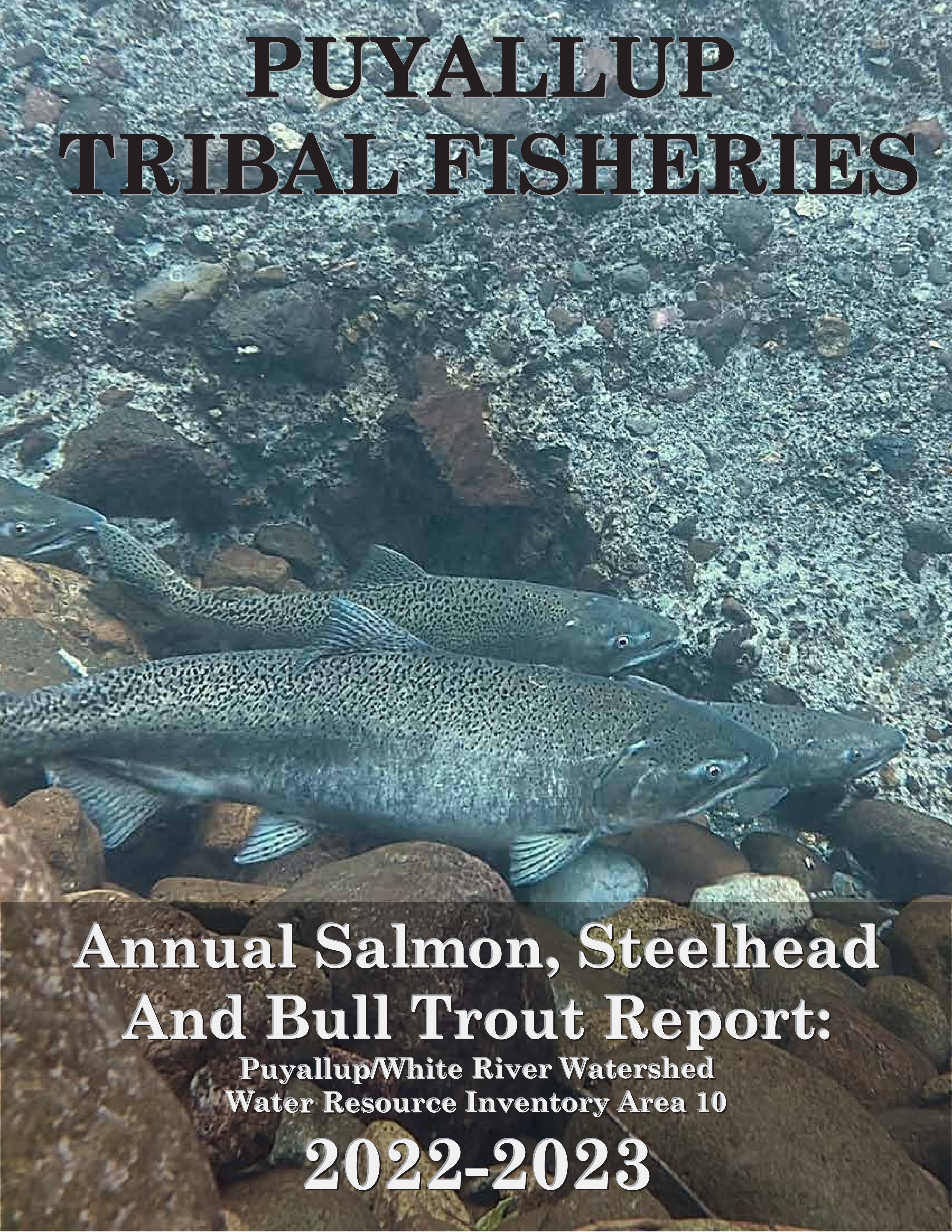
PUYALLUP TRIBAL FISHERIES



Annual Salmon, Steelhead And Bull Trout Report:

Puyallup/White River Watershed
Water Resource Inventory Area 10

2022-2023

The following annual report is the culmination of a year of extensive field work and research. Funding for projects was provided though the Pacific Coast Salmon Recover Fund (PCSRF), Cascade Water Alliance (CWA) settlement fund, B.I.A 638, Pacific Salmon Treaty (PST), Forest and Fish, TFW, Puyallup Tribal funding, King County Flood Control District cooperative watershed management grant and the Puget Sound Energy Electron settlement fund.

Additional data incorporated into this report was provided by Mt. Rainier National Park staff (MORA-U.S. National Park Service), Washington Department of Fish and Wildlife (WDFW), and the U.S. Army Corps of Engineers (USACE).

The updated written material and data contained in this report supersedes and replaces all previous annual reports. Data represented may be revised as new or additional information becomes available. While the authors believe the contents of this report are accurate, readers should not presume and are encouraged to verify the information in this report through additional sources.

An electronic format of this report is available at: https://www.puyalluptribe-nsn.gov/member-services/tribal-natural-resources/fisheries/annual-reports/

Cover Photo: Chinook salmon in the Clearwater River.

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Puyallup
Tribe of Indians

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Puyallup Tribal Fisheries Annual Salmon, Steelhead And Bull Trout Report:

Puyallup/White River Watershed
Water Resource Inventory Area 10

2022-2023

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Puyallup Tribe: Mission Statement

"The Puyallup Tribe of Indians is committed to protecting and exercising the inherent and inalienable sovereign rights of the Tribe and individuals in the interests of the Medicine Creek Treaty Territories, as stewards to ensure the preservation of our cultural and environmental integrity for common good and prosperity of all."

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(Mt. Rainier)

INTRODUCTION

About This Report

The Puyallup Tribe's Fisheries Department goal is to: "preserve, protect and enhance salmon (sčədadxʷ) populations throughout all usual and accustomed areas (U&A); in company with, the water resources and habitat that determine their viability." It's the department's goal to fulfill its obligations by leading and participating in habitat restoration efforts, harvest management/policy, fish enhancement/recovery projects; as well as, research and monitoring activities. Puyallup Tribal Fisheries produces this report annually to convey fisheries information and data associated with tribal research, monitoring and enhancement projects. The updated written material and data published in this report is intended to supersede and replaces all previous annual reports. Data represented may be revised as new or additional information becomes available. The adult salmonid (sal·mo·nid) escapement information and data presented within this report largely focuses on tributary and mainstem river reaches identified as supporting the majority of adult spawners. This report is organized alphabetically by stream, project or facility name. If applicable, each includes river miles surveyed, the WRIA designation number, as well as a brief description. Spawning ground escapement data is graphically represented by species and illustrates the seasonal total(s) of live fish, dead fish, and redds observed; as well as Chinook carcass sampling results. In addition, annual species comparisons are presented when three or more years of survey data is available; however, all raw survey data for each stream and river surveyed can be found in Appendix B. Also incorporated into this report is information and data collected from several other Puyallup Tribal Fisheries (PTF) projects including fish monitoring and sampling at the U.S. Army Corps of Engineers (USACE) Fish Passage Facility *(FPF)* on the White River *(Buckley Trap)*; fish monitoring/sampling at Electron Hydro's fish collection facility *(Puyallup River)*; the Puyallup Tribal Fisheries juvenile salmonid production assessment projects (*smolt traps*) on the Puyallup and White rivers; as well as, the Puyallup Tribe's operations of two salmon hatcheries located on Clarks and Diru creeks *(lower Puyallup River)*. Additional data in this report was provided by Mt. Rainier National Park (MORA), Department of Fish and Wildlife (WDFW), the U.S. Army Corps of Engineers (USACE), and Electron Hydro LLC.

Puyallup/White River Watershed Description

The availability and nature of fish and stream habitats are frequently altered. The habitat descriptions in this report provide a general analysis of habitat conditions and fish utilization; however, descriptions are not intended to fulfill the requirements of a rigorous biological assessment/evaluation.

The Puyallup/White River Watershed is identified as Watershed Resource Inventory Area 10 (WRIA 10) by the Washington State Department of Ecology *(right image)*. Hylebos and Wapato creeks are part of WRIA 10, yet are independent drainages that flow directly into Commencement Bay. The Puyallup/White River Watershed provides over 1,300 linear river

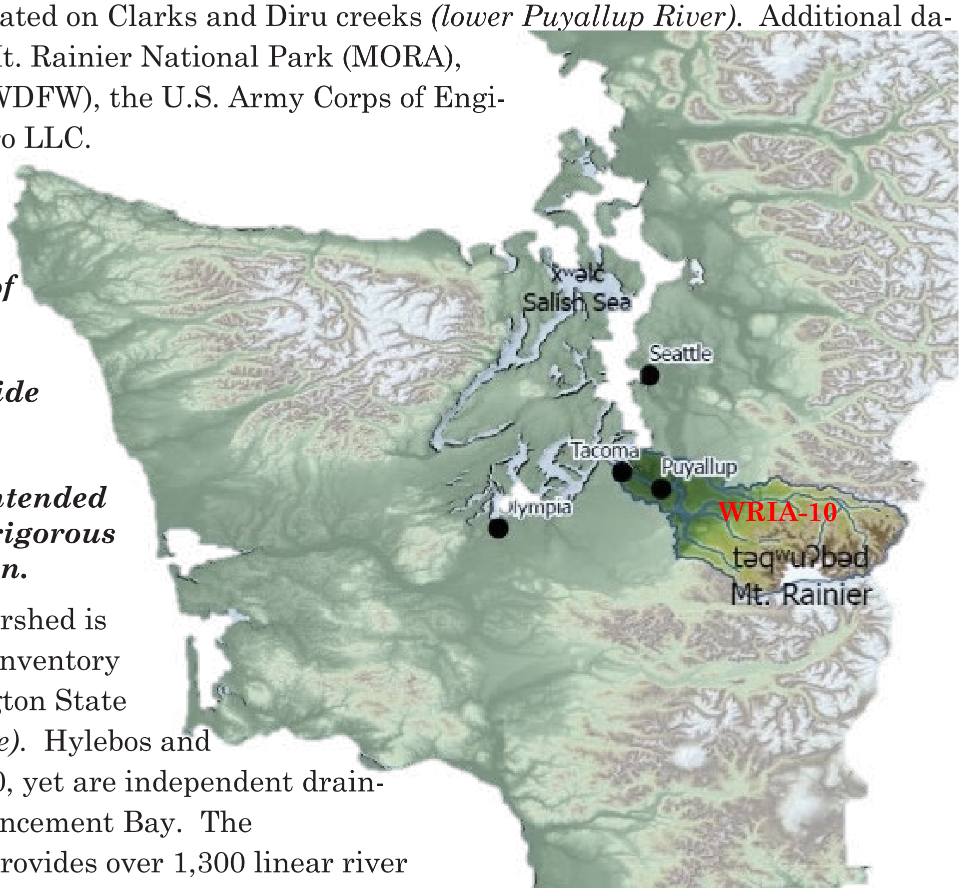


Image created by Angela Dillon (PTF)

miles (RM) of drainage over an area greater than 1,000 square miles. The Puyallup, White and Carbon river basins fall almost entirely within Pierce County; though, part of the White River drainage falls within South King County. All three river systems originate from north and west slope glaciers situated on Mt. Rainier. The Carbon and White rivers converge with the Puyallup River at approximately RM 17.8 and RM 10.4 respectively.

The White River is a significant tributary to the Puyallup River, with a drainage area larger than the Puyallup itself. However, the White and Puyallup drainages are often viewed and managed as two distinct entities. This management approach is due in part because prior to 1906, the White River did not flow directly into the Puyallup. Prior to 1906, the majority of the White River flowed north, where it eventually joined with the Green River. Despite this northern course, some of the water from the White often flowed south into the Puyallup through the Stuck River channel. In November of 1906, a flood event mobilized a tremendous amount of woody debris that blocked the north flowing channel in what is now downtown Auburn. The blockage forced the river to avulse and find a new channel. This newly created diversion sent nearly the entire White River flow down through the Stuck River channel into the Puyallup; more than doubling the size of the Puyallup River drainage. In 1915, a concrete diversion structure was constructed; thus, permanently diverting the White River into the Puyallup. The Puyallup River continues flowing 10.4 miles west from its confluence with the White River until it reaches Commencement Bay in the city of Tacoma. An extensive system of levees, approximately 90 miles, was constructed along the Puyallup, White, and Carbon rivers from the early-to-mid 20th century. Several significant fish bearing tributaries feed these mainstem rivers including; the West Fork White River, Clearwater River, Greenwater River, Mowich River, Huckleberry Creek, Boise Creek, and South Prairie Creek.

The West Fork White River enters the White River at RM 49.2 on the left bank, is glacially driven, and characterized by generally unconfined, anastomosing channel networks. Abundant spawning gravels are present in pool tail-outs, as well as the channel margins and low velocity areas along the lower river. Woody debris is abundant although much of it has been deposited too high to interact with the regular seasonal flows. To a great extent, the overstory riparian zone is either second growth conifer or hardwoods; except for the zone through Mt. National Park with consist of mostly old growth.

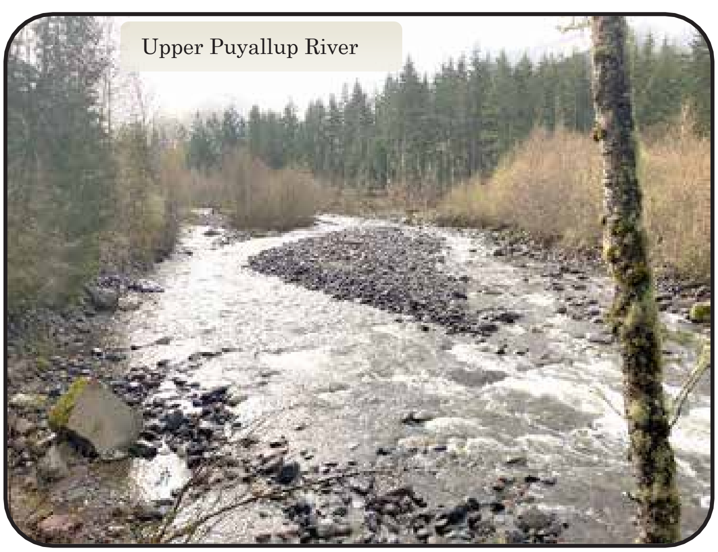
There are approximately 5 river miles between Mud Mountain Dam *(earthen flood control dam)* and the U.S. Army Corps of Engineers' *(USACE)* Fish Passage Facility *(FPF)* located downstream. The USACE operates both Mud Mountain Dam (MMD) and the FPF located at RM 24.3 on the White River in the city of Buckley. Pacific salmon *(Onchorynchus spp.)*, bull trout *(Salvelinus confluentus)*, and other native fishes *(mountain whitefish -Prosopium williamsoni) and cutthroat (O. clarki)* migrating to the upper White River enter this trap and are transported and released approximately 2 miles upstream of MMD. The Corps' trapping facility is uniquely integrated into a diversion dam and flume intake that was, up until January 2004, used to divert water from the White River to generate power *(The new Fish Passage Facility began full operations in mid- 2021).* Since PSE ceased power production; some measure of water has continued to be diverted from the White River by current project owner/operator Cascade Water Alliance (CWA). CWA is a water purveyor who continues to divert water to maintain the water levels and water quality in Lake Tapps *(screened for fish exclusion since May, 1996).*

The Puyallup, White, Carbon, and Mowich rivers originate from glaciers located on Mt. Rainier. Each of these river systems convey tremendous quantities of fluvial materials which extensively contributes to their dynamic configuration. The high sediment loads are responsible for the anastomosing *(braided channel morphology)* characteristic of broad unconfined upper valley segments which are quite prevalent throughout the upper reaches. Channel gradients in the upper basins are typically moderate, with a high riffle-low pool character. River and stream bedding consists mainly of Tertiary sedimentary rock and other products created by ancient volcanic activity. Substrate size within active river channels is typically large; consisting primarily of large gravels, cobble and boulders. Significant quantities of LWD are present within channel migration zones; however, a considerable amount of the larger wood settles on the higher bars and is detached from, or perched well above active channels during average flow regimes, thereby reducing any habitat creating interactions. Headwater tributaries are typically non-glacial and are characterized by confined, steep valley channels, with comparatively short anadromous reaches of low-to-moderate gradients.

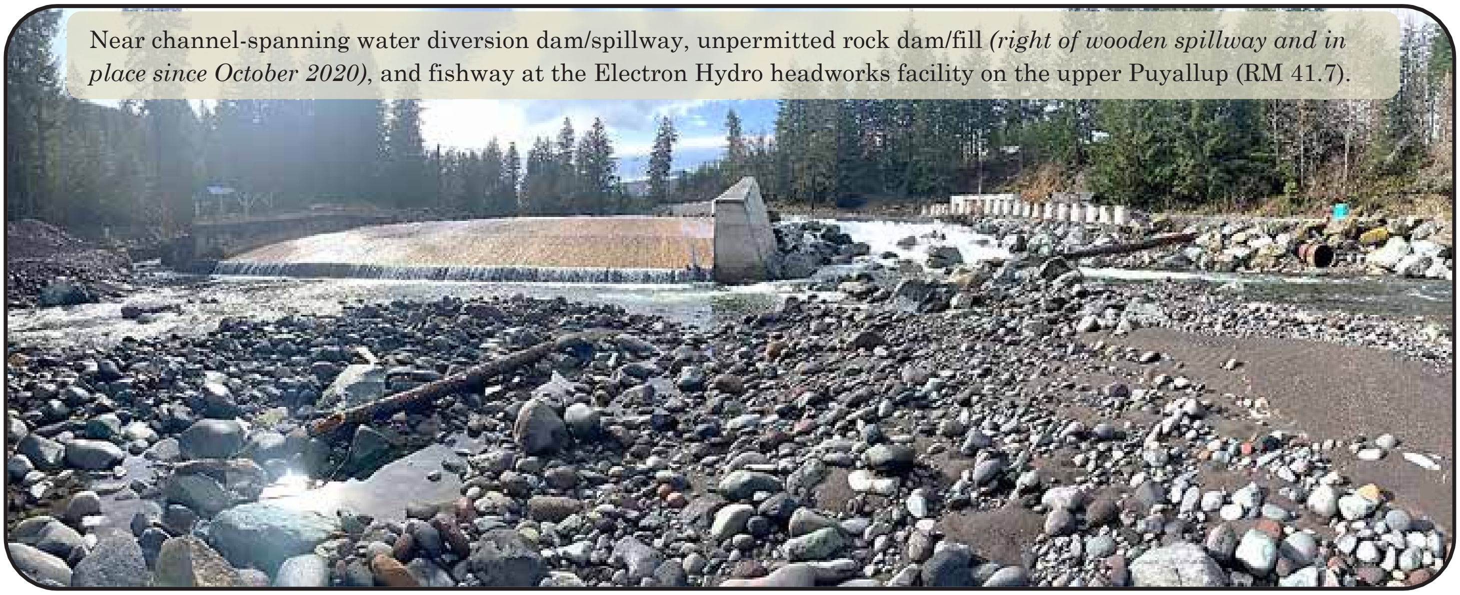

Upper Puyallup River

The Puyallup River has been severely impacted by over a century of land and water resource exploitation, including damming and substantial water diversions; considerable riparian alterations; dewatering and low instream flow regimes; as well as, significant channel manipulation. These impacts have resulted in discernible deterioration in the land and hydrological behavior of this river system by causing water flow of poorer quality, quantity and timing. Several limiting factors have been recognized and accepted with regards to the healthy function of stream habitat and salmonid populations in the watershed. Limiting factors include lost or diminished habitat connectivity and migration corridors; fragmentation and reduction of habitat quality; diminished water quality; fish entrainment; entrapment; unknown species interactions and climate change impacts.

The river channel downstream of the National Park boundary courses through private and National Forest land. Most land bordering the river is primarily held by private timber and hydro power company ownership's. As a result, a prolific transportation network of roads extends throughout the basin. The transportation network within the Upper Puyallup Basin consists almost entirely of unimproved roads developed and utilized primarily for timber harvesting; as well as, hunting, recreational activities, hydropower operations, and wildlife/fisheries applications. Road density in timber production areas may approach as much as six lineal miles per square mile. Current road networks and bridge emplacements along the Puyallup and Mowich rivers directly interact or alter the hydrology within the upper basin. Roads have contributed many of their trademark problems such as landslides, slope failures, altered hydrology; as well as, culvert and bridge projects which can effect upstream migration and increase levels of sedimentation within effected drainages; however, improvements to bridge approaches and culverts have been made. Although timber management has contributed a great deal of habitat degradation, the greatest negative impact on fish has been the Electron hydropower project *(see Electron Hydro section in this report).*


Upper Puyallup River

Near channel-spanning water diversion dam/spillway, unpermitted rock dam/fill *(right of wooden spillway and in place since October 2020)*, and fishway at the Electron Hydro headworks facility on the upper Puyallup (RM 41.7).



Due to the presence of the Electron Diversion Dam, approximately 26+ miles of stream habitat located in the Upper Puyallup Basin *(upstream of RM 41.7)* was void of upstream migratory anadromous salmonids from1904-to-2000. Upstream connectivity was reestablished in the fall of 2000 with the completion of a 215' fishway/ladder *(cost: $1.1 million)*. The Electron hydropower project is the only human-made structure that continues to severely impact survival; as well as, upstream and downstream migration of salmon, steelhead and bull trout. Currently, the Electron project involves a near channel spanning water diversion dam/spillway *(top image)*, and a unpermitted rock dam/fill *(in place since October 2020-pg. 11)*; a 10.1 mile of flume/flow line; a settling basin for sediment removal *(also called Lizard Lake)*; a forebay for water storage *(approximately 124 acre-ft)*; fish collocation facility *(fish trap)*; a power generation station *(power house)*, and transmission equipment. In 1997, the Puyallup Tribe entered into a Resource Enhancement Agreement *(REA)* with Puget Sound Energy (Puget Sound Energy and Puyallup Tribe of Indians 1997). The REA initiated fisheries restoration efforts within the project affected area and is scheduled to expire at the end of 2026.

The REA includes provisions for the maintenance of Minimum Instream Flows (MIF) within the project bypass reach *(a 10.5-mile section of the river, from the diversion to the power house, formerly subjected to extreme/total water withdrawal)*. Under the REA, Electron Hydro will provide 60-cfs year-round in the bypass reach. This increases to 80-cfs during the four-month period from July 15-to-November 15. The MIF was not based on any scientific determination. Depending on timing, manipulations in flow regimes through the bypass reach can have deleterious effects on fish by altering habitat availability and connectivity, dewatering of redds, and water temperature. Completion of the 215-foot roughened channel with chevron weirs fish ladder was the centerpiece of the REA. Viable fish habitat must be accessible to realize full production potential. The fishway is designed to operate with at least 40-cfs and incorporates a modified weir and rock design. Electron Hydro had effectively maintained fish passage through the ladder since purchasing the project in 2014; however, upstream fish passage has been seriously obstructed since July 2020 due to major construction and modification to the diversion dam structure.

The inability of anadromous fish to access habitat above the Electron Dam prior to 2000 has in all likelihood biased the scrutiny and regulatory oversight of past land use, forest practice and road construction/maintenance actions. Manulife Investment Management Timberland and Agricultural, Inc. (Formally Hancock) is the primary private landowner/land manager in this WAU but the federal government has considerable holdings as well. The bulk of the Forest Service ownership is contiguous with the Mount Rainier National Park and located on the east headwaters. Several index tributaries, in addition to numerous unnamed wall base tributaries converge with the Puyallup and Mowich rivers, providing prime salmonid spawning, rearing, and foraging habitat.

The long-standing presence of private industry, primarily hydropower and commercial timber harvesting; in addition to, the repercussions of recreational usage and negative air and water quality have all created lasting impacts on the upper watershed. These impacts include; loss of in-stream large woody debris and LWD recruitment; stream bank modifications; increased sedimentation issues and slope failures due to deforestation; unsatisfactory RMZ management; new road construction; road failures, and road decommissioning or abandonment. A great deal of the forestland throughout the Upper Puyallup Basin has been harvested multiple times, leading to many of the wide-ranging issues common with deforestation and land degradation. Air and water quality issues vary from measurable levels of airborne contaminants which have been detected in Mt. Rainier National Park; including heavy metals and pesticides discovered in samples of snow, soil and fish (Landers et al. 2008).

Electron Hydro's project *(non-FERC licensed)* directly diverts up to 400 cfs. of water *(not screened to prevent fish entrainment)* from the Puyallup River at RM 41.7. This operation contributes, in whole or in part, too many of the impact issues previously stated. For 96 years the diversion dam completely severed upstream access for anadromous salmonids, and isolated the population(s) of bull trout and other salmonids established throughout the 26+ miles of habitat upstream of the structure; thereby, stemming the genetic flow from bull trout *(populations)* located elsewhere in the basin or watershed for multiple generations. Prior to 1998, no methods were established or employed to remove fish entrained in the project, and as a consequence, fish losses were colossal. In 1998, PSE began operating a fish trap to help address the fish losses associated with the project; the effect on fish survival was negligible. Since purchasing the project in 2014, Electron Hydro has made frequent assurances towards addressing the continuous fish losses associated with the project. However, as of the printing of this report, no improvements to fish protection measures have been made and the project is considered one of the most significant threats to fish survival and recovery in the watershed.

Turf and Crumb Rubber Discharged into the Puyallup River and Unpermitted Rock Dam

From August 10, 2020, tribal fisheries biologists have been extensively involved in the search, recovery, and documentation of the unpermitted, and permitted construction/fill materials utilized by Electron Hydro, and impermissibly discharged into the river and downstream, during its late July 2020 construction of a flow bypass channel located at the fish ladder/headworks ("project") site *(see web map link on this page)*. Subsequently, as reported by Electron Hydro, approximately 617-square yards of the materials utilized to construct a three-layered river bed "liner" were discharged downstream from the project site when the HDPE and geotechnical fabric; as well as, the turf placed under the HDPE and fabric tore away in the river flow. Discharged materials included, but were not limited to, artificial grass turf *(generally comprised of a polyethylene plastic)*, crumb rubber *(derived from vehicle tires)*, High Density Polyethylene plastic sheeting *(HDPE)*, and geotechnical fabric *(made from either polypropylene or polyester plastic)*. On August 31, 2023, a federal judge found both Electron Hydro and its COO, Thom Fischer, legally responsible under the Clean Water Act for illegally discharging artificial turf, crumb rubber and HDPE materials into the river *(See Appendix I)*.

> Web Map Application
>
> Locations of Impermissibly Discharged Materials into the Puyallup River as a Result of Electron Hydro's Operations (URL):
>
> https://puyalluptribe.maps.arcgis.com/apps/instant/attachmentviewer/index.html?appid=ae9d997f28864feebdefe25a8adf0262

Over the three months following Electron Hydro's discharge of materials into the river *(July 2020)*, it was clearly evident they were not meeting their obligation of thoroughly cleaning-up discharged materials from the river. On November 12, 2020, tribal fisheries initiated what would be a broad and concerted effort to find, remove, and document Electron Hydro's discharged materials. Although it was not the responsibility of the Puyallup Tribe to clean up damages caused by Electron, the tribe was compelled to do what was necessary for the river environment and fish populations. After only a brief recovery effort, Electron had repeatedly claimed it had cleaned-up construction materials that were placed, discharged, and released downstream in the River. Based on tribal biologists observations, since August of 2020, significant amounts of material remained throughout the river, on its banks, hung up in vegetation, and even buried in the substrate at and near the project site.

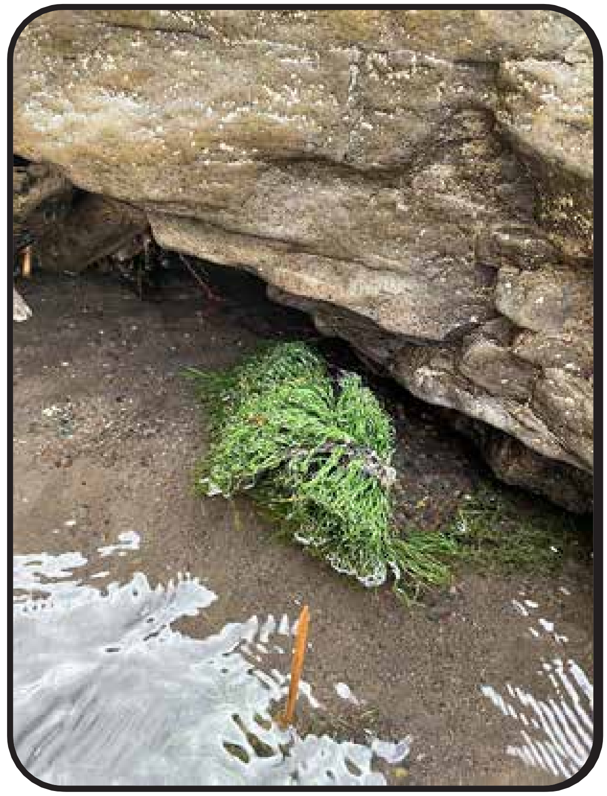
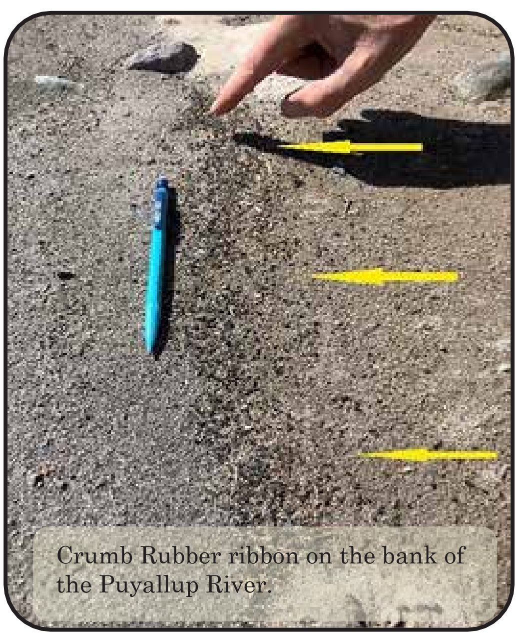


Image of a turf mat observed on October 31, 2023, embedded in the river substrate just below the diversion dam. Turf is still present in the river 3-years after Electron ceased cleaned-up operations.

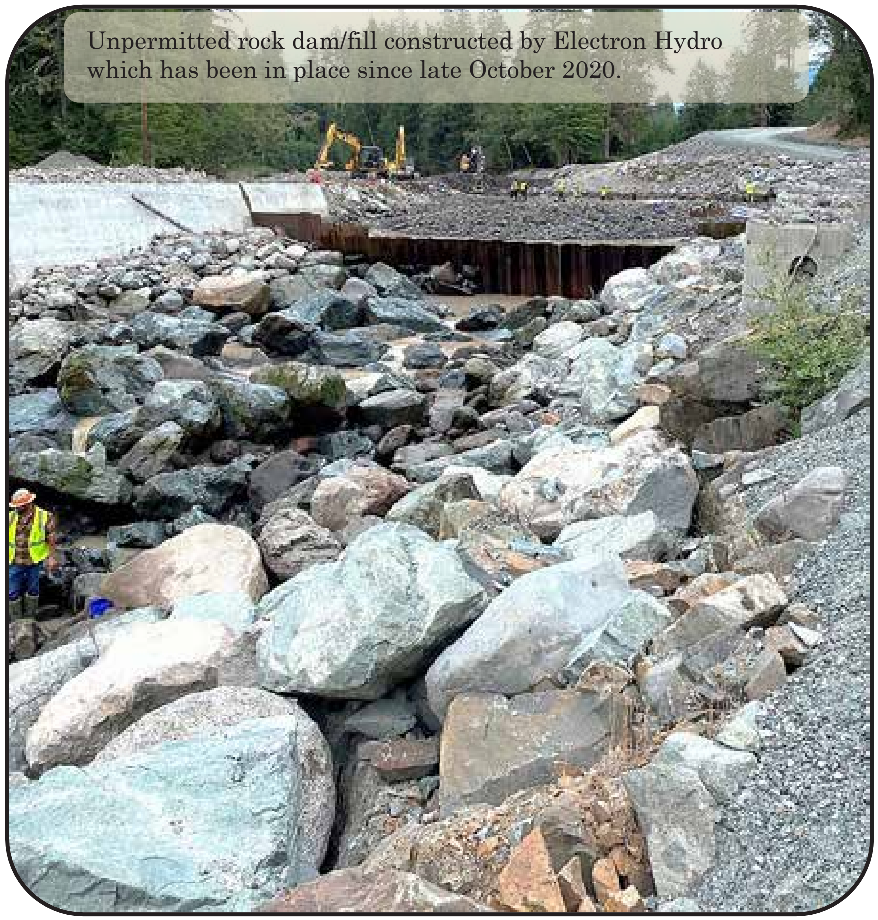
Over the next roughly 14 months *(November 12, 2020 through February 4, 2022)*, fisheries biologists discovered substantial quantities of turf fibers, intact turf pieces and turf mats, HDPE plastic liner, crumb rubber, and geotechnical fabric. The Tribe's recovery of liner materials has been documented via over 2,200 images and videos. Over the course of recovery, these liner materials were found dispersed throughout the river, from the project site *(RM 41.7)*, down into the Puyallup Tribe's reservation reach on the lower Puyallup *(approximately RM 2.9)*. All material types were found hung-up/caught on rocks, vegetation, woody debris, log jams, root wads, or buried to some extent in the river channel substrate. The Puyallup Tribe later discovered in February 2022, that significant quantities of construction *(liner)* materials, including turf and crumb rubber, were not removed during Electron Hydro's post-construction removal process, but were purposely left buried in the substrate at the project site. The buried liner materials were observed only after 18 months of scouring river flows began to expose them. Additioanl materials have been recovered well into 2023.



Crumb Rubber ribbon on the bank of the Puyallup River.

Removing intact turf pieces and larger turf mats was crucial due to the sheer number of fibers that would be dispersed throughout the river as the turf backing, the material that holds the fibers in place, degraded. Intact turf has approximately 72 fibers per square inch, with each fiber generally being between 4.5-to-6 inches in length. This equates to over 10,300 fibers per square foot of turf material. The turf and HDPE materials recovered have shown themselves to be extremely resilient, even after 18 months in the river. However, eventually these material will break down into smaller fragments *(nanoplastics & microplastic)*. Plastics discharged into the aquatic environment threaten fish and other aquatic organisms due to the fact these materials do not biodegrade, but only break down into smaller pieces fish and other organisms can ingest. Plastics in the aquatic environment absorb or collect bacteria and toxic pollutants like DDT, PCB's and metals. Scientific investigations have found that fish are ingesting these toxins when they ingest plastic, resulting in the bioaccumulation of the chemicals up the food chain.

In addition to the turf, plastic fibers, crumb rubber, HDPE liner and construction materials left in the river, Electron also constructed a rock dam, with an anchored sheet pile wall, as part of its final work to remove the turf in the fall of 2020. The Tribe was told that the rock dam would be removed within a year. However, no further complete permit applications were submitted by Electron to remove the rock dam, and it remains in place today. With each high flow event, however, the dam is moved, along with sediments placed within its voids, and that unpermitted fill is moved downstream. Tribal fisheries biologist made several site visits during the winter and spring of 2021-2022, and found the rock dam had transformed, as the Tribe predicted and similar, if not worse than the previous year, due to the seasonal flows. It was unfortunate that changes lead to the potential for fish passage to be even *worse* than 2021.


Unpermitted rock dam/fill constructed by Electron Hydro which has been in place since late October 2020.

The area of large rock that was added downstream of the sheet pile dam has been stripped of all fine gravel, cobble and small rubble as predicted *(right image)*. What remained is highly angular boulders, with large voids that create an abrupt obstruction and provide little or no pool features that would allow for fish to stage a jump or to otherwise make successful passage upstream. Even if a fish could clear the required 6' vertical clearance at the steel sheet pile of the rock dam, while not impossible, is far from ideal much less desirable for a facility whose fish passage systems have been repeatedly called into question.

The fact that so much flow goes over the sheetpile dam contributes to the attraction of upstream migrating fish. This very effectively leads to their exhaustion, injury and in all likelihood reduces their chances at reproducing successfully. These feature are antagonistic to the collective efforts of many toward stock recovery and naturally reproducing populations of fish in the upper-Puyallup River. The rock dam itself is a barrier to fish passage, the increased height of the steel structure, which was not installed as permitted to begin with, now completely blocks fish passage. Furthermore, the rock dam continues to be a false attraction and dead end for fish searching for upstream passage around the project.

In addition to the continued problem associated with the rock dam, the flow over the wood crib structure had created a high velocity and turbulent condition which is naturally more attractant to fish and was highly likely encumbering fish from finding the fishway entrance. This makes it *very* unlikely fish could find the fish ladder even on the right bank *(see Electron Hydro LLC section in this report for additional detailed information*).

Watershed Salmonids

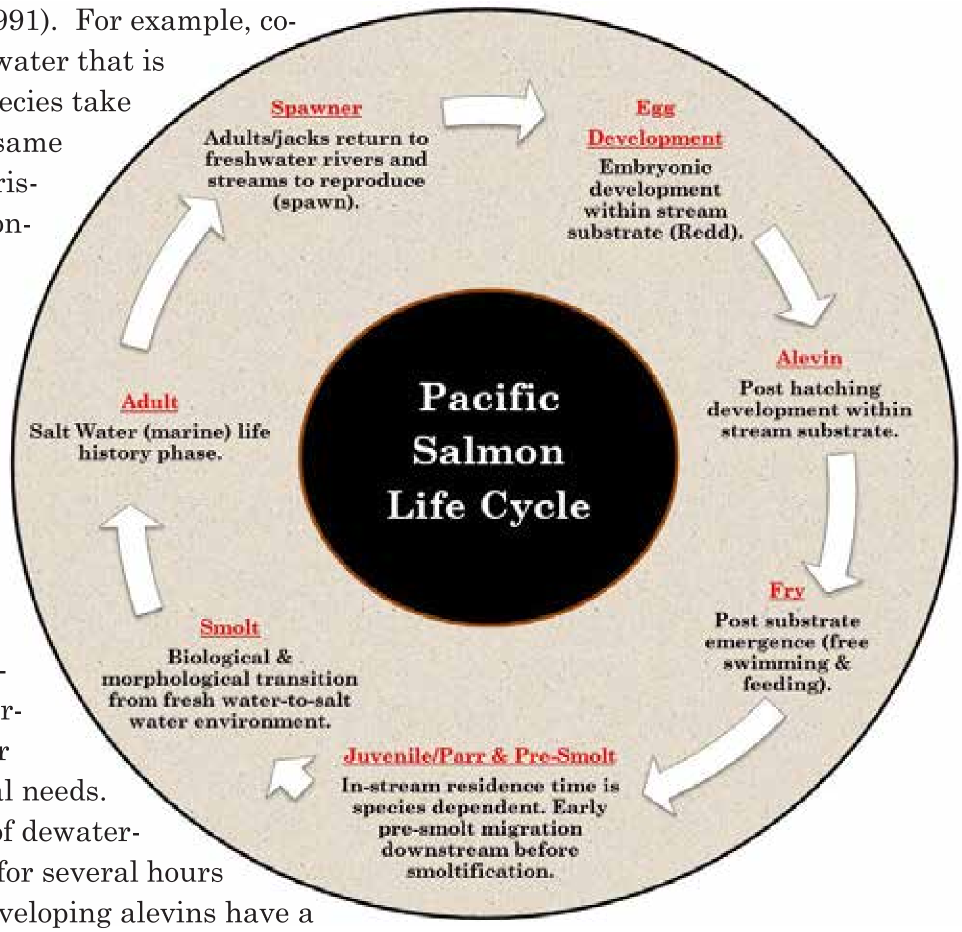
The Puyallup/White River Watershed supports several species of native salmonids, including Chinook *(Oncorhychus tshawytscha)*, coho *(O. kisutch)*, chum *(O. keta)*, pink *(O. gorbuscha)*, sockeye *(O. nerka)*, steelhead/rainbow *(O. mykiss)*, cutthroat *(O. clarki)*, bull trout *(Salvelinus confluentus)*, mountain whitefish (*Prosopium williamsoni*); as well as non-native brook trout *(S. fontinalis)* and brown trout (*Salmo trutta).* Both listed in 1999, Puget Sound Chinook and Coastal-Puget Sound bull trout are currently listed as threatened under the U.S. Federal Endangered Species Act enacted into law in December of 1973 (ESA Law: https://www.gpo.gov/fdsys/pkg/STATUTE-87/pdf/STATUTE-87-Pg884.pdf). In May of 2007, the National Marine Fisheries Service (NMFS) announced the listing of Puget Sound Steelhead as threatened under ESA. The ESA listing of steelhead offers protection for naturally spawned steelhead; however, it does not offer protection for rainbow trout, the fresh water resident form of the species.

Each of the eight Pacific salmonid species present in the Puyallup/White River system exhibits unique life-history strategies. However, the five major Pacific salmon species *(Chinook, coho, chum, pink, and sockeye)* all share some common life-history characteristics. Pacific salmon are all anadromous; meaning, fish spawn and reside in fresh water; however, the instream residence time varies considerably by and within species. Salmon will eventually emigrate to marine waters *(smoltification)* where they will continue to forage and grow until they return to fresh water as mature *(developed gonads)* or immature *(undeveloped gonads)* adults, or jacks *(males)*, to reproduce. Furthermore, these species will only reproduce once *(semelparous)* during their life cycle. This single reproductive event requires tremendous amounts of energy and effort; as well as, proper spawning site selection to be successful. Therefore, the end result of this reproductive strategy is that all five major species of Pacific salmon will die as a result of this reproductive process. Nevertheless, this sole reproductive strategy is very successful due to the considerable degree of energy put into producing vast amounts of gametes *(eggs and sperm)*, thus ensuring the survival of at least some offspring. Other salmonid species; such as steelhead, cutthroat, and bull trout, may reproduce more than once *(iteroparous)* throughout their respective life phases.

All female salmonids are oviparous *(*/ōˈvipərəs/: *producing eggs that hatch outside the body)*, and during the act of spawning the male and female will release gametes in a simultaneous effort. Eggs released by the female drift to the bottom and are actively buried in the substrate creating an egg pocket. A redd is the excavated site formed in the substrate from multiple spawning events and typically contains several egg pockets. The rate of development and growth varies between species and is greatly influenced by water temperature (Piper et al. 1986; Groot and Margolis 1991). As fish age, they lay down annual growth rings on their scales, these scales are often collected to determine age; as well as important growth, environmental, and life history factors.

Early Salmonid Development

During the act of spawning, males and females release gametes *(eggs and sperm)* in a synchronized effort. The fertilization of eggs occurs rather quickly. The membrane surrounding each egg is gas permeable and is initially quite malleable. Penetration of a single spermatozoon into the egg *(through the micropyle)* will create a reactionary process preventing the infiltration of additional spermatozoa. However, once eggs exit the female and are exposed to water, each egg will begin to take up water causing the internal pressure of the egg to increase and swell (Alderdice et al. 1984). This process causes the outer membrane of the egg to firm up or "water harden"; whereby, closing the micropyle and preventing fertilization in as few as 30 seconds (Groot and Margolis 1991). Once an egg is fertilized it goes through three phases of development prior to hatching *(cleavage, epiboly, and organogenesis)*. Some of the water properties influencing salmonid egg survival and development are temperature, dissolved oxygen, and velocity (McNeil 1966; Leman 1993; Peterson and Quinn 1996). The rate of development and growth varies between species, and is significantly influenced by water temperature (Piper et al. 1986; Beacham and Murray 1990; Groot and Margolis 1991). For example, coho salmon take 50 days to hatch in water that is 10°C *(50°F)*; other Pacific salmon species take between 47-65 days to hatch at the same temperature. Stream bed characteristics and water properties are additional factors that are imperative to the survival and development of salmonid eggs and larvae.



Upon hatching, young salmonid larvae *(alevins* [ˈaləvən]*)* are not fully developed and are unable to feed; therefore, they remain within the interstitial spaces of the gravel substrate while continuing to grow and further develop. Young alevins do, however, possess a considerable yolk sack necessary to fuel their prolonged growth and developmental needs. Alevins are also relatively tolerant of dewatering and low dissolved oxygen levels for several hours after hatching. Although buried, developing alevins have a sense of up and down *(geotaxis)*, and if the substrate size allows, they will often migrate vertically and horizontally throughout the substrate depending on light stimulus *(Phototaxis)* and the level of dissolved oxygen available in the water (Heard 1964; Carey and Noakes 1981; Groot and Margolis 1991; Quinn 2005). Alevins will migrate toward the surface of the substrate when their yolk sacks are absorbed *(buttoned-up)*. Emergence of the newly, or nearly, buttoned-up fry generally occurs during late winter and early spring; however, this emergence point is ultimately dependent on the species, ambient environmental conditions and the spawn timing of the parents.


Chinook alevins

The duration of time newly emerged fry spend instream varies by species and within species *(see species descriptions for more information)*. Depending on the species, salmon fry will emigrate to marine waters within days or weeks upon emergence, or may remain in fresh water for an extensive period of time to rear *(several months or years)*. Both adaptive strategies have advantages and disadvantages in regards to growth and survival. Fish that emigrate early to more productive, and possibly warmer marine waters, will grow faster; yet, they face a higher rate of mortality due to their smaller size, as well as the substantial increase in predation. Fish that rear in fresh water will grow slower *(less available food, colder water)*, but face a lower predation risk and will be larger *(lower mortality risk)* when they emigrate to the marine environment.

Anadromous salmon and steelhead will inevitably emigrate to marine waters *(smolts)*. For young migrating salmon and steelhead this process of "smoltification" is complex. Smolts will undergo behavioral; as well as tremendous internal and/or external physiological changes including body metamorphosis, coloration and metabolic transformations. In addition, smolts must undergo the osmoregulation adaptations necessary to make the transition from a fresh water environment to a marine environment. The physiological process of osmoregulation involves the forceful governing of the osmotic pressure of bodily fluids in order to maintain internal stability, or homeostasis, of the body's water content. In the case of fish, it essentially prevents a fish's bodily fluid from becoming too dilute or too concentrated with salt. Fish in freshwater actively expel excess water to conserve salt; whereas fish in marine waters actively excrete salt to maintain homeostasis. This process of osmoregulation is critical when making the transition from fresh water to salt water, or when undertaking the reverse process. Fish, such as salmonids, with this ability to tolerate and adapt to such a wide range of salinity are known as euryhaline species. Fish that make the transition to the marine environment successfully may spend several months, or years, foraging and growing in the more productive marine waters before returning to freshwater to spawn.

Spawning Site Selection

Spawning site selection for salmonids is critical to insure offspring survival. Stream bed characteristics and water properties are important factors in the survival and development of salmonids eggs and larvae. Some of the water properties influencing salmonid egg survival and development are temperature, dissolved oxygen, and velocity (McNeil 1966; Leman 1993; Peterson and Quinn 1996). Substrate size and density are primary factors involved in the permeability of bottom materials (Wicket 1958; McNeil and Ahnell 1964; McNeil 1966). Temperature dictates the rate of development and metabolic level of salmonids from earliest development through adulthood. Adequate levels of dissolved oxygen must be present in the water to support energetic demands of growing embryos and fry. Dissolved oxygen levels vary with stream topography (Peterson and Quinn 1996), as well as temperature and depth (Leman 1993). Survival depends on oxygenated water reaching the buried eggs and larvae within a redd site. Sources of intergravel water include ground water and surface water (McNeil 1966).

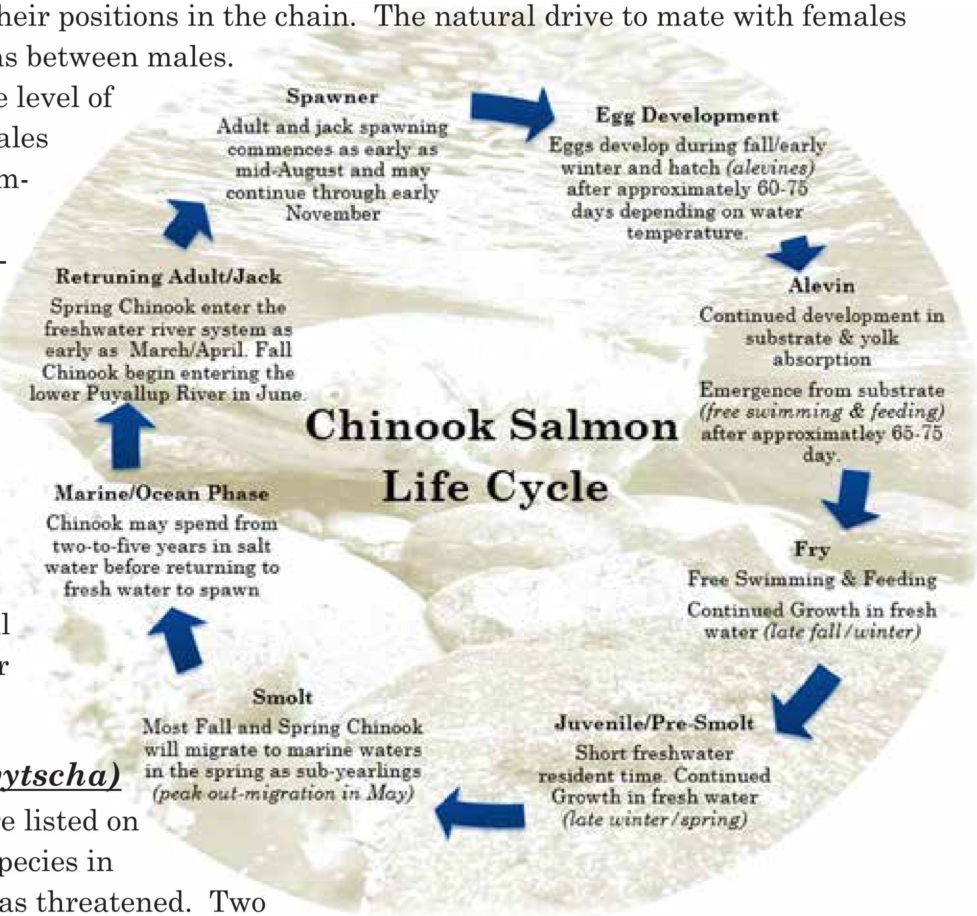
Having established the fact that oxygenated water is important for survival and development; velocity of delivery is also important (Leman 1993). Salmon may be able to detect variation in water velocity more readily than substrate quality (Witzel and MacCrimmon 1983). The variations in velocity are often influenced by different substrate types; salmonids may choose, indirectly, suitable substrate size for redd sites based on water velocity (Shirvell and Dungey 1983). The rate of oxygen utilization varies with development (McNril 1966; Peterson and Quinn 1996). As metabolic demands of developing salmon utilize the available oxygen; more must be supplied. The velocity *(rate)* at which oxygenated water can be delivered is largely governed by the general size and density of substrate materials. McNeil (1966) states: "The permeability of bottom materials is a function of particle compaction, arrangement, and size." According to McNeil and Ahnell (1964) the velocity of intergravel water is related to the size of the bottom materials. Smaller materials (fines) decrease the velocity of water through redds. Wicket (1958) showed that the survival of pink and chum salmon eggs and larvae increased with the increased permeability of the stream bed.

Spawning Behavior

Aggression is an integral aspect of spawning behavior in Pacific salmon *(Oncorhychus)* species (Chebanov et al. 1983; Keenley and Dupuis 1988; Quinn et al. 1996). Several factors influence the frequency and focus of male aggression, including the operational sex ratio *(OSR)* (Quinn et al. 1996), size of the male (Chebanov et al. 1983; Foote 1989; Keenleyside and Dupuis 1991), density of spawners (Chebanov 1991, 1994) and an individual's status (Schroder 1973; Chebanov et al. 1983). The OSR represents the number of ripe *(ready to reproduce)* male to the number of ripe females. Variations in the OSR affect the frequency of aggression in males; changes lead to an increase *(low OSR)* or decrease *(high OSR)* in aggressive behavior (Quinn et al. 1996). Aggression can be displayed in several forms (Mork 1995); including charging, chasing, biting, fighting, as well as, lateral and frontal displays. Mork (1995) reported that lateral movements, charging, chasing, and biting were often the preferred methods of aggression displayed by salmon under study. Aggression is not only focused towards the same species, but other species as well.

A male size affects his position in the hierarchal structure and his success in spawning (Chebanov 1983; Foote 1989). Larger males are more successful at securing females and are therefore more often in the position of dominance. Females prefer to mate with larger males (Foote 1989) and may delay spawning if courted by small males. Holding a dominate position leads to increased encounters with other males who are trying to displace him, or attempting to mate with the female (Chebanov et al. 1983; Chebanov 1994). A change in the density of spawners leads to changes in the frequency of aggression. As the densities of spawning fish increases, so will the number of aggressive actions (Schroder 1973; Parenskiy 1990); this holds true for both males and females. Furthermore, at lower densities, aggressive actions decrease.

An individual's status may also determine the frequency and focus of aggressive actions. Schroder (1973) describes how dominate or "Alpha" males take up positions just behind the females and shift from side to side defending their territory and females. Satellite males line up behind the dominate male. These sub-dominate males defend their positions in the chain. The natural drive to mate with females often leads to aggressive interactions between males.
The success of males depends on the level of aggression directed toward other males (Chebanov et al. 1983). Females compete with other females for nesting sites (Schroder 1973, 1981; Keenleyside and Dupuis 1988). Female's attempt to defend their nests *(redds)* against other female's attempts to overtake them, and guard sites to prevent superimposition *(displacing or covering over)* of their eggs (Schroder 1981; Keenleyside and Dupuis 1988). Females dig their nests and guard them until they die, or are displaced by another female (Schroder 1973).



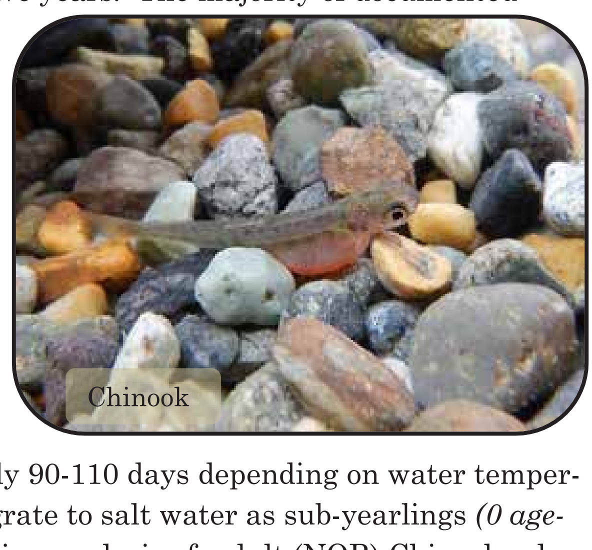
Chinook Salmon *(O. tshawytscha)*

Puget Sound Chinook stocks were listed on the federal register of endangered species in 1999, and are currently designated as threatened. Two distinct stocks of Chinook are present in the Puyallup/White River system. They include the White River

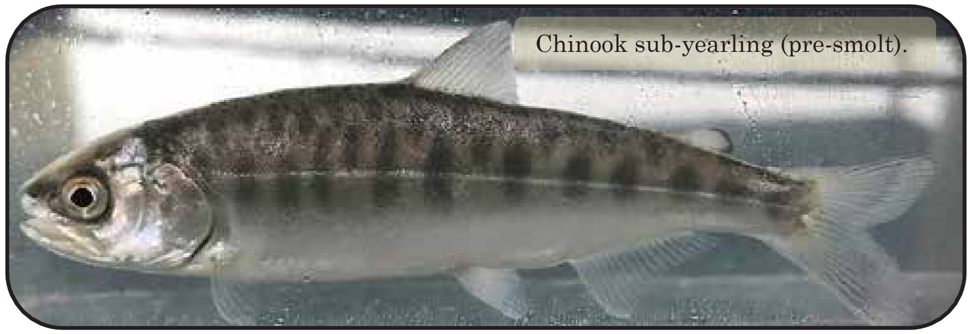
Spring Chinook *(springer or spring-run)* and Puyallup River Fall Chinook *(fall or fall-run)*. White River Spring Chinook are the only Spring Chinook stock existing in the Puget Sound region and are unique due to their genetic and life-history traits (WDFW et al. 1996). This unique stock of Chinook was classified as distinct in the 1992 Washington State Salmon and Steelhead Inventory (WDFW et al. 1993). Microsatellite DNA analysis of Chinook from the White River shows a distinct mixture of spring and fall-run Chinook stocks (Spidle 2010; Shaklee and Young 2003; Ford et al. 2004). Spidle (2010), analyzed 913 tissue samples collected by PTF from NOR Chinook captured in the USACE trap on the White River from 2004-2007. Genetic samples were evaluated to calculate the proportion of Spring and Fall Chinook returning to the upper White River. Results from the multilocus microsatellite genotypes analysis showed a range of 84.6% (2004) to 93.1% (2005) of samples tested were Spring Chinook *(95% confidence interval)*. Spidle also stated, "In addition to mixture modeling, Bayesian lineage clustering was conducted to determine if there was evidence for multiple populations of Spring or Fall Chinook salmon, and also to look more closely at the separation of the spring and fall populations. There was no evidence of multiple populations within either run-time." Ford et al. (2004), reported that approximately 60% of Chinook smolts genetically sampled above the Buckley diversion were spring-run, and 40% were fall-run; whereas, smolts sampled below the dam were approximately 42% springers and 58% fall.


Adult fall Chinook (♀) spawning phase.

Spring Chinook typically enter the freshwater river system as early as April, but have been documented as early as March. Springers hold in the river during spring and summer while their gonads mature. Spawning commences as early as mid-August *(typically September)*; with the earlier spawn timing generally occurring higher in the watershed. Adults largely return as three-to-four-year-olds; however, the age of adult Chinook returning to spawn can range between two-to-five years. The majority of documented spawning occurs in the mid-to-larger tributaries such as the Huckleberry Creek, and the Greenwater and Clearwater rivers. However, mainstem spawning of has been documented throughout the upper mainstem White River by PTF biologists via radio telemetry studies (Ladley et al. 1996), and observations made during annual spawning ground surveys. Spring Chinook spawning also occurs throughout the lower White River *(below RM 24.3)*, and species specification is verified through tags or markings observed during carcass sampling.


Chinook

Egg to fry emergence of young Chinook takes approximately 90-110 days depending on water temperature variations. The majority of juvenile Spring Chinook migrate to salt water as sub-yearlings *(0 age-less than one year old-next page)* (Dunston 1955). DNA and aging analysis of adult (NOR) Chinook collected from the USACE trap in Buckley and integrated into the Muckleshoot's White River Spring Chinook program, showed that 77% of the springers sampled migrated to salt water as sub-yearlings (Johnson unpublished work). Aging data from 2,879 readable scale samples taken by PTF biologists from Chinook captured in the USACE's FPF *(1994-2008)*; revealed 91.73% of Chinook sampled *(springers & falls)* migrated as sub-yearlings.



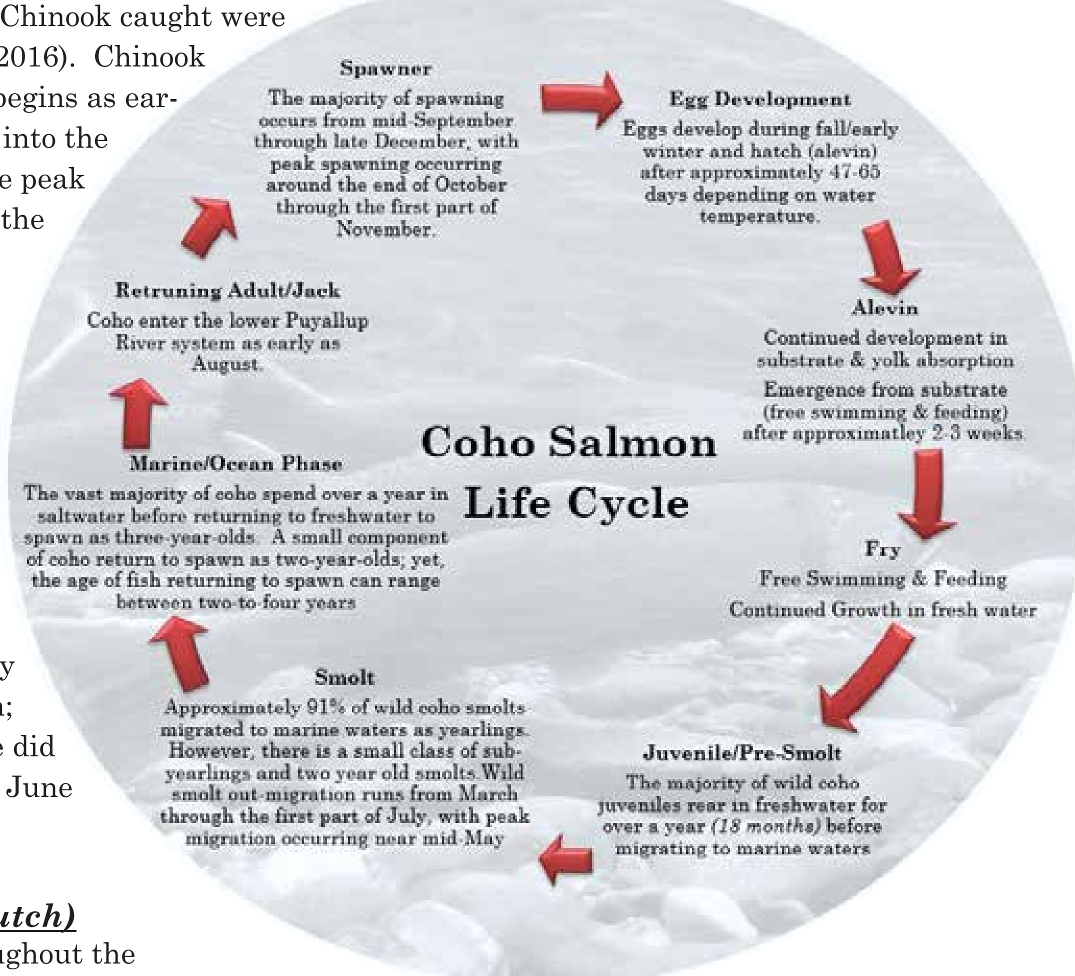
Chinook sub-yearling (pre-smolt).

Escapement data for White River Spring Chinook has been collected from fish captured in the U.S. Army Corps of Engineers' (USACE) FPF on the White River near the city of Buckley since 1941. After 1950, there was a steep decline in the number of Spring Chinook captured in the trap. Spring Chinook escapements dropped under 1,000 fish annually after 1955; continued to decline to as few as 66 fish in 1977, and plunged down to only 6 fish in 1986. This precipitous decline prompted the State of Washington and South Puget Sound Tribes to implement a recovery plan in the mid-70s (WDFW et al. 1996). The recovery plan involved starting a program involving the artificial propagation of wild and captive brood stocks. Currently, there are two Spring Chinook programs in operation; the Muckleshoot Indian Tribe's hatchery on the White River and WDFW's Minter Creek program. The White River Spring Chinook Program at Minter Creek is going to be phased out. These artificial propagation programs in conjunction with the use of acclimation ponds, continues to be an integral part of restoring the run to near historic levels.

Puyallup River Fall Chinook are endemic throughout the Puyallup River, Carbon River, Lower White River; as well as, many of the tributaries associated with these mainstem river systems. A large component of the adult fall spawners are hatchery origin from the WDFW Fall Chinook program operated on Voights Creek. In 2004, the Puyallup Tribe began operation of its own Fall Chinook hatchery *(@RM 1)* on Clarks Creek, a tributary to the lower Puyallup River *(RM 5.8)*. The Puyallup River Fall Chinook Baseline Report (WDFW 2000) states that genetic testing has shown similarities in both hatchery and wild Puyallup River Fall Chinook, with those of Chinook stocks found in several other watersheds within the Puget Sound region. The similarities are likely due to significant numbers of Fall Chinook imported to these watersheds from the Green River hatchery. Although Spring Chinook are known to spawn in the Puyallup River system, the straying rate is significantly less than that of Puyallup River origin Fall Chinook. Additional evidence shows a significant number of Puyallup River Fall Chinook stray into the White River system to spawn. There is no Fall Chinook supplementation program on the White River; however, carcass sampling from 2002 to 2017 on Boise Creek, a significant Chinook spawning tributary to the White *(RM 23.5)*, showed an average of 59% of the Chinook sampled to be of fall hatchery origin due to the presence of a coded-wire-tag and missing adipose fin, or just a missing adipose fin *(see Chinook carcass sampling results in the Boise Creek section of this report and Appendix H for fin marking ID)*.

Puyallup River Fall Chinook typically enter the Lower Puyallup River in June, and continue to move through the system as late as November. The majority of tributary spawning activity occurs from September through late October, with the exception of some lower tributaries which may have fish present into early November. Initial spawning generally commences in the upper watershed; while the lower river and tributaries commonly experience active spawning beyond the time that live fish are even observed in the upper watershed. The age of adult Fall Chinook returning to spawn can range between two-to-five years of age. However, the largest constituent of adult returns are typically comprised of four-year-olds; with a smaller component of the runs returning as three-year-olds.

The majority of post emergent fry spend a moderate period of time residing instream before migrating to marine waters. Trapping data from a rotary screw trap in the lower Puyallup River showed that 99.5% *(n=869)* of wild out-migrant Chinook caught were sub-yearlings (Berger et al. 2016). Chinook emigration in the Puyallup begins as early as January and runs well into the last week of August, with the peak of migration taking place at the end of May. Berger et al. (2015), reported that sub-yearling Chinook sampled varied in length from 32-115mm during the trapping season *(January 30-July 26)*, with significant size increases occurring throughout the season. The average fork length of Chinook measured from January through late July was 61mm; yet, the minimum size range did not exceed 50mm until after June 8th.



Coho Salmon *(O. kisutch)*

Coho are prevalent throughout the Puyallup/White River Watershed, with several of the lower and mid-range drainages experiencing some escapement. Coho are frequently observed spawning as high as Silver Springs on the White River (RM 60.5), and a limited number make their way into the habitat available above Electron Hydro LLC's Electron Diversion Dam on the Puyallup River (RM 41.7). Although the majority of coho in the system are primarily tributary spawners, some mainstem spawning does take place. Key spawning areas for coho include South Prairie Creek, Boise Creek, Clearwater River, Greenwater River, Huckleberry Creek; as well as Fox Creek on the Puyallup. The WDFW hatchery on Voights Creek has artificially propagated coho since 1917, having in the past incorporated fry and smolts from other drainages, including Big Soos Creek, Minter Creek, Garrison Springs, George Adams Creek; as well as the Skagit and Washougal rivers. Voights Creek currently produces approximately 800,000, 100% mass marked *(adipose clip)* yearling pre-smolts annually, of which, 100,000 *(decreased from 200K)* are transferred to acclimation ponds in the upper Puyallup Watershed when available *(see Salmon and Steelhead Hatchery Production; as well as Fish Enhancement and Restoration sections in this report).* Currently, approximately 300K coho reared at WDFW's Puyallup Trout Hatchery fish from Voights Creek are released in April and generally move rapidly down-

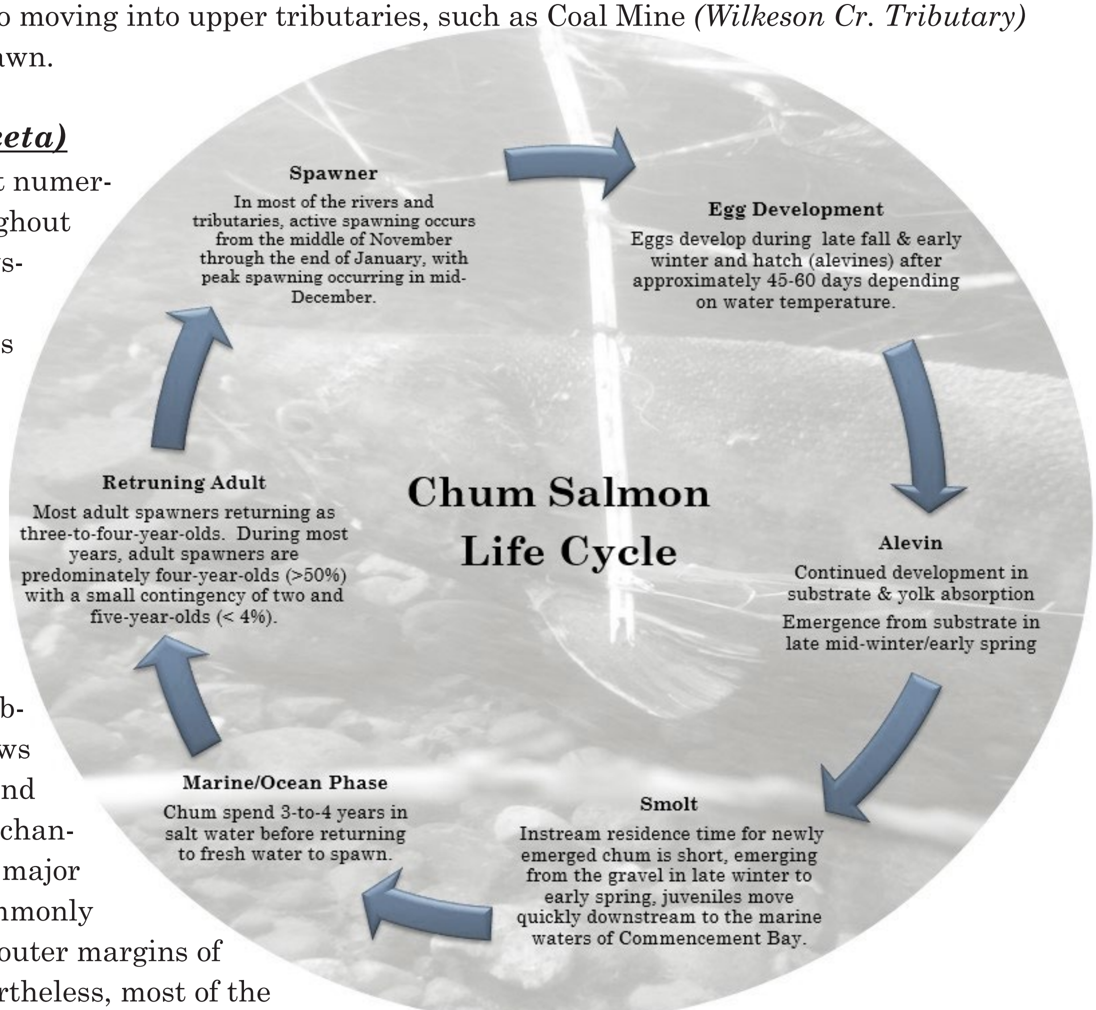

Adult coho (spawning phase).

stream. The majority of wild coho juveniles rear in freshwater for over a year *(18- months)* before migrating to marine waters. Wild smolt out-migration runs from March through the first part of July, with peak migration occurring near mid-May. Smolt trapping data in 2005 on the Puyallup River indicated that approximately 91% of wild coho smolts migrated to marine waters as yearlings (Berger and Williamson 2005). However, there is a small class of sub-yearlings and two year old smolts. The vast majority of coho spend over a year in saltwater before returning to freshwater to spawn as three-year-olds. A small component of coho return to spawn as two-year-olds; yet, the age of fish returning to spawn can range between two-to-four years. Adult coho enter the lower Puyallup River system in early August. Spawning surveys and USACE Buckley trap data show coho continue to move through the watershed as late as February/early March. The majority of spawning occurs from mid-September through late December, with peak spawning occurring around the end of October through the first part of November. The South Prairie Creek drainage has a unique late run of coho that spawn well into February and early March. Hundreds of adult coho are often observed holding in South Prairie Creek in December prior to moving into upper tributaries, such as Coal Mine *(Wilkeson Cr. Tributary)* and Spiketon creeks to spawn.


Juvenile coho

Chum Salmon *(O. keta)*

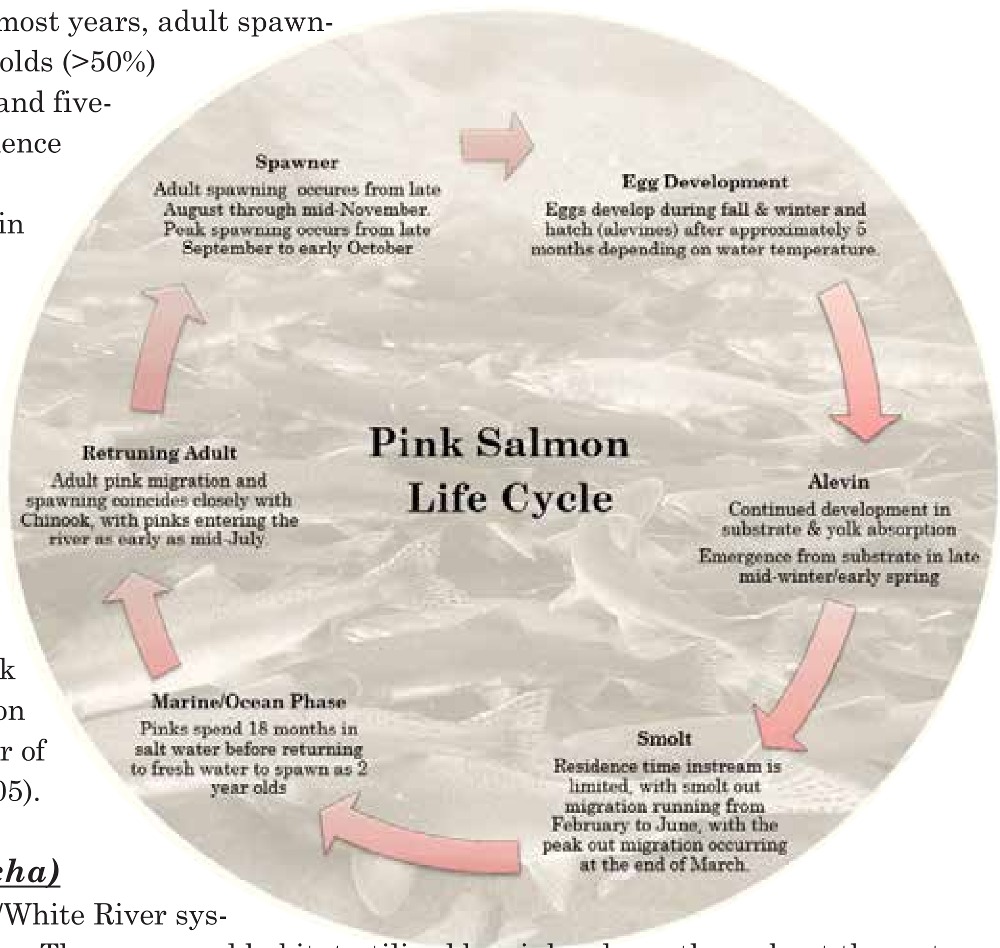
Chum salmon are most numerous and widespread throughout the lower and mid-river system. Chum have been observed spawning as high as Boise Creek on the White River (RM 23.5), Fox Creek on the Puyallup (RM 29.5), and as high as river mile 8.5 on the Carbon and river mile 12 on South Prairie Creek. Chum are mass spawners, frequently utilizing the habitat found in the placid flows of primary side channels and secondary ephemeral side channels established along the major mainstem rivers. Also commonly utilized are the shallower outer margins of the mainstem rivers; nevertheless, most of the spawning efforts are focused in the numerous smaller tributaries located off the lower Puyallup and White rivers, as well as South Prairie Creek. A split stock of wild and hatchery origin chum are present



in the Puyallup/White system. Genetic testing implies a difference between lower Puyallup River chum *(Clarks, Diru, Swan and Clear creeks)* and upper river chum *(Carbon River, White River, Salmon Tributary, South Prairie Creek, Fennel and Canyonfalls creeks)* (Ford and Schwenke 2004). The Puyallup Tribe began rearing and releasing chum from its Diru Creek Hatchery facility, a small tributary to Clarks Creek on the lower Puyallup River, in 1979. The Puyallup Tribe currently raises 1.5 to 2.7 million-chum smolts annually for release into the lower Puyallup River. This program significantly augments a tribal river fishery and All Citizen purse seine fishery in East and West Pass in Puget Sound. This stock originated initially from Chambers Creek. Eliminating the need to import chum from outside the Puyallup/White River Watershed, the Puyallup Tribe began propagating chum for its own program at Diru Creek in 1993. Currently, this is the only chum propagation program operating in the Puyallup/White River Watershed.


Chum fry

Adult chum salmon enter the Puyallup River as early as October. An early run of chum in Fennel Creek and the Carbon River can be observed spawning in late October. In most of the rivers and tributaries, active spawning occurs from the middle of November through the end of January, with peak spawning occurring in mid-December. Scale data collected by Puyallup Tribal Fisheries (PTF) from commercial gill-net fisheries in the lower Puyallup and Diru Creek Hatchery returns, show most adult spawners returning as three-to-four-year-olds. During most years, adult spawners are predominately four-year-olds (>50%) with a small contingency of two and five-year-olds (< 4%). Instream residence time for newly emerged chum is short, emerging from the gravel in late winter to early spring, juveniles move quickly downstream to the marine waters of Commencement Bay. Since 2001, the Puyallup Tribal Fisheries Department has operated a rotary screw fish trap on the lower Puyallup (RM 10.6). Trapping data reports downstream migrating chum are captured in the trap as early as the first week of March, with peak out-migration occurring during the first quarter of May (Berger and Williamson 2005).



Pink Salmon *(O. gorbuscha)*

Pink salmon in the Puyallup/White River system return on odd years to spawn. The range and habitat utilized by pink salmon throughout the watershed has changed considerably since 2003. Washington Department of Fisheries biologists, in a 1975 publication, describe pink salmon utilization to be almost exclusively limited to the mainstem Puyallup River; the lower Carbon and White rivers; South Prairie Creek and Fennel Creek (Williams et al. 1975). This description of pink salmon utilization was generally accurate until 2003, when an unprecedented number of adult pink salmon returned to the Puyallup/White River Watershed. Washington Department of Fish and Wildlife escapement data from 1959 to 2001 shows the number of adult pinks returning to the Puyallup system ranged from 2,700 to 49,000, with an average seasonal return of 19,400. Pink escapement estimates obtained from WDFW reported an estimated pink return of 185,000 during the 2003 run; and in 2005 the escapement was estimated at over 466,000 (Scharpf 2006). The adult pink escapement for 2007 was estimated at well over 600,000, and just over 1.2 million in 2009. Adult pink escapement has decreased since its peak in 2009.


Pink salmon

With the increased returns, significant numbers of pink salmon have been transported above Mud Mountain Dam to spawn in the Upper White River, and the West Fork White River. Substantial escapement of pinks have been observed in several key tributaries including Silver Springs Creek, Huckleberry Creek, and the Greenwater and Clearwater rivers. In addition, several pink spawners have been documented in Cripple, Pinochle, and Wrong creeks. Pinks have been observed spawning as high as Sunrise Creek located at river mile 63. The Puyallup and Carbon River drainages have not experienced the same significant expansion of pink salmon as the White River. Even so, pink escapements have been exceedingly elevated throughout the mainstem Puyallup River below river mile 27.5; as well as the lower Carbon River, South Prairie, Wilkeson and Fennel creeks. The Puyallup and Carbon River drainages have not experienced the same significant expansion of pink salmon as the White River.

All pink salmon in the Puyallup/White system are wild. Adult pink migration and spawning coincides closely with Chinook, with pinks entering the river as early as mid-July, and spawning from late-August through mid-November. Like chum, pinks are mass spawners and frequently utilize habitat formed in the placid flows of primary side channels and secondary ephemeral side channels established along the major mainstem rivers. Also commonly utilized are the shallower outer margins of the mainstem rivers; although, much of the spawning efforts are centered on the numerous anadromous tributaries. Peak spawning occurs from late-September to early-October, with fry emerging from late fall through winter. Residence time instream is limited, with smolt out migration running from February to June, with the peak out migration occurring at the end of March. The production estimate for the 2003 pink brood year, calculated 1,988,441 out-migrants (Berger and Williamson 2004); estimates for the 2005 brood year was 7,095,017 pink smolts (Berger et al. 2006); estimates for 2007 and 2009 pink smolt escapement is 14,936,007 and 11,148,303 (Berger et al. 2008; Berger et al. 2010). See Puyallup and White Rivers juvenile production assessment project descriptions and summary

Four species of salmon fry.

data in this report. After two years in the marine environment, adults return to spawn as two-year-olds, hence the odd year spawn timing; however, a few pinks do return on even years. The unique life history of pink salmon does make the species more susceptible to stochastic events, which can have an immeasurable impact on an entire year class.


Adult sockeye captured in White River (♀).

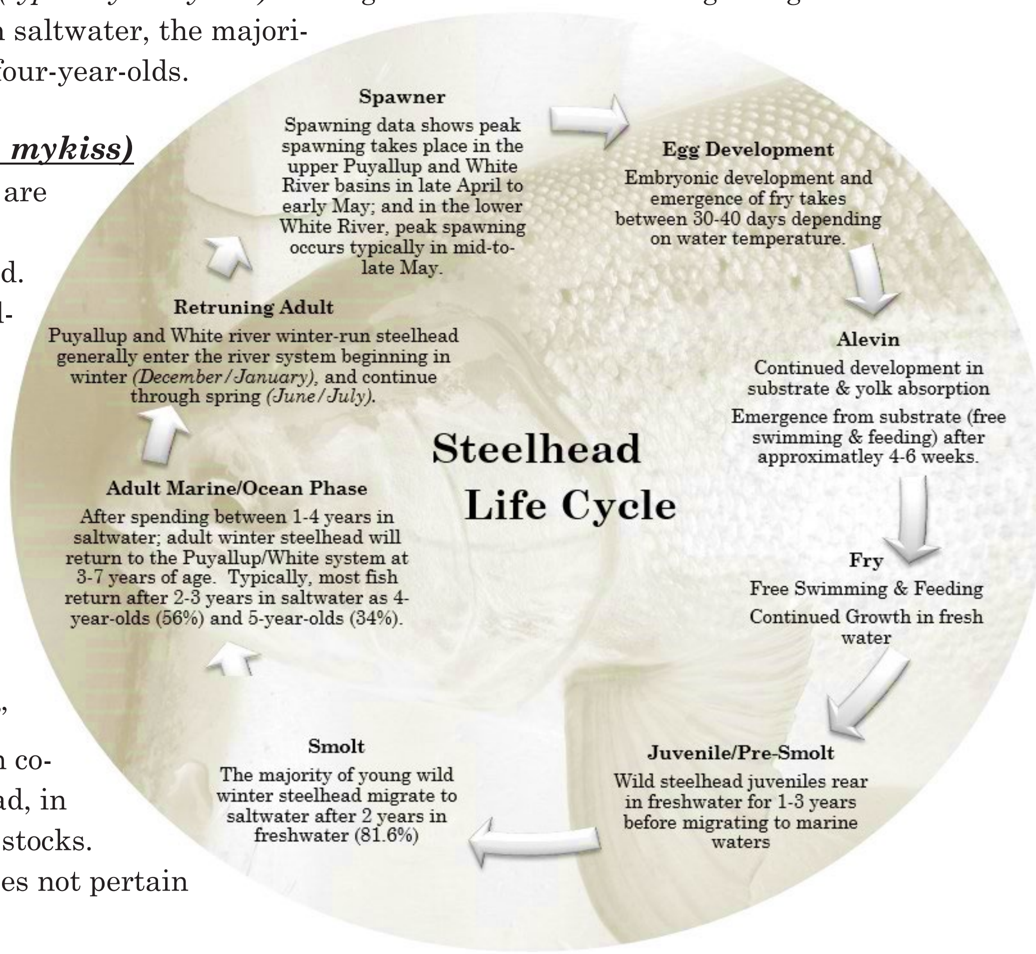
Sockeye Salmon

(O. nerka)

Sockeye are occasionally encountered or documented throughout most of the Puyallup/White River basin. Each year from 1980 to 2018, between 0 and 378 *(annual average of 33)* adult upstream migrants were captured and transported above Mud Mountain Dam which provides a rare opportunity to collect data on adult sockeye. It is currently undetermined how many, if any, of the adult sockeye are native to the system or are strays from other watersheds. Migrating adults are caught in the trap from mid-July through early September. Sockeye transported to the upper White are observed in several of the major tributaries, including the Greenwater River, Clearwater River and Huckleberry Creek. Spawn timing runs from mid-September through October, coinciding with Chinook, pink, and coho spawners. Sockeye often utilize similar spawning habitat as Chinook and coho, which is evident by the fact that sockeye are regularly seen spawning side-by-side with these other species. Spawning sockeye are easily distinguished from other salmon species by their distinctive bright red bodies and green heads. Post emergence, juvenile sockeye spend one-to-two years *(typically two years)* rearing in freshwater before migrating to marine waters. After two-to-three years in saltwater, the majority of adults return to spawn as four-year-olds.

Steelhead/Rainbow *(O. mykiss)*

Both steelhead and rainbow are present throughout the Puyallup/White River Watershed. The steelhead is simply an anadromous form of rainbow; offspring from either steelhead or rainbow can become anadromous, or remain in freshwater (*resident form*) their entire lives. In May of 2007, NOAA's National Marine Fisheries Service released a statement regarding the listing of Puget Sound steelhead as "threatened" under ESA. The ESA protection covers naturally spawned steelhead, in addition to a couple of hatchery stocks. However, the ESA protection does not pertain to rainbows.

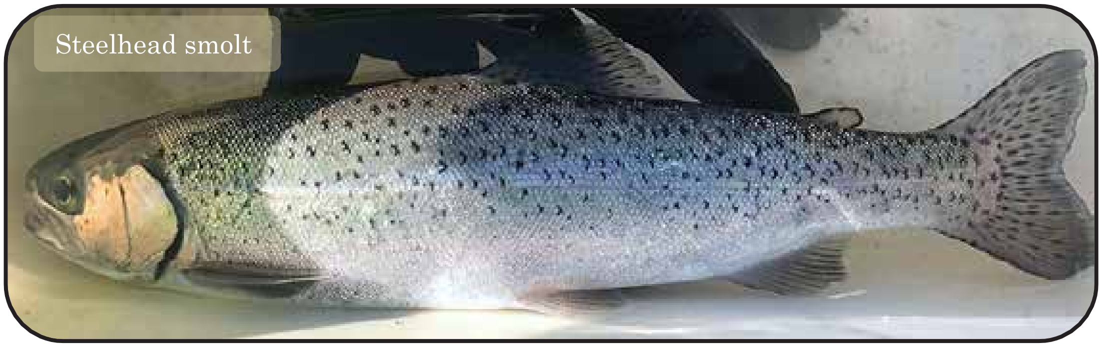


Steelhead are generally categorized as *winter-run* or *summer-run*, depending on the time of the year they return to freshwater river systems to reproduce. Unlike other pacific salmonid species, steelhead can spawn more than once *(iteroparous)* during their life-cycle. Scales collected from 1985-to-2018 by Puyallup Tribal Fisheries biologists at the USACE trap on the White River and analyzed by WDFW, show an average of 3.61% *(range 0-26.4%)* repeat spawners returning annually *(frequently females).* Puyallup and White river winter-run steelhead generally enter the river system beginning in winter *(January)*, and continue through spring *(June)*, whereas summers migrate during late spring and summer seasons. Summer and winter-run steelhead enter freshwater systems in various degrees of reproductive maturation (Pauley et al. 1986).

Summer steelhead enter river systems immature, and will not be ready to spawn until the following spring; whereas, winter steelhead will be ripe *(mature)* enough to spawn within a few months or less after entering freshwater (Pauley et al. 1986). The major distribution of winter-run steelhead includes many of the coastal and Puget Sound river systems such as the Humptulips, Quinalt, Chehalis, Hoh, Bogachiel, Soleduc, Skagit, Skykomish, Snoqualmie, Green, Puyallup and Nisqually rivers. Winter-run steelhead are also present in several river systems along the lower Columbia River. Summer-run steelhead distribution in the Puget Sound includes the Skagit, Stilliguamish, Skykomish and Green rivers.

The principal stock of steelhead returning to the Puyallup and White river system are winter-run. However, a few summer-run strays, likely from the Green or Skykomish rivers, are caught annually during August and September in the lower Puyallup; as well as the USACE trap on the White River. Therefore, steelhead are often present in the watershed throughout the year. The main run of hatchery origin winter steelhead *(Voights Creek production ceased in 2009)* enters the Puyallup River in November, with the peak of the run occurring in mid-December. On the White River, steelhead are occasionally caught in the USACE trap as early as late December. Although, most fish don't start migrating towards the upper reaches until March. The winter run continues through June, with peak migration occurring in mid-to-late April, through early May. Puyallup Tribal Fisheries spawning ground data shows peak spawning takes place in the upper Puyallup and White River basins in mid-April to early-May; and in the lower White River, peak spawning occurs typically in mid-to-late May.

Steelhead spawners frequently utilize the mainstem Puyallup, White, and Carbon rivers; whereas, the majority of spawning occurs within many of the associated smaller tributaries. Some of the major tributaries on the White River supporting winter steelhead include Boise Creek, in addition to the Clearwater and Greenwater rivers. Along the Puyallup River, the upper reach tributaries of Kellog, Niesson and LeDout creeks, support the majority of spawners. In addition, the roughly five miles of mainstem river channel below the Electron diversion dam (RM 41.7) consistently experiences steelhead spawning activity as well. The habitat above Electron has been accessible since the completion of a 215 foot fish ladder/fishway in the fall of 2000. Steelhead are known to be accessing habitat in the reach above the Electron Dam; yet, no long-term data has been collected regarding spawning and rearing utilization, and distribution. Prior to 2015, the majority of information available was from aerial surveys conducted on the upper Puyallup and Mowich rivers during the spring of 2005 and 2006. Surveys conducted in 2006, revealed limited steelhead spawning activity in the mainstem Puyallup River, and no spawning activity in the Mowich. However, low flow conditions during the spring of 2015 allowed for numerous foot surveys to be conducted, and several redds were observed in the upper Puyallup and lower Mowich rivers; as well as Rushingwater Creek *(Mowich River tributary)*.



The Carbon River mainstem, below river mile 11, has consistently supported steelhead spawners. Spawning ground survey data from 1995 to 2017, illustrates an average of 14 redds annually *(range 0-59)* in the mainstem Carbon; however, escapement has dropped significantly over the last decade. South Prairie Creek, a substantial tributary to the Carbon River, has long been the one of the most significant salmon and steelhead drainage in the Puyallup basin. Survey data obtained from WDFW shows the average number of steelhead redds observed in South Prairie from 1999 to 2017, was 170 *(range 32-585)*. Voights Creek, on the lower Carbon River, also experiences a small steelhead escapement.

After fertilized eggs are deposited in the gravel substrate, the embryonic development and emergence of fry takes between 4-8 weeks depending on water temperature. Juvenile steelhead will rear in freshwater for 1-4 years before migrating to marine waters in the spring. Scale data from 792 adult winter steelhead captured in the USACE trap from 1985 to 2004 shows the majority of young wild winter steelhead migrate to saltwater after 2 years in freshwater (81.6%). Approximately 2.5% of the steelhead sampled spent 1 year in freshwater, 15.6% three-years, and less than 0.25% four-years before out-migrating. None of the steelhead sampled spent more than 4 years residing in freshwater. Nearly all hatchery reared steelhead, if grown to a large enough size *(five fish-to-the-pound, or 90 grams each)*; will migrate to saltwater shortly upon release as yearlings *(one-year-old plus fish)*. After spending between 1-4 years in saltwater; adult winter steelhead will return to the Puyallup/White system at 3-7 years of age. Typically, most fish return after 2-3 years in saltwater as 4-year-olds (56%) and 5-year-olds (34%).

Prior to January, 2009, WDFW conducted the only long-term winter steelhead supplementation program in the basin. Each spring, the Washington Department of Fish and Wildlife's hatchery on Voights Creek released yearling fish into the system. In 2005, the Voights Creek facility released over 207,000 adipose (*Appendix H for fin marking ID*) clipped steelhead, and over 231,000 in 2004 (Berger and Williamson 2005). Brood-stock for this program had originated from several different drainages, including the Humptulips, Bogachiel, and Skagit rivers; as well as Chambers and Tokul creeks. From 1980 to 2000, the Puyallup Tribe operated a winter steelhead program at the Diru Creek facility *(located in the city of Puyallup)*. The brood-stock for this supplementation program came from the coastal Quinalt River system. During the 20 year span of the program, the Tribe released between 8,237 and 116,957 yearling smolts annually into the Puyallup system. The Diru Creek program was successful, with an average of 915 (*range 364-1,144*) adults returning annually from 1993 to 1999. Unfortunately, this earlier program was discontinued due the lack of water resources necessary to rear steelhead year-round.

During the spring of 2006, in response to the declining number of winter steelhead, the Puyallup and Muckleshoot Tribes; as well as the Washington Department of Fish and Wildlife, began a steelhead supplementation pilot project developed for the White River. The primary goal of this project was to restore the run to a strong self-sustaining population. The pilot project utilizes captured wild brood stock from the USACE trap in Buckley to generate approximately 25K-35K+ yearling smolts *(see appendix F for additional data).*

Beginning in January of 2009 (Program was discontinued in 2022), the Puyallup Tribe assumed the majority of responsibility for continuing this important restoration/recovery effort. Steelhead brood-stock collected from the White River USACE's FPF in Buckley are currently held, spawned, incubated, and reared at the Puyallup Tribe's Diru Creek hatchery for a year. From 2007-2013, after rearing for a year, and when the fish were of size *(approximately 17 fish-per-pound)*, the pre-smolts were transported to the Muckleshoot hatchery on the White River to acclimate before being released. Since 2014, the steelhead have been planted and released from one of the available acclimation ponds located in the upper White River *(see map on page 49)*. The Puyallup Tribe discontinued this program in 2022 due to the availability of broodstock as a result of diminished adult returns at the USACE's FPF facility.

The winter steelhead stocks in the Puyallup basin have declined since 1990. The precipitous decline created serious concern among fisheries managers. Factor(s) responsible for the decline in steelhead escapement are unknown, especially when other salmon species are experiencing relatively good success. Escapement numbers for the USACE trap in Buckley during 2005 *(152 adults)* was the lowest ever recorded since 1941. Decreased numbers of redds have been observed in several other drainages as well; yet a few, such as Boise Creek on the White River, have experienced comparatively stronger returns in spite of the general basin-wide declines. The smolt trapping program operated by the Puyallup Tribe's Fisheries department on the Puyallup River observed a substantial decrease in the number of steelhead smolts captured from 2003 to 2005 (*average 62.6 [range 39-77] from 2003-2005 vs. average of 315 [range 156-539] from 2000-2002)* (Berger and Williamson 2005). However, significant increases in escapement were observed from 2008-2011 *(average 362 [range 189-579])* (Berger et al. 2011). The previous numbers don't include the steelhead escapement for the White River due to the traps location approximately 0.2 miles above the White/Puyallup confluence.

Bull Trout *(Salvelinus confluentus)*

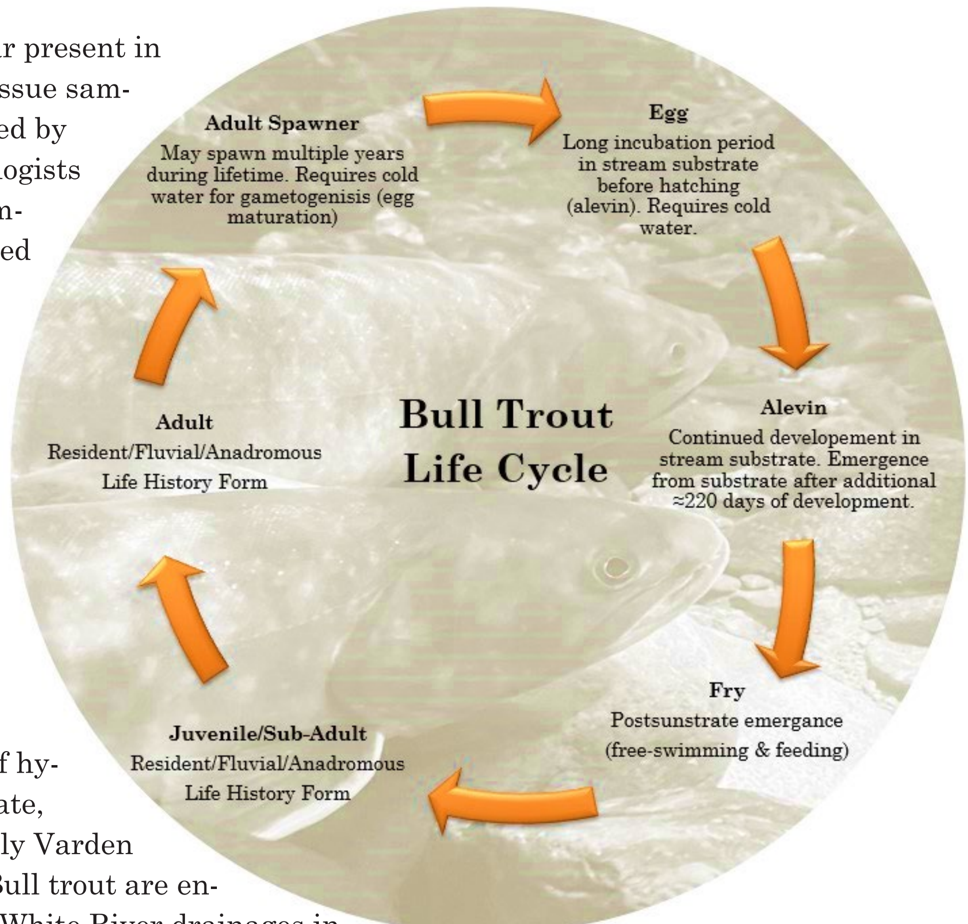
Bull trout have existed historically throughout many Pacific Northwest coastal and inland rivers, streams, lakes, reservoirs and marine waters; from southern Alaska northern California, and inland to Idaho, western Montana and northern Nevada (Fraley and Shepard 1989, Buchanan et al. 1997, Rieman et al. 1997, High et al. 2008). On November 1, 1999, all bull trout in the coterminous United States were listed as "threatened" on the federal register of endangered species by the U.S. Fish and Wildlife Service (USFWS 1999). The USFWS updates the status and current risks to bull trout every 5 years. This process involves significant collection of the most current information and data, as well as, in depth communications with watershed stakeholders including tribes and regula-

Adult bull trout in Silver Creek, a headwater tributary to the White River.

tory agencies.

Bull trout are a cold water species sensitive to deleterious changes in water quality (Selong et al. 2001, Dunham et al. 2003); as well as the fragmentation and loss of habitat (Rieman and McIntyre 1995). Bull trout require unobstructed migration corridors and connectivity of rivers, streams, and other water bodies (Rieman and McIntyre 1993) in order to provide access to spawning, rearing, foraging, and over-wintering habitats. Bull trout belong to a group of fishes called char *(genus Salvelinus)*, a subgroup of the family Salmonidae. Char include Dolly Varden *(S. malma)*; white spotted char *(S. leucomaenis)*; Arctic char *(S. alpinus)*; brook trout (*S. fontinalis)*, and lake trout *(S. namaycush)*. Morphologically, bull trout and Dolly Varden are nearly indistinguishable; however, genetic and morphometric analysis in the late 1970s distinguished that bull trout and Dolly Varden are in fact different species (Cavender 1978). The bull trout is actually more closely related to the Asiatic white-spotted char (Cannings and Ptolemy 1998). In addition, regional research has established that both bull trout and Dolly Varden reside sympatrically in several Western Washington Rivers and streams (Leary and Allendorf 1997).

To determine the specie(s) of char present in the Puyallup/White River system, tissue samples from over 110 char were collected by Puyallup Tribal Fisheries *(PTF)* biologists for genetic analysis. Most of the samples collected were from char captured in the US Army Corps of Engineers *(USACE)* FPF on the White River, as well as a limited number collected from Electron Hydro LLC's *(Formally Puget Sound Energy)* Electron forebay on the Puyallup River, and one sample came from the Lower Puyallup River near Commencement Bay.



Results from the genetic analysis disclosed that all samples collected were bull trout, with no indication of hybridization (Baker et al. 2003). To date, there has been no verification of Dolly Varden in the Puyallup River Watershed. Bull trout are endemic to the Puyallup, Carbon, and White River drainages in which they exhibit primarily residential and fluvial life history traits. Although diminished, the Puyallup Watershed also supports the anadromous life history form of bull trout. Resident bull trout reside in smaller headwater tributaries, while fluvial bull trout frequently utilize mainstem rivers and tributaries to forage and overwinter.

During the fall, migratory bull trout journey from spawning and foraging habitats in the upper watershed to foraging and overwintering habitats located lower in the river system. From spring through early summer, migrant bull trout commence their upstream journey to cooler spawning, rearing, and foraging refugium high in the watershed where spawning will occur primarily during the month of September (Ladley et al. 2008, Marks et al. 2009). In response to changing habitat and reproductive needs, migratory bull trout in the White River travel up to 75 miles or more between the lower river and the headwaters located in, or near Mt. Rainier N.P. To achieve this, bull trout require unobstructed migration corridors and connectivity of streams and rivers to provide them with necessary access to spawning, rearing, foraging, and overwintering habitats. Currently, the genetic relationships and population(s) size of bull trout within the Puyallup core area is undetermined. The National Park Service conducts ongoing studies addressing bull trout ecology within the park.

Bull trout are primarily piscivorous *(fish eaters)*. However, they are opportunistic feeders, feeding on a variety of prey items depending on their particular life history strategy and stage of development. Adults feed almost exclusively on other fish, including a range of salmon and trout species; as well as other resident fish species. Juveniles feed on aquatic invertebrates, including stoneflies *(Plecoptera)*, caddisflies *(Trichoptera)*, and mayflies *(Ephemeroptera)*. Bull trout require a healthy aquatic environment in order to survive and prosper. They need an environment that provides the prey base; in addition to the rearing and reproductive habitat necessary to ensure their continued survival and reproductive success. Bull trout are endemic to the Puyallup, Carbon, and White River drainages. Currently the population dynamics of bull trout within the watershed is unknown. However, since the Coastal Puget Sound listing in 1999, the Puyallup Tribal Fisheries department has made a focused effort on collecting biological data; as well as spatial information on bull trout distribution and utilization. Documented areas of utilization include the lower and upper mainstem of the Puyallup, White, Carbon and Mowich rivers. Currently, the best documentation of bull trout utilization exists on the White and Mowich Rivers. The Upper White River provides some of the preeminent critical habitat for bull trout spawning and rearing. Significant research efforts conducted since 2000, of headwater tributaries along the White River and the West Fork White River has revealed the significant presence and utilization of adult and juvenile bull trout in several of the drainages.

Each year, since 1999, adult upstream migrants were captured and sampled in the USACE trap on the White River and transported above Mud Mountain Dam. This trap and haul operation conducted by the U.S. Army Corps of Engineers has been functioning since 1941. The abundance of upstream migrants captured in the USACE trap has increased precipitously since 2009. From 1999-2008, an average of 36 *(range 14-49)* bull trout were captured and sampled annually. From 2009-2020, an average of 242 *(range 68-406)* bull trout were captured and sampled, a significant increase over the previous decade+. The Potential contributing factors as to why the White River bull trout population size has increased significantly over the past several years is currently under investigation. Data gathered by PTF on these captured fish strongly indicates both *fluvial* and *anadromous* life history traits. Fluvial bull trout utilize the main river system and tributaries to forage as adults; yet, migrate to their natal streams or other spawning tributaries to reproduce. Anadromous fish migrate downstream to forage in more productive marine waters.

Adult migratory bull trout (♀) captured and PIT tagged at USACE's FPF, White River.

Spawning ground surveys conducted by Puyallup Tribe Fisheries biologists on Klickitat Creek during the 2002 through 2006 seasons, observed floy tagged adult fish previously captured in the USACE trap, spawning with non-tagged fish. In view of the fact that larger adults are rarely observed in the smaller spawning tributaries pre-or-post spawning, it is surmised that most of the fish observed were fluvial *(mainstem river)* bull trout. However, it is undetermined what component of adults spawners, if any, are residents. Further research is needed to understand and identify the life history patters and population dynamics of bull trout in the Puyallup/White River Watershed. Addressing this issue, in 2006 and 2007, Puyallup Tribe Fisheries biologists conducted extensive bull trout migration telemetry studies and redd surveys along the upper White River and West Fork White River, focusing heavily on the headwaters located within Mt. Rainier National Park.

Telemetry study results showed the cold high elevation mountain streams located within Mt. Rainier National Park provides the majority of bull trout spawning habitat throughout the basin. The study involved surgically implanting bull trout captured in the USACE trap with LOTEK radio transmitters *(10 fish in 2006, 19 in 2007)*. The radio tagged bull trout were then tracked for 6-months as they made their upstream migrations to spawning sites in the upper White River; as well as their post-spawning migrations downstream. During the 2006 study, seven of the ten bull trout spawned in tributaries located on the mainstem of the White River within Mt. Rainier National Park; one spawned in Lodi Creek on the West Fork within the park, and another in Silver Creek *(lowest observed spawning elevation in White River @ 2600')*just a half mile outside of the National Park. In 2007, 8 radio tagged bull trout were observed spawning in tributaries located on the White River inside the National Park. Two other bull trout were tracked up the West Fork White near Lodi Creek. Additional telemetry studies were conducted by USFWS since 2007 *(2014-2017)*. Considerably more has been learned about bull trout distribution and utilization in the Puyallup, Carbon and Mowich rivers since the species ESA listing.

The Upper Puyallup Basin encompasses the Mowich River and the North and South Forks of the Puyallup; as well as the mainstem Puyallup River. The upper basin supports several species of salmonids including bull trout, Chinook *(Oncorhychus tshawytscha)*, coho *(O. kitsutch)*, pink *(O. gorbuscha)*, sockeye *(O. nerka)*, steelhead/rainbow *(O. mykiss)*, and cutthroat *(O. clarki)*. Bull trout have been observed in all three river systems. Bull trout spawning throughout the watershed occurs primarily during the last three weeks in September; however, spawning has been observed taking place from the last week of August through the first two weeks of October. Bull trout are iteroparous *(have the ability to spawn more than once)*; therefore, recovering pre-or-post spawn mortalities for examination is extremely rare. Spawners in the upper White River tributaries are observed utilizing various sized substrate from small gravels to small cobble. Redds are often constructed in the tail-out of pools and along the channel margins. Embryonic development is slow *(depending on water temperatures)*; it may take between 165-235 days for eggs to hatch and for alevin to absorb their yolk (Pratt 1992). Bull trout fry emerge in late winter-through- early spring.

Several tributaries within the Upper Puyallup River Basin have been identified as potential or known bull trout occupied/spawning habitats. However, several seasons of bull trout spawning surveys and telemetry studies conducted on the White River have shown that in addition to well established occupied habitats, bull trout frequently exploit small, often unknown or unidentified tributaries of ephemeral flow (Marks et al. 2010). Unlike the Upper White River, much of the headwater habitat located within the Upper Puyallup Basin falls outside of the National Park boundary where land use is intensive and natural resource protections are diminished. Bull trout habitat throughout the Puyallup and White rivers has been severely impacted by over a century of land and water resource exploitation; including, damming and substantial water diversions, considerable riparian alterations *(deforestation)*, dewatering and low instream flow regimes, as well as significant channel manipulation. Impacts have led to marked habitat deterioration and hydrological modifications within these river systems. Several limiting factors are involved with regards to the healthy function of stream habitats and bull trout populations throughout the watershed; including lost or diminished habitat connectivity and migration corridors *(human-made fish passage barriers)*, fragmentation and reduction of habitat quality *(entrainment, transportation networks, forest management practices and operations, direct water withdrawal)*; in addition to, water quality, fish entrainment and entrapment, unknown species interactions, and climate change impacts.

Point specific areas of human-made fish migration barriers or obstacles include Electron Hydro LLC's *(formally owned/operated from 1904-2014 by Puget Sound Energy)* Electron hydropower facility located on the Puyallup River. The hydro operation diverts up to 400 cfs. *(179,532 gallons per minute)* from the Puyallup River at RM 41.7. For 96 years *(1904-2000)* the diversion dam completely isolated the population(s) of bull trout established throughout the 26+ miles of habitat upstream of the structure, which resulting in the stem of genetic flow from bull trout located elsewhere in the basin, and watershed, for numerous generations. A diversion dam and flume intake; as well as a Fish Passage Facility *(FPF)*, is also located on the White River near the city of Buckley. In addition, Mud Mountain Dam, an earthen dam designed for flood control, is located on the White River just over 5 miles upstream of the Buckley diversion dam. The operation of these facilities contribute, in whole or in part, to many of the limiting factors previously stated.

To summarize, based on White River studies and information collected from other Puyallup and Carbon River basin projects, we can make the following general inferences regarding migration/movement.

Adults

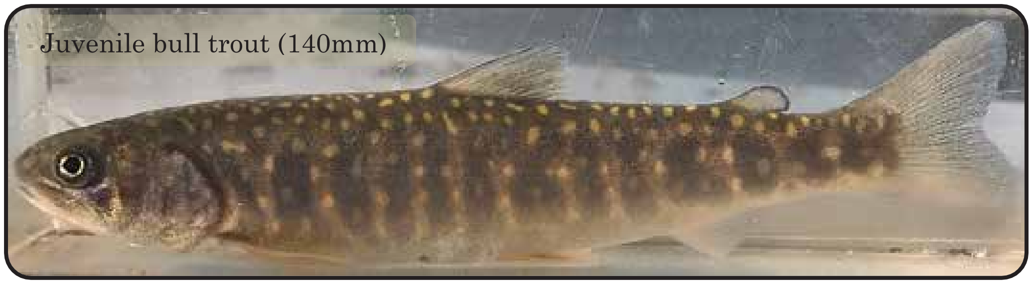
Adults are also observed in tributaries throughout the watershed year-round *(foraging/overwintering)*. Little is known about adult resident bull trout life history. Fluvial adults are consistently moving throughout the watershed. Fluvial adults frequently overwinter in the lower and mid watershed habitats *(mainstem & tributaries)*; whereas anadromous fish may go to marine waters to overwinter. It is currently hypothesized larger anadromous adults may retire from anadromy during later life stages. Upstream migrations to spawn/forage in upper watersheds typically occurs from May-to-late-August, with peak migration occurring in June/July *(peak month alternates)*. Little is known about adult resident bull trout life history.

In general, upstream spring/summer migrants continue moving upstream at fluctuating intervals; however, some do fall back downstream. Fish tend to stage in mainstem habitats for periods of days-to-several weeks at a time before eventually entering spawning habitats. However, not all fish migrating/moving upstream actually spawn; a significant number of upstream migrants are unaccounted for on spawning grounds *(White River telemetry study results)*. Commencement of spawning is frequently correlated with a drop in stream temperature, typically below 8°C *(46°F)*, with spawning temperatures ranging between 5.7-12°C *(42.3-53.6°F)*. Since bull trout spawning surveys were initiated in 2000, an observable adaptation in spawn timing has occurred. Overall spawn timing; as

Bull trout in spawning phase, Mowich River headwater tributary.

well as, peak spawning activity, has shifted slightly later into the month of September, and now extends into early-to-mid October. The early September component of spawners has chiefly disappeared, and once uncommon in earlier years, spawning activity is frequently observed into early-to mid- October. Peak spawn timing has also shifting slightly later, from the second-and-third weeks of September, into the third-and-fourth weeks of September.

Spawners are extremely opportunistic; in addition to regularly available spawning habitat, fish will frequently utilize new/provisionally existing habitat. Due the dynamic nature of glacial river systems, habitat availability is constantly fluctuating. Downstream migration post-spawning occurs from approximately late August-to-early November, is often rapid for females, yet more prolonged for males. Males will often move through multiple streams searching for other females to spawn with.


Juvenile bull trout (140mm)

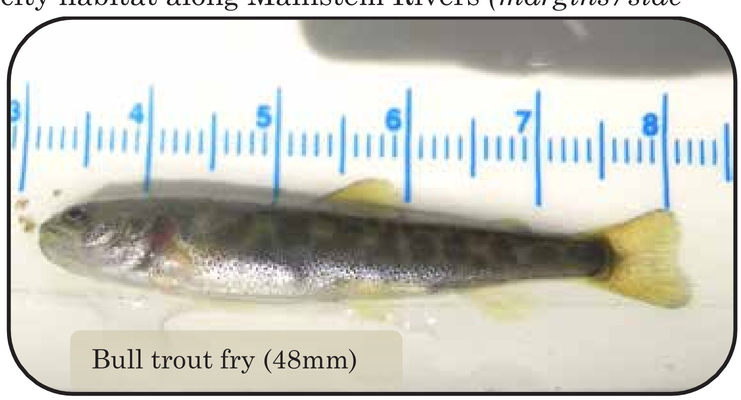
Sub-adults (Juveniles)

Similar to adults, juveniles are consistently moving throughout the watershed and frequently overwinter in the lower and mid watershed habitats *(mainstem & tributaries)*; whereas anadromous fish may migrate to marine waters. Upstream migrations to forage in the upper watershed typically occurs from May-to-late-August, with peak migration occurring in June and July. Downstream movement to overwinter in lower/mid river habitats occurs approximately late August-to-early November. In addition, sub-adults are also observed in tributaries throughout the watershed year-round *(foraging/overwintering)*. Less is known about juvenile resident life history.

Fry

Downstream movement can occur from late winter *(emergence)*, through spring and early summer. Downstream movement can be volitional or non-volitional. Fry have been observed and captured (<50mm) throughout the upper and lower White River during the spring and early summer *(adult steelhead escapement surveys, seining)*. Fry will utilize lower velocity habitat along Mainstem Rivers *(margins/side channels/ pools)*. The few fry captured in the fish collection facility at Electron were captured April-through-June.

A prolific transportation network of surfaced and unimproved roads extends throughout both watersheds. Additionally, the upper White River Watershed has a network of trails utilized by hikers, horseback riders and mountain bikers. The trans-



Bull trout fry (48mm)

portation network within the Upper Puyallup Basin consists almost entirely of unimproved roads developed and utilized primarily for timber harvesting; as well as, hunting, recreational activities and hydropower operation. The transportation networks within the Upper White River basin consist of both paved and unimproved roadways. Lands in timber production areas are densely roaded with some sections approaching six lineal miles per square mile. Roads have contributed many of their trademark problems such as landslides, slope failures, altered hydrology, as well a culvert and bridge projects which can effect upstream migration, and increased levels of sedimentation within effected drainages. Current, as well as former major transportation lines such as highway 410, Sunrise Park Road and the USFS access road #74, in addition to several other road networks and bridge emplacements along the Puyallup and White rivers, all directly interact or alter the hydrology within both upper watersheds. Like the Puyallup, The Upper White River Basin has a vast network of unpaved roads developed and utilized primarily for timber harvesting; as well as recreational activities. There is no direct fishery on bull trout in the Puyallup/White drainage; however, they are legal to catch, but must be released.

The long-standing presence of private industry, primarily hydropower and commercial timber harvesting; in addition to recreational uses and the repercussions of negative air and water quality issues, have all produced lasting impacts on the upper watersheds. These impacts include; loss of in-stream large woody debris and LWD recruitment, stream bank modifications, increased sedimentation issues and slope failures due to deforestation, unsatisfactory RMZ management; in addition to, new road construction, road failures, and road decommissioning. A great deal of the aforementioned forestland has been harvested at least once, and in many cases twice; leading to many of the wide-ranging issues common with deforestation. Air and water quality issues vary from measurable levels of airborne contaminants which have been detected in Mt. Rainier National Park; including heavy metals and pesticides discovered in samples of snow, soil and fish (Landers et al. 2008). Additional private industrial impacts include PSE's substantial 2006 diesel fuel spill into Silver Creek *(estimated @18,000 gal.)*, a well-documented bull trout spawning stream. The spill emanated from Puget Sound Energy's back-up electrical generation station on Crystal Mountain. However, current and future collective climate change affects likely pose the greatest threat to bull trout persistence throughout the watershed.

Bull trout recovery has been slow, however, this species has shown some remarkable resilience, especially in the White River where bull trout numbers have exhibited improvement since 2009. Resource managers continue to research and gather information required for the management, enhancement and protection of bull trout. Collecting and compiling species specific data will provide the foundation for the maintenance of existing bull trout occupied habitats; as well as future conservation, restoration, and recovery actions *(see following page)*. The USFWS finalized bull trout recover plan (2015) and Coastal Recovery Unit Implementation Plan (RUIP) for Bull Trout is available at:

- Species with Recovery Plans (fws.gov)

Since bull trout were ESA listed *(1999)*, the majority of restoration efforts within the Puyallup/White River Watershed have been supported through salmon recovery funding sources; unfortunately, little direct funding has been available for bull trout recovery. Needless-to-say, bull trout have benefitted indirectly from salmon recovery and enhancement projects conducted throughout the watershed. Additional/increased funding will be required to address the ongoing research, monitoring, evaluation, and restoration needs necessary for the full recovery of this species *(see table on the following page)*.

Key Puyallup Core Area Bull Trout Recovery/Action Plan[1,2] objectives to be addressed:

- Monitoring and assessing distribution, population status, life history, migratory movements, and genetic characteristics[1].
- Monitor additional local populations to provide more accurate abundance estimates for each core area[1].
- Minimize demographic threats to bull trout by restoring connectivity or populations where appropriate to promote diverse life history strategies and conserve genetic diversity[1].
- Puyallup Core Area Recovery Action Number 1.2.2: Practice non-intrusive flood control and flood repair activities[2].
- Puyallup Core Area Recovery Action Number 1.2.3: Ensure access to potential spawning and rearing refugia[2].
- Puyallup Core Area Recovery Action Number 2.1.1: Provide adequate fish passage around Buckley Diversion and Mud Mountain Dam[2].
- Puyallup Core Area Recovery Action Number 2.1.2: Provide adequate downstream passage around Electron Dam[2].
- Puyallup Core Area Recovery Action Number 2.3.1: Ensure protection of existing spawning areas in the Upper Puyallup and Mowich Rivers local population[2].
- Puyallup Core Area Recovery Action Number 4.1.1: Evaluate projected impacts from climate change induced glacial outbursts[2].
- Puyallup Core Area Recovery Action Number 4.1.2: Evaluate projected impacts from climate change induced channel widening[2].
- Puyallup Core Area Recovery Action Number 4.2.2: Assess the feasibility of enhancing populations of bull trout in the Upper Puyallup and Mowich River local populations[2].

[1][USFWS] U.S. Fish and Wildlife Service. 2015a. Recovery plan for the coterminous United States population of bull trout (*Salvelinus confluentus*). Portland, Oregon. xii + 179 pages.

[2][USFWS] U.S. Fish and Wildlife Service. 2015b. Coastal Recovery Unit Implementation Plan for Bull Trout *(Salvelinus confluentus)*. Portland, Oregon. xii + 160 pages.

Harvest

For thousands of years the native populations depended on the Puyallup River as a critical resource. In December of 1854, the Puyallup Tribe along with several other Western Washington Tribes, signed the Treaty of Medicine Creek with territorial governor Isaac Stevens *(March 25, 1818 – September 1, 1862)*. In accordance with the treaty of Medicine Creek, the Tribes agreed to reside on appointed reservations, which further required them *(the treaty Tribes)* to relinquish much of their historic fishing and hunting lands. However, fishing and hunting rights were addressed in ARTICLE 3 of the treaty which states in part: The rights of natives to fish would be protested and challenged many times, yet the Tribe's treaty right to fish their usual and accustomed areas *(U&A)* was reaffirmed in February 1974, by Judge George Boldt *(Case number C70-9213; U.S. vs. Washington, also known as "The Boldt Decision")*. This historic decision allowed treaty member Tribes a right to take 50% of the annual harvestable returns. As a result of the Boldt decision, treaty Tribes also became responsible for managing their own fisheries.

Today, the Puyallup Tribe continues to view the Puyallup and White rivers as a valuable cultural and economical resource to be protected. In a cooperative effort with state and federal regulatory agencies, the Puyallup Tribe has become an integral link in "Co-Managing" the fisheries and water resources of the Puyallup Watershed. The Puyallup Tribe currently targets Fall Chinook, coho and chum in its net fishery on the Lower Puyallup River. As a protection and enhancement measure, the Puyallup Tribe did not targeted Spring Chinook in any of its fisheries for over 30 years. Also, the Puyallup Tribe releases all wild steelhead caught incidentally in its fisheries. For additional information about native treaty rights.

The goal for all target species is to maintain a harvestable stock by ensuring that a sizable escapement component successfully makes it to the spawning grounds to reproduce. Timing and fishing efforts are focused on harvesting the stronger hatchery stocks of Fall Chinook, coho and chum; while protecting the more vulnerable stocks of wild fish. A harvest biologist with the Puyallup Tribe manages the fishery to prevent overharvest and to protect species of concern. The Puyallup Tribal Fisheries Department works closely with biologists from other state, federal, and tribal agencies to determine the tribal fishing regulations for each season. The Puyallup Tribe employs a rigorous monitoring and evaluation program to monitor and assess effects of in-river harvest management actions. Monitoring and evaluation efforts include extensive spawning ground escapement surveys for Chinook, coho, pink, chum and steelhead; as well as, sampling adult anadromous salmonid returns at the USACE's FPF on the White River.

In conjunction with tribal fishing, the Puyallup River system has long supported a significant sport fishery. Sport fishing regulations and laws are managed and enforced by the Washington Department of Fish and Wildlife. The sport anglers in the Puyallup basin target several species, including Chinook, coho, pink, chum, and steelhead. Seasons and limits *(quantity, size, origin: wild or hatchery, type of gear used, fishing areas)* are specifically set for each target species to prevent overharvesting and to protect threatened or depressed stocks such as bull trout, Spring Chinook, and wild winter steelhead.

In addition to in-river sport fishing and local tribal harvests, salmon produced in the Puyallup/White River system are harvested outside of the watershed by commercial, sport, and other tribal fisheries. Significant numbers of Puyallup/White River produced salmon are caught annually in the Puget Sound and other fisheries ranging from Oregon to Alaska.

For additional information on Puget Sound salmon and steelhead harvest and management, go to:

- https://wdfw.wa.gov/publications/01947/wdfw01947.pdf

Limiting Factors Affecting Fish Populations

The following pages addressing limiting factors (through flood control history) was written by Russ Ladley, and was originally printed in the 2000 Puyallup River Fall Chinook Baseline Report. The following version has been edited multiple times since originally drafted in 1999.

Over 96 miles of levee exists along the Puyallup, White and Carbon rivers. As a result, habitat restoration and enhancement actions must emphasize the need to promote freedom for stream channel movement and natural floodplain processes. Within the Salmon Recovery Planning Act, limiting factors are defined as "conditions that limit the ability of habitat to fully sustain populations of salmon." Clearly, levees which block access to peripheral habitat and reduce the available area of active channel have had a limiting affect on the fish production. Channel confinement by levees has dramatically reduced availability of suitable spawning habitat. Setback levees are one of the solutions to mitigating this problem. The first setback levee project on the Puyallup River *(RM 24-26)* is an outstanding example of what can be accomplished and the many benefits that are possible. In the period since the completion of the Ford setback levee in 1998, the river has braided and migrated forming a natural meander pattern that has reduced gradient. The lower average velocity has permitted retention of gravel material that was previously scoured away under high velocity flows. Channel braiding and large woody debris recruitment has added channel complexity and established productive spawning and rearing habitat where it did not previously exist. Additional setback levee projects include the Old Soldiers Home levee setback *(2006)* on the Puyallup River between river mile 21.3 and 22.3; the Calistoga setback levee *(City of Orting)* on the Puyallup River *(2014)*, and the County Line setback levee on the White River *(2017)* between river mile 5 and 6.3. For additional information, go to:

- https://www.co.pierce.wa.us/AgendaCenter/ViewFile/Item/501?fileID=566
- https://kingcounty.gov/en/dept/dnrp/nature-recreation/environment-ecology-conservation/flood-services/capital-projects-studies/pacific-right-bank-flood-protection-project/about-pacific-right-bank-flood-protection-project

Development is the greatest threat to habitat restoration and enhancement. Development within both Sumner and Puyallup has, in many cases, encroached so close to the levee that any setback opportunity has either been lost or is so costly to be prohibitive. Further "infilling" will diminish restoration opportunities and at the same time increase dependency upon structural flood management alternatives.

Commencement Bay/Puyallup River Estuary

The Port of Tacoma is today the third largest commercial shipping terminus in the western U.S. Since 1880, a wide variety of activities associated with industrialization and commerce have affected the physical, chemical and biological functions of the Puyallup River estuary. The physical change involves the transformation of 5,700 acres of intertidal wetlands and mudflats into uplands suitable for commercial and industrial development. In 1982, the federal government ranked Commencement Bay amongst the most hazardous waste sites in the U. S. and portions of the area were officially designated as Superfund sites under CERCLA. The Commencement Bay/Nearshore Tide flats (CB/NT) was later added to the National Priorities List (NPL) after fish, shellfish and sediments were found to contain elevated levels of harmful substances.

Commencement Bay is surrounded by industrial, commercial and residential development and is one of the most highly modified and stressed estuaries in Puget Sound (Shreffler et al. 1992). The Tacoma Pierce County Health Department has identified approximately 480 point and non-point sources that discharge into Commencement Bay (Rogers et al. 1983). The first step in cleanup actions involves source control. The industries that have contributed to this dubious distinction include, shipbuilding, coal gasification, petroleum storage and refining, ore handling and smelting, wood products storage, burning, and manufacturing, including Kraft pulp bleaching, chemical storage and manufacturing, solvent processing and many others. The chemical and biological impacts associated with industrial process contamination have proven the most difficult and costly to assess.

After numerous years of study, natural resource managers are just beginning to understand the full extent of contamination. Although some sites have been remediated, cleanup in many areas is still years away. Research related to fish health and/or injury resulting from contamination is far from conclusive. However, work by Varanasi et al. (1993) indicates juvenile Chinook are susceptible to PCB uptake in polluted estuaries. Furthermore, this contamination has been linked to suppression of the immuno-response system in these fish. Ongoing research is being conducted concerning impacts of contamination of Tidal and Nearshore habitats on Chinook salmon.

Restoration planning of the CB/NT area is the responsibility of the Natural Resource Damage Trustees. This group includes the NOAA, USFWS, DOE, DNR, WDFW, and the Puyallup and Muckleshoot

Tribes. The Trustees are charged with restoring injured natural resources. The approach they will use is outlined in the Commencement Bay Restoration Plan and Final Programmatic Environmental Impact Statement (1997). Because of the dramatic loss of intertidal wetland and salt marsh habitat during the last 120+ years, restoration planning and CB/NT mitigation projects will require the conversion of subtidal or upland habitat into intertidal habitat. As result of settlement agreements with the Port of Tacoma; several habitat restoration and preservation efforts along the Hylebos watershed/waterway and Commencement Bay have been completed. The restoration of this waterway provides potential environmental, cultural and economic benefits.

Sewage Treatment Facilities (Waste Water Treatment)

At the present time there are six wastewater treatment plants (WWTP) which discharge directly to the Puyallup and Carbon rivers. These are Carbonado, Wilkeson, South Prairie, Orting, Sumner, and Puyallup.

The outfall from the City of Tacoma's WWTP was moved from the Puyallup River to Commencement Bay in 1990. That outfall extends 1200-feet offshore and discharges 38 MGD at a depth of 150-feet. Most of the existing WWTP's provide secondary treatment. Both Puyallup and Orting plants were expanded to provide both increased capacity as well as advanced treatment. The Wilkeson plant and South Prairie plant are undersized for current capacity. The City of Sumner WWTP has a permitted capacity of 2.62 MGD. Sumner employs chlorine disinfection and sulfur dioxide dechlorination. The actual outfall diffuser is located on the White River 0.4 mile upstream of the confluence with the Puyallup River.

Pierce County is presently evaluating its sewer system within the context of a programmatic EIS. This is being done as part of Comprehensive Plan requirements to prepare and update a long-range service plan. The concepts under review include centralized treatment where all potential sewer service areas will route to the Chambers Creek Regional WWTP. This concept differs from the current decentralized treatment that utilizes facilities based on watershed or sub-watershed proximity and maximizes gravity flow. One of the major concerns with this alternative relates to instream flow loss resulting from the transfer of water out of basin. Storm water in upper Leach Creek has been pumped out of basin and discharged into city waterway since the late 60's. Given low instream summer/fall flows, this practice should be discontinued. All of the alternatives under consideration have controversial impacts as does the no-action alternative. Defining the impacts of increased wastewater discharge on fisheries, fish habitat, and the state's antidegradation policy for groundwater are significant and complex matters. Although these issues apply to both centralized and decentralized systems, fisheries impacts are probably greater with a decentralized system because of required plant capacity increases necessary to accommodate future growth.

Upper Puyallup River

The Upper Puyallup Basin had been void of anadromous fish between the construction of the Electron Dam in 1904 and the completion of the 215 foot roughened channel fish ladder in 2000. The Electron Hydro-project *(formally Puget Sound Energy)* involves a water diversion structure located at RM 41.7, 10.1 miles of flume, a forebay for sediment removal, power generation station and transmission equipment. The project operates under a 400-cfs water right but typical operating flows utilize about 350-cfs withdrawal. In 1997 the Puyallup Tribe entered into a Resource Enhancement Agreement (REA) with Puget Sound Energy, the project owner/operator, to begin fisheries restoration efforts within the project affected area. The REA includes provisions for the maintenance of minimum instream flows within the project bypass *(a 10.1-mile reach of the Puyallup River formerly subject to withdrawal of all water save for tributary inflow).* The Electron project was sold and ownership transferred to Electron Hydro LLC in the fall of 2014; however, the project continues to operate under the REA agreement since no sale or transfer agreement was made with the Puyallup Tribe. PSE canceled its power purchase agreement with Electron Hydro in November, 2020. How this will affect future operations of this project is unclear.

Excellent fish habitat exists throughout the Upper Puyallup Watershed, including the riverine environments located upstream of Electron Hydro's diversion structure *(RM 41.7)*. Adult Chinook were reintroduced to the Upper Puyallup River in 1999. Surplus Chinook from the WDFW Voights Creek Hatchery were trucked and released at three different locations to maximize disbursement. Subsequent spawning redds surveys revealed excellent results. Additional adult Chinook plants have been made annually when surplus fish were available. Low spring flows in 2015 provided a rare opportunity to survey habitat upstream of the Electron diversion. Several steelhead redds were documented on the North Fork and mainstem Puyallup River, Mowich River, and Rushingwater Creek. The REA also provided for construction and operation of rearing ponds for coho and Chinook supplementation. The fish production potential of the upper Puyallup is unknown. The ladder is designed to operate with at least 40-cfs and incorporates a modified weir and rock design. The REA also provides for minimum instream flows which were not previously required despite established state law. Under the REA, Electron Hydro will provide 60-cfs year-round in the bypass reach. This will increases to 80-cfs during the four-month period from July-15 and November-15 to facilitate adult salmon migrating upstream. Water spilled at the dam in conjunction with tributary and spring flow accretion will provide sufficient flow for upstream passage.

Completion of the fish ladder was the centerpiece of the REA. Viable fish habitat must be accessible to realize full production potential. The absence of anadromous fish above Electron Dam prior to 2000 has in all likelihood biased the scrutiny and regulatory oversight of past land use, forest practice and road construction/maintenance actions. The bulk of the Forest Service ownership is contiguous with the Mount Rainier National Park and located on the east headwaters. Primary tributaries to the upper Puyallup include: Niesson Creek, Kellogg Creek, LeDout Creek, Swift Creek, Deer Creek, Mowich River and the North Fork Puyallup River. In addition, numerous small-unnamed wall base channels parallel the Puyallup River and provide prime rearing habitat. Because of the large basin size (110,080 acres) and the quality of habitat available, recovery efforts are a high priority for the Tribe.

Carbon River

The Carbon River flows 33 miles before reaching the Puyallup River near the City of Orting and has a mean annual flow of 664-cfs. The Carbon supports all five species of salmon as well as steelhead/rainbow, cutthroat and bull trout. Approximately 66,000-acres are in federal ownership, including National Park designation. The upper 12 miles of the Carbon River in the vicinity of Carbonado and Fairfax are deeply incised in a bedrock gorge which restricts human access. A number of small tributaries enter in this reach but plunge vertically into the river and hence, are not fish bearing. The lower 8.5 miles of the river are artificially confined with a network of levees built and maintained by Pierce County for flood control purposes. This reach of the Carbon also supports a number of naturally spawning Chinook, chum, and steelhead. Productive habitat is severely limited due to confinement between levees and levee/culvert blockages of wall base channels.

South Prairie Creek

South Prairie Creek has long been considered the heart of the Puyallup River fisheries resource. Although returns have declined over the past several decades, it remains one of the top salmon and steelhead producers in the Puyallup/White River system. No other stream in the Puyallup/White basin, with the exception of Boise Creek on the White River, is as productive in terms of both spawning density *(number of spawners per mile)* and total escapement. The 15.4-miles of anadromous habitat in South

Prairie Creek support more Chinook, pink, coho, chum and steelhead than the entire 68 miles of the mainstem Puyallup River. South Prairie is also provides critically important bull trout habitat. Resource protection within this drainage is therefore paramount. Land use policy, increasing development and water allocation are three issues that will play a critical role in the long-term viability of this unique and vital drainage. South Prairie Creek was placed on the state 303-(d) list in 1997 for water temperature excursions. This is alarming particularly because the causal mechanism is not evident. South Prairie Creek flows westward within a steep valley and is bordered by a relatively healthy RMZ throughout much of its course. The fact that the excursion was measured on private timberlands is all the more mysterious. Perhaps ambient water temperatures are naturally warm in this system. Further monitoring will hopefully help edify this enigma.

Lower Puyallup River

Two primary landform processes are responsible for the current configuration of the Puyallup River valley; glaciation and deposition of alluvial materials. The valley is bordered by uplands made up of unstratified till deposits that were carried by moving ice. They consist of clay, sand and gravel and boulders. Tills are generally stable and well compacted from the weight of glacial ice they once supported. The valley walls often lack the same compaction and consist primarily of sand and gravel. This material is open and loose. This geological makeup makes them prime candidates for aggregate materials commonly used for Portland cement and structural fill. This high demand resource explains the proliferation of gravel mines in such areas. The primary component of the floodplain is alluvial deposits from streams and rivers. This material is made up of fine sand, silt and clay. These are the nutrient rich soils that brought agricultural fame to the Puyallup valley. Prior to flood control projects, alluvial materials were deposited on the valley floor during seasonal flood events.

The "Limiting Factors Analysis" for the Puyallup River Basin completed by the Washington State Conservation Commission (WCC 1999) found the lower section of the Puyallup River to function primarily as a transportation corridor having lost most of its riparian habitat, spawning habitat, and rearing habitat. Tidal influence can extend upstream to approximately RM 6.0. The salinity halocline has been observed as far upstream as Interstate 5 (WDOT). Solutions to today's absence of estuarine habitat focus on introducing historical processes, functions and conditions where possible. Although the Commencement Bay tide-flats area may never again resemble pre-European settlement conditions, many opportunities remain to improve upon current conditions. In the fall of 2008, the Puyallup Tribe completed construction of one of its most prevalent watershed restoration projects to date. The Sha Dadx *(Frank Albert Road)* wetland restoration project is located on the lower Puyallup River *(see Habitat Restoration section in this report).*

Flood Control History

The flood control history described in the White River Spring Chinook Recovery Plan also applies to much of the Puyallup and Carbon rivers. Essentially, flood control was achieved through a combination of practices such as dredging, straightening, revetment and levee construction. The most intensive application of these methods was directed toward the lower Puyallup River from the confluence of the White River to Commencement Bay. In this 10.4-mile stretch, the river is channeled and constrained within a concrete trapezoidal revetment. This effort was initiated by a legislative Act in 1913 which created the Inter-County River Improvement District. This entity was a joint King and Pierce County entity was established to address flooding problems that primarily originated on the White River but which have the greatest impact on the lower Puyallup River.

The bulk of the gravel mining had traditionally taken place in the vicinity of Orting both on the Carbon and Puyallup rivers. Both rivers are tightly confined by levees, which further fuels the perceived need for gravel removal. When a gravel bar is deposited after high flow events, the obvious perception is that it is blocking the channel and must be removed. Many local residents believe gravel mining is an essential component of flood prevention. Public visibility has been an important factor in siting gravel removal operations. The problem with this is that we are recruiting and familiarizing more and more people to the practice who will likely acquire the sentiment that gravel extraction is necessary for flood safety. Gravel removal operations have ceased since the ESA listing of Chinook. Surprisingly, there is little if any scientific data that supports gravel removal as a viable means of flood protection. On the other hand, if residents understood the fact that the flood carrying capacity of the Carbon and Puyallup rivers is less than the 100-year flood at numerous locations (Prych 1988) then they might acknowledge the need for additional land acquisitions and/or setback levee construction. They might also be less willing to purchase homes located in close proximity to the floodway.

The annual volume of gravel material removed from the Puyallup and Carbon rivers has not been well documented. However, most recently, HPA data reveal a trend toward diminishing volumes. Part of this relates to increased concerns about impacts to fish habitat and related difficulties in permitting. Pierce County Water Programs *(formerly River Improvement)* targets gravel removal sites in proximity to public facilities. Bridges and levees that are prone to material buildup *(aggradation)* are typically at the top of the list for gravel removal. The Department of Natural Resources had the option of charging royalties on aggregate materials mined from waters of the state. The term waters of the state apply to navigable waters which have been determined to be the Puyallup River downstream of the confluence with the Carbon River (RM 17.3). Ideally, mining royalties could be collected and applied to WRIA based mitigation, enhancement and/or land acquisition programs.

On the Puyallup River upstream of Orting, RM 21-25, Pierce County has emphasized property acquisition in lieu of costly maintenance repairs and reconstruction. For additional information on the Pierce County Land Acquisition Program, go to: https://www.co.pierce.wa.us/1600/Property-Acquisition-Program. This approach was taken to reduce maintenance expenditures associated with repetitive losses of high-risk levee facilities. In 1997 a 2-mile long setback levee was constructed on the right-bank of the Puyallup between RM 23 and 25. Over 123 acres of public land was added to the floodplain as part of the levee setback. The expanded floodplain will allow flood flow energy to dissipate over a greater area thereby reducing scour depth and providing greater channel stability. In 2006, a 6000 foot levee set-back was completed upstream of the Calistoga Bridge in the town of Orting. This new set-back added over 55 acres to the floodplain within this reach. Freedom from levee confines has permitted natural fluvial processes to reengage the surrounding landscape. Already significant and beneficial changes are apparent. The wooded bottom lands are being flooded, scoured and are forming a diverse floodplain providing characteristic physical and biological features and functions that have been absent since the levees were constructed over 50 years ago.

Property buyout and setback programs must be encouraged. Although expensive, this approach represents the best opportunity for reestablishing natural production. The levee setbacks should be considered only the first in a long list of habitat recovery projects. Additional restoration opportunities offering flood protection benefits are discussed in the Puyallup Tribes, Restoration Site Catalog (Ladley and Smith, 1999). However, there are many more sites that can be added to this list to provide significant habitat additions. Language governing take propose significant restrictions to current land use policies. For example, the recognition of channel migration zone (CMZ) will be a key element within the evolving

ESA § 4(d) rule now being packaged by the Tri-County governments. It is possible that levee repairs in repetitive loss locations may conflict with CMZ management principles currently under development. This issue is also pertinent to the NMFS concept of properly functioning conditions (PFC). Rule language in the Federal Register reads: properly functioning conditions is the sustained presence of natural habitat forming processes in a watershed (*e.g. riparian community succession, bedload transport, precipitation runoff pattern, channel migration*) that are necessary for the long term survival of the species through the full range of environmental variation. Gravel mining operations clearly affect three of the four italicized elements.

In 1997, at the request of the Puyallup Tribe, Pierce County formed an ad hoc committee on gravel mining. After the February 8, 1996 flood event, a renewed interest in flood protection and gravel removal arose. Pierce County went as far as to prepare a public bid package for the removal of 1-million cubic yards of gravel from the Puyallup River system. Fortunately, no action was taken. The committee addressed local demand for riverine aggregate materials while at the same time recognized the need to protect fish and their habitat. The group was instrumental in approving gravel removal proposals and for the first time used current spawning survey data to minimize adverse impacts to significant spawning habitat. Vegetation management is another important component of flood management in the Puyallup River, particularly on levees and/ or revetment. For over 65 years vegetation was actively managed to limit size and distribution. The general theory follows that any vegetation that covers revetments may hide obvious signs of structural weakness or potential problems. Root structures from trees were also perceived as a threat to levee integrity. Root balls torn out by flooding or high wind may expose the underlying levee fill material. Without the armor layer to provide protection a levee can rapidly unravel and is susceptible to catastrophic failure.

The Puyallup Tribe has entered in to a levee vegetation management agreement with both Pierce County and the Corps of Engineers. The Corps has flood facility jurisdiction on the lower Puyallup River from RM 3.0 to the mouth. Pierce County has jurisdiction upstream of RM 3.0 to RM 8.26 on the Carbon and to RM 27 on the Puyallup. These agreements were designed to reform levee management practices and reduce habitat injury associated with levee maintenance. The agreements specify where and what vegetation is permissible both on and/or near revetment structures. The arrangement provides for both structural inspection needs and a modicum of fisheries habitat requirements. Since the agreements were adopted, levee vegetation has flourished. Although riparian conditions are still far from ideal, the existing vegetation does provide an important shading function.

<u>Salmonid Escapement Monitoring and Evaluation Program</u>

Project Description

The project involves rigorous watershed monitoring and evaluation efforts to determine the status, trends, responses and uses by various life history stages of ESA listed Chinook and winter steelhead; as well as non-listed coho, pink, sockeye and chum salmon within the Puyallup/White River Watershed *(Puget Sound ESU).* Project elements include: monitoring and evaluating adult and juvenile escapements and survival; migration; distribution; habitat utilization; as well as, monitoring and assessing effects of in-river harvest management actions. The monitoring program is an <u>ongoing annual effort</u> supported through several funding sources. Monitoring and evaluation efforts involve extensive spawning ground escapement surveys for salmon and steelhead; escapement monitoring and biological sampling of adult Chinook, steelhead, and bull trout upstream migrants captured in the U.S. Army Corps of Engineers' *(USACE)* FPF on the White River; adult and juvenile salmonid migrant and mortality monitoring at the Electron hydropower project forebay fish collection facility *(when operating/generating)*; juvenile salmonid escapement by the use of a rotary screw trap operated on the Puyallup and White Rivers *(Puyallup Tribe)*; examination of significant fisheries impact related projects that arise; continuous monitoring of the watershed for deleterious habitat, water quality and hydraulic violation issues affecting salmonids; as well as surveying and sampling habitat restoration sites for salmonid utilization.

Goals, Tasks and Expected Benefits

Recovery and sustainability of ESA listed Spring/Fall Chinook, and winter steelhead stocks; as well as non-listed coho, pink, chum and sockeye. The RM&E project is vital for constructing informative and adaptive management decisions leading to effective actions in support of maintaining and improving fisheries stocks for implementation of tribal treaty and subsistence fishing rights. The monitoring and evaluation project is a high priority for the Puyallup Tribe and is vital towards assessing the status and trends of Natural Origin Recruits (NORs) and hatchery salmonids and their environments; as well as, investigating factors affecting salmonid population viability and providing information essential for resolving existing and potential habitat, water quality and hydraulic violation issues through corrective and/or mitigatory actions. The following project tasks/objectives *(following page)* addresses and supports the needs presented in the WDFW, Puyallup and Muckleshoot Tribes Recovery Plan for White River Spring Chinook Salmon[1]; WDFW's Statewide Steelhead Management Plan: Statewide Policies, Strategies, and Action[2]; the National Marine Fisheries Service Recovery Plan for the Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha*)[3] and the National Marine Fisheries Service Puget Sound Salmon Recovery Plan - Volume 1[4].

[1]Washington Department of Fish and Wildlife, Puyallup Indian Tribe and Muckleshoot Indian Tribe. 1996. Recovery Plan for White River Spring Chinook Salmon. WDFW, Olympia WA.

[2]Washington Department of Fish and Wildlife. 2008. *Statewide Steelhead Management Plan*: *Statewide Policies, Strategies, and Action*. WDFW, Olympia WA.

[3]National Marine Fisheries Service. 2006. Recovery Plan for the Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha*). National Marine Fisheries Service, Northwest Region. Seattle, WA.

[4]National Marine Fisheries Service. 2007. Puget Sound Salmon Recovery Plan - Volume 1. Plan adopted by the National Marine Fisheries Service (NMFS) and Submitted by the Shared Strategy Development Committee. Seattle, WA.

Monitoring and Evaluation Program Tasks/Objectives, Deliverables and Expected Benefits	
Species: Pacific salmon, steel-head and bull trout	➢ Winter Steelhead *(Oncorhynchus mykiss)* ➢ Fall Chum *(Oncorhynchus keta)* ➢ Spring & Fall Chinook *(Oncorhynchus tshawytscha)* ➢ Coho *(Oncorhynchus kisutch)* ➢ Pink Salmon *(Oncorhynchus gorbuscha)* ➢ Sockeye Salmon *(Oncorhynchus nerka)* ➢ Bull Trout *(Salvelinus confluentus)*
Species Federal ESA listed status.	➢ Steelhead (Winter): **Threatened** ➢ Chum Salmon (Fall & Winter): **Non-Listed** ➢ Chinook Salmon (Spring & Fall): **Threatened** ➢ Coho Salmon (Fall): **Non-Listed** ➢ Pink Salmon: **Non-Listed** ➢ Sockeye Salmon: **Non-Listed** ➢ Bull Trout: **Threatened**
Tasks/Objectives that will be achieved by the project.	➢ Determine spatial and temporal distribution, annual escapement and composite of NORs and hatchery origin Spring/Fall Chinook and coho spawners. ➢ Determine spatial and temporal distribution, and annual escapement of adult steelhead. ➢ Estimate annual Puyallup River escapement for juvenile Spring/Fall Chinook, coho, steelhead, chum and pink salmon. ➢ Assess the status of ESA threatened Puget Sound Spring/Fall Chinook and Steelhead, to determine if current recovery actions are working. ➢ Monitor ecological interactions. ➢ Monitor genetic stock compositions of Chinook and steelhead. ➢ Estimate fry/smolt survival and run forecasts. ➢ Develop and institute harvest management plans for the Puyallup Tribe's commercial, subsistence and ceremonial in-river fisheries actions provided under treaty rights. ➢ Support federal, state and tribal managers in their development and establishment of harvest management actions for commercial and sport fisheries. ➢ Monitor escapement of ESA listed Chinook and steelhead; as well as non-listed coho entrained in Electron Hydro LLC's Hydropower Project on the Puyallup River. ➢ Ascertain escapement of ESA listed Chinook and steelhead through the U.S. Army Corps of Engineers' (USACE) adult Fish Passage Facility (FPF) on the White River. ➢ Determine salmonid utilization within site specific habitat restorations sites. ➢ Identify deleterious habitat, water quality, and hydraulic violation issues affecting salmonids or salmon ecology.

Tasks/Objectives that will be achieved by the project (Continued).	➢ Provide Coded-Wire Tags *(CWT)* collected from Chinook and coho for inclusion in the RMIS database. ➢ Exchange and communicate pertinent data and information with watershed co-managers and regulating agencies.
Time period tasks occurred:	➢ August 2022-to-October 2023.
Deliverables that will be produced by completing tasks/objectives.	➢ Conduct comprehensive monitoring of native anadromous salmonids which is essential for exercising tribal-treaty fishing and native subsistence fishing rights; as well as, the regulation of non-tribal harvest management actions affecting ESA listed and non-listed salmonids. ➢ Provide future tribal harvest opportunities. ➢ Provide extensive and statistically rigorous data and information on the status and trends of ESA listed and non-listed salmonids within the Puyallup/White River Watershed. ➢ Provide data addressing factors significant to natural events or human activities that impact the viability and ecology of anadromous salmonids. ➢ Disseminate monitoring and evaluation program discoveries to resource managers. ➢ Compile comprehensive annual report on the final project(s) findings.
Species benefits that will be achieved.	➢ Develop adaptive management plans resulting in effective enhancement, and protection of ESA listed (Chinook & steelhead) and non-listed salmonids present in the Puyallup/White River Watershed. ➢ Provide account of genetic makeup of Chinook and steelhead present in the Puyallup/White River basin to distinguish and preserve genetic diversity and gene flow among local populations. ➢ Protection and maintenance of pacific salmon and steelhead habitat may benefit other ESA listed salmonid species including bull trout. ➢ Recommendation of potential restoration or recovery projects, including additional research, assessment or monitoring needs. ➢ Protection and maintenance of existing salmonid occupied habitats. ➢ Monitoring of additional salmonid local populations. ➢ Comprehensive index of spawning reaches necessary for monitoring reproductive salmonid abundance and productivity trends. ➢ Formulate and institute plans to insure that operations can be adaptively managed to optimize hatchery and natural production, sustain harvest, and minimize ecological impacts. ➢ Provide statistically analyzable data to establish relationship between adult and juvenile escapements and subsequent smolt production. ➢ Resolve existing or potential habitat, water quality and hydraulic violation issues through corrective and/or mitigatory actions.

The Washington Department of Fish and Wildlife regularly conducts surveys on several key *(index)* drainages, including the Clearwater River and Wilkeson Creek for steelhead; as well as South Prairie Creek for Chinook and steelhead. Precise escapement for the upper White River drainage is known, given that all adult salmon and steelhead that spawn in the upper White are first captured in the USACE's FPF, then transported and released above Mud Mountain Dam *(MMD @ RM 29.6)*. Therefore, surveys conducted on the upper White River are done primarily to determine fish distribution and spawning success. Adult spawning data is especially important regarding Spring Chinook, since adult production monitoring is an integral part of the White River Spring Chinook Recovery Plan.

Fall and early winter river conditions are often marked by extremely low, turbid flows. Early in the Chinook run, flows in the main stem river side channels and tributaries are often too low to allow fish access to these key spawning habitat areas. The resulting focus by Chinook on mainstem spawning is therefore extremely difficult to document due to highly turbid conditions in the Puyallup, White, and Carbon Rivers. Low water visibility during the spring often affects the late steelhead surveys in the mainstem rivers as well. Most of this report summarizes spawning ground data gathered from August through June of each spawning season. Chinook *(pink in odd years)* surveys commence in mid-to-late-August and continue through the first week of November, with peak spawning occurring around the later part of September into early October. The window for bull trout reproduction is quit brief; with the majority of spawning taking place during September and continuing into early October. Coho are observed on the spawning grounds the mid-part of September through late December, peaking around the end of October through the first part of November *(upper South Prairie Creek experiences a late run into February/March)*. Chum spawn as early as the end of October *(Fennel Creek)*, continuing through the first half of February, hitting their spawning peak in mid-to-late December. Steelhead *(winter run)* surveys begin in mid-March and conclude in mid-June. However, do to the occurrence of both summer and winter steelhead, adult steelhead are often present in the Puyallup/White River Watershed year round. Most streams are surveyed by foot, with the exception of the Puyallup, White and Carbon Rivers, as well as South Prairie Creek, which are floated by raft. Peak spawning in the upper watershed occurs in late April to early May; while peak spawning in the lower river system occurs mid-to-late May.

Data collected for all species during spawning surveys include the number of live and dead fish observed throughout the survey reach. With respect to Chinook, steelhead, and bull trout; the number and locations of redds are also documented. Redds are marked with flagging, and the redd locations are collected using a hand held GPS unit. Maps are generated from the GPS data collected, showing the redd locations for Chinook *(even years)*, bull trout, and steelhead *(Appendix C)*. Significant carcass sampling is conducted for adult Chinook and coho throughout the watershed. Carcasses are examined for fin clips *("marked fish" removal of adipose or left/right ventral fin--see Appendix H)* and checked for coded wire tags *(CWT's)* with a metal detecting wand. Chinook carcasses with a left or right ventral clip are White River Spring Chinook from acclimation ponds located above Mud Mountain Dam. Carcasses with an adipose clip or a combination adipose clip, and CWT, are hatchery origin Fall Chinook. Adult coho carcasses are examined for adipose clips and CWT's. Coho carcasses with no marks or CWT's are considered wild, whereas coho with a missing adipose, and/or CWT's, are considered hatchery origin fish. The snouts are removed from carcasses with detectable CWT's, labeled, and then forwarded to the WDFW for identification and entry into the Regional Mark Processing Center's RMIS database accessible at: http://www.rmpc.org/.

Puyallup Tribal Fisheries has worked to improve collection of fish and habitat data upstream of the Electron diversion; however, a void continues to exist regarding bull trout and other salmonid species distribution and utilization within the Upper Puyallup *(above Electron Diversion @RM 41.7)*. Identifying and assessing the tributary and mainstem habitat available along more than 26 miles of the Upper Puyallup River Basin supporting bull trout, Chinook, coho, and steelhead will provide an invaluable foundation for future conservation, restoration, land acquisition, and recovery actions. Evaluating physical and biological data collected on salmonids in the Upper Puyallup will assist in differentiating genetic diversity among basin populations and aid in recovery planning and implementation. However, such extensive undertakings require additional funding to accomplish. Yet, continuing efforts are being made by the Puyallup Tribe to increase and expand the survey coverage area in order to improve escapement estimates. Improved effort is especially needed in expanding bull trout and steelhead survey areas.

To date, only modest effort has been applied toward surveying the habitat above the Electron diversion dam on the Puyallup River, as well as the mainstem White above Mud Mountain Dam, or the habitat above the upper Carbon River Gorge. Through spawning survey observations and data collected from adult and juvenile fish caught in the Electron forebay; it is know that Chinook, coho, steelhead and bull trout are accessing and spawning in the upper reach of the Puyallup, as well as the Mowich River. Unfortunately, limited data has been collected on escapement and spawning distribution of fish in the upper Puyallup River basin.

Adult Salmon and Steelhead Escapement Estimates

It is important to note that the numbers of live fish observed and represented in the graphs are an accumulation of all fish seen throughout the survey season. The total number of live fish observed does not depict the actual estimated escapement which is derived through either statistical analysis (AUC method) or by expanding the number of redds observed by a pre-established number of fish per redd. The area-under-the-curve method used for most of the salmon escapement estimates is the trapezoidal approximation (English et al. 1992, Bue et al. 1998).

Currently, adult Chinook escapement during non-pink years is typically determined by expanding the number of redds observed by 2.5 fish per redd (Smith and Castle, 1994). Due to the tremendous volume of pink salmon during odd years, the success of determining Chinook redds from pinks is vastly reduced. Therefore, the Area Under the Curve (AUC) method is used to determine escapement during pink runs. At present, the Puyallup Tribal Fisheries Department and WDFW determine steelhead escapement based on redd counts. Since the mid 1980's, state biologists have derived steelhead escapement from data obtained through WDFW's *(formally Washington Department of Game)* Snow Creek Research Project (Freymond and Foley 1985). Researchers placed a weir on Snow Creek, and over several years were able to count the number of steelhead passed above, as well as the number of redds produced by spawners. A final factor of 0.81 females per redd was calculated. Furthermore, a ratio of 1 male to 1 female is used when no sex ratio is known; which is the case throughout the Puyallup/White River system. Therefore, to determine the total escapement for steelhead, each redd is typically multiplied by a factor of 1.62 *(i.e. 42 redds x 1.62 steelhead per redd = total escapement of 68 steelhead)*. Additional biological expansion factors are applied to some rivers and streams to estimate escapement for suitable habitat reaches that are often unsurveyable *(i.e. South Prairie Cr. & Carbon River)*. This system; however, is not applied to steelhead redds observed in the upper White River drainage. Accurate escapement numbers for the upper White River drainage are derived from the USACE trap counts. Adult salmon and steelhead that spawn in the upper White are first captured in the U.S. Army Corps of Engineers' FPF, then transported and released above Mud Mountain Dam. Therefore, surveys conducted on the upper White River are done primarily to determine fish distribution and spawning success.

Juvenile Salmon and Steelhead Production Estimation

The Puyallup Tribe began monitoring marine-migrating salmonids *(smolts)* on the lower Puyallup River *(RM 10.6)* in 2000, and the White River *(RM 3.6)* in 2016. The principal objectives of the Puyallup and White Rivers Juvenile Salmonid Production Assessment Projects are to obtain juvenile production estimates, run-timing, survival; as well as growth and species composition indices on Chinook, coho, chum, pink and steelhead out-migrants *(wild and hatchery for Chinook, coho, and steelhead)*. Fisheries managers can correlate these indices with the estimated adult escapements obtained through spawning surveys to produce juvenile survival rates, along with forecasting future adult returns. The "smolt trapping" mechanism utilized on both traps is an E.G. Solutions' 8-foot diameter rotary screw mounted on two 40-foot pontoon floats *(see Puyallup and White Rivers Juvenile Salmonid Production Assessment Project sections in this report)*. Depending on budget and river conditions, the traps are generally operated on a continuous basis from February/March-through-August/September. To obtain copies of report findings, contact the Puyallup Tribal Fisheries Department.

Salmon Production

There are six salmon hatchery facilities; as well as seven acclimation ponds and net-pens located within the Puyallup/White River Watershed. These facilities are operated by the Puyallup Tribe *(3 facilities + 6 acclimation ponds)*, WDFW *(2 facilities)*, Muckleshoot Indian Tribe *(1 facility)*. Collectively, the hatcheries produce and/or rear; Spring and Fall Chinook, coho and chum *(see Appendix D for data)*.

Spring Chinook

Currently, there are two White River Spring Chinook programs in operation; the Muckleshoot Indian Tribe's hatchery on the White River and WDFW's Minter Creek *(located outside of the watershed)*. Due to the success of the White River Spring Chinook Program, the Minter Creek Program is going to be phased out. All fish produced at Minter will be transferred and reared at Puyallup Trout then marked by WDFW and transferred to the White River acclimation ponds. Currently, there is a moratorium on transferring fish from Minter Creek Hatchery because of an IHN detection in the 2016 broodstock. The phasing out of the program will commence in 2020 unless there is another detection of a regulated pathogen. The MIT White River hatchery currently releases approximately 500,000 *(on station)* 100% marked 0-age Spring Chinook. Since 2013, approximately 800K Spring Chinook from the White River hatchery have been reared and marked at WDFW's Clarks Creek Puyallup Trout hatchery *(transferred as eyed eggs)*. Juveniles are later transported by PTF to acclimation ponds within the White River Basin.

Fall Chinook

Two Fall Chinook hatchery facilities currently operate in the Puyallup Basin. In 2004, the Puyallup Tribal Fisheries Department began acclimating and releasing Fall Chinook from the Clarks Creek salmon hatchery facility, thereby discontinuing all Chinook releases from the Diru Creek hatchery. The incubation building at Clarks houses 32 incubator stack; with each stack capable of holding up to 77,000 Chinook eggs. This provides for a total capacity of approximately 2.5 million eggs. The Tribe's Clarks Creek hatchery has released between 163,880-to-1,538,977 zero-aged Fall Chinook annually since 2004 *(see Clarks Creek salmon hatchery section in this report)*.

The Tribe's Clarks Creek hatchery facility was constructed in order to address several fish management, and water supply issues which included minimizing the straying of adult Fall Chinook reared by the Tribe; providing additional space for rearing and acclimating White River Spring Chinook and chum; creating an independent and self-sustaining Fall and Spring Chinook program for the Tribe; as well as, providing a reliable water supply to rear and expand fish production. The Puyallup Tribe's acclimation facility *(opera-*

tional since 2018) located on Wilkeson Creek *(tributary to South Prairie Creek→Carbon River)* will rear and release up to 200K Fall Chinook, which are transferred from the Clarks Creek hatchery as juveniles.

WDFW operates a Fall Chinook facility at RM 0.5 on Voights Creek, a tributary to the Carbon River. The current facility, which replaced the old flood prone facility, began operations in 2015. The current hatchery facility rears Fall Chinook and coho *(Chinook propagation initiated circa 1917 from local and lower Columbia River stocks).* Current Chinook productions stands at approximately 1.6 million, of which approximately 400K are transferred to the Puyallup Tribe's Clarks Creek hatchery as eyed eggs. For more information on Voight Creek hatchery escapements, go to: https://wdfw.wa.gov/hatcheries/escapement/

Coho

Three terminal hatchery facilities currently rear and release coho. WDFW has artificially propagated coho on Voights Creek since 1917, having in the past incorporated fry and smolts from other drainages including Big Soos Creek, Minter Creek, Garrison Springs, George Adams Creek; as well as, the Skagit and Washougal rivers. In 2015, the current Voights Creek hatchery facility replaced the old flood prone complex. Voights Creek currently produces approximately 1.2 million, 100% mass marked *(adipose fin clip)* coho pre-smolts annually; of which, 100K are customarily transferred to acclimation ponds in the upper Puyallup Watershed when available, and an additional 300K *(as eyed eggs)* are transferred to WDFW's Puyallup Trout hatchery on Clarks Creek *(program initiated in 2015).* Starting in 2016, the Puyallup Tribe began producing up to 100,000 mass marked coho at its Clarks Creek hatchery facility. The coho yearlings are destined for the tribe's net-pen enhancement program located on Lake Kapowsin *(re-initiated during winter of 2019).* The Kapowsin net-pen program was initially conducted from 1995-1997 with tremendous success.

Chum

The Puyallup Tribe currently raises up to 3.3 million winter chum smolts for release into the lower Puyallup River from the Diru Creek hatchery facility located in the City of Puyallup *(1,000-to-5,700 fish pounds annually based on available brood stock returns to Diru Creek hatchery).* The program was started in 1991 and has become self-sustaining *(see Diru Creek Hatchery section in this report and Appendix D for juvenile fish released).* This program significantly augments a tribal in-river fishery and All Citizen purse seine fishery in East and West Pass in Puget Sound. This stock originated initially from Chambers Creek.

Steelhead (This program was discontinued in 2022 due to insufficient brood-stock availability.)

In 2006, the Puyallup Tribe, in partnership with WDFW and the Muckleshoot Tribe, began artificially propagating White River winter steelhead. Rearing young steelhead is an integral part of the White River winter steelhead pilot project, a program designed to increase winter steelhead escapement in the White River. Since January of 2014, the Puyallup Tribe has assumed all responsibility for continuing this important enhancement effort. Steelhead brood-stock collected from the White River USACE's FPF in Buckley are currently held, spawned, incubated, and reared at the Puyallup Tribe's Diru Creek hatchery for a year. After rearing for a year and fish are of size *(approximately 11 to 17 fish-per-pound/average size of 150mm)*, the pre-smolts are currently transported to one of the acclimation ponds located on the White River to imprint before being released *(Appendix D).* Due to poor steelhead returns/captures at the USACE's Fish Passage Facility during 2022, no adult steelhead broodstock were taken.

Salmon and Steelhead Acclimation Ponds

The Puyallup Tribe currently operates 6 salmon acclimation ponds in the watershed *(see image on pg. 49).* Acclimation ponds are an extension, or satellite rearing facility, operating outside of the traditional hatchery matrix. Acclimation ponds are a well-established method at increasing the quantity of harvestable fish; as well as, the number of adults returning successfully to the spawning grounds to reproduce naturally *(escapement)*.

White River Acclimation Ponds

Since 1994, the Puyallup Tribe has constructed and operated acclimation ponds to enhance White River Spring Chinook recovery by transferring juvenile Spring Chinook into acclimation ponds located in the upper reaches of the White River. Depending on availability, between 100,000-to-900,000+ Spring Chinook program fish are transported to the acclimation ponds in early spring, and volitionally released in late spring *(an approximately 3 month acclimation period)*. Spring Chinook are mass marked with left or right ventral fin clips before being planted in acclimation ponds. Odd brood years *(year the fish were collected & spawned)* are marked with left ventral fin clips *(see Appendix H)*, and even brood years with right ventral clips. These fish can later be immediately identified and aged when caught at the USACE's Fish Passage Facility *(FPF)* in Buckley, and then transported above Mud Mountain dam to spawn naturally.

The four functional acclimation ponds *(page 49 or Appendix D)* the Puyallup Tribe currently operates are satellite facilities to the White River Spring Chinook hatchery *(Muckleshoot Tribe),* and in the past (2014-2022), a pond was utilized as part of the White River winter steelhead recovery/enhancement program *(Puyallup Tribe)*. The acclimation ponds are located in the upper White River Watershed on the Clearwater River *(Jensen Creek)*; Huckleberry Creek; Greenwater River *(George Creek)* and Twentyeight Mile Creek *(Greenwater R.)*. Spring Chinook production levels for planting in the acclimation ponds fluctuates depending on the number of brood stock available and the survival of offspring through early development, but planting numbers average around 400,000+ pre-smolts annually.

Puyallup River Acclimation Ponds

The Puyallup Tribe operates two natural salmon acclimation ponds in the Upper Puyallup River Watershed; as well as a rearing/acclimation facility on Wilkeson Creek, and a net-pen project on Lake Kapowsin. Acclimation ponds are a proven method for increasing fish numbers on the spawning grounds. The acclimation ponds are used for enhancing Fall Chinook and coho throughout a 26+ mile reach of the Upper Puyallup River above the Electron Dam *(RM 41.7)*. Up to 100,000 *(reduced from 200K)* coho yearlings are acclimated *(imprinted)* and released from the Cowskull and Rushingwater ponds. Coho originate from WDFW's Voights Creek Hatchery where 100,000 juvenile coho are adipose clipped and coded wire tagged *(CWT)*. Fish are planted in late winter and released at the end of May. In the summer of 2022, the Cow Skull (right) and Rushingwater ponds were re-engineered to bring them up to modern design specification. The new ponds are scheduled to be completed in late 2023, and will have increased fish capacity and predator prevention.


The new Cow Skull acclimation pond (2023).

Wilkeson Creek Acclimation Ponds

The Wilkeson Creek salmon hatchery is a Puyallup Tribe of Indians facility located at RM 2 on Wilkeson Creek *(10.0432)*, a tributary to South Prairie Creek. In its current operating state, the hatchery is utilized solely as a salmon rearing and acclimation site. Currently, specially tagged coho *(distinctive net-pen coded wire tags)* from The Puyallup Tribe's Clarks Creek hatchery are reared in net-pens located on Lake Kapowsin.

Salmon Enhancement and Recovery

Project Description

The Puyallup Tribe operates several acclimation ponds in the Puyallup/White River Watershed designed to reestablish and enhance Spring/Fall Chinook and coho stocks. Each of two acclimation ponds *(Cowskull & Rushingwater)* on the Puyallup River receive as many as 100K+ hatchery origin Spring/Fall Chinook and/or coho. Four additional acclimation ponds located in the Upper White River basin *(George Creek [Greenwater River], Huckleberry, Jensen, and Twentyeight Mile creeks)* can be planted collectively with up to 900K+ White River Spring Chinook. The pond located on Twentyeight Mile Creek *(Greenwater River)* was completed in the fall of 2015. The Jensen Creek pond *(Clearwater River*) was completed in the fall of 2012.

When obtainable, the Puyallup Tribe will collect, haul and plant surplus adult hatchery Fall Chinook and coho from WDFW's Voights Creek hatchery *(Carbon River)* to spawn naturally in minor spawning or underutilized areas in the upper Puyallup River basin. Also when available, the Puyallup Tribe will in-stream plant juvenile hatchery Fall Chinook and chum from the Tribe's Clarks and Diru Creek hatchery facilities to underutilized habitat areas.

Goals

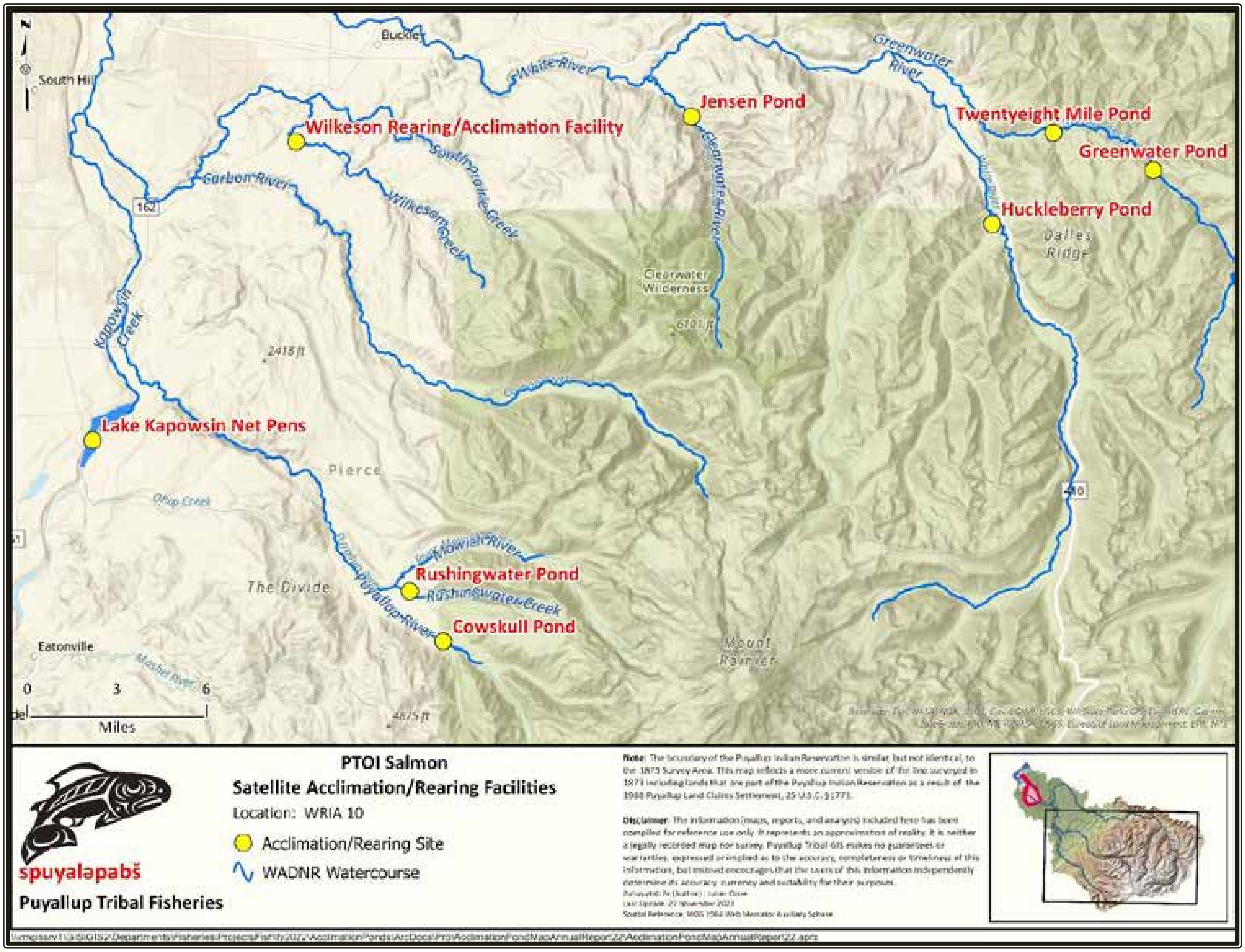
One of the Puyallup Tribe's most significant restoration goals is to rebuild depressed Chinook stocks, ultimately leading to their removal from ESA listing. Acclimation ponds, juvenile in-stream plants and adult surplus fish plants are a proven method for increasing fish stocks, and are key component to restoration goals. Using acclimation ponds, limiting harvest, and creating substantial gains in habitat restoration, the Tribe will be able to accomplish restoration and recovery goals.

Purpose

- Produce Spring/Fall Chinook and coho for the Puyallup/White River salmon conservation and harvest programs.
- Establish a total annual return of Spring Chinook Natural Origin Recruits (NORs) that meets/exceeds the escapement goals for White River Spring Chinook recovery.
- Provide sustainable harvest for tribal and non-tribal fisheries on Fall Chinook and non ESA listed coho.
- Optimize hatchery/natural production consistent with conservation of naturally produced native fish.
- Maintain genetic makeup of Chinook and steelhead populations spawned or reared in captivity.

Benefits

- ➢ Reestablish and enhance ESA listed Spring/Fall Chinook, as well as non-listed coho into their endemic range.
- ➢ Increased total abundance of the composite natural/hatchery populations.
- ➢ Increased spawning ground escapement and trend of Natural Origin Recruits (NORs).
- ➢ Improve distribution of salmon to minor spawning and underutilized rearing habitat areas.
- ➢ Provide future tribal and sport harvest opportunities.
- ➢ Nutrient enhancement in oligotrophic *(nutrient poor)* streams.



PTOI satellite salmon acclimation/rearing facilities within the Puyallup/White River Watershed.

Habitat Restoration

Sha Dadx (Lower Puyallup River)

In the fall of 2008, at the cost of over $4 million dollars, the Puyallup Tribe completed construction of one of its most prevalent watershed restoration projects to date. The Sha Dadx *(Frank Albert Road)* wetland restoration project, located on the lower Puyallup River at RM 4.6, created a 17-acre off-channel wetland habitat for salmonids and other freshwater resident fish. The project was instrumental in reestablishing an old disconnected oxbow; in addition to a low-lying wetland back into the mainstem river. The reclaimed habitat was originally lost during the construction of the lower river levee system in the early twentieth century. In response to the loss of nearly an entire estuarine ecosystem that once existed, the creation of this critical and necessary lower river environment will provide overwintering; as well as foraging opportunities for young juvenile salmon. In addition, this habitat will offer some of the benefits that the estuary once provided to out migrating *(smolting)* salmon during the transition from fresh water to salt water. For more information about this site/project go to:

- http://nwtreatyTribes.org/puyallup-Tribe-looking-for-new-residents-in-sha-dadx/
- http://www.activeconstruction.com/08-011-sha-dadx/

Clearwater River Floodplain Restoration Project (White River)

Kristin Williamson -South Puget Sound Salmon Enhancement Group

http://nwifc.org/puyallup-Tribe-tracking-salmon-making-way-newly-restored-habitat/

Project Description (Completed 2015)

The Clearwater River Floodplain Restoration Project is planned to address major limiting habitat factors and impaired processes on the Clearwater River through strategic placement of large wood structures and removal of nearly a mile of road from the historic floodplain. Historically, the Clearwater River meandered through a forested valley floor with large trees, a dense canopy, and a system of branching channels. The advent of timber harvest in the watershed and construction of a rail line (now road) in the Clearwater River floodplain for transport of timber in the early 1900s removed critical riparian structure from the valley floor and confined the floodplain. Loss of the riparian buffer has resulted in easily erodible banks due to root loss and associated soil cohesion, dramatic reductions in large wood debris recruitment to the stream channel, and loss of overhanging vegetation.

Project efforts would install up to 39 wood structures of varying types and sizes to meter natural wood through the system, trap sediment, and aggrade incised sections of the channel for the long term reconnection of a network of 19 side channels in the floodplain. The project would also decommission nearly a mile of road and remove 10 associated culverts. Removal of three of the culverts would provide immediate improved passage to wall-based wetland channels, and the removal of the other 7 would provide long term access to spring fed channels and alluvial fans currently impounded by the road.

The Puyallup and White River Salmon Recovery Strategy specifically identifies the Clearwater River as a high priority geographic area for White River Spring Chinook recovery, as determined by Mobrand EDT modeling. By extension, this project will also benefit other native stocks, including coho and pink salmon, steelhead, and bull trout. This project will specifically address strategic priorities identified within the strategy including: increasing the quantity and quality of instream habitat through input of wood structures and improving the riparian conditions in the watershed through abandonment and decompaction of a stream adjacent road prism and active plantings.

Watershed and Aquatic Benefits

The overall goal of the project is to increase spawning and rearing capacity of the watershed for Spring Chinook, steelhead, coho, pink, and coastal and resident cutthroat trout species. Realized benefits from project actions will include:

- Activate 14.5 acres of historic floodplain through road decommissioning and removal of 10 culverts.
- Active 70 acres of floodplain through placement of wood structures and subsequent aggradations of the channel bed.
- Activate 19 existing side channels and promote the formation of new side channels through channel migration.
- Dissipate flood energy through placement of wood structures to partition sheer stress.
- Increase quantity and quality of instream, pool, and refuge habitat via placement of wood structures.
- Improve riparian function through abandonment/ripping of a stream adjacent road.
- Establish a riparian corridor on former road prism through planting of 2,500 native trees.

A total of 18 large and small engineered log jams were installed in the Clearwater River between river mile 2.3 and 3.1 in summer 2013. Placement of these log jams will activate flows to a network of 11 existing side channels, dissipate flood flows, and increase instream structure and cover in the river. This work completed about half of the proposed work plan. An additional 10 ELJ's were installed during the summer of 2015; as well as the decommissioning of the old roadway from the 6000 bridge to the lower washout *(phase 2&3)*

Greenwater River Floodplain Restoration Project (White River)

Written by: Kristin Williamson
South Puget Sound Salmon Enhancement Group

Project Description (Completed 2014)

The objective of the Greenwater River Floodplain Restoration Project is to restore aquatic and riparian habitat within a 2 mile reach of the Greenwater River. The project reach is River Mile 5.0 to 7.0 within the Mount Baker-Snoqualmie National Forest, adjacent to Forest Service Road 70. Restoration is focused on the re-introduction of functional wood and the removal of .8miles/4,500 linear feet of the abandoned Forest Service Road 7000 located within the Greenwater River Floodplain.

Historically, the Greenwater River was one of the principle spawning and rearing areas in the White River watershed for Spring Chinook, bull trout, steelhead and coho. Based upon the old-growth forest in the Greenwater Valley floor, evident in the 1956 aerial photographs, recruitment of large trees to the floodplain was likely the primary factor maintaining salmon habitat in the River. Early photos show the River to be in pristine condition, characterized by sinuous channels with many large, deep pools associated with log jams. Pool habitat is critical for rearing salmon, bull trout, and other resident fishes to provide cool places for forage and refuge from predators.

A legacy of timber harvest altered the Greenwater River between the late 1950s and mid 1980's. During this period, the majority of the trees in the Greenwater River were removed from the valley all the way to the banks of the River. These practices effectively stripped the Greenwater River of all instream wood, removed the forest structure from the floodplain, and subsequently increased channel incision, stream velocities, and river bed scour. The current channel is incised with very few pools, little holding and rearing habitat available to salmonids, and almost no functional stream side cover to provide shade, structure, input of nutrients, and recruitment of woody debris.

Given these impacts and the current lack of large woody debris, the young age of the existing stream-side forest, and large volumes of sediment available in the Greenwater River, it could take centuries for the system to return to a river sustained by natural processes. To help reestablish the natural conditions needed to sustain salmon and other species utilizing the system, a restoration plan was developed to rehabilitate the lost processes of wood recruitment, forest canopy, and floodplain connection through strategic placement of Engineered Log Jams (ELJs) and removal of road fill and armor from the floodplain.

Watershed and Aquatic Benefits

Overall, project efforts will increase flood storage within the project reach and reduce downstream peak flows, thereby providing greater stability and balance to the watershed. The proposed log jam structures will accelerate and maintain system-wide natural processes while reducing sediment loading, stabilizing banks for establishment of stream-side forest, and providing habitat for salmon and other fish. The species benefiting from this project include: White River Spring Chinook, Puget Sound steelhead, pink salmon, coho salmon, bull trout, and coastal and resident cutthroat.

Specifically, project efforts will:

- Create large, persistent structures that will trap mobile wood and sediment.
- Reduce erosion and sediment sources within the project reach by dampening peak flow velocities.
- Aggrade the existing river bed elevation to reconnect stream flows to the floodplain to increase flood storage, and provide back-water, flood refuge for rearing juvenile fish.
- Increase side channel rearing capacity and spawning opportunity for juvenile and adult salmon.

- Encourage trapping and sorting of spawning gravels within the main stream channel to increase spawning opportunity.
- Improve salmon egg retention and survival by reducing scour stress of the river.
- Increase the quantity and quality of pools with lots of overhead, woody cover for predator avoidance for juvenile salmon, and for staging of upstream-migrating adult salmon.
- Provide interim, instream structure and stability to allow the Greenwater valley forest to regenerate to a size that will naturally stabilize the river.

South Fork Channel Restoration (Puyallup River)

An extensive side channel restoration project conducted by Pierce County near the community of Alderton, added over 4,000 linear feet of off channel fish habitat and flood protection.

Upper Clear Creek Mitigation Site (Lower-Puyallup River)

In 2016, Port of Tacoma finished construction of a roughly 40-acre restoration project on upper Clear Creek. The project created a floodplain wetland and a new, more naturalized stream channel. The project was created as a result of a mitigation settlement with the EPA, at a cost of $9 million dollars.

Boise Creek Restorations (White River)

In 2013 & 2018, King County Water and Land Resources Division initiated channel enhancement projects along the middle Boise Creek channel above (Evan's project), and below (Van Wieringen project) 268th. In 2010, the establishment of a new lower channel restoration was completed; starting from Mud Mountain Dam Road, downstream to the White River. The new lower channel restoration provides improved rearing and spawning habitat. The project is designed to improve instream and surrounding wetland complexity, as well as fish and wildlife utilization. For more information about this restoration project.

Meeker Creek Restoration Project (Clarks Creek-Lower Puyallup River)

Meeker Creek is a small tributary to Clarks Creek located in the city of Puyallup. The restoration project created floodplain wetland and a new, more naturalized stream channel with the goal of improving water quality and salmon habitat.

Gog-le-hi-te Wetlands 1&2 (Lower-Puyallup River)

The Gog-le-hi-te wetlands (1&2) are located near the mouth of the Puyallup River. The two lower river wetlands sites were constructed as a result of a mitigation settlement with the Port of Tacoma for filling in tidal wetlands. The Gog-le-hi-te wetlands currently sustain a diverse ecosystem of plants, mammals, fish and amphibians.

South Prairie Creek Preserve Floodplain Restoration Project

Written by: Kristin Williamson
South Puget Sound Salmon Enhancement Group

The South Prairie Creek Preserve Floodplain Restoration project aims to restore habitat for fish and wildlife in the South Prairie Creek valley. Project actions will restore critical habitat functionality, thermal diversity, hydrologic stability, and geomorphic structure to support adult to juvenile out-migrant survival and productivity for spawning, rearing, foraging, migrating, and overwintering life history stages in South Prairie Creek for fall Chinook, steelhead, coho, chum, pink, cutthroat and bull trout.

South Prairie Creek is one of the most productive tributaries for Puyallup River Fall Chinook and Steelhead and yet the effects of historical land use practices have limited the potential of this sub-basin to provide the highest level of spawning and rearing opportunity for salmon and trout populations. The project properties were previously managed for agricultural production since the early 1900s and much of the project area was cleared, burned, plowed, filled, and used for pasture and hay production for nearly a century. The loss of the floodplain forest resulted in a deficit of instream complexity and floodplain connectivity, creating high velocity conditions which limit egg-to-fry survival for peak-flow timed spawners (Chinook, Pink, Coho, and Chum). Existing flow velocities in the mainstem project reach exceeds 8 feet per second (fps) during annual, bankfull flows events typically occurring during egg incubation periods for Fall Chinook, Pink, Coho and Chum salmon. Currently summer low flow conditions in South Prairie Creek result in elevated temperatures creating thermal stress on upstream migrating and staging adult fall Chinook and Pink salmon. Summer stream temperatures also create thermal barriers for rearing and foraging Chinook, Coho, Steelhead, Cutthroat, and Bull Trout

Between 2005 and 2011, the Pierce Conservation District acquired the former Inglin Dairy Farm and Pierce County acquired 3 adjacent properties upstream, therein securing 129 acres for large scale restoration efforts. Since 2013, the Pierce Conservation District, Puyallup Tribe, Pierce County, and South Puget Sound Salmon Enhancement Group have been working towards implementation of a reach-scale floodplain reconnection and off-channel restoration project between river mile 4.0 and 4.5 on South Prairie Creek on these properties.

The whole project scope includes the following actions:

- Demolition of 11 former dairy buildings and a creosote bridge over South Prairie Creek.
- Installation of a new bridge over Silver Springs Creek and removal of a culvert and water supply tank from the Silver Springs channel.
- Restoration of 2,600 linear feet of side channel on the north floodplain.
- Installation of 113 engineered log structures, totaling 4,648 new pieces of wood in the project reach.
- Noxious weed treatment and re-vegetation of 36 acres of floodplain and riparian forest.

Installation of wood structures in the mainstem South Prairie Creek will induce hydraulic complexity to slow water velocities, reduce scour potential of spawning bed substrates, and partition flood flows into floodplain side channels to reduce effects of high flows on egg incubation. Installation of engineered log jams will provide near-term instream complexity and floodplain function, while reestablishment of native plant communities will ensure habitat complexity sustained by a healthy floodplain forest will persist into the future.

Project floodplain reconnection efforts will boost water storage and groundwater recharge to increase thermal diversity year-round, and the restored floodplain forest and wetland vegetation will further retain water, sequester carbon, and provide shade and root structure to support groundwater dynamics and mitigate temperature impacts under changing climate conditions. Project efforts will also improve overwinter rearing conditions by providing flood refuge and improve summer rearing conditions through groundwater recharge and therein thermal refuge through metering of cold groundwater discharge and hyporheic exchange during periods of summer low flows

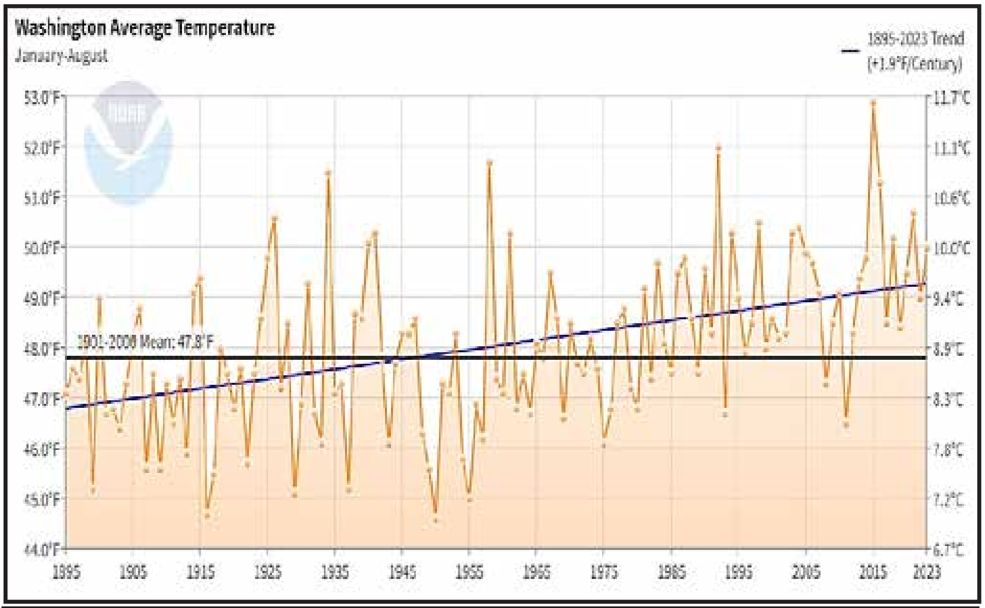
The project will yield an immediate 100% increase in habitat area equating to an additional half mile of off-channel/side channel habitat for rearing and spawning life stages of salmon and trout. Project actions are also expected to improve main channel habitat complexity and reduce mean substrate size in South Prairie Creek to increase spawning potential and capacity for adult life stages. The project will alleviate velocity barriers to upstream migration during high flows to increase spatial distribution of fish within the watershed. Improved rearing conditions may yield greater life-history diversity by sustaining river-type life history strategies for Chinook, Steelhead, Coho, Cutthroat and foraging Bull Trout.

Funding to support design and construction of this project has been a collaborative effort spanning many years. With strong partnerships between the Pierce Conservation District, Pierce County, Puyallup Tribe, and South Puget Sound Salmon Enhancement Group, the project team has been able to raise funding support from the Puyallup and Chambers Watershed Salmon Recovery Lead Entity and the Recreation and Conservation Office along with the many other State, Local, and Federal funding sources, see **Table 1** below. Project construction was completed in fall of 2020 and planting efforts will be ongoing through at least 2022, pending funding to adequately support those efforts.

Table 1. South Prairie Creek Preserve Floodplain Restoration Project Funding Package

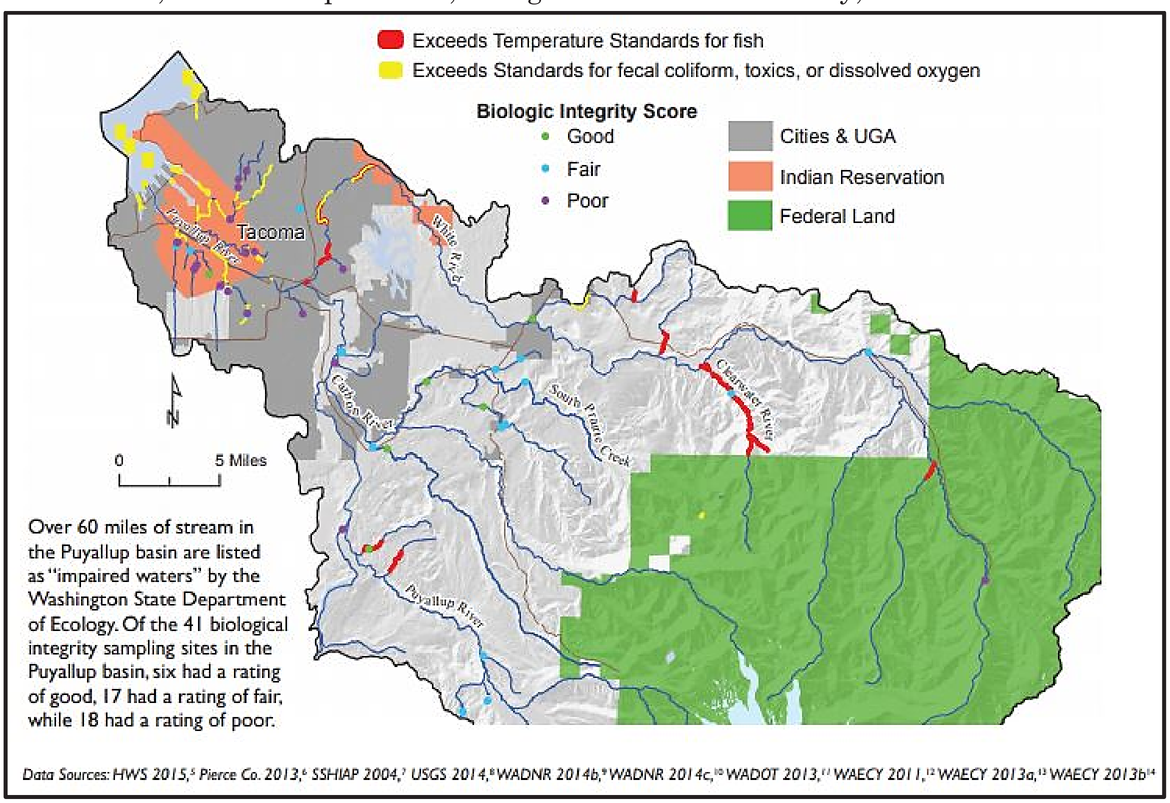
South Prairie Creek Restoration River Mile 4.0-4.5 Funding Package			
Source	**Year**	**Stage**	**Amount**
WRIA 10/12 Lead Entity Project Development Funds	2013	30% Design	$81,850
Puyallup Tribe Grant Funds, EPA	2013	60% Design	$40,000
Pierce County Surface Water Management	2013	60% Design	$40,000
Salmon Recovery Funding Board and Puget Sound Acquisition and Restoration (RCO 14-1504)	2014	Final Design	$198,000
Salmon Recovery Funding Board and Puget Sound Acquisition and Restoration (RCO 15-1224)	2015	Construction and Planting	$1,363,438
Salmon Recovery Funding Board and Puget Sound Acquisition and Restoration (RCO 16-1577)	2016	Construction and Planting	$1,653,413
Value of Forest Service Donated Wood to Puyallup Tribe	2016	Construction	$280,000
Habitat Strategic Initiative, Near Term Action, National Estuary Program Funds	2017	Construction	$248,000
Conservation Commission Funds, Pierce Conservation District	2018	Planting	$15,984
Ecology Coastal Protection Fund, Pierce Conservation District	2018	Planting	$20,000
Ecology Clean Water Act Section 319, Pierce Conservation District	2019	Planting	$325,125
Pierce County Surface Water Management	2020	Construction	$100,000
Puyallup Tribe Fish Commission	2020	Construction	$487,574
Total for Design and Construction			**$4,853,384**

Climate Change Impacts and the Puyallup/White River Watershed



WASHINGTON STATE AVERAGE AMBIENT AIR TEMPERATURE TREND CHART
Chart represents the temperature average, mean and trend of Washington from 1895-2023. Source: NOAA National Centers for Environmental information, Climate at a Glance: Statewide Time Series.
Image retrieved from: https://www.ncdc.noaa.gov/cag/statewide/time-series

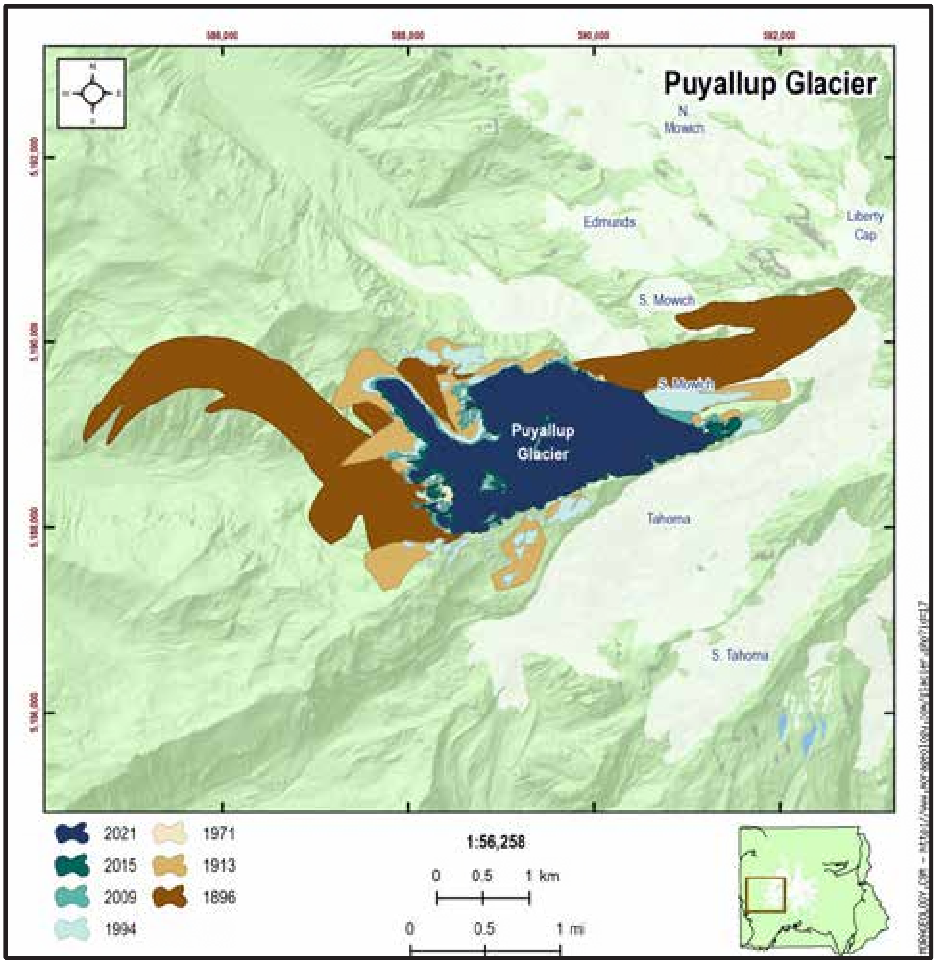
Despite skepticism and conjecture, an overwhelming scientific consensus prevails regarding the anthropogenic climate change hazards on our oceans, watersheds and natural resources as a result of an increasingly warming planet. Unfortunately, it is widely expected that salmonid populations will decline due to deleterious environmental impacts over the next century. Annual and seasonal climate variances throughout the Pacific Northwest have shifted over the past century. As the average annual temperature graph *(top right figure)* taken from NOAA's National Centers for Environmental information illustrates, the average annual atmospheric temperature in the Pacific Northwest has risen by about 1.3°F *(2.3°C)* (Kunkel et al. 2013). Stream temperatures have increased by approximately 0.2°C *(0.36°F)* per decade since 1980 (Isaak et al. 2011). Salmonids subjected to, or exceeding thermal tolerances *(lower right figure)* can experience several harmful effects including: elevated levels of stress; increased vulnerability to diseases, toxins and parasites; face greater risk of mortality; alteration of emergence timing; as well as, adverse effects on growth and reproduction. Annual temperatures throughout the northwest and Puget Sound region are predicted to increase by approximately 3°F-to-10°F *(5.4°C-18°C)* by the end of the century; with the largest increases expected to occur during the summer seasons (Kunkel et al. 2013). Future annual precipitation is projected to fall



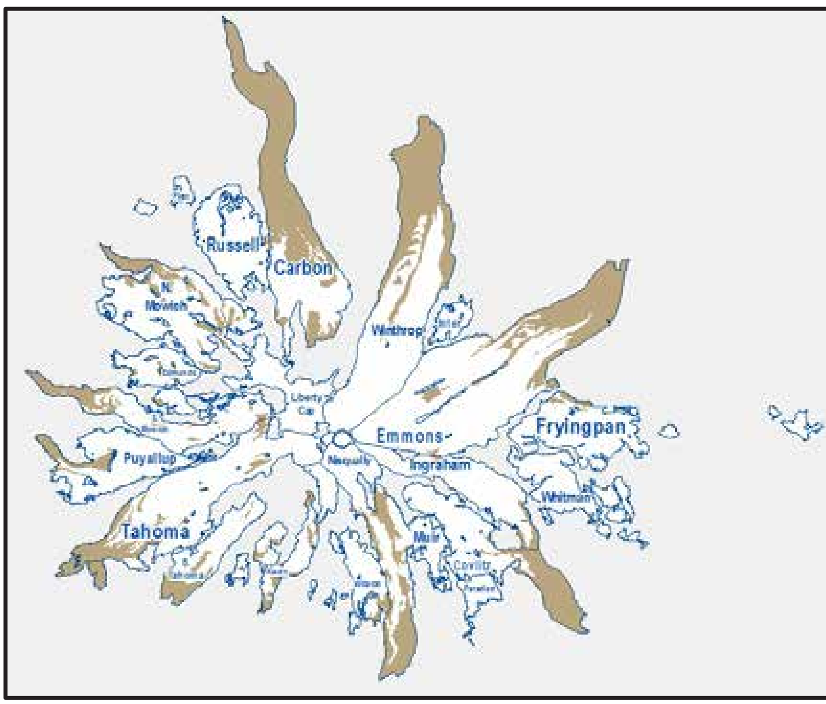
TEMPERATURE AND BIOLOGICALLY IMPAIRED WATERS IN THE PUYALLUP RIVER WATERSHED
Source: Puyallup Tribe of Indians, 2016. Image retrieved from: https://geo.nwifc.org/SOW/SOW2016_Report/Puyallup.pdf

more in the form of rain rather than snow, leading to increased flooding and high flow events in both frequency and intensity; as well as, an anticipated decrease in spring and summer flow regimes *(average annual precipitation expected to remain the same).* This shift has, and will continue to generate consequential alterations of river and stream hydrology, and is expected to be a major factor in the decline of salmonid populations through the end of century or beyond.

Prominent glaciers on Mt. Rainier continue to retreat at an alarming rate *(top right figure)*; contributing heavily to the aggradation of mainstem river channels and the elevated probability of glacial outburst events. Aggradation can lead to increased flooding risks, higher peak river flows and channel widening. Geologists reported glacial volume on Mt. Rainier has likely decreased by as much as 18% from 2003-to-2009, a loss of approximately 3% per year, which is a rate loss of nearly 10 times that of any past scientific reporting (Beason et al. 2009). A study of the Emmons glacier's *(White River)* mass balance in 2011 (Riedel and Larrabee 2015), showed a glacial mass net loss of 89.4 million m^3. The study also determined during the summer of 2011 *(May1-to-September 30)*, glacial melt water contributed approximately 9% *(65.2 million m^3)* of the total in-river flows; the lowest flow contribution recorded since 2003. Beason et al., 2023 reported, "The change in glacial area from 1896 to 2021 was -53.812 km^2 (-20.777 mi^2), a total reduction of 41.6%. This corresponds to an average rate of -0.430 km^2 per year (-0.166 mi^2 × yr^{-1}) during the 125-year period. Recent changes (between the 6-year period of 2015 to 2021) showed a reduction of -

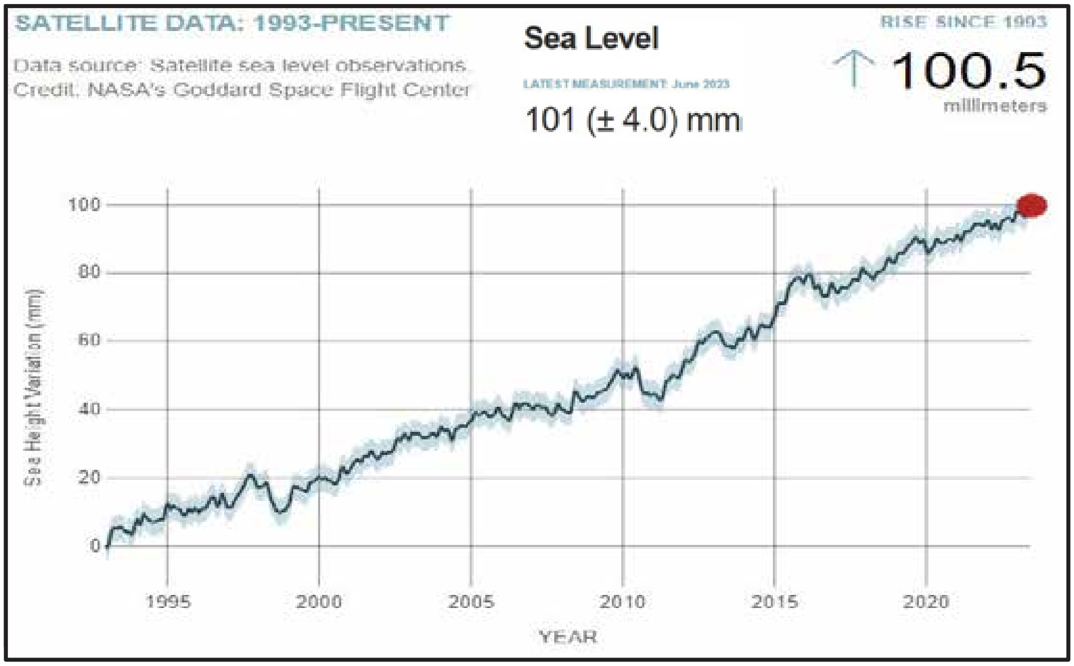


CHANGE IN EXTENT OF PUYALLUP GLACIER (1896-2021)
Source: Beason 2023. https://www.morageology.com/glacier.php?id=0
Image retrieved from: **https://www.morageology.com/glacier.php?id=17**

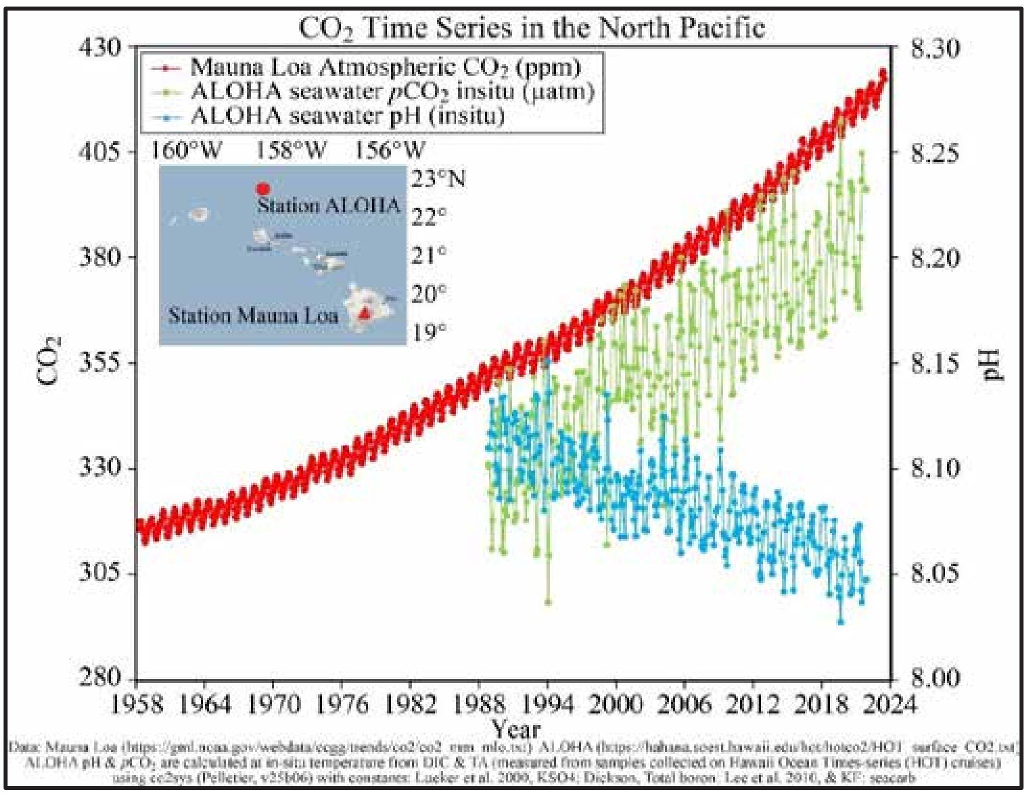


MT. RAINIER GLACIAL OVERVIEW
Source: Beason 2023.
Image retrieved from: https://www.morageology.com/glacier.php?id=0

3.262 km² (-1.260 mi²) of glacial area, or a 4.14% reduction at a rate of -0.544 km² per year (-0.210 mi² × yr⁻¹). This rate is 2.23 times that estimated in 2015 (2009-2015) of -0.244 km² per year (-0.094 mi² × yr⁻¹).” Aggradation levels of rivers located within Mt. Rainier National Park were reported to have increased an average of 1 foot *(0.3m)* from 1997 to 2006; however, some rivers recorded significantly higher levels of aggradation (Beason 2007). Aggradation rates have reportedly increased since the 1980s along the lower reaches of Puyallup and White Rivers; with the White River channel near Auburn reportedly accumulating up to1.8 inches per year; however, less aggradation was recorded on the lower Puyallup River and the White River reach downstream of Mud Mountain Dam at RM 29.6 (Czuba et al. 2010).



GLOBAL SEA LEVEL RISE FROM 1993-(April) 2023. Source: NASA, Global Climate Change, Vital Signs of the Planet. Image retrieved from: https://climate.nasa.gov/vital-signs/sea-level/



CARBON DIOXIDE (CO₂) TIME SERIES IN THE NORTH PACIFIC. Source: NOAA, Pacific Marine Environmental Laboratory (PMEL), Carbon Program, Hawaii Carbon Dioxide Time-Series. Image retrieved from: https://www.pmel.noaa.gov/co2/file/Hawaii+Carbon+Dioxide+Time-Series

Ocean and marine conditions play a major role in salmonid survival since species typically spend from 1-to-5 years in the marine environment. The temperature of the upper 75m *(246 feet)* of ocean surfaces have experiences an increase of >0.1°C *(0.18°F)* per decade over a period 39 years (Pörtner et al. 2014). Ocean acidification *(OA)* has increased with the elevated absorption of CO_2, and seawater pH is expected to continue declining over the next century. Oceanic pH levels are currently below 8.1 *(down from 8.2-lower figure)*, which is slightly basic. Unabating global sea level rise over the next century due to glacial and polar ice melt *(top figure)* is projected to have acute deleterious impacts on marine ecosystems in the Puget Sound.

The decline of salmonid populations over the next century seems inevitable despite possible natural adaptations that may occur, or any human interventions employed to combat climate change. The following is a summary of expected hazard impacts on watershed salmonids and their habitat; as well as, proposed adaptive actions that may be taken to abate the anticipated consequences of a warming Puget Sound climate.

Climate Change and Potential Impacts on Watershed Salmonids and Stream Habitat

- The Puget Sound Region has faced annual/seasonal temperature increases and declines in annual snowpack over the past several decades.
  - Decreases in spring stream flows which are critical for out-migrating salmon *(smolts)*.
  - Earlier shifts in peak spring flows can alter downstream migration queues of smolts.
- Significant and rapid loss of glacial volume and increased aggradation of river channels.
  - Increased flood risks, higher peak river flows and channel widening.
  - Elevated risk of losing critical fish habitat, especially in headwater streams due to channel widening, glacial outburst and high flow *(scour)* events.
- Winter precipitation is projected to fall more in the form of rain rather than snow; leading to increased flood and high flow events in both frequency and intensity *(average annual precipitation expected to remain the same)*.
  - Escalated risk of early developmental fish stage losses *(eggs and alevins)* due to streambed scour and fine sediment deposition *(redd smothering)* caused by flood/high flow events.
  - Non-volitional *(forced)* movement/migration of young fish from primary rearing habitats *(i.e. natal tributary streams, alcoves, overwintering/off-channel habitats)*.
- Loss/decline of streamside riparian habitat and surrounding established/mature forest lands.
  - Reduced solar protection of river and streams resulting in increased water temperatures.
  - Decreased terrestrial retention/regulation of rain fall and snow melt.
  - Increased sedimentary input caused by erosion, surface water runoff, and bank/slope failures.
  - Diminished recruitment of in-stream large woody debris *(LWD)*. LWD formations are fundamental for creating vital salmonid habitat *(i.e. cold water refugia)*; in addition to largely dissipating flood/high flow forces.
- Elevated stream temperatures, declining annual snowpack, lower spring/summer stream flows and increasing flood/high flow events are anticipated to result in the following harmful effects on salmonid populations:
  - Low river and stream flows can alter migration queues and run timing; increase the inability of fish to access spawning habitat; decrease the amount of habitat available for spawning, rearing and foraging; as well as, the dewatering of redds post spawning.
  - Salmonids subjected to, or exceeding higher thermal tolerances *(natural and hatchery environments)*, can experience several detrimental effects including: increased levels of stress; are more vulnerable to diseases, toxins and parasites; face greater risk of mortality; alteration/shift in emergence timing; as well as, adverse effects on growth and reproduction. Cold-water temperatures are crucial for salmonid gametogenesis *(i.e. egg development in female salmonids)* and early instream development of larvae.
  - The metabolic activity/state of salmonids rises with the increase in ambient water temperature. The result is a greater requirement for oxygen; however, the amount of dissolved oxygen available in water decreases with the increase in water temperature.

- Salmon hatcheries lacking alternate sources of cold water *(i.e. well water or other ground water resources)* may encounter difficulties with incubating and rearing young salmon; as well as holding adult salmon prior to spawning *(effects of general water quality & thermal tolerances).*
- Warmer stream temperatures will favor non-salmonids such as largemouth bass, yellow perch, rock bass, black crappie, bluegill, pumpkin seed sunfish, walleye, and bullhead catfish.
- Warmer stream temperatures will reduce or extirpate benthic stream invertebrates *(i.e. insects)* which are an essential prey resource for salmonids.

Adaptive Actions Regarding Climate Change Impacts on Salmonids and Stream Habitat

Developing and implementing adaptation plans will be essential for the management, enhancement and protection of salmonids in the future. Maintaining effective research, monitoring and evaluation programs to look for deviations from current baseline conditions will provide resource protection managers and stakeholders with the essential tools necessary to achieve effective strategies towards assisting salmonids adjustment to a warming climate. The following are several adaptive options and actions to consider:

- Preserve and expand the availability and quality of cold-water refugia through aquatic and forest habitat protection, enhancement, and recovery measures in order to insure the stability and persistence of Pacific salmon, steelhead and bull trout populations.
- Support collaborative strategies among resource managers and stakeholders regarding the development and implementation of fish and habitat policies, strategies, procedures, programs, and projects.
- Identifying and cataloging essential salmonid spawning, rearing, and foraging areas highly vulnerable to hazardous anthropogenic impacts and developing effective protection measures.
- Categorize known and potential fish and habitat limiting factors *(i.e. diminished habitat connectivity and migration corridors; fragmentation and reduction of habitat quality; water quality; hydro and logging).*
- Identify and inventory priority sites where habitat restoration or protection projects will help mitigate anticipated hazardous anthropogenic impacts; in addition to, addressing current recovery needs.
- Protect current cold water sources and develop additional/supplementary resources of cold water.
- Execute restoration, enhancement, protection, and recovery projects identified by resource managers; as well as conducting/achieving additional research, assessment and monitoring needs.
- Improve river flows through by-pass reaches; as well as, increasing minimum in-stream flow requirements *(improve thermal refugia available during lower summer flows; in addition to, habitat and migratory connectivity).*
- Reduce or eliminate surface water withdrawals, water impoundment and anthropogenic instream flow manipulations/alterations *(improve water quality, prevent fish entrainment and stranding).*
- Diminish causes of environmental degradation through improved protection and resource management.
- Improve and maintain riparian buffer zones throughout forested areas to better retain/regulate rain fall and snow melt; as well as, reducing sedimentary input and water temperatures. Cooling of small-

er and moderate streams through natural shading would benefit salmonid species since a significant amount of spawning and rearing occurs in tributary habitats.

- Increase and improve storm water *(and wastewater)* catchment and treatment before releasing into rivers and streams.
- Expand and improve the flood capacity of rivers and streams through development and implementation of capital projects including levee setbacks, reconnecting floodplains/side channels, and increasing off channel storage habitats.
- Prevent or reduce the damaging impacts *(degradation)* of stream channel widening, incision, and aggradation through the design and application of natural and effective slope, streambank, and streambed, restoration and stabilization projects.

For additional information on regional hazardous anthropogenic impacts, adaptation plans and options check out the following links.

- State of Knowledge Report Climate Change Impacts and Adaptation in Washington State: Technical Summaries for Decision Makers (2013). http://cses.washington.edu/db/pdf/snoveretalsok816.pdf
- Climate Change Impact Assessment and Adaptation Options Puyallup Tribe of Indians (2016). http://www.puyallup-tribe.com/tempFiles/PuyallupClimateChangeImpactAssessment_2016_FINAL_pages.pdf
- Climate Change and Our Natural Resources A Report from the Treaty Tribes in Western WA. http://nwifc.org/w/wp-content/uploads/downloads/2017/01/CC_and_Our_NR_Report_2016-1.pdf
- IPCC Intergovernmental Panel on Climate Change https://www.ipcc.ch/report/ar5/wg2/
- Ocean ecosystem indicators of salmon marine survival in the Northern California Current https://www.nwfsc.noaa.gov/research/divisions/fe/estuarine/oeip/
- Impacts of Climate Change on Salmon of the Pacific Northwest. https://www.nwfsc.noaa.gov/assets/4/9042_02102017_105951_Crozier.2016-BIOP-Lit-Rev-Salmon-Climate-Effects-2015.pdf
- Primer for Identifying Cold-Water Refuges to Protect and Restore Thermal Diversity in Riverine Landscapes (EPA, 91 pp, 20 MB, February 2012). Primer for Identifying Cold-Water Refuges to Protect and Restore Thermal Diversity in Riverine Landscapes (PDF)

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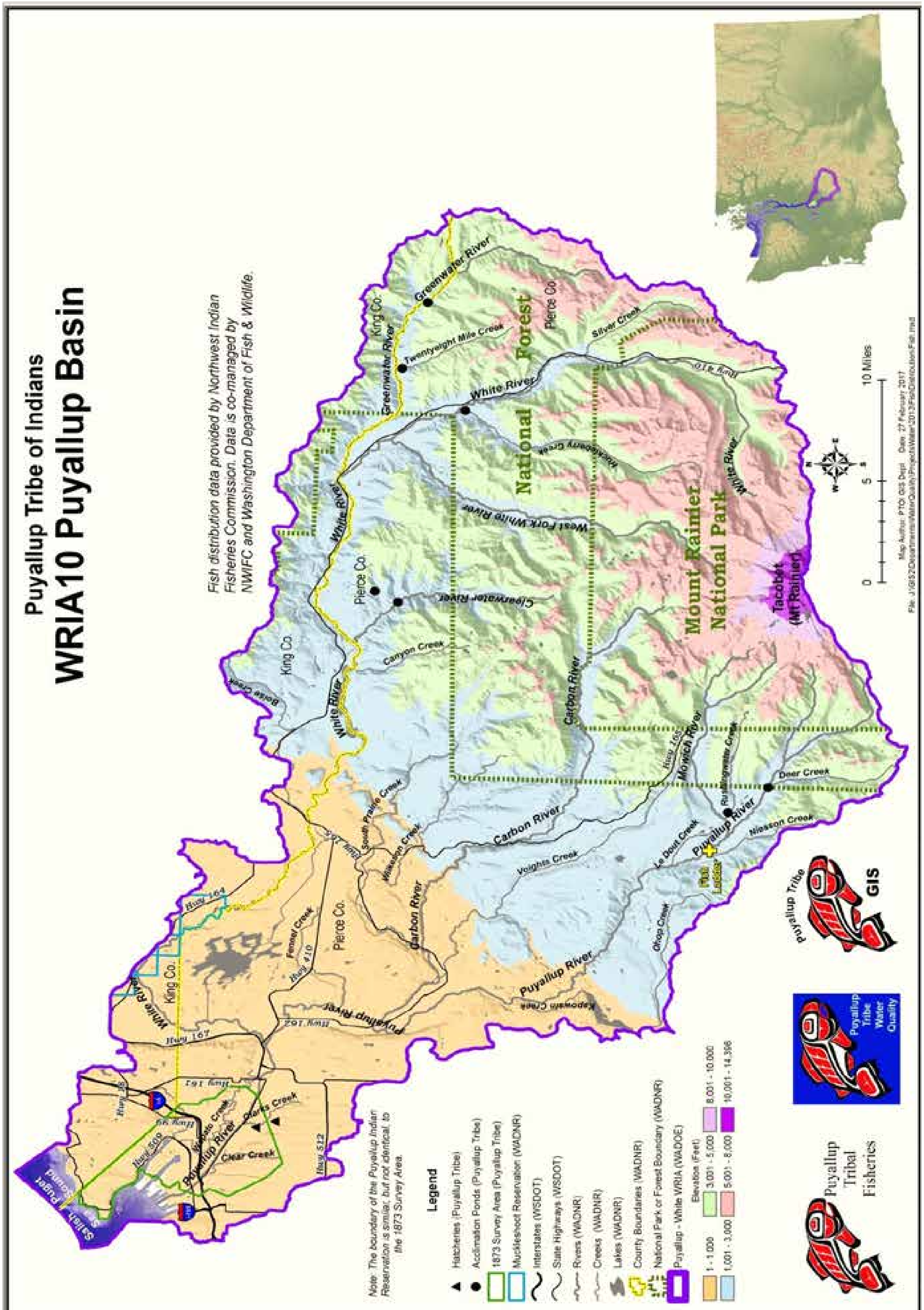
SUMMARY OF 2022-2023 ACCOMPLISHMENTS

Several fisheries escapement and enhancement projects were continued or completed during the 2022-2023 seasons. Most of the following projects or studies are covered in more detail in this report. Other Puyallup tribal fisheries projects involving harvest, TFW, environmental, management, and habitat are covered in separate reports.

- Spring Chinook spawning surveys in the upper White River above Mud Mountain Dam.
- Spring/Fall Chinook spawning surveys in the Puyallup and lower White River Watershed.
- Upper White and Puyallup Rivers bull trout spawning surveys.
- Coho spawning surveys in the Puyallup/White River Watershed.
- Chum spawning surveys in the Puyallup and White Rivers.
- Winter steelhead spawning surveys in the Puyallup and White Rivers.
- Juvenile salmonid production assessment projects on the lower Puyallup and White Rivers.
- Sampled and monitored adult salmonids at the USACE's Fish Passage Facility on the White River.
- Spring Chinook acclimation project on upper White River tributaries.
- Fall Chinook juvenile/pre-smolt plants in Hylebos Creek.
- Fall Chinook production at Puyallup Tribe's hatchery facility on Clarks Creek.
- Fall Chinook acclimation at Puyallup Tribe's Wilkeson Creek acclimation/rearing facility.
- Chum production at Puyallup Tribe's hatchery facility on Clarks Creek.
- Juvenile coho net-pen enhancement program on Lake Kapowsin *(Reinitiated in 2018)*.

ABBREVIATIONS & ACRONYMS

AUC: Area under the curve
AP: Acclimation Pond
BWT: Blank Wire Tag
CB/NT: Commencement Bay/Nearshore Tideflats
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
CFS: Cubic Feet per Second
CMZ: Channel Migration Zone
CWT: Coded Wire Tag
DNA: Deoxyribonucleic acid (genetic sample)
DNR: Department of Natural Resources
EIS: Environmental Impact Statement
ELJ: Engineered Log Jam
ESA: Endangered Species Act
FERC: Federal Energy Regulatory Commission
FPF: Fish Collection Facility (USACE fish trap & haul facility)
GIS: Geographic Information Systems
GPM: Gallons per Minute
GPS: Global Positioning System
HOR: Hatchery Origin Return
IHN: Infectious Haematopoietic Necrosis (infectious viral disease)
LP: Lower Pond
LWD: Large Woody Debris
M: Marked fish (internal/external tags or fin clipped), Hatchery origin
MIT: Muckleshoot Indian Tribe
MGD: Million Gallons per Day
MMD: Mud Mountain Dam (USACE Facility)
MORA: Mount Rainier (NPS Designation)
MS-222: Tricaine methanesulfonate (anesthetic)
N/O: None Observed
NOAA: National Oceanic & Atmospheric Administration
NOR: Natural Origin Recruit (Wild)
NPS: National Park Service
NTU: Nephelometric Turbidity Units
NWIFC: Northwest Indian Fisheries Commission
PCSRF: Pacific Coast Salmon Recovery Fund
RM: River Mile
RMIS: Regional Mark Information System
RMZ: Riparian Management Zone
PIT: Passive Integrated Transponder (internal)
PSE: Puget Sound Energy
PTF: Puyallup Tribal Fisheries
PTOI: Puyallup Tribe of Indians
TFW: Timber, Fish and Wildlife
U: Unmarked fish (no internal/external tags or fin clips), Wild
UP: Upper Pond
USACE: United States Army Corps of Engineers
USFS: United States Forest Service
USFWS: U.S. Fish and Wildlife Service
WDFW: Washington Department of Fish and Wildlife
WRIA: Water Resource Inventory Area
0 (age): Sub-yearling, zero aged fish (less than one year old), young of the year
Yearling: (1 year + age fish)


Puyallup Tribe of Indians
WRIA10 Puyallup Basin
Fish distribution data provided by Northwest Indian Fisheries Commission. Data is co-managed by NWIFC and Washington Department of Fish & Wildlife.
Note: The boundary of the Puyallup Indian Reservation is similar, but not identical, to the 1873 Survey Area.
Legend
Hatcheries (Puyallup Tribe)
Acclimation Ponds (Puyallup Tribe)
1873 Survey Area (Puyallup Tribe)
Muckleshoot Reservation (WADNR)
Interstates (WSDOT)
State Highways (WSDOT)
Rivers (WADNR)
Creeks (WADNR)
Lakes (WADNR)
County Boundaries (WADNR)
National Park or Forest Boundary (WADNR)
Puyallup - White WRIA (WADOE)
Elevation (Feet)
1 - 1,000
1,001 - 3,000
3,001 - 5,000
5,001 - 8,000
8,001 - 10,000
10,001 - 14,398
Mount Rainier National Park
National Forest
Tacobet (Mt Rainier)
White River
Greenwater River
Carbon River
Puyallup River
Pierce Co.
King Co.
Puyallup Tribal Fisheries
Puyallup Tribe Water Quality
Puyallup Tribe GIS
10 Miles

ANTLER CREEK

WRIA 10.0352

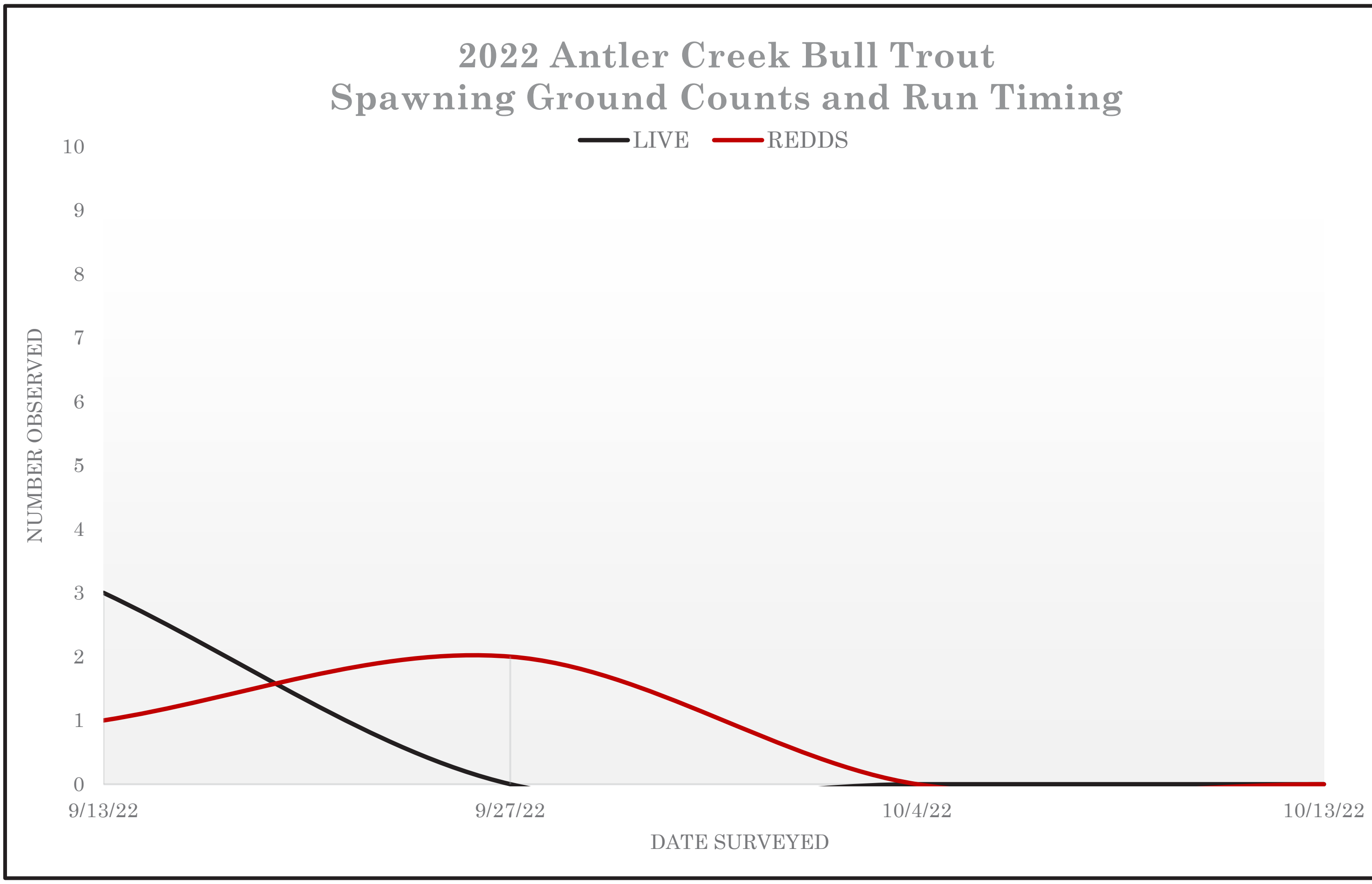
Antler Creek is not officially named; however, for easy identification the creek is referred to as "Antler" by PTF staff. Antler is a small, short run *(1.2+ miles total length)*, west facing right bank headwater tributary to the White River. Primarily supporting bull trout and cutthroat, Antler Creek is a small stream located entirely within Mt. Rainier National Park (MORA). Despite its lack of habitat accessibility by salmon and steelhead, the lower reach of Antler does provide suitable habitat conditions for bull trout rearing and spawning.

Antler Creek has been surveyed for bull trout spawning activity since 2006. Due to the vastness of the park and the significant number of streams supporting bull trout spawning, the Puyallup Tribal Fisheries staff and National Park Service collaborate on conducting bull trout surveys within the Park. Spawning frequently occurs from early September-to-mid October, with peak spawning typically occurring around the third-to-fourth week of September *(see Appendix B for survey data).* Additional salmonid species utilizing Antler include juvenile coho.

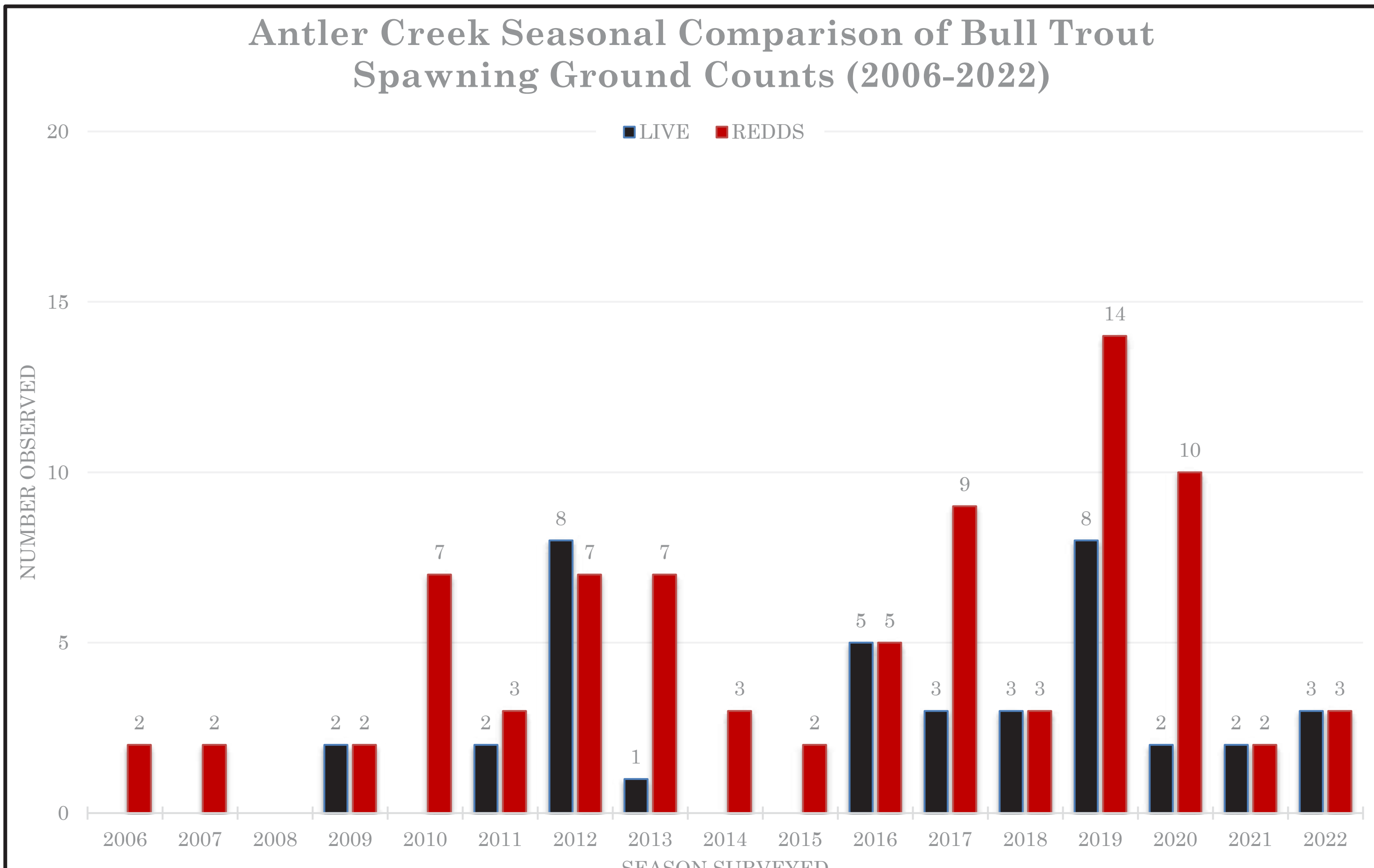
Antler originates along the slopes of Crystal Mountain Ridge and flows entirely within Mt. Rainier National Park *(NPS stream designation w09-00a),* eventually entering the White River at approximately RM 65.9; which is 0.4 miles downstream of Crystal Creek. Characteristic of many headwater tributaries, the mouth of the creek frequently drifts due to its position within the open channel migration zone of the White River. As a result of mainstem river incursions, the creeks lower channel *(100'+)* and riparian habitat are frequently impacted. In addition, this reach of the creek is highly subjected to the possibility of redd scouring or heavy silt deposition due to the influences of the mainstem White River.

Nearly the entire accessible reach of the creek is low gradient. Although spawning does occur within this small stretch *(depending on mainstem influence),* it is often limited due the lack of quality spawning substrate created by the fine alluvial deposits *(sand & silt)* from the White River. There are small quantities of instream LWD present, as well as a beneficial riparian buffer zone of primarily conifers along the majority of the creek. Upstream of the accessible reach, the creek enters the heavily forested lower slope of the valley floor as it begins to climbs up the valley wall. From this point, the creek assumes a pool-riffle-cascade configuration up the steep basin wall. At approximately RM 0.2, the creek passes under Hwy 410, near mile marker 61. For more information on bull trout, refer to the Klickitat Creek section in this report.

Bull Trout



See Appendix B for spawning data, and Appendix C for bull trout redd locations. 2022 surveys conducted by PTF & National Park Service-MORA.



BOISE CREEK

WRIA 10.0057

Spawning Chinook

Boise Creek is a significant tributary to the White River, converging with the White River at RM 23.5, just upstream of where highway 410 crosses the river north of the city of Buckley. In contrast to most of the Puyallup/White River Watershed which falls within Pierce County, Boise Creek lies within South King County, where much of the lower creek flows just south of the city of Enumclaw. With its headwaters located in a well forested area of the Grass Mountain Range, Boise creek drains an area of approximately 15.4 mi^2. Despite its numerous impairments, Boise Creek has often proven to be a highly productive tributary. The majority of the lower 4.5 miles of the creek provides suitable spawning, rearing and foraging habitat for several salmonid species including Spring and Fall Chinook *(right image)*, coho, pink, chum, sockeye, steelhead/rainbow, bull trout and cutthroat.

A 12-ft bedrock falls at RM 4.5 marks the upper extent of adult salmon and steelhead migration. Cutthroat and rainbow have been observed above the falls; although, no data is available on the size or range of the population(s). Above the falls, the gradient increases, becoming a small cascade/step-pool configuration. The channel upstream of the falls, to where Boise crosses under highway 410, was altered back in the mid 1930's to accommodate for the construction of the highway. Upstream of 410, the creek passes through the old Weyerhaeuser mill site, which continues to be a source of sedimentary input. For approximately 0.2 miles below the falls, Boise flows through a lower gradient riffle-pool channel bordered by a dense second growth forest; there are several spawning opportunities throughout this forested stretch. Continuing downstream of the forested area is a low gradient reach flowing for approximately 0.5 miles within the Enumclaw Golf Course. The riparian zone alongside this section is exceptionally sparse; the banks are merely riprapped and bordered by maintained turf grass, blackberry, and small deciduous trees. There is, however, a short section located within the golf course below RM 4.0 with an intact hardwood riparian zone. Spawning is noticeably reduced throughout the entire reach of the creek flowing within the open range of the golf course. Downstream from the golf course, Boise Creek begins to flow through residential and agricultural lands. This more developed reach extends from approximately RM 3.7 down to RM 0.3; much of the stream along this stretch is incised to depths of 20 feet or more. Extensive tracts of land bordering Boise Creek below RM 3.5 are primarily used for maintaining cattle and other livestock.

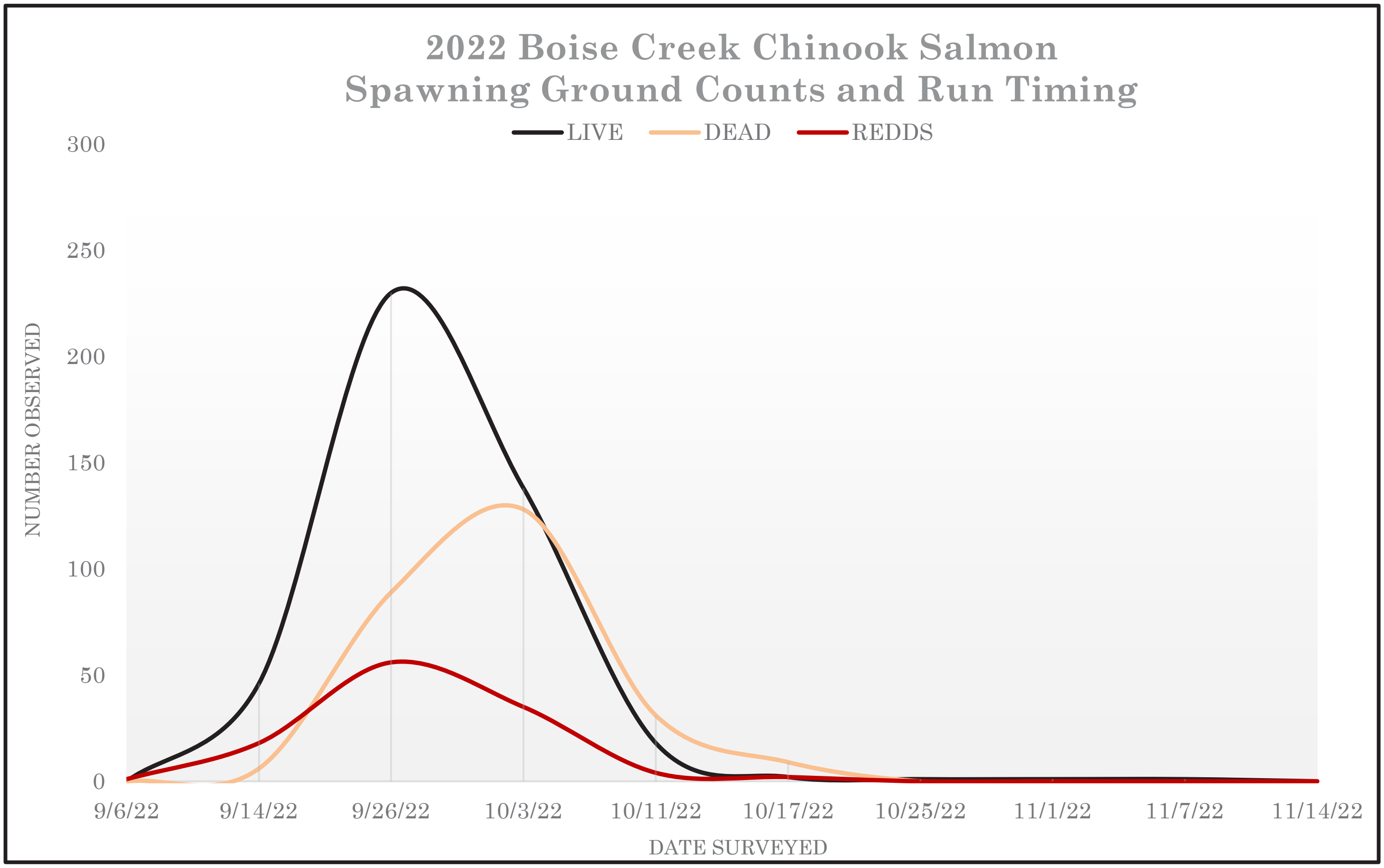
Spawning activity for all species, except bull trout, occurs throughout the entire 4.5 miles. Boise has continued to support a significant number of Chinook spawners, as well as pinks on odd years. Carcass sampling from 2002-to-2017 on Boise Creek, showed an average of 59% of the Chinook sampled to be of fall hatchery origin due to the presence of external/internal tags or markings *(coded-wire-tag/missing adipose fin, or just a missing adipose fin. See Chinook carcass sampling results)*. DNA sampling studies of Chinook in the White River, Ford et al. (2004), showed an approximately 60% fall and 40% Spring Chinook component in the lower river *(below RM 24.3/Buckley* *diversion)*. The pink salmon returns to Boise in 2005, 2007 and 2009 were unprecedented. Estimate calculations put the escapement at nearly 16,000 fish in 2005, nearly 28,000 in 2007, and over 100,000 in 2009 *(peak escapement year)*. Although still significant, pink returns since 2009 have diminished. During the 2005 season, the first significant numbers of chum salmon were observed as high as RM 1.5. Chum were observed in the lower 2.5 miles of the creek during the 2008-through-2010 seasons. However, few chum have not been observed since 2010. Despite its many habitat related shortcomings, Boise Creek continues to support returns of wild steelhead, a remarkable fact in light of the basin-wide declines since the late 1980's. In fact, Boise has exhibited some of the highest steelhead redd densities found anywhere in the watershed, including South Prairie Creek. Spawning opportunities for all species is considerably reduced in the lower 0.1-to-0.3 miles of the creek *(upstream of Mud Mountain Dam Road)*. The gradient throughout this short stretch is steeper, the banks are confined by high sheer walls, and the substrate consists of mostly boulders and large cobble with some isolated pockets of gravel.

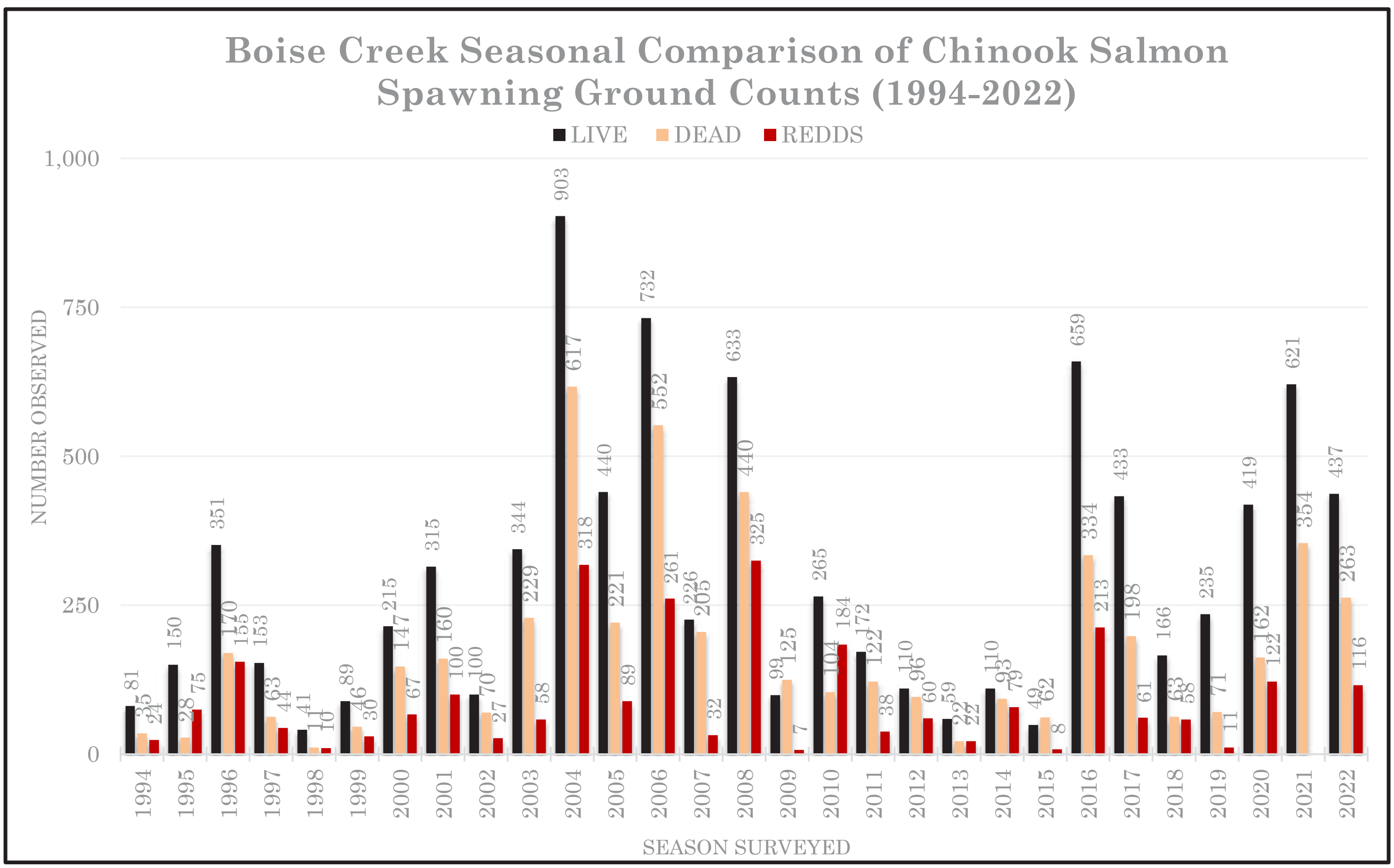
Chinook, coho, and steelhead are especially vulnerable to poaching and harassment in this urban stream. In addition, surrounding agricultural land use continues to impact channel and water quality conditions. Several limiting factors affect the creek including the loss of, and connection to historic flood plain habitat; the absence of sufficient streamside riparian and buffer widths; significant channel confinement and realignment; temperature and other water quality issues *(surface water discharge)*; as well as, reduced LWD inputs and the removal of instream LWD and substrate material *(dredging)* by land owners. Tremendous improvements to riparian and stream channel conditions are possible but require willing land owners, technical expertise and funding.

In 2013 & 2018, King County Water and Land Resources Division initiated channel enhancement projects along the middle Boise Creek channel above (*Evan's project)*, and below (*Van Wieringen project)* 268th. In 2010, the establishment of a lower channel restoration was completed; starting from Mud Mountain Dam Road, downstream to the White River confluence. The new channel provides improved rearing and spawning habitat. The project is designed to improve instream and surrounding wetland complexity, as well as fish and wildlife utilization. For additional information on King County restoration projects in Boise Creek, go to: https://www.kingcounty.gov/services/environment/animals-and-plants/restoration-projects/boise-creek.aspx.

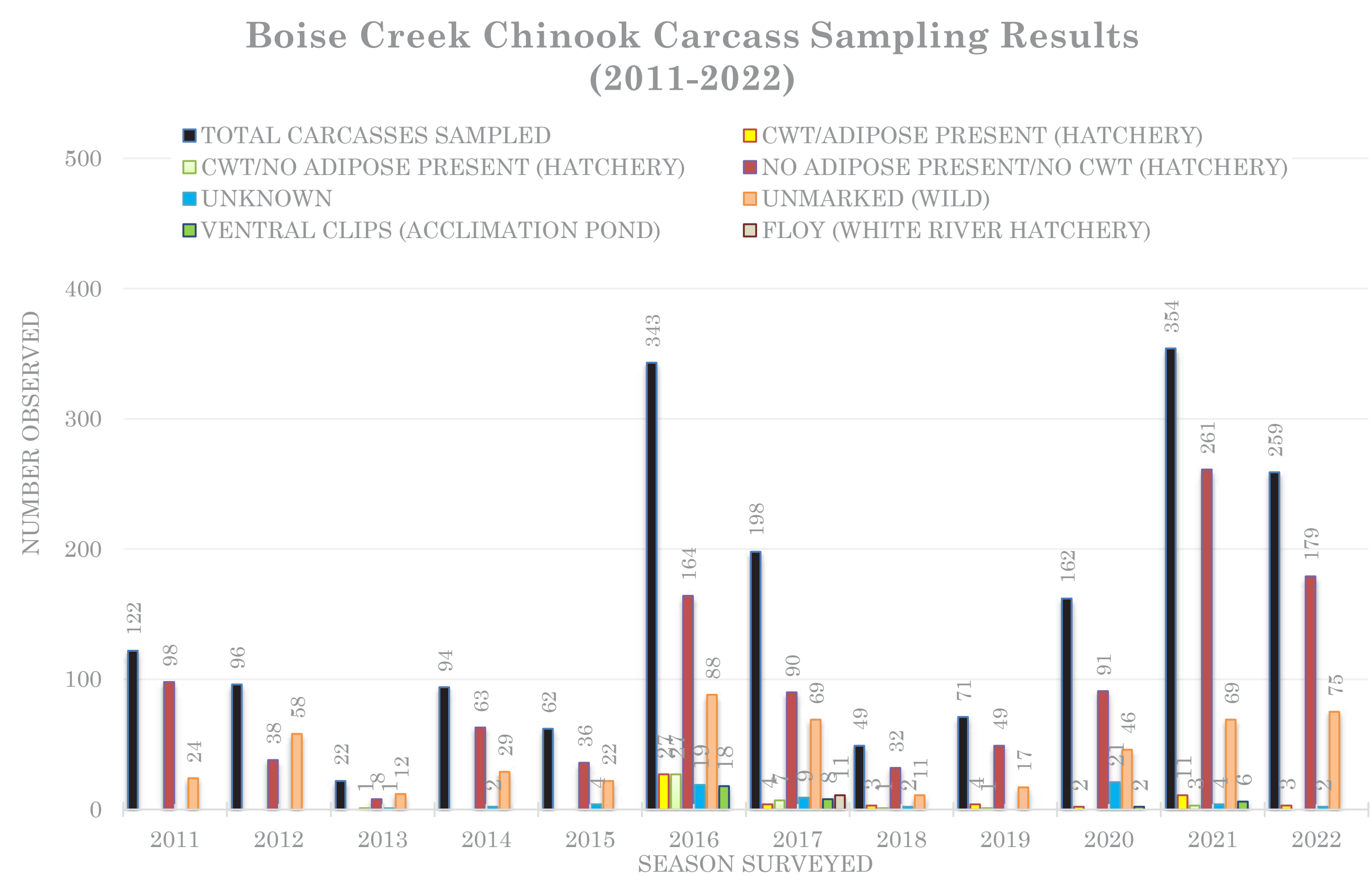
In August of 2003, the city of Tacoma *(TPU)* removed its 99-year-old concrete pipeline crossing located at RM 23 on the White River. The concrete and rebar structure had long been suspected of injuring salmon and limiting upstream migration of weaker swimmers like chum salmon. The removal of the old concrete structure has resulted in chum salmon being able to access Boise Creek.

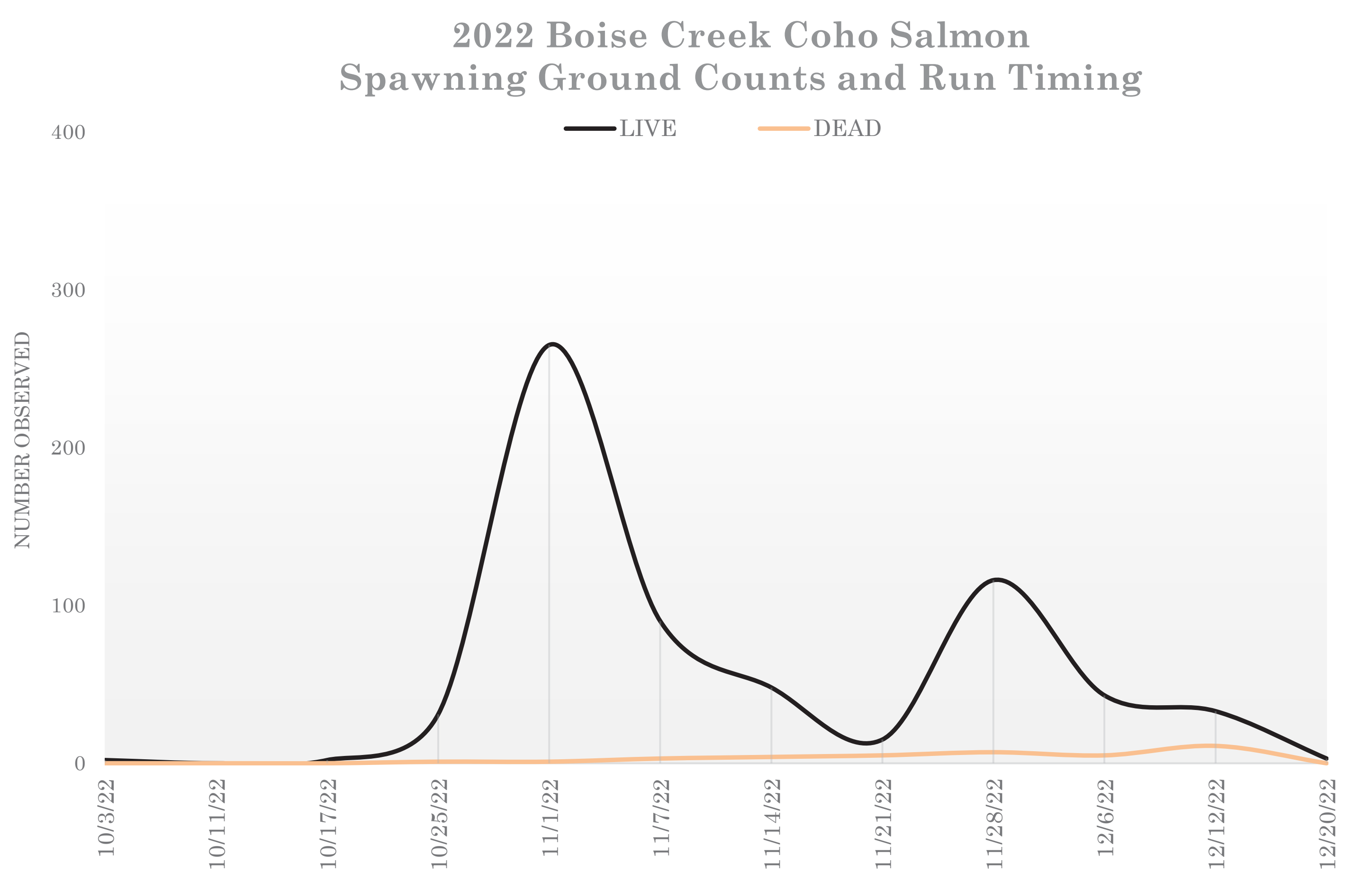
New channel constructed through the golf course (2023).

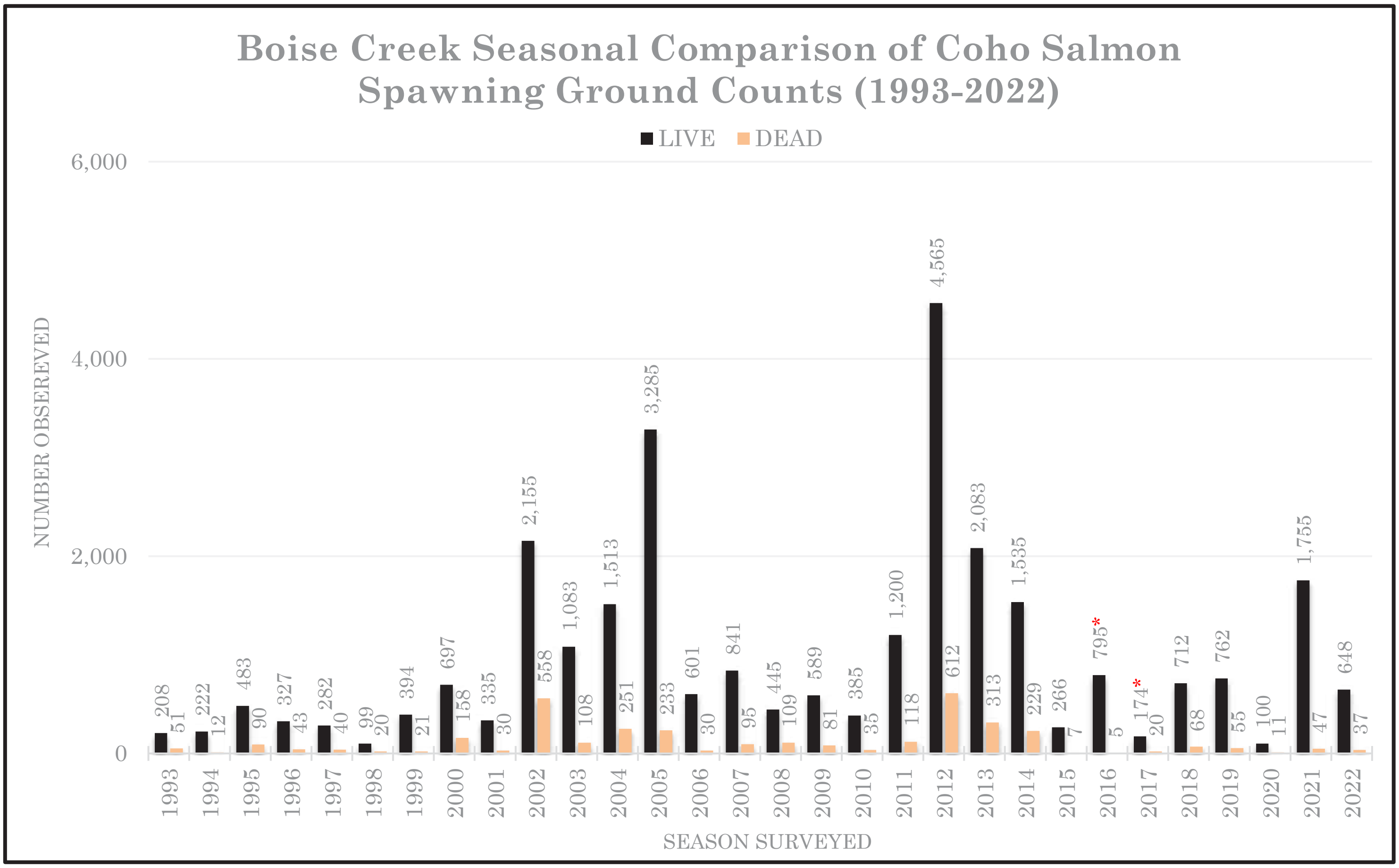




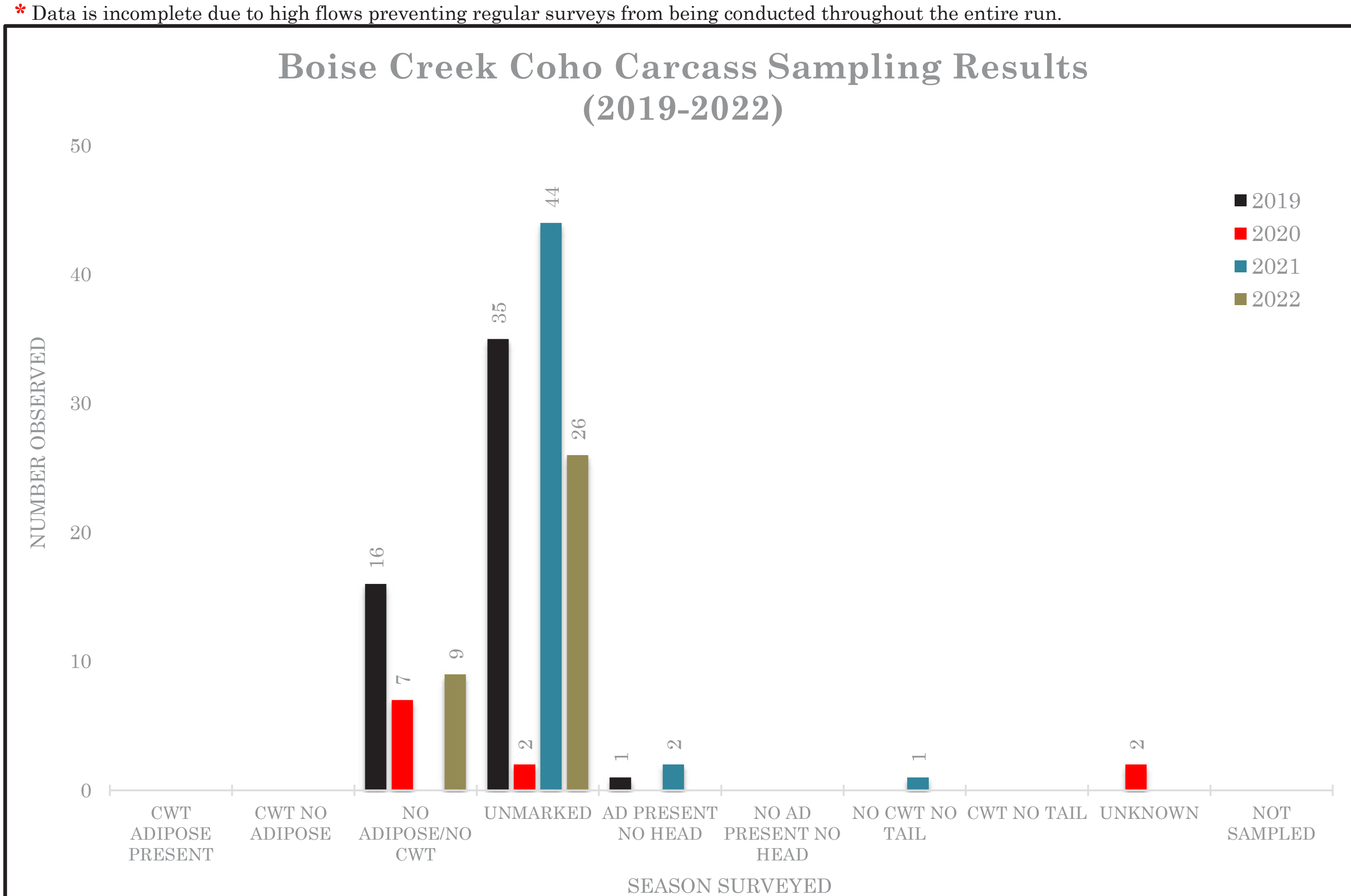
Adult Chinook escapement is determined by expanding the number of redds observed by 2.5 fish per redd (Smith and Castle, 1994). Due to the tremendous volume of pink salmon during odd years (since 2003), the success of determining Chinook redds from pinks is vastly reduced. Therefore, the AUC method is used to determine escapement during pink runs (odd years).

