Klickitat Subbasin Monitoring and Evaluation

- Yakima/Klickitat Fisheries Project (YKFP)

BPA Project # 1995-063-35

Report covers work performed under BPA contract #(s) 56662 REL 82, REL 106, REL 134, REL 162, REL 188, REL 213, REL 239, REL 264

Report was completed under BPA contract #(s) 56662 REL 264, REL 288

1/1/2016 - 12/31/2022

Nicolas Romero, Joseph Zendt, Kory Kuhn, Ryan Gerstenberger, and Michael Babcock

Yakama Confederated Tribes, Klickitat, WA, 98628

6/2023

This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views in this report are the author's and do not necessarily represent the views of BPA.

Table of Contents

List of Figures

List of Tables

I. Executive Project Summary/Abstract

This report describes the results of monitoring and evaluation (M&E) activities for salmonid fish populations and habitat in the Klickitat River subbasin in south-central Washington. The M&E activities described here were conducted as a part of the Bonneville Power Administration (BPA)-funded Yakima/Klickitat Fisheries Project (YKFP). Anadromous salmonid populations present in the Klickitat subbasin on which M&E activities focus include spring Chinook salmon and steelhead (both of which are native populations and focal species in this subbasin), and fall Chinook and coho salmon (which are both nonnative populations primarily sustained in this subbasin by hatchery production for harvest augmentation).

Major tasks described in this report include adult salmonid monitoring (monitoring adult salmonid population sizes, demographics, and spatial distribution via spawner surveys, and adult salmonid trapping at the Lyle Falls Fishway on the lower Klickitat River) and genetic analysis (characterizing genetic traits of salmonid populations, including genetic stock composition, hatchery/wild introgression, and anadromous/resident and summer- and winter-run steelhead relationships). The primary M&E type accomplished by the project is status and trend monitoring of fish populations and habitat, with data collection also occurring to monitor effectiveness of hatchery and habitat actions in the Klickitat subbasin.

Results of mark-recapture run size estimates at Lyle Falls at rivermile (RM) 2.4 on the Klickitat River indicate a depressed adult return of wild spring Chinook, averaging about 550 fish including adults and jacks from 2007-2022. Current returns are not consistent with historical reports of a large run of spring Chinook on the Klickitat River; these results are a continued cause for significant concern regarding the status and trend of this native population. Estimates of hatchery spring Chinook return to Lyle Falls are considerably higher, averaging about 3750 adults and jacks for 2007-2022. Run reconstruction estimates of spring Chinook run size (which use a combination of hatchery returns, harvest estimates, and redd counts) generally produce lower run size estimates than the mark-recapture methods, and support the depressed status determination for wild spring Chinook.

Mark-recapture estimates for steelhead returns to Lyle Falls for run years 2005-06 through 2022-23 indicate an average of about 1600 wild (summer and winter) steelhead and 2340 hatchery steelhead. This population may be close to meeting National Marine Fisheries Service (NMFS)-recommended mean minimum abundance criteria for this ESA-listed stock, but likely does not meet broader-sense recovery goals as defined by regional recovery partners and co-managers.

Results from spawning ground surveys (redd counts) indicate that majority of wild spring Chinook spawning occurs in the upper middle Klickitat River between Big Muddy Creek (RM 54) and Castile Falls (RM 64), but that a potentially large percentage of spawners on natural spawning grounds in the Klickitat River are hatchery-origin fish. Redd counts also agree with other adult monitoring methods in the determination that wild spring Chinook currently have low escapement numbers to natural spawning grounds. Trends in spring Chinook redd counts over the past 25 years have been either declining or somewhat stable but at very low levels (averaging about 100-120 redds per

year), and true trends in natural-origin spawners are difficult to accurately assess due to the presence of hatchery-origin fish on spawning grounds. Extended river turbidity has impacted the ability to obtain accurate redd counts in the middle and lower Klickitat River below glacial runoff inputs from Mt. Adams. Results also suggest that spring Chinook recolonization in the upper Klickitat River above Castile Falls following enhancements to past anthropogenically-impaired passage has been slow.

Redd count and carcass recovery results for fall Chinook and coho indicate both populations are largely sustained by hatchery production. Large numbers of fall Chinook escape to spawning grounds in most years (recent 10-year average redd count of about 1300), with most spawning occurring from the Klickitat Hatchery (RM 42) downstream to the Twin Bridges (RM 18) area near the town of Klickitat. Redd counts for coho are highly variable due to frequent high flows during surveys and variation in actual returns above Lyle Falls; in many years coho (generally much lower numbers than fall Chinook) spawn up to and around Klickitat Hatchery and in multiple tributaries in the middle and lower subbasin.

Spawning ground surveys indicate a fairly spatially diverse steelhead population in the Klickitat subbasin, with spawning occurring in many geographic locations throughout the middle and lower Klickitat subbasin, including multiple tributary streams, with the most use observed in the White Creek watershed and the middle and lower mainstem from RM 11 to 42. There is also some use (likely a low amount, but with uncertainty due to limited survey access) in the upper Klickitat River above Castile Falls.

Genetic sampling and analysis conducted under this project has provided valuable data in monitoring hatchery/wild interactions, stock identification of fish use of the lower Klickitat River, subpopulation structure within the subbasin, anadromous/resident relationships, and adult run timing characteristics. The summary of results for steelhead to date suggests the following: natural-origin and hatchery-origin steelhead sampled as adults and juveniles in the Klickitat appear to remain genetically distinct suggesting low introgression/interbreeding rates (with further monitoring to determine introgression rates between the stocks underway); multiple anadromous subpopulations (at least 6 or 7) exist within different areas of the Klickitat subbasin; primarily anadromous populations reside in the mid and lower subbasin downstream of major passage obstructions; resident populations use upstream areas but intermix with some anadromous populations; and there is a fairly high rate of use of the lower Klickitat River by out-of-subbasin populations. Additional analysis has identified multiple candidate genetic markers associated with anadromy and with summer/winter run timing in steelhead.

Conclusions from spring Chinook genetic analysis are that hatchery interbreeding with Wells Hatchery summer Chinook in the late 1970s and 1980s is the most likely cause of a hybridized genotype observed in Klickitat spring Chinook. Present hatchery releases of upriver bright fall Chinook stocks in the Klickitat do not appear to be exacerbating this status; but this finding does highlight the need for changes to the current spring Chinook program at Klickitat Hatchery (which are proposed in the Klickitat Master Planning process).

Scale age analysis has provided the following conclusions to date: for spring and fall Chinook, 4-year-olds continue to be the most common age of returning adults; for coho, 3-year-olds continue to dominate the returning adult population; for steelhead, 3- and 4-year-olds comprise similar percentages of returning adults with 5-year-olds making up a small percentage of the population.

Smolt-to-adult return rate estimates to date (from PIT tagging) for Klickitat Hatchery spring Chinook are fairly low (approximately 0.4%). Smolt-to-adult return rate estimates for Skamania Hatchery steelhead released in the Klickitat River are higher, at approximately 2.4%. Both of these are at or below other Middle Columbia populations.

A network of PIT tag arrays installed in anadromous fish bearing tributaries in the lower and middle sections of the subbasin were used document valuable life history and migratory movement pattern information. Of the monitored tributaries, the White Creek watershed (middle subbasin) and Snyder Creek (lower subbasin) were the most important steelhead producing streams. Summit Creek and Snyder Creek had the highest percentage of out-migrants (~50%) and Bowman Creek lowest (~18%). Swale Creek had the highest number of juvenile O. mykiss detections from fish tagged in other streams. Results indicate that Swale Creek provides important seasonal rearing and staging habitat for migratory natural-origin juvenile O. mykiss originating from other tributaries. In general, downstream migrants in monitored tributaries exhibited a bimodal out-migration pattern with peaks in the early winter and the spring. For fish detected migrating downstream past Bonneville Dam, results suggest two distinct life history stages with some fish rearing in the Klickitat River for at least an additional year prior to out-migrating to the Columbia River and other fish migrating directly down the Klickitat and Columbia rivers to Bonneville Dam within about a month of exiting rearing streams. These results indicate that resident/anadromous O. mykiss exhibit a "spreading of risk" strategy, with some utilizing rearing habitats in tributaries and some in the mainstem Klickitat River.

Natural-origin steelhead smolts emigrate from the Klickitat River during an abbreviated period (March-June). The majority of smolts out-migrate during the months of April and May. The number of natural-origin steelhead smolts collected at the screw trap declined each year from a peak in 2018 to a low in 2022. Estimates of natural-origin steelhead abundance ranged from 98,796 (CI 78,927-118,663) in 2018 to 34,109 (CI 28,359-39,859) in 2022. Survival of natural-origin steelhead smolts between the Klickitat River and Bonneville Dam was below 60% for all years except in 2019 (~84%). A significant decline in SAR to Bonneville Dam occurred from 2018 to 2019. Although concerning, our estimates are similar to reported declines in smolt production and adult returns throughout the Columbia River basin over the reporting period.

A decline in flow permanence in anadromous fish bearing tributaries in the lower and middle portions of the Klickitat River subbasin has been anecdotally observed over the last decade. In the fall of 2022, low flow surveys were conducted to spatially and temporally quantify flow conditions in anadromous fish bearing tributaries. Of the eleven streams surveyed, only three streams (Little Klickitat River, Bowman Creek, and Summit Creek) maintained perineal flow. Results of the flow survey in the White Creek drainage, Dead Canyon Creek, Swale Creek, Snyder Creek, Logging Camp Creek, Wheeler Creek, and Dillacort Creek quantified dry channel in 59%, 74%, 45%, 13%, 22%, 100%, and 39% of the cumulative fish bearing length in each tributary, respectively.

A gradient of stream water temperatures were observed from cooler temperatures in the upper basin to higher temperatures in the lower basin. The number of days reaching 7-day average daily maximum temperatures of 18° C in the lower basin was 33-fold and ~2-fold greater than upper basin and middle basin, respectively. The upper basin did not record a single day that reached 22° C 7-day average daily maximum temperatures. The lower basins had twice as many days than the middle basin that reached 7-day average daily maximum temperatures of 22° C. High temperatures and associated reductions in dissolved oxygen, along with dewatering, present potentially significant habitat limitations for juvenile salmonids, especially for Mid-Columbia steelhead.

II. Acknowledgements

YN Fisheries/YKFP technicians (Sandy Pinkham, Rodger Begay, Scott Spino, John Washines, Dean Antone and Jeremy Takala) collected most of the field data presented in this report. YN Fisheries/YKFP Southern Territories coordinator Bill Sharp provided oversight and management. Flo Wallahee, Winna Switzler, and Jeff Trammel of YN/YKFP provided fish video counts for Castile Falls. Jerod Bartholomew, Gregg Knott, and Duane Spino of YN/YKFP maintained facilities and equipment at Lyle Falls and Castile Falls. David Lindley and Shawn Bechtol of YN/YKFP assisted with data collection and management and database report development. Jeanette Burkhardt, YN/YKFP watershed planner/outreach coordinator, provided website content development and assisted with field data collection. Shawn Narum, Jon Hess, and Erin Collins with Columbia River Inter-Tribal Fish Commission (CRITFC) provided genetic analysis information. Lyle adult trap operation and population estimation began as a joint project between WDFW and YN/YKFP – methods have been adapted from that effort as begun by Steve Gray and Dan Rawding of WDFW.

III. Introduction

This report describes the results of monitoring and evaluation (M&E) activities for salmonid fish populations and habitat in the Klickitat River subbasin in south-central Washington (map in Figure 1). The M&E activities described here were conducted as a part of the Bonneville Power Administration (BPA)-funded Yakima/Klickitat Fisheries Project (YKFP) and were designed by consensus of the scientists with the Yakama Nation (YN) Fisheries Program. YKFP is a joint project between YN and Washington Department of Fish and Wildlife (WDFW). Overall YKFP goals are to increase natural production of and opportunity to harvest salmon and steelhead in the Yakima and Klickitat subbasins using hatchery supplementation, harvest augmentation and habitat improvements. Klickitat subbasin M&E activities have been subjected to scientific and technical review by members of the YKFP Science/Technical Advisory Committee (STAC) as part of the YKFP's overall M&E proposal. Yakama Nation YKFP biologists have transformed the conceptual design into the tasks described. YKFP biologists have also been involved in various Columbia basin regional efforts to standardize M&E data collection and reporting protocols, and are working towards keeping Klickitat M&E activities consistent with applicable standards.

Anadromous salmonid populations present in the Klickitat subbasin on which M&E activities focus include spring and fall Chinook salmon (Oncorhychus tshawytscha), coho salmon (O. kisutch), and steelhead (O. mykiss). Spring Chinook salmon and steelhead are both native populations and focal species in this subbasin; fall Chinook and coho salmon are nonnative populations primarily sustained in this subbasin by hatchery production for harvest augmentation (NPCC 2004). Steelhead in the Klickitat subbasin are part of the Endangered Species Act (ESA)-listed (threatened) Middle Columbia River distinct population segment.

Other important salmonid populations present in the Klickitat subbasin include resident rainbow trout (O. mykiss), cutthroat trout (O. clarkii), ESA-threatened bull trout (Salvelinus confluentus) and nonnative brook trout (S. fontinalis).

This report describes progress and results for the following major categories of YN-managed tasks under this contract:

- Adult salmonid monitoring – monitoring adult salmonid population sizes, demographics, and spatial distribution via spawner surveys, adult salmonid trapping at the Lyle Falls Fishway on the lower Klickitat River, and video monitoring at the Castile Falls fishway on the upper Klickitat River
- Genetic analysis – characterizing genetic traits of salmonid populations, including genetic stock composition, hatchery/wild introgression, anadromous/resident and summer- and winter-run steelhead relationships, refining methods of detecting within-stock and between-stock variation
- Juvenile and resident salmonid monitoring – monitoring outmigration, survival, spatial distribution, and life history patterns via smolt trapping, stream populations surveys, PIT tagging, and operation of PIT tag interrogation arrays.
- Habitat monitoring – monitoring physical habitat parameters and ecosystem responses to habitat actions via habitat surveys, temperature, water quality, and streamflow monitoring.

These tasks have elements of status and trend monitoring of fish populations and habitat, as well as incorporating designs aimed at monitoring effectiveness of hatchery and habitat actions in the Klickitat subbasin.

Additional and updated information for this project is also available at the YKFP website (www.ykfp.org/klickitat/).

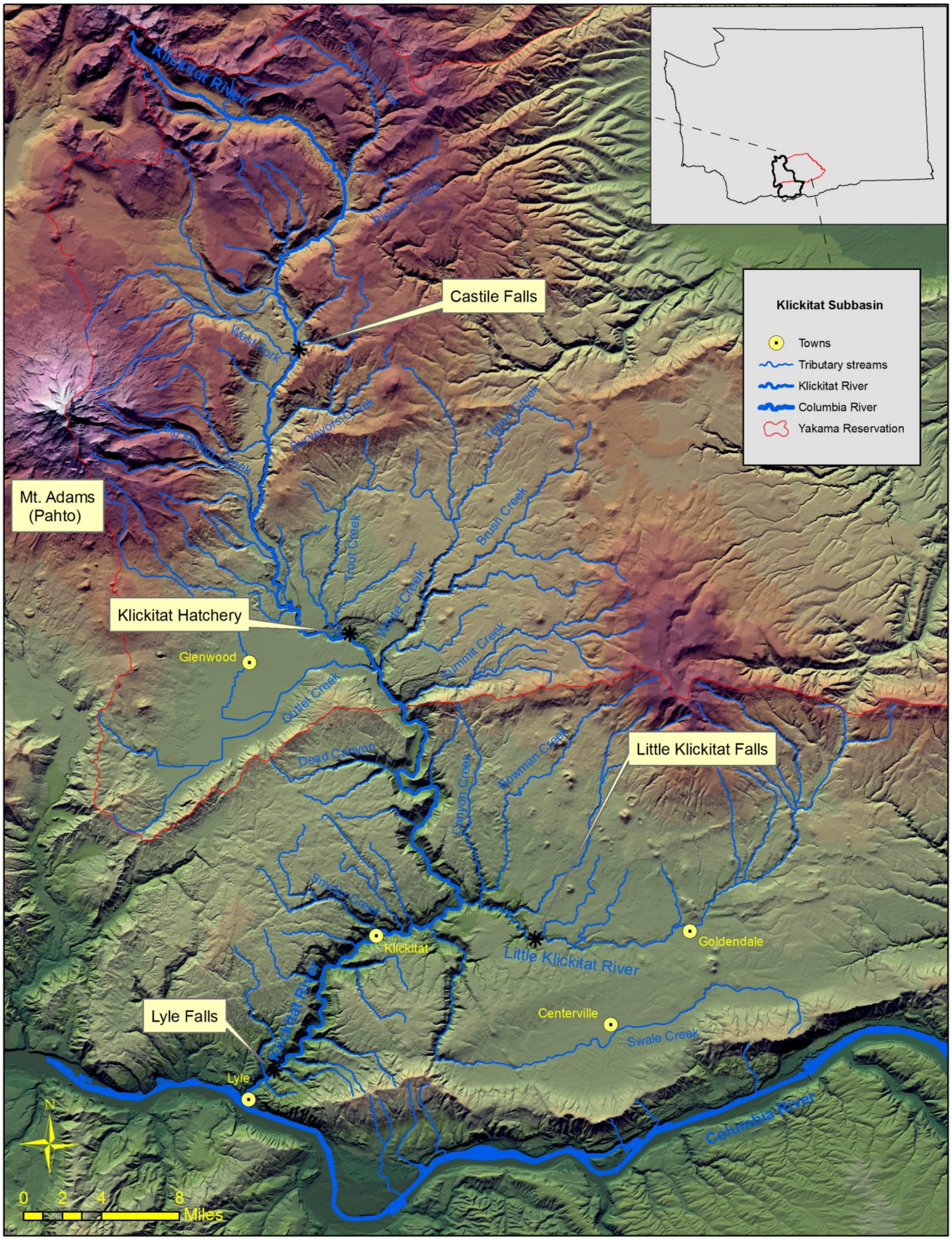

Figure 1. Map of the Klickitat subbasin with major landmarks.

IV. Work Elements / Tasks

Adult salmonid monitoring at Lyle Falls fishway

Introduction

Monitoring adult salmonid run size, run timing, and passage, and collecting biological data from returning adults are ongoing key objectives in the Klickitat River. The Lyle Falls fishway at RM 2.4 (Figure 1) on the Klickitat River was constructed in the early 1950s to improve fish passage; however the natural falls are not a complete barrier and many adult salmonids do ascend the falls (counts of fish in the fish ladder are not a census of fish returning to the Klickitat River). This facility provides a key monitoring site via operation of an adult salmonid fish trap in the fishway. During 2010-2013, significant construction improvements to the fishway and adult trap were completed under BPA Project # 1988-115-35 (YKFP Klickitat River Design and Construction Project); major tasks included upstream extension of the fishway to an improved fish exit location, screened auxiliary water intake to allow for improved attraction flow; modified weirs in the lower fishway to improve hydraulic conditions, and an offline adult trap that allows for mechanical crowding, lifting, and water-to-water transfer (via a false weir and flume system) to a fish handling and sampling facility (a mobile trailer that can be moved during flood flows). The improved adult trap and fish handling facility were operational in early 2013.

Adult run size monitoring, especially with mark-recapture methods of abundance at Lyle Falls, focuses on spring Chinook and steelhead as these are native focal species in the Klickitat subbasin (NPCC 2004). Fall Chinook and coho are important production stocks providing harvest opportunities and are also monitored, but adequate sample sizes of marks and recaptures are not achieved in all years to establish mark-recapture estimates for those stocks.

Methods

Adult salmonids were trapped, enumerated, sampled, and then released in the Lyle Falls fish ladder. Under previous trap operations (2005 - 2012), water levels inside the fishway were lowered via gate operation to allow personnel to enter the fishway trap area and capture adult salmonids with dipnets. Beginning in early 2013, new trap facilities allowed for mechanical crowding and lifting from the offline trap, followed by volitional attraction via false weir into a flume that transported fish into a mobile trailer that serves as the fish handling and sampling area. Inside the trailer fish were held in 325-gallon holding tanks lined and covered with custom-made soft mesh nets that allowed for fish retrieval and handling. A low-voltage electronarcosis system (Hudson et al. 2011) with fixed electrodes in the holding tanks was used to immobilize fish for sampling. After sampling, fish were released via the flume system into a low-velocity area of the fishway which allowed for continued upstream migration. Details of the electronarcosis system as well as results of an evaluation of effects of this technique are found in Keep et al. (2015). This evaluation found no differences in travel times, after release to points 10 and 20 miles upstream, between fish treated either with electronarcosis or carbon dioxide (another widely-used fish sedative). Hudson et al. (2014) also found a lack of effect on embryo mortality and fry growth from adult coho salmon treated with electronarcosis prior to spawning. Other chemical sedatives were deemed inappropriate for use due to the fact that fish can be harvested after release from this facility, and most chemical agents require a withdrawal period prior to human consumption. Biological data were collected from individual fish including fork length, sex, scales, genetic samples, body and gill color, existing marks, and presence of CWT (coded wire tag) and PIT (passive integrated transponder) tags. Because counts of fish in the adult trap are not a census of fish returning to the Klickitat River, mark-recapture methods are used to monitor run size. Marks (floy tags) were administered and subsequently used along with a second sampling event to develop mark-recapture population estimates. Spring Chinook population estimates were made following recapture of hatchery fish that voluntarily returned to the adult holding pond at the Klickitat Hatchery. Carcass recovery during spawner surveys also potentially provides recapture data on marked fish for salmon species, but in most years too few marked carcasses have been observed to yield precise population estimates with that method. Steelhead recaptures occurred via anglers; a select group of anglers fishing at various locations on the middle and lower Klickitat River (but upstream of Lyle Falls) recorded total numbers of steelhead caught and numbers of tagged steelhead caught during the sport steelhead fishing season (June 1 – November 30). Steelhead in the Klickitat River are listed as threatened under the Endangered Species Act (ESA), and only hatchery steelhead were tagged with floy tags at Lyle Falls. For population estimation, wild steelhead were assumed to use the fish ladder in the same proportion as hatchery fish, and the same capture-recapture ratio was used to generate wild steelhead estimates (using the total number of wild steelhead trapped at Lyle Falls as the "marked" fish). Steelhead were also divided into two runs for estimation purposes: summer run (those passing Lyle Falls from May 1 through November 30) and winter run (those passing Lyle Falls December 1 through April 30). The mark-recapture population estimates were generated for summer steelhead (hatchery and wild). For winter steelhead, due to the lack of a recapture effort (there is no sport steelhead angling season during the winter run), trap counts for the December-April period were used as a census count. This assumes all steelhead during the winter period use the fish ladder and do not ascend the natural falls; although this is what is believed to occur at falls on other nearby rivers such as the Wind and Kalama due to low water temperatures (Gray 2006), this assumption is likely inaccurate on the Klickitat River and requires further evaluation. Winter steelhead that ascend the natural falls on the lower Klickitat River likely result in a winter steelhead estimate that is biased low. Hatchery steelhead passing Lyle Falls December 1 through April 30 were counted as summer steelhead because all hatchery juveniles released in the Klickitat River are summer-run Skamania Hatchery stock. The counts of these hatchery fish were simply added to the mark-recapture estimates for summer hatchery steelhead.

Population estimates were generated using the Peterson estimator with modification for small sample size (Chapman 1951, as described in Seber 1982):

$$N = \frac{(m+1)(c+1)}{(r+1)} - 1$$

where N = population estimate (in this case N represents the population/run size estimate at Lyle Falls), m = the number of fish marked or tagged and released back into the population, c = total number of fish captured at the second sampling event, and r = number of fish captured in the second sampling event that were marked or tagged (recaptures). Variance was estimated as:

$$S^2 = \frac{(m+1)(c+1)(m-r)(c-r)}{(r+1)^2(r+2)}$$

(Seber 1982). Normal confidence intervals (CI) can be calculated as:

$$95\%\ CI = 1.96 * S$$

However, a non-normal, asymmetric confidence interval calculation with improved coverage was generally used (Arnason et al. 1991):

$$T = N^{-1/3}$$

$$S(T) = T * \frac{S(N)}{3N}$$

$$(T_L, T_U) = T \pm 1.96 * S(T)$$

$$(N_L, N_U) = (1/T_L^3, 1/T_U^3)$$

where N_L and N_U are the lower and upper 95% confidence limits.

In cases where winter steelhead trap counts were added to population estimates (as described above), these assumed census counts were also simply added to the upper and lower confidence limits that resulted from the above equations.

Results

A summary of fish counts at the Lyle Falls adult trap by calendar year for 2013-2022 is in Table 51 in Appendix B. Results of mark-recapture population/run size estimates at Lyle Falls for spring Chinook are shown in Figure 2 below and in Table 52 (Appendix B). The first year that all returning adults were 100% adipose fin marked was 2007. Estimates of total run size (adults and jacks) for 2007-2022 indicate an average of approximately 3750 hatchery spring Chinook (ranging from about 1100 to 5900) and approximately 550 wild spring Chinook (ranging from about 180 to 1040). The two most recent estimates generated are the lowest and highest on record for wild spring Chinook: the 2018 estimate (179) is on the low end, while the 2022 estimate (1043) represents the high end. Mark-recapture estimates for spring Chinook were not generated in 2019, 2020, and 2021 due to capture of hatchery broodstock at Lyle Falls (implemented because of very low return forecasts) limiting the number of fish available for mark and release. Jacks averaged 19% of the run at Lyle Falls in those years.

Results for summer steelhead are in Figure 3 below; total wild and hatchery steelhead estimates are shown in Table 53 (Appendix B). For run years 2005-06 through 2022-23 (estimates were generated for all but 2 years during that period), wild steelhead (summer and winter) returns to Lyle Falls averaged 1600 fish (ranging from 540 to 3270) and hatchery steelhead returns averaged about 2340 fish (ranging from 442 [in 2021-22] to 5150). The geometric mean of wild steelhead (summer and winter) returns to Lyle Falls for the same time period is approximately 1400 fish.

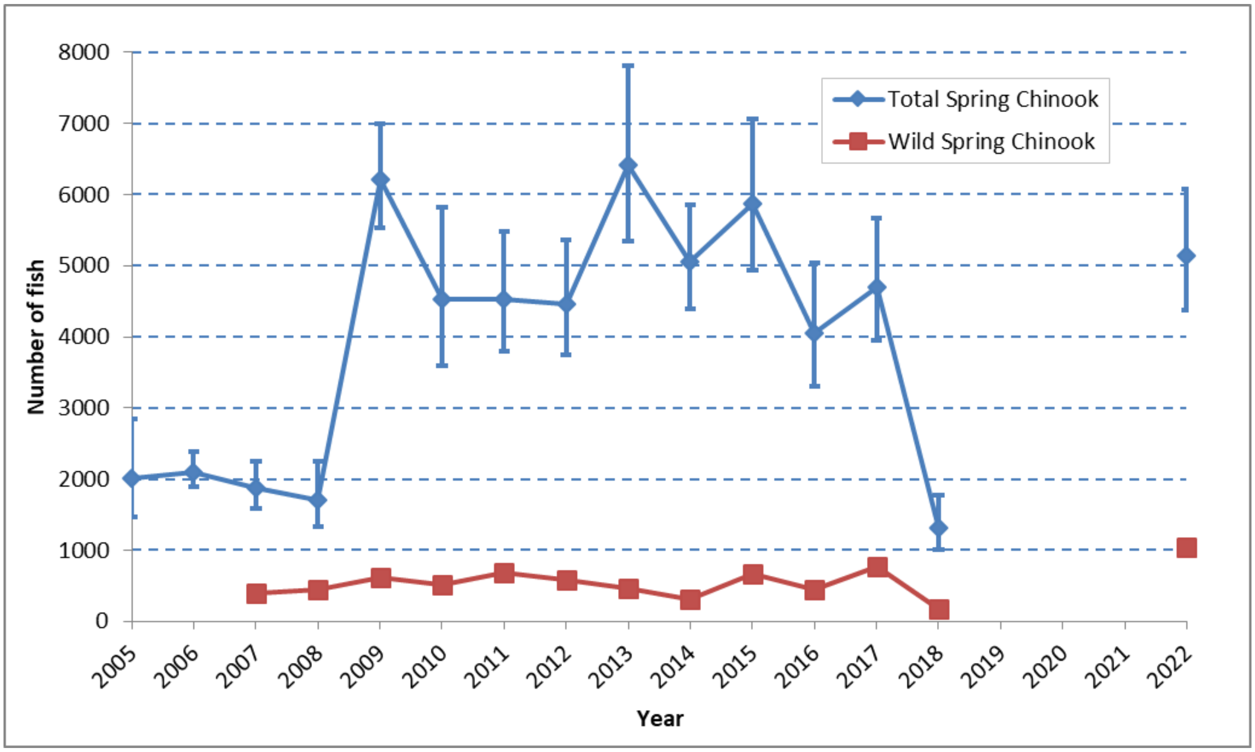

Figure 2. Mark-recapture estimates of spring Chinook run size at Lyle Falls on the lower Klickitat River. Error bars represent 95% confidence intervals. Estimates were not generated in 2019, 2020, and 2021 due to hatchery broodstock collection.

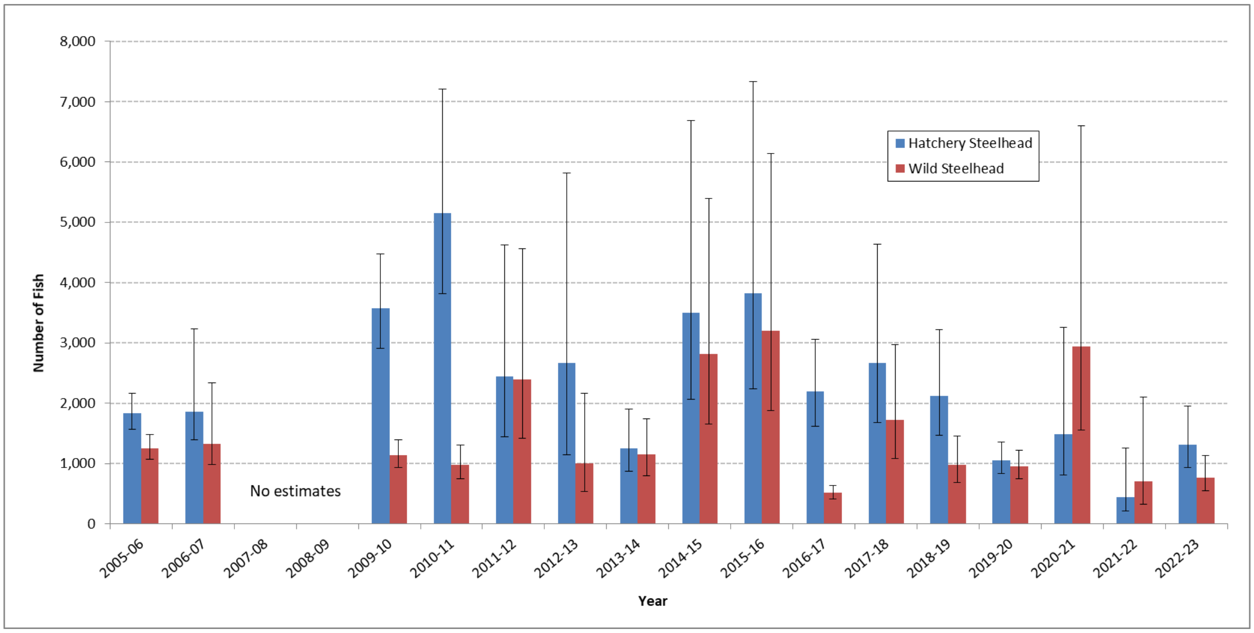

Figure 3. Mark-recapture estimates of summer steelhead run size at Lyle Falls on the lower Klickitat River. Error bars represent 95% confidence intervals.

Current updated daily and annual trap count data are available at the YKFP website (http://www.ykfp.org/klickitat/Data_lyleadulttrap.htm).

Conclusions

With an average run size of about 500 fish at Lyle Falls, current wild spring Chinook returns do not seem consistent with historical reports of a "large run of spring chinook" (Bryant 1949). Although Klickitat spring Chinook, as part of the Middle Columbia River evolutionarily significant unit, are not listed under the ESA, they have been rated as "depressed" by WDFW's Salmonid Stock Inventory (SaSI) due to chronically low returns (WDFW 2002). These results continue to cause significant concern to co-managers regarding the status and trend of this native population. Hatchery reforms are in final planning and design stages which would change the Klickitat Hatchery spring Chinook program from segregated to integrated (using some wild fish for broodstock under certain percentage limits to protect wild returns).

For steelhead, which in the Klickitat subbasin are part of the Middle Columbia River distinct population segment and are listed under the ESA as threatened, a National Marine Fisheries Service (NMFS)-recommended recovery goal for delisting includes, among other criteria, a mean minimum abundance threshold of 1,000 naturally-produced spawners in order to achieve viable status or a 5% or less risk of extinction over a 100-year timeframe (NMFS 2009). In addition, broad-sense recovery goals can be defined, and the Yakama Nation has proposed the achievement of a highly viable status for this population (which corresponds to a 1% risk of extinction in a 100-year period) as a recovery goal (NMFS 2009). The 2005-2019 estimates yield a mean and a geometric mean of about 1400-1600 total wild steelhead return to Lyle Falls (Table 53 in Appendix B); whether or not this constitutes achievement of the abundance criteria would require a determination by NMFS and regional recovery partners and co-managers. Important additional factors in that analysis would include: the mark-recapture estimates reported here are estimates of population size at Lyle Falls on the lower Klickitat River and not necessarily the resulting spawner abundance as specified in NMFS criteria (i.e., pre-spawning mortality likely results in an actual spawner abundance somewhat less than the Lyle Falls run size); genetic analysis and tagging data indicate some out-of-subbasin temporary stray (dip-in) steelhead migrate past Lyle Falls before exiting the Klickitat River and are included in the mark-recapture estimates (see Genetic Analysis section below); and the fact that winter steelhead abundance estimates are almost certainly biased low at Lyle Falls (see Methods description above).

Adult salmonid monitoring at Castile Falls fishway

Introduction

Monitoring adult salmonid passage into the upper Klickitat River is an important ongoing objective. Castile Falls is a series of 11 falls on the upper Klickitat River (Figure 1) which limited but did not preclude natural passage of native spring Chinook and steelhead; fishways were constructed in the early 1960s to improve passage but likely limited natural passage further (NPCC 2004). Passage improvements (weir reconstruction) at the Castile Falls #10 and 11 fishway at RM 64.6 were completed in 2005. Additional upgrades (video monitoring, PIT tag detection, and on-site power generation) were completed in 2012 under BPA Project # 1988-115-35 (YKFP Klickitat River Design and Construction Project).

Adult passage monitoring focuses on spring Chinook and steelhead, as these are native focal species in the Klickitat subbasin (NPCC 2004), and other anadromous species rarely ascend above Castile Falls. Video counts in the Castile Falls 10/11 fishway are currently presumed to be census counts as virtually all passage is through this fishway; a weir above Falls 10 limits natural upstream passage in the river.

Methods

A digital video camera in the below-grade observation room adjacent to the upper end of the Castile Falls 10/11 fishway was used to record video footage through a window into the fishway; a vertical aluminum picket crowder crowds fish to within approximately 1 foot of the observation window. Video footage with detected motion was transferred via satellite internet connection to technicians who then viewed the video and enumerated upstream migrating anadromous salmonids, recording species, adult/jack status, and adipose clip status.

Results

Video monitoring began at the Castile Falls 10/11 fishway on June 28, 2012. Because of its location high in the subbasin and the fact that the vast majority of fish passing Castile Falls in a given run year do so in summer through early fall, the run year is considered as June 1 through May 31. To date relatively low numbers of fish per return year have been observed; the highest overall counts were during the first return year of 2012-13 when 40 steelhead (33 wild and 7 hatchery fish) and 12 spring Chinook (11 wild and 1 hatchery) were observed. Most years since then have seen fewer than 10 fish of a given species/origin per return year with occasional slightly higher numbers of both wild and hatchery steelhead (Figure 4). To date only spring Chinook and steelhead have been counted; no other anadromous salmonid species has been observed. For spring Chinook, the majority passes through the fishway in July and the run is generally complete by the end of August. For steelhead, most fish pass in July-August, with small numbers passing in winter and spring months.

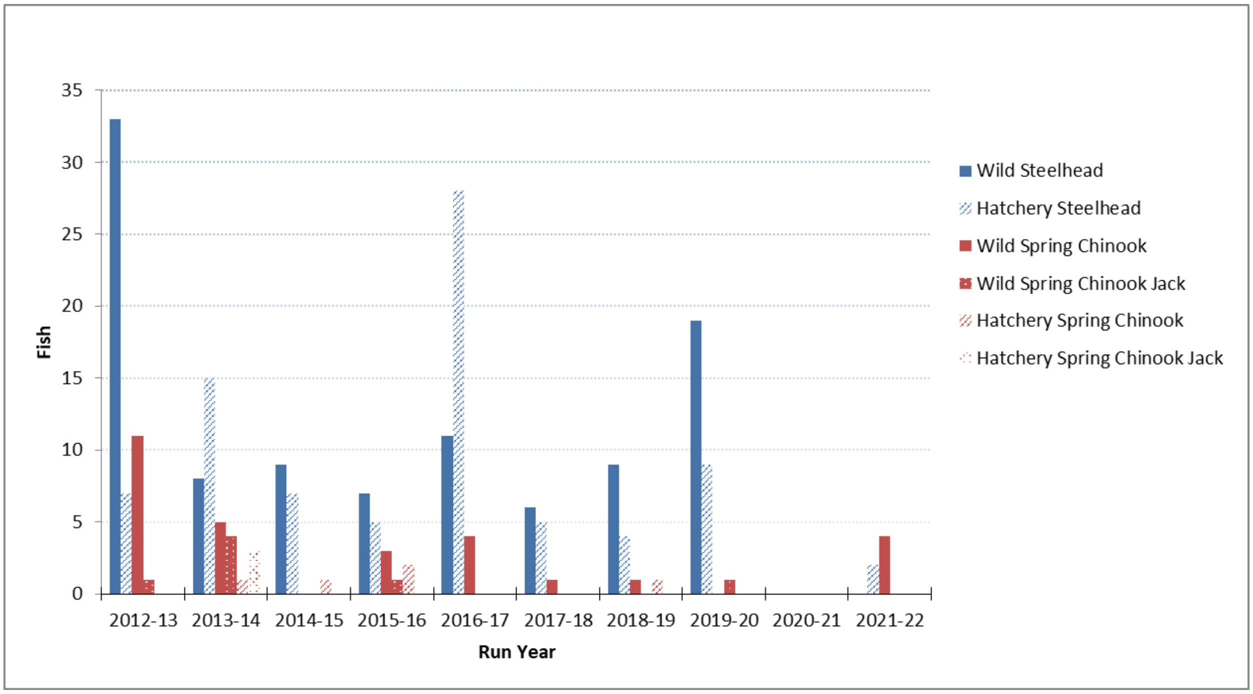

Figure 4. Video counts by run year of anadromous salmonids at the Castile Falls 10/11 fishway on the upper Klickitat River. Run year is June 1 – May 31.

Conclusions

With overall low numbers of fish observed to date at the Castile Falls 10/11 fishway video monitoring facility, results suggest (and generally agree with results from spawning ground surveys) that large numbers of fish are not utilizing the upper Klickitat subbasin, despite now having enhanced access to significant amounts of high quality spawning habitat. The role of the hatchery steelhead that are observed at the Castile Falls 10/11 fishway is unknown; since these fish are mostly migrating in the summer and early fall, it is unknown if they remain in the upper Klickitat River to spawn or move to other areas prior to spawning season.

Spawning ground surveys (redd counts)

Introduction

In order to monitor spatial and temporal redd distribution of spring and fall Chinook, coho, and steelhead, and to collect biological data from carcasses, spawning ground surveys are conducted throughout the Klickitat subbasin. Spawning ground surveys provide a means of monitoring annual adult spawner escapement as well as spawner distribution.

Methods

Regular foot and/or raft surveys were conducted within the known geographic range for each species. Surveys were generally conducted every two weeks in each river reach. Individual redds were counted and their locations recorded using handheld GPS units. Counts of live fish and carcasses were also recorded. Carcasses were examined for sex determination, egg/milt retention (percent spawned), and presence of CWT tags or external experimental marks. Observations of carcasses with floy tags (inserted into adult salmon and hatchery steelhead at the Lyle Falls adult trap at RM 2.4) aided in population estimation. Scale samples were also taken from carcasses using methods outlined in Crawford et al. (2007).

Spawning ground surveys were conducted as follows: spring Chinook – mid August through early October; fall Chinook – late October through mid December; coho – late October through late January; steelhead – late February through mid June. Attempts were made to cover the entire known spawning range of each species, although in some cases, access, flows, and visibility limited surveys. Stream reaches were surveyed multiple times during the spawning periods, with most reaches receiving at least 2-3 passes, and survey passes being conducted approximately two weeks apart in each reach. Subsequent survey passes generally continued in each reach until no live spawners were observed. Methods generally followed those of Gallagher et al. (2007).

Results

Spawner survey results are briefly discussed by species below. Figure 5 through Figure 8 show the observed spawning distribution for spring Chinook, fall Chinook, coho, and steelhead, respectively. Additional tabular and graphical summaries of spawning ground survey results are presented in Appendix B.

Spring Chinook

Observed spring Chinook spawning distribution for 2013 through 2022 is shown in Figure 5. Natural spring Chinook spawning typically occurs in the Klickitat mainstem upstream of the Little Klickitat River confluence (RM 20), with most of the spawning occurring upstream of the Big Muddy Creek confluence (RM 54) up to Castile Falls (RM 64). Additional spawning occurs above Castile Falls which historically had some natural passage and had also been seeded in recent years (2000 and 2002-4) by transporting and releasing surplus adult spring Chinook that returned to the Klickitat Hatchery. No adult fish have been transported above Castile Falls since 2004. Improvements completed in 2005 at the Castile Falls fish ladders enhanced fish passage and corrected problems with the original 1960s ladders, which had actually impaired natural passage and had likely reduced fish numbers above the falls from historic levels.

Surveys in 2021-2022 began in mid August (August 16 in 2021 and August 15 in 2022) and continued into October (October 18 in 2021 and October 5 in 2022). Surveys covered 67 river miles in the mainstem Klickitat River in 2021 and 57 in 2022, from above McCormick Meadows at about RM 88 to the Little Klickitat River at RM 20. No surveys were conducted in Diamond Fork Creek in either year, and in 2022 no surveys were conducted in the Signal Peak Bridge to old USGS gage/Parrotts Crossing reach (a key wild spawning reach). Extended high turbidity in both years delayed surveys in the river below Big Muddy Creek (where most of the glacial runoff from Mt. Adams enters the Klickitat R.) until late September or early October. In 2022 these conditions along with a shortage of experienced crew prevented surveys in the Signal Peak Bridge to old USGS gage/Parrotts Crossing reach for the entire season. This results in a 2022 redd count that was biased low. Table 55 in Appendix B shows results of spring Chinook redd counts for 1989-2022 by river reach. Surveys for the 2010-2018 period years show a general increase over counts from the 2004-2009 period, during which some of the lowest redd counts on record were recorded. Redd counts in 2019-2022 are well below long term average but all those years except 2021 were affected by survey conditions and visibility. The 1989-2021 (excluding 2019, 2020, and 2022) average spring Chinook redd count is 105. If survey conditions that were present in several recent years persist in the future, the utility of spring Chinook redd counts in monitoring spawner abundance and distribution may decrease.

As in other recent years, results of spawner surveys above Castile Falls showed very little use by spring Chinook spawners in the upper Klickitat River, with no redds observed in 2021 or 2022. A peak number of redds of 36 was observed in 2007; some of the returning fish in that year may have resulted from the past releases of surplus hatchery adults in that area. Figure 19 in Appendix B shows results of redd counts above Castile Falls.

One significant factor in the redd count trends is the presence of hatchery-origin fish on spring Chinook spawning grounds. From 2007-2022 (2007 is the first year in which all returning 4- and 5-year-old hatchery spring Chinook adults were 100% ad-clipped), the percentage of hatchery-origin carcasses recovered on spawner surveys has averaged 37% (Table 56 in Appendix B). Sample sizes of recovered spring Chinook carcasses are quite low due to typically low overall returns and fast river conditions in some reaches, so uncertainty exists in annual estimates, but results to date indicate a significant percentage of hatchery-origin adults, including in core wild spring Chinook spawning reaches.

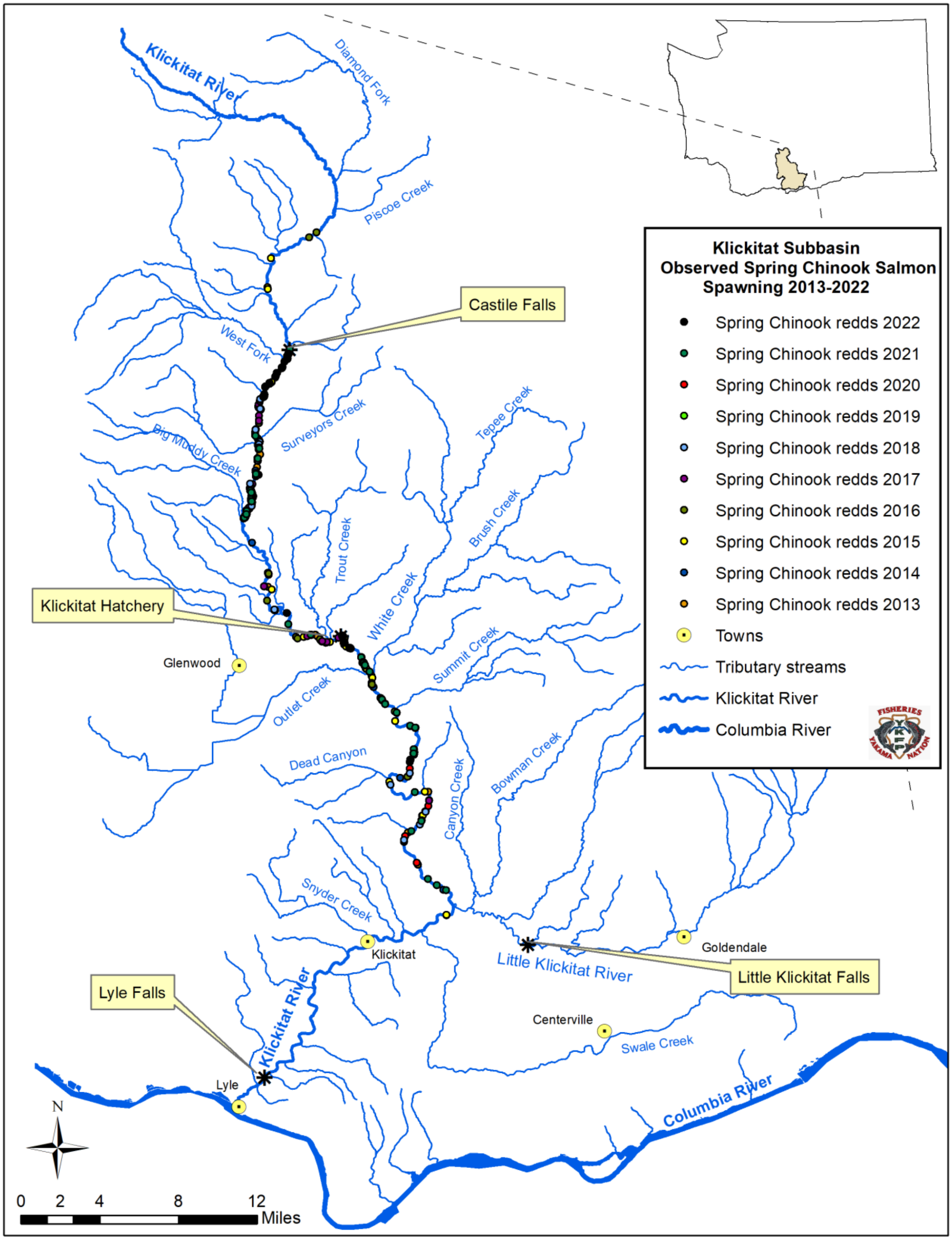

Figure 5. Observed spring Chinook spawning distribution in the Klickitat subbasin for 2013-2022.

Fall Chinook

Fall Chinook are mainstem spawners and generally utilize the lower portion of the river, downstream of the Klickitat Hatchery. Observed fall Chinook spawning distribution for 2013 through 2022 is shown in Figure 6.

Table 57 in Appendix B shows results of fall Chinook redd counts in the Klickitat subbasin for 1995-2022 by river reach. After record highs in 2013-2014 (along with very high overall Columbia River basin fall Chinook returns) with 3600-3800 redds observed, counts dropped to near record lows in 2017-2019 at around 200-300 redds, also similar to basinwide returns. Counts in 2020-2022 rose and fell again, with counts in 2021 biased significantly low due to extended high river turbidity in November and early December. The recent ten-year (2012-2022 excluding 2021) average redd count is 1302. Surveys in 2021-2022 were conducted from late October until early-mid December. Surveys covered approximately 41 river miles. The highest redd densities occurred in the river reach from Klickitat Hatchery (RM 42) downstream to Stinson Flats (RM 29), as well as just upstream of the Little Klickitat River confluence (RM 20).

No carcasses intact enough to determine adipose fin status were recovered on 2021 surveys and only 3 were recovered in 2022 surveys; 1 was adipose-clipped and 2 were not. No floy-tagged fish (from the Lyle Falls adult trap) were observed in 2021-22. The small carcass sample sizes from 2021-22 were not useful in long term trend analysis of origin/marks in this population. In recent previous years, these observed percentages of ad-clipped carcasses are somewhat similar to ad-clipped percentages of hatchery juveniles released in years that would produce adults for these return years. On average 60.8% (ranging from 24.4% for release year 2017 to 100% in 2016) of fall Chinook juveniles released in the Klickitat in 2012-2017were ad-marked in those release years (Fish Passage Center data), while the average of ad-clipped carcasses across the corresponding return years was 54.9%. Those results would suggest that, despite observed spawning activity and relatively high redd counts in some years, fall Chinook natural production in the Klickitat River in most years does not successfully produce high numbers of returning adults.

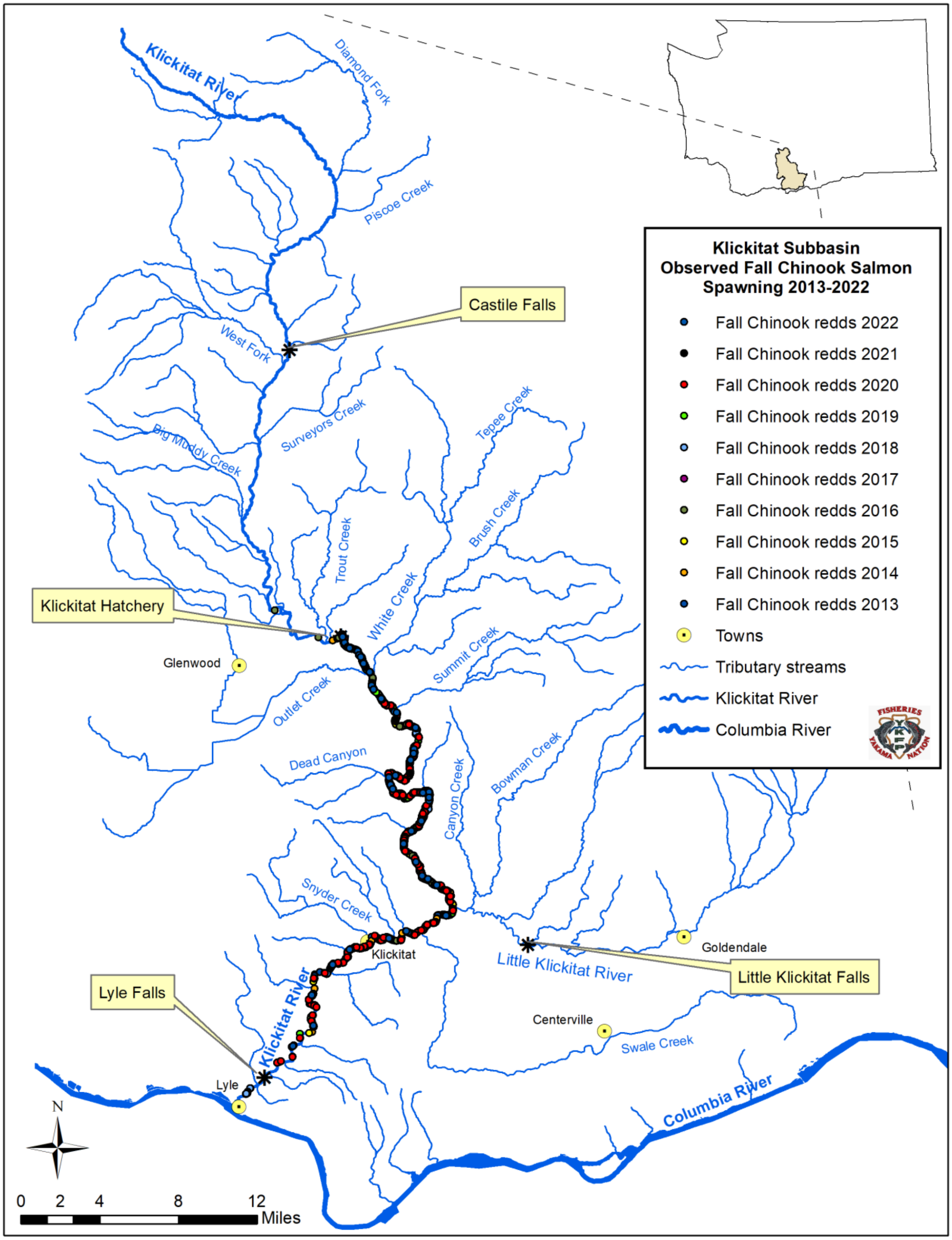

Figure 6. Observed fall Chinook spawning distribution in the Klickitat subbasin for 2013-2022.

