CRITFC

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Upstream Migration Timing of Columbia Basin Chinook and Sockeye Salmon and Steelhead in 2020

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September 30, 2022

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Columbia River Inter-Tribal Fish Commission Technical Report for BPA Project 2008-518-00, Contract 73354

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ABSTRACT

Between May 21 and October 16, 2020, Chinook (*Oncorhynchus tshawytscha*) and Sockeye (*Oncorhynchus nerka*) salmon as well as steelhead (*Oncorhynchus mykiss*) were sampled at the Bonneville Dam Adult Fish Facility (AFF). Fish were measured for fork length, scales were collected for analysis of age, tissue samples collected for genetic analysis, and the fish were tagged with Passive Integrated Transponder (PIT) tags. These fish were tracked upstream as they passed through sites with PIT tag antennas, including fish ladders at dams, juvenile bypasses, hatcheries, and weirs, as well as in-stream antennas. Total numbers of fish tracked upstream were 194 spring Chinook, 1,074 summer Chinook, 2,003 fall Chinook, 1,474 steelhead, and 1,730 Sockeye Salmon. Our Spring Chinook sample size was greatly reduced as the US Army Corps of Engineers (which provides access to the AFF) did not allow sampling to begin at Bonneville Dam until May 21, 2020, by which time 71.6% of the spring Chinook run had already passed the site.

Chinook Salmon median migration rates between mainstem dams ranged between 17.6 km/day for fall Chinook migrating between Rock Island and Rocky Reach dams and 57.3 km/day for fall Chinook migrating between John Day and McNary dams. An estimated 42.3% of spring Chinook sampled after May 21, 2020, passed into the Snake Basin upstream of Ice Harbor Dam, while an estimated 69.9% of summer Chinook passed into the portion of the Columbia Basin upstream of Priest Rapids Dam. Among fall Chinook, the primary terminal area was between McNary Dam (passed by 56.4%), while Ice Harbor Dam had 9% pass and Priest Rapids Dam had 12.5% pass. Due to restricted sampling at Bonneville Dam during most of the spring Chinook migration, most of the statistics were not calculated for spring Chinook Salmon and are not reported.

Steelhead median migration rates reported between mainstem dams ranged from 3.0 km/day between Bonneville and John Day dams to 22.5 km/day between John Day and McNary dams. Among Steelhead classified as B-run (greater or equal to 78 cm fork length) that were last detected in terminal areas (tributaries between Bonneville and McNary Dam and above McNary Dam), 96.1% were detected in the Snake Basin. Based on the data reported, the percentage of steelhead classified as B-run at Bonneville Dam reached its highest level at 78.0% of the run in Statistical Week 40. The number of B-run steelhead peaked in Week

37 at 7,284 steelhead while the number of A-run (<78 cm) peaked in Week 31 at 13,172 fish. A total of 158 steelhead PIT tagged and tracked in 2020 were detected moving downstream (mostly in juvenile bypasses) after spawning, recovered or detected in kelt programs, or detected moving upstream in summer/fall 2020 or in 2021 and were designated as kelt.

For Sockeye the median migration rates between mainstem dams ranged between 30.1 (between Priest Rapids and Rock Island dams and 56.6 (between John Day and McNary dams) km/day for adults tagged at Bonneville Dam. Escapement estimates for the entire Sockeye run derived from PIT tag detections at mainstem Columbia River dams differ from those estimated by visual counts by -10.9% to 9.8% (does not include the lower Snake River dams).

The principal age components with percentage of run for summer Chinook were Age 1.2 (64.7%), 1.3 (12.8%) and Age 1.1 (10.3%) and for fall Chinook Age 0.3 (44.2%), and 0.2 (30.9%).The steelhead run was 45.0% Age 1.2, 24.0% r.2 (unreadable freshwater age and two years in saltwater) and 18.5% Age 2.2. The Sockeye run was 98.6% Age 1.2 with other age groups (1.1, 2.1, 1.3, and 2.2) comprising only 1.4% of the run.

Stray rates were estimated using both Genetic Stock Identification (GSI]) and Parental Based Tagging (PBT) and site of last PIT tag detection. The stray rate was 4.8% for PBT-classified steelhead and 20.5% for GSI-classified steelhead. For Chinook, the stray rate was 3.7% for PBT-classified Chinook and 7.6% for GSI-classified Chinook. For Sockeye, the stray rate estimated by this project using GSI was 1.6%. Insufficient numbers of Sockeye could not be classified by PBT, so a stray rate was not estimated.

ACKNOWLEDGMENTS

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INTRODUCTION

Since 1985, the Columbia River Inter-Tribal Fish Commission (CRITFC) has been funded by the Pacific Salmon Commission (PSC) to sample Chinook (*Oncorhynchus tshawytscha*) and Sockeye (*Oncorhynchus nerka*) salmon at Bonneville Dam to determine age, length-at-age, and, in the case of Sockeye Salmon, stock composition (Fryer 2009). In 2004, CRITFC took over a similar long-running steelhead (*Oncorhynchus mykiss*) sampling program at Bonneville Dam from Oregon Department of Fish and Wildlife (Whiteaker and Fryer 2008). The development and maturation of two new technologies, Passive Integrated Transponder (PIT) tags and genetic stock identification (GSI), have provided an opportunity to greatly expand the information obtained from our stock monitoring program at Bonneville Dam. PIT tag antennas are now installed in fish ladders at most mainstem Columbia and Snake River dams, as well as at dams and weirs on many of the Columbia Basin tributaries. By PIT tagging fish sampled at Bonneville Dam, we can track tagged fish upstream providing valuable information on migration timing and survival rates. Data on the movement of PIT tagged fish through Columbia Basin receivers is readily available to all managers and researchers on a near real-time basis through the PIT Tag Information System (PTAGIS) at www.ptagis.org. The information obtained by PIT tags can be further expanded by identifying the origin of the fish using GSI. Using these two technologies it becomes possible to determine migration timing, stray rates, and upstream survival on a stock-specific basis for Chinook and Sockeye salmon and steelhead.

The vast majority of PIT tagging in the Columbia Basin is conducted on juvenile salmonids captured at hatcheries, tributary smolt traps, or at dam juvenile bypasses. These tagging programs predominantly study downstream juvenile migration and survival through the hydrosystem, but rarely tag enough fish to assess survival of returning adults as they pass Bonneville Dam and migrate to the spawning grounds. There are also many salmon stocks in the Columbia Basin which are not PIT tagged, thus it is difficult to answer questions on upstream migration timing, straying, and survival for those stocks. Because our project randomly samples adult salmon and steelhead passing through the Bonneville Dam Adult Fish Facility (AFF) trap, this study tags salmonid stocks that have not previously been tagged and monitored.

METHODS

Sampling

Chinook and Sockeye salmon and steelhead were collected from May 21 through October 16, 2020, at the Bonneville Dam AFF, located adjacent to the Second Powerhouse at river km 234. This facility uses a weir with four pickets to divert fish ascending the Washington shore fish ladder into the AFF collection pool. An attraction flow is used to draw fish that enter the collection pool through a false weir where they then can be selected for sampling. Fish not selected, and fish that have recovered from sampling, migrate back to the Washington shore fish ladder above the pickets. An attempt was made to exclude minijacks (defined as Chinook spending no winters in saltwater) from the sample by not diverting Chinook Salmon into the sampling tank that were estimated to be less than 36 cm in length, and immediately releasing without sampling any fish diverted that turned out to be less than this threshold length. These small Chinook Salmon are excluded because sampling these fish would reduce our sample of larger Chinook as well as other species which are of more importance to managers. Also excluded from further analysis, other than reporting the site of final PIT tag detection, were any Chinook, Steelhead, and Sockeye Salmon that, based on scale analysis, did not spend a winter in saltwater.

Use of the AFF is restricted by protocols established by the Fish Passage Operation and Maintenance Coordination Team[1]. These protocols include restrictions on the number of salmonids that can simultaneously be in the anesthetic and recovery tanks and restrict picket lead operations at higher fish abundances. At temperatures above 21.1°C (70.0°F), sampling is restricted to four days per week from 0600-1030 hours, the number of salmonids allowed in the anesthetic tank is reduced, and picket lead operations are changed to divert fewer fish into the AFF. Above 22.2°C (72.0°F) sampling is halted until the daily average water temperature drops to 21.16°C (71.9°F). Picket lead deployment is also restricted when abundance of salmonids or shad is high with further restrictions when abundance occurs at high temperatures (Appendix A).

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[1] The protocols can be found at https://pweb.crohms.org/tmt/documents/fpp/2020/final/FPP20_AppG_100820.pdf

Salmon and steelhead selected for sampling were diverted into a tank where they were anesthetized, examined for tags, fin clips, wounds, and condition. They were measured for fork length, and tissue and six scales (four scales for Sockeye) were collected for age analysis (Whiteaker and Fryer 2008, Kelsey et. al 2011). A small caudal clip for later genetic analysis was also collected (https://www.monitoringresources.org/Document/Method/Details/4087). Fish were scanned for PIT tags. If no tags were detected, standard techniques were used to inject PIT tags using a needle that penetrates the fish between the posterior tip of the pectoral fin and the anterior point of the pelvic girdle (CBFWA 1999). Tagged fish were then scanned for the PIT tag code, which was recorded if detected. If no tag was detected, no effort was made to re-tag the fish. Data on each PIT tagged fish was uploaded to www.ptagis.org.

Columbia Basin Chinook Salmon are classified by Bonneville Dam passage date as being spring, summer, or fall run. Spring Chinook are most commonly considered as those Chinook passing Bonneville Dam between March 15 and May 31 annually (FPC 2020), although for management purposes June 15 is used as the end date of the spring Chinook migration (https://www.fws.gov/lsnakecomplan/Reports/USvOregon/FINAL.2018-%202027%20USvOR%20Management%20Agreement%20with%20Signature%20Feb%202018%20.pdf). This report will use the May 31 date, although some comparisons using the June 15 date will be provided. Chinook passing Bonneville Dam on or after June 1 will be classified as summer Chinook, while those passing between August 1 and November 15 will be classified as fall Chinook Salmon.

Upstream Detection

As tagged salmon and steelhead continued their migration they were detected by PIT tag receivers located in the adult fish ladders at major Columbia Basin mainstem dams (Bonneville, The Dalles, John Day, McNary, Priest Rapids, Rock Island, Rocky Reach, and Wells dams on the Columbia River; Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams on the Snake River) as well as in numerous tributaries and hatcheries in the Columbia Basin (Appendix C – Table C1 and Figure C1). PIT tag detection data from these sites is uploaded to www.ptagis.org, which is then accessible to users of the site.

Almost all detection sites have multiple antennas, often laid out in parallel so that the antennas span a river or fishway in more than one location. We refer to each parallel antenna array as a “weir.” Salmon can be detected more than once as they pass over or through each weir. Each detection will subsequently be referred to as a “weir detection.” The combination of all detections at the multiple weirs at a given site, regardless of the time between those detections, will subsequently be referred to as a “site detection.” For example, the configuration of PIT tag antennas at Rock Island Dam is shown in Figure 1. Salmon or steelhead can pass this dam using any of three fish ladders. Each ladder has two weirs (referred to as baffles 2 and 4 at each ladder) with PIT tag detection and two antennas in each weir (numbered as 01 to 0C in hexadecimal format). If a fish

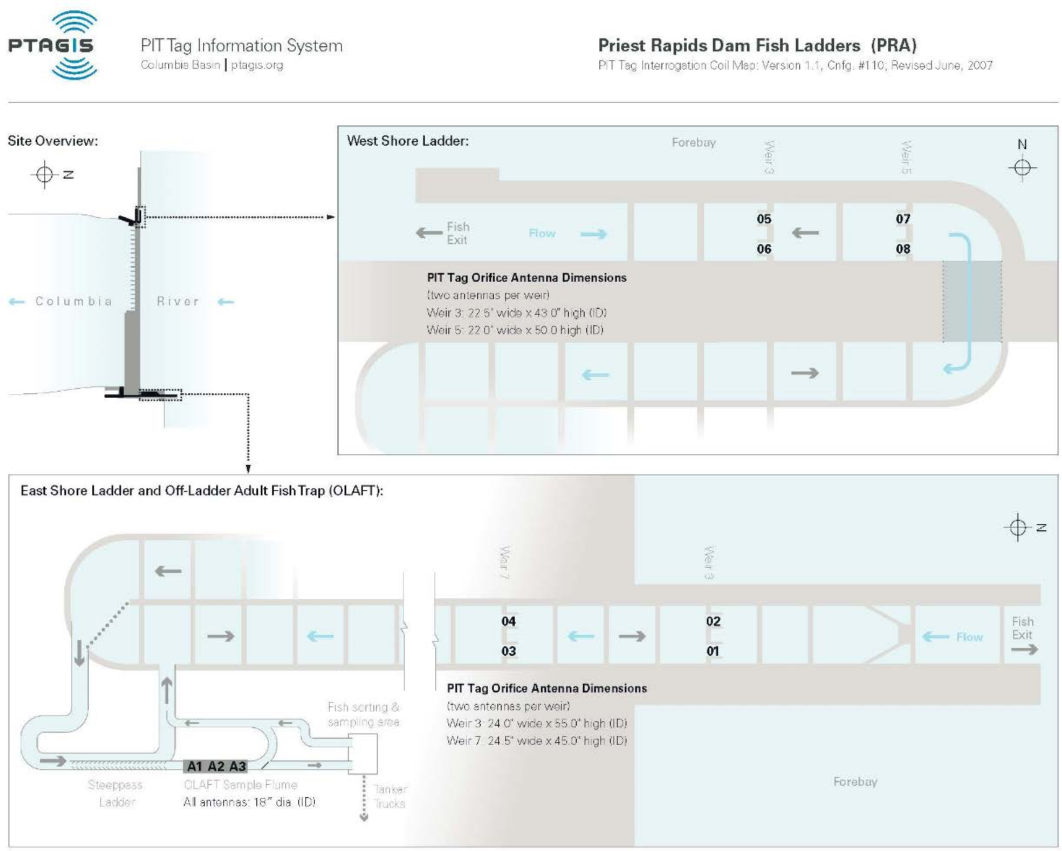

Figure 1. PIT tag detection configuration at Priest Rapids Dam showing two adjoining antennas at two weirs in each fish ladder (Figure from www.ptagis.org.)

ascended the left ladder and generated two detections at Baffle 2 and three at Baffle 4 (the words “baffle” and “weir” are interchangeable), this is five weir detections, but only one site detection (Rock Island Dam).

Site Detection Percentage

All fish PIT tagged and released at the Bonneville Dam AFF exit into a fish ladder with PIT tag antennas in both the upstream and downstream directions at site BO3. However, these antennas are at the underwater orifices with no monitoring of overflow weirs (Figure 2) which many salmonids, especially Sockeye Salmon use. Furthermore, it is possible for any salmon that moves downstream following tagging could pass upstream through the navigation locks at Bonneville Dam (Figure 3). There are other dams with navigation locks (The Dalles, John Day, McNary, Ice Harbor, Little Goose, Lower Monumental, and Lower Granite dams) where PIT tagged salmon can pass undetected. The percentage of PIT tagged fish missed at each dam with PIT tag detection arrays was calculated by looking at the fish detected upstream of the site in question and estimating the percentage not detected at that site. For example, the percentage missed at Rocky Reach Dam was calculated as:

$$P = \frac{R_m}{R_d}$$

where R_m was the number of fishes missed at Rocky Reach Dam but detected upstream of Rocky Reach Dam and R_d was the number of fish detected upstream of Rocky Reach Dam.

PIT tag detection antennas in fish ladders are always placed in at least two locations in relatively close proximity. PIT tag interrogation maps (available at www.ptagis.org) indicate that these antennas are placed at vertical slots, weirs, or pools. To simplify the nomenclature, these locations will all subsequently be referred to as weirs.

Bonneville Dam Vertical Slot Antenna

Bonneville Dam underwater antenna with unmonitored overflow weir

Figure 2. Pictures of the two types of PIT tag antennas at Bonneville Dam. The vertical slot antennas are at the upper end of both ladders, while the underwater antennas are in the lower parts of the ladders. Photos courtesy of Alan Brower of PTAGIS.

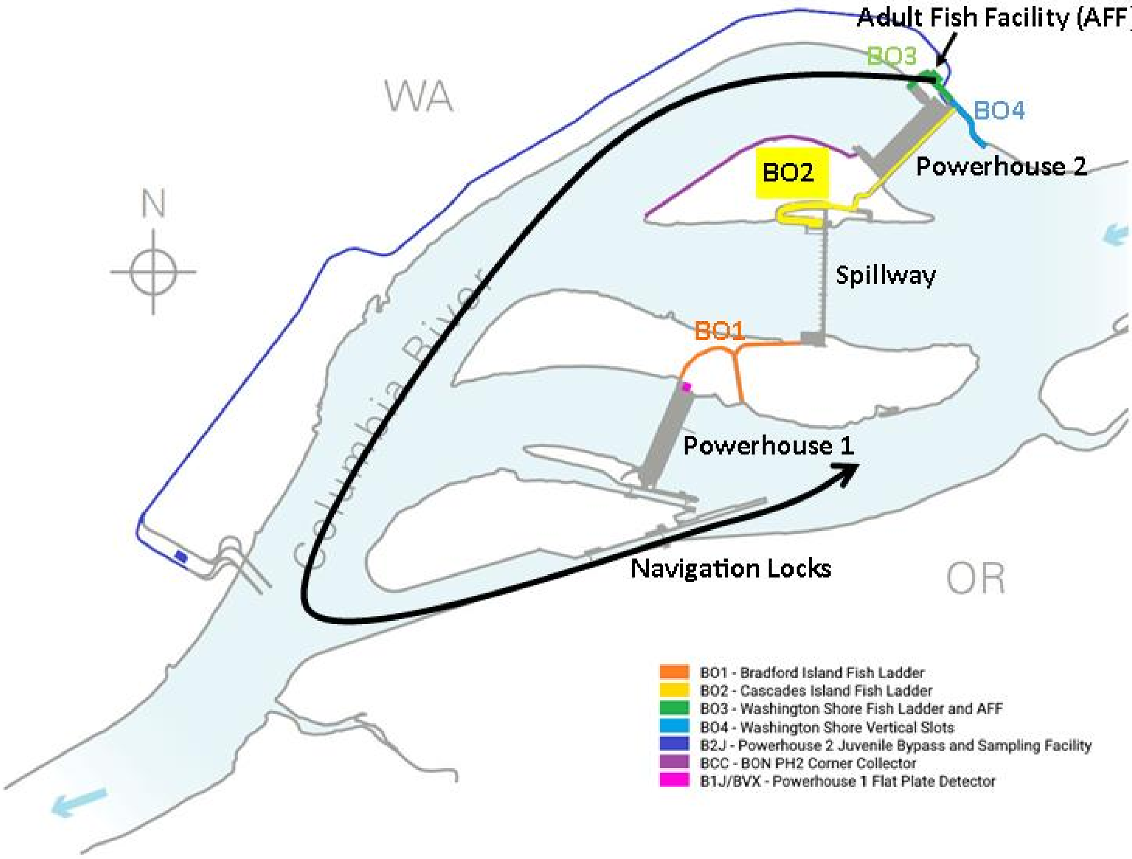

Figure 3. Site of Bonneville Dam PIT tag antennas and the most likely route for fish tagged at the Adult Fish Facility to pass upstream undetected (Figure from www.ptagis.org).

Age Analysis

Visual assessment of scale patterns was used to determine age composition through techniques developed for the Bonneville Stock Sampling project *(*Whiteaker and Fryer 2008, Kelsey et al. 2011*).* The European method for fish age description (Koo 1962) was used where the number of winters a fish spent in freshwater (not including the winter of egg incubation) is described by an Arabic numeral followed by a period. The number following the period indicates the number of winters a fish spent in saltwater. Total age, therefore, is equal to one plus the sum of both numerals. If poor scale quality, particularly in the freshwater, prevents age determination in all scales collected from a particular fish, no age is assigned. The exception is steelhead, where if saltwater age can be reliably determined, the age is designated as r.y where “y” is the saltwater age and “r” stands for regenerated. Any salmonid (Chinook, steelhead, or Sockeye) judged by scale analysis to have spent no winters in saltwater were excluded from further analysis.

Other sources of age information are available in the form of age since release, from PIT tags from salmonids tagged as juveniles, as well as the total age of salmonids that could be identified using Parental Based Tagging (PBT). In 2020, the PBT age was available when Chinook and steelhead were being aged and that information was considered in estimating a scale age.

Escapement

Chinook and Sockeye salmon escapements at upstream detection sites were estimated as:

$$N = \sum_i \frac{B_i R_i}{T_i}$$

where N was the estimated escapement at a particular upstream site, *i* was the week at Bonneville Dam, B_i was the weekly count of fish passing Bonneville Dam in week *i*, T_i was the number of fish PIT tagged at Bonneville Dam in week *i,* and R_i was the number of PIT tag detections at the dam where escapement was being estimated of those fish tagged in week *i.* Estimated dam counts using PIT tag data were compared with dam counts made at fish ladder viewing windows or weir counts. No estimates were made for steelhead because many overwinter between dams on their upstream migration making it difficult to compare PIT tag estimates with dam counts.

Migration Rates and Passage Times

Run timing was estimated using the date and time of detection between sites. Migration rates were calculated between sites as the time between the last detection at the first site and the first detection at the upper site. The amount of time required to pass each dam was estimated as the difference between the first detection time at a dam and the last detection time at the same dam.

Upstream Age and Length-at-Age Composition Estimates

The age composition at upstream locations was calculated as:

$$T_j = \sum_k A_{j,k} * W_k$$

where T_j was the estimate for age group *j* at a particular location, $A_{j,k}$ was the percentage of fish for age group *j* in week *k* at Bonneville Dam (such that $\sum_j A_{j,k} = 1$) and W_k was the percentage of the run that passed Bonneville Dam in week *k.*

Fallback

Three methods were used to determine fallback, which is defined as a fish that ascends a fish ladder into the reservoir above the dam, then "falls back" to the downstream side of the dam either over the spillway, or through the navigation locks, juvenile bypass systems, or turbines. Migrating downstream through the fish ladders is not considered a fallback. The first method was if an adult salmon or steelhead was detected in the juvenile bypass system. However, on the Columbia River, only Bonneville, John Day, McNary, and Rocky Reach dams have juvenile bypass system PIT detection capability while all four dams in the Snake River have juvenile detection. Furthermore, there is no detection at any dam for fish falling back over the spillway or through the navigation locks or turbines. Therefore, a second method of estimating fallback was to look at each dam for fish detected at an "upper" weir followed by detection at a "lower" weir separated by more than two hours. At McNary and Bonneville dams, the upper detection weir is at the fish counting windows (which are believed to detect all passing PIT tagged fish), while the PIT tag detectors near the entrance to the fish ladder are the lower weirs. At Priest Rapids, Rock Island, Rocky Reach, and Wells dams, there are only two weirs with PIT tag detection in each fish ladder, so these were designated as the upper and lower detection weirs, even if they are not at the top or bottom of the ladders. At McNary and Bonneville dams, detection histories of fish detected at multiple ladders were also reviewed (MC1 and MC2 for McNary and BO1 and BO4 for Bonneville) (see http://www.ptagis.org for maps of sites). Finally, a third method of estimating fallback was ascertained by fish that passed an upstream PIT tag detector at a given dam but then were next observed at a site downstream of the dam in question. These methodologies will underestimate fallback as they do not include fish that fall back over a dam and are not subsequently detected.

Adult steelhead downstream movements on or after March 31, 2021, were not considered fallbacks; rather, they were considered kelts on their way downstream. Some steelhead move out of the system before April 1st, and with more detection sites added at dams and in-stream arrays placed in tributaries in the last few years, it has been easier to determine more kelts between March 1st and April 1st. Consideration of these fish as kelts versus assigning them as fallbacks is now part of the analysis process.

Night Passage

Fish counting at Columbia Basin dams is not consistent between dams. Salmonids passing Corps of Engineers-operated dams (Bonneville, The Dalles, John Day, McNary, Ice Harbor, Lower Monumental, Little Goose and Lower Granite) are counted live by observers stationed at fish ladder viewing windows 50 minutes per hour (with the counts then expanded by 20% to account for the missing 10 minutes) from 0400 to 2000 PST with most supplemented with video counts of passage between 2000 and 0400 from June through September (https://www.fpc.org/111_sharedfiles/adult_metadatav3.php), which is the span of months that salmonids are tagged by this study. Salmonids passing Priest Rapids, Rock Island, Rocky Reach, and Wells dams are all counted 24 hours per day from recorded video. Tributary dam passage is estimated using 24-hour recorded video and/or counts at adult fish traps.

Night passage rates (where night is defined as 2000 to 0400 PST) were calculated based on the last time fish were detected in a fish ladder for all dams passed. This last time detected at a ladder was used as an approximation for passage time at the counting window, as the uppermost weir is closest to the fish counting window at nearly all ladders. (For maps of site configuration for mainstem dams see http://www.ptagis.org.)

Steelhead B-Run Analyses

For management purposes, Columbia Basin steelhead are commonly referred to as being either A- or B-run. B-run steelhead are defined as greater than or equal to 78 cm in length, while A-run steelhead are under 78 cm (Busby et al. 1996). B-run steelhead are generally older, spending three winters in saltwater compared to one or two winters for A-run steelhead, and generally pass Bonneville Dam after August 25, while A-run steelhead generally pass earlier (Busby et al. 1996). Upstream, run timing separation is not observed and the groups are separated based on size and age (Busby et al. 1996). B-run steelhead are thought to only be produced in the Clearwater, Middle Fork and South Fork Salmon rivers (Busby et al. 1996).

Analyses of B-run steelhead consisted of comparing the timing of the A- and B-runs at Bonneville Dam with the established August 25 criteria, comparing the length group of sampled steelhead with where they were last detected, and looking at the destination of B-run-sized steelhead by statistical week sampled at Bonneville Dam.

Steelhead Kelt Analyses

Steelhead differ from other salmonids studied in this project as they are capable of spawning multiple times. After spawning in late winter or early spring, some steelhead will migrate downstream to the ocean to feed; these fish are known as kelt. The fish that survive return in a subsequent spawning season. We considered all steelhead detected moving downstream (mostly in juvenile bypasses) on or after March 31, the year after tagging, to be kelt and tabulated where they were last detected. We also carefully considered fish moving between March 1st and April 1st through juvenile bypasses and the Bonneville Corner Collector as kelts, especially when tag detections indicate they have visited upper reaches of tributaries in late winter early spring.

Straying

Since 2017, stray rates have been estimated by comparing PIT tag movements of steelhead and Chinook with GSI/PBT results. A matrix of final-PIT-fate categories (neutral, on-target, putative stray, and putative overshoot) was created where “neutral” fates indicate movements through the mainstem river corridor on route to their expected destination (basin-of-origin, population-of-origin, or hatchery-of-origin). “On-target” fates indicate fish that were last detected at their expected destination. “Putative stray” indicates fish that were last detected in tributaries or the mainstem that were outside of a normal route to their expected destination. “Putative overshoot” indicates when a fish may have gone into an area adjacent to its expected destination. Common examples of “putative overshoot” are Umatilla River Chinook last detected at McNary Dam and Priest Rapids Hatchery Chinook last detected at Priest Rapids Dam. The stray rate for a given stock was estimated as the number of “putative stray” fish divided by the sum of the “on-target” and “putative stray” fish for that stock. This is the template that we will build upon in future years.

Whooshh FishL™ Recognition System (WFRS) Testing

In 2019, Whooshh Innovations (WI) installed the WFRS at one exit flume at the AFF (Fryer et al. 2021). This system was designed by WI to capture images of passing fish to select fish for transport via the Whooshh passage system (www.whooshh.com). The WFRS was installed on the right (south) flume at the AFF downstream of the location where fish were diverted for sampling. Thus, the WFRS only collected images from those fish not selected for sampling for our studythat passed through that flume. Data collected included fork length, adipose fin presence or absence, and species for each fish imaged. These data from steelhead, Chinook, and Sockeye that were not sampled by our study were used to compare with data from study sampled fish as well as to assess the potential for improving precision of estimates provided by our study.

Data from this system was used in 2019 to supplement data from our sample as well as to compare the length as well as the percentage adipose clipped of sampled versus bypassed Sockeye Chinook, and steelhead which passed through the Whooshh system.

We were looking forward to applying lessons learned from the WFRS in 2019 to enable us to take better advantage of the system in 2020, However, on Friday January 17, 2020, the USACE Operations Project Manager issued Whooshh a letter denying Whooshh's access request and required the system be removed by February 6, 2020. We were not informed of this until Monday, January 27 and we were unable to rally sufficient support to change this decision, thus Whooshh was removed early the week of February 3, 2022.

Loss of Spring Chinook Salmon Sampling

We were unable to sample spring Chinook in 2020 until May 21 due to the Corps of Engineers (COE) not allowing us to dispose of anesthetic water. This resulted in us missing the bulk of the spring Chinook run for the first time since we began this sampling in 1987, resulting in the following data losses for the region:

1.) Continuous 33-year dataset for age, growth, fin clip, and injury data for spring Chinook. This was our best dataset as we have no gaps due to high temperatures and face minimal trap restrictions and picket lead regulations due to fish abundance compared to other species or Chinook runs. Data had been collected since 1987.
2.) Continuous 30-year dataset for age, growth, fin clip, and injury data for the spring-summer Chinook transition. Data had been collected since 1990.
3.) Continuous 22-year dataset for age, growth, fin clip, and injury data for the entire Chinook run. Data had been collected since 1997.
4.) Continuous 12-year dataset of PIT tagging the transition from spring to summer Chinook which is of interest to managers. Data had been collected since 2008.
5.) Continuous 18-year dataset on spring Chinook genetics data used for genetics stock identification. Data had been collected since 2002.
6.) Continuous 8-year data set on spring Chinook genetics data used for Parental Based Tagging (PBT). Data had been collected since 2012.

Since 2017 this analysis has been conducted in-season for harvest analysis.

Email threads on this anesthetic water and sampling loss topic are in Appendix B, an overview is as follows:

- The first email regarding Aqui-S disposal was January 29, 2020, though changes to the Aqui-S disposal likely came up verbally around the time of the January FPOM meeting a couple of weeks earlier.
- The Bonneville Dam Project Biologists initially asked verbally if John Whiteaker could get discharge permits through the Yakama Nation since CRITFC is able to get WA state collection permits through the tribe.
- March 11 – Whiteaker updated the Project Biologists that the Yakama Nation does not issue discharge permits and provided information from WA Ecology that disposal to the ground or sewer system was preferred and didn't require a permit. The Aqui-S Investigational New Animal Drugs (INAD) Study Protocol was also included and highlighted anesthetic disposal in the email.
- March 11-12 – Whiteaker was put in contact with the Project Environmental Specialist and provided copies of our INAD Participation Letter and Study Protocol to both the Project Biologist and Environmental Specialist along with outlining the issue.
- April 1 – The Environmental Specialist responds suggesting avoiding a permit by preferably discharging to the sewer, and that dumping to the ground at Bonneville Dam would be a worst case scenario.
- April 29 – The Project Biologist responds that CRITFC cannot dump to the sewer.
- May 4 – Whiteaker was informed by phone that CRITFC cannot dump anywhere on COE property. We were hoping to start sampling by May 5-6. Mid-April is the usual start of sampling.
- May 13 – The Project Biologist sends a disposal solution email outlining information from the Aqui-S INAD Program Administrator, the Participation Letter, and disposal guidance from the Study Protocol. Whiteaker had already provided the same materials on March 11-12 but sent him a new copy anyway.
- May 21 – sampling began with Aqui-S being disposed of on the ground.

RESULTS-CHINOOK

Sample Size

A total of 195 spring Chinook, 1,079 summer Chinook, and 2,023 fall Chinook Salmon were sampled between May 21 and October 16, 2020[2]. (Tables 1-3). The spring Chinook sample was much smaller than usual due to the U.S. Army Corps of Engineers not allowing access to the Adult Fish Facility until May 21, which meant that this project missed sampling 71.7% of the run. Sampling restrictions due to water temperatures exceeding 21.1°C reduced sampling days and hours during Statistical weeks[3] 32 through 36 of the fall Chinook run but never shut it down entirely as the water temperature never exceeded 22.2C. Restrictions on the number of pickets which could be lowered to divert fish into the AFF due to fish abundance affected sampling in weeks 23-28 and 37-40. A total of 191 spring Chinook, 1,067 summer Chinook, and 2,019 fall Chinook Salmon were PIT tagged (Tables 1-3). After adding previously tagged fish (which were sampled and therefore identified for the tracking study and included in our sample), subtracting fish that were not detected after release (due to shed tags, mortalities, malfunctioning tags, or PIT tagged Chinook missing PIT tag antennas), and excluding 2 summer Chinook and 6 fall Chinook classified as minijacks, the numbers of Chinook tracked upstream and used in analysis consisted of 194 spring Chinook, 1074 summer Chinook, and 2004 fall Chinook Salmon (Table 1-3). One summer Chinook (3DD.003D365361) was sampled twice during Week 23, once on June 2 with the next subsequent detection entering the Bonneville fish trap on June 4, 2022. The second sampling event was excluded from further analysis as it seems likely that this downstream movement after tagging was a result of the tagging process.

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[2] An addition 150 Tule Chinook (identified by their dark coloration) were sampled between August 20 and October 24 for a genetics study and are not included in the results but will be briefly summarized in the discussion.

[3] Statistical weeks are sequentially numbered calendar-year weeks. Excepting the first and last weeks of most years, statistical weeks are seven days long beginning on Sunday and ending on Saturday. In 2020, for instance, Statistical Week 23 began on May 31 and ended on June 6.

Table 1. Number of sampled and PIT tagged spring Chinook Salmon at Bonneville Dam that were then tracked, by date and statistical week, in 2020.

Sample Dates	Week	Percentage of Run	Number Sampled	Number Tagged	Previously Tagged		Mortalities	Not Detected After Release	Total Tracked	Days Sampling Restrictions in Effect		
					By this study at AFF	By other Studies				Reduced Sampling-Temperature	Reduced Sampling-Shad or Salmonid Abundance	Sampling not-Allowed by COE
No Sampling	16	1.9%	0	0								5
No Sampling	17	4.5%	0	0								5
No Sampling	18	17.9%	0	0								5
No Sampling	19	27.8%	0	0								5
No Sampling	20	17.6%	0	0								5
5/21-5/22	21	12.4%	34	34	0	0	0	0	34	0	0	3
5/26-29	22	18.0%	161	157	0	4	0	1	160	0	0	0
Total			**195**	**191**	**0**	**4**	**0**	**1**	**194**	**0**	**0**	**28**

Table 2. Number of sampled and PIT tagged summer Chinook Salmon at Bonneville Dam that were then tracked, by date and statistical week in 2020.

Sampling Dates	Week	Percentage of Run	Number Sampled	Number Tagged	Previously Tagged		Mortalities	Not Detected After Release	Excluded as Minijacks	Total Tracked	Days Sampling Restrictions in Effect		
					By this study at AFF	By other Studies					Reduced Sampling-Temperature	Reduced Sampling-Shad or Salmonid Abundance	No Sampling-Temperature
6/1-6/5	23	10.1%	241	237	1	3	0	1	0	240	0	5	0
6/8-6/12	24	12.4%	110	106	0	3	0	0	0	109	0	5	0
6/15-6/19	25	16.3%	145	144	0	1	0	0	0	145	0	5	0
6/22-6/26	26	19.5%	128	126	0	2	0	0	0	128	0	5	0
6/29-7/2	27	15.2%	70	69	0	1	0	0	0	70	0	4	0
7/9-7/10	28	9.7%	41	41	0	0	0	0	0	41	0	2	0
7/13-7/17	29	7.7%	111	110	0	1	0	1	1	110	5	0	0
7/20-7/24	30	5.3%	135	135	0	0	0	1	1	134	5	0	0
7/27-7/30	31	3.8%	98	97	0	0	0	0	0	97	2	0	0
Total			**1079**	**1067**	**1**	**11**	**0**	**3**	**2**	**1074**	**12**	**26**	**0**

Table 3. Number of sampled and PIT tagged fall Chinook Salmon at Bonneville Dam that were then tracked, by date and statistical week in 2020.

Sampling Dates	Week	Percentage of Run	Number Sampled	Number Tagged	Previously Tagged		Mortalities	Not Detected After Release	Excluded as Minijacks	Total Tracked	Days Sampling Restrictions in Effect		
					By this study at AFF	By other Studies					Reduced Sampling-Temperature	Reduced Sampling-Shad or Salmonid Abundance	No Sampling-Temperature
8/3-8/6	32	0.9%	70	69	0	1	0	1	0	69	4	0	1
8/10-13	33	0.7%	42	42	0	0	0	0	1	41	4	0	1
8/17-8/20	34	5.7%	161	161	0	0	0	1	2	158	4	0	1
8/24-8/27	35	10.8%	171	171	0	0	0	1	0	170	4	0	1
8/31-9/3	36	25.5%	293	292	0	1	4	2	0	287	4	0	1
9/9-9/11	37	19.1%	145	144	0	1	0	0	0	145	0	3	0
9/14,9/16-18	38	15.4%	265	264	1	0	0	0	0	265	0	4	0
9/21-9/25	39	10.1%	285	285	0	0	0	0	0	285	0	3	0
9/28-10/2	40	5.5%	265	265	0	0	0	1	3	261	0	2	0
10/5-10/9	41	3.6%	251	251	0	0	1	2	0	248	0	0	O
10/13-16	42	2.5%	75	75	0	0	0	0	0	75	0	0	O
Total			**2023**	**2019**	**1**	**3**	**5**	**8**	**6**	**2004**	**20**	**12**	**5**

Distribution of Sample

The weekly distribution of spring Chinook sampled at Bonneville Dam differed greatly from the actual run distribution due to the closure of the AFF into Week 21 (Figure 4). The summer Chinook sample was reduced in Weeks 24 through 28 due to concurrent Sockeye sampling (Figure 5), similarly fall Chinook were reduced in weeks in which steelhead were sampled (Figure 6). Sample sizes in weeks 36-38 were sampled primarily under protocols c) and d) which required leaving pickets up for some or all of the day due to high abundance and water temperatures above 21.1C which likely reduced our sample size. Details on picket lead protocols can be found in Appendix D. In addition, poor air quality caused by nearby forest fires reduced sampling hours in this period for the health of the technicians.

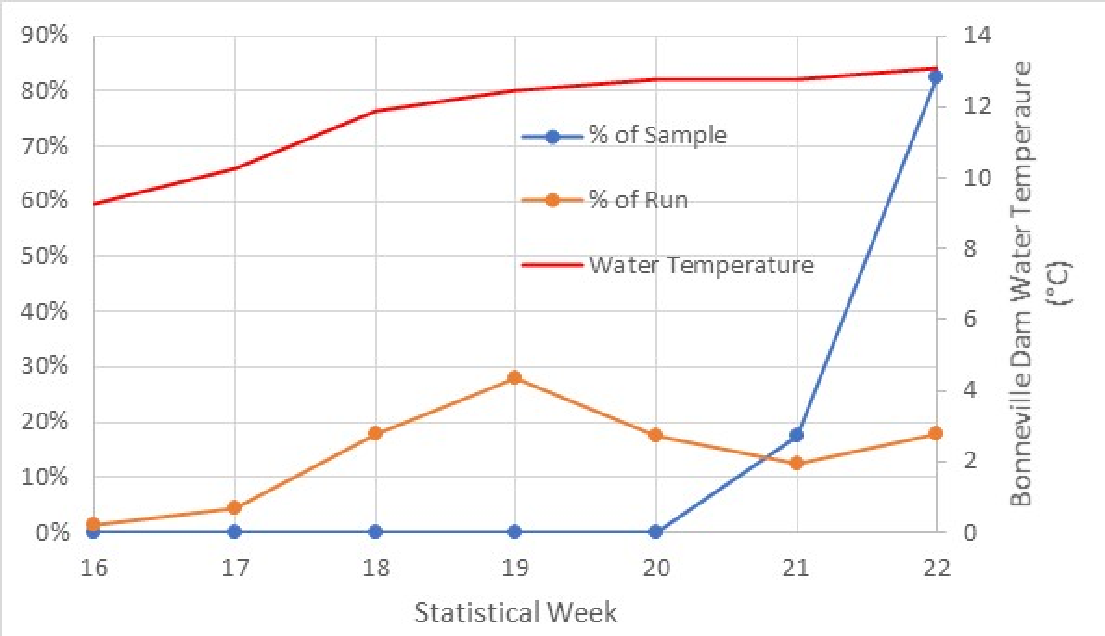

Figure 4. The weekly spring Chinook sample and run as a percentage of the total sample and run size at Bonneville Dam in 2020. AFF regulations require reduced sampling at 21.1°C with sampling halted at 22.2°C.

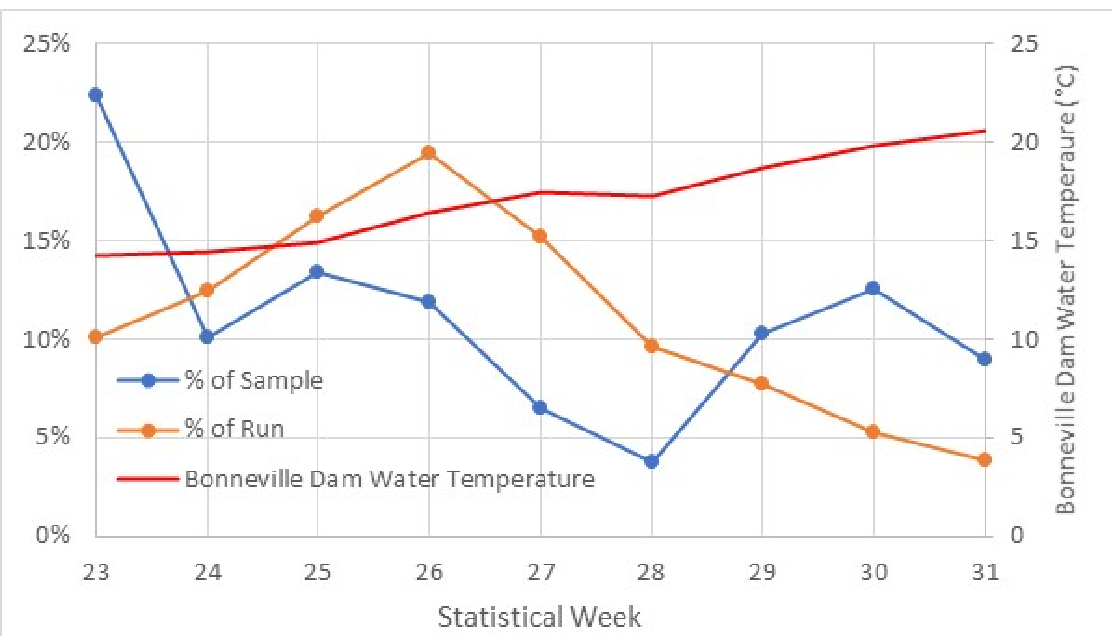

Figure 5. The weekly summer Chinook sample and run as a percentage of the total sample and run size at Bonneville Dam in 2020. AFF regulations require reduced sampling at 21.1°C with sampling halted at 22.2°C.

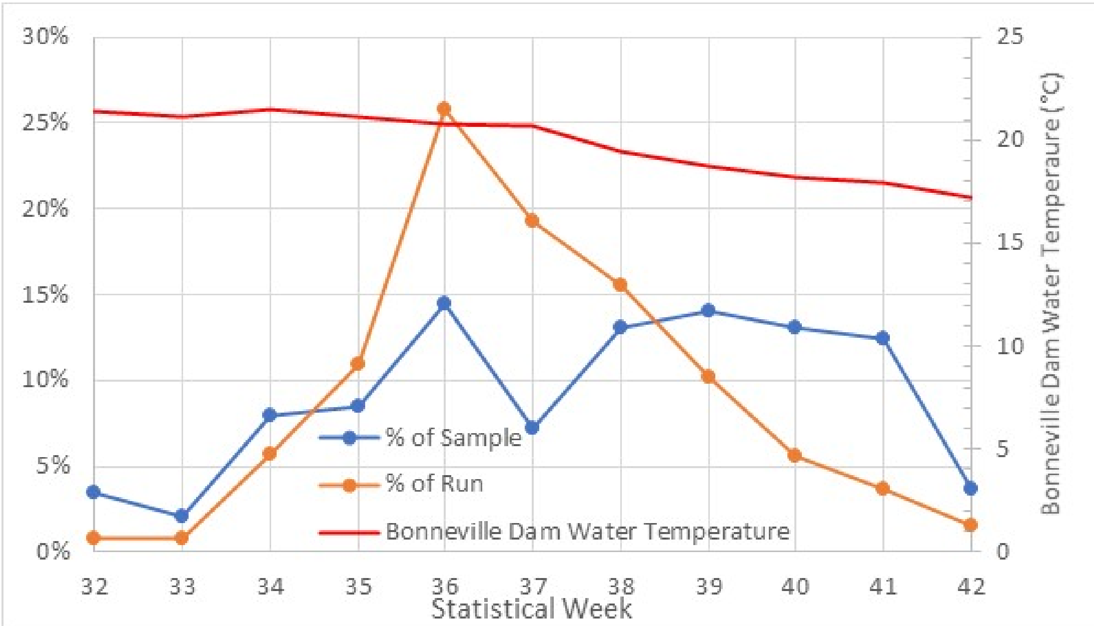

Figure 6. The weekly fall Chinook sample and run as a percentage of the total sample and run size at Bonneville Dam in 2020. AFF regulations require reduced sampling at 21.1°C with sampling halted at 22.2°C.

Detection Numbers

The tracking of 194 spring Chinook generated 13,751 weir detections, which were grouped into 1,461 site detections at 81 sites. The 1,074 summer Chinook generated 117,174 weir detections, grouped into 8,702 site detections at 102 sites, and the 2,004 fall Chinook generated 73,950 weir detections grouped into 9,016 site detections at 52 sites. Maps and table of sites found in the Appendix C (Table C1 and Figures C1, C2-C15) show the sites and the categorical ranges of detection numbers at the sites throughout the Columbia Basin. Note that the number of Chinook tracked in each run is determined by the migration timing at Bonneville, with the spring Chinook run ending May 31st, the summer Chinook running from June 1 through July 31st, and the fall Chinook run starting August 1st (FPC 2021) with minijacks and Tules excluded.

Mainstem Dam Recoveries, Mortality, and Escapement Estimates

Chinook bound for the Snake River predominated among the last two weeks of the Spring Chinook run we were permitted to sample (Table 4). Summer Chinook were predominantly last detected upstream in terminal areas upstream of Priest Rapids Dam and fall Chinook in spawning areas between McNary and Ice Harbor/Priest Rapids dams (Table 4, Figures 7-8). The early run was primarily last detected downstream of McNary Dam, transitioning to a run bound for the Snake River, peaking in Week 21 (Figure 9). Beginning in early June, summer Chinook bound for above Priest Rapids dam predominated with the percentage decreasing in late July when sampling was halted. Chinook last detected downstream of McNary dam comprised the majority of the run though Statistical Week 38, with fall Chinook last detected at areas between McNary and Ice Harbor/Priest Rapids dams predominated (Table 4, Figure 9). This area is the location of Ringold and Priest Rapids hatcheries, which rear fall Chinook Salmon as well as the spawning grounds of Hanford Reach wild fall Chinook.

Table 4. Percentage of spring, summer, and fall Chinook Salmon tracked from Bonneville Dam detected at or upstream of Columbia and Snake River dams in 2020.

Dam	Spring Chinook (May 21-31 only)	Summer Chinook	Fall Chinook
The Dalles	77.1%	89.8%	70.5%
John Day	73.7%	84.3%	60.4%
McNary	67.5%	82.2%	56.4%
Priest Rapids	14.7%	69.9%	12.5%
Rock Island	14.7%	68.8%	5.3%
Rocky Reach	8.3%	62.4%	4.5%
Wells	6.8%	51.2%	3.3%
Ice Harbor	42.3%	11.1%	9.0%
Lower Monumental	42.0%	10.9%	8.7%
Little Goose	41.2%	10.6%	8.5%
Lower Granite	40.8%	10.6%	8.4%

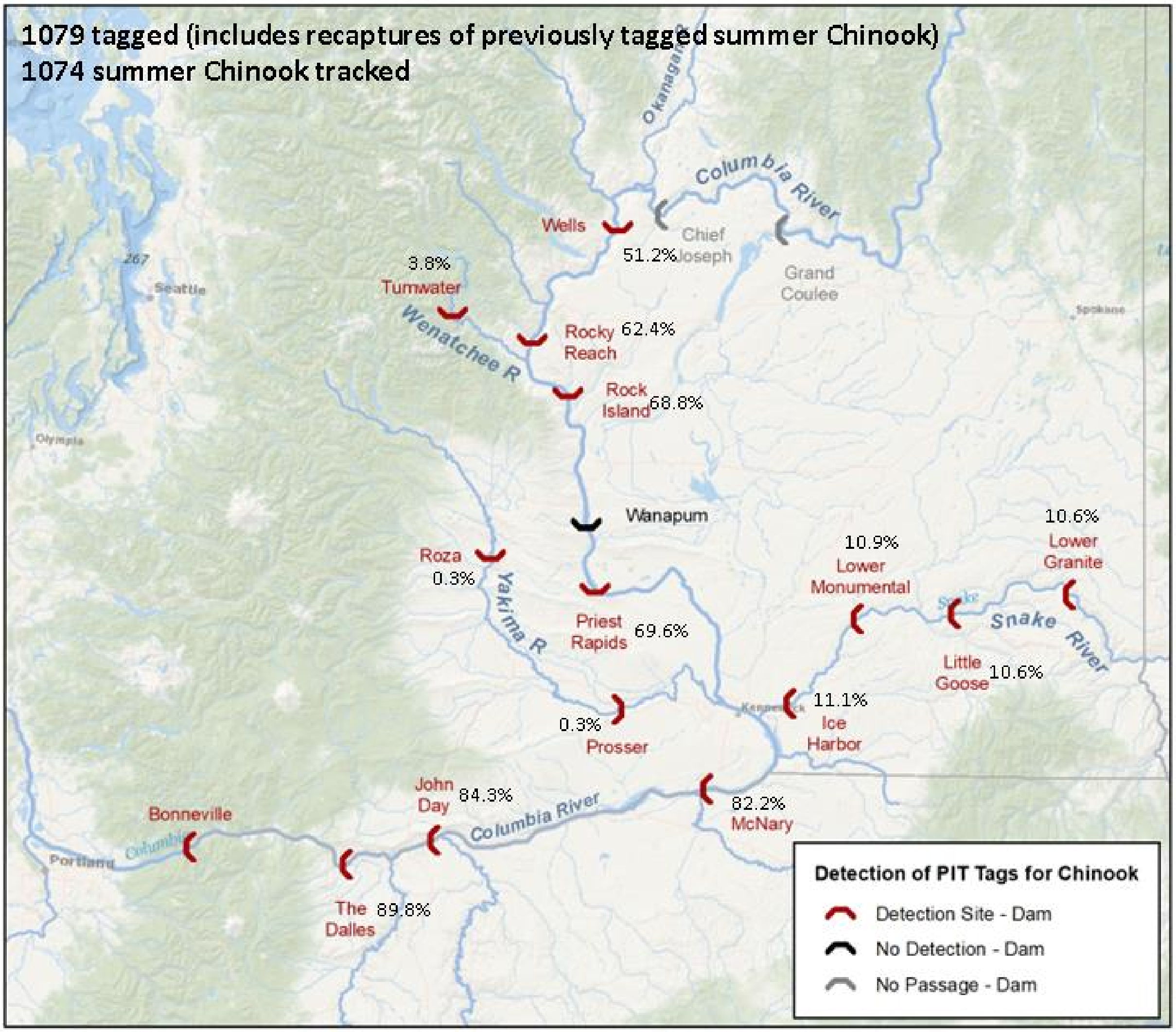

Figure 7. Map of the Columbia River Basin from Bonneville to Wells and Lower Granite dams showing the number of summer Chinook Salmon PIT tagged at Bonneville Dam, and the percentage of the run estimated to pass upstream dams in 2020.

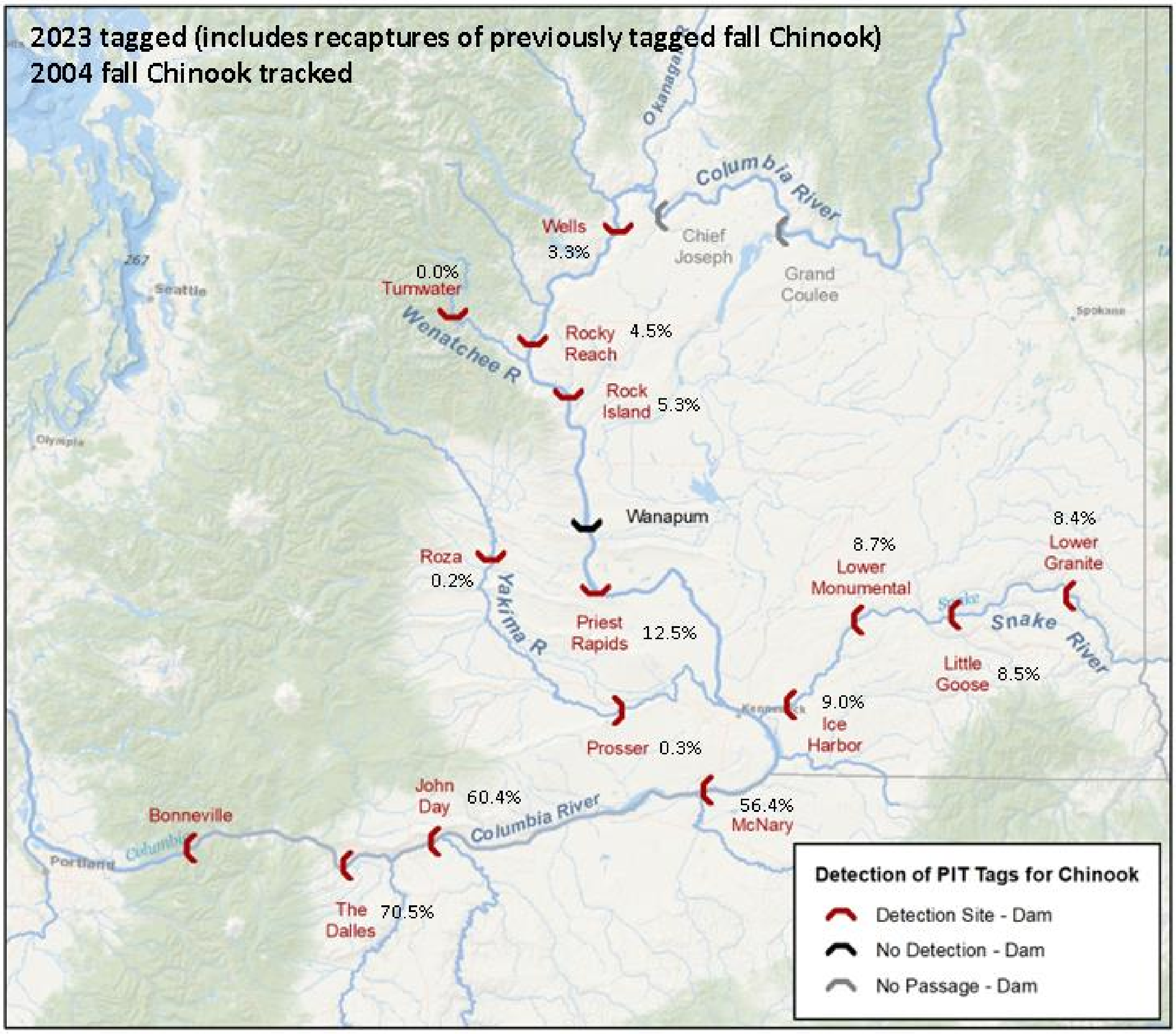

Figure 8. Map of the Columbia River Basin from Bonneville to Wells and Lower Granite dams showing the number of fall Chinook Salmon PIT tagged at Bonneville Dam, and the percentage of the run estimated to pass upstream dams in 2020.

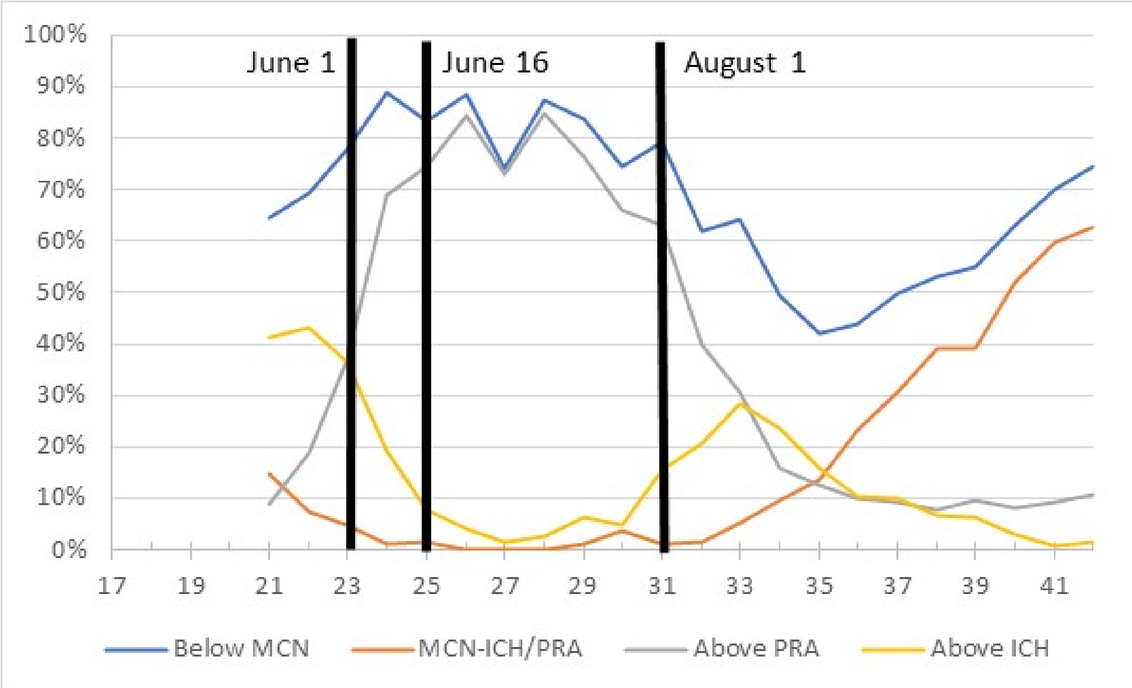

Figure 9. Distribution of final detection areas of the Columbia Basin by statistical week for Chinook Salmon PIT tagged at Bonneville Dam in 2020. Dates used to differentiate spring, summer, and fall Chinook are shown, with both June 1 and June 16 used to differentiate spring and summer Chinook.

The mean percentage of PIT tagged Chinook Salmon passing mainstem Columbia and Snake River dams without detection, was 0.2% for the last two weeks of the spring Chinook migration, 0.7% for summer Chinook and 1.0% for fall Chinook (Table 5). Bonneville, The Dalles, John Day, McNary, Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams all have navigation locks where it is possible that PIT tagged fish could pass upstream undetected.

The mean deviation between total Chinook escapement estimates based on PIT tags and those estimated by visual counts was 1.0% for summer Chinook and 30.2% for fall Chinook (Table 6).

Table 5. Percentage of Chinook Salmon detected upstream that missed detection at mainstem dams in 2020.

Dam	Spring	Summer	Fall
Bonneville	0.0%	0.1%	0.1%
The Dalles	0.0%	0.6%	2.3%
John Day	0.7%	1.8%	0.8%
McNary	0.8%	0.9%	0.5%
Priest Rapids	0.0%	0.0%	0.0%
Rock Island	0.0%	1.3%	0.0%
Rocky Reach	0.0%	0.0%	0.0%
Wells	0.0%	0.0%	0.0%
Ice Harbor	0.0%	1.3%	1.1%
Lower Monumental	0.0%	0.7%	2.3%
Little Goose	0.0%	0.7%	0.6%
Lower Granite	0.0%	0.0%	0.0%
Weighted Mean	**0.2%**	**0.7%**	**1.0%**

Table 6. Spring, summer, fall, and total Chinook Salmon escapement at Columbia Basin mainstem dams upstream of Bonneville Dam in 2020. Estimates are from both PIT tag recoveries and dam counts (FPC 2021). Due to restricted sampling at Bonneville Dam during most of the spring migration, statistics were not calculated for spring or total Chinook Salmon.

Site	Spring Chinook Salmon			Summer Chinook Salmon		
	Viewing Window Count	PIT Tag Estimate	Percent Difference	Viewing Window Count	PIT Tag Estimate	Percent Difference
The Dalles	46,016	NA	NA	88,238	89,738	1.7%
John Day	43,111	NA	NA	79,535	84,205	5.5%
McNary	37,498	NA	NA	77,726	82,157	5.4%
Priest Rapids	5,962	NA	NA	72,056	69,878	-3.1%
Rock Island	8,388	NA	NA	73,271	68,704	-6.6%
Rocky Reach	4,477	NA	NA	67,320	62,383	-7.9%
Wells	6,258	NA	NA	52,542	51,166	-2.7%
Ice Harbor	24,772	NA	NA	8,690	11,130	21.9%
L. Monumental	26,339	NA	NA	8,434	10,855	22.3%
Little Goose	26,001	NA	NA	9,139	10,633	14.0%
Lower Granite	26,011	NA	NA	8,775	10,581	17.1%
Mean (weighted)						**1.0%**
	Fall Chinook Salmon			**Total Chinook Salmon**		
The Dalles	203,071	248,213	18.2%	337,325	NA	NA
John Day	150,230	212,537	29.3%	272,876	NA	NA
McNary	122,575	198,458	38.2%	237,799	NA	NA
Priest Rapids	19,569	43,975	55.5%	97,587	NA	NA
Rock Island	5,936	18,525	68.0%	87,595	NA	NA
Rocky Reach	4,558	15,740	71.0%	76,355	NA	NA
Wells	2,413	11,562	79.1%	61,213	NA	NA
Ice Harbor	27,290	31,603	13.6%	60,752	NA	NA
L. Monumental	27,207	30,710	11.4%	61,980	NA	NA
Little Goose	23,596	30,047	21.5%	58,736	NA	NA
Lower Granite	21,766	29,506	26.2%	56,552	NA	NA
Mean (weighted)			**30.2%**			

Major deviations between race classifications based on passage date were largest for Bonneville summer Chinook passing upstream of Lower Granite, Lower Monumental, Little Goose, and Ice Harbor dams as spring Chinook Table 7.