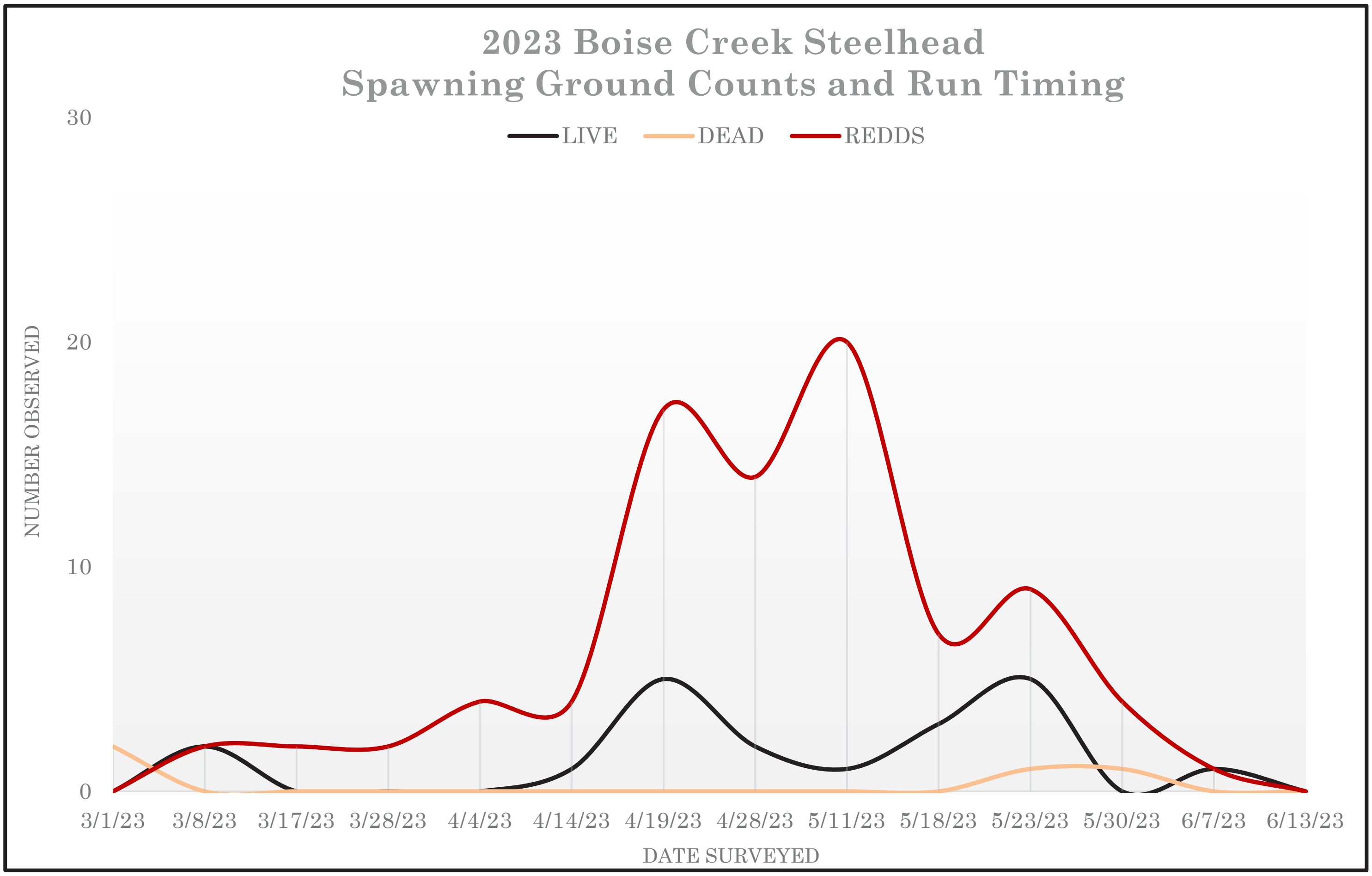

Boise Creek Chinook Carcass Sampling Results (2011-2022)
TOTAL CARCASSES SAMPLED
CWT/ADIPOSE PRESENT (HATCHERY)
CWT/NO ADIPOSE PRESENT (HATCHERY)
NO ADIPOSE PRESENT/NO CWT (HATCHERY)
UNKNOWN
UNMARKED (WILD)
VENTRAL CLIPS (ACCLIMATION POND)
FLOY (WHITE RIVER HATCHERY)
NUMBER OBSERVED
SEASON SURVEYED
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022

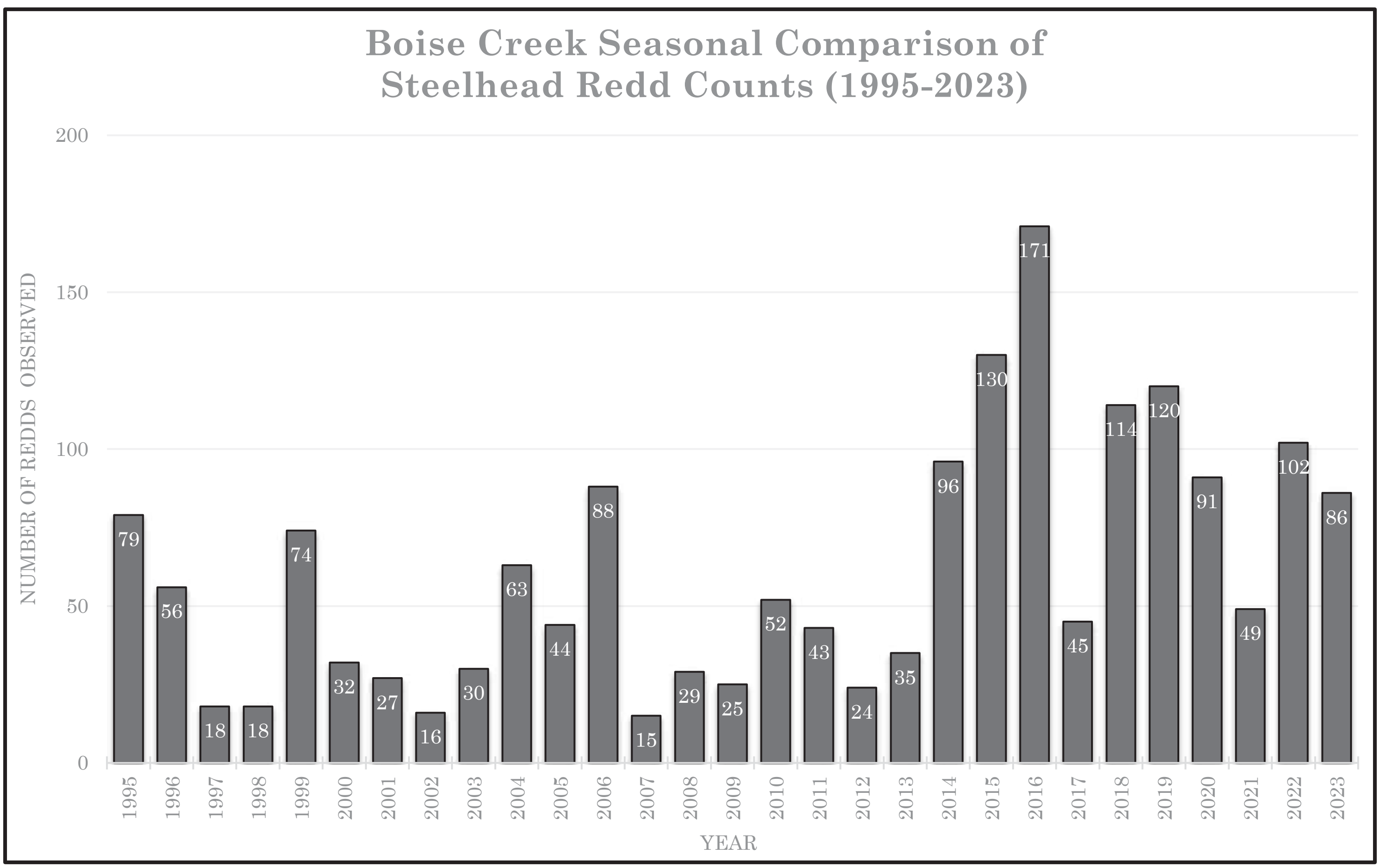

2022 Boise Creek Coho Salmon Spawning Ground Counts and Run Timing
LIVE
DEAD
NUMBER OBSERVED
DATE SURVEYED
10/3/22
10/11/22
10/17/22
10/25/22
11/1/22
11/7/22
11/14/22
11/21/22
11/28/22
12/6/22
12/12/22
12/20/22



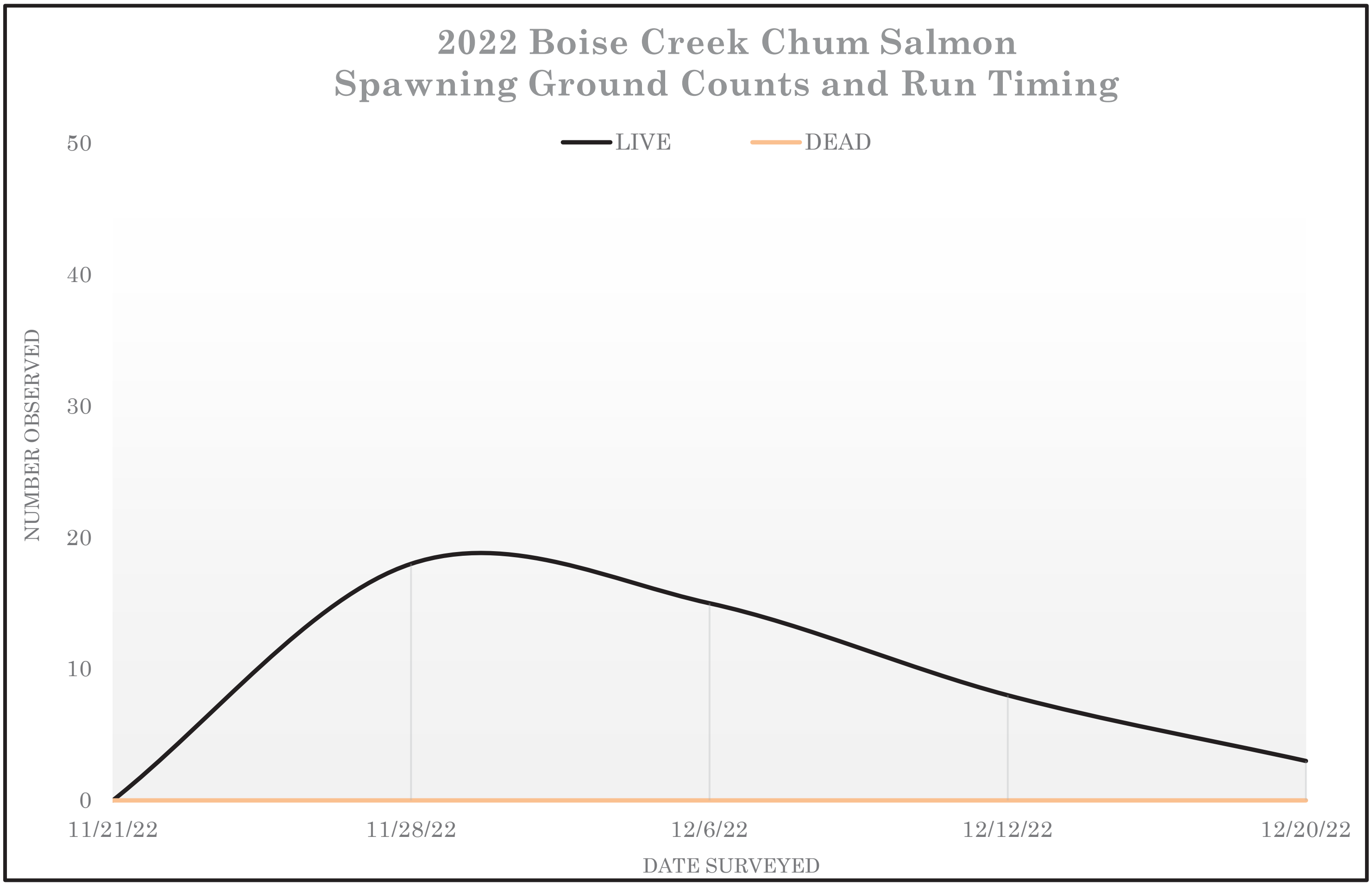
* Data is incomplete due to high flows preventing regular surveys from being conducted throughout the entire run.





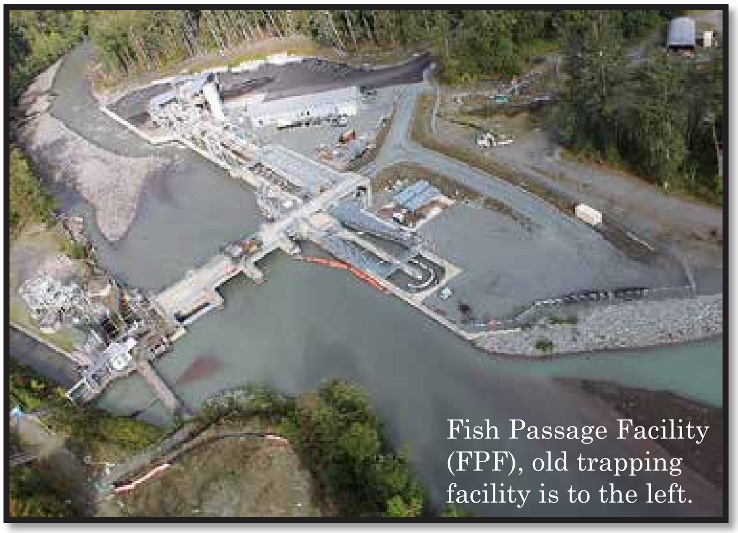


To determine the total escapement for steelhead, each redd is multiplied by a factor of 1.62 *(i.e. 42 redds x 1.62 steelhead per redd = total escapement of 68 steelhead)*; no additional expansion factors are applied.



2022 Boise Creek Chum Salmon
Spawning Ground Counts and Run Timing
LIVE
DEAD
NUMBER OBSERVED
50
40
30
20
10
0
11/21/22
11/28/22
12/6/22
12/12/22
12/20/22
DATE SURVEYED

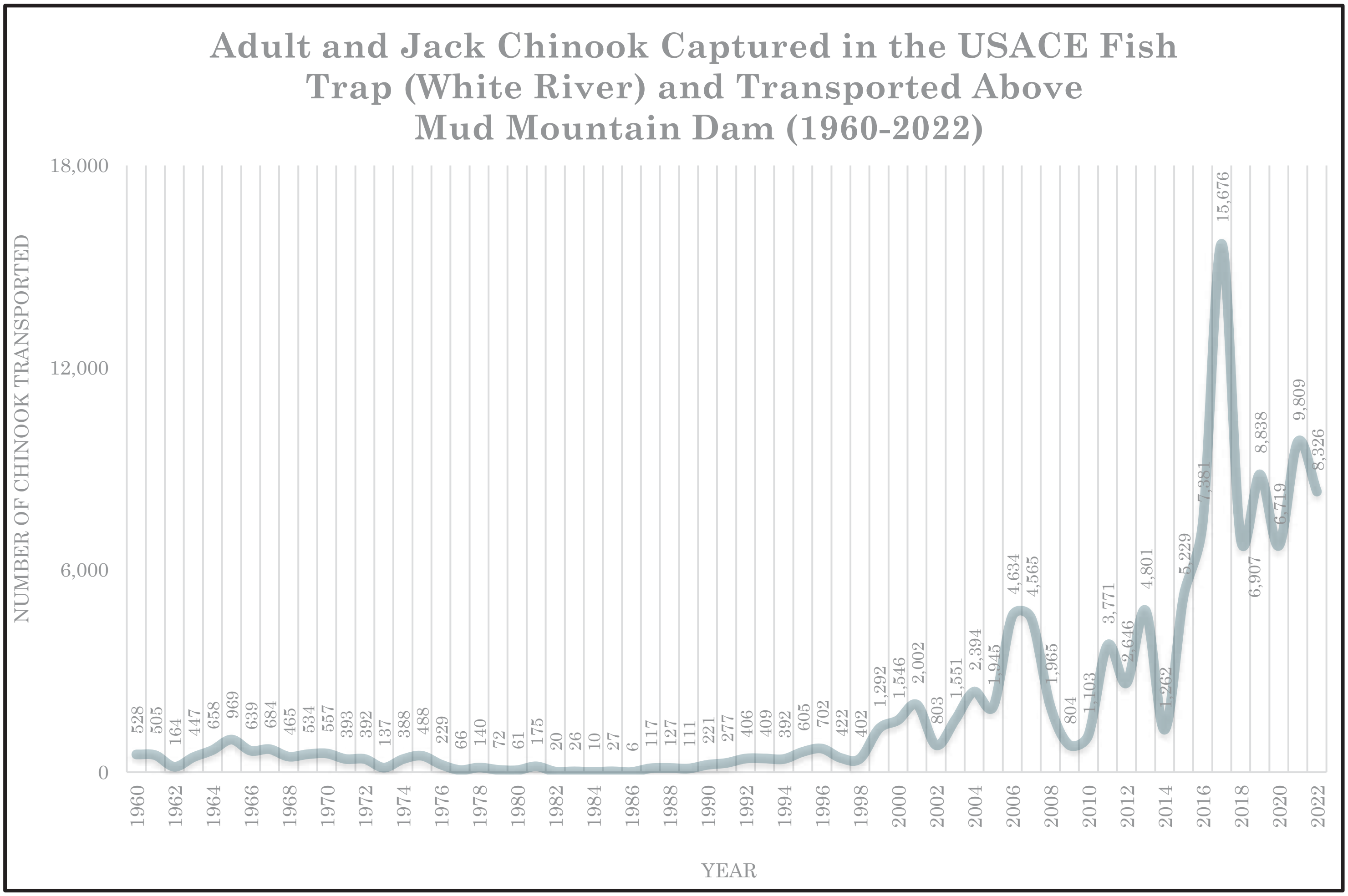
BUCKLEY TRAP
USACE
FISH PASSAGE FACILITY
WHITE RIVER


Fish Passage Facility (FPF), old trapping facility is to the left.

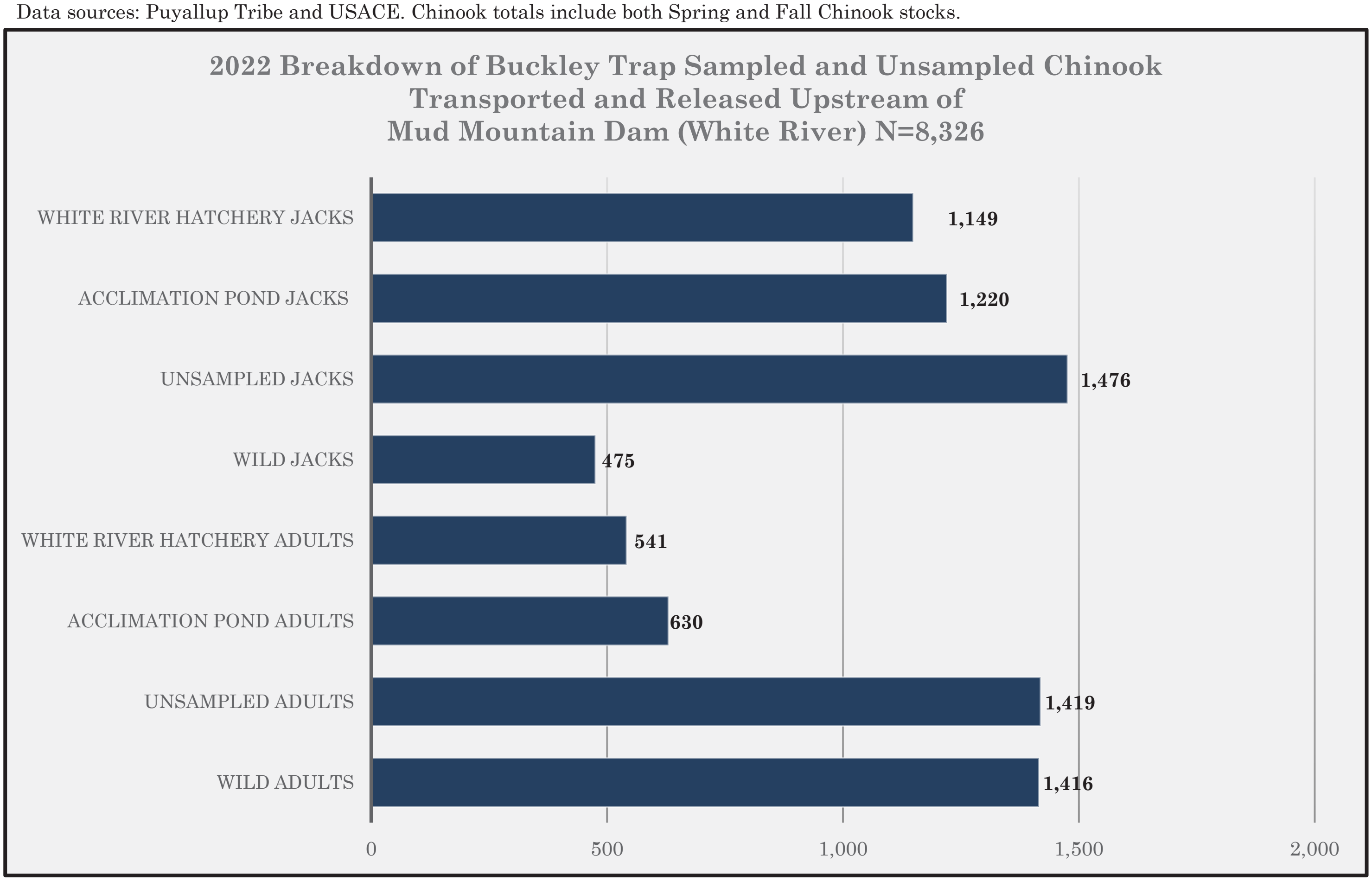
The U.S. Army Corps of Engineers' *(USACE)* Fish Passage Facility (FPF) *(completed in 2021-see image above)* is located at RM 24.3 near Buckley. Salmon, steelhead *(top image)*, bull trout and other native fishes *(mountain whitefish, rainbow & cutthroat)* migrating to the upper White River enter this trap and are transported above Mud Mountain Dam. Fish not allowed upstream during sampling include marked hatchery released Fall Chinook and summer-run steelhead strays *(ad clipped)*. Only BWT steelhead released as part of the White River recovery program are passed upstream. The Corps' new Fish Passage Facility replaced the antiquated trap built in the early 1940's. The new facility diverts up to 400 cfs to operate the facility. Since PSE ceased power production, some measure of water has continued to be diverted from the White River to maintain the water levels and water quality in Lake Tapps. Construction of the new Fish Passage Facility began in June 2018, and was operating by mid-2021. Unfortunately, the new facility has been plagued with operation set-backs and difficulties. However, the new facility still provides biologists access to significant numbers of salmonids, which has been an invaluable tool for research, salmon recovery and escapement estimates. During the months that salmon, steelhead and bull trout return to the upper White River, the USACE moves fish daily. Fish are loaded into tanker trucks and transported above Mud Mountain Dam where they are released back into the White River at RM 33.6; four miles above the dam and approximately one mile below the confluence with the Clearwater River.

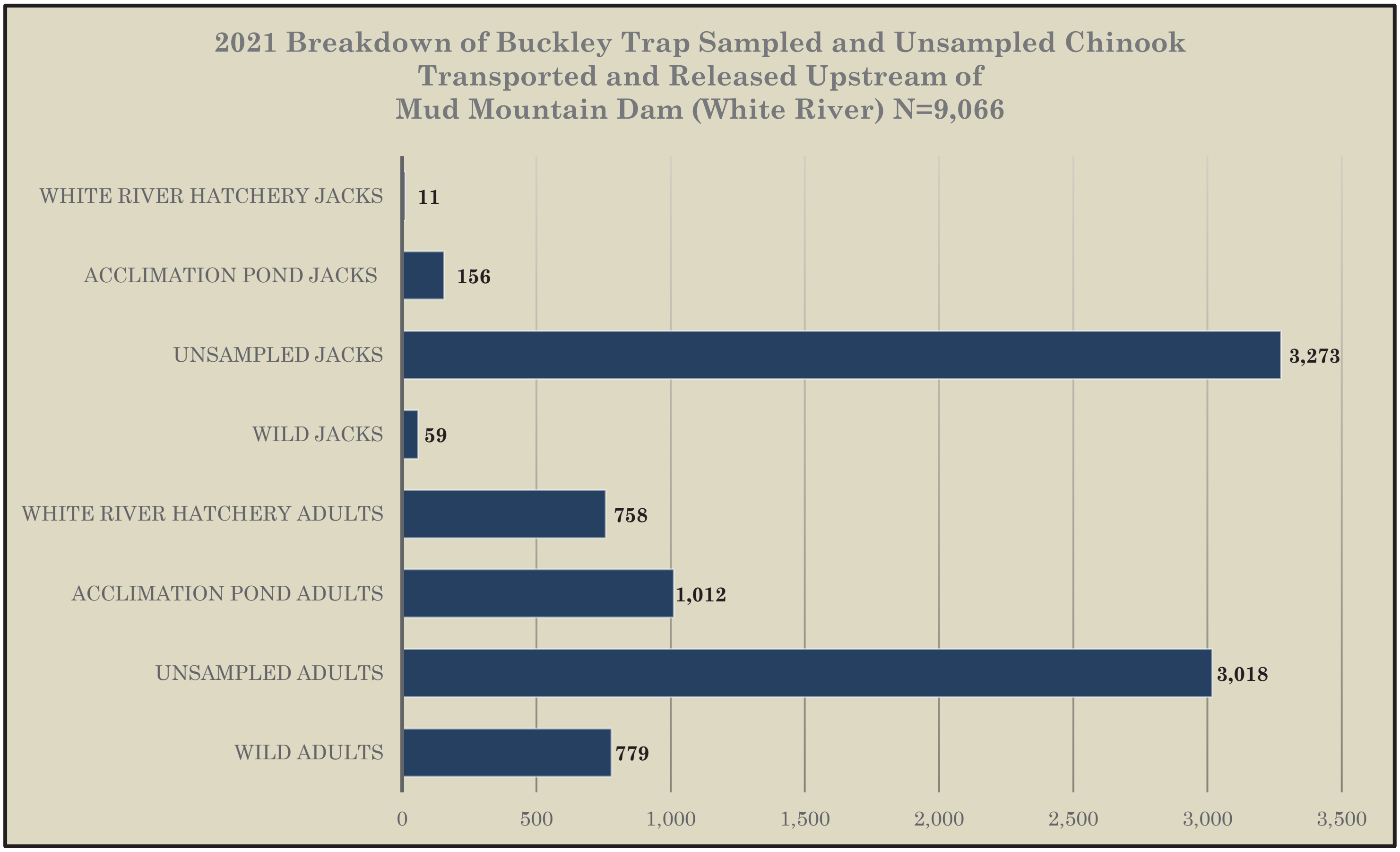
Species of salmonids captured in the trap include Spring and Fall Chinook, coho, pink, sockeye, chum, steelhead, cutthroat and bull trout. Puyallup Tribe Fisheries staff samples the contents of the trap once a week throughout the entire year. Species sampled regularly include Chinook, steelhead, sockeye, and bull trout. During the Spring Chinook/sockeye/bull trout run *(May-to-early October)* PTF staff sample the trap 1 to 7 days per week; the frequency is dependent on the number of fish captured throughout the entire run. Steelhead are sampled regularly by PTF staff from late January through June. All fish sampled are examined for fin–clips; in addition, Chinook and steelhead are sampled for coded/blank wire tags with a metal detector, and bull trout are scanned for PIT tags. Further sampling efforts includes measuring each of the previous species for fork length; collecting a tissue sample for DNA analysis; as well as several scales for aging and other life history information. DNA sampling involves removing a small amount of the anal fin tissue and placing it on a DNA blotting sheet for later analysis. In addition to DNA and scale samples, bull trout are PIT tagged and transported above Mud Mountain Dam. Wild, and White River program steelhead are transported and release approximately 2 miles above Mud Mountain dam, while non- White River steelhead *(adipose clipped)* are returned back to the White River below the USACE trap as per agreement with the Muckleshoot Indian Tribe and the State of Washington.


Chinook sampling

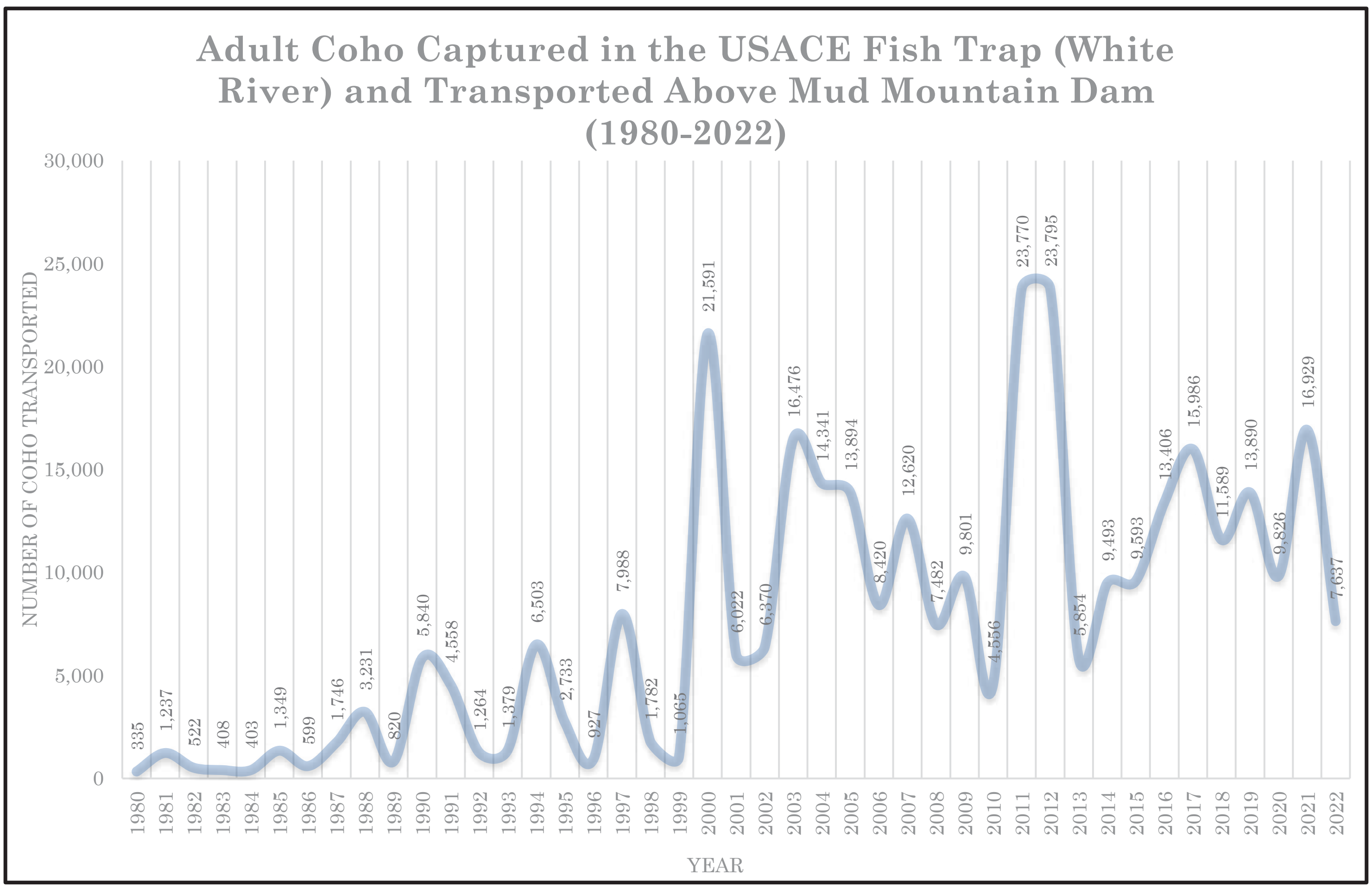


Data sources: Puyallup Tribe and USACE. Chinook totals include both Spring and Fall Chinook stocks.

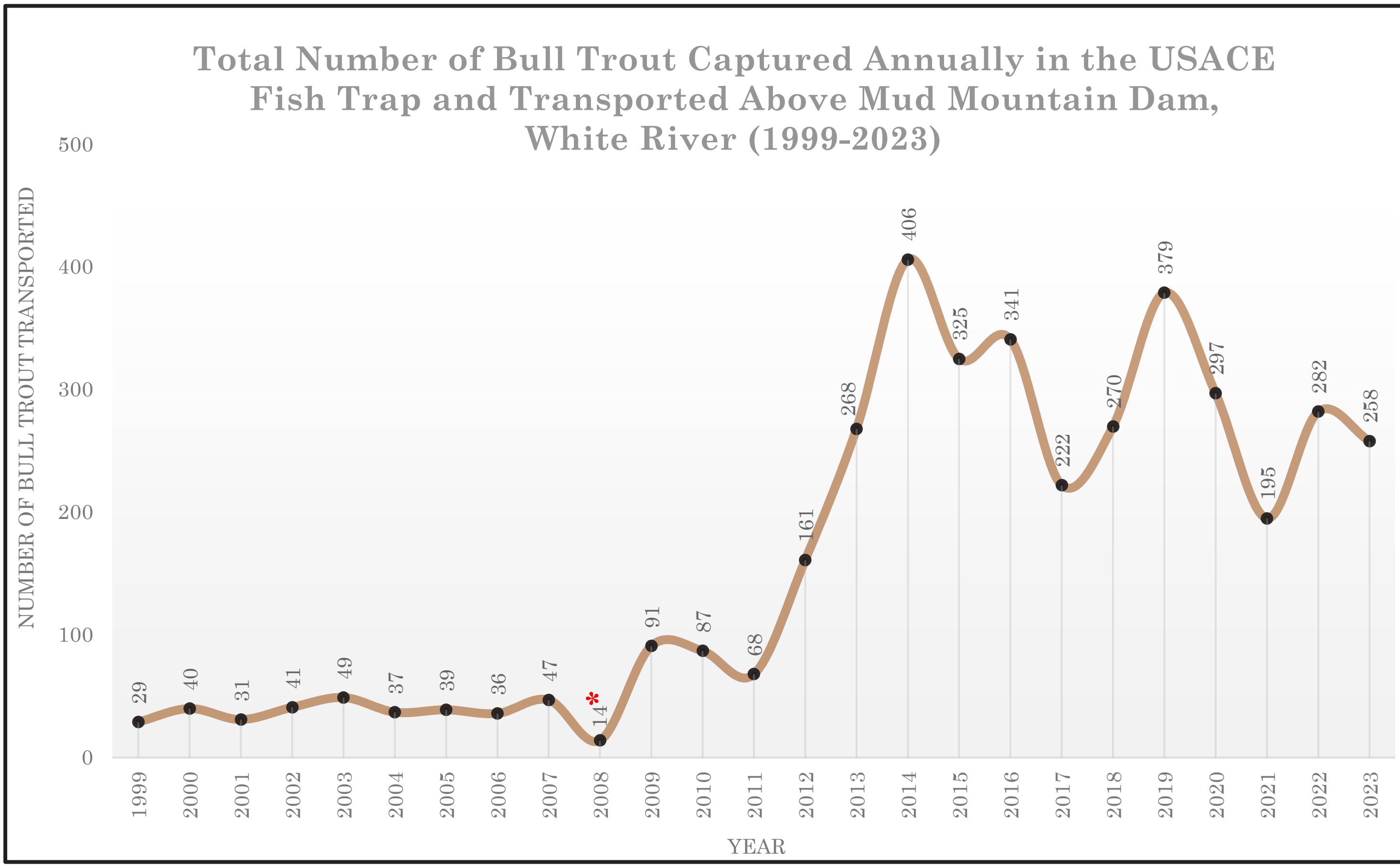




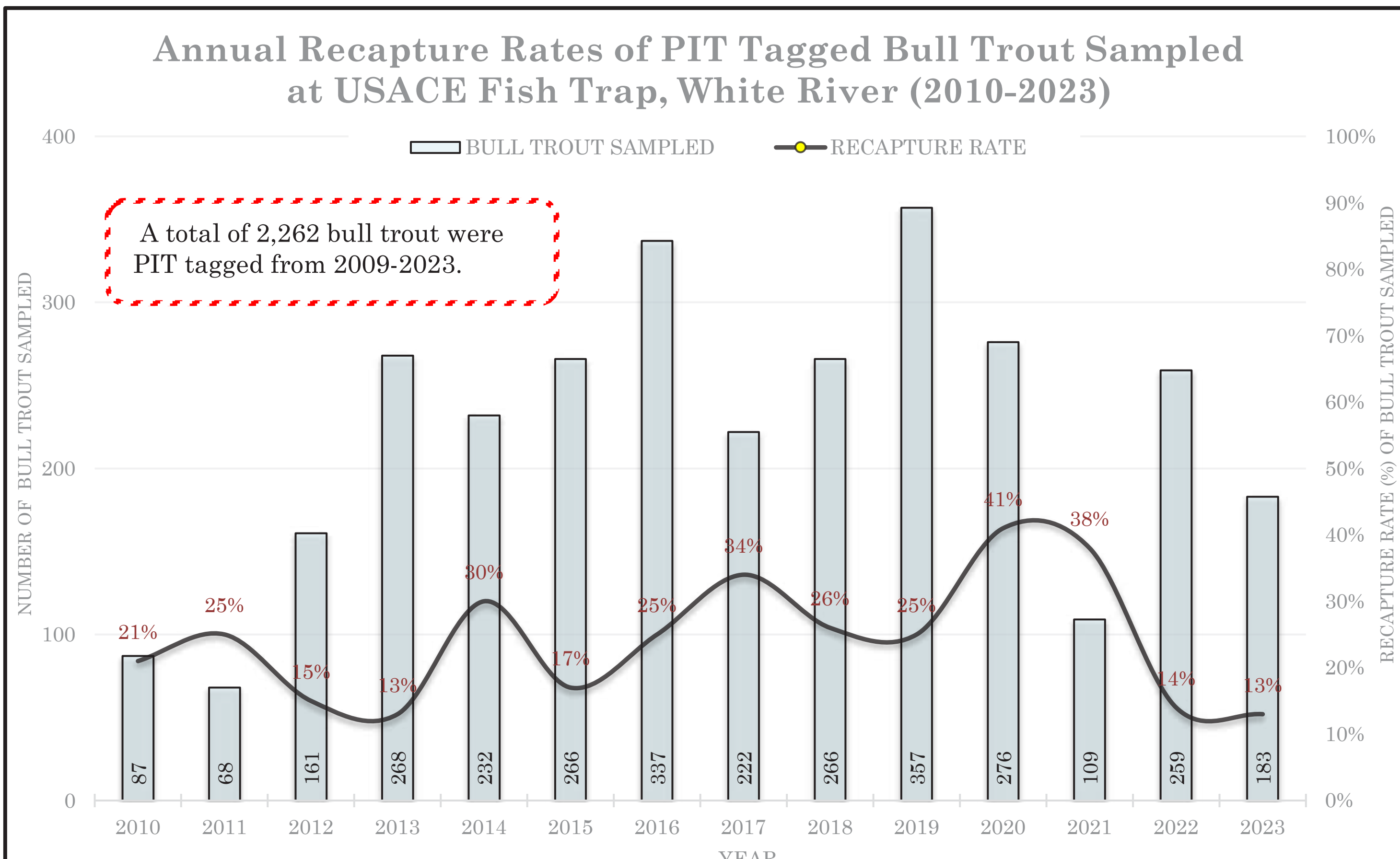
See Appendix E for data on Chinook returns and age compositions. Chinook totals include both Spring and Fall Chinook stocks.



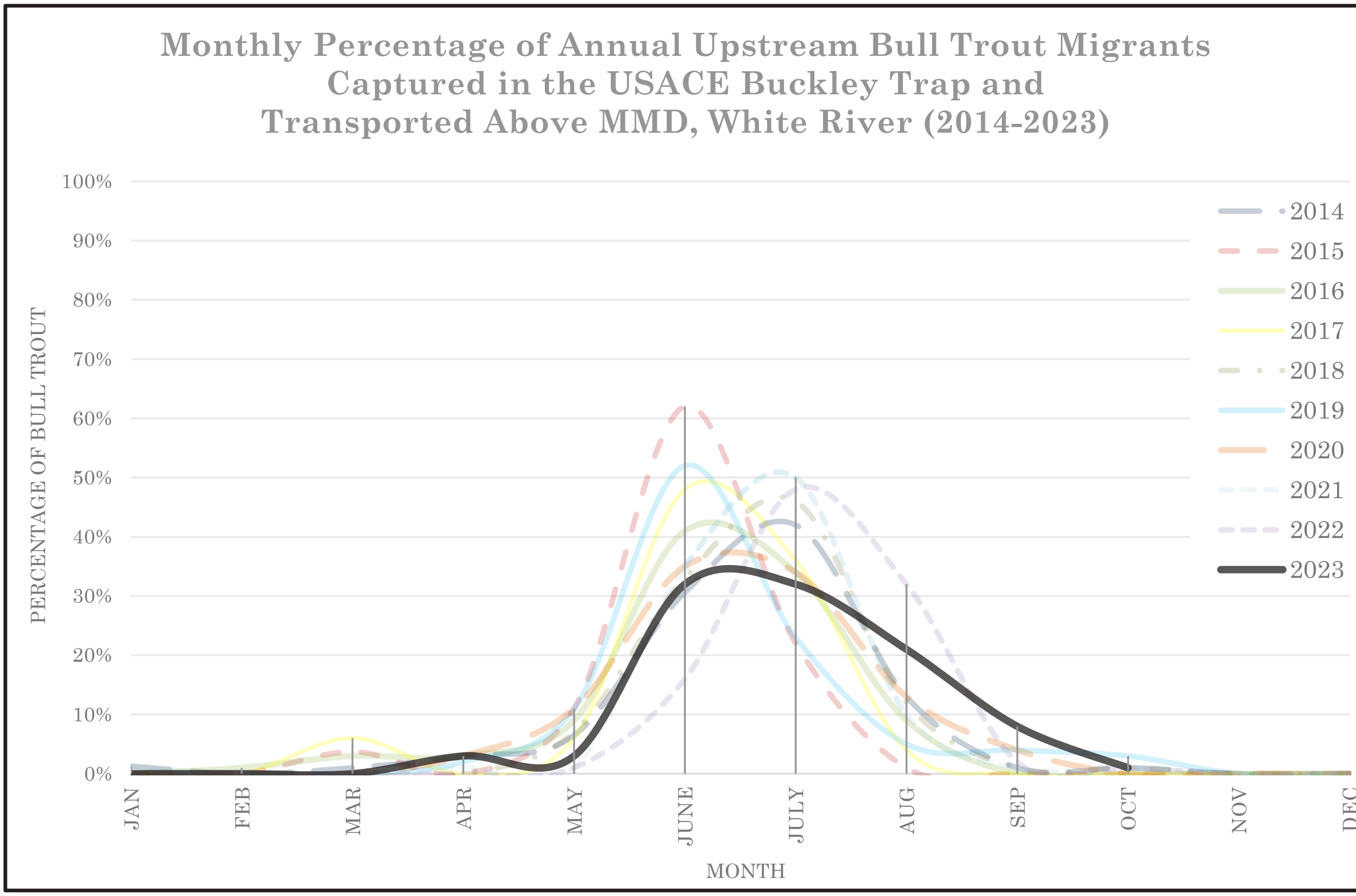
Data source: USACE MMD website http://www.nws.usace.army.mil/Missions/CivilWorks/LocksandDams/MudMountainDam/FishCounts.aspx

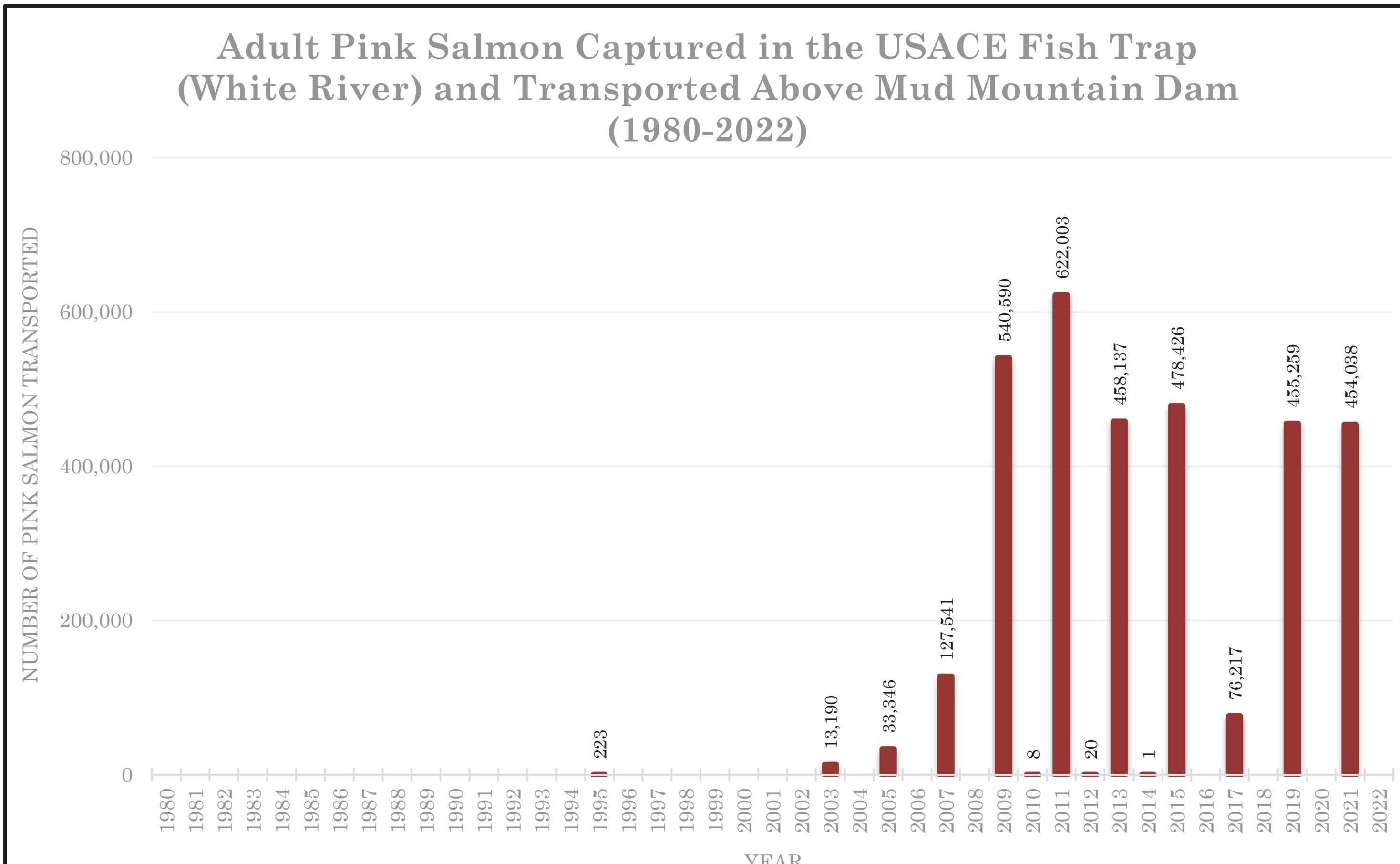


2023 data shows the total number of bull trout transported (sampled & unsampled) through October 30th. *The low number of bull trout captured in 2008 is likely due to significant complications which occurred with trapping operations.

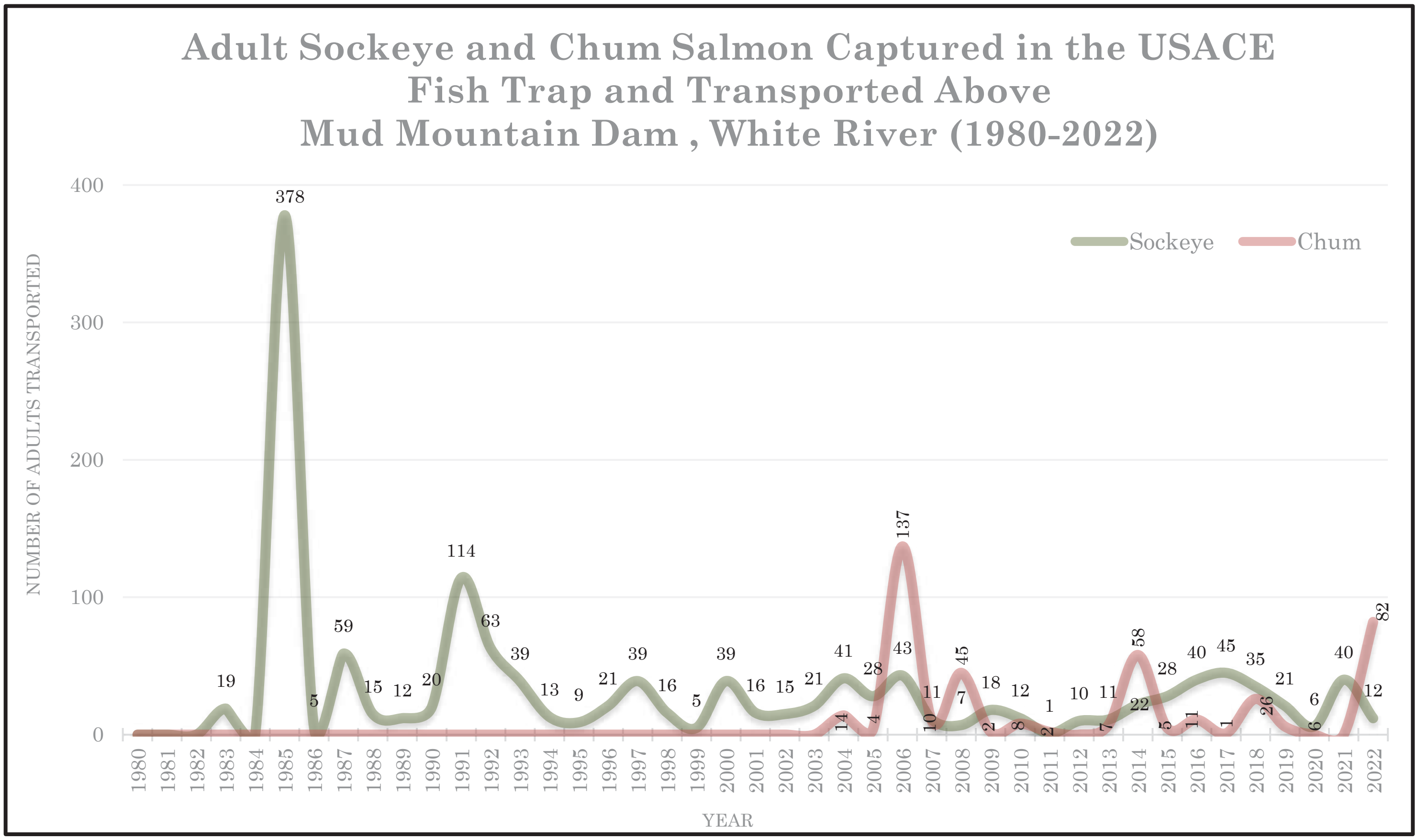


The White River bull trout PIT tagging project was discontinued during 2023.

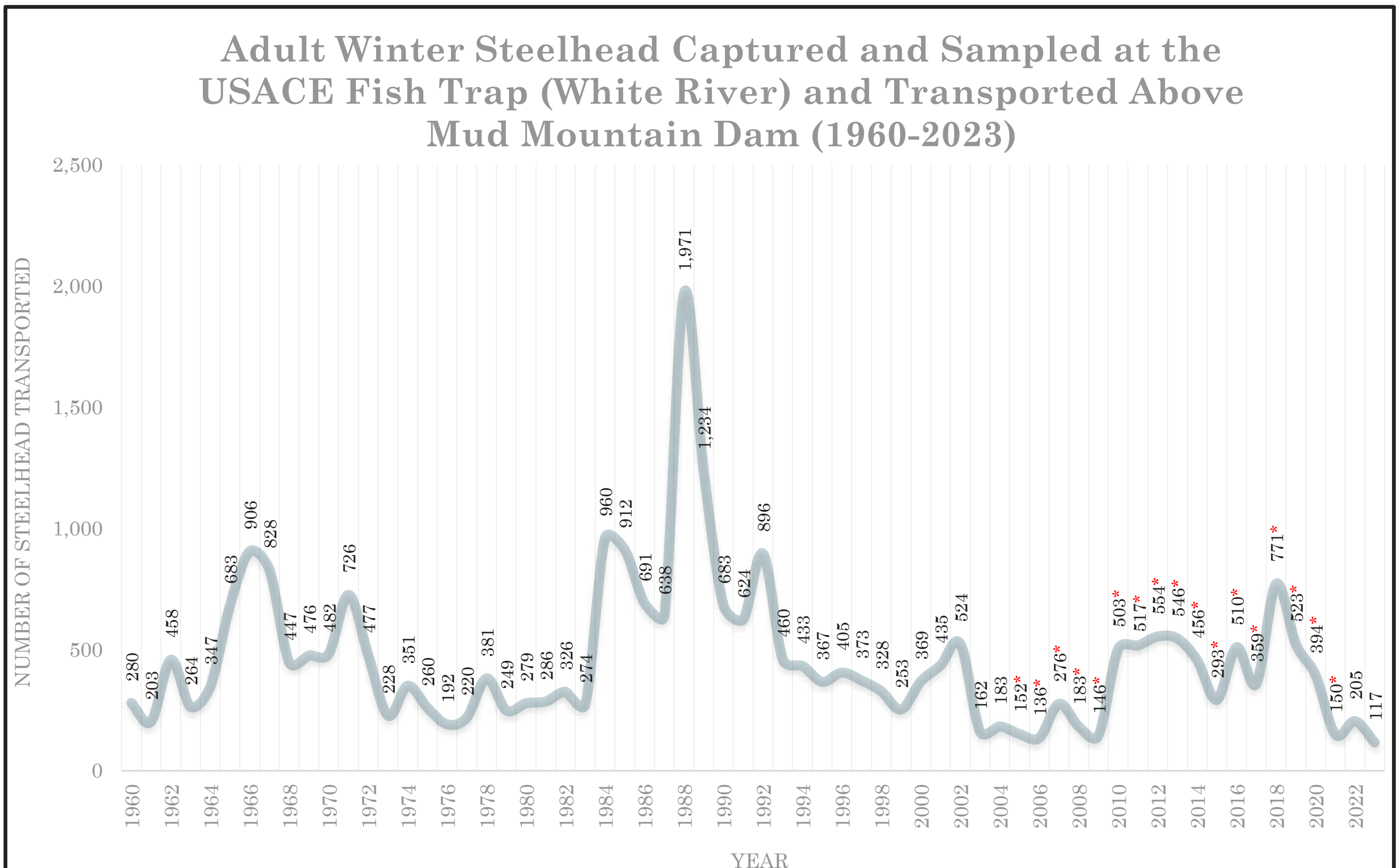




Data Source: USACE MMD website http://www.nws.usace.army.mil/Missions/CivilWorks/LocksandDams/MudMountainDam/FishCounts.aspx



Data Source: USACE MMD website http://www.nws.usace.army.mil/Missions/CivilWorks/LocksandDams/MudMountainDam/FishCounts.aspx



The graph above details the number of steelhead <u>transported</u> above Mud Mountain Dam. *Additional steelhead captured in the trap from 2006-2021 were taken as brood-stock for the White River steelhead supplementation project (discontinued in 2022) and were not transported above MMD. <u>See following page; as well as, Appendix F for the breakdown/age of steelhead returns sampled.</u>

Winter Steelhead Adult Returns Sampled at USACE Fish Trap and Pre-Smolts Released, White River (2012-2023)

YEAR SAMPLED/ RELEASED	ADULTS N=	ADULTS WILD(NOR)	*FISH TAKEN FOR BROOD-STOCK PROGRAM	ADULTS WITH ‡BWT (PROGAM FISH)	PRE-SMOLTS RELEASED (BROOD YEAR) [RELEASE SITE]
2023	117	88	0	29	Program discontinued in 2022 due to insufficient brood-stock availability.
2022	205	170	0	35	21,950 (2021) [Jensen Cr. Acclimation Pond)]
2021	150	122	12	16	28,823 (2020) [Direct plant into Twentyeight mile Cr. & Clearwater River]
2020	394	293	24	77	30,200 (2019) [Direct plant into Clearwater River]
2019	547	447	24	76	34,550 (2018) [Jensen Cr. Acclimation Pond]
2018	795	582	24	189	30,000 (2017) [Jensen Cr. Acclimation Pond]
2017	385	288	26	71	27,625 (2016) [Twentyeight Mile Cr. Acclimation Pond]
†2016	533	476	23	34	29,920 (2015) [Jensen Cr. Acclimation Pond]
†2015	319	273	26	20	31,219 (2014) [Jensen Cr. Acclimation Pond]
2014	479	392	23	64	49,998 (2013) [Huckleberry Cr. Acclimation Pond]
2013	574	338	28	208	27,990 (2012) [Muckleshoot WR Hatchery]
2012	578	345	24	209	31,129 (2011) [Muckleshoot WR Hatchery]

Adult steelhead sampling conducted by Puyallup Tribal Fisheries. See Appendix F for additional steelhead sampling results. See Appendix D for current acclimation pond sites.

*During the spring of 2006, in response to the declining number of winter steelhead, the Puyallup and Muckleshoot Tribes; as well as the Washington Department of Fish and Wildlife, began a steelhead supplementation pilot project developed for the White River. Since 2014, the Puyallup Tribe has assumed the sole responsibility for the continuance of this vital fish enhancement program. The primary goal of this project is to restore the run to a strong self-sustaining population. The project is currently funded and managed by the Puyallup Tribe and utilizes captured wild brood-stock from the USACE trap in Buckley to generate approximately 25K-35K+ yearling smolts. Program discontinued in 2022 due to insufficient brood-stock availability.

†An undetermined number of adult steelhead ascended above the Buckley diversion dam due to missing panels.

‡ Blank Wire Tag (BWT): Same as a Coded Wire Tag (CWT) implant minus the binary code.

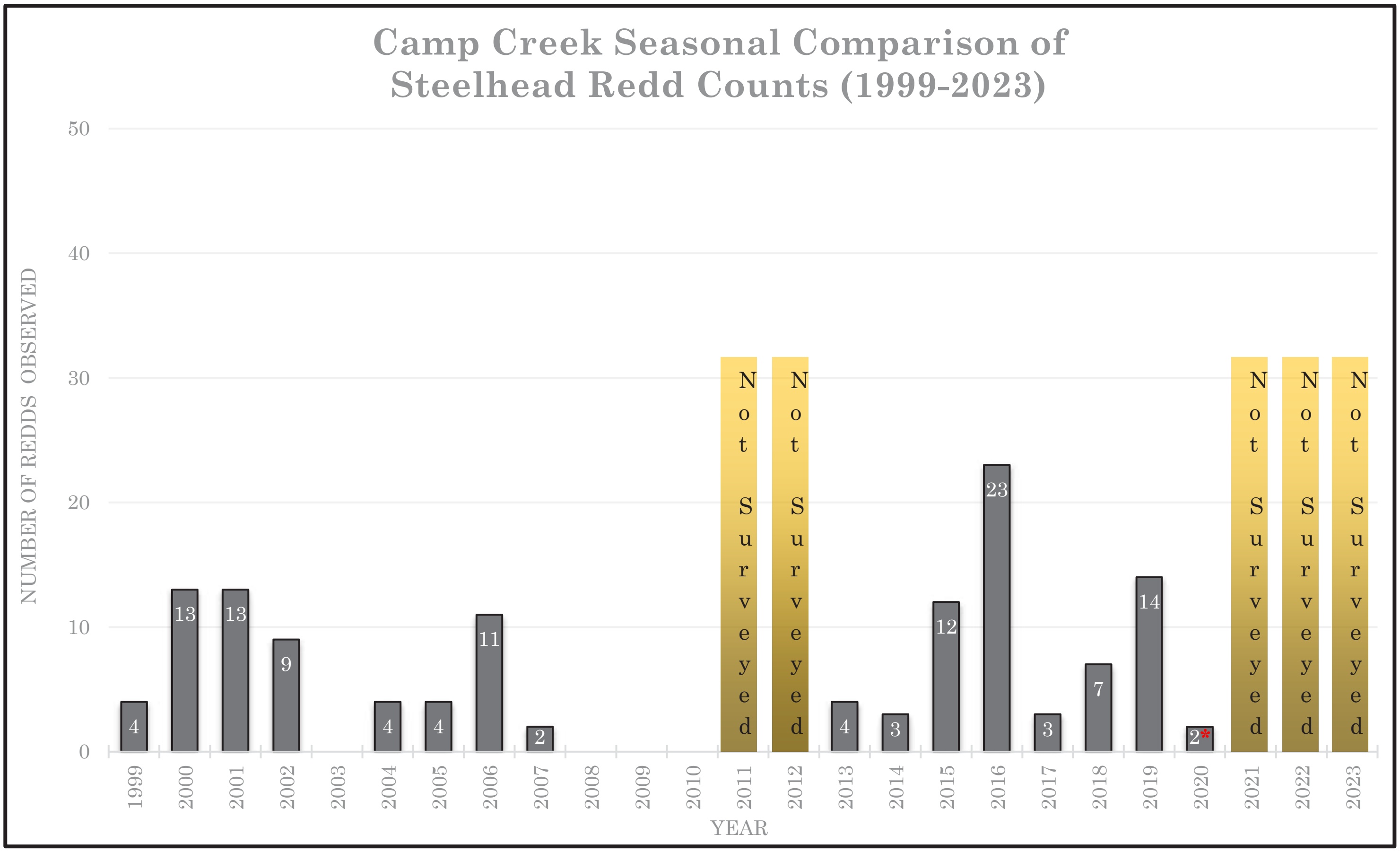
CAMP CREEK

WRIA 10.0112

Camp Creek is a left bank tributary of the upper White River (RM 43.3), located near the community of Greenwater. Camp is approximately 3.6 miles in length; however, only the lower 0.75 miles is anadromous. The creek supports ESA listed Spring Chinook, steelhead and bull trout; as well as non-listed coho, pink and cutthroat, by providing foraging, spawning and overwintering habitat for all life stages. However, insufficient flows can prevent adult Chinook from accessing the creek in late summer and early fall. Therefore, the creek is surveyed essentially for adult steelhead spawning activity. All adult salmon and steelhead that spawn in the Upper White River and its tributaries are initially captured in the USACE fish trap in Buckley; then transported above Mud Mountain dam *(RM 29.6)*. Since precise escapement numbers for the Upper White River drainage are known, surveys are conducted to determine fish distribution and spawning success. This is especially important regarding Spring Chinook and steelhead, given that adult production monitoring is an essential part of recovery planning.

Typical of many upper river tributaries, the mouth of the creek frequently drifts due to its position within the open channel migration zone of the White River. As a result of mainstem river incursions, the creeks lower channel and riparian habitat are frequently altered. The habitat within this section is the least conducive to spawning due to a primarily sandy substrate. In addition, this reach of the creek is highly subjected to the possibility of redd scouring or heavy silt deposition due to the influences of the mainstem White River.

Nearly the entire anadromous reach of the creek *(approximately 0.75 miles)* is low gradient *(lower images)*. Although spawning does occur within this anadromous reach *(depending on mainstem river influence),* it is limited due the quantity and quality spawning substrate created by the fine alluvial deposits *(sand & silt)* from the White River. In addition, adult salmon spawning has more consistent and frequent in this tributary compared to that observed in other upper river tributaries located along the White River such as Rocky Run Creek, located 1.2 miles upstream. Limited quantities of small and medium instream woody debris is present, as well as a beneficial riparian buffer zone of primarily alders and conifers along the majority of the creek. Upstream of the anadromous reach, the creek enters the more heavily forested lower slope of the valley floor as it begins to climbs up the valley wall. From this point, the creek assumes a pool-riffle-cascade configuration as it ascends the lower valley slope.



*2020 data is incomplete (results based on single survey). All adult steelhead that spawn in the Camp Creek were captured at the USACE fish trap in Buckley, and transported above Mud Mountain dam. Since precise escapement numbers for the Upper White River are known (Appendix E & F), surveys for steelhead are conducted for distribution, timing and spawning success. See steelhead redd location map in appendix C.

CANYON CREEK

WRIA 10.0022A

Lower Canyon Creek.

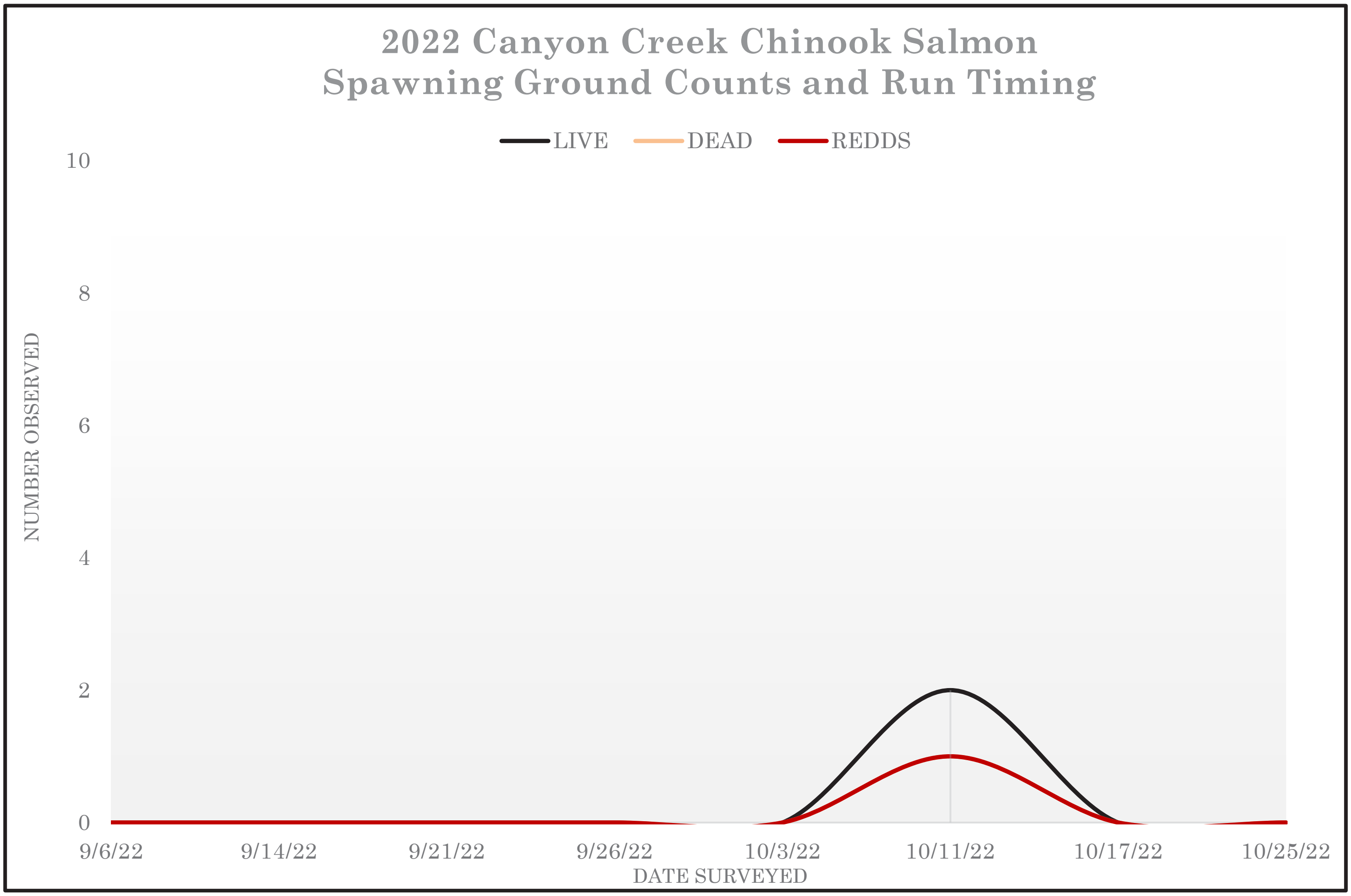
Canyon Creek is a small tributary within the larger 12.1 mi^2 Clear Creek Basin *(10.0022)*. The Clear Creek Basin drains the plateaus and flatlands running along the southern valley of the lower Puyallup River, just west of the city of Puyallup. Canyon Creek doesn't appear on the hydrology of most common mapping systems. Canyon supports several species including: Chinook, coho, pink, chum, steelhead/rainbow, cutthroat and bull trout.

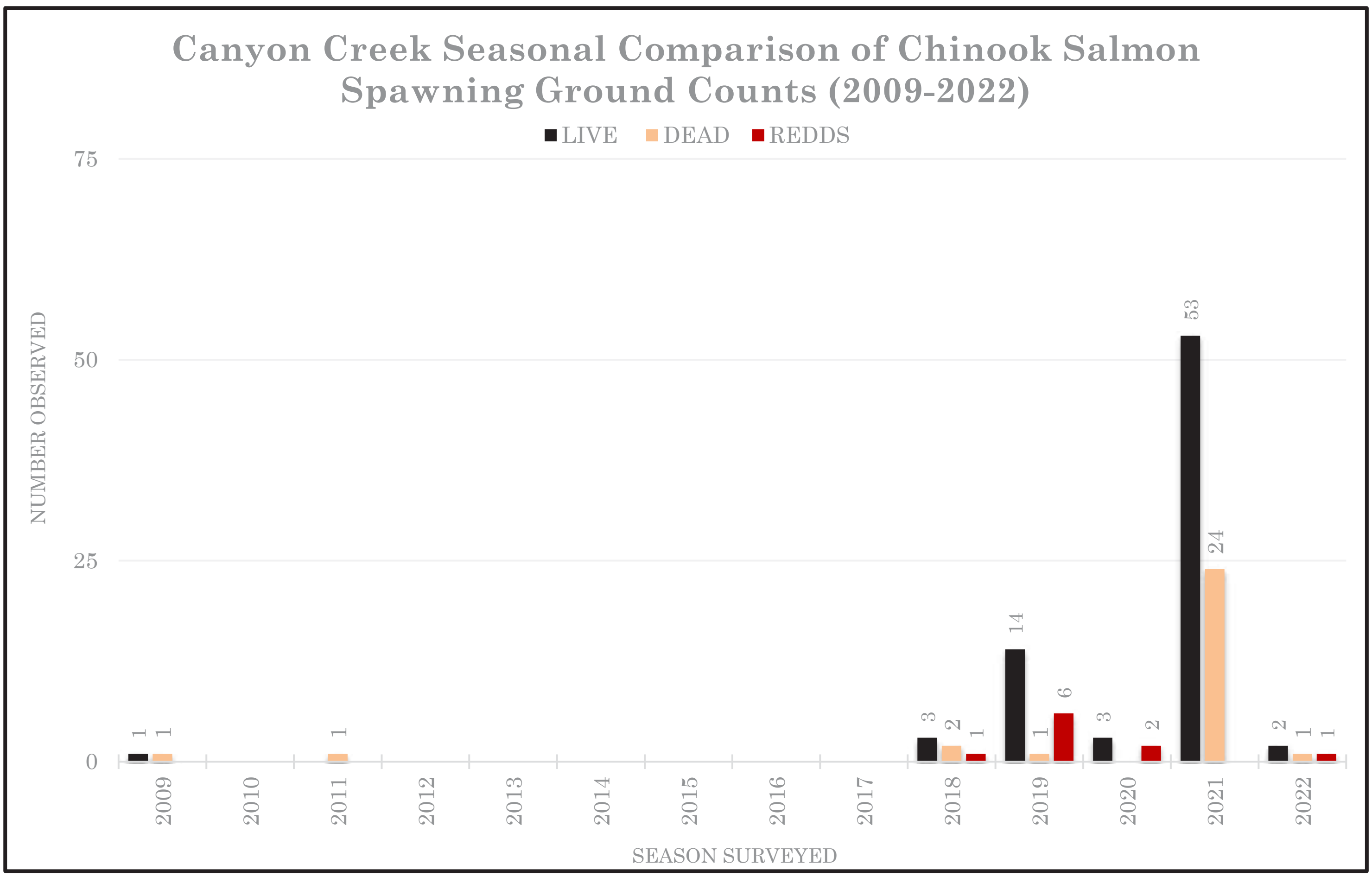
Little stream complexity exists within Canyon Creek, and seasonal flows are rarely adequate to allow access for adult Chinook or steelhead to spawn. However, adult Chinook have been observed in the creek and it's highly likely juveniles from adult spawners *(Chinook and coho)* in Clear and Swan creeks utilize Canyon Creek, especially for foraging and overwintering. There is often an abundance of chum fry during the spring, as well as coho fry throughout spring and summer for steelhead and cutthroat to forage on. Adult fluvial bull trout are also known to forage in the smaller tributaries of the lower Puyallup, including Canyon Creek.

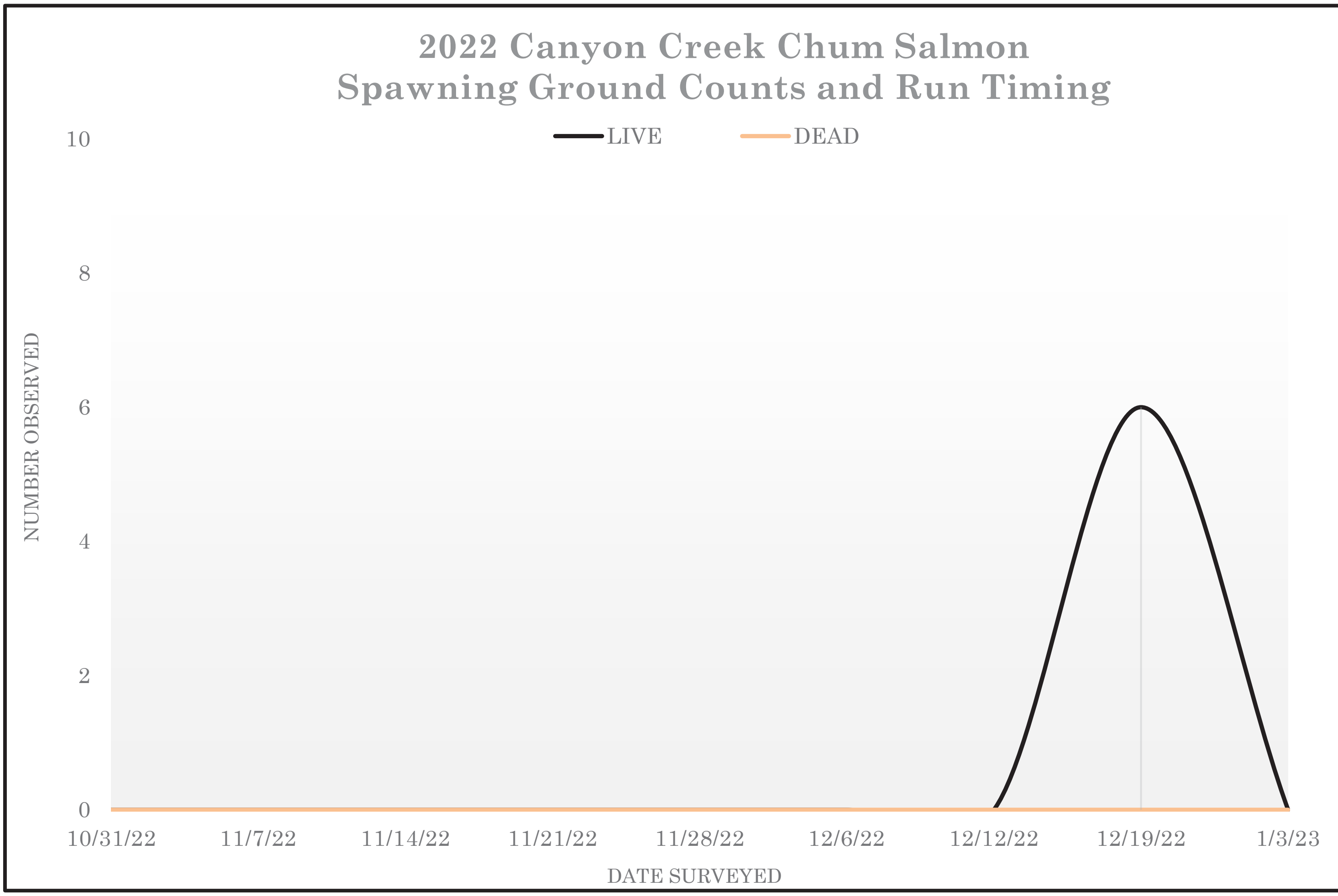
Chum salmon are the only species regularly observed spawning in Canyon, and can be seen spawning from late November through January. Unfortunately, chum escapement has dropped precipitously since 2011. Adult Chinook and coho are periodically observed, but regular surveys are conducted for coho by the Puyallup Tribe given their escapement numbers are extremely low and spawning habitat is limited; however, juvenile coho are often observed. Canyon lacks significant habitat complexity such as LWD, riparian, off channel habitat, or variation in stream channel type. The greater part of the lower reach of the creek consists of a flat low gradient channel with few hydraulic breaks. All species are able to ascend just upstream of the culvert running under Canyon Road. Cutthroat and bull trout are capable of ascending the steeper gradient beyond the culvert. Cutthroat and sculpin are the predominant species present in the upper anadromous reach located below the culvert crossing adjacent to the Miles quarry on Canyon Road.

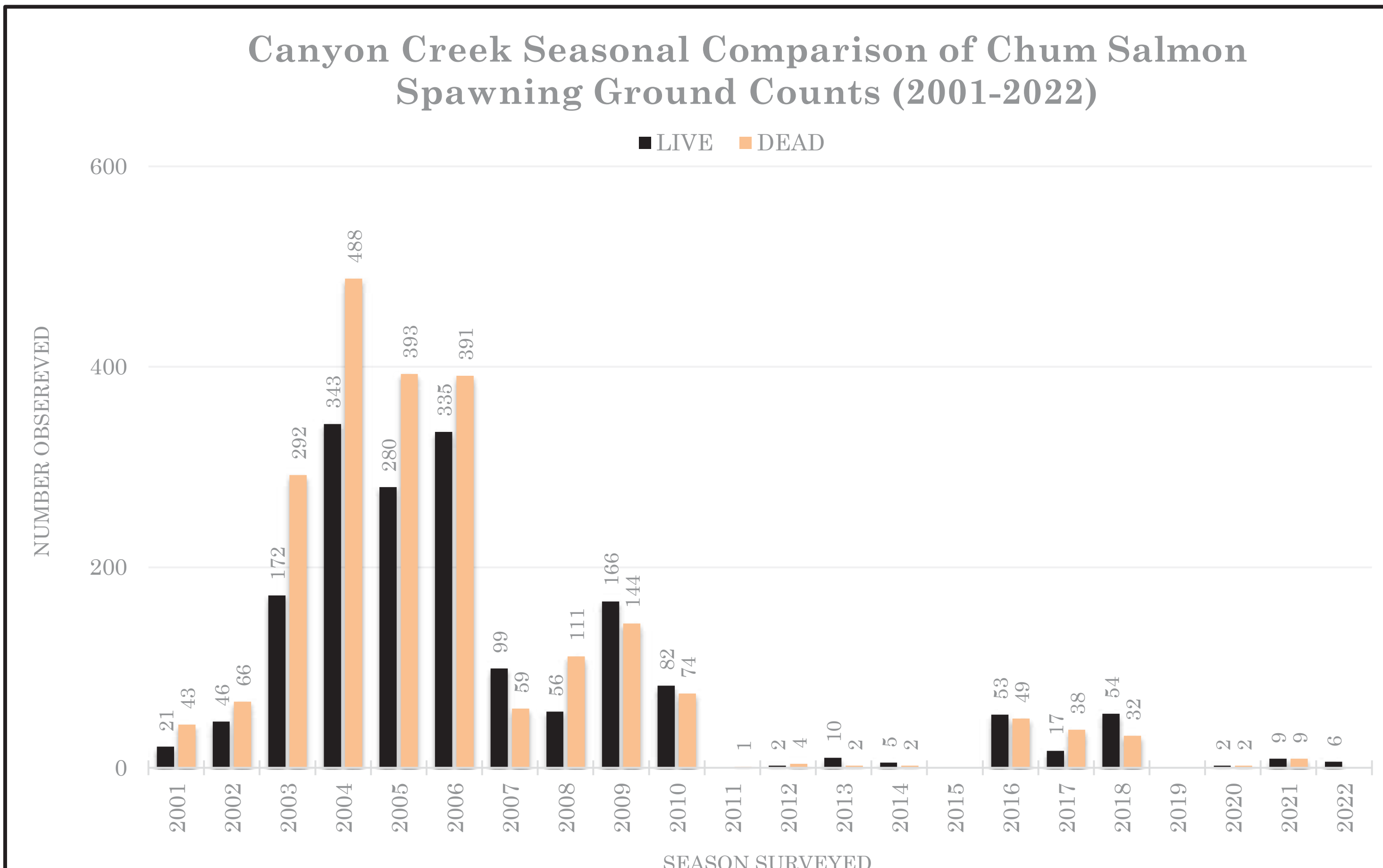
Upstream of the culvert crossing under lower Canyon Road, the gradient increases and prevents weaker swimmers like chum from ascending further. In the past, the culvert itself did not appear to be an encumbrance to chum, since they were often observed spawning on the fine gravel within the culvert. The main channel above the culvert has been engineered with the placement of log weirs to retain gravel. They appear to be only moderately effective because the amount of fines in the entire reach is excessive. However, a problematic issue is the continuing bedload accumulations within the culvert and at the downstream opening causing the channel below to avulse when bedload builds. Downstream of Pioneer, the substrate consists largely of fines and patches of extremely compacted small gravel.

Fall Chinook. ♂


2022 Canyon Creek Chinook Salmon
Spawning Ground Counts and Run Timing
LIVE
DEAD
REDDS
NUMBER OBSERVED
10
8
6
4
2
0
9/6/22
9/14/22
9/21/22
9/26/22
10/3/22
10/11/22
10/17/22
10/25/22
DATE SURVEYED


Canyon Creek Seasonal Comparison of Chinook Salmon
Spawning Ground Counts (2009-2022)
LIVE
DEAD
REDDS
NUMBER OBSERVED
75
50
25
0
1
1
1
3
2
1
14
1
6
3
2
53
24
2
1
1
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
SEASON SURVEYED


2022 Canyon Creek Chum Salmon
Spawning Ground Counts and Run Timing
LIVE
DEAD
NUMBER OBSERVED
10
8
6
4
2
0
10/31/22
11/7/22
11/14/22
11/21/22
11/28/22
12/6/22
12/12/22
12/19/22
1/3/23
DATE SURVEYED


Canyon Creek Seasonal Comparison of Chum Salmon
Spawning Ground Counts (2001-2022)
LIVE
DEAD
NUMBER OBSEREVED
600
400
200
0
21 43
46 66
172 292
343 488
280 393
335 391
99 59
56 111
166 144
82 74
1
2 4
10 2
5 2
53 49
17 38
54 32
2 2
9 9
6
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
SEASON SURVEYED

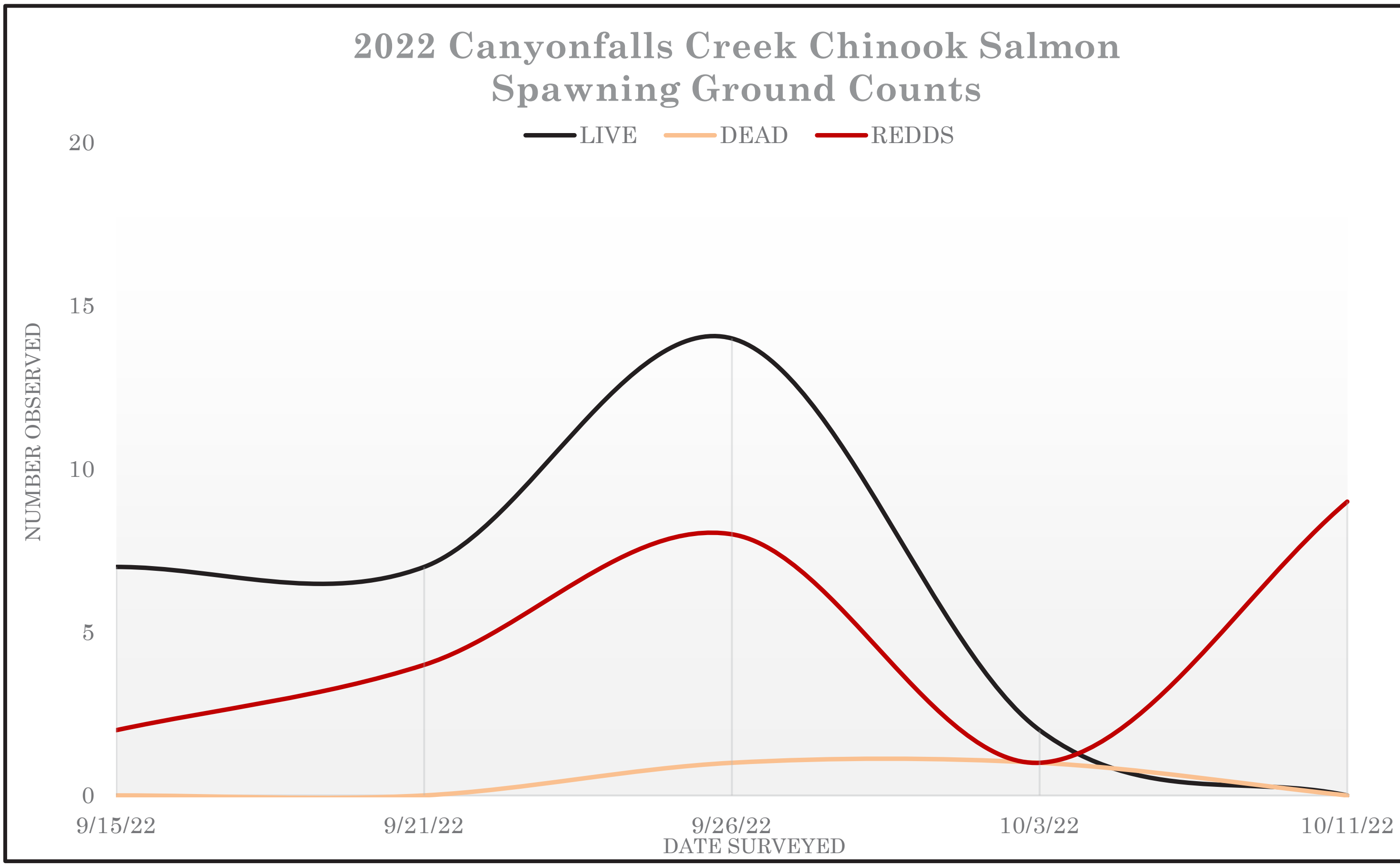
CANYONFALLS CREEK

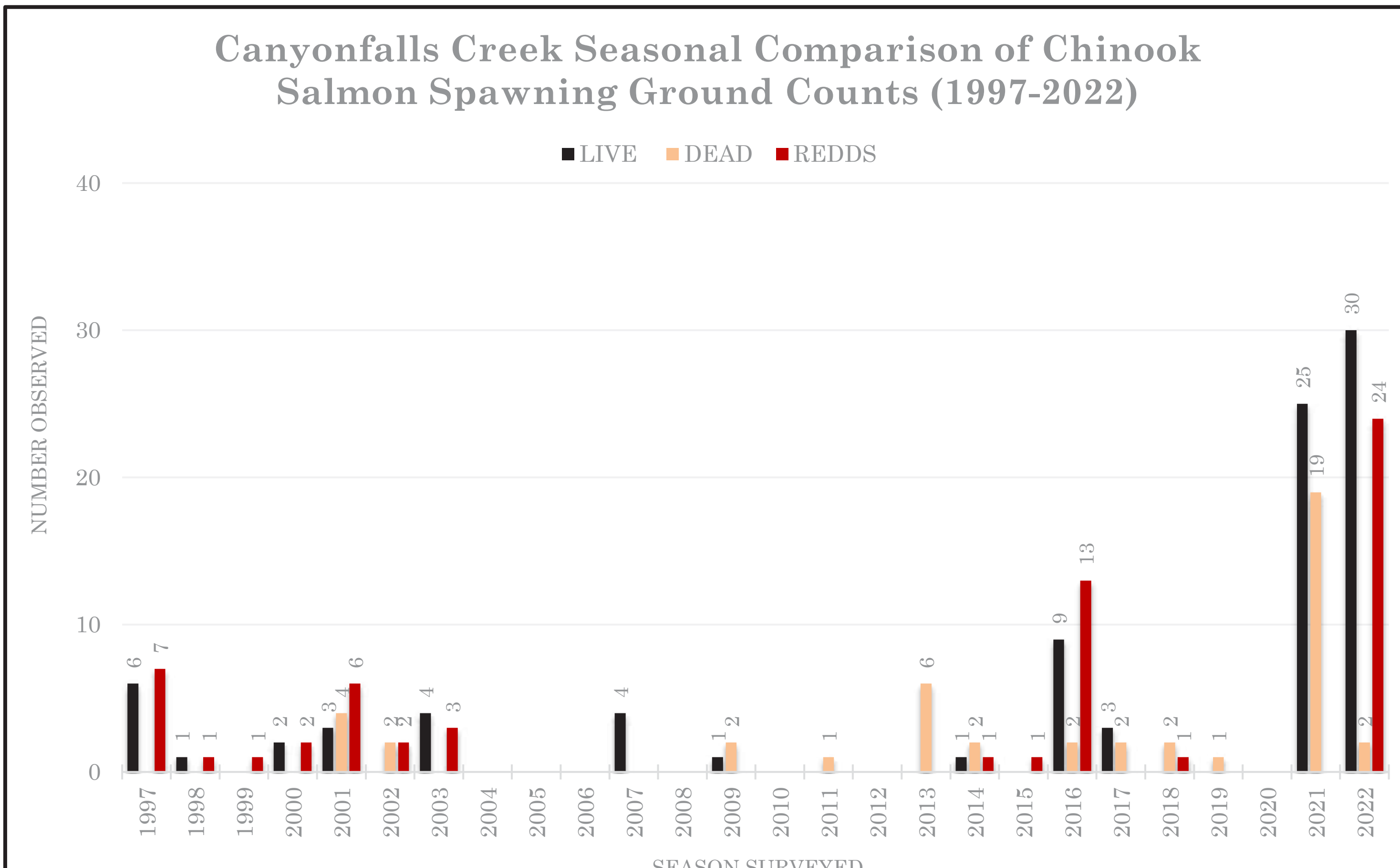
WRIA 10.0410

Canyonfalls Creek is a small tributary entering the Puyallup River at approximately RM 16.2, near the town of McMillin *(north of the city of Orting)*. Canyonfalls is primarily a spring fed stream that has relatively consistent instream flows, even in late summer. Although the stream length is three miles, nearly all spawning activity for species common to the creek takes place below the culvert under McCutcheon Rd. at RM 0.5. The gradient quickly increases above the culvert, but several pockets of usable spawning gravel exist just upstream of the culvert. In 2003, Pierce County replaced the culvert under McCutcheon Road with a larger cement box culvert. However, significant aggradation of bedload has created potential road flooding risks; as well as, upstream anadromous access to spawning habitat. This culvert is once again due for replacement in order to meet current hydraulic and fish passage needs.

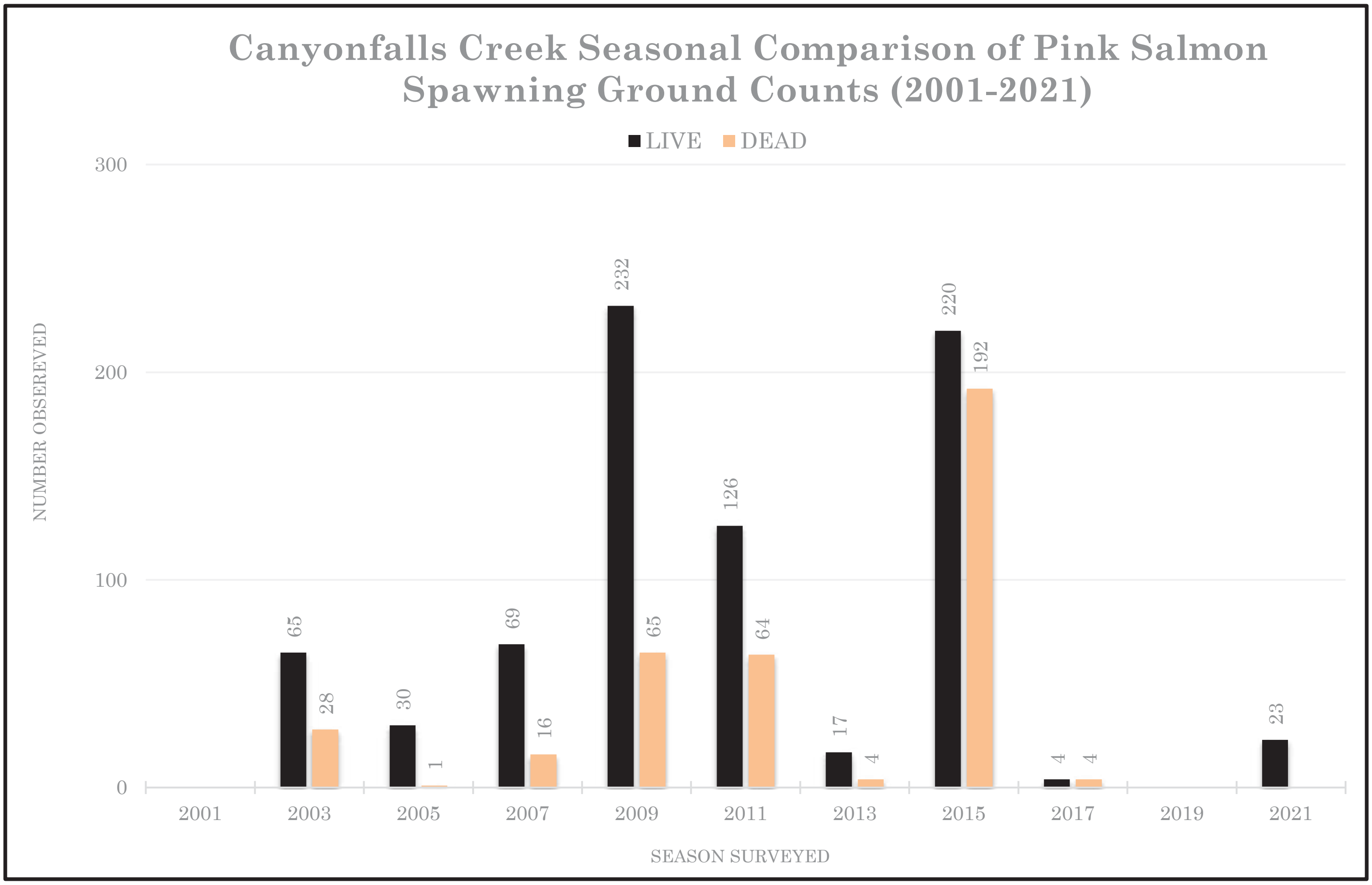
Approximately 400 feet upstream of the culvert, the creek rapidly climbs nearly 300 feet in elevation to where it's discharged from a privately-owned hatchery *(Trout Lodge)*. The creek is diverted to meet the needs of raising trout for planting in regional lakes. Above the hatchery the creek continues to climb through a forested area. As mentioned, the lower anadromous reach of the creek extends downstream of McCutcheon road; the substrate is a combination of sand and gravel within a low gradient pool-rifle channel. In the summer of 2002, 220 cubic yards of 1-to-3 inch spawning quality drain rock was deposited directly downstream of the McCutcheon road culvert, and distributed along an approximately 0.2 mile *(1,000')* stretch of the creek. The rock was deposited as a result of a settlement agreement between the Puyallup Tribe, and Fennel Resources, which has a gravel mining operation located on Fennel Creek. Nearly all spawning activity observed occurs within this short 0.2 mile stretch of the creek. Below this point the substrate consists primarily of fines, which is more typical for this stream type, but unfortunately is rarely suitable for spawning. The riparian is primarily alder and salmonberry. The width of the riparian zone along the right bank is limited due to the extremely close proximity of McCutcheon Rd. Canyonfalls Creek also benefits from small amounts of woody debris inputs; as well as excellent coho habitat created by frequent beaver (*Castor canadensis*) activity. Although in 2004, a beaver dam below the survey reach prevented Chinook from accessing the spawning habitat farther upstream. Currently, beaver dams are notched in the fall to establish connectivity to spawning habitat.

Chinook, coho and chum are the most prevalent species observed spawning in the creek. Coho juveniles and fry are present in the creek year round, and are often observed during adult spawning surveys. In addition to these key species, pink salmon have been observed consistently during odd years since 2003. Prior to 1998, steelhead were documented spawning in the creek on a regular annual basis. Unfortunately, similar to many lower watershed streams within the Puyallup and White Rivers, few live steelhead or signs of spawning activity have been observed since 1999. Adult bull trout have been caught by sport anglers in the Puyallup River near the mouth of Canyonfalls; however, bull trout utilization within this spring fed drainage is unknown, but presumed. Canyonfalls does offer excellent foraging and overwintering opportunities for all species, including bull trout.

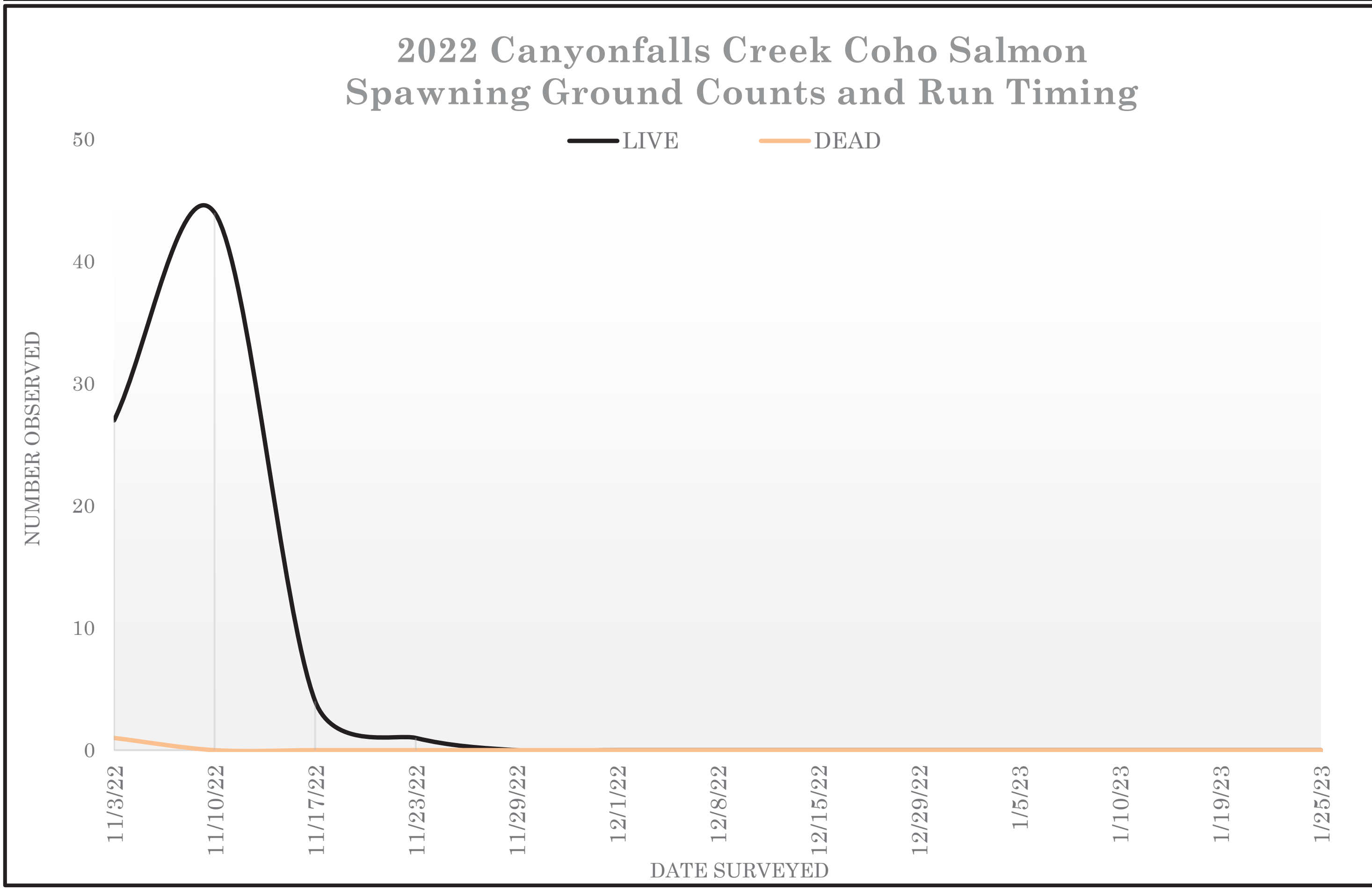




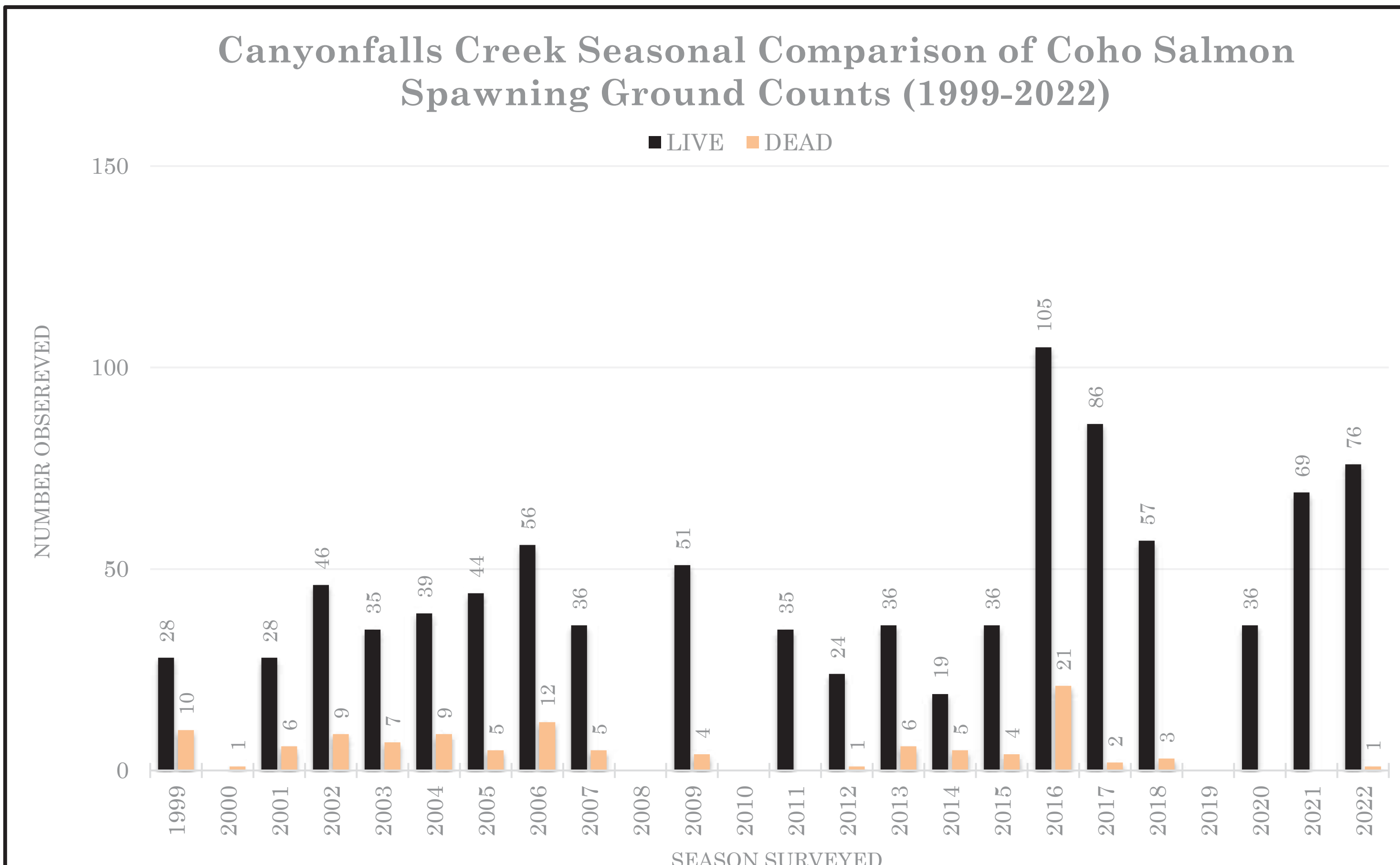
Adult Chinook escapement is determined by expanding the number of redds observed by 2.5 fish per redd (Smith and Castle, 1994). Due to the tremendous volume of pink salmon during odd years, the success of determining Chinook redds from pinks is vastly reduced. Therefore, The AUC method is used to determine escapement during pink runs (odd years).

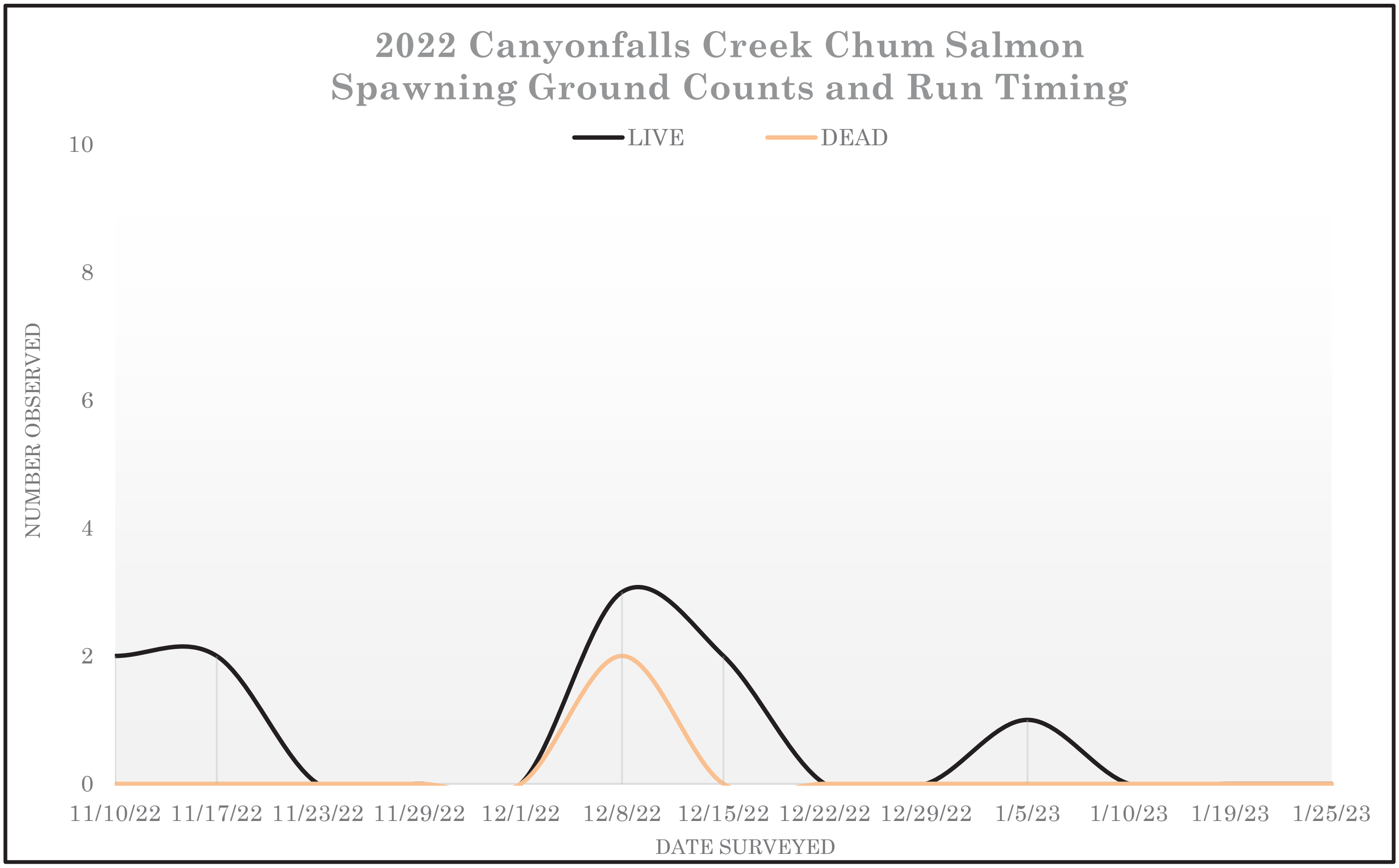


Canyonfalls Creek Seasonal Comparison of Pink Salmon Spawning Ground Counts (2001-2021)
LIVE
DEAD
NUMBER OBSEREVED
SEASON SURVEYED
300
200
100
0
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
65
28
30
1
69
16
232
65
126
64
17
4
220
192
4
4
23

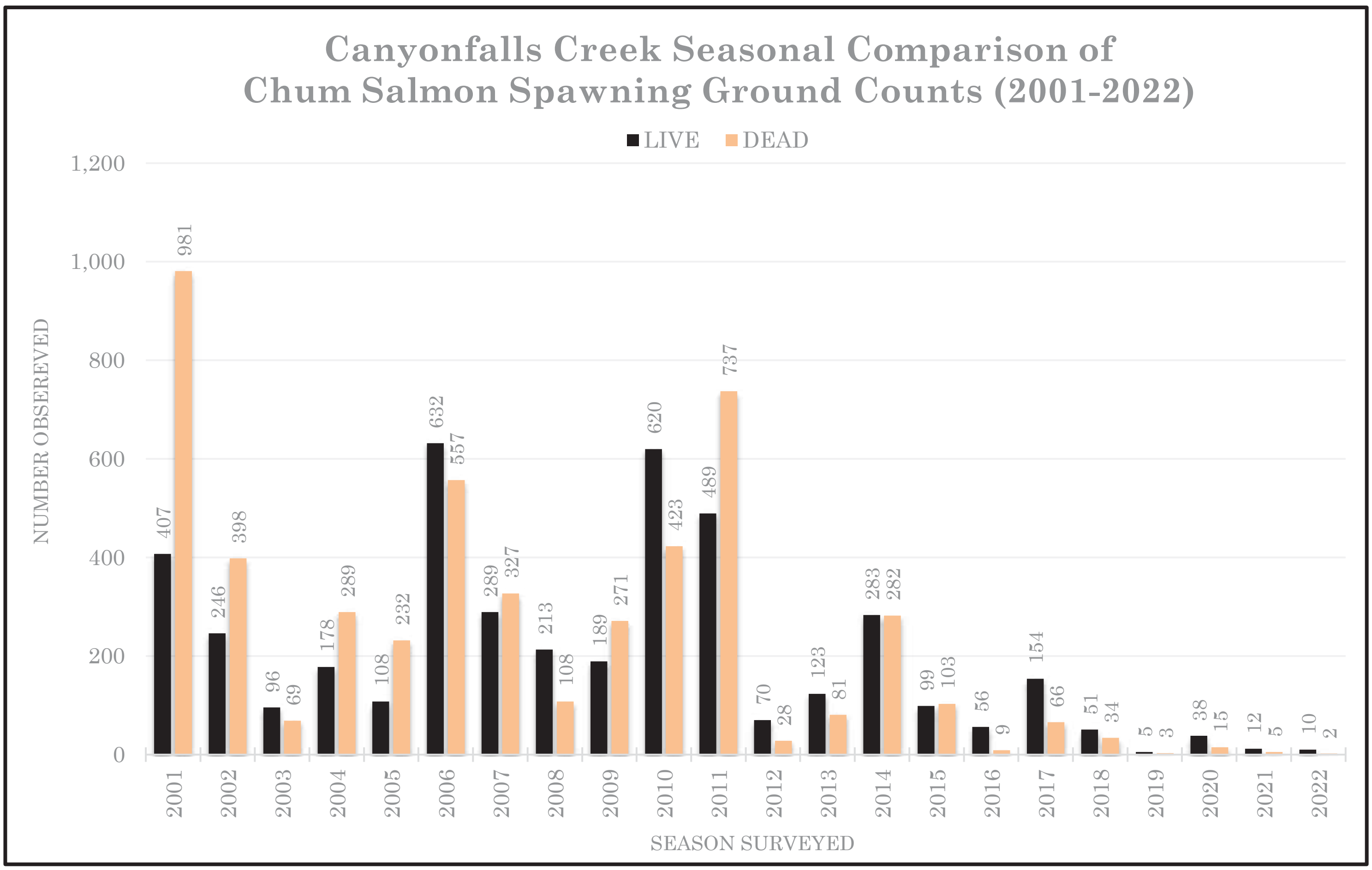


Canyonfalls Creek coho graphs were generated using survey data collected and provided by WDFW biologists.

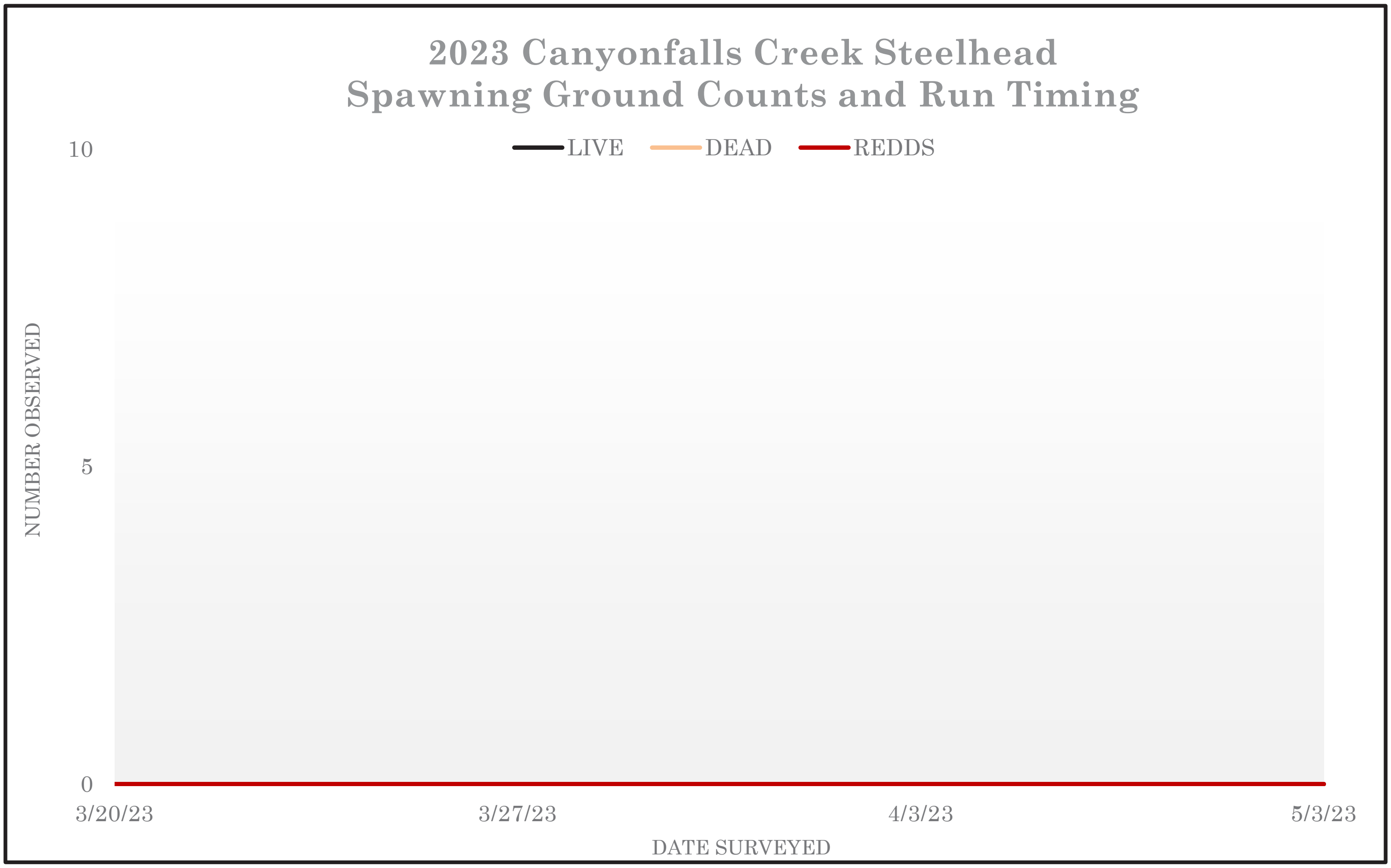


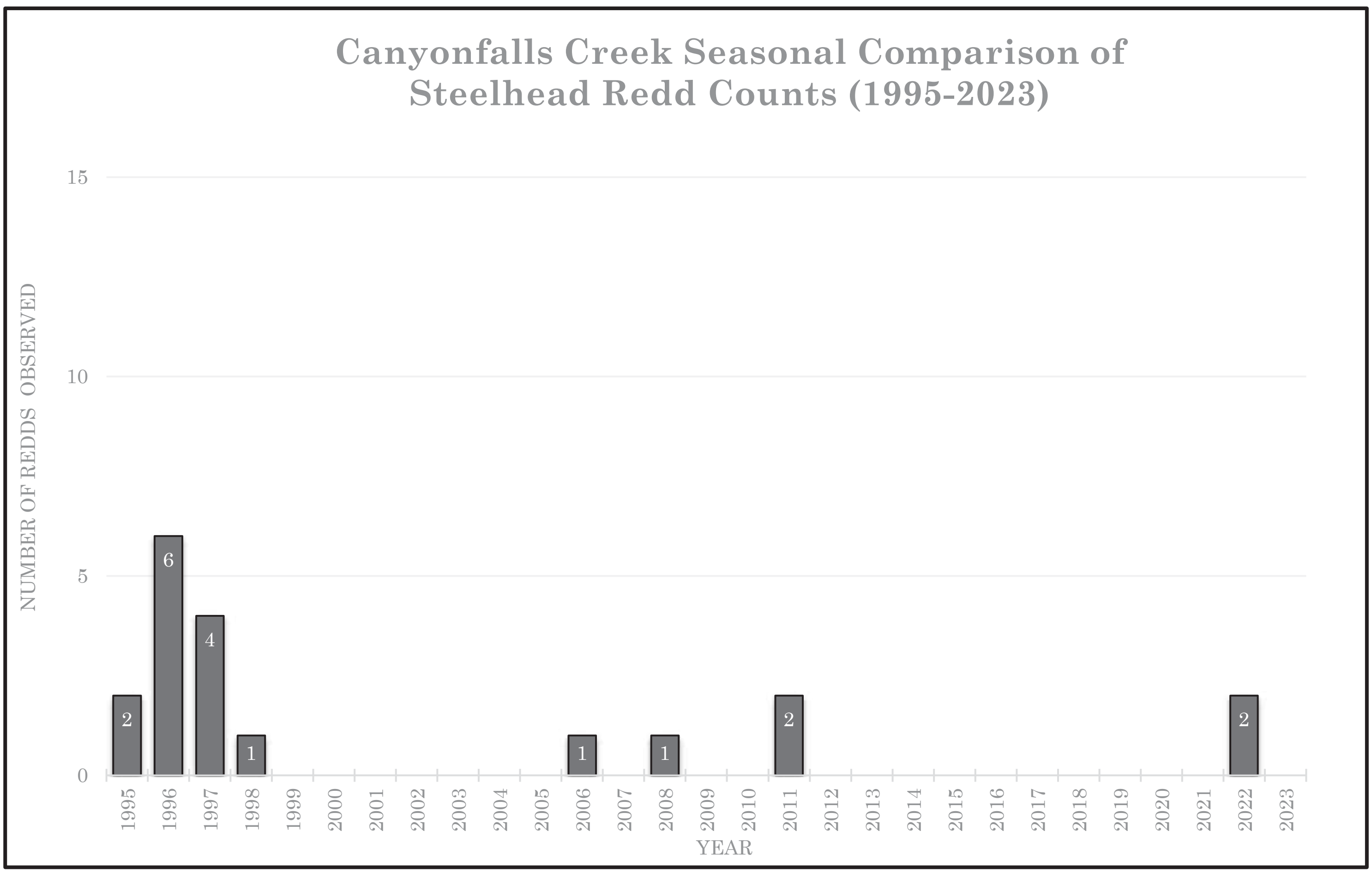


Canyonfalls Creek chum graphs were generated using survey data collected and provided by WDFW biologists.



Canyonfalls Creek chum graphs were generated using survey data collected and provided by WDFW biologists.





To determine the total escapement for steelhead, each redd is multiplied by a factor of 1.62 *(i.e. 42 redds x 1.62 steelhead per redd = total escapement of 68 steelhead).*

CARBON RIVER

WRIA 10.0413

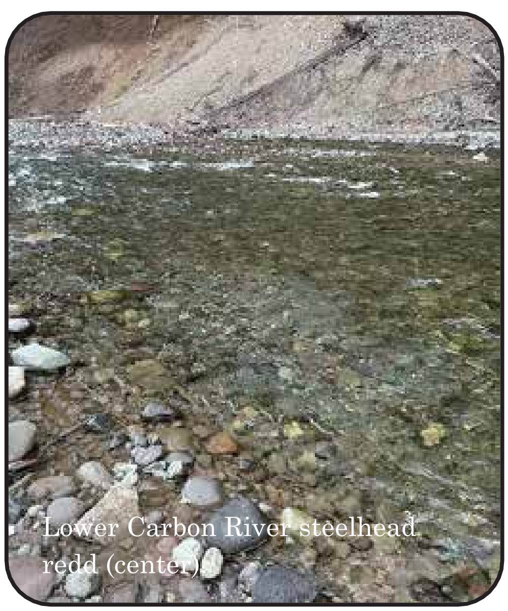

Lower Carbon River

The Carbon River is a major tributary of the Puyallup River, entering the Puyallup at RM 17.9, just north of the city of Orting. The Carbon River drainage provides excellent spawning and rearing opportunities for salmon, steelhead and bull trout. In the past, steelhead have been documented as high as the Mt. Rainier National Park boundary. However, the majority of spawning for all species within this drainage, with the exception of bull trout, occurs within the lower 11 miles of the mainstem Carbon River and lower 12.6 miles of South Prairie Creek.

The lower 3 miles of the Carbon River are constrained by earthen levees. Failures along this levee system during the November 2006 flood event reinforces the need for levee set-backs, which would help address the need for improved fish habitat and increase flood capacity within this drainage. Currently, the lower river channel varies considerably in width *(up to 1000')*. The resulting channel is only moderately diverse with a pool riffle character. Spawning gravel exists in limited quantities and is utilized by all species of salmonids present, although not in the numbers observed in the upper reaches. From RM 3.0 to the mouth of South Prairie Creek at RM 6.0, the river is constrained by a levee along the south bank. Large natural bluffs hold the Carbon along its northern bank allowing the river to migrate over a channel of up to 0.5 miles wide. This reach contains multiple channels and many woody debris jams throughout its length. The spawning and rearing habitat is more improved throughout this reach and spawning densities are frequently higher along this section of the river.

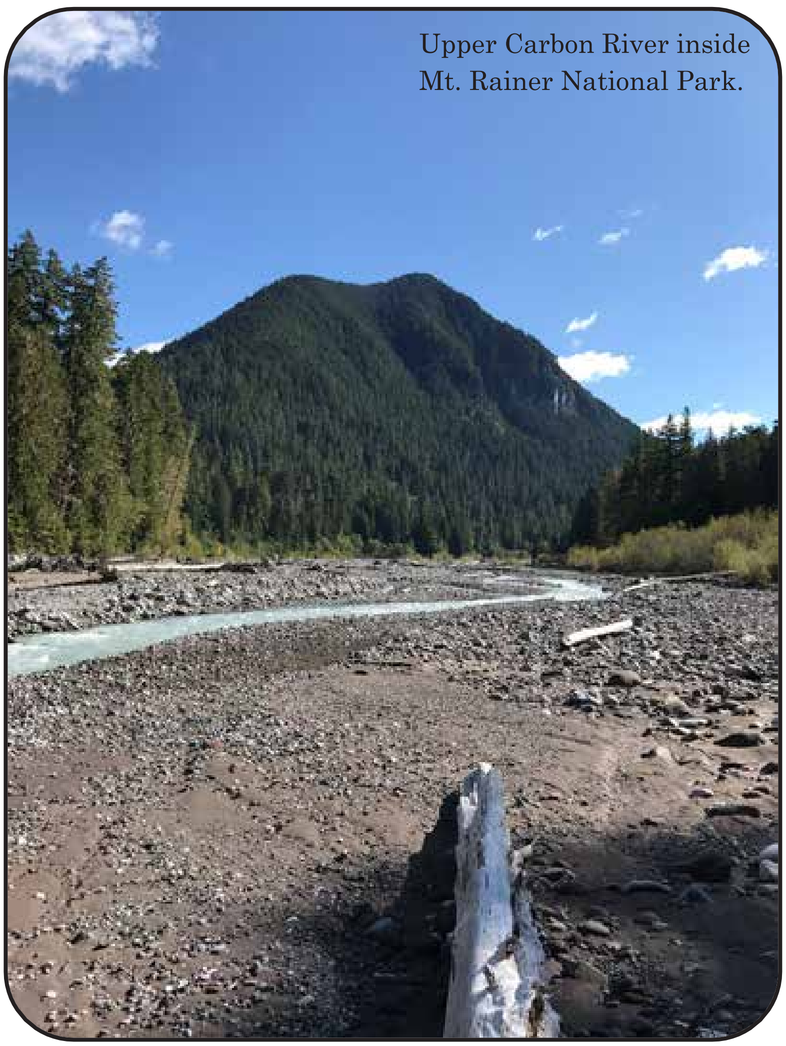
The reach above South Prairie Creek, from RM 6.0 to 8.5, is again constrained by both levees and natural bluffs along the north bank. This reach has a slightly higher gradient than the lower reach and as a result contains less spawning habitat. There are portions that are utilized by Chinook and steelhead, but not in the densities observed in the stretch above Voights Creek *(RM 4.0)*. Above RM 8.5, the Carbon River flows through a narrow canyon for several miles before becoming unconstrained downstream of the Mt. Rainier National Park boundary. This canyon reach supports Chinook and steelhead spawning, however, chum and pink salmon have not been observed above RM 8.

The Mt. Rainier National Park boundary is located at RM 23. From the park boundary, up to approximately RM 26, the gradient remains low enough to provide some spawning opportunities along channel margins and pool tail-outs. Several small and moderate debris jams occur throughout this reach. Above RM 26, the gradient gradually increases to the terminus of the Carbon glacier. There is less channel braiding in this section and the substrate is considerably larger providing far fewer spawning opportunities. Several tributaries of the Carbon River providing critical habitat for fish include South


Lower Carbon River steelhead redd (center)

Prairie Creek, Voights Creek, Ranger and Ipsut creeks.

South Prairie Creek is a major tributary of the Carbon River, entering the Carbon near RM 6, just downstream of the Highway 162 and the Foothills Trail bridge crossings. With a drainage area over 90 mi², South Prairie Creek is considered one of the most productive drainages in the Puyallup/White River Watershed. The headwaters originate along the northwest foothills of Mt. Rainier within the Mt. Baker-Snoqualmie National Forest. The mainstem creek flows for over 21.5 miles; coursing its way through or near the communities of Wilkeson, Burnett, and South Prairie. The creek offers critical spawning and rearing habitat for adult and juvenile salmonids including; Chinook, pink, coho, chum and steelhead. Bull trout have been documented in the creek, but distribution and utilization is unknown. Limiting factors associated with South Prairie include; low summer flows, channel confinement and narrowing, bank erosion, disconnected floodplain, water quality *(303 (d) listed for temperature)*, areas of deficient riparian cover, and invasive non-native plant species.


Upper Carbon River inside Mt. Rainer National Park.

The anadromous range extends roughly the first 15 miles of the mainstem; a series of impassable falls near RM 15.4 prevents any further upstream migration. Tributaries including Wilkeson, Spiketon, Beaver, plus several unnamed tributaries, add miles of additional spawning and rearing habitat, as well as flow contributions.

From the mouth, upstream to RM 12.6, the stream is typically a low to moderate gradient pool-riffle channel with many deep pools and a few short low gradient cascades. The lower 8 miles flows within a broad valley floor and spawning opportunities for all species is abundant throughout. Land use along this section is mainly agricultural and recreational. Chinook spawning occurs primarily within the lower 8 miles, while coho show increased usage throughout the middle and upper reaches of the 15 mile anadromous section of the creek. South Prairie experiences a unique late-run of coho, which often spawn into late February and early March. Chum regularly utilize the lower 3 miles heavily but are frequently observed well above RM 10. Steelhead utilize areas along the entire stream below the barrier falls; however, usage is reduced in the canyon reach below the falls. The valley walls narrow significantly above RM 8; at this point the creek channel becomes more confined and the gradient increases. Spawning and rearing opportunities are still prevalent here, as is the increase in LWD and LWD inputs from the surrounding forest.

From RM 12.6 to the falls at RM 15.4, the channel gradient increases substantially and the creek channel becomes moderately to extremely confined within a steep canyon. Spawning and rearing opportunities are severely reduced or non-existent. Spawning gravel is scarce in this upper reach and many heavily scoured bedrock sections exist.

The riparian zone changes dramatically over the 15.4 miles of anadromous stream. The upper canyon reach flows through a commercial forest and streamside vegetation consists of second growth fir and alder. Buffer widths along recent harvest areas are generally wider than the state regulated minimum due to steep, potentially unstable slopes along the canyon. From RM 12.6 to RM 6.0 the riparian zone is relatively intact, consisting of mature hardwoods with some fir. Below this point, to the confluence, significant portions of the banks are armored and streamside residential development is common. Much of the lower 6 miles flows through active agricultural land where alder and cottonwood are the most common streamside tree species.

Winter steelhead stocks have experienced declines for the better part of the past twenty years. Tribal and state fisheries managers are currently working on a recovery plan to improve future steelhead returns and hope to implement this plan within the next few years. Continuing efforts are being made by the Puyallup Tribe fisheries staff to increase the survey coverage along the Carbon River through increased rafting and helicopter surveys from the NPS boundary at RM 23, to its confluence with the Puyallup River.


Spawned-out Chinook salmon carcass in the Carbon River.

Voights Creek is a tributary to the lower Carbon River, entering the Carbon at RM 4.0. Voights is currently only surveyed for steelhead due to the presence of a state salmon hatchery at RM 0.5. There are just less than 4 miles of anadromous habitat available in Voights Creek, an impassable falls at RM 3.9 blocks any further upstream migration. Steelhead are often observed spawning throughout the entire creek, right up to the falls. During higher autumn flows, coho, and occasionally Chinook, easily bypass the hatchery and spawn throughout the entire creek up to the falls. The stream channel varies in complexity from wide, braided channels, to confined narrow gorges. Nearly the entire 3.9 miles below the falls contains excellent, although somewhat sporadic patches of gravel within a moderate gradient stream channel. However, below the water intake for the state hatchery at RM 1.0 the gradient decreases, the substrate size is more consistent although smaller and somewhat compacted. The riparian zone is a mix of 2nd growth conifer and deciduous trees. There is a moderate amount of small and medium woody debris recruited, and minute amounts of LWD present, what little is present is generally quite old.

Ranger Creek is a left bank tributary to the upper Carbon River; entering at RM 26.8. Typical of many headwater tributaries, Ranger Creek is non-glacial and is characterized by confined steep valley channels with a comparatively short, low-to-moderate gradient anadromous reach. This mountain stream flows for just over 3 miles through a steep glacial valley originating between Howard and Tolmie Peaks along the Alki Crest. Ranger flows entirely within Mt. Rainier National Park. Headwater sources are derived from snowpack accumulations and outflow from Lake Tom *(elev. 4400′)*; as well as other minor surrounding surface and groundwater sources. These headwater sources all feed the creek until it reaches Green Lake *(elev. 3185′)* at approximately RM 1.3. The creek continues to drop precipitously from Green Lake until it reaches the channel migration zone of the Carbon River, at which point the creek channel is reduced to a low gradient pool-riffle channel capable of supporting salmonids.

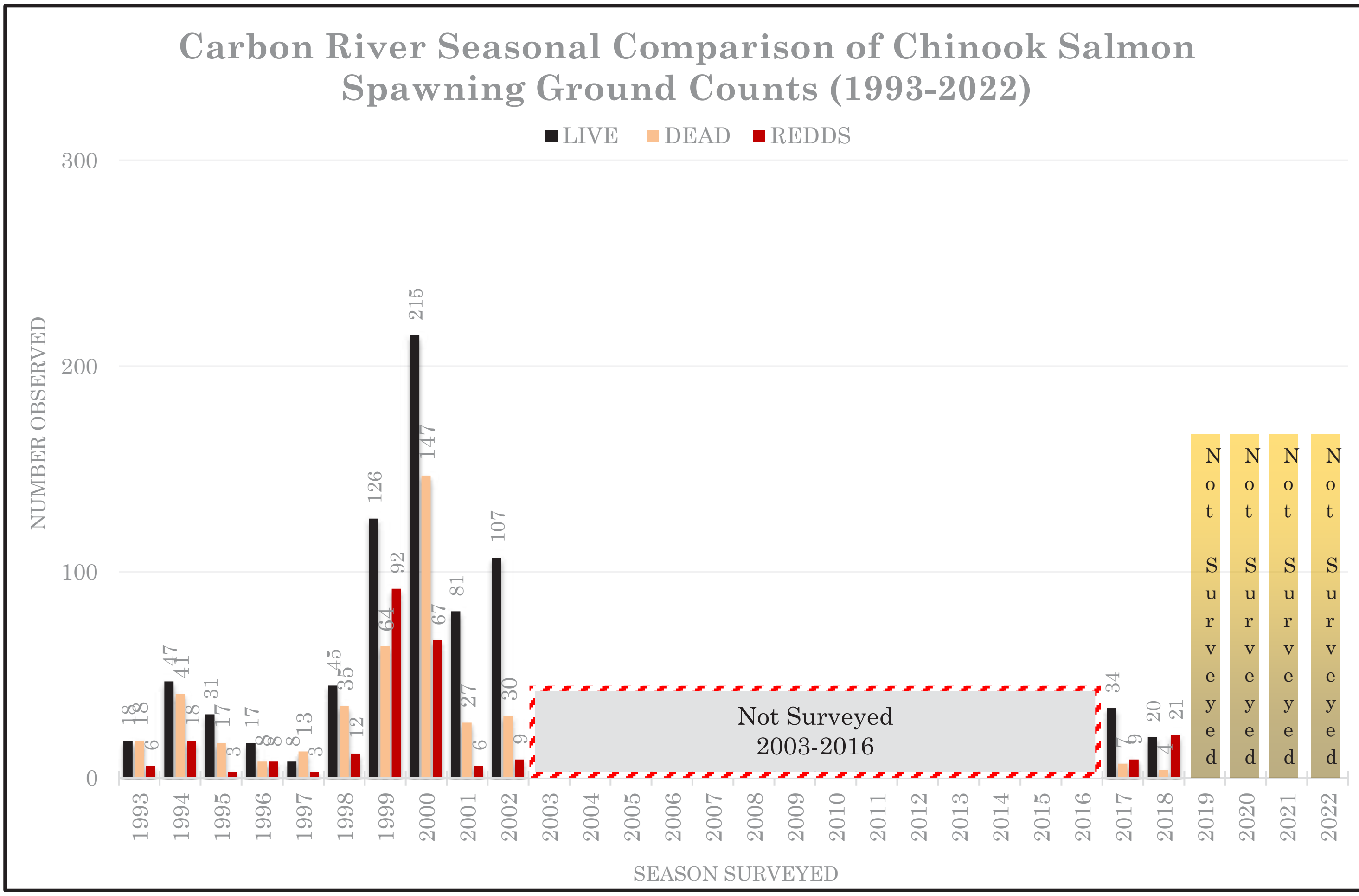
Various survey methods have verified both resident and fluvial bull trout utilization within Ranger; furthermore, the creeks 2,080′ elevation makes it one of the lowest elevation streams known to support bull trout spawning and is quite capable of supporting Chinook, coho, pink and steelhead as well. However, salmonid migration upstream to reach headwater tributaries in the upper Carbon Basin, including Ranger, is assumed to be extremely limited due to substantial cascades present throughout the roughly 5 mile long Carbon River Gorge. The Puyallup Tribe conducted salmon, steelhead and bull trout spawning surveys during 2000 and 2001; yet, no salmon or steelhead were observed. However, surveyors did observe several redds early in the spawning season *(September)*, but their small size and timing matched the bull trout spawning documented in other headwater tributaries in the watershed. Other species including cutthroat, non-native brook trout and sculpins are known to inhabit the creek.

The anadromous reach of Ranger Creek provides excellent habitat conditions for bull trout rearing and spawning. With approximately 0.5 miles of anadromous habit, Ranger is an excellent salmonid stream in several ways. The riparian zone consists of old growth cedar, fir and hemlock which contribute essential woody debris and diversity to the channel. The lower 0.4 miles is low gradient with several deep pools; as well as numerous pockets of spawning gravel. The Carbon River Road crosses the creek at approximately RM 0.35. Due to recurrent flood damage, the road has been closed to vehicular traffic beyond the park entrance. Above 0.4 miles the gradient of the creek increases significantly, and beyond RM 0.5, steep cascades preventing any further upstream migration. Unfortunately, no substantial data is available on bull trout population size within the upper Carbon River.

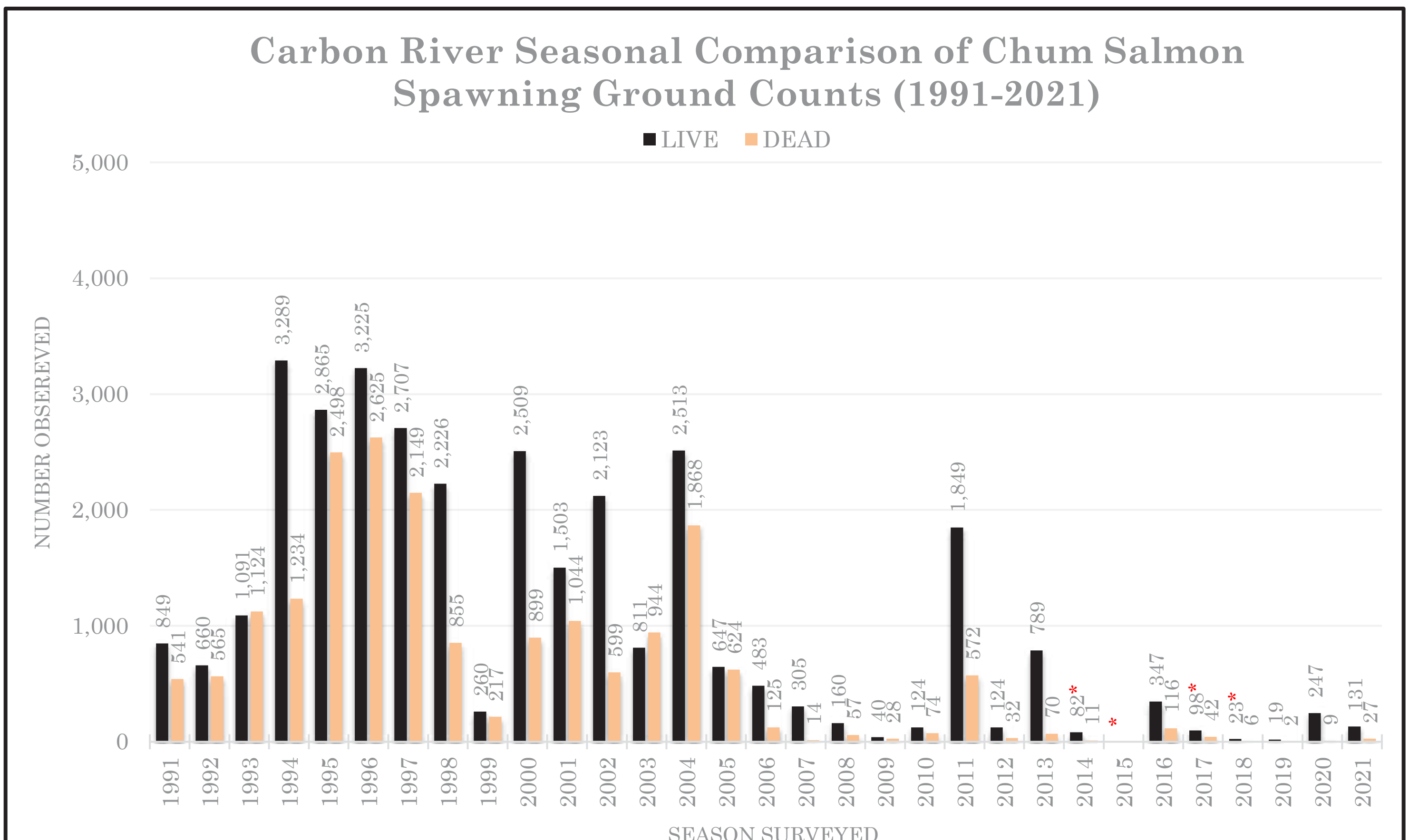
Ipsut Creek is a left bank tributary to the upper Carbon River; entering at RM 28.3. Typical of many headwater tributaries, Ipsut Creek is non-glacial and is characterized by confined steep valley channels with a comparatively short, low-to-moderate gradient anadromous reach. This mountain stream flows for just over 2.8 miles through a steep glacial valley originating near Castle Peak along the Alki Crest. Ipsut flows entirely within Mt. Rainier National Park. Headwater sources are derived from snowpack accumulations; as well as other surrounding surface and groundwater sources including Doe Creek *(right bank- RM 1.2)* and an unnamed tributary *(right bank- RM 0.8)*. Neither tributary is accessible by fish. The creek continues to drop precipitously from through much of its length until it reaches the lower channel migration zone of the Carbon River, at which point the creek channel is reduced to a low-moderate gradient pool-riffle channel capable of supporting salmonids.

Past surveys have verified bull trout utilization within Ipsut; furthermore, the creeks 2300' elevation makes it one of the lowest elevation streams known to support bull trout spawning and is quite capable of supporting Chinook, coho, pink and steelhead as well. Other species including cutthroat, non-native brook trout and sculpins are known to inhabit the creek. However, salmonid migration upstream to reach headwater tributaries in the upper Carbon Basin, including Ipsut, is assumed to be extremely limited due to substantial cascades present throughout the roughly 5 mile long Carbon River Gorge. The Puyallup Tribe conducted salmon, steelhead and bull trout spawning surveys during 2000 and 2001; yet, no salmon or steelhead were observed. However, surveyors did observe several redds early in the spawning season *(September)*, but their timing matched the bull trout spawning documented in other headwater tributaries in the watershed including Ranger Creek and several Upper White River tributaries.

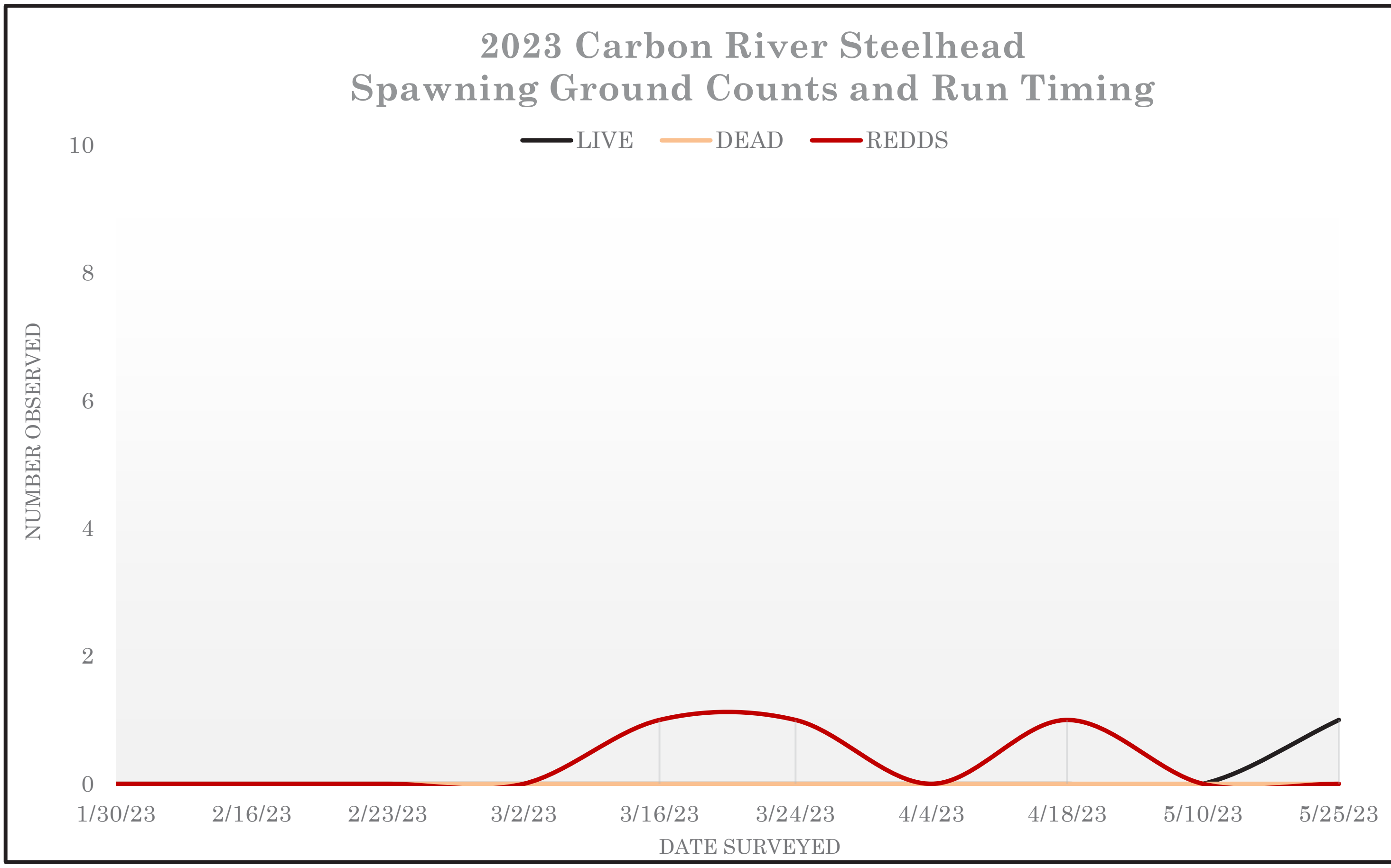
The riparian zone along Ipsut consists primarily of old growth cedar, fir and hemlock which contributes greatly to the large woody debris in the stream; as well as diversity to the channel habitat. Unfortunately, spawning opportunities are limited due to the size and makeup of the substrate material; much of which consists of flat and angular stones not conducive to movement, especially by smaller fish such as bull trout. However, small patches of suitable gravel do exist. The lower anadromous reach of the creek is also subject to, and has frequently experienced disturbances caused by Carbon River high flow/flood events. These intrusions often deposit significant amounts of fine material and woody debris. An impassable falls at approximately RM 0.7 prevents any further upstream migration.

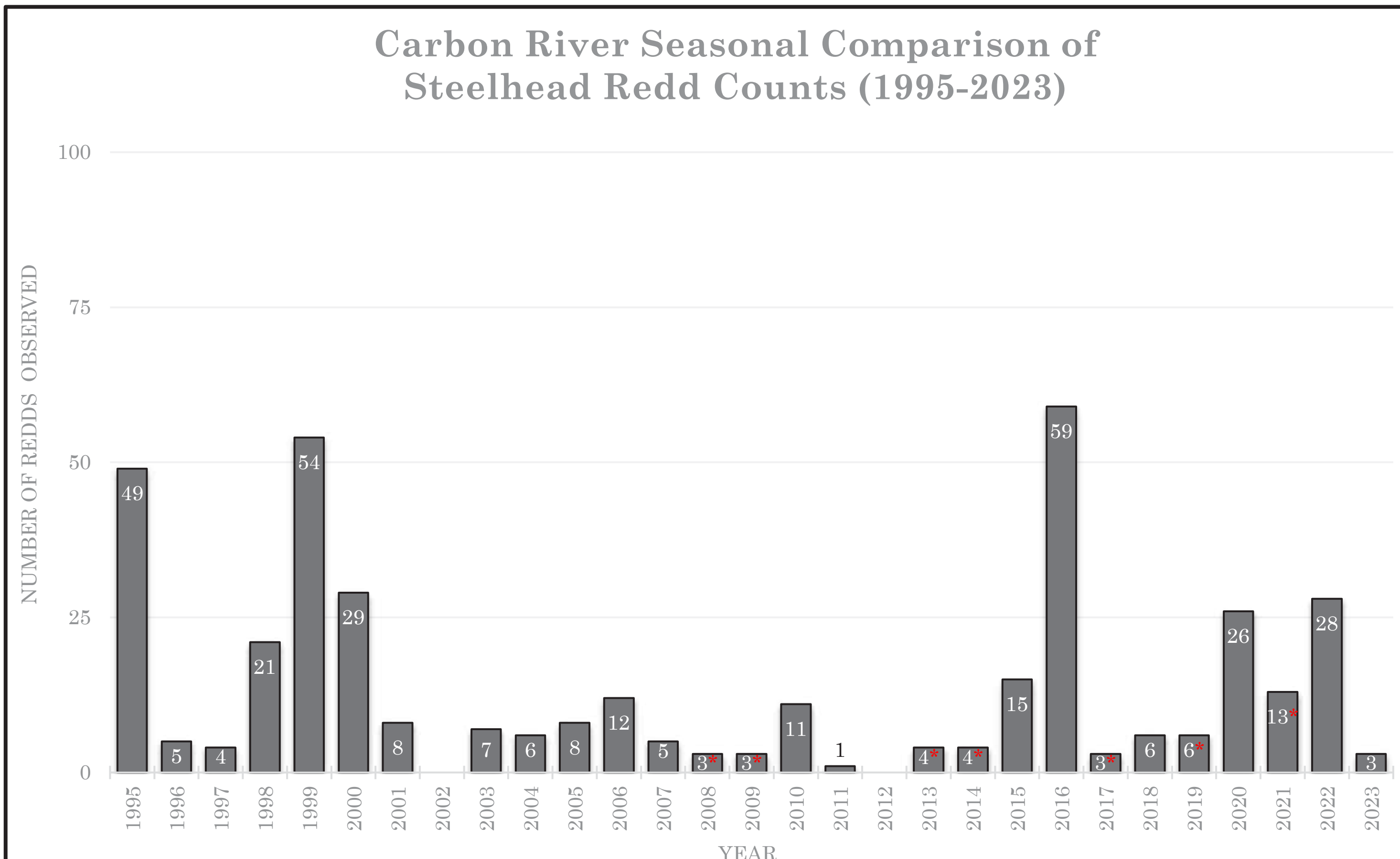


Surveys were not conducted from 2003-2016 due to unsatisfactory survey conditions.



*The 2014, 2015, 2017, 2018 & 2019 chum data is incomplete due to survey condition which prevented a regular full season of surveys.





*The redd data is incomplete due to extremely poor survey condition which prevented a regular full season of surveys. To determine the total escapement for steelhead, each redd is multiplied by a factor of 1.62 *(i.e. 42 redds x 1.62 steelhead per redd = total escapement of 68 steelhead)*. Addition biological expansion factors are applied to estimate escapement for suitable habitat areas that are often unsurveyable.

CLARKS CREEK

WRIA 10.0027

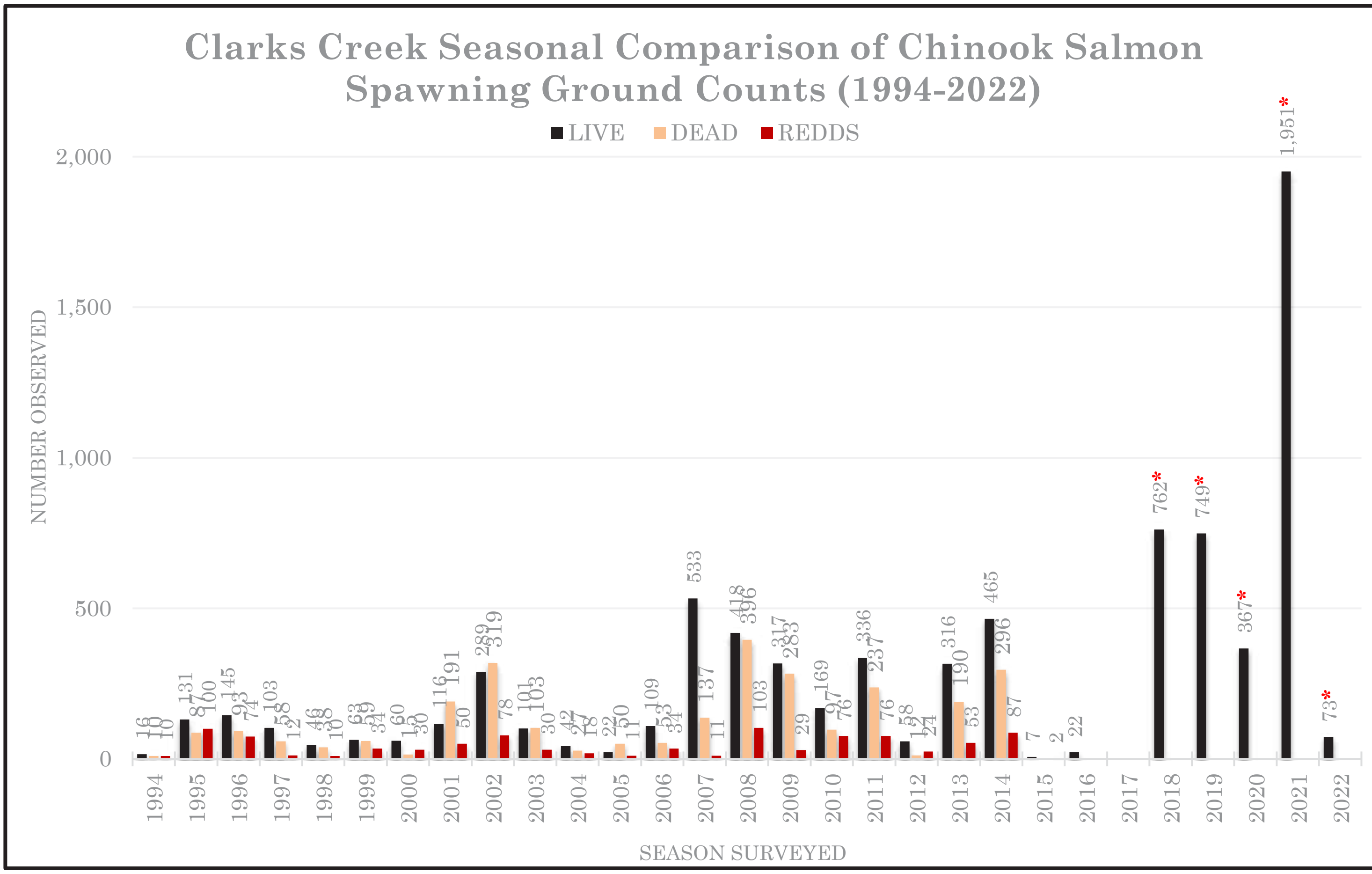
Clarks Creek is an urban tributary flowing into the lower Puyallup River, entering the Puyallup at RM 5.8. The Clarks Creek Basin drains the plateaus and flatlands running along the southern valley of the lower Puyallup River, just west of the city of Puyallup. The basin drains a 13 mi^2 area, with an average flow of nearly 60 cfs *(Basin Gauge #12102075)*. Clarks has several smaller tributaries, including Diru and Rody creeks; both of which are salmon bearing streams supporting Chinook *(above)*, coho, chum, pink, steelhead, and bull trout. Woodland Creek and Meeker Ditch contribute additional flow. Several salmonid species are known to utilize Clarks Creek for spawning, rearing and foraging. Species include ESA threatened Chinook, steelhead and bull trout; as well as non-listed coho, pink, chum and cutthroat. Brown trout, a non-native species is also present in the basin.

Several fish and habitat limiting factors associated with Clarks include; channel confinement, complete fish barriers, no off-channel habitat, flooding and channel erosion, absent or deficient riparian cover, water quality *(Iron, pH & bacteria)*, conveyance of storm water run-off, and the expansive growth of elodea (*Elodea canadensis*). In addition, there is considerable development along the creek, primarily rural residential.

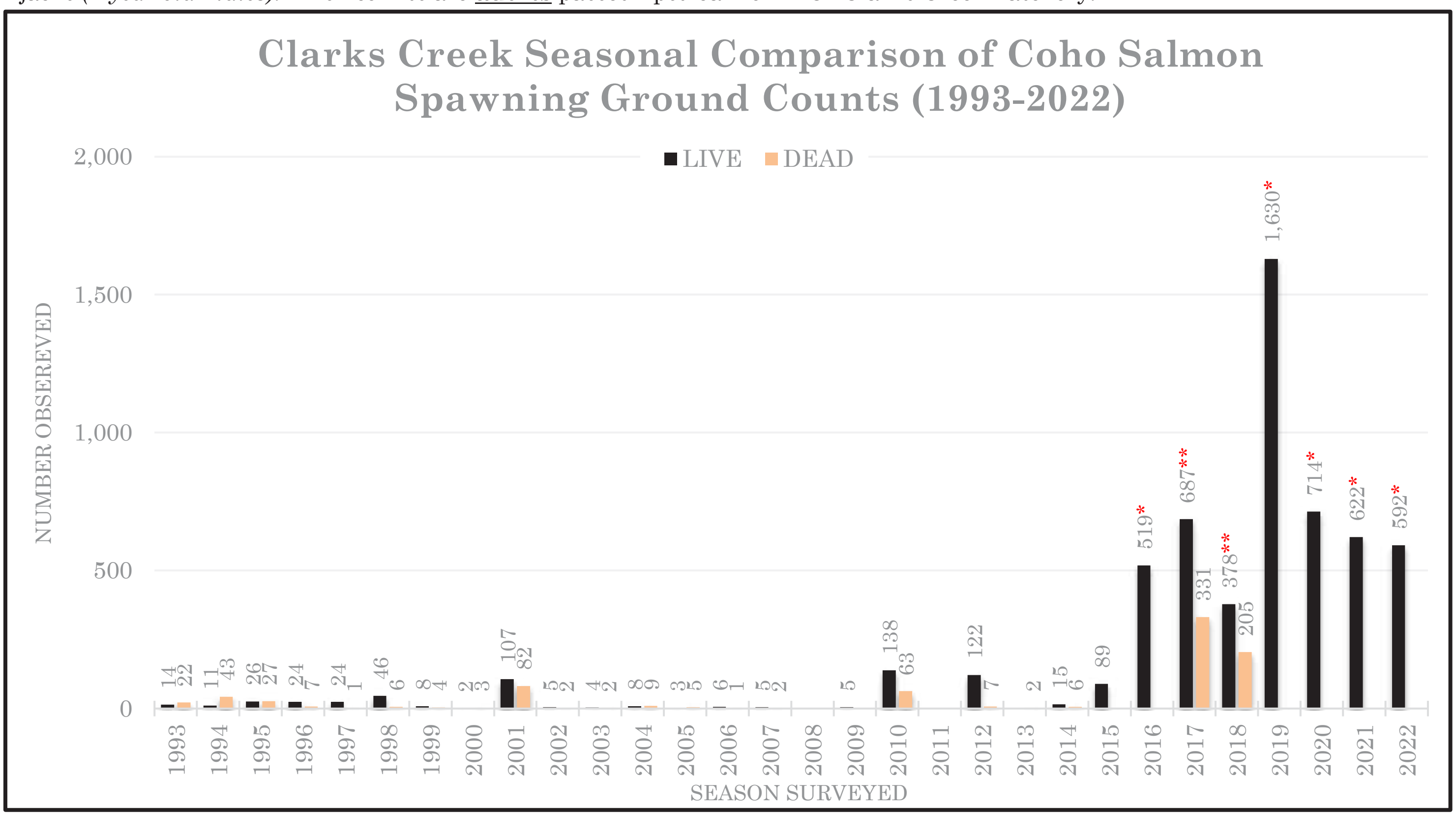
The anadromous reach of Clarks is a low gradient spring-fed stream *(Maplewood Springs)* with a pool-riffle character. The surveyed reach of Clarks Creek *(RM 3.4 to 3.7)* provides abundant spawning opportunities for all species; however, upstream migration is blocked by a dam at RM 3.7. Consequently, the dam also prevents the continuity of gravel conveyance downstream to critical spawning areas.

Salmonberry, maple, and alder dominate the overstory riparian zone along much of the upper surveyed reach. The remaining stream channel below the surveyed reach *(RM 3.4)* contains little gravel and the substrate consists of fine sand and mud; subsequently, little or no spawning has been observed downstream of this point. WDFW operates a fish hatchery near the barrier dam on Clarks. The state operated hatchery raises trout for stocking local lakes; as well as, rearing Spring Chinook *(transferred as eyed eggs from White River Hatchery since 2013)* for planting in White River acclimation ponds, and coho *(300k transferred as juveniles from Voights Creek Hatchery)* which are released on station. Spawning size gravel was introduced into the channel from RM 3.5 to 3.7 in the fall of 1997, and the summer of 1999. In addition to gravel inputs, several log weirs have been placed above the interpretive bridge to aid in gravel retention. This has greatly enhanced the spawning opportunities for Chinook, pink, coho and chum salmon. Unfortunately, adult steelhead spawning activity has rarely been observed in Clarks Creek since 1997. However, steelhead are occasionally captured or observed in tributaries of Clarks Creek. Due to limited availability of spawning habitat, high densities of Chinook and chum has often resulted in considerable redd superimposition throughout this short reach. Adult and sub-adult bull trout are also known to forage in Clarks Creek.

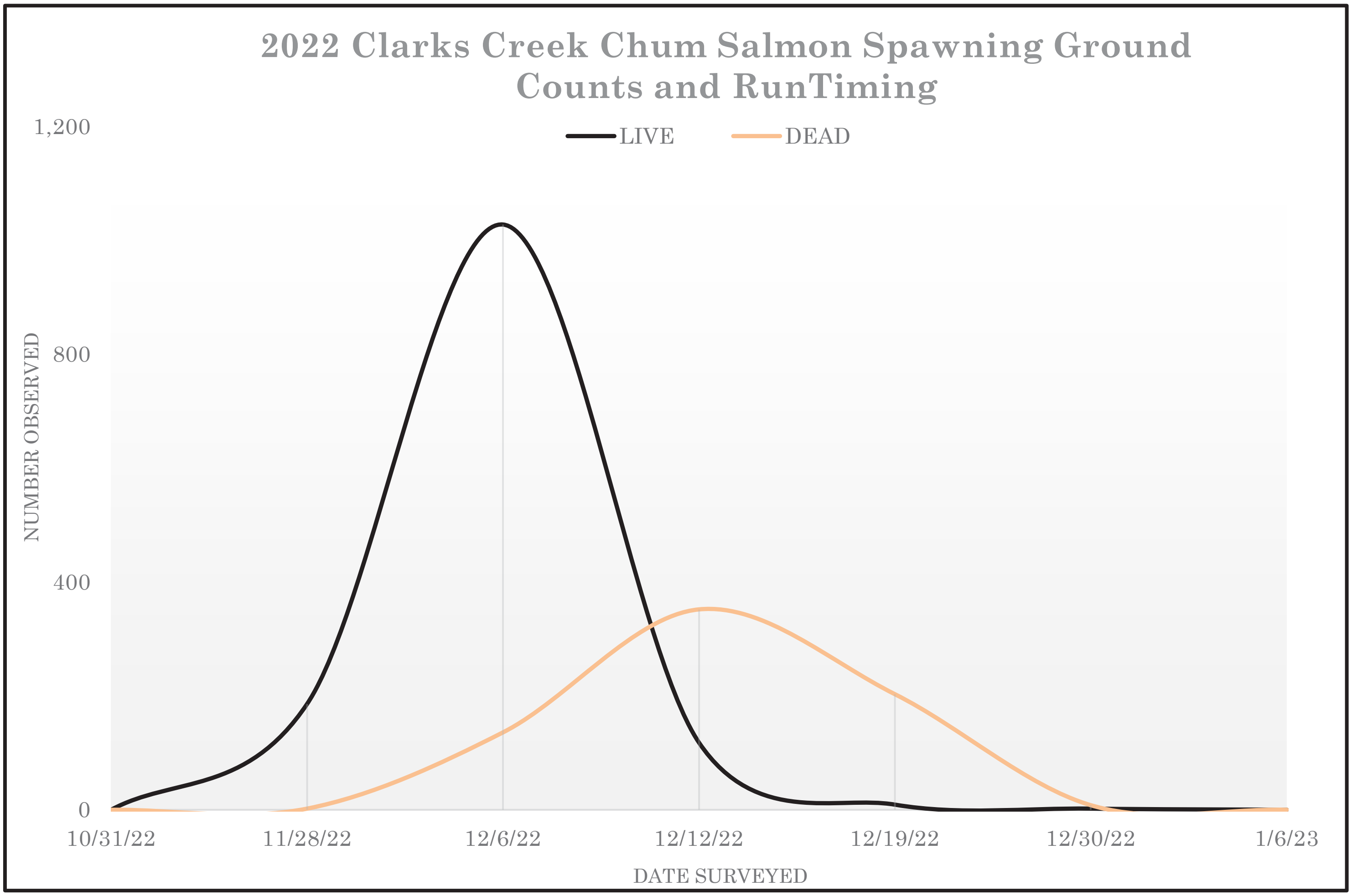
In 2004, the Puyallup Tribe completed construction of a Fall Chinook salmon hatchery on Clarks Creek *(RM 1.0)*. The hatchery was constructed in order to address several fish management issues, one of which includes minimizing the straying of adult Fall Chinook reared by the Puyallup Tribe and previously released from Diru Creek hatchery.

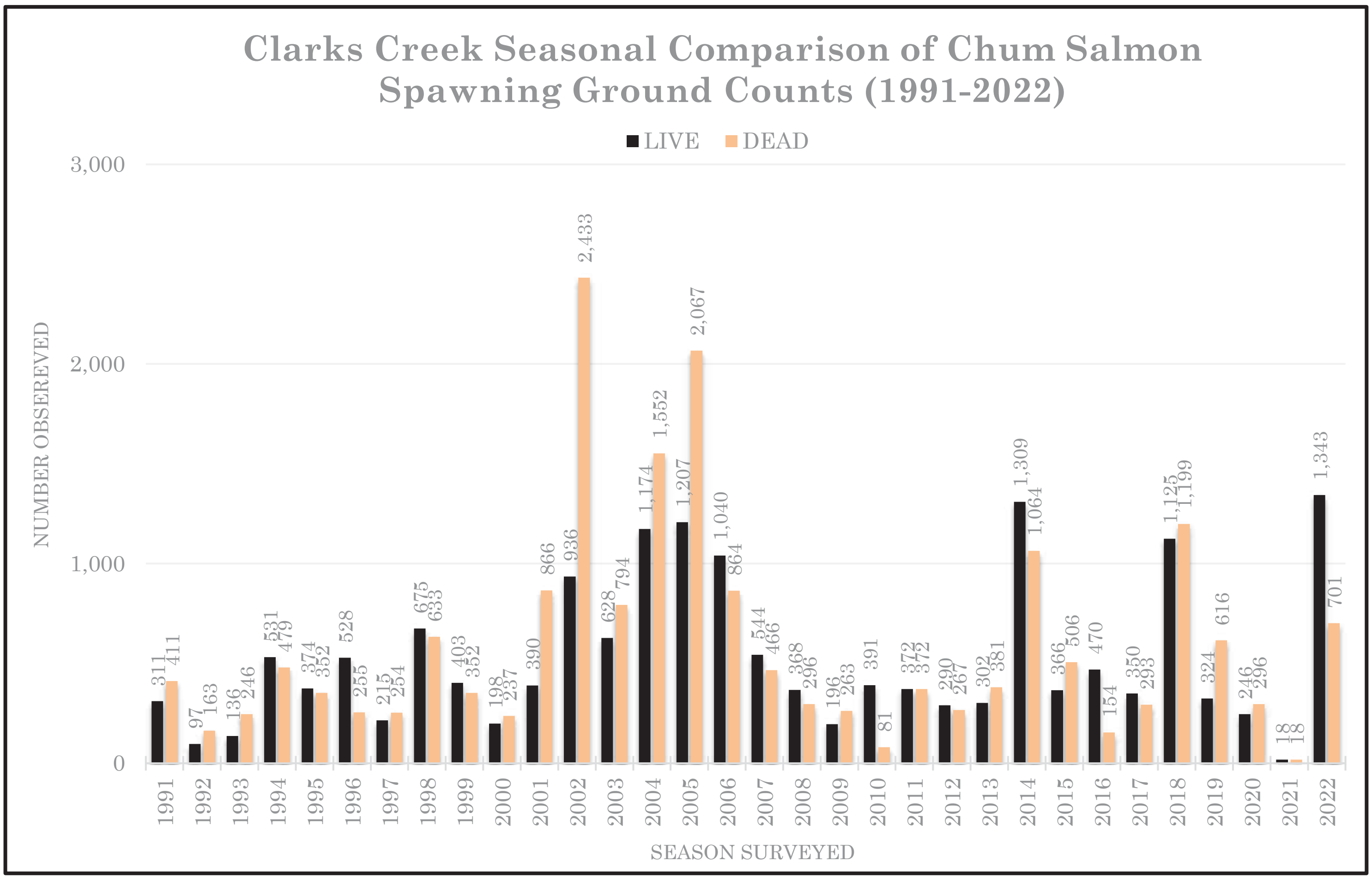


Adult Chinook escapement is determined by expanding the number of redds observed by 2.5 fish per redd (Smith and Castle, 1994). Due to the tremendous volume of pink salmon during odd years, the success of determining Chinook redds from pinks is vastly reduced. Therefore, The AUC method is used to determine escapement during pink runs (odd years). **Note:** A high proportion of the Chinook observed in 2007, were jacks *(2 year old males)*. *Fish counts are **adults** passed upstream of PTOI Clarks Creek hatchery.



**Fish counts are adults passed upstream of PTOI Clarks Creek hatchery. Primarily hatchery returns from WDFW's Puyallup Trout hatchery which began releasing up to 300K coho annually beginning in 2015


2022 Clarks Creek Chum Salmon Spawning Ground Counts and RunTiming
LIVE
DEAD
1,200
800
400
0
NUMBER OBSERVED
10/31/22
11/28/22
12/6/22
12/12/22
12/19/22
12/30/22
1/6/23
DATE SURVEYED


Clarks Creek Seasonal Comparison of Chum Salmon Spawning Ground Counts (1991-2022)
LIVE
DEAD
3,000
2,000
1,000
0
NUMBER OBSEREVED
SEASON SURVEYED

CLARKS CREEK SALMON HATCHERY

Puyallup Tribe of Indians (PTOI) Hatchery Facility


Chinook in natural acclimation pond at Clarks Creek

Clarks Creek Salmon Hatchery is a Puyallup Tribe of Indians facility located at RM 1 on Clarks Creek *(10.0027)*, a tributary to the lower Puyallup River. The Clarks Creek hatchery *(below)* was constructed in order to address several fish management, and water supply issues including; minimizing the straying of adult Fall Chinook reared by the Tribe; providing space for rearing and acclimating White River Spring Chinook and chum if necessary; creating an independent and self-sustaining fall and Spring Chinook program for the Tribe; as well as providing a reliable water supply to rear and expand fish production.

Water is supplied from five vertical turbine pumps, each 20-horsepower. Each pump has a flow capacity of 1,600 gpm. Each pump is capable of supplying one of four ponds with approximately 3.6 cfs. Each of the four ponds has approximately 12,000+ cubic feet of water volume, two ponds are concrete lined and designed to hold adult and juveniles, while the other two are natural acclimation ponds.

In addition, the Puyallup Tribe operates several salmon acclimation ponds in the Puyallup Watershed. Two of the acclimation ponds *(Cow Skull & Rushingwater)* are used for enhancing Fall Chinook and coho into a 30-mile reach in the Upper Puyallup River above the Electron Dam. Anadromous fish passage was reestablished around the Electron diversion dam (RM 41.7) in the fall of 2000. The project had prevented upstream fish passage for 96 years. Several additional acclimation ponds are located in the Upper White River drainage *(Huckleberry Cr., Greenwater River (George Cr.), Twentyeight Mile Cr. (Greenwater R.)& Jensen Cr. (Clearwater R.).* These ponds are used for enhancing White River Spring Chinook and steelhead back into their endemic ranges. All ponds have approximately 25,000 cubic feet of rearing space and between 1 to 3 cubic feet per second flow. A 35,000 cu. ft. Spring Chinook acclimation pond was completed in the summer of 2007 near George Creek *(Greenwater River)* and has the capacity for rearing/acclimating over 500,000 Spring Chinook. The newest pond located on 28 Mile Creek *(Greenwater River)* was completed in the fall of 2015 and is utilized for acclimating Spring Chinook.

The Puyallup Tribe's restoration goal is to rebuild depressed Chinook and steelhead stocks and remove them from ESA listing. Using acclimation ponds, limiting harvest, and making substantial gains in habitat restoration, the Tribe will be able to accomplish this task. Levee setbacks, oxbow reconnections both inter tidal and upland, Commencement Bay cleanup, and harvest cutbacks have already been initiated. Only the re-establishment of Chinook in habitat areas devoid of fish has remained one of our biggest challenges. Acclimation ponds are a proven method in increasing fish numbers on the spawning grounds. Hatchery rearing 200,000 Fall Chinook for release on station and 200,000 for acclimation ponds in the upper Puyallup River for a combined 6,857 pounds of fish. Historically, Fall Chinook have been reared since 1980 with a variety of stocks, goals, and objectives.


Raceways constructed in 2016

Spring Chinook Hatchery Production

The Puyallup Tribe operates several acclimation ponds in the Upper White River Watershed designed to reestablish and enhance Spring Chinook stocks *(Huckleberry Cr., Greenwater River (George Cr.), Twentyeight Mile Cr. (Greenwater R.)& Jensen Cr.(Clearwater R.)*. Acclimation ponds could be planted collectively with up to 900K+ White River Spring Chinook. The Jensen Creek Pond *(Clearwater River)* was completed in the fall of 2012. The newest pond located on 28 Mile Creek *(Greenwater River)* was completed in the fall of 2015. Currently, Spring Chinook designated for acclimation ponds are reared at WDFW's Clarks Creek facility *(since 2013)*, and Muckleshoot White River hatchery.

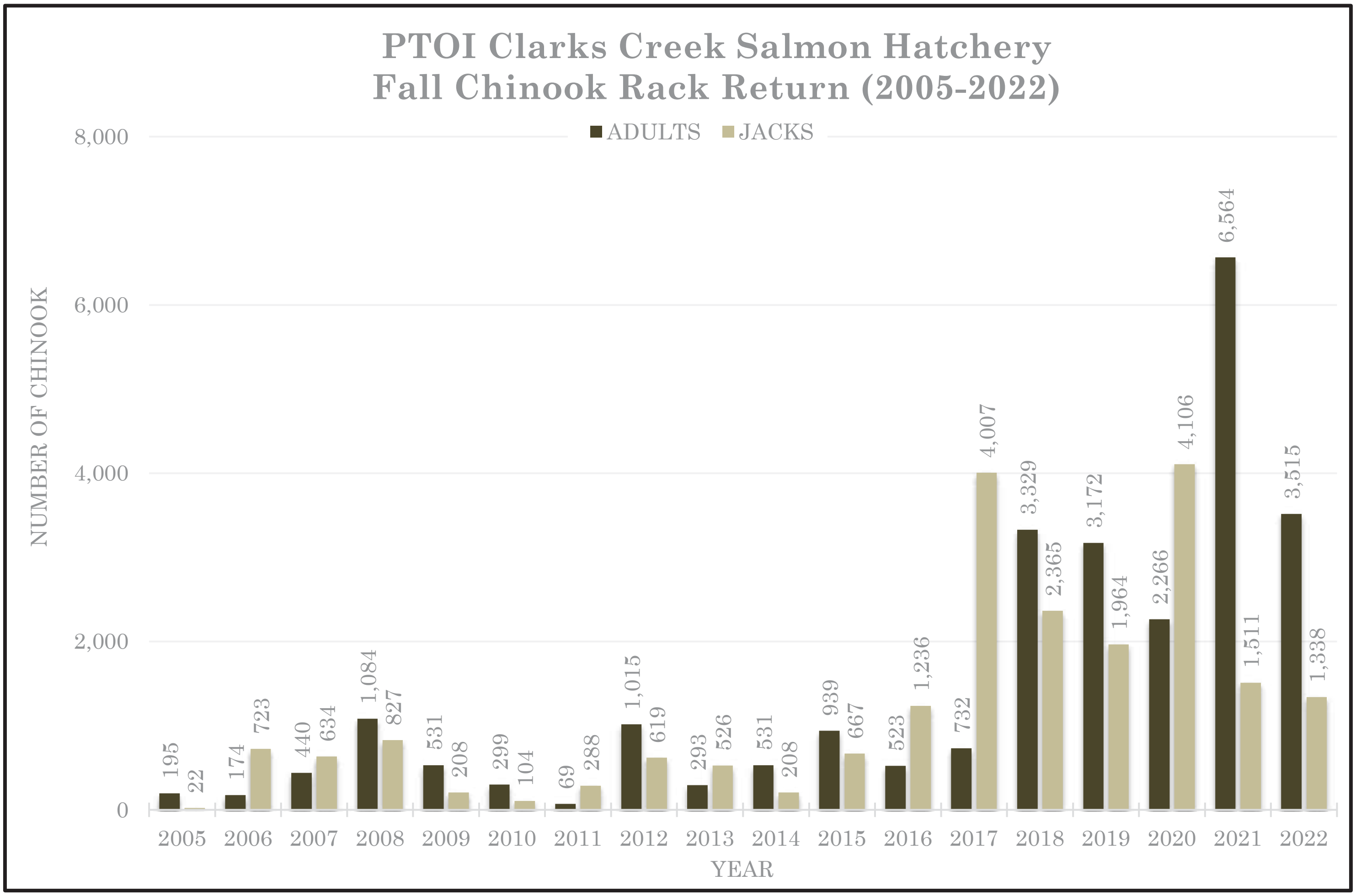
Current Fall Chinook Hatchery Production

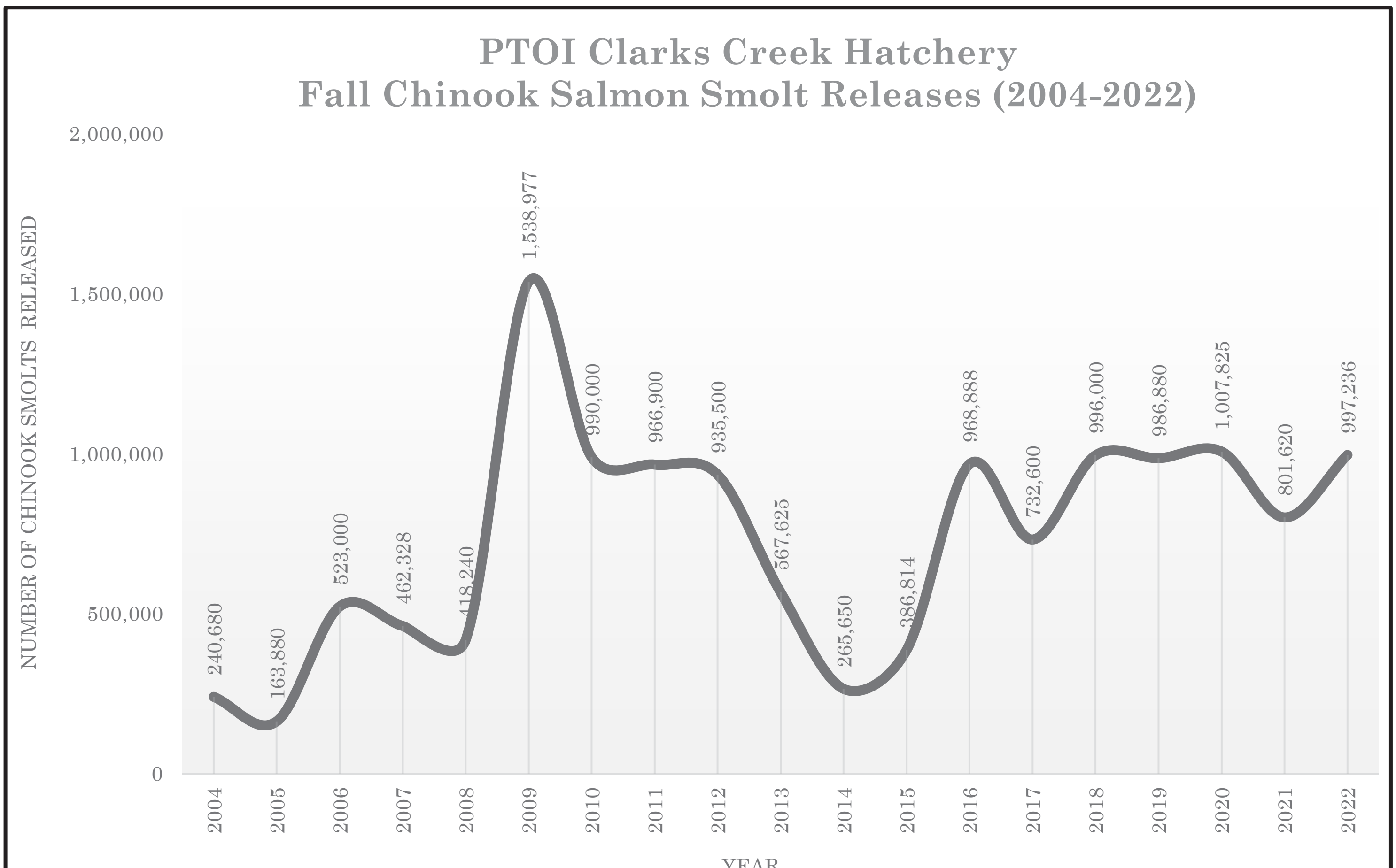
In 2004, the Puyallup Tribal Fisheries Department began acclimating and releasing Fall Chinook from the Clarks Creek facility; thus, discontinuing all Chinook releases from the Diru Creek hatchery. Adult and jack Chinook begin moving into the hatchery holding pond in September, and continue to arrive well into late October. Ripe *(ready to spawn)* adults are collected 2-3 times a week. Eggs and sperm, at a 1male-to-1 female ratio, are mixed in a small bucket to induce fertilization *(left)*. Fertilized eggs are placed into an incubator tray until they hatch. In early 2005, construction of a new incubation building was completed at Clarks Creek. The incubation building houses 32 incubator stack capable of holding up to 77,000 Chinook eggs, for a total capacity of approximately 2.5 million eggs *(bottom image)*. Once fish are ready to be moved from the incubators, they are transferred to one of the concrete raceways *(top image)*.


Salmon egg incubators

Holding the Chinook in the raceways is only temporary until they are up to a large enough size, usually sometime during late March to early April, to be massed marked with an automated tagger *(right)* and transferred to one of two natural ponds. The automated fish tagging trailer is operated by the Northwest Indian Fisheries Commission *(NWIFC)* out of Olympia. A proportion of the young Chinook are implanted with a coded wire tag *(CWT)* and the adipose fin is removed. The remaining fish are all massed marked by removing the adipose fin only. The markings and CWT's will be used to identify these Chinook as hatchery origin fish in the future when they return to the hatchery, are caught by fisherman, or are observed on the spawning grounds. The CWT is inscribed with a specific code that will identify the particular hatchery where the fish was tagged. Once tagged, fish are planted in one of the two natural acclimation ponds. The young Chinook are fed regularly to increase their size until they are ready to be released into the creek from late May, through early June.


Automated fish tagger


PTOI Clarks Creek Salmon Hatchery
Fall Chinook Rack Return (2005-2022)
ADULTS
JACKS
NUMBER OF CHINOOK
8,000
6,000
4,000
2,000
0
YEAR
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022
195 22
174 723
440 634
1,084 827
531 208
299 104
69 288
1,015 619
293 526
531 208
939 667
523 1,236
732 4,007
3,329 2,365
3,172 1,964
2,266 4,106
6,564 1,511
3,515 1,338


PTOI Clarks Creek Hatchery
Fall Chinook Salmon Smolt Releases (2004-2022)
NUMBER OF CHINOOK SMOLTS RELEASED
2,000,000
1,500,000
1,000,000
500,000
0
YEAR
2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022
240,680
163,880
523,000
462,328
418,240
1,538,977
990,000
966,900
935,500
567,625
265,650
386,814
968,888
732,600
996,000
986,880
1,007,825
801,620
997,236

CLEAR CREEK

WRIA 10.0022

Clear Creek is a tributary to the lower Puyallup River, joining with the Puyallup at RM 2.9. The Clear Creek Basin *(12.1 mi²)* drains the plateaus and flatlands running along the southern valley of the lower Puyallup River, between the cities of Puyallup and Tacoma. Clear Creek has several tributaries which include: Swan Creek, Squally Creek, Canyon Creek, and an unnamed tributary entering at RM 3.05 on the right bank. Only Swan, Squally and Canyon creeks are accessible to adult salmon.

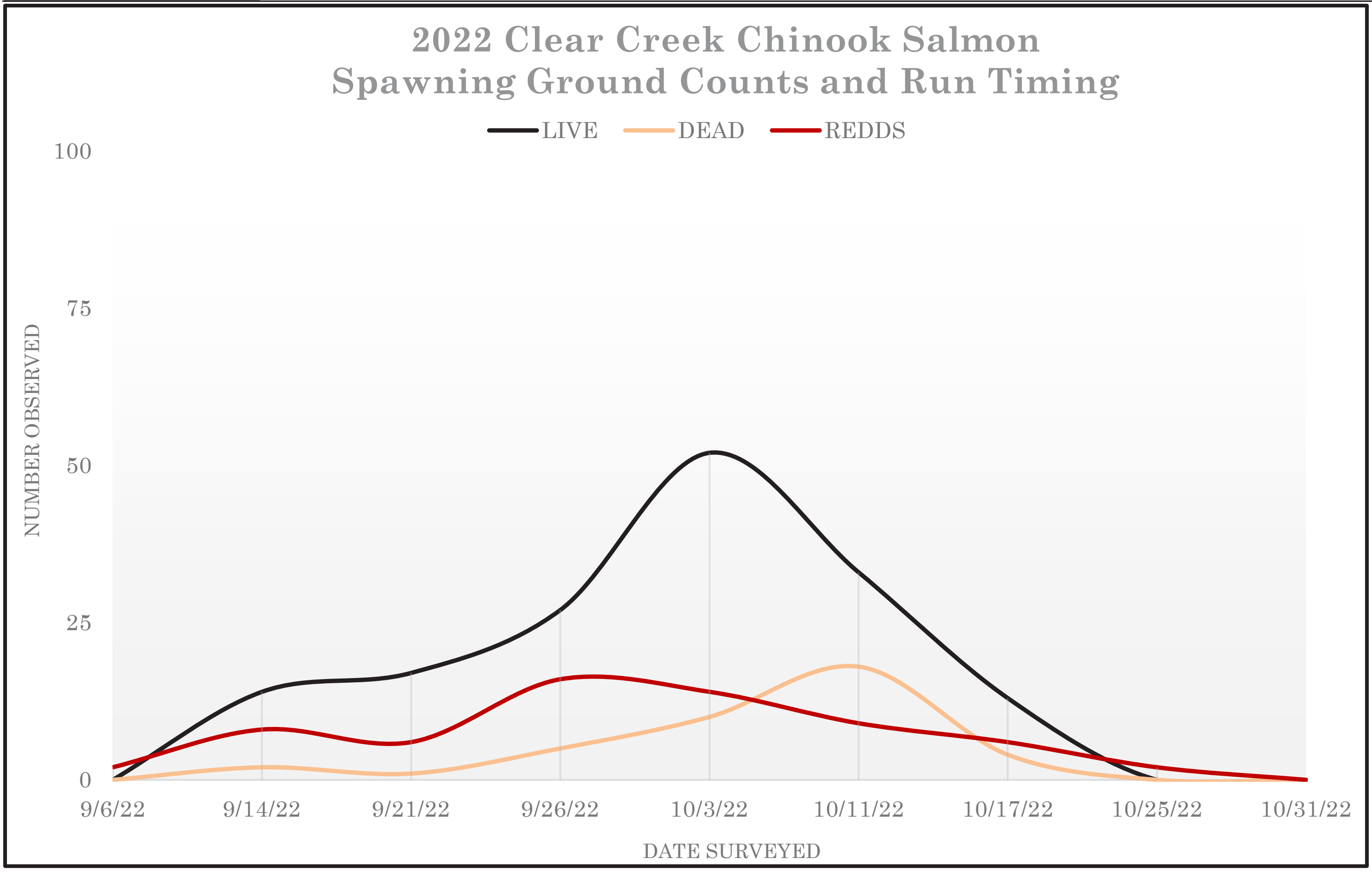
Several salmonid species are known to utilize Clear Creek for spawning, rearing and foraging. Species include ESA listed Chinook *(top image)*, steelhead and bull trout; as well as, non-listed species including coho, pink, chum and cutthroat. Various limiting factors involved with Clear Creek include, low flows, channel confinement, an anadromous barrier, lack of spawning habitat, aquatic noxious weeds, flooding and channel erosion, conveyance of storm water run-off, water quality *(D.O. & bacteria)*; as well as, absent or poor riparian cover.

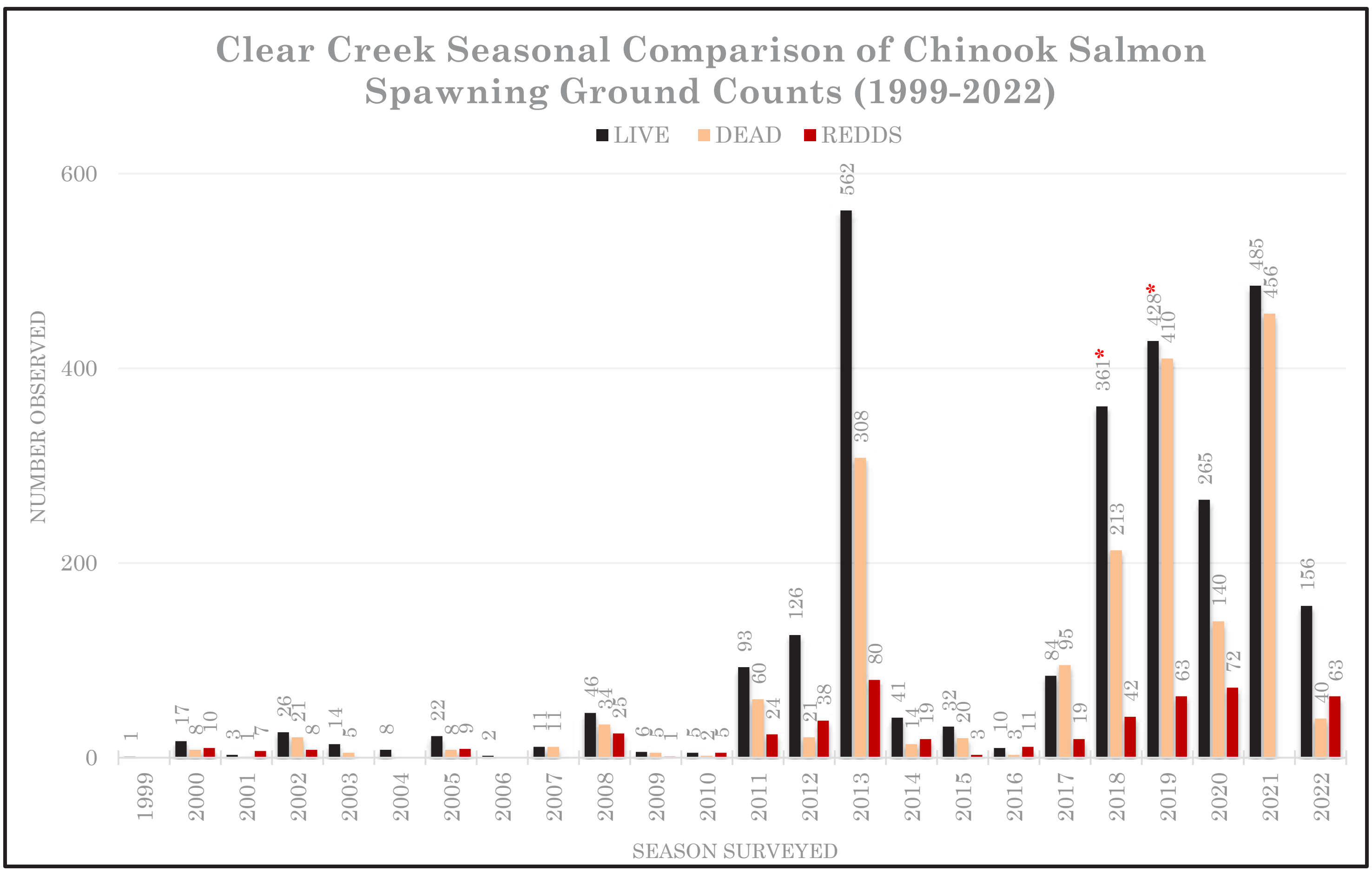
Above Pioneer Way, Clear Creek flows as a low-to-moderate gradient pool-riffle stream before paralleling the road for several hundred feet. The upper anadromous *(spawning)* reach contains sufficient spawning gravel from RM 1.7 to 1.9. Although a significant section of the riparian area is not intact, there are undercut banks and moderate amounts of in-stream cover. A high density of reed canary grass (*Phalaris arundinacea)* and other vegetation *(watercress)* chokes approximately 300 feet of the spawning reach every summer/early fall; effectively trapping a significant amount of fine sediment which covers the available spawning gravel by several inches.

An anadromous blockage in the form of a cement diversion dam is located at RM 1.9; the dam is in place to ensure pathogen-free water for hatchery raised rainbow at the Trout Lodge facility. Consequently, this also disrupts the continuity of gravel recruitment downstream to vital spawning areas. The reach above the dam is not surveyed; however, suitable spawning habitat does exist and could be utilized if access were established. The draw off of water by the hatchery, specifically during the summer and fall seasons, significantly reduces the water throughout the bypass *(spawning)* reach. The bypass reach is the section of stream from the water intake for the hatchery, to its discharge point downstream. Chinook are often observed holding in a large pool located at the hatchery discharge outlet. The low flows resulting from the hatchery draw regularly prevent Chinook from accessing the bypass reach where suitable spawning habitat is available.

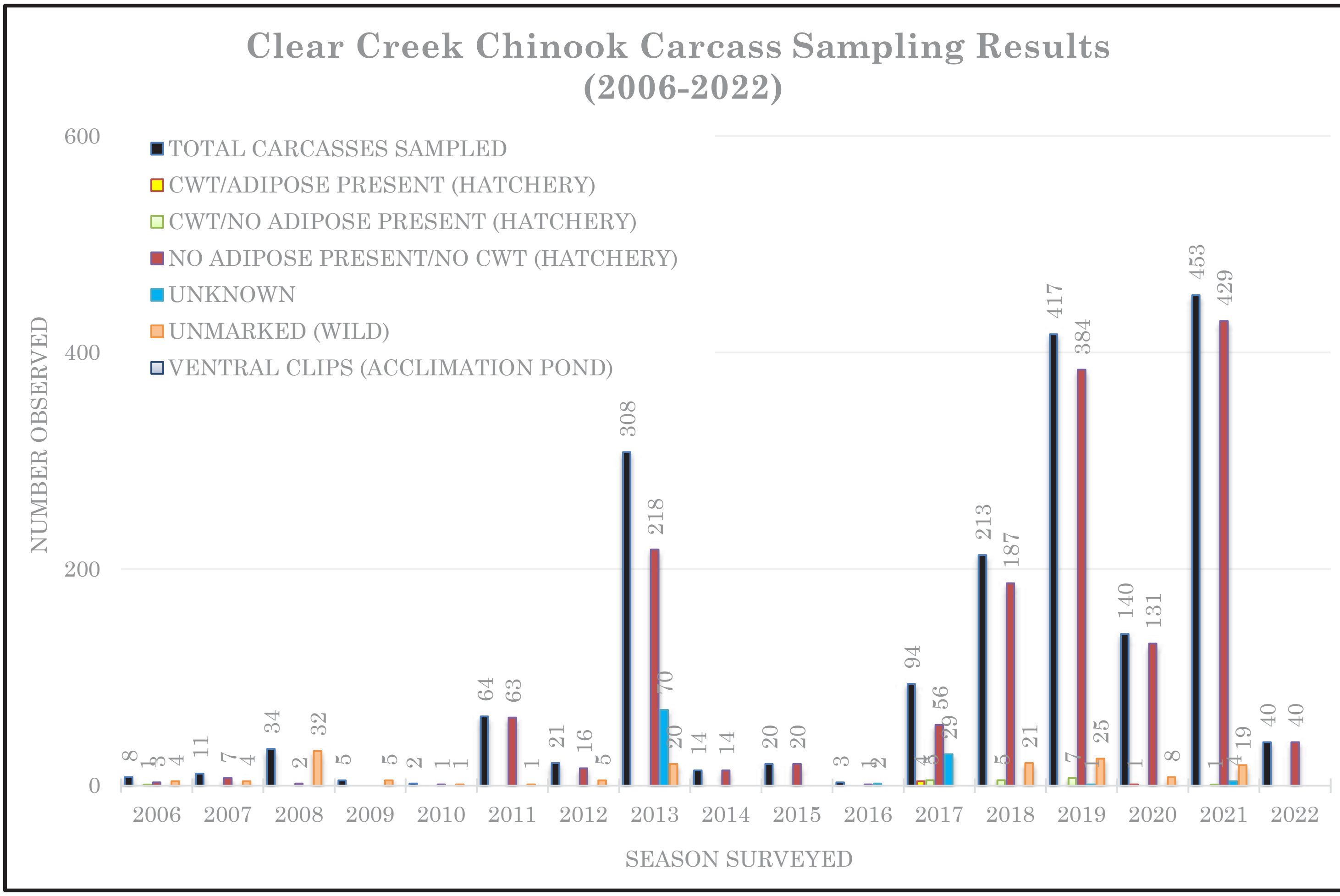
Late fall and winter flows are regularly sufficient for chum salmon to spawn in the 0.2 miles of available habitat below the barrier dam. Adult steelhead and coho also utilize Clear Creek; however, escapement for these species is low. Bull trout are also known to utilize Clear Creek, which offers excellent foraging and overwintering opportunities.

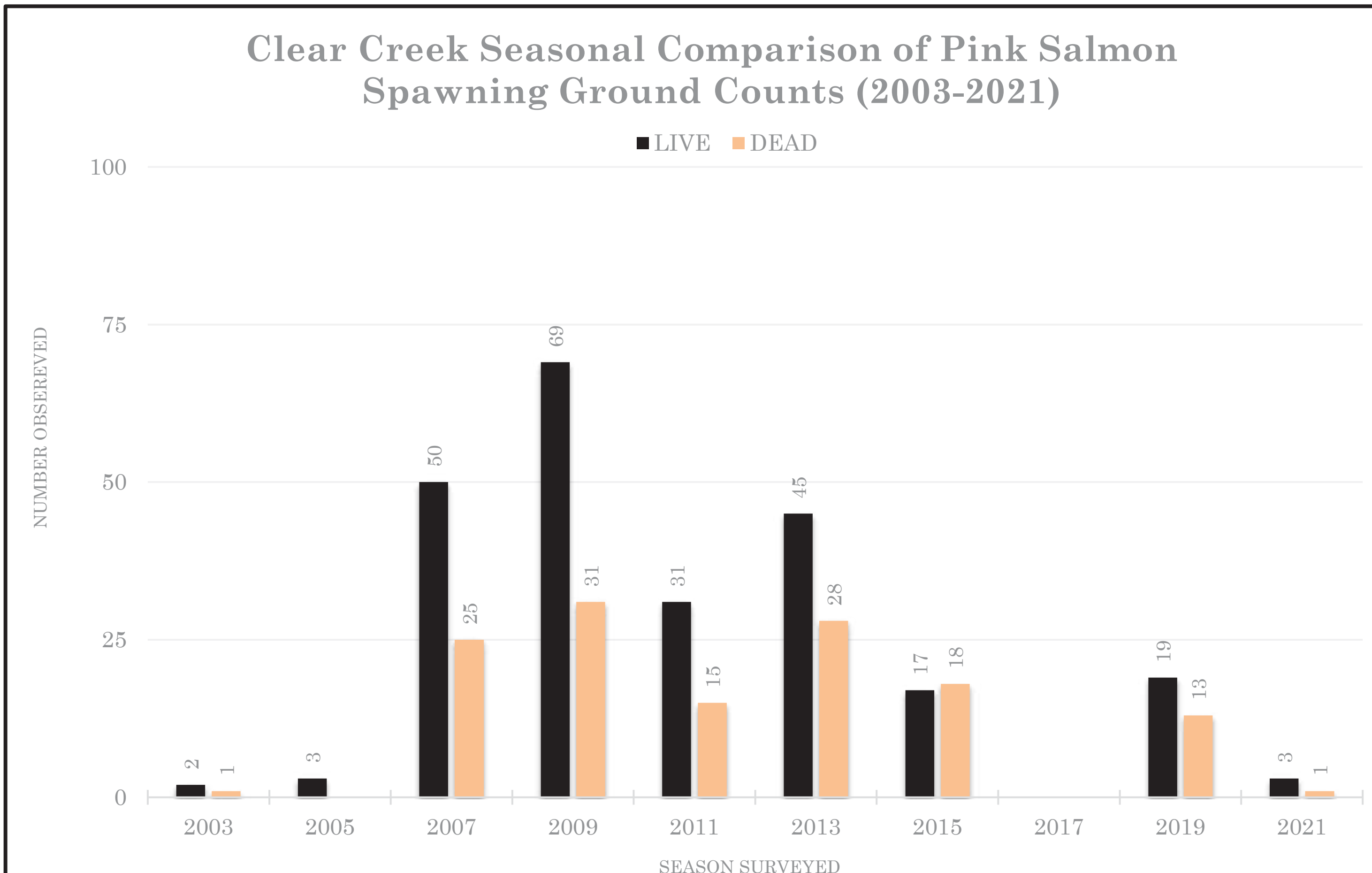
In 2016, Port of Tacoma finished constructed of a roughly 40-acre restoration project on upper Clear Creek. The project created floodplain wetland and a new, more naturalized stream channel. The project was created as a result of a mitigation settlement with EPA at a cost of approximately $9 million dollars. Also, Pierce County initiated development of a lower Clear Creek flood plan *(link below)* to address bottomland flooding issues *(2018)*.
http://www.co.pierce.wa.us/3321/Clear-Creek-Flooding

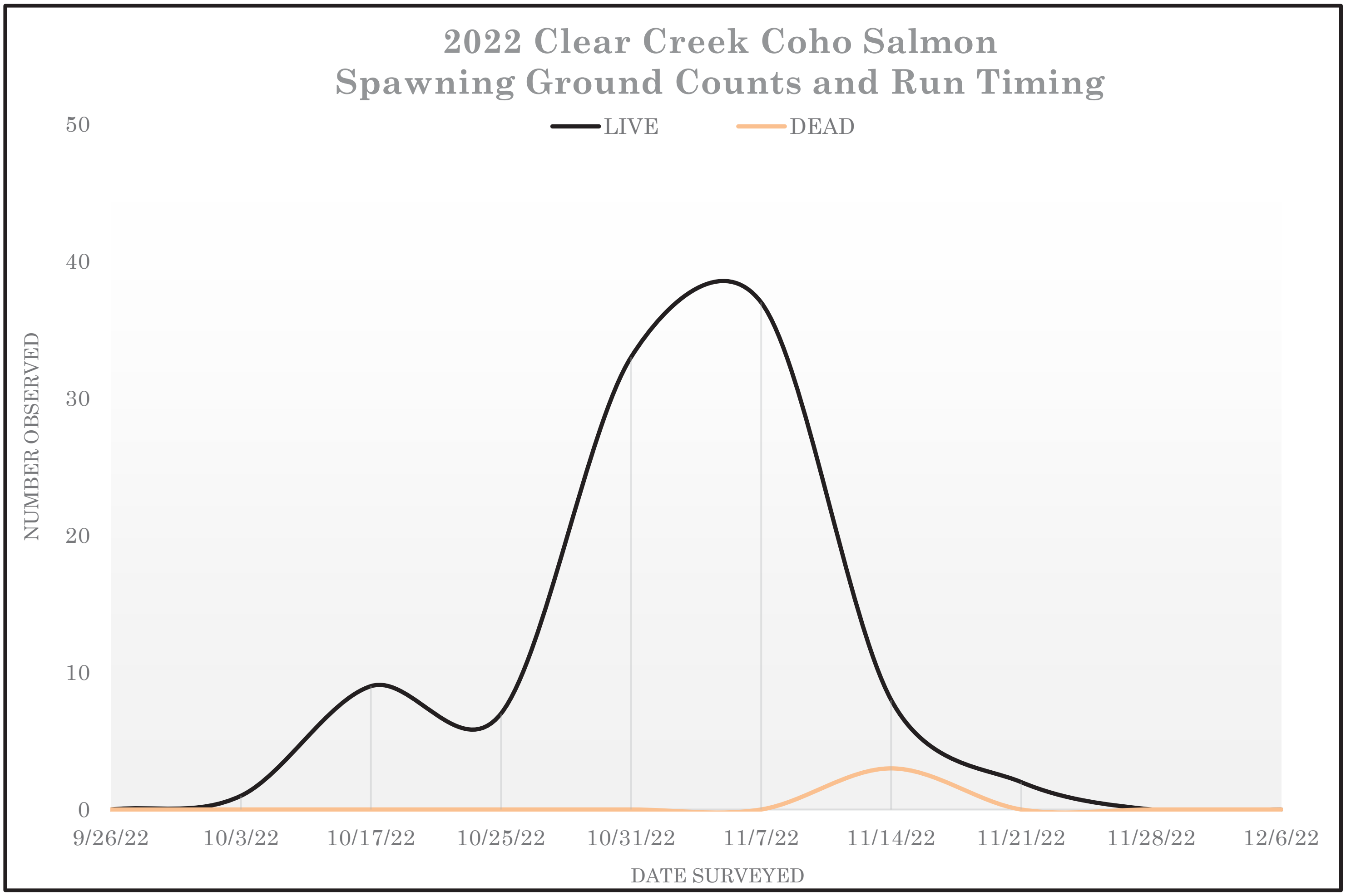


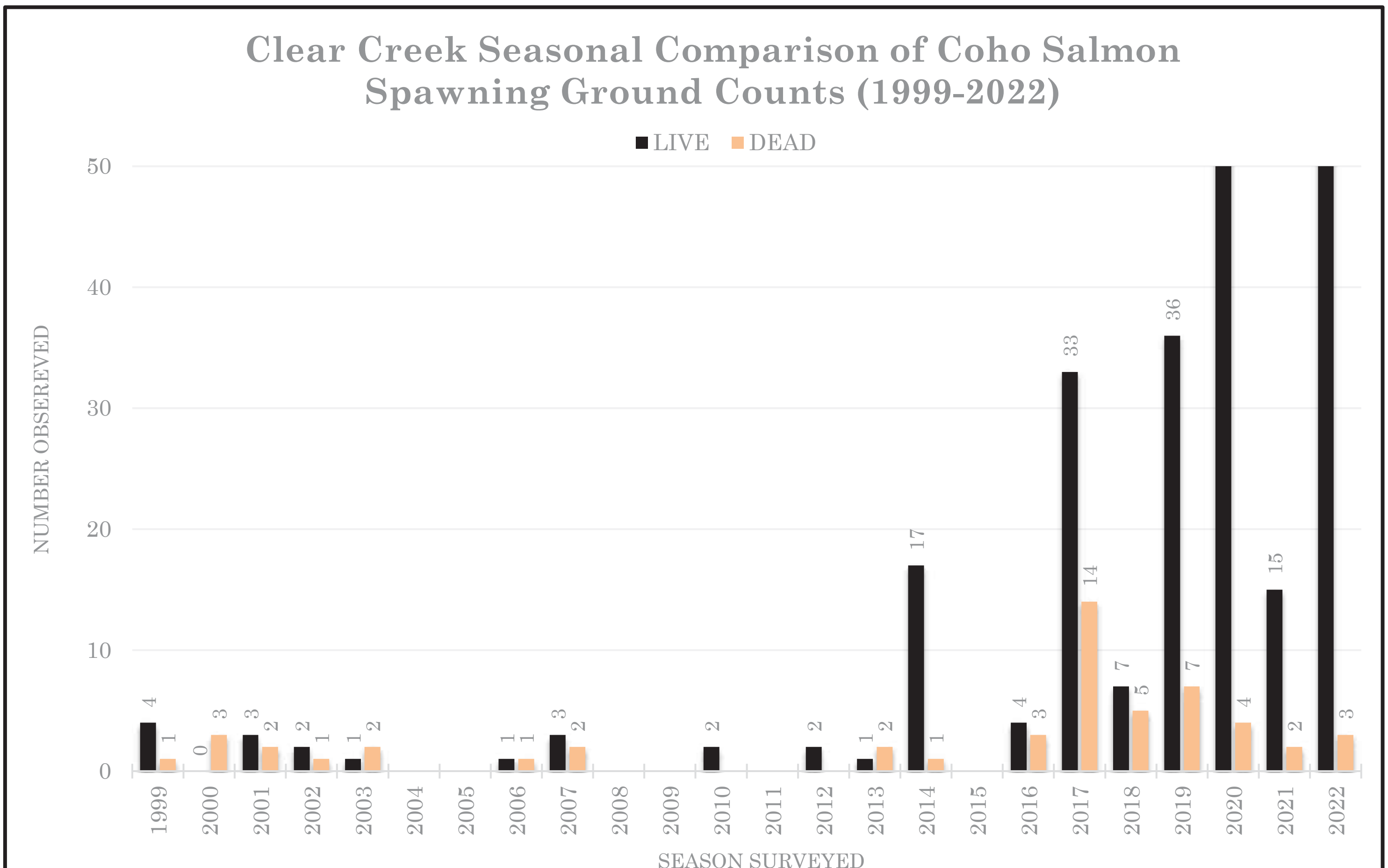


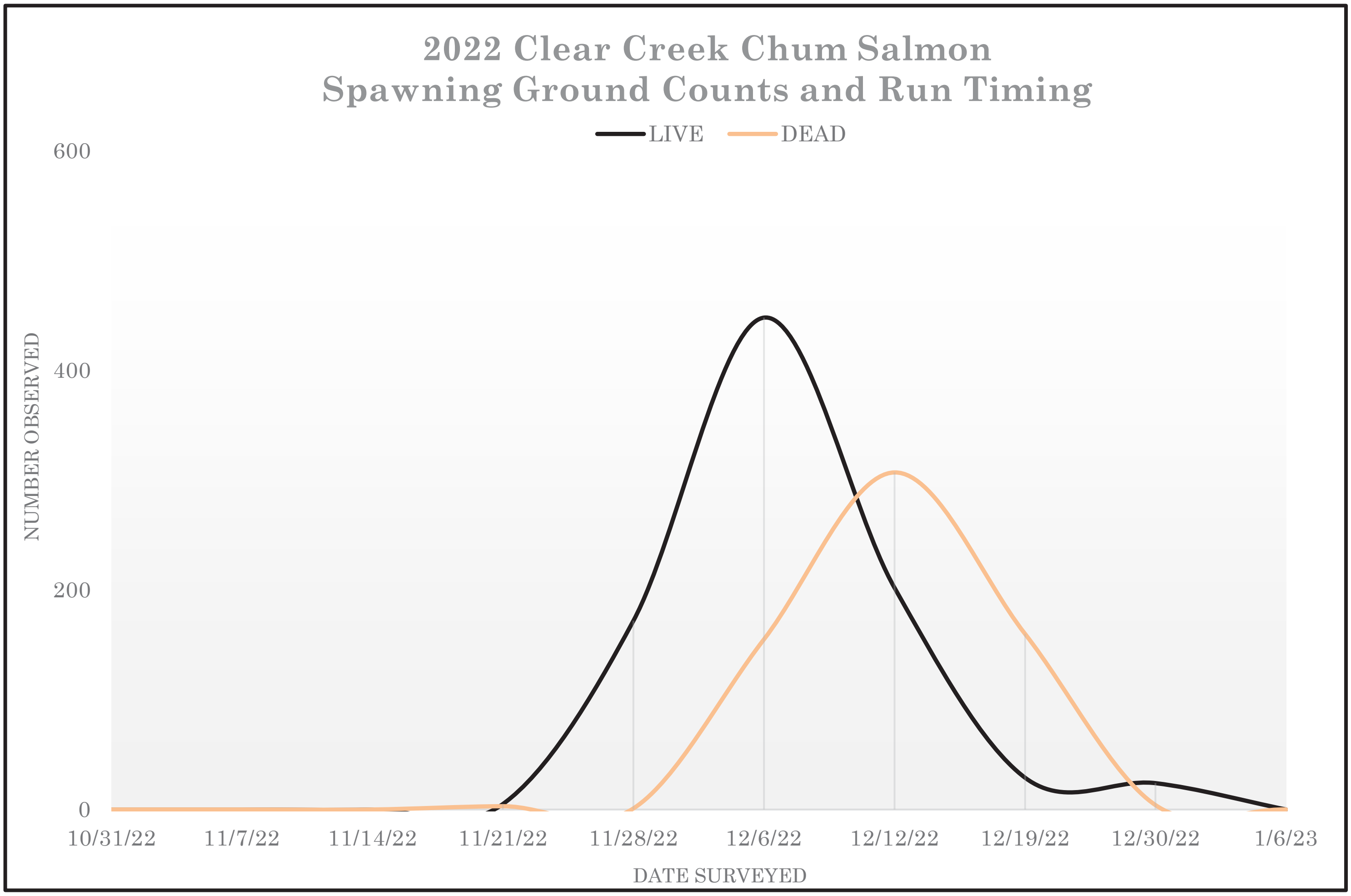
Superimposition of redds is a frequent occurrence due to the extremely short spawning reach and the density of spawners. *Pre-spawn mortality of females was extremely high (2019: 41% & 2021: 36%).

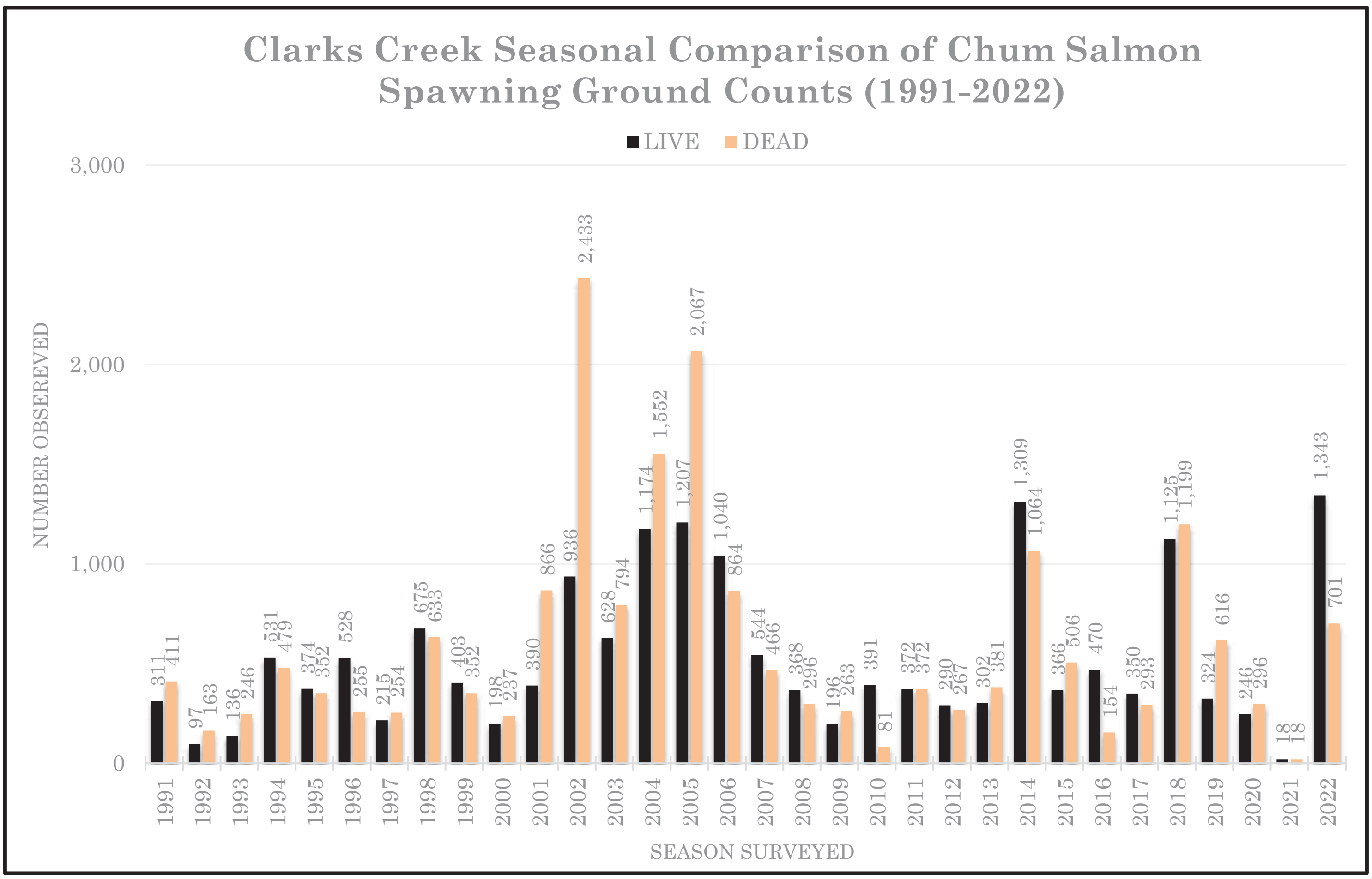

Clear Creek Chinook Carcass Sampling Results (2006-2022)
TOTAL CARCASSES SAMPLED
CWT/ADIPOSE PRESENT (HATCHERY)
CWT/NO ADIPOSE PRESENT (HATCHERY)
NO ADIPOSE PRESENT/NO CWT (HATCHERY)
UNKNOWN
UNMARKED (WILD)
VENTRAL CLIPS (ACCLIMATION POND)
NUMBER OBSERVED
SEASON SURVEYED
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022


Clear Creek Seasonal Comparison of Pink Salmon Spawning Ground Counts (2003-2021)
LIVE
DEAD
NUMBER OBSEREVED
SEASON SURVEYED
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021


2022 Clear Creek Coho Salmon
Spawning Ground Counts and Run Timing
LIVE
DEAD
NUMBER OBSERVED
50
40
30
20
10
0
9/26/22
10/3/22
10/17/22
10/25/22
10/31/22
11/7/22
11/14/22
11/21/22
11/28/22
12/6/22
DATE SURVEYED

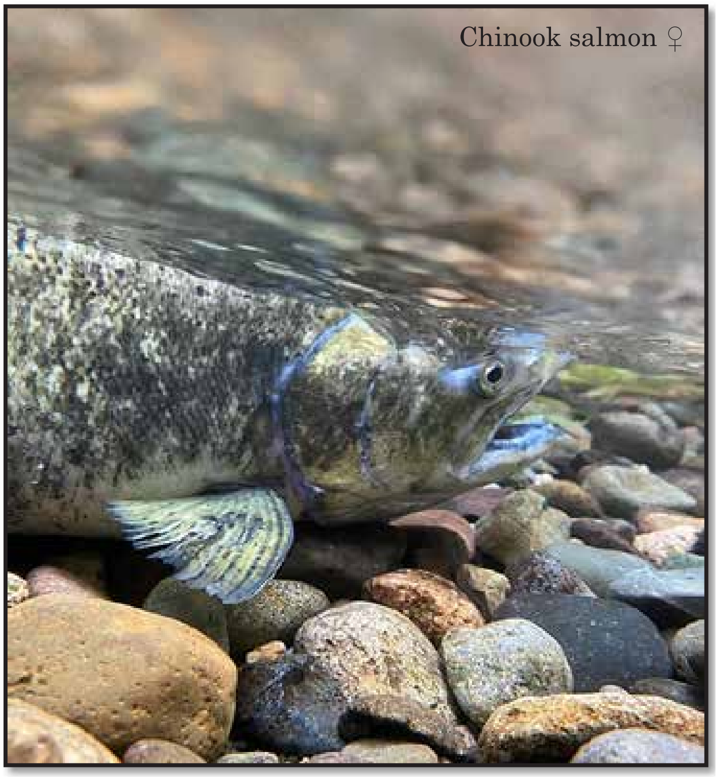

Clear Creek Seasonal Comparison of Coho Salmon
Spawning Ground Counts (1999-2022)
LIVE
DEAD
NUMBER OBSEREVED
50
40
30
20
10
0
4 1
0 3
3 2
2 1
1 2
1 1
3 2
2
2
1 2
17 1
4 3
33 14
7 5
36 7
4
15 2
3
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
SEASON SURVEYED


2022 Clear Creek Chum Salmon
Spawning Ground Counts and Run Timing
LIVE
DEAD
600
400
200
0
NUMBER OBSERVED
10/31/22
11/7/22
11/14/22
11/21/22
11/28/22
12/6/22
12/12/22
12/19/22
12/30/22
1/6/23
DATE SURVEYED


Clarks Creek Seasonal Comparison of Chum Salmon
Spawning Ground Counts (1991-2022)
LIVE
DEAD
3,000
2,000
1,000
0
NUMBER OBSEREVED
1991 311 411
1992 97 163
1993 136 246
1994 531 479
1995 374 352
1996 528 255
1997 215 254
1998 675 633
1999 403 352
2000 198 237
2001 390 866
2002 936 2,433
2003 628 794
2004 1,174 1,552
2005 1,207 2,067
2006 1,040 864
2007 544 466
2008 368 296
2009 196 263
2010 391 81
2011 372 372
2012 290 267
2013 302 381
2014 1,309 1,064
2015 366 506
2016 470 154
2017 350 293
2018 1,125 1,199
2019 324 616
2020 246 296
2021 18 18
2022 1,343 701
SEASON SURVEYED

CLEARWATER RIVER

WRIA 10.0080



The Clearwater River is a large tributary to the Upper White River, draining an area of nearly 40 mi². The Clearwater is a non-glacial river and originates on Bear Head Mountain, just west of the White River *(south of Greenwater)*. From Bear Head Mountain, the river flows just over 10.5 miles to its confluence with the White River at RM 35.3. The upper 5 miles of the river runs through a steep narrow channel within the Snoqualmie National Forest. The lower 5.5 miles of the Clearwater flows within a broader valley plain located within the privately owned White River tree farm *(owned by Muckleshoot Indian Tribe)*, and currently managed by Manulife.

Limited amounts of LWD are present in the lower channel and much of what is present is undersized or hardwood in origin. There are a series of cascades just above Lyle Creek at approximately RM 4.5; these cascades are considered a block to further upstream migration. However, much of the spawning takes place in the lower 2 miles of the river, although fish and redds are often observed and documented in the upper reaches later in the season.

The substrate throughout much of the lower reach of the river consists of small cobbles and flat angular stone, with smaller spawning size gravel in the many of the lower gradient riffles and tail-outs. The riparian area is primarily second growth conifer forest; however, recent clear cutting is evident along several areas of the upper and lower survey reach *(RM 0-3.8)*. The Clearwater River hosts several tributaries including: Falls, Mineral, Byron, Lyle, Lilly, and Milky creeks. There is some limited coho and pink spawning in both Byron and Mineral creeks.

Some of the habitat and fish limiting factors associated with the Clearwater River include, water quality issues, timber harvesting *(heavier silt load intrusion)* and channel confinement by logging roads which continues to affected the rivers natural morphology. Channel confinement has reduced the adequacy of off channel habitat critical for adult spawning, as well as overwintering for juvenile Chinook, steelhead and coho. In addition, low in-stream flows are often encountered during the late summer and early fall, and can prevent Chinook from advancing beyond the lower 1 or 2 miles of the river to spawn. Chinook, pink and coho are often seen holding in pools in the lower river for extended periods of time before increased flows *(freshet)* allow further upstream migration. Despite these deficiencies, the Clearwater River continues to support a substantial number of Chinook, coho, pink and steelhead spawners. Bull trout utilization is unknown, but presumed. Predation and scavenging is common along the Clearwater. Observations and signs of black bear *(Ursus americanus)* and river otter (*Lutra canadensis)* are prev-


Pink salmon

alent. It's important to note that all adult salmon and steelhead that spawn in the Clearwater River were captured at the USACE fish trap in Buckley, and transported above Mud Mountain dam. Since precise escapement numbers for the upper White River drainage are known, surveys are conducted to determine fish distribution and spawning success.

This is especially important regarding Spring Chinook, since adult production monitoring is part of the White River Spring Chinook Recovery Plan. Puyallup tribal fisheries biologists survey the Clearwater annually for Chinook, coho and pink *(odd years)* salmon. Coho have been observed in the Clearwater since surveys began for Chinook in 1991, but were not surveyed for until 2002. Coho survey data is often incomplete because it's often difficult to survey the river when late autumn and winter flows increase. The first pink salmon surveys were conducted beginning in 2003. Prior to 2003, few or no pinks were captured at the Buckley trap to be transported upriver to spawn. Biologists with WDFW regularly survey the Clearwater for steelhead spawning activity in the spring.

As part of the Spring Chinook recovery plan, the Puyallup Tribe has operated a Spring Chinook acclimation pond since 1995. Prior to 2009, approximately 200,000 plus Spring Chinook from the Muckleshoot White River hatchery were transported to the Clearwater pond on Mineral Cr. in early spring, and released in late May. All Spring Chinook destined for acclimation ponds fish are mass marked with left or right ventral fin clips. Odd brood years are marked with left ventral clips, and even years with right ventral clips. These acclimation pond fish are easily identified in the future when caught as adults or jacks at the USACE fish trap in Buckley, and can be passed above Mud Mountain dam to spawn naturally. Unfortunately, the road accessing the Mineral Cr. acclimation pond was washed out in January, 2009. The active river channel currently occupies the old road base; preventing future repairs and access to the pond site and the acclimation pond has since been decommissioned. Construction of a new acclimation pond, located approximately one mile downstream near Jensen Creek, began in July 2012 *(lower right)*, and was completed in late August. The new pond will be utilized to enhance both White River Spring Chinook. In addition, a large woody debris enhancement project through SPSSEG slated for the lower Clearwater in 2012, was initiated during the summer of 2013 *(see following page)*. Also, the installation of a USGS flow gauge at the 6050 road bridge in 2011 will help correlate fish spawning density, and upstream access extent, with instream flows.


Jensen Creek acclimation pond

Clearwater River Floodplain Restoration Project

Written by: Kristin Williamson
Salmon Restoration Biologist
South Puget Sound Salmon Enhancement Group
(Reprinted with Permission)

Project Completed in 2015

A total of 18 large and small engineered log jams were installed in the Clearwater River between river mile 2.3 and 3.1 in summer 2013. Placement of these log jams will activate flows to a network of 11 existing side channels, dissipate flood flows, and increase instream structure and cover in the river. This work completed about half of the proposed work plan. An additional 10 ELJ's were installed during the summer of 2015; as well as the decommissioning of the old roadway from the 6000 bridge to the lower washout *(phase 2&3)*.

Original Project Description and Benefits

The Clearwater River Floodplain Restoration Project is planned to address major limiting habitat factors and impaired processes on the Clearwater River through strategic placement of large wood structures and removal of nearly a mile of road from the historic floodplain. Historically, the Clearwater River meandered through a forested valley floor with large trees, a dense canopy, and a system of branching channels. The advent of timber harvest in the watershed and construction of a rail line (now road) in the Clearwater River floodplain for transport of timber in the early 1900s removed critical riparian structure from the valley floor and confined the floodplain. Loss of the riparian buffer has resulted in easily erodible banks due to root loss and associated soil cohesion, dramatic reductions in large wood debris recruitment to the stream channel, and loss of overhanging vegetation.

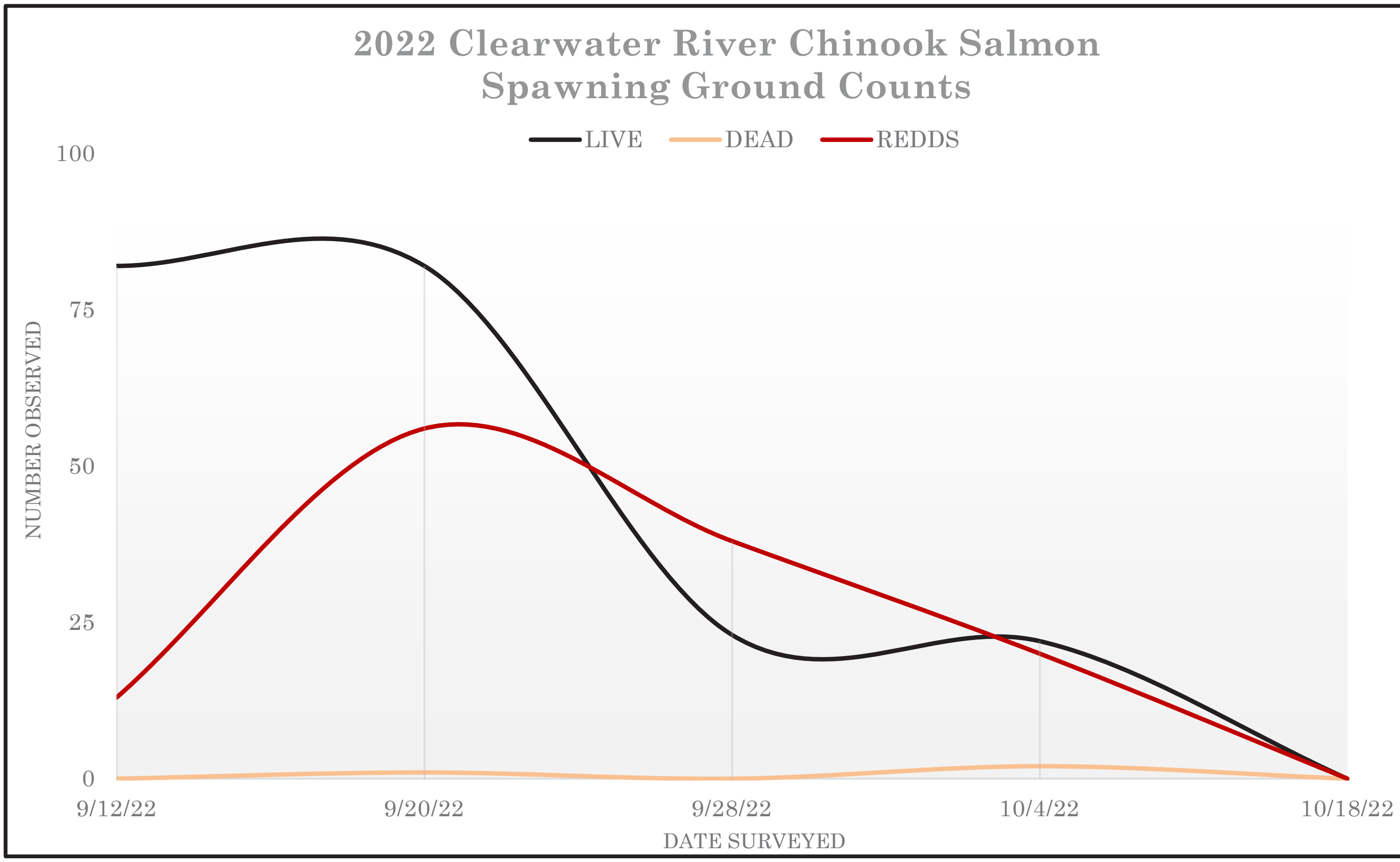
Project efforts would install up to 39 wood structures of varying types and sizes to meter natural wood through the system, trap sediment, and aggrade incised sections of the channel for the long term reconnection of a network of 19 side channels in the floodplain. The project would also decommission nearly a mile of road and remove 10 associated culverts. Removal of three of the culverts would provide immediate improved passage to wall-based wetland channels, and the removal of the other 7 would provide long term access to spring fed channels and alluvial fans currently impounded by the road. wetland channels, and the removal of the other 7 would provide long term access to spring fed channels and alluvial fans currently impounded by the road.

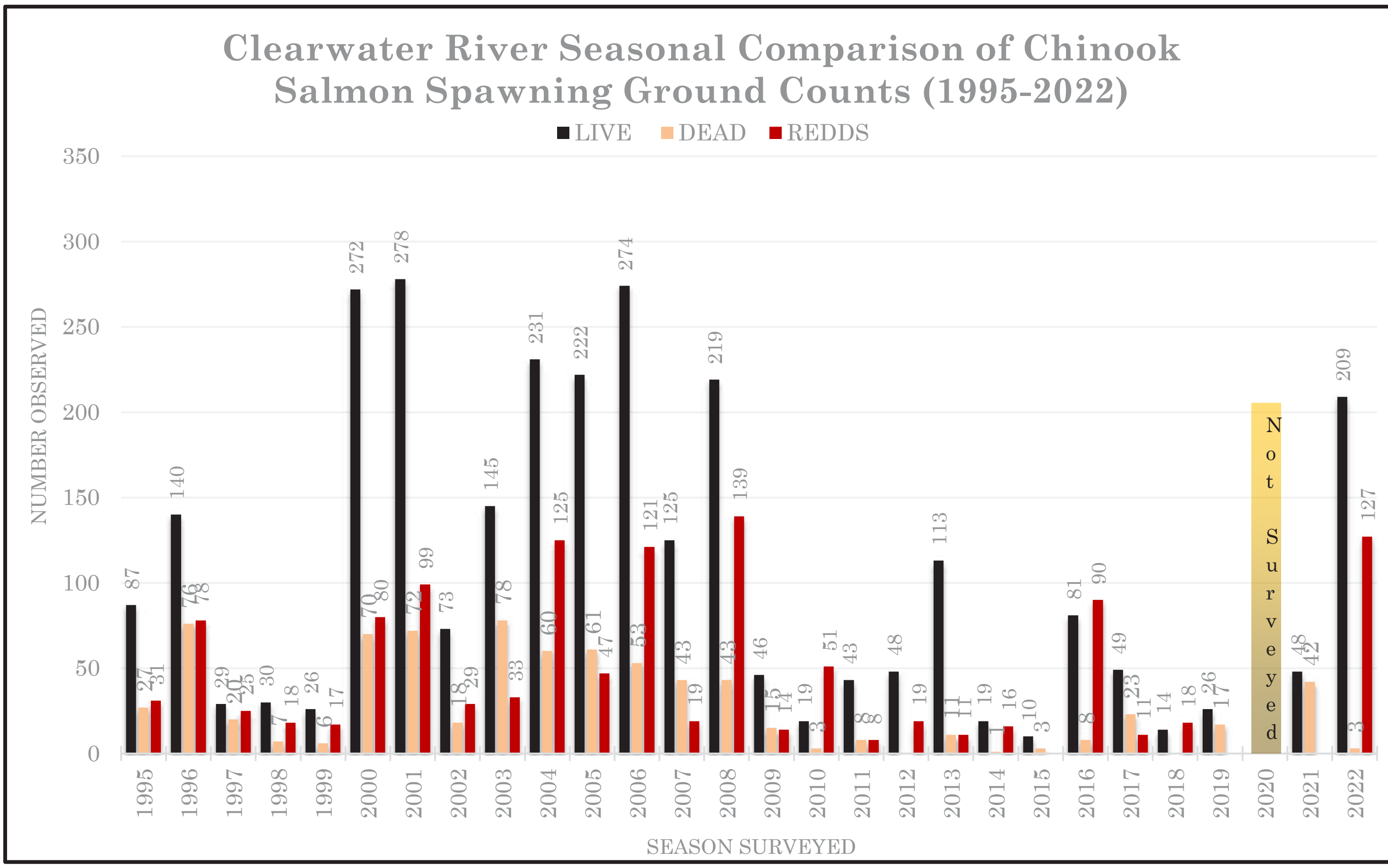
The Puyallup and White River Salmon Recovery Strategy specifically identifies the Clearwater River as a high priority geographic area for White River Spring Chinook recovery, as determined by Mobrand EDT modeling. By extension, this project will also benefit other native stocks, including coho and pink salmon, steelhead, and bull trout. This project will specifically address strategic priorities identified within the strategy including: increasing the quantity and quality of instream habitat through input of wood structures and improving the riparian conditions in the watershed through abandonment and decompaction of a stream adjacent road prism and active plantings.

Watershed and Aquatic Benefits:

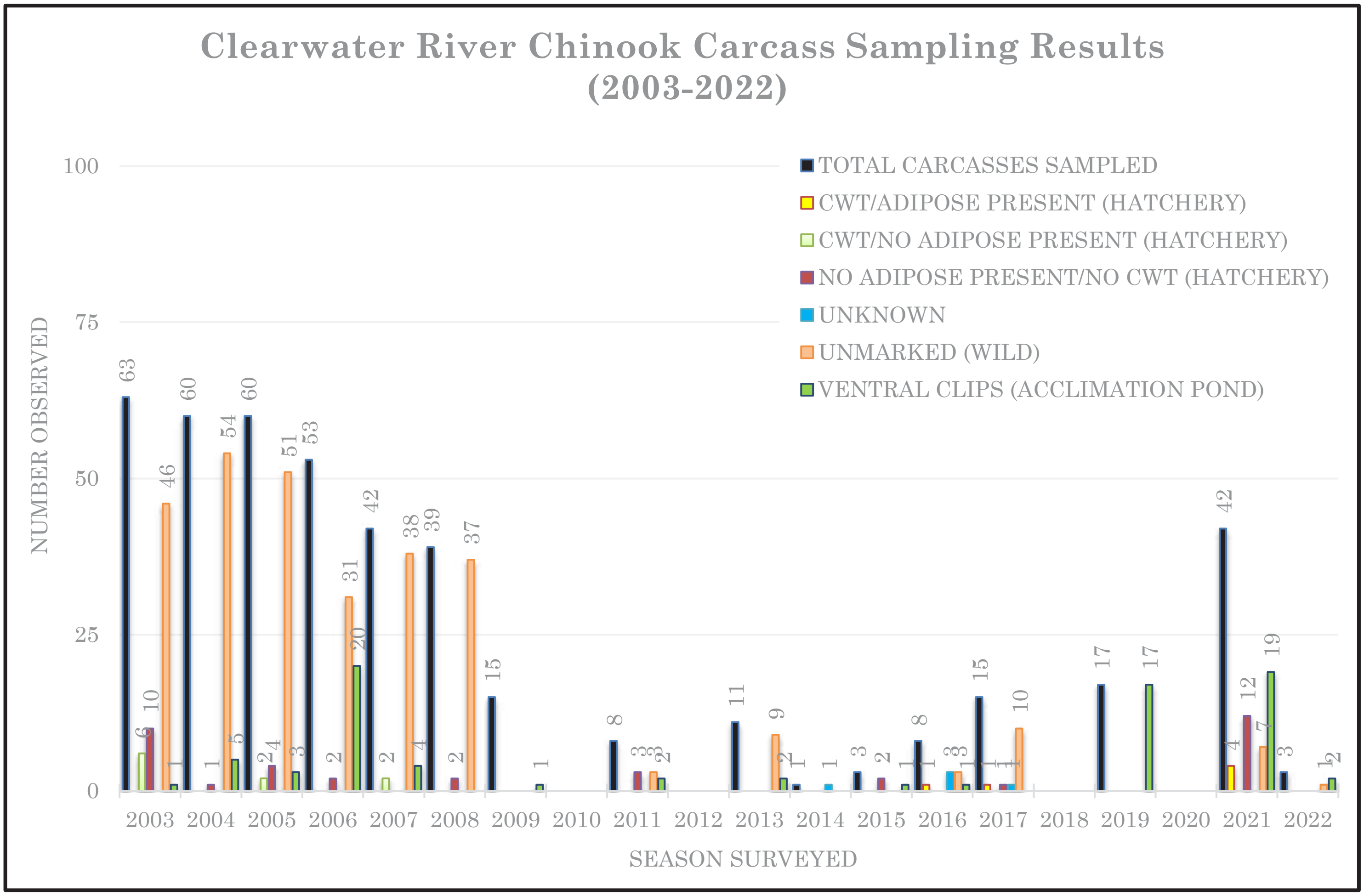
The overall goal of the project is to increase spawning and rearing capacity of the watershed for Spring Chinook, steelhead, coho, pink, and coastal and resident cutthroat species. Realized benefits from project actions will include:

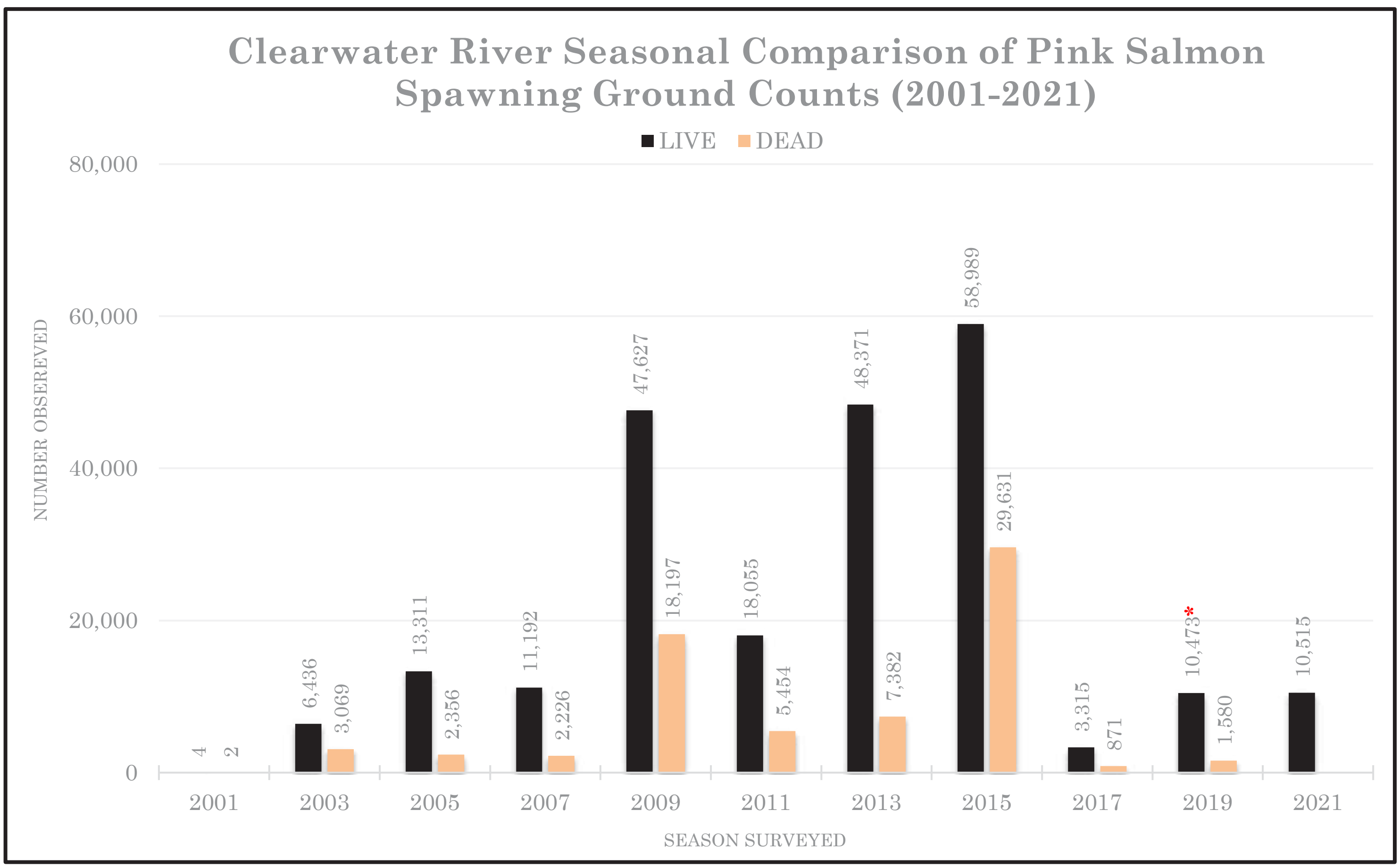
- Activate 14.5 acres of historic floodplain through road decommissioning and removal of 10 culverts.
- Active 70 acres of floodplain through placement of wood structures and subsequent aggradations of the channel bed.
- Activate 19 existing side channels and promote the formation of new side channels through channel migration.
- Dissipate flood energy through placement of wood structures to partition sheer stress.
- Increase quantity and quality of instream, pool, and refuge habitat through placement of wood structures.
- Improve riparian function through abandonment/ripping of a stream adjacent road.
- Establish a riparian corridor on former road prism through planting of 2,500 native trees.



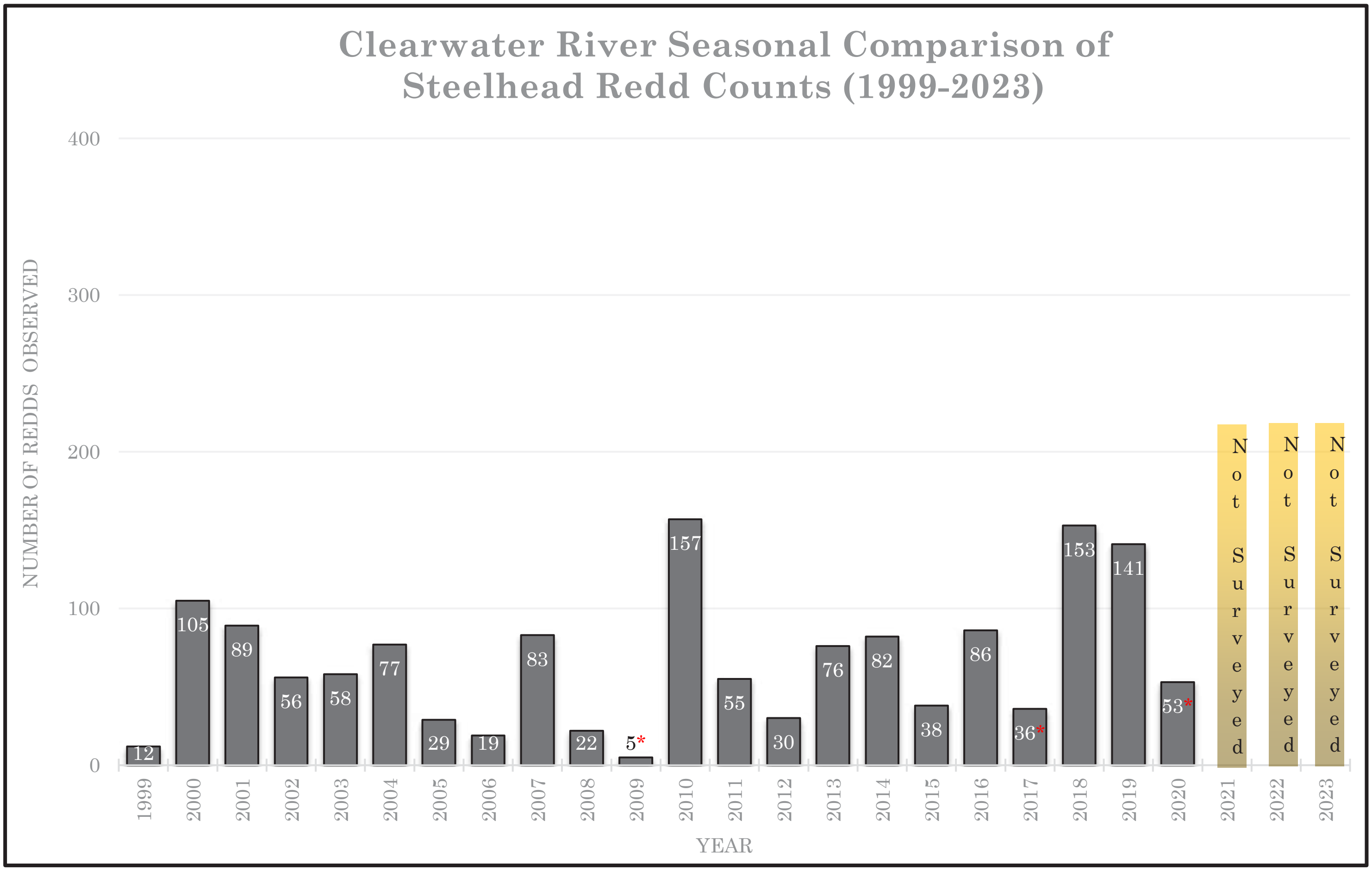


Adult Chinook escapement is determined by expanding the number of redds observed by 2.5 fish per redd (Smith and Castle, 1994). Due to the tremendous volume of pink salmon during odd years, the success of determining Chinook redds from pinks is vastly reduced. Therefore, The AUC method is used to determine escapement during pink runs (odd years). *2019 survey data is incomplete. 2020 surveys were not conducted do to wildfire closure.

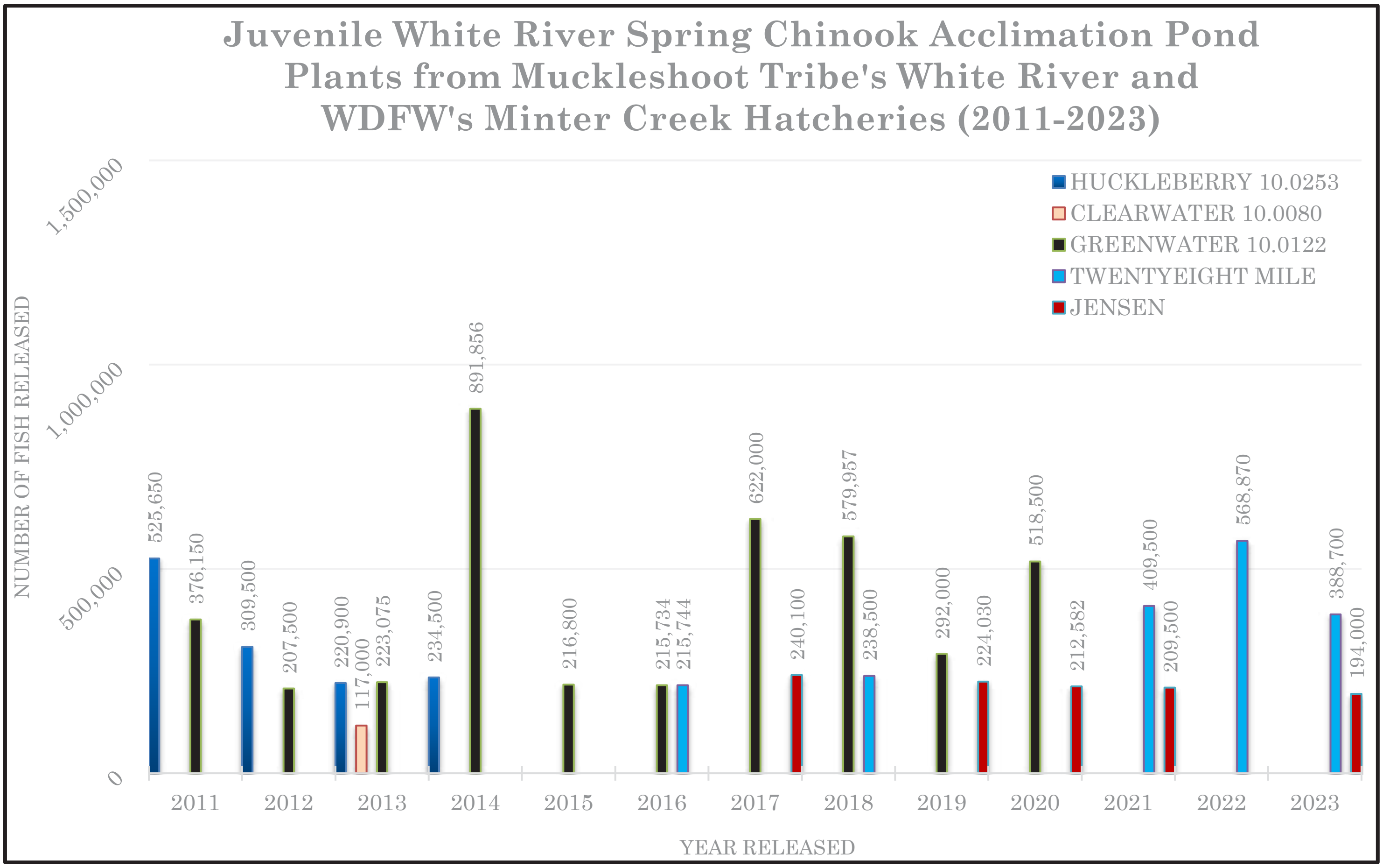




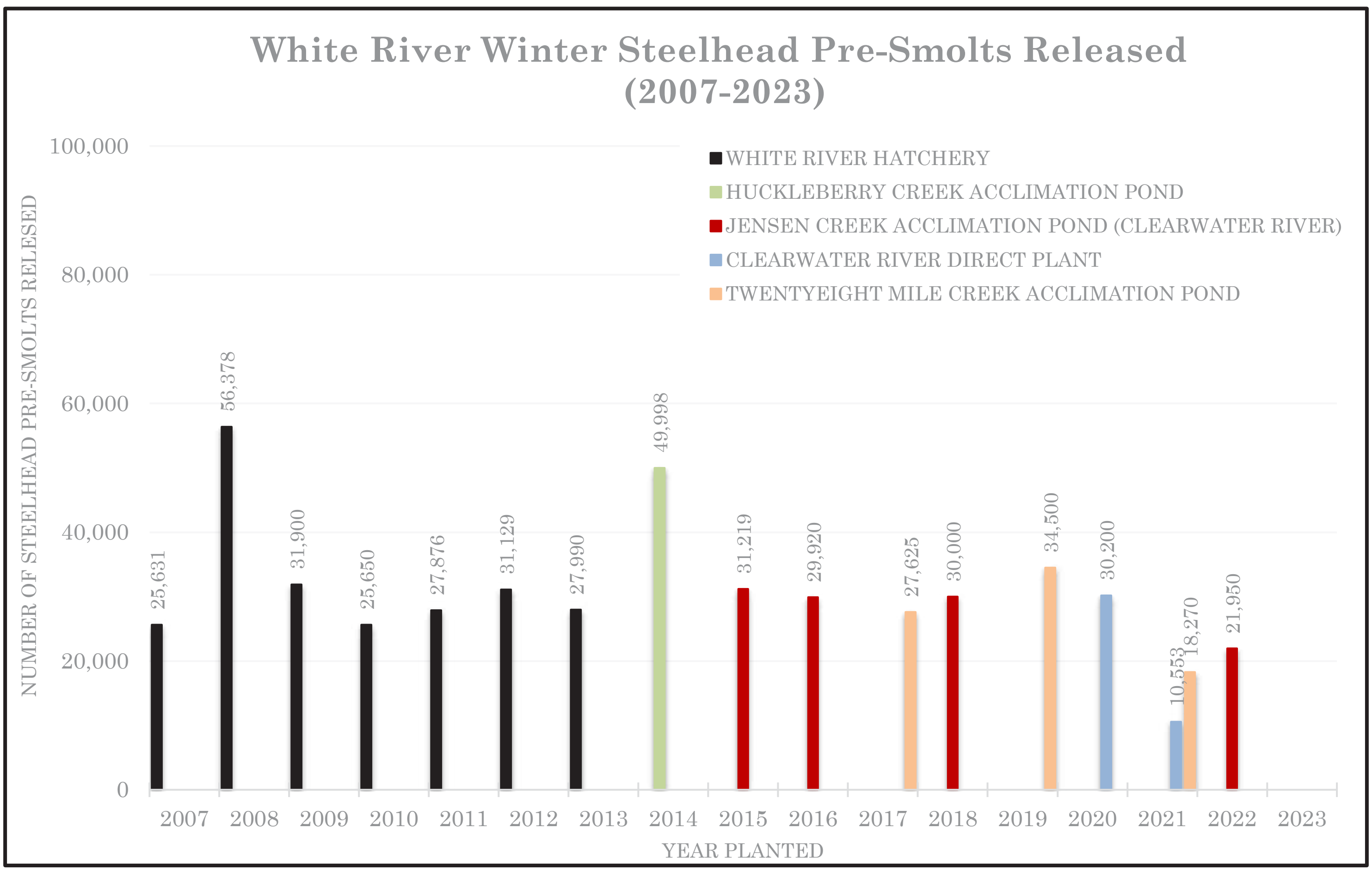
*2019 survey data is incomplete.



*The redd data is incomplete due to extremely poor survey condition which prevented a regular full season of surveys. Redd data collected by WDFW. To determine the total escapement for steelhead, each redd is multiplied by a factor of 1.62 *(i.e. 42 redds x 1.62 steelhead per redd = total escapement of 68 steelhead).* Addition biological expansion factors are applied to estimate escapement for suitable habitat areas that are often unsurveyable.



Acclimation ponds opperated by Puyallup Tribe. See for acclimation pond location sites. No data indicates no fish were planted.



Acclimation ponds opperated by Puyallup Tribe. Steelhead program was discontinued in 2022 due to insufficient brood-stock availability.

COAL MINE CREEK

WRIA 10.0432A

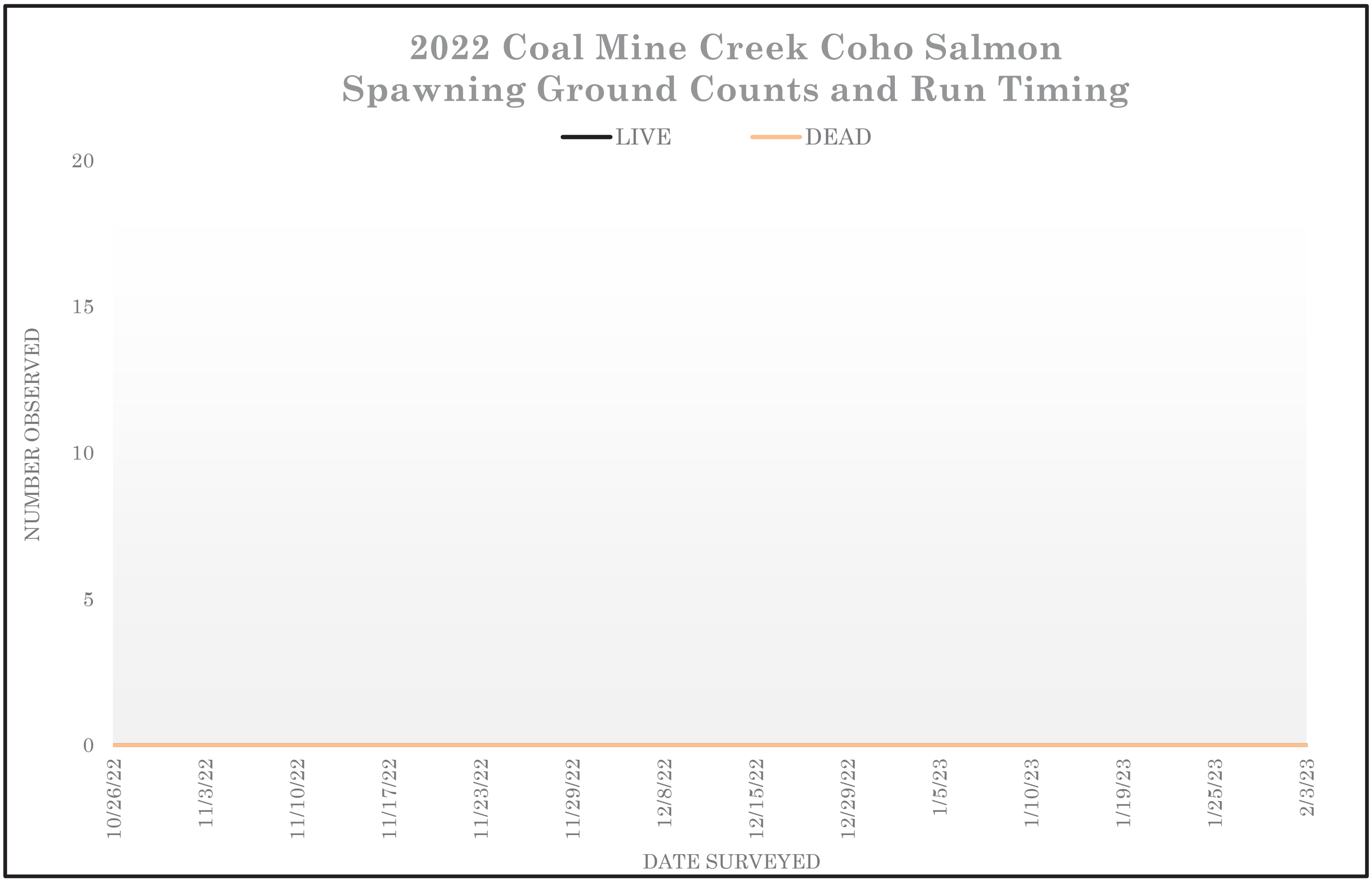
Coal Mine Creek, which derived its name from the local areas profound history in the coal mining industry, is a small tributary to Wilkeson Creek *(10.0432)*. Wilkeson Creek in turn is a major tributary to South Prairie Creek *(10.0429)*. The creek flows southwest for just over a mile before entering Wilkeson Creek near RM 5.7, just south of the community of Wilkeson.

Coal Mine is one of 5 index streams in the Puyallup Watershed that is surveyed for coho by the Washington Department of Fish and Wildlife. State biologists use the coho escapement from five "Index" tributaries *(Coal Mine, Spiketon, Fiske, Fennel and Canyonfalls)* to estimate the total escapement for the Puyallup River. Surveys of the creek over the past decade have yet to document adult Chinook or steelhead spawning. Low instream seasonal flows in Wilkeson, as well as Coal Mine, are likely the strongest limiting factors preventing these species from reaching the stream to spawn. Although inconsistent from season to season, small numbers of chum have been observed spawning in Coal Mine during the month of December. Bull trout utilization within this small stream is unknown, but presumed.

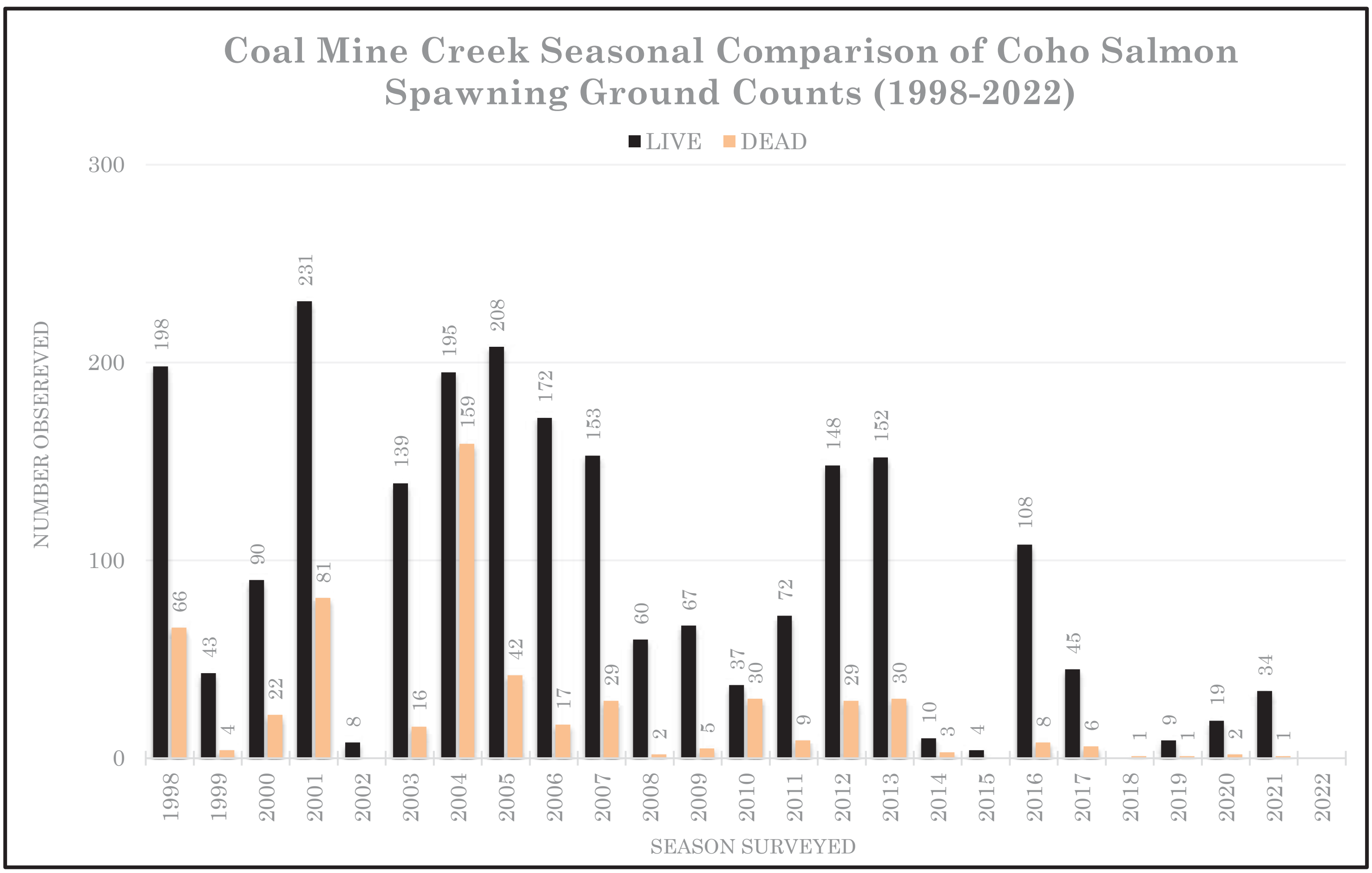
Coal Mine is a small order short run stream with moderately low gradient; making it somewhat ideal for coho, pink and chum. Unfortunately, the majority of the steam has little complexity; several portions of the creek have minimal natural bank protection, little or no instream woody debris or quality spawning gravel. However, the creek does provide good quality rearing and overwintering conditions for juvenile salmonids. Coho juveniles are frequently observed throughout the entire surveyed reach of the creek. Cutthroat are also ever-present in this small rural stream. It is likely that juvenile steelhead, the offspring from adult spawners in Wilkeson Creek, utilize Coal Mine for rearing, foraging and overwintering as well.