Coho

Coho spawning generally occurs in the lower reaches of most lower river tributaries and the mainstem below Parrott's Crossing (RM 49.4). Observed coho spawning distribution for 2013 through 2022 is shown in Figure 7. In 2021, high river turbidity in November delay the start of surveys until early December; surveys ended in late February. Surveys started in late October in 2022 (in conjunction with fall Chinook surveys) and concluded in early March. Coho redd counts vary significantly from year to year based on survey conditions and actual returns. The redd count for 2021-22 was 40; for 2022-23 the count was 123. Surveys covered from 60 river miles in the mainstem and tributaries. In 2021, 93% of the redds were observed in tributaries; in 2022 when better mainstem survey conditions existed, 41% of the redds were observed in tributaries with 59% in the mainstem. Mainstem spawning mostly occurred from Klickitat Hatchery to the Little Klickitat River. Tributary streams in which coho spawning was observed in 2021 and 2022 included White Creek, Summit Creek, Dead Canyon Creek, Bowman Creek, Swale Creek, Snyder Creek, Wheeler Creek, and Canyon Creek (below Lyle Falls).

Relatively low numbers of intact carcasses (for which adipose fin status was observable) were recovered during this report period (4 in 2021; 18 in 2022); all were adipose-clipped. No floy-tagged fish (from the Lyle Falls adult trap) were observed in the 2021 or 2022 coho surveys. Similar to fall Chinook, the correspondence in the percentages of ad-clipped carcasses to ad-clipped percentages of hatchery juveniles in release years that produce returning adults for these years (which average 97.5% for release years 2014-18 [Fish Passage Center data]) suggest that natural coho production in the Klickitat subbasin in most years does not successfully produce large numbers of returning adults. Small sample sizes and difficult sampling conditions may also result in higher year-to-year variation in this metric.

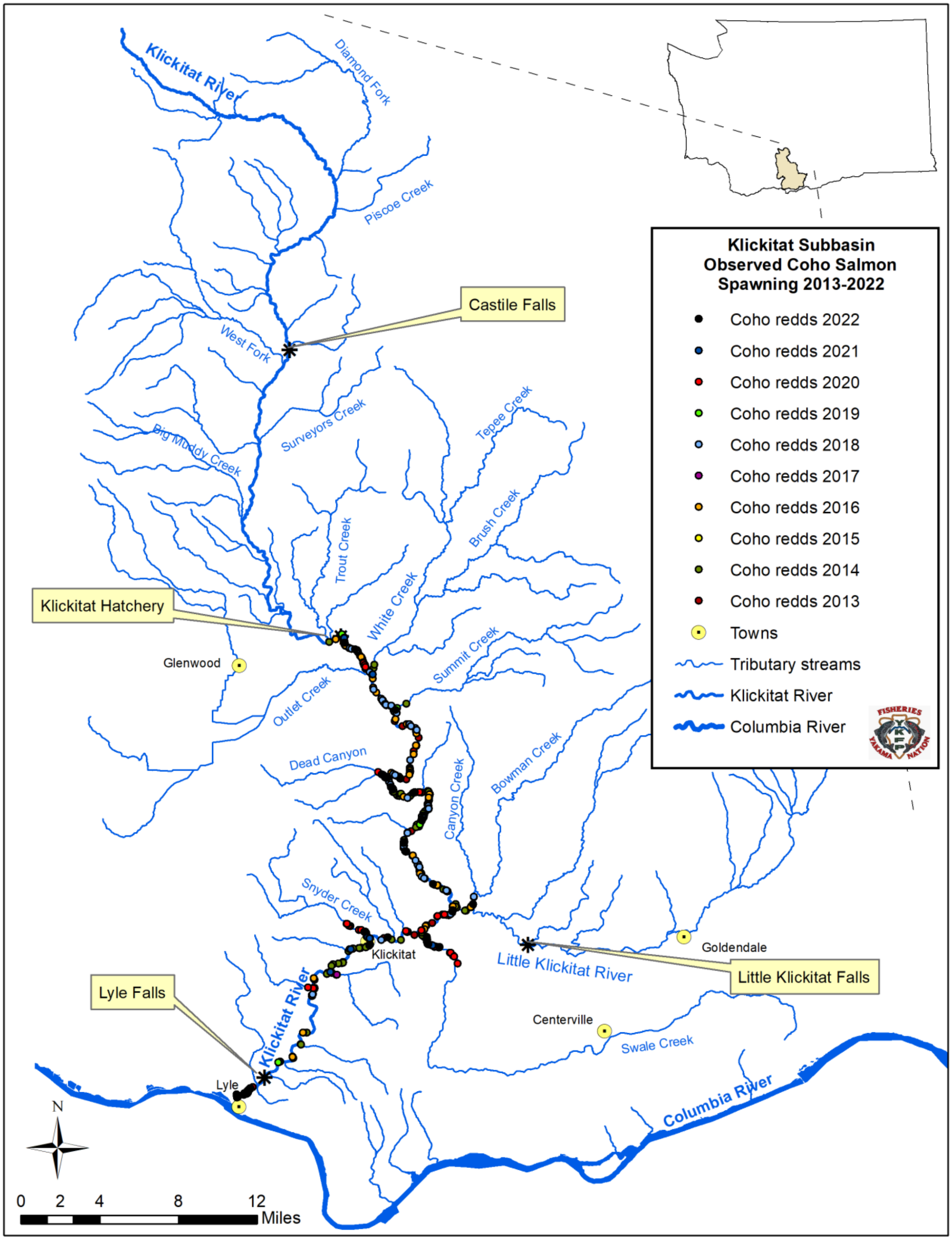

Figure 7. Observed coho spawning distribution in the Klickitat subbasin for 2013-2022.

Steelhead

Steelhead spawner surveys are typically conducted from February through mid June. Attempts are made to cover the entire known spawning range of the species, although in some cases, access, flows, and visibility limited surveys. In most years, high spring flows and turbidity limit the effectiveness of the mainstem Klickitat steelhead redd surveys, leading to an unavoidable bias toward undercounting of redds. Several areas are undersurveyed in most years; these include the mid and upper Klickitat River above Big Muddy Creek (including the area above Castile Falls which frequently has limited access due to snow), and the Little Klickitat River from Little Klickitat falls to Goldendale (with surveys being limited due to landowner access).

Observed steelhead spawning distribution for 2013 through 2022 is shown in Figure 8. Key steelhead spawning areas include the mainstem Klickitat from just downstream of the town of Klickitat to the Klickitat Hatchery (RM 11 to 42), with tributary spawning occurring in the White Creek watershed, Summit Creek, Dead Canyon Creek, the lower Little Klickitat watershed (including Bowman and Canyon Creeks), Swale Creek, Snyder Creek, and occasional use of tributaries below the town of Klickitat. The White Creek watershed (including Brush and Tepee creeks) is one of the most heavily used tributary watersheds, accounting for an average of 39% of the observed steelhead redds from 2002-2022 (excluding 2014, 2017, and 2019 due to limited surveys in the mainstem Klickitat and likely bias in estimates for those years).

Surveys in 2021 and 2022 started in late February and ended in early June. The 2021 redd count was 132 (with 48% in tributaries) and in 2022 it was 68 (with 65% in tributaries). Surveys in both years covered just over 107 river miles; in 2022 surveys were limited somewhat by high flows (which prevented surveys in some streams, especially White Creek until May or early June.

Very few steelhead carcasses are typically recovered on spawner surveys in the Klickitat, as steelhead can survive the spawning process and migrate downstream as kelts. In 2021, 2 intact carcasses were observed; one was adipose-clipped and one was not. No carcasses were recovered in 2022.

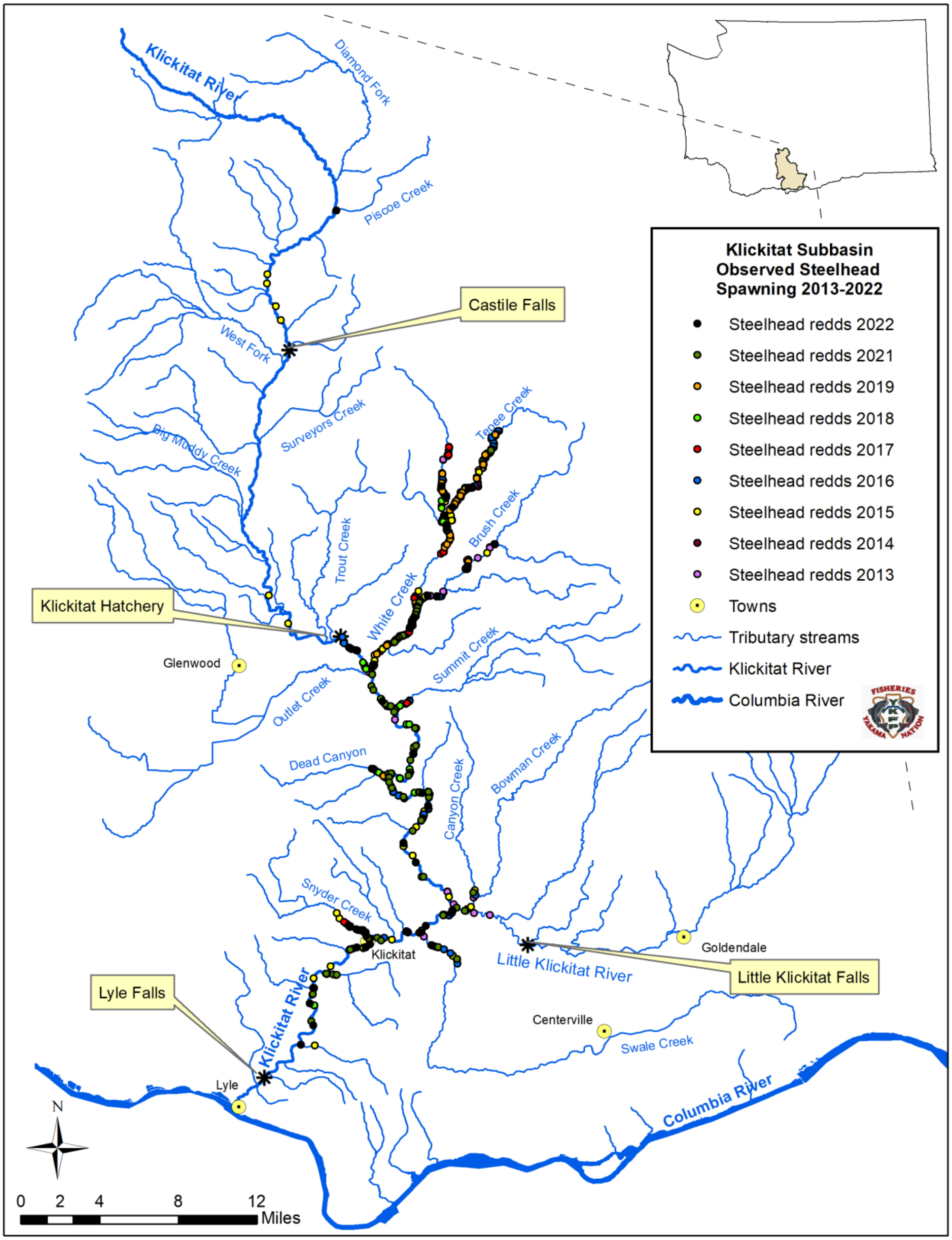

Figure 8. Observed steelhead spawning distribution in the Klickitat subbasin for 2013-2022. No surveys were conducted in 2020. Note – the upper Klickitat River upstream of Big Muddy Creek and Little Klickitat River upstream of Bowman Creek) are often not surveyed.

Conclusions

Spring Chinook

Surveys indicate that majority of wild spring Chinook spawning occurs in the upper middle Klickitat River between Big Muddy Creek (RM 54) and Castile Falls (RM 64), but that a potentially large percentage of spawners on natural spawning grounds in the Klickitat River are hatchery-origin fish. Because of genetic introgression concerns likely caused by hatchery interbreeding with previously-released summer Chinook stocks (see description in Genetic analysis section), and because of overall low numbers of spring Chinook redds observed in most years, the status of the wild population of Klickitat spring Chinook appears to be quite depressed. For a number of years, spring Chinook redd counts provided a more accurate indicator of annual spawner escapement than other species in the Klickitat due to the fairly limited geographic area of spawning and relatively good survey conditions in most years. This has not been the case in several recent years with extended high turbidity in the Klickitat River. Results from redd counts generally agree with results from mark-recapture estimates and other run size monitoring (in Adult salmonid monitoring section) as to this depressed status of this native population, and suggest that current spring Chinook runs are not nearly as large as historic runs (Bryant 1949). Results also suggest that spring Chinook recolonization in the upper Klickitat River above Castile Falls following enhancements to past anthropogenically-impaired passage has been slow. This is most likely due to low overall returns of spring Chinook. Trends in spring Chinook redd counts are currently not showing significant declines as had been observed in recent years, but the redd counts include potential hatchery-origin spawners, which may be masking true trends in natural-origin spawners.

Fall Chinook

Redd counts indicate that a fairly large number of fall Chinook spawners return to the Klickitat River in most years, and that most of the spawning occurs from the Klickitat Hatchery (RM 42) downstream to the Twin Bridges (RM 18) area near the town of Klickitat. Carcass recoveries suggest that, while some natural production may exist, this non-native population is largely sustained by hatchery production.

Coho

Spawner surveys indicate that coho spawners use the lower Klickitat River from the Klickitat Hatchery downstream and many lower subbasin tributaries. Redd counts for coho are highly variable due to frequent high flows during surveys and some variation in actual returns above Lyle Falls, making robust assessments of spawner abundance from redd counts difficult. There are however, large returns of coho evident in some years. Carcass recoveries suggest that, while some natural production does exist in some years, this non-native population is largely sustained by hatchery production.

Steelhead

Surveys indicate that steelhead are spawning in many geographic locations throughout the middle and lower Klickitat subbasin, including multiple tributary streams, with the most use observed in the White Creek watershed and the middle and lower mainstem from RM 11 to 42. There is also some use (likely a lower amount, but with high uncertainty due to limited survey access) in the upper Klickitat River above Castile Falls. These results, along with the finding of multiple genetically distinct subpopulations (see Genetic analysis section) suggest a fairly spatially diverse steelhead population in the Klickitat subbasin. Status and trends in spawner abundance is difficult to assess for steelhead from redd count data due to high variation from flow and visibility limitations. More robust conclusions can be drawn from the mark-recapture estimates of run size (see the Adult salmonid monitoring section) for this native ESA-listed population. Also, due to low numbers of recovered steelhead carcasses, conclusions regarding percentages of hatchery-origin spawners from spawner surveys are not very reliable (although most recent carcass recoveries have been wild fish).

Spring Chinook run reconstruction

Introduction

In addition to adult monitoring at the Lyle Falls fishway and on spawner ground surveys, a long-term run reconstruction dataset is maintained for spring Chinook returns to the Klickitat River. Data is compiled from harvest monitoring, age sampling, hatchery returns, and redd counts to populate this dataset, which is provided to co-managers and used for long-term monitoring and run forecasting purposes.

Methods

Data is compiled from spring Chinook adult returns to the Klickitat Hatchery, harvest from both sport (provided by WDFW) and tribal (provided by YN Fisheries Resource Management Program) fisheries, redd counts (described in the Spawning ground survey section), and scale age sampling at Lyle adult trap and Klickitat Hatchery (described in the Scale and Coded Wire Tag analysis section) to generate a run reconstruction table. Harvest, and escapement (to the hatchery and to natural spawning grounds) by age are estimated from the compiled data, and total returns to the mouth of the Klickitat River are estimating by summing the harvest and escapement estimates. It should be noted that the natural escapements resulting from redd counts may underestimate the actual natural spawner escapement in some years, and that this estimate also includes hatchery-origin fish that spawn on the natural spawning grounds (see Spawning ground survey section).

Results

See Table 54 in Appendix B for complete results of the run reconstruction estimates. The long-term average for adult (age 4, 5, and 6) spring Chinook return to the mouth of the Klickitat River under these methods is just over 1900 fish, with about 1490 hatchery-origin fish and about 440 wild fish. Estimates of escapement average about 870 hatchery fish and 280 wild fish. Estimates of escapement in 2019 are likely biased low due to small samples sizes in harvest estimates and were not used in long term averages.

Conclusions

The results of the run reconstruction estimates are generally lower than the mark-recapture estimates, which may be due to underestimation of escapement (from redd counts) and harvest. Both sets of estimates, however, indicate that while hatchery spring Chinook returns are quite variable, returns of several thousand fish are possible. And for wild fish, returns of only several hundred fish, with natural spawner escapements of only about 300 or fewer fish are not uncommon. The run reconstruction estimates, like the mark-recapture estimates, indicate a wild spring Chinook return that is much lower than likely historic numbers (Bryant 1949), support the WDFW "depressed" rating for this stock, and warrant significant concern regarding the status and trend of this native population.

Genetic analysis

Introduction

Objectives of genetic analysis are to gain a thorough understanding of the genetic characteristics (including stock identification, diversity, and degree of introgression between various stocks) of anadromous salmonid populations in order to maintain long term genetic variability and minimize the impacts of artificial production on native populations (spring Chinook and steelhead). A thorough knowledge of baseline genetic conditions, landscape and habitat influences, effects of past and current hatchery practices, anadromous/resident interactions, and dip-in rates by out-of-basin adults is important in order to adhere to YKFP genetic guidelines, minimize negative effects, and monitor hatchery actions aimed at improving population parameters.

Methods

Genetic samples were collected from adult steelhead and Chinook salmon at the Lyle Falls adult trap on the lower Klickitat River (RM 2.4). As fish were enumerated, netted and removed from the live trap, small fin clips or opercle punches of Chinook and steelhead were collected. Genetic samples were also collected from adult spring Chinook spawned for broodstock at the Klickitat Hatchery, beginning in 2006. In addition, genetic samples were collected from juvenile and resident fish during stream electrofishing activities and from outmigrating juveniles at the floating rotary screw trap (via a non-lethal fin clip). Samples were stored on Whatman gridded paper. A genetic sample number was recorded with the biodata collected for each fish.

Samples were sent to the Columbia River Intertribal Fish Commission (CRITFC) Genetics Laboratory in Hagerman, Idaho, for analysis and archival. Information resulting from tissue analysis is added to existing regional genetic databases and incorporated into reports, manuscripts, and management actions. Various types of genetic information are derived from sample analysis, including: genetic stock identification, parentage-based tagging identification (where possible), diversity metrics, introgression rates, and determination of phylogenetic relationships both within the Klickitat subbasin and between the Klickitat and other subbasins.

Results

Steelhead

Analysis of juvenile *O. mykiss* samples from Klickitat River screw traps found that an estimated 6 to 7 genetically distinct subpopulations were present in the subbasin, approximately 4.0% of naturally-produced steelhead smolts had their most likely assignment to Skamania Hatchery stock, and that genetic integrity and variation of native Klickitat steelhead was fairly intact (Narum et al. 2006).

Analysis of *O. mykiss* samples collected via stream electrofishing from multiple tributary locations throughout the subbasin found primarily anadromous populations (with higher genetic diversity) in the lower elevation, warmer portions of the Klickitat subbasin; primarily resident populations (with lower genetic diversity) were found in higher elevation areas above higher gradient stream reaches and passage obstructions. Intermediate areas also exist with varying levels of mixing of the two life history types (Narum et al. 2008).

Further analysis of samples collected via stream electrofishing shows relatively small amounts of gene flow between the Skamania Hatchery stock and native Klickitat steelhead (similar to what was observed in screw trap samples), with certain tributaries showing a somewhat higher level of gene flow (e.g., Logging Camp, Swale, Bowman, and Dead Canyon creeks all showed a preliminary percentage Skamania ancestry of between 10 and 20%; CRITFC unpublished data). Determining whether this gene flow is recent or ongoing vs. historic is difficult as Klickitat native steelhead were used in the founding of the Skamania Hatchery stock (Crawford 1979).

Analysis of samples from returning adult steelhead has yielded estimates of relative production of different areas within the subbasin (in terms of proportions of adults sampled at Lyle Falls), with middle Klickitat tributaries (e.g. White Creek, lower Summit Creek) contributing a high proportion of adults (over 50%) and other significant contributions coming from lower subbasin tributaries such as Dead Canyon, Bowman Creek, lower Little Klickitat River, and Swale Creek (Narum et al. 2007). Results of genetic stock identification indicate on average for 2007-2012 approximately 25% of natural-origin steelhead and 30% of hatchery-origin steelhead sampled at the Lyle Falls adult trap are from outside the Klickitat subbasin (including an average of nearly 12% of fish being identified as Snake River stocks).

Analysis using the various collections of *O. mykiss* samples from the Klickitat subbasin led to identification of several candidate genetic markers associated with anadromy (Narum et al. 2011). A predictive multivariate logistic model developed from the allele frequencies of these markers was tested against Klickitat populations with previous knowledge of likely anadromy or residency. The results were generally consistent with these previous determinations, indicating the possible strength of the candidate markers. Further study is needed to determine whether these findings apply to other geographic areas (Narum et al. 2011).

Additional analysis of adult steelhead samples identified several candidate genetic markers that were significantly associated with migration timing (summer- vs. winter-run) and explained 46% of the trait variation, with an additional group of markers identified that explained up to 60% of trait variation (Hess et al. 2016). Further research is warranted to characterize the extent to which this genetic mechanism for this migration-timing trait applies across the geographical distribution of the species (Hess et al. 2016).

More recent analysis of adult and juvenile steelhead samples collected from 2012-2021 indicates that although genetic variation has been influenced somewhat by hatchery programs and natural-origin straying from other subbasins, genetic diversity remains high throughout the Klickitat subbasin, and both early (summer-run) and late (winter-run) migration alleles are maintained in the population. Genetic assignment of Klickitat steelhead indicated that the majority were produced in or near tributaries of the middle Klickitat River (including lower Trout Creek, Summit Creek, Dead Canyon Creek, Bowman Creek, Little Klickitat River, and Swale Creek); most hatchery-origin adults (80.8%) assigned to Skamania Hatchery; and hatchery- and natural-origin adults were identified from other subbasins, including from the Snake River subbasin (Collins et al. 2023).

Spring Chinook

Analysis of spring Chinook samples from Lyle Falls adult trap and Klickitat Hatchery have resulted in the identification of an introgressive hybridized genotype in the Klickitat spring Chinook population that contains alleles normally found in the interior stream type Chinook (typically spring Chinook) and in ocean type Chinook (typically fall or summer Chinook) in the Columbia basin (Hess et al. 2011). Phylogenetically the Klickitat spring Chinook population sits in an intermediate position between (and distinct from) other interior stream type stocks and lower Columbia and ocean type stocks. The introgressed genotype appears in both wild and hatchery spring Chinook in the Klickitat. A combination of computer simulations and empirical samples were used to evaluate four hypothetical causes of this introgression: historical admixture, recent admixture (which could include hatchery intermixing), isolation by distance gene flow, and selection. Simulations excluded isolation by distance and selection as they were the least likely to result in the observed introgression patterns, leaving historical or recent admixture as likely causes. Comparisons of samples collected from Klickitat spring Chinook in the early 1980s to more recent (2006-2008) samples showed a substantial shift in genetic composition: samples from the early 1980s were predominantly interior stream type pure genotypes while more recent samples showed markedly more ocean type influence (Hess el al 2011). This shift coincided in time with the adult returns of Wells Hatchery summer (Upper Columbia ocean type) Chinook that were released in the Klickitat in the late 1970s. Hatchery records and anecdotal evidence from Klickitat Hatchery staff point to the likelihood that some of these returning summer Chinook were incorporated into broodstock collections for spring Chinook, and possible interbreeding occurred via this mechanism. These fish returned (volunteering into hatchery holding ponds via the hatchery adult fish ladder) and sexually matured at a later date than most of the spring Chinook, but enough overlap in this timing was present to provide for potential interbreeding.

Additional analysis to date has provided little evidence that this introgression has resulted in reduced fitness or altered run timing in Klickitat spring Chinook (CRITFC unpublished data).

Further analysis, especially with regard to effects on run timing, is ongoing using restriction site associated DNA (RAD) sequencing.

Conclusions

Steelhead

Genetic sampling and analysis conducted under this project has provided valuable data in monitoring hatchery/wild interactions, stock identification of fish use of the lower Klickitat River, subpopulation structure within the subbasin, and anadromous/resident relationships. The summary of results for steelhead to date suggests the following: natural-origin and hatchery-origin steelhead sampled as adults and juveniles in the Klickitat appear to remain genetically distinct suggesting low introgression/interbreeding rates (with further monitoring to determine introgression rates between the stocks underway); multiple subpopulations (at least 6 or 7) exist within different areas of the Klickitat subbasin; primarily anadromous populations are in the mid and lower subbasin downstream of major passage obstructions; resident populations using upstream areas but intermixing with some anadromous populations; and a fairly high rate of use of the lower Klickitat River by out-of-subbasin populations.

The results from the O. mykiss candidate anadromous genetic markers study were useful in predicting anadromy/residency for Klickitat subbasin fish. Additional study in other geographic areas is needed, but these findings could be very useful in characterizing relationships and interactions between anadromous and resident populations, traits that lead to anadromous behavior (typically a combination of genetic and environmental factors are involved), and the role of resident rainbow trout in the recovery of steelhead populations. Findings from the summer/winter run timing study may help predict adult migration timing which could benefit conservation by characterizing differences associated with these adult alternative migration tactics that pertain to pre-adult life stages (e.g. juvenile migration and size-at-age), and categorizing adults on spawning grounds into migration categories.

Spring Chinook

Conclusions from the spring Chinook analysis are that hatchery interbreeding with Wells Hatchery summer Chinook is the most likely cause of the introgressive hybridized genotype observed in Klickitat spring Chinook. It is unknown if this introgression has effects on stock fitness or is playing a role in depressed abundance (described in Adult salmonid monitoring and Spawning ground survey sections), but it is quite possible (see discussion in Hess et al 2011). Present hatchery releases of Upper Columbia upriver bright fall Chinook stocks in the Klickitat produce returning adults that spawn largely at different times and different river reaches than spring Chinook (see Spawning ground survey section). And decades of releases of Lower Columbia tule Chinook (among other stocks) appears not to have significantly affected Klickitat spring Chinook genetic composition, as evidenced in the samples analyzed from the early 1980s. These factors point primarily to the Wells Hatchery releases. This finding highlights the need for changes to the current spring Chinook program at Klickitat Hatchery; many changes are proposed in the Klickitat Master

Plan (Yakama Nation 2018) including a shift to natural-origin broodstock and continued genetic and population monitoring.

Scale and Coded Wire Tag analysis

Introduction

The objective of scale and coded wire tag (CWT) analysis is to determine age composition, length-at-age, and origin stock of adult salmonid stocks. Results are used by state and tribal fisheries managers for run reconstruction and forecasting.

Methods

Scale samples were collected from adult carcasses encountered during spawner surveys, from fish captured at the Lyle Falls adult trap (RM 2.4 on the Klickitat River), and from spring Chinook collected at the Klickitat Hatchery adult holding pond during hatchery spawning activities. Scale collection follows methods outlined in Crawford et al. (2007). Scales were analyzed by YKFP/YN Fisheries Program staff; scales are pressed and read according to methods described in DeVries and Frie (1996). Coded wire tags (CWT), collected from carcasses on spawner surveys and at Klickitat Hatchery, were also used to validate and correct age determinations from scale reading when possible. CWT data is uploaded to the Regional Mark Information System (RMIS) database. Age data are presented in the "year-old" format as described in Groot and Margolis (1991), i.e., number of years old for an individual fish represents number of winters starting with the egg stage.

Results

Readable scale samples were obtained from a total of 9 adult spring Chinook, 3 fall Chinook, and 45 coho salmon, and 1 steelhead during 2021 and 2022 spawner surveys. A total of 341 adult spring Chinook, 286 fall Chinook, 24 coho salmon, and 387 steelhead were sampled and yielded readable scales in the Lyle adult trap in 2021 and 2022. A total of 287 spring Chinook were also sampled during hatchery spawning at Klickitat Hatchery in 2021 and 2022.

A brief description of the results by species is below. Table 58 through Table 66 in Appendix B presents the age breakdown by year and marks with accompanying fork and postorbital-hypural length averages and ranges for each species sampled. Due to a lack of 100% marking of fall Chinook, origin (hatchery or wild) of these fish sampled could not always be reliably determined. Hatchery spring Chinook and coho salmon, as well as Skamania Hatchery steelhead, that are released in the Klickitat River are currently 100% adipose-clip marked.

Overall during the 2021-2022 return years the majority of spring Chinook adults were 4-year-olds, including 86% of the adult trap-sampled fish and 90% of hatchery-sampled fish. Five-year-olds were more prevalent in natural-origin spring Chinook (22-23%) than in hatchery-origin fish (5-8%). Age and length data for spring Chinook carcasses recovered on spawning ground surveys are in Table 58; data for fish captured in the Lyle Falls adult trap are in Table 59; data for fish returning to the Klickitat Hatchery adult holding pond are in Table 60 (all in Appendix B).

For fall Chinook during 2021-2022, 4-year-old fish made up the largest portion of the returns at 66%; 5-year-olds made up 14% and 3-year-old jacks made up 19% of the samples. Age and length data for fall Chinook carcasses recovered on spawning ground surveys are in Table 61; data for fish captured in the Lyle Falls adult trap are in Table 62 (Appendix B).

For coho in 2021-2022 all samples collected were 3-year-olds. Age and length data for carcasses recovered on spawning ground surveys are in Table 63; data for fish captured in the Lyle Falls adult trap in Table 64 (Appendix B).

For steelhead in 2021-2022, 3-year-olds represented 24.5% of the returning adults sampled, 68.0% were 4-year-olds, and 7.4% were 5-year-olds. Total age and length data for carcasses recovered on spawning ground surveys are in Table 65; data for fish captured in the Lyle Falls adult trap are in Table 66 (Appendix B).

Conclusions

For spring and fall Chinook, 4-year-olds continue to be the most common age of returning adults; 5-year-olds comprise a small percentage of the spring Chinook return and a slightly larger percentage of the fall Chinook return. For coho, 3-year-olds continue to dominate the returning adult population. For steelhead, 4-year-olds comprised the highest percentage of returning adults during this reporting period, with 3-year-olds making up slightly less of the population and 5-year-olds a small percentage.

Hatchery spring Chinook and steelhead PIT tagging

Introduction

Objectives of using Passive Integrated Transponder (PIT) tagging as a means of monitoring spring Chinook salmon and steelhead travel and/or holdover time between the Klickitat River and Bonneville Dam detection sites, estimating smolt survival rates, and estimating smolt-to-adult return rates for these hatchery populations. Monitoring smolt survival and smolt-to-adult rates under current hatchery production practices will provide effectiveness monitoring information for comparisons of these parameters under planned future hatchery actions, as well as for comparisons to wild populations.

Methods

Spring Chinook salmon juveniles from the Klickitat Hatchery were injected with PIT tags in early summer of each year and released from the hatchery into the Klickitat River in early spring of the following year. PIT tagging of the spring Chinook production population at Klickitat Hatchery began in 2006. Approximately 10,000-20,000 fish were tagged each year; estimated numbers of fish released per year are shown in Table 1. Fewer fish were tagged in 2016 due to high bacterial kidney disease at the hatchery. No spring Chinook were tagged in 2020 due to Covid-19 restrictions; and no spring Chinook were tagged in 2021 due to staffing issues that stemmed from Covid-19 and also due to fish health and feed issues that caused high juvenile mortality at the hatchery that year. That means brood years 2019 and 2020 (release years 2021 and 2022) will not be represented via PIT tagging and SAR and other return data will be unavailable for those cohorts. The number of fish released is derived from monitoring the hatchery pond for tagged-fish mortalities and subtracting these fish from the total number of fish tagged. Steelhead juveniles at Skamania Hatchery were also tagged in the early fall each year beginning in 2009; these fish are transported via truck and released in the Klickitat River the following spring. Approximately 10,000 hatchery steelhead are tagged per year; numbers of fish released per year are shown in Table 2. No steelhead were tagged in 2020 due to Covid-19 restrictions. The estimates of fish released also come from numbers of fish tagged minus mortalities tallied by hatchery staff. Tag data was entered into the regional PIT Tag Information System (PTAGIS) database for monitoring at mainstem Columbia River detection sites. Returning adult fish are detected at Bonneville Dam adult fish ladders to provide smolt-to-adult return rate (SAR) information. SAR estimates are generated by dividing Bonneville Dam detections of adults by estimated release numbers.

Results

A summary of tagging and returning fish detections is given below for spring Chinook (Table 1) and for steelhead (Table 2). The average spring Chinook SAR estimate (using projected returns of 5- and 6-year-old fish for the more recent brood years based on average age compositions) for brood years 2005 through 2017 fish is fairly low, at approximately 0.4%. This includes some very low estimates from brood years 2014 and 2015, brood years which experienced very low returns in 2018-2020.

For steelhead, the estimated SAR is approximately 2.4% for brood years 2009-2017. More recent years have projected numbers in older age classes based on average age compositions.

Table 1. Klickitat Hatchery spring Chinook PIT-tagged releases and returns to Bonneville Dam to date.

Brood Year	Tagging Year	Release Year	Total Jack/Adult Returns[3] (Age 3-6)	Total Adult Returns[3] (Age 4-6)	Number of Tagged Fish Released[2]	SAR[3] (incl. jacks)
2004	2005	2005	0	0	9830	0%[4]
2005	2006	2007	17	14	4917	0.35%
2006	2007	2008	24	19	4635	0.52%
2007	2008	2009	35	34	6848	0.51%
2008	2009	2010	259	154	34643	0.75%
2009	2010	2011	96	69	23849	0.40%
2010	2011	2012	117	86	20954	0.56%
2011	2012	2013	118	97	18936	0.62%
2012	2013	2014	51	42	19208	0.27%
2013	2014	2015	113	91	19912	0.57%
2014	2015	2016	3	2	19742	0.02%
2015	2016	2017	1	1	9591	0.01%
2016	2017	2018	64	43	20011	0.32%
2017	2018	2019	*63*	*48*	18631	*0.34%*
2018	2019	2020			19655	
					Average	0.40%

[1]Based on detections at Bonneville adult ladders
[2]Based on known tagged fish minus known pre-release mortalities and sheds at Klickitat Hatchery
[3]Italicized numbers are projections based on partial brood year returns and average age composition
[4]2005 release was thinning group with lower survival expected, not included in average

Table 2. Klickitat River Skamania Hatchery steelhead PIT-tagged releases and returns to Bonneville Dam to date.

Tagging Year	Release Year	Total Adult Returns[3] (Age 2-6)	Number of Tagged Fish Released[2]	SAR[3]
2009	2010	325	9937	3.27%
2010	2011	150	9737	1.54%
2011	2012	437	9960	4.39%
2012	2013	333	9945	3.35%
2013	2014	413	9996	4.13%
2014	2015	95	9972	0.95%
2015	2016	195	9964	1.96%
2016	2017	96	9566	1.00%
2017	2018	135	9994	*1.35%*
			Average	2.44%

[1]Based on detections at Bonneville adult ladders
[2]Based on known tagged fish minus known pre-release mortalities at Skamania Hatchery
[3]Italicized numbers are projections based on partial brood year returns and average age composition

Conclusions

To date, SAR estimates for Klickitat Hatchery spring Chinook have been fairly low (approximately 0.4%), at levels similar to or lower than other hatchery spring Chinook stocks in the Middle Columbia region (CSS 2022) and also low considering that these fish have only one mainstem

Columbia dam (Bonneville Dam) to pass as outmigrating smolts and returning adults. Recent return years (2018-2020) experienced low returns and very low SAR rates, also similar to other regional populations. Preliminary SAR estimates for Skamania Hatchery steelhead released in the Klickitat River are higher, at approximately 2.6%. This appears to be similar to other steelhead populations in the Middle Columbia region (CSS 2022).

Future analysis will include additional methods of SAR and other survival rate estimation such as those described in Buchanan and Skalski (2007). Continued PIT tagging and monitoring will also allow for analysis of changes in SAR following changes to hatchery production programs and comparisons to wild populations.

White Creek PIT tag Study

Introduction

The White Creek drainage (HUC 1710701060208 ;WRIA 30) is a large anadromous fish bearing tributary that enters the Klickitat River at river kilometer (rkm) 63 (Figure 9). The White Creek drainage originates at Lost Springs near the headwaters of White Creek at approximately a 1,200-meter elevation and flows in a southwesterly direction for 32 rkm before emptying into the Klickitat River. The drainage encompasses an area of approximately 337 square kilometers. The Klickitat River delineates the western border of the drainage. The northern basalt plateaus of located within the Yakima Nation Reservation form the eastern and southern boundaries. The Summit Creek drainage delineates the southern boundary. The drainage consists of six sub-drainages: White Creek, Brush Creek, Tepee Creek, East Fork Tepee Creek, and West Fork White Creek.

Climate is characterized by the temperate influences of the moderate marine climatic zone and the arid influences of the interior continental climatic zone. Climatic gradients are observable across the subbasin moving from the temperate northwest to the arid southeast. Summers are generally hot and dry (averaging 13°C - 21°C) and winters cold and wet (averaging -4°C - 3°C). The drainage mean annual precipitation is 79.2 centimeters.

Spawning surveys conducted since the early 2000s indicate that the White Creek drainage is an important producer of steelhead in the Klickitat River sub-basin. In some years, the White Creek drainage accounted for as much as 40% of the observed redds. Given the importance of the White Creek drainage to steelhead production, increasing understanding of *Oncorhynchus mykiss* population dynamics and life history strategies provides important baseline information to guide monitoring and management objectives. The main objectives of the White Creek PIT Tag Study are to determine: 1) population distribution, structure, and composition; 2) the proportion of *O. mykiss* that leave the White Creek sub-basin as downstream out-migrants; 3) run timing of downstream out-migrants; 4) and to quantify in-timing migration of anadromous salmonids.

Methods

In 2009, a PIT tag interrogation array was installed in White Creek to monitor juvenile natural-origin *Oncorhynchus mykiss* out-migration and returning adult steelhead to White Creek. The PIT tag interrogation array is located in lower White Creek approximately 200 meters upstream of the confluence with the Klickitat River. The PIT tag interrogation site consists of a Biomark IS1001 Master Controller Multiplexing Transceiver System (Model IS1000-MTS) and antennae arrays. Antennas are comprised of litz wire cable encased in watertight HDPE pipe. The PIT tag interrogation system consists of three arrays. Each array consists of paired antenna that spans the wetted width of the stream channel. Paired antennae arrays were longitudinally spaced approximately 15-meters apart to provide detection redundancy and directionality in movement.

A data storage buffer in the Master Controller recorded PIT tag detections. Each PIT tag detection record consists of a date, time, antenna, and PIT tag code stamp. M&E staff downloaded the buffer on a bi-weekly basis and subsequently uploaded interrogation files to the PTAGIS database.

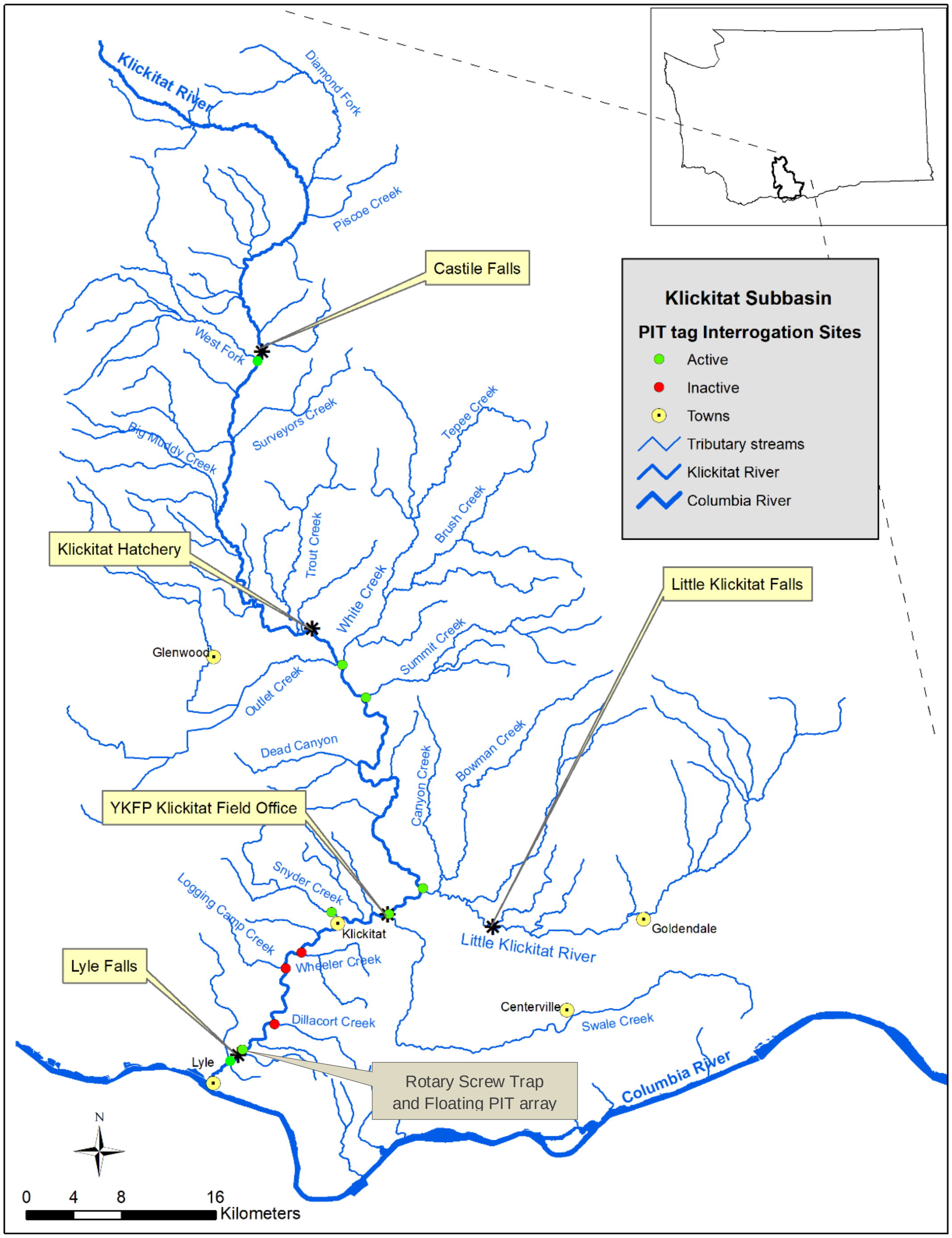

Figure 9. Map of the Klickitat River subbasin showing the location of remote PIT tag interrogation sites and Yakama Nation Fisheries infrastructure (Lyle Falls Fishway and Adult Trap Facility, rotary screw trap and floating PIT array, Klickitat Field Office, Klickitat Hatchery, Castile Falls Fishway and Adult Enumeration Facility).

Interrogation data was paired with stage data collected from a stream gauge station located 200 meters upstream of the WHC PIT tag array. Southern Ceded Territories Habitat Project staff operate and maintain the stream gauge. A pressure transducer continuously measured water stage levels at 15-minute intervals.

Twenty-one monitoring/tagging sites were initially established at the start of the study in 2009. In 2011, another four tagging sites (in Brush Creek, Blue Creek, and White Creek) were added to address spatial gaps in sampling (Figure 10). Single-pass electrofishing was used to capture fish. Captured fish were held in 5-gallon buckets with aeration supplied by battery-powered aerators. Captured *O. mykiss* ≥65 millimeters were anesthetized with MS-222, injected with a Passive Interrogator Transponder (PIT) tag, length and weight recorded and held in a recovery bucket. Handled fish recovered in flow-through buckets in the stream and released at the completion of sampling. Tagging files were submitted to a regional database repository of PIT tag data (PTAGIS) in the Columbia River basin.

Results

Natural-origin *O. mykiss* are widely distributed throughout the White Creek drainage. Fish were collected in each of the 25 sampling sites. However, we observed inter-annual variation in relative fish abundance during the reporting period (Table 3). Fish abundance increased continuously from 2016 to a peak in 2018 followed by a precipitous decline beginning in 2019 and continuing through 2022.

A total of 916 fish were collected in 2016 consisting of 912 PIT tagged, 13 handled, and 35 recaptures (Table 3). White Creek, Tepee Creek, and Brush Creek accounted for ~92% of the fish. Collectively Blue Creek, East Fork Tepee Creek, and West Fork White Creek accounted for remaining captured fish. Fish lengths and weights varied from 65-217 millimeters and 2.7-108.4 grams. Average fish weight was greatest in Tepee Creek (20.0 g) and lowest in Brush Creek (11.6 g). Pooled fish density across streams was 4.6 fish/100 meter^2 with the highest density occurring in Blue Creek (3.2 fish/100 meter^2) and lowest (zero fish) in West Fork White Creek.

The number of fish collected in 2017 increased by 32% over 2016. White Creek, Tepee Creek, and Brush Creek accounted for ~93% of the fish (Table 3). Approximately 5% of the captured fish were recaptures. Fish lengths and weights ranged from 65-222 millimeters and 2.6-120.8 grams. Average fish length was greatest in White Creek (97.3 mm) and lowest in West Fork White Creek (79.2 mm). Average fish weight was greatest in Tepee Creek and White Creek (12.2 g) and lowest in West Fork White Creek (6.2 g). Pooled fish density across streams was 4.6 fish/100 meter^2 with the highest density occurring in Blue Creek (7.2 fish/100 meter^2) and lowest in West Fork White Creek (1.1 fish/100 meter^2).

The 2018 sampling season marked another sizable increase in the number of fish collected compared to previous years. The total number fish collected in 2018 increased by ~47% and ~37% of 2016 and 2017 levels, respectively (Table 3). White Creek, Tepee Creek, and Brush Creek accounted for ~95% of the fish. Collectively Blue Creek, East Fork Tepee Creek, and West Fork White Creek accounted for ~5% of the captured fish. Recaptures accounted for 7% of the fish

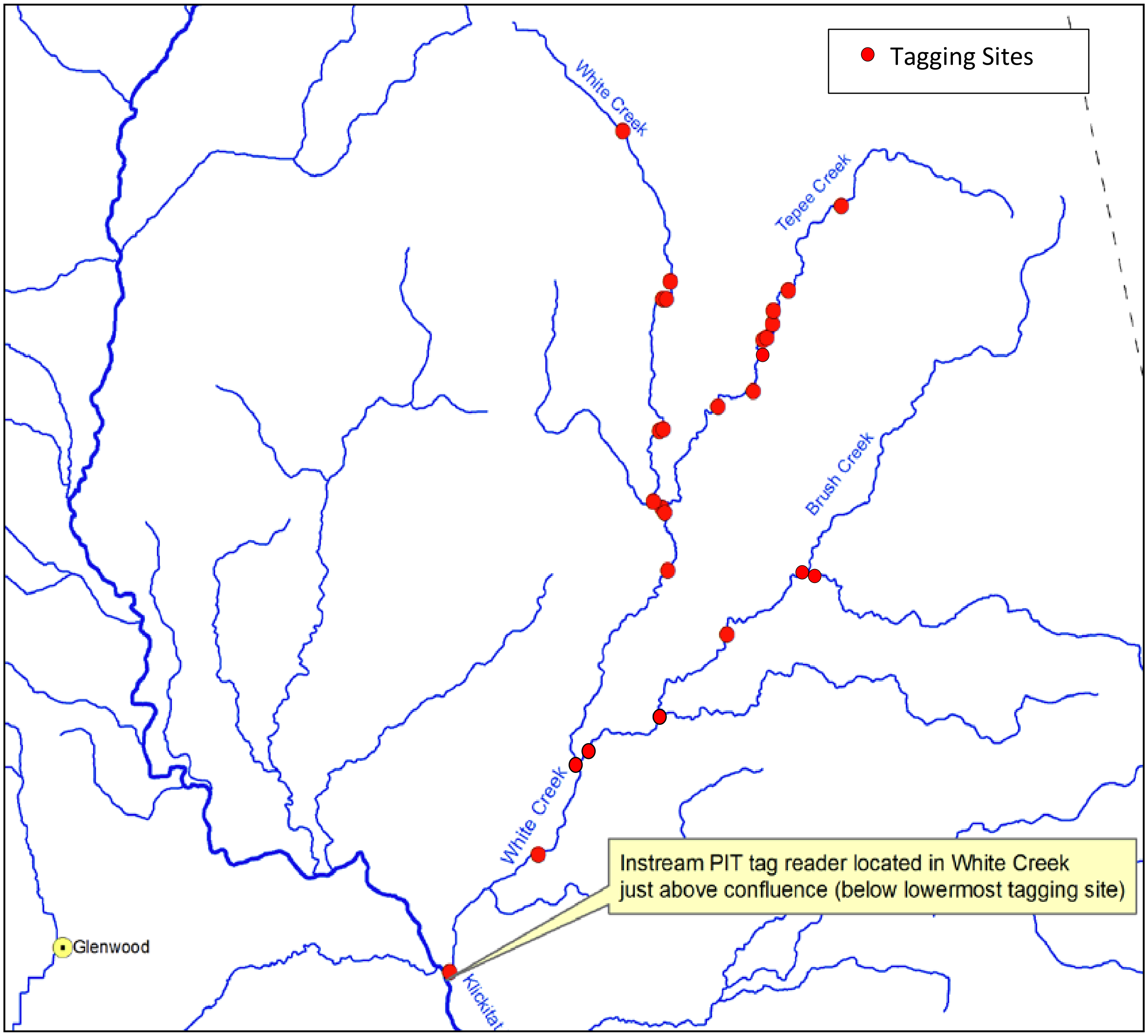

Figure 10. Map of PIT tagging sites in the White Creek Drainage.

collected. Average fish length was greatest in Tepee Creek (97.3 mm) and lowest in West Fork White Creek (80.6 mm). Average fish weight was greatest in Tepee Creek (13.9 g) and lowest in West Fork White Creek (6.9 g). Pooled fish density across streams was 7.3 fish/100 meter^2 with the highest density occurring in White Creek (8.0 fish/100 meter^2) and lowest in West Fork White Creek (0.7 fish/100 meter^2).

The total number of fish collected in 2019 declined by 59% from 2018 (Table 3). The significant decline was likely attributable to observed drought conditions that resulted in increased channel drying, reduction in over-summer rearing habitat, and poorer quality habitat conditions.

Table 3. Summary statistics of PIT tagged Oncorhynchus mykiss collected by single-pass electrofishing in the White Creek drainage (January 1, 2016 – December 31, 2022).

Sample Year	No. Fish Handled	No. Fish Tagged	No. Fish Recaps	Fish/ 100m²	Avg Fork Length (mm)	Med Fork Length (mm)	Fork Length Range (mm)	Avg Weight (g)	Med Weight (g)	Weight Range (g)	# Genetic Samples
2022	4	417	44	1.6	124.8	114	67-237	27.7	16.5	3.3-161.1	431
2021	20	455	19	1.7	111.5	106	64-230	18.3	12.3	3.0-152.8	474
2020[1]	-	-	-	-	-	-	-	-	-	-	-
2019	6	811	95	3.2	108.0	105	65-220	17.1	12.9	3.0-150.9	811
2018	30	2,106	92	7.3	98.2	92	64-230	12.8	9.0	2.5-118.0	2,108
2017	24	1,315	66	4.6	95.8	90	65-222	11.8	8.2	2.6-120.8	1,339
2016	13	912	35	3.2	103.6	96	65-217	15.1	10.0	2.7-108.4	916
Total	**97**	**6,016**	**351**	**4.9**	**102.8**	**95**	**64-237**	**15.0**	**9.7**	**2.5-161.1**	**6,079**

[1]Sampling suspended due to Covid-19 pandemic restrictions.

Electrofishing did not occur in West Fork White Creek because the stream channel was dry by mid-June. White Creek, Tepee Creek, and Brush Creek accounted for ~94% of the fish. Blue Creek and East Fork Tepee Creek accounted for ~6% of the captured fish. Approximately 10% of the captured fish were recaptures. Average fish length was greatest in East Fork Tepee Creek (116.8 mm) and lowest in Blue Creek (103.8 mm). Average fish weight was greatest in East Fork Tepee Creek (20.5 g) and lowest in Blue Creek (13.2 g). Pooled fish density across streams was 3.2 fish/100 meter^2 with the highest density occurring in White Creek (3.5 fish/100 meter^2) and lowest in East Fork White Creek (2.9 fish/100 meter^2).

Sampling did not occur in 2020 due to Covid-19 pandemic restrictions. Drought conditions continued to persist in the summer of 2021. As a result, the number of fish collected in 2021 declined to nearly half of the level observed in 2019. The low catch numbers were likely attributable to the continued decline in summer rearing habitat availability and quality compared to previous years. White Creek, Tepee Creek, and Brush Creek accounted for ~97% of the fish. Blue Creek and East Fork Tepee Creek accounted for the remaining captured fish. Approximately 4% of the captured fish were recaptures. Average fish length was greatest in Blue Creek (128.0 mm) and lowest in White Creek (107.8 mm). Average fish weight was greatest in Blue Creek (24.2 g) and lowest in White Creek (17.0 g). Pooled fish density across streams was 1.7 fish/100 meter^2 with the highest density occurring in White Creek (2.4 fish/100 meter^2) and lowest in East Fork White Creek (0.7 fish/100 meter^2). Electrofishing did not occur in West Fork White Creek because the stream channel was dry by mid-June.

The 2022 sampling season marked the lowest catch numbers over the reporting period. As was the case the previous two seasons, electrofishing did not occur in West Fork White Creek because the stream channel was dry by mid-June. Approximately 9% of the captured fish were recaptures. White Creek accounted for ~76% of the sampled fish, Brush Creek and Tepee Creek ~22%, and Blue Creek and East Fork Tepee Creek 3%. Although fish catch numbers were the lowest in 2021, fish lengths and weights were greater than previous years. Average fish length was greatest in East Fork Tepee Creek (159.3 mm) and lowest in White Creek (121.6 mm). Average fish weight was greatest in East Fork Tepee Creek (45.2 g) and lowest in White Creek (16.4 g). Pooled fish density across streams was 1.6 fish/100 meter^2 with the highest density occurring in White Creek (2.4 fish/100 meter^2) and lowest in Blue Creek (0.5 fish/100 meter^2).

