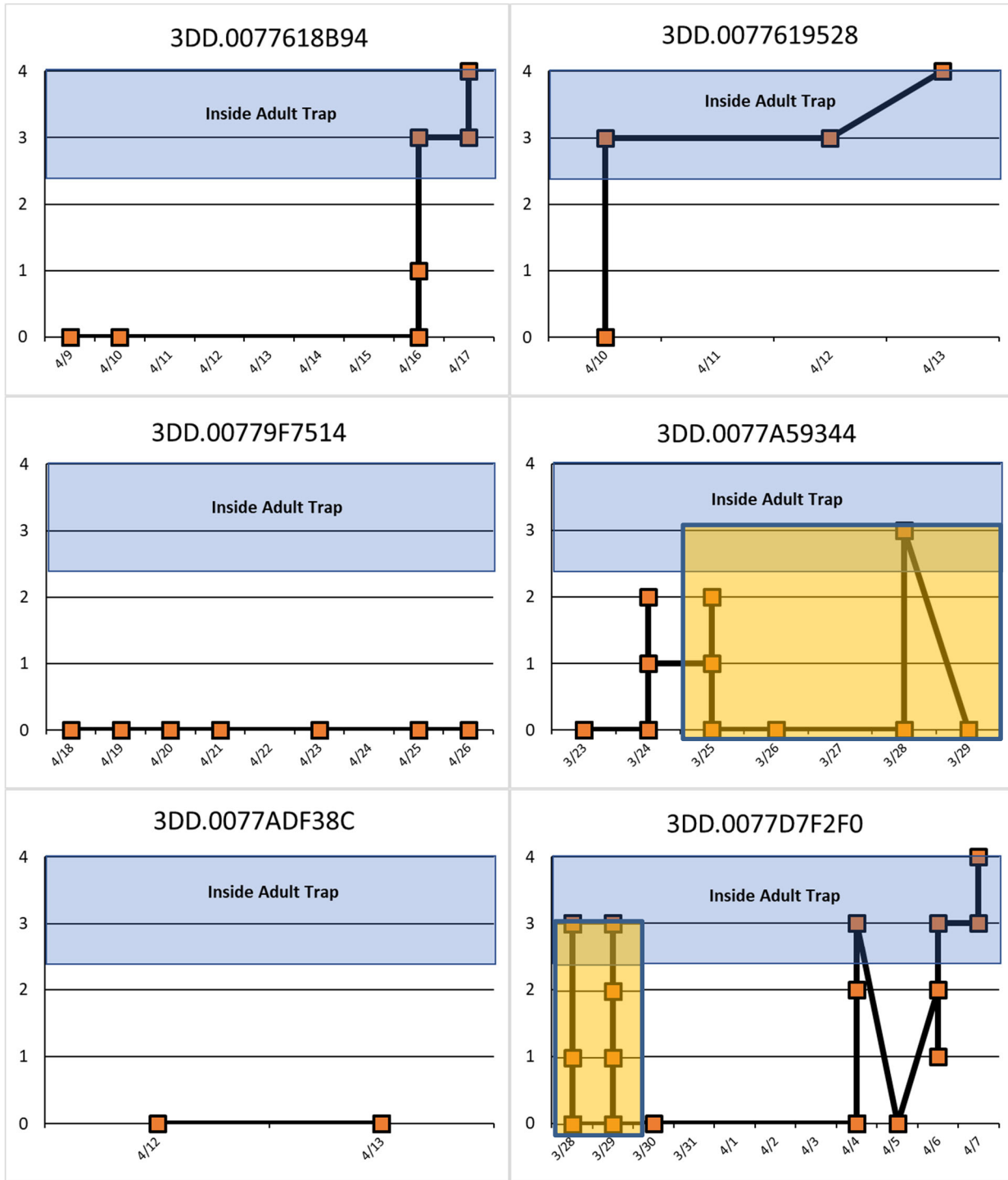
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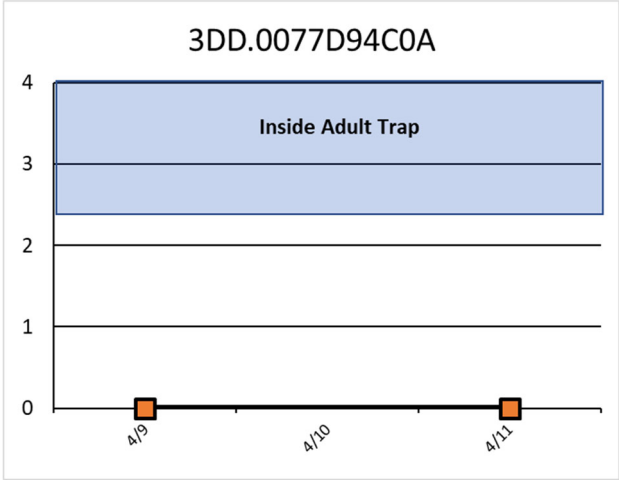
Appendix B