Moderate rural development exists along the lower 0.5 mile section of the creek; consisting primarily of private family homes, county and private roads, as well as a rock quarry and public school. The creek flows through a fish passable cement box culvert approximately 0.15 miles up from the mouth, and a second culvert near RM 0.6. When the fish passable box culvert was installed under Railroad Avenue several years ago, some complexity had been added to the creek via a small restoration project which included the placement of small sill logs, root wads, boulders, along with native tree and vegetative plantings. The alder along the banks have since grown to provide improved coverage of the stream.

Spawning opportunities are noticeably reduced downstream of the culvert crossing at Railroad Ave. due to a narrow confined channel, in addition to the absence of suitable spawning graves. Most of the substrate through this section consists of fine silt, sand, and exceedingly small patches of undersized gravel; however, relatively abundant spawning gravel exists above the culvert. Nevertheless, several silt deposits exist throughout the entire surveyed section. The rock and gravel quarry site located near the creek is one of the suspected sources of the silt.



Graphs generated using survey data provided by WDFW.



COW SKULL CREEK

SALMON ACCLIMATION POND

Cowskull Cr. natural aclimation pond

Cow Skull Creek is not officially named; however, for easy identification the creek is referred to as "Cow Skull" by PTF staff. Cow Skull Creek is a small left bank tributary to the upper Puyallup River, entering the Puyallup at RM 45.5. Unfortunately, anadromous salmon were unable to access Cow Skull for nearly a century due to the streams location upstream of the Electron diversion dam. With the completion of the Electron fish ladder *(@ RM 41.7)* in the fall of 2000, anadromous fish passage was restored for the first time since 1904. Restoring anadromous access to the upper Puyallup River has made approximately 26+ miles of spawning, rearing, and foraging habitat above the diversion available for several species, including Chinook, coho, pink, steelhead, and bull trout. Cow Skull is one of two acclimation ponds used for enhancing coho, and occasionally Chinook *(spring & fall)*, into a 26+ mile reach of the Upper Puyallup River. Acclimation ponds are a proven method in increasing fish numbers on the spawning grounds. The pond is located just off the main channel of the Puyallup at RM 0.1.

The old Cow Skull pond was over two decades old and had weathered high flows and significant sediment deposition which has decreased its operational capabilities and efficiency. As of the summer of 2022, the Cow Skull pond has been re-engineered to bring it up to modern design specification. The new pond is scheduled to be completed in late 2023, and will have increased fish capacity (25,000 cubic feet of water storage) and predator prevention.

In past years (2001-2007), 20,000 to 100,000+ coho yearlings were imprinted and released from Cow Skull annually. Coho yearlings originated from Voights Creek Hatchery, where they were adipose clipped and coded wire tagged for future identification. Fish were released at 20 fish per pound, for a total biomass of 10,000 pounds. When available, Fall Chinook are acclimated in Cowskull as well. During the summer of 2015, the pond was given its first maintenance dredging since it was originally constructed. This was necessary due to more than half of the ponds capacity being lost due to sediment build-up.

The Cow Skull drainage flows within the Kapowsin tree farm, which is private timber property managed by Manulife. This high mountain stream originates from snowpack accumulations near 3,400'; as well as, surface and groundwater from the surrounding valley. Cow Skull is non-glacial and flows northwest through a steep narrow valley for much of its 1.2 mile length. The gradient decreases substantially over the lower 0.46 miles; in so doing, provides beneficial habitat for fish rearing, foraging and spawning. Cow Skull supports juvenile Chinook *(planted)*; as well as juvenile and adult coho *(planted and NOR),* and cutthroat. Steelhead and bull trout utilization is unknown. However, bull trout utilization is presumed, to some degree, since the upper Puyallup is a documented occupied habitat area.

Watershed Fish Enhancement Program

Project Description: The Puyallup Tribe operates several acclimation ponds in the Puyallup/White River Watershed designed to reestablish and enhance Spring/Fall Chinook and coho stocks. Each of two acclimation ponds *(Cowskull & Rushingwater)* on the Puyallup would receive as many as 100K+ hatchery origin Spring/Fall Chinook and/or coho. Additional acclimation ponds located in the Upper White River drainage *(Huckleberry Cr., Greenwater River (George Cr.), Twentyeight Mile Cr. (Greenwater R.)& Jensen Cr.(Clearwater R.)* would be planted collectively with up to 900K+ White River Spring Chinook. The newest pond located on 28 Mile Creek *(Greenwater River)* was completion in the fall of 2015. The Jensen Creek pond *(Clearwater River)* was completed in the fall of 2012. When obtainable, the Puyallup Tribe will collect, haul and plant surplus adult hatchery Fall Chinook and coho from WDFW's Voights Creek hatchery to spawn naturally in minor spawning or underutilized areas.

Goals, Purpose and Expected Benefits: One of the Puyallup Tribe's most significant restoration goals is to rebuild depressed Chinook and steelhead stocks and remove them from ESA listing. Acclimation ponds, juvenile in-stream plants and adult surplus fish plants are a proven method for increasing fish stocks, and are key components to restoration goals. Using acclimation ponds, limiting harvest and creating substantial gains in habitat restoration, the Tribe will be able to accomplish restoration goals. Levee setbacks, oxbow reconnections both inter tidal and upland, Commencement Bay cleanup, and harvest cutbacks have already been initiated.

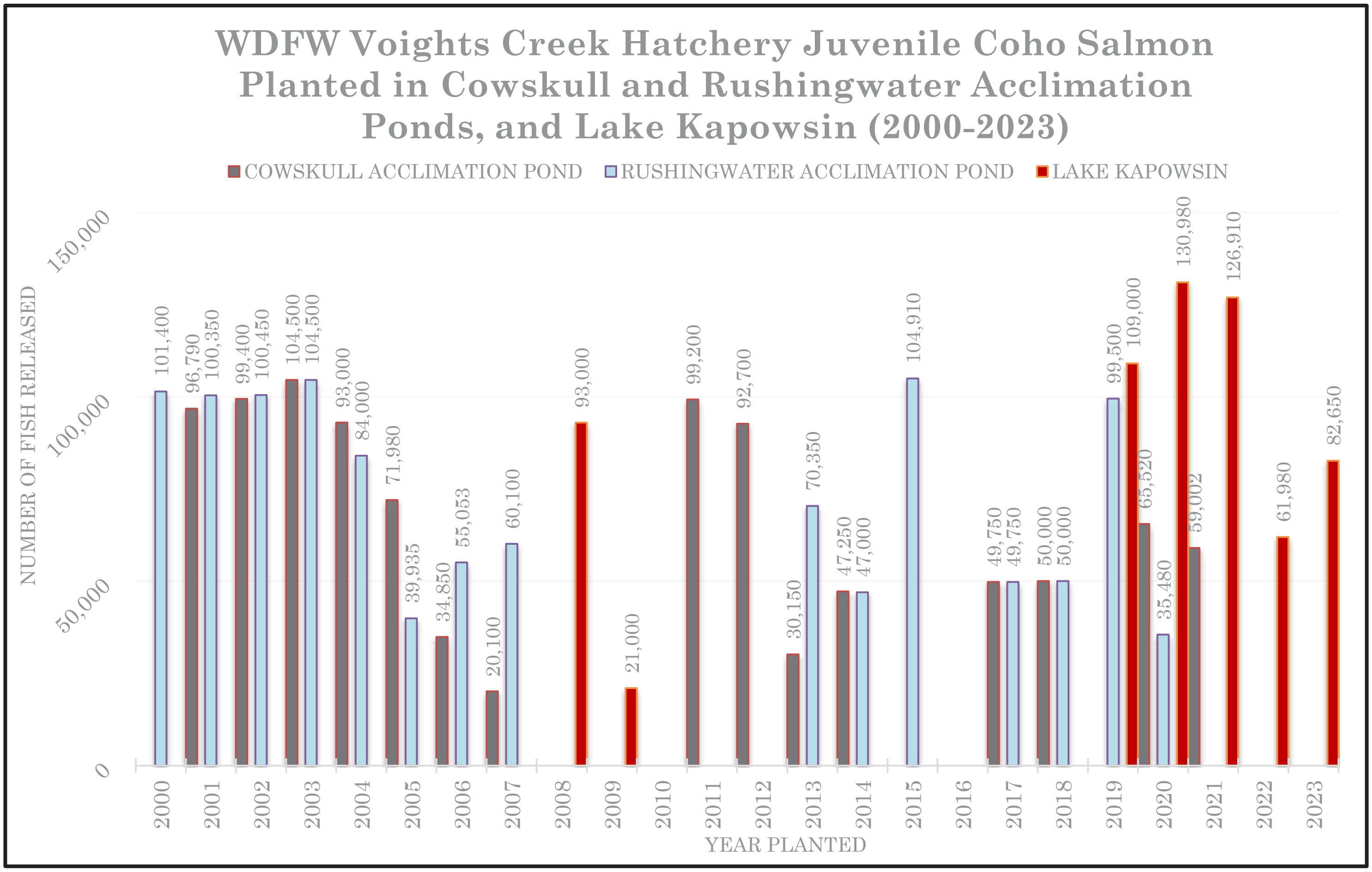
Purpose:

- Produce Spring/Fall Chinook and coho for the Puyallup/White River salmon conservation and harvest programs.
- Establish a total annual return of Spring Chinook Natural Origin Recruits (NORs) that meets the escapement goals for White River Spring Chinook Recovery.
- Provide sustainable harvest for tribal and non-tribal fisheries on Fall Chinook and non-ESA listed coho.
- Optimize hatchery and natural production consistent with the conservation of naturally produced native fish.
- Maintain genetic makeup of Chinook and steelhead populations.

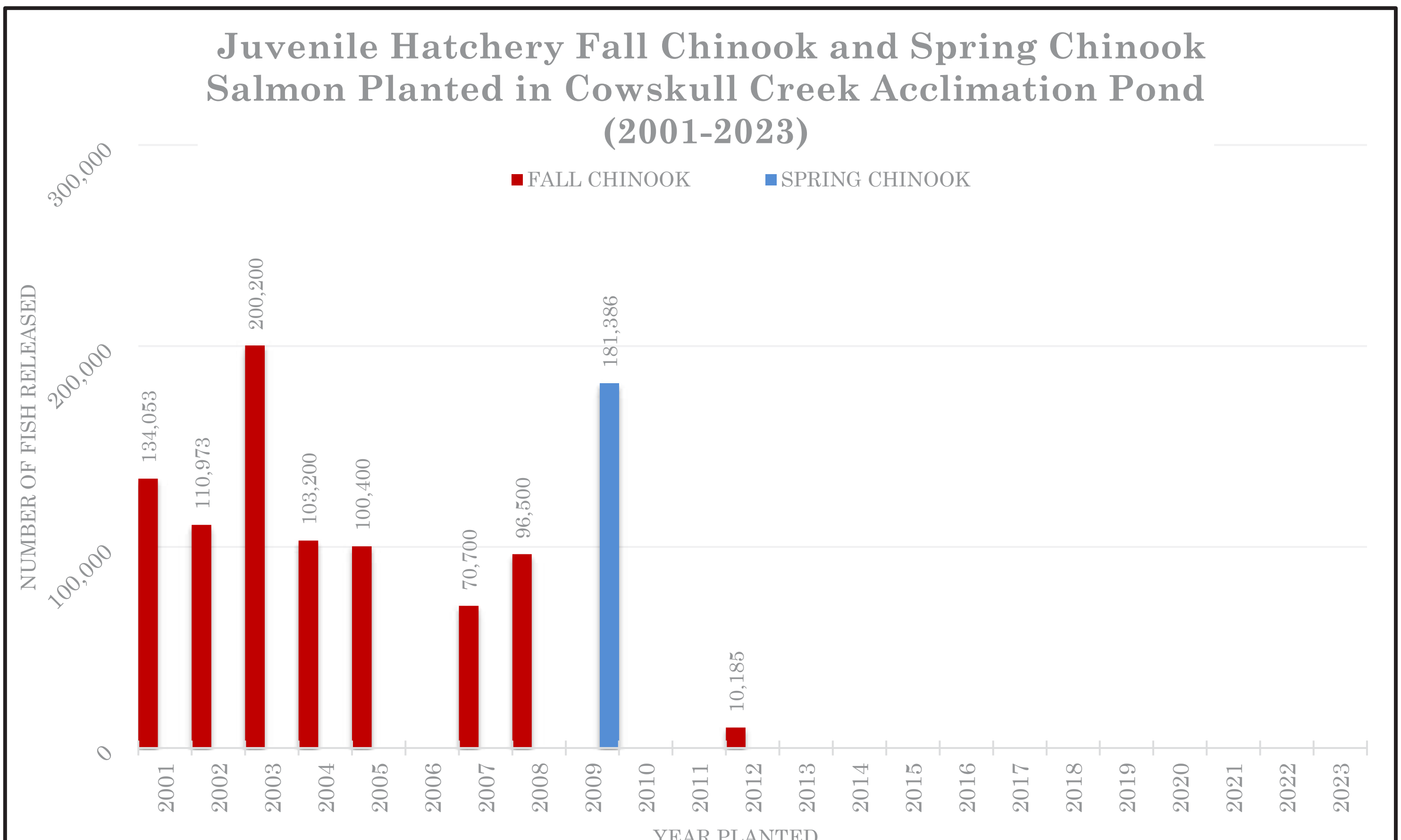
Benefits:

- Reestablish and enhance ESA listed Spring/Fall Chinook, as well as non-listed coho into their endemic ranges.
- Increased total abundance of the composite natural/hatchery population.
- Increased spawning ground escapement and trend of Natural Origin Recruits (NORs).
- Improve distribution *(out planting of live fish)* of salmon to minor spawning and underutilized rearing habitat areas.
- Provide future tribal and sport harvest opportunities.
- Nutrient enhancement in oligotrophic *(nutrient-poor)* streams.

The re-engineered Cow Skull pond under construction during the summer of 2023.



Acclimation ponds opperated by Puyallup Tribe. See Appendix D for acclimation pond location sites. No data indicates no fish were planted.

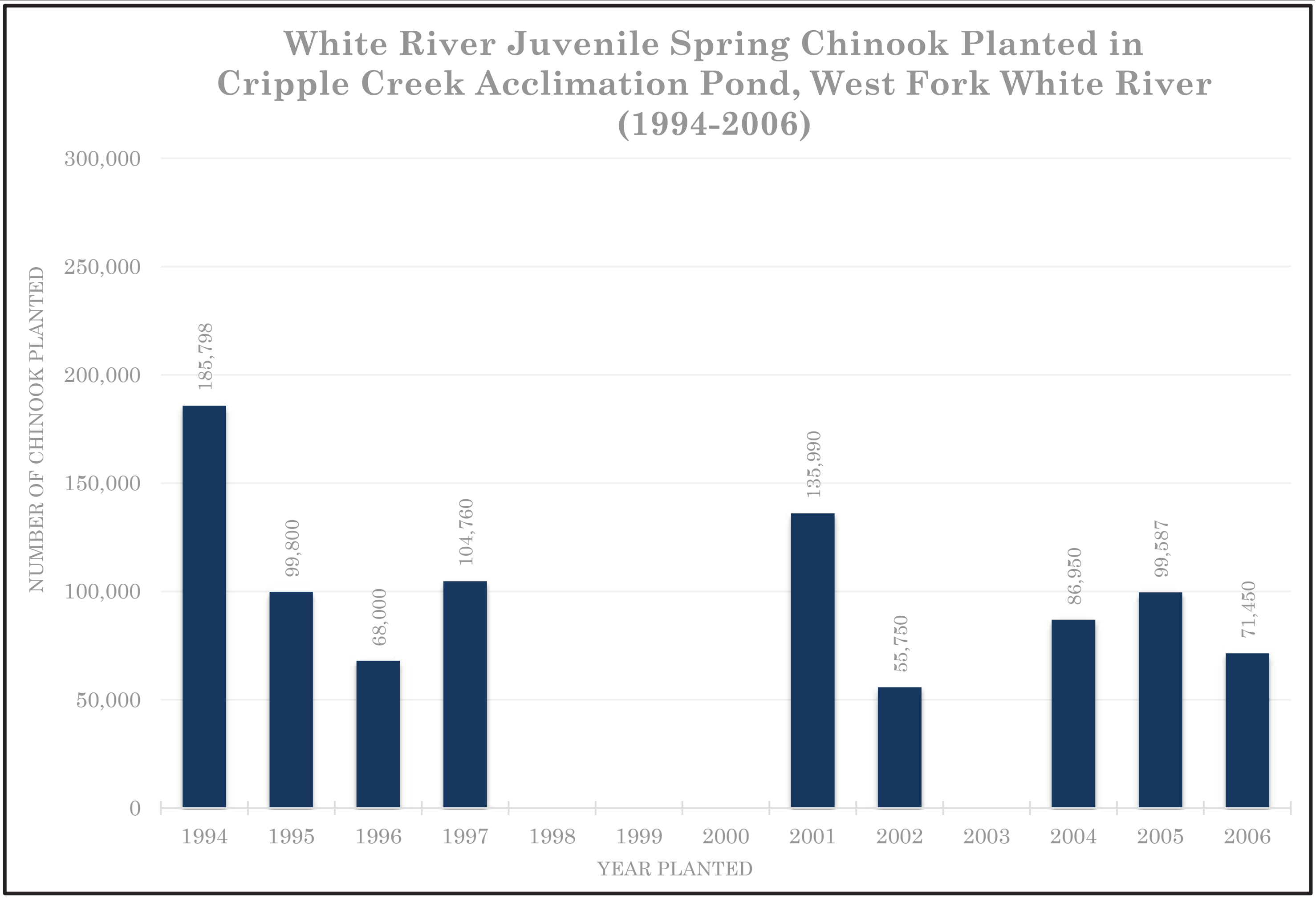


Acclimation ponds opperated by Puyallup Tribe. See Appendix D for acclimation pond location sites. No data indicates no fish were planted.

CRIPPLE CREEK

Cripple Creek is a short-run tributary that flows within the West Fork White River flood plain. The stream channel has a moderate amount of stream complexity created by a few well-placed pieces of LWD; in addition to the stream natural sinuosity. Cripple quickly joins Pinochle Creek approximately 0.5 miles above Pinochle's confluence with the West Fork White River. Cripple Creek flows through a low gradient pool riffle channel with generally thick, brushy riparian cover; as well as a mix of coniferous and deciduous trees. The substrate contains a large amount of fine materials, but several small patches of suitable spawning gravel exist throughout the entire reach. Coho frequently spawn within the lower 0.3 miles of the creek; however, low flows can prevent Chinook from accessing the creek to spawn in August and early September. Other species known to utilize the creek include pink, sockeye, cutthroat, rainbow and bull trout.

Cripple was surveyed for adult salmon escapement, and is the site for one of the Puyallup Tribe's acclimation ponds. Unfortunately, flood damage to Forest Service Road 74 has prevented access to the creek since 2006; so, no escapement surveys or fish plants have occurred since. All adult salmon that spawn in Cripple Creek were initially captured at the USACE fish trap in Buckley, and transported above Mud Mountain dam. Specific escapement numbers for the upper White River drainage are known; therefore, surveys were conducted to determine fish distribution and spawning success. This is especially important regarding Spring Chinook, since adult production monitoring is part of the White River Spring Chinook Recovery Plan. Also, as part of the recovery plan, the Puyallup Tribe operated a Spring Chinook acclimation pond located at RM 0.3 *(bottom image)*. Spring Chinook were reared and released from Cripple Creek for several years *(1994-2006)*. Approximately 50,000 plus Spring Chinook from the Muckleshoot White River hatchery were transported annually to the Cripple Creek acclimation pond in early spring, and released in late spring. Returns to this small stream, as well as Pinochle and Wrong creeks, are likely the result of these earlier plantings.



Acclimation ponds opperated by Puyallup Tribe. See Appendix D for acclimation pond location sites. No data indicates no fish were planted.

DEADWOOD CREEK

WRIA 10.0355


Bull trout

Deadwood Creek is a significant right bank headwater tributary to the White River. The creek is exclusively surveyed for bull trout from early September-to-mid October. Deadwood Creek is a phenomenal non-glacial stream, originating from the Deadwood Lakes *(elev. 5236')* near Yakima Peak *(Chinook Pass)*. Deadwood is a north facing stream flowing entirely within Mt. Rainier National Park. Deadwood enters the White River at approximately RM 67.5, roughly 0.4 miles downstream from Klickitat Creek. The creek is surrounded by old growth and the water temperature is tempered by cold clear water year round. Deadwood flows for approximately 2.5 miles from upper Deadwood Lake to its convergence with the White River; however, only the lower 0.45 miles provides spawning and rearing opportunities. A single unnamed tributary adds flow to Deadwood; unfortunately, it does not contribute any beneficial spawning or rearing habitat given it is located above natural anadromous barriers.


Bull trout redd.

Deadwood provides exceptional habitat conditions for bull trout rearing and spawning. The first 0.1 miles is low gradient, with significant fines and sparse spawning gravel; as well as significant amounts of in-channel LWD. The next 0.44 miles flows through the perimeter of the forested area along the White River channel. The creek channel contains several pieces of LWD and abundant spawning gravels, in addition to a heavily mixed conifer riparian overstory. Numerous pools and side channels provide excellent habitat for all life history stages of bull trout; from newly emerged fry to adults. At approximately RM 0.45-0.6, the creek curves and swiftly climbs up the valley wall. At this point the stream quickly develops into a series of impassable cascades preventing any further upstream migration. Numerous surveys have been conducted above this point; however, no fish or redds have been observed, nor have any other salmon species been observed spawning in the creek. Fluvial and residential bull trout are observed spawning in the creek during late summer and early fall. In addition, juvenile bull trout have been observed within pools and lateral habitats during annual surveys. The few dead bull trout encountered during surveys appear to be pre-spawned mortalities due to predation.

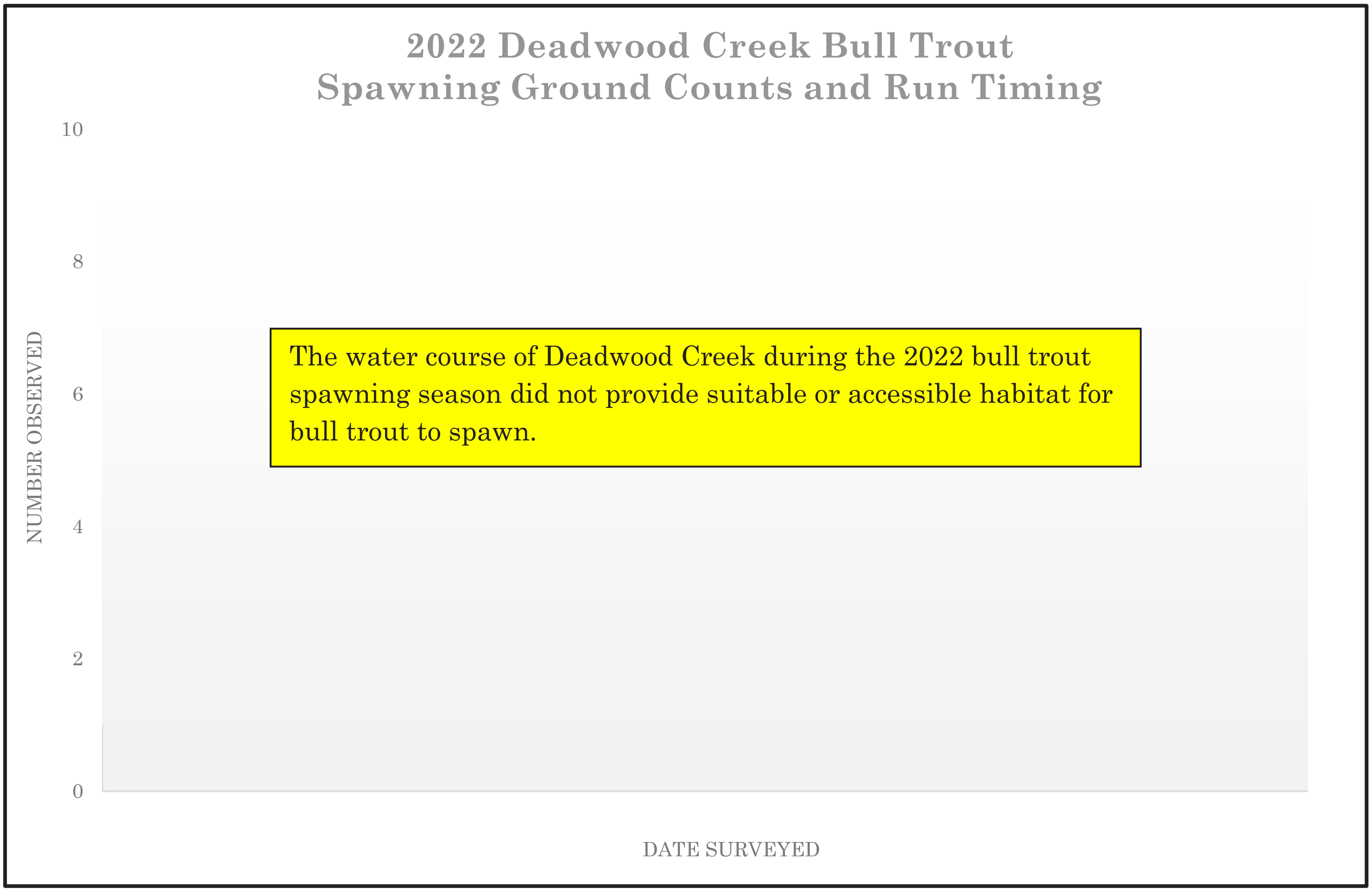
For three seasons *(2005-2007)*, PTF biologists conducted extensive bull trout migration telemetry studies in conjunction with redd surveys along the upper White River and West Fork White River. The study focused heavily on the headwater tributaries located within and adjacent to Mt. Rainier National Park. Study results showed that the cold high mountain streams located within the park provide the majority of the critical bull trout spawning habitat within the basin. The USFWS conducted additional telemetry studies from 2014-2017.

Resident bull trout reside in smaller headwater tributaries, while fluvial bull trout frequently travel long distances; utilizing the mainstem rivers and larger tributaries to forage and overwinter. During the fall, migratory forms of bull trout journey from spawning and rearing habitats in the upper watershed to foraging and overwintering habitats located lower in the river system. Beginning in spring and early summer, they begin the return journey back to spawning and foraging areas high in the watershed. In response to changing habitat and reproductive needs, migratory bull trout in the White River travel up to 75 miles or more between the lower river and headwaters located in or near Mt. Rainier N.P. To accomplish this, bull trout require unobstructed migration corridors and connectivity of streams and rivers in order to provide them with access to spawning, rearing, foraging, and overwintering habitats.

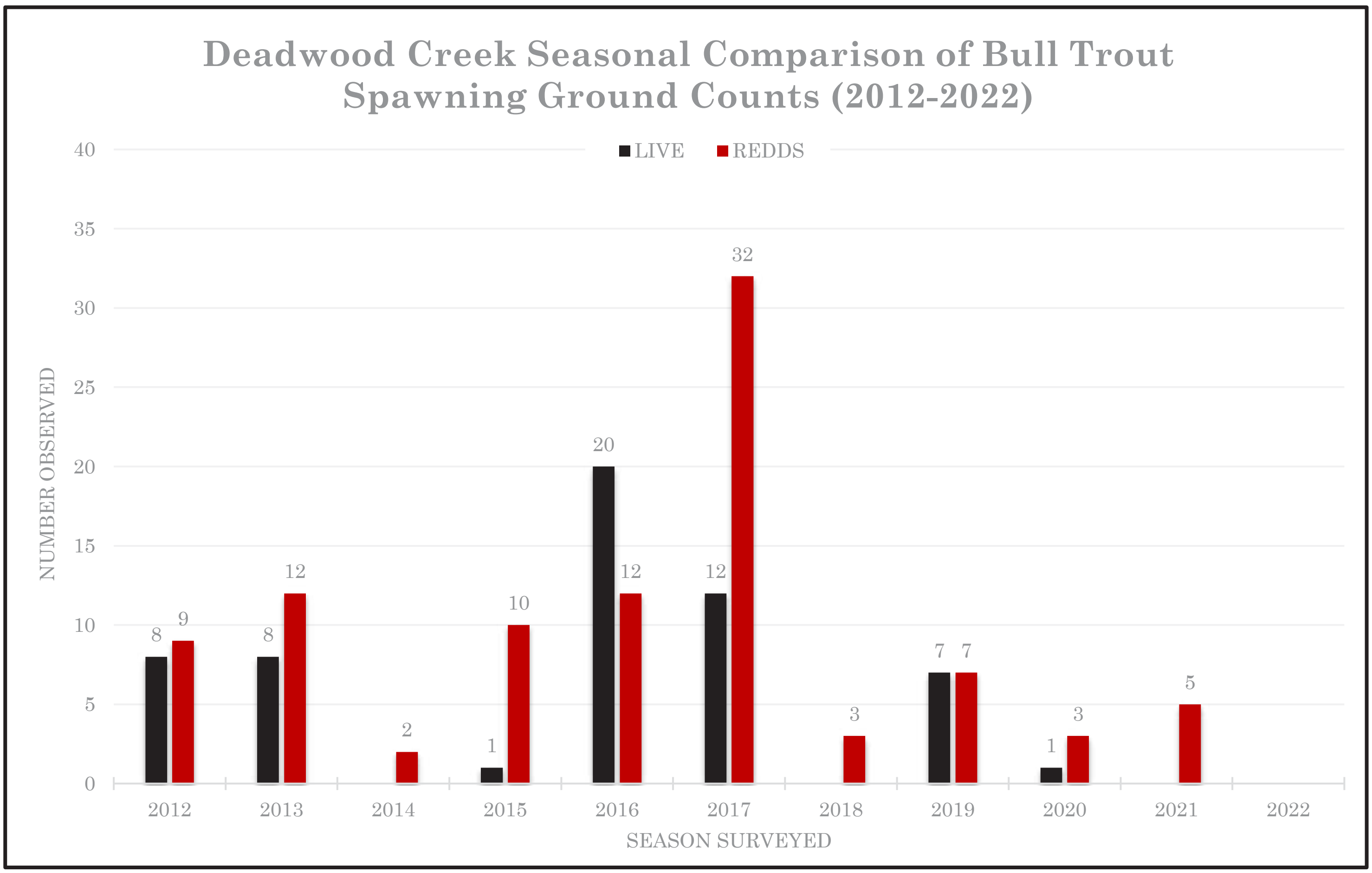
Spawning frequently occurs from early September-to-mid October, with peak spawning typically occurring around the third-to-fourth week of September *(see Appendix B for survey data)*.. Bull trout are iteroparous *(have the ability to spawn more than once)*; therefore, recovering pre-or-post spawn mortalities for examination is extremely rare. Spawners in the upper White River tributaries are observed utilizing various sized substrate from small gravels to small cobble. Redds are often constructed in the tail-out of pools and along channel margins. Embryonic development is slow *(depending on water temperatures)*; it may take between 165-235 days for eggs to hatch and for alevin to absorb their yolk (Pratt 1992). Bull trout fry emerge in late winter and early spring and young fry can be observed by mid-March foraging.

Bull trout habitat throughout the Puyallup and White rivers has been severely impacted by over a century of land and water resource exploitation; including, damming and substantial water diversions, considerable riparian alterations *(deforestation)*, dewatering and low instream flow regimes, as well as significant channel manipulation. These impacts have lead to a marked deterioration in land and hydrological behavior within these river systems by causing water flow of poorer quality, quantity and timing. Several limiting factors are involved with regards to the healthy function of stream habitat and bull trout populations in the watershed; including lost or diminished habitat connectivity and migration corridors *(human-made fish passage barriers)*, fragmentation and reduction of habitat quality *(entrainment, transportation networks, forest management practices and operations, direct water withdrawal)*. In addition, water quality, fish entrainment and entrapment, unknown species interactions, and potential climate change impacts *(changes in flow regimes, scour effects, thermal variations, and changes in water chemistry)*.

Bull trout are primarily piscivorous [pi-siv-er-uh s] *(fish eaters)*; however, they are opportunistic feeders, feeding on a variety of prey items depending on their particular life history strategy and stage of development. Adults feed almost exclusively on other fish, including a range of salmon and trout species; as well as other resident fish species. Juveniles feed on aquatic invertebrates, including stoneflies *(Plecoptera)*, caddisflies *(Trichoptera)*, and mayflies *(Ephemeroptera)*. Bull trout require a healthy aquatic environment in order to survive and flourish. They need an environment that provides the necessary prey base; in addition to the rearing and reproductive habitat essential to ensure their continued survival and reproductive success.



See Appendix B for spawning data, and Appendix C for redd locations. 2022 surveys conducted by PTF & National Park Service (MORA).



DEER CREEK

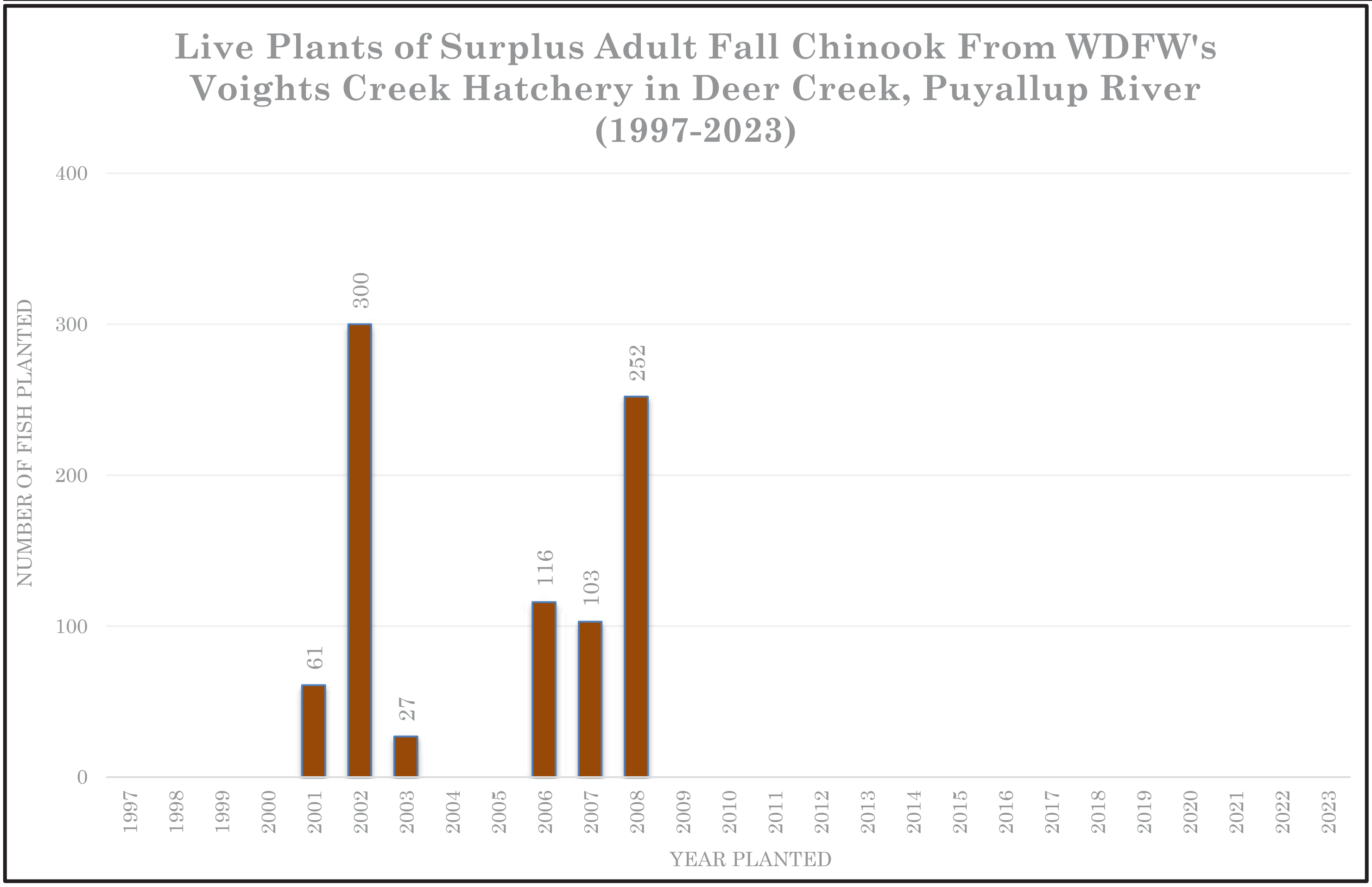
WRIA 10.0685

Deer Creek is a left bank headwater tributary to the Puyallup River; entering the upper Puyallup at mile 45.7, approximately 0.6 miles below Swift Creek. This high mountain stream flows northwest through a steep narrow glacial valley along the lower western slope of Mt. Rainier. Nearly the entire 6.5 miles of the Deer Creek drainage flows within the Mt. Baker-Snoqualmie National Forest and is non-glacial in origin. Instead, its sources originate from snowpack accumulations; as well as other surface and groundwater sources from the surrounding valley. Additional surface water sources are derived from three tributaries including Big Creek, and two unnamed tributaries. Unfortunately, these tributaries do not add any beneficial spawning or rearing habitat given their locations are well above natural anadromous barriers.

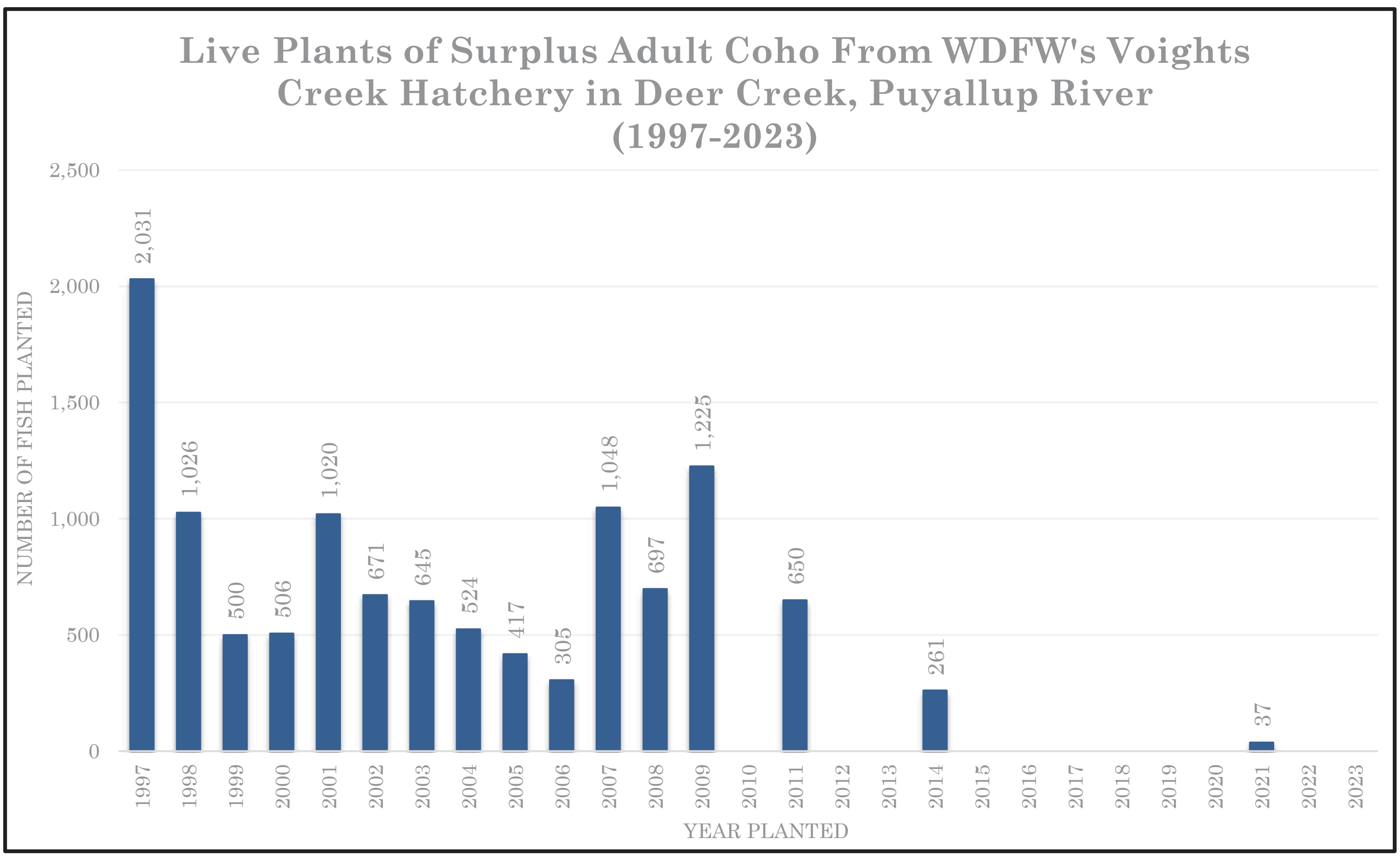
Past forestry operations along the creek, primarily timber harvesting and road construction, have had negative impacted on portions of the stream. Currently, a beneficial riparian buffer zone of conifers and mixed deciduous trees exists along the majority of the creek. The creek channel is confined by moderate to steep valley walls, with an impassable falls located at approximately RM 2.7. Spawning is significantly reduced upstream of RM 1.2 due to the substantial increase in gradient, flow velocities, and the lack of suitable spawning substrate. The gradient along the lower 1.2 miles is moderate with numerous deep pools. The substrate throughout a great deal of this spawning reach consists of small boulders, cobble, and flat/angular stones; however, several pockets of good spawning medium are often located along the stream margins and pool tail-outs.

Unfortunately, anadromous salmon were unable to access Deer Creek for nearly a century due to the streams location upstream of the Electron diversion dam on the Puyallup River. With the completion of the Electron fish ladder *(@ RM 41.7)* in the fall of 2000, anadromous fish passage was restored for the first time since 1904. Restoring anadromous access to the upper Puyallup River has made approximately 26+ miles of spawning, rearing, and foraging habitat above the diversion available for several species including Chinook, coho, pink, steelhead, and bull trout.

Deer Creek has been part of the surplus adult Chinook and coho planting program for over 20 years. Deer Creek is one of the few streams in late summer and early fall with adequate water flow to plant adult Chinook. Surplus adult Chinook from the WDFW hatchery located on Voights Creek are planted during late summer-to-early fall, and coho in late fall when available. The Puyallup Tribe has been hauling surplus adults from Voights Creek and planting them in the upper Puyallup Watershed since1997; unfortunately, no natural returns of Chinook or coho have been documented in Deer Creek as a result of these efforts. However, natural returns of adult coho have occurred in Rushingwater, Cow Skull, Niesson, and Kellog creeks. Deer Creek is not surveyed regularly; rather, it is spot checked to see how successful the adult plants were. The creek does host a resident population of cutthroat. Bull trout are well documented in the Mowich River and upper Puyallup; however, the degree of bull trout utilization in Deer creek is unknown, but presumed. Steelhead utilization is also unknown; however, steelhead spawning is well documented within the Puyallup River reach where Deer Creek is located.



Surplus Fall Chinook adults provided by WDFW Voights Creek Hatchery when available. No data indicates no fish were planted.



Surplus coho adults provided by WDFW Voights Creek Hatchery when available. No data indicates no fish were planted.

DIRU CREEK
SALMON HATCHERY

Puyallup Tribe of Indians (PTOI)
Salmon Hatchery Facility

Diru Creek Hatchery is located on Diru Creek *(Rainbow Springs*), a tributary to Clarks Creek in the city of Puyallup. Water for the hatchery is supplied from two pumped wells (*800 gpm*); as well as gravity flow from Diru Creek (*200-500 gpm*). Incubation consists of 20 vertical stacks of 12 trays. Initial rearing uses 16 shallow troughs in the hatchery building. Additional rearing containers include four (4) 50'x5'x5' raceways, eight (8) 66'x5'x3' raceways, and one 13,000 cubic foot pond that is used for holding returning adults, as well as juveniles.

In addition, the Puyallup Tribe operates several acclimation ponds in the Puyallup Watershed. Two of the acclimation ponds *(Cowskull & Rushingwater)* are used for enhancing Spring/Fall Chinook and coho into the Upper Puyallup River reach located upstream of the Electron Dam. Electron Dam has been an anadromous barrier for 96 years. A fish ladder was constructed, and completed in fall of 2000. The other acclimation ponds are located in the Upper White River drainage. These ponds are used for enhancing White River Spring Chinook back into their endemic range. All ponds have approximately 25,000 cubic feet of rearing space and between 1 to 3 cubic feet per second flow. A 35,000 cu. ft. acclimation pond was completed in the summer of 2007 near George Creek. Capable of holding over 500,000 Spring Chinook, the construction of the acclimation pond was funded by the City of Tacoma as a result of a mitigation settlement.

The Puyallup Tribe's restoration goal is to rebuild depressed Chinook and steelhead stocks and remove them from ESA listing. Using acclimation ponds, limiting harvest, and making substantial gains in habitat restoration, the Tribe will be able to accomplish this task. Levee setbacks, oxbow reconnections both inter tidal and upland, Commencement Bay cleanup, and harvest cutbacks have already been initiated. Only the ongoing enhancement efforts of increasing Chinook populations in habitat areas lacking, or devoid of fish, remains the largest challenge. Acclimation ponds are a proven method in increasing fish numbers on the spawning grounds. Hatchery rearing 200,000 Fall Chinook for release on station and 200,000 for acclimation ponds in the upper Puyallup River for a combined 6,857 pounds of fish. Historically, Fall Chinook have been reared since 1980 with a variety of stocks, goals, and objectives.

Spring Chinook Hatchery Production

The Puyallup Tribe operates several acclimation ponds in the Puyallup/White River Watershed designed to reestablish and enhance Spring/Fall Chinook and coho stocks. Each of two acclimation ponds on the Puyallup would receive as many as 100K+ hatchery origin Spring or Fall Chinook and/or coho. Four additional acclimation ponds located in the Upper White River drainage *(See Appendix D for current acclimation pond sites.)* would be planted collectively with up to 900K+ White River Spring Chinook. The Jensen Creek in the Clearwater River drainage was completed in the fall of 2012.

Fall Coho Hatchery Production

Up to 100,000 coho yearlings are acclimated *(imprinted)* and released in the Upper Puyallup Watershed *(acclimation ponds)*. Coho originate from Voights Creek Hatchery where 100,000 are adipose clipped and coded wire tagged. Fish are released at 20 fish per pound, for a total biomass of approximately 5,000 pounds.

Winter Chum Hatchery Production

The Puyallup Tribe currently raises 1.5 to 2.3 million chum smolts for release into the lower Puyallup River. This program significantly augments a Tribal river fishery and All Citizen purse seine fishery in East and West Pass in Puget Sound. This stock originated initially from Chambers Creek. Puyallup Tribal Fisheries releases 1,000 to 3,000 pounds annually based on available brood- stock returns to Diru Creek Hatchery. The program was started in 1991 and has become self-sustaining.

Fall Chinook Hatchery Production

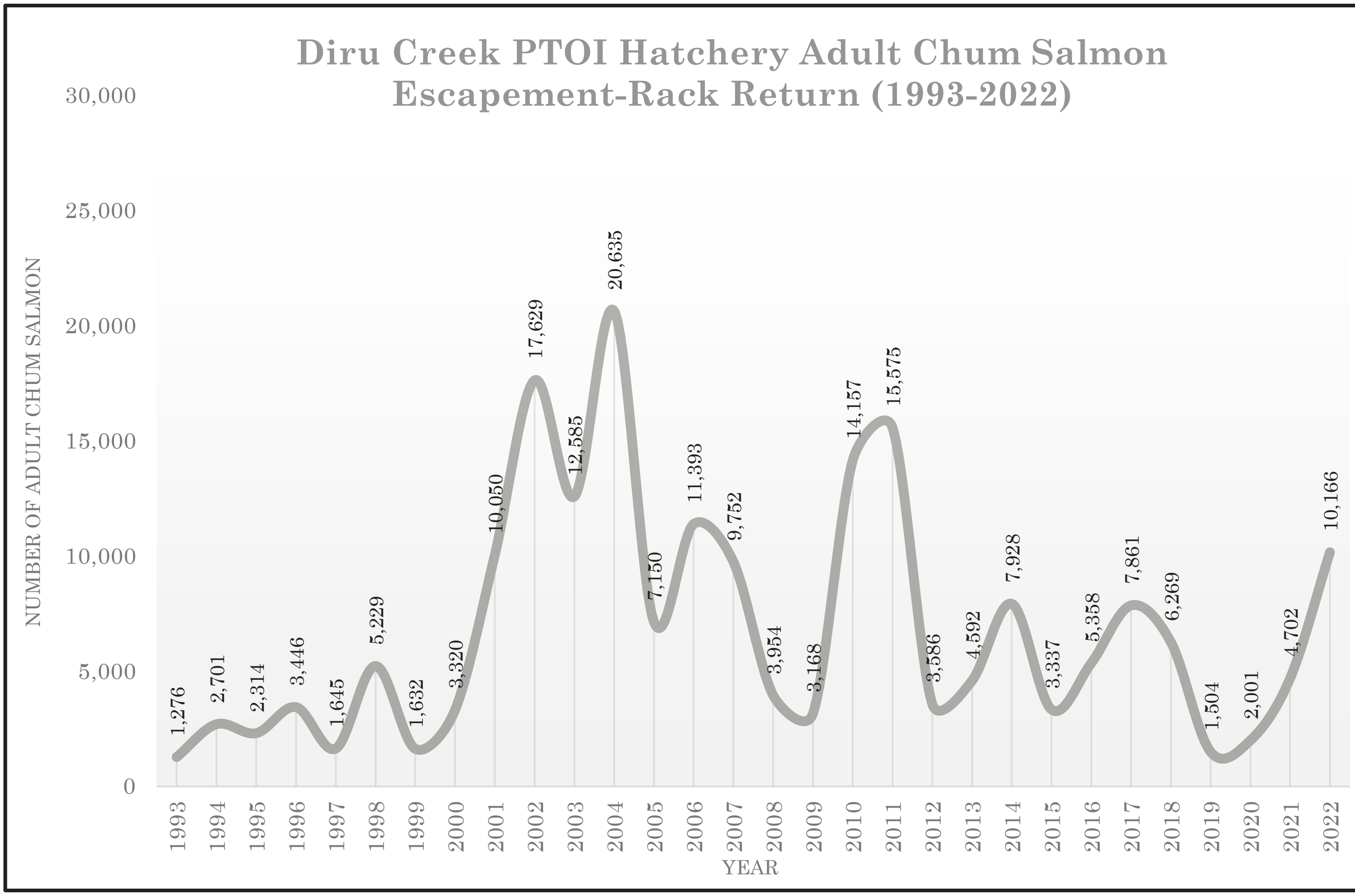
In 2004, the Puyallup Tribal Fisheries Department began acclimating and releasing Fall Chinook from its Clarks Creek facility, thereby discontinuing all Chinook releases from the Diru Creek Hatchery. In early 2005, construction of a new incubation building was completed at Clarks Creek. The incubation building houses 32 incubator stack; each stack is capable of holding up to 77,000 Chinook eggs. This provides for a total capacity of approximately 2.5 million eggs. Once fish are ready to be moved from the incubators, they can be place in one of the 16 aluminum raceway-troughs and hand feeding can begin. The troughs are 16 feet in length with a flow rate of up to 25 gpm. When the fish are approximately 500 to the pound, they are transferred to one of two cement lined rearing ponds. Holding the Chinook in the cement pond is only temporary until they are up to a large enough size, usually in late April, to be massed marked via an automated tagger. Once tagged, the fish are planted in one of the two natural acclimation ponds until they are released in late May or early June.

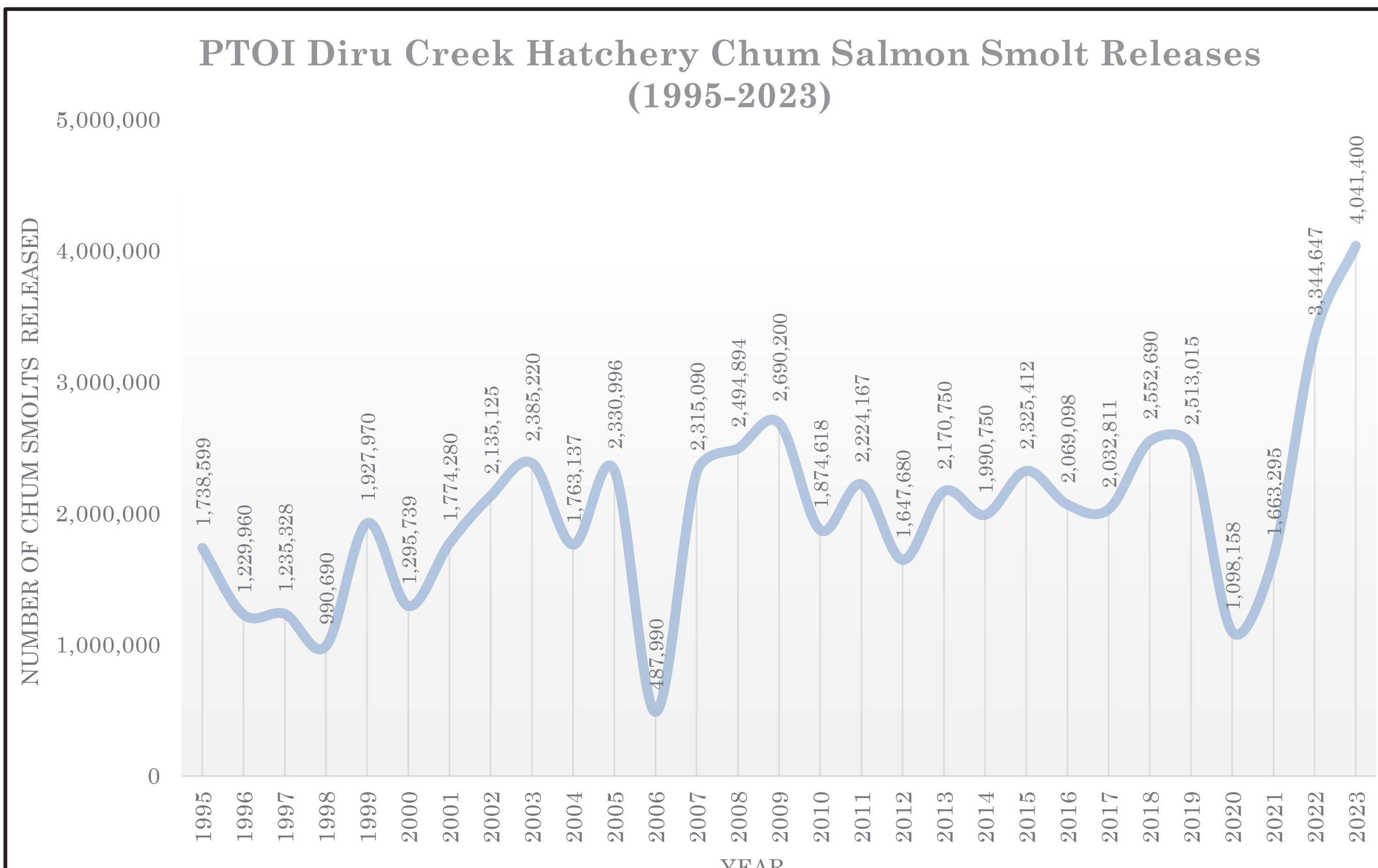

Spawning chum

White River Winter Steelhead Production

This program was discontinued in 2022 due to insufficient brood-stock availability.

In 2006, the Puyallup Tribe, in partnership with WDFW and the Muckleshoot Tribe, began artificially propagating White River winter steelhead. Rearing young steelhead is an integral part of the White River winter steelhead pilot project, a program designed to increase winter steelhead escapement in the White River. Beginning in 2009, the Puyallup Tribe assumed the majority of responsibility for continuing this important restoration effort. Steelhead brood-stock *(approximately 10 males and 10 females)* are collected from the White River USACE fish trap in Buckley and are held, spawned *(right)*, incubated, and reared at the Puyallup Tribe's Diru Creek hatchery for a year. Each fish is implanted with a coded wire tag for later identification. After rearing for a year and fish are of size *(approximately 17 fish per pound)*, the pre-smolts are transported to the White River to acclimate before being released into the White River *(see data in Buckley and White River sections of this report)*. The project goal is to release between 35,000-40,000 steelhead pre-smolts annually.


Diru Creek PTOI Hatchery Adult Chum Salmon Escapement-Rack Return (1993-2022)
NUMBER OF ADULT CHUM SALMON
0
5,000
10,000
15,000
20,000
25,000
30,000
YEAR
1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022
1,276
2,701
2,314
3,446
1,645
5,229
1,632
3,320
10,050
17,629
12,585
20,635
7,150
11,393
9,752
3,954
3,168
14,157
15,575
3,586
4,592
7,928
3,337
5,358
7,861
6,269
1,504
2,001
4,702
10,166


PTOI Diru Creek Hatchery Chum Salmon Smolt Releases (1995-2023)
NUMBER OF CHUM SMOLTS RELEASED
0
1,000,000
2,000,000
3,000,000
4,000,000
5,000,000
YEAR
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023
1,738,599
1,229,960
1,235,328
990,690
1,927,970
1,295,739
1,774,280
2,135,125
2,385,220
1,763,137
2,330,996
487,990
2,315,090
2,494,894
2,690,200
1,874,618
2,224,167
1,647,680
2,170,750
1,990,750
2,325,412
2,069,098
2,032,811
2,552,690
2,513,015
1,098,158
1,663,295
3,344,647
4,041,400

Winter Steelhead Adult Returns Sampled at USACE Fish Trap and Pre-Smolts Released, White River (2011-2023)

YEAR SAMPLED/ RELEASED	ADULTS N=	ADULTS WILD(NOR)	*FISH TAKEN FOR BROOD-STOCK PROGRAM	ADULTS WITH ‡BWT (PROGAM FISH)	PRE-SMOLTS RELEASED (BROOD YEAR) [RELEASE SITE]
2023	117	88		29	Program discontinued in 2022 due to insufficient brood-stock availability.
2022	205	170	0	35	21,950 (2021) [Jensen Cr. Acclimation Pond]
2021	150	122	12	16	28,823 (2020) [Direct plant into Twentyeight mile Cr. & Clearwater River]
2020	394	293	24	77	30,200 (2019) [Jensen Cr. Acclimation Pond]
2019	547	447	24	76	34,550 (2018) [Jensen Cr. Acclimation Pond]
2018	795	582	24	189	30,000 (2017) [Jensen Cr. Acclimation Pond]
2017	385	288	26	71	27,625 (2016) [Twentyeight Mile Cr. Acclimation Pond]
†2016	533	476	23	34	29,920 (2015) [Jensen Cr. Acclimation Pond]
†2015	319	273	26	20	31,219 (2014) [Jensen Cr. Acclimation Pond]
2014	479	392	23	64	49,998 (2013) [Huckleberry Cr. Acclimation Pond]
2013	574	338	28	208	27,990 (2012) [Muckleshoot WR Hatchery]
2012	578	345	24	209	31,129 (2011) [Muckleshoot WR Hatchery]
2011	539	164	22	353	27,876 (2010) [Muckleshoot WR Hatchery]

Adult steelhead sampling conducted by Puyallup Tribal Fisheries. See Appendix F for additional steelhead sampling results. See Appendix D for current acclimation pond sites.

*During the spring of 2006, in response to the declining number of winter steelhead, the Puyallup and Muckleshoot Tribes; as well as the Washington Department of Fish and Wildlife, began a steelhead supplementation pilot project developed for the White River. Since 2014, the Puyallup Tribe has assumed the sole responsibility for the continuance of this vital fish enhancement program. The primary goal of this project is to restore the run to a strong self-sustaining population. The project is currently funded and managed by the Puyallup Tribe and utilizes captured wild brood-stock from the USACE trap in Buckley to generate approximately 25K-35K+ yearling smolts. Program discontinued in 2022 due to insufficient brood-stock availability.

†An undetermined number of adult steelhead ascended above the Buckley diversion dam due to missing panels.

‡ Blank Wire Tag (BWT): Same as a Coded Wire Tag (CWT) implant minus the binary code.

DISCOVERY CREEK

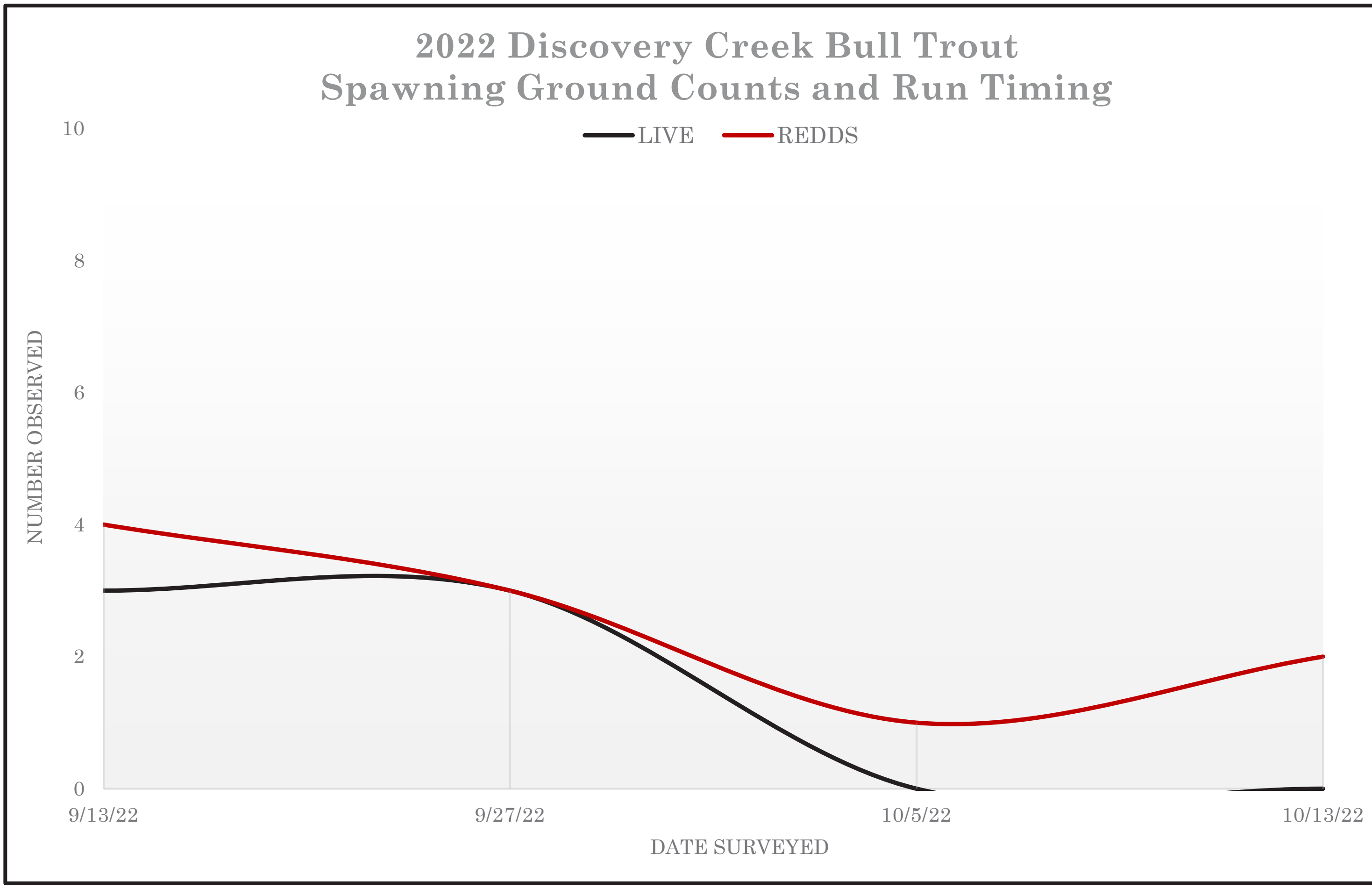
Discovery Creek is not officially named, nor is it identified on most topological or hydrological maps; however, for easy identification the creek is referred to as "Discovery Creek" by PTF staff. Discovery Creek is a small right bank tributary to the upper White River; this small creek was discovered in 2007 while conducting telemetry and spawning ground surveys for bull trout, hence the name. Due to the vastness of the park and the significant number of streams supporting bull trout spawning, the Puyallup Tribal Fisheries staff and National Park Service collaborate on conducting bull trout surveys within the Park. Discovery Creek originates from a spring at the base of a small ridge running parallel to the White River access road. Discovery Creek enters the White River just upstream of Shaw Creek at approximately RM 69.5, and provides 0.5+ miles of exceptional habitat conditions for bull trout rearing and spawning.

The creek is low gradient and flows within the channel migration zone *(CMZ)* and floodplain of the White River. The habitat within this section offers suitable spawning conditions for bull trout. However, a 2-3 foot jump in the creek channel Conversely, higher flows would undoubtedly provide access to the upper reach above this small bench. The remaining 0.5 miles of the creek meanders through the edge of the forested area along the White River floodplain. The creek channel gradient increases slightly, as well as the stream complexity due to some small debris jams and LWD input. The surrounding riparian consists of primarily mature conifers with a limited number of mixed deciduous trees. Near RM 0.5 the creek turns sharply into the base of a small valley ridge.

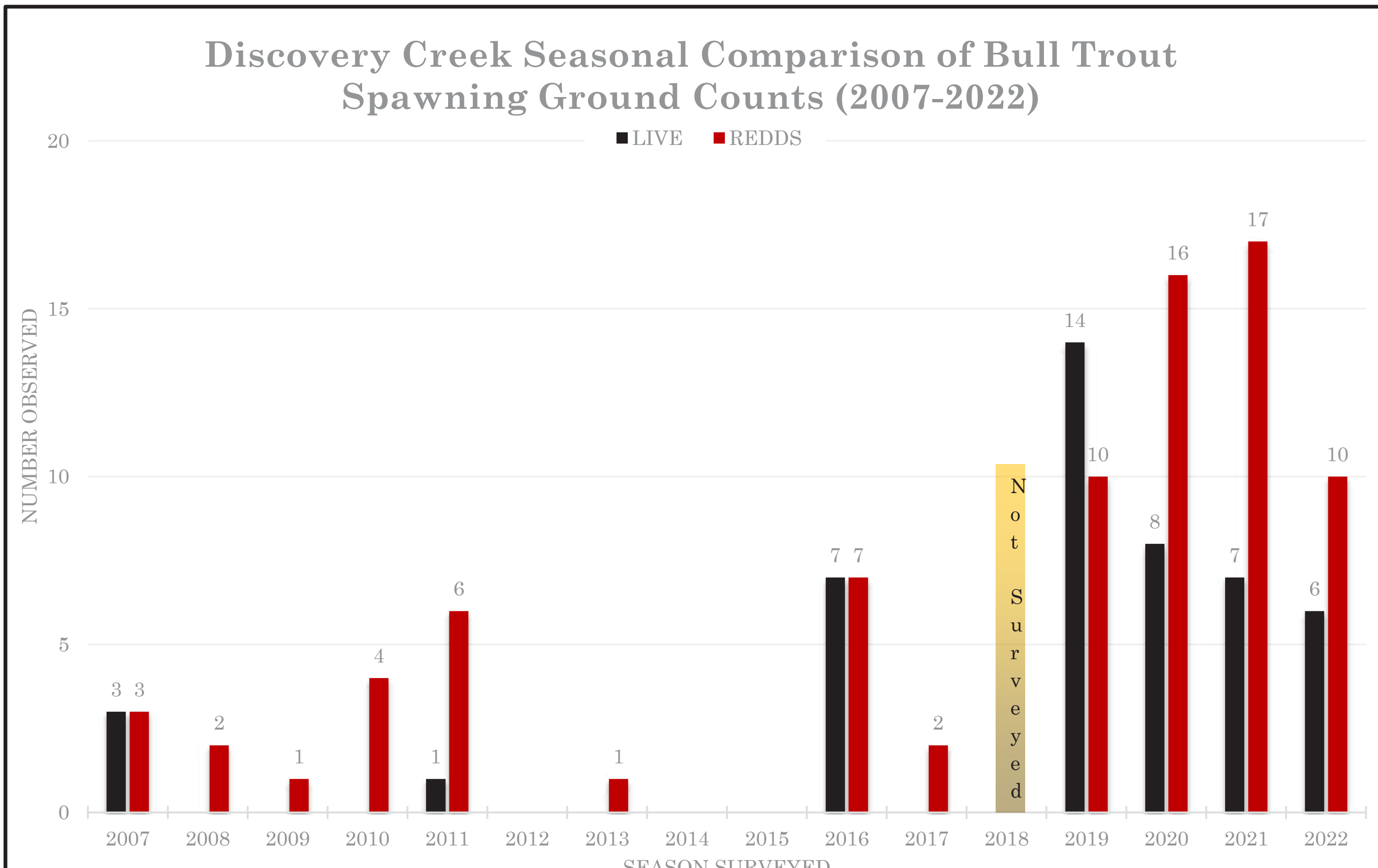
From 2005-2007, PTF biologists conducted extensive bull trout migration telemetry studies and redd surveys along the upper White River and West Fork White River, focusing heavily on the headwaters located within Mt. Rainier National Park. The study results determined that the cold high mountain streams located within the National Park, including Discovery, provide the majority of the critical bull trout spawning habitat in the basin. In addition, bull trout spawning was less frequent in this tributary compared to that observed in several significant headwater tributaries.

Spawning activity was first observed during the 2007 season. During 2007, two of the bull trout observed spawning were part of the PTF migration telemetry study. Both bull trout were surgically implanted with LOTEK® Wireless Inc.'s Nano Tag Series transmitters *(NTC-4-2L)* and released near the Greenwater River (*RM 45*) in late June. The USFWS conducted additional telemetry studies from 2014-2017.


Bull Trout



See Appendix B for spawning data, and Appendix C for bull trout redd locations. 2022 surveys conducted by National Park Service (MORA).



ELECTRON HYDRO LLC

PUYALLUP RIVER WATER DIVERSION & HYDROPOWER PROJECT

Electron Hydro operates a hydropower project *(formally owned/operated by Puget Sound Energy1904-2014)* utilizing water diverted from the Puyallup River at RM 41.7. Approximately 26 miles of stream habitat located in the Upper Puyallup Basin *(upstream of RM 41.7)* was void of anadromous fish from1904-2000 due to the construction of the Electron Diversion Dam in 1903-1904. The mid-to-upper Puyallup River has been severely and adversely affected by over a century of water resource exploitation by the Electron Project. These harms have included the Dam's blockage of all access to habitat and fish populations upstream of the dam for 96 years, the Project's diversion of flow out of the Puyallup River, and harm to fish drawn and entrained into the Project's flume, forebay, and drawn into the penstocks.

There is no new fish data to report. Electron has not drawn water into the project or generated since late July, 2020. As of the publishing of this report, the Electron project continues to be under a court ordered injunction preventing the operation from opening its intake to draw in water and entrain ESA listed Chinook, steelhead and bull trout until it has obtained an approved Habitat Conservation Plan (HCP) and accompanying Incidental Take Permit.

In addition to the extensive work tribal fisheries biologists have done in searching, recovering, and documenting the unpermitted, and permitted construction/fill materials utilized by Electron Hydro, and impermissibly discharged into the river and downstream during Electron's late July 2020 construction of a flow bypass channel located at the fish ladder/headworks ("project") site *(See appendix I for Partial Summary Judgment in this case)*. In addition, as of December 2023, the Puyallup Tribe and Earthjustice are involved in litigation over an ESA suit filed against Electron.

The following information describing the ongoing harm to salmon, steelhead and bull trout (as well as other species) caused by Electron's actions was taken from the Expert Report of Eric Marks submitted in the case of *Puyallup Tribe of Indians v. Electron Hydro, LLC et al., No. 2:20-cv-1864 (W.D. Wash).*

SUMMARY OF OPINIONS

This report represents my professional opinions in the matter of Puyallup Tribe of Indians v. Electron Hydro, LLC concerning harm to fish from the Project, its operation, and alterations to the Project by the defendants in this case. In general, the Project has repeatedly in the past harmed Chinook salmon, steelhead, and bull trout, all listed under the Endangered Species Act ("ESA"). Operations of the dam have greatly and negatively affected the physical characteristics of the river and have negatively affected the healthy function of river habitat and harmed individual fish and fish populations since its inception. Alterations to the dam including the installation of a Rock Dam in the fall of 2020 with an anchored Sheet Pile wall in the river channel, as well as subsequent alterations and regular maintenance, continues to harm and in many ways increases harms to listed species multiple ways, including by threatening the successful migration and survival of ESA listed Chinook, steelhead and bull trout by blocking, impeding, and/or delaying their migration, injuring or killing migrating adults and out-migrating juveniles, and by trapping migrating adults and juveniles throughout every year of the Project's existence.

(1) The installation of the Rock Dam and Sheet Pile, as well as subsequent alterations, has created harmful conditions for upstream and downstream migrating fish by 1) creating a problematic migration pathway, and competing or *false attraction* of fishes which can result in the misdirection, delay, or prevention of fish from *effec-*

tively finding the fish ladder entrance; 2) misdirecting, delaying, exhausting, injuring, and killing adult spawners resulting in unsuccessful reproduction and decreased future fish production, as well as population recovery and sustainability; 3) subjecting fish drawn-up into or entrained along the Rock Dam and coarse downstream channel to potential direct mortality, bruising, descaling, injury to organs, impingement, loss of equilibrium and disorientation, increased rate of predation, and reduced fitness rate leading to delayed/latent mortality; and 4) trapping fish in the voids within the large rocks.

(2) Alterations to the Project by Electron in 2021 perpetuated the passage and injury issues for fish by 1) installing additional large rock to the downstream face of the Rock Dam; 2) intensifying the hydraulic influences/energy of water plunging off the wood spillway which only acted to confuse and disorient fish, thereby rendering the fish ladder inaccessible or undetectable by fish; 3) not resolving adverse impacts from the Rock Dam; 4) leaving a significant section of the Sheet Pile exposed and unprotected, thereby subjecting fish to ongoing harm; 5) not adequately addressing false attractions flows from the Rock Dam channel; and 6) and not addressing fish passage *effectiveness*.

(3) The proposed bladder dam as designed will continue to falsely attract adult migrants away from safe fish passage as well as physically harm fish plummeting from the dam crest to the concrete scour pad below.

<u>INFORMATION RELIED UPON FOR THIS REPORT</u>

In preparing this Report, I have relied extensively on my fisheries education and experience as a fisheries biologist, my experience with harmful fish conditions and the instinctive behavior of fish that are analogous to those that exist at the Electron Dam site, my involvement in this case including years of site visits, and my tens of thousands of hours in the field monitoring and studying the Puyallup River and its fish populations. I have also reviewed images and videos of the site and relevant literature.

My experience includes involvement with situations in the Puyallup and White River watersheds (the White River is a tributary of the Puyallup) that I have personally observed that are analogous to conditions at Electron Dam and which I describe in detail below. Over the past twenty-two years of my work for the Puyallup Tribe on the Puyallup and White Rivers, I have witnessed several examples of conditions injurious to salmonids that have resulted in significant harm to fish as a result of their encounters with anthropogenic structures. The causes and damaging effects of these types of encounters were, and are, predictable and preventable and are readily related to the conditions at Electron Dam.

a. Electron has created conditions comparable to the harms to fish I witnessed for many years at the diversion dam (hydro) on the White River. A fish ladder leading to a fish trap (trap & haul) is located on the left bank just downstream of the dam, yet fish were constantly drawn to false attraction flows over and through the wood/timber diversion dam structure, and away from the comparatively low-volume discharge from the fish ladder. This resulted in significant delays, injuries, and mortalities in the following ways:
   (1) Fish exhausted themselves by continuously attempting to swim up the wood/timber apron and past the vertical flashboard dam face.
   (2) Fish became stranded on, and in, the lower apron of the dam and subsequently died as a result of dewatering and predation.
   (3) Fish were unable to successfully locate the fish ladder/trap entrance; resulting in delays and non-passage.
   (4) Fish swimming and jumping injured themselves on pointed wood shards along the toe of the wood/timber apron, as well as exposed metal spikes used to tie down the wood timbers.

b. Tacoma Public Utilities' (TPU) former pipeline 1 crossing (a Grade Control Structure used to protect the pipeline from streambed

bed erosion) on the White River is another excellent example of the deleterious effects on upstream and downstream migrating fish when confronted by a substantial non-fish friendly obstruction. TPU's channel spanning concrete pipeline crossing, with an integrated fish ladder, was constructed in the 1920's to protect a shallow draft water pipeline (circa 1912). However, the markedly deteriorated concrete and exposed rebar structure had long been responsible, and well known, for injuring and killing fish, as well as for delaying and preventing upstream migration. The structure was responsible for numerous adult and juvenile fish strandings and mortalities along the downstream face and toe of the structure as result of manipulated river flows from hydro power (water withdrawal) and Mud Mountain Dam (flood control) operations, as well as natural drops in river flows. In response to the harmful effects of the pipeline crossing, in August of 2003, TPU removed its 99-year-old structure, thus eliminating the ongoing harm to fish and restoring unobstructed fish passage.

c. The large rocks and Sheet Pile wall has created harmful conditions analogous to that of the now defunct U.S. Army Corps of Engineers ("USACE") Buckley fish trap on the White River (fish ladder and trap integrated into the White River Diversion Dam). Fish captured in the old Buckley trap would regularly jump into the direction of the flow discharged through a metal grated opening located within a thick concrete wall. As a result, fish frequently struck the concrete wall and/or grate as well as landing and striking the wood brailer (floor). The results of such impacts were a common cause of head (head burn/scalping), snout, and jaw injuries. In the same instinctive manner, fish trying to navigate through and over the Rock Dam will attempt to jump obstructions they can't swim through, and by doing so, are likely to strike large rocks or Sheet Pile, likely resulting in injury or worse.

d. I have observed that even the simple construction of recreational rock dams within waterways is harmful for fish. Even relatively small recreational dams create upstream and downstream fish passage and migratory delays, and can strand and trap fish. Recreational Rock Dams are smaller dams constructed across streams from locally sourced rock for the purpose of backing-up water to create a pool to cool off or swim in, keep beverages cold, or simply as a way to pass the time. Unfortunately, these structures are often left for the next group to build upon until they are completely unpassable by fish, both upstream and downstream. It is also quite common for multiple recreational Rock Dams to be constructed in succession along a single stream channel, thereby creating multiple barriers for fish. The cause and effects are again predictable and preventable. Due to the proliferation and size of many recreational Rock Dams, the simplest solution is to "notch" a section of the dam by removing enough of the rock to create a dominant attraction flow and provide a safe navigable pathway for fish. I have notched or removed countless recreational dams during my career to allow fish passage and prevent harm.

<u>Background regarding Puyallup River and listed salmonids</u>

The Puyallup River (and a few of its major river tributaries) arises from glaciers on Mt. Rainier flowing to Puget Sound. The Puyallup River enters Puget Sound at Commencement Bay (City of Tacoma). There are a number of tributaries to the Puyallup River both below and above the Electron Dam (the Dam). Some of those tributaries above the Dam are the Mowich River, Rushingwater Creek, Deer Creek, Meadow Creek, and numerous unnamed tributaries all of which provide excellent and much-needed habitat for salmonids. Because it is a Pacific Northwest glacial river, the Puyallup River often carries a heavy sediment load during the summer and early fall months. From 1909-2022, the mean monthly flow/discharges of the

Puyallup River near Electron (USGS Gage #12092000) ranged from 392-767 cfs. However, the natural flow of the River can vary significantly depending on the time of year and snow and precipitation levels. Those factors can also affect the sediment loads in the River and the movement and deposition of substrate materials (i.e. sand, gravel, and cobble) in the River. Fish species in the River have adapted behaviors and responses to take advantage of these natural stream conditions and they do best in those natural conditions.

The Puyallup River Watershed supports several species of native salmonids, including the following three (3) species which are listed under the ESA: Chinook (*Oncorhychus tshawytscha*), steelhead (*Oncorhychus mykiss*), and bull trout (*Salvelinus confluentus*). Both Puget Sound Chinook and Coastal-Puget Sound bull trout were listed in 1999 as threatened. In May of 2007, the National Marine Fisheries Service listed Puget Sound Steelhead as threatened. The Puyallup River has been designated as **critical habitat** for Chinook, steelhead, and bull trout. Habitat damage and destruction, blocked or reduced access to habitat, and entrainment are primary causes of declines of native salmonids leading to their threatened status under the ESA and they continue to be primary threats to the continued survival and recovery of native salmonids, including the three listed species in the Puyallup River.

Salmon, steelhead and bull trout require adequate stream flows (quantity) and timing of flows to support survival throughout all life history stages (i.e. upstream and downstream migrations), stream bed characteristics that support spawning, intact riparian shade and cool water, pools that provide cold water refugia during summer months, large wood/debris jams that provide protective and resting refugia, side channel habitat, and off-channel habitat for rearing, overwintering, and foraging. These species also require unobstructed connectivity of rivers, streams, and other water bodies in order to provide access to spawning, rearing, foraging, and overwintering habitats.

Water temperature is a critical health and survival factor throughout all life history stages of salmonids as it significantly regulates and influences their biological functions, development, and behavior. Salmonids are cold-blooded (ectothermic) animals and are intolerant of warm water. The US Environmental Protection Agency (EPA) and regional regulatory authorities have established recommended temperature criteria for salmonids in the Pacific Northwest/Region 10 (McCullough et al. 2001; EPA 2003). Salmonids subjected to, or exceeding higher thermal tolerances can experience several detrimental effects including: increased levels of stress; increased vulnerability to diseases, toxins, and parasites; greater risk of mortality; alteration/shift of emergence timing; as well as adverse effects on growth and reproduction. Cold-water temperatures are crucial for salmonid **gametogenesis** (egg development in females), gamete production (quantity), and instream development of larvae. Higher stream temperatures also create thermal barriers for migrating, rearing and foraging Chinook, steelhead, and bull trout.

Stream bed characteristics and water properties/qualities are important *habitat* factors in the survival and development of salmonids eggs and larvae. Spawning site/habitat selection for salmonids is critical to insure offspring survival. Some of the primary water properties influencing salmonid egg survival and development are temperature, dissolved oxygen, and velocity (McNeil 1966; Leman 1993; Peterson and Quinn 1996). Substrate size and density are primary factors involved in the permeability of bottom materials (Wicket 1958; McNeil and Ahnell 1964; McNeil 1966), which is also critically important to spawning and the survival of eggs and larval development (pre and post hatching).

Chinook Salmon (*O. tshawytscha*)

Chinook salmon are an anadromous species of fish meaning that they spawn and rear in freshwater habitats and estuaries and spend their adult life in saltwater habitats. These characteristics mean that migration is an important part of their life stages, both adult migration upstream to spawn as well as downstream migration for juveniles to saltwater habitat to forage and grow into reproductive adults. Blocked or delayed migration in either direction or life stage can have significant negative consequences. Delayed adult migration can result in exhaustion or death prior to spawning or may result in fish spawning in less-than-ideal conditions, or not spawning at all. Anadromous juvenile salmon will inevitably migrate downstream to marine waters ("smolts"). For young migrating salmon the process of "smoltification" is complex. Smolts will undergo behavioral, as well as tremendous internal and/or external physiological changes and metabolic transformations. This process is tremendously demanding and stressful for young fish and increases their susceptibility to harmful or injurious conditions occurring before they reach saltwater. Injury to fish during adult or juvenile migration can severely reduce an individual, a population, or a species' viability.

Two distinct stocks of Chinook are present in the Puyallup River system: the White River Spring Chinook ("springer" or "spring-run") and Puyallup River Fall Chinook ("fall" or "fall-run"). White River Spring Chinook are the only Spring Chinook stock existing in the Puget Sound region and are unique due to their genetic and life-history traits (WDFW et al. 1996). This unique stock of Chinook was classified as distinct in the 1992 Washington State Salmon and Steelhead Inventory (WDFW et al. 1993). The Puyallup River has been designated by NMFS as critical habitat for these two Chinook Evolutionarily Significant Units ("ESUs").

Spring Chinook typically enter the Puyallup River system prior to spawning in April, but on occasion have been documented as early as March. Springers hold in the river during spring and summer while their gonads mature. To reiterate, cold-water temperatures are crucial for winter Spring Chinook holding in the river prior to spawning as it is an essential factor in gametogenesis (i.e. egg development), gamete production, and instream development of larvae. Spawning commences as early as mid-August (typically September), with the earlier spawn timing generally occurring higher in the watershed.

Returning Puyallup River Fall Chinook typically enter the Puyallup River in June, and they continue to move through the system to spawning locations as late as November. Fall Chinook frequently spawn in the mainstem of the River, but more frequently spawn in tributaries with sufficient water flow and favorable conditions for their offspring to rear and are less prone to episodic disturbances. The majority of spawning activity occurs from September through late October, with the exception of some lower tributaries which may have fish present into early November. The age of adult Fall Chinook returning to spawn can range between two-to-five years of age.

The majority of post emergent Chinook fry (juvenile salmon life stage after emerging from the gravel substrate and are free swimming and actively feeding) spend only a few months (~4-7) residing instream before migrating to marine waters. The majority of juvenile Spring Chinook migrate to salt water as sub-yearlings (less than one year old) (Dunston 1955). Trapping data from a rotary screw trap in the lower Puyallup River showed that 99.5% (*n*=869) of wild out-migrant Chinook caught were sub-yearlings (Berger et al. 2015). Chinook smolt emigration in the Puyallup begins as early as January and runs well into the last week of August, with the peak of migration taking place at the end of May.

Steelhead (*O. mykiss*)

The stock of steelhead in the Puyallup are characterized as winter-run and are present throughout the watershed. The Puyallup River has been designated by NMFS as critical habitat for steelhead. Like all migratory salmonids, steelhead require unobstructed migration corridors and connectivity of rivers, streams, and other water bodies. Unlike other pacific salmonid species, steelhead can spawn more than once (iteroparous) during their life-cycle and are therefore susceptible to threats/dangers during multiple upstream and downstream spawning migrations. Winter steelhead will enter the Puyallup River prior to spawning as early as November-December and may be present in the mid-to-upper watershed shortly after. Most steelhead start migrating into the mid-to-upper reaches in March. Cold-water temperatures are crucial for winter steelhead holding in the river prior to spawning as it is an essential factor in **gametogenesis** (egg development prior to spawning).

Steelhead spawning generally occurs from early-March through mid-June, with peak spawning occurring from late-April to mid-May. Steelhead spawners frequently utilize the middle-to-upper mainstem Puyallup River. The middle reach of the Puyallup, or bypass reach, spans the 10.5 miles of the River from the Projects powerhouse (RM 31.2) to the Dam (RM 41.7) and is impacted by water withdrawals when the Project is operating. The upper-Puyallup is the 26+ miles of river and stream habitat located upstream of the Dam. Embryonic development and emergence of fry takes between 4–8 weeks depending on water temperature (warmer = faster / colder = slower). Juvenile steelhead require favorable rearing conditions including: connectivity of habitat essential for foraging and migrations, cold and oxygenated water, an ample food/prey base to support development (i.e. insects/larvae, zooplankton, and fish eggs), and habitat features that provide hiding/protection from predators (i.e. logs/woody debris, vegetation, and rocks). Juvenile steelhead may rear in fresh water for 1–4 years before smolting (physiological and metabolic transformations undergone while transitioning from fresh water to salt water) and migrating to marine waters. The majority of steelhead will migrate to marine waters after 2 years in freshwater. Some steelhead smolts may begin to migrate as early as late winter; however, the majority of smolts outmigrate during the spring with peak out-migration occurring during the month of May.

Bull Trout (*S. confluentus*)

Bull trout exhibit primarily residential and fluvial (migratory) life history traits. The Puyallup Watershed also supports an anadromous life history form of bull trout. Preliminary genetic analysis strongly indicates the population of bull trout in the Upper Puyallup (upstream of Project) is comprised of a single distinct spawning population. Consequently, due to the impacts of the Project, this population is most at risk of extirpation arising from a long history of isolation, blocking or delaying upstream migrations, entrainment of individuals, and low flows in the bypass/middle reach (RM 31.2-to-41.7) due to water withdrawals which have limited habitat availability and quality. In addition, known bull trout occupied habitats of the upper-Puyallup River have been designated by US Fish and Wildlife Service (USFWS) as **critical habitat** for bull trout. Bull trout are a cold-water species highly sensitive to changes in water quality (Selong et al. 2001, Dunham et al. 2003), as well as the fragmentation and loss of habitat (Rieman and McIntyre 1995). As with all the species addressed in this Report, it is critical that bull trout have unobstructed migration corridors and connectivity of rivers, streams, and other waterbodies (Rieman and McIntyre 1993) in order to provide access to cold water refugia (critical for all life stages), spawning, rearing, foraging, and overwintering habitats. This is especially true for the population in the upper-Puyallup (upstream of the Dam RM 41.7) because the *only* bull trout spawning habitat available is located several miles *upstream* of the Electron Dam. Very cold water is absolutely critical during the early larval development of bull trout and is only available in higher elevations streams. Also, bull trout are less tolerant of warmer temperature than other salmonid species (Selong et al. 2001). Bull trout are also iteroparous (spawn more than once), making them even more susceptible to harm from the Project, as migrants will have to pass—or attempt to pass—the Electron Dam many times in the course of a lifetime during both upstream and downstream migrations.

Bull trout are continuously moving up and down through the watershed. From spring through early summer, migrant bull trout commence their upstream journey to cooler spawning, rearing, and foraging refugium higher in the watershed. Cold-water temperatures are crucial for bull trout holding in the river prior to spawning as it is—once more—an essential factor in gametogenesis. Bull trout spawning throughout the watershed occurs primarily during the last three weeks in September, but spawning has been observed taking place from as early as the last week of August through the first two weeks of October (Marks et al. 2022). Downstream migration post-spawning occurs from approximately late August through early November.

Similar to adults, juvenile bull trout are consistently moving throughout the watershed and frequently overwinter in the lower and mid watershed habitats (mainstem & tributaries). Typically, during the months of May-to-late August, juveniles may migrate upstream to forage and seek colder refugia in the upper watershed, with peak migration occurring in June or July. Following their upstream migration, downstream movement to overwinter in lower-to-mid river habitats occurs approximately late August-to-early November. Fry movement downstream (forced or volitional) can occur from late winter (emergence), throughout spring and early summer.

Harms To Listed Species From Electron Hydro Project

A. Harms From the Electron Project Prior To 2020.

The mid-to-upper Puyallup River has been severely and adversely affected by over a century of water resource exploitation by the Electron Project. These harms have included the Dam's blockage of all access to habitat and fish populations upstream of the dam for 96 years, the Project's diversion of flow out of the Puyallup River, and harm to fish drawn and entrained into the Project's flume and forebay.

The Dam was originally constructed as a timber crib spillway dam at river mile 41.7. It completely spanned and blocked the river from bank to bank. The upper-Puyallup is the 26+ miles of river and tributary habitat located upstream of the Dam. Until late-2000, there was no fish passage at all around the Dam. Thus, for 96-years (1904–2000), the Electron Project's diversion dam completely blocked upstream migrating fish from accessing the 26+ miles of habitat located upstream of the diversion dam. Connectivity of aquatic habitats is vitally important to fish and other aquatic organisms. The loss and fragmentation of aquatic habitat by anthropogenic barriers is often associated with the loss of fish populations and extirpation of fish species (Nehlsen et al. 1991; Sheer and Steel 2006; Roscoe and Hinch 2010). The impacts of the Electron Project have resulted in an extensive history of completely isolating upstream fish populations and decreasing population size and available spawner abundance, lost or diminished habitat connectivity and migration corridors, fragmentation and reduction of habitat quality, diminished water quality, fish entrainment, and delays in migrations.

The middle reach, or bypass reach, spans the 10.5 miles of the River from the Project's powerhouse (RM 31.2) to the Dam (RM 41.7) and is impacted by water withdrawals when the Project is operating. This causes diminished flow and water quality, including increased temperatures that can occur from diminished flow, and trapping of sediment that can affect water quality.

The Dam is designed to divert water towards the project intake and from there into a flume (water conveyance) located along the left side of the river (looking downstream). The flume parallels the river to where the water is eventually delivered into the project forebay (water impoundment/storage) located 10.1 miles downstream of the dam and just over 800 feet in elevation above the powerhouse located at RM 31.2.

Throughout the operational history of the Electron Project, downstream migrating fish have been routinely drawn in with the diverted water at the intake and entrained. Entrained fish are carried down the 10.1-mile flume and eventually discharged into the forebay. As a result, tremendous fish losses including Chinook, steelhead and bull trout have occurred. In 1998, Puget Sound Energy ("PSE"), the former owners of the Project, built a fish collection facility (fish trap & haul) in the Project forebay in an attempt to address the continuous fish harm, however, it did little to reduce the impacts. The fish trap itself can be a turbulent and violent environment for fish, particularly for subyearling and smaller yearling aged fish, and even adult fish have died in the trap. It is expected that small fish, less than 50mm, suffer a disproportionally higher mortality while in the forebay and fish trap than would larger fish, for a number of reasons including:

(1) All fish entrained in the forebay are subject to predation by fish-eating birds such as mergansers, kingfishers, and eagles.
(2) Larger predatory fish including bull trout, cutthroat trout, and steelhead/rainbow trout, all of which have a high propensity to prey on smaller fish (piscivorous), also commonly re-

side in the forebay and are capable of entering and exiting the trap to forage on fish.

(3) The forebay does not include protection measures that fully prevent fry or small juveniles from migrating beyond the guide net and passing within close, or immediate proximity, to the penstocks intake. From there, they would be naturally attracted to or drawn by the intake flow of the penstocks, and subsequently killed by the high pressure within the penstock conduits and the powerhouse generators.

(4) Reproductive bull trout and steelhead are removed from the spawning population.

On July 29, 2020, I participated, along with Tara Livengood-Schott of Washington Department of Fish and Wildlife, in the fish salvage activities that were required when Electron Hydro, LLC, closed its intake to begin construction of their bladder dam. While such activities had once routinely been a yearly maintenance activity during PSE's tenure, Electron Hydro, LLC had only performed the activity once prior during August of 2015. Electron Hydro failed to incorporate any of the measures recommended by the Tribe's biologists for the proper recovery and handling of fish during the July 29, 2020 event. Ms. Livengood-Schott prepared a fish kill report outlining the failures and horrific conditions for fish encountered during the outage. Incorporated in the report were several photos I took of fish mortalities recovered during the event, which include seven (7) bull trout, one of which was a study fish that had been previously tagged on April 5, 2018 with a Passive Integrated Transponder tag.

Electron Hydro failed to incorporate any of the recommendations we at the Tribe provided, at their request, as to how to perform the outage and protect fish. While we counted at least 40 fish mortalities, most were ESA listed species; however, those numbers severely underreport the actual mortalities caused that day. Many of the fish that were put in transport tanks, and transported to the River, were injured beyond any ability to recover. We witnessed fish that, in my professional opinion, were dead before being transported to the River, would die before they even reached the River, or would die shortly after being released into the River. These fish were never recovered or documented. After the July 29, 2020 fish kill in the forebay, twenty-seven (27) dead fish I recovered and identified as steelhead/rainbow trout were transferred to the National Marine Fisheries Service (NMFS). NMFS had the DNA and otoliths (ear bones) from the fish analyzed, the results showed that twenty-three (23) of the fish were steelhead. In addition, at least two (2) Chinook smolt mortalities were recovered. If fish are ever entrained in the Project again, the predictable outcome will be more dead fish and the loss of future fish production.

Several elements in this report, including those discussed above, have led to the Electron Project being identified as a *significant threat* to salmon, steelhead, bull trout and other fish populations in the Puyallup River. This is consistent with the listing decisions by NMFS and USFWS which identify barriers like dams as a significant cause and/or contributor to listing of salmonids and bull trout under the ESA. Because of the precarious position of the listed fish species in the Puyallup River, it is essential to clarify that the *loss of any fish is damaging* towards achieving recovery of the species and the ultimate goal of naturally sustainable fish populations and habitat recovery in the middle and upper-Puyallup River, as well as towards the protection and advancement of the Puyallup Tribe's treaty protected fisheries rights.

After years of pressure from the Puyallup Tribe, and as part of a settlement agreement with the Tribe, the former owner of Electron, Puget Sound Energy, agreed to install a fish ladder at the Dam. The fish ladder construction was completed in late-2000. While the ladder allowed some fish passage, the ladder did not fully solve the problems for listed species with the Electron Dam. The primary reason for this was that the ladder was constructed on River right (looking downstream), contrary to the recommendations of the Tribe, which is on the opposite side of the River where there is the primary flow. Upstream migrating fish are instinctively impelled to orient and move against (into) the direction of flow. Placing the fish ladder on the opposite side of the River from where predominant flow is directed creates complications which can result in the misdirection, delay, or prevention of fish from effectively finding the fish ladder entrance. For downstream migrating juveniles that are primarily moving with the current, they are more likely to be swept over the Dam on the side of the River where the primary flow is located as opposed to the safe passage down the ladder. Migrants face additional difficulties moving with the flow as it can increase their travel rates downstream. Increases in travel rates may result in less time for fish to evaluate signals relating to upcoming conditions they may encounter and want to avoid such as the Rock Dam. Also, because of the heavy sediment load and the annual movement of rock in the Puyallup River, the fish ladder has required regular maintenance which includes use of heavy equipment (excavator), to keep the entrances open and the water flowing in the ladder. In the past, the Puyallup Tribe expended a tremendous amount of time and resources maintaining the fish ladder and access road until the road washed for the second time within an eight-year period in early 2014, after which maintenance by the Tribe became extremely difficult.

In sum, the adverse impacts of the diversion dam on the species described herein (as well as other migrating fish species) are:

(1) isolation of fish populations from impeded migration up and down the River;
(2) lost or diminished habitat connectivity and migration corridors which causes fish to lose access to food, rearing and spawning locations;
(3) fragmentation and reduction of habitat quality;
(4) diminished flow and water quality (increased temperatures can occur from diminished flow and trapping of sediment can affect water quality; also release of pollutants from the Project); and
(5) fish entrainment and or entrapment.

B. **Harms From Electron Dam From 2020 To Present.**

In late-July of 2020, the current owners of the Dam commenced work on a spillway replacement project to remove a section of the old wooden dam/spillway located on the left side of the River and install a 70-foot wide, 12-foot tall inflatable bladder dam. As is customary, regulatory agencies required the work to be completed during what is commonly referred to as a "fish window," meaning a time of year when the least harm to fish is anticipated to occur.[1] This time is typically July 15-to-September 15, which is a period of time that is past the peak of juvenile fish migrating downstream, and prior to the peak of adult fish migrating upstream. After issues arose with Electron Hydro placing turf and other materials in the River that then broke off and were impermissibly discharged into the River, various agencies issued stop work orders.

Then, in October of 2020, Electron Hydro constructed an elevated Rock Dam ("Rock Dam") in the Puyallup River channel at the diversion dam site (River Mile 41.7). The Rock Dam work included the placement of a seventy (70) foot wide metal Sheet Pile wall ("Sheet Pile") spanning the River from the left bank all the way to a concrete center abutment wall that was constructed and connected to the remaining wood spillway. The Sheet Pile wall with a sheer, sharp, and roughened edge, was installed vertically in the River and reinforced on the downstream side with the placement of immensely large rock (up-to and greater than six-man-plus in size—6,000–8,000lbs+/54in–60in+) from the Sheet Pile Wall to approximately 70+-feet downstream from the Sheet Pile Wall. The large, angular rock placed was not native to the River and was generally neither smooth nor rounded (where native rock, worn smooth by the River is), and contained substantial open and interstitial voids that can trap and impinge fish creating *extremely altered conditions* that are *tremendously rough* compared to that of the original full channel spanning wood spillway structure it replaced.

During the initial installation of the Rock Dam, Electron placed smaller aggregate materials over the large rock in an attempt to fill-in the voids and give the appearance of a flatter and smoother surface. The fill material did not remain in place

[1] It should be noted that there is no time of year that fish are not present in the River and there is always the potential of harm from this type of work. Rather, the concept of the "fish window" is to minimize that harm as much as possible. It can never be eliminated.

very long as it was hydraulically lifted, moved, and carried downstream during winter flows in 2020/2021, again exposing the *tremendously rough* structure of the underlying large rock base and opening new voids in the Rock Dam. Also, after winter flows in 2020/2021, many of the large angular boulders were displaced downstream making the height between the boulders and the top of the Sheet Pile even higher than when initially installed. This is the exact situation the Tribe's technical team cautioned Electron Hydro would happen. In 2021, Electron Hydro moved the boulders back upriver to rebuild the Rock Dam. After winter flows in 2021/2022, the boulders again shifted downstream, where they remain.

The anthropogenic structures at the Electron project site (headworks, Rock Dam, wood spillway and poorly-placed, challenging to maintain, fish ladder) have greatly affected the physical characteristics of the River including the channel bed/substrate, natural flows, and hydraulic conditions. Singly and combined, these alterations threaten the successful upstream and downstream migration and survival of fish, including listed species.

In early 2021, Electron indicated the need to conduct repairs yet again, which included a section upstream of the Rock Dam along the lower intake structure wall. Electron submitted a proposal to conduct what they inaccurately branded as a "Fish Passage Enhancement Project" (the "2021 Project" or "interim" work). In this proposal, Electron wrote, "Last winter (2020-2021) high flows displaced the rock placed below the temporary rock spillway. The result is that water flowing over the rock spillway falls several feet onto the remaining rock, and then passes downstream in a highly turbulent cascade. Upstream migrating fish may be attracted to and potentially injured as they try to pass over these conditions at the temporary rock spillway. In addition, the submerged riverbank immediately upstream of the temporary spillway below the intake wall has eroded and is at risk of partially breaching the structure. Such a breach could lead downstream migrating fish to be sucked into this void and it could also increase attraction flows at the temporary spillway, leading upstream migrating adults away from the fish ladder (the ladder is on the opposite side of the river). To avoid these fish passage problems the temporary rock spillway needs to be reinforced." One of the most significant elements of the plan was to rebuild and reinforce the Rock Dam and channel which had been restructured by the previous winter's flows. In response, the Tribe recommended an alternative solution similar to what was proposed in 2020, that would have Electron cut down the top 5-plus feet of the Sheet Pile wall and restructure the downstream face of the dam into a fish passable roughened channel. Electron rejected/chose to disregard the Tribe's recommendations, and the 2021 Project made the following modifications to and/or at the Dam:

(1) Repositioned existing large rocks on the downstream side of the dam Sheet Pile wall that were displaced by winter flows, by restacking them back upstream more immediately below the Sheet Pile.
(2) Placed an *additional twenty (20) 6-man-plus rocks* against the downstream face of the Sheet Pile/Rock Dam, and an *additional fourteen (14) 6-man-plus rocks* along the project intake on the upstream side of the dam.
(3) Adjusted the elevation of the Rock Dam and wood spillway crests in an effort to direct more flow over the wood spillway and nearer to the fish ladder entrance.
(4) Resurfaced the rough wood spillway in the middle of the River with a layer of Douglas fir boards, and an additional surface layer of Alaska Yellow Cedar.
(5) Added a flow deflector on the wood spillway to dissipate some of the flow energy directed at the front of the downstream fish ladder entrance.
(6) Added a steel bullnose cap on the exposed Sheet Pile wall (which does not cap the entire length of the Sheet Pile; some rough/sharp Sheet Pile is still exposed right next to the concrete abutment).
(7) Constructed a channel across the bottom of the wood spillway with the intent of improving

adult fish attraction to the existing fish ladder.[2]

DISCUSSION OF OPINIONS

OPINION 1: The Rock Dam and Sheet Pile Harm Chinook, Steelhead, And Bull Trout.

The Rock Dam and Sheet Pile harm fish in two ways, by:

(1) physically harming migrating fish, and
(2) creating competing (false) attraction flows that draw fish away from the fish ladder thereby impeding migration.

A. **The Rock Dam Creates Barriers and Unsafe Conditions for Fish Migration.**

Electron's reference to the Rock Dam structure as a "rock fill spillway" is misrepresentative, as the structure falls far outside the exemplification of a typical spillway that conforms to a design that provides a safe and efficient downstream passage route for adult and juvenile migrants. Spillway design must be benign, and provide the maximum survival rate for fish passing over the structure. Also, crucial considerations must be taken regarding flows and other hydraulic factors (i.e. falling water/spill) over the structure and the discharge into the spillway pool or channel below. The Rock Dam does and is none of these things.

Rather, the Rock Dam has created *tremendously rough* conditions that harm adults, and to a greater extent, the smaller bodied juvenile fish less capable of opposing hydraulic forces created by swift-moving and turbulent flows they will most likely encounter passing through the Rock Dam. Furthermore, since no plunge pool/channel exists below the Sheet Pile wall crest, during lower flow conditions, fish moving downstream over the dam crest are likely to fall several feet onto rocks, or into rocky voids along the extreme downstream face. Over a wide range of flows, fish entrained along the Rock Dam and coarse downstream channel will be subjected to impacts/strikes which have the potential of causing direct mortality, bruising, descaling, injury to organs, impingement, loss of equilibrium and disorientation, increased rate of predation, and reduced fitness rate leading to delayed/latent mortality.

I also want to emphasize that adult steelhead and bull trout are capable of reproducing multiple times throughout their lives and the life-history strategies of these two species have important ramifications for their management, survival, and recovery. Adult steelhead and bull trout require effective, safe, and unobstructed passage *both upstream and downstream* (i.e. foraging and spawning). However, upstream fish passage facilities—including the fish ladder at the site—are typically designed for adult anadromous salmonids that return only once to spawn during their life-cycle and subsequently die, requiring safe and effective one-way passage upstream. Dams or other barriers that have only upstream fish passage facilities, such as at Electron Dam, negatively affect and harm steelhead and bull trout populations if they do not also provide a safe and effective downstream passage route. At Electron Dam, the downstream passage route through the Rock Dam does not provide safe and effective passage for juvenile Chinook, adult or juvenile steelhead and bull trout. Rather, the downstream passage through the Rock Dam harms juvenile Chinook and adult and juvenile steelhead and bull trout. Bull trout can live up to 10-years or greater. Their longevity exposes them to an increased level of harm, as they do, and will, experience a higher rate of encounters and confrontations with the Project's infrastructure as they pass—or attempt to pass—the dam both upstream and downstream innumerable times over a life span.

B. **The Sheet Pile Wall Creates Barriers and Unsafe Conditions for Fish Migration.**

In addition to the Rock Dam, the Sheet Pile wall is a harmful condition for fish. During the ini-

[2] It should be noted that this near-annual heavy construction work in the River, as well as the work in the river with equipment that Electron does to manipulate the fish ladder entrances and flows, is a disruption and possible harm to fish. As noted in the expert report of Russ Ladley, this work is necessitated in part by the improper placement of the fish ladder in the River as well as the complications introduced from the construction of the Sheet Pile wall and Rock Dam.

tial 11-months of the Rock Dam's presence in the River, all of the exposed edges of the Sheet Pile were extremely jagged/rough. The exposed Sheet Pile is capable of injuring adult and juvenile fish that are drawn/forced over or along exposed edges during out-migration. In addition, the Sheet Pile can impede and injure adult fish by imposing a vertical barrier to upstream migration and it will cause injury from direct impacts as fish attempt to jump or move past (see USACE Buckley fish trap on the White River section earlier in this report). Again, it is certain that fish are and will be drawn over and up to the Sheet Pile wall because the main flow of the River is over that part of the Dam. Since 2021, Electron installed a cap over the top of the Sheet Pile wall. While this addressed some of the potential for injury it did not completely solve the problem. First, the cap does not extend all the way against either end of the wall crest leaving an area of sharpness (approximately 20-linear feet total) that fish can be drawn over or against. Second, the Sheet Pile wall remains a vertical barrier on the downstream side against which fish will still attempt to jump and injure themselves when they strike the steel wall.

C. **The Rock Dam's Location Has Created a Substantial and Harmful Condition for Upstream Migrating Fish By Significantly Altering The Fish Ladder's Effectiveness.**

The most important single part of any fish ladder, particularly those at barriers such as dams, is the lower/downstream fish ladder entrance. To be most *effective*, a fish ladder entrance must be located at a position where fish can easily detect the attraction flow and successfully find the entrance (Williams et al. 2012; Silva et al. 2018). The location of the fish ladder entrance should avoid, or be free of, high velocity and turbulent zones such as those that may occur at a powerhouse or spillway tailrace (the water channel below a dam or spillway) (NMFS 2008). All flows, such as those passing through or over dams and spillways (hydraulic energy/influences), which may misroute or disrupt fish from successfully finding and migrating without delay through the fish ladder, are fundamentally considered competing flows, or false attraction flows (WDF 1992; Clay 1995; NMFS 2008). The instinctive behavior of salmonids is rheotactical, meaning, they tend to orient and respond to the direction and scale (stimulus) of surrounding water flows and are impelled to orient and move against (positive rheotaxis), or with (negative rheotaxis) the direction of flow. This instinctive impulse and directional-movement is largely governed by flow velocity, flow direction, turbulence (chaotic variations in fluid motion), scale of flow, hydrodynamic (flow) noise, temperature, and fish life history stage or strategy. In respect to upstream fish passage, any flows or discharges separate from the fish ladder flow may create competing or *false attraction* of fishes which can result in the misdirection, delay, or prevention of fish from *effectively* finding the fish ladder entrance. This is especially true with competing flows or discharges that are significantly greater than the water flow exiting the fish ladder (WDF 1992; Clay 1995; NMFS 2008). In addition, downstream migrating fish will typically move with the predominant channel flow and will attempt to avoid areas of severe, or abrupt changes that can result in harm (*i.e.* velocity, gradients, powerful turbulence, acceleration, and deceleration). Downstream migrants face additional difficulties moving with the flow as it can increase their travel rates downstream. Increases in travel rates may result in less time for fish to evaluate signals relating to upcoming conditions they may encounter and want to avoid. Furthermore, a fish's size and condition effects its swimming ability; so, smaller bodied fish, as well as post-spawned adults (steelhead and bull trout) having expended considerable amounts of energy and physiological resources may lack the swimming strength, stamina, and speed to avoid adverse downstream conditions. To ensure upstream and downstream fish passage will be most effective and safe, it's imperative that anthropogenic structures be constructed, located, and flows directed, such that fish are not subjected to delays, misdirection, or harm.

The Electron Dam fish ladder was engineered and installed to operate most effectively in concert with the *original* linear channel spanning spillway.[3] In regard to the original dam/spillway structure at the time the ladder was constructed, the design was meant to have upstream migrating fish encountering the dam to instinctively move laterally along the toe of the spillway in search of upstream passage, and to a large extent, this instinctive behavior improved, but did not ensure, the likelihood of a fish locating the ladder entrance. Again, the location of the fish ladder has never been ideal since it was placed on the opposite side of the River (right side looking downstream) from the main attraction flow typically falling off the spillway on the left bank of the river channel (project owner Puget Sound Energy wouldn't allow ladder to be built on the left-bank). The current configuration and placement of the Rock Dam is not good at all for fish as it has created conditions that now draw, or falsely attract, fish upstream through the coarse rock-filled channel and up to the Rock Dam and Sheet Pile wall, and *away* from the fish ladder entrance. This is because, since 1904, the natural flow regimes of the River have been significantly altered through channel manipulation and forcibly redirecting the flow path towards the Project's water intake located on the left bank (looking downstream) and concurrently over the Rock Dam. With the predominant flow over the Rock Dam, fish will now attempt to navigate upstream to find passage through and over the Rock Dam and Sheet Pile, not the fish ladder. Fish will be unsuccessful at finding passage forward through the Rock Dam and/or over the Sheet Pile wall, encountering multiple impassable barriers. Fish can be injured or killed when they strike the non-native angular rock; they can become trapped in the voids within the rock; they can injure themselves futilely jumping at the large rocks and/or the Sheet Pile wall and they can exhaust themselves to death or fail to spawn from the effort. This all can result in fish misdirection/delays, exhaustion, injuries, mortality and failed reproduction and population recovery/sustainability. And, once fish are in the Rock Dam portion of the River, it is highly unlikely that they will find their way out as the instinctive behavior and directional-movement of upstream migrating salmonids to move against the direction of flow means fish generally will not orient or move downstream in search of pathways around obstructions (WDF 1992; Clay 1995).

OPINION 2: The Alterations to The Project In 2021 *Did Not Improve* The Adverse Conditions For Upstream Or Downstream Migrating Fish.

The post-Project conditions only perpetuated the passage and injury issues for fish. The reconstruction of the Rock Dam, including adding twenty (20) immense rocks placed along the downstream face of the Sheet Pile, did not improve the adverse conditions for upstream and downstream migrating fish. The tremendously rough structure has only prolonged the significant hazards to fish due to continuing flows over and through the Dam. Downstream migrants continue be carried over the Dam crest and entrained in the Rock Dam and channel. Upstream migrants continue to be drawn up the dead-end channel to the Rock Dam and Sheet Pile. By redirecting the predominant flow from the Rock Dam to the wood spillway and nearer to the fish ladder entrance, Electron intensified the hydraulic influences/energy of water plunging off the wood spillway. In doing so, Electron created additional adverse and harmful conditions for upstream migrating fish, in addition to those produced by the Rock Dam, which has only acted to confuse and disorient fish (i.e. flow velocity, flow direction, turbulence). The resulting spill in front of the fish ladder entrance has only made it more difficult for fish to locate the comparatively low-volume discharge from the fish ladder entrance in the midst of the more substantial and chaotic discharge plunging off the spillway. The shift in flows brought into effect similar conditions that occurred during the summer/fall of 2020, during which time river flow was diverted by Electron through a temporary bypass channel (HDPE plastic/Artificial turf liner), over the wood spillway and plunging in front of the fish ladder.

[3] Again, the placement and construction of the fish ladder at Electron Dam does not alleviate the harms from the Dam and Project. While it has in the past allowed some safe passage for upstream-migrating adult fish (and downstream for juveniles in the instances where they happened to be drawn into by flow), even that minimal improvement is now compromised.

The increased flows discharged in front of the fish ladder entrance resulted in frequently impassable conditions by rendering the fish ladder inaccessible or undetectable by fish. Once more, to be *effective*, a fish ladder entrance must be located at a position where fish can easily detect the attraction flow and find the fish ladder entrance (Williams et al. 2012; Silva et al. 2018). The location of the fish ladder entrance should avoid, or be *free of, high velocity and turbulent zones* such as those that may occur at a powerhouse or spillway tailrace (the water channel below a dam) (NMFS 2008). As I have stated numerous times, and is extensively supported by relevant scientific literature, it is a problem wherever fish are attracted to flow, hydraulic energy, falling water, etc. not directly associated with upstream fish passage facilities. This will be a problem with the proposed bladder dam, as the dominant flow path will be on the opposite side of the River from the fish ladder (see further discussion below in Opinion 3: The proposed bladder dam will continue to harm fish).

a. The fish passage enhancement project did not resolve adverse impacts from the Rock Dam. When river flows exceed approximately 350 ft^3/s, (which is almost all of the time) the flow over the Rock Dam will still result in upstream migrating fish to be inexorably drawn (false attraction) to the Rock Dam channel, up the rocky cascade, and towards the largely impassable Sheet Pile wall with adverse consequences and harm as described above.
b. The installation of a steel bullnose cap on the crest of the Sheet Pile wall did not eliminate the adverse conditions due to the fact that several feet (approximately 20-linear feet total) of the Sheet Pile wall were left exposed and unprotected, thereby, subjecting fish to ongoing harm.
c. Electron constructed a shallow channel along the toe of the wooden spillway with the objective of directing fish ladder and spillway flows towards the Rock Dam channel. This was largely ineffective in increasing attraction to the fish ladder due the elevation of the Rock Dam channel bed being higher than the spillway channel. During most flow scenarios this has caused water from the Rock Dam channel to flow into the channel below the wood spillway, thereby, producing an additional competing, or false attraction flow that will draw fish away from the fish ladder entrance and into the Rock Dam channel and Rock Dam/Sheet Pile.
d. Electron's fish ladder monitoring efforts are conducted *once per week* to primarily assess fish ladder *function* (i.e. is there water flowing in the ladder or is it choked off by sediment or debris), and do not adequately address fish passage *effectiveness*. The fish ladder entrance is possibly the most critical component in the design of an upstream fish passage system. Yet, Electron has focused solely on irrelevant technicalities of fish ladder function *within* the existing fish ladder. The fish ladder monitoring, for all practical purposes, is ineffectual other than determining if fish can successfully migrate *through* the ladder—which assumes that fish can find it, an unsupported and unsupportable assumption given the status of the Dam as described above. Monitoring report do not include any information or images of the Rock Dam at the time of the monitoring of the fish ladder, a necessary component of assessing the fish ladder's efficacy. If there is no simultaneous monitoring of the condition and possible fish presence around the Rock Dam there is inadequate comparative analysis of safe and effective fish passage. Fish passage effectiveness monitoring methods were suggested; however, to-date, no additional monitoring or evaluation actions, outside of monitoring fish ladder function, has been performed or presented by Electron since the modifications were completed.
e. Fish passage conditions at the project site have worsened since flow was diverted over the wooden spillway in August 2021. On November 4–5, 2022, a high flow event (≈11,000 ft^3/s) caused the main river channel flow to be conveyed once again over the Rock Dam and that is the current condition with

all the attendant harms discussed herein and previously by me in this case.

In my experience, having conducted countless adult salmon escapement surveys, post-spawning carcass sampling, fish removal and recovery operations, fish passage survival studies, and telemetry studies, it is not the case that if no dead or injured fish are observed, it must therefore be conclusive that no fish have been harmed or killed. In the flowing waters of a river, dead or injured fish can travel substantial distances downstream from the point of harm; they can be eaten by predatory fish; they may be moved within or removed from the river entirely by terrestrial and avian predators and scavengers (Havn et al. 2017). What's more, a dead fish is slightly negatively buoyant and will therefore generally sink toward the bottom of the river, making it often difficult or impossible to detect until decomposition *may* make the carcass buoyant (approximately 7–10 days). In a river system such as the Puyallup, carcasses of fish that sink to the bottom are often buried by the fluvial movements of substrate materials or by fine sediments during glacial flows that occur from late spring-through-early fall.

As an example, I was one of the primary biologists involved in a Chinook radio telemetry study conducted in 2014 on the White River. A total of 186 adult Chinook were fitted with radio telemetry tags (esophageal/throat) and tracked for approximately 3.5 months (Late June-Mid October). The study only recovered and sampled a total of four (4) carcasses in the White River (2.2% of study fish). Locating the carcasses in the river was primarily achieved through the detection of radio tags by radio telemetry. Several additional tags were recovered from the river, its banks, and surrounding landscapes; however, very little or nothing remained of the carcasses.

Also, it is not the case that if no live fish are observed, there are no fish present. Detecting live or dead fish is often dependent on visual observations, which can be especially challenging in weather and water circumstances that may result in poor observational conditions. This can include: time of year, time of day (day or night), poor water clarity, flow, turbulence, water depth, woody debris, vegetation, rocks, distance from the site under observation, and ambient weather conditions (i.e., raining, snowing, windy, cloudy, or sunny). Also, the external markings and cryptic coloration (camouflage) make salmonids difficult to locate or identify. Observational frequency and duration are *considerable* factors in successfully detecting fish as well. Accurate observation requires long and very frequent periods of observation, for entire days, multiple times a week. For example, for at least the past 11-years, while monitoring/sampling adult salmon and bull trout at the USACE fish trap located at the old White River Diversion Dam (mid-May-to-late September), myself and other fisheries staff were on site 5–7 days a week for up to six hours a day. This onsite presence greatly contributed to the tribal fisheries staff's ability to observe and document the harm that was occurring and discussed earlier in this report.

In conclusion, I know ESA listed fish (juveniles & adults) are present upstream, downstream, and near the project (i.e. observations, steelhead & bull trout spawning data, offspring from adult Chinook planted upstream of the project). So, even in the absence of observing dead or live fish at the site, I assert that fish are being harmed by the Project. As I have presented in this report, my assertion is based on my experience with harmful situations to fish in the Puyallup and White River watersheds that I have personally observed that are analogous to conditions at Electron Dam, as well as the instinctive behavior and life history of Chinook, steelhead and bull trout. Also, the potential harm caused by anthropogenic structures to fish, such as dams, spillways and grade control structures—in lieu of dead or live fish being observed—is well documented in the relevant scientific literature.

<u>OPINION 3: The Proposed Bladder Dam Will Harm Fish.</u>

Based on current planning/drawings submitted, the bladder dam's location and configuration would continue to falsely attract adult migrants into a dead-end channel that they would otherwise be instinctively driven to pass by. Furthermore, if the proposed concrete footing/scour pad with embedded rock is installed below the flow falling up to 12-feet off the bladder dam's crest, fish plummeting from the dam crest to the scour pad below would undoubtedly be problematic, as they would likely hit the concrete or embedded rocks at high velocity which will likely result in injury, moribundity, or mortality. A plunge of this magnitude is atypical anywhere else along the reaches of the river that I regularly monitor up to, and beyond, the National Park Boundary.

Conclusion

Throughout its history, the Electron Project has severely harmed the treaty protected fisheries of the Puyallup Tribe through fish loss and habitat impairment. Grounded on historical information that salmon in vast numbers once migrated up the River to the proximity of Mt. Rainier (Lane & Lane Associates et al. 1981), and the fact that habitat upstream of the Electron Dam was readily accessible to anadromous fish prior to Electron's construction, as well as the fact that some small salmonid species/populations managed to persist upstream of the Dam post construction, watershed biologists and mangers have concluded that anadromous salmon, and other fish species, were in fact historically present in the upper-Puyallup watershed and in significant numbers.

Over the past several decades the Puyallup Tribe and others have worked ceaselessly, and at substantial costs to the Tribe, to attempt to lessen the significant and ongoing prolific harm inflicted upon fish, fish populations, and the aquatic habitat necessary to their survival that has been caused by over 119 years of the diversion dam's existence and Electron's operations. Unfortunately, in spite of the substantial fish enhancement and recovery efforts conducted by the Tribe and others, and in stark contrast to the rest of the Puyallup watershed, fish populations throughout the Electron affected reaches, from the powerhouse located at river mile 31.2 to the headwaters in Mt. Rainier National Park, continue to struggle to achieve a measurable level of improvement towards recovery, with harms to fish from the Dam and associated work at the Dam being a major factor in that failure of improvement. In my opinion, there will always be harm to fish and habitat associated with the operation of the Project, as there are no complete measures Electron can put in place to completely prevent harm from occurring in the future.

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FENNEL CREEK

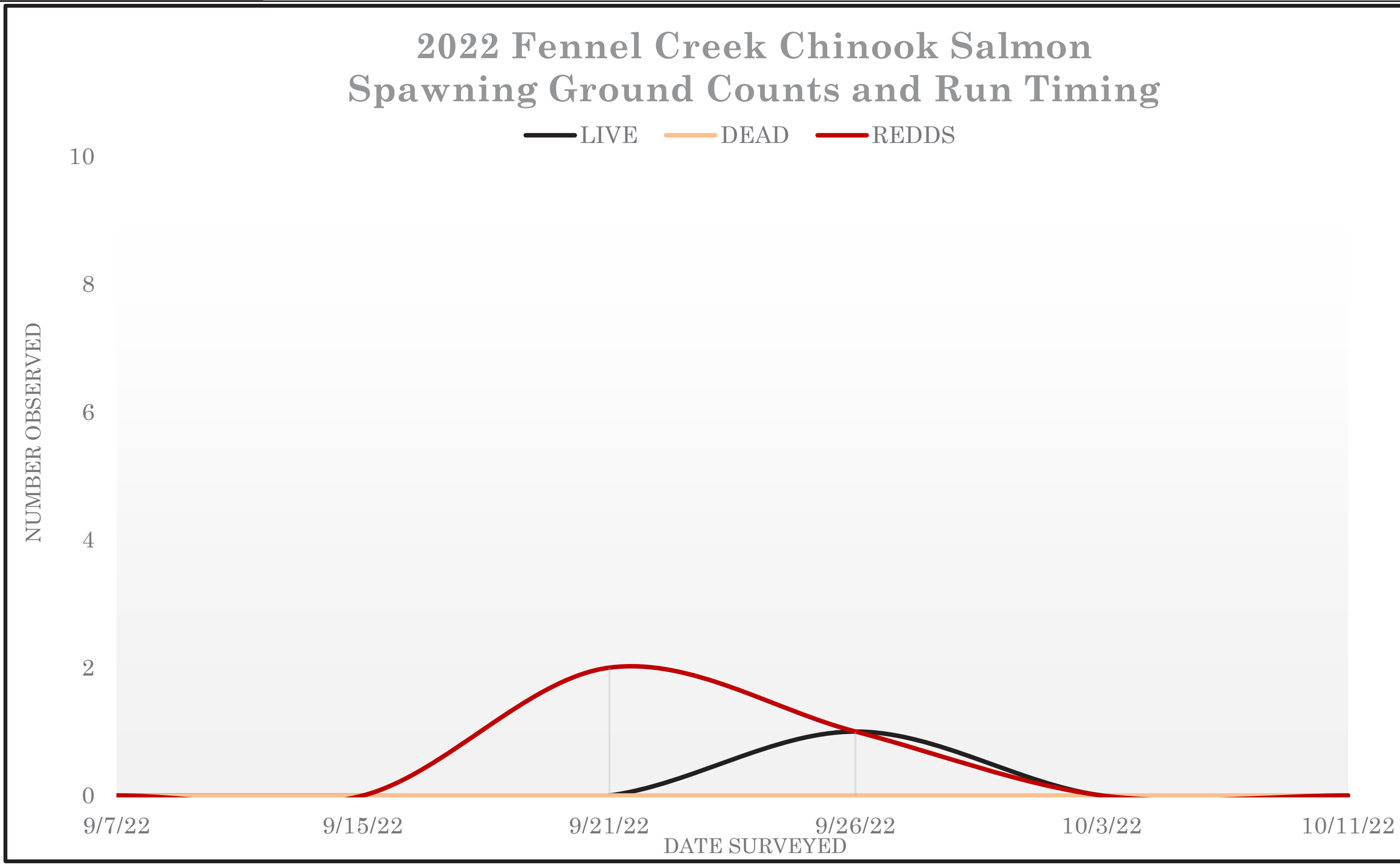
WRIA 10.0406

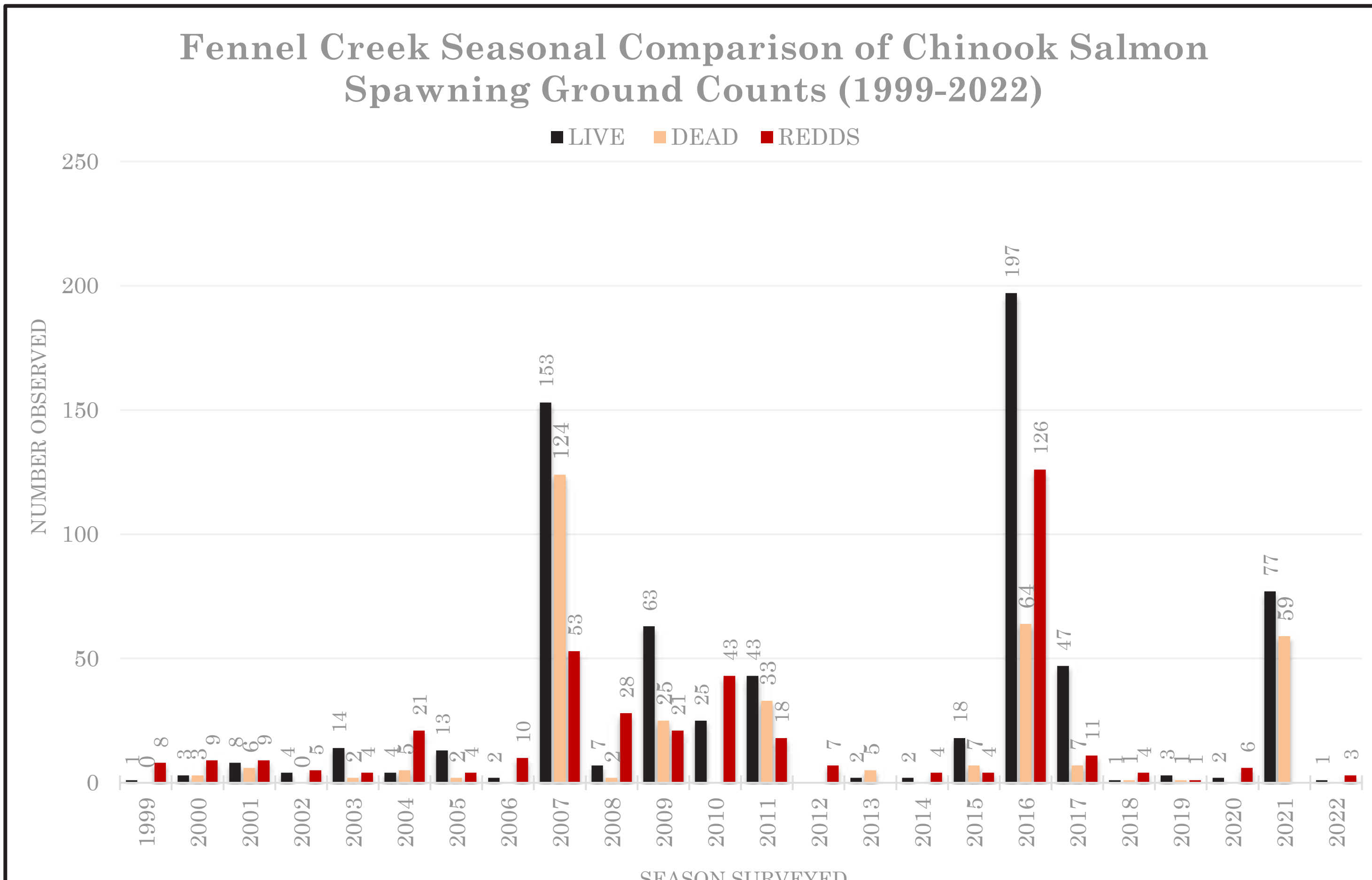
Fennel Creek (*Kelly Cr.*) flows nearly 8 miles from its source of wetlands and lowland lakes located on the plateau near Bonney Lake and HWY 410. The creek eventually convergence with the Puyallup River near Alderton at RM 15.5. With a drainage area of over 6.5 square miles, Fennel Creek provides approximately 2 miles of anadromous usage. A natural 100 foot falls (*Victor Falls*) is located at river mile 1.9. The anadromous reach provides abundant suitable habitat for Chinook, coho, pink, chum, and steelhead. Pink and chum salmon are undoubtedly the most prolific species to spawn in the creek; unfortunately, steelhead escapement has dropped precipitously over the past decade. Bull trout utilization in Fennel Creek is unknown; however, it is assumed that adult/sub adult fluvial bull trout likely exploit prey species in Fennel Creek. Other species present throughout Fennel include cutthroat, sculpins, sticklebacks, and lamprey.

Chinook salmon in lower Fennel Creek.

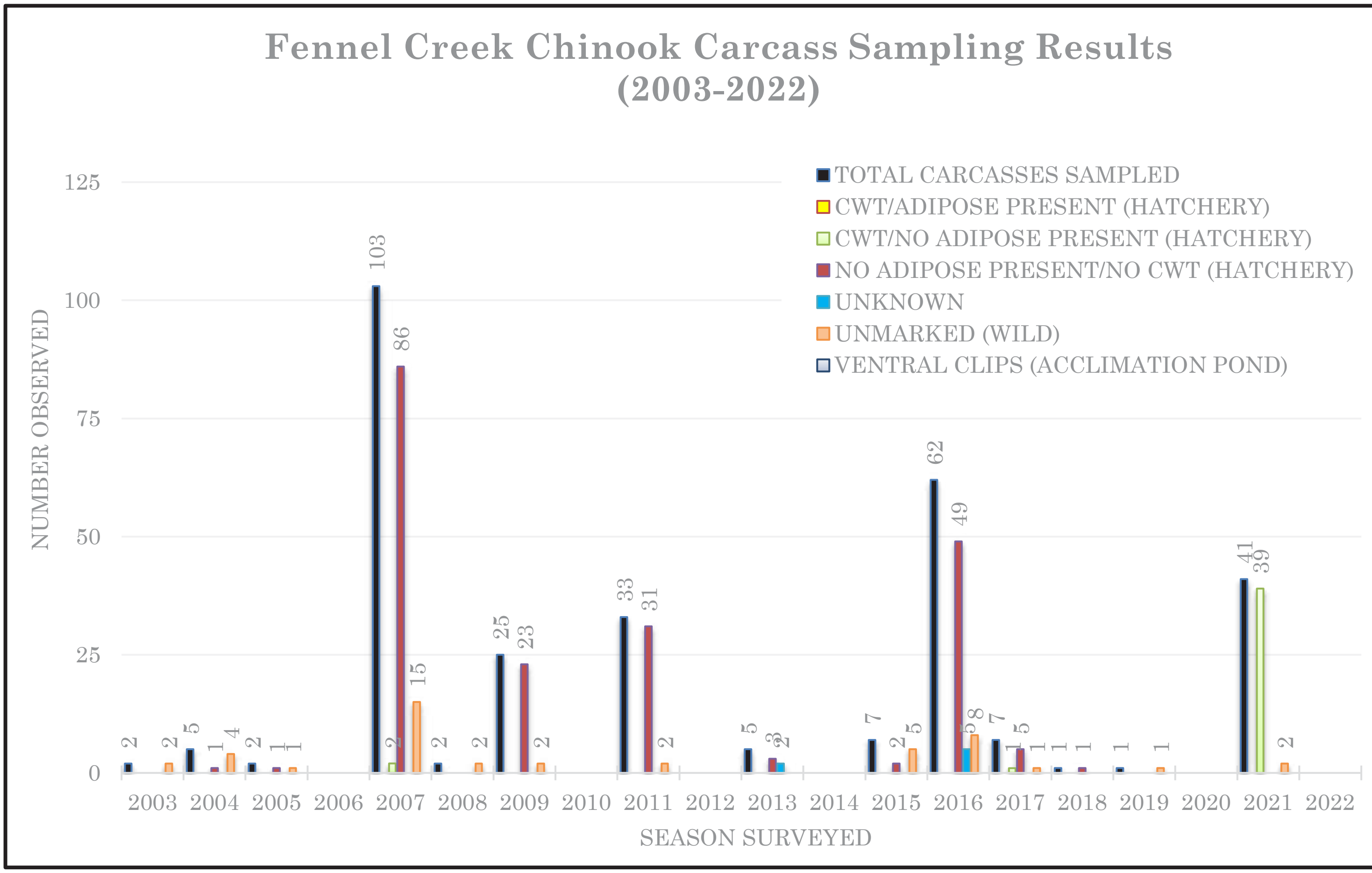
In 2015, Pierce County completed the construction of a new lower channel restoration on Fennel creek. The new channel and adjacent 40 acres is designed to improve instream and surrounding wetland complexity, as well as fish and wildlife utilization. The new stream channel restoration meanders downstream over 1,800 feet from McCutchen Road.

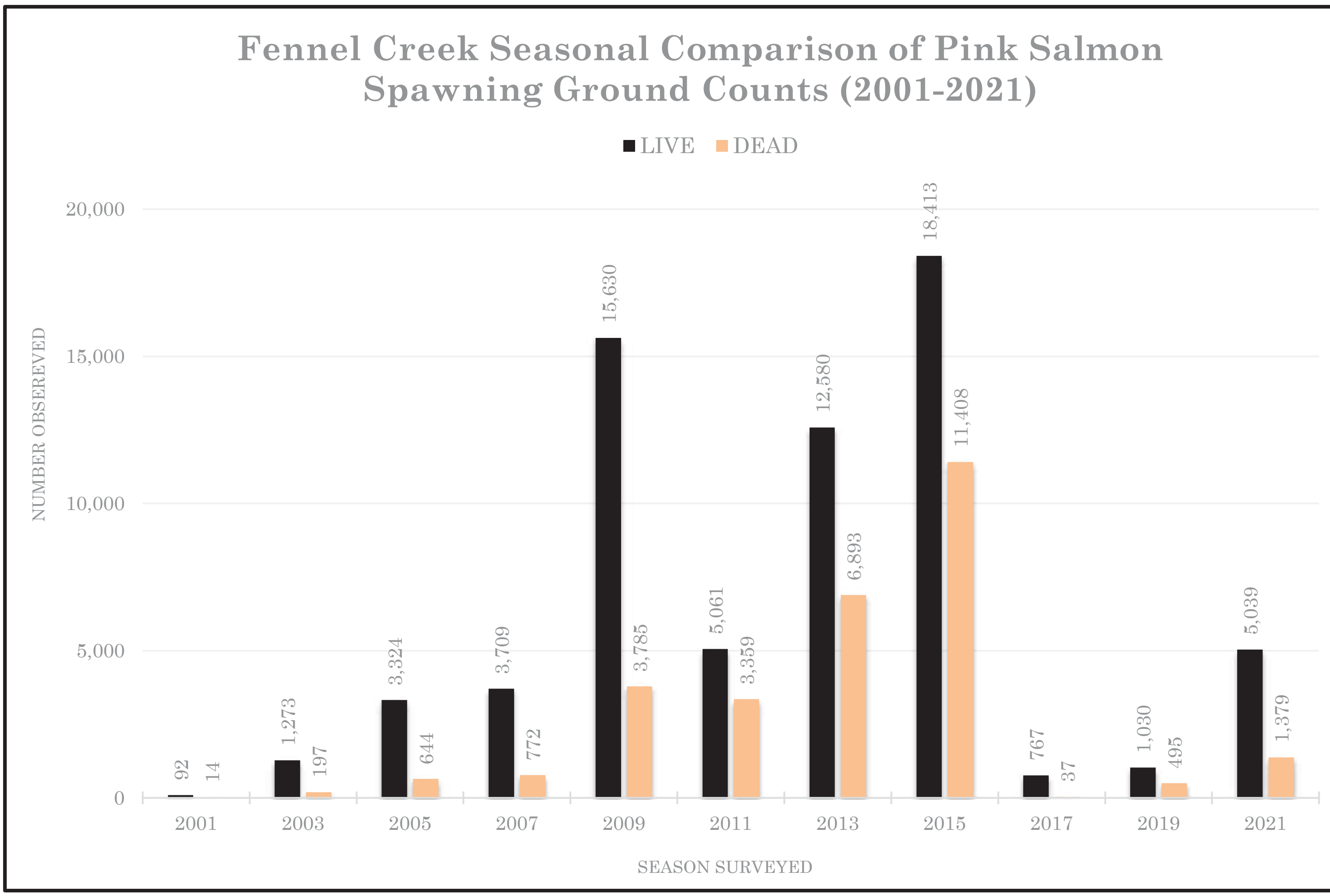
Approximately 0.2 miles upstream of the McCutcheon Bridge is a short run spring fed tributary, Fennel Tributary, which contains excellent spawning gravel and has supported high densities of adult chum spawners in the past. The upper anadromous reach of Fennel Creek is a complex, moderate gradient, pool-riffle/step-pool stream flowing through a broad valley. Victor falls, at RM 1.9, blocks any further upstream migration. The riparian zone is well intact due to little or no agricultural or residential land use development along most of the creek channel; the overstory riparian consists of a mature hardwood and conifer forest with a dense understory of salmonberry and vine maple. Throughout the upper 1.5 mile anadromous stretch, abundant LWD lies in and adjacent to the channel; as well as several small in-stream logjams. Spawning gravel is abundant and excellent throughout this reach, as are numerous deep resting pools for juveniles and adult migrants. Uniquely, Fennel Creek experiences an early run of chum salmon each year; with fish often entering the creek in late October, nearly three weeks earlier than most lower Puyallup tributaries. In May of 2009, a 9.75-acre land conservation area along Fennel Creek in Bonney Lake was created through a cooperative partnership between Pierce County, the City of Bonney Lake, and the Cascade Land Conservancy. The land conservancy will protect habitat along Fennel Creek and will eventually be the location of the Fennel Creek Trailhead.

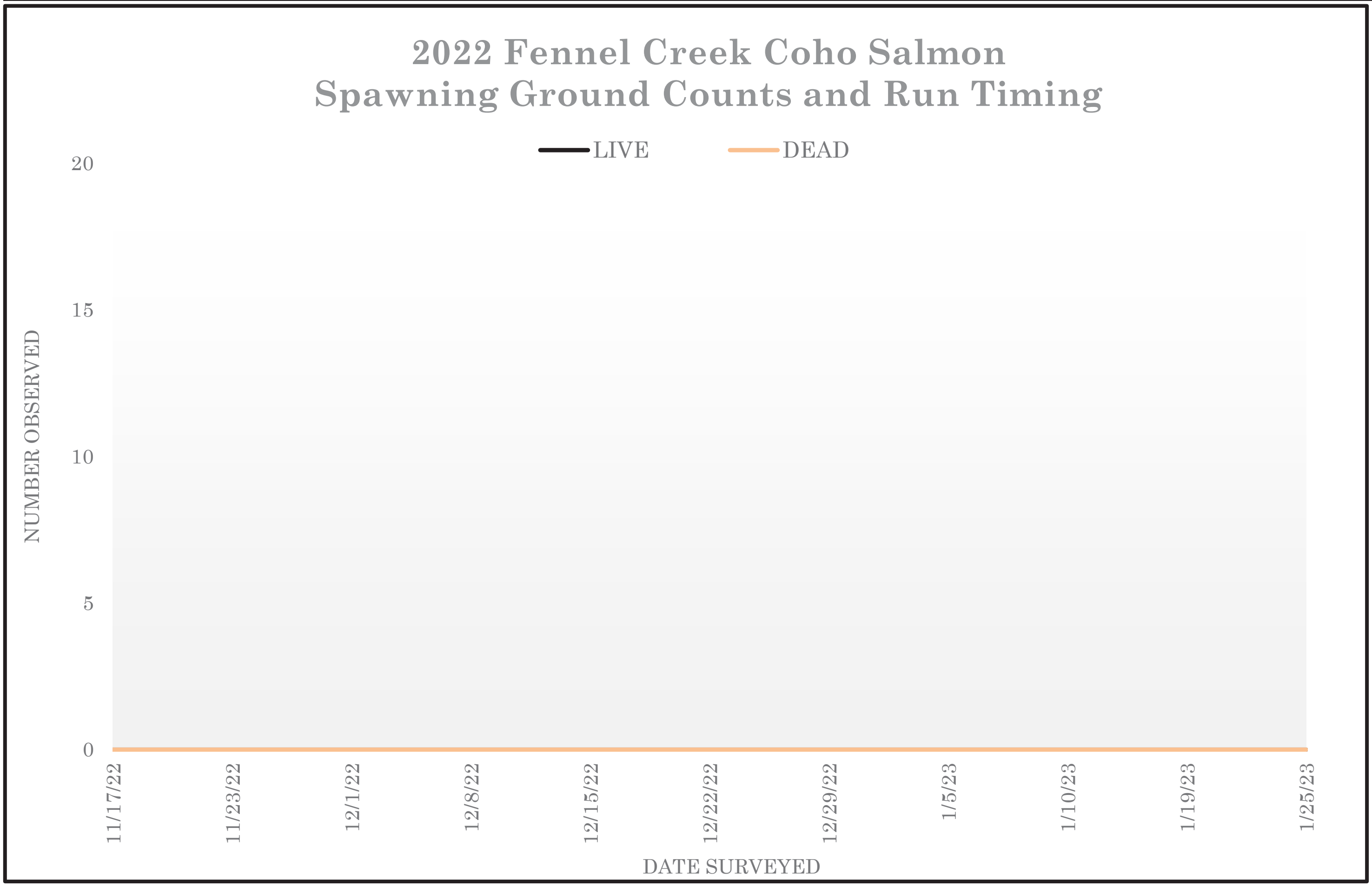




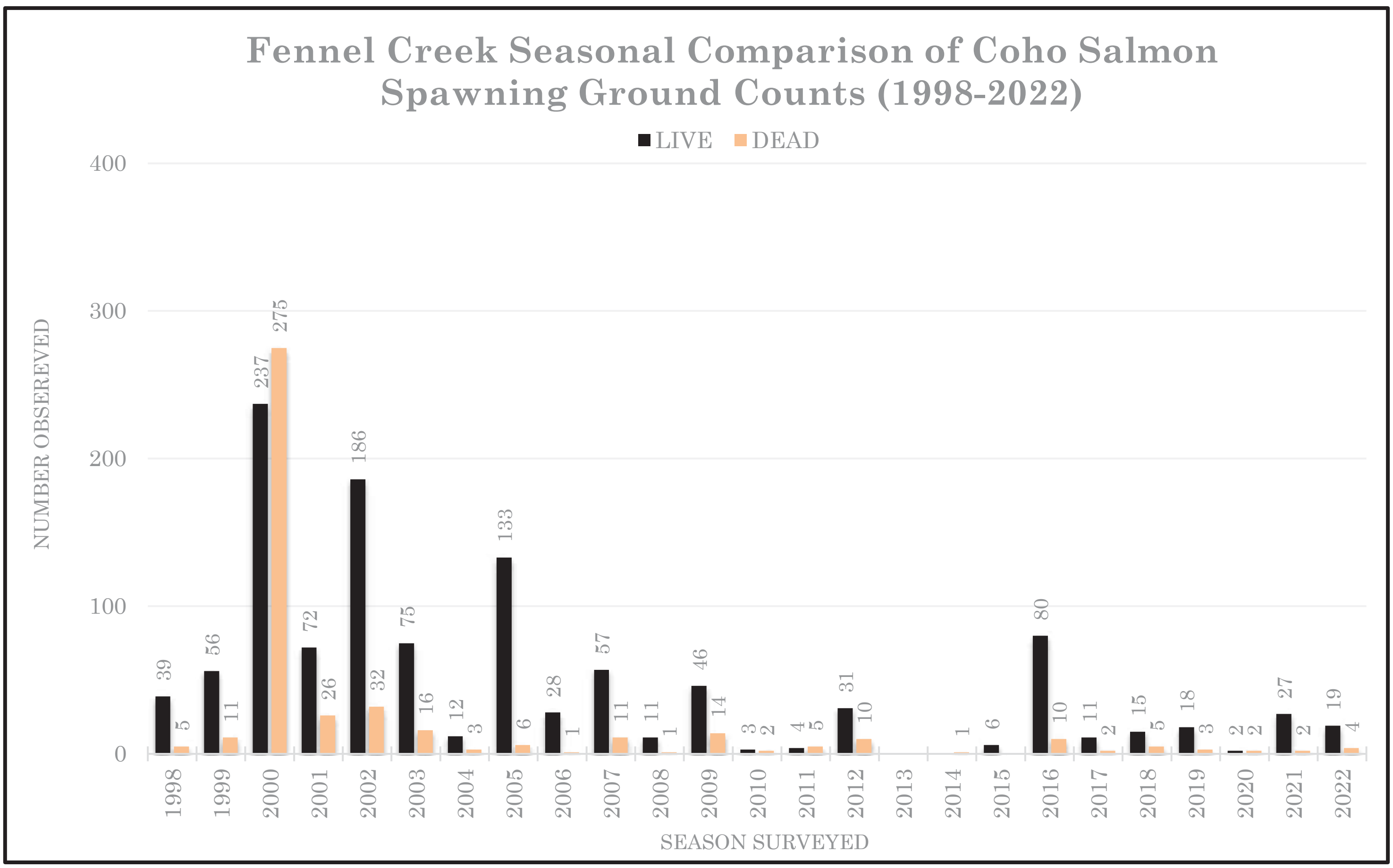
Adult Chinook escapement is determined by expanding the number of redds observed by 2.5 fish per redd (Smith and Castle, 1994). Due to the tremendous volume of pink salmon during odd years, the success of determining Chinook redds from pinks is vastly reduced. Therefore, The AUC method is used to determine escapement during pink runs (odd years).


Fennel Creek Chinook Carcass Sampling Results
(2003-2022)
TOTAL CARCASSES SAMPLED
CWT/ADIPOSE PRESENT (HATCHERY)
CWT/NO ADIPOSE PRESENT (HATCHERY)
NO ADIPOSE PRESENT/NO CWT (HATCHERY)
UNKNOWN
UNMARKED (WILD)
VENTRAL CLIPS (ACCLIMATION POND)
NUMBER OBSERVED
SEASON SURVEYED
0
25
50
75
100
125
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022

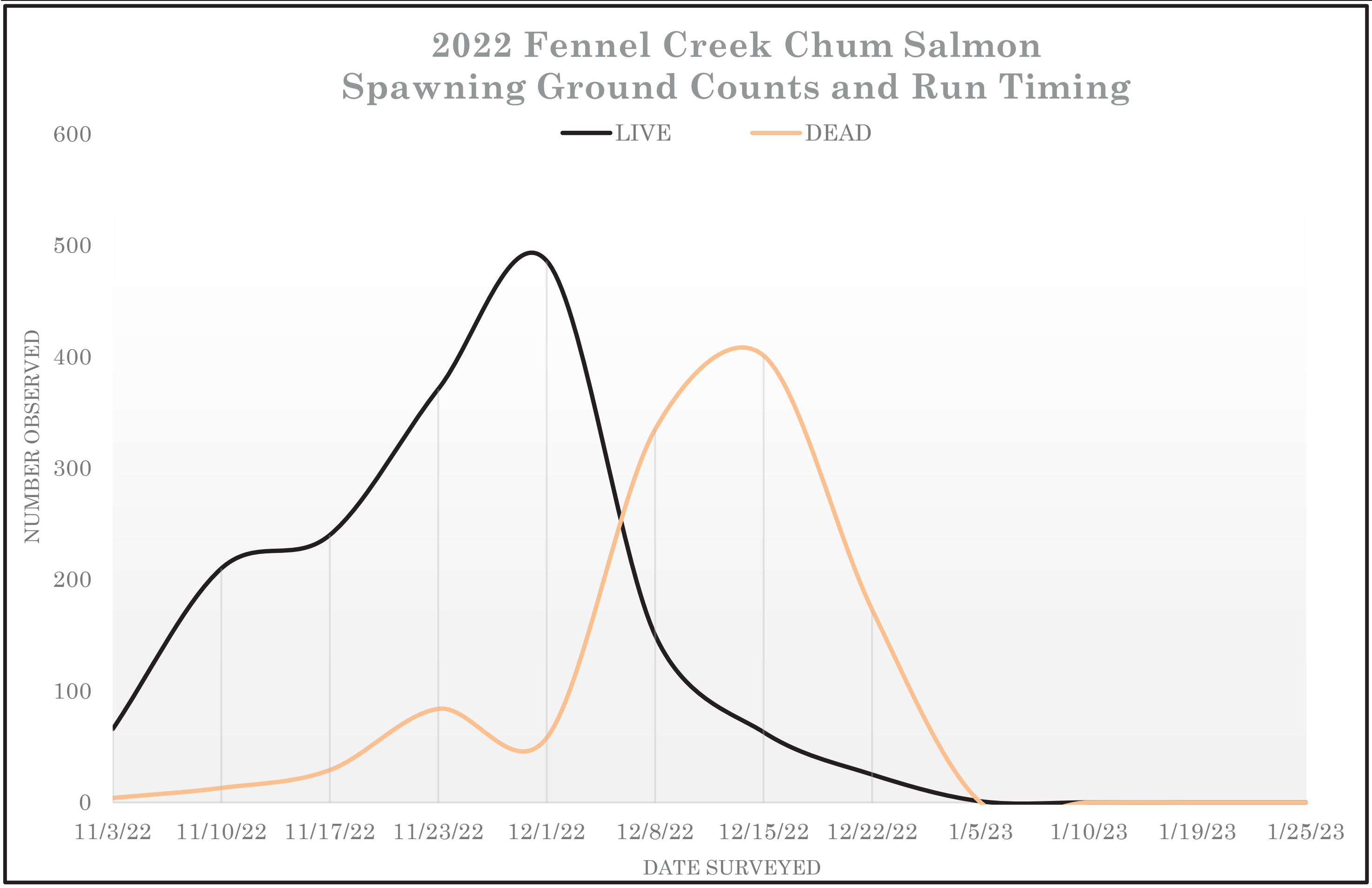

Fennel Creek Seasonal Comparison of Pink Salmon
Spawning Ground Counts (2001-2021)
LIVE
DEAD
NUMBER OBSEREVED
SEASON SURVEYED
0
5,000
10,000
15,000
20,000
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019 2021
92
14
1,273
197
3,324
644
3,709
772
15,630
3,785
5,061
3,359
12,580
6,893
18,413
11,408
767
37
1,030
495
5,039
1,379



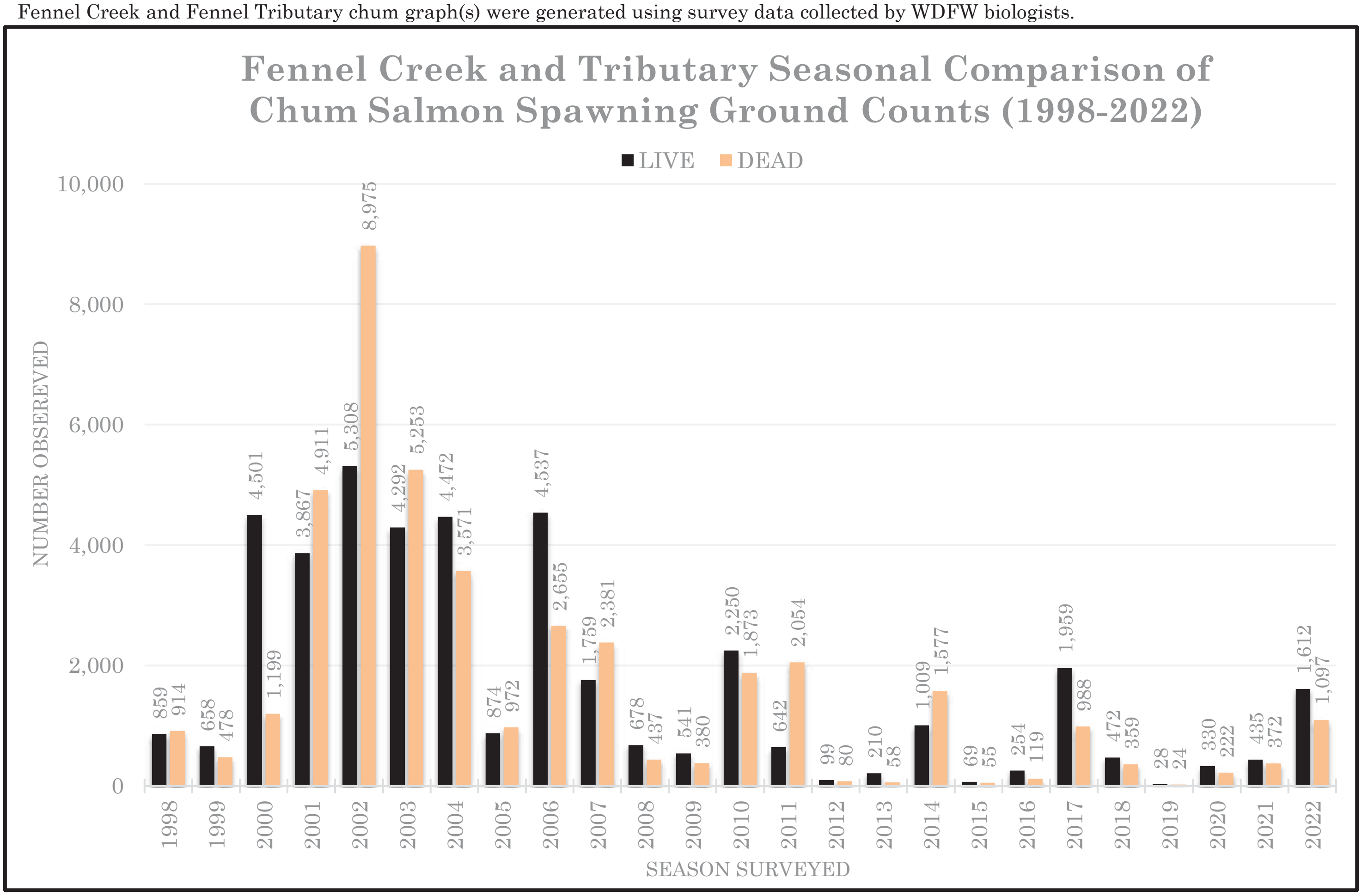
Fennel Creek coho graph(s) were generated using survey data collected and provided by WDFW.

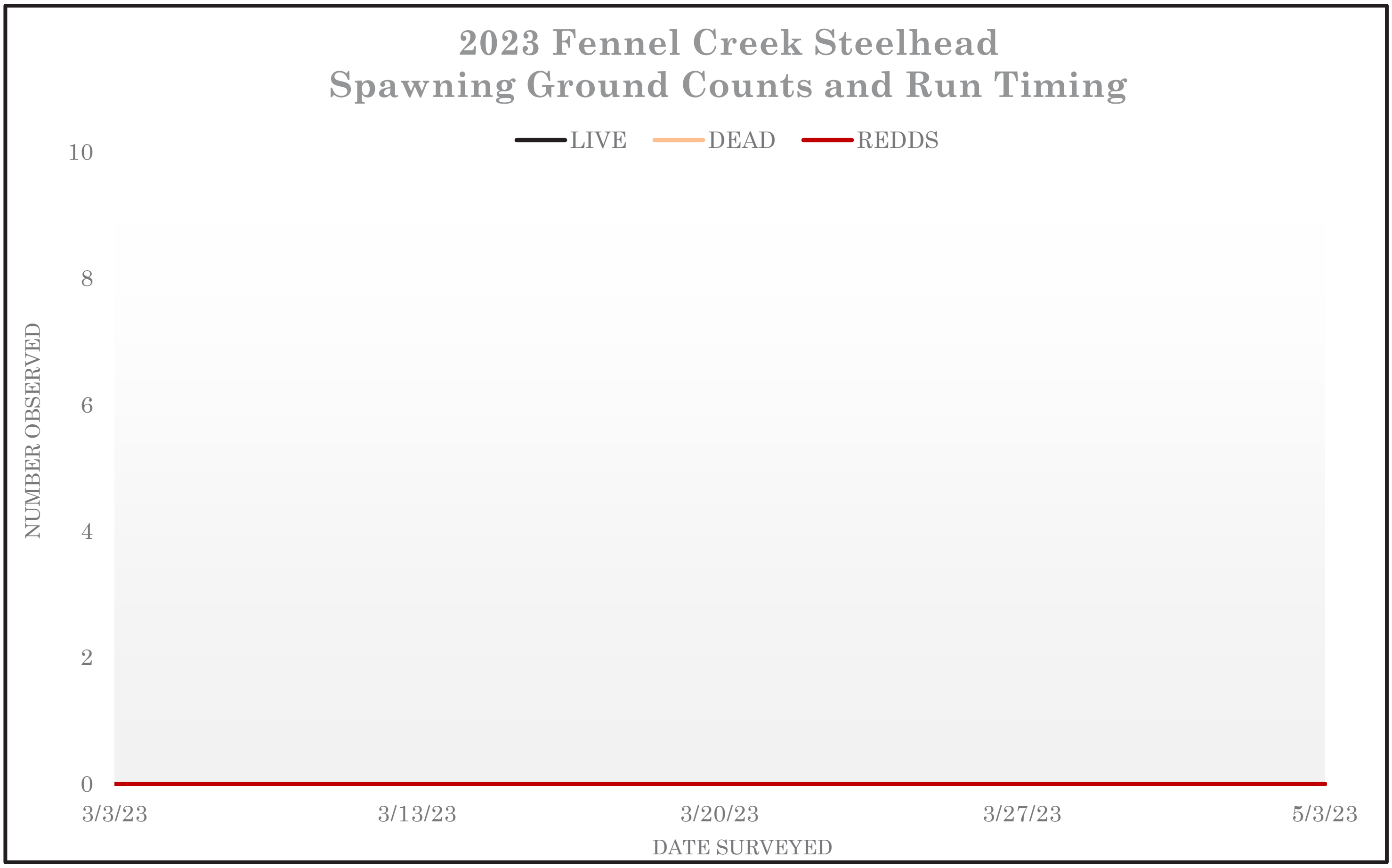


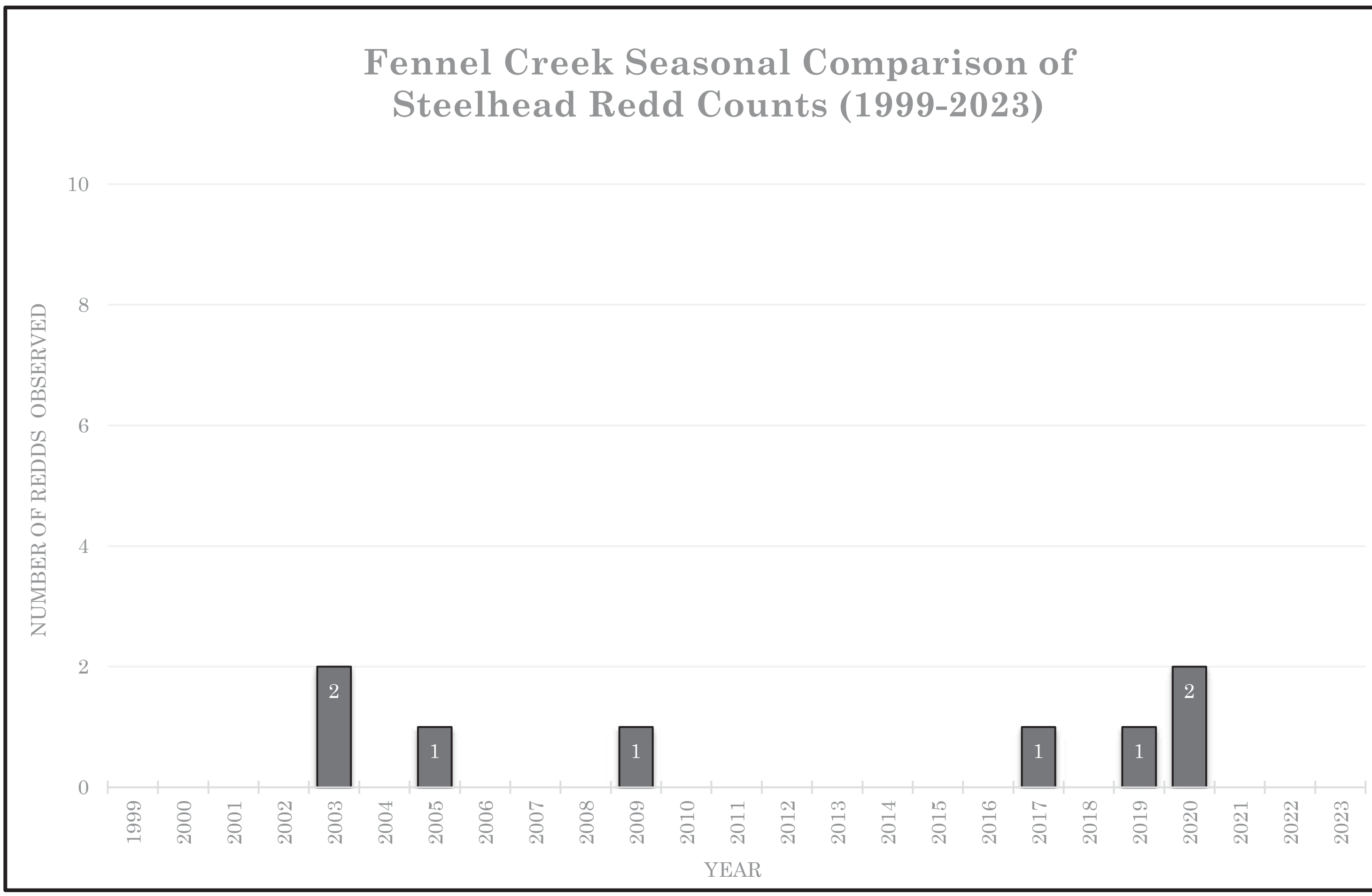
Fennel Creek and Fennel Tributary coho graph(s) were generated using survey data collected by WDFW biologists.



Fennel Creek and Fennel Tributary chum graph(s) were generated using survey data collected by WDFW biologists.







To determine the total escapement for steelhead, each redd is multiplied by a factor of 1.62 *(i.e. 42 redds x 1.62 steelhead per redd = total escapement of 68 steelhead).*

FISKE CREEK

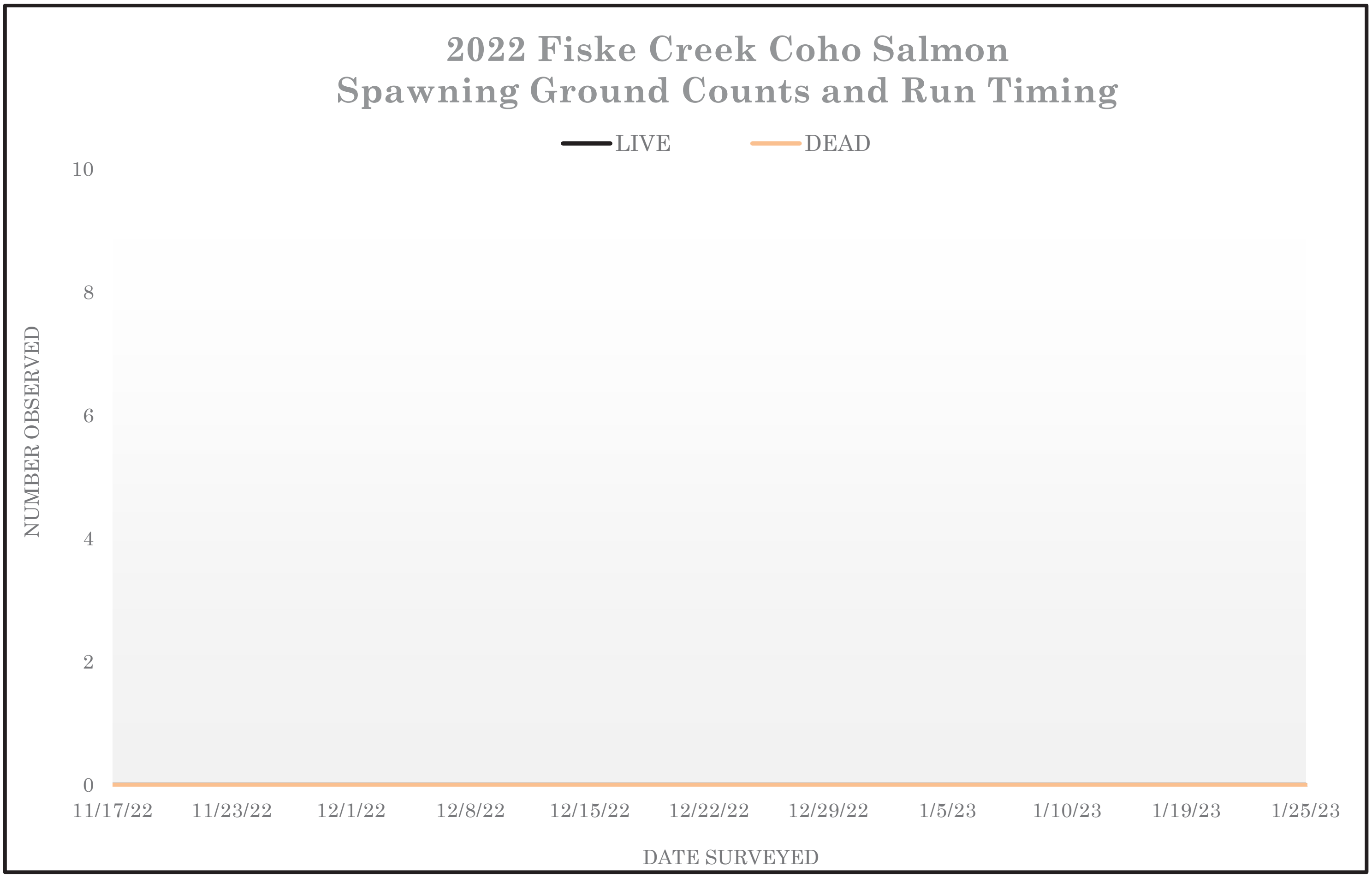
WRIA 10.0596

Fiske Creek is a small tributary to the Puyallup River, entering the Puyallup at approximately RM 26.6. Fiske Creek, (*fiske is a Swedish word meaning "fish"*) is one of 5 index streams in the Puyallup Watershed surveyed for coho by the Washington Department of Fish and Wildlife. State biologists use the coho escapement from five "index" tributaries (*Coal Mine, Spiketon, Fiske, Fennel and Canyonfalls creeks*) to estimate the total escapement for the Puyallup River.

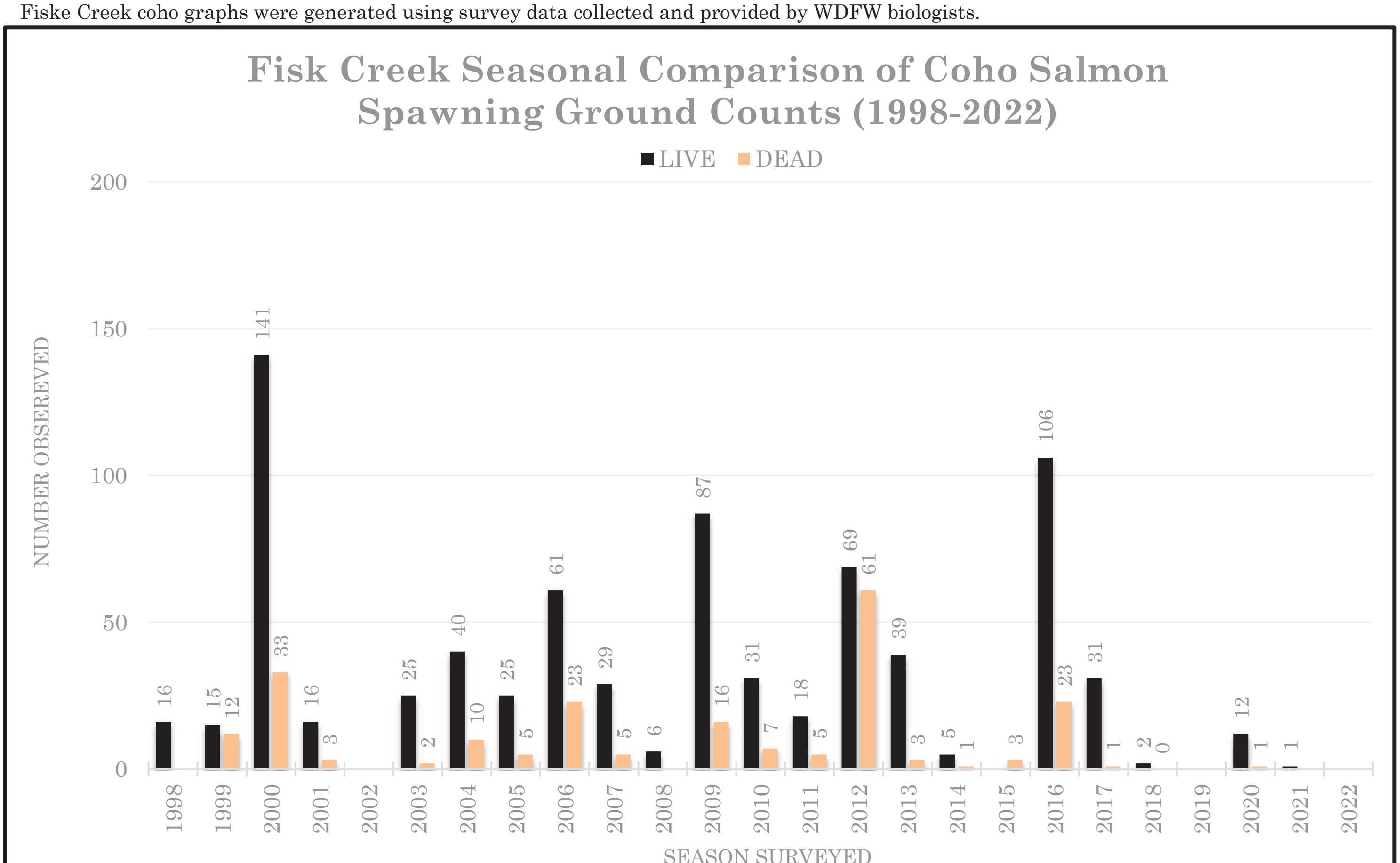
Coho are the only species observed spawning within Fiske Creek in significant numbers, although those numbers are relatively low. In the past, steelhead, pink and chum have been documented spawning in the creek as well. Unfortunately, seasonal flows within Fiske Creek can be insufficient to allow access for Chinook or steelhead to spawn. Furthermore, the streams location in the watershed, nearly 27 miles from Commencement Bay, make is less than ideal for chum. Bull trout are known to utilize the mainstem river; however, it's currently unknown what bull trout utilization is, if any, within Fiske.

Fiske Creek is a small stream flowing just over 2 miles, with a small unnamed tributary entering its right bank at RM 1.0. The upper headwaters reach is primarily cascades/step pool, with a substrate consisting primarily of large cobble and boulders. The lower reach of the creek consists of a low to moderate gradient pool-riffle channel with moderate riparian cover from the surrounding conifer and deciduous forest. Relatively abundant spawning gravel exists throughout most of the stream, but is somewhat compacted in the lower portion of the channel

There are several limiting factors affecting fish and habitat within Fiske. The creek channel is confined due to natural channel cutting, steep banks *(erosion)* and rip-rapped banks. Along the road and within the boundaries of private property, the channel is slightly incised and lacks any real complexity or off-channel habitat such as wetlands, side channels, or large woody debris. Moderate amounts of residential and other land use development exist along the creek, including private forest management. Land use along the lower reach consists mostly of private family residences and a county road (*Brooks Road*) which often traverses the creek. In addition, water is regularly diverted from the creek into a private pond on the lower reach. The creek passes through a couple of small, yet fish passable culverts, as well as a low narrow bridge located approximately 0.3 miles up from its mouth. Several years ago, some complexity was added to the creek via a small restoration project which included the placement of small sill logs and boulders. However, tremendous improvements are still possible to stream channel habitat and instream flows.



Fiske Creek coho graphs were generated using survey data collected and provided by WDFW biologists.



Fiske Creek coho graphs were generated using survey data collected and provided by WDFW biologists.

FOX CREEK

WRIA 10.0608

Lower Fox Creek

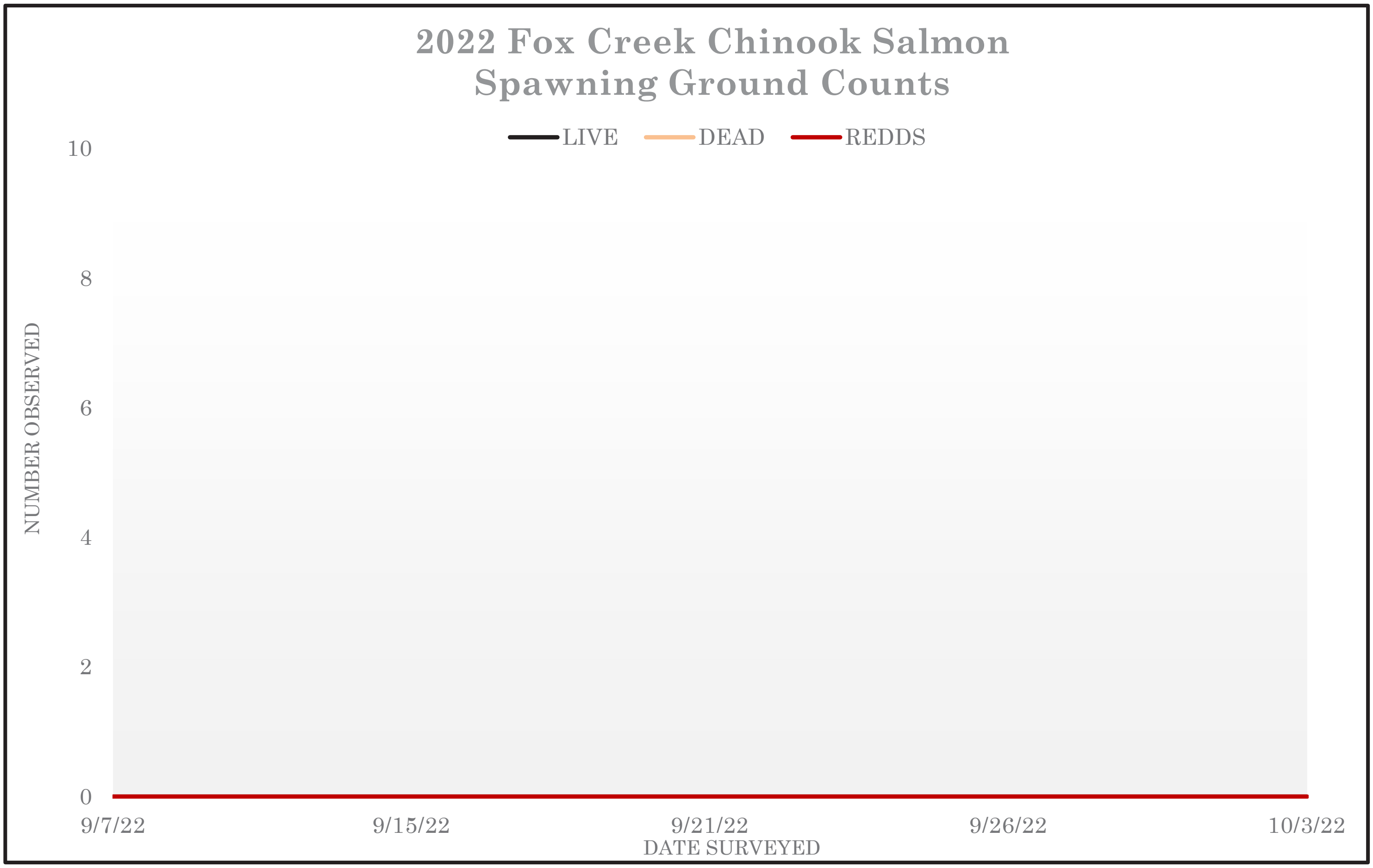
Fox Creek joins the Puyallup River at RM 29.5. Fox Creek is primarily a coho stream *(above)*, with fish likely ascending as far up as the 6 Road; however, the majority of spawning occurs within the first mile of the creek. Other species observed spawning in Fox include Chinook, steelhead and chum. Fox Creek flows within the Kapowsin tree farm (*Manulife*); where roads and timber harvesting have impacted several portions of the stream in the past. The most suitable spawning habitat exists from the mouth, up to the Road 1 Bridge.

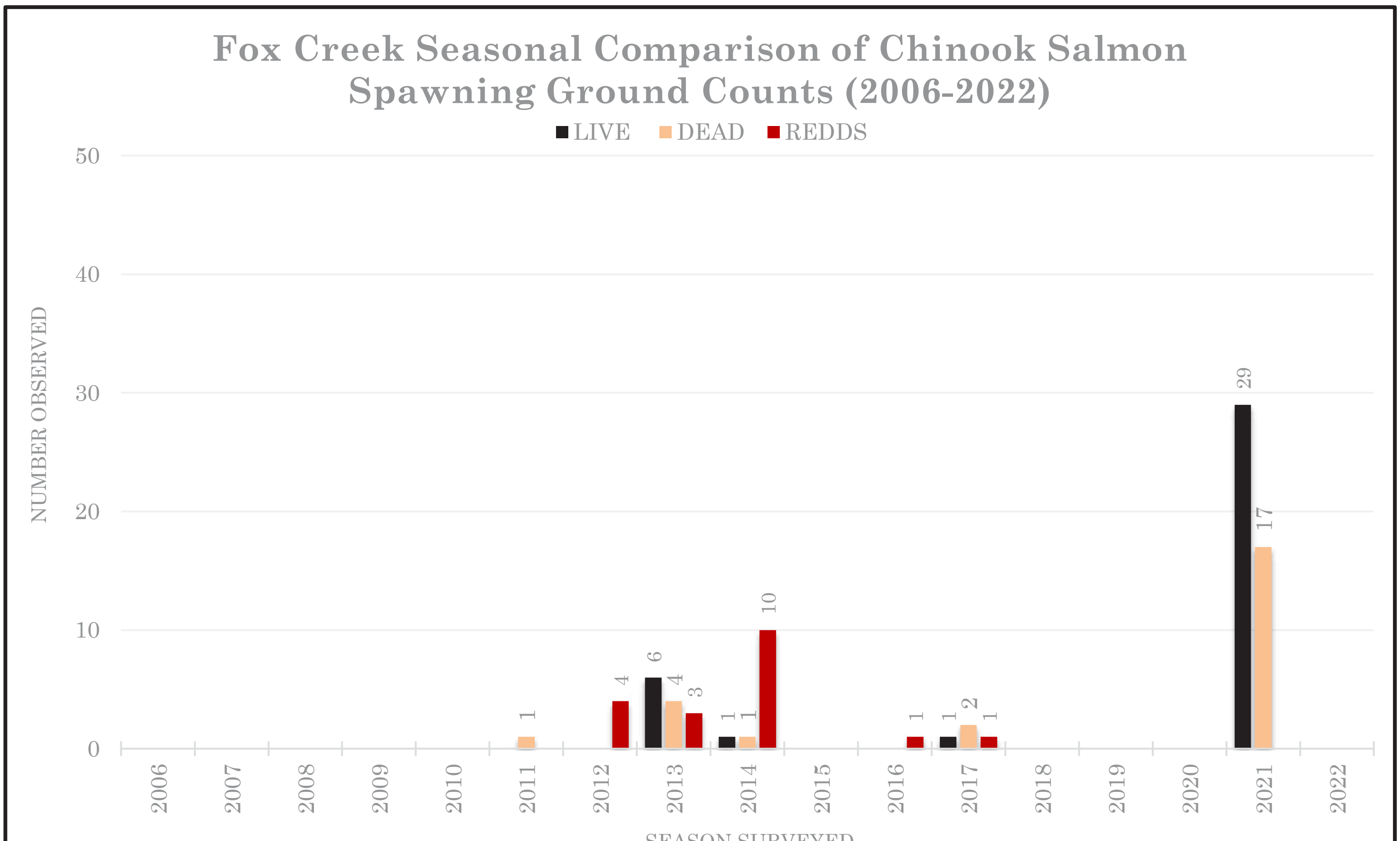
Extensive sampling of coho carcasses for coded wire tags and fin clips has revealed that many of the spawners in Fox are Voights Creek hatchery origin fish. As juveniles, these fish were relocated from Voights Creek hatchery to acclimation ponds in the upper Puyallup River (*Cowskull and Rushingwater*) or Lake Kapowsin. Each spring, as many as 200,000+ coho yearlings are imprinted and released from the acclimation ponds, or are planted directly into the lake. All fish are marked with an adipose fin clip and approximately half are implanted with a coded wire tag, in addition to an adipose fin clip.

From its confluence with the Puyallup River, to approximately RM 0.3, Fox is a low gradient pool-riffle stream flowing through a moderately dense forested area consisting mostly of alders. There's abundant spawning habitat available throughout the lower 1 mile reach. Spawning activity by pink, coho, chum and steelhead have been observed within this lower reach. Beyond this, from RM 0.3 to 0.5 the creek meanders through a grassy area with little riparian cover and moderate amounts of fine materials obscuring the gravelly substrate. The channel is relatively narrow and incised, yet coho spawning is prolific throughout the entire segment. This "middle reach" often has the highest spawning densities. Beyond RM 0.5, Fox becomes a moderate gradient step-pool/riffle stream with good pool frequency, along with adequate small conifer and hardwood riparian cover. There are few mature conifers in this reach, although many young Grand firs were planted as a part of a past restoration project. Bear and otter predation is also extremely heavy along the spawning reach of the creek

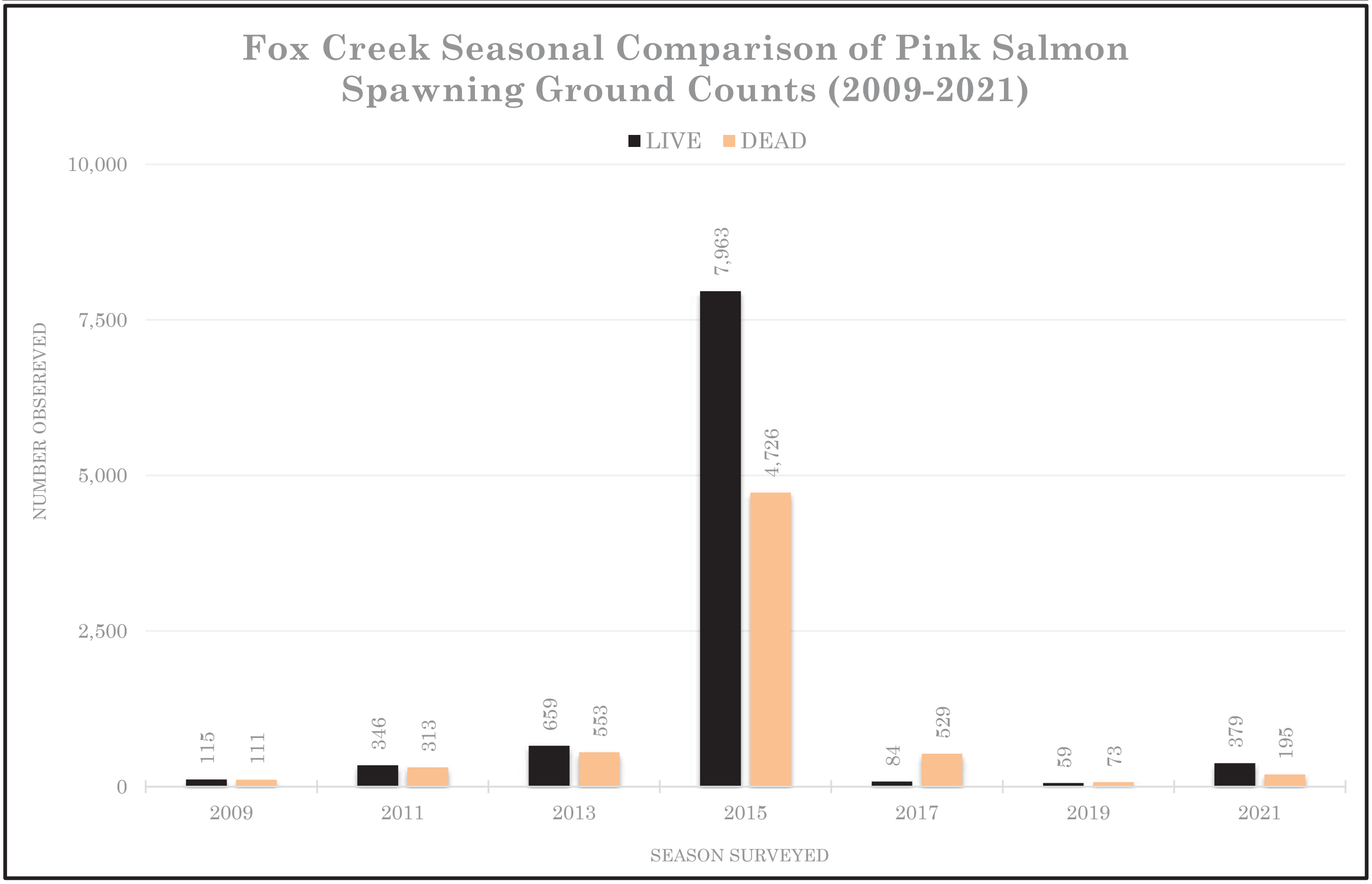
A substantial amount of beaver (*Castor canadensis*) activity exists throughout Fox Creek *(center image)*. Beaver dams, some up to six feet in height, often completely block and prevent fish from migrating upstream. Dams located along the lower mile of the creek are often breached during the beginning of the coho season to allow fish access to the spawning habitat above. Currently, the lower reach of the creek *(RM 0-0.15)* is a low gradient channel flowing within the open channel migration zone of the Puyallup River; a section repeatedly manipulated by mainstem river incursions.

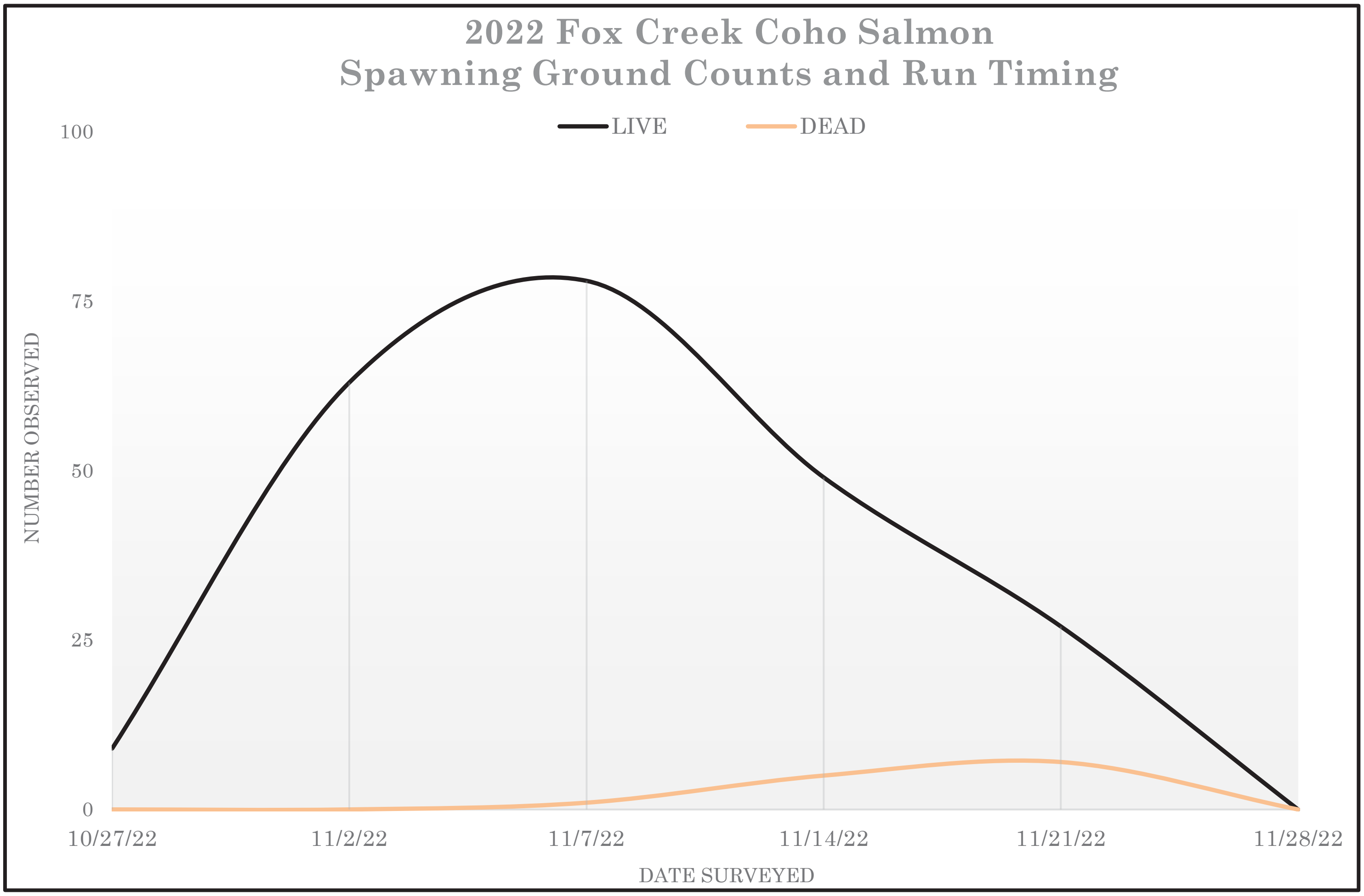
Coho spawning in Fox Creek.

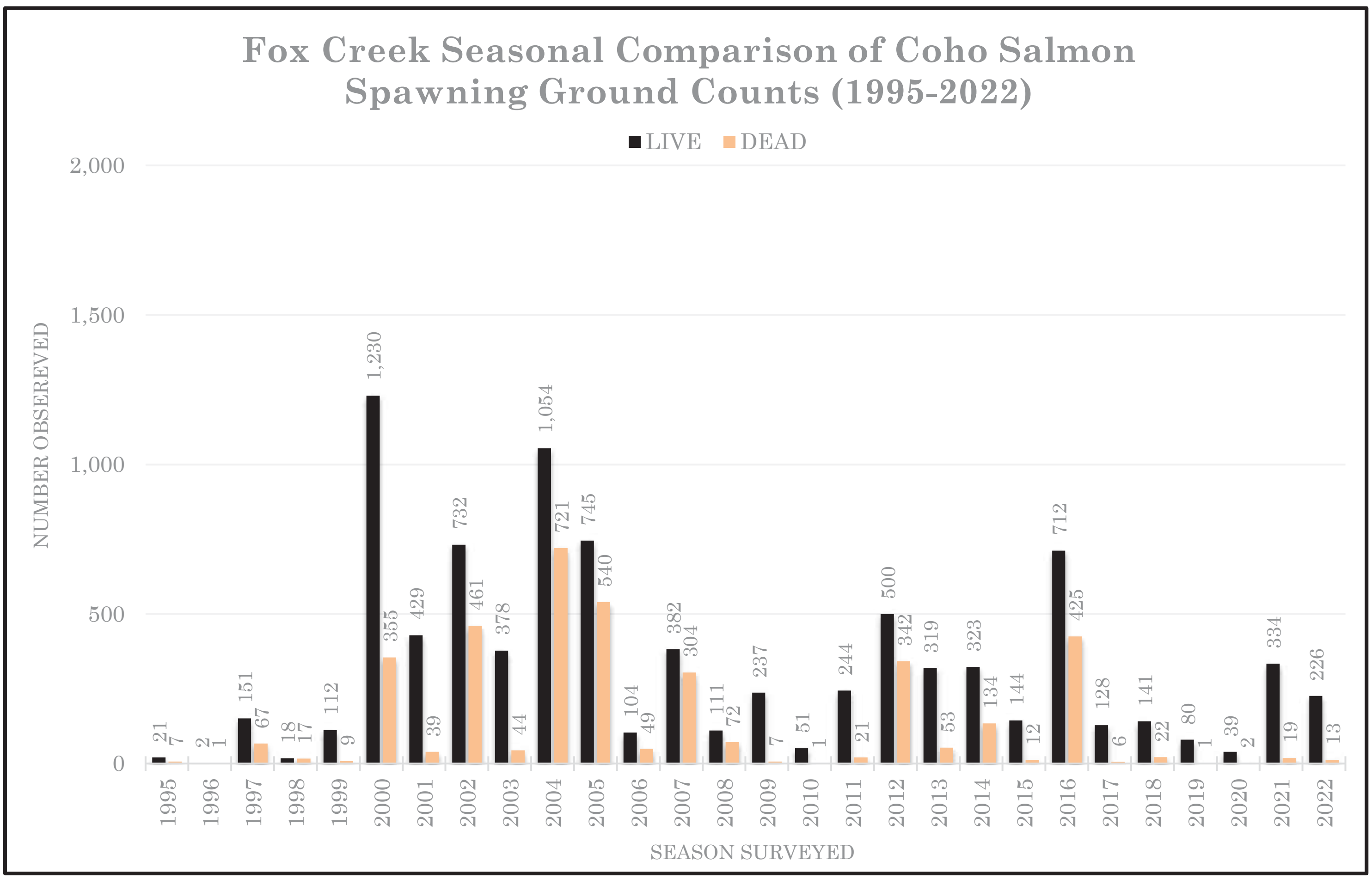




Adult Chinook escapement is determined by expanding the number of redds observed by 2.5 fish per redd (Smith and Castle, 1994). Due to the tremendous volume of pink salmon during odd years, the success of determining Chinook redds from pinks is vastly reduced. Therefore, The AUC method is used to determine escapement during pink runs (odd years).


Fox Creek Seasonal Comparison of Pink Salmon Spawning Ground Counts (2009-2021)
LIVE
DEAD
10,000
7,500
5,000
2,500
0
NUMBER OBSEREVED
115
111
346
313
659
553
7,963
4,726
84
529
59
73
379
195
2009
2011
2013
2015
2017
2019
2021
SEASON SURVEYED


2022 Fox Creek Coho Salmon
Spawning Ground Counts and Run Timing
LIVE
DEAD
100
75
50
25
0
NUMBER OBSERVED
10/27/22
11/2/22
11/7/22
11/14/22
11/21/22
11/28/22
DATE SURVEYED


Fox Creek Seasonal Comparison of Coho Salmon
Spawning Ground Counts (1995-2022)
LIVE
DEAD
2,000
1,500
1,000
500
0
NUMBER OBSEREVED
21
7
2
1
151
67
18
17
112
9
1,230
355
429
39
732
461
378
44
1,054
721
745
540
104
49
382
304
111
72
237
7
51
1
244
21
500
342
319
53
323
134
144
12
712
425
128
6
141
22
80
1
39
2
334
19
226
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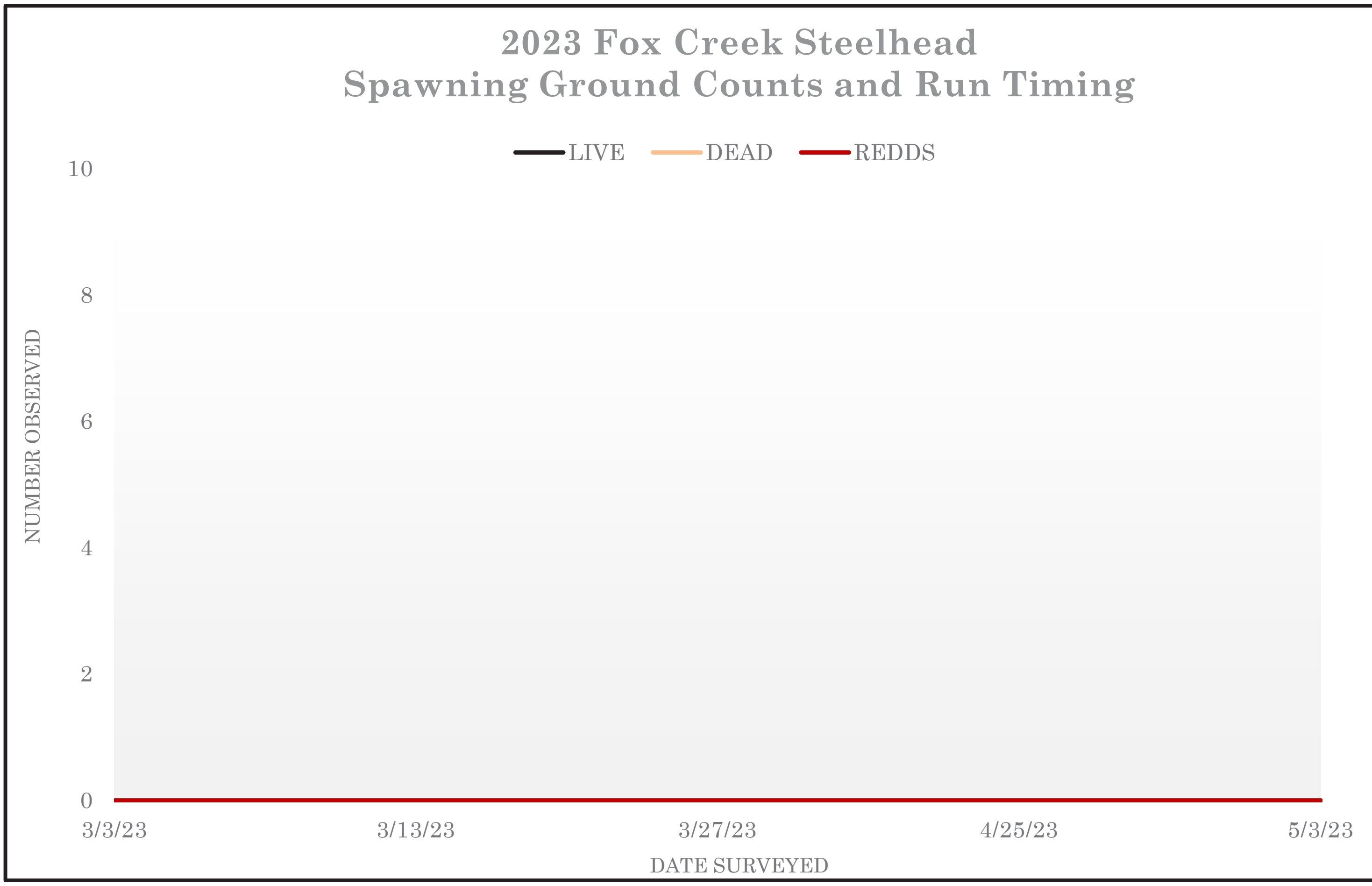
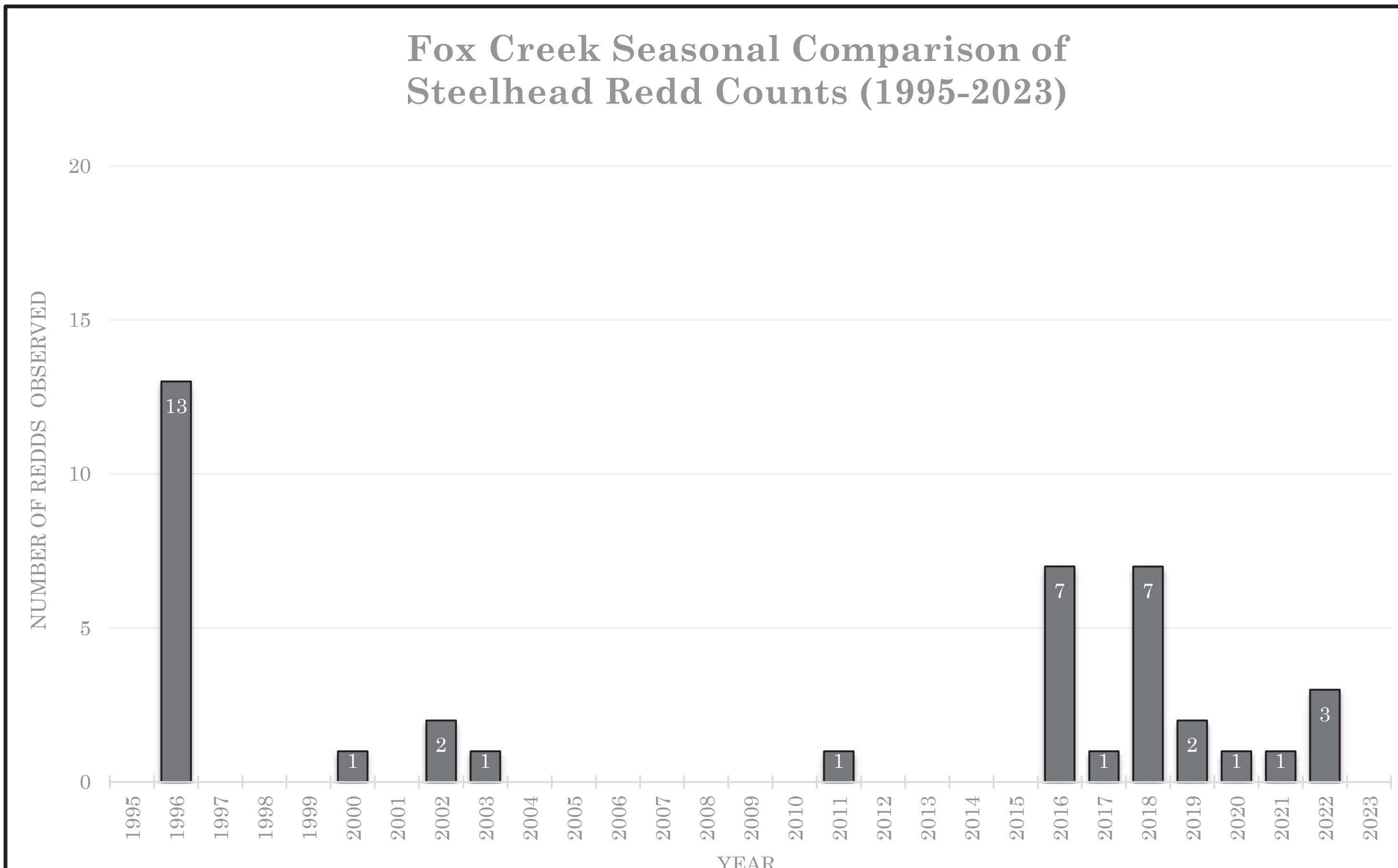
2020
2021
2022
SEASON SURVEYED





To determine the total escapement for steelhead, each redd is multiplied by a factor of 1.62 *(i.e. 42 redds x 1.62 steelhead per redd = total escapement of 68 steelhead).* See steelhead redd location map in appendix C.

FRYINGPAN CREEK

WRIA 10.0369

Fryingpan Creek is a moderate sized right bank tributary to the Upper White River. This headwaters creek is surveyed for bull trout from early September-to-mid October However, steelhead are quite capable of ascending to this headwater tributary to spawn; therefore, this should not preclude the possibility of steelhead utilization within this stream. Fryingpan does host a population of resident cutthroat and bull trout *(below)*, and provides excellent rearing and spawning habitat for these two species.

Fryingpan enters the White River north of Sunrise Park Road at approximately RM 70.5. Fryingpan provides approximately 1.7 miles of anadromous usage. A falls *(following page)* located at approximately RM 1.7 blocks any further upstream migration. The creek is almost entirely bordered by an old growth coniferous forest, and the water is cooled year round by glacial melt water from Fryingpan Glacier. In addition to the glacial influenced mainstem flow, there are several smaller non-glacial tributaries contributing flow along Fryingpan's nearly 4.7 mile length.

Typical of headwater streams, substrate bedding consists mainly of Tertiary sedimentary rock and other products created by ancient volcanic activity. Substrate size within active river channels is typically large; consisting primarily of large gravels, cobble and boulders. Significant quantities of LWD are present within the channel migration zone; however, a considerable amount of the larger wood which is deposited during high flow events and settles on the higher bars is detached from, or perched well above active channels during average flow regimes, thereby reducing any habitat creating interactions. The first 1.4 miles of Fryingpan consists of a large active braided channel that is low-to-moderate gradient. Several patches of excellent spawning gravel are available throughout this lower reach of the creek. Considerable amounts of LWD are present in the channel, although a great deal of it doesn't interact with the stream during average seasonal flows. Nevertheless, ample amounts of LWD are embedded in the creek channel creating beneficial fish habitat. In addition to spawning habitat, numerous pools and side channels are located throughout this lower reach; providing excellent rearing habitat for juvenile fish. Wright Creek and an unnamed tributary *(see Winzig Cr. in this report)*, both right bank tributaries located at RM 1.5 and 1.3, provide additional spawning and rearing habitat for bull trout.

From approximately RM 1.4 to the falls, the channel begins to narrow considerably due to the confinement created by steep upper valley walls. The channel assumes a step-pool configuration from this point on. Throughout this final reach of fish utilization, spawning opportunities are reduced due to the increased gradient, predominately larger substrate and rapid flows encountered. Bull trout have been documented ascending as far as the base of the falls.

Resident bull trout reside in smaller headwater tributaries, while fluvial bull trout frequently travel long distances; utilizing the mainstem rivers and larger tributaries to forage and overwinter.

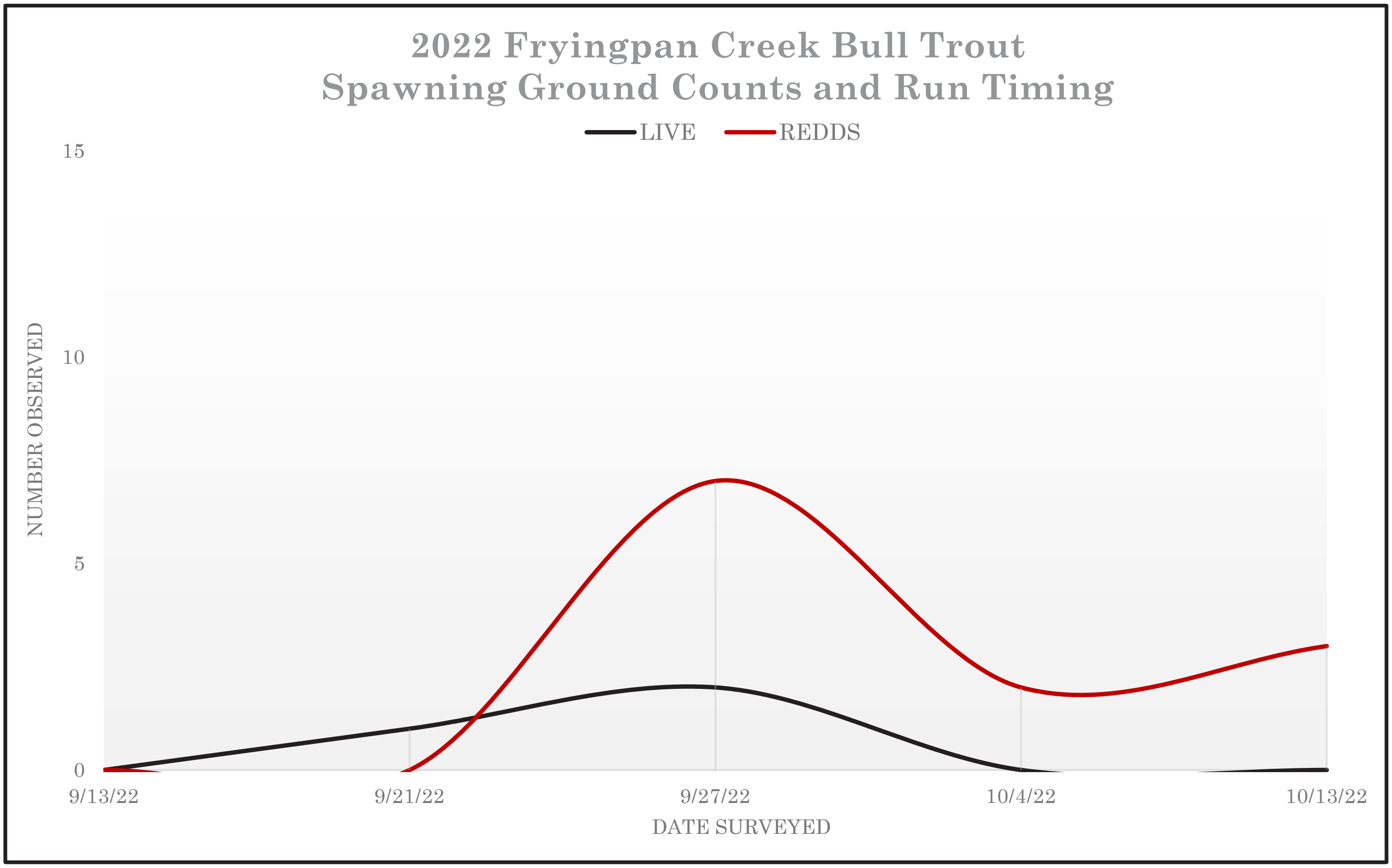
During the fall, migratory forms of bull trout journey from spawning and foraging habitats in the upper watershed to foraging and overwintering habitats located lower in the river system. Beginning in spring and early summer, they begin the return journey back to spawning and rearing areas high in the watershed. In response to changing habitat and reproductive needs, migratory bull trout in the White River travel up to 75 miles or more between the lower river and headwaters located in or near Mt. Rainier N.P. To accomplish this, bull trout require unobstructed migration corridors and connectivity of streams and rivers in order to provide them with access to spawning, rearing, foraging, and overwintering habitats.


Fryingpan Creek falls.

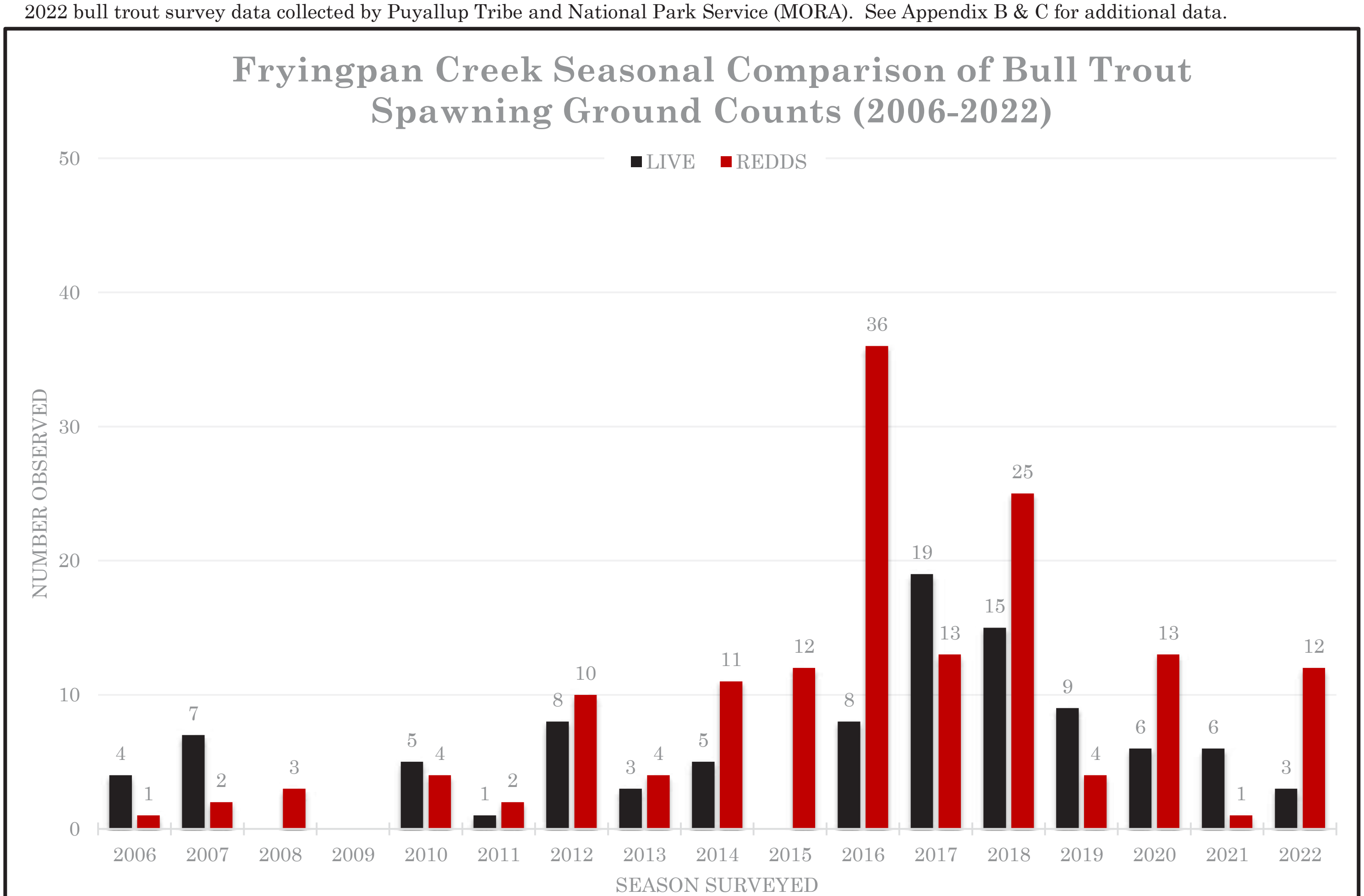
Bull trout spawning occurs primarily during the month of September, however, spawning has been observed taking place from the last week of August through the second week of October. Due to the vastness of the park and the significant number of streams supporting bull trout spawning, the Puyallup Tribal Fisheries staff and National Park Service collaborate on conducting bull trout surveys within the Park. Bull trout are iteroparous *(ability to spawn more than once)*; therefore, recovering preor-post spawn mortalities for examination is extremely rare. Spawners in the upper White River tributaries are observed utilizing various sized substrate from small gravels to small cobble. Redds are often constructed in the tail-out of pools and along the channel margins. Embryonic development is slow *(depending on water temperatures)*; it may take between 165-235 days for eggs to hatch and for alevin to absorb their yolk (Pratt 1992). Bull trout fry emerge in late winter and early spring. Young fry can often be seen by mid-March foraging in the lateral habitat along the upper mainstem White River and associate tributaries.

Bull trout habitat throughout the Puyallup and White rivers has been severely impacted by over a century of land and water resource exploitation; including, damming and substantial water diversions, considerable riparian alterations *(deforestation)*, dewatering and low instream flow regimes, as well as significant channel manipulation. These impacts have lead to a marked deterioration in land and hydrological behavior within these river systems by causing water flow of poorer quality, quantity and timing. Several limiting factors are involved with regards to the healthy function of stream habitat and bull trout populations in the watershed; including lost or diminished habitat connectivity and migration corridors, fragmentation and reduction of habitat quality *(entrainment, transportation networks, forest management practices and operations, direct water withdrawal)*. In addition, water quality, fish entrainment and entrapment, unknown species interactions, and potential climate change impacts.

Bull trout are primarily piscivorous [pi-siv-er-uh s] *(fish eaters)*. However, they are extremely opportunistic feeders, feeding on a variety of prey items depending on their particular life history strategy and stage of development. Adults feed almost exclusively on other fish, including a range of salmon and trout species; as well as other resident fish species. Juveniles feed on aquatic invertebrates, including stoneflies *(Plecoptera)*, caddisflies *(Trichoptera)*, and mayflies *(Ephemeroptera)*. Bull trout require a healthy aquatic environment in order to survive and flourish. Furthermore, they need an environment that provides the necessary prey base; in addition to the rearing and reproductive habitat essential to ensure their continued survival and reproductive success.



2022 bull trout survey data collected by Puyallup Tribe and National Park Service (MORA). See Appendix B & C for additional data.



GREENWATER RIVER

WRIA 10.0122

The Greenwater River is a right bank tributary to the upper mainstem White River. The Greenwater originates in the Norse Peaks Wilderness area on Castle Mountain and flows westerly until it converges with the White River (*RM 46*) near the small town of Greenwater. The Greenwater basin drains an area over 73 square miles with an average water discharge of 210 cfs (*USGS gauge #12097500*). Several significant tributaries contribute flow along the Greenwater River's 21 mile course including Pyramid; Lost; Maggie; Slide; Midnight and Twentyeight Mile creeks. Historically, the Greenwater River has supported ESA listed Spring Chinook *(1999 listing)* and steelhead (*2007 listing*). In addition to Chinook and steelhead, the Greenwater supports large runs of pink and coho salmon. Other species present include bull trout *(1999 ESA listing)*, rainbow and cutthroat. Traditionally, the Greenwater Basin has also supported a substantial amount of recreational use, which has had its impacts on fish and wildlife.

The Greenwater is a modest sized, low gradient pool-riffle stream with abundant high quality spawning gravel. Much of the river flows through U.S. Forest Service land and the riparian zone consists primarily of second growth conifers, and hardwoods. Forestry operations along the river, primarily timber harvesting and road construction, have negatively impacted portions of the stream. Only limited amounts of LWD exist in the channel, and the average size reflects the surrounding young forest and is therefore generally small in nature. Unfortunately, large key pieces of timber are located too far from the river channel; thus, the need for additional ELJ projects.

The Greenwater has been surveyed in the past for both Chinook and steelhead by the Washington Department of Fish and Wildlife; however, surveys are not conducted for coho. As with all upper White River surveys; adult salmon and steelhead that spawn in the Greenwater River were captured at the USACE fish trap in Buckley, and transported above Mud Mountain dam. Since precise escapement numbers for the upper White River drainage are known, surveys are conducted to determine fish distribution and spawning success. The Upper White River coho escapement is derived from counts made at the Army Corps of Engineers' Buckley trap.

Acclimation pond on George Creek.

In the spring of 2007, the Puyallup Tribe transported 223,740 juvenile Spring Chinook from WDFW's Minter Creek facility, to the Greenwater River. These fish were planted directly into the creek since there was no acclimation pond available on the Greenwater prior to 2007. To address this issue, a Spring Chinook acclimation pond was completed in the summer of 2007, near George Creek (*center image*). Capable of holding over 500,000 Spring Chinook; the construction of the acclimation pond was funded by the City of Tacoma as a result of a mitigation settlement. Design engineering was funded by the Pacific Coast Salmon

Recovery Fund (*PCSRF*). The Twentyeight Mile Creek acclimation pond was completed in 2015 *(below)*. The bulk of the funding for Twentyeight Mile *($385,685)* was provided from two sources including the NRDA trustees as partial mitigation to the PSE Crystal Mountain/ Silver Creek oil spill of November, 2006 and an EPA Puget Sound Restoration and Protection grant for $112,450. Project coordination, permitting and planning time by tribal staff was paid for using Cascade Water Alliance funding.

Watershed Fish Enhancement Project: The Puyallup Tribe operates up to several acclimation ponds in the Puyallup/White River Watershed designed to reestablish and enhance Spring/Fall Chinook and coho stocks. Each of two acclimation ponds *(Cowskull & Rushingwater)* on the Puyallup would receive as many as 100K+ hatchery origin spring/Fall Chinook and/or coho *(depending on*

Twentyeight Mile Creek aclimation pond.

availability). The additional acclimation ponds located in the Upper White River drainage *(Huckleberry Cr., Greenwater River (George Cr.), Twentyeight Mile Cr. (Greenwater R.) & Jensen Cr. (Clearwater R.)* can be planted collectively with up to 900K+ White River Spring Chinook. When obtainable, the Puyallup Tribe will collect, haul and plant surplus adult hatchery Fall Chinook and coho from WDFW's Voights Creek hatchery to spawn naturally in minor spawning or underutilized areas. When available, the Puyallup Tribe will in-stream plant juvenile hatchery Fall Chinook and chum smolts from the Tribe's Clarks and Diru Creek hatchery facilities to underutilized habitat areas.

Goals, Purpose and Expected Benefits: One of the Puyallup Tribe's most significant restoration goals is to rebuild depressed Chinook and steelhead stocks and remove them from ESA listing. Acclimation ponds, juvenile in-stream plants and adult surplus fish plants are a proven method for increasing fish stocks, and are key components to restoration goals.

Purpose:

- Produce Spring/Fall Chinook and coho for the Puyallup/White River salmon conservation and harvest programs.
- Establish a total annual return of Spring Chinook Natural Origin Recruits (NORs) that meets the escapement goals for White River Spring Chinook Recovery.
- Provide sustainable harvest for tribal and non-tribal fisheries on Fall Chinook and non-ESA listed coho.
- Optimize hatchery and natural production consistent with the conservation of naturally produced native fish.
- Maintain genetic makeup of Chinook and steelhead populations spawned or reared in captivity.

Benefits:

- Reestablish and enhance ESA listed Spring/Fall Chinook and steelhead; as well as non-listed coho into their endemic ranges.
- Increased total abundance of the composite natural/hatchery population.
- Increased spawning ground escapement and trend of Natural Origin Recruits (NORs).
- Improve distribution *(out planting of live fish)* of salmon to minor spawning and underutilized rearing habitat areas.
- Provide future tribal and sport harvest opportunities.
- Nutrient enhancement in oligotrophic *(nutrient-poor)* streams.

In 2011, an extensive floodplain restoration project was completed on the Greenwater River.

The following aptly describes the project that restored a two mile reach along the lower river.

Greenwater River Floodplain Restoration Project

Written by: Kristin Williamson
-South Puget Sound Salmon Enhancement Group
(Reprinted with Permission)

Project Description

The objective of the Greenwater River Floodplain Restoration Project is to restore aquatic and riparian habitat within a 2-mile reach of the Greenwater River. The project reach is River Mile 5.0 to 7.0 within the Mount Baker-Snoqualmie National Forest, adjacent to Forest Service Road 70. Restoration is focused on the re-introduction of functional wood and the removal of .8miles/4,500 linear feet of the abandoned Forest Service Road 7000 located within the Greenwater River Floodplain.

Restoration Plan for the Greenwater River Floodplain Restoration Project, including placement of 13 ELJS and removal of nearly 1-mile of abandoned Forest Road from the floodplain

Historically, the Greenwater River was one of the principle spawning and rearing areas in the White River watershed for Spring Chinook, bull trout, steelhead and coho. Based upon the old-growth forest in the Greenwater Valley floor, evident in the 1956 aerial imagegraphs, recruitment of large trees to the floodplain was likely the primary factor maintaining salmon habitat in the River. Early images show the River to be in pristine condition, characterized by sinuous channels with many large, deep pools associated with log jams. Pool habitat is critical for rearing salmon, bull trout, and other resident fishes to provide cool places for forage and refuge from predators.

A legacy of timber harvest altered the Greenwater River between the late 1950s and late 1960s. During this period, the majority of the trees in the Greenwater River were removed from the valley all the way to the banks of the River. These practices effectively stripped the Greenwater River of all instream wood, removed the forest structure from the floodplain, and subsequently increased channel incision, stream velocities, and river bed scour. The current channel is incised with very few pools, little holding and rearing habitat available to salmonids, and almost no functional stream side cover to provide shade, structure, input of nutrients, and recruitment of woody debris.

Given these impacts and the current lack of large woody debris, the young age of the existing stream-side forest, and large volumes of sediment available in the Greenwater River, it could take centuries for the system to return to a river sustained by natural processes. To help reestablish the natural conditions needed to sustain salmon and other species utilizing the system, a restoration plan was developed to rehabilitate the lost processes of wood recruitment, forest canopy, and floodplain connection through strategic placement of Engineered Log Jams (ELJs) and removal of road fill and armor from the floodplain.

Watershed and Aquatic Benefits

Overall, project efforts will increase flood storage within the project reach and reduce downstream peak flows, thereby providing greater stability and balance to the watershed. The proposed log jam structures will accelerate and maintain system-wide natural processes while reducing sediment loading, stabilizing banks for establishment of stream-side forest, and providing habitat for salmon and other fish. The species benefiting from this project include: White River Spring Chinook, Puget Sound steelhead, pink salmon, coho salmon, bull trout, and coastal and resident cutthroat.

Specifically, project efforts will:

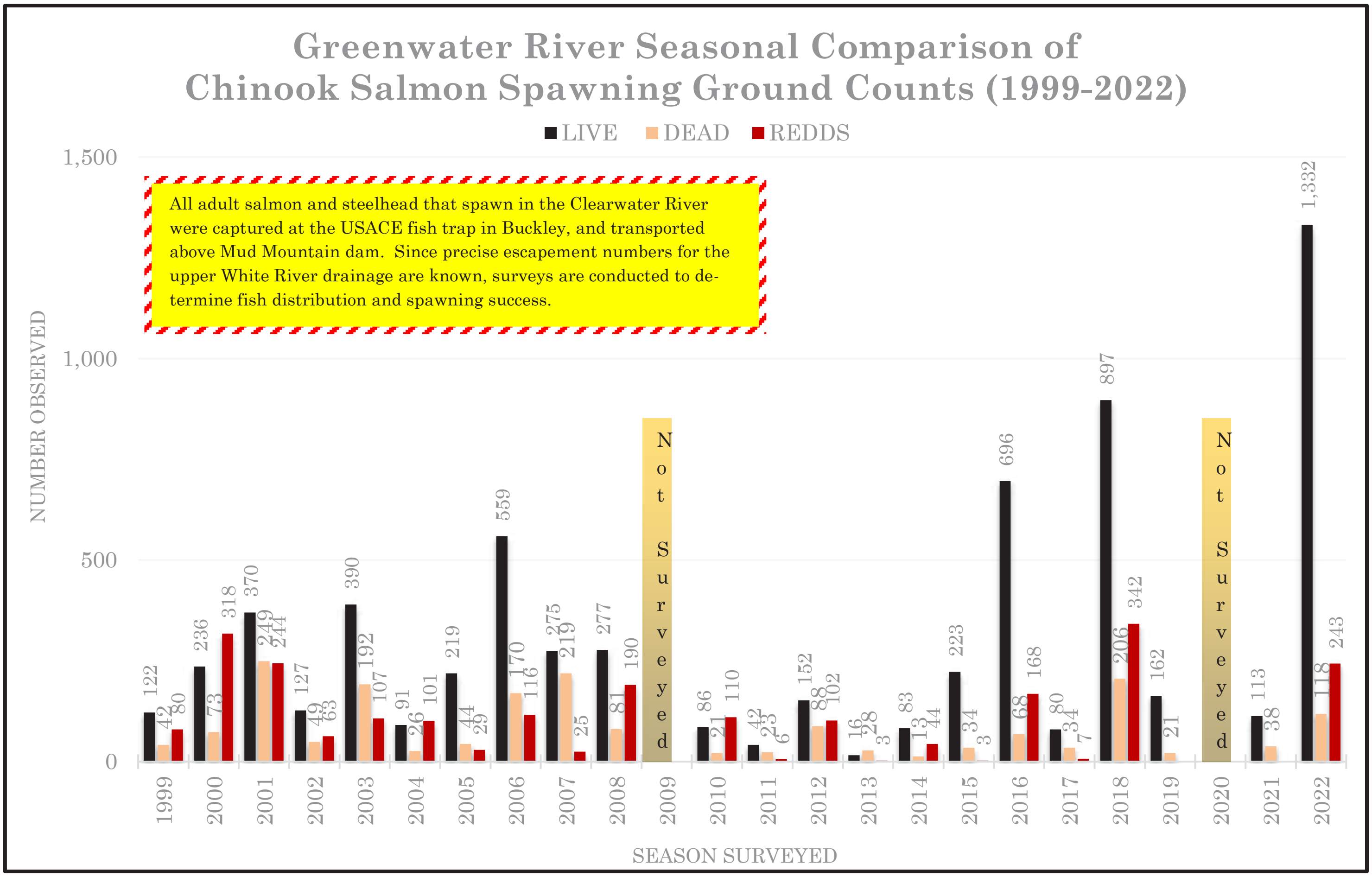
- Create large, persistent structures that will trap mobile wood and sediment
- Reduce erosion and sedimentation sources within the project reach by dampening peak flow velocities
- Aggrade the existing river bed elevation to reconnect stream flows to the floodplain to increase flood storage, and provide back-water, flood refuge for rearing juvenile fish
- Increase side channel rearing capacity and spawning opportunity for juvenile and adult salmon
- Encourage trapping and sorting of spawning gravels within the main stream channel to increase spawning opportunity
- Improve salmon egg retention and survival by reducing scour stress of the river
- Increase the quantity and quality of pools with lots of overhead, woody cover for predator avoidance for juvenile salmon, and for staging of upstream-migrating adult salmon.
- Provide interim, instream structure and stability to allow the Greenwater valley forest to regenerate to a size that will naturally stabilize the River.

Project Partners

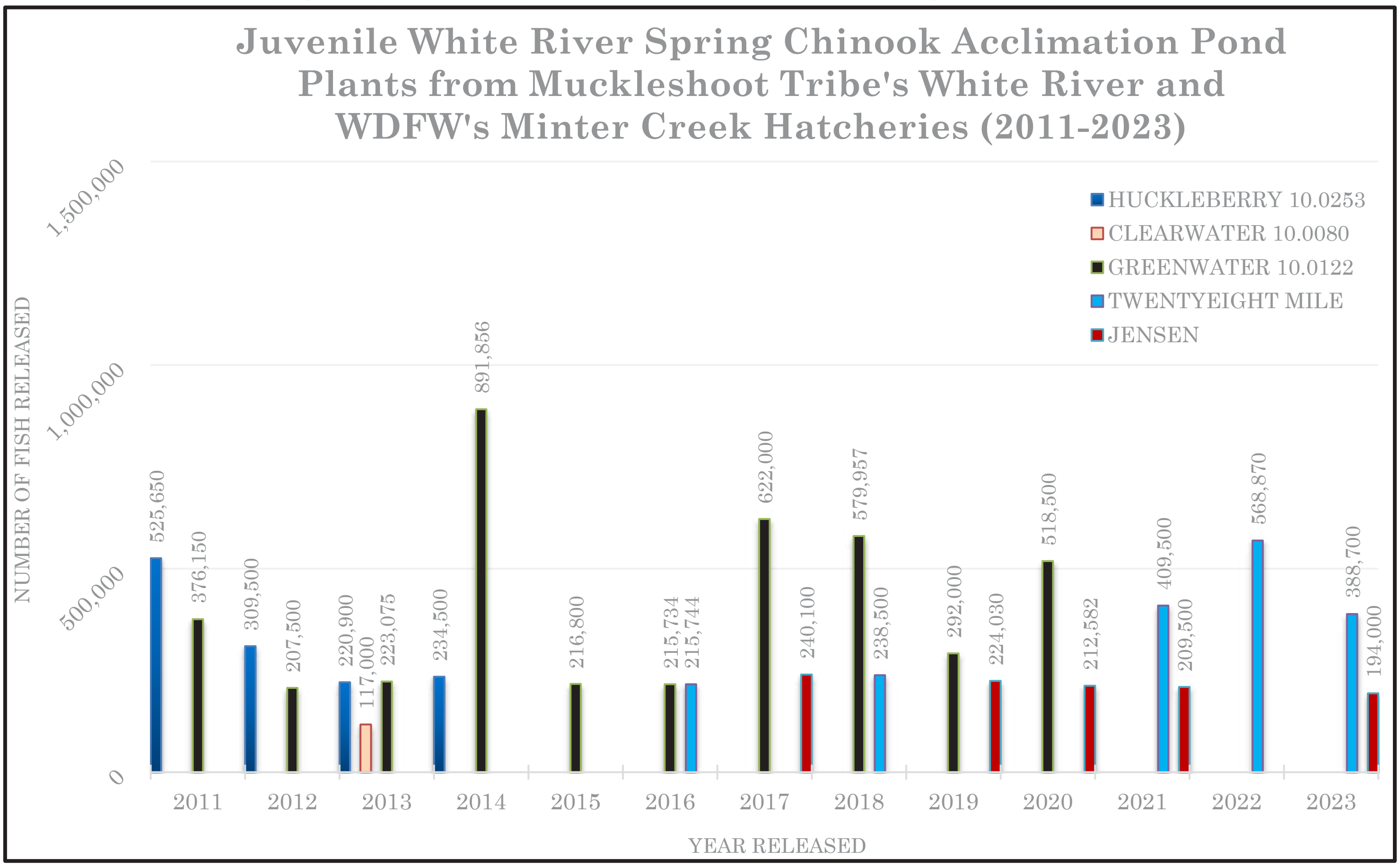
- **Project Managers:** South Puget Sound Salmon Enhancement Group
- **Engineers**: Herrera Environmental Consultants, Cardno ENTRIX, Olympic Region Engineering Cluster
- **Contractors**: RV Associates, McClung Construction, Southworth and Sons
- **Stakeholders**: US Forest Service, Muckleshoot Tribe, Puyallup Tribe, Community of Greenwater
- **Funding Partners**: Salmon Recovery Funding Board, Forest Service, Puyallup Tribe and Puget Sound Partnership, Natural Resource Damage Assessment Trustees, Washington State Department of Transportation.

Funding: Collective funding for the project totaled $1.9million in salmon recovery and mitigation dollars.

Source	Amount
SRFB/RCO 06-2223	485,000
SRFB/RCO 07-1867	590,000
Forest Service RAC Grant	10,300
EPA/PSP-Puyallup Tribe	101,300
Donated Wood, Forest Service and USACE	145,100
WSDOT Mitigation	287,000
NRDA Funds-PSE Spill	313,000
Total Funding	**$1,931,700**



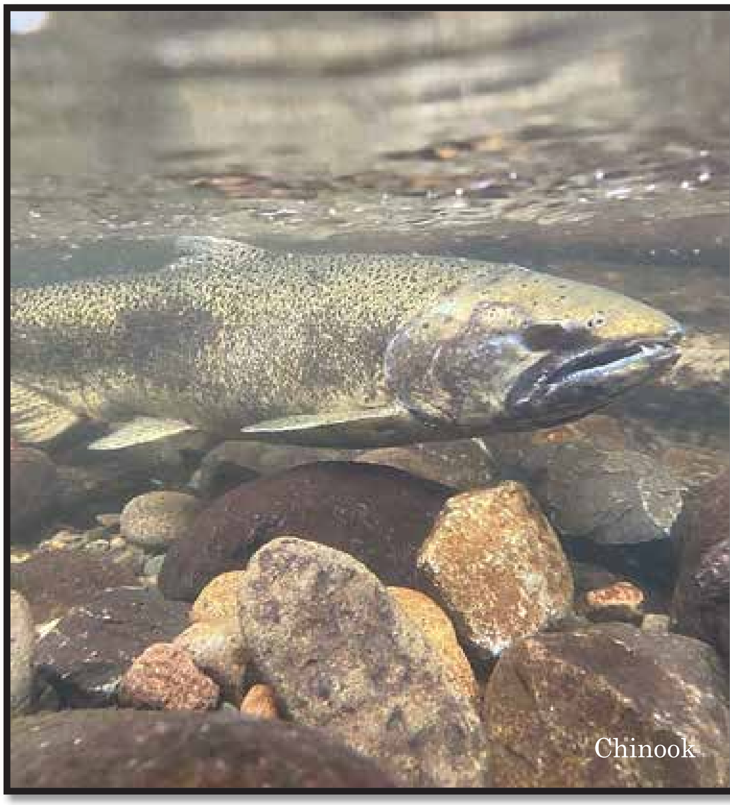
Greenwater River Chinook graph was generated using survey data collected by WDFW & Puyallup Tribe biologists.



Acclimation ponds opperated by Puyallup Tribe. See map of acclimation pond location sites on Page 49. No data indicates no fish were planted.

HUCKLEBERRY CREEK

WRIA 10.0253


Chinook

Huckleberry Creek is a tributary to the Upper White River. The creek originates from the Huckleberry basin along the North Slope of Mt. Rainier and is non-glacial. The creek flows through the National Park and Snoqualmie National Forest lands before meeting the West Fork of the White at RM 53.1. The lower 0.5 miles consists of a low gradient, occasionally braided channel with a large side channel complex breaking off around RM 0.3. The surrounding riparian is a mixture of conifers and deciduous trees. The spawning gravel is excellent in the first half mile reach, which consistently supports the highest densities of Spring Chinook and coho spawners each season; as well as, a significant escapement of pinks on odd years. Steelhead usage has also been documented in Huckleberry; however, steelhead surveys have not been conducted for several years. Bull trout presence has been documented; however, the extent of utilization is unknown. The gradient increases slightly From RM 0.5 to 1.5, but the gravel quality remains excellent, although slightly larger and patchy in nature. The riparian corridor consists of old growth conifers upstream of the acclimation pond at RM 0.5, offering excellent LWD recruitment. In-stream LWD is moderate throughout the entire creek, creating several logjams, as well as free and fixed channel spanning structures.

As with all upper White River tributaries, adult salmon and steelhead that spawn in Huckleberry Creek were captured at the USACE fish trap in Buckley, then transported and released approximately 4 miles above Mud Mountain Dam. Since precise adult fish escapement for the upper White River drainage is known, spawning surveys are conducted to determine fish distribution and spawning success. This is important regarding Spring Chinook, since adult production monitoring is part of the recovery plan process.

The Puyallup Tribe currently operates a single acclimation pond used for acclimating Spring Chinook *(upper left)*. Juveniles are planted in March, and released in late May or early June. The Spring Chinook plants are an integral part of the White River Spring Chinook Recovery Plan. The juvenile Spring Chinook originated from the Muckleshoot White River Hatchery and WDFW's hatchery on Minter Creek. Unfortunately, WDFW terminated fish contribution to the Spring Chinook restoration project in 2012. Production levels have been around 400,000 smolts; although, it fluctuates based on available broodstock. They have a production capacity of 837,000 zero age smolts. Between 100,000 to 500,000+ Spring Chinook are transported to the Huckleberry Creek acclimation ponds in early spring, and released in late spring. All fish are mass marked with left or right ventral fin clips. Odd brood years are marked with left ventral clips, and even years with right ventral clips. These fish can later be identified when caught at the USACE fish trap in Buckley and passed above the Mud Mountain dam to spawn.

Watershed Fish Enhancement Project: The Puyallup Tribe operates several acclimation ponds in the Puyallup/White River Watershed designed to reestablish and enhance Spring/Fall Chinook and coho stocks. Each of two acclimation ponds *(Cowskull & Rushingwater)* on the Puyallup would receive as many as 100K+ hatchery origin Spring/Fall Chinook and/or coho. Additional acclimation ponds located in the Upper White River drainage *(Huckleberry Cr., Greenwater River (George Cr.), Twentyeight Mile Cr. (Greenwater R.)& Jensen Cr.(Clearwater R.)* can be planted collectively with up to 900K+ White River Spring Chinook. When available, the Puyallup Tribe will collect, haul and plant surplus adult hatchery Fall Chinook and coho from WDFW's Voights Creek hatchery to spawn naturally in minor spawning or underutilized areas. When available, the Puyallup Tribe will in-stream plant juvenile hatchery Fall Chinook and chum from the Tribe's Clarks and Diru Creek hatchery facilities to underutilized habitat areas.

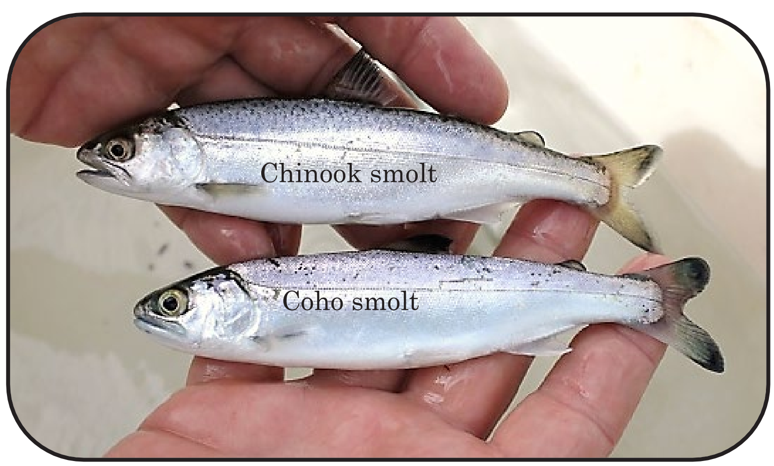
Goals, Purpose and Expected Benefits: One of the Puyallup Tribe's most significant restoration goals is to rebuild depressed Chinook and steelhead stocks and remove them from ESA listing. Acclimation ponds, juvenile in-stream plants and adult surplus fish plants are a proven method for increasing fish stocks, and are key component to restoration goals.

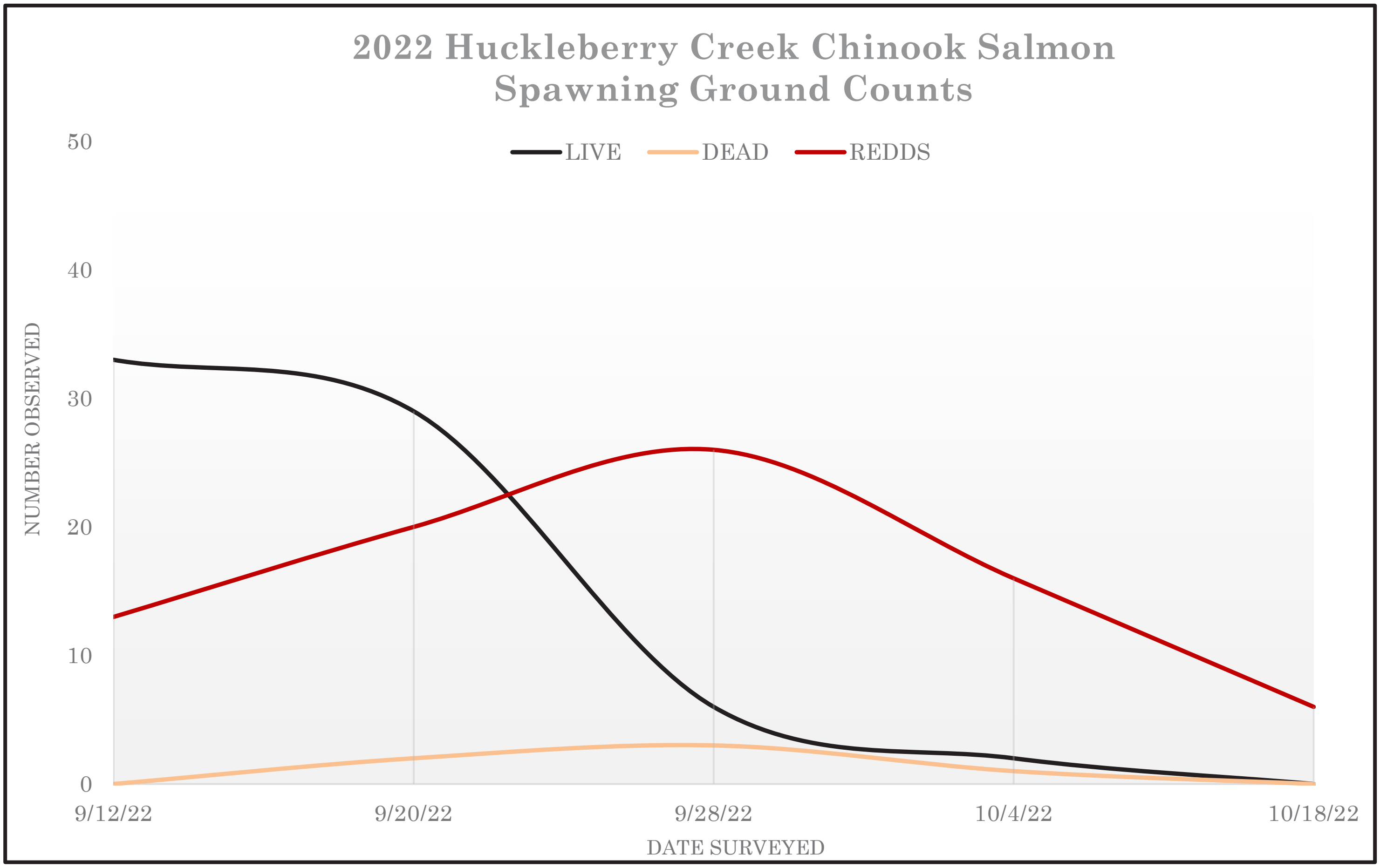
Purpose:

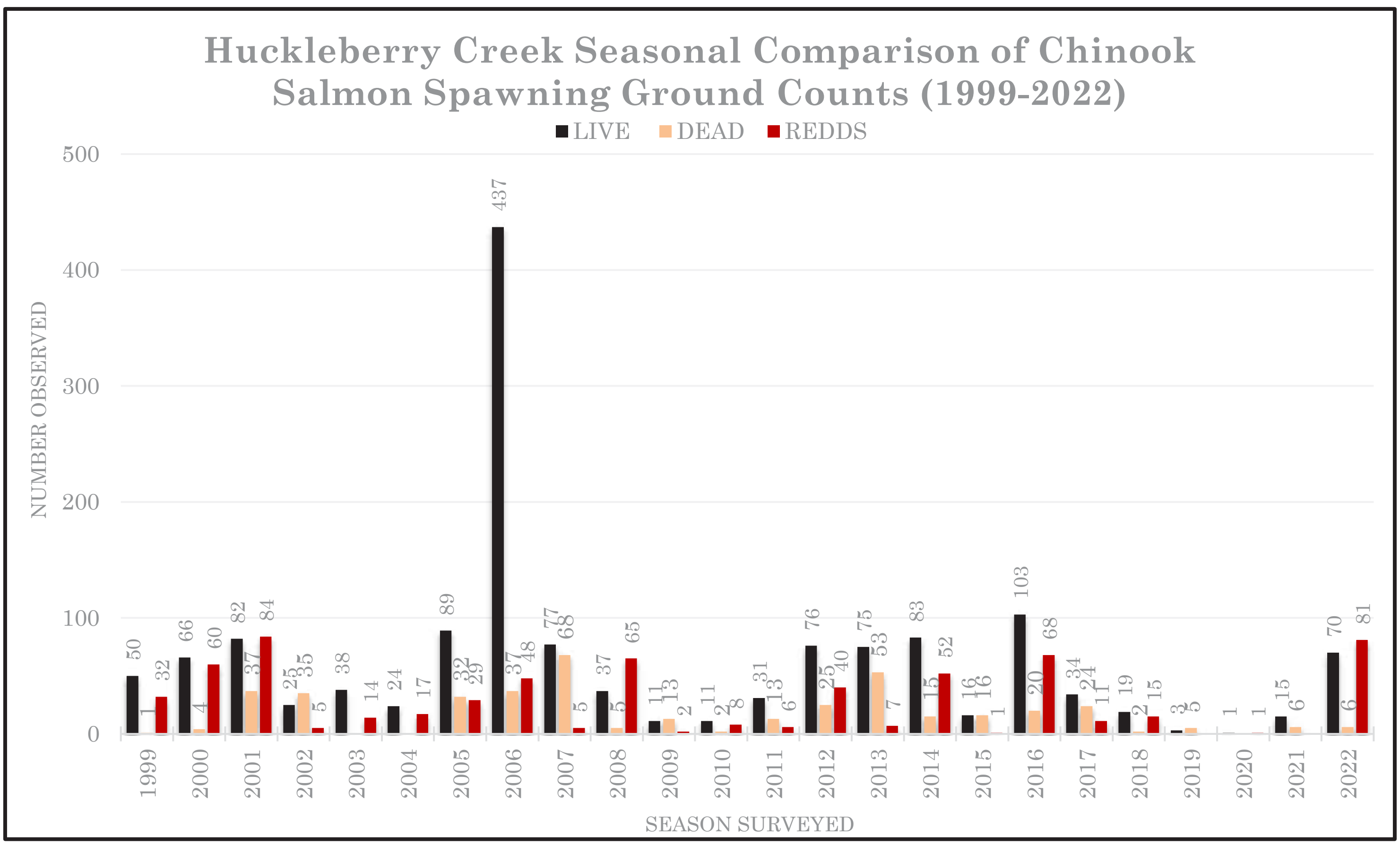
- Produce Spring/Fall Chinook and coho for the Puyallup/White River salmon conservation and harvest programs.
- Establish a total annual return of Spring Chinook Natural Origin Recruits (NORs) that meets the escapement goals for White River Spring Chinook Recovery.
- Provide sustainable harvest for tribal and non-tribal fisheries on Fall Chinook and non ESA listed coho.
- Optimize hatchery and natural production consistent with the conservation of naturally produced native fish.
- Maintain genetic makeup of Chinook and steelhead populations spawned or reared in captivity.

Benefits:

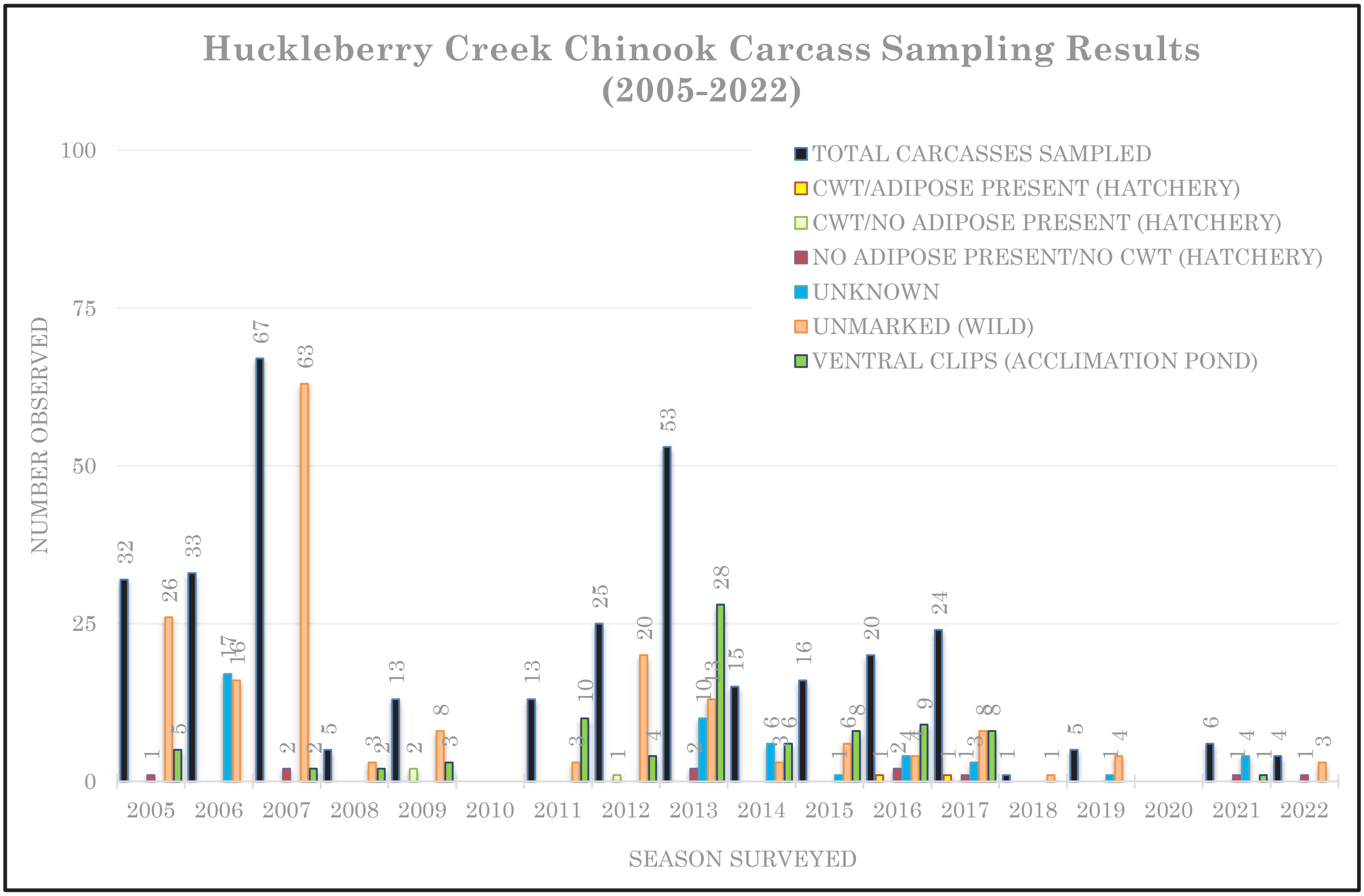
- Reestablish and enhance ESA listed Spring/Fall Chinook, as well as non-listed coho into their endemic ranges.
- Increased total abundance of the composite natural/hatchery population.
- Increased spawning ground escapement and trend of Natural Origin Recruits (NORs).
- Improve distribution *(out planting of live fish)* of salmon to minor spawning and underutilized rearing habitat areas.
- Provide future tribal and sport harvest opportunities.
- Nutrient enhancement in oligotrophic *(nutrient-poor)* streams.

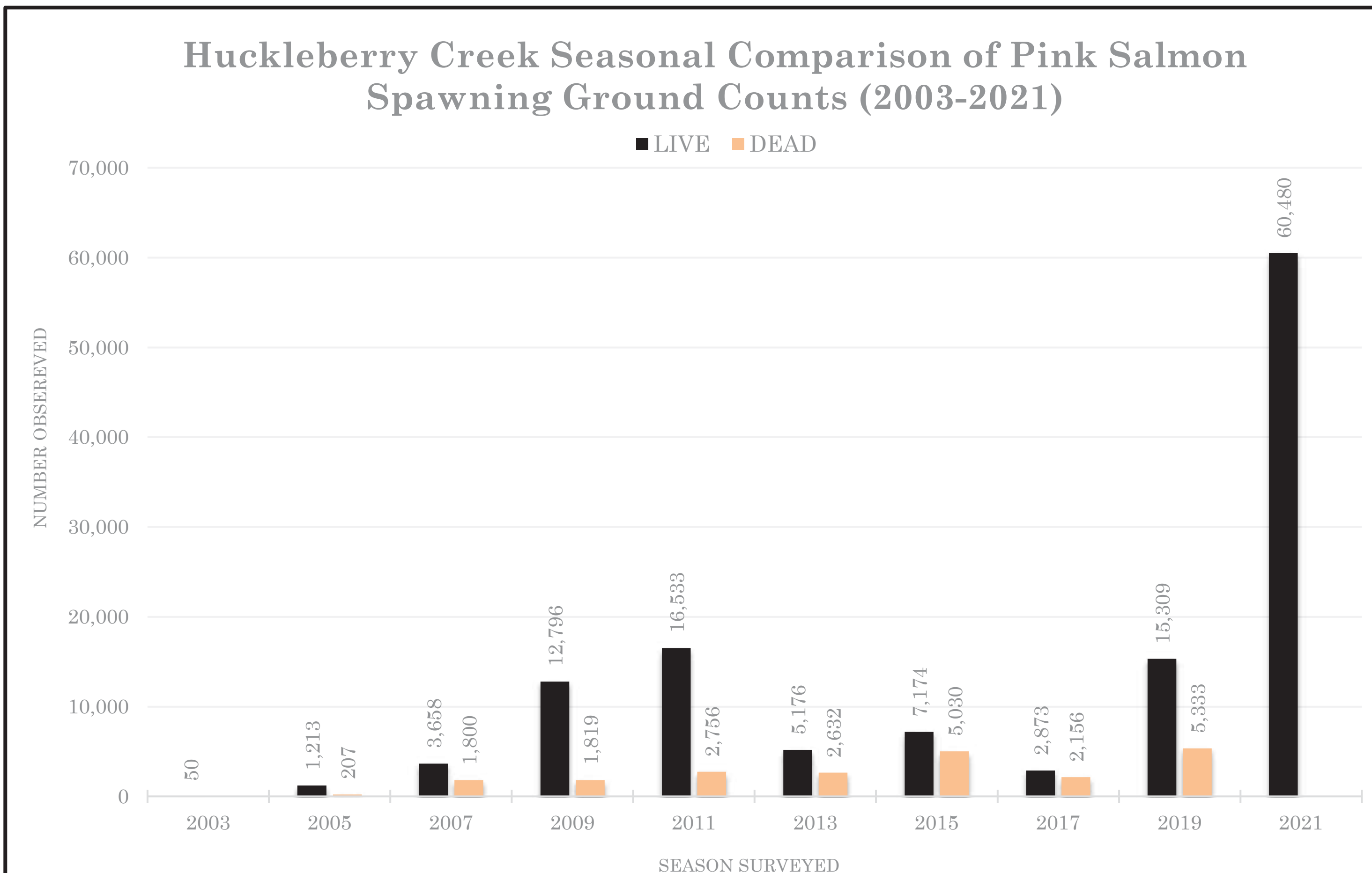






Only one survey was condudcted in 2020 due to fire closure. Upper White River surveys show distribution and timing. Actual escapement totals are known from the USACE trap counts. Adult Chinook escapement is determined by expanding the number of redds observed by 2.5 fish per redd (Smith and Castle, 1994). Due to the tremendous volume of pink salmon during odd years, the success of determining Chinook redds from pinks is vastly reduced. Therefore, The AUC method is used to determine escapement during pink runs (odd years).


Huckleberry Creek Chinook Carcass Sampling Results (2005-2022)
TOTAL CARCASSES SAMPLED
CWT/ADIPOSE PRESENT (HATCHERY)
CWT/NO ADIPOSE PRESENT (HATCHERY)
NO ADIPOSE PRESENT/NO CWT (HATCHERY)
UNKNOWN
UNMARKED (WILD)
VENTRAL CLIPS (ACCLIMATION POND)
NUMBER OBSERVED
SEASON SURVEYED


Huckleberry Creek Seasonal Comparison of Pink Salmon Spawning Ground Counts (2003-2021)
LIVE
DEAD
NUMBER OBSEREVED
SEASON SURVEYED

HYLEBOS CREEK

WRIA 10.0006

Hylebos Creek *(Named after Peter Francis Hylebos (1848-1918),original native name haxtl', also called "Koch" by early natives)*[1] is an large, independent drainage from that of the Puyallup/White River system. Draining an area of over 18 square miles, the headwaters of the Hylebos system originate in the city of Federal Way and flow southwest until it empties into the Hylebos Waterway; one of several waterways located in Commencement Bay within the city of Tacoma. The East and West Forks of the Hylebos comprise two of the three basins within this system, and make up the upper part of the watershed. The East and West Forks converge just east of I-5 to form the Lower Hylebos.

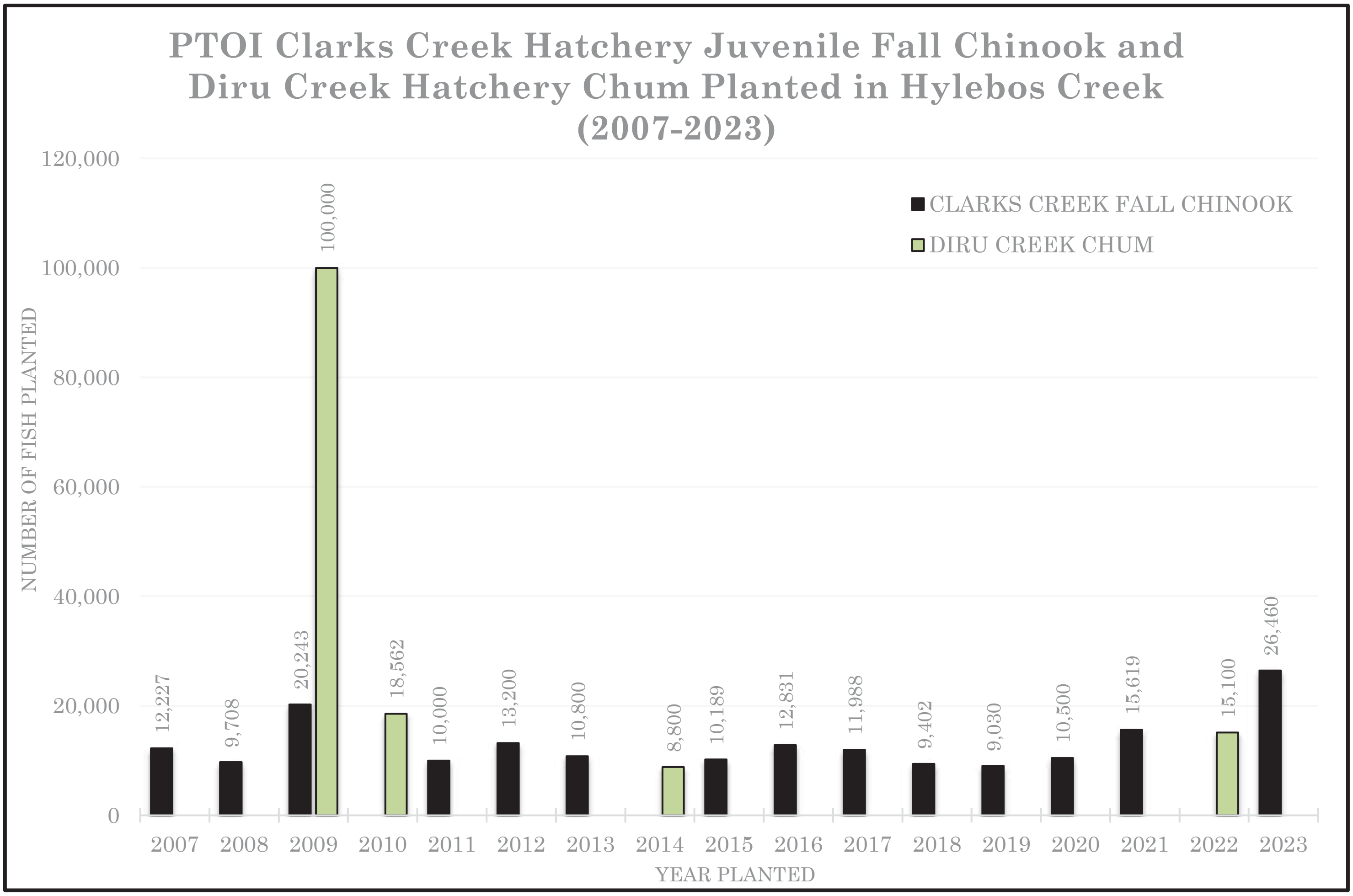
The Hylebos Watershed has been severely impacted by urban development. Land uses over the past several decades has resulted in an extensive loss of estuarine and wetland habitats, reduction of water quality (*303(d) listed*) and fish production, as well as diminished instream flows and stream channel continuity. Nevertheless, the watershed does have protected areas, and substantial parcels of the creek and surrounding land have been acquired in recent years for protection and restoration.