Table 7. Percentage of Chinook sampled at Bonneville Dam as one race (as determined by run timing) that passed upstream dams as another race (as determined by run timing) in 2020. Due to restricted sampling at Bonneville Dam during most of the spring migration, statistics were not calculated for spring or total Chinook Salmon.

Last Date Spring Run	First Date Fall Run	Race at Bonneville	Spring	Summer	Summer	Fall
		Race at Dam Listed Below	Summer	Spring	Fall	Summer
June 3	August 4	The Dalles	NA	0.0%	0.7%	0.0%
June 5	August 6	John Day	NA	1.5%	1.3%	0.1%
June 8	August 9	McNary	NA	2.7%	1.2%	1.2%
June 13	August 14	Priest Rapids	NA	0.1%	0.7%	1.0%
June 17	August 18	Rock Island	NA	0.3%	0.7%	0.9%
June 19	August 20	Rocky Reach	NA	0.6%	1.1%	1.6%
June 28	August 29	Wells	NA	3.9%	1.2%	3.1%
June 11	August 12	Ice Harbor	NA	15.1%	4.6%	3.3%
June 13	August 14	L. Monumental	NA	18.8%	6.0%	2.0%
June 15	August 16	Little Goose	NA	17.8%	6.8%	3.4%
June 17	August 18	Lower Granite	NA	19.9%	5.5%	3.4%

As in past years, dam escapement estimates for three tributary dams (Tumwater Dam on the Wenatchee River and Prosser and Roza dams on the Yakima River), were compared with estimates from visual counts (Table 8). The deviations of the PIT tag escapement estimate from visual counts at these dams were generally much greater than those at mainstem dams. Much lower sample sizes (as well as no sampling during most of the migration season) than at mainstem dams likely contributed to this difference. Chinook that ultimately passed these three dams primarily passed Bonneville Dam in the spring and, to a lesser extent, in the fall (Figure 10).

Table 8. Chinook Salmon escapement, as estimated using PIT tag detections, to Tumwater, Prosser, and Roza dams in 2020

Location and River	Number of Tag Detections	Escapement Estimate from Visual Counts	Estimated Escapement Using PIT Tags	Percent Difference
Tumwater Dam, Wenatchee River	49	4051	4487	10.8%
Prosser Dam, Yakima River	21	5366	2991	-44.3%
Roza Dam, Yakima River	12	2257	2287	1.3%

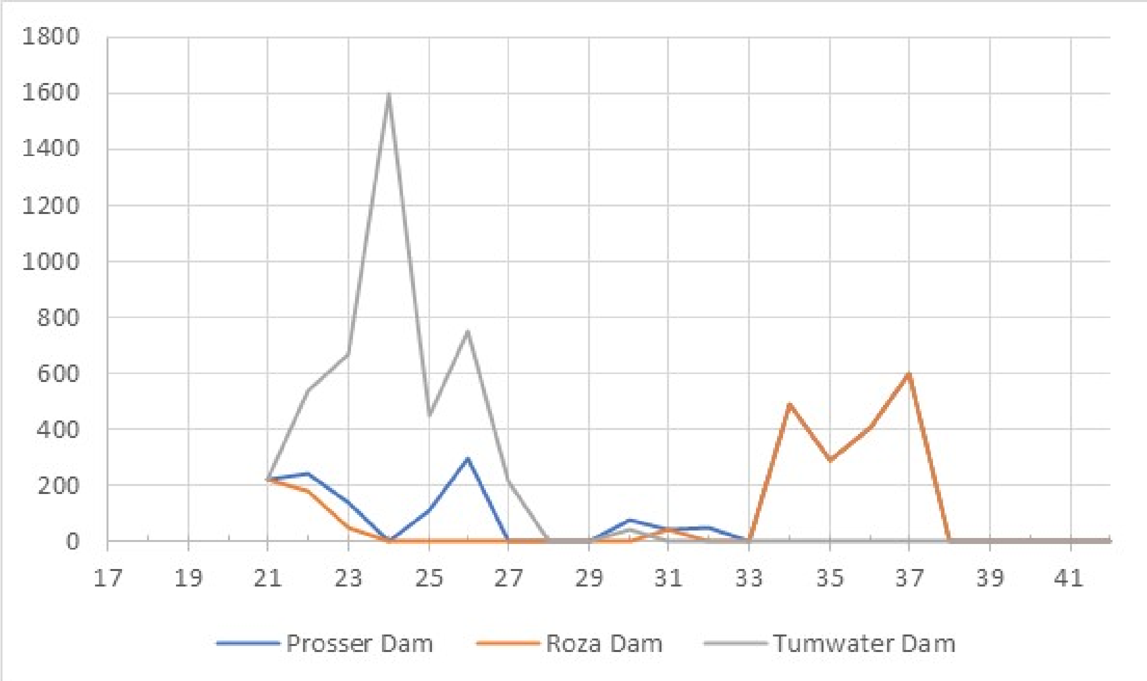

Figure 10. Percentage of Chinook Salmon by statistical week tagged at Bonneville Dam in 2020 destined for the Tumwater Dam (Wenatchee River), Prosser Dam (Yakima River) and Roza Dam (Yakima River) based on upstream PIT tag detections.

Migration Rates and Passage Time

Chinook migration rates between mainstem dams in 2020 ranged between 17.6 km/day for fall Chinook between Rock Island and Rocky Reach dams and 57.3 km/day for fall Chinook between John Day and McNary dams (Table 9) when comparing all three races of Chinook.

Among the mainstem Columbia and Snake River dams, Chinook Salmon had the greatest median dam passage time (as determined by minutes between first detection time and last detection time at a dam) at Wells Dam for spring and summer Chinook and at Lower Granite Dam for fall Chinook (Table 10). At Bonneville, Lower Granite, McNary, Rocky Reach and Wells dams, there is a greater distance between the furthest downstream and furthest upstream PIT tag detection antennas than at other dams; conversely, the distance between the PIT tag detection antennas at most other dams are placed at adjacent or nearby weirs. Passage times at Lower Granite, Bonneville, Priest Rapids, Tumwater, and Wells dams may also be inflated by trapping operations that take place at fish ladders at those dams. Sample sizes for spring Chinook were small; for example, spring Chinook had a median time of over 3 hours to pass Tumwater Dam, but n=10.

Table 9. Chinook Salmon migration rates between Columbia Basin dams estimated using PIT tag data in 2020.

		Median Migration Rate (km/day)		
Between Mainstem Dams	Distance (km)	Spring Chinook	Summer Chinook	Fall Chinook
Bonneville-The Dalles	74	34.1	36.8	36.9
The Dalles-John Day	39	26.7	29.3	35.8
John Day-McNary	123	45.8	51.9	57.3
McNary-Priest Rapids	169	24.6	33.1	25.5
Priest Rapids-Rock Island	124	27.6	26.0	22.3
Rock Island-Rocky Reach	33	24.2	28.8	17.6
Rocky Reach-Wells	67	18.8	28.8	25.6
Bonneville-John Day	113	28.4	30.1	36.3
Bonneville-McNary	236	33.8	38.6	40.6
Bonneville-Priest Rapids	405	23.8	34.5	31.5
Bonneville-Wells	596	22.0	30.1	30.5
Bonneville-Ice Harbor	304	34.2	34.4	42.6
Bonneville-Lower Granite	461	31.4	32.7	38.0
Priest Rapids-Wells	191	22.4	26.2	23.2
McNary-Ice Harbor	68	32.1	32.8	39.4
Ice Harbor-Lower Granite	157	26.4	30.2	32.2
To and Between Tributary Sites				
Rock Island - Tumwater	68	2.0	3.3	NA
McNary - Prosser	145	26.9	9.0	8.9
Prosser - Roza	130	11.9	21.6	NA
Lower Granite - South Fork Salmon (SFG)	375	16.4	22.6	NA

Table 10. Median passage time in minutes by run, from the time of first detection to time of last detection at a dam and the percentage of Chinook taking more than 12 hours between first and last detection in 2020.

	Median Passage Time (minutes)			Percentage of run with more than 12 hours between first and last detection at a dam		
Dam	Spring Chinook	Summer Chinook	Fall Chinook	Spring Chinook	Summer Chinook	Fall Chinook
Bonneville	70.5	82.2	70.7	9.8%	7.2%	3.3%
The Dalles	0.1	0.1	0.1	2.7%	2.4%	1.3%
John Day	1.2	0.1	0.1	4.2%	3.9%	2.1%
McNary	107.1	85.2	80.4	9.8%	4.5%	5.1%
Priest Rapids	4.6	6.6	4.6	0.0%	1.7%	11.6%
Rock Island	56.7	43.4	162.6	7.4%	11.0%	21.8%
Rocky Reach	12.5	11.3	16.3	0.0%	5.0%	3.1%
Wells	225.9	107.0	97.3	35.7%	12.0%	2.4%
Ice Harbor	3.5	3.9	2.0	8.4%	5.9%	1.1%
Lower Monumental	0.4	0.8	0.2	3.7%	8.1%	2.4%
Little Goose	0.1	0.1	0.0	5.0%	4.8%	4.1%
Lower Granite	102.8	103.3	149.6	3.8%	6.8%	13.7%
Prosser	0.2	5.7	4.7	0.0%	0.0%	0.0%
Roza	1.9	2.3	NA	16.7%	0.0%	NA
Tumwater	184.9	24.4	NA	40.0%	18.4%	NA

Bonneville Dam Chinook Salmon Age Composition

Spring Chinook sampling was only conducted in the last two weeks of the run representing only 30.4% of the run. Age 1.2 was the dominant age group in both weeks (Table 11). The age composition for the other 69.6% of the run is unknown. The dominant age class for summer Chinook was also 1.2, comprising an estimated 64.7% of the summer Chinook population (Tables 12, Figure 11). The predominant age class for fall Chinook was 0.3 at an estimated 44.2% of the population (Table 13). The percentage of yearling freshwater (Age 1.x) Chinook was at or near 100% through Week 23, then began to decline through the rest of the year, with the percentage of subyearling freshwater Chinook (0.x) showing the opposite trend (Figure 12). The first week that Age 0.x Chinook predominated was Week 32 at 54.5% of the run.

Table 11. Weekly and total age composition of spring Chinook Salmon at Bonneville Dam as estimated from scale patterns in 2020. Composite estimates were not calculated due to the very limited spring Chinook sampling we were allowed to conduct.

			Brood Year and Age Class			
	Percent	Number	2017	2016		2015
Week	of Run	Ageable	1.1	0.3	1.2	1.3
17	6.4%	NA	NA	NA	NA	NA
18	17.9%	NA	NA	NA	NA	NA
19	27.8%	NA	NA	NA	NA	NA
20	17.6%	NA	NA	NA	NA	NA
21	12.4%	31	35.5%	0.0%	64.5%	0.0%
22	18.0%	138	7.2%	1.4%	85.5%	5.8%
Composite		**169**	**NA**	**NA**	**NA**	**NA**

Table 12. Weekly and total age composition of summer Chinook Salmon at Bonneville Dam as estimated from scale patterns in 2020. Composite age composition estimates are weighted by the percentage of the run passing Bonneville Dam in each week.

			Brood Year and Age Class								
	Percent	Number	2018	2017		2016			2015		
Week	of Run	Ageable	0.1	0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2
23	10.1%	210	0.0%	0.5%	9.5%	6.2%	65.2%	0.0%	0.0%	17.6%	1.0%
24	12.4%	84	0.0%	1.2%	11.9%	7.1%	63.1%	0.0%	0.0%	16.7%	0.0%
25	16.3%	116	0.0%	0.9%	9.5%	6.0%	61.2%	0.9%	0.9%	17.2%	3.4%
26	19.5%	107	0.0%	0.9%	9.3%	12.1%	56.1%	0.0%	0.0%	18.7%	2.8%
27	15.2%	61	0.0%	1.6%	8.2%	4.9%	80.3%	0.0%	0.0%	4.9%	0.0%
28	9.7%	36	0.0%	5.6%	8.3%	8.3%	69.4%	0.0%	0.0%	8.3%	0.0%
29	7.7%	92	1.1%	1.1%	20.7%	10.9%	63.0%	0.0%	0.0%	3.3%	0.0%
30	5.3%	119	0.8%	3.4%	10.1%	4.2%	73.9%	0.0%	0.8%	5.0%	1.7%
31	3.8%	86	3.5%	17.4%	9.3%	10.5%	44.2%	0.0%	3.5%	11.6%	0.0%
Composite		**744**	**0.3%**	**2.2%**	**10.3%**	**7.9%**	**64.7%**	**0.1%**	**0.3%**	**12.8%**	**1.3%**

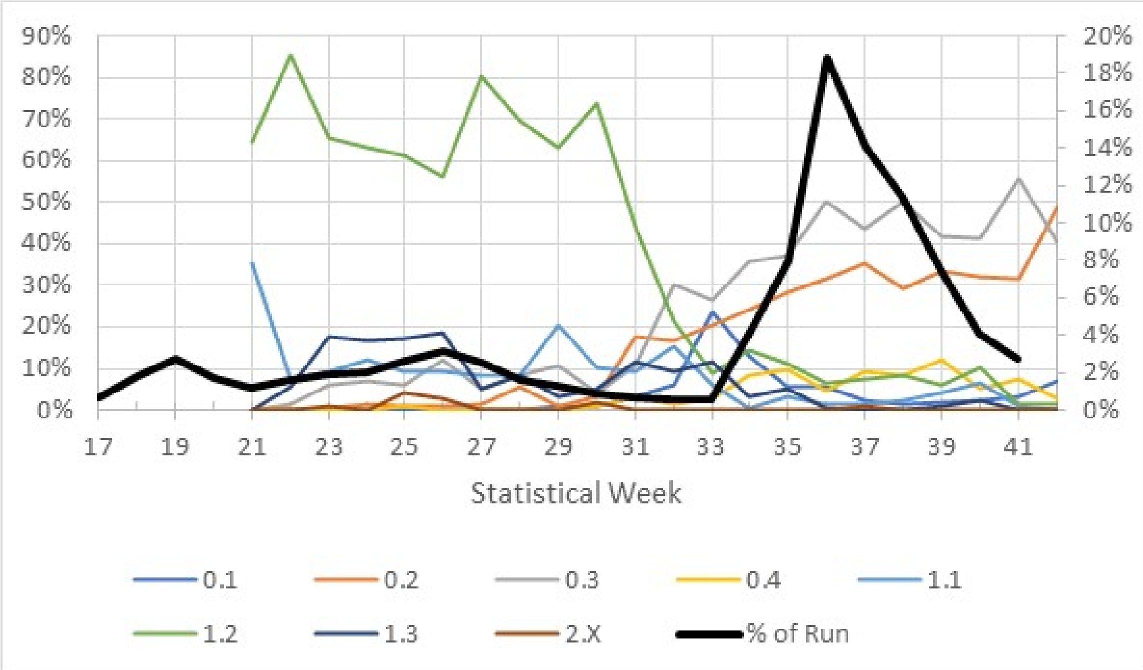

Figure 11. Weekly age composition of Chinook Salmon at Bonneville Dam as estimated from scale patterns in 2020 with weekly percentage of run.

Table 13. Weekly and total age composition of fall Chinook Salmon at Bonneville Dam as estimated from scale patterns in 2020. Composite age composition estimates are weighted by the percentage of the run passing Bonneville Dam in each.

Week	Percent of Run	Number Ageable	Brood Year and Age Class							
			2018	2017		2016		2015		2014
			0.1	0.2	1.1	0.3	1.2	0.4	1.3	2.3
32	0.9%	66	6.1%	16.7%	15.2%	30.3%	21.2%	1.5%	9.1%	0.0%
33	0.7%	34	23.5%	20.6%	5.9%	26.5%	8.8%	2.9%	11.8%	0.0%
34	5.7%	145	13.1%	24.1%	0.7%	35.9%	14.5%	8.3%	3.4%	0.0%
35	10.8%	162	5.6%	28.4%	3.1%	37.0%	11.1%	9.9%	4.9%	0.0%
36	25.5%	276	5.4%	31.5%	1.4%	50.0%	6.5%	4.7%	0.4%	0.0%
37	19.1%	131	2.3%	35.1%	1.5%	43.5%	7.6%	9.2%	0.0%	0.8%
38	15.4%	245	1.2%	29.4%	2.4%	50.2%	8.6%	8.2%	0.0%	0.0%
39	10.1%	270	1.9%	33.3%	4.1%	41.9%	5.9%	12.2%	0.7%	0.0%
40	5.5%	250	2.4%	32.0%	6.4%	41.2%	10.4%	5.2%	2.4%	0.0%
41	3.6%	246	3.3%	31.7%	0.8%	55.7%	1.2%	7.3%	0.0%	0.0%
42	2.5%	72	6.9%	48.6%	0.0%	40.3%	1.4%	2.8%	0.0%	0.0%
Composite	**100.0%**	**1897**	**4.6%**	**30.9%**	**3.1%**	**44.2%**	**8.1%**	**7.4%**	**1.7%**	**0.1%**

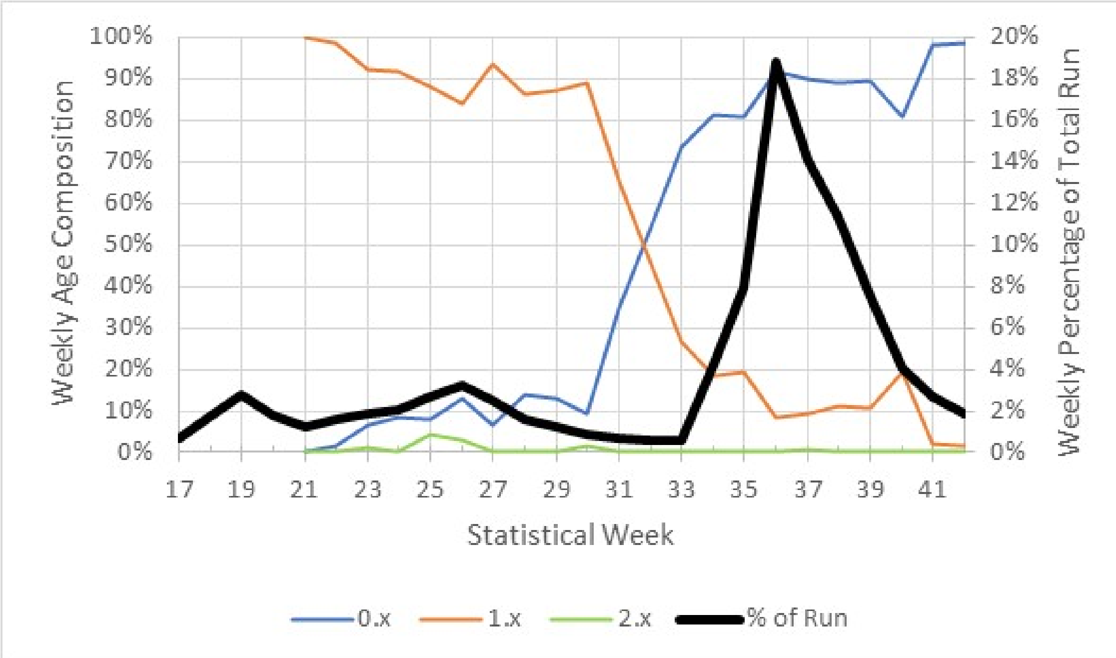

Figure 12. Weekly age composition of Chinook Salmon at Bonneville Dam as estimated from scale patterns in 2020 with weekly percentage of run.

Upstream Age and Length-at-Age Composition

Age 1.2 was the dominant age class for summer Chinook at all dams (Table 14, Figure 13). Among fall Chinook, Age 0.3 was the predominant age class at Bonneville and The Dalles dams and Age 0.2 was predominant at John Day through Rocky Reach dams and Ice Harbor through Lower Granite dams. Age 1.2 was the largest age class at Wells Dam (Table 14, Figure 14). Length-at-age composition estimates at mainstem dam sites are summarized in Tables 15-17.

Table 14. Unweighted age composition estimates of summer and fall Chinook Salmon at mainstem Columbia Basin dams as estimated using upstream PIT tag detections for Chinook sampled at Bonneville Dam and aged using scale pattern analysis in 2020[4]. No spring Chinook estimates are presented due to the minimal sampling we were allowed to conduct.

Run and Site	Ageable	Brood Year and Age Class									
		2018	2017		2016			2015			2014
Summer	**N**	**0.1**	**0.2**	**1.1**	**0.3**	**1.2**	**2.1**	**0.4**	**1.3**	**2.2**	**2.3**
Bonneville	903	0.6%	3.0%	10.7%	7.5%	63.6%	0.1%	0.6%	12.7%	1.2%	0.0%
The Dalles	810	0.6%	3.2%	10.5%	7.9%	62.6%	0.1%	0.5%	13.2%	1.4%	0.0%
John Day	753	0.4%	2.5%	10.5%	7.8%	63.3%	0.1%	0.4%	13.4%	1.5%	0.0%
McNary	736	0.4%	2.6%	10.7%	7.9%	62.6%	0.1%	0.4%	13.7%	1.5%	0.0%
Priest Rapids	582	0.2%	2.4%	8.8%	9.1%	61.7%	0.2%	0.3%	15.8%	1.5%	0.0%
Rock Island	573	0.2%	2.4%	8.6%	9.2%	61.8%	0.2%	0.3%	15.7%	1.6%	0.0%
Rocky Reach	518	0.2%	2.7%	7.9%	8.5%	62.4%	0.2%	0.4%	16.2%	1.5%	0.0%
Wells	433	0.2%	3.0%	8.3%	9.2%	63.5%	0.2%	0.5%	13.4%	1.6%	0.0%
Ice Harbor	139	1.4%	3.6%	20.9%	2.9%	63.3%	0.0%	0.0%	6.5%	1.4%	0.0%
Low. Mon.	135	1.5%	3.7%	20.7%	3.0%	63.7%	0.0%	0.0%	5.9%	1.5%	0.0%
Little Goose	132	1.5%	3.8%	21.2%	3.0%	62.9%	0.0%	0.0%	6.1%	1.5%	0.0%
Lower Granite	131	1.5%	3.8%	21.4%	3.1%	62.6%	0.0%	0.0%	6.1%	1.5%	0.0%
Fall	**N**	**0.1**	**0.2**	**1.1**	**0.3**	**1.2**	**2.1**	**0.4**	**1.3**	**2.2**	**2.3**
Bonneville	1861	4.5%	31.2%	3.2%	44.1%	7.9%	0.0%	7.4%	1.7%	0.0%	0.1%
The Dalles	1311	4.7%	35.0%	3.9%	38.7%	8.6%	0.0%	7.4%	1.8%	0.0%	0.0%
John Day	1112	4.3%	37.9%	3.9%	36.5%	8.4%	0.0%	7.6%	1.5%	0.0%	0.0%
McNary	1039	4.3%	38.7%	4.1%	35.9%	8.4%	0.0%	6.9%	1.6%	0.0%	0.0%
Priest Rapids	210	3.8%	41.0%	7.6%	27.6%	13.3%	0.0%	4.3%	2.4%	0.0%	0.0%
Rock Island	72	6.9%	29.2%	12.5%	23.6%	19.4%	0.0%	1.4%	6.9%	0.0%	0.0%
Rocky Reach	60	6.7%	26.7%	13.3%	23.3%	20.0%	0.0%	1.7%	8.3%	0.0%	0.0%
Wells	38	5.3%	15.8%	18.4%	23.7%	26.3%	0.0%	0.0%	10.5%	0.0%	0.0%
Ice Harbor	171	11.7%	48.0%	2.9%	25.1%	8.8%	0.0%	1.8%	1.8%	0.0%	0.0%
Low. Mon.	167	12.0%	47.9%	3.0%	25.1%	8.4%	0.0%	1.8%	1.8%	0.0%	0.0%
Little Goose	163	11.7%	48.5%	2.5%	25.2%	8.6%	0.0%	1.8%	1.8%	0.0%	0.0%
Lower Granite	161	11.8%	49.1%	1.9%	25.5%	8.1%	0.0%	1.9%	1.9%	0.0%	0.0%

[4] The Bonneville estimates in this table differ up to 2.2 percentage points from those presented in Tables 12-14 for two reasons. First is that Table 15 does not include fish not detected at Bonneville Dam and second, estimates in this table are unweighted by run size while tables 12-14 are weighted.

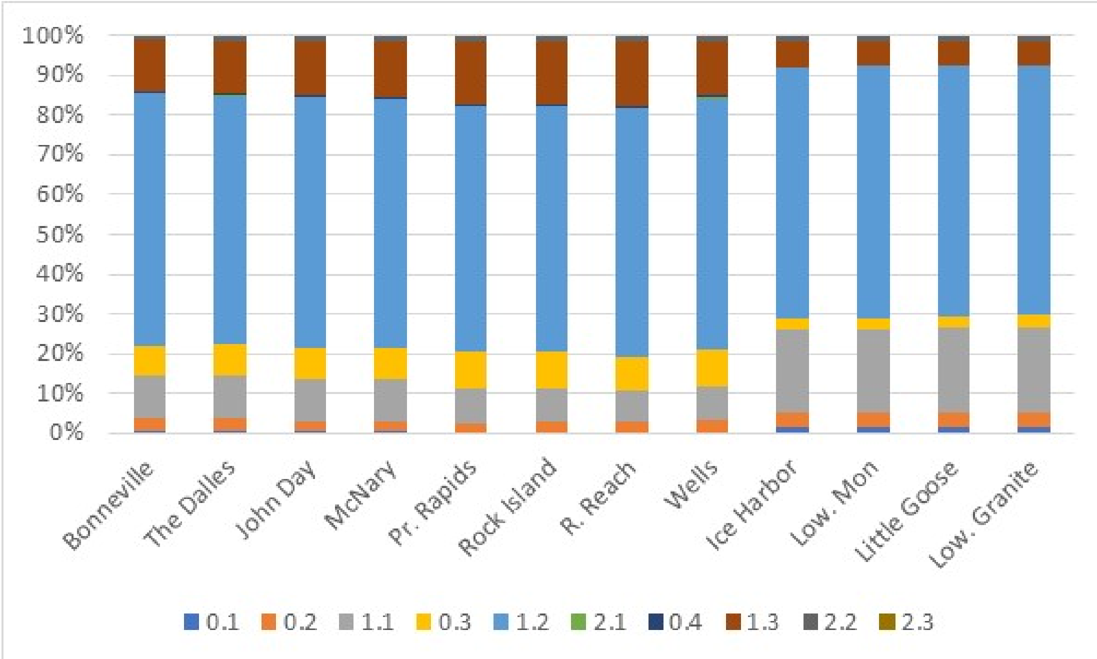

Figure 13. Summer Chinook age composition at Columbia and Snake River dams estimated using PIT tagged Chinook tracked by this project. Summer Chinook are defined as passing Bonneville Dam between June 1 and July 31, 2020.

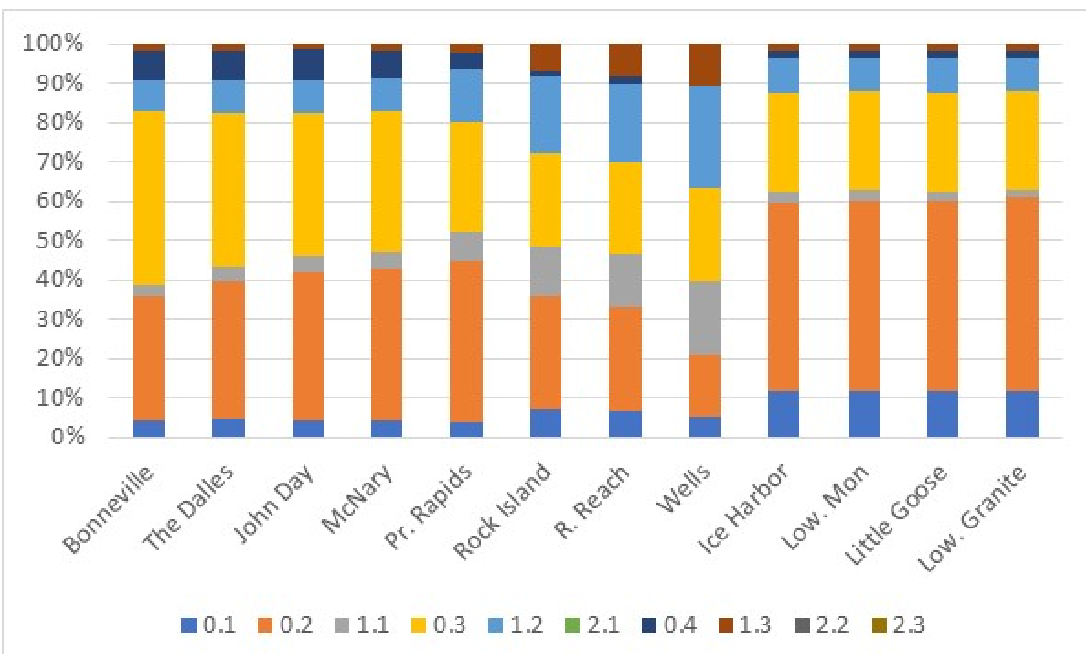

Figure 14. Fall Chinook age composition at Columbia and Snake river dams estimated using PIT tagged Chinook tracked by this project. Fall Chinook are defined as passing Bonneville Dam on or after August 1, 2020.

Table 15. Spring Chinook Salmon length-at-age composition, as estimated by PIT tag detections at upstream dams of fish aged using scale pattern analysis that passed Bonneville Dam on or before May 31 at Columbia and Snake River dams in 2020. (Note that sampling we were not allowed to sample until Week 22 and thus missed 69.6% of the spring Chinook run - Table 11)

Dam	Statistic	Brood Year and Age Class							
		2018	2017		2016			2015	
		0.1	0.2	1.1	0.3	1.2	2.1	0.4	1.3
Bonneville	μ			50.6	87.8	69.9			85.4
	s			6.0	4.6	7.4			5.6
	n			21	2	138			8
The Dalles	μ			50.6	87.8	69.7			85.4
	s			6.0	4.6	8.4			5.6
	n			21	2	100			8
John Day	μ			50.6	87.8	69.8			85.4
	s			60	4.6	8.6			5.6
	n			21	2	94			8
McNary	μ			49.9	87.8	69.9			85.4
	s			6.0	4.6	8.7			5.6
	n			18	2	89			8
Priest Rapids	μ			49.8	87.8	68.8			86.8
	s			3.2	4.6	19.1			5.6
	n			4	2	16			6
Rock Island	μ			49.8	87.8	68.8			86.8
	s			3.2	4.6	19.1			5.6
	n			4	2	16			6
Rocky Reach	μ			51.3	87.8	73.3			85
	s			3.9	4.6	7.4			3.7
	n			2	2	6			5
Wells	μ			51.3	87.8	71.4			86
	s			3.9	4.6	6.3			4.6
	n			2	2	5			3
Ice Harbor	μ			49.5		70.3			81.3
	s			5.2		4.1			3.9
	n			11		63			2
Lower Monumental	μ			49.5		70.4			81.3
	s			5.2		4.1			3.9
	n			11		62			2
Little Goose	μ			49.5		70.4			81.3
	s			5.2		4.1			3.9
	n			11		61			2
Lower Granite	μ			49.5		70.3			81.3
	s			5.2		4.1			3.9
	n			11		60			2

Table 16. Summer Chinook Salmon length-at-age composition, as estimated by PIT tag detections at upstream dams of fish aged using scale pattern analysis that passed Bonneville Dam between June 1-July 31 at Columbia and Snake River dams in 2020.

		Brood Year and Age Class								
		2018	2017		2016			2015		
Dam	**Statistic**	**0.1**	**0.2**	**1.1**	**0.3**	**1.2**	**2.1**	**0.4**	**1.3**	**2.2**
Bonneville	μ	42.5	62.7	52.5	80.3	72.8	65.0	85.5	81.1	77.0
	s	2	8.9	5.6	5.9	31	--	10.5	7.5	12.9
	n	5	27	97	68	574	1	5	115	11
The Dalles	μ	42.5	62.7	52.5	80.1	73	65.0	84.6	81.1	77.0
	s	2	8.9	5.8	6	32.9	--	12	7.8	12.9
	n	5	26	85	64	507	1	4	107	11
John Day	μ	43.2	61.4	52.1	80.0	72.9	65.0	86.5	81.1	77.0
	s	2	6.4	5.5	6	33.9	--	13.9	7.9	12.9
	n	3	19	79	59	477	1	3	101	11
McNary	μ	43.2	61.4	52.1	80.0	73	65.0	86.5	81.1	77.0
	s	2	6.4	5.5	6.1	34.5	--	13.9	7.9	12.9
	n	3	19	79	58	461	1	3	101	11
Priest Rapids	μ	41.0	59.8	52.5	79.6	73.3	65.0	79.0	81.4	75.1
	s	--	5	6.1	6.0	39	--	7.1	7.8	13.6
	N	1	14	51	53	359	1	2	92	9
Rock Island	μ	41.0	59.8	52.6	79.6	73.4	65.0	79.0	81.4	75.1
	s	--	5	6.1	6.0	39.2	--	7.1	7.9	13.6
	N	1	14	49	53	354	1	2	90	9
Rocky Reach	μ	41.0	59.8	53.3	79.5	73.4	65.0	79	81.3	75.3
	s	--	5	6	6.3	41	--	7.1	8	14.5
	n	1	14	41	44	323	1	2	84	8
Wells	μ	41.0	60.6	53.9	80	73.9	65.0	79.0	79.9	74.9
	s	--	4	6	6.5	44.4	--	7.1	8.1	15.6
	n	1	13	36	40	275	1	2	58	7
Ice Harbor	μ	44.3	66	51.6	81.9	71.9			77.2	85.3
	s	1.1	8.2	4.3	5.8	4.7			8.6	5.3
	n	2	5	29	4	88			9	2
Lower Monumental	μ	44.3	66	51.6	81.9	71.9			75.5	85.3
	s	1.1	8.2	4.3	5.8	4.7			7.5	5.3
	n	2	5	28	4	86			8	2
Little Goose	μ	44.3	66	51.6	81.9	72			75.5	85.3
	s	1.1	8.2	4.3	5.8	4.7			7.5	5.3
	n	2	5	28	4	83			8	2
Lower Granite	μ	44.3	66	51.6	81.9	72			75.5	85.3
	s	1.1	8.2	4.3	5.8	4.7			7.5	5.3
	n	2	5	28	4	82			8	2

Table 17. Fall Chinook Salmon length-at-age composition, as estimated by PIT tag detections at upstream dams of fish aged using scale pattern analysis that passed Bonneville after July 31 for fall Chinook Salmon at Columbia and Snake River dams in 2020.

Dam	Statistic	Brood Year and Age Class									
		2018	2017		2016			2015			2014
		0.1	0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	2.3
Bonneville	μ	49.6	64.8	58.8	76.6	74.1		83.7	80.6		79.0
	s	5.9	5.7	5.9	5.4	6.7		5.7	7.8		--
	n	84	581	59	820	147		138	31		1
The Dalles	μ	47.2	63.8	58.8	76.5	73.6		83.6	80.3		
	s	4.5	4.8	5.8	5.6	7		5.7	8.1		
	n	61	459	51	507	113		97	23		
John Day	μ	47.6	64	59.3	76.5	73.8		83.6	79.3		
	s	4.4	4.5	5.9	5.5	7.1		6	8.6		
	n	48	421	43	406	93		84	17		
McNary	μ	47.4	64	59.3	76.2	73.7		83.4	79.3		
	s	4.4	4.5	5.9	5.5	6.9		5.8	8.6		
	n	45	402	43	373	87		72	17		
Priest Rapids	μ	48.4	64.1	57.9	76.1	73.2		82.9	79.1		
	s	2.4	4.5	6.7	5.2	7.6		8.7	11.5		
	n	8	86	16	58	28		9	5		
Rock Island	μ	48.5	63	54.6	76.3	70.2		75.5	79.1		
	s	2.4	4.3	6	5.4	7.5		--	11.5		
	n	5	21	9	17	14		1	5		
Rocky Reach	μ	48.6	62.4	54.9	75.6	69.6		75.5	79.1		
	s	2.8	4.7	6.3	5.3	7.4		--	11.5		
	n	4	16	8	14	12		1	5		
Wells	μ	47	64	55.1	77.2	67.8			78.3		
	s	3.5	4.8	6.8	5	6.5			13		
	n	2	6	7	9	10			4		
Ice Harbor	μ	47.9	63.2	58.4	77.3	72.2		80.2	74.3		
	s	3.5	4.9	5.8	8.4	9.5		3.3	9.3		
	n	20	82	5	43	15		3	3		
Lower Monumental	μ	47.9	63.3	58.4	77.5	72.9		80.2	74.3		
	s	3.5	4.9	5.8	8.5	9.5		3.3	9.3		
	n	20	80	5	42	14		3	3		
Little Goose	μ	47.9	63.2	60	77.8	72.9		80.2	74.3		
	s	3.6	4.9	5.2	8.3	9.5		3.3	9.3		
	n	19	79	4	41	14		3	3		
Lower Granite	μ	47.9	63.2	59.5	77.8	72.1		80.2	74.3		
	s	3.6	4.9	6.3	8.3	9.4		3.3	9.3		
	n	19	79	3	41	13		3	3		

Fallback

Estimated fallback rates, based on Chinook Salmon reascending fish ladders or being detected downstream after ascending a fish ladder, ranged from 0.0% spring Chinook at Priest Rapids and Rock Island dams to 38.7% for fall Chinook at Priest Rapids Dam (Table 18). These rates likely underestimate the true fallback rates as they do not include any fish that ascended a dam, fell back, and then were not subsequently detected. Of the 87 fall Chinook fallbacks estimated at Priest Rapids Dam, 55 were subsequently detected at Priest Rapids Hatchery located 4 km downstream. An additional 10 fallbacks were subsequently detected at Ringold Hatchery located 68 km downstream.

Table 18. Estimated minimum Chinook Salmon fallback rates by race at Columbia Basin dams with PIT tag detection in 2020 as estimated by PIT tags[5].

Dam	Spring Chinook	Summer Chinook	Fall Chinook
Bonneville	3.1%	1.1%	1.4%
The Dalles	8.0%	3.4%	2.0%
John Day	1.4%	1.8%	1.3%
McNary	3.0%	1.0%	1.3%
Priest Rapids	0.0%	2.4%	38.7%
Rock Island	0.0%	1.2%	11.5%
Rocky Reach	11.1%	8.8%	4.7%
Wells	28.6%	16.9%	2.4%
Ice Harbor	9.6%	7.1%	1.7%
L. Monumental	4.9%	6.0%	1.1%
Little Goose	1.3%	2.0%	1.8%
Lower Granite	2.5%	3.4%	6.0%
Tumwater	10.0%	2.6%	NA
Weighted Mean	**4.3%**	**3.8%**	**3.0%**

A total of 382 Chinook generated 534 fallback events at mainstem dams with adult PIT tag detection (Table 19). A total of 102 Chinook had more than one fallback event at a single dam or several dams with four Chinook falling back 5 times each and one Chinook with 6 fallbacks. Figures showing the movement of some of these Chinook are in the Appendix C (Table C1 and Figures C26 and C27).

[5] Fallback rates do not include Chinook Salmon which may have fallen back over a dam and were not subsequently detected.

Table 19. Frequency of fallback events for spring, summer, and fall Chinook Salmon tagged by this project in 2020.

Fallback Events per Chinook	Total Number of Chinook
1	280
2	68
3	23
4	6
5	4
6	1
Number of Chinook falling back at least once	**382**
Percentage of Chinook with at least one fallback event	**11.7%**
Total fallback events	**534**
Number of Chinook (excluding minijacks and Tules) in study	**3241**
Fallback events per Chinook	**0.16**

Night Passage

Night passage (2000-0400 Pacific Standard Time) of tagged Chinook Salmon was under 10% at all mainstem dams except for fall Chinook at Rock Island Dam (Table 20). Higher percentages of night passage were estimated at tributary dams, but sample sizes are relatively small (for example, 5 of only 11 summer Chinook and 2 of 6 fall Chinook passed Prosser Dam at night, Table 20).

Table 20. Chinook Salmon night passage (2000-0400) in 2020 at Columbia Basin dams as estimated by PIT tag detections.

Site	Spring Chinook	Summer Chinook	Fall Chinook
Bonneville	0.5%	0.5%	0.4%
The Dalles	4.0%	3.2%	1.7%
John Day	1.4%	0.8%	0.9%
McNary	2.3%	0.8%	1.1%
Priest Rapids	0.0%	1.4%	3.6%
Rock Island	0.0%	3.0%	11.5%
Rocky Reach	0.0%	2.6%	1.6%
Wells	0.0%	2.7%	2.4%
Ice Harbor	2.4%	2.0%	3.4%
Lower Monumental	0.0%	2.7%	0.6%
Little Goose	1.3%	0.7%	3.0%
Lower Granite	5.1%	2.7%	1.8%
Prosser	16.7%	45.5%	33.3%
Roza	25.0%	14.3%	NA
Tumwater	0.0%	13.2%	NA

Straying

Estimated Chinook stray rates by stock using PBT for those stocks with more than 10 fish that were designated as either putative strays or on-target, ranged from 29.6% for Spring Creek hatchery stocks to 0% for Pahsimmeroi Hatchery (Table 21). The hatcheries with the greatest number of strays were Little White Salmon and Priest Rapids Hatchery (14 each, and all are fall Chinook). Little White Salmon Hatchery strays were all last detected at or upstream of John Day Dam while Priest Rapids Hatchery strays were all detected at or upstream of Rock Island Dam. The combined stray rate estimated using PBT for all stocks was 3.7% with 3.8% categorized as putative overshoots.

Estimated Chinook stray rates by stock using GSI for those stocks with more than 10 fish that were designated as either putative strays or on-target, ranged from 87.5% for the Hells Canyon group (with strays last detected in the Salmon, Imnaha, Grande Ronde, Yakima, Wenatchee, and Methow rivers) to 13.3% for the Deschutes fall Chinook group (Table 22). The combined stray rate estimated using GSI was 20.3%

Table 21. Table showing final-PIT-fate categories by hatchery in 2020 using Parental Based Tagging (PBT). Fate categories are categorized by color. Grey is neutral (meaning last detected on route to expected destinations), green is on target (meaning last detected at their expected destination), yellow is putative overshoot meaning a fish last detected in an area adjacent to its expected destination, and red is putative stray meaning a fish was last detected in tributaries or the mainstem outside their normal route to their expected destination. Stray rates are also tabulated.

Basin or Dam	Bonneville Dam				Bonneville Pool Sites							The Dalles		Deschutes		John Day Dam			Umatilla River	
Stock Classification Using Parental Based Tagging	Oregon Shore Ladder	Spillway Ladder	Lower Washington Shore Ladder	Upper Washington Shore Ladder	Carson Hatchery	Upper Wind River rkm 30	Spring Creek Hatchery	Hood River Mouth	Lyle Falls Fishway, Klickitat R	Klickitat Floating Array at RKM5	Summit Creek, Klickitat	The Dalles-East Ladder	The Dalles-North Ladder	Shear's Falls, Deschutes	Warm Springs River PIT array	John Day Juvenile Bypass	John Day Dam-Oregon Shore	John Day Dam-WA Shore	Three Mile Dam, Umatilla	Umatilla-Feed Dam
PTAGIS site	BO1	BO2	BO3	BO4	CAL	WRU	SCL	HRM	LFF	KLR	SUC	TD1	TD2	DSF	WSH	JDJ	JO1	JO2	TMF	UMW
Carson Hatchery	0	0	0	3	2	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0
Chief Joseph Hatchery (summer/Fall)	0	0	0	13	0	0	0	0	0	0	0	4	1	0	0	0	1	1	0	0
Clearwater Hatchery	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clearwater-Powell Creek Facility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Deschutes (Hatchery)	0	0	0	0	0	0	0	0	0	0	0	1	0	3	1	0	0	0	0	0
Dworshak Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eastbank Hatchery (Summer)	0	0	1	21	0	0	0	0	0	0	0	9	0	0	0	0	2	0	0	0
Entiat Hatchery (Summer)	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0	2	0	0	0
Imnaha	1	0	0	4	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Klickitat Hatchery	0	0	1	10	0	0	0	0	7	0	0	0	0	0	0	0	1	0	0	0
Leavenworth Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Little White Hatchery (fall)	0	0	3	164	0	65	0	2	10	4	0	17	3	0	0	0	3	0	0	1
Little White Salmon (Spring)	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lookingglass hatchery	0	0	0	4	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
McCall Hatchery	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Methow River	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Methow River (Hatchery)	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nez Perce Hatchery	0	0	1	5	0	0	0	0	0	0	0	4	2	0	0	0	2	2	0	0
Pahsimmeroi Hatchery	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Parkdale Fish Facility	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Priest Rapids Hatchery (fall)	1	1	3	51	0	0	0	0	0	0	0	8	2	0	0	0	12	4	0	0
Priest Rapids Hatchery (fall)-Ringold	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rapid River Hatchery	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Sawtooth Hatchery	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spring Creek (Hatchery)	6	2	2	96	0	1	19	1	0	0	0	3	1	0	0	0	0	1	0	0
Umatilla	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Washougal Hatchery	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells Hatchery	0	0	0	8	0	0	0	0	0	0	0	5	0	0	0	1	1	1	0	0
Yakima River Basin-Roza integrated	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
Total	9	3	12	403	2	70	19	4	18	4	1	58	10	3	1	1	26	10	1	1

Basin or Dam	McNary Dam			Snake River Ice Harbor-Lower Granite							Clearwater Basin							Grand Ronde	
Stock Classification Using Parental Based Tagging	McNary-Oregon Shore	McNary-WA Shore	Nursery Bridge-Walla Walla	Ice Harbor Dam	Lower Monumental Ladders	Lower Tucannon River	Little Goose Dam Ladders	Lower Granite Ladders	Lower Granite Juvenile Bypass	Lower Granite Spillway	SF Clearwater rkm 1	SF Clearwater rkm 2	Lower Lochsa	Upper Lochsa	Lower Selway River	Upper Selway River	Dworshak Hatchery	Wallow River rkm 32	Catherine Creek Weir
PTAGIS site	MC1	MC2	NBA	ICH	LMA	LTR	GOA	GRA	GRJ	GRS	SC1	SC2	LRL	LRU	SW1	SW2	DWL	WR2	CCW
Carson Hatchery	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chief Joseph Hatchery (summer/Fall)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clearwater Hatchery	0	0	0	0	0	0	0	1	0	1	3	2	0	0	0	0	0	0	0
Clearwater-Powell Creek Facility	0	1	0	0	0	0	0	1	0	0	0	0	3	4	0	0	0	0	0
Deschutes (Hatchery)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dworshak Hatchery	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0	0
Eastbank Hatchery (Summer)	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Entiat Hatchery (Summer)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Imnaha	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Klickitat Hatchery	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leavenworth Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Little White Hatchery (fall)	4	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Little White Salmon (Spring)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lookingglass hatchery	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	6	2
McCall Hatchery	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Methow River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Methow River (Hatchery)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nez Perce Hatchery	2	0	0	0	0	0	1	20	1	0	2	3	0	0	3	2	0	0	0
Pahsimmeroi Hatchery	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Parkdale Fish Facility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Priest Rapids Hatchery (fall)	58	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Priest Rapids Hatchery (fall)-Ringold	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rapid River Hatchery	0	1	0	0	0	0	0	14	0	2	0	0	0	1	0	0	0	0	0
Sawtooth Hatchery	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0
Spring Creek (Hatchery)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Washougal Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells Hatchery	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yakima River Basin-Roza integrated	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	66	35	1	3	0	1	2	50	1	3	6	6	3	5	3	2	1	6	2

Basin or Dam	Salmon Basin							Imnaha Basin				Yakima					
Stock Classification Using Parental Based Tagging	South Fork Salmon km 15	SF Salmon-Krassel Cr	Upper Grand Ronde	Big Creek	Upper Salmon rkm 437	Upper Salmon rkm 460	Yankee Fork	Imnaha River km 41	Imnaha Weir Adult Ladder	Lower Imnaha	Lower Imnaha	Prosser Dam	Roza Dam	Ringold Hatchery	Priest Rapids Hatchery	Priest Rapids Ladder	Rock Island Dam Ladder
PTAGIS site	SFG	KRS	UGS	TAY	USE	USI	YFK	IR3	IML	IR4	IR5	PRO	ROZ	RSH	PRH	PRA	RIA
Carson Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chief Joseph Hatchery (summer/Fall)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Clearwater Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clearwater-Powell Creek Facility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Deschutes (Hatchery)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dworshak Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eastbank Hatchery (Summer)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2
Entiat Hatchery (Summer)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Imnaha	0	0	0	0	0	0	0	1	11	1	5	0	0	0	0	0	0
Klickitat Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leavenworth Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Little White Hatchery (fall)	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0
Little White Salmon (Spring)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lookingglass hatchery	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
McCall Hatchery	2	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Methow River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Methow River (Hatchery)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nez Perce Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pahsimmeroi Hatchery	0	0	0	0	2	5	0	0	0	0	0	0	0	0	0	0	0
Parkdale Fish Facility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Priest Rapids Hatchery (fall)	0	0	0	0	0	0	0	0	0	0	0	0	0	47	143	38	2
Priest Rapids Hatchery (fall)-Ringold	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rapid River Hatchery	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Sawtooth Hatchery	0	0	0	0	5	8	1	0	0	0	0	0	0	0	0	0	0
Spring Creek (Hatchery)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Washougal Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells Hatchery	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2
Yakima River Basin-Roza integrated	0	0	0	0	0	0	0	1	0	0	0	0	9	0	0	0	0
Total	2	11	2	1	7	13	1	2	11	1	5	3	9	48	144	44	8

Basin or Dam	Wenatchee									Rocky Reach			Entiat				Methow						Okanogan	
Stock Classification Using Parental Based Tagging	Lower Wenatchee River	Icicle Creek	Leavenworth Hatchery	Tumwater Dam Ladder	Lower Chiwawa	Upper Chiwawa	Upper Wenatchee	Lower Nason Creek	Upper Nason Creek	Rocky Reach ladders	Rocky Reach Juvenile Bypass	East Bank Hatchery	Lower Entiat River	Entiat Hatchery	Wells Dam	Wells Hatchery	Methow	Methow River at Carlton	Upper Chewuch	Spring Creek Acclimation Pond	Methow River at Winthrop	Methow Hatchery	Lower Okanogan River	Zosel Dam
PTAGIS site	LWE	ICL	LNF	TUF	CHL	CHU	UWE	NAL	NAU	RRF	RRJ	EBO	ENL	EHL	WEA	WEH	LMR	MRC	CRW	SCP	MRW	MSH	OKL	ZSL
Carson Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chief Joseph Hatchery (summer/Fall)	1	0	0	0	0	0	0	0	0	3	0	0	0	0	73	8	1	0	0	0	0	0	55	1
Clearwater Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clearwater-Powell Creek Facility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Deschutes (Hatchery)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Dworshak Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eastbank Hatchery (Summer)	16	2	0	7	1	3	1	4	5	23	2	6	3	0	64	13	6	17	1	0	1	0	5	0
Entiat Hatchery (Summer)	0	0	0	0	0	0	0	0	0	1	1	0	5	26	1	0	0	0	0	0	0	0	1	0
Imnaha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Klickitat Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leavenworth Hatchery	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Little White Hatchery (fall)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Little White Salmon (Spring)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lookingglass hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
McCall Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Methow River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	2	0	0
Methow River (Hatchery)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	2	1	0	0	0
Nez Perce Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Pahsimmeroi Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Parkdale Fish Facility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Priest Rapids Hatchery (fall)	1	0	0	0	0	0	0	0	0	3	0	4	0	0	2	2	0	0	0	0	0	0	0	0
Priest Rapids Hatchery (fall)-Ringold	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rapid River Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sawtooth Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Spring Creek (Hatchery)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Washougal Hatchery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells Hatchery	0	0	0	0	0	0	0	0	0	2	1	0	1	0	25	37	4	0	0	0	0	0	0	0
Yakima River Basin-Roza integrated	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	18	3	1	7	1	3	1	4	5	32	5	10	9	26	169	60	11	17	2	2	2	2	62	1

Stock Classification Using Parental Based Tagging	Neutral	On Target	Putative Stray	Putative overshoot	%Neutral	%On Target	%Putative Stray	%Putative overshoot	% Strays (strays/(strays+On target)
Carson Hatchery	3	3	2	1	33.3%	33.3%	22.2%	11.1%	40.0%
Chief Joseph Hatchery (summer/Fall)	108	56	2	0	65.1%	33.7%	1.2%	0.0%	3.4%
Clearwater Hatchery	4	5	0	0	44.4%	55.6%	0.0%	0.0%	0.0%
Clearwater-Powell Creek Facility	2	7	0	0	22.2%	77.8%	0.0%	0.0%	0.0%
Deschutes (Hatchery)	1	4	1	0	16.7%	66.7%	16.7%	0.0%	20.0%
Dworshak Hatchery	1	3	0	0	25.0%	75.0%	0.0%	0.0%	0.0%
Eastbank Hatchery (Summer)	39	180	0	0	17.8%	82.2%	0.0%	0.0%	0.0%
Entiat Hatchery (Summer)	8	31	1	1	19.5%	75.6%	2.4%	2.4%	3.1%
Imnaha	9	18			33.3%	66.7%	0.0%	0.0%	0.0%
Klickitat Hatchery	11	7	2	0	55.0%	35.0%	10.0%	0.0%	22.2%
Leavenworth Hatchery		2			0.0%	100.0%	0.0%	0.0%	0.0%
Little White Hatchery (fall)	167	81	14	20	59.2%	28.7%	5.0%	7.1%	14.7%
Little White Salmon (Spring)	1	3	0	0	25.0%	75.0%	0.0%	0.0%	0.0%
Lookingglass hatchery	8	8	3	0	42.1%	42.1%	15.8%	0.0%	27.3%
McCall Hatchery	4	11	2	0	23.5%	64.7%	11.8%	0.0%	15.4%
Methow River	1	3	0	1	20.0%	60.0%	0.0%	20.0%	0.0%
Methow River (Hatchery)	3	3	0		50.0%	50.0%	0.0%	0.0%	0.0%
Nez Perce Hatchery	40	10	1	0	78.4%	19.6%	2.0%	0.0%	9.1%
Pahsimmeroi Hatchery	3	7	0	0	30.0%	70.0%	0.0%	0.0%	0.0%
Parkdale Fish Facility	3	1	0	0	75.0%	25.0%	0.0%	0.0%	0.0%
Priest Rapids Hatchery (fall)	167	190	14	38	40.8%	46.5%	3.4%	9.3%	6.9%
Priest Rapids Hatchery (fall)-Ringold	3	0	0	0	100.0%	0.0%	0.0%	0.0%	NA
Rapid River Hatchery	7	16	2	0	28.0%	64.0%	8.0%	0.0%	11.1%
Sawtooth Hatchery	13	14	1	0	46.4%	50.0%	3.6%	0.0%	6.7%
Spring Creek (Hatchery)	106	19	8	0	79.7%	14.3%	6.0%	0.0%	29.6%
Umatilla	1	1	0	0	50.0%	50.0%	0.0%	0.0%	0.0%
Washougal Hatchery	1	0	0	0	100.0%	0.0%	0.0%	0.0%	NA
Wells Hatchery	48	37	6	0	52.7%	40.7%	6.6%	0.0%	14.0%
Yakima River Basin-Roza integrated	4	9	1	0	28.6%	64.3%	7.1%	0.0%	10.0%
Total	762	720	59	61	47.6%	44.9%	3.7%	3.8%	7.6%

Table 22. Table showing final-PIT-fate categories by hatchery in 2020 using Genetic Stock Identification (GSI). Fate categories are categorized by color. Grey is neutral (meaning last detected on route to expected destinations), green is on target (meaning last detected at their expected destination), yellow is putative overshoot meaning a fish last detected in an area adjacent to its expected destination, and red is putative stray meaning a fish was last detected in tributaries or the mainstem outside their normal route to their expected destination. Stray rates are also tabulated.

	Bonneville Dam			Bonneville Pool					Deschutes					John Day R.			McNary Dam							
Stock Classification using Genetic Stock Identification	Bonneville-Oregon Shore	Bonneville-WA Shore Ladder	Bonneille WA Ladder Slots	Little White Salmon Hatchery	Spring Creek Hatchery	Lyle Falls Fishway, Klickitat R	The Dalles-East Ladder	The Dalles-North Ladder	Deschutes Sherars Falls	Warm Springs River PIT Array	Warm Springs River PIT array	John Day Dam-Oregon Shore	John Day Dam-WA Shore	John Day River, McDonald Ferry	Upper John Day River	Three Mile Dam	McNary-Oregon Shore	McNary-WA Shore	McNary Juvenile Bypass	Ice Harbor Dam	Lower Monumental Ladders	Little Goose Dam	Lower Granite	Lower Granite Spillway
	BO1	BO3	BO4	LWL	SCL	LFF	TD1	TD2	DSF	WSR	WSH	JO1	JO2	JD1	JDM	TMF	MC1	MC2	MCJ	ICH	LMA	GOA	GRA	GRS
	234	234	234	261	269	290	308	308	328	328	328	347	347	351	351	465	470	470	470	522	522	522	522	522
Estuary									3	1														
Cowlitz		2	8				1																	
Willamette		1	4																					
Spr Crk Tule	1		41	1	5			1									1							
Klickitat			1																					
Deschutes			1								2													
John Day			1												2									
Yakima			1				1							1				1			2			
UpColSp			2										1	1			1	1					1	
Hells Canyon			9				5					3	1	1	2								6	
SF Salmon			5											1									1	
Upper Salmon																							1	
MF Salmon																						1	1	
Upper Salmon	1		3					1													1		7	
SR Fall		4	29				23	3	4	1		6	3				17	15		1	1		25	1
Deschutes Fall			5				14	1	12	1														
Upper Columbia Summer	3	8	149	4		3	88	12	3			29	8			1	197	150	1	1	2		23	
Total	5	15	259	5	5	3	132	18	22	3	2	38	13	4	4	1	216	167	1	2	6	1	65	1

	Clearwater River					Grande Ronde				Salmon River											Imnaha		
Stock Classification using Genetic Stock Identification	Dworshak Hatchery	SF Clearwater rkm 2	Lower Lochsa	Upper Lochsa	Lower Selway River	Wallowa River at river km 14	Minam River	Wallow River rkm 32	Upper Grande Ronde	Secesh River at Zena Cr. Ranch	EFSF Salmon River at Parks Cr.	SF Salmon-Krassel Cr	Big Creek at Taylor Ranch	Bear Valley Adult Video Weir	Marsh Creek	Lemhi River Weir	Upper Salmon rkm 437	Upper Salmon rkm 460	Valley Creek, Downstream Site	Valley Creek, Upstream Site	Lower Imnaha	Big Sheep Creek	Lower Imnaha
	DWL	SC2	LRL	LRU	SW1	WR1	MR1	WR2	UGR	ZEN	ESS	KRS	TAY	BRC	MAR	LRW	USE	USI	VC2	VC1	IR2	BSC	IR5
	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522
Estuary																							
Cowlitz																							
Willamette																							
Spr Crk Tule																							
Klickitat																							
Deschutes																							
John Day																							
Yakima																							
UpColSp	1	1			1	1	4					1			1		1						
Hells Canyon		1		1	1	1	1	2	1			3	1		1	1	1					1	1
SF Salmon			1							8	4	3	1				2						1
Upper Salmon																							
MF Salmon												1	2	3	2								
Upper Salmon											1				1		3	4	1	2			
SR Fall		1			2																1		
Deschutes Fall																							
Upper Columbia Summer		1																					
Total	1	4	1	1	4	2	5	2	1	8	5	8	4	3	5	1	7	4	1	2	1	1	2

	Yakima River							Wenatchee River											Entiat					Methow River				Okanogan River			
Stock Classification using Genetic Stock Identification	Prosser Dam	Sunnyside Instream Array	Roza Dam	Ringold Hatchery	Priest Rapids Hatchery	Priest Rapids Ladder	Rock Island Dam Ladder	Lower Wenatchee River	Icicle Creek	Tumwater Dam Ladder	Lower Chiwawa River	Upper Chiwawa	Upper Wenatchee	Lower Nason Creek	Upper Nason Creek	Little Wentachee	Rocky Reach Dam	Rocky Reach Bypass	Lower Entiat River	Entiat Hatchery	Upper Entiat rkm 17	Wells Dam Ladders	Wells Hatchery	Methow	Methow River at Carlton	Upper Chewuch	Spring Creek Acclimation Pond	Lower Okanogan Weir	Zosel Dam Combined	Okangan Channel near Oliver, BC	Penticton Channel PIT Array
	PRO	SUN	ROZ	RSH	PRH	PRA	RIA	LWE	ICL	TUF	CHL	CHU	UWE	NAL	NAU	LWN	RRF	RRJ	ENL	EHL	ENA	WEA	WEH	LMR	MRC	CRU	SCP	OKL	ZSL	OKC	OKP
	539	539	539	567	635	639	730	754	754	754	754	754	754	754	754	754	763	763	778	778	778	830	830	843	843	843	843	858	858	858	858
Estuary																								1							
Cowlitz																															
Willamette																															
Spr Crk Tule																															
Klickitat	1																				1										
Deschutes																															
John Day																															
Yakima	1		9																												
UpColSp			1						1	2	2	1		3							1										
Hells Canyon		1										1			1												1				
SF Salmon																															
Upper Salmon																															
MF Salmon																															
Upper Salmon																										1					
SR Fall	1			2		6																2						6	1		
Deschutes Fall						1	1																								
Upper Columbia Summer	4	1		2	39	44	7	17	2	14			2			1	13	1	3	6	2	55	10	4	4			117	12	4	1
Total	7	2	10	4	39	51	8	17	3	16	2	2	2	3	1	1	13	1	3	6	4	57	10	5	4	1	1	123	13	4	1

Stock Classification using Genetic Stock Identification	Total	Neutral	On Target	Putative Stray	Putative overshoot	%Neutral	%On Target	%Putative Stray	%Putative overshoot	% Strays (strays/(strays+On target)
Estuary	5	0	0	5	0	0.0%	0.0%	100.0%	0.0%	100.0%
Cowlitz	11	0	0	1	10	0.0%	0.0%	9.1%	90.9%	100.0%
Willamette	5	0	0	0	5	0.0%	0.0%	0.0%	100.0%	NA
Spr Crk Tule	50	42	6	1	1	84.0%	12.0%	2.0%	2.0%	14.3%
Klickitat	3	1	0	2	0	33.3%	0.0%	66.7%	0.0%	100.0%
Deschutes	3	1	2	0	0	33.3%	66.7%	0.0%	0.0%	0.0%
John Day	3	1	2	0	0	33.3%	66.7%	0.0%	0.0%	0.0%
Yakima	16	3	10	3	0	18.8%	62.5%	18.8%	0.0%	23.1%
UpColSp	29	5	10	14	0	17.2%	34.5%	48.3%	0.0%	58.3%
Hells Canyon	48	24	3	21	0	50.0%	6.3%	43.8%	0.0%	87.5%
SF Salmon	27	6	15	6	0	22.2%	55.6%	22.2%	0.0%	28.6%
Upper Salmon	1	1	0	0	0	100.0%	0.0%	0.0%	0.0%	NA
MF Salmon	10	2	7	1	0	20.0%	70.0%	10.0%	0.0%	12.5%
Upper Salmon	26	13	10	3	0	50.0%	38.5%	11.5%	0.0%	23.1%
SR Fall	155	133	3	19	0	85.8%	1.9%	12.3%	0.0%	86.4%
Deschutes Fall	35	20	13	2	0	57.1%	37.1%	5.7%	0.0%	13.3%
Upper Columbia Summer	1048	648	362	35	3	61.8%	34.5%	3.3%	0.3%	8.8%
Total	1475	900	443	113	19	61.0%	30.0%	7.7%	1.3%	20.3%

RESULTS-STEELHEAD

Sample Size

A total of 1,484 steelhead were sampled at Bonneville Dam in 2020, of which 1,469 were PIT tagged (Table 23). After adding previously tagged fish (15) (which were sampled and therefore identified for the tracking study and included in our sample) and subtracting the number not detected after release (10), the number of steelhead tracked upstream totaled 1,474 (Table 23). Unlike with spring Chinook where 71.1% of the visual count occurred during the time the AFF was closed, only 0.4% of the steelhead visual count occurred during this period.