Movement histories of previously PIT tagged summer steelhead at the Tucannon River adult weir/trap, 2020. Location Key: 0 – Antennas below adult weir/trap; 1 – Bottom fish ladder; 2 – Top fish ladder; 3 – Antenna in adult trap box; 4 – Adult Trap Capture. Note: Orange shading in two of the graphs represent a period where the trap throat was removed and fish were able to go in and out of the trap unrestricted.



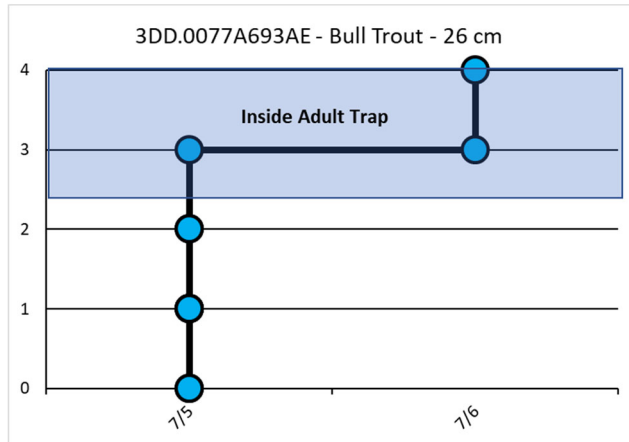






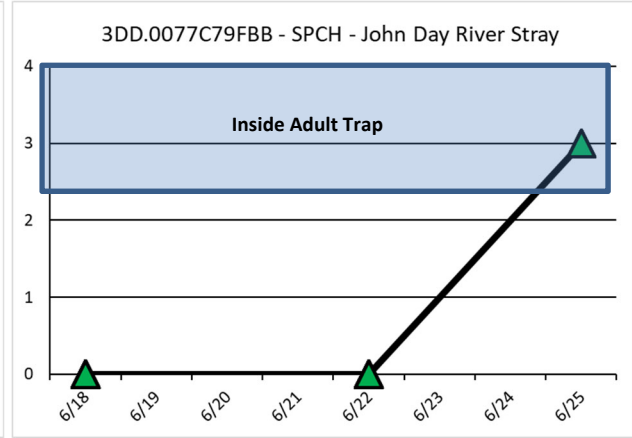
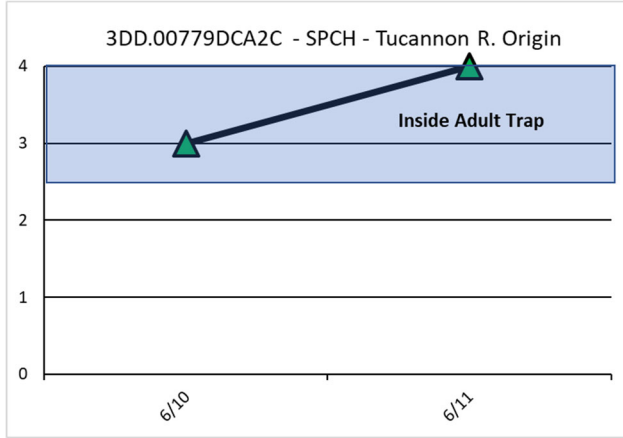
Appendix C

Movement histories of previously PIT tagged Bull Trout at the Tucannon River adult weir/trap, 2020. Location Key: 0 – Antennas below adult weir/trap; 1 – Bottom fish ladder; 2 – Top fish ladder; 3 – Antenna in adult trap box; 4 – Adult Trap Capture.



Appendix D

Movement histories of previously PIT tagged spring Chinook Salmon at the Tucannon River adult weir/trap, 2020. Location Key: 0 – Antennas below adult weir/trap; 1 – Bottom fish ladder; 2 – Top fish ladder; 3 – Antenna in adult trap box; 4 – Adult Trap Capture.



**Washington Department of Fish and Wildlife
Snake River Lab
401 S. Cottonwood Street
Dayton, WA 99328**



**U.S. Fish and Wildlife Service
Lower Snake River Compensation Plan Office
1387 S. Vinnell Way, Suite 343
Boise, ID 83709-1657**



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