Although spawning frequency is low for all species and inconsistent for some; Chinook, chum, pink, coho, and steelhead have all been observed spawning within the surveyed area of Hylebos Creek. In addition, Hylebos Creek also host a large population of cutthroat, as well as other native and nonnative species including sticklebacks, sculpins, lamprey and bass. The stream section most often surveyed by the Puyallup Tribe is the Lower West Fork Hylebos extending from 373rd St., upstream to the Montessori school at Hwy. 99 and downstream from 373rd to the East Fork. The upper extent of Chinook spawning is generally a half mile past the convergence of the East and West Forks. Passage beyond this is often difficult due low instream flows that can prevent Chinook from migrating far up either fork. Higher instream flows experienced during the fall and winter often allow coho and chum to access the upper reaches of the Hylebos.

As part of the continuing fish and habitat restoration efforts, the Puyallup Tribe regularly released between 10-to-20 thousand juvenile Fall Chinook into the West Fork of Hylebos Creek during the spring. Spawning surveys over time have identified these fish on the spawning grounds due to fin clips administered at the hatchery prior release. In addition, the 27 acres above 373rd St., known as the Spring Valley Ranch, was purchased by the Washington State Department of Transportation (*WSDOT*) in 2004. Restoration efforts for this site were completed in 2007. The restoration project restored nearly a quarter mile of creek channel and wetland habitat. The project will also establish a riparian buffer zone comprised of native trees and plants. In 2008, the City of Federal Way acquired the 22 acre Goldmax property. This acquisition will preserve 1,200 feet of creek channel and surrounding land located on the West Fork of the Hylebos. For additional information about the Hylebos Creek watershed, go to:

- https://www.earthcorps.org/ftp/ECScience/Hylebos/HylebosWatershedPlan_2016.pdf
- http://www.earthcorps.org/hylebos.php

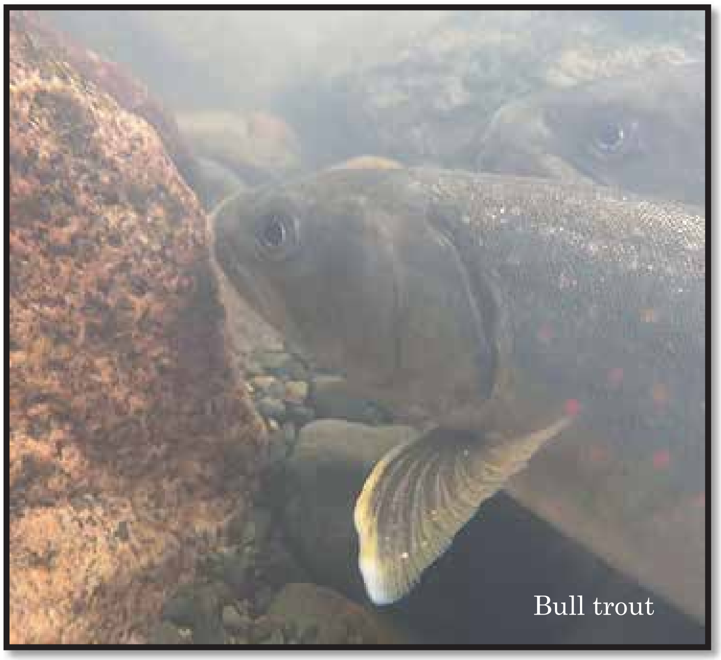
[1] Caster, D. 2003. Father Hylebos, St. George's Indian School and Cemetery, and St. Claire's Mission Church. Prepared for the Historical Society of Federal Way. 18pp.



Clarks Creek Fall Chinook and Diru Creek chum salmon are spawned and reared at Puyallup Tribal salmon hatcheries. No data indicates no fish were planted.

IPSUT CREEK

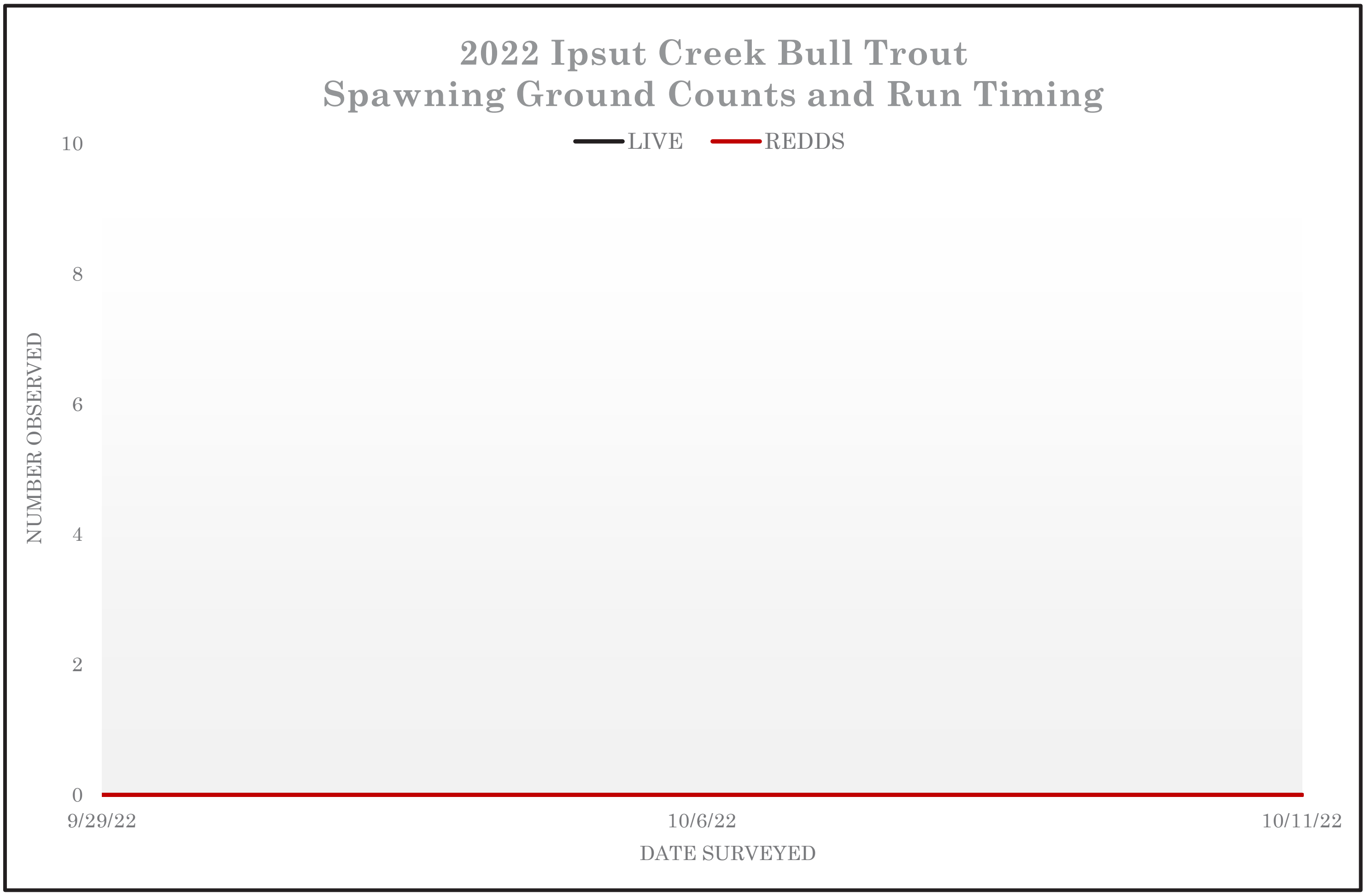
WRIA
10.0550


Bull trout

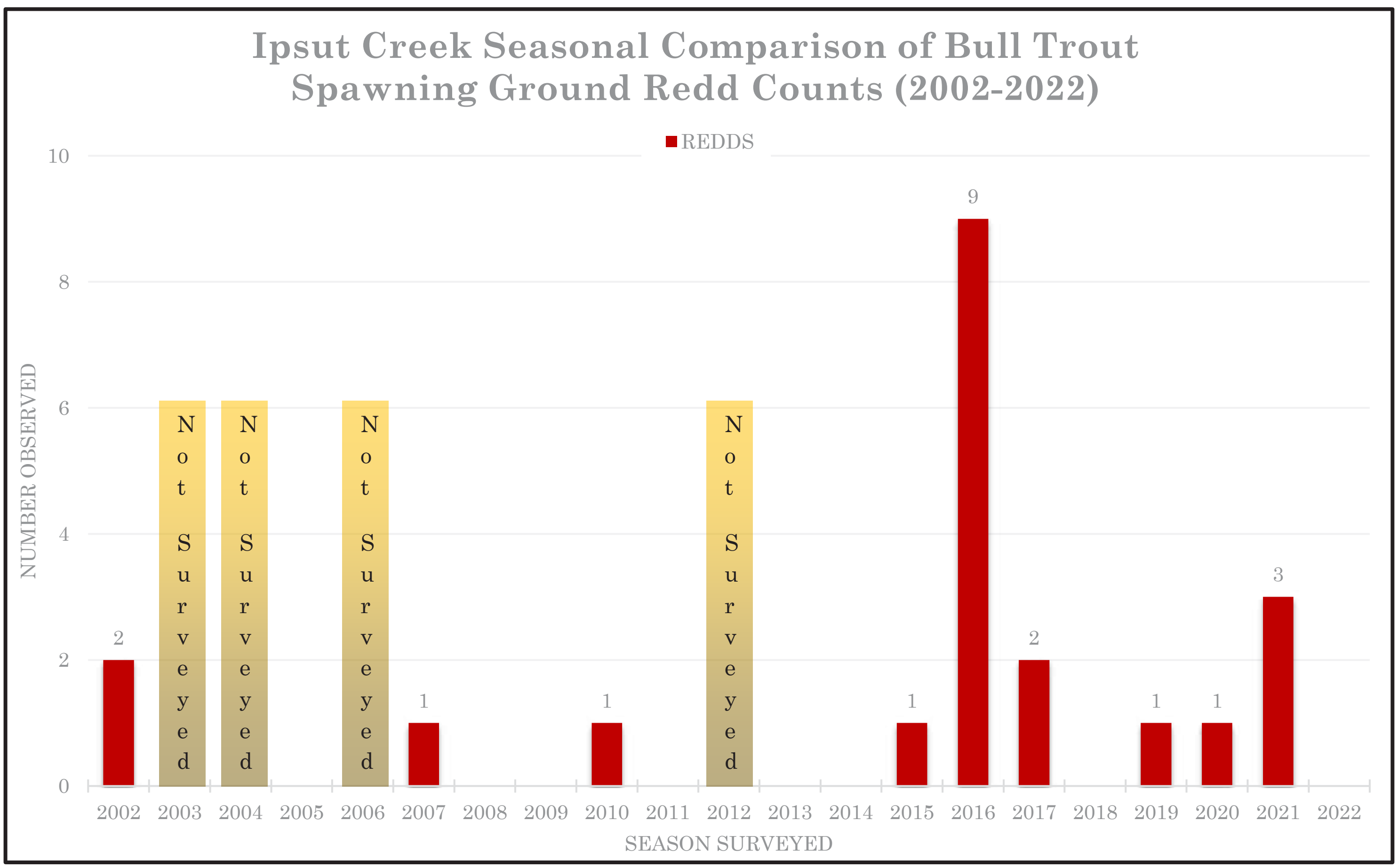
Ipsut Creek is a left bank tributary to the upper Carbon River; entering at RM 28.3. Typical of many headwater tributaries, Ipsut Creek is non-glacial and is characterized by confined steep valley channels with a comparatively short, low-to-moderate gradient anadromous reach. This mountain stream flows for just over 2.8 miles through a steep glacial valley originating near Castle Peak along the Alki Crest. Bull trout require a healthy aquatic environment in order to survive and flourish. They need an environment that provides the necessary prey base; in addition to the rearing and reproductive habitat essential to ensure their continued survival and reproductive success. Ipsut flows entirely within Mt. Rainier National Park. Headwater sources are derived from snowpack accumulations; as well as other surrounding surface and groundwater sources including Doe Creek *(right bank- RM 1.2)* and an unnamed tributary *(right bank- RM 0.8)*. Neither tributary is accessible to fish. The creek continues to drop precipitously throughout much of its length until reaching the lower channel migration zone of the Carbon River, at which point the creek channel is reduced to a low-moderate gradient pool-riffle channel capable of supporting salmonids.

Bull trout spawning frequently occurs from early September-to-mid October, with peak spawning typically occurring around the third-to-fourth week of September *(see Appendix B for survey data)*. Redds are often constructed in the tail-out of pools and along channel margins. Unfortunately, spawning opportunities are limited due to the size and makeup of the substrate material; much of which consists of flat and angular stones not conducive to movement, especially by smaller fish such as bull trout. However, small patches of suitable gravel do exist. Spawners in the upper Carbon River tributaries are observed utilizing various sized substrate from small gravels to small cobble. Past surveys have verified bull trout utilization within Ipsut; furthermore, the creeks 2,300' elevation makes it one of the lowest elevation streams known to support bull trout spawning and is quite capable of supporting Chinook, coho, pink and steelhead as well. Other species including cutthroat, non-native brook trout and sculpins are known to inhabit the creek. However, salmonid migration upstream to reach headwater tributaries in the upper Carbon Basin, including Ipsut, is assumed to be extremely limited due to substantial cascades present throughout the roughly 5 mile long Carbon River Gorge.

The riparian zone along Ipsut consists primarily of old growth cedar, fir and hemlock which contributes greatly to the large woody debris in the stream; as well as diversity to the channel habitat. The lower anadromous reach of the creek is also subject to, and has frequently experienced disturbances caused by Carbon River flood events. These intrusions often deposit significant amounts of fine material and woody debris. An impassable falls at approximately RM 0.15 prevents any further upstream migration.



2022 Ipsut Creek bull trout survey data was collected by PTF and Mt. Rainier National Park Service (MORA) biologists.



KAPOWSIN CREEK

WRIA 10.0600

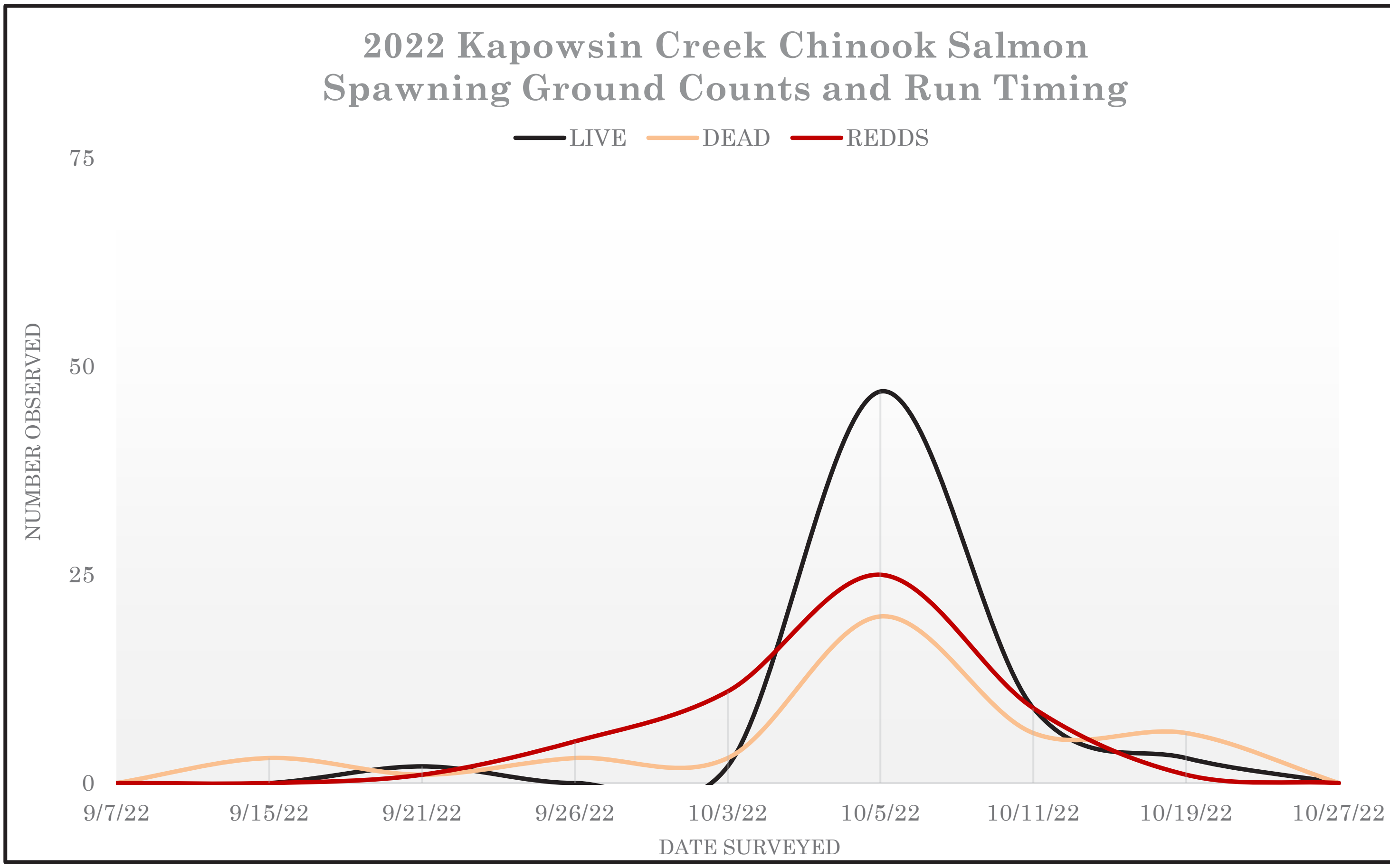
Kapowsin Creek is a tannic stream originating at the north shore of Lake Kapowsin, which sits approximately 3.6 miles upstream from the creeks confluence with the Puyallup River. Kapowsin Creek supports a host of adult salmon species including; Chinook, pink, coho, steelhead, bull trout and occasionally a few chum. Chinook have not been observed beyond the top of Kapowsin Creek where it enters the lake. On the other hand, coho, and occasionally a few steelhead move through Kapowsin Lake into Ohop Creek to spawn. Ohop Creek, which enters the south end of the lake, is technically considered the continuation of Kapowsin creek. Lake Kapowsin supports a large population of game fish including: bluegill, largemouth bass, black crappie, yellow perch and pumpkinseed. WDFW also stocks the lake annually with rainbow.

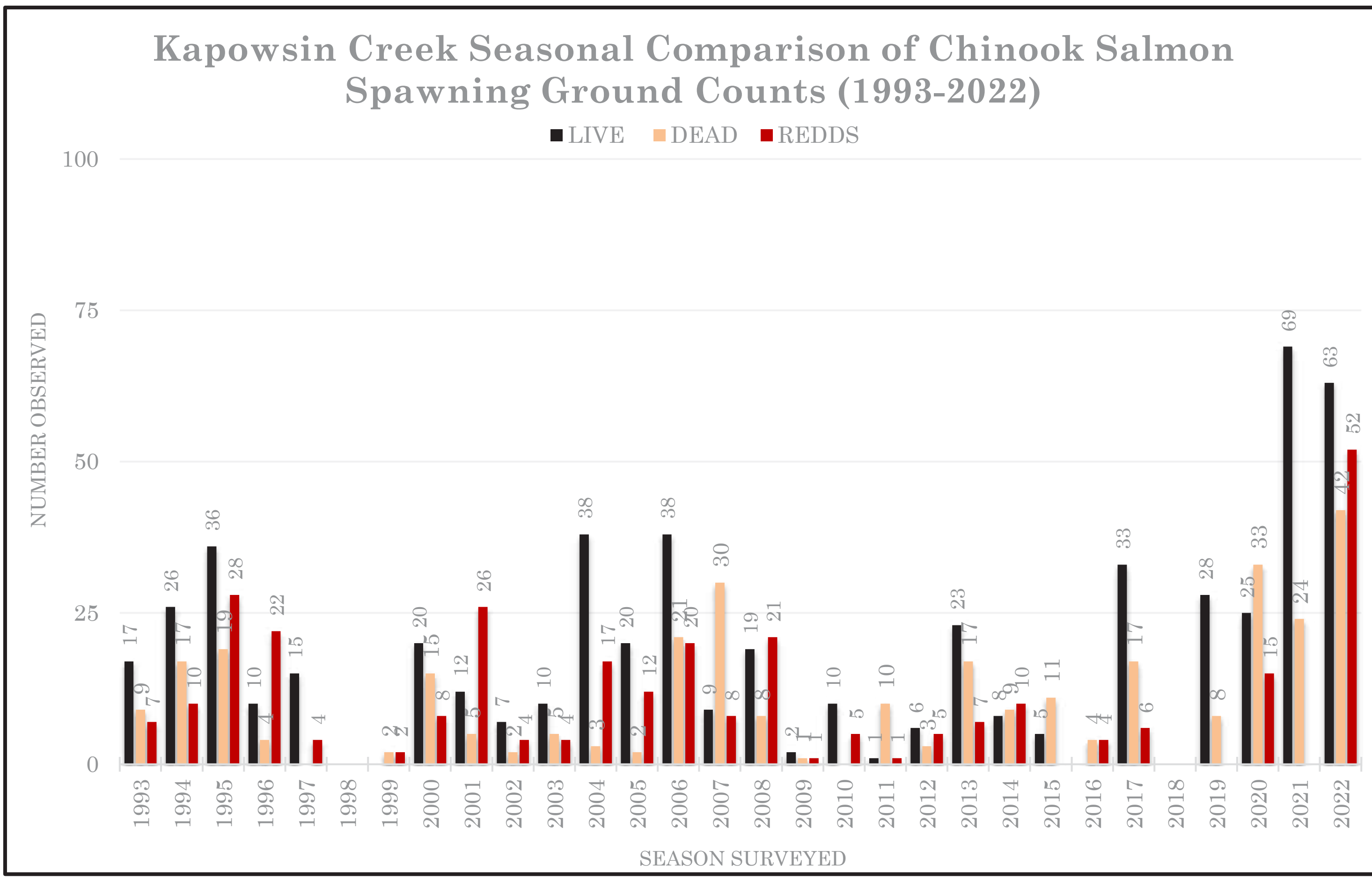
Unfortunately, steelhead escapement in Kapowsin is low, however, this drop in escapement is not uncommon; winter steelhead stocks in the Puyallup basin have been declining since 1990. The precipitous decline within just the past few years has created serious concern among fisheries managers. Factor(s) responsible for the decline in steelhead escapement are unknown, especially when other salmon species are experiencing relatively good success.

Coho are the predominate species in the creek. Recovered CWT data has shown that many of the coho spawning in Kapowsin are fish that were released a couple of years earlier as juveniles from the upper Puyallup acclimation ponds (*Cowskull and Rushingwater*), or are descendants of the net-pen acclimation project in Kapowsin Lake. From 1993 to 1997, the Puyallup Tribe fisheries staff transported juvenile coho from WDFW's Voights Creek hatchery to four net-pens in Kapowsin Lake to acclimate. Prior to this fish restoration project, few or no coho were observed in Kapowsin or Ohop.

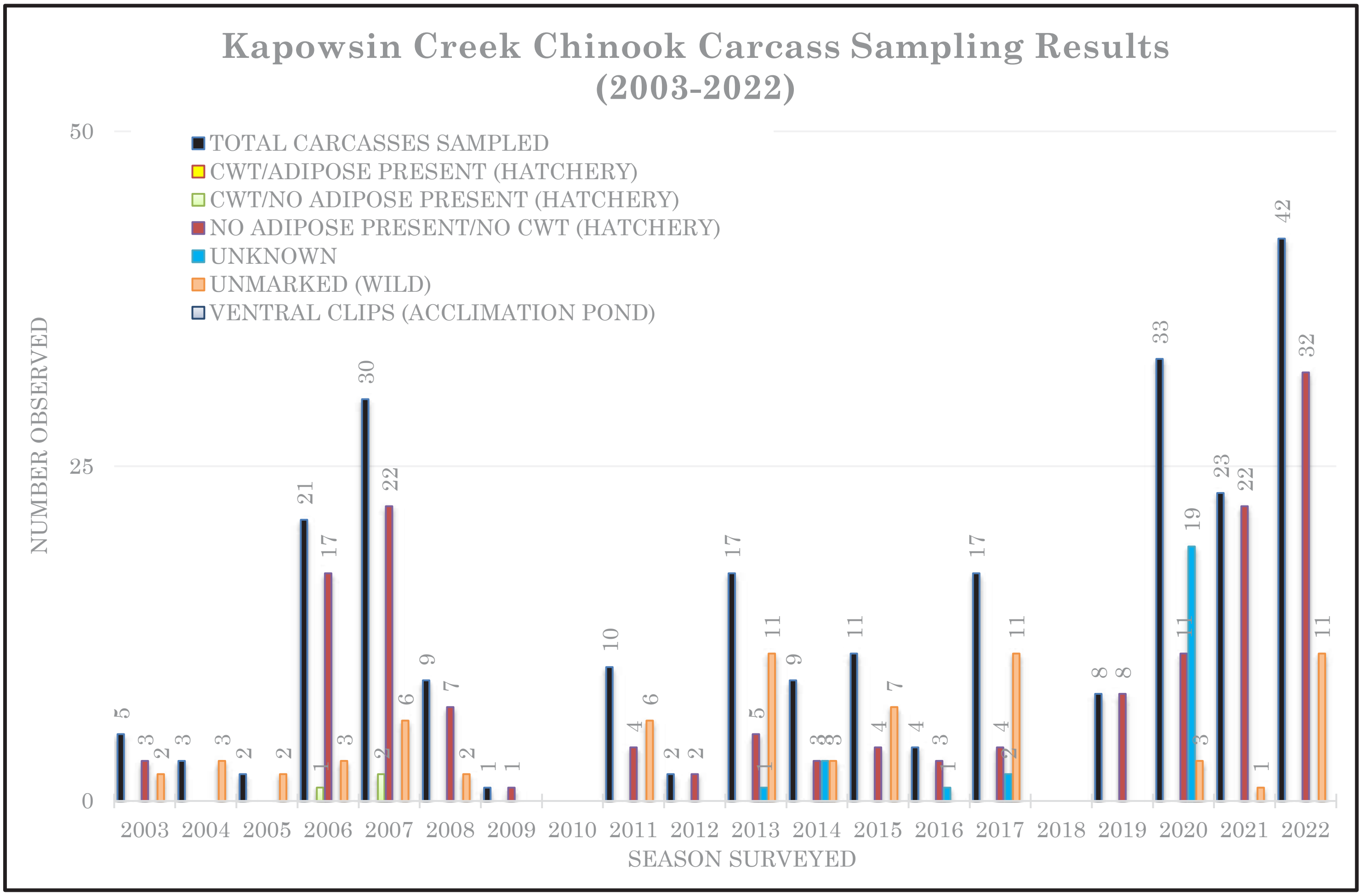
Suitable spawning gravel is available throughout the 3.6 mile survey reach of Kapowsin, although much of it is sporadic. A number of downed trees within the channel along with several sizable logjams create complexity throughout the stream. Cattle and other livestock have been allowed access to the stream channel at approximately RM 1.7. Homes and outbuilding are frequently present along the creek between RM 0.5 and RM 2.0. Human-made rock dam structures; as well as sill logs, span the creek and alter the channel hydrology along this stretch. During the summer and fall when water levels are low, these formations that can cause upstream migration issues for adult salmon. In addition to human-made obstacles, the creek experiences frequent beaver (*Castor canadensis*) activity. Beaver dams, often constructed during the low summer flow, regularly occlude the entire creek channel preventing upstream migration. Most of the stream has a dense riparian zone consisting of fir, cedar, alder, cottonwood, and salmonberry.

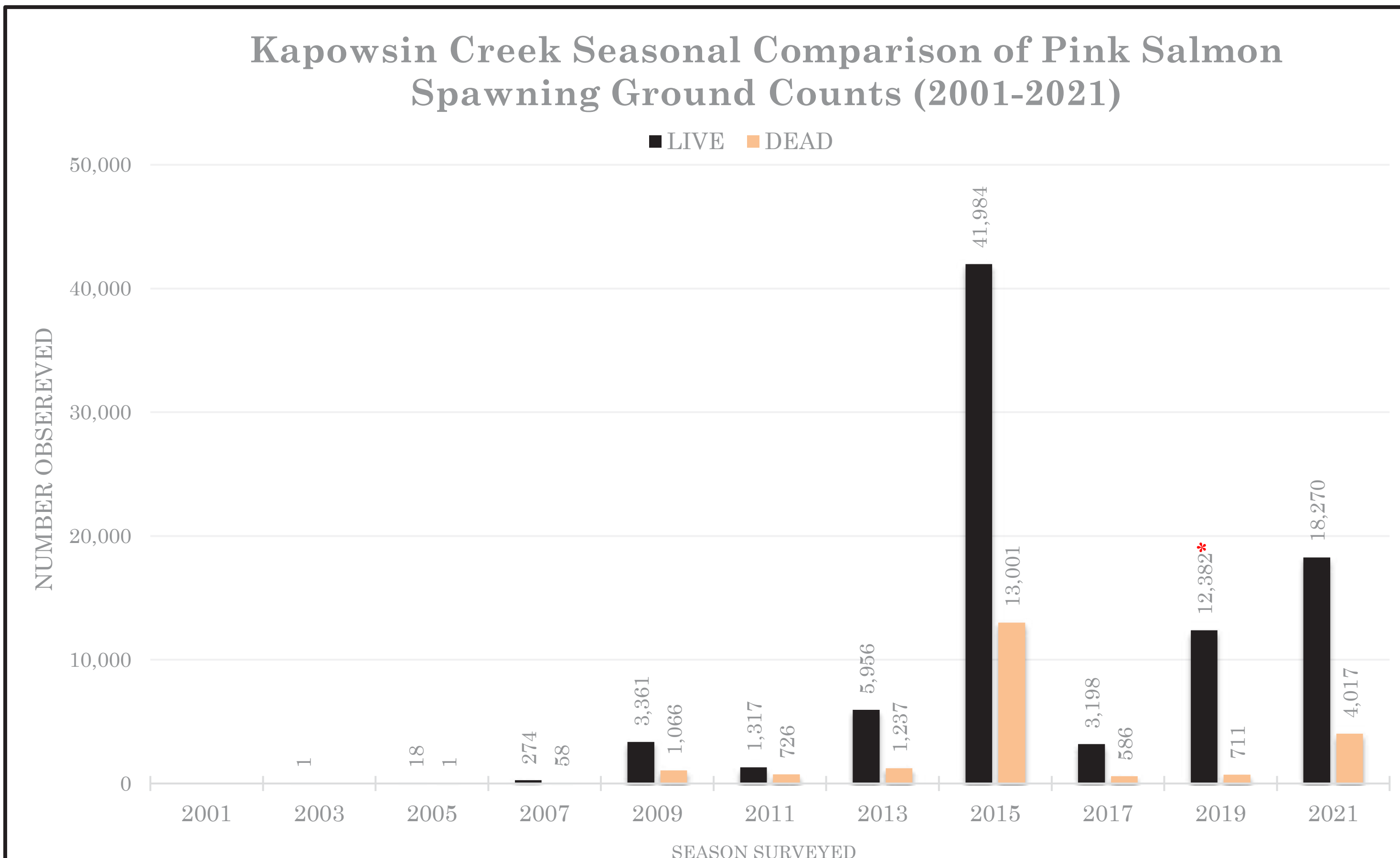
Pierce County completed construction of the new Orville road bridge over the head of Kapowsin Creek in early 2006. In addition, the 2006 flood event destroyed extended portions of the levee along Orville Rd. near Kapowsin Creek. Currently, the lower segment of the creek *(RM 0-0.2)* is a low gradient channel flowing within the open channel migration zone of the Puyallup River, and is repeatedly occupied by mainstem river incursions.



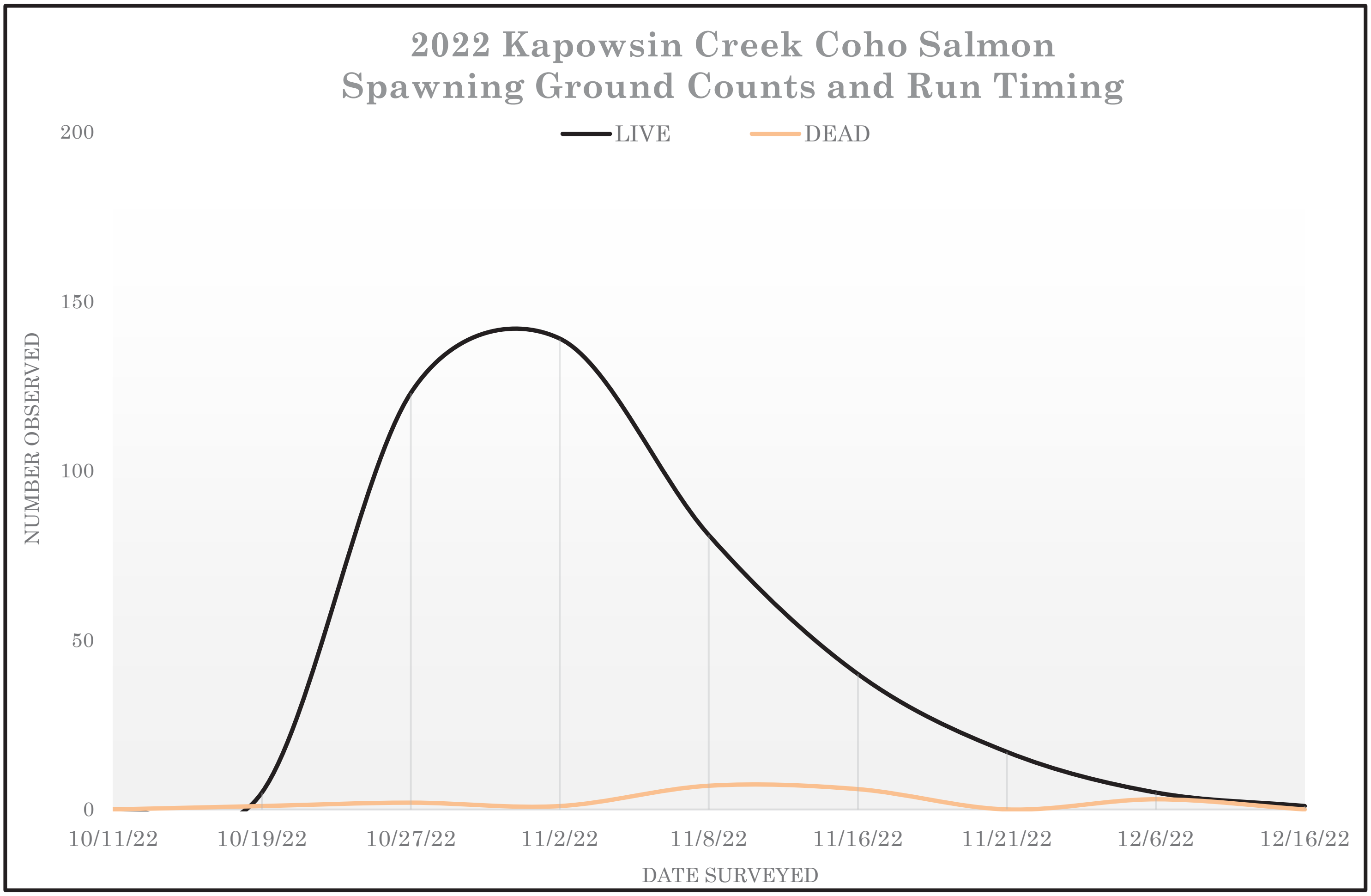


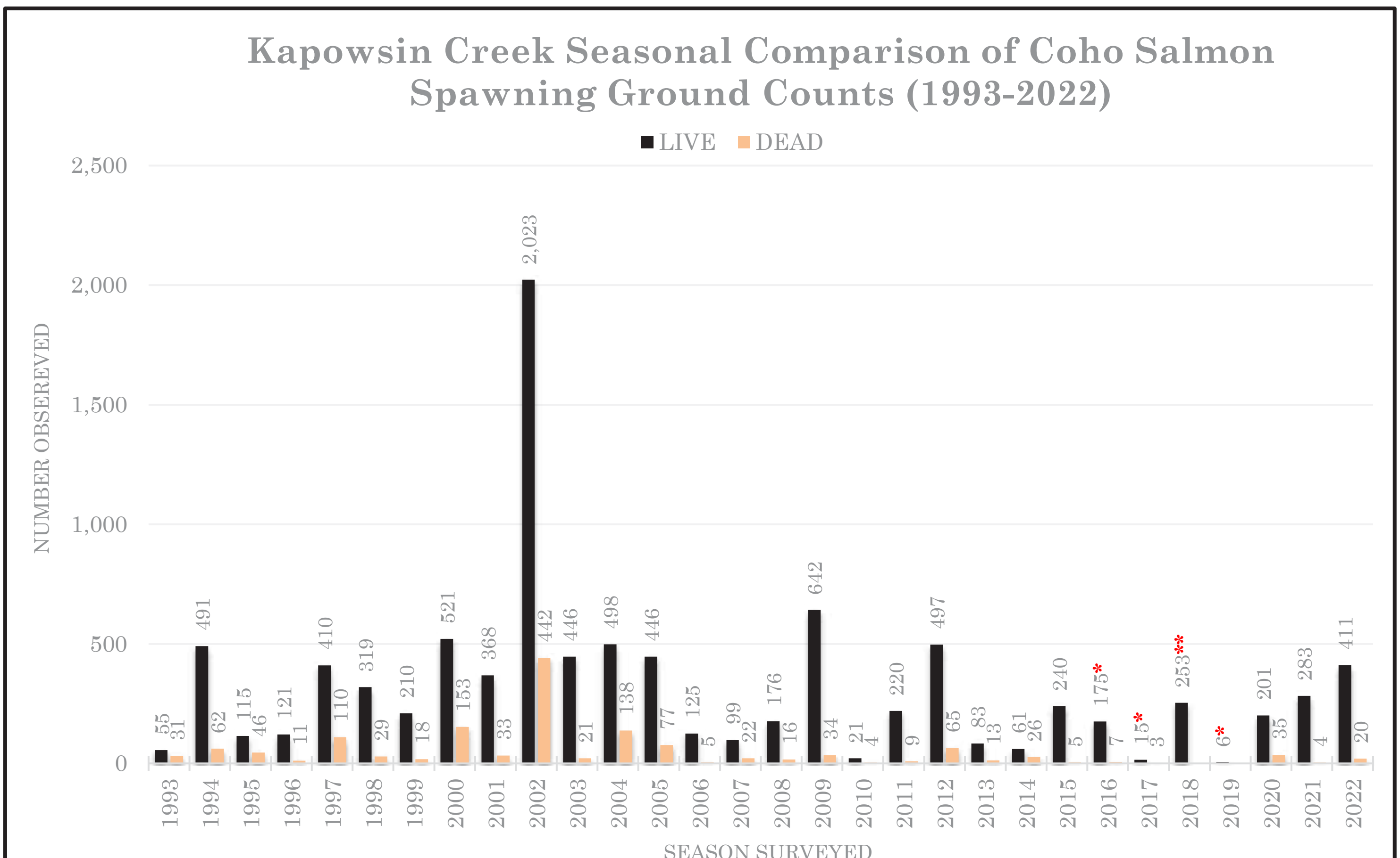
Adult Chinook escapement is determined by expanding the number of redds observed by 2.5 fish per redd (Smith and Castle, 1994). Due to the tremendous volume of pink salmon during odd years, the success of determining Chinook redds from pinks is vastly reduced. Therefore, The AUC method is used to determine escapement during pink runs (odd years).



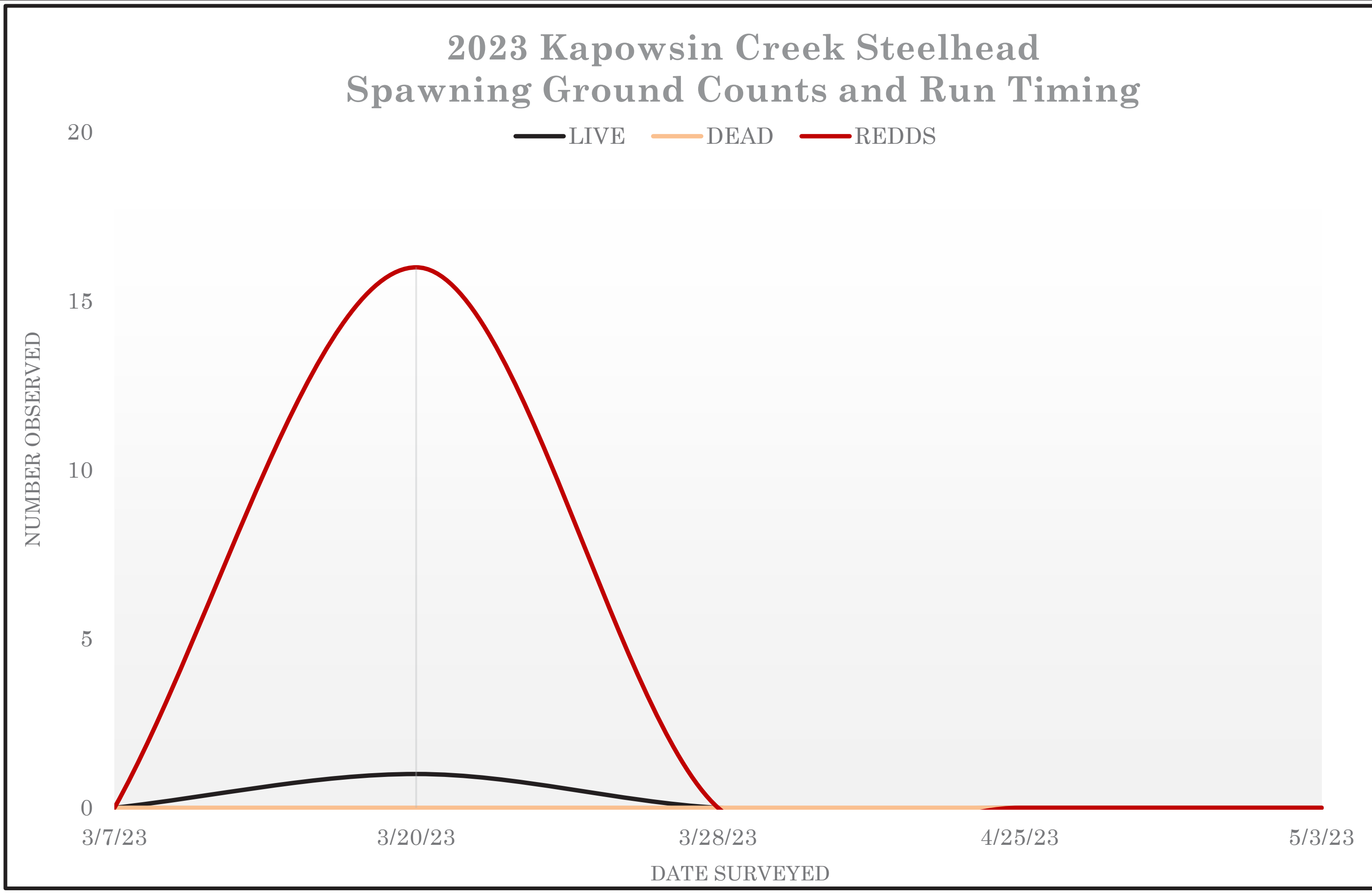


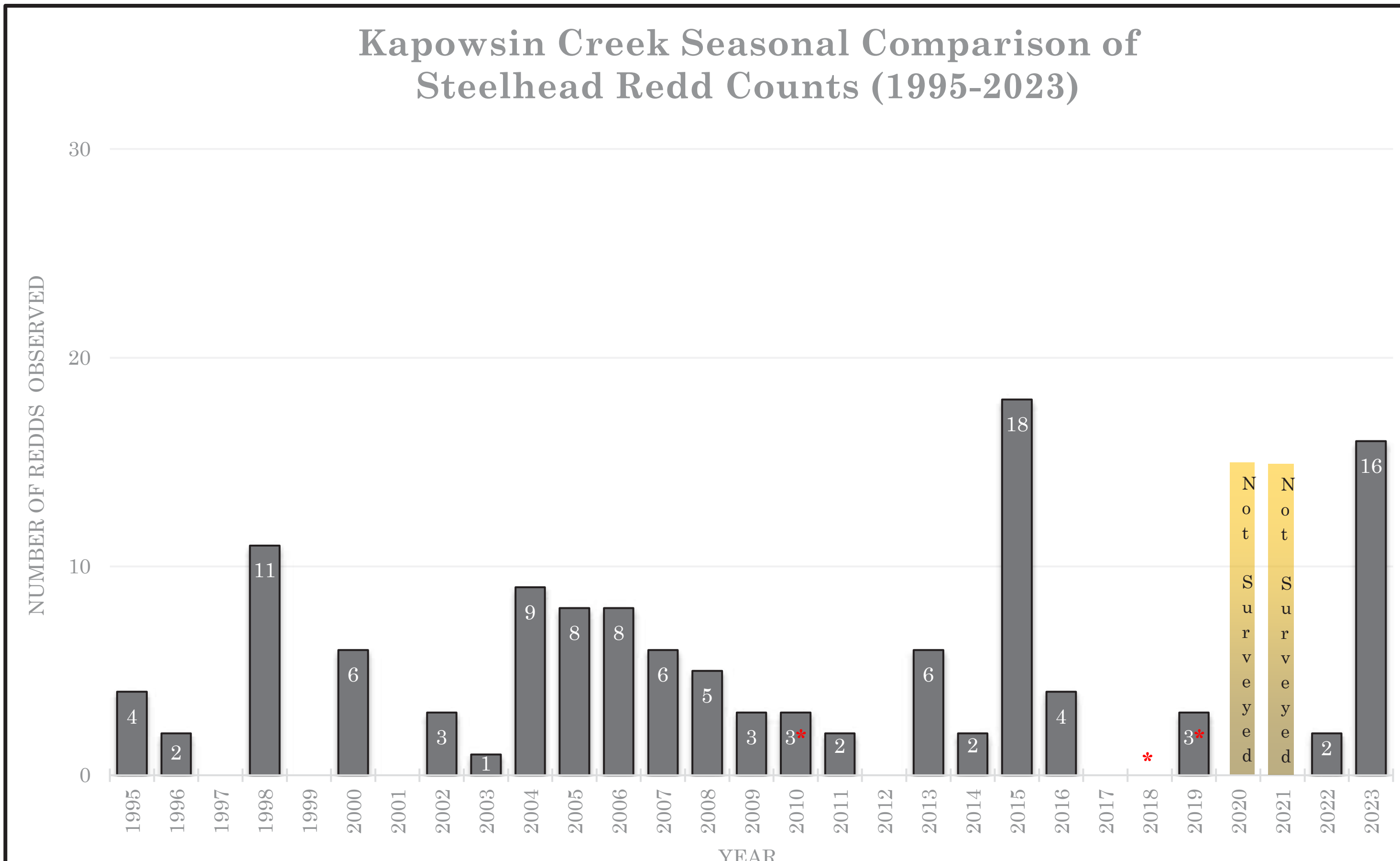
*2019 data is incomplete.





*Survey data is incomplete due to extreme high water and poor visibility. **Live fish are from Voights Creek hatchery surplus plant.





*Survey data is incomplete due to extreme high water and poor visibility. To determine the total escapement for steelhead, each redd is multiplied by a factor of 1.62 *(i.e. 42 redds x 1.62 steelhead per redd = total esc. of 68 steelhead).* See steelhead redd location map in appendix C.

KELLOG CREEK

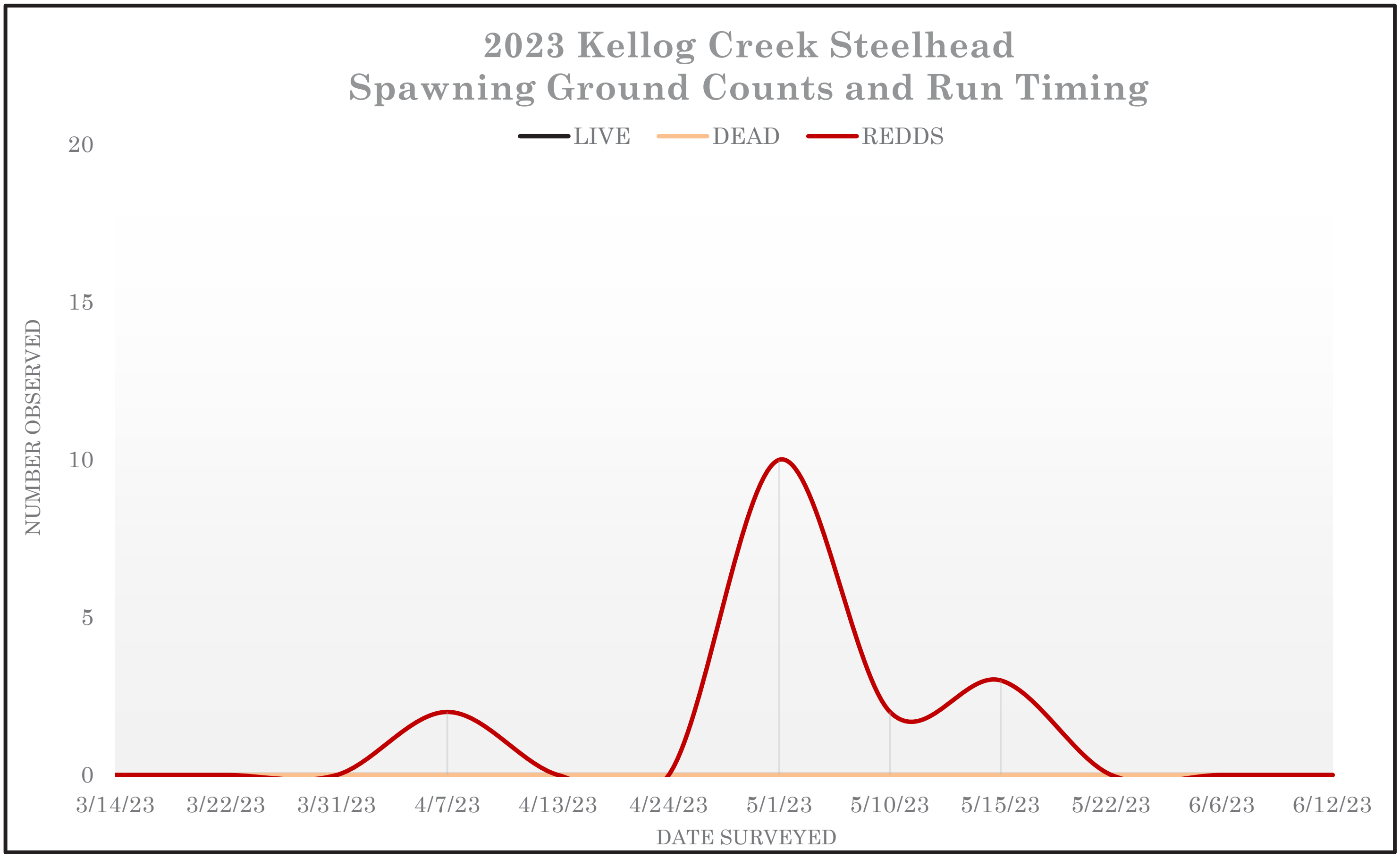
WRIA 10.0621

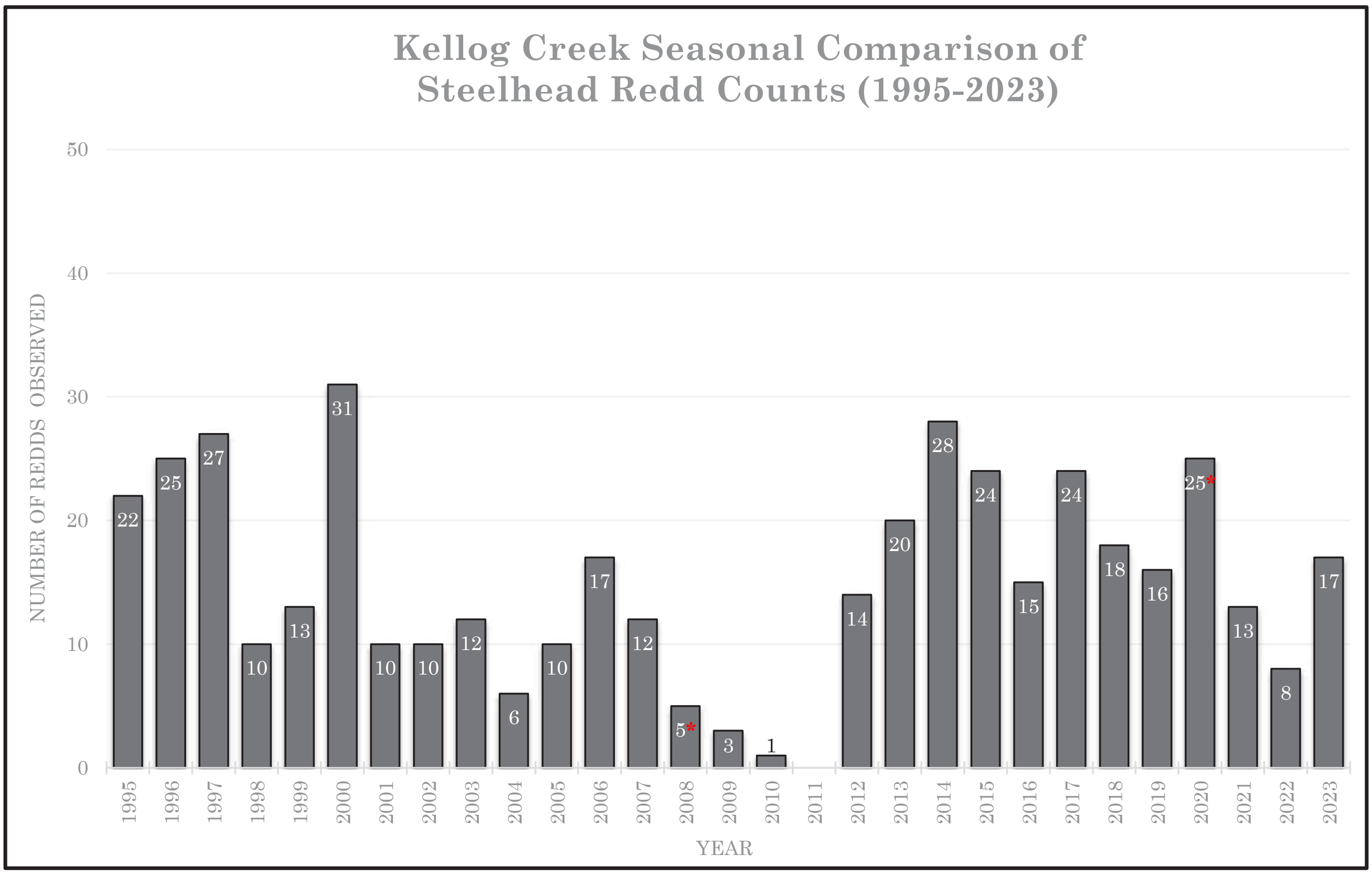
Kellog Creek is a headwater tributary to the Puyallup River, entering the Puyallup at approximately RM 39.7. Kellog is a short run stream with nearly three miles of accessible habitat; however, the anadromous spawning usage extends approximately the first 2 miles of the creek. At RM 2.5, Kellog passes through a large fish passage culvert *(installed 2008)* running under the Mainline 2 Road within the Kapowsin Tree Farm. Kellog Creek flows entirely within the privately owned Kapowsin tree farm where roads and past timber harvests have negatively impacted several portions of the stream.

Kellog provides spawning habitat for adult salmon and steelhead, and rearing/foraging habitat for juvenile steelhead, coho, Chinook, and bull trout. Wild steelhead maintained a small foothold in Kellog Creek prior to 2000 due to the fact that the mouth of the creek is located downstream of the Electron diversion dam. Flows over the past century have frequently been sufficient during late winter and spring; thereby allowing steelhead access to tributaries located downstream of the diversion dam at RM 41.7. Naturally returning coho were observed in Kellog Creek in 2004. These were the first natural spawners seen since adult and juvenile coho plants began in the upper Puyallup basin in 1997. Coho activity has been observed as high as RM 1.4, whereas steelhead activity is observed as high as RM 2.1. Bull trout have been observed; however, spawning utilization is unknown. It is suspected bull trout utilize the creek for rearing, overwintering, and foraging. The first adult Chinook spawner was observed in 2013.

Upstream of the culvert, the creek assumes a moderate to high gradient step-pool composition unsuitable for larger adult spawners such as coho or steelhead. Steelhead surveys are conducted from the culvert, downstream to the mouth. From the culvert at RM 2.5, downstream to RM 1.6, the creek flows through a moderate gradient step-pool/cascade channel containing patchy gravel. Several sections of the surrounding banks are comprised of exposed compacted glacial debris; contributing both fine and small course materials to the stream. Due to timber harvesting, the riparian zone throughout this reach consists of a thin mature 2nd growth conifer buffer on both sides. However, there is a significant amount of wind-throw in the channel associated with this insufficient riparian buffer. Steelhead spawning activity is occasionally observed in this segment; however, steelhead spawning generally begins below RM 1.6. At this point, substantial flow from a left bank tributary, and the reduction in gradient, create a more beneficial spawning environment.

Below RM 1.5, the gradient relaxes over the ensuing mile and excellent spawning gravel is consistently available. The majority of steelhead spawning activity is observed within this lower 1.5 miles. The RMZ is more intact along this lower reach as well. In addition to a few substantial debris jams, there are several interactive pieces of LWD present in the stream channel. The gradient increases near RM 0.5 as the creek drops down into the Puyallup River flood plain. A large, structurally complex section of the channel exists just below the Electron flume line. This wood complex was created by historic amounts of course materials moved during the 1996 flood event *(still largely intact)*. Near the mouth of Kellog, the creek initially drops into the Puyallup River channel migration zone and may flow for an additional 0.1-0.5 miles before dumping into the active main river channel.





*The 2008 & 2020 redd data is incomplete due to extremely poor survey conditions which prevented a regular full season of surveys. To determine the total escapement for steelhead, each redd is multiplied by a factor of 1.62 *(i.e. 42 redds x 1.62 steelhead per redd = total escapement of 68 steelhead)*. See steelhead redd location map in appendix C.

KLICKITAT CREEK

WRIA 10.0357

Bull Trout

Klickitat Creek is a significant right bank headwater tributary to the White River. The word Klickitat is a native word meaning "beyond" or "prairie people". The creek is exclusively surveyed for bull trout from early September-to-mid October. In 2007, PTF biologist observed pink salmon in Sunrise Creek *(RM 63-elev. 2800')* which is located just inside the National Park boundary. During 2019, 2 two pink salmon were observed in No Name Creek *(elev. 3600')* which is located at approximately RM 68.4 on the White River.

Klickitat Creek is a phenomenal non-glacial stream, originating from Ghost Lake *(elev. 4396')* near Cayuse Pass. Klickitat is a north facing stream flowing entirely within Mt. Rainier National Park, and is the source of drinking water for the NPS White River compound. Klickitat enters the White River north of Sunrise Park Road at approximately RM 67.9. The creek is surrounded by old growth and the water temperature is tempered by cold clear water year round *(three year average summer temperature from 2006-2008 was 6.56 ºC [range 3.8-8.5 ºC]).* The only drawback being, there is only about 0.3 miles of anadromous usage. Three significant unnamed tributaries add flow to Klickitat; unfortunately, they do not contribute any beneficial spawning or rearing habitat given they are located well above natural anadromous barriers.

Lower Klickitat provides exceptional habitat conditions for bull trout (*char*) and cutthroat rearing and spawning. The first 0.3 miles is low gradient, with excellent spawning gravel and significant amounts of in-channel LWD *(lower right)*. Numerous pools and side channels provide excellent habitat for all life history stages of bull trout; from newly emerged fry to adults. A series of bedrock falls and cascades at RM 0.3 blocks any further upstream migration. The Puyallup Tribe has surveyed Klickitat for bull trout escapement since 1999; thus far, no other salmon species have been observed spawning in the creek. Bull trout from the mainstem White River are observed spawning in the creek early in the fall, and juvenile bull trout have been observed in the pools and lateral habitat during these surveys. The few dead bull trout encountered during surveys appear to be pre-spawned mortalities due to predation.

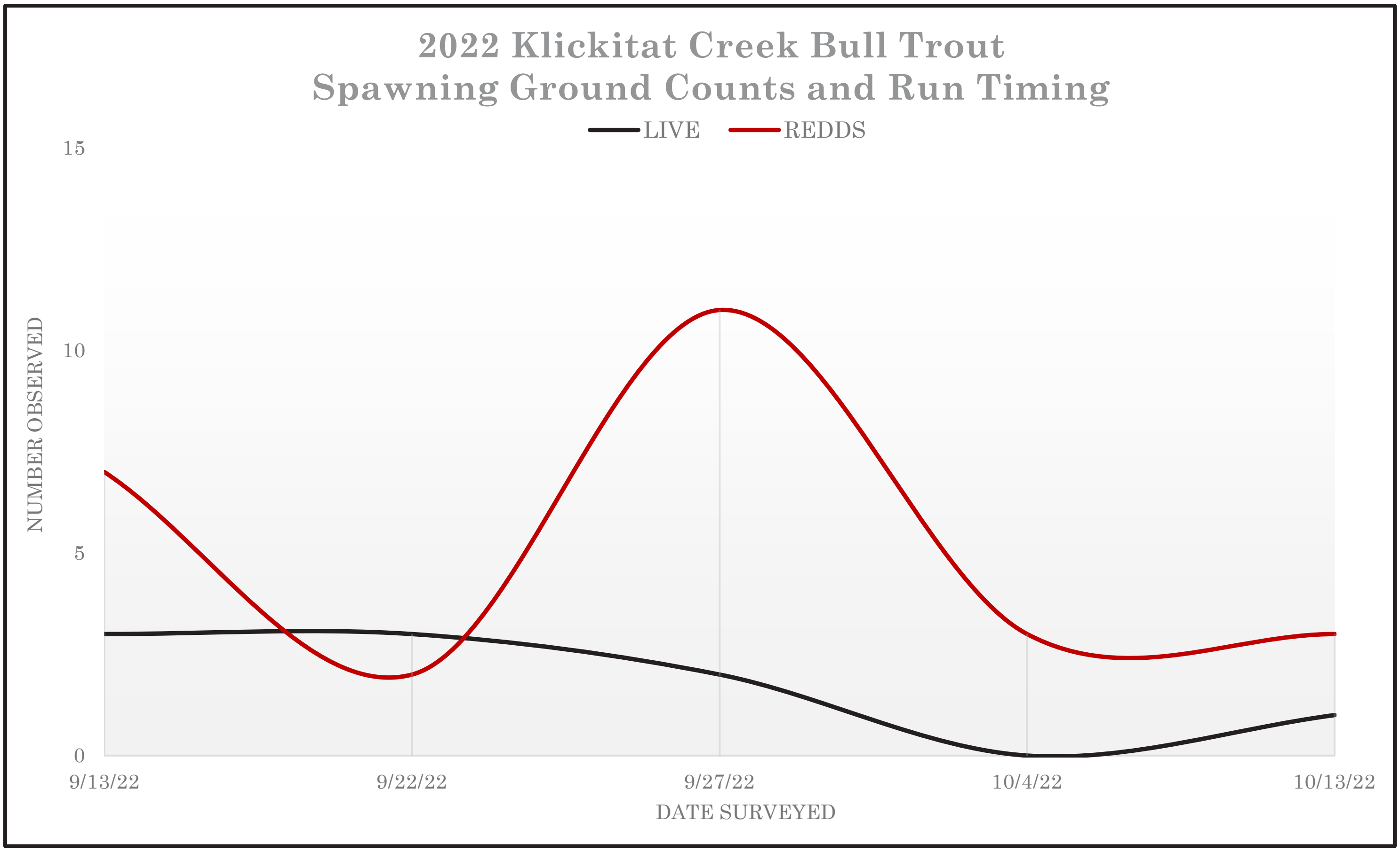
Klickitat Creek has been recognized as a key index stream for bull trout spawning. During the 2002 through 2007 survey seasons, bull trout floy tagged at the USACE trap in Buckley were observed spawning in the creek.

Resident bull trout reside in smaller headwater tributaries, while fluvial bull trout frequently travel long distances; utilizing the mainstem rivers and larger tributaries to forage and overwinter. During the fall, migratory forms of bull trout journey from spawning and rearing habitats in the upper watershed to foraging and overwintering habitats located lower in the river system. Beginning in spring and early summer, they begin the return journey back to spawning and foraging areas high in the watershed. In response to changing habitat and reproductive needs, migratory bull trout in the White River travel up to 75 miles or more between the lower river and headwaters located in or near Mt. Rainier N.P. To accomplish this, bull trout require unobstructed migration corridors and connectivity of streams and rivers in order to provide them with access to spawning, rearing, foraging, and overwintering habitats.

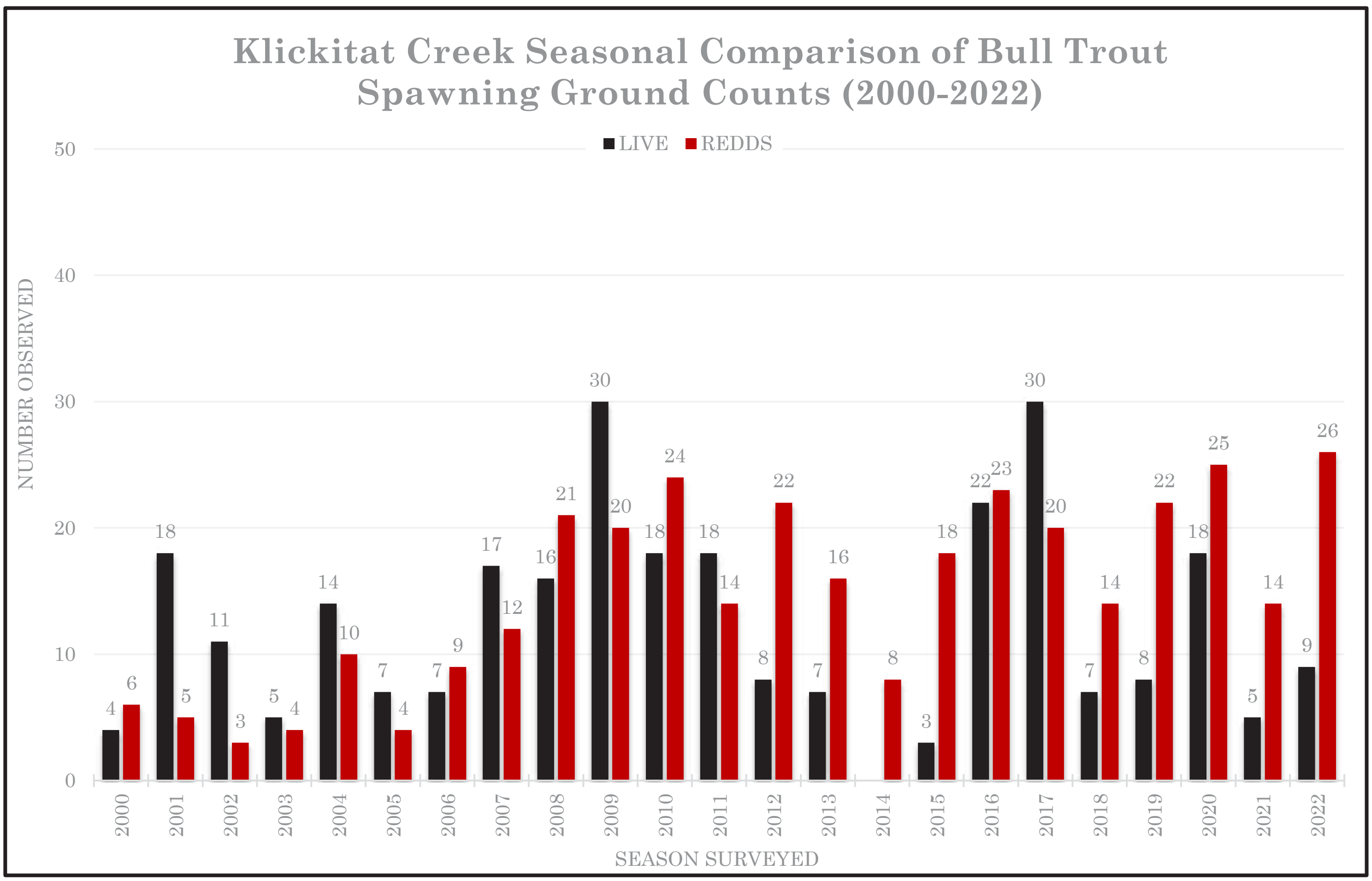
Spawning frequently occurs from early September-to-mid October, with peak spawning typically occurring around the third-to-fourth week of September *(see Appendix B for survey data)*. Due to the vastness of the park and the significant number of bull trout streams supporting bull trout spawning, the Puyallup Tribal Fisheries staff and National Park Service collaborate on conducting bull trout surveys within the Park. Bull trout are iteroparous *(ability to spawn more than once)*; therefore, recovering pre-or-post spawn mortalities for examination is extremely rare. Spawners in the upper White River tributaries are observed utilizing various sized substrate from small gravels to small cobble. Redds are often constructed in the tail-out of pools and along channel margins. Embryonic development is slow *(depending on water temperatures)*; it may take between 165-235 days for eggs to hatch and for alevin to absorb their yolk (Pratt 1992). Bull trout fry emerge in late winter and early spring. Young fry can often be seen by mid-March foraging in the lateral habitat along the upper mainstem White River and associate tributaries.

Bull trout habitat throughout the Puyallup and White rivers has been severely impacted by over a century of land and water resource exploitation; including, damming and substantial water diversions, considerable riparian alterations *(deforestation)*, dewatering and low instream flow regimes, as well as significant channel manipulation. These impacts have lead to a marked deterioration in land and hydrological behavior within these river systems by causing water flow of poorer quality, quantity and timing. Several limiting factors are involved with regards to the healthy function of stream habitat and bull trout populations in the watershed; including lost or diminished habitat connectivity and migration corridors *(human-made fish passage barriers)*, fragmentation and reduction of habitat quality *(entrainment, transportation networks, forest management practices and operations, direct water withdrawal)*; in addition to, water quality, fish entrainment and entrapment, unknown species interactions, and potential climate change impacts.

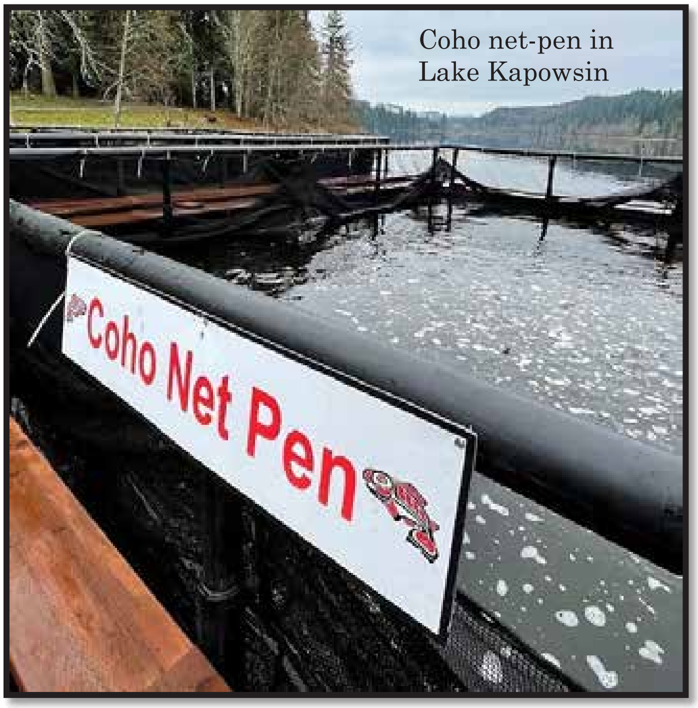
Bull trout are primarily piscivorous [pi-siv-er-uhs] *(fish eaters)*; however, they are opportunistic feeders, feeding on a variety of prey items depending on their particular life history strategy and stage of development. Adults feed almost exclusively on other fish, including a range of salmon and trout species; as well as other resident fish species. Juveniles feed on aquatic invertebrates, including stoneflies *(Plecoptera)*, caddisflies *(Trichoptera)*, and mayflies *(Ephemeroptera)*. Bull trout require a healthy aquatic environment in order to survive and flourish. They need an environment that provides the necessary prey base; in addition to the rearing and reproductive habitat essential to ensure their continued survival and reproductive success.



2022 Klickitat Creek bull trout survey data collected by Puyallup Tribe and National Park Service (MORA). See Appendix B for bull trout spawning data, and Appendix C for redd locations.



LAKE KAPOWSIN

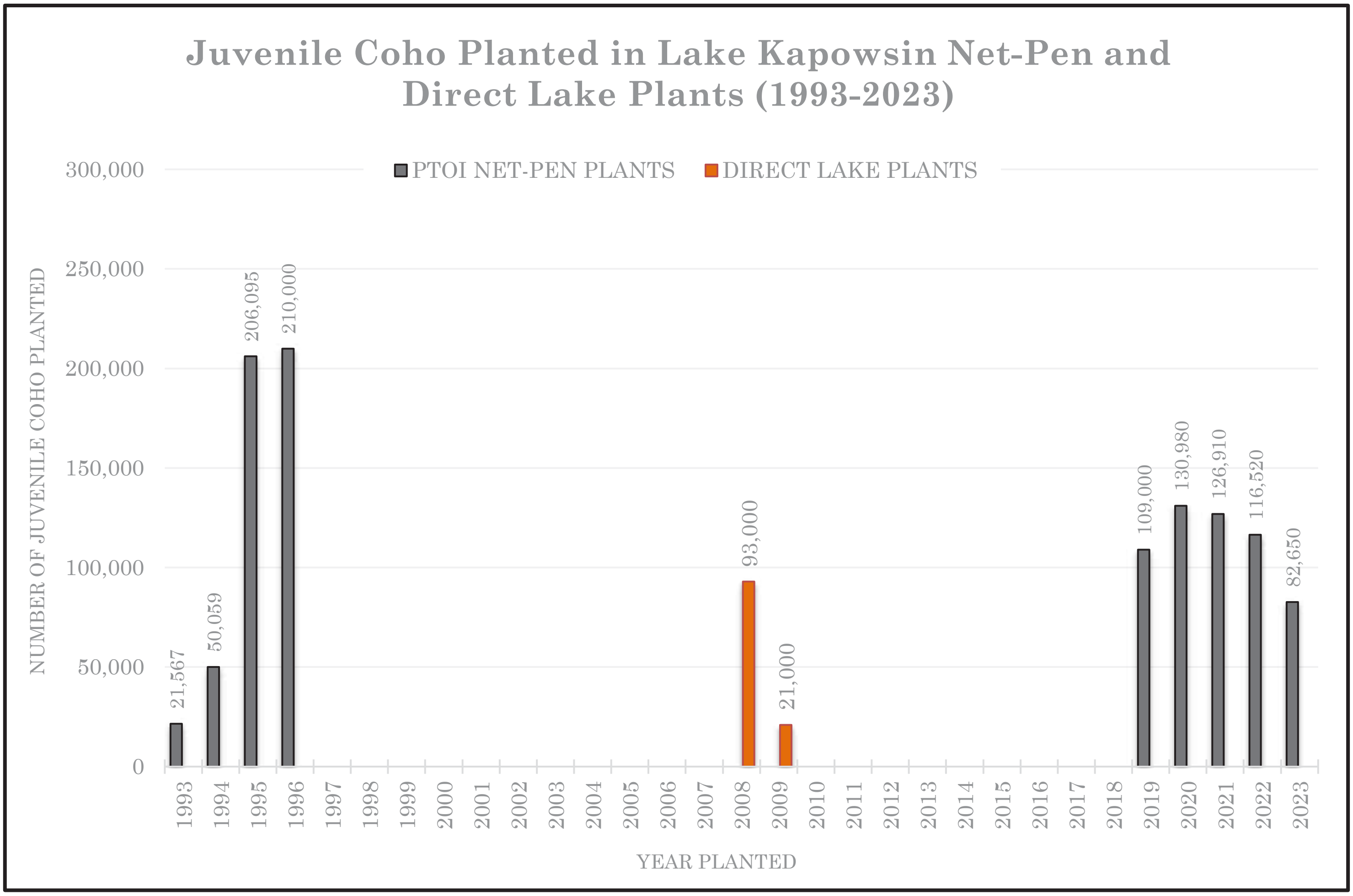


Coho net-pen in Lake Kapowsin

Lake Kapowsin is a 512-acre naturally formed lowland lake located near the town of Graham. Uses of the lake and surrounding lands include recreation, conservation and enhancement. The lake was designated as a State Aquatic Reserve in September of 2016. There are several oranizations that own land adjacent to this largly undeveloped lake, including the Puyallup and Muckleshoot Tribes.

Kapowsin Lake was formed approximately 500 years ago by a significant geological event. The Electron lahar/mud flow *(hydrothermally altered rock - highly fluidic slurry of soil materials, rocky debris and water)* originated along the west slope of Mt. Rainier and coursed its way down the mountain into the lower valley, inflicting tremendous destruction on the lowland forest habitat. In its wake, the resulting lahar deposits created a dam which formed Lake Kapowsin. The remnants of the forest that once occupied the area the lake currently rests, is still visible today. The woody materials *(stumps, trees)* which have persisted in the lake provide vital and sustaining habitat for many forms of wildlife including fish, amphibians and mammals. The lake also provides critical wetland habitats for wildlife. Lake Kapowsin is a relatively shallow *(20'-30')*, and links Ohop Creek *(inlet)* and Kapowsin Creek *(outlet)*. The lake supports a significant array of salmonids and warm water species including; coho, pink, steelhead, cutthroat and rainbow trout, largemouth bass, yellow perch, rock bass, black crappie, bluegill, pumpkin seed sunfish, walleye, and bullhead catfish. Kapowsin Creek also supports Chinook, chum and bull trout.

Lake Kapowsin is also an essential fisheries enhancement resource. From 1993-1997, the Puyallup Tribe operated an extremely successful coho net-pen enhancement program in the lake with the purpose of establishing a self-sustaining coho run in Kapowsin and Ohop creeks *(program reinitiated in 2018-top left image)*. Currently, specially tagged coho *(coded wire tags)* from The Puyallup Tribe's Clarks Creek hatchery are reared in the lake. Although coho escapements in Kapowsin and Ohop creeks have decreased, decedents of the original net-pen program continue to return to the creeks to spawn. Additional enhancement efforts are made seasonally to supplement the coho run by planting surplus adult coho, when available, from WDFW's Voights Creek Hatchery into Ohop Creek.

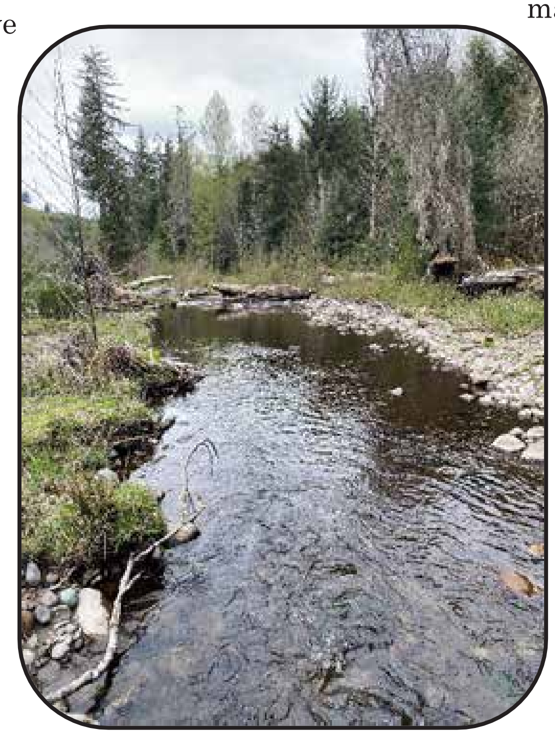


Net-Pen opperated by Puyallup Tribe. No data indicates fish were not planted.

LE DOUT CREEK

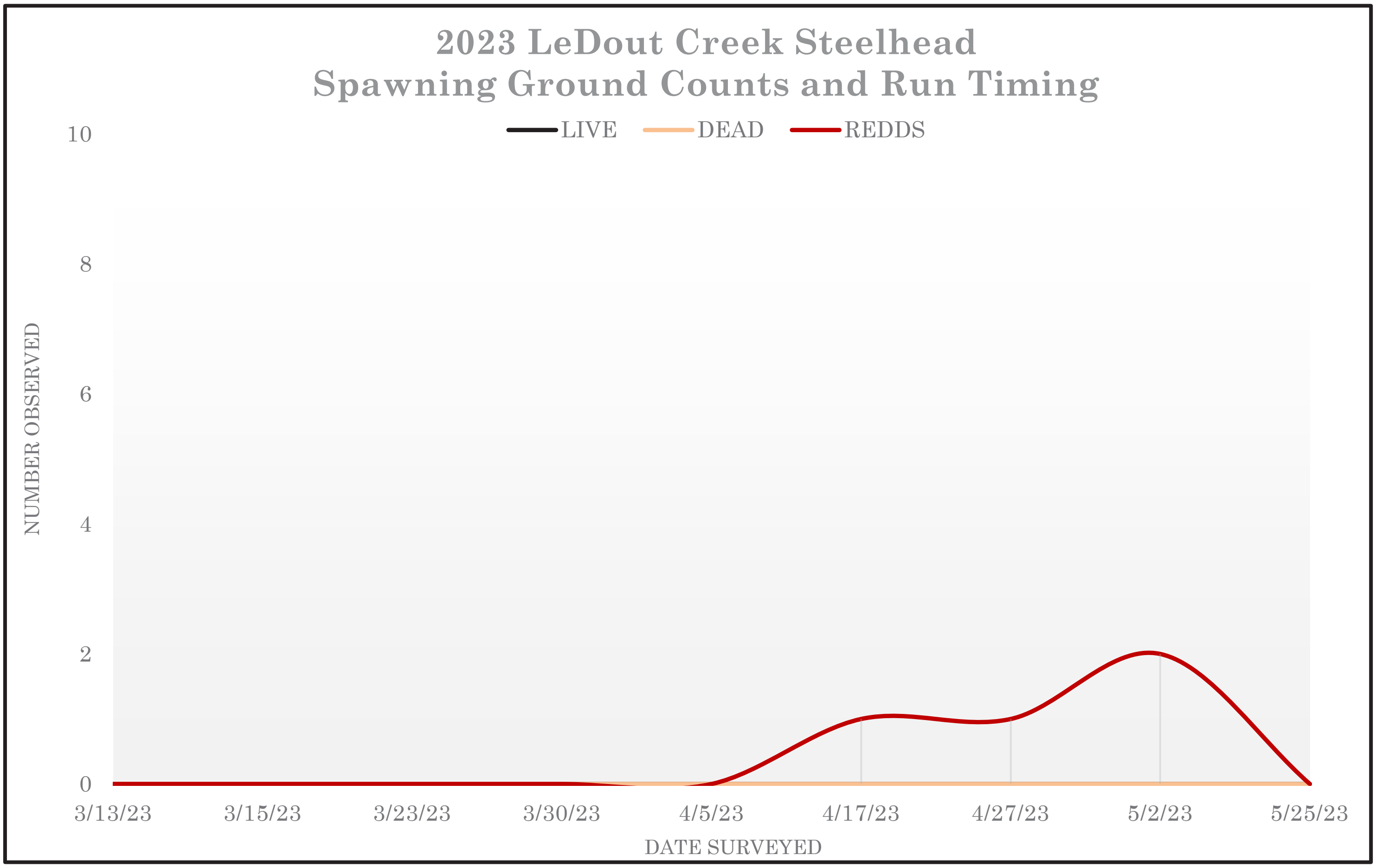
WRIA 10.0620

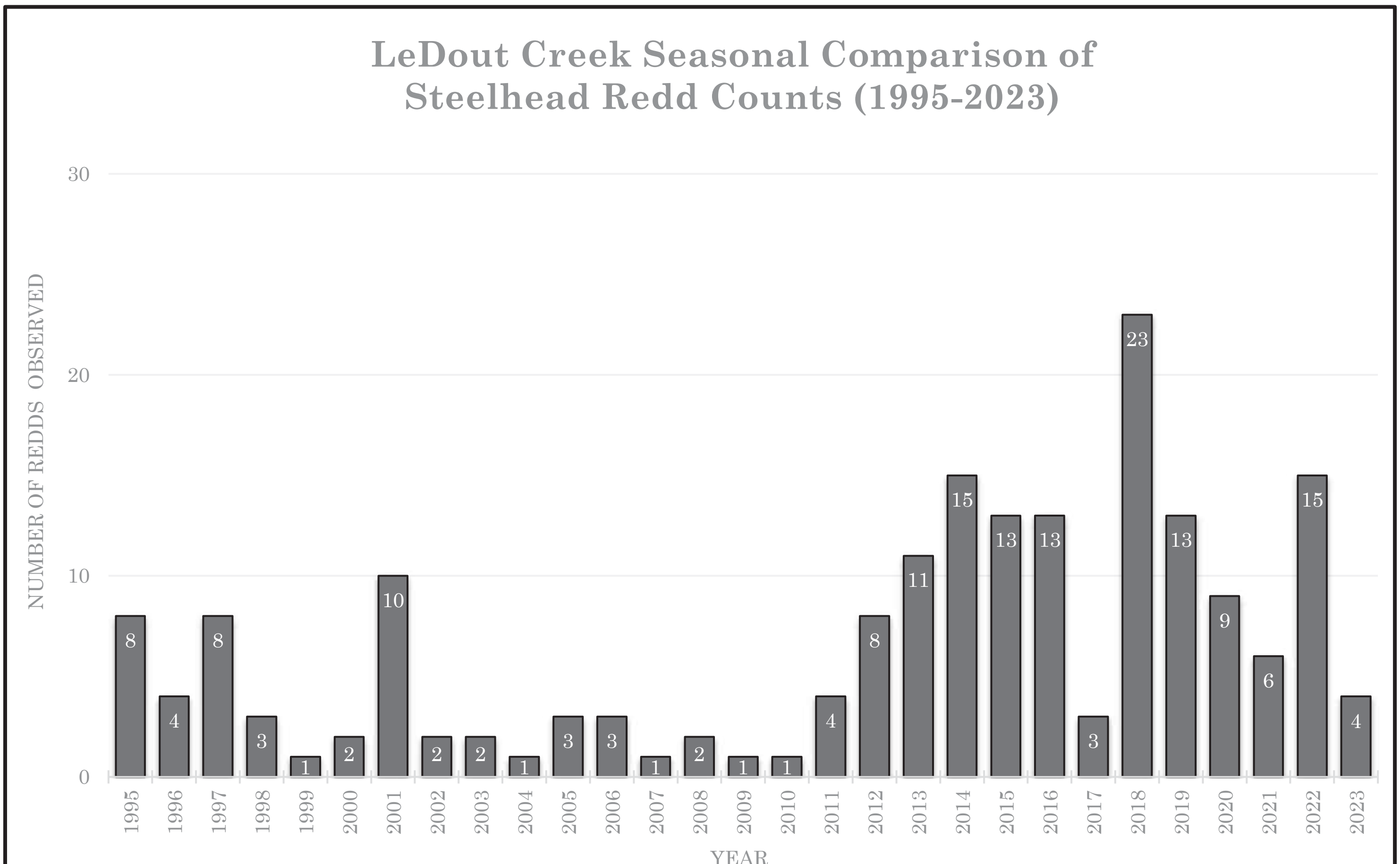
Le Dout Creek is a small tributary to the Upper Puyallup River, entering the mainstem river channel at RM 39.2. This small order stream drains a wetland area at just over 1,800 feet, and flows northwest for approximately 2.5 miles before meeting the Puyallup. Unfortunately, low flows *(major factor)* can prevent adult salmon from ascending past the first 0.45 miles. Le Dout is located within the Kapowsin tree. Several areas along the upper reach have undergone several timber harvests in the past. Le Dout Creek supports an exceptionally limited number of coho and steelhead spawners. Creek flow can be insufficient during late summer to allow Chinook access to spawn; however, higher than average flow allowed the first significant number of adult Chinook to enter the creek in 2013. Bull trout utilization is unknown. However, bull trout utilization is well documented in the Mowich and Puyallup; as well as nearby tributaries Rushingwater and Kellog Creeks.



Le Dout is a stream with moderate complexity, and habitat that is well suited for coho and steelhead adult spawners, as well as juveniles. To a large extent the substrate present throughout Le Dout consists of small and large cobble; yet, good quality patches of spawning gravels are available. The channel habitat consists mostly of low gradient pools and riffles. The creek contains a substantial proportion of small and medium size woody debris, and the surrounding riparian zone consists mostly of alder and Douglas fir. Logging activities occurred along the lower reach of LeDout in the past; however, there is currently a good RMZ along the majority of the lower spawning reach of the creek. A split in the channel at RM 0.45 can prevent adult fish from migrating further upstream due an increase in the gradient along with a reduction in flow. The upper reach of the creek is steep with impassable cascades. The 62 Rd. crosses Le Dout Creek approximately 0.45 miles from its confluence with the Puyallup River.

The mouth of Le Dout is located about 2.6 miles below the Electron diversion dam. Given that the creek is downstream of the diversion dam, and river flows over the past century have often been high enough during late winter and spring to prevent the mainstem channel of the Puyallup River from being drawn dry, wild steelhead have managed to maintain a minute foothold in Le Dout Creek. Steelhead surveys in Le Dout are conducted annually by the Puyallup Tribe. Winter steelhead stocks in the Puyallup basin have experienced a dramatic decline since 1990 *(ESA listed in 2007).* Factor(s) responsible for the decline in steelhead survival are unknown, especially when other salmon species are experiencing relatively good success.

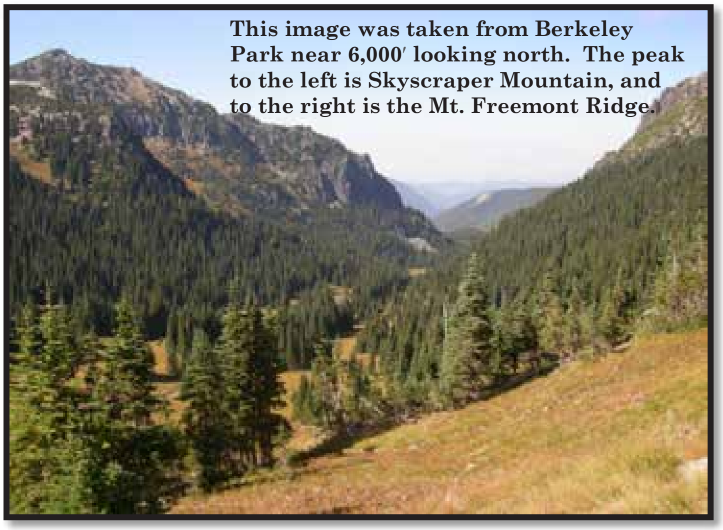




To determine the total escapement for steelhead, each redd is multiplied by a factor of 1.62 *(i.e. 42 redds x 1.62 steelhead per redd = total escapement of 68 steelhead).* See steelhead redd location map in appendix C.

LODI CREEK

WRIA 10.0227



This image was taken from Berkeley Park near 6,000′ looking north. The peak to the left is Skyscraper Mountain, and to the right is the Mt. Freemont Ridge.

Lodi Creek is a significant right bank headwater tributary to the West Fork White River. The name Lodi apparently originated from early mineral prospectors in the region. This high mountain stream flows northwest through a steep glacial valley, bordered by Skyscraper Mountain to the west and the Mount Fremont ridgeline running along the east *(top left)*. Lodi flows entirely within Mt. Rainier National Park *(NPS stream designation #f09-00a)*, the creek is non-glacial in origin; rather, its sources are derived from snowpack accumulations within Berkeley Park, located at 6,400+ feet of elevation *(top left)*; as well as other surrounding surface and groundwater sources. Berkeley Park is nestled into the northern slopes of the Burroughs Mountain Range. Lodi Creek flows for just over 4 miles from its headwaters before entering the White River at approximately RM 13.7; situating it about a mile upstream of Van Horn Creek *(RM 12.65)*.

The lower reach of Lodi provides excellent habitat conditions for bull trout rearing and spawning. Various surveys have verified both resident and fluvial bull trout utilization within this stream. PTF surveys the creek for bull trout spawning during the month of September. From 2005-2007, PTF biologists conducted extensive bull trout migration telemetry studies and redd surveys along the upper White River and West Fork White River; focusing heavily on the headwaters located within Mt. Rainier National Park. The study results showed that the cold high mountain streams located within the National Park, including Lodi, provide the majority of the critical bull trout spawning habitat in the basin. In addition, bull trout spawning was less consistent and frequent in this tributary compared to that observed in several significant headwater tributaries located along the White River.

During the 2007 season, several bull trout redds were documented in Lodi from mid-to-late September. During the 2008 season, no bull trout spawning activity was observed. The only bull trout observed spawning during 2006 was part of the migration telemetry study.

Characteristic of many headwater tributaries, the lower reach of the creek is a low gradient channel flowing within the open channel migration zone of the West Fork White River floodplain, and is repeatedly manipulated by mainstem river incursions. There is little significant LWD present in this portion of the channel and the high solar exposure results in significant algae mats accumulating over the substrate *(below)*. Although spawning does occur within this small stretch, it can be limited due the lack of quality spawning substrate created by the alluvial deposits *(fine sand and silt)* from the West Fork White River. Beyond the open floodplain, the creek enters the forested lower slope of the valley floor as it parallels the West Fork White River channel. From this point, the creek assumes a pool-riffle configuration for approximately the next 0.8 miles before climbing its way up the steep valley wall; an impassable falls prevent any further upstream migration. The forested reach provides quality spawning and rearing opportunities.

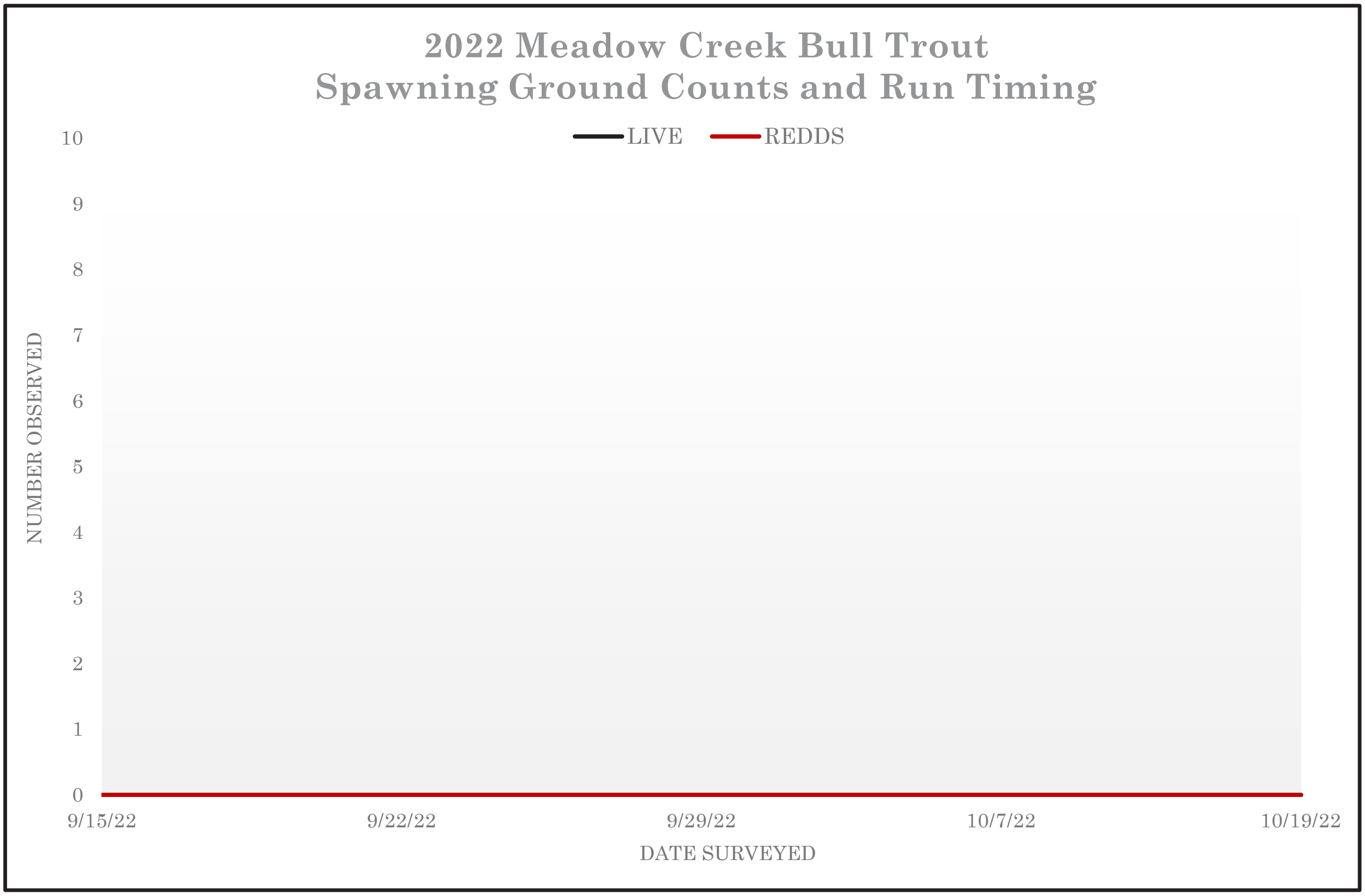
MEADOW CREEK

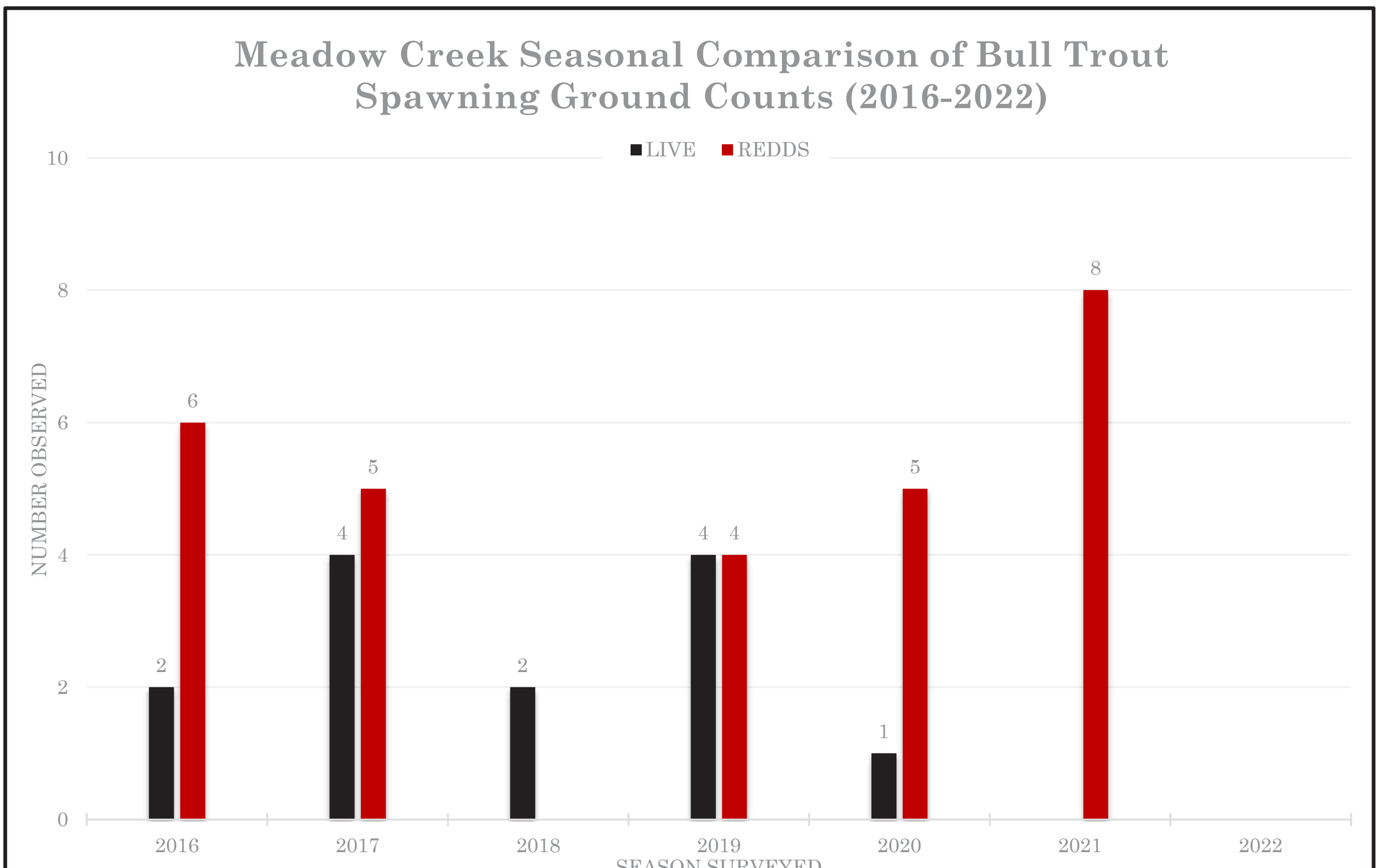
WRIA 10.0630

Meadow Creek is a tributary to the Mowich River, entering the Mowich at RM 3.9. The creek was named by Bailey Willis *(1857-1949)* in 1883. Willis was a geological engineer who played an essential role in establishing Mt. Rainier as a national park. Meadow originates from Eunice Lake *(elev. 5353')*, deep within Mt. Rainier National Park. With exception of the Mountain Meadows habitat area below Eunice Lake, the creek flows through a high gradient, frequently confined channel for most of its 4.6 mile length. Meadow Creek has one significant tributary, Hayden Creek, at RM 2.5. Pristine spawning and rearing habitat exists within the lower one-mile reach of the creek. This anadromous reach consists of a low to moderate gradient channel, with a pool-riffle character, abundant spawning gravel, LWD; as well as an intact mature riparian zone along the entire creek. Several pieces of LWD along with stable log jams have created remarkable stream complexity throughout the lower reach of the creek.

Meadow Creek is unspoiled in many ways and has incredible potential to be a highly productive salmon and steelhead stream. Unfortunately, anadromous salmon were unable to access the creek for nearly a century due to the streams location above the Electron diversion dam on the Puyallup River. With the completion of the Electron fish ladder *(@ RM 41.7)* in the fall of 2000, anadromous fish passage was restored for the first time since 1904. Restoring anadromous access to the upper Puyallup River has made approximately 26+ miles of spawning, rearing and foraging habitat above the diversion available for several species including Chinook, coho, pink, steelhead, and bull trout. The creek does; however, have a resident population of cutthroat. Bull trout presence and spawning utilization was first documented in 2016.

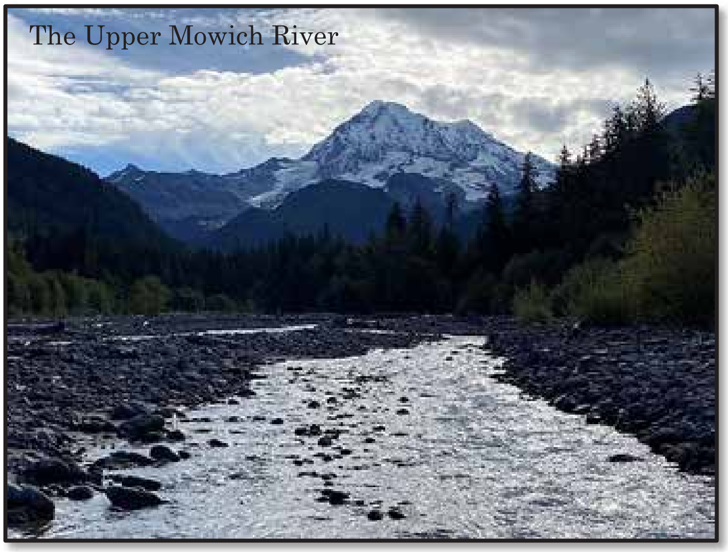
Due to the lengthy absence of anadromous fish usage and the poor rate of natural fish reestablishment, Meadow Creek is only occasionally surveyed to determine if salmon or steelhead are utilizing the stream. Disappointingly, many of the fish enhancement techniques employed by the Puyallup Tribe such as adult, juvenile, or fry plants; as well as the use of acclimation ponds, are not possible due to the creeks remote location and lack of vehicle access. Currently, no proposals exist for enhancing steelhead into Meadow Creek or the Upper Puyallup system. Yet, the need for action is paramount due to the steeply declining stock of wild steelhead in the Puyallup Watershed. The first/only documented steelhead redd occurred in May of 2014; however, regular/consistent surveys have not been conducted since 2014.


2022 Meadow Creek Bull Trout
Spawning Ground Counts and Run Timing
LIVE
REDDS
NUMBER OBSERVED
0
1
2
3
4
5
6
7
8
9
10
9/15/22
9/22/22
9/29/22
10/7/22
10/19/22
DATE SURVEYED


Meadow Creek Seasonal Comparison of Bull Trout
Spawning Ground Counts (2016-2022)
LIVE
REDDS
NUMBER OBSERVED
0
2
4
6
8
10
2016
2017
2018
2019
2020
2021
2022
2
6
4
5
2
4
4
1
5
8
SEASON SURVEYED

MOWICH RIVER

WRIA 10.0624



The Upper Mowich River

The Mowich River converges with the Puyallup River at RM 42.3, this is approximately 0.6 miles above the Electron diversion dam. *The availability and nature of fish and stream habitats are not static conditions and are frequently altered. The habitat descriptions in this report provide a general analysis of habitat conditions, and are not intended to fulfill the requirements of a rigorous biological assessment/evaluation.*

The glacial headwaters of the Mowich River originate from the Edmunds, and the North and South Mowich glaciers on the west slope of Mt. Rainier. The Mowich and its associated tributaries provide excellent spawning and rearing opportunities for salmon, steelhead and bull trout. Significant tributaries to the Mowich include; Crater, Spray, Meadow, and Rushingwater creeks. Meadow originates from Eunice Lake, deep within Mt. Rainier National Park and enters the Mowich at RM 3.9. The creek flows through a high gradient, frequently confined channel for most of its 4.6 mile length. Meadow Creek has one significant tributary, Hayden Creek, at RM 2.5. However, the lower mile of the creek has a low to moderate gradient, with a pool-riffle character, abundant spawning gravel, LWD, and riparian cover along the entire channel. Several pieces of LWD along with stable log jams have created remarkable stream complexity throughout the lower reach of the creek. Steelhead and bull trout have been documented spawning in Meadow Creek.

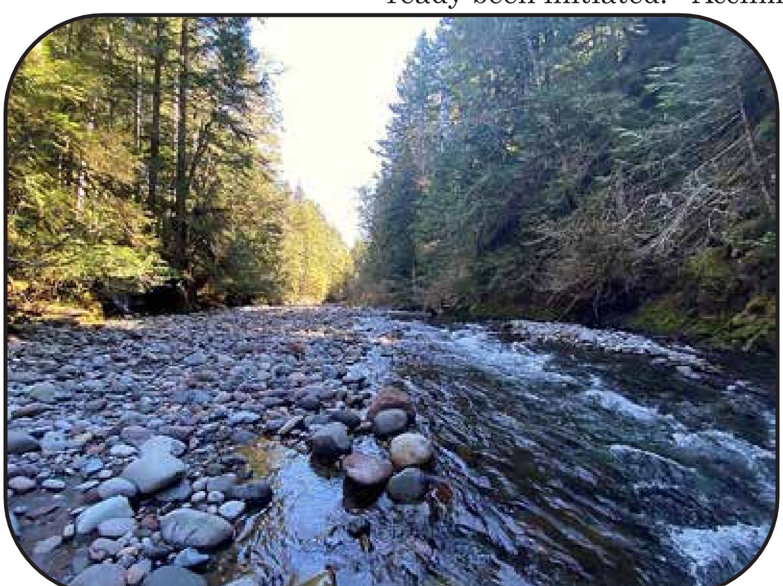
Rushingwater Creek originates from the Golden Lakes in Mt. Rainier National Park. Rushingwater flows over 5 miles to its confluence with the Mowich River at RM 0.6. Most of Rushingwater flows within the Kapowsin tree farm where roads and timber harvesting have impacted several portions of the stream. The upper survey reach of the creek is mostly comprised of pools and glides, with fine and medium sized substrate. Abundant in-stream woody debris and a moderate to dense canopy cover extend throughout most of this reach.

The North and South Mowich forks flow though Mt. Rainier National Park and reach their convergence at RM 7.5 to form the main stem Mowich River. The upper 4-5 miles of the Mowich River consist of steep and moderate gradients, with a largely cobble and boulder substrate. There is little spawning habitat available, yet some suitable spawning conditions exists in the outlying side channels below RM 7.5. The channels of the North and South Mowich are bordered by mature dense conifer and mixed deciduous forests. From RM 6.5 to 3.1, the Mowich River is comprised of more complex habitat. The gradient decreases along this reach, resulting in a more pool-riffle character where smaller spawning substrate is deposited and resting pools are available for fish rearing, foraging and migration.

Chinook in the Mowich River.

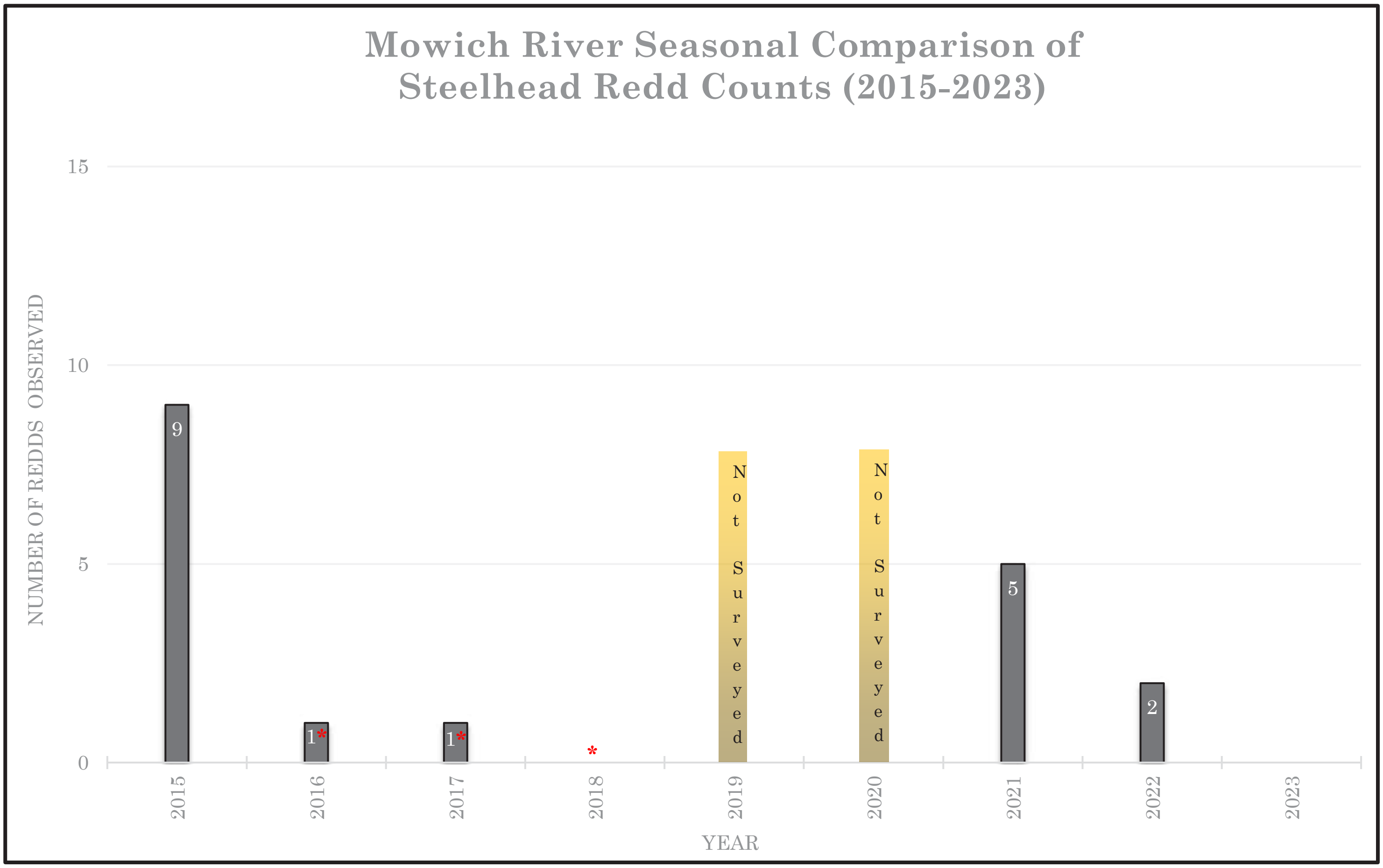

Lower Mowich River.

The lower three mile of the river flows within the Kapowsin tree farm. Most of the lower three miles of the channel becomes confined and narrowed by the steepening valley walls. Fortunately, much of the channel retains its complexity and spawning opportunities are abundant for both salmon and steelhead. Juvenile coho have been observed as high as RM 5.0, whereas adult and juvenile bull trout have been documented as high the lower North Mowich. Of special note is the first documented spawning of naturally returning Chinook in the Mowich River in 97 years. Two females on separate redds were observed spawning in the lower reach *(RM 1.0)* on September 7, 2001.

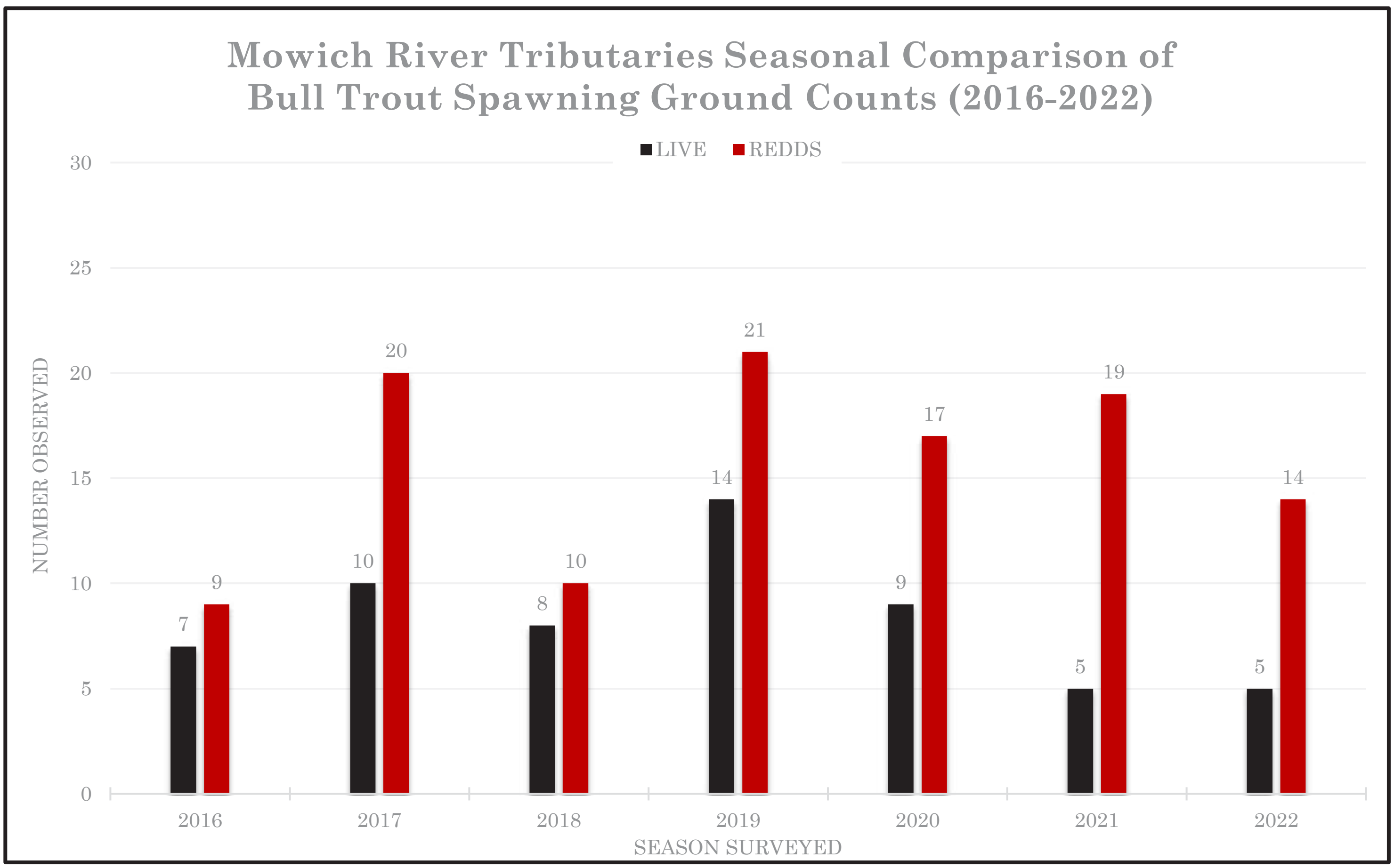


With the completion of the Electron fish ladder *(RM 41.7)* in the fall of 2000, anadromous fish passage was restored for the first time since 1904. Since the late 1990's, as part of the tribes fish enhancement program, surplus adult Chinook and coho salmon from Voights Creek Hatchery have been planted, to spawn naturally, in the Mowich and Rushingwater Creek. One of two acclimation ponds used for enhancing coho *(prior to 2008)* into a 26+ mile reach of the Upper Puyallup River is located just off the main channel of Rushingwater Creek at RM 0.6. The pond holds 14,000 cu. ft. of water with a flow rate of 1-3 cfs, in past years, 40,000 to 100,000+ coho yearlings were imprinted and released from Rushingwater annually. Coho yearlings originated from Voights Creek Hatchery where they were adipose clipped and coded wire tagged. Fish were released at 20 fish per pound, for a total biomass of 10,000 pounds. There was also a natural acclimation pond on the Mowich used for rearing Fall Chinook, located at RM 0.1. Unfortunately, the water intake was destroyed during a flood event; rendering this pond nonoperational.

The Puyallup Tribe's restoration goal is to rebuild depressed Chinook and steelhead stocks and remove them from ESA listing. Historically, Fall Chinook have been reared since 1980 with a variety of stocks, goals, and objectives. Using acclimation ponds, limiting harvest, and making substantial gains in habitat restoration, the Tribe will be able to accomplish this task. Levee setbacks, oxbow reconnections both inter tidal and upland, Commencement Bay cleanup, and harvest cutbacks have already been initiated. Acclimation ponds are a proven method in increasing fish numbers on the spawning grounds. Hatchery rearing Fall Chinook for acclimation ponds in the upper Puyallup River is a key component to restoration goals. Surveys conducted for bull trout spawning activity, initiated in 2016, has resulted in identifying several index spawning sites. Preliminary genetic analysis conducted on 47 tissue samples collected from bull trout recovered from the Electron forebay *(2002-2015)*, strongly indicates the population of bull trout in the Upper Puyallup/Mowich is comprised of a single distinct spawning population *(genetic work is ongoing)*.



*2016-2018 redd data is incomplete due to extremely poor survey conditions which prevented a regular full season of surveys. To determine the total escapement for steelhead, each redd is multiplied by a factor of 1.62 *(i.e. 42 redds x 1.62 steelhead per redd = total escapement of 68 steelhead)*. See steelhead redd location map in appendix C.



NIESSON CREEK

WRIA 10.0622

Steelhead spawning in Niesson Creek.

Niesson Creek is a tributary to the Upper Puyallup River. Originating from snowpack run-off and ground water, the creek runs northerly for approximately 5.3 miles before meeting the Puyallup at RM 41.1. Anadromous usage extents throughout the first 2.2 miles of the creek; supporting Chinook *(planted)*, coho *(NOR & hatchery plants)*, steelhead, and bull trout.

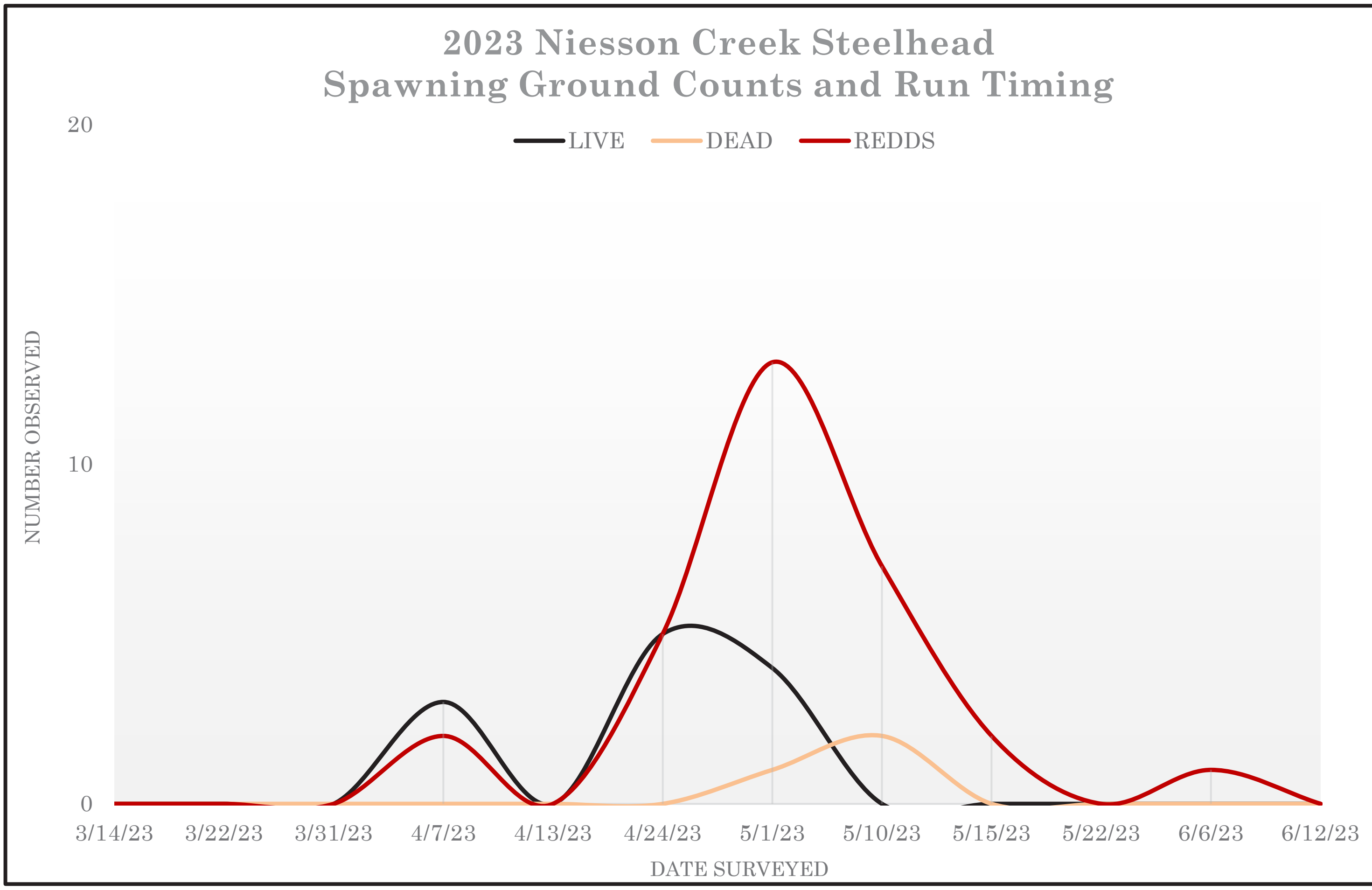
Beyond RM 2.2, the creek climbs steeply along the remaining 3.1 miles to its origin at just over 4,000 feet. Niesson Creek is located within the Kapowsin Tree Farm. The overstory riparian zone consists of mixed conifers and deciduous trees. Continuing timber harvesting activities have reduced the riparian zone to the state required minimum along several extended segments of the lower creek.

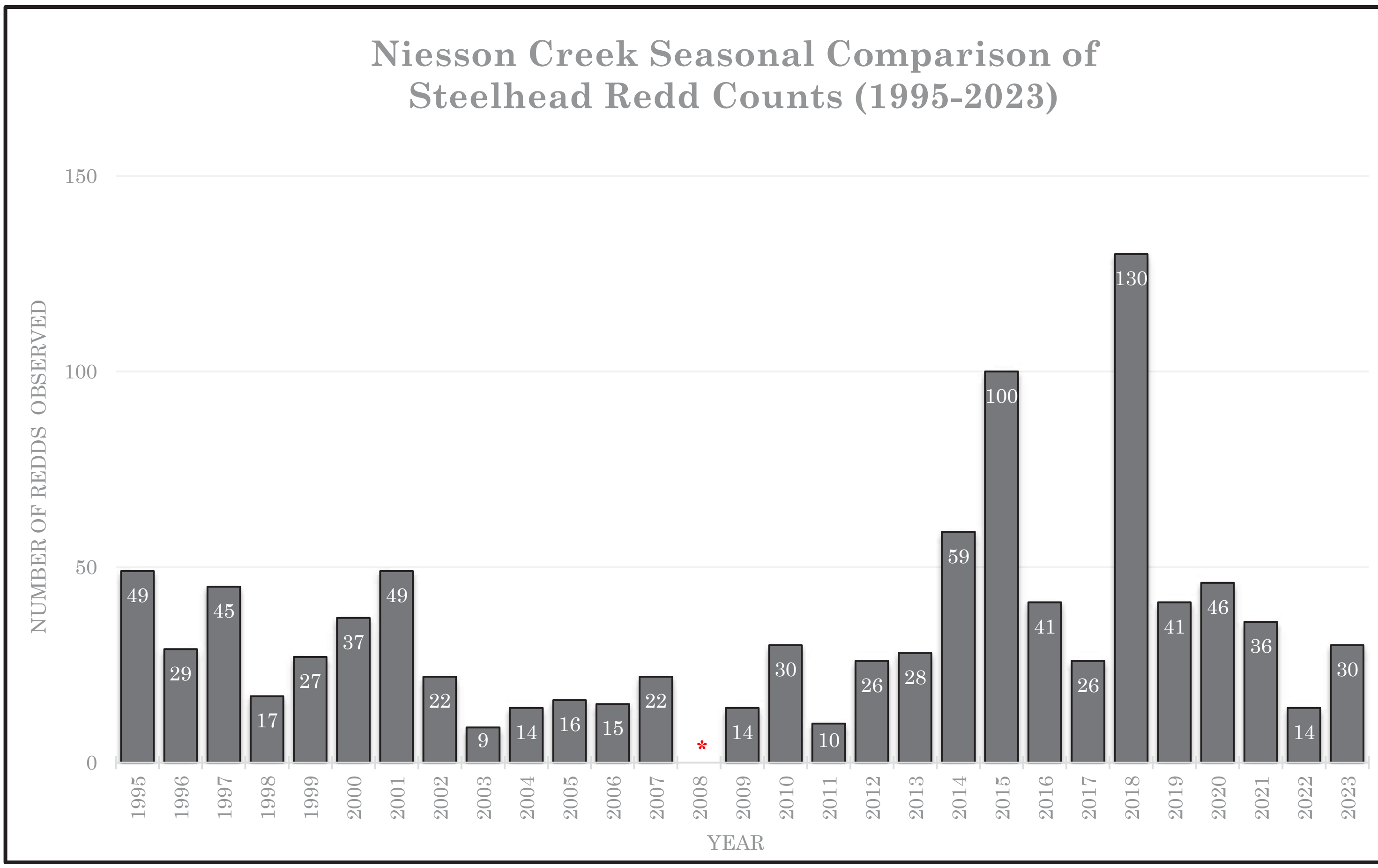
Niesson is a complex, moderate sized stream, which varies between a pool-riffle and forced pool-riffle character. The creek contains excellent and frequent spawning gravel, as well as significant LWD and debris jams throughout the 2.2 mile anadromous reach.

Niesson Creek is surveyed consistently for wild steelhead and spot checked for coho. Steelhead have been observed spawning as high as RM 2.2 near the abandoned 22 Rd. Naturally returning coho were observed for the first time in 2002. The natural returns are a result of live adult plantings and juvenile acclimation projects conducted by the Puyallup Tribal Fisheries Department. Since 1998, the Puyallup Tribe has been transporting live surplus adult coho from the WDFW's Voights Creek Hatchery in Orting; however, no fish were planted in 2004 or 2007. Instead, naturally retuning adult coho were allowed to spawn without intrusion from hatchery planted coho. Adult surplus Fall Chinook have been planted in the past when fish were available and creek flows allowed; unfortunately, the creek flow can be too low to allow naturally returning Chinook access to the creek in late summer and early fall.

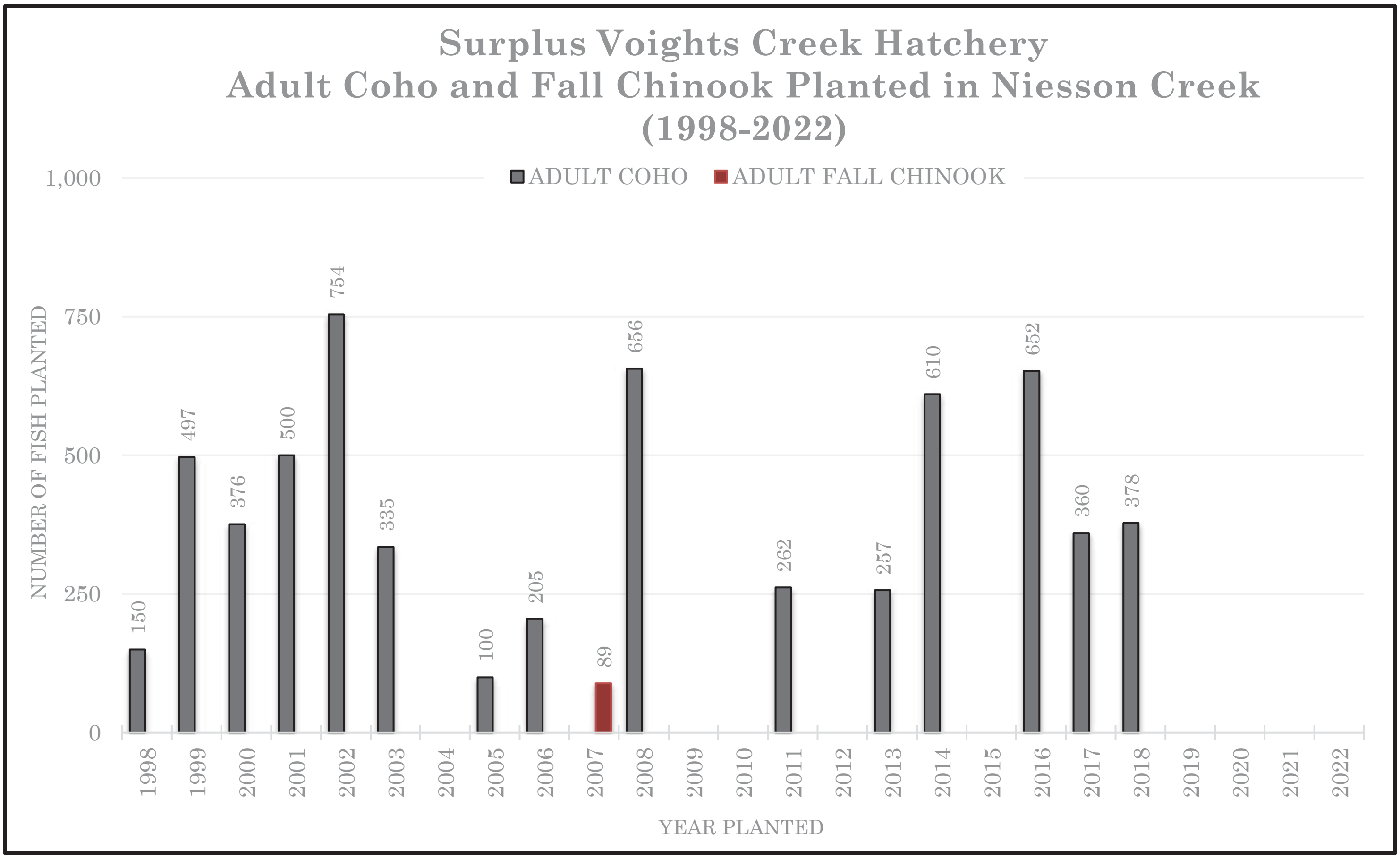
Like Kellog and Le Dout creeks, the mouth of Niesson Creek is located downstream of the Electron diversion dam. Flows over the past century have often been high enough during late winter and spring to prevent the mainstem channel of the Puyallup River from being drawn dry; the higher winter/spring flows have thereby allowed wild steelhead to maintain a foothold in Niesson Creek. Unfortunately, escapement in Niesson has decreased significantly over the past several years. The winter steelhead stocks in the Puyallup basin have been declining since 1990. The precipitous decline within the past several years has created serious concern among fisheries managers. Factor(s) responsible for the decline in steelhead escapement are unknown, especially when other salmon species are experiencing relatively good success. Unlike the White River, there are currently no enhancement or supplementation programs for steelhead on the Puyallup River.

Lower Niesson Creek





*2008 redd data is incomplete due to extremely poor survey conditions which prevented a regular full season of surveys. To determine the total escapement for steelhead, each redd is multiplied by a factor of 1.62 *(i.e. 42 redds x 1.62 steelhead per redd = total escapement of 68 steelhead).*



Surplus coho and Chinook adults provided by WDFW Voights Creek Hatchery when available.

NO NAME CREEK

WRIA 10.0364

Bull Trout

No Name is not the officially designated name for this stream as established by the Washington State Board on Geographic Names; however, it's regularly referred to as "No Name Creek" by PTF staff *(NPS designation w14-00a)*. No Name is a small south facing left bank headwater tributary of the White River; at nearly 3.5 miles in length, only the lower 0.7 miles offers exceptional habitat conditions for rearing and spawning. The creek supports all bull trout life history stages, as well as residential and fluvial life history types. No Name is surveyed for bull trout from early September-to-mid October. No Name Creek, like Klickitat Creek, is pristine in many ways. Originating along the slopes of the Sourdough Mountains near Sunrise Park, the creek flows entirely within Mt. Rainier National Park. No Name Creek enters the White River north of Sunrise Park Road at approximately RM 68.1.

The first 0.34 miles of the creek is low gradient and flows within the channel migration zone of the White River *(below)*. The habitat within this section is the least conducive to spawning due to a primarily sandy substrate; however, pools and side channels provide excellent habitat for juvenile bull trout which are often observed in the pools and lateral habitat during adult spawning surveys. In addition, this reach of the creek is highly subjected to the possibility of redd scouring or heavy silt deposition due to the influence of the mainstem White River.

The next 0.12 miles flows through the edge of the forested area along the White River channel. At this point the channel gradient increases slightly, as do the spawning opportunities. Although the substrate throughout this section is somewhat sandy, several pockets of suitable spawning gravel exist. Stream complexity increases due to some small debris jams and limited LWD. The surrounding riparian consists of primarily alder with some small to moderate sized Douglas fir and cedar; even so, solar exposure is still high through this portion of the creek.

The final quarter mile of anadromous usage contains the most frequently utilized habitat. The channel contains several pieces of LWD and spawning gravels, in addition to a heavy riparian zone consisting of fir and cedar. At approximately RM 0.71 the creek turns sharply and rapidly climbs up the valley wall. At this point the stream quickly develops into a series of impassable cascades preventing any further upstream migration. Bull trout have been observed spawning in the creek from early September-to-mid October.

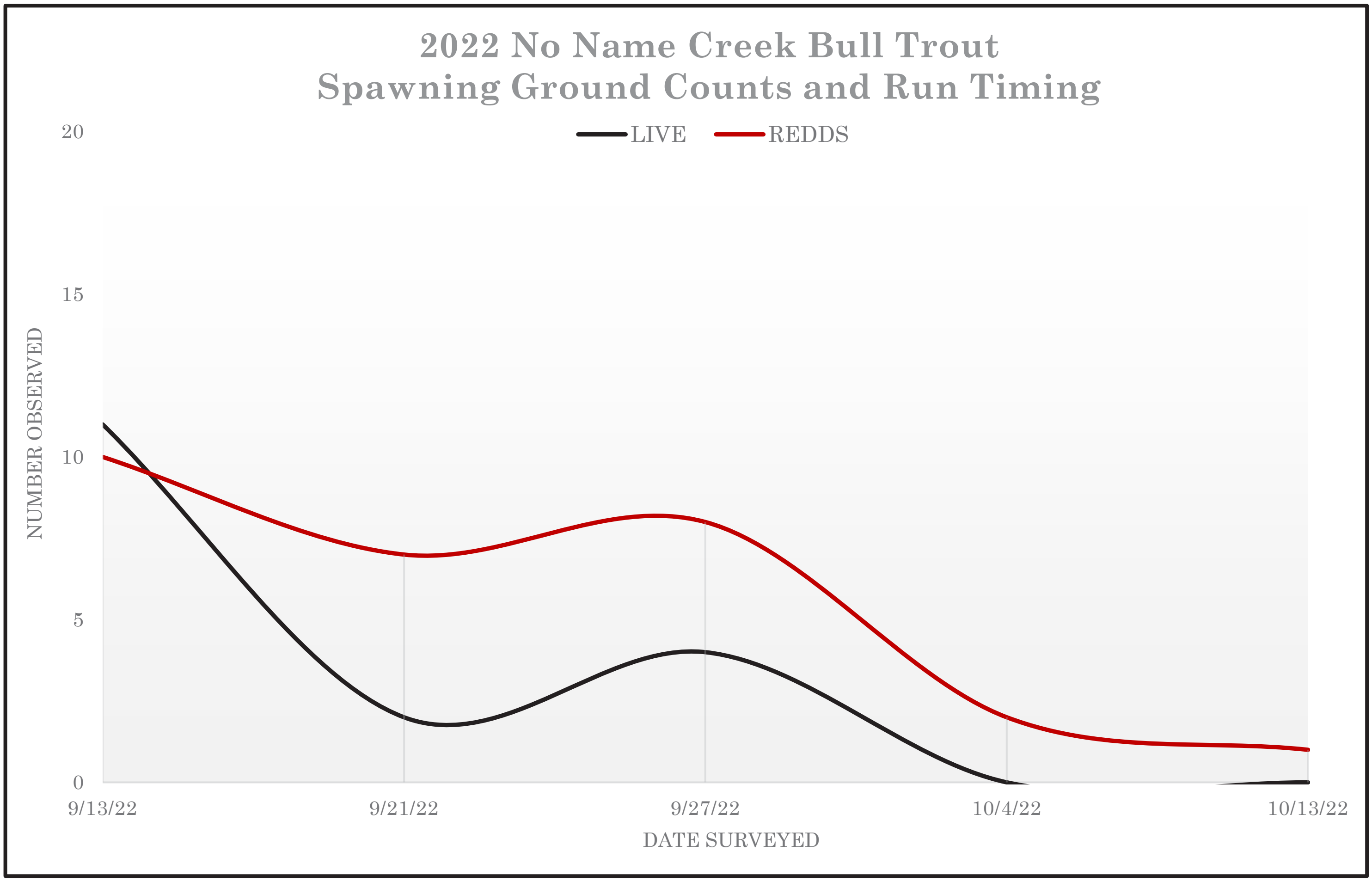
In 2006 and 2007, PTF biologist conducted extensive bull trout radio telemetry and redd surveys along the upper White River; focusing heavily on the headwaters located within Mt. Rainier National Park. During the 2007 season, several bull trout were observed spawning in No Name Creek from early to late September. One of the bull trout observed spawning in the creek was part of the migration telemetry study. This bull trout was surgically implanted with LOTEK® Wireless Inc.'s Nano Tag Series transmitters *(NTC-4-2L)* and released near the Greenwater River (*RM 45*) in late June, and was observed spawning in late September.

Resident bull trout reside in smaller headwater tributaries, while fluvial bull trout frequently travel long distances; utilizing the mainstem rivers and larger tributaries to forage and overwinter. During the fall, migratory forms of bull trout journey from spawning and rearing habitats in the upper watershed to foraging and overwintering habitats located lower in the river system. Beginning in spring and early summer, they begin the return journey back to spawning and foraging areas high in the watershed. In response to changing habitat and reproductive needs, migratory bull trout in the White River travel up to 75 miles or more between the lower river and headwaters located in or near Mt. Rainier N.P. To accomplish this, bull trout require unobstructed migration corridors and connectivity of streams and rivers in order to provide them with access to spawning, rearing, foraging, and overwintering habitats.

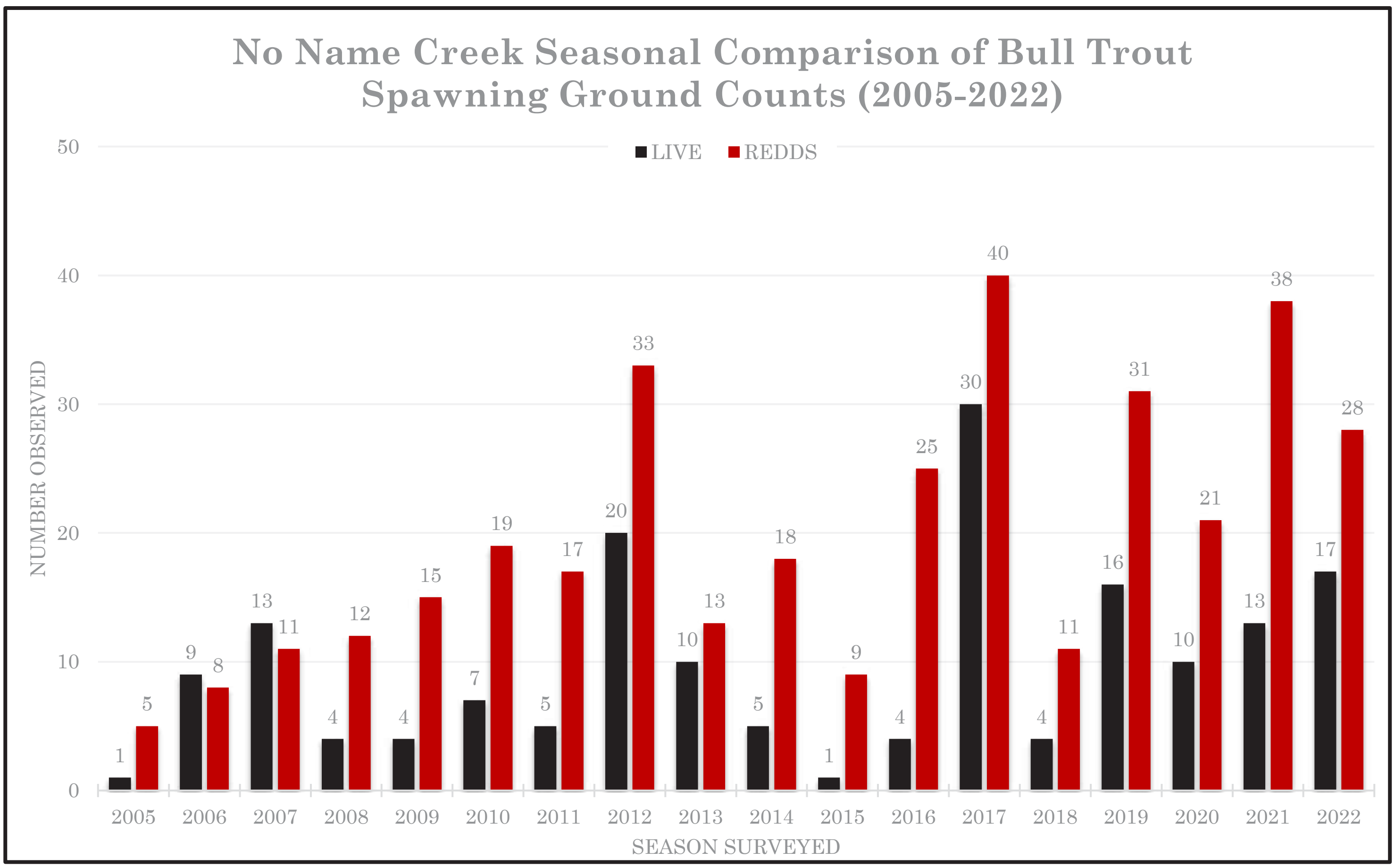
Spawning frequently occurs from early September-to-mid October, with peak spawning typically occurring around the third-to-fourth week of September *(see Appendix B for survey data)*. Bull trout are iteroparous *(ability to spawn more than once)*; therefore, recovering pre-or-post spawn mortalities for examination is extremely rare. Spawners in the upper White River tributaries are observed utilizing various sized substrate from small gravels to small cobble. Redds are often constructed in the tail-out of pools and along channel margins. Embryonic development is slow *(depending on water temperatures)*; it may take between 165-235 days for eggs to hatch and for alevin to absorb their yolk (Pratt 1992). Bull trout fry emerge in late winter-to-early spring. Young fry can often be seen by mid-March foraging in the lateral habitat along the upper mainstem White River and associate tributaries.

Bull trout habitat throughout the Puyallup and White rivers has been severely impacted by over a century of land and water resource exploitation; including, damming and substantial water diversions, considerable riparian alterations *(deforestation)*, dewatering and low instream flow regimes, as well as significant channel manipulation. These impacts have lead to a marked deterioration in land and hydrological behavior within these river systems by causing water flow of poorer quality, quantity and timing. Several limiting factors are involved with regards to the healthy function of stream habitat and bull trout populations in the watershed including: lost or diminished habitat connectivity and migration corridors *(human-made fish passage barriers)*, fragmentation and reduction of habitat quality *(entrainment, transportation networks, forest management practices and operations, direct water withdrawal)*; in addition to, water quality, fish entrainment and entrapment, unknown species interactions, and potential climate change impacts *(changes in flow regimes, scour effects, thermal variations, changes in water chemistry)*.

Bull trout are primarily piscivorous [pi-siv-er-uh s] *(fish eaters)*; however, they are opportunistic feeders, feeding on a variety of prey items depending on their particular life history strategy and stage of development. Adults feed almost exclusively on other fish, including a range of salmon and trout species; as well as other resident fish species. Juveniles feed on aquatic invertebrates, including stoneflies *(Plecoptera)*, caddisflies *(Trichoptera)*, and mayflies *(Ephemeroptera)*. Bull trout require a healthy aquatic environment in order to survive and flourish. They need an environment that provides the necessary prey base; in addition to the rearing and reproductive habitat essential to ensure their continued survival and reproductive success.



2022 data collected by the Puyallup Tribe and National Park Service (MORA). Spawning data for No Name Creek can be found in Appendix B. See Appendix C for bull trout redd locations.



OHOP CREEK

WRIA
10.0600

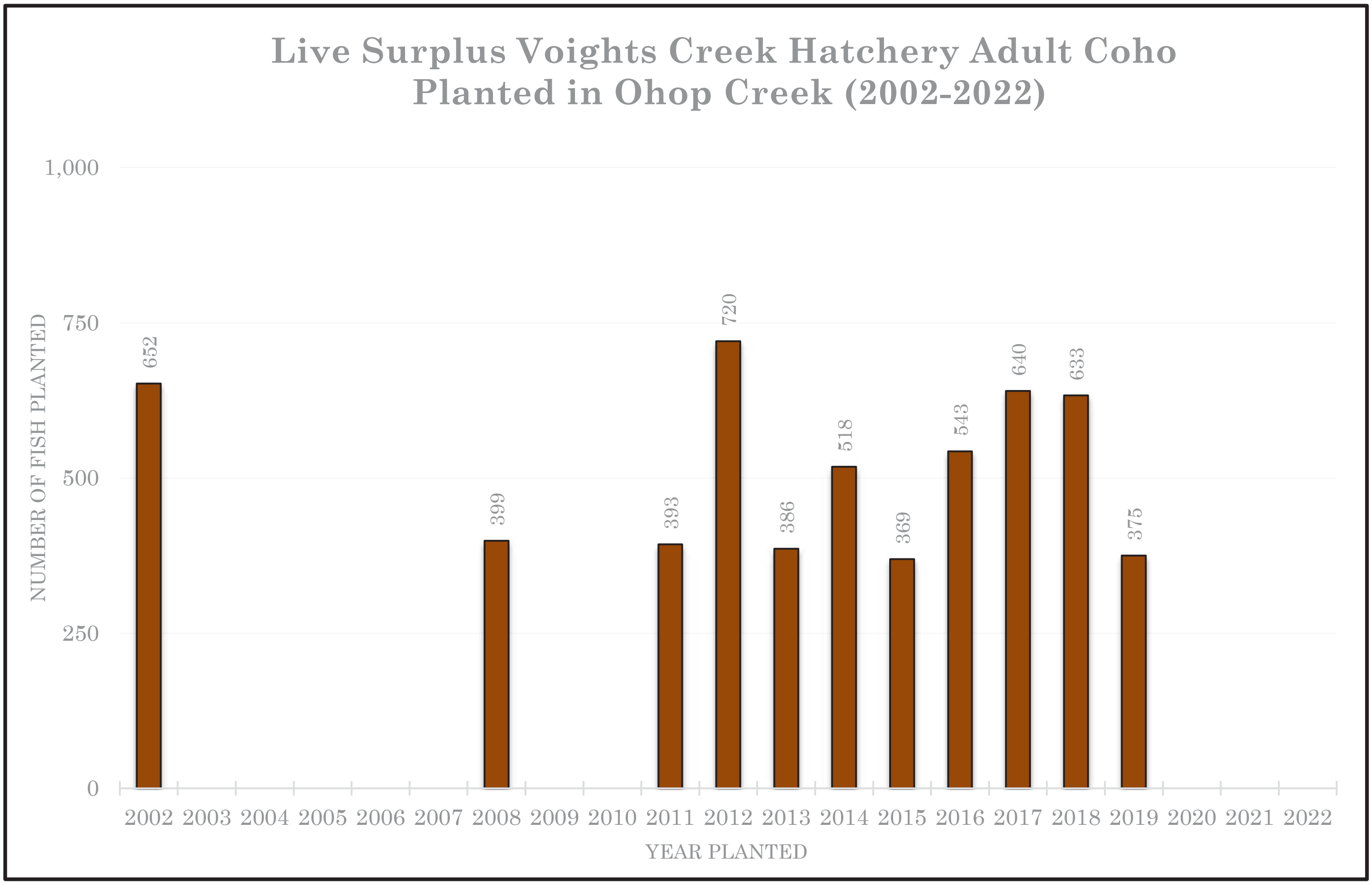
Ohop Creek is the primary feeder stream (*inlet)* to Lake Kapowsin; not to be mistaken for the Ohop Creek which is a tributary to the Nisqually. Ohop Creek and Kapowsin Creek share the same WRIA designation *(10.0600)*. Continuing for nearly 8.5 miles beyond Lake Kapowsin, the creek currently supports primarily coho. In addition to coho, the creek likely continues to support a limited number of steelhead as well.

The lower 0.2 miles of Ohop Creek flows through a narrow and incised channel within the wetland boundary along the south end of Lake Kapowsin. This initial stretch is nonconductive to spawning and is heavily vegetated *(largely reed canary grass [Phalaris arundinacea])*, and is commonly the site of recurrent beaver (*Castor canadensis*) activity. From RM 6.5 to RM 7.0, the creek assumes a low gradient pool-riffle structure; containing excellent spawning gravel, as well as several deep pools and moderate amounts of in-stream woody debris. The channel meanders through a forest of cedar, fir, alder and maple that is fairly dense along much of the lower reach *(RM 6.5 to 8)*. Several side channels branch off along this reach, offering additional spawning and rearing habitat. High water events often reestablish some significantly long complex side channels located above RM 0.4. These side channels are often utilized by coho. Cattle occasionally have access to the creek, but they have had minor impact.

The upper reaches of Ohop Creek extend well into the Kapowsin tree farm. Logging roads and timber harvesting have impacted several portions of the stream; by way of, increased sedimentary inputs, windthrow, increased solar exposure, as well as confinement and constriction of the stream channel.

Despite the 3 year coho net-pen project employed in Lake Kapowsin by the Puyallup Tribe from 1995-1997 *(program reinstated in 2019)*, adult coho escapement has dropped in Ohop and Kapowsin creeks over the last two decade. Additional enhancement efforts are made seasonally to supplement the coho run by planting surplus adult coho, when available, from WDFW's Voights Creek Hatchery into Ohop Creek, where they are able to spawn naturally. Steelhead surveys have been reduced to periodic spot checks during the spring since none have been observed for several years. However, it's likely that a small number of steelhead may continue to spawn in the creek above the survey area since they are observed consistently in Kapowsin Creek.

The winter steelhead stocks in the Puyallup basin have declined since 1990. The decline has been a cause of concern among fisheries managers. The factor(s) responsible for the decline in steelhead escapement are unknown, especially when other salmon species are experiencing relatively good success.



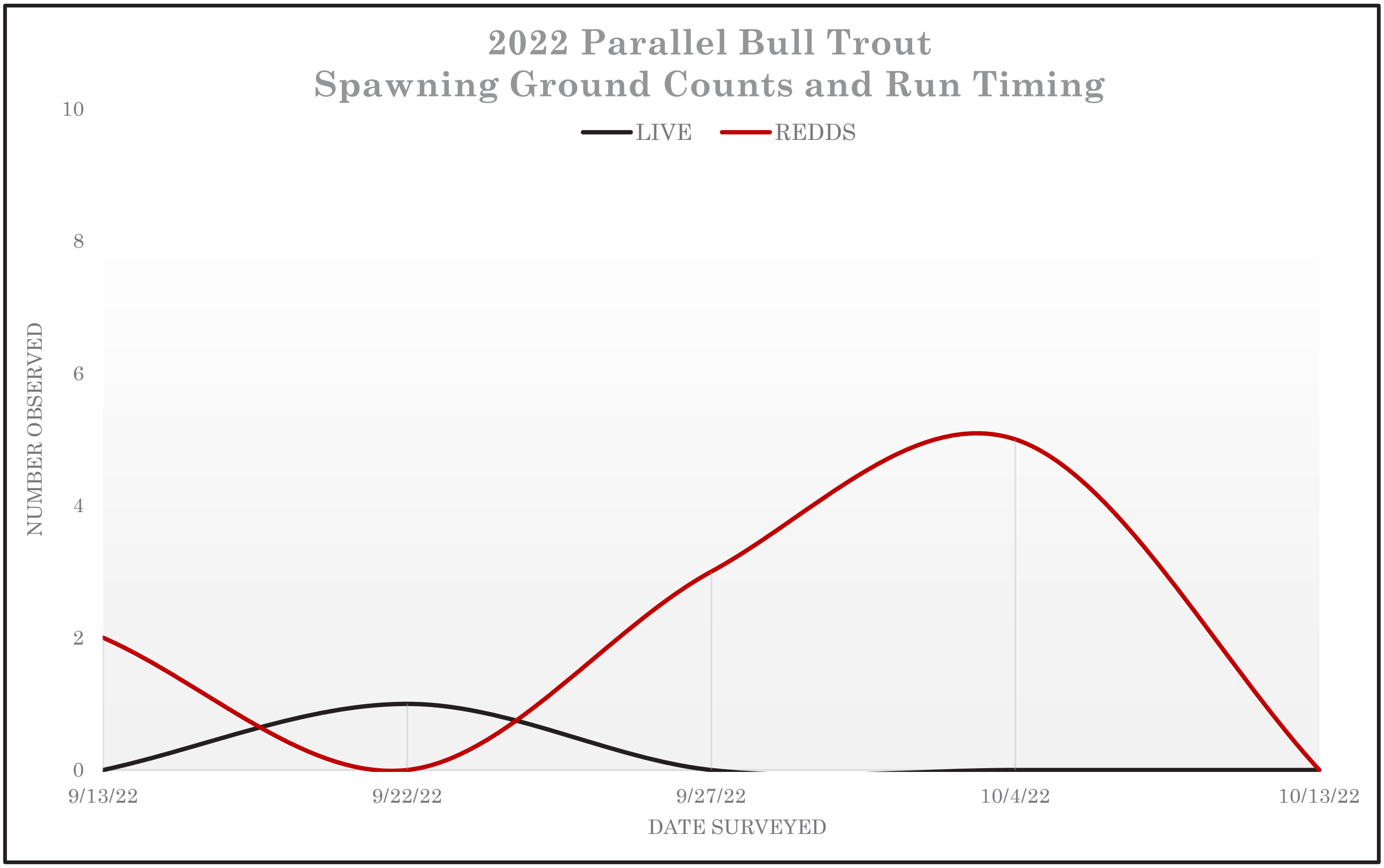
Surplus adults provided by WDFW Voights Creek and Puyallup Tribe's Clarks Creek (since 2017) hatcheries when available.

PARALLEL CREEK

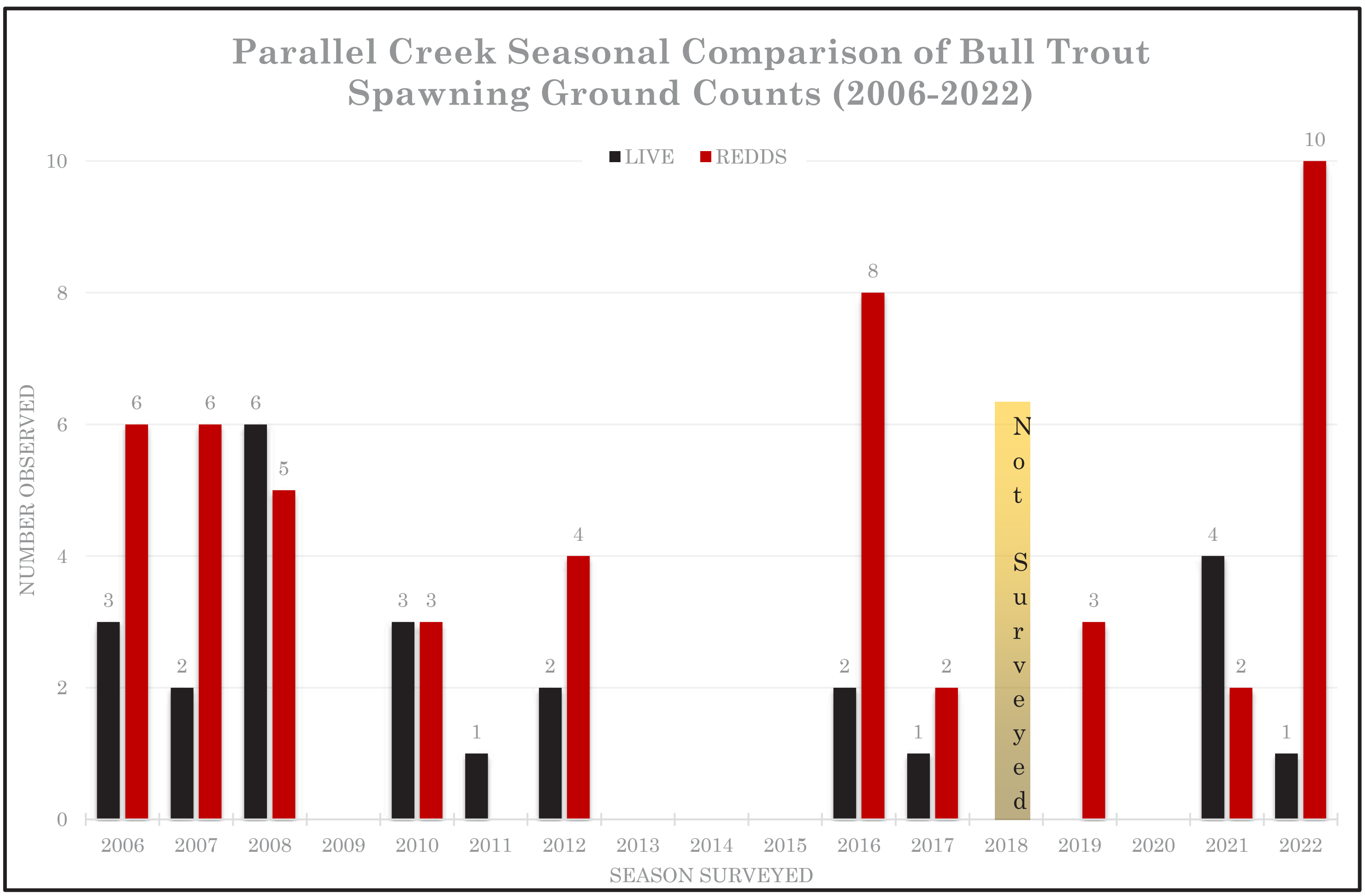
Parallel Creek is not officially named, nor is it identified on most topological or hydrological maps; however, for easy identification the creek is referred to as "Parallel" by PTF staff. Parallel is a small south facing left bank headwater tributary to the White River; with the lower 0.6 miles flowing parallel *(hence the name)* to the White River channel. Parallel Creek, like other bull trout streams such as Klickitat Creek and No Name, is pristine in many ways. The creek provides exceptional habitat conditions for bull trout rearing and spawning. Since 2006, the Puyallup Tribe has surveyed the creek for bull trout spawning activity. Spawning frequently occurs from early September-to-mid October, with peak spawning typically occurring around the third-to-fourth week of September *(see Appendix B for survey data).* Originating along the slopes of Sunrise Ridge, the creek flows entirely within Mt. Rainier National Park, entering the White River approximately at approximately RM 67.9; which is directly across the river channel from Klickitat Creek.

Characteristic of many headwater tributaries, the mouth of the creek is frequently translocated due to its position within the open channel migration zone of the White River floodplain. As a result of the mainstem river incursions, the creeks lower channel and riparian habitat is frequently altered. The habitat within this section is often the least conducive to spawning due to a primarily fine/sandy substrate. In addition, this reach of the creek is highly subjected to the possibility of redd scouring or heavy silt deposition due to the influence of the mainstem White River.

Nearly the entire anadromous reach of the creek is low gradient, and the channel is somewhat narrow and incised. The surrounding riparian near the mouth consists primarily of alder *(pioneer species)* with some small to moderate sized Douglas fir and cedar; even so, solar exposure is still low through this portion of the creek during the summer. The approximately 0.5 miles of stream channel upstream of the mainstem area of influence flows through a heavily forested area along the White River channel. Stream complexity within this section increases due to small debris jams and moderate amounts of LWD. Throughout the majority of the anadromous reach, the channel gradient remains low as the stream meander significantly through the forest. Due to the low gradient and tranquil flow throughout this reach, the substrate consists mainly of fine material; however, several pockets of suitable spawning gravel exist, providing adult spawning opportunities *(lower right image).* At approximately RM 0.6 the creek rapidly climbs up the valley wall. At this point the stream quickly develops into a series of impassable cascades preventing any further upstream migration.



2022 data collected by the Puyallup Tribe and National Park Service (MORA). See Appendix C for bull trout redd locations.



PINOCHLE CREEK

WRIA 10.0198

Pinochle Creek is a moderate sized tributary to the West Fork White River, located on the left bank at RM 6.8, and flows within USFS Snoqualmie National Forest management area. Coho are the most abundant and common species observed in Pinochle Creek. Other species known to utilize the creek include Chinook, coho, pink, sockeye, cutthroat and steelhead/rainbow. Bull trout utilization is unknown but presence is presumed since the species is present in the West Fork White River and other West Fork tributaries. Low flows can make it problematic for Chinook to access the creek in August and September to spawn; as a result, Chinook escapement in Pinochle is often low or absent. A bedrock falls about 0.3 miles upstream of the bridge over Pinochle blocks further upstream migration. From the falls, to the confluence with the West Fork, there exists excellent spawning and rearing habitat for all species. The channel is low gradient, unconfined, and pool-riffle in character with. In addition, there is abundant woody debris from the surrounding old-growth forest. Wrong Creek and Pinochle Creek are two small tributaries to Pinochle, entering near RM 0.2.

In the past, Pinochle was surveyed for adult salmon escapement; unfortunately, flood damage to Forest Service Road 74 has prevented access to the creek since 2006; so, no escapement surveys or fish plants in the nearby acclimation pond located on Cripple Creek have occurred since. When escapement surveys were conducted, coho were often observed each season holding in two large pools just below the confluence with Pinochle and Wrong Creeks. Many of these coho would ascend Cripple and Wrong a couple of weeks after entering Pinochle. Spawning activity for all species occurs predominately within in the lower 0.2 miles. Prior to 2006, the creek was a popular recreational site; unfortunately, this often had a negative impact on the creek including human biological waste, trash and toxic materials; as well as human made anadromous blockages and fish harassment.

All adult salmon that spawn in Pinochle Creek were originally captured at the USACE fish trap in Buckley, and transported above Mud Mountain dam. Specific escapement numbers for the upper White River drainage are known; therefore, surveys were conducted to determine fish distribution and spawning success. This is especially important regarding Spring Chinook, since adult production monitoring is part of the White River Spring Chinook Recovery Plan. Also, as part of the recovery plan, the Puyallup Tribe operated a Spring Chinook acclimation pond located at RM 0.3 on Cripple Creek. Spring Chinook were reared and released from Cripple Creek for several years *(1994-2006)*. Approximately 50,000 plus Spring Chinook from the Muckleshoot White River hatchery were transported annually to the Cripple Creek acclimation pond in early spring, and released in late spring. Returns to Pinochle, as well as, Cripple and Wrong creeks, were likely associated with these earlier plantings.

PUYALLUP RIVER

WRIA 10.0021

The Puyallup Watershed is identified as Water Resource Inventory Area 10 *(WRIA 10)* by the Washington State Department of Ecology. The Puyallup River Watershed provides over 1,300 linear river miles *(RM)* of drainage over an area greater than 1,000 square miles. The three major river drainages include the Puyallup, White, and Carbon rivers which flow almost entirely within Pierce County and part of South King County. All three river systems originate from glaciers along the north and west slopes of Mt. Rainier, located entirely within Mt. Rainier National Park. The Carbon and White rivers converge with the Puyallup River at RM 17.8 and RM 10.4 respectively. *The availability and nature of fish and stream habitats are not static conditions and are frequently altered. The habitat descriptions in this report provide a general analysis of habitat conditions, and are not intended to fulfill the requirements of a rigorous biological assessment/evaluation.* The White River is a significant tributary, with a drainage area larger than the Puyallup River. However, the White and Puyallup drainages are often viewed and managed as two distinct and separate entities. This management approach is due in part because prior to 1906, the White River did not flow into the Puyallup. Salo and Jagielo (1983) described that prior to 1906; the majority of the White River flowed north towards Elliot Bay. Yet, some of the water from the White often flowed south to the Puyallup through the Stuck River channel. In November of 1906, a flood event mobilized a tremendous amount of wood debris that blocked the north flowing channel in what is now downtown Auburn. The blockage forced the river to avulse and find a new channel. This newly created diversion sent nearly the entire White River flow down through the Stuck River channel into the Puyallup; more than doubling the size of the Puyallup River drainage. In 1915, a concrete structure was constructed, thereby permanently diverting the White River into the Puyallup.

The Puyallup River continues to flow west from its confluence with the White until it reaches Commencement Bay in Tacoma. An extensive system of levees, approximately 90 miles, was constructed along the Puyallup, White and Carbon rivers beginning in the early through mid-20th century. There are a significant number of large tributaries that feed these mainstem rivers including the Clearwater River, Greenwater River, Mowich River, Huckleberry Creek and South Prairie Creek.

In addition to the White River, the Carbon River is also key tributary of the Puyallup River, entering the Puyallup at RM 17.9; just north of the city of Orting. The Carbon River and its associated tributaries provide excellent spawning and rearing opportunities for salmon, steelhead, and bull trout. In the past, steelhead have been documented as high as the Mt. Rainier National Park boundary. However, the majority of spawning for all species within this drainage, with the exception of bull trout, occurs in South Prairie Creek and the lower 11 miles of the mainstem Carbon.

The mean annual flow of the Puyallup River over the first 86 year gauged history was 2,922 cfs. The largest flood of record was 57,000 cfs and occurred in December 1933. The majority of the large flood events have occurred in the months of November and December in response to heavy rains on a substantial snow pack. The minimum low flow defined as the 90%-exceedance level for the Puyallup was 1,156 cfs. Over the past two decades there has been a trend of decreasing low flows (Sumioka 2004). The Puyallup River at Puyallup flow gage

(#12101500) was activated in 1915 and is located at RM 6.6.

The systems glacial origin is responsible for the turbid conditions that are most noticeable during warmer weather in late spring and summer. The White, Carbon, and Puyallup rivers carry a tremendous volume of bed load material which contributes to the dynamic nature of the system. The high sediment loads are responsible for the anastomized channel morphology characteristic of broad valley segments. This condition is most prevalent in the upper reaches within and immediately outside the National Park boundaries.

Sha Dadx wetland restoration site.

Outside the Park boundaries, the rivers course through industrial forestlands including national forest but primarily private timber company ownership. Much of these forestlands have been harvested at least once and in many cases twice. Lands in timber production are densely roaded with some sections approaching six linear miles per square mile. Roads have contributed to many of their trademark problems such as landslides, slope failures, altered hydrology, culvert and bridge projects that can effect upstream migration, and of course high levels of sedimentation within effected drainages.

The lowest section of the Puyallup River, from the confluence with the White River at RM 10.4 to Commencement Bay is confined by levees and the habitat lacks complexity *(lower left)*. The small amount of suitable gravel present is often compacted and offers little spawning opportunity. Steelhead have been observed spawning just upstream from the White River confluence; the lowest documented spawning of any species in the river. In the fall of 2008, the Puyallup Tribe completed construction of one of its most prevalent watershed restoration projects to date. The Sha Dadx *(Frank Albert Road-top center)* wetland restoration project, located on the lower Puyallup River, created an accessible 12-acre off-channel wetland habitat for salmonids and other freshwater resident fish. The project was instrumental in reestablishing an old disconnected oxbow and low lying wetland. The reclaimed habitat was lost during the construction of the lower river levee system in the early 1900's. In response to the loss of nearly an entire estuarine ecosystem that once existed, the creation of this critical and necessary lower river environment will provide overwintering, as well as foraging opportunities for young juvenile salmon. In addition, this habitat will offer the benefits that the estuaries once provided to out migrating *(smolting)* salmon during the transition from fresh water to salt water. An extensive side channel restoration project conducted by Pierce County near the community of Alderton, added over 4,000 linear feet of off channel fish habitat and flood protection.

For more information about this restoration project, go to: **www.co.pierce.wa.us/southfork**.

Confined lower Puyallup River near I-5

The Puyallup continues to be tightly confined by levees on both sides with the expected lack of channel complexity. These levee constraints continue from the White River confluence to approximately RM 25, just south of the town of Orting. This reach is similar to the lower Puyallup, but does support sporadic spawning by chum, Chinook and steelhead during their respective seasons. Along Orville Rd., upstream of Orting, a levee setback project was completed in the summer of 1999. Approximately 2 miles of new levee was built back from the original levee, adding over a hundred acres to the floodplain in this reach. In 2013, Pierce County completed the installment of a unique Engineered Log Jam *(ELJ)* revetment project in the Puyallup River along Orville Road *(RM 27).* The ELJs utilize large concrete dolosse to tether large timbers and other woody material. Dolosse were used for the first time in 2009, to reinforce the North Levee on the lower Puyallup River in the city of Fife.

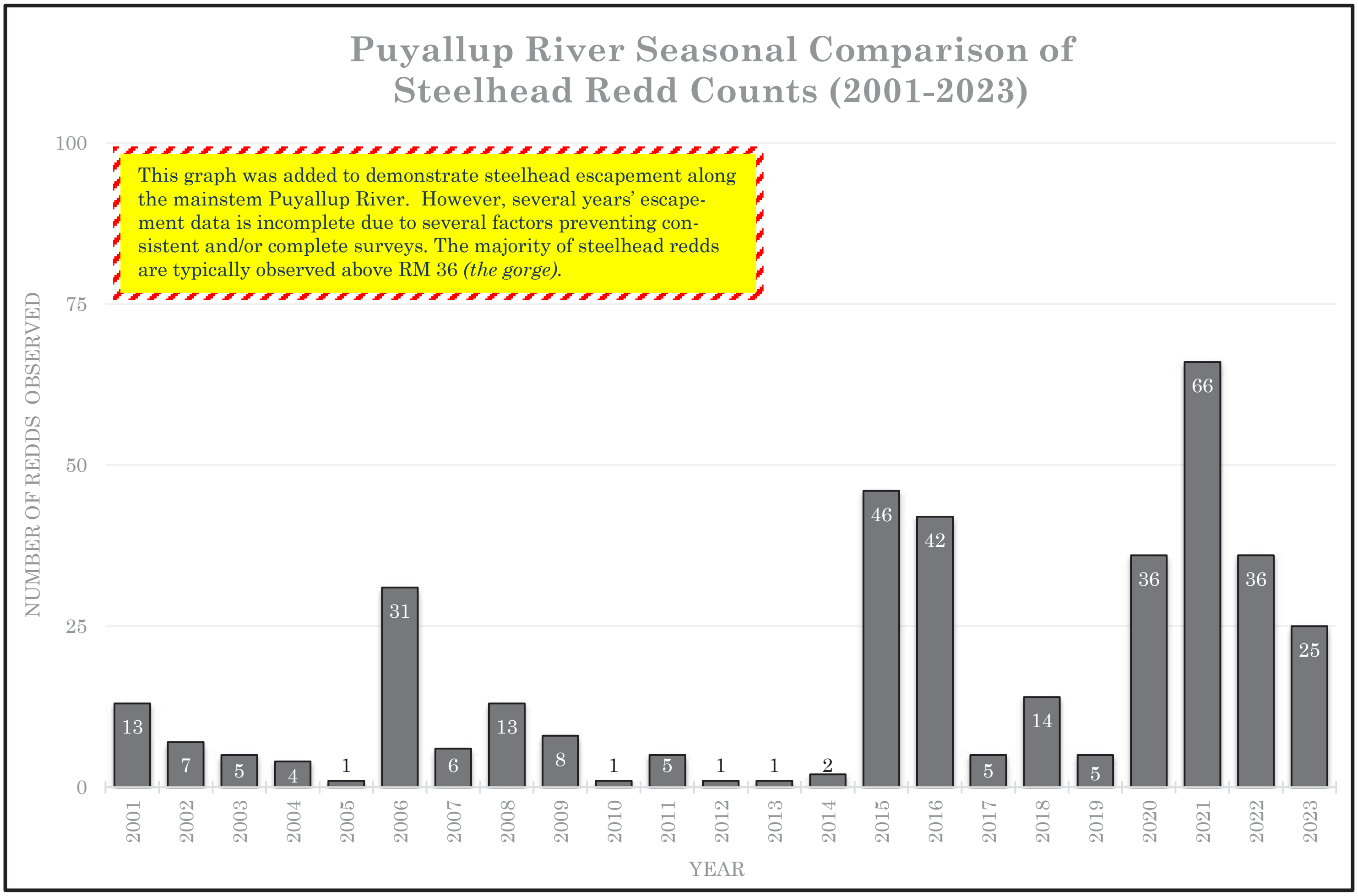
The Puyallup continues to be tightly confined by levees on both sides with the expected lack of channel complexity. These levee constraints continue from the White River confluence to approximately RM 25, just south of the city of Orting. This reach is similar to the lower Puyallup, but does support sporadic spawning by chum, Chinook and steelhead during their respective seasons. Along Orville Rd., upstream of Orting, a levee setback project was completed in the summer of 1999. Approximately 2 miles of new levee was built back from the original levee adding over one hundred acres to the floodplain in this reach. Several high water events later, many side channels have formed and spawning gravel has been retained. In late 2006, a 6,000 foot levee set-back was completed upstream of the Calistoga Bridge in the town of Orting. This set-back added over 55 acres to the floodplain within this reach. From RM 25.5 to 30.8 the channel is only partially contained by levees and there are several accessible side channels. There is little spawning activity within this reach due to the higher gradient and resulting increase in average substrate size. Upstream from Electron *Hydro's*. Electron powerhouse at RM 30.8 the river flows through a deep, narrow canyon *(right).* There are many small vertical drops and bedrock cascades within this 6 mile canyon, all of which are passable to salmon and steelhead. There are frequent spawning opportunities in the tail-outs of the many deep pools located within this upper river reach.

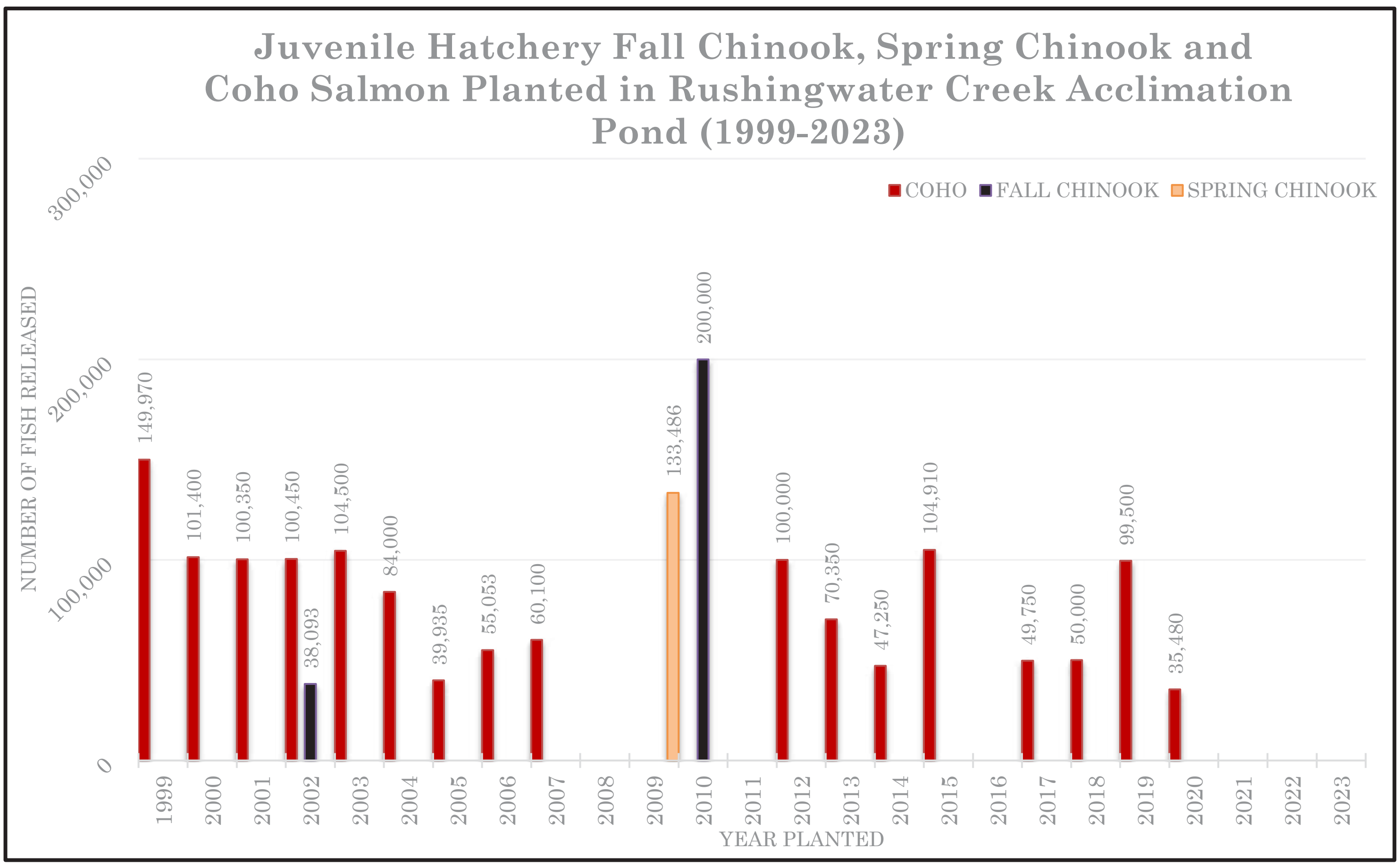

South Fork of the Puyallup River.

From the top of the canyon, to the diversion dam at RM 41.7, the river is moderately confined and provides several high-quality spawning opportunities. The highest densities of steelhead spawning in the Puyallup River occur within this reach. With the completion of the Electron fish ladder in the fall of 2000, anadromous fish passage was restored for the first time since 1904. There are approximately 26+ miles of exploitable habitat above the diversion and surveys are conducted occasionally in response to the Puyallup Tribes live surplus Chinook and coho plants.

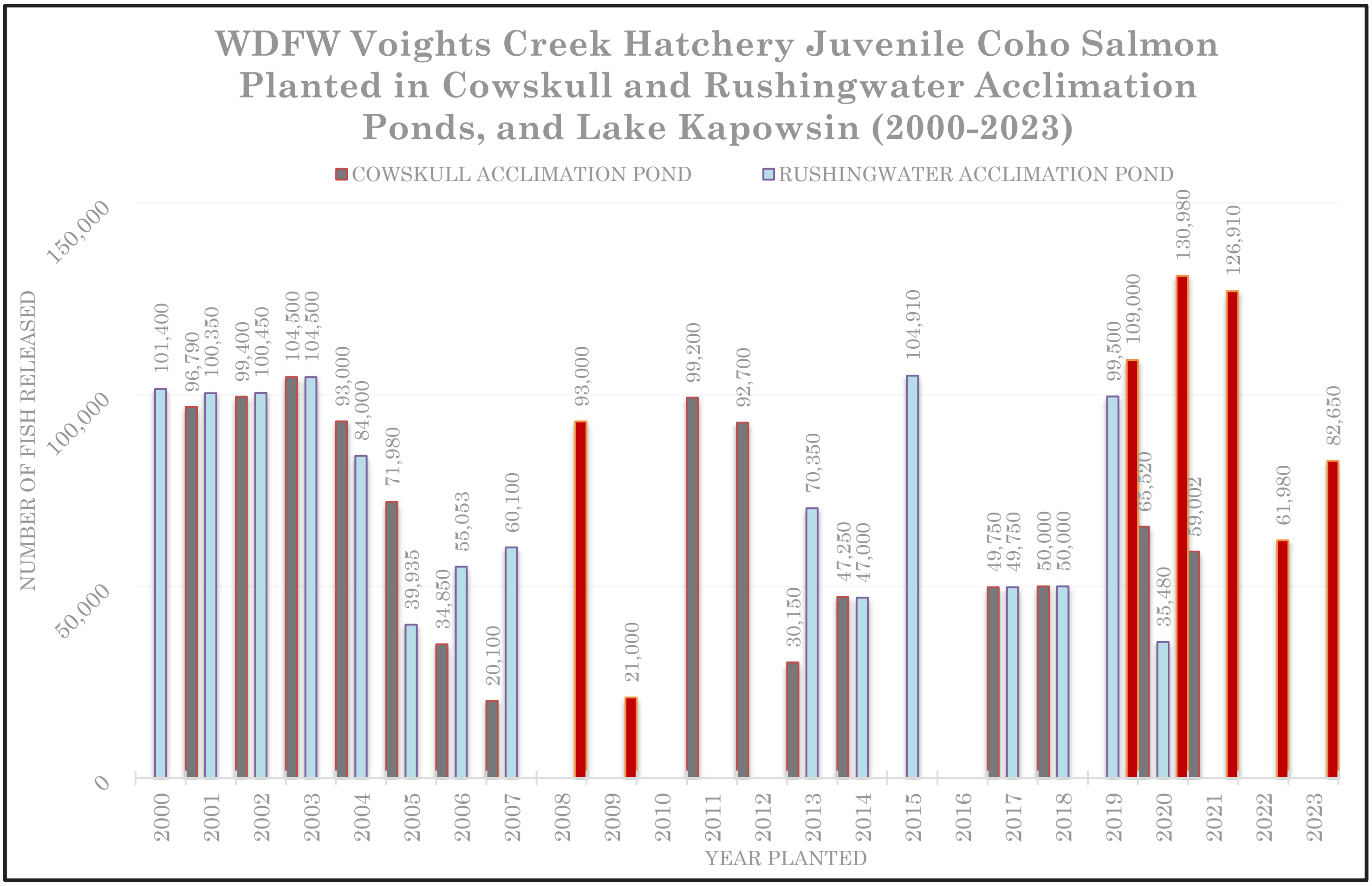

North Fork of the Puyallup River.

The Mowich River converges with the Puyallup River at RM 42.3; approximately 0.5 miles above the Electron diversion dam. The glacial headwaters of the Mowich River originate from the Edmunds, and the North and South Mowich glaciers on the west slope of Mt. Rainier. Significant tributaries to the Mowich include: Crater, Spray, Meadow, and Rushingwater creeks. Species documented utilizing this basin include Chinook, coho, steelhead/rainbow, cutthroat and bull trout.

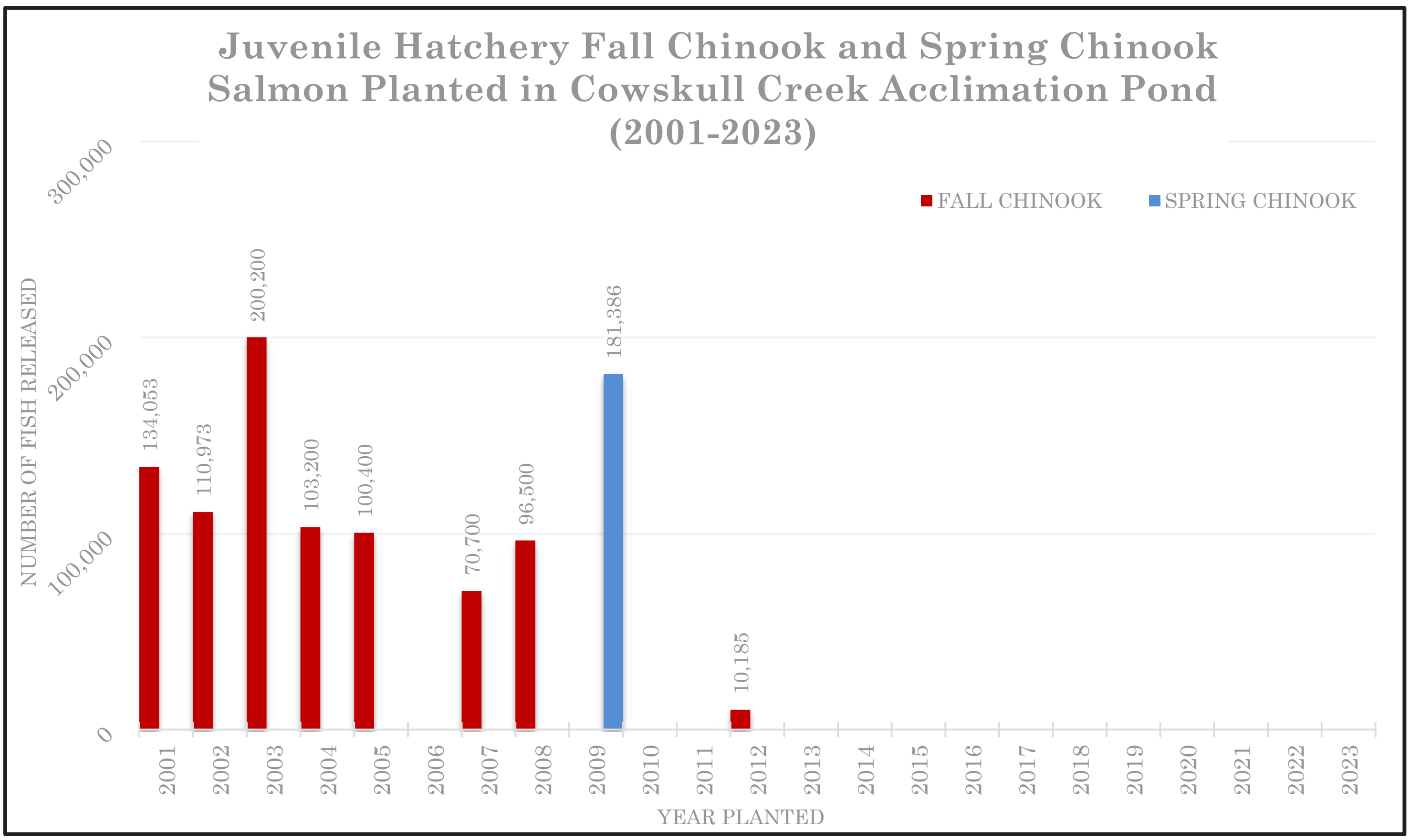




Acclimation ponds opperated by Puyallup Tribe. See acclimation pond location sites in Appendix D. No data indicates fish were not planted.



Coho provided by WDFW Voights Creek Hatchery when available. Acclimation ponds opperated by Puyallup Tribe. See map of acclimation pond location sites In Appendix D. No data indicates fish were not planted.



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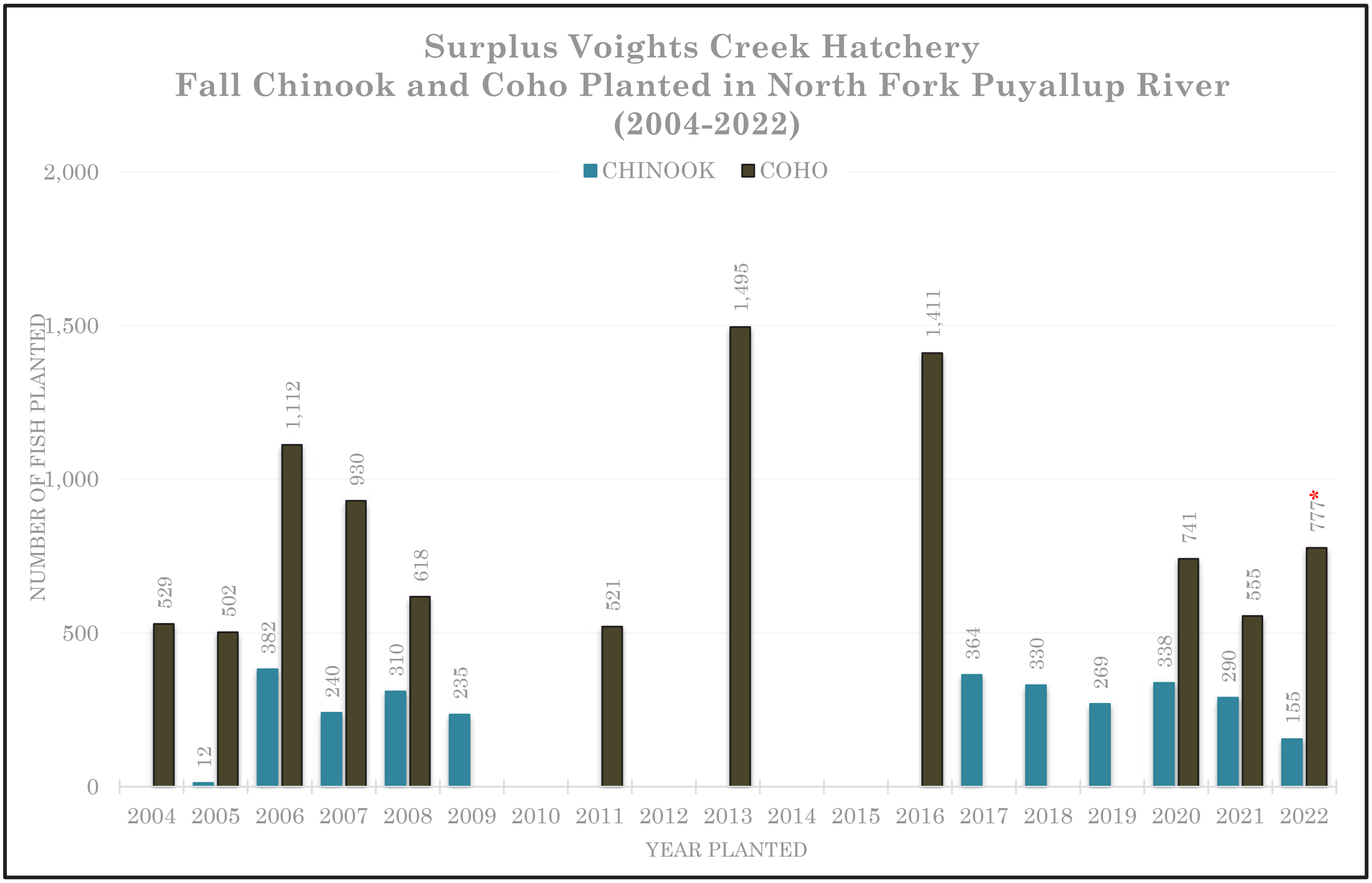
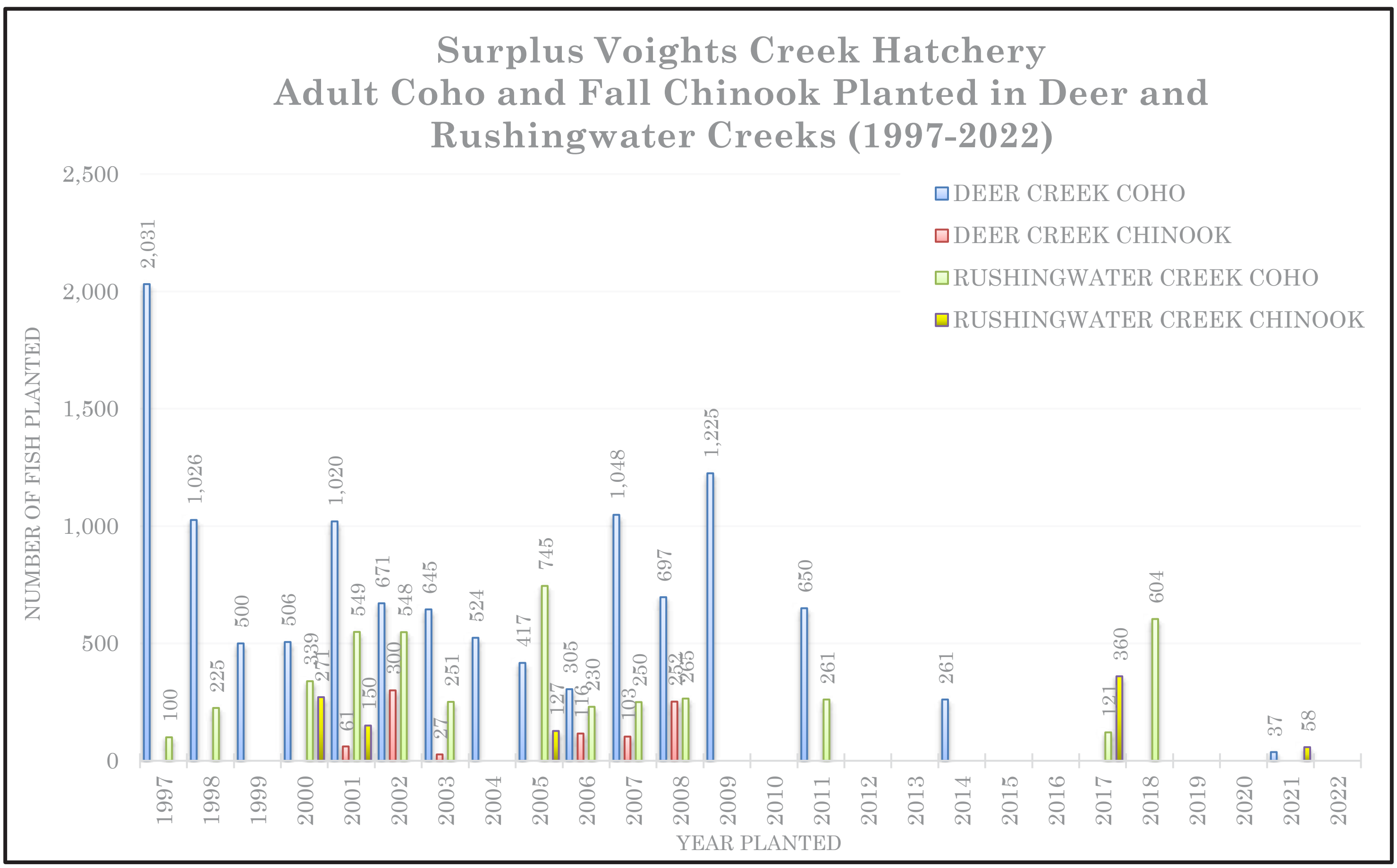


Surplus adult Chinook and coho provided by WDFW Voights Creek Hatchery when available. No data indicates fish were not planted.



Surplus adult Chinook and coho provided by WDFW Voights Creek Hatchery when available. No data indicates fish were not planted.

PUYALLUP RIVER

PUYALLUP RIVER JUVENILE SALMONID PRODUCTION ASSESSMENT PROJECT

Prepared by: Andrew Berger & Julian Close

The Puyallup River Juvenile Salmonid Production Assessment Project began in 2000. The Puyallup Tribal Fisheries Department started the project to estimate juvenile production of native salmonids, with an emphasis on natural Fall Chinook salmon production and survival of hatchery and acclimation pond Chinook. In 2011, a newly constructed trapping platform employing an E. G. Solutions 8-ft diameter rotary screw *(formally 5′)* was put into place on the lower Puyallup at RM 10.6, just upstream of the confluence with the White River.

As more data becomes available, juvenile production estimates may provide baseline information allowing managers to meet escapement objectives in the watershed create a production potential-based management strategy and accurately forecast future returns of hatchery and naturally produced adults. In addition, a basin spawner/recruit analysis will indicate stock productivity, helping to determine the overall health of the watershed and evaluate the contribution of enhancement projects.

Trapping Gear and Operations

The rotary screw-trap used in this study consists of a rotary cone suspended within a steel structure on top of twin, 40-foot pontoons. The opening of the rotary cone is 8 feet in diameter, allowing for a sampling depth of 4 feet. The cone and live box assembly are attached to a steel frame and may be raised or lowered by hand winches located at the front and rear of the assembly.

Three five-ton bow-mounted anchor winches with 3/8″ steel cables were used to secure and adjust the direction of the trap and keep it in the thalweg. The cables were secured to trees on opposite banks.

The 8-ft diameter rotary screw trap was installed in the lower Puyallup River (RM 10.6) just above the confluence with the White River. Trap operation continue, when feasible, 24 hours a day, seven days a week throughout the trapping season. The trap was checked for fish twice a day at dawn and dusk. In some instances, the trap was checked plus or minus two hours of dusk or dawn due to the availability of personnel. During hatchery releases and high flow events, personnel remained onsite through the night to clear the trap of debris and to keep fish from overcrowding.

Revolutions per minute (rpm), water temperature, secchi depth (cm), turbidity (NTU), weather conditions, and stream flow (cfs) were described for each completed trap check. A cross sectional area of the river at the smolt trap was taken to monitor channel morphology at the site.

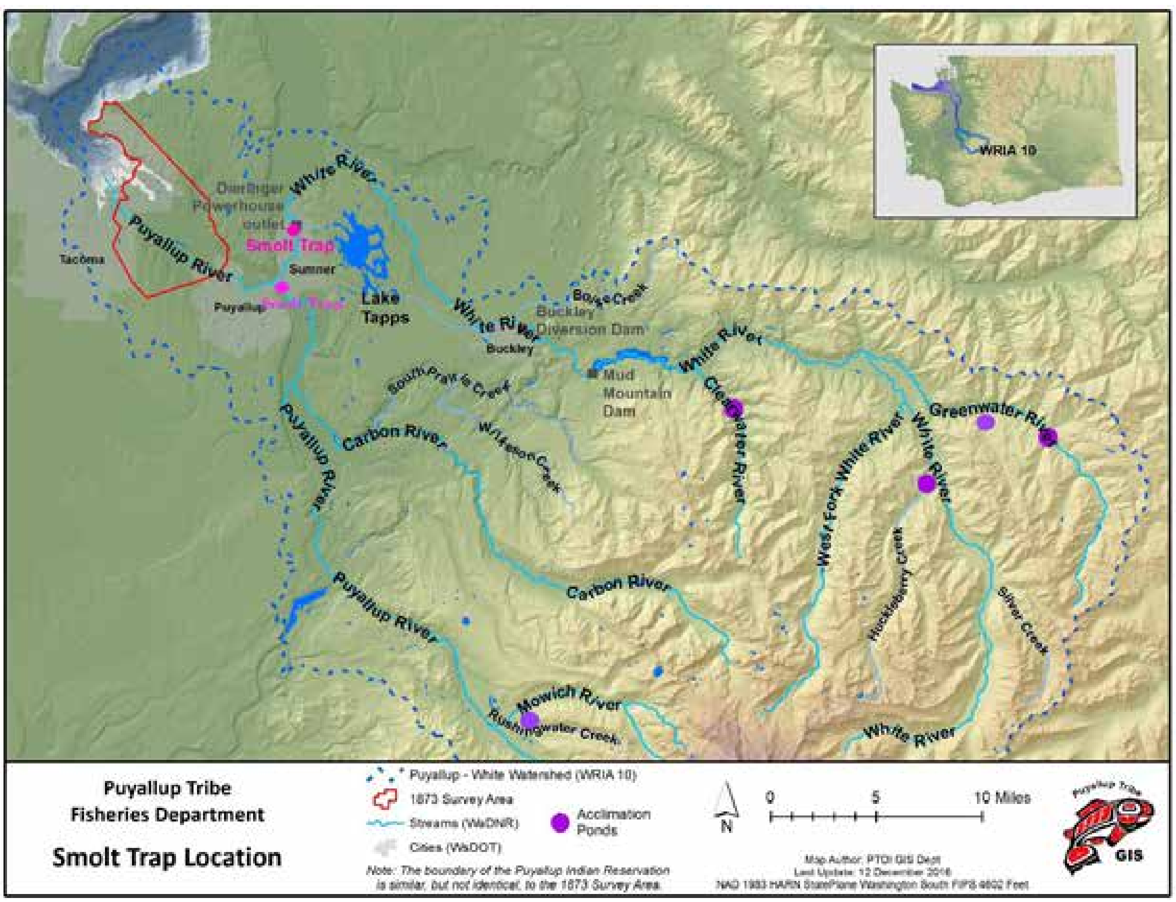
Goals and Objectives

The goal of this project is to report production estimates, characterize juvenile migration timing, describe length distribution for all wild salmonid, out-migrants and fulfill the objectives of the Puyallup River Fall Chinook Recovery Plan.
To reach these goals, this study will produce population estimates of out-migrating smolts, estimate species specific migration timing, compare natural versus hatchery production and run timing, analyze mean fork length of wild smolts and detail species composition of the sample population. The objectives of this project are to:

1. Estimate juvenile production for salmonids in the Puyallup River and determine freshwater survival for unmarked juvenile Chinook.
2. Estimate in-river mortality of hatchery and acclimation pond Chinook.
3. Investigate physical factors such as, light (day vs. night), flow and turbidity and their importance to trap efficiency.

Sampling Procedures

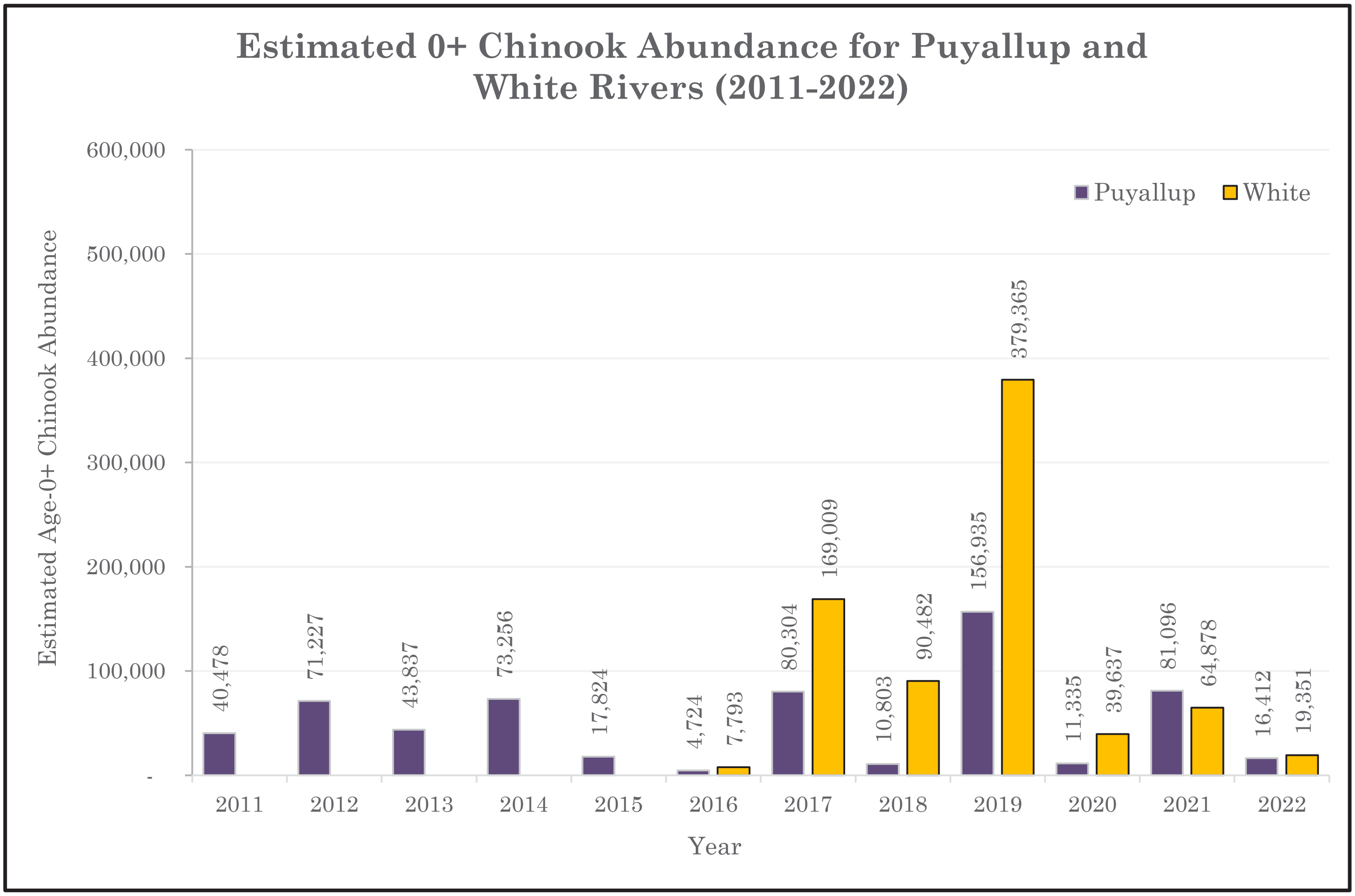
Smolts were anesthetized with MS-222 (tricaine methanesulfonate) for handling purposes and subsequently placed in a recovery bin of river water before release back to the river. Juveniles were identified as natural or hatchery origin as unmarked or marked respectively. Fork length (mm) was measured and recorded for unmarked fish. When possible, 50 chum, 50 pinks, 50 age1+ coho, 25 age 0+ coho, 25 age 0+ Chinook, and 25 steelhead were measured per day. Scale samples were additionally taken on all wild steelhead smolts.

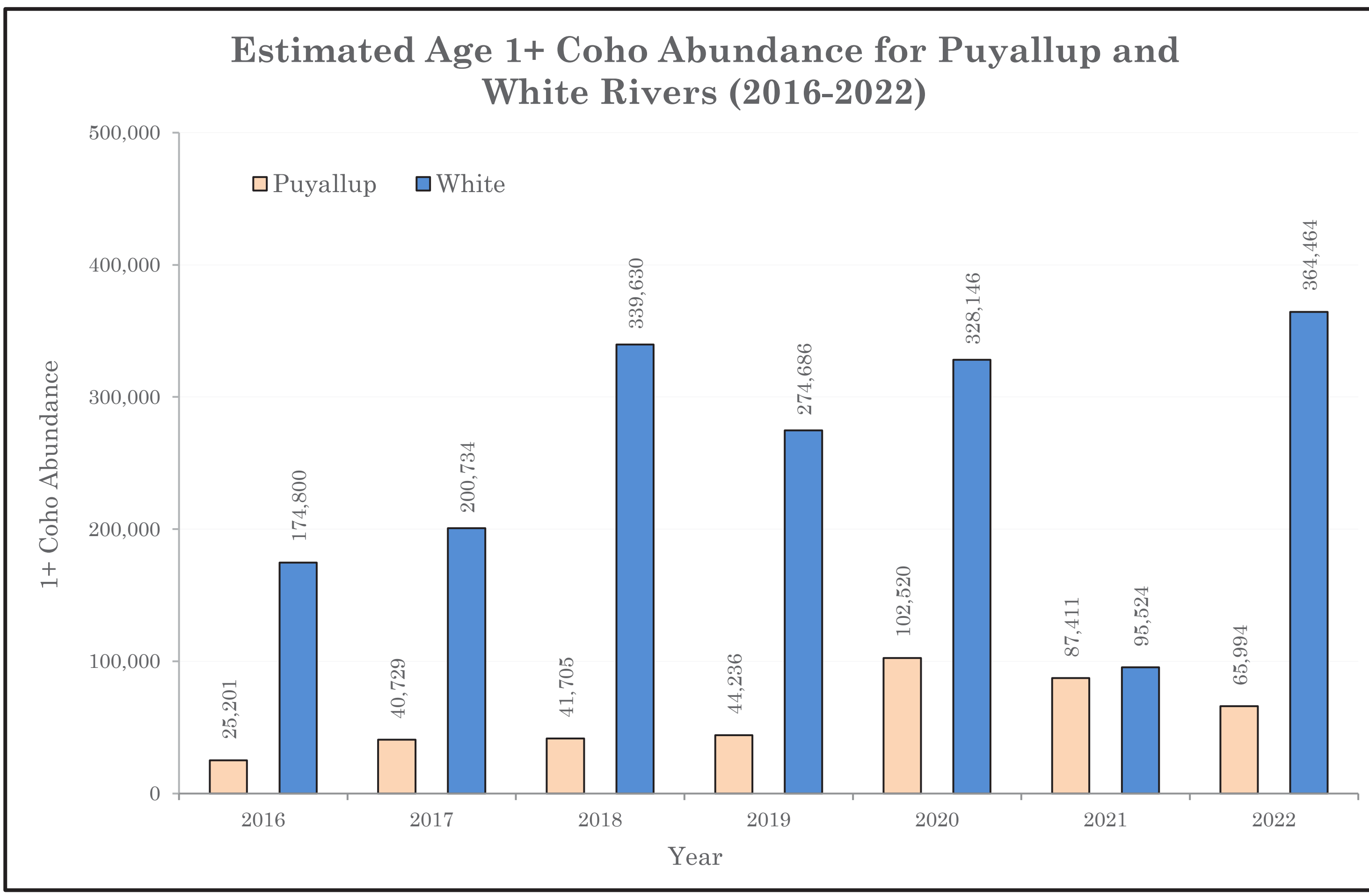


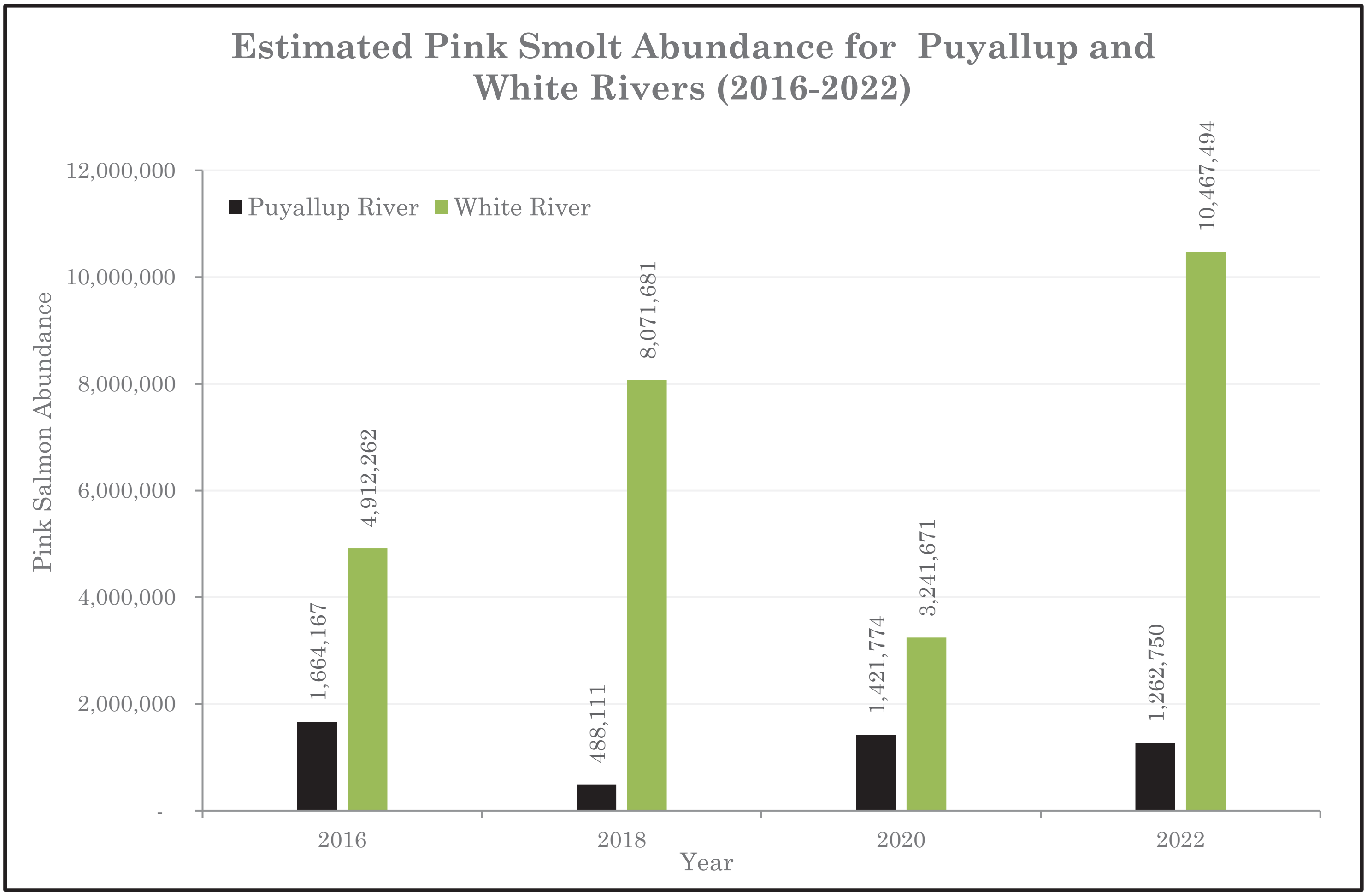
Species were separated by size/age class. Coho were identified as fry, age 0+ (<70mm) or smolts, age 1+ (>70mm). Chinook smolts were separated by age 0+ (<150mm) or age 1+ (>150mm). All chum and pinks were identified as age 0+. Trout fry age 0+ (<60mm) were not differentiated to species.

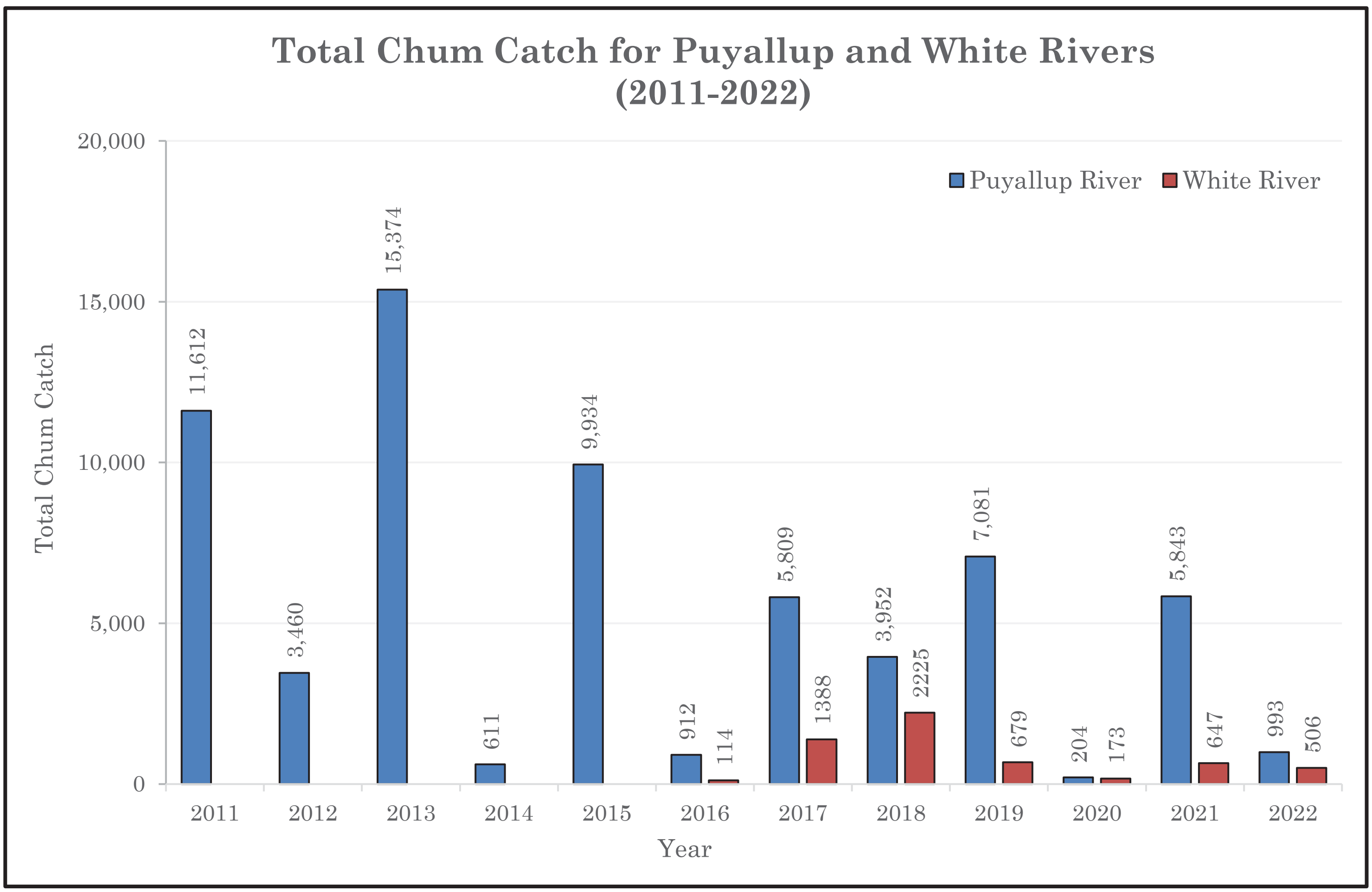
Hatchery origin fish were identified in three ways: 1) by visual inspection for adipose fin clips, 2) with a Northwest Marine Technology "wand" detector used for coded wire tag detection, and 3) with a Destron Fearing Portable Transceiver system for Passive Integrated Transponder (PIT) tagged fish.

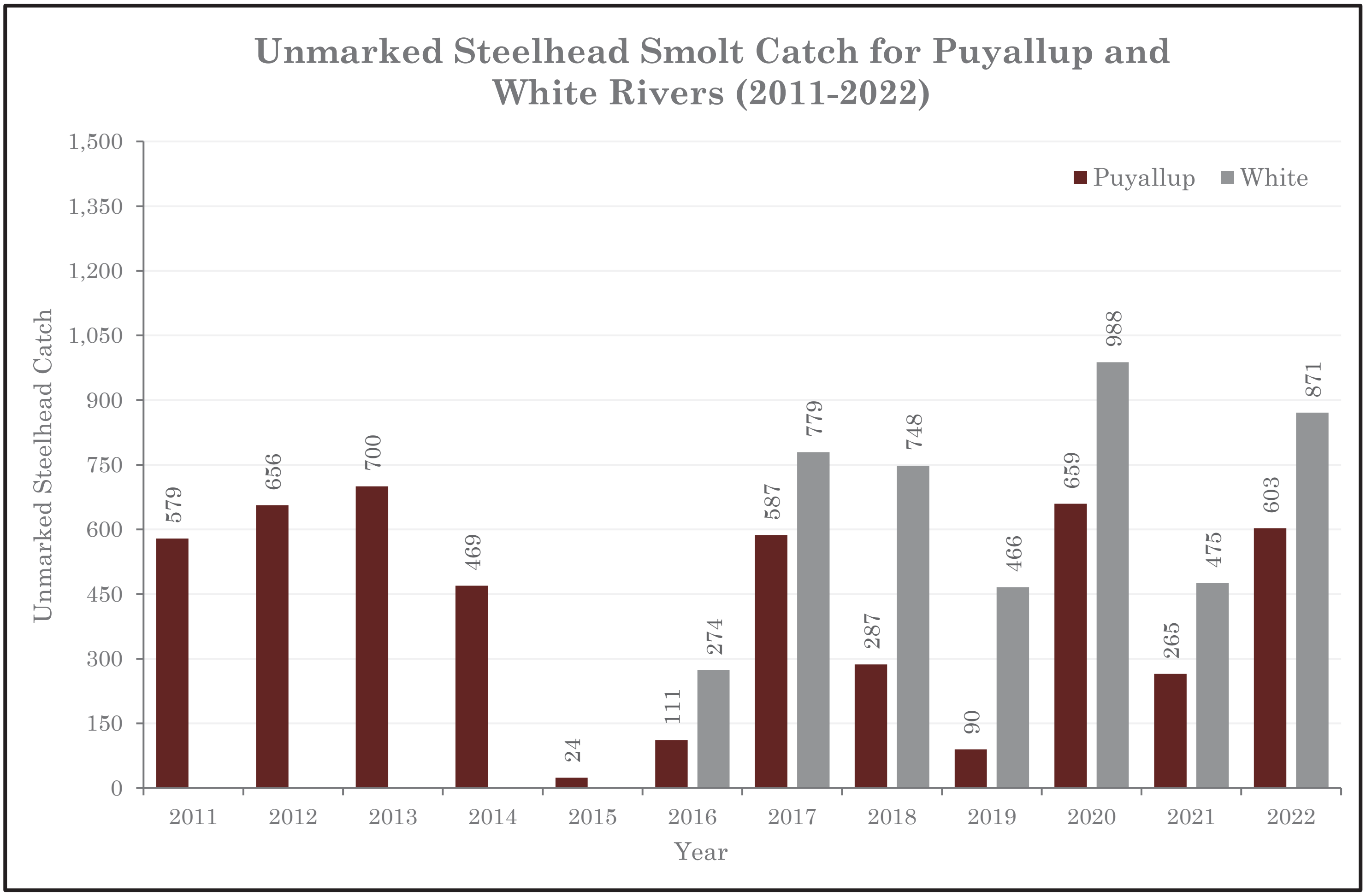
To request a full copy of the current, or previous seasonal reports, contact:
Puyallup Tribal Fisheries Department at 253-680-5560, or Andrew Berger-Senior Stock Assessment Biologist at: andrew.berger@puyalluptribe-nsn.gov 253-680-5569.


Estimated 0+ Chinook Abundance for Puyallup and White Rivers (2011-2022)
Estimated Age-0+ Chinook Abundance
600,000
500,000
400,000
300,000
200,000
100,000
-
Puyallup
White
40,478
71,227
43,837
73,256
17,824
4,724
7,793
80,304
169,009
10,803
90,482
156,935
379,365
11,335
39,637
81,096
64,878
16,412
19,351
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
Year


Estimated Age 1+ Coho Abundance for Puyallup and White Rivers (2016-2022)
1+ Coho Abundance
500,000
400,000
300,000
200,000
100,000
0
Puyallup
White
25,201
174,800
40,729
200,734
41,705
339,630
44,236
274,686
102,520
328,146
87,411
95,524
65,994
364,464
2016
2017
2018
2019
2020
2021
2022
Year


Estimated Pink Smolt Abundance for Puyallup and White Rivers (2016-2022)
Pink Salmon Abundance
Year
Puyallup River
White River
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
-
2016
2018
2020
2022
1,664,167
4,912,262
488,111
8,071,681
1,421,774
3,241,671
1,262,750
10,467,494


Total Chum Catch for Puyallup and White Rivers (2011-2022)
Total Chum Catch
Year
Puyallup River
White River
20,000
15,000
10,000
5,000
0
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
11,612
3,460
15,374
611
9,934
912
114
5,809
1388
3,952
2225
7,081
679
204
173
5,843
647
993
506


Unmarked Steelhead Smolt Catch for Puyallup and White Rivers (2011-2022)
Puyallup
White
Unmarked Steelhead Catch
Year
1,500
1,350
1,200
1,050
900
750
600
450
300
150
0
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
579
656
700
469
24
111
274
587
779
287
748
90
466
659
988
265
475
603
871

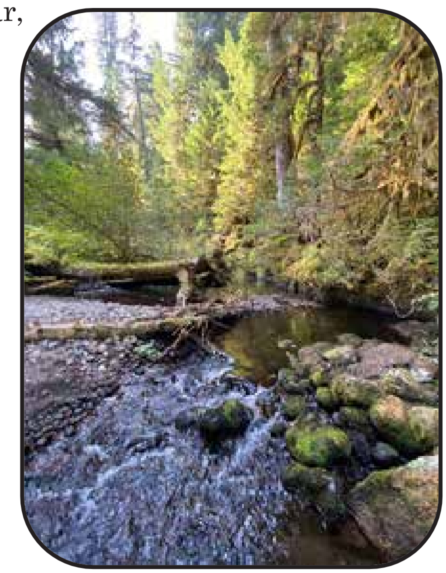
RANGER CREEK

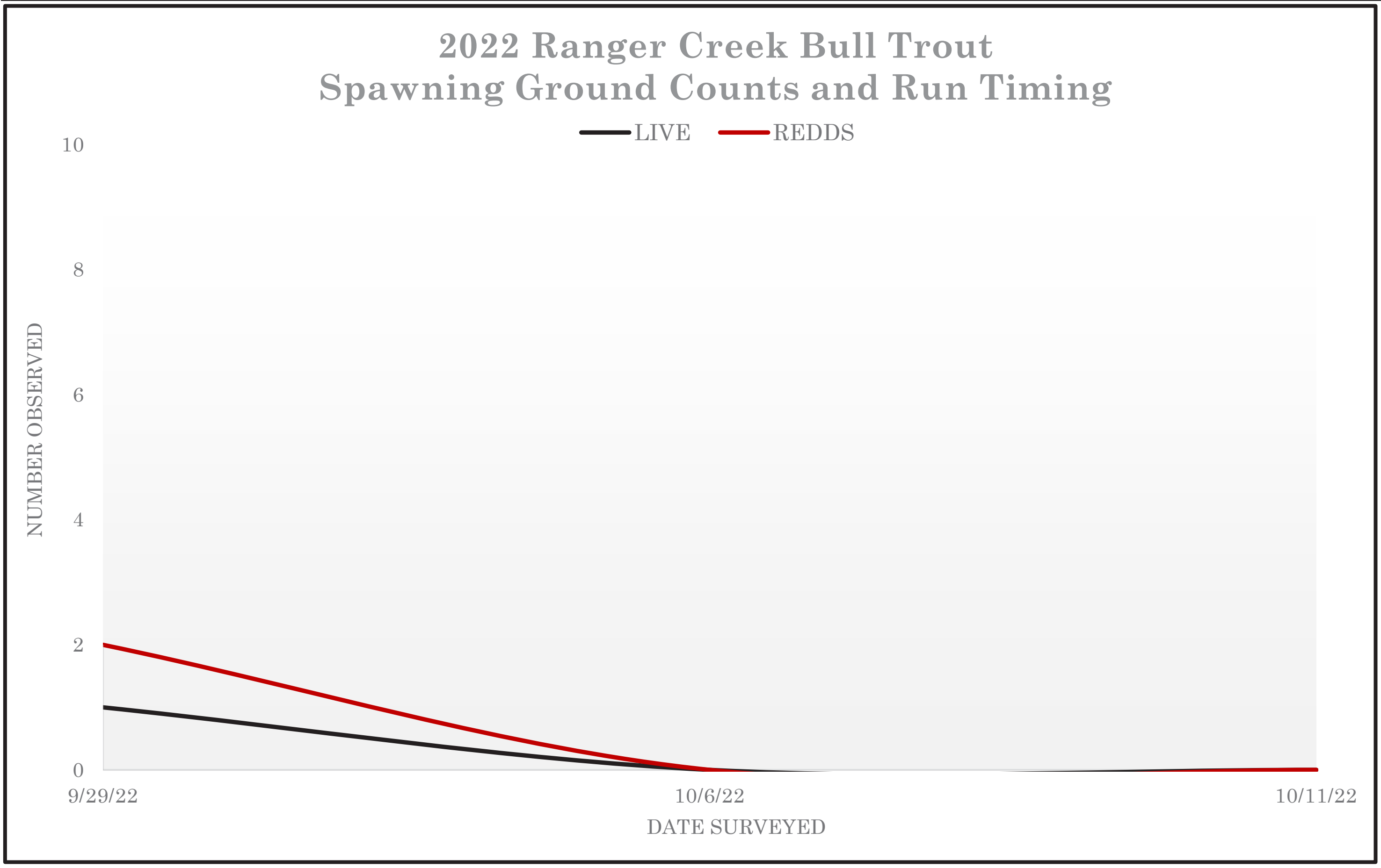
WRIA 10.0530

Ranger Creek is a left bank tributary to the upper Carbon River; entering at RM 26.8. Typical of many headwater tributaries, Ranger Creek is non-glacial and is characterized by confined steep valley channels with a comparatively short, low-to-moderate gradient anadromous reach. This mountain stream flows for just over 3 miles through a steep glacial valley originating between Howard and Tolmie Peaks along the Alki Crest. Ranger flows entirely within Mt. Rainier National Park. Headwater sources are derived from snowpack accumulations and outflow from Lake Tom *(elev. 4400′)*; as well as other minor surrounding surface and groundwater sources. These headwater sources all feed the creek until it reaches Green Lake *(elev. 3185′)* at approximately RM 1.3. The creek continues to drop precipitously from Green Lake until it reaches the channel migration zone of the Carbon River, at which point the creek channel is reduced to a low gradient pool-riffle channel capable of supporting salmonids.

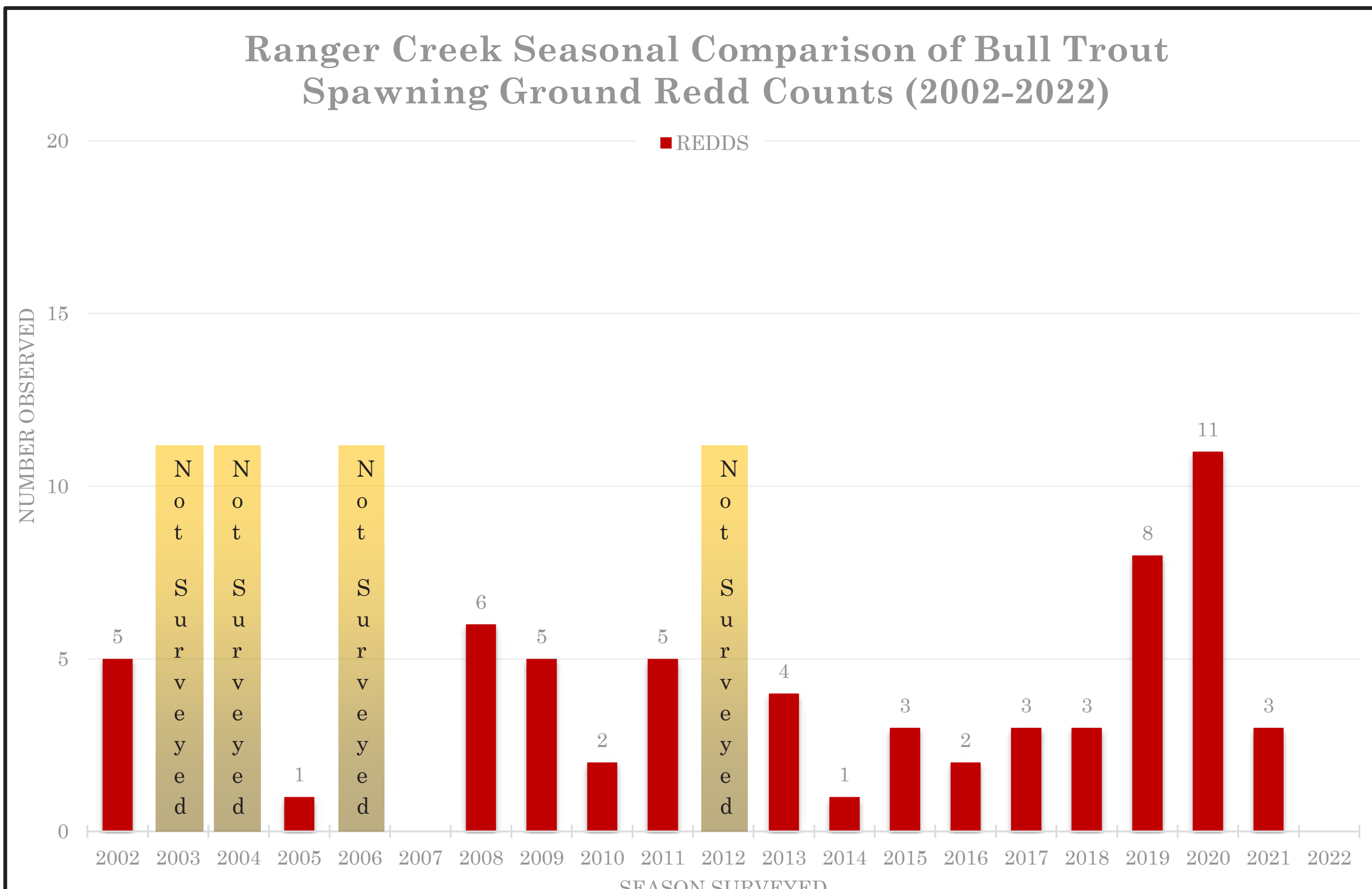
Various survey methods have verified both resident and fluvial bull trout utilization within Ranger; furthermore, the creeks 2,080′ elevation makes it one of the lowest elevation streams known to support bull trout spawning and is quite capable of supporting Chinook, coho, pink and steelhead as well. However, salmonid migration upstream to reach headwater tributaries in the upper Carbon Basin, including Ranger, is assumed to be extremely limited due to substantial cascades present throughout the roughly 5 mile long Carbon River Gorge. The Puyallup Tribe conducted salmon, steelhead and bull trout spawning surveys during 2000 and 2001; yet, no salmon or steelhead were observed. However, surveyors did observe several redds early in the spawning season *(September)*, but their small size and timing matched the bull trout spawning documented in other headwater tributaries in the watershed. Other species including cutthroat, non-native brook trout and sculpins are known to inhabit the creek.

The anadromous reach of Ranger Creek provides excellent habitat conditions for bull trout rearing and spawning. With approximately 0.5 miles of anadromous habit, Ranger is an excellent salmonid stream in several ways. The riparian zone consists of old growth cedar, fir and hemlock which contribute essential woody debris and diversity to the channel. The lower 0.4 miles is low gradient with several deep pools; as well as numerous pockets of spawning gravel. The Carbon River Road crosses the creek at approximately RM 0.35. Due to recurrent flood damage, the road is been closed to vehicular traffic beyond the park entrance. Above 0.4 miles the gradient of the creek increases significantly, and beyond RM 0.5, steep cascades preventing any further upstream migration. However, NPS data specified the presence of cutthroat and sculpins at the outlet to Green Lake *(Samora, personal communication, February 16, 2012)*. Unfortunately, no substantial data is available on bull trout population size within the upper Carbon River.





2022 Ranger Creek bull trout survey data was collected by PTF and Mt. Rainier National Park Service (MORA).



ROCKY RUN CREEK

WRIA 10.0117

Rocky Run Creek is a left bank tributary of the upper White River (RM 44.5), located near the community of Greenwater. Rocky Run is approximately 3.1 miles in length; however, only the lower 0.6 miles is anadromous. The creek supports ESA listed Spring Chinook, steelhead and bull trout; as well as non-listed coho, pink and cutthroat, by providing foraging, spawning and overwintering habitat for all life stages. However, insufficient flows can prevent adult Chinook from accessing the creek in late summer and early fall. Therefore, the creek is surveyed essentially for adult steelhead spawning activity. All adult salmon and steelhead that spawn in the Upper White River and its tributaries are initially captured in the USACE fish trap in Buckley; then transported above Mud Mountain dam *(RM 29.6)*. Since precise escapement numbers for the Upper White River drainage are known, surveys are conducted to determine fish distribution and spawning success. This is especially important regarding Spring Chinook and steelhead, given that adult production monitoring is an essential part of recovery planning.

Typical of many upper river tributaries, the mouth of the creek frequently drifts due to its position within the open channel migration zone of the White River. As a result of mainstem river incursions, the creeks lower channel *(0.15 miles)* and riparian habitat are frequently altered. The habitat within this section is the least conducive to spawning due to a primarily sandy substrate. In addition, this reach of the creek is highly subjected to the possibility of redd scouring or heavy silt deposition due to the influences of the mainstem White River.

Nearly the entire anadromous reach of the creek *(approximately 0.6 miles)* is low gradient *(top left & bottom images)*. Although spawning does occur within this small stretch *(depending on mainstem influence)*, it is often limited due the lack of quality spawning substrate created by the fine alluvial deposits *(sand & silt)* from the White River. In addition, adult salmon spawning has been less consistent and frequent in this tributary compared to that observed in more significant upper river tributaries located along the White River such as Camp Creek, located 1.2 miles downstream. Small quantities of undersized instream woody debris is present, as well as a beneficial riparian buffer zone of primarily conifers and alder along the majority of the creek. Upstream of the anadromous reach, the creek enters the heavily forested lower slope of the valley floor as it begins to climbs up the valley wall. From this point, the creek assumes a pool-riffle-cascade configuration as it ascends the lower valley slope.

RODY CREEK

WRIA 10.0028

Rody Creek, a tributary to Clarks Creek, is part of the lower Puyallup River drainage system. Rody is approximately 1.6 miles in length; however, only the lower 0.6 miles is accessible to adult spawners. The creek passes under Pioneer Way E. through an undersized, yet generally fish passable culvert at RM 0.5. Rody has numerous deficits including, but not limited to; a confined and straightened channel, intermittent or complete fish barriers, no off-channel habitat, flooding and channel erosion, absent or deficient riparian cover, disconnected floodplain and the infestation of reed canary grass *(Phalaris arundinacea)*.

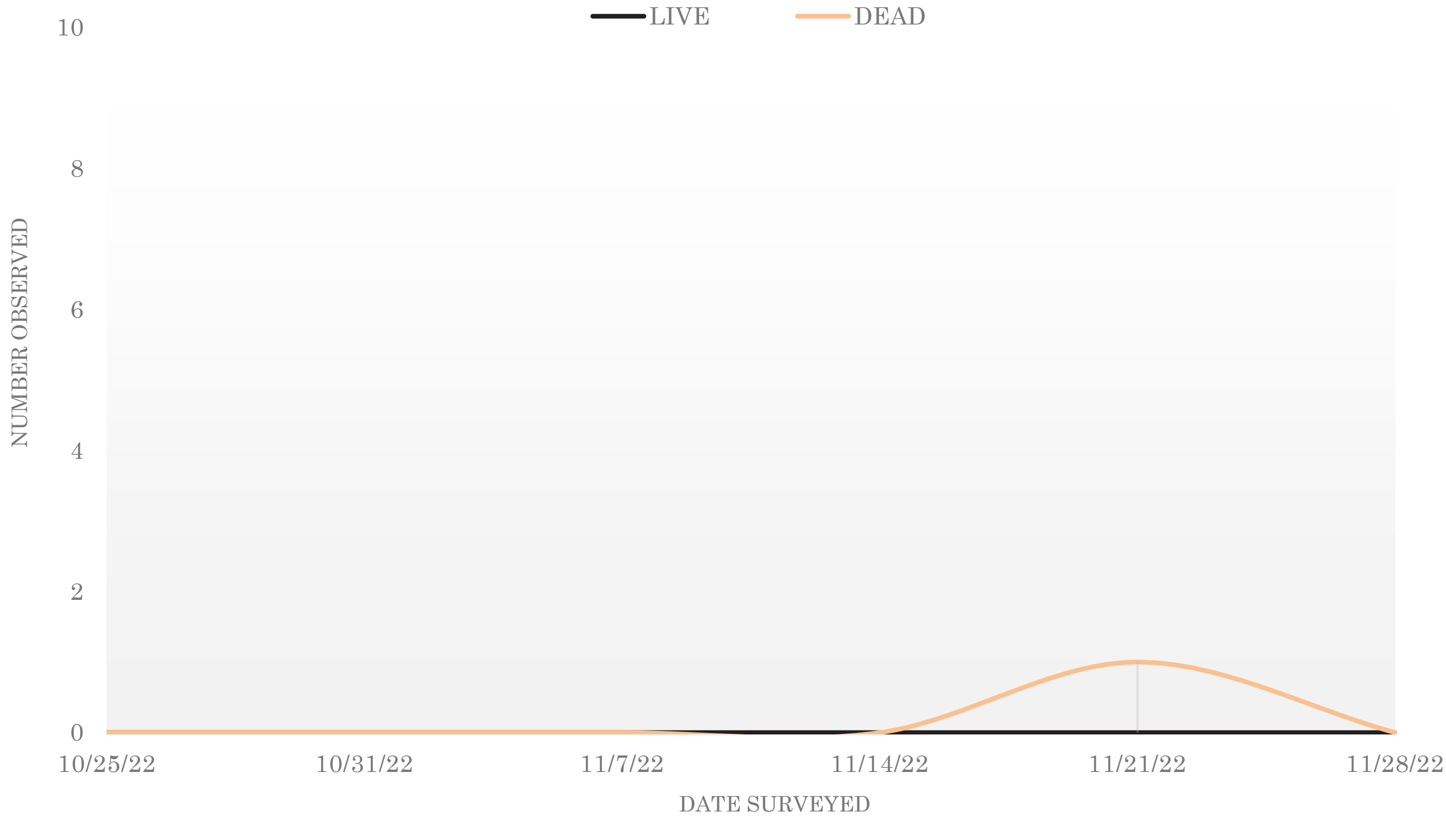
Rody Creek primarily supports adult chum spawners; however, adult coho are occasionally observed as well. Insufficient flows generally prevent adult Chinook from accessing the creek in late summer and early fall. Although present in the drainage, adult steelhead have not been observed spawning in Rody. Juvenile coho; as well as Chinook and steelhead forage and rear in the creek. Bull trout are known to forage in the smaller tributaries of the lower Puyallup. Cutthroat are also present in Rody Creek.

Approximately 300-400 feet of anadromous usage is available above the culvert under Pioneer Way; however, a 3 foot high stone barrier prevents fish passing above this point. Above the stone barrier, additional habitat is available and could be utilized if the blockage were removed. In sharp contrast to the reach below Pioneer Way E., the upper reach of the creek has the only intact riparian zone which consists largely of alder.

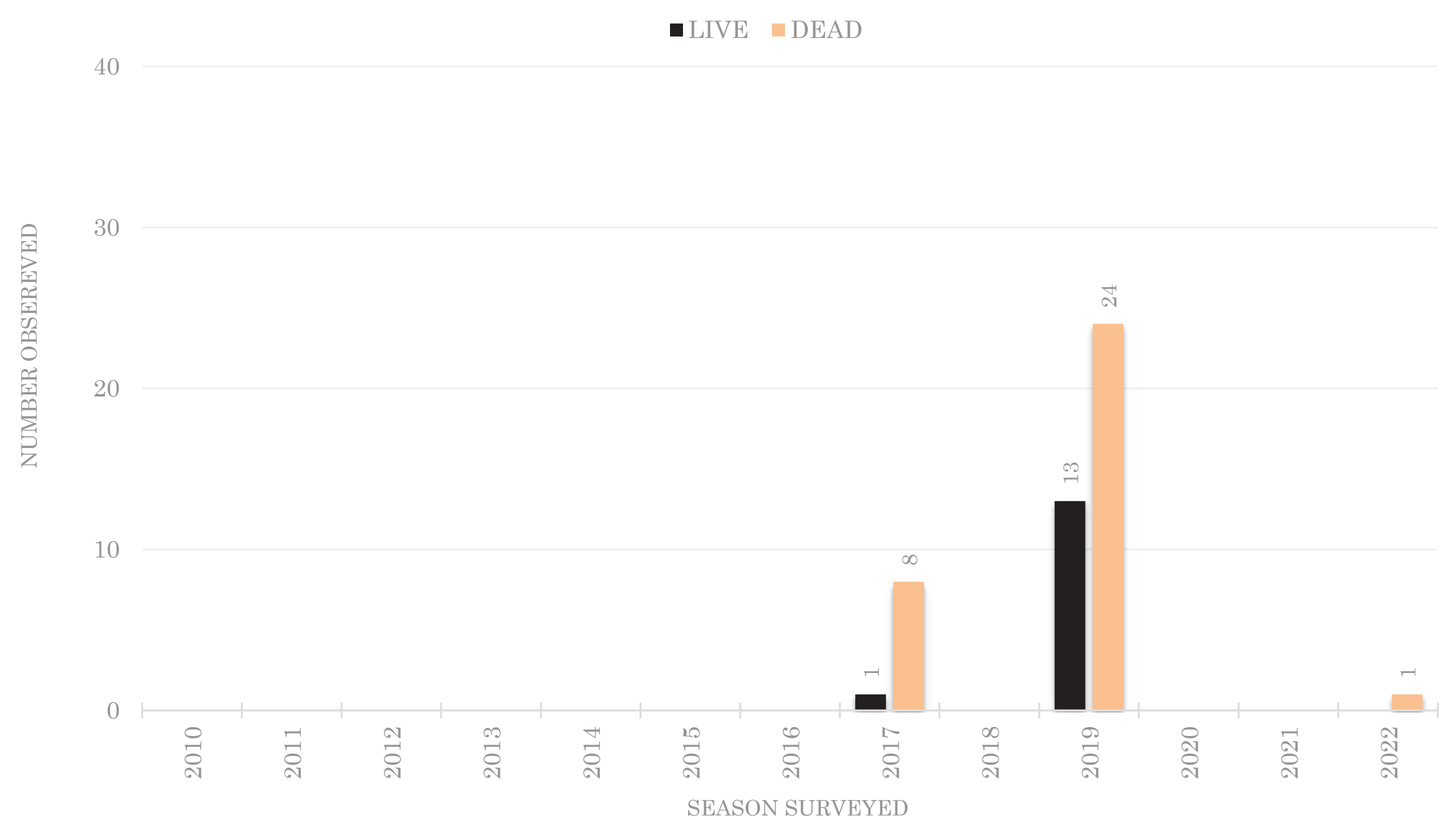
Downstream, from Pioneer Way E. to the mouth, Rody flows through a channel that is best described as an incised and straightened drainage ditch *(left)*. The habitat throughout most of the lower half mile reach of Rody Creek is remarkably poor; much of the accessible channel has no suitable spawning gravel, and the riparian consist more or less entirely of blackberry, turf grass, and reed canary grass. However, some riparian improvements have been made along the south bank of the spawning reach below Pioneer. Unfortunately, much of the spawning reach is regularly hogged-out to reduce flood risks to a nearby home and agricultural field. The reed canary grass, as well as watercress, can be overwhelming during some seasons; often choking extended lengths of the channel and trapping or preventing fish from migrating through. In addition, the grass traps and holds large amounts of fine materials, consequently covering the spawning substrate. However, chum salmon are regularly observed spawning in the spawning reach when the channel clears. Chum spawn each season in a section of available habitat just below Pioneer. An extremely high water event in the January of 2006 redistributed a large quantity of gravel throughout the channel for approximately 300 feet below Pioneer Way *(both images)*; however, a hydraulics violation was committed when this section of stream was illegally excavated by a land owner in fall of 2010. A half mile downstream of the culvert passage under Pioneer, Rody Creek passes under 66th and flows into Clarks Creek.

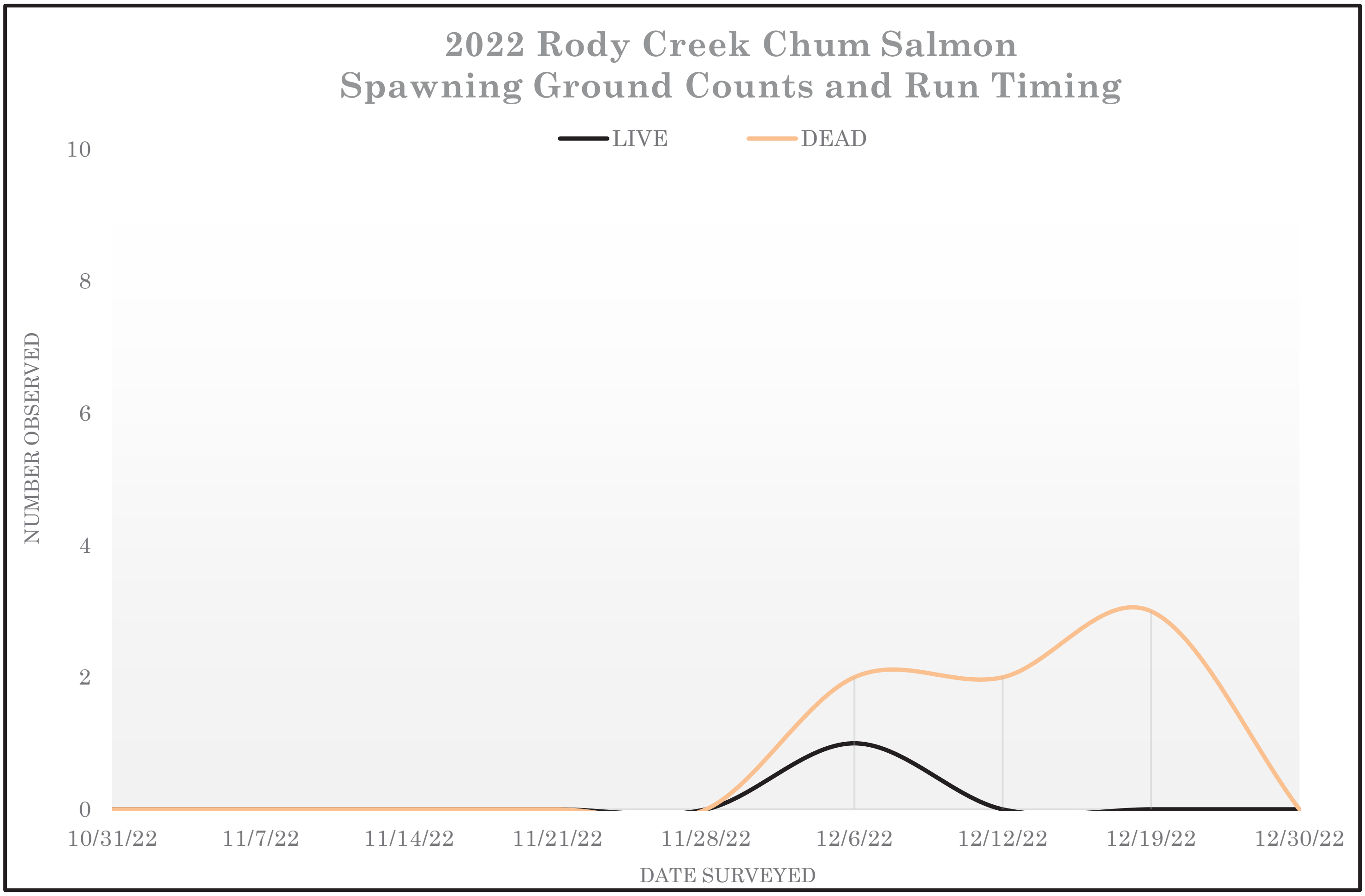

Chum salmon

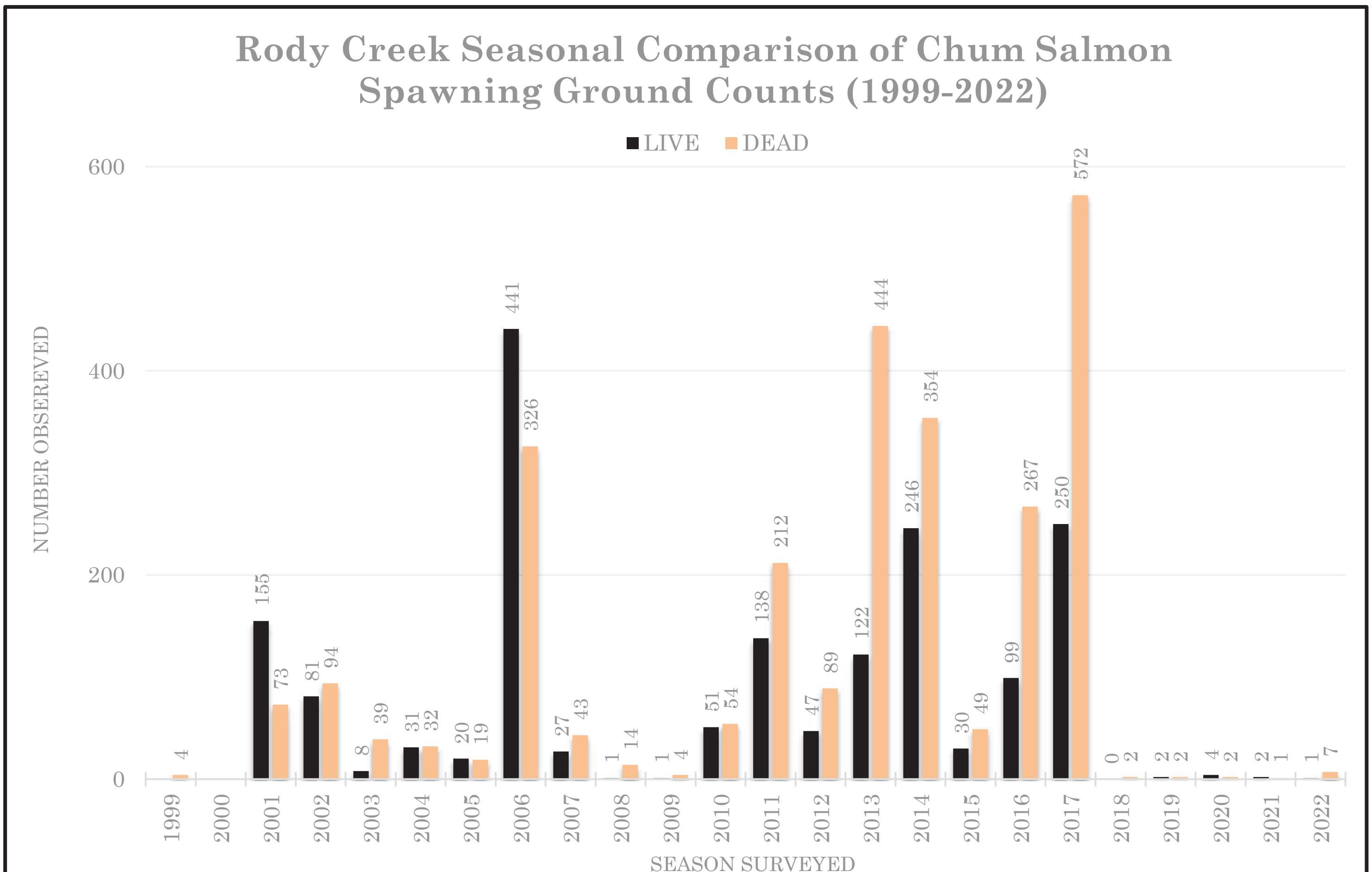
2022 Rody Creek Coho Salmon Spawning Ground Counts and Run Timing



Rody Creek Seasonal Comparison of Coho Salmon Spawning Ground Counts (2010-2022)




2022 Rody Creek Chum Salmon
Spawning Ground Counts and Run Timing
LIVE
DEAD
10
8
6
4
2
0
NUMBER OBSERVED
10/31/22
11/7/22
11/14/22
11/21/22
11/28/22
12/6/22
12/12/22
12/19/22
12/30/22
DATE SURVEYED


Rody Creek Seasonal Comparison of Chum Salmon
Spawning Ground Counts (1999-2022)
LIVE
DEAD
600
400
200
0
NUMBER OBSEREVED
4
155
73
81
94
8
39
31
32
20
19
441
326
27
43
1
14
1
4
51
54
138
212
47
89
122
444
246
354
30
49
99
267
250
572
0 2
2 2
4 2
2 1
1 7
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
SEASON SURVEYED

RUSHINGWATER CREEK

WRIA 10.0625

Rushingwater Creek originates from the Upper and Lower Golden Lakes located in Mt. Rainier National Park. Rushingwater flows over 5 miles from the lower lake to its confluence with the Mowich River at RM 0.6. Approximately the first 2 miles of the creek are anadromous. Downstream of the N.P. boundary the creek flows through the Mt. Baker-Snoqualmie National Forest before reaching private timber property. The lower reach of Rushingwater flows within the Kapowsin tree farm. Logging roads and timber harvesting have impacted sections of the stream, specifically windthrow located along the lower reach. Rushingwater supports adult and juvenile Chinook, coho, steelhead, bull trout and cutthroat. Bull trout have been observed in Rushingwater; however, spawning utilization is unknown. However, bull trout utilization is well documented in the Mowich and Puyallup.

One of two acclimation ponds used for enhancing coho, and occasionally Chinook *(spring & fall)*, into a 26+ mile reach of the Upper Puyallup River is located just off the main channel of Rushingwater at RM 0.6. The old Rushingwater pond was over two decades old and had weathered high flows and significant sediment deposition which has decreased its operational capabilities and efficiency. As of the summer of 2022, the Rushingwater pond has been re-engineered to bring it up to modern design specification. The new pond is scheduled to be completed in late 2023, and will have increased fish capacity (16,000 cubic feet of water storage) and predator prevention. In addition to the acclimation of juvenile coho and Chinook, adult surplus coho and Chinook from Voights Creek Hatchery have been planted in Rushingwater when available. However, no adult fish were planted in 2004. Instead, the first naturally retuning adult coho were allowed to spawn without intrusion from hatchery planted coho. Future live plants may be reduced or eliminated based on the number of NOR's.

Dividing this stream into four reaches, the lowest reach covers the first mile of the creek. This initial reach consists of a complex riffle-pool system with considerably large substrate; consisting of large gravel, cobble and boulders. Several windblown trees, the result of poor RMZ management, span the channel the length of this stretch. Abundant instream woody debris and a moderate to dense canopy cover extend through most of this reach. Beaver (*Castor canadensis*) activity is frequent throughout the upper portion. Beyond this, in reach 2, the creek climbs nearly 1,000 feet over the next 2 miles. An impassable cascade is located within this reach preventing any further upstream migration.

The 3rd reach harbors significantly different habitat. For roughly the next mile the creek assumes a

placid flow and contains excellent spawning habitat, as well as considerable amounts of beaver activity and LWD structures. This reach is one of the sites where adult surplus coho are planted. The final reach of Rushingwater once again climbs swiftly *(2,000 feet)* over the next 1.6 miles to the outlet of Golden Lake at 4,500 feet.

Fish Enhancement Project Description: Operate several acclimation ponds in the Puyallup/White River Watershed designed to enhance Chinook, coho and steelhead stocks. Each of the two acclimation ponds *(Cowskull & Rushingwater)* on the Puyallup may receive as many as 100K+ hatchery origin spring/Fall Chinook and/or coho. Four additional acclimation ponds located in the Upper White River drainage *(Huckleberry Cr., Greenwater River (George Cr.), Twentyeight Mile Cr. (Greenwater R.) & Jensen Cr. (Clearwater R.)* would be planted collectively with as many as 900K+ White River Spring Chinook. When available, the Puyallup Tribe will collect, haul and plant surplus adult hatchery Fall Chinook and coho from WDFW Voights Creek hatchery. During the summer of 2015, the pond was given its first maintenance dredging since it was originally constructed. This was necessary due to more than half of the ponds capacity being lost due to sediment build-up.