Table 23. Number of steelhead PIT tagged at Bonneville Dam and tracked past Bonneville by date and statistical week in 2020.

Dates	Week	Sampled	PIT Tagged	Previously Tagged	Not Detected After Release	Total Tracked	Days Sampling Restrictions in Effect		
							Reduced Sampling-Temp	Reduced Sampling-Shad or Salmon Abundance	No Sampling Due to Temp
No Sampling	16								
No Sampling	17								
No Sampling	18								
No Sampling	19								
No Sampling	20								
5/21-5/22	21	0	0	0	0	0	0	0	0
5/26-29	22	2	2	0	0	2	0	0	0
6/1-6/5	23	2	2	0	0	2	0	5	0
6/8-6/12	24	3	3	0	1	3	0	5	0
6/15-6/19	25	4	4	0	0	4	0	5	0
6/22-6/26	26	7	7	0	0	7	0	5	0
6/29-7/2	27	10	10	0	0	10	0	4	0
7/9-7/10	28	12	12	0	0	12	0	2	0
7/13-7/17	29	68	67	1	0	68	5	0	0
7/20-7/24	30	136	135	1	0	136	5	0	0
7/27-7/30	31	178	176	2	2	178	2	0	0
8/3-8/6	32	181	180	1	1	181	4	0	1
8/10-13	33	149	149	0	2	149	4	0	1
8/17-8/20	34	122	118	4	3	122	4	0	1
8/24-8/27	35	103	101	2	1	103	4	0	1
8/31-9/3	36	62	62	0	0	62	4	0	1
9/9-9/11	37	28	28	0	0	28	0	3	0
9/14,9/16-18	38	74	74	0	0	74	0	4	0
9/21-9/25	39	115	114	1	0	115	0	3	0
9/28-10/2	40	109	107	2	0	109	0	2	0
10/5-10/9	41	70	69	1	0	70	0	0	0
10/13-16	42	49	49	0	0	49	0	0	0
Total		**1484**	**1469**	**15**	**10**	**1474**	**32**	**38**	**5**

Distribution of Sample

The distribution of the sample over the run was relatively similar to the run distribution with the primary exception being weeks 36-38 when the run was undersampled (Figure 15). This was likely because in all three weeks we sampled primarily under protocols c) and d) which required leaving pickets up for some or all of the day which likely reduced our sample size. In addition, nearby forest fires resulted in poor air quality which closed the sampling facilities early on some days. in this period. Details on picket lead protocols can be found in Appendix D. A second exception was at the end of the run after all sampling restrictions had ended; the Chinook run had decreased, and we were sampling mostly steelhead, which resulted in percent sampled higher than percent of run.

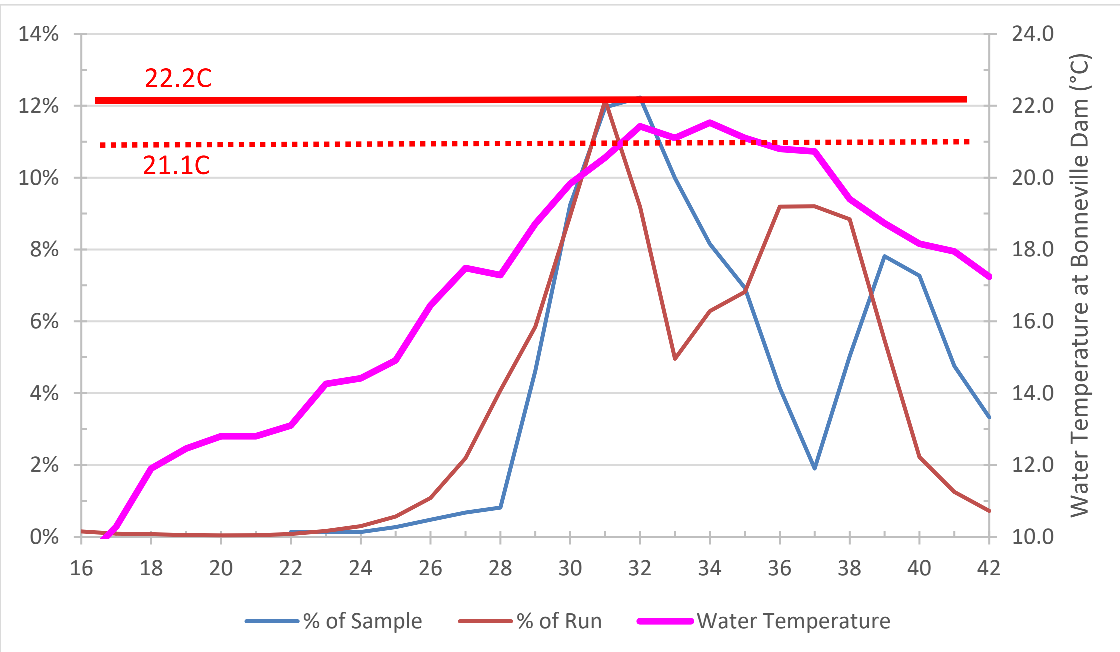

Figure 15. The weekly steelhead sample and run as a percentage of the total sample and run size at Bonneville Dam in 2020. Sampling was reduced at 21.1°C and halted at 22.2°C.

Detection Numbers

The 1,474 steelhead tracked in 2020 through December 31, 2021, generated 101,524 weir detections and 10,943 site detections at 164 sites. Maps and table of sites (Table C1 and Figures C1, C17-C21) found in Appendix C show the categorical ranges of detection numbers at the sites throughout the Columbia Basin.

Bonneville Dam Steelhead Age Composition

The predominant age for 2020 steelhead was 1.2, comprising an estimated 45.0% of the run (Figure 16, Table 24) while Age 2.2 comprised 18.5% and Age r.2 was 24.0%.

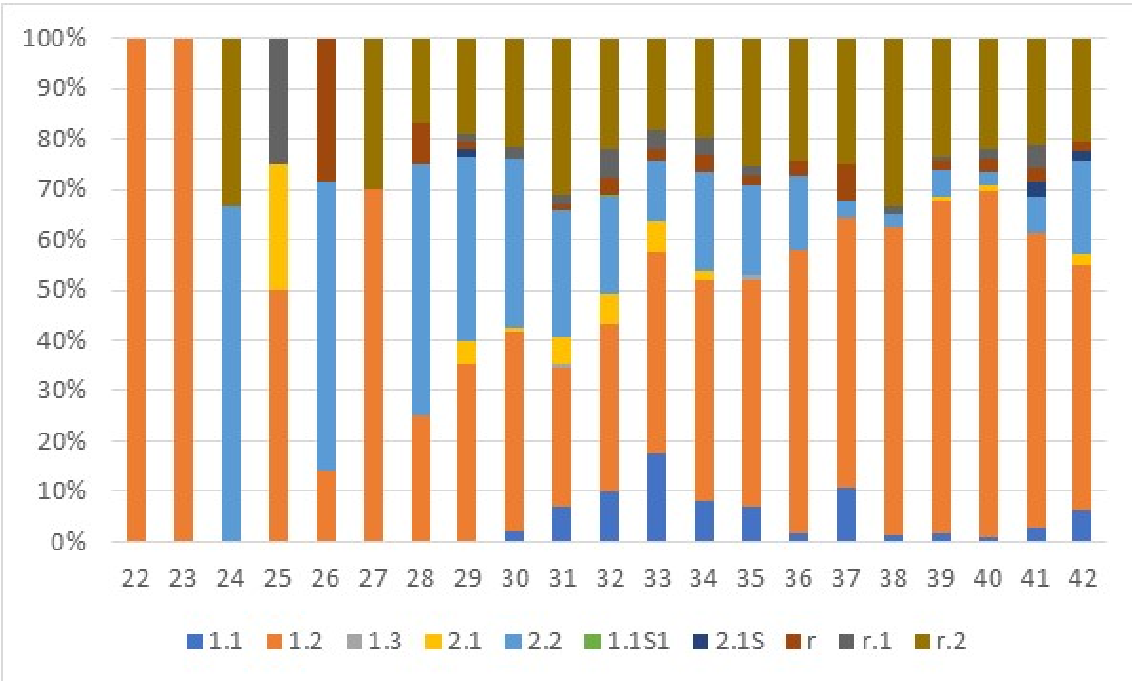

Figure 16. Weekly age composition of steelhead at Bonneville Dam as estimated from scale patterns for age classes in 2020 with weekly abundance.

Table 24. Weekly and total age composition of steelhead at Bonneville Dam as estimated from scale patterns in 2020. Composite age composition estimates are weighted by the percentage of the run passing Bonneville Dam in each week. (r = unreadable)

Week	Weight	N	Brood Year and Age Class								Repeat Spawners
			2017	2016		2015		Freshwater Zone Unageable			
			1.1	1.2	2.1	1.3	2.2	r	r.1	r.2	
22	0.1%	2	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
23	0.2%	2	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
24	0.3%	3	0.0%	0.0%	0.0%	0.0%	66.7%	0.0%	0.0%	33.3%	0.0%
25	0.6%	4	0.0%	50.0%	25.0%	0.0%	0.0%	0.0%	25.0%	0.0%	0.0%
26	1.1%	7	0.0%	14.3%	0.0%	0.0%	57.1%	28.6%	0.0%	0.0%	0.0%
27	2.2%	10	0.0%	70.0%	0.0%	0.0%	0.0%	0.0%	0.0%	30.0%	0.0%
28	4.1%	12	0.0%	25.0%	0.0%	0.0%	50.0%	8.3%	0.0%	16.7%	0.0%
29	5.9%	68	0.0%	35.3%	4.4%	0.0%	36.8%	1.5%	1.5%	19.1%	1.5%
30	9.0%	134	2.2%	39.6%	0.7%	0.0%	33.6%	0.0%	2.2%	21.6%	0.0%
31	12.2%	173	6.9%	27.7%	5.2%	0.6%	25.4%	1.2%	1.7%	31.2%	0.0%
32	9.2%	181	9.9%	33.1%	6.1%	0.0%	19.3%	3.3%	5.5%	22.1%	0.6%
33	5.0%	149	17.4%	40.3%	6.0%	0.0%	12.1%	2.0%	4.0%	18.1%	0.0%
34	6.3%	121	8.3%	43.8%	1.7%	0.0%	19.8%	3.3%	3.3%	19.8%	0.0%
35	6.8%	102	6.9%	45.1%	0.0%	1.0%	17.6%	2.0%	2.0%	25.5%	0.0%
36	9.2%	62	1.6%	56.5%	0.0%	0.0%	14.5%	3.2%	0.0%	24.2%	0.0%
37	9.2%	28	10.7%	53.6%	0.0%	0.0%	3.6%	7.1%	0.0%	25.0%	0.0%
38	8.9%	72	1.4%	61.1%	0.0%	0.0%	2.8%	0.0%	1.4%	33.3%	0.0%
39	5.5%	115	1.7%	66.1%	0.9%	0.0%	5.2%	1.7%	0.9%	23.5%	0.0%
40	2.2%	109	0.9%	68.8%	0.9%	0.0%	2.8%	2.8%	1.8%	22.0%	0.0%
41	1.3%	70	2.9%	58.6%	0.0%	0.0%	7.1%	2.9%	4.3%	21.4%	2.9%
42	0.7%	49	6.1%	49.0%	2.0%	0.0%	18.4%	2.0%	0.0%	20.4%	2.0%
Total	**38.2%**	**1473**	**5.3%**	**45.0%**	**2.2%**	**0.1%**	**18.5%**	**2.8%**	**2.0%**	**24.0%**	**0.4%**

Estimated unweighted age composition was similar at all mainstem dams with little difference in age composition for those steelhead bound for the Snake River (above Ice Harbor) and above Priest Rapids Dam (Table 25 and Figure 17). Upstream length-at-age estimates are in Table 26.

Table 25. Unweighted age composition of steelhead at mainstem dams in 2020 for principal age groups (excluding those steelhead with freshwater zones where age could not be determined).

Dam	N ageable	1.1	1.2	2.1	1.3	2.2	Repeat Spawners
Bonneville	1056	8.4%	63.2%	3.7%	0.2%	24.1%	0.5%
The Dalles	911	9.0%	62.5%	3.6%	0.0%	24.4%	0.5%
John Day	751	8.9%	61.1%	3.6%	0.0%	25.8%	0.5%
McNary	729	9.1%	62.3%	3.3%	0.0%	24.8%	0.5%
Priest Rapids	654	9.6%	65.6%	2.4%	0.0%	22.0%	0.3%
Rock Island	648	9.6%	65.7%	2.5%	0.0%	21.9%	0.3%
Rocky Reach	643	9.6%	66.1%	2.3%	0.0%	21.6%	0.3%
Wells	634	9.5%	66.7%	2.4%	0.0%	21.1%	0.3%
Ice Harbor	578	9.2%	66.8%	2.4%	0.0%	21.3%	0.3%
Lower Monumental	565	8.8%	66.5%	2.5%	0.0%	21.8%	0.4%
Little Goose	548	8.8%	67.0%	2.6%	0.0%	21.5%	0.2%
Lower Granite	530	8.7%	67.2%	2.5%	0.0%	21.5%	0.2%

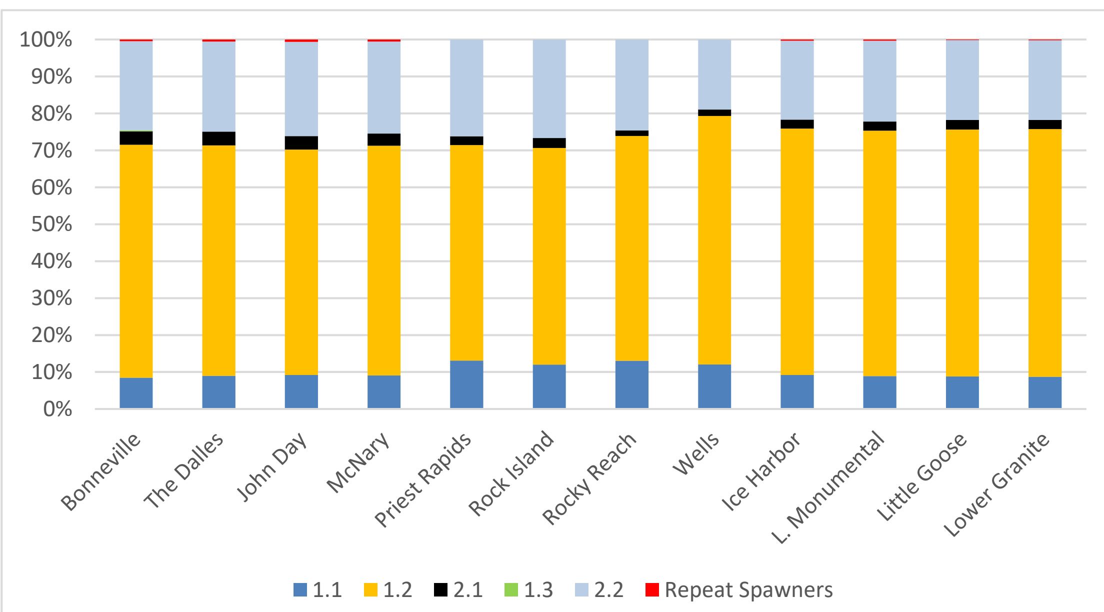

Figure 17. Unweighted age composition of steelhead at mainstem dams in 2020 for principal age groups (excluding those steelhead with freshwater zones where age could not be determined).

Table 26. Steelhead length-at-age composition at mainstem Columbia Basin dams, as estimated by upstream PIT tag detections of steelhead sampled at Bonneville Dam in 2020. (r = unreadable, S=spawning check mark in the scale)

		Age Class									
Dam	**Statistic**	**1.1**	**1.2**	**2.1**	**1.3**	**2.2**	**r**	**r.1**	**r.2**	**1.1S1**	**2.1S**
Bonneville	μ	55.8	75.3	56.5	83.0	71.0	70.1	55.8	74.4	64.5	67.6
	s	4.3	8.5	4.5	10.6	6.0	12.4	3.9	8.9	--	3.4
	n	89	664	39	2	254	33	36	336	1	4
The Dalles	μ	55.8	75.4	56.8		70.7	69.3	55.5	74.1	64.5	67.6
	s	4.4	8.5	4.6		5.9	13.2	3.7	8.9	--	3.4
	n	82	567	33		222	23	31	282	1	4
John Day	μ	55.9	76.0	56.9		71.0	68.8	55.4	74.4	64.5	68.3
	s	4.2	8.4	4.9		5.9	13.2	3.7	7.7	--	3.8
	n	67	457	27		194	21	29	242	1	3
McNary	μ	56.0	76.0	56.9		71.3	68.8	55.4	74.4	64.5	68.3
	s	4.2	8.4	4.9		6.0	13.2	3.8	7.7	--	3.8
	n	66	452	24		181	21	28	239	1	3
Priest Rapids	μ	55.1	70.6	54.0		71.6	77.5	56.0	69.2		
	s	3.1	4.5	0.7		4.5	--	4.2	5.5		
	n	11	49	2		22	1	5	18		
Rock Island	μ	55.3	71.2	54.0		72.1	77.5	55.8	69.4		
	s	2.8	4.0	0.7		4.5	--	4.8	5.4		
	n	9	44	2		20	1	4	16		
Rocky Reach	μ	55.3	71.3	54.5		71.4	77.5	55.8	69.4		
	s	2.8	4.1	--		4.2	--	4.8	5.4		
	n	9	42	1		17	1	4	16		
Wells	μ	54.6	71.4	54.5		70.1	77.5	56.7	69.0		
	s	2.8	4.0	--		4.0	--	5.5	5.7		
	n	7	39	1		11	1	3	14		
Ice Harbor	μ	56.2	76.8	58.2		71.9	72.0	55.5	75.6		67.0
	s	4.2	8.6	5.7		6.2	12.4	3.8	7.8		4.2
	n	53	384	14		123	16	20	192		2
Lower Monumental	μ	56.2	76.8	58.2		71.9	72.0	55.4	75.8		67.0
	s	4.0	8.6	5.7		6.2	12.4	3.8	7.8		4.2
	n	50	374	14		123	16	19	182		2
Little Goose	μ	56.0	77.0	58.2		72.1	72.0	55.4	75.7		64.0
	s	4.0	8.7	5.7		6.2	12.4	3.8	7.8		--
	n	48	365	14		118	16	19	177		1
Lower Granite	μ	56.2	77.1	57.6		72.3	73.2	55.1	75.6		64.0
	s	4.0	8.7	5.5		6.1	11.9	3.3	7.7		--
	n	46	354	13		114	15	16	173		1

Mainstem Dam Recoveries, Mortality, and Escapement Estimates

Data on tag detections through December 31, 2021, was downloaded from www.ptagis.org. An estimated 55.2% of the run was last detected at or above Ice Harbor Dam compared to 6.9% at or above Priest Rapids Dam in 2020 (Figure 18).

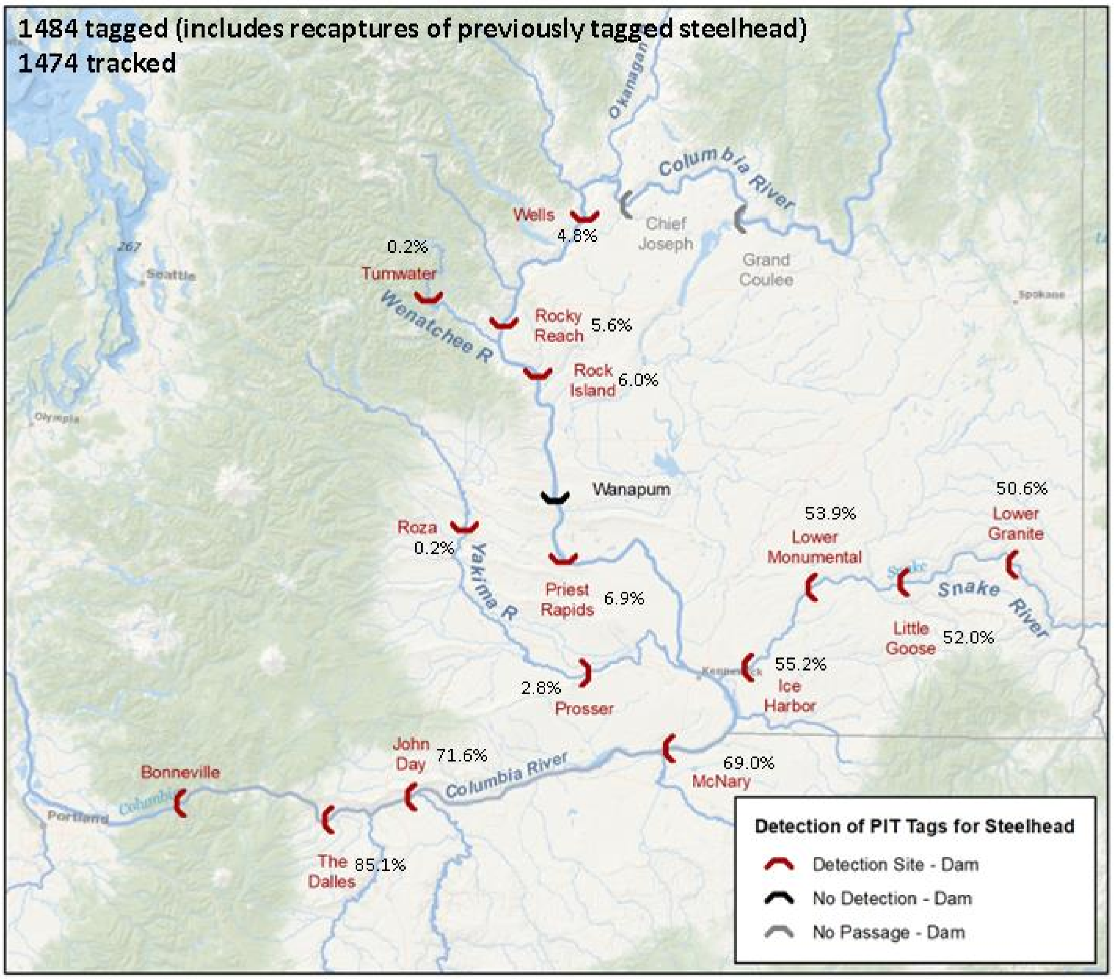

Figure 18. Map of the Columbia River Basin from Bonneville to Wells and Lower Granite dams showing the number of steelhead PIT tagged at Bonneville Dam, and the percentage estimated to pass upstream dams in 2020.

Steelhead last detected in the Snake River dominated the run after weeks 22-27 when sample sizes were small. (Table 27, Figures 19-20).

Table 27. Most upstream detection by Statistical Week and region for steelhead tracked by this study in 2020.

Statistical Week	% of Run	Sample Size	At main-stem dams between Bonneville- and McNary	Tributaries between Bonneville and McNary Dams	Between McNary and Priest Rapids dams	Above Priest Rapids Dam	Above Ice Harbor (Snake River)
22	0.1%	2	50.0%	0.0%	0.0%	0.0%	50.0%
23	0.2%	2	100.0%	0.0%	0.0%	0.0%	0.0%
24	0.3%	3	100.0%	0.0%	0.0%	0.0%	0.0%
25	0.6%	4	75.0%	25.0%	0.0%	0.0%	0.0%
26	1.1%	7	28.6%	0.0%	28.6%	0.0%	42.9%
27	2.2%	10	50.0%	10.0%	10.0%	20.0%	10.0%
28	4.1%	12	33.3%	16.7%	8.3%	0.0%	41.7%
29	5.9%	68	11.8%	14.7%	13.2%	10.3%	50.0%
30	9.0%	136	27.9%	11.0%	9.6%	11.8%	39.7%
31	12.2%	178	26.0%	16.4%	12.4%	6.8%	38.4%
32	9.2%	181	23.9%	7.8%	11.7%	12.8%	43.9%
33	5.0%	149	25.7%	7.4%	8.1%	12.8%	45.9%
34	6.3%	122	30.0%	2.5%	10.0%	8.3%	49.2%
35	6.8%	103	26.5%	2.9%	4.9%	4.9%	60.8%
36	9.2%	62	19.4%	3.2%	1.6%	6.5%	69.4%
37	9.2%	28	17.9%	0.0%	3.6%	0.0%	78.6%
38	8.9%	74	24.3%	0.0%	2.7%	1.4%	71.6%
39	5.5%	115	25.2%	0.0%	1.7%	0.0%	73.0%
40	2.2%	109	19.3%	4.6%	0.0%	0.0%	76.1%
41	1.3%	70	10.0%	0.0%	4.3%	2.9%	82.9%
42	0.7%	49	24.5%	16.3%	8.2%	0.0%	51.0%
Weeks 17-42	**38.2%**	**1,474**	**25.0%**	**6.9%**	**7.4%**	**6.4%**	**54.4%**

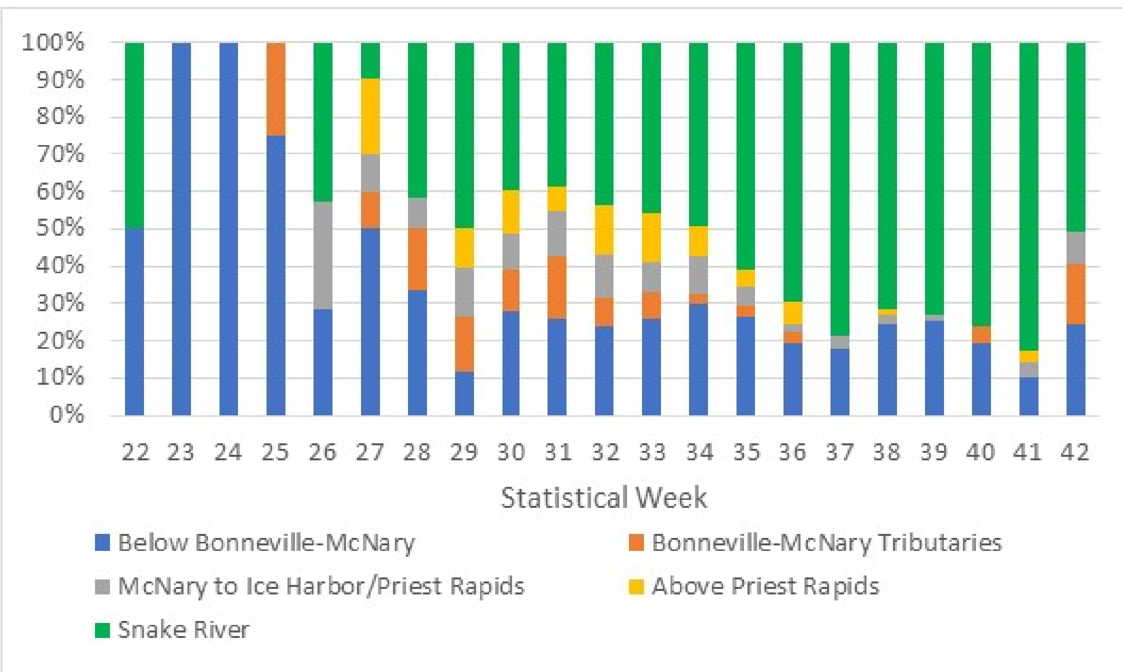

Figure 19. Most upstream detection by Statistical Week and region for steelhead tracked by this study in 2020 as a percentage of the weekly run.

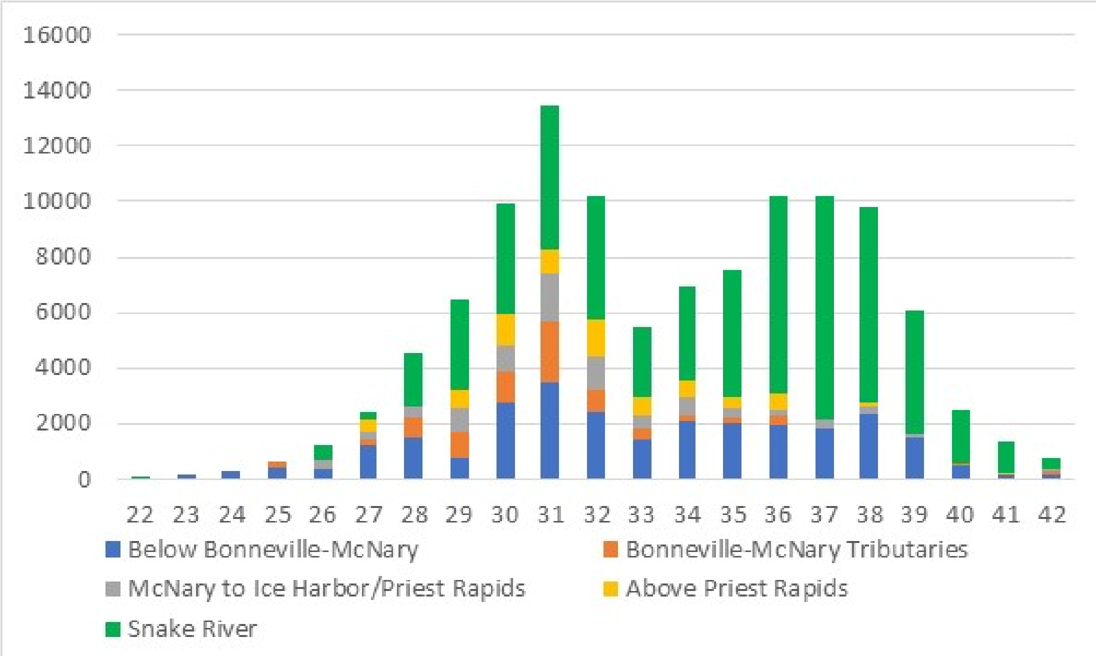

Figure 20. Most upstream detection by Statistical Week and region for steelhead tracked by this study in 2020 as estimated by numbers of fish passing Bonneville Dam by week.

The percentage of PIT tagged steelhead passing a dam without detection was 1% or under (Table 28) at most dams except for The Dalles and John Day dams at 2.1% and 1.2%, respectively.

Table 28. Percentages of steelhead passing a dam undetected that were subsequently detected upstream in 2020.

Dam	Percent not Detected
Bonneville	0.1%
The Dalles	2.1%
John Day	1.2%
McNary	0.9%
Priest Rapids	0.9%
Rock Island	1.0%
Rocky Reach	0.0%
Wells	0.0%
Ice Harbor	0.1%
Lower Monumental	0.3%
Little Goose	0.5%
Lower Granite	0.0%
Mean (weighted by number passing each dam)	**0.7%**

Migration Rates and Passage Time

The fastest median migration rate between mainstem dams, as measured in kilometers per day, was between John Day and McNary dams (22.5 km/day), while the slowest was 3.0 km/day between Bonneville and John Day dams (Table 29).

Table 29. Steelhead migration rate between Columbia Basin dams as estimated by PIT tag detections in 2020.

Dam Pair	Distance (km)	Median Migration Rate (km/day)
Bonneville-The Dalles	74	5.0
The Dalles-John Day	39	3.0
John Day-McNary	123	22.5
Bonneville-John Day	113	4.1
Bonneville - McNary	231	7.4
McNary - Priest Rapids	167	15.8
Priest Rapids - Rock Island	89	10.3
Rock Island - Rocky Reach	33	13.1
Rocky Reach - Wells	65	8.6
Rock Island - Tumwater	68	2.4
Bonneville – Rock Island	487	15.2
Bonneville - Wells	585	14.9
McNary - Ice Harbor	67	8.3
Ice Harbor - Lower Granite	156	11.3
Bonneville-Lower Granite	461	9.5

Lower Granite, Wells, McNary, and Rock Island dams had the greatest median passage time from first to last PIT tag detection among mainstem Columbia Basin dams (Table 30). Passage times at Wells, Lower Granite, Priest Rapids, and Bonneville dams may be inflated because of fish trapping programs delaying fish passage. At many of the dams, passage times are very short, which reflects the very short distance between lower-most and upper-most PIT tag antennas.

Table 30. Steelhead median passage times from time of first detection at a dam to time of last detection and the percentage of steelhead taking more than 12 hours between first detection and last detection in 2020.

Dam	Median Passage Time (minutes)	Percentage with more than 12 hours between first detection and last detection at a dam
Bonneville	6.2	2.6%
The Dalles	0.1	3.4%
John Day	1.3	2.4%
McNary	79.7	4.6%
Priest Rapids	4.8	3.7%
Rock Island	52.2	6.2%
Rocky Reach	8.5	2.2%
Wells	84.1	2.6%
Ice Harbor	3.4	4.2%
Lower Monumental	1.2	7.5%
Little Goose	0.0	3.3%
Lower Granite	156.4	15.4%

Fallback

Estimated minimum fallback rates based on steelhead either reascending fish ladders or steelhead subsequently detected downstream for mainstem Columbia Basin dams ranged from 2.0% at Bonneville Dam to 23.4% at Wells Dam in 2020 (Table 31). These rates likely underestimate the true fallback rates as they do not include any fish that ascended a dam, fell back, and then were not subsequently detected. Steelhead migrating downstream through a fish ladder were not considered fallbacks. Steelhead were detected falling back up to seven times over dams (Table 32). Figures showing examples of the movements of the steelhead with between five and seven fallbacks are in Appendix C (Figures C28 and C29).

Table 31. Estimated minimum steelhead fallback at mainstem Columbia Basin dams in 2020 as estimated by PIT tag[6] detections.

Dam	Number of Fallbacks	Percent Fallback
Bonneville	30	2.0%
The Dalles	71	5.8%
John Day	44	4.0%
McNary	65	6.4%
Priest Rapids	21	19.4%
Rock Island	14	14.4%
Rocky Reach	12	13.3%
Wells	18	23.4%
Ice Harbor	47	5.8%
Lower Monumental	45	5.7%
Little Goose	53	6.9%
Lower Granite	65	8.8%

Table 32. Frequency of fallback events for steelhead tagged by this project in 2020.

Number of Dams Fallen Back Over	Total Number of Steelhead
1	205
2	42
3	23
4	13
5	5
7	1
Number of steelhead falling back at least once	**442**
Precent of steelhead with at least one fallback event	**19.6%**
Total fallback events	**289**
Number of steelhead in study	**1471**
Fallback events per steelhead	**0.30**

Night Passage

Night passage (2000-0400 Pacific Standard Time) by tagged steelhead ranged for the mainstem dams from 0.9% at Bonneville and Priest Rapids dams to 11.7% at Wells Dam (Table 33). The Bonneville Dam estimate is likely biased low as sampling generally took place between 0600 and 1400. Given the median Bonneville Dam passage time of 3.1 minutes (Table 30), steelhead we sampled and tagged would be expected to pass during daytime hours.

[6] Fallback rates do not include steelhead that may have fallen back over a dam and were not subsequently detected.

Table 33. Estimated steelhead night passage (2000-0400 PST) at Columbia Basin dams in 2020.

Site	Percentage Night Passage
Bonneville	0.9%
The Dalles	5.5%
John Day	5.4%
McNary	5.5%
Priest Rapids	0.9%
Rock Island	9.3%
Rocky Reach	2.2%
Wells	11.7%
Ice Harbor	6.2%
Lower Monumental	9.5%
Little Goose	10.0%
Lower Granite	4.2%

B-Run Analyses

A total of 415 B-run steelhead were sampled in 2020 (where B-run is defined as steelhead greater than or equal to 78.0 cm fork length). Among the weeks sampled, the percentage of steelhead sampled and tagged that were classified as B-run peaked in Statistical Week 40 at 78.0% (Figure 21, Table 34). The estimated B-Run escapement at Bonneville Dam (estimated by multiplying the weekly run size, using counting window data, by the percentage B-run in that week estimated by this project) peaked in Week 37 at 7,284 fish while the A-run steelhead peaked in Week 31 at 13,172 fish (Table 34). Among steelhead sampled and detected above McNary Dam and in tributaries between Bonneville and McNary dams (thereby eliminating most of the steelhead that may have been captured in the Zone 6 fishery in the mainstem Columbia between those dams), 96.1% of steelhead with fork lengths 78.0 cm and greater were destined for the Snake Basin, all of which passed Bonneville on or after Week 35 (Figure 22). Among the B-run steelhead sampled at Bonneville Dam where ocean age could be estimated, two-ocean steelhead was comprised of 99.8% of the B-run and 0.2% of three-ocean fish compared to A-run steelhead which were 16.1% one-ocean, 83.8% two-ocean and 0.1% three-ocean (Table 35).

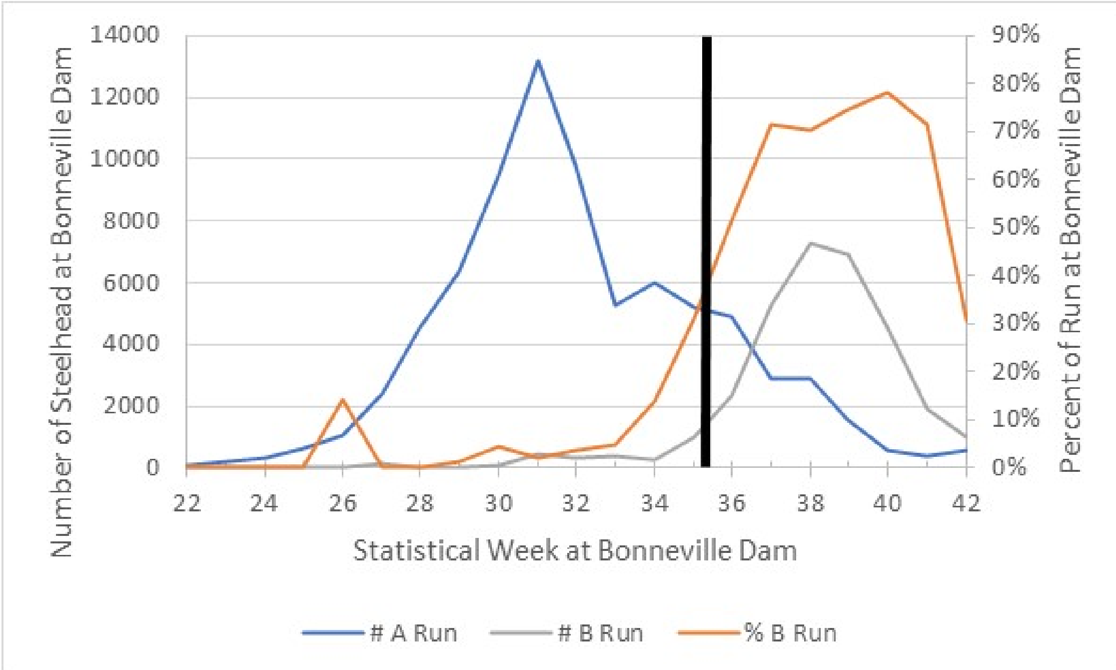

Figure 21. Percentage of B-run steelhead and estimated A- and B-run escapement at Bonneville Dam by statistical week in 2020. The vertical line shows approximately August 25, which is considered the date that separates A- and B-run steelhead.

Table 34. Percentage and number of A- and B-run steelhead estimated at Bonneville Dam by Statistical Week in 2020.

Week	Percent of Run	Sample Size	B-Run Sample Size	% A Run	% B Run	# A Run	# B Run	% B-Run (of those in terminal areas) in Snake River
22	0.1%	2	0	100.0%	0.0%	91	0	-
23	0.2%	2	0	100.0%	0.0%	184	0	-
24	0.3%	3	0	100.0%	0.0%	333	0	-
25	0.6%	4	0	100.0%	0.0%	625	0	-
26	1.1%	7	1	85.7%	14.3%	1029	172	100.0%
27	2.2%	10	0	100.0%	0.0%	2428	0	-
28	4.1%	12	0	100.0%	0.0%	4521	0	-
29	5.9%	68	1	98.5%	1.5%	6386	95	100.0%
30	9.0%	136	6	95.6%	4.4%	9472	437	33.3%
31	12.2%	178	4	97.8%	2.2%	13172	303	-
32	9.2%	181	7	96.1%	3.9%	9789	394	66.7%
33	5.0%	149	5	94.6%	5.4%	5201	295	50.0%
34	6.3%	122	17	86.1%	13.9%	5996	971	85.7%
35	6.8%	103	32	68.9%	31.1%	5210	2348	95.0%
36	9.2%	62	32	48.4%	51.6%	4931	5259	100.0%
37	9.2%	28	20	28.6%	71.4%	2914	7284	100.0%
38	8.9%	74	52	29.7%	70.3%	2914	6887	100.0%
39	5.5%	115	86	25.2%	74.8%	1530	4536	100.0%
40	2.2%	109	85	22.0%	78.0%	543	1921	98.5%
41	1.3%	70	50	28.6%	71.4%	396	991	97.8%
42	0.7%	49	15	69.4%	30.6%	554	245	66.7%
	100.0%	**1484**	**415**	**70.9%**	**29.1%**	**78255**	**32102**	**96.1%**[7]

Table 35. Ocean age composition of A- (<78 cm fork length) and B-Run (≥78 cm fork length) steelhead sampled at Bonneville Dam in 2020 (weighted by run size).

Run	N	One-Ocean (x.1)	Two-Ocean (x.2)	Three Ocean (x.3)
A-Run	1033	16.1%	83.8%	0.1%
B-Run	403	0.0%	99.8%	0.2%
All Steelhead	**1436**	**11.6%**	**88.3%**	**0.1%**

[7] Weighted by the estimated weekly B-run abundance.

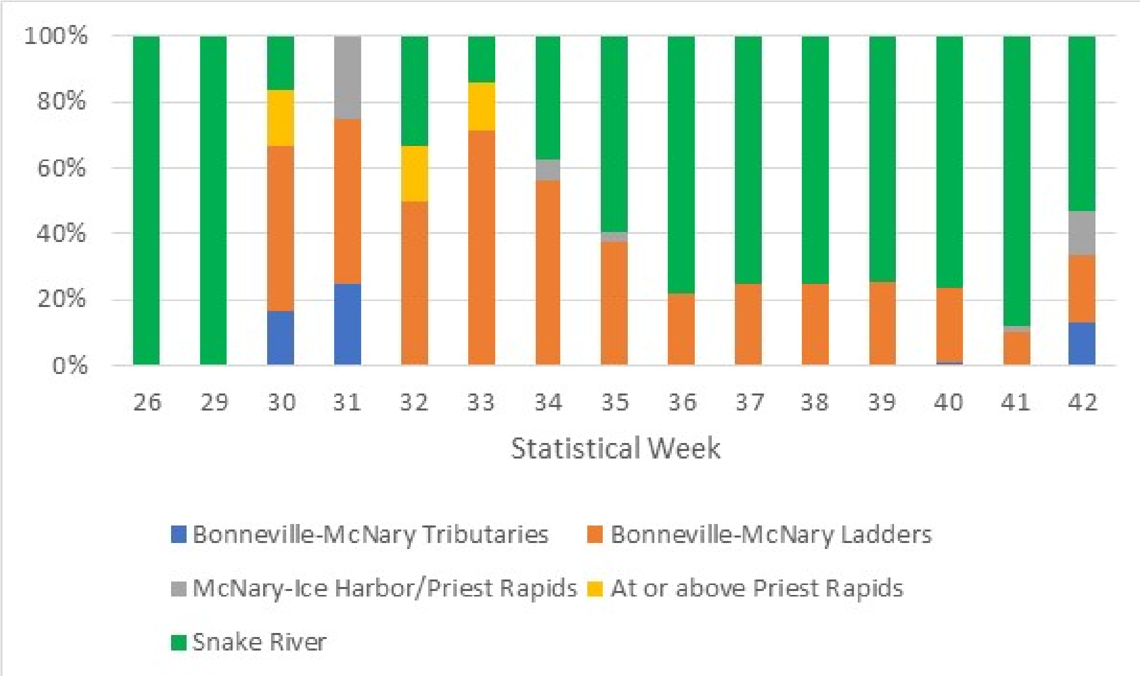

Figure 22. Most upstream detection site for B-run steelhead (≥78 cm fork length) by Statistical Week they were sampled at Bonneville Dam in 2020.

Kelt Analyses

A total of 158 steelhead PIT tagged in 2020 were detected going downstream in the Columbia Basin in late winter, spring, and summer of 2021, presumably attempting to return to the ocean after spawning (kelts), or detected moving back upstream later in 2021, or as part of the Kelt Reconditioning Project (Hatch et. al. multiple years) as spawned-out and moving back downriver or moving back into reaches as reconditioned fish ready to spawn (Tables 36 and C2). At the start of this study in 2009, we assigned a cutoff date of March 31st to define kelts so that any steelhead moving downstream before April 1st were assumed to still be wandering the basin and would eventually spawn. However, in the last few years, as more and more PIT detector systems have been placed in the Columbia Basin, we can now track and observe that several steelhead move out of the system before April 1st after visiting the upper reaches of tributaries (assumed to spawn); usually these fish spawn in the tributaries between Bonneville and McNary dams. Therefore, each year we assess and add several more steelhead that have left the system before the cutoff date to the list of kelts, based on the detailed movements of these fish. In 2020, eight steelhead were moving downriver after spawning before April 1st (Tables 36 and C3) so identified as kelts. The highest percentage of kelt passing Bonneville for weeks where more than 10 steelhead were sampled was in week 28 at 25.0% (n=12, week 25 was also 25.0%

but n=4; week 32 was 20.4% with n=181).The greatest number of kelt was estimated to be in Week 32 at 2,082 steelhead (Figures 23 and 24).

Table 36. Some biological and detection information on the steelhead moving in the Columbia Basin system in 2020 that were determined to be kelts (CRITFC Kelt Project) or repeat spawners and potential kelts (because of their behavior). Please see Appendix C for more details on the detected behavior of the steelhead. (last 3 columns not corrected)

					Most Upstream Site		Last Site Detected		Moving Downstream at Last Detection	Upstream in Summer/ Fall 2021	In Kelt Program
PIT Tag	Date Encountered at AFF	Fin Clip	Age	Fork Length	Basin and Site	Date	Basin and Site	Date			
3DD.003D365540	7/2/2020		r.2	74.5	Snake (GRA)	7/21/2020	Columbia (BCC)	5/19/2021	X		
3DD.003D3655D2	8/17/2020		2.2	79.0	Snake (GRA)	9/4/2020	Snake (GRS)	5/28/2021	X		
3DD.003D3655D3	8/17/2020		2.2	76.0	Snake (GRA)	10/11/2020	Snake (GRS)	4/29/2021	X		
3DD.003D3655D6	8/12/2020	AD	1.1	51.0	Grande Ronde (WR2)	5/19/2021	Grande Ronde (WR2)	5/19/2021	X		
3DD.003D3655FB	8/12/2020		1.2	66.0	Tucannon (JPT)	4/1/2021	Tucannon (JPT)	3/8/2021	X		
3DD.003D3655FF	8/12/2020		2.1	54.0	Umatilla (UMW)	3/17/2021	Columbia (JDJ)	5/18/2021	X		
3DD.003D365626	8/12/2020		2.1	49.0	Snake (GRA)	9/30/2020	Snake (GRS)	4/29/2021	X		
3DD.003D365661	8/18/2020		2.2	76.0	Snake (GRA)	9/12/2020	Columbia (BCC)	6/10/2021	X		
3DD.003D365664	8/19/2020	AD	1.1	58.0	Snake (GRA)	9/29/2020	Snake (GRS)	5/7/2021	X		
3DD.003D365681	8/18/2020		2.2	69.5	Snake (GRA)	10/11/2020	Columbia (BCC)	5/20/2021	X		
3DD.003D365696	8/20/2020	AD	1.1	54.5	Tucannon (JPT)	5/2/2021	Columbia (MCJ)	5/6/2021	X		
3DD.003D365698	8/20/2020		1.2	70.5	Tucannon (BBT)	3/24/2021	Tucannon (BBT)	3/2/2021	X		
3DD.003D365699	8/19/2020		1.2	71.5	Grande Ronde (JOC)	4/3/2021	Snake (GRJ)	4/11/2021	X		
3DD.003D3656AA	8/19/2020		1.2	80.0	Clearwater (LRU)	3/28/2021	Snake (GRS)	5/19/2021	X		
3DD.003D3656AF	8/20/2020		2.2	66.5	Entiat (MAD)	4/14/2021	Columbia (RRJ)	5/2/2021	X		
3DD.003D3656C8	8/19/2020		r	53.5	Columbia (MC2)	9/17/2020	Columbia (BCC)	5/21/2021	X		
3DD.003D3656D7	8/19/2020	AD	1.2	68.5	Snake (GRA)	10/10/2020	Tucannon (MTR)	3/1/2021	X		
3DD.003D3656D8	8/24/2020		2.2	69.5	Snake (GRA)	10/24/2020	Tucannon (UTR)	3/24/2021	X		
3DD.003D3656ED	8/20/2020	AD	1.2	73.5	Snake (GRA)	9/29/2020	Snake (GRS)	4/15/2021	X		
3DD.003D3656F0	8/20/2020		1.2	73.0	Yakima (ROZ)	4/6/2021	Yakima (LWC)	4/8/2021	X		X

PIT Tag	Date Encountered at AFF	Fin Clip	Age	Fork Length	Most Upstream Site: Basin and Site	Most Upstream Site: Date	Last Site Detected: Basin and Site	Last Site Detected: Date	Moving Downstream at Last Detection	Upstream in Summer/ Fall 2021	In Kelt Program
3DD.003D36571E	8/26/2020	AD	r.2	85.0	Clearwater (SC2)	4/22/2021	Clearwater (SC2)	4/22/2021	X		
3DD.003D365735	8/27/2020		2.2	77.0	Clearwater (LRU)	3/28/2021	Snake (GRS)	5/24/2021	X		
3DD.003D365737	8/26/2020	AD	1.2	65.0	Grande Ronde (WR2)	4/23/2021	Grande Ronde (WR2)	4/16/2021	X		
3DD.003D365757	8/26/2020		2.2	77.0	Clearwater (SEL)	5/21/2021	Salmon (LRL)	5/27/2021	X		
3DD.003D365763	8/24/2020		2.2	79.0	Salmon (ESS)	4/24/2021	Snake (GRS)	5/23/2021	X		
3DD.003D365764	8/20/2020	AD	2.2	67.0	Methow (TWR)	4/18/2021	Columbia (BCC)	5/10/2021	X		
3DD.003D3658CB	8/24/2020		r.2	66.5	Tucannon (JPT)	3/26/2021	Tucannon (JPT)	3/26/2021	X		
3DD.003D3659B6	8/6/2020		2.2	72.5	Umatilla (UMW)	3/24/2021	Umatilla (UMW)	3/24/2021	X		
3DD.003D3659BC	8/5/2020		2.2	65.0	Tucannon (JPT)	3/22/2021	Tucannon (JPT)	2/25/2021	X		
3DD.003D3659C1	8/4/2020		r.2	70.5	Grande Ronde (WR2)	5/24/2021	Grande Ronde (WR1)	5/24/2021	X		
3DD.003D3659C2	8/6/2020	AD	r.2	71.0	Tucannon (JPT)	3/10/2021	Tucannon (JPT)	3/10/2021	X		
3DD.003D3659D0	8/4/2020		r.2	69.5	Snake (GRA)	3/2/2021	Tucannon (UTR)	3/21/2021	X		
3DD.003D3659DD	8/5/2020		r.2	67.5	Columbia (BO2)	8/6/2020	Columbia (TWX)	4/14/2021	X		
3DD.003D3659E1	8/5/2020		2.2	80.5	Snake (GRA)	10/9/2020	Snake (GRS)	4/17/2021	X		
3DD.003D3659F1	8/4/2020		2.1	52.5	Grande Ronde (JOC)	4/20/2021	Columbia (BCC)	5/11/2021	X		
3DD.003D3659F6	8/6/2020		2.2	68.0	Yakima (SAT)	4/29/2021	Yakima (SAT)	4/14/2021	X		
3DD.003D3659F8	8/5/2020		r.2	71.5	Snake (GRA)	9/17/2020	Snake (GRS)	5/15/2021	X		
3DD.003D3659FD	8/6/2020	AD	1.2	72.5	Tucannon (MTR)	3/27/2021	Tucannon (MTR)	3/20/2021	X		
3DD.003D365A02	8/5/2020		2.2	65.5	Snake (GRA)	3/21/2021	Columbia (BCC)	5/15/2021	X		
3DD.003D365A08	8/6/2020		2.1	61.5	Salmon (YFK)	6/1/2021	Salmon (USI)	6/3/2021	X		
3DD.003D365A09	8/6/2020		2.2	78.0	Snake (GRA)	9/19/2020	Snake (GRS)	5/17/2021	X		
3DD.003D365A0B	8/6/2020		2.2	65.5	Yakima (PRO)	10/23/2020	Columbia (BCC)	5/29/2021	X		

PIT Tag	Date Encountered at AFF	Fin Clip	Age	Fork Length	Most Upstream Site		Last Site Detected		Moving Downstream at Last Detection	Upstream in Summer/ Fall 2021	In Kelt Program
					Basin and Site	Date	Basin and Site	Date			
3DD.003D365A20	8/11/2020		2.2	74.0	Grande Ronde (WR2)	5/29/2021	Grande Ronde (WR2)	5/1/2021	X		
3DD.003D365A2F	8/10/2020		2.1	54.5	Snake (GRA)	3/31/2021	Columbia (B2J)	5/31/2021	X		
3DD.003D365A3A	8/10/2020		2.1	53.5	Wenatchee (MCL)	5/11/2021	Wenatchee (MCL)	3/26/2021	X		
3DD.003D365A4D	8/12/2020		2.2	67.0	Snake (GRA)	10/6/2020	Snake (GRS)	5/3/2021	X		
3DD.003D365A65	8/11/2020	AD	1.2	61.5	Snake (GRA)	10/14/2020	Snake (GOJ)	3/31/2021	X		
3DD.003D365A69	8/11/2020		2.2	66.5	Grande Ronde (JOC)	4/14/2021	Snake (GRS)	4/27/2021	X		
3DD.003D365A6F	8/11/2020	AD	r	77.5	Methow (LMR)	9/24/2020	Columbia (WEJ)	4/19/2021	X		
3DD.003D365A77	8/11/2020	AD	r.2	65.5	Snake (GRA)	9/25/2020	Columbia (BCC)	5/15/2021	X		
3DD.003D365A7D	8/3/2020		2.2	68.5	Snake (ACM)	4/6/2021	Snake (GRS)	4/26/2021	X		
3DD.003D365A7F	8/3/2020		1.2	75.5	Columbia (WEA)	8/24/2020	Columbia(BO4)	9/18/2021	X	X	
3DD.003D365A85	8/3/2020		r	50.5	Yakima (SAT)	4/11/2021	Yakima (SAT)	3/6/2021	X		X
3DD.003D365A8A	7/30/2020	AD	1.2	64.5	Snake (GRA)	10/13/2020	Snake (GRS)	5/7/2021	X		
3DD.003D365AA4	8/3/2020		1.1	63.0	Yakima (SAT)	4/7/2021	Yakima (SAT)	1/16/2021	X		
3DD.003D365AA5	8/3/2020	AD	1.1	52.5	Columbia (WEA)	8/23/2020	Columbia (RRJ)	4/21/2021	X		
3DD.003D365AAE	8/3/2020		r	54.5	Tucannon (TPJ)	5/13/2021	Tucannon (TPJ)	4/22/2021	X		
3DD.003D365AB3	8/4/2020		1.2	72.0	Umatilla (UMW)	3/19/2021	Umatilla (TMF)	03/21/2021	X		
3DD.003D365AC3	7/30/2020	AD	r.2	60.0	Okanogan (NMC)	4/26/2021	Okanogan (NMC)	4/18/2021	X		
3DD.003D365AD3	7/30/2020		2.1	52.5	Grande Ronde (WR1)	5/30/2021	Grande Ronde (WR1)	2/23/2021	X		
3DD.003D365AD6	8/3/2020		2.2	68.0	Clearwater (SWT)	3/19/2021	Columbia (BCC)	4/30/2021	X		
3DD.003D365AD7	8/4/2020		r	69.5	Salmon (YFK)	4/19/2021	Snake (GRS)	5/21/2021	X		
3DD.003D365ADB	8/4/2020	AD	r.2	76.5	Snake (GRA)	10/2/2020	Snake (GRS)	4/17/2021	X		
3DD.003D365AE4	8/4/2020		2.2	76.5	Snake (GRA)	9/29/2020	Snake (GRS)	4/18/2021	X		

PIT Tag	Date Encountered at AFF	Fin Clip	Age	Fork Length	Most Upstream Site		Last Site Detected		Moving Downstream at Last Detection	Upstream in Summer/ Fall 2021	In Kelt Program
					Basin and Site	Date	Basin and Site	Date			
3DD.003D365AE6	8/4/2020		2.2	74.5	Yakima (SAT)	4/11/2021	Yakima (SAT)	3/17/2021	X		X
3DD.003D365AEB	8/6/2020		2.2	66.0	Grande Ronde (WR2)	4/30/2021	Grande Ronde (WR2)	4/30/2021	X		
3DD.003D365B0E	8/5/2020	AD	1.2	68.0	Tucannon (JPT)	3/29/2021	Tucannon (JPT)	3/29/2021	X		
3DD.003D365B3B	8/5/2020		2.2	70.5	Snake (GRA)	10/4/2020	Columbia (BCC)	5/7/2021	X		
3DD.003D365B8D	9/3/2020	AD	1.2	81.0	Salmon (YFK)	4/26/2021	Snake (GRS)	5/9/2021	X		
3DD.003D365BD1	9/3/2020		1.2	76.0	Tucannon (MTR)	4/1/2021	Tucannon (MTR)	3/23/2021	X		
3DD.003D365BD3	9/3/2020		2.2	72.0	Salmon (SFG)	4/8/2021	Columbia (BCC)	5/20/2021	X		
3DD.003D365BDA	9/3/2020		2.2	71.0	Grande Ronde (JOC)	3/31/2021	Columbia (BCC)	5/4/2021	X		
3DD.003D53A8EB	6/23/2020		2.2	68.0	Snake (GOA)	3/21/2021	Tucannon (JPT)	4/13/2021	X		
3DD.003D53A977	7/20/2020	AD	1.2	66.5	Columbia (WEA)	9/11/2020	Columbia (RRJ)	5/11/2021	X		
3DD.003D53A981	7/21/2020	AD	1.2	71.5	Columbia (WEA)	8/15/2020	Columbia (RRJ)	5/3/2021	X		
3DD.003D53A9B0	7/27/2020		2.2	68.5	Snake (GRA)	10/11/2020	Columbia (BCC)	5/26/2021	X		
3DD.003D53A9E7	7/28/2020		1.2	58.0	Yakima (SAT)	3/19/2021	Yakima (PRO)	10/29/2021	X	X	X
3DD.003D53A9EC	7/28/2020		r.2	70.5	Grande Ronde (MR1)	5/1/2021	Snake (GRS)	5/29/2021	X		
3DD.003D53AA4D	7/24/2020		2.2	72.0	Snake (GRA)	9/25/2020	Snake (GRS)	5/17/2021	X		
3DD.003D53AA4F	7/27/2020		2.2	74.0	Clearwater (LAP)	4/29/2021	Clearwater (LAP)	3/20/2021	X		
3DD.003D53AAC7	7/1/2020		r.2	68.5	Okanogan (WHC)	4/21/2021	Columbia (RRJ)	4/25/2021	X		
3DD.003D53AB98	7/10/2020		2.2	62.5	Columbia (JD1)	12/21/2020	Columbia (BCC)	5/5/2021	X		
3DD.003D53ABDC	7/9/2020		2.2	63.0	Snake (LMA)	7/20/2020	Columbia (BCC)	4/21/2021	X		
3DD.003D53ABFA	7/29/2020	AD	1.2	73.0	Columbia (BO4)	3/18/2021	Columbia (BCC)	3/18/2021	X		