M&E staff collected 1,075 scale samples from natural-origin juvenile *O. mykiss* in 2018-2022 (Table 4). Sixty-seven percent of the scale samples were successfully aged. The dominant age groups consisted of one and two-year old fish. One-year-old fish dominated age composition in 2018 and 2022. However, the dominant age group shifted from one-year old fish in 2018 to two-year old fish in 2019 and 2021. Age-3 fish accounted for 8%, 15%, and 3% of the aged fish in 2018, 2019, and 2021, respectively. Age-0 and four year (and older) fish comprised a very small percentage of the sampled population.

Detection efficiency at the White Creek PIT tag interrogation array (WHC) in the 2016-2022 reporting period varied from a low of 65% in 2017 to a high of 100% in 2020 (Table 5). There were 1,416 unique PIT tag codes detected at the WHC array from juvenile *O. mykiss* tagged in the

Table 4. Age composition summary of juvenile Oncorhynchus mykiss collected from the White Creek drainage 2018-2022.

Sample Year	Total Fish	Total Samples	Aged Samples	Proportion by Age: Age 0	Age 1	Age 2	Age 3	Age ≥4	Population Composition: Age 0	Age 1	Age 2	Age 3	Age ≥4
2022	465	179	139	0.00	0.60	0.19	0.08	0.02	0	281	90	84	10
2021	494	165	85	0.00	0.32	0.59	0.08	0.01	0	157	290	41	6
2020[1]	-	-	-	-	-	-	-	-	-	-	-	-	-
2019	912	230	133	0.01	0.22	0.62	0.15	0.01	7	199	562	137	7
2018	2,228	501	368	0.01	0.65	0.30	0.03	0.01	12	1,459	672	67	18
Total	**4,099**	**1,075**	**725**	**0.01**	**0.53**	**0.37**	**0.09**	**0.01**	**19**	**2,096**	**1,615**	**328**	**41**

[1]Sampling suspended due to Covid-19 pandemic restrictions.

White Creek drainage. After applying an expansion multiplier, an expanded estimate of 1,846 (~30%) *O. mykiss* out-migrants passed the WHC array from the tagging population (n=6,016). The remaining undetected PIT tagged fish either adopted a resident life history, have not yet out-migrated, or met a mortality fate.

Nearly all of the fish detections (99%) at the WHC interrogation array occurred within three years of a tagging event (Table 6).The vast majority fish detections occurred within two years of tagging with the highest recorded in the 2019 tag cohort (~93%) and lowest in 2018 tag cohort (~89%). In each tag cohort, all migratory fish emigrated from the White Creek drainage in four to five years.

Fish in mainstem White Creek exhibited a greater tendency to out-migrate compared to fish tagged in other streams in the White Creek drainage (Table 5). A comparison of streams indicates that mainstem White Creek had the highest proportion (0.25) of PIT tags detected at the WHC PIT tag array and West Fork White Creek had the lowest (0.15) after pooling PIT tags across sampling years for each stream. White Creek accounted for more than half (57%) of all the tagged fish and ~62% of the all the unique detections at the WHC PIT tag array whereas other streams had proportionally fewer PIT tags detected. Tepee Creek accounted for 23% of tagged fish but ~21% of fish detected at the array. Brush Creek accounted for ~14% of the tagged fish and ~13% of the detected fish. Collectively Blue Creek, East Fork Tepee Creek, and West Fork White Creek accounted for ~6% of the tagged fish and a proportionally similar percentage of the detections.

Results indicate that the lower 8-kilometer section of White Creek below the Brush Creek confluence provides critical refugia and staging habitat for rearing juvenile *O. mykiss* during the late-summer and early-fall low flow period. Perineal stream flow characterizes the lower 8-kilometer section compared to intermittent and seasonal flow patterns throughout the drainage above the Brush Creek confluence. The persistence of water in the lowest reach of the drainage during the low flow period is critical to the survival of rearing and staging juveniles. The importance of this critical habitat is highlighted by the observation that more than half (54%) of the detected fish originated from the lower 8-kilometers but only accounted for 39% of the tagged fish during the reporting period.

Table 5. Summary of unique detections, detection efficiency, and detection expansion of out-migrating Oncorhynchus mykiss at the White Creek PIT tag interrogation array (WHC) for fish PIT tagged in the White Creek drainage (January 01, 2016 – December 31, 2022).

Detection Year	Unique PIT tag detections in White Creek drainage streams								?				
	Blue	Brush	Tepee	EF Tepee	White	WF White	Total		OtherSites[1] Detections	WHC and Other Site Detections[2]	Detection Efficiency	Expansion Multiplier	Expansion Estimate
2022	0	8	1	2	101	0	112		9	8	0.89	1.13	126
2021	0	6	2	3	32	0	43		13	13	1.00	1.00	43
2020	0	11	22	8	101	0	142		47	43	0.91	1.09	155
2019	14	82	87	4	247	1	435		65	53	0.82	1.23	533
2018	5	19	122	7	153	1	307		70	46	0.66	1.52	467
2017	3	27	27	2	157	0	216		37	24	0.65	1.54	333
2016	2	32	35	8	83	1	161		28	24	0.86	1.17	188
Total	**24**	**185**	**296**	**34**	**874**	**3**	**1,416**		**269**	**211**	**0.78**	**-**	**1,846**

[1]Total number of unique detections at PIT tag interrogation sites in the Columbia River basin other than White Creek. Observation only counted for the interrogation site with the initial detection.

[2]Total number of unique detections that conditionally occurred at both the White Creek interrogation array and another PIT tag interrogation site.

Table 6. Summary matrix of unique PIT tag detections at the White Creek PIT tag interrogation array by mark year and detection year for natural-origin juvenile Oncorhynchus mykiss PIT tagged in the White Creek drainage (June 01, 2016 – December 31, 2022).

		Detection Year							
Mark Year	Total Tagged Fish	2016	2017	2018	2019	2020	2021	2022	Total
2016	912	38	123	14	1	0	0	0	**176**
2017	1,315	0	89	265	29	2	1	0	**386**
2018	2,106	0	0	26	393	28	5	0	**452**
2019	811	0	0	0	11	108	13	2	**134**
2020[1]	-	-	-	-	-	-	-	-	**-**
2021	455	0	0	0	0	0	23	100	**123**
2022	417	0	0	0	0	0	0	6	**6**
Total	**6,016**	**38**	**212**	**305**	**434**	**138**	**42**	**108**	**1,277**

[1]Sampling suspended due to Covid-19 pandemic restrictions.

Out-migrants exhibited a consistent bi-modal out-migration timing pattern during each migration year. The initial pulse of out-migrating fish occurred in the late-fall/early-winter during the ascending limb of hydrograph and decreasing water temperatures. Out-migrating fish peaked in the spring (March-May) during the descending limb of the hydrograph and increasing water temperature. The percentage of out-migrants that passed the White Creek PIT tag array March-June varied from a high of 95% in 2019 to a low of 42% in 2021. The low percentage of fish out-migrating in spring 2021 was the result of suspended tagging in 2020 due to Covid-19 pandemic restrictions. Each year the out-migration peak consistently occurred at the intersection of descending stage height and increasing water temperature (Figure 11). This intersection generally occurred each year between early-April and late-May.

Detections of out-migrants from the White Creek drainage occurred in seven of ten observation sites located downstream of the WHC PIT tag array in the Klickitat River subbasin (Table 7). The Little Klickitat River PIT tag array recorded the highest number of unique PIT tag detections with the site accounting for 81 of 204 detection encounters. The mainstem Klickitat River floating PIT tag array accounted for 61 observations. Summit Creek, located ~4-kilometers downstream of White Creek, accounted for 39 of the detection history encounters. Swale Creek, Snyder Creek, the rotary screw trap, and the Lyle Adult Facility collectively accounted for the remaining 10% of the encounters. Wheeler Creek, Logging Camp Creek, and Dillacort Creek PIT tag arrays did not record a detection of a White Creek out-migrant.

Columbia River observation sites recorded ninety-five unique PIT tag detections of fish that out-migrated from the White Creek drainage during the reporting period (January 1, 2016 – December 31, 2022; Table 8). White Creek fish accounted for the majority of the detections (~58%) followed by Tepee Creek (~25%) and Brush Creek (11%). East Fork Tepee Creek, West Fork White Creek, and Blue Creek collectively accounted for ~6% of the detections. Although the total number of unique detections differed, the proportion of tagged to detected fish was similar among White Creek (0.038) and Tepee Creek (0.042) but lower for Brush Creek (0.029).

Out-migrants passed Bonneville Dam over a 4-month period between March–June of each year. After pooling juvenile detections at Bonneville Dam for the reporting period, the majority of out-migrants passed Bonneville Dam in May (56%) followed by June (28%) and April (14%). The timing of out-migration each year occurred at or near the peak of the Columbia River hydrograph. There appears to be an energetic and survival advantage to timing out-migration with peak flows. High flow conditions may reduce the energetic cost to migrate down the Columbia River because high flows efficiently transport fish downstream. In addition, higher flows decrease travel time through the Columbia River and likely reducing the risk of piscivorous and avian predation.

Few PIT tagged fish from White Creek returned to Bonneville Dam as adults (Table 9). All creeks with the exception of East Fork Tepee Creek had at least one tagged fish return to Bonneville as an adult. Two of seven adults detected at Bonneville Dam were also observed passing through the juvenile bypass as downstream migrants. One adult detected at Bonneville Dam was previously detected at the Klickitat floating PIT tag array as a downstream migrant. All three fish returned to Bonneville Dam as 2-salt fish. Three of the seven adults detected at Bonneville Dam entered the Lyle Adult Fishway facility located at rkm 3. Travel time from Bonneville Dam to the Lyle Adult Fish Facility ranged from 3-12 days.

Data collected from the WHC PIT tag array reinforces the importance of the White Creek drainage as a significant producer of natural-origin steelhead in the Klickitat River sub-basin. Wild *O. mykiss* accounted for 98.5% of the detections at the WHC PIT tag interrogation array during the reporting period (Table 10). The bulk of the unique detections came from juveniles PIT tagged further upstream in the drainage. However, natural-origin steelhead accounted for 92 of the 95 observed anadromous adult salmonid detections. Most of the adult steelhead observed at the WHC PIT tag interrogation array were tagged as adults at the Lyle Adult Fish Trap (n=83) and six were tagged as adults in the Columbia River. The remaining adult steelhead were tagged as juveniles in the White Creek drainage (n=1), Klickitat Rotary screw trap (n=2), and Lower Granite Dam (n=1).

The White Creek drainage appears to be utilized almost exclusively by natural-origin steelhead. Hatchery-origin steelhead accounted for 59% of the 2,252 adult steelhead PIT tagged at the Lyle Fish Trap but only ~1% of the detections at the White Creek PIT tag interrogation array (January 1, 2016 – December 31, 2022). In addition, the WHC PIT tag array only recorded two coho adults entering the drainage during the reporting period. These observations suggest that hatchery-wild interactions are minimal between spawning natural-origin and hatchery-origin steelhead and coho and underscore the importance of the White Creek drainage as critical habitat to the production of natural-origin steelhead in the Klickitat River sub-basin.

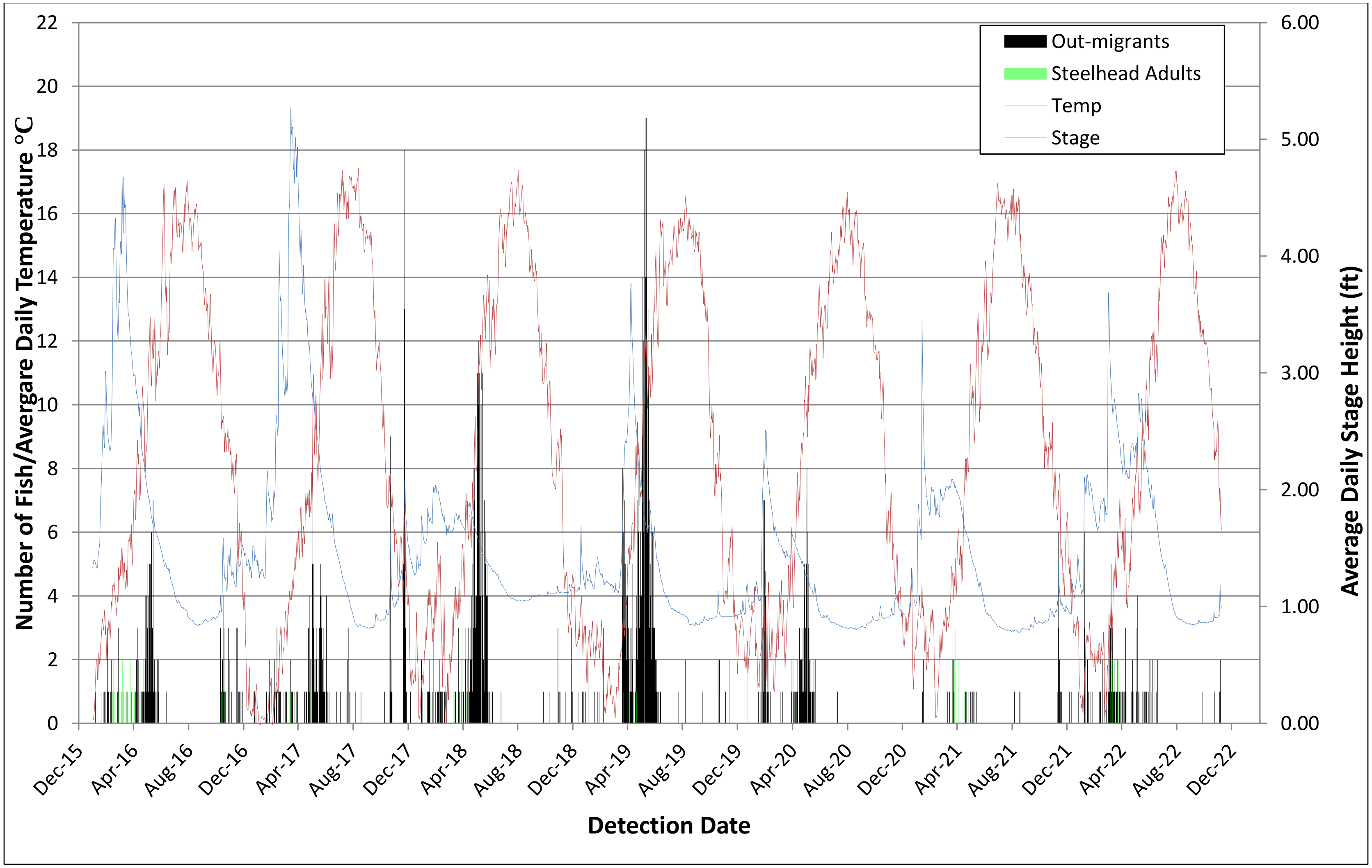

Figure 11. Relationship between PIT tagged fish detections at the White Creek PIT tag array, average daily stage height (ft) and temperature (°C) during 2016-2022 migration years (January 1, 2016 - December 31, 2022).

Table 7. Encounter history of PIT tagged natural-origin juvenile Oncorhynchus mykiss from the White Creek drainage to other Klickitat River sub-basin PIT tag interrogation sites (January 1, 2016 – December 31, 2022).

Detection Year	Klickitat River Subbasin Interrogation/Observation Sites										Total
	Summit Creek	L. Klickitat River	Swale Creek	Snyder Creek	Wheeler Creek[2]	Logging Camp Cr.[2]	Dillacort Creek[2]	Screw Trap	Klickitat River	Lyle Adult Fishway	
2022	0	3	0	0	-	-	-	1	1	0	**5**
2021	2	3	0	0	-	-	-	1	2	0	**8**
2020[1]	3	5	4	0	-	-	-	-	18	0	**30**
2019	14	26	3	0	-	-	-	3	15	0	**61**
2018	12	32	3	0	-	-	-	3	17	1	**68**
2017	4	12	2	1	0	0	0	-	8	1	**28**
2016	4	0	0	0	0	0	0	-	0	0	**4**
Total	**39**	**81**	**12**	**1**	**0**	**0**	**0**	**8**	**61**	**2**	**204**

[1]Sampling suspended due to Covid-19 pandemic restrictions

[2]PIT tag arrays de-activated and removed in 2018

Table 8. Summary of unique PIT tag detections in Columbia River observation sites for natural-origin juvenile Oncorhynchus mykiss marked in the White Creek drainage (January 1, 2010 – December 31, 2022).

Detection Year	Columbia River Unique Juvenile PIT Tag Detections						Total
	Blue Creek	Brush Creek	Tepee Creek	EF Tepee Creek	White Creek	WF White Creek	
2022	0	0	0	0	3	0	**3**
2021	0	1	2	0	3	0	**6**
2020	0	2	5	1	3	0	**11**
2019	1	0	6	1	17	1	**26**
2018	0	2	6	1	7	0	**16**
2017	0	2	2	0	12	0	**16**
2016	1	1	7	0	7	1	**17**
Total	**2**	**8**	**28**	**3**	**52**	**2**	**95**

Table 9. Summary of unique PIT tag detections at Bonneville Dam for natural-origin adult steelhead marked in the White Creek drainage as juveniles (January 1, 2016 – December 31, 2022).

Detection Year	Bonneville Dam Unique Adult PIT Tag Detections						Total
	Blue Creek	Brush Creek	Tepee Creek	EF Tepee Creek	White Creek	WF White Creek	
2022	0	0	0	0	1	0	**1**
2021	0	0	0	0	0	0	**0**
2020	0	0	0	0	0	0	**0**
2019	0	0	0	0	1	0	**1**
2018	0	0	1	0	0	0	**1**
2017	0	0	0	0	1	0	**1**
2016	1	1	0	0	1	0	**3**
Total	**1**	**1**	**1**	**0**	**3**	**1**	**7**

Table 10. Summary of PIT tag detections at the White Creek PIT tag interrogation array by species, origin, and life stage (January 1, 2016 – December 31, 2022).

	Natural-Origin Steelhead		Hatchery-Origin Steelhead		Natural-Origin Chinook		Hatchery-Origin Chinook		Unknown-Origin Coho	
Detection Year	Adult	Out-migrant	Adult	Out-migrant	Adult	Out-migrant	Adult	Out-migrant	Adult	Out-migrant
2022	9	112	0	1	0	0	0	0	0	0
2021	11	43	0	0	0	0	0	0	0	0
2020	5	142	1	0	0	0	0	0	0	0
2019	8	435	0	0	0	0	0	4	0	1
2018	15	307	0	0	0	0	0	4	0	4
2017	7	216	0	0	0	0	0	1	2	2
2016	37	161	0	0	0	0	0	2	0	0
Total	**92**	**1,416**	**1**	**1**	**0**	**0**	**0**	**11**	**2**	**7**

Conclusions

O. mykiss are widely distributed throughout the White Creek drainage. PIT-tagged *O. mykiss* were detected out-migrating from White Creek from all tagging sites, indicating that a variety of life histories likely exists and that multiple locations throughout the watershed contribute to migratory O. mykiss and anadromous steelhead populations. Lower White Creek below the Brush Creek confluence, which maintains perennial flow compared to intermittent flow in upstream reaches, likely functions as both a refugia and staging area for downstream migrants during the low flow period. Fish tagged in lower White Creek also made up a disproportionately high percentage of the total out-migrants. Downstream migrants exited the watershed over an 11-month period in a consistent bimodal outmigration pattern, with peaks in the early winter and the spring. Out-migrants passed Bonneville Dam over a 4-month period between March–June of each year with the majority entering the Columbia in April. The low number of PIT-tagged juveniles returning as adult steelhead to Bonneville Dam (n=7) is concerning and indicates poor smolt-to -adult survival. Although only a single PIT tagged juvenile returned to White Creek as a an adult, most anadromous salmonids detected at the White Creek PIT tag array consisted of natural-origin steelhead tagged at the Lyle adult trap on the lower Klickitat river. These observations indicate that natural-origin steelhead primarily utilize the White Creek drainage and reinforces the importance of the White Creek drainage as a significant producer of natural-origin steelhead in the Klickitat River sub-basin.

Summit Creek PIT Tag Study

Introduction

Summit Creek is an anadromous fish bearing stream that enters the Klickitat River from the east at river kilometer 60 and is one of three tributaries along the lower 70- kilometers of the Klickitat River that maintains perennial surface flow connection at the confluence. The Summit Creek headwaters are located on the west side of Satus Pass at an approximate elevation of 1,728 meters. Summit Creek flows in a southwesterly direction for approximately 23.7 kilometers before entering the Klickitat River (Figure 9). The total drainage area is approximately 117 square kilometers.

A habitat survey was conducted along the lower 2 kilometers of anadromous fish bearing portion of stream during Fall 2014. The stream channel was generally constrained by alternating terrace and hillslope and the stream gradient was high at 5.7%. The total wetted area for the anadromous fish bearing portion was 14,171.2 m^2. Boulder and cobble were the dominant substrate accounting for approximately two-thirds of the substrate area. Riffle was the most common geomorphic unit delineated comprising 65% of the wetted area and 64% of the survey length. Ponderosa Pine and Oregon White Oak were the most common upslope trees. Red Alder and Big Leaf Maple were the dominant and sub-dominant riparian vegetation, respectively. The canopy covered approximately 41% of the wetted area.

Electrofishing surveys conducted in the 1990s documented the presence of *O. mykiss* and brook trout on Summit Creek. On-going spawning surveys conducted since the early 2000s document spawning in the lower 2 kilometers by adult coho and steelhead. YN fisheries staff expressed the need to improve understanding of fish usage (rearing and spawning) in Summit Creek given the availability of perennial fish habitat and surface flow connection to the Klickitat River. In 2014, a PIT tag array was installed in Summit Creek to begin to address study objectives. Summit Creek population sampling began summer 2015 and continued through summer 2021, with the exception of suspended sampling during summer 2020 due to Covid-19 pandemic restrictions. The main objectives of the Summit Creek PIT tag study were to determine: 1) the proportion of *O. mykiss* that leave Summit Creek as downstream out-migrants; 2) *O. mykiss* population distribution, age composition, and genetic structure; 3) run timing of downstream out-migrants; 4) and to quantify in-timing migration and returns of anadromous salmonids.

Methods

A PIT tag array (SUC) located in Summit Creek (approximately 370 meters upstream of the Summit Creek/Klickitat River confluence) was used to monitor PIT tagged fish. Operation of the Summit Creek PIT array began October 31st 2014 and was upgraded with new and more robust HDPE antennas during fall 2018. Paired antenna arrays (consisting of one antenna per array) were anchored to the stream bottom by straps, earth anchors, and bolts. Antenna arrays were longitudinally spaced 10 meters apart to provide detection redundancy and directionality. Each antenna was controlled by an IS 1001 antenna control node reader. The two (6-meter litz wire high-density polyethylene) antennas provided complete interrogation coverage of the wetted channel width. The two IS1001 readers stored a date stamp, time stamp, antenna number and PIT tag code on the internal and external (flash drive) memory of the synced readers. M&E staff downloaded interrogation data bi-weekly and uploaded data files to the Columbia Basin PIT Tag Information System (PTAGIS) for archiving and data sharing. The PIT tag interrogation array site was paired with a staff gage and sensor/data logger (to record continuous water surface elevation and water temperature) approximately 5 meters upstream of the uppermost PIT tag array and was operated by Southern Territories Habitat Project (STHP) staff.

A continuous habitat survey of the anadromous fish bearing portion of stream was conducted by YKFP M&E and STHP staff during the summer of 2014 (Romero 2020). Geomorphic units (pools, glides, riffles and cascades) were established and assigned a GPS waypoint and a unit number to geo-reference captured fish to spatially defined habitat units. Single pass electrofishing was conducted to collect natural-origin juvenile *O. mykiss* from the confluence with the Klickitat River upstream to a waterfall that restricts upstream fish passage/anadromy approximately 2 kilometers upstream. Captured *O. mykiss* ≥65 millimeters in fork length were anesthetized with MS-222, injected with a PIT tag, DNA and scales collected, fork length measured and capture location recorded. PIT tagged fish recovered from anesthesia in aerated buckets and were released back to Summit Creek at the completion of sampling. PIT tagging files were uploaded to the PTAGIS database at the conclusion of sampling for archiving, data sharing and data analysis purposes.

Results

With the exception of 2018, relative abundance was similar among all years in Summit Creek (Table 11). Fish abundance was approximately 1.5-fold greater in 2018 compared to other years. The total number of fish PIT tagged in Summit Creek during the reporting period was 2,096 natural-origin *O. mykiss* and the total number of recaptured fish was 69 natural-origin *O. mykiss*. Average *O. mykiss* fork length varied from low of 114 millimeters in 2016 to a high of 132 millimeters in 2021. A total of 2,192 genetic samples were collected from initially captured fish (excluding recaptures).

Scale samples were collected from a subset of fish for aging and totaled 239 samples from 2018-2021 (Table 12). Of the 239 fish that had scales collected, approximately 50% of the fish were successfully aged. One-year olds comprised the highest proportion of aged fish for 2018 and 2021 accounting for ~66% and ~57% of the aged scales, respectively. However, two-year olds were the dominant age class in 2019 accounting for approximately two-thirds of the aged scales. Three-year olds accounted for a small percentage of the fish each year. Four-year olds were only present in 2021.

Detection efficiency at the Summit Creek array ranged from 57% in 2015 to 100% for years 2016, 2019, 2020 (Table 13). Unique PIT tag detections at the Summit Creek array for fish tagged in Summit Creek for 2015, 2016, 2017, 2018, 2019, 2020 and 2021 was 95, 108, 104, 119, 148, 93, 67, and 82, respectively. After applying an expansion multiplier, an estimate of 984 (~47%) natural-origin *O. mykiss* out-migrants crossed the Summit Creek PIT tag array during the reporting period from a tagging population of 2,096 fish. The remaining undetected PIT tagged fish either adopted a resident life history, have not yet out-migrated, or met a mortality fate.

Table 11. Summary statistics of PIT tagged Oncorhynchus mykiss collected from single pass electrofishing in Summit Creek (January 1, 2015-December 31, 2021).

Sample Year	No. Fish Handled	No. Fish Tagged	No. Fish Recaps	Fish/ 100m^2	Avg Fork Length (mm)	Med Fork Length (mm)	Fork Length Range (mm)	# Genetic Samples
2021	0	306	9	2.2	132	123	80-251	307
2020[1]	-	-	-	-	-	-	-	-
2019	1	318	26	2.4	126	122	65-235	319
2018	4	482	18	3.6	119	114	65-287	482
2017	2	298	12	2.2	117	112	65-253	311
2016	4	343	3	2.5	114	115	65-230	348
2015	11	349	1	2.6	115	113	65-250	425

[1]Sampling suspended due to Covid-19 pandemic restrictions.

Table 12. Age composition summary of juvenile Oncorhynchus mykiss collected from Summit Creek 2018-2021.

Sample Year	Total Fish	Total Samples	Aged Samples	Proportion by Age					Population Composition				
				Age 0	Age 1	Age 2	Age 3	Age ≥4	Age 0	Age 1	Age 2	Age 3	Age ≥4
2021	315	69	44	0.023	0.568	0.364	0.023	0.023	7.159	179	114.55	7.16	7.159
2020[1]	-	-	-	-	-	-	-	-	-	-	-	-	-
2019	345	67	20	0	0.35	0.6	0.05	0	0	120.8	207	17.25	0
2018	504	103	55	0	0.655	0.327	0.018	0	0	329.9	164.95	9.16	0

[1]Sampling suspended due to Covid-19 pandemic restrictions.

Table 13. Summary of unique detections, detection efficiency, and detection expansion of out-migrating Oncorhynchus mykiss at the Summit Creek PIT tag interrogation array (SUC) for fish tagged in Summit Creek.

Detection Year	SUC Unique Detections		SUC detection efficiency, expansion multiplier, and expansion estimate				
			OtherSites[1] Detections	SUC and Other Site Detections[2]	Detection Efficiency	Expansion Multiplier	Expansion Estimate
2022	82		7	6	0.86	1.17	96
2021	67		18	15	0.83	1.20	80
2020	93		21	21	1.00	1.00	93
2019	148		20	20	1.00	1.00	148
2018	119		18	17	0.94	1.06	126
2017	104		16	10	0.63	1.60	166
2016	108		11	11	1.00	1.00	108
2015	95		7	4	0.57	1.75	166
Total	**816**		**118**	**104**	**0.88**	**1.13**	**984**

[1]Total number of unique detections at PIT tag interrogation sites in the Columbia River basin other than Summit Creek. Observation only counted for the interrogation site with the initial detection.

[2]Total number of unique detections that conditionally occurred at both the Summit Creek PIT tag interrogation array and another PIT tag interrogation site.

For mark year 2015 and 2016, 66% and 46% of out-migrants were detected at the array within the same year of tagging, respectively (Table 14). For years 2017, 2018, 2019 and 2021, 47%, 54%, 54%, and 66% of fish were detected out-migrating past the array one year after tagging, respectively. The majority of emigration occurred within two years of a tagging event in 2015-2019. Fish from the 2021 tag cohort are expected to also exhibit the same pattern.

Summit Creek PIT tagged *O. mykiss* were detected at every interrogation site in the Klickitat River sub-basin except Logging Camp Creek (Table 15). The absence of detections at Logging Camp Creek could be due to limited temporal access due to this stream disconnecting from the Klickitat River during late-spring. The Little Klickitat River PIT tag array recorded the highest percentage of detections (28%). The Little Klickitat River is the first major tributary downstream of Summit Creek that exhibits perennial flow. The next highest percentage of fish (19%) detected by a tributary array were fish detected at the Swale Creek array. Swale Creek is the next major tributary downstream of the Little Klickitat River and has a wide alluvial fan and no barrier to juvenile fish movement at the mouth. The Klickitat River floating PIT array detected 31% of the total fish detected at arrays other than Summit Creek. Detections at the Klickitat River array indicate that these fish were likely out-migrating as smolts and exhibiting an anadromous life history.

Columbia River interrogation sites detected 45 unique PIT tagged natural-origin juvenile *O. mykiss* out-migrants from Summit Creek during years 2015-2022 (Table 16). The decline of out-migrant

Table 14. Summary matrix of unique PIT tag detections at the Summit Creek interrogation array by mark year and detection year for natural-origin juvenile Oncorhynchus mykiss marked in Summit Creek.

Mark Year	Total Tagged Fish	Detection Year								Total
		2015	2016	2017	2018	2019	2020	2021	2022	
2015	349	92	43	4	0	0	0	0	0	**139**
2016	343	0	70	65	15	0	1	1	0	**152**
2017	298	0	0	36	62	25	5	3	0	**131**
2018	482	0	0	0	40	95	33	4	3	**175**
2019	318	0	0	0	0	34	56	12	2	**104**
2020[1]	-	-	-	-	-	-	-	-	-	**-**
2021	306	0	0	0	0	0	0	43	85	**128**
Total	**2096**	**92**	**113**	**105**	**117**	**154**	**95**	**63**	**90**	**829**

[1]Sampling suspended due to Covid-19 pandemic restrictions.

detections in 2021 was likely due to suspended tagging in 2020. The greatest number of out-migrant detections in the Columbia River occurred in 2019, which was driven by a large tagging (482 fish) group in 2018 and large percentage (54%) detected out-migrating Summit Creek in 2019. Approximately 91% of the unique Summit Creek detections in the Columbia River occurred at the juvenile bypass. The other 9% of detections were recoveries at Columbia River bird colonies (East Sand Island and Rice Island). Only one of the fish detected at Bonneville Dam was also recovered as a bird colony mort.

There were 41 unique PIT tagged natural-origin juvenile *O. mykiss* out-migrants from Summit Creek detected at Bonneville Dam years 2015-2022. Of the 41 fish, 66%, 32% and 2% of fish were detected at Bonneville one year, two years and three years following tagging, respectively. Approximately 17%, 68% and 15% of all Summit Creek tagged fish detected at Bonneville Dam occurred April, May and June, respectively. The first detection at Bonneville Dam was April 12th, April 27th, April 17th, May 1st, April 23rd, May 16th and May 4th for years 2016, 2017, 2018, 2019, 2020, 2021 and 2022, respectively. The last detection was May 29th, May 26th, June 2nd, June 13th, June 10th, June 3rd and May 9th for years 2016, 2017, 2018, 2019, 2020, 2021 and 2022, respectively. Travel times from Summit Creek to Bonneville Dam ranged from a low of 3 days to a high of 524 days. Fish with travel times in excess of a year likely reared in the Klickitat River for an additional year prior to out-migrating as smolts. Average travel time to Bonneville Dam using the last detection at the SUC array was 101 days and the median travel time was 29 days. Travel time between Bonneville Dam and the Columbia River Estuary could not be calculated because there were no fish detected at both sites.

Two fish tagged as juveniles in Summit Creek were detected at Bonneville Dam as adults (Table 16). The adult returning in year 2020 was PIT tagged in 2016 and the adult returning in year 2022 was

PIT tagged in 2018. Scale data and length at time of tagging indicate that both individuals returned as five-year-old fish.

Summit Creek array detections for all species (steelhead, Chinook and coho) and life stages (adult and out-migrant) were observed except natural-origin Chinook out-migrants (Table 17). The absence of natural-origin Chinook out-migrant detections is a result of not tagging natural-origin Chinook juveniles in Summit Creek. Hatchery-origin juvenile steelhead and Chinook detected in Summit Creek originated from either direct releases (Skamania stock steelhead) or volitional releases of hatchery spring and fall Chinook from the Klickitat Salmon Hatchery. The majority of the adult natural-origin *O. mykiss* detections at the Summit Creek array were tagged at locations other than Summit Creek. Fish tagged at the Lyle Falls Adult Trap accounted for the highest percentage (89%) of PIT tagged adults detected at the Summit Creek array. Juveniles PIT tagged in Summit Creek accounted for 7% of the adult detections. Adult natural-origin steelhead detected at Summit Creek also originated from the Klickitat River screw trap and Tepee Creek at contributions of approximately 2% and 2%, respectively. Of the six hatchery-origin adult steelhead detected at the Summit Creek array, five fish came from the Lyle adult trap tagging site and one fish was from a Skamania hatchery release to the Klickitat River. Thirty-three adult coho were detected in Summit Creek during years 2015, 2017, 2018, 2019, 2021. Of the thirty-three adult coho, all but one fish was tagged as an adult at the Lyle Falls adult trap.

O. mykiss out-migrant detections were observed during all months in Summit Creek after 2015, with the majority of detections occurring when stream discharge was ascending (Figure 12). The exception is late summer of 2016 when there was an increase in *O. mykiss* out-migrant detections during the low stage period. This could potentially be explained by fish out-migrating to utilize Klickitat River habitat or a result of stream temperatures exceeding 16 degrees Celsius in mid-August 2016 where 12 detections during a two-day period coincided with a stream temperature peak. Peaks in out-migration from 2015-2022 (Figure 12) were most prominent in spring, fall and late summer.

Out-migrant detections were not observed prior to summer 2015 because tagging did not begin in Summit Creek until July 2015. PIT tagging did not occur in 2020 which is likely why a drop in out-migrants was observed during summer 2020 and spring and summer of 2021. After tagging commenced in 2015, out-migrant detections were observed in the fall, winter, summer and spring with the majority of fish detections occurring in spring except for 2017 where a higher percentage (36%) of fish were detected in fall. The higher percentage of fish out-migrating fall 2017 is likely due to high stream temperatures during August 2016 which may have accelerated out-migration and reduced the population that would have emigrated the following spring. None of these fish were detected outside of Summit Creek again so their fate is undetermined.

Adult natural-origin steelhead were detected winter through spring and appeared to be correlated with a rise in stream discharge (Figure 12). Higher numbers of natural-origin adult steelhead were detected at the Summit Creek array during spring which coincided with the spawning period. All natural-origin adult steelhead entered Summit Creek in the Spring for years 2017-2022. Adult hatchery-origin steelhead also enter Summit Creek in the spring but in lower numbers than their

Table 15. Encounter history of PIT tagged natural-origin juvenile Oncorhynchus mykiss from Summit Creek to other Klickitat River sub-basin PIT tag interrogation sites (January 1, 2015 - December 31, 2022).

	Klickitat River Subbasin Interrogation/Observation Sites										
Detection Year	White Creek	L. Klickitat River	Swale Creek	Snyder Creek	Wheeler Creek	Logging Camp Cr.	Dillacort Creek	Screw Trap	Klickitat River	Lyle Adult Fishway	Total
2022	3	4	3	0	0	0	0	3	1	0	**14**
2021	0	12	0	0	0	0	0	2	1	0	**15**
2020	2	5	0	0	0	0	0	0	12	0	**19**
2019	0	3	3	0	0	0	0	2	11	0	**19**
2018	2	3	1	0	0	0	0	1	5	0	**12**
2017	0	1	3	1	0	0	0	0	1	1	**7**
2016	3	0	4	0	1	0	2	0	0	0	**10**
2015	0	0	5	0	0	0	0	0	0	0	**5**
Total	**10**	**28**	**19**	**1**	**1**	**0**	**2**	**8**	**31**	**1**	**101**

Table 16. Summary of unique PIT tag detections at Columbia River observation sites for natural-origin juvenile/adult Oncorhynchus mykiss marked in Summit Creek (January 1, 2015 – December 31, 2022).

	Unique out-migrant Columbia River PIT tag Detections	Unique Adult Return Bonneville PIT tag Detections
Detection Year	**Summit Creek**	**Summit Creek**
2022	4	1
2021	2	0
2020	6	1
2019	15	0
2018	6	0
2017	5	0
2016	7	0
2015	0	0
Total	**45**	**2**

Table 17. Summary of PIT tag detections at the Summit Creek PIT tag interrogation array by species, origin, and life stage (January 1, 2015 - December 31, 2022).

Detection Year	Natural-Origin Steelhead		Hatchery-Origin Steelhead		Natural-Origin Chinook		Hatchery-Origin Chinook		Unknown-Origin Coho	
	Adult	Out-migrant	Adult	Out-migrant	Adult	Out-migrant	Adult	Out-migrant	Adult	Out-migrant
2022	5	82	2	1	1	0	0	1	0	1
2021	5	69	0	0	0	0	0	0	2	0
2020	6	99	0	2	0	0	2	0	3	0
2019	1	160	2	0	0	0	0	1	1	0
2018	10	132	1	0	0	0	0	1	14	3
2017	1	106	1	0	0	0	0	0	10	5
2016	12	115	0	0	0	0	0	0	0	3
2015	6	106	0	0	0	0	1	6	3	40
Total	**46**	**869**	**6**	**3**	**1**	**0**	**3**	**9**	**33**	**52**

natural-origin counterpart. Of the six hatchery adults that entered Summit Creek during years 2017, 2018, 2019 and 2022, two fish entered Summit Creek in April and June and one fish entered in February and May. With the exception of a singled adult coho entering Summit Creek in Fall 2021, all other adult coho entered Summit Creek during the winter (Figure 12).

Conclusions

Summit Creek appears to be a moderately productive *O. mykiss* stream with consistent inter-annual relative abundance. The stable population is likely attributable to perennial stream flow and cool water temperatures. The age structure of natural-origin O. mykiss in Summit Creek is dominated by one-year and two-year old fish. A small percentage of the population is comprised of three-year and four year-old fish. Although nearly half of the tagging population out-migrated from Summit Creek, only a small percentage of the out-migrant population was detected in the Columbia River. The low Columbia River detection numbers could be the result of poor Bonneville Dam detection rates or a portion of the population exhibiting a fluvial life history and remaining in the Klickitat River.

O. mykiss out-migrant detections were observed during all months in Summit Creek after 2015 with the majority of detections occurring when stream discharge was ascending. During years 2016-2022 out-migrant detections were observed during fall, winter, summer and spring, with the majority of detections occurring in spring. The majority fish left Summit Creek within two years of tagging in years 2015-2019 and we expect fish from tag year 2021 to also exhibit a similar trend.

Summit Creek is utilized primarily by adult natural-origin steelhead compared to other adult salmonid species. Although adult coho were observed in sizable numbers, their does not appear to be a viable population of juvenile coho rearing in Summit Creek. The number of adult natural-origin steelhead detected at the Summit Creek PIT tag array was nearly 8-fold greater than the number of adult hatchery-origin steelhead detections. This result indicates that interactions between natural-origin and hatchery-origin steelhead may be minimal.

As streams warm and dry earlier in the year, perennial streams like Summit Creek will likely contribute a higher proportion of steelhead to the Klickitat River compared to other Klickitat River tributaries where flow permanence is an issue. Although Summit Creek has perennial flow, climate change poses the threat of increasing stream temperature to levels nearing or surpassing *O. mykiss* thermal thresholds. Considering the potential impacts of climate change, Klickitat M&E will continue to monitor the Summit Creek to track status and trends of this important natural-origin *O. mykiss* population.

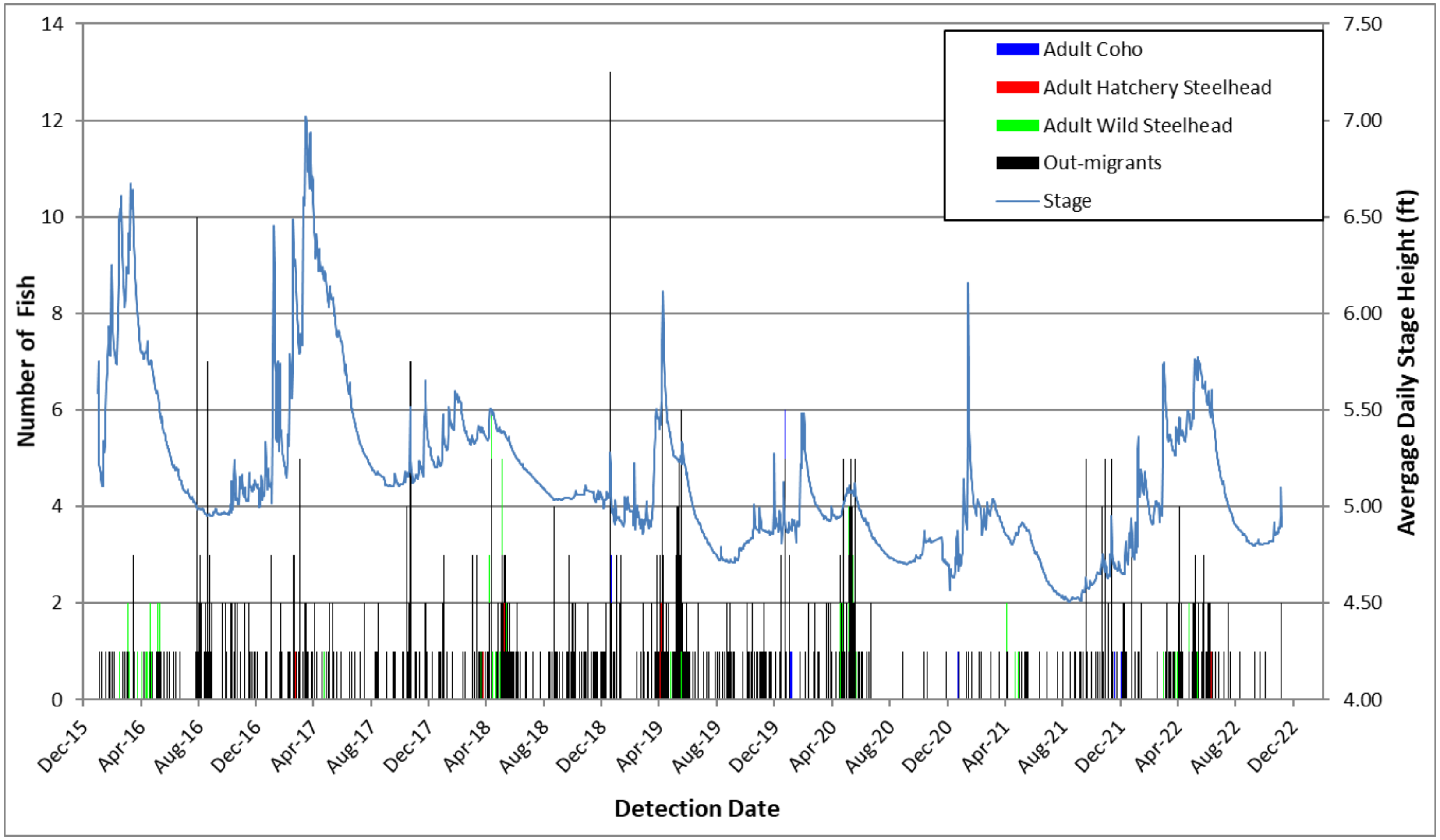

Figure 12. Relationship between average daily stage height (ft) and the number of fish detected by species at the Summit Creek PIT array during 2016-2022 migration years (January 1, 2016 - December 31, 2022).

Bowman Creek PIT Tag Study

Introduction

Bowman Creek is a perennial anadromous fish bearing stream that enters the Little Klickitat River from the north at river kilometer 2. The Bowman Creek headwaters are located on the western flank of the Simcoe Mountains (near Potato Butte) at an approximate elevation of 1,771 meters. Bowman Creek flows in a southwesterly direction for approximately 31 kilometers before entering the Little Klickitat River (Figure 9). The total drainage area is approximately 153 square kilometers. The stream channel is generally constrained by alternating terrace and hillslope and the total stream gradient for the study section is 4.4% from the mouth to a waterfall barrier approximately 2 kilometers upstream. The total length of the anadromous fish bearing portion of Bowman Creek is approximately 2 km in length and 11,499 m^2 of total wetted area. Riffles and pools are the dominant geomorphic unit in the 2 km sample section comprising 53% and 21%, respectively. Boulder and cobble are the dominant substrate type comprising 82% of the substrate area. Ponderosa Pine and Oregon White Oak are the most common upslope trees, with Red Alder and Big Leaf Maple comprising the dominant and sub-dominant riparian vegetation, respectively. Canopy coverage of the wetted area is approximately 75%.

Bowman Creek population sampling began summer 2019 and has continued through 2022, with the exception of suspended sampling during summer 2020 due to Covid-19 pandemic restrictions. The main objectives of the Bowman Creek PIT tag study are to determine: 1) the proportion of *O. mykiss* that leave Bowman Creek as downstream out-migrants; 2) *O. mykiss* population distribution, age composition, and genetic structure; 3) run-timing of downstream out-migrants; 4) and to quantify in-timing migration and returns of anadromous salmonids.

Methods

A PIT tag array (LKR) located in the Little Klickitat River (approximately 1.5 kilometers downstream of the Bowman Creek confluence) was used to monitor PIT tagged fish. Operation of the Little Klickitat River PIT array began January 24, 2017. The LKR PIT PIT tag array is located approximately 340 meters upstream of the confluence with the mainstem Klickitat River. Paired antenna arrays (consisting of two antennas per array) were anchored to the stream bottom by straps, earth anchors, and bolts. Antenna arrays were longitudinally spaced 10 meters apart to provide detection redundancy and directionality. An IS1001 Master Controller (MC) multiplexes four IS1001 antenna control nodes affixed to their respective antennas. The four (litz wire high-density polyethylene) antennas provide complete interrogation coverage of the wetted channel width. The MC interprets the tag signal from each antenna and stores a date stamp, time stamp, antenna number and PIT tag code on the master controller internal memory. Interrogation data was paired with stage data collected from a Washington Department of Ecology stream gauge station located in the Little Klickitat River approximately 700 meters upstream of the confluence with the Klickitat River. M&E staff downloaded interrogation data bi-weekly and uploaded data files to the Columbia Basin PIT Tag Information System (PTAGIS) for archiving and data sharing.

A continuous habitat survey of the anadromous fish bearing portion of stream was conducted by YKFP M&E staff during the summer of 2019 (Kuhn and Romero 2020). Geomorphic units (pools, glides, riffles and cascades) were established and assigned a GPS waypoint and a unit number to geo-reference captured fish to spatially defined habitat units. Single-pass electrofishing was conducted to collect natural-origin juvenile *O. mykiss* from the confluence with the Little Klickitat River upstream to a waterfall that restricts upstream fish passage/anadromy. Captured *O. mykiss* ≥65 millimeters in fork length were anesthetized with MS-222, injected with a PIT tag, DNA and scales collected, fork length measured and capture location recorded. PIT tagged fish recovered from anesthesia in aerated buckets and were released back to Bowman Creek at the completion of sampling. PIT tagging files were uploaded to the PTAGIS database at the conclusion of sampling for archiving, data sharing and data analysis purposes.

Results

We observed inter-annual variation in the relative abundance of natural-origin juvenile *O. mykiss* in Bowman Creek for sample years 2019, 2021 and 2022. Fish abundance ranged from a low of 4.7 fish/100m^2 in 2019 to a high of 7.7 fish/100m^2 in 2021 (Table 18). Average *O. mykiss* fork length for sample years 2019, 2021, 2022 was 128, 99, and 107 millimeters, respectively. Sample year 2019 had the lowest fish abundance of all three sample years but the largest average fork length. The total number of fish PIT tagged in Bowman during the reporting period was 2,097 natural-origin juvenile *O. mykiss* and the total number of recaptured fish was 51 natural-origin juvenile *O. mykiss*. Genetic samples were collected from every healthy fish that was not a recapture and totaled 2,127 samples for the reporting period.

Four hundred and seven scale samples were collected from a subset of fish for aging purposes and 73% of collected samples were successfully aged (Table 19). One-year olds were the dominant age-class in 2019 and 2022, comprising 55% and 60% of the aged samples, respectively. However, age-0 fish (52%) were the dominant age-class for year 2021. Year 2021 had the lowest percentage of age two (>1%) and three (0%) fish of any sample year. Year 2019 and 2022 had approximately 9% and 1% age three fish, respectively.

Detection efficiency at the Little Klickitat PIT tag array ranged from a low of 45% in 2022 to 100% during years 2019 and 2021 (Table 20). Unique PIT tag detections at the LKR PIT tag array for fish tagged in Bowman Creek in 2019, 2020, 2021, 2022 was 37, 65, 62 and 77, respectively. After applying an expansion multiplier, an estimate of 382 (~18%) natural-origin *O. mykiss* out-migrants crossed the LKR PIT tag array during years 2019, 2020, 2021, 2022 from a tagging population of 2,097 fish. The remaining undetected PIT tagged fish either adopted a resident life history, have not yet out-migrated, or met a mortality fate.

For mark year 2019 and 2021, 100% and 96% of fish were detected at the array one year after tagging, respectively (Table 21). We expect the majority of the 2022 tag cohort to out-migrate in 2023, as this pattern has been observed with fish PIT tagged in 2019 and 2021. The observed one-year delay from tagging to detection at the Little Klickitat River PIT array is likely the result of tagging occurring during the low flow period (fall) when fish movement is minimal. Although tagging occurred mid-summer in 2019, sampling coincided with a rapidly receding hydrograph.

Table 18. Summary statistics of PIT tagged Oncorhynchus mykiss collected from single pass electrofishing in Bowman Creek (January 1, 2019-December 31, 2022).

Sample Year	No. Fish Handled	No. Fish Tagged	No. Fish Recaps	Fish/ $100m^2$	Avg Fork Length (mm)	Med Fork Length (mm)	Fork Length Range (mm)	# Genetic Samples
2022	12	718	48	6.8	107	91	65-235	717
2021	30	856	2	7.7	99	86	65-245	886
2020[1]	-	-	-	-	-	-	-	-
2019	12	523	1	4.7	128	121	67-305	524

[1]Sampling suspended due to Covid-19 pandemic restrictions.

Unlike other tributaries in the lower basin that seasonally disconnect from the Klickitat River and undergo intermittent flow, Bowman Creek maintains perennial flow and connectivity (to the Little Klickitat River). These conditions provide favorable rearing habitat to fish during the limiting period of the year. Swale Creek was the only Klickitat River subbasin tributary other than the Little Klickitat River to detect fish PIT tagged in Bowman Creek (Table 22). Swale Creek accounted for approximately 48% of the detection encounters other than LKR (Table 22). Bowman Creek fish resided in Swale Creek from late-December to early-April. Approximately 90% of Bowman Creek fish that entered Swale Creek were detected during the winter and 10% were detected during the spring. Swale Creek is located approximately 4.2 kilometers downstream of the Little Klickitat confluence with the mainstem Klickitat. Swale Creek has a wide alluvial fan and no barrier to juvenile fish movement at the mouth aside from when Swale disconnects from the mainstem during early summer.

Of the Bowman tagged fish using Swale Creek, one fish was detected at screw trap and one fish was detected at the floating PIT tag array. The Klickitat River floating PIT array and Klickitat River screw trap detected 43% and 9% of the total fish detected at arrays other than LKR for years 2019-2022, respectively. Detections at the Klickitat River floating array and Klickitat River screw trap indicate that these fish are likely out-migrating as smolts and exhibiting an anadromous life history.

Columbia River interrogation sites detected 21 unique PIT tagged natural-origin juvenile *O. mykiss* out-migrants that were tagged in Bowman Creek during years 2019-2022 (Table 23). Columbia River detections of Bowman Creek tagged out-migrants only occurred for years 2020 and 2022. In 2020, all detections in the Columbia River occurred at the Bonneville Dam juvenile bypass. In 2022, the Bonneville Dam juvenile bypass and Columbia River Estuary accounted for 57% and 43% of the unique detections, respectively.

Table 19. Age composition summary of juvenile Oncorhynchus mykiss collected from Bowman Creek 2019-2022.

Sample Year	Total Fish	Total Samples	Aged Samples	Proportion by Age: Age 0	Age 1	Age 2	Age 3	Age ≥4	Population Composition: Age 0	Age 1	Age 2	Age 3	Age ≥4
2022	778	137	112	0.259	0.598	0.134	0.009	0	201	465	104	7	0
2021	888	174	131	0.519	0.473	0.008	0	0	461	420	7	0	0
2020[1]	-	-	-	-	-	-	-	-	-	-	-	-	-
2019	536	96	53	0	0.547	0.358	0.094	0	0	293.3	192.15	50.57	0

[1]Sampling suspended due to Covid-19 pandemic restrictions.