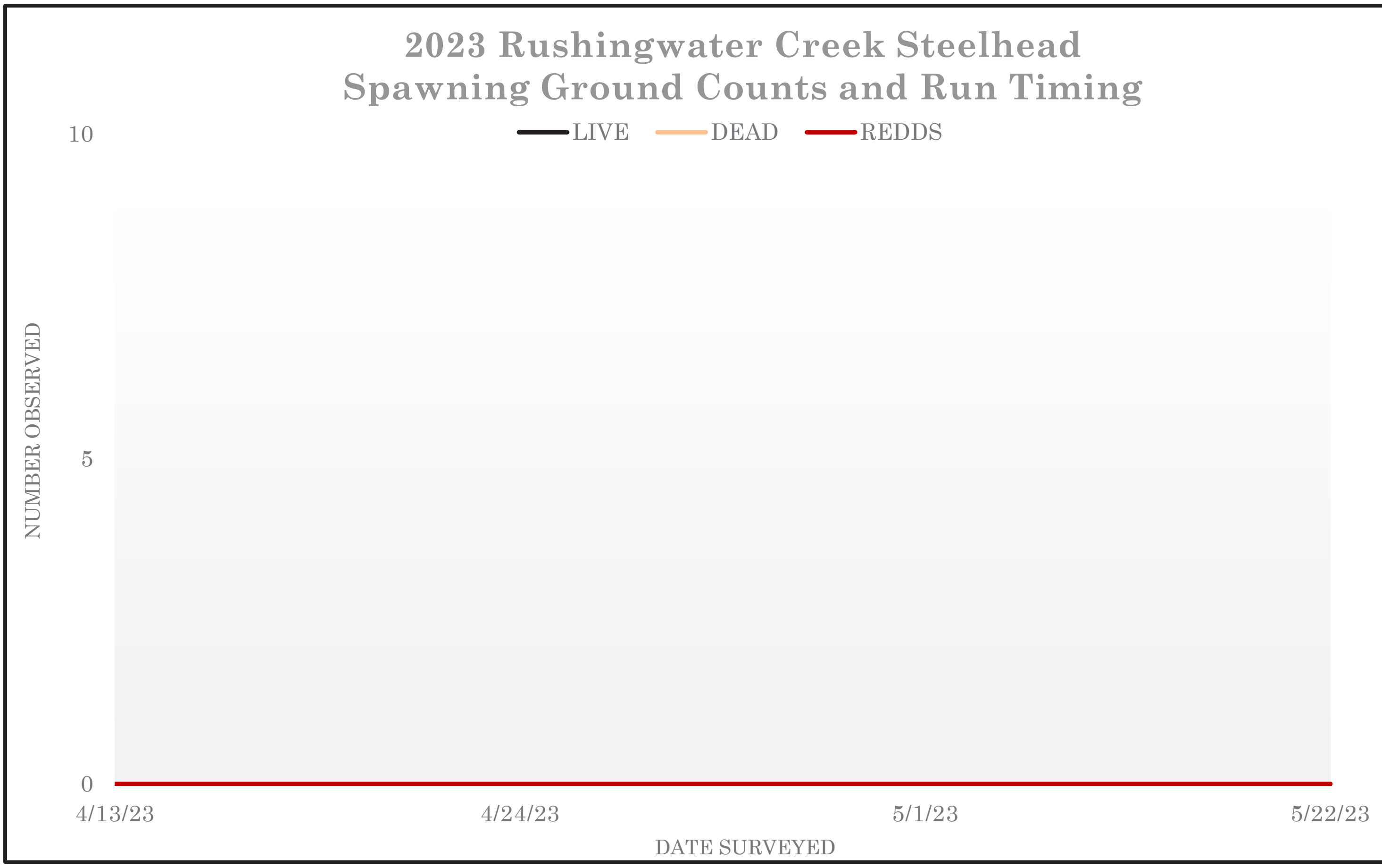
Goals, Purpose and Expected Benefits: One of the Puyallup Tribe's most significant restoration goals is to rebuild depressed Chinook stocks and remove them from ESA listing. Acclimation ponds are a proven method for increasing fish stocks, and are a key component to restoration goals. All six acclimation ponds in the basin were funded and are operated by the Puyallup Tribe.

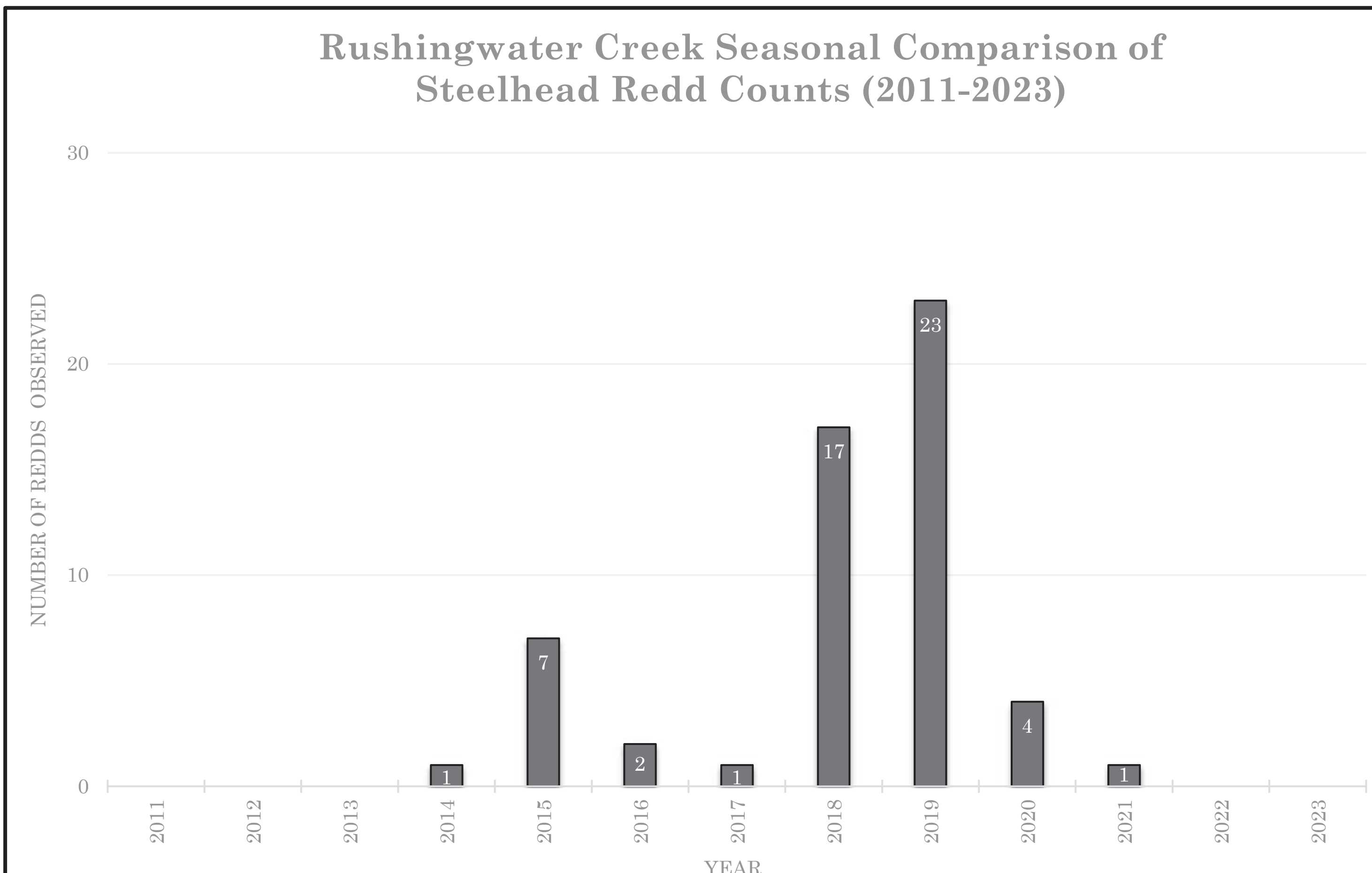
Purpose of Project:
1. Supplementing ESA listed salmonid spawning.
2. Increasing weak or depressed wild salmonids *(non-ESA listed)*.
3. Sustaining/enhancing a fishery population.

Expected Benefits Include:
- Enhancing Chinook and coho into their endemic ranges.
- Increased total abundance of the composite natural/hatchery population.
- Increased spawning ground escapement and trend of Natural Origin Recruits (NORs).
- Improve distribution (out planting of live fish) to minor spawning and underutilized rearing habitat areas.
- Nutrient enhancement in oligotrophic *(nutrient-poor)* streams.

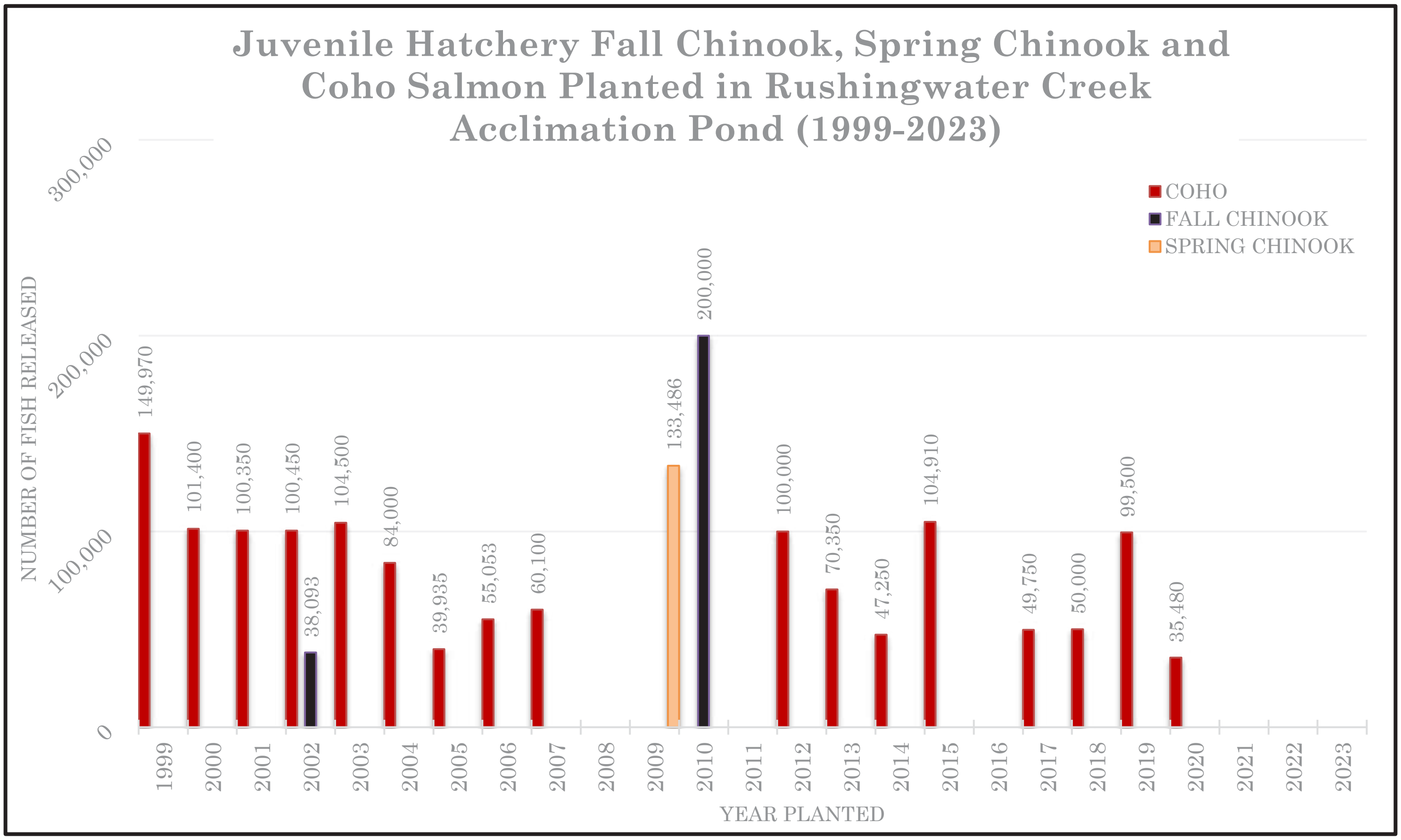
*The 2012-season was the first year a significant escapement of Chinook was observed spawning in Rushingwater Creek. Sampling data *(ventral fin clips)* showed many of the Chinook were survivors from juvenile Spring Chinook released from the Rushingwater *(n=133,486)*, or Cowskull *(n=181,386)* acclimation ponds in 2009 *(2008 brood year)*.

The re-engineered Rushingwater pond under construction during the summer of 2023.

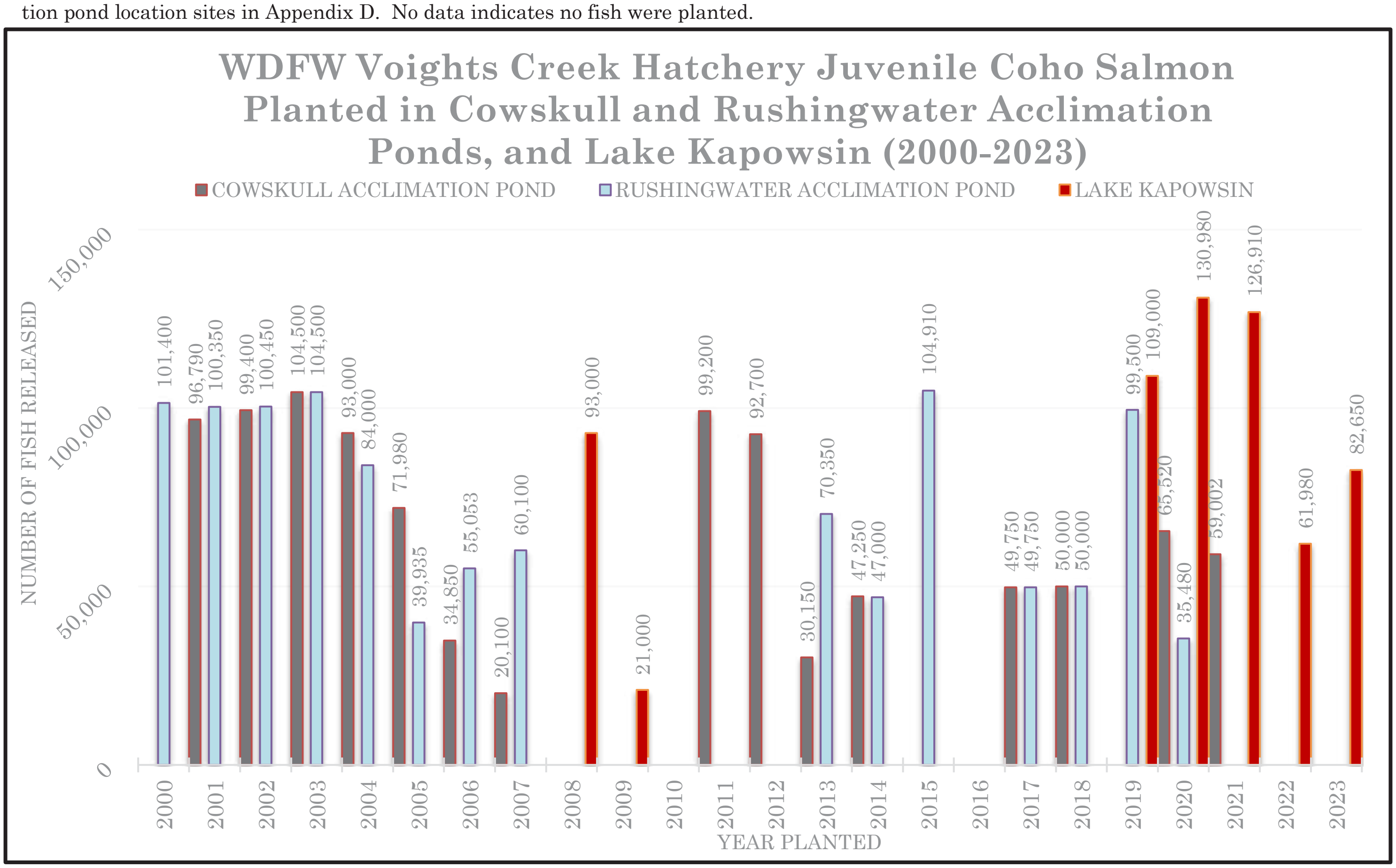




To determine the total escapement for steelhead, each redd is multiplied by a factor of 1.62 *(i.e. 42 redds x 1.62 steelhead per redd = total escapement of 68 steelhead).* See steelhead redd location map in appendix C.



Surplus adults provided by WDFW Voights Creek Hatchery when available. Acclimation ponds opperated by Puyallup Tribe. See map of acclimation pond location sites in Appendix D. No data indicates no fish were planted.



Acclimation ponds opperated by Puyallup Tribe. Coho provided by WDFW Voights Creek Hatchery when available. See map of acclimation pond location sites in Appendix D. No data indicates fish were not planted.

SALMON CREEK

WRIA 10.0035

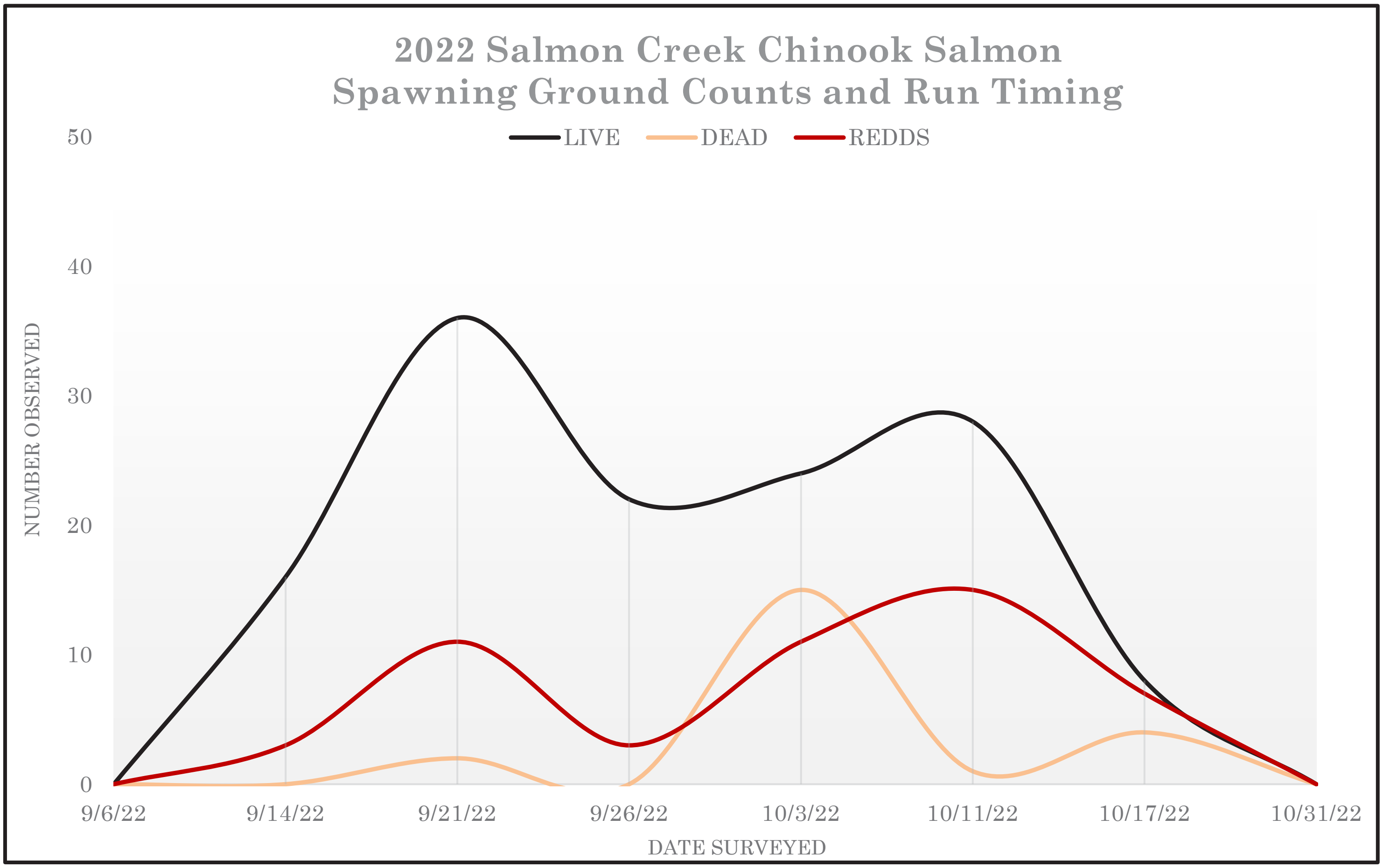
Salmon Creek, also known as Strawberry Creek, flows just north of downtown Sumner. The creek channel is narrow and incised, especially along the lower 0.5 miles. Most of the creek flows through moderately developed private and commercial properties before entering the White River at RM 2.1. In 2004, the City of Sumner completed a large wetland restoration project adjacent to the lower reach of Salmon Creek *(RM 0.4)*. The 11 acre site was the result of a mitigation settlement with Davis Properties and Fred Myers.

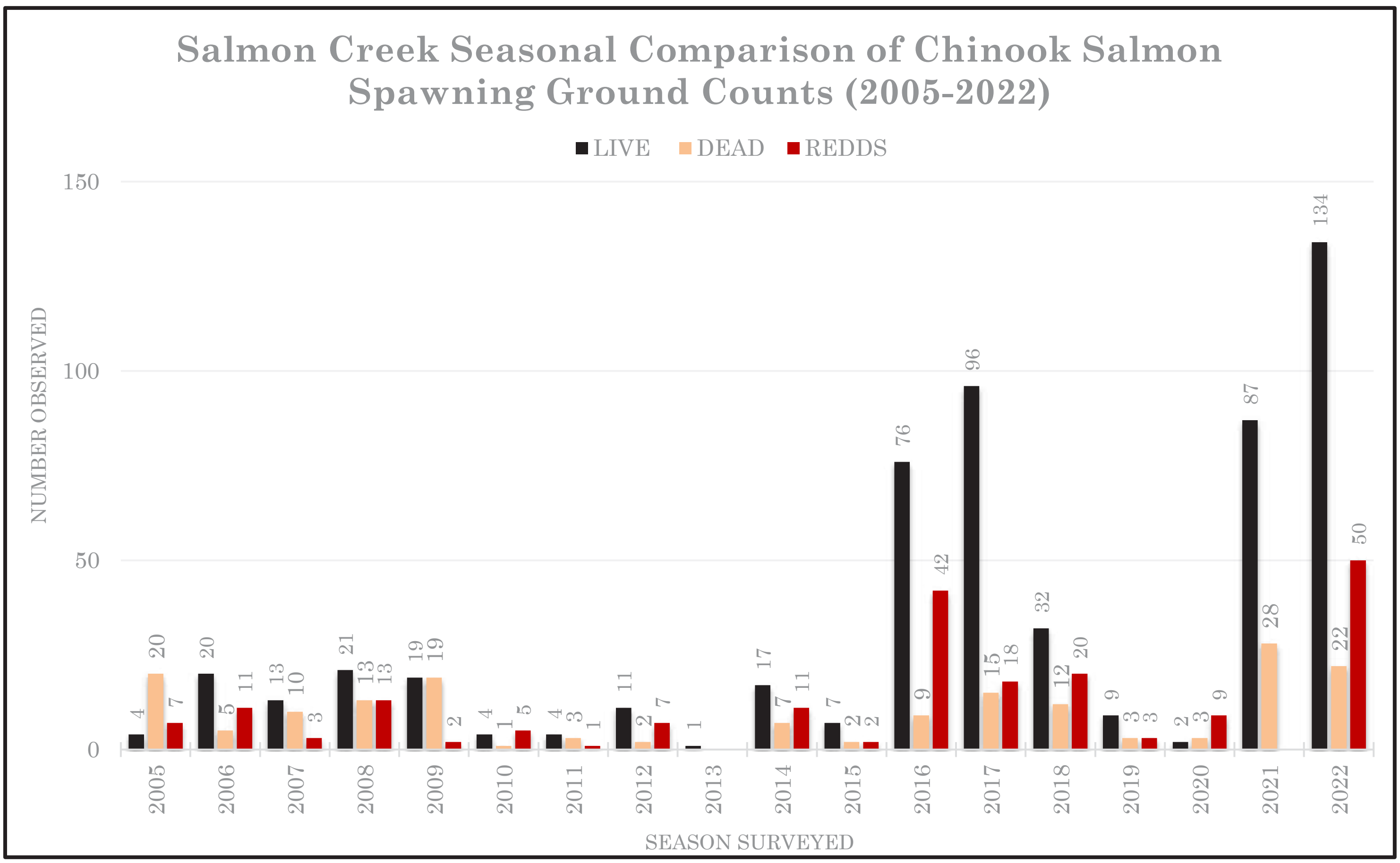
Several of the limiting factors impacting fish production in Salmon Creek include: a confined and straightened stream channel, disconnected floodplain, channel erosion, absent or deficient riparian cover, as well as low summer and fall seasonal flows. High sediment inputs, industrial discharge, and lack of channel habitat are additional limiting factors.

The riparian along portions of the creek consist of sparse stands of alder, fir and maple. Unfortunately, large sections of the stream riparian consist of nothing other than blackberry, turf grass, and reed canary grass *(Phalaris arundinacea)* which provide little or nothing in the way of shade or LWD inputs. The substrate is largely fine sediment, clay, and undersized gravel; however, limited patches of adequate sized spawning gravel, principally throughout the lower section of the creek, are available. Most of the spawning habitat within the creek, although quite limited, exists in the lower 0.5 miles of the creek. It's likely that a great deal of the gravel present throughout the lower reach is recruited from Salmon Tributary. Fish do ascend above the first half mile despite the fact that spawning opportunities are few and the habitat is considerably poorer in quality. In response to the limited spawning habitat available, several of the chum salmon observed in Salmon Creek are likely to be ascending to the spring fed tributary, Salmon Tributary, which enters Salmon Creek at RM 0.5 on the right bank. The consistent flow into Salmon Creek from this perennial tributary contributes greatly to the accessibility of Chinook during the late summer and early fall when instream flows in many streams are too low for Chinook to enter.

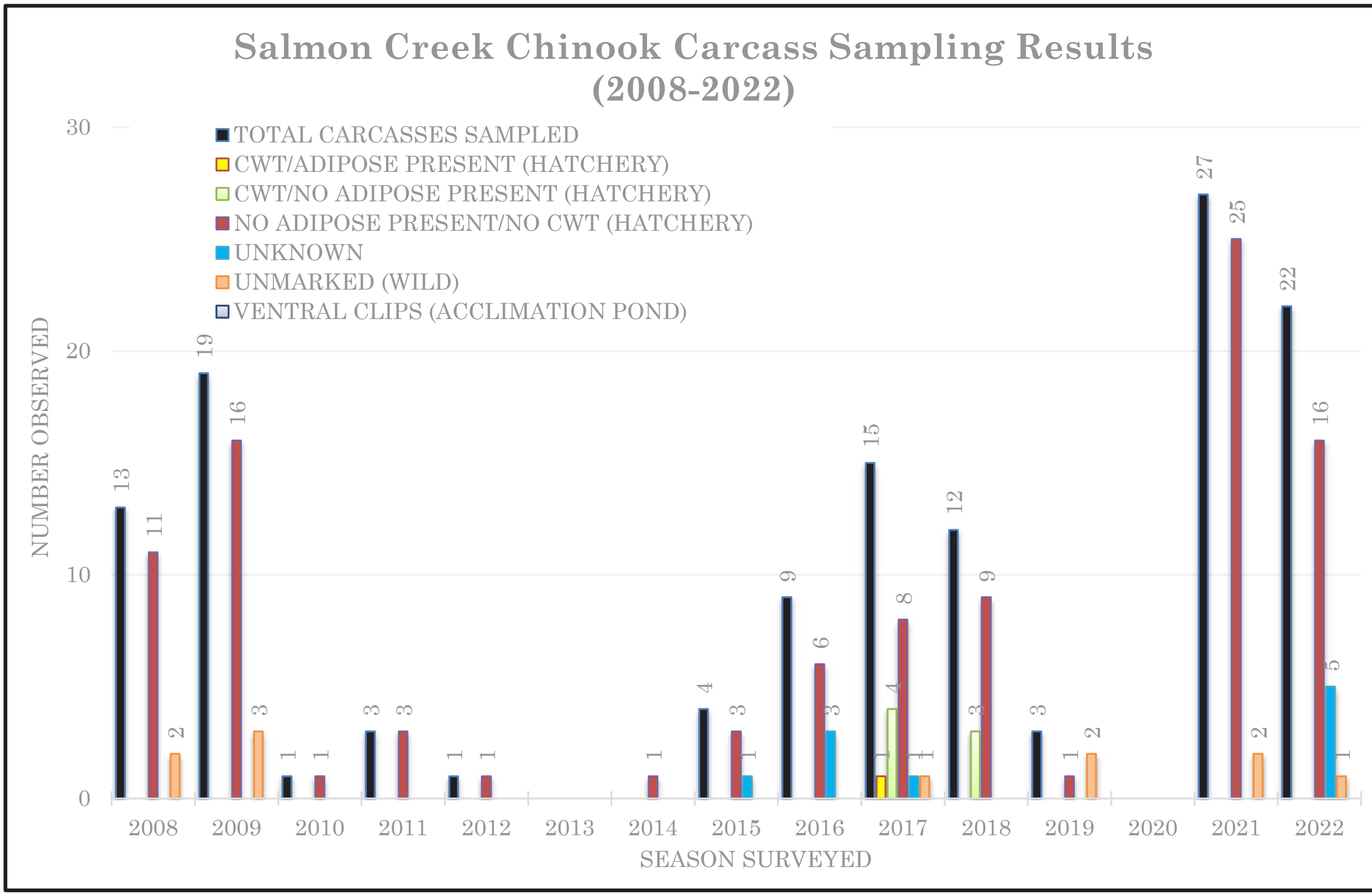
Salmon Creek supports adult Chinook, pink, coho, and chum spawners; with chum being the most abundant species present. Coho are observed spawning; however, their numbers have been consistently low. Steelhead and bull trout utilization is unknown, but presumed due to their well-documented presence throughout the White River. Prior to 2005, Salmon Creek was not regularly surveyed for Chinook since they were seldom observed. However, a few Chinook carcasses were observed within the lower 300 feet of the creek while conducting coho surveys. Annual Chinook surveys conducted since 2005 have documented spawning as high as to the old Weber plant *(Elm St. E & 160th Ave E)*; however, the majority of spawning occurs in the lower 0.5 miles of the creek. Adult coho have been observed as high as 60th St. E. A new oversized culvert was installed near the mouth in 2007, and another culvert and road crossing was installed upstream in 2009.

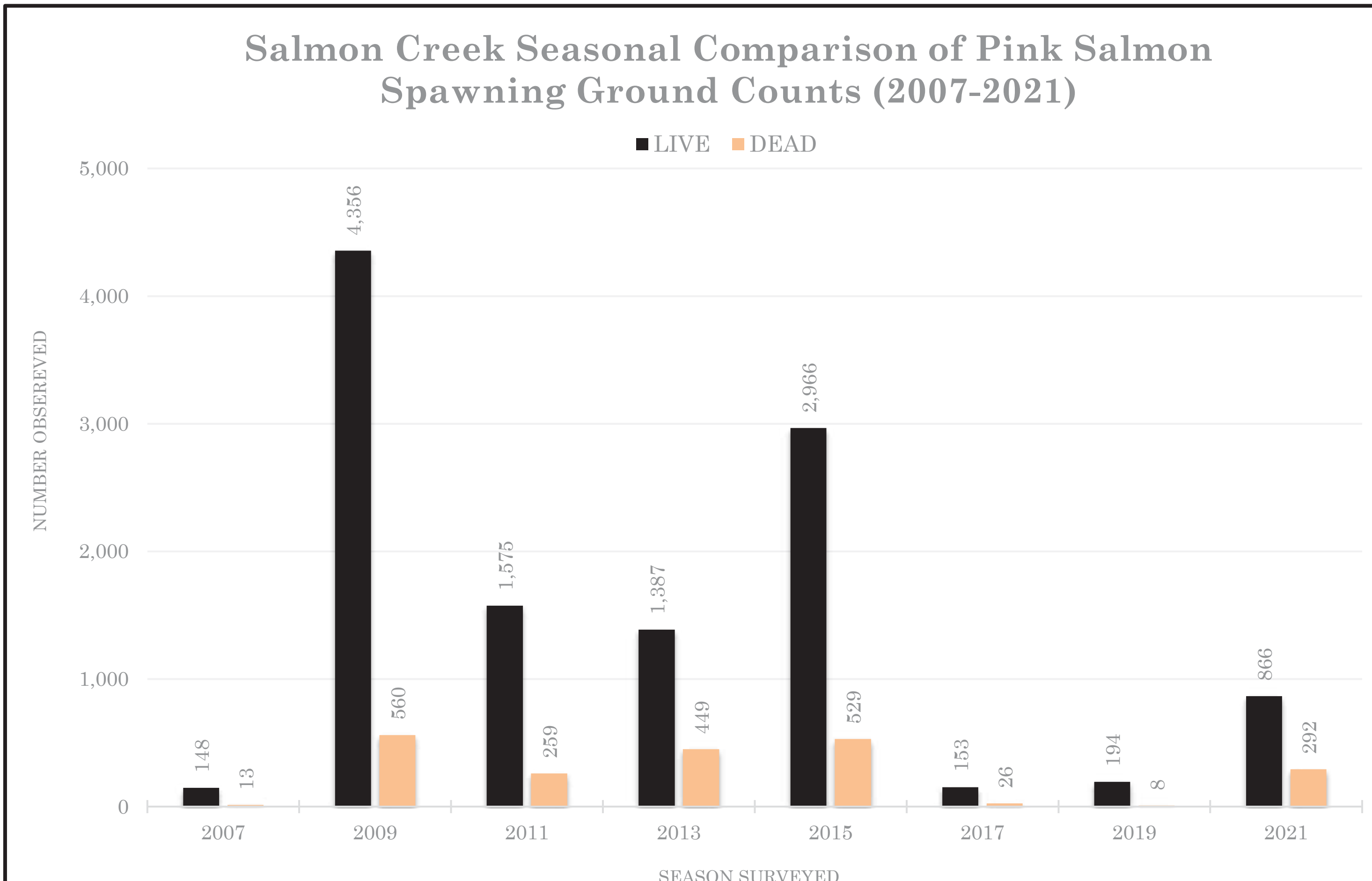
Chinook salmon.

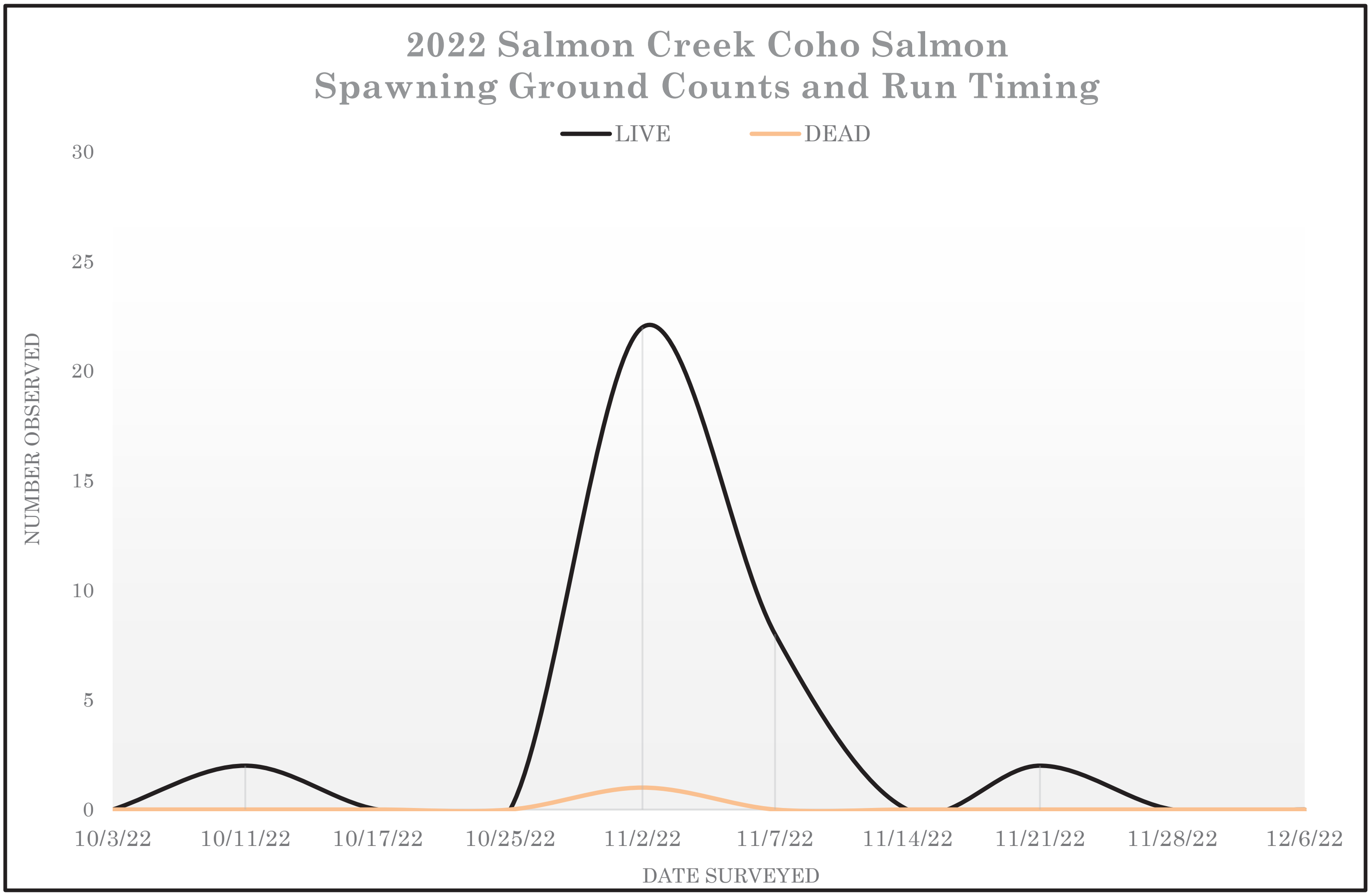


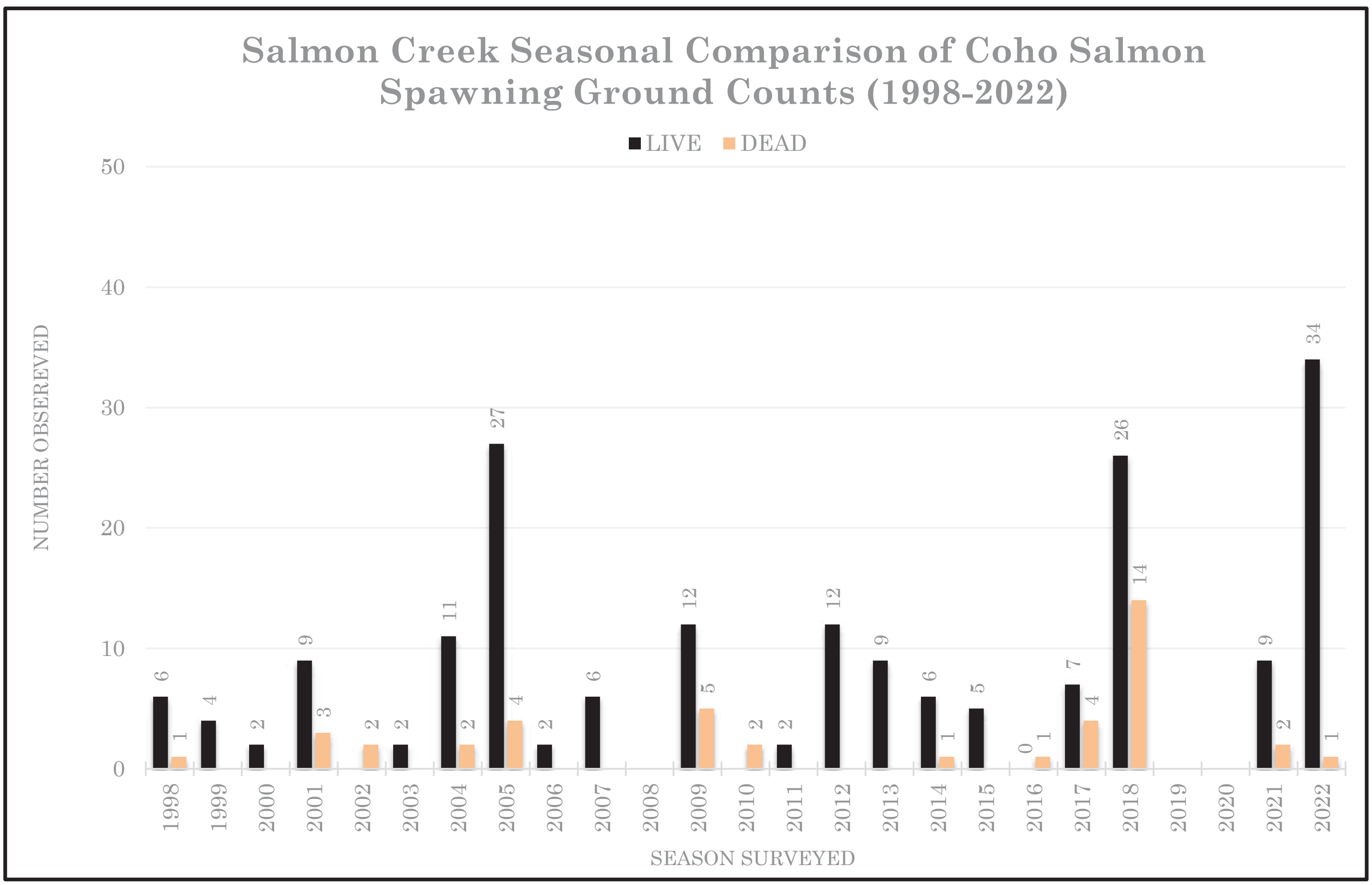


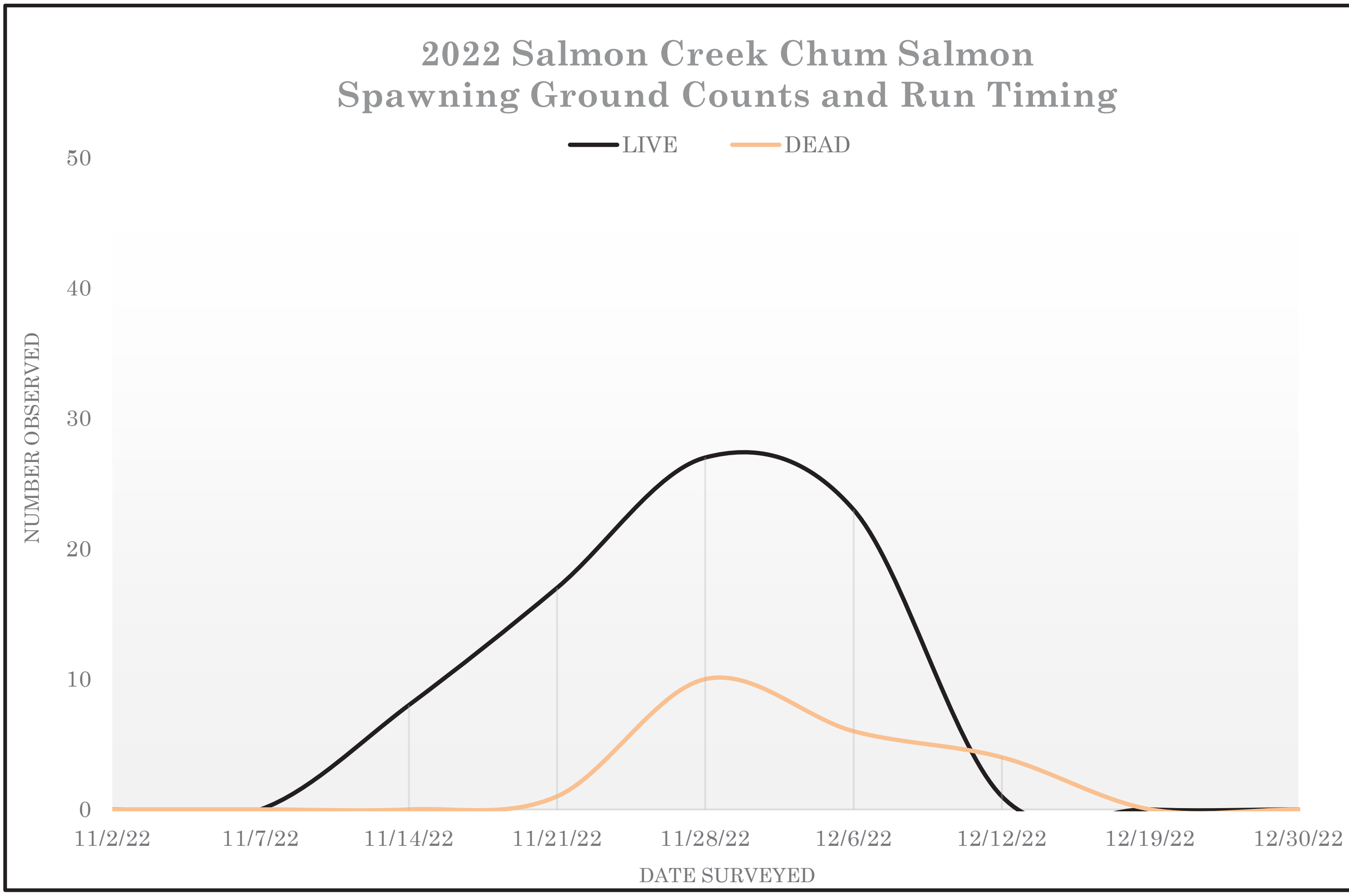
Adult Chinook escapement is determined by expanding the number of redds observed by 2.5 fish per redd (Smith and Castle, 1994). Due to the tremendous volume of pink salmon during odd years, the success of determining Chinook redds from pinks is vastly reduced. Therefore, The AUC method is used to determine escapement during pink runs (odd years).

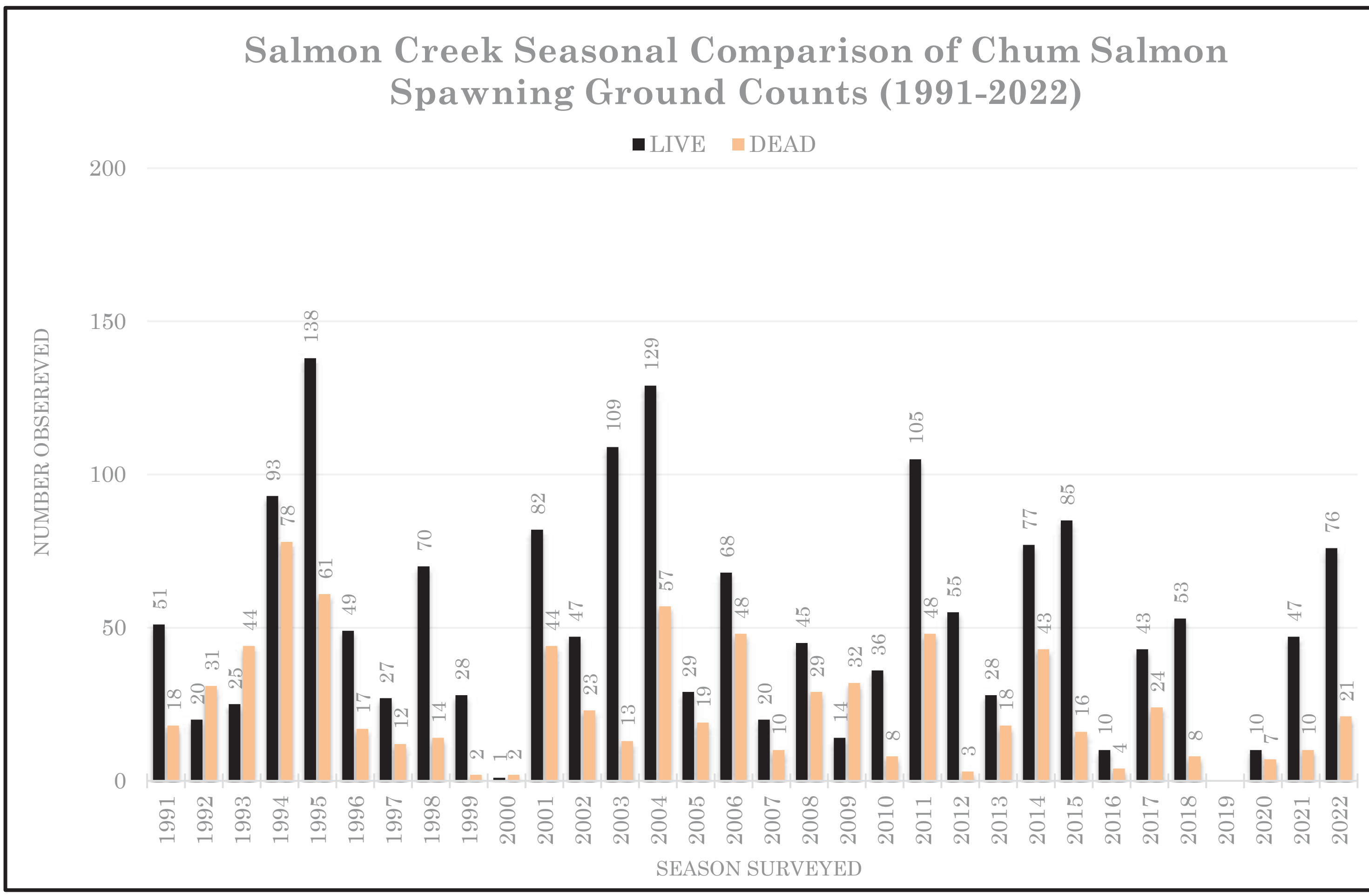

Salmon Creek Chinook Carcass Sampling Results (2008-2022)
TOTAL CARCASSES SAMPLED
CWT/ADIPOSE PRESENT (HATCHERY)
CWT/NO ADIPOSE PRESENT (HATCHERY)
NO ADIPOSE PRESENT/NO CWT (HATCHERY)
UNKNOWN
UNMARKED (WILD)
VENTRAL CLIPS (ACCLIMATION POND)
NUMBER OBSERVED
SEASON SURVEYED
0
10
20
30
2008
13
11
2
2009
19
16
3
2010
1
1
2011
3
3
2012
1
1
2013
2014
1
2015
4
3
1
2016
9
6
3
2017
15
1
4
8
1
1
2018
12
3
9
2019
3
1
2
2020
2021
27
25
2
2022
22
16
5
1


Salmon Creek Seasonal Comparison of Pink Salmon Spawning Ground Counts (2007-2021)
LIVE
DEAD
NUMBER OBSEREVED
SEASON SURVEYED
0
1,000
2,000
3,000
4,000
5,000
2007
148
13
2009
4,356
560
2011
1,575
259
2013
1,387
449
2015
2,966
529
2017
153
26
2019
194
8
2021
866
292


2022 Salmon Creek Coho Salmon
Spawning Ground Counts and Run Timing
LIVE
DEAD
NUMBER OBSERVED
0
5
10
15
20
25
30
10/3/22
10/11/22
10/17/22
10/25/22
11/2/22
11/7/22
11/14/22
11/21/22
11/28/22
12/6/22
DATE SURVEYED


Salmon Creek Seasonal Comparison of Coho Salmon
Spawning Ground Counts (1998-2022)
LIVE
DEAD
NUMBER OBSEREVED
0
10
20
30
40
50
1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022
6 1 4 2 9 3 2 2 11 2 27 4 2 6 12 5 2 2 12 9 6 1 5 0 1 7 4 26 14 9 2 34 1
SEASON SURVEYED


2022 Salmon Creek Chum Salmon
Spawning Ground Counts and Run Timing
LIVE
DEAD
NUMBER OBSERVED
50
40
30
20
10
0
11/2/22
11/7/22
11/14/22
11/21/22
11/28/22
12/6/22
12/12/22
12/19/22
12/30/22
DATE SURVEYED


Salmon Creek Seasonal Comparison of Chum Salmon
Spawning Ground Counts (1991-2022)
LIVE
DEAD
NUMBER OBSEREVED
200
150
100
50
0
SEASON SURVEYED
1991 51 18
1992 20 31
1993 25 44
1994 93 78
1995 138 61
1996 49 17
1997 27 12
1998 70 14
1999 28 2
2000 1 2
2001 82 44
2002 47 23
2003 109 13
2004 129 57
2005 29 19
2006 68 48
2007 20 10
2008 45 29
2009 14 32
2010 36 8
2011 105 48
2012 55 3
2013 28 18
2014 77 43
2015 85 16
2016 10 4
2017 43 24
2018 53 8
2019
2020 10 7
2021 47 10
2022 76 21

SALMON TRIBUTARY

WRIA 10.0036

Salmon Tributary is located in the city of Sumner and is a short run, spring-fed stream entering Salmon Creek *(Strawberry Creek)* at RM 0.5. Salmon Tributary has approximately 0.13 miles *(700 feet)* of highly productive spawning habitat. The lower anadromous reach consists of a low to moderate gradient channel with excellent spawning gravel available throughout its length. Although the creek lacks significant structure or complexity, it manages quite well in supporting adult spawners including Chinook, chum, pink and coho; as well as, providing rearing and overwintering opportunities for juvenile Chinook and coho.

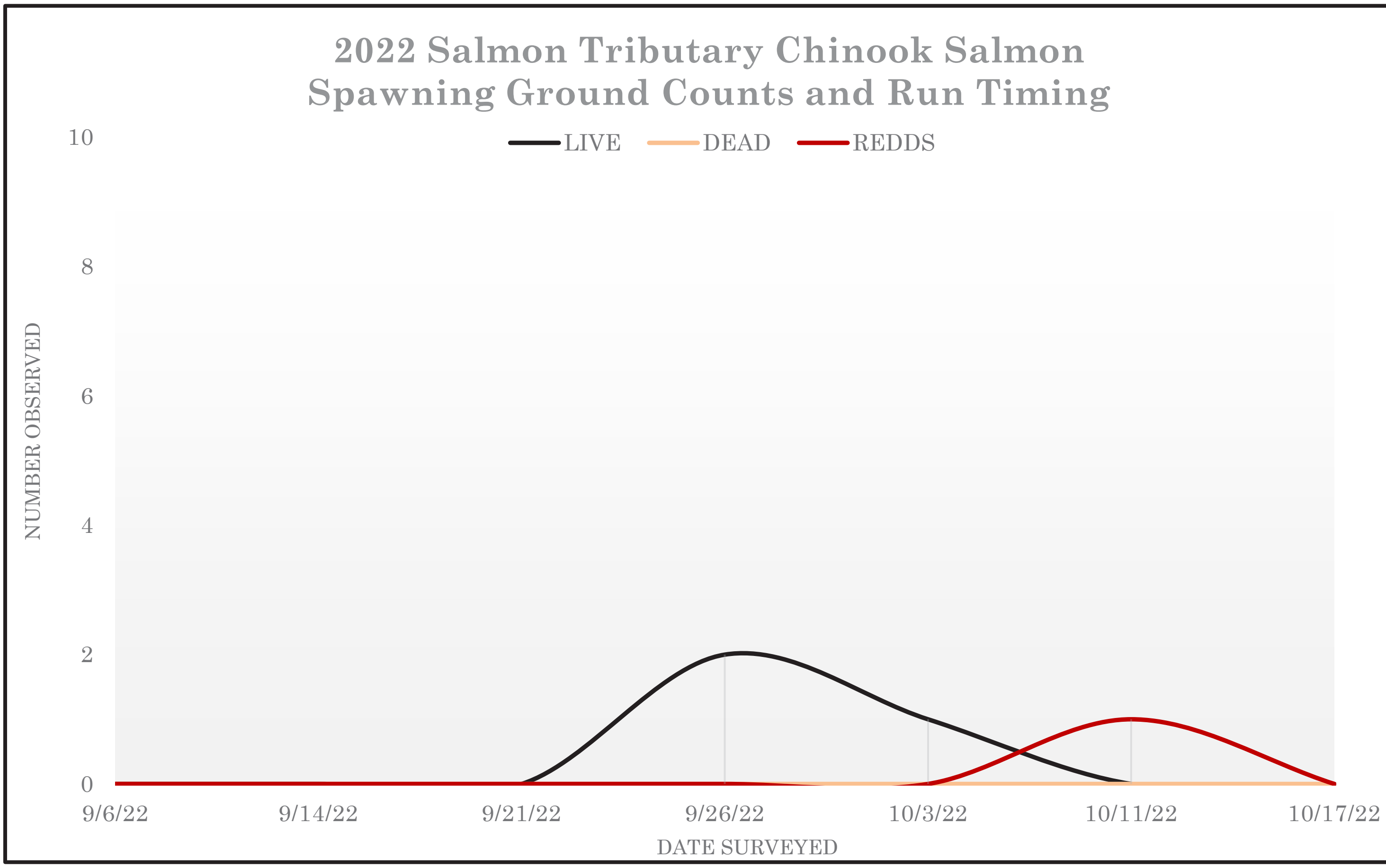
Beyond the anadromous reach the creek climbs quickly to a point where impassable cascades prevent any further upstream migration. The riparian along the lower reach of the creek consists largely of alder, as well as a few conifers and holly. A few pieces of small in-stream woody debris are present; however, LWD recruitment is limited and undersized. The riparian zone along the upper non-anadromous reach is well intact.

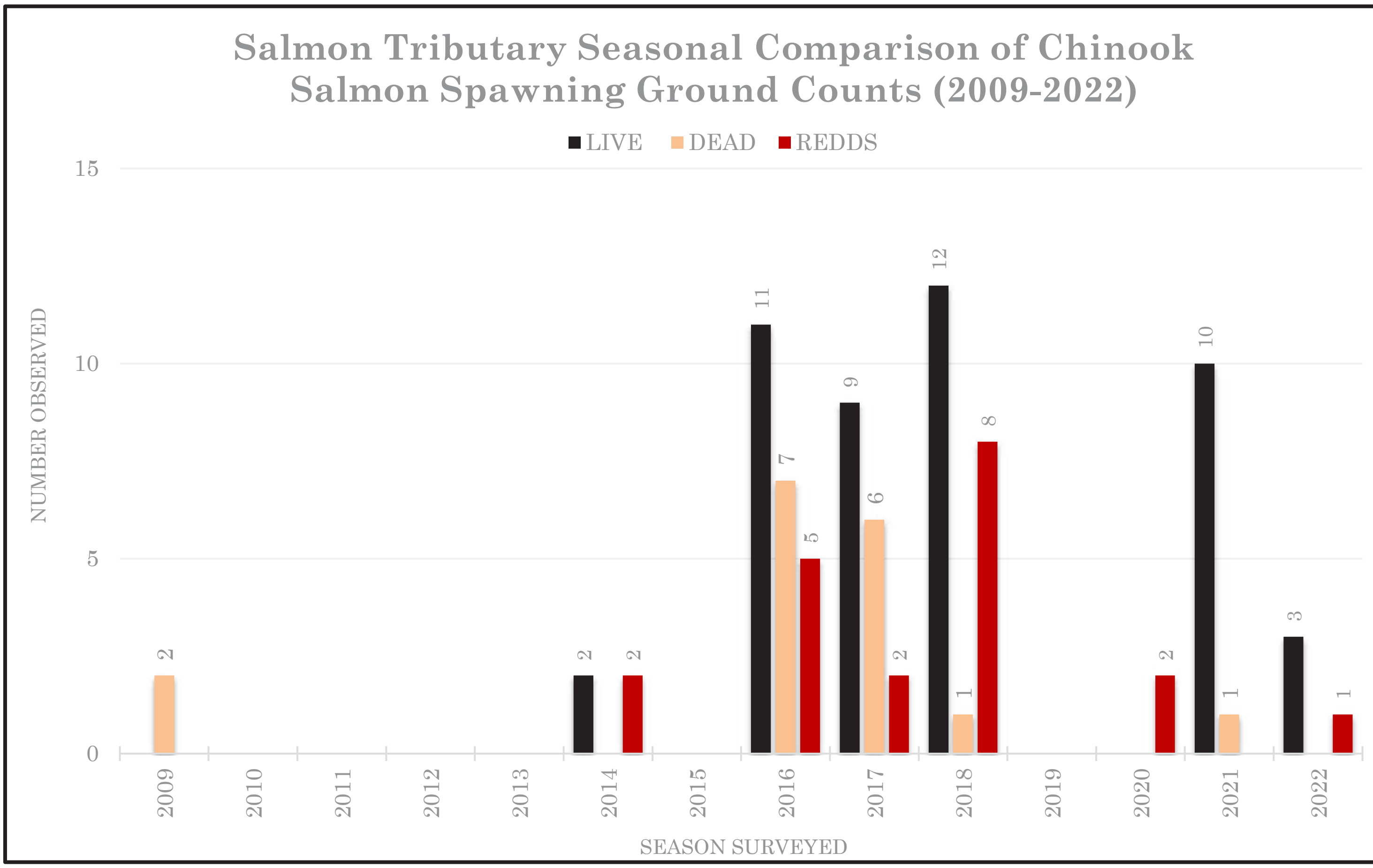
In the past, two perched culverts located on Salmon Creek have been responsible for periodically preventing adult salmon, primarily chum, from accessing Salmon Tributary. The upper culvert on Salmon Creek often created a significant fish passage problem until late 2007, when bank erosion permitted the creek to breech the culvert. During the fall of 2008, the two lower undersized cement culverts that had long been responsible for fish passage issues were removed.

Beyond RM 0.13, the gradient increases substantially and the channel narrows. The increase in gradient and flow is by and large an obstacle to chum, which are typically the most abundant species to spawn in the creek annually. Post emergence, chum fry will spend a brief time rearing in the creek prior to migrating towards marine waters. Moderate-to-heavy prespawn mortality due to predation is common most years, and is most prevalent with chum and pink than other species. Unfortunately, chum have experienced a sharp decline in escapement watershed wide since 2006.

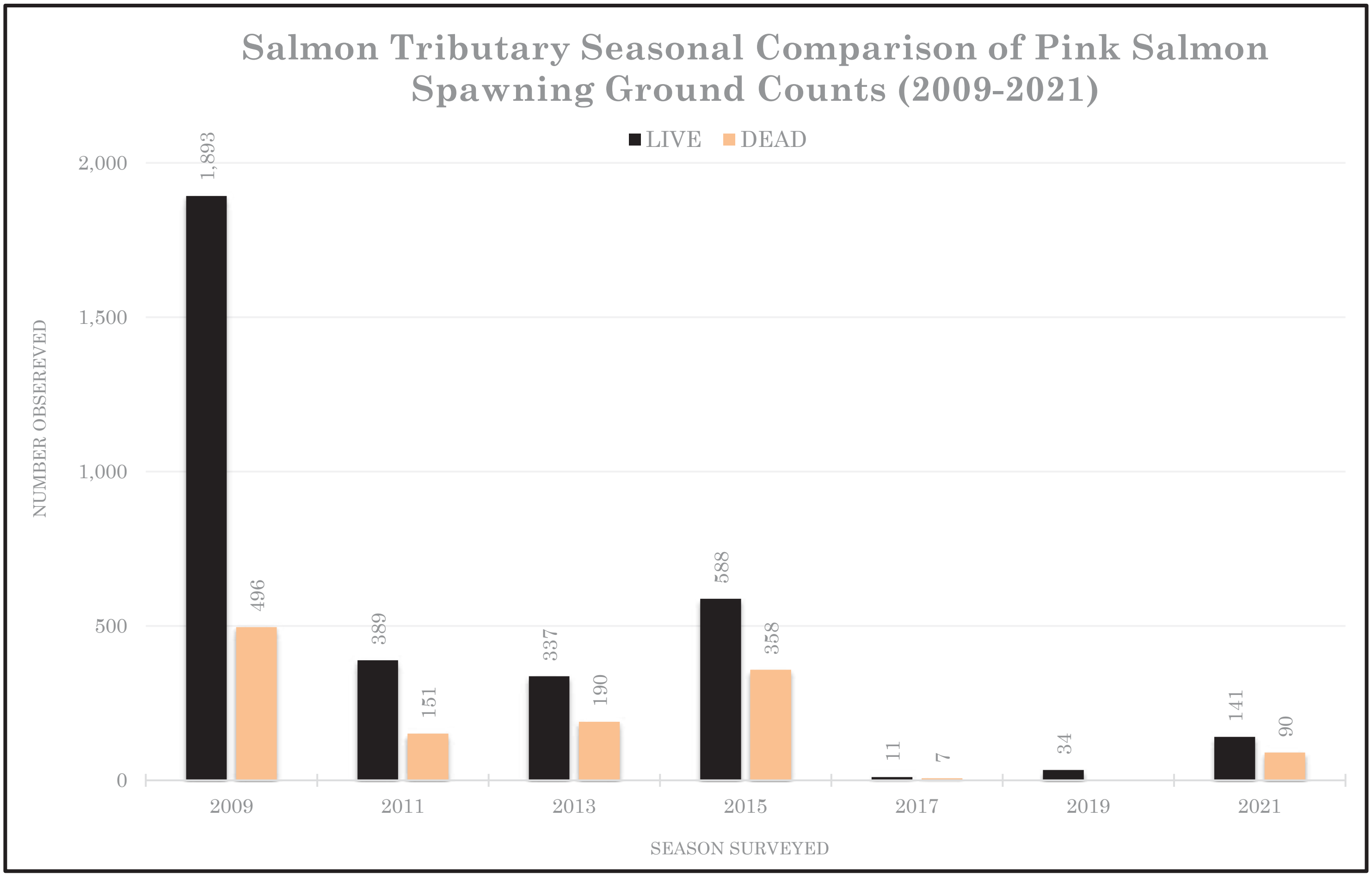
Chum salmon

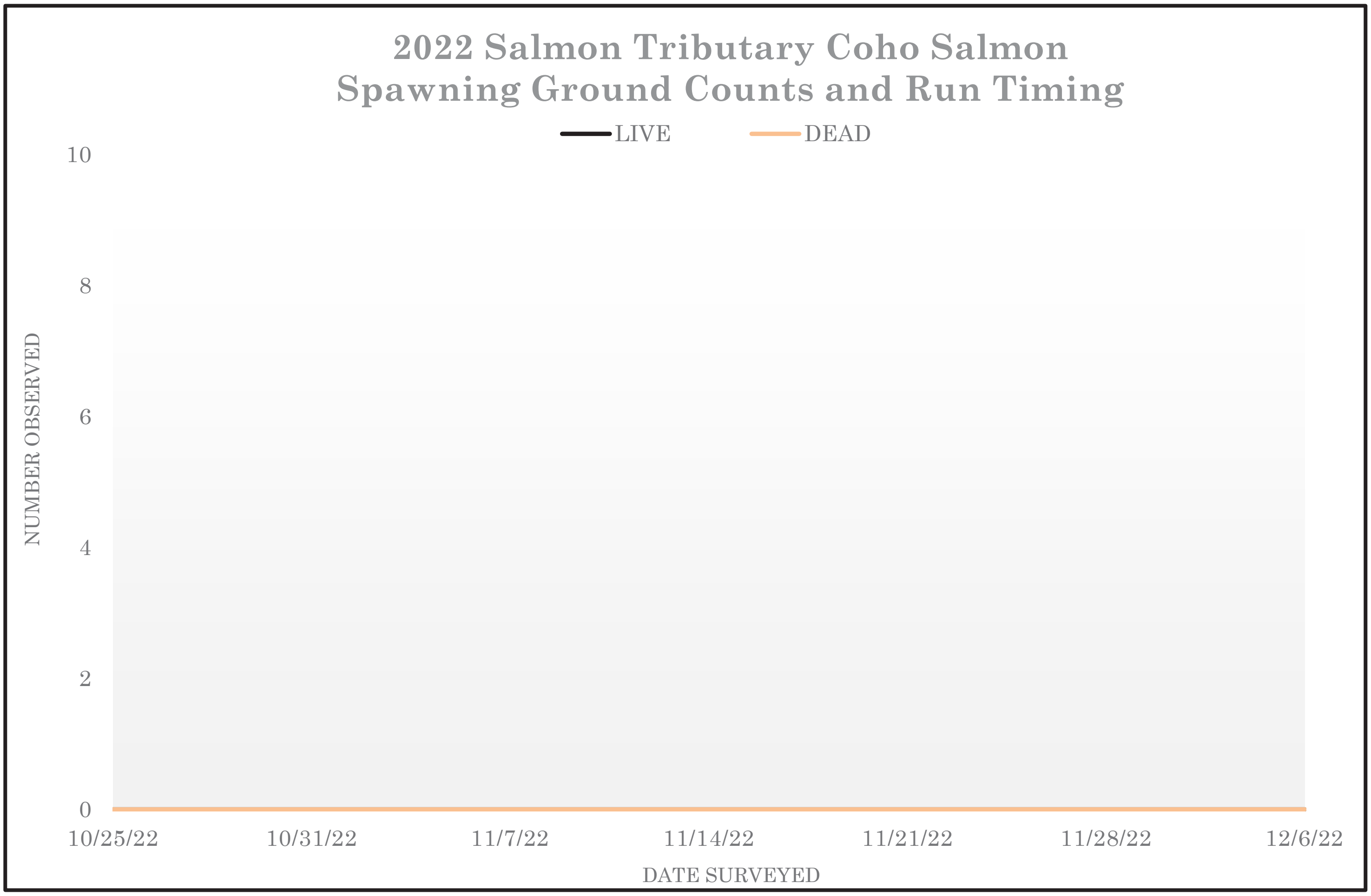
Also, during the fall run, coho are often observed spawning throughout the lower 250 feet of the tributary. Newly emerged coho fry are regularly seen in late January and early February during the latter part of chum surveys. Since 2016, Chinook have been observed spawning with greater frequency in both Salmon Creek and lower Salmon Tributary.

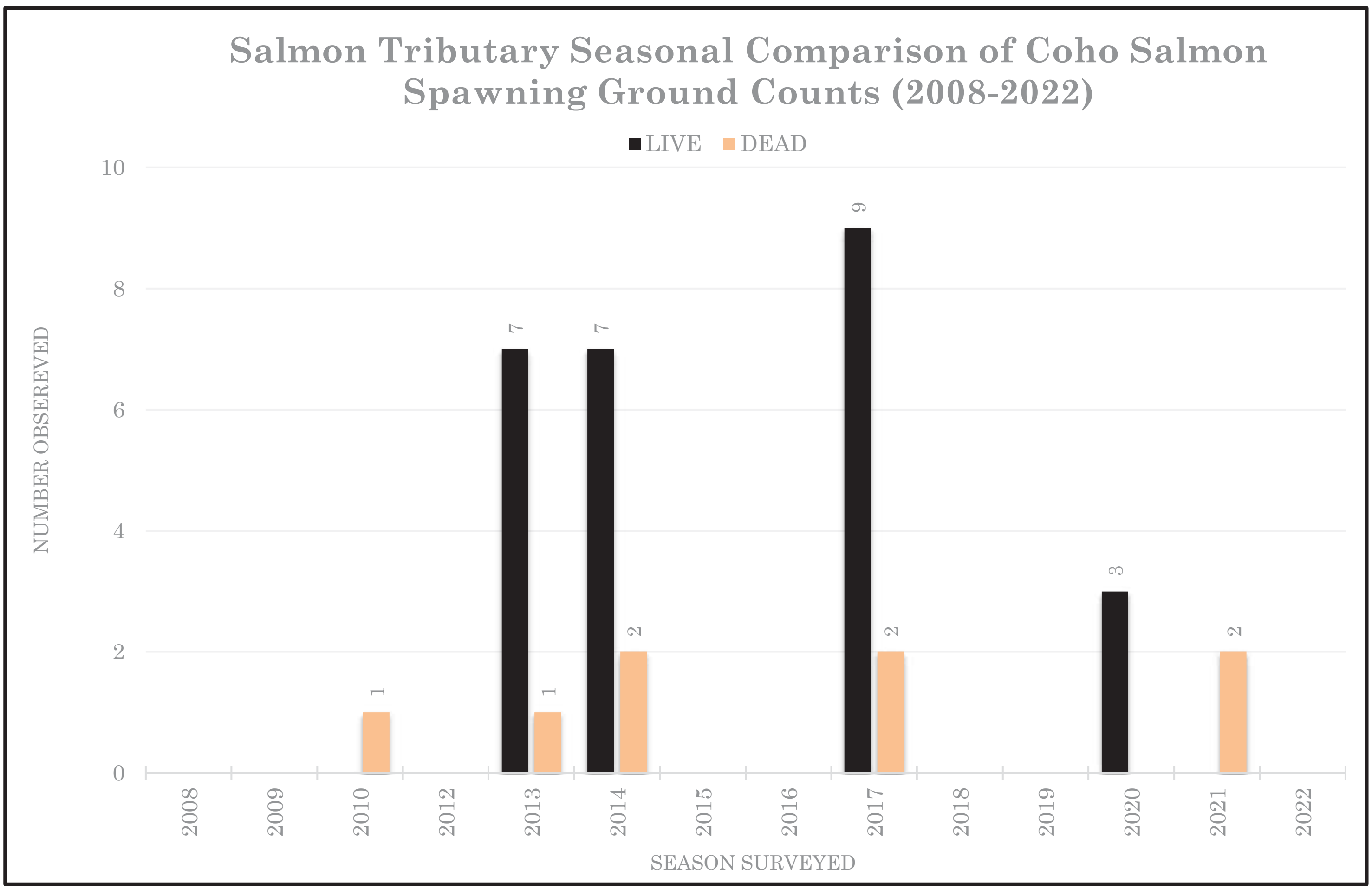


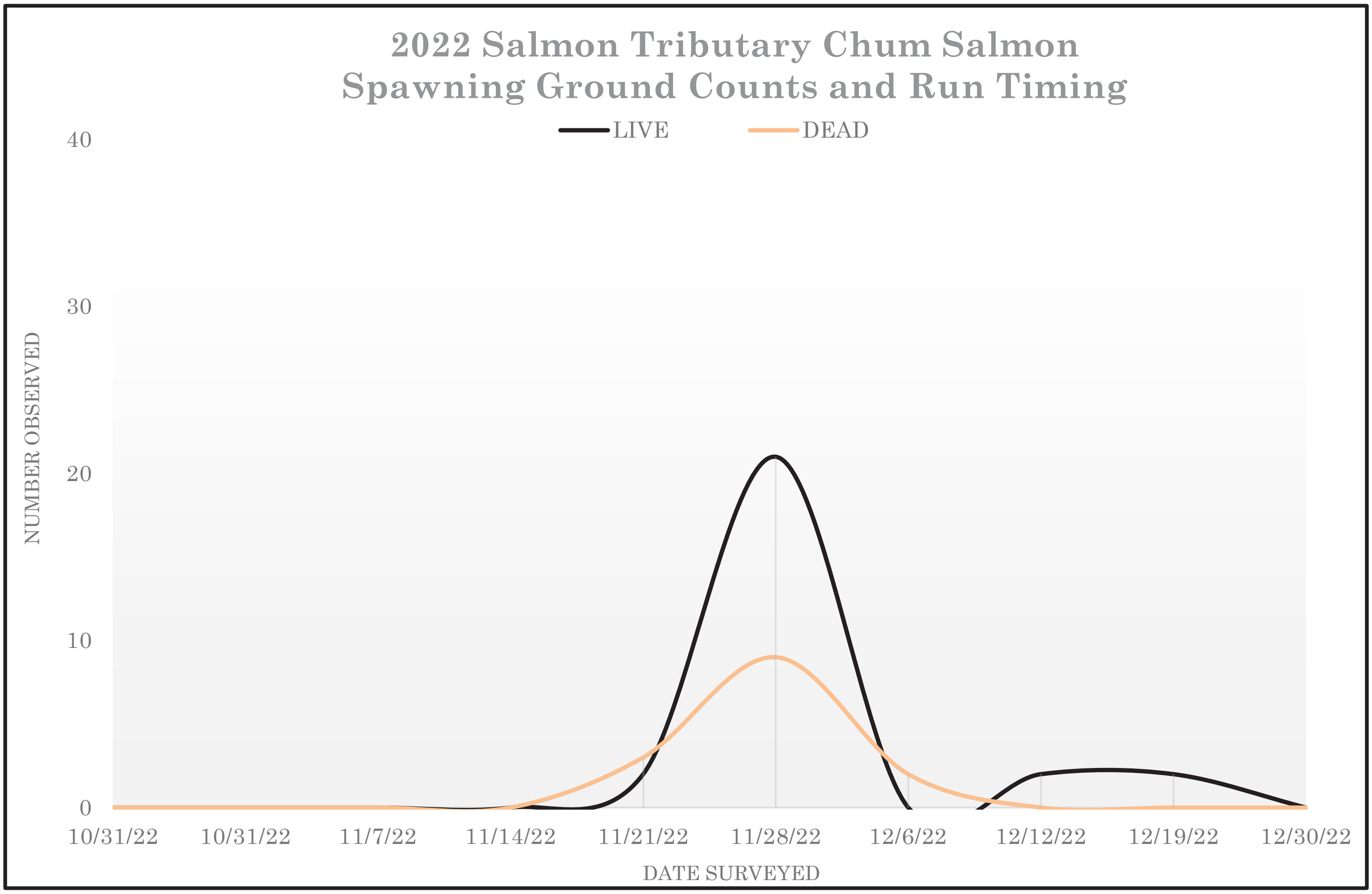


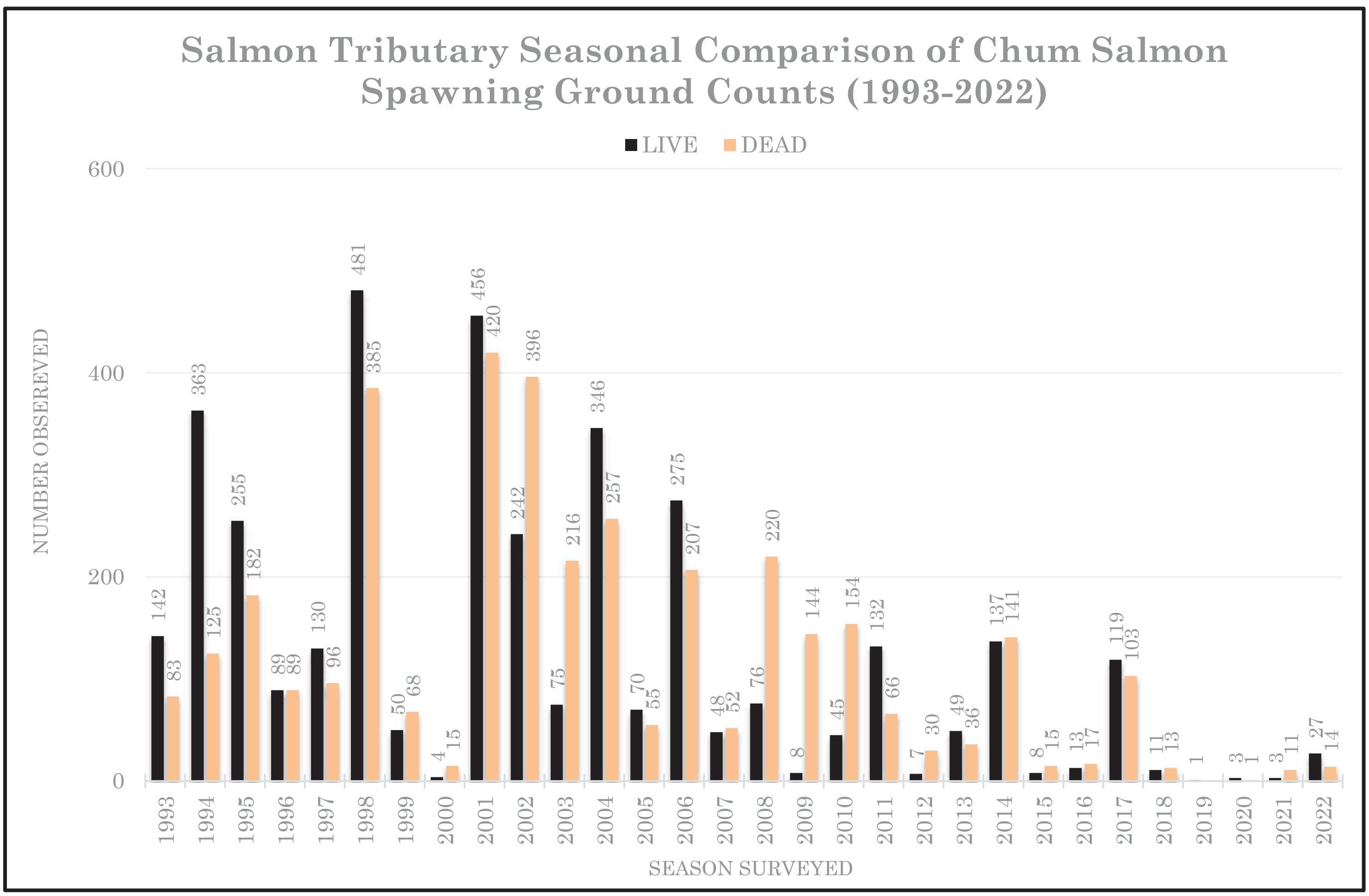
Adult Chinook escapement is determined by expanding the number of redds observed by 2.5 fish per redd (Smith and Castle, 1994). Due to the tremendous volume of pink salmon during odd years, the success of determining Chinook redds from pinks is vastly reduced. Therefore, The AUC method is used to determine escapement during pink runs (odd years).


Salmon Tributary Seasonal Comparison of Pink Salmon Spawning Ground Counts (2009-2021)
LIVE
DEAD
NUMBER OBSEREVED
0
500
1,000
1,500
2,000
1,893
496
389
151
337
190
588
358
11
7
34
141
90
2009
2011
2013
2015
2017
2019
2021
SEASON SURVEYED


2022 Salmon Tributary Coho Salmon
Spawning Ground Counts and Run Timing
LIVE
DEAD
NUMBER OBSERVED
10
8
6
4
2
0
10/25/22
10/31/22
11/7/22
11/14/22
11/21/22
11/28/22
12/6/22
DATE SURVEYED


Salmon Tributary Seasonal Comparison of Coho Salmon
Spawning Ground Counts (2008-2022)
LIVE
DEAD
NUMBER OBSEREVED
10
8
6
4
2
0
1
7
1
7
2
9
2
3
2
2008
2009
2010
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
SEASON SURVEYED


2022 Salmon Tributary Chum Salmon
Spawning Ground Counts and Run Timing
LIVE
DEAD
NUMBER OBSERVED
40
30
20
10
0
10/31/22
10/31/22
11/7/22
11/14/22
11/21/22
11/28/22
12/6/22
12/12/22
12/19/22
12/30/22
DATE SURVEYED


Salmon Tributary Seasonal Comparison of Chum Salmon
Spawning Ground Counts (1993-2022)
LIVE
DEAD
NUMBER OBSEREVED
600
400
200
0
1993 142 83
1994 363 125
1995 255 182
1996 89 89
1997 130 96
1998 481 385
1999 50 68
2000 4 15
2001 456 420
2002 242 396
2003 75 216
2004 346 257
2005 70 55
2006 275 207
2007 48 52
2008 76 220
2009 8 144
2010 45 154
2011 132 66
2012 7 30
2013 49 36
2014 137 141
2015 8 15
2016 13 17
2017 119 103
2018 11 13
2019 1
2020 3 1
2021 3 11
2022 27 14
SEASON SURVEYED

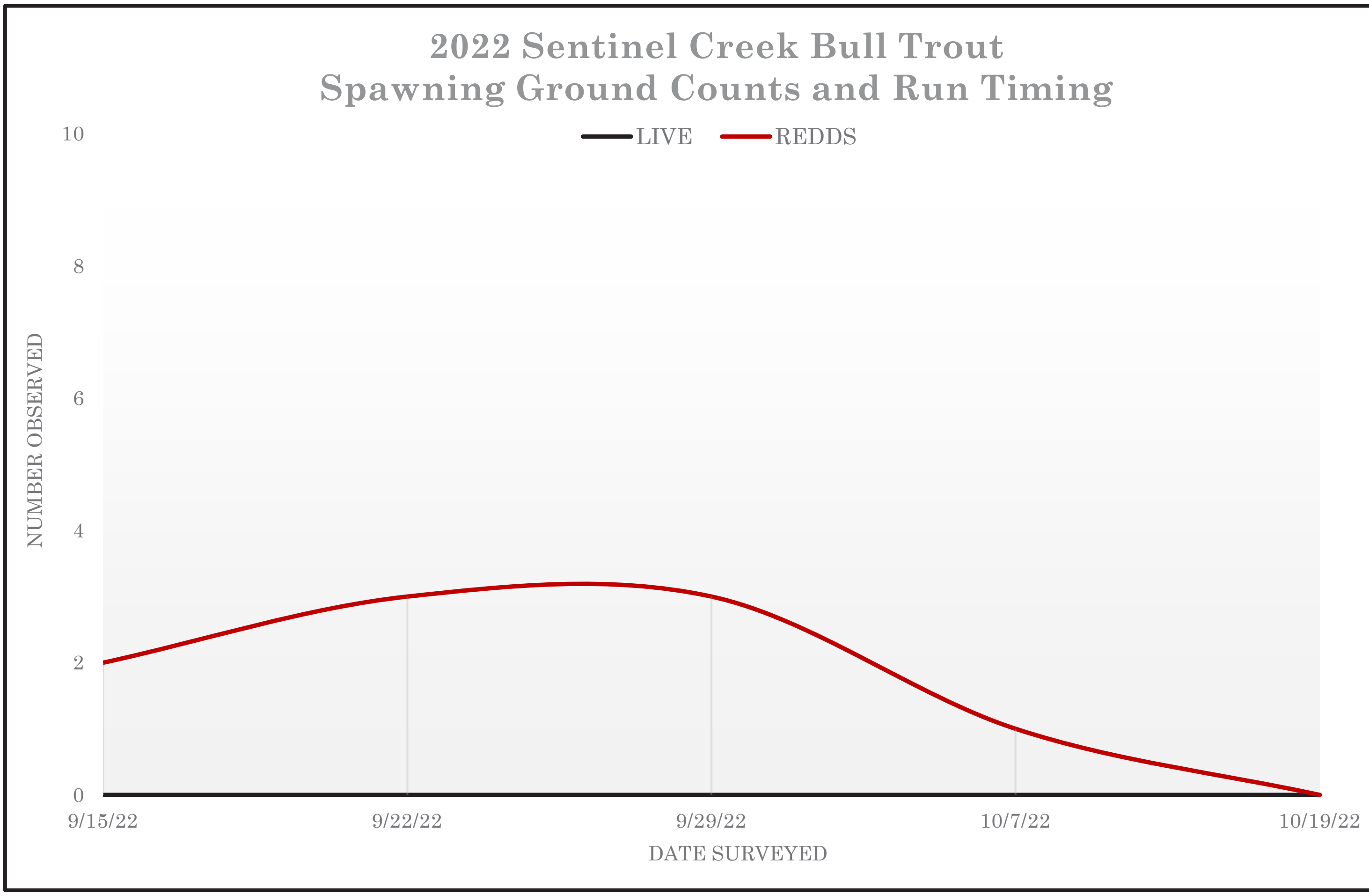
SENTINEL CREEK

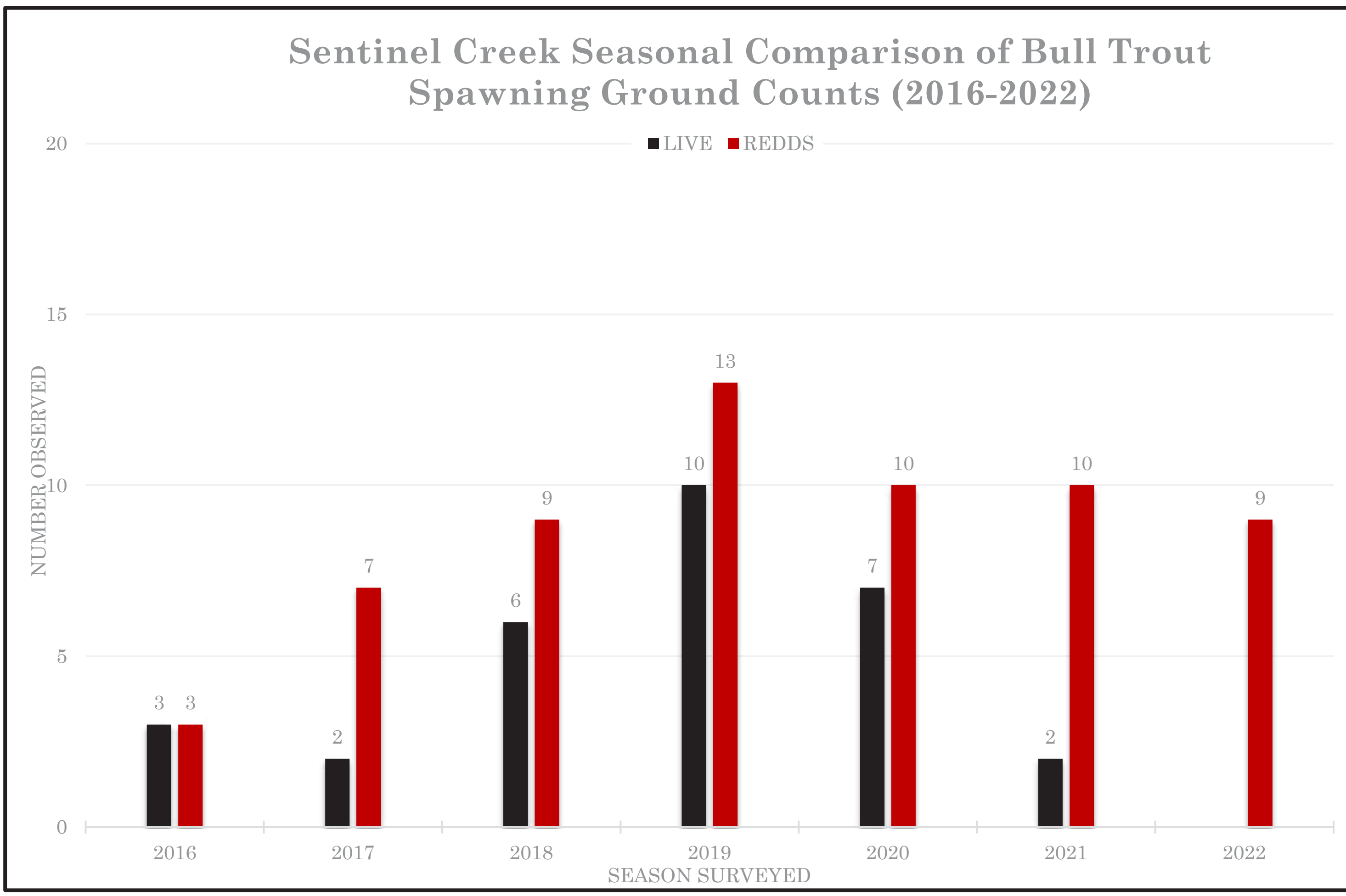
Bull trout

Sentinel Creek is not the officially designated name for this stream; however, as a means of convenient identification, it's referred to as "Sentinel Creek" by PTF staff. The Creek doesn't appear on the hydrology of most mapping systems and has no WRIA or NPS designations. Sentinel Creek, located within Mt. Rainer National Park, is a small left bank headwater tributary joining with the Mowich River at approximately RM 7.5; which is just downstream of the North Fork and South Mowich confluence. This high mountain drainage *(elevation 2530′ at mouth)* is a north facing stream *(total stream length unknown)* providing 500′+ of anadromous habitat which is profoundly contingent on the frequency and intensity of mainstem river incursions. Fortunately, this anadromous channel reach provides excellent habitat for bull trout rearing and spawning when stream flows are sufficient. Spawning gravel availability is moderate, as are logjams and in-channel LWD. A few small pools and side channels provide excellent habitat for juvenile and adult fish utilizing the creek.

Sentinel provides essential conditions for bull trout rearing and spawning by offering summer thermal refuge and protective overwintering habitat. PTF began surveying this creek for bull trout spawning activity/escapement in 2016, and the creek has demonstrated itself to be the most consistent; as well as the highest density spawning tributary in the Upper Puyallup/Mowich basin. Spawning surveys are conducted from early-September through mid-October. Although bull trout spawning has been consistent in this tributary, it does not parallel the spawning frequency/density or elevation experienced in many streams located in the White River basin. Also, at just over 2500′ of elevation, Sentinel is the second highest elevation stream *(St. Andrew's Creek @ 2650′)* in the Puyallup/Mowich basin to have documented bull trout spawning.

Similar to many headwater tributaries within the national park, the lower 500′+ of the creek is comprised of a narrow, low gradient channel flowing within the open channel migration zone of the Mowich River floodplain. Although spawning may occur throughout this small reach, opportunities can become acutely limited due the lack of quality spawning substrate created by the fine alluvial deposits from the Mowich River, and like many wall-based tributaries the lower creek channel is repeatedly manipulated and affected by mainstem river flows. However; even in the face of mainstem incursions, bull trout are frequently observed spawning in pockets of moderate-to-heavily influenced glacial mix water.


2022 Sentinel Creek Bull Trout
Spawning Ground Counts and Run Timing
LIVE
REDDS
NUMBER OBSERVED
0
2
4
6
8
10
9/15/22
9/22/22
9/29/22
10/7/22
10/19/22
DATE SURVEYED


Sentinel Creek Seasonal Comparison of Bull Trout
Spawning Ground Counts (2016-2022)
LIVE
REDDS
NUMBER OBSERVED
0
5
10
15
20
3
3
2
7
6
9
10
13
7
10
2
10
9
2016
2017
2018
2019
2020
2021
2022
SEASON SURVEYED

SHAW CREEK

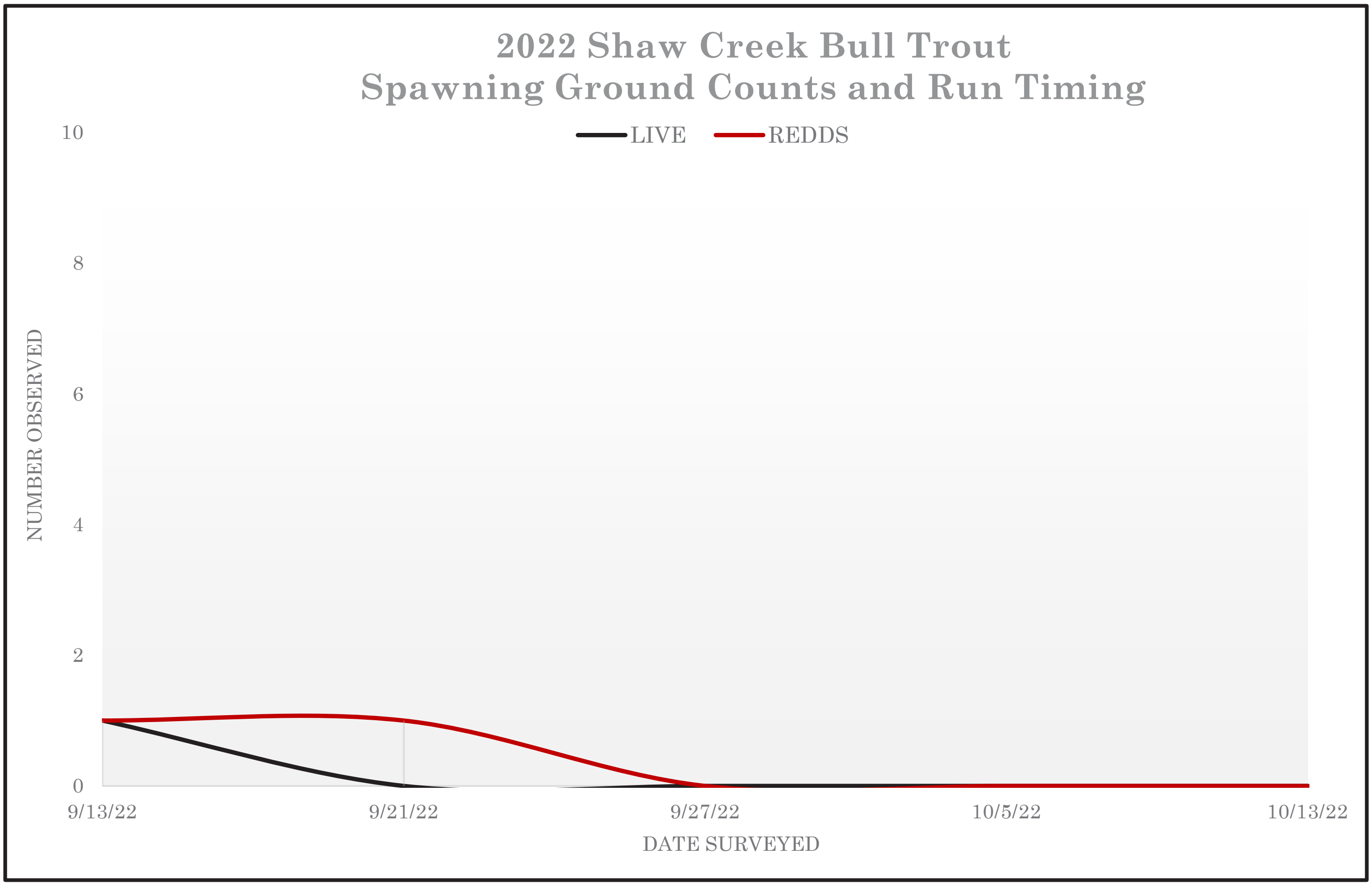
WRIA 10.0365

Shaw Creek is a small right bank headwater tributary of the White River. This high mountain drainage is a north facing stream flowing through the Shaw Creek Valley, between Tamanos Mountain to the west, and Governors Ridge to the east. Located entirely within Mt. Rainier National Park, the creek is non-glacial in origin; rather, its source comes from the Owyhigh Lakes located at nearly 5,200′. Shaw Creek flows for approximately 3.5 miles from Owyhigh Lakes plateau before entering the White River at approximately RM 68.8, just upstream of Klickitat Creek.

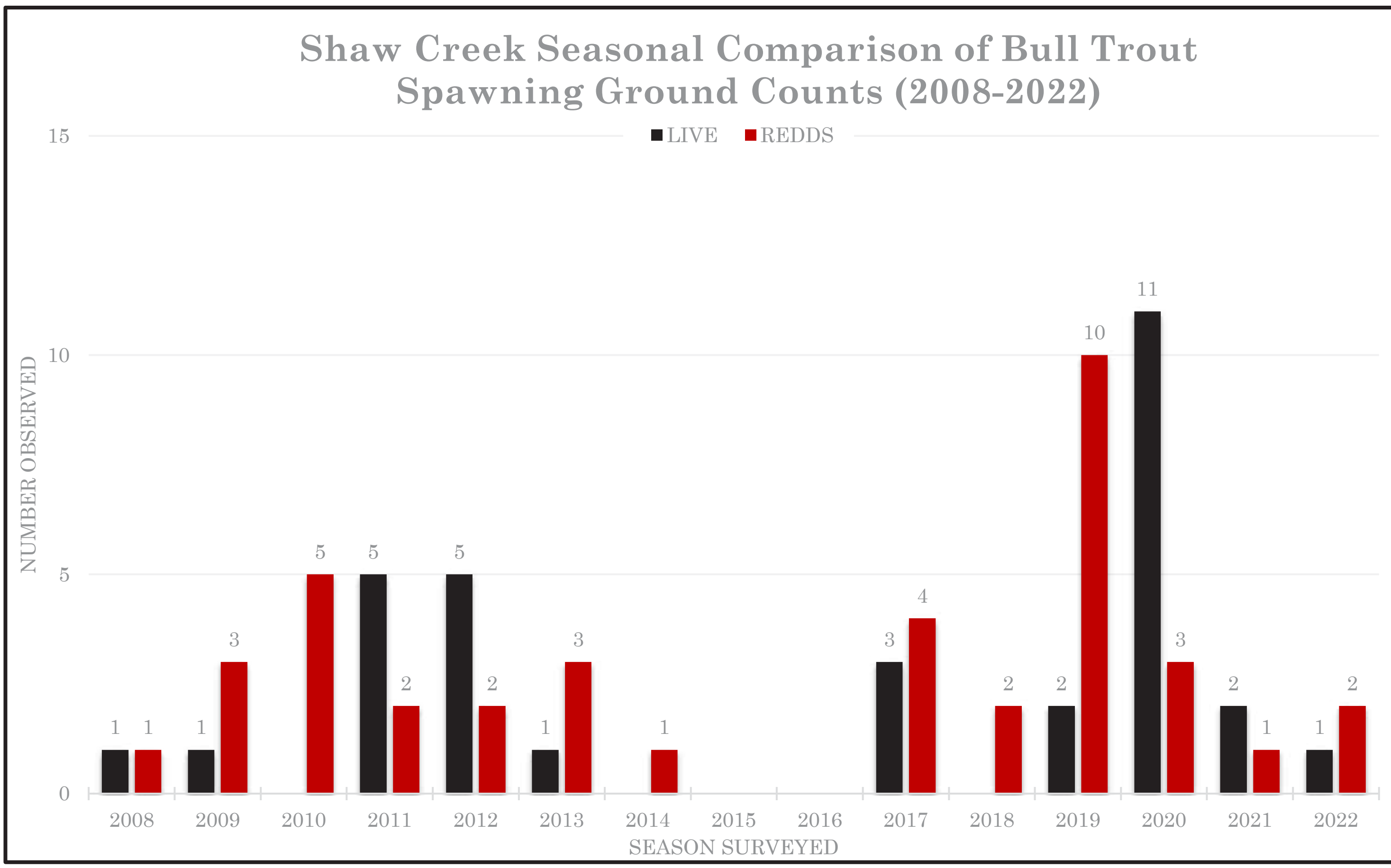
Shaw provides vital habitat conditions for bull trout rearing and spawning. PTF and the Park Service surveys the creek for bull trout from early September-to-mid October with spawning frequently occurring from early September-to-mid October, with peak spawning typically occurring around the third-to-fourth week of September *(see Appendix B for survey data)*. Although bull trout spawning is quite consistent in this tributary, it does not parallel the spawning frequency/density experienced in index streams such as Klickitat or No Name creeks. Analogous to many headwater tributaries within the park, the lower 300-400 feet of the creek is comprised of a narrow, low gradient channel flowing within the open channel migration zone of the White River floodplain. Although spawning does occur within this small stretch, it is acutely limited due the lack of quality spawning substrate created by the fine alluvial deposits from the White River, and the creek channel is repeatedly manipulated and affected by mainstem river incursions.

Beyond the open floodplain, Shaw Creek enters the heavily forested lower slope of the valley floor as it parallels the White River. From this point, the creek channel assumes a pool-riffle configuration for approximately the next 0.65 miles. Unfortunately, only about 0.5 miles of this reach provides quality spawning and rearing opportunities. Frequently, during periods of lower flows, the creek water becomes hyporheic approximately 0.5 miles after entering the forested area, resulting in a provisional yet significant barrier. Furthermore, if flows are low enough, additional barriers are created throughout the wetted channel by small jumps in channel height due to bedload built-up behind LWD embedded in the channel. Fortunately, this wetted channel section provides excellent habitat for rearing; as well as spawning when flows are sufficient. Spawning gravel is abundant, as are significant logjams and in-channel LWD. Numerous deep pools and side channels provide excellent habitat for juvenile and adult fish utilizing the creek.

The seasonally dry channel reach continues beyond the Sunrise Park Road Bridge, located at approximately RM 0.62. Beyond the bridge crossing, the gradient begins to increase significantly as the stream channel begins to climb up the valley wall toward the high lakes. At this point, a series of impassable cascades marks the permanent upper extent of anadromy. The stream continues to course its way through the steep Shaw Creek Valley until reaching the Owyhigh Lakes plateau. Several small unnamed tributaries contribute additional flow to Shaw along this upper reach; unfortunately, they do not add any beneficial spawning or rearing habitat given they are located well above the anadromous barriers.



2021 data collected by the Puyallup Tribe and National Park Service (MORA). Raw spawning data for Shaw Creek can be found in Appendix B. See Appendix C for bull trout redd locations.



SILVER CREEK

WRIA 10.0313

Silver Creek is a right bank headwaters tributary of the White River located at RM 60.5, just outside of the northern boundary of Mt. Rainier National Park. Silver Creek originates along the Crystal Mountain Ridge within the Wenatchee National Forest, and flows for over 7 miles through steep mountainous terrain, dropping nearly 3,000 feet from its source until reaching its confluence with the White River immediately West of Highway 410. Silver Creek has one major tributary; 4.4 mile Goat Creek *(10.0314)*, which enters on the right bank of Silver Creek 0.2 miles up from its mouth. Upstream of Goat Creek there are numerous smaller named and unnamed tributaries contributing flow to Silver Creek as well. Spawning frequently occurring from early September-to-mid October, with peak spawning typically occurring around the third-to-fourth week of September.

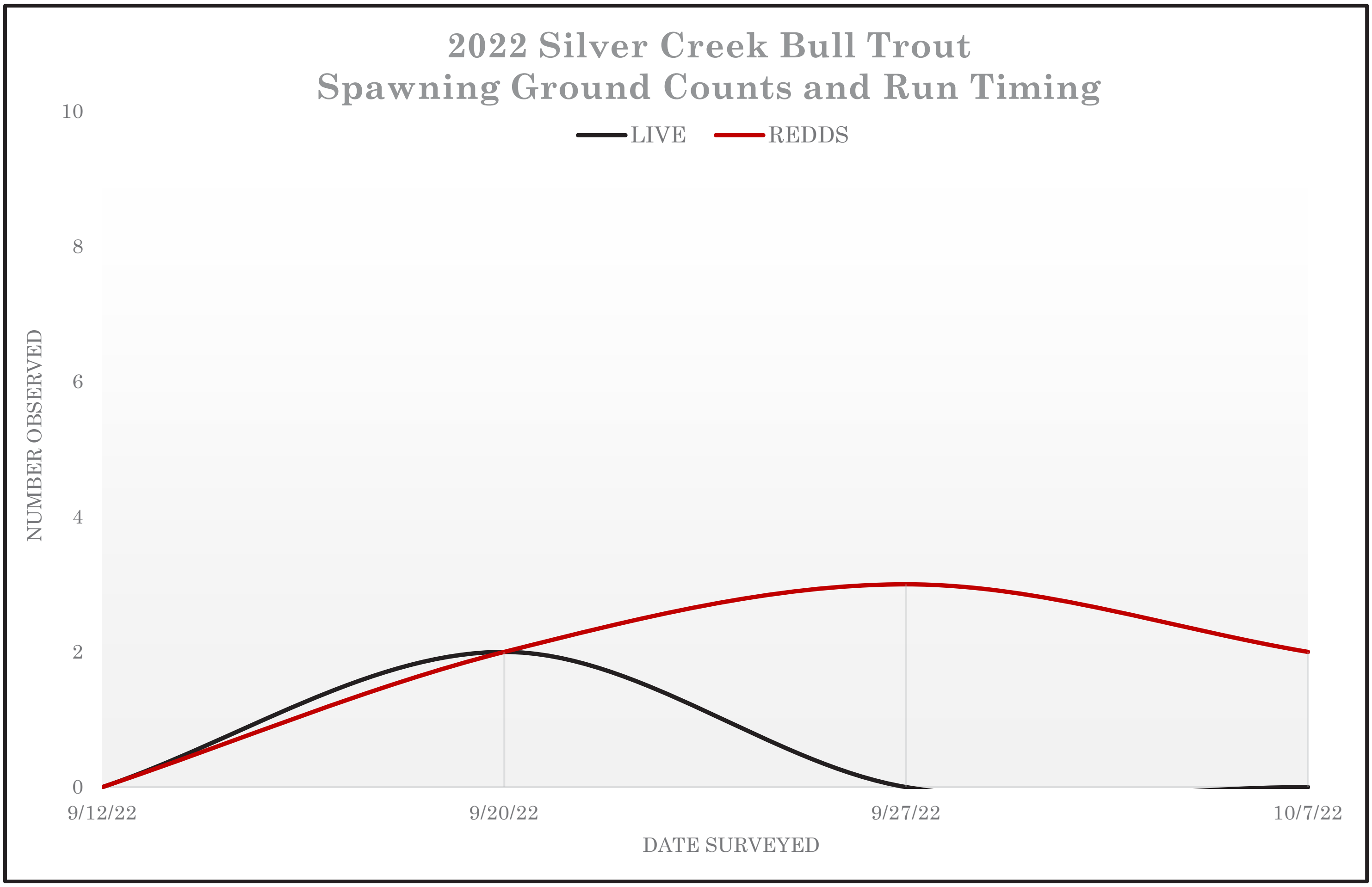
The surrounding riparian zone consists of some old growth conifers, and a mixture of younger coniferous and deciduous trees. The in-stream habitat throughout the lower 0.5 miles of Silver Creek consists of mostly moderate to high gradient cascades with shallow and moderately deep scour pools. The scour pools and some low energy pocket areas provide what little spawning habitat is available along the lower creek. Incredibly, the few spawning habitat areas available are utilized each season by bull trout. In 2007, the South Puget Sound Salmon Enhancement Group *(SPSSEG)*, with funding from the USFWS and the USFS, completed the removal of an old diversion dam suspected of causing a barrier to migrating salmon and bull trout. The removal of this aged structure has enhanced access to available spawning habitat upstream.

Bull trout, which are often observed spawning in Silver Springs, were not surveyed for in Silver Creek prior to 2006. However, in 2006 and 2007, a bull trout migration and spawning ground telemetry study was conducted by PTF on the White River. In support of the project, several bull trout captured in the USACE Buckley trap were implanted with radio transmitters. The fish were tracked over the next 6 months from their release site to several spawning sites located in the upper White River including Silver Creek. A bull trout tagged during the 2006 study was observed holding in Silver Creek prior to spawning at a site approximately 200 feet upstream from the mouth. Bull trout spawning utilization has been consistent since surveys were initiated in 2006. Additional telemetry studies have been conducted by USFWS since 2007 *(2014-2017)*.

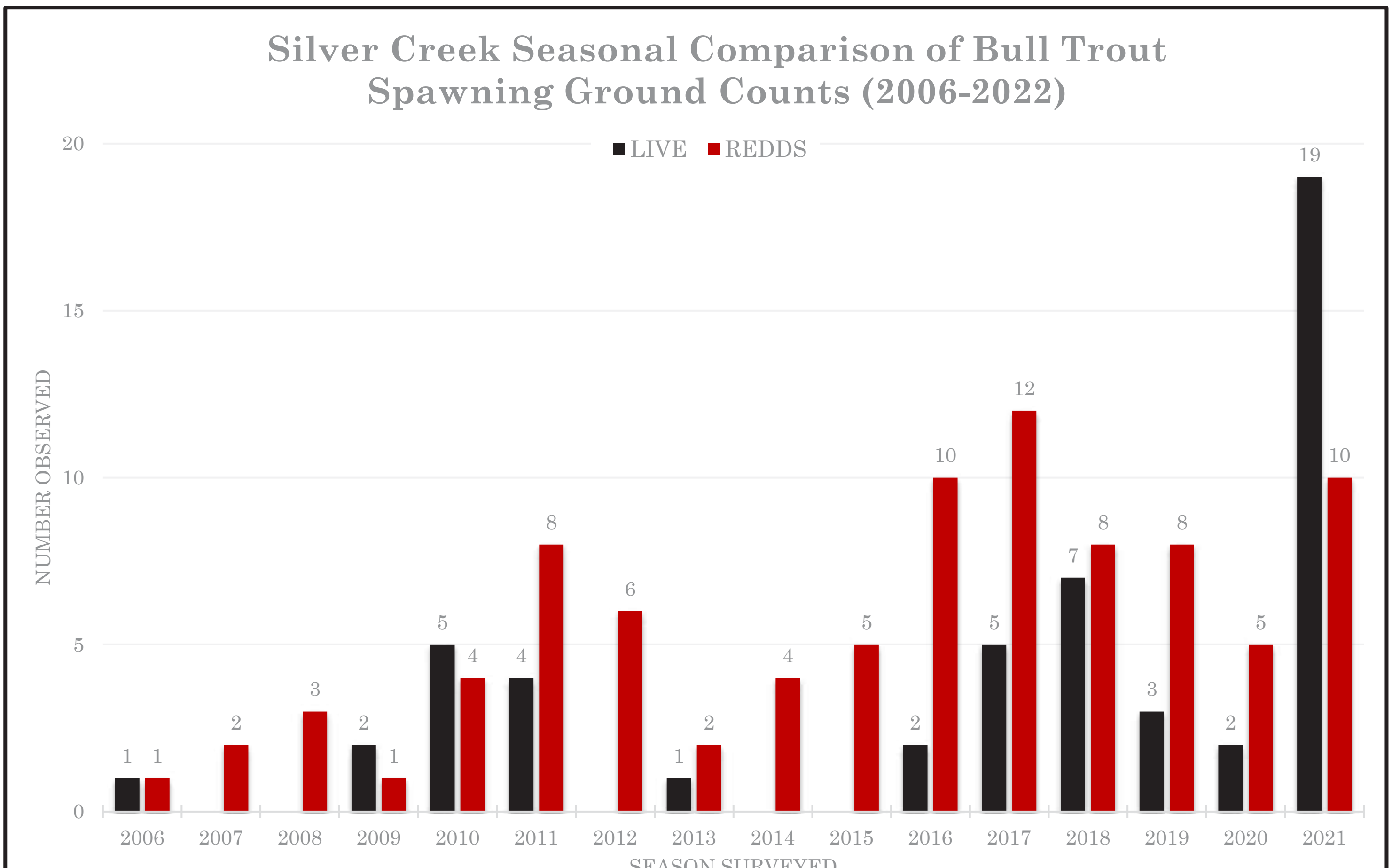
Although entirely feasible, steelhead utilization is currently unknown since no surveys have been conducted to determine usage. However, coho, Chinook and pinks are frequently observed in nearby Silver Springs; yet, with the exception of coho and pink salmon, PTF biologist have not observed any other salmon species spawning in Silver Creek.

In November of 2006, over 18,000 gallons of diesel fuel from a facility owned and operated by Puget Sound Energy was inadvertently released from back-up generator storage tanks. Approximately 7,900 gallons of the diesel released infiltrated Silver Creek. PSE; as well as state and federal regulatory agencies responded to the spill by conducting an emergency clean-up of contaminated soil and preventing additional fuel from entering Silver Creek.

Also of interest, Silver Creek is the final resting place of Henry C. Allen *(1848-1898)*; a civil war veteran and Purple Heart recipient who fought with the 16th Wisconsin Infantry.



Spawning data for Shaw Creek can be found in Appendix B. See Appendix C for bull trout redd locations.



SILVER SPRINGS CREEK

WRIA 10.0332A

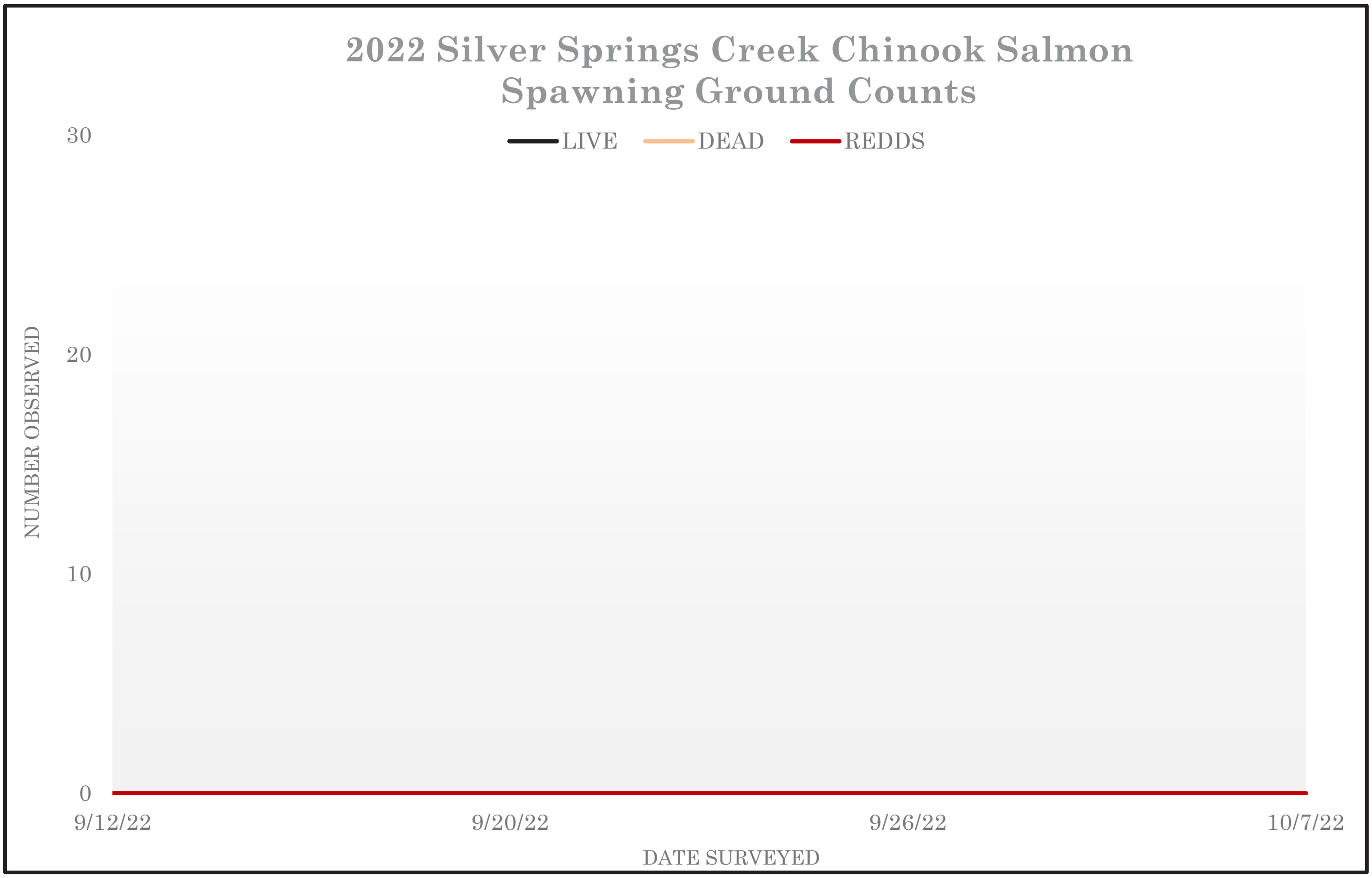
Silver Springs is a short, spring-fed headwater tributary to the White River *(RM 60.5)*. With its clear and consistent flow, this cool spring offers excellent spawning and rearing habitat for several species of salmonids. Erupting from a small bench along the forest floor within the Silver Springs Campground, this spring creek runs adjacent to Hwy. 410, approximately 0.5 mile north of the Mt. Rainier National Park boundary. Silver Springs flows for approximately 0.3 miles within a low gradient pool riffle channel. At a point along the lower creek, the channel passes through an undersized, yet fish passable culvert.

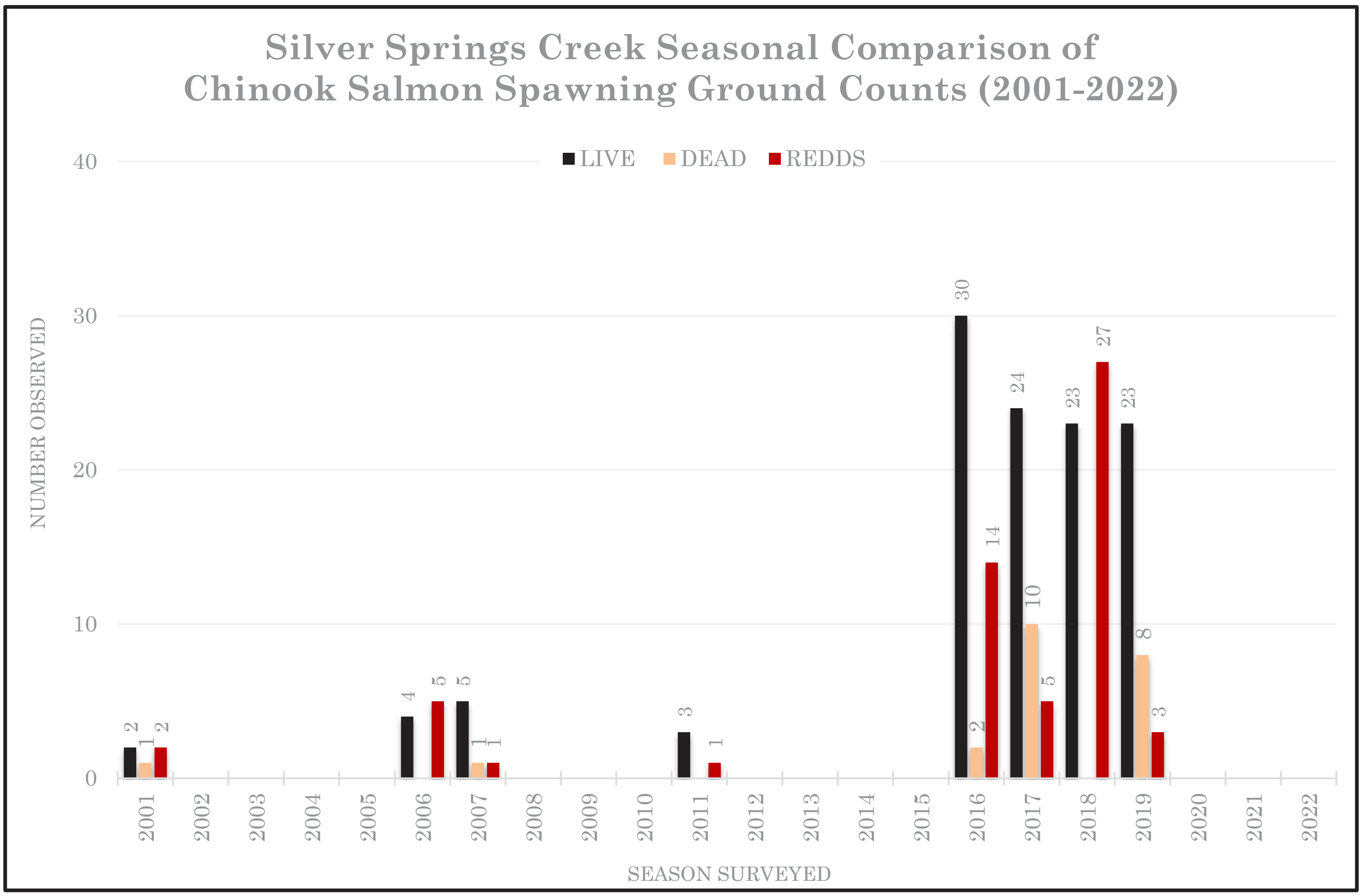
The creek contains a moderate amount of interactive in-stream LWD, in addition to one significant long-term woody debris jam located in the lower channel. The overstory riparian consists largely of mature conifers, in addition to several hardwoods located near the confluence with the White River and Silver Creek. Typical of this type of stream, the substrate is made up primarily of sand and small gravel. However, several pockets of excellent spawning size medium is present throughout the reach, although it is frequently obscured by fine sand. Aggradation of the White River channel along segments of Silver Springs, and upstream into the National Park, has increased to an elevation greater than the creek and nearby highway 410. As a result, Silver Springs has on several occasion been inundated by silt and woody debris from the White River during high-water and flood events. In addition, portions of the creek may be glacially influence or inundated by mainstem river incursions during regular flow regimes.

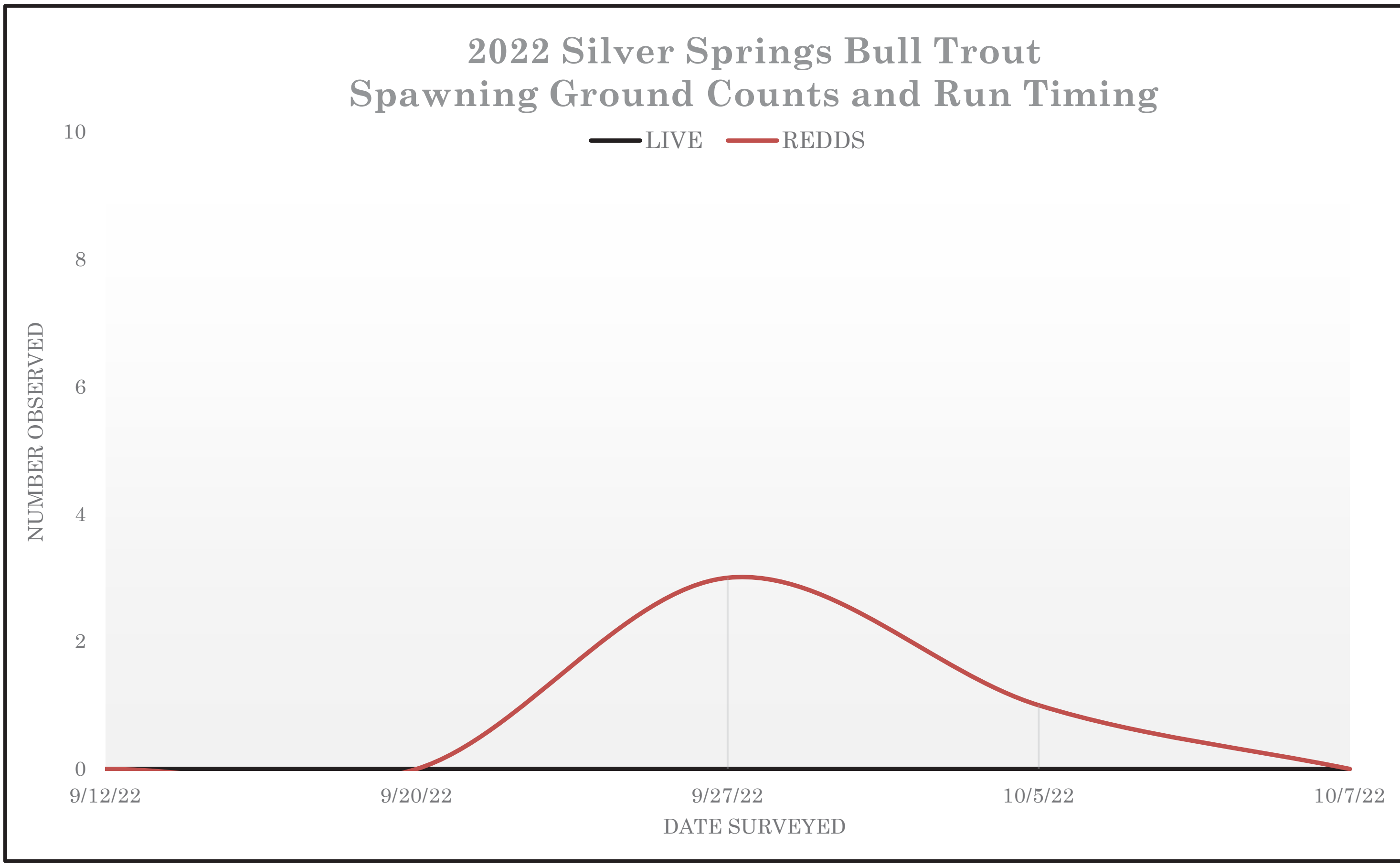
Silver Springs is utilized by several species for rearing and spawning. Species present include Spring and Fall Chinook, coho, pink, and sockeye salmon; as well as bull trout. Although steelhead are present in the upper watershed, their utilization is unknown. Pink salmon have been documented spawning in the creek during odd years since 2003.

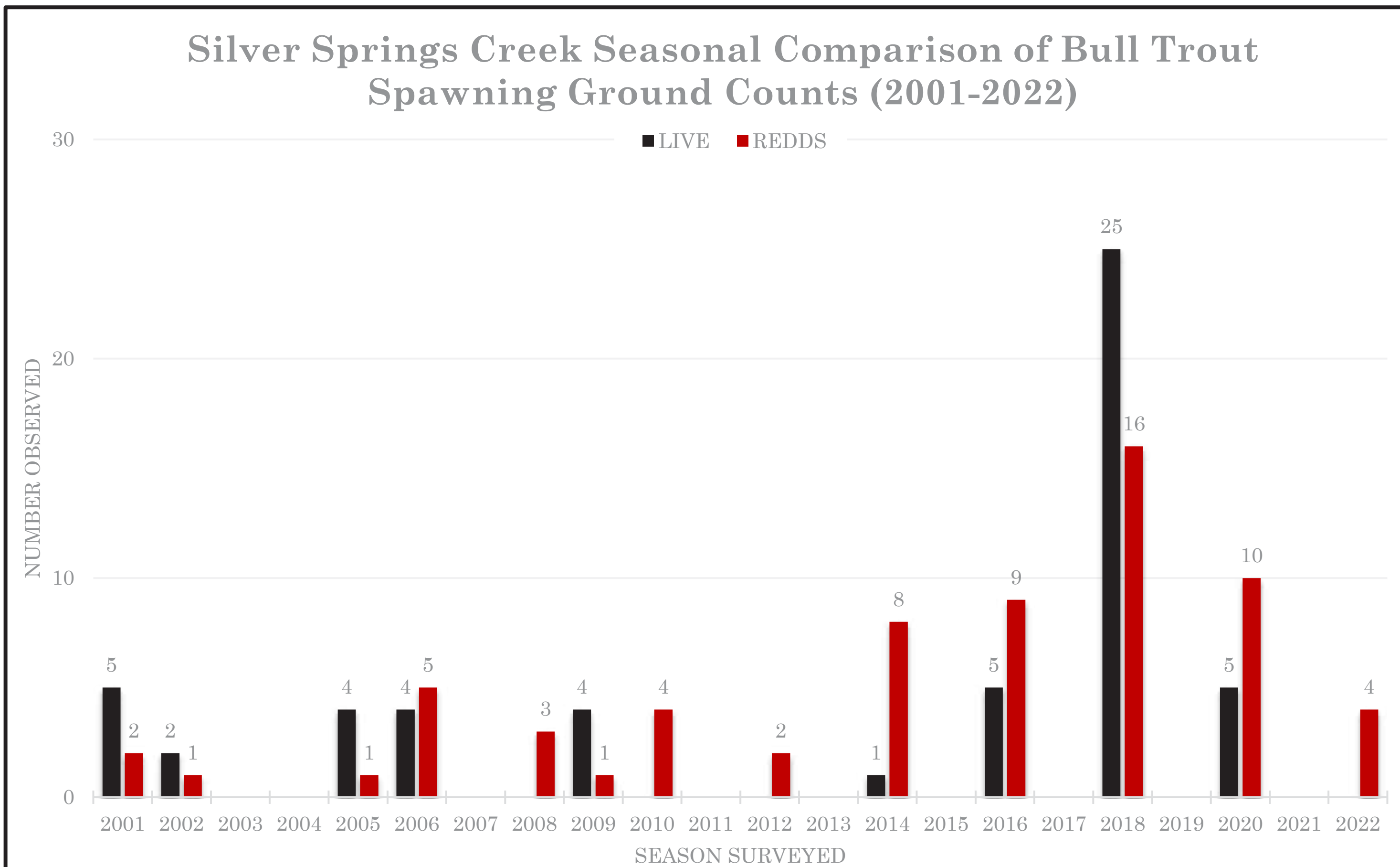
All adult salmon species spawning in Silver Springs Creek were previously captured at the USACE fish trap in Buckley, and transported above Mud Mountain dam. Since precise escapement numbers are known, spawning surveys are conducted to determine fish distribution and spawning success.

Bull trout spawning in Silver Springs generally commences in early September. However, bull trout spawning in Silver Springs is somewhat inconsistent. It's conceivable the creeks proximity to campsites and all the activities involving the presence of campers may disrupt bull trout spawning. Determining bull trout escapement in Silver Springs Creek on odd years is difficult due the presence of pink salmon spawning in the creek as well. Bull trout spawning is based on the observations of redds; when other species utilize the same habitat, redds are indistinguishable between these species unless bull trout are observed on redds.


2022 Silver Springs Creek Chinook Salmon Spawning Ground Counts
LIVE
DEAD
REDDS
NUMBER OBSERVED
30
20
10
0
9/12/22
9/20/22
9/26/22
10/7/22
DATE SURVEYED


Silver Springs Creek Seasonal Comparison of Chinook Salmon Spawning Ground Counts (2001-2022)
LIVE
DEAD
REDDS
NUMBER OBSERVED
40
30
20
10
0
2
1
2
4
5
5
1
1
3
1
30
2
14
24
10
5
23
27
23
8
3
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
SEASON SURVEYED





*Determining bull trout escapement in Silver Springs Creek on odd years is extremely difficult due the presence of pink salmon spawning in the creek as well. Bull trout spawning is based on the observations of redds; when other species utilize the same habitat, redds are indistinguishable between these species unless bull trout are observed on a redd. Raw spawning data for Silver Springs Creek can be found in Appendix B.

SOUTH PRAIRIE CREEK

WRIA 10.0429

South Prairie Creek is a major tributary of the Carbon River, entering the Carbon near RM 6, just downstream of the Highway 162 and Foothills Trail bridge crossings. With a drainage area over 90 mi^2, South Prairie Creek is considered one of the most fish productive drainages in the Puyallup/White River Watershed. The headwaters originate along the northwest foothills of Mt. Rainier within the Mt. Baker-Snoqualmie National Forest. The mainstem creek flows for over 21.5 miles; coursing its way through or near the communities of Wilkeson, Burnett and South Prairie. The creek offers critical spawning and rearing habitat for adult and juvenile salmonids including; Chinook, pink, coho, chum and steelhead. Bull trout have been observed and captured in the creek; however, distribution, population size and overall utilization is unknown. Limiting factors associated with South Prairie include: low summer flows, channel confinement and narrowing, bank erosion, disconnected floodplain, water quality *(303 (d) listed for temperature)*, areas of deficient riparian cover, and invasive plant species.

The anadromous range extends through the first 15 miles of the mainstem; a series of impassable falls near RM 15.4 prevents any further upstream migration. Tributaries including Wilkeson, Spiketon and Beaver; plus, several unnamed tributaries add miles of additional spawning and rearing habitat, as well as flow contributions.

From the mouth, upstream to RM 12.6, the stream is typically a low to moderate gradient pool-riffle channel with many deep pools and a few short low gradient cascades. The lower 8 miles flows within a broad valley floor and spawning opportunities for all species is abundant. Land use along this section is mainly agricultural and recreational. Chinook spawning occurs primarily within the lower 8 miles, while coho show increased usage throughout the middle and upper reaches of the 15 mile anadromous section of the creek. South Prairie experiences a unique late-run of coho *(into February and early March)*. Chum regularly utilize the lower 3 miles, but are frequently observed well above RM 10. Steelhead utilize areas along the entire stream below the barrier falls; however, usage is reduced in the canyon reach below the falls. The valley walls narrow significantly above RM 8; at this point the creek channel becomes more confined and the gradient increases. Spawning and rearing opportunities are still prevalent here, as is the increase in LWD and LWD inputs from the surrounding forest.

From RM 12.6 to the falls at RM 15.4, the channel gradient increases substantially and the creek channel becomes moderately to extremely confined within a steep canyon. Spawning and rearing opportunities are severely reduced or non-existent. Spawning gravel is scarce in this upper reach and many heavily scoured bedrock segments exist.

The riparian zone changes dramatically throughout the 15.4 miles of anadromous access. The upper canyon reach flows through a commercial forest and streamside vegetation consists of second growth fir and alder. Buffer widths along recent harvest areas are generally wider than the state regulated minimum due to steep, potentially unstable slopes along the canyon. From RM 12.6 down to RM 6.0, the riparian zone is relatively intact, consisting of mature hardwoods and fir. Below this point, to the confluence, significant portions of the banks are armored and streamside residential development is common. Much of the lower 6 miles flows through active agricultural land where alder and cottonwood are the most common streamside tree species.

South Prairie Creek Preserve Floodplain Restoration Project

Written by: Kristin Williamson

The South Prairie Creek Preserve Floodplain Restoration project aims to restore habitat for fish and wildlife in the South Prairie Creek valley. Project actions will restore critical habitat functionality, thermal diversity, hydrologic stability, and geomorphic structure to support adult to juvenile outmigrant survival and productivity for spawning, rearing, foraging, migrating, and overwintering life history stages in South Prairie Creek for fall Chinook, Steelhead, Coho, Chum, Pink, and Cutthroat and Bull Trout.

South Prairie Creek is one of the most productive tributaries for Puyallup River Fall Chinook and Steelhead and yet the effects of historical land use practices have limited the potential of this subbasin to provide the highest level of spawning and rearing opportunity for salmon and trout populations. The project properties were previously managed for agricultural production since the early 1900s and much of the project area was cleared, burned, plowed, filled, and used for pasture and hay production for nearly a century. The loss of the floodplain forest resulted in a deficit of instream complexity and floodplain connectivity, creating high velocity conditions which limit egg-to-fry survival for peak-flow timed spawners (Chinook, Pink, Coho, and Chum). Existing flow velocities in the mainstem project reach exceed 8 feet per second (fps) during annual, bankfull flows events typically occurring during egg incubation periods for Fall Chinook, Pink, Coho and Chum salmon. Currently summer low flow conditions in South Prairie Creek result in elevated temperatures creating thermal stress on upstream migrating and staging adult fall Chinook and Pink salmon. Summer stream temperatures also create thermal barriers for rearing and foraging Chinook, Coho, Steelhead, Cutthroat, and Bull Trout

Between 2005 and 2011, the Pierce Conservation District acquired the former Inglin Dairy Farm and Pierce County acquired 3 adjacent properties upstream, therein securing 129 acres for large scale restoration efforts. Since 2013, the Pierce Conservation District, Puyallup Tribe, Pierce County, and South Puget Sound Salmon Enhancement Group have been working towards implementation of a reach-scale floodplain reconnection and off-channel restoration project between river mile 4.0 and 4.5 on South Prairie Creek on these properties.

The whole project scope includes the following actions:

- Demolition of 11 former dairy buildings and a creosote bridge over South Prairie Creek.
- Installation of a new bridge over Silver Springs Creek and removal of a culvert and water supply tank from the Silver Springs channel.
- Restoration of 2,600 linear feet of side channel on the north floodplain.
- Installation of 113 engineered log structures, totaling 4,648 new pieces of wood in the project reach.
- Noxious weed treatment and re-vegetation of 36 acres of floodplain and riparian forest.

Installation of wood structures in the mainstem South Prairie Creek will induce hydraulic complexity to slow water velocities, reduce scour potential of spawning bed substrates, and partition flood flows into floodplain side channels to reduce effects of high flows on egg incubation. Installation of engineered log jams will provide near-term instream complexity and floodplain function, while reestablishment of native plant communities will ensure habitat complexity sustained by a healthy floodplain forest will persist into the future.

Project floodplain reconnection efforts will boost water storage and groundwater recharge to increase thermal diversity year-round, and the restored floodplain forest and wetland vegetation will further retain water, sequester carbon, and provide shade and root structure to support groundwater dynamics and mitigate temperature impacts under changing climate conditions. Project efforts will also improve over-winter rearing conditions by providing flood refuge and improve summer rearing conditions through groundwater recharge and therein thermal refuge through metering of cold groundwater discharge and hyporheic exchange during periods of summer low flows

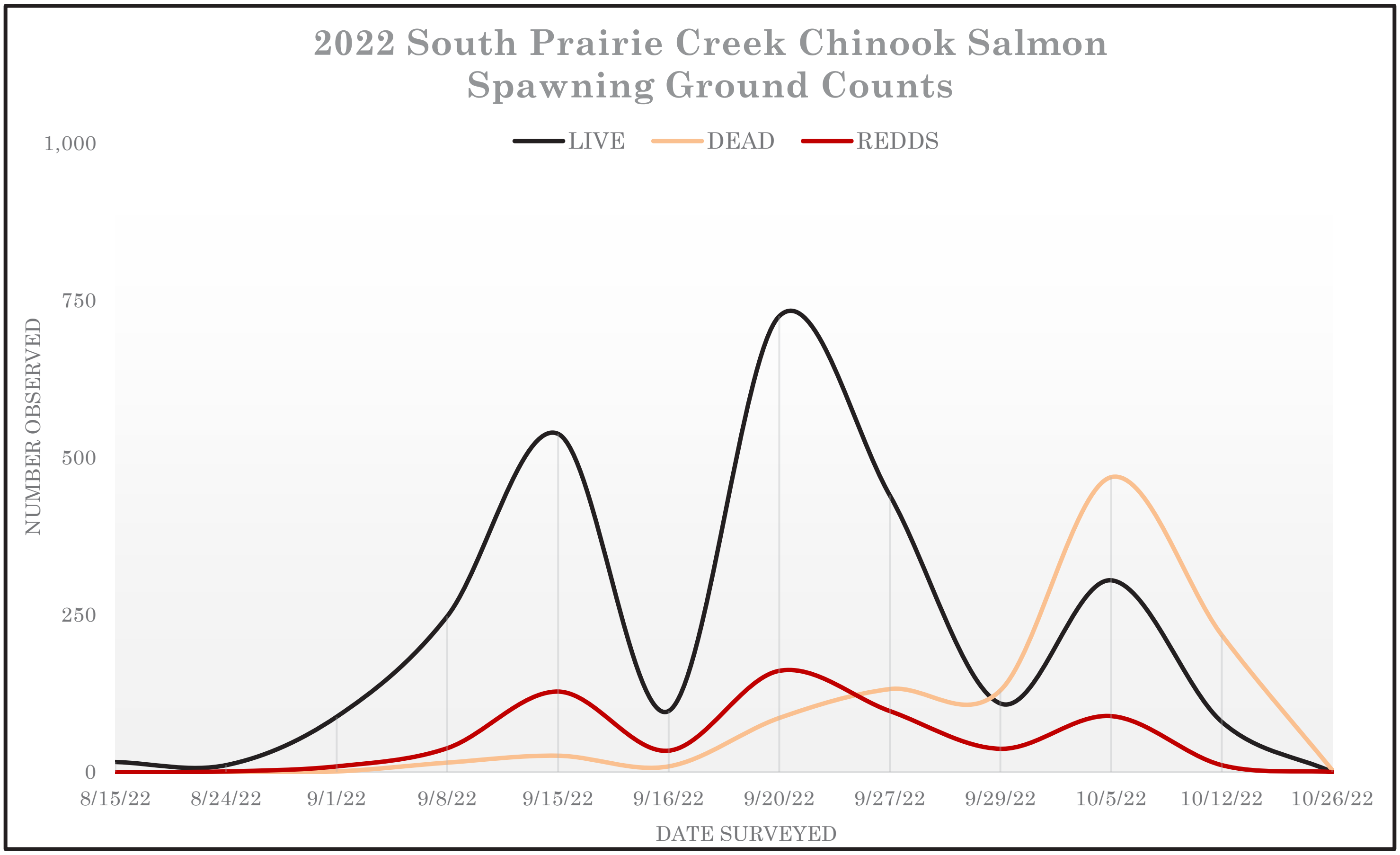
The project will yield an immediate 100% increase in habitat area equating to an additional half mile of off-channel/side channel habitat for rearing and spawning life stages of salmon and trout. Project actions are also expected to improve main channel habitat complexity and reduce mean substrate size in South Prairie Creek to increase spawning potential and capacity for adult life stages. The project will alleviate velocity barriers to upstream migration during high flows to increase spatial distribution of fish within the watershed. Improved rearing conditions may yield greater life-history diversity by sustaining river-type life history strategies for Chinook, Steelhead, Coho, Cutthroat and foraging Bull Trout.

Funding to support design and construction of this project has been a collaborative effort spanning many years. With strong partnerships between the Pierce Conservation District, Pierce County, Puyallup Tribe, and South Puget Sound Salmon Enhancement Group, the project team has been able to raise funding support from the Puyallup and Chambers Watershed Salmon Recovery Lead Entity and the Recreation and Conservation Office along with the many other State, Local, and Federal funding sources, see Table 1. Below/left.

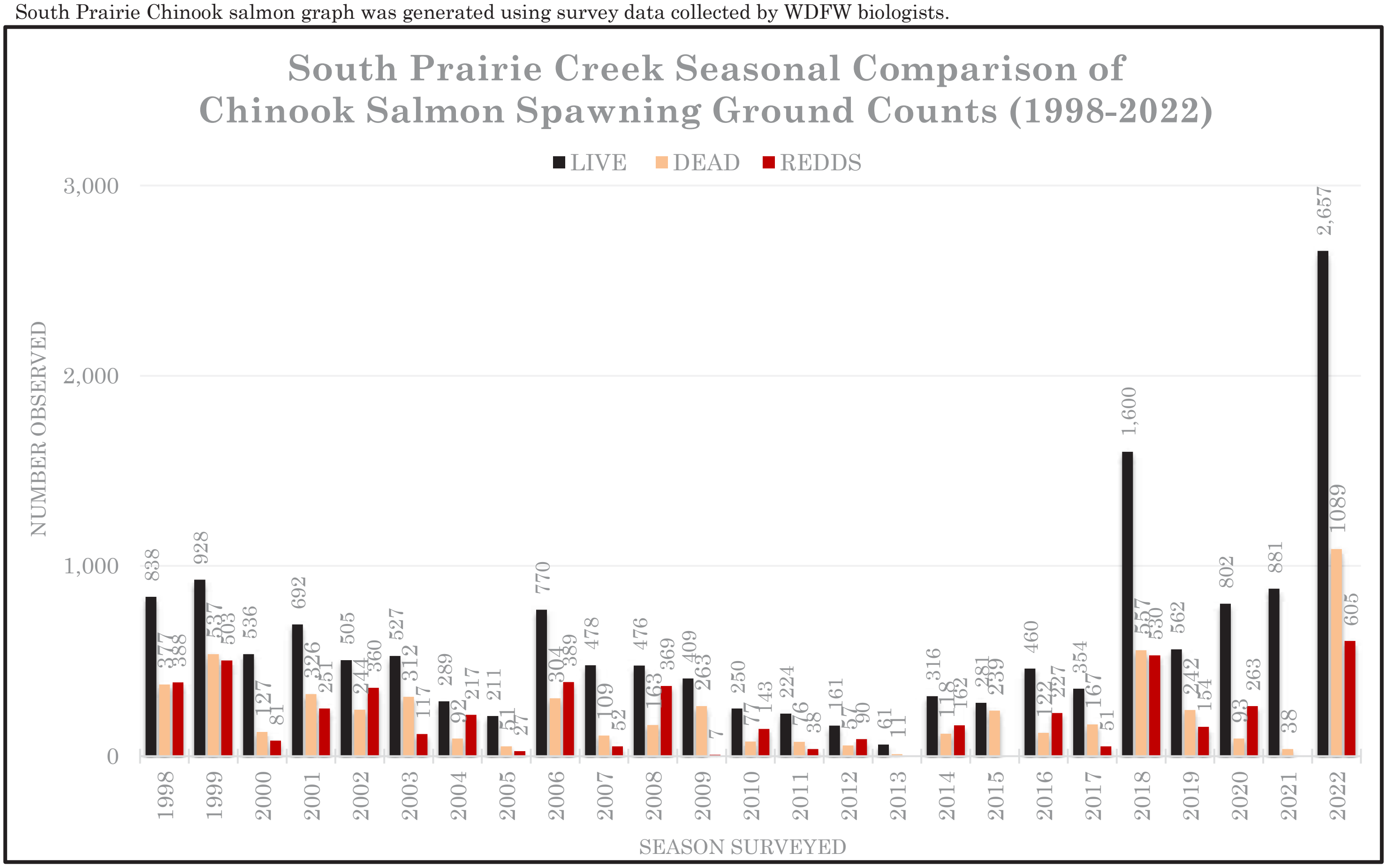
Project construction was completed in fall of 2020 and planting efforts will be ongoing through at least 2022, pending funding to adequately support those efforts.

South Prairie Creek Restoration River Mile 4.0-4.5 Funding Package

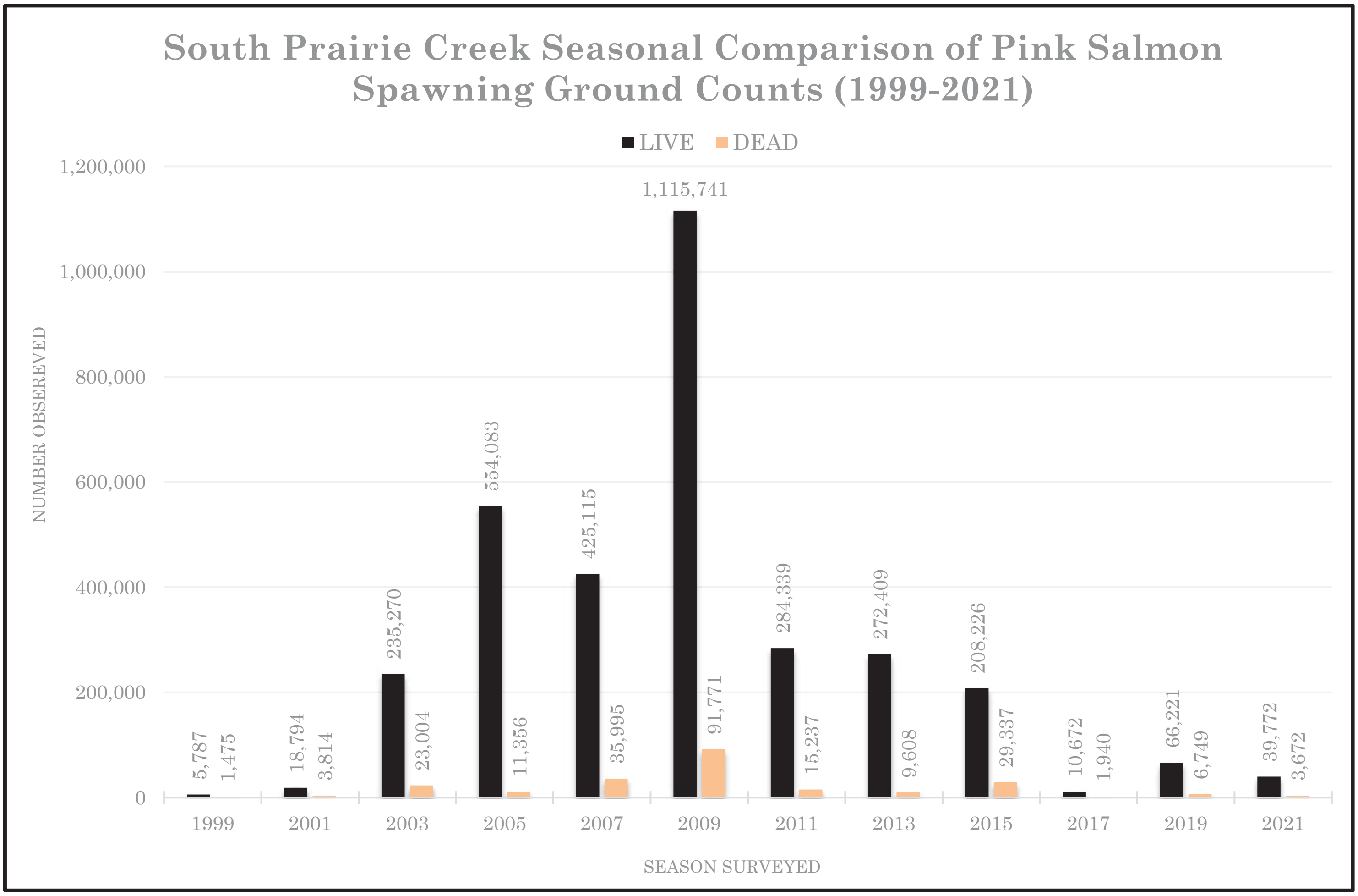
Source	Year	Stage	Amount
WRIA 10/12 Lead Entity Project Development Funds	2013	30% Design	$81,850
Puyallup Tribe Grant Funds, EPA	2013	60% Design	$40,000
Pierce County Surface Water Management	2013	60% Design	$40,000
Salmon Recovery Funding Board and Puget Sound Acquisition and Restoration (RCO 14-1504)	2014	Final Design	$198,000
Salmon Recovery Funding Board and Puget Sound Acquisition and Restoration (RCO 15-1224)	2015	Construction and Planting	$1,363,438
Salmon Recovery Funding Board and Puget Sound Acquisition and Restoration (RCO 16-1577)	2016	Construction and Planting	$1,653,413
Value of Forest Service Donated Wood to Puyallup Tribe	2016	Construction	$280,000
Habitat Strategic Initiative, Near Term Action, National Estuary Program Funds	2017	Construction	$248,000
Conservation Commission Funds, Pierce Conservation District	2018	Planting	$15,984
Ecology Coastal Protection Fund, Pierce Conservation District	2018	Planting	$20,000
Ecology Clean Water Act Section 319, Pierce Conservation District	2019	Planting	$325,125
Pierce County Surface Water Management	2020	Construction	$100,000
Puyallup Tribe Fish Commission	2020	Construction	$487,574
Total for Design and Construction			**$4,853,384**

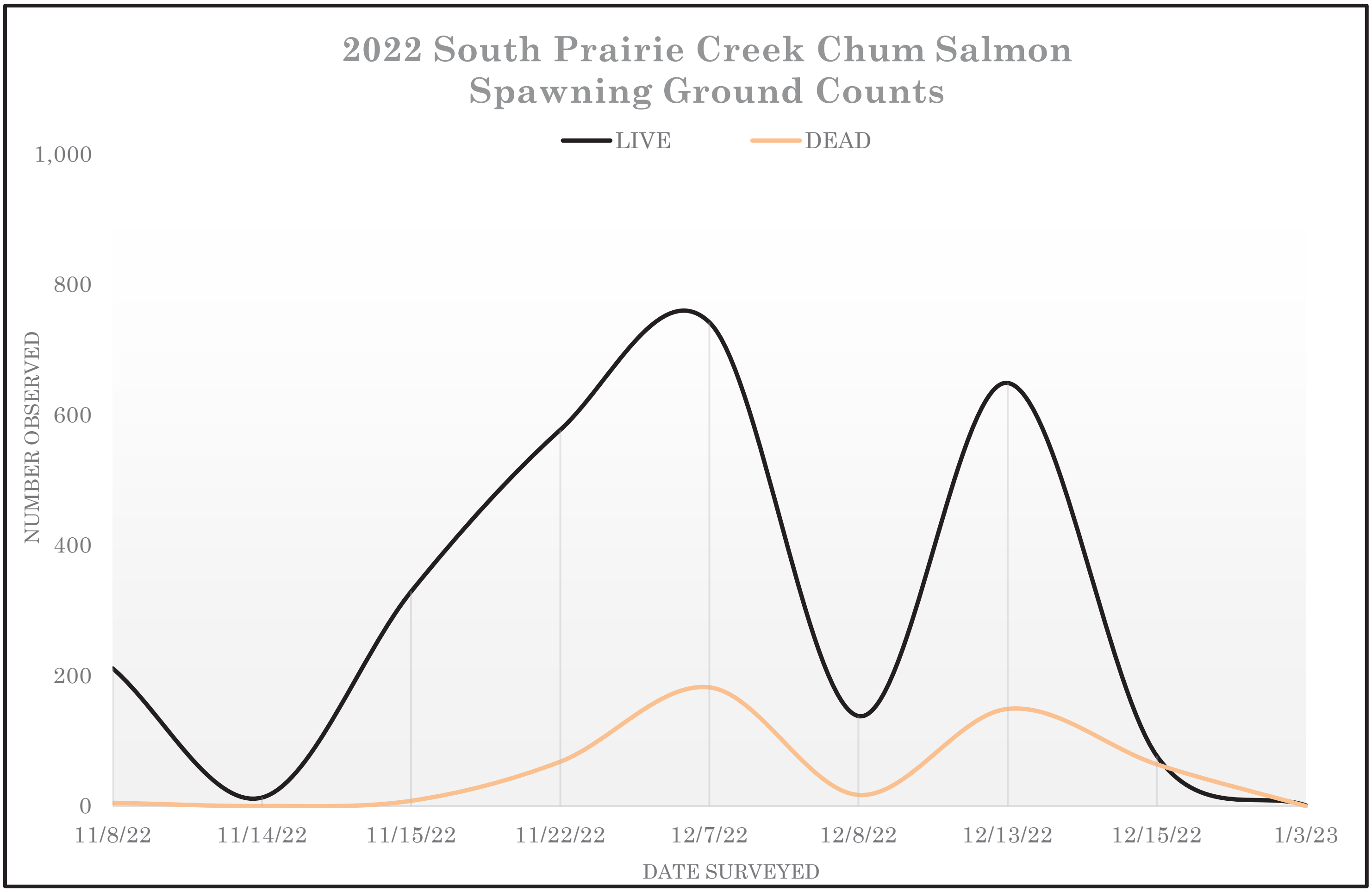


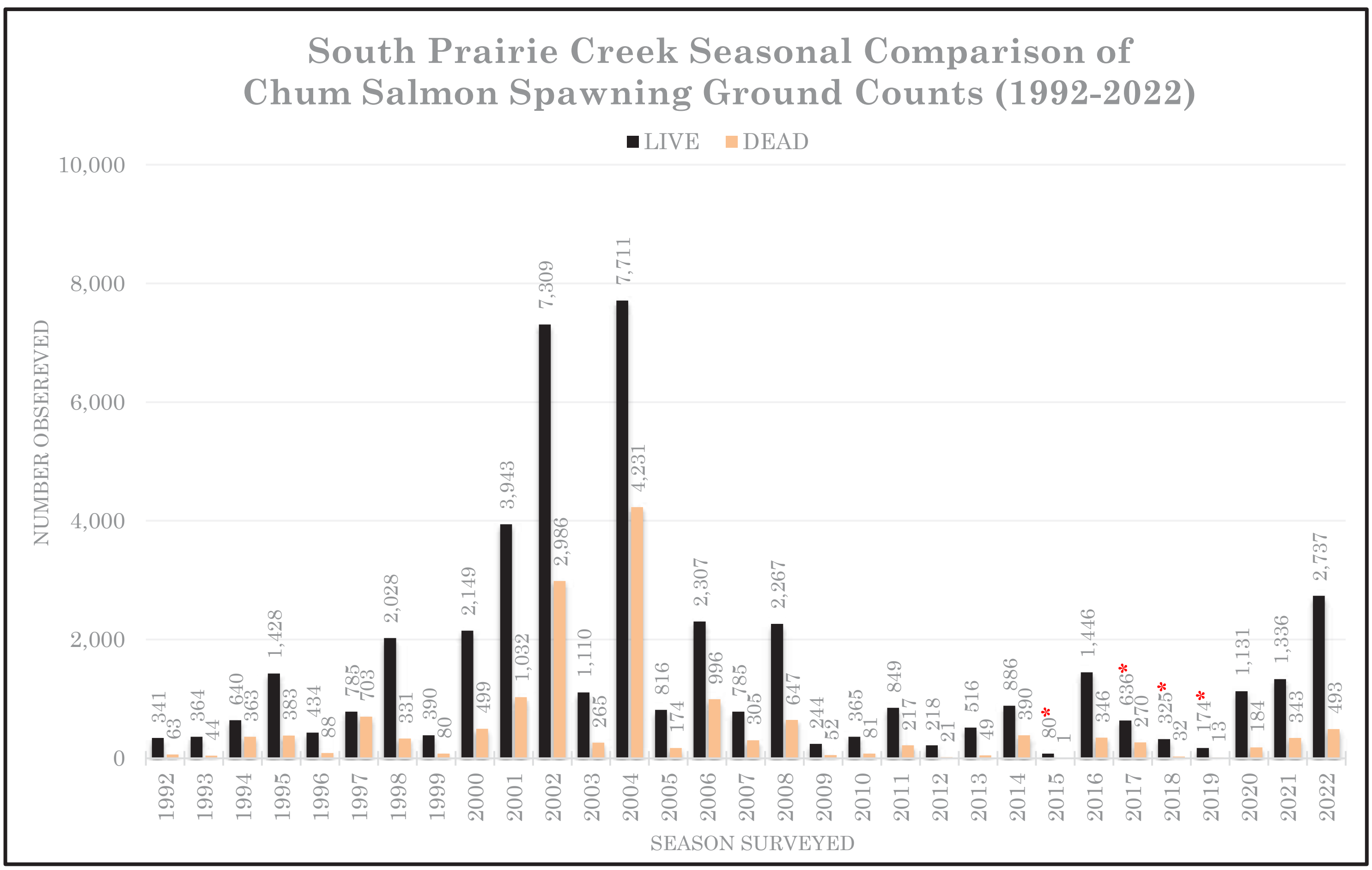
South Prairie Chinook salmon graph was generated using survey data collected by WDFW biologists.



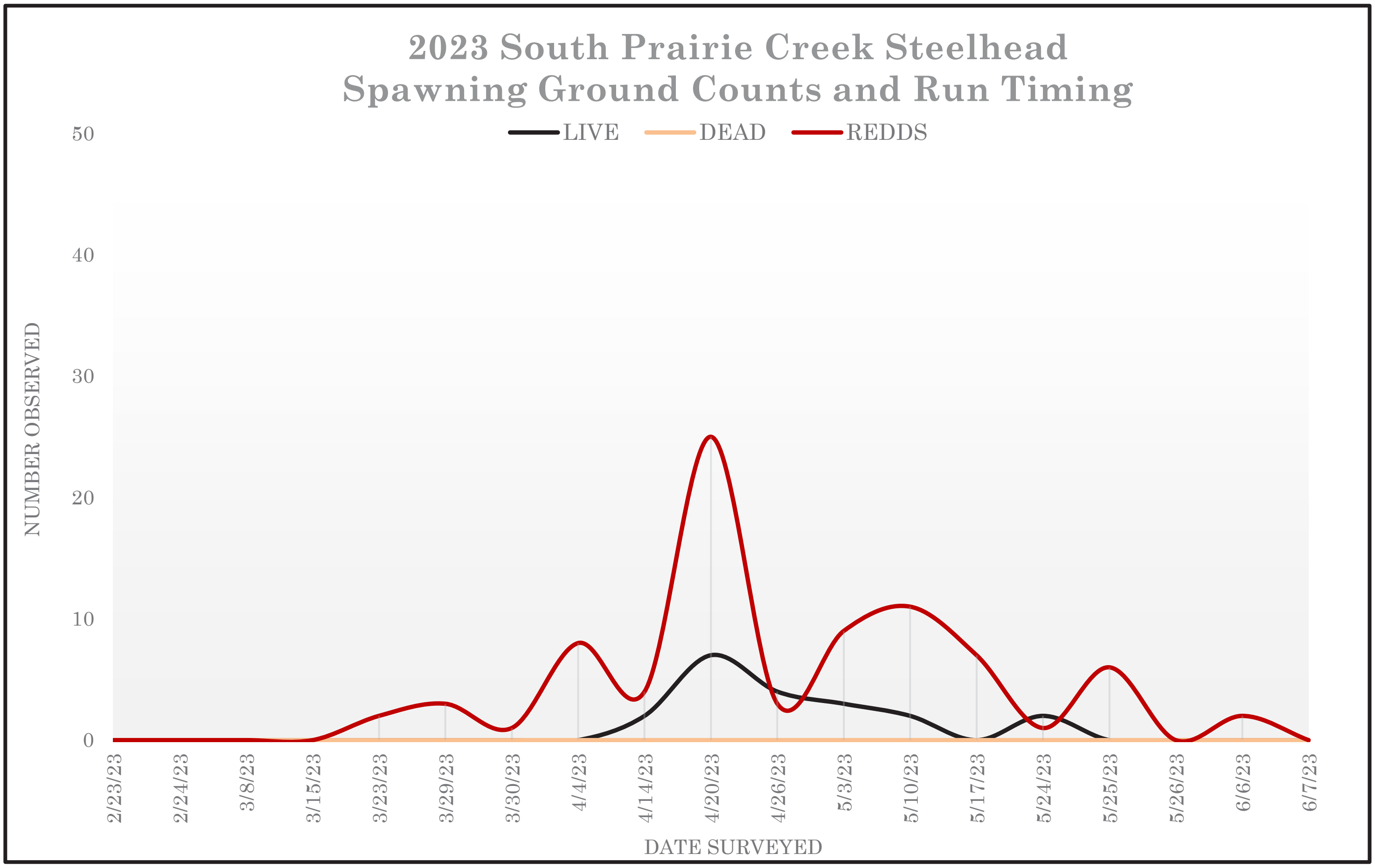
South Prairie Chinook salmon graph was generated using survey data collected by WDFW biologists. Adult Chinook escapement is determined by expanding the number of redds observed by 2.5 fish per redd (Smith and Castle, 1994). Due to the tremendous volume of pink salmon during odd years, the success of determining Chinook redds from pinks is vastly reduced. Therefore, The AUC method is used to determine escapement during pink runs (odd years).

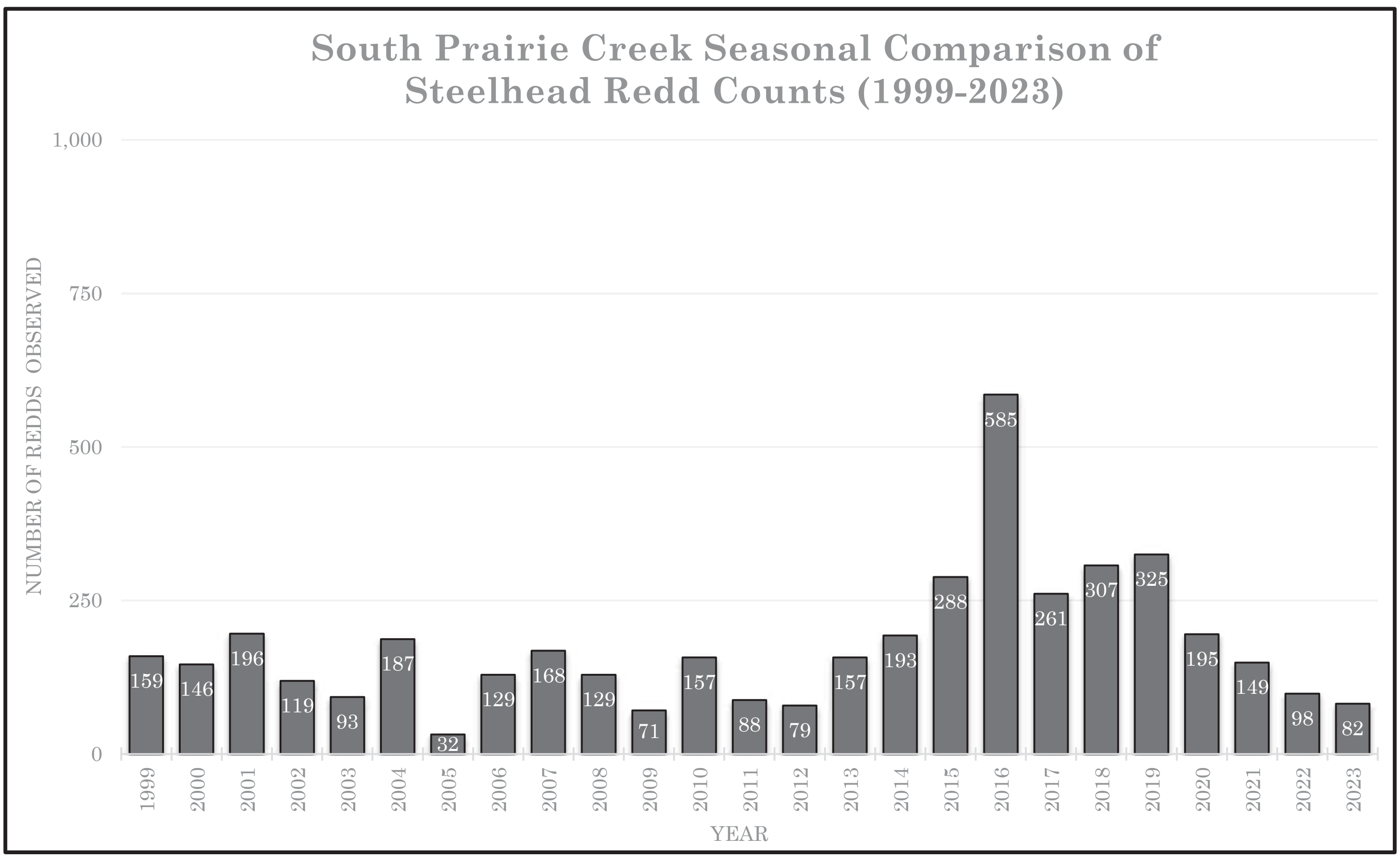

South Prairie Creek Seasonal Comparison of Pink Salmon Spawning Ground Counts (1999-2021)
LIVE
DEAD
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
NUMBER OBSEREVED
5,787
1,475
18,794
3,814
235,270
23,004
554,083
11,356
425,115
35,995
1,115,741
91,771
284,339
15,237
272,409
9,608
208,226
29,337
10,672
1,940
66,221
6,749
39,772
3,672
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
SEASON SURVEYED





South Prairie chum salmon graphs generated using survey data collected by Puyallup Tribe biologists. *Surveys were incomplete.





South Prairie steelhead graphs were generated using survey data collected by WDFW biologists. To determine the total escapement for steelhead, each redd is multiplied by a factor of 1.62 *(i.e. 42 redds x 1.62 steelhead per redd = total escapement of 68 steelhead).* Additional biological expansion factors are also applied to S. Prairie to estimate total escapement.

SPRING CREEK

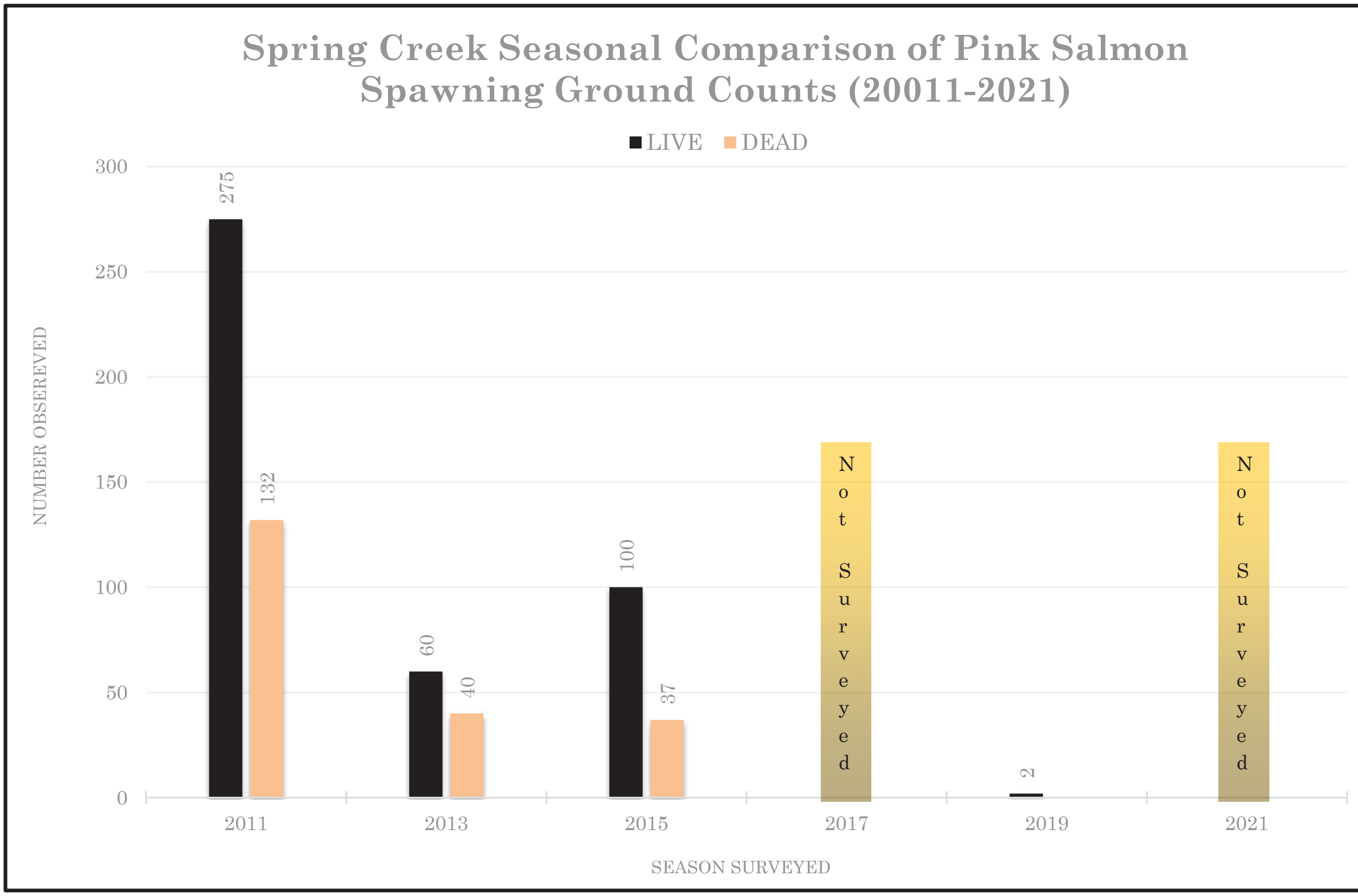
WRIA 10.0430

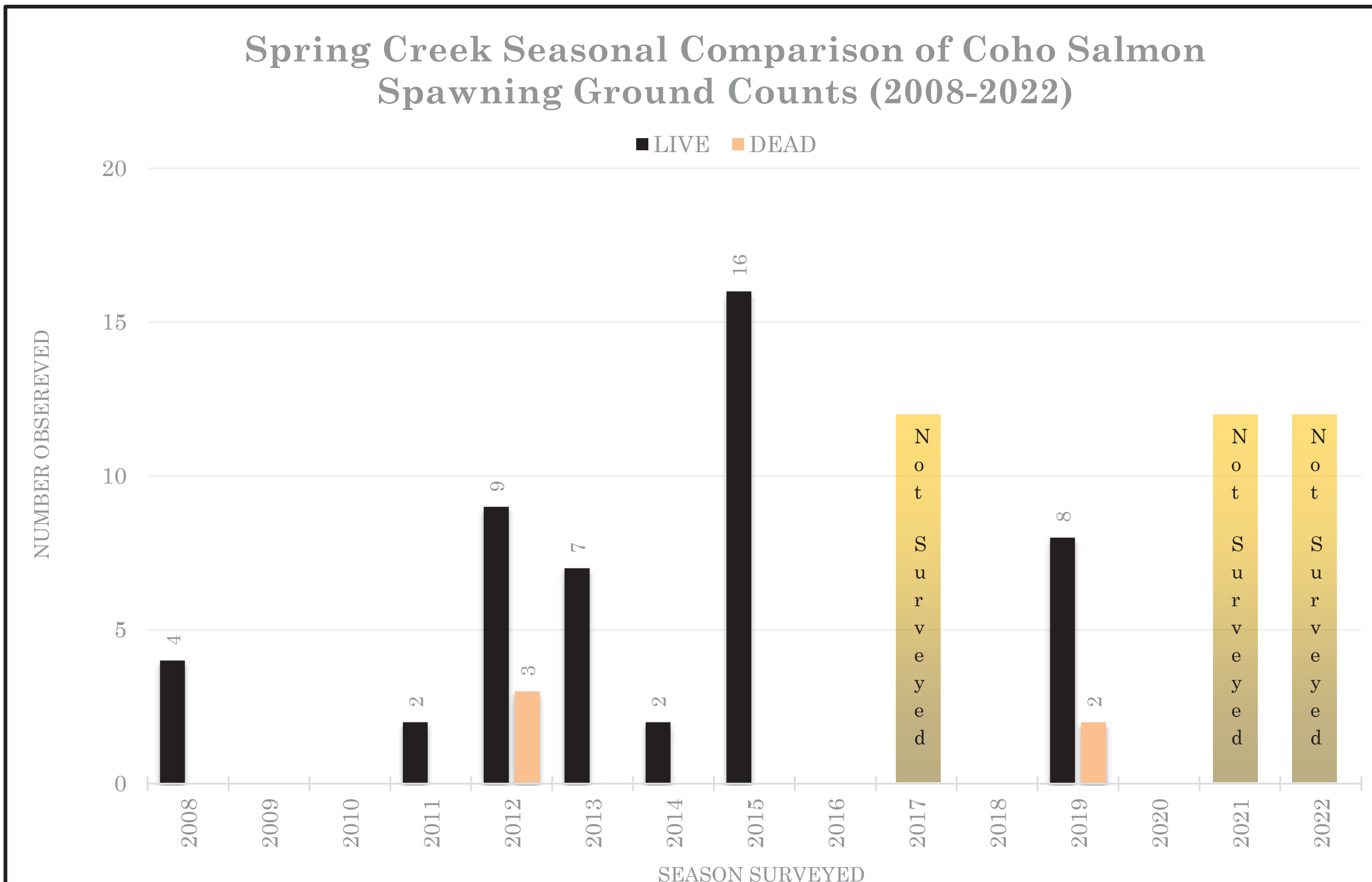
Spring Creek, also known as, South Silver Springs Creek, is a short spring-fed tributary to South Prairie Creek *(RM 4)*. Prior to the fall of 2010, the majority of the creek was inaccessible to adult and juvenile salmon. In addition to the lack of fish access, the lower reach of the creek was void of any suitable spawning habitat for salmon due to decades of agricultural and commercial land use *(U-fish Trout Farm)*. When accessible, the spring currently offers improved spawning and rearing habitat for several species of salmonids including coho, chum, pink, rainbow and cutthroat. Adult chum initially utilized the creek during the 2010 fall/winter spawning season; yet, the first adult pink and coho were not observed until the 2011 spawning season. However, the creek has already proven to be an invaluable overwintering source for juvenile coho since its restoration.

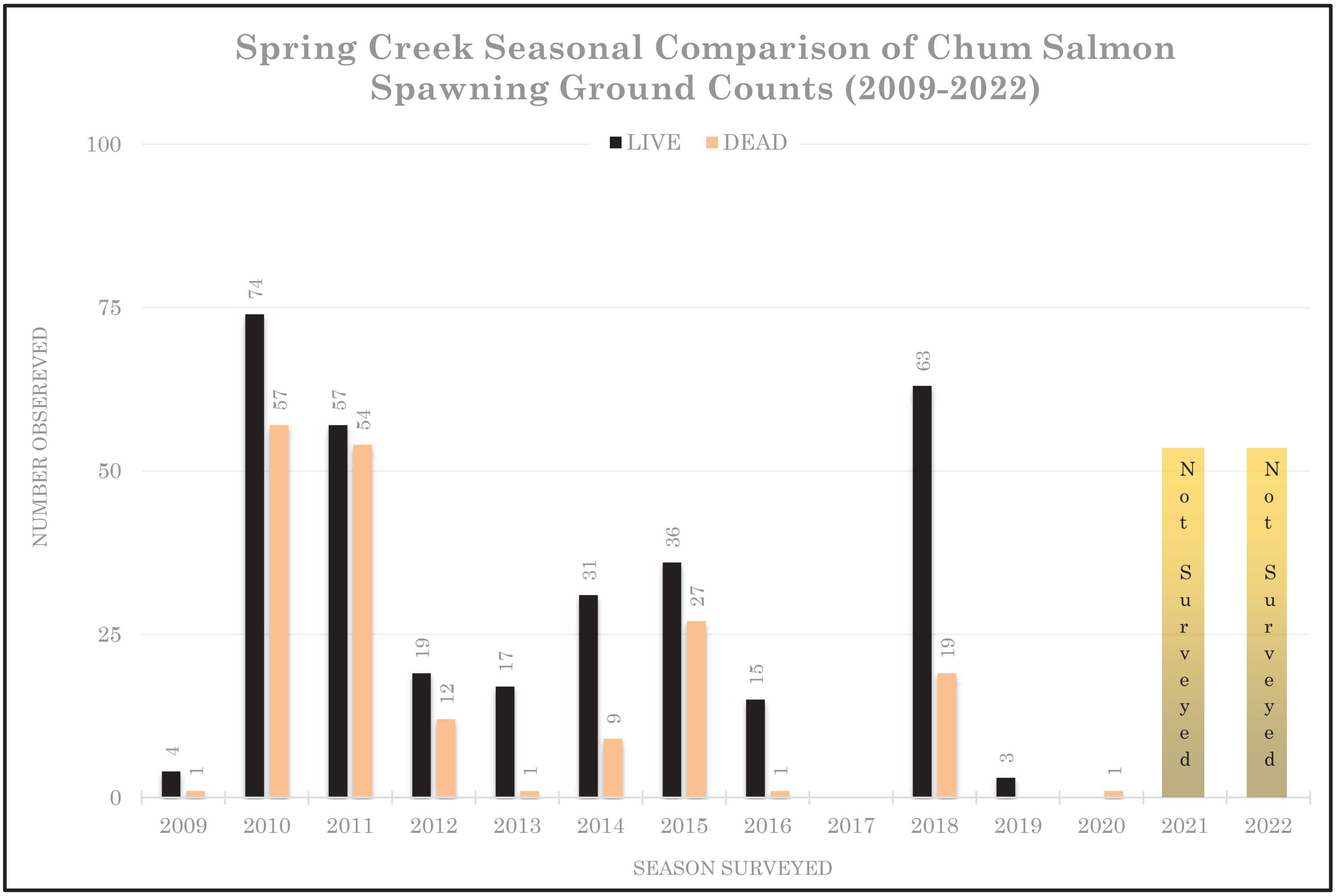
As part of a significant restoration project conducted by Pierce County; a new channel was completed along the lower stream reach in September 2010. The restoration project included increasing the mainstem channel and off-channel length by nearly 1,300′. In addition to increasing channel length, significant improvements were made to stream complexity, spawning and rearing habitat; as well as, the connectivity to tributaries and surrounding floodplain. The project involved re-grading and enhancing nearly 13-acres of adjacent wetland habitat via the removal of non-native invasive weeds and plants, then instituting a substantial planting plan of native trees and ground cover.

Erupting from a small bench along the forest floor; the creek runs adjacent to Spring Site Rd, just south of the town of South Prairie. Spring Creek flows for approximately 0.4 miles within a low gradient pool riffle channel. The creek contains a moderate amount of interactive in-stream LWD; in addition to significant long-term woody debris jams toed into the lower channel reach *(bottom left image)*. Additional flow is contributed via a small spring tributary flowing under Spring Site Rd. and entering Spring Creek at approximately RM 0.15. The overstory riparian along the upper reach consists largely of mature hardwoods and conifers; however, the lower reach is void of riparian cover until plantings from winter of 2011 mature.

Since the project's completion, several hundred feet of the lower channel within the restoration area has become subjected to periodic influxes of watercress. Typical of this stream type, the substrate is made up largely of fines and small gravel; though, several pockets of excellent spawning gravel are present throughout the lower spawning reach. The reach upstream of the restoration is heavily forested and vegetated, and is commonly the site of recurrent beaver (*Castor canadensis*) activity. This upper reach is populated by cutthroat, which has been the predominant species in the creek for many years.


Spring Creek Seasonal Comparison of Pink Salmon Spawning Ground Counts (20011-2021)
LIVE
DEAD
NUMBER OBSEREVED
SEASON SURVEYED
300
250
200
150
100
50
0
275
132
60
40
100
37
2
Not Surveyed
Not Surveyed
2011
2013
2015
2017
2019
2021


Spring Creek Seasonal Comparison of Coho Salmon Spawning Ground Counts (2008-2022)
LIVE
DEAD
NUMBER OBSEREVED
SEASON SURVEYED
20
15
10
5
0
4
2
9
3
7
2
16
8
2
Not Surveyed
Not Surveyed
Not Surveyed
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022


Spring Creek Seasonal Comparison of Chum Salmon Spawning Ground Counts (2009-2022)
LIVE
DEAD
100
75
50
25
0
NUMBER OBSEREVED
4
1
74
57
57
54
19
12
17
1
31
9
36
27
15
1
63
19
3
1
Not Surveyed
Not Surveyed
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
SEASON SURVEYED

SQUALLY CREEK

WRIA 10.0024

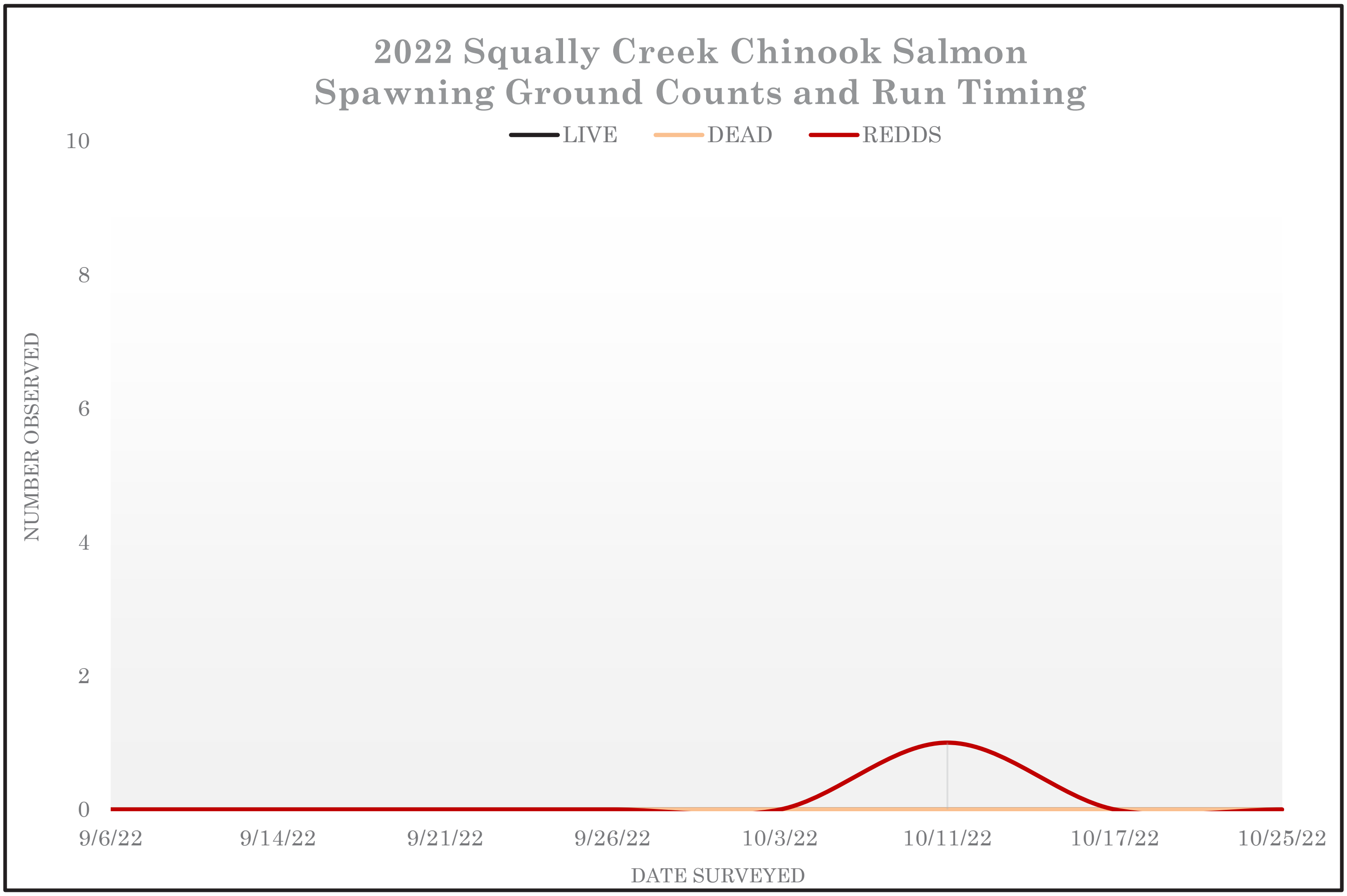
Squally Creek is a small tributary located within the larger 12.1 mi^2 Clear Creek Basin *(10.0022)*. The Clear Creek Basin drains the plateaus and flatlands running along the southern valley of the lower Puyallup River, just west of the city of Puyallup. Encompassing an area of nearly 1 square mile, Squally Creek is the smallest of three main tributaries feeding Clear Creek. Squally originates along the upper valley plateau near 72nd Street East and flows north, dropping through a steep narrow canyon along the valley wall. Near the foot of the valley the creek passes under Pioneer Way and the BNSF rail line before reaching Clear Creek.

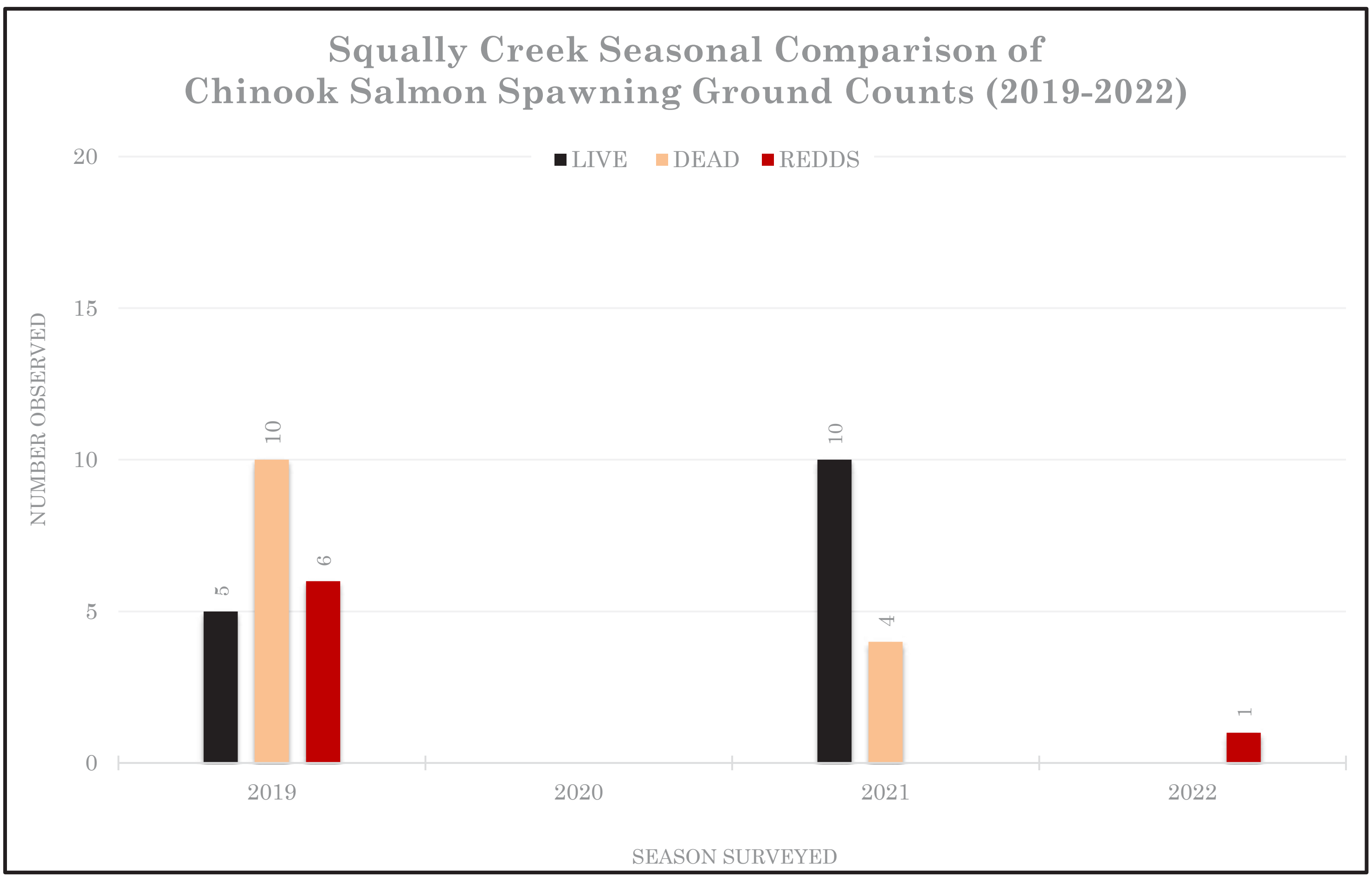
Squally supports Chinook, coho, chum, bull trout and cutthroat. The creek is mainly utilized by chum, although, coho adults are occasionally observed spawning in the lower stretch of the creek during December. No adult steelhead usage has been documented; however, adult and juvenile Chinook utilization has been documented. Squally also supports bull trout and cutthroat. Chum have been observed spawning within the BNSF culvert; however, the current steel culvert no longer meets minimum standards for water crossing guidelines *(hydraulic/fishway)* and needs to be replaced; as does the culvert crossing under Pioneer Way.

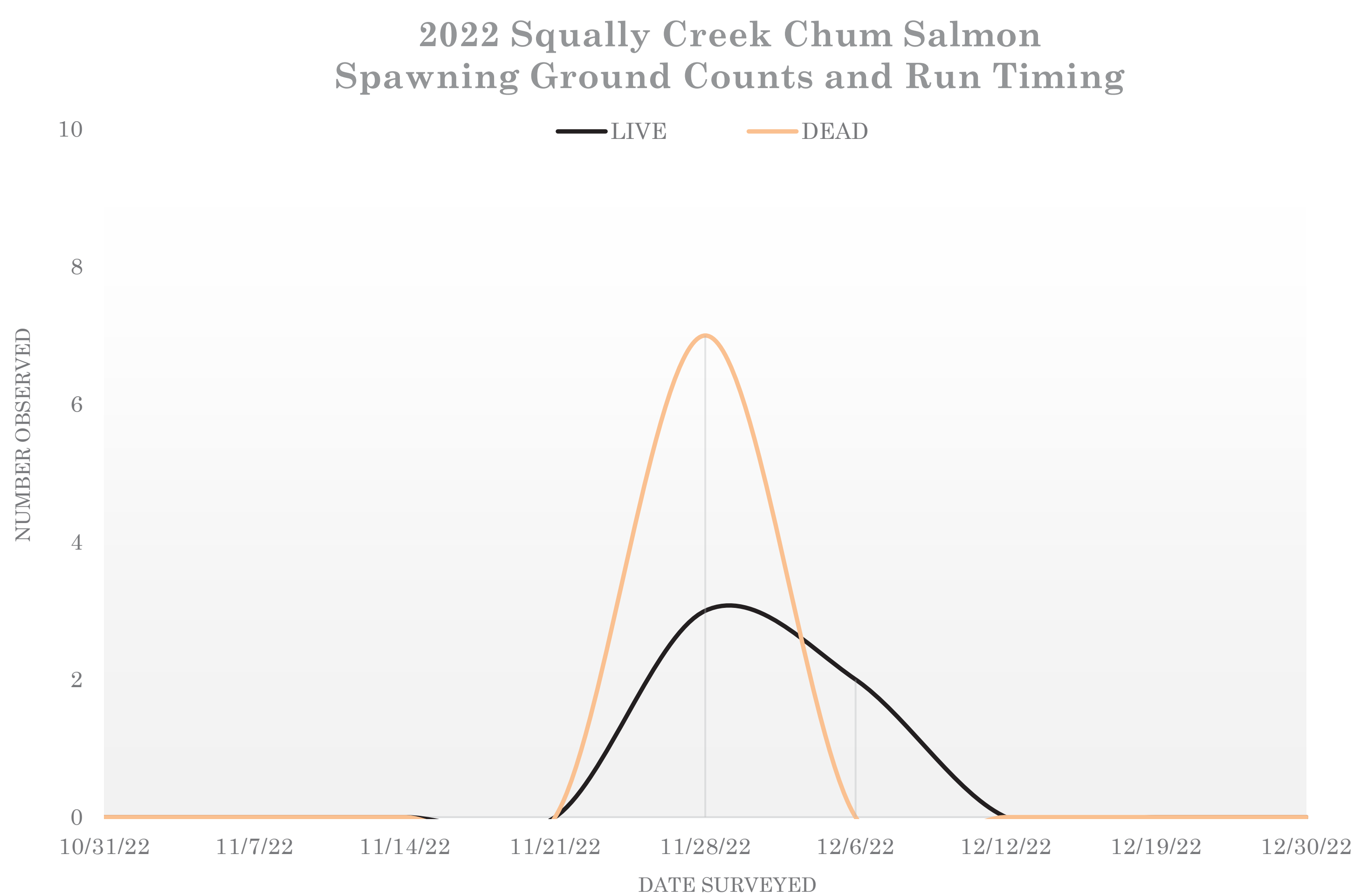
Several of the fish and habitat limiting factors include: channel confinement, intermittent or complete fish barriers, noncompliant culverts, no off-channel habitat, compacted substrate, flooding and channel erosion, absent or deficient riparian cover, and the influx of reed canary grass, and Himalayan blackberry. In addition, there is some development along the creek; primarily private residential, as well as storm run-off that is channeled into the creek. A large detention pond built by Pierce County is located on the western tributary of upper Squally. The pond was constructed to address excessive storm run-off and sediment issues.

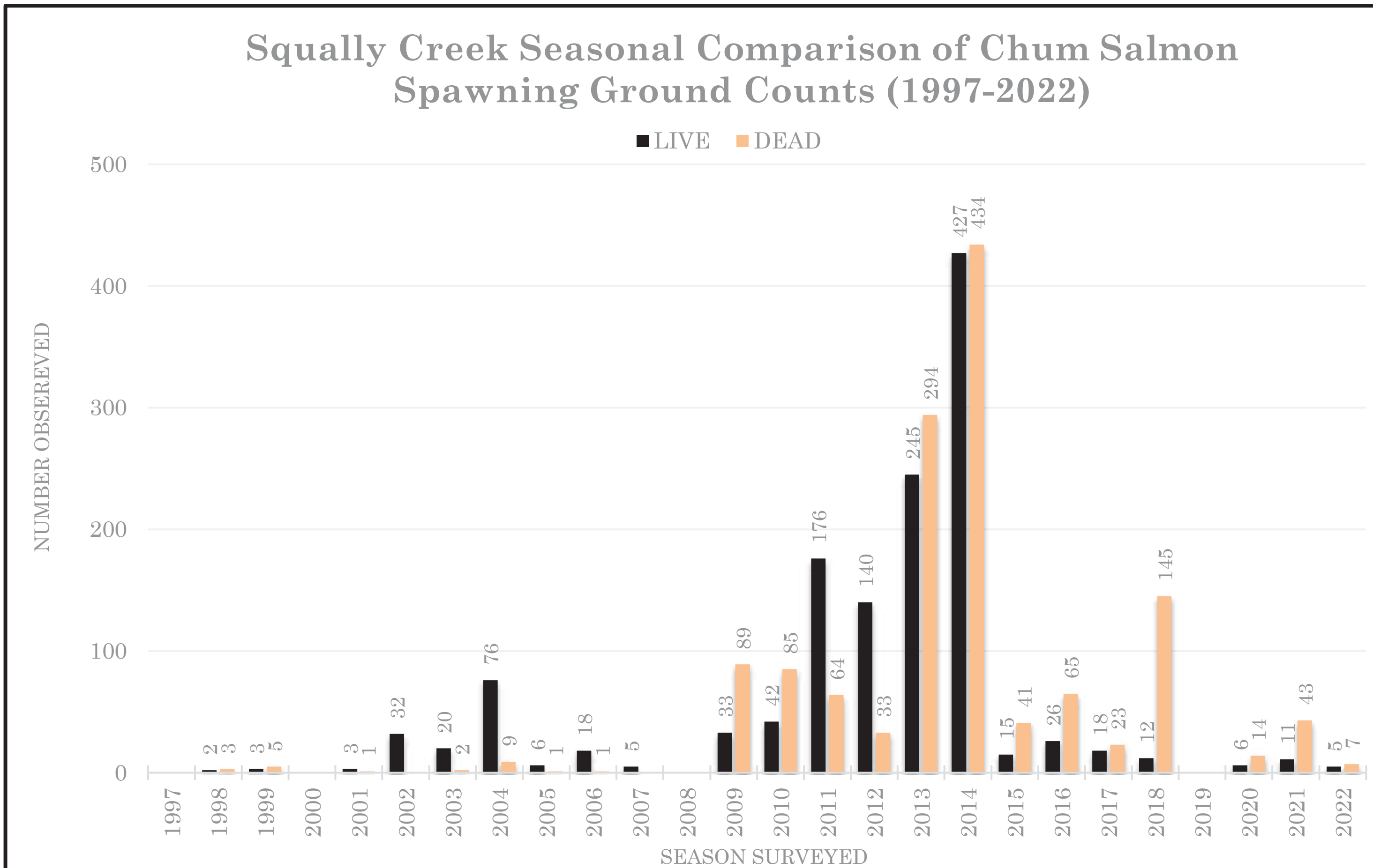
The anadromous reach has two short distinct segments, one below and one above Pioneer Way. Downstream of Pioneer Way, the channel is deeply incised with a substrate consisting of moderately compacted gravel, clay, and abundant fines. This substrate type is typical of the entire basin; a result of glacial deposits and compaction. Natural channel cutting through this hardened substrate created a two foot jump in the channel, preventing chum from ascending beyond the lower 200 feet for several seasons *(2002-2008)*. The riparian is sparse along the lower 300 feet, consisting mainly of a few small alders, blackberry, and reed canary grass. The last 80 feet of the creek runs through a culvert passing under the BNSF rail line, where Squally finally flows into Clear Creek.

Upstream of where the creek passes under Pioneer Way, the gradient increases and the less confined channel quickly becomes braided. Due to the channel braiding in this reach, the stream depth is often shallow. However, there are several pieces of hardwood debris present, as well as moderate quantities of suitable spawning gravel. The riparian along this section consists mostly of alder, mixed deciduous and coniferous trees. Excellent spawning gravel exists through much of the upper reach. Chum spawning is most consistent within this upper reach section that extends for approximately 0.4 miles upstream of Pioneer Way. However, over several seasons, the inspection of chum carcasses has often revealed fish were intercepted by predators prior to spawning *(pre-spawn mortality)*.


2022 Squally Creek Chinook Salmon
Spawning Ground Counts and Run Timing
LIVE
DEAD
REDDS
NUMBER OBSERVED
10
8
6
4
2
0
9/6/22
9/14/22
9/21/22
9/26/22
10/3/22
10/11/22
10/17/22
10/25/22
DATE SURVEYED


Squally Creek Seasonal Comparison of
Chinook Salmon Spawning Ground Counts (2019-2022)
LIVE
DEAD
REDDS
NUMBER OBSERVED
20
15
10
5
0
5
10
6
10
4
1
2019
2020
2021
2022
SEASON SURVEYED


2022 Squally Creek Chum Salmon
Spawning Ground Counts and Run Timing
LIVE
DEAD
NUMBER OBSERVED
0
2
4
6
8
10
10/31/22
11/7/22
11/14/22
11/21/22
11/28/22
12/6/22
12/12/22
12/19/22
12/30/22
DATE SURVEYED

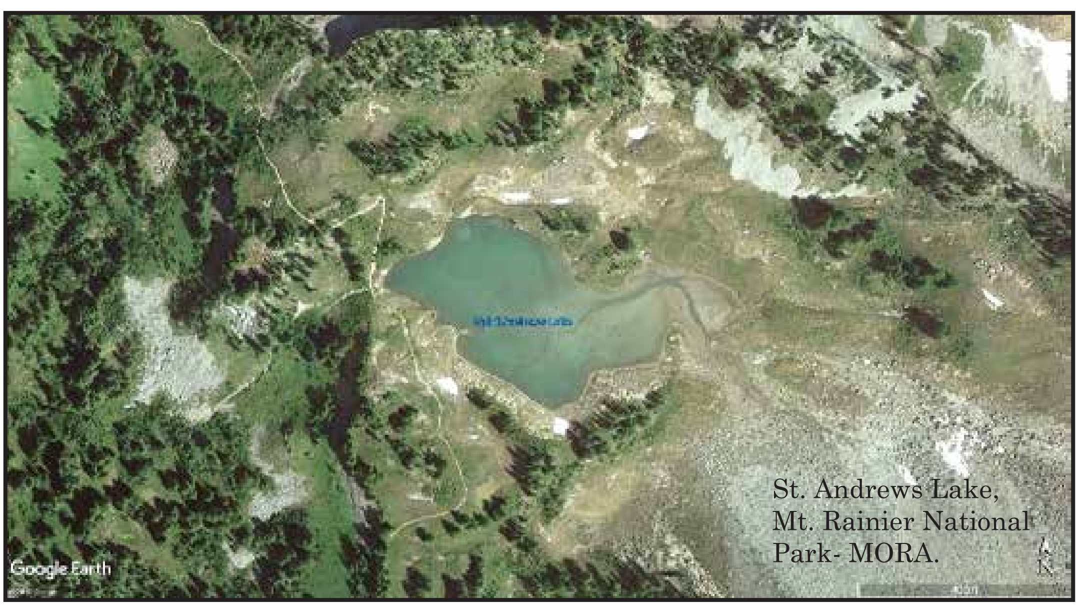

Squally Creek Seasonal Comparison of Chum Salmon
Spawning Ground Counts (1997-2022)
LIVE
DEAD
NUMBER OBSEREVED
0
100
200
300
400
500
2 3
3 5
3 1
32
20 2
76 9
6 1
18 1
5
33 89
42 85
176 64
140 33
245 294
427 434
15 41
26 65
18 23
12 145
6 14
11 43
5 7
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022
SEASON SURVEYED

ST. ANDREWS CREEK

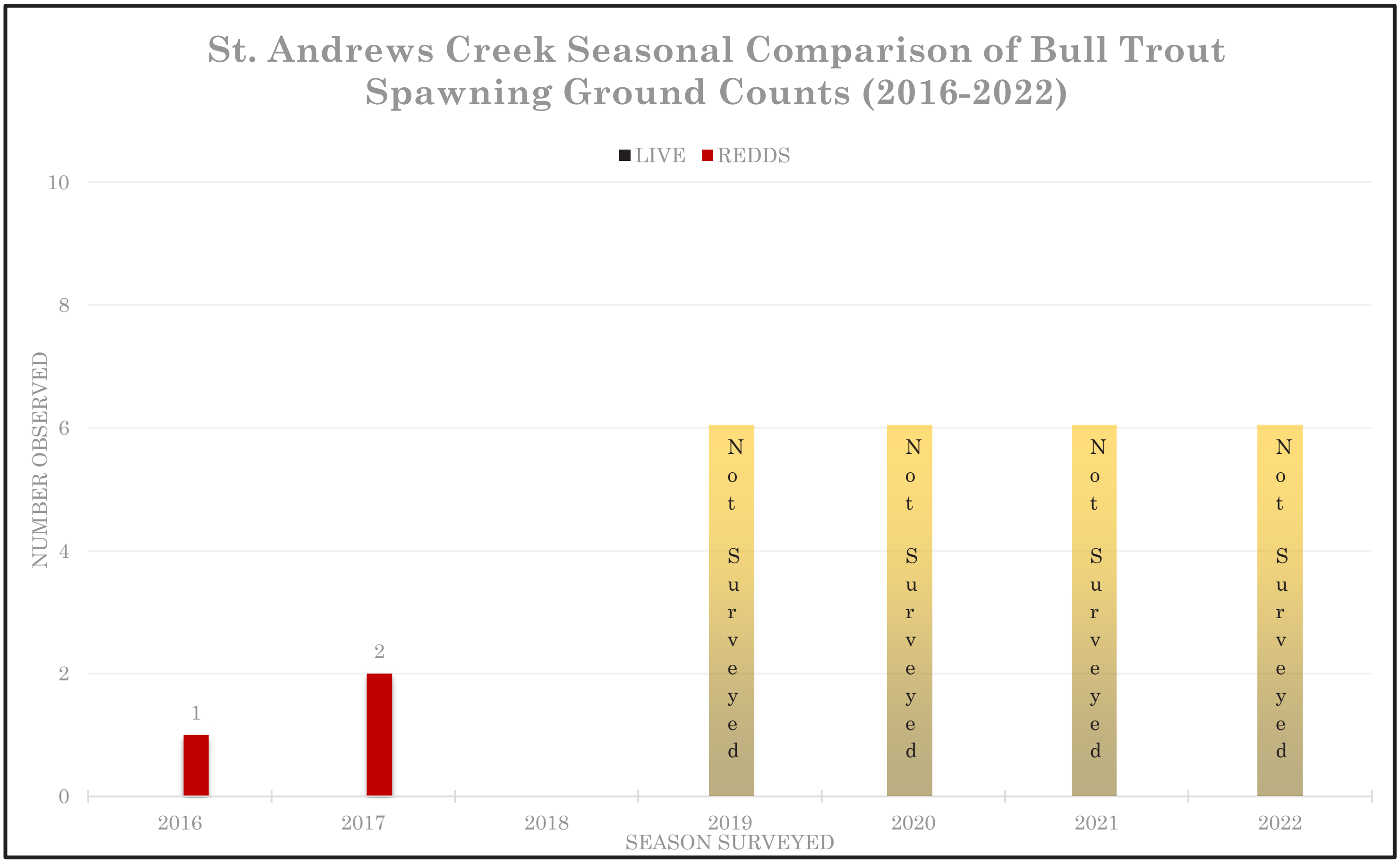
WRIA 10.0714

St. Andrew Creek is a right bank headwater tributary to the South Fork Puyallup River. The creek is known to support bull trout, cutthroat and sculpin. Other salmonid species utilization is unknown; however, anadromous access does exist. Anadromous access to the creek was severed for nearly a century due to the streams location above the Electron diversion dam on the Puyallup River. With the completion of the Electron fish ladder *(@ RM 41.7)* in the fall of 2000, anadromous fish passage was restored for the first time since 1904. From its origin at St Andrews Lake *(elev. 5900')* located in Mt. Rainier National Park *(bottom image)*; this mountain stream courses west along the base of Klapatche Ridge which runs along the streams northern border *(right bank)*. With the exception of the lowest reach of the creek, the majority of the stream flows within the boundaries of Mt. Rainier National Park *(NPS stream designation p03-***)* and is non-glacial in origin. St. Andrews Creek flows for 3.2 miles from the lake and other water contributing sources before entering the South Fork Puyallup River at approximately RM 49.7 *(elev. 2800')*; positioning the lower several hundred feet of the creek just outside the National Park boundary.

PTF initiated bull trout spawning surveys on St. Andrews in 2016, and conducts surveys for spawning activity from early September-to-mid October. The lower anadromous reach of St. Andrews provides suitable habitat conditions for bull trout rearing and spawning and is one of the few documented bull trout spawning sites located outside of the national park. Similar to many headwater tributaries, the lower 300'+ of the creek is comprised of a narrow, low gradient channel flowing within the open channel migration zone of the South Fork Puyallup River floodplain *(top left image)*. Although bull trout utilization has been documented within this small reach, opportunities are acutely limited due the lack stream complexity creating structures and quality spawning substrate. Like many wall-based tributaries, the lower creek channel is repeatedly manipulated and affected by mainstem river flows. Unfortunately, there are currently no large wood assemblages present to sufficiently protect or buffer the spawning/rearing reach of this stream from damaging mainstem flows. However, even in the face of mainstem incursions, bull trout redds have been observed.



St. Andrews Lake, Mt. Rainier National Park- MORA.


St. Andrews Creek Seasonal Comparison of Bull Trout Spawning Ground Counts (2016-2022)
LIVE
REDDS
NUMBER OBSERVED
SEASON SURVEYED
10
8
6
4
2
0
1
2
2016
2017
2018
2019
2020
2021
2022
Not Surveyed
Not Surveyed
Not Surveyed
Not Surveyed

SUNRISE CREEK

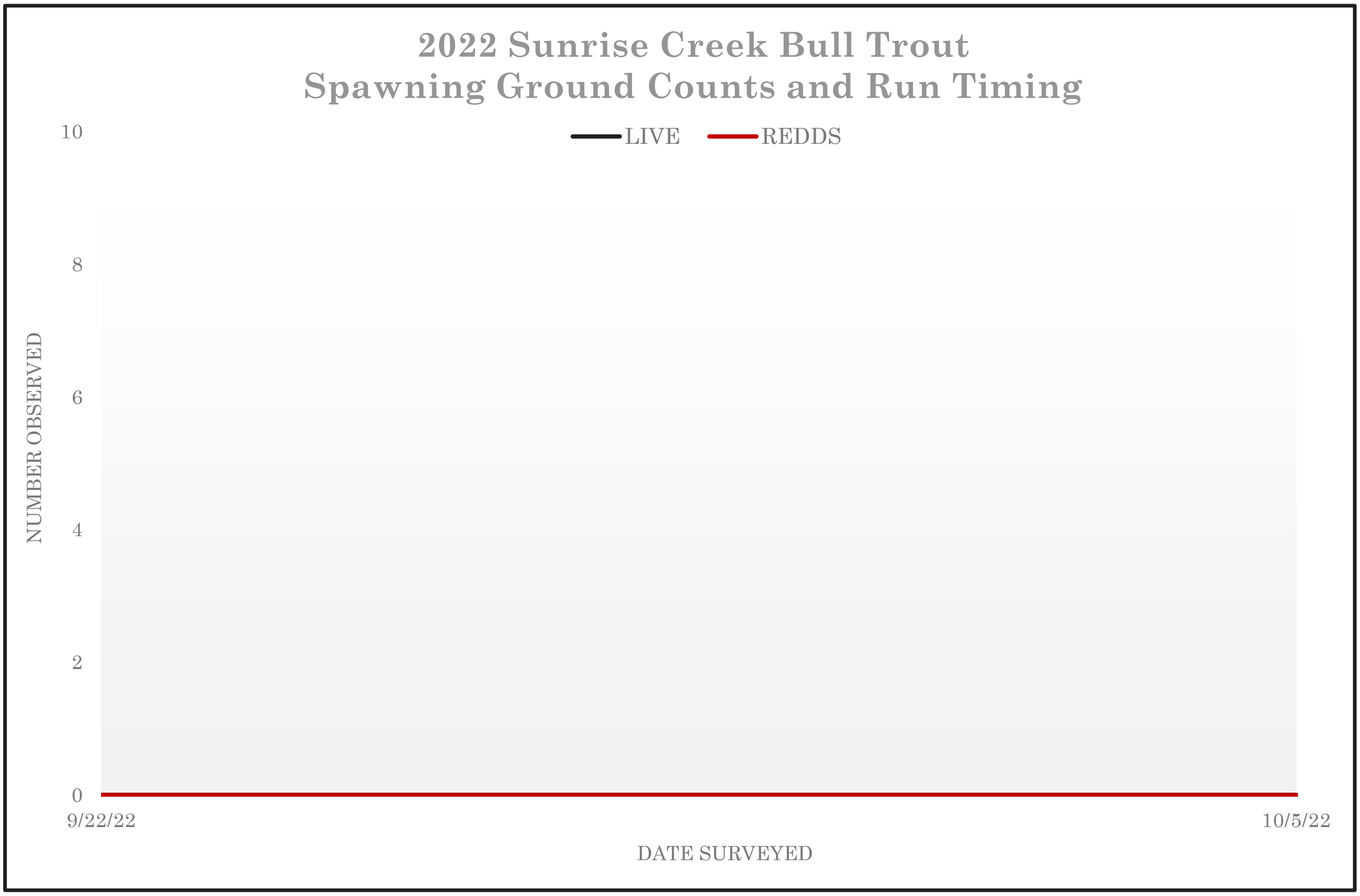
WRIA 10.0337

Sunrise Creek is a left bank headwater tributary to the White River. This mountain stream *(lowest elev. 2800′)* flows northeast through the steep Sunrise Creek Valley, between the Sourdough Mountains to the northwest and Sunrise Ridge along the southeast. Located entirely within the boundaries of Mt. Rainier National Park *(NPS #W06-00a)*, the creek is non-glacial in origin; rather, its sources originate from several sub-alpine lakes including Clover Lake *(elev. 5732′)* and Hidden Lake *(elev. 5915′)*; as well as, snowpack accumulations within the White River Park region. White River Park is nestled into the eastern slopes of the Sourdough Mountain Range located along the northeastern edge of the park. Sunrise Creek flows for 4.5 miles from its headwaters before entering the White River at approximately RM 63; positioning the mouth of the creek just inside the National Park.

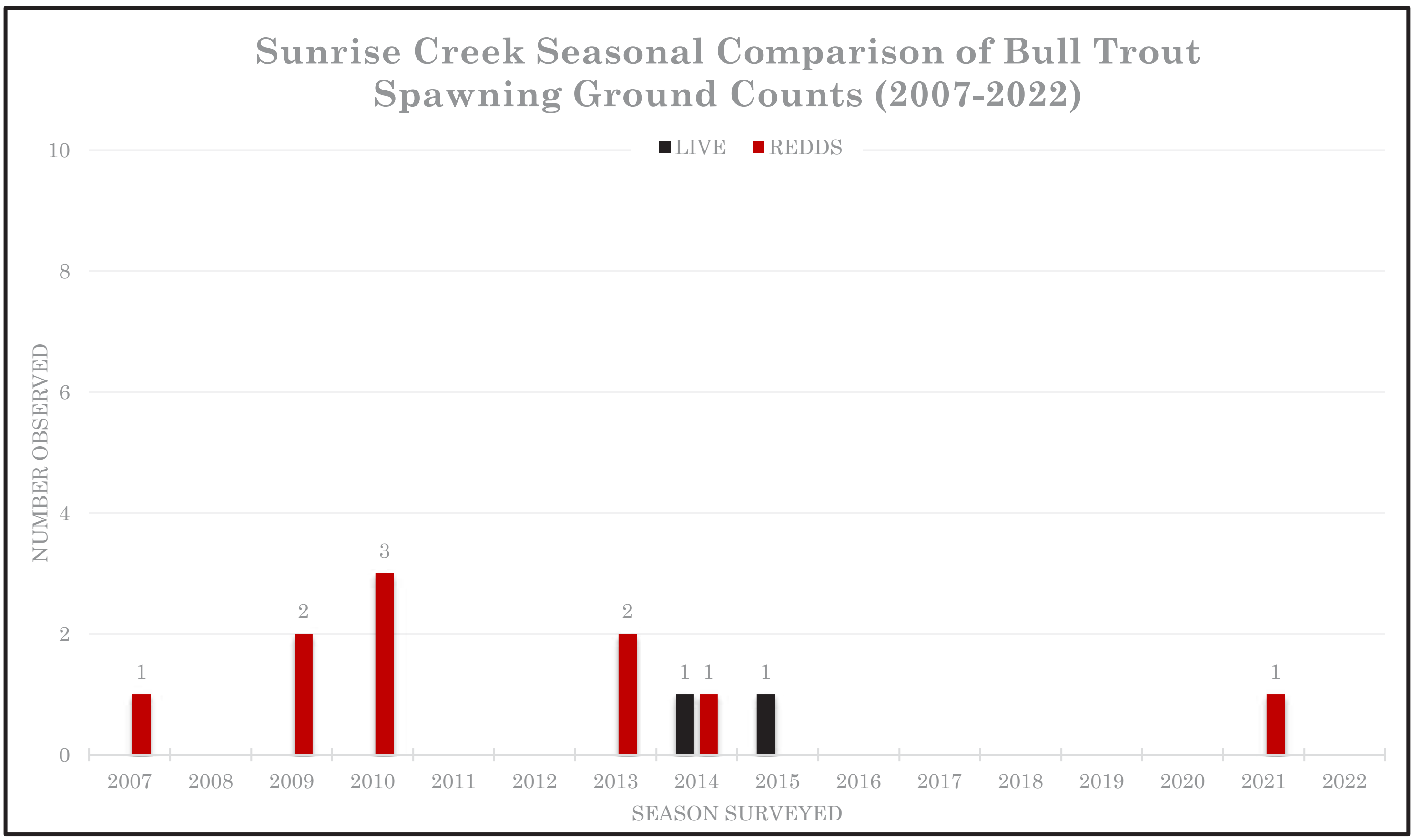
PTF & NPS surveys the creek for bull trout spawning activity from early September-to-mid October.

The cold high mountain streams located within the National Park, including Sunrise, provide the majority of the critical bull trout spawning habitat in the basin. In addition, bull trout spawning has been less frequent in this tributary compared to that observed in more significant headwater tributaries located along the White River, such as Klickitat Creek *(elev. 3300′)* located 5 miles upstream. Other species known to utilize the creek include cutthroat, brook trout, and pink salmon. The brook trout are likely descendants from fish plants in Hidden and Clover lakes during the early to mid-part of the last century. Pink salmon have been observed in the creek since 2007. Over 300 pinks spawners were observed in 2015. Although Sunrise has not been surveyed for coho; it is reasonable to assume that coho have, or do, utilize this creek since it is located a short distance upstream from Silver Springs which is consistently exploited by adult coho spawners. Chinook and steelhead use is unknown.

The anadromous reach of Sunrise provides suitable habitat conditions for bull trout rearing and spawning. The lower reach of the creek *(RM 0-0.15)* is a low gradient channel flowing within the White River channel migration zone *(CMZ)*, and is repeatedly influenced by mainstem river incursions. There are moderate quantities of LWD present; as well as a beneficial riparian buffer zone of conifers and mixes deciduous trees along the majority of the creek. Although spawning does occur within this small stretch, it can be limited due the lack of quality spawning substrate created by the alluvial deposits *(sand & silt)* from the White River. Upstream of the CMZ, the creek enters the heavily forested lower slope of the valley floor, and then rapidly begins to climbs up the valley. From this point, the creek assumes a pool-riffle-cascade configuration up into the steep valley; this forested reach provides quality rearing habitat, but few spawning opportunities. An impassable falls at approximately RM 0.26, prevents any further upstream migration.



2022 data provided by the National Park Service (MORA). Raw spawning data can be found in Appendix B. See Appendix C for bull trout redd locations.



SWAN CREEK

WRIA 10.0023


Chum salmon

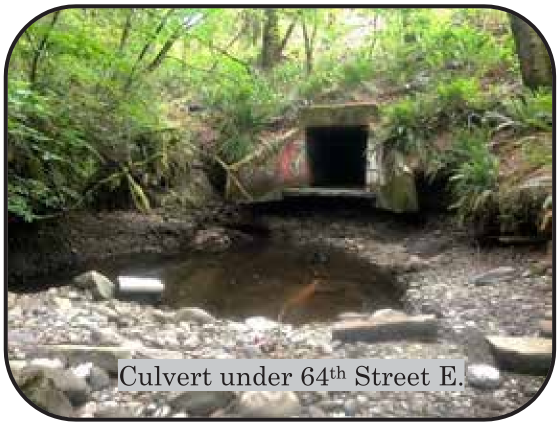
Swan Creek is a moderate sized tributary located within the larger Clear Creek Basin *(10.0022)*. The Clear Creek Basin drains the plateaus and flatlands running along the southern valley of the lower Puyallup River, between the cities of Puyallup and Tacoma. The head waters of Swan Creek originate just south of Highway 512, and flow just over 6 miles north to meet up with Clear Creek near Pioneer Way E. The Swan Creek basin drains a moderately developed land area of nearly 4 mi^2. The land use along the creek is largely rural residential and recreational. The average water discharge recorded by the USGS flow gauge *(#12102190)* for a five year period *(1990-1991, 1995-1997)* was 4.78 ft^3 per second.

Several of the fish and habitat limiting factors involved with Swan Creek including: channel confinement, intermittent or complete fish barriers, unstable substrate, flooding and channel erosion, absent or deficient riparian cover, invasive non-native plants, and water quality *(bacteria)*. In addition, there is some development present along the creek; primarily private residential, as well as storm runoff that is channeled into the creek. A large detention pond built by Pierce County is located on the lower reach of the creek. The pond was constructed to address excessive sediment and gravel movement issues.

Although Swan Creek has been surveyed for several salmon species including Chinook, pink, coho, chum and steelhead; however, only chum are observed in relatively abundant numbers. In addition to chum, limited numbers of coho are observed spawning in the creek in December. However, substantial numbers of coho juveniles are often observed in the spring. Unfortunately, summer and early fall flows can prevent Chinook from accessing the creek; however, a few Chinook have spawned successfully. Although bull trout utilization is unknown within Swan Creek; adult fluvial bull trout are known to forage in the lower tributaries of the Puyallup. Swan also supports a large population of cutthroat, which can be observed spawning in the spring. Two steelhead redds were observed during the April 2004 survey season. They were the first steelhead redds seen in Swan Creek in several years. However, no steelhead redds have been observed since. Other species present in the creek include catfish, lamprey and sculpins.

From its origins, the creek flows within a narrow distinct channel for approximately 3 miles through the upland plateau south of 72nd Street East. Near 72nd, the creek begins to drop into an increasingly narrow valley. The creek passes through a large concrete box culvert under 64th Street E. *(upper left image on next page)*; then drops nearly three feet back into the creek channel. This jump in elevation is an upstream barrier to all species; with the exception of steelhead, which may be able to pass if flows are high enough. However, spawning opportunities are extremely

limited and the habitat quality is poor upstream of this point.


Culvert under 64th Street E.

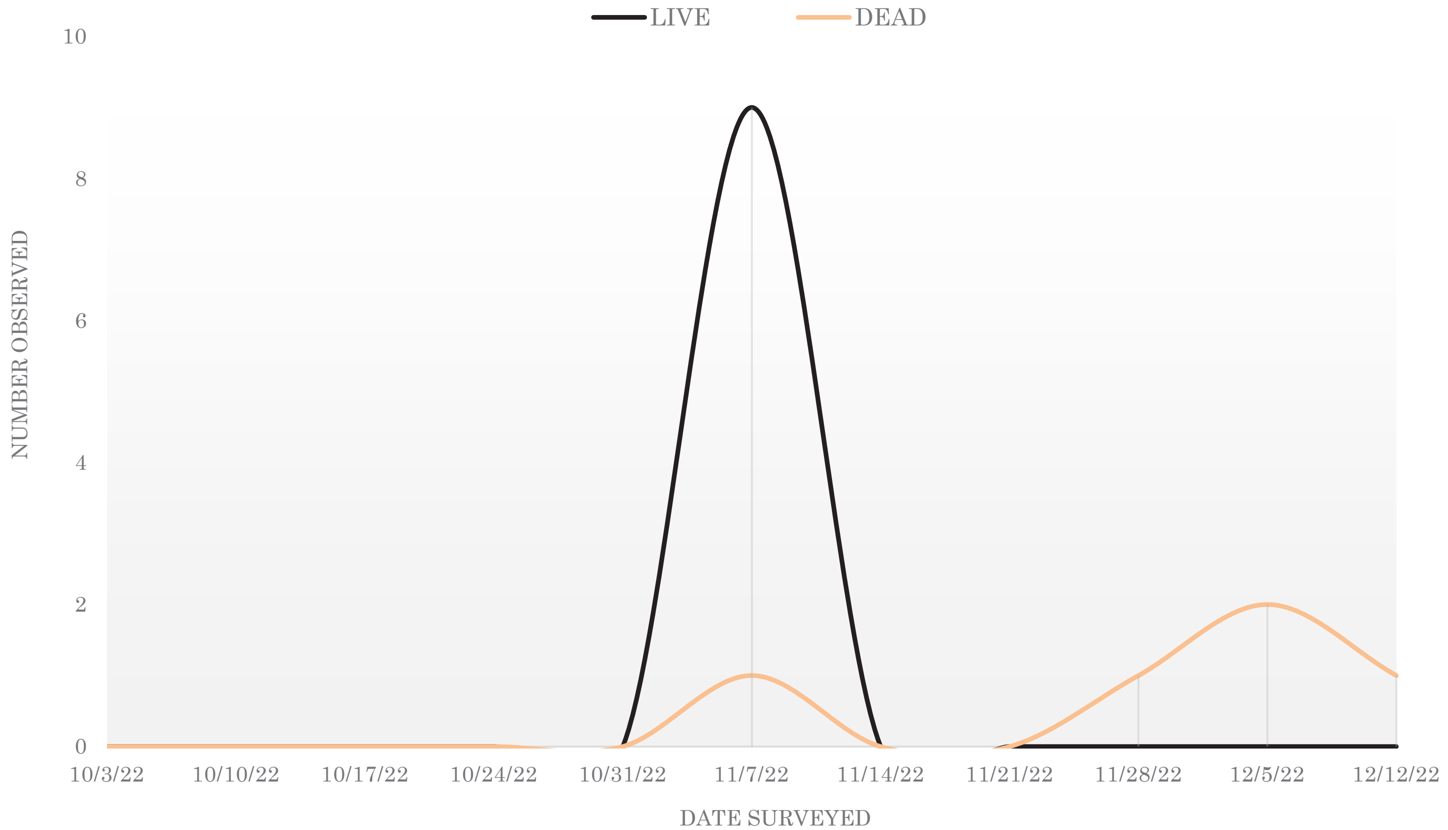
Downstream of the culvert, the next 0.2 miles of the creek flows through a well-defined channel with little spawning habitat or complexity. Beyond this, the creek channel takes on more complexity due to the placement of sill logs which hold back bed load and create pool habitat through this narrow valley section *(previous page-lower right)*. Unfortunately, one of the structures has developed into a likely barrier to upstream migration during low flows. This narrow valley reach continues for approximately the next 1.8 miles until the gradient and the valley walls begin to ease around RM 0.8. The channel dynamics change considerable through this reach; from a single well defined channel to braided sections. There are several pieces of instream LWD; as well as several smaller pieces of wood and woody debris jams. Several sections of the banks consist of actively eroding compacted glacial debris; contributing fine and small course materials into the stream channel. Spawning habitat is available throughout; yet, the substrate is largely made up of fine sand and undersized gravel. The RMZ is well intact along the valley section; consisting largely of mature Doulas fir, alder, cottonwood and maple. A rapid shift in the RMZ occurs around RM 1.5; at this point the surrounding forest consists primarily of a much thinner stand of alder, cottonwood and maple. To a large extent, the lower part of Swan Creek passes through the 290-acre Swan Creek Park. The park is largely undeveloped with a hiking trail paralleling the creek.

From RM 0.8 to 0.5, the stream is pool-riffle in character and contains good spawning gravel, riparian diversity and channel complexity. There is also a noticeable decrease in LWD and woody debris in the channel. Swan Creek is prone to high water events however, and the substrate is only moderately stable. A sediment detention pond is located at RM 0.5 *(bottom center)* and is dredged annually or biannually by Pierce County.

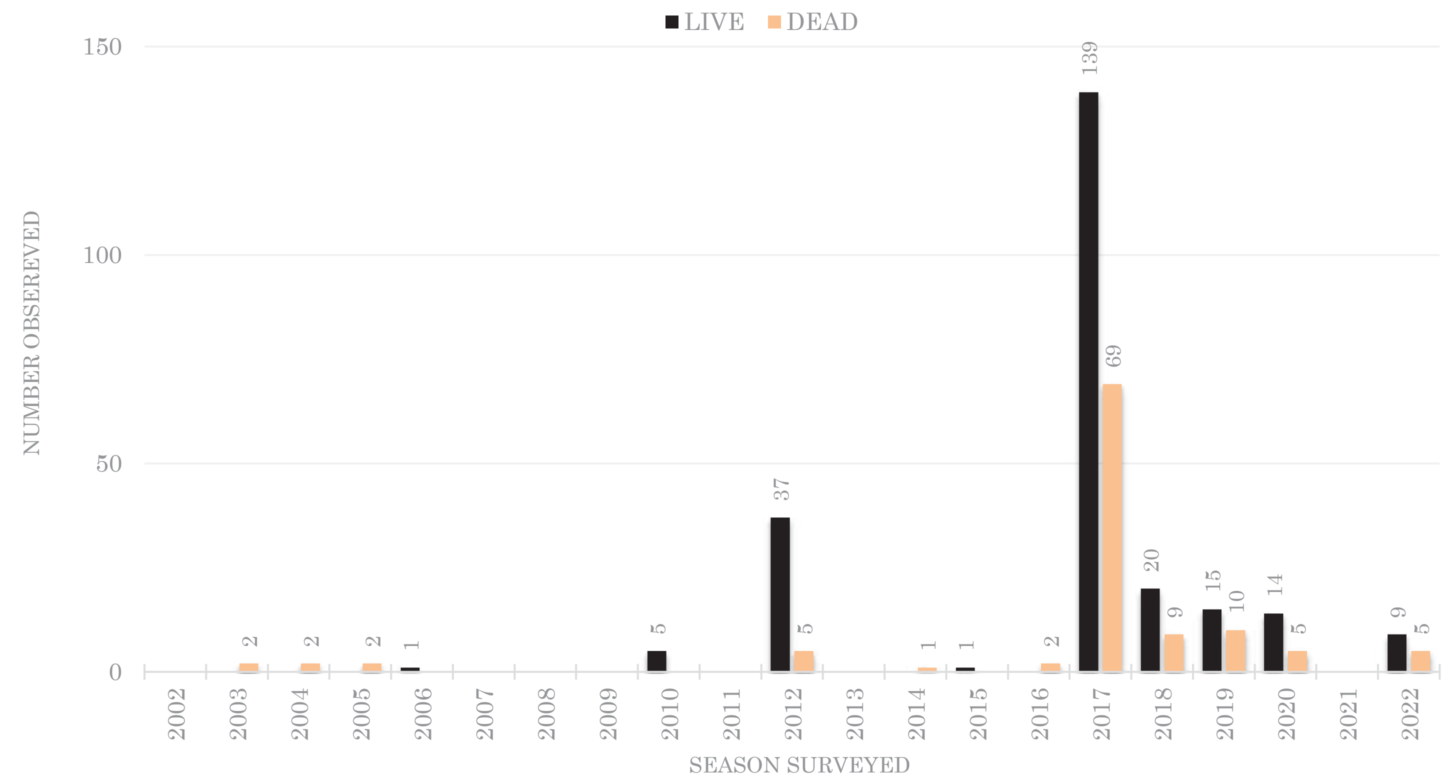

Haire wetlands

Just downstream of the detention pond, the creek flows through a short narrow channel and under Pioneer Way E. Much of the channel is confined by rip-rap. The RMZ along this short stretch is extremely poor and heavy erosion is occurring along the left bank. The creek then flows a few hundred feet before reaching the Haire Wetlands. Some restoration work has been completed in the past on the lower reach of the creek. In 2001, a 12-acre site located just downstream of Pioneer Way was utilized to develop a side channel for overwintering juveniles and as a means of reconnecting Swan Creek to the Haire Wetlands. In addition, the restoration included the removal of invasive and non-native plant species, and replanting the area with native trees and shrubs. The City of Tacoma financed the Haire Wetlands restoration site along Clear and Swan creeks through the Natural Resource Damages Assessment Program (NRDA).

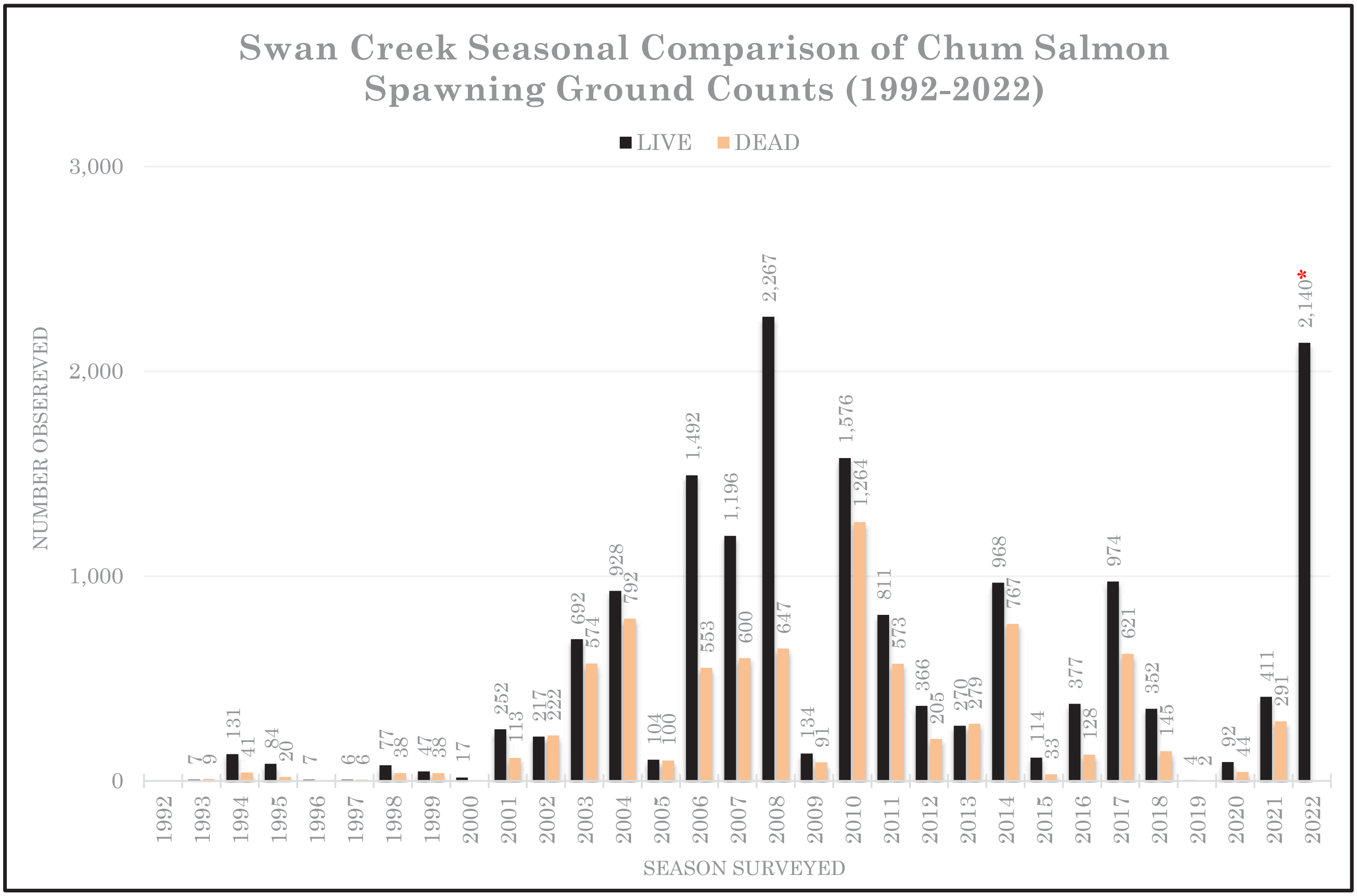
2022 Swan Creek Coho Salmon Spawning Ground Counts and Run Timing



Swan Creek Seasonal Comparison of Coho Salmon Spawning Ground Counts (2002-2022)



2017-2022 surveys conducted, and data provided by University of Washington, Tacoma.



*2022 chum were linve surplus plants from PTF hatcheries.

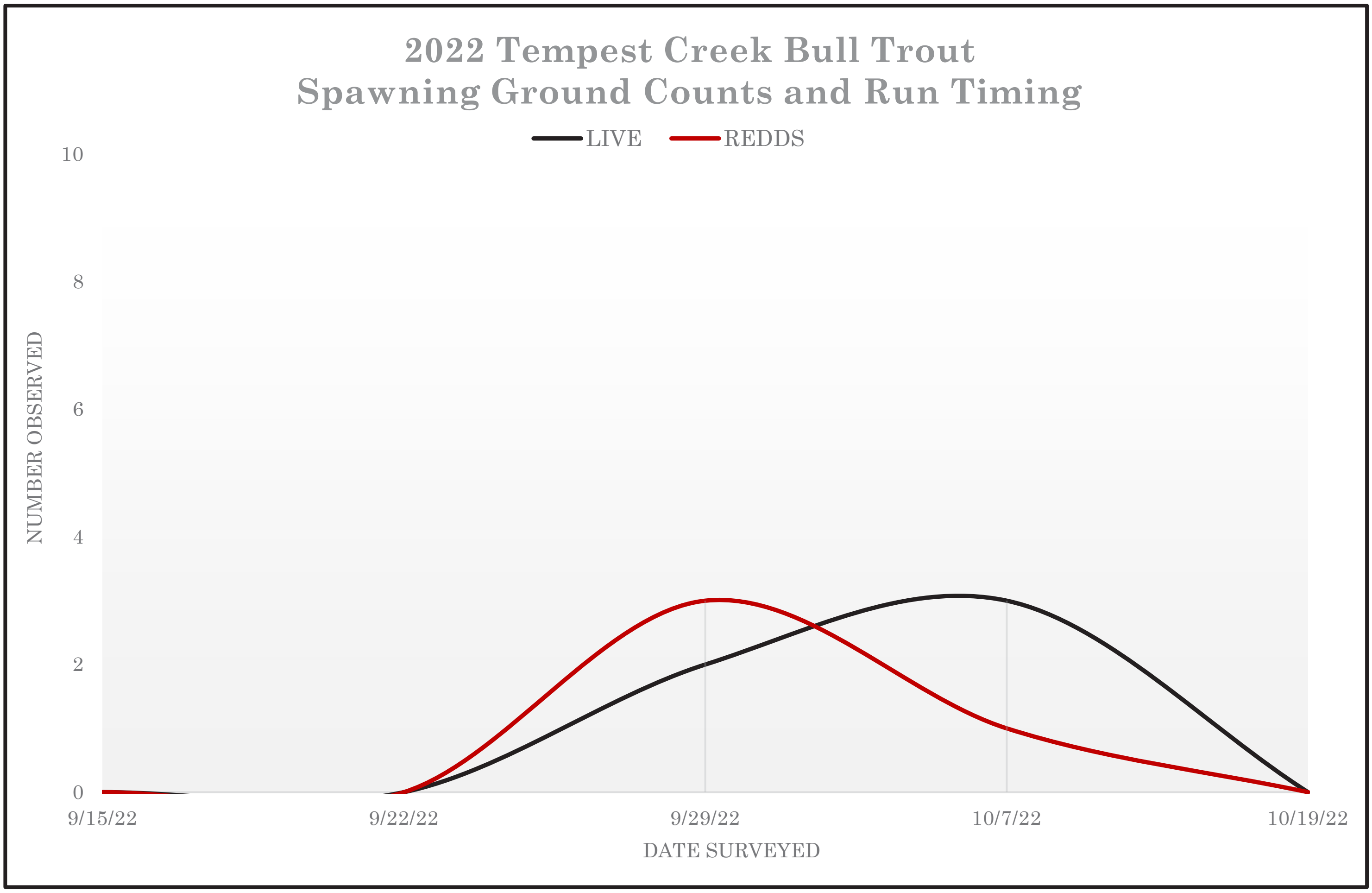
TEMPEST CREEK

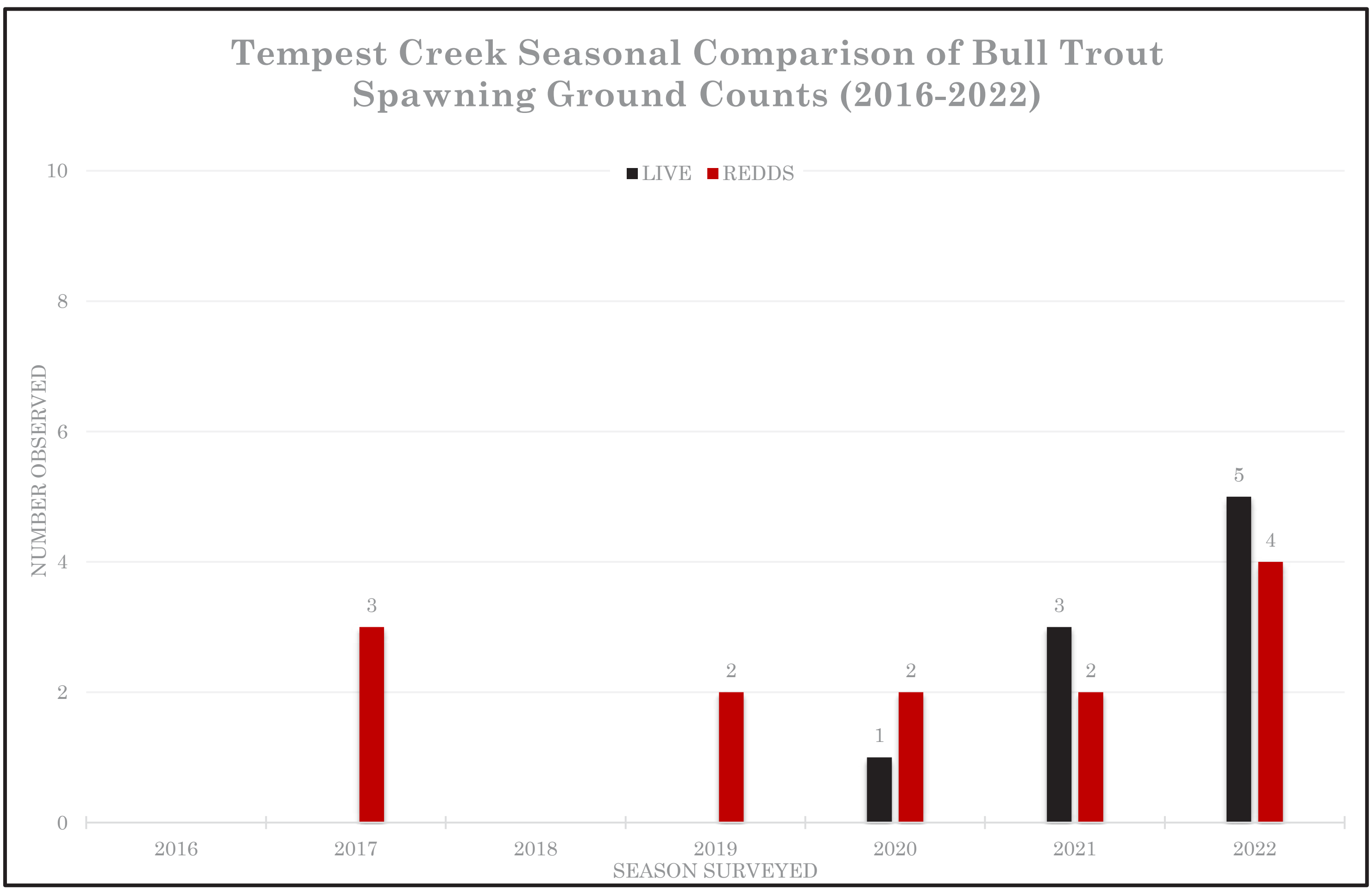
Tempest Creek is not the officially designated name for this stream; however, as a means of convenient identification, it's referred to as "Tempest Creek" by PTF staff. The Creek doesn't appear on the hydrology of most mapping systems and has no WRIA designations. Tempest Creek, located outside of Mt. Rainer National Park, is a small left bank headwater tributary joining with the Mowich River at approximately RM 5.8; which is just downstream of the North Fork and South Mowich confluence. This drainage *(elevation 2300′ at mouth)* is a north facing stream *(total stream length unknown)* providing 500′+ of anadromous habitat which is profoundly contingent on the frequency and intensity of mainstem river incursions. Fortunately, this anadromous channel reach provides excellent habitat for bull trout rearing and spawning when stream flows are sufficient. Spawning gravel availability is moderate, as are logjams and in-channel LWD. A few small pools and side channels provide excellent habitat for juvenile and adult fish utilizing the creek.

Chinook spawning in Tempest Creek (Mowich River Plant).

Tempest provides essential conditions for salmonid rearing and spawning by offering summer thermal refuge and protective overwintering habitat. PTF began surveying this creek for bull trout spawning activity/escapement in 2016, and the creek has demonstrated itself to a consistent bull trout spawning tributary in the Upper Mowich basin. Spawning surveys are conducted from early-September through mid-October. Although bull trout spawning has been consistent in this tributary, it does not parallel the spawning frequency/density or elevation experienced in many streams located in the White River basin. Also, at approximately 2300′ of elevation, Tempest is the second lowest elevation stream *(Meadow Creek @ 2250′)* in the Puyallup/Mowich basin to have documented bull trout spawning.

Similar to many headwater tributaries within the national park, the lower 500′+ of the creek is comprised of a narrow, low gradient channel flowing within the open channel migration zone of the Mowich River floodplain. Although spawning may occur throughout this small reach, opportunities can become acutely limited due the lack of quality spawning substrate created by the fine alluvial deposits from the Mowich River, and like many wall-based tributaries the lower creek channel is repeatedly manipulated and affected by mainstem river flows. However, even in the face of mainstem incursions, bull trout are frequently observed spawning in pockets of moderate-to-heavily influenced glacial mix water.


2022 Tempest Creek Bull Trout
Spawning Ground Counts and Run Timing
LIVE
REDDS
10
8
6
4
2
0
NUMBER OBSERVED
9/15/22
9/22/22
9/29/22
10/7/22
10/19/22
DATE SURVEYED


Tempest Creek Seasonal Comparison of Bull Trout
Spawning Ground Counts (2016-2022)
LIVE
REDDS
10
8
6
4
2
0
NUMBER OBSERVED
3
2
1
2
3
2
5
4
2016
2017
2018
2019
2020
2021
2022
SEASON SURVEYED

VOIGHTS CREEK

WRIA 10.0414

Voights Creek is a tributary to the lower Carbon River, entering the Carbon at RM 4.0 just southeast of the city of Orting. Voights Creek originates along the northwest foothills of Mt. Rainier, just west of Martin Peak and north of the Mowich River. The creek flows for nearly 20 miles in a northwest direction until it joins the Carbon River. Encompassing a drainage area of nearly 23 mi^2, the mainstem creek offers nearly 4 miles of anadromous usage; in addition, a small tributary enters Voights at RM 0.7 *(Coplar Creek)*. Unfortunately, Coplar Creek does not contain suitable spawning habitat, but does offer good overwintering habitat for juveniles. The anadromous habitat available in Voights supports Chinook, coho and steelhead; as well as occasional pink and chum spawners. Other species present include cutthroat, sculpin and lamprey. A range of fish and habitat limiting factors associated with Voights Creek include: erosion, flooding, water quality *(temperature)*, channel confinement, loss of off channel habitat and a disconnected flood plain on the lower reach.

The Washington Department of Fish and Wildlife operates a salmon hatchery located at RM 0.5. The newly constructed facility, which replaced the old flood prone facility, began operations in 2015. The current hatchery facility rears Fall Chinook *(Chinook propagation initiated circa 1917 from local and lower Columbia River stocks).* WDFW has artificially propagated coho on Voights Creek since 1917, having in the past incorporated fry and smolts from other drainages including Big Soos Creek, Minter Creek, Garrison Springs, George Adams Creek; as well as the Skagit and Washougal rivers. Voights Creek currently produces approximately 800K *(formally 1.2 million)*, 100% mass marked *(adipose fin clip)* coho pre-smolts annually; of which, 100K-to-200K are customarily transferred to acclimation ponds in the upper Puyallup Watershed when available. Extreme high water temperatures in June and July of 2015 resulted in the loss of 60% of program coho pre-smolts. Ideally a ground water well can be installed in the future to temper peak temperatures. In addition, hatchery rearing 200K+ Fall Chinook *(current acclimation pond production is 100K)* for acclimation ponds in the upper Puyallup River is a key component to restoration goals. The Puyallup Tribe currently operates two acclimation ponds in the Upper Puyallup River Watershed. Acclimation ponds are a proven method for increasing fish numbers on the spawning grounds. The acclimation ponds are used for enhancing Fall Chinook *(reared at PTI's Clarks Cr. hatchery)* and coho reared at WDFW's Voights Creek hatchery, into a 26+ mile reach of the Upper Puyallup River above Electron Dam *(RM 41.7)*. The Electron diversion dam had been an anadromous barrier for nearly a century *(1904-2000)*. In addition to the rearing and acclimation of juveniles, surplus live adult Fall Chinook and coho from the WDFW Voights Creek hatchery are planted in the upper Puyallup River drainage when surplus fish are available.


Voights Creek falls

The Puyallup Tribe has been hauling surplus adults from Voights Creek and planting them in the upper Puyallup Watershed since1997.

Puyallup River Fall Chinook are endemic throughout the Puyallup River, Carbon River, Lower White River, as well as several of the tributaries associated with these mainstem river systems. A large component of adult Fall Chinook spawners are hatchery origin from the WDFW Fall Chinook program operated on Voights Creek. Voights Creek is currently surveyed for adult steelhead spawning activity only.

Throughout its anadromous length, Voights Creek varies greatly in channel complexity. The lower mile is confined by armored banks and levees, with large segments of significantly deficient riparian cover and negligible instream LWD. The extreme high water event of 2009 caused the creek channel to avulse just upstream of the former diversion dam/ hatchery water intake. The new channel currently runs just north of the old channel, then reconnects with the older established channel just upstream of Hyw162. The new channel provides few spawning opportunities. Continuing upstream, the channel begins to encounter the influences caused by increasing elevation as it ascends out of the valley floor. The gradient increases slightly; however, the channel is no longer confined, thereby allowing the creek to branch out creating several braids and significant side channels over the next 0.8 miles. The riparian throughout this section is well intact and there is a significant increase in LWD and debris jams.

Near RM 2, the valley walls close in tightly and the channel is naturally restricted to a defined, moderate sized channel and with narrow gorges. The surrounding riparian is primarily a mix of 2nd growth conifer and deciduous trees. Nearly the entire 2 mile reach, from the old hatchery water diversion to the falls, is a moderate gradient channel containing excellent, although somewhat sporadic patches of

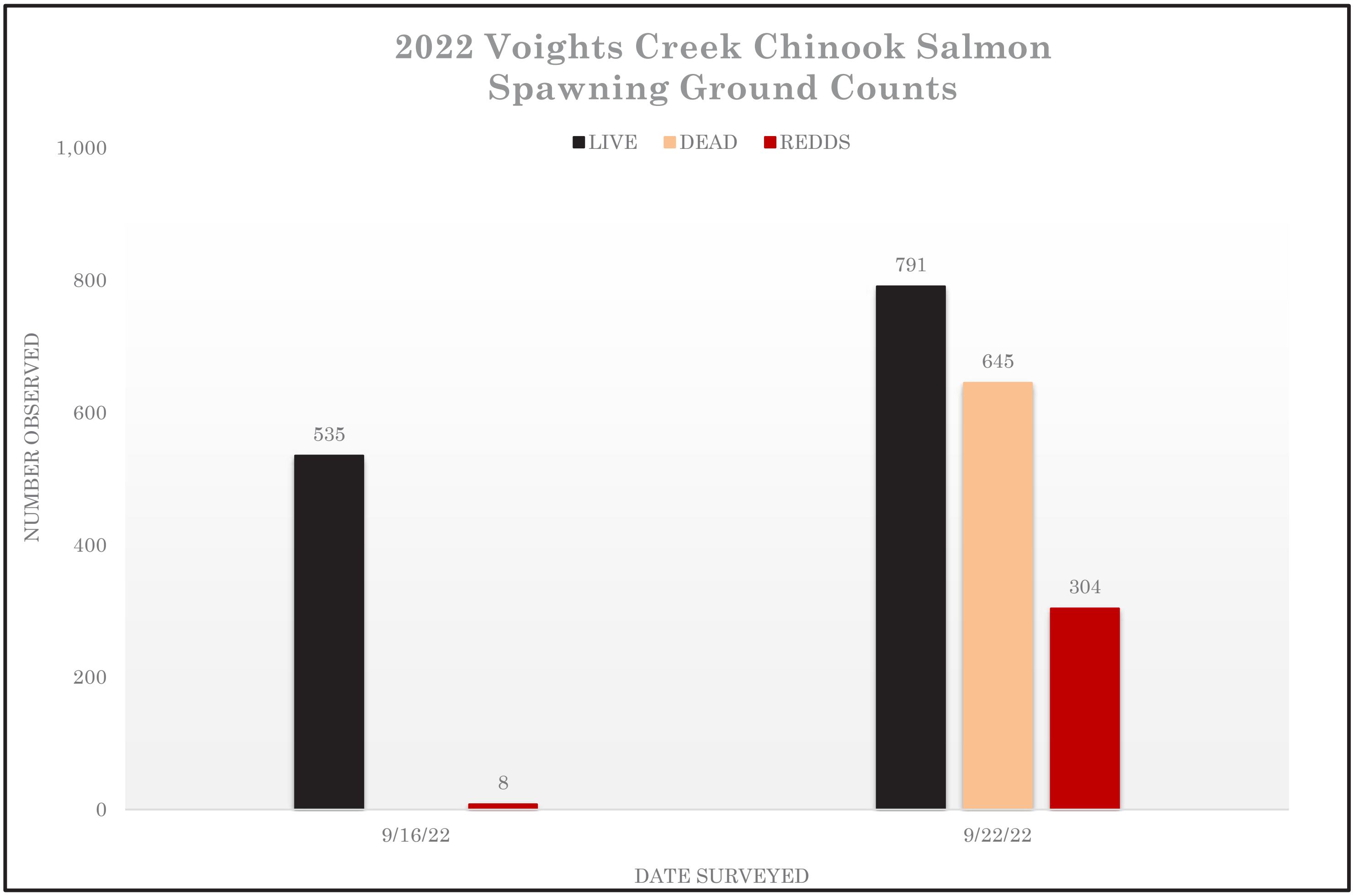

Juvenile steelhead

gravel. Several pieces of LWD and significant log jams are present throughout this reach as well. Several large mass wasting's are present along the hills and slopes of the upper reach above the gorge, contributing substantially to LWD and gravel inputs

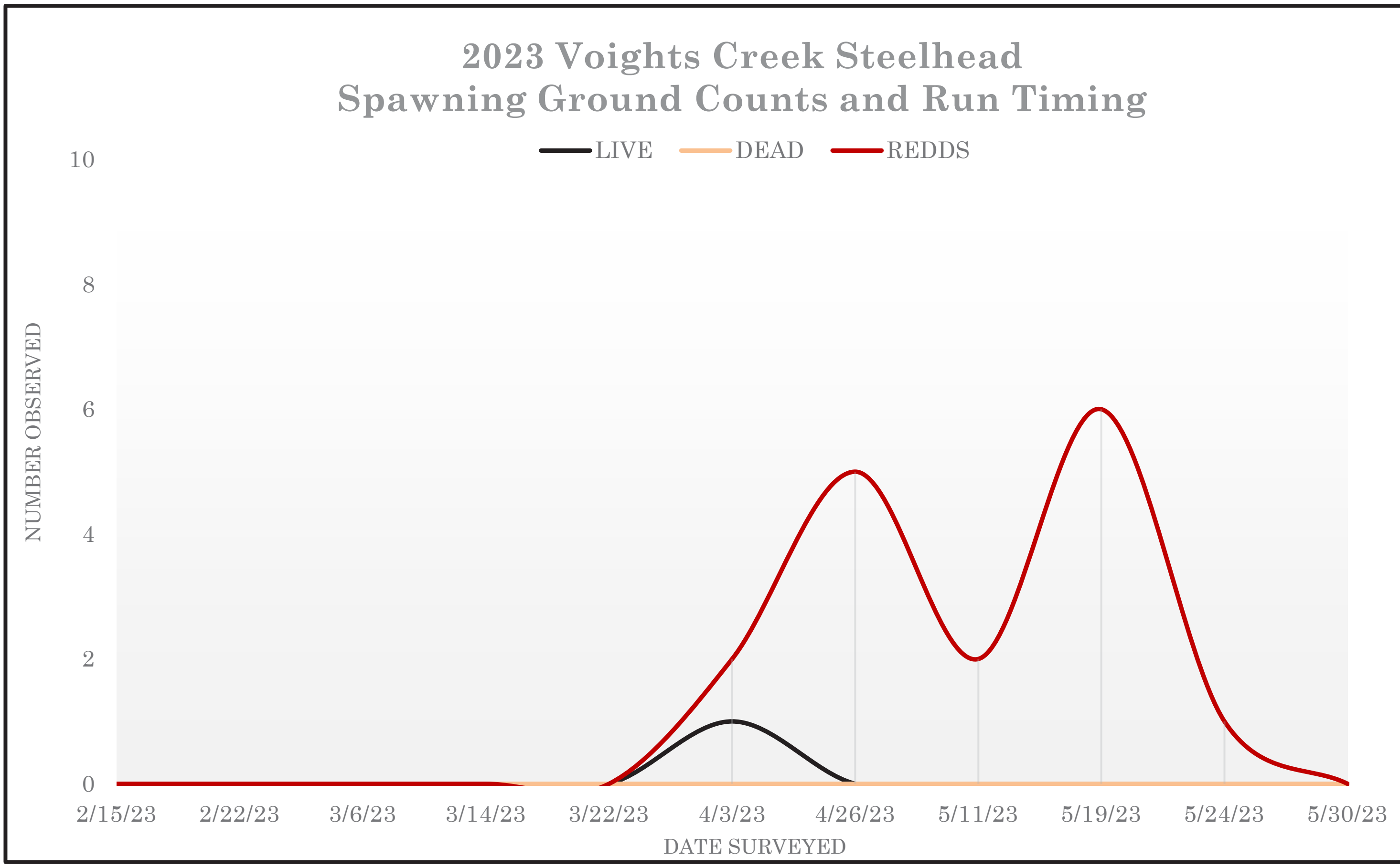

Juvenile coho

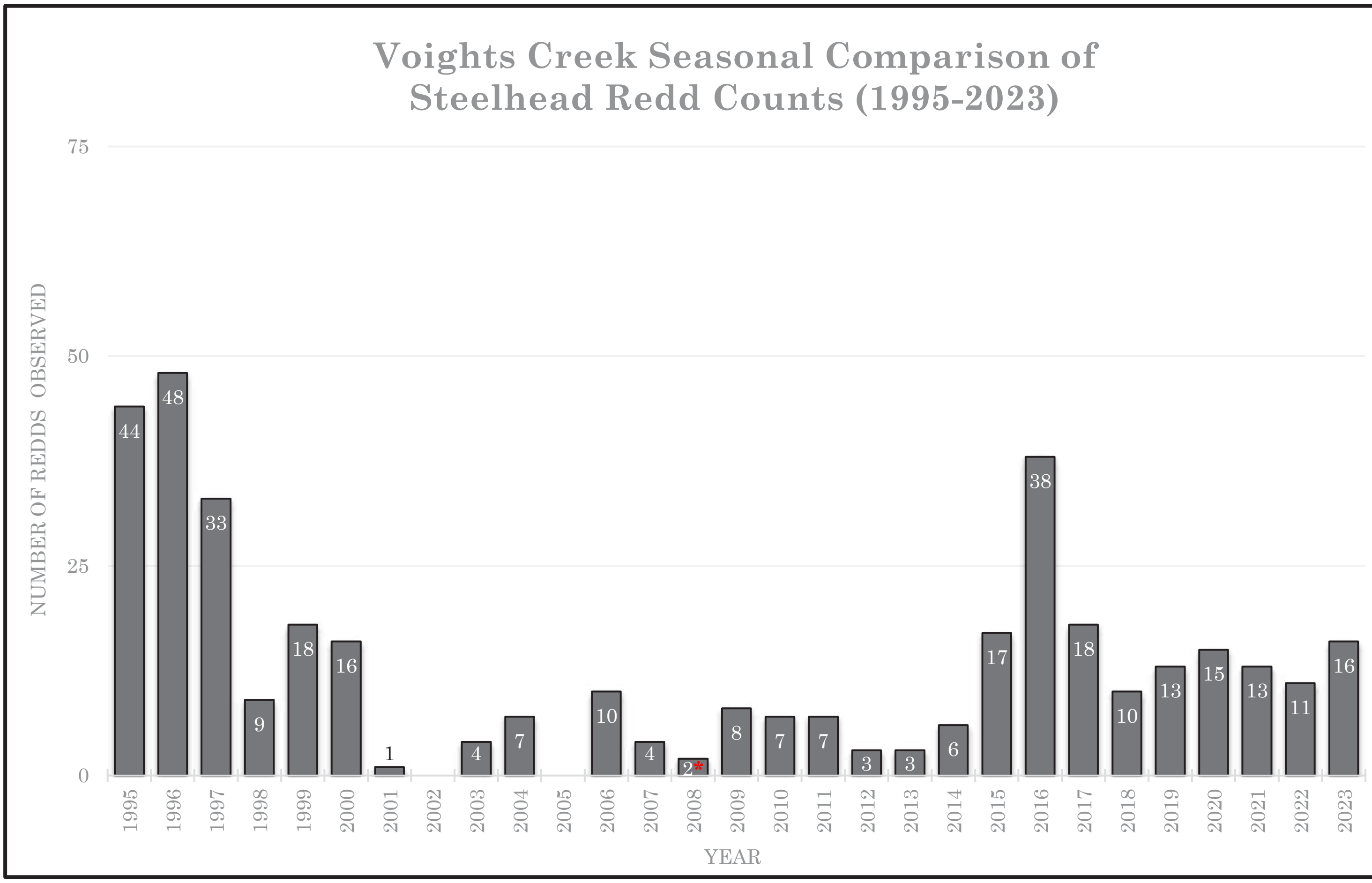
downstream.

An impassable falls located at RM 3.9 blocks any further upstream migration *(top left)*. Steelhead spawning activity is observed throughout the entire 3.4 mile stretch above the hatchery. Unfortunately, steelhead escapement in Voights Creek has dropped over the past two decades. On average, winter steelhead populations in the Puyallup basin have been declining for the better part of the past three decades. The steep decline observed in steelhead escapement over the past several years has created serious concern among fisheries managers. Factor(s) responsible for the decline in steelhead escapement are unknown.