PIT Tag	Date Encountered at AFF	Fin Clip	Age	Fork Length	Most Upstream Site		Last Site Detected		Moving Downstream at Last Detection	Upstream in Summer/ Fall 2021	In Kelt Program
					Basin and Site	Date	Basin and Site	Date			
3DD.003D53AC05	7/28/2020		2.2	67.0	Columbia (MC1)	9/28/2020	Columbia (BCC)	4/28/2021	X		
3DD.003D53AC0D	7/29/2020		r	57.0	Snake (AFC)	4/13/2021	Snake (AFC)	3/29/2021	X		
3DD.003D53AC12	7/29/2020	AD	1.2	60.5	Snake (GOA)	10/21/2020	Tucannon (LTR)	3/8/2021	X		
3DD.003D53AC36	7/29/2020		2.2	67.0	Yakima (SAT)	4/26/2021	Yakima (SAT)	3/30/2021	X		X
3DD.003D53AC71	6/16/2020		2.1	55.5	Hood (TRA)	5/4/2021	Columbia (BCC)	5/16/2021	X		
3DD.003D53ADCC	7/15/2020		r.2	73.5	Tucannon (JPT)	4/5/2021	Tucannon (BBT)	4/8/2021	X		
3DD.003D53ADDD	7/15/2020		2.2	72.5	Grande Ronde (WR2)	3/22/2021	Grande Ronde (WR1)	4/15/2021	X		
3DD.003D53ADEB	7/29/2020		r.2	79.5	Yakima (SAT)	3/10/2021	Columbia (BCC)	4/3/2021	X		
3DD.003D53ADF2	7/23/2020		r.2	75.5	Methow (BVC)	5/9/2021	Columbia (RRJ)	5/20/2021	X		
3DD.003D53AE0C	7/27/2020		r.2	65.5	Columbia (MC1)	9/24/2020	Umatilla (TMF)	5/13/2021	X		
3DD.003D53AE0D	7/29/2020	AD	1.1	55.5	Snake (GRA)	10/19/2020	Tucannon (JPT)	3/22/2021	X		
3DD.003D53AE0E	7/28/2020		1.2	69.5	Umatilla (UMW)	4/10/2021	Umatilla (UMW)	4/10/2021	X		
3DD.003D53AE24	7/23/2020	AD	1.2	70.0	Snake (GRA)	10/1/2020	Snake (LMJ)	4/1/2021	X		
3DD.003D53AE3C	7/27/2020		1 scale upside down	72.0	Grande Ronde (JOC)	4/18/2021	Grande Ronde (JOC)	3/20/2021	X		
3DD.003D53AF22	7/10/2020		2.2	67.0	Grande Ronde (JOC)	4/9/2021	Grande Ronde (JOC)	3/4/2021	X		
3DD.003D53AF54	7/13/2020		2.2	68.0	Salmon (MAR)	5/7/2021	Columbia (BCC)	5/29/2021	X		
3DD.003D53AF8F	7/21/2020		2.2	77.5	Wenatchee (TUF)	8/16/2020	Columbia (BCC)	4/29/2021	X		
3DD.003D53AF91	7/21/2020		r.2	70.5	Grande Ronde (MR1)	3/29/2021	Grande Ronde (MR1)	3/20/2021	X		
3DD.003D53AFA1	7/21/2020		2.2	71.5	Grande Ronde (UGR)	3/5/2021	Snake (GRS)	4/29/2021	X		
3DD.003D53AFAC	7/21/2020		2.2	69.5	Imnaha (IR3)	4/30/2021	Columbia (BCC)	6/6/2021	X		

					Most Upstream Site		Last Site Detected		Moving Downstream at Last Detection	Upstream in Summer/ Fall 2021	In Kelt Program
PIT Tag	Date Encountered at AFF	Fin Clip	Age	Fork Length	Basin and Site	Date	Basin and Site	Date			
3DD.003D53AFB7	7/21/2020	AD	1.2	73.0	Methow (LMR)	4/15/2021	Columbia (RRJ)	4/30/2021	X		
3DD.003D53AFCE	7/21/2020		2.2	69.5	Grande Ronde (MR1)	5/31/2021	Columbia (BCC)	6/22/2021	X		
3DD.003D53B114	7/17/2020		2.2	66.5	Yakima (TP2)	4/7/2021	Columbia (BCC)	5/7/2021	X		
3DD.003D53B13B	7/17/2020		2.1	52.5	Yakima (SAT)	4/17/2021	Yakima (SAT)	1/17/2021	X		X
3DD.003D53B13C	7/17/2020		2.2	70.0	Wenatchee (CRW)	4/12/2021	Columbia (RRJ)	4/22/2021	X		
3DD.003D53B15D	7/16/2020		2.2	65.5	Columbia (JD1)	11/5/2020	Columbia (BCC)	5/13/2021	X		
3DD.003D53B170	7/16/2020		2.1S	70.0	Tucannon (MTR)	2/28/2022	Tucannon (MTR)	2/28/2022	X	X	
3DD.003D53B19B	7/16/2020		2.2	70.0	Salmon (PCA)	4/6/2021	Columbia (BCC)	6/2/2021	X		
3DD.003D53B1CD	7/23/2020		R.2	73.0	Walla Walla (NBA)	3/4/2021	Columbia (BCC)	4/26/2021	X		
3DD.003D53B1D6	7/23/2020		2.2	69.5	Columbia (MC1)	10/22/2020	Columbia (BCC)	5/7/2021	X		
3DD.003D53B200	7/23/2020		r.1	54.0	Yakima (SAT)	4/13/2021	Yakima (SAT)	1/16/2021	X		
3DD.003D53B202	7/23/2020		2.2	65.0	Wenatchee (WEN)	4/30/2021	Snake (GRS)	5/19/2021	X		
3DD.003D53B205	7/22/2020		2.2	67.0	Grande Ronde (MR1)	4/21/2021	Snake (GRS)	5/1/2021	X		
3DD.003D53B209	7/22/2020		1.2	71.0	Columbia (RIA)	8/29/2020	Tucannon (JPT)	4/18/2021	X		
3DD.003D53ECA7	9/18/2020	AD	r.2	78.5	Clearwater (SC1)	2/27/2021	Snake (GRS)	5/1/2021	X		
3DD.003D53EE07	9/24/2020		2.2	82.0	Clearwater (SEL)	3/17/2021	Snake (GRS)	5/17/2021	X		
3DD.003D53EE6F	9/28/2020	AD	1.2	66.5	Snake (ACM)	4/8/2021	Snake (ACM)	4/1/2021	X		
3DD.003D53EE76	9/28/2020		r.2	71.0	Snake (GRA)	10/25/2020	Columbia (BCC)	4/24/2021	X		
3DD.003D53EE98	9/25/2020		1.2	80.5	Clearwater (SC2)	4/14/2021	Clearwater (SC2)	3/3/2021	X		
3DD.003D53EED4	9/18/2020	AD	1.2	86.5	Snake (GRA)	10/12/2020	Snake (GRS)	3/28/2021	X		

PIT Tag	Date Encountered at AFF	Fin Clip	Age	Fork Length	Most Upstream Site: Basin and Site	Most Upstream Site: Date	Last Site Detected: Basin and Site	Last Site Detected: Date	Moving Downstream at Last Detection	Upstream in Summer/ Fall 2021	In Kelt Program
3DD.003D53EF07	9/18/2020		r.2	80.0	Clearwater (LC2)	4/30/2021	Clearwater (LC2)	4/2/2021	X		
3DD.003D53EF2C	9/22/2020		1.2	82.5	Tucannon (LTR)	4/11/2021	Tucannon (LTR)	4/3/2021	X		
3DD.003D53EF40	9/22/2020		2.2	83.0	Clearwater (LRU)	3/23/2021	Snake (GRS)	5/16/2021	X		
3DD.003D53EF53	9/22/2020	AD	1.2	84.5	Snake (GRA)	3/22/2021	Snake (GRS)	4/16/2021	X		
3DD.003D53EF5C	9/22/2020		r.2	76.0	Snake (GRA)	10/15/2020	Columbia (MCJ)	4/23/2021	X		
3DD.003D53EFB3	9/29/2020		r	93.0	Snake (GRA)	2/27/2021	Snake (GRS)	5/2/2021	X		
3DD.003D53F00F	9/16/2020		r.2	82.0	Salmon (ZEN)	5/14/2021	Columbia (BCC)	6/7/2021	X		
3DD.003D53F029	9/16/2020	AD	1.2	76.0	Clearwater (SC2)	3/18/2021	Clearwater (SC2)	3/18/2021	X		
3DD.003D6316BA	10/2/2020		1.2	76.0	Salmon (USE)	4/4/2021	Snake (GRS)	5/7/2021	X		
3DD.003D6318DC	10/13/2020		1.1	61.0	Imnaha (GCM)	5/21/2021	Imnaha (GCM)	4/28/2021	X		
3DD.003D6318F8	10/14/2020		2.2	66.0	Tucannon (LTR)	5/5/2021	Tucannon (LTR)	4/30/2021	X		
3DD.003D631921	10/14/2020	AD	1.2	68.0	Tucannon (JPT)	4/16/2021	Tucannon (JPT)	4/3/2021	X		
3DD.003D631928	10/9/2020		2.1S	64.0	Salmon (WB1)	4/24/2021	Columbia (BCC)	5/29/2021	X		
3DD.003D6319E1	10/6/2020		2.1S	71.0	Yakima (TP2)	4/25/2021	Yakima (TP2)	4/9/2021	X		
3DD.003D631A2F	10/7/2020		2.2	73.0	Clearwater (SC2)	5/25/2021	Clearwater (SC2)	3/16/2021	X		
3DD.003DA24F9D	8/13/2020		r.2	64.0	Wenatchee (CHW)	5/5/2021	Wenatchee (CHW)	4/6/2021	X		
3DD.003DA24FAA	8/31/2020		1.2	77.5	Clearwater (LRU)	5/14/2021	Clearwater (LRU)	3/18/2021	X		
3DD.003DA24FAD	7/30/2020		2.2	69.0	Grande Ronde (JOC)	3/22/2021	Snake (GRS)	4/7/2021	X		
3DD.003DA24FB8	8/4/2020		r.2	71.5	Salmon (HYC)	6/1/2021	Salmon (HYC)	6/1/2021	X		
3DD.003DA24FC9	8/4/2020		2.2	73.5	Grande Ronde (JOC)	4/4/2021	Grande Ronde (JOC)	2/25/2021	X		
3DD.003DA24FCE	8/20/2020		2.2	65.0	Snake (GOA)	12/1/2020	Tucannon (JPT)	5/14/2021	X		

PIT Tag	Date Encountered at AFF	Fin Clip	Age	Fork Length	Most Upstream Site: Basin and Site	Most Upstream Site: Date	Last Site Detected: Basin and Site	Last Site Detected: Date	Moving Downstream at Last Detection	Upstream in Summer/ Fall 2021	In Kelt Program
3DD.003DA24FD2	8/6/2020		1.2	69.5	Methow (TWR)	4/4/2021	Methow (MRC)	4/7/2021	X		
3DD.003DA24FD8	9/16/2020		2.2	72.0	Salmon (KRS)	5/27/2021	Columbia (JDJ)	6/12/2021	X		
3DD.003DA24FDC	8/6/2020		r.2	64.5	Okanogan (OBF)	4/22/2021	Columbia (RRJ)	4/30/2021	X		
3DD.003DA24FDD	8/6/2020		1.1S1	64.5	Yakima (PRO)	9/15/2020	Columbia (BCC)	5/18/2021	X		
3DD.003DA24FE5	8/20/2020		1.2	63.5	Salmon (HYC)	5/12/2021	Salmon (HYC)	5/12/2021	X		
3DD.003DA24FF0	8/4/2020		2.2	68.5	Yakima (SAT)	3/12/2021	Yakima (SAT)	2/22/2021	X		
3DD.00776669B4	8/4/2020		r.2	71.5	Tucannon (MTR)	4/18/2021	Tucannon (MTR)	3/27/2021	X		
3DD.0077A2F97F	8/24/2020		2.2	64.0	Salmon (USE)	3/28/2021	Snake (GRS)	5/9/2021	X		
3DD.0077BB89FA	7/23/2020		1.1	56.5	Salmon (LLR)	6/30/2021	Salmon (LLR)	5/1/2021	X		

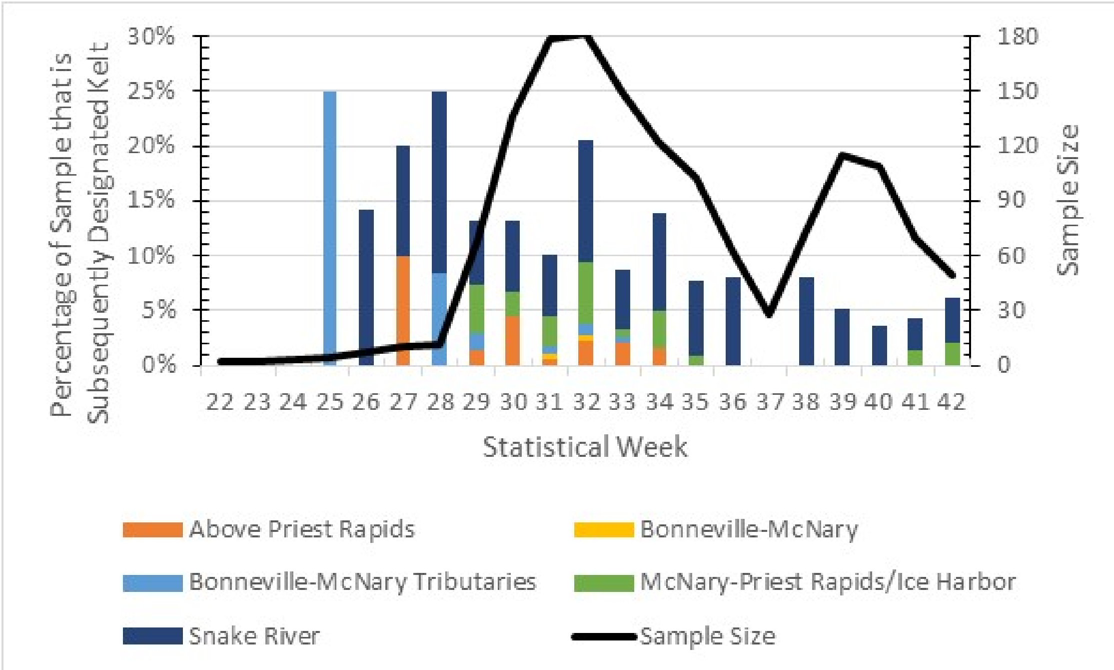

Figure 23. Percentage of run designated as kelt by week sampled in 2020 at Bonneville Dam and the most upstream detection area.

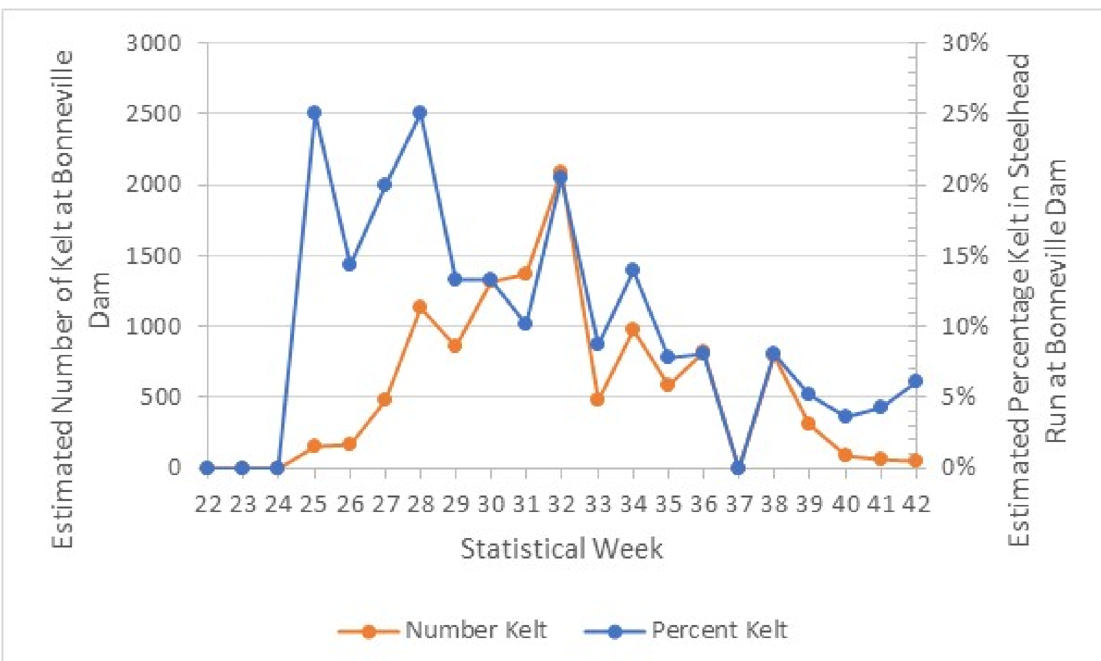

Figure 24. Percentage and number of kelt estimated to be passing Bonneville Dam by Statistical Week as estimated by this project in 2020.

Many kelts that are detected moving out of the system are last detected in the juvenile bypasses of the major Columbia and Snake dams. For 2020 tagged fish, the juvenile bypass at these dams detected kelts: Bonneville (1), John Day (2), McNary (2), Lower Monumental (1), Little Goose (1), Lower Granite (1), and Rocky Reach (9) (Table 37 and C2). Another major exit location for kelts is the Bonneville Dam Corner Collector, where 33 steelhead tagged by this study were last detected migrating downstream in spring and summer 2021. In addition, an antennas at a Lower Granite Dam spillway (GRS) detected a total of 56 steelhead that were part of this study, 43 of which were detected after January 1, 2021. For 34 of these fish, they were last detection in the system at GRS. Of the 158 identified kelts, 118 of them were tracked into the Columbia River tributaries; many had multiple detections in the tributaries as they made their way to the spawning grounds and back out after spawning, 70 kelts with this behavior (Tables C1, C2, and Figure C1 – map of all detection locations). This year, 7 steelhead were collected by the CRITFC Kelt Program, and all were collected at Prosser Dam as they were moving downstream after spawning. Three steelhead tagged and track in 2020 behaved like repeat spawners, as they were tracked upriver, and in most cases into tributaries, during 2020 and spring of 2021, and then tracked again in either the late summer, fall, or early winter 2021, moving upstream through the Bonneville Dam fish ladders and also detected further upriver. One of these fish was in the Kelt Program and was release in the Yakama River where it moved upriver.

We have also updated information on kelts/repeat spawners from several past annual reports with data from 2017/2018/2019 movements. Some steelhead already identified as kelts or repeat spawners in the past reports have new information added; others are newly added because they were detected a year or two later moving upriver again to spawn. Up to three past years of tagged steelhead have appeared in the detection system; see Table C4 in Appendix C for new information on steelhead tagged in 2017 (no records), 2018 (one record), and 2019 (five records).

Table 37. PIT tagged steelhead sampled at Bonneville Dam subsequently designated as kelt by being last detected moving downstream the year after sampling or being last detected moving upstream the year after sampling for sampling years 2009-2020. Data is categorized by last detection site.

	Tag Year											
Last site	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**2012**	**2011**	**2010**	**2009**
Bonneville Corner Collector	33	24	17	14	32	25	38	30	25	10	23	61
Bonneville Juvenile Bypass	1	6	2	6	1	5	3	6	5	1	4	7
Bonneville Dam Bradford Island Ladders heading downstream	0	1	0	0	0	2	1	3	2	0	0	0
Bonneville Dam ladders heading downstream	0	1	1	1	0	0	0	0	0	0	0	0
Estuary Trawl or Pile Dikes (TWX or PD7)	1	0	2	1	1	0	0	2	2	0	0	1
Ice Harbor Juvenile Bypass	0	1	0	0	2	1	0	0	0	1	6	0
Ice Harbor Ladders heading downstream	0	0	0	0	0	0	0	1	0	NA	NA	NA
John Day Juvenile Bypass	2	3	3	3	20	6	2	8	6	3	11	3
Little Goose Juvenile Bypass	1	5	7	5	11	5	2	9	5	11	13	6
Lower Granite Juvenile Bypass	1	5	11	7	5	0	3	4	3	4	10	3
Lower Monumental Juvenile Bypass	0	5	5	5	4	0	2	7	1	12	9	4
Lower Granite Dam adult ladders moving downstream	0	0	1	0	0	0	0	0	0	0	0	0
Lower Granite Spillway (new in 2019)	34	24	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Washington Shore McNary Dam ladder downstream	0	0	3	1	3	0	1	0	0	0	2	1
McNary Dam Juvenile Bypass	2	1	2	3	4	1	1	4	4	3	2	4
Rocky Reach Juvenile Bypass	9	3	9	5	1	2	10	1	0	4	6	7
Migrating downstream in tributaries	70	35	22	9	2	6	NA	4	3	0	0	0
Repeat spawners, at Bonneville Dam or above migrating upstream	3	3	0	4	4	4	5	12	1	NA	NA	NA
Trapped by CRITFC Kelt Program												
Snake Basin	0	3	10	6	7	5	4	11	NA	NA	NA	NA
Yakima Basin	7	6	4	0	1	1	6	6	1	NA	NA	NA
Total[8]	**158**	**121**	**85**	**64**	**98**	**63**	**77**	**108**	**58**	**49**	**86**	**97**
Estimated kelt as percentage of run	**10.7%**	**14.9%**	**9.5%**	**7.6%**	**6.1%**	**5.3%**	**4.5%**	**7.2%**	**4.0%**	**3.1%**	**5.2%**	**4.8%**
Additional steelhead detected migrating upstream in subsequent migration year not previously reported	**1**	**2**	**9**	**7**	**0**	**0**	**2**	**5**	**13**	**3**	**9**	**5**
Minimum number of kelts	**159**	**123**	**94**	**71**	**98**	**63**	**79**	**113**	**71**	**52**	**95**	**102**

[8] Since some kelt were both detected downstream and trapped by the CRITFC Kelt Program, the total may exceed the sum of the detections by site plus the number trapped by the Kelt Program.

Among the 1,436 steelhead sampled at Bonneville Dam where ocean age could be estimated, when kelt were compared to non-kelt, kelt had a higher percentage of one-ocean fish (50.8% vs. 47.3%) and lower percentage of two ocean fish (49.2% vs. 52.6%) (Table 38). The mean length of non-kelt was 72.3 cm compared to 68.9 cm for kelt.

Table 38. Ocean age composition of steelhead designated as kelt or non-kelt sampled at Bonneville Dam in 2020.

Run	Number Ageable for Ocean Age	One-Ocean (x.1)	Two-Ocean (x.2)	Three-Ocean (x.3)
Kelt	143	13.3%	86.7%	0.0%
Non-Kelt	1293	11.4%	88.5%	0.2%

Straying

Steelhead stray rates by stock were estimated with stock classification by two different criteria. The first was for stock that could be designated by PBT, presumably the most accurate genetic stock classification (Table 39). For those fish for which PBT was not available, stock classifications were made using Genetic Stock Identification (GSI) (Table 40). The overall stray rate for PBT-classified steelhead was 14.4% and 20.5% for GSI-classified steelhead.

Table 39. Showing final-PIT-fate categories by stock as determined using PBT for fish tagged in 2020. Fate categories are categorized by color. Grey is neutral (meaning last detected on route to expected destinations), green is on target (meaning last detected at their expected destination), yellow is putative overshoot meaning a fish last detected in an area adjacent to its expected destination, and red is putative stray meaning a fish was last detected in tributaries or the mainstem outside their normal route to their expected destination. Stray rates are also tabulated.

Dam/Basin	Bonneville					The Dalles		Deschutes		John Day			McNary								Clearwater		Gr. Ronde					Wenatchee			Methow												
Stock Classification using Parental Based Tagging (PBT)	Bonneville-Bradford Ladder	Bonneville-WA Shore Ladder	Bonneille WA Ladder Slots	Spring Creek Hatchery	Lyle Falls Fishway, Klickitat R	The Dalles-Oregon Shore	The Dalles-WA Shore	Shearer's Falls	Warm Springs River	John Day-Oregon Shore	John Day-WA Shore	Upper John Day River	McNary Dam-Oregon Shore	McNary Dam-WA Shore	Walla Walla	Ice Harbor	Lower Monumental	Middle Tucannon River	Little Goose Dam	Lower Granite Dam	Lower SF Clearwater	Lower SF Clearwater	Wallowa River (rkm 14)	Upper Salmon	Imnaha River	Priest Rapids Dam	Rock Island Dam	Tumwater Dam	Chiwawa River	Wells Dam	Methow River-Carlton	Methow River	Lower Okanogan River	Total	Neutral	On Target	Putative Stray	Putative overshoot	%Neutral	%On Target	%Putative Stray	%Putative overshoot	% Strays (strays/(strays+On target)
Columbia RKM	234	234	234	269	290	308	308	328	328	347	347	351	470	470	509	522	522	522	522	522	522	522	522	522	522	635	730	754	763	830	843	843	858										
PTAGIS Site	BO1	BO3	BO4	SCL	LFF	TD1	TD2	DSF	WSR	JO1	JO2	JD1	MC1	MC2	JPT	ICH	LMA	MTR	GOA	GRA	SC1	SC2	WR1	USE	IR1	PRA	RIA	TUF	RRF	WEA	LMR	MRC	OKL										
Dworshak	1		35			19	8			5	2		7	3		6	3		4	161	1													255	93	162	0	0	36.5%	63.5%	0.0%	0.0%	2.5%
Eastbank																												1						1	0	1	0	0	0.0%	100.0%	0.0%	0.0%	0.0%
Grande Ronde			12			7	1			3	2		2	1	1		4	2	4	34						1				2				76	71	0	5	0	93.4%	0.0%	6.6%	0.0%	57.1%
MGILCS			5			9	2	17			1			1					1	8					1									45	27	1	17	0	60.0%	2.2%	37.8%	0.0%	44.4%
Oxbow			1			4	1	2		2			3	1		2	1		2	41														60	17	41	2	0	28.3%	68.3%	3.3%	0.0%	7.7%
Pahisimmeroi			6			6	3			2	2	1	4	1		2				41				2										70	67	2	1	0	95.7%	2.9%	1.4%	0.0%	0.0%
Sawtooth		1	5			4	1	1		1			1			2			1	54				3		1				2	1		1	79	70	3	6	0	88.6%	3.8%	7.6%	0.0%	0.0%
Skamania		1	23		4	1											1																	30	26	4	0	0	86.7%	13.3%	0.0%	0.0%	0.0%
S. Fork Clearwater			16			18	4	1		2	1			1		3				66		2												114	111	2	1	0	97.4%	1.8%	0.9%	0.0%	20.0%
Touchet													1	1													1							3	2	0	1	0	66.7%	0.0%	33.3%	0.0%	0.0%
Tucannon										1			1				1																	3	3	0	0	0	100.0%	0.0%	0.0%	0.0%	0.0%
Upper Salmon			1										1	1					1	10									1					15	14	0	1	0	93.3%	0.0%	6.7%	0.0%	0.0%
Wallowa	1		9			5		4	1	2			1			2			1	31			1										1	59	52	1	6	0	88.1%	1.7%	10.2%	0.0%	0.0%
Wells			1								1																			13		1	1	17	2	15	0	0	11.8%	88.2%	0.0%	0.0%	0.0%
Wells-Methow						1																								3				4	1	3	0	0	25.0%	75.0%	0.0%	0.0%	0.0%
Wells-Okanogan			1																										1	1			1	4	2	2	0	0	50.0%	50.0%	0.0%	0.0%	0.0%
Winthrop							1																							3	1			5	5	0	0	0	100.0%	0.0%	0.0%	0.0%	100.0%
Total	2	2	115	0	4	74	21	25	1	18	9	1	21	10	1	17	10	2	14	446	1	2	1	5	1	2	1	1	2	24	2	1	4	840	563	237	40	0	67.0%	28.2%	4.8%	0.0%	14.4%

Table 40. Showing final-PIT-fate categories by stock as determined using GSI for fish tagged in 2020. Fate categories are categorized by color. Grey is neutral (meaning last detected on route to expected destinations), green is on target (meaning last detected at their expected destination), yellow is putative overshoot meaning a fish last detected in an area adjacent to its expected destination, and red is putative stray meaning a fish was last detected in tributaries or the mainstem outside their normal route to their expected destination. Stray rates are also tabulated.

Stock Classification using Genetics Stock Identification (GSI)	Bonneville	Bonneville-Cascades Ladder	Bonneville-WA Shore Ladder	Bonneille WA Ladder Slots	Trout Creek	Trout Creek at 43 Road	Upper Wind River	Moving Falls Ladder	Hood River Mouth	Lyle Falls Fishway, Klickitat R	Klickitat	Little Klickitat	The Dalles-Oregon Shore	The Dalles-WA Shore	15 Mile Creek	Deschutes R. Mouth	Sherar's Falls		John Day-Oregon Shore	John Day-WA Shore	John Day River	Bridge Creek	South Fork John Day	John Day River	Three Mile Dam	Umatilla River at rkm 9
	Bonneville				Wind River			Hood River		Klickitat			The Dalles			Deschutes			John Day Dam		John Day River				Umatilla	
Columbia RKM	234	234	234	234	251	251	251	273	273	290	290	290	308	308	309	328	328	328	347	347	351	351	351	351	465	465
PTAGIS Site	BO1	BO2	BO3	BO4	TRC	TC4	WRU	MVF	HRM	LFF	KLR	LKR	TD1	TD2	158	DRM	DSF	WSR	JO1	JO2	JD1	BR0	SJ2	JDM	TMF	UMW
Lower Columbia	1			1																						
Skamania			2	4	2	1	1	2		1																
Willamette			1						1																	
Big White Salmon			1																							
Klickitat	1		4			1		1		3		3	2													
MGILCS		1	33	4							1		10	3	2	2	2	4	5	5	6		2	6	5	2
Yakima			1	1									2			1										
Upper Columbia			1														1								1	
SF Clearwater			2																1	1		1				
Upper Clearwater			1																							
SF Salmon																			1							
MF Salmon																										
Upper Salmon													1													
Grand Total	**2**	**1**	**47**	**10**	**2**	**2**	**1**	**3**	**1**	**4**	**1**	**3**	**15**	**3**	**2**	**3**	**3**	**4**	**8**	**6**	**6**	**1**	**2**	**6**	**7**	**2**

Stock Classification using Genetics Stock Identification (GSI)	McNary Dam-Oregon Shore	McNary Dam-Washington Shore	Walla Walla River Bridge	Touchet River	Touchet River-Bolles Bridge	Mill Creek	Nursery Bridge	**Ice Harbor Dam**	**Lower Monumental Dam**	Middle Tucannon	Tucannon Fish Hatchery	**Little Goose**	**Lower Granite**	Lapwai Creek	Sweetwater Creek	East Fork Potlatch	Dworshak Hatchery	Lolo Creek	Lochsa River	Lower SF Clearwater	Upper Selway
	McNary		Walla Walla							Tucannon				Clearwater							
Columbia RKM	470	470	509	509	509	509	509	522	522	522	522	522	522	522	522	522	522	522	522	522	522
PTAGIS Site	MC1	MC2	WWB	HST	BBT	MCD	NBA	ICH	LMA	MTR	TFH	GOA	GRA	LAP	SWT	EPR	DWL	LC2	LRU	SC2	SW2
Lower Columbia																					
Skamania																					
Willamette																					
Big White Salmon																					
Klickitat																					
MGILCS	18	7	1	1	2	2	1	2	1	3	1	2	26	2	2	1					
Yakima													1								
Upper Columbia													4								
SF Clearwater													10	1				2		1	
Upper Clearwater	1																		4		1
SF Salmon													1								
MF Salmon													6								
Upper Salmon		1											4								
Grand Total	**19**	**8**	**1**	**1**	**2**	**2**	**1**	**2**	**1**	**3**	**1**	**2**	**52**	**3**	**2**	**1**	**1**	**2**	**4**	**1**	**1**

Stock Classification using Genetics Stock Identification (GSI)	Asotin Creek	Joseph Creek	Wenaha River	Minam River	Wallowa River rkm 14	Wallowa River rkm 32	Upper Grand Ronde rkm 155	Catherine Creek	EFSF Salmon River	SF Salmon-Guard Station Bridge	Panther Creek	NF Salmon	Hayden Creek	Upper Salmon River at rkm 437	Upper Salmon River at rkm 460	Lower Imaha at rkm 7	Lower Imnaha km 10	Big Sheep Creek	Prosser Dam	Satus Creek	Simcoe Creek	Toppenish Creek	Sunnyside	Lower Naches	Roza Dam	Taneum Creek	Swauk Creek	Teanaway River
	Grande Ronde								Salmon River							Imnaha			Yakima									
Columbia RKM	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	539	539	539	539	539	539	539	539	539	539
PTAGIS Site	ACB	JOC	WEN	MR1	WR1	WR2	UGR	CCW	ESS	KRS	PCA	NFS	HYC	USE	USI	IR1	IR2	BSC	PRO	SAT	SM1	TP2	SUN	LNR	ROZ	TAN	SWK	LMT
Lower Columbia																												
Skamania																												
Willamette																												
Big White Salmon																												
Klickitat																												
MGILCS	2	7	2	4	1	2	4	2					1		1		2	3	2				1		1	1		
Yakima																			2	1	1	2	1	4		1	1	1
Upper Columbia							1																					
SF Clearwater														1														
Upper Clearwater																												
SF Salmon									1	1																		
MF Salmon																												
Upper Salmon											1	1				1												
Grand Total	**2**	**7**	**2**	**4**	**1**	**2**	**5**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**2**	**3**	**4**	**1**	**1**	**2**	**2**	**4**	**1**	**2**	**1**	**1**

Stock Classification using Genetics Stock Identification (GSI)	**Ringgold Hatchery**	**Priest Rapids Dam**	**Rock Island Dam**	Peshastin Creek	Upper Peshastin Creek	Upper Wenatchee	Upper Nason Creek	**Wells Dam**	Gold Creek	Methow River-Carlton	Chewuch River-Winthrop	Upper Chewuch	Lower Okanogan	Loup Loup Creek	Omak Creek	Salmon Creek	Antoine Creek	Zosel Dam	Nine Mile Creek
				Wenatchee					Methow				Okanogan						
Columbia RKM	567	639	730	754	754	754	754	830	843	843	843	843	858	858	858	858	858	858	858
PTAGIS Site	RSH	PRA	RIA	PES	PEU	UWE	NAU	WEA	GLC	MRC	CRW	CRU	OKL	LLC	OMK	SA1	ANT	ZSL	NMC
Lower Columbia																			
Skamania																			
Willamette																			
Big White Salmon																			
Klickitat																			
MGILCS	3	1	1	1	1			4	1	2		1		1		1			1
Yakima		1											1					1	
Upper Columbia	1	1	2			1	1				1	1			1	1	1		
SF Clearwater																			
Upper Clearwater																			
SF Salmon																			
MF Salmon																			
Upper Salmon	1																		
Grand Total	**5**	**3**	**3**	**1**	**1**	**1**	**1**	**4**	**1**	**2**	**1**	**2**	**1**	**1**	**1**	**2**	**1**	**1**	**1**

Stock Classification using Genetics Stock Identification (GSI)	N	Neutral	On-Target	Stray	Overshoot	%Neutral	%On Target	%Putative Stray	%Putative overshoot	Stray Rate
Lower Columbia	2	0	0	0	2	0.0%	0.0%	0.0%	100.0%	NA
Skamania	13	6	7	0	0	46.2%	53.8%	0.0%	0.0%	0.0%
Willamette	2	0	0	1	1	0.0%	0.0%	50.0%	50.0%	100.0%
Big White Salmon	1	1	0	0	0	100.0%	0.0%	0.0%	0.0%	NA
Klickitat	15	5	8	0	2	33.3%	53.3%	0.0%	13.3%	0.0%
MGILCS	219	115	55	49	0	52.5%	25.1%	22.4%	0.0%	47.1%
Yakima	23	4	14	5	0	17.4%	60.9%	21.7%	0.0%	26.3%
Upper Columbia	19	1	10	8	0	5.3%	52.6%	42.1%	0.0%	44.4%
SF Clearwater	20	14	1	5	0	70.0%	5.0%	25.0%	0.0%	83.3%
Upper Clearwater	7	2	5	0	0	28.6%	71.4%	0.0%	0.0%	0.0%
SF Salmon	4	2	2	0	0	50.0%	50.0%	0.0%	0.0%	0.0%
MF Salmon	6	6	0	0	0	100.0%	0.0%	0.0%	0.0%	NA
Upper Salmon	10	6	2	2	0	60.0%	20.0%	20.0%	0.0%	50.0%
Grand Total	**346**	**162**	**104**	**70**	**5**	**47.5%**	**30.5%**	**20.5%**	**1.5%**	**40.2%**

RESULTS-SOCKEYE[9]

Bonneville Sample Size and Upstream Detection

In 2020, a total of 1,757 Sockeye Salmon were sampled for this project at the Bonneville Dam Adult Fish Facility between May 21 and August 13 (Table 41). Of these, 1,751 were tagged, to which were added 5 recaptures of Sockeye Salmon which had been previously PIT tagged as juveniles on their downstream migration. There was one additional recapture of a Sockeye Salmon first sampled the morning of June 25, 2020, and tagged with PIT tag 3DD.003D3654BD and then recaptured later that day and double tagged with tag 3DD.003D3654B5. In the analyses for this report, this fish will be considered to have a single tagging event and the detections upstream merged. Twenty-one Sockeye Salmon were not detected after release and there were 5 mortalities, resulting in a total of 1,730 Sockeye Salmon tracked upstream (which will hereafter be referred to as Bonneville-tagged Sockeye Salmon although this includes recaptures). In 2020, sampling restrictions resulting in raised picket leads on 33 sampling days during weeks Sockeye Salmon were sampled; 25 of which were due to high shad abundance and 8 days due to high water temperatures (21.1 - 22.2C, Table 41)[10]. An additional 4 days of sampling were lost due to a 4-day weekly sampling limit when temperatures were between 21.1 and 22.2C in weeks 30 and 31.

The tracking of 1,730 Sockeye Salmon generated 72,113 weir detections, which were grouped into 13,881 site detections at 46 sites. Based on Sockeye Salmon PIT tagged at Bonneville Dam by this study, the mainstem dam with the highest percentage passing upstream undetected in 2020 was John Day Dam (4.5%, Table 42). In the Okanagan Basin, Zosel and Skaha dams had high rates of PIT-tagged Sockeye Salmon missing detection due to high river flows allowing Sockeye Salmon to avoid detection by migrating through the unmonitored spillway rather than through fish ladders where there was PIT tag detection. Maps and table of sites found in the Appendix C (Table C1 and Figures C1, C22 and C25) show the sites and the categorical ranges of detection numbers at the sites throughout the Columbia Basin.

[9] The information presented in this section of the report is a summary of Fryer et al. 2021.
[10] Raising picket leads is required by trap regulations and decreases the number of fish going through the trap and can introduce trap biases (Fryer et al. 2011).

Table 41. Number of Sockeye Salmon sampled, and PIT tagged at Bonneville Dam and tracked upstream by date and statistical week in 2020.

Sampling Dates	Statistical Week[11]	Percent of Run	Sampled (N)	Tagged	Previously Tagged		Mortalities	Not Detected After Tagging	Detected at or upstream of Bonneville ladder exit antennas	Days Sampling Restrictions in Effect		
					At AFF by this project	Other Agencies				Reduced Temperature	Reduced Shad or Salmon Abundance	No Sampling Temperature
5/21-6/5	22-23	0.5	19	19	0	0	0	0	19	0	5	0
6/8-6/12	24	3.1	109	108	0	1	0	7	102	0	5	0
615-6/19	25	11.2	293	293	0	0	1	3	289	0	5	0
6/22-6/26	26	27.7	352	350	1	1	0	1	350	0	5	0
6/29-7/2	27	35.5	391	389	0	2	2	3	386	0	3	0
7/9-7/10	28	16.5	121	121	0	0	0	0	121	0	2	0
7/13-7/17	29	3.9	264	264	0	0	1	3	260	0	0	0
7/20-7/24	30	1.3	146	145	0	1	0	4	142	0	0	1
7/27-7/30	31	0.3	51	51	0	0	1	0	50	2	0	1
8/3-8/6, 8/10-8/13	32-33	0.1	11	11	0	0	0	0	11	6	0	2
Total			**1757**	**1751**	**1**	**5**	**5**	**21**	**1730**	**8**	**25**	**4**

[11] Statistical weeks are sequentially numbered calendar-year weeks. Excepting the first and last week of most years, statistical weeks are seven days long beginning on Sunday and ending on Saturday. In 2020, for instance, Statistical Week 23 began on May 31 and ended on June 6.

Table 42. Percentage of Bonneville Dam PIT tagged Sockeye Salmon not detected at upstream dams and in-stream PIT tag arrays on their migration route for 2006-2020.

		Percentage Not Detected by Dam and Year															
Dam/Array	**Type**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Mean**
Bonneville (BO1 & BO4)	A	0.2	2.1	0.4	0.6	0.7	0.5	1.8	0.4	0.7	1.6	2.8	0.2	1.1	1.5	1.0	1.0
The Dalles	A	--	--	--	--	--	--	--	1.6	0.3	0.6	0.4	2.1	0.9	0.5	1.4	1.0
John Day	A	--	--	--	--	--	--	--	--	--	--	--	--	2.8	3.3	4.5	3.5
McNary	A	3.1	6.5	10.1	5.0	3.8	1.6	12.1	2.1	3.8	1.1	2.4	5.2	2.9	2.9	2.9	4.4
Priest Rapids	B	0.0	0.8	0.3	0.3	0.6	0.2	0.4	0.0	0.2	0.4	0.3	0.0	0.1	0.0	0.0	0.2
Rock Island	B	1.3	6.8	6.9	2.6	6.2	4.4	5.4	4.4	41.5	10.2	2.9	5.9	28.3	4.1	2.8	8.9
Rocky Reach	B	12.3	0.7	0.2	0	0.5	0.7	1.4	0.0	0.3	0.0	0.0	0.7	0.2	0.0	0.0	1.1
Wells	B	--	--	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ice Harbor	A	--	--	0.0	20.0	0.0	--	0.0	--	12.5	0.0	0.0	0.0	0.0	0.0	0.0	3.0
Lower Monumental	A	--	--	--	--	--	--	--	--	--	0.0	0.0	0.0	0.0	0.0	--	0.0
Little Goose	A	--	--	--	--	--	--	--	--	--	0.0	0.0	0.0	0.0	0.0	--	0.0
Lower Granite	A	--	--	--	--	--	--	--	--	0.0	--	0.0	0.0	0.0	0.0	--	0.0
Tumwater	B	--	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7[12]	0.1
Zosel (ZSL)	C	--	--	--	--	--	98.6	83.0	87.3	0.9	0.0	1.6	74.5	57.5	0.0	76.2	48.0
Lower Wenatchee (LWE)	D	--	--	--	--	--	--	--	--	48.0	17.9	54.7	49.6	68.4	33.3	78.4	50.0
Upper Wenatchee (UWE)	D	--	--	--	--	--	--	--	--	52.7	24.6	9.7	9.3	9.9	3.2	11.3	17.2
Lower Okanagan (OKL)	D	--	--	--	--	--	--	--	--	68.9	13.8	59.4	47.4	50.1	66.7	40.4	49.5
Okanagan Channel (OKC)	D	--	--	--	--	--	--	--	--	--	--	16.9	--	7.7	5.3	5.7	8.9
Skaha (SKA)	C	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0	41.5	20.8

Detection Type

A	Antennas in fish ladders at a dam with navigation locks providing upstream migrating PIT tagged fish a means to pass undetected
B	Antennas in fish ladders at a dam with no passage route for upstream migrating PIT tagged fish other than through ladder PIT tag antennas
C	Antennas in fish ladders at a dam where, at high flows, upstream migrating PIT tagged fish can pass through unmonitored spillways
D	In-stream antennas where PIT tagged salmonids can pass undetected. In general, the higher the flow, the lower the detection rate.

[12] The two Sockeye Salmon not detected likely passed during a power outage that occurred at Tumwater Dam between 0540 7/21/20 and 0106 7/22/20. These were the first Sockeye Salmon tagged by this study at Bonneville Dam missing detection at Tumwater Dam since antennas were installed at this site in 2008.

Age Composition

The predominant age group in 2020 was Age 1.2 at 98.6% of the run, followed by Age 1.1 at 0.9% of the run (Table 43). Over the run, the percentage of Age 1.2 Sockeye Salmon ranged from 90.3% (Week 30) to 100.0% (weeks 24, 28, 32-33). The only other age group with weekly percentage greater than 3.0% was Age 1.1 in weeks 22-23 (5.6%) and in Week 30 (7.1%, Figure 25).

Table 43. Weekly and total age composition of Sockeye Salmon at Bonneville Dam as estimated from scale patterns in 2020. Composite estimates are weighted by the percentage of the run passing Bonneville Dam in each week.

Statistical Week	% of Run	N Ageable	Age Class				
			1.1	1.2	2.1	1.3	2.2
22-23	0.5%	18	5.6%	94.4%	0.0%	0.0%	0.0%
24	3.1%	106	0.0%	100.0%	0.0%	0.0%	0.0%
25	11.2%	260	2.7%	96.5%	0.0%	0.8%	0.0%
26	27.7%	342	1.2%	98.0%	0.3%	0.3%	0.3%
27	35.5%	385	0.3%	99.5%	0.0%	0.0%	0.3%
28	16.5%	120	0.0%	100.0%	0.0%	0.0%	0.0%
29	3.9%	257	1.2%	98.4%	0.0%	0.4%	0.0%
30	1.3%	113	7.1%	90.3%	0.0%	2.7%	0.0%
31	0.3%	39	2.6%	97.4%	0.0%	0.0%	0.0%
32-33	0.1%	11	0.0%	100.0%	0.0%	0.0%	0.0%
Composite	**100.0%**	**1651**	**0.9%**	**98.6%**	**0.1%**	**0.2%**	**0.2%**

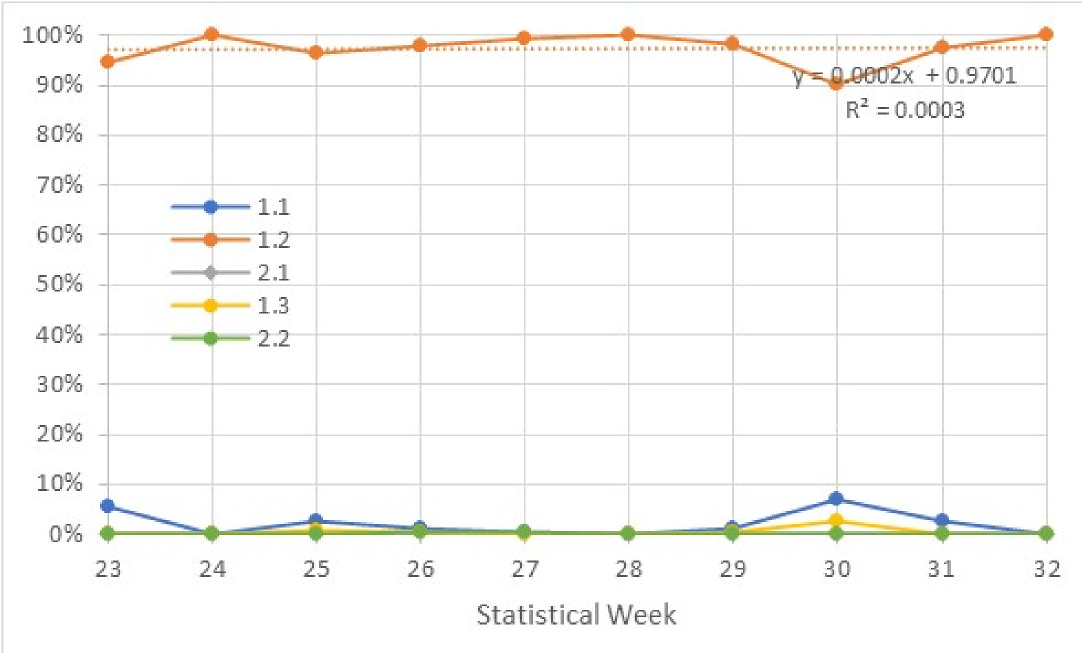

Figure 25. Weekly age composition estimates by Statistical Week for Sockeye Salmon sampled at Bonneville Dam in 2020.

Upstream Recoveries, Mortality, and Escapement

The percentage of Sockeye Salmon passing Bonneville Dam that were estimated to pass upstream sites (Figure 26) was higher in 2020 than the 2006-2020 mean at all sites but Tumwater Dam (Table 44)[13].

[13] Tumwater Dam is only passed by Wenatchee stock Sockeye Salmon so rate differences to Tumwater Dam (as well as Rocky Reach and Wells dams) also reflect annual variations in stock composition.

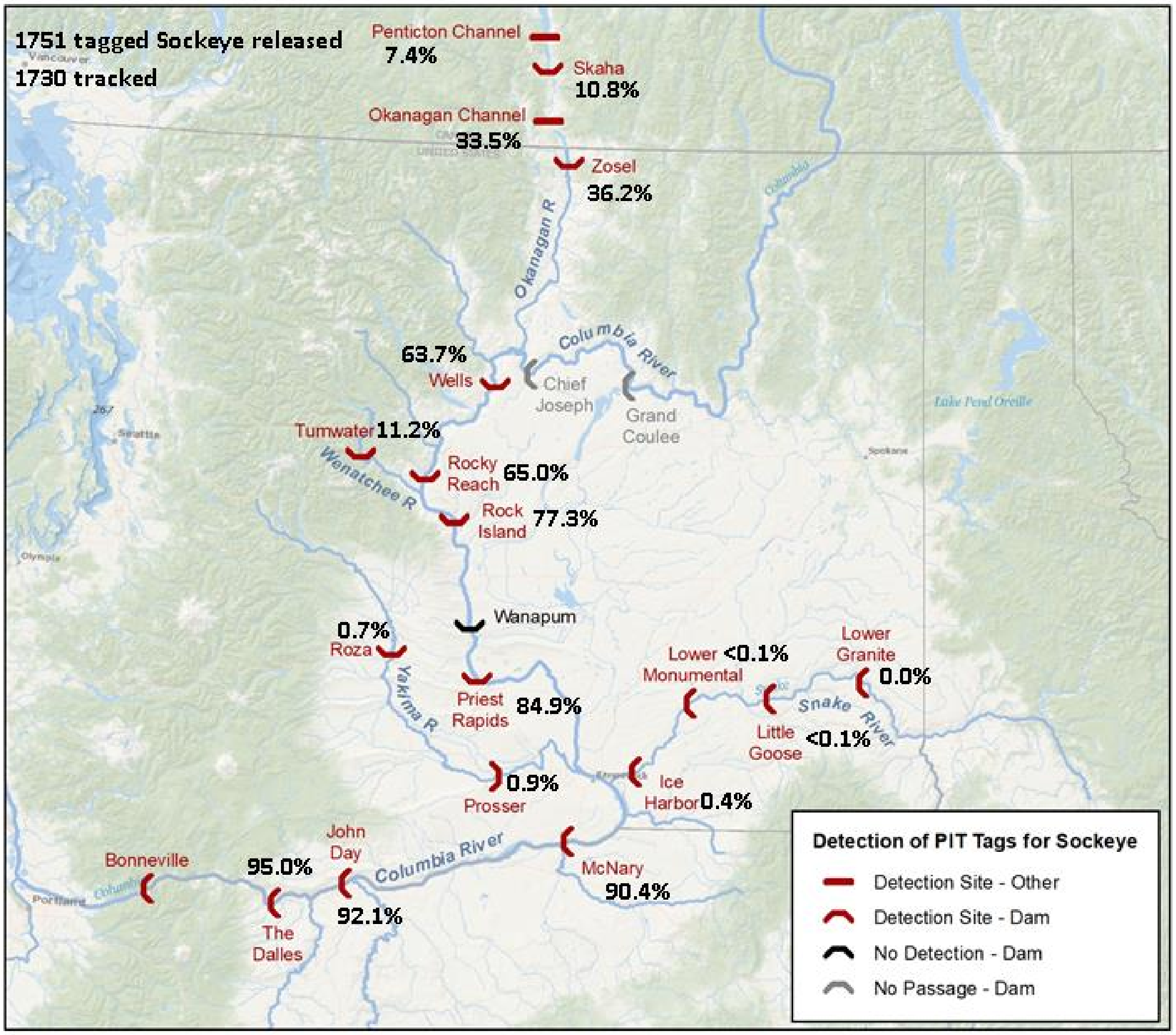

Figure 26. Map of the Columbia River Basin showing the number of fish PIT tagged at Bonneville Dam, and the percentage of the run estimated to pass upstream dams in 2020.

Table 44. Estimated survival of Sockeye Salmon PIT tagged at Bonneville Dam passing upstream dams 2006-2020.

	Percentage by Year															
Dam or Site	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Mean**
The Dalles	--	--	--	--	--	--	--	89.5	93.1	82.8	94.0	89.3	93.3	94.6	95.0	91.4
John Day	--	--	--	--	--	--	--	--	--	--	--	--	90.9	92.7	92.1	91.8
McNary	88.4	84.0	89.4	85.7	81.5	76.1	82.4	83.6	88.3	54.0	89.2	81.7	88.9	84.2	90.4	83.2
Priest Rapids	84.8	77.4	86.3	82.1	78.4	71.9	77.3	78.6	84.5	44.9	85.3	74.6	85.4	82.4	84.9	78.5
Rock Island	81.1	73.4	85.8	80.2	76.3	68.9	75.0	74.2	79.5	40.6	81.6	70.8	80.7	81.6	77.3	75.1
Rocky Reach	58.8	62.2	73.7	67.1	63.7	55.3	62.1	52.4	65.3	31.6	60.5	43.7	73.9	73.4	65.0	60.5
Wells	53.8	60.9	71.1	65.2	62.6	53.9	60.8	50.5	64.2	29.4	59.3	42.5	72.7	72.4	63.7	58.8
Tumwater	--	--	9.4	12.2	13.3	14.2	12.9	20.9	13.6	8.3	20.8	25.8	6.0	8.7	11.2	13.6
Okanagan Channel (OKC)	--	--	--	--	32.5	40.2	25.9	30.7	22.5	2.2	38.1	25.1	45.7	44.6	33.5	32.5

Survival rates were also calculated using similar methods for returning adults from a group of juvenile Sockeye Salmon (project goal is 3000) captured and PIT tagged annually at the Rock Island Dam juvenile bypass since 2008[14] (Table 45). Both Wenatchee and Okanagan juvenile Sockeye Salmon are tagged at this site, making it a mixed stock most similar to Sockeye Salmon tagged as adults at Bonneville Dam[15]. Sample sizes of returning adults from the Rock Island tagging program are often small with only 16-35 returns annually between 2016-2019, however this increased to 78 returning in 2020 (Table 45). Sockeye Salmon tagged by this program which passed Bonneville Dam in 2020 had survival rates from 0.7 to 2.9 percentage points higher than those tagged as juveniles at Rock Island Dam at all 5 dams (Bonneville-Rock Island) passed by both stocks (Figure 27). Annual survival rates for these fish from Bonneville Dam to Priest Rapids Dam are compared with adults tagged by this study at Bonneville Dam in Figure 28[16]. This survival rate was greater for returning Rock Island-tagged juvenile salmon compared to Bonneville-tagged adults in 8 out of 14 years, however only in 2018 was this difference significant at $\alpha=0.05$ ($p=0.002$).

Upstream of Rock Island Dam, some differences are apparent for Rock Island-tagged Sockeye Salmon which likely reflect a higher percentage of Wenatchee versus Okanagan stock Sockeye Salmon in the returning Rock Island-tagged Sockeye Salmon compared with those tagged at Bonneville Dam (Figure 28).

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[14] Tagging of juvenile Sockeye Salmon at Rock Island Dam has occurred since 1992; however, returns from these fish were lower and there were fewer detection sites prior to 2008.

[15] Juvenile Sockeye Salmon are also tagged in the Okanagan and Wenatchee basins. However, these programs have a shorter data set in terms of years tagged with collection methods and tag numbers that have varied by year.

[16] Priest Rapids was chosen as it is the last dam with a high PIT tag detection rate passed by both Okanagan and Wenatchee Sockeye Salmon.

Table 45. Survival of Sockeye Salmon PIT tagged as smolts at Rock Island Dam, on their adult upstream migration from Bonneville Dam to upstream dams for years 2008-2020[17].

	Percentage by Year and Mean of All Years													
Dam	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Mean**
# at Bonneville	**38**	**33**	**130**	**125**	**121**	**66**	**155**	**128**	**35**	**16**	**32**	**20**	**78**	**74.9**
# Tagged at Rock Is.	**1910**	**2059**	**3528**	**2977**	**3231**	**2674**	**3131**	**1689**	**4109**	**2210**	**3332**	**2859**	**3115**	**2809**
The Dalles	No PIT tag detection at this site					87.9	92.9	85.9	82.9	87.5	100.0	100.0	93.6	91.0
John Day	No PIT tag detection at this Site										100.0	100.0	89.7	100.0
McNary	89.5	100	82.3	74.4	74.4	80.3	87.1	60.2	74.3	81.3	100.0	90.0	89.7	82.8
Priest Rapids	89.5	93.9	81.5	73.6	71.9	74.2	83.9	54.7	74.3	68.8	100.0	85.0	83.3	79.3
Rock Island	81.6	90.9	79.2	68.8	69.4	68.2	77.4	46.9	68.6	68.8	93.9	85.0	74.4	74.9
Rocky Reach	55.3	87.9	70.0	55.2	48.8	56.1	60.0	36.7	45.7	68.8	65.6	55.0	56.4	58.8
Wells	55.3	87.9	68.5	52.8	43.8	56.1	58.7	32.8	42.9	62.5	62.5	55.0	55.1	56.6
Tumwater	26.3	3.0	10.0	14.4	23.1	10.6	16.1	13.3	22.9	6.3	25.0	25.0	16.7	16.3

[17] Years prior to 2008 were not included due to low sample sizes for returning Sockeye Salmon tagged as juveniles at Rock Island Dam. (From 2002-2007, the number of Sockeye Salmon PIT tagged at Rock Island Dam as juveniles detected returning to Bonneville ranged between one and eight fish annually.) Year 2013 the first year for detection at The Dalles Dam, and 2018 the first year for John Day Dam.

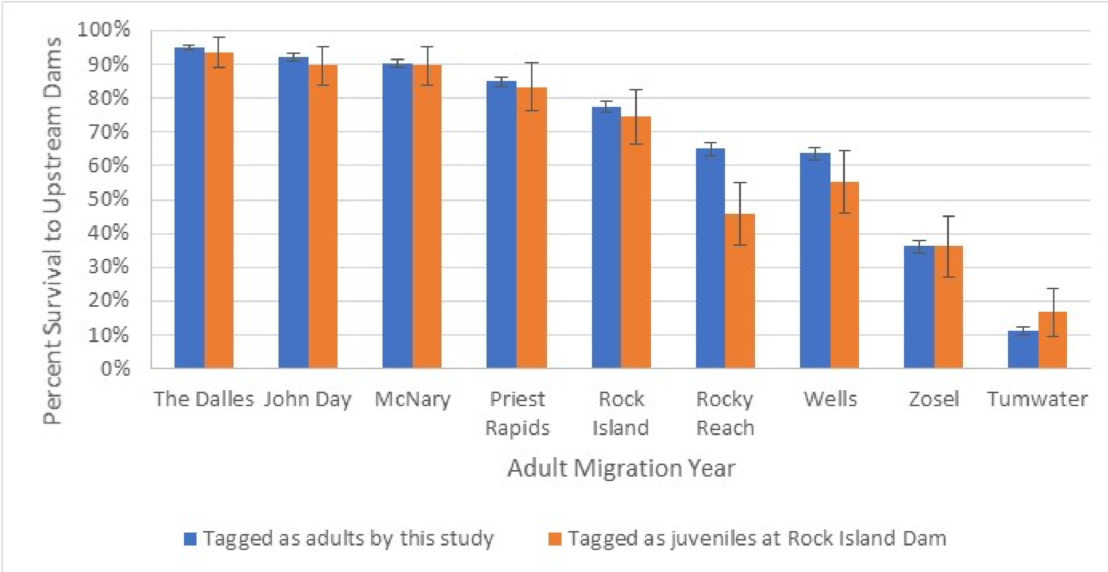

Figure 27. Estimated percentage of Sockeye Salmon passing Bonneville Dam detected at or upstream of The Dalles, John Day, McNary, Priest Rapids, Rock Island, Rocky Reach, Wells, Zosel and Tumwater dams with 90% CI for Sockeye Salmon PIT tagged as juveniles at Rock Island Dam and as adults at Bonneville Dam in 2020.

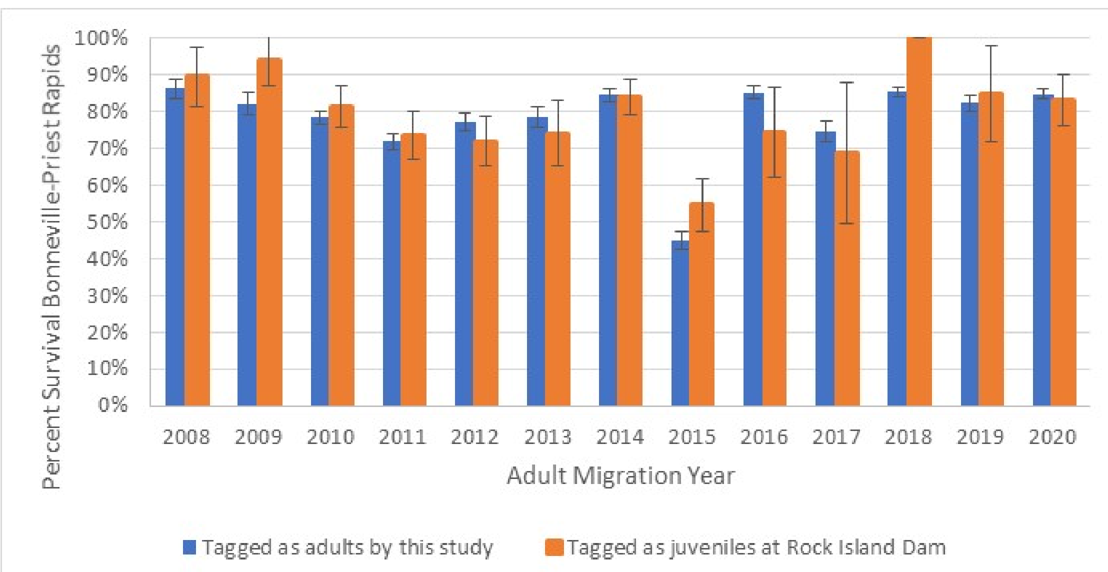

Figure 28. Annual estimated survival rate with 90% CI from Bonneville Dam to Priest Rapids Dam for adult Sockeye Salmon tagged by this study and for returning Sockeye Salmon tagged as juveniles at Rock Island Dam 2008-2020. (Priest Rapids Dam was chosen for this comparison as it is the most upstream dam with consistently high rates of PIT tag detection passed by both Okanagan and Wenatchee Sockeye Salmon.