Table 20. Summary of unique detections, detection efficiency and detection expansion of out-migrating natural-origin juvenile Oncorhynchus mykiss at the Little Klickitat PIT tag interrogation array (LKR) for fish tagged in Bowman Creek.

Detection Year	LKR Unique Detections	LKR detection efficiency, expansion multiplier, and expansion estimate: OtherSites[1] Detections	LKR and Other Site Detections[2]	Detection Efficiency	Expansion Multiplier	Expansion Estimate
2022	77	29	13	0.45	2.23	172
2021	62	2	2	1.00	1.00	62
2020	65	29	17	0.59	1.71	111
2019	37	1	1	1.00	1.00	37
Total	**241**	**61**	**33**	**0.54**	**1.85**	**382**

[1]Total number of unique detections at PIT tag interrogation sites in the Columbia River basin other than Little Klickitat. Observation only counted for the interrogation site with the initial detection.
[2]Total number of unique detections that conditionally occurred at both the Little Klickitat PIT tag interrogation array and another PIT tag interrogation site.

Table 21. Summary matrix of unique PIT tag detections at the Little Klickitat River interrogation array by mark year and detection year for natural-origin juvenile Oncorhynchus mykiss marked in Bowman Creek (January 1, 2019-December 31, 2022).

Mark Year	Total Tagged Fish	Detection Year 2019	2020	2021	2022	Total
2019	523	0	30	0	0	**30**
2020[1]	-	-	-	-	-	**-**
2021	856	0	0	1	26	**27**
2022	718	0	0	0	2	**2**
Total	**2,097**	**0**	**30**	**1**	**28**	**59**

[1]Sampling suspended due to Covid-19 pandemic restrictions.

Table 22. Encounter history of PIT tagged natural-origin juvenile Oncorhynchus mykiss from Bowman Creek to other Klickitat River sub-basin PIT tag interrogation sites (January 1, 2019 - December 31, 2022).

Detection Year	Klickitat River Subbasin Interrogation/Observation Sites: Summit Creek	White Creek	Swale Creek	Snyder Creek	Screw Trap	Klickitat River	Lyle Adult Fishway	Total
2022	0	0	12	0	4	9	0	**25**
2021	0	0	1	0	0	0	0	**1**
2020	0	0	8	0	0	10	0	**18**
2019	0	0	0	0	0	0	0	**0**
Total	**0**	**0**	**21**	**0**	**4**	**19**	**0**	**44**

Table 23. Summary of unique PIT tag detections at Columbia River observation sites for natural-origin juvenile/adult Oncorhynchus mykiss marked in Bowman Creek (January 1, 2019 – December 31, 2022).

Detection Year	Unique out-migrant Columbia River PIT tag Detections	Unique Adult Return Bonneville PIT tag Detections
2022	7	2
2021	0	0
2020	14	0
2019	0	0
Total	**21**	**2**

There were 18 natural-origin *O. mykiss* out-migrants detected at Bonneville Dam during years 2020 and 2022. All 18 fish were detected passing Bonneville Dam one year after tagging. The majority (93% and 100%) were detected in May for years 2020 and 2022, respectively. The first detection at Bonneville was April 28th and May 8th for year 2020 and 2022, respectively. The last detection was May 24th and May 29th for years 2020 and 2022, respectively. Average travel time to Bonneville using the last detection at the LKR array was 4.7 days. Travel time from Bonneville to the estuary could not be calculated because no fish were detected at both Bonneville Dam and the Columbia River Estuary.

There were two adult detections for Bowman Creek tagged natural-origin *O. mykiss* returning to Bonneville Dam in 2022. Both returning adults were marked in 2019, with one adult returning to Bonneville in June and the other in July. We expect to see greater numbers of natural-origin adult *O. mykiss* return in future years when fish from the 2021 and 2022 tag groups reach maturity and return to spawn.

We observed Little Klickitat PIT tag array detections for all species (steelhead, Chinook and coho) and life stages (adult and out-migrant) (Table 24). Hatchery-origin juvenile steelhead and juvenile Chinook were not tagged in Bowman Creek or the Little Klickitat River and any detected fish originated from either direct releases (Skamania stock steelhead) or volitional releases of hatchery spring and fall Chinook from the Klickitat Salmon Hatchery (Table 24). The majority of the natural-origin steelhead adult detections at the Little Klickitat PIT tag array (2017-2022) came from fish tagged at locations other than Bowman Creek. Fish tagged at the Lyle Falls Adult Trap accounted for the majority (~77%) of the unique natural-origin steelhead adult detections at the Little Klickitat PIT array. Additional tagging sites for adult natural-origin steelhead detected at the LKR array consisted of the Lyle Falls Screw Trap (KLICKR), Lower Granite Dam (LGR/LGRLDR), Bowman Creek (BOWMNC), White Creek (WHITEC), Summit Creek (SUMI3C) and the Columbia River (COLR2) at contributions of approximately 10%, 5%,3%,2%,2% and 1%, respectively.

Table 24. Summary of PIT tag detections at the Little Klickitat Creek PIT tag interrogation array by species, origin, and life stage (January 1, 2017 - December 31, 2022).

Detection Year	Natural-Origin Steelhead		Hatchery-Origin Steelhead		Natural-Origin Chinook		Hatchery-Origin Chinook		Unknown-Origin Coho	
	Adult	Out-migrant	Adult	Out-migrant	Adult	Out-migrant	Adult	Out-migrant	Adult	Out-migrant
2022	5	90	5	1	2	0	3	0	7	0
2021	16	76	6	1	1	0	0	0	9	0
2020	15	75	7	10	0	0	3	2	4	1
2019	13	72	8	14	0	1	0	1	27	1
2018	12	37	2	11	0	0	4	0	30	1
2017	6	16	4	1	0	0	4	0	20	0
Total	**67**	**366**	**32**	**38**	**3**	**1**	**14**	**3**	**97**	**3**

Bowman Creek has perennial flow with peak discharge early-winter through late-spring (rainfall and snowmelt driven) and a low discharge during the summer and fall months. Natural-origin *O. mykiss* out-migrants in Bowman Creek tend to emigrate when stream discharge is on the rise during the spring months but a proportion also are detected at the LKR array during lower summer flows. Out-migrants exhibit a bimodal out-migration pattern from Bowman Creek. The peak migration generally occurs in the spring followed by a secondary pulse in the summer/fall that tends to be smaller than in the spring. The timing of fish crossing the Little Klickitat River array drastically varied from 2019-2022. For year 2019, approximately 89% of natural-origin *O. mykiss* out-migrants were detected leaving Bowman Creek during July and August and approximately 11% were detected leaving Bowman during the fall/winter months. Tagging did not begin until summer of 2019, which is why we did not see spring out-migrants for 2019. For year 2020, approximately 83% of natural-origin *O. mykiss* out-migrants left Bowman in the spring, 14% during summer and 3% during the winter. For year 2021, approximately 68% of natural-origin *O. mykiss* left in the fall, 15% during summer, 10% during winter and 7% during the spring. For year 2022, approximately 47% of natural-origin *O. mykiss* out-migrants left during spring, 25% during winter, 16% during summer and 12% during fall.

Natural-origin adult steelhead were primarily detected winter through spring during the spawning period. Fish detections coincided with a rise in stream discharge (Figure 13). Approximately 34%, 23%, 11%, 9%, 5%, 5%, 5%, 4%, 2%, 2% of natural-origin *O. mykiss* adults entered the Little Klickitat River in April, March, January, December, June, October, November, September, February and May, respectively. Approximately 22%, 22%, 19%, 15%, 7%, 7%, 4%, and 4% of hatchery-origin *O. mykiss* adults entered the Little Klickitat River in January, February, December, March, November, April, August, and October, respectively. Approximately 67% of natural-origin Chinook adults entered the Little Klickitat River in October and 33% in June. Approximately 36%, 36%, 21%, and 7% hatchery-origin Chinook adults entered the Little Klickitat River in June, July, August and May, respectively. Approximately 43%, 22%, 17%, 14% 2% and 1% unknown-origin adult coho entered the Klickitat in November, October, December, January, September and February, respectively.

Conclusions

Bowman Creek appears to be a productive natural-origin *O. mykiss* stream based on relative abundance ranging from 4.7-7.7 fish/100m^2 during the reporting period. The decrease in the number of captured fish from 2021 to 2022 was likely attributed to decreased survival resulting from very high ambient air temperatures (>43 degrees Celsius) in late June 2021, which increased stream temperatures throughout the basin. The age structure of natural-origin O. mykiss in Bowman Creek is dominated by subyearling and one-year old fish. Two-year old fish accounted for a smaller percentage but were present in each sample year. Approximately one-fifth of the tagging population out-migrated from Bowman Creek, which is generally lower than out-migration rates of other monitored tributaries in the Klickitat River subbasin. The lower rates of out-migration observed in Bowman Creek may be attributable to perennial stream flow and cool water temperatures favorable to a resident life history.

There were two natural-origin juvenile *O. mykiss* out-migrant peaks observed at the Little Klickitat array. One occurred in the summer/fall which tended to be smaller and the other in the spring. The majority (~91%) of PIT detections at sites in the Klickitat River subbasin other than LKR occurred at Swale Creek and the Klickitat River floating PIT array. The majority of Bowman PIT tagged fish exited the stream one year after tagging. There were 21 unique Bowman PIT tagged natural-origin juvenile *O. mykiss* out-migrants detected at Columbia River interrogation sites during 2019-2022 and of the 21 detections, 18 occurred at Bonneville Dam. All 18 of the Bonneville Dam out-migrant detections occurred one year after tagging and average travel time from the LKR array to Bonneville Dam was 4.7 days.

Chinook, steelhead and coho of both adult and juvenile life stages were detected at the LKR array. Tagging sites for these fish consisted of Klickitat River basin tagging sites as well as out of basin tagging sites. The Lyle Falls Adult Trap accounted for ~77% of natural-origin steelhead adult detections at LKR. The majority of natural-origin steelhead adults enter the Little Klickitat during the spring and the majority of the hatchery-origin steelhead adults enter the Little Klickitat during the winter.

PIT tagging in this stream started summer of 2019 but was not sampled in 2020 due to Covid-19 pandemic restrictions. We expect to see an increase in natural-origin adult steelhead returns in future years as tag cohorts grow to maturity and return to spawn. As streams warm and dry earlier in the year, perennial streams like Bowman Creek will likely contribute a higher proportion of steelhead productivity to the Klickitat River compared to other Klickitat River tributaries where flow permanence is an issue.

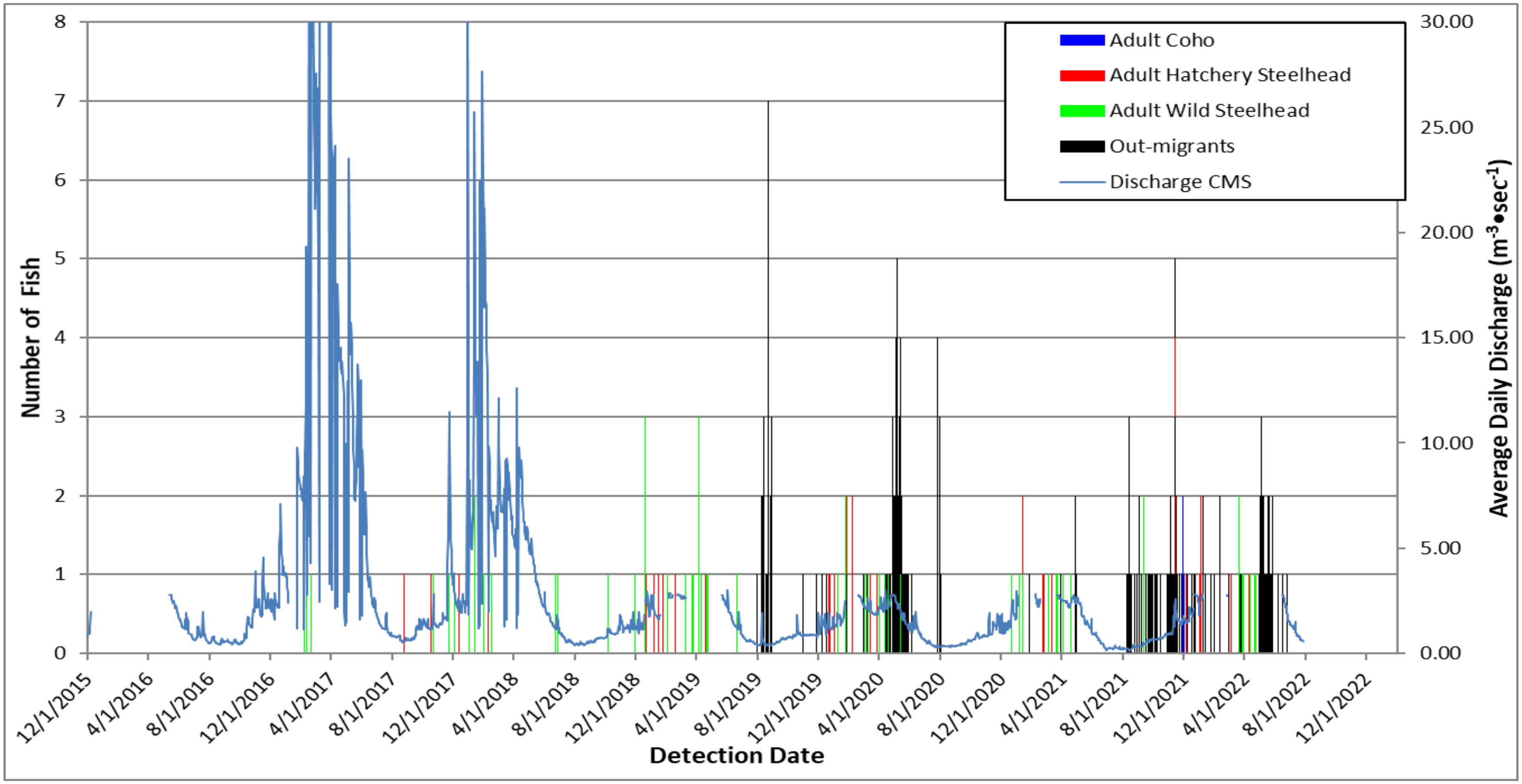

Figure 13. Relationship between average daily stream discharge and the number of fish detected by species at the Little Klickitat River PIT tag array during 2016-2022 migration years (January 1, 2016 - December 31, 2022).

Swale Creek PIT Tag Study

Introduction

Swale Creek is an anadromous fish bearing stream that enters the Klickitat River from the east at river kilometer 28.1 (Figure 9). The Swale Creek headwaters are located 12 kilometers southeast of the town of Goldendale, WA in the Columbia Hills at an approximate elevation of 981 meters. Swale Creek flows in a westerly direction for approximately 37 kilometers from Columbia Hills through the Goldendale Plateau, before changing to a northerly direction through Swale Canyon and eventually meeting the Klickitat River after flowing a total length of 51.7 kilometers. The total drainage area is approximately 325 square kilometers. Swale Creek maintains surface flow connection to the Klickitat River until July most years, at which point connection to the Klickitat River is severed and Swale Creek shifts to a flow regime of isolated pools and intermittent flow.

The stream channel is generally constrained by a road and fill from a decommissioned railroad on the south east bank and has a total stream gradient of 1.6%. A habitat survey of the lower 10 kilometers was conducted during spring 2014 and 2015. The total wetted area for both primary and secondary channels combined was 62,376 m^2. Riffles were the most common geomorphic unit comprising 46% of the wetted area. Boulder and cobble was the dominant substrate type accounting for approximately 72% of the substrate area. Ponderosa Pine, Oregon White Oak, and Douglas Fir were the most common upslope trees. Red Alder and Scoulers Willow were the dominant and sub-dominant riparian vegetation, respectively. Canopy coverage of the wetted area was approximately 39%.

Swale Creek *O. mykiss* population sampling began summer 2014 and continued through summer 2017. The main objectives of the Swale Creek PIT tag study were to determine: 1) the proportion of *O. mykiss* that leave Swale Creek as downstream out-migrants; 2) *O. mykiss* population distribution and genetic structure; 3) run timing of downstream out-migrants; 4) and to quantify in-timing migration and returns of anadromous salmonids.

Methods

Operation of the Swale Creek PIT tag array began January 15th 2014 and was upgraded with new and more robust HDPE antennas during fall 2018. Three antenna arrays (consisting of two 6-meter antennas per array) were anchored to the stream bottom by straps, earth anchors, and bolts approximately 100 meters upstream of the confluence with the Klickitat River. Antenna arrays were longitudinally spaced 10 meters apart to provide detection redundancy and directionality. An IS1001 Master Controller (MC) multiplexes six IS1001 antenna control nodes housed in a job box on the bank. The six (litz wire high-density polyethylene) antennas provide complete interrogation coverage of the wetted channel width. The MC interprets the tag signal from each antenna and stores a date stamp, time stamp, antenna number and PIT tag code on the master controller internal memory. M&E staff downloaded interrogation data bi-weekly and uploaded data files to the Columbia Basin PIT Tag Information System (PTAGIS) for archiving and data sharing. The PIT tag interrogation array site was paired with a staff gage and sensor/data logger (to record continuous water surface elevation and water temperature) operated by Southern Territories Habitat Project (STHP) staff.

A continuous habitat survey of approximately 10 kilometers of the anadromous fish bearing section of Swale Creek was conducted by YKFP M&E and STHP staff during the spring of 2014 (Kuhn and Romero 2020). Spawning surveys indicate that anadromy in Swale Creek likely doesn't extend upstream of river kilometer 13. Randomly selected electrofishing sections 300-meters in length were established in each fish-bearing kilometer because logistical limitations precluded efforts to census the entire 10 kilometers. The established electrofishing sections were repeatedly sampled each year. Geomorphic units (pools, glides, riffles, and cascades) were established and assigned a GPS waypoint and a unit number to geo-reference captured fish to spatially defined habitat units. Captured *O. mykiss* ≥65 millimeters were anesthetized with MS-222, injected with a PIT tag, DNA collected, fork length measured and capture location recorded. PIT tagged fish recovered from anesthesia in aerated buckets and were released back to Swale Creek at the completion of sampling. PIT tagging files were uploaded to the PTAGIS database at the conclusion of sampling for archiving, data sharing and data analysis purposes.

Results

Relative abundance of natural-origin juvenile *O. mykiss* in Swale Creek was fairly consistent among years. Natural-origin juvenile *O. mykiss* abundance for years 2014, 2015, 2016 and 2017 was 1.6, 1.5, 1.0 and 1.7 fish/100m^2, respectively (Table 25). The total number of fish PIT tagged in Swale Creek during the reporting period was 889 natural-origin juvenile *O. mykiss* and the total number of recaptured fish was 7 natural-origin juvenile *O. mykiss*. Average *O. mykiss* fork length for sample years 2014, 2015, 2016, 2017 was 137, 142, 160 and 143 millimeters, respectively. Genetic samples were collected from every healthy fish that was not a recapture. A total of 899 genetic samples were collected for the reporting period.

Detection efficiency at the Swale Creek array remained high from 2014-2018 (Table 26). Detection efficiency was 100% each year with the exception of 2015 where detection efficiency declined to 79%. Unique PIT tag detections at the Swale Creek array for fish tagged in Swale Creek for years 2014, 2015, 2016, 2017, 2018 and 2019, was 69, 55, 38, 44, 65, 3, respectively. The majority of out-migrants exited Swale Creek within two years of tagging, which is why no out-migrants were detected after 2019. After applying an expansion multiplier, an estimate of 286 (~32%) natural-origin *O. mykiss* out-migrants crossed the Swale Creek array during years 2014-2022, from a tagging population of 889 fish. The remaining undetected PIT tagged fish either adopted a resident life history or met a mortality fate.

Years where the majority of fish out-migrated the same year of tagging included 2014 (87%), 2015 (77%), and 2016 (55%), (Table 27). The exception was 2017 where the majority of the fish (~70%) out-migrated the year following tagging. PIT tagging coincided with spring emigration and the high percentage of fish detected leaving Swale Creek the same year of tagging is a result of changing environmental conditions (flow and temperature cues). Swale Creek becomes disconnected from the Klickitat River and subsequently forces fish to over-summer in habitat consisting of intermittent flow and isolated pools from early summer until the first substantial rains in early-fall if they don't emigrate by late spring. Swale Creek temperature and water quality is not ideal for salmonid rearing during the summer months and likely explains why we see outmigration the same year as tagging. Tagging in 2017 took place 2-weeks later than any other previous year, which could

Table 25. Summary statistics of PIT tagged Oncorhynchus mykiss collected from single pass electrofishing in Swale Creek (January 1, 2014-December 31, 2017).

Sample Year	No. Fish Handled	No. Fish Tagged	No. Fish Recaps	Fish/ 100m^2	Avg Fork Length (mm)	Med Fork Length (mm)	Fork Length Range (mm)	# Genetic Samples
2017	3	302	2	1.7	143	140	103-264	311
2016	3	163	1	1.0	160	151	104-293	163
2015	9	206	4	1.5	142	135	76-220	207
2014	8	218	0	1.6	137	130.5	82-269	218

Table 26. Summary of unique detections, detection efficiency and detection expansion of out-migrating natural-origin juvenile Oncorhynchus mykiss at the Swale Creek PIT tag interrogation array (SWC) for fish tagged in Swale Creek.

		SWC detection efficiency, expansion multiplier, and expansion estimate				
Detection Year	SWC Unique Detections	OtherSites[1] Detections	SWC and Other Site Detections[2]	Detection Efficiency	Expansion Multiplier	Expansion Estimate
2022	0	0	0	-	-	-
2021	0	0	0	-	-	-
2020	0	0	0	-	-	-
2019	3	0	0	-	-	-
2018	65	18	18	1.00	1.00	65
2017	44	9	9	1.00	1.00	44
2016	38	6	6	1.00	1.00	38
2015	55	14	11	0.79	1.27	70
2014	69	13	13	1.00	1.00	69
Total	**274**	**60**	**57**	**0.95**	**1.05**	**286**

[1]Total number of unique detections at PIT tag interrogation sites in the Columbia River basin other than Swale Creek. Observation only counted for the interrogation site with the initial detection.

[2]Total number of unique detections that conditionally occurred at both the Swale Creek PIT tag interrogation array and another PIT tag interrogation site.

Table 27. Summary matrix of unique PIT tag detections at the Swale Creek interrogation array by mark year and detection year for natural-origin juvenile Oncorhynchus mykiss marked in Swale Creek (January 1, 2014-December 31, 2017).

Mark Year	Total Tagged Fish	2014	Detection Year 2015	2016	2017	2018	2019	2020	2021	2022	Total
2014	218	69	9	1	0	0	0	0	0	0	**79**
2015	206	0	46	13	0	0	1	0	0	0	**60**
2016	163	0	0	23	18	0	0	1	0	0	**42**
2017	302	0	0	0	25	65	3	0	0	0	**93**
Total	**889**	**69**	**55**	**37**	**43**	**65**	**4**	**1**	**0**	**0**	**274**

explain why we observed the majority (~70%) of fish leaving the year after tagging, as a portion of the 2017 out-migrants likely emigrated before tagging occurred. Swale Creek PIT tagged fish were detected at the Little Klickitat array, Snyder Creek array, Wheeler Creek array, Klickitat River screw trap, Klickitat River floating PIT array and Lyle Falls adult fish facility (Table 28). The Little Klickitat River PIT tag array recorded the highest percentage (20%) of Swale Creek unique fish detections of any tributary. The Klickitat River floating array and the Klickitat River screw trap accounted for approximately 30% and 25% of the total natural-origin juvenile *O. mykiss* detected at arrays for years 2014-2020, respectively. Detections at the Klickitat River floating array and Klickitat River screw trap indicate that these fish are likely out-migrating as smolts and exhibiting an anadromous life history. No Swale Creek fish were detected at Summit Creek, White Creek, Logging Camp Creek and Dillacort Creek. An absence of detections at White Creek and Summit Creek was likely due to the long distance upstream (>30 kilometers) between them and Swale Creek. The absence of detections at Dillacort Creek and Logging Camp Creek could be due to limited temporal access because these streams disconnect from the Klickitat River during late-spring. With the exception of a single detection in the Little Klickitat River in 2020, the absence of out-migrant detections in other tributaries after 2018 was likely due to the suspension of juvenile tagging in Swale Creek after 2017.

Swale creek juvenile natural-origin *O. mykiss* were detected each year in the Columbia River. Three-quarters of the detections occurred in migration years 2014, 2015, and 2018 (Table 29). Approximately 70% of the 2017 tag cohort was detected out-migrating from Swale Creek in 2018, which differs from other years where the majority of fish leave Swale Creek the same year as tagging. The juvenile bypass at Bonneville Dam, Columbia River Estuary, and Sand Island bird colony accounted for 81%, 2% and 16% of the detections, respectively. Ten percent of the fish detected at the juvenile bypass were also detected as mortalities at Sand Island.

There were 35 natural-origin *O. mykiss* out-migrants detected at Bonneville Dam from 2014-2018. Of the 35 fish, 57% were detected at Bonneville Dam one year after tagging and 43% the same year of tagging. Of these fish, 12 were detected in April, 18 in May, and 5 in June. The first detection at

Bonneville for 2014, 2015, 2016, 2017, and 2018 was May 7th, April 28th, April 20th, May 1st, and April 10th, respectively. The last detection for 2014, 2015, 2016, 2017 and 2018 was June 13th, May 26th, June 6th, May 6th and May 15th, respectively. Travel times from last PIT detection at Swale Creek to the first PIT detection at Bonneville Dam greatly varied and ranged from a low of 1 day to 395 days. Fish with travel times in excess of a year likely utilized Klickitat River habitat prior to out-migrating as smolts the following year. This behavior is observed in Snyder Creek and White Creek as these streams are similar to Swale where surface flow connection to the Klickitat River disconnects annually. Average travel time to Bonneville Dam using the last detection at the Swale Creek array was 52 days and the median travel time was 16.5 days. Travel time from Bonneville Dam to the Columbia River Estuary could not be calculated because no fish were detected at both interrogation locations.

A total of six fish tagged as juveniles in Swale Creek returned to Bonneville Dam as adult steelhead from 2014-2019 (Table 29). Four of the six adults (~67%) returned to Bonneville Dam 3 years after tagging, one fish returned 1 year after tagging, and one fish returned 2 years after tagging. Of the 6 natural-origin adult steelhead detections at Bonneville, 67%, 17% and 17% returned in July, April and September, respectively. Considering most returning Klickitat River natural-origin steelhead adults rarely exceed 3-salt fish, it is unlikely any additional steelhead adults will be observed from the Swale Creek PIT tagging effort that concluded in 2017.

Swale Creek PIT tag array detections for steelhead and coho of both life stages (adult and out-migrant) were observed (Table 30). Natural-origin juvenile *O. mykiss* from tag streams other than Swale Creek were detected entering Swale Creek at a higher frequency than was observed at other PIT arrays. Of the 341 unique detections of natural-origin *O. mykiss* at the Swale Creek array (2014-2022), approximately one-fifth (n=66) came from fish tagged in Bowman Creek (33%), White Creek basin streams (30%), Dillacort Creek (2%), Snyder Creek (4%), Summit Creek (23%) and Wheeler Creek (8%). The absence of natural-origin Chinook out-migrant and adult detections is a result of not tagging natural-origin Chinook juveniles in Swale Creek. Detected hatchery-origin steelhead and Chinook originated from either direct releases (Skamania stock steelhead) or volitional releases of hatchery spring and fall Chinook from the Klickitat Salmon Hatchery. Although hatchery-origin coho smolts are not tagged before hatchery releases, large numbers of coho smolts were observed swamping the lower 3.2 kilometers of Swale Creek during spring electrofishing surveys. Although the impact of coho swamping in the lower 3.2 kilometers is unknown, the high coho densities may potentially impact out-migrant timing and food availability for natural-origin *O. mykiss* occupying the same habitat.

The majority of the adult natural-origin *O. mykiss* detections at the Swale Creek array were tagged at other locations. The Lyle Falls Adult Trap contributed the largest percentage (~68%) of natural-origin adult steelhead detections at the Swale Creek array. Natural-origin adult steelhead detections also originated from fish tagged at Bonneville Adult Fish Facility, Lyle Falls Screw Trap, Columbia River, and Asotin Creek at contributions of approximately 12%, 8%, 4%, 4% and 4%, respectively.

Table 28. Encounter history of PIT tagged natural-origin juvenile Oncorhynchus mykiss from Swale Creek to other Klickitat River sub-basin PIT tag interrogation sites (January 1, 2014 - December 31, 2022).

	Klickitat River Subbasin Interrogation/Observation Sites										
Detection Year	White Creek	L. Klickitat River	Summit Creek	Snyder Creek	Wheeler Creek	Logging Camp Cr.	Dillacort Creek	Screw Trap	Klickitat River	Lyle Adult Fishway	Total
2022	0	0	0	0	0	0	0	0	0	0	**0**
2021	0	0	0	0	0	0	0	0	0	0	**0**
2020	0	1	0	0	0	0	0	0	0	0	**1**
2019	0	0	0	0	0	0	0	0	0	0	**0**
2018	0	0	0	0	0	0	0	5	5	0	**10**
2017	0	3	0	0	0	0	0	0	1	1	**5**
2016	0	0	0	0	1	0	0	0	0	0	**1**
2015	0	0	0	3	0	0	0	0	0	0	**3**
2014	0	0	0	0	0	0	0	0	0	0	**0**
Total	**0**	**4**	**0**	**3**	**1**	**0**	**0**	**5**	**6**	**1**	**20**

Table 29. Summary of unique PIT tag detections at Columbia River observation sites for natural-origin juvenile/adult Oncorhynchus mykiss marked in Swale Creek (January 1, 2014 – December 31, 2022).

Detection Year	Unique out-migrant Columbia River PIT tag Detections	Unique Adult Return Bonneville PIT tag Detections
2022	0	0
2021	0	0
2020	0	0
2019	0	2
2018	12	2
2017	4	1
2016	6	0
2015	11	1
2014	10	0
Total	**43**	**6**

Table 30. Summary of PIT tag detections at the Swale Creek PIT tag interrogation array by species, origin, and life stage (January 1, 2014 - December 31, 2022).

Detection Year	Natural-Origin Steelhead		Hatchery-Origin Steelhead		Natural-Origin Chinook		Hatchery-Origin Chinook		Unknown-Origin Coho	
	Adult	Out-migrant	Adult	Out-migrant	Adult	Out-migrant	Adult	Out-migrant	Adult	Out-migrant
2022	0	15	0	5	0	0	0	0	4	0
2021	1	1	4	0	0	0	0	0	3	0
2020	4	13	4	4	0	0	0	0	0	0
2019	6	10	5	12	0	0	0	1	2	0
2018	2	71	2	1	0	0	0	1	13	1
2017	0	50	1	8	0	0	0	1	4	9
2016	7	47	5	1	0	0	1	0	2	21
2015	3	62	6	0	0	0	1	0	20	38
2014	2	72	3	1	0	0	0	5	22	97
Total	**25**	**341**	**30**	**32**	**0**	**0**	**2**	**8**	**70**	**166**

Natural-origin *O. mykiss* out-migrants tend to emigrate from Swale Creek during the receding limb of the hydrograph (Figure 14). Fish may be leaving Swale Creek to utilize more favorable rearing habitat in the Klickitat River compared to harsher over-summer rearing conditions in Swale Creek during the summer and early-fall. After Swale Creek disconnects from the Klickitat River, habitat becomes limited to isolated pools that potentially subject fish to water temperatures near or above salmonid temperature thresholds. A drop in discharge is likely a signal for fish to out-migrate to the Klickitat. The large number of PIT tagged fish documented leaving Swale Creek in in spring of 2016, 2017 and 2018 coincided with declining discharge (Figure 14). During years 2016, 2017 and 2018 approximately 100%, 90% and 93% of fish out-migrated from Swale Creek during the spring months. A small percentage of remaining fish were detected out-migrating in early summer (before Swale Creek became disconnected) and during the following late-fall/early-winter (after Swale Creek became reconnected to the Klickitat).

Adult hatchery-origin and natural-origin steelhead entered Swale Creek through the winter and spring months during the ascending limb of the hydrograph (Figure 14). After pooling detections from 2014-2022, approximately 31%, of adult natural-origin steelhead were detected crossing the Swale Creek array in February whereas the months of December, January, March, and April each accounted for 17% of the detections. For years 2014-2022, approximately 33%, 26%, 22%, 11%, 4% and 4% of hatchery-origin steelhead adults were detected entering Swale Creek in January, February, December, March, April and May, respectively. Only one adult coho was detected crossing the Swale Creek array in December of 2016.

Conclusions

Swale Creek does not appear to be a very productive *O. mykiss* stream based on low relative abundance estimates ranging from 1.0-1.7 fish/100m^2 during the reporting period. Although relative abundance was lower in Swale Creek compared to other tributaries, fish were generally larger. Approximately one-third of the tagging population out-migrated from Swale Creek, which is similar to out-migration rates observed in White Creek. Results indicate that Swale Creek provides important seasonal rearing and staging habitat for migratory natural-origin juvenile *O. mykiss* originating from other tributaries. High hatchery-origin coho smolt densities through the lower 3.2 kilometers may have unintended competitive consequences on food availability and out-migration timing for natural-origin juvenile *O. mykiss*. Although tagging has concluded in Swale Creek, operation of the Swale Creek PIT tag array will continue into the future to passively monitor adult salmonids entering the stream.

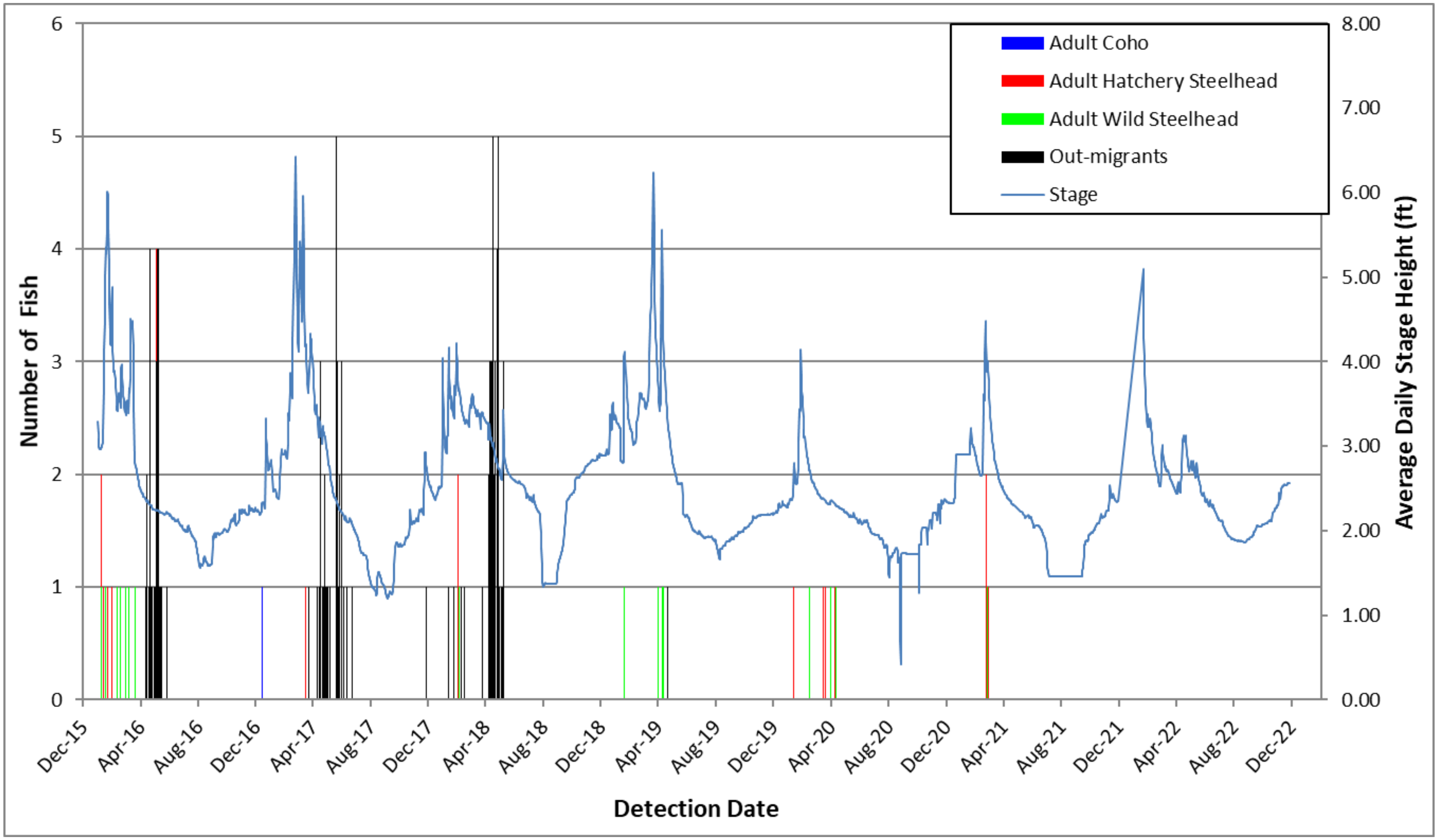

Figure 14. Relationship between average daily stage height (ft) and the number of fish detected by species at the Swale Creek PIT array during 2016-2022 migration years (January 1, 2016 - December 31, 2022).

Snyder Creek PIT Tag Study

Introduction

Snyder Creek (HUC 1710701060406; WRIA 30) is an anadromous fish bearing tributary that enters the Klickitat River at rkm 24 (Figure 9). Snyder Creek originates at a series of springs (Harmon Spring and Legall Spring) located on the plateau northwest of the confluence with the Klickitat River. The headwaters are located at an elevation of 753-meter and flows in a southeasterly direction for 18-kilometers before emptying into the Klickitat River (at 135-meter elevation) in the town of Klickitat. The drainage encompasses an area of approximately 63 square kilometers. The Klickitat River delineates the eastern border of the drainage. Deep and steep-walled basalt canyons carved by Snyder Creek characterize the drainage moving from the headwaters to the mouth. Channel gradients range from discrete vertical drops (waterfall barriers) to less than 1% along the lower stretches of the valley bottom. Canopy covers approximately 56% of the drainage area. Douglas Fir and Ponderosa Pine are the dominant upslope species. Alder, Big Leaf Maple, Willow, and Douglas Fir are the dominant riparian species.

In 2011, M&E staff conducted habitat assessments and fish surveys in five lower Klickitat River anadromous fish bearing tributaries (Swale Creek, Snyder Creek, Wheeler Creek, Logging Camp Creek, and Dillacort Creek) to quantify baseline physical and biological conditions in seasonally disconnected streams. Of the tributaries surveyed, crews documented the largest population of natural-origin *Oncorhynchus mykiss* in Snyder Creek. The relative abundance of natural-origin *O. mykiss* population in Snyder Creek was greater than the four other tributaries combined. Given the potential significance of the Snyder Creek *O. mykiss* population to steelhead production in the lower Klickitat River sub-basin, staff identified the need to understand population dynamics and life history strategies of this population and to quantify the population's contribution to steelhead production in the lower Klickitat River. The main objectives of the Snyder Creek PIT Tag Study are to determine: 1) population distribution, structure, and composition; 2) the proportion of *O. mykiss* that leave the Snyder Creek sub-basin as downstream out-migrants; 3) run-timing of downstream out-migrants; 4) and to quantify in-timing migration and returns of anadromous salmonids.

Methods

In 2014, Klickitat M&E installed a PIT tag interrogation array in Snyder Creek to address study objectives. Placement of the PIT tag array, located approximately 1,100 meters above the confluence with the Klickitat River, was selected upstream of the influence of a highly modified concrete channel located within the footprint of an abandoned lumber mill. The PIT tag interrogation array consists of two IS1001 readers operating as standalones and synchronized in master-secondary mode. Each IS1001 reader was paired with an antenna. Antennas are comprised of litz wire cable encased in watertight HDPE pipe. The PIT tag interrogation site consists of two arrays and each array consists of single antenna that spans the wetted width of the stream channel. Antennae arrays were longitudinally spaced approximately 10-meters apart to provide detection redundancy and directionality. A data storage buffer in each IS1001 reader recorded PIT tag detections. Each PIT tag detection record consists of a date, time, antenna, and PIT tag code stamp.

M&E staff downloaded the buffer on a bi-weekly basis and subsequently uploaded interrogation files to the PTAGIS database.

Interrogation data was paired with stage data collected from a stream gauge station located 300 meters upstream of the WHC PIT tag array. Southern Ceded Territories Habitat Project staff operates and maintains the stream gauge. A pressure transducer continuously measured water stage levels at 15-minute intervals.

Single-pass electrofishing was used to capture fish for PIT tagging and to determine relative fish abundance. In 2014, randomly selected electrofishing sample sites 300-meters in length were established in each fish-bearing kilometer and repeatedly sampled each year. Sites were sampled continuously from the downstream to upstream boundary. Electrofishing sites were delineated into geomorphic units (pools, glides, riffles, and cascades). Geomorphic units were assigned a GPS waypoint and a unit number to geo-reference captured fish to spatially defined habitat units. Captured *O. mykiss* ≥65 millimeters were anesthetized with MS-222, injected with a PIT tag, DNA collected, fish length and geomorphic unit of capture recorded, and held in a recovery bucket. Handled fish recovered in flow-through buckets in the stream and released at the completion of sampling. Tagging files were submitted to a regional database repository of PIT tag data (PTAGIS) in the Columbia River basin.

Results

We observed inter-annual variation in relative abundance of natural-origin *O. mykiss* in Snyder Creek along the 6.4-kilometers of fish bearing length during the reporting period. Fish abundance ranged from a low of 5.8 fish/100 meter^2 in 2016 to a high of 22.1 fish/ 100 meter^2 in 2018 (Table 31). Fish abundance was approximately 2-fold, 3-fold, and 4-fold lower in 2016 than 2021, 2017, and 2018, respectively. Although fish abundance was lowest in 2016, the average fish length was greater than other years.

M&E staff collected four hundred and thirty-seven scale samples from natural-origin juvenile *O. mykiss* in 2018 and 2021 (Table 32). Sixty-five percent of the scale samples were successfully aged. One-year (81%) and two-year (19%) old fish dominated age composition in 2018. In 2022, the dominant age groups shifted to age-0 (44%) and age-1 (49%) fish. One -year old fish accounted for 70% of the fish after pooling samples from both years. Age-0 (15%) and two-year old fish (14%) accounted for most of the remaining fish. Three-year old fish accounted for one percent of the aged fish.

Detection efficiency at the Snyder Creek PIT tag array (SYC) was high during the 2016-2022 reporting period. Detection efficiency at the SYC PIT tag array varied from a low of 81% in 2016 to a high of 100% in 2018, 2020, 2021, and 2022 (Table 33). There were 1,556 unique PIT tag codes detected at the SYC PIT tag array from juvenile *O. mykiss* PIT tagged in Snyder Creek. After applying an expansion multiplier, an expanded estimate of 1,636 (~51%) *O. mykiss* out- migrants passed the SYC PIT tag array from the tagging population (n=3,219). The remaining undetected PIT tagged fish either adopted a resident life history, have not yet out-migrated, or met a mortality fate.

Table 31. Summary statistics of PIT tagged Oncorhynchus mykiss collected by single-pass electrofishing in Snyder Creek (January 1, 2016 – December 31, 2022).

Sample Year	No. Fish Handled	No. Fish Tagged	No. Fish Recaps	Fish/ 100•m²	Avg Fork Length (mm)	Med Fork Length (mm)	Fork Length Range (mm)	# Genetic Samples
2022[1]	-	-	-	-	-	-	-	-
2021	13	716	0	10.9	104.6	98	65-207	728
2020[2]	-	-	-	-	-	-	-	-
2019[1]	-	-	-	-	-	-	-	-
2018	23	1,408	48	22.1	116.8	113	66-224	1,451
2017	1	614	17	15.0	113.7	112	69-207	631
2016	13	481	36	5.8	119.2	116	65-220	514
Total	**50**	**3,219**	**101**	**12.6**	**144.0**	**113**	**65-224**	**3,324**

[1]Sampling did not occur

[2]Sampling suspended due to Covid-19 pandemic restrictions

Table 32. Age composition summary of juvenile Oncorhynchus mykiss collected in Snyder Creek 2018-2021.

				Proportion by Age					Population Composition				
Sample Year	Total Fish	Total Samples	Aged Samples	Age 0	Age 1	Age 2	Age 3	Age ≥4	Age 0	Age 1	Age 2	Age 3	Age ≥4
2022[1]	-	-	-	-	-	-	-	-	-	-	-	-	-
2021	729	144	100	0.44	0.49	0.05	0.02	0.00	321	357	36	15	0
2020[2]	-	-	-	-	-	-	-	-	-	-	-	-	-
2019[1]	-	-	-	-	-	-	-	-	-	-	-	-	-
2018	1,479	293	183	0.00	0.81	0.19	0.01	0.00	0	1,196	275	8	0
2017[1]													
2016[1]													
Total	**2,208**	**437**	**283**	**0.15**	**0.70**	**0.14**	**0.01**	**0.00**	**321**	**1,553**	**311**	**23**	**0**

[1]Scale samples not taken

[2]Sampling suspended due to Covid-19 pandemic restrictions

Table 33. Summary of unique detections, detection efficiency, and detection expansion of out-migrating Oncorhynchus mykiss at the Snyder Creek PIT tag interrogation array (SYC) for fish PIT tagged in Snyder Creek (January 01, 2016 – December 31, 2022).

Detection Year	SYC Detections	SYC detection efficiency, expansion multiplier, and expansion estimate				
		OtherSites[1] Detections	SYC and Other Site Detections[2]	Detection Efficiency	Expansion Multiplier	Expansion Estimate
2022	206	33	33	1.00	1.00	206
2021	40	4	4	1.00	1.00	40
2020	38	7	7	1.00	1.00	38
2019	284	52	50	0.96	1.04	296
2018	459	49	49	1.00	1.00	459
2017	311	30	28	0.93	1.07	333
2016	215	32	26	0.81	1.23	265
Total	**1,553**	**207**	**197**	**0.96**	**-**	**1,636**

[1]Total number of unique detections at PIT tag interrogation sites in the Columbia River basin other than Snyder Creek. Observation only counted for the interrogation site with the initial detection.

[2]Total number of unique detections that conditionally occurred at both the Snyder Creek interrogation array and another PIT tag interrogation site.

Nearly all PIT tagged fish detected at the SYC PIT tag array out-migrated within three years of a tagging event (Table 34). The vast majority of out-migrating fish detected at SYC PIT tag array left within 2-years of tagging with the highest percentage recorded in the 2017 tag cohort (97%) and the lowest in the 2018 tag cohort (~94%). This out-migration pattern was consistent across each tag cohort with the exception of 2016. One individual from the 2016 tagging cohort was detected four years after the tagging event.

Natural-origin *O. mykiss* production in Snyder Creek occurred primarily in the lower 5-kilometers (Table 35; Figure 15). Observed fish abundance declined precipitously above a partial barrier located at kilometer 4.8 and continued to decline above barriers at kilometers 5.5 and 6. Fish abundance in the lower 5 kilometers was 3-5 and 4-7 fold higher than kilometers 5-6 and 6-7, respectively.

As with natural-origin *O. mykiss* production, steelhead smolt production occurred almost entirely in the lower 5-kilometers (Table 35; Figure 15). The highest rate of out migration in the lower 5-kilomiters occurred in kilometer 1-2 (7.8 fish/100•meter^2) and lowest in kilometer 4-5 (3.5 fish/100•meter^2). The proportion of tagged to detected fish varied from half in kilometer 1-2 to one-third in kilometer 4-5. Overall, nearly half of the fish PIT tagged in the lower 5-kilometers out-migrated from Snyder Creek. Only a single fish PIT tagged above kilometer 4.8 was detected at the SYC PIT tag array. Sampling of these isolated populations above waterfalls (at kilometer 5 and 6) was discontinued following 2016 after it was determined the fish exhibited a resident life history.

Table 34. Summary matrix of unique PIT tag detections at the Snyder Creek PIT tag interrogation array by mark year and detection year for natural-origin juvenile Oncorhynchus mykiss PIT tagged in Snyder Creek (June 01, 2016 – December 31, 2022).

Mark Year	Total Tagged Fish	Detection Year 2016	2017	2018	2019	2020	2021	2022	Total
2016	481	65	125	11	1	0	0	0	**202**
2017	614	0	175	153	10	0	0	0	**338**
2018	1,408	0	0	294	275	38	0	0	**607**
2019	-	-	-	-	-	-	-	-	**-**
2020[1]	-	-	-	-	-	-	-	-	**-**
2021	716	0	0	0	0	0	40	206	**246**
2022	-	-	-	-	-	-	-	-	**-**
Total	**3,219**	**65**	**300**	**458**	**286**	**38**	**40**	**206**	**1,393**

[1]Sampling suspended due to Covid-19 pandemic restrictions.

Table 35. Summary of natural-origin O. mykiss PIT tagged, detected, and proportion of tagged fish detected at each kilometer sample section in Snyder Creek (June 01, 2014 – December 31, 2022).

Stream Kilometer	Number of Tagged Fish	PIT Tagged Fish/100•m²	Unique SYC Array Fish Detections	Detected Fish/100•m²	Proportion of Tagged Fish Detected
1-2	1,140	17.0	582	7.8	**0.46**
2-3	1,110	12.4	522	5.5	**0.44**
3-4	1,150	13.1	532	5.7	**0.44**
4-5	914	10.2	328	3.5	**0.34**
5-6	178	3.1	0	0.0	**0.00**
6-7	120	2.4	1	<0.1	**0.01**
Total	**4,612**	**10.5**	**1,833**	**4.2**	**0.40**

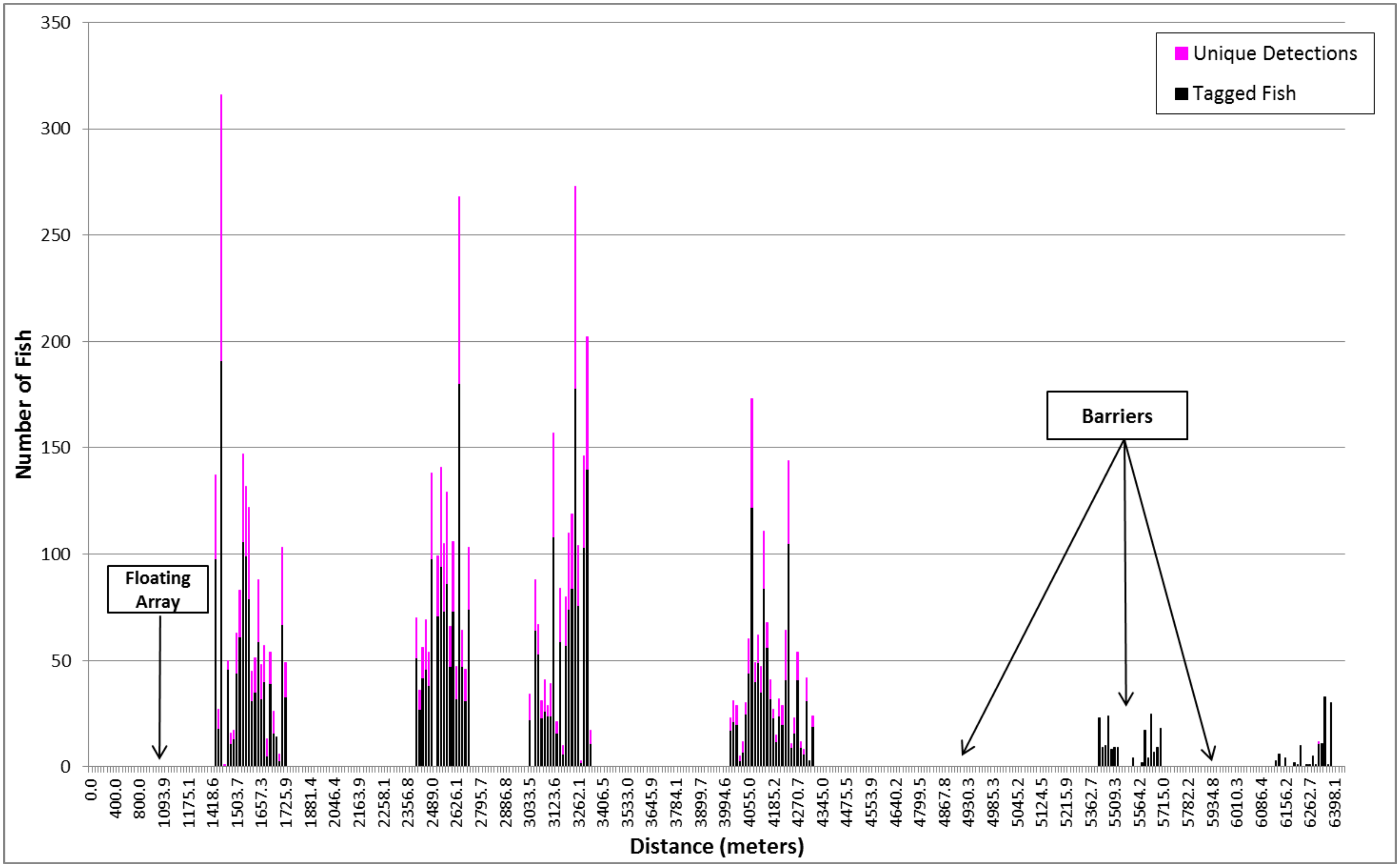

Figure 15. Summary of the number of PIT tagged (n=4,612) and detected (n=1,833) fish along the fish bearing length in Snyder Creek (June 01, 2014 – December 31, 2022).

Two surface flow patterns characterized the annual hydrology of Snyder Creek. Spatially continuous surface flow persists (after the arrival of rain) in late fall/early-winter through late-spring/early-summer. The arrival of the low flow period in early summer quickly changes surface flow patterns from continuous to intermittent throughout the length of fish distribution. Channel drying is most pronounced in kilometer 0-1 each year resulting in a 4-5 month period when Snyder Creek becomes disconnected from the Klickitat River. Channel drying poses a physical barrier to downstream fish movement until surface flows reconnect to the Klickitat River after arrival of late-fall/early winter rains.