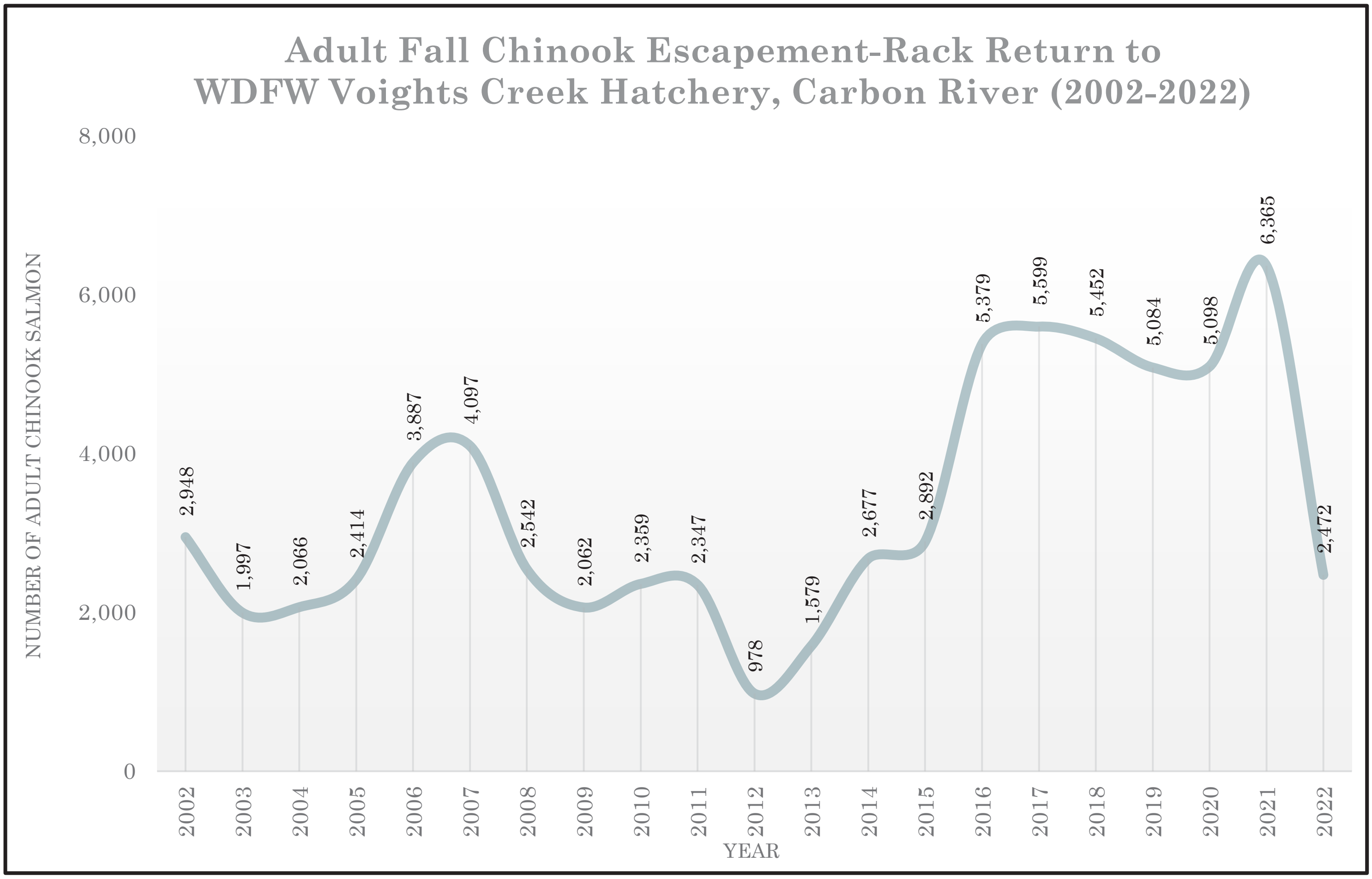


During the 2022 season, Chinook salmon were allowed access to the three miles of habitat above Voights Creek Hatchery. Chinook were observed spawning throughout the entire reach. See Appendix C for Chinook spawning site locations.

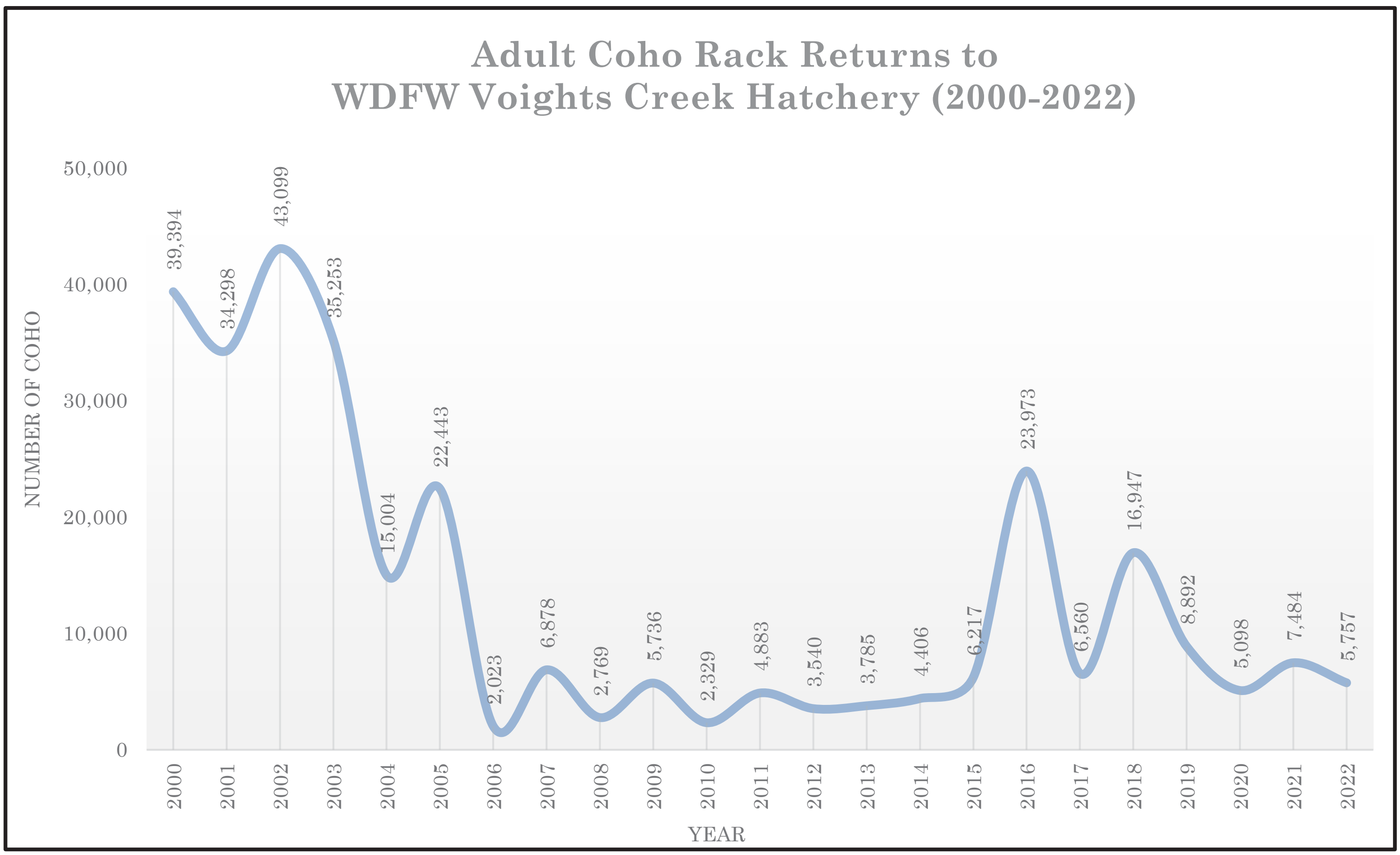




*The 2008 redd data is incomplete due to extremely poor survey conditions and access issues which prevented a regular full season of surveys. To determine the total escapement for steelhead, each redd is multiplied by a factor of 1.62 *(i.e. 42 redds x 1.62 steelhead per redd = total escapement of 68 steelhead)*. See steelhead redd location map in appendix C.



Data source: Washington Department of Fish and Wildlife http://www.wdfw.wa.gov/hatcheries/escapement/



Data source: Washington Department of Fish and Wildlife http://www.wdfw.wa.gov/hatcheries/escapement/

WHITE RIVER

WRIA 10.0031

The White River *(Stuck)* is a vast and dynamic glacially driven river system. The headwaters of the White originate from the Emmons and Fryingpan glaciers on the north face of Mt. Rainier. Flowing 76.7 miles from its mountain source to its eventual confluence with the Puyallup River; the White River Watershed drains an area of nearly 494 mi^2, slightly larger than the Puyallup River drainage. However, the White and Puyallup drainages are often viewed and managed as two distinct and separate entities. This management approach is due in part because prior to 1906, the White River did not flow into the Puyallup. Salo and Jagielo *(1983)* described that prior to 1906; the majority of the White River flowed north towards Elliot Bay. Yet, some of the water from the White often flowed south to the Puyallup through the Stuck River channel. In November of 1906, a flood event mobilized a tremendous amount of wood debris that blocked the north flowing channel in what is now downtown Auburn. The blockage forced the river to avulse and find a new channel. This newly created diversion sent nearly the entire White River flow down through the Stuck River channel into the Puyallup, more than doubling the size of the Puyallup River drainage. In 1915, a concrete structure was constructed, thereby permanently diverting the White River into the Puyallup.

Significant tributaries of the White include the West Fork White River, Huckleberry Creek, Boise Creek, Clearwater River, and the Greenwater River. The White River Watershed provides critical spawning and rearing habitat for several salmonids including several ESA listed species such as; native White River Spring Chinook *(bottom image)*, winter steelhead, and bull trout. Other non-listed species include coho, pink, chum, sockeye, rainbow, cutthroat, and whitefish. These tributaries, with the exception of the West Fork White River, are described in this report.

All adult salmon and steelhead that spawn in the Upper White River and its tributaries are initially captured in the USACE fish trap in Buckley; then transported above Mud Mountain dam *(RM 29.6)*. Since precise escapement numbers for the Upper White River drainage are known, surveys are conducted to determine fish distribution and spawning success. This is especially important regarding Spring Chinook, since adult production monitoring is part of the recovery plan.

The availability and nature of fish and stream habitats are not static conditions and are frequently altered. The habitat descriptions in this report provide a general analysis of habitat conditions, and are not intended to fulfill the requirements of a rigorous biological assessment/evaluation. The systems glacial origin is responsible for the turbid conditions that are most noticeable during warmer weather experienced during late spring and summer. The White River conveys a tremendous volume of bed load material which contributes to the dynamic nature of the system. The high sediment loads are responsible for the anastomosing channel morphology characteristic of broad valley segments. This condition is most prevalent in the upper reaches within and immediately outside the National Park boundaries *(river miles 56 to 71 – top image on previous page).* The entire White River provides vital migrating, foraging and rearing habitat for bull trout. Although the upper headwaters provide reduced mainstem spawning opportunities, the pristine and unspoiled tributaries in the National Park provide the majority of the critical bull trout spawning and rearing habitat within the system. Mt. Rainier National Park protects/preserves over 369 square miles *(236,381 acres)* of wilderness and aquatic habitat. Sunrise Creek *(RM 63)*, located 2.5 miles inside Mt. Rainier National Park, marks the highest salmon *(pink)* migration point documented by PTF staff.

Downstream of the NPS boundary near RM 61, the mainstem river; as well as many of its tributaries, course through industrial forestlands including National Forest, but primarily within private timber company ownership. Much of these forestlands have been harvested at least once and in many cases twice. Lands in timber production areas are often densely roaded with some sections approaching six linear miles per square mile. Roads have contributed to many of their trademark problems such as landslides, slope failures, altered hydrology, culvert and bridge projects that can effect upstream migration, and of course higher levels if sedimentation within effected drainages. In contrast to the headwaters reach, mainstem spawning opportunities are frequently available throughout much of the upper mainstem from RM 55 downstream to Mud Mountain Dam *(MMD)* at RM 29.5. Chinook, coho and pink salmon have all been observed spawning in the lower velocity margins of the mainstem within this section.

The West Fork White River entering at RM 49.2 on the left bank is glacially driven as well, and is characterized by generally unconfined, complex anastomized channels. Abundant spawning gravels are present in pool tail, as well as the margins and low velocity areas along the lower river. Woody debris is abundant, although much of it has been deposited too high to interact with the regular seasonal flows. To a great extent, the overstory riparian zone is either second growth conifer or hardwoods; except for the zone through Mt. National Park which consist of mostly old growth. Several tributaries including Pinochle, Cripple and Wrong creeks; frequently support Chinook, coho and pink spawners. In addition, the clear headwater tributaries of the West Fork, specifically Lodi Creek, provide several key spawning and rearing opportunities for bull trout.


Lower White River (RM 0.5).

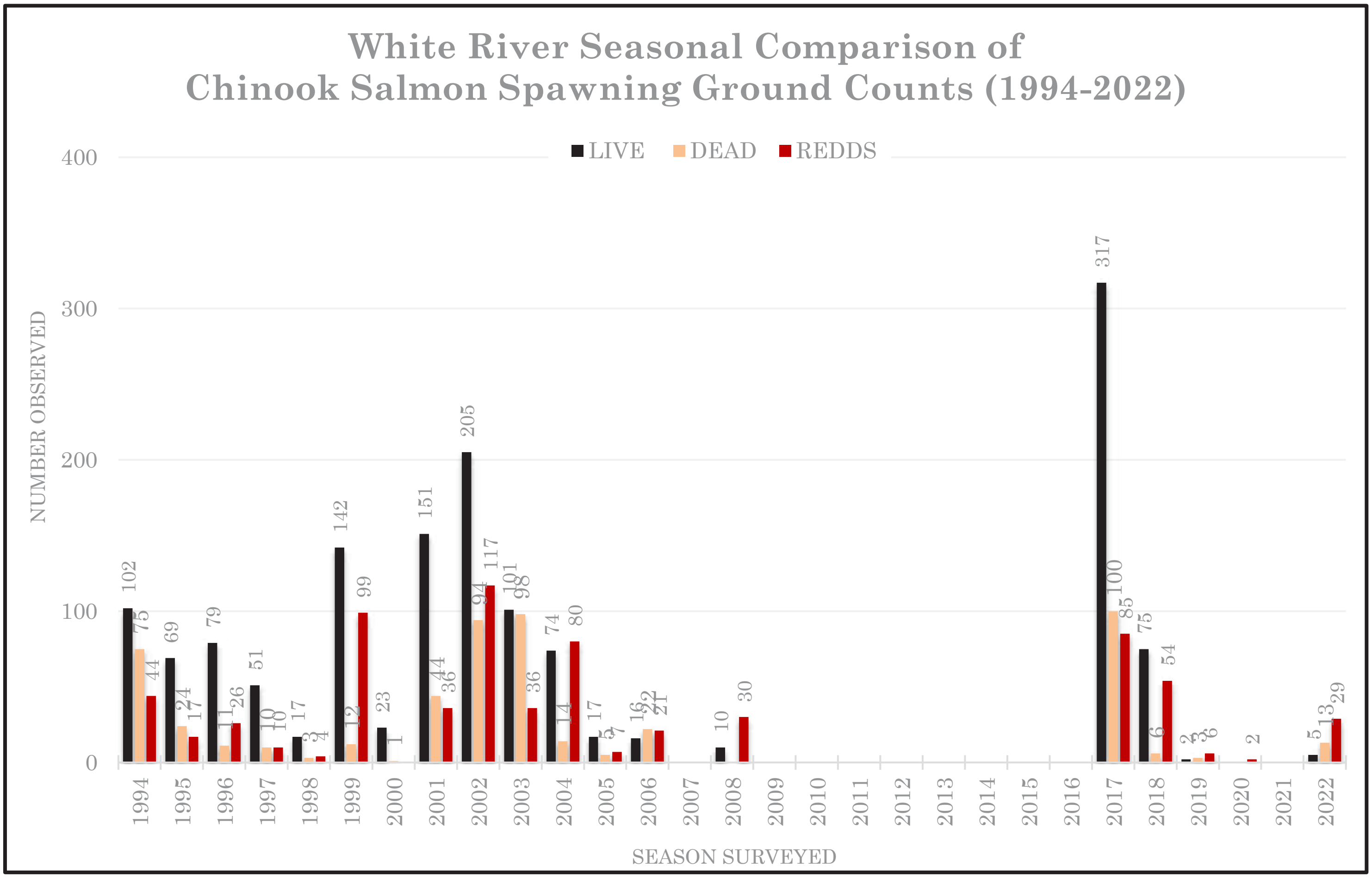
Mud Mountain Dam is an earthen dam built for flood control *(completed in 1948)* and is a complete blockage to upstream migration. Mud Mountain Dam is also suspected of causing increased mortality among downstream migrants, and is also the cause of frequent downstream flow manipulation. However, the magnitude of impacts to fish and the aquatic biota when dropping or dewatering over 29 miles of critical habitat cannot be over stated. Ongoing research is being conducted concerning impacts of Mud Mountain Dam on survival of downstream migrants passing through the dam. Upstream fish passage is accomplished by capturing fish downriver in Buckley and transported/releasing them back into the White River approximately 2 miles upstream of MMD. The Corps' trap & haul facility. The U.S. Army Corps of Engineers' *(USACE)* fish trapping facility *(circa 1948)* is located at RM 24.3 near the city of Buckley. Construction of the new diversion dam and Fish Passage Facility (FPF) facility began in June of

2018, and initial operation began late-2020. Salmon, steelhead, bull trout and other native fishes *(mountain whitefish, rainbow & cutthroat)* migrating to the upper White River enter this trap and are transported above Mud Mountain Dam. There is approximately 5 miles of suitable habitat between Mud Mountain Dam and the USACE Buckley trap at RM 24.3; unfortunately, only modest spawning at best takes place due to lack of fish access between the two sites. Since Puget Sound Energy *(PSE)* ceased power production *(2004)*, instream flows have increased considerably in the by-pass reach *(RM 3.6-24.3)*. Thus far, some measure of water has continued to be diverted from the river to maintain the water levels and water quality in Lake Tapps. However, the effect on fish passage is the same; a small percentage of fish will fall back downstream below Mud Mountain and utilize this disenfranchised reach of the river between the two fish passage barriers.

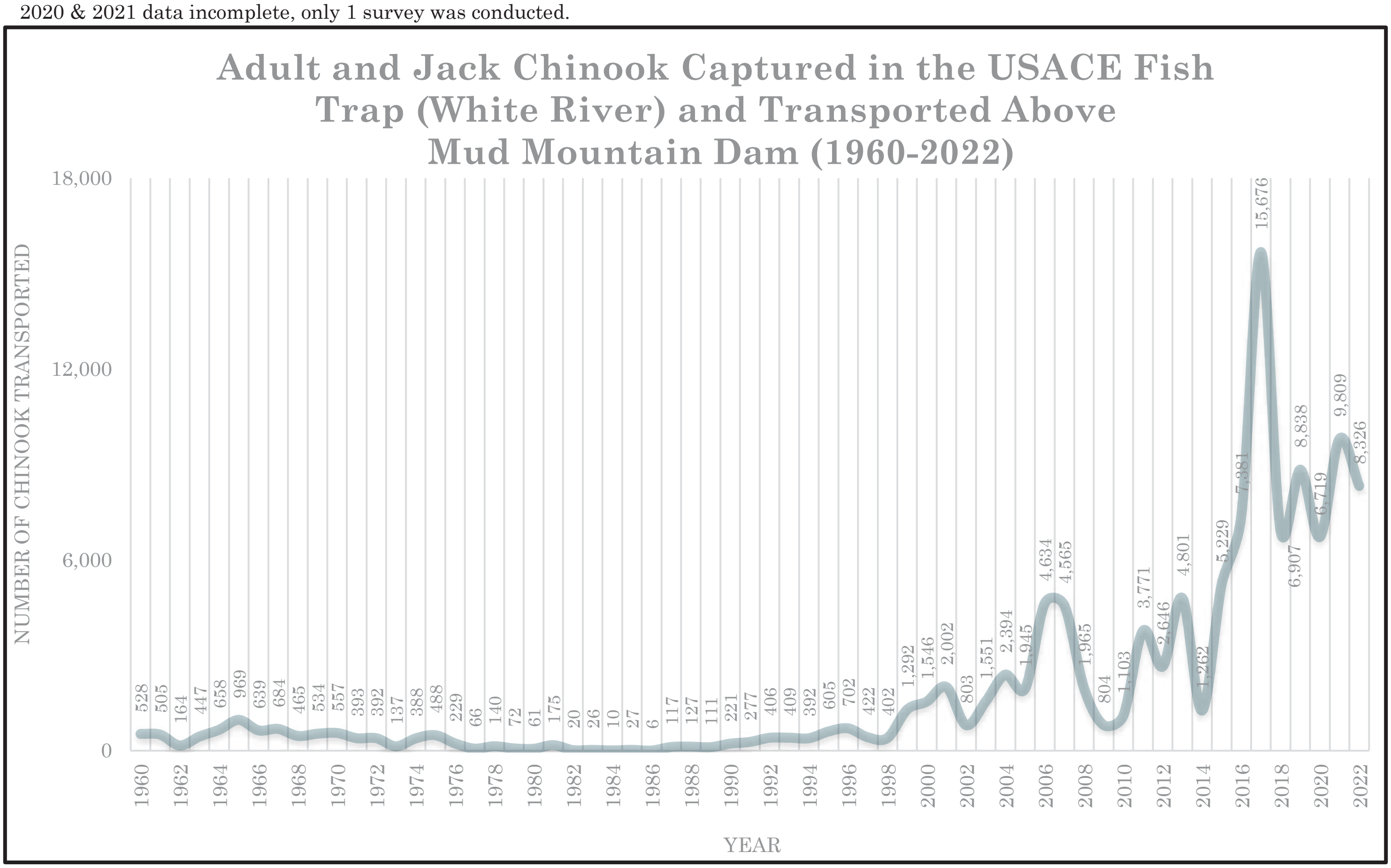
Downstream of the diversion dam at RM 24.3; to approximately RM 11, there is frequent and concentrated use by Chinook, pink, coho and steelhead. Some chum spawning activity takes place within this reach as well; however, the majority of chum spawn below RM 15. There are side channels, as well as LWD and log jams contributing to the complexity of the lower River. This reach provides numerous spawning and rearing opportunities. Downstream from approximately RM 11, the channel is constrained by levees. The channel from this point loses some complexity and there is a marked decrease in both spawning gravel and spawning activity of all species.

In 2016, the Puyallup Tribe initiated the White River Juvenile Salmonid Production Assessment Project. Project funding is provided by the King county flood control district through a cooperative watershed management grant. Puyallup Tribal Fisheries Department initiated the project to estimate juvenile production of native salmonids. The study project focuses on all salmon, with an emphasis on natural Spring and Fall Chinook salmon production and survival of hatchery and acclimation pond Chinook. In late winter of 2016, a newly constructed trapping platform employing an E. G. Solutions 8-ft diameter rotary screw was put into place on the lower White River *(see following White River Juvenile Salmonid Production Assessment Project section in this report)*.

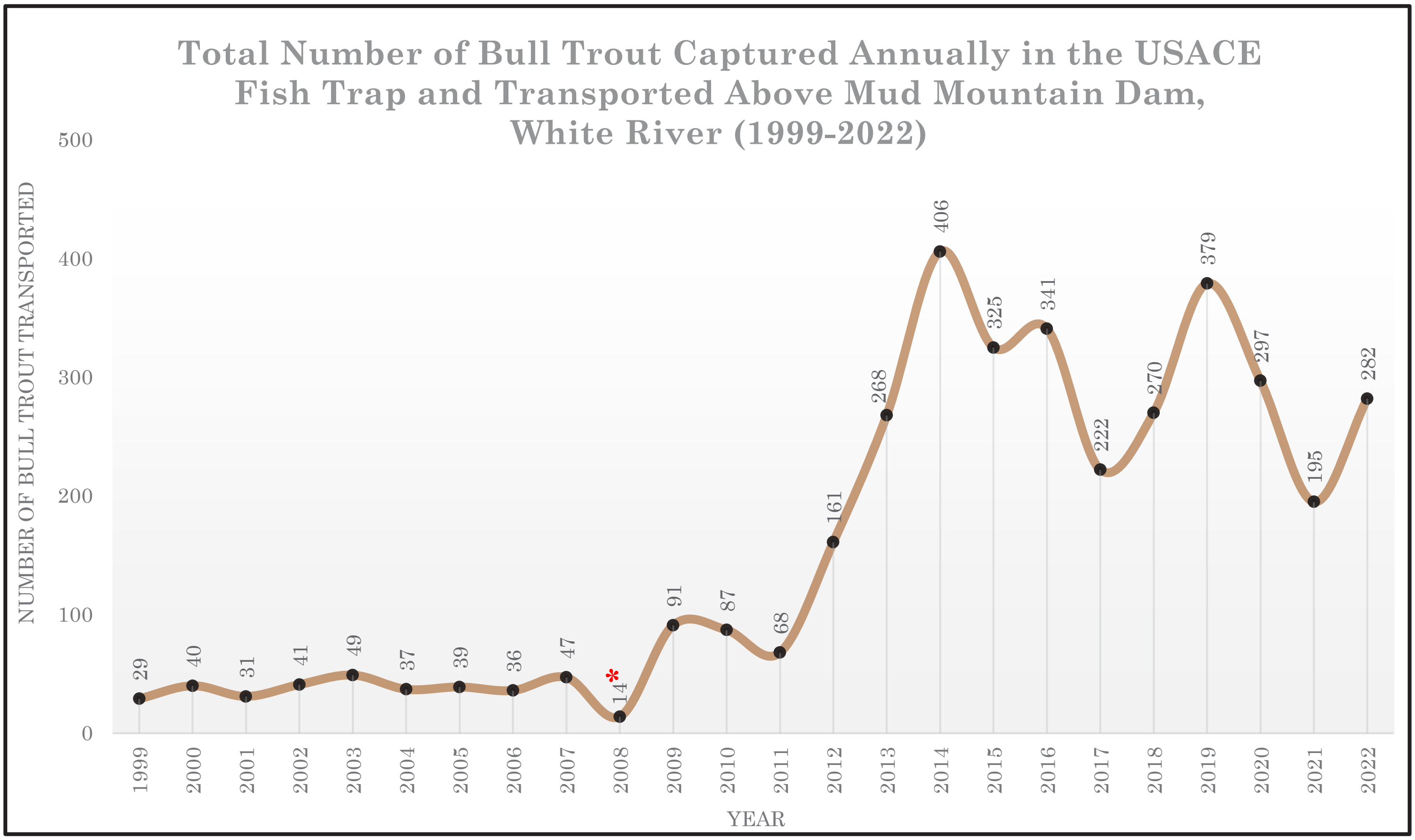

Upper White River inside Mt. Rainier National Park.



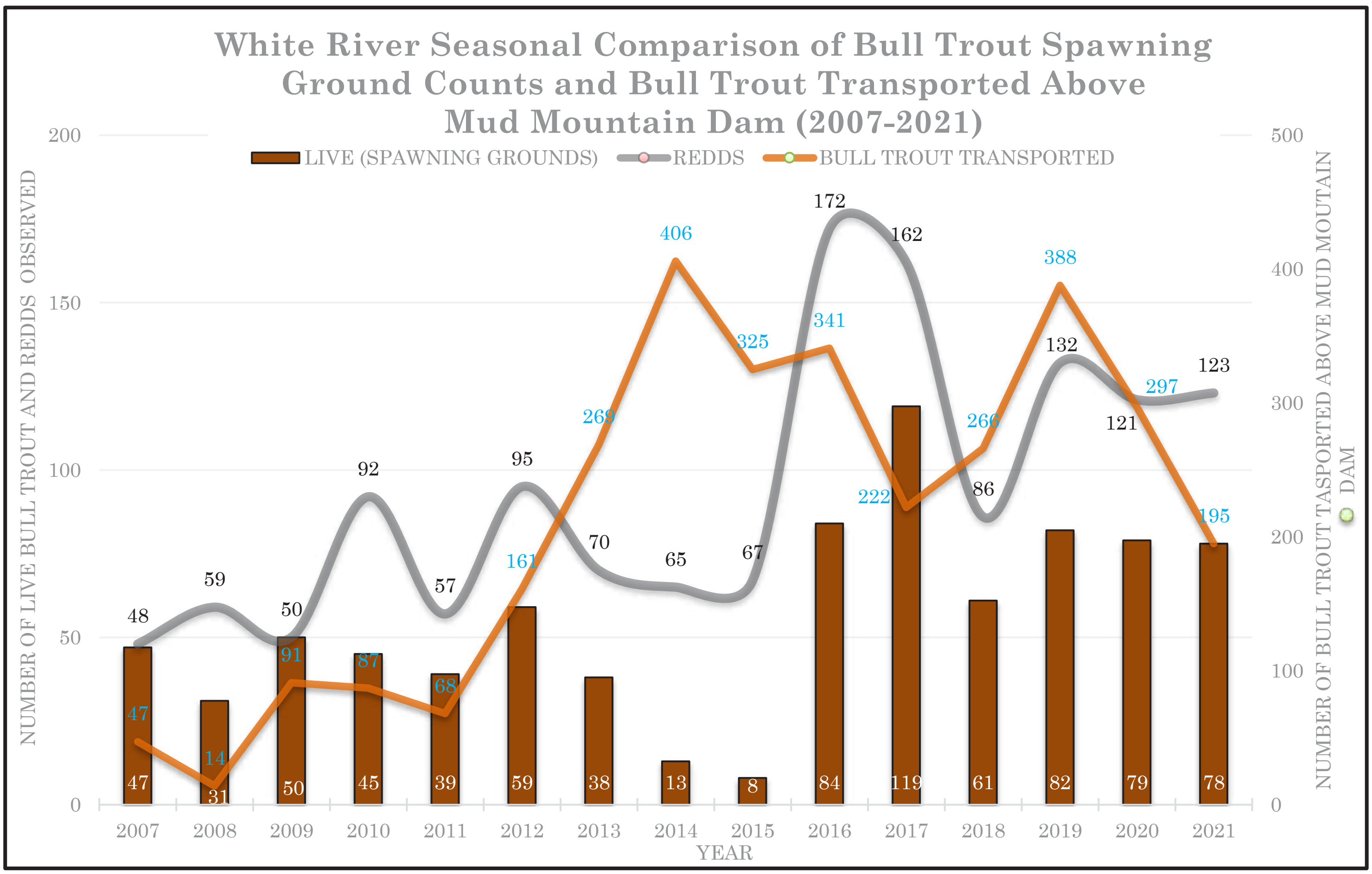
2020 & 2021 data incomplete, only 1 survey was conducted.



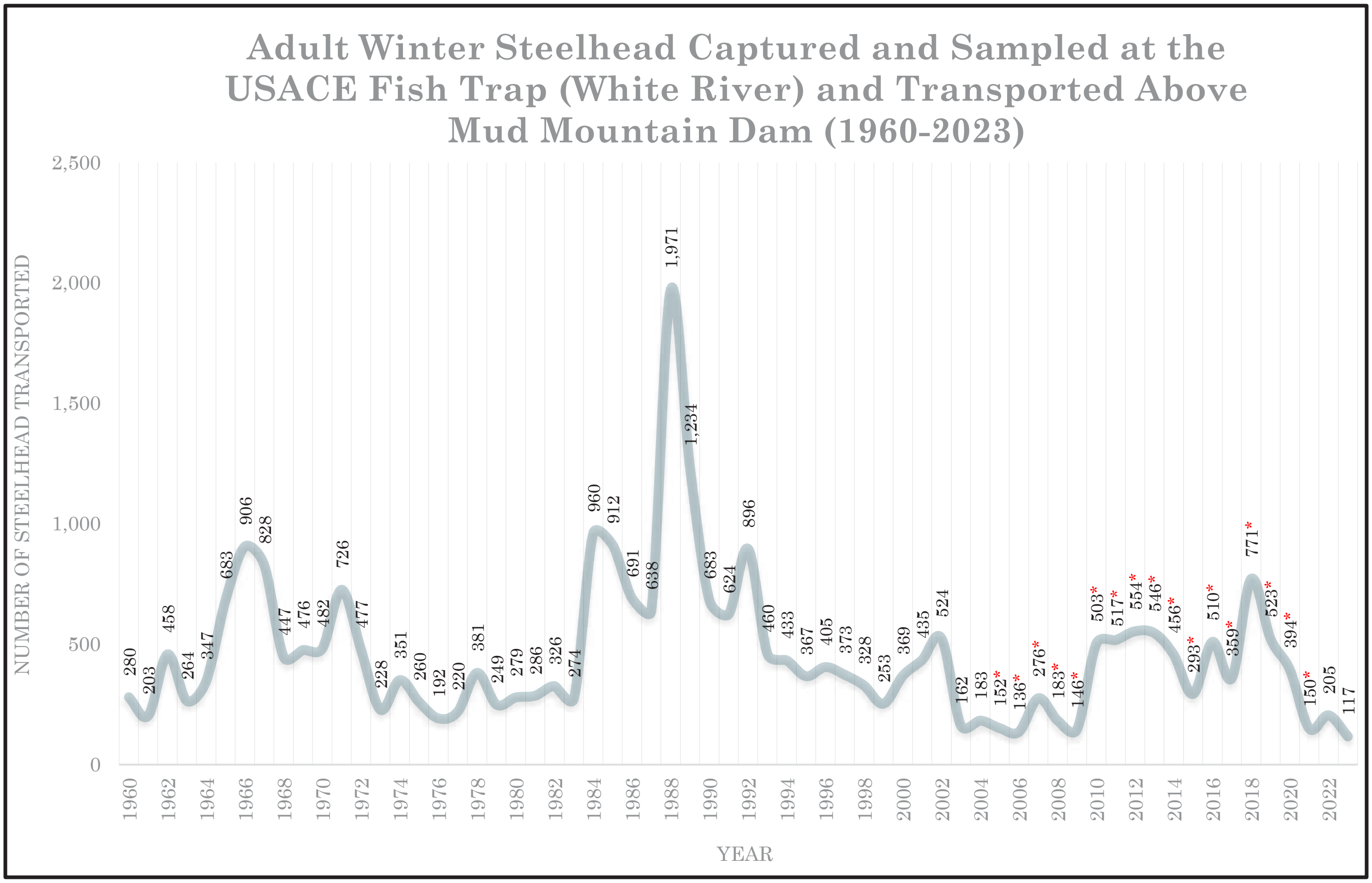
See Appendix E for data on Chinook return and age composition (NOR & Hatchery). Chinook totals include both Spring and Fall Chinook stocks. Data source: USACE website http://www.nws.usace.army.mil/Missions/CivilWorks/LocksandDams/MudMountainDam/FishCounts.aspx



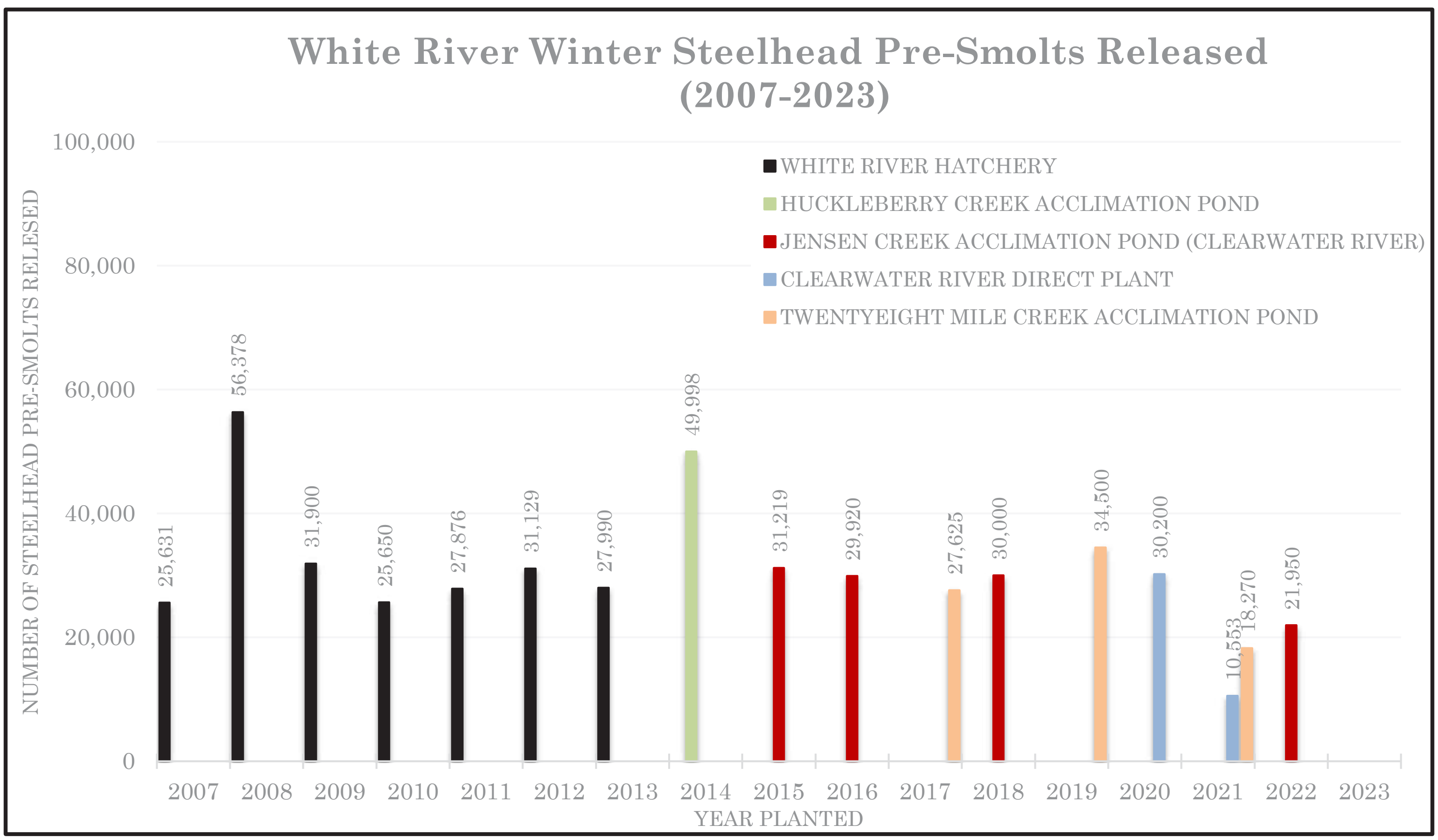
2022 data indicates the number of bull trout transported through October 30th. *The low number of bull trout captured in 2008 is likely due to significant complications which occurred with trapping operations.



Data sources: Puyallup Tribe and National Park Service (MORA).



The graph above details the number of steelhead transported above Mud Mountain Dam. *Additional steelhead captured in the trap from 2006-2021 were taken as brood-stock for the White River steelhead supplementation project (Program discontinued in 2022 due to insufficient brood-stock availability). See Appendix F or following page for the breakdown of steelhead returns.



Acclimation ponds opperated by Puyallup Tribe. See map of acclimation pond location sites in Appendix D.

Winter Steelhead Adult Returns Sampled at USACE Fish Trap and Pre-Smolts Released, White River (2011-2023)

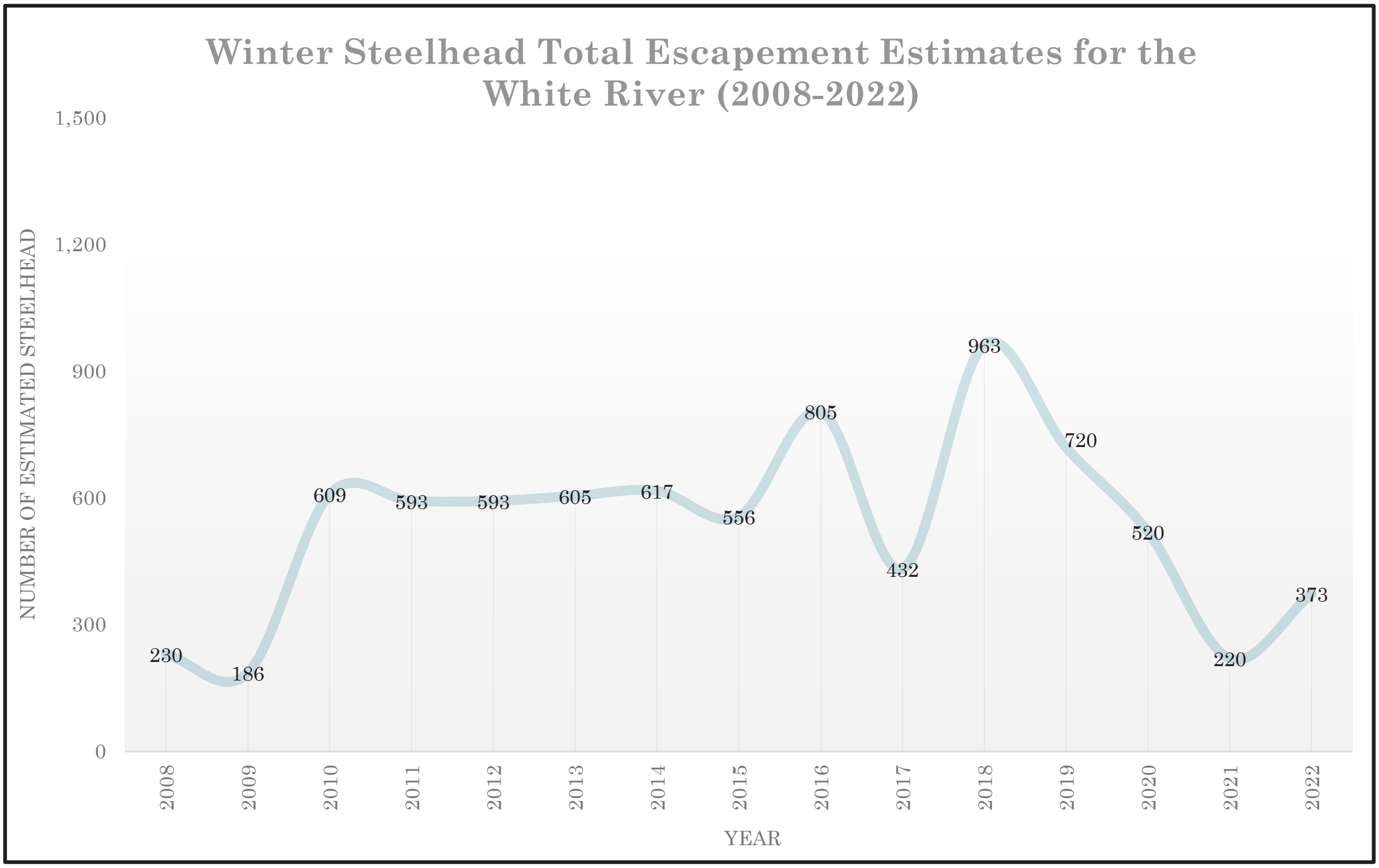
YEAR SAMPLED/ RELEASED	ADULTS N=	ADULTS WILD(NOR)	*FISH TAKEN FOR BROOD-STOCK PROGRAM	ADULTS WITH ‡BWT (PROGAM FISH)	PRE-SMOLTS RELEASED (BROOD YEAR) [RELEASE SITE]
2023	117	88		29	Program discontinued in 2022 due to insufficient brood-stock availability.
2022	205	170	0	35	21,950 (2021) [Jensen Cr. Acclimation Pond]
2021	150	122	12	16	28,823 (2020) [Direct Plant in Twentyeight Mile Cr. Acclimation Pond]
2020	394	293	24	77	30,200 (2019) [Direct Plant in Clearwater River]
2019	547	447	24	76	34,550 (2018) [Twentyeight Mile Cr. Acclimation Pond]
2018	795	582	24	189	30,000 (2017) [Jensen Cr. Acclimation Pond]
2017	385	288	26	71	27,625 (2016) [Twentyeight Mile Cr. Acclimation Pond]
†2016	533	476	23	34	29,920 (2015) [Jensen Cr. Acclimation Pond]
†2015	319	273	26	20	31,219 (2014) [Jensen Cr. Acclimation Pond]
2014	479	392	23	64	49,998 (2013) [Huckleberry Cr. Acclimation Pond]
2013	574	338	28	208	27,990 (2012) [Muckleshoot WR Hatchery]
2012	578	345	24	209	31,129 (2011) [Muckleshoot WR Hatchery]
2011	539	164	22	353	27,876 (2010) [Muckleshoot WR Hatchery]

Adult steelhead sampling conducted by Puyallup Tribal Fisheries. See Appendix F for additional steelhead sampling results. See Appendix D for current acclimation pond sites.

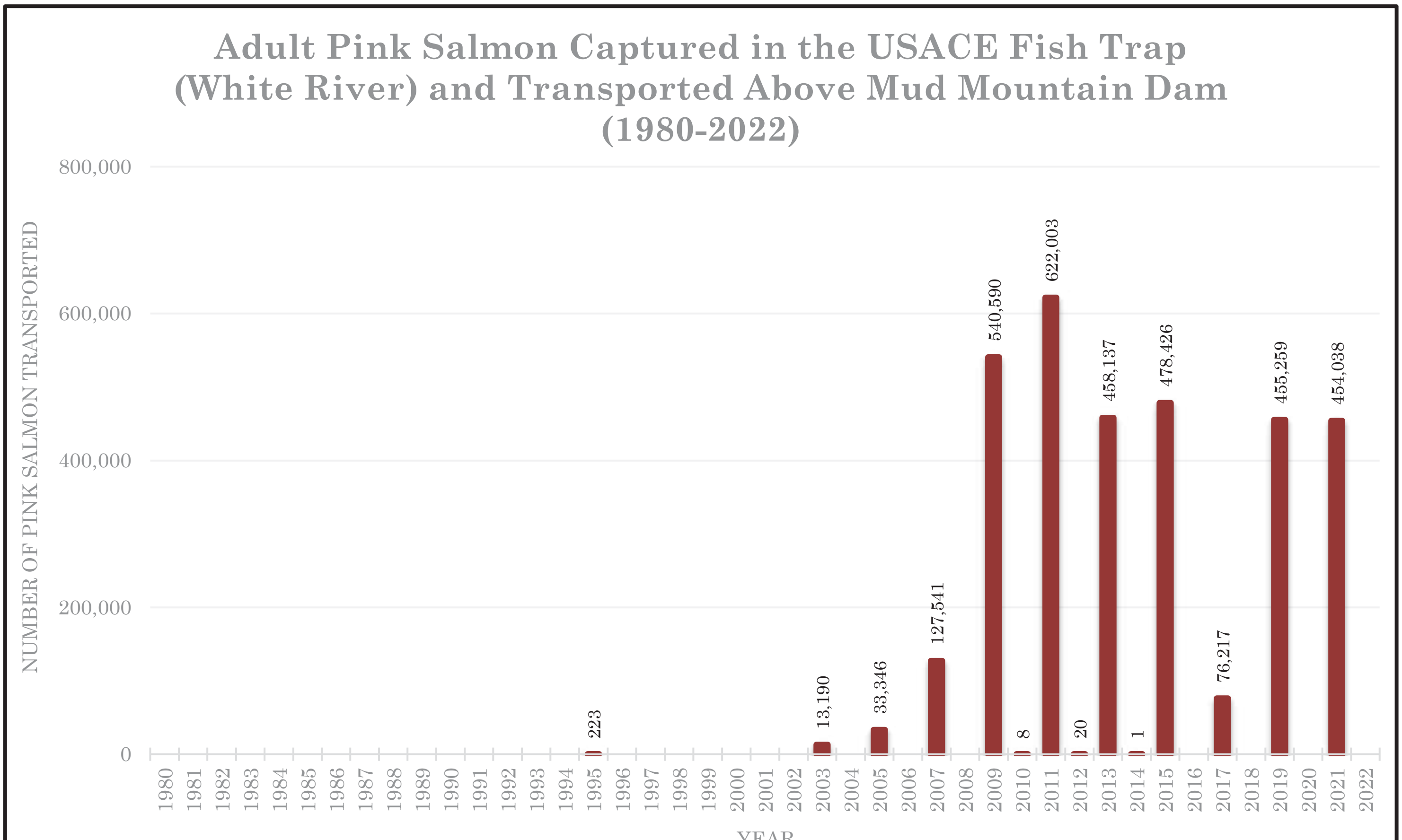
*During the spring of 2006, in response to the declining number of winter steelhead, the Puyallup and Muckleshoot Tribes; as well as the Washington Department of Fish and Wildlife, began a steelhead supplementation pilot project developed for the White River. Since 2014, the Puyallup Tribe has assumed the sole responsibility for the continuance of this vital fish enhancement program. The primary goal of this project is to restore the run to a strong self-sustaining population. The project is currently funded and managed by the Puyallup Tribe and utilizes captured wild brood-stock from the USACE trap in Buckley to generate approximately 25K-35K+ yearling smolts. Program discontinued in 2022 due to insufficient brood-stock availability.

†An undetermined number of adult steelhead ascended above the Buckley diversion dam due to missing panels.

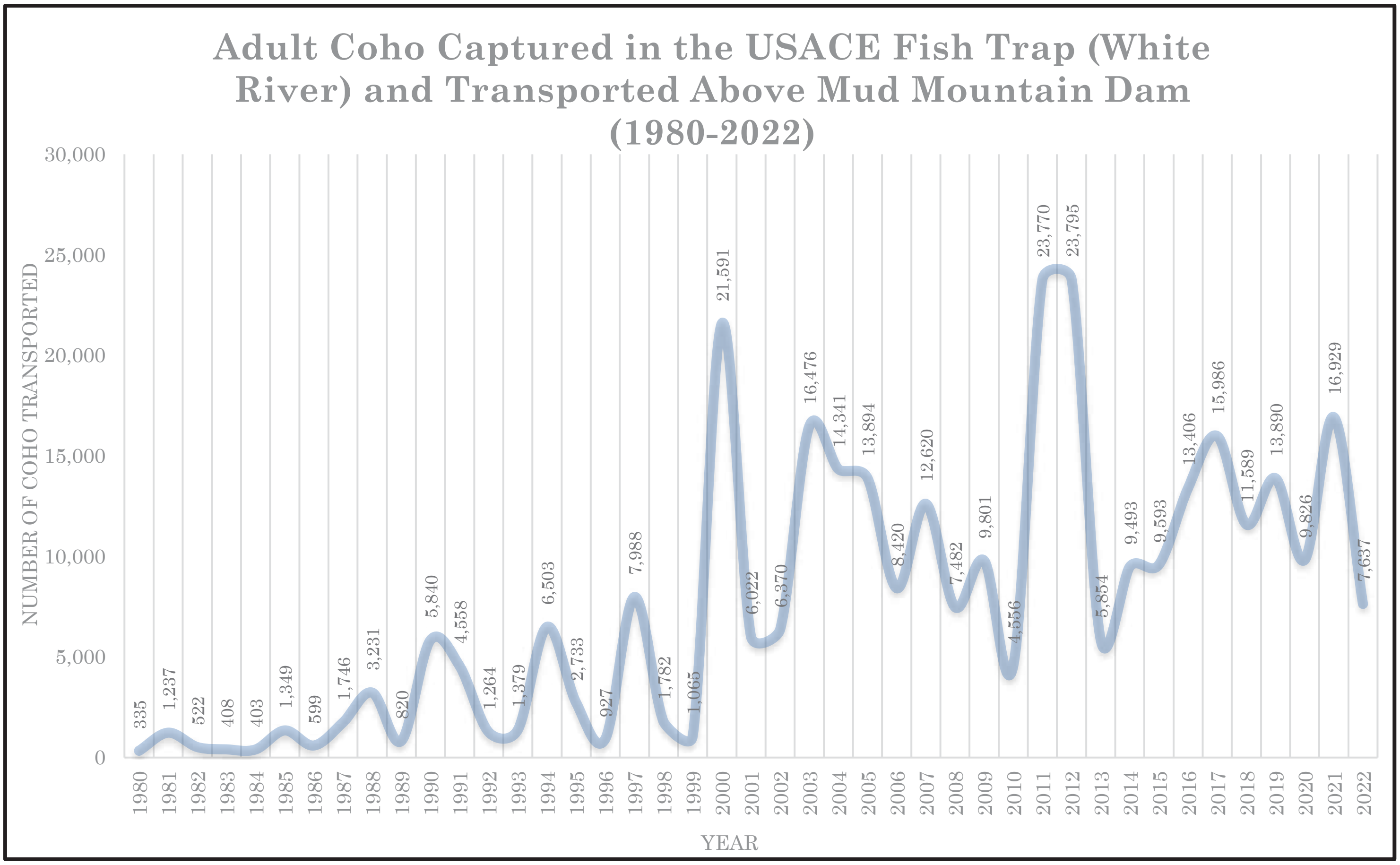
‡ Blank Wire Tag (BWT): Small piece of wire implanted in the snout that is the same as a Coded Wire Tag (CWT) implant minus the binary code.



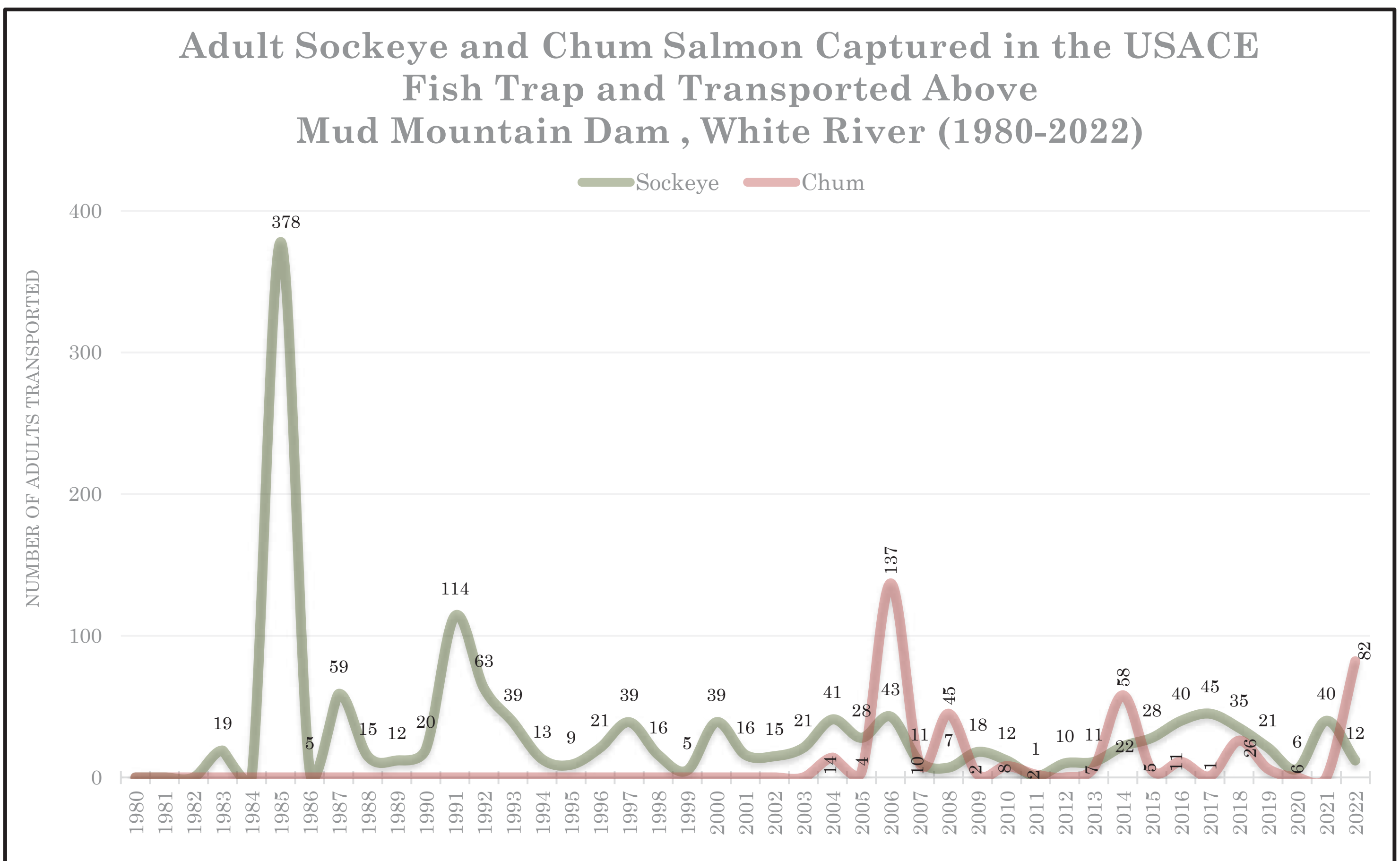
Estimated steelhead escapement totals were calculated and provided by WDFW biologists. Escapement and total run size was determined by utilizing both PTF White River tributary and mainstem spawning escapement data, and Buckley trap capture/sampling data.



Data source: USACE website http://www.nws.usace.army.mil/Missions/CivilWorks/LocksandDams/MudMountainDam/FishCounts.aspx



Data source: USACE website http://www.nws.usace.army.mil/Missions/CivilWorks/LocksandDams/MudMountainDam/FishCounts.aspx



Data source: USACE website http://www.nws.usace.army.mil/Missions/CivilWorks/LocksandDams/MudMountainDam/FishCounts.aspx

WHITE RIVER

JUVENILE SALMONID PRODUCTION ASSESSMENT PROJECT

Prepared by: Andrew Berger

The White River Juvenile Salmonid Production Assessment Project In 2016, the Puyallup Tribal Fisheries Department began the White River Juvenile Salmon Production Assessment project to address data gaps for ESA-listed populations in the watershed. An eight-foot diameter rotary screw trap is operated on the lower White River at R.M. 3.6, just upstream of the confluence with the Puyallup River. The trap is used to capture and sample the outmigration of juvenile salmonids. In 2000 and 2001, the WDFW operated a rotary screw trap on the White River but since this time no data has been collected. This project aims to establish a long-term data set to detail salmon production in the watershed.

As more data become available, juvenile abundance estimates may provide baseline information allowing managers to evaluate escapement objectives, monitor production potential in the watershed and forecast future returns of hatchery and naturally produced adults. In addition, data gathered from the project could help determine health of the watershed and evaluate the contribution of enhancement projects.

As more data becomes available, juvenile production estimates may provide baseline information allowing managers to meet escapement objectives in the watershed create a production potential-based management strategy and accurately forecast future returns of hatchery and naturally produced adults. In addition, a basin spawner/recruit analysis will indicate stock productivity, helping to determine the overall health of the watershed and evaluate the contribution of enhancement projects.

Trapping Gear and Operations

The rotary screw-trap used in this study consists of a rotary cone suspended within a steel structure on top of twin, 40-foot pontoons. The opening of the rotary cone is 8 feet in diameter, allowing for a sampling depth of 4 feet. The cone and live box assembly are attached to a steel frame and may be raised or lowered by hand winches located at the front and rear of the assembly. Three five-ton bow-mounted anchor winches with 3/8′′ steel cables are used to secure and adjust the direction of the trap and keep it in the thalweg. The cables are secured to trees on opposite banks.

The 8-ft diameter rotary screw trap is currently installed in the lower White River (RM 3.6) just downstream of the Dieringer tailrace outlet below Lake Tapps *(Cascade Water Alliance facility).* Trap operation continue, when feasible, 24 hours a day, seven days a week throughout the trapping season. The trap is checked for fish twice a day at dawn and dusk. In some instances, the trap is checked plus-or-minus two hours of dusk or dawn due to the availability of personnel. During hatchery releases and high flow events, personnel remain onsite through the night to clear the trap of debris and to keep fish from overcrowding and prevent mortalities. Revolutions per minute (rpm), water temperature, secchi depth (cm), turbidity (NTU), weather conditions, and stream flow (cfs) are described for each completed trap check. A cross sectional area of the river at the smolt trap is taken to monitor channel morphology at the site.

Goals and Objectives

The goals of this project are to estimate the abundance of juvenile salmonids, characterize juvenile migration timing, describe length distribution for wild salmonids and fulfill objectives of the White and Puyallup River Spring and Fall Chinook Recovery Plans. These same goals generally align with Viable Salmonid Populations (VSP) criteria for ESA-listed species defined by National Oceanic Atmospheric Administration (NOAA) (McElhany et. al., 2000).

To achieve these goals, this project will address the following objectives:

1. Estimate juvenile abundance and freshwater survival for naturally produced Chinook and Steelhead in the White River.
2. Investigate physical factors such as light (day vs. night), river flow, and river turbidity and their importance to trap capture efficiency.
3. Continue to develop and refine methodologies and models used to estimate abundance of salmon.
4. Detail species length and run timing in order to investigate environmental factors contributing to life history patterns.

recorded for unmarked fish. When possible, 50 chum, 50 pinks, 50 age1+ coho, 25 age 0+ coho, 25 age 0+ Chinook, and 25 steelhead are measured per day. In addition, scale samples are taken on all wild steelhead smolts.

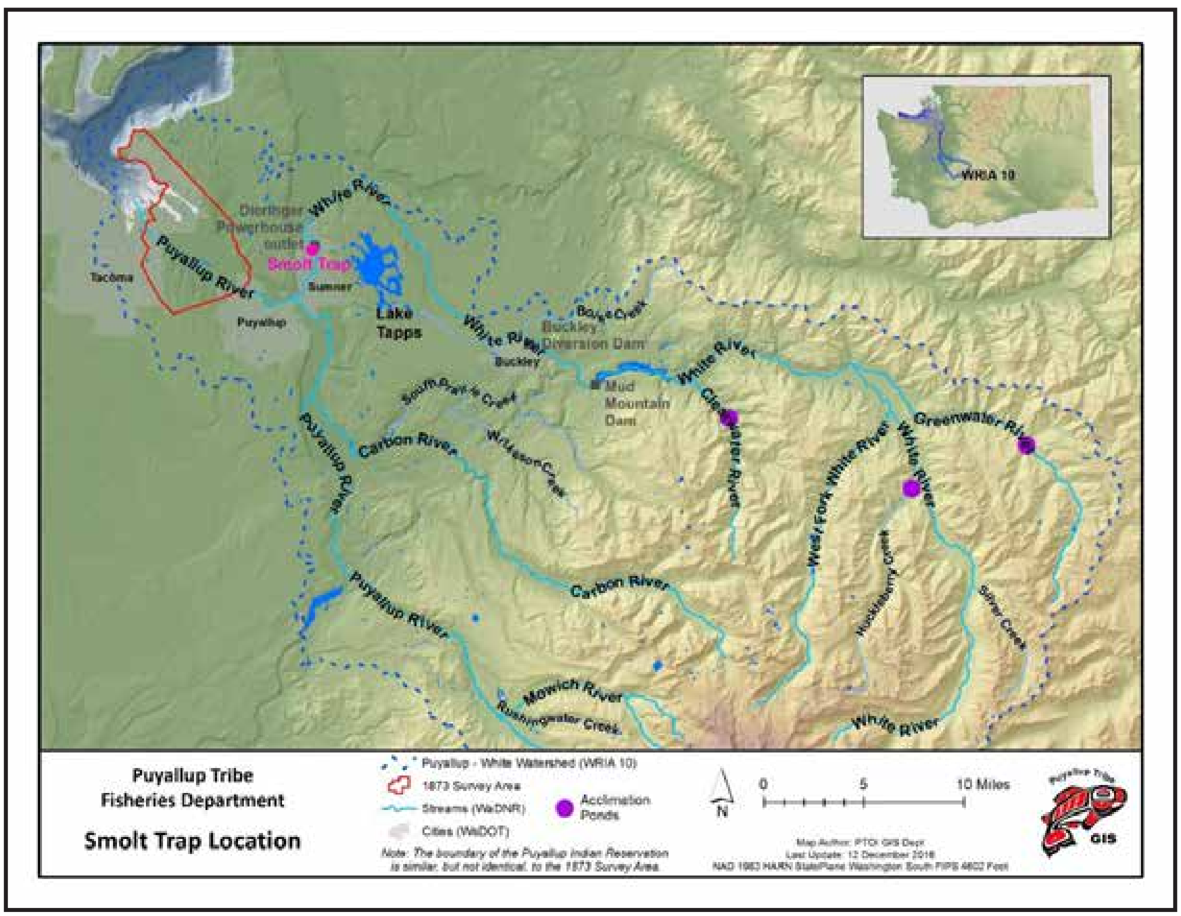
Species are separated by size/age class. Coho were identified as fry, age 0+ (<70mm) or smolts, age 1+ (>70mm). Chinook smolts are separated by age 0+ (<150mm) or age 1+ (>150mm). All chum and pinks are identified as age 0+. Trout fry age 0+ (<60mm) are not differentiated to species.

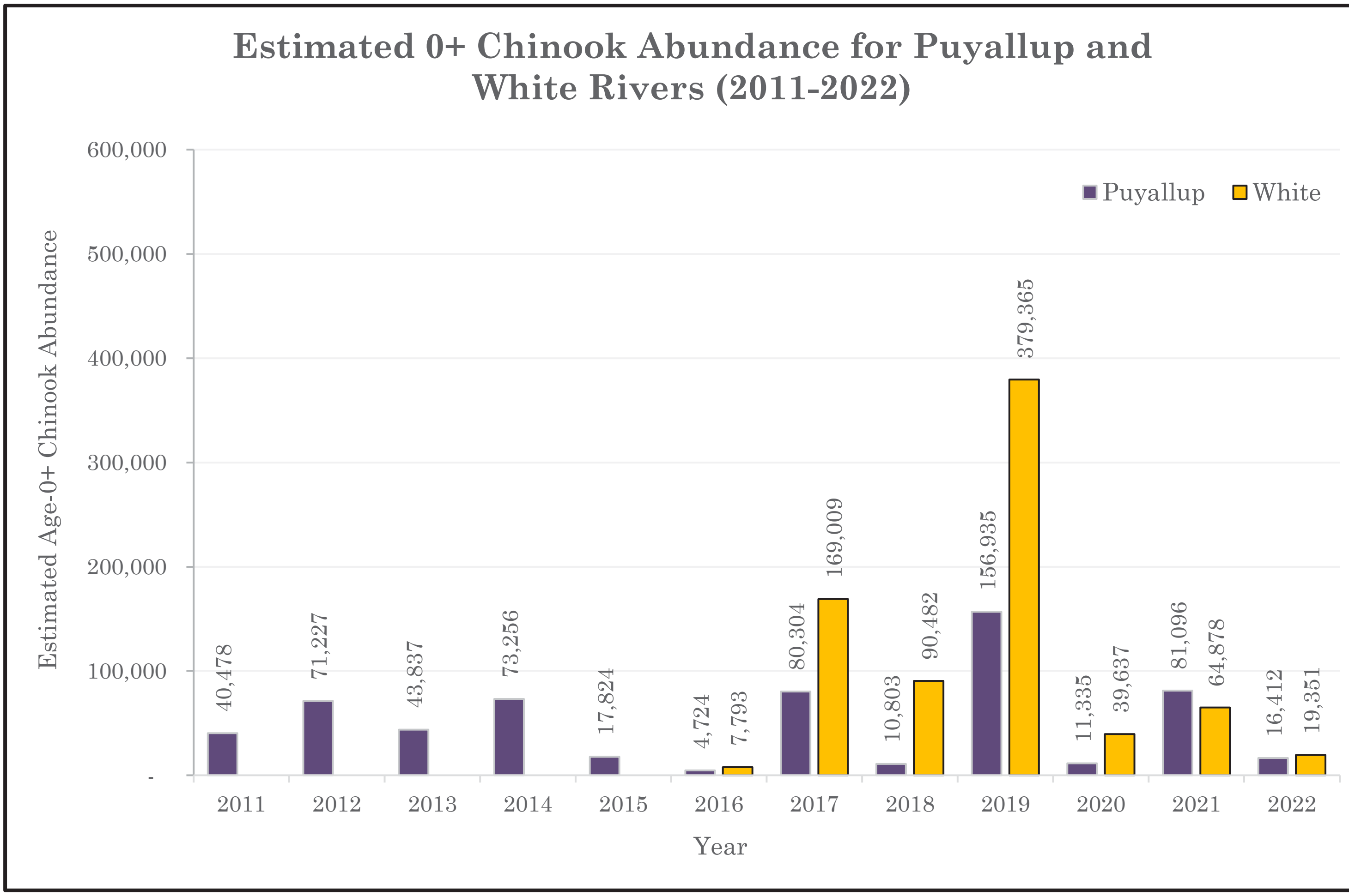
Hatchery origin fish are identified in three ways: 1) by visual inspection for adipose fin clips, 2) with a Northwest Marine Technology "wand" detector used for coded wire tag detection, and 3) with a Destron Fearing Portable Transceiver system for Passive Integrated Transponder (PIT) tagged fish.

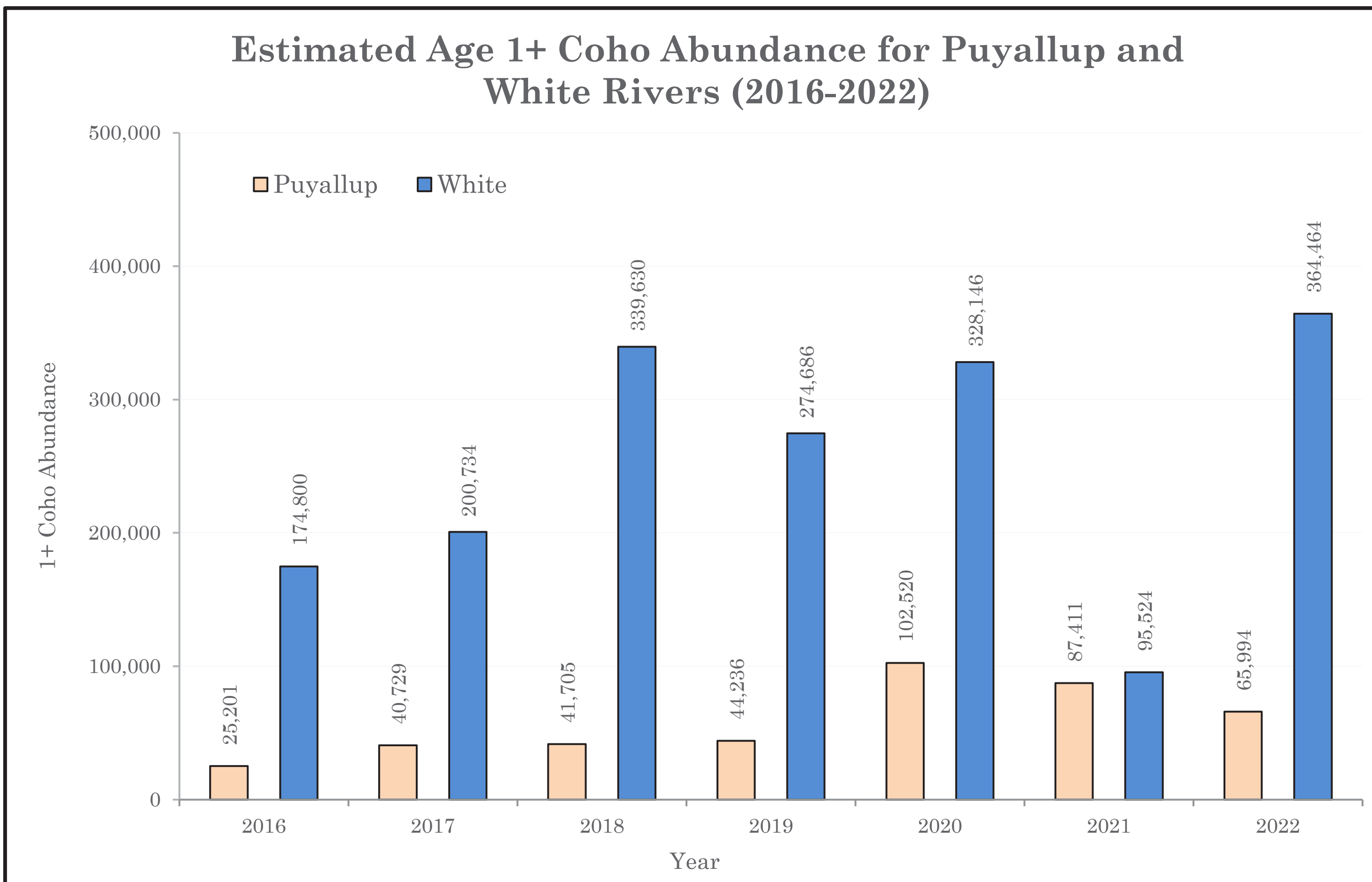
To request a full copy of the current, or previous seasonal reports, contact:
Puyallup Tribal Fisheries Department
(253)-680-5560, or Andrew Berger: Senior Stock Assessment Biologist at:
andrew.berger@puyalluptribe-nsn.gov

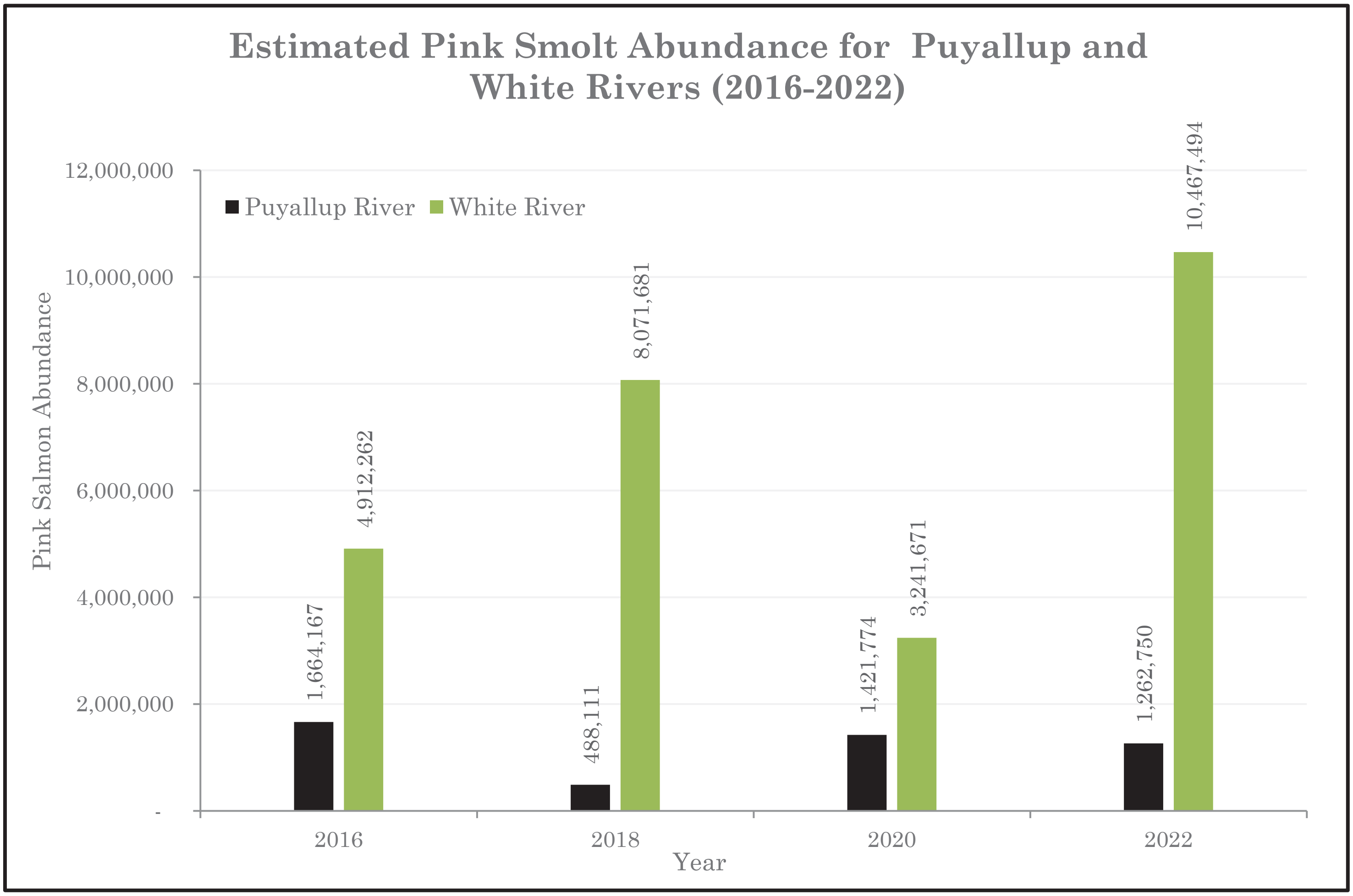
Sampling Procedures

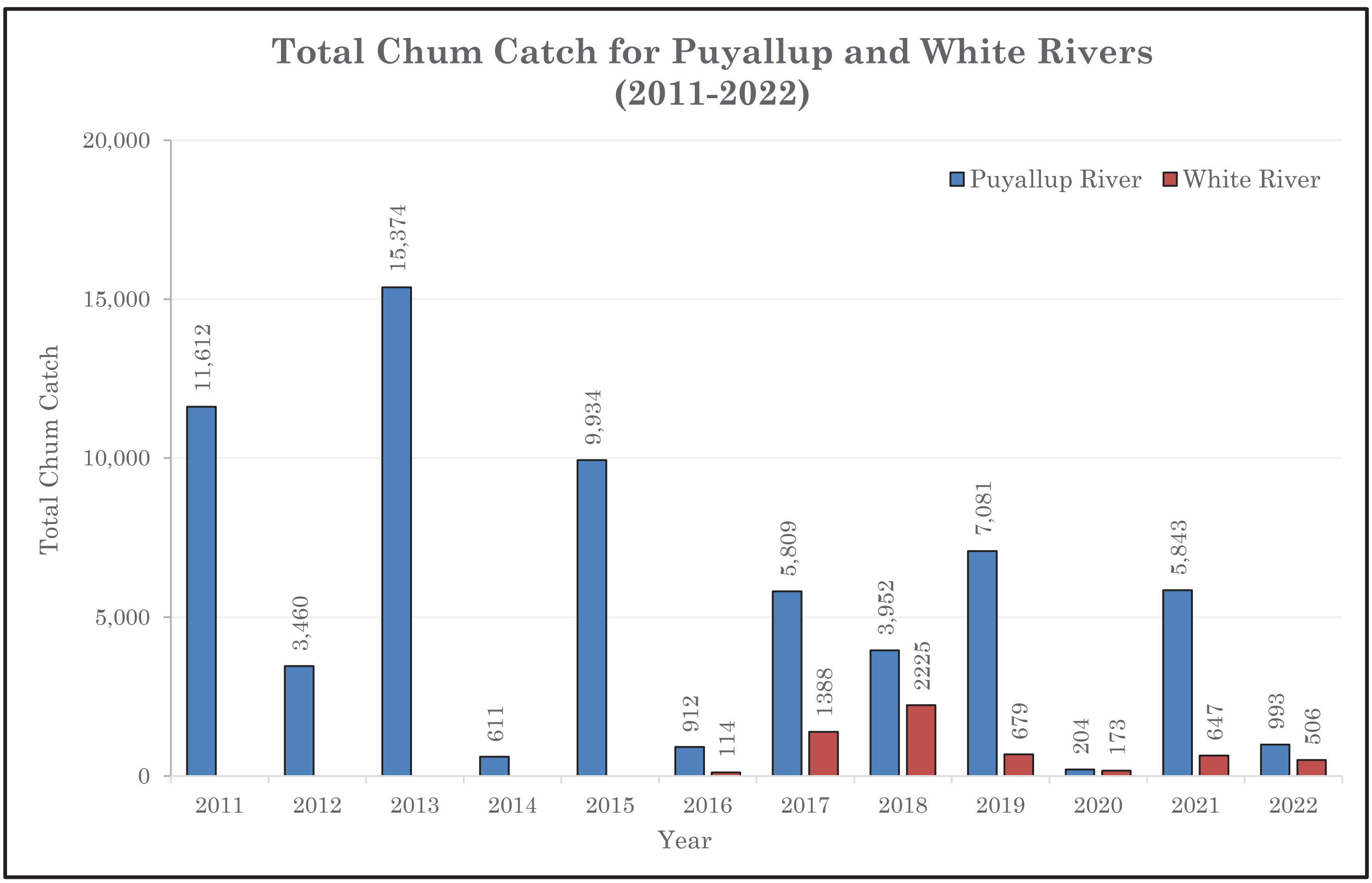
Smolts are anesthetized with MS-222 (tricaine methanesulfonate) for handling purposes and subsequently placed in a recovery bin of river water before release back to the river. Juveniles are identified as natural or hatchery origin as unmarked or marked respectively. Fork length (mm) is measured and

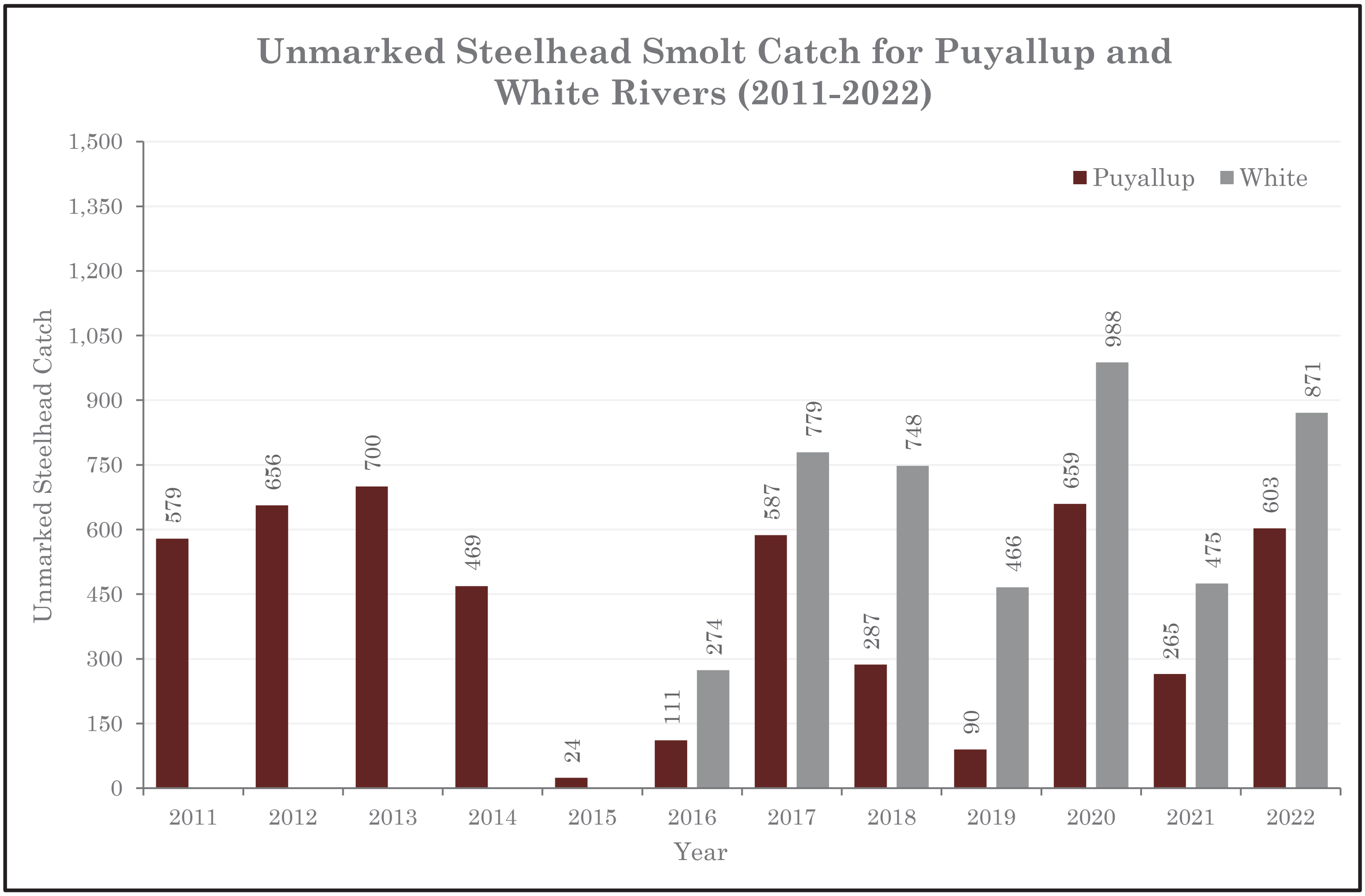



Estimated 0+ Chinook Abundance for Puyallup and White Rivers (2011-2022)
Puyallup
White
Estimated Age-0+ Chinook Abundance
600,000
500,000
400,000
300,000
200,000
100,000
-
40,478
71,227
43,837
73,256
17,824
4,724
7,793
80,304
169,009
10,803
90,482
156,935
379,365
11,335
39,637
81,096
64,878
16,412
19,351
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
Year


Estimated Age 1+ Coho Abundance for Puyallup and White Rivers (2016-2022)
Puyallup
White
1+ Coho Abundance
500,000
400,000
300,000
200,000
100,000
0
25,201
174,800
40,729
200,734
41,705
339,630
44,236
274,686
102,520
328,146
87,411
95,524
65,994
364,464
2016
2017
2018
2019
2020
2021
2022
Year


Estimated Pink Smolt Abundance for Puyallup and White Rivers (2016-2022)
Puyallup River
White River
Pink Salmon Abundance
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
-
1,664,167
4,912,262
488,111
8,071,681
1,421,774
3,241,671
1,262,750
10,467,494
2016
2018
2020
2022
Year


Total Chum Catch for Puyallup and White Rivers (2011-2022)
Puyallup River
White River
Total Chum Catch
20,000
15,000
10,000
5,000
0
11,612
3,460
15,374
611
9,934
912
114
5,809
1388
3,952
2225
7,081
679
204
173
5,843
647
993
506
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
Year


Unmarked Steelhead Smolt Catch for Puyallup and White Rivers (2011-2022)
Puyallup
White
Unmarked Steelhead Catch
Year
0
150
300
450
600
750
900
1,050
1,200
1,350
1,500
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
579
656
700
469
24
111
274
587
779
287
748
90
466
659
988
265
475
603
871

WILKESON CREEK

WRIA 10.0432

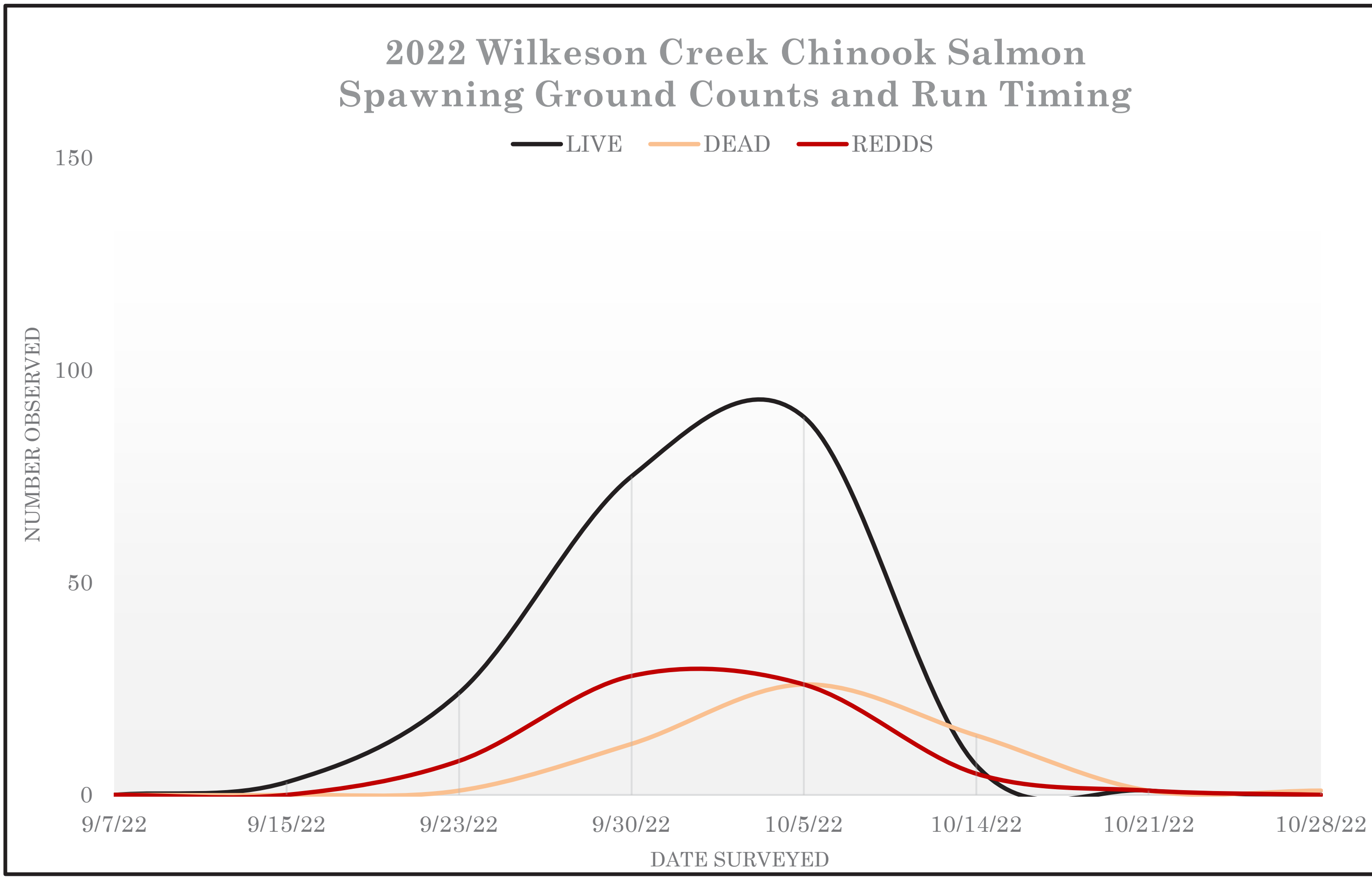
Chinook

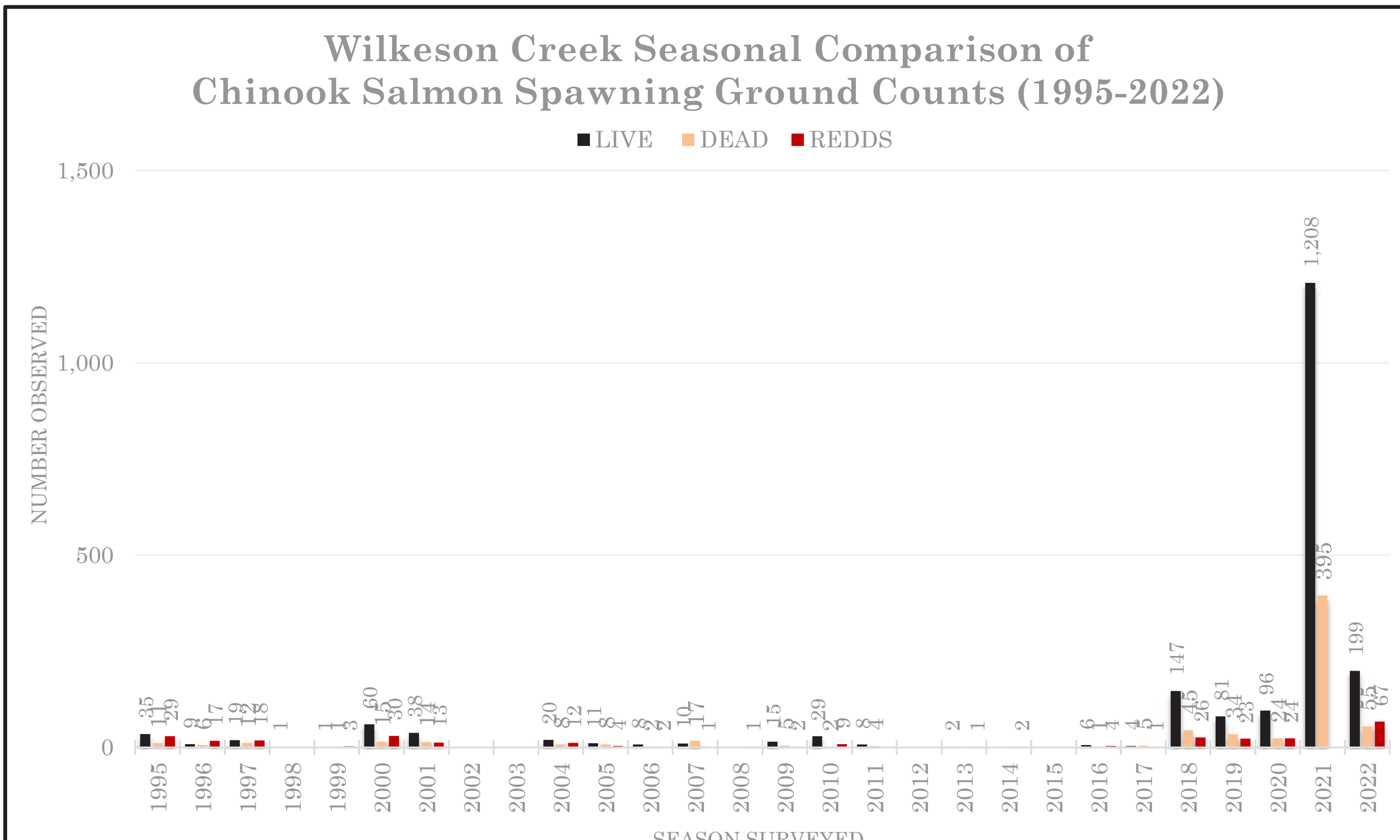
Wilkeson Creek is a large tributary to lower South Prairie Creek. Wilkeson flows for 12.3 miles from its source in the Mt. Baker-Snoqualmie National Forest; passing through the community of Wilkeson before meeting with South Prairie Creek *(RM 6.7)* just east of the town of South Prairie. Unfortunately, only the lower half of Wilkeson is accessible to salmon; a series of falls at RM 6.2 marks the upper extent of anadromous migration/access.

Despite its limitations, the Wilkeson Creek basin is a productive system providing suitable spawning and rearing habitat for Chinook, coho, pink, chum, steelhead, rainbow, cutthroat, and bull trout. Several fish and habitat related issues associated with Wilkeson Creek include: erosion, water quality *(temperature)*, channel confinement, low flows, water withdrawal, and aquatic noxious weeds (*Japanese knotweed-Polygonum cuspidatum)*. In addition, pieces of coal still visible in the creek channel continue to bring to light the regions coal mining history and its lasting impacts on the creek. Currently, the primary land use along Wilkeson is rural residential, recreational, light commercial, and forestry. Chinook use and access can be limited due to the extremely low flows common during late summer and early fall.

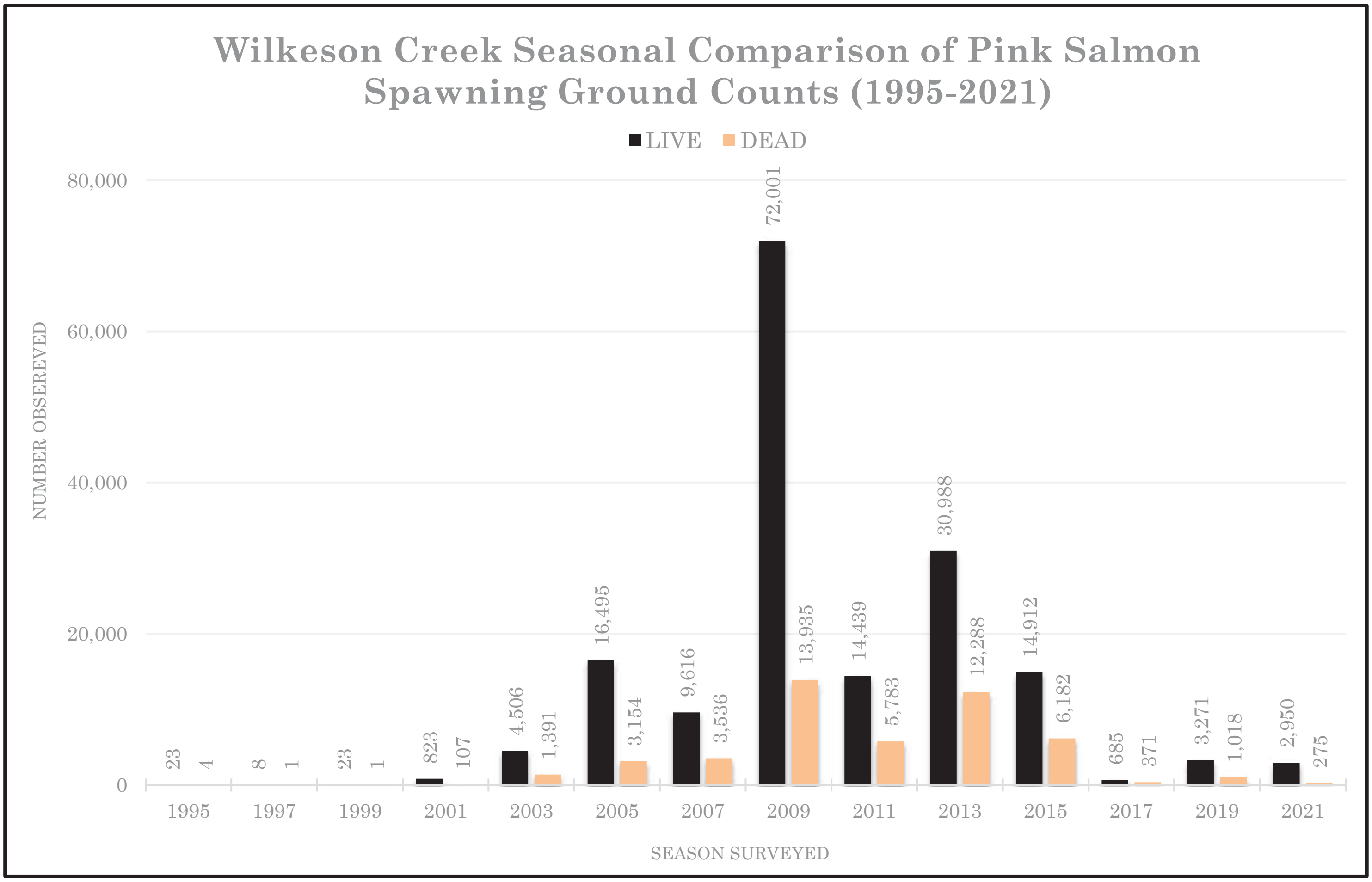
From the barrier falls at RM 6.2, down to approximately RM 5, the creek is confined by valley walls; yet the channel width and gradient are conducive to providing ample spawning opportunities for all species. Coal Mine Creek, entering near RM 5.7, is the only significant tributary entering the anadromous segment of Wilkeson Creek. Coal Mine Creek *(see description in this report)* supports coho, chum, and pink spawners and provides overwintering and foraging habitat for all life stages of salmonids.

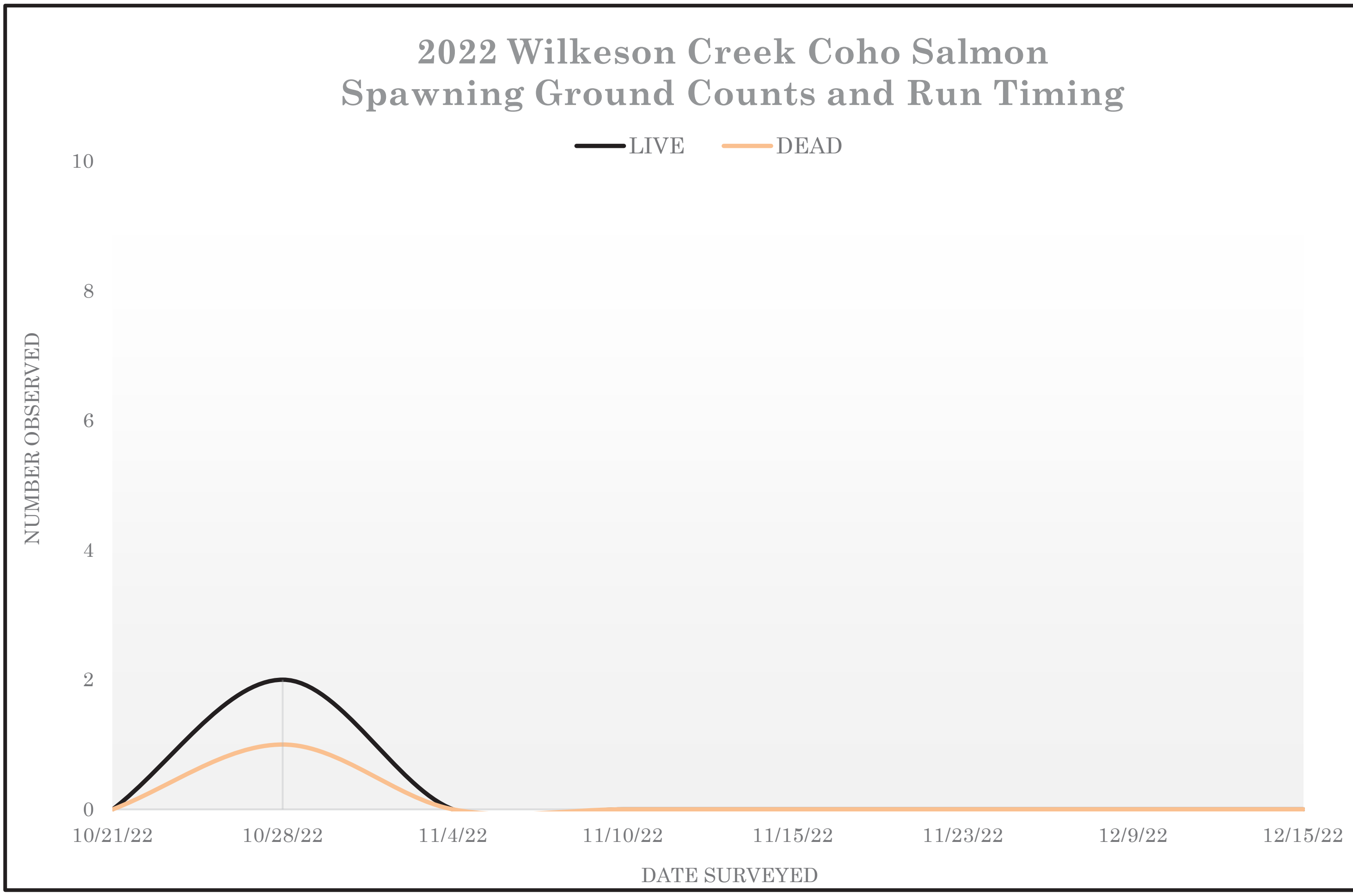
Between RM 5 and 4, Wilkeson Creek meanders through the town of Wilkeson. The channel is often deeply entrenched and the banks are generally riprapped and confined. Spawning opportunities throughout this section are available, although somewhat reduced compared to the rest of the creek. At RM 4.2, the Wilkeson Waste Water Treatment Plant discharges its treated domestic wastewater into the creek. Downstream of river mile 4 and the community of Wilkeson, the creek travels through generally undeveloped forested land until it reaches South Prairie Creek. The lower 4 miles of Wilkeson is a pool-riffle stream with a gravel/cobble substrate. With a few exceptions, abundant spawning gravel is present throughout this 4 mile section. The overstory riparian along lower Wilkeson consists of mixed hardwoods and conifers with a diverse understory of native shrubs and vegetation. Large swaths of Japanese knot weed are also present along much of the stream. Instream woody debris is plentiful providing both channel complexity and cover. The lower 3 miles has natural sinuosity, with a heavily wooded riparian zone. Debris jams and several side channels provide excellent spawning opportunities; as well as, overwintering habitat for juvenile coho, Chinook and steelhead. The lower 1.5-2 miles of the creek frequently supports the highest spawning densities of Chinook, pink, and chum. In 2017, the Puyallup Tribe completed construction of a Fall Chinook hatchery on Wilkeson Creek (RM 2).

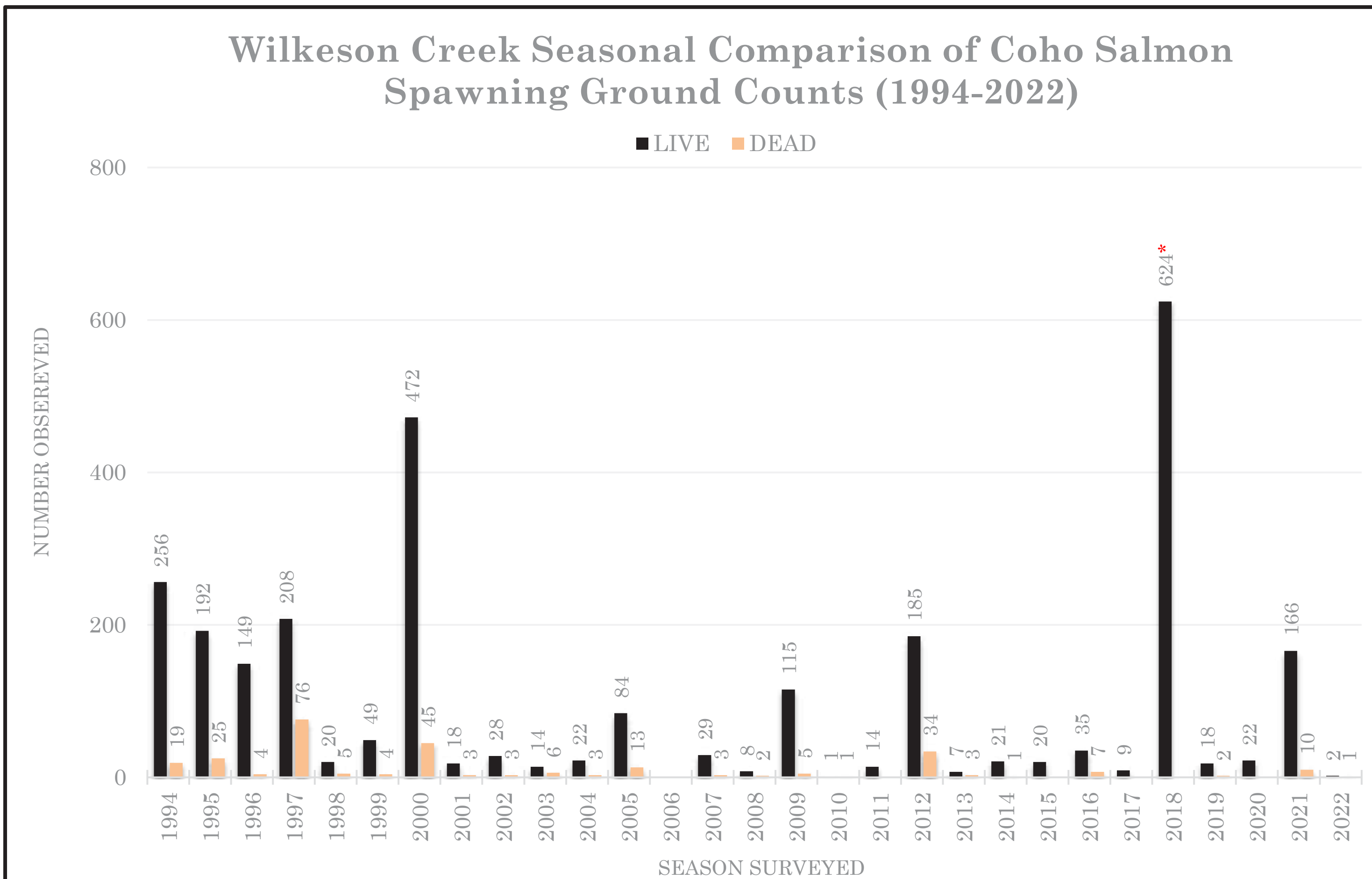


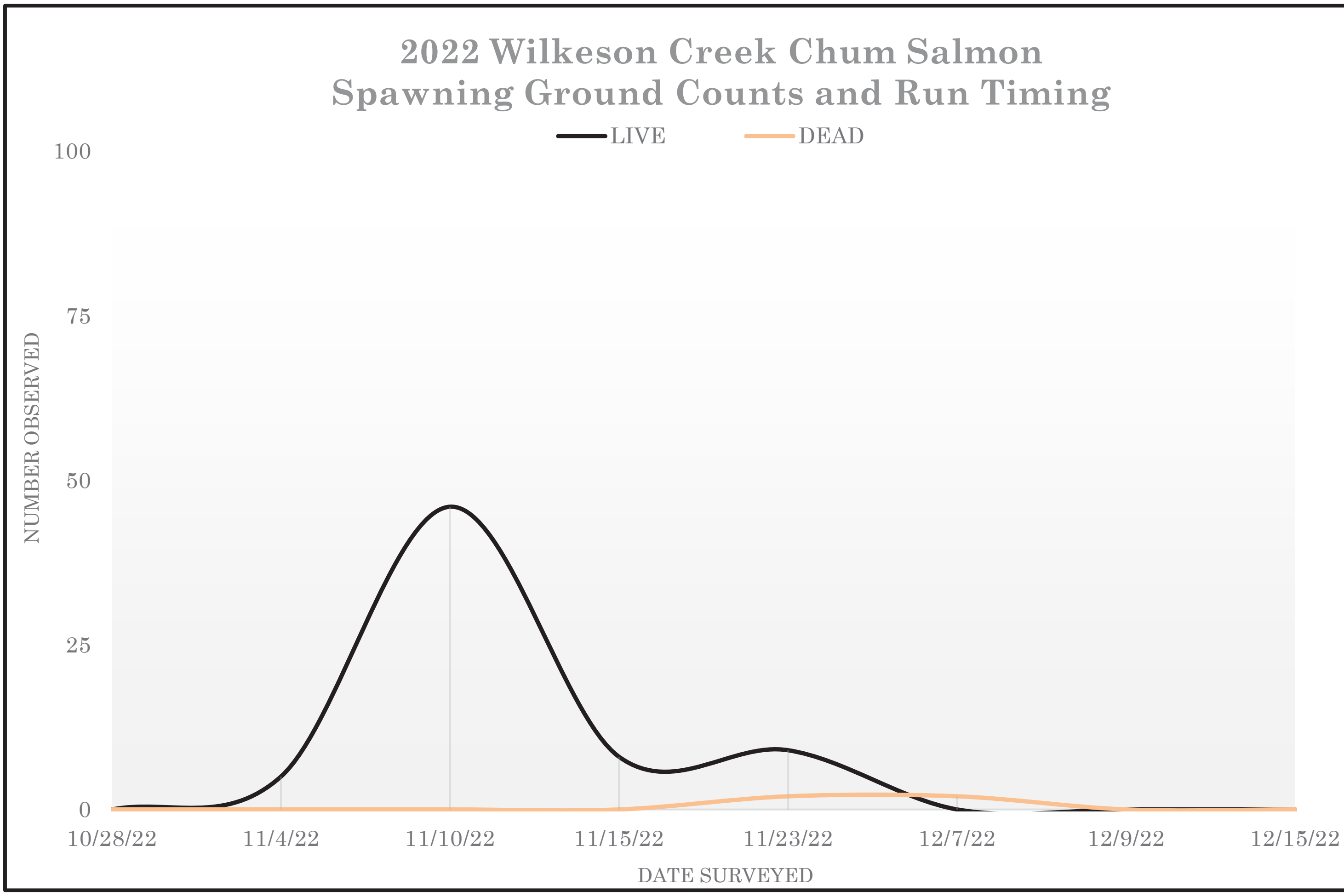


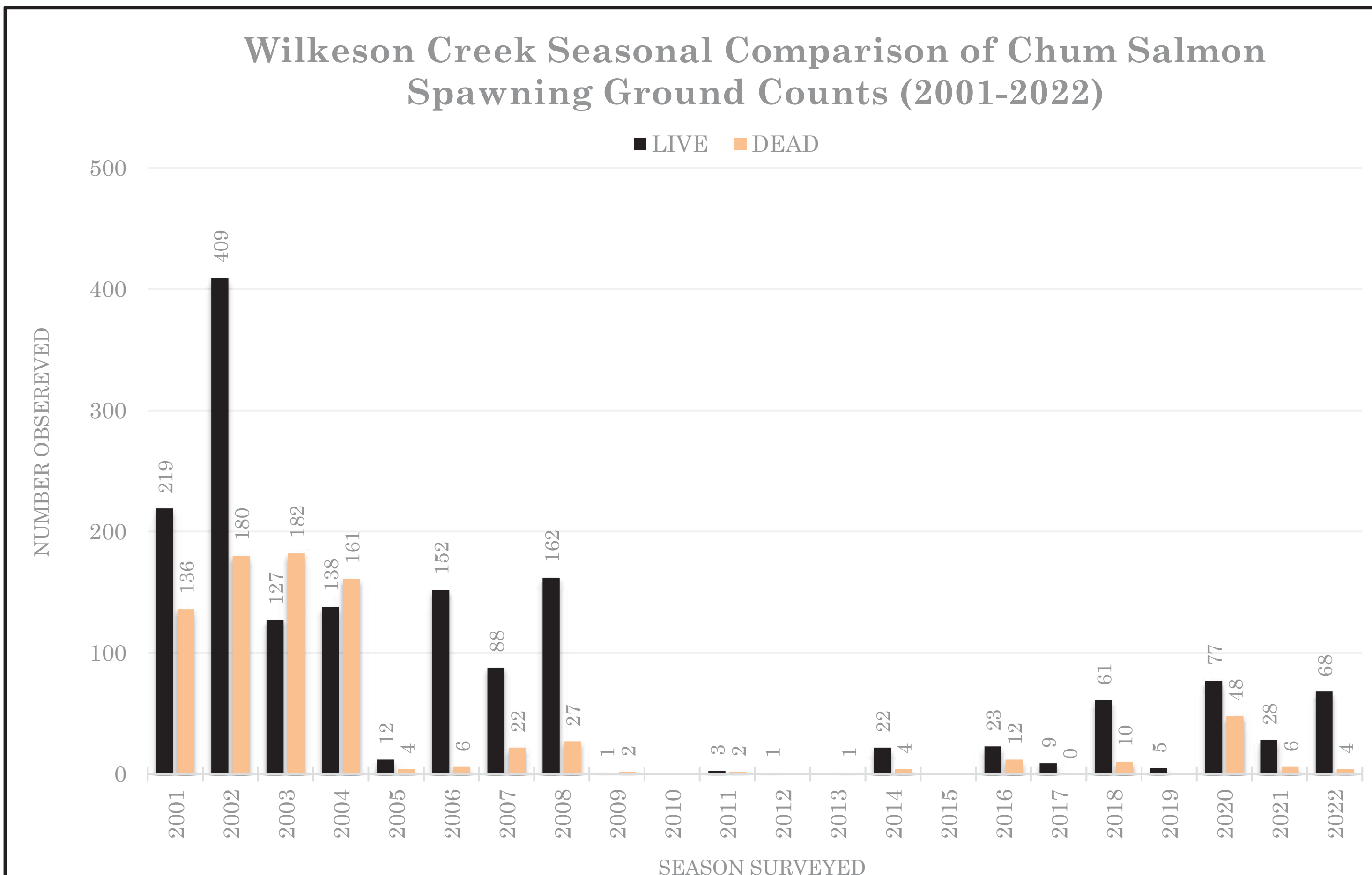
Adult Chinook escapement is determined by expanding the number of redds observed by 2.5 fish per redd (Smith and Castle, 1994). Due to the tremendous volume of pink salmon during odd years, the success of determining Chinook redds from pinks is vastly reduced. Therefore, The AUC method is used to determine escapement during pink runs (odd years).

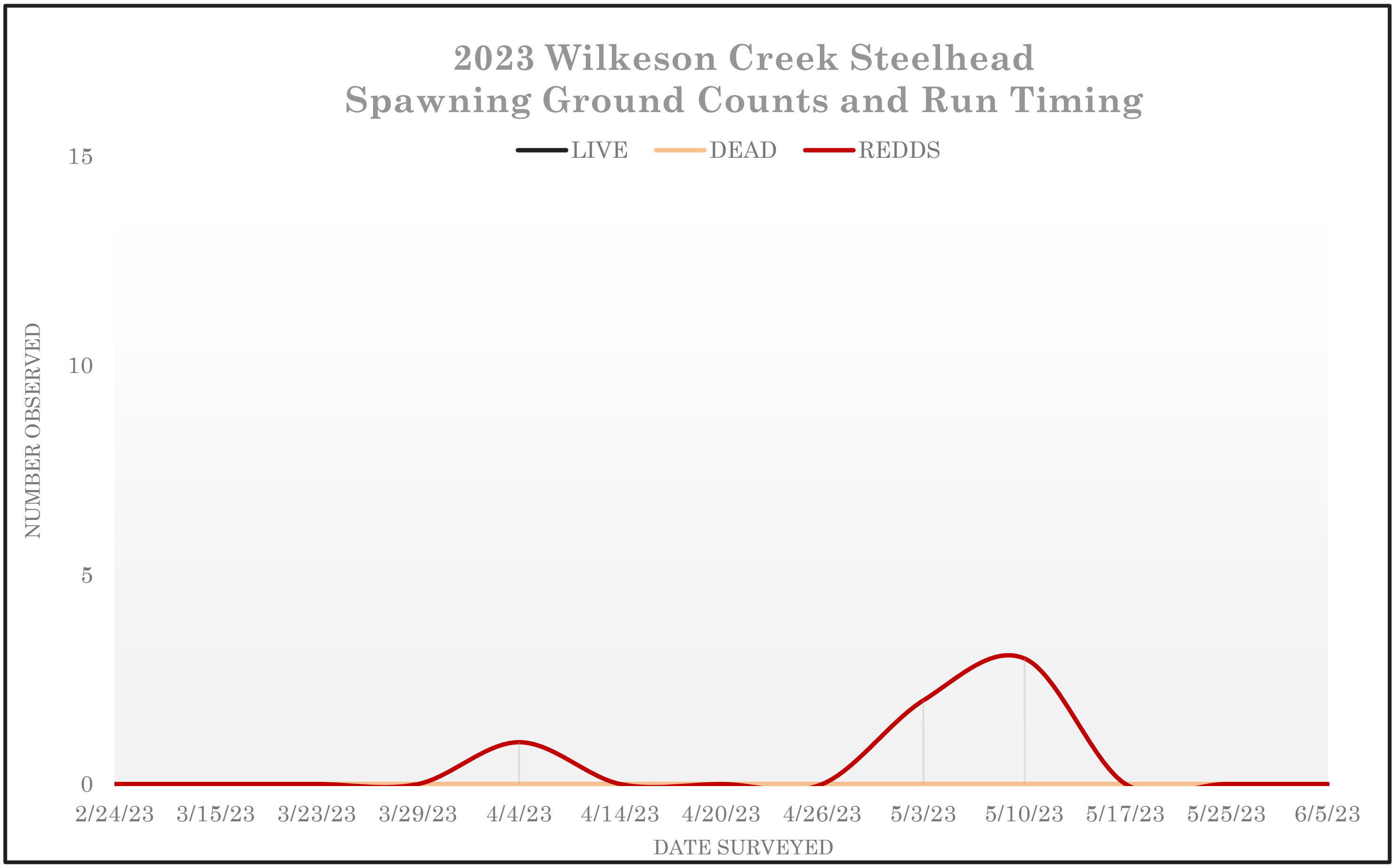

Wilkeson Creek Seasonal Comparison of Pink Salmon Spawning Ground Counts (1995-2021)
LIVE
DEAD
NUMBER OBSEREVED
80,000
60,000
40,000
20,000
0
23
4
8
1
23
1
823
107
4,506
1,391
16,495
3,154
9,616
3,536
72,001
13,935
14,439
5,783
30,988
12,288
14,912
6,182
685
371
3,271
1,018
2,950
275
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
SEASON SURVEYED


2022 Wilkeson Creek Coho Salmon
Spawning Ground Counts and Run Timing
LIVE
DEAD
NUMBER OBSERVED
0
2
4
6
8
10
10/21/22
10/28/22
11/4/22
11/10/22
11/15/22
11/23/22
12/9/22
12/15/22
DATE SURVEYED

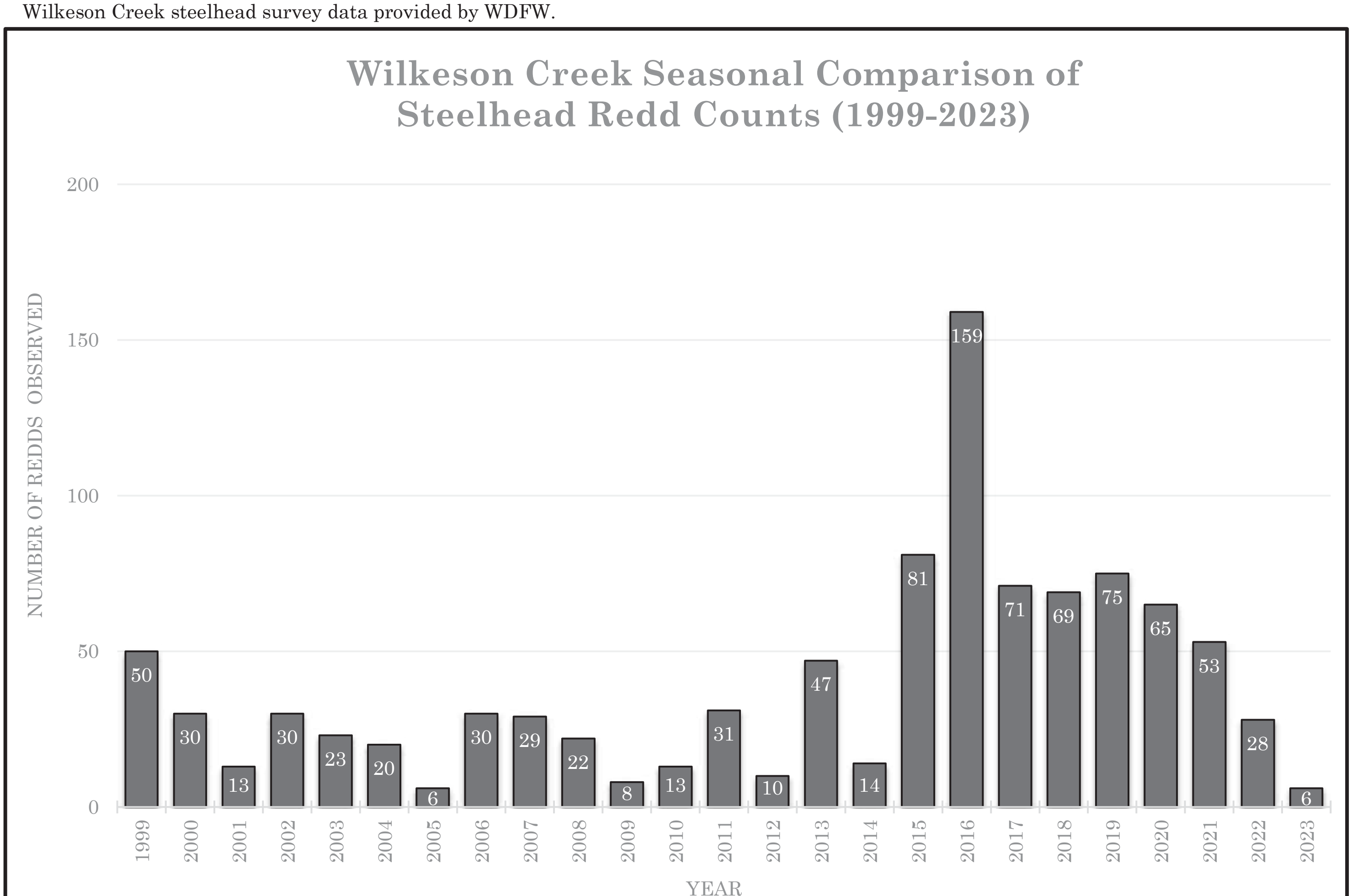

Wilkeson Creek Seasonal Comparison of Coho Salmon
Spawning Ground Counts (1994-2022)
LIVE
DEAD
NUMBER OBSEREVED
0
200
400
600
800
256
19
192
25
149
4
208
76
20
5
49
4
472
45
18
3
28
3
14
6
22
3
84
13
29
3
8
2
115
5
1
1
14
185
34
7
3
21
1
20
35
7
9
624*
18
2
22
166
10
2
1
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
SEASON SURVEYED


2022 Wilkeson Creek Chum Salmon
Spawning Ground Counts and Run Timing
LIVE
DEAD
NUMBER OBSERVED
100
75
50
25
0
10/28/22
11/4/22
11/10/22
11/15/22
11/23/22
12/7/22
12/9/22
12/15/22
DATE SURVEYED


Wilkeson Creek Seasonal Comparison of Chum Salmon
Spawning Ground Counts (2001-2022)
LIVE
DEAD
NUMBER OBSEREVED
500
400
300
200
100
0
219 136
409 180
127 182
138 161
12 4
152 6
88 22
162 27
1 2
3 2
1
1
22 4
23 12
9 0
61 10
5
77 48
28 6
68 4
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
SEASON SURVEYED



Wilkeson Creek steelhead survey data provided by WDFW.



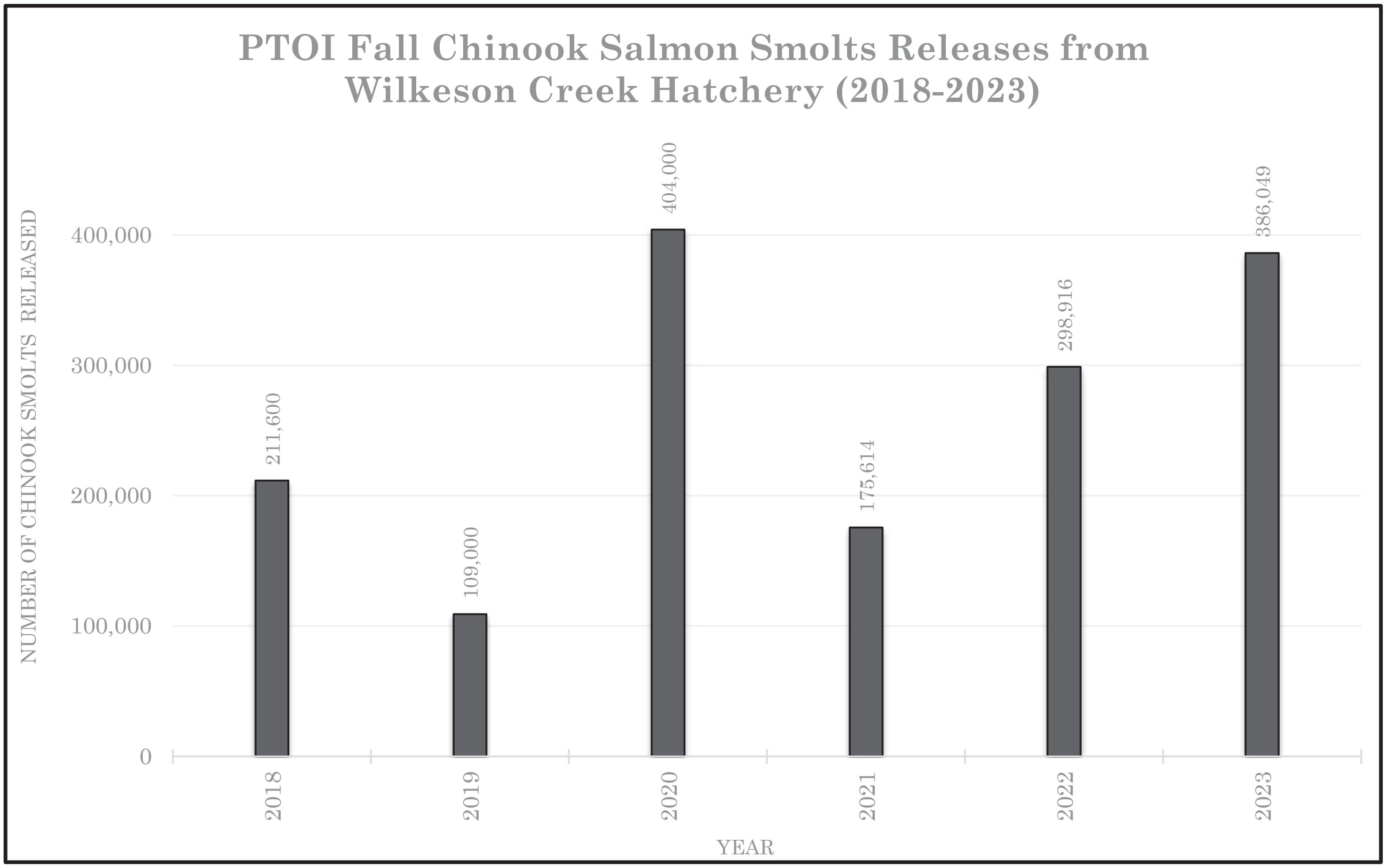
WILKESON CREEK SALMON HATCHERY

Puyallup Tribe of Indians Hatchery Facility


Chinook

Wilkeson Creek salmon hatchery is a Puyallup Tribe of Indians facility located at RM 2 on Wilkeson Creek *(10.0432)*, a tributary to South Prairie Creek. In its current operating state, the hatchery is utilized solely as a salmon rearing and acclimation site; however, future development may include the addition of spawning and egg incubation structures. The Wilkeson facility was completed in the fall of 2017 after a seven year process and at a cost of $1.2 million dollars. Presently, the Puyallup Tribe utilizes the facility as an extension of its Clarks Creek Fall Chinook hatchery located in Puyallup. The Fall Chinook extension program was initiated with the goal of producing additional adult spawners that will return to South Prairie and Wilkeson Creeks, with the anticipation of increasing natural production within these streams. The program is also intended to enhanced prey availability for the Southern Puget Sound Resident Orca population; as well as, supplementing tribal and sport Chinook fisheries in the lower Puyallup River.

In early spring, the Tribe transfers 200,000+ 100% mass marked Fall Chinook from the Clarks Creek hatchery to the Wilkeson Creek site. The fish are acclimated *(imprinted)* for approximately 3 months before being released in late May or early June when they are of size *(60 fish-per-pound)*. Water for the facility is gravity fed and is supplied primarily by two screened intake structures set into the Wilkeson Creek channel. The primary intake is a channel spanning surface flow collector capable of providing up to 7 cfs; however, current operations only require approximately 4 cfs to meet the facility needs. The second intake, buried several feet within the substrate, collects hyporheic flow and provides up to an additional 0.5 cfs of sediment free water that in the future can be used for incubation. In addition to the creeks surface and hyporheic flow, an open channel collector accumulates surface and ground water from a small ridge bordering the south side of the hatchery. The primary structures located on site are four rearing/acclimation ponds; two of which are concrete lined and two in a considerably more roughened natural state. Each pond has a holding capacity of 14,000 cubic feet of water *(104,440 gallons)* and is capable of accommodating up to 254,400 Chinook sub-yearlings for a total terminal rearing capacity of 1.02 million fish.



Chinook juveniles are transferred to Wilkeson from PTOI's Clarks Creek hatchery facility.

WINZIG CREEK

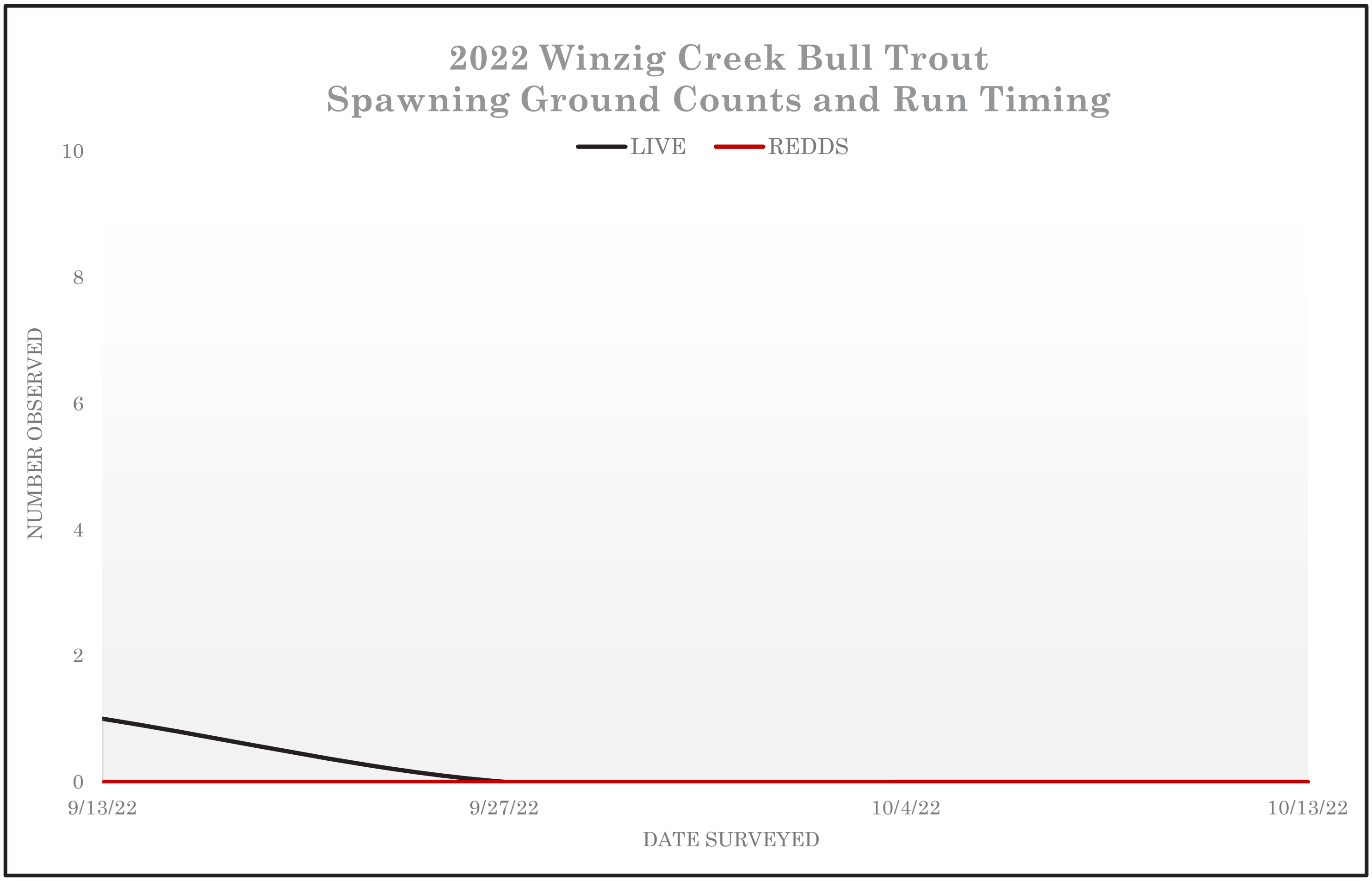
Winzig Creek is not officially named, nor is it identified on topographical maps; however, for easy identification the creek is referred to as "Winzig" by PTF staff. Located within Mt. Rainier National Park, Winzig is a small right bank tributary to Fryingpan Creek. This tiny *(winzig means tiny in German)* mountain stream did not exist during prior seasonal bull trout surveys and was surveyed for the first time in 2009. The mouth of Winzig Creek is located at nearly 4000′ elevation. Despite its lack of anadromous length or initial bull trout spawner escapement, the lower reach of Winzig does provide suitable habitat for bull trout rearing and spawning.

Nearly the entire anadromous reach of the creek *(approximately 800′)* is low gradient. There are small quantities of LWD present within this stretch, in addition to a beneficial riparian buffer zone of primarily conifers exists along the right bank of the creek. Even though spawning has been documented within this small stretch *(depending on mainstem influence);* it is limited due the lack of quality spawning substrate created by the alluvial deposits *(sand & silt)* from Fryingpan Creek. The habitat within this section is the least conducive for spawning due to a primarily cobble and sandy substrate. In addition, this reach of the creek is highly subjected to the possibility of redd scouring or heavy silt deposition due to the influence of Fryingpan creek. Upstream of the anadromous reach, the creek enters the heavily forested lower slope of the valley as it begins to climbs up the valley wall. From this point, the creek assumes a pool-riffle-cascade configuration up the steepening valley wall.

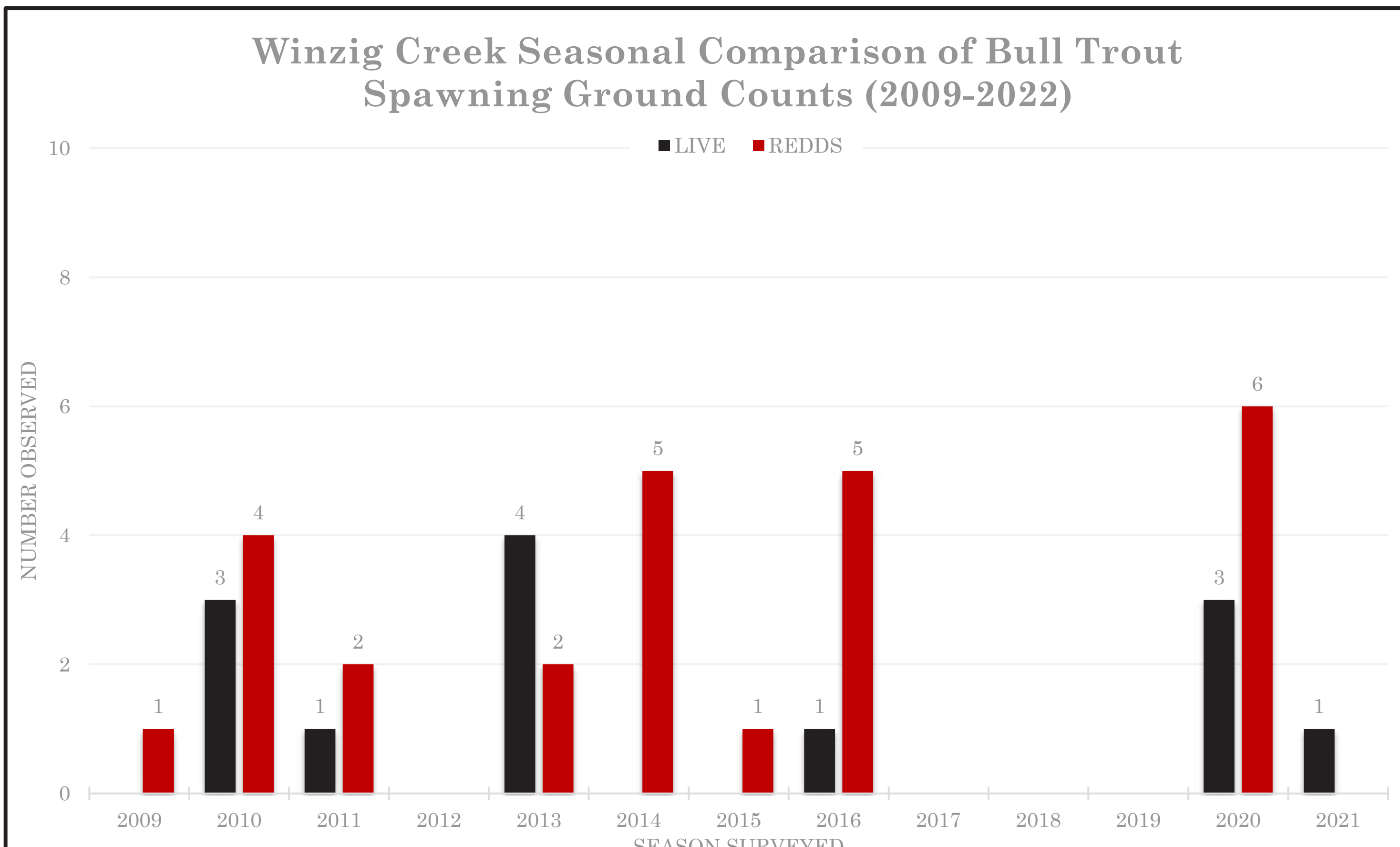
Winzig Creek merges with Fryingpan at approximately RM 1.3; less than a mile upstream of the Sunrise Park Road crossing, and approximately 0.2 miles below Wright creek. The total length of the creek is unknown; however, only the lower 0.15 miles is accessible by salmonids. A series of bedrock cascades and falls blocks any further upstream migration. The lower creek is almost entirely bordered by an old growth coniferous forest.

The first 0.1 mile of the creek consists of a narrow, moderate gradient channel flowing *(late summer flow app. 2-3 cfs.)* within the open Fryingpan Creek channel migration zone. Spawning opportunities in this newly established channel have improved since 2009. There is no significant LWD or natural cover present in this portion of the channel.

Beyond the open channel migration zone, the creek enters the forested slope along Fryingpan. The channel assumes a step-pool configuration from this point on. Throughout this final reach of fish usage, spawning opportunities are reduced due to the increased gradient, predominately larger substrate, and rapid flows encountered. Approximately 0.1 miles after entering the forested area, the creek climbs rapidly up a series of bedrock cascades and small falls.



2021 data provided by the Puyallup Tribe and National Park Service (MORA). Raw spawning data for Winzig Creek can be found in Appendix B. See Appendix C for bull trout redd locations.



WRIGHT CREEK

WRIA 10.0370

Bull trout

Wright Creek, located within Mt. Rainier National Park, is a small right bank tributary to Fryingpan Creek. This small mountain stream is surveyed for bull trout from early September-to-mid October. The mouth of Wright Creek is located at nearly 4000′ elevation. Wright Creek does provide excellent rearing and spawning habitat for a host of resident and fluvial bull trout. In 2006 and 2007, Puyallup Tribal Fisheries staff radio tagged bull trout captured in the USACE fish trap near Buckley. Subsequently, a few of these bull trout were tracked from their release site at RM 45 on the White River (*near the town of Greenwater*) to Fryingpan Creek and Wright Creek. Spawning was observed in both creeks during September. The telemetry studies and redd surveys along the upper White River and West Fork White River, focused heavily on the headwaters located within Mt. Rainier National Park. The study results showed the cold high mountain streams located within the National Park, including Wright Cr., provide the majority of the critical bull trout spawning habitat in the basin.

Wright Creek enters Fryingpan at approximately RM 1.5; less than a mile upstream of the Sunrise Park Road crossing. Of its 1.7 mile length, Wright Creek provides approximately 0.2 miles of accessible salmonid usage. A series of bedrock cascades and falls blocks any further upstream migration. The creek is almost entirely bordered by an old growth coniferous forest and the water is cooled year round by snow and glacial melt water from Sarvant Glacier, which is located on the northern slopes of the Cowlitz Chimneys *(Sarvant Glacier is named after Henry M. Sarvant (1869-1940), an engineer and early surveyor of the mountain).* Additional flow is contributed by a small non-glacial tributary entering on the left bank at RM 1.4.

The first 0.1 mile of the Wright Creek consists of a narrow, moderate gradient channel flowing within the open Fryingpan Creek channel migration zone. Several patches of excellent spawning gravel are available throughout this section of the creek and the majority of spawning has occurred within this segment. There is no significant LWD or natural cover present in this portion of the channel; however, spawning activity is often observed within close proximity of the few pieces of small woody debris present.

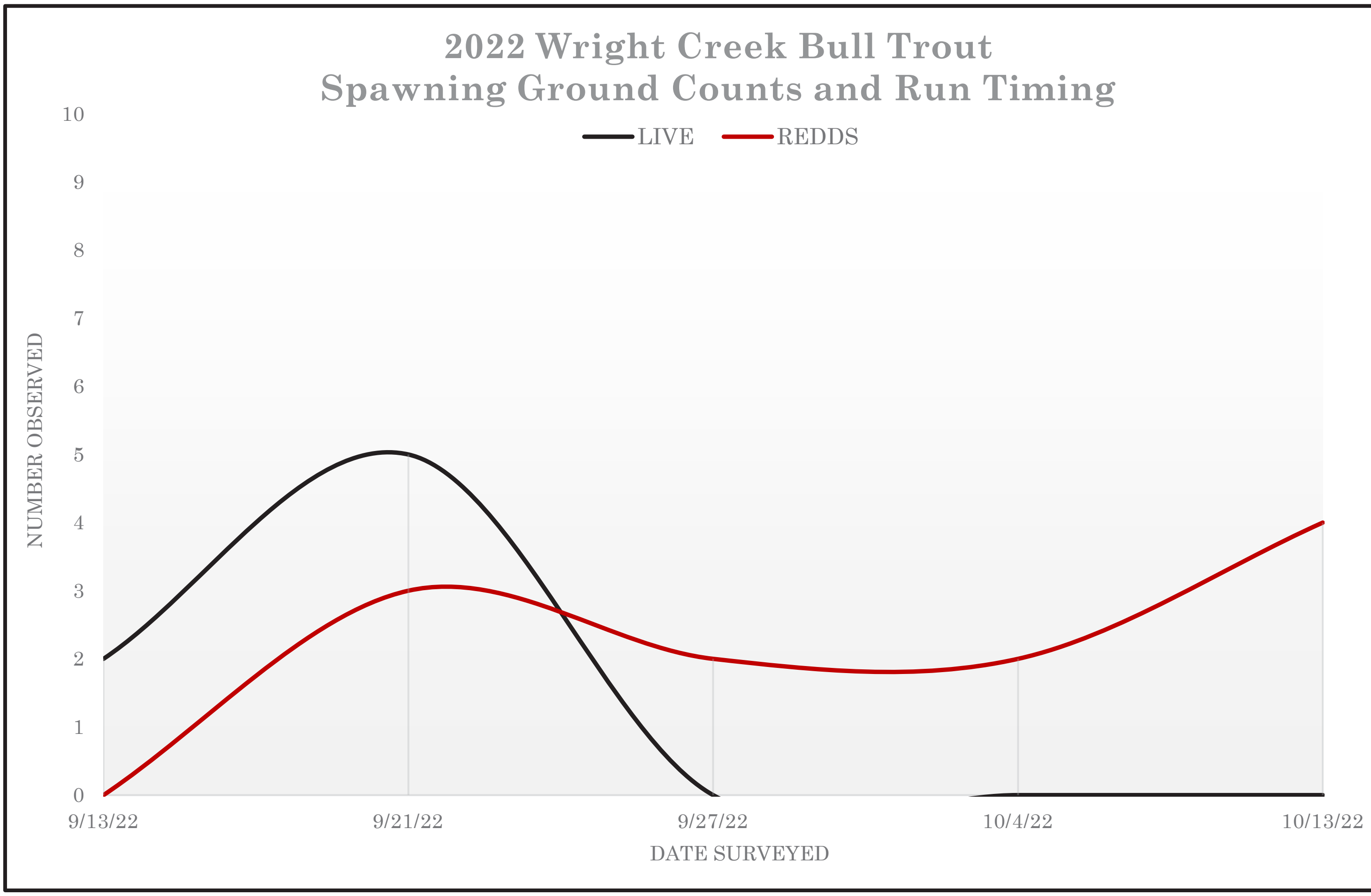
Beyond the open channel, Wright Creek enters the heavily forested slope bordering Fryingpan and assumes a step-pool configuration for the next 0.1 miles. Throughout this final reach of fish usage, spawning opportunities are reduced due to the increased gradient, predominately larger substrate, and rapid flows encountered. Although the majority of this short upper section provides excellent rearing habitat, it doesn't offer much in the way of spawning opportunities. Approximately 0.1 miles after entering the forested area, the creek climbs rapidly up a series of bedrock cascades and small falls; marking the end of habitat accessible by salmonids.

Resident bull trout reside in smaller headwater tributaries, while migratory bull trout frequently travel long distances; utilizing the mainstem rivers and larger tributaries to forage and overwinter. During the fall, migratory forms of bull trout journey from spawning and rearing habitats in the upper watershed to foraging and overwintering habitats located lower in the river system. Beginning in spring and early summer *(May-July)*, they begin the return journey back to spawning and rearing areas high in the watershed. In response to changing habitat and reproductive needs, migratory bull trout in the White River travel up to 75 miles or more between the lower river and headwaters located in or near Mt. Rainier N.P. To accomplish this, bull trout require unobstructed migration corridors and connectivity of streams and rivers in order to provide them with access to spawning, rearing, foraging, and overwintering habitats.

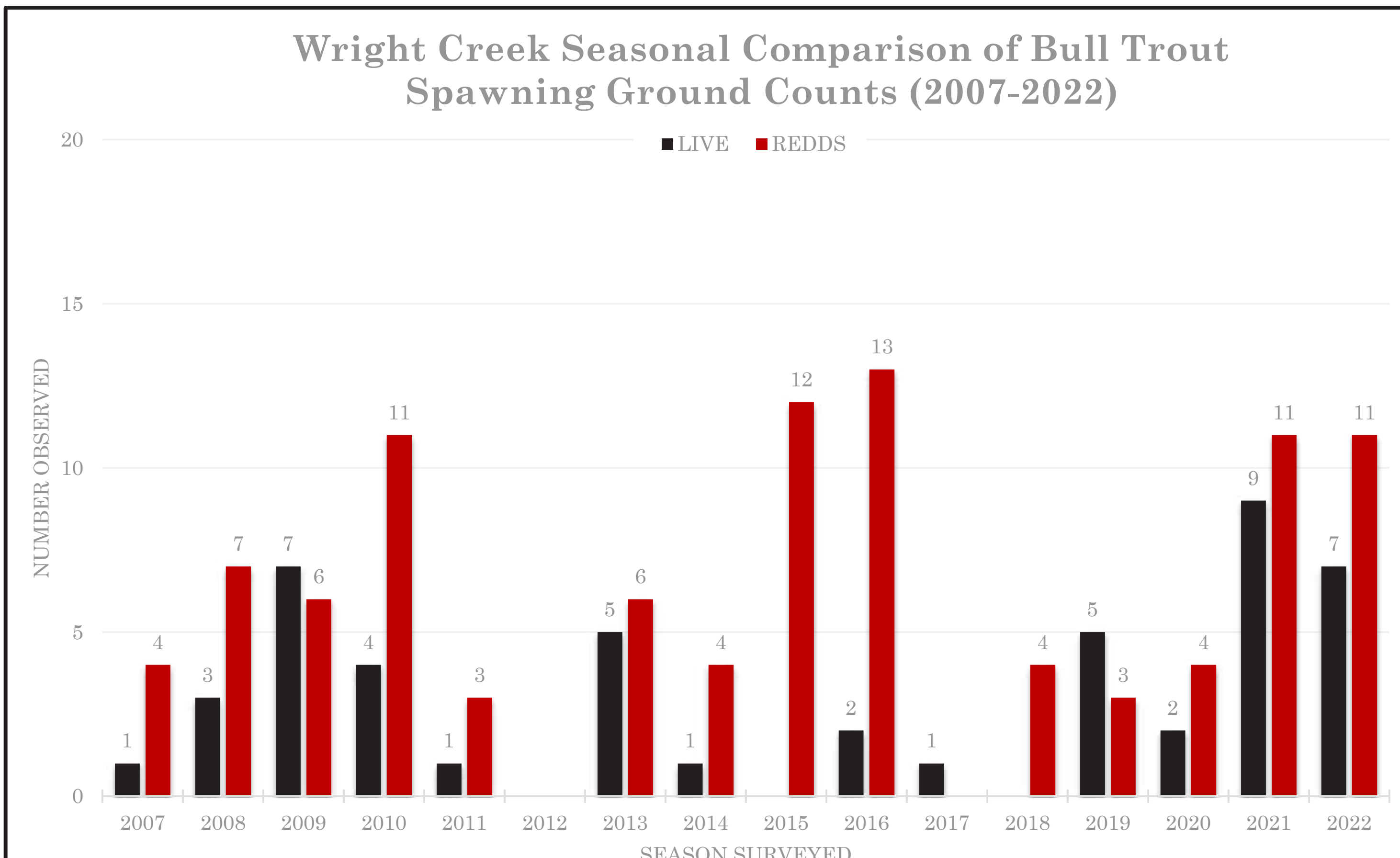
Bull trout are primarily piscivorous [pi-siv-er-uh s] *(fish eaters)*. However, they are opportunistic feeders; feeding on a variety of prey items depending on their particular life history strategy and stage of development. Adults feed almost exclusively on other fish, including a range of salmon and trout species; as well as other resident fish species. Juveniles feed on aquatic invertebrates, including stoneflies *(Plecoptera)*, caddisflies *(Trichoptera)*, and mayflies *(Ephemeroptera)*. Bull trout require a healthy aquatic environment in order to survive and prosper. They need an environment that provides the prey base; in addition to the rearing and reproductive habitat necessary to ensure their continued survival and reproductive success.

Bull trout spawning occurs primarily during the first three weeks in September, however, spawning has been observed taking place from the last week of August through the first week of October. Bull trout are iteroparous *(have the ability to spawn more than once)*; therefore, recovering pre-or-post spawn mortalities for examination is extremely rare. Spawners in the upper White River tributaries are observed utilizing various sized substrate from small gravels to small cobble. Redds are often constructed in the tail-out of pools and along channel margins. Embryonic development is slow; it may take between 165-235 days for eggs to hatch *(depending on water temperatures)* and for alevins to absorb their yolk (Pratt 1992). Bull trout fry emerge in late winter and early spring. Young fry can often be seen by mid-March foraging in the lateral habitats along the upper mainstem White River and tributaries.

Bull trout habitat throughout the Puyallup and White rivers has been severely impacted by over a century of land and water resource exploitation; including, damming and substantial water diversions, considerable riparian alterations *(deforestation)*, dewatering and low instream flow regimes, as well as significant channel manipulation. These impacts have lead to a marked deterioration in land and hydrological behavior within these river systems by causing water flow of poorer quality, quantity and timing. Several limiting factors are involved with regards to the healthy function of stream habitat and bull trout populations in the watershed; including lost or diminished habitat connectivity and migration corridors *(human-made fish passage barriers)*, fragmentation and reduction of habitat quality *(entrainment, transportation networks, forest management practices and operations, direct water withdrawal)*; in addition to, water quality, fish entrainment and entrapment, unknown species interactions, and potential climate change impacts *(changes in flow regimes, scour effects, thermal variations, changes in water chemistry)*.



2021 data provided by the Puyallup Tribe and National Park Service (MORA). Raw spawning data can be found in Appendix B. See Appendix C for bull trout redd locations.



WRONG CREEK

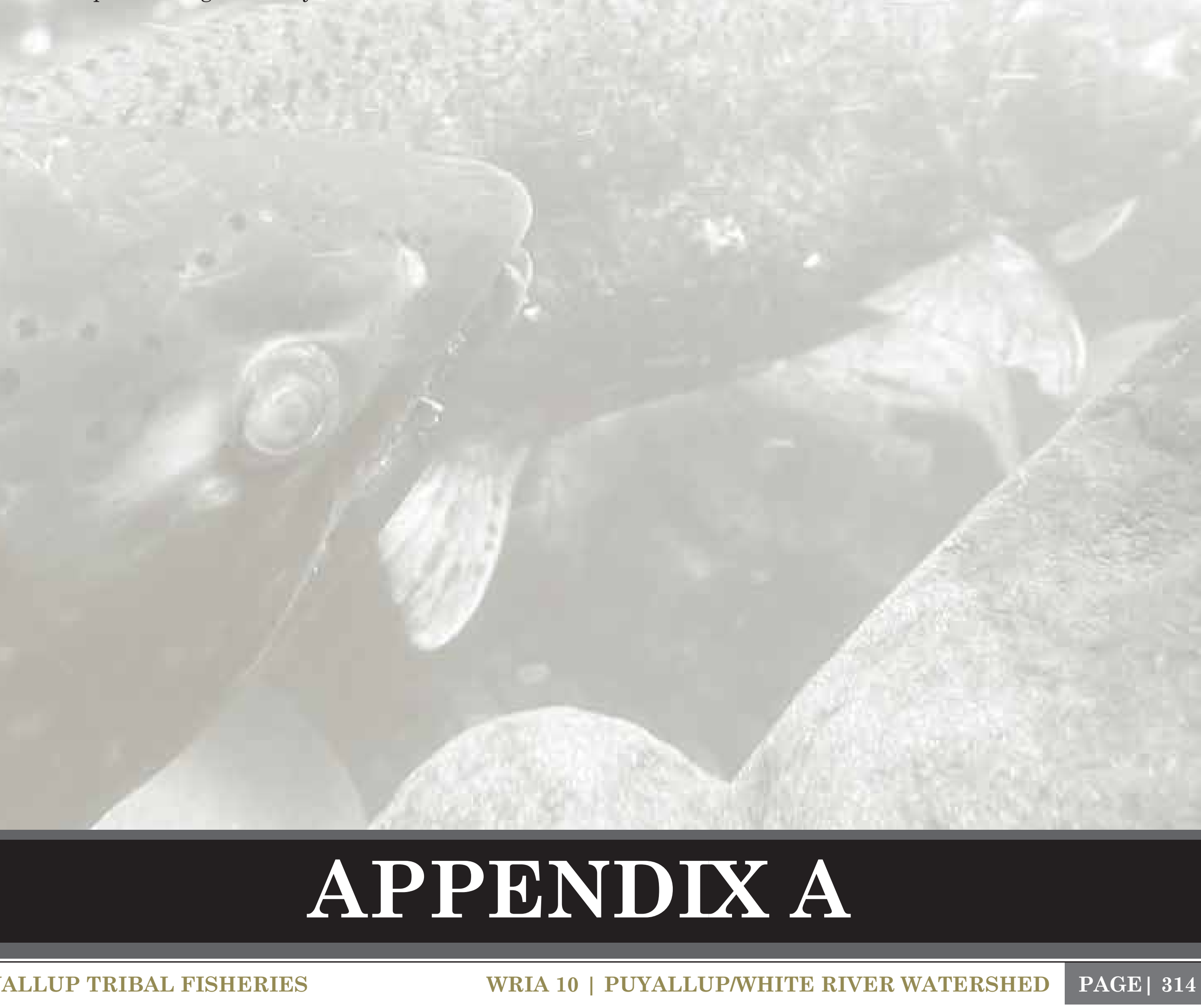
WRIA 10.0205

Wrong Creek is a small tributary entering Pinochle Creek, approximately 0.2 miles above Pinochle's confluence with the West Fork White River. Wrong Creek originates along Clear West Peak around 4,500 feet. The lower, approximately 2.5 miles, flows within the West Fork White River's floodplain. There is no development along Wrong Creek, with the exception of the USFS bridge crossing at approximately RM 0.4. There are small patches of suitable spawning gravel present primarily in the lower 0.5 miles of the creek. The riparian zone consists of mature second growth hardwoods and conifers with an understory of blueberry and salmonberry. Wrong Creek hosts several sizable log jams containing numerous key components. Coho are the most abundant and common species observed in Wrong Creek. Other species known to utilize the creek include Chinook, pink, sockeye, cutthroat and rainbow; however, steelhead utilization is unknown. Bull trout utilization is presumed since they are known to occupy several other habitats throughout the West Fork drainage. Unfortunately, low flows can make it problematic for Chinook to access the creek in August and September to spawn; as a result, Chinook escapement in Wrong is often low or absent.

In the past, Wrong was surveyed for adult salmon escapement; unfortunately, flood damage to Forest Service Road 74 has prevented access to the creek since early 2006; so, no escapement surveys or fish plants in the nearby acclimation pond located on Cripple Creek have occurred since. When escapement surveys were conducted, coho were often observed each season holding in two large pools in Pinochle, just below the confluence with Wrong Creek. Many of these coho would ascend Cripple and Wrong a couple of weeks after entering Pinochle Creek. All adult salmon that spawn in Wrong Creek were initially captured at the USACE fish trap in Buckley, and transported above Mud Mountain dam. Salmonid escapement numbers for the upper White River drainage are known; therefore, surveys were conducted to determine fish distribution and spawning success. This is especially important regarding Spring Chinook, since adult production monitoring is part of the White River Spring Chinook Recovery Plan. Also, as part of the Spring Chinook Recovery Plan, the Puyallup Tribe operated a Spring Chinook acclimation pond located at RM 0.3 on Cripple Creek. Spring Chinook were reared and released from Cripple Creek for several years *(1994-2006)*. Approximately 50,000 plus Spring Chinook from the Muckleshoot White River hatchery were transported annually to the Cripple Creek acclimation pond in early spring, and released in late spring. Returns to Pinochle; as well as Cripple and Wrong creeks, is likely the result of these earlier plantings.

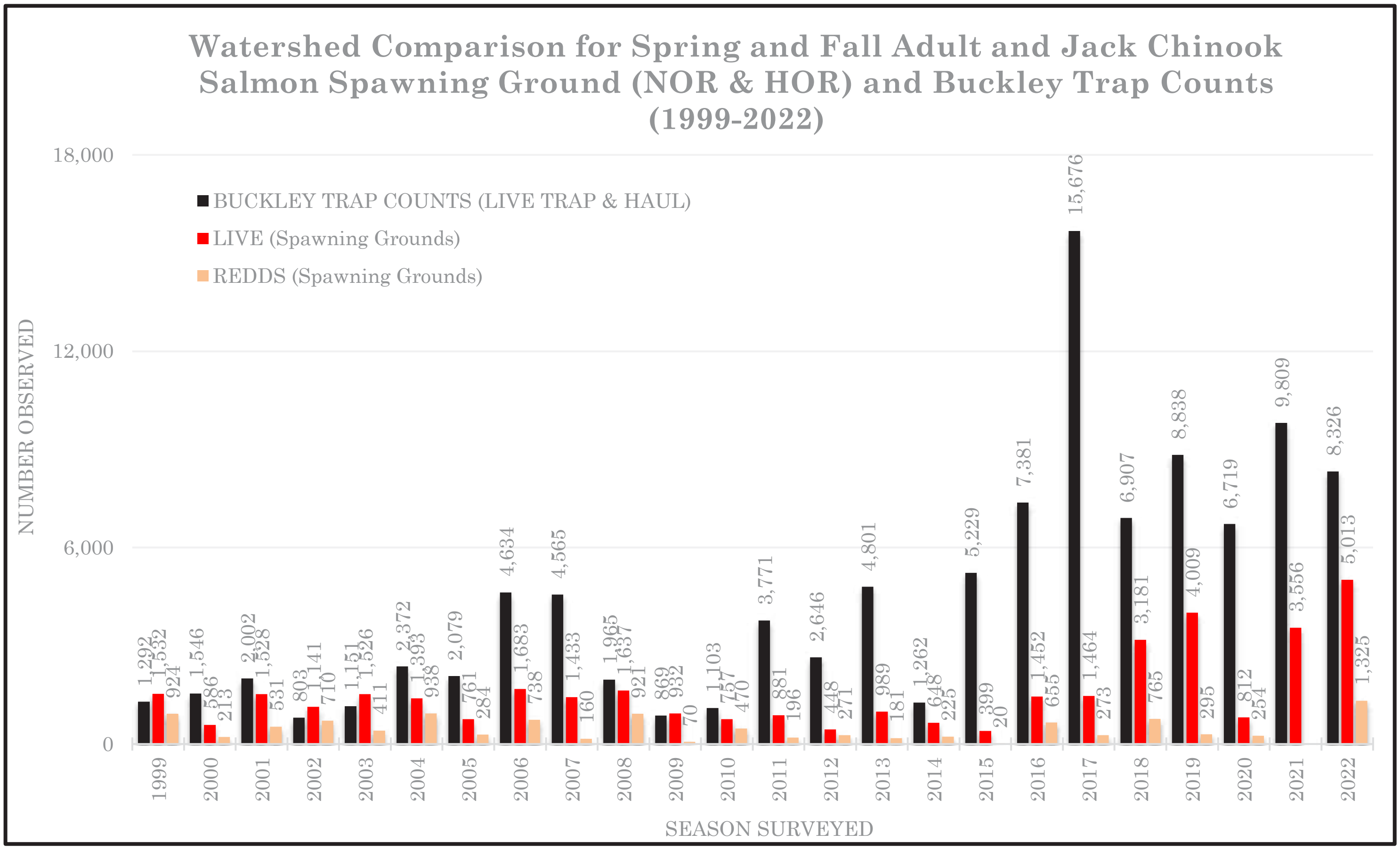
Annual Comparisons of Salmon and Steelhead Spawning Ground Counts; Escapement Estimates; USACE FishTrap Counts (White River), and Hatchery Returns.

The following charts are separated by species and include both wild (NOR) and hatchery (HOR) origin escapements. They are a compilation of the yearly survey totals conducted by the Puyallup Tribe Fisheries Department, Washington Department of Fish and Wildlife and the Army Corps of Engineers' Buckley trap counts. These data yield an estimated and empirical representation of total natural/hatchery escapement for the entire WRIA 10: Puyallup/White River Watershed. It's important to note that the number of live fish observed and represented in the graphs is an accumulation of all fish seen throughout the survey season. The total number of live fish observed does not depict the estimated escapement which is derived through statistical analysis. As additional DNA results become available, the reassignment of Spring and Fall Chinook may result in adjustments to the escapement estimates. The live and redds totals in the following graphs do not include the fish or redds observed above RM 24.3 on the White River, since these actual escapement totals are known from the USACE Buckley trap counts. Due to the tremendous number of pink salmon during odd years, the success of determining Chinook redds from pinks is significantly reduced.

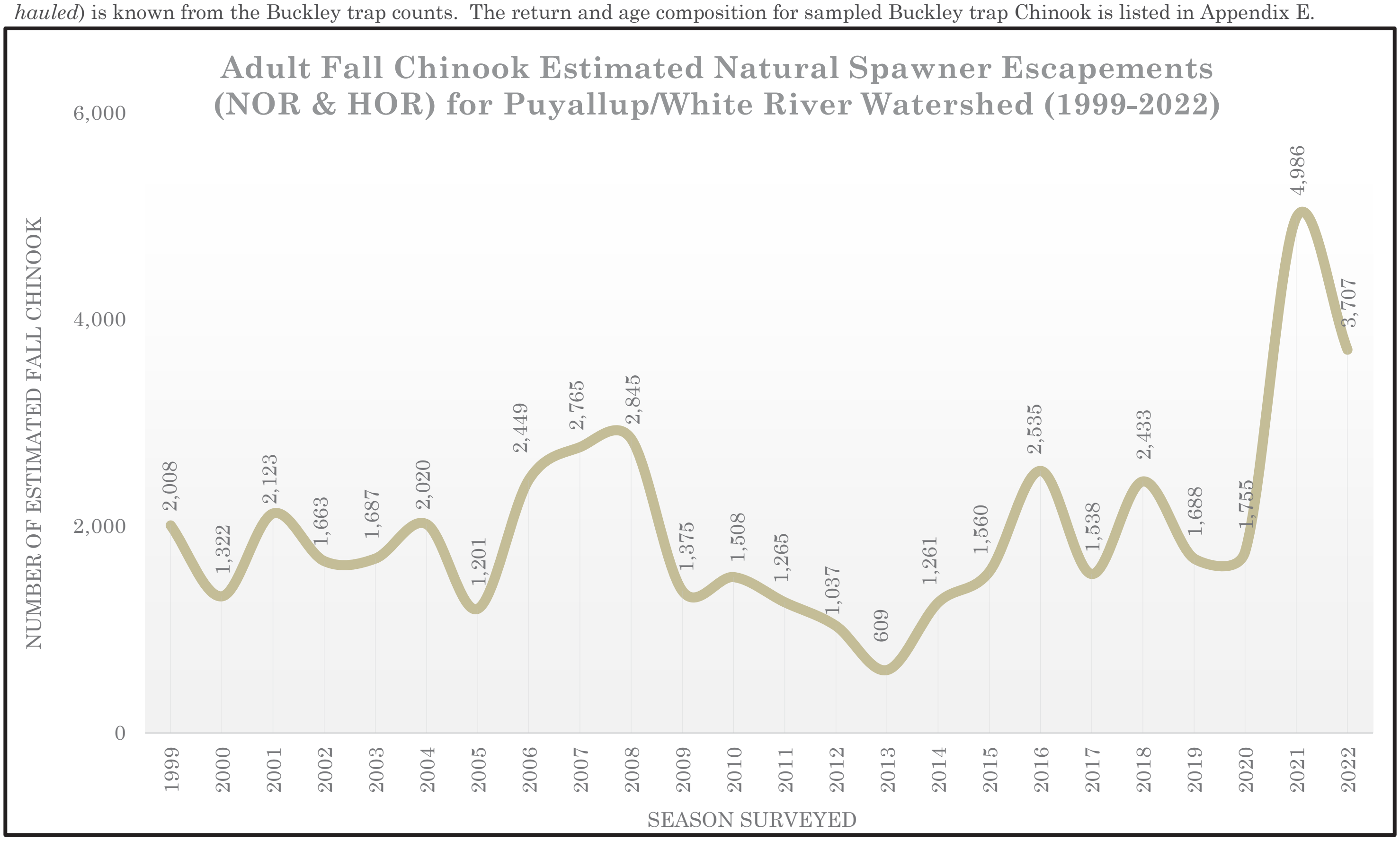


Chinook salmon in Boise Creek.

APPENDIX A

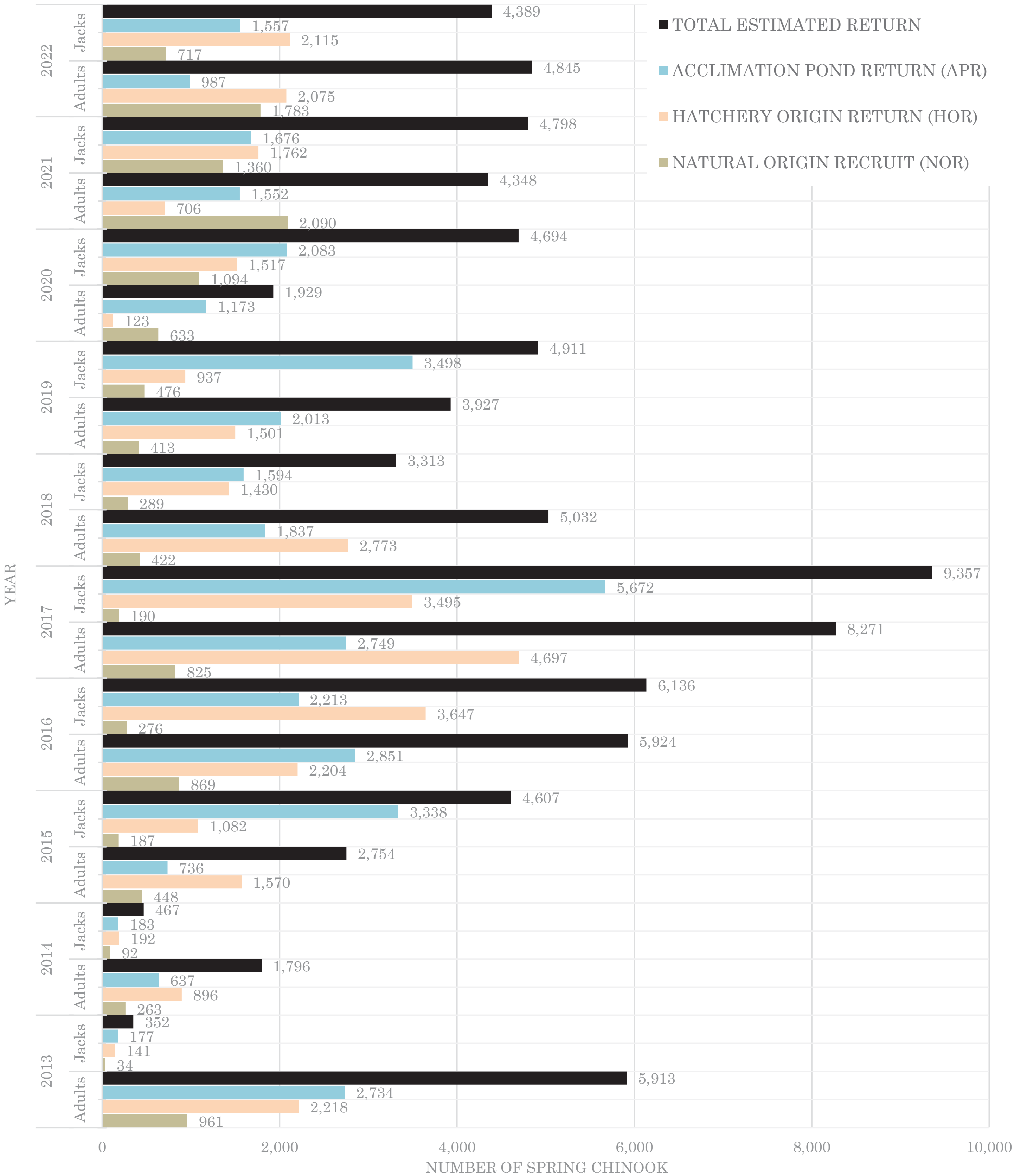


Live, dead and redds totals in this graph <u>do not</u> include Chinook/redds observed above RM 24.3 on the White River; actual escapement *(fish hauled*) is known from the Buckley trap counts. The return and age composition for sampled Buckley trap Chinook is listed in Appendix E.

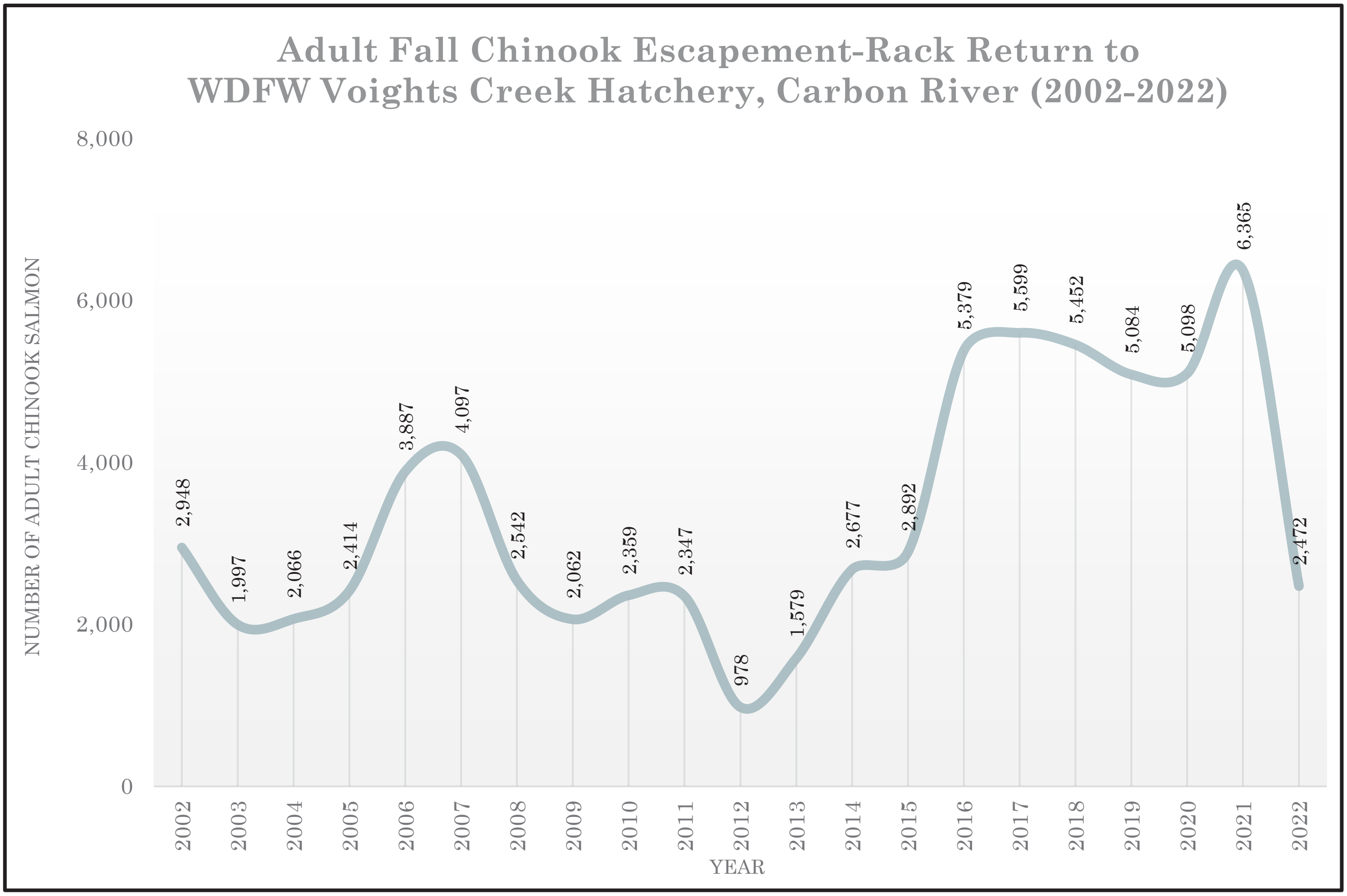


Estimated Fall Chinook escapement totals were calculated and provided by WDFW biologists using both PTF and WDFW spawning escapement data. <u>As additional DNA results become available, the reassignment of Spring and Fall Chinook may result in adjustments to the escapement estimates.</u> Adjustment in the AUC methods used to determine escapement during pink runs (odd years) may alter prior estimates. Addition biological expansion factors are applied to estimate escapement for suitable habitat areas that are often unsurveyable (i.e. mainstem rivers).

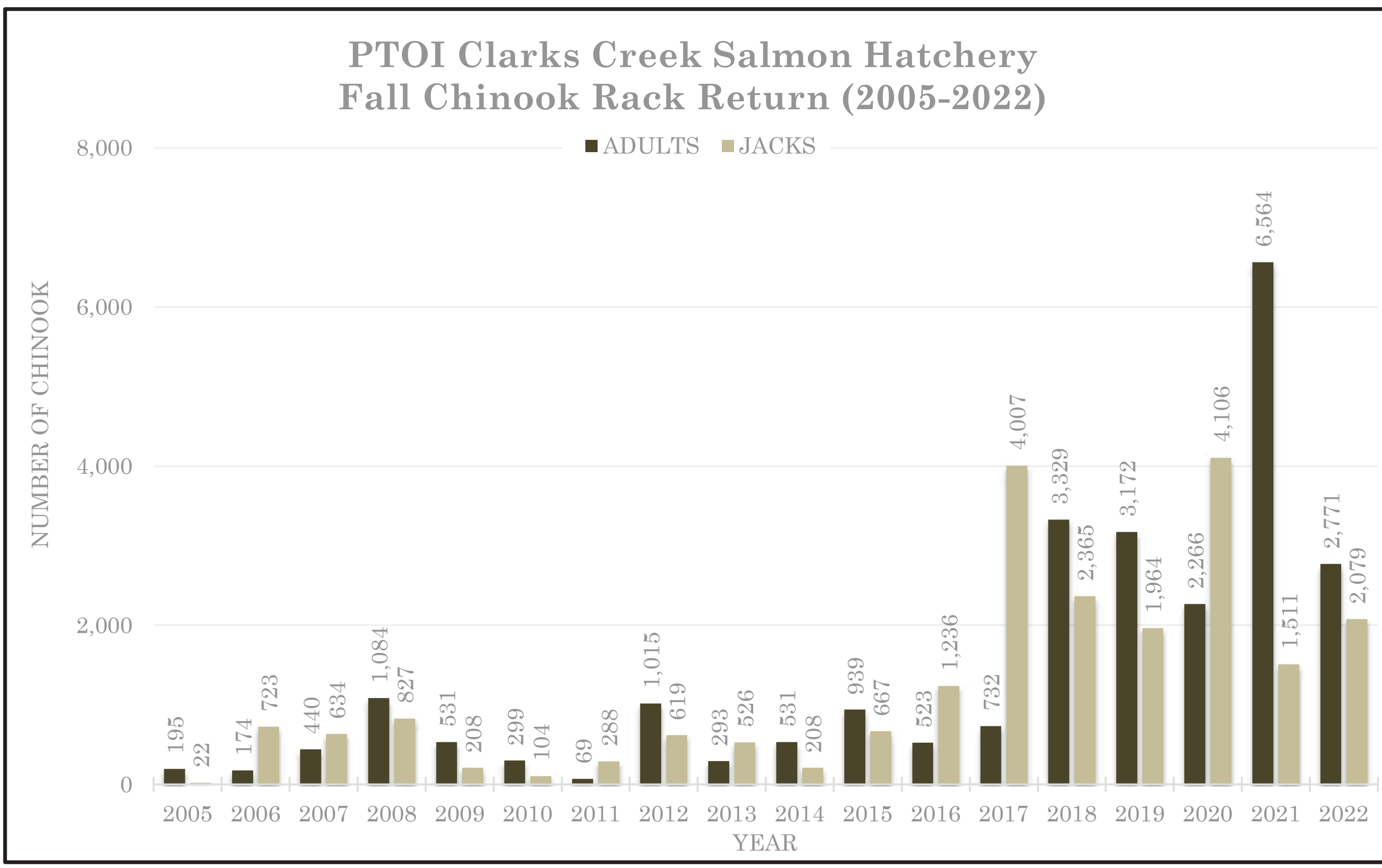
White River Spring Chinook Total Return Estimates for Natural Origin, Hatchery Origin and Acclimation Pond Adults and Jacks (2013-2022)

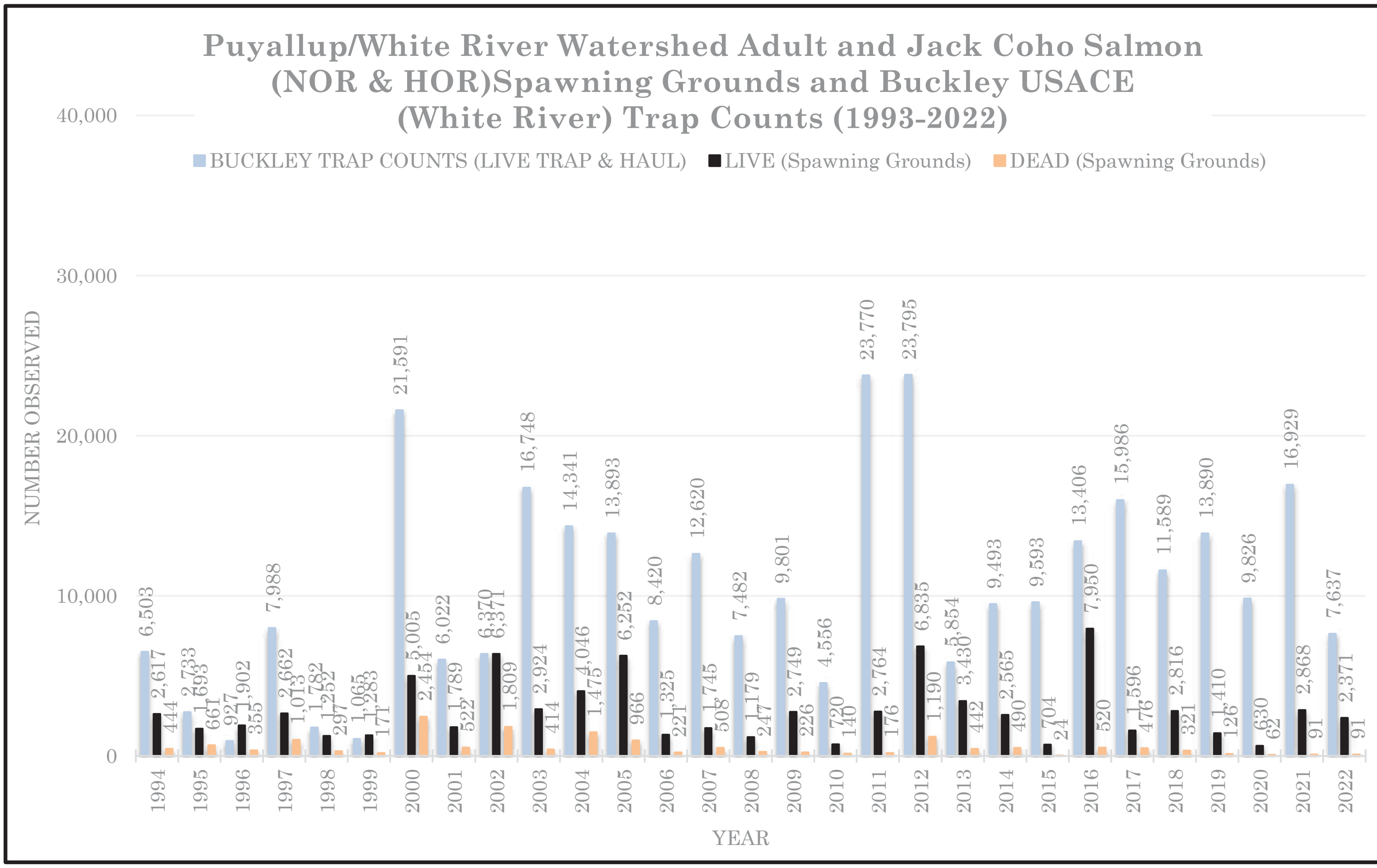


Return estimates generated by WDFW based on USACE Buckley trap data and Muckleshoot White River hatchery returns. The return and age composition for sampled Buckley trap Chinook are listed in Appendix E. As additional DNA results become available, the reassignment of Spring and Fall Chinook may result in adjustments to the escapement estimates. Chinook captured in the USACE Buckley trap are a mix stock of Spring and Fall Chinook.

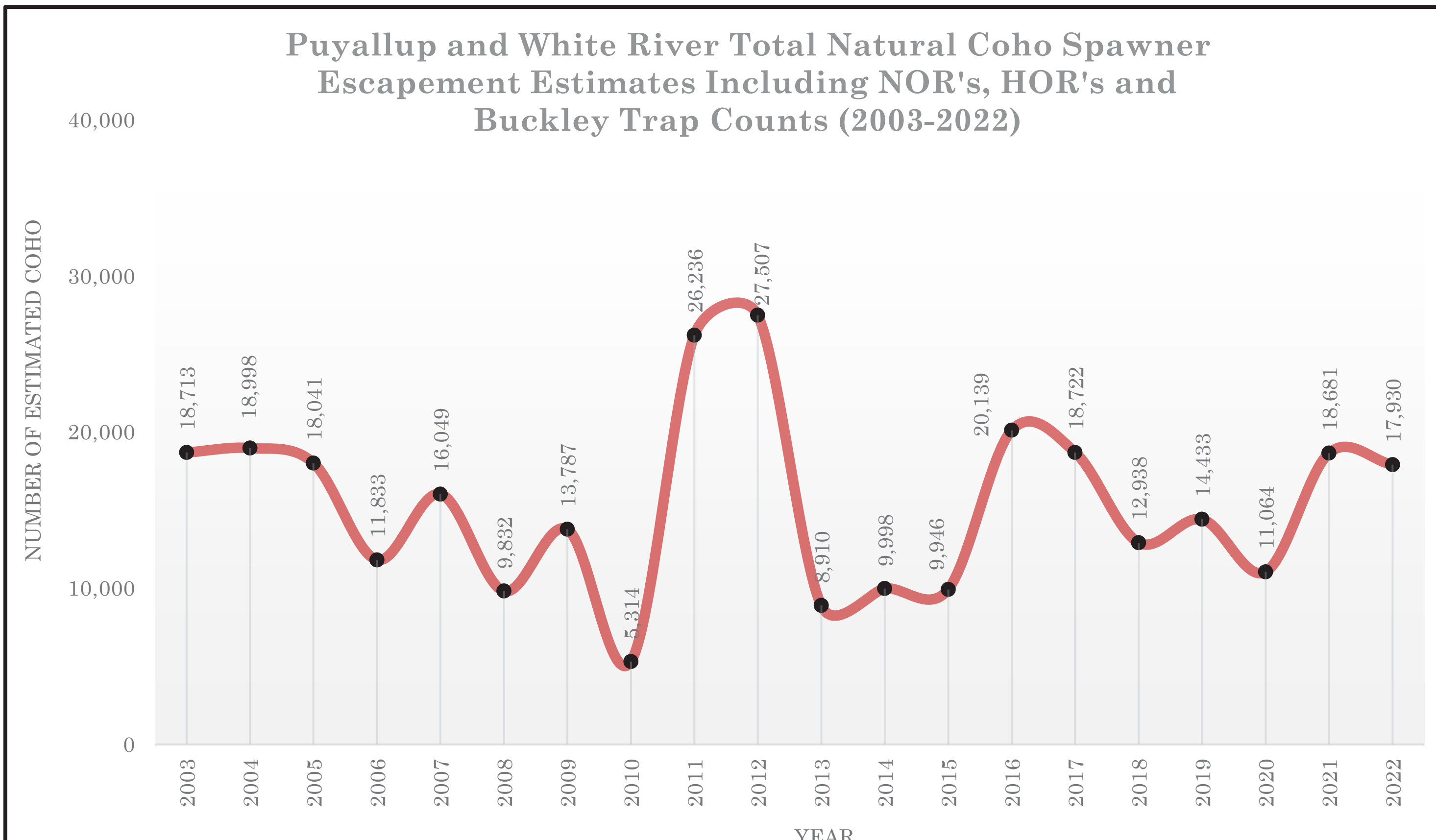


Data source: https://wdfw.wa.gov/hatcheries/escapement/

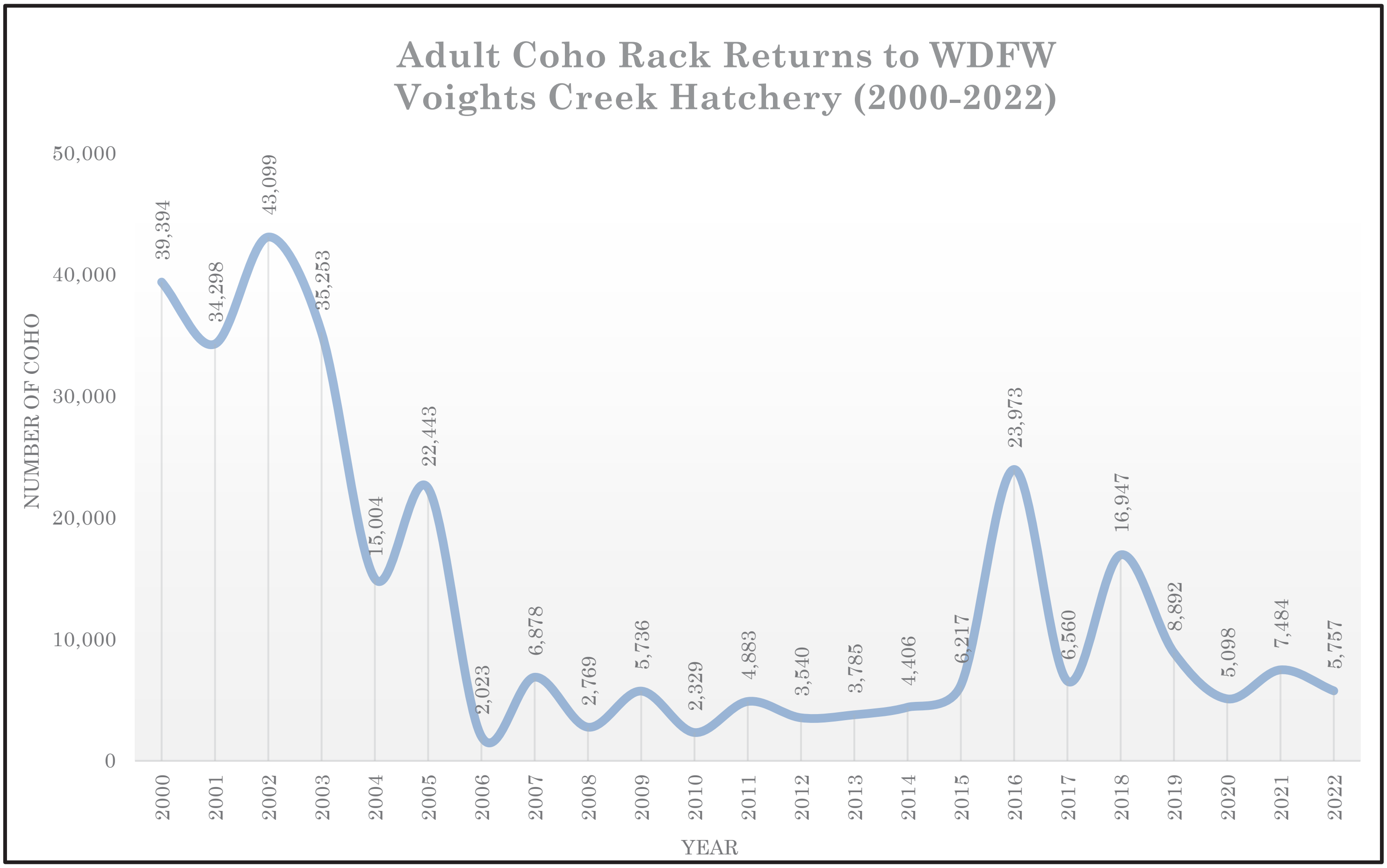




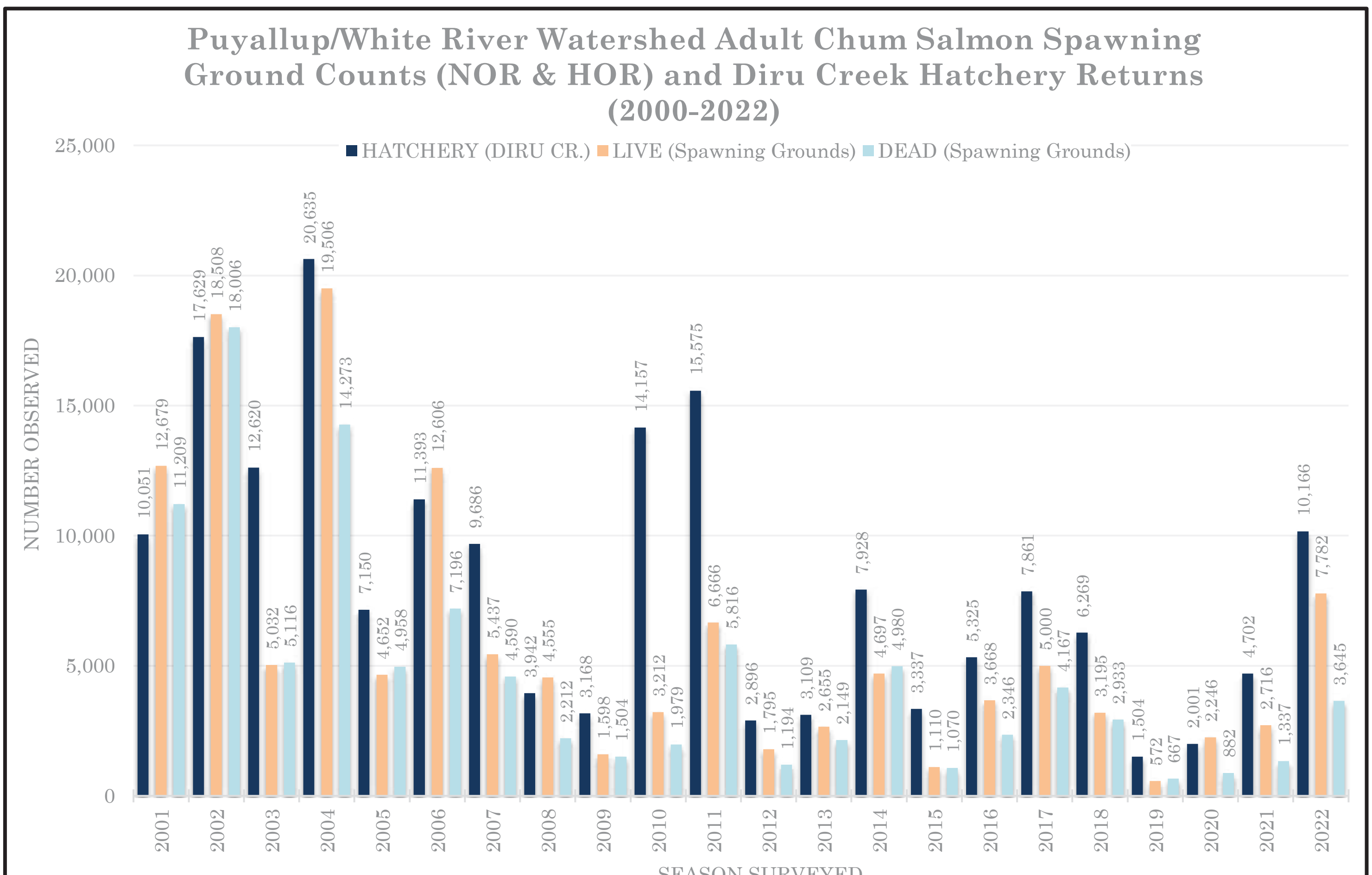
The live and dead totals in this graph do not include the coho observed above RM 24.3 on the White River; actual escapement totals are known from the USACE Buckley trap counts. Buckley trap data taken from USACE website: http://www.nws.usace.army.mil/Missions/CivilWorks/LocksandDams/MudMountainDam/FishCounts.aspx

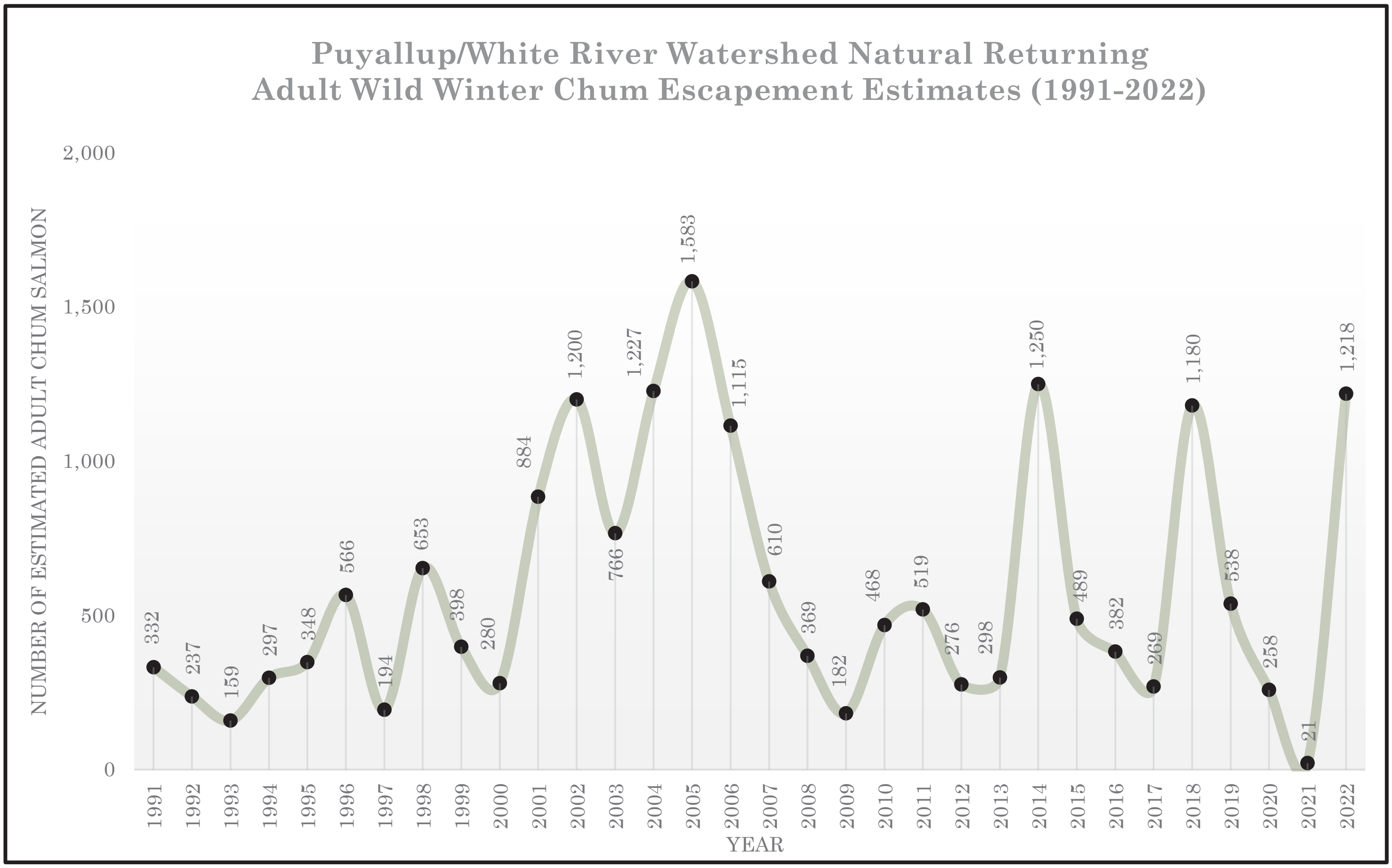


Estimated escapements for naturally returning coho spawners provided by WDFW, utilizing PTF and WDFW spawning data collected.

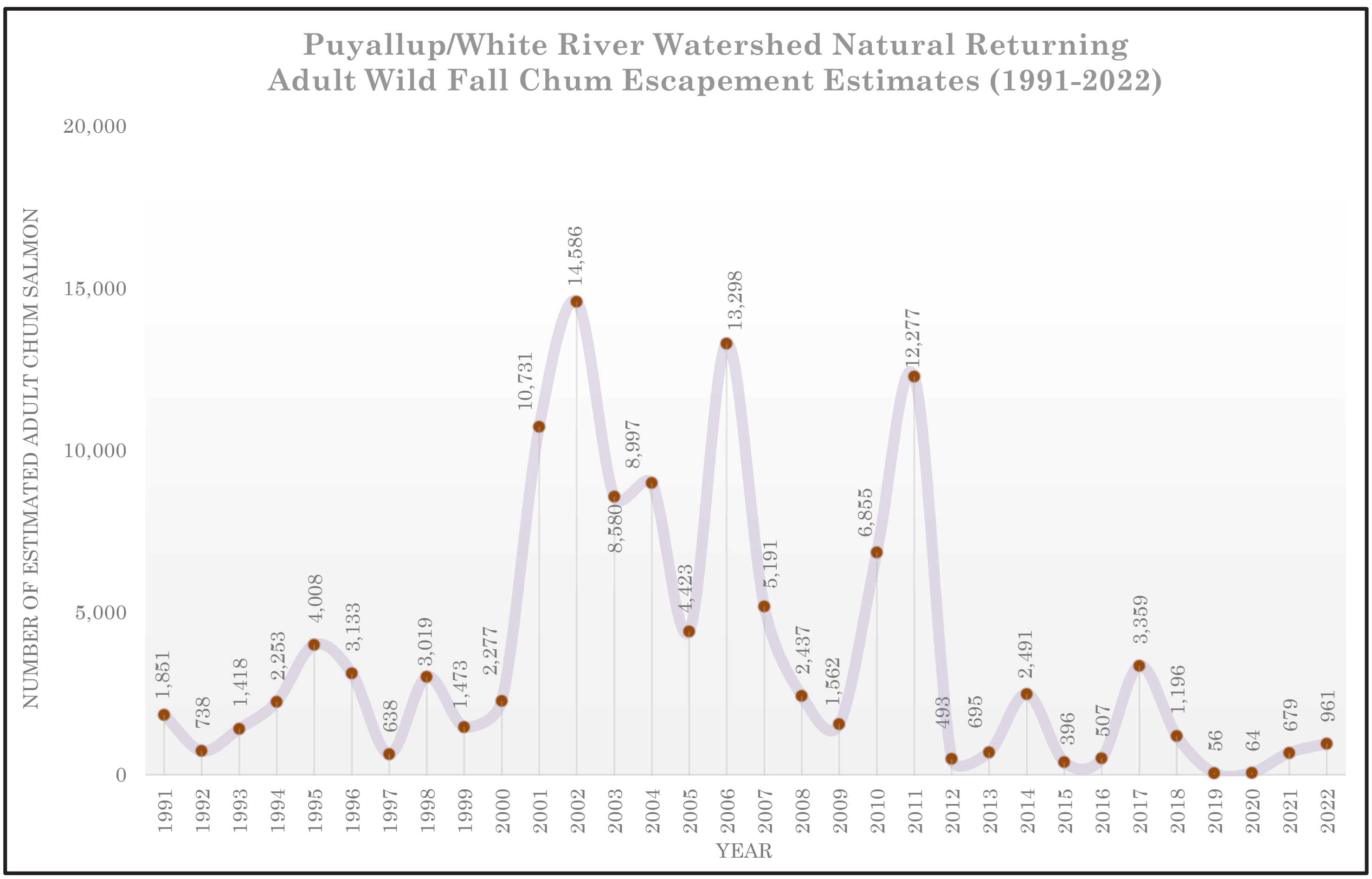


Data source: https://wdfw.wa.gov/hatcheries/escapement/

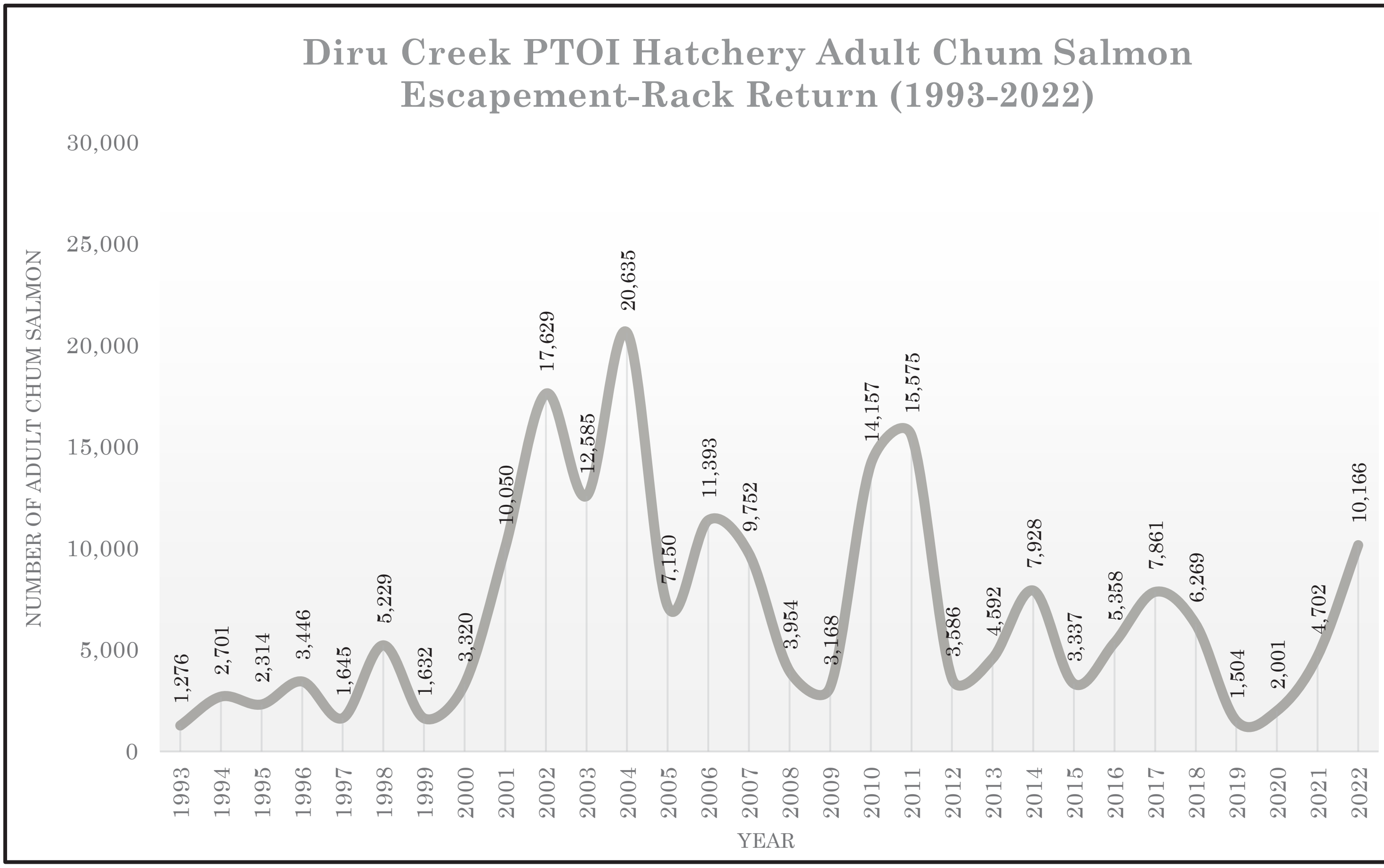




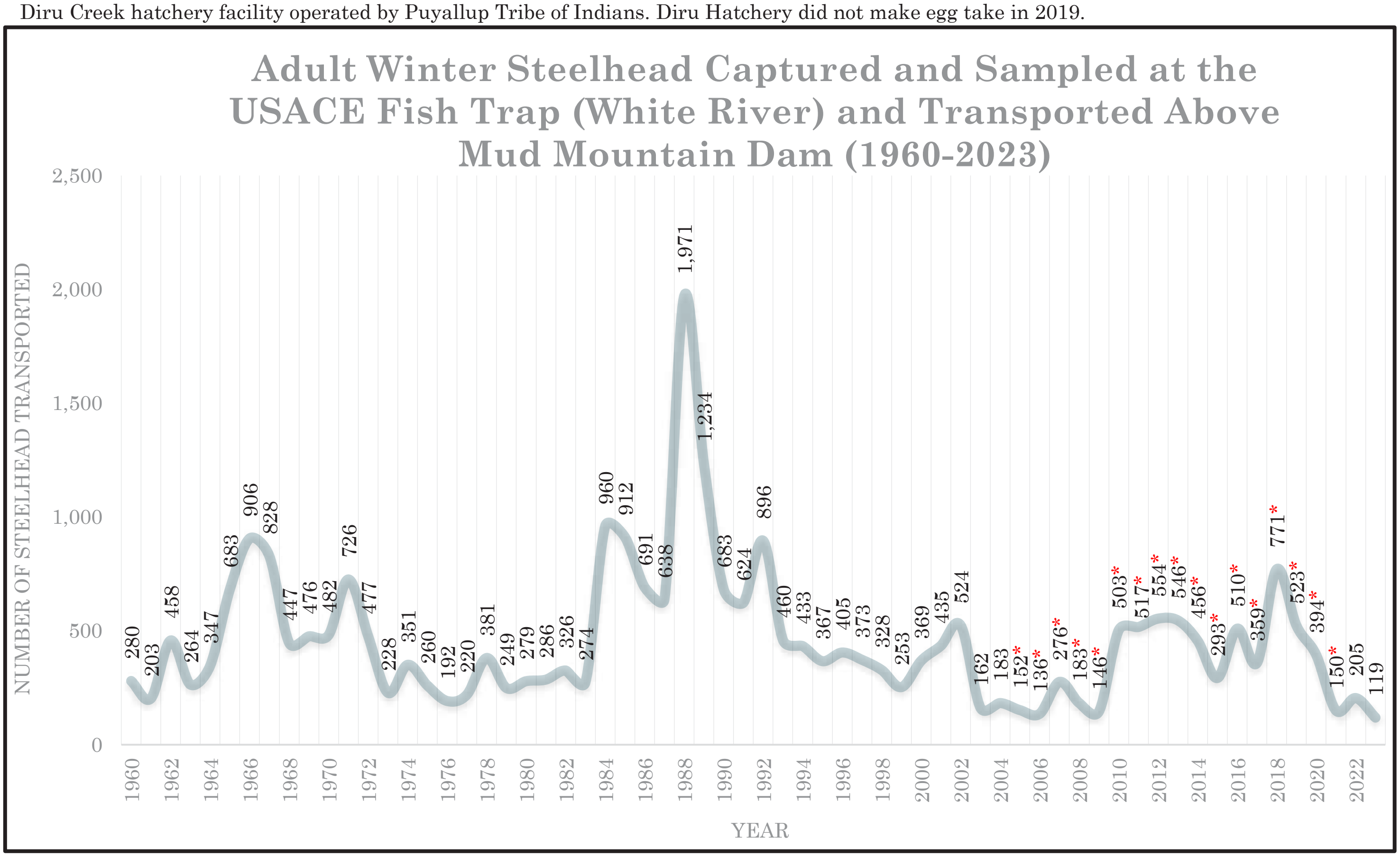
Estimated winter chum escapement totals were calculated by WDFW by means of PTF spawning grounds escapement data.



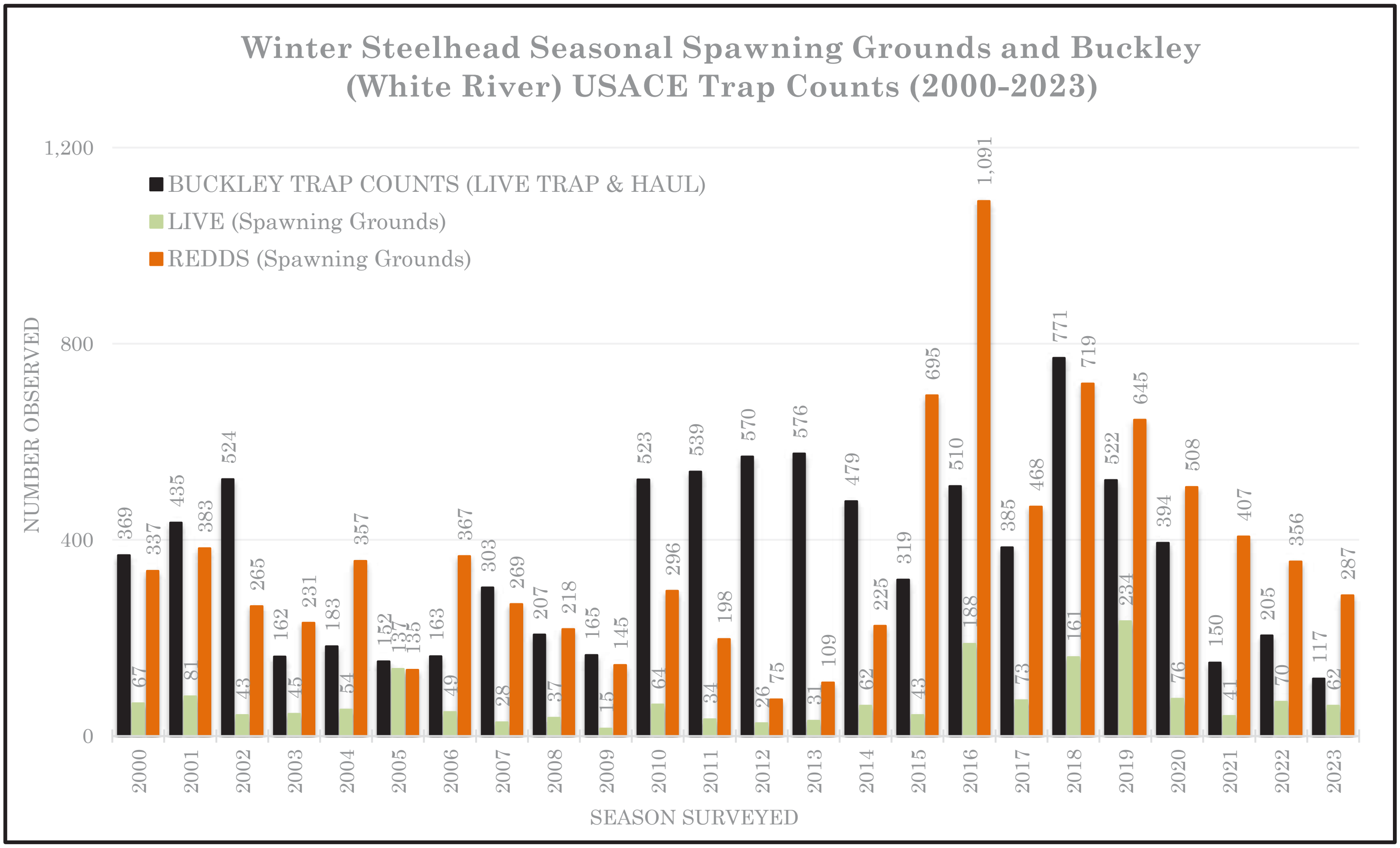
Estimated fall chum escapement totals were calculated by WDFW by means of PTF and WDFW spawning grounds escapement data.



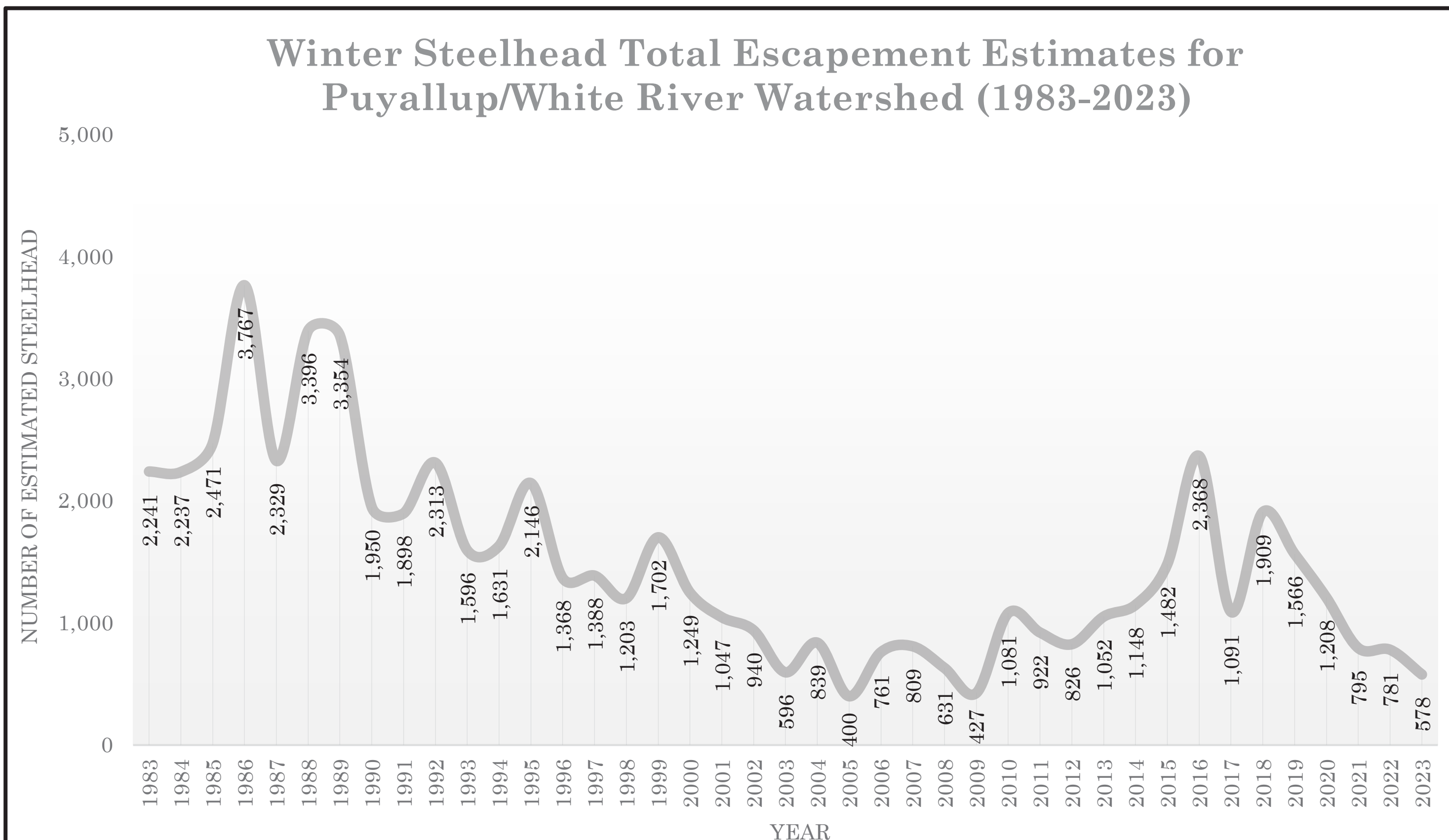
Diru Creek hatchery facility operated by Puyallup Tribe of Indians. Diru Hatchery did not make egg take in 2019.



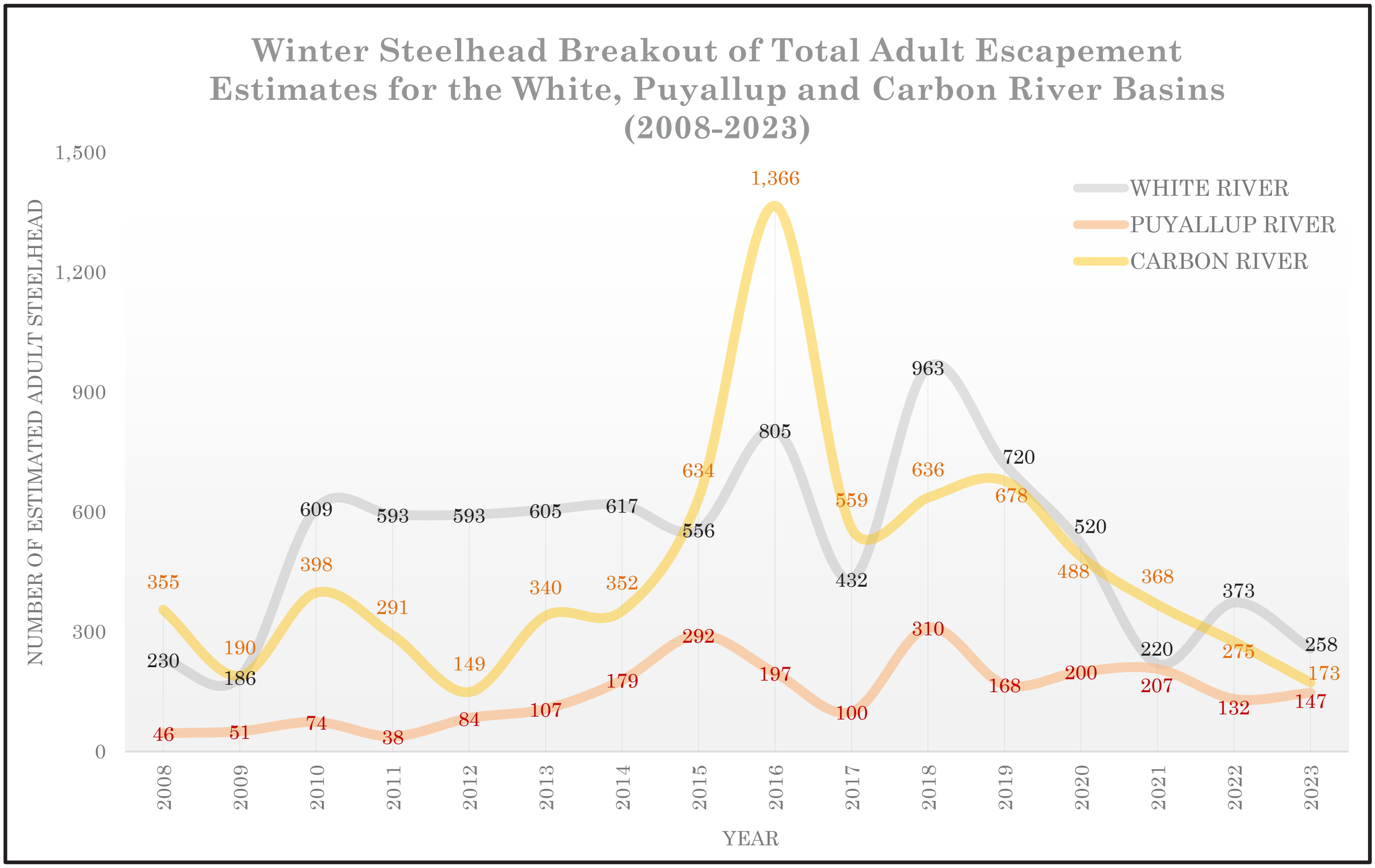
The graph above details the number of steelhead transported above Mud Mountain Dam. *Additional steelhead captured in the trap from 2006-2021 were taken as brood-stock for the White River steelhead supplementation project (Program was discontinued in 2022 due to insufficient brood-stock availability). See Appendix F&G for the breakdown/age of steelhead returns sampled.



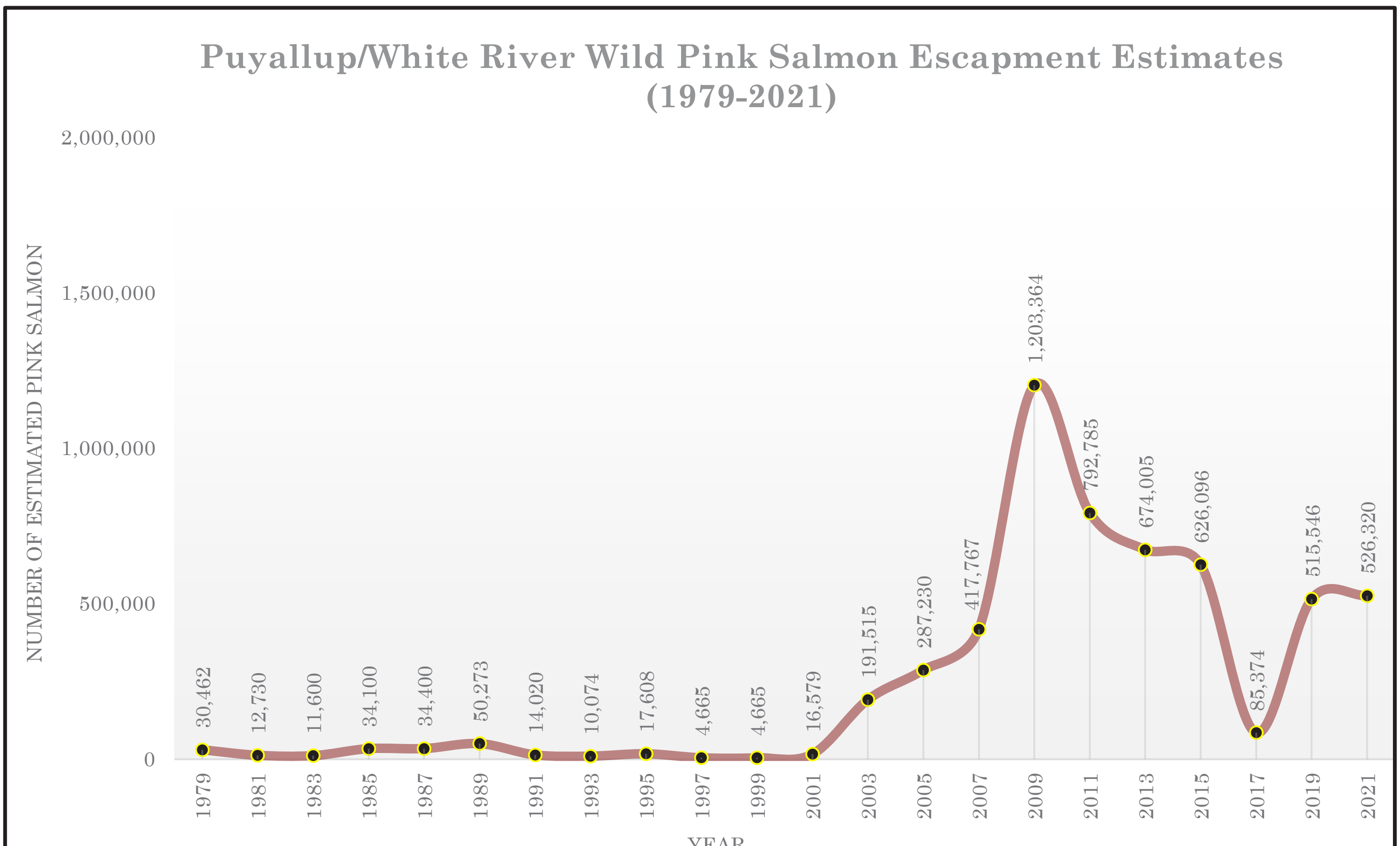
The live, dead and redd totals in this graph do not include steelhead or redds observed above RM 24.3 on the White River; actual escapement totals are known from the USACE Buckley trap (FPF: Fish Passage Facility) counts (see Appendix F & G).



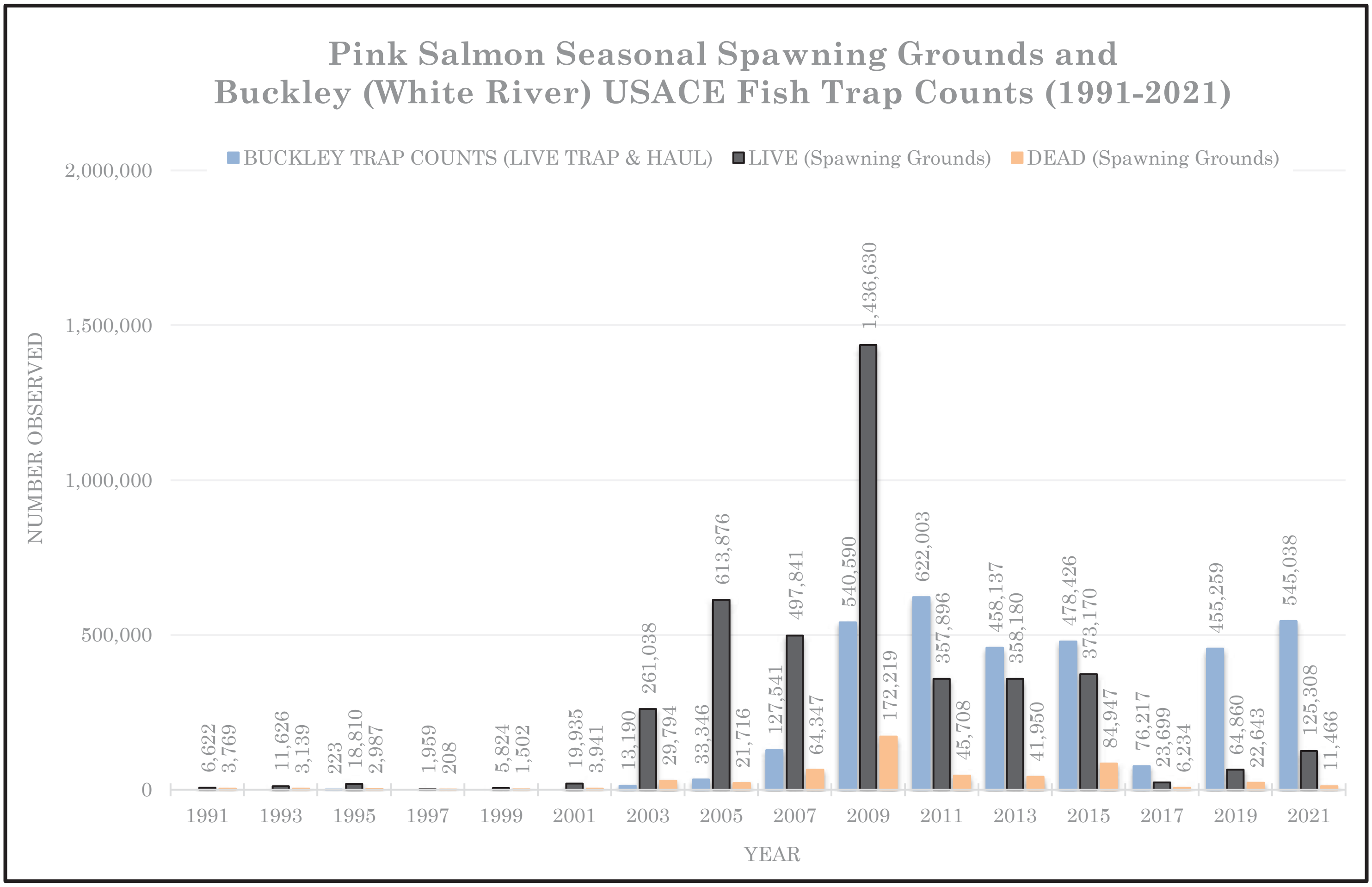
Estimated steelhead escapement totals were calculated and provided by WDFW biologists. Escapement and total run size were determined by utilizing PTF and WDFW spawning escapement data; Buckley trap capture/sampling data, and biological expansion factors. Addition biological expansion factors are applied to estimate escapement for suitable habitat areas that are often unsurveyable (i.e. mainstem rivers and tributary headwaters). See following graph for the breakout of the White, Puyallup and Carbon river basins steelhead escapements.



Steelhead escapement was determined by WDFW utilizing PTF & WDFW spawning escapement data and USACE Buckley sampling data.



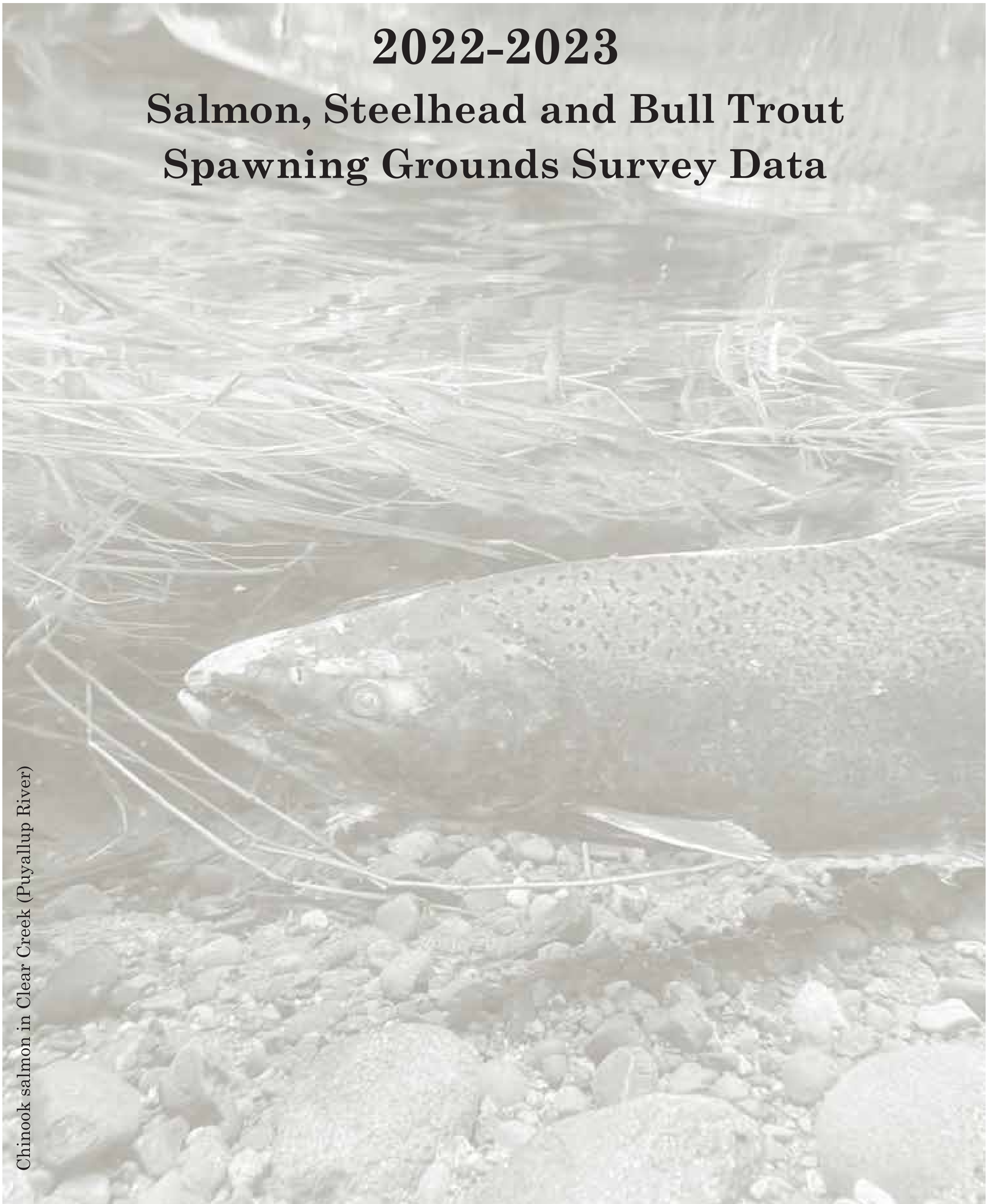
Pink escapement estimates determined WDFW utilizing PTF & WDFW spawning escapement data and USACE Buckley trap capture data.