The estimated escapement based on upstream PIT tag detections of the Bonneville-tagged Sockeye Salmon was greater than the number of Sockeye Salmon counted at The Dalles, John Day, and McNary dams, but less at Rock Island, Priest Rapids, Rocky Reach, Wells, and Tumwater dams (Table 46, Figure 29). The PIT tag estimates show a consistent decrease in Sockeye Salmon escapement estimates as the run progresses upstream which is to be expected as fisheries and other sources of mortality take their toll. However, the visual dam counts show an irregular pattern of increases and decreases as the Sockeye Salmon run progresses upstream. There were more Sockeye Salmon counted at John Day Dam (309,959) than at any other dam upstream of Bonneville Dam on the river and more Sockeye Salmon were counted at Priest Rapids Dam than downstream at McNary Dam. PIT tag estimates for Snake River and Yakima River dams were based on very few detections (1 to 6 for the Snake River, 12 at Roza, and 16 at Prosser), resulting in larger differences between PIT and visual estimates for these sites.

Table 46. Estimated Sockeye Salmon escapement from both PIT tags and visual means, and the difference between the PIT tag and visual escapement estimate at Columbia Basin dams in 2020.

Dam	Escapement Estimate Using Bonneville PIT Tagged Sockeye Salmon	Visual Dam Count	Difference Between Bonneville PIT Tag and Visual Estimates
Bonneville	--	341,716	--
The Dalles	324,617	295,776	9.8%
John Day	314,814	309,959	1.6%
McNary	308,849	284,924	8.4%
Priest Rapids	290,044	291,106	-0.4%
Rock Island	264,141	280,440	-5.8%
Rocky Reach	222,209	249,521	-10.9%
Wells	217,833	226,107	-3.7%
Tumwater	38,429	43,391	-11.4%
Ice Harbor	1,474	2,330	-36.7%
L. Monumental	51	1,257	-95.9%
Little Goose	51	831	-93.9%
Lower Granite	38,429	43,391	-11.4%
Little Goose	51	831	-93.9%
Prosser	3,201	2,549	25.6%
Roza	2,510	4,379	-42.7%

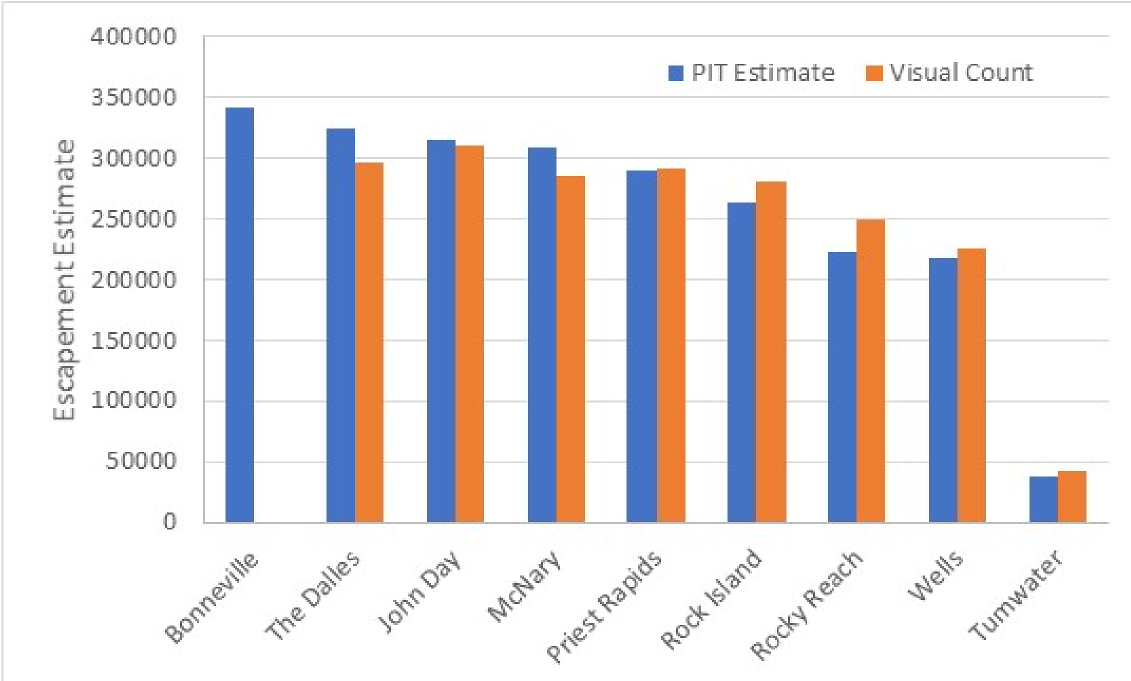

Figure 29. Estimated PIT tag and visual count estimates of escapement at Columbia River and Tumwater dams in 2020.

Sockeye Salmon tagged at Bonneville Dam show a significant decrease in survival to upstream dams over the period of the run in 2020 (Table 47, Figure 30). There was not a significant decrease in survival for Sockeye Salmon tagged as juveniles although sample sizes were lower (Table 47).

Table 47. Sockeye Salmon survival through selected reaches by statistical week as estimated by PIT tag detections in 2020 and the p-value for a linear regression between weekly reach survival and statistical week.

Statistical Week at Bonneville Dam	Survival from Bonneville for Sockeye Salmon Tagged as Adults at Bonneville Dam					Sockeye Salmon Tagged as Juveniles Survival from Bonneville-Priest Rapids		
	The Dalles	John Day	McNary	Priest Rapids	Rock Island	Wenatchee (n=83)	Okanagan (n=164)	Rock Island (n=78)
22-23	100.0%	100.0%	100.0%	100.0%	89.8%	NA	100.0%	100.0%
24	92.9%	88.8%	88.8%	81.6%	71.4%	100.0%	80.0%	71.4%
25	97.6%	96.2%	95.1%	88.5%	72.7%	66.7%	92.3%	70.0%
26	94.3%	91.1%	89.4%	83.9%	76.1%	71.0%	88.0%	91.3%
27	96.1%	93.0%	92.4%	86.4%	78.6%	76.9%	82.0%	85.0%
28	94.2%	91.7%	88.4%	86.0%	83.5%	56.3%	80.8%	91.7%
29	91.5%	88.0%	82.2%	75.7%	73.4%	100.0%	20.0%	50.0%
30	86.0%	82.6%	73.6%	58.7%	56.2%	0.0%	50.0%	100.0%
31	84.0%	80.0%	56.0%	44.0%	42.0%	50.0%	100.0%	NA
32-33	72.7%	72.7%	54.5%	45.5%	36.4%	NA	NA	NA
Composite[18]	**95.0%**	**92.1%**	**90.4%**	**84.9%**	**77.3%**	**71.0%**	**81.7%**	**83.3%**
p-value	**<0.01**	**<0.01**	**<0.01**	**<0.01**	**<0.01**	**0.14**	**0.37**	**0.76**

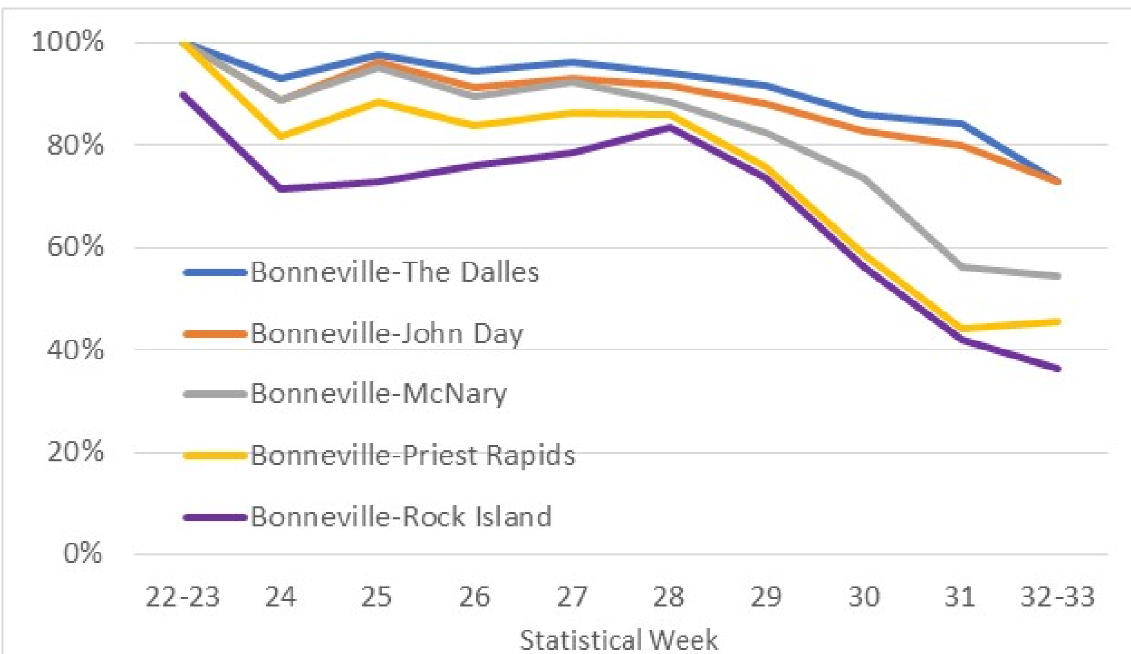

Figure 30. Survival of Sockeye Salmon PIT tagged at Bonneville Dam to The Dalles, John Day, McNary, Priest Rapids, and Rock Island dams by statistical week in 2020.

[18] Composite estimates for Bonneville Dam Sockeye Salmon are weighted by Statistical Week, juvenile estimates are unweighted.

The returning Rock Island juvenile-tagged Sockeye Salmon had highest upstream survival to Priest Rapids Dam[19] (85.0%) followed by adults tagged at Bonneville Dam (84.9%, Table 48). Sockeye Salmon tagged as juveniles in the Wenatchee basin had the highest conversion rate to spawning ground arrays (45.0%) followed by adults tagged at Bonneville Dam (41.1%), juveniles tagged at Rock Island (41.0%) and juveniles tagged in the Okanagan basin (38.1%, Table 48).

Table 48. Survival of Sockeye Salmon groups PIT tagged as juveniles from Bonneville Dam to upstream dams with adults tagged by this study at Bonneville Dam included for comparison in 2020. Yellow shaded cells represent sites that are not on the migration route for the group tagged.

			Percent Survival to Upstream Dam									
Tagging Location	Life Stage at Tagging	# at BON	The Dalles	John Day	McNary	Priest Rapids	Rock Island	Rocky Reach	Wells	Tumwater	Ice Harbor	Conversion Rate BON to PIT Arrays on Spawning Ground (%)[20]
Okanagan	Juvenile	164	93.9	87.8	82.9	81.7	73.2	72.0	71.3	0.0	0.0	38.1
Wenatchee	Juvenile	100	91.0	90.0	87.0	83.0	71.0	14.0	10.0	66.0	0.0	45.0
Rock Island	Juvenile	78	100.0	100.0	90.0	85.0	85.0	55.0	55.0	25.0	0.0	41.0
Snake	Juvenile	5	100.0	100.0	100.0	0.0	0.0	0.0	0.0	0.0	100.0	20.0
Bonneville	Adult	1848	95.0	92.1	90.4	84.9	77.3	65.0	63.7	11.2	0.4	41.1

Migration Rates and Passage Time

Adult Sockeye Salmon travelled quickly upstream in 2020 with median migration rates between mainstem dams ranging between 30.0 and 56.6 km/day for adults tagged at Bonneville and 29.2 to 55.6 km/day for tagged juveniles returning as adults (Table 49).

Like most previous years, Sockeye Salmon tagged at Bonneville Dam later in the migration traveled significantly faster than those tagged earlier in the migration through the mainstem Columbia River (Table 50). Median travel times between the Okanagan and Wenatchee stocks differed by 0.2 days or less for all dam pairs listed that are in the normal migration corridor for both stocks. The nine

[19] Priest Rapids Dam is used in this comparison because it has been the furthest upstream dam with consistently very high rates of PIT tag detection [Table 42] that is passed by both predominant stocks (Okanagan and Wenatchee).
[20] Spawning grounds refers to detection at or above OKC in the Okanagan, LWE or WTL in Wenatchee, or RFL in the Snake Basin.

Wenatchee-stock Sockeye Salmon which were detected at Wells Dam had shorter migration times to Rocky Reach and Wells Dam than did Okanagan Sockeye Salmon on their usual migration route.

Table 49. Median Sockeye Salmon migration rates and travel time between dams as estimated by PIT tag detections in 2020.

		Adults Tagged at Bonneville Dam		Returning Adults Tagged as Juveniles	
Dam Pair	Distance (km)	Median Travel Time (days)	Median Migration Rate (km/day)	Median Travel Time (days)	Median Migration Rate (km/day)
Bonneville-The Dalles	74	1.8	40.5	1.6	44.3
The Dalles-John Day	39	0.9	46.4	0.9	48.3
John Day-McNary	63	2.1	56.6	2.1	55.6
McNary-Priest Rapids	167	4.9	34.5	5.0	33.9
Priest Rapids-Rock Island	89	3.0	30.1	3.1	29.2
Rock Island-Rocky Reach	33	1.0	32.6	1.0	32.6
Rocky Reach-Wells	65	1.8	36.7	1.9	36.5
Rock Island-Tumwater	73	9.6	7.2	9.7	7.1
Bonneville-John Day	113	2.8	41.6	2.6	44.1
Bonneville-McNary	231	4.9	47.7	4.8	48.1
Bonneville-Priest Rapids	329	9.9	40.5	10.0	40.3
Bonneville-Rock Island	487	13.0	37.8	13.4	36.7
Bonneville-Tumwater	560	24.0	23.3	23.8	23.5
Bonneville-Wells	585	16.0	37.0	16.4	36.1

Table 50. Adult Sockeye Salmon median travel time in days between dam pairs by statistical week tagged at Bonneville Dam, the p-value for a linear regression between travel time and statistical week, and mean travel time by stock as estimated using PIT tags in 2020.

Statistical Week at Bonneville Dam	BON to TDA	BON to JDA	BON to MCN	BON to PRA	BON to RIA	BON to TUF	BON to RRF	BON to WEA	BON to ZSL	WEL to ZSL	RIA to TUF
23	1.9	3.1	6.9	15.1	20.4	0.0	21.9	24.1	NA	NA	NA
24	1.9	3.1	5.6	13.8	17.3	38.6	19.0	21.1	NA	NA	17.7
25	1.8	2.9	5.2	11.7	16.4	31.4	17.7	19.8	89.8	59.6	14.9
26	1.8	2.8	4.9	11.0	14.2	26.0	15.0	17.0	69.4	44.7	10.7
27	1.8	2.8	4.8	9.0	11.8	20.9	12.7	14.7	60.9	45.2	8.7
28	1.7	2.7	4.7	8.7	11.9	21.0	12.0	13.9	40.2	26.1	7.4
29	1.7	2.6	4.7	8.6	11.0	20.2	11.9	13.7	42.6	28.5	8.1
30	1.7	2.7	4.8	8.8	11.7	22.6	12.8	14.7	26.7	12.2	8.3
31	1.5	2.3	4.5	8.1	10.7	23.7	12.0	14.1	30.0	8.7	12.9
32	1.6	2.8	4.3	10.2	13.3	0.0	15.1	17.0	25.2	10.2	NA
p-value	**<0.01**	**0.01**	**<0.01**	**<0.01**	**<0.01**	**0.03**	**0.01**	**0.01**	**<0.01**	**<0.01**	**0.12**
Stock											
Okanagan	1.8	2.8	4.9	9.8	13.0	NA	13.9	16.0	43.0	29.6	NA
Wenatchee	1.8	2.8	4.9	10.0	13.0	23.8	13.1	15.2	NA	NA	9.6

The median passage time at a dam for Sockeye Salmon tagged at Bonneville Dam in 2020 was 9.4 with the greatest median passage time at Tumwater Dam, likely due to trapping activities at that site.

Table 51. Sockeye Salmon median passage time (from time of first detection at a dam to last detection at a dam) and the percentage of Sockeye Salmon taking greater than 12 hours between first detection and last detection at upstream dams in 2020.

Dam	N	Median Passage (Minutes)	%>12 Hours
Bonneville	1730	24.5	9.1%
The Dalles	1589	0.1	2.1%
John Day	1494	0.3	5.0%
McNary	1466	0.2	1.0%
Priest Rapids	1393	9.4	3.4%
Rock Island	1235	23.6	2.2%
Rocky Reach	1076	6.2	2.6%
Wells	1046	7.6	7.6%
Zosel	188	0.7	2.1%
Tumwater	166	48.0	18.1%
Ice Harbor	6	8.3	16.7%
Lower Monumental	1	0.2	0.0%
Little Goose	1	0.1	0.0%
Lower Granite	0	NA	NA
Weighted Mean (by detection number)		**9.4**	**4.4%**

Night Passage

Okanagan Sockeye Salmon tagged at Bonneville Dam passed PIT tag antennas at night (2000-0400 hours) at a higher rate than Wenatchee Sockeye Salmon at 6 out of 9 dams where Sockeye Salmon from both stocks were detected (Table 52). Adults tagged at Bonneville passed dams at night at a higher rate than Sockeye Salmon tagged as juveniles at 6 out of 10 dams.

Table 52. Estimated Sockeye Salmon night passage (2000-0400) by stock at Columbia River, Zosel, and Tumwater dams in 2020.

Dam	Adults Tagged at Bonneville Dam			Sockeye Salmon Tagged as Juveniles
	All Adults	Okanagan	Wenatchee	
Bonneville	0.6%	0.7%	0.0%	2.2%
The Dalles	8.1%	9.0%	3.9%	7.5%
John Day	4.0%	4.9%	0.5%	2.3%
McNary	7.2%	8.3%	0.9%	3.7%
Priest Rapids	3.4%	3.9%	1.0%	4.3%
Rock Island	4.3%	4.2%	4.5%	3.9%
Rocky Reach	7.2%	7.3%	4.5%	9.7%
Wells	11.2%	11.0%	33.3%	8.2%
Tumwater	3.6%	NA	3.7%	3.8%
Zosel	27.1%	27.1%	NA	11.1%

Fallback

Fallback rates at mainstem Columbia River dams for adults tagged at Bonneville Dam in 2020 ranged from 0.3% at McNary Dam to 6.0% at John Day Dam while among all 347 returning Sockeye Salmon tagged as juveniles, the range was from 0.0% at Rock Island Dam to 9.1% at Rocky Reach Dam (Table 53).

Of the 295 Sockeye Salmon tagged as adults by this project in 2020 which fell back over at least one dam, 13 fell back over two dams 2 fell back over three dams, and 1 fell back over four dams (Table 54). Among Sockeye Salmon tagged as juveniles, the mean number of fallback events per Sockeye Salmon ranged from 0.16 for Sockeye Salmon tagged in the Okanagan (n-164) to 0.60 for those tagged in the Snake Basin (n=5) compared to 0.19 for adult-tagged Sockeye Salmon in our Bonneville study (Table 54). Figures showing examples of the movements of the Sockeye with between three and five fallbacks are in Appendix C (Figures C30 and C31).

Table 53. Estimated minimum fallback rates for Sockeye Salmon at dams in 2020[21]. NA indicates Sockeye Salmon were not detected at a dam outside the range of the particular stock. The sample size (n) is the number of tagged Sockeye Salmon detected moving upstream past Bonneville Dam.

	Tagged as Adults	Tagged as Juveniles by Tagging Location				
Dam	Bonneville AFF (n=1696)	Okanagan Basin (n=164	Rock Island Dam (n=78)	Snake Basin (n=5)	Wenatchee Basin (n=100)	Total (n=347)
Bonneville	0.4%	0.6%	1.3%	0.0%	0.0%	0.6%
The Dalles	3.0%	1.9%	1.4%	0.0%	1.1%	1.5%
John Day	6.0%	4.9%	8.6%	20.0%	6.7%	6.5%
McNary	0.3%	1.5%	1.4%	0.0%	0.0%	1.0%
Priest Rapids	2.3%	3.7%	0.0%	NA	0.0%	1.8%
Rock Island	1.1%	0.0%	0.0%	NA	0.0%	0.0%
Rocky Reach	5.5%	1.7%	6.8%	NA	78.6%	9.1%
Wells	2.3%	1.7%	2.3%	NA	100.0%	7.6%
Tumwater	1.2%	NA	7.7%	NA	7.6%	7.6%
Zosel	0.3%	5.9%	0.0%	NA	NA	4.0%
Skaha	3.3%	5.0%	10.0%	NA	NA	6.7%
Ice Harbor	33.3%	NA	NA	NA	NA	NA
Lower Monumental	0.0%	0.0%	0.0%	20.0%	NA	20.0%
Little Goose	0.0%	0.0%	0.0%	20.0%	NA	20.0%
Lower Granite	NA	NA	NA	0.0%	NA	0.6%

[21] Does not include Sockeye Salmon that may have fallen back over a dam and were not subsequently detected.

Table 54. Number of fallback events by tag group for returning Sockeye Salmon tagged as juveniles and Sockeye Salmon included in our Bonneville adult tagging study in 2020.

	Sockeye Salmon Tagged as Adults	Sockeye Salmon Tagged as Juveniles by Tagging Location			
Fallback Events	**Bonneville Dam AFF**	**Okanagan Basin**	**Rock Island Dam**	**Snake Basin**	**Wenatchee Basin**
1	279	27	14	3	26
2	13	0	1	0	7
3	2	0	0	0	0
≥4	1	0	0	0	0
Number of Sockeye Salmon falling back at least once	**295**	**27**	**15**	**3**	**33**
% of Sockeye Salmon with at least one fallback event	**16.5%**	**16.5%**	**19.2%**	**60.0%**	**33.3%**
Total fallback events	**315**	**27**	**16**	**3**	**40**
Number of Sockeye Salmon detected at or upstream of Bonneville Dam	**1696**	**164**	**78**	**5**	**100**
Fallbacks events per Sockeye Salmon	**0.19**	**0.16**	**0.21**	**0.60**	**0.40**

Straying

The Sockeye stray rate estimated by this project is 1.6% (Table 55). Among the 13 Sockeye strays in Table 55, 8 were from the Yakima Sockeye reintroduction program and 5 Wenatchee or Okanagan Sockeye were last detected in the Entiat or Methow rivers.

A reintroduction program at Cle Elum Lake in the Yakima Basin complicates stray analysis. Some Yakima stock Sockeye can be identified using PBT, but those are rare. Sockeye not identified by PBT are classified using GSI, which cannot differentiate between a Wenatchee or Okanagan stock Sockeye and the offspring of Wenatchee or Okanagan stock Sockeye Salmon whose parents spawned in the Yakima Basin. It is likely that the three “Okanagan” stock Sockeye Salmon last detected in the Yakima River were actually offspring of Okanagan stock Sockeye Salmon which spawned upstream of Cle Elum Lake.

Table 55. Showing final-PIT-fate categories by stock as determined using Genetics Stock Identification for fish tagged in 2020. Fate categories are categorized by color. Grey is neutral (meaning last detected on route to expected destinations), green is on target (meaning last detected at their expected destination), yellow is putative overshoot meaning a fish last detected in an area adjacent to its expected destination, and red is putative stray meaning a fish was last detected in tributaries or the mainstem outside their normal route to their expected destination. Stray rates are also tabulated.

	Bonneville Dam			The Dalles		John Day Dam			McNary Dam				Yakima Basin						Wenatchee Basin						Rocky Reach Dam		Entiat Basin				Methow Basin			Okanagan Basin							Totals						
Genetic Stock Identification Classification	OR Shore Ladder	Lower WA Shore Ladder	Upper WA Shore Ladder	East Shore Ladder	West Shore Ladder	Juvenile Bypass	Oregon Shore	WA Shore	Oregon Shore	WA Shore	Juvenile Bypass	Ice Harbor Dam	Prosser Dam	Sunnyside Diversion	Roza Dam	Priest Rapids Harchery	Priest Rapids Dam	Rock Island Dam	Lower Wenatchee	Icicle Creek	Tuwater Dam	Upper Wenatchee	Little Wenatchee	White River	Rocky Reach Dam	Rocky Reach Bypass	Lower Entiat River	Upper Entiat river	Wells Hatchery	Wells Ladders	Lower Methow River	Methow River-Carlton	Twisp River	Lower Okanagan River	Zosel Dam	Okanagan River-liver	McIntyre Dam	Skaha Dam	Okanagan River-Penticton	Okanagan River-Penticton	Total	Neutral	On Target	Putative Stray	Putative Overshoot	Likely Cle Elum Program	% Putative Stray/On Target
Columbia RKM	234	234	234	308	308	347	347	347	470	470	470	522	539	539	539	635	639	730	754	754	754	754	754	754	763	763	778	778	829	830	843	843	843	858	858	858	858	858	858	858							
Last Site	**BO1**	**BO3**	**BO4**	**TD1**	**TD2**	**JDJ**	**JO1**	**JO2**	**MC1**	**MC2**	**MCJ**	**ICH**	**PRO**	**SUN**	**ROZ**	**PRH**	**PRA**	**RIA**	**LWE**	**ICL**	**TUF**	**UWE**	**LWN**	**WTL**	**RRF**	**RRJ**	**EHL**	**ENA**	**WEH**	**WEA**	**LMR**	**MRC**	**TWR**	**OKL**	**ZSL**	**OKC**	**OKM**	**SKA**	**OKP**	**OKP**	**Total**						
Okanagan	2	8	71	39	5	1	25	16	25	41	1			1	2		92	26							13	2	1		5	349	1			54	54	371	4	27	60	60	1346	711	630	2	0	3	0.3%
Wenatchee	3	2	27	3		1	6	4	8	7							24	7	4	1	7	42	15	99	1	1		1				1	1								260	87	168	3	2	0	1.8%
Snake			1				2																																		3	3	0	0	0	0	NA
Yakima			1	1			1		5	7		4	3		10	1	2		1					1	1									1							39	18	13	8	0	0	38.1%
Total	**5**	**10**	**100**	**43**	**5**	**2**	**34**	**20**	**38**	**55**	**1**	**4**	**3**	**1**	**12**	**1**	**118**	**33**	**5**	**1**	**7**	**42**	**15**	**100**	**15**	**3**	**1**	**1**	**5**	**349**	**1**	**1**	**1**	**55**	**54**	**371**	**4**	**27**	**60**	**60**	1648	819	811	13	2	3	1.6%

DISCUSSION

In 2020, this project tracked a total of 3,272 Chinook, 1,474 steelhead, and 1,730 Sockeye (Table 56) upstream to estimate parameters such as upstream escapement, age composition, length composition, and migration rates at and between mainstem dams and other tributary interrogation sites. The year 2020 marked the 15th year of Sockeye Salmon PIT tagging, the 14th year of Chinook Salmon PIT tagging and the 12th year of steelhead PIT tagging at Bonneville Dam. Over this time, the number of PIT tag detection sites in the Columbia Basin has continually increased, increasing our understanding about the movement of tagged salmonids.

Table 56. Total number of Chinook and Sockeye salmon and steelhead PIT tags tracked by year (includes recaptures of previously PIT tagged fish) 2009-2020.

	Total Tracked				Percent of Run Tracked			
Year	**Chinook**	**Steelhead**	**Sockeye**	**Total**	**Chinook**	**Steelhead**	**Sockeye**	**Total**
2009	2,968	2,485	838	6,291	0.42%	0.41%	0.47%	0.42%
2010	2,579	1,741	913	5,233	0.29%	0.42%	0.24%	0.31%
2011	3,253	1,377	763	5,393	0.38%	0.37%	0.41%	0.38%
2012	3,438	1,451	1,601	6,496	0.50%	0.62%	0.31%	0.45%
2013	3,406	1,276	772	5,454	0.26%	0.55%	0.42%	0.32%
2014	3,869	1,717	1,400	6,986	0.27%	0.63%	0.27%	0.33%
2015	3,563	898	901	5,362	0.25%	0.33%	0.18%	0.24%
2016	3,396	1,610	1,653	6,659	0.44%	0.86%	0.48%	0.51%
2017	2,805	836	1,079	4,720	0.69%	0.71%	1.23%	0.87%
2018	3,178	893	1,848	5,919	0.95%	0.87%	0.95%	0.94%
2019	3,483	820	972	5,275	0.79%	1.06%	1.54%	0.92%
2020	3,272	1,474	1,730	6,475	0.54%	1.29%	0.51%	0.61%
Mean	**3,267**	**1,382**	**1,206**	**5,855**	**0.48%**	**0.68%**	**0.58%**	**0.52%**
All Years	**39,210**	**16,578**	**14,470**	**70,263**				

In past years, this study has looked closely at the definition of spring and summer Chinook, however we were not allowed to sample most of the spring Chinook run in 2020, stopping a dataset on age and length-at-age composition which had been collected every year since 1987.

Tules, which are mature, very dark colored fall Chinook primarily bound for lower Columbia River hatcheries and tributaries, have not normally been included in our sample due to the fact that scales are very difficult to remove for aging and aging is difficult, if not impossible due to the extreme resorption of the outer part of the scales. However, in 2020 (as in 2019 – 150 sampled), we did sample 122 Tules between weeks 34 and 40. Of these, 102 were last detected at Bonneville Dam (101 of which were at the upper antennas prior to entering Bonneville Pool), 11 were last detected at Spring Creek Hatchery, with 3 at Little White Salmon Hatchery, 2 at McNary Dam, and 1 each at Hood River mouth, The Dalles Dam, John Day Dam, and Lower Tucannon River (Figure C16 in Appendix C).

PBT classification for Tules sampled in 2020 was 72 Spring Creek Hatchery, 3 Little White Salmon Hatchery, and 1 each from Lyons Ferry, Nez Perce, and Priest Rapids hatcheries. These latter three fish were likely extremely mature Chinook which had a Tule coloration and not of the Tule race.

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APPENDIX A

Section on Adult Trap Protocols out of the 2019 Fish Passage Plan for Bonneville Adult Fish Facility. Full document can be found at http://pweb.crohms.org/tmt/documents/fpp/2019/final/FPP19_AppG.pdf.

1. BONNEVILLE DAM ADULT FISH FACILITY

The following protocols will be implemented by agencies conducting research in the Bonneville Dam second powerhouse Adult Fish Facility (AFF). These protocols were coordinated with fish agencies and tribes through the Fish Passage Operation and Maintenance Coordination Team (FPOM). The purpose of these protocols is to provide measures to limit mortality resulting from stress when handling fish.

1.1. General Facility Protocols.

1.1.1. Users must have appropriate documentation for conducting research at the dam (see *Guide for Researchers at Bonneville Dam*). This includes valid state and federal permits that cover all listed species passing the project during the trapping period. Users shall comply with all fish handling conditions in the permits. *If permit conditions are more restrictive than the following protocols, users must follow permit conditions*.

1.1.2. The Corps reserves the right to terminate trapping operations at any time.

1.1.3. Users will be trained in the proper operation of the AFF to insure fish and personnel safety. Users may request training through the Project Biologists.

1.1.4. Bridge crane certification is required prior to operating the overhead crane. Training will not be provided by the Corps of Engineers.

1.1.5. Hard hats, long pants or raingear, steel-toed shoes or rubber boots are to be worn at all times. Shorts, tennis shoes, or sandals will not be permitted in the lab.

1.1.6. Water temperatures should be observed upon arrival and periodically during the day.

1.1.7. Personnel conducting research are required to be present in the AFF to divert desired fish into the anesthetic tank using the flume swing gates. While the AFF is in operation, flumes shall be open and a researcher must be on-site.

1.1.8. Undesired fish will be bypassed to the return pool.

1.1.9. Researchers shall perform no maintenance on Corps owned/installed equipment. Nets may be mended as necessary.

1.1.10. Qualified users may lower the main ladder picket leads and downstream exit bulkhead when they arrive, and must raise the picket leads when they are completed for the day. The downstream exit bulkhead may be left down when shad and lamprey are attempting to pass.

1.1.11. Users will be permitted to operate valves 9 and 10 to control flow down the flumes at their discretion and to operate the raw water booster pump. Users may operate valve 12 to provide flow in the holding pool and valve 15 to drain water at the return pool.

1.1.12. Users must use a sanctuary net large enough to safely handle the largest fish passing the project during the trapping period.

1.1.13. Fish greater than 100 cm forklength may be diverted into the main anesthetic tank or returned to the ladder untouched. These fish will not be diverted into any auxiliary anesthetic tanks.

1.2. Notification & Documentation.

1.2.1. Users will notify the control room when they set up and close down the lab.

1.2.2. Users will record the times picket leads are lowered and raised and which agency they are representing on the sheet provided by the project biologists.

1.2.3. Lamprey may be held up to 48 hours in the AFF. Researchers will notify Project Fisheries and the Control Room whenever lamprey are held.

1.2.4. Any and all mortalities must be immediately reported to a Project Biologist. The Project Biologist will examine the mortality and take any photos. The researcher shall give a detailed report including:

- **(a)** Species;
- **(b)** Origin;
- **(c)** Length;
- **(d)** Weight;
- **(e)** Marks and injuries;
- **(f)** Cause and time of death;
- **(g)** Future preventative measures.

1.2.5. All mortalities are included in Project Fisheries weekly reports submitted to FPOM.

1.3. Trapping Protocols – Ladder Water Temperatures <70°F.

1.3.1. There will be no start time restriction for trapping operations.

1.3.2. There will be no more than 4 Chinook, or 4 steelhead, or 6 sockeye, or any combination of 4 adult salmonids allowed in the anesthetic tank at any one time. This assumes that users can effectively track the length of time fish stay in the anesthetic tank.

1.3.3. There will be no more than two adult fish in any one observation tank at any one time. The brail pool is the primary and preferred recovery area.

1.3.3.1. Observation tanks will primarily be used for fish in "*distress*", defined as fish that have sustained injury during the trapping and sampling process; fish that have a previous injury (e.g., fish in "*fair*" or "*poor*" condition upon trapping due to marine mammal injuries or similar) fish that are showing symptoms of heavy sedation (e.g., diminishing gill movement, reduced gasp response when out of water).

1.3.3.2. Fish will be released from the observation tanks when they are in the state of "*Partial Equilibrium,*" defined as: gilling normally, making weak tailing movements, cannot swim upright and swims off course without avoiding obstacles; fish will not strongly try to break free of handlers.

1.3.3.3. All fish in an observation tank must be continuously observed by a dedicated observer to ensure adult fish do not recover beyond partial equilibrium prior to return to the brail pool. No lid or restraining device shall be installed on top of the observation tanks.

1.3.3.4. Observation tanks may be used for study objectives such as monitoring recovery time from anesthetic, if approved by FPOM and USACE.

1.3.4. Anesthetic tank water will be replaced at least two times per day. Water temperatures in the anesthetic tank will be maintained within 2°F of the fish ladder water temperature. *If anesthetic tank water temperature exceeds 70℉, criteria in **section 4** will go into effect.*

1.3.5. Water in the observation tanks will be running continuously to allow a constant exchange of water through the tank.

1.3.6. Personnel shall ensure fish are sampled as quickly as possible. It is recommended that it take no longer than 25 minutes to transition the fish from entry into the anesthetic tank to release back into the return ladder or transportation tank.

1.3.7. Personnel shall ensure that fish are fully recovered from anesthetization prior to release into the return ladder. Fish may volitionally leave the brail pool when they are ready.

1.3.8. When trapping is completed for the day, users will properly shut down the lab.

1.3.9. Four picket leads will be allowed during trap operations for up to four hours. After all picketed leads are raised, fish already in the AFF can be sampled for an additional one hour. The picketed lead operations are as follows[1]:

- **(a) 0–6,000:** All 4 picket leads can be lowered for 4 continuous hours.
- **(b) 6,000–12,000:** All 4 picket leads down for 3 hours. At the 3rd hour, raise at least 1 picket lead for ½ hour, and then continue sampling for additional 1 hour.
- **(c) 12,000–25,000:** All 4 picket leads down for 2 hours. At the 2nd hour, raise at least 2 picket leads for ½ hour, and then continue sampling for an additional 2 hours.
- **(d) 25,000–35,000:** Two picket leads down for four hours.
- **(e) > 35,000:** No picket leads down.

1.3.10. Researchers will also be required to monitor the ladder every hour to ensure there is no crowding. If evidence of crowding is occurring at least two picket leads will be raised.

[1] All counts are of adult salmonids (including jacks) as enumerated the previous day at the Washington Shore count station. Assumes 4 shad = 1 salmonid (e.g., 6,000 salmonids + 4,000 shad = 7,000 total).

1.3.11. Project Fisheries will notify FPOM as soon as Weir 37 violates FPP criteria.

1.3.12. Project biologists retain the authority to raise additional picket leads depending on fish densities and ladder conditions.

1.4. Trapping Protocols – Ladder Water Temperatures >=70°F.

1.4.1. Trapping will not occur when fish ladder water temperatures meet or exceed 70°F as measured in the brail pool. The only exception is for *US v Oregon* requirements and for nighttime lamprey trapping. Nighttime is defined as official sunset to sunrise.

1.4.1.1. Project Biologists will use the Corps temperature probe reading as the official temperature.

1.4.1.2. Temperatures are both instantaneous readings and 0000–2400 daily averages. Researchers can review daily average, minimum and maximum temperatures from www.nwd-wc.usace.army.mil/tmt/documents/ops/temp/daily_by_basin.html to determine if the trap is within temperature criteria prior to traveling to BON. Instantaneous temperatures will be used to determine if trapping operations will continue for the day.

1.4.1.3. Project biologists will collect temperature data weekly from the data logger in the exit ladder. Daily checks may be requested when temperatures approach 70°F.

1.4.2. At water temperatures of 70–72°F, sampling will be permitted as defined below for up to four days per week from 0600-1030 hours to allow for *U.S. v Oregon* requirements. This operation will remain in effect until daily average water temperature drops to ≤ 69.9°F. All sampling will cease when temperature reaches 72°F. No sampling may resume until daily average water temperature drops to ≤ 71.9°F. An exception is that nighttime lamprey trapping will be permitted up to 73.9°F for tagging and transport purposes. All nighttime trapping for lamprey will cease when temperatures reach 74°F.

1.4.3. Researchers may continue to work through fish in the holding pool for one hour after picket leads have been raised.

1.4.4. Project Fisheries will notify FPOM as soon as Weir 37 consistently violates FPP criteria.

1.4.5. The density criteria for picket lead operations will be altered and the operations will be as follows (density criteria and adult ladder monitoring outlined above in **1.3.9** also apply[1]):

- **(a) 0–3,000:** All 4 picket leads can be lowered for 4 continuous hours.
- **(b) 3,000–6,000:** All 4 picket leads down for 3 hours. At the 3rd hour, raise at least 1 picket lead for ½ hour and then continue sampling for an additional 1 hour.
- **(c) 6,000–9,000:** All 4 picket leads down for 2 hours. At the 2nd hour, raise at least 1 picket lead for ½ hour and then continue sampling for an additional 2 hours.
- **(d) 9,000–18,000:** 2 leads down for 4 hours. All picket leads raised by 10:30 am.
- **(e) > 18,000:** No picket leads down.

1.4.6. There will be no more than 3 adult Chinook or steelhead or 4 sockeye in the anesthetic tank at a time. A combination of salmonids is allowed, with the maximum of either 2 Chinook or steelhead and 1 sockeye, or 1 Chinook or steelhead and 2 sockeye. This assumes users can effectively track the length of time fish stay in the anesthetic tank.

1.4.7. The brail pool is the primary and preferred recovery pool.

1.4.8. The observation tanks will be used for fish in distress under guidelines established in 3.3.1 through 3.3.4.

1.4.9. If used, water in the observation tanks will be running continuously allowing a constant exchange of water through the tank.

1.4.10. Assure oxygen levels are maintained at saturation in the anesthetic and recovery tanks. There will be no depression in oxygen levels in the anesthetic or recovery tanks. To assure this, water in the anesthetic tank will be replaced at least every three hours.

1.4.11. Maintain the anesthetic and recovery tank water temperatures 1-2°F lower than the ladder water temperature. If ice is used to cool the anesthetic or recovery tank water, the ice should be from river water or from an un-chlorinated water source and should be added in individual sealed containers. Do not exceed a 2°F difference between the anesthetic or recovery tank water and fish ladder water.

1.4.12. Personnel shall ensure fish are sampled as quickly as possible. It is recommended that it take no longer than 25 minutes to transition the fish from entry into the anesthetic tank to release back into the return ladder or transportation tank.

1.4.13. Personnel shall ensure fish are fully recovered from anesthetization prior to release. Fish may volitionally leave the brail pool when they are ready.

1.4.14. Project biologists retain the authority to raise additional picket leads depending on fish densities and ladder conditions.

1.5. <u>Winter Trapping Protocols (December 1 – March 14).</u>

The purpose of these protocols is to provide measures to limit passage delay and stress from overcrowding in the brail pool. Personnel conducting research during this time are not required to be present in the AFF. Users are allowed to activate the flume swing gates to divert all fish into the brail pool.

1.5.1. Fish will not be permitted to remain in the brail pool longer than 24 hours. It is recommended that handling of fish occurs daily by 1800 hours. This assures that if fish are sampled at the end of the day, most of the fish captured are only held from the morning until afternoon since passage at night is minimal, thus reducing delay.

1.5.2. During sampling, the brail pool should be raised and one adult salmonid netted, via a sanctuary net, and placed into the anesthetic tank at a time. After removing fish from the brail pool into the anesthetic tank, the brail pool will be lowered back to its full depth.

1.5.3. There will be no more than three adult salmonids in the anesthetic tank at a time. This assumes users can effectively track the length of time fish are in the anesthetic tank.

1.5.4. There will be no more than two adult salmonids in the recovery tank at a time.

1.5.5. Water in the recovery tank will be running continuously, allowing a constant exchange of water through the tank.

1.5.6. Personnel shall ensure fish are sampled as quickly as possible. It is recommended that it take no longer than 25 minutes to transition the fish from entry into the anesthetic tank to release back into the return ladder or transportation tank.

1.5.7. Personnel shall ensure fish are fully recovered from anesthesia prior to release.

1.5.8. If daily sampling is not to occur within 24 hours, the main ladder picket leads and downstream exit gate will be raised. The lab will be properly returned to bypass mode.

APPENDIX B

Email threads on the anesthetic water disposal and sampling loss between the Corps of Engineers and CRITFC.

From: Derugin, Andrew G CIV (USA) <Andrew.G.Derugin@usace.army.mil>
Sent: Wednesday, January 29, 2020 9:58 AM
To: John Whiteaker <whij@critfc.org>
Subject: Bon AFF

Hi John,

We're moving forward with the metalworks fixes in our AFF. The brail pool will be operational, and I'm waiting to find out when the rest of the replacement parts will arrive.

What we haven't been able to figure out what we will be doing with the sample water with aqui-s. Project environmental stakk have new discharge permits coming through for the dam and that is not on them. Our drainage system from the AFF to the treatment plant uses small ~1" pipes, so I'm assuming that would slow you guys down way too much. Another option is pumping it outside to a tank on a truck that could then be properly disposed of. Either way, we should talk about this soon.

V/r,

Andrew Derugin
Fish Biologist & Research Coordinator
Bonneville Lock & Dam
U.S. Army Corps of Engineers
o: 541.374.4020
m: 503.278.2376

From: Derugin, Andrew G CIV (USA) <Andrew.G.Derugin@usace.army.mil>
Sent: Monday, February 24, 2020 2:46 PM
To: John Whiteaker <whij@critfc.org>
Subject: RE: 2020 Bonneville AFF research pack

Hi John,

Just a heads up, the research request packet only needs to go to myself and Erin Kovalchuk. She posts it on the website, I do the processing. Tammy doesn't actually have any work in it, she just forwards it to Erin.

-Any ideas about the Aqui-s discharge?

V/r,

Andrew Derugin
Fish Biologist & Research Coordinator
Bonneville Lock & Dam
U.S. Army Corps of Engineers
o: 541.374.3879
m: 503.278.2376

-----Original Message-----
From: John Whiteaker [mailto:whij@critfc.org]
Sent: Friday, February 21, 2020 9:13 AM
To: Mackey, Tammy M CIV USARMY CENWP (USA) <Tammy.M.Mackey@usace.army.mil>
Cc: Derugin, Andrew G CIV (USA) <Andrew.G.Derugin@usace.army.mil>
Subject: [Non-DoD Source] 2020 Bonneville AFF research pack

Hi Tammy,

I have included copies of our request to access the Bonneville Dam AFF for the 2020 sampling season. Our ESA coverage will continue under the Harvest BiOp and I will send a copy of our Yakama Nation sampling permit to Andrew when it arrives. Let me know if you need anything else.

John Whiteaker
Fishery Scientist
Columbia River Inter-Tribal Fish Commission
700 NE Multnomah St., Suite 1200
Portland OR. 97232
(503) 238-3562

From: John Whiteaker
Sent: Wednesday, March 11, 2020 2:10 PM
To: 'Derugin, Andrew G CIV (USA)' <Andrew.G.Derugin@usace.army.mil>; 'Hausmann, Benjamin J CIV USARMY CENWP (USA)' <Benjamin.J.Hausmann@usace.army.mil>
Subject: AquiS disposal update.

Hi Ben and Andrew,
It turns out the Yakama Nation only has a cooperative agreement with the state of Washington for collection permits. I'm told that they have to go through the Department of Ecology for discharge permits but have verbal clearance to discharge MS222 which doesn't help us.

I contacted Carey Cholski who is the SW Region Permit Coordinator and she didn't think disposing AquiS directly into the river could be done without a permit and stated that the preferred method would be to dispose anesthetic water to the ground, or septic/sewer system. She also wasn't sure about jurisdiction with us being Tribal and the facility being federal. I requested her contact at the federal EPA to follow up.

As a participant of the AquiS INAD through the USFWS, we are given a study protocol (attached) and section XI. Treatment Schedules discusses disposal as follows:

E. Disposition of anesthetic solution
If at all possible, discharge of anesthetic solution remaining in the treatment containers following completion of treatment should be to the ground. If ground discharge is not possible, anesthetic solution may be released/mixed with facility effluent or released directly into public surface water. In situations where minimal dilution of anesthetic solution occurs prior to release to public surface waters, a pulsed-release of anesthetic solution should be employed to minimize discharge levels.

I will continue to follow up on this until we can work out a solution.

John Whiteaker
Fishery Scientist
Columbia River Inter-Tribal Fish Commission
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From: Derugin, Andrew G CIV (USA) <Andrew.G.Derugin@usace.army.mil>
Sent: Wednesday, March 11, 2020 1:50 PM
To: John Whiteaker <whij@critfc.org>; Mcbain, Melissa A CIV (USA)
<Melissa.A.Mcbain@usace.army.mil>
Subject: AFF discharge

John- this is Melissa, our environmental compliance coordinator

Missy- this is John, he leads the CRITFC sampling effort in our AFF and has some questions about discharge permitting

V/r,

Andrew Derugin
Fish Biologist & Research Coordinator
Bonneville Lock & Dam
U.S. Army Corps of Engineers
o: 541.374.3879
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From: John Whiteaker
Sent: Thursday, April 2, 2020 9:58 AM
To: Mcbain, Melissa A CIV (USA) <Melissa.A.Mcbain@usace.army.mil>
Cc: Derugin, Andrew G CIV (USA) <Andrew.G.Derugin@usace.army.mil>
Subject: RE: AFF discharge

Missy,
Thanks for looking into this and I know it's a busy time.

I've been thinking about pumping our used anesthetic water to a transfer tank and then trickle that water into the sewer pipe to keep from overloading the system. If the sewer drain pipe is 1 inch then we could use a .5-.75 inch pipe from the transfer tank. We usually have a couple of hours between water changes and that would give the transfer tank time to drain.

John

-----Original Message-----
From: Mcbain, Melissa A CIV (USA) <Melissa.A.Mcbain@usace.army.mil>
Sent: Wednesday, April 1, 2020 3:28 PM
To: John Whiteaker <whij@critfc.org>
Cc: Derugin, Andrew G CIV (USA) <Andrew.G.Derugin@usace.army.mil>
Subject: RE: AFF discharge

This is a little complicated to answer directly. But...

We do not have discharge permits. We are currently awaiting Industrial Wastewater permits from EPA, however the discharge from the AFF would be applicable under an aquaculture permit like hatcheries utilize. Where the State has been delegated authority they will issue permits for federal facilities. With NPDES Aquaculture I am unsure who has the authority, EPA or Ecology. I do not know if the AFF falls under this category or if there is an exemption.

To avoid a permit, I would suggest routing this discharge to the sewer system. I can talk internally about that with our treatment plant operator when he comes in this afternoon. Andrew and I discussed this previously and I need to revisit how the piping works or how feasible this is. I want to avoid discharge to the ground, that would be worst case scenario.

Thank you for your patience. I will get back to you very soon.

Missy McBain
Bonneville Lock and Dam
Environmental Specialist
US Army Corps of Engineers
Portland District

Office: (541) 374-3850
Cell: (971) 302-8056

From: John Whiteaker [mailto:whij@critfc.org]
Sent: Thursday, March 12, 2020 9:22 AM
To: Mcbain, Melissa A CIV (USA) <Melissa.A.Mcbain@usace.army.mil>
Cc: Derugin, Andrew G CIV (USA) <Andrew.G.Derugin@usace.army.mil>
Subject: [Non-DoD Source] RE: AFF discharge

Hi Missy,

Just a quick background. We are signed up for the AquiS INAD (participation letter attached) which allows us to immediately release fish we sample without a withdrawal period. In the study protocol (also attached) under Section XI. Treatment Schedules they discuss the disposal/discharge of the anesthetic water

E. Disposition of anesthetic solution

If at all possible, discharge of anesthetic solution remaining in the treatment containers following completion of treatment should be to the ground. If ground discharge is not possible, anesthetic solution may be released/mixed with facility effluent or released directly into public surface water. In situations where minimal dilution of anesthetic solution occurs prior to release to public surface waters, a pulsed-release of anesthetic solution should be employed to minimize discharge levels.

Aqui S20E contains a 10% concentration of the active ingredient eugenol. We use 230ml (23ml active ingredient) mixed with approximately 300 gallons of water for each anesthetic bath and we run 1-3 baths per day.

It's my understanding that the Corps no longer wants us to discharge our anesthetic water to the river so I contacted Carey Cholski who is the SW Region Permit Coordinator at Washington Department of Ecology and she stated that the preferred method would be to dispose anesthetic water to the ground, or septic/sewer system. She assumed we would need a discharge permit to dump anesthetic water to the river but was unsure about jurisdiction with us be a tribal organization and the facility being federal.

Due to logistical issues with the AFF, my long term goal would be to work out discharging anesthetic water to the river through WA Ecology, EPA, or with the Corps. In the short term, would it be possible to work out a solution to discharge the anesthetic water to the ground or to the Corps sewer/septic system? For the Corps discharge permitting, do you go through WA Ecology, Oregon DEQ, or EPA directly (is there a federal contact person I can connect with)? Please let me know how we should proceed and I can be available for a call or meet in person if necessary.

John Whiteaker
Fishery Scientist
Columbia River Inter-Tribal Fish Commission
700 NE Multnomah St., Suite 1200
Portland, OR. 97232
(503) 238-3562

From: Derugin, Andrew G CIV (USA) <Andrew.G.Derugin@usace.army.mil>
Sent: Thursday, April 23, 2020 3:53 PM
To: John Whiteaker <whij@critfc.org>
Subject: RE: AHA Fish Sampling and Related Activities (002).pdf

No, I'll push it up and over to force it.

-----Original Message-----
From: John Whiteaker [mailto:whij@critfc.org]
Sent: Thursday, April 23, 2020 2:23 PM
To: Derugin, Andrew G CIV (USA) <Andrew.G.Derugin@usace.army.mil>
Subject: [Non-DoD Source] RE: AHA Fish Sampling and Related Activities (002).pdf

Hi Andrew,
Here are the badge request forms and I'll find out what day works best for the crew and get back to you. Still no word from Missy on dump options?

John

-----Original Message-----
From: Derugin, Andrew G CIV (USA) <Andrew.G.Derugin@usace.army.mil>
Sent: Thursday, April 23, 2020 1:36 PM
To: John Whiteaker <whij@critfc.org>
Subject: RE: AHA Fish Sampling and Related Activities (002).pdf

Hi John,

I'll be in Sunday -Wednesday. Monday or Tuesday morning for the safety talk would be fine. Do we have access paperwork already for them?

We still need a finalized plan for disposal of the sampling water. Other than that, I reviewed your covid protocol and it sounds good to me. We are in between safety officers this week. Our regular officer will be back from deployment next week, so I'll ask for the official stamp of approval then.

Andrew

-----Original Message-----
From: John Whiteaker [mailto:whij@critfc.org]
Sent: Thursday, April 23, 2020 1:20 PM
To: Derugin, Andrew G CIV (USA) <Andrew.G.Derugin@usace.army.mil>
Subject: [Non-DoD Source] RE: AHA Fish Sampling and Related Activities (002).pdf

Hi Andrew,
We are tentatively looking to set up the AFF next week and possibly start sampling May 4. We are looking to do a phased start with Crystal, Agnes, and Jayson for the first week or two and then start our two new hires. What days are you working next week so we can setup a safety talk for Crystal, Agnes, and Jayson? What outstanding issues do we need to iron out before we get going?

From: Derugin, Andrew G CIV (USA) <Andrew.G.Derugin@usace.army.mil>
Sent: Monday, April 27, 2020 8:40 AM
To: John Whiteaker <whij@critfc.org>
Subject: AFF approval letter

Attached is your AFF work approval letter.

V/r,

Andrew Derugin
Fish Biologist & Research Coordinator
Bonneville Lock & Dam
U.S. Army Corps of Engineers
o: 541.374.3879
m: 503.278.2376

From: Derugin, Andrew G CIV (USA) <Andrew.G.Derugin@usace.army.mil>
Sent: Wednesday, April 29, 2020 5:24 PM
To: John Whiteaker <whij@critfc.org>
Subject: RE: Project Bio tomorrow/friday

Hi John,

Leif and our new hire Jeanette will be here Thursday/ Friday and can assist with badging, your access applications are ready to go with security. I'll be in M-Wed and happy to help.

As for the Aqui-s. I spoke with our new wastewater treatment plant manager and we reviewed the SDS. Unfortunately, he won't take it. It's an activated sludge plant and adding that chemical to the oxidation ditch on a regular basis would change the makeup of the bacteria. He doesn't have the facilities to deal with it separately.

All I can do right now is recommend we test your pump on Monday to see if it'll push over the wall and into an IBC effectively. I think they hold 275 gallons. Let's talk about this over the phone soon. Ben is familiar and can speak to it if I'm not in.

V/r,

Andrew Derugin
Fish Biologist & Research Coordinator
Bonneville Lock & Dam
U.S. Army Corps of Engineers
o: 541.374.3879
m: 503.278.2376

-----Original Message-----
From: John Whiteaker [mailto:whij@critfc.org]
Sent: Wednesday, April 29, 2020 2:14 PM
To: Derugin, Andrew G CIV (USA) <Andrew.G.Derugin@usace.army.mil>
Subject: [Non-DoD Source] Project Bio tomorrow/friday

Hi Andrew,

We have a meeting tomorrow related to setup/sampling at the AFF. Is there Bio on duty tomorrow/Friday should we decide to get badged and start setting up? What's your schedule next week? Also, can we use the floor drain temporarily for the anesthetic water until we can play around with other options and/or get guidance from Missy? We will only run one tank per day.

John

Phone Call Monday May 4, 2020; Andrew Derugin and John Whiteaker: Andrew says we cannot dump anywhere on Bonneville Dam COE property.

From: Derugin, Andrew G CIV (USA) <Andrew.G.Derugin@usace.army.mil>
Sent: Wednesday, May 13, 2020 5:11 PM
To: John Whiteaker <whij@critfc.org>
Cc: Hausmann, Benjamin J CIV USARMY CENWP (USA) <Benjamin.J.Hausmann@usace.army.mil>
Subject: Aff Anesthetic

Hi John,

Our environmental team made a decision on the Aqui-s disposal that I think you'll be able to work with. This decision is only for the 2020 sampling season, they will be conducting a more thorough review for the 2021 season.

In speaking with the USFWS AADAP Program Director and the INAD Program Administrator, we learned that CRITFC should in fact be covered by an FDA authorization letter that is sent annually to Andrew Pierce as the CRITFC program monitor. If you can provide this letter, then you may proceed with using Aqui-s and we can follow the discharge guidelines set forth in section XI of the Study Protocol, instead of the Aqui-s SDS.

The Study Protocol dictates that used anesthetic water may be discharged to ground or surface water. Bonneville's pending EPA NPDS permit does not cover this discharge to the Columbia River, so it must be discharged to ground. We've identified 3 suitable release areas on project, and ask that you cycle through them, in order to reduce saturation. Our Environmental Supervisor will monitor these locations throughout the season and decide if any changes are warranted. The locations are detailed in a document that our Environmental Supervisor will provide by the end of this week.

As for transporting the water, you are welcome to inquire with Brad Eppard about the temporary use of the trailers near the AFF. They are his equipment, and we cannot speak to their condition. You are welcome to begin sampling as soon as this comes together.

V/r,

Andrew Derugin
Fish Biologist & Research Coordinator
Bonneville Lock & Dam
U.S. Army Corps of Engineers
o: 541.374.3879
m: 503.278.2376

APPENDIX C

Table C1. List of PTAGIS interrogation sites (three letter code, name, and description) to use with maps that follow. Out of 341 active sites, 180 sites detected the fish tagged in 2020.

Site Code	Site Name	Site Description
158	Fifteenmile Ck at Eighteenmile Ck	The site is located in Fifteenmile Ck at Eighteenmile Ck confluence at rkm 4.
30M	Thirtymile Crk John Day Basin	This site is located at rkm 0.5 on Thirtymile Creek, a tributarty to the John Day River.
85M	Eightmile Ck at Fivemile Ck	The site is located at the confluence of both creeks with three antennas in each.
ACB	Asotin Cr. at Cloverland Brdg.	The site is located near Cloverland Bridge (RKM 4.5) on Asotin Creek, a tributary of the Snake River.
ACM	Asotin Creek near mouth	Near the mouth of Asotin Creek 50 m upstream of the Highway 129 bridge spanning the mainstem of Asotin Creek in two serial sets of two antennas.
AFC	No./So. Fk Asotin Cr. Jct. ISA	The site is located at the confluence of the North and South Forks Asotin Creek, a tributary of the Snake River.
AH1	Ahtanum at Lasalle HS	Ahtanum Creek site is located 3 rkm from the mouth of Ahtanum Creek at the lower end of the Lasalle High School property.
ANT	Antoine Creek Instream Array	The site is located on Antoine Creek, 0.48 km upstream from the confluence with the Okanogan River. Antoine Creek enters the Okanogan River at RKM 98.5, approximately 6 km upstream from the city of Tonasket, WA.
B2J	Bonneville PH2 Juvenile	Bonneville Dam PH2 Juvenile Bypass and Sampling Facility.
BBA	Big Bear Creek	The site is located on Big Bear Creek about 1.3 rkm from the confluence with Potlatch River.
BBT	Touchet River at Bolles Bridge	The Bolles Bridge site is located about 200 feet above the State HWY 124 bridge on the Touchet River, near Bolles Road, at River Kilometer 65.2.
BCC	BON PH2 Corner Collector	Bonneville Dam 2nd Powerhouse Corner Collector Outfall Channel.
BGM	Burlingame Dam and Canal	Burlingame Diversion Dam is located on the lower Walla Walla River.
BO1	Bonneville Bradford Is Ladder	Bradford Island Adult Fishway at Bonneville Dam.
BO2	Bonneville Cascades Is Ladder	Cascades Island Adult Fishway at Bonneville Dam.
BO3	Bonneville WA Shore Ladder/AFF	Washington Shore Adult Fishway and AFF at Bonneville Dam; replaces B2A and BWL.
BO4	Bonneville WA Ladder Slots	Washington Shore Fishway Vertical Slots at Bonneville Dam.
BRC	Bear Valley Adult Video Weir	Interrogation system on the existing Bear Valley Creek Chinook adult monitoring weir.
BSC	Big Sheep Creek ISA at KM 6	The site is located in Big Sheep Creek at rkm 6.
BVC	Beaver Creek, Methow River	Beaver Creek site was located at rkm 3, in July 2014, the site was burned over by a wildfire and removed. In March 2015, the site was reinstalled 2 rkm downstream from the original location.
CAL	Carson NFH Adult Return Ladder	Hatchery adult spring Chinook return ladder from the Wind River to Carson NFH.
CCU	Catherine Creek at Union	This is an in-stream interrogation system located near the town of Union on Catherine Creek, at rkm 25.
CCW	Catherine Creek Ladder/Weir	Instream detection array located in the adult return fish ladder at the Catherine Creek weir.
CFJ	Clark Flat Acc. Pond	This site monitors releases from Clark Flat acclimation pond, which is located at rkm 270 on the Yakima River.
CHL	Lower Chiwawa River	Chiwawa River rkm 1, located between the Chiwawa smolt trap and the Chiwawa Acclimation Ponds.
CHU	Upper Chiwawa River	Chiwawa River rkm 12, located above the Forest Road 62 bridge and below Alder Creek.
CHW	Chiwaukum Creek	This site is located at rkm 0.4 on Chiwaukum Creek (Wenatchee River Basin), located near Tumwater Campground (access through site 51).
CRU	Upper Chewuch instream Array	Instream PIT tag interrogation site at RKM 28.35 on the Chewuch River.
CRW	Chewuch River above Winthrop	Chewuch River at river km 1, above Winthrop, WA.
DSF	Deschutes Sherars Falls	Site consists of two monitored weirs in the main fishway and two monitored weirs in the high flow fishway; one
DWL	Dworshak NFH adult trap	Located at the terminus of the Dworshak National Hatchery adult fish ladder in the North Fork Clearwater River.
EBO	East Bank Hatchery Outfall	Located in the East Bank Hatchery outfall channel.
EHL	Entiat NFH Adult Ladder	This adult interrogation site is located in the Entiat National Fish Hatchery adult ladder.
ENA	Upper Entiat River at rkm 17.1	The site is located approximately 400 meters above the mouth of the Mad River near the township of Ardenvoir
ENL	Lower Entiat River	Entiat River rkm 2, located immediately upstream of Entiat, WA.
EPR	East Fork Potlatch Array	The site is located in the East Fork Potlatch River about 3 rkm from the confluence with the Potlatch River.
ESS	EFSF Salmon River at Parks Cr	East Fk South Fk Salmon River (rkm 21) near Parks Creek.
EVL	Eagle Valley Ranch - Lower	This site is located at the downstream end of a restoration zone at Eagle Valley Ranch on the Lemhi River, near rkm 16.
EVU	Eagle Valley Ranch - Upper	This site is located at the upstream end of a restoration zone at Eagle Valley Ranch on the Lemhi River, near rkm 20.
GCM	Grouse Creek Mouth	Located in Grouse Creek in the Imnaha River Basin approximately 25m upstream from the confluence with the Imnaha River.
GLC	Gold Creek, Methow River	The site is located at rkm 0.18 of Gold Creek in the Methow River Basin.
GOA	Little Goose Fish Ladder	Adult Fishway at Little Goose Dam.
GOJ	Little Goose Dam Juvenile	Little Goose Dam Juvenile Fish Bypass/Transportation Facility.
GRA	Lower Granite Dam Adult	Lower Granite Dam Adult Fishway and Fish Trap.
GRJ	Lower Granite Dam Juvenile	Lower Granite Dam Juvenile Fish Bypass/Transportation Facility.
GRS	Lower Granite Dam Spillway	This site is located 173 rkm on the Snake River at the spillway 1 for the Lower Granite Dam.
HRM	Hood River Mouth	Located at the mouth of the Hood River against the west side jetty just inside the bar where the Hood River meets the Columbia River.
HST	Touchet River at Harvey Shaw	Site at RKM 50 on the Touchet river.
HYC	Hayden Creek Instream Array	Lower section of Hayden Creek, in the Lemhi River Basin.