Natural-origin steelhead smolts generally out-migrated from Snyder Creek October-June and displayed a consistent bi-modal out-migration timing pattern each migration year (Figure 16). The initial pulse of out-migrating fish occurred in the late-fall/early-winter (November-January) during the ascending limb of hydrograph. A secondary pulse of fish out-migrated in the spring (March-May) during the descending limb of the hydrograph. Collectively the two pulses accounted for 96% of the unique PIT tag detections with 42% and 54% of the fish passing the array in the early and late pulses, respectively. Each year the out-migration peak consistently occurred at the intersection of descending stage height and increasing water temperature (Figure 16). This intersection generally occurred each year between early-April and late-May.

Detections of out-migrants from Snyder Creek occurred in six of ten observation sites in the Klickitat River subbasin (Table 36). The bulk of the encounters occurred at sites downstream of Snyder Creek. Wheeler Creek, the rotary screw trap, Klickitat River PIT tag array, and Lyle Adult Fish Way accounted for ~92% of the encounters. The Klickitat River PIT tag array and rotary screw trap recorded the highest number observations accounting for 53 and 32 of 117 encounters, respectively. A small percentage of fish moved upstream into Swale Creek and the Little Klickitat River after leaving Snyder Creek. White Creek and Summit Creek PIT tag arrays did not record a detection of a Snyder Creek out-migrant.

Columbia River observation sites recorded 112 unique PIT tag detections of fish that out-migrated from the Snyder Creek drainage during the reporting period (January 1, 2016 – December 31, 2022; Table 37). The majority of the unique detections (~83%) occurred from 2016 through 2019. The observed discrepancy in Columbia River detections between 2016-2019 and 2020-2022 was a function of sampling effort. Continuous sampling occurred 2014-2018 resulting in 3,896 PIT tagged fish compared to only one sample event 2019-2022 resulting in 716 PIT tagged fish.

We documented three distinct movement types from Snyder Creek to the Columbia River consisting of spring, winter, and delayed out-migrants. Spring out-migrants left Snyder Creek from March through June. Spring out-migrants comprised 79% of the fish detected in the Columbia River. Travel time from Snyder Creek to Bonneville Dam varied from 0-57 days with 65% passing Bonneville Dam within 30 days. Winter out-migrants moved out of Snyder Creek October through February. These fish spent two to six months in the Klickitat River prior to commencing the downstream migration into the Columbia River. The third group of fish delayed movement into the Columbia River by 1-2 years after leaving Snyder Creek. These fish comprised a small percentage (5%) of the

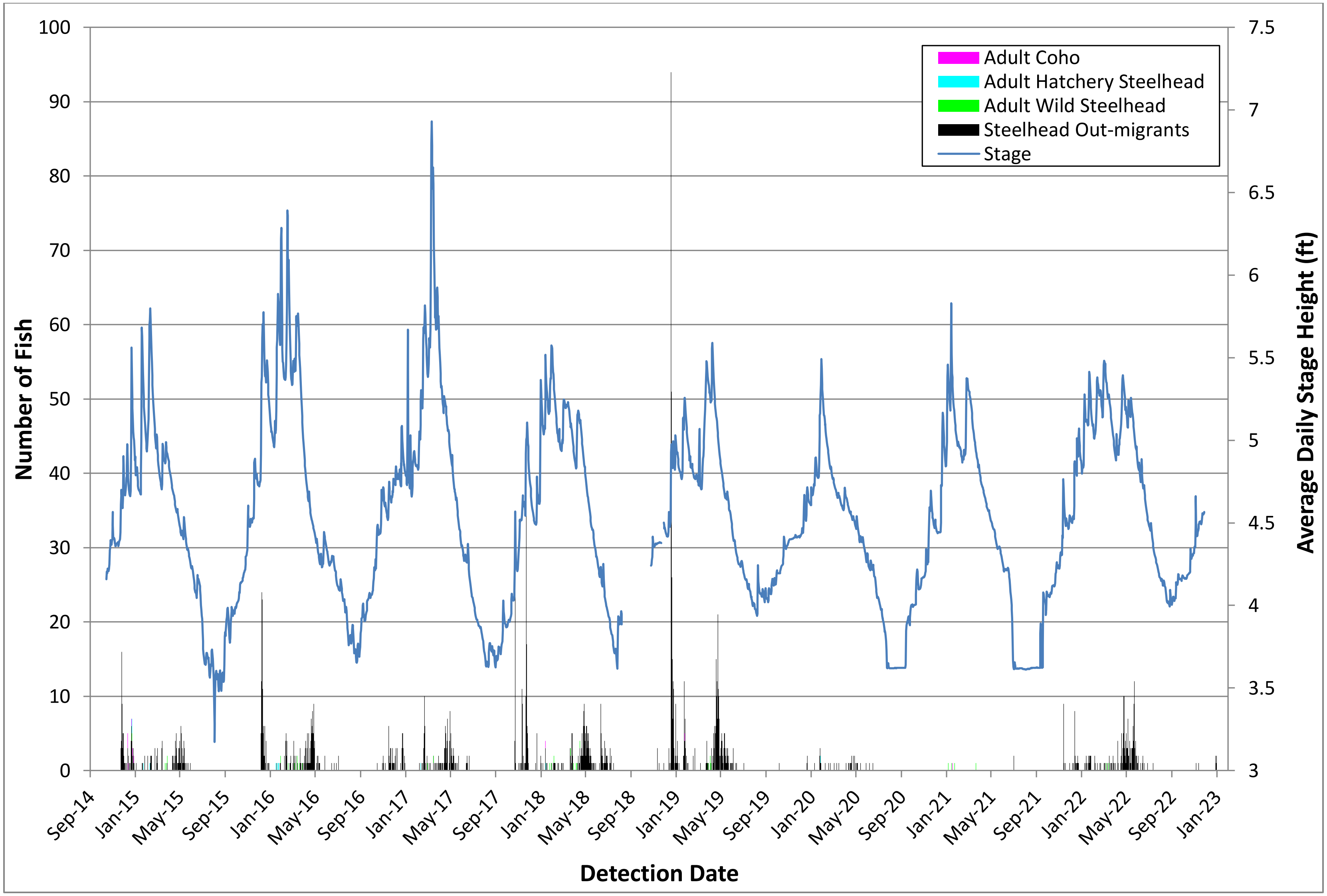

Figure 16. Relationship between PIT tagged fish detections at the Snyder Creek PIT tag array and average daily stage height (ft) during 2016-2022 migration years (January 1, 2016 - December 31, 2022).

Table 36. Encounter history of PIT tagged natural-origin juvenile Oncorhynchus mykiss from Snyder Creek at other Klickitat River sub-basin PIT tag interrogation sites (January 1, 2016 – December 31, 2022).

	Klickitat River Subbasin Interrogation/Observation Sites										
Detection Year	Summit Creek	L. Klickitat River	Swale Creek	Snyder Creek	Wheeler Creek[2]	Logging Camp Cr.[2]	Dillacort Creek[2]	Screw Trap	Klickitat River	Lyle Adult Fishway	Total
2022	0	3	0	0	-	-	-	10	13	0	**26**
2021	0	0	0	0	-	-	-	0	0	0	**0**
2020[1]	0	1	0	0	-	-	-	-	4	2	**7**
2019	0	1	1	0	-	-	-	15	17	2	**36**
2018	0	0	1	0	-	-	-	7	12	3	**23**
2017	0	0	0	0	1	0	0	0	7	0	**12**
2016	0	0	2	0	5	0	0	-	0	1	**8**
Total	**0**	**5**	**4**	**0**	**10**	**0**	**0**	**32**	**53**	**13**	**117**

[1]Sampling suspended due to Covid-19 pandemic restrictions

[2]PIT tag arrays de-activated and removed in 2018

Table 37. Summary of unique PIT tag detections in Columbia River (COLR) observation sites for natural-origin juvenile and adult steelhead and encounter history of downstream migrants from Snyder Creek in the Columbia River (January 1, 2016 – December 31, 2022).

	COLR Unique PIT Tag Detections		Out-migrant COLR Encounter History			
Detection Year	**Adult COLR Detections**	**Out-migrant COLR Detections**	**Bonneville Dam**	**COLR Fixed Sties**	**Estuary Trawl**	**Bird Colonies**
2022	1	11	12	0	2	2
2021	1	0	0	0	0	0
2020	4	8	11	0	0	0
2019	2	28	26	1	6	1
2018	0	20	20	0	4	5
2017	6	14	14	1	1	3
2016	0	31	28	1	3	2
Total	**14**	**112**	**111**	**3**	**16**	**11**

out-migrants detected in the Columbia River. Travel time from Snyder Creek to Bonneville Dam ranged from 318-528 days for fish that delayed movement into the Columbia River.

Out-migrants passed Bonneville Dam over a 3-month period between April–June. After pooling all juvenile detections at Bonneville Dam for the reporting period, the majority of out-migrants passed Bonneville Dam in May (66%) followed by April (31%) and June (4%). The timing of out-migration each year occurred at or near the peak of the Columbia River hydrograph. There appears to be an energetic and survival advantage to timing out-migration with peak flows. High flow conditions may reduce the energetic cost to migrate down the Columbia River because high flows efficiently transport fish downstream. In addition, higher flows decrease travel time through the Columbia River and likely reducing the risk of piscivorous and avian predation.

Natural-origin *O. mykiss* is the dominant salmonid species in Snyder Creek (Table 38). Coho appear to utilize Snyder Creek to some degree but not at a level to establish a viable population. Hatchery-origin steelhead comprised one-quarter of the adult steelhead detections in Snyder Creek. Most hatchery-origin adult steelhead entered Snyder Creek in January (n=5) and the other two entered in February and March. The Snyder Creek PIT tag array also had 29 unique PIT tag detections of natural-origin adult steelhead during the reporting period. Of the 29 natural-origin steelhead adults documented entering Snyder Creek, most were marked at Lyle Adult Trap as adults (n=20), followed by Snyder Creek as juveniles (n=5), than Bonneville Dam as adults (n=3), and one from Wheeler Creek as a juvenile. Natural-origin adult steelhead entered Snyder Creek over a 4-month period. The highest number of natural-origin adult steelhead entered Snyder Creek in March (n=12), then April (n=8), followed by January (n=6), and February (n=3). In addition, the Snyder Creek PIT tag array recorded three juvenile *O. mykiss* PIT tagged in other drainages (Summit Creek, East Fork Tepee Creek, and White Creek) entering Snyder Creek in 2017.

Table 38. Summary of PIT tag detections at the Snyder Creek PIT tag interrogation array by species, origin, and life stage (January 1, 2016 – December 31, 2022).

Detection Year	Natural-Origin Steelhead		Hatchery-Origin Steelhead		Natural-Origin Chinook		Hatchery-Origin Chinook		Unknown-Origin Coho	
	Adult	Out-migrant	Adult	Out-migrant	Adult	Out-migrant	Adult	Out-migrant	Adult	Out-migrant
2022	2	206	0	0	0	0	0	0	0	0
2021	4	40	0	0	0	0	0	0	1	0
2020	0	38	1	0	0	0	0	0	0	0
2019	6	285	0	1	0	0	0	0	1	0
2018	7	459	1	0	0	0	0	0	1	0
2017	2	313	1	0	0	0	0	0	0	0
2016	8	216	4	2	0	0	0	0	0	1
Total	**29**	**1,557**	**7**	**3**	**0**	**0**	**0**	**0**	**3**	**1**

Conclusions

O. mykiss are widely distributed throughout the lower seven kilometers of Snyder Creek. A barrier located at kilometer 4.8 delineates a resident life history form upstream and mixed anadromous and resident life history types downstream. Fish production downstream of the barrier was significantly greater than upstream. Nearly half of the PIT-tagged *O. mykiss* below the barrier at kilometer 4.8 were detected out-migrating from Snyder Creek whereas only one fish above the barrier was detected. Natural-origin *O. mykiss* generally out-migrated from Snyder Creek October-June and displayed a consistent bi-modal out-migration timing pattern each year. Natural-origin *O. mykiss* exhibited three distinct movement types from Snyder Creek consisting of spring (March-June), winter (October –February), and delayed out-migrants. Nearly four-fifths of the unique detections at Bonneville Dam consisted of fish during the spring period followed by fish out-migrating in the winter. A small fraction of the fish that out-migrated from Snyder Creek delayed migration into the Columbia River by 1-2 years. Out-migrants passed Bonneville Dam over a 3-month period between April–June with the majority of out-migrants passed Bonneville Dam in May (66%) followed by April (31%) and June (4%). Most anadromous salmonids detected at the Snyder Creek PIT tag array consisted of natural-origin steelhead. Natural-origin adult steelhead entered Snyder Creek over a 4-month period. The highest number of natural-origin adult steelhead entered Snyder Creek in March (n=12), then April (n=8), followed by January (n=6), and February (n=3). Natural-origin steelhead production in Snyder Creek is higher than the combined steelhead production from the other steelhead producing tributaries (Swale Creek, Wheeler Creek, Logging Camp Creek, and Dillacort Creek) in the lower 30 kilometers. These observations indicate that natural-origin steelhead primarily utilize the Snyder Creek drainage and reinforces the importance of the Snyder Creek drainage as a significant producer of natural-origin steelhead in the Klickitat River sub-basin. Monitoring of the Snyder Creek *O. mykiss* population will continue to track the status and trends of this important steelhead producing population.

Juvenile outmigration monitoring

Introduction

A rotary screw trap in the Klickitat river located 4.5-kilometers upstream from the confluence with the Columbia River was used to monitor out-migrating juvenile salmonids from the Klickitat River, Washington (Figure 9). As part of an effort to provide more robust estimates of smolt abundance, a pilot study was initiated in 2017 after the rotary screw trap project underwent a revamping in personnel, protocol, and infrastructure following completion of the 2016 smolt migration year. Infrastructure upgrades included the installation of a new 2.4-meter rotary screw trap and cabling system, electronic trap winch, on-site laboratory, and floating Passive Integrated Transponder (PIT) tag interrogation array (Figure 17). The main objectives of the juvenile out-migration study are to quantify: 1) natural-origin juvenile steelhead out-migration abundance; 2) natural-origin juvenile steelhead out-migration survival to Bonneville Dam; 3) run-timing of out-migrants; 4) natural-origin juvenile steelhead population age and genetic composition; 5) and natural-origin steelhead smolt-to-adult returns to Bonneville Dam.

Methods

The Klickitat RM&E Project operated a 2.4-meter rotary screw trap (E.G. Solutions Inc., Corvallis, Oregon) at rkm 4.5 on the Klickitat River. The trap was operated from early-March/early-April through late-June each year. Trapping operations were subject to temporal gaps due to large-scale hatchery releases, high debris loads, high discharge events and large wood, acting independently or in combination. The duration of the trapping season mirrored the spring emigration period of natural-origin juvenile steelhead.

Fish were netted from the live-box, placed in coolers, sorted by species, and either tallied or selected for mark/recapture studies. Tallied fish were released directly into the river from the trap. Fish selected for sampling were placed in 5-gallon buckets with aerated stream water and transported to the on-site laboratory for sampling. Fish were anesthetized in a tricaine methanesulfonate (MS-222) ~ 69 mg/liter solution adhering to methods detailed in the PIT Tag Marking Procedures Manual (Columbia Basin Fish and Wildlife Authority 2014). Individuals were identified to species and categorized as either a parr or smolt, injected with a PIT tag, DNA fin clip collected, fork length and weight (grams) recorded. Scale samples were collected each day from the first 20 PIT tagged *O. mykiss*. Scales were also taken from each upriver recaptured natural-origin juvenile steelhead. Upriver recaptures consisted of fish PIT tagged in tributaries upstream of the rotary screw trap.

Natural-origin juvenile steelhead (≥65 millimeter fork length) were selected for mark-recapture studies. Capture efficiency for the rotary screw trap was calculated from results of daily efficiency release trials. PIT tagged fish that appeared healthy were included in an efficiency release located at rkm 6. Injured individuals or fish tagged the day before the cone was pulled were excluded from efficiency releases. Prior to releasing each group of fish, staff inspected each bucket to ensure that

Figure 17. Photos of the rotary screw trap and floating PIT tag interrogation array at river kilometer 4.5. Photo descriptions starting at top left and proceeding clockwise: aerial view looking north to south, downstream view from east bank, and upstream view at the channel level (aerial photos by David Lindley).

all fish were alive. Mortalities were recorded, scanned for a PIT tag, and removed from the efficiency release groups. The release date and time of each efficiency release group was recorded in the database.

Natural-origin juvenile steelhead emigrant abundance was estimated using Darroch Analysis with Ranked Reductions software application script (DARR 2.9.1) in the open source statistical program R Studio (Bjorkstedt 2000; Bjorkstedt 2005; and Bjorkstedt 2010). DARR 2.9.1 applies algorithms to stratified mark-recapture data to pool strata with similar capture probabilities to generate a statistically acceptable abundance estimate using the 1961 Darroch stratified Petersen-Lincoln estimator. The DARR algorithm calculates an abundance estimate for each stratum by multiplying the total number of fish captured by the number of fish marked and dividing the product by the number of recaptures. Recaptured individuals are identifiable by the stratum they were marked and released and by the stratum they were recaptured. Strata were delineated by weekly intervals. The "one trap" and "no prior pooling of strata" options were selected for the analysis. Bjorkstedt 2005 describes a detailed statistical summary of the algorithm's application of Darroch's stratified Petersen-Lincoln estimator to mark-recapture data. Temporal gaps in trapping were filled by taking the mean of first time captured, marked, and recaptured individuals from the week preceding the start and the week following the end of each gap. The 95% confidence interval was calculated for each stratum by the method described in Volkhardt et al. 2007:

$$\hat{U} \pm 1.96\sqrt{V(\hat{U})}$$

where

$\hat{U}$ = Estimate of juvenile abundance

$V(\hat{U})$ = Variance associated with the abundance estimate

Survival estimates to Bonneville Dam were generated in PTAGIS using the PitPro Interrogation Detail and PitPro Tagging standard report queries. Interrogation and tagging analysis files were subsequently imported into PitPro to generate a file output containing the detection history for each PIT tagged steelhead in each annual emigration period (Westhagen and Skalski 2009). Detection histories of juvenile steelhead PIT tagged at the rotary screw trap were analyzed in the Survival Under Proportional Hazards (SURPH) program which uses a Cormack-Jolly-Seber model to estimate survival rate and detection probability (Lady et al. 2001)

Run-timing of emigrating natural-origin juvenile steelhead was quantified at multiple temporal and spatial scales using capture data from the screw trap, detection data from the floating PIT tag array, and detections at Columbia River PIT tag interrogation sites. Trap capture data was summarized to quantify daily and seasonal emigration rates from the Klickitat River sub-basin. Travel times from the Klickitat floating PIT tag array to Bonneville Dam and Columbia River Estuary were estimated from interrogation data collected at these sites.

Scale and genetic samples were collected to determine age structure and genetic composition of natural-origin steelhead emigrating from the Klickitat River sub-basin. The Washington Department of Fish and Wildlife (WDFW) Scale and Otolith Ageing Laboratory (Olympia, WA) completed scale aging. The Columbia River Inter-tribal Fish Commission (CRITFC) Hagerman Genetics Laboratory (Hagerman, ID) completed genetic analysis of DNA samples.

Results

The rotary screw trap operated intermittently from late-May to early-October for a total of 43 days in 2017 (Table 39). We could not quantify emigrant steelhead abundance, run timing, or survival estimates at the trap in 2017 due to an abbreviated trapping season, low catch numbers, and low recapture rates. The pilot study was used to refine and validate trap operations, sampling protocol, and temporally define subsequent trapping seasons. The newly implemented protocol met or exceeded target goals in several ways. First, we captured more natural-origin juvenile steelhead in an abbreviated spring trapping season than the entirety of many previous seasons. Second, capture rates of emigrating natural-origin juvenile steelhead in 2017 were significantly higher than most previous trapping seasons even though water discharge in May and June 2017 (91.2 m-3 •s-1) was well above the 90-year mean for the same period (62.2 m-3 •s-1 ; USGS stream gage 141113000, Klickitat River near Pitt, WA). Third, the rotary screw trap operated intermittently into early-fall 2017 but only captured a small number of natural-origin juvenile steelhead (n=59) and zero natural-origin Chinook smolts after June 23. The significant decline in catch numbers after June did not justify the continuous operation of the rotary screw trap through early-fall in subsequent seasons. This decision was affirmed in several ways. By the end of June, 98% and 93% steelhead smolts from upstream tributaries passed the Klickitat floating PIT tag array in 2018 and 2019, respectively. Second, the number of natural-origin steelhead smolts captured in September 2017 accounted for only ~1.5% of the total wild steelhead smolts trapped in 2018 and 2019, respectively. Third, we did not collect a single natural-origin Chinook smolt from June through early-October. Based on results from 2017, an early-March/early-April through June trapping season was defined for subsequent seasons.

The rotary screw trap operated more continuously in 2018, 2019, 2021, and 2022 (Table 39). The trap operated 78 days in 2018, 67 days in 2019, 84 days in 2021, and 93 days in 2022. Large-scale hatchery releases suspended trapping operations for 11 days in 2018, 8 days in 2019, 6 days in 2021, and 13 days in 2022. Suspension of trapping operations also occurred for 2 days in 2019 to repair a broken beam and 2 days in 2021 to repair a broke winch cable.

The absolute number of natural-origin steelhead smolts collected at the trap declined each year from a peak in 2018 to a low in 2022 (Table 40). A precipitous drop in total catch occurred in 2021 and 2022 compared to catch levels in 2018 and 2019. Of the 11,452 natural-origin juvenile steelhead captured during the 2018-2022 trapping seasons, 31.5%, 30.3%, 23.1%, and 15.0% of the fish were captured in 2018, 2019, 2021, and 2022, respectively. Average lengths ranged from a low of 177.8 millimeters in 2018 to a high of 181.2 millimeters in 2019. Minimum lengths were similar among years ranging from 74-78 millimeters whereas maximum lengths were more variable ranging from 258-296 millimeters. Average weights varied from a low 55.6 grams in 2018 to a high of 59.6 millimeters in 2019. Minimum and maximum weights ranged from 3.8-5.2 grams and 123-266 grams in 2017-2022, respectively.

Table 39. Summary of screw trap operations and physical characteristics collected at the rotary screw trap located at river kilometer 4.5, Klickitat River, Washington, 2017-2019. Parentheses indicate ± one standard error of the mean.

Year	Trapping Dates	Total Trapping Days	Mean Cone RPM	Min Cone RPM	Max Cone RPM	Mean Flow ($m^{-3} \bullet s^{-1}$)	Min Flow ($m^{-3} \bullet s^{-1}$)	Max Flow ($m^{-3} \bullet s^{-1}$)	Mean Water (°C)	Min Water (°C)	Max Water (°C)
2017	24 May – 01 Oct.	43	8.7 (0.14)	7	11	46.3 (2.10)	24.7	119.8	13.0 (0.17)	6.7	18.6
2018	03April – 28 June	78	10.1 (0.18)	7	13	57.0 (1.88)	32.0	88.3	11.2 (0.24)	5.3	17.6
2019	02 April – 16 June	67	9.4 (0.11)	8	12	67.6 (2.20)	36.2	137.3	10.7 (0.23)	6.1	18.6
2020[1]	Not Fished	-	-	-	-	-	-	-	-	-	-
2021	25 March – 25 June	84	9.4 (0.07)	8	11	49.1 (1.92)	31.3	72.8	11.2 (0.29)	5.1	20.2
2022	08 March – 25 June	93	9.5 (0.06)	8	11	66.0 (1.80)	51.3	105.9	8.8 (0.28)	6.3	14.0

[1]Trap operations suspended due to COV ID-19 pandemic restrictions.

Even though the number of trapping days was lowest in 2017, the absolute number of natural-origin spring Chinook smolts collected was highest in 2017 (Table 40). Catch numbers declined significantly in subsequent years. Average lengths ranged from a low of 71 millimeters in 2017 to a high of 105.4 millimeters in 2022. Minimum lengths varied from a low of 54 millimeters in 2017 to a high of 75 millimeters in 2021. Maximum lengths ranged from a low of 111 millimeters in 2017 to 142 millimeters in 2021.Average weights varied from a low 9.8 grams in 2018 to a high of 12.9 millimeters in 2022. Minimum and maximum weights ranged from 3.3-4.8 grams and 17.7-36.4 grams.

M&E staff collected 3,537 scale samples from natural-origin juvenile *O. mykiss* in 2018-2022 (Table 41). Seventy-one percent of the scale samples were successfully aged. Two-year old fish dominated the age composition each year, followed by one-year olds, and three-year olds. Four-year olds comprised a small fraction of the population (n=5). Age-0 fish were absent from the out-migrating population each year. Two-year old fish accounted for 71% of the fish after pooling samples from all years. Age-1(16%) and three-year old fish (12%) accounted for most of the remaining fish. Four-year old fish accounted for <1 percent of the aged fish.

In 2018 and 2019, a total of 1,846 genetic samples collected at the screw trap were analyzed with the Columbia River basin Genetic Stock Identification (GSI) baseline to determine the influence of out-of-basin strays and hatchery-origin steelhead to the genetic composition of Klickitat River natural-origin steelhead (Table 42). The Columbia River basin GSI baseline consisted of five reporting groups (Klickitat, Lower Columbia, Middle Columbia, Upper Columbia, and Yakima). Results of the GSI analysis determined that 94.3% and 98.9% of the fish assigned to the Klickitat GSI reporting group in 2018 and 2019, respectively. The Middle Columbia GSI group comprised 0.7% of the genotyped fish in 2018 and 5% in 2019. Less than 1% of the fish assigned to The Lower Columbia, Upper Columbia, and Yakima each year.

Genetic samples were analyzed to determine migration timing associated genotypes of early vs. late alleles (summer, transitional, and winter run timing). Results indicate that run-timing of natural-origin steelhead in the Klickitat River is diverse. In 2018, run-timing was proportionally similar between summer and transitional with each accounting for slightly more than one-third of the assignments (Table 42). Winter run fish accounted for slightly less than one-third of the run-timing assignments in 2018. The proportion of run-timing genotype assignments increased for transitional fish, remained similar for summer run fish, and decreased for winter fish in 2019 compared to 2018.

We conducted a total of 547 efficiency release trials involving 10,684 PIT tagged natural-origin juvenile steelhead over 288 aggregated days (2017-2022) to determine capture efficiency at the rotary screw trap (Table 43). Substantially fewer efficiency release trials were conducted in 2017 compared to subsequent years due to the abbreviated trapping effort during the steelhead emigration period. Trap efficiency confidence was low in 2017 due to very low recapture numbers. In ensuing years, trap efficiency varied from a high of 9.4% in 2021 to a low of 4.6% in 2019.

The floating PIT tag interrogation array was operational for 215 days in 2017, 279 days in 2018, 273 days in 2019, 356 days in 2020, 306 days in 2021, and 365 days in 2022 (Table 44). A total of

Table 40. Number of emigrating natural-origin juvenile steelhead and spring Chinook (Oncorhynchus tshawytscha) smolts captured, tagged with passive integrated transponder (PIT) tags, scale and genetic tissue samples, and biometric data collected at the rotary screw trap located at river kilometer 4.5, Klickitat River, Washington in 2017-2022.

Year and Species	Total Captured	Total Tagged	# Genetic Samples	Average Length	Median Length	Min Length	Max Length	Average Weight	Median Weight	Min Weight	Max Weight
2017											
Steelhead	231	221	222	171.9	169	78	242	51.7	48.5	3.4	123.0
Chinook	306	122	122	71.1	71	54	111	-	-	-	-
2018											
Steelhead	3,616	3,210	3,204	180.8	180	74	280	59.1	56.5	3.8	210.9
Chinook	58	34	33	95.2	97	70	113	9.8	10.3	3.3	17.7
2019			0								
Steelhead	3,475	3,397	3,392	181.2	180	78	296	59.6	55.9	5.2	266.0
Chinook	26	22	22	92.5	85	70	130	10.3	7.3	3.6	27.1
2020[1]	-		-	-	-	-	-	-	-	-	-
2021											
Steelhead	2,640	2,358	2,354	180.8	180	78	273	59.3	56.1	5.5	178.6
Chinook	14	11	11	96.4	91	75	142	12.1	8.9	4.8	36.4
2022											
Steelhead	1,721	1,628	1,625	177.8	177	76	258	55.6	53.1	4.3	177.4
Chinook	30	29	29	105.4	107.5	74	134	12.9	12.7	4.2	23.7

[1]Trap operations suspended due to COV ID-19 pandemic restrictions.

Table 41. Age composition summary of juvenile Oncorhynchus mykiss collected from the rotary screw trap located at river kilometer 4.5, Klickitat River, Washington, 2018-2022.

					Proportion by Age						Population Composition				
Sample Year	Total Fish	Total Samples	Aged Samples		Age 0	Age 1	Age 2	Age 3	Age ≥4		Age 0	Age 1	Age 2	Age 3	Age ≥4
2022	1,721	932	750		0.00	0.10	0.75	0.15	0.00		0	170	1,292	259	0
2021	2,640	985	704		0.00	0.29	0.62	0.09	0.00		0	754	1,642	244	0
2020[1]	-	-	-		-	-	-	-	-		-	-	-	-	-
2019	3,475	924	702		0.00	0.15	0.68	0.17	<0.01		0	515	2,361	579	20
2018	3,616	696	370		0.00	0.10	0.85	0.05	<0.01		0	352	3,059	195	10
Total	**11,452**	**3,537**	**2,526**		**0.00**	**0.16**	**0.71**	**0.12**	<0.01		**0**	**1,881**	**8,120**	**1,428**	**23**

[1]Trap operations suspended due to COV ID-19 pandemic restrictions.

Table 42. Genetic Stock Identification (GSI) assignments and run-timing of natural-origin steelhead smolts collected at the rotary screw located at river kilometer 4.5, Klickitat River, Washington (2018-2019).

		Run-timing Genotypes			
Year	GSI Group Assignment	Pre-mature (Summer)	Heterozygous (Transitional)	Mature (Winter)	Total
2022[1]	-	-	-	-	**-**
2021[1]	-	-	-	-	**-**
2020[2]					
2019	Klickitat	478	520	323	**1,321**
	Lower Columbia	1	0	0	**1**
	Middle Columbia	2	4	3	**9**
	Upper Columbia	2	0	2	**4**
	Yakima	0	0	0	**0**
	Total	**483**	**524**	**328**	**1,335**
2018	Klickitat	179	166	139	**484**
	Lower Columbia	0	0	0	**0**
	Middle Columbia	1	10	14	**25**
	Upper Columbia	0	0	2	**2**
	Yakima	0	1	1	**2**
	Total	**179**	**177**	**156**	**513**

[1]Samples have not been genotyped

[2]Trap operations suspended due to Covid-19 pandemic restrictions

Table 43. Number of efficiency release days and efficiency release groups and number of natural-origin juvenile steelhead (O. mykiss) captured, tagged with passive integrated transponder (PIT) tags, and recaptured at the rotary screw trap located at river kilometer 4.5, Klickitat River, Washington in 2017-2022.

Year	Total Release Days	Number Efficiency Trials	Total Number Captured	Total Number Marked	Total Efficiency Released	Number Efficiency Recaptured	Percent Efficiency Recaptured
2022	78	115	1,721	1,628	1,561	93	6.0
2021	68	114	2,640	2,358	2,342	220	9.4
2020[1]	-	-	-	-	-	-	-
2019	54	151	3,475	3,397	3,384	157	4.6
2018	62	141	3,616	3,210	3,187	159	5.0
2017	26	26	231	221	210	3	1.4

[1]Trap operations suspended due to COV ID-19 pandemic restrictions.

Table 44. Natural-origin juvenile steelhead PIT tagged at the rotary screw trap and detected at the floating PIT tag interrogation array at river kilometer 4.5, Klickitat River, Washington, 2017-2022.

Year	Operation Dates	Total Operation Days	Total Marked	Unique Detections	Percent Detected
2022	01 Jan-31 Dec	365	1,628	150	9.2
2021	01 Mar-31 Dec	306	2,358	166	7.0
2020[1]	01 Jan-31 Dec	365	-	-	-
2019	22 Mar-19 Dec	273	3,397	177	5.2
2018	03 Mar-10 Dec	279	3,210	239	7.4
2017	21 Apr-21Nov	215	221	21	9.5

[1]Trap operations suspended due to COV ID-19 pandemic restrictions.

753 of 11,889 (6.3%) natural-origin juvenile steelhead PIT tagged at the screw trap were detected passing the floating PIT array in 2017-2022. The percent of PIT tagged natural-origin juvenile steelhead detected at the floating PIT tag array ranged from a low of 5.2% in 2019 to a high of 9.5% in 2017. With the exception of 2021, detection probability at the floating array was higher than capture probability at the rotary screw trap each year. The largest observed difference between detection probability and capture probability was in 2017.

Steelhead smolt arrival dates to the rotary screw trap, Klickitat River floating PIT tag array, Bonneville Dam, and the Columbia River Estuary were generally similar among years (Table 45). Median arrival date to the screw trap was earliest in 2018 and 2-3 days later in subsequent years. Ninety-percent of steelhead smolts out-migrated from the Klickitat River by late-May. Median arrival dates to Bonneville Dam varied from May 7 in 2018 to May 19 in 2022. As with the screw trap, the median arrival date was earliest in 2018 with smolts arriving later each subsequent year. Ninety percent of the smolts arrived to Bonneville Dam by late-May/early-June. All smolts passed Bonneville Dam by early-July. The median arrival date of wild steelhead smolts to the Columbia River Estuary was earliest in 2018 (May 9) and latest in 2022 (May 24). Ninety-percent of steelhead smolts arrived to the Columbia River Estuary by early-June. The latest arrival date to the Columbia River Estuary varied from June 4 in 2019 to June 14 in 2018.

Natural-origin steelhead smolts exhibited fast and consistent transit times between the screw trap and Bonneville Dam and the Columbia River Estuary (Table 46). With the exception of one fish that took over 1-year to pass Bonneville Dam, steelhead smolts took from <1 to 45 days to travel between the screw trap and Bonneville Dam. The median and 90th percentile of travel days between the screw trap and Bonneville Dam was consistently 2 and 5 days, respectively. Steelhead smolts took 13 to 22 days to travel between the screw trap and Columbia River Estuary. The median number of travel days between the screw trap and the Columbia River Estuary was 4 days each year. Ninety percent of the fish arrived to the Columbia River Estuary in 7.1 to 8.2 days.

The abundance of natural-origin juvenile steelhead emigrating from the Klickitat River subbasin was highest in 2018, followed by a slight drop in 2019, and then declined significantly in 2021 and 2022 (Table 47). The number of natural-origin juvenile steelhead out-migrating from the Klickitat River subbasin was estimated at 98,796 (95% CI = 78,927-118,663) in 2018, 96,167 (95% CI = 77,154-113,180) in 2019, 33,573 (95% CI = 28,676-38,470) in 2021, and 34,109 (95% CI = 28,359-39,859) in 2022.

Survival of natural-origin juvenile steelhead from the Klickitat River screw trap site to Bonneville Dam was 56.2% (CI=26.7-85.6%) in 2018, 59.6% (CI=35.8-83.2%) in 2019, 83.7% (CI=62.7-100%) in 2021, and 58.2% (CI=22.4-93.9%) in 2022 (Table 48). We estimated that 55,513 (CI=26,409-84,618), 56,681 (CI=34,112-79,251), 28,104 (CI=16,522-35,573), and 19,834 (CI=7,647-32,022) natural-origin juvenile steelhead survived from the Klickitat River to Bonneville Dam in 2018, 2019, 2021, an 2022, respectively.

Table 45. First, 10th percentile, 25th percentile, median, 75th percentile, 90th percentile, and last arrival dates to the rotary screw trap (ST), floating PIT tag interrogation array (FA), Bonneville Dam (BD), and Columbia River Estuary (CRE) for emigrating natural-origin juvenile steelhead (O. mykiss) from the Klickitat River, Washington during the 2018 and 2019 out-migration periods.

Year	Site	n	First	10th	25th	Median	75th	90th	Last
2021	ST	2,640	03/27	04/26	05/02	05/13	05/19	05/28	06/21
	FA	166	04/06	04/23	05/02	05/14	05/24	05/30	10/31
	BD	464	04/12	04/28	05/04	05/15	05/19	05/29	06/21
	CRE	26	04/23	04/24	05/01	05/19	05/24	06/01	06/08
2022	ST	1,721	03/12	04/23	05/03	05/14	05/28	06/02	06/24
	FA	150	03/25	04/19	05/02	05/14	05/28	06/03	06/21
	BD	166	04/06	05/01	05/07	05/19	05/29	06/03	06/14
	CRE	40	04/26	05/01	05/09	05/24	06/02	06/07	06/10
2020[1]	-	-	-	-	-	-	-	-	-
2019	ST	3,475	04/02	04/24	05/01	05/09	05/20	05/25	06/16
	FA	200	04/14	04/26	05/04	05/11	05/23	06/01	07/04
	BD	470	04/16	04/30	05/08	05/13	05/23	05/27	06/17
	CRE	77	04/19	04/29	05/06	05/16	05/20	05/29	06/04
2018	ST	3,616	04/09	04/23	04/29	05/06	05/12	05/29	06/23
	FA	239	04/11	04/21	04/29	05/07	05/31	06/04	08/29
	BD	344	04/12	04/26	05/01	05/07	05/24	06/03	07/01
	CRE	58	04/30	05/01	05/03	05/09	05/31	06/06	06/14

[1]Trap operations suspended due to COV ID-19 pandemic restrictions.

Table 46. Minimum, 10th percentile, 25th percentile, median, 75th percentile, 90th percentile, and maximum travel days from the rotary screw trap to Bonneville Dam (BD) and Columbia River Estuary (CRE) for emigrating natural-origin juvenile steelhead (O. mykiss) from the Klickitat River, Washington during the 2018 and 2019 out-migration periods.

Year	Site	n	First	10th	25th	Median	75th	90th	Last
2022	BD	166	1	1	2	2	4	5	45
	CRE	40	2	3	3	4	6	7.9	17
2021	BD	464	0	1	2	2	3	5	40
	CRE	26	3	3	4	4	5	7.6	13
2020[1]	-	-	-	-	-	-	-	-	-
2019	BD	470	1	1	2	2	3	5	375
	CRE	77	2	3	4	4	6	8.2	17
2018	BD	344	1	1	2	2	3	5	24
	CRE	58	2	3	3	4	5	7.1	22

[1]Trap operations suspended due to COV ID-19 pandemic restrictions.

Table 47. Total trap catch, efficiency release numbers, efficiency release recaptures, capture efficiency (CE), emigrant abundance estimate (AE), standard error (SE), 95% confidence interval (CI), and coefficient of variation for emigrating juvenile natural-origin juvenile steelhead (O. mykiss) by emigration year from the rotary screw trap located at river kilometer 4.5, Klickitat River, Washington during calendar years 2018 and 2019.

Year	Number Caught[1]	Number Tagged[2]	Number Recaps[3]	% CE	AE	SE	95% CI	% CV
2018	4071	3626	176	4.9	98,796	10,137	78,927-118,663	10.3
2019	3762	3658	167	4.6	95,167	9,190	77,154-113,180	9.7
2020[4]	-	-	-	-	-	-	-	-
2021	2,285	2,504	231	9.2	33,573	2,998	28,676-38,470	7.4
2022	1,823	1,648	91	5.5	34,109	3,826	28,359-39,859	11.2

[1]Estitimated number of fish caught had the screw trap been fishing during non-operational periods (n=462 for 05/15-05/21/18; n=96 for 04/06-04/13/19; n=190 for 04/29-04/30/19; n=18 for 03/30-04/05/2021; n=167 for 05/07-05/08/2021; n=7 for 03/13-03/19/22; n=17 for 03/29-04/02/22; n=82 for 05/08-05/09/22).

[2]Estimated number of tagged fish had the screw trap been fishing during non-operational periods (n=441 for 05/15-05/21/18; n=88 for 04/06-04/13/19; n=186 for 04/29-04/30/19; n=12 for 03/30-04/05/2021; n=150 for 05/07-05/08/2021; n=5 for 03/13-03/19/22; n=16 for 03/29-04/02/22; n=65 for 05/08-05/09/22).

[3]Estitimated number of fish recaptures had the screw trap been fishing during non-operational periods (n=18 for 05/15-05/21/18; n=2 for 04/06-04/13/19; n=7 for 04/29-04/30/19; n=0 for 03/30-04/05/2021; n=12 for 05/07-05/08/2021; n=1 for 03/13-03/19/22; n=1 for 03/29-04/02/22; n=4 for 05/08-05/09/22).

[4]Trap operations suspended due to Covid-19 pandemic restrictions

Table 48. Survival estimates for natural-origin juvenile steelhead smolts (O. mykiss) between the Klickitat River and Bonneville Dam for migration years 2018-2022. Parentheses indicate ± one standard error of the mean.

Year	Emigrant Abundance	95% CI Emigrant Abundance	Survival Rate to Bonneville	Detection Probability at Bonneville	Abundance Estimate to Bonneville	95% CI Bonneville Abundance
2018	98,796	78,927-118,663	0.5619 (0.1503)	0.1897 (0.0515)	55,513	26,409-84,618
2019	95,167	77,154-113,180	0.5956 (0.1210)	0.2311 (0.0478)	56,681	34,112-79,251
2020[1]	-	-	-	-	-	-
2021	33,573	28,676-38,470	0.8371 (0.2086)	0.2357 (0.0595)	28,104	16,522-35,573
2022	34,109	28,359-39,859	0.5815 (0.1823)	0.1757 (0.0563)	19,834	7,647-32,022

[1]Trap not fished in 2020 due to COV ID-19 pandemic.

Smolt-to-adult returns (SAR) to Bonneville Dam were generally low for fish PIT tagged at the screw trap. The highest SAR estimate occurred in 2018 (n=45; 1.4%) and lowest in 2019 (n=10; 0.3%). Although 2017 had an abbreviated trapping season, the SAR estimate was slightly less than 1 percent (n=2; 0.9%). A SAR estimate for fish PIT tagged in 2021 and 2022 was not included in this report because adults will continue returning to Bonneville Dam for up to three years after their out-migration year. Although the observed low SAR estimates are concerning, the estimates align with observed poor returns for natural-origin steelhead throughout the Columbia River basin over the reporting period.

Conclusions

The absolute number of natural-origin steelhead smolts collected at the screw trap declined each year from a peak in 2018 to a low in 2022. The vast majority of natural-origin steelhead emigrated from the Klickitat River between March and June with 90% of the fish arriving to the screw trap by late-May each year. Two-year olds were the dominant age-class each year, followed by one-year olds, and a small fraction of three-year olds. GSI analysis indicated that out-of-basin introgression was limited with 94.3% and 99.1% of the fish assigned to the Klickitat GSI reporting group. Genetic analysis also indicated that run-timing of natural-origin steelhead is diverse with summer, transitional, and winter run-timing types with proportionally similar representation. Natural-origin steelhead smolts exhibited fast and consistent transit times between the screw trap and Bonneville Dam and the Columbia River Estuary. Steelhead smolt movement into the Columbia River coincided with high flow conditions likely to decrease transit time and exposure to avian and piscivorous predators. Ninety percent of the fish passed Bonneville Dam and entered the Columbia River Estuary by late-May/early-June. The estimated abundance of natural-origin steelhead emigrating from the Klickitat River declined precipitously from 2018-2019 to 2021-2022. Survival of natural-origin steelhead smolts between the Klickitat River and Bonneville Dam was below 60% for all years except in 2019 (~84%). A significant decline in SAR to Bonneville Dam occurred from 2018 to 2019. Although concerning, our estimates are similar to reported declines in smolt production and adult returns throughout the Columbia River basin over the reporting period.

Habitat Survey: Low flow water mapping

Introduction

A decline in flow permanence in tributaries in the lower and mid portions of the Klickitat River subbasin has been anecdotally observed over the last decade. The reduction of surface flow during the water-limiting period can adversely affect fish through the loss of critical over-summer rearing habitat via channel drying, poor habitat quality (increased stream temperatures), by longitudinally disconnecting populations, and increasing fish stranding and mortality. YKFP M&E staff in collaboration with the Southern Territories Habitat Project (STHP) recognize the importance of spatially and temporally quantifying flow permanence in anadromous fish bearing tributaries given the concerning and accelerated trajectory of channel drying in the lower and middle sections of the Klickitat River subbasin.

Methods

YKFP M&E and STHP staff conducted water surveys during the low flow period of 2022 in eleven different tributaries to the Klickitat River. The surveys established a baseline for future low water surveys in the same streams to quantify, map, and compare flow permanence inter-annually. YKFP and STHP staff walked the anadromous fish bearing portion of eleven lower and mid-basin tributaries to the Klickitat River that experience flow issues during the summer and early-fall limiting period. Due to logistical limitations, only the anadromous fish bearing portions of these streams were surveyed and not the stream entirety. We recognize the presence of native fish populations outside the spatial extent of these surveys and that these populations are also potentially impacted by declining surface flow through the limiting period.

The streams surveyed were Dillacort Creek, Logging Camp Creek, Wheeler Creek, Snyder Creek, Swale Creek, Little Klickitat River, Bowman Creek, Dead Canyon Creek, White Creek, Brush Creek, and Tepee Creek. Crews of one to two staff members walked the anadromous fish bearing portion of each stream and delineated wet from dry channel. Crews were equipped with a handheld GPS unit and a datasheet to record survey data. The surveyor recorded a waypoint for the start of the survey and categorized the channel category as wet or dry. Wetted channels were further classified as standing or flowing water. A waypoint was recorded at each transition from a wet to dry channel category. The procedure was repeated until the surveyor reached the end of the anadromous fish bearing portion of stream at which point a waypoint was recorded to delineate the end of the survey.

Waypoints were imported into Google Earth Pro to create a map layer. Each survey was dynamically segmented by using the ruler tool to measure distances between waypoints delineating channel categories. The longitudinal distance for each survey was calculated and total distance summarized for each channel category.

Results

The cumulative length of the low flow surveys in the eleven tributaries totaled approximately 77,598 meters. Some tributaries remain wetted year round (Summit Creek, Bowman Creek and

Little Klickitat) while others exhibited intermittent flow and isolated pools to streams that dry completely during the summer months (Wheeler Creek).

Lower basin tributaries consist of Dillacort Creek, Logging Camp Creek, Wheeler Creek, Snyder Creek, Swale Creek, Bowman Creek, and Little Klickitat River (Table 49). All of these tributaries disconnect from the Klickitat River annually except for the Little Klickitat River. West aspect tributaries such as Snyder Creek and Logging Camp Creek had the highest percent wetted channel at 86.87% and 78.1%, respectively. However, Snyder and Logging Camp creeks contain healthy populations of natural-origin *O. mykiss* and tend to be cooler and retain more water than east aspect streams (Dillacort Creek, Wheeler Creel, and Swale Creek) that tend to be hotter and drier.

Middle basin tributaries that were surveyed consist of Dead Canyon Creek, Summit Creek, White Creek, Brush Creek, and Tepee Creek. Brush Creek and Tepee Creek are tributaries to White Creek. Nearly three-quarters of the anadromous bearing portion of Dead Canyon Creek was dry. The lower third section of Dead Canyon Creek consists of a broad valley and distributary channel network where channel drying commonly occurs. However, channel drying was observed through significant lengths of stream within a narrow valley with mature riparian vegetation. White Creek disconnects annually from the mainstem Klickitat River. White Creek, Brush Creek and Tepee Creek had wetted channel percentages of 53.4%, 34.3%, and 28.4%, respectively. The White Creek drainage is identified as a large producer of both resident and anadromous *O. mykiss.* Since 2018, M&E staff observed declines in *O. mykiss* populations in White Creek and its tributaries. The decline in *O. mykiss* populations over the last four years appears to be correlated to increased channel drying that has been anecdotally observed over the same period.

Perennial streams consist of the Little Klickitat River, Bowman Creek, and Summit Creek (mid-basin stream). Healthy populations of natural-origin *O. mykiss* exist in Bowman Creek and Summit Creek. These perennial streams will increasingly hold a more important role in providing critical over summering rearing habitat compared to fish bearing tributaries where flow permanence will increasingly become an issue.

Conclusion

Salmonid populations and water availability are in decline in some tributaries in the Klickitat River subbasin. Over the past four years, channel drying, loss of summer rearing habitat, and declines in fish abundance has been observed in some streams. East aspect tributaries tend to have lower wetted channel percentages when compared to west aspect streams. Perennial streams such as Bowman Creek and Summit Creek will likely provide increasingly important over summer refugia habitat for *O. mykiss* during the limiting low flow period. Staff will continue to repeatedly survey these same sections of streams each year to document a temporal and spatial record of flow permanence throughout the lower and middle portions of the Klickitat River subbasin.

Table 49. Summary of linear anadromous fish bearing distance, wetted distance, linear dry distance, percent wetted channel, and percent dry channel by stream for the 2022 low water.

	2022 Klickitat River Tributary Low Water Survey				
Sample Stream	**Anadromous Bearing Length**	**Wetted Meters**	**Dry Meters**	**Percent Wetted**	**Percent Dry**
Dillacort Creek	1,635.6	1,006.4	629.2	61.5	38.5
Wheeler Creek	1,820.9	0.0	1,820.9	0.0	100.0
Logging Camp Creek	1,915.0	1,495.6	419.4	78.1	21.9
Snyder Creek	6,429.2	5,584.9	844.3	86.9	13.1
Swale Creek	12,210.0	6,722.8	5,487.2	55.1	44.9
Little Klickitat River	10,590.0	0.0	10,590.0	100.0	0.0
Bowman Creek	2,053.2	0.0	2,053.2	100.0	0.0
Dead Canyon Creek	5,359.0	1,410.0	3,949.0	26.3	73.7
Summit Creek	2,134.0	2,134.0	0.0	100.0	0.0
White Creek	23,251.5	12,412.9	10,838.6	53.4	46.6
Brush Creek	13,552.8	4651.7	8901.1	34.3	65.7
Tepee Creek	13,245.3	3763.2	9482.1	28.4	71.6

Stream temperature monitoring

Introduction

The objectives of the temperature monitoring study are to monitor status and trends of stream temperatures in the mainstem and tributaries throughout the Klickitat River subbasin. The data provides basic water temperature information for important salmonid habitat and baseline information for comparing changes through time related to land use and climate change.

Methods

Stream temperatures were monitored via continuously recording Onset thermographs (set to record at 30-min. intervals) at 30 locations on 22 streams within the Klickitat subbasin (Figure 18). M&E staff downloaded thermographs twice a year with a portable shuttle. Temperature data was subsequently imported into a relational database (Microsoft Access). Data analysis consisted of summarizing the number of times the daily minimum temperature was less than 0.5°C and 4.4°C; the number of times the daily average temperature was less than 0.5°C and 4.4°C; the number of times the daily maximum temperature was greater than 23°C and 24°C; the number of times the 7-day average daily maximum temperature was greater than 12°C, 16°C, 17.5°C, 18°C, and 22°C (the 7-day average daily maximum was calculated by averaging the daily maximum temperatures across the time period that started 3 days prior to and ended 3 days after a given day); the monthly 1-day maximum temperature (the highest instantaneous temperature recorded in a given month); the monthly 1-day maximum range (the largest daily range in temperature recorded during a given month); and the monthly average daily range (the average daily range in temperature recorded during a given month).

Results

Numerous laboratory and stream studies have shown that *Oncorhynchus mykiss* exposed to water temperatures of 18°C for an extended period time may undergo physiological stress and at 22°C the upper incipient temperature tolerance may be reached resulting in death (Bear and McMahon 2005, Richter and Kolmes 2005). Stream habitat quality for salmonids (primarily *O. mykiss*) in the Klickitat River subbasin was assessed using a 7-day average daily maximum temperature of 18° C and 22°C during the summer and early-fall limiting period. Results indicate a gradient of water temperatures from suitable cooler water temperatures in the upper basin to unsuitable warmer water temperatures in the lower basin (Table 50). During the reporting period, a total of 51, 922, 1,706 days were recorded that met the 18°C 7-day average daily maximum temperature in the upper basin, middle basin, and lower basin, respectively. A total of 0,66, 135 days were recorded that met the 22°C 7-day average daily maximum temperature in the upper basin, middle basin, and lower basin, respectively. In the upper basin, the Klickitat River at Castile Bridge generally recorded the highest water temperatures. In the middle basin, Outlet Creek consistently recorded the highest water temperatures. The high water temperatures recorded in Outlet Creek are likely due to a shallow reservoir located upstream of the monitoring site that impounds water draining out of the Conboy Wildlife Refuge marsh. High water temperatures also were recorded in lower White Creek. In the lower basin, the Little Klickitat River consistently recorded the highest temperatures. The Little Klickitat River accounted for 30% and 77% of the days that reached 7-day average daily maximum temperatures of 18° C and 22° C, respectively. In general, water temperatures at all sites in the lower basin were consistently reaching the 18° C threshold. A more detailed summary of the all the temperature metrics are contained in summary reports for each site in Appendix C.

Conclusions

A gradient of stream water temperatures were observed from cooler temperatures in the upper basin to warmer temperatures in the lower basin. The number of days reaching 7-day average daily maximum temperatures of 18° C in the lower basin was 33-fold and ~2-fold greater than upper basin and middle basin, respectively. The upper basin did not record a single day that reached 7-day average daily maximum temperatures of 22° C. The lower basins had twice as many days than the middle basin that reached 7-day average daily maximum temperatures of 22° C. High temperatures and associated reductions in dissolved oxygen, along with dewatering, present potentially significant habitat limitations for juvenile salmonids, especially for Mid-Columbia steelhead.