The live and dead totals in this graph <u>do not</u> include the pink salmon observed above RM 24.3 on the White River; actual escapement totals are known from the USACE Buckley trap counts. Buckley trap (FPF: Fish Passage Facility) data source is the USACE Mud Mountain Dam website: http://www.nws.usace.army.mil/Missions/CivilWorks/Lock sandDams/MudMountainDam/FishCounts.aspx

2022-2023

Salmon, Steelhead and Bull Trout Spawning Grounds Survey Data



Chinook salmon in Clear Creek (Puyallup River)

APPENDIX B

2022 CHINOOK SPAWNING SURVEY DATA

STREAM NAME	WRIA	DATE SURVEYED	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
BOISE CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
BOISE	10.0057	9/6/22	0.0	2.2	0	0	1
BOISE	10.0057	9/14/22	0.0	4.5	46	6	18
BOISE	10.0057	9/26/22	0.0	3.5	230	89	56
BOISE	10.0057	10/3/22	0.0	3.5	138	128	35
BOISE	10.0057	10/11/22	0.0	3.5	18	31	4
BOISE	10.0057	10/17/22	0.0	3.5	2	9	2
BOISE	10.0057	10/25/22	0.0	3.5	1	0	0
BOISE	10.0057	11/1/22	0.0	4.5	1	0	0
BOISE	10.0057	11/7/22	0.0	4.5	1	0	0
BOISE	10.0057	11/14/22	0.0	4.5	0	0	0
			BOISE CREEK	TOTAL	437	263	116
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS
CANYON CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
CANYON CREEK	10.0022A	9/6/22	0.0	0.5	0	0	0
CANYON CREEK	10.0022A	9/14/22	0.0	0.5	0	0	0
CANYON CREEK	10.0022A	9/21/22	0.0	0.5	0	0	0
CANYON CREEK	10.0022A	9/26/22	0.0	0.5	0	0	0
CANYON CREEK	10.0022A	10/3/22	0.0	0.5	0	0	0
CANYON CREEK	10.0022A	10/11/22	0.0	0.5	2	1	1
CANYON CREEK	10.0022A	10/17/22	0.0	0.5	0	0	0
CANYON CREEK	10.0022A	10/25/22	0.0	0.5	0	0	0
			CANYON CREEK	TOTAL	2	1	1
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS
CANYON FALLS	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
CANYON FALLS	10.0410	9/15/22	0.3	0.6	7	0	2
CANYON FALLS	10.0410	9/21/22	0.3	0.6	7	0	4
CANYON FALLS	10.0410	9/26/22	0.3	0.6	14	1	8
CANYON FALLS	10.0410	10/3/22	0.3	0.6	2	1	1
CANYON FALLS	10.0410	10/11/22	0.3	0.6	0	0	9
			CANYON FALLS	TOTAL	30	2	24
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS
CLEAR CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
CLEAR	10.0022	9/6/22	1.7	1.9	0	0	2
CLEAR	10.0022	9/14/22	1.7	1.9	14	2	8
CLEAR	10.0022	9/21/22	1.5	1.9	17	1	6
CLEAR	10.0022	9/26/22	1.5	1.9	27	5	16
CLEAR	10.0022	10/3/22	1.5	1.9	52	10	14

CLEAR	10.0022	10/11/22	1.5	1.9	33	18	9
CLEAR	10.0022	10/17/22	1.5	1.9	13	4	6
CLEAR	10.0022	10/25/22	1.5	1.9	0	0	2
CLEAR	10.0022	10/31/22	1.5	1.9	0	0	0
			CLEAR CREEK	TOTAL	156	40	63
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS
CLEARWATER RIVER	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
CLEARWATER	10.0080	9/12/22	0.0	1.5	82	0	13
CLEARWATER	10.0080	9/20/22	0.0	1.5	82	1	56
CLEARWATER	10.0080	9/28/22	0.0	1.5	23	0	38
CLEARWATER	10.0080	10/4/22	0.0	1.5	22	2	20
CLEARWATER	10.0080	10/18/22	0.0	1.5	0	0	0
			CLEARWATER RIVER	TOTAL	209	3	127
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS
FENNEL CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
FENNEL	10.0406	9/7/22	0.0	0.5	0	0	0
FENNEL	10.0406	9/15/22	0.0	0.3	0	0	0
FENNEL	10.0406	9/21/22	0.0	0.3	0	0	2
FENNEL	10.0406	9/26/22	0.0	0.3	1	0	1
FENNEL	10.0406	10/3/22	0.0	0.3	0	0	0
FENNEL	10.0406	10/11/22	0.0	0.3	0	0	0
			FENNEL CREEK	TOTAL	1	0	3
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS
FOX CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
FOX	10.0608	9/7/22	0.0	0.3	0	0	0
FOX	10.0608	9/15/22	0.0	0.3	0	0	0
FOX	10.0608	9/21/22	0.0	0.3	0	0	0
FOX	10.0608	9/26/22	0.0	0.3	0	0	0
FOX	10.0608	10/3/22	0.0	0.3	0	0	0
			FOX CREEK	TOTAL	0	0	0
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS
GREENWATER RIVER	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
Data collected by MIT/WDFW							
*GREENWATER	10.0122	9/7/22	1.2	3.9	343	2	65
*GREENWATER	10.0122	9/14/22	0.0	3.9	551	33	103
*GREENWATER	10.0122	9/22/22	0.0	3.9	436	81	68
*GREENWATER	10.0122	10/6/22	3.9	7.9	2	2	7
			GREENWATER RIVER	TOTAL	1,332	118	243
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS

HUCKLEBERRY CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
HUCKLEBERRY	10.0253	9/12/22	0.0	2.3	33	0	13
HUCKLEBERRY	10.0253	9/20/22	0.0	2.3	29	2	20
HUCKLEBERRY	10.0253	9/28/22	0.0	2.3	6	3	26
HUCKLEBERRY	10.0253	10/4/22	0.0	2.3	2	1	16
HUCKLEBERRY	10.0253	10/18/22	0.0	2.3	0	0	6
			HUCKLEBERRY CREEK	TOTAL	70	6	81
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS

KAPOWSIN CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
KAPOWSIN	10.0600	9/7/22	0.0	0.5	0	0	0
KAPOWSIN	10.0600	9/15/22	0.0	1.3	0	3	0
KAPOWSIN	10.0600	9/21/22	0.0	1.3	2	1	1
KAPOWSIN	10.0600	9/26/22	0.0	1.3	0	3	5
KAPOWSIN	10.0600	10/3/22	0.0	1.3	2	3	11
KAPOWSIN	10.0600	10/5/22	1.3	3.0	47	21	25
KAPOWSIN	10.0600	10/11/22	0.0	1.0	9	6	9
KAPOWSIN	10.0600	10/19/22	0.0	3.0	3	6	1
KAPOWSIN	10.0600	10/27/22	0.0	1.0	0	0	0
			KAPOWSIN CREEK	TOTAL	63	43	52
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS

SALMON CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
SALMON	10.0035	9/6/22	0.0	0.5	0	0	0
SALMON	10.0035	9/14/22	0.0	0.5	16	0	3
SALMON	10.0035	9/21/22	0.0	0.5	36	2	11
SALMON	10.0035	9/26/22	0.0	0.5	22	0	3
SALMON	10.0035	10/3/22	0.0	0.9	24	15	11
SALMON	10.0035	10/11/22	0.0	0.9	28	1	15
SALMON	10.0035	10/17/22	0.0	0.9	8	4	7
SALMON	10.0035	10/31/22	0.0	0.9	0	0	0
			SALMON CREEK	TOTAL	134	22	50
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS

SALMON TRIBUTARY	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
SALMON TRIB	10.0036	9/6/22	0.0	0.1	0	0	0
SALMON TRIB	10.0036	9/14/22	0.0	0.1	0	0	0
SALMON TRIB	10.0036	9/21/22	0.0	0.1	0	0	0
SALMON TRIB	10.0036	9/26/22	0.0	0.1	2	0	0
SALMON TRIB	10.0036	10/3/22	0.0	0.1	1	0	0
SALMON TRIB	10.0036	10/11/22	0.0	0.1	0	0	1
SALMON TRIB	10.0036	10/17/22	0.0	0.1	0	0	0
			SALMON TRIBUTARY	TOTAL	3	0	1
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS

SILVER SPRINGS	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
SILVER SPRINGS	10.0332A	9/12/22	0.0	0.3	0	0	0
SILVER SPRINGS	10.0332A	9/20/22	0.0	0.3	0	0	0
SILVER SPRINGS	10.0332A	9/26/22	0.0	0.3	0	0	0
SILVER SPRINGS	10.0332A	10/7/22	0.0	0.3	0	0	0
			SILVER SPRINGS	TOTAL	0	0	0
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS
SOUTH PRAIRIE CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
*SOUTH PRAIRIE	10.0429	8/15/22	0.3	3.8	16	0	0
*SOUTH PRAIRIE	10.0429	8/24/22	0.3	6.7	11	0	1
*SOUTH PRAIRIE	10.0429	9/1/22	0.3	6.7	88	1	9
*SOUTH PRAIRIE	10.0429	9/8/22	0.3	8.0	248	15	38
*SOUTH PRAIRIE	10.0429	9/15/22	0.3	8.0	538	26	128
*SOUTH PRAIRIE	10.0429	9/16/22	1.1	2.6	97	9	34
*SOUTH PRAIRIE	10.0429	9/20/22	0.3	10.2	725	86	161
*SOUTH PRAIRIE	10.0429	9/27/22	0.3	12.6	440	132	97
*SOUTH PRAIRIE	10.0429	9/29/22	2.0	3.8	109	130	37
*SOUTH PRAIRIE	10.0429	10/5/22	0.3	12.6	305	469	89
*SOUTH PRAIRIE	10.0429	10/12/22	0.3	8.0	80	218	11
*SOUTH PRAIRIE	10.0429	10/26/22	0.3	8.0	0	3	0
*Data collected by WDFW			SOUTH PRAIRIE CREEK	TOTAL	2,657	1,086	605
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS
SQUALLY CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
SQUALLY CREEK	10.0024	9/6/22	0.0	0.2	0	0	0
SQUALLY CREEK	10.0024	9/14/22	0.0	0.2	0	0	0
SQUALLY CREEK	10.0024	9/21/22	0.0	0.2	0	0	0
SQUALLY CREEK	10.0024	9/26/22	0.0	0.3	0	0	0
SQUALLY CREEK	10.0024	10/3/22	0.0	0.3	0	0	0
SQUALLY CREEK	10.0024	10/11/22	0.0	0.3	0	0	1
SQUALLY CREEK	10.0024	10/17/22	0.0	0.3	0	0	0
SQUALLY CREEK	10.0024	10/25/22	0.0	0.3	0	0	0
			SQUALLY CREEK	TOTAL	0	0	1
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS
SWAN CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
SWAN CREEK	10.0023	9/16/22	0.3	1.0	0	0	0
SWAN CREEK	10.0023	10/3/22	0.3	1.0	0	0	0
SWAN CREEK	10.0023	10/10/22	0.3	1.0	0	0	0
SWAN CREEK	10.0023	10/17/22	0.3	1.0	0	0	0
SWAN CREEK	10.0023	10/24/22	0.3	1.0	0	0	0
SWAN CREEK	10.0023	10/31/22	0.3	1.0	0	0	0
SWAN CREEK	10.0023	11/7/22	0.3	1.0	0	0	0
SWAN CREEK	10.0023	11/14/22	0.3	1.0	0	0	0
			SWAN CREEK	TOTAL	0	0	0
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS

VOIGHTS CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
VOIGHTS CREEK	10.0414	9/16/22	0.5	3.4	535	0	8
VOIGHTS CREEK	10.0414	9/22/22	0.5	3.4	791	645	304
			WHITE RIVER	TOTAL	1,326	645	312
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS

WHITE RIVER	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
WHITE RIVER	10.0031	10/12/22	15.5	24.3	5	13	29
			WHITE RIVER	TOTAL	5	13	29
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS

WILKESON CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
WILKESON	10.0432	9/7/22	0.0	2.0	0	0	0
WILKESON	10.0432	9/15/22	0.0	2.0	3	0	0
WILKESON	10.0432	9/23/22	0.0	2.0	24	1	8
WILKESON	10.0432	9/30/22	0.0	4.0	75	12	28
WILKESON	10.0432	10/5/22	0.0	4.0	89	26	26
WILKESON	10.0432	10/14/22	0.0	4.0	7	14	5
WILKESON	10.0432	10/21/22	0.0	4.0	1	1	1
WILKESON	10.0432	10/28/22	0.0	4.0	0	1	0
			WILKESON CREEK	TOTAL	199	55	68
					TOTAL LIVE	TOTAL DEAD	TOTAL REDDS

	LIVE	DEAD	REDDS
TOTAL SPAWNING GROUND COUNTS (Excluding fish transported above Mud Mountain Dam on White River-See Buckley Trap):	5,013	2,170	1,325

2022 BULL TROUT SPAWNING DATA (WHITE RIVER)

Survey conducted by PTF (Black) **Survey conducted by NPS (Red)**

STREAM	WRIA# / NPS#	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
ANTLER CREEK	10.0352 / w09-00a	9/13/22	0.0	0.8	3	0	1
ANTLER CREEK	10.0352 / w09-00a	9/27/22	0.0	0.8	0	0	2
ANTLER CREEK	10.0352 / w09-00a	10/4/22	0.0	0.8	0	0	0
ANTLER CREEK	10.0352 / w09-00a	10/13/22	0.0	0.8	0	0	0
			ANTLER CREEK	Total	3	0	3
					LIVE	DEAD	REDDS
DEADWOOD	10.0355 / w12-00a	9/13/22	0.0	0.0	0	0	0
			DEADWOOD CREEK	Total	0	0	0
					LIVE	DEAD	REDDS
DISCOVERY (Unidentified)	White River	9/13/22	0.0	0.7	3	0	4
DISCOVERY (Unidentified)	White River	9/27/22	0.0	0.7	3	0	3
DISCOVERY (Unidentified)	White River	10/5/22	0.0	0.7	0	0	1
DISCOVERY (Unidentified)	White River	10/13/22	0.0	0.7	0	0	2
			DISCOVERY	Total	6	0	10
					LIVE	DEAD	REDDS
FRYINGPAN	10.0369 / w17-00a	9/13/22	0.0	1.0	0	0	0
FRYINGPAN	10.0369 / w17-00a	9/21/22	0.0	1.0	1	0	0
FRYINGPAN	10.0369 / w17-00a	9/27/22	0.0	1.0	2	0	7
FRYINGPAN	10.0369 / w17-00a	10/4/22	0.0	2.0	0	0	2
FRYINGPAN	10.0369 / w17-00a	10/13/22	0.0	2.0	0	0	3
			FRYINGPAN CREEK	Total	3	0	12
					LIVE	DEAD	REDDS
HIDDEN SPRINGS	w15.5-00a	9/13/22	0.0	0.8	2	0	1
HIDDEN SPRINGS	w15.5-00a	9/27/22	0.0	0.8	2	0	2
HIDDEN SPRINGS	w15.5-00a	10/4/22	0.0	0.8	1	0	3
HIDDEN SPRINGS	w15.5-00a	10/13/22	0.0	0.8	0	0	1
			HIDDEN SPRINGS	Total	5	0	7
					LIVE	DEAD	REDDS

KLICKITAT	10.0357 / w13-00a	9/13/22	0.0	0.3	3	0	7
KLICKITAT	10.0357 / w13-00a	9/22/22	0.0	0.3	3	0	2
KLICKITAT	10.0357 / w13-00a	9/27/22	0.0	0.3	2	0	11
KLICKITAT	10.0357 / w13-00a	10/4/22	0.0	0.3	0	0	3
KLICKITAT	10.0357 / w13-00a	10/13/22	0.0	0.3	1	0	3
			KLICKITAT	Total	9	0	26
					LIVE	DEAD	REDDS
NO-NAME CREEK	10.0364 / w14-00a	9/13/22	0.0	1.6	11	0	10
NO-NAME CREEK	10.0364 / w14-00a	9/21/22	0.0	1.6	2	0	7
NO-NAME CREEK	10.0364 / w14-00a	9/27/22	0.0	1.6	4	0	8
NO-NAME CREEK	10.0364 / w14-00a	10/4/22	0.0	1.6	0	0	2
NO-NAME CREEK	10.0364 / w14-00a	10/13/22	0.0	1.6	0	0	1
			NO-NAME CREEK	Total	17	0	28
					LIVE	DEAD	REDDS
PARALLEL CREEK	w13.5-00a	9/13/22	0.0	0.7	0	0	2
PARALLEL CREEK	w13.5-00a	9/22/22	0.0	0.7	1	0	0
PARALLEL CREEK	w13.5-00a	9/27/22	0.0	0.7	0	0	3
PARALLEL CREEK	w13.5-00a	10/4/22	0.0	0.7	0	0	5
PARALLEL CREEK	w13.5-00a	10/13/22	0.0	0.7	0	0	0
			PARALLEL CREEK	Total	1	0	10
					LIVE	DEAD	REDDS
SHAW CREEK	10.0365 / w15-00a	9/13/22	0.0	0.2	1	0	1
SHAW CREEK	10.0365 / w15-00a	9/21/22	0.0	0.2	0	0	1
SHAW CREEK	10.0365 / w15-00a	9/27/22	0.0	0.2	0	0	0
SHAW CREEK	10.0365 / w15-00a	10/5/22	0.0	0.2	0	0	0
SHAW CREEK	10.0365 / w15-00a	10/13/22	0.0	0.2	0	0	0
			SHAW CREEK	Total	1	0	2
					LIVE	DEAD	REDDS
SILVER CREEK	10.0313	9/12/22	0.0	0.1	0	0	0
SILVER CREEK	10.0313	9/20/22	0.0	0.1	2	0	2
SILVER CREEK	10.0313	9/27/22	0.0	0.1	0	0	3
SILVER CREEK	10.0313	10/7/22	0.0	0.1	0	0	2
			SILVER CREEK	Total	2	0	7
					LIVE	DEAD	REDDS

SILVER SPRINGS	10.0332A	9/12/22	0.0	0.3	0	0	0
SILVER SPRINGS	10.0332A	9/20/22	0.0	0.3	0	0	0
SILVER SPRINGS	10.0332A	9/27/22	0.0	0.3	0	0	3
SILVER SPRINGS	10.0332A	10/5/22	0.0	0.3	0	0	1
SILVER SPRINGS	10.0332A	10/7/22	0.0	0.3	0	0	0
			SILVER SPRINGS	**Total**	**0**	**0**	**4**
					LIVE	**DEAD**	**REDDS**
SUNRISE CREEK	10.0337 / w06-00a	9/22/22	0.0	0.2	0	0	0
SUNRISE CREEK	10.0337 / w06-00a	10/5/22	0.0	0.2	0	0	0
			SUNRISE CREEK	**Total**	**0**	**0**	**0**
					LIVE	**DEAD**	**REDDS**
TRIBUTARY 67.5 (Unidentified @ LB-RM 67.5)	White River	9/13/22	0.0	0.1	0	0	0
TRIBUTARY 67.5 (Unidentified @ LB-RM 67.5)	White River	9/27/22	0.0	0.1	0	0	0
			UNIDENTIFIED TRIB	**Total**	**0**	**0**	**0**
					LIVE	**DEAD**	**REDDS**
WINZIG CREEK (Unidentified)	Fryingpan Tributary	9/13/22	0.0	0.1	1	0	0
WINZIG CREEK (Unidentified)	Fryingpan Tributary	9/27/22	0.0	0.1	0	0	0
WINZIG CREEK (Unidentified)	Fryingpan Tributary	10/4/22	0.0	0.1	0	0	0
WINZIG CREEK (Unidentified)	Fryingpan Tributary	10/13/22	0.0	0.1	0	0	0
			WINZIG CREEK	**Total**	**1**	**0**	**0**
					LIVE	**DEAD**	**REDDS**
WRIGHT CREEK	10.0370 / w17-02a	9/13/22	0.0	0.2	2	0	0
WRIGHT CREEK	10.0370 / w17-02a	9/21/22	0.0	0.2	5	0	3
WRIGHT CREEK	10.0370 / w17-02a	9/27/22	0.0	0.2	0	1	2
WRIGHT CREEK	10.0370 / w17-02a	10/4/22	0.0	0.2	0	0	2
WRIGHT CREEK	10.0370 / w17-02a	10/13/22	0.0	0.2	0	0	4
			WRIGHT CREEK	**Total**	**7**	**1**	**11**
					LIVE	**DEAD**	**REDDS**

w07-00a	w07-00a	9/13/22	0.0	0.2	0	0	0
w07-00a	w07-00a	9/22/22	0.0	0.2	0	0	0
w07-00a	w07-00a	9/27/22	0.0	0.2	0	0	0
w07-00a	w07-00a	10/5/22	0.0	0.2	0	0	2
			w07-00a	**Total**	**0**	**0**	**2**
					LIVE	**DEAD**	**REDDS**
				Total:	**54**	**1**	**122**
					LIVE	**DEAD**	**REDDS**

2022 BULL TROUT SPAWNING DATA (MOWICH RIVER)

Survey conducted by Puyallup Tribal Fisheries (Black)

STREAM	WRIA#	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
MEADOW CREEK (@RM 5.1/RB)	10.0630	9/15/22	0.0	0.8	0	0	0
MEADOW CREEK (@RM 5.1/RB)	10.0630	9/22/22	0.0	0.8	0	0	0
MEADOW CREEK (@RM 5.1/RB)	10.0630	9/29/22	0.0	0.8	0	0	0
MEADOW CREEK (@RM 5.1/RB)	10.0630	10/7/22	0.0	0.8	0	0	0
MEADOW CREEK (@RM 5.1/RB)	10.0630	10/19/22	0.0	0.8	0	0	0
			MEADOW CREEK	**Total**	**0**	**0**	**0**
					LIVE	**DEAD**	**REDDS**
TEMPEST CREEK (Unidentified @RM 5.8/LB)	Mowich River	9/15/22	0.0	0.2	0	0	0
TEMPEST CREEK (Unidentified @RM 5.8/LB)	Mowich River	9/22/22	0.0	0.2	0	0	0
TEMPEST CREEK (Unidentified @RM 5.8/LB)	Mowich River	9/29/22	0.0	0.2	2	0	3
TEMPEST CREEK (Unidentified @RM 5.8/LB)	Mowich River	10/7/22	0.0	0.2	3	0	1
TEMPEST CREEK (Unidentified @RM 5.8/LB)	Mowich River	10/19/22	0.0	0.2	0	0	0
			TEMPEST CREEK	**Total**	**5**	**0**	**4**
					LIVE	**DEAD**	**REDDS**
SENTINEL CREEK-MORA (Unidentified @ RM 7.5/LB)	Mowich River	9/15/22	0.0	0.3	0	0	2
SENTINEL CREEK-MORA (Unidentified @ RM 7.5/LB)	Mowich River	9/22/22	0.0	0.3	0	0	3
SENTINEL CREEK-MORA (Unidentified @ RM 7.5/LB)	Mowich River	9/29/22	0.0	0.3	0	0	3
SENTINEL CREEK-MORA (Unidentified @ RM 7.5/LB)	Mowich River	10/7/22	0.0	0.3	0	0	1
SENTINEL CREEK-MORA (Unidentified @ RM 7.5/LB)	Mowich River	10/19/22	0.0	0.3	0	0	0
			SENTINAL CREEK	**Total**	**0**	**0**	**9**
					LIVE	**DEAD**	**REDDS**

HUMBUG CREEK-MORA (Un-identified @RM 7.6/RB)	Mowich River	9/15/22	0.0	0.1	0	0	0
HUMBUG CREEK-MORA (Un-identified @RM 7.6/RB)	Mowich River	9/22/22	0.0	0.1	0	0	0
HUMBUG CREEK-MORA (Un-identified @RM 7.6/RB)	Mowich River	9/29/22	0.0	0.1	0	0	1
HUMBUG CREEK-MORA (Un-identified @RM 7.6/RB)	Mowich River	10/7/22	0.0	0.1	0	0	0
HUMBUG CREEK-MORA (Un-identified @RM 7.6/RB)	Mowich River	10/19/22	0.0	0.1	0	0	0
			HUMBUG CREEK	Total	0	0	1
					LIVE	DEAD	REDDS
				Total:	5	0	14
					LIVE	DEAD	REDDS

2022 BULL TROUT SPAWNING DATA (S.F. PUYALLUP RIVER)

Survey conducted by Puyallup Tribal Fisheries (Black)

STREAM	WRIA#	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
ST. ANDREWS CREEK	10.0714	10/19/22	0.0	0.1	0	0	0
			ST. ANDREWS CREEK	Total	0	0	0
					LIVE	DEAD	REDDS
				Total:	0	0	0
					LIVE	DEAD	REDDS

2022 BULL TROUT SPAWNING DATA (N.F. PUYALLUP RIVER)

Survey conducted by Puyallup Tribal Fisheries (Black)

STREAM	WRIA#	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
UNNAMED TRIBUTARY #1-MORA (RM 1.9/RB)		9/29/22	0.0	0.0	0	0	0
UNNAMED TRIBUTARY #1-MORA (RM 1.9/RB)		10/14/22	0.0	0.0	0	0	0
			UNNAMED TRIBUTARY	Total	0	0	0
					LIVE	DEAD	REDDS
UNNAMED TRIBUTARY #2-MORA (RM 2.2/RB)	10.0701	9/29/22	0.0	0.4	0	0	0
UNNAMED TRIBUTARY #2-MORA (RM 2.2/RB)	10.0701	10/14/22	0.0	0.4	0	0	0
			UNNAMED TRIBUTARY	Total	0	0	0
					LIVE	DEAD	REDDS
UNNAMED TRIBUTARY #3 (RM 1.8/LB)		9/29/22	0.0	0.3	0	0	0
UNNAMED TRIBUTARY #3 (RM 1.8/LB)		10/14/22	0.0	0.3	0	0	0
			UNNAMED TRIBUTARY	Total	0	0	0
					LIVE	DEAD	REDDS

UNNAMED TRIBUTARY #4-MORA (RM 2.4/RB)	10.0702	9/29/22	0.0	0.0	0	0	0
UNNAMED TRIBUTARY #4-MORA (RM 2.4/RB)	10.0702	10/14/22	0.0	0.0	0	0	0
			UNNAMED TRIBUTARY	Total	0	0	0
					LIVE	DEAD	REDDS
				Total:	0	0	0
					LIVE	DEAD	REDDS

2022 BULL TROUT SPAWNING DATA (CARBON RIVER)

Survey conducted by National Park Service (Red) **Survey conducted by Puyallup Tribal Fisheries (Black)**

STREAM	WRIA# / NPS#	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
RANGER CREEK	10.0530 / c06-00a	9/29/22	0.0	0.3	1	0	2
RANGER CREEK	10.0530 / c06-00a	10/6/22	0.0	0.3	0	0	0
RANGER CREEK	10.0530 / c06-00a	10/11/22	0.0	0.3	0	0	0
			RANGER CREEK	Total	1	0	2
					LIVE	DEAD	REDDS
IPSUT CREEK	10.0550 / c08-00a	9/29/22	0.0	0.1	0	0	0
IPSUT CREEK	10.0550 / c08-00a	10/6/22	0.0	0.1	0	0	0
IPSUT CREEK	10.0550 / c08-00a	10/11/22	0.0	0.1	0	0	0
			IPSUT CREEK	Total	0	0	0
					LIVE	DEAD	REDDS
JUNE CREEK	c03-00a	10/3/22	0.0	0.1	0	0	1
JUNE CREEK	c03-00a	10/6/22	0.0	0.1	0	0	0
JUNE CREEK	c03-00a	10/11/22			0	0	4
			JUNE CREEK	Total	0	0	5
					LIVE	DEAD	REDDS
CHENUIS CREEK	c07-00a	9/29/22	0.0	0.5	0	0	0
CHENUIS CREEK	c07-00a	10/6/22	0.0	0.5	0	0	1
CHENUIS CREEK	c07-00a	10/11/22	0.0	0.5	0	0	0
			CHENUIS CREEK	Total	0	0	1
					LIVE	DEAD	REDDS
				Total:	1	0	8
					LIVE	DEAD	REDDS

Watershed Totals:	89	1	151
	LIVE	DEAD	REDDS

2022 COHO SPAWNING SURVEY DATA

STREAM	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
BOISE CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
BOISE	10.0057	10/3/22	0.0	3.5	2	0
BOISE	10.0057	10/11/22	0.0	3.5	0	0
BOISE	10.0057	10/17/22	0.0	3.5	2	0
BOISE	10.0057	10/25/22	0.0	4.5	31	1
BOISE	10.0057	11/1/22	0.0	4.5	265	1
BOISE	10.0057	11/7/22	0.0	4.5	90	3
BOISE	10.0057	11/14/22	0.0	4.5	48	4
BOISE	10.0057	11/21/22	0.0	4.5	15	5
BOISE	10.0057	11/28/22	0.0	4.5	116	7
BOISE	10.0057	12/6/22	0.0	4.5	43	5
BOISE	10.0057	12/12/22	0.0	4.5	33	11
BOISE	10.0057	12/20/22	0.0	4.5	3	0
			BOISE		648	37
					TOTAL LIVE	TOTAL DEAD
CANYON CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
CANYON CREEK	10.0022A	10/25/22	1.0	1.2	0	0
CANYON CREEK	10.0022A	10/31/22	1.0	1.2	0	0
CANYON CREEK	10.0022A	11/7/22	1.0	1.2	0	0
CANYON CREEK	10.0022A	11/14/22	1.0	1.2	0	0
CANYON CREEK	10.0022A	11/21/22	1.0	1.2	0	0
CANYON CREEK	10.0022A	11/28/22	1.0	1.2	0	0
CANYON CREEK	10.0022A	12/6/22	1.0	1.2	0	0
			CANYON CREEK	TOTAL:	0	0
					TOTAL LIVE	TOTAL DEAD
CANYON FALLS	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
CANYON FALLS	10.0410	11/3/22	0.3	0.6	27	1
CANYON FALLS	10.0410	11/10/22	0.3	0.6	44	0
CANYON FALLS	10.0410	11/17/22	0.3	0.6	4	0
CANYON FALLS	10.0410	11/23/22	0.3	0.6	1	0
CANYON FALLS	10.0410	11/29/22	0.3	0.6	0	0
CANYON FALLS	10.0410	12/1/22	0.3	0.6	0	0
CANYON FALLS	10.0410	12/8/22	0.3	0.6	0	0
CANYON FALLS	10.0410	12/15/22	0.3	0.6	0	0
CANYON FALLS	10.0410	12/29/22	0.3	0.6	0	0
CANYON FALLS	10.0410	1/5/23	0.3	0.6	0	0
CANYON FALLS	10.0410	1/10/23	0.3	0.6	0	0
CANYON FALLS	10.0410	1/19/23	0.3	0.6	0	0
CANYON FALLS	10.0410	1/25/23	0.3	0.6	0	0
Surveys conducted by WDFW			CANYON FALLS	TOTAL:	76	1
					TOTAL LIVE	TOTAL DEAD

CARBON RIVER	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
CARBON RIVER	10.0410	11/16/22	0.0	6.0	9	0
CARBON RIVER	10.0410	11/29/22	0.0	6.0	5	0
CARBON RIVER	10.0410	12/8/22	0.0	6.0	0	1
CARBON RIVER	10.0410	12/14/22	0.0	6.0	0	0
CARBON RIVER	10.0410	1/4/23	0.0	6.0	0	0
			CARBON RIVER	**TOTAL:**	**95**	**2**
					TOTAL LIVE	**TOTAL DEAD**

CLARKS CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
CLARKS	10.0027	Coho passed upstream of Clarks Creek hatchery.			592	
CLARKS	10.0027					
			CLARKS	**TOTAL:**	**592**	**NA**
					TOTAL LIVE	**TOTAL DEAD**

CLEAR CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
CLEAR	10.0022	9/26/22	1.7	1.9	0	0
CLEAR	10.0022	10/3/22	1.5	1.9	1	0
CLEAR	10.0022	10/17/22	1.5	1.9	9	0
CLEAR	10.0022	10/25/22	1.5	1.9	7	0
CLEAR	10.0022	10/31/22	1.5	1.9	33	0
CLEAR	10.0022	11/7/22	1.5	1.9	37	0
CLEAR	10.0022	11/14/22	1.5	1.9	8	3
CLEAR	10.0022	11/21/22	0.7	1.9	2	0
CLEAR	10.0022	11/28/22	1.5	1.9	0	0
CLEAR	10.0022	12/6/22	1.5	1.9	0	0
			CLEAR	**TOTAL:**	**97**	**3**
					TOTAL LIVE	**TOTAL DEAD**

COAL MINE CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
COAL MINE CREEK	10.0432A	10/26/22	0.0	0.4	0	0
COAL MINE CREEK	10.0432A	11/3/22	0.0	0.4	0	0
COAL MINE CREEK	10.0432A	11/10/22	0.0	0.4	0	0
COAL MINE CREEK	10.0432A	11/17/22	0.0	0.4	0	0
COAL MINE CREEK	10.0432A	11/23/22	0.0	0.4	0	0
COAL MINE CREEK	10.0432A	11/29/22	0.0	0.4	0	0
COAL MINE CREEK	10.0432A	12/8/22	0.0	0.4	0	0
COAL MINE CREEK	10.0432A	12/15/22	0.0	0.4	0	0
COAL MINE CREEK	10.0432A	12/29/22	0.0	0.4	0	0
COAL MINE CREEK	10.0432A	1/5/23	0.0	0.4	0	0
COAL MINE CREEK	10.0432A	1/10/23	0.0	0.4	0	0
COAL MINE CREEK	10.0432A	1/19/23	0.0	0.4	0	0
COAL MINE CREEK	10.0432A	1/25/23	0.0	0.4	0	0
COAL MINE CREEK	10.0432A	2/3/23	0.0	0.4	0	0
Surveys conducted by WDFW			**COAL MINE**	**TOTAL:**	**0**	**0**
					TOTAL LIVE	**TOTAL DEAD**

FENNEL CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
FENNEL	10.0406	11/3/22	0.0	1.9	14	2
FENNEL	10.0406	11/10/22	0.0	1.9	0	1
FENNEL	10.0406	11/17/22	0.0	1.9	0	0
FENNEL	10.0406	11/23/22	0.0	1.9	2	1
FENNEL	10.0406	12/1/22	0.0	1.9	0	0
FENNEL	10.0406	12/8/22	0.0	1.9	0	0
FENNEL	10.0406	12/15/22	0.0	1.9	3	0
FENNEL	10.0406	12/22/22	0.0	1.9	0	0
FENNEL	10.0406	1/5/23	0.0	1.9	0	0
FENNEL	10.0406	1/10/23	0.0	1.9	0	0
FENNEL	10.0406	1/19/23	0.0	1.9	0	0
FENNEL	10.0406	1/25/23	0.0	1.9	0	0
Surveys conducted by WDFW			FENNEL	TOTAL:	19	4
					TOTAL LIVE	TOTAL DEAD
FISK CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
FISK CREEK	10.0596	11/17/22	0.3	1.1	0	0
FISK CREEK	10.0596	11/23/22	0.3	1.1	0	0
FISK CREEK	10.0596	12/1/22	0.3	1.1	0	0
FISK CREEK	10.0596	12/8/22	0.3	1.1	0	0
FISK CREEK	10.0596	12/15/22	0.3	1.1	0	0
FISK CREEK	10.0596	12/22/22	0.3	1.1	0	0
FISK CREEK	10.0596	12/29/22	0.3	1.1	0	0
FISK CREEK	10.0596	1/5/23	0.3	1.1	0	0
FISK CREEK	10.0596	1/10/23	0.3	1.1	0	0
FISK CREEK	10.0596	1/19/23	0.3	1.1	0	0
FISK CREEK	10.0596	1/25/23	0.3	1.1	0	0
Surveys conducted by WDFW			FISK	TOTAL:	0	0
					TOTAL LIVE	TOTAL DEAD
FOX CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
FOX	10.0608	10/27/22	0.0	1.0	9	0
FOX	10.0608	11/2/22	0.0	1.0	63	0
FOX	10.0608	11/7/22	0.0	1.0	78	1
FOX	10.0608	11/14/22	0.0	1.0	49	5
FOX	10.0608	11/21/22	0.0	1.0	27	7
FOX	10.0608	11/28/22	0.0	1.0	0	0
			FOX	TOTAL:	226	13
					TOTAL LIVE	TOTAL DEAD
GREENWATER RIVER	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
*GREENWATER	10.0122	9/7/22	1.2	3.9	0	0
*GREENWATER	10.0122	9/14/22	0.0	3.9	72	0
*GREENWATER	10.0122	9/22/22	0.0	3.9	77	0
*GREENWATER	10.0122	10/6/22	5.6	7.9	0	0
Surveys conducted by WDFW			GREENWATER	TOTAL:	149	0
					TOTAL LIVE	TOTAL DEAD

KAPOWSIN CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
KAPOWSIN	10.0600	10/11/22	0.0	1.0	0	0
KAPOWSIN	10.0600	10/19/22	0.0	3.2	5	1
KAPOWSIN	10.0600	10/27/22	0.0	3.2	123	2
KAPOWSIN	10.0600	11/2/22	0.0	3.2	139	1
KAPOWSIN	10.0600	11/8/22	0.0	3.2	81	7
KAPOWSIN	10.0600	11/16/22	0.0	3.2	40	6
KAPOWSIN	10.0600	11/21/22	0.0	1.7	17	0
KAPOWSIN	10.0600	12/6/22	0.0	3.2	5	3
KAPOWSIN	10.0600	12/16/22	0.0	3.2	1	0
			KAPOWSIN	TOTAL:	411	20
					TOTAL LIVE	TOTAL DEAD
PUYALLUP RIVER	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
PUYALLUP RIVER	10.0021	12/8/22	17.9	22.1	0	0
PUYALLUP RIVER	10.021					
PUYALLUPRIBER	10.021					
PUYALLUP RIVER	10.0021					
			PUYALLUP RIVER	TOTAL:	0	0
					TOTAL LIVE	TOTAL DEAD
RODY CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
RODY CREEK	10.0028	10/25/22	0.4	0.5	0	0
RODY CREEK	10.0028	10/31/22	0.4	0.5	0	0
RODY CREEK	10.0028	11/7/22	0.4	0.5	0	0
RODY CREEK	10.0028	11/14/22	0.4	0.5	0	0
RODY CREEK	10.0028	11/21/22	0.4	0.5	0	1
RODY CREEK	10.0028	11/28/22	0.4	0.5	0	0
			RODY CREEK	TOTAL:	0	1
SALMON CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
SALMON	10.0035	10/3/22	0.0	0.5	0	0
SALMON	10.0035	10/11/22	0.0	0.5	2	0
SALMON	10.0035	10/17/22	0.0	0.5	0	0
SALMON	10.0035	10/25/22	0.0	0.5	0	0
SALMON	10.0035	11/2/22	0.0	0.5	22	1
SALMON	10.0035	11/7/22	0.0	0.5	8	0
SALMON	10.0035	11/14/22	0.0	0.5	0	0
SALMON	10.0035	11/21/22	0.0	0.5	2	0
SALMON	10.0035	11/28/22	0.0	0.5	0	0
SALMON	10.0035	12/6/22	0.0	0.5	0	0
			SALMON CREEK	TOTAL:	34	1
					TOTAL LIVE	TOTAL DEAD

SALMON TRIBUTARY	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
SALMON TRIB	10.0036	10/25/22	0.0	0.1	0	0
SALMON TRIB	10.0036	10/31/22	0.0	0.1	0	0
SALMON TRIB	10.0036	11/7/22	0.0	0.1	0	0
SALMON TRIB	10.0036	11/14/22	0.0	0.1	0	0
SALMON TRIB	10.0036	11/21/22	0.0	0.1	0	0
SALMON TRIB	10.0036	11/28/22	0.0	0.1	0	0
SALMON TRIB	10.0036	12/6/22	0.0	0.1	0	0
			SALMON TRIB	TOTAL:	0	0
					TOTAL LIVE	TOTAL DEAD
SOUTH PRAIRIE CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
SOUTH PRAIRIE	10.0429	9/1/22	1.1	5.6	0	0
SOUTH PRAIRIE	10.0429	9/8/22	0.3	5.6	3	0
SOUTH PRAIRIE	10.0429	9/15/22	1.1	8.0	0	0
SOUTH PRAIRIE	10.0429	9/20/22	3.8	8.0	0	0
SOUTH PRAIRIE	10.0429	9/27/22	1.1	10.2	4	0
SOUTH PRAIRIE	10.0429	9/29/22	2.0	2.6	1	0
SOUTH PRAIRIE	10.0429	10/5/22	2.6	10.2	28	1
SOUTH PRAIRIE	10.0429	10/12/22	3.8	6.7	34	0
SOUTH PRAIRIE	10.0429	11/8/22	0.0	8.0	1	0
SOUTH PRAIRIE	10.0429	11/14/22	8.0	10.2	18	0
SOUTH PRAIRIE	10.0429	11/15/22	0.3	6.0	1	1
SOUTH PRAIRIE	10.0429	11/22/22	0.0	6.0	0	0
SOUTH PRAIRIE	10.0429	12/7/22	0.0	8.0	1	0
SOUTH PRAIRIE	10.0429	12/13/22	0.0	8.0	0	0
SOUTH PRAIRIE	10.0429	12/15/22	8.0	10.2	0	0
SOUTH PRAIRIE	10.0429	1/3/23	0.3	8.0	2	0
SOUTH PRAIRIE	10.0429	1/5/23	8.0	12.6	34	0
SOUTH PRAIRIE	10.0429	1/10/23	1.1	8.0	14	0
SOUTH PRAIRIE	10.0429	2/23/23	0.3	10.2	4	0
SOUTH PRAIRIE	10.0429	2/24/23	10.2	12.6	11	0
SOUTH PRAIRIE	10.0429	3/8/23	0.3	8.0	0	1
SOUTH PRAIRIE	10.0429	3/15/23	0.3	12.6	3	0
SOUTH PRAIRIE	10.0429	3/23/23	10.2	11.4	3	0
SOUTH PRAIRIE	10.0429	3/24/23	0.0	8.3	0	0
			SOUTH PRAIRIE	TOTAL:	162	3
					TOTAL LIVE	TOTAL DEAD
SPIKETON CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
SPIKETON	10.0453	10/26/22	0.0	0.2	0	0
SPIKETON	10.0453	11/3/22	0.0	0.2	0	0
SPIKETON	10.0453	11/10/22	0.0	0.2	0	0
SPIKETON	10.0453	11/17/22	0.0	0.2	0	0
SPIKETON	10.0453	11/23/22	0.0	0.2	0	0
SPIKETON	10.0453	11/29/22	0.0	0.2	0	0
SPIKETON	10.0453	12/8/22	0.0	0.2	0	0
SPIKETON	10.0453	12/15/22	0.0	0.2	0	0
SPIKETON	10.0453	12/22/29	0.0	0.2	0	0
SPIKETON	10.0453	12/29/22	0.0	0.2	0	0
SPIKETON	10.0453	1/5/23	0.0	0.2	0	0

SPIKETON	10.0453	1/10/23	0.0	0.2	0	0
SPIKETON	10.0453	1/19/23	0.0	0.2	0	0
SPIKETON	10.0453	1/25/23	0.0	0.2	0	0
SPIKETON	10.0453	2/3/23	0.0	0.2	0	0
Surveys conducted by WDFW			SPIKETON CREEK	TOTAL:	0	0
					TOTAL LIVE	TOTAL DEAD
SQUALLY CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
SQUALLY CREEK	10.0024	10/25/22	0.0	0.3	0	0
SQUALLY CREEK	10.0024	10/31/22	0.0	0.3	0	0
SQUALLY CREEK	10.0024	11/7/22	0.0	0.3	0	0
SQUALLY CREEK	10.0024	11/14/22	0.0	0.3	0	0
SQUALLY CREEK	10.0024	11/21/22	0.0	0.3	0	0
SQUALLY CREEK	10.0024	11/28/22	0.0	0.3	0	0
SQUALLY CREEK	10.0024	12/6/22	0.0	0.3	0	0
			SQUALLY CREEK	TOTAL:	0	0
					TOTAL LIVE	TOTAL DEAD
SWAN CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
SWAN CREEK	10.0023	10/3/22	0.0	1.3	0	0
SWAN CREEK	10.0023	10/10/22	0.3	1.3	0	0
SWAN CREEK	10.0023	10/17/22	0.3	1.3	0	0
SWAN CREEK	10.0023	10/24/22	0.3	1.3	0	0
SWAN CREEK	10.0023	10/31/22	0.3	1.3	0	0
SWAN CREEK	10.0023	11/7/22	0.3	1.3	9	1
SWAN CREEK	10.0023	11/14/22	0.3	1.3	0	0
SWAN CREEK	10.0023	11/21/22	0.0	1.3	0	0
SWAN CREEK	10.0023	11/28/22	0.3	1.3	0	1
SWAN CREEK	10.0023	12/5/22	0.3	1.3	0	2
SWAN CREEK	10.0023	12/12/22	0.3	1.3	0	1
			SWAN CREEK	TOTAL:	9	5
					TOTAL LIVE	TOTAL DEAD
WILKESON CREEK	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD
WILKESON	10.0432	10/21/22	0.0	4.0	0	0
WILKESON	10.0432	10/28/22	0.0	6.1	2	1
WILKESON	10.0432	11/4/22	0.0	4.0	0	0
WILKESON	10.0432	11/10/22	0.0	4.0	0	0
WILKESON	10.0432	11/15/22	0.0	1.0	0	0
WILKESON	10.0432	11/23/22	0.0	4.5	0	0
WILKESON	10.0432	12/9/22	2.0	6.1	0	0
WILKESON	10.0432	12/15/22	0.0	4.5	0	0
			WILKESON	TOTAL:	2	1
					TOTAL LIVE	TOTAL DEAD

WATERSHED TOTAL:	2,371	91
SEASON TOTALS (EXCLUDING COUNTS ABOVE BUCKLEY)	TOTAL LIVE	TOTAL DEAD

2022 CHUM SPAWNING SURVEY DATA

STREAM	WRIA	DATE	LOWER RM	UPPER RM	LIVE	DEAD
BOISE	10.0057	11/21/22	0.0	4.5	0	0
BOISE	10.0057	11/28/22	0.0	4.5	18	0
BOISE	10.0057	12/6/22	0.0	4.5	15	0
BOISE	10.0057	12/12/22	0.0	4.5	8	0
BOISE	10.0057	12/20/22	0.0	4.5	3	0
			BOISE	**TOTAL:**	**44**	**0**
					LIVE	**DEAD**

STREAM	WRIA	DATE	LOWER RM	UPPER RM	LIVE	DEAD
CANYON	10.0022A	10/31/22	1.0	1.2	0	0
CANYON	10.0022A	11/7/22	1.0	1.2	0	0
CANYON	10.0022A	11/14/22	1.0	1.2	0	0
CANYON	10.0022A	11/21/22	1.0	1.2	0	0
CANYON	10.0022A	11/28/22	1.0	1.2	0	0
CANYON	10.0022A	12/6/22	1.0	1.2	0	0
CANYON	10.0022A	12/12/22	1.0	1.2	0	0
CANYON	10.0022A	12/19/22	1.0	1.2	6	0
			CANYON	**TOTAL:**	**6**	**0**
					LIVE	**DEAD**

STREAM	WRIA	DATE	LOWER RM	UPPER RM	LIVE	DEAD
Surveys conducted by WDFW						
CANYONFALLS	10.0410	11/10/22	0.3	0.6	2	0
CANYONFALLS	10.0410	11/17/22	0.3	0.6	2	0
CANYONFALLS	10.0410	11/23/22	0.3	0.6	0	0
CANYONFALLS	10.0410	11/29/22	0.3	0.6	0	0
CANYONFALLS	10.0410	12/1/22	0.3	0.6	0	0
CANYONFALLS	10.0410	12/8/22	0.3	0.6	3	2
CANYONFALLS	10.0410	12/15/22	0.3	0.6	2	0
CANYONFALLS	10.0410	12/22/22	0.3	0.6	0	0
CANYONFALLS	10.0410	12/29/22	0.3	0.6	0	0
CANYONFALLS	10.0410	1/5/23	0.3	0.6	1	0
CANYONFALLS	10.0410	1/10/23	0.3	0.6	0	0
CANYONFALLS	10.0410	1/19/23	0.3	0.6	0	0
CANYONFALLS	10.0410	1/25/23	0.3	0.6	0	0
			CANYONFALLS	**TOTAL:**	**10**	**2**
					LIVE	**DEAD**

STREAM	WRIA	DATE	LOWER RM	UPPER RM	LIVE	DEAD
CARBON RIVER	10.0413	11/16/22	0.0	6.0	136	4
CARBON RIVER	10.0413	11/29/22	0.0	6.0	444	75
CARBON RIVER	10.0413	12/8/22	0.0	6.0	235	114
CARBON RIVER	10.0413	12/14/22	0.0	6.0	157	88
CARBON RIVER	10.0413	12/14/22	8.5	11.5	0	0
CARBON RIVER	10.0413	1/4/23	0.0	6.0	1	0
			CARBON	**TOTAL:**	**973**	**281**
					LIVE	**DEAD**
STREAM	**WRIA**	**DATE**	**LOWER RM**	**UPPER RM**	**LIVE**	**DEAD**
CLARKS	10.0027	10/31/22	3.4	3.7	0	0
CLARKS	10.0027	11/28/22	3.4	3.7	186	2
CLARKS	10.0027	12/6/22	3.4	3.7	1,028	136
CLARKS	10.0027	12/12/22	3.4	3.7	118	352
CLARKS	10.0027	12/19/22	3.4	3.7	9	203
CLARKS	10.0027	12/30/22	3.4	3.7	2	8
CLARKS	10.0027	1/6/23	3.4	3.7	0	0
			CLARKS	**TOTAL:**	**1,343**	**701**
					LIVE	**DEAD**
STREAM	**WRIA**	**DATE**	**LOWER RM**	**UPPER RM**	**LIVE**	**DEAD**
CLEAR	10.0022	10/31/22	1.7	1.9	0	0
CLEAR	10.0022	11/7/22	1.7	1.9	0	0
CLEAR	10.0022	11/14/22	1.7	1.9	0	0
CLEAR	10.0022	11/21/22	0.7	1.9	5	3
CLEAR	10.0022	11/28/22	1.7	1.9	172	1
CLEAR	10.0022	12/6/22	1.7	1.9	448	155
CLEAR	10.0022	12/12/22	1.7	1.9	202	307
CLEAR	10.0022	12/19/22	1.7	1.9	29	160
CLEAR	10.0022	12/30/22	1.7	1.9	24	4
CLEAR	10.0022	1/6/23	1.7	1.9	0	0
			CLEAR	**TOTAL:**	**880**	**630**
					LIVE	**DEAD**
STREAM	**WRIA**	**DATE**	**LOWER RM**	**UPPER RM**	**LIVE**	**DEAD**
DIRU (WINTER STOCK)	10.0029	12/2/22	0.0	0.5	NA	92
DIRU (WINTER STOCK)	10.0029	12/9/22	0.0	0.5	NA	165
DIRU (WINTER STOCK)	10.0029	12/16/22	0.0	0.5	NA	131
			DIRU	**TOTAL:**	NA	**388**
					LIVE	**DEAD**

STREAM	WRIA	DATE	LOWER RM	UPPER RM	LIVE	DEAD
Surveys conducted by WDFW						
FENNEL (+tributary)	10.0406	11/3/22	0.0	1.9	66	4
FENNEL (+tributary)	10.0406	11/10/22	0.0	1.9	210	13
FENNEL (+tributary)	10.0406	11/17/22	0.0	1.9	240	29
FENNEL (+tributary)	10.0406	11/23/22	0.0	1.9	371	84
FENNEL (+tributary)	10.0406	12/1/22	0.0	1.9	486	58
FENNEL (+tributary)	10.0406	12/8/22	0.0	1.9	150	335
FENNEL (+tributary)	10.0406	12/15/22	0.0	1.9	63	401
FENNEL (+tributary)	10.0406	12/22/22	0.0	1.9	25	173
FENNEL (+tributary)	10.0406	1/5/23	0.0	1.9	1	0
FENNEL (+tributary)	10.0406	1/10/23	0.0	1.9	0	0
FENNEL (+tributary)	10.0406	1/19/23	0.0	1.9	0	0
FENNEL (+tributary)	10.0406	1/25/23	0.0	1.9	0	0
			FENNEL	**TOTAL:**	**1,612**	**1,097**
					LIVE	**DEAD**

STREAM	WRIA	DATE	LOWER RM	UPPER RM	LIVE	DEAD
PUYALLUP RIVER	10.0021	12/8/22	17.9	22.1	0	0
			PUYALLUP R.	**TOTAL:**	**0**	**0**
					LIVE	**DEAD**

STREAM	WRIA	DATE	LOWER RM	UPPER RM	LIVE	DEAD
RODY	10.0028	10/31/22	0.4	0.6	0	0
RODY	10.0028	11/7/22	0.4	0.6	0	0
RODY	10.0028	11/14/22	0.4	0.6	0	0
RODY	10.0028	11/21/22	0.4	0.6	0	0
RODY	10.0028	11/28/22	0.4	0.6	0	0
RODY	10.0028	12/6/22	0.4	0.6	1	2
RODY	10.0028	12/12/22	0.4	0.6	0	2
RODY	10.0028	12/19/22	0.4	0.6	0	3
RODY	10.0028	12/30/22	0.4	0.6	0	0
			RODY	**TOTAL:**	**1**	**7**
					LIVE	**DEAD**

STREAM	WRIA	DATE	LOWER RM	UPPER RM	LIVE	DEAD
SALMON	10.0035	11/2/22	0.0	0.5	0	0
SALMON	10.0035	11/7/22	0.0	0.5	0	0
SALMON	10.0035	11/14/22	0.0	0.5	8	0
SALMON	10.0035	11/21/22	0.0	0.5	17	1
SALMON	10.0035	11/28/22	0.0	0.5	27	10
SALMON	10.0035	12/6/22	0.0	0.5	23	6
SALMON	10.0035	12/12/22	0.0	0.5	1	4

SALMON	10.0035	12/19/22	0.0	0.5	0	0
SALMON	10.0035	12/30/22	0.0	0.5	0	0
			SALMON	**TOTAL:**	**76**	**21**
					LIVE	**DEAD**
STREAM	**WRIA**	**DATE**	**LOWER RM**	**UPPER RM**	**LIVE**	**DEAD**
SALMON TRIBUTARY	10.0036	10/31/22	0.0	0.1	0	0
SALMON TRIBUTARY	10.0036	10/31/22	0.0	0.1	0	0
SALMON TRIBUTARY	10.0036	11/7/22	0.0	0.1	0	0
SALMON TRIBUTARY	10.0036	11/14/22	0.0	0.1	0	0
SALMON TRIBUTARY	10.0036	11/21/22	0.0	0.1	2	3
SALMON TRIBUTARY	10.0036	11/28/22	0.0	0.1	21	9
SALMON TRIBUTARY	10.0036	12/6/22	0.0	0.1	0	2
SALMON TRIBUTARY	10.0036	12/12/22	0.0	0.1	2	0
SALMON TRIBUTARY	10.0036	12/19/22	0.0	0.1	2	0
SALMON TRIBUTARY	10.0036	12/30/22	0.0	0.1	0	0
			SALMON TRIB.	**TOTAL:**	**27**	**14**
					LIVE	**DEAD**
STREAM	**WRIA**	**DATE**	**LOWER RM**	**UPPER RM**	**LIVE**	**DEAD**
SOUTH PRAIRIE	10.0429	11/8/22	0.0	8.0	211	5
SOUTH PRAIRIE	10.0429	11/14/22	8.0	10.2	13	0
SOUTH PRAIRIE	10.0429	11/15/22	0.0	6.0	329	8
SOUTH PRAIRIE	10.0429	11/22/22	0.0	6.0	577	68
SOUTH PRAIRIE	10.0429	12/7/22	0.0	8.0	742	182
SOUTH PRAIRIE	10.0429	12/8/22	8.0	10.2	138	17
SOUTH PRAIRIE	10.0429	12/13/22	0.0	8.0	649	149
SOUTH PRAIRIE	10.0429	12/15/22	8.0	10.2	77	64
SOUTH PRAIRIE	10.0429	1/3/23	0.0	8.0	1	0
			SOUTH PRAIRIE	**TOTAL:**	**2,737**	**493**
					LIVE	**DEAD**
STREAM	**WRIA**	**DATE**	**LOWER RM**	**UPPER RM**	**LIVE**	**DEAD**
Surveys conducted by WDFW						
SPIKETON	10.0453	11/10/22	0.0	0.2	0	0
SPIKETON	10.0453	11/23/22	0.0	0.2	0	0
SPIKETON	10.0453	11/29/22	0.0	0.2	0	0
SPIKETON	10.0453	12/1/22	0.0	0.2	0	0
SPIKETON	10.0453	12/8/22	0.0	0.2	0	0
SPIKETON	10.0453	12/15/22	0.0	0.2	0	0
SPIKETON	10.0453	12/22/22	0.0	0.2	0	0
SPIKETON	10.0453	1/5/23	0.0	0.2	0	0
SPIKETON	10.0453	1/10/23	0.0	0.2	0	0

			SPIKETON	TOTAL:	0	0
					LIVE	DEAD
STREAM	**WRIA**	**DATE**	**LOWER RM**	**UPPER RM**	**LIVE**	**DEAD**
SQUALLY	10.0024	10/31/22	0.0	0.3	0	0
SQUALLY	10.0024	11/7/22	0.0	0.3	0	0
SQUALLY	10.0024	11/14/22	0.0	0.3	0	0
SQUALLY	10.0024	11/21/22	0.0	0.3	0	0
SQUALLY	10.0024	11/28/22	0.0	0.3	3	7
SQUALLY	10.0024	12/6/22	0.0	0.3	2	0
SQUALLY	10.0024	12/12/22	0.0	0.3	0	0
SQUALLY	10.0024	12/19/22	0.0	0.3	0	0
SQUALLY	10.0024	12/30/22	0.0	0.3	0	0
			SQUALLY	TOTAL:	5	7
					LIVE	DEAD
STREAM	**WRIA**	**DATE**	**LOWER RM**	**UPPER RM**	**LIVE**	**DEAD**
WILKESON	10.0432	10/28/22	0.0	6.1	0	0
WILKESON	10.0432	11/4/22	0.0	4.0	5	0
WILKESON	10.0432	11/10/22	0.0	4.0	46	0
WILKESON	10.0432	11/15/22	0.0	1.0	8	0
WILKESON	10.0432	11/23/22	0.0	4.5	9	2
WILKESON	10.0432	12/7/22	0.0	2.0	0	2
WILKESON	10.0432	12/9/22	2.0	6.1	0	0
WILKESON	10.0432	12/15/22	0.0	4.5	0	0
			WILKESON	TOTAL:	68	4
					LIVE	DEAD

	LIVE	DEAD
TOTAL:	**7,782**	**3,645**

2023 STEELHEAD SPAWNING SURVEY DATA

STREAM	WRIA	DATE	LOWER R.M.	UPPER R.M.	LIVE	DEAD	REDDS
BOISE	10.0057	3/1/23	0.0	4.5	0	2	0
BOISE	10.0057	3/8/23	0.0	4.5	2	0	2
BOISE	10.0057	3/17/23	0.0	4.5	0	0	2
BOISE	10.0057	3/28/23	0.0	4.5	0	0	2
BOISE	10.0057	4/4/23	0.0	4.5	0	0	4
BOISE	10.0057	4/14/23	0.0	4.5	1	0	4
BOISE	10.0057	4/19/23	0.0	4.5	5	0	17
BOISE	10.0057	4/28/23	0.0	4.5	2	0	14
BOISE	10.0057	5/11/23	0.0	4.5	1	0	20
BOISE	10.0057	5/18/23	0.0	4.5	3	0	7
BOISE	10.0057	5/23/23	0.0	4.5	5	1	9
BOISE	10.0057	5/30/23	0.0	4.5	0	1	4
BOISE	10.0057	6/7/23	0.0	4.5	1	0	1
BOISE	10.0057	6/13/23	0.0	4.5	0	0	0
			BOISE	TOTAL	20	4	86
					LIVE	DEAD	REDDS
CANYONFALLS	10.0410	3/20/23	0.3	0.6	0	0	0
CANYONFALLS	10.0410	3/27/23	0.3	0.6	0	0	0
CANYONFALLS	10.0410	4/3/23	0.3	0.6	0	0	0
CANYONFALLS	10.0410	5/3/23	0.3	0.6	0	0	0
			CANYONFALLS	TOTAL	0	0	0
					LIVE	DEAD	REDDS
CARBON	10.0413	1/30/23	8.5	10.5	0	0	0
CARBON	10.0413	2/16/23	8.5	10.5	0	0	0
CARBON	10.0413	2/23/23	6.0	8.5	0	0	0
CARBON	10.0413	3/2/23	0.0	6.0	0	0	0
CARBON	10.0413		8.5	10.5	0	0	0
CARBON	10.0413	3/16/23	0.0	6.0	0	0	1
CARBON	10.0413		8.5	10.5	0	0	0
CARBON	10.0413	3/24/23	0.0	6.0	0	0	1
CARBON	10.0413		8.5	10.5	0	0	0
CARBON	10.0413	4/4/23	0.0	6.0	0	0	0
CARBON	10.0413	4/18/23	0.0	8.5	0	0	1
CARBON	10.0413	5/10/23	8.5	10.2	0	0	0
CARBON	10.0413	5/25/23	0.0	8.5	1	0	0
			CARBON	TOTAL	1	0	3
					LIVE	DEAD	REDDS
FENNEL	10.0406	3/3/23	0.0	0.5	0	0	0
FENNEL	10.0406	3/13/23	0.0	0.5	0	0	0
FENNEL	10.0406	3/20/23	0.0	0.5	0	0	0
FENNEL	10.0406	3/27/23	0.0	0.5	0	0	0
FENNEL	10.0406	5/3/23	0.0	1.0	0	0	0
			FENNEL	TOTAL	0	0	0
					LIVE	DEAD	REDDS

FOX	10.0608	3/3/23	0.0	1.0	0	0	0
FOX	10.0608	3/13/23	0.0	1.0	0	0	0
FOX	10.0608	3/27/23	0.0	0.5	0	0	0
FOX	10.0608	4/25/23	0.0	0.5	0	0	0
FOX	10.0608	5/3/23	0.0	0.5	0	0	0
			FOX	**TOTAL**	**0**	**0**	**0**
					LIVE	**DEAD**	**REDDS**
KAPOWSIN	10.0600	3/7/23	0.0	3.2	0	0	0
KAPOWSIN	10.0600	3/20/23	0.0	3.2	1	0	16
KAPOWSIN	10.0600	3/28/23	0.0	3.2	0	0	0
KAPOWSIN	10.0600	4/25/23	0.0	3.2	0	0	0
KAPOWSIN	10.0600	5/3/23	0.0	3.2	0	0	0
			KAPOWSIN	**TOTAL**	**1**	**0**	**16**
					LIVE	**DEAD**	**REDDS**
KELLOG	10.0621	3/14/23	0.0	2.0	0	0	0
KELLOG	10.0621	3/22/23	0.0	2.0	0	0	0
KELLOG	10.0621	3/31/23	0.0	2.0	0	0	0
KELLOG	10.0621	4/7/23	0.0	2.0	0	0	2
KELLOG	10.0621	4/13/23	0.0	2.0	0	0	0
KELLOG	10.0621	4/24/23	0.0	2.0	0	0	0
KELLOG	10.0621	5/1/23	0.0	2.0	0	0	10
KELLOG	10.0621	5/10/23	0.0	2.0	0	0	2
KELLOG	10.0621	5/15/23	0.0	2.0	0	0	3
KELLOG	10.0621	5/22/23	0.0	2.0	0	0	0
KELLOG	10.0621	6/6/23	0.0	2.0	0	0	0
KELLOG	10.0621	6/12/23	0.0	2.0	0	0	0
			KELLOG	**TOTAL**	**0**	**0**	**17**
					LIVE	**DEAD**	**REDDS**
LEDOUT	10.0620	3/13/23	0.0	0.3	0	0	0
LEDOUT	10.0620	3/15/23	0.0	0.3	0	0	0
LEDOUT	10.0620	3/23/23	0.0	0.3	0	0	0
LEDOUT	10.0620	3/30/23	0.0	0.3	0	0	0
LEDOUT	10.0620	4/5/23	0.0	0.3	0	0	0
LEDOUT	10.0620	4/17/23	0.0	0.3	0	0	1
LEDOUT	10.0620	4/27/23	0.0	0.3	0	0	1
LEDOUT	10.0620	5/2/23	0.0	0.3	0	0	2
LEDOUT	10.0620	5/25/23	0.0	0.3	0	0	0
LEDOUT	10.0620		0.0	0.3			
			LEDOUT	**TOTAL**	**0**	**0**	**4**
					LIVE	**DEAD**	**REDDS**
MEADOW	10.0630	5/4/23	0.0	0.8	0	0	0
			MEADOW	**TOTAL**	**0**	**0**	**0**
					LIVE	**DEAD**	**REDDS**

MOWICH RIVER	10.0624	3/23/23	0.0	5.0	0	0	0
MOWICH RIVER	10.0624	3/31/23	0.0	1.0	0	0	0
MOWICH RIVER	10.0624	4/21/23	0.0	5.0	0	0	0
MOWICH RIVER	10.0624	5/2/23	0.0	1.0	0	0	0
			MOWICH RIVER	**TOTAL**	**0**	**0**	**0**
					LIVE	**DEAD**	**REDDS**
NIESSON	10.0622	3/14/23	0.0	2.0	0	0	0
NIESSON	10.0622	3/22/23	0.0	2.0	0	0	0
NIESSON	10.0622	3/31/23	0.0	2.0	0	0	0
NIESSON	10.0622	4/7/23	0.0	2.0	3	0	2
NIESSON	10.0622	4/13/23	0.0	3.2	0	0	0
NIESSON	10.0622	4/24/23	0.0	3.2	5	0	5
NIESSON	10.0622	5/1/23	0.0	3.2	4	1	13
NIESSON	10.0622	5/10/23	0.0	3.4	0	2	7
NIESSON	10.0622	5/15/23	0.0	3.4	0	0	2
NIESSON	10.0622	5/22/23	0.0	3.4	0	0	0
NIESSON	10.0622	6/6/23	0.0	3.4	0	0	1
NIESSON	10.0622	6/12/23	0.0	3.4	0	0	0
			NIESSON	**TOTAL**	**12**	**3**	**30**
					LIVE	**DEAD**	**REDDS**
PUYALLUP R. (LOWER REACH)	10.0021	3/9/23	22.1	29.9	5	0	1
PUYALLUP R. (LOWER REACH)	10.0021	3/10/23	10.2	16.2	2	0	0
PUYALLUP R. (LOWER REACH)	10.0021	3/21/23	18.1	29.9	0	0	3
PUYALLUP R. (LOWER REACH)	10.0021	3/29/23	18.1	29.9	0	0	3
PUYALLUP R. (LOWER REACH)	10.0021	4/26/23	18.1	29.9	0	0	0
			PUYALLUP R. (LOWER)	**TOTAL**	**5**	**0**	**7**
					LIVE	**DEAD**	**REDDS**
PUYALLUP R. (BYPASS REACH)	10.0021	3/15/23	36.4	41.7	0	0	3
PUYALLUP R. (BYPASS REACH)	10.0021	3/23/23	36.4	41.5	0	0	1
PUYALLUP R. (BYPASS REACH)	10.0021	3/30/23	36.4	41.7	0	0	4
PUYALLUP R. (BYPASS REACH)	10.0021	4/5/23	36.4	41.7	0	0	5
PUYALLUP R. (BYPASS REACH)	10.0021	4/17/23	36.4	41.7	2	0	2
PUYALLUP R. (BYPASS REACH)	10.0021	4/27/23	35.5	41.7	0	0	2
PUYALLUP R. (BYPASS REACH)	10.0021	5/2/23	35.5	41.7	0	0	0
PUYALLUP R. (BYPASS REACH)	10.0021	5/9/23	35.5	41.7	0	0	1
			PUYALLUP R. (BYPASS)	**TOTAL**	**2**	**0**	**18**
					LIVE	**DEAD**	**REDDS**

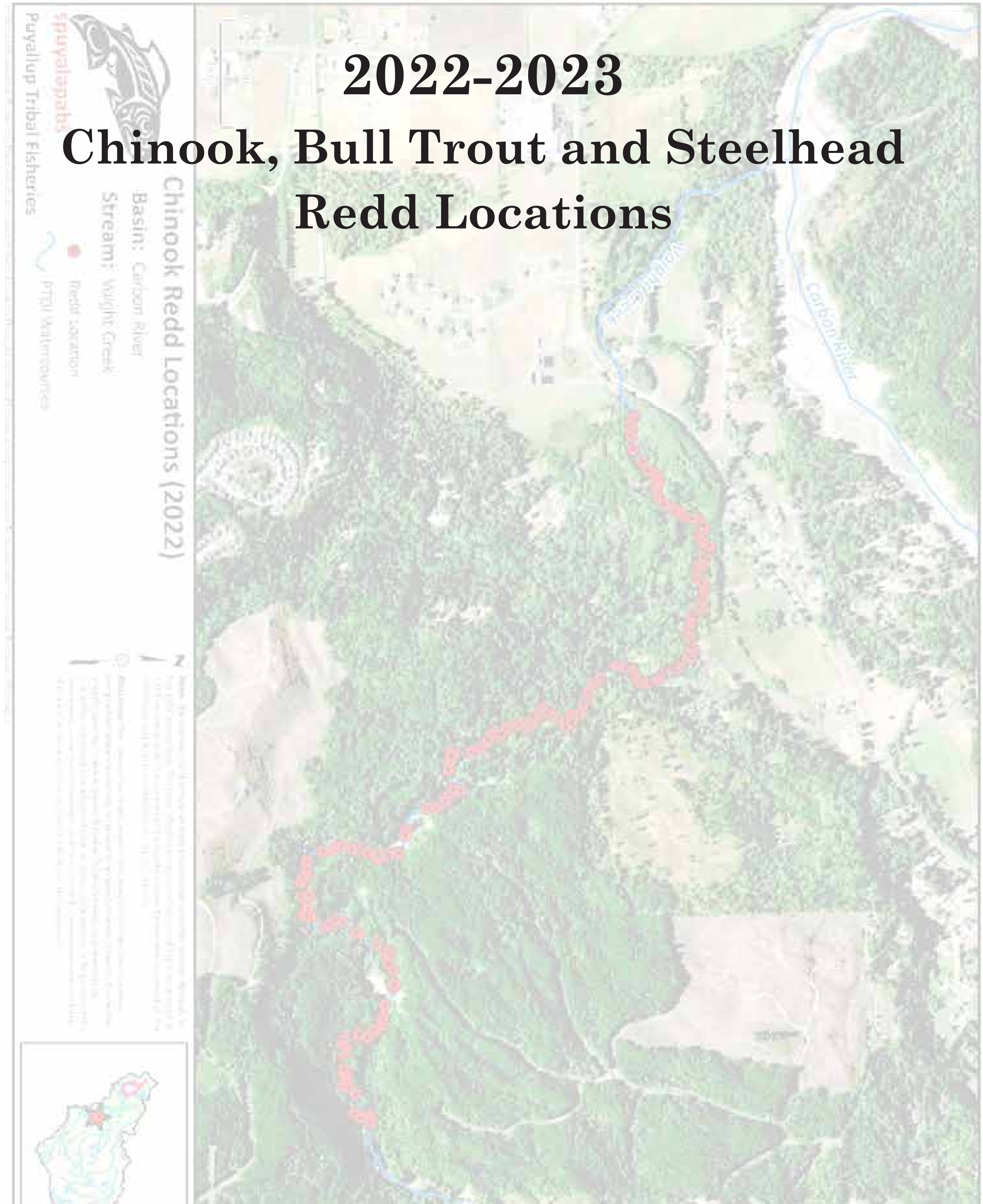
PUYALLUP R. (ABOVE ELRCTRON)	10.0021	3/23/23	41.7	46	0	0	0
PUYALLUP R. (ABOVE ELRCTRON)	10.0021	3/31/23	42.3	43.8	0	0	0
PUYALLUP R. (ABOVE ELRCTRON)	10.0021	4/21/23	41.7	47	0	0	0
			PUYALLUP R. (A.E.)	**TOTAL**	**0**	**0**	**0**
					LIVE	**DEAD**	**REDDS**
RUSHINGWATER	10.0265	4/13/23	0.5	1.2	0	0	0
RUSHINGWATER	10.0265	4/24/23	0.5	1.2	0	0	0
RUSHINGWATER	10.0265	5/1/23	0.5	1.2	0	0	0
RUSHINGWATER	10.0265	5/22/23	0.5	1.2	0	0	0
			RUSHINGWATER	**TOTAL**	**0**	**0**	**0**
					LIVE	**DEAD**	**REDDS**
SALMON CREEK	10.0035	3/27/23	0.3	0.5	0	0	0
			SALMON CREEK	**TOTAL**	**0**	**0**	**0**
					LIVE	**DEAD**	**REDDS**
Surveys conducted by WDFW							
SOUTH PRAIRIE	10.0429	2/23/23	0.3	10.2	0	0	0
SOUTH PRAIRIE	10.0429	2/24/23	10.2	12.6	0	0	0
SOUTH PRAIRIE	10.0429	3/8/23	0.3	8.0	0	0	0
SOUTH PRAIRIE	10.0429	3/15/23	0.3	12.6	0	0	0
SOUTH PRAIRIE	10.0429	3/23/23	0.3	12.6	0	0	2
SOUTH PRAIRIE	10.0429	3/29/23	0.3	12.6	0	0	3
SOUTH PRAIRIE	10.0429	3/30/23	2.6	5.6	0	0	1
SOUTH PRAIRIE	10.0429	4/4/23	0.0	12.6	0	0	8
SOUTH PRAIRIE	10.0429	4/14/23	5.6	10.2	2	0	4
SOUTH PRAIRIE	10.0429	4/20/23	0.0	12.6	7	0	25
SOUTH PRAIRIE	10.0429	4/26/23	0.3	10.2	4	0	3
SOUTH PRAIRIE	10.0429	5/3/23	0.3	8.0	3	0	9
SOUTH PRAIRIE	10.0429	5/10/23	0.3	12.6	2	0	11
SOUTH PRAIRIE	10.0429	5/17/23	0.3	12.6	0	0	7
SOUTH PRAIRIE	10.0429	5/24/23	0.0	3.8	2	0	1
SOUTH PRAIRIE	10.0429	5/25/23	6.7	14.5	0	0	6
SOUTH PRAIRIE	10.0429	5/26/23	3.8	5.6	0	0	0
SOUTH PRAIRIE	10.0429	6/6/23	0.0	5.6	0	0	2
SOUTH PRAIRIE	10.0429	6/7/23	5.6	11.4	0	0	0
			SOUTH PRAIRIE	**TOTAL**	**20**	**0**	**82**
					LIVE	**DEAD**	**REDDS**
VOIGHTS	10.0414	2/15/23	0.5	3.4	0	0	0
VOIGHTS	10.0414	2/22/23	0.5	3.4	0	0	0
VOIGHTS	10.0414	3/6/23	0.5	3.4	0	0	0
VOIGHTS	10.0414	3/14/23	0.5	3.4	0	0	0
VOIGHTS	10.0414	3/22/23	0.5	3.4	0	0	0
VOIGHTS	10.0414	4/3/23	0.5	3.4	1	0	2
VOIGHTS	10.0414	4/26/23	0.5	3.4	0	0	5

VOIGHTS	10.0414	5/11/23	0.5	3.4	0	0	2
VOIGHTS	10.0414	5/19/23	0.5	3.4	0	0	6
VOIGHTS	10.0414	5/24/23	0.5	3.4	0	0	1
VOIGHTS	10.0414	5/30/23	0.5	3.4	0	0	0
			VOIGHTS	**TOTAL**	**1**	**0**	**16**
					LIVE	**DEAD**	**REDDS**
WHITE RIVER	10.0031	4/4/23	23.3	23.3	0	0	1
WHITE RIVER	10.0031	4/20/23	15.5	24.3	0	0	2
			WHITE RIVER	**TOTAL**	**0**	**0**	**2**
					LIVE	**DEAD**	**REDDS**
Surveys conducted by WDFW							
WILKESON	10.0432	2/24/23	0.0	6.1	0	0	0
WILKESON	10.0432	3/15/23	0.0	6.1	0	0	0
WILKESON	10.0432	3/23/23	0.0	6.1	0	0	0
WILKESON	10.0432	3/29/23	0.0	6.1	0	0	0
WILKESON	10.0432	4/4/23	0.0	6.1	0	0	1
WILKESON	10.0432	4/14/23	0.0	6.1	0	0	0
WILKESON	10.0432	4/20/23	0.0	6.1	0	0	0
WILKESON	10.0432	4/26/23	0.0	6.1	0	0	0
WILKESON	10.0432	5/3/23	0.0	6.1	0	0	2
WILKESON	10.0432	5/10/23	0.0	6.1	0	0	3
WILKESON	10.0432	5/17/23	0.0	6.1	0	0	0
WILKESON	10.0432	5/25/23	0.0	6.1	0	0	0
WILKESON	10.0432	6/5/23	0.0	6.1	0	0	0
			WILKESON	**TOTAL**	**0**	**0**	**6**
					LIVE	**DEAD**	**REDDS**

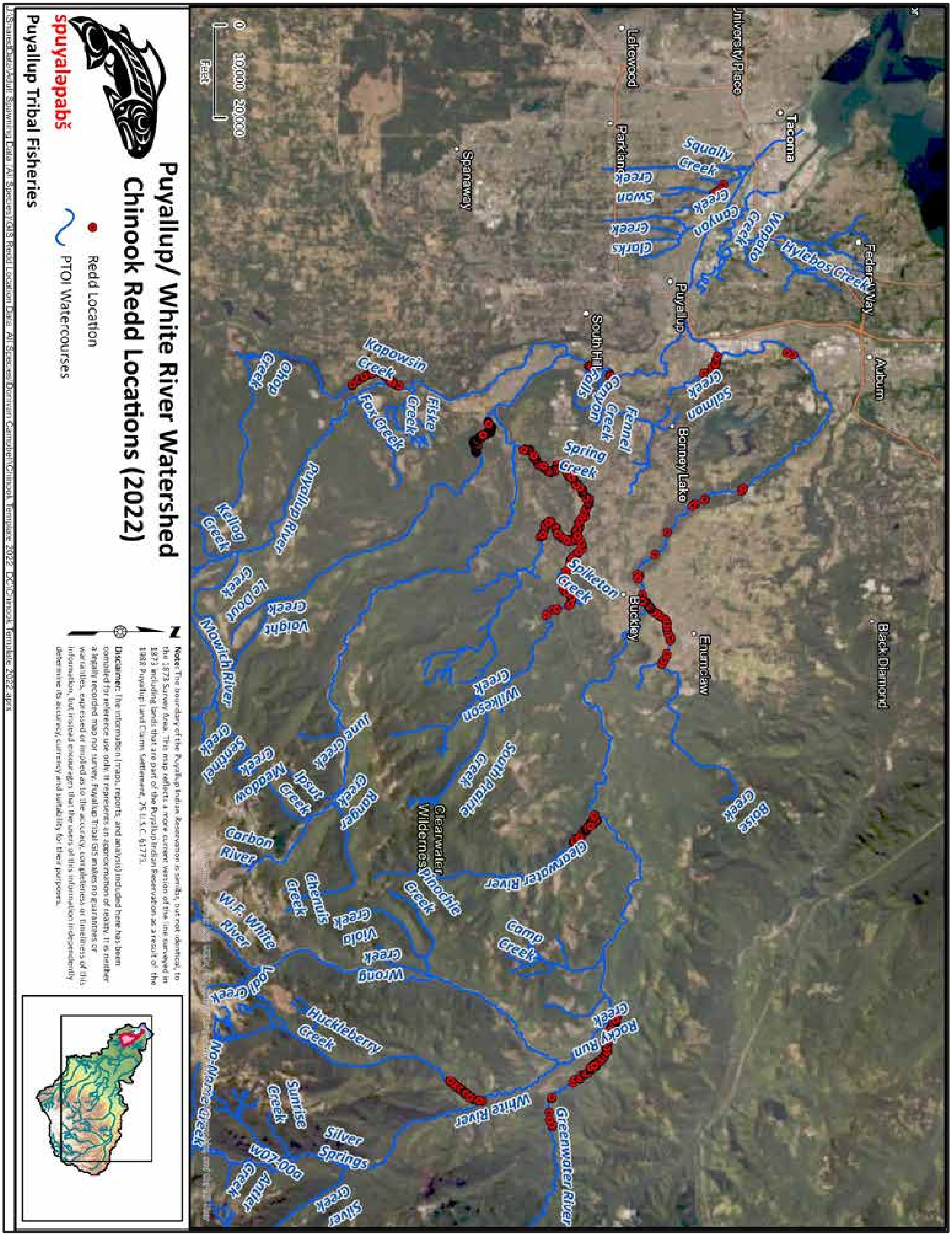
*Redd totals do not include redds observed above RM 24.3 (Buckley) on the White River

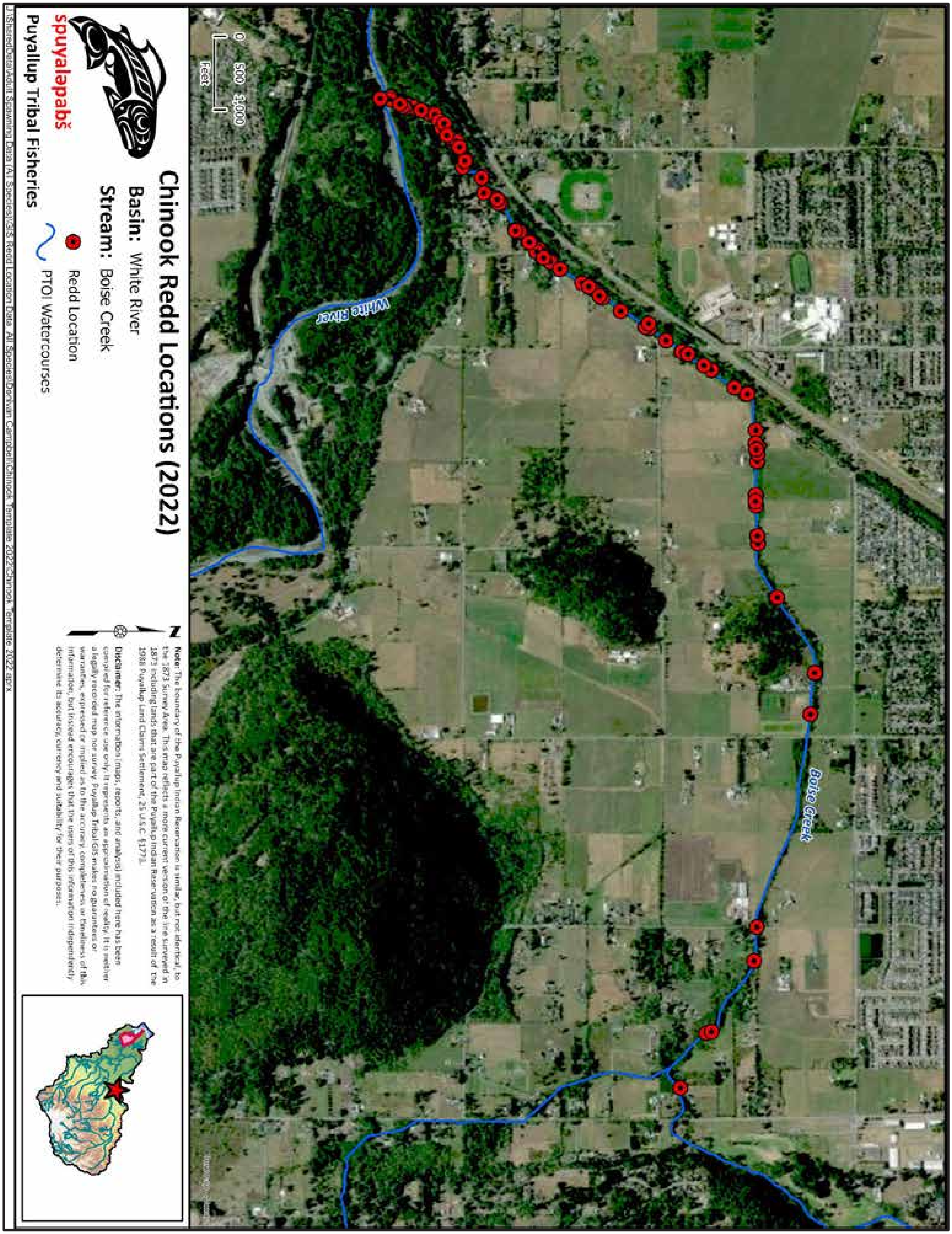
	LIVE	DEAD	REDDS
STEELHEAD SURVEY TOTALS:	**62**	**7**	**287**

2022-2023
Chinook, Bull Trout and Steelhead Redd Locations



APPENDIX C


Puyallup/ White River Watershed
Chinook Redd Locations (2022)
Redd Location
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
0 10,000 20,000
Feet
Tacoma
University Place
Lakewood
Parkland
Spanaway
Federal Way
Auburn
Puyallup
South Hill
Bonney Lake
Buckley
Enumclaw
Black Diamond
Squally Creek
Swan Creek
Canyon Creek
Clarks Creek
Wapato Creek
Hylebos Creek
Salmon Creek
Canyon Falls Creek
Fennel Creek
Spring Creek
Spiketon Creek
Kapowsin Creek
Fiske Creek
Fox Creek
Ohop Creek
Puyallup River
Kellog Creek
LeDout Creek
Voight Creek
Mowich River
Wilkeson Creek
South Prairie Creek
June Creek
Sentinel Creek
Meadow Creek
Ipsut Creek
Ranger Creek
Carbon River
Clearwater Wilderness
Clearwater River
Pinochle Creek
Chenuis Creek
Viola Creek
W.F. White River
Camp Creek
Wrong Creek
Lodi Creek
Huckleberry Creek
Rocky Run Creek
Boise Creek
White River
Greenwater River
Sunrise Creek
Silver Springs
Silver Creek
Antler Creek
No-Name Creek


Chinook Redd Locations (2022)
Basin: White River
Stream: Boise Creek
Redd Location
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
0 500 1,000
Feet
White River
Boise Creek
N
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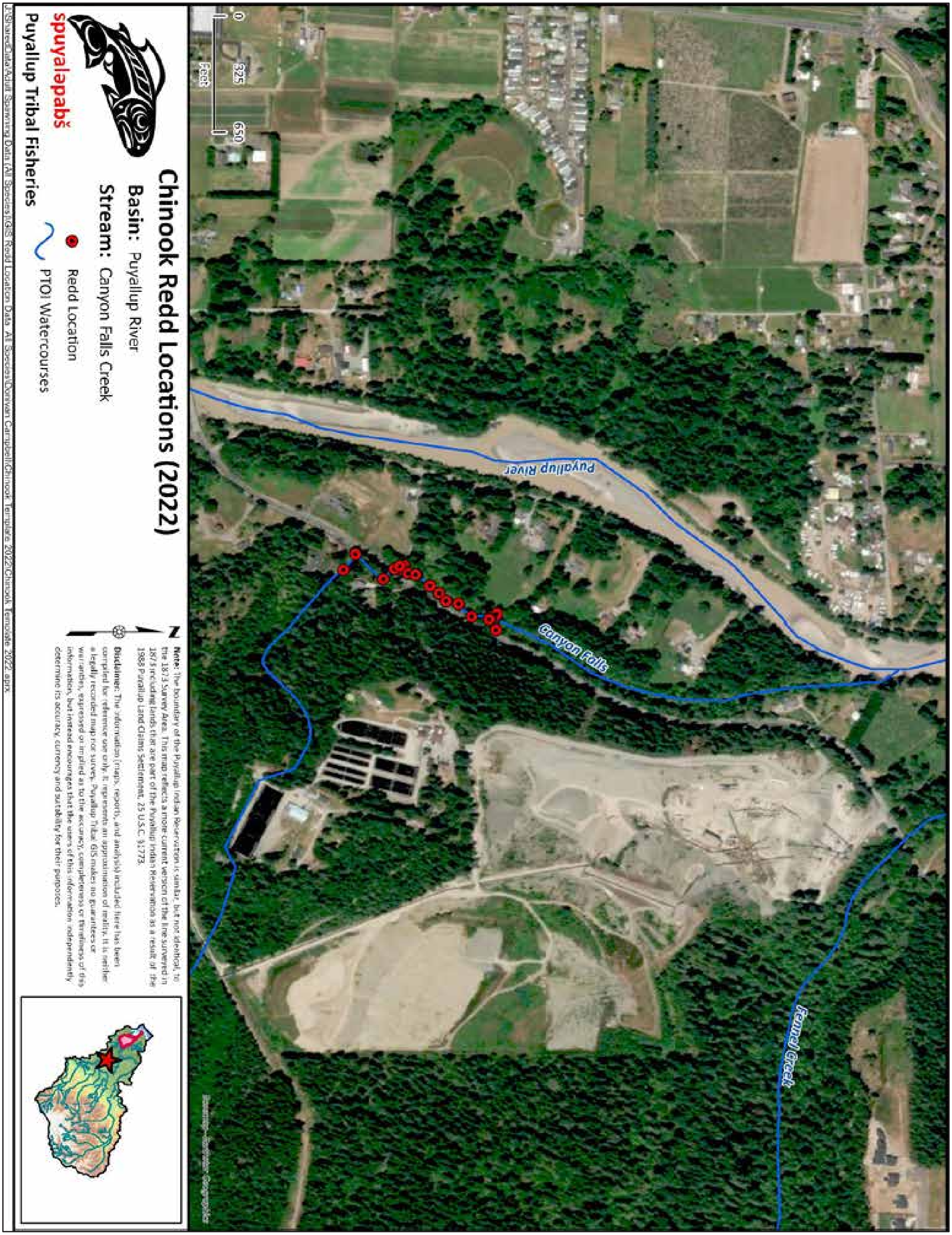
Chinook Redd Locations (2022)
Basin: Puyallup River
Stream: Canyon Falls Creek
Redd Location
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
0 325 650
Feet
Puyallup River
Canyon Falls
Fennel Creek
N
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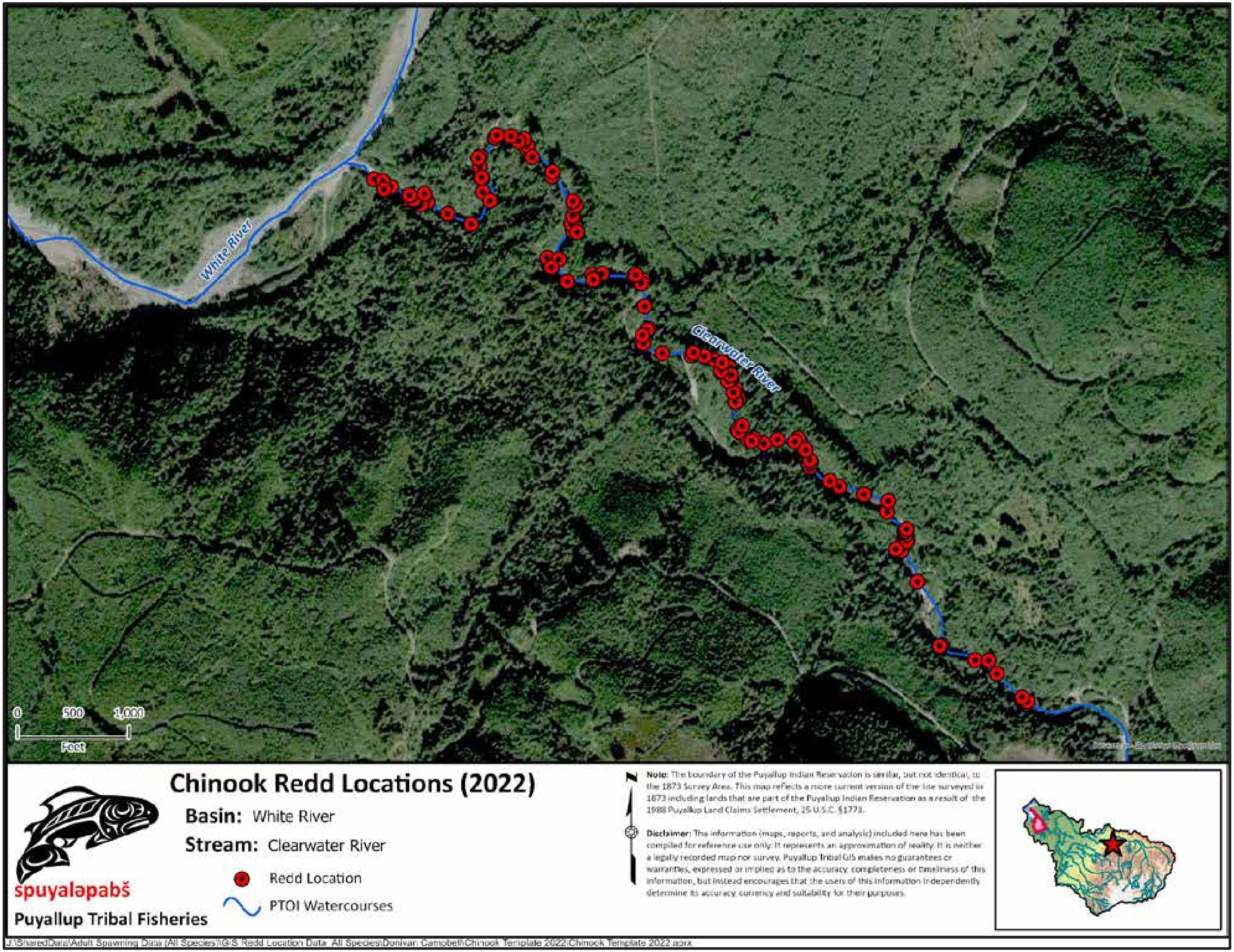
White River
Clearwater River
0 500 1,000
Feet
Chinook Redd Locations (2022)
Basin: White River
Stream: Clearwater River
Redd Location
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
N
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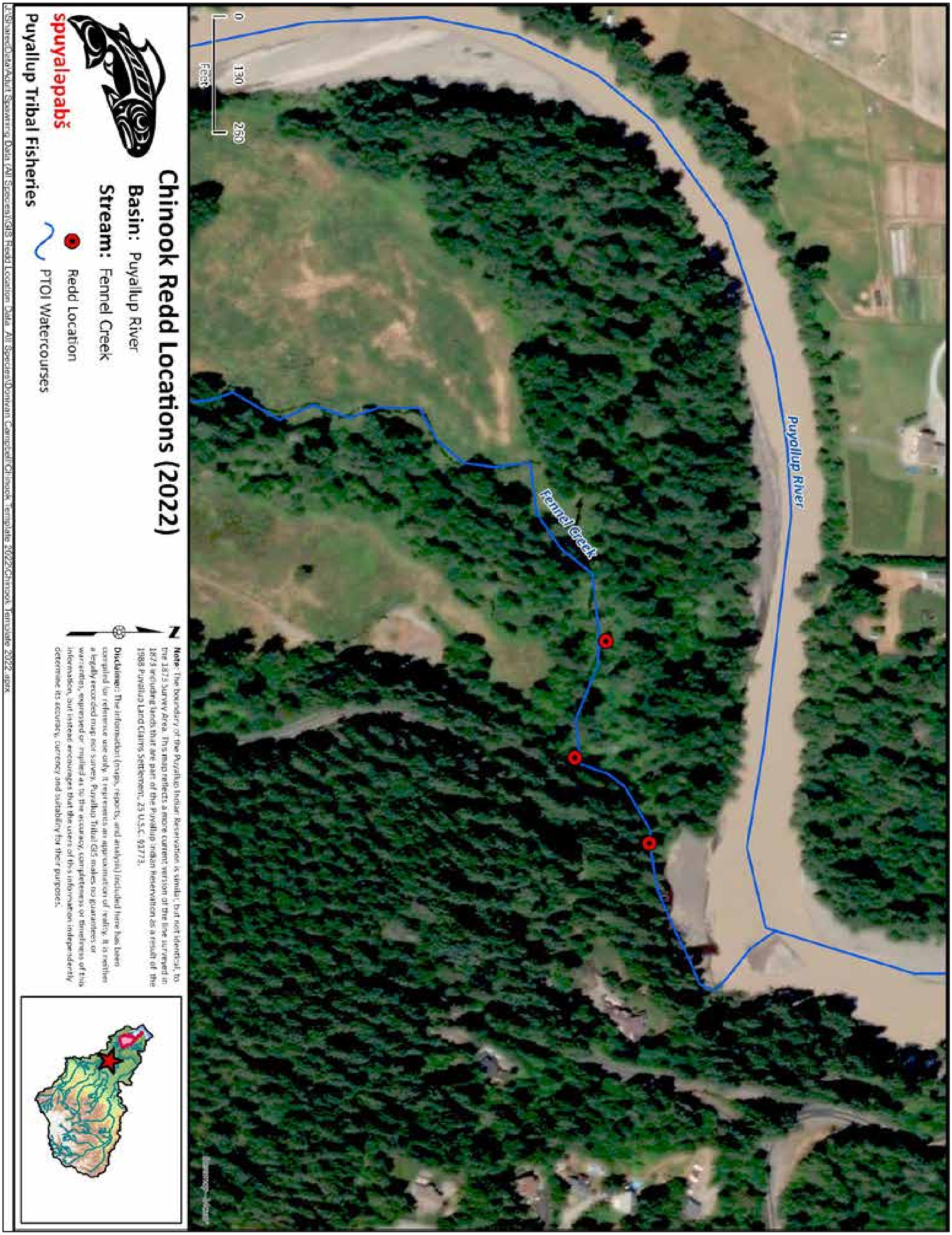
Chinook Redd Locations (2022)
Basin: Puyallup River
Stream: Fennel Creek
Redd Location
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
0 130 260
Feet
Puyallup River
Fennel Creek
N
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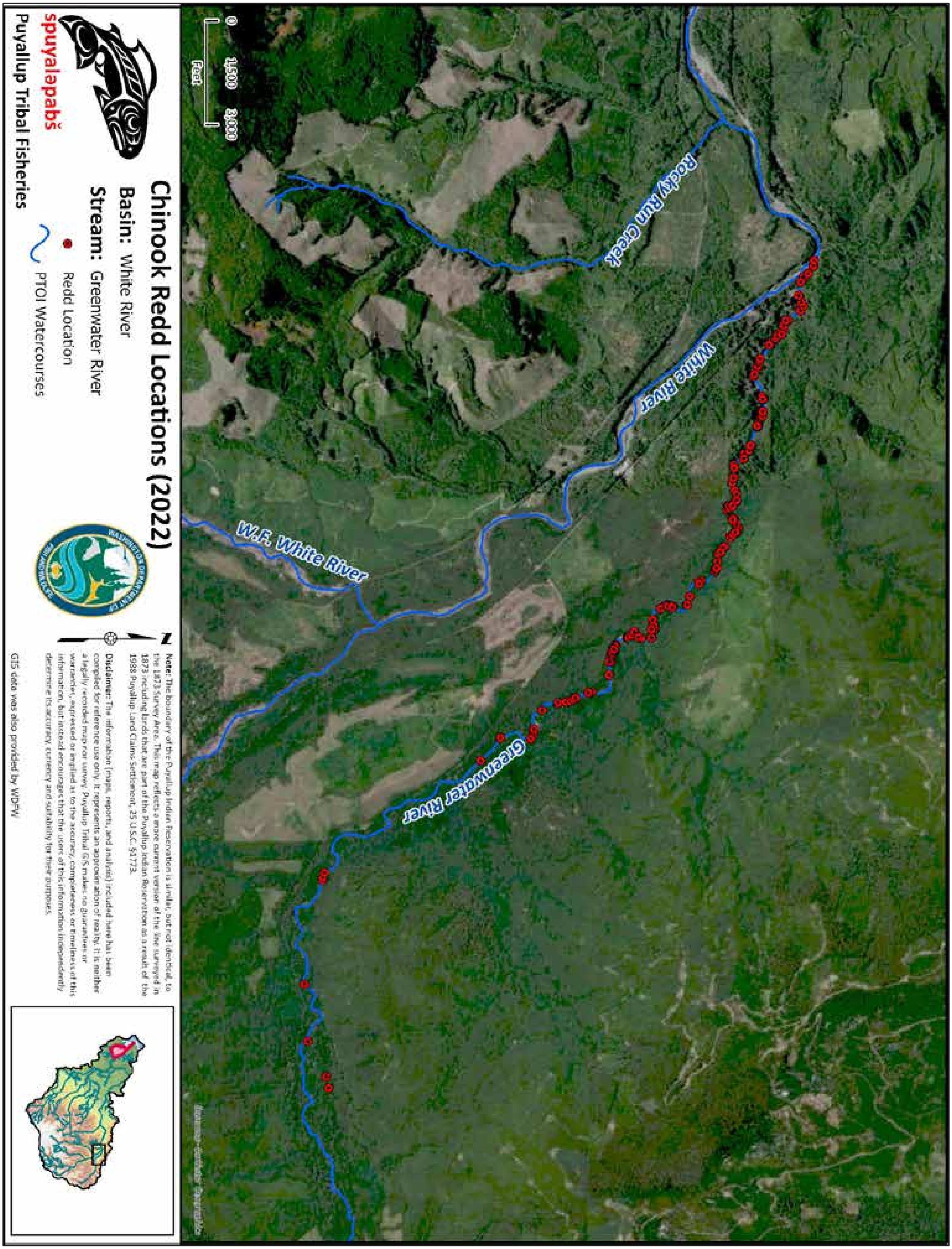
Chinook Redd Locations (2022)
Basin: White River
Stream: Greenwater River
Redd Location
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
0 1,500 3,000
Feet
N
Rocky Run Creek
White River
W.F. White River
Greenwater River
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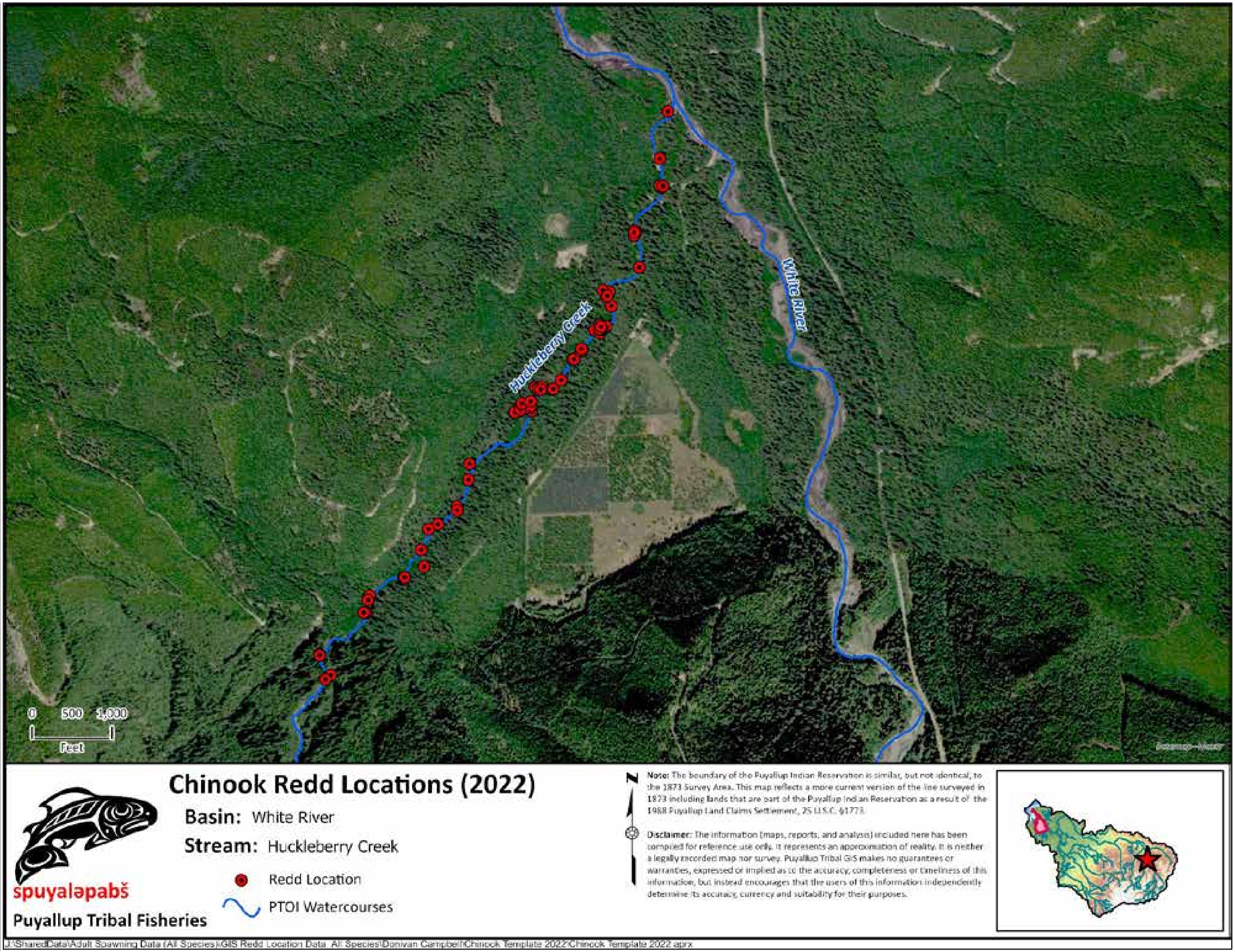
GIS data was also provided by WDFW


Huckleberry Creek
White River
0 500 1,000
Feet
Chinook Redd Locations (2022)
Basin: White River
Stream: Huckleberry Creek
Redd Location
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
N
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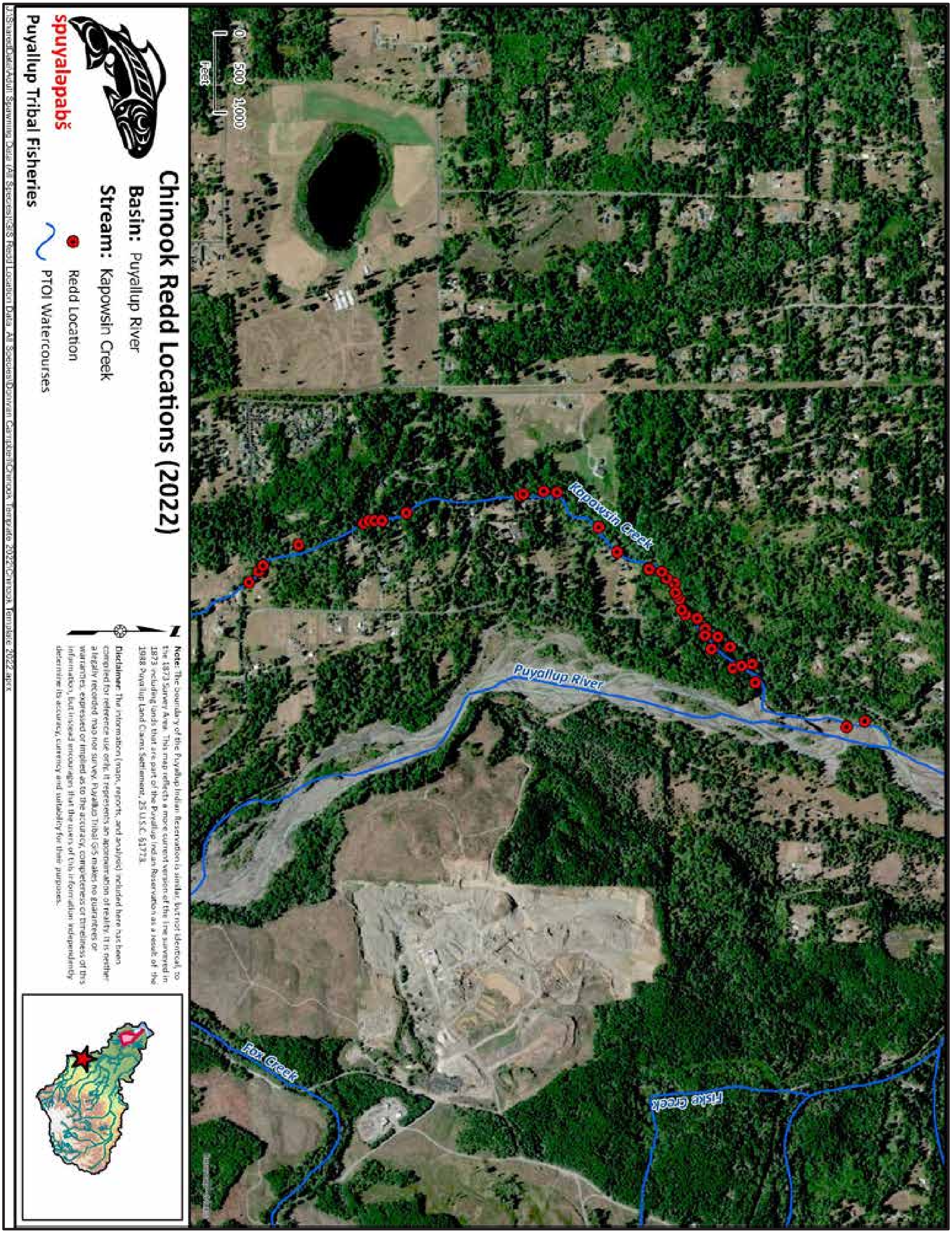
Chinook Redd Locations (2022)
Basin: Puyallup River
Stream: Kapowsin Creek
Redd Location
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
0 500 1,000
Feet
Kapowsin Creek
Puyallup River
Fox Creek
Fiske Creek
Note: The boundary of the Puyallup Indian Reservation is similar, but not identical, to the 1873 Survey Area. This map reflects a more current version of the line surveyed in 1873 including lands that are part of the Puyallup Indian Reservation as a result of the 1988 Puyallup Land Claims Settlement, 25 U.S.C. §1773.
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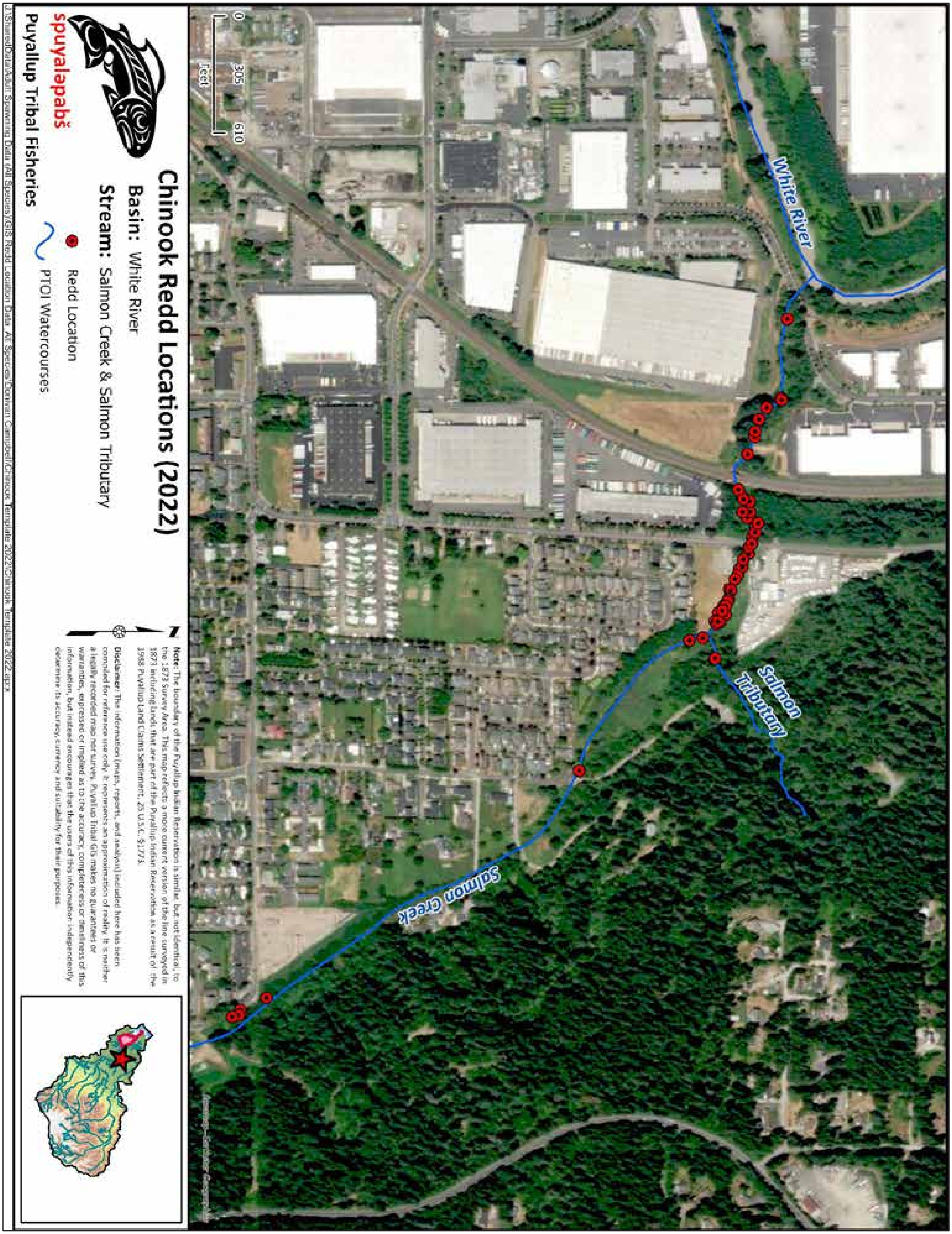
Chinook Redd Locations (2022)
Basin: White River
Stream: Salmon Creek & Salmon Tributary
Redd Location
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
0 305 610
Feet
White River
Salmon Tributary
Salmon Creek
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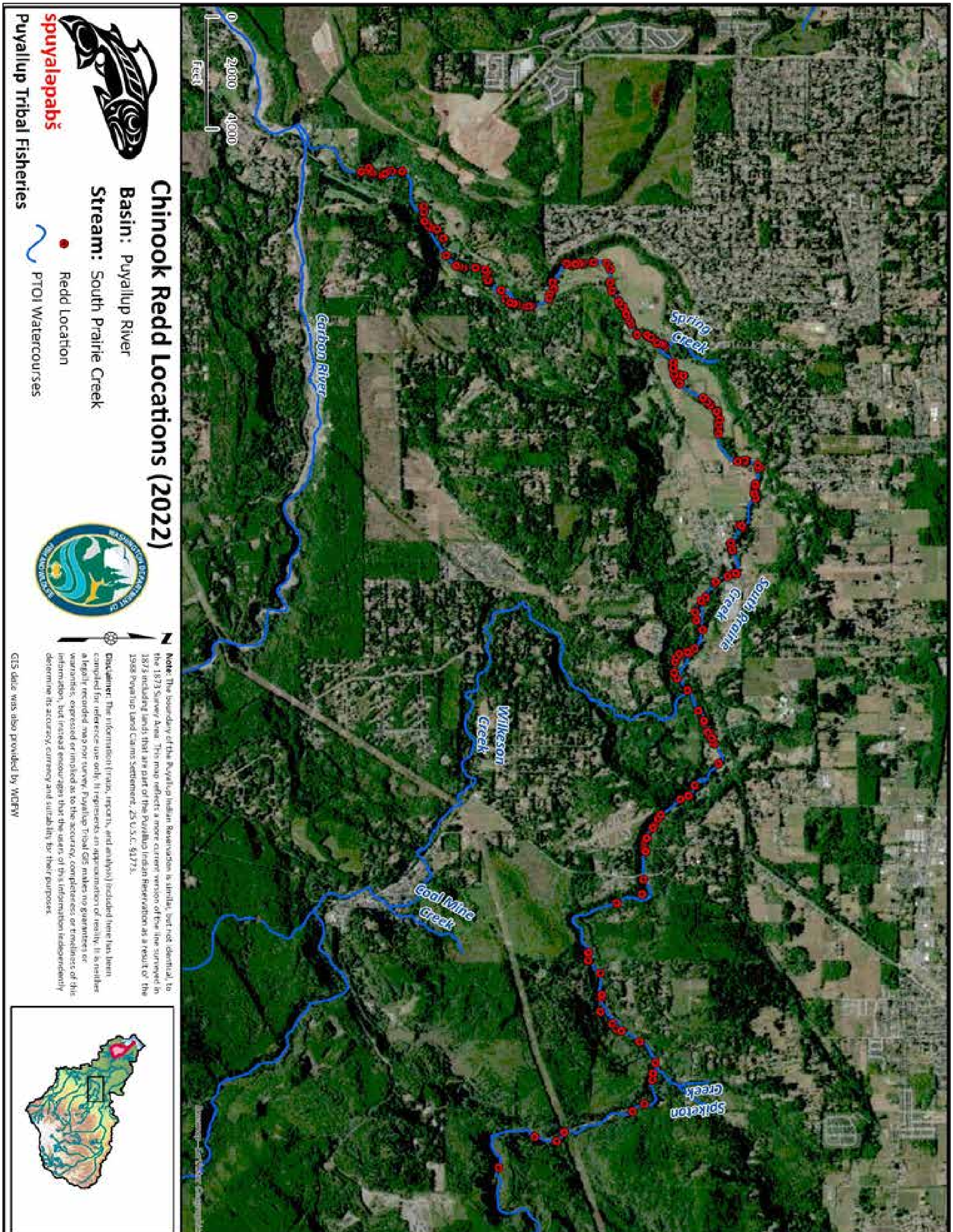
Spring Creek
South Prairie Creek
Spiketon Creek
Wilkeson Creek
Coal Mine Creek
Carbon River
0 2,000 4,000
Feet
Chinook Redd Locations (2022)
Basin: Puyallup River
Stream: South Prairie Creek
Redd Location
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
N
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Chinook Redd Locations (2022)

Basin: Puyallup River

Stream: Squally, Clear, and Canyon Creeks

Redd Location

PTOI Watercourses

spuyaləpabš

Puyallup Tribal Fisheries

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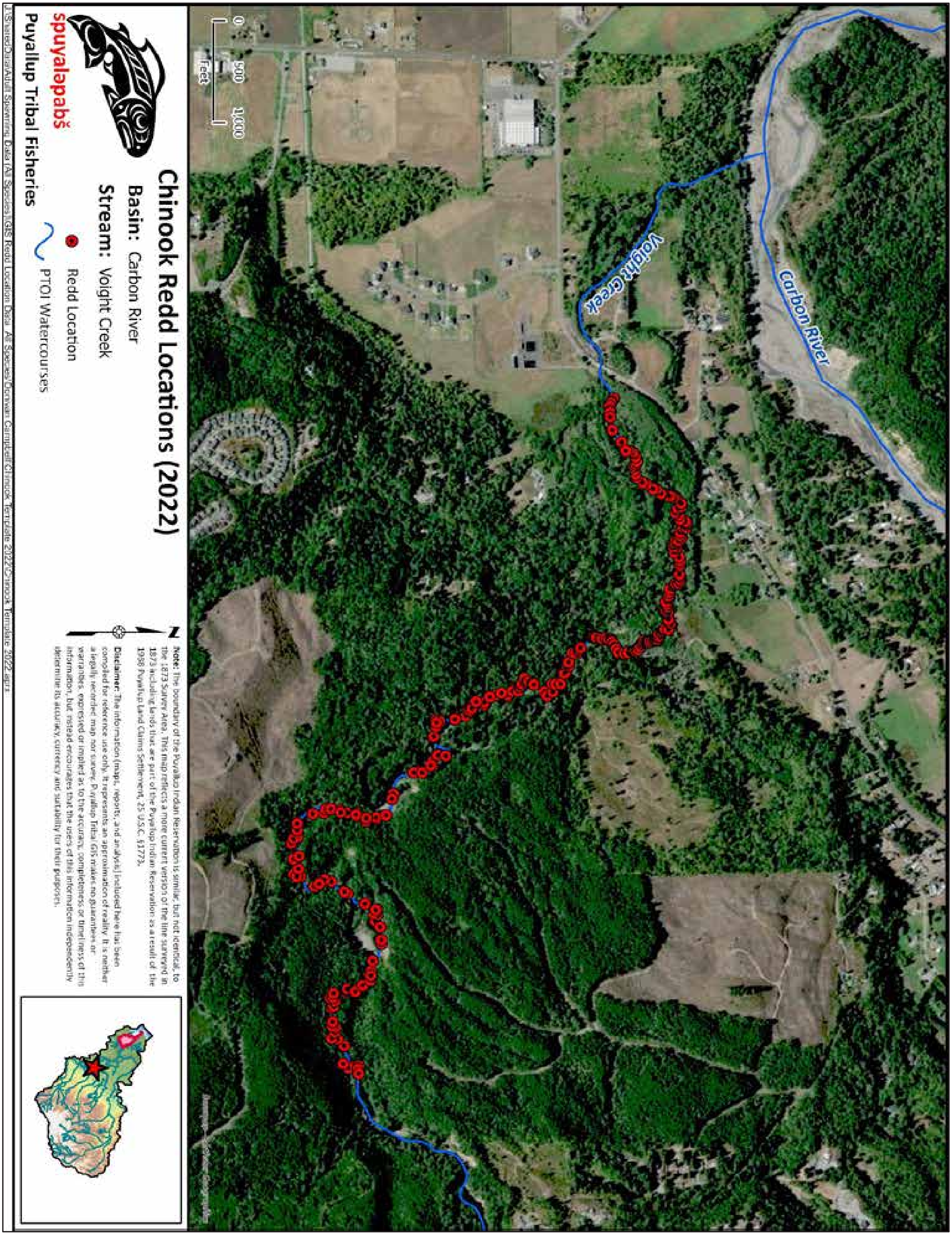
Chinook Redd Locations (2022)
Basin: Carbon River
Stream: Voight Creek
Redd Location
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
Carbon River
Voight Creek
0 500 1,000
Feet
N
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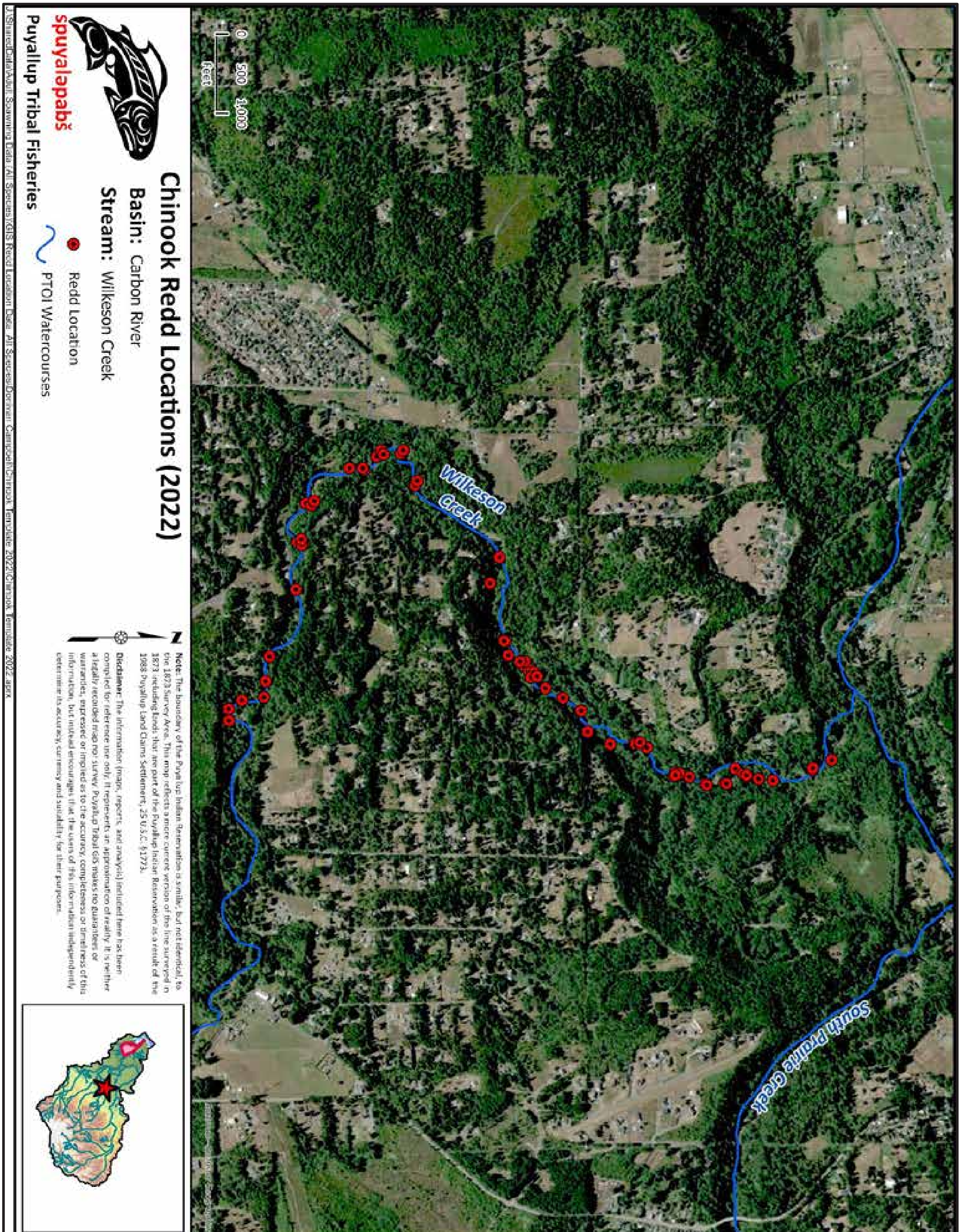
Chinook Redd Locations (2022)
Basin: Carbon River
Stream: Wilkeson Creek
Redd Location
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
0 500 1,000
feet
Wilkeson Creek
South Prairie Creek
N
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Bull Trout Redd Locations (2022)
Basin: White River
Stream: White River Tributaries
Redd Location
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
0 4,000 8,000
Feet
N
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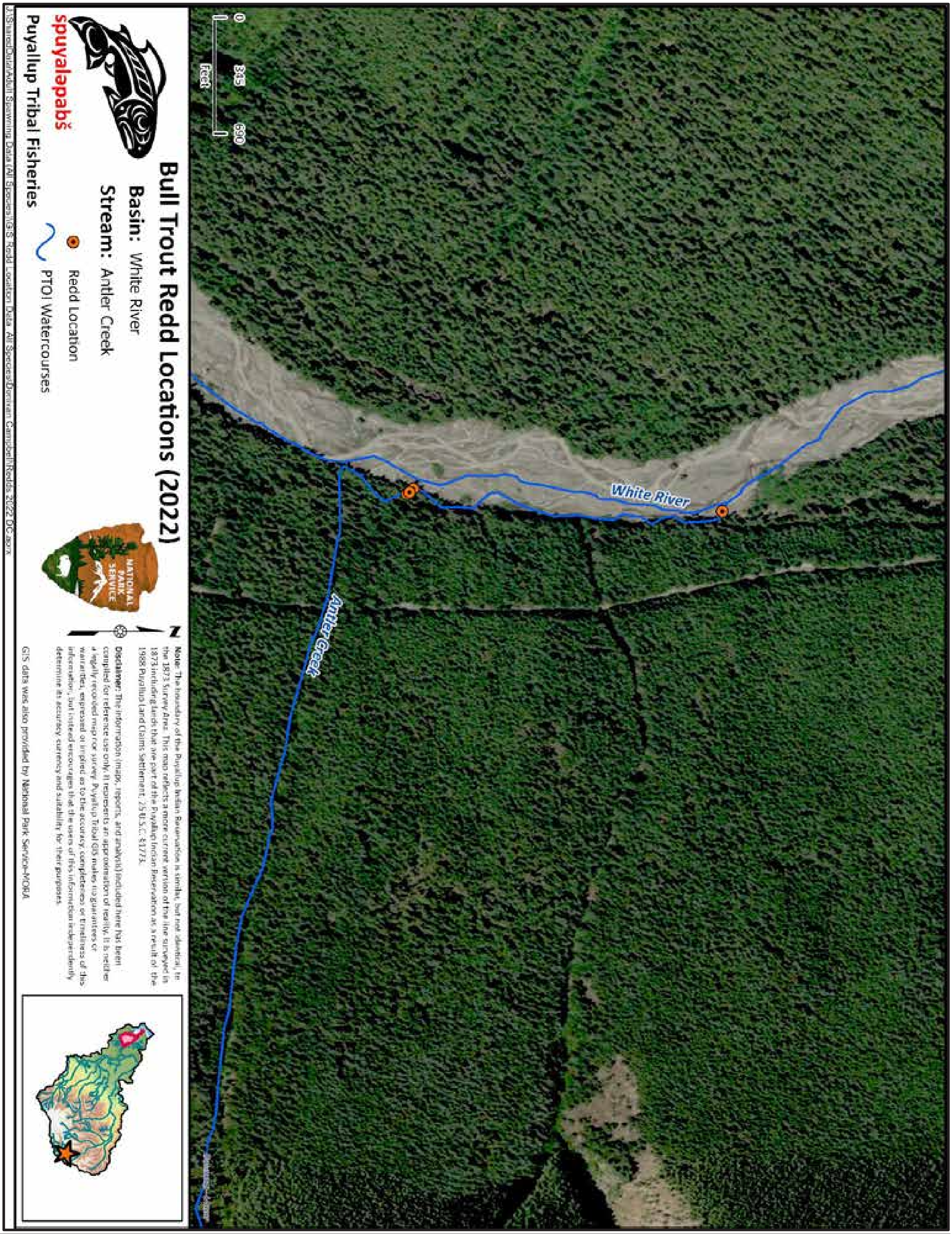
GIS data was also provided by National Park Service-MORA
NATIONAL PARK SERVICE
W.F. White River
Lodi Creek
Huckleberry Creek
Fryingpan Creek
Wright Creek
Wirtig Creek
Discovery Creek
No Name Creek
Shaw Creek
Parallel Creek
Tributary 67.5
Hidden Springs
Klickitat Creek
Deadwood Creek
Sunrise Creek
Amber Creek
White River
Silver Springs
Silver Creek


Bull Trout Redd Locations (2022)
Basin: White River
Stream: Antler Creek
Redd Location
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
White River
Antler Creek
0 345 690
Feet
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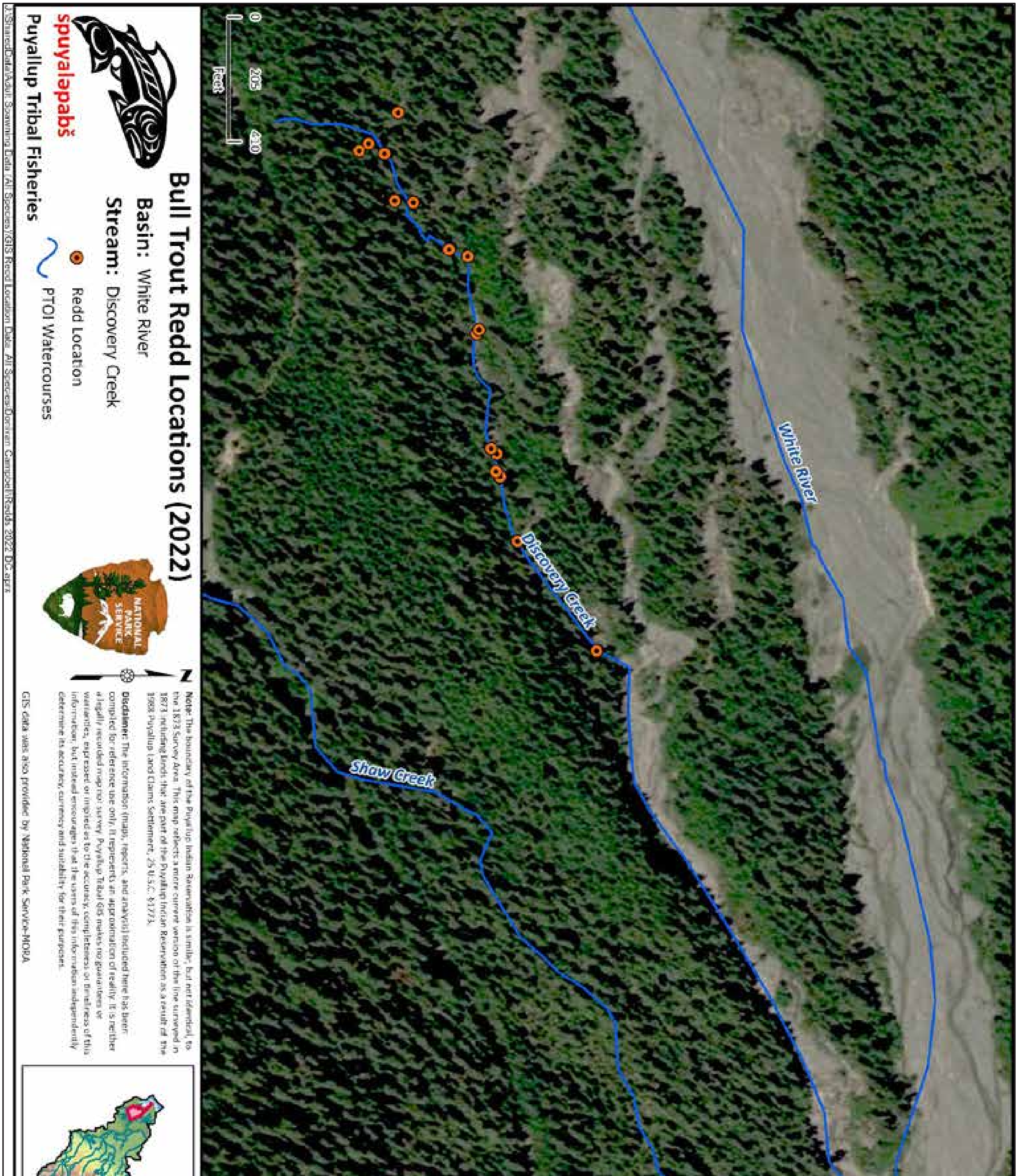
NATIONAL PARK SERVICE


White River
Discovery Creek
Shaw Creek
0 205 410
Feet
Bull Trout Redd Locations (2022)
Basin: White River
Stream: Discovery Creek
Redd Location
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
NATIONAL PARK SERVICE
N
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J:\SharedData\Adult Spawning Data (All Species)\GIS Redd Location Data_All Species\Donivan Campbell\Redds 2022 DC.aprx


Bull Trout Redd Locations (2022)
Basin: White River
Stream: Fryingpan Creek
Redd Location
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
0 375 750
Feet
Fryingpan Creek
Wauhaukaupauken Creek
White River
NATIONAL PARK SERVICE
N
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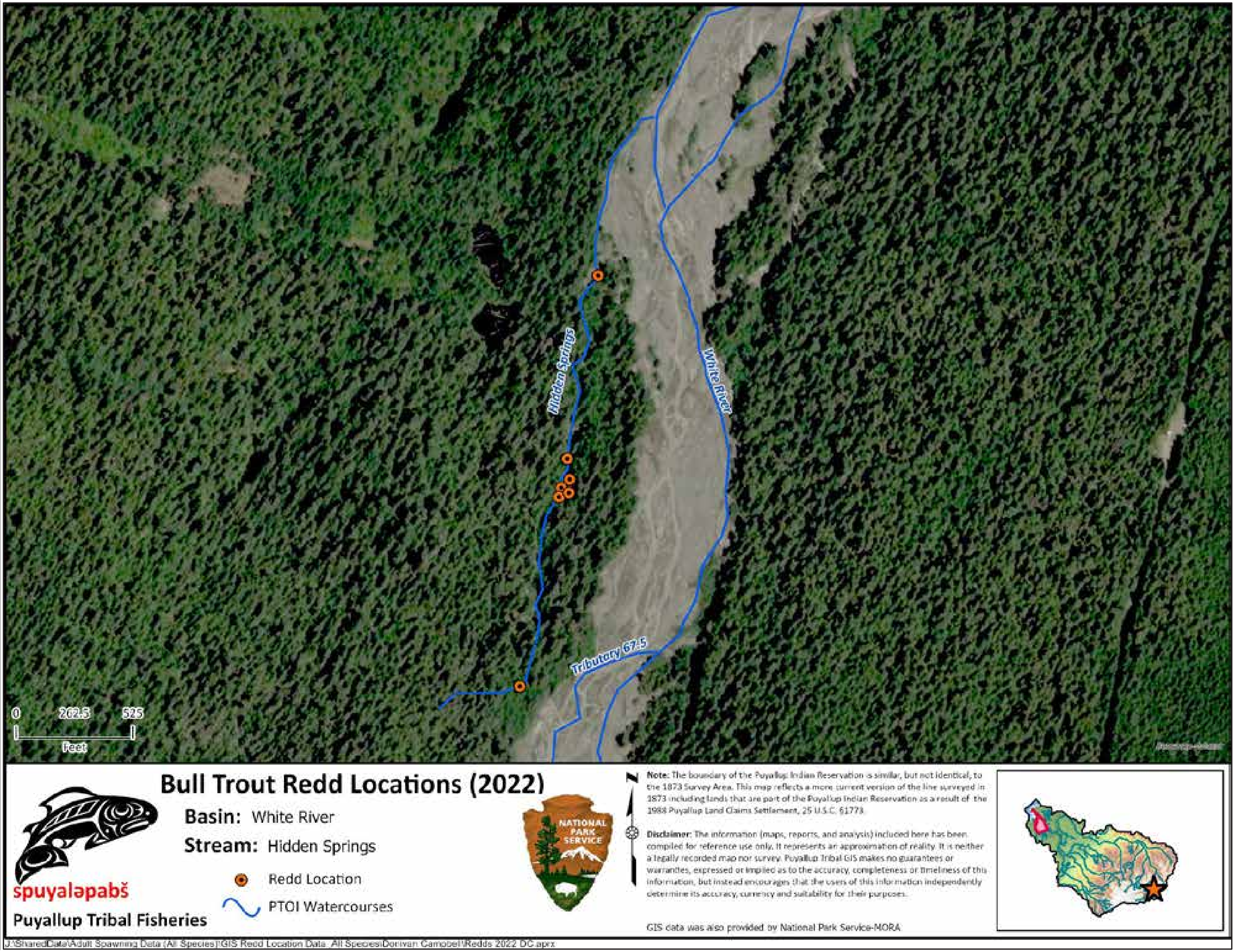
GIS data was also provided by National Park Service-MORA


Hidden Springs
White River
Tributary 67.5
0 262.5 525
Feet
Bull Trout Redd Locations (2022)
Basin: White River
Stream: Hidden Springs
Redd Location
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
NATIONAL PARK SERVICE
N
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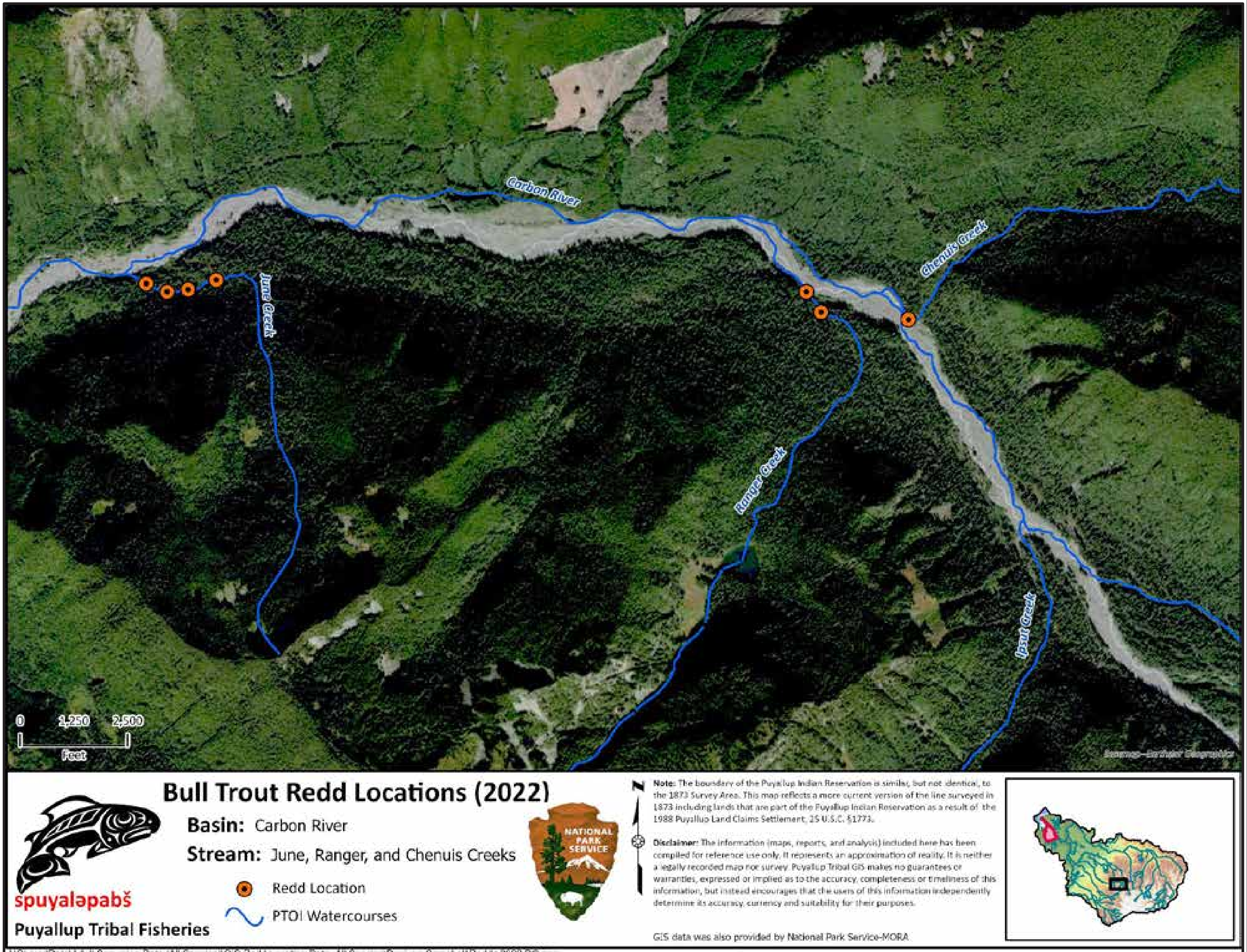
Carbon River
June Creek
Ranger Creek
Chenuis Creek
Ipsut Creek
0 1,250 2,500
Feet
Bull Trout Redd Locations (2022)
Basin: Carbon River
Stream: June, Ranger, and Chenuis Creeks
Redd Location
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
NATIONAL PARK SERVICE
N
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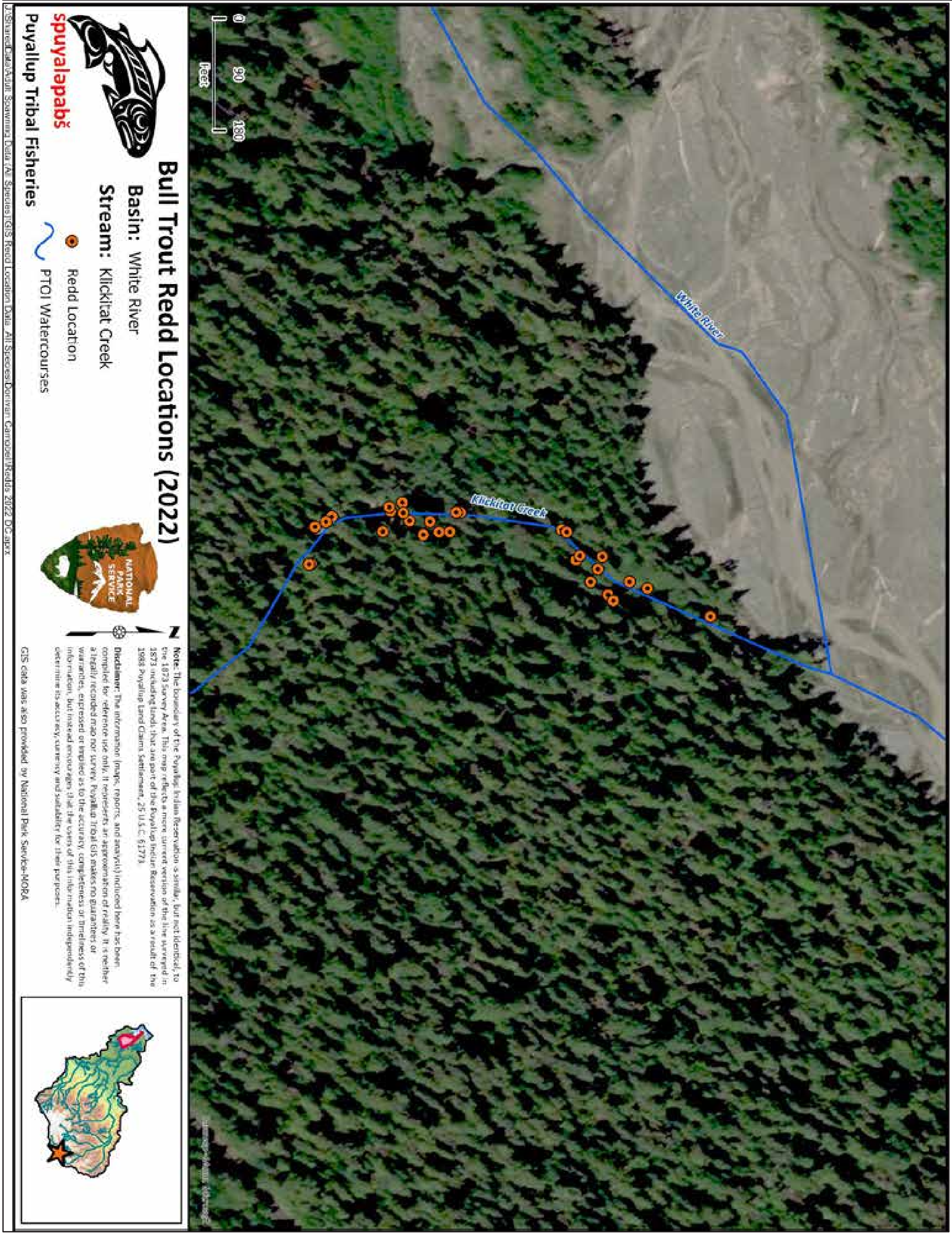

White River
Klickitat Creek
0 90 180
Feet
Bull Trout Redd Locations (2022)
Basin: White River
Stream: Klickitat Creek
Redd Location
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
NATIONAL PARK SERVICE
N
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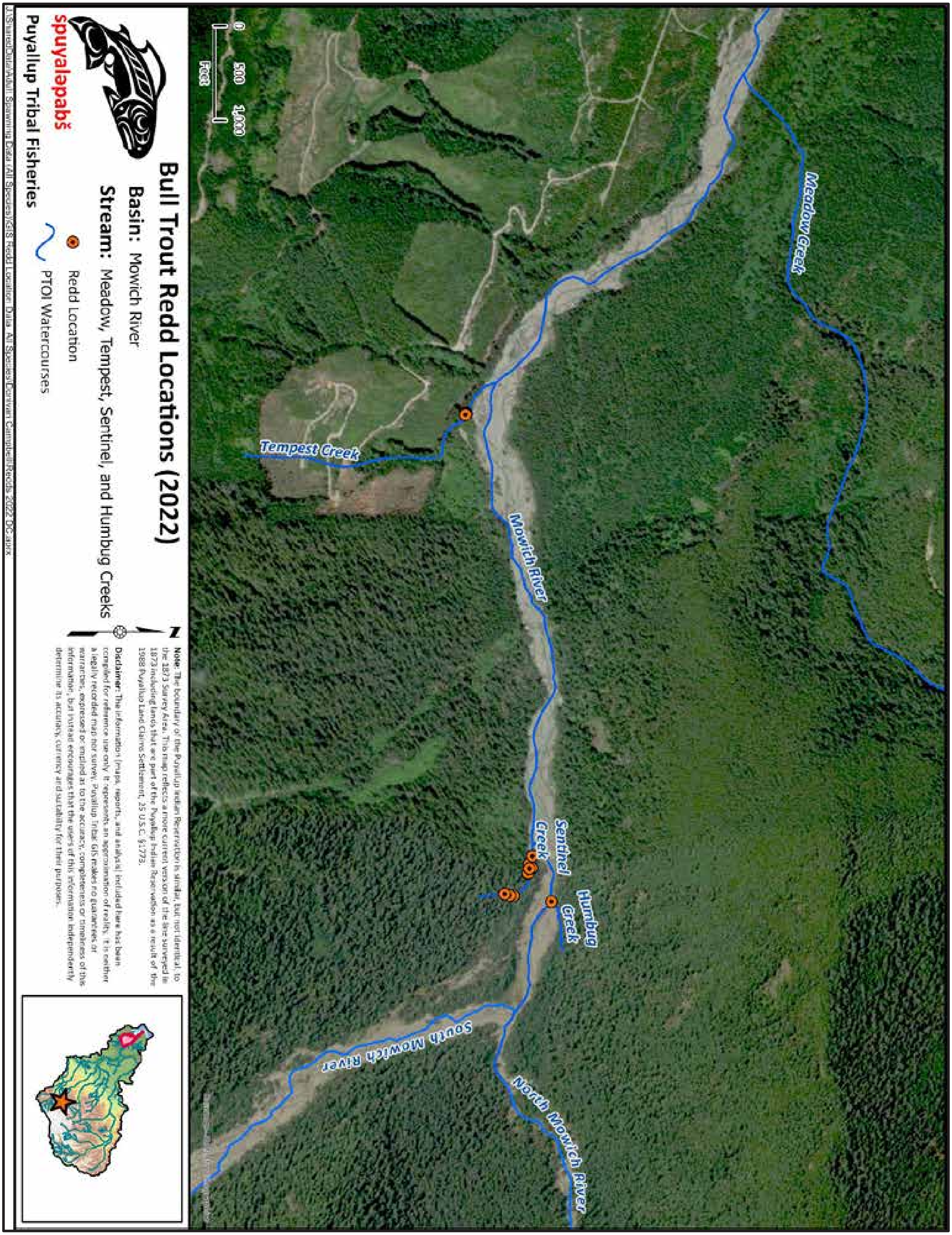
Bull Trout Redd Locations (2022)
Basin: Mowich River
Stream: Meadow, Tempest, Sentinel, and Humbug Creeks
Redd Location
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
0 500 1,000
Feet
Meadow Creek
Tempest Creek
Mowich River
Sentinel Creek
Humbug Creek
South Mowich River
North Mowich River
N
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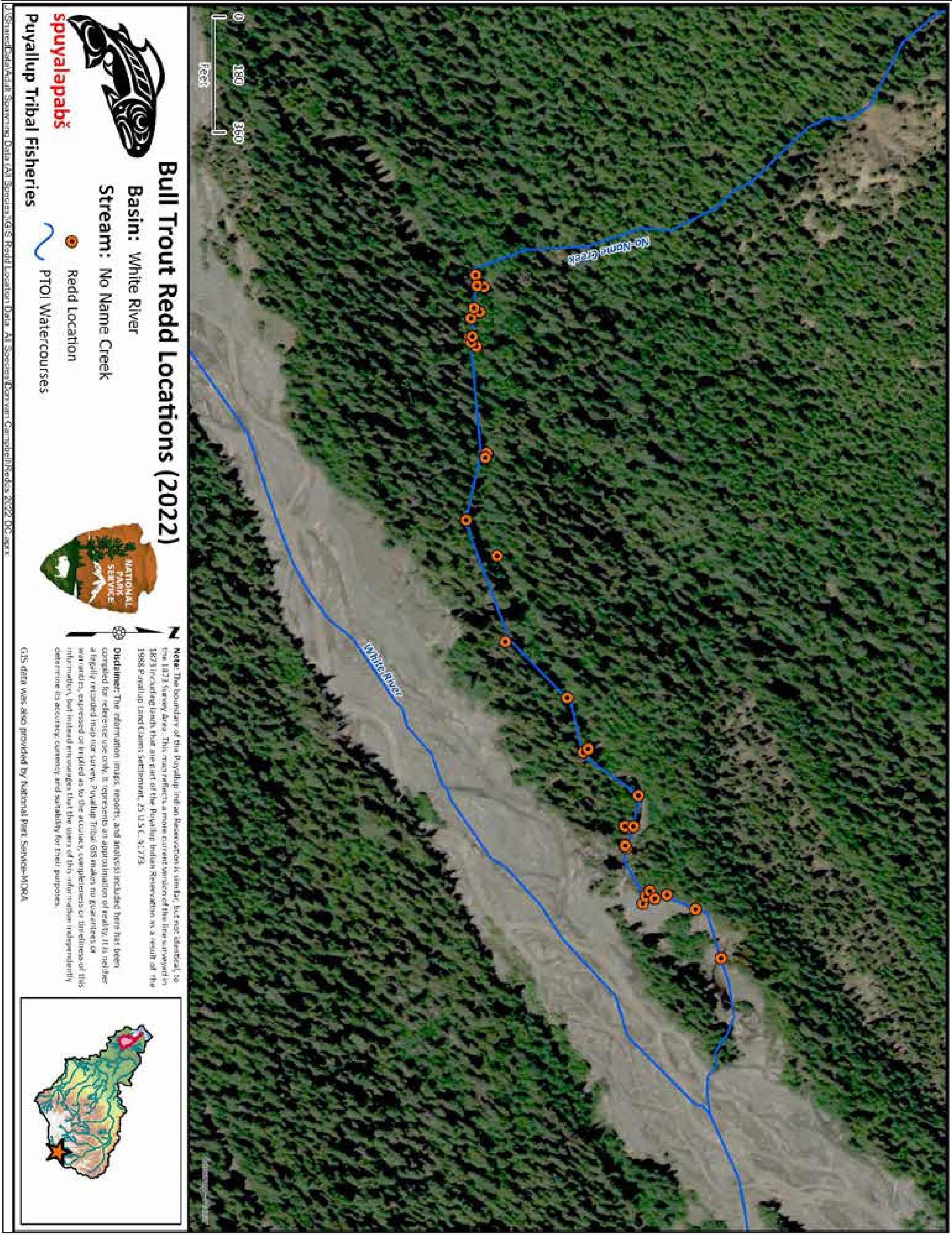
Bull Trout Redd Locations (2022)
Basin: White River
Stream: No Name Creek
Redd Location
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
NATIONAL PARK SERVICE
N
0 180 360
Feet
No-Name Creek
White River
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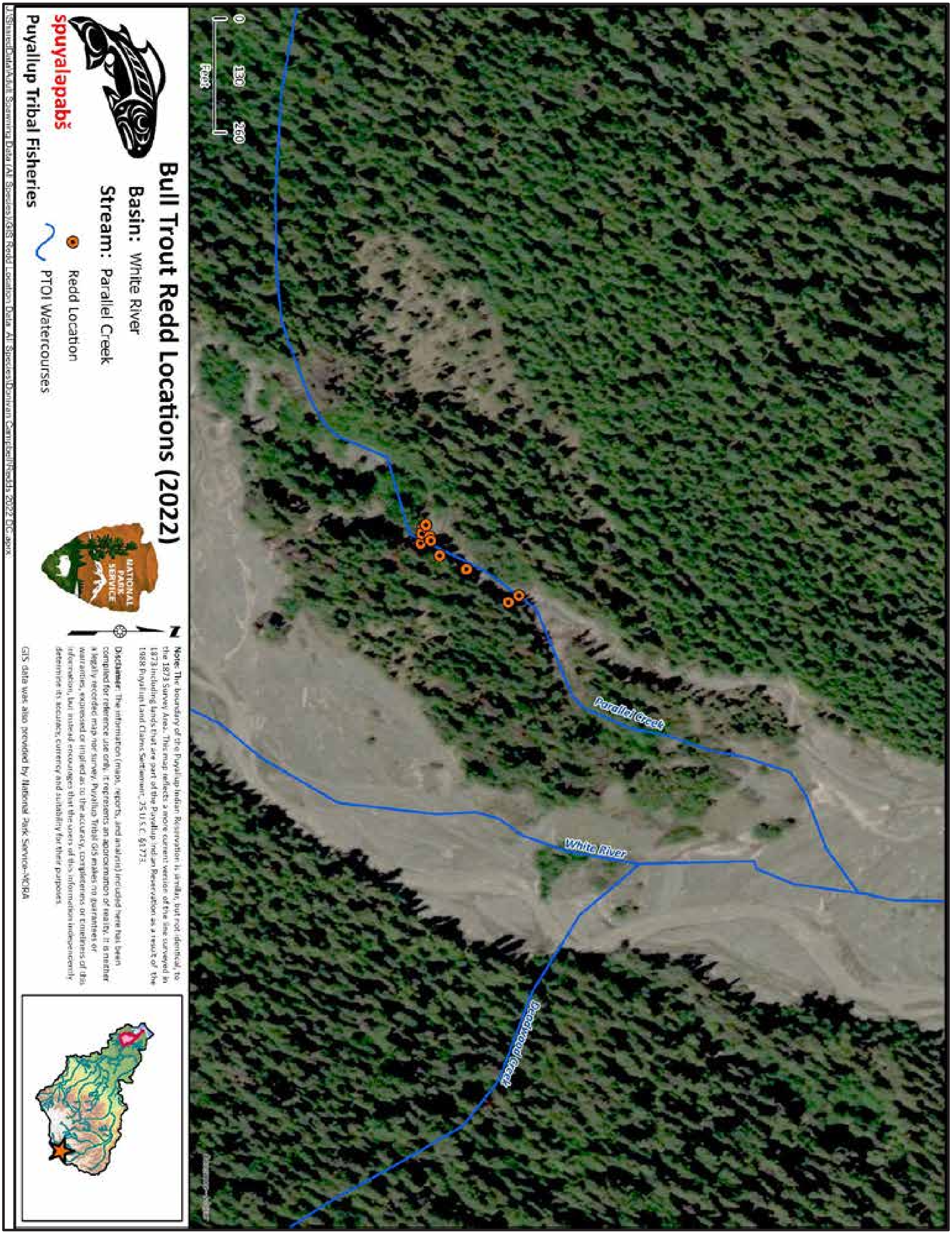
J:\SharedData\Adult Spawning Data (All Species)\GIS Redd Location Data_All Species\Donvan Campbell\Redds 2022 DC.aprx


Bull Trout Redd Locations (2022)
Basin: White River
Stream: Parallel Creek
Redd Location
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
0 130 260
Feet
Parallel Creek
White River
Deadwood Creek
NATIONAL PARK SERVICE
N
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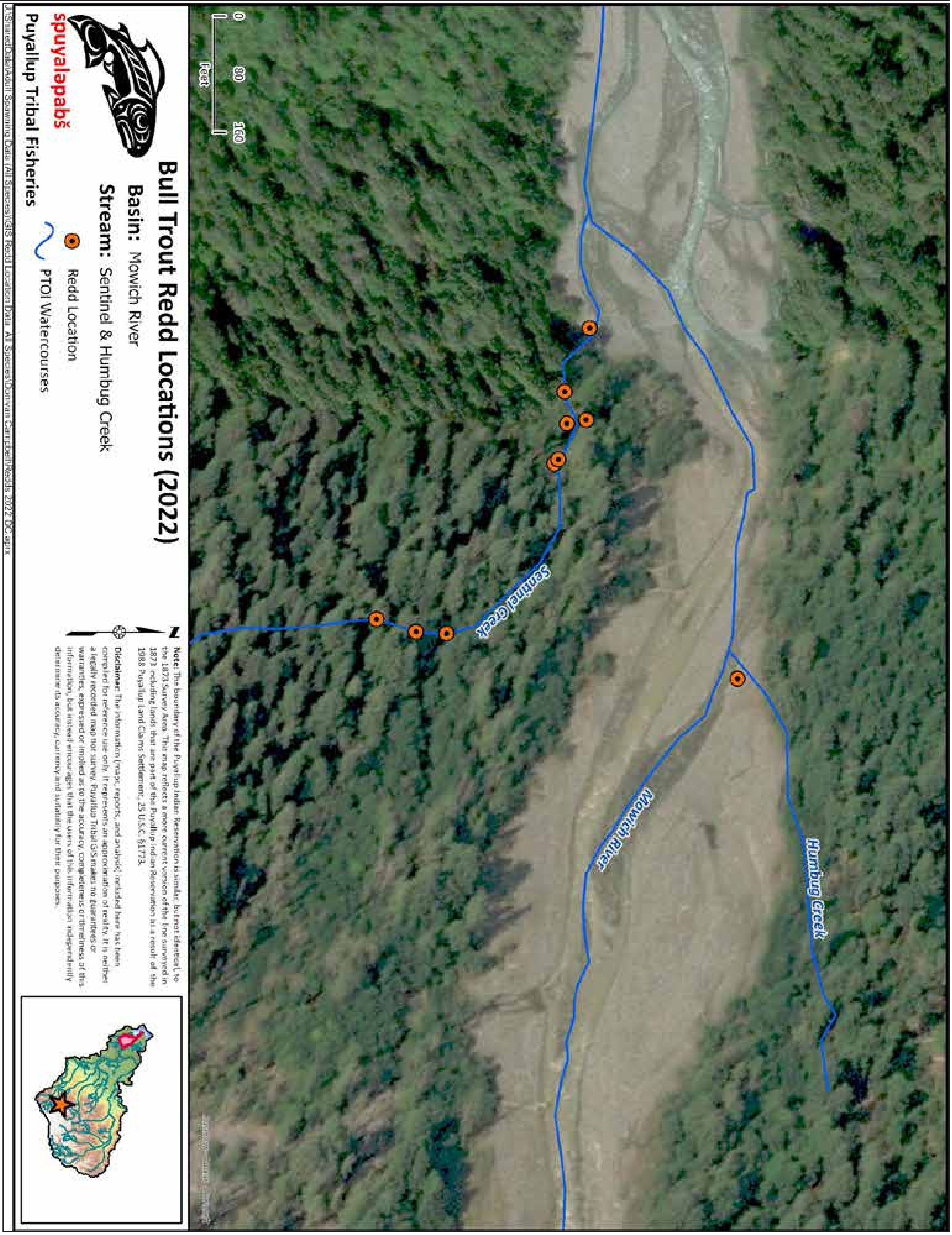
Bull Trout Redd Locations (2022)
Basin: Mowich River
Stream: Sentinel & Humbug Creek
Redd Location
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
0 80 160
Feet
Sentinel Creek
Mowich River
Humbug Creek
N
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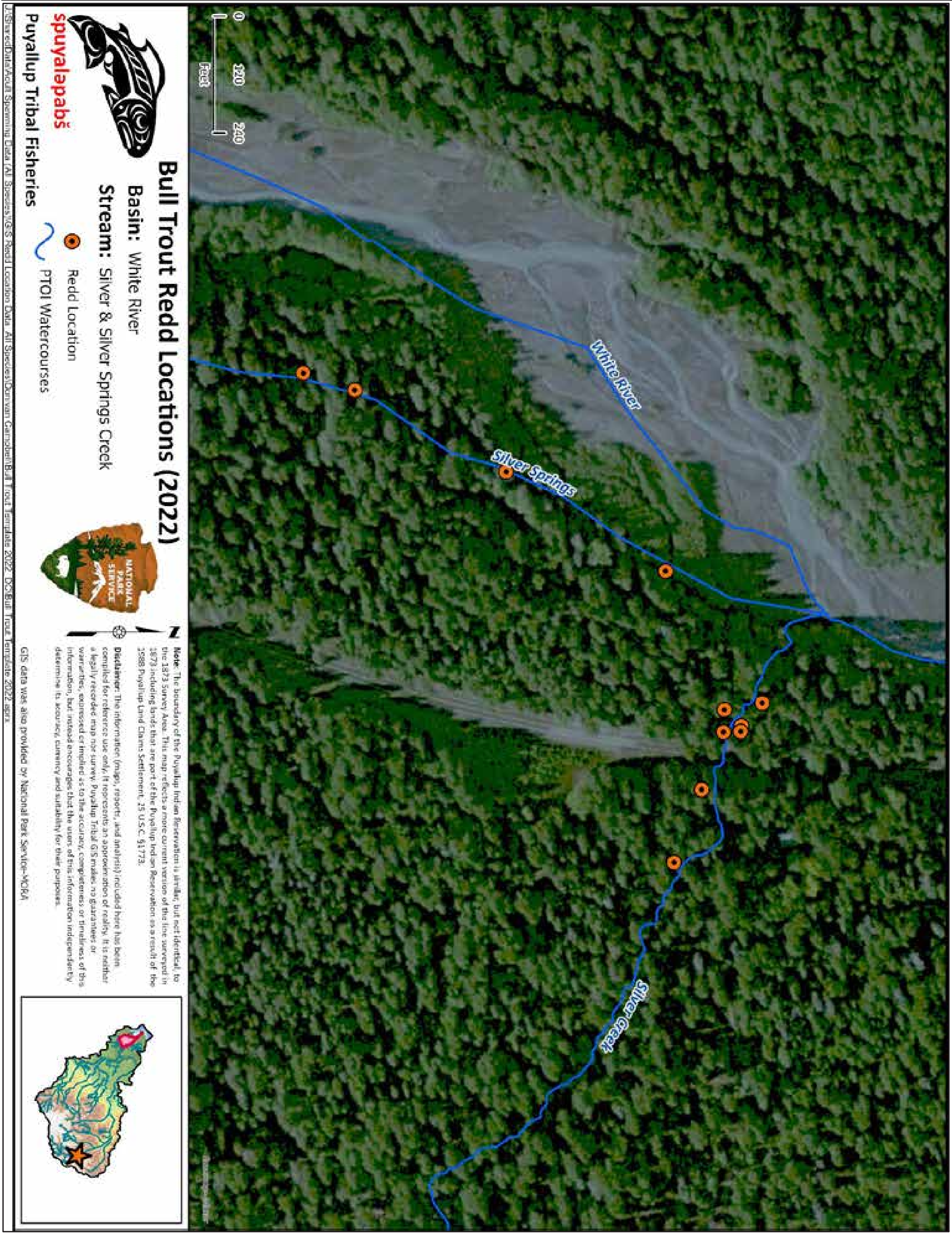
Bull Trout Redd Locations (2022)
Basin: White River
Stream: Silver & Silver Springs Creek
Redd Location
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
0 120 240
Feet
White River
Silver Springs
Silver Creek
NATIONAL PARK SERVICE
N
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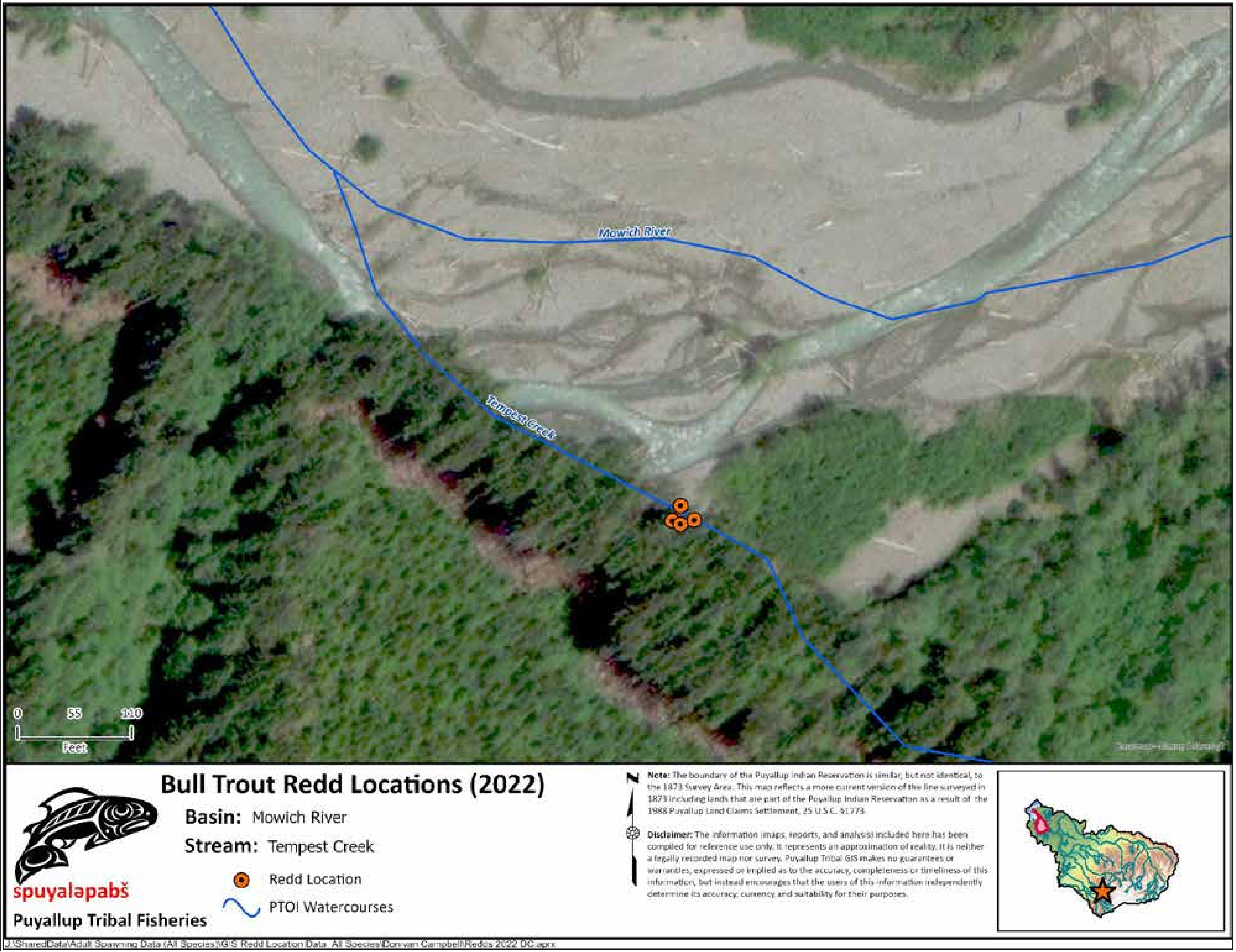
Bull Trout Redd Locations (2022)
Basin: Mowich River
Stream: Tempest Creek
Redd Location
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
Mowich River
Tempest Creek
0 55 110
Feet
N
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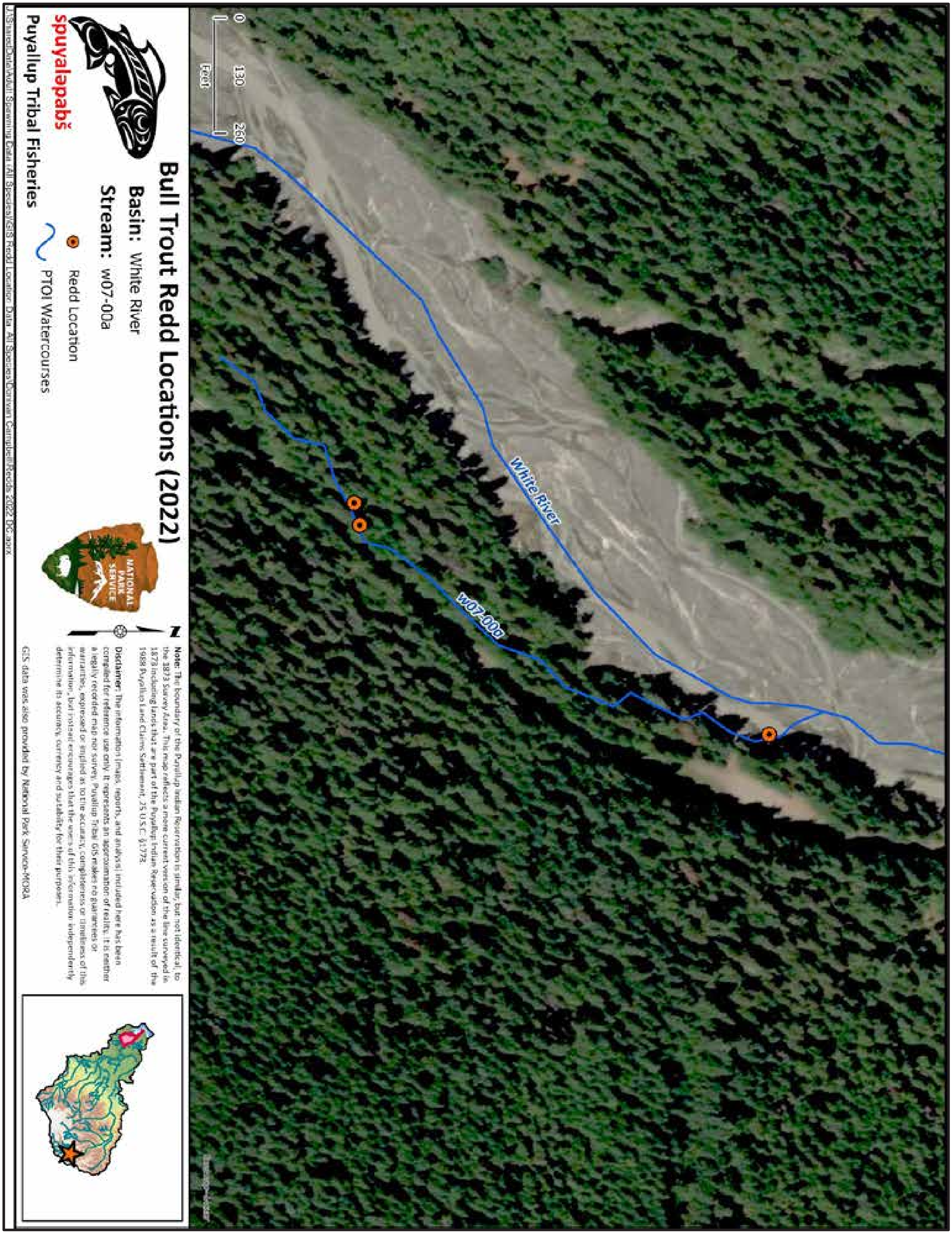
J:\SharedData\Adult Spawning Data (All Species)\GIS Redd Location Data_All Species\Donvan Campbell\Redds 2022 DC.aprx


Bull Trout Redd Locations (2022)
Basin: White River
Stream: w07-00a
Redd Location
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
White River
w07-00a
0 130 260
Feet
N
NATIONAL PARK SERVICE
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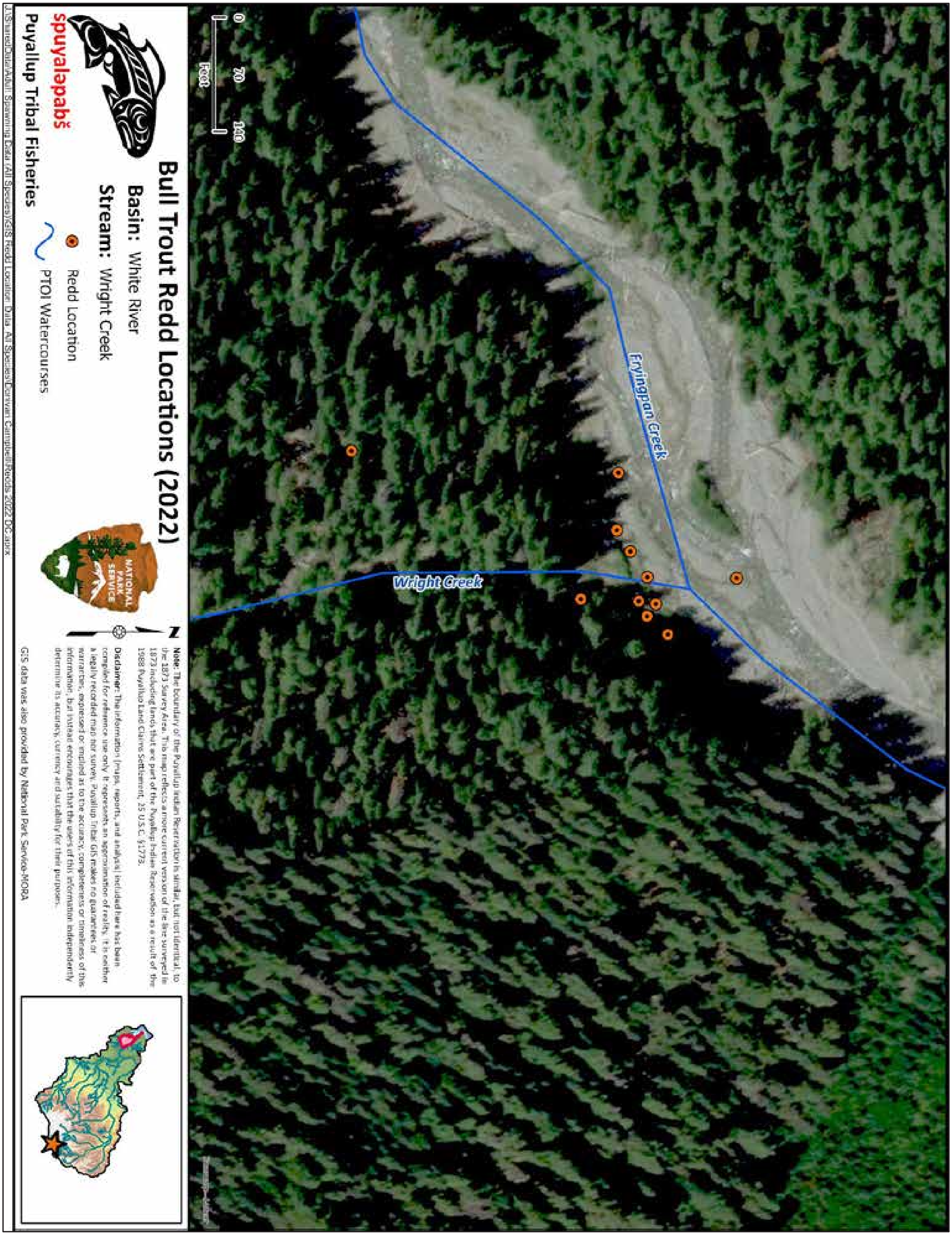
Fryingpan Creek
Wright Creek
0 70 140
Feet
Bull Trout Redd Locations (2022)
Basin: White River
Stream: Wright Creek
Redd Location
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
NATIONAL PARK SERVICE
N
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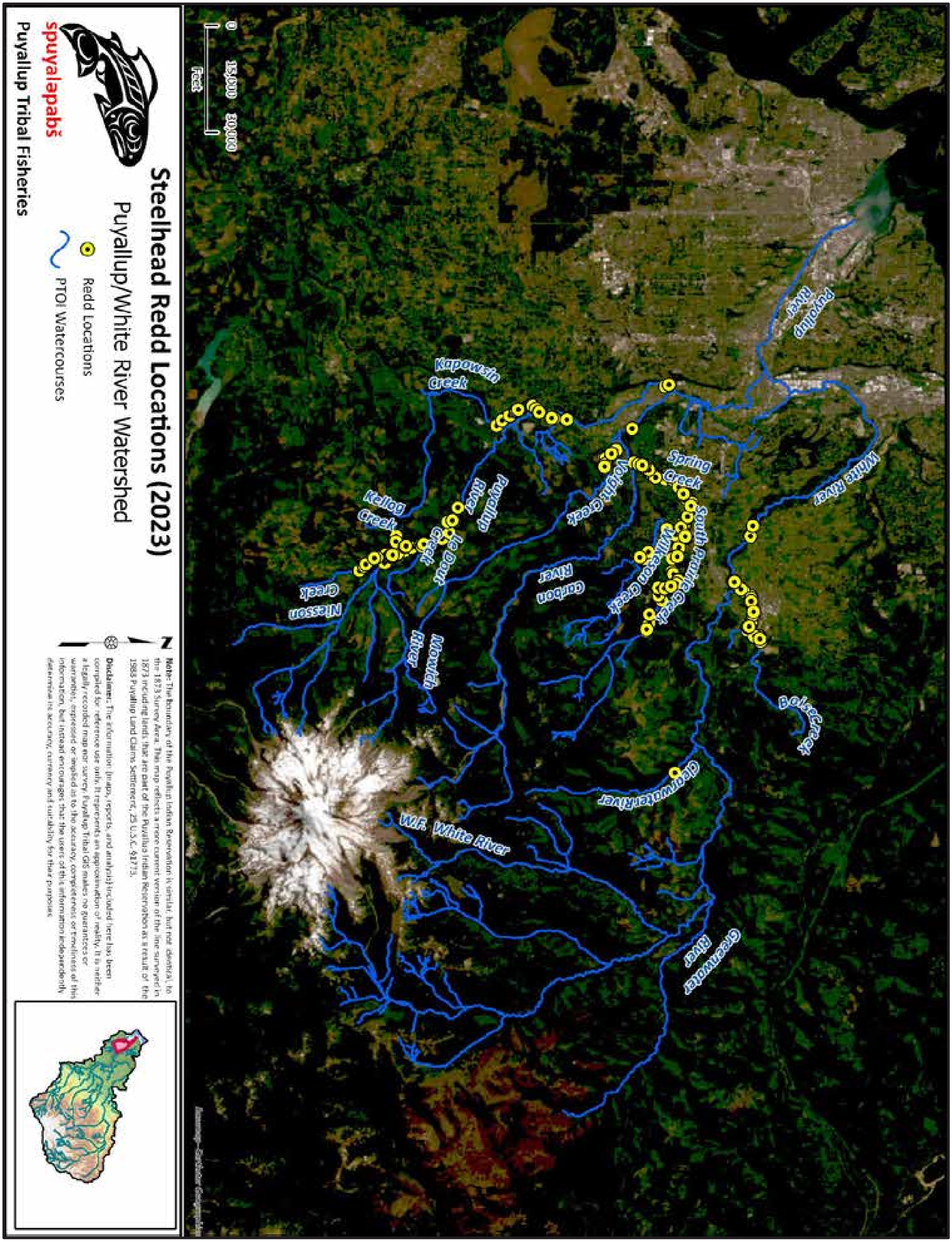
Steelhead Redd Locations (2023)
Puyallup/White River Watershed
Redd Locations
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
Puyallup River
White River
Boise Creek
Greenwater River
Clearwater River
South Prairie Creek
Spring Creek
Wilkeson Creek
Voight Creek
Carbon River
Puyallup River
Le Dout Creek
Kapowsin Creek
Kellog Creek
Mowich River
W.F. White River
Niesson Creek
0 15,000 30,000
Feet
N
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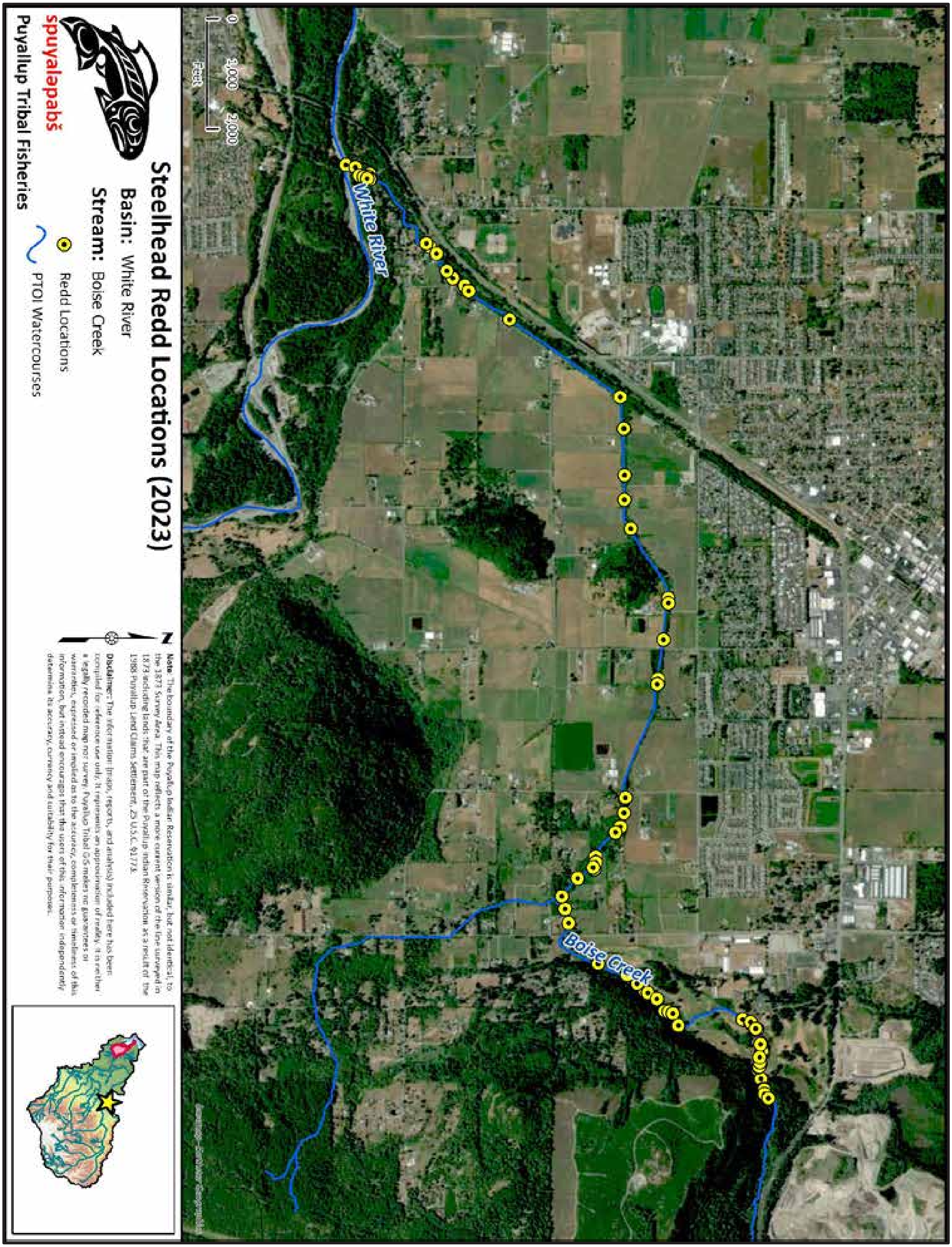
Steelhead Redd Locations (2023)
Basin: White River
Stream: Boise Creek
Redd Locations
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
0 1,000 2,000
Feet
White River
Boise Creek
N
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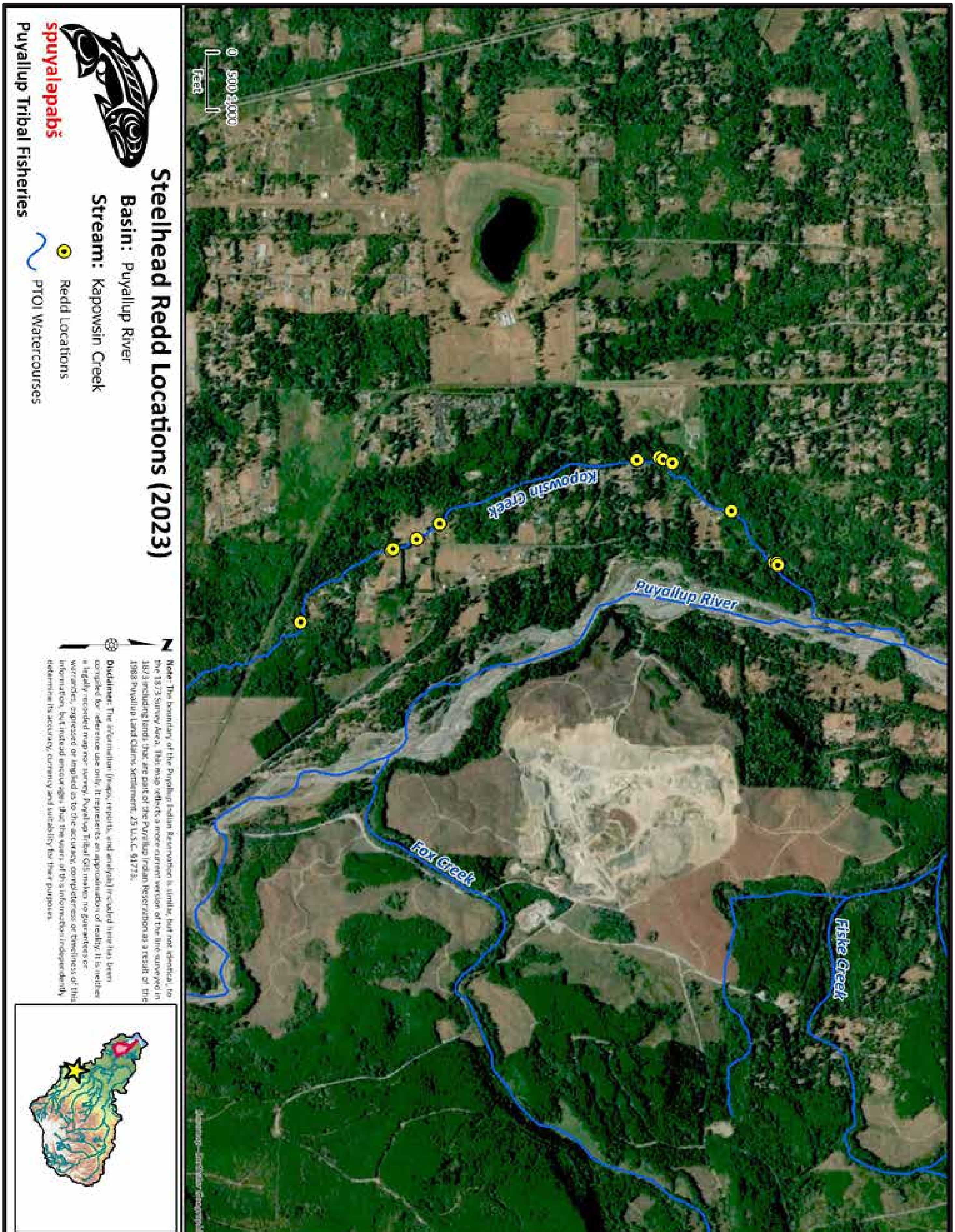
Steelhead Redd Locations (2023)
Basin: Puyallup River
Stream: Kapowsin Creek
Redd Locations
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
0 500 1,000
Feet
N
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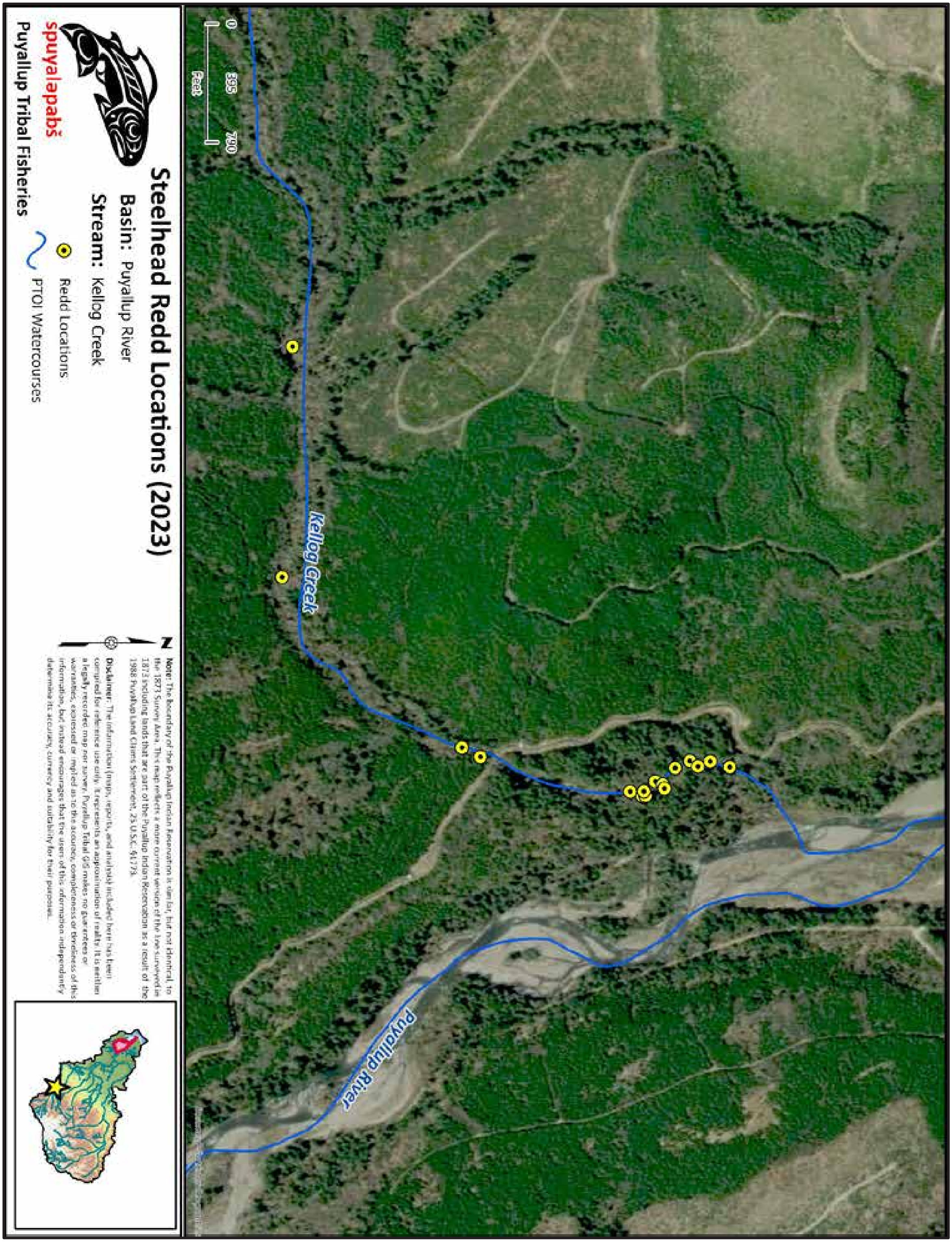
Kapowsin Creek
Puyallup River
Fox Creek
Fiske Creek


Steelhead Redd Locations (2023)
Basin: Puyallup River
Stream: Kellog Creek
Redd Locations
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
0 395 790
Feet
N
Kellog Creek
Puyallup River
Note: The Boundary of the Puyallup Indian Reservation is similar, but not identical, to the 1873 Survey Area. This map reflects a more current version of the line surveyed in 1873 including lands that are part of the Puyallup Indian Reservation as a result of the 1988 Puyallup Land Claims Settlement, 25 U.S.C. §1773.
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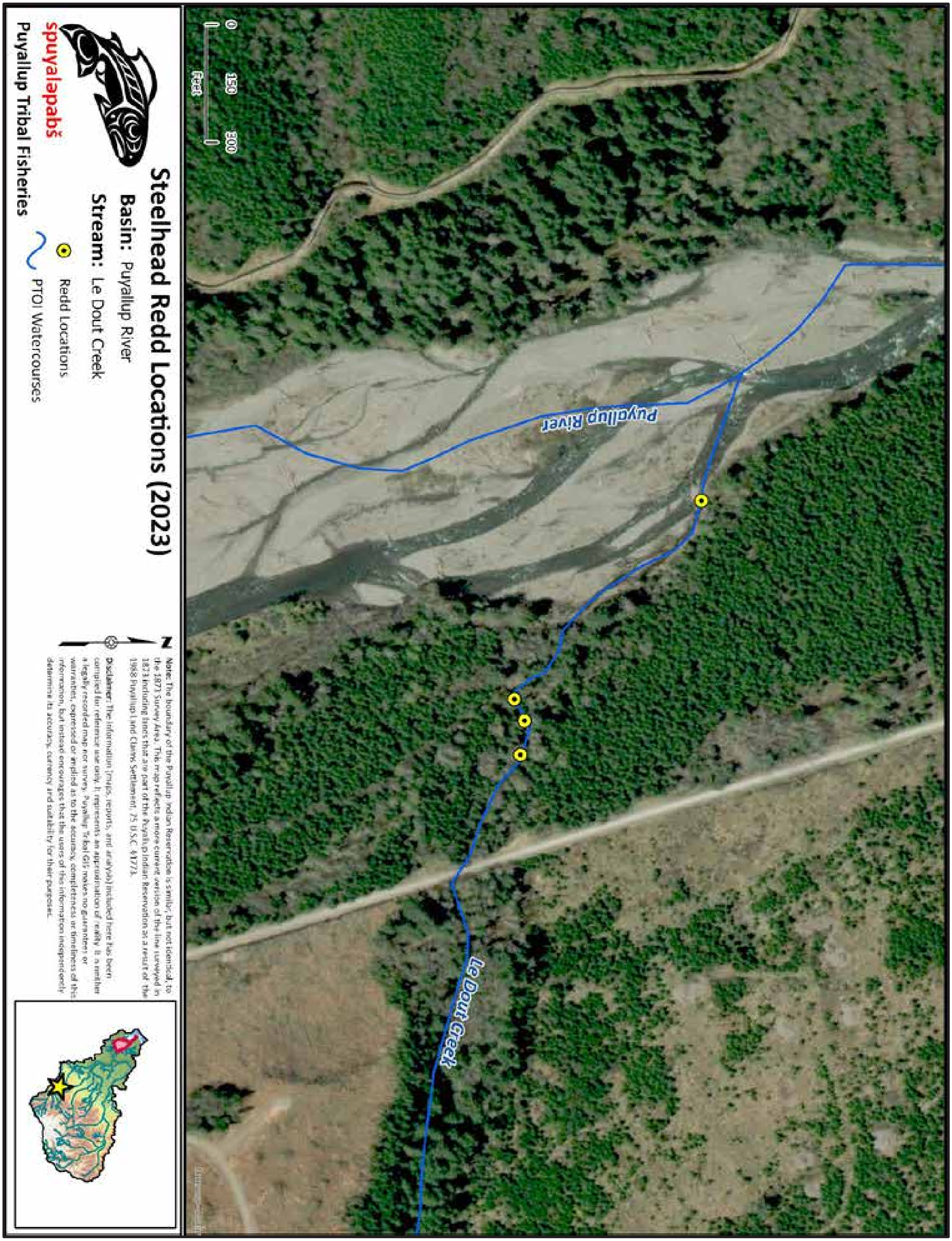

Puyallup River
Le Dout Creek
0 150 300
Feet
Steelhead Redd Locations (2023)
Basin: Puyallup River
Stream: Le Dout Creek
Redd Locations
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
N
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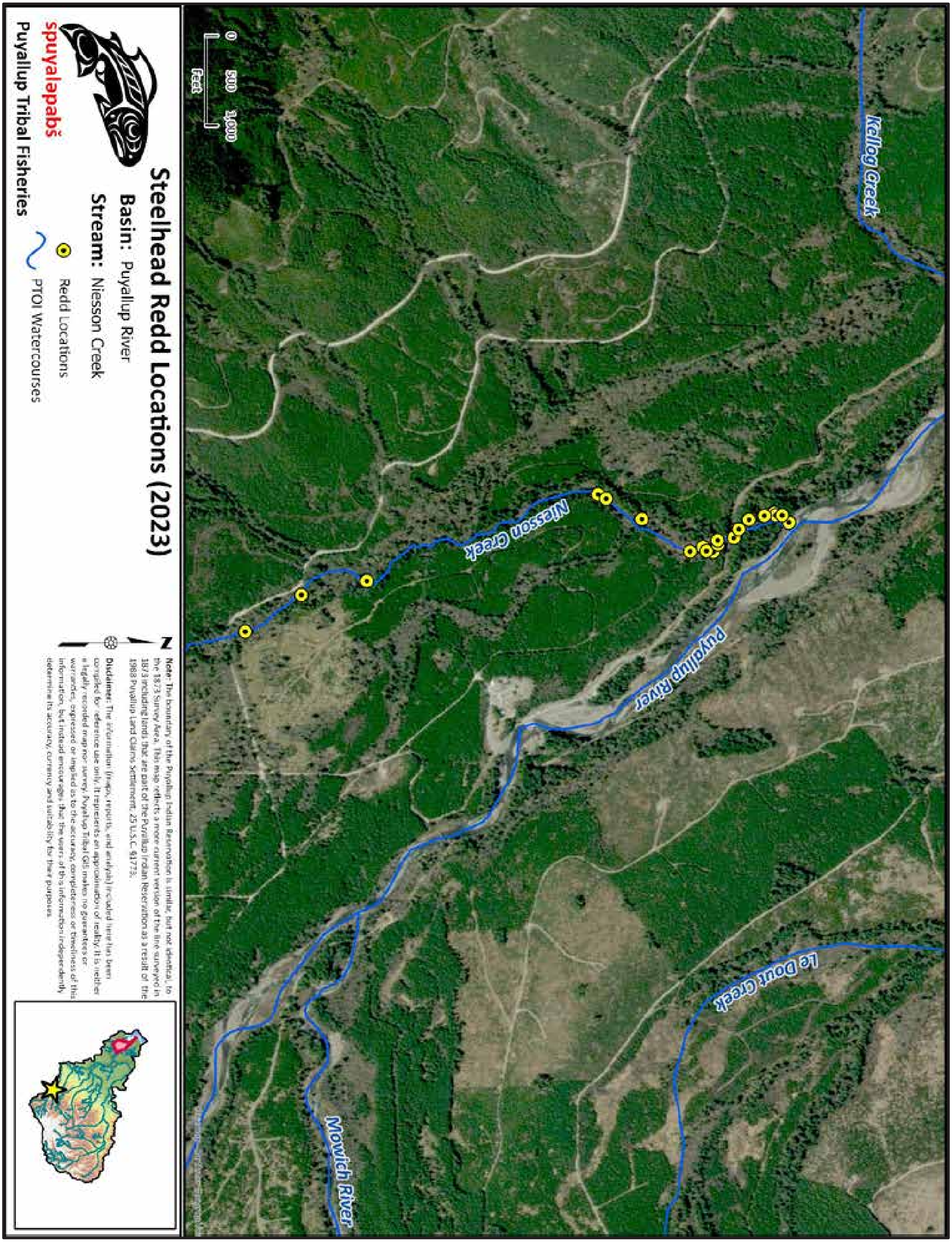
Steelhead Redd Locations (2023)
Basin: Puyallup River
Stream: Niesson Creek
Redd Locations
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
0 500 1,000
Feet
N
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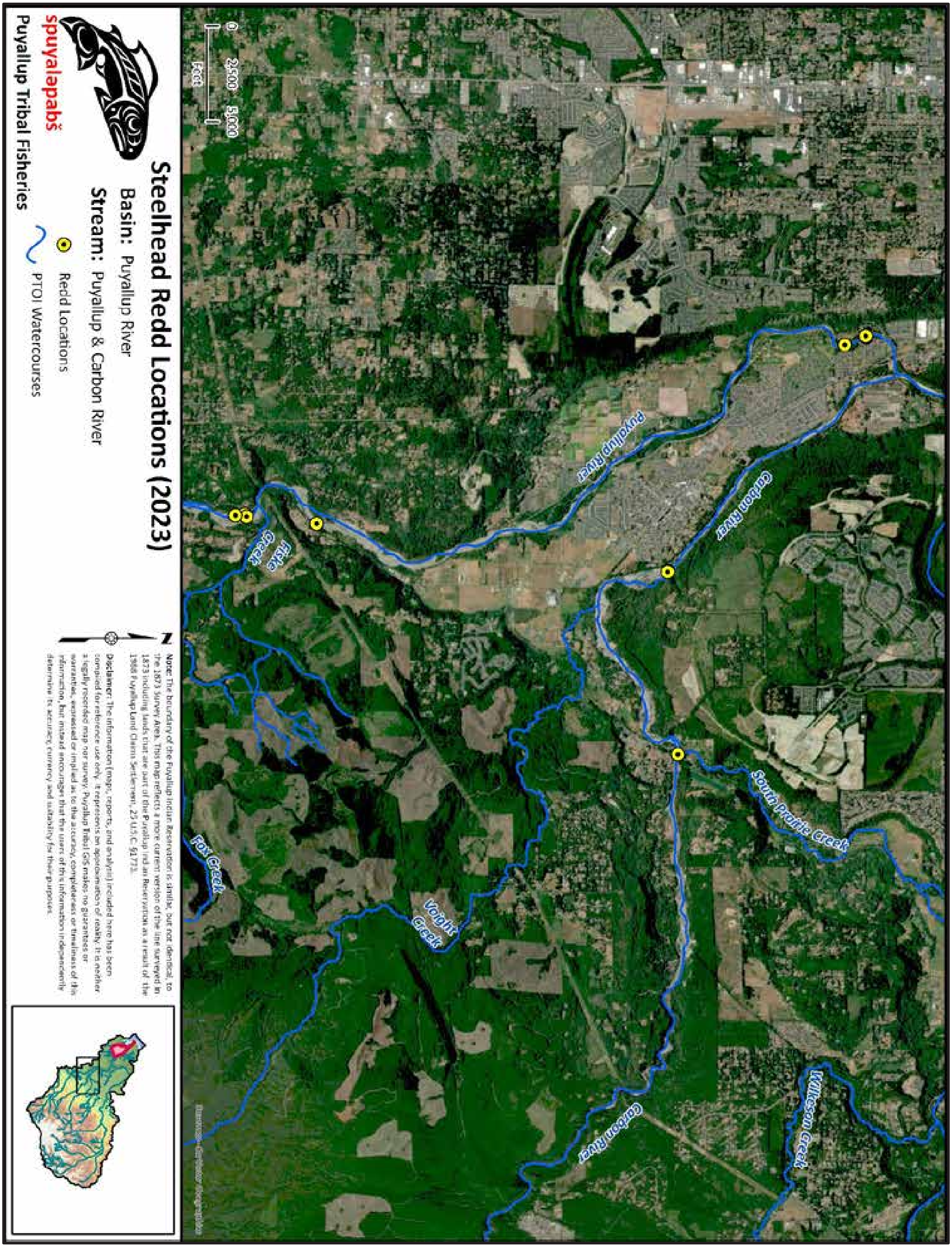
Kellog Creek
Niesson Creek
Puyallup River
Le Dout Creek
Mowich River


Steelhead Redd Locations (2023)
Basin: Puyallup River
Stream: Puyallup & Carbon River
Redd Locations
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
0 2,500 5,000
Feet
N
Puyallup River
Carbon River
South Prairie Creek
Fiske Creek
Fox Creek
Voight Creek
Wilkeson Creek
Carbon River
Note: The boundary of the Puyallup Indian Reservation is similar, but not identical, to the 1873 Survey Area. This map reflects a more current version of the line surveyed in 1873 including lands that are part of the Puyallup Indian Reservation as a result of the 1988 Puyallup Land Claims Settlement, 25 U.S.C. §1773.
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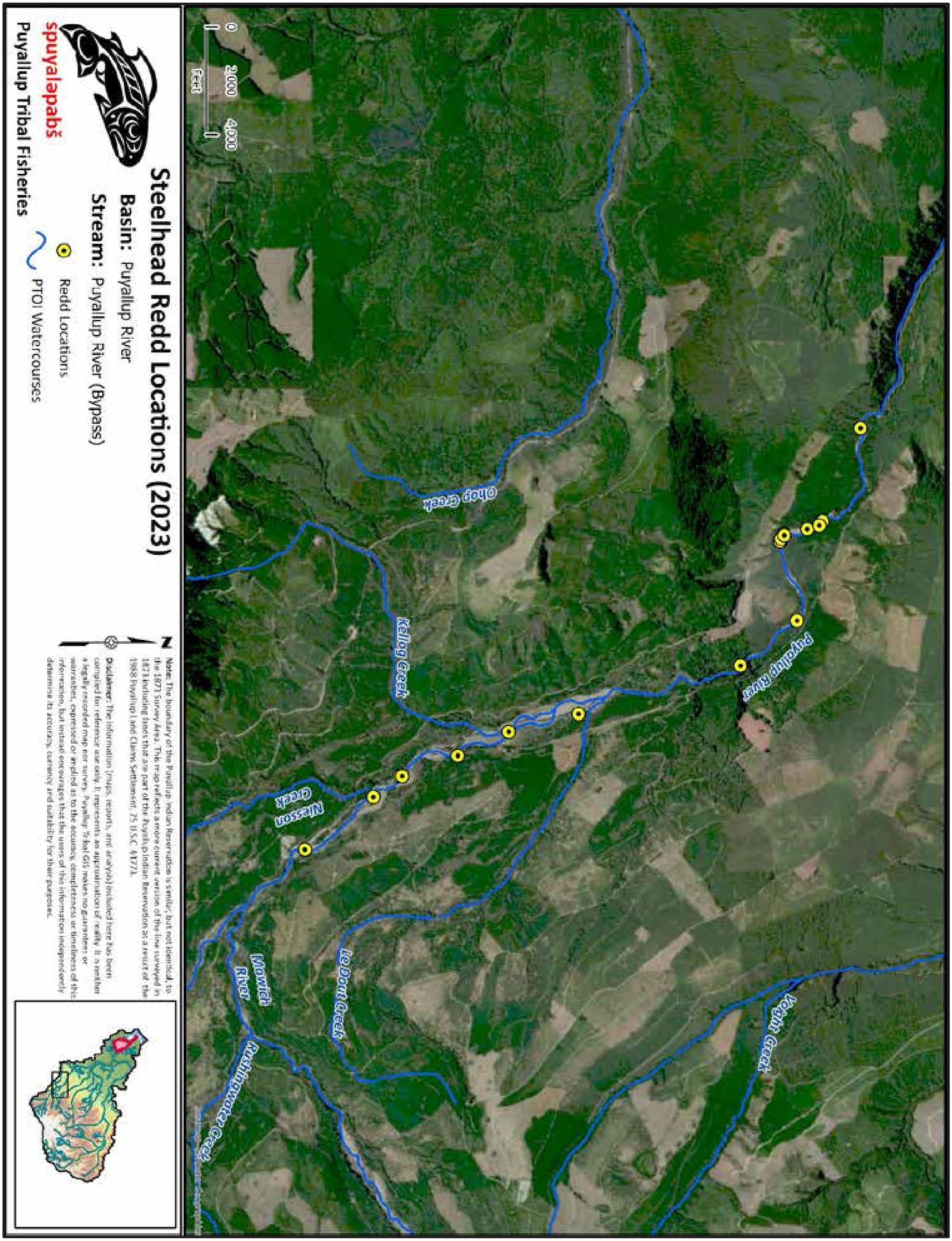
Steelhead Redd Locations (2023)
Basin: Puyallup River
Stream: Puyallup River (Bypass)
Redd Locations
PTOI Watercourses
spuyaləpabš
Puyallup Tribal Fisheries
0
2,000
4,000
Feet
N
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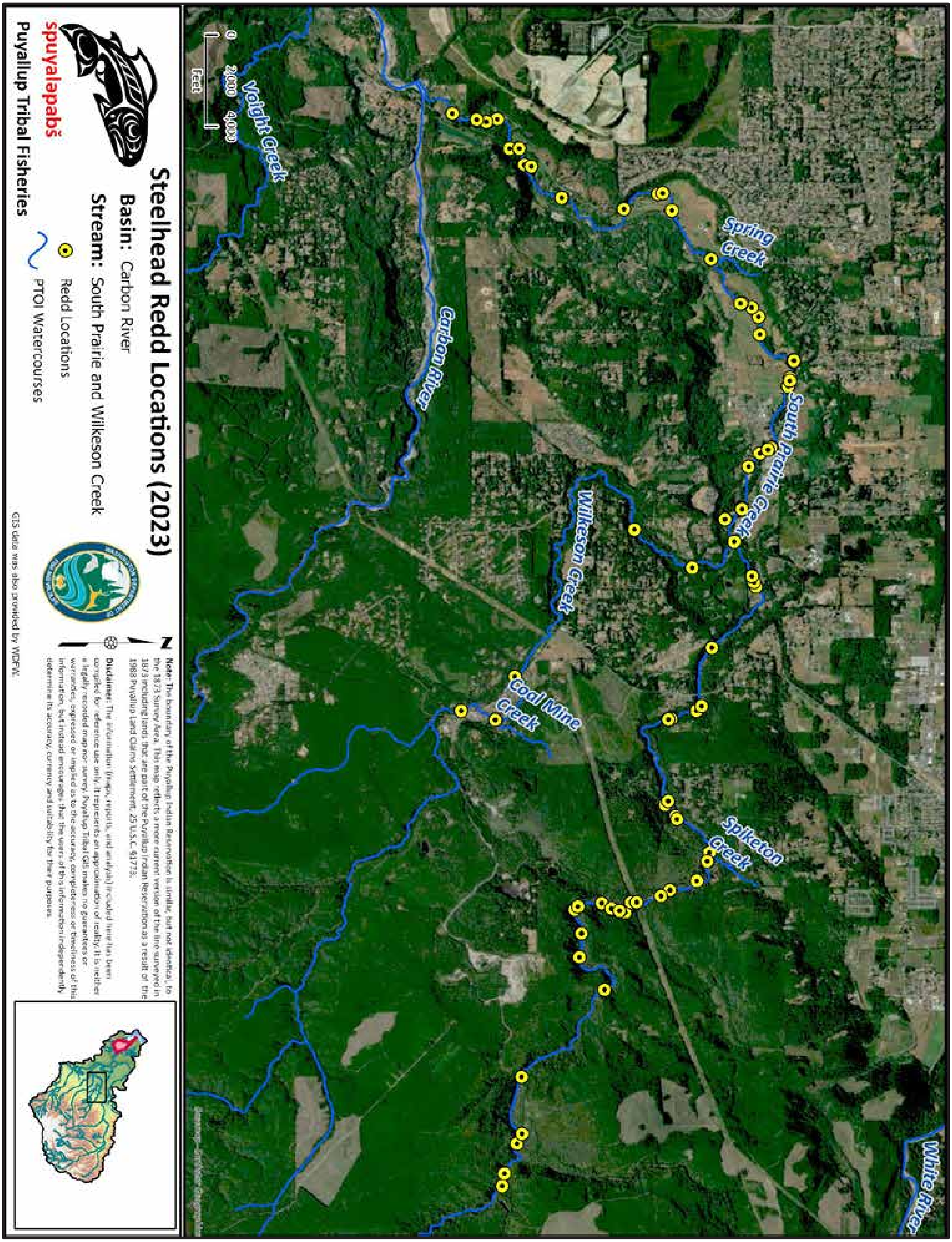
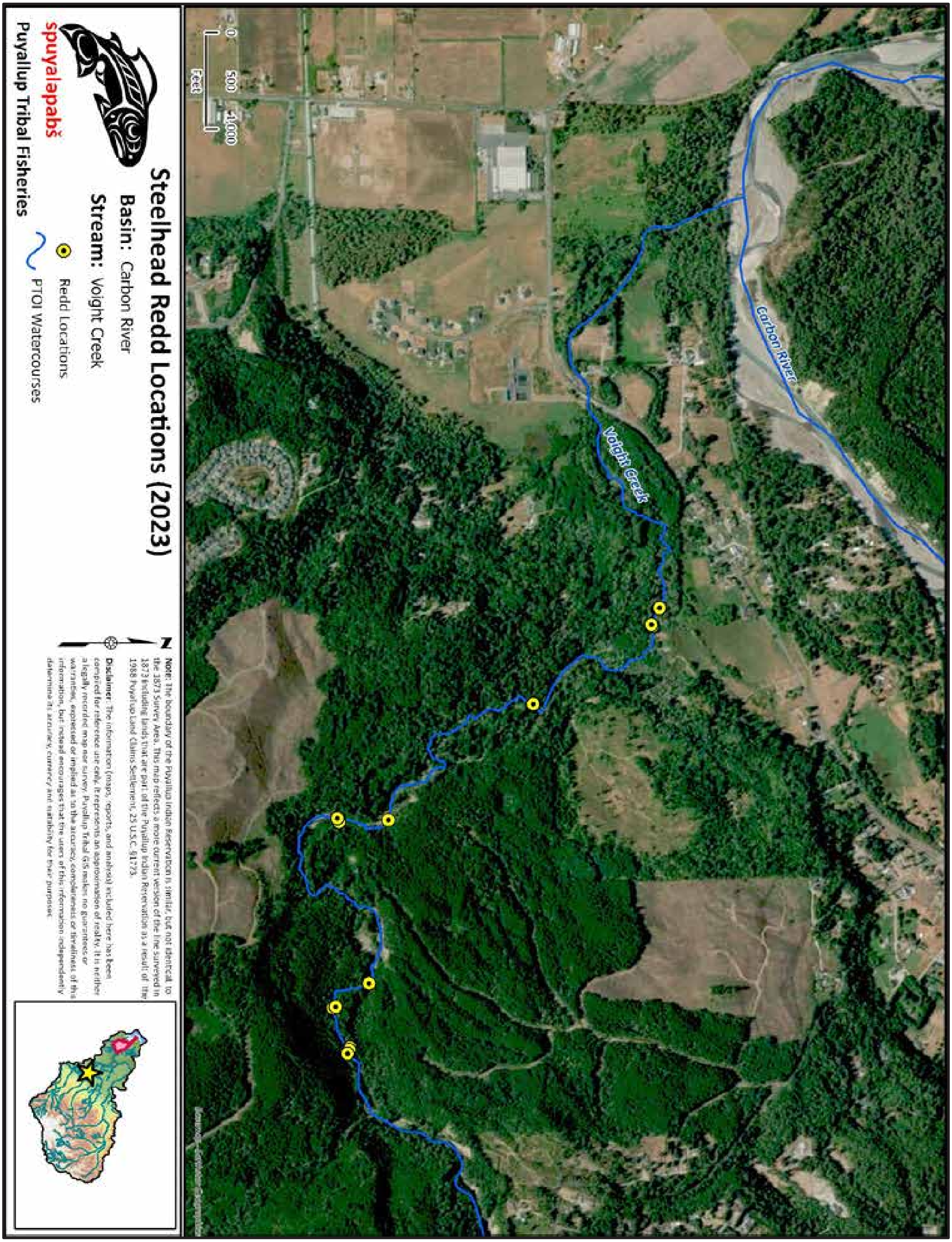
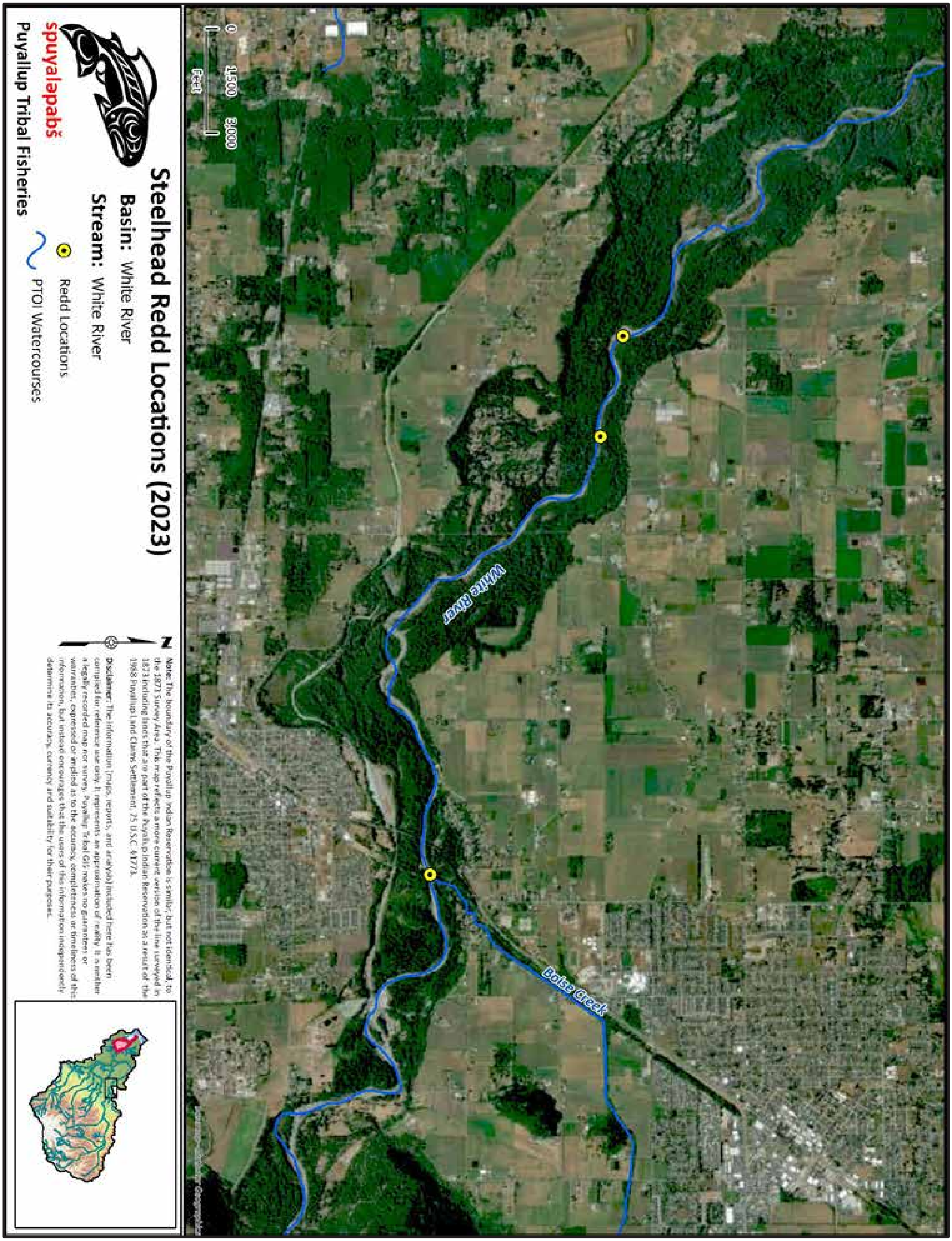
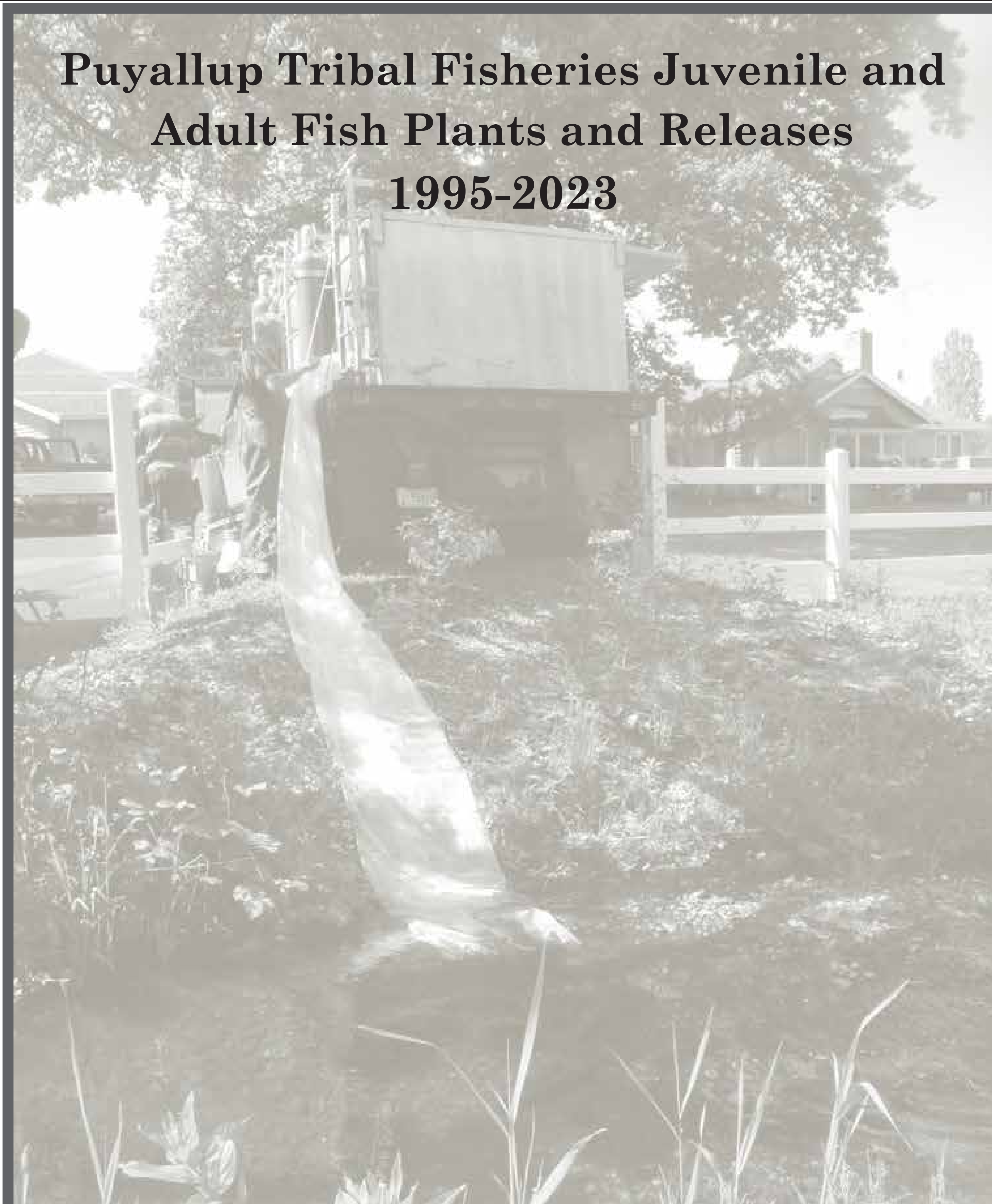
Puyallup River
Voight Creek
Ohop Creek
Kellog Creek
Le Dout Creek
Niesson Creek
Mowich River
Rushingwater Creek


Steelhead Redd Locations (2023)
Basin: Carbon River
Stream: South Prairie and Wilkeson Creek
Redd Locations
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
0 2,000 4,000
Feet
N
Note: The boundary of the Puyallup Indian Reservation is similar, but not identical, to the 1873 Survey Area. This map reflects a more current version of the line surveyed in 1873 including lands that are part of the Puyallup Indian Reservation as a result of the 1988 Puyallup Land Claims Settlement, 25 U.S.C. §1773.
Disclaimer: The information (maps, reports, and analysis) included here has been compiled for reference use only. It represents an approximation of reality. It is neither a legally recorded map nor survey. Puyallup Tribal GIS makes no guarantees or warranties, expressed or implied as to the accuracy, completeness or timeliness of this information, but instead encourages that the users of this information independently determine its accuracy, currency and suitability for their purposes.
GIS data was also provided by WDFW.
Voight Creek
Carbon River
Spring Creek
South Prairie Creek
Wilkeson Creek
Coal Mine Creek
Spiketon Creek
White River

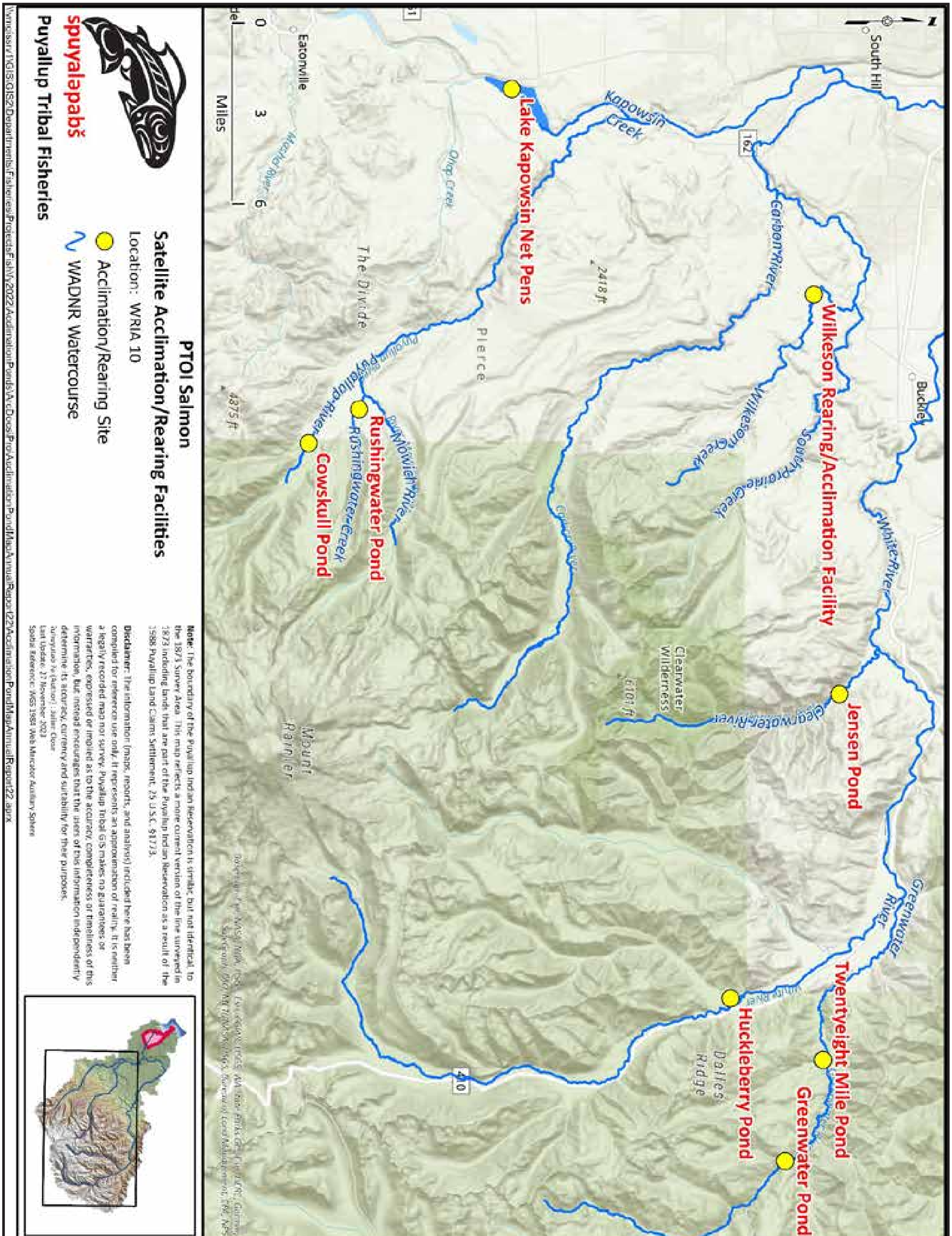

Steelhead Redd Locations (2023)
Basin: Carbon River
Stream: Voight Creek
Redd Locations
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
0 500 1,000
Feet
N
Carbon River
Voight Creek

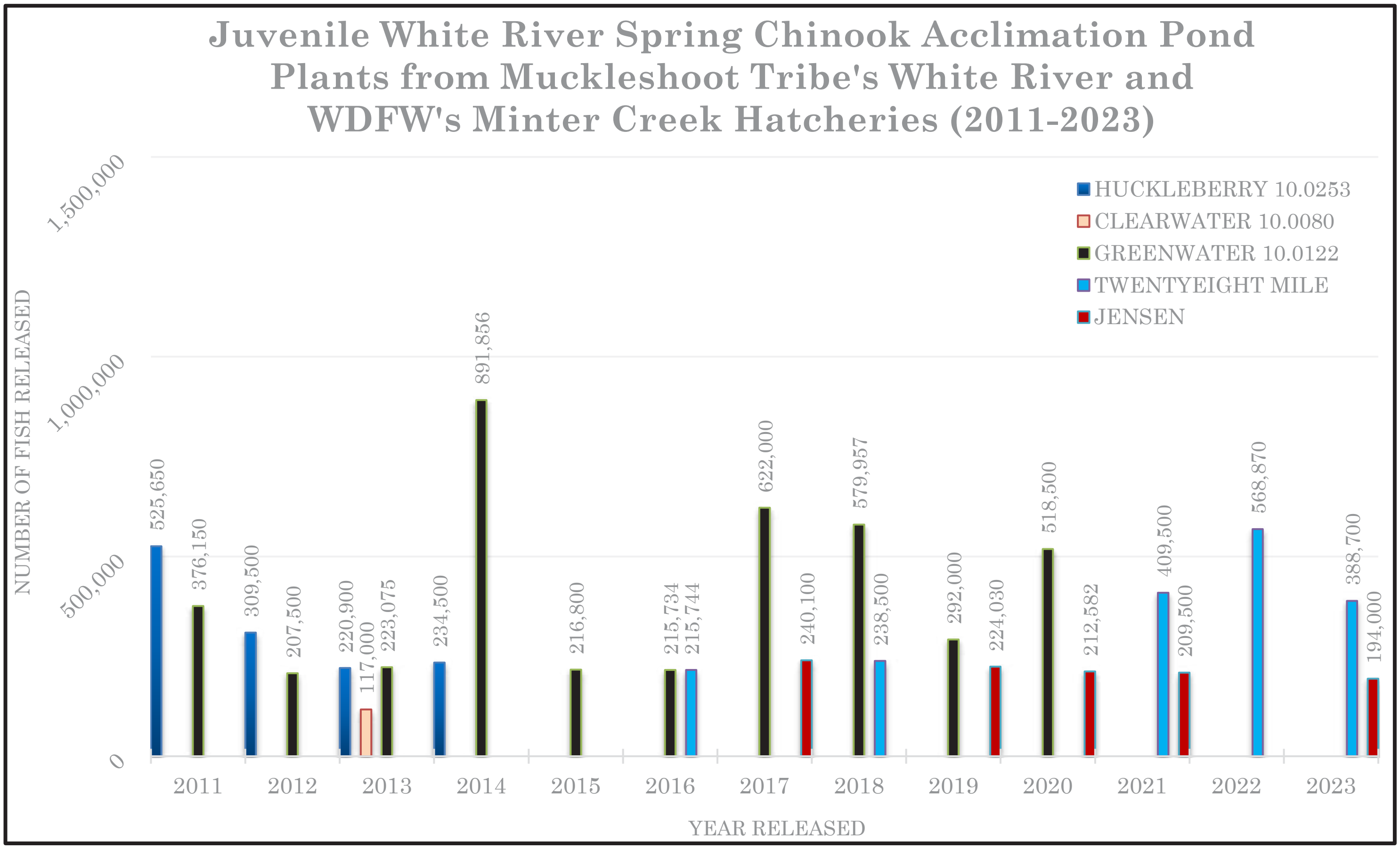

Steelhead Redd Locations (2023)
Basin: White River
Stream: White River
Redd Locations
PTOI Watercourses
spuyalapabš
Puyallup Tribal Fisheries
0 1,500 3,000
Feet
N
White River
Boise Creek
Note: The boundary of the Puyallup Indian Reservation is similar, but not identical, to the 1873 Survey Area. This map reflects a more current version of the line surveyed in 1873 including lands that are part of the Puyallup Indian Reservation as a result of the 1988 Puyallup Land Claims Settlement, 25 U.S.C. §1773.
Disclaimer: The information (maps, reports, and analysis) included here has been compiled for reference use only. It represents an approximation of reality. It is neither a legally recorded map nor survey. Puyallup Tribal GIS makes no guarantees or warranties, expressed or implied as to the accuracy, completeness or timeliness of this information, but instead encourages that the users of this information independently determine its accuracy, currency and suitability for their purposes.

Puyallup Tribal Fisheries Juvenile and Adult Fish Plants and Releases 1995-2023

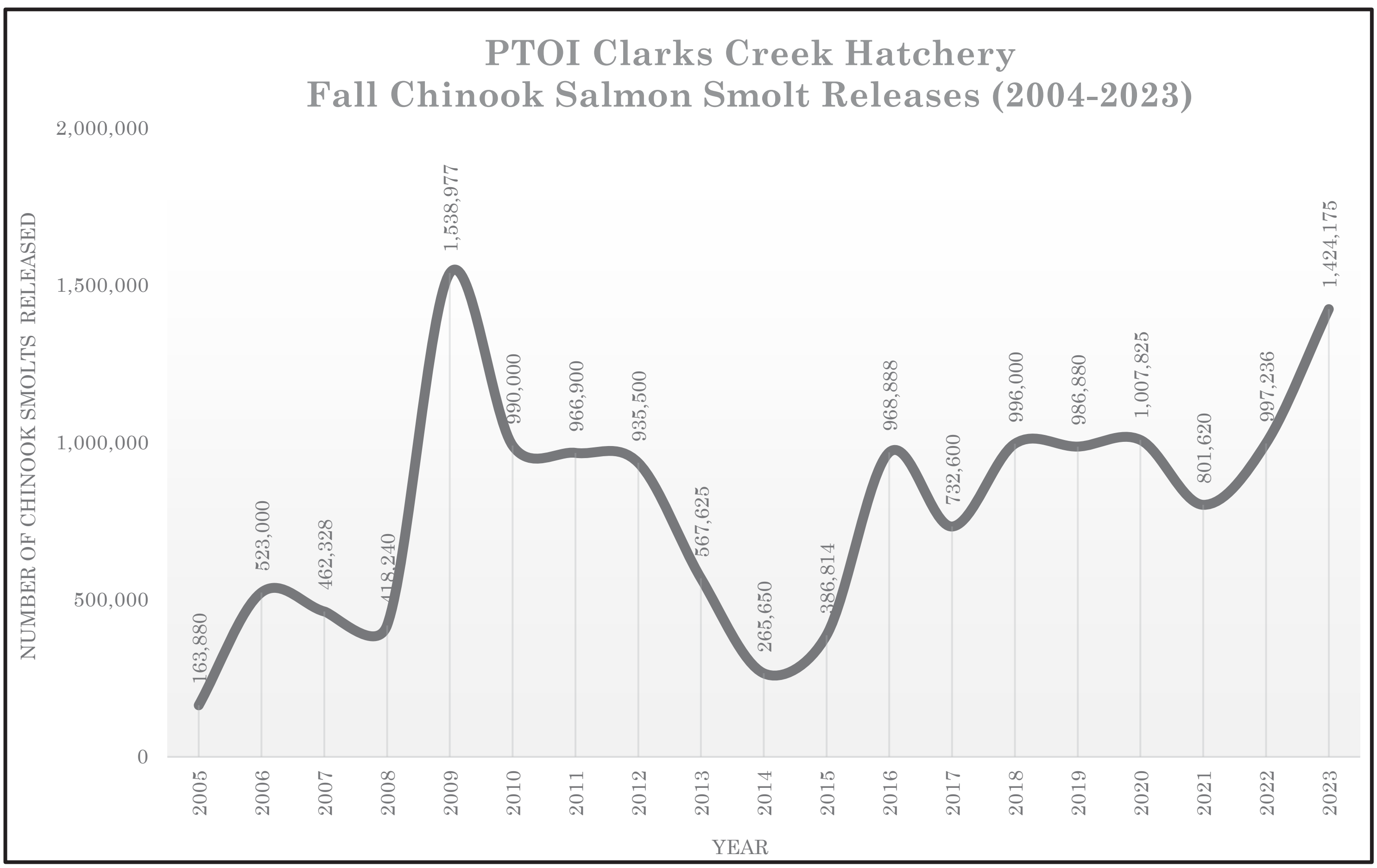


APPENDIX D

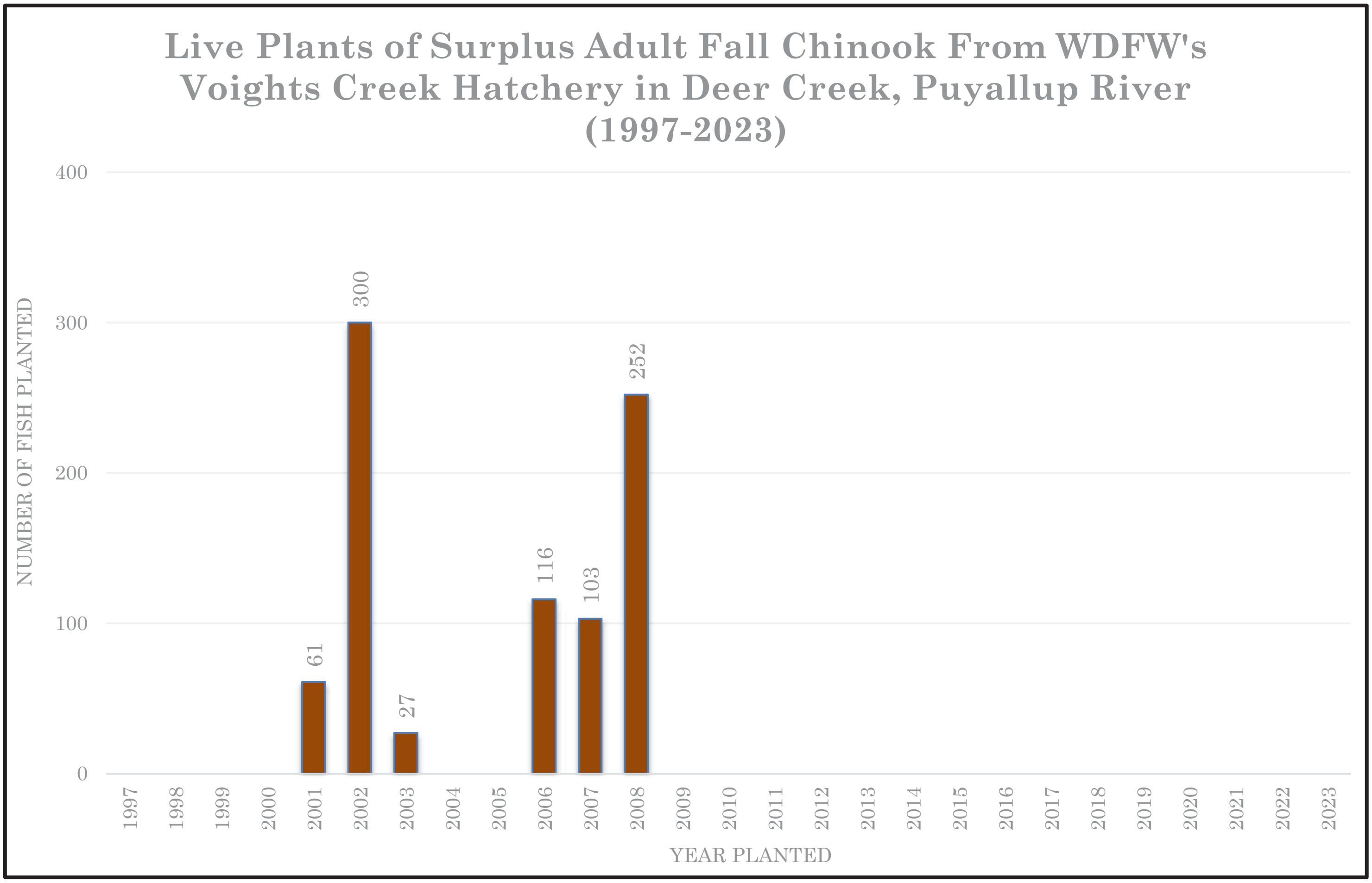

PTOI Salmon
Satellite Acclimation/Rearing Facilities
Location: WRIA 10
Acclimation/Rearing Site
WADNR Watercourse
spuyalapabš
Puyallup Tribal Fisheries
0 3 6
Miles
Lake Kapowsin Net Pens
Wilkeson Rearing/Acclimation Facility
Jensen Pond
Rushingwater Pond
Cowskull Pond
Twentyeight Mile Pond
Huckleberry Pond
Greenwater Pond
South Hill
Buckley
Eatonville
Kapowsin Creek
Carbon River
Wilkeson Creek
South Prairie Creek
White River
Clearwater River
Clearwater Wilderness
Greenwater River
Puyallup River
Mowich River
Rushingwater Creek
Ohop Creek
Mashel River
The Divide
Pierce
Mount Rainier
Dalles Ridge
2418 ft
4875 ft
6101 ft
162
410



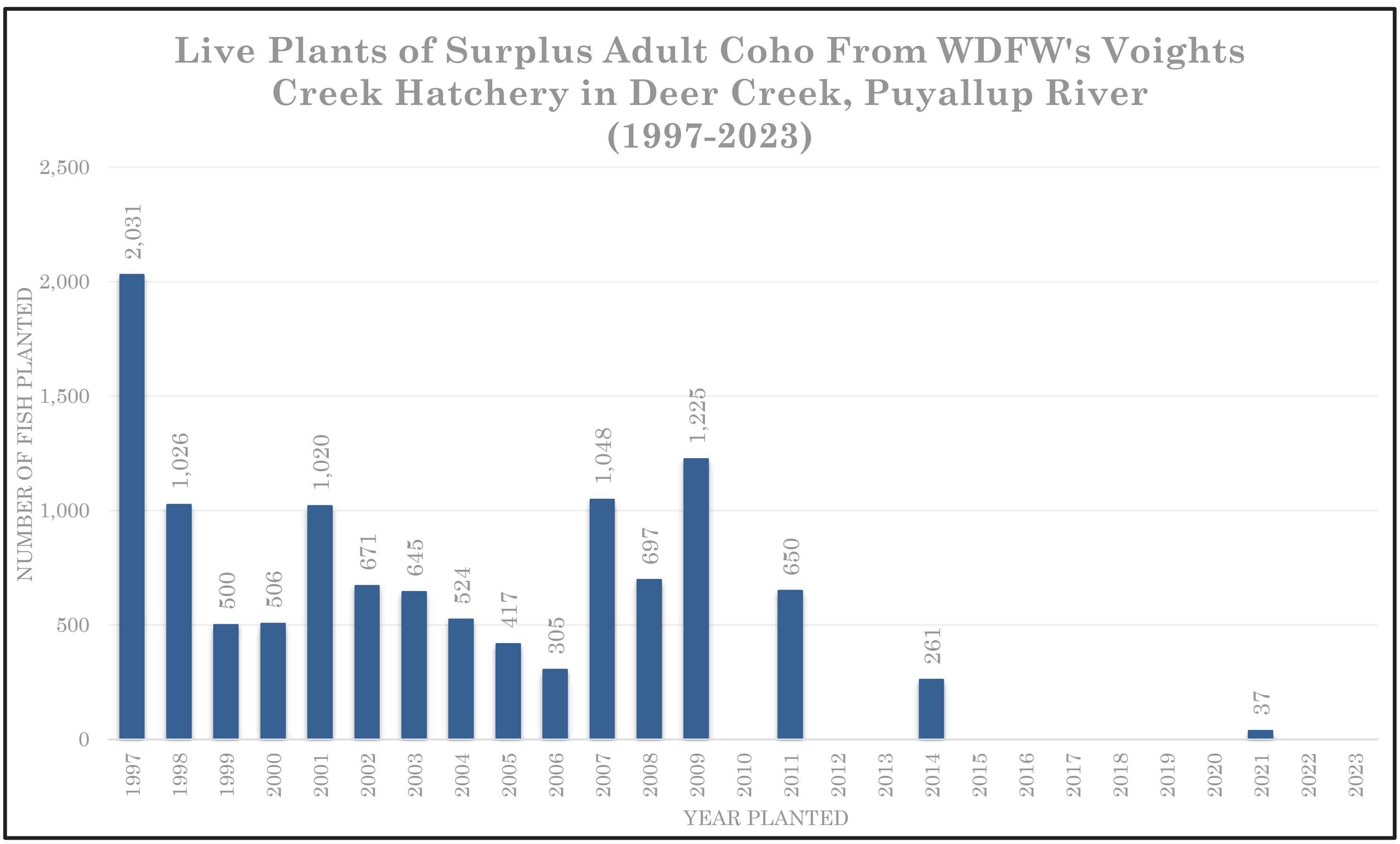
Spring Chinook were providede by the Muckleshoot Indian Tribe and WDFW. No data indicates no fish were planted.



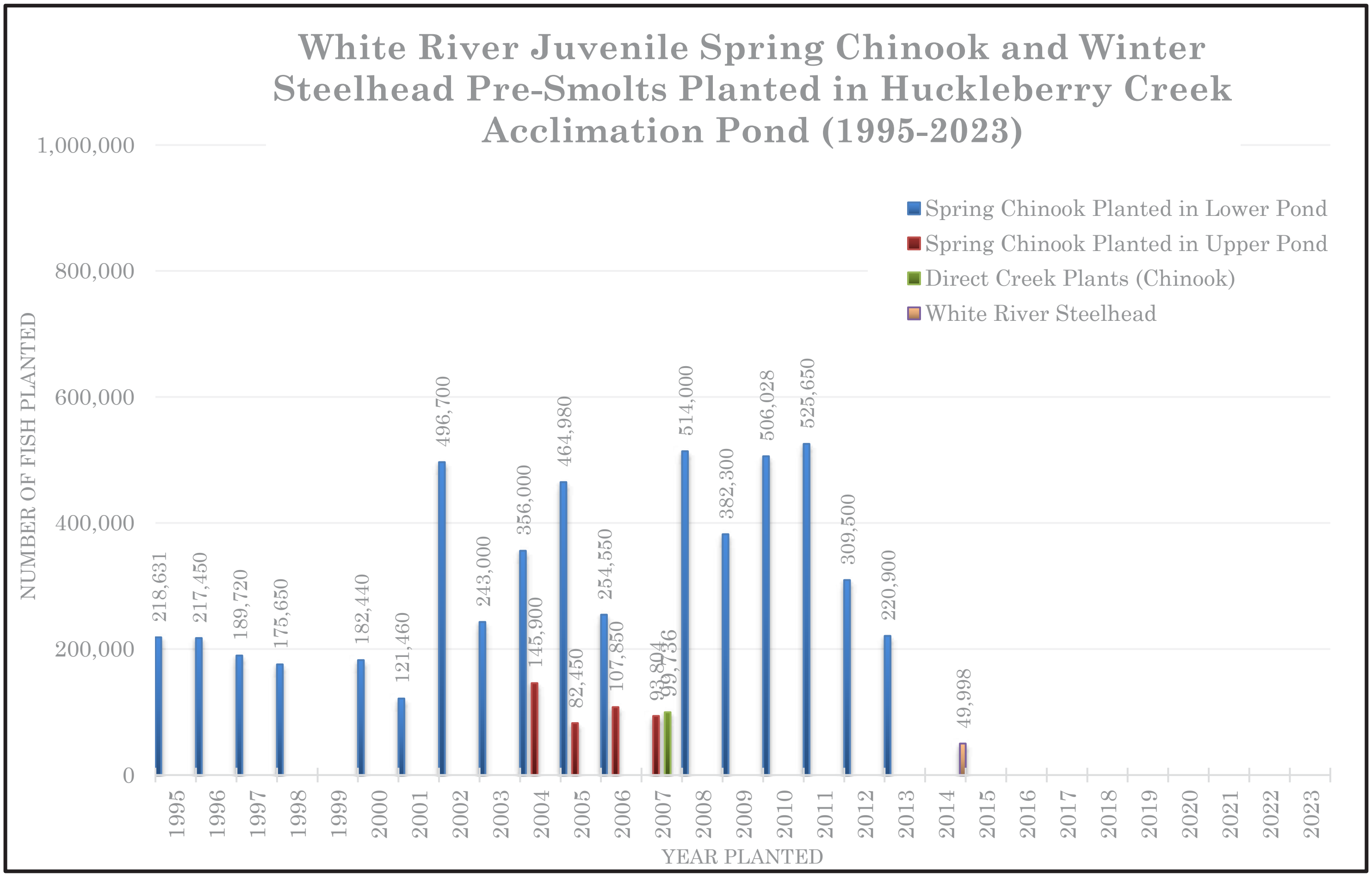
Clarks Creek Fall Chinook salmon hatchery opperated by the Puyallup Tribe.



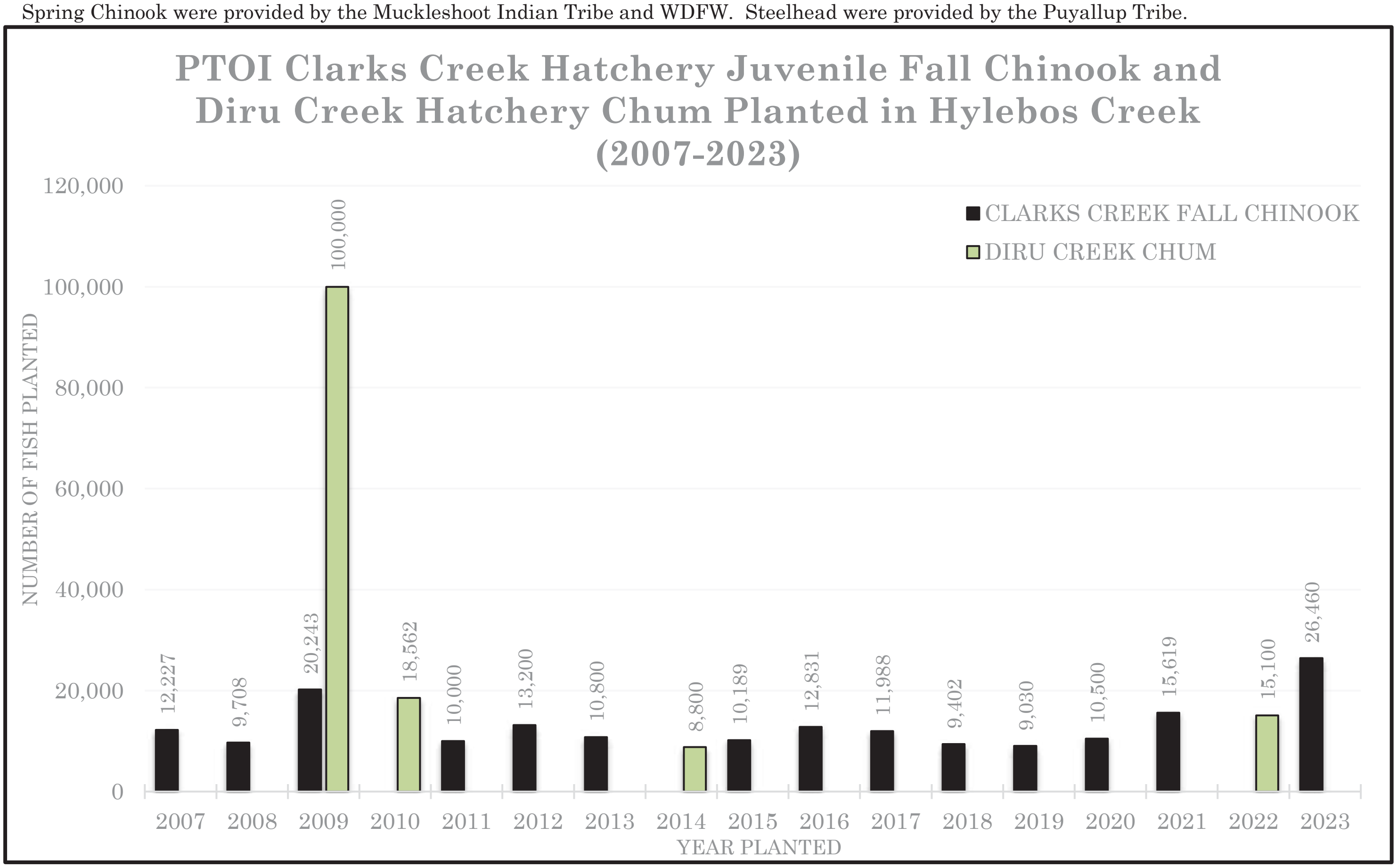
Surplus Fall Chinook adults provided by WDFW Voights Creek Hatchery when available. No data indicates no fish were planted.



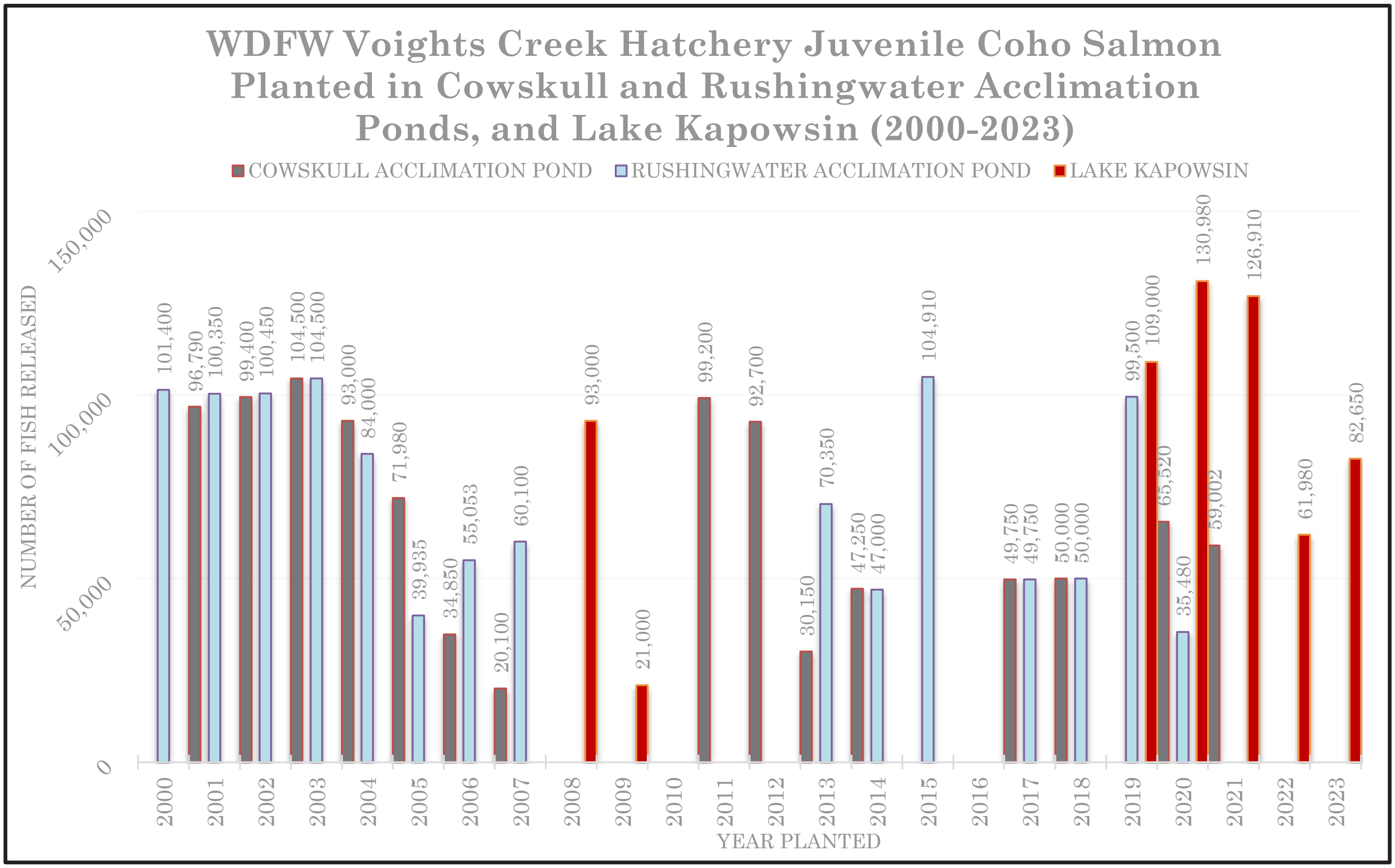
Surplus coho adults provided by WDFW Voights Creek Hatchery when available. No data indicates no fish were planted.



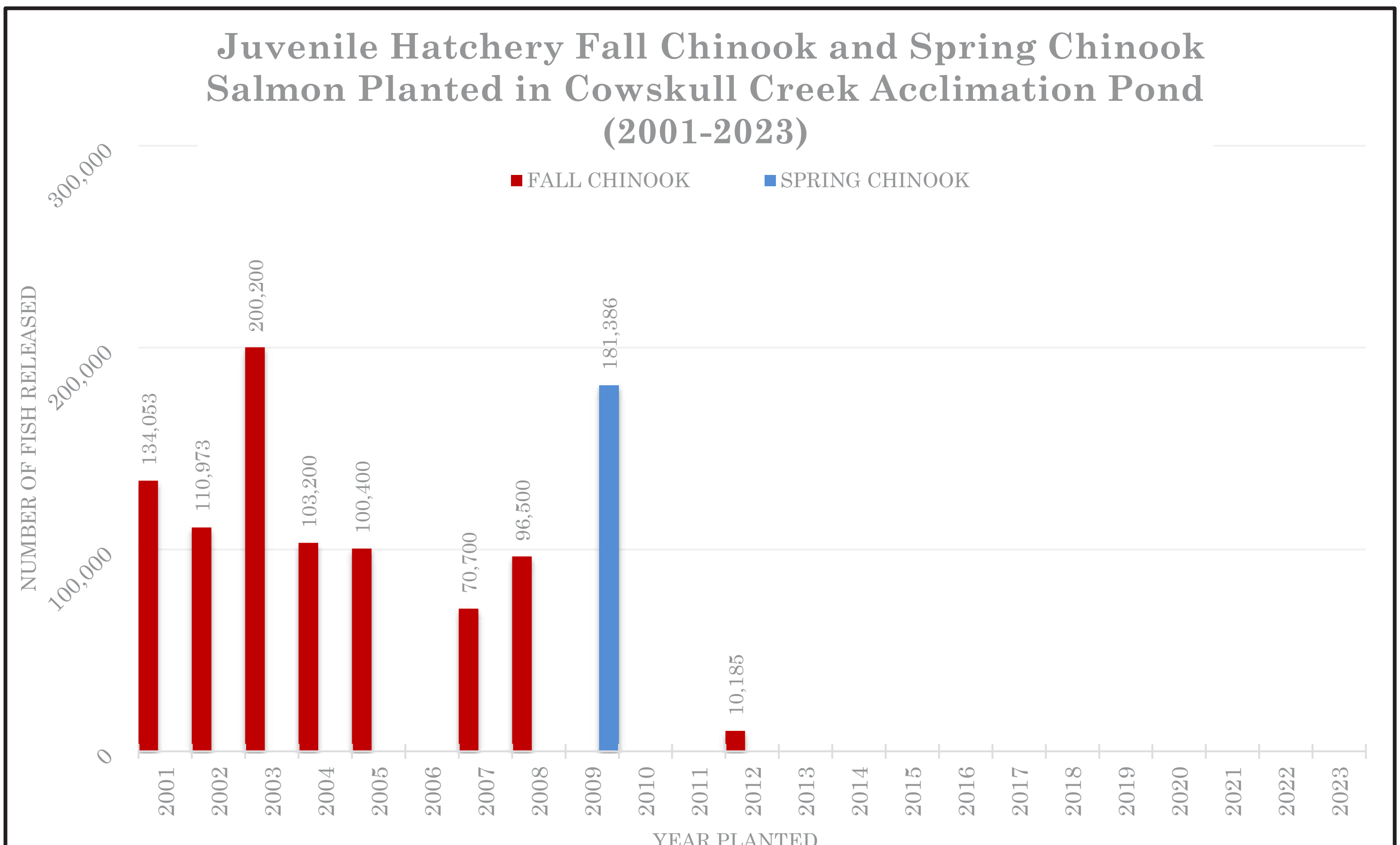
Spring Chinook were provided by the Muckleshoot Indian Tribe and WDFW. Steelhead were provided by the Puyallup Tribe.



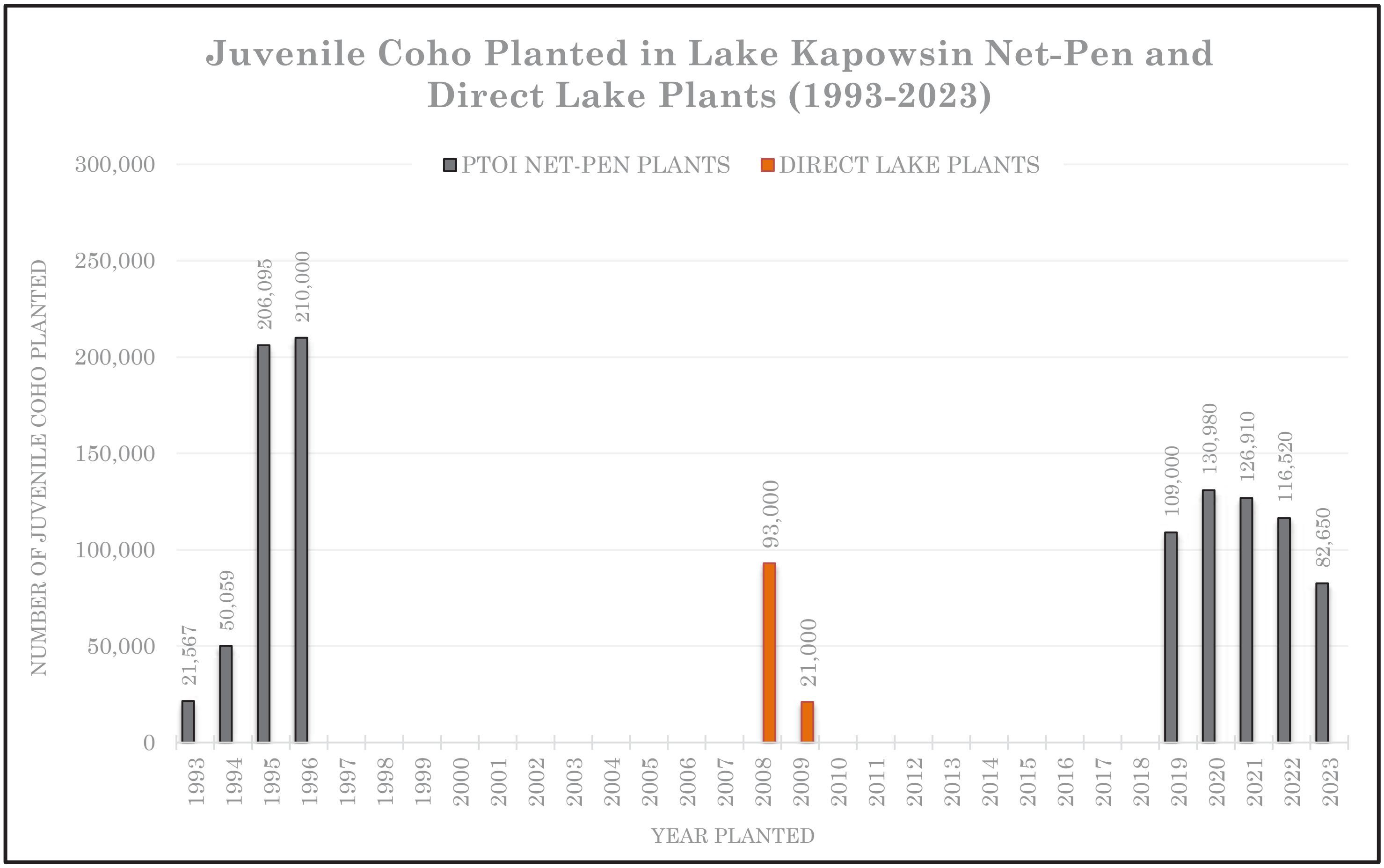
Fall Chinook and chum produced and provided by the Puyallup Tribe. No data indicates fish were not planted.



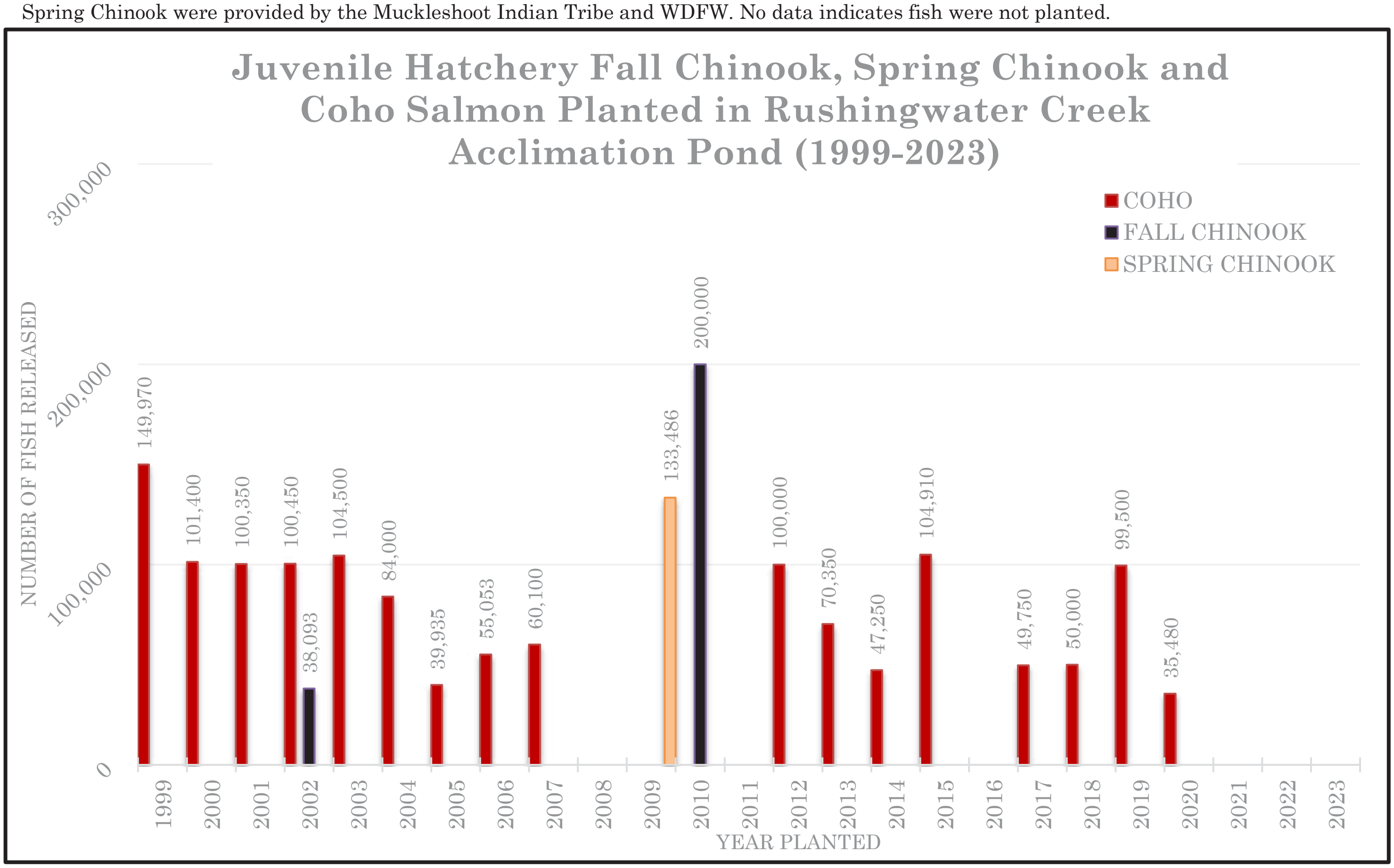
Voights Creek coho salmon are produced and provided by WDFW when available. No data indicates fish were not planted.



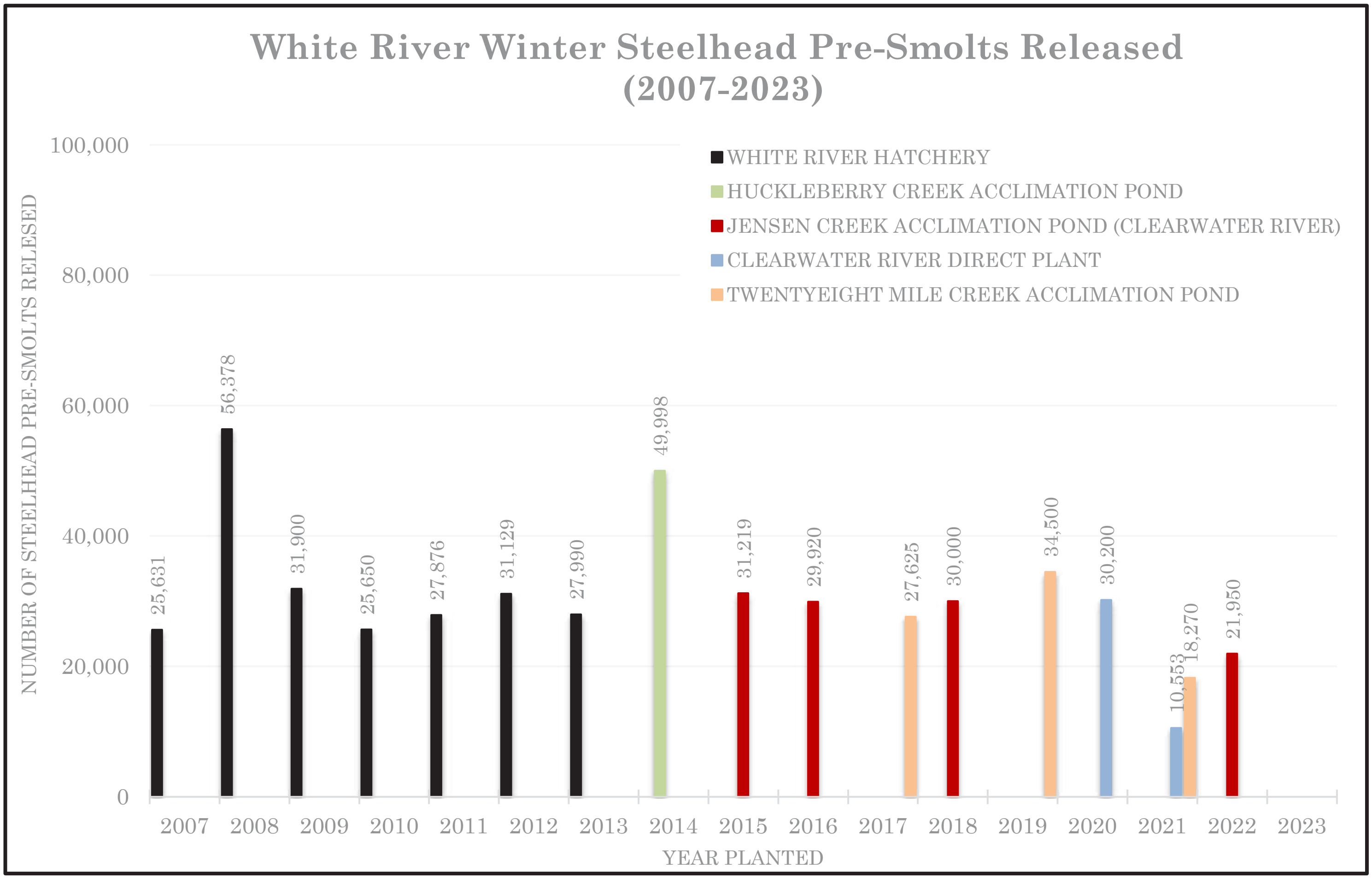
Spring Chinook were provided by the Muckleshoot Indian Tribe and WDFW. Fall Chinook were provided by the Puyallup Tribe and WDFW.



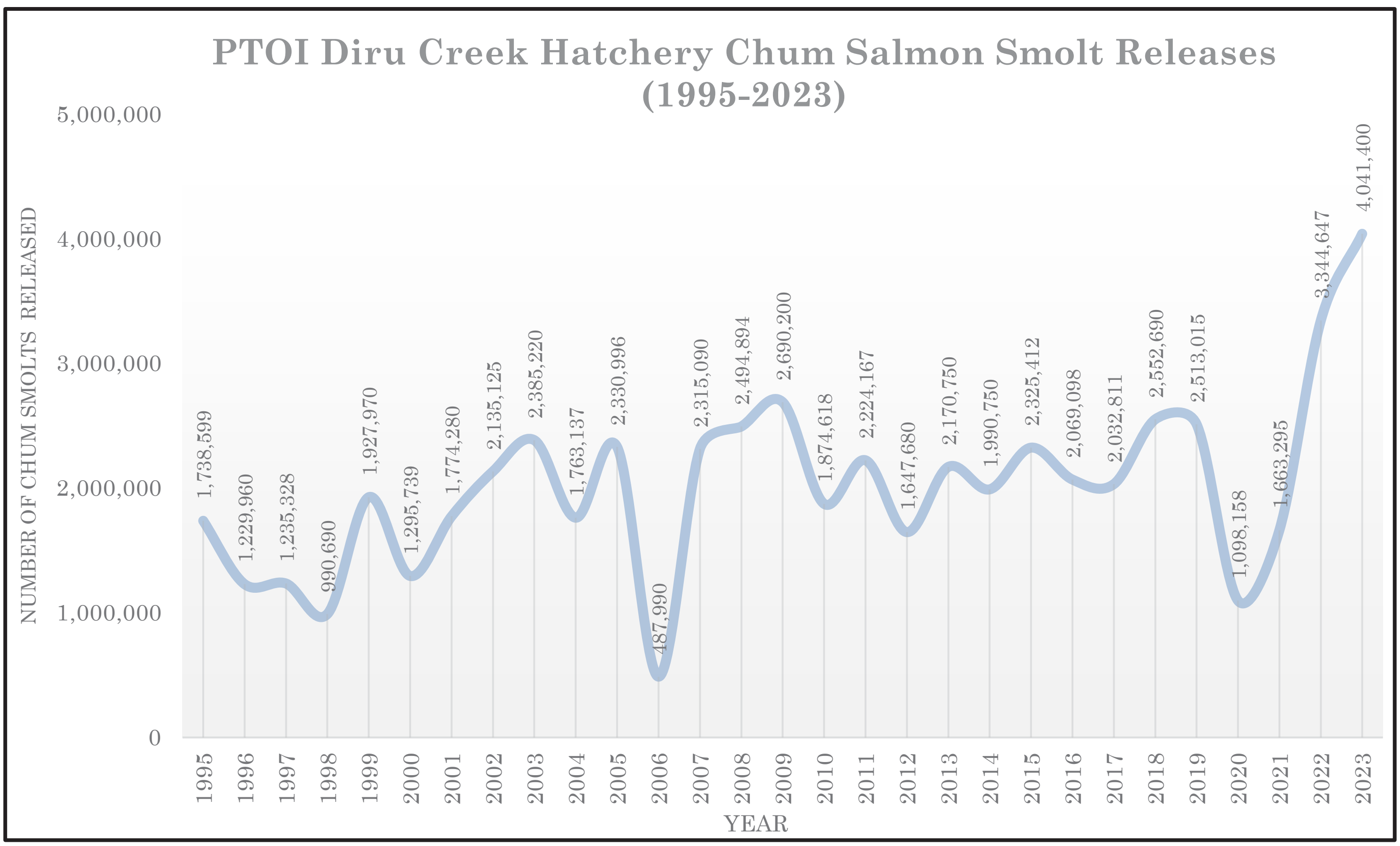
Spring Chinook were provided by the Muckleshoot Indian Tribe and WDFW. No data indicates fish were not planted.



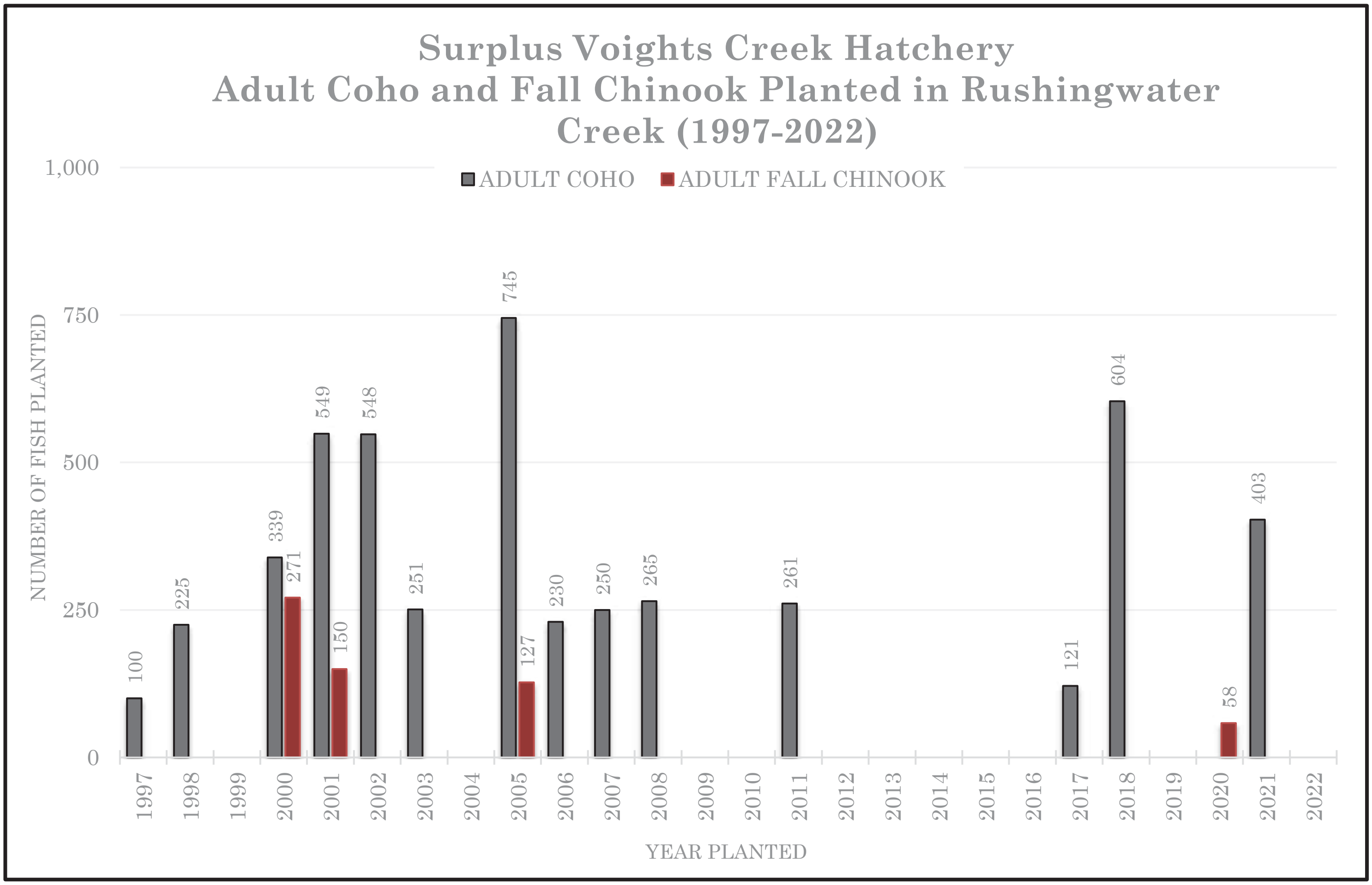
Spring Chinook were provided by the Muckleshoot Indian Tribe and WDFW. Fall Chinook were provided by the Puyallup Tribe and WDFW. Coho were provided by WDFW's Voights Creek hatchery. No data indicates fish were not planted.



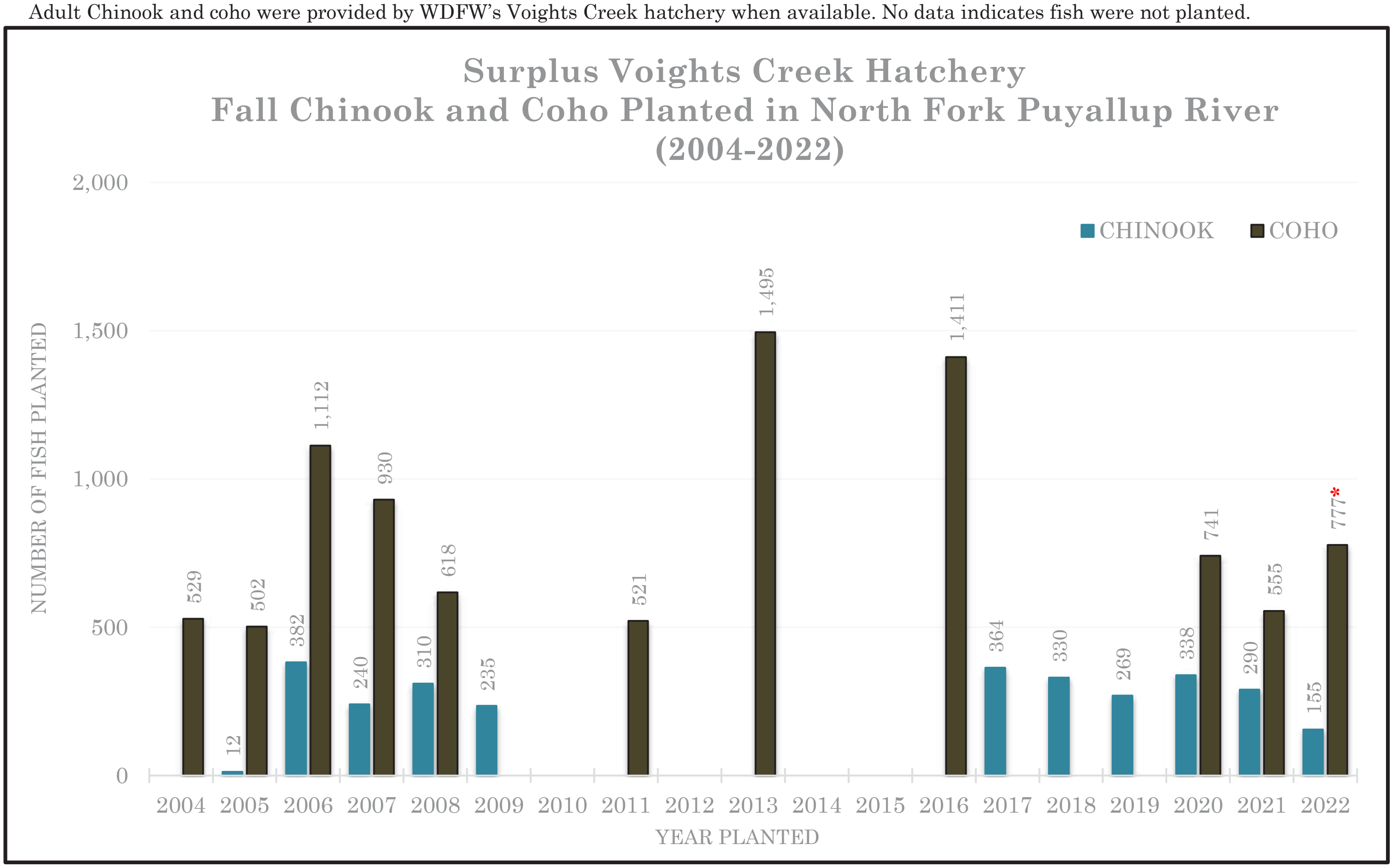
Acclimation ponds opperated by Puyallup Tribe. Program was discontinued in 2022 due to insufficient brood-stock availability.



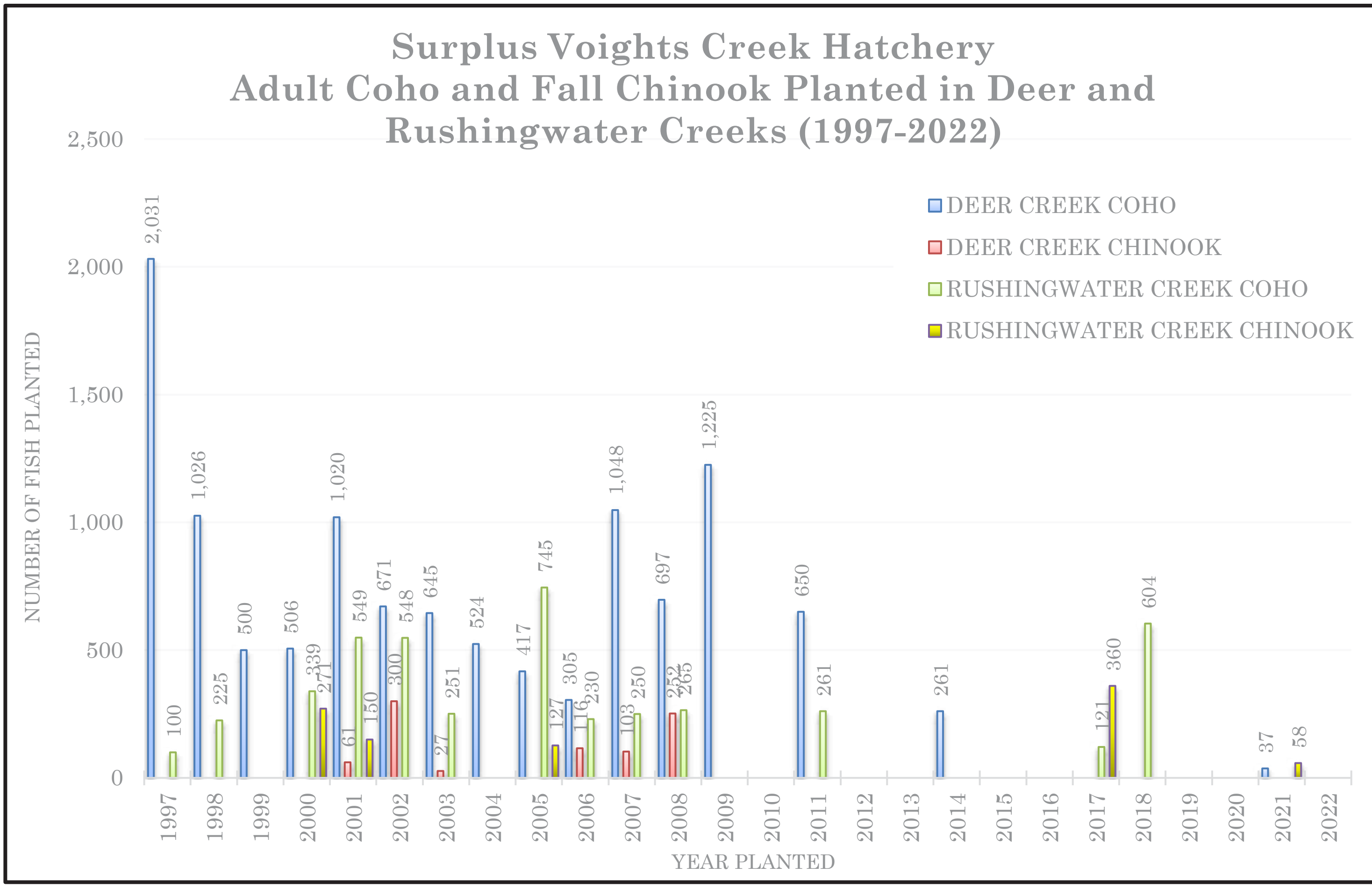
Diru Creek chum salmon hatchery opperated by the Puyallup Tribe.