Table C1. Continued.

Site Code	Site Name	Site Description
ICH	Ice Harbor Dam (Combined)	Ice Harbor Dam Adult Fishways (both) and Full Flow Bypass.
ICL	Lower Icicle Instream Array	Located at rkm 0.4 on Icicle Creek (Wenatchee River Basin), near Leavenworth, WA.
IML	Imnaha River Weir Adult Ladder	Located in the adult return fish ladder at the Imnaha River weir. Site is on public land.
IR1	Lower Imnaha River ISA at km 7	Lower Imnaha River at river km 7 (N 45.761162, W -116.750658).
IR2	Lower Imnaha River ISA at km 10	Lower Imnaha River at river km 10 (N 45.742839 W -116.764563).
IR3	Upper Imnaha River ISA at km 41	Upper Imnaha River at river km 41 (N 45.49004 W 116.80393).
IR4	Imnaha Weir Downstream Array	Located downstream of the Oregon Dept. of Fish and Wildlife (ODFW) fish weir on the Imnaha River.
IR5	Imnaha Weir Upstream Array	Located upstream of the Oregon Dept. of Fish and Wildlife (ODFW) fish weir on the Imnaha River.
JA1	Jacks Creek Seasonal IPTDS	The site is downstream of rkm 1 on Jacks Creek.
JD1	John Day River, McDonald Ferry	John Day River in-stream detection, near McDonald Ferry at RM 20.
JDJ	John Day Dam Juvenile	John Day Dam Juvenile Fish Bypass and Sampling Facility.
JDM	Upper John Day Array	Located on the Upper Mainstem John Day River approximately 7 miles upstream of Dayville, Oregon.
JO1	John Day Dam South Fish Ladder	The interrogation site at the John Day Dam south fish ladder.
JO2	John Day Dam North Fish Ladder	The interrogation site at the John Day Dam north fish ladder.
JOC	Joseph Creek ISA at km 3	Joseph Creek, Grande Ronde basin at river km 3 (N 46.030016, W -117.016042).
JPT	Juvenile Pond Touchet	The site is at rkm 87.5 on the Touchet River.
KHS	Big Bear Cr at Kendrick HS	The site is located near the mouth of Big Bear Creek adjacent to the high school in the town of Kendrick, Idaho.
KLR	Klickitat River Floating Array	The array is located in the lower Klickitat River, Klickitat County, Washington.
KRS	SF Salmon River at Krassel Creek	This in-stream interrogation system is located near Krassel Creek at rkm 65 on the South Fork Salmon River.
LAP	Libby Creek, Methow River	The site at RKM 1 on Libby Creek.
LC1	Lower Lolo Creek at rkm 21	Lolo Creek, a tributary to the Clearwater River located at river km 522.224.087.021 (N 46.294434 W -115.976119).
LC2	Upper Lolo Creek at rkm 25	Lolo Creek, a tributary to the Clearwater River located at river km 522.224.087.025 (N 46.290562 W -115.934153.
LFF	Lyle Falls Fishway	The Lyle Falls Fishway in Klickitat River.
LKR	Little Klickitat River Array	The array is located in the Little Klickitat River, a tributary to the Klickitat River, Klickitat County, Washington, approximately 0.4 kilometers upstream from the confluence.
LLC	Loup Loup Creek Instream Array	This site is located 0.42 km from the confluence with the Okanogan River on Loup Loup Creek which enters the Okanogan River at RKM 27.2, within the city of Malott, WA.
LLR	Lower Lemhi River	Lower Lemhi River in Salmon, ID.
LMA	Lower Monumental Adult Ladders	This interrogation site is in both ladders at Lower Monumental Dam.
LMJ	Lower Monumental Dam Juvenile	Lower Monumental Dam Juvenile Fish Bypass/Transportation Facility.
LMR	Lower Methow River at Pateros	Lower Methow River near the WDFW 'Miller Hole' access site on the lower Methow River immediately upstream of Pateros, WA.
LNF	Leavenworth NFH Adult Ladder	Located in the Leavenworth National Fish Hatcheries adult ladder and holding pond.
LRL	Lower Lochsa River Array Site	Site is located in lower 1km of the mainstem Lochsa River.
LRU	Lochsa River Upper Site	Site is located in lower 3km of the mainstem Lochsa River.
LRW	Lemhi River Weir	Lemhi River above the mouth of Hayden Creek and below the IDFG weir.
LTR	Lower Tucannon River	Near the mouth of the Tucannon River. The upstream array group was located at an abandoned railroad bridge abutment upstream of Hwy 261 on the Tucannon River downstream from Starbuck. The CO in-stream array was relocated below the Hwy 261 bridge on Sept. 29, 2010.
LWC	Lower Wenas Creek	This site is located in Wenas Creek about 2 rkms upstream of the confluence with the Yakima River on property owned by the Bureau of Reclamation.
LWE	Lower Wenatchee River	Wenatchee River rkm 2.
LWL	Ltl. White Salmon NFH returns	Adult fish ladder allowing passage from the Little White Salmon River into the adult holding ponds at Little White Salmon NFH.
LWN	Little Wenatchee River	Instream PIT tag interrogation site at rkm 4 located at the old fish weir.
MAD	Mad River, Entiat River Basin	This site is at Mad River rkm 1, located at Ardenvoir, WA.
MAR	Marsh Cr at Lola Cr Campground	The site is on Marsh Creek at Lola Creek Campground.
MC1	McNary Oregon Shore Ladder	Oregon Shore Adult Fishway at McNary Dam.
MC2	McNary Washington Shore Ladder	Washington Shore Adult Fishway at McNary Dam.
MCD	Mill Creek Diversion Project	The site is located in the fish bypass and passage facilities at the (Bennington) Diversion Dam and the first Division Works in the Mill Creek Diversion Project in the Walla Walla Basin, near rkm 19.
MCJ	McNary Dam Juvenile	McNary Dam Juvenile Fish Bypass/Transportation Facility.
MCL	Lower Mission Creek Instream	Located at rkm 0.7 on Mission Creek (Wenatchee River Basin), near Cashmere, WA.
MIN	Mine Reach of Wind River, WA	The site is located in upper Wind River approximately 1.75 road Km upstream of the mouth of Falls Creek.
MJ1	Middle Fork John Day Array	The site is on the Middle Fork John Day River, near the current confluence with Mosquito Creek on Malheur National Forest Service Land.
MJ2	Middle Fork John Day Ritter	The site is located on the Middle Fork John Day River at RKM 24 at Ritter Oregon.
MR1	Minam River at River KM 0.5	The site is located in the Minam River approximately 0.5 km upstream of the confluence of the Minam and
MRC	Methow River at Carlton	Located in the mainstem Methow River near the town of Carlton at rkm 45.
MRW	Methow River at Winthrop	Methow River. During 2009 and early 2010, the array was located at river km 81, above Winthrop, WA near Winthrop National Fish Hatchery. In Sept. 2010 it was moved upstream to its new location below Wolf Creek on the mainstem Methow River, at river km 85.
MSH	Methow Fish Hatchery Outfall	On the outlet of the Washington Department of Fish and Wildlife (WDFW) Methow Hatchery located on the Methow River at Rk 82.3 from the confluence with the Columbia River.
MTD	Mill Creek at The Dalles	Array is approximately 2.5 km upstream of the mouth of Mill Creek and the confluence with the Columbia River, below The Dalles Dam.
MTR	Middle Tucannon River	The Middle Tucannon River site is located about 250 feet above the River Ranch Ln bridge on the Tucannon River, at River Kilometer 19.5.
MVF	Moving Falls Fish Ladder	Located in the fish ladder at a site known as Moving Falls on the West Fork of the Hood River.

Table C1. Continued.

Site Code	Site Name	Site Description
NAL	Lower Nason Creek	Nason Creek rkm 1, located within Lake Wenatchee State Park.
NAU	Upper Nason Creek	Nason Creek rkm 19 (Wenatchee River Basin).
NBA	Nursery Bridge Adult	Nursery Bridge Dam Fishways (both), Walla Walla River at Milton-Freewater, OR.
NMC	Ninemile Creek Instream Array	The site is located on Ninemile Creek, 0.78 km upstream from the confluence with Lake Osoyoos. north of the town of Oroville, WA.
OBF	Omak Creek below Mission Falls	The site is located approximately 9.90 rkm upstream from the confluence of the Okanogan River.
OKC	Okanagan Channel at VDS-3	The OKC site is located in the Okanagan (Canadian spelling) Channel at 310th Avenue/Road 18 upstream from Osoyoos Lake.
OKL	Lower Okanogan Instream Array	Site at RKM 24.9 on the mainstem Okanogan River, upstream of Chiliwist area in Okanogan County.
OKM	McIntyre Dam	The site montiors each side of spill bay 1 at McIntyre Dam. The dam is located downstream of Vaseux Lake and upstream of Okanagan Lake, in Canada.
OKP	Penticton Channel PIT Array	Penticton Channel, is the channelized portion of the Okanagan River connecting Okanagan Lake with Skaha Lake, within the city of Penticton BC.
OKS	Shingle Creek	The site is on Shingle Creek, a tributary to the Okanagan River in Canada, and is located immediately adjacent to the Okanagan Nation Alliance (ONA) Fish Hatchery.
OKV	Vaseux Creek, BC, Canada	The site is located 200m upriver from mouth of Vaseux Creek a trib of Okanogan River.
OMF	Omak Creek Above Mission Falls	Omak Creek enters the Okanogan River at RKM 51.5, approximately 1 km upstream from the city of Omak, WA. The site is located on Omak Creek, 10.5 rkm from the confluence with the Okanogan River.
OMK	Omak Creek Instream Array	Omak Creek enters the Okanogan River at RKM 51.5, approximately 1 km upstream from the city of Omak, WA. The site is located on Omak Creek, 0.24 rkm from the confluence with the Okanogan River.
OMP	Omak Acclimation Pond	Located at 23 Brooks Tracts Rd. in Omak, WA.
PCA	Panther Creek Array	The array is on Panther Creek approximately 5 rkm from the confluence with Salmon River.
PD7	Columbia River Estuary rkm 70	The site is in the Columbia River Estuary at river km 70.
PRA	Priest Rapids Adult	Priest Rapids Dam Adult Fishways (both).
PRH	Priest Rapids Hatchery Outfall	Priest Rapids Hatchery outfall channel. The site is located just upstream of the typical point of inundation in the channel.
PRO	Prosser Diversion Dam Combined	Adult Fishways (all three) and Juvenile Bypass/Sampling Facility at Prosser Dam.
RCJ	Rock Creek John Day Basin	This site is located at rkm 2.0 on Rock Creek a tributary to the John Day River.
RCL	Rock Creek (WA) at rkm 5	The site is on Rock Creek (WA) at rkm 5 near the Yakama Nation Longhouse.
RCS	Rock Creek (WA) at rkm 14	The sites is on Rock Creek (WA) at rkm 14 at the confluence of Rock and Squaw Creeks.
RIA	Rock Island Adult	Rock Island Dam Adult Fishways (all three).
ROZ	Roza Diversion Dam (Combined)	Roza Dam Smolt Bypass.
RRF	Rocky Reach Fishway	Rocky Reach Dam Adult Fishway.
RRJ	Rocky Reach Dam Juvenile	Juvenile Fish Bypass Surface Collector.
RSH	Ringold Springs Hatch. Outfall	PIT tag detection system located in the Ringold Springs Hatchery outfall channel.
SA0	Salmon Creek below OID DIV	Salmon Creek enters the Okanogan River at RKM 41.3, in the town of Okanogan, WA. The site is approximately 6.35 KM upstream from the confluence.
SA1	Salmon Creek Instream Array	Salmon Creek enters the Okanogan River at RKM 41.3, in the town of Okanogan, WA. The site is approximately 2.9 KM upstream from the confluence.
SAT	Lower Satus Creek	This site is located approximately 1700 meters upstream from the confluence of the Yakima River on Satus Creek.
SC1	Lower SF Clearwater R at rkm 1	Lower South Fork Clearwater River at river km 0.9 (N 46.13685 W -115.98091).
SC2	Lower SF Clearwater R at rkm 2	Lower South Fork Clearwater River at river km 2 (N 46.12749 W -115.97730).
SCL	Spring Creek NFH Adult Ladder	Fish ladder allowing passage from the Columbia River into the adult holding ponds at Spring Creek NFH.
SCP	Spring Creek Acclimation Pond	Juvenile releases from and adults returning to Winthrop National Fish Hatchery.
SFG	SF Salmon at Guard Station Br.	Located at rkm 30 near the lower South Fork Salmon River Guard Station on the South Fork Salmon River.
SJ1	SF John Day (Mid)	This site is an in-stream array located on the South Fork John Day River south of Dayville on the PW Schneider Wildlife Management Area (ODFW) near rkm 10.
SKA	Skaha Dam Fish Ladder	Skaha Dam is located within the community of Okanagan Falls at the south end of Skaha Lake, BC along the Okanagan River. The fishway is at the western edge of the dam.
SUC	Summit Creek, Klickitat	The site is located 400m up Summit Creek, from the confluence with Klickitat River.
SUN	Sunnyside Instream Array	Located 600 M below Sunnyside Dam on the Yakima River.
SW1	Lower Selway River Array	PIT tag array is located 5 rkm upstream of the mouth of the Selway River in the upper Clearwater Basin Idaho.
SW2	Upper Selway River Array	PIT tag array is located 13 rkm upstream of the mouth of the Selway River in the upper Clearwater Basin Idaho.
SWT	Sweetwater Cr. Near Its Mouth	The site is an in-stream array approximately 0.1 kilometers upstream from the mouth of Sweetwater Creek.
SYC	Snyder Creek PIT Tag Array	The site is on Snyder Creek approximately 1.3 kilometers upstream from the confluence with the Klickitat River.

Table C1. Continued.

Site Code	Site Name	Site Description
TAY	Big Creek at Taylor Ranch	Centered around the bridge at Taylor Ranch, Big Creek, ID.
TD1	The Dalles East Fish Ladder	East Fish Ladder at The Dalles Dam.
TD2	The Dalles North Fish Ladder	North Fish Ladder at The Dalles Dam.
TFH	Tucannon Fish Hatchery	The Tucannon Fish Hatchery site is located about 200 feet above the Tucannon Fish Hatchery Adult Trap and Water Intake System on the Tucannon River, at River Kilometer 59.4.
TMF	Three Mile Falls Dam Combined	Adult Fishway and Juvenile Bypass/subsampling facility at Three Mile Falls Dam.
TNK	Tunk Creek Instream Array	The site is on Tunk Creek approximately 50 meters upstream from the confluence of the Okanogan River.
TOP	Lower Toppenish Creek	The site is located approximately 1700 meters upstream from the confluence of Toppenish Creek with the Yakima River at rkm 130.
TP2	Toppenish Creek at Simcoe Ck	The array is located about 0.75 km upstream from the confluence of Toppenish Creek and Simcoe Creek.
TPJ	Tucannon at Panjab Creek	The site is an instream array at rkm 74.5 on the Tucannon River near the mouth of Panjab Creek.
TR1	Lower Trout Cr - Deschutes	The site is located at rkm 0.7 upstream from the confluence with the Deschutes River on privately owned land.
TRA	Trout Creek Auxillary Site	The site si in Trout Creek, WA at rkm 2.
TRC	Trout Creek, Wind River	The site is located at rkm 2 upstream from the confluence with Wind River (WA) above Hemlock Lake on Trout Creek.
TUF	Tumwater Dam Adult Fishway	Adult Fishway at Tumwater Dam.
TWR	Lwr Twisp Rvr near MSRF Ponds	Lower Twisp River adjacent to the Methow Salmon Recovery Foundation Ponds.
TWX	Estuary Towed Array (Exp.)	The TWX experimental trawl detector is typically deployed in the Columbia River estuary, at and above Jones Beach (rkm 75).
UGR	Upper Grande Ronde at rkm 155	Grand Ronde River located at river km 522.271.155 (45. 593338, -117.903124).
UGS	Upper Grande Ronde Starkey	In-stream detection array near the upper Grande Ronde weir at Starkey.
UMW	Umatilla R Recycled Water Fac	The site is an instream detection array in the Umatilla River adjacent to the City of Hermiston's Recycled Water Plant.
USE	Upper Salmon River at rkm 437	Located in the Salmon River at river km 522.303.437 (N45.028939 W-113.915892).
USI	Upper Salmon River at rkm 460	Located in the mainstem Salmon River at river km 522.303.460 (N44.890380 W-113.962575).
UTR	Upper Tucannon River	The Upper Tucannon River site is located about 200 yards above Don Howards House on the Tucannon River, at River Kilometer 53.2.
UWE	Upper Wenatchee River	Located at rkm 81.2 on the Wenatchee River, near Plain, WA.
VC1	Valley Creek, Upstream Site	Located on Valley Creek at Stanley, ID., in the Upper Salmon River.
WB1	White Bird Cr Seasonal IPTDS	The site is located at rkm 2.
WEA	Wells Dam, DCPUD Adult Ladders	Wells Dam Adult Fishways (both).
WEH	Wells Dam Hatchery	Points of detection include the adult fish handling facility, juvenile pond outflows and adult volunteer channel.
WEJ	Wells Dam Bypass Bay Sample	Site is located in Bypass Bay 2 on the right (west) side of Wells dam on the Columbia River, Washington.
WEN	Wenaha River Mouth	Array on the Wenaha River near Troy, Oregon.
WFC	Wolf Creek, Methow River	The site is located approx. 330m up Wolf Creek, from the confluence with Methow River.
WHC	Lwr White Creek, Klickitat Bsn	Site is in White Creek (Klickitat River Basin) approximately 150 meters upstream from the mouth.
WHS	Wildhorse Spring Creek	The site is located approximately 0.1 rkm upstream from the confluence with the Okanogan River.
WR1	Wallowa River at river km 14	Instream array located in the Wallowa River, Oregon rkm 522.271.131.014 (N 45.633769 ° W -117.73369°).
WR2	Wallowa River at Rkm 32	The array is located in the Wallowa River at approximately river km 32 just upstream of Lower Diamond Road bridge near the town of Wallowa, OR.
WRA	Upper Wind River Auxillary	The site is in the Wind River, WA at rkm 27.
WRU	Upper Wind River (WA) rkm 30	At rkm 30 of the Wind River, WA. The site is at the FR3065 bridge over the Wind River.
WSH	Warm Springs Hatchery	Adult Fishway at Warm Springs NFH.
WSR	Warm Springs River PIT Array	The Warm Springs River PIT tag array is installed end-to-end across the entire river channel.
WTL	White River, Wenatchee Basin	A permanent instream PIT tag interrogation site at RKM 2.88 on the White River.
WWB	Walla Walla River Barge	Site is a floating barge anchored in place at roughly 5 rkm upstream from the mouth.
YFK	Yankee Fork Salmon River	The site is located 3.14 rkm upstream from the confluence with the Salmon River at an elevation of 1855m.
ZEN	Secesh River at Zena Cr Ranch	Near the Zena Creek Ranch.
ZSL	Zosel Dam Adult Fishways	Zosel Dam is located at Okanogan River km 132, approximately 3 km downstream from the outlet of Lake Osoyoos in the town of Oroville, Washington.

Table C2. Season by season activities of steelhead tagged in 2020 and later labeled as kelts or repeat spawners when they began migrating downstream (after March 31st) and upstream in spring, summer, or fall of 2020, presumably to and from the ocean.

Tag Year	Tag Number	First Detection After Tagging 2020 in All Seasons	Fall 2020	Winter 2020/21	Spring 2021	Summer 2021	Fall 2021	Comments
2020	3DD.003D3659DD	Bonneville WA Ladder - August 7th			Estuary Towed Array - April 14th			Steelhead tagged on August 5th, 2020 at the Bonneville AFF.
2020	3DD.003D53B1D6	The Dalles East Ladder - July 26th	McNary - October 22nd	Lower Umatilla - January 7th	Lower Umatilla - May 1st Bonneville Corner Collector - May 7th			
2020	3DD.003D53AC71	Lower Wind - April 23rd			Trout Creek (Wind) - May 4th Bonneville Corner Collector - May 16th			Steelhead captured at Bonneville on June 16th, 2020, where it was between June and April is unknown.
2020	3DD.003D53B1CD	The Dalles East Ladder - July 26th	McNary - October 15th	Lower Walla Walla - February 23rd	Middle Walla Walla - March 4th Lower Walla Walla - April 1st Bonneville Corner Collector - April 26th			
2020	3DD.003D365A02	The Dalles North Ladder - August 5th	Lower Granite - October 20th		Lower Granite - March 21st Bonneville Corner Collector - May 15th			
2020	3DD.003D365A7F	The Dalles North Ladder - August 5th	Wells - August 24th		Rocky Reach Juvenile - April 10th Bonneville Corner Collector - May 3rd		Bonneville WA Ladder - September 18th	Steelhead spawned in spring and then may have entered the ocean for a short period before heading back upriver.
2020	3DD.003D365A0B	The Dalles North Ladder - August 9th	Prosser Dam (Yakima) - October 23rd		Bonneville Corner Collector - May 29th			
2020	3DD.003D53B114	The Dalles East Ladder - July 20th	Prosser Dam (Yakima) - October 14th		Lower Toppenish Creek (Yakima) - March 19th Lower Toppenish Creek (Yakima) - April 12th Bonneville Corner Collector - May 7th			
2020	3DD.003D631928	The Dalles East Ladder - October 11th	Lower Granite - October 27th		Bonneville Corner Collector - May 29th			
2020	3DD.003D53EE76	The Dalles East Ladder - September 30th	Lower Granite - October 25th		Bonneville Corner Collector - April 24th			
2020	3DD.003D3656C8	The Dalles East Ladder - September 12th	Lower Granite - September 17th		Bonneville Corner Collector - May 21st			
2020	3DD.003D53B15D	The Dalles East Ladder - July 20th	Lower John Day - November 5th		Bonneville Corner Collector - May 13th			
2020	3DD.003D53AF8F	The Dalles North Ladder - July 24th	Tumwater Dam (Wenatchee) - August 16th		Bonneville Corner Collector - April 29th			
2020	3DD.003D365B3B	The Dalles East Ladder - September 10th	Lower Granite - October 4th		Lower Granite Spillway - April 25th Bonneville Corner Collector - May 7th			
2020	3DD.003D53A9B0	The Dalles East Ladder - September 28th	Lower Granite - October 11th		Bonneville Corner Collector - May 26th			
2020	3DD.003D53AC05	The Dalles East Ladder - September 25th	Three Miles Falls Dam (Umatilla) - November 7th		Bonneville Corner Collector - April 28th			Steelhead captured at Bonneville on July 28th, 2020, where it was between August and November is unknown.
2020	3DD.003D53ABDC	The Dalles East Ladder - July 11th	Lower Monumental - July 20th		Bonneville Corner Collector - April 21st			
2020	3DD.003DA24FDD	The Dalles North Ladder - August 8th	Prosser Dam (Yakima) - September 15th		Bonneville Corner Collector - May 18th			
2020	3DD.003D53B19B	The Dalles East Ladder - July 19th	Lower Granite - August 16th		Panther Creek (Salmon) - April 6th	Bonneville Corner Collector - June 2nd		
2020	3DD.003D53AB98	The Dalles East Ladder - July 12th	John Day - September 27th	Lower John Day - December 21st	Bonneville Corner Collector - May 5th			
2020	3DD.003D365661	The Dalles East Ladder - August 20th	Lower Granite - September 12th		Lower Granite Spillway - May 31st	Bonneville Corner Collector - June 10th		
2020	3DD.003D365AD6	The Dalles North Ladder - August 5th	Lower Granite - September 19th		Lapwai Creek (Clearwater) - March 7th Sweetwater Creek (Clearwater) - March 9th Lapwai Creek (Clearwater) - March 19th Bonneville Corner Collector - April 30th			
2020	3DD.003D365BDA	The Dalles East Ladder - October 21st	Lower Granite - November 14th	Joseph Creek (Grande Ronde) - February 24th	Joseph Creek (Grande Ronde) - March 31st Bonneville Corner Collector - May 4th			
2020	3DD.003D3659F1	The Dalles North Ladder - August 6th	Lower Granite - September 13th		Joseph Creek (Grande Ronde) - March 25th Joseph Creek (Grande Ronde) - April 20th Bonneville Corner Collector - May 11th			
2020	3DD.003D53AF54	The Dalles East Ladder - July 17th	Lower Granite - September 25th		Marsh Creek (Salmon) - April 22nd Marsh Creek (Salmon) - May 7th Bonneville Corner Collector - May 29th			
2020	3DD.003D365BD3	The Dalles East Ladder - September 5th	Lower Granite - September 21st		SF Salmon - April 8th Lower Granite Spillway - May 10th Bonneville Corner Collector - May 20th			
2020	3DD.003D53AFAC	The Dalles East Ladder - July 24th	Lower Granite - October 25th		Lower Imnaha - April 7th Middle Imnaha - April 30th	Bonneville Corner Collector - June 6th		
2020	3DD.003D53F00F	The Dalles East Ladder - September 19th	Lower Granite - September 27th		SF Salmon - April 3rd Secesh (Salmon) - April 19th to May 14th	Bonneville Corner Collector - June 7th		
2020	3DD.003D53AFCE	The Dalles East Ladder - September 10th	Lower Granite - September 29th		Lower Wallowa (Grande Ronde) - April 29th Minam (Grande Ronde) - April 30th to May 31st	Bonneville Corner Collector - June 22nd		
2020	3DD.003D365681	The Dalles East Ladder - September 20th	Lower Granite - October 11th		Lower Granite Spillway - May 6th Ice Harbor - May 14th Bonneville Corner Collector - May 20th			
2020	3DD.003D365540	The Dalles East Ladder - July 5th	Lower Granite - July 21st		Lower Granite Spillway - May 9th Bonneville Corner Collector - May 19th			
2020	3DD.003D53ADEB	The Dalles East Ladder - July 31st	Prosser Dam (Yakima) - September 29th	Lower Satus Creek (Yakima) - January 15th	Lower Satus Creek (Yakima) - March 10th Bonneville Corner Collector - April 3rd			
2020	3DD.003D365764	The Dalles East Ladder - August 23rd	Wells - September 26th	Lower Methow - January 30th	Middle Methow - March 15th Twisp (Methow) - March 15th to April 18th Rocky Reach Juvenile Bypass - April 26th Bonneville Corner Collector - May 10th			Steelhead was sampled and released at the Twisp trap/weir on April 5th.
2020	3DD.003D365A77	The Dalles North Ladder - August 14th	Lower Granite - September 25th		Bonneville Corner Collector - May 15th			
2020	3DD.003D365A2F	The Dalles East Ladder - September 11th	Middle Deschutes - October 9th	John Day - December 23rd Lower Monumental - January 15th	Lower Granite - March 31st Bonneville Juvenile Bypass - May 31st			
2020	3DD.003D3655FF	The Dalles East Ladder - September 9th	Three Mile Falls Dam (Umatilla) - November 8th		Lower Umatilla - March 17th Three Mile Falls Dam (Umatilla) - May 14th John Day Juvenile Bypass - May 18th			
2020	3DD.003DA24FD8	The Dalles East Ladder - September 19th	Lower Granite - October 6th		SF Salmon - May 1st to 27th	John Day Juvenile Bypass - June 12th		
2020	3DD.003D53EF5C	The Dalles East Ladder - September 25th	Lower Granite - October 15th		McNary Juvenile Bypass - April 23rd			
2020	3DD.003D365696	The Dalles North Ladder - September 27th	McNary - October 4th		Lower Touchet (Walla Walla) - March 7th Lower Touchet (Walla Walla)) - April 3rd to May 2nd Lower Touchet (Walla Walla) - May 4th McNary Juvenile Bypass - May 6th			

Table C2 (Continued).

Tag Year	Tag Number	First Detection After Tagging 2020 in All Seasons	Fall 2020	Winter 2020/21	Spring 2021	Summer 2021	Fall 2021	Comments
2020	3DD.003D53B170	The Dalles East Ladder - September 23rd	Lower Monumental - September 29th		Tucannon - March 6th to 31st		Lower Monumental - October 8th	Steelhead spawned in spring and then may have entered the ocean for a short period before heading back upriver.
2020	3DD.003D53AE24	The Dalles East Ladder - September 10th	Lower Granite - October 1st	Lower Tucannon - January 16th	Lower Tucannon - March 15th Lower Monumental Juvenile Bypass - April 1st			
2020	3DD.003D365699	The Dalles East Ladder - August 30th	Lower Granite - October 22nd		Joseph Creek (Grande Ronde) - March 5th Joseph Creek (Grande Ronde) - April 3rd Lower Granite Juvenile Bypass - April 11th			
2020	3DD.003D365ADB	The Dalles East Ladder - September 10th	Lower Granite - October 2nd		Lower Granite Spillway - April 17th			
2020	3DD.003D53EFB3	The Dalles East Ladder - October 19th	Little Goose - November 9th	Lower Granite - February 27th	Lower Granite Spillway - May 2nd			
2020	3DD.003D365A8A	The Dalles East Ladder - September 29th	Lower Granite - October 13th		Lower Granite Spillway - May 7th			
2020	3DD.003D365A4D	The Dalles North Ladder - August 28th	Lower Granite - October 6th		Lower Granite Spillway - May 3rd			
2020	3DD.003D365664	The Dalles East Ladder - September 17th	Lower Granite - September 29th		Lower Granite Spillway - May 7th			
2020	3DD.003D3659E1	The Dalles East Ladder - September 28th	Lower Granite - October 9th		Lower Granite Spillway - April 17th			
2020	3DD.003D365626	The Dalles North Ladder - September 16th	Lower Granite - September 30th		Lower Granite Spillway - April 29th			
2020	3DD.003D3655D3	The Dalles North Ladder - September 12th	Lower Granite - October 11th		Lower Granite Spillway - April 29th			
2020	3DD.003D53AA4D	The Dalles East Ladder - July 27th	Lower Granite - September 25th		Lower Granite Spillway - May 17th			
2020	3DD.003D3656ED	The Dalles East Ladder - September 10th	Lower Granite - September 29th		Lower Granite Spillway - April 15th			
2020	3DD.003D3659F8	The Dalles East Ladder - August 8th	Lower Granite - September 17th		Lower Granite Spillway - May 15th			
2020	3DD.003D6316BA	The John Day South Ladder - October 6th	Lower Granite - October 16th		Upper Salmon - April 4th Lower Granite Spillway - May 7th			
2020	3DD.0077A2F97F	The Dalles East Ladder - August 26th	Lower Granite - September 12th		Upper Salmon - March 28th Lower Granite Spillway - May 9th			
2020	3DD.003D53AFA1	The Dalles East Ladder - July 23rd	Little Goose - November 25th	Lower Granite - December 31st	Upper Grande Ronde - March 5th Lower Granite Spillway - April 29th			
2020	3DD.003D365AE4	The Dalles East Ladder - August 6th	Lower Granite - September 29th		Lower Granite Spillway - April 18th			
2020	3DD.003D53EE07	The Dalles East Ladder - September 27th	Lower Granite - October 10th		Lower Selway (Clearwater) - March 17th Lower Granite Spillway - May 17th			
2020	3DD.003D3656AA	The Dalles East Ladder - September 9th	Lower Granite - October 19th		Upper Lochsa (Clearwater) - March 28th Lower Granite Spillway - May 19th			
2020	3DD.003D53EF40	The Dalles North Ladder - September 26th	Lower Granite - October 7th		Upper Lochsa (Clearwater) - March 23rd Lower Granite Spillway - May 16th			
2020	3DD.003D365735	The Dalles North Ladder - September 13th	Lower Granite - September 28th		Upper Lochsa (Clearwater) - March 28th Lower Granite Spillway - May 24th			
2020	3DD.003D53ECA7	The Dalles East Ladder - September 20th	Lower Granite - October 4th	Lower SF Clearwater - February 27th	Lower Granite Spillway - May 1st			
2020	3DD.003D365B8D	The Dalles East Ladder - October 1st	Lower Granite - October 14th		Upper Salmon - April 2nd Yankee Fork (Salmon) - April 14th to 26th Upper Salmon - May 1st Lower Granite Spillway - May 9th			
2020	3DD.003D365AD7	The Dalles North Ladder - August 31st	Lower Granite - September 12th		Yankee Fork (Salmon) - April 19th Lower Granite Spillway - May 21st			
2020	3DD.003D365A69	The Dalles East Ladder - September 9th	Lower Granite - September 20th		Joseph Creek (Grande Ronde) - March 17th Joseph Creek (Grande Ronde) - April 14th Lower Granite Spillway - April 27th			
2020	3DD.003DA24FAD	The Dalles North Ladder - August 1st	Lower Granite - October 30th		Joseph Creek (Grande Ronde) - March 5th Joseph Creek (Grande Ronde) - March 22nd Lower Granite Spillway - April 7th			
2020	3DD.003D53B202	The Dalles East Ladder -July 26th	Lower Granite - August 27th		Wenaha River (Grande Ronde) - March 19th to April 30th Lower Granite Spillway - May 19th			
2020	3DD.003D53B205	The Dalles East Ladder - September 26th	Lower Granite - October 8th		Wallowa (Grande Ronde) - March 24th Minam (Grande Ronde) - March 24th to April 21st Lower Granite Spillway - May 1st			
2020	3DD.003D53EE6F	The Dalles East Ladder - September 30th	Lower Granite - October 18th		Lower Asotin Creek - April 1st Lower Asotin Creek - April 8th Lower Granite Spillway - April 14th			
2020	3DD.003D365763	The Dalles East Ladder - September 11th	Lower Granite - October 6th		EF Salmon - April 5th EF SF Salmon - April 24th Lower Granite Spillway - May 23rd			
2020	3DD.003D53A9EC	The Dalles North Ladder - July 31st	Lower Granite - October 1st		Lower Wallowa (Grande Ronde) - April 30th Lower Minam (Grande Ronde) - May 1st Lower Granite Spillway - May 29th			
2020	3DD.003D365A7D	The Dalles East Ladder - September 30th	Lower Granite - October 7th		Lower Asotin Creek - March 21st Lower Asotin Creek - April 6th Lower Granite Spillway - April 26th			
2020	3DD.003D53EF53	The Dalles East Ladder - October 3rd			John Day - March 13th Lower Granite) - March 22nd Lower Granite Spillway - April 16th			Steelhead spent many months between The Dallas and John Day dams before making a run for the Snake in March, 2021.
2020	3DD.003D365A09	The Dalles East Ladder - August 31st	Lower Granite - September 19th		Lower Granite Spillway - May 17th			
2020	3DD.003D3655D2	The Dalles East Ladder - August 19th	Lower Granite - September 4th		Lower Granite Spillway - May 28th			
2020	3DD.003D365A6F	The Dalles East Ladder - August 14th	Lower Methow River - September 24th		Wells Juvenile Bypass - April 19th			
2020	3DD.003DA24FDC	The Dalles East Ladder - August 24th	Lower Okanagan - October 4th		Omak Creek (Okanagan) - March 20th to April 6th Rocky Reach Juvenile Bypass - April 30th			

Table C2 (Continued).

Tag Year	Tag Number	First Detection After Tagging 2020 in All Seasons	Fall 2020	Winter 2020/21	Spring 2021	Summer 2021	Fall 2021	Comments
2020	3DD.003D53A977	The Dalles North Ladder - July 23rd	Wells - September 11th Wells Juvenile Bypass- September 12th		Rocky Reach Juvenile Bypass - May 2nd			
2020	3DD.003D3656AF	The Dalles East Ladder - August 24th	Rocky Reach - November 12th		Mad River (Entiat) - March 19th to April 14th Rocky Reach Juvenile Bypass - May 2nd			
2020	3DD.003D365AA5	The Dalles East Ladder - August 6th	Wells - August 23rd		Rocky Reach - March 31st Rocky Reach Juvenile Bypass - April 21st			
2020	3DD.003D53AFB7	The Dalles East Ladder - July 26th	Wells - November 17th		Lower Methow - March 31st Lower Methow - April 15th Rocky Reach Juvenile Bypass - April 30th			
2020	3DD.003D53B13C	The Dalles East Ladder - July 21st	Wells - August 7th		Middle Methow - March 18th Cheech River (Methow) - April 3rd to 12th Rocky Reach Juvenile Bypass - April 22nd			
2020	3DD.003D53ADF2	The Dalles East Ladder - July 26th	Wells - September 27th		Lower Methow - March 28th Beaver Creek (Methow) - April 19th to May 9th Rocky Reach Juvenile Bypass - May 20th			
2020	3DD.003D53AAC7	The Dalles East Ladder - July 4th	Wells - July 25th		Wildhorse Creek (Okanagan) - April 4th to 21st Rocky Reach Juvenile Bypass - April 25th			
2020	3DD.003D53A981	The Dalles East Ladder - July 23rd	Wells - August 15th		Wells Juvenile Bypass - April 9th Rocky Reach Juvenile Bypass - May 3rd			
2020	3DD.003D6319E1	The Dalles East Ladder - October 8th	Prosser Dam (Yakima) - October 18th		Lower Toppenish (Yakima) - March 30th Lower Toppenish (Yakima) - April 27th			
2020	3DD.003D53B200	The Dalles North Ladder - July 26th	Prosser Dam (Yakima)- September 21st	Lower Satus (Yakima) - January 16th	Lower Satus (Yakima) - March 2nd Lower Satus (Yakima) - April 13th			
2020	3DD.003D365AA4	The Dalles East Ladder - September 10th	Prosser Dam (Yakima)- September 23rd	Lower Satus (Yakima) - January 16th	Lower Satus (Yakima) - March 17th Lower Satus (Yakima) - April 7th			
2020	3DD.003D3659F6	The Dalles North Ladder - August 8th	McNary - August 22nd		Prosser Dam (Yakima) - March 9th Middle Satus (Yakima) - April 14th Lower Satus (Yakima) - April 29th			
2020	3DD.003DA24F9D	The Dalles East Ladder - August 16th	Tumwater Dam (Wenatchee) - October 13th		Lower Chewaukum Creek (Wenatchee) - April 6th Lower Chewaukum Creek (Wenatchee) - May 5th			
2020	3DD.003D365A3A	The Dalles East Ladder - September 3rd	Lower Wenatchee - October 7th		Mission Creek (Wenatchee) - March 6th Mission Creek (Wenatchee) - May 11th			
2020	3DD.003D53B1DE	John Day North Ladder - July 28th	Wells - September 11th		Lower Methow - March 21st Lower Methow - April 2nd			
2020	3DD.003DA24FD2	The Dalles East Ladder - August 8th	Wells - August 29th		Lower Methow - March 11th Twisp (Methow) - March 28th to April 4th Middle Methow - April 7th			
2020	3DD.003D365AC3	The Dalles North Ladder - August 1st	Lower Okanagan - September 26th		Zosel Dam (Okanagan) - April 16th Lower Ninemile Creek (Okanagan) - April 18th Lower Ninemile Creek (Okanagan) - April 26th			
2020	3DD.003D53AE0E	The Dalles East Ladder - July 31st	McNary - November 13th		Three Mile Dam (Umatilla) - April 8th Three Mile Dam (Umatilla) - May 13th			
2020	3DD.003D53AE0C	The Dalles East Ladder - July 30th	Threemile Dam (Umatilla) - November 19th		Threemile Dam (Umatilla) - May 6th			
2020	3DD.003D3659B6	The Dalles East Ladder - September 23rd	John Day - September 24th		Threemile Dam (Umatilla) - March 23rd Threemile Dam (Umatilla) - May 6th			
2020	3DD.003D365AB3	The Dalles North Ladder - October 31st	Umatilla - October 22nd	Threemile Dam (Umatilla) - December 23rd	Threemile Dam (Umatilla) - March 9th Threemile Dam (Umatilla) - March 21st			
2020	3DD.003D3659BC	The Dalles East Ladder - September 9th	McNary - September 24th	Lower Touchet (Walla Walla) - January 3rd Upper Touchet (Walla Walla) -February 25th	Upper Touchet (Walla Walla) - March 21st Lower Touchet (Walla Walla) - April 13th			
2020	3DD.003D3659C2	The Dalles East Ladder - August 30th	McNary - October 22nd	Lower Touchet (Walla Walla) - February 20th	Middle Touchet (Walla Walla) - March 2nd Upper Touchet (Walla Walla) - March 10th Lower Touchet (Walla Walla) - April 3rd			
2020	3DD.003D3655FB	The Dalles North Ladder - October 19th	McNary - October 22nd	Lower Touchet (Walla Walla) - February 25th	Middle Touchet (Walla Walla) - March 2nd Upper Touchet (Walla Walla) - March 8th to April 1st Lower Touchet (Walla Walla) - April 21st			
2020	3DD.003D53ADCC	The Dalles East Ladder - July 20th	Ice Harbor - October 21st		Lower Touchet (Walla Walla - March 20th Upper Touchet (Walla Walla) - March 25th to April 5th Lower Touchet (Walla Walla - April 14th			
2020	3DD.003D53A8EB	The Dalles East Ladder - June 26th	Lower Monumental - November 22nd		Lower Monumental - March 19th Middle Touchet (Walla Walla) - April 5th Upper Touchet (Walla Walla) - April 13th Middle Touchet (Walla Walla) - May 18th			
2020	3DD.003D3658CB	The Dalles East Ladder - September 25th	McNary - September 28th	Lower Walla Walla - February 25th	Lower Touchet (Walla Walla) - March 3rd Upper Touchet (Walla Walla) - March 26th Middle Touchet (Walla Walla) - April 18th			
2020	3DD.003DA24FCE	The Dalles East Ladder - August 23rd	Lower Monumental - November 26th	Little Goose - December 1st	Lower Touchet (Walla Walla) - April 13th Upper Touchet (Walla Walla) -May 14th Lower Touchet (Walla Walla) - May 18th			
2020	3DD.003D365B0E	The Dalles East Ladder - September 11th	Lower Monumental - October 10th		Lower Touchet (Walla Walla) - March 15th Upper Touchet (Walla Walla) -March 29th Lower Touchet (Walla Walla) - April 2nd			

Table C2 (Continued).

Tag Year	Tag Number	First Detection After Tagging 2020 in All Seasons	Fall 2020	Winter 2020/21	Spring 2021	Summer 2021	Fall 2021	Comments
2020	3DD.003D631921	The Dalles East Ladder - October 18th	McNary - October 22nd		Lower Touchet (Walla Walla) - March 5th Upper Touchet (Walla Walla) - April 3rd to 16th Lower Touchet (Walla Walla) - April 24th			
	3DD.003D53AE0D	John Day - October 7th	Lower Granite Spillway - November 15th		Lower Touchet (Walla Walla) - April 4th Upper Touchet (Walla Walla) - April 18th Lower Touchet (Walla Walla) - April 23rd			
2020	3DD.003D53B209	The Dalles North Ladder - July 26th			Lower Touchet (Walla Walla) - March 16th Upper Touchet (Walla Walla) - March 26th to April 19th Lower Touchet (Walla Walla) - April 20th			
2020	3DD.0077666984	The Dalles East Ladder - September 10th	Little Goose - October 20th		Lower Tucannon - March 18th Upper Tucannon - March 27th to April 18th Lower Tucannon - April 22nd			
2020	3DD.003D3656D8	The Dalles East Ladder - September 18th	Lower Granite - October 24th		Lower Tucannon - March 9th Upper Tucannon - March 24th Lower Tucannon - April 13th			
2020	3DD.003D3659D0	The Dalles East Ladder - August 8th	Lower Granite - September 21st		Lower Tucannon - March 7th Upper Tucannon - March 21st Lower Tucannon - April 4th			
2020	3DD.003D365AAE	The Dalles East Ladder - September 11th	John Day - October 14th	John Day - January 16th Lower Monumental - February 4th	Little Goose - March 6th Lower Tucannon - March 16th Panjab Creek (Tucannon) - April 22nd to May 13th Lower Tucannon - May 19th			
2020	3DD.003D6318F8	The Dalles East Ladder - October 21st			John Day - March 28th Lower Monumental - April 25th Lower Tucannon - March 1st to 31st Lower Tucannon - April 1st			This steelhead was tagged on October 14th, 2020 unknown where it was between October, 2020 and March 2021.
2020	3DD.003D53EF2C	The Dalles East Ladder - September 25th			The Dalles East Ladder - March 20th Lower Monumental - March 31st Lower Tucannon - April 3rd Lower Tucannon - April 11th			This steelhead was tagged on September 22nd, 2020 unknown where it was between September, 2020 and March 2021.
2020	3DD.003D365BD1	The Dalles East Ladder - September 6th			The Dalles East Ladder - March 15th Lower Monumental - March 21st Lower Tucannon - March 22nd Middle Tucannon - March 23rd to April 1st Lower Tucannon - April 2nd			This steelhead was tagged on September 3rd, 2020 unknown where it was between September, 2020 and March 2021.
2020	3DD.003D3656D7	The Dalles North Ladder - August 21st	Lower Granite - October 25th	Lower Tucannon - February 23rd	Middle Tucannon - March 1st to 31st Lower Tucannon - April 1st			
2020	3DD.003D53AC0D	The Dalles East Ladder - August 4th	Lower Granite - September 12th		Lower Asotin - March 20th Upper Asotin - March 29th to April 13th Lower Asotin - April 22nd			
2020	3DD.003D631A2F	The Dalles East Ladder - October 9th	Lower Granite - October 20th		Lower SF Clearwater - March 15th Lower SF Clearwater - May 25th			
2020	3DD.003D53EE98	The Dalles East Ladder - October 1st	Lower Granite - October 25th		Lower SF Clearwater - March 3rd Lower SF Clearwater - April 14th			
2020	3DD.003D36571E	The Dalles North Ladder - October 21st	The Dalles North Ladder - November 2nd		Bonneville - March 14th Lower Granite - March 24th Lower SF Clearwater - March 29th Lower SF Clearwater - April 22nd			This steelhead was tagged on August 26th, 2020 and had several fall back events passing Bonneville and The Dalles dams more then once. Also unknown where it was between November, 2020 and March 2021.
2020	3DD.003DA24FAA	The Dalles East Ladder - September 3rd	Lower Granite - October 3rd		Lower Lochsa (Clearwater) - March 18th Upper Lochsa (Clearwater) - March 18th to May 21st Upper Lochsa (Clearwater) - May 14th			
2020	3DD.003D365757	The Dalles East Ladder - September 10th	Lower Granite - October 1st		Lower Selway (Clearwater) - March 15th Upper Selway (Clearwater) - March 16th to May 21st Lower Lochsa (Clearwater) - May 27th			
2020	3DD.003D365800	The Dalles East Ladder - October 14th	Lower Granite - October 25th		Lower Selway (Clearwater) - March 7th Lower Selway (Clearwater) - April 30th			
2020	3DD.003D53EF07	The Dalles East Ladder - September 20th		The Dalles North Ladder - December 26th Lower Monumental - February 4th	Little Goose - March 8th Lower Lolo Creek (Clearwater) - April 2nd Upper Lolo Creek (Clearwater) - April 2nd to 30th Lower Lolo Creek (Clearwater) - May 1st			This steelhead was tagged on September 18th, 2020, unknown where it was between September, 2020 and December 2020.
2020	3DD.003D53AA4F	The Dalles North Ladder - August 17th	Lower Granite - September 29th		Lapwai Creek (Clearwater) - March 20th Lapwai Creek (Clearwater) - April 29th			
2020	3DD.003D365AD3	The Dalles East Ladder - August 2nd	Lower Granite - September 15th	Lower Wallowa (Grande Ronde) - February 23rd	Lower Wallowa (Grande Ronde) - May 30th			
2020	3DD.003D365AEB	The Dalles North Ladder - August 25th	Lower Granite - October 19th		Lower Wallowa (Grande Ronde) - April 28th	Lower Wallowa (Grande Ronde) - June 2nd		
2020	3DD.003D365A20	The Dalles East Ladder - August 14th			John Day - March 8th Lower Granite - March 27th Lower Wallowa (Grande Ronde) - April 29th Lower Wallowa (Grande Ronde) - May 29th			Unknown where this steelhead was between August 2020 and March 2021, between The Dalles and John Day dams.

Table C2 (Continued).

Tag Year	Tag Number	First Detection After Tagging 2020 in All Seasons	Fall 2020	Winter 2020/21	Spring 2021	Summer 2021	Fall 2021	Comments
2020	3DD.003D365737	The Dalles East Ladder - August 28th	McNary - September 10th	Lower Monumental - December 14th	Lower Tucannon - March 6th Lower Monumental - March 26th Lower Granite - March 31st Lower Wallowa (Grande Ronde) - April 16th Lower Wallowa (Grande Ronde) - April 23rd			Unknown where this steelhead was between September 2020 and December 2020, between McNary and Ice Harbor dams.
2020	3DD.003D3659C1	The Dalles East Ladder - September 29th	Lower Granite - October 15th		Middle Wallowa (Grande Ronde) - May 5th to 24th Lower Wallowa (Grande Ronde) - May 24th			
2020	3DD.003D53AF91	The Dalles East Ladder - July 23rd			Lower Wallowa (Grande Ronde) - March 19th Middle Wallowa (Grande Ronde) - March 20th to 29th Lower Wallowa (Grande Ronde) - April 26th			
2020	3DD.003D53ADDD	The Dalles East Ladder - July 17th	Lower Granite - August 5th		Middle Wallowa (Grande Ronde) - March 22nd Upper Minam (Grande Ronde) - April 4th Lower Wallowa (Grande Ronde) - April 14th			
2020	3DD.003D3655D6	The Dalles East Ladder - August 30th	Lower Wallowa (Grande Ronde - September 29th		Lower Wallowa (Grande Ronde) - May 19th			
2020	3DD.003DA24FC9	The Dalles North Ladder - September 25th	Lower Granite - October 27th	Joseph Creek (Grande Ronde) - February 25th	Joseph Creek (Grande Ronde) - April 4th			
2020	3DD.003D53AE3C	The Dalles East Ladder - August 3rd	Lower Granite - September 25th		Joseph Creek (Grande Ronde) - March 20th Joseph Creek (Grande Ronde) - April 18th			
2020	3DD.003DA24FCA	The Dalles North Ladder - August 15th	Lower Granite - October 3rd		Joseph Creek (Grande Ronde) - March 4th Joseph Creek (Grande Ronde) - April 28th			
2020	3DD.003D53AF22	The Dalles North Ladder - July 13th	Lower Granite - October 13th		Joseph Creek (Grande Ronde) - March 4th Joseph Creek (Grande Ronde) - April 9th			
2020	3DD.003D365A08	The Dalles East Ladder - September 25th	Lower Granite - October 3rd		Upper Salmon - March 18th Yankee Fork (Salmon) - April 27th to May 31st	Yankee Fork (Salmon) - June 1st Upper Salmon - June 3rd		
2020	3DD.003DA24FB8	The Dalles East Ladder - September 4th	Lower Granite - September 21st		Lower Lemhi River (Salmon) - May 12th	Middle Lemhi River (Salmon) - June 1st Lower Lemhi River (Salmon) - June 15th		
2020	3DD.0077BB89FA	The Dalles East Ladder - July 25th	Lower Granite - September 8th		Lower Lemhi River (Salmon) - May 1st	Lower Lemhi River (Salmon) - June 30th		
2020	3DD.003DA24FE5	The Dalles East Ladder - September 20th	Lower Granite - October 5th		Lower Lemhi River (Salmon) - April 5th Middle Lemhi River (Salmon) - May 12th Lower Lemhi River (Salmon) - May 21st			
2020	3DD.003D6318DC	The Dalles North Ladder - October 15th	Lower Granite - October 25th		Lower Imnaha - April 4th Grouse Creek (Imnaha) - April 28th to May 21st Lower Imnaha - May 23rd			
2020	3DD.003D53AE1E	The Dalles East Ladder - October 1st	Prosser Dam (Yakima) - October 12th		Roza Dam (Yakima) - April 15th Prosser Dam (Yakima) - May 14th			Steelhead recaptured at Bonneville AFF on July 27th, 2020. Steelhead was recaptured/retained on May 14th, 2021 at Prosser Dam by CRITFC Kelt Project. Released to spawn on Oct 28, 2021 in Yakima River. Considered a kelt, by Kelt Project.
2020	3DD.003D53A9E7	The Dalles East Ladder - July 30th	Prosser Dam (Yakima) - October 7th	Lower Satus (Yakima) - January 15th	Lower Satus (Yakima) - March 19th Prosser Dam (Yakima) - April 12th		Prosser Dam (Yakima) - October 29th	Steelhead tagged at Bonneville AFF on July 28th, 2020. Steelhead was recaptured/retained on April 12th, 2021 at Prosser Dam by CRITFC Kelt Project. Released to spawn on Oct 28, 2021 in Yakima River. Considered a kelt, by Kelt Project.
2020	3DD.003D3656F0	The Dalles East Ladder - August 22nd	Prosser Dam (Yakima) - November 6th		Roza Dam (Yakima) - April 6th Wenas Creek (Yakima) - April 8th to 20th Prosser Dam (Yakima) - April 23rd			Steelhead tagged at Bonneville AFF on August 20th 2020. Steelhead was recaptured/retained on April 23rd, 2021 at Prosser Dam by CRITFC Kelt Project. Considered a kelt, by Kelt Project.
2020	3DD.003D365A85	The Dalles East Ladder - August 5th	Prosser Dam (Yakima) - October 9th		Lower Satus (Yakima) - March 6th Lower Satus (Yakima) - April 11th Prosser Dam (Yakima) - April 15th			Steelhead tagged at Bonneville AFF on August 3rd, 2020. Steelhead was recaptured/retained on April 15th, 2021 at Prosser Dam by CRITFC Kelt Project. Considered a kelt, by Kelt Project.
2020	3DD.003D365AE6	The Dalles East Ladder - August 10th	Prosser Dam (Yakima) - October 2nd		Lower Satus (Yakima) - March 17th Lower Satus (Yakima) - April 11th Prosser Dam (Yakima) - April 15th			Steelhead tagged at Bonneville AFF on August 4th, 2020. Steelhead was recaptured/retained on April 15th, 2021 at Prosser Dam by CRITFC Kelt Project. Considered a kelt, by Kelt Project.
2020	3DD.003D53B13B	The Dalles East Ladder - July 1st	Prosser Dam (Yakima) - October 1st	Lower Satus (Yakima) - January 17th	Lower Satus (Yakima) - March 4th Lower Satus (Yakima) - April 17th Prosser Dam (Yakima) - April 19th			Steelhead tagged at Bonneville AFF on July 17th, 2020. Steelhead was recaptured/retained on April 19th, 2021 at Prosser Dam by CRITFC Kelt Project. Released to spawn on Oct 28, 2021 below Bonneville. Considered a kelt, by Kelt Project.
2020	3DD.003D53AC36	The Dalles East Ladder - September 1st	Priest Rapids - September 16th		Prosser Dam (Yakima) - March 25th Lower Satus (Yakima) - March 30th Lower Satus (Yakima) - April 26th Prosser Dam (Yakima) - April 29th			Steelhead tagged at Bonneville AFF on July 29th, 2020. Steelhead was recaptured/retained on April 29th, 2021 at Prosser Dam by CRITFC Kelt Project. Considered a kelt, by Kelt Project.

Key - - - Upstream | Downstream | Spawning

Table C3. Season by season activities of steelhead tagged in 2020 and later labeled as kelts or repeat spawners when they began migrating downstream (before April 1st) and upstream in spring, summer, or fall 2021, presumably to and from the ocean.

Tag Year	Tag Number	First Detection After Tagging 2020 in Spring/Summer/Fall	Fall 2020	Winter 2020/21	Spring 2021	Comments
2020	3DD.003D53ABFA	Bonneville Ladders - July 29th			Bonneville Corner Collector - March 18th	Steelhead tagged at Bonneville AFF on July 29th, 2020. Where is was between August and March is unknown.
2020	3DD.003D53EED4	The Dalles East Ladder - September 29th	Lower Granite - October 12th		Lower Granite Spillway - March 28th	
2020	3DD.003DA24FF0	The Dalles East Ladder - September 27th	Prosser Dam (Yakima) - October 5th	Lower Satus (Yakima) - February 22nd	Lower Satus (Yakima) - March 12th	
2020	3DD.003D365A65	The Dalles North Ladder - August 30th	Lower Granite - October 14th		Lower Granite Juvenile Bypass - March 24th Little Goose Juvenile Bypass- March 31st	
2020	3DD.003D3659FD	The Dalles East Ladder - September 12th	Little Goose - October 16th		Lower Tucannon - March 18th Middle Tucannon - March 20th to 27th Lower Tucannon - March 28th	
2020	3DD.003D53F029	The Dalles North Ladder - September 18th	Lower Granite - September 30th		Lower SF Clearwater - March 18th Lower SF Clearwater - March 28th	
2020	3DD.003D53AC12	The Dalles East Ladder - October 1st	Little Goose - October 21st		Middle Tucannon - March 8th Lower Tucannon - March 15th	
2020	3DD.003D365698	The Dalles East Ladder - September 13th	McNary - October 6th	Middle Touchet (Walla Walla) - January 13th	Upper Touchet (Walla Walla) - March 2nd Upper Touchet (Walla Walla) - March 24th	

Key - - - Upstream Downstream Spawning

Table C4. Season by season activities of steelhead tagged in past years 2019 and 2018 (year 2017 was checked, but no new movements from fish) and later labeled as kelts or repeat spawners when they began migrating downstream and upstream presumably to and from the ocean. Any new steelhead or steelhead with additional information from previous annual reports is included here as behavioral detections became available in 2019/20/21.