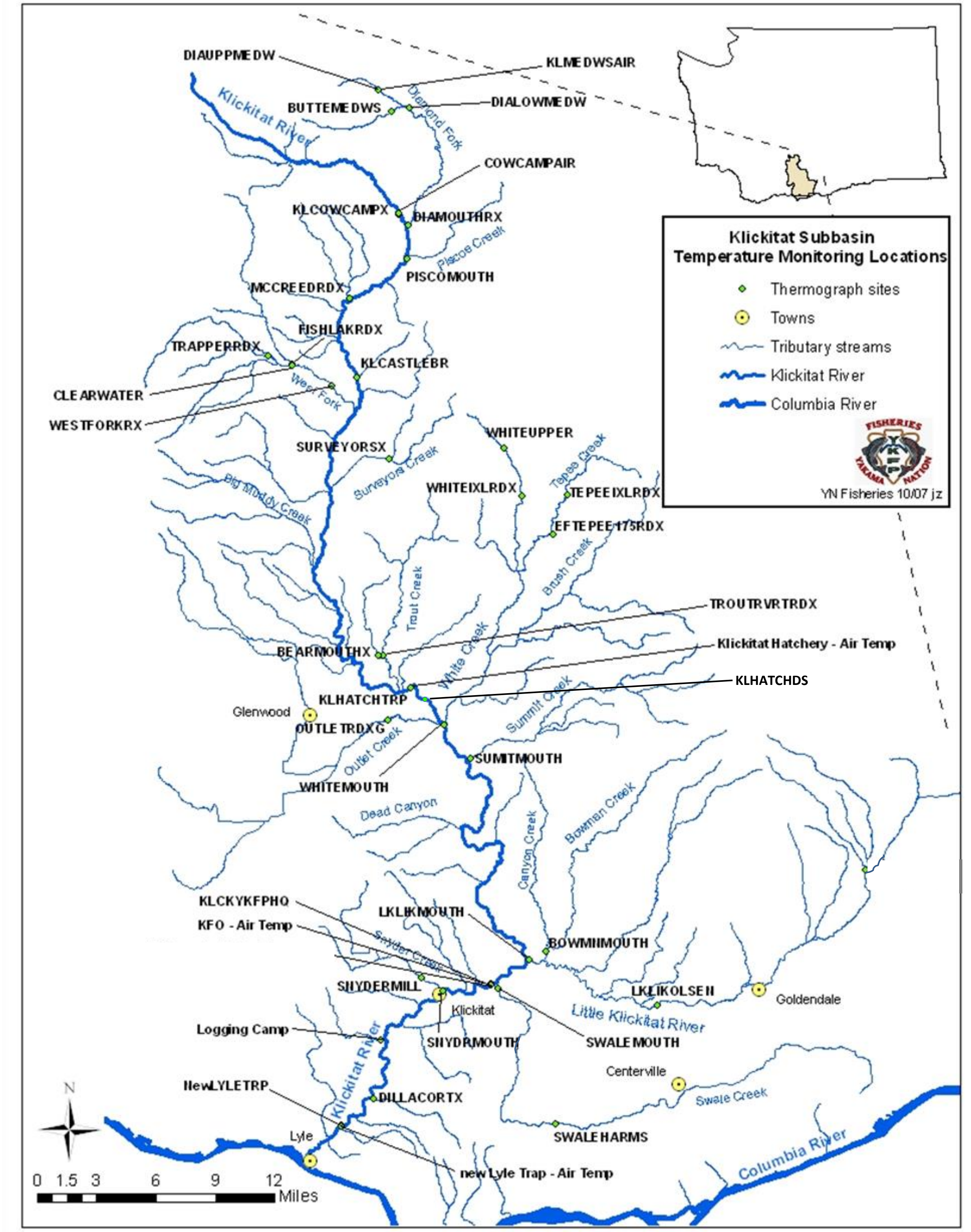

Figure 18. Locations of Klickitat subbasin water temperature monitoring sites.

Table 50. Summary of 7-day average daily maximum temperature greater than 18°C and 22°C for stream temperature monitoring sites during the June-October limiting period (2016-2022) in the Klickitat River subbasin, WA. Dashes indicate no data available.

Stream	Site Name	2016		2017		2018		2019		2020		2021		2022	
		>18	>22	>18	>22	>18	>22	>18	>22	>18	>22	>18	>22	>18	>22
Upper Basin															
Butte Meadows	BUTTEMEDWS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diamond Fork	DIAUPPMEDW	1	0	0	0	6	0	0	0	7	0	12	0	2	0
Diamond Fork	DIALOWMEDW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diamond Fork	DIAMOUTHRX	0	0	0	0	0	0	0	0	0	0	6	0	0	0
Piscoe	PISCOMOUTH	0	0	0	0	0	0	0	0	0	0	0	0	0	0
McCreedy	MCCREEDRDX	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Klickitat River	KLCOWCAMPX	7	0	0	0	7	0	0	0	0	0	0	0	0	0
Klickitat River	KLCASTLEBR	-	-	0	0	17	0	6	0	6	0	9	0	0	0
Trappers	TRAPPERRDX	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clearwater	CLEARWATER	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fish Lake Stream	FISHLAKRDX	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WF Klickitat	WESTFORKRX	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Surveyors	SURVERYORSX	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		**8**	**0**	**0**	**0**	**24**	**0**	**0**	**0**	**7**	**0**	**12**	**0**	**0**	**0**
Middle Basin															
Bear	BEARMOUTHX	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trout	TROUTRVRTRDX	14	0	20	0	29	0	21	0	31	0	59	8	0	0
Klickitat River	KLHATCHTRP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Klickitat River	KLHATCHDS	-	-	-	-	0	0	0	0	0	0	0	0	0	0
Outlet	OUTLETRDXG	80	2	84	16	78	9	-	-	69	11	60	15	-	-
White	WHITEUPPER	0	0	0	0	0	0	0	0	0	0	0	0	0	0
White	WHITEMOUTH	60	0	63	0	39	0	29	0	0	0	25	0	0	0
Tepee	TEPEEIXLRDX	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EF Tepee	EFTEPEE175RDX	0	0	0	0	0	0	0	0	15	0	56	5	0	0
Summit	SUMITMOUTH	5	0	0	0	7	0	5	0	12	0	51	0	0	0
Total		**159**	**2**	**167**	**16**	**153**	**9**	**65**	**0**	**127**	**11**	**251**	**28**	**0**	**0**
Lower Basin															
Little Klickitat	LKLIKMOUTH	77	6	114	0	54	11	79	6	87	23	79	58	13	0
Bowman	BOWMNMOUTH	5	0	0	0	5	0	0	0	23	0	59	0	0	0
Swale	SWALEMOUTH	55	0	71	0	13	0	82	0	39	0	18	1	0	0
Snyder	SNYDERMILL	45	0	36	0	57	0	72	0	20	0	10	0	0	0
Logging Camp	LOGGCAMPCR	-	-	74	14	40	0	16	0	43	0	57	16	0	0
Klickitat River	KLCKYKFPHQ	22	0	0	0	27	0	28	0	0	0	55	0	15	0
Klickitat River	KLnewLYLETRP	32	0	0	0	4	0	56	0	64	0	60	0	0	0
Total		**236**	**6**	**295**	**14**	**200**	**11**	**333**	**6**	**276**	**23**	**338**	**75**	**28**	**0**

[1]7-day average daily maximum temperature results confounded by channel drying June-October each year.

V. References

Arnason, A.N., C.J. Schwartz, and J.M. Gerrard. 1991. Estimating closed population size and number of marked animals from sighting data. Journal of Wildlife Management 55(4):718-730.

Bear, E.A and T. McMahon. 2005. Effects of temperature on survival and growth of Westslope Cutthroat Trout and Rainbow Trout: Implications for conservation and restoration. Master Thesis. Montana State University, Bozeman, MT.

Bryant, F.G. 1949. A survey of the Columbia River and its tributaries with special reference to the management of its fishery resources – 2. Washington streams from the mouth of the Columbia River to and including the Klickitat River (Area I). U.S. Department of the Interior, Fish and Wildlife Service. Special Scientific Report No. 62.

Bjorkstedt, E. 2000. DARR (Darroch analysis with rank reduction): A method for analysis of stratified mark-recapture data from small populations with application to estimating abundance of smolts from outmigrant trap data. NOAA-NMFS Southwest Fisheries Science Center. Administrative Report SC-00-02. 28 pp. http://santacruz.nmfs.noaa.gov/files/pubs/00116.pdf

Bjorkstedt, E. 2005. DARR 2.0: Updated software for estimating abundance from stratified mark-recapture data. NOAA-TM-NMFS-SWFSC 68. 21pp. http://santacruz.nmfs.noaa.gov/files/pubs/00439.pdf

Bjorkstedt, E. 2010. DARR 2.02: DARR for R. http://swfsc.noaa.gov/textblock.aspx?Division=FED&id=3346

Buchanan, R.A. and J.R. Skalski. 2007. A Migratory Life-Cycle Release-Recapture Model for Salmonid PIT-Tag Investigations. Journal of Agricultural, Biological, and Environmental Statistics, Volume 12, Number 3, Pages 325-345.

Collins, E.E., J.E. Hess, S. Bechtol, N. Romero, S.R. Narum, and J.S. Zendt. 2023. Genetic monitoring of steelhead in the Klickitat River to estimate productivity, straying, and migration timing. North American Journal of Fisheries Management in press. https://doi.org/10.1002/nafm.10921

Columbia Basin Fish and Wildlife Authority. 2014. PIT Tag Marking Procedures Manual. PIT Tag Steering Committee, Portland, Oregon (see Supplemental Material, Reference S3, http://www.ptagis.org/docs/default-source/ptagis-program-documents/2014-mark-procedures-manual.pdf?sfvrsn=2 (September 2014).

Crawford, B.A. 1979. The origin and history of the trout brood stocks of the Washington Department of Game. Washington State Game Department. Fishery Research Report. Olympia.

Crawford, B., T.R. Mosey, and D.H. Johnson. 2007. Carcass counts. Pages 59-86 in D.H. Johnson, B.M. Shrier, J.S. O'Neal, J.A. Knutzen, X. Augerot, T.A. O'Neil, and T.N. Pearsons. Salmonid field protocols handbook: techniques for assessing status and trends in salmon and trout populations. American Fisheries Society, Bethesda, Maryland.

CSS 2022. Comparative Survival Study (CSS) of PIT-tagged spring/summer/fall Chinook, summer steelhead, and sockeye. 2022 Annual Report. Prepared by CSS Oversight Committee and Fish Passage Center. BPA Contract #19960200. Available at: https://www.fpc.org/documents/CSS/CSS%20Final%20Revised%202022.pdf

DeVries, D.R., and R.V. Frie. 1996. Determination of age and growth. Pages 483-512 in B.R. Murphy and D.W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Gallagher, S.P., P.K.J. Hahn, and D.H. Johnson. 2007. Redd counts. Pages 197-234 in D.H. Johnson, B.M. Shrier, J.S. O'Neal, J.A. Knutzen, X. Augerot, T.A. O'Neil, and T.N. Pearsons. Salmonid field protocols handbook: techniques for assessing status and trends in salmon and trout populations. American Fisheries Society, Bethesda, Maryland.

Gray, S.W. 2006. Determine the Origin, Movements, and Relative Abundance of Bull Trout in Bonneville Reservoir. 2005-2006 Annual Report. Project No. 200306500, 81 electronic pages (BPA Report DOE/BP-00022537-1). Available at: https://pisces.bpa.gov/release/documents/documentviewer.aspx?doc=P103852

Gray, S.W. 2007. Determine the Origin, Movements, and Relative Abundance of Bull Trout in Bonneville Reservoir. 2006-2007 Annual Report. Project No. 200306500, 159 electronic pages (BPA Document ID # P103326). Available at: http://pisces.bpa.gov/release/documents/documentviewer.aspx?doc=P103326

Groot, C., and L. Margolis. 1991. Preface. Pages ix-xi in Groot, C. and L. Margolis. Pacific salmon life histories. UBC Press, Vancouver, BC.

Hess, J.E., A.P. Matala, J.S. Zendt, C.R. Frederiksen, B. Sharp, and S.R. Narum. 2011. Introgressive hybridization among major Columbia River Chinook salmon (*Oncorhynchus tshawytscha*) lineages within the Klickitat River due to hatchery practices. Canadian Journal of Fisheries and Aquatic Sciences 68: 1876-1891.

Hess, J.E., J.S. Zendt, A.R. Matala, and S.R. Narum. 2016. Genetic basis of adult migration timing in anadromous steelhead discovered through multivariate association testing. Proc. R. Soc. B 283: 20153064. http://dx.doi.org/10.1098/rspb.2015.3064

Hudson, J. M., J. R. Johnson, and B. Kynard. 2011. A portable electronarcosis system for anesthetizing salmonids and other fish. North American Journal of Fisheries Management 31:2, 335-339.

Hudson, J. M., M. Kavanagh, S. Castle, and B. Silver. 2014. Lack of effect on embryo mortality and fry growth from adult Coho salmon subjected to electronarcosis prior to spawning. North American Journal of Aquaculture 76:346-350.

Keep, S. G., M. B. Allen, J. S. Zendt. 2015. Comparison of electronarcosis and carbon dioxide sedation effects on travel time in adult Chinook and coho salmon. North American Journal of Fisheries Management 35:906-912.

Kuhn, K.G. and Romero, N. 2020. Bowman Creek (Klickitat River Subbasin, Washington) Rapid Aquatic Habitat Assessment Stream Report. Yakima/Klickitat Fisheries Project, Klickitat, Washington. http://www.ykfp.org/klickitat/Library/Habitat%20Reports/Summit_Creek_Habitat_Report_2020.pdf

Kuhn, K.G. and Romero, N. 2020. Swale Creek (Klickitat River Subbasin, Washington) Rapid Aquatic Habitat Assessment Stream Report. Yakima/Klickitat Fisheries Project, Klickitat, Washington. http://www.ykfp.org/klickitat/Library/Habitat%20Reports/Swale_Creek_Habitat_Report_Final_2020.pdf

Lady, J., P. Westhagen and Skalski, J. 2001. SURPH, Survival under Proportional Hazards. Available. Prepared for the Bonneville Power Administration. Project No. 1989-107-00, Contract Number DE-B179-90BP02341. Portland, Oregon. http://www.cbr.washington.edu/analysis/apps/surph/

Narum, S. R., M. S. Powell, R. Evenson, B. Sharp, and A. J. Talbot. 2006. Microsatellites reveal population substructure of Klickitat River native steelhead and genetic divergence from an introduced stock. North American Journal of Fisheries Management 26:67-75.

Narum, S.R , J.S. Zendt, C. Frederiksen, N. Campbell, A. Matala, and W.R. Sharp. 2011. Candidate genetic markers associated with anadromy in *Oncorhynchus mykiss* of the Klickitat River. Transactions of the American Fisheries Society 140:843-854.

Narum, S.R., J.S. Zendt, C. Frederiksen, and W.R. Sharp. 2007. Substructure of native steelhead in the Klickitat River and genetic identification of spawning populations. Pages 294-295 in Carline, R.F. and C. LoSapio, eds. Sustaining wild trout in a changing world; Proceedings of Wild Trout IX symposium. 2007 October 9-12. West Yellowstone, Montana.

Narum, S.R., J.S. Zendt, D. Graves, and W.R. Sharp. 2008. Influence of landscape on resident and anadromous life history types of Oncorhynchus mykiss. Canadian Journal of Fisheries and Aquatic Sciences 65:1013-1023.

National Marine Fisheries Service (NMFS). 2009. Recovery Plan for the Klickitat River Population of the Middle Columbia River Steelhead Distinct Population Segment. Available at http://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains/interior_columbia/middle_columbia/mid-c-klickitat.pdf

Northwest Power and Conservation Council (NPCC). 2004. Klickitat Subbasin Plan. Available at http://www.nwcouncil.org/fw/subbasinplanning/klickitat/plan/

Richter, A. and S.A. Kolmes. 2005. Maximum Temperature Limits for Chinook, Coho, and Chum Salmon, and Steelhead Trout in the Pacific Northwest. Reviews in Fisheries Science, 13:23-49.

Romero, N. 2020. Summit Creek (Klickitat River Subbasin, Washington) Rapid Aquatic Habitat Assessment Stream Report. Yakima/Klickitat Fisheries Project, Klickitat, Washington. http://www.ykfp.org/klickitat/Library/Habitat%20Reports/Summit_Creek_Habitat_Report_2020.pdf

Seber, G.A.F. 1982. The estimation of animal abundance and related parameters. 2nd edition. The Blackburn Press, Caldwell, New Jersey.

Thompson, W.L., G.C. White, and C. Gowan. 1998. Monitoring vertebrate populations. Academic Press, Inc., San Diego, California.

Volkhardt, G.C., Johnson, S.L., Miller, B.A., Nickelson, T.E., and Seiler, D.E. 2007, Rotary screw traps and inclined plane screen traps, in Johnson, D.H., Shrier, B.M., O'Neal, J.S., Knutzen, J.A., Augerot, X. O'Neal, T.A., and Pearsons, T.N., eds., Salmonid field protocols handbook: Techniques for assessing status and trends in salmon and trout populations: American Fisheries Society, p. 235–266.

Washington Department of Fish and Wildlife (WDFW). 2002. Salmonid Stock Inventory. Available at http://wdfw.wa.gov/fish/sasi/.

Westhagen, P., and J R Skalski. 2009. Program PitPro 4.0. Columbia Basin Research, University of Washington, Seattle.

Yakama Nation. 2018. Klickitat River Spring Chinook Master Plan. Prepared for the Northwest Power and Conservation Council. https://nwcouncil.app.box.com/s/kwyixxemc8y9mc848bem1om98az9jldi

VI. Appendix A: Use of Data & Products

Data generated from this project is available at several web sites and publicly-accessible databases, as outlined below. Use of these data is conditional upon a sufficient understanding of data limitations and knowledge of valid inferences that can be made from various data analyses. Contact the following staff with questions regarding data collection, use, and limitations: Adult salmonid and genetic data - Joseph Zendt (jzendt@ykfp.org); Juvenile salmonid and habitat data - Nicolas Romero (nromero@ykfp.org); web site or data systems - Michael Babcock (mbabcock@ykfp.org).

Fish population and tagging monitoring data:
http://www.ykfp.org/klickitat/Data.htm
https://dashboard.yakamafish-star.net/
https://cax.streamnet.org/
http://www.ptagis.org/
http://www.rmpc.org/

Habitat data:
http://www.ykfp.org/klickitat/Data.htm

Past reports and publications:
http://www.ykfp.org/klickitat/Reports&Pubs.htm

VII. Appendix B: Detailed Results

Table 51. Summary of fish counts at the Lyle Falls adult trap for calendar years 2013-2022.

Year	Trapping Days	Steelhead				Chinook					Coho
		Winter	Summer		Unknown Run	Spring		Fall	Summer	Unknown Run	
		Wild	Wild	Hatchery	Unknown Rear	Wild	Hatchery	Undetermined	Undetermined	Unknown Rear	Undetermined
2013	130		52	287	195					4692	394
2014	77	8	104	285	158					3683	2070
2015	132	69	537	337	170	20	199	404	235	1595	375
2016	114	36	61	246	35	20	202	31	15	243	676
2017	103	3	111	268	32	57	272	221	33	199	286
2018	178	56	120	335	16	21	130	349	17	215	591
2019	174	52	133	327	140	18	106	194	7	1237	521
2020	165	61	78	97	239	15	417	134	15	1834	338
2021	159	39	69	59	49	58	451	108	10	951	1618
2022	158	45	172	353	9	143	582	1016	14	164	188
Average	139	41	144	259	104	44	295	307	43	1481	706

Table 52. Mark-recapture estimates of spring Chinook run size at Lyle Falls on the lower Klickitat River for 2005-2022.

Year		Pop. Estimate (total)	L 95% CL	U 95% CL	- 95% CI	+ 95% CI	% Wild[3]	Hatchery	Wild	% Jacks[4]	Adult total
2005	*1/*	2011	1475	2842	536	831					
2006	*1/*	2100	1884	2391	216	291					
2007	*2/*	1882	1585	2257	297	375	20.9%	1489	393	17.7%	1549
2008		1712	1330	2256	382	544	26.2%	1263	449	35.9%	1097
2009		6204	5526	6997	678	793	10.0%	5584	620	22.2%	4827
2010		4535	3599	5825	936	1290	11.2%	4027	508	9.8%	4091
2011		4536	3794	5483	742	947	15.1%	3851	685	21.0%	3583
2012		4452	3740	5357	712	905	13.0%	3873	579	21.4%	3499
2013		6421	5339	7817	1082	1396	7.2%	5959	462	38.8%	3930
2014		5060	4399	5861	661	801	6.1%	4751	309	20.0%	4048
2015		5865	4928	7056	937	1191	11.3%	5202	663	5.7%	5531
2016		4052	3304	5043	748	991	10.9%	3610	442	24.6%	3055
2017		4703	3947	5664	756	961	16.3%	3936	767	9.8%	4242
2018		1316	1002	1777	314	461	13.6%	1137	179	13.0%	1145
2019	*5/*										
2020	*5/*										
2021	*5/*										
2022		5137	4382	6075	755	938	20.3%	4094	1043	9.3%	4659
Avg.		3999					14.0%	3752	546	19.2%	3481
Geomean		3564						3328	503		3111

1/ Estimates from Gray 2007
2/ 2007 is first year all returning adult age classes were 100% ad marked
3/ Percentage of wild (adipose-present) fish as counted at Lyle Falls adult trap
4/ Percentage of jacks as counted at Lyle Falls adult trap
5/ No mark-recapture estimate generated due to hatchery broodstock collection at Lyle Falls adult trap and lack of fish for mark and release

Note: Hatchery/wild numbers estimated from proportions observed at Lyle adult trap. Estimates include jacks and adults (except Adult total column).

Table 53. Mark-recapture estimates of steelhead run size at Lyle Falls on the lower Klickitat River for run years 2005-06 through 2022-23.

		Total				Hatchery				Wild (Summer and Winter)				Wild (Summer)				
Year		Pop. Estimate	SE	L 95% CL	U 95% CL	Pop. Estimate	SE	L 95% CL	U 95% CL	Pop. Estimate	SE	L 95% CL	U 95% CL	Pop. Estimate	SE	L 95% CL	U 95% CL	Wild (Winter)[1]
2005-06	[2]	3,410	250	2,967	3,961	1,833	148	1,572	2,160	1,577	102	1,395	1,801	1,252	102	1,070	1,476	325
2006-07	[2,3]	3,523	610	2,718	5,918	1,854	349	1,394	3,231	1,669	261	1,324	2,687	1,325	261	980	2,343	344
2007-08	[4]																	90
2008-09	[4]																	82
2009-10	[5]	4,868	506	4,003	6,021	3,578	390	2,913	4,470	1,290	116	1,090	1,551	1,137	116	937	1,398	153
2010-11	[3,5]	6,265	971	4,698	8,647	5,154	834	3,813	7,209	1,111	137	885	1,438	979	137	753	1,306	132
2011-12		4,926	1,424	2,945	9,279	2,443	715	1,448	4,630	2,483	709	1,497	4,649	2,399	709	1,413	4,565	84
2012-13		3,726	1,277	1,750	8,048	2,663	929	1,146	5,818	1,063	348	604	2,230	999	348	540	2,166	64
2013-14	[3]	2,477	478	1,741	3,726	1,255	248	873	1,904	1,222	230	868	1,822	1,146	230	792	1,746	76
2014-15		6,456	1,875	3,857	12,221	3,500	1,035	2,066	6,687	2,956	840	1,791	5,534	2,815	840	1,650	5,393	141
2015-16		7,087	2,099	4,178	13,545	3,817	1,142	2,235	7,333	3,270	957	1,943	6,212	3,202	957	1,875	6,144	68
2016-17	[3]	2,734	409	2,070	3,730	2,190	353	1,622	3,058	544	56	448	672	512	56	416	640	32
2017-18		4,455	1,122	2,830	7,666	2,670	683	1,682	4,631	1,785	439	1,148	3,035	1,725	439	1,088	2,975	60
2018-19		3,144	607	2,206	4,725	2,119	420	1,472	3,217	1,025	187	734	1,508	973	187	682	1,456	52
2019-20		2,060	250	1,641	2,644	1,051	132	831	1,359	1,009	118	810	1,285	948	118	749	1,224	61
2020-21		4,483	1,587	2,410	9,910	1,492	523	805	3,262	2,991	1,064	1,605	6,648	2,947	1,064	1,561	6,604	44
2021-22		1,205	527	582	3,416	442	197	208	1,262	763	330	374	2,154	709	330	320	2,100	54
2022-23		2,153	391	1,543	3,157	1,318	248	932	1,956	835	143	611	1,201	768	143	544	1,134	67
Avg:		3,936	899	2,634	6,663	2,336	522	1,563	3,887	1,600	377	1,070	2,777	1,490	377	961	2,667	107
Geo. mean:		**3,571**		**2,372**	**5,898**	**2,021**		**1,320**	**3,374**	**1,403**		**963**	**2,264**	**1,291**		**858**	**2,139**	**86**

[1]Count of fish captured in Lyle adult trap Dec 1 - Apr 30 (assumes no winter steelhead ascend falls, which likely biases estimate low). No recaptures of winter fish due to no winter sport fishery.
[2]From Gray 2007
[3]Winter steelhead counts estimated from previous winters' proportion of total, due to winter trap shutdowns.
[4]No estimate; angler recapture data not collected.
[5]Estimate of hatchery fish may be biased high by a high dip-in rate by out-of-basin fish

Table 54. Klickitat spring Chinook (Adult age 4, 5, and 6) returns, harvest, and escapement (from run reconstruction estimation). 2019 data is likely biased low and not included in summary statistics.

Return	Returns			Harvest					Escapement		
					Sport		Tribal				
Year	Total	Hatchery	Wild	Total	Hatchery	Wild	Hatchery	Wild	Total	Hatchery	Wild
1977	533	380	153	95	6	3	61	25	438	312	126
1978	1,528	1,160	368	906	202	64	486	154	622	472	150
1979	851	773	78	89	81	8	0	0	762	692	70
1980	1,685	1,619	66	67	6	0	59	2	1,618	1,555	63
1981	2,528	2,211	317	574	133	19	369	53	1,954	1,709	245
1982	3,238	2,988	250	1,775	399	33	1,239	104	1,463	1,350	113
1983	2,417	2,190	227	1,745	256	27	1,325	137	672	609	63
1984	1,323	1,086	237	754	268	59	350	77	569	467	102
1985	848	340	508	716	73	108	215	320	132	53	79
1986	1,112	860	252	485	19	5	357	104	627	485	142
1987	1,682	1,235	447	507	118	42	255	92	1,175	863	312
1988	3,929	2,239	1,690	1,353	141	107	630	475	2,576	1,468	1,108
1989	5,254	4,807	447	1,783	760	71	871	81	3,471	3,176	295
1990	2,583	1,858	725	1,785	256	100	1,028	401	798	574	224
1991	1,477	1,018	459	702	96	43	388	175	775	534	241
1992	1,540	1,026	514	587	82	41	309	155	953	635	318
1993	3,702	2,985	717	1,483	228	55	967	233	2,219	1,789	430
1994	958	831	127	233	44	7	158	24	725	629	96
1995	696	606	90	140	0	0	122	18	556	484	72
1996	1,156	782	374	308	97	46	112	53	848	574	274
1997	1,861	1,083	778	437	157	113	97	70	1,424	829	595
1998	702	397	305	149	8	6	76	59	553	313	240
1999	728	578	150	151	60	16	60	15	577	458	119
2000	2,708	1,601	1,107	1,446	233	162	621	430	1,262	746	516
2001	1,162	614	548	500	85	75	180	160	662	350	312
2002	2,549	1,250	1,299	787	183	190	203	211	1,762	864	898
2003	3,976	1,936	2,040	1,750	374	393	479	504	2,226	1,084	1,142
2004	3,039	1,710	1,329	1,171	338	262	321	250	1,868	1,051	817
2005	1,428	1,140	288	809	322	81	324	82	619	494	125
2006	1,593	1,175	418	671	216	0	336	119	922	623	298
2007	1,078	852	225	337	73	0	209	55	741	571	170
2008	1,115	823	292	593	121	0	348	124	522	354	169
2009	1,607	1,446	161	513	390	0	123	0	1,094	933	161
2010	1,784	1,584	200	641	242	0	371	28	1,143	971	172
2011	1,699	1,442	257	559	475	0	79	5	1,140	888	252
2012	2,298	1,999	299	1,148	698	0	411	39	1,150	890	260
2013	1,623	1,506	117	484	359	0	122	3	1,139	1,025	114
2014	2,724	2,558	166	1,358	327	0	923	108	1,366	1,308	58
2015	3,122	2,778	343	1,411	662	0	722	27	1,711	1,394	316
2016	2,128	1,894	234	1,113	493	0	508	112	1,015	893	122
2017	2,173	1,825	348	602	392	0	170	40	1,571	1,263	308
2018	723	622	101	161	141	0	20	0	562	461	101
2019	406	333	73	112	32	0	20	60	294	281	13
2020	1,747	1,659	87	661	608	0	53	0	1,086	998	87
2021	1,971	1,774	197	753	482	0	240	31	1,218	1,052	166
2022	2,088	1,670	418	618	410	0	208	0	1,470	1,052	418
Min	533	340	66	67	0	0	0	0	132	53	58
Max	5254	4807	2040	1785	760	393	1325	504	3471	3176	1142
Avg	1,926	1,487	439	776	247	47	367	115	1,150	873	277

Table 55. Results of spring Chinook spawning ground surveys (redd counts) in the Klickitat subbasin for 1989-2022.

		Redd Counts																																	
REACH	MILES	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015[1]	2016	2017	2018	2019[2]	2020[2]	2021	2022[3]
Diamond Fork	8.5	ns	0	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	0	0	0	0	0	ns	0	ns	ns	ns	0	ns	0	ns	ns	0	0	ns	ns
McCormick Mdws - Castile Falls	18.0	0	0	0	0	0	1	0	0	0	0	0	64	2	243	165	122	4	6	36	0	4	1	0	5	0	0	3	2	0	0	0	0	0	0
Castile Falls #10 - Falls #1	0.8	ns	ns	ns	ns	ns	ns	ns	ns	3	3	2	0	7	0	4	0	0	0	3	0	0	0	3	3	2	2	1	0	0	0	0	0	0	0
Castile Falls - Signal Peak Br.	3.3	20	17	28	34	33	18	17	24	87	56	40	39	33	50	41	18	11	14	18	15	21	13	31	20	35	18	22	15	27	26	2	17	13	30
Signal Peak Br. - Big Muddy Cr.	6.9	33	42	61	63	84	20	25	51	118	53	38	29	78	75	71	38	9	39	34	34	26	44	38	57	44	29	*41*	69	58	35	11	16	32	*28*
Big Muddy Cr. - Old USGS gage	3.3	ns	ns	0	5	15	0	0	0	0	0	0	2	0	5	0	0	0	0	0	2	0	2	2	5	1	2	*3*	0	0	0	0	0	0	*0*
Old USGS gage - Klickitat Hatchery	8.2	ns	ns	ns	ns	ns	ns	ns	14	2	0	0	27	1	16	34	10	15	4	8	5	3	18	28	35	26	10	28	35	12	1	0	0	2	2
Klickitat Hatchery - Summit Cr.	5.5	ns	ns	2	ns	ns	ns	ns	8	14	1	2	4	1	0	17	3	7	15	5	9	9	14	45	19	7	14	78	28	9	8	2	8	27	12
Summit Creek - Leidl	5.6	ns	ns	2	ns	ns	ns	ns	8	3	0	1	2	1	0	0	1	3	3	0	11	2	3	4	1	7	7	1	10	4	5	2	2	14	2
Leidl - Stinson Flats	3.2	ns	ns	ns	ns	ns	ns	ns	5	4	ns	ns	ns	ns	ns	ns	0	1	0	0	0	2	2	0	0	1	1	2	0	14	4	0	1	0	0
Stinson Flats - Soda Springs/Beeks Canyon	4	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	3	0	1	0	0	3	0	0	2	4	1	2	0	1	5	0	5	4	0
Soda Springs/Beeks - Twin Bridges	6.4	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	0	6	7	3	2	4	2	0	1	0	4	5	0
Twin Bridges - Pitt Bridge	8	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	0	0	ns	ns	ns	0	0	0	ns
Pitt - Turkey Farm	5	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Turkey Farm - Lyle Falls	2	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Totals	**88.7**	**53**	**59**	**93**	**102**	**132**	**39**	**42**	**110**	**231**	**113**	**83**	**167**	**123**	**389**	**332**	**195**	**50**	**82**	**104**	**76**	**70**	**97**	**157**	**154**	**130**	**86**	**185**	**161**	**125**	**85**	**17**	**53**	**97**	**74**
Totals (minus releases above Castile)		**53**	**59**	**93**	**102**	**132**	**39**	**42**	**110**	**231**	**113**	**83**	**103**	**123**	**146**	**167**	**73**	**50**	**82**	**104**	**76**	**70**	**97**	**157**	**154**	**130**	**86**	**185**	**161**	**125**	**85**	**17**	**53**	**97**	**74**
Totals above Castile (minus releases)		**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**4**	**6**	**36**	**0**	**4**	**1**	**0**	**5**	**0**	**0**	**3**	**2**	**0**	**0**	**0**	**0**	**0**	**0**
Totals in Wild index reach		53	59	89	97	117	38	42	75	205	109	78	68	111	125	112	56	20	53	52	49	47	57	69	77	79	47	ns	84	85	61	ns	33	45	58
Percent of Total in Wild index reach		100%	100%	96%	95%	89%	97%	100%	68%	89%	96%	94%	66%	90%	86%	67%	77%	40%	65%	50%	64%	67%	59%	44%	50%	61%	55%		52%	68%	72%			46%	
Totals in Hatchery reach										16	1	2	31	2	16	51	13	22	19	13	14	12	32	73	54	33	24	106	63	21	9	ns	8	29	14
Percent of Total in Hatchery reach										7%	1%	2%	30%	2%	11%	31%	18%	44%	23%	13%	18%	17%	33%	46%	35%	25%	28%		39%	17%	11%			30%	19%

ns = not surveyed

Italics = estimated value

[1] In 2015, Cougar Creek fire-related road closures prevented surveys from Signal Peak Bridge to Old USGS gage site. 2015 redd counts for those reaches are estimated based on linear regression with total wild fish run size at Lyle Falls in 2015 and recent years' proportions of total redd counts observed in those reaches.

[2] In 2019 and 2020, extended river trubidity (both years) and wildfire smoke (2020) limited surveys and reaches below Signal Peak Bridge were surveyed only 1-2 times likely leading to low redd counts

[3] In 2022, extended river turbidity and crew shortages prevented surveys in the Signal Peak Bridge - old USGS gage reach, and the turbidity delayed and affected visibility for surveys below Big Muddy Creek.

Note: In 2000, 2002, 2003, and 2004 surplus spring Chinook adults from Klickitat Hatchery were transported and released above Castile Falls. High redd counts above Castile Falls in those years are almost exclusively a result of those releases. For this reason the "Totals (minus releases above Castile)" row provides for a more consistent across-year comparison of natural spawner escapement in the Klickitat subbasin. The "Totals above Castile (minus releases)" row provides an across-year comparison of natural spawner escapement and passage above Castile Falls, assuming virtually no natural passage in 2000, 2002, 2003, and 2004. The "Wild Index Reach" is Castile Falls to Big Muddy Cr. The "Hatchery Reach" is old USGS gage to Summit Cr.

Table 56. Klickitat subbasin spring Chinook spawner survey carcass observations for 2007-2022. 2007 is the first year in which all returning hatchery-origin adults were 100% ad-clipped. 2015, 2019, and 2020 data are not used due to limited surveys and carcass recoveries.

	Carcasses observed		
Year	Ad-clipped	Unclipped	% Ad-clipped
2007	6	10	38%
2008	2	4	33%
2009	1	8	11%
2010	4	3	57%
2011	11	7	61%
2012	4	3	57%
2013	1	5	17%
2014	5	3	63%
2016	2	2	50%
2017	1	4	20%
2018	1	7	13%
2021	3	2	60%
2022	0	4	0%
		Avg.	37%

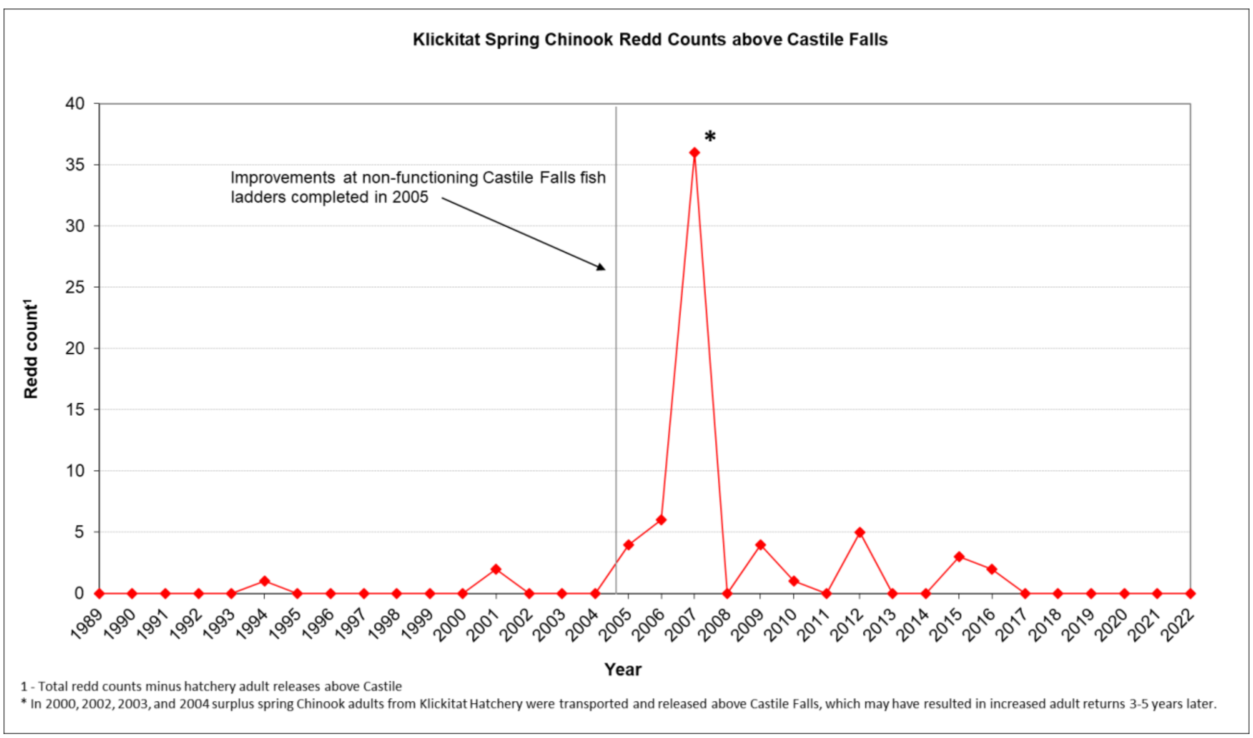

Figure 19. Results of spring Chinook redd counts above Castile Falls (RM 64) in the upper Klickitat River for 1989-2022.

Table 57. Results of fall Chinook spawning ground surveys (redd counts) in the Klickitat subbasin for 1995-2022.

REACH	MILES	Redd Counts 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
Old USGS gage - Klickitat Hatchery	8.2	ns	1	12	6	0	0	0	3	ns	4	1	ns	5	0	ns	0	1	12	0	11	ns	6	0	0	ns	0	ns	ns
Klickitat Hatchery - Summit Cr.	5.5	194	300	248	475	263	468	35	75	18	65	88	72	112	92	313	423	336	58	416	537	132	234	14	47	74	105	16	41
Summit Creek - Leidl Bridge	5.6		303	310	434	239	492	49	258	159	94	199	1	23	16	108	291	232	143	498	273	87	234	30	39	42	121	6	16
Leidl Bridge - Stinson Flats	3.2	120	104	144	183	160	207	138	97	190	52	55	2	39	21	101	132	157	65	404	164	269	144	13	8	20	150	0	11
Stinson Flats - Soda Springs/Beeks Canyon	7.5		159	68	180	66	86	53	160	26	84	68	23	24	2	60	119	134	6	445	689	282	205	56	24	48	257	6	16
Soda Springs/Beeks - Twin Bridges	6.4	140	146	90	413	82	227	112	420	43	368	77	21	32	12	152	152	322	71	1324	1536	532	266	82	33	62	329	0	16
Twin Bridges - Pitt Bridge	8	27	100	46	1	19	138	1	163	34	68	13	0	15	0	12	65	309	51	512	508	246	201	24	34	35	194	0	21
Pitt - Turkey Farm	5	15	18	11	8	6	31	7	38	0	18	4	0	0	0	8	46	64	26	50	89	37	62	13	9	12	87	0	12
Turkey Farm - Lyle Falls	2	ns	2	ns	ns	ns	ns	ns	11	4	10	0	0	2	ns	0	10	25	4	8	11	8	5	4	7	6	13	0	2
Below Lyle Falls	0.3	ns	ns	ns	ns	ns	ns	13	ns	ns	14	0	ns	1	4	ns	41	19	ns	ns	ns	ns	14	ns	20	ns	ns	ns	ns
Totals	**51.7**	**496**	**1133**	**929**	**1700**	**835**	**1649**	**408**	**1225**	**474**	**777**	**505**	**119**	**253**	**147**	**754**	**1279**	**1599**	**436**	**3657**	**3818**	**1593**	**1371**	**236**	**221**	**299**	**1256**	**28***	**135**

ns = not surveyed

Recent 10-year average (excl. 2021): 1302

Note: High flows and/or turbidity in some years (especially 2003, 2006, 2008, 2009, 2012, 2015, and 2021) limit survey coverage and visibility and may bias redd counts low; *2021 redd counts are likely biased significantly low*. High flows and suspended sediment in October 2003 and November 2006 also caused significant pre-spawn mortality of fall Chinook. Some survey reaches were combined in 1995 data.

Table 58. Scale ages by return year and mark with mean, minimum, and maximum fork lengths and postorbital-hypural lengths for spring Chinook recovered on spawning ground surveys in the Klickitat River in 2021-2022.

			Fork Length			POH Length			
Spring Chinook	total age	Count	Mean	Min	Max	Mean	Min	Max	% of Total
2021									
Ad clipped									
	4	3	714	627	860	585	530	690	100%
Total		3							100%
Unmarked									
	4	2	905	925	885	695	690	700	100%
Total		2							100%
2022									
Unmarked									
	3	1	678	678	678	525	525	525	25%
	4	3	850	845	854	690	670	706	75%
Total		4							100%

Table 59. Scale ages by return year and mark with mean, minimum, and maximum fork lengths and postorbital-hypural lengths for spring Chinook captured in the Lyle Falls adult trap in 2021-2022.

			Fork Length			POH Length			
Spring Chinook	total age	Count	Mean	Min	Max	Mean	Min	Max	% of Total
2021									
Ad clipped									
	4	53	750	620	889	608	520	713	95%
	5	3	878	802	952	706	649	749	5%
Total		56							100%
Unmarked									
	4	25	748	650	857	609	520	684	78%
	5	7	877	835	905	712	690	736	22%
Total		32							100%
2022									
Ad clipped									
	3	1	565	565	565	458	458	458	1%
	4	150	712	579	832	580	461	694	91%
	5	14	822	762	900	669	611	740	8%
Total		165							100%
Unmarked									
	3	3	536	495	575	429	390	465	3%
	4	65	707	589	854	579	470	709	74%
	5	20	842	718	975	697	600	802	23%
Total		88							100%

Table 60. Scale ages by return year and mark with mean, minimum, and maximum fork lengths and postorbital-hypural lengths for spring Chinook returning to the Klickitat Hatchery adult holding pond in 2021-2022.

			Fork Length			POH Length			
Spring Chinook	total age	Count	Mean	Min	Max	Mean	Min	Max	% of Total
2021									
Ad clipped									
	3	12	602	467	693	485	378	560	8%
	4	119	739	572	910	604	471	740	83%
	5	12	800	717	873	651	575	692	8%
Total		143							100%
Unmarked									
	4	3	750	642	814	612	524	669	100%
Total		3							100%
2022									
Ad clipped									
	3	1	598	598	598	461	461	461	1%
	4	135	722	575	915	562	445	656	96%
	5	5	811	725	912	633	589	694	4%
Total		141							100%

Table 61. Scale ages by return year and mark with mean, minimum, and maximum fork lengths and postorbital-hypural lengths for fall Chinook recovered on spawning ground surveys in the Klickitat River in 2021-2022. High river turbidity limited surveys and carcass recovery in both years.

			Fork Length			POH Length			
Fall Chinook	total age	Count	Mean	Min	Max	Mean	Min	Max	% of Total
2022									
Ad clipped									
	3								0%
	4	1	806	806	806	682	682	682	100%
	5								0%
Total		1							100%
Unmarked									
	3	1	585	585	585	455	455	455	50%
	4	1	779	779	779	636	636	636	50%
	5								0%
Total		2							100%

Table 62. Scale ages by return year and mark with mean, minimum, and maximum fork lengths and postorbital-hypural lengths for fall Chinook captured in the Lyle Falls adult trap in 2021-2022.

			Fork Length			POH Length			
Fall Chinook	total age	Count	Mean	Min	Max	Mean	Min	Max	% of Total
2021									
Ad clipped									
	4	12	774	709	845	621	545	670	71%
	5	5	852	801	880	699	652	735	29%
Total		17							100%
Unmarked									
	4	19	766	691	942	616	543	740	79%
	5	5	841	812	872	679	651	705	21%
Total		24							100%
2022									
Ad clipped									
	3	3	598	579	631	490	465	521	4%
	4	67	751	648	859	624	522	732	83%
	5	11	831	773	882	703	643	745	14%
Total		81							100%
Unmarked									
	3	52	602	515	690	492	408	590	32%
	4	92	685	598	941	566	490	804	56%
	5	20	833	755	925	692	634	755	12%
Total		164							100%

Table 63. Scale ages by return year and mark with mean, minimum, and maximum fork lengths and postorbital-hypural lengths for coho recovered on spawning ground surveys in the Klickitat River in 2021-2022.

			Fork Length			POH Length			
Coho	total age	Count	Mean	Min	Max	Mean	Min	Max	% of Total
2021									
Ad clipped									
	3	43	642	540	779	506	430	611	100%
Total		43							100%
Unmarked									
	3	2	578	520	635	453	410	495	100%
Total		2							100%

Table 64. Scale ages by return year and mark with mean, minimum, and maximum fork lengths and postorbital-hypural lengths for coho captured in the Lyle Falls adult trap in 2021-2022.

			Fork Length			POH Length			
Coho	total age	Count	Mean	Min	Max	Mean	Min	Max	% of Total
2021									
Ad clipped									
	3	22	661	500	810	511	390	635	100%
Total		22							100%
Unmarked									
	3	2	676	631	720	541	511	570	100%
Total		2							100%

Table 65. Scale ages by return year and mark with mean, minimum, and maximum fork lengths and postorbital-hypural lengths for steelhead recovered on spawning ground surveys in the Klickitat River in 2021-2022. No scale samples were collected in 2022.

			Fork Length			POH Length			
Steelhead	total age	Count	Mean	Min	Max	Mean	Min	Max	% of Total
2021									
Ad clipped									
	3	1	708	708	708	556	556	556	100%
Total		1							100%

Table 66. Scale ages by return year and mark with mean, minimum, and maximum fork lengths and postorbital-hypural lengths for steelhead captured in the Lyle Falls adult trap in 2021-2022.