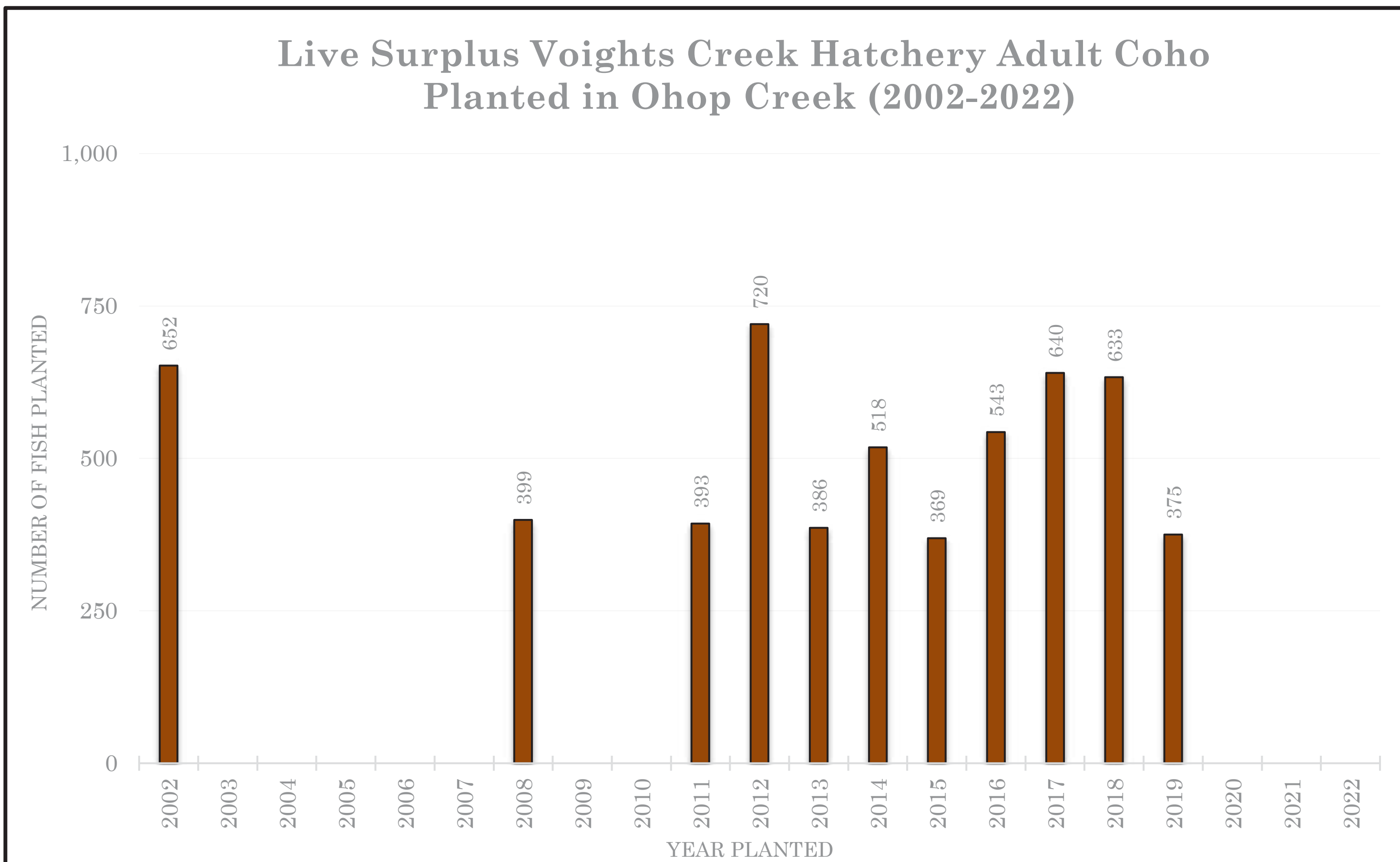
Adult Chinook and coho were provided by WDFW's Voights Creek hatchery when available. No data indicates fish were not planted.



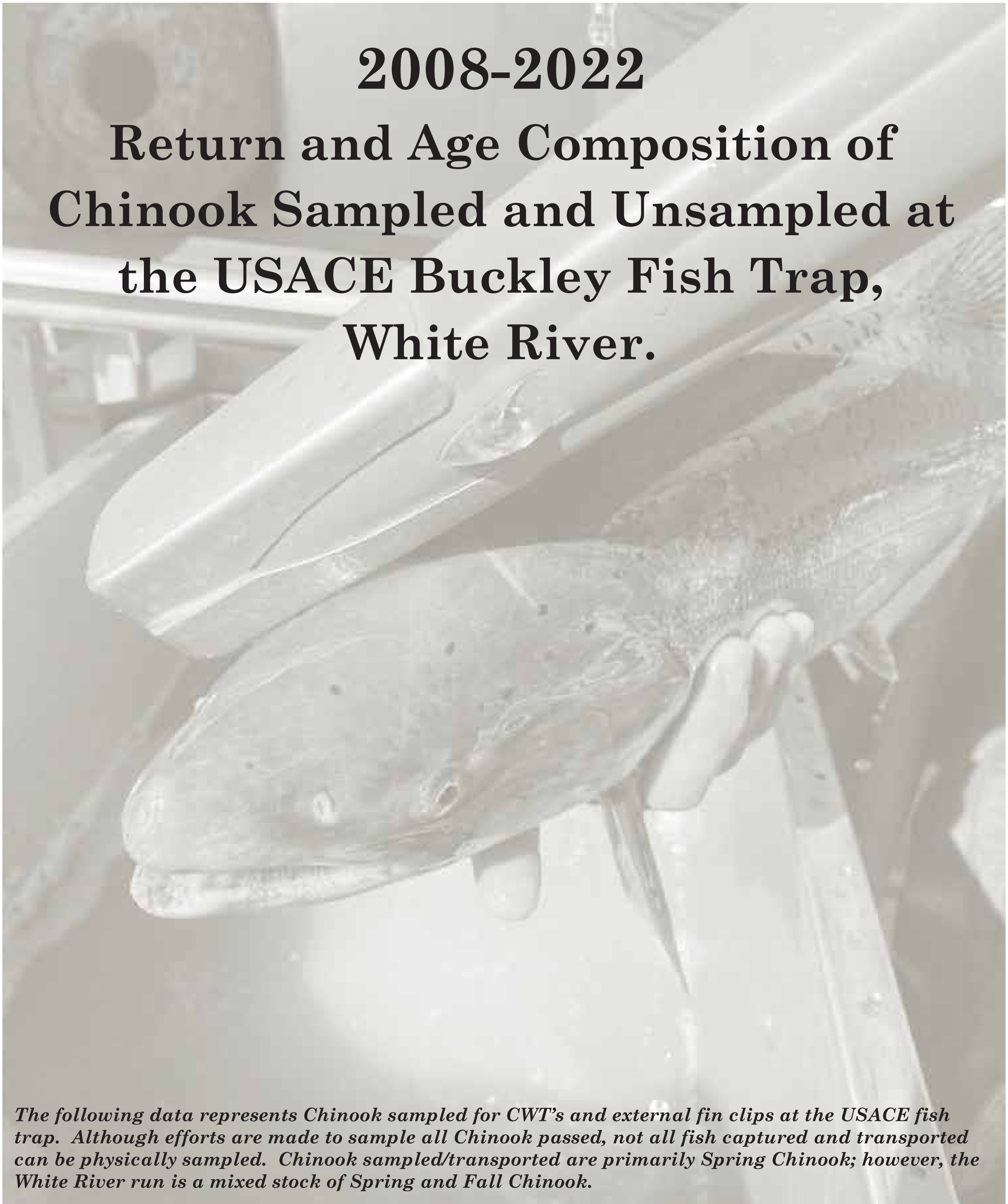
Adult Chinook and coho were provided by WDFW's Voights Creek hatchery when available. No data indicates fish were not planted.



Adult coho and Chinook were provided by WDFW's Voights Creek hatchery when available. No data indicates fish were not planted.



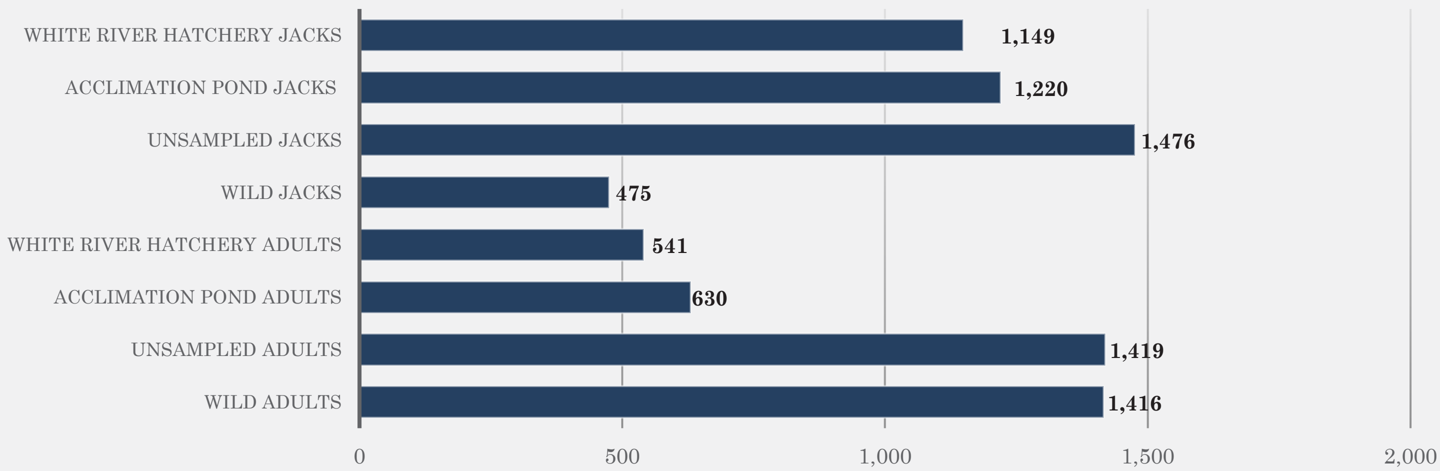
2008-2022
Return and Age Composition of Chinook Sampled and Unsampled at the USACE Buckley Fish Trap, White River.



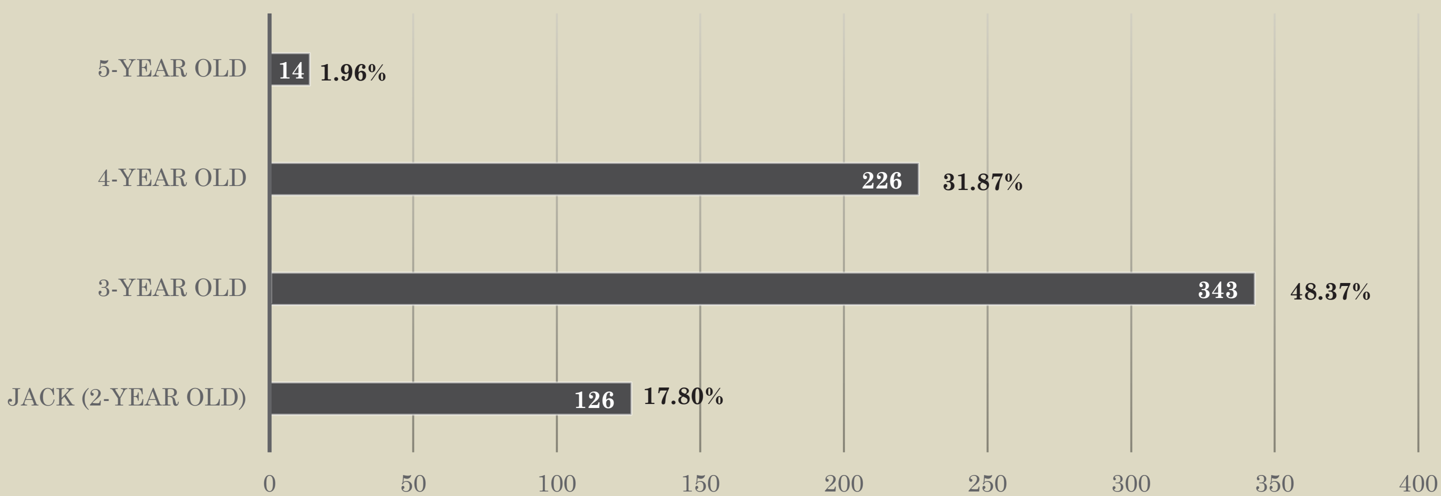
The following data represents Chinook sampled for CWT's and external fin clips at the USACE fish trap. Although efforts are made to sample all Chinook passed, not all fish captured and transported can be physically sampled. Chinook sampled/transported are primarily Spring Chinook; however, the White River run is a mixed stock of Spring and Fall Chinook.

APPENDIX E

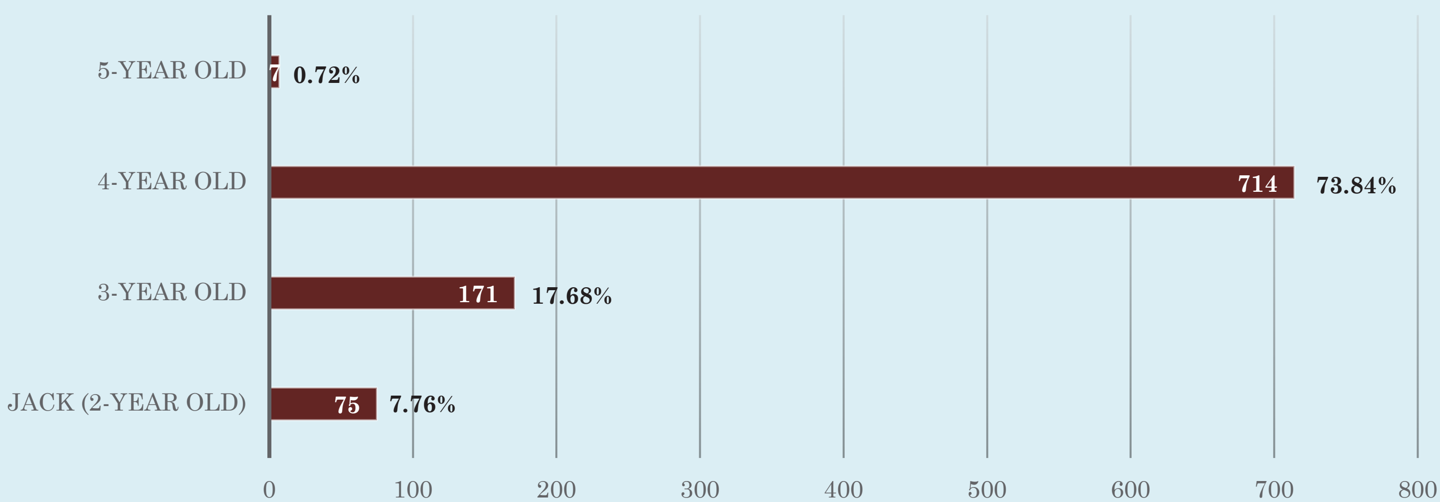
2022 Breakdown of Buckley Trap Sampled and Unsampled Chinook Transported and Released Upstream of Mud Mountain Dam (White River) N=8,326

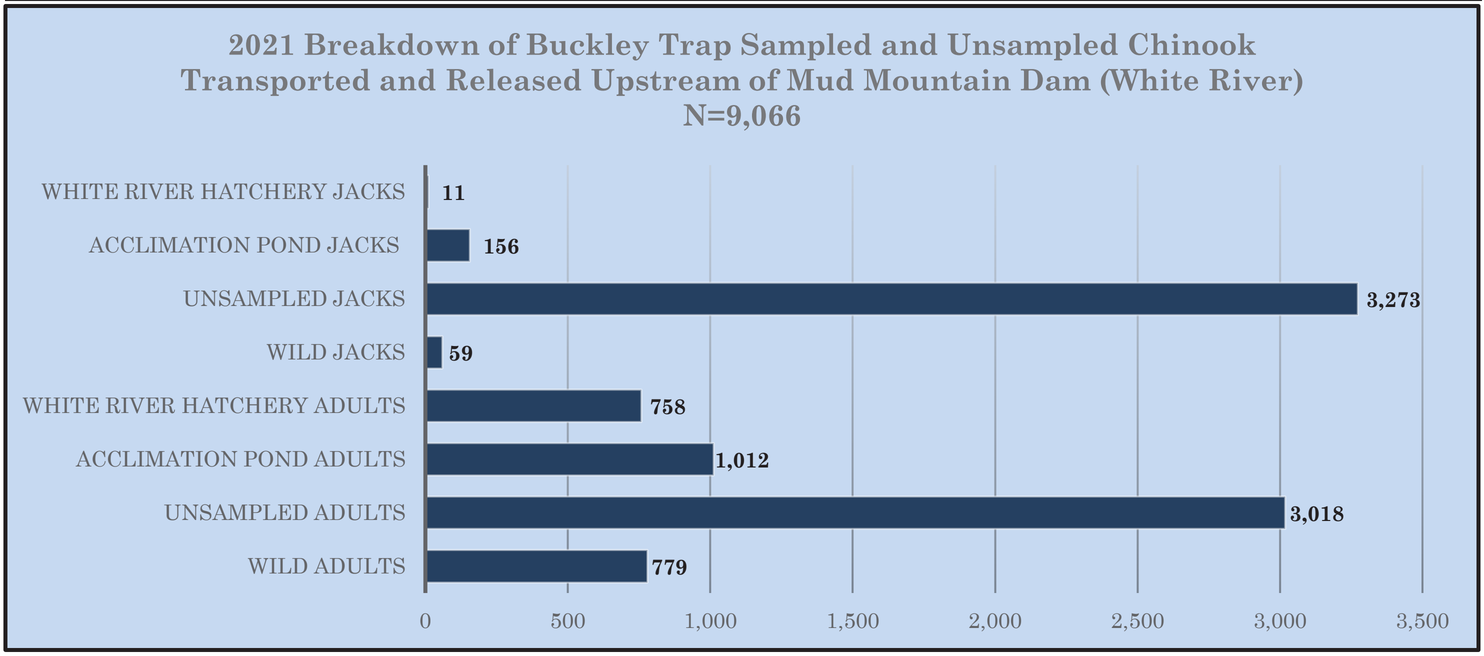


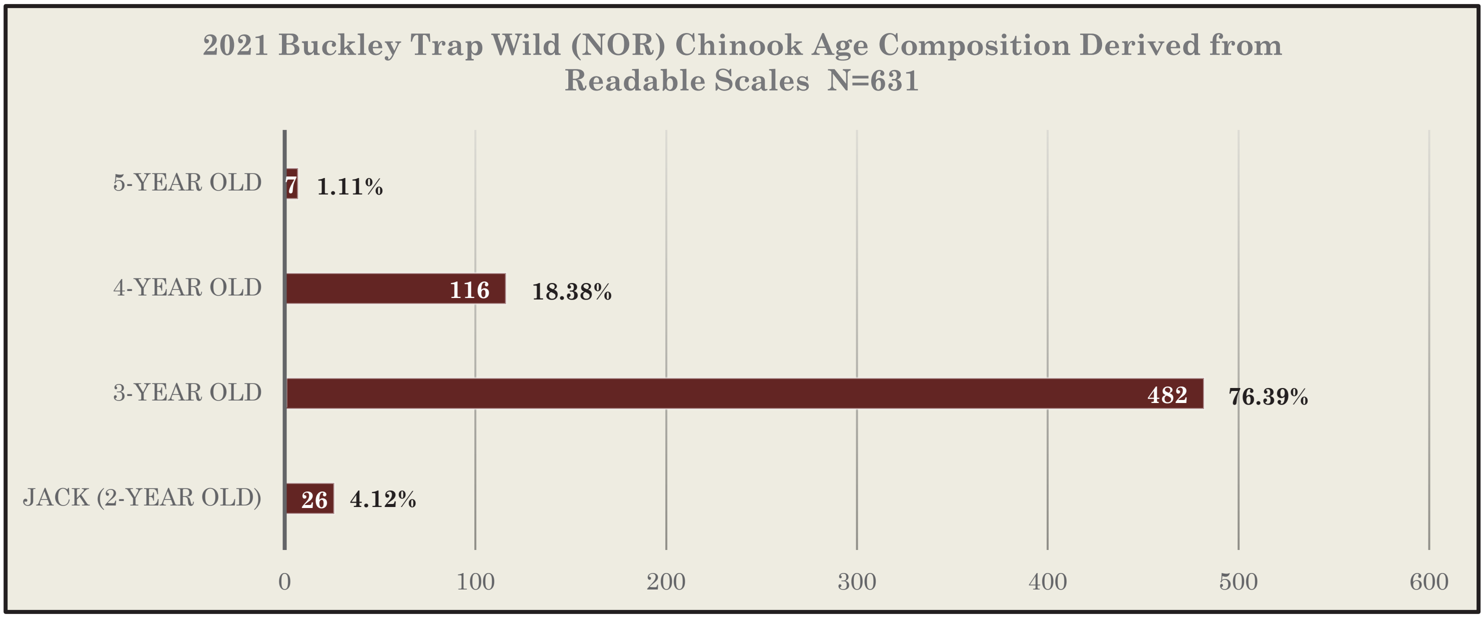
2022 Buckley Trap Acclimation Pond Chinook Age Composition Derived from Readable Scales N=709

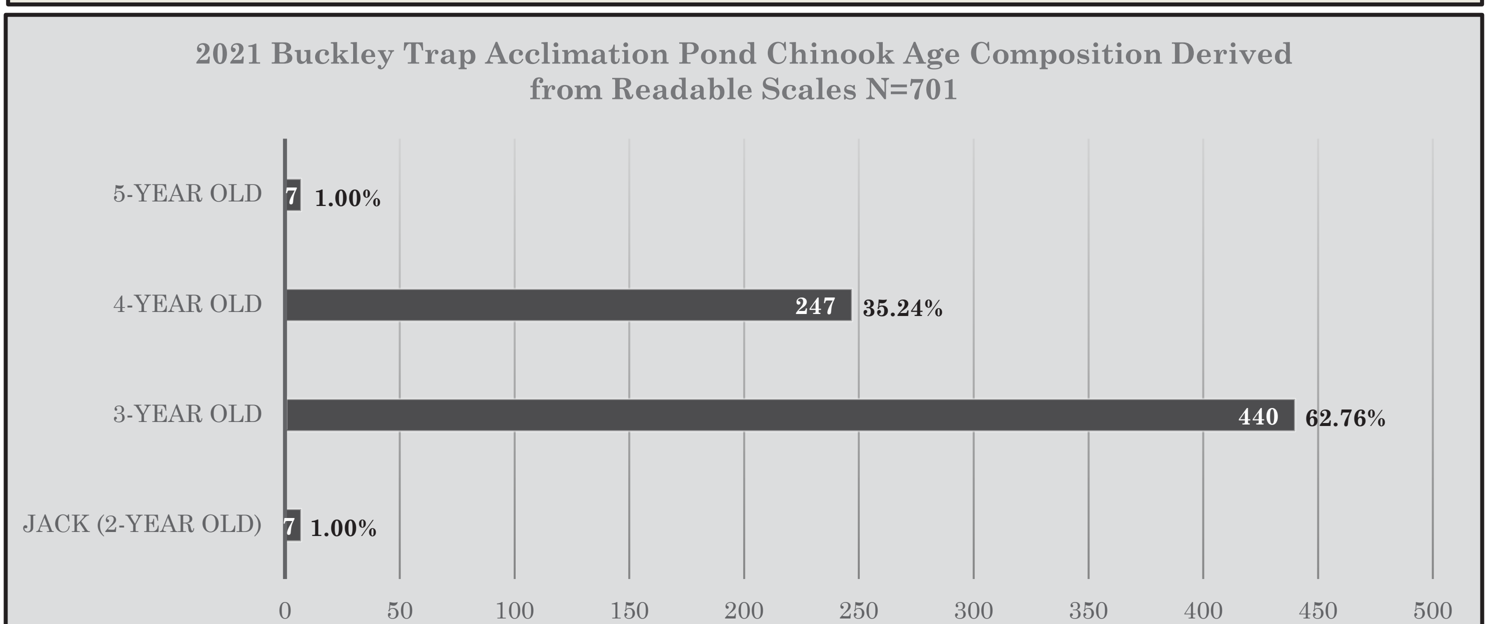


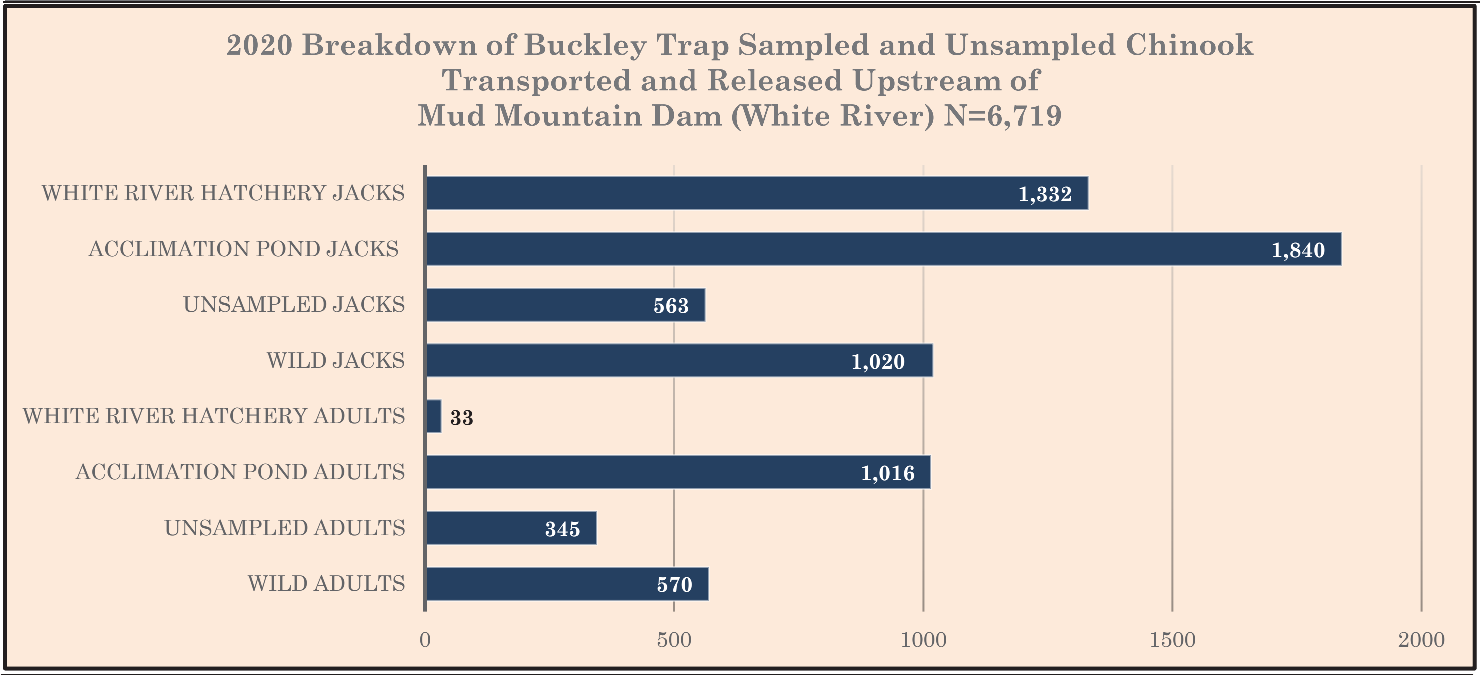
2022 Buckley Trap Wild (NOR) Chinook Age Composition Derived from Readable Scales N=967

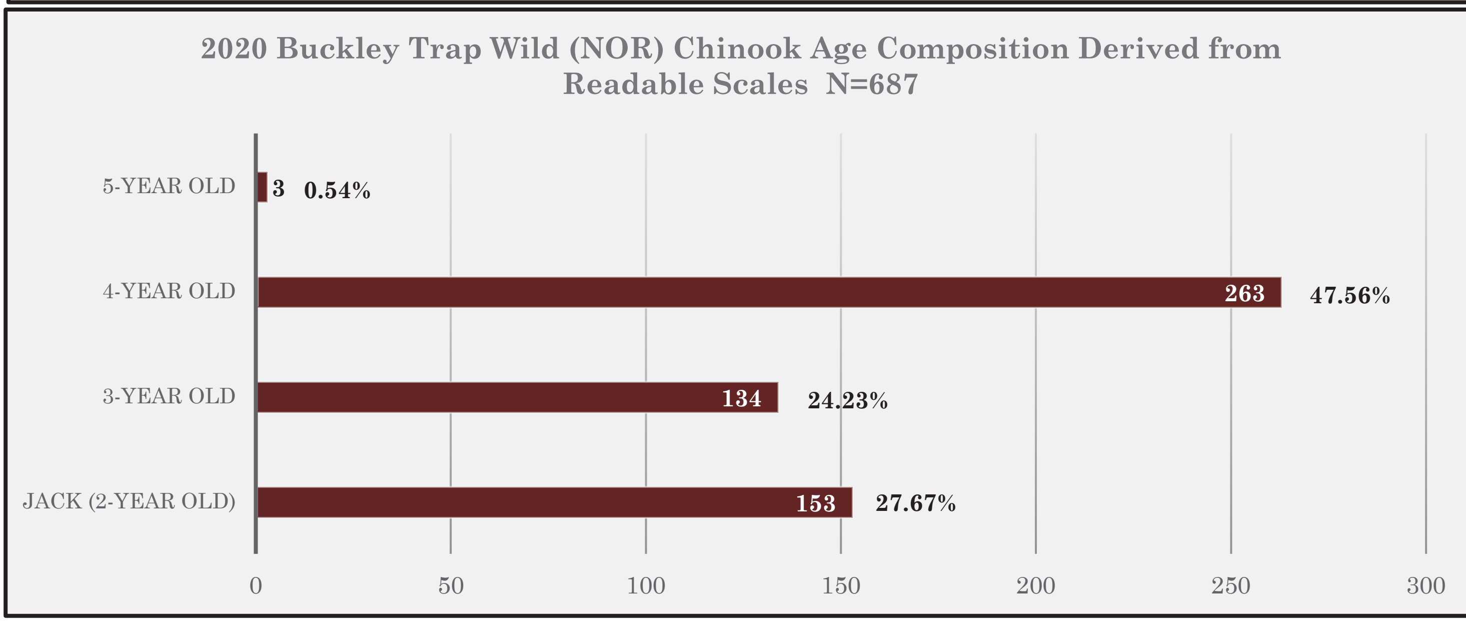


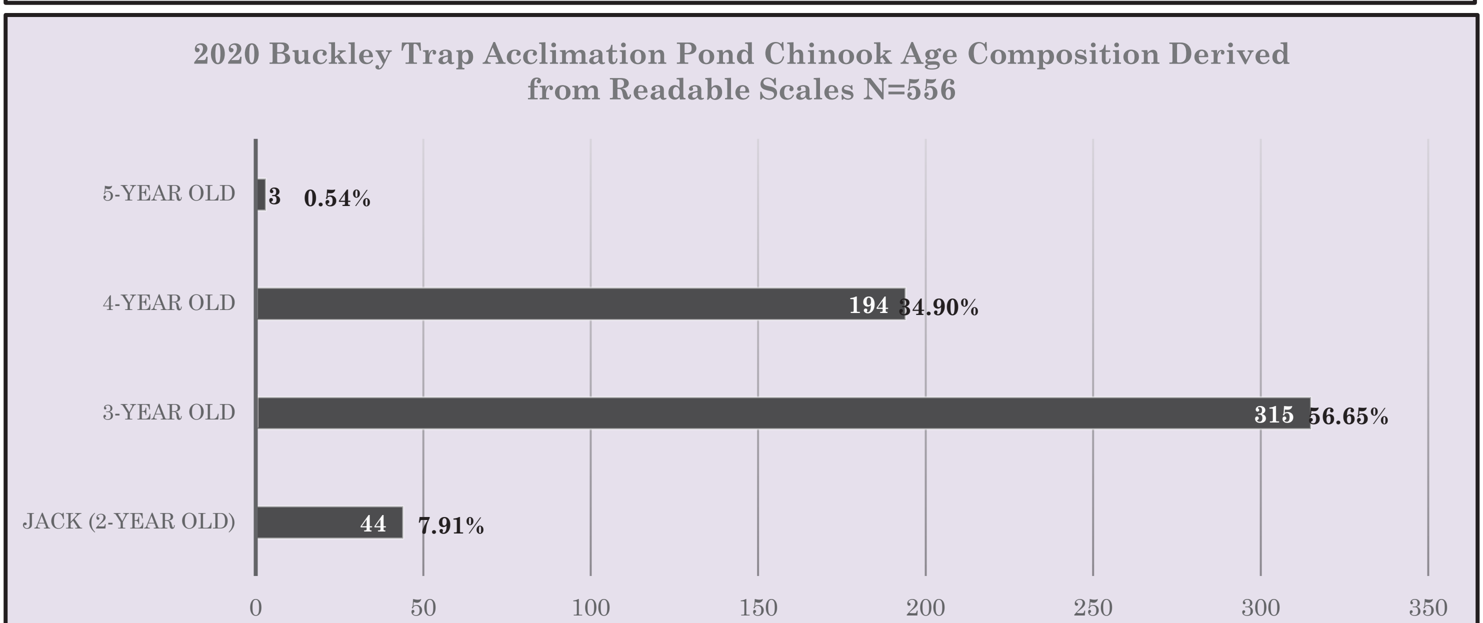

2021 Breakdown of Buckley Trap Sampled and Unsampled Chinook Transported and Released Upstream of Mud Mountain Dam (White River)
N=9,066
WHITE RIVER HATCHERY JACKS
ACCLIMATION POND JACKS
UNSAMPLED JACKS
WILD JACKS
WHITE RIVER HATCHERY ADULTS
ACCLIMATION POND ADULTS
UNSAMPLED ADULTS
WILD ADULTS
11
156
3,273
59
758
1,012
3,018
779
0
500
1,000
1,500
2,000
2,500
3,000
3,500

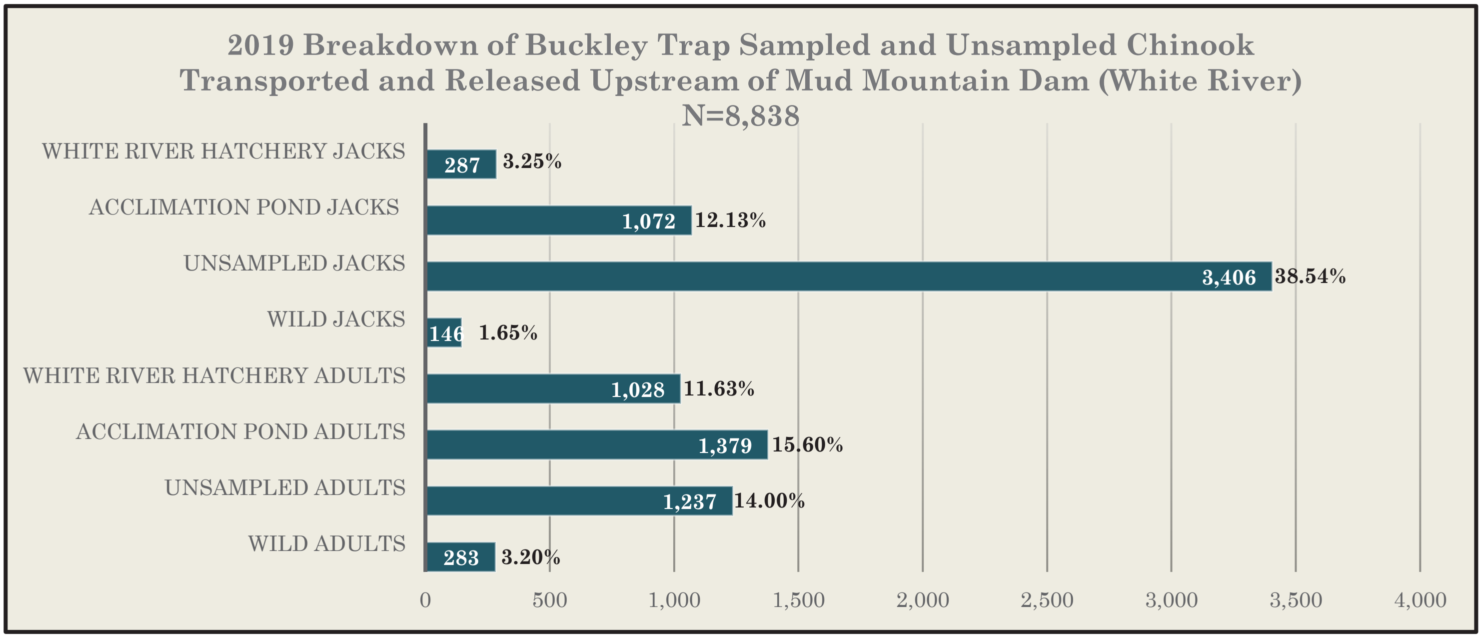

2021 Buckley Trap Wild (NOR) Chinook Age Composition Derived from Readable Scales N=631
5-YEAR OLD
4-YEAR OLD
3-YEAR OLD
JACK (2-YEAR OLD)
7
1.11%
116
18.38%
482
76.39%
26
4.12%
0
100
200
300
400
500
600

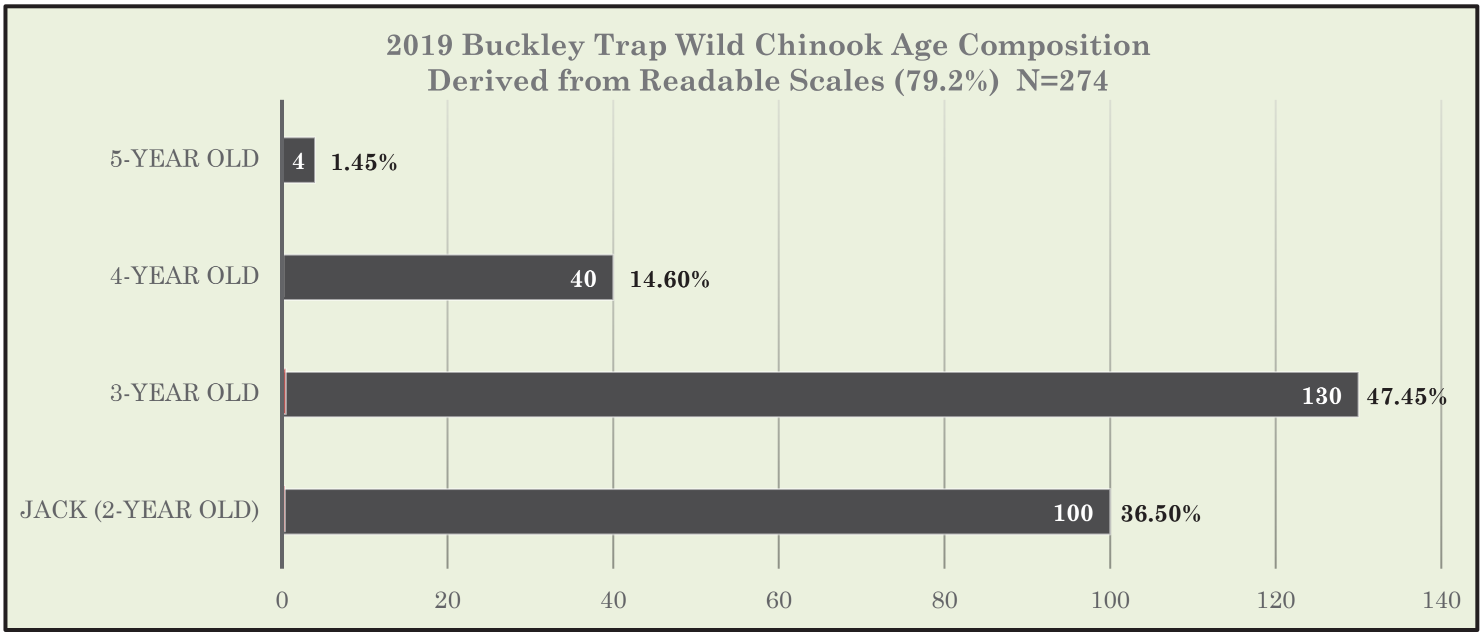

2021 Buckley Trap Acclimation Pond Chinook Age Composition Derived from Readable Scales N=701
5-YEAR OLD
4-YEAR OLD
3-YEAR OLD
JACK (2-YEAR OLD)
7
1.00%
247
35.24%
440
62.76%
7
1.00%
0
50
100
150
200
250
300
350
400
450
500

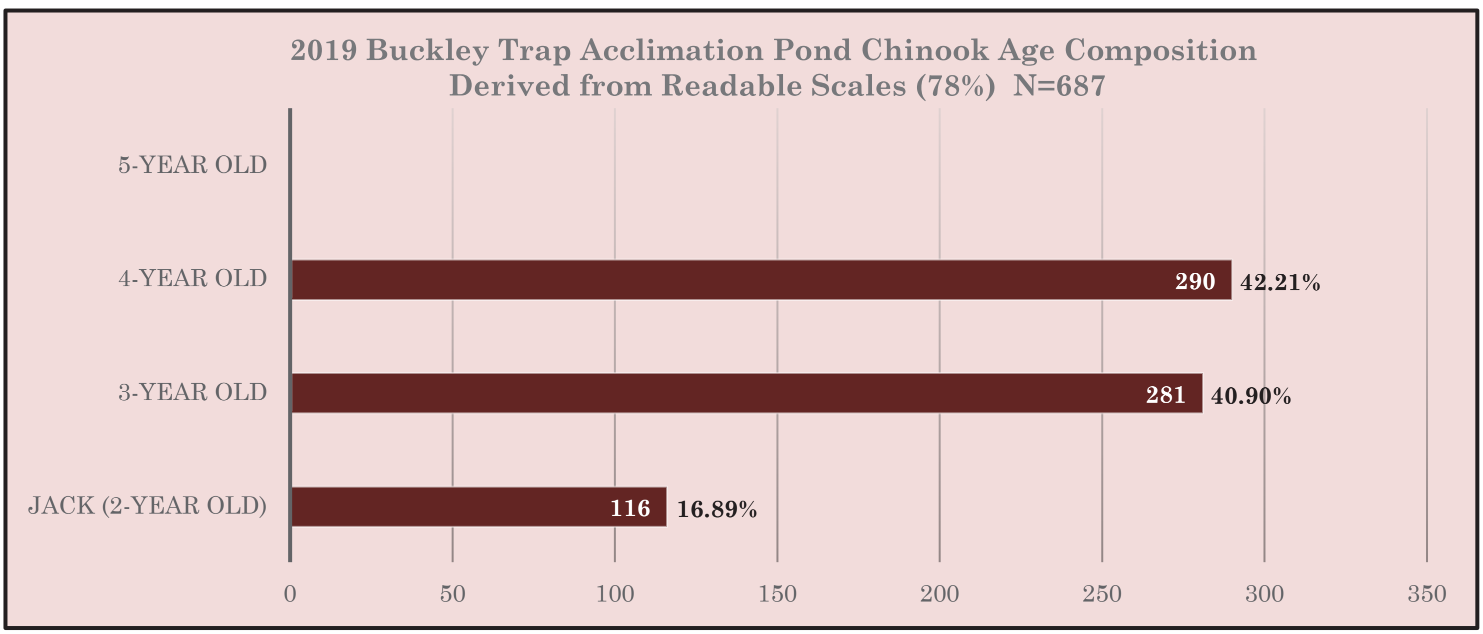

2020 Breakdown of Buckley Trap Sampled and Unsampled Chinook Transported and Released Upstream of Mud Mountain Dam (White River) N=6,719
WHITE RIVER HATCHERY JACKS 1,332
ACCLIMATION POND JACKS 1,840
UNSAMPLED JACKS 563
WILD JACKS 1,020
WHITE RIVER HATCHERY ADULTS 33
ACCLIMATION POND ADULTS 1,016
UNSAMPLED ADULTS 345
WILD ADULTS 570
0
500
1000
1500
2000

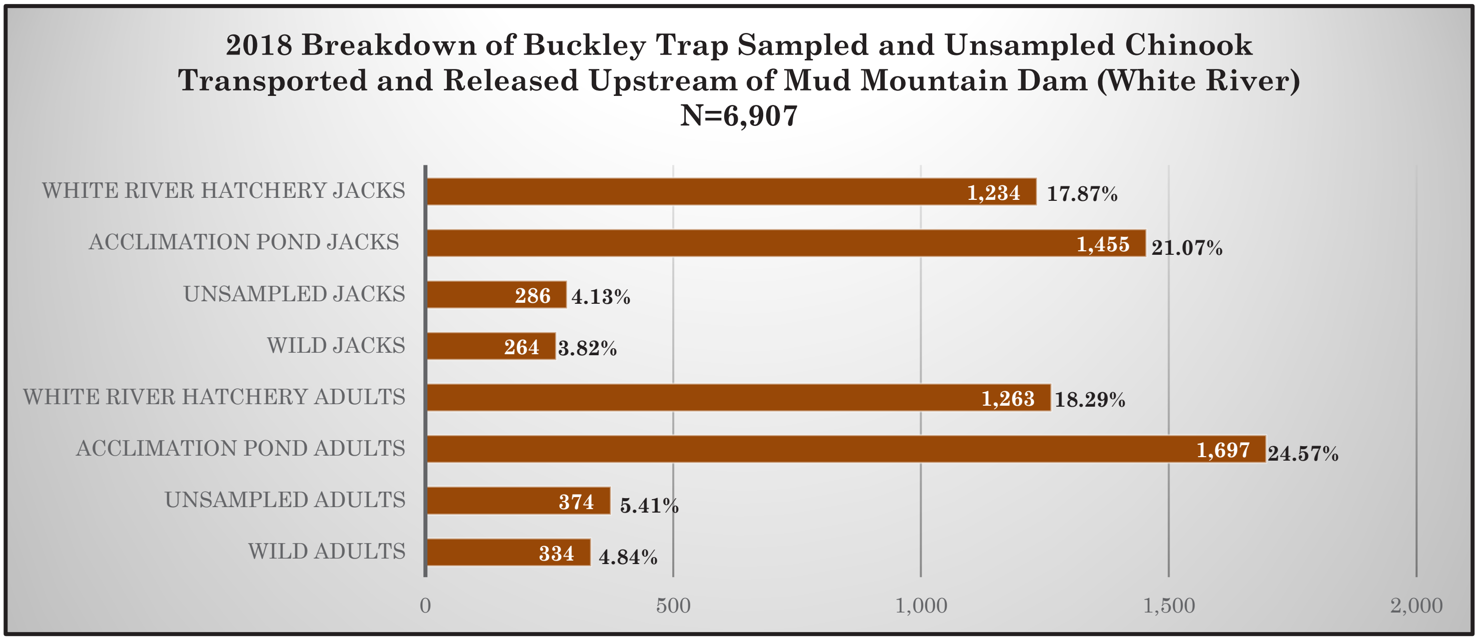

2020 Buckley Trap Wild (NOR) Chinook Age Composition Derived from Readable Scales N=687
5-YEAR OLD 3 0.54%
4-YEAR OLD 263 47.56%
3-YEAR OLD 134 24.23%
JACK (2-YEAR OLD) 153 27.67%
0
50
100
150
200
250
300

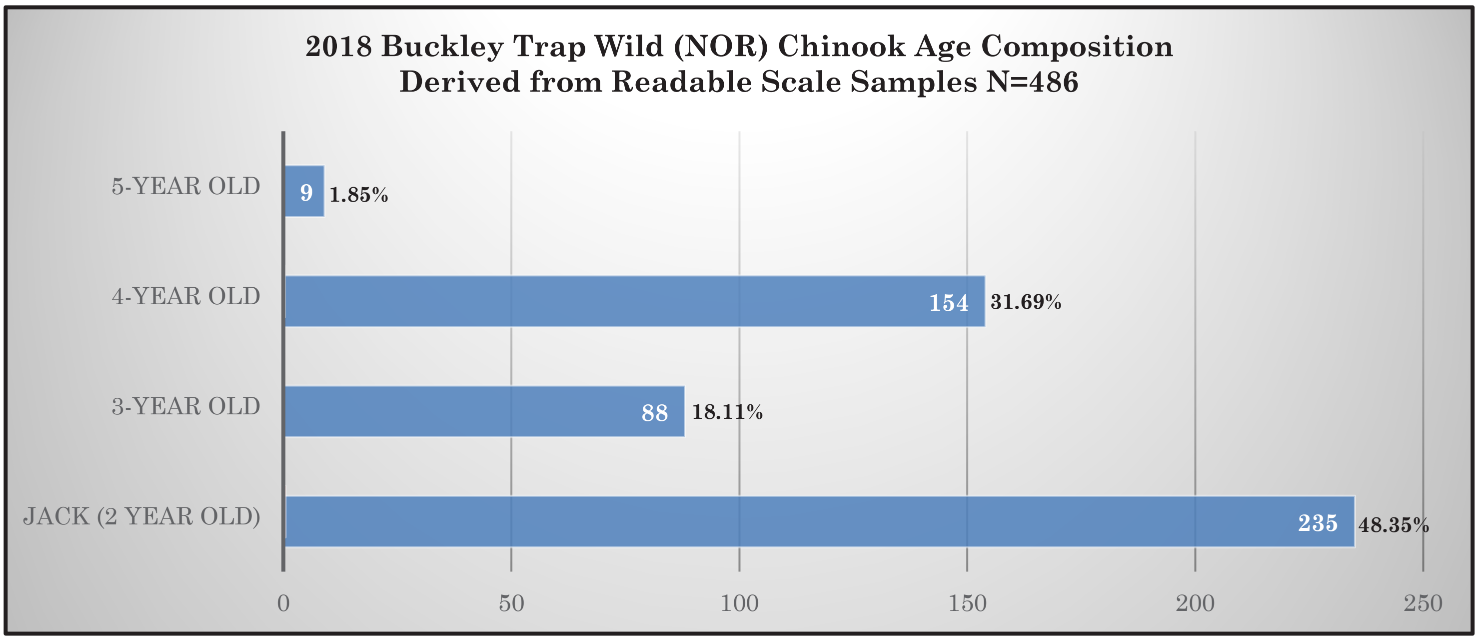

2020 Buckley Trap Acclimation Pond Chinook Age Composition Derived from Readable Scales N=556
5-YEAR OLD 3 0.54%
4-YEAR OLD 194 34.90%
3-YEAR OLD 315 56.65%
JACK (2-YEAR OLD) 44 7.91%
0
50
100
150
200
250
300
350

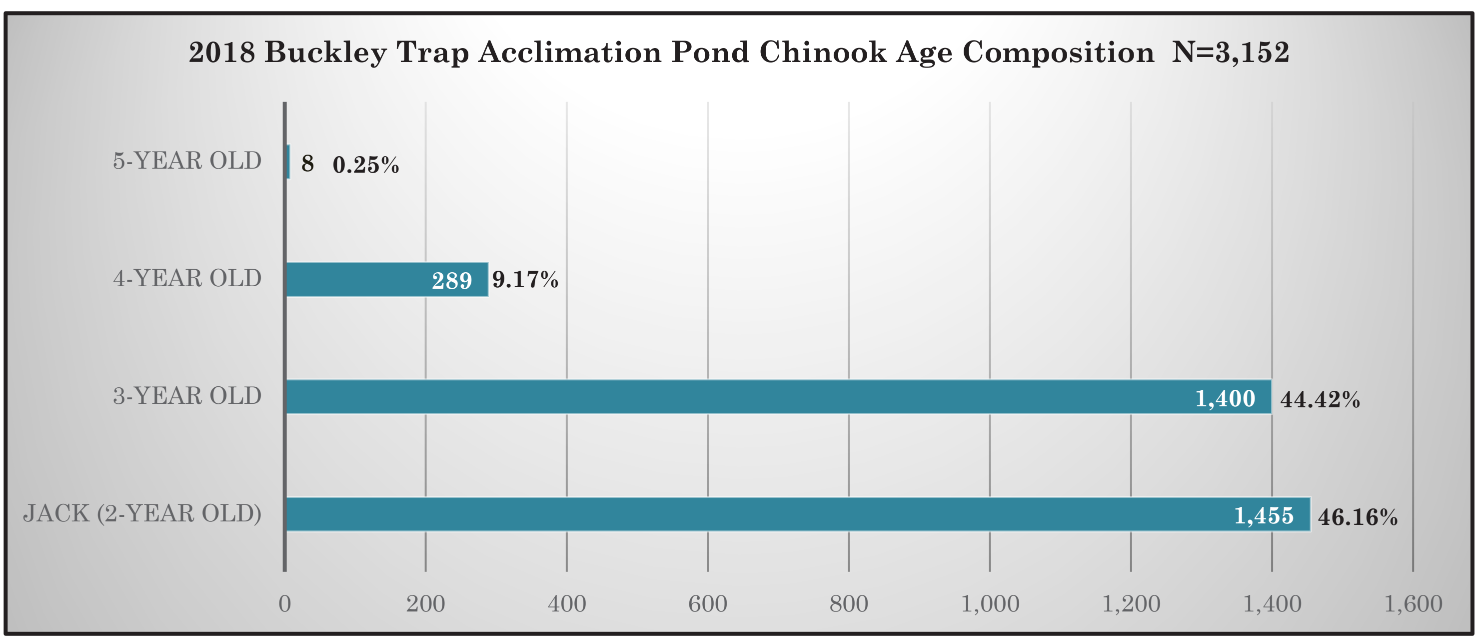

2019 Breakdown of Buckley Trap Sampled and Unsampled Chinook Transported and Released Upstream of Mud Mountain Dam (White River)
N=8,838
WHITE RIVER HATCHERY JACKS
287 3.25%
ACCLIMATION POND JACKS
1,072 12.13%
UNSAMPLED JACKS
3,406 38.54%
WILD JACKS
146 1.65%
WHITE RIVER HATCHERY ADULTS
1,028 11.63%
ACCLIMATION POND ADULTS
1,379 15.60%
UNSAMPLED ADULTS
1,237 14.00%
WILD ADULTS
283 3.20%
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000

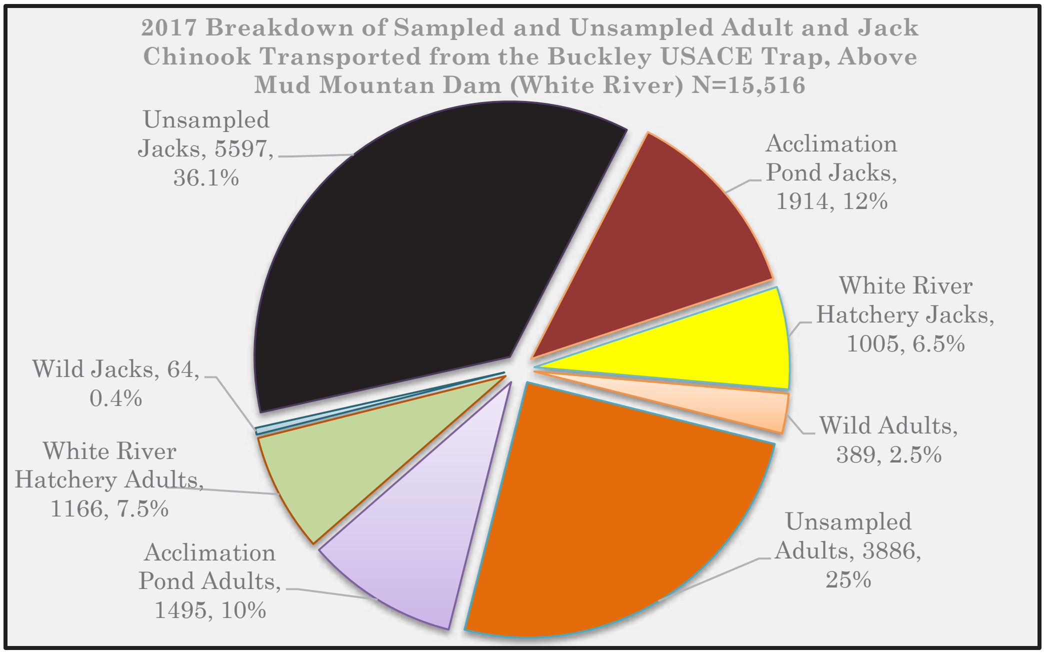

2019 Buckley Trap Wild Chinook Age Composition Derived from Readable Scales (79.2%) N=274
5-YEAR OLD
4 1.45%
4-YEAR OLD
40 14.60%
3-YEAR OLD
130 47.45%
JACK (2-YEAR OLD)
100 36.50%
0
20
40
60
80
100
120
140


2019 Buckley Trap Acclimation Pond Chinook Age Composition Derived from Readable Scales (78%) N=687
5-YEAR OLD
4-YEAR OLD
290 42.21%
3-YEAR OLD
281 40.90%
JACK (2-YEAR OLD)
116 16.89%
0
50
100
150
200
250
300
350

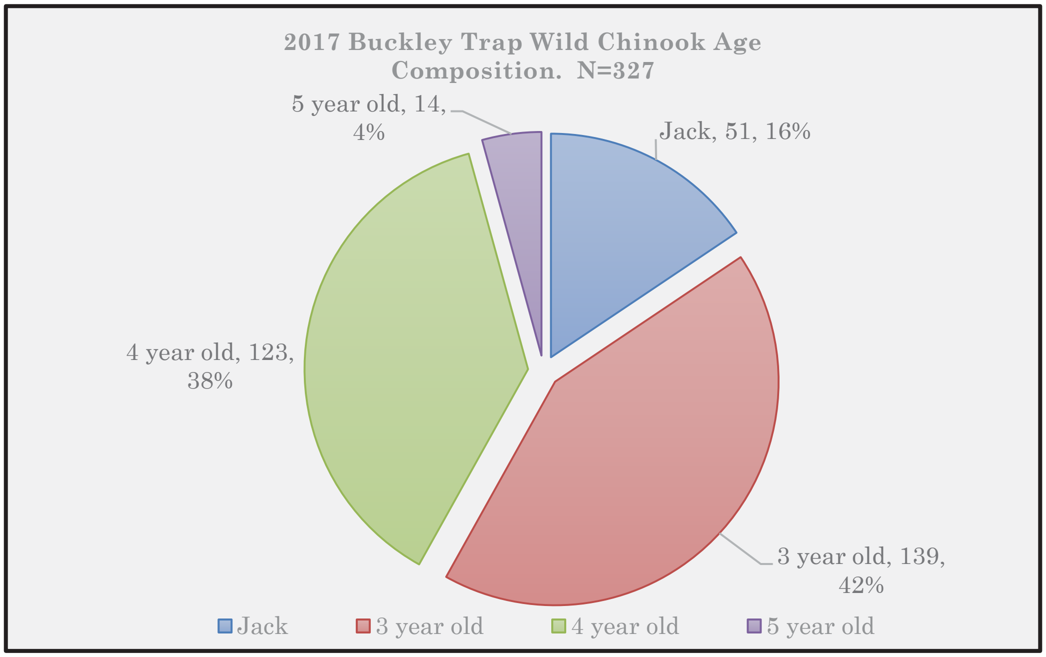

2018 Breakdown of Buckley Trap Sampled and Unsampled Chinook
Transported and Released Upstream of Mud Mountain Dam (White River)
N=6,907
WHITE RIVER HATCHERY JACKS
1,234
17.87%
ACCLIMATION POND JACKS
1,455
21.07%
UNSAMPLED JACKS
286
4.13%
WILD JACKS
264
3.82%
WHITE RIVER HATCHERY ADULTS
1,263
18.29%
ACCLIMATION POND ADULTS
1,697
24.57%
UNSAMPLED ADULTS
374
5.41%
WILD ADULTS
334
4.84%
0
500
1,000
1,500
2,000


2018 Buckley Trap Wild (NOR) Chinook Age Composition
Derived from Readable Scale Samples N=486
5-YEAR OLD
9
1.85%
4-YEAR OLD
154
31.69%
3-YEAR OLD
88
18.11%
JACK (2 YEAR OLD)
235
48.35%
0
50
100
150
200
250

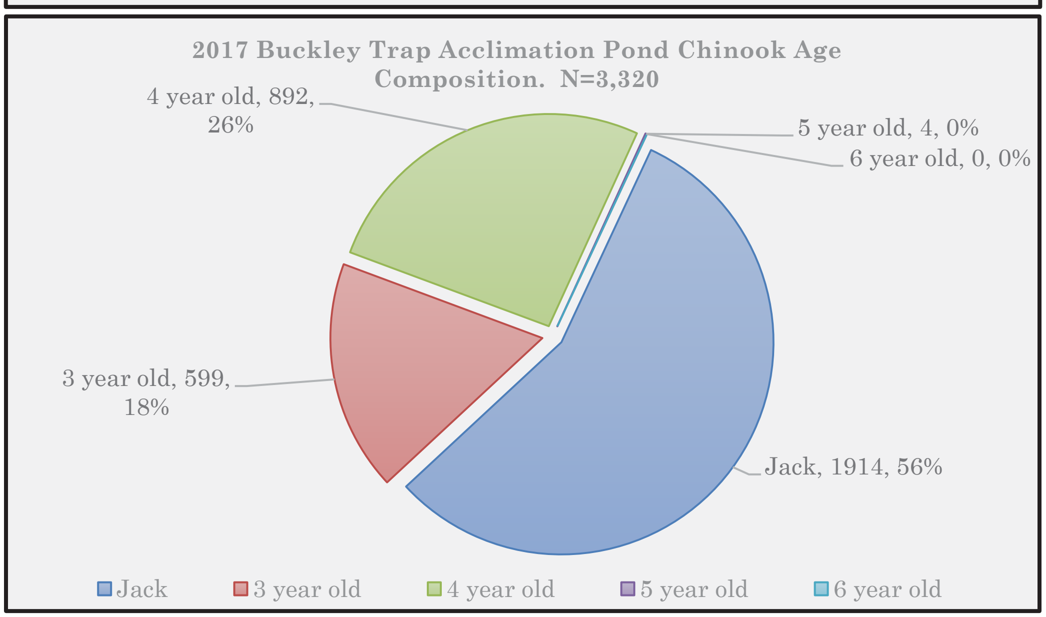

2018 Buckley Trap Acclimation Pond Chinook Age Composition N=3,152
5-YEAR OLD
8
0.25%
4-YEAR OLD
289
9.17%
3-YEAR OLD
1,400
44.42%
JACK (2-YEAR OLD)
1,455
46.16%
0
200
400
600
800
1,000
1,200
1,400
1,600



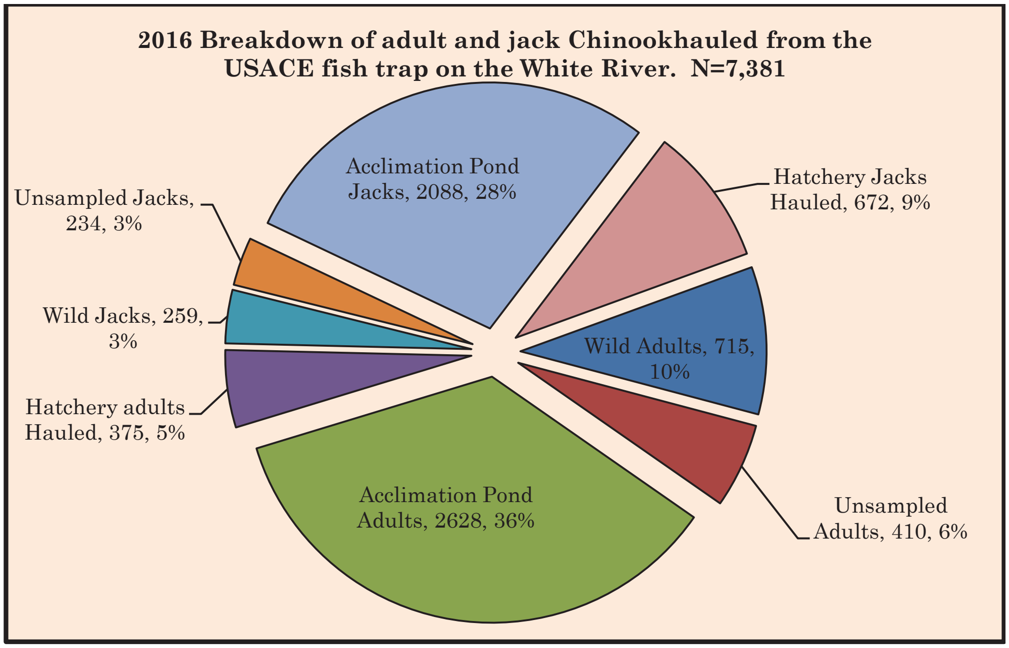
2017: Breakdown of sampled and unsampled Chinook adult and jack Chinook at Buckley USACE trap (White River).



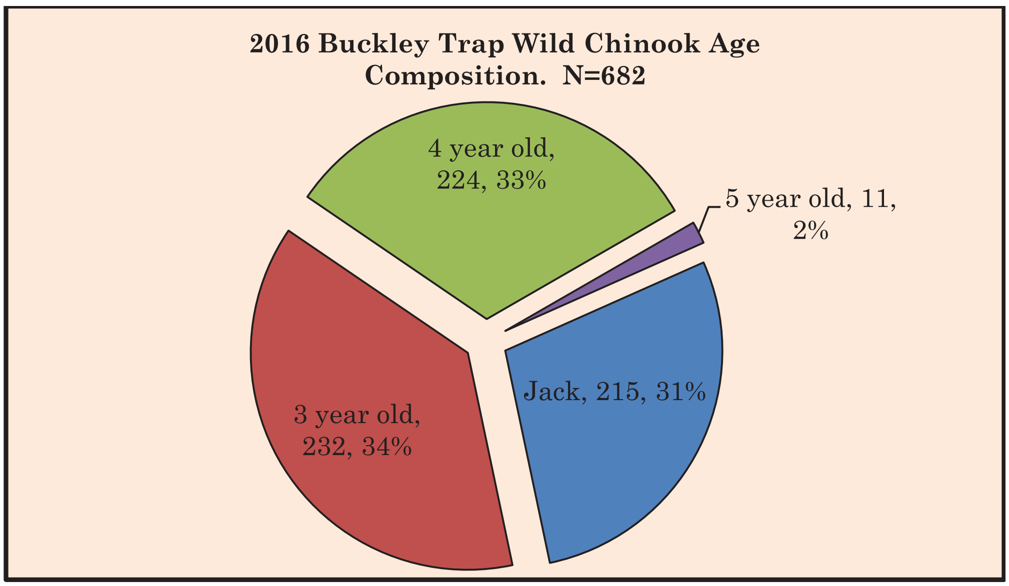
2017: Age breakdown of wild adult and jack Chinook sampled in the USACE fish trap.



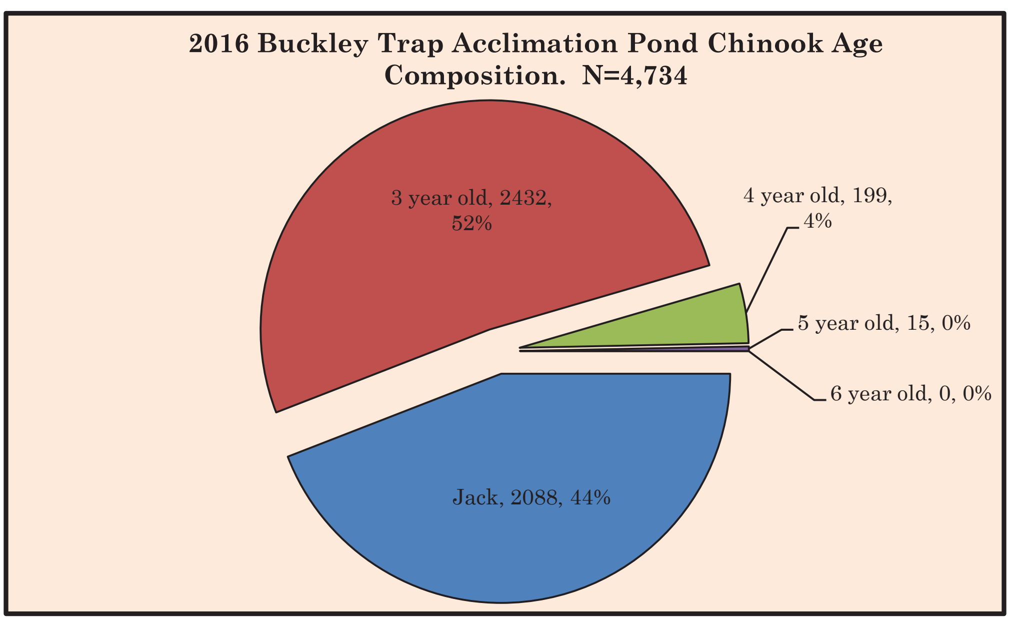
2017: Breakdown of adult and jack acclimation pond Chinook age sampled in the USACE fish trap.



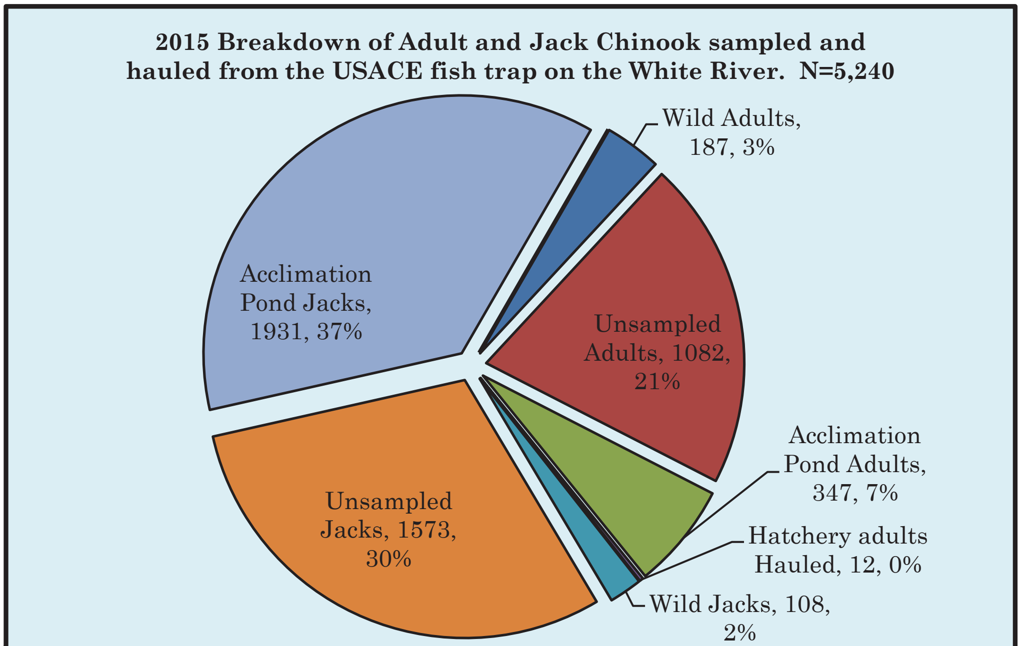
2016: Total number of Chinook hauled from the USACE fish trap including wild, acclimation and White River hatchery.



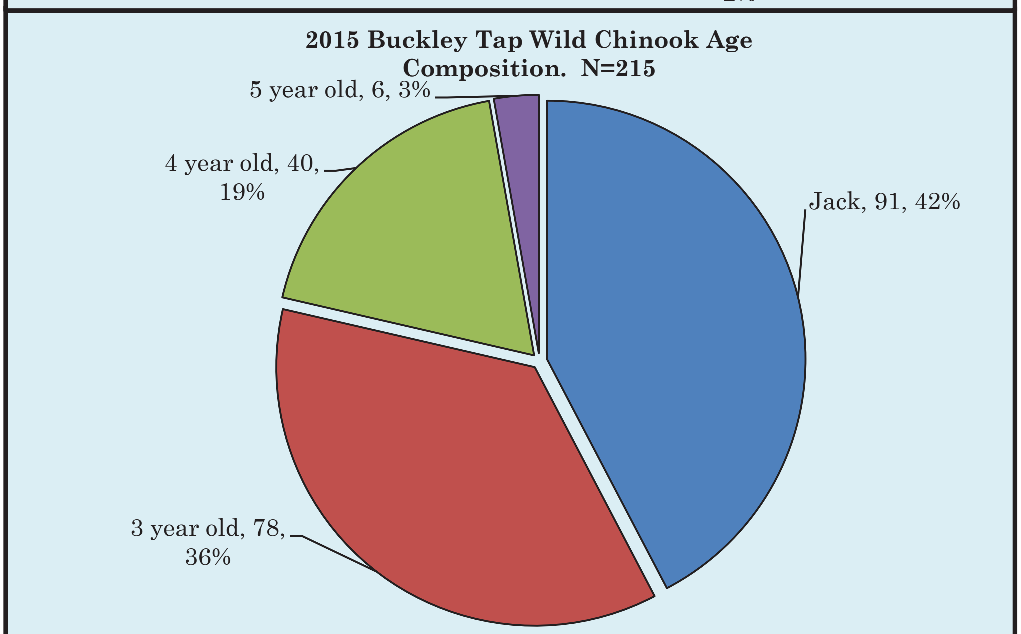
2016: Age breakdown of wild adult and jack Chinook sampled in the USACE fish trap.



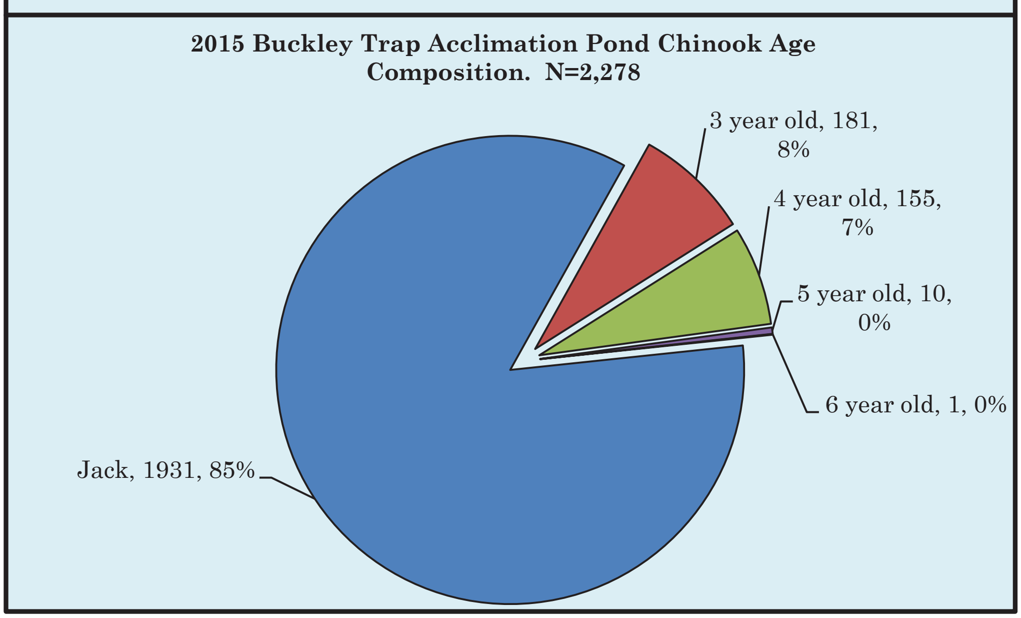
2016: Breakdown of adult and jack acclimation pond Chinook sampled in the USACE fish trap.



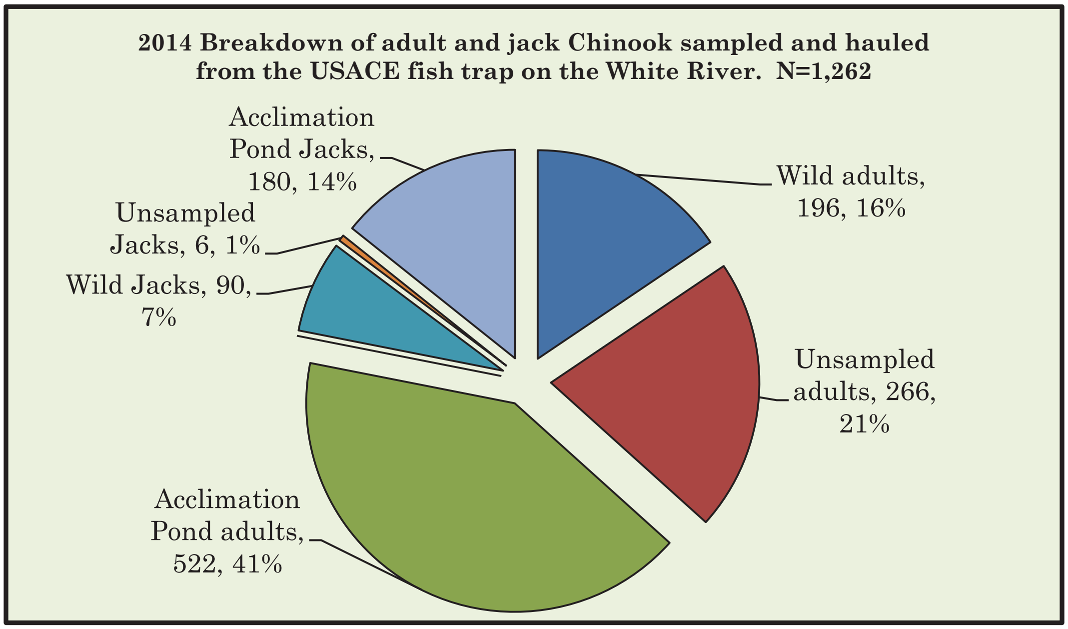
2015: Total number of Chinook sampled/unsampled and hauled from the USACE fish trap including wild, acclimation and White River hatchery.



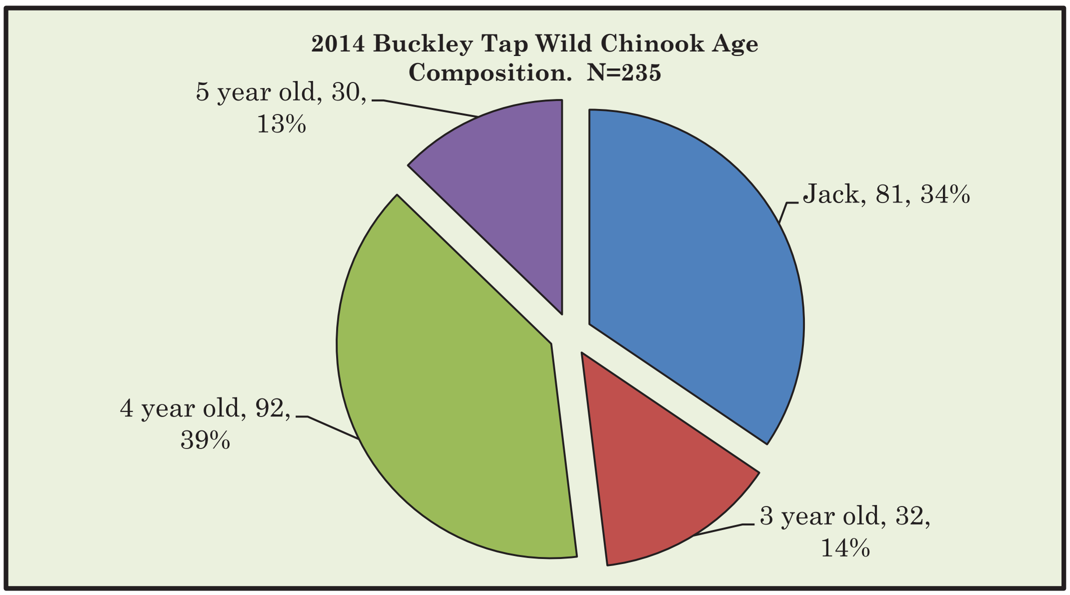
2015: Age breakdown of wild adult and jack Chinook sampled in the USACE fish trap.



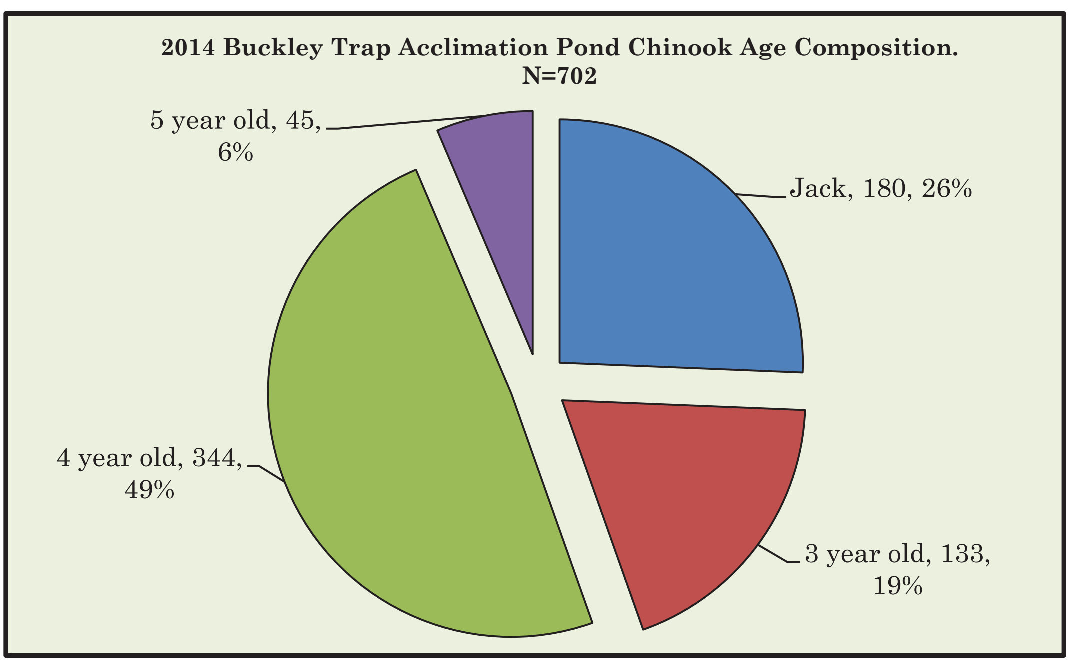
2015: Breakdown of adult and jack acclimation pond Chinook sampled in the USACE fish trap.



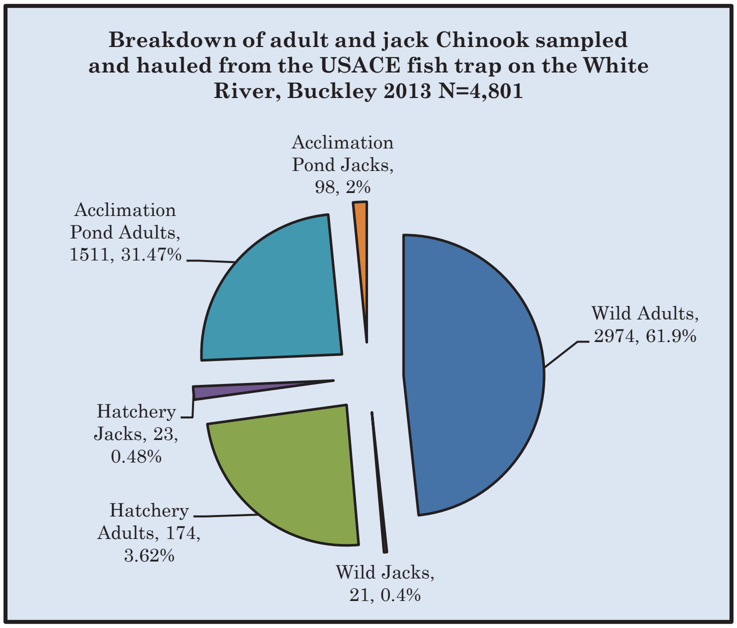
2014: Total number of Chinook sampled/unsampled and hauled from the USACE fish trap including wild, acclimation and White River hatchery.



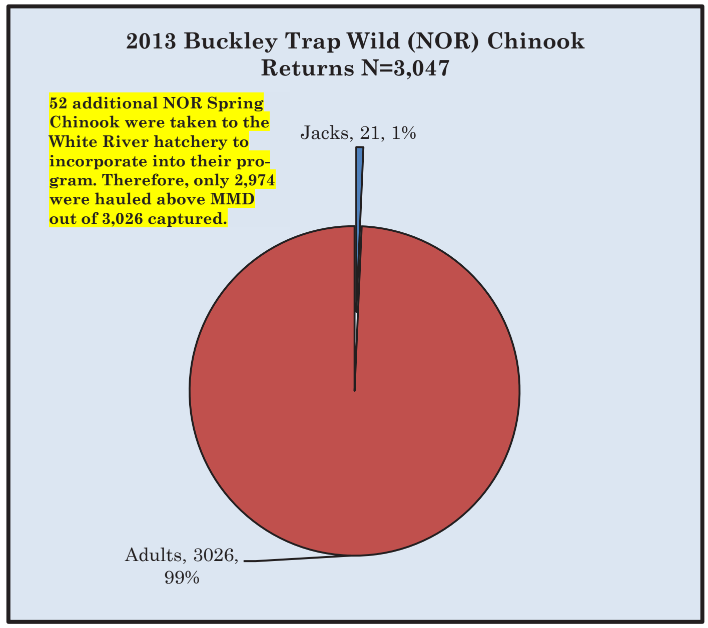
2014: Age breakdown of wild adult and jack Chinook sampled in the USACE fish trap.



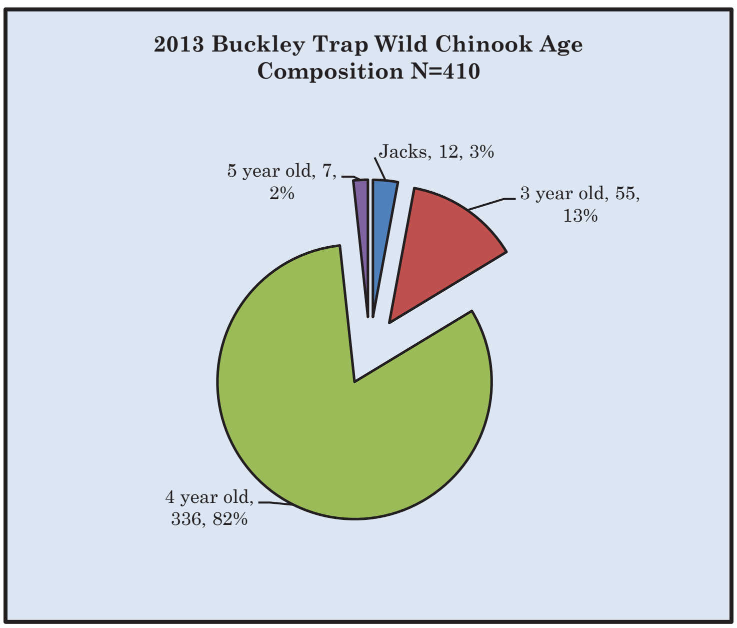
2014: Breakdown of adult and jack acclimation pond Chinook sampled in the USACE fish trap.



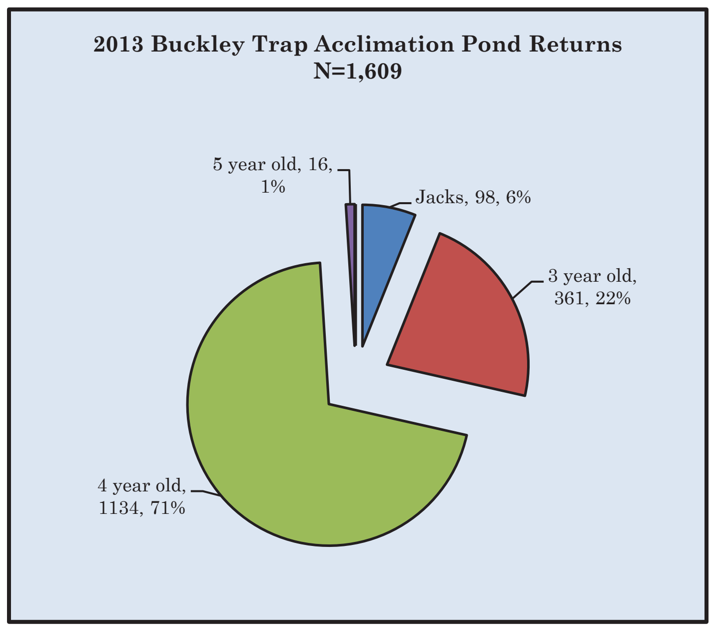
2013: Total number of Chinook sampled in the USACE fish trap including wild, acclimation and White River hatchery.



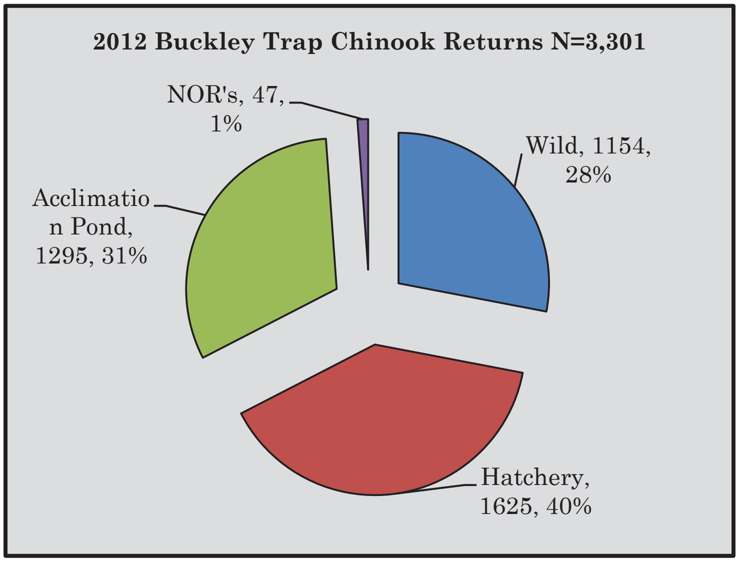
2013: Breakdown of adult and jack NOR's *(natural origin return)* sampled in the USACE fish trap.



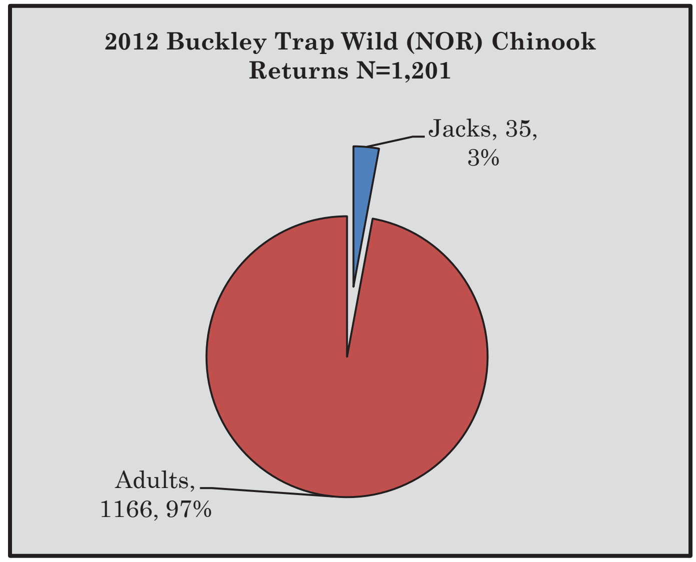
2013: Age breakdown of wild adult and jack Chinook sampled in the USACE fish trap.



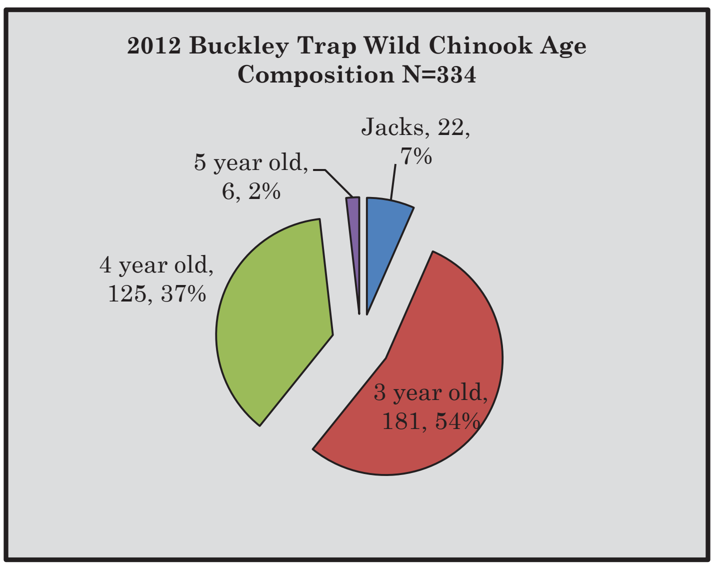
2013: Breakdown of adult and jack acclimation pond Chinook sampled in the USACE fish trap.



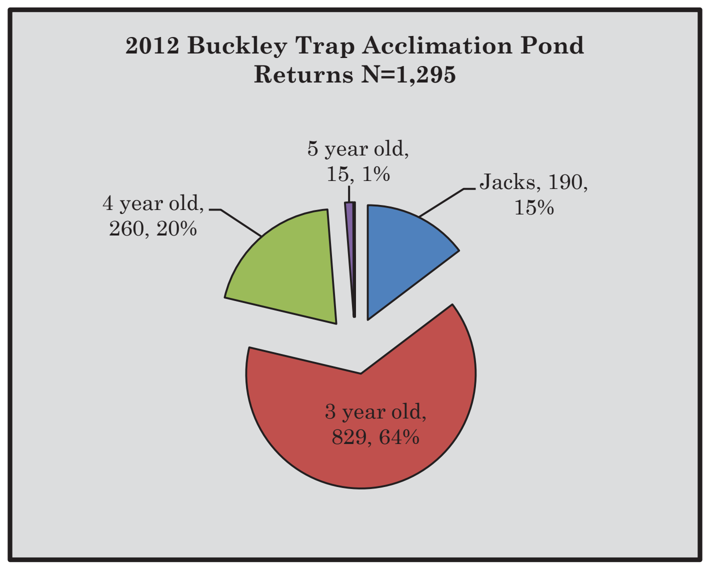
2012: Total number of Chinook sampled in the USACE fish trap including wild, acclimation and White River hatchery.



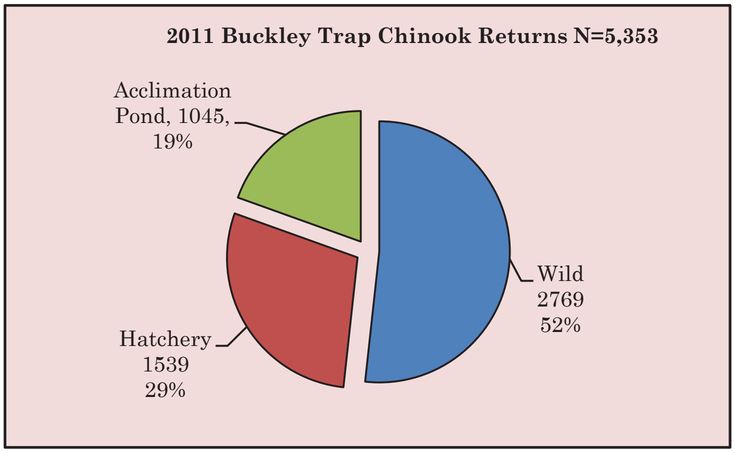
2012: Breakdown of adult and jack NOR's *(natural origin return)* sampled in the USACE fish trap.



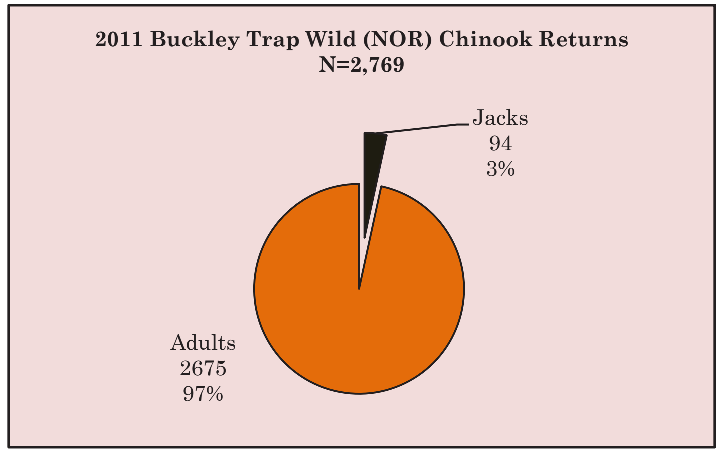
2012: Age breakdown of wild adult and jack Chinook sampled in the USACE fish trap.



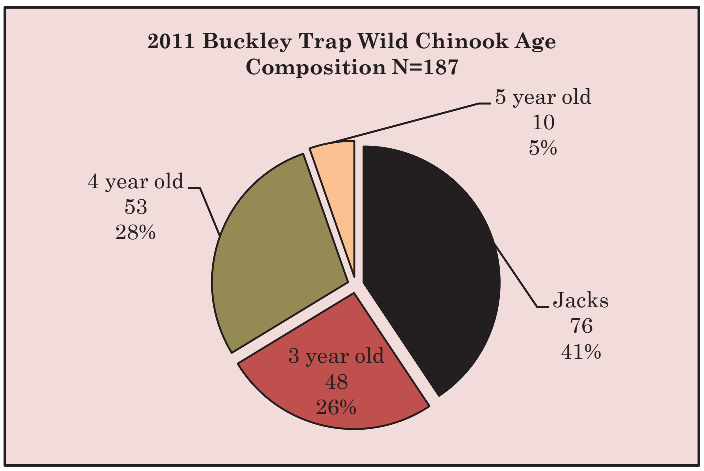
2012: Breakdown of adult and jack acclimation pond Chinook sampled in the USACE fish trap.



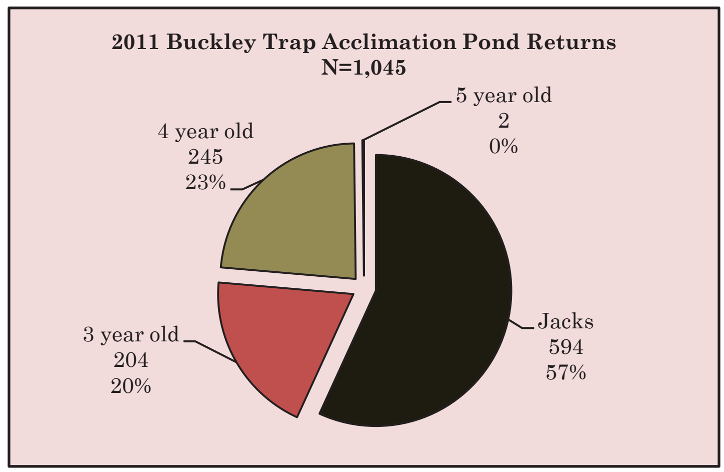
2011: Total number of Chinook sampled in the USACE fish trap including wild, acclimation and White River hatchery.



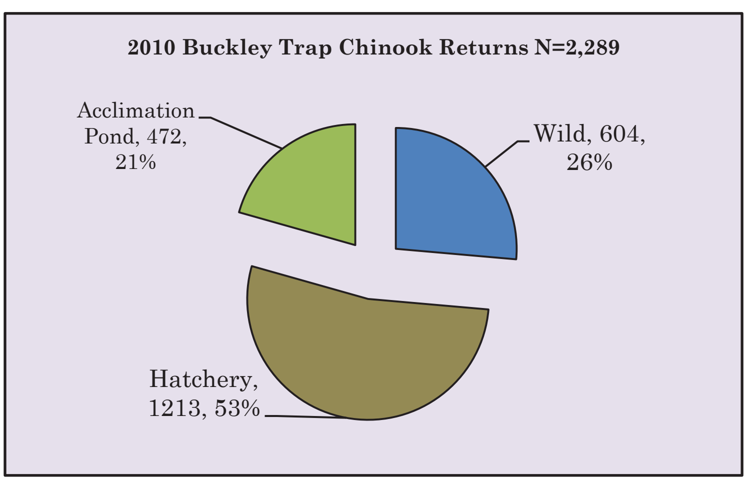
2011: Breakdown of adult and jack NOR's *(natural origin return)* sampled in the USACE fish trap.



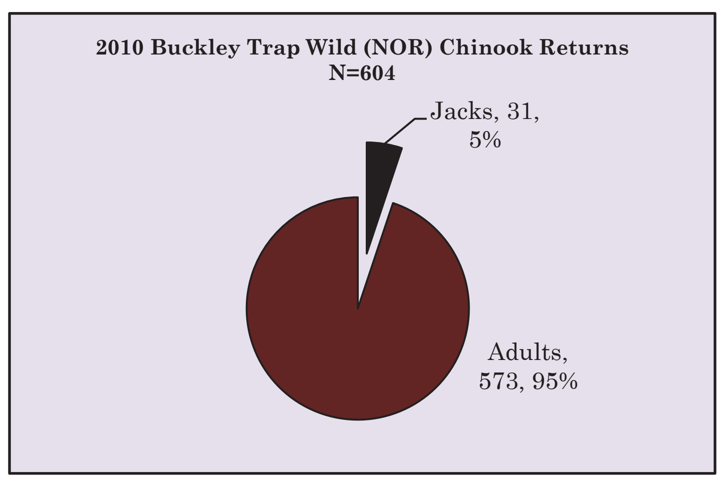
2011: Age breakdown of wild adult and jack Chinook sampled in the USACE fish trap.



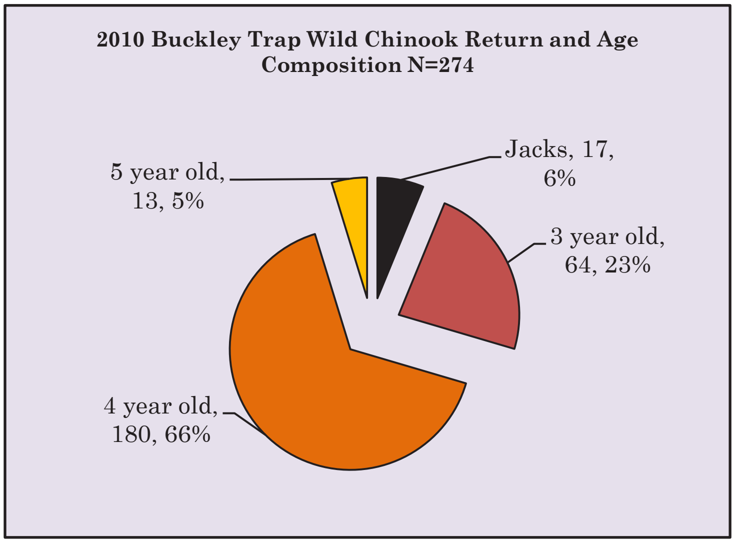
2011: Breakdown of adult and jack acclimation pond Chinook sampled in the USACE fish trap.



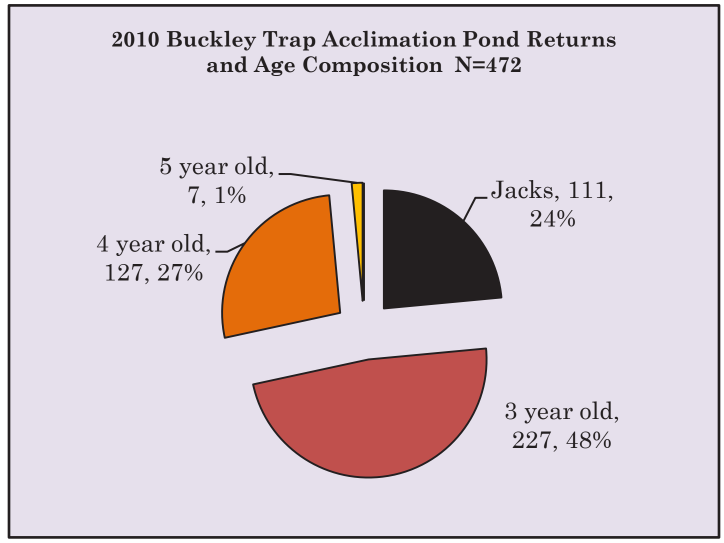
2010: Total number of Chinook sampled in the USACE fish trap including wild, acclimation and White River hatchery.



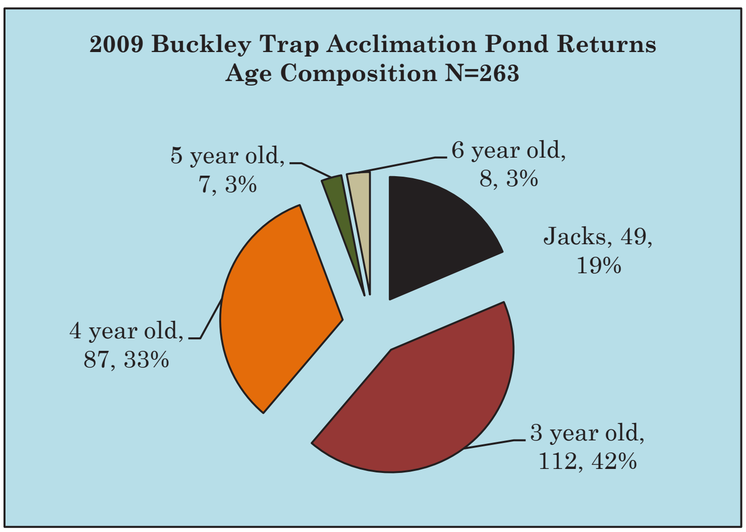
2010: Breakdown of adult and jack NOR's *(natural origin return)* sampled in the USACE fish trap.



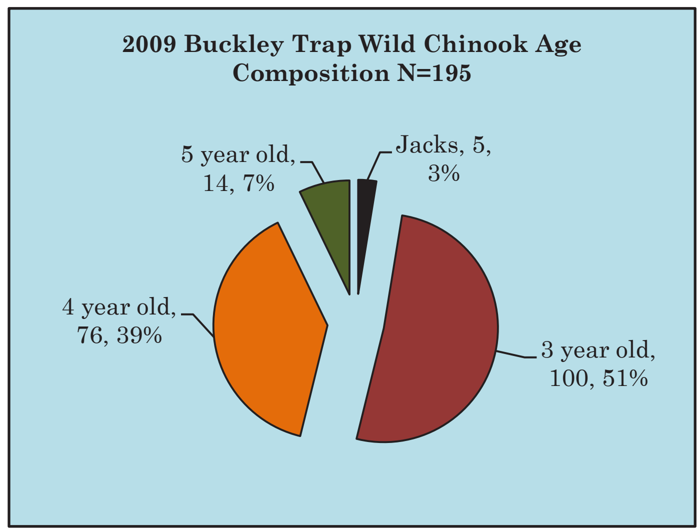
2010: Age breakdown of wild adult and jack Chinook sampled in the USACE fish trap.



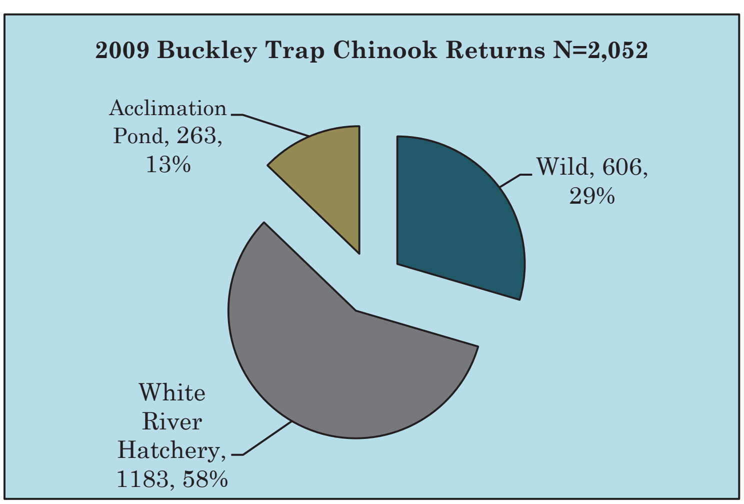
2010: Breakdown of adult and jack acclimation pond Chinook sampled in the USACE fish trap.



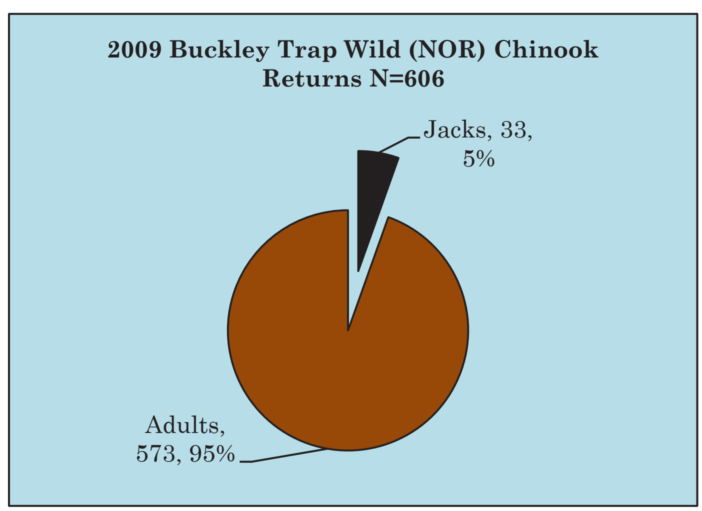
2009: Breakdown of adult and jack acclimation pond Chinook sampled in the USACE fish trap.



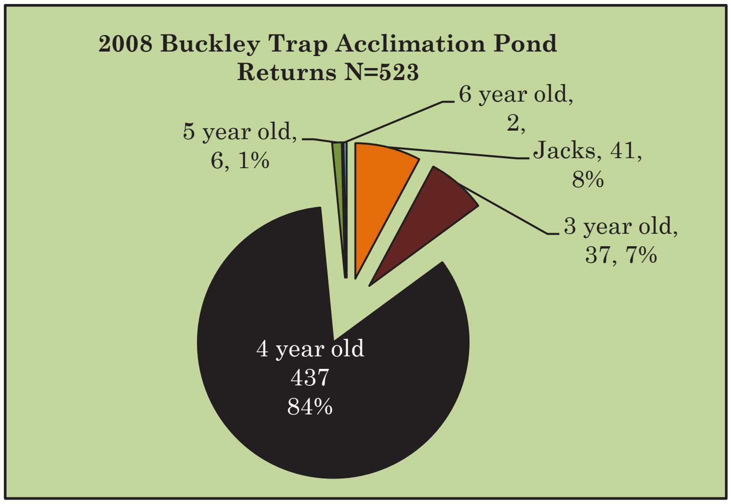
2009: Breakdown of adult and jack NOR's *(natural origin return)* sampled in the USACE fish trap.



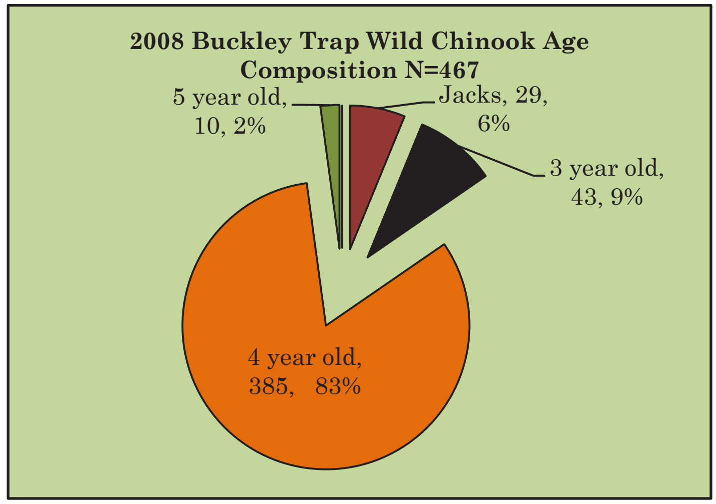
2009: Total number of Chinook sampled in the USACE fish trap including wild, acclimation and White River hatchery.



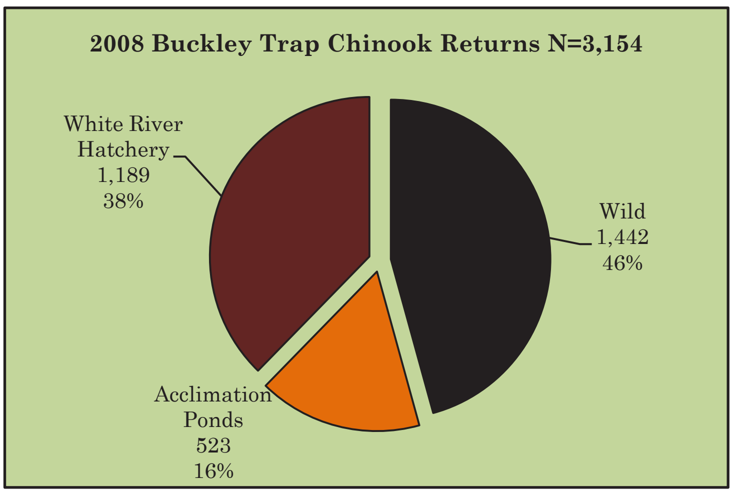
2009: Age breakdown of wild adult and jack Chinook sampled in the USACE fish trap.



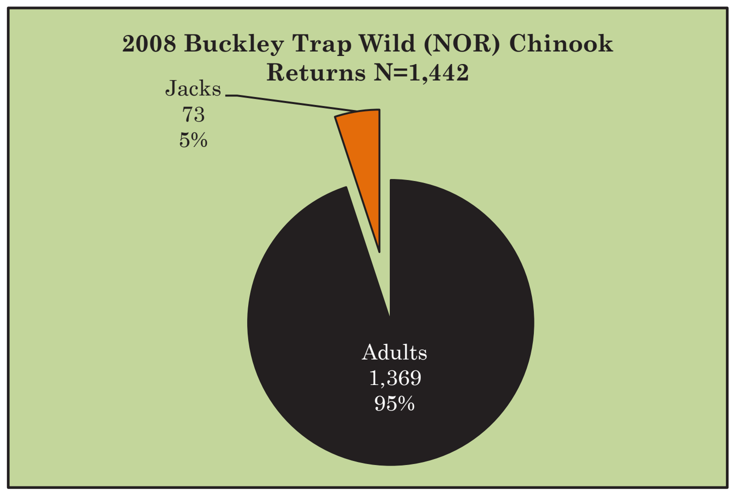
2008: Breakdown of adult and jack acclimation pond Chinook sampled in the USACE fish trap.



2008: Breakdown of adult and jack NOR's *(natural origin return)* sampled in the USACE fish trap.

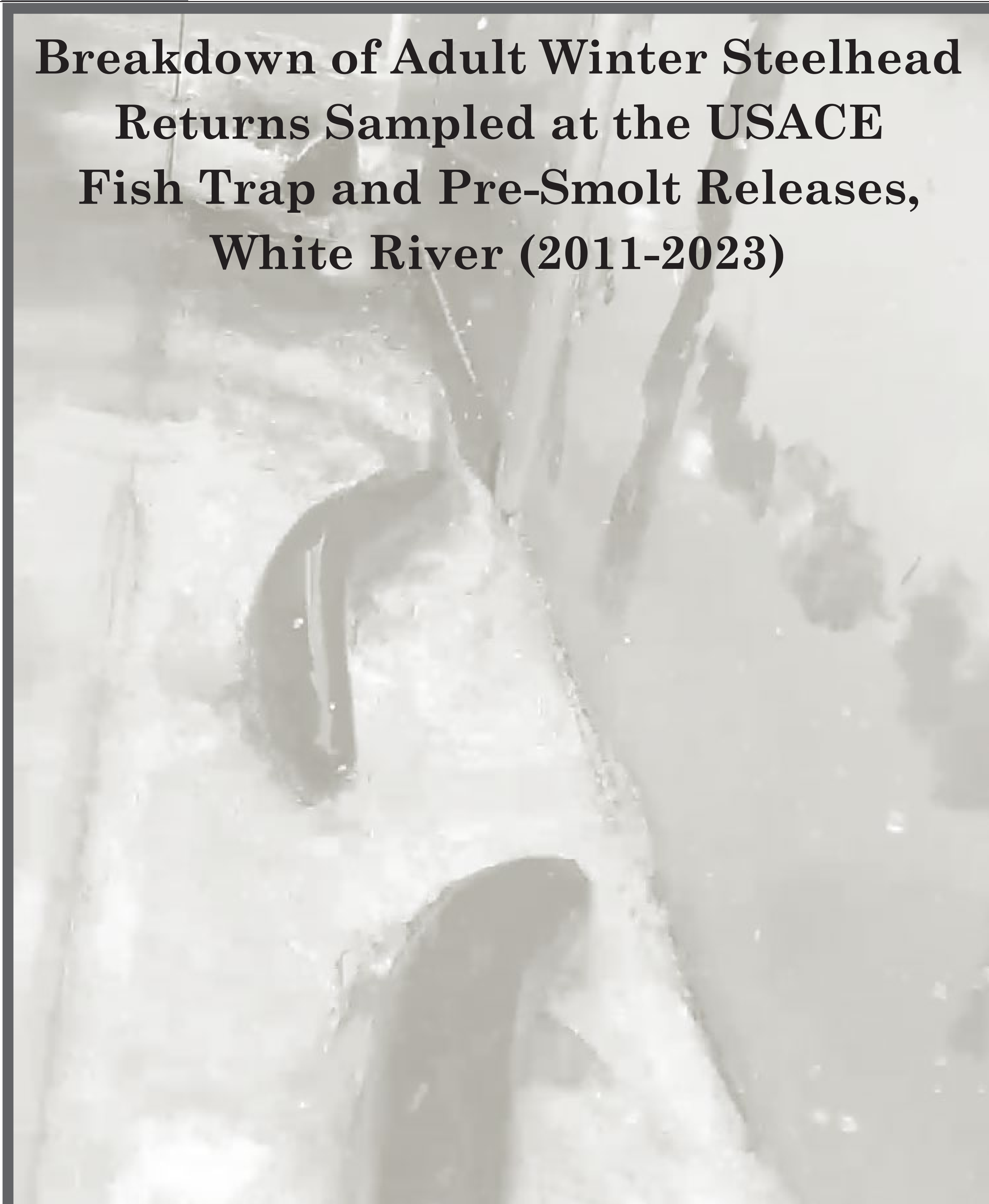


2008: Total number of Chinook sampled in the USACE fish trap including wild, acclimation and White River



2008: Age breakdown of wild adult and jack Chinook sampled in the USACE fish trap.

Breakdown of Adult Winter Steelhead Returns Sampled at the USACE Fish Trap and Pre-Smolt Releases, White River (2011-2023)



APPENDIX F

Winter Steelhead Adult Returns Sampled at USACE Fish Trap and Pre-Smolts Released, White River (2011-2023)

YEAR SAMPLED/ RELEASED	ADULTS N=	ADULTS WILD/NOR	*FISH TAKEN FOR BROOD-STOCK PROGRAM	ADULTS WITH ‡BWT (PROGAM FISH)	PRE-SMOLTS RELEASED (BROOD YEAR) [RELEASE SITE]
2023	117	88	0	29	Program discontinued in 2022 due to insufficient brood-stock availability.
2022	205	170	0	35	21,950 (2021) [Jensen Cr. Acclimation Pond]
2021	150	122	12	16	28,823 (2020) [Twentyeight Mile Cr. Acclimation Pond]
2020	394	293	24	77	30,200 (2019) [Direct plant into Clearwater River]
2019	547	447	24	76	34,550 (2018) [Twentyeight Mile Cr. Acclimation Pond]
2018	795	582	24	189	30,000 (2017) [Jensen Cr. Acclimation Pond]
2017	385	288	26	71	27,625 (2016) [Twentyeight Mile Cr. Acclimation Pond]
†2016	533	476	23	34	29,920 (2015) [Jensen Cr. Acclimation Pond]
†2015	319	273	26	20	31,219 (2014) [Jensen Cr. Acclimation Pond]
2014	479	392	23	64	49,998 (2013) [Huckleberry Cr. Acclimation Pond]
2013	574	338	28	208	27,990 (2012) [Muckleshoot Hatchery]
2012	578	345	24	209	31,129 (2011) [Muckleshoot Hatchery]
2011	539	164	22	353	27,876 (2010) [Muckleshoot Hatchery]

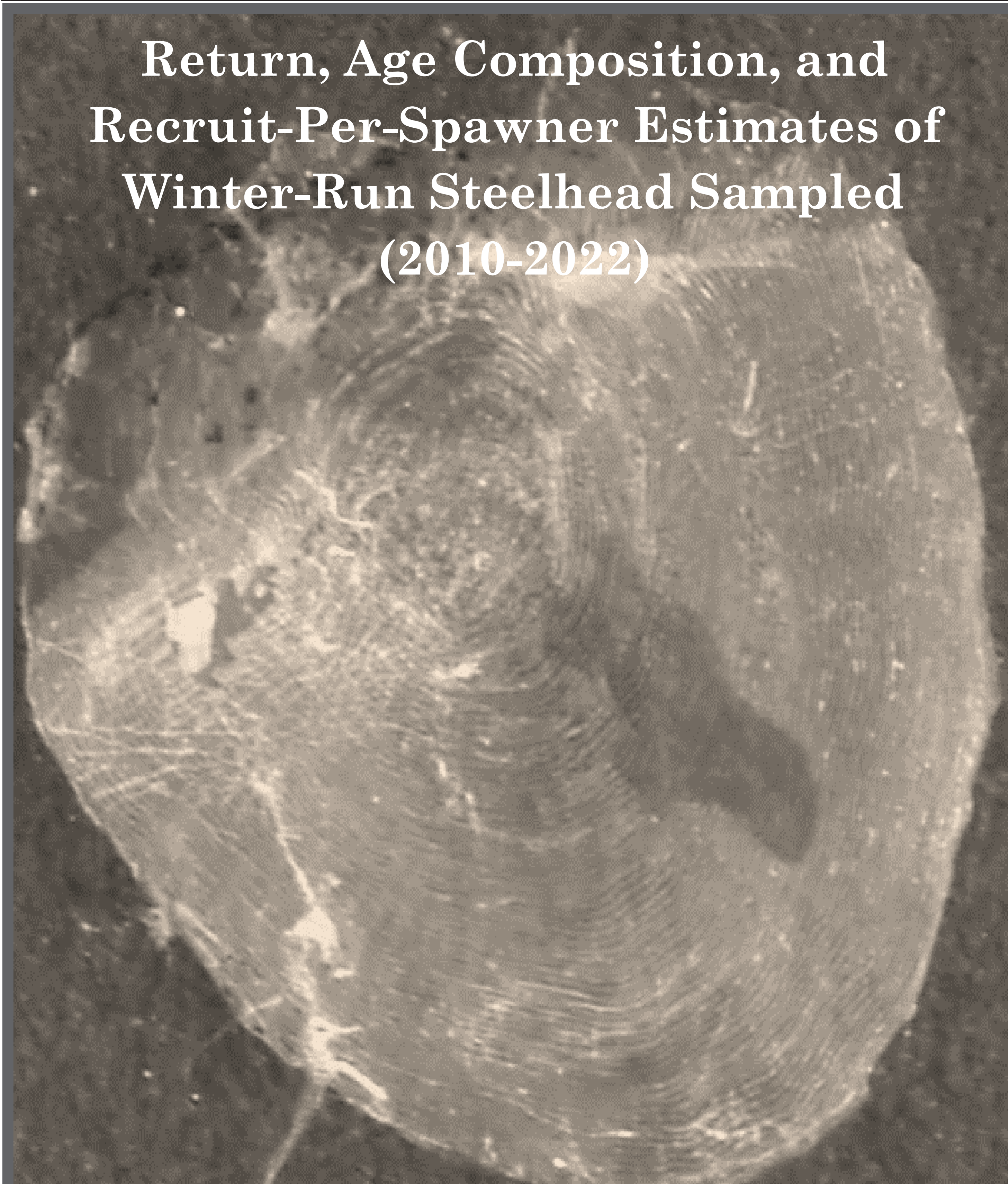
Adult steelhead sampling conducted by Puyallup Tribal Fisheries. See Appendix G for additional steelhead sampling results. See Appendix D for current salmon and steelhead acclimation pond sites.

*During the spring of 2006, in response to the declining number of winter steelhead, the Puyallup and Muckleshoot Tribes; as well as the Washington Department of Fish and Wildlife, began a steelhead supplementation pilot project developed for the White River. Since 2014, the Puyallup Tribe has assumed the sole responsibility for the continuance of this vital fish enhancement program. The primary goal of this project is to restore the run to a strong self-sustaining population. The project is currently funded and managed by the Puyallup Tribe and utilizes captured wild brood-stock from the USACE trap in Buckley to generate approximately 25K-35K+ yearling smolts. Program discontinued in 2022 due to insufficient brood-stock availability.

†An undetermined number of adult steelhead ascended above the Buckley diversion dam due to missing panels.

‡ Blank Wire Tag (BWT): Small piece of wire implanted in the snout that is the same as a Coded Wire Tag (CWT) implant minus the binary code.

Return, Age Composition, and Recruit-Per-Spawner Estimates of Winter-Run Steelhead Sampled (2010-2022)



Scale collection/sampling conducted by Puyallup Tribal Fisheries. Scale age reading conducted by WDFW.

APPENDIX G

Box 2-1. Ageing Steelhead (continued)

The Washington Department of Fish and Wildlife uses a modified version of the Narver and Withler (1971) scale aging method to age steelhead scales. This ageing method for steelhead consists of chronological arrangements of the following symbols:

"." = initial saltwater entry.

Arabic numerals = number of consecutive winters in freshwater or in saltwater. To qualify for a numeral the annulus must be followed by more widely spaced circuli (i.e.: spring or summer growth).

"+" = used for winter-run steelhead only, indicates less than one year in salt or freshwater, usually denotes spring and/or summer circuli but may include some winter circuli (after a period (".") a "+" denotes saltwater existence).

"S" = spawning check, represents approximately 1 to 6 months for winter-run fish or 6 to 12 months for summer-run fish.

"+S" = one chronological year for winter-run steelhead.

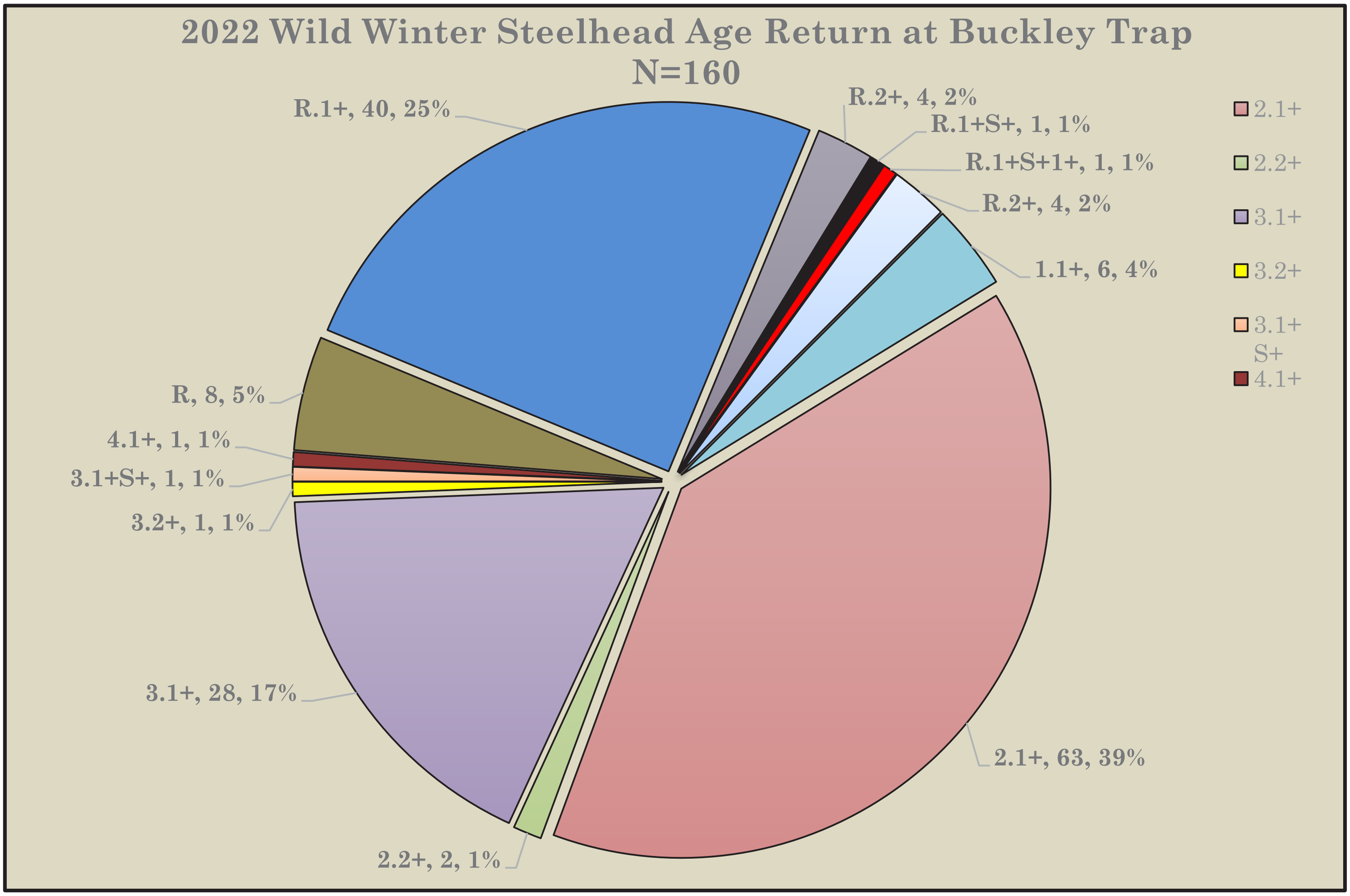
"W" = Wild designation, used to identify natural-origin steelhead that smolted and entered saltwater after one year in freshwater.

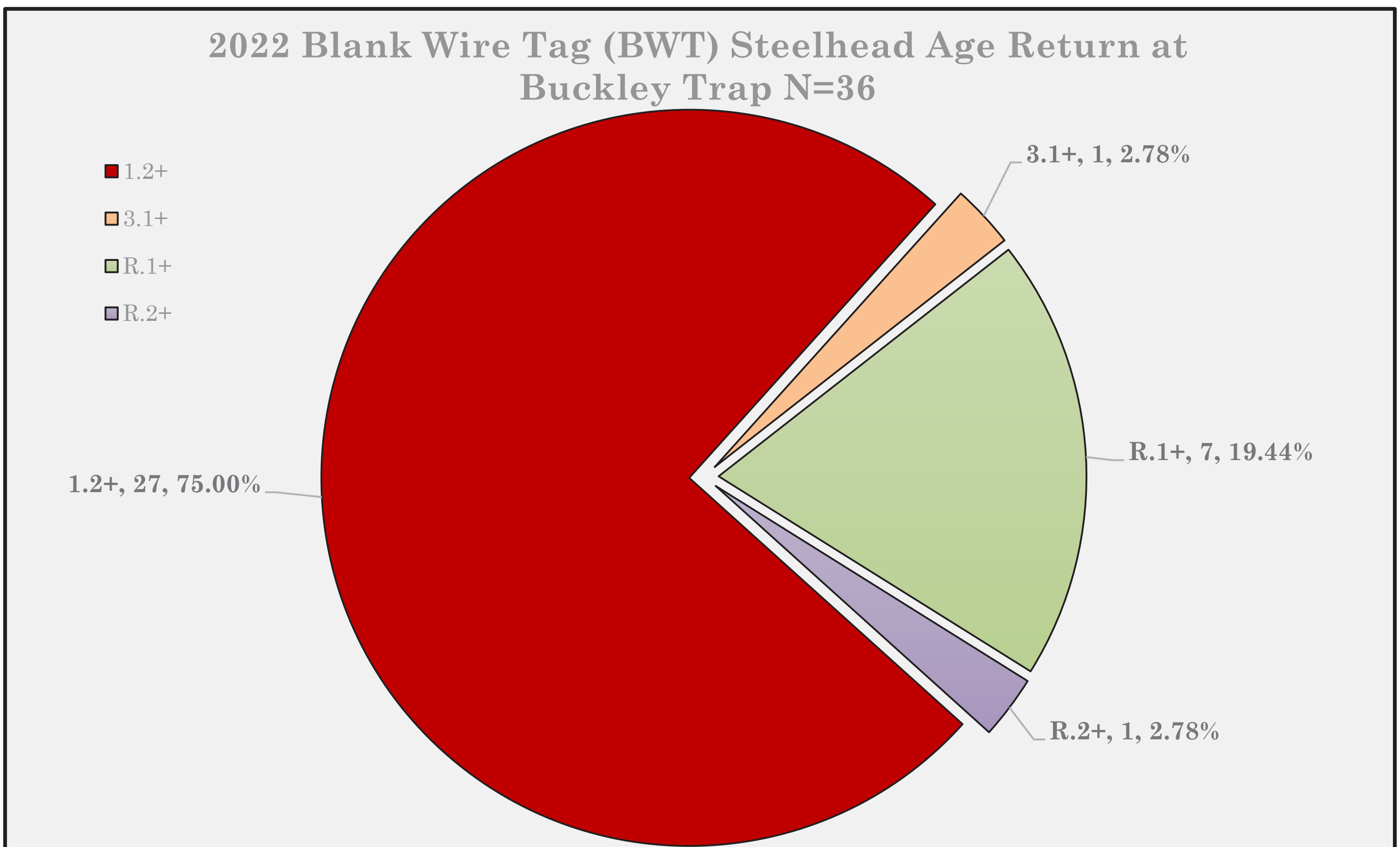
Combinations of freshwater age, total age, and the corresponding WDFW age designation for winter steelhead are illustrated in the table below.

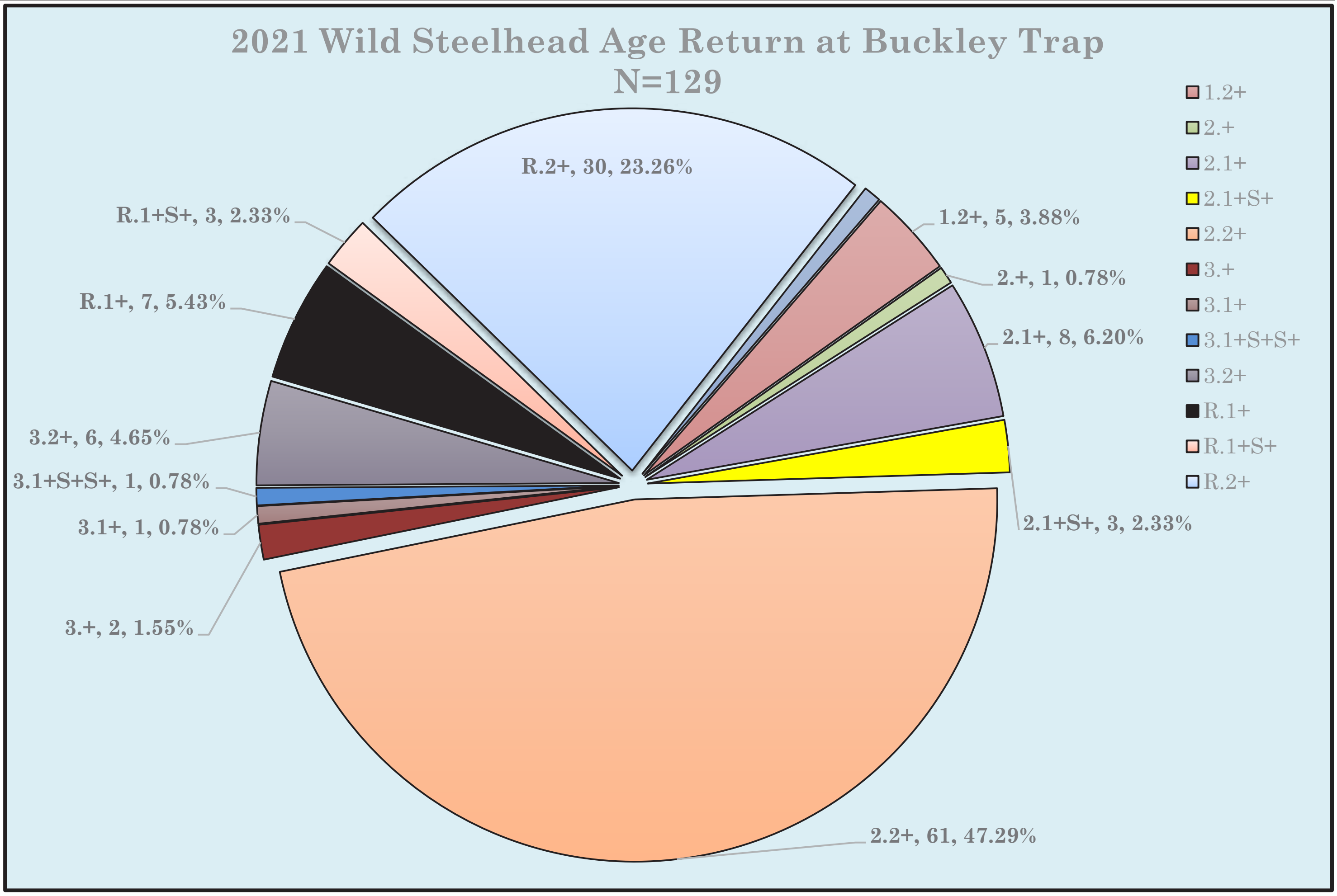
Freshwater winter(s)	Total age (years)				
	2	3	4	5	6
1	W1.+	W1.1+	W1.2+	W1.3+	
			W1.1+S+	W1.1+S+S+	W1.1+S+S+S+
				W1.2+S+	W1.2+S+S+
2		2.+	2.1+	2.2+	2.3+
			2.+S+	2.+S+S+	2.+S+S+S+
				2.1+S+	2.1+S+S+
					2.2+S+

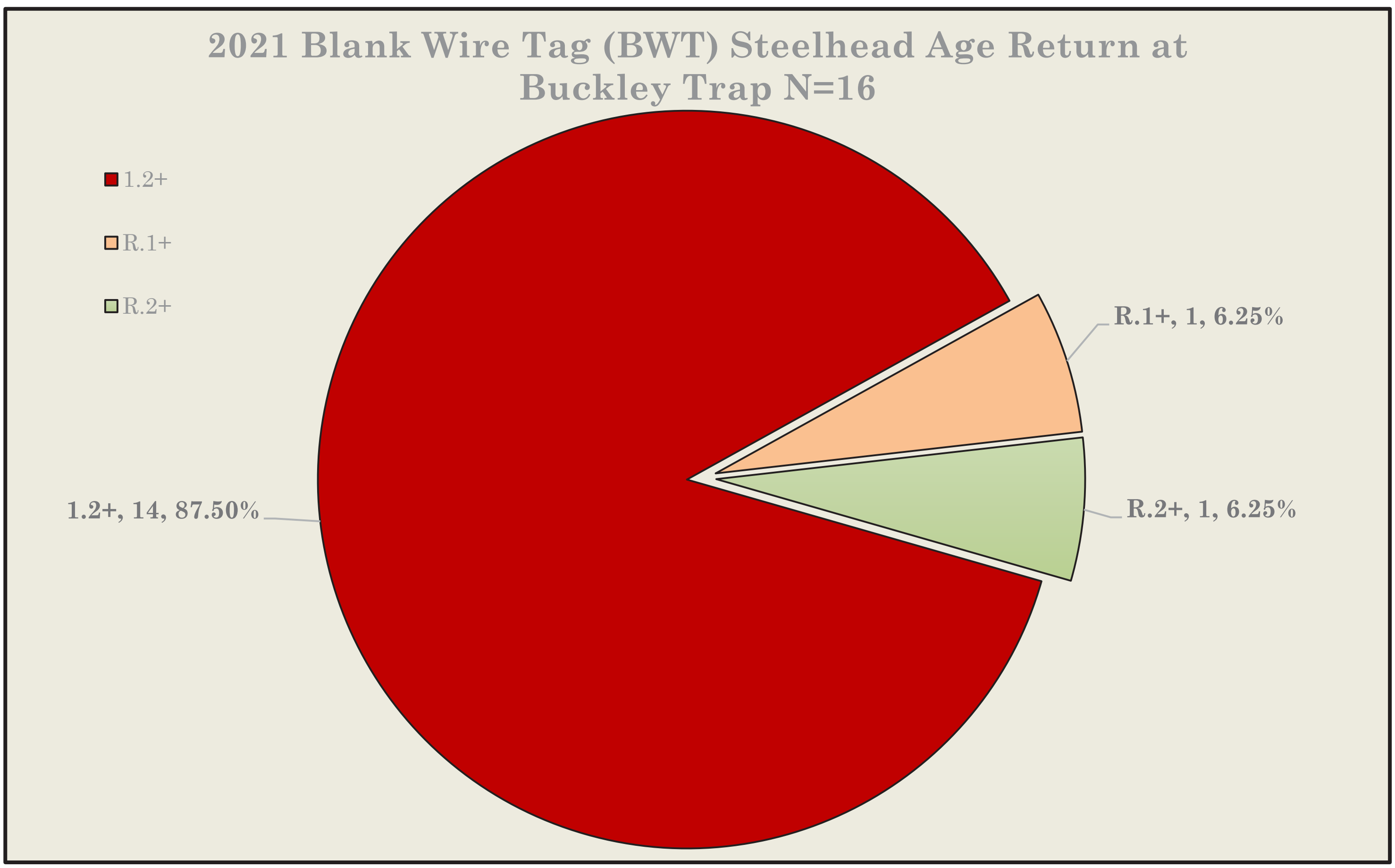
Source:
Oncorhynchus mykiss: Assessment of Washington State's Steelhead Populations and Programs.
Edited by: James B. Scott, Jr. and William T. Gill
Washington Department of Fish and Wildlife Olympia, Washington. February 1, 2008

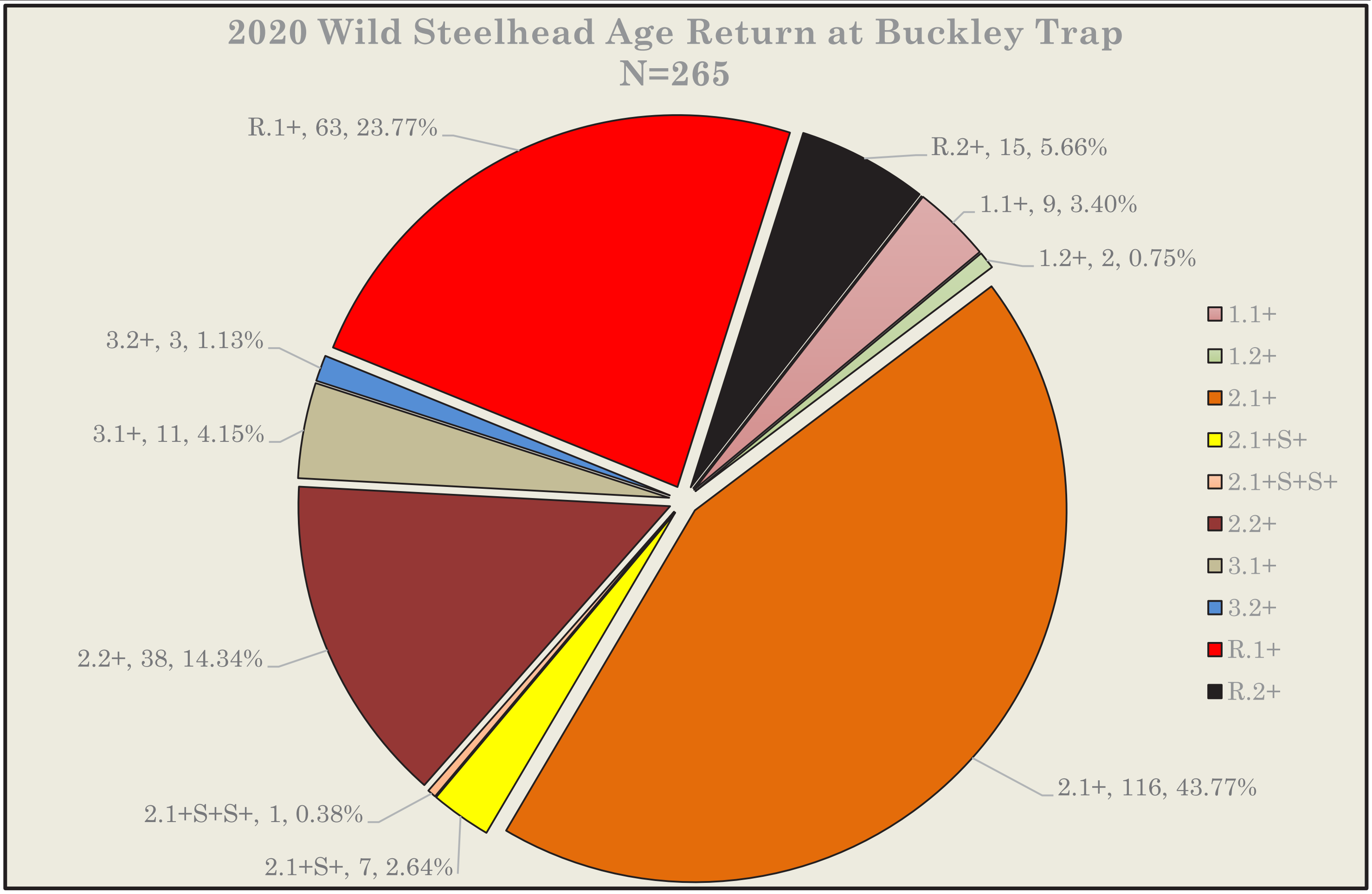
R= The slight <u>regeneration</u> of scales can result in the loss of this freshwater year.
H= Hatchery origin, program fish.

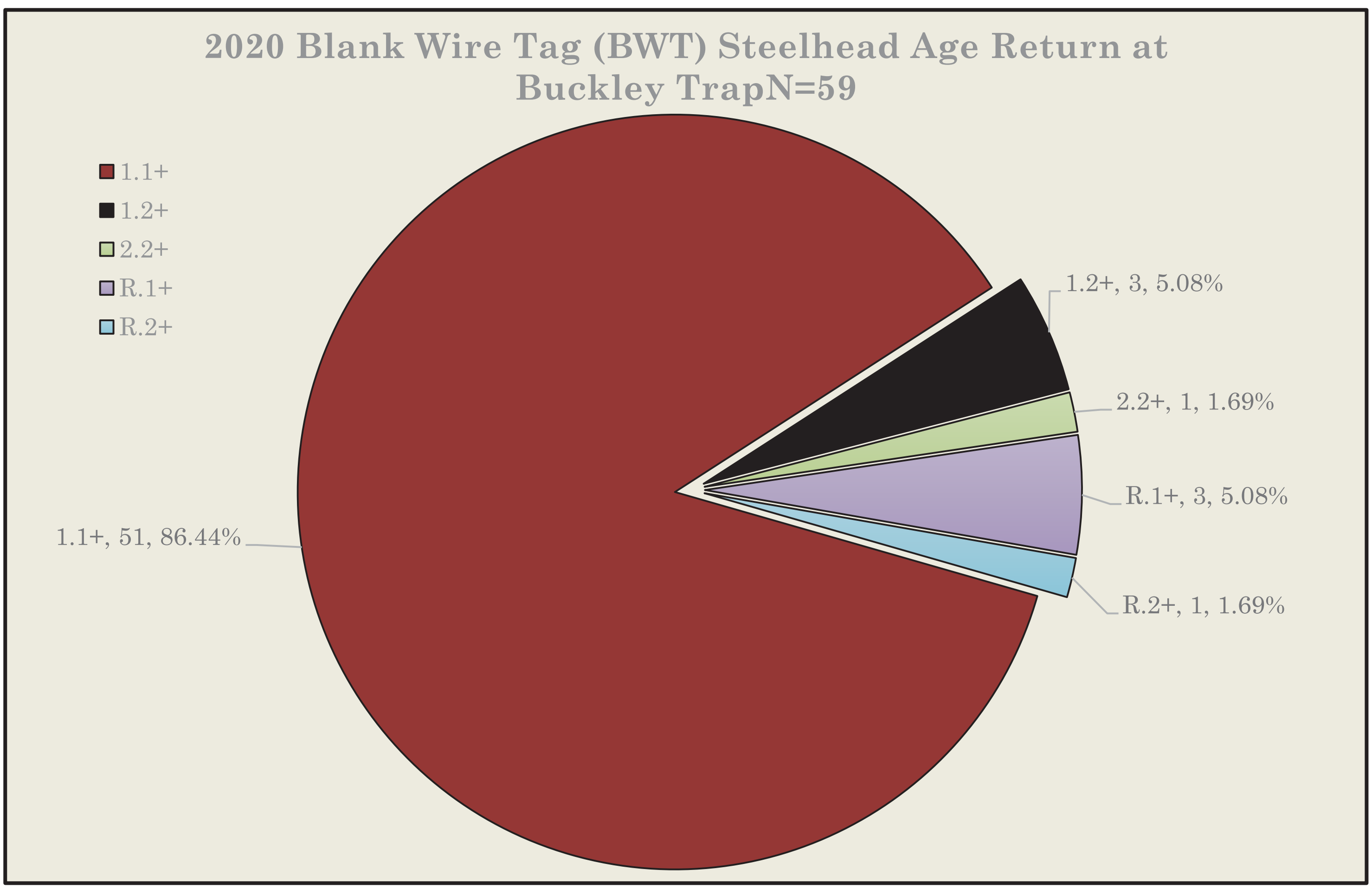

2022 Wild Winter Steelhead Age Return at Buckley Trap
N=160
R.1+, 40, 25%
R.2+, 4, 2%
R.1+S+, 1, 1%
R.1+S+1+, 1, 1%
R.2+, 4, 2%
1.1+, 6, 4%
R, 8, 5%
4.1+, 1, 1%
3.1+S+, 1, 1%
3.2+, 1, 1%
3.1+, 28, 17%
2.1+, 63, 39%
2.2+, 2, 1%
2.1+
2.2+
3.1+
3.2+
3.1+ S+
4.1+

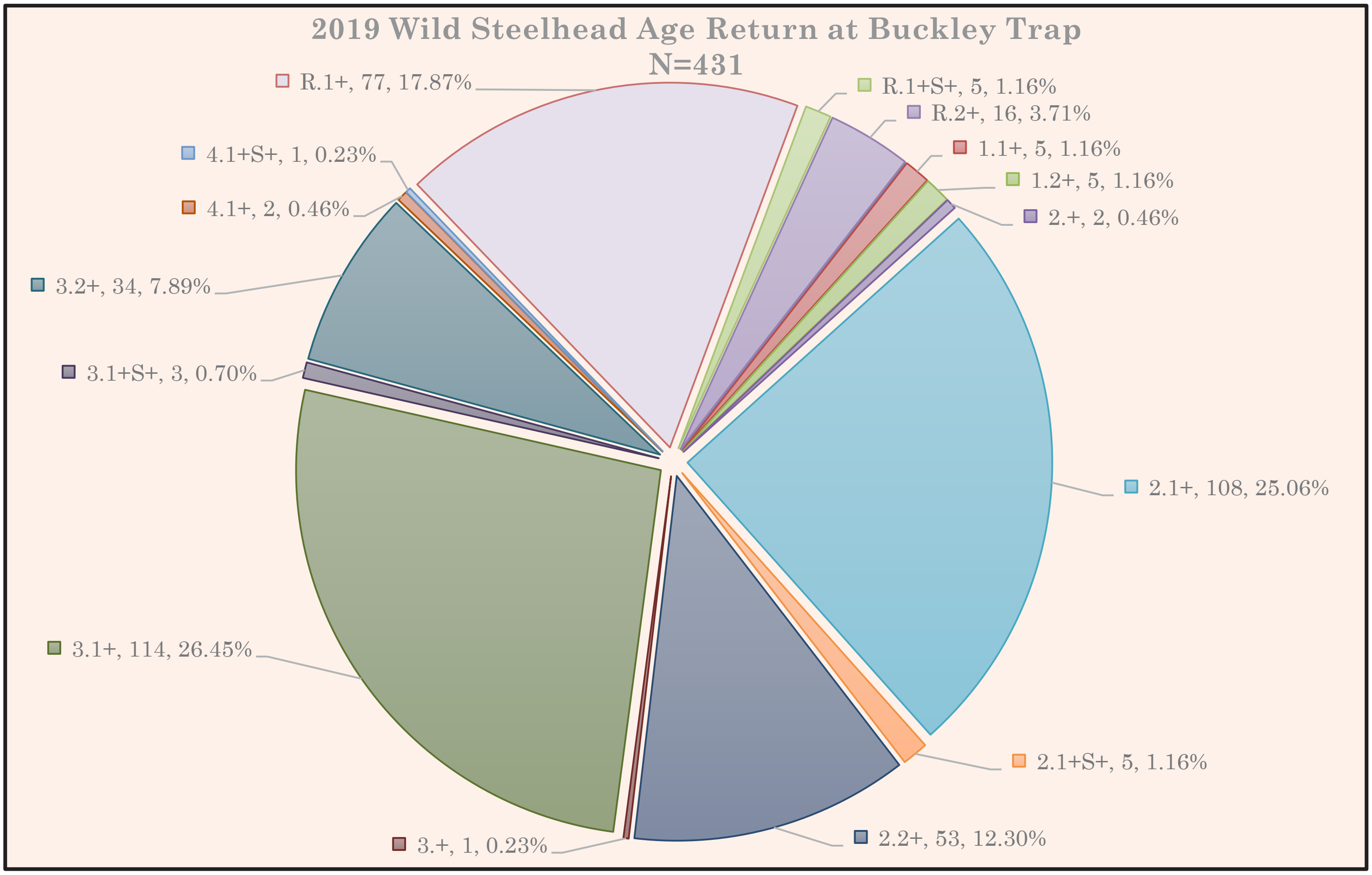

2022 Blank Wire Tag (BWT) Steelhead Age Return at Buckley Trap N=36
1.2+
3.1+
R.1+
R.2+
3.1+, 1, 2.78%
R.1+, 7, 19.44%
1.2+, 27, 75.00%
R.2+, 1, 2.78%


2021 Wild Steelhead Age Return at Buckley Trap
N=129
1.2+
2.+
2.1+
2.1+S+
2.2+
3.+
3.1+
3.1+S+S+
3.2+
R.1+
R.1+S+
R.2+
R.2+, 30, 23.26%
R.1+S+, 3, 2.33%
1.2+, 5, 3.88%
2.+, 1, 0.78%
R.1+, 7, 5.43%
2.1+, 8, 6.20%
3.2+, 6, 4.65%
3.1+S+S+, 1, 0.78%
3.1+, 1, 0.78%
2.1+S+, 3, 2.33%
3.+, 2, 1.55%
2.2+, 61, 47.29%

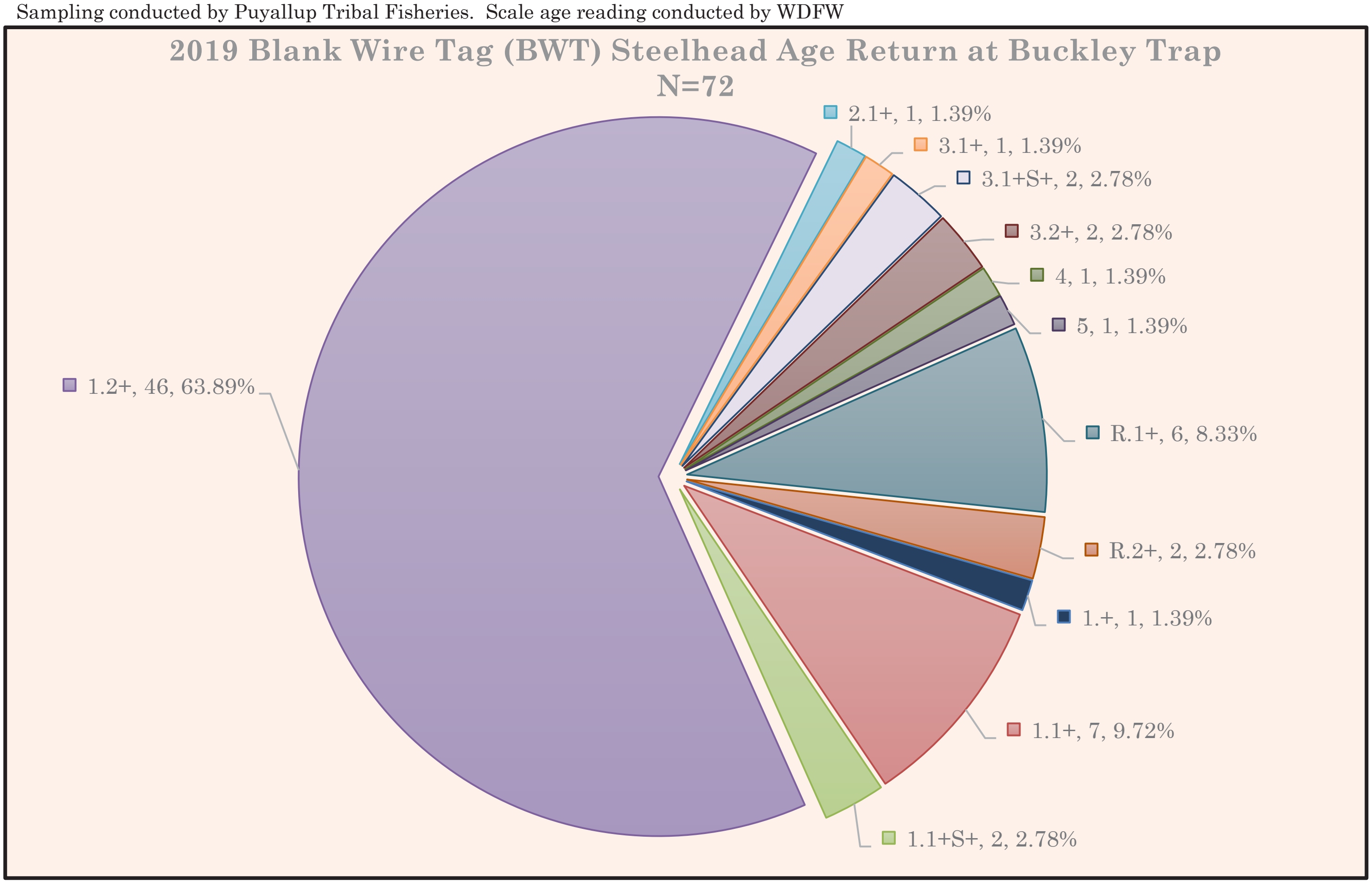

2021 Blank Wire Tag (BWT) Steelhead Age Return at
Buckley Trap N=16
1.2+
R.1+
R.2+
R.1+, 1, 6.25%
1.2+, 14, 87.50%
R.2+, 1, 6.25%

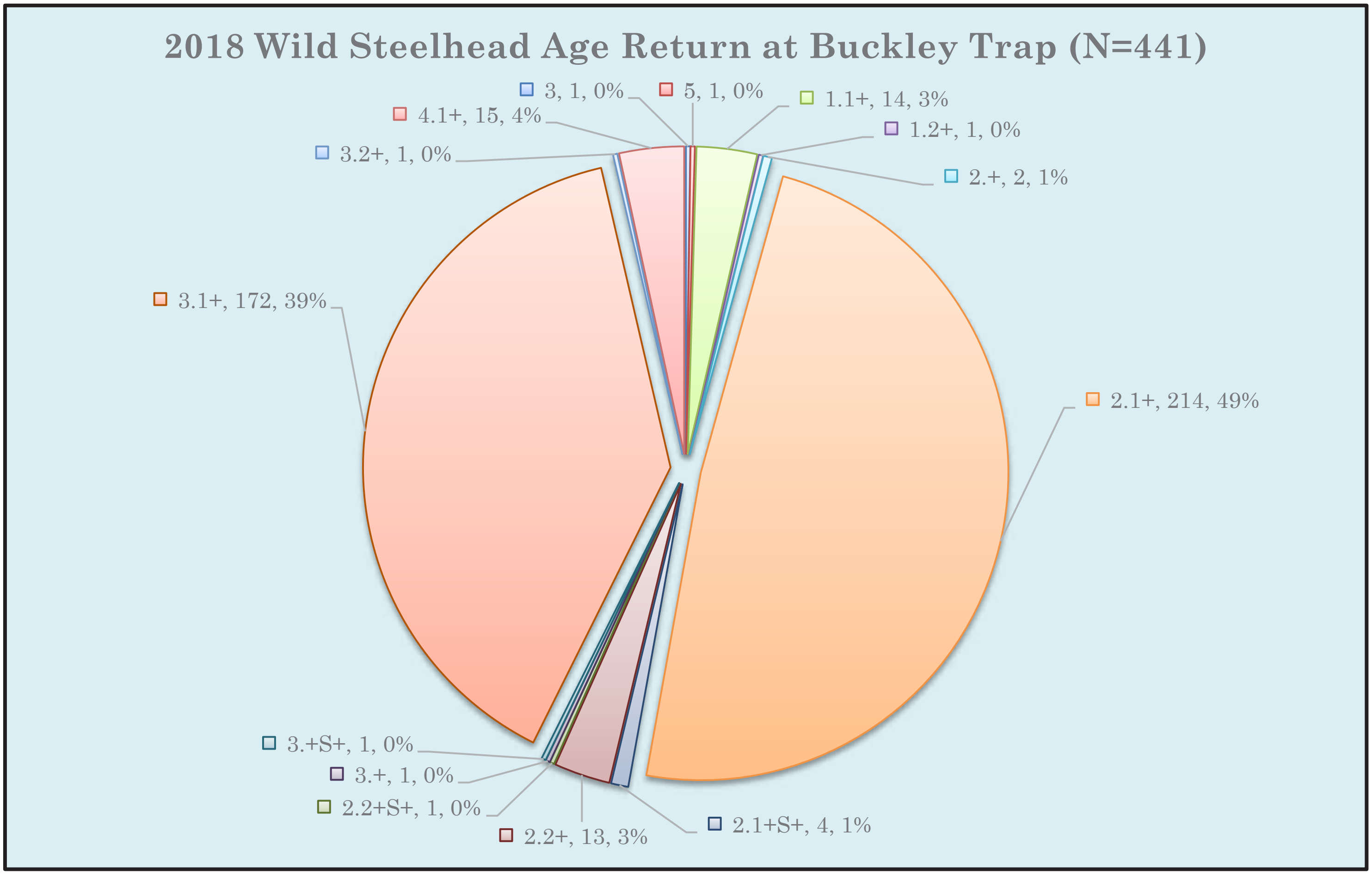

2020 Wild Steelhead Age Return at Buckley Trap
N=265
R.1+, 63, 23.77%
R.2+, 15, 5.66%
1.1+, 9, 3.40%
1.2+, 2, 0.75%
3.2+, 3, 1.13%
3.1+, 11, 4.15%
2.2+, 38, 14.34%
2.1+S+S+, 1, 0.38%
2.1+S+, 7, 2.64%
2.1+, 116, 43.77%
1.1+
1.2+
2.1+
2.1+S+
2.1+S+S+
2.2+
3.1+
3.2+
R.1+
R.2+


2020 Blank Wire Tag (BWT) Steelhead Age Return at Buckley TrapN=59
1.1+
1.2+
2.2+
R.1+
R.2+
1.2+, 3, 5.08%
2.2+, 1, 1.69%
R.1+, 3, 5.08%
R.2+, 1, 1.69%
1.1+, 51, 86.44%

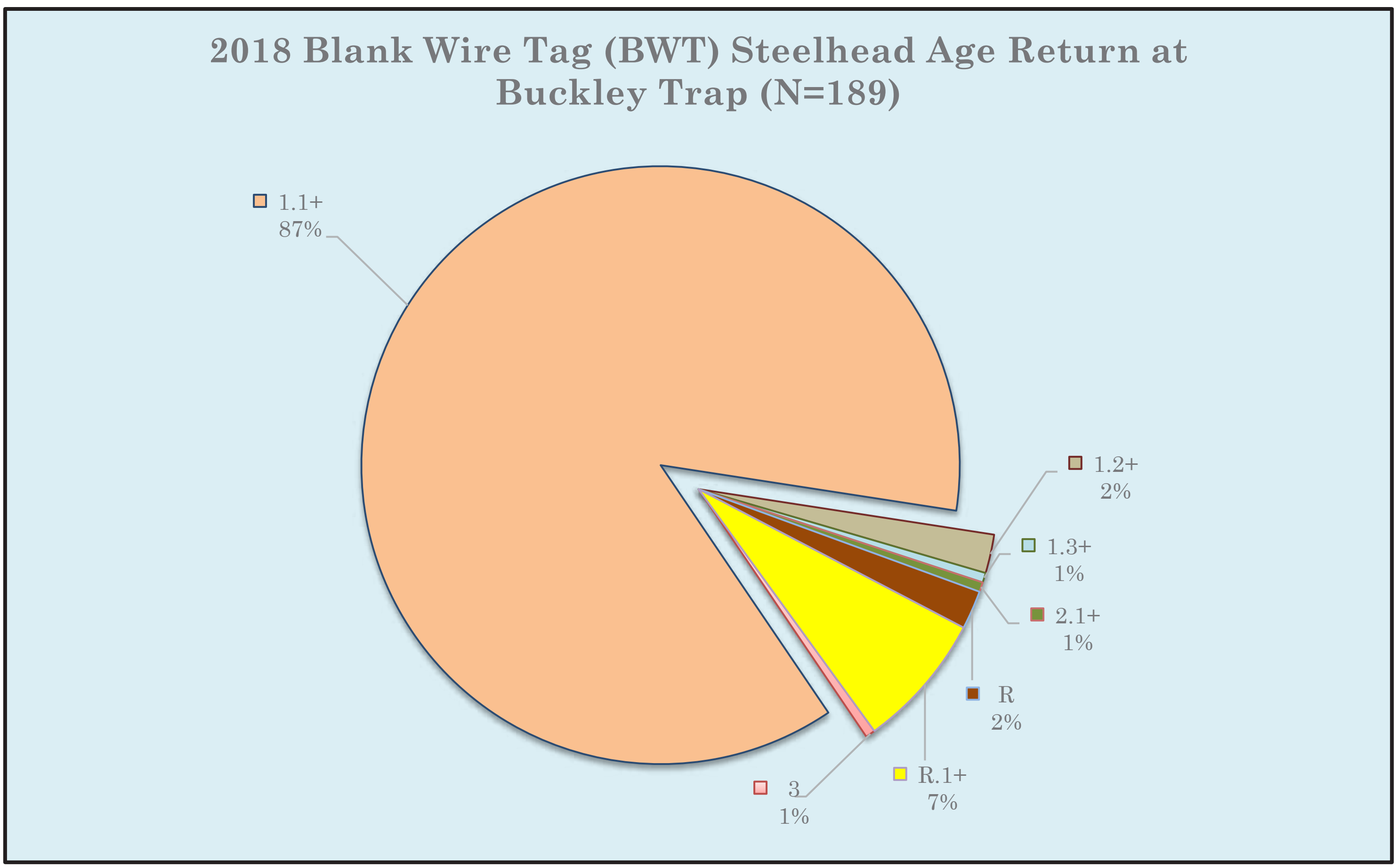


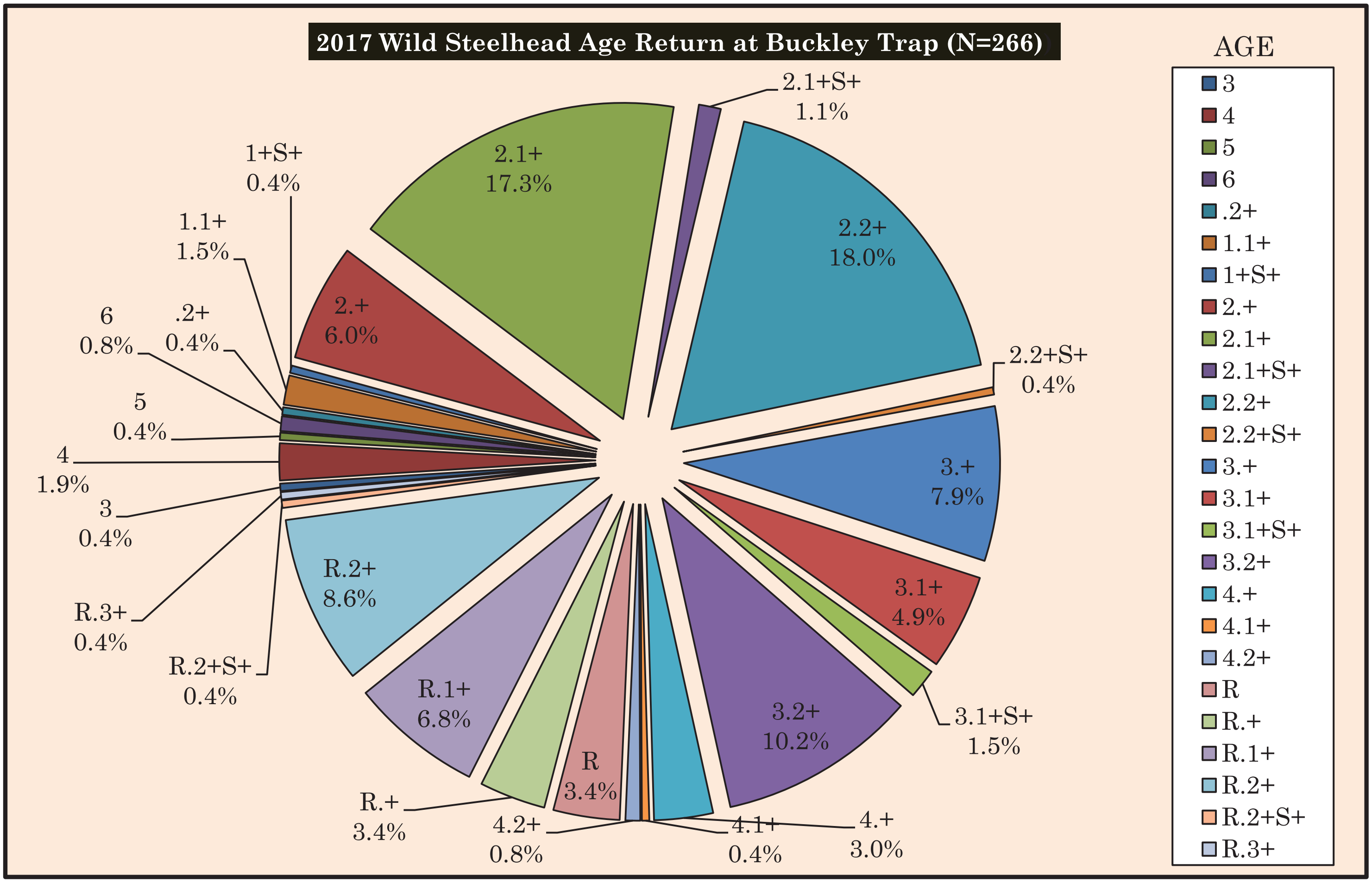
Sampling conducted by Puyallup Tribal Fisheries. Scale age reading conducted by WDFW



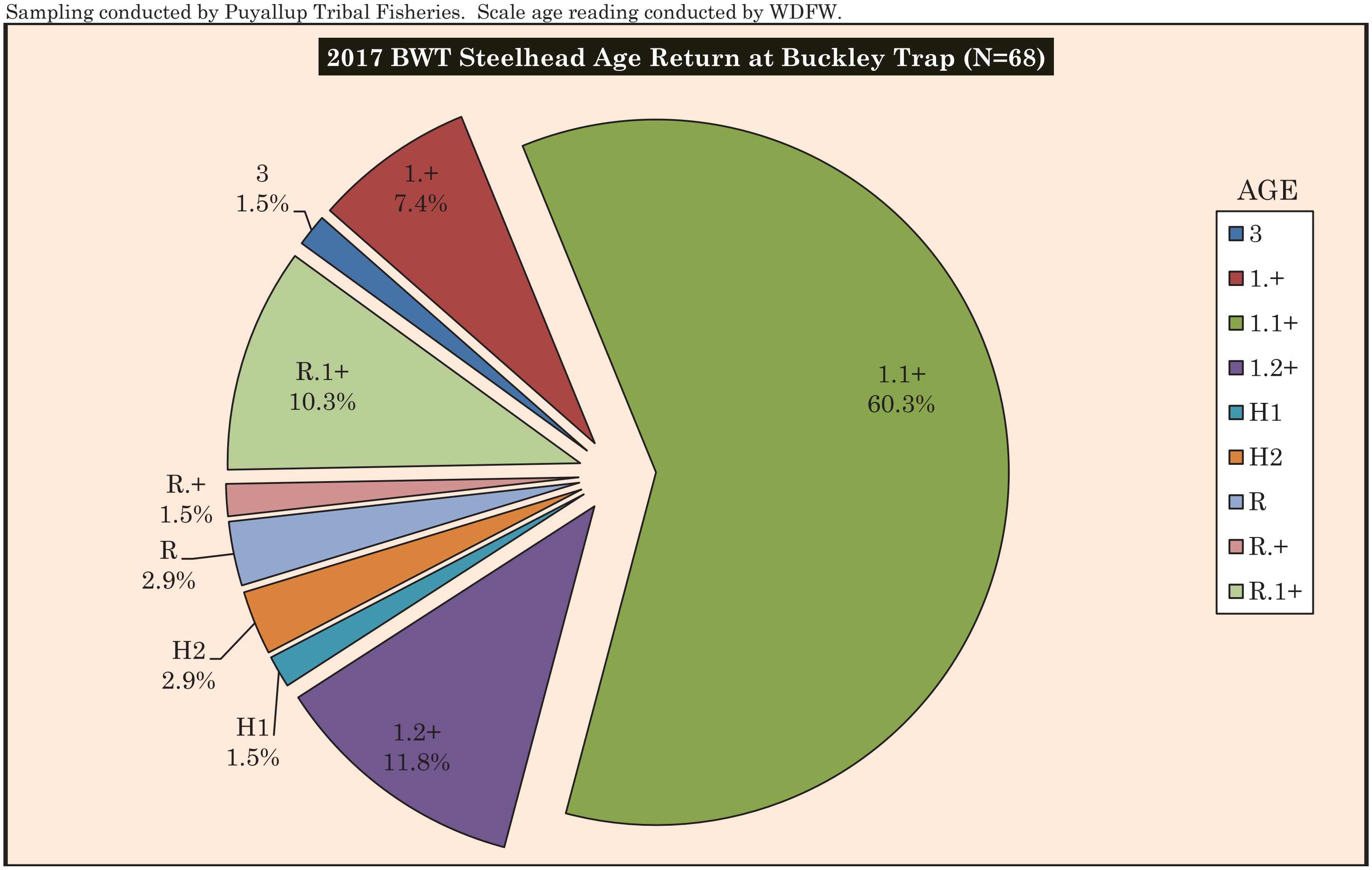


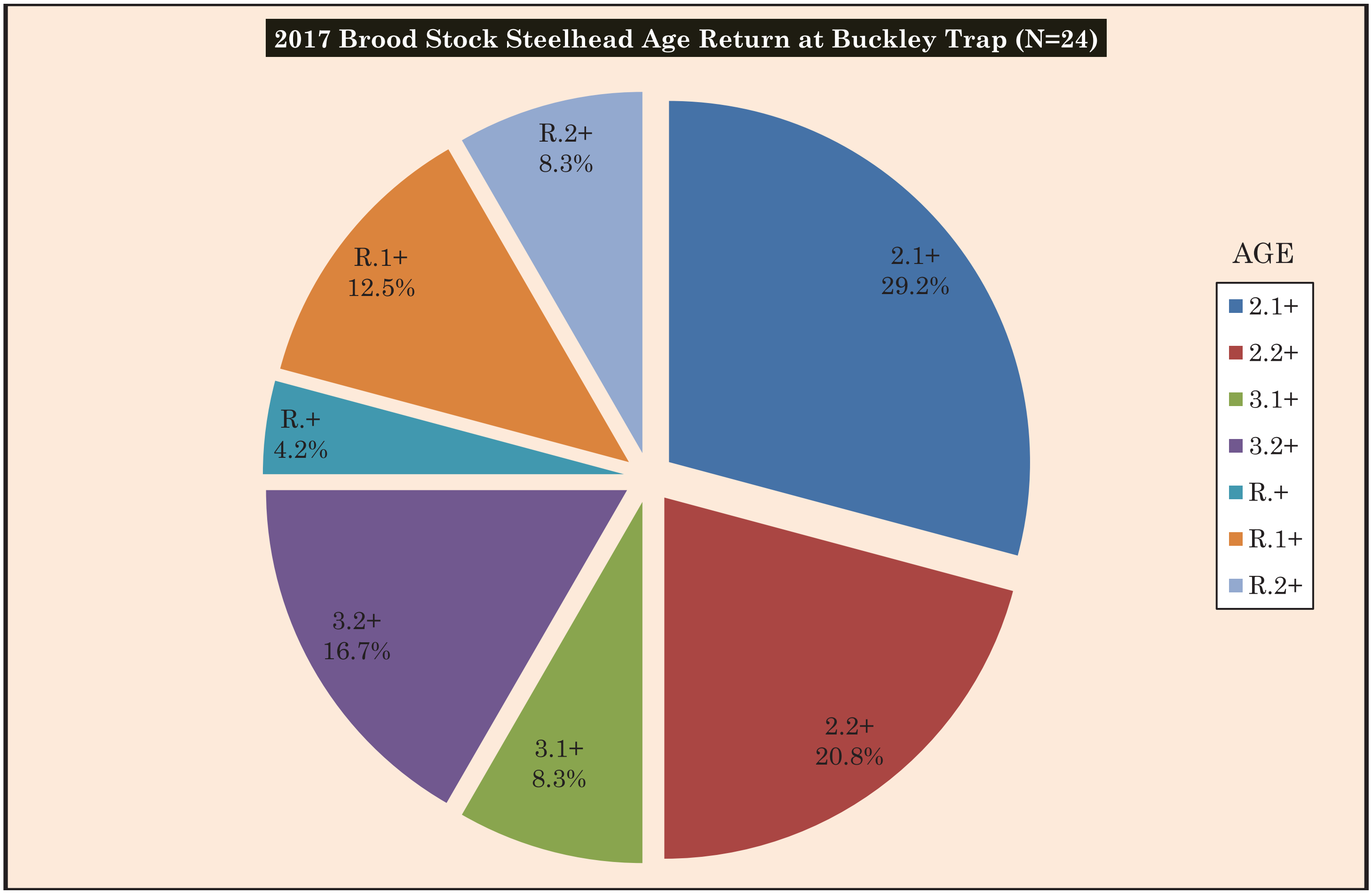
Sampling conducted by Puyallup Tribal Fisheries. Scale age reading conducted by WDFW.



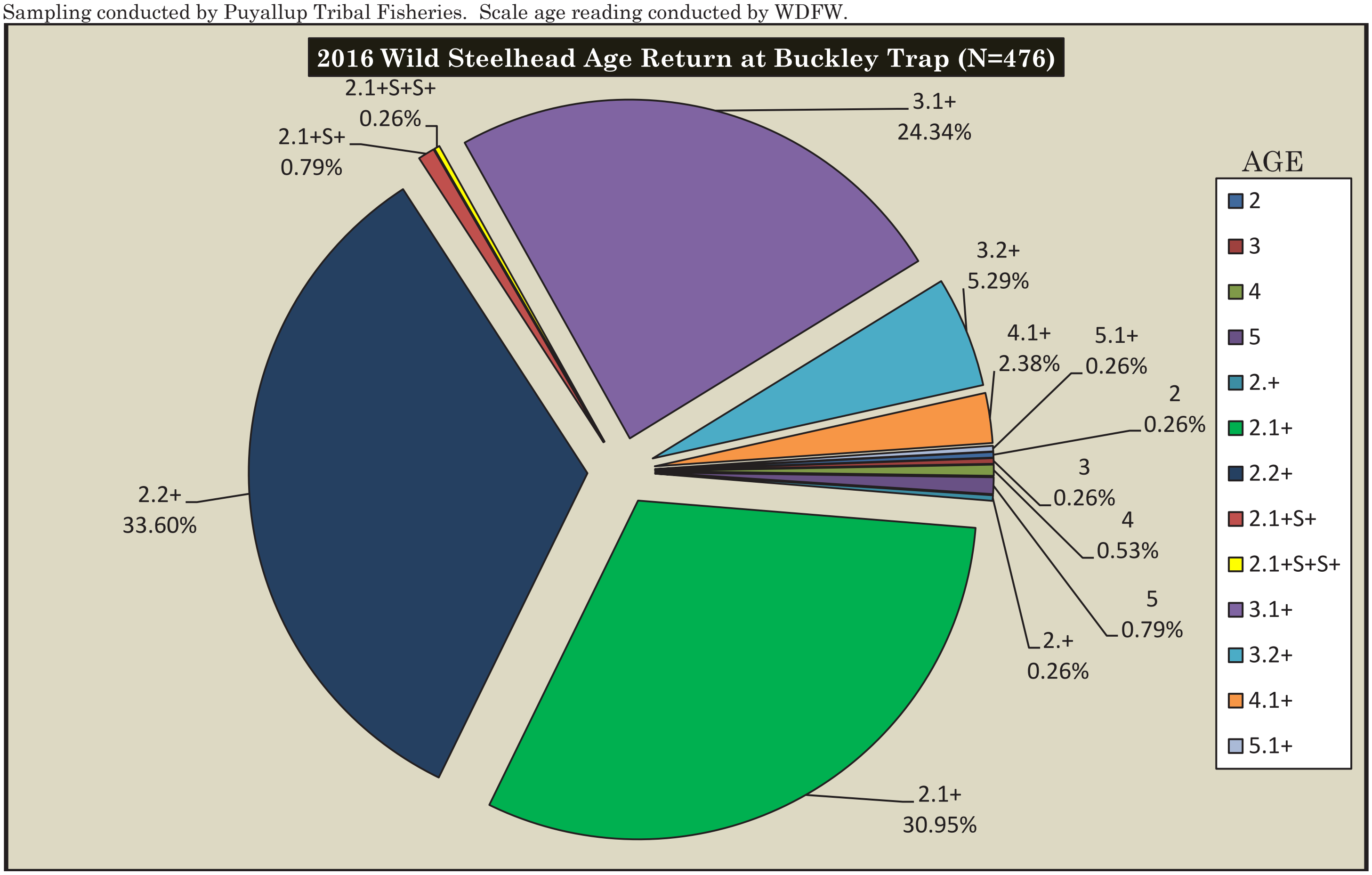


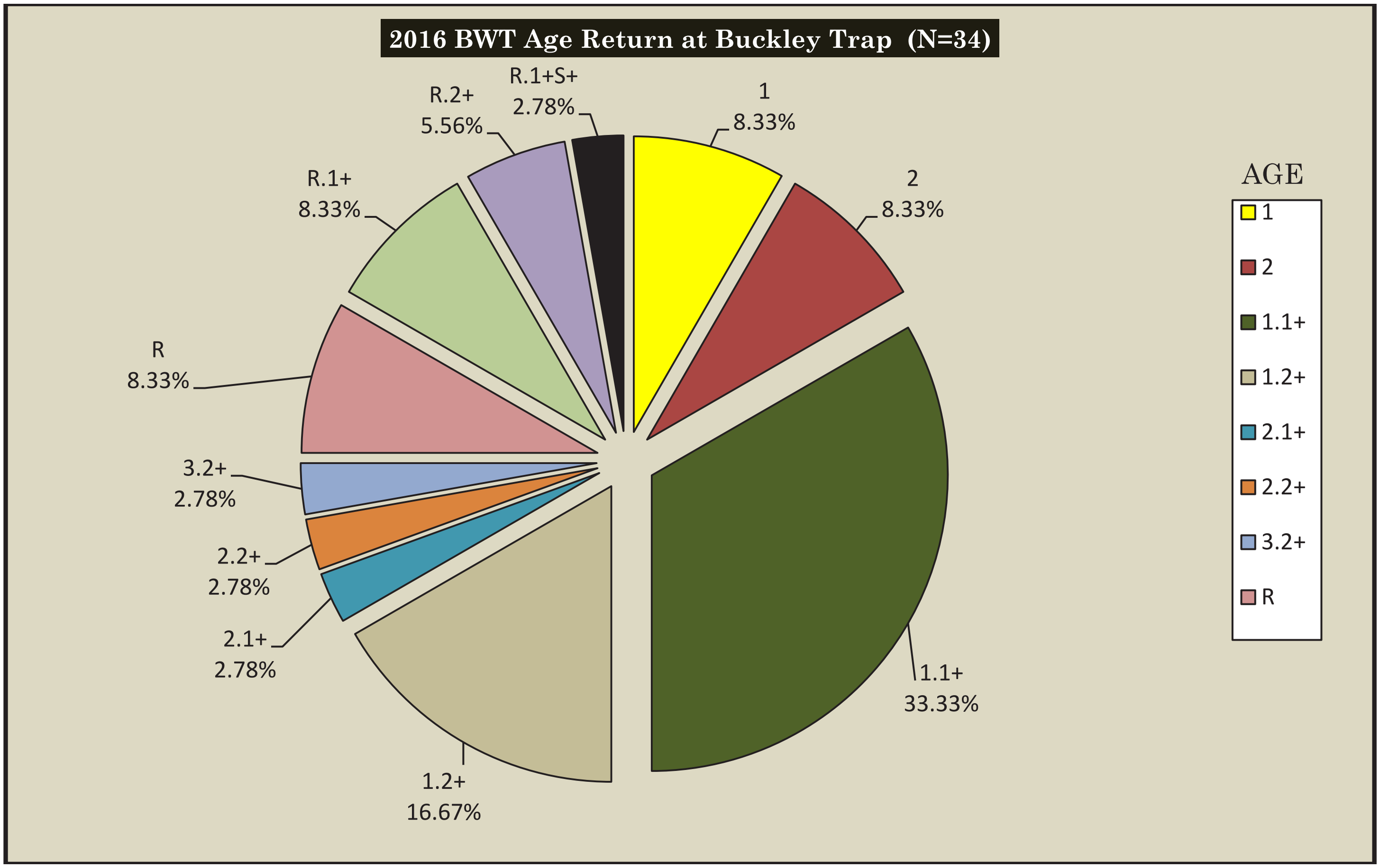
Sampling conducted by Puyallup Tribal Fisheries. Scale age reading conducted by WDFW.





Sampling conducted by Puyallup Tribal Fisheries. Scale age reading conducted by WDFW.





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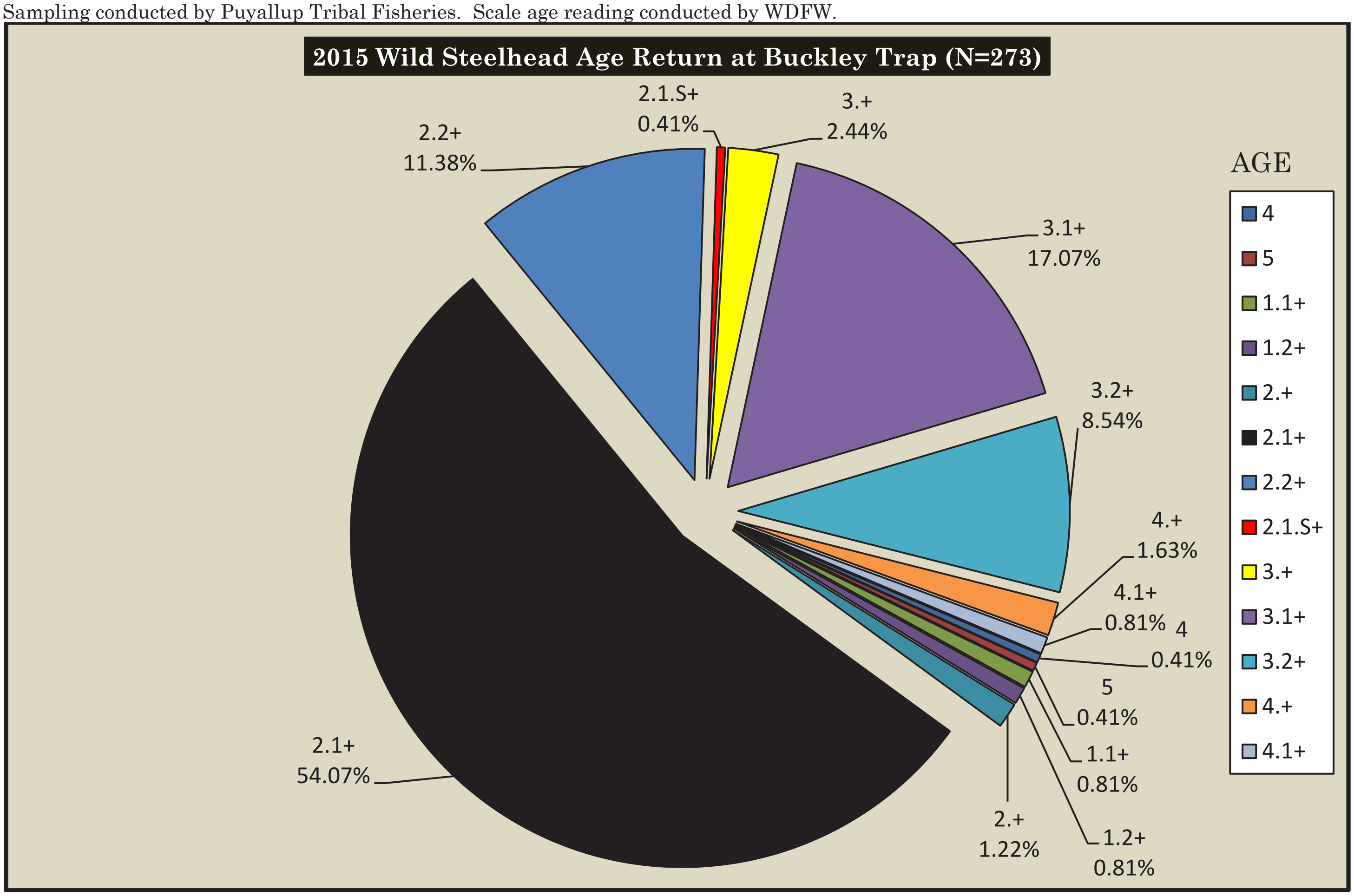
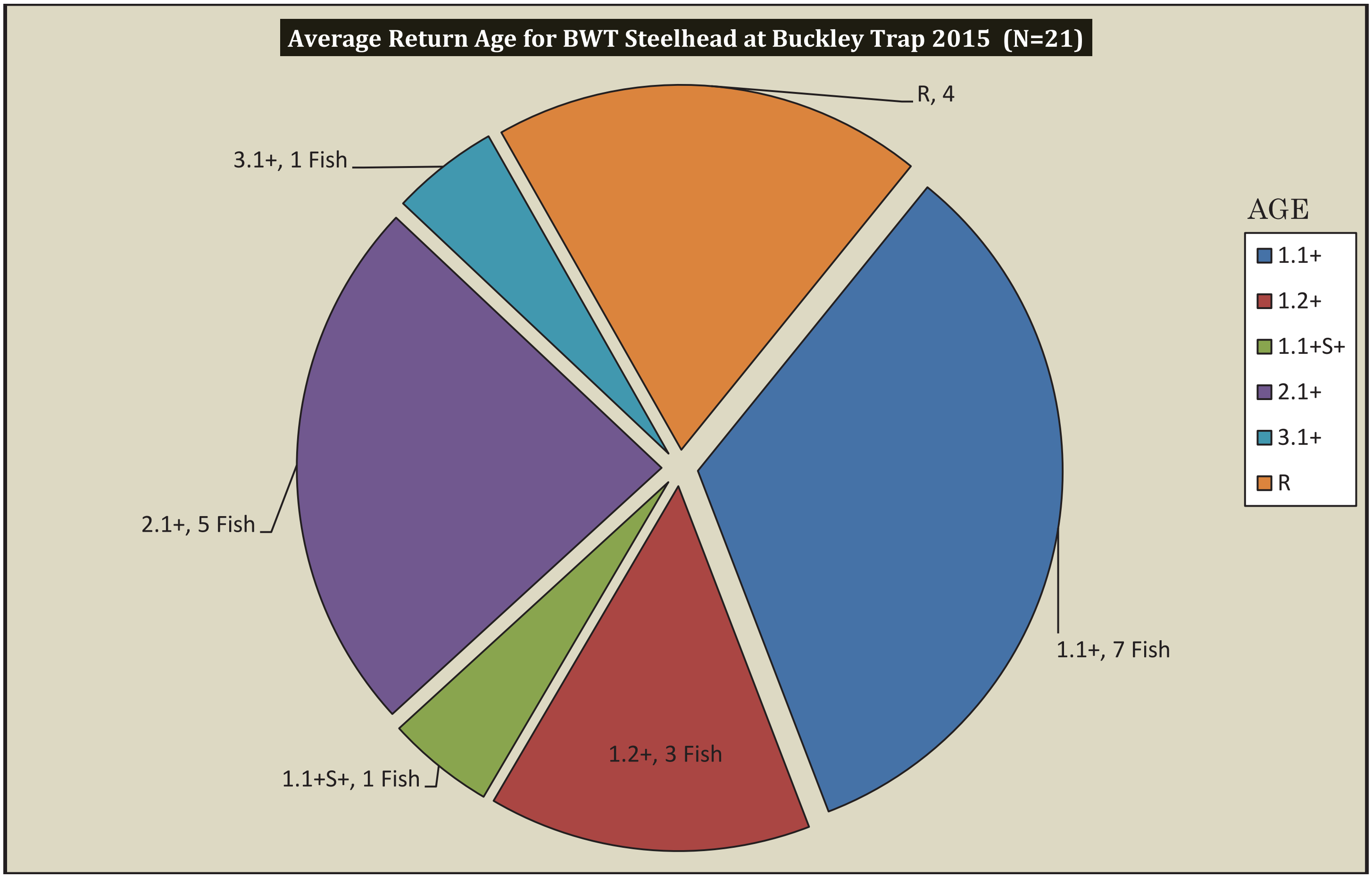
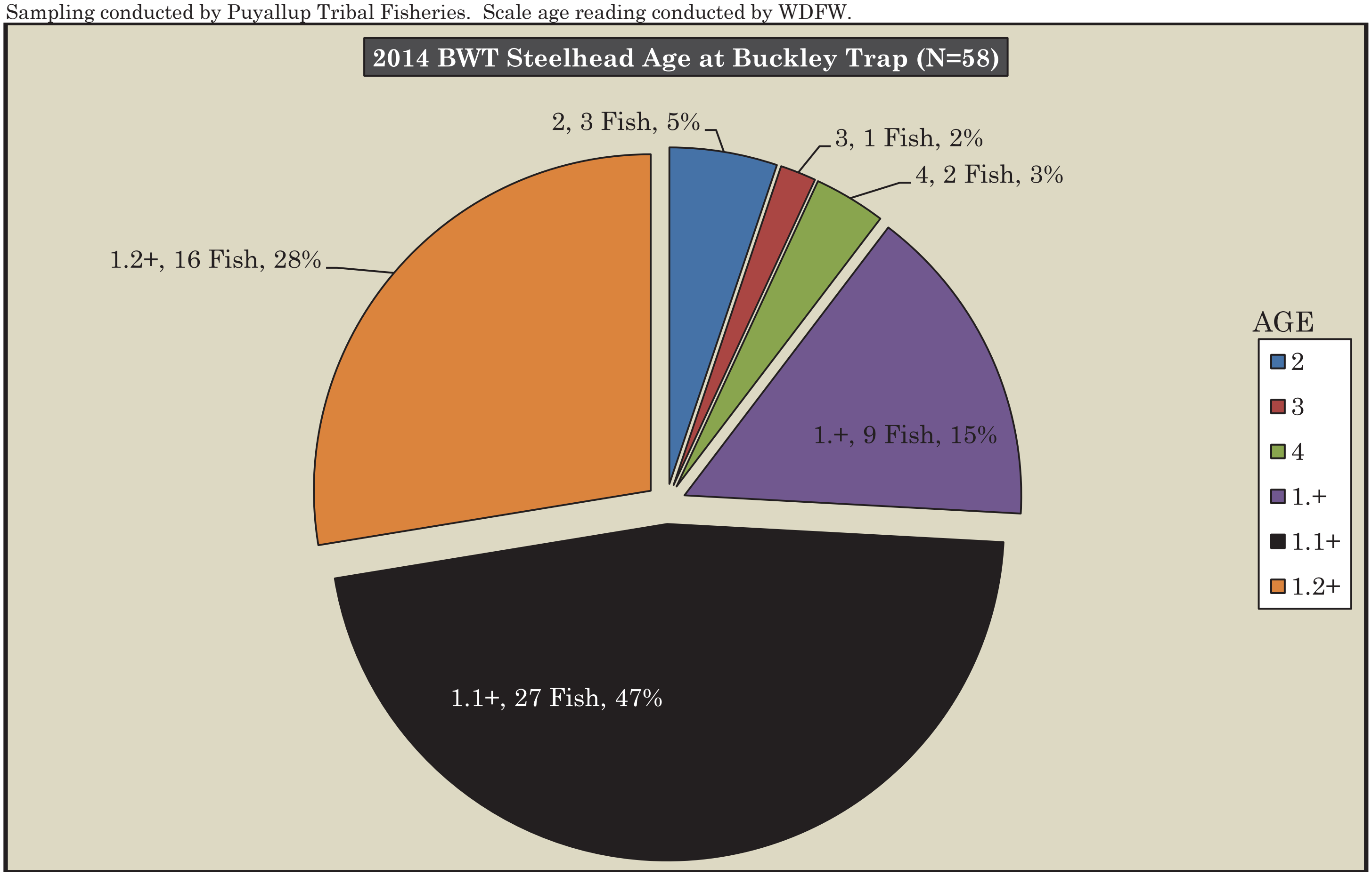
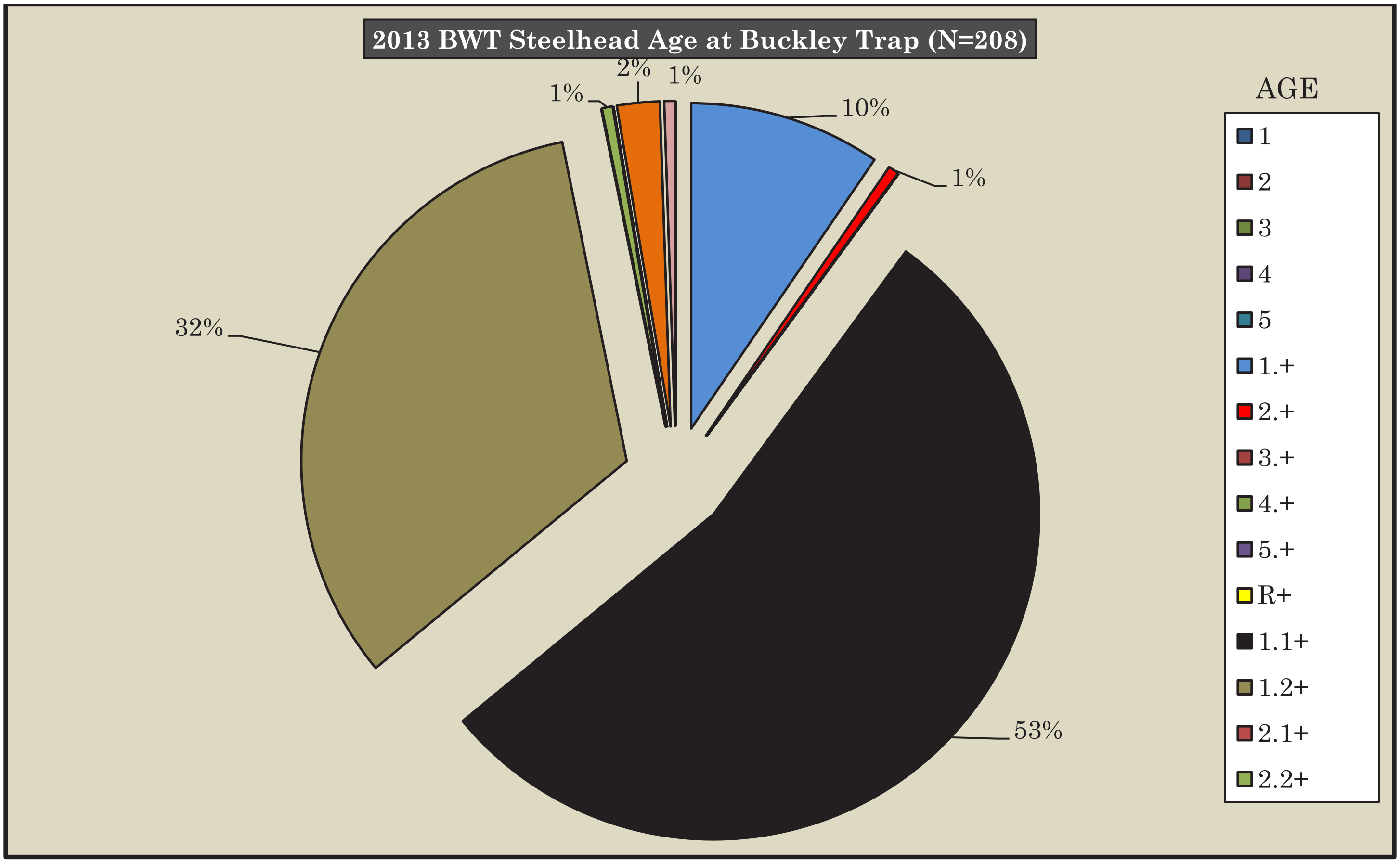




Sampling conducted by Puyallup Tribal Fisheries. Scale age reading conducted by WDFW.



Sampling conducted by Puyallup Tribal Fisheries. Scale age reading conducted by WDFW.



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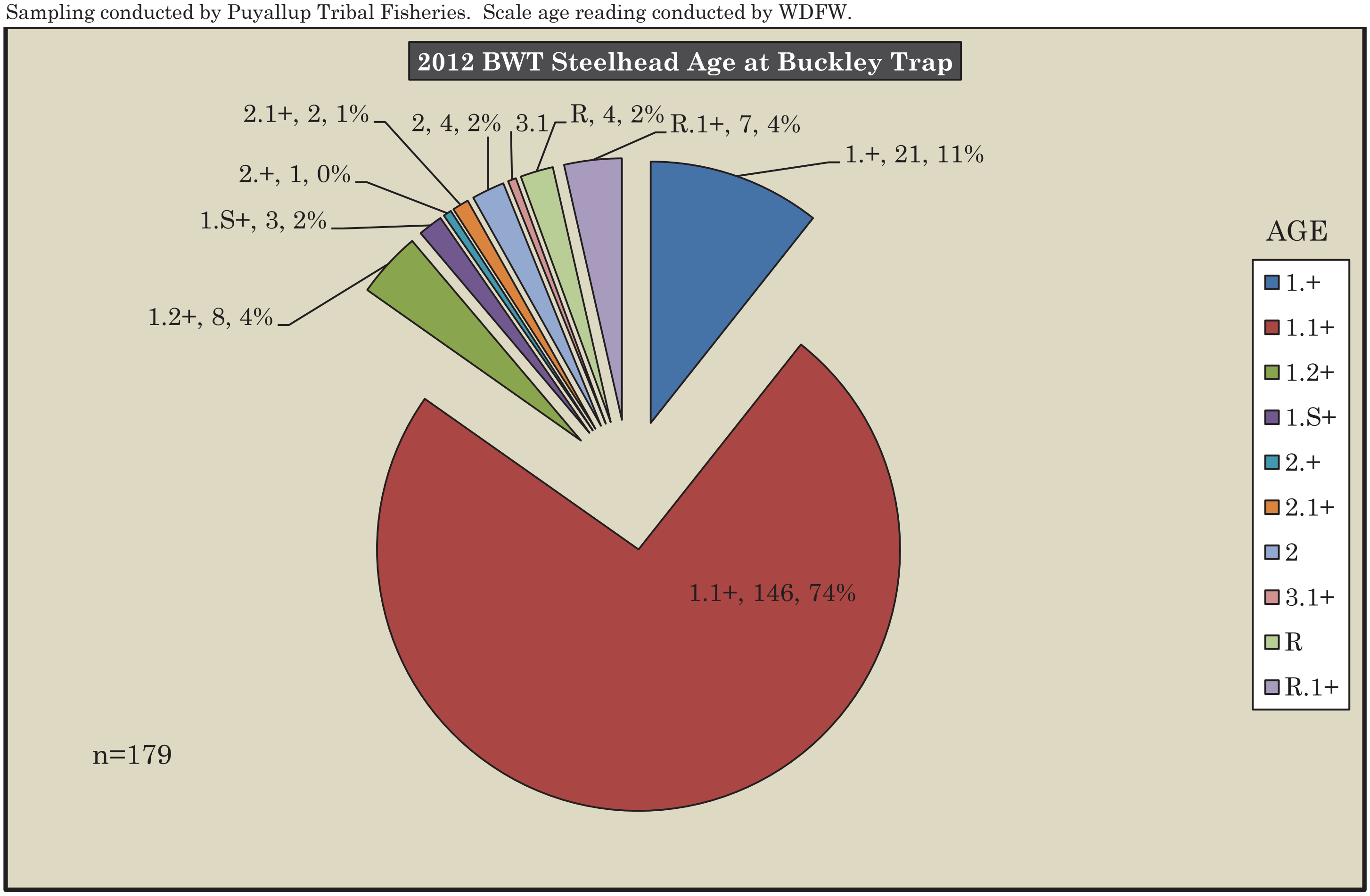

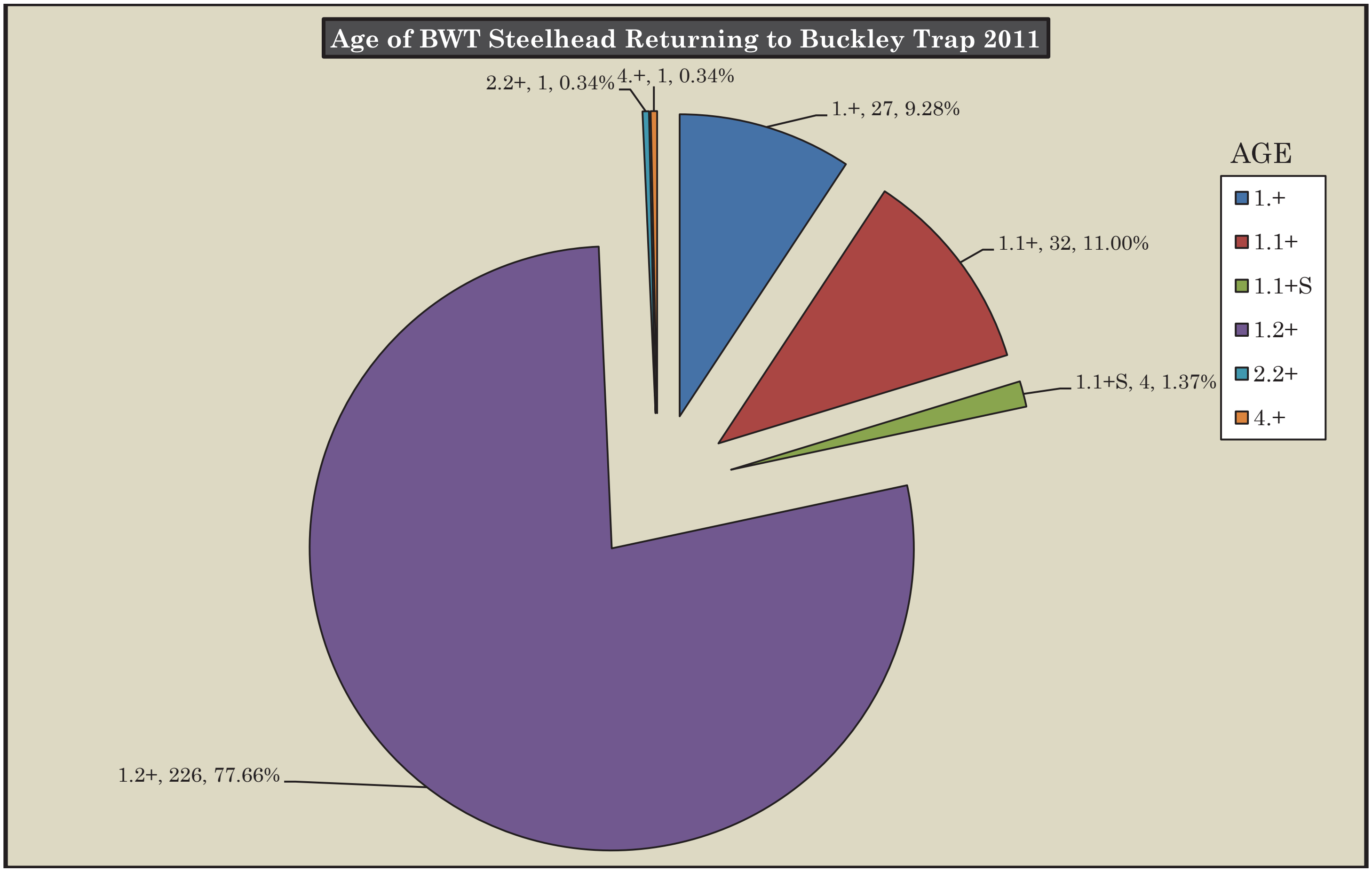

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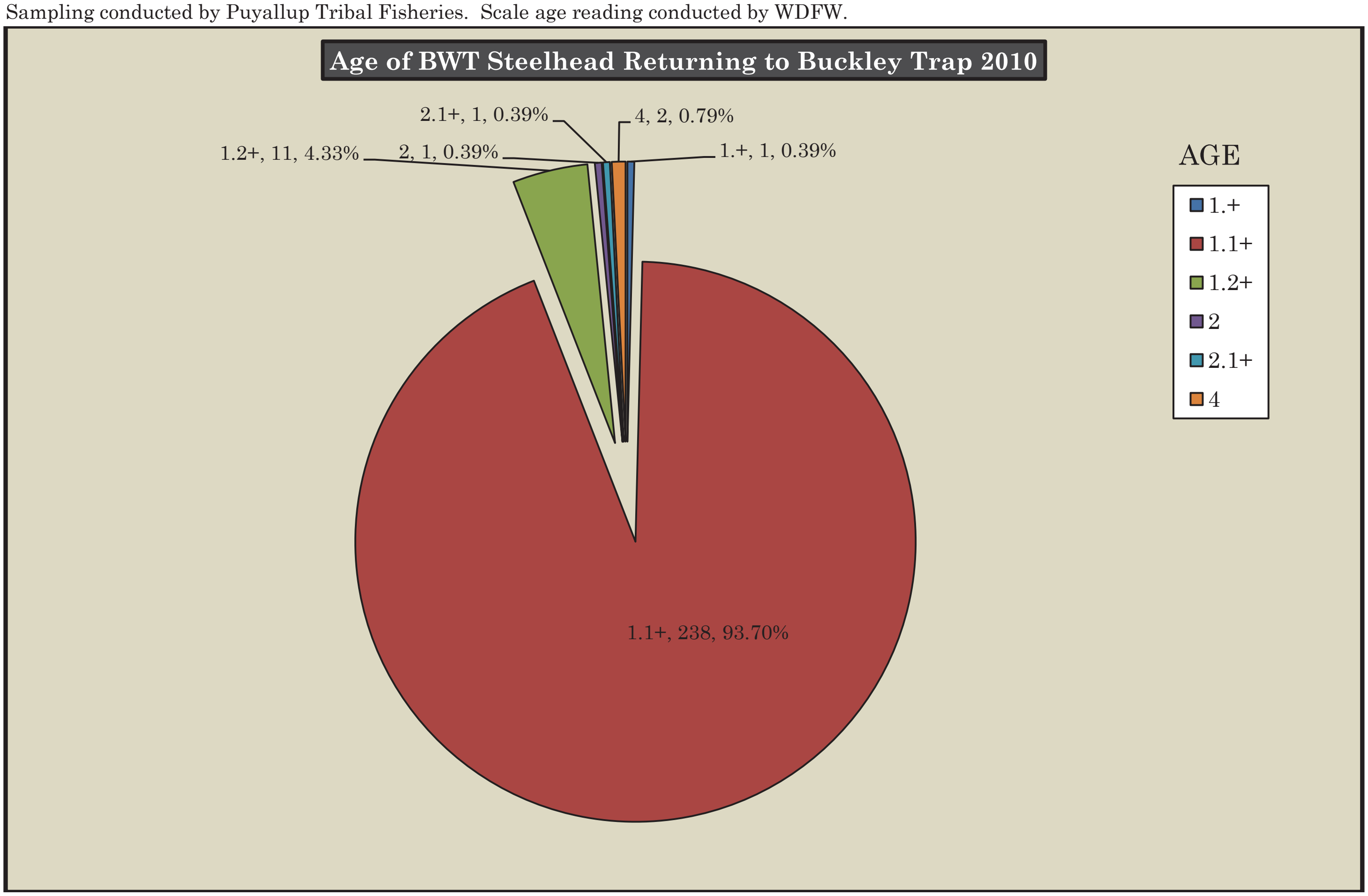
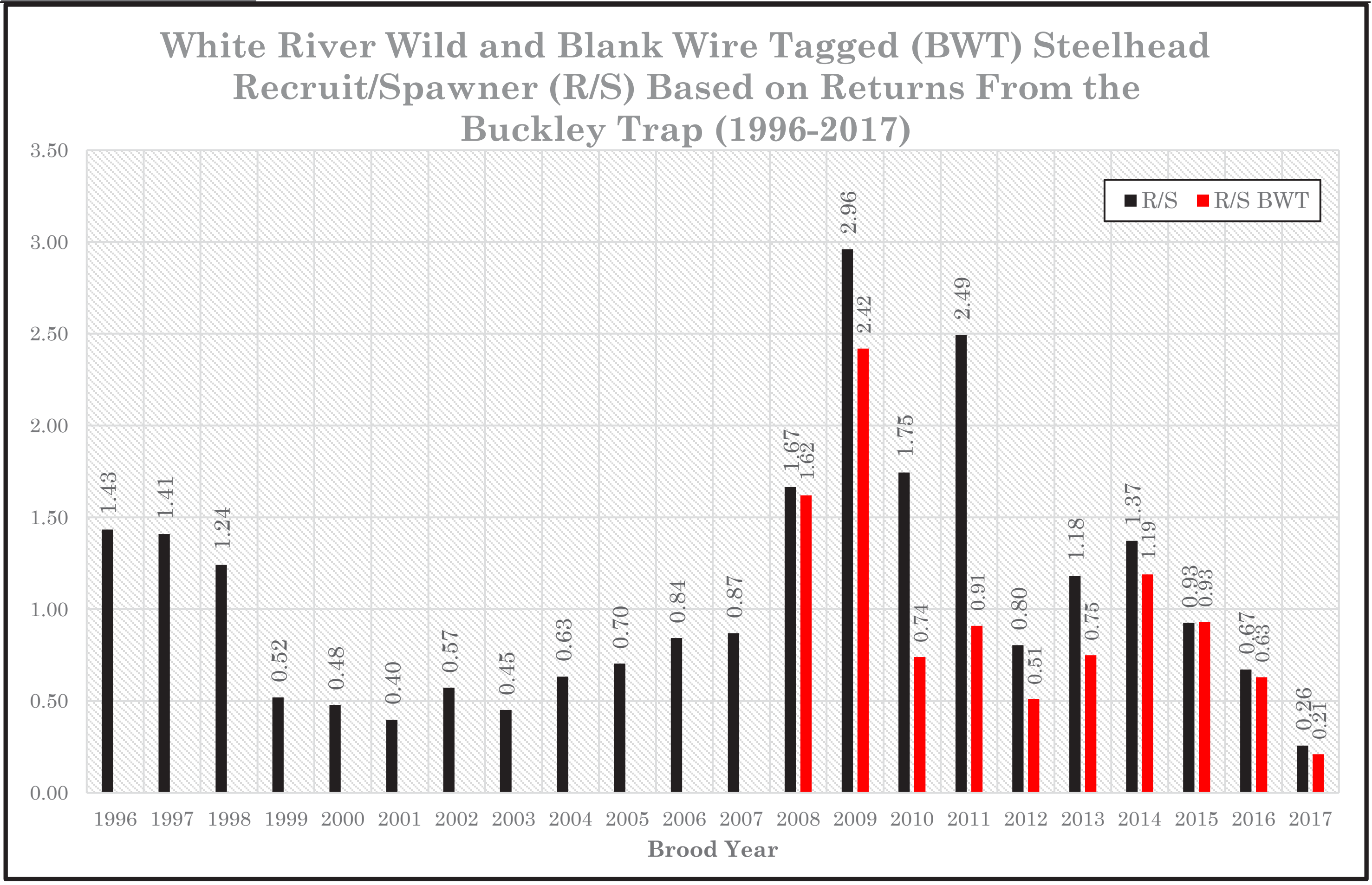
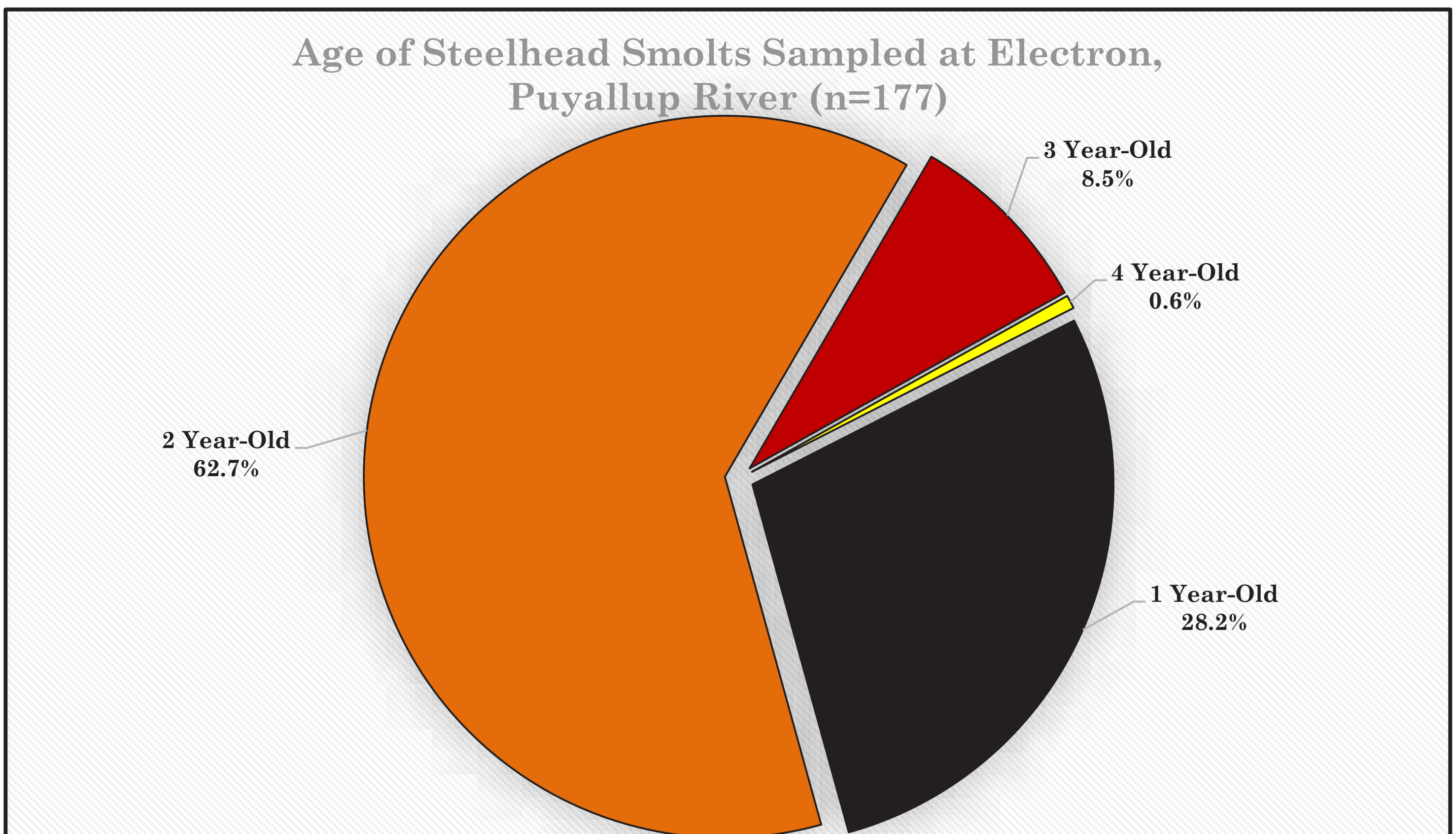


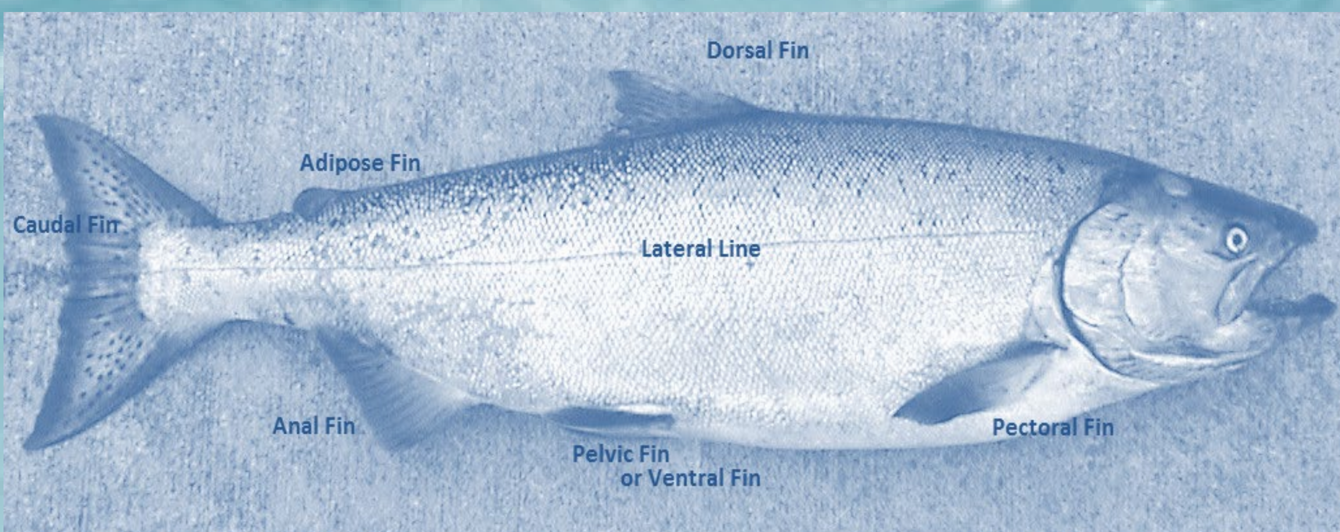


The steelhead recruits *(adults)* per spawner ratio *(R/S)* are an estimate of the natural productivity/success of the population. The lag–time in updating this graph can be 6-7 years due to the life history pattern of steelhead.

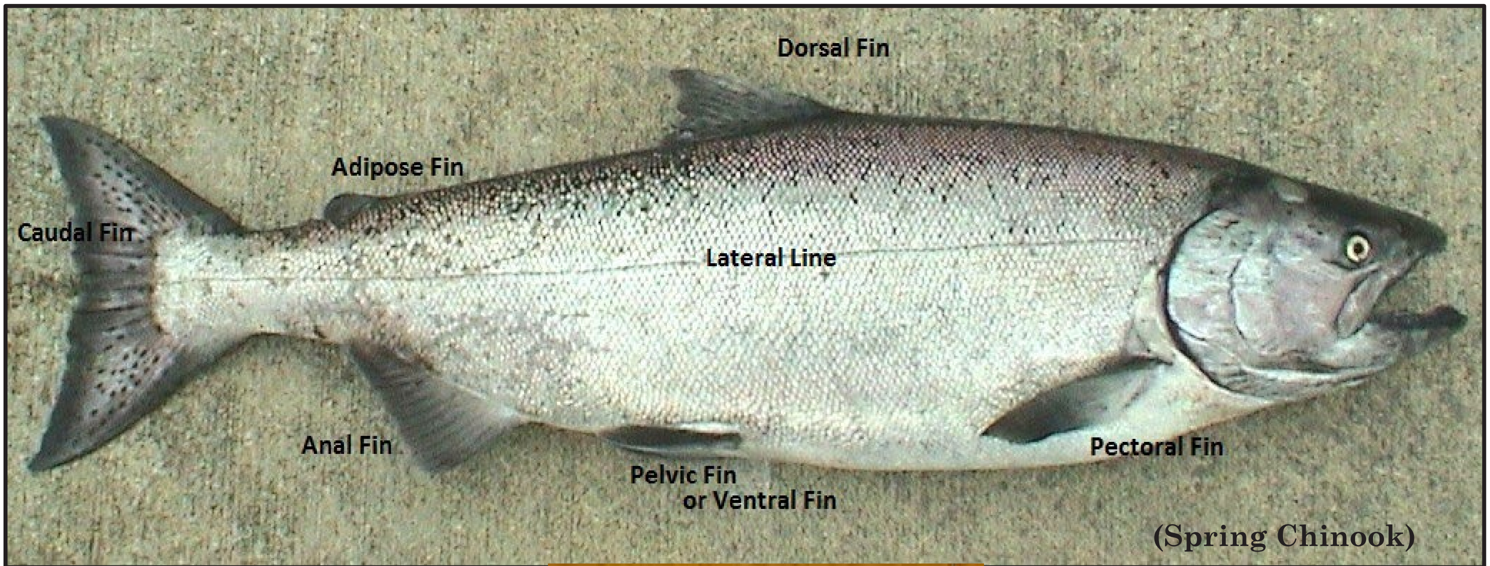


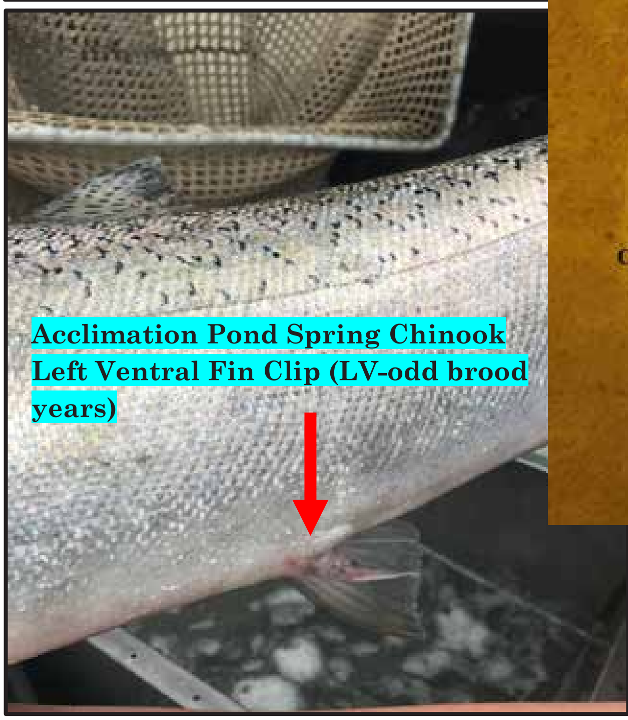
Sampling conducted by Electron Hydro and Puyallup Tribal Fisheries. Scale age reading conducted by WDFW.

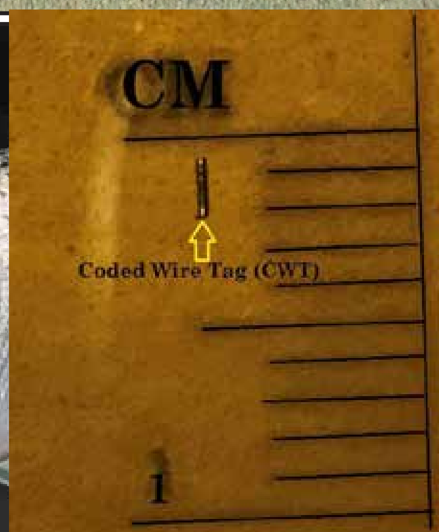
Fish Fin
Identification & Markings



APPENDIX H







Adipose Fin Clip (Hatchery Coho)

Partial Summary Judgment in the Clean Water Act Case of *U.S. v. Electron Hydro LLC and Thom A. Fischer, No. C20-1746-JCC, U.S. District Court, Western District of Washington*

APPENDIX I

THE HONORABLE JOHN C. COUGHENOUR

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON
AT SEATTLE

UNITED STATES OF AMERICA, Plaintiff, PUYALLUP TRIBE OF INDIANS, *et al.*, Plaintiff-Intervenors, v. ELECTRON HYDRO, LLC and THOM A. FISCHER, Defendants.	CASE NO. C20-1746-JCC ORDER

This matter comes before the Court on Plaintiff's motion for summary judgment (Dkt. No. 123), Plaintiff-Intervenor Puyallup Tribe of Indians' motion for partial summary judgment (Dkt. No. 130), and Defendants' motion for partial summary judgment (Dkt. No. 124). Having thoroughly considered the briefing and the relevant record, and finding oral argument unnecessary, the Court hereby GRANTS in part and DENIES in part the motions for the reasons explained herein.

I. BACKGROUND

The Clean Water Act ("CWA") is intended "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." 33 U.S.C. § 1251(a). It prohibits, amongst other things, the discharge of pollutants into "navigable waters" absent compliance with its permitting requirements. *See* 33 U.S.C. §§ 1251, 1311(a). And it provides for several enforcement measures. For example, the U.S. Environmental Protection Agency ("E.P.A.") may seek monetary penalties through a civil enforcement action. *See* 33 U.S.C. § 1319(b), (g). The E.P.A. may also seek to enjoin a continued discharge. *See* 33 U.S.C. § 1364. A private citizen may also bring a civil suit under the CWA "against any person . . . who is alleged to be in violation of [the CWA]." *See* 33 U.S.C. § 1365(a), (h).

In 2014, Defendant Electron Hydro, LLC ("Electron Hydro") acquired a power generating facility along the Puyallup River (this river, by stipulation, is navigable water subject to CWA protection). (*See* Dkt. Nos. 127-5 at 2, 125-17 at 2.) The facility was comprised of a variety of components; one of which, the power intake, included a wooden spillway, with an intake on one side and a fish ladder on the other side. (*See* Dkt. No. 126-3 at 8.) Electron Hydro planned various improvements to this area, including replacing the spillway with an inflatable bladder-type spillway. (*See* Dkt. No. 127-7.) In the summer of 2020, it moved forward on this work. (*Id.*)

As a preliminary step, it needed to divert water away from the spillway to demolish and replace it. (*Id.*) After constructing a temporary diversion channel, Electron Hydro and its contractor hit a snag. Shortly after it directed water into the channel, a portion of the high-density polyethylene ("HDPE") lining material ruptured. (*See* Dkt. No. 127-12.) This sent pieces of the HDPE downstream, along with underlying geotextile fabric and field turf, which Electron Hydro's contractor used to cushion the HDPE. (*Id.*) This also released loose particles of crumb rubber. (*Id.*) Those particles had been contained within the turf, but when it ruptured, the crumb rubber released and went downstream as well. (*Id.*)

Pierce County[1] and the U.S. Army Corps of Engineers ("Corps"),[2] upon learning of this development, issued stop-work orders. (Dkt. Nos. 127-14, 127-15.) At that point, the agencies' primary focus became (1) preserving adequate flow to the fish ladder, (2) removing the downstream foreign material, and (3) ensuring no additional material went downstream. (*See* Dkt. Nos. 125-5 at 9–10, 130-3 at 22.) A complicating factor was the short work window available—to minimize the impact of in-stream construction to endangered salmon, this period was typically limited to a couple months during the late summer. (*See* Dkt. No. 127-47 (work period extension request).) Therefore, not much time was left.

Electron Hydro knew that it needed to direct water away from the channel to remove the remaining lining material. But the parties disagreed over the best approach, particularly in light of the short time window. (*See generally* Dkt. Nos. 123, 124, 130, 137.) Because the original spillway was now gone, Electron Hydro felt it appropriate to continue with its original plan, *i.e.*, install the bladder-style spillway right away. (Dkt. No. 127-12 at 8.) Only then would it divert water away from the channel and recover whatever foreign material remained. (*Id.*) The Puyallup Tribe of Indians, Pierce County and the Corps disagreed. They wanted Electron Hydro to remove the material as quickly as possible—before any other work on the spillway. (*See* Dkt. Nos. 127-25, 127-31, 127-33, 127-38, 127-41, 127-42, 127-43).

After significant back-and-forth, and faced with a now-dwindling construction season, Electron Hydro proposed a scaled-back plan, limited to construction of an interim rock structure

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[1] Pierce County had issued a shoreline substantial development permit for the project. (*See* Dkt. No. 127-9.) None of the CWA claims in this suit directly implicate compliance with that permit. Therefore, the Court will not address this issue.

[2] The Corps previously indicated that the project, at least as described to it, was covered under Nationwide Permits ("NWP") 3 and 13 for permissible dredging or fill activities, *i.e.*, CWA Section 404-exempt activities. (*See* Dkt. No. 127-10.) As such, it concluded, no individual permit would be needed for the initially proposed work. (*Id.*) But Electron Hydro did not advise the Corps of the type of material it would line the diversion channel with. (*See* Dkt. No. 125-5 at 9–10; *see also* Dkt. No. 127-7 at 27, 29 (generic reference in plans to liner material).) Meaning, the Corps had not considered Electron's use of field turf in assessing the project's compliance with the NWPs.

where the original spillway once stood, in order to stabilize the inlet area. (*See* Dkt. No. 127-35.) This did not involve installation of the inflatable bladder spillway (at least not during the remaining 2020 construction season). (*Id.*) Based on this proposal, the Corps and Pierce County lifted the stop work orders. (*See* Dkt. Nos. 127-2, 127-3.) Electron Hydro modified the plan one last time—it added a steel sheet on the upstream side of the temporary rock structure to reduce entrapment hazards to passing fish.[3] (*See* Dkt. No. 127-50.) Finally, in late October 2020, with the details nailed down, Electron Hydro constructed the temporary rock spillway, shifted flow away from the diversion channel, and removed the remaining foreign material from the diversion channel. (*See* Dkt. No. 127-1 at 6.) It has engaged in no significant work since, as it awaits permitting under the Endangered Species Act and other regimes. (*Id.* at 6–7.)

The United States, on behalf of the E.P.A., was the first to file suit, which it did in the fall of 2020. (*See* Dkt. No. 1.)[4] It sought civil penalties and injunctive relief for a variety of alleged CWA violations. The Court later granted the Puyallup Tribe of Indians' motion to intervene. (Dkt. No. 37.) The Tribe sought similar, but not the same, relief as Plaintiff. (*Compare* Dkt. No. 73 at 22–23, *with* Dkt. No. 82 at 35–37.) Citizens for a Healthy Bay, and Puget Soundkeeper Alliance also sought to intervene—a request the Court later granted. (*See* Dkt. No. 28.)

Now before the Court are various summary judgment motions. Plaintiff seeks summary judgment on all claims, arguing there are no genuine issues of fact. (*See generally* Dkt. No. 123.) Communities for a Health Bay and Puget Soundkeeper Alliance join. (*See* Dkt. No. 131.) The Tribe moves for partial summary judgment on some of its claims. (*See generally* Dkt. No. 130.) And Defendants seek partial summary judgment solely on claims arising from construction of the temporary rock spillway. (*See generally* Dkt. No. 124.)

[3] According to Electron Hydro, the Washington Department of Fish and Wildlife put forth this requirement pursuant to its Hydraulic Project Approval ("HPA") authority. (*See* Dkt. Nos. 127-4, 127-51.) None of the claims in this matter involve HPA compliance, though, so no further discussion of this scheme will follow.

[4] It later amended the complaint. (*See* Dkt. No. 73.)

II. DISCUSSION

A. Legal Standard

"The court shall grant summary judgment if the movant shows that there is no genuine dispute as to any material fact and the movant is entitled to judgment as a matter of law." Fed. R. Civ. P. 56(a). In making such a determination, the Court must view the facts and justifiable inferences in the light most favorable to the nonmoving party. *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 255 (1986). Once a motion for summary judgment is properly made and supported, the opposing party "must come forward with 'specific facts showing that there is a *genuine issue for trial.*'" *Matsushita Elec. Indus. Co. v. Zenith Radio Corp.*, 475 U.S. 574, 587 (1986) (emphasis in original) (quoting Fed. R. Civ. P. 56(e)). The nonmoving party "may not rest upon the mere allegations or denials of his pleading . . . ." *Anderson*, 477 U.S. at 248 (citations omitted).

B. Use of Field Turf

In general, to discharge a pollutant into the Puyallup River, Electron Hydro needed a Section 402 National Pollution Discharge Elimination System ("NPDES") permit. *See* 33 U.S.C. §§ 1311(a), 1342(b). Similarly, to place fill material into the river, it needed either a site-specific Section 404 permit or to demonstrate compliance with an applicable Nationwide Permit ("NWP"). *See* 33 U.S.C. §§ 1311(a), 1344(a), (e). Because Plaintiff and the Tribe allege Electron Hydro lacked authority under either CWA permitting regime, they assert three distinct causes of action regarding use of the lining materials, each of which they now seek summary judgment on: (1) a 33 U.S.C. § 1311(a) violation based on Electron's initial placement of lining materials in the diversion channel, (2) a separate and distinct § 1311(a) violation for its breakup and downstream transport, and (3) a § 1344 violation based on Electron's failure to comply with NWPs 3 and 13. (*See* Dkt. Nos. 73 at 17–20, 82 at 26–30.) Before turning to the merits, the Court first addresses Defendants' threshold arguments regarding the Tribe's claims.

First, Defendants contend that any of the Tribe's claims as to Electron Hydro's use of HDPE and the geotextile fabric are inadequately pled and, therefore, untimely. (*See* Dkt. No. 139

at 7.) The Court agrees, at least with respect to the geotextile fabric. As it relates to the HDPE, the Tribe referenced it frequently throughout the complaint, (*see, e.g.*, Dkt. No. 82 at 14–16 (interchangeably using "HDPE" or "plastic liner")), all of which, the Tribe then incorporated into its claims, (*see id.* at 26–30.) But the same cannot be said for the geotextile. There is no mention of it in the Tribe's complaint. (*See generally* Dkt. No. 82.) While the Tribe suggests it should be granted leave to amend, to now include such allegations, this would be unduly prejudicial. *See Johnson v. Buckley*, 356 F.3d 1067, 1077 (9th Cir. 2004) (establishing factors to consider the propriety of a Rule 15(b) request to amend a pleading). Discovery is closed and the case is scheduled for trial in the next few months. (*See* Dkt. No. 119.) Defendants do not have sufficient time to prepare a defense for claims based on what would be newly introduced geotextile allegations. For this reason, the Tribe is barred from seeking relief based on Electron Hydro's use of geotextile fabric in the diversion channel.

Second, Defendants contend that, because it is undisputed that Electron Hydro removed the remaining turf and HDPE from the diversion channel, the Tribe may not now seek relief based on the discharge of these materials into the river, at least pursuant to the CWA's citizen suit provision, 33 U.S.C. § 1365. (*See* Dkt. No. 139 at 5.) This is because, according to Defendants, the Tribe could not make a good-faith allegation of ongoing harm from the turf and HDPE, which is a baseline requirement for a citizen suit. (*See* Dkt. No. 139 at 5 (citing *Gwaltney of Smithfield, Ltd. v. Chesapeake Bay Found., Inc.*, 484 U.S. 49, 64 (1987)).) But the Tribe provides unrefuted evidence that pieces of these materials persist, both proximate to and downstream of where the diversion channel stood. (*See* Dkt. No. 135-1 at 8–11.) So the clean-up is not complete. Accordingly, the Court FINDS that it does have jurisdiction over the Tribe's CWA claims, at least based on Electron Hydro's use of HDPE and field turf.

The Court now turns to the merits of Plaintiff and the Tribe's first three claims.

1. Initial Placement of Turf[5]—§ 1311(a) Violation

In their first respective causes of action, Plaintiff and the Tribe contend that the addition of the field turf to the diversion channel represented a 33 U.S.C. § 1311(a) violation. (Dkt. Nos. 73 at 17–18, 82 at 26–27.) A claim based on a § 1311(a) violation requires one to prove the following: A discharge of a pollutant into navigable waters from a point source without permit authorization. *Headwaters, Inc. v. Talent Irrigation Dist.*, 243 F.3d 526, 532 (9th Cir. 2001). Here, there is no dispute that, when Electron Hydro's contractor initially placed the field turf into the diversion channel, it was an unpermitted discharge of that material into navigable water. (*See* Dkt. Nos. 125-5 at 9, 125-17 at 2, 137 at 7–9.) The only issues, then, are (a) whether the turf constitutes a pollutant and (b) whether it was discharged from a point source. For the reasons described below, the Court FINDS that, based on the undisputed facts, the placement of the turf into the diversion channel does, indeed, qualify as a pollutant discharged into the Puyallup River from a point source.

a. *The Field Turf Is a Pollutant*

A pollutant, according to the CWA, includes "solid waste . . . garbage . . . and industrial, municipal, and agricultural waste." 33 U.S.C. § 1362(6). While the CWA does not define waste, it is uncontroverted the field turf was "basically old" and "obviously used," and that Defendants acquired it "from a waste yard" where "somebody had accumulated and stored rolls of used turf." (Dkt. No. 130-3 at 267; *see also id.* at 103 (describing the field turf as "trash").) According to a comparable environmental regime, CERCLA, once a product has "served its intended purpose and is no longer wanted" it is "waste." *See Ecological Rights Found. v. P. Gas and Elec. Co.*, 713 F.3d 502, 515 (9th Cir. 2013). Defendants present no persuasive argument why the same should not be said here. (*See* Dkt. No. 137 at 8–9.) Accordingly, the Court FINDS that the field turf is a pollutant.

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[5] The briefing is devoid of argument regarding whether the use of the HDPE and geotextile materials was a separate CWA violation. (*See generally* Dkt. Nos. 123, 130, 137, 139.) Therefore, the Court reserves judgment on this issue.

b. *It Was Discharged Via a Point Source*

A point source is "any discernable . . . conveyance . . . conduit . . . from which pollutants are or may be discharged." 33 U.S.C. § 1362(14). This includes heavy equipment such as a "bulldozer" or "tractor." *Borden Ranch Partn. v. U.S. Army Corps of Engineers*, 261 F.3d 810, 815 (9th Cir. 2001). Here, it is undisputed that Electron Hydro and/or its contractor placed rolls of the field turf into the riverbed using a crane. (*See* Dkt. No. 127-1 at 10.) Defendants suggest that, because the rolls were then spread using "human hands," they were not discharged *by a point source*. (Dkt. No. 137 at 9.) But this does not address the initial conveyance. Moreover, Defendants do not present authority for the proposition that human hands could not be a means of conveyance. *See, e.g., Rattlesnake Coalition v. U.S. E.P.A.*, 509 F.3d 1095, 1100 (9th Cir. 2007) (legal citation is required to support an argument opposing summary judgment). The Court FINDS that the field turf was, indeed, discharged into the Puyallup River through a point source.

Accordingly, the Court GRANTS summary judgment to Plaintiff and the Tribe on their first respective causes of action, at least as it relates to the field turf. (*See* Dkt. Nos. 73 at 17–18, 82 at 26–27.)

2. Subsequent Breakup—Separate § 1311(a) Violation

In their second respective causes of action, Plaintiff and the Tribe contend that the introduction of water into the diversion channel and/or the resulting field turf breakup, which sent it and its constituent crumb rubber downstream, represents a separate 33 U.S.C. § 1311(a) violation. (Dkt. Nos. 73 at 17–18, 82 at 26–27.) The elements for this claim are the same as the first. The fundamental issue, which is a purely legal one, is whether this can represent a separate § 1311(a) violation, given the earlier violation of conveying the rolled turf into riverbed. For the reasons described below, the Court FINDS that it can and does.

Resolution of this issue turns on an interpretation of *L.A. Cnty. Flood Control Dist. v. Nat. Res. Def. Council, Inc.*, 568 U.S. 78 (2013). In that case, the Court found that the flow of polluted water from an improved portion of a navigable waterway to an unimproved portion was not a discharge. *Id.* at 81. In doing so, the Court relied heavily on a prior decision, *S. Fla. Water*

Mgt. Dist. v. Miccosukee Tribe of Indians, where it found that pumping polluted water from one part of a body of water to another was not a discharge. *See* 541 U.S. 95, 109–12 (2004). But there is an obvious distinction between those cases and this one. In those instances, the same storm sewer and/or runoff was conveyed between two points within the same waterway. *See L.A. Cnty. Flood Control Dist.*, 568 U.S. at 81–82; *S. Fla. Water Mgt. Dist.*, 541 U.S. at 100–02. The characteristics of the substance did not change. *Id.* Whereas here, the characteristics changed dramatically. It is undisputed that, what started as intact large sections of field turf conveyed into a confined area, became small pieces of turf and free-floating constituent crumb rubber disbursed downstream. (Dkt. No. 78 at 10–11.) This is much more analogous to *Rybachek v. U.S. E.P.A.*, 904 F.2d 1276 (9th Cir. 1990)[6] than to *L.A. Cnty. Flood Control Dist.* or to *S. Fla. Water Mgt. Dist.*

Accordingly, the Court GRANTS summary judgment to Plaintiff and the Tribe on their second respective causes of action. (*See* Dkt. Nos. 73 at 18–19, 82 at 27–29.)

3. <u>Turf Not Compliant with NWPs—§ 1344 Violation</u>

In their third respective causes of action, Plaintiff and the Tribe contend that Electron Hydro used the field turf in a manner not conforming to its Section 404 permit and, as such, its use constituted a 33 U.S.C. § 1344 violation. (Dkt. Nos. 73 at 19–20, 82 at 29–30.) It is uncontroverted that the Corps did not have a site-specific Section 404 permit and, instead, relied on NWPs 3 (Maintenance) and 13 (Bank Stabilization). (*See* Dkt. No. 126-3 at 2.) Therefore, to succeed on their third respective claims, Plaintiff and the Tribe need only prove that some aspect of the field turf did not comply with those NWPs. *See* 33 U.S.C. § 1344(a); *see also* 40 C.F.R. § 122.41(a) (permit noncompliance constitutes a CWA violation). And Plaintiff points to two areas of noncompliance: (1) the turf "violated the condition that no material shall be 'placed in a

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[6] In *Rybachek*, the court found that placer mining, which resuspended streambed material into stream flow, sufficiently changed the nature of that material as to constitute a new discharge. *See* 904 F.2d at 1285.

manner that will be eroded by normal or expected high flows'" and (2) it "violated the condition that prohibits permittees from using 'unsuitable material,' including 'trash' and 'debris.'" (Dkt. No. 123 at 19–20 (citing Issuance and Reissuance of Nationwide Permits, 82 Fed. Reg. 1860-01 (Jan. 6, 2017)).) The Tribe relies solely on the second issue—the turf material's suitability. (Dkt. No. 130 at 22.)

Defendants suggest that, because Electron Hydro did not initially expose the turf to the stream flow (instead using it solely as an underlayment to the HDPE liner), it did not *intend* for the turf to be exposed to water. (*See* Dkt. No. 137 at 10–11 (discussing its use purely as an underlayment).) Nevertheless, it undisputed that this is exactly what happened. (*See* Dkt. No. 78 at 10 (Defendant's admission that the HDPE liner breached, tearing the field turf and sending portions of it and constituent crumb rubber downstream).) Nothing in the NWPs speak to the issue of intent—just the "manner" in which the material is placed. *See* 82 Fed. Reg. 1860-01. And that manner is uncontroverted. (*See* Dkt. No. 78 at 10.) Nor is the result controverted—it broke up, *i.e.*, eroded. (*Id.*) This, alone, is sufficient to support summary judgment. If it were not, the Court also FINDS that the turf was unsuitable as a matter of law, because, as discussed above, *see supra* Part II.B.1.a., it was waste material, *i.e.*, trash.

Accordingly, the Court GRANTS summary judgment to Plaintiff and the Tribe on their third (respective) causes of action, at least as it relates to the field turf.[7] (*See* Dkt. Nos. 73 at 19–20, 82 at 29–31.)

C. Temporary Stabilization Activities

All agree that Electron Hydro secured NWP 3 authorization well before the 2020 construction season began. (*See* Dkt. No. 127-10.) But Plaintiff and the Tribe contend this did not extend to the later-developed site stabilization plan. (*See* Dkt. Nos. 135 at 10–13, 136 at 18–20.)

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[7] *See supra* note 5.

After the Corps issued its stop work order, (*see* Dkt. No. 127-15), Electron Hydro told it that Electron should be allowed to, nevertheless, continue with the spillway replacement as originally envisioned. (*See* Dkt. No. 127 at 2–4 (list of relevant communications).) When the Corps concluded inadequate time in the season remained, Electron formulated a plan to stabilize the area, which would allow it to return and complete the spillway replacement in a subsequent work season. (*See* Dkt. No. 127-31 (communication from Corps "requesting that [Electron] propose a plan to stabilize the work site, minimize impacts to aquatic resources and species and prepare for the high fall/winter water flows until the next in-water work opens").) The Corps agreed to this plan and lifted the stop work order, at least for the limited purpose of implementing it. (*See* Dkt. Nos. 127-2, 127-38, 127-44.)

Because this plan was not explicitly permitted, Plaintiff and the Tribe assert respective 33 U.S.C. § 1311(a) causes of action, (*see* Dkt. Nos. 73 at 21–22 (Plaintiff's fifth claim), 82 at 32–33 (Tribe's sixth claim)), and the Tribe asserts a § 1344 cause of action, (*see* Dkt. No. 82 at 29–30 (Tribe's third claim)). In addition, the Tribe asserts a cause of action pursuant to 33 U.S.C. § 1341 for Electron Hydro's failure to obtain a site-specific Section 401 certification. (*See id.* at 31–32 (Tribe's fifth claim).) Plaintiff, the Tribe, and Defendants each move for summary judgment on the § 1311(a) and § 1344 claims; the Tribe also moves for summary judgment on its § 1341 claim. (*See* Dkt. Nos. 123 at 22–23, 130 at 22–28, 124 at 16–22.)

1. <u>§ 1311(a) and § 1344 Claims</u>

Absent a site-specific Section 404 permit, Electron Hydro needed to comply with applicable NWPs when implementing its October 2020 temporary stabilization plan. *See* 33 U.S.C. § 1344(a), (e). And it is uncontested that it had no site-specific Section 404 permit. (*See generally* Dkt. No. 124.) Instead, Defendants contend that (1) its temporary stabilization efforts were authorized under the original NWP 3 authorization, based on the nature of the activity; if not, (2) Electron's discussions with the Corps throughout September 2020 were informal consultations which modified the Corp's prior NWP 3 authorization. (*See* Dkt. No. 124 at 16–

22.) Because the relevant facts are undisputed, resolution of these arguments turn on purely legal issues.

Defendant's first argument is without merit. In August 2018, the Corps verified that the spillway replacement project was authorized on the condition that it complied with NWP 3. (Dkt. No. 127-10.) But, as clearly indicated in the Corps' verification letter, this was based on the "proposal as depicted [by Electron] on the enclosed drawings dated March 28, 2017." (*Id.* at 2.) Defendants readily admit that the October 2020 stabilization activities were not included in those drawings. (*See* Dkt. No. 144 at 8.) Instead, Defendants point to a provision within NWP 3. (*See* Dkt. No. 124 at 16–22.) It authorizes the construction of a "temporary structure . . . '*necessary* to conduct the [exempt] activity.'" (Dkt. No. 144 at 8 (citing 82 Fed. Reg. at 1984) (emphasis added).) Defendants focus on the "necessary" language. (*Id.*) But they provide the Court with no authority suggesting that this provision circumvents the pre-activity verification process. Nor would it seem logical that it would. *See* 33 C.F.R. § 330.6(a) (describing verification process). Therefore, the Court FINDS that the October 2020 stabilization work was not authorized by NWP 3, at least as originally verified by the Corps in 2018. For this reason, Defendants' first argument fails.

Defendants' second argument is more compelling. They contend that the Corps utilized its discretion pursuant to 33 C.F.R. § 330.5(d)(2)(i) to modify the NWP 3 authorization, at least for the purpose of constructing the temporary spillway. (*See* Dkt. No. 124 at 21.) In response, Plaintiff and the Tribe focus on the caveat within each of the Corps' letters that they are "not a permit." (*See* Dkt. Nos. 135 at 10, 136 at 23–24 (referencing Dkt. Nos. 127-2, 127-38, 127-44).) That is not the point. Defendants do not argue that the letters are, in fact, site-specific or individual Section 404 permits. (*See generally* Dkt. Nos. 124, 144.) Rather, they argue that the letters modified the prior NSP 3 authorization, at least for purposes of implementing the proposed stabilization plan. (*Id.*) This is consistent with language within the letters. (*See, e.g.*, Dkt. No. 127-2 at 4 ("we are lifting the Stop Work Order for the implementation of the temporary activities as described [in Electron's proposal]" which represent "authorized temporary work.").) To the extent this is not what the Corps intended, neither Plaintiff nor the Tribe provide a plausible explanation of what it did intend by those letters.[8]

Nor is the Court persuaded by the argument that Electron Hydro's application of field turf to the diversion channel permanently invalidated its NWP 3 authorization. (*See* Dkt. No. 136 at 20.) If that were so, there would be no need for regulations regarding suspending and/or modifying such authorizations—but there is. *See* 33 C.F.R. § 330.4(e). Nor would the Corps have had a basis to later *lift* the stop work order (*i.e.*, once invalid always invalid)—but it did three times. (*See* Dkt. Nos. 127-2, 127-38, 127-44). In addition, the Tribe's argument that, in fact, the original project did not qualify under NWP 3 authority in the first place, (*see* Dkt. No. 135 at 10), is unpersuasive, given the contents of the Corps' 2018 verification letter saying that it did. (Dkt. No. 127-10.) Use of the turf was, undoubtedly, not authorized pursuant to NWP 3. But nothing suggests that this alone is sufficient to permanently invalidate NWP coverage. *See* 33 C.F.R. § 330.1(c).

Accordingly, the Court GRANTS summary judgment to Electron Hydro and DENIES summary judgment to Plaintiff and the Tribe on Plaintiff's fifth and the Tribe's third and sixth causes of action, at least as it relates to construction of the temporary rock spillway.[9] (*See* Dkt. Nos. 73 at 21–22; 82 at 29–30, 32–33.)

2. <u>§ 1341 Claim</u>

CWA Section 401 mandates that an applicant for a federal permit provide notice of certain permitted discharges, so that the regulating agency can determine whether the anticipated

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[8] To the extent the Corps changed its mind as to what activity should be authorized, (*see* Dkt. No. 135-2), as it now appears to have done, (*see* Dkt. No. 136 at 23–24), it is too late. What is relevant is what it authorized in 2020, when the activity took place. Not a *post hoc* determination.

[9] Defendants moved for partial summary judgment solely on claims relating to construction of the temporary rock spillway—not on other October 2020 activities. (*See* Dkt. No. 124-1.) As a result, the Court will not consider the import of this ruling on other aspects of the the Tribe's § 1311(a) and/or § 1344 claims associated with stabilization activities. (*See* Dkt. No. 82 at 30, 33.)

discharge may exceed effluent limitations. *See* 33 U.S.C. § 1341(a). The Tribe asserts a cause of action based on Electron Hydro's failure to obtain a project-specific certification from the Washington Department of Ecology for its October 2020 stabilization work. (*See* Dkt. No. 82 at 31–32.) And it now seeks summary judgment on this claim. (*See* Dkt. No. 130 at 25–28.) For the reasons described below, the Court declines to do so.

Electron Hydro submitted a Joint Aquatic Resources Permit Application as part of the original spillway replacement project. (*See* Dkt. No. 130-3.) And it provided the Department of Ecology with Section 401 notice, which the Department declined to act on. (*Id.* at 17.) Because, as discussed above, that same NWP 3 authorization remains in effect, albeit in a limited form, it is not entirely clear whether an additional 401 notification would be required, at least as suggested by the flush language of the CWA. *See* 33 U.S.C. § 1341(a) (referencing an "applicant"). While the Tribe suggests as much, (*see* Dkt. No. 147 at 13–14), it provides no legal citation supporting this interpretation of the CWA. And a naked argument lacking in legal citation is insufficient to support summary judgment. *See, e.g.*, *Rattlesnake Coalition*, 509 F.3d at 1100.

Accordingly, the Court DENIES summary judgment to the Tribe on its fifth cause of action.[10] (*See* Dkt. No. 82 at 31–32.)

D. Construction Stormwater General Permit Compliance

The CWA also allows for construction-related storm water discharges through Section 402 Construction Stormwater General Permits ("CSWGP"). *See* 33 U.S.C. § 1342(b). Both Ecology and/or the E.P.A. are charged with enforcing compliance with these permits. *Id.* In 2018, Ecology issued Electron Hydro a CSWGP. (*See* Dkt. No. 128-2.) Plaintiff later asserted a

[10] While Defendants indicate they seek partial summary judgment on "all claims relating to the temporary rock spillway," (*see* Dkt. No. 124 at 4 (cleaned up)), they provide no argument supporting summary judgment on the Tribe's fifth cause of action, which implicates compliance with 33 U.S.C. § 1341.

cause of action for noncompliance with aspects of this permit, which it now seeks summary judgment on. (*See* Dkt. Nos. 73 at 20–21, 123 at 24–29.)

Plaintiff first seeks summary judgment on Electron Hydro's failure to update its Notice of Intent ("NOI") to reflect the true size of the construction area, *i.e.*, the disturbed area. (Dkt. No. 123 at 24.) Electron Hydro originally reported this to be 4.5 acres. (*See* Dkt. No. 128-6 at 3.) Anything above five acres triggers additional monitoring requirements. (*See, e.g.*, Dkt. No. 128-4 at 17.) But by June 2020, Steven Goodrich, the Electron Hydro employee responsible for stormwater inspections, determined that this amount was "low" and, in fact, it was "closer to six or seven" acres. (Dkt. Nos. 125-3 at 31, 138-8 at 20.) Nevertheless, Electron Hydro did not contemporaneously revise its NOI. (*See* Dkt. No. 137 at 18–19.) Defendants only response is to take issue with the total amount of disturbed area, as later determined by Ecology (which it estimated to be closer to ten acres). (*Id.*) But this does not establish a genuine issue of fact as to whether Electron Hydro underreported the disturbed area based on information available to it, *and* that this underreporting reduced otherwise-applicable monitoring requirements. Therefore, the Court FINDS this is a 33 U.S.C. § 1342 violation.

Plaintiff next seeks summary judgment on Electron Hydro's failure to (a) adequately stabilize soil in the construction area, provide secondary containment of equipment containing fuel, and maintain and repair erosion and sediment control Best Management Practices, all of which were required. (*See* Dkt. Nos. 123 at 25–26, 128-4 at 29–34.)[11] Ecology confirmed this to be true through post-incident inspections. (*See* Dkt. Nos. 128-6 at 3, 15, 16; 128-7 at 3, 9–11; 128-8 at 14, 18; *see also* Dkt. No. 129 at 2–3 (declaration of E.P.A. biologist and enforcement officer).) Defendants ostensibly concede this issue. (*See* Dkt. No. 137 at 17 (noting inspectors "saw what they saw").) Therefore, the Court FINDS this is also a 33 U.S.C. § 1342 violation.

Plaintiff also seeks summary judgment on Electron Hydro's inspection and recordkeeping practices. (*See* Dkt. No. 123 at 27–28.) Pursuant to its CSWGP, it needed to perform and log

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[11] By failing to follow these practices, Ecology asserted that Electron Hydro increased turbidity risk during construction activities. (*Id.*)

weekly inspections in a manner prescribed by its permit. (*See* Dkt. No. 128-4 at 14–16.) Plaintiff points to the period from July 2018 through August 8, 2020. (Dkt. No. 123 at 27–28.) During this time, Electron Hydro prepared no contemporaneous logs; instead, Mr. Goodrich recreated inspection reports after the fact, using field book notes. (*See* Dkt. No. 125-10 at 2–201.) But, as Plaintiff rightly points out, this does not meet CSWGP requirements. (*See* Dkt. No. 128-4 at 15.) Therefore, the Court FINDS this is also a 33 U.S.C. § 1342 violation.

Finally, Plaintiff seeks summary judgment on Electron Hydro's failure, on six occasions, to timely submit water sampling results through discharge monitoring reports. (*See* Dkt. No. 123 at 9.) This is another CSWGP requirement and, therefore, a potential violation. (*See* Dkt. No. 128-4 at 21–22.) Defendants assert this allegation is not adequately pleaded. (*See* Dkt. No. 137 at 22–23.) The Court disagrees. The complaint's reference to CSWGP Condition S5.B is sufficient, as this is the condition at issue here. (*See* Dkt. No. 73 at 11–12.) Therefore, the Court FINDS this is also a 33 U.S.C. § 1342 violation.

Accordingly, the Court GRANTS summary judgment to Plaintiff on its fourth cause of action. (*See* Dkt. No. 73 at 20–21.)

E. Persons Subject to CWA Liability

Lastly, Plaintiff and the Tribe ask the Court to find both Defendants—Electron Hydro *and* its Governor, COO, and Manager Thom Fischer—liable for the violations described above. (*See* Dkt. Nos. 123 at 13–15, 130 at 28–30.) Mr. Fischer's leadership role is not disputed.[12] (Dkt. Nos. 73 at 3, 81 at 3.) But this is not dispositive. For liability to attach, Plaintiff and/or the Tribe must demonstrate that Mr. Fischer was personally involved in the violations, *see* U.S.C. § 1319(a)(1), or that he is responsible for them based on the responsible officer doctrine. *U.S. v. Iverson*, 162 F.3d 1015, 1025 (9th Cir. 1998). The Court concludes that Mr. Fischer is liable based on either mechanism.

As to direct involvement, Plaintiff and the Tribe point to testimony and evidence

[12] He also admits that he is a "person" as defined by the CWA. (Dkt. No. 125-5 at 8.)

describing his knowledge of, and control over, the day-to-day aspects of the 2020 construction work, and his role in the permitting process. (*See* Dkt. Nos. 123 at 13, 130 at 28–30, 141 at 17–18 (citing Dkt. Nos. 78 at 12, 125-3 at 5–6, 10–11, 28–29; 125-11 at 5; 125-12 at 5, 11, 14–15, 22; 125-16 at 5; 130-3 at 5, 116, 123, 126, 220, 223–25, 233–34; 142-3 at 5).) Defendants present evidence that the decision to use the turf was initially that of a contractor, and that Mr. Fischer was not on-site when its installation began. (*See* Dkt. No. 138-4 at 3–4, 7–9.) But this is of no import, as Plaintiffs and the Tribe present unrefuted evidence that Mr. Fischer arrived later that day and, ostensibly, ratified this and many other decisions resulting in CWA violations. (*See, e.g.*, Dkt. Nos. 125-12 at 5, 11, 14–15, 22; 130-3 at 5, 116, 123, 126, 220, 223–25, 233–34.) Therefore, Defendants fail to establish a genuine issue of fact regarding Mr. Fischer's personal involvement in the conduct resulting in the violations described above.

Mr. Fischer also had "authority to exercise control over [Electron Hydro's] activity that is causing the discharges." *Iverson*, 162 F.3d at 1025 (9th Cir. 1998). This appears undisputed. (*See generally* Dkt. Nos. 137 at 24–27.) This is sufficient to trigger the responsible officer doctrine. Defendants suggest that Mr. Fischer can escape liability because he delegated some of the initial decisions resulting in the violations. (*See* Dkt. No. 137 at 24–26.) But this is not a shield from liability under the doctrine. *See, e.g.*, *Duarte Nursery, Inc. v. U.S. Army Corps of Engineers*, 2016 WL 4717986, slip op. at 14 (E.D. Cal. 2016); *see also Stillwater of Crown Point Homeowner's Ass'n, Inc. v. Kovich*, 820 F. Supp. 2d 859, 889 (N.D. Ind. 2011) (compiling cases applying the doctrine to CWA civil enforcement actions). This is particularly true here, where Plaintiff and the Tribe point to repeated instances where Mr. Fischer then ratified those decisions. (*See, e.g.*, Dkt. Nos. 125-12 at 5, 11, 14–15, 22; 130-3 at 5, 116, 123, 126, 220, 223–25, 233–34.)

Accordingly, the Court FINDS that Electron Hydro and Mr. Fischer are both liable for the CWA violations described above.

III. CONCLUSION

For the reasons described above, Plaintiff's motion for summary judgment (Dkt. No. 123) is GRANTED in part and DENIED in part, Plaintiff-Intervenor Puyallup Tribe of Indians' motion for partial summary judgment (Dkt. No. 130) is GRANTED in part and DENIED in part, and Defendants' motion for partial summary judgment (Dkt. No. 124) is GRANTED in part and DENIED in part.

A bench trial in this matter is currently set for October 10, 2023. Accordingly, the parties are ORDERED to meet and confer and provide the Court with a joint status report no later than September 15, 2023. It should summarize what genuine issues of fact remain that the parties believe are necessary to resolve the claims not fully disposed of by the rulings above.

DATED this 31st day of August 2023.

John C. Coughenour
UNITED STATES DISTRICT JUDGE

Puyallup Tribal Fisheries Annual Salmon, Steelhead And Bull Trout Report:

Puyallup/White River Watershed
Water Resource Inventory Area 10

2022-2023

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