Tag Year	Tag Number	First Detection After Tagging and Spring/Summer Following Year	Fall	Winter	Spring	Comments
2019	3DD.003D364C05	The Dalles North Ladder - September 15th, 2019	Lower Monumental - September 26th, 2019	Lower Tucannon - January 18th, 2020	Lower Tucannon - March 2nd, 2020	Steelhead spawned in spring and then may have entered the ocean for a short period before heading back upriver. Information added.
				Middle Tucannon - January 28th to February 28th, 2020		
			Lower Monumental - November 19th, 2020	Lower Tucannon - January 18th, 2021	Upper Tucannon - March 16th, 2021	
				Middle Tucannon - February 25th, 2021	Lower Tucannon - March 18th, 2021	
2019	3DD.003D364A23	The Dalles East Ladder - August 5th, 2019	McNary - September 27th, 2019			Steelhead may have spawned in spring and then entered the ocean for a short period before heading back upriver. Information added.
			Bonneville - September 2nd, 2020			
			McNary - September 10th, 2020			
				John Day - January 31st, 2021		
2019	3DD.003D364AE9	The Dalles East Ladder - August 31st, 2019	Prosser Dam (Yakima) - October 23rd, 2019		Roza Dam (Yakima) - April 10th, 2020	Steelhead tagged at Bonneville AFF on August 28th, 2019. Steelhead was recaptured/retained on May 27th, 2019 at Prosser Dam by CRITFC Kelt Project. Released in the Yakima River on October 20th, 2020. Considered a kelt, by Kelt Project. Information added.
					Prosser Dam (Yakima) - May 27th, 2020	
					Roza Dam (Yakima) - March 19th, 2021	
2019	3DD.0077C0C904	Lower Klickitat - June 23rd, 2019		Little Klickitat - February 6th to 27th, 2020	Lower Klickitat - March 29th, 2020	Steelhead may have spawned in spring and then entered the ocean for a year before heading back upriver. Information added.
		Bonneville - June 13th, 2021				
		Lower Klickitat - June 19th, 2021				
2019	3DD.003D3649DE	The Dalles East Ladder - July 22nd, 2019	Middle Okanagan - October 25th, 2019		Rocky Reach Juvenile - April 2nd, 2020	This steelhead wandered around the middle Columbia and lower Snake rivers in April, 2020. New kelt.
		Bonneville - July 5th, 2021	Middle Okanagan - October 25th, 2021			
2018	3DD.0077C049E9	The Dalles North Ladder - October 13th, 2018	Lower Granite - November 12th, 2018		Lower Granite Juvenile Bypass - May 12th, 2019	This steelhead was recaptured by CRITFC Kelt Project on May 13th, 2019 and released in the Snake River. Considered a kelt, by Kelt Project. Information added.
			Lower Granite - November 12th, 2020		Lower Granite Spillway - May 29th, 2021	

Key - - - Upstream Downstream Spawning

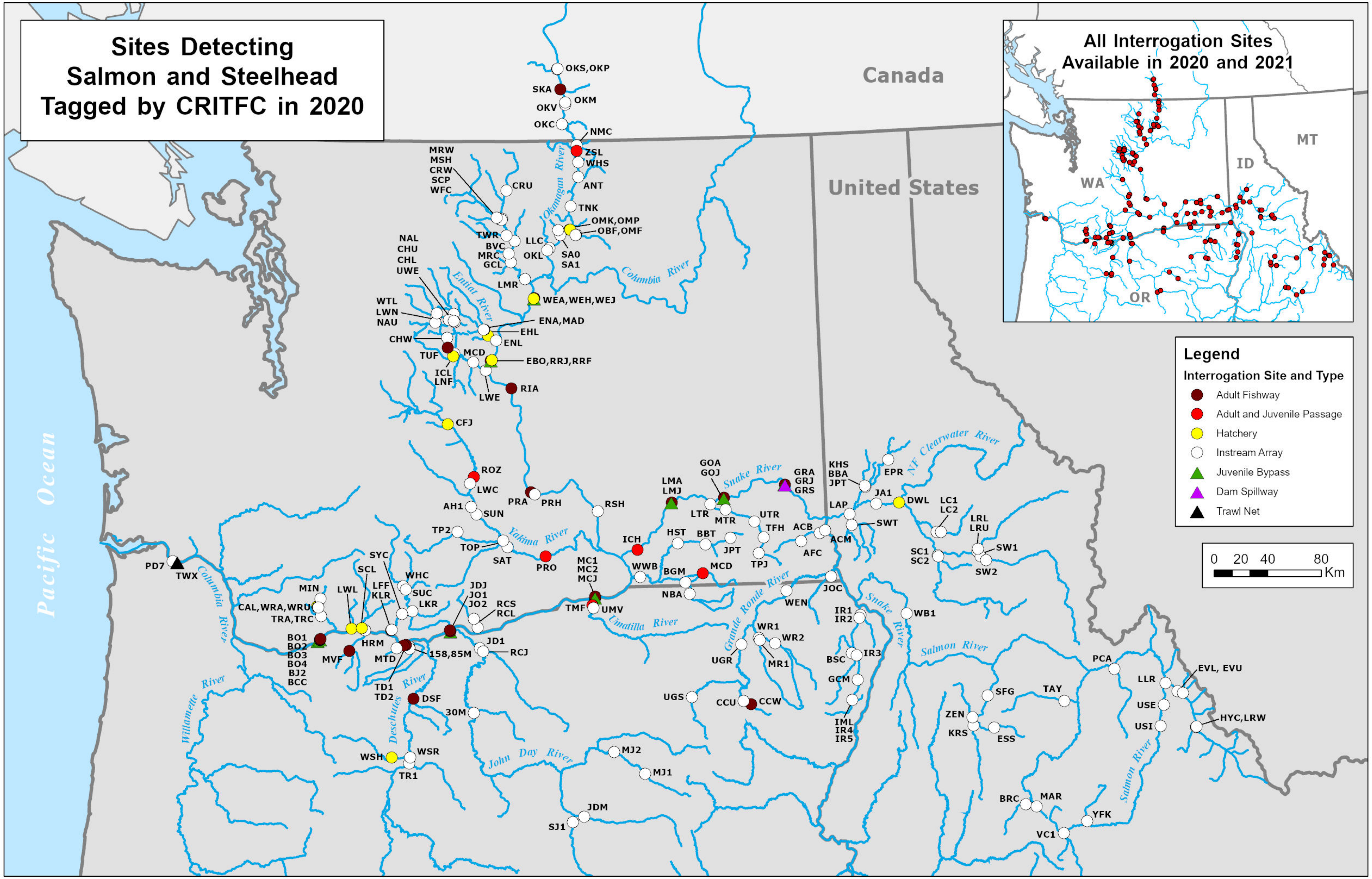

Figure C1. Map of Columbia River interrogation sites that detected Chinook and Sockeye salmon, and steelhead in 2020. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map.

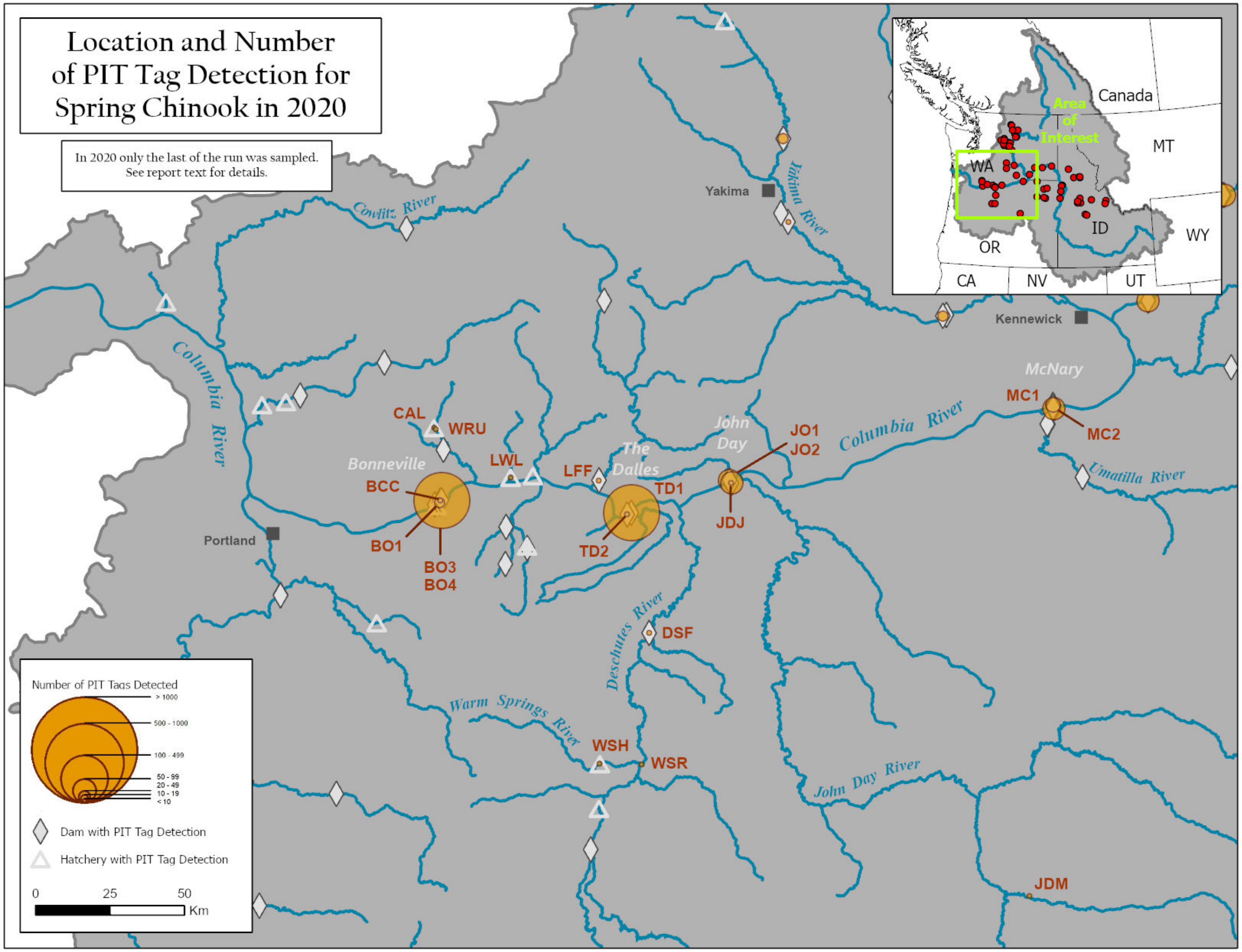

Figure C2. Map of Lower Columbia River detection sites (below Snake River) and number of spring Chinook Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map. Spring Chinook is defined as fish passing Bonneville Dam from January 1 to June 1.

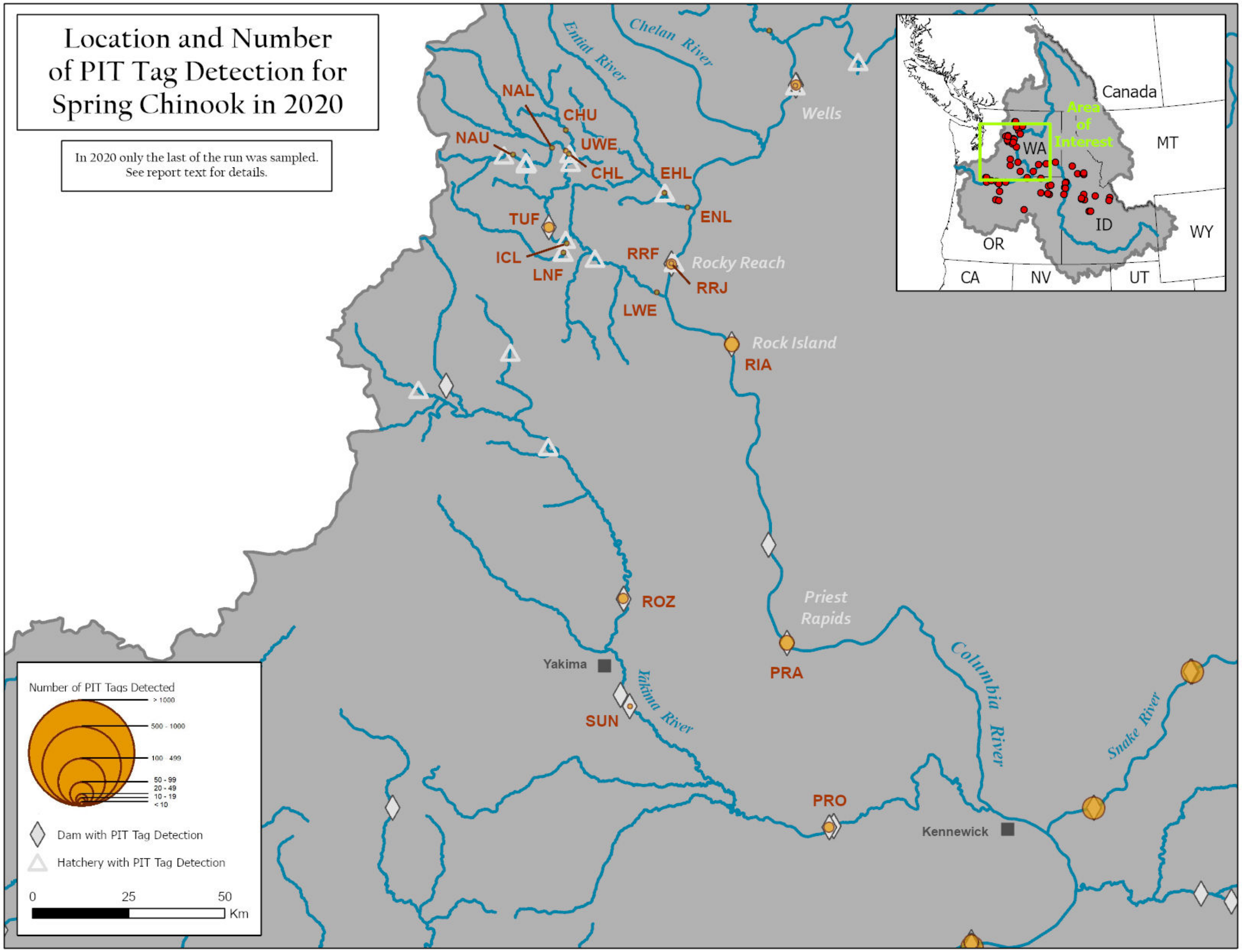

Figure C3. Map of Upper Columbia River (between the Snake River and Wells Dam) detection sites and number of spring Chinook Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map. Spring Chinook is defined as fish passing Bonneville Dam from January 1 to June 1.

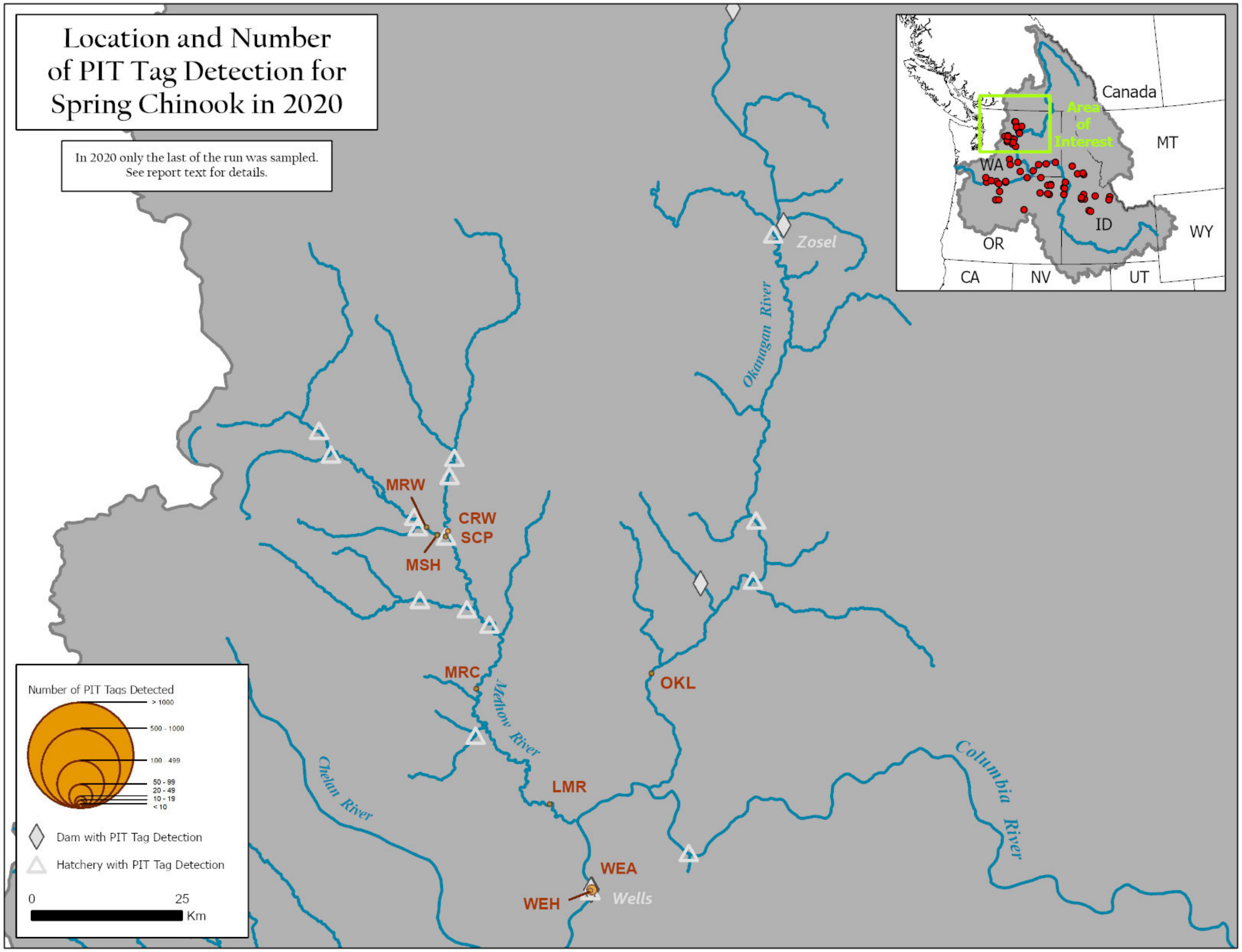

Figure C4. Map of Upper Columbia River (Wells Dam and above) detection sites and number of spring Chinook Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map. Spring Chinook is defined as fish passing Bonneville Dam from January 1 to June 1.

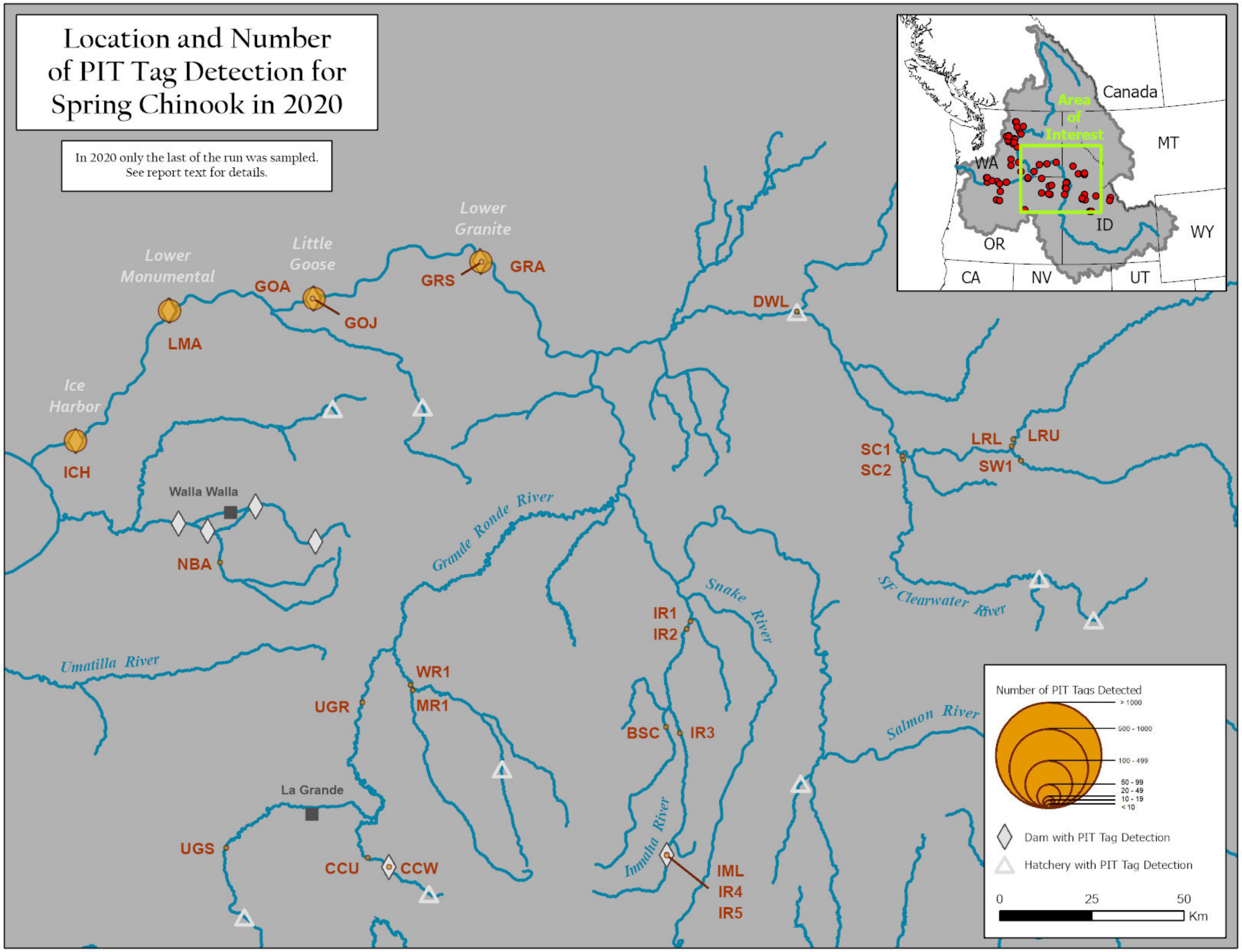

Figure C5. Map of Lower Snake River detection sites (Salmon River not included) and number of spring Chinook Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map. Spring Chinook is defined as fish passing Bonneville Dam from January 1 to June 1.

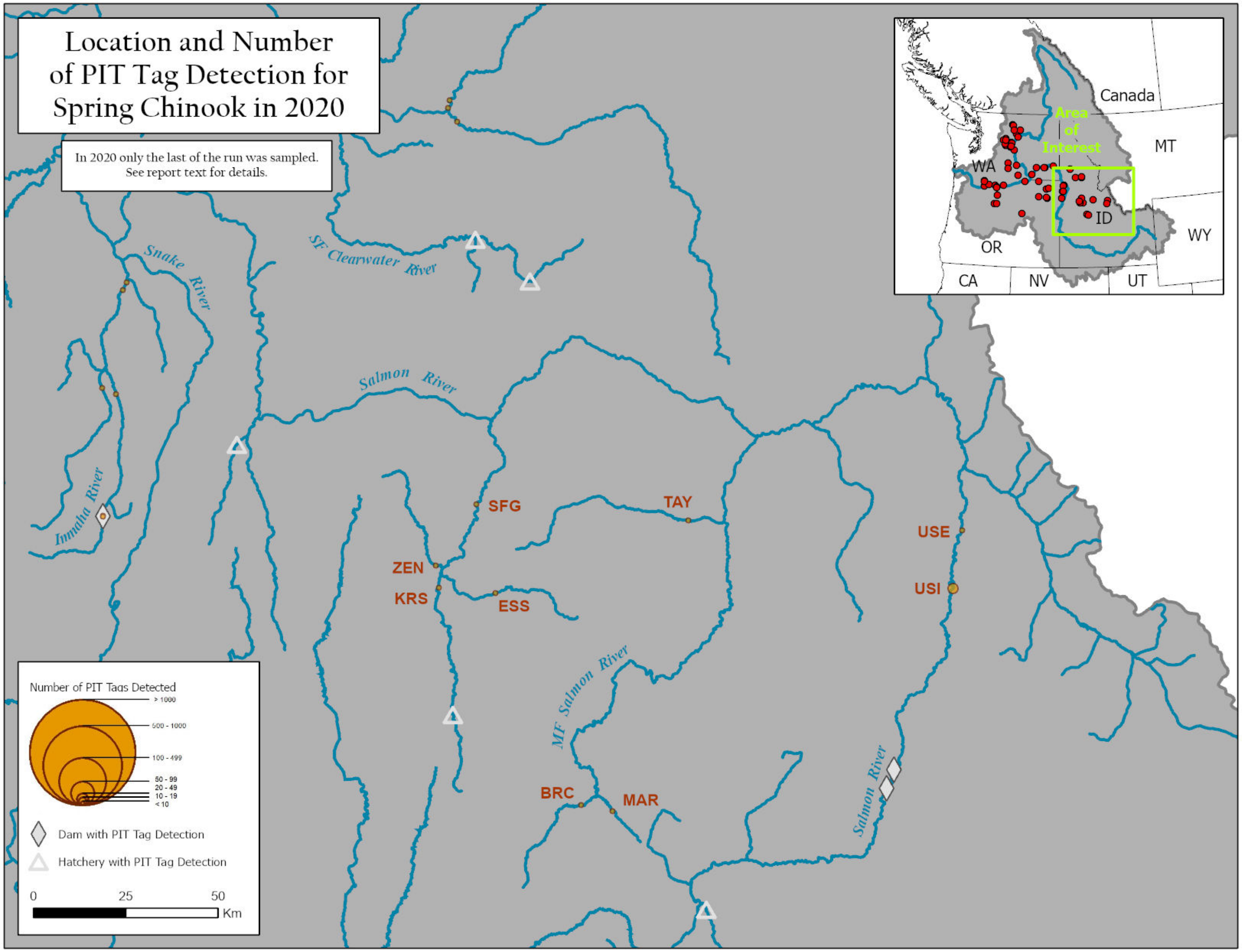

Figure C6. Map of Salmon River detection sites and number of spring Chinook Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map. Spring Chinook is defined as fish passing Bonneville Dam from January 1 to June 1.

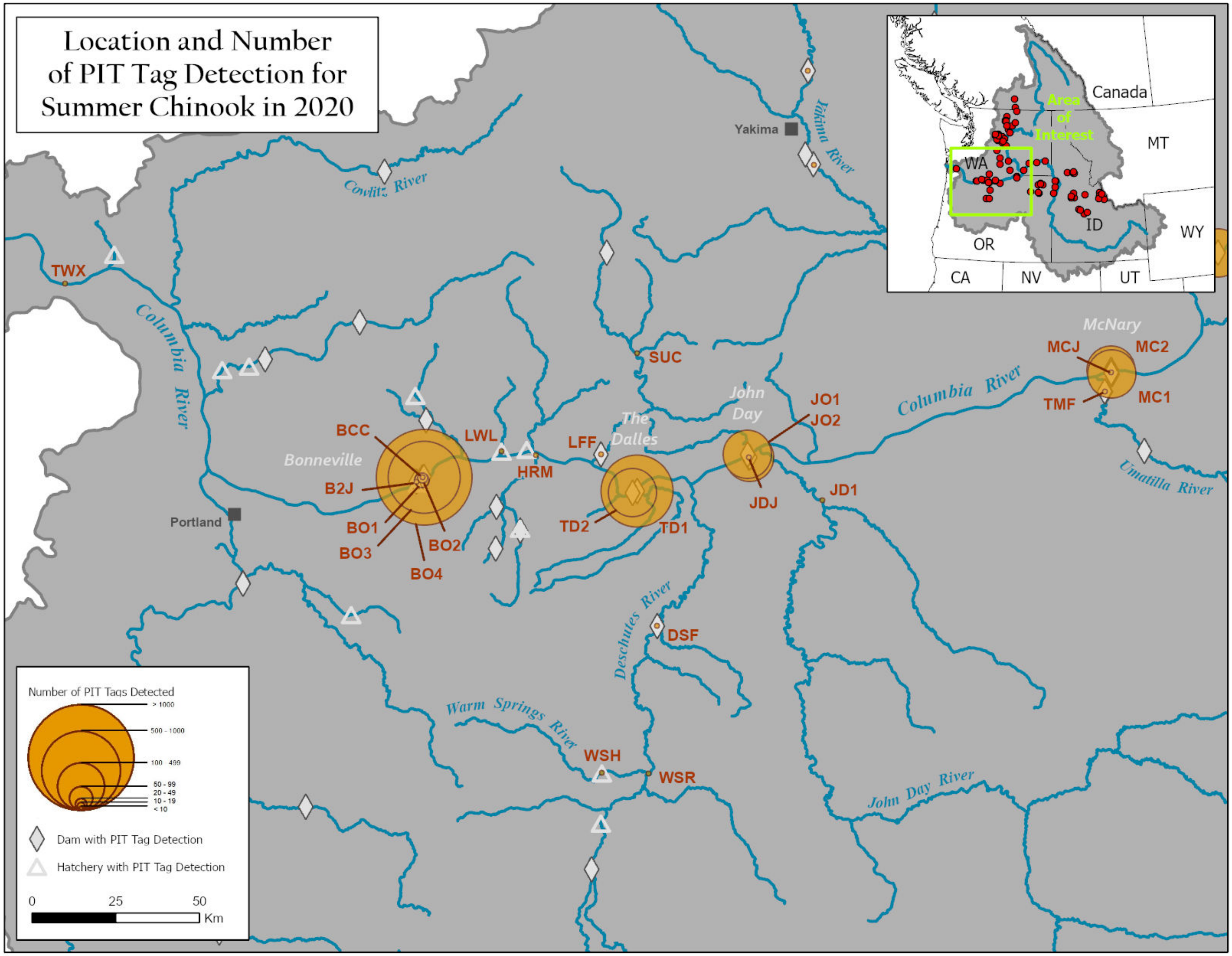

Figure C7. Map of Lower Columbia River detection sites (below Snake River) and number of summer Chinook Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map. Summer Chinook is defined as fish passing Bonneville Dam from June 1 to August 1.

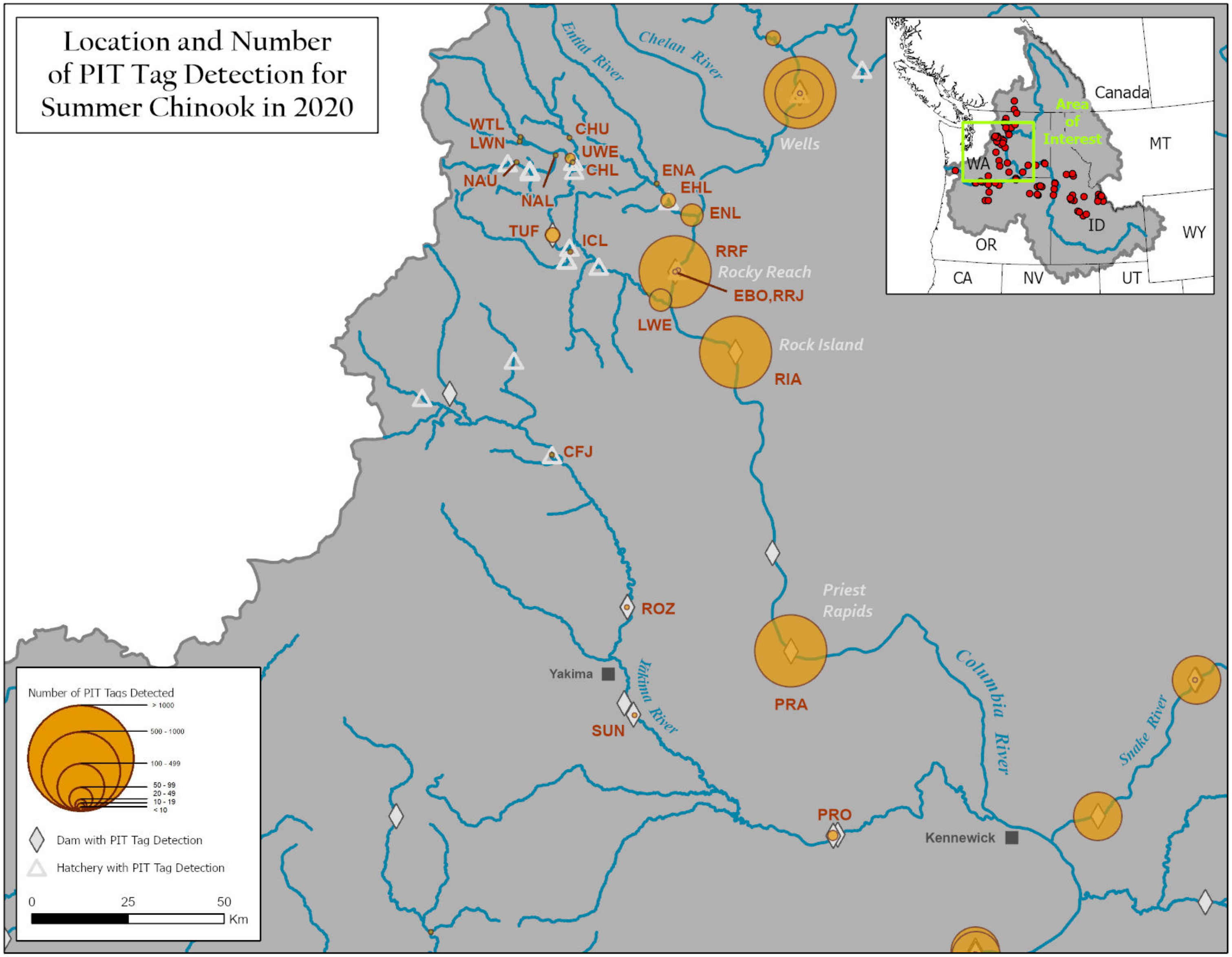

Figure C8. Map of Upper Columbia River (between the Snake River and Wells Dam) detection sites and number of summer Chinook Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map. Summer Chinook is defined as fish passing Bonneville Dam from June 1 to August 1.

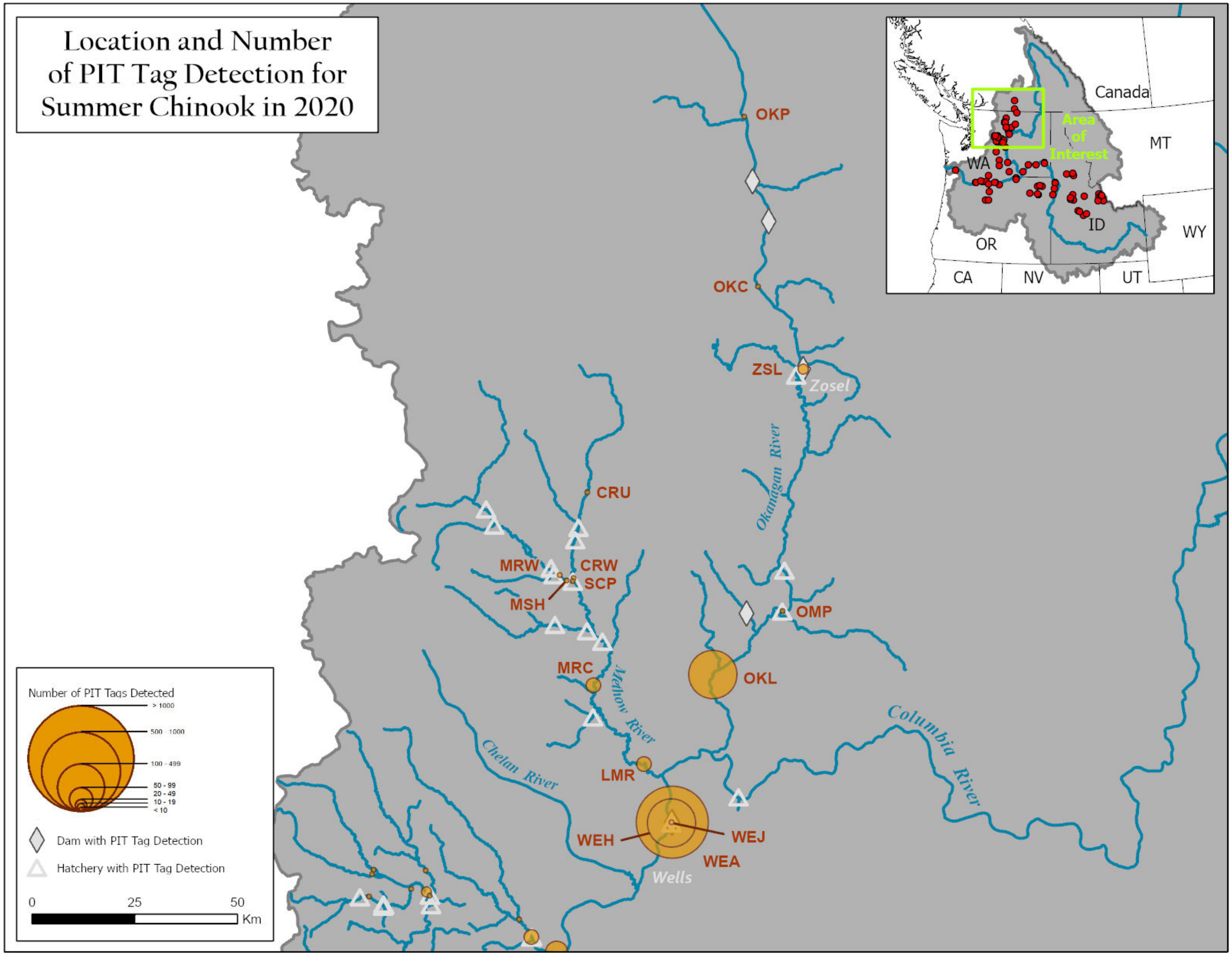

Figure C9. Map of Upper Columbia River (Wells Dam and above) detection sites and number of summer Chinook Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map. Summer Chinook is defined as fish passing Bonneville Dam from June 1 to August 1.

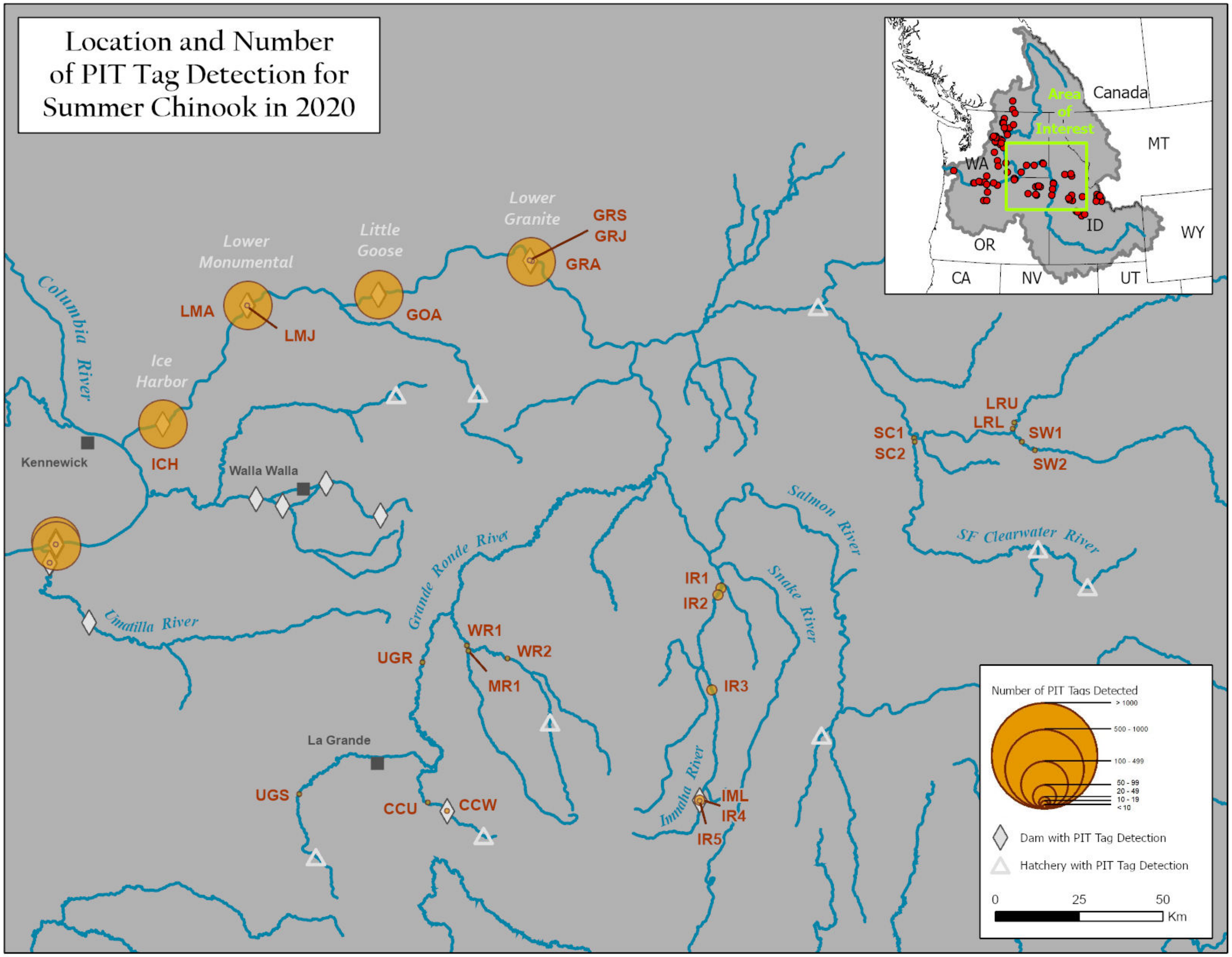

Figure C10. Map of Lower Snake River detection sites (Salmon River not included) and number of summer Chinook Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map. Summer Chinook is defined as fish passing Bonneville Dam from June 1 to August 1.

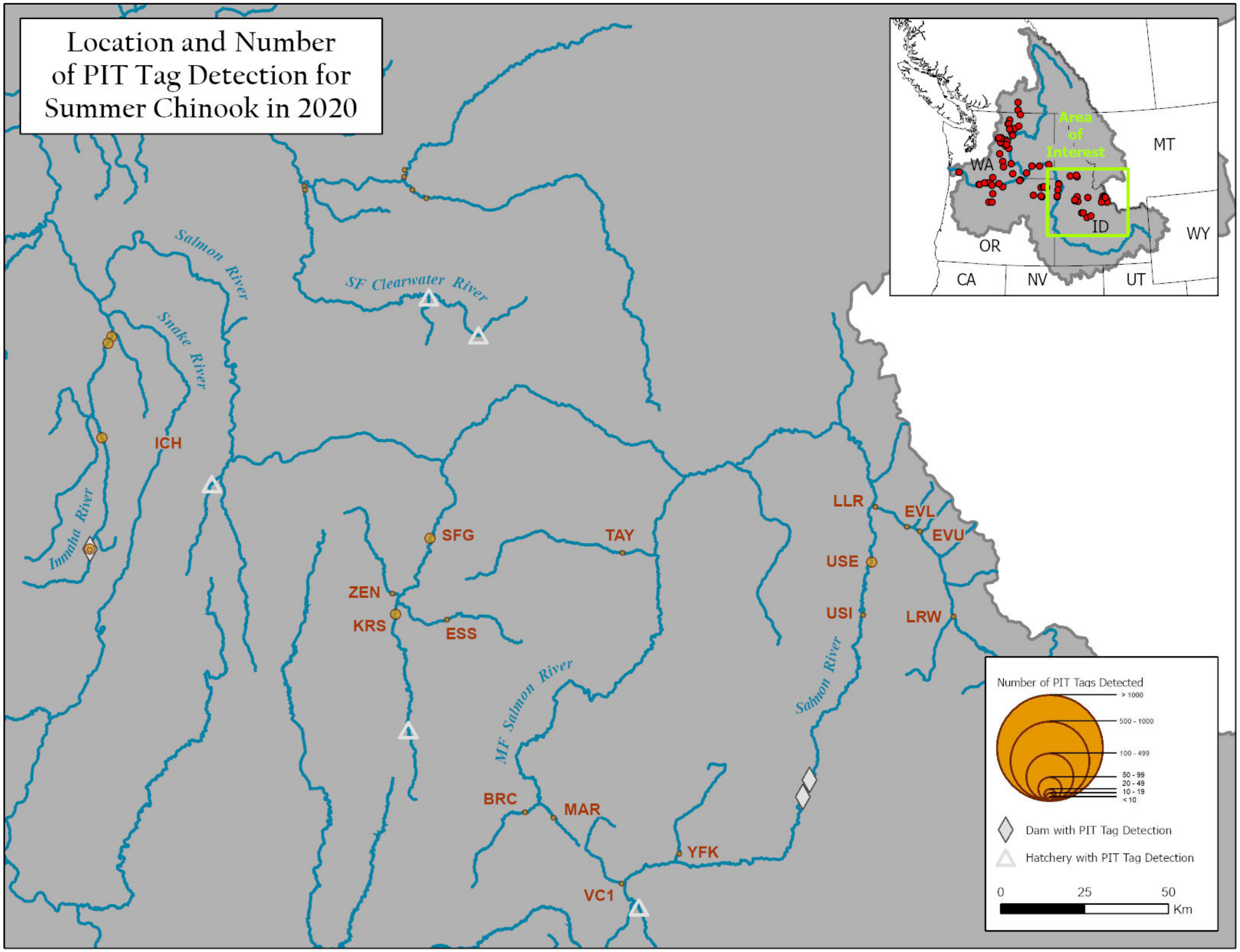

Figure C11. Map of Salmon River detection sites and number of summer Chinook Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map. Summer Chinook is defined as fish passing Bonneville Dam from June 1 to August 1.

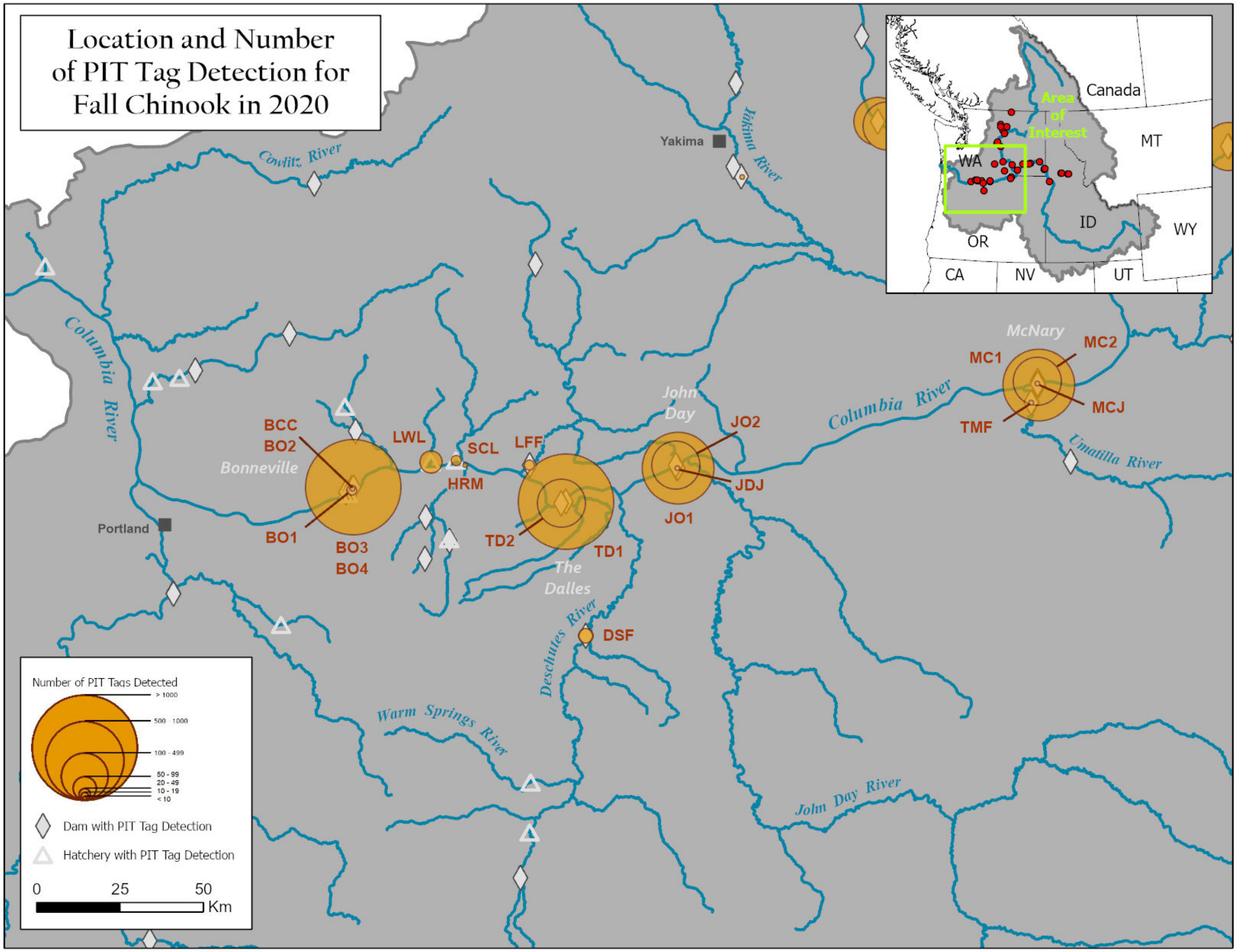

Figure C12. Map of Lower Columbia River detection sites (below Snake River) and number of fall Chinook Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map. Fall Chinook is defined as fish passing Bonneville Dam from August 1 to end of year.

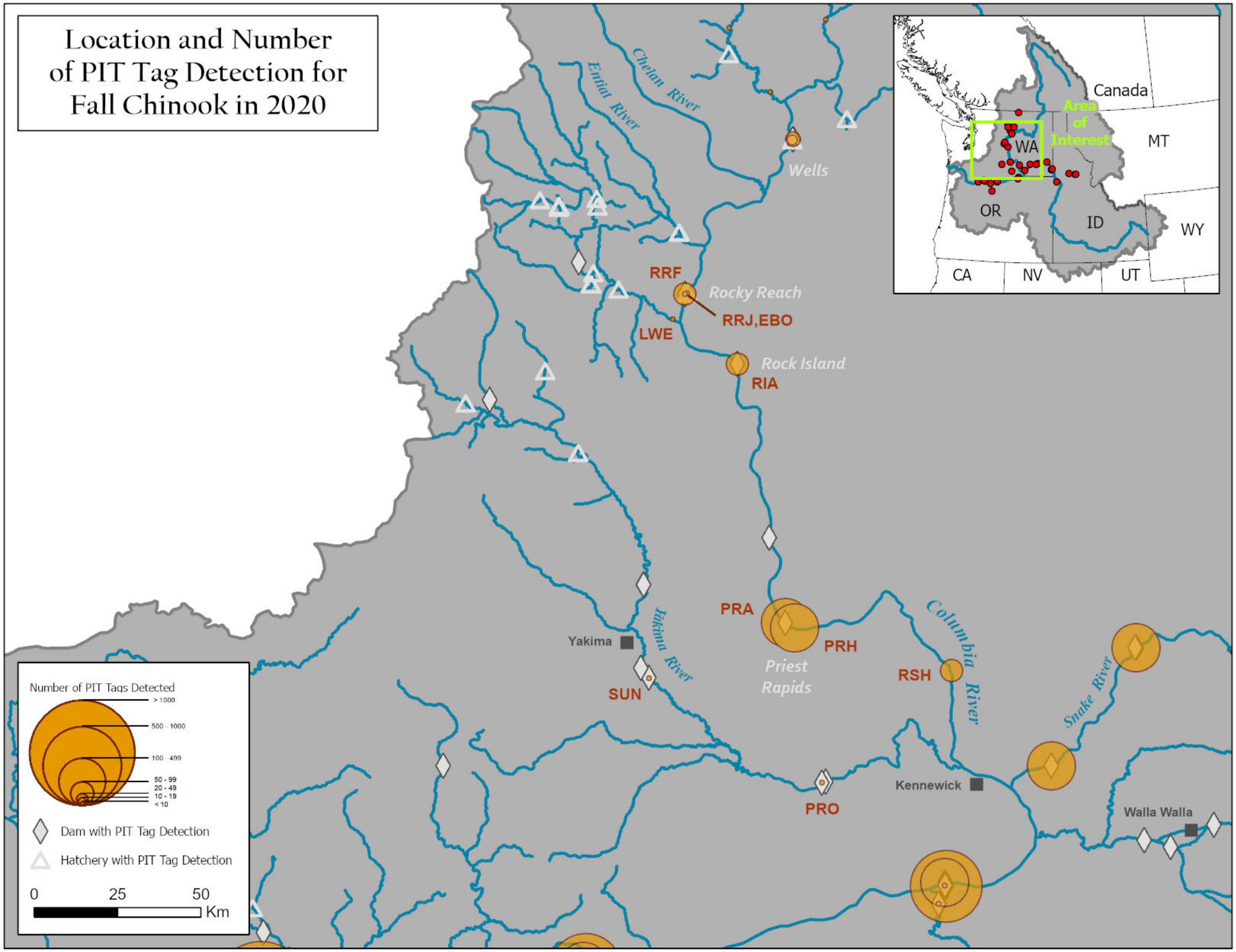

Figure C13. Map of Upper Columbia River (between the Snake River and Wells Dam) detection sites and number of fall Chinook Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map.

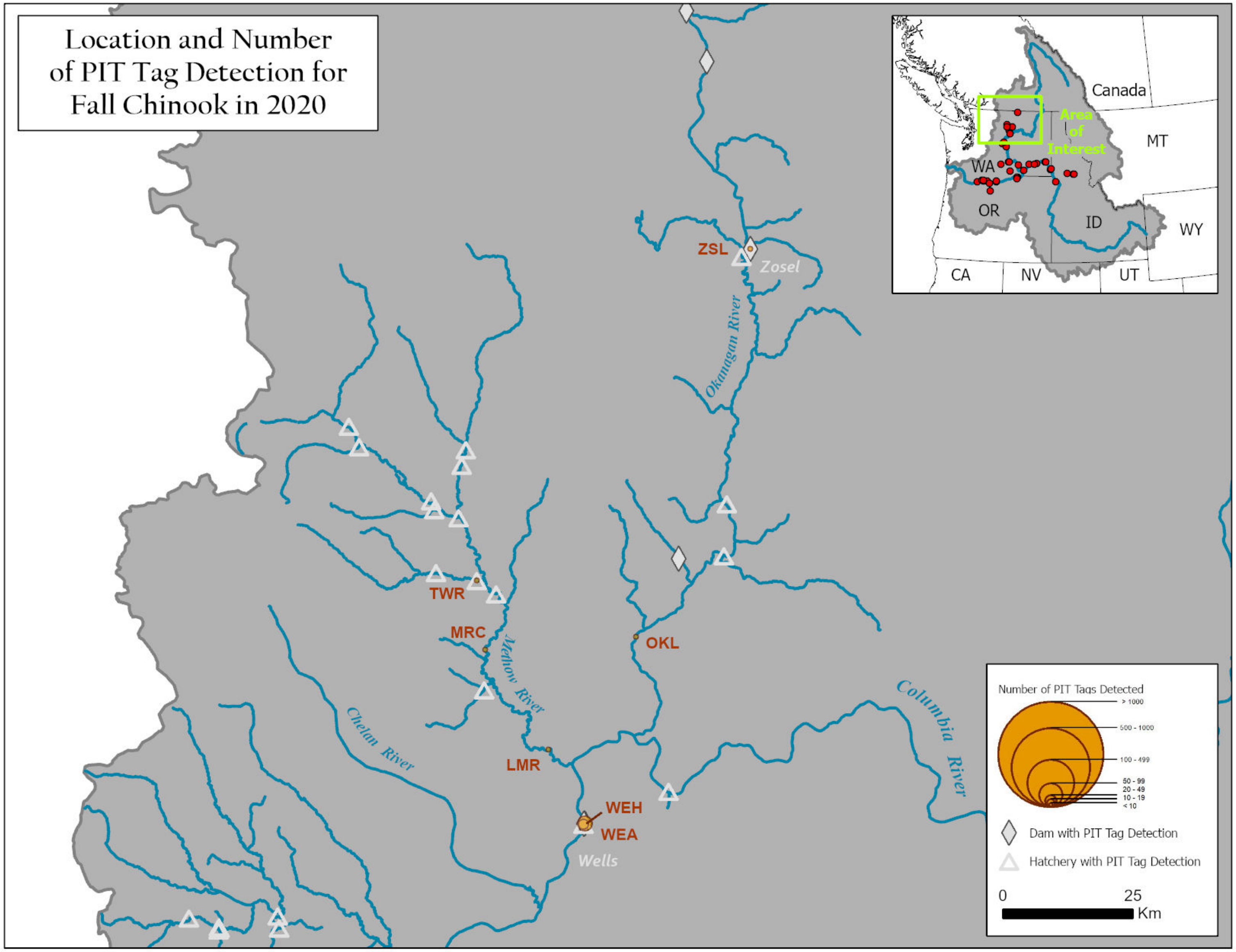

Figure C14. Map of Upper Columbia River detection sites (Wells Dam and above) and number of fall Chinook Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map. Fall Chinook is defined as fish passing Bonneville Dam from August 1 to end of year.

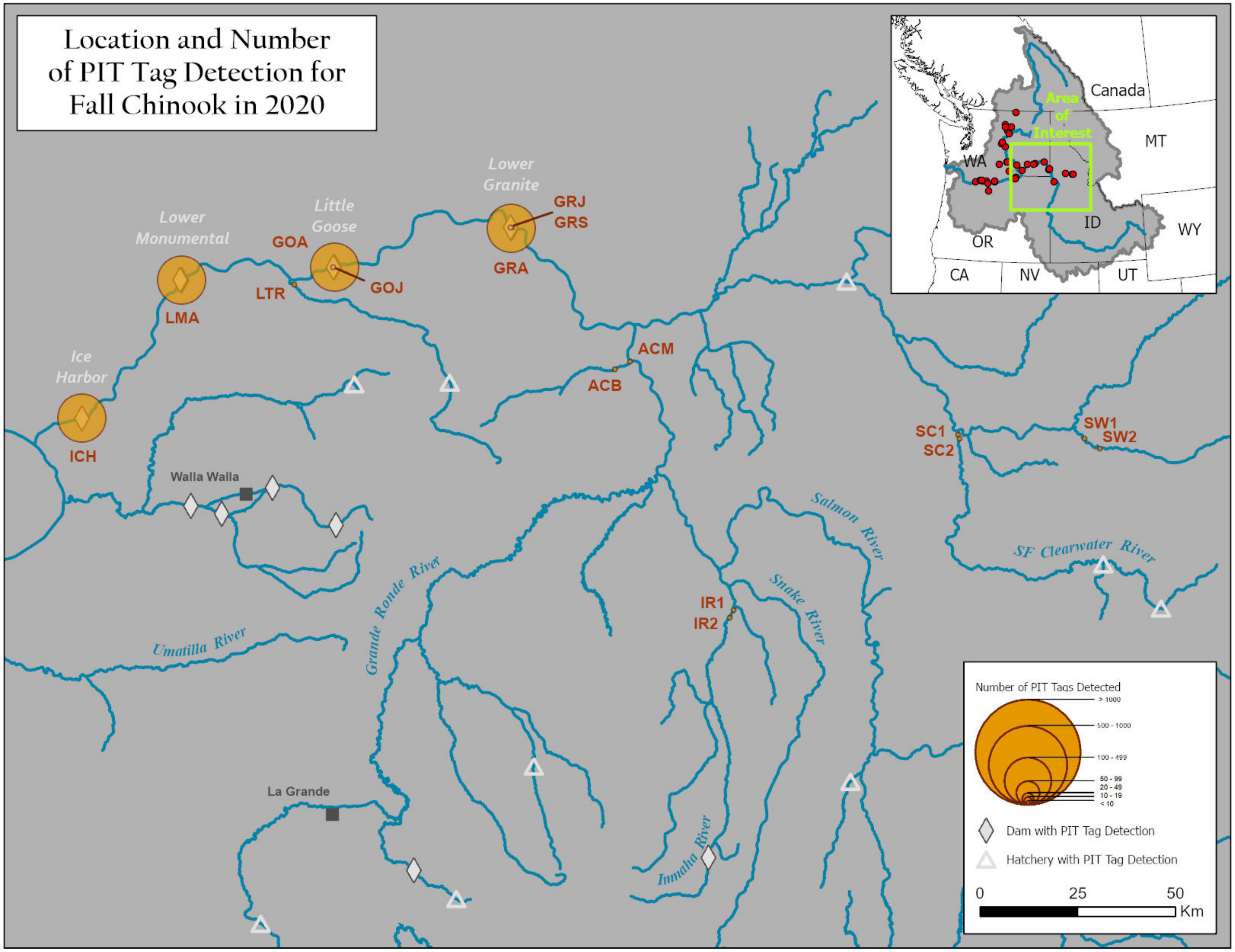

Figure C15. Map of Lower Snake River detection sites and number of fall Chinook Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map. Fall Chinook is defined as fish passing Bonneville Dam from August 1 to end of year.

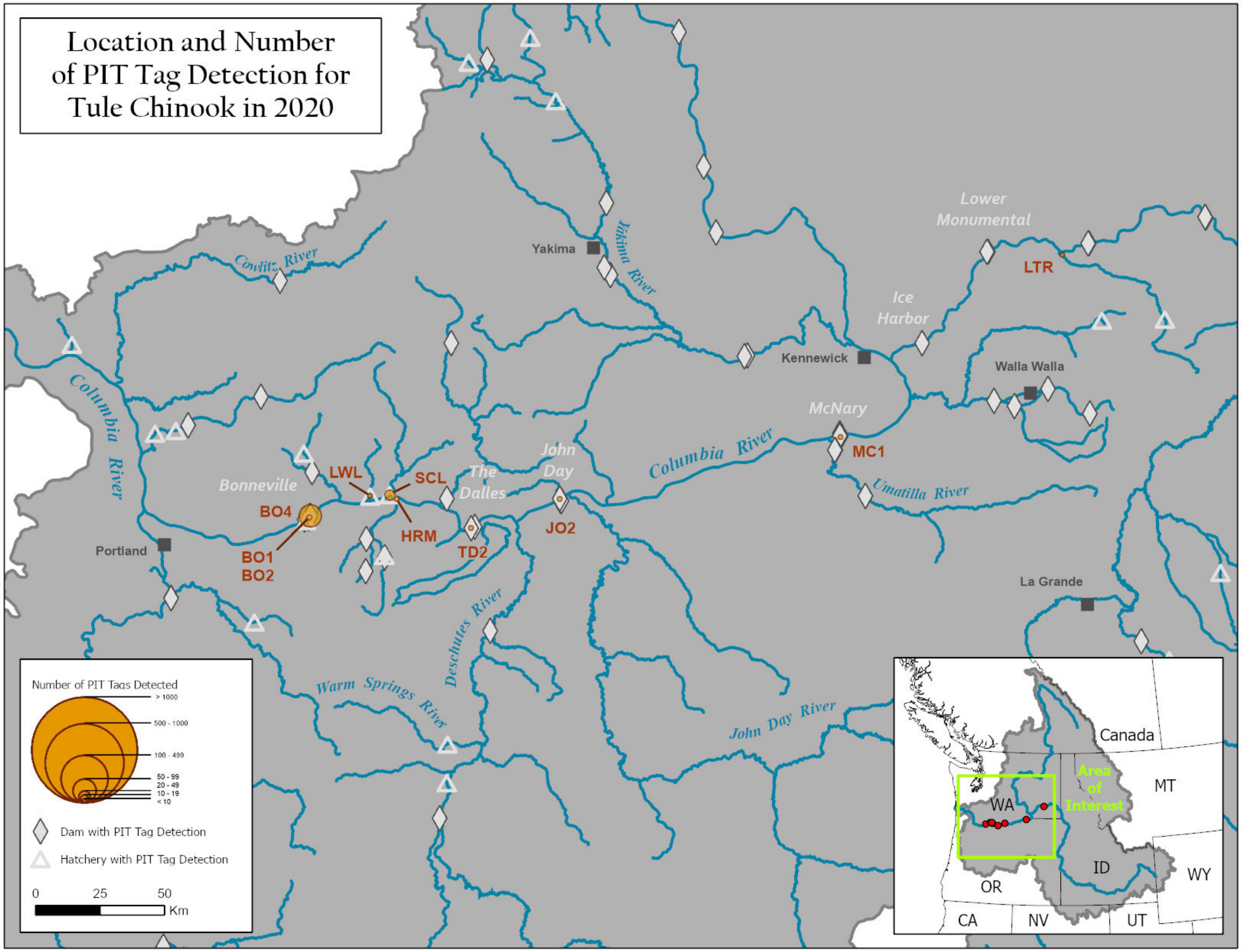

Figure C16. Map of Lower Columbia and Snake rivers detection sites and number of Tule fall Chinook Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map. Tule Chinook are defined as dark spawning mature fish passing Bonneville Dam near the end of the Chinook run.