			Fork Length			POH Length			
Steelhead	total age	Count	Mean	Min	Max	Mean	Min	Max	% of Total
2021									
Ad clipped									
	3	17	668	562	735	536	445	600	47%
	4	17	764	683	836	622	555	679	47%
	5	2	812	810	814	673	655	691	6%
Total		36							100%
Unmarked									
	3	19	644	531	789	526	440	631	28%
	4	45	744	612	911	599	487	702	65%
	5	5	753	687	823	613	533	681	7%
Total		69							100%
2022									
Ad clipped									
	3	37	664	345	744	551	290	645	23%
	4	112	719	647	821	600	518	692	71%
	5	9	750	670	869	619	540	703	6%
Total		158							100%
Unmarked									
	3	21	645	514	803	528	423	698	17%
	4	90	706	580	836	584	465	713	73%
	5	13	737	628	825	614	519	706	10%
Total		124							100%

VIII. Appendix C: Summary Reports of Stream Temperature Monitoring Sites

Bear Creek Monthly Temperature Summaries (degrees C)

BEARMOUTHX

2016	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	5	31	4	31	0	0	0	0	0	0	0	4.1	2.1	0.7
February	29	0	28	0	20	0	0	0	0	0	0	0	6.4	2.0	1.1
March	31	0	9	0	1	0	0	0	0	0	0	0	9.2	4.1	2.1
April	30	0	0	0	0	0	0	0	0	0	0	0	10.6	3.2	2.3
May	31	0	0	0	0	0	0	0	0	0	0	0	11.5	3.0	2.2
June	30	0	0	0	0	0	0	0	0	0	0	0	12.0	3.4	2.3
July	31	0	0	0	0	0	0	0	0	0	0	0	12.2	3.1	2.4
August	31	0	0	0	0	0	0	0	0	0	0	0	12.0	3.3	2.5
September	30	0	0	0	0	0	0	0	0	0	0	0	10.3	3.5	2.3
October	31	0	0	0	0	0	0	0	0	0	0	0	9.9	2.8	1.1
November	26	0	4	0	2	0	0	0	0	0	0	0	8.4	1.9	1.2
December	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--

BEARMOUTHX

2017	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
February	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
March	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
April	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
May	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
July	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
August	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
September	50	0	0	0	0	0	0	0	0	0	0	0	14.3	4.9	2.1
October	12	0	0	0	0	0	0	0	0	0	0	0	7.9	2.8	2.3
November	23	0	10	0	6	0	0	0	0	0	0	0	8.3	2.1	1.0
December	31	2	28	2	27	0	0	0	0	0	0	0	5.7	2.0	0.9

Tuesday, April 4, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data. ***Page 1 of 4***

BEARMOUTHX

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	26	0	0	0	0	0	0	0	5.1	2.0	0.8
February	28	2	26	0	20	0	0	0	0	0	0	0	6.6	2.4	1.5
March	31	0	28	0	17	0	0	0	0	0	0	0	7.9	3.6	2.3
April	30	0	5	0	0	0	0	0	0	0	0	0	11.7	5.2	2.9
May	31	0	0	0	0	0	0	2	0	0	0	0	12.9	5.5	3.1
June	30	0	0	0	0	0	0	3	0	0	0	0	12.5	4.1	2.7
July	31	0	0	0	0	0	0	24	0	0	0	0	13.6	3.6	2.8
August	31	0	0	0	0	0	0	13	0	0	0	0	13.3	3.2	2.3
September	30	0	0	0	0	0	0	0	0	0	0	0	11.3	3.0	2.2
October	31	0	11	0	0	0	0	0	0	0	0	0	9.8	2.9	1.7
November	30	1	24	0	21	0	0	0	0	0	0	0	9.1	2.2	1.3
December	31	3	30	0	28	0	0	0	0	0	0	0	5.1	2.2	0.9

BEARMOUTHX

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	2	31	1	31	0	0	0	0	0	0	0	4.2	2.0	0.9
February	28	18	28	15	28	0	0	0	0	0	0	0	4.0	1.9	0.6
March	31	8	31	7	29	0	0	0	0	0	0	0	7.0	3.9	1.3
April	30	0	2	0	0	0	0	0	0	0	0	0	11.0	4.8	2.8
May	31	0	0	0	0	0	0	8	0	0	0	0	13.3	4.1	2.6
June	30	0	0	0	0	0	0	21	0	0	0	0	16.0	3.9	2.9
July	31	0	0	0	0	0	0	31	0	0	0	0	15.2	3.7	2.7
August	31	0	0	0	0	0	0	31	0	0	0	0	16.2	3.2	2.3
September	30	0	0	0	0	0	0	10	0	0	0	0	14.3	2.5	1.6
October	31	3	16	2	11	0	0	0	0	0	0	0	8.9	3.4	1.9
November	30	10	26	7	23	0	0	0	0	0	0	0	6.4	2.4	1.2
December	31	13	31	10	31	0	0	0	0	0	0	0	3.4	2.1	0.7

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

BEARMOUTHX

2020	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	8	31	6	30	0	0	0	0	0	0	0	5.3	2.1	0.8
February	29	3	28	0	27	0	0	0	0	0	0	0	5.4	2.0	1.3
March	31	2	29	0	23	0	0	0	0	0	0	0	7.9	3.3	2.2
April	30	0	12	0	4	0	0	0	0	0	0	0	12.7	5.5	3.8
May	31	0	0	0	0	0	0	16	0	0	0	0	16.7	6.0	4.0
June	30	0	0	0	0	0	0	30	5	0	0	0	18.1	5.1	3.6
July	31	0	0	0	0	0	0	31	15	1	0	0	19.0	5.3	4.1
August	31	0	0	0	0	0	0	31	6	0	0	0	17.3	4.4	3.7
September	28	0	0	0	0	0	0	10	0	0	0	0	15.4	4.2	2.8
October	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
November	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
December	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--

BEARMOUTHX

2021	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
February	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
March	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
April	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
May	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June	15	0	0	0	0	0	0	15	11	8	7	0	21.2	5.4	4.5
July	31	0	0	0	0	0	0	31	24	8	4	0	19.5	5.0	4.2
August	31	0	0	0	0	0	0	29	13	1	0	0	18.1	4.0	3.1
September	30	0	0	0	0	0	0	9	0	0	0	0	14.1	3.7	2.2
October	31	0	5	0	1	0	0	0	0	0	0	0	9.8	2.6	1.4
November	30	0	19	0	15	0	0	0	0	0	0	0	8.8	3.2	1.4
December	31	11	29	8	29	0	0	0	0	0	0	0	8.7	2.8	1.0

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

BEARMOUTHX

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	15	31	12	31	0	0	0	0	0	0	0	3.1	1.8	0.5
February	28	10	28	5	28	0	0	0	0	0	0	0	3.1	1.9	0.9
March	31	0	23	0	15	0	0	0	0	0	0	0	8.7	3.9	2.2
April	30	0	16	0	5	0	0	0	0	0	0	0	9.2	4.1	2.6
May	31	0	0	0	0	0	0	0	0	0	0	0	11.9	4.9	3.1
June	30	0	0	0	0	0	0	18	0	0	0	0	14.7	3.5	2.0
July	6	0	0	0	0	0	0	6	0	0	0	0	14.0	2.0	1.4

Tuesday, April 4, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data. *Page 4 of 4*

Bowman Creek Monthly Temperature Summaries (degrees C)

BOWMNMOUTH

2016	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	23	0	17	0	0	0	0	0	0	0	6.4	1.8	1.0
February	29	0	10	0	2	0	0	0	0	0	0	0	8.6	2.9	1.8
March	31	0	1	0	0	0	0	0	0	0	0	0	12.1	5.4	2.6
April	30	0	0	0	0	0	0	16	0	0	0	0	14.1	5.4	3.8
May	31	0	0	0	0	0	0	31	0	0	0	0	16.1	4.7	3.4
June	30	0	0	0	0	0	0	30	12	0	0	0	18.9	5.2	3.6
July	31	0	0	0	0	0	0	31	27	8	5	0	19.3	5.2	3.9
August	31	0	0	0	0	0	0	31	21	2	0	0	18.1	5.4	3.9
September	30	0	0	0	0	0	0	29	0	0	0	0	14.7	4.4	2.7
October	31	0	0	0	0	0	0	4	0	0	0	0	13.5	3.0	1.5
November	30	0	0	0	0	0	0	0	0	0	0	0	10.7	2.2	1.4
December	1	0	1	0	0	0	0	0	0	0	0	0	5.4	1.3	1.3

BOWMNMOUTH

2017	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
February	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
March	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
April	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
May	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
July	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
August	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
September	30	0	0	0	0	0	0	25	0	0	0	0	16.2	4.1	2.4
October	31	0	0	0	0	0	0	0	0	0	0	0	11.1	3.3	2.0
November	30	0	2	0	0	0	0	0	0	0	0	0	10.1	2.1	1.3
December	31	0	26	0	26	0	0	0	0	0	0	0	6.8	2.4	1.0

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

BOWMNMOUTH

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	13	0	6	0	0	0	0	0	0	0	6.9	1.7	1.0
February	28	0	17	0	12	0	0	0	0	0	0	0	9.0	3.0	1.9
March	31	0	12	0	3	0	0	0	0	0	0	0	10.5	4.1	2.7
April	30	0	0	0	0	0	0	4	0	0	0	0	13.5	5.4	3.1
May	31	0	0	0	0	0	0	30	0	0	0	0	15.7	5.1	3.2
June	30	0	0	0	0	0	0	30	5	0	0	0	17.5	4.6	3.3
July	31	0	0	0	0	0	0	31	26	11	5	0	19.7	4.8	4.0
August	31	0	0	0	0	0	0	31	21	6	0	0	18.8	4.2	3.2
September	30	0	0	0	0	0	0	24	0	0	0	0	15.0	3.6	2.6
October	31	0	0	0	0	0	0	0	0	0	0	0	13.2	3.2	1.9
November	30	0	13	0	11	0	0	0	0	0	0	0	12.4	2.6	1.4
December	31	0	16	0	14	0	0	0	0	0	0	0	7.1	2.8	1.0

BOWMNMOUTH

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	24	0	13	0	0	0	0	0	0	0	7.5	2.1	1.1
February	28	0	27	0	25	0	0	0	0	0	0	0	6.3	2.5	1.4
March	31	1	22	0	17	0	0	0	0	0	0	0	10.0	4.9	2.6
April	30	0	0	0	0	0	0	9	0	0	0	0	13.8	5.5	3.1
May	31	0	0	0	0	0	0	30	0	0	0	0	16.0	5.4	3.3
June	30	0	0	0	0	0	0	30	6	0	0	0	18.0	4.8	3.6
July	31	0	0	0	0	0	0	31	29	0	0	0	18.0	5.0	3.6
August	31	0	0	0	0	0	0	31	26	7	0	0	18.8	4.1	3.1
September	30	0	0	0	0	0	0	27	4	0	0	0	16.7	3.0	2.0
October	31	0	4	0	2	0	0	0	0	0	0	0	11.9	3.4	2.0
November	30	0	19	0	10	0	0	0	0	0	0	0	8.9	2.5	1.3
December	31	0	18	0	15	0	0	0	0	0	0	0	6.4	1.8	0.9

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

BOWMNMOUTH

2020	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	11	0	7	0	0	0	0	0	0	0	7.8	2.1	1.0
February	29	0	21	0	14	0	0	0	0	0	0	0	8.1	3.4	2.0
March	31	0	17	0	4	0	0	0	0	0	0	0	9.7	4.4	2.8
April	30	0	3	0	0	0	0	6	0	0	0	0	13.2	5.9	3.7
May	31	0	0	0	0	0	0	27	0	0	0	0	17.0	5.5	3.5
June	30	0	0	0	0	0	0	30	10	5	1	0	19.5	5.1	3.0
July	31	0	0	0	0	0	0	31	29	19	16	0	20.5	4.9	3.7
August	31	0	0	0	0	0	0	31	28	12	6	0	19.2	4.1	3.1
September	30	0	0	0	0	0	0	30	12	0	0	0	18.8	7.5	3.7
October	31	0	3	0	2	0	0	11	0	0	0	0	13.3	4.4	2.0
November	30	0	8	0	6	0	0	0	0	0	0	0	11.0	2.9	1.5
December	31	0	23	0	18	0	0	0	0	0	0	0	8.1	3.0	1.1

BOWMNMOUTH

2021	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	10	0	7	0	0	0	0	0	0	0	7.4	2.2	1.1
February	28	0	20	0	16	0	0	0	0	0	0	0	6.8	2.2	1.3
March	31	0	10	0	0	0	0	0	0	0	0	0	9.6	4.1	2.5
April	30	0	2	0	0	0	0	3	0	0	0	0	14.1	5.0	3.7
May	31	0	0	0	0	0	0	29	1	0	0	0	16.2	4.8	3.6
June	30	0	0	0	0	0	0	30	19	12	11	0	22.2	5.7	3.8
July	31	0	0	0	0	0	0	31	31	31	31	0	20.2	5.6	4.2
August	31	0	0	0	0	0	0	31	20	17	17	0	20.2	4.1	3.0
September	30	0	0	0	0	0	0	30	0	0	0	0	16.5	3.7	2.4
October	31	0	0	0	0	0	0	0	0	0	0	0	12.4	3.4	1.9
November	30	0	6	0	2	0	0	0	0	0	0	0	11.7	3.2	1.5
December	31	1	24	0	17	0	0	0	0	0	0	0	8.4	3.3	1.2

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

BOWMNMOUTH

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	2	31	1	30	0	0	0	0	0	0	0	5.5	2.7	1.0
February	28	0	27	0	16	0	0	0	0	0	0	0	6.6	2.6	1.8
March	31	0	9	0	1	0	0	0	0	0	0	0	10.8	3.7	2.4
April	30	0	3	0	0	0	0	0	0	0	0	0	11.2	4.8	2.9
May	31	0	0	0	0	0	0	7	0	0	0	0	13.8	4.8	2.9
June	30	0	0	0	0	0	0	30	3	0	0	0	17.1	4.6	2.8
July	6	0	0	0	0	0	0	6	0	0	0	0	16.6	4.1	2.9

Tuesday, April 4, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

Clearwater Creek Monthly Temperature Summaries (degrees C)

CLEARWATER

2016	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	3.7	0.6	0.2
February	29	0	29	0	29	0	0	0	0	0	0	0	3.9	0.3	0.1
March	31	0	31	0	31	0	0	0	0	0	0	0	3.9	0.3	0.1
April	30	0	25	0	18	0	0	0	0	0	0	0	5.5	1.4	0.6
May	31	0	0	0	0	0	0	0	0	0	0	0	7.1	1.8	1.0
June	30	0	0	0	0	0	0	0	0	0	0	0	9.6	2.9	1.6
July	31	0	0	0	0	0	0	0	0	0	0	0	10.0	3.0	2.1
August	31	0	0	0	0	0	0	0	0	0	0	0	9.8	3.0	2.5
September	30	0	1	0	0	0	0	0	0	0	0	0	8.1	2.7	1.7
October	31	0	7	0	1	0	0	0	0	0	0	0	7.0	1.7	0.9
November	30	2	18	1	15	0	0	0	0	0	0	0	6.1	3.6	0.9
December	31	31	31	31	31	0	0	0	0	0	0	0	0.6	4.2	0.9

CLEARWATER

2017	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	31	31	31	31	0	0	0	0	0	0	0	–0.1	0.3	0.1
February	28	28	28	27	28	0	0	0	0	0	0	0	1.9	1.9	0.1
March	31	19	31	17	31	0	0	0	0	0	0	0	3.6	3.3	0.3
April	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
May	31	0	23	0	8	0	0	0	0	0	0	0	12.0	8.5	2.5
June	30	0	2	0	0	0	0	0	0	0	0	0	8.9	3.0	2.2
July	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
August	30	0	0	0	0	0	0	2	2	0	0	0	18.7	10.5	2.7
September	30	0	0	0	0	0	0	0	0	0	0	0	9.0	2.8	1.7
October	31	0	22	0	7	0	0	0	0	0	0	0	6.2	2.0	1.2
November	30	0	29	0	29	0	0	0	0	0	0	0	5.0	1.4	0.5
December	31	0	31	0	31	0	0	0	0	0	0	0	4.2	1.3	0.7

Tuesday, April 4, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data. *Page 1 of 4*

CLEARWATER

2018	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	4.0	1.3	0.5
February	28	0	28	0	28	0	0	0	0	0	0	0	4.6	1.6	0.8
March	31	0	31	0	31	0	0	0	0	0	0	0	5.1	1.7	1.1
April	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
May	31	0	2	0	0	0	0	1	1	1	0	0	8.3	2.8	1.9
June	30	0	1	0	0	0	0	0	0	0	0	0	9.5	3.1	2.2
July	31	0	0	0	0	0	0	0	0	0	0	0	11.2	3.9	2.8
August	31	0	0	0	0	0	0	0	0	0	0	0	10.8	3.6	2.8
September	30	0	5	0	0	0	0	0	0	0	0	0	8.9	3.2	1.9
October	31	0	20	0	2	0	0	0	0	0	0	0	6.9	1.9	1.4
November	30	0	25	0	23	0	0	0	0	0	0	0	6.9	1.6	0.9
December	31	0	31	0	31	0	0	0	0	0	0	0	4.0	1.2	0.7

CLEARWATER

2019	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	3.9	1.5	0.9
February	28	2	28	0	28	0	0	0	0	0	0	0	3.9	1.9	1.0
March	31	0	31	0	31	0	0	0	0	0	0	0	5.2	2.2	1.5
April	30	0	30	0	23	0	0	0	0	0	0	0	6.0	2.5	1.6
May	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
July	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
August	31	0	0	0	0	0	0	0	0	0	0	0	11.0	3.9	2.8
September	30	0	3	0	2	0	0	0	0	0	0	0	9.3	3.0	1.5
October	31	0	25	0	14	0	0	0	0	0	0	0	6.5	2.5	1.4
November	30	1	28	0	21	0	0	0	0	0	0	0	6.2	1.6	1.0
December	31	0	31	0	31	0	0	0	0	0	0	0	4.2	1.4	0.7

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

CLEARWATER

2020	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	1	31	0	31	0	0	0	0	0	0	0	4.2	1.6	0.8
February	29	0	29	0	29	0	0	0	0	0	0	0	4.2	1.5	0.9
March	31	0	31	0	31	0	0	0	0	0	0	0	5.1	1.9	1.3
April	30	0	25	0	12	0	0	0	0	0	0	0	6.7	3.0	2.0
May	31	1	10	0	0	1	1	7	0	0	0	0	9.3	3.7	2.1
June	30	0	1	0	0	0	0	0	0	0	0	0	10.1	3.9	2.4
July	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
August	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
September	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
October	31	0	8	0	7	0	0	0	0	0	0	0	7.3	1.7	0.9
November	30	0	27	0	27	0	0	0	0	0	0	0	6.2	1.2	0.6
December	31	0	31	0	31	0	0	0	0	0	0	0	3.9	1.4	0.7

CLEARWATER

2021	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	3.8	1.2	0.6
February	28	2	28	0	28	0	0	0	0	0	0	0	4.2	1.4	0.8
March	31	0	31	0	31	0	0	0	0	0	0	0	5.1	2.3	1.3
April	30	0	29	0	23	0	0	0	0	0	0	0	6.7	2.8	2.0
May	31	0	16	0	2	0	0	0	0	0	0	0	8.6	3.4	2.3
June	30	0	2	0	0	0	0	0	0	0	0	0	11.9	4.0	2.8
July	31	0	0	0	0	0	0	0	0	0	0	0	11.0	4.5	3.6
August	31	0	0	0	0	0	0	0	0	0	0	0	11.3	4.3	2.7
September	30	0	1	0	0	0	0	0	0	0	0	0	9.2	3.1	2.0
October	31	0	15	0	6	0	0	0	0	0	0	0	6.9	2.0	1.2
November	29	0	28	0	22	0	0	0	0	0	0	0	6.1	1.8	0.8
December	31	0	30	0	29	0	0	0	0	0	0	0	5.9	1.6	0.8

Tuesday, April 4, 2023   NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.   *Page 3 of 4*

CLEARWATER

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	1	31	0	31	0	0	0	0	0	0	0	4.2	2.3	0.9
February	28	1	28	0	28	0	0	0	0	0	0	0	4.5	1.8	1.0
March	31	0	31	0	26	0	0	0	0	0	0	0	5.3	1.7	1.0
April	30	0	30	0	27	0	0	0	0	0	0	0	5.4	2.2	1.3
May	31	0	21	0	6	0	0	0	0	0	0	0	7.1	2.7	1.7
June	30	0	1	0	0	0	0	0	0	0	0	0	9.0	3.1	1.9
July	7	0	0	0	0	0	0	0	0	0	0	0	8.4	2.3	1.6

Tuesday, April 4, 2023   NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.   *Page 4 of 4*

Diamond Creek Monthly Temperature Summaries (degrees C)

DIAMOUTHRX

2016	# Days Recorded	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
		< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22			
January	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
February	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
March	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
April	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
May	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
July	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
August	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
September	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
October	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
November	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
December	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--

DIAMOUTHRX

2017	# Days Recorded	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
		< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22			
January	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
February	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
March	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
April	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
May	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
July	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
August	28	0	0	0	0	0	0	28	0	0	0	0	15.8	5.8	4.6
September	30	0	1	0	0	0	0	11	0	0	0	0	14.1	4.7	3.1
October	31	1	28	0	20	0	0	0	0	0	0	0	7.3	3.2	2.2
November	30	3	30	1	30	0	0	0	0	0	0	0	4.4	1.7	1.0
December	31	30	31	26	31	0	0	0	0	0	0	0	2.1	1.6	0.3

Tuesday, April 4, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data. *Page 1 of 4*

DIAMOUTHRX

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	13	31	7	31	0	0	0	0	0	0	0	2.6	1.4	0.8
February	28	20	28	14	28	0	0	0	0	0	0	0	4.0	2.0	0.8
March	31	15	31	6	31	0	0	0	0	0	0	0	4.8	2.9	1.7
April	30	2	30	0	27	0	0	0	0	0	0	0	7.9	5.3	3.1
May	31	0	14	0	1	0	0	0	0	0	0	0	12.4	6.0	4.3
June	30	0	2	0	0	0	0	14	0	0	0	0	15.4	6.5	4.9
July	31	0	0	0	0	0	0	31	15	0	0	0	17.9	7.0	5.8
August	31	0	0	0	0	0	0	30	5	0	0	0	17.4	5.8	4.7
September	30	0	3	0	0	0	0	7	0	0	0	0	12.8	5.4	3.7
October	31	0	24	0	14	0	0	0	0	0	0	0	9.5	3.2	2.4
November	30	16	26	13	26	0	0	0	0	0	0	0	7.5	2.4	1.1
December	31	29	31	24	31	0	0	0	0	0	0	0	1.7	1.4	0.4

DIAMOUTHRX

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	24	31	13	31	0	0	0	0	0	0	0	1.9	1.7	0.7
February	28	25	28	25	28	0	0	0	0	0	0	0	1.8	0.9	0.2
March	31	16	31	12	31	0	0	0	0	0	0	0	4.2	3.1	1.2
April	30	0	30	0	30	0	0	0	0	0	0	0	6.7	4.9	3.0
May	31	0	19	0	3	0	0	0	0	0	0	0	10.3	5.9	3.8
June	30	0	2	0	0	0	0	13	0	0	0	0	15.2	7.1	5.3
July	31	0	0	0	0	0	0	31	0	0	0	0	16.2	6.8	5.3
August	31	0	0	0	0	0	0	31	4	0	0	0	17.2	6.1	5.0
September	30	0	3	0	2	0	0	9	0	0	0	0	14.4	4.9	3.1
October	31	8	30	3	23	0	0	0	0	0	0	0	7.0	3.9	2.3
November	30	14	30	11	30	0	0	0	0	0	0	0	5.4	2.6	1.2
December	31	29	31	21	31	0	0	0	0	0	0	0	1.8	1.7	0.4

Tuesday, April 4, 2023

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

DIAMOUTHRX

2020	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	21	31	13	31	0	0	0	0	0	0	0	2.5	1.6	0.6
February	29	21	29	13	29	0	0	0	0	0	0	0	2.4	2.2	1.0
March	31	19	31	6	31	0	0	0	0	0	0	0	5.2	3.8	2.1
April	30	4	30	0	27	0	0	0	0	0	0	0	7.1	5.4	3.7
May	31	0	21	0	4	0	0	0	0	0	0	0	13.0	6.6	4.1
June	30	0	0	0	0	0	0	12	0	0	0	0	16.7	7.6	4.7
July	31	0	0	0	0	0	0	31	12	0	0	0	18.5	7.3	6.0
August	31	0	0	0	0	0	0	31	2	0	0	0	17.2	6.6	5.2
September	30	0	0	0	0	0	0	8	0	0	0	0	14.6	5.7	3.5
October	31	3	14	2	12	0	0	0	0	0	0	0	10.4	3.4	2.5
November	30	22	28	17	28	0	0	0	0	0	0	0	7.5	3.2	0.9
December	31	29	31	26	31	0	0	0	0	0	0	0	1.6	1.3	0.3

DIAMOUTHRX

2021	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	23	31	15	31	0	0	0	0	0	0	0	1.9	1.6	0.6
February	28	25	28	21	28	0	0	0	0	0	0	0	1.9	1.5	0.4
March	31	12	31	0	31	0	0	0	0	0	0	0	4.2	3.4	1.8
April	30	3	30	0	28	0	0	0	0	0	0	0	6.8	4.6	3.6
May	31	0	26	0	7	0	0	0	0	0	0	0	11.7	6.3	4.2
June	30	0	5	0	0	0	0	15	8	5	4	0	19.4	6.8	5.2
July	31	0	0	0	0	0	0	31	20	3	2	0	18.7	6.9	6.0
August	31	0	0	0	0	0	0	28	8	0	0	0	17.4	6.2	4.6
September	30	0	0	0	0	0	0	6	0	0	0	0	13.8	5.2	3.7
October	31	0	23	0	17	0	0	0	0	0	0	0	8.7	3.7	2.4
November	29	7	29	3	26	0	0	0	0	0	0	0	6.1	2.8	1.4
December	31	23	30	19	30	0	0	0	0	0	0	0	6.0	2.1	0.6

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

DIAMOUTHRX

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	25	31	20	31	0	0	0	0	0	0	0	2.1	1.5	0.4
February	28	20	28	11	28	0	0	0	0	0	0	0	2.4	1.8	0.8
March	31	5	31	1	31	0	0	0	0	0	0	0	5.9	3.5	2.2
April	30	10	30	0	29	0	0	0	0	0	0	0	6.5	5.1	3.0
May	31	0	29	0	13	0	0	0	0	0	0	0	8.5	5.4	3.5
June	30	0	2	0	0	0	0	7	0	0	0	0	14.5	6.0	3.6
July	7	0	0	0	0	0	0	5	0	0	0	0	13.8	5.1	3.9

Tuesday, April 4, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data. *Page 4 of 4*

East Fork Tepee Creek Monthly Temperature Summaries (degrees C)

EFTEPEE175RDX

2016	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	12	31	7	31	0	0	0	0	0	0	0	2.3	1.0	0.4
February	29	1	29	0	29	0	0	0	0	0	0	0	5.2	2.5	1.3
March	31	0	30	0	16	0	0	0	0	0	0	0	8.1	4.1	2.2
April	30	0	1	0	0	0	0	0	0	0	0	0	11.9	4.9	3.6
May	31	0	0	0	0	0	0	1	0	0	0	0	13.5	4.8	3.4
June	30	0	0	0	0	0	0	20	0	0	0	0	15.4	4.9	3.7
July	31	0	0	0	0	0	0	31	5	0	0	0	17.7	4.9	3.8
August	31	0	0	0	0	0	0	31	4	0	0	0	17.0	5.7	4.6
September	30	0	5	0	0	0	0	0	0	0	0	0	12.4	5.0	3.4
October	31	0	4	0	1	0	0	0	0	0	0	0	10.7	3.0	1.5
November	30	0	14	0	12	0	0	0	0	0	0	0	7.6	2.1	1.3
December	31	27	31	22	31	0	0	0	0	0	0	0	3.3	1.7	0.4

EFTEPEE175RDX

2017	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	28	31	25	31	0	0	0	0	0	0	0	1.2	0.7	0.2
February	28	18	28	10	28	0	0	0	0	0	0	0	1.7	1.2	0.5
March	31	0	31	0	25	0	0	0	0	0	0	0	7.0	4.0	1.7
April	30	0	12	0	0	0	0	0	0	0	0	0	9.8	5.1	3.0
May	31	0	0	0	0	0	0	14	0	0	0	0	14.3	5.7	4.1
June	30	0	0	0	0	0	0	20	0	0	0	0	14.4	4.5	3.3
July	31	0	0	0	0	0	0	31	0	0	0	0	15.0	4.3	3.8
August	31	0	0	0	0	0	0	31	0	0	0	0	16.7	4.8	3.8
September	30	0	0	0	0	0	0	11	0	0	0	0	15.2	4.1	2.7
October	31	1	24	0	21	0	0	0	0	0	0	0	7.1	3.2	2.0
November	30	2	28	0	27	0	0	0	0	0	0	0	7.9	2.5	1.0
December	31	20	31	15	31	0	0	0	0	0	0	0	3.6	1.4	0.5

Tuesday, April 4, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data. *Page 1 of 4*

EFTEPEE175RDX

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	2	31	1	31	0	0	0	0	0	0	0	3.6	1.9	0.9
February	28	9	28	6	27	0	0	0	0	0	0	0	5.5	2.2	1.2
March	31	4	31	0	28	0	0	0	0	0	0	0	6.9	3.9	2.1
April	30	0	16	0	4	0	0	0	0	0	0	0	11.5	5.6	3.4
May	31	0	0	0	0	0	0	21	0	0	0	0	13.9	6.1	4.0
June	30	0	0	0	0	0	0	15	0	0	0	0	14.7	5.3	3.9
July	31	0	0	0	0	0	0	31	15	0	0	0	18.4	6.6	5.5
August	31	0	0	0	0	0	0	27	6	0	0	0	18.0	5.5	4.3
September	30	0	8	0	0	0	0	0	0	0	0	0	11.8	4.3	3.4
October	31	0	20	0	16	0	0	0	0	0	0	0	9.8	3.4	2.1
November	30	22	25	21	25	0	0	0	0	0	0	0	8.2	2.4	0.5
December	31	26	31	22	31	0	0	0	0	0	0	0	2.3	1.8	0.3

EFTEPEE175RDX

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	28	31	23	31	0	0	0	0	0	0	0	1.8	1.4	0.4
February	28	26	28	26	28	0	0	0	0	0	0	0	1.4	0.7	0.1
March	31	23	31	20	31	0	0	0	0	0	0	0	5.0	3.6	0.8
April	30	0	18	0	8	0	0	0	0	0	0	0	11.0	5.2	3.1
May	31	0	1	0	0	0	0	10	0	0	0	0	14.1	6.0	4.0
June	30	0	0	0	0	0	0	30	0	0	0	0	16.3	5.8	4.5
July	31	0	0	0	0	0	0	31	5	0	0	0	17.1	6.8	5.1
August	31	0	0	0	0	0	0	31	13	0	0	0	18.2	6.4	5.0
September	30	0	3	0	0	0	0	12	0	0	0	0	15.5	4.9	2.9
October	31	8	29	5	22	0	0	0	0	0	0	0	6.6	4.1	1.8
November	30	26	30	25	30	0	0	0	0	0	0	0	3.6	1.8	0.3
December	31	31	31	31	31	0	0	0	0	0	0	0	0.1	0.1	0.0

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

EFTEPEE175RDX

2020	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	22	31	21	31	0	0	0	0	0	0	0	4.0	1.7	0.5
February	29	9	29	2	29	0	0	0	0	0	0	0	4.5	2.8	1.5
March	31	9	31	2	30	0	0	0	0	0	0	0	5.9	4.0	2.4
April	30	1	15	0	6	0	0	0	0	0	0	0	10.9	5.2	3.7
May	31	0	0	0	0	0	0	7	0	0	0	0	15.3	6.1	3.8
June	30	0	0	0	0	0	0	22	6	0	0	0	18.7	7.1	4.6
July	31	0	0	0	0	0	0	31	19	15	12	0	20.7	8.4	6.6
August	31	0	0	0	0	0	0	31	16	4	3	0	18.7	7.3	5.6
September	30	0	0	0	0	0	0	9	0	0	0	0	15.5	5.4	3.6
October	31	8	13	6	12	0	0	0	0	0	0	0	10.3	4.2	2.4
November	30	24	29	22	28	0	0	0	0	0	0	0	7.1	4.0	0.7
December	31	31	31	31	31	0	0	0	0	0	0	0	0.3	0.4	0.0

EFTEPEE175RDX

2021	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	9	31	3	31	0	0	0	0	0	0	0	3.6	2.0	0.8
February	28	15	28	8	28	0	0	0	0	0	0	0	2.9	2.1	0.9
March	31	1	31	0	31	0	0	0	0	0	0	0	6.4	4.2	2.6
April	30	0	22	0	5	0	0	0	0	0	0	0	12.1	5.6	4.2
May	31	0	1	0	0	0	0	10	0	0	0	0	15.3	7.3	5.2
June	30	0	0	0	0	3	1	28	13	10	9	4	24.3	8.2	6.2
July	31	0	0	0	0	0	0	31	31	31	31	1	22.3	9.6	8.4
August	31	0	0	0	0	0	0	31	19	17	16	0	21.9	8.3	6.1
September	30	0	0	0	0	0	0	12	0	0	0	0	15.2	6.6	4.4
October	31	1	22	0	14	0	0	0	0	0	0	0	9.1	4.1	2.6
November	29	7	27	5	23	0	0	0	0	0	0	0	7.5	2.7	1.4
December	31	23	31	18	30	0	0	0	0	0	0	0	5.9	2.7	0.7

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

EFTEPEE175RDX

2022	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	22	31	17	31	0	0	0	0	0	0	0	2.2	1.0	0.5
February	28	22	28	9	28	0	0	0	0	0	0	0	2.7	1.7	0.9
March	31	2	28	0	21	0	0	0	0	0	0	0	7.9	3.7	2.3
April	30	0	25	0	12	0	0	0	0	0	0	0	8.7	4.9	3.0
May	31	0	3	0	0	0	0	0	0	0	0	0	12.2	5.4	3.4
June	30	0	0	0	0	0	0	17	0	0	0	0	14.8	4.5	3.3
July	7	0	0	0	0	0	0	7	0	0	0	0	14.0	4.2	2.9

Tuesday, April 4, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

Fish Lake Stream Monthly Temperature Summaries (degrees C)

FISHLAKRDX

2016	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	4	31	3	31	0	0	0	0	0	0	0	3.2	1.7	0.6
February	29	0	29	0	29	0	0	0	0	0	0	0	3.5	1.2	0.7
March	31	1	31	0	31	0	0	0	0	0	0	0	4.5	2.0	1.2
April	30	0	30	0	26	0	0	0	0	0	0	0	6.0	2.6	1.8
May	31	0	2	0	0	0	0	0	0	0	0	0	10.4	3.4	2.3
June	30	0	0	0	0	0	0	2	0	0	0	0	13.7	4.0	2.7
July	31	0	0	0	0	0	0	0	0	0	0	0	11.7	4.1	3.1
August	31	0	0	0	0	0	0	0	0	0	0	0	10.5	3.7	3.0
September	30	0	4	0	0	0	0	0	0	0	0	0	8.5	3.2	2.1
October	31	0	3	0	1	0	0	0	0	0	0	0	7.3	1.9	1.0
November	30	0	15	0	1	0	0	0	0	0	0	0	6.5	1.3	0.8
December	31	11	31	4	31	0	0	0	0	0	0	0	3.2	1.5	0.8

FISHLAKRDX

2017	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	16	31	11	31	0	0	0	0	0	0	0	2.9	2.1	0.7
February	28	6	28	1	28	0	0	0	0	0	0	0	2.6	1.9	1.0
March	31	0	31	0	31	0	0	0	0	0	0	0	4.1	1.8	1.0
April	30	0	30	0	30	0	0	0	0	0	0	0	4.9	2.4	1.5
May	31	0	19	0	14	0	0	0	0	0	0	0	10.5	3.6	2.4
June	30	0	0	0	0	0	0	10	0	0	0	0	13.0	3.9	2.5
July	31	0	0	0	0	0	0	6	0	0	0	0	12.8	3.9	3.4
August	30	0	0	0	0	0	0	0	0	0	0	0	11.3	4.3	2.8
September	30	0	0	0	0	0	0	0	0	0	0	0	9.3	2.8	1.9
October	31	0	25	0	13	0	0	0	0	0	0	0	6.3	2.2	1.4
November	30	0	30	0	29	0	0	0	0	0	0	0	4.9	1.3	0.6
December	31	8	31	1	31	0	0	0	0	0	0	0	3.6	1.6	0.8

Tuesday, April 4, 2023   NOTE: All Temperatures and Ranges in degrees C,   -- Indicates No Available Data.   *Page 1 of 4*

FISHLAKRDX

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	3.0	1.2	0.6
February	28	6	28	2	28	0	0	0	0	0	0	0	3.5	1.5	0.9
March	31	0	31	0	31	0	0	0	0	0	0	0	4.6	2.0	1.5
April	30	0	30	0	27	0	0	0	0	0	0	0	6.4	3.3	1.9
May	31	0	3	0	0	0	0	0	0	0	0	0	12.3	3.3	2.3
June	30	0	0	0	0	0	0	0	0	0	0	0	12.4	4.1	2.9
July	31	0	0	0	0	0	0	0	0	0	0	0	11.9	4.4	3.7
August	31	0	0	0	0	0	0	0	0	0	0	0	11.2	3.7	2.9
September	30	0	5	0	0	0	0	0	0	0	0	0	8.9	3.1	2.2
October	31	0	20	0	10	0	0	0	0	0	0	0	7.1	2.0	1.5
November	30	0	25	0	24	0	0	0	0	0	0	0	7.2	2.0	0.9
December	31	1	31	0	31	0	0	0	0	0	0	0	3.1	1.6	0.7

FISHLAKRDX

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	2	31	0	31	0	0	0	0	0	0	0	3.3	1.7	0.9
February	28	13	28	5	28	0	0	0	0	0	0	0	3.0	1.8	1.0
March	31	8	31	2	31	0	0	0	0	0	0	0	4.7	2.6	1.8
April	30	0	30	0	30	0	0	0	0	0	0	0	5.2	2.5	1.8
May	31	0	6	0	2	0	0	7	0	0	0	0	11.1	3.4	2.1
June	30	0	0	0	0	0	0	5	0	0	0	0	13.5	4.0	3.0
July	31	0	0	0	0	0	0	0	0	0	0	0	11.4	4.4	3.2
August	31	0	0	0	0	0	0	0	0	0	0	0	11.5	3.9	3.0
September	30	0	3	0	2	0	0	0	0	0	0	0	10.1	3.1	1.8
October	31	1	27	0	19	0	0	0	0	0	0	0	6.4	2.7	1.6
November	30	2	28	2	25	0	0	0	0	0	0	0	5.8	1.9	1.0
December	31	2	31	0	31	0	0	0	0	0	0	0	3.4	1.7	0.7

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

FISHLAKRDX

2020	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	6	31	1	31	0	0	0	0	0	0	0	3.4	1.4	0.8
February	29	5	29	0	29	0	0	0	0	0	0	0	3.3	1.7	1.0
March	31	0	31	0	31	0	0	0	0	0	0	0	4.8	2.4	1.5
April	30	0	30	0	27	0	0	0	0	0	0	0	5.9	3.2	2.2
May	31	0	9	0	4	0	0	0	0	0	0	0	13.2	3.9	2.1
June	30	0	0	0	0	0	0	8	0	0	0	0	13.8	3.9	2.4
July	31	0	0	0	0	0	0	0	0	0	0	0	12.2	4.2	3.5
August	31	0	0	0	0	0	0	0	0	0	0	0	10.9	3.8	3.0
September	23	0	0	0	0	0	0	0	0	0	0	0	9.8	3.3	2.2
October	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
November	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
December	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--

FISHLAKRDX

2021	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
February	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
March	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
April	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
May	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June	21	0	0	0	0	0	0	14	0	0	0	0	16.4	4.0	2.9
July	31	0	0	0	0	0	0	14	0	0	0	0	14.9	4.1	3.4
August	31	0	0	0	0	0	0	0	0	0	0	0	11.3	3.8	2.7
September	30	0	0	0	0	0	0	0	0	0	0	0	9.5	3.1	2.1
October	31	0	18	0	8	0	0	0	0	0	0	0	7.1	2.2	1.5
November	3	0	3	0	2	0	0	0	0	0	0	0	4.5	0.7	0.4
December	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--

FISHLAKRDX

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	23	3	23	0	23	0	0	0	0	0	0	0	3.4	1.7	0.8
February	28	5	28	2	28	0	0	0	0	0	0	0	3.6	1.8	1.0
March	31	1	31	0	31	0	0	0	0	0	0	0	4.6	2.0	1.2
April	30	0	30	0	30	0	0	0	0	0	0	0	5.3	2.9	1.8
May	31	0	24	0	14	0	0	0	0	0	0	0	7.3	3.1	2.0
June	30	0	0	0	0	0	0	7	0	0	0	0	13.4	3.8	2.3
July	31	0	0	0	0	0	0	2	0	0	0	0	13.0	3.7	3.0
August	12	0	0	0	0	0	0	0	0	0	0	0	11.2	3.6	2.9

Tuesday, April 4, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

Klickitat River Monthly Temperature Summaries (degrees C)

KLCOWCAMPX

2016	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	10	31	6	31	0	0	0	0	0	0	0	3.8	2.1	1.0
February	29	1	29	0	29	0	0	0	0	0	0	0	4.4	2.4	1.5
March	31	1	31	0	30	0	0	0	0	0	0	0	6.9	4.4	2.5
April	30	0	30	0	9	0	0	0	0	0	0	0	7.7	4.7	3.5
May	31	0	15	0	0	0	0	0	0	0	0	0	11.0	5.7	4.0
June	30	0	1	0	0	0	0	7	0	0	0	0	14.2	6.6	4.7
July	31	0	0	0	0	0	0	31	8	0	0	0	18.2	7.0	5.6
August	31	0	0	0	0	0	0	31	20	8	7	0	17.8	7.0	5.7
September	30	0	0	0	0	0	0	16	0	0	0	0	13.6	5.9	4.1
October	31	0	1	0	0	0	0	0	0	0	0	0	10.9	3.8	1.7
November	30	0	18	0	15	0	0	0	0	0	0	0	7.4	1.9	1.2
December	31	26	31	24	31	0	0	0	0	0	0	0	3.6	2.6	0.4

KLCOWCAMPX

2017	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	27	31	26	31	0	0	0	0	0	0	0	2.3	1.6	0.2
February	28	17	28	10	28	0	0	0	0	0	0	0	3.4	2.2	1.0
March	31	2	31	0	31	0	0	0	0	0	0	0	5.7	4.0	2.1
April	30	0	30	0	22	0	0	0	0	0	0	0	7.6	5.0	3.1
May	31	0	30	0	5	0	0	0	0	0	0	0	9.3	5.4	4.1
June	30	0	6	0	0	0	0	0	0	0	0	0	12.3	6.0	4.2
July	31	0	0	0	0	0	0	31	3	0	0	0	16.4	7.0	6.2
August	30	0	0	0	0	0	0	30	8	0	0	0	17.1	6.9	5.4
September	30	0	0	0	0	0	0	14	0	0	0	0	16.0	6.0	3.9
October	31	0	22	0	10	0	0	0	0	0	0	0	8.9	4.0	2.4
November	30	0	30	0	29	0	0	0	0	0	0	0	5.9	1.8	1.0
December	31	18	31	13	31	0	0	0	0	0	0	0	3.2	2.1	0.6

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

KLCOWCAMPX

2018	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	2	31	0	31	0	0	0	0	0	0	0	3.3	2.0	1.0
February	28	11	28	6	28	0	0	0	0	0	0	0	4.5	2.1	1.4
March	31	6	31	0	30	0	0	0	0	0	0	0	7.5	5.2	3.0
April	30	0	30	0	19	0	0	0	0	0	0	0	8.8	5.5	3.5
May	31	0	20	0	0	0	0	0	0	0	0	0	10.3	5.8	4.0
June	30	0	3	0	0	0	0	10	0	0	0	0	13.2	6.6	5.1
July	31	1	1	0	0	0	0	31	21	13	7	0	18.9	7.5	6.7
August	31	0	0	0	0	0	0	31	16	2	0	0	18.6	6.8	5.7
September	30	0	0	0	0	0	0	11	0	0	0	0	14.9	6.3	4.6
October	31	0	14	0	1	0	0	0	0	0	0	0	10.6	3.7	2.8
November	30	6	25	1	24	0	0	0	0	0	0	0	8.0	2.4	1.5
December	31	15	31	10	31	0	0	0	0	0	0	0	3.1	1.9	0.9

KLCOWCAMPX

2019	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	17	31	9	31	0	0	0	0	0	0	0	3.2	2.7	1.2
February	28	25	28	21	28	0	0	0	0	0	0	0	3.3	1.8	0.6
March	31	14	31	11	31	0	0	0	0	0	0	0	6.3	4.8	2.4
April	30	0	30	0	20	0	0	0	0	0	0	0	7.9	4.9	3.4
May	31	0	20	0	0	0	0	0	0	0	0	0	9.2	5.8	3.5
June	30	0	1	0	0	0	0	16	0	0	0	0	14.0	6.8	5.6
July	31	0	0	0	0	0	0	31	12	1	0	0	17.9	7.6	6.2
August	31	0	0	0	0	0	0	31	29	8	4	0	19.0	7.3	6.0
September	30	0	0	0	0	0	0	13	2	0	0	0	16.4	6.2	3.6
October	31	3	24	1	15	0	0	0	0	0	0	0	8.4	4.0	2.7
November	30	8	29	5	27	0	0	0	0	0	0	0	7.0	2.9	1.6
December	31	15	31	11	31	0	0	0	0	0	0	0	3.1	1.8	0.8

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

KLCOWCAMPX

2020	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	10	31	7	31	0	0	0	0	0	0	0	3.3	1.7	0.9
February	29	10	29	2	29	0	0	0	0	0	0	0	4.2	3.0	1.7
March	31	7	31	0	29	0	0	0	0	0	0	0	7.1	4.7	3.3
April	30	0	30	0	9	0	0	0	0	0	0	0	8.7	5.9	4.1
May	31	0	24	0	1	0	0	0	0	0	0	0	10.3	5.8	3.8
June	30	0	2	0	0	0	0	0	0	0	0	0	12.6	6.9	4.4
July	31	0	0	0	0	0	0	30	13	0	0	0	18.6	7.6	6.3
August	31	0	0	0	0	0	0	31	21	0	0	0	18.3	7.1	5.9
September	30	0	0	0	0	0	0	14	3	0	0	0	16.7	6.5	4.3
October	31	0	11	0	9	0	0	0	0	0	0	0	11.4	4.4	2.7
November	30	7	28	1	27	0	0	0	0	0	0	0	8.5	3.5	1.6
December	31	15	31	12	31	0	0	0	0	0	0	0	3.2	1.9	0.9

KLCOWCAMPX

2021	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	5	31	0	31	0	0	0	0	0	0	0	3.1	1.9	1.1
February	28	20	28	19	28	0	0	0	0	0	0	0	3.7	3.0	0.9
March	31	7	31	0	31	0	0	0	0	0	0	0	6.5	5.5	3.3
April	30	0	30	0	17	0	0	0	0	0	0	0	8.0	5.6	4.6
May	31	0	30	0	1	0	0	0	0	0	0	0	9.5	5.6	4.3
June	30	0	5	0	0	0	0	7	0	0	0	0	14.8	6.2	4.7
July	31	0	0	0	0	0	0	31	22	0	0	0	18.2	7.4	6.5
August	31	0	0	0	0	0	0	31	17	3	0	0	18.8	6.7	5.4
September	30	0	0	0	0	0	0	15	0	0	0	0	15.7	6.5	4.5
October	31	0	13	0	4	0	0	0	0	0	0	0	9.7	4.2	2.6
November	29	0	25	0	21	0	0	0	0	0	0	0	6.4	2.1	1.2
December	31	10	30	6	30	0	0	0	0	0	0	0	6.0	1.8	0.9

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

KLCOWCAMPX

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	15	31	13	31	0	0	0	0	0	0	0	3.5	1.7	0.8
February	28	13	28	5	28	0	0	0	0	0	0	0	3.9	2.5	1.5
March	31	1	31	0	28	0	0	0	0	0	0	0	6.7	4.0	2.6
April	30	3	30	0	21	0	0	0	0	0	0	0	8.0	5.6	3.7
May	31	0	27	0	6	0	0	0	0	0	0	0	9.2	5.9	3.6
June	30	0	10	0	0	0	0	0	0	0	0	0	11.3	5.7	3.9
July	7	0	0	0	0	0	0	0	0	0	0	0	11.5	5.4	4.1

Monday, March 27, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

Klickitat River Monthly Temperature Summaries (degrees C)

KLCASTLEBR

2016	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
February	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
March	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
April	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
May	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
July	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
August	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
September	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
October	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
November	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
December	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--

KLCASTLEBR

2017	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
February	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
March	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
April	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
May	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
July	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
August	28	0	0	0	0	0	0	28	15	2	0	0	17.9	6.4	4.8
September	30	0	0	0	0	0	0	15	9	0	0	0	17.4	8.7	5.3
October	31	0	24	0	8	0	0	0	0	0	0	0	9.8	7.7	3.2
November	30	0	30	0	28	0	0	0	0	0	0	0	5.5	1.4	1.0
December	31	20	31	14	31	0	0	0	0	0	0	0	2.9	1.4	0.7

Tuesday, April 4, 2023

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

KLCASTLEBR

2018	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	1	31	0	31	0	0	0	0	0	0	0	3.4	1.9	0.9
February	28	12	28	6	28	0	0	0	0	0	0	0	4.8	1.9	1.3
March	31	5	31	0	28	0	0	0	0	0	0	0	6.7	3.7	2.5
April	30	0	28	0	11	0	0	0	0	0	0	0	9.1	4.8	2.9
May	31	0	2	0	0	0	0	0	0	0	0	0	12.3	6.0	3.8
June	30	0	0	0	0	0	0	15	0	0	0	0	15.2	5.7	4.4
July	31	0	0	0	0	0	0	31	24	18	11	0	19.7	6.4	5.6
August	31	0	0	0	0	0	0	31	20	12	6	0	19.1	6.0	4.8
September	30	0	0	0	0	0	0	12	0	0	0	0	15.1	5.3	3.9
October	31	0	11	0	0	0	0	0	0	0	0	0	11.2	3.3	2.4
November	30	4	25	0	24	0	0	0	0	0	0	0	8.8	2.5	1.4
December	31	15	31	7	31	0	0	0	0	0	0	0	3.1	1.7	0.9

KLCASTLEBR

2019	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	18	31	8	31	0	0	0	0	0	0	0	3.4	2.5	1.2
February	28	24	28	16	28	0	0	0	0	0	0	0	3.3	2.2	0.9
March	31	16	31	8	31	0	0	0	0	0	0	0	6.3	4.1	2.6
April	30	0	29	0	11	0	0	0	0	0	0	0	8.0	4.6	3.0
May	31	0	6	0	0	0	0	0	0	0	0	0	10.5	5.2	3.4
June	30	0	0	0	0	0	0	21	0	0	0	0	15.2	6.4	4.6
July	31	0	0	0	0	0	0	31	18	2	0	0	18.0	6.7	5.2
August	31	0	0	0	0	0	0	31	28	10	6	0	19.6	6.3	5.1
September	30	0	0	0	0	0	0	15	4	0	0	0	16.8	5.4	3.2
October	31	3	19	1	11	0	0	0	0	0	0	0	8.9	4.0	2.5
November	30	7	29	4	24	0	0	0	0	0	0	0	6.7	2.8	1.6
December	31	13	31	6	31	0	0	0	0	0	0	0	3.0	1.4	0.9

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

KLCASTLEBR

2020	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	11	31	7	31	0	0	0	0	0	0	0	3.8	2.0	1.0
February	29	7	29	3	29	0	0	0	0	0	0	0	4.2	2.7	1.5
March	31	5	31	0	30	0	0	0	0	0	0	0	6.5	3.9	2.6
April	30	0	27	0	6	0	0	0	0	0	0	0	8.4	4.9	3.5
May	31	0	8	0	0	0	0	0	0	0	0	0	12.3	5.7	3.6
June	30	0	0	0	0	0	0	13	0	0	0	0	15.4	6.2	4.1
July	31	0	0	0	0	0	0	31	17	7	4	0	20.0	6.5	5.3
August	31	0	0	0	0	0	0	31	25	6	2	0	19.1	6.5	5.1
September	30	0	0	0	0	0	0	22	3	0	0	0	16.8	6.0	3.7
October	31	0	10	0	8	0	0	0	0	0	0	0	12.2	3.8	2.5
November	30	5	27	0	27	0	0	0	0	0	0	0	8.0	2.9	1.5
December	31	18	31	11	31	0	0	0	0	0	0	0	3.6	2.0	1.1

KLCASTLEBR

2021	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	6	31	2	31	0	0	0	0	0	0	0	3.3	1.7	1.0
February	28	17	28	8	28	0	0	0	0	0	0	0	3.9	2.9	1.3
March	31	0	31	0	30	0	0	0	0	0	0	0	6.4	4.0	3.0
April	30	0	29	0	10	0	0	0	0	0	0	0	8.4	5.0	3.8
May	31	0	14	0	0	0	0	0	0	0	0	0	11.5	5.5	4.0
June	30	0	0	0	0	0	0	14	4	0	0	0	17.7	6.0	4.6
July	31	0	0	0	0	0	0	31	31	14	2	0	18.9	6.5	5.5
August	31	0	0	0	0	0	0	31	18	16	7	0	19.6	6.2	4.7
September	30	0	0	0	0	0	0	15	0	0	0	0	16.1	5.5	3.9
October	31	0	12	0	3	0	0	0	0	0	0	0	10.5	4.0	2.5
November	29	0	24	0	20	0	0	0	0	0	0	0	7.0	2.2	1.3
December	31	12	30	7	29	0	0	0	0	0	0	0	6.4	2.0	0.9

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

KLCASTLEBR

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	16	31	13	31	0	0	0	0	0	0	0	3.9	1.6	0.7
February	28	9	28	5	28	0	0	0	0	0	0	0	3.5	2.1	1.3
March	31	1	31	0	24	0	0	0	0	0	0	0	6.9	3.5	2.3
April	30	1	29	0	19	0	0	0	0	0	0	0	7.8	4.6	3.0
May	31	0	16	0	0	0	0	0	0	0	0	0	9.8	4.9	3.2
June	30	0	0	0	0	0	0	8	0	0	0	0	13.9	5.5	3.7
July	7	0	0	0	0	0	0	5	0	0	0	0	13.7	5.2	3.6

Tuesday, April 4, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data. ***Page 4 of 4***

Klickitat River Monthly Temperature Summaries (degrees C)

KLHATCHTRP

2016	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	5	31	4	30	0	0	0	0	0	0	0	4.8	1.2	0.7
February	29	0	26	0	18	0	0	0	0	0	0	0	5.9	1.5	0.9
March	31	0	20	0	7	0	0	0	0	0	0	0	7.6	2.7	1.5
April	30	0	0	0	0	0	0	0	0	0	0	0	9.0	2.8	2.2
May	31	0	0	0	0	0	0	1	0	0	0	0	12.2	3.6	2.5
June	30	0	0	0	0	0	0	21	0	0	0	0	15.8	4.2	3.1
July	31	0	0	0	0	0	0	31	0	0	0	0	16.2	3.8	2.9
August	31	0	0	0	0	0	0	31	0	0	0	0	15.3	3.0	2.4
September	30	0	0	0	0	0	0	1	0	0	0	0	12.3	2.9	2.0
October	31	0	0	0	0	0	0	0	0	0	0	0	10.4	1.8	0.8
November	30	0	9	0	4	0	0	0	0	0	0	0	8.4	1.4	0.9
December	31	11	31	2	31	0	0	0	0	0	0	0	4.5	2.0	1.0

KLHATCHTRP

2017	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	16	31	15	31	0	0	0	0	0	0	0	3.5	1.5	0.5
February	28	3	28	1	28	0	0	0	0	0	0	0	4.4	1.9	1.1
March	31	0	22	0	13	0	0	0	0	0	0	0	6.9	2.3	1.3
April	30	0	4	0	0	0	0	0	0	0	0	0	8.4	3.1	1.9
May	31	0	0	0	0	0	0	0	0	0	0	0	11.3	3.4	2.6
June	30	0	0	0	0	0	0	12	0	0	0	0	14.0	3.8	2.7
July	31	0	0	0	0	0	0	31	0	0	0	0	15.7	4.5	4.0
August	59	0	0	0	0	0	0	59	0	0	0	0	15.5	4.2	3.3
September	36	0	0	0	0	0	0	17	0	0	0	0	13.9	3.4	2.2
October	31	0	4	0	1	0	0	0	0	0	0	0	8.8	2.3	1.5
November	30	0	20	0	15	0	0	0	0	0	0	0	6.5	1.9	0.8
December	31	2	31	1	30	0	0	0	0	0	0	0	5.0	1.6	0.7

Monday, March 27, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data. *Page 1 of 4*

KLHATCHTRP

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	30	0	0	0	0	0	0	0	4.8	1.7	0.7
February	28	1	26	0	23	0	0	0	0	0	0	0	5.8	2.2	1.2
March	31	0	23	0	17	0	0	0	0	0	0	0	7.5	3.0	1.7
April	30	0	4	0	1	0	0	0	0	0	0	0	9.6	3.3	2.0
May	31	0	0	0	0	0	0	5	0	0	0	0	13.3	3.9	2.5
June	30	0	0	0	0	0	0	20	0	0	0	0	15.7	4.5	3.4
July	31	0	0	0	0	0	0	31	12	0	0	0	17.3	4.8	4.3
August	31	0	0	0	0	0	0	31	0	0	0	0	16.3	4.3	3.5
September	30	0	0	0	0	0	0	9	0	0	0	0	13.2	3.7	2.7
October	31	0	1	0	0	0	0	0	0	0	0	0	10.5	2.6	1.6
November	30	0	22	0	18	0	0	0	0	0	0	0	9.1	2.3	1.0
December	31	0	31	0	31	0	0	0	0	0	0	0	4.7	1.6	0.8

KLHATCHTRP

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	4.5	1.5	0.9
February	28	10	28	6	28	0	0	0	0	0	0	0	4.6	2.6	1.1
March	31	4	30	1	19	0	0	0	0	0	0	0	6.9	3.0	2.0
April	30	0	5	0	0	0	0	0	0	0	0	0	8.9	3.2	2.1
May	31	0	0	0	0	0	0	2	0	0	0	0	12.3	3.6	2.4
June	30	0	0	0	0	0	0	26	0	0	0	0	15.5	4.8	3.6
July	31	0	0	0	0	0	0	31	0	0	0	0	16.2	4.7	4.0
August	31	0	0	0	0	0	0	31	4	0	0	0	17.0	4.6	3.8
September	30	0	0	0	0	0	0	13	0	0	0	0	15.0	3.8	2.4
October	31	1	10	0	8	0	0	0	0	0	0	0	8.8	3.1	1.9
November	30	2	22	1	19	0	0	0	0	0	0	0	7.3	2.1	1.1
December	31	1	31	0	31	0	0	0	0	0	0	0	4.2	1.5	0.8

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

KLHATCHTRP

2020	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	3	31	0	29	0	0	0	0	0	0	0	5.7	1.9	0.9
February	29	0	29	0	28	0	0	0	0	0	0	0	5.4	1.8	1.3
March	31	0	27	0	15	0	0	0	0	0	0	0	7.4	2.9	1.9
April	30	0	7	0	3	0	0	0	0	0	0	0	9.3	3.6	2.5
May	31	0	0	0	0	0	0	5	0	0	0	0	13.3	3.7	2.4
June	30	0	0	0	0	0	0	17	0	0	0	0	16.6	4.8	3.0
July	31	0	0	0	0	0	0	31	16	0	0	0	17.9	5.2	4.3
August	31	0	0	0	0	0	0	31	3	0	0	0	17.0	5.8	4.3
September	30	0	0	0	0	0	0	23	0	0	0	0	15.8	5.6	3.6
October	31	0	8	0	4	0	0	0	0	0	0	0	11.2	3.3	1.9
November	30	0	27	0	25	0	0	0	0	0	0	0	8.9	2.9	1.2
December	31	3	31	0	29	0	0	0	0	0	0	0	5.2	2.4	0.9