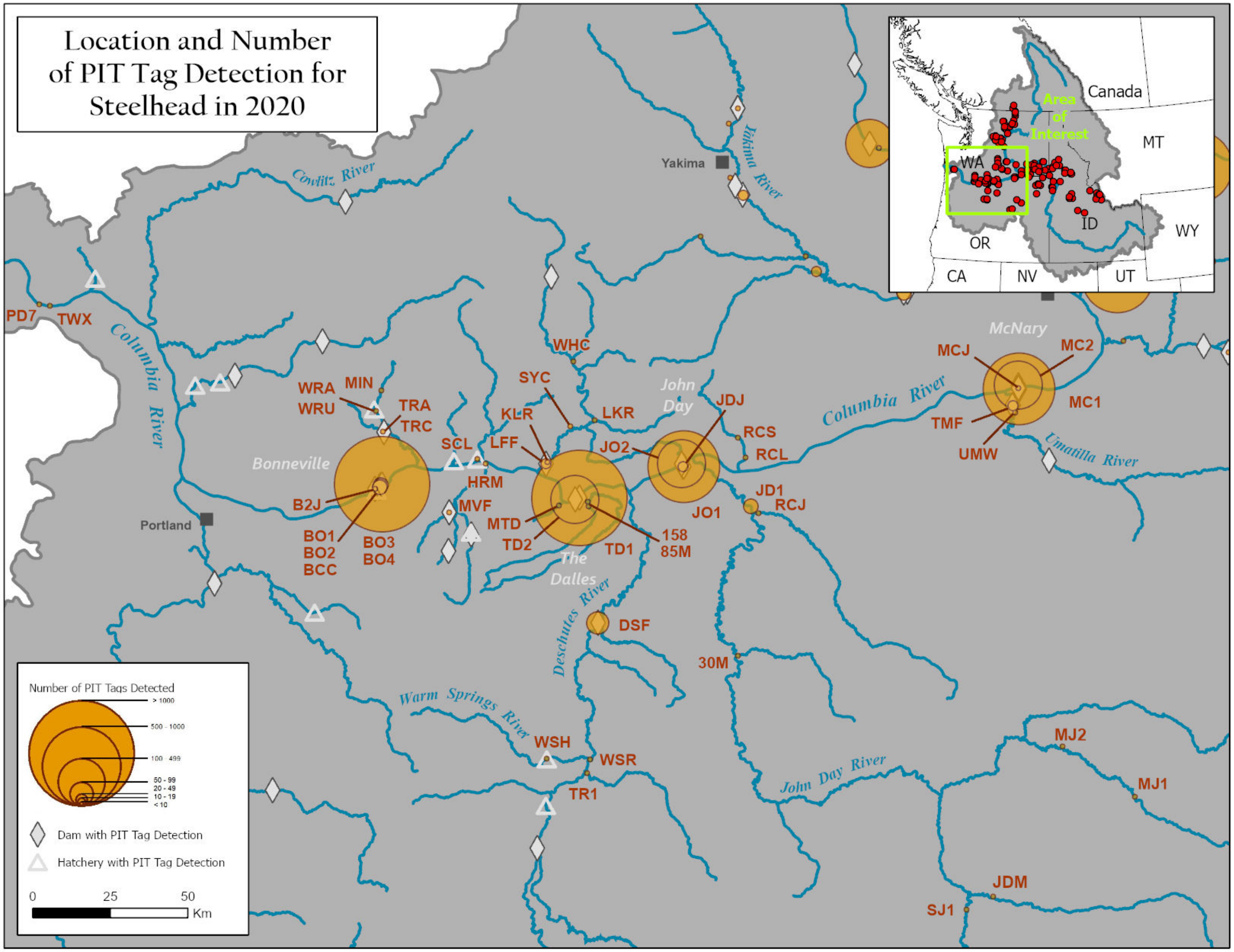

Figure C17. Map of Lower Columbia River detection sites (below Snake River) and number of steelhead detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map.

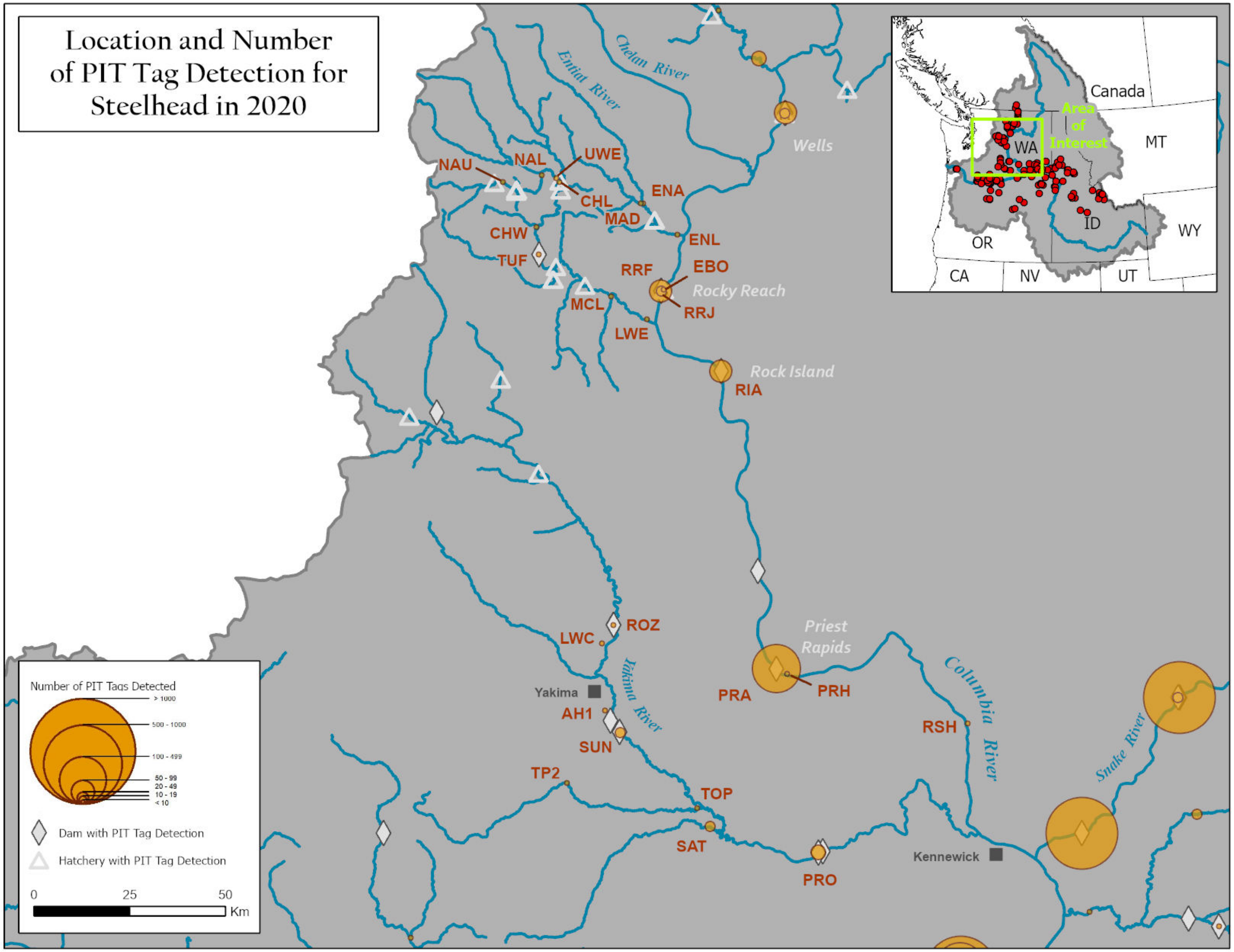

Figure C18. Map of Upper Columbia River (between the Snake River and Wells Dam) detection sites and number of steelhead detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map.

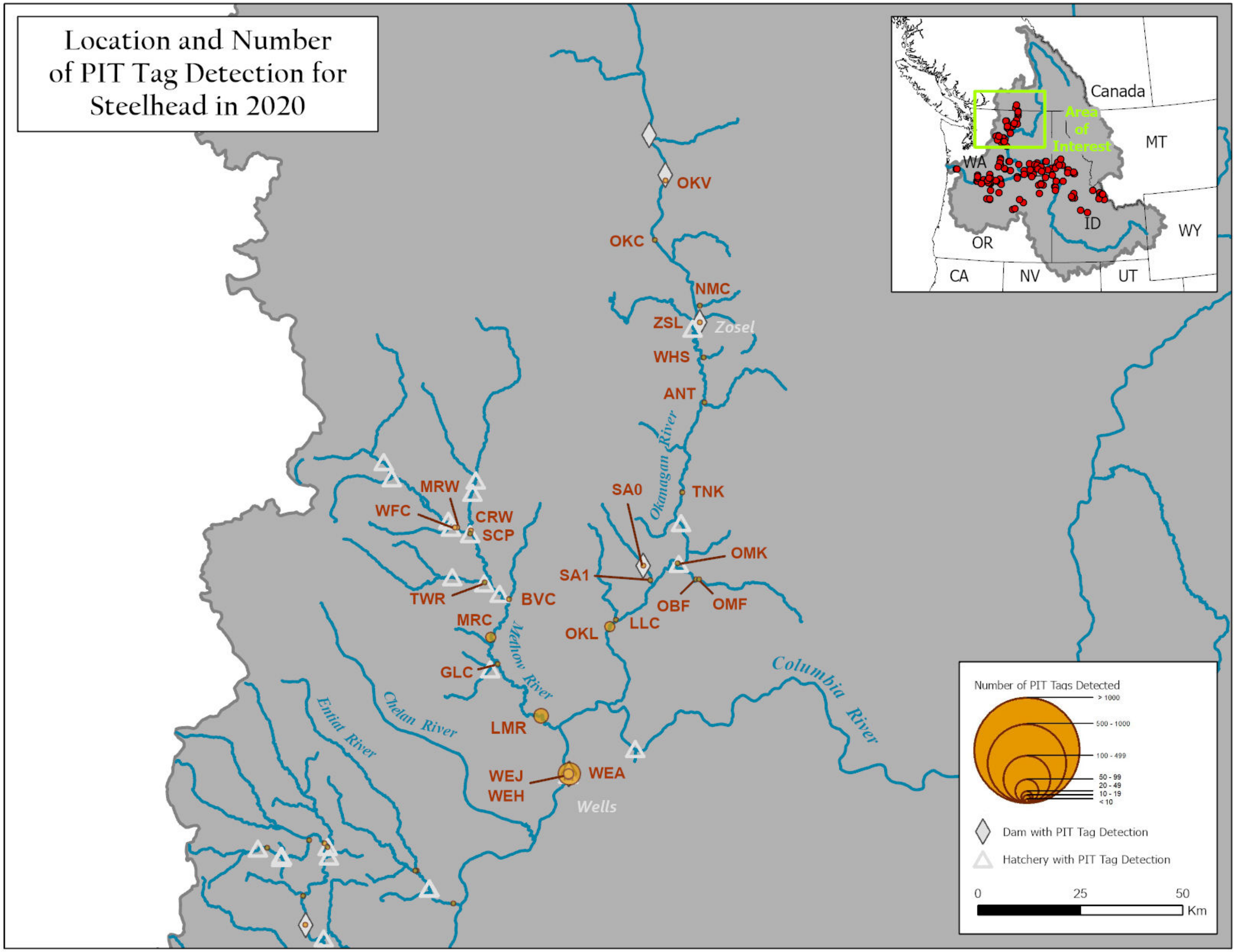

Figure C19. Map of Upper Columbia River (Wells Dam and above) detection sites and number of steelhead detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map.

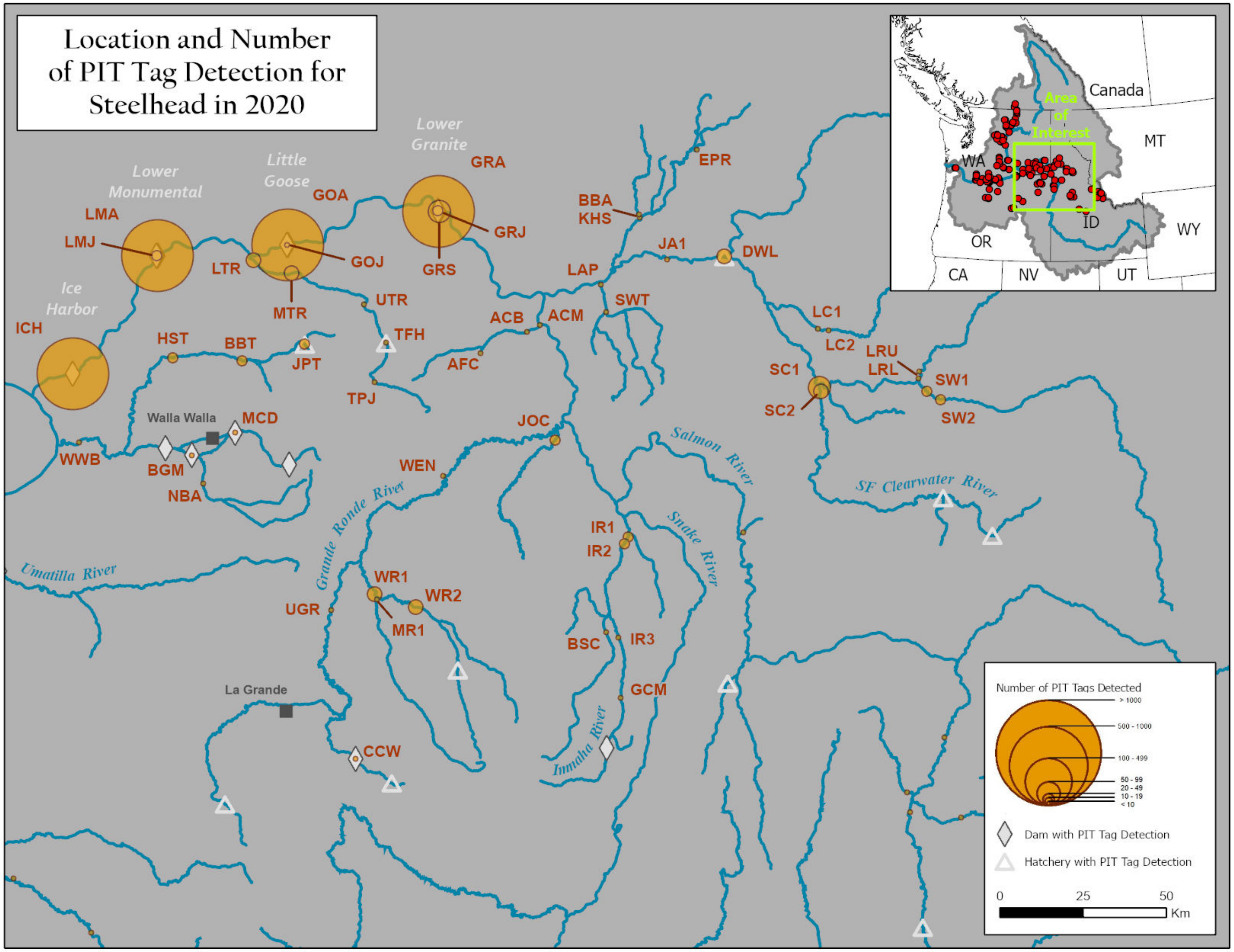

Figure C20. Map of Lower Snake River detection sites (Salmon River not included) and number of steelhead detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map.

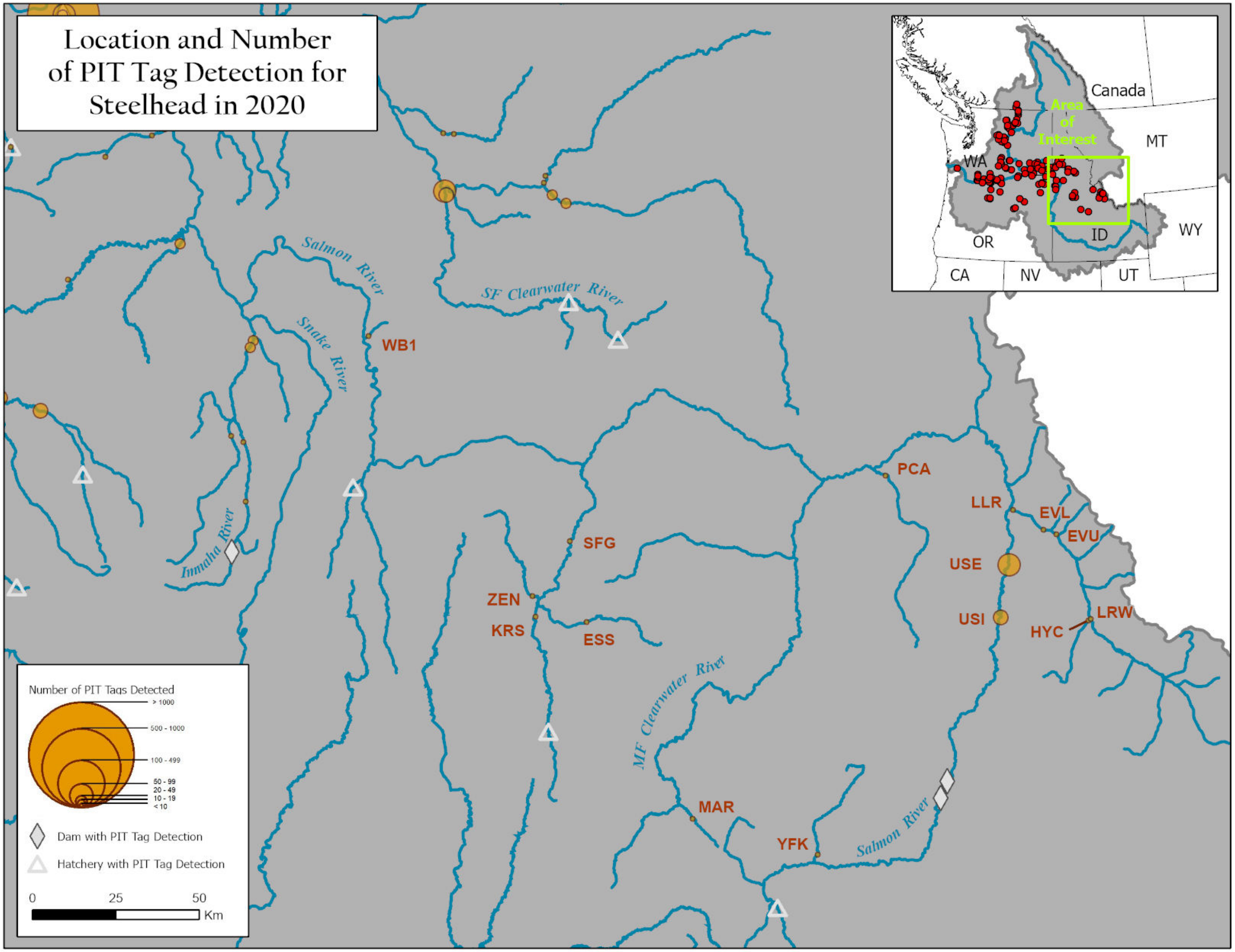

Figure C21. Map of Salmon River detection sites and number of steelhead detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map.

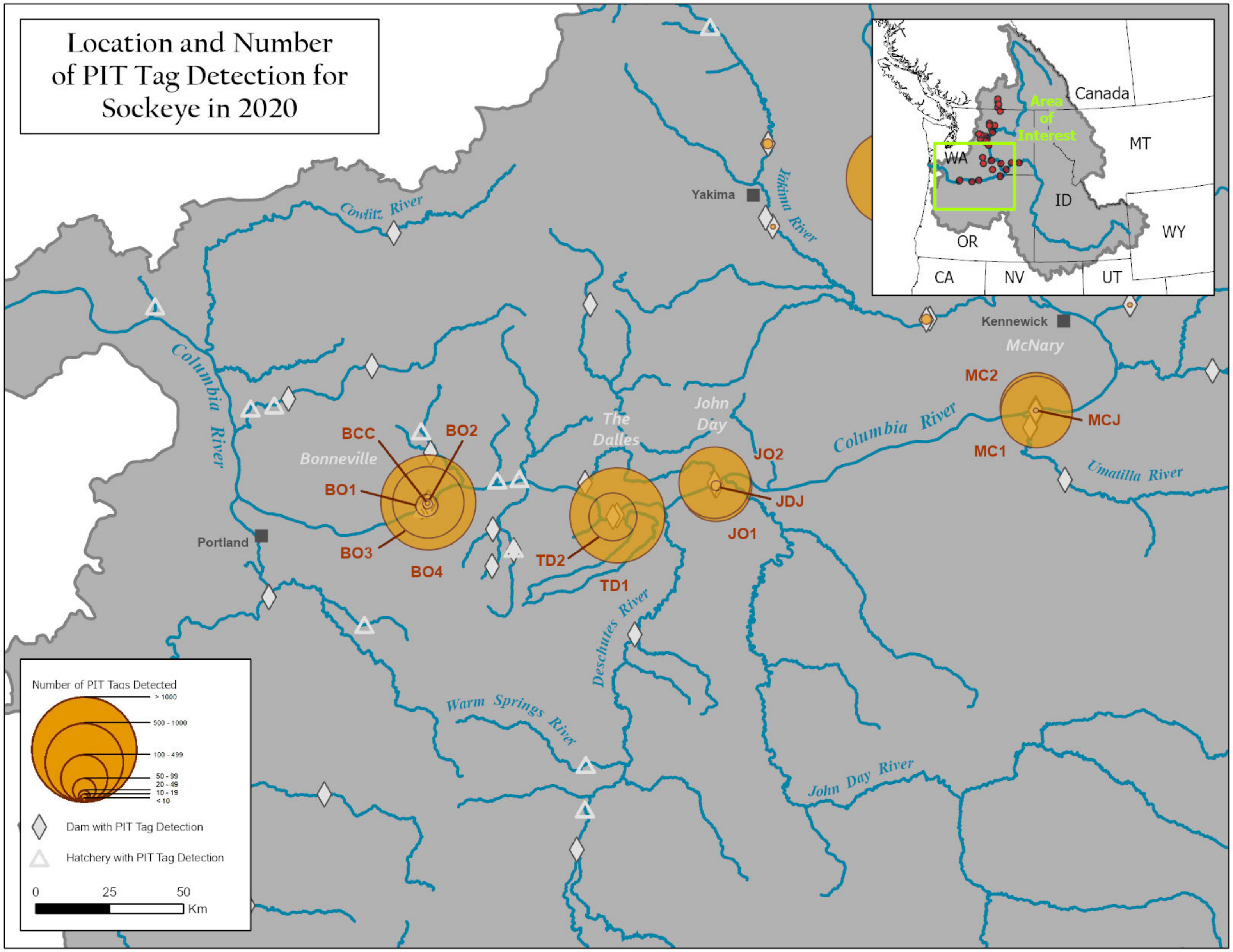

Figure C22. Map of Lower Columbia River detection sites (below Snake River) and number of Sockeye Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map.

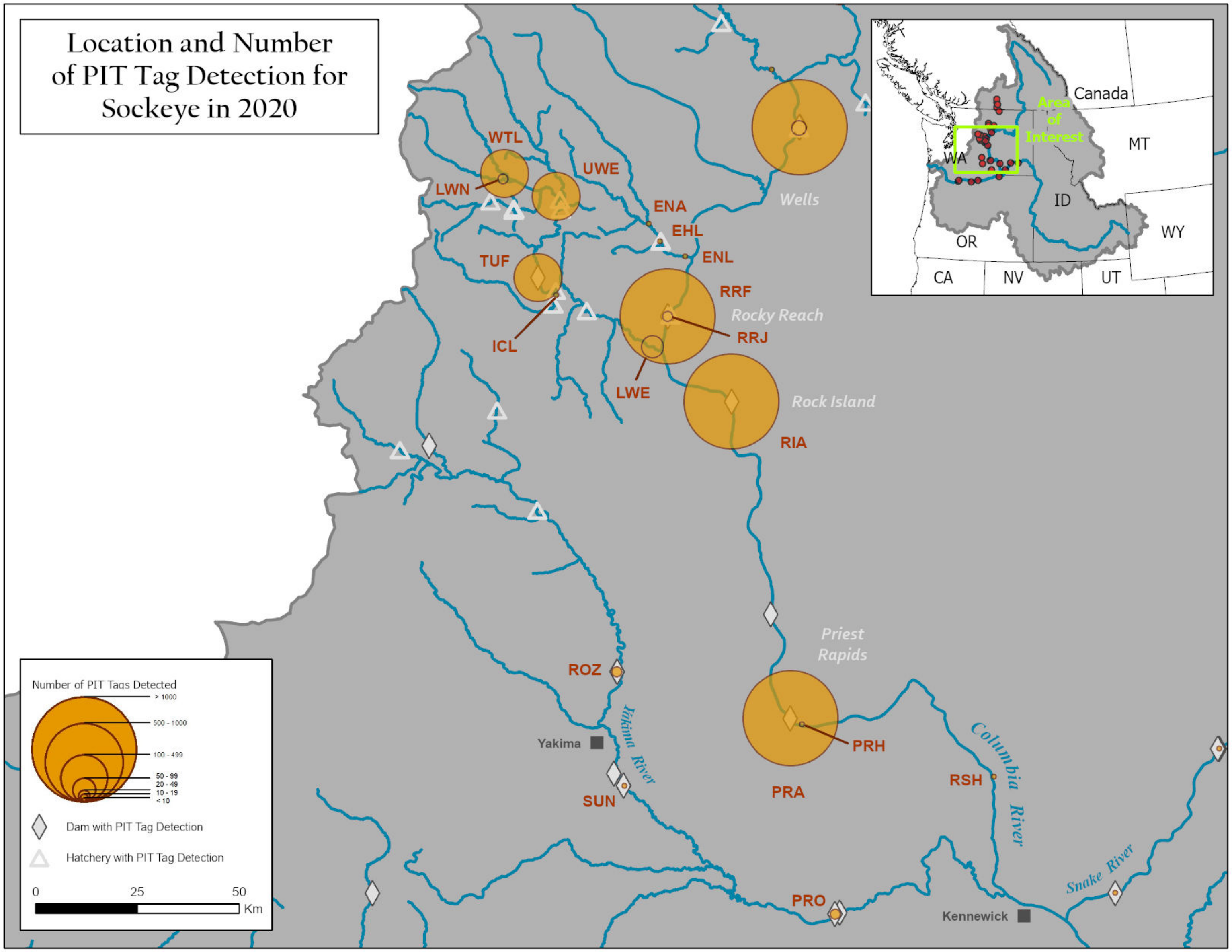

Figure C23. Map of Upper Columbia River (between the Snake River and Wells Dam) detection sites and number of Sockeye Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map.

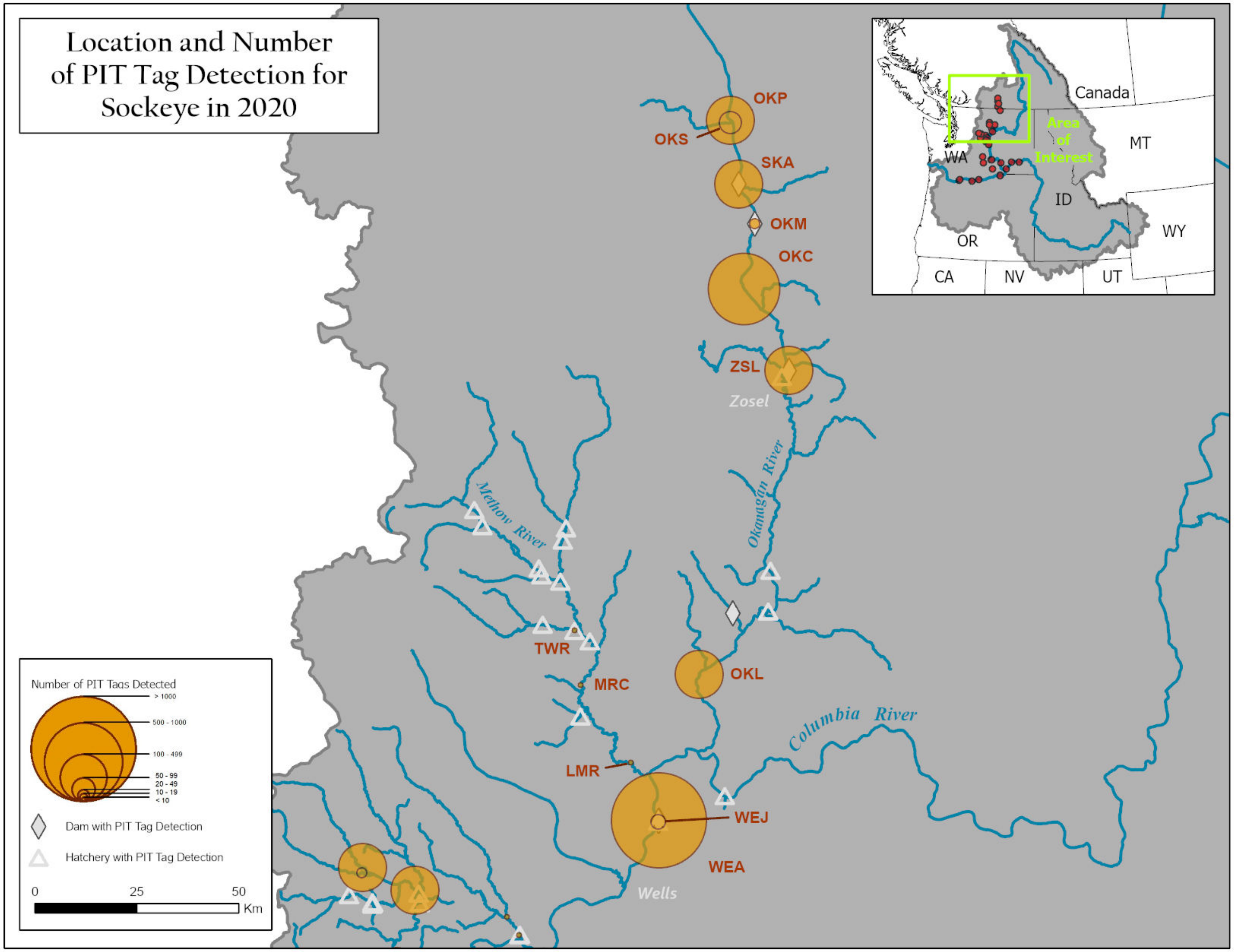

Figure C24. Map of Upper Columbia River (Wells Dam and above) detection sites and number of Sockeye Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map.

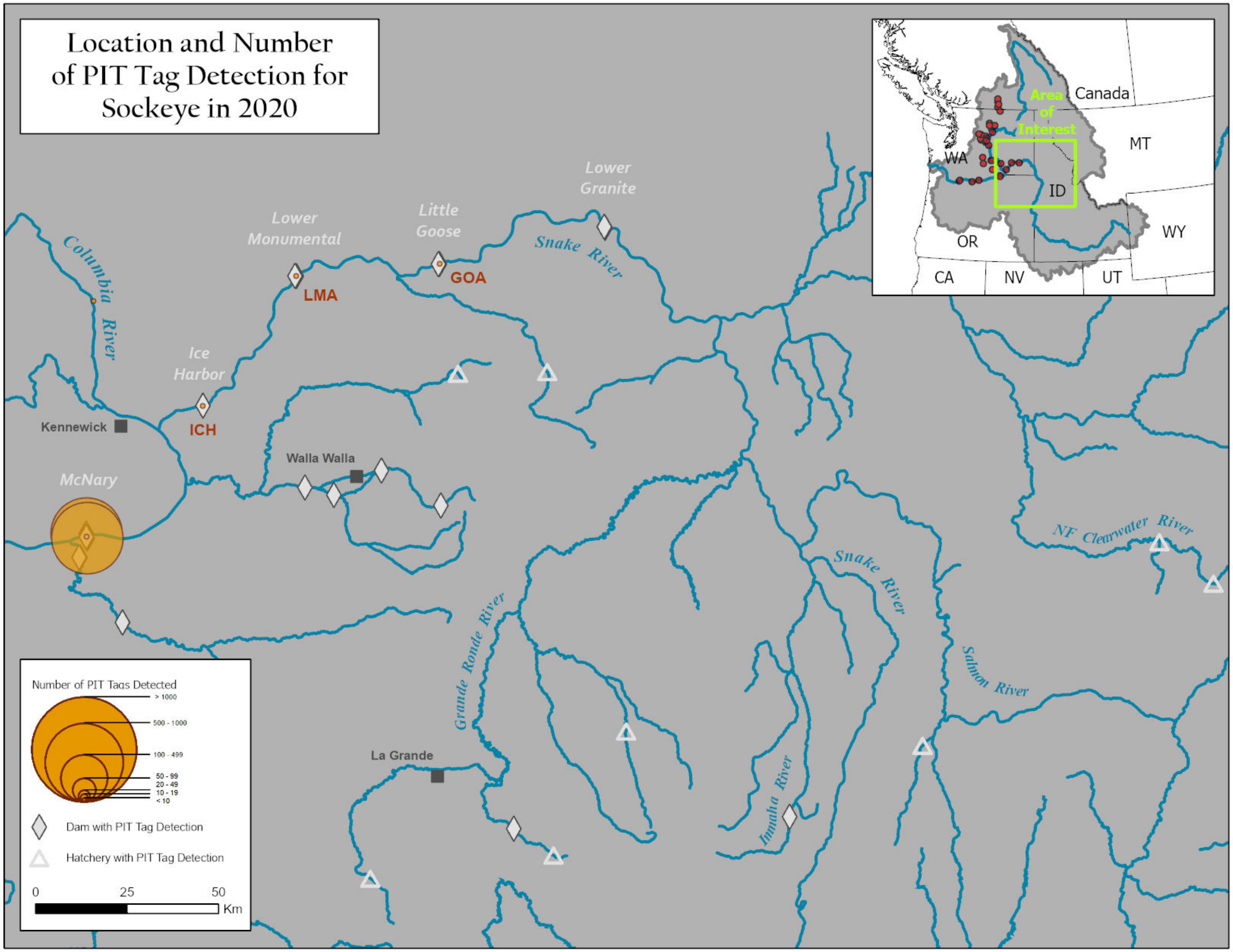

Figure C25. Map of Lower Snake River detection sites (Salmon River not included) and number of Sockeye Salmon detected. Table C1 in Appendix C lists the PTAGIS sites' full name and the three-letter codes on this map.

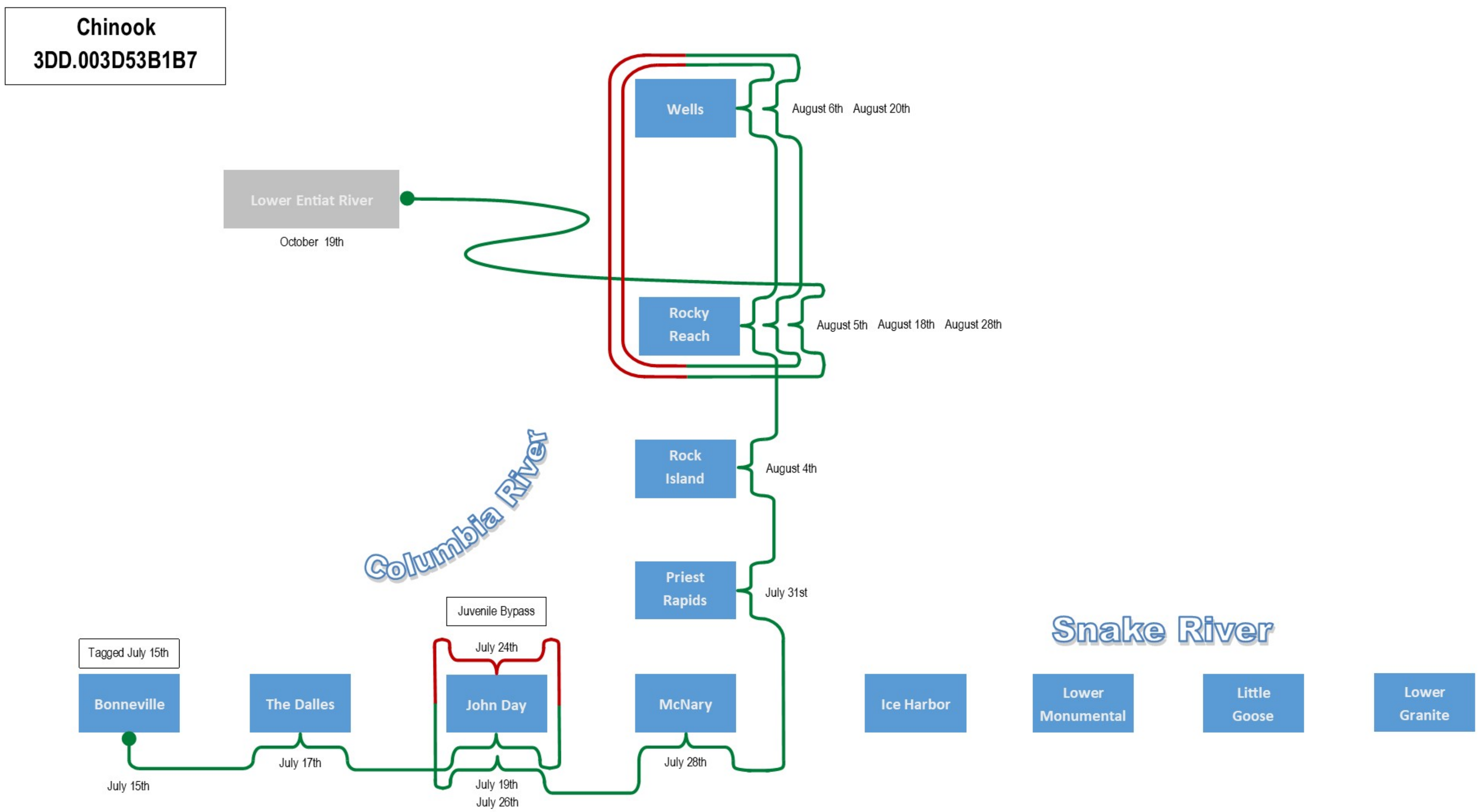

Figure C26. Chart showing the pattern and location of fallback events at mainstem dams on the Columbia and Snake rivers for Chinook Salmon with PIT tag 3DD.003D53B1B7, tagged and tracked in 2020.

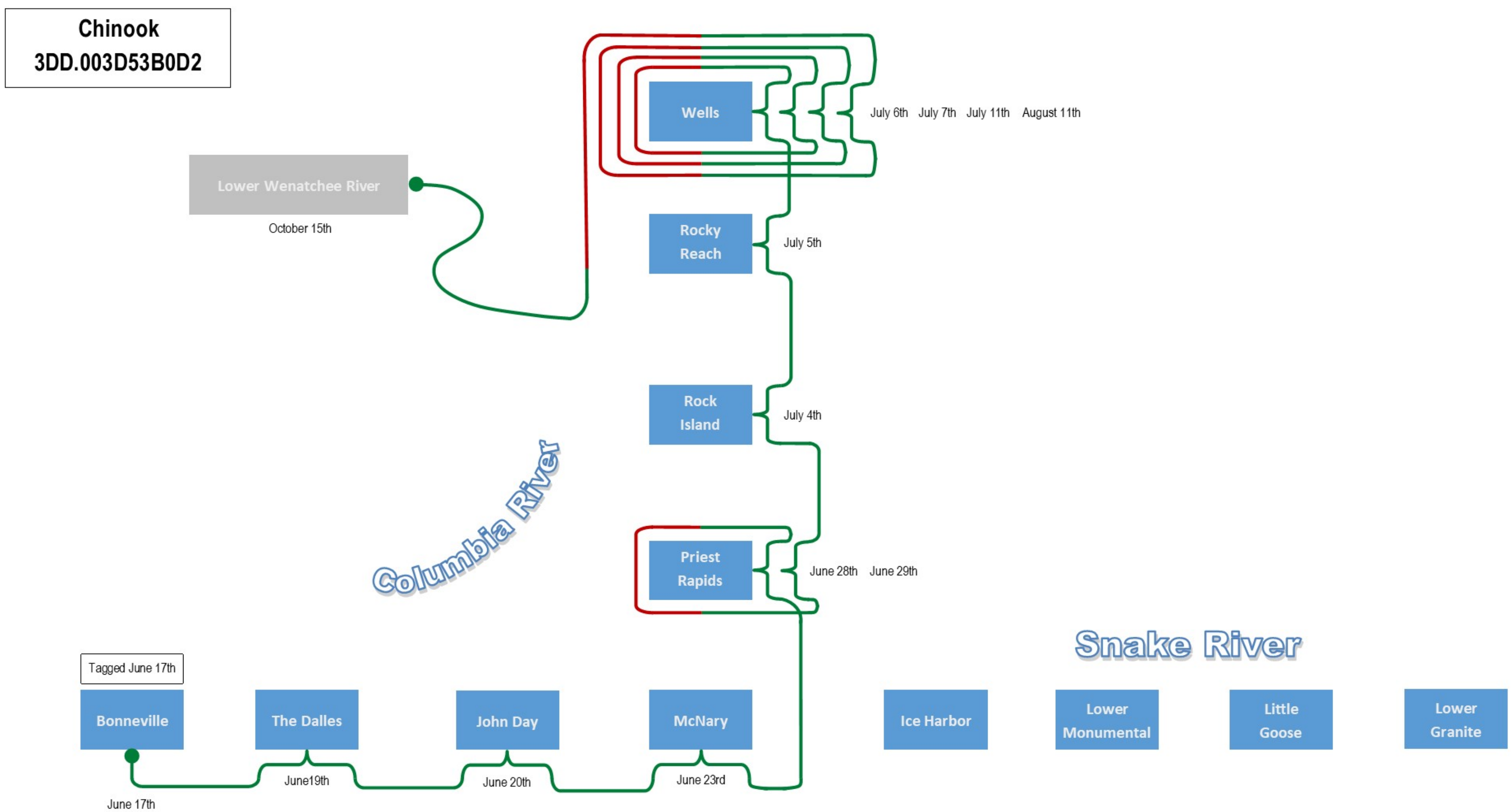

Figure C27. Chart showing the pattern and location of fallback events at mainstem dams on the Columbia and Snake rivers for Chinook Salmon with PIT tag 3DD.003D53B0D2, tagged and tracked in 2020.

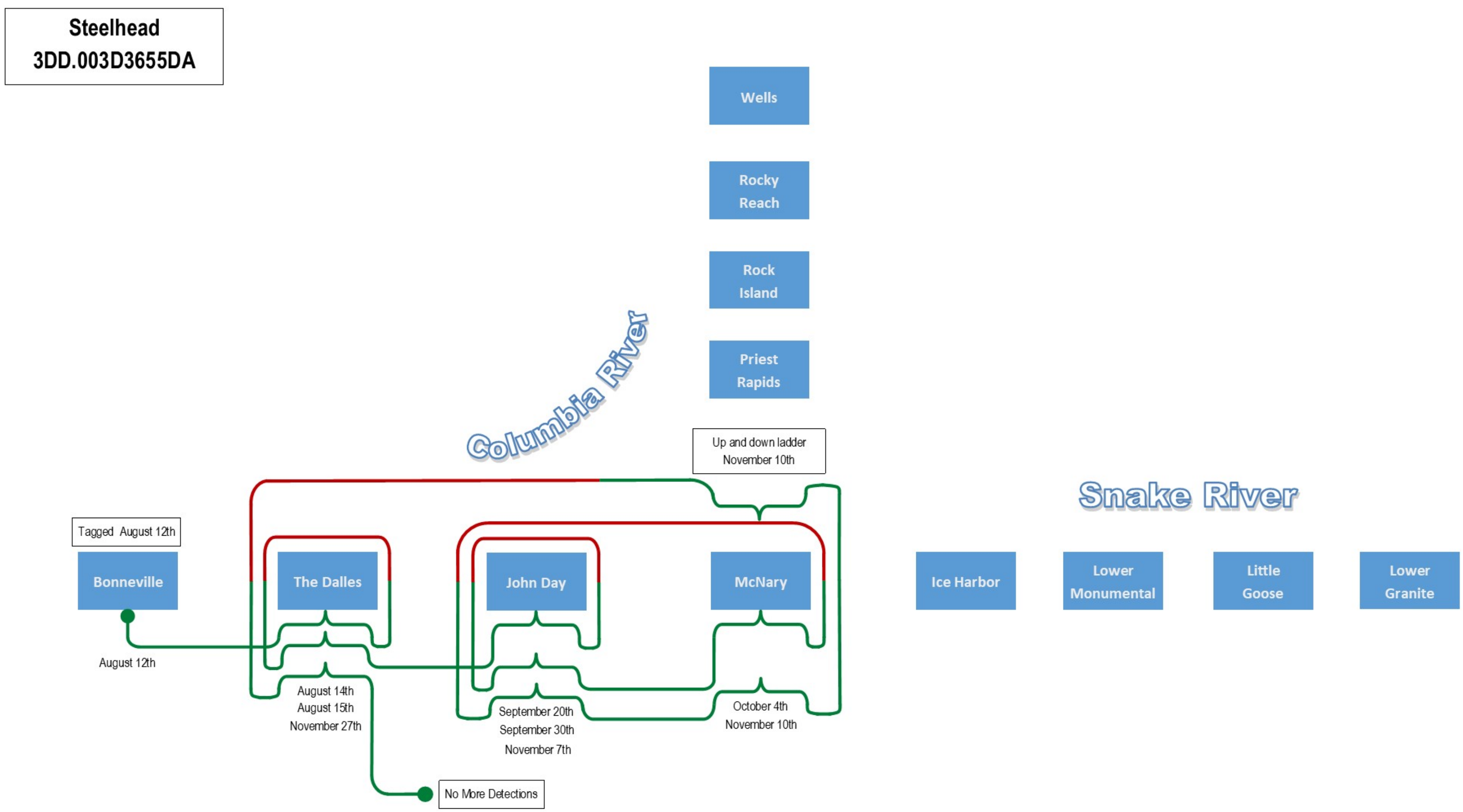

Figure C28. Chart showing the pattern and location of fallback events at mainstem dams on the Columbia and Snake rivers for steelhead with PIT tag 3DD.003D3655DA, tagged and tracked in 2020.

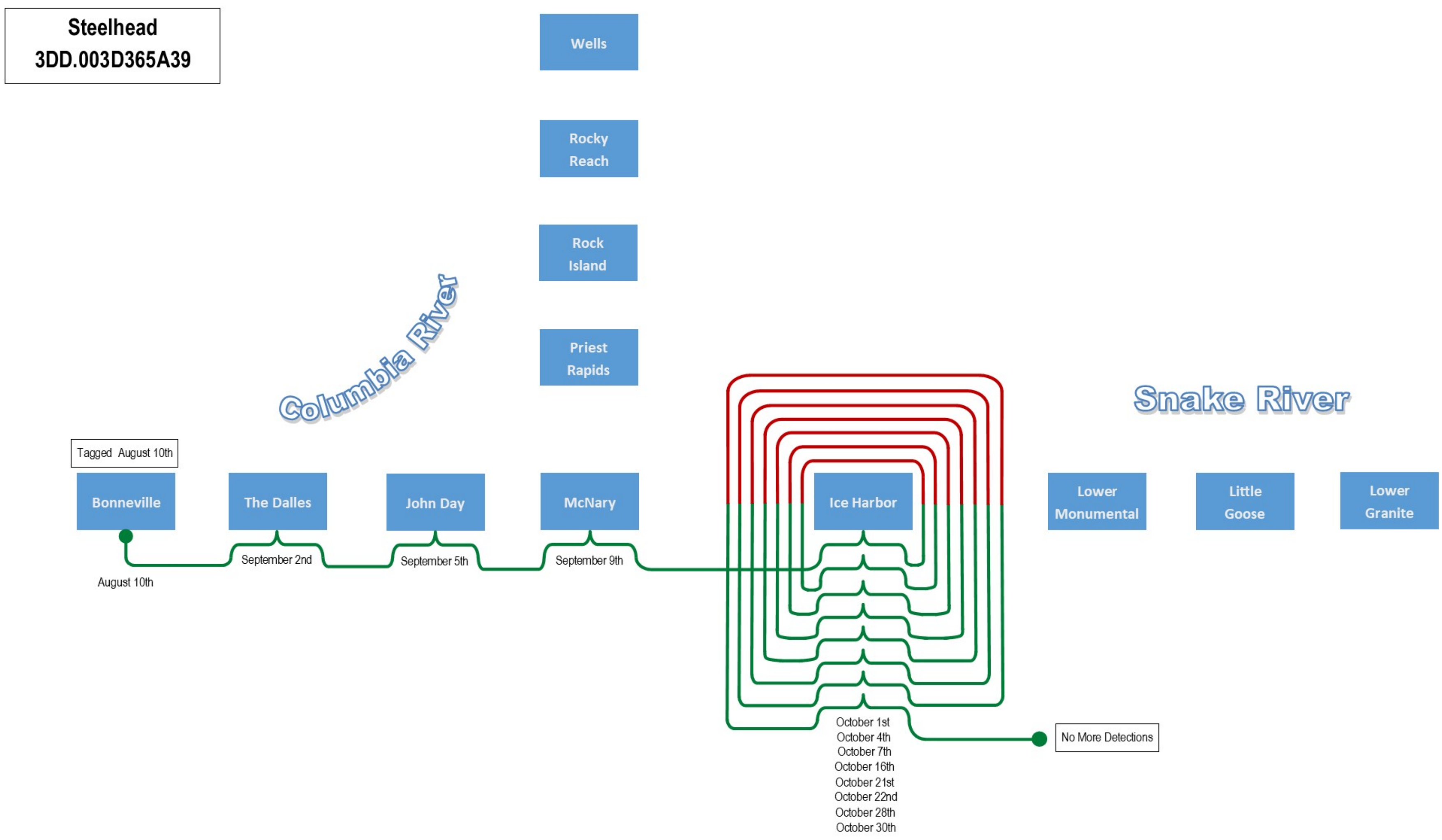

Figure C29. Chart showing the pattern and location of fallback events at mainstem dams on the Columbia and Snake rivers for steelhead with PIT tag 3DD.003D365A39, tagged and tracked in 2020.

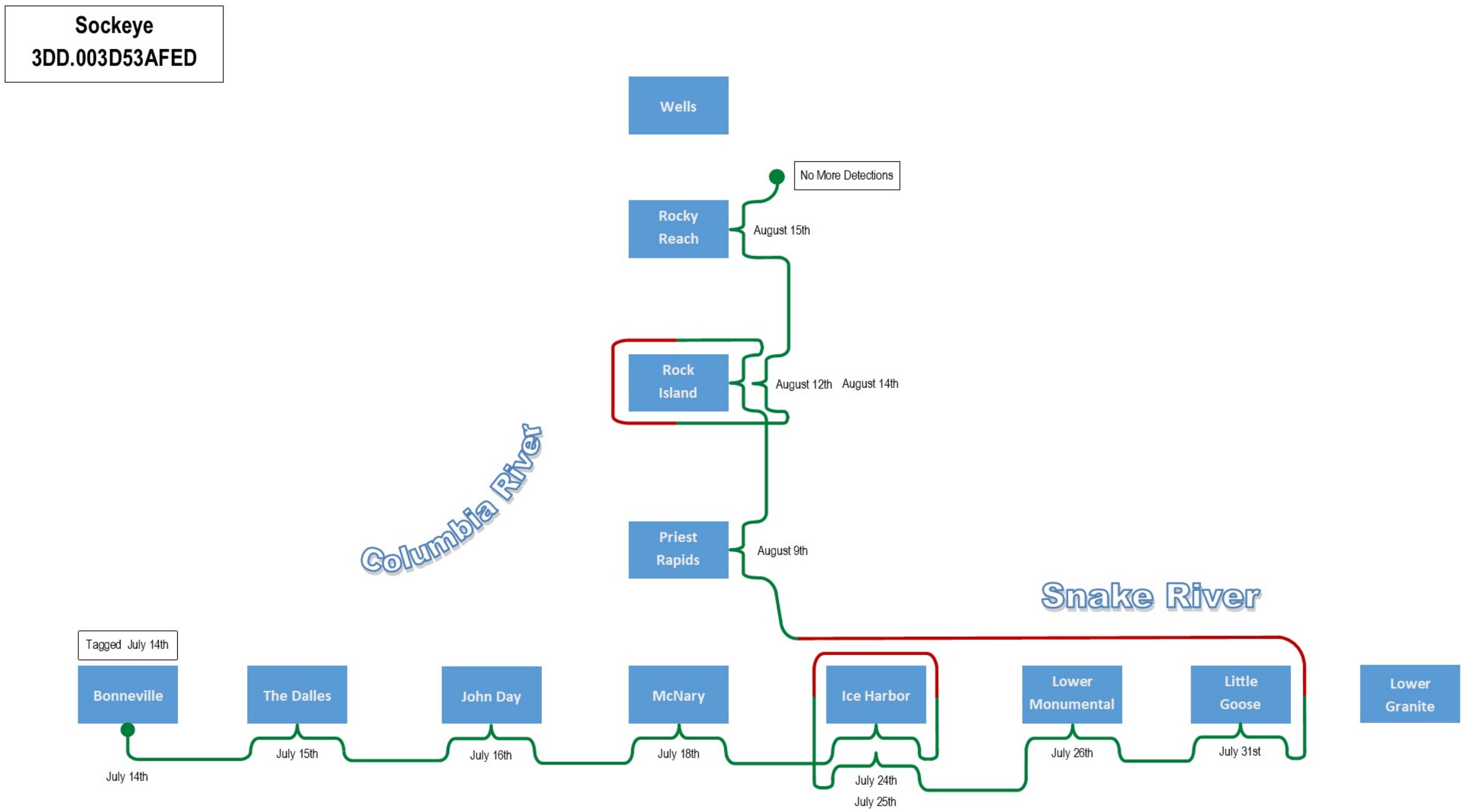

Figure C30. Chart showing the pattern and location of fallback events at mainstem dams on the Columbia and Snake rivers for Sockeye Salmon with PIT tag 3DD.003D53AFED, tagged and tracked in 2020.

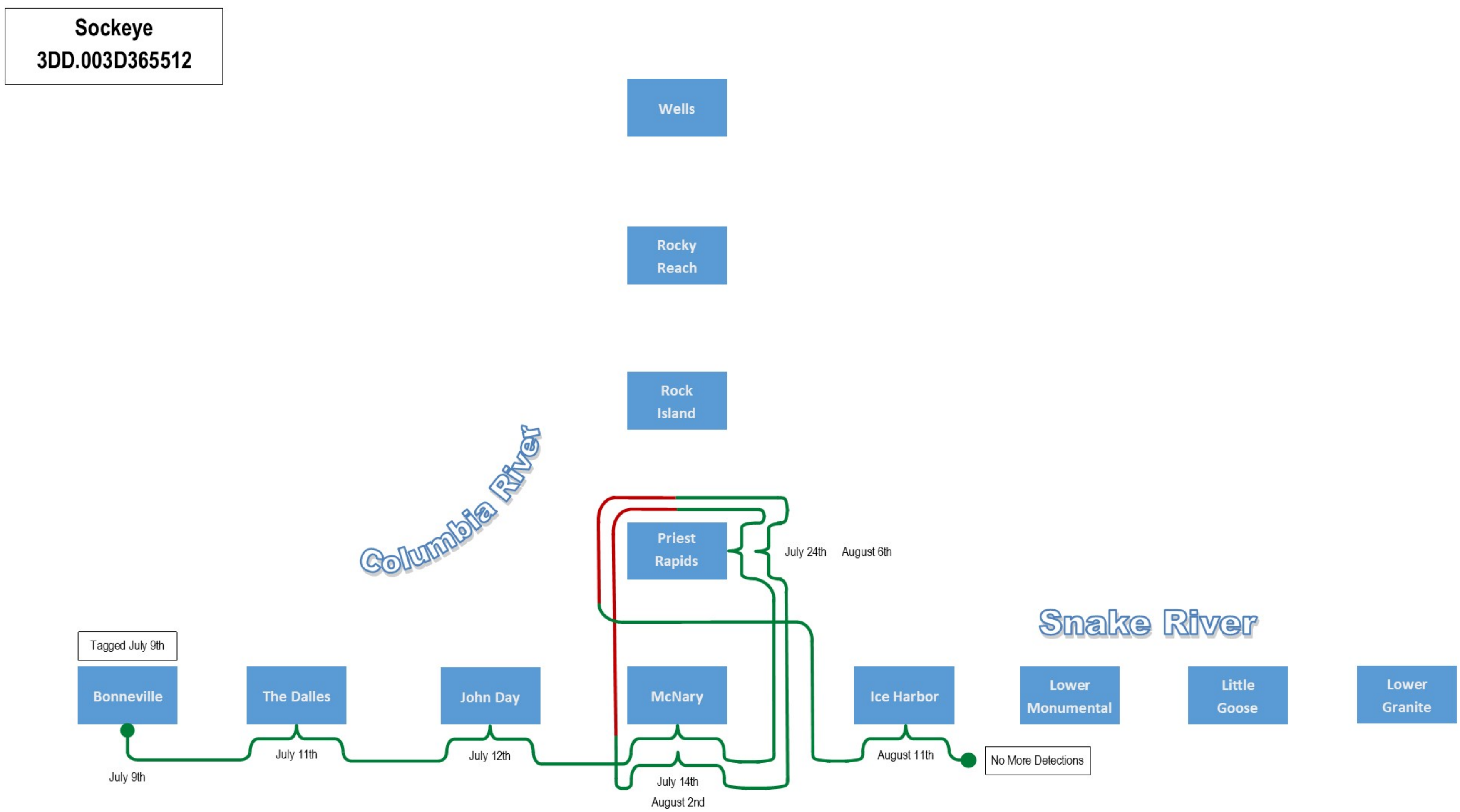

Figure C31. Chart showing the pattern and location of fallback events at mainstem dams on the Columbia and Snake rivers for Sockeye Salmon with PIT tag 3DD.003D365512, tagged and tracked in 2020.

APPENDIX D

Table D1. Table showing picket lead protocols that affected sampling of salmonids in 2020. Pickets are used to direct fish into the trap ladder and the number that can be used is affected by temperature and fish abundance numbers.

Protocols specified at different temperatures and abundances (based on previous day count at Bonneville Dam Washington Shore ladder (DART Adult Passage Ladder Summary for All Species | Columbia Basin Research (washington.edu)) for AFF operations (FPP Appendix G (crohms.org))										
Temperature (F)	<70	<70	<70	<70	<70	≥70	≥70	≥70	≥70	≥70
Abundance	0-6000	6000-12000	12000-25000	25000-35000	.35000	0-3000	3000-6000	6000-9000	9000-18000	>18000
Picket Leads	All 4 lowered 4 hours	4 down 3 hours, 1 up for ½ hour, sample 1 more hour	4 down 2 hours, raise 2 pickets for ½ hour, sampled 2 more hours	Two down for 4 hours	No pickets down	All 4 lowered 4 hours	4 down 3 hours, 1 up for ½ hour, sample additional 1 hour	4 down 2 hours, raise 1 picket for ½ hour, sample 2 more hours	2 leads down 4 hours, all pickets up at 10:30 AM	No pickets down
Week	**<70 Protocol (a)**	**<70 Protocol (b)**	**<70 Protocol (c)**	**<70 Protocol (d)**	**<70 Protocol (e)**	**>70 Protocol (a)**	**>70 Protocol (b)**	**>70 Protocol (c)**	**>70 Protocol (d)**	**>70 Protocol (e)**
16	No Sampling Permitted by U.S. Army Corps of Engineers									
17										
18										
19										
20										
21	2	0	0	0	0	0	0	0	0	0
22	4	0	0	0	0	0	0	0	0	0
23	0	1	4	0	0	0	0	0	0	0
24	0	0	1	2	2	0	0	0	0	0

25	0	0	0	2	3	0	0	0	0	0
26	0	0	5	0	0	0	0	0	0	0
27	0	1	3	0	0	0	0	0	0	0
28	0	2	0	0	0	0	0	0	0	0
29	5	0	0	0	0	0	0	0	0	0
30	5	0	0	0	0	0	0	0	0	0
31	2	0	0	0	0	2	0	0	0	0
32	0	0	0	0	0	4	0	0	0	0
33	0	0	0	0	0	4	0	0	0	0
34	0	0	0	0	0	1	2	1	0	0
35	0	0	0	0	0	0	2	1	1	0
36	0	0	0	0	0	0	0	4	0	0
37	0	0	2	1	0	0	0	0	0	0
38	0	1	3	0	0	0	0	0	0	0
39	2	3	0	0	0	0	0	0	0	0
40	3	2	0	0	0	0	0	0	0	0
41	5	0	0	0	0	0	0	0	0	0
42	4	0	0	0	0	0	0	0	0	0
Total	**32**	**10**	**18**	**5**	**5**	**11**	**4**	**6**	**1**	**0**

Four picket leads will be allowed during trap operations for up to four hours. After all picketed leads are raised, fish already in the AFF can be sampled for one additional hour. Abundances are the previous day's Washington Shore ladder count (DART Adult Passage Ladder Summary for All Species | Columbia Basin Research (washington.edu)). The picketed lead operations are as follows:

<70F(a) 0–6,000: All 4 picket leads can be lowered for 4 continuous hours.
<70F(b) Protocol b 6,000–12,000: All 4 picket leads down for 3 hours. At the 3rd hour, raise at least 1 picket lead for ½ hour, and then

continue sampling for additional 1 hour.

<70F(c) Protocol c 12,000–25,000: All 4 picket leads down for 2 hours. At the 2nd hour, raise at least 2 picket leads for ½ hour, and then continue sampling for an additional 2 hours.

<70F(d) Protocol d 25,000–35,000: Two picket leads down for four hours.

<70F(e) Protocol e > 35,000: No picket leads down.

>70F(a) 0–3,000: All 4 picket leads can be lowered for 4 continuous hours.

>70F(b) 3,000–6,000: All 4 picket leads down for 3 hours. At the 3rd hour, raise at least 1 picket lead for ½ hour and then continue sampling for an additional 1 hour.

>70F(c) 6,000–9,000: All 4 picket leads down for 2 hours. At the 2nd hour, raise at least 1 picket lead for ½ hour and then continue sampling for an additional 2 hours.

>70F(d) 9,000–18,000: 2 leads down for 4 hours. All picket leads raised by 10:30 am.

>70F(e)> 18,000: No picket leads down.