KLHATCHTRP

2021	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	4.6	1.8	0.9
February	28	6	28	4	28	0	0	0	0	0	0	0	4.9	2.8	1.1
March	31	0	26	0	15	0	0	0	0	0	0	0	7.4	3.2	1.9
April	30	0	8	0	0	0	0	0	0	0	0	0	9.7	3.5	2.7
May	31	0	0	0	0	0	0	1	0	0	0	0	12.4	3.5	2.6
June	30	0	0	0	0	0	0	20	7	0	0	0	17.9	4.1	3.2
July	31	0	0	0	0	0	0	31	31	0	0	0	17.7	5.1	4.4
August	31	0	0	0	0	0	0	31	8	0	0	0	17.4	4.8	3.7
September	30	0	0	0	0	0	0	13	0	0	0	0	14.4	4.4	2.8
October	31	0	2	0	0	0	0	0	0	0	0	0	10.2	3.1	1.7
November	30	0	15	0	11	0	0	0	0	0	0	0	7.9	2.2	1.0
December	31	5	29	2	28	0	0	0	0	0	0	0	7.3	1.9	0.9

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

KLHATCHTRP

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	6	31	4	31	0	0	0	0	0	0	0	4.6	2.1	0.9
February	28	5	28	1	28	0	0	0	0	0	0	0	4.6	2.1	1.2
March	31	0	17	0	11	0	0	0	0	0	0	0	7.7	2.4	1.6
April	30	0	18	0	8	0	0	0	0	0	0	0	8.3	3.7	2.2
May	31	0	0	0	0	0	0	0	0	0	0	0	10.4	3.7	2.3
June	30	0	0	0	0	0	0	10	0	0	0	0	14.5	3.8	2.5
July	6	0	0	0	0	0	0	6	0	0	0	0	14.4	3.8	2.6

Monday, March 27, 2023

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

Klickitat River Monthly Temperature Summaries (degrees C)

KLHATCHDS

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
February	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
March	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
April	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
May	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
July	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
August	4	0	0	0	0	0	0	4	0	0	0	0	13.2	3.2	2.9
September	30	0	0	0	0	0	0	6	0	0	0	0	12.6	3.0	2.2
October	31	0	0	0	0	0	0	0	0	0	0	0	10.4	2.0	1.3
November	30	0	14	0	9	0	0	0	0	0	0	0	9.3	1.8	0.8
December	31	0	24	0	19	0	0	0	0	0	0	0	5.4	1.4	0.6

KLHATCHDS

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	26	0	22	0	0	0	0	0	0	0	5.4	1.1	0.7
February	28	0	26	0	26	0	0	0	0	0	0	0	5.5	1.8	0.8
March	31	0	15	0	12	0	0	0	0	0	0	0	7.3	2.3	1.5
April	30	0	0	0	0	0	0	0	0	0	0	0	9.0	2.8	1.8
May	31	0	0	0	0	0	0	1	0	0	0	0	12.1	3.2	2.1
June	30	0	0	0	0	0	0	25	0	0	0	0	14.9	4.1	3.1
July	31	0	0	0	0	0	0	31	0	0	0	0	15.2	4.0	3.4
August	31	0	0	0	0	0	0	31	0	0	0	0	15.8	3.8	3.2
September	30	0	0	0	0	0	0	11	0	0	0	0	14.1	3.1	2.0
October	31	0	4	0	3	0	0	0	0	0	0	0	9.1	2.6	1.5
November	30	0	15	0	11	0	0	0	0	0	0	0	7.8	1.6	0.9
December	31	0	25	0	21	0	0	0	0	0	0	0	5.4	1.3	0.6

Tuesday, April 4, 2023   NOTE: All Temperatures and Ranges in degrees C,   -- Indicates No Available Data.   *Page 1 of 3*

KLHATCHDS

2020	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	21	0	15	0	0	0	0	0	0	0	6.2	1.6	0.8
February	29	0	28	0	23	0	0	0	0	0	0	0	5.9	1.6	1.1
March	31	0	15	0	5	0	0	0	0	0	0	0	8.1	2.4	1.6
April	30	0	2	0	0	0	0	0	0	0	0	0	9.5	3.0	2.2
May	31	0	0	0	0	0	0	5	0	0	0	0	13.1	3.5	2.2
June	30	0	0	0	0	0	0	16	0	0	0	0	15.7	4.1	2.6
July	31	0	0	0	0	0	0	31	0	0	0	0	16.4	4.3	3.6
August	31	0	0	0	0	0	0	31	0	0	0	0	15.6	3.8	3.2
September	30	0	0	0	0	0	0	8	0	0	0	0	14.1	3.5	2.1
October	31	0	3	0	2	0	0	0	0	0	0	0	10.9	2.8	1.5
November	30	0	15	0	12	0	0	0	0	0	0	0	9.1	2.4	1.0
December	31	0	27	0	24	0	0	0	0	0	0	0	5.7	2.1	0.8

KLHATCHDS

2021	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	24	0	17	0	0	0	0	0	0	0	5.4	1.4	0.7
February	28	0	24	0	21	0	0	0	0	0	0	0	5.7	2.1	0.9
March	31	0	8	0	0	0	0	0	0	0	0	0	7.8	2.6	1.5
April	30	0	3	0	0	0	0	0	0	0	0	0	9.8	3.1	2.4
May	31	0	0	0	0	0	0	1	0	0	0	0	12.3	3.1	2.2
June	30	0	0	0	0	0	0	20	5	0	0	0	17.2	3.8	2.9
July	31	0	0	0	0	0	0	31	7	0	0	0	16.9	4.3	3.8
August	31	0	0	0	0	0	0	31	0	0	0	0	16.2	4.1	3.1
September	30	0	0	0	0	0	0	12	0	0	0	0	13.6	3.5	2.2
October	31	0	0	0	0	0	0	0	0	0	0	0	10.2	2.6	1.3
November	2	0	0	0	0	0	0	0	0	0	0	0	6.1	0.5	0.4
December	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Tuesday, April 4, 2023

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

KLHATCHDS

2022	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	17	0	16	0	15	0	0	0	0	0	0	0	5.3	1.2	0.6
February	28	0	27	0	21	0	0	0	0	0	0	0	5.4	1.8	1.1
March	31	0	12	0	6	0	0	0	0	0	0	0	8.0	2.1	1.4
April	30	0	8	0	2	0	0	0	0	0	0	0	8.5	3.3	2.0
May	31	0	0	0	0	0	0	0	0	0	0	0	10.5	3.4	2.2
June	30	0	0	0	0	0	0	10	0	0	0	0	14.2	3.5	2.3
July	6	0	0	0	0	0	0	6	0	0	0	0	14.2	3.4	2.5

Tuesday, April 4, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data. *Page 3 of 3*

Klickitat River Monthly Temperature Summaries (degrees C)

KLCKYKFPHQ

2016	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	0	13	0	11	0	0	0	0	0	0	0	6.6	0.9	0.4
February	29	0	5	0	2	0	0	0	0	0	0	0	7.9	1.7	0.9
March	31	0	0	0	0	0	0	0	0	0	0	0	10.1	3.4	1.7
April	30	0	0	0	0	0	0	0	0	0	0	0	10.9	3.6	2.1
May	31	0	0	0	0	0	0	23	0	0	0	0	14.9	4.6	2.9
June	30	0	0	0	0	0	0	30	12	4	3	0	18.8	5.8	4.1
July	31	0	0	0	0	0	0	31	31	19	12	0	19.8	5.8	4.8
August	31	0	0	0	0	0	0	31	28	14	7	0	18.9	5.6	4.9
September	30	0	0	0	0	0	0	30	0	0	0	0	15.0	5.1	3.7
October	31	0	0	0	0	0	0	0	0	0	0	0	12.7	3.0	1.4
November	30	0	0	0	0	0	0	0	0	0	0	0	9.7	1.7	1.0
December	31	0	29	0	27	0	0	0	0	0	0	0	7.2	2.8	1.1

KLCKYKFPHQ

2017	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	13	31	6	31	0	0	0	0	0	0	0	4.0	1.7	0.7
February	28	0	28	0	28	0	0	0	0	0	0	0	5.0	2.5	1.4
March	31	0	6	0	0	0	0	0	0	0	0	0	9.9	3.1	1.6
April	30	0	0	0	0	0	0	0	0	0	0	0	10.8	3.3	2.1
May	31	0	0	0	0	0	0	10	0	0	0	0	13.4	3.3	2.3
June	30	0	0	0	0	0	0	29	4	0	0	0	16.7	4.2	2.9
July	31	0	0	0	0	0	0	31	31	7	0	0	18.6	5.0	4.3
August	59	0	0	0	0	0	0	59	33	0	0	0	17.8	5.0	3.9
September	31	0	0	0	0	0	0	21	0	0	0	0	15.8	4.3	2.8
October	31	0	0	0	0	0	0	0	0	0	0	0	11.1	3.2	1.9
November	30	0	0	0	0	0	0	0	0	0	0	0	7.9	1.9	0.8
December	31	0	25	0	23	0	0	0	0	0	0	0	6.3	1.3	0.6

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

KLCKYKFPHQ

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	13	0	6	0	0	0	0	0	0	0	7.1	1.5	0.7
February	28	0	16	0	14	0	0	0	0	0	0	0	8.4	2.2	1.4
March	31	0	6	0	0	0	0	0	0	0	0	0	9.7	2.8	2.0
April	30	0	0	0	0	0	0	0	0	0	0	0	12.1	3.3	2.0
May	31	0	0	0	0	0	0	22	0	0	0	0	15.2	3.4	2.4
June	30	0	0	0	0	0	0	30	12	0	0	0	17.6	4.5	3.5
July	31	0	0	0	0	0	0	31	31	25	23	0	19.7	6.4	4.8
August	31	0	0	0	0	0	0	31	21	10	4	0	19.0	4.9	4.1
September	30	0	0	0	0	0	0	29	0	0	0	0	15.6	4.5	3.7
October	31	0	0	0	0	0	0	0	0	0	0	0	13.1	3.1	2.1
November	30	0	15	0	9	0	0	0	0	0	0	0	10.6	1.8	1.1
December	31	0	17	0	12	0	0	0	0	0	0	0	6.4	1.9	0.8

KLCKYKFPHQ

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	21	0	17	0	0	0	0	0	0	0	6.4	1.6	0.9
February	28	0	27	0	25	0	0	0	0	0	0	0	6.0	2.1	1.3
March	31	2	19	0	15	0	0	0	0	0	0	0	11.1	4.3	2.4
April	30	0	0	0	0	0	0	0	0	0	0	0	12.9	4.1	2.4
May	31	0	0	0	0	0	0	16	0	0	0	0	17.5	6.2	3.0
June	30	0	0	0	0	0	0	30	15	4	0	0	18.6	5.8	4.3
July	31	0	0	0	0	0	0	31	31	22	18	0	19.2	6.1	4.9
August	31	0	0	0	0	0	0	31	31	19	10	0	20.3	5.8	4.1
September	30	0	0	0	0	0	0	27	9	0	0	0	17.8	5.0	3.3
October	31	0	6	0	3	0	0	0	0	0	0	0	11.0	7.0	2.9
November	30	1	19	0	12	0	0	0	0	0	0	0	8.3	2.5	1.5
December	31	0	21	0	16	0	0	0	0	0	0	0	6.2	1.5	0.7

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

KLCKYKFPHQ

2020	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	14	0	11	0	0	0	0	0	0	0	10.7	6.1	1.1
February	29	0	10	0	6	0	0	0	0	0	0	0	7.3	2.3	0.8
March	31	0	0	0	0	1	1	0	0	0	0	0	33.4	27.0	1.8
April	30	0	0	0	0	0	0	0	0	0	0	0	10.5	1.4	0.9
May	31	0	0	0	0	0	0	7	0	0	0	0	13.6	1.6	0.9
June	30	0	0	0	0	0	0	30	0	0	0	0	16.4	2.0	1.3
July	31	0	0	0	0	0	0	31	16	0	0	0	17.0	1.8	1.1
August	31	0	0	0	0	0	0	31	5	0	0	0	17.1	1.1	0.7
September	29	0	0	0	0	0	0	28	0	0	0	0	15.0	1.0	0.5
October	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
November	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
December	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--

KLCKYKFPHQ

2021	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
February	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
March	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
April	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
May	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June	23	0	0	0	0	0	0	23	14	11	9	0	20.4	5.5	4.3
July	31	0	0	0	0	0	0	31	31	31	31	0	20.2	5.8	4.7
August	31	0	0	0	0	0	0	31	23	16	15	0	19.8	5.6	4.2
September	30	0	0	0	0	0	0	29	0	0	0	0	17.0	5.3	3.6
October	29	0	0	0	0	0	0	0	0	0	0	0	11.9	3.9	2.1
November	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
December	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

KLCKYKFPHQ

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	20	0	20	0	19	0	0	0	0	0	0	0	5.4	1.7	0.9
February	28	0	27	0	22	0	0	0	0	0	0	0	6.2	2.6	1.3
March	31	0	7	0	1	0	0	0	0	0	0	0	9.8	3.0	1.8
April	30	0	0	0	0	0	0	0	0	0	0	0	11.0	3.9	2.5
May	31	0	0	0	0	0	0	0	0	0	0	0	13.3	3.8	2.4
June	30	0	0	0	0	0	0	27	6	0	0	0	17.1	4.5	2.9
July	31	0	0	0	0	0	0	31	25	20	11	0	19.5	4.9	4.1
August	31	0	0	0	0	0	0	31	31	19	4	0	18.7	5.1	4.2
September	30	0	0	0	0	0	0	30	3	0	0	0	17.1	4.0	3.2
October	31	0	0	0	0	0	0	9	0	0	0	0	13.1	3.5	2.3
November	30	0	22	0	18	0	0	0	0	0	0	0	9.2	2.3	1.2
December	31	3	29	2	28	0	0	0	0	0	0	0	5.4	2.0	0.9

Monday, April 3, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

Klickitat River Monthly Temperature Summaries (degrees C)

KLnewLYLETRP

2016	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	20	0	15	0	0	0	0	0	0	0	6.1	1.2	0.6
February	29	0	5	0	3	0	0	0	0	0	0	0	7.6	1.6	0.8
March	31	0	0	0	0	0	0	0	0	0	0	0	10.0	2.7	1.2
April	30	0	0	0	0	0	0	0	0	0	0	0	11.5	2.9	1.7
May	31	0	0	0	0	0	0	28	0	0	0	0	14.9	3.3	2.3
June	30	0	0	0	0	0	0	30	15	4	2	0	18.7	3.7	2.8
July	31	0	0	0	0	0	0	31	31	22	15	0	20.8	4.4	2.9
August	31	0	0	0	0	0	0	31	31	22	15	0	19.8	4.2	3.3
September	30	0	0	0	0	0	0	30	0	0	0	0	15.6	3.5	2.6
October	31	0	0	0	0	0	0	2	0	0	0	0	12.9	2.4	1.2
November	30	0	1	0	0	0	0	0	0	0	0	0	9.5	1.9	1.1
December	31	6	29	1	27	0	0	0	0	0	0	0	6.1	2.9	1.2

KLnewLYLETRP

2017	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	15	31	12	31	0	0	0	0	0	0	0	4.3	2.1	0.6
February	15	1	15	0	15	0	0	0	0	0	0	0	4.1	2.1	1.3
March	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
April	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
May	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
July	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
August	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
September	26	0	0	0	0	0	0	19	0	0	0	0	16.7	3.6	2.3
October	31	0	0	0	0	0	0	0	0	0	0	0	11.7	2.7	1.8
November	30	0	2	0	0	0	0	0	0	0	0	0	8.1	1.8	0.9
December	31	0	25	0	25	0	0	0	0	0	0	0	6.4	1.7	0.7

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

KLnewLYLETRP

2018	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	0	13	0	7	0	0	0	0	0	0	0	6.6	1.4	0.7
February	28	0	15	0	14	0	0	0	0	0	0	0	8.1	2.4	1.4
March	31	0	5	0	1	0	0	0	0	0	0	0	10.1	3.1	1.9
April	30	0	0	0	0	0	0	0	0	0	0	0	13.2	3.8	2.3
May	31	0	0	0	0	0	0	29	0	0	0	0	16.5	4.3	3.2
June	30	0	0	0	0	0	0	30	16	10	4	0	19.0	4.8	3.6
July	3	0	0	0	0	0	0	3	3	0	0	0	18.2	3.3	3.1
August	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
September	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
October	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
November	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
December	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--

KLnewLYLETRP

2019	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
February	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
March	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
April	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
May	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June	24	0	0	0	0	0	0	24	18	9	4	0	19.5	4.9	3.7
July	31	0	0	0	0	0	0	31	31	31	30	0	20.0	4.3	3.5
August	31	0	0	0	0	0	0	31	31	31	22	0	20.6	4.0	3.2
September	30	0	0	0	0	0	0	27	11	5	0	0	18.6	3.4	2.3
October	31	0	4	0	3	0	0	0	0	0	0	0	11.2	2.7	1.9
November	30	1	19	1	11	0	0	0	0	0	0	0	8.5	2.3	1.2
December	31	1	19	0	16	0	0	0	0	0	0	0	6.3	1.5	0.8

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

KLnewLYLETRP

2020	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	0	13	0	10	0	0	0	0	0	0	0	6.8	1.8	0.9
February	29	0	19	0	12	0	0	0	0	0	0	0	7.3	2.8	1.6
March	31	0	7	0	1	0	0	0	0	0	0	0	10.6	3.5	2.5
April	30	0	0	0	0	0	0	0	0	0	0	0	12.8	4.3	3.1
May	31	0	0	0	0	0	0	26	0	0	0	0	17.2	4.9	3.2
June	30	0	0	0	0	0	0	30	14	10	8	0	20.4	5.2	3.4
July	31	0	0	0	0	0	0	31	31	29	27	0	22.0	4.6	3.6
August	31	0	0	0	0	0	0	31	31	31	26	0	20.9	4.0	3.2
September	30	0	0	0	0	0	0	30	7	5	3	0	18.8	3.8	2.2
October	31	0	4	0	2	0	0	11	0	0	0	0	13.7	4.0	2.0
November	30	0	14	0	6	0	0	0	0	0	0	0	10.4	2.8	1.2
December	31	0	24	0	22	0	0	0	0	0	0	0	7.1	2.3	0.9

KLnewLYLETRP

2021	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	0	11	0	10	0	0	0	0	0	0	0	6.5	1.7	0.8
February	28	3	19	1	13	0	0	0	0	0	0	0	6.8	2.5	1.3
March	31	0	1	0	0	0	0	0	0	0	0	0	9.8	3.8	2.3
April	30	0	0	0	0	0	0	0	0	0	0	0	13.0	4.4	3.3
May	31	0	0	0	0	0	0	20	0	0	0	0	16.0	4.5	3.3
June	30	0	0	0	0	0	0	30	19	12	11	0	21.4	5.3	3.7
July	31	0	0	0	0	0	0	31	31	31	31	0	21.1	4.3	3.5
August	31	0	0	0	0	0	0	31	30	19	18	0	21.1	4.6	3.2
September	30	0	0	0	0	0	0	30	8	0	0	0	17.7	3.9	2.6
October	31	0	0	0	0	0	0	3	0	0	0	0	12.5	3.0	1.6
November	30	0	7	0	2	0	0	0	0	0	0	0	8.9	2.6	1.1
December	31	1	23	0	19	0	0	0	0	0	0	0	7.9	2.1	1.0

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

KLnewLYLETRP

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	7	4	7	3	7	0	0	0	0	0	0	0	3.2	2.3	0.9
February	19	1	16	0	10	0	0	0	0	0	0	0	6.0	2.4	1.7
March	31	0	4	0	1	0	0	0	0	0	0	0	11.0	2.9	1.7
April	2	0	0	0	0	0	0	0	0	0	0	0	9.7	2.9	2.8
May	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
July	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
August	2	0	0	0	0	0	0	2	2	2	0	0	18.4	4.0	3.3
September	30	0	0	0	0	0	0	30	6	2	0	0	18.4	3.5	2.7
October	31	0	0	0	0	0	0	10	0	0	0	0	13.7	2.6	1.8
November	30	1	21	0	20	0	0	0	0	0	0	0	9.9	2.3	1.2
December	31	4	31	4	31	0	0	0	0	0	0	0	4.7	2.4	0.8

Tuesday, April 4, 2023

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

Little Klickitat River Monthly Temperature Summaries (degrees C)

LKLIKMOUTH

2016	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	5	23	4	20	0	0	0	0	0	0	0	6.7	1.6	0.8
February	29	0	8	0	3	0	0	0	0	0	0	0	8.7	2.2	1.4
March	31	0	0	0	0	0	0	0	0	0	0	0	11.3	3.6	1.9
April	30	0	0	0	0	0	0	20	0	0	0	0	14.6	4.0	2.8
May	31	0	0	0	0	0	0	31	2	0	0	0	17.2	4.1	3.0
June	30	0	0	0	0	0	0	30	26	20	17	0	22.6	5.1	3.6
July	31	0	0	0	0	4	0	31	31	31	31	6	24.0	4.8	3.9
August	31	0	0	0	0	0	0	31	31	31	29	0	22.3	4.5	3.6
September	30	0	0	0	0	0	0	30	3	0	0	0	16.9	3.1	2.2
October	31	0	0	0	0	0	0	8	0	0	0	0	13.8	2.7	1.1
November	30	0	0	0	0	0	0	0	0	0	0	0	11.6	2.3	1.0
December	31	17	29	9	28	0	0	0	0	0	0	0	6.3	2.1	0.9

LKLIKMOUTH

2017	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	22	31	20	31	0	0	0	0	0	0	0	3.2	1.6	0.3
February	28	2	28	0	28	0	0	0	0	0	0	0	5.0	2.5	1.4
March	31	0	7	0	0	0	0	0	0	0	0	0	9.5	3.6	2.0
April	30	0	0	0	0	0	0	0	0	0	0	0	11.4	3.7	2.3
May	31	0	0	0	0	0	0	27	3	0	0	0	17.8	4.4	3.2
June	30	0	0	0	0	0	0	30	16	12	11	0	20.7	4.4	3.2
July	31	0	0	0	0	0	0	31	31	31	31	0	22.3	4.5	3.9
August	31	0	0	0	0	0	0	59	59	59	59	0	22.0	4.6	3.2
September	30	0	0	0	0	0	0	35	17	15	13	0	19.2	3.3	2.1
October	31	0	1	0	0	0	0	0	0	0	0	0	11.7	2.6	1.5
November	30	0	6	0	3	0	0	0	0	0	0	0	9.9	2.7	1.2
December	31	3	27	3	25	0	0	0	0	0	0	0	6.3	2.2	0.9

Tuesday, April 4, 2023

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

LKLIKMOUTH

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	16	0	9	0	0	0	0	0	0	0	7.1	1.6	0.9
February	28	1	18	0	14	0	0	0	0	0	0	0	9.0	2.7	1.5
March	31	0	7	0	3	0	0	0	0	0	0	0	10.0	2.9	1.8
April	30	0	0	0	0	0	0	8	0	0	0	0	14.3	4.4	2.5
May	31	0	0	0	0	0	0	31	15	0	0	0	18.7	4.3	3.0
June	30	0	0	0	0	0	0	30	23	15	14	0	21.3	4.5	3.4
July	31	0	0	0	0	2	0	31	31	31	31	10	23.9	5.1	4.3
August	31	0	0	0	0	1	0	31	31	25	23	1	23.0	4.2	3.2
September	30	0	0	0	0	0	0	27	9	0	0	0	17.1	3.1	2.4
October	31	0	0	0	0	0	0	1	0	0	0	0	13.9	2.5	1.6
November	30	2	20	1	16	0	0	0	0	0	0	0	11.9	2.3	1.2
December	31	0	22	0	18	0	0	0	0	0	0	0	6.7	2.5	0.9

LKLIKMOUTH

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	28	0	25	0	0	0	0	0	0	0	6.4	1.9	0.8
February	28	8	27	6	27	0	0	0	0	0	0	0	6.1	2.5	1.1
March	31	5	20	3	18	0	0	0	0	0	0	0	9.5	4.3	2.2
April	30	0	0	0	0	0	0	9	0	0	0	0	14.2	3.9	2.4
May	31	0	0	0	0	0	0	30	5	2	2	0	18.8	4.2	2.9
June	30	0	0	0	0	0	0	30	30	20	15	0	21.8	4.5	3.5
July	31	0	0	0	0	0	0	31	31	31	31	0	22.0	4.8	3.7
August	31	0	0	0	0	2	0	31	31	31	31	6	24.0	4.6	3.3
September	30	0	0	0	0	0	0	27	13	9	8	0	20.0	2.8	2.0
October	31	1	6	0	3	0	0	0	0	0	0	0	11.9	2.8	1.8
November	30	2	20	1	19	0	0	0	0	0	0	0	8.0	2.4	1.3
December	31	3	24	2	21	0	0	0	0	0	0	0	5.8	2.0	0.8

Tuesday, April 4, 2023

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

LKLIKMOUTH

2020	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	3	15	1	14	0	0	0	0	0	0	0	7.1	2.2	1.0
February	29	0	19	0	16	0	0	0	0	0	0	0	7.9	3.4	1.5
March	31	0	8	0	3	0	0	0	0	0	0	0	10.9	3.1	2.2
April	30	0	0	0	0	0	0	16	0	0	0	0	14.5	4.3	2.9
May	31	0	0	0	0	0	0	31	7	5	5	0	20.1	4.7	3.0
June	30	0	0	0	0	1	0	30	30	15	14	0	23.3	5.0	3.4
July	31	0	0	0	0	10	7	31	31	31	31	16	25.5	5.3	4.3
August	31	0	0	0	0	4	0	31	31	31	31	7	23.4	4.7	3.5
September	30	0	0	0	0	0	0	30	9	7	6	0	20.3	3.7	2.0
October	31	0	5	0	3	0	0	11	0	0	0	0	13.3	3.5	1.7
November	30	0	18	0	14	0	0	0	0	0	0	0	9.9	2.7	1.3
December	31	3	26	0	24	0	0	0	0	0	0	0	7.7	3.0	0.9

LKLIKMOUTH

2021	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	14	0	9	0	0	0	0	0	0	0	7.3	2.0	0.9
February	28	5	20	4	17	0	0	0	0	0	0	0	6.7	2.8	1.2
March	31	0	5	0	0	0	0	0	0	0	0	0	9.6	3.4	2.1
April	30	0	0	0	0	0	0	15	0	0	0	0	15.6	4.2	3.1
May	31	0	0	0	0	0	0	31	10	3	2	0	19.3	5.0	3.3
June	30	0	0	0	0	10	6	30	28	25	23	11	28.5	5.9	4.1
July	31	0	0	0	0	24	16	31	31	31	31	31	25.4	5.4	4.3
August	31	0	0	0	0	12	7	31	31	29	23	16	25.8	5.0	3.4
September	30	0	0	0	0	0	0	30	13	4	0	0	18.9	3.6	2.2
October	29	0	0	0	0	0	0	3	0	0	0	0	12.7	2.3	1.3
November	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
December	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

LKLIKMOUTH

2022	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	28	3	28	3	28	0	0	0	0	0	0	0	4.9	1.5	0.7
February	28	4	25	1	20	0	0	0	0	0	0	0	5.9	2.6	1.4
March	31	0	7	0	1	0	0	0	0	0	0	0	11.3	2.9	1.9
April	30	0	0	0	0	0	0	0	0	0	0	0	11.4	3.7	2.3
May	31	0	0	0	0	0	0	13	0	0	0	0	14.4	4.0	2.5
June	30	0	0	0	0	0	0	30	11	7	7	0	20.0	4.1	2.8
July	6	0	0	0	0	0	0	6	6	6	6	0	19.7	3.9	2.7

Tuesday, April 4, 2023

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

Logging Camp Creek Monthly Temperature Summaries (degrees C)

LOGGCAMPCR

2016	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	7	0	9	0	0	0	0	0	0	0	6.2	1.3	0.7
February	29	0	8	0	0	0	0	0	0	0	0	0	8.8	2.1	1.3
March	31	0	0	0	0	0	0	0	0	0	0	0	9.7	2.7	1.6
April	30	--	--	--	--	--	--	--	--	--	--	--	--	--	--
May	31	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June	30	--	--	--	--	--	--	--	--	--	--	--	--	--	--
July	31	--	--	--	--	--	--	--	--	--	--	--	--	--	--
August	31	--	--	--	--	--	--	--	--	--	--	--	--	--	--
September	30	0	0	0	0	0	0	30	5	0	0	0	17.4	0.8	0.5
October	31	0	0	0	0	0	0	12	0	0	0	0	14.1	1.1	0.4
November	30	0	0	0	0	0	0	0	0	0	0	0	11.9	1.5	0.5
December	31	0	16	9	28	0	0	0	0	0	0	0	8.2	2.8	0.9

LOGGCAMPCR

2017	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	7	31	0	26	0	0	0	0	0	0	0	4.8	1.7	0.6
February	28	0	1	0	22	0	0	0	0	0	0	0	5.6	1.9	0.8
March	31	0	8	0	2	0	0	0	0	0	0	0	8.8	3.1	1.5
April	30	0	0	0	0	0	0	0	0	0	0	0	10.4	3.1	2.1
May	31	0	0	0	0	0	0	10	0	0	0	0	15.5	2.9	2.3
June	30	0	0	0	0	0	0	29	7	1	0	0	19.1	4.1	2.4
July	31	0	0	0	0	5	0	31	31	31	31	14	26.4	12.9	5.5
August	31	0	0	0	0	0	0	31	31	31	31	0	19.6	1.7	0.6
September	30	0	0	0	0	0	0	30	17	13	12	0	19.7	2.1	0.8
October	31	0	0	0	0	0	0	5	0	0	0	0	13.7	1.7	0.7
November	30	0	0	0	0	0	0	0	0	0	0	0	10.5	2.1	0.7
December	31	0	16	0	13	0	0	0	0	0	0	0	7.2	1.6	0.6

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

LOGGCAMPCR

2018	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	7	0	7	0	0	0	0	0	0	0	7.0	1.4	0.7
February	28	0	14	0	11	0	0	0	0	0	0	0	8.5	2.1	1.2
March	31	0	6	0	2	0	0	0	0	0	0	0	9.0	2.4	1.5
April	30	0	0	0	0	0	0	0	0	0	0	0	11.7	3.4	2.0
May	31	0	0	0	0	0	0	27	0	0	0	0	15.6	2.9	1.9
June	30	0	0	0	0	0	0	30	9	0	0	0	17.5	2.9	1.6
July	31	0	0	0	0	0	0	31	28	19	16	0	19.6	1.6	0.8
August	31	0	0	0	0	1	0	31	31	31	24	0	19.8	1.6	0.8
September	30	0	0	0	0	0	0	30	11	0	0	0	17.0	0.8	0.5
October	31	0	0	0	0	0	0	8	0	0	0	0	13.4	0.8	0.4
November	30	0	0	0	0	0	0	0	0	0	0	0	12.0	1.2	0.5
December	31	0	0	0	0	0	0	0	0	0	0	0	8.4	1.8	0.6

LOGGCAMPCR

2019	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	2	0	1	0	0	0	0	0	0	0	6.8	1.2	0.6
February	28	2	27	0	22	0	0	0	0	0	0	0	5.7	1.3	0.9
March	31	1	22	0	11	0	0	0	0	0	0	0	7.7	2.4	1.6
April	30	0	0	0	0	0	0	0	0	0	0	0	11.3	2.9	1.8
May	31	0	0	0	0	0	0	23	0	0	0	0	16.1	3.4	2.1
June	30	0	0	0	0	0	0	30	6	0	0	0	17.8	2.8	1.5
July	31	0	0	0	0	0	0	31	25	3	0	0	17.7	0.8	0.6
August	31	0	0	0	0	0	0	31	31	31	16	0	18.9	0.9	0.5
September	30	0	0	0	0	0	0	30	16	8	0	0	18.0	1.2	0.5
October	31	0	0	0	3	0	0	0	0	0	0	0	11.4	1.2	0.5
November	30	0	2	0	1	0	0	0	0	0	0	0	8.6	1.4	0.4
December	31	0	9	0	9	0	0	0	0	0	0	0	6.6	1.8	0.4

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

LOGGCAMPCR

2020	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	0	0	0	0	0	0	0	0	0	0	0	8.0	1.8	0.8
February	29	0	16	0	7	0	0	0	0	0	0	0	7.9	2.1	1.2
March	31	0	10	0	3	0	0	0	0	0	0	0	9.0	2.8	1.9
April	30	0	0	0	0	0	0	0	0	0	0	0	12.5	3.6	2.4
May	31	0	0	0	0	0	0	22	0	0	0	0	15.2	2.5	1.3
June	30	0	0	0	0	0	0	30	8	0	0	0	17.2	0.9	0.6
July	31	0	0	0	0	0	0	31	22	10	5	0	18.9	1.5	0.9
August	31	0	0	0	0	0	0	31	31	31	31	0	20.2	2.8	1.3
September	30	0	0	0	0	0	0	30	0	9	7	0	18.7	1.9	1.2
October	31	0	0	0	0	0	0	20	0	0	0	0	14.3	1.1	0.5
November	30	0	0	0	0	0	0	0	0	0	0	0	9.5	1.0	0.4
December	31	0	4	0	1	0	0	0	0	0	0	0	9.1	1.44	0.5

LOGGCAMPCR

2021	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	0	9	0	7	0	0	0	0	0	0	0	7.4	1.4	0.7
February	28	4	19	1	15	0	0	0	0	0	0	0	6.9	2.7	1.3
March	31	0	11	0	0	0	0	0	0	0	0	0	9.8	5.9	2.4
April	30	0	0	0	0	0	0	0	0	0	0	0	13.0	3.9	2.7
May	31	0	0	0	0	0	0	24	0	0	0	0	14.6	2.5	1.6
June	30	0	0	0	0	0	0	30	10	5	3	0	18.5	1.2	0.7
July	31	0	0	0	0	0	0	31	31	31	31	0	19.3	1.1	0.7
August	31	0	0	0	0	0	0	31	31	27	23	16	19.8	1.9	0.7
September	30	0	0	0	0	0	0	30	16	4	0	0	17.1	1.0	0.6
October	31	0	0	0	0	0	0	9	0	0	0	0	13.7	0.9	0.4
November	0	0	0	0	0	0	0	0	0	0	0	0	11.4	1.5	0.5
December	0	0	3	0	1	0	0	0	0	0	0	0	9.7	1.5	0.6

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

LOGGCAMPCR

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	1	17	0	13	0	0	0	0	0	0	0	6.7	3.1	0.7
February	28	0	21	0	10	0	0	0	0	0	0	0	5.5	1.9	1.1
March	31	0	4	0	1	0	0	0	0	0	0	0	10.3	2.2	1.5
April	30	0	0	0	0	0	0	0	0	0	0	0	9.5	2.9	1.8
May	31	0	0	0	0	0	0	1	0	0	0	0	12.3	2.6	1.7
June	30	0	0	0	0	0	0	30	3	0	0	0	16.8	2.9	1.8
July	6	0	0	0	0	0	0	3	0	0	0	0	16.6	2.4	1.6

Tuesday, April 4, 2023

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

Page 4 of 4

McCreedy Creek Monthly Temperature Summaries (degrees C)

MCCREEDRDX

2016	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	4.0	1.3	0.6
February	29	0	29	0	29	0	0	0	0	0	0	0	4.2	1.3	0.7
March	31	0	31	0	31	0	0	0	0	0	0	0	4.9	2.2	1.0
April	30	0	30	0	24	0	0	0	0	0	0	0	6.0	2.7	1.8
May	31	0	17	0	0	0	0	0	0	0	0	0	8.7	4.2	2.6
June	30	0	1	0	0	0	0	0	0	0	0	0	11.3	3.7	2.4
July	31	0	0	0	0	0	0	0	0	0	0	0	11.0	2.9	2.0
August	31	0	0	0	0	0	0	0	0	0	0	0	10.2	2.5	2.0
September	30	0	0	0	0	0	0	0	0	0	0	0	8.6	2.4	1.5
October	31	0	1	0	0	0	0	0	0	0	0	0	7.5	1.8	0.9
November	30	0	15	0	15	0	0	0	0	0	0	0	6.7	1.8	0.8
December	31	0	31	0	31	0	0	0	0	0	0	0	4.0	1.8	0.8

MCCREEDRDX

2017	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	3.7	1.3	0.7
February	28	0	28	0	28	0	0	0	0	0	0	0	3.7	1.7	0.9
March	31	0	31	0	31	0	0	0	0	0	0	0	4.5	1.6	0.7
April	30	0	30	0	30	0	0	0	0	0	0	0	5.1	2.0	1.1
May	31	0	28	0	16	0	0	0	0	0	0	0	7.8	3.5	2.3
June	30	0	5	0	0	0	0	0	0	0	0	0	10.4	4.3	2.9
July	31	0	0	0	0	0	0	0	0	0	0	0	10.6	3.4	2.6
August	30	0	0	0	0	0	0	0	0	0	0	0	10.6	2.6	1.9
September	30	0	0	0	0	0	0	0	0	0	0	0	9.9	2.2	1.5
October	31	0	20	0	6	0	0	0	0	0	0	0	6.4	2.0	1.2
November	30	0	29	0	28	0	0	0	0	0	0	0	5.3	1.1	0.5
December	31	0	31	0	31	0	0	0	0	0	0	0	3.9	1.1	0.7

Tuesday, April 4, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

MCCREEDRDX

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	4.0	1.4	0.6
February	28	1	28	0	28	0	0	0	0	0	0	0	4.5	1.5	0.9
March	31	0	31	0	31	0	0	0	0	0	0	0	4.8	1.6	1.1
April	30	0	30	0	27	0	0	0	0	0	0	0	6.3	2.7	1.5
May	31	0	13	0	1	0	0	0	0	0	0	0	9.5	4.3	2.7
June	30	0	1	0	0	0	0	0	0	0	0	0	10.2	3.5	2.3
July	31	0	0	0	0	0	0	0	0	0	0	0	11.2	2.9	2.3
August	31	0	0	0	0	0	0	0	0	0	0	0	11.1	2.4	1.9
September	30	0	0	0	0	0	0	0	0	0	0	0	8.9	2.6	1.6
October	31	0	10	0	0	0	0	0	0	0	0	0	7.5	1.8	1.3
November	30	0	24	0	23	0	0	0	0	0	0	0	7.0	1.4	0.8
December	31	0	31	0	31	0	0	0	0	0	0	0	4.1	1.2	0.7

MCCREEDRDX

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	4.2	1.3	0.8
February	28	0	28	0	28	0	0	0	0	0	0	0	4.2	1.7	0.9
March	31	0	31	0	31	0	0	0	0	0	0	0	4.9	1.8	1.1
April	30	0	30	0	30	0	0	0	0	0	0	0	5.1	2.2	1.3
May	31	0	20	0	3	0	0	0	0	0	0	0	8.3	3.3	2.2
June	30	0	1	0	0	0	0	0	0	0	0	0	10.6	3.9	2.6
July	31	0	0	0	0	0	0	0	0	0	0	0	10.1	3.0	2.0
August	31	0	0	0	0	0	0	0	0	0	0	0	10.9	2.5	1.9
September	30	0	1	0	0	0	0	0	0	0	0	0	9.7	1.9	1.2
October	31	0	20	0	12	0	0	0	0	0	0	0	6.8	2.4	1.3
November	30	0	23	0	19	0	0	0	0	0	0	0	6.2	1.5	1.0
December	31	0	31	0	31	0	0	0	0	0	0	0	4.3	1.3	0.6

MCCREEDRDX

2020	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	4.3	1.3	0.6
February	29	0	29	0	29	0	0	0	0	0	0	0	4.0	1.8	1.0
March	31	0	31	0	31	0	0	0	0	0	0	0	4.7	1.8	1.1
April	30	0	30	0	27	0	0	0	0	0	0	0	5.9	2.5	1.6
May	31	0	19	0	6	0	0	0	0	0	0	0	9.6	4.1	2.3
June	30	0	2	0	0	0	0	0	0	0	0	0	10.8	3.7	2.2
July	31	0	0	0	0	0	0	0	0	0	0	0	11.5	2.9	2.3
August	31	0	0	0	0	0	0	0	0	0	0	0	10.9	2.7	2.0
September	23	0	0	0	0	0	0	0	0	0	0	0	9.8	2.3	1.6
October	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
November	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
December	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--

MCCREEDRDX

2021	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
February	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
March	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
April	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
May	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June	17	0	0	0	0	0	0	0	0	0	0	0	12.5	3.7	2.9
July	31	0	0	0	0	0	0	0	0	0	0	0	11.8	3.4	2.5
August	31	0	0	0	0	0	0	0	0	0	0	0	11.0	2.5	1.8
September	30	0	0	0	0	0	0	0	0	0	0	0	9.5	2.4	1.6
October	31	0	11	0	3	0	0	0	0	0	0	0	7.2	2.3	1.2
November	30	0	25	0	21	0	0	0	0	0	0	0	6.2	2.1	0.9
December	31	0	30	0	29	0	0	0	0	0	0	0	5.9	1.7	0.8

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

MCCREEDRDX

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	1	31	0	31	0	0	0	0	0	0	0	3.9	2.3	0.8
February	28	1	28	0	28	0	0	0	0	0	0	0	4.0	1.3	0.9
March	31	0	31	0	31	0	0	0	0	0	0	0	4.9	2.1	1.1
April	30	0	30	0	30	0	0	0	0	0	0	0	5.0	2.3	1.4
May	31	0	29	0	14	0	0	0	0	0	0	0	7.0	3.1	1.8
June	30	0	7	0	0	0	0	0	0	0	0	0	10.6	3.9	2.6
July	7	0	0	0	0	0	0	0	0	0	0	0	9.8	3.0	2.2

Tuesday, April 4, 2023

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

Piscoe Creek Monthly Temperature Summaries (degrees C)

PISCOMOUTH

2016	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	10	31	5	31	0	0	0	0	0	0	0	2.3	1.1	0.5
February	29	2	29	0	29	0	0	0	0	0	0	0	3.7	1.2	0.7
March	31	0	31	0	31	0	0	0	0	0	0	0	4.9	2.2	1.2
April	30	0	25	0	11	0	0	0	0	0	0	0	8.1	3.7	2.5
May	31	0	0	0	0	0	0	0	0	0	0	0	10.6	3.9	2.7
June	30	0	0	0	0	0	0	11	0	0	0	0	14.3	4.1	2.9
July	31	0	0	0	0	0	0	28	0	0	0	0	15.7	4.0	3.0
August	31	0	0	0	0	0	0	29	0	0	0	0	14.5	3.9	3.0
September	30	0	0	0	0	0	0	0	0	0	0	0	11.0	3.0	2.0
October	31	0	1	0	0	0	0	0	0	0	0	0	8.8	2.0	1.1
November	30	0	15	0	15	0	0	0	0	0	0	0	7.0	1.8	0.9
December	31	26	31	20	30	1	1	0	0	0	0	0	48.6	47.3	1.9

PISCOMOUTH

2017	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	21	31	19	31	0	0	0	0	0	0	0	1.6	1.0	0.3
February	28	14	28	9	27	0	0	0	0	0	0	0	2.8	1.2	0.7
March	31	0	31	0	31	0	0	0	0	0	0	0	4.4	1.9	0.9
April	30	0	30	0	29	0	0	0	0	0	0	0	6.1	3.3	1.7
May	31	0	9	0	1	0	0	0	0	0	0	0	8.9	3.5	1.4
June	30	0	0	0	0	0	0	0	0	0	0	0	11.1	1.5	1.0
July	31	0	0	0	0	0	0	10	0	0	0	0	12.8	1.4	1.1
August	30	0	0	0	0	0	0	30	0	0	0	0	18.2	7.9	2.7
September	30	0	0	0	0	0	0	10	0	0	0	0	13.4	2.7	1.8
October	31	0	19	0	9	0	0	0	0	0	0	0	7.6	1.9	1.2
November	30	0	30	0	30	0	0	0	0	0	0	0	4.6	1.1	0.6
December	31	24	31	19	31	0	0	0	0	0	0	0	2.2	1.1	0.4

Tuesday, April 4, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

PISCOMOUTH

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	4	31	3	31	0	0	0	0	0	0	0	2.5	1.1	0.5
February	28	12	28	10	27	0	0	0	0	0	0	0	3.4	1.4	0.6
March	31	5	31	1	31	0	0	0	0	0	0	0	3.7	1.6	1.0
April	30	0	30	0	25	0	0	0	0	0	0	0	7.3	3.8	1.9
May	31	0	2	0	0	0	0	0	0	0	0	0	11.9	4.2	2.7
June	30	0	0	0	0	0	0	11	0	0	0	0	13.8	3.9	2.9
July	31	0	0	0	0	0	0	29	0	0	0	0	16.4	4.3	3.7
August	31	0	0	0	0	0	0	25	0	0	0	0	16.1	3.8	2.9
September	30	0	0	0	0	0	0	0	0	0	0	0	11.8	3.2	2.0
October	31	0	11	0	5	0	0	0	0	0	0	0	9.0	2.2	1.1
November	30	0	24	0	24	0	0	0	0	0	0	0	7.0	1.2	0.5
December	31	0	31	0	31	0	0	0	0	0	0	0	3.0	0.9	0.3

PISCOMOUTH

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	9	31	4	31	0	0	0	0	0	0	0	1.8	1.3	0.5
February	28	22	28	17	28	0	0	0	0	0	0	0	1.9	1.6	0.3
March	31	14	31	14	31	0	0	0	0	0	0	0	3.0	1.2	0.5
April	30	0	30	0	29	0	0	0	0	0	0	0	5.1	1.7	1.1
May	31	0	4	0	2	0	0	0	0	0	0	0	9.1	2.0	1.2
June	30	0	0	0	0	0	0	6	0	0	0	0	13.4	3.7	2.3
July	31	0	0	0	0	0	0	23	0	0	0	0	14.3	3.9	2.9
August	31	0	0	0	0	0	0	31	0	0	0	0	14.6	3.5	2.7
September	30	0	0	0	0	0	0	7	0	0	0	0	13.2	2.5	1.6
October	31	0	21	0	15	0	0	0	0	0	0	0	6.9	2.8	1.2
November	30	5	30	2	29	0	0	0	0	0	0	0	5.1	1.6	0.8
December	31	13	31	11	31	0	0	0	0	0	0	0	3.0	1.9	0.5

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

PISCOMOUTH

2020	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	9	31	7	31	0	0	0	0	0	0	0	2.9	1.8	0.5
February	29	6	29	4	29	0	0	0	0	0	0	0	2.4	1.1	0.6
March	31	7	31	1	31	0	0	0	0	0	0	0	3.5	1.4	1.0
April	30	0	27	0	19	0	0	0	0	0	0	0	7.6	3.3	1.9
May	31	0	5	0	0	0	0	0	0	0	0	0	12.3	3.8	2.4
June	30	0	0	0	0	0	0	10	0	0	0	0	14.9	4.3	2.6
July	31	0	0	0	0	0	0	30	0	0	0	0	16.3	4.2	3.5
August	31	0	0	0	0	0	0	31	0	0	0	0	15.1	4.0	3.0
September	30	0	0	0	0	0	0	7	0	0	0	0	13.4	3.1	2.0
October	31	0	10	0	10	0	0	0	0	0	0	0	10.0	2.3	1.4
November	30	0	27	0	27	0	0	0	0	0	0	0	6.5	1.7	0.8
December	31	17	31	14	31	0	0	0	0	0	0	0	2.4	1.1	0.4

PISCOMOUTH

2021	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	11	31	6	31	0	0	0	0	0	0	0	2.3	1.1	0.5
February	28	12	28	9	28	0	0	0	0	0	0	0	1.9	0.7	0.4
March	31	0	31	0	31	0	0	0	0	0	0	0	3.0	1.3	0.8
April	30	0	30	0	27	0	0	0	0	0	0	0	7.0	3.1	1.9
May	31	0	12	0	0	0	0	0	0	0	0	0	11.3	4.1	3.0
June	30	0	0	0	0	0	0	13	4	0	0	0	17.6	4.3	3.2
July	31	0	0	0	0	0	0	31	3	0	0	0	17.1	4.6	3.9
August	31	0	0	0	0	0	0	21	0	0	0	0	16.2	3.8	2.8
September	30	0	0	0	0	0	0	0	0	0	0	0	12.5	3.1	2.0
October	31	0	11	0	3	0	0	0	0	0	0	0	8.2	2.1	1.2
November	29	0	25	0	23	0	0	0	0	0	0	0	6.2	1.8	0.8
December	31	0	30	0	29	0	0	0	0	0	0	0	6.1	1.3	0.5

Tuesday, April 4, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

PISCOMOUTH

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	5	31	4	31	0	0	0	0	0	0	0	2.3	0.8	0.3
February	28	0	28	0	28	0	0	0	0	0	0	0	2.0	0.6	0.4
March	31	0	31	0	31	0	0	0	0	0	0	0	4.1	1.3	0.7
April	30	0	30	0	30	0	0	0	0	0	0	0	5.0	2.3	1.4
May	31	0	18	0	8	0	0	0	0	0	0	0	9.2	4.0	2.3
June	30	0	0	0	0	0	0	4	0	0	0	0	13.1	3.6	2.4
July	7	0	0	0	0	0	0	1	0	0	0	0	12.6	3.1	2.2

Tuesday, April 4, 2023

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

Snyder Creek Monthly Temperature Summaries (degrees C)

SNYDERMILL

2016	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	0	28	0	23	0	0	0	0	0	0	0	5.9	1.4	0.8
February	29	0	13	0	4	0	0	0	0	0	0	0	8.5	2.6	1.6
March	31	0	1	0	0	0	0	0	0	0	0	0	9.2	3.2	1.9
April	30	0	0	0	0	0	0	8	0	0	0	0	13.5	3.7	2.6
May	31	0	0	0	0	0	0	31	0	0	0	0	15.7	4.1	2.9
June	30	0	0	0	0	0	0	30	18	12	9	0	20.6	4.5	3.2
July	31	0	0	0	0	0	0	31	31	28	22	0	20.8	3.0	2.0
August	31	0	0	0	0	0	0	31	31	22	14	0	19.1	2.0	1.5
September	30	0	0	0	0	0	0	30	1	0	0	0	16.4	1.9	1.2
October	31	0	0	0	0	0	0	9	0	0	0	0	13.9	2.9	1.1
November	15	0	0	0	0	0	0	0	0	0	0	0	10.8	1.5	1.0
December	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--

SNYDERMILL

2017	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
February	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
March	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
April	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
May	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
July	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
August	28	0	0	0	0	0	0	28	28	28	28	0	21.9	2.3	1.7
September	30	0	0	0	0	0	0	30	13	10	8	0	18.7	2.0	1.3
October	31	0	0	0	0	0	0	0	0	0	0	0	11.9	2.2	1.4
November	30	0	1	0	0	0	0	0	0	0	0	0	9.3	1.9	1.1
December	31	2	28	0	26	0	0	0	0	0	0	0	6.1	1.8	0.7

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

SNYDERMILL

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	21	0	13	0	0	0	0	0	0	0	7.0	1.8	0.9
February	28	1	18	0	14	0	0	0	0	0	0	0	8.4	2.2	1.3
March	31	0	15	0	6	0	0	0	0	0	0	0	9.0	2.9	1.7
April	30	0	1	0	0	0	0	0	0	0	0	0	12.4	3.7	2.2
May	31	0	0	0	0	0	0	30	1	0	0	0	17.0	4.0	2.8
June	30	0	0	0	0	0	0	30	15	12	6	0	19.5	4.4	3.2
July	31	0	0	0	0	0	0	31	31	31	29	0	21.7	4.6	2.9
August	31	0	0	0	0	0	0	31	31	23	22	0	21.2	2.0	1.4
September	30	0	0	0	0	0	0	28	2	0	0	0	16.5	2.0	1.4
October	31	0	0	0	0	0	0	2	0	0	0	0	13.3	2.5	1.3
November	30	1	20	0	16	0	0	0	0	0	0	0	11.6	2.3	1.2
December	31	0	23	0	15	0	0	0	0	0	0	0	6.8	1.6	0.8

SNYDERMILL

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	30	0	0	0	0	0	0	0	5.6	1.8	0.8
February	28	10	28	5	27	0	0	0	0	0	0	0	4.8	1.9	1.1
March	31	7	27	2	21	0	0	0	0	0	0	0	7.9	3.2	1.9
April	30	0	0	0	0	0	0	0	0	0	0	0	12.6	3.4	2.2
May	31	0	0	0	0	0	0	28	2	0	0	0	17.1	4.2	2.9
June	30	0	0	0	0	0	0	30	25	9	6	0	20.1	4.8	3.6
July	31	0	0	0	0	0	0	31	31	31	30	0	20.5	4.0	2.7
August	31	0	0	0	0	0	0	31	31	31	30	0	21.7	2.7	2.0
September	30	0	0	0	0	0	0	27	13	8	6	0	18.8	2.1	1.3
October	31	0	6	0	3	0	0	0	0	0	0	0	11.1	2.4	1.6
November	30	2	20	1	20	0	0	0	0	0	0	0	7.8	2.4	1.2
December	31	3	26	3	22	0	0	0	0	0	0	0	6.3	2.6	0.9

Monday, March 27, 2023   NOTE: All Temperatures and Ranges in degrees C,   -- Indicates No Available Data.

SNYDERMILL

2020	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	0	20	0	16	0	0	0	0	0	0	0	7.3	1.8	1.0
February	29	0	25	0	21	0	0	0	0	0	0	0	7.6	2.2	1.3
March	31	0	22	0	12	0	0	0	0	0	0	0	9.4	4.3	2.7
April	30	0	4	0	0	0	0	13	0	0	0	0	13.8	6.6	4.4
May	31	0	0	0	0	0	0	31	5	0	0	0	18.0	5.3	3.3
June	30	0	0	0	0	0	0	30	14	10	10	0	20.7	4.8	3.0
July	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
August	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
September	30	0	0	0	0	1	0	30	12	10	10	0	23.0	11.1	3.2
October	31	0	3	0	3	0	0	12	0	0	0	0	12.9	2.4	0.8
November	30	0	10	0	4	0	0	0	0	0	0	0	8.8	2.2	1.1
December	31	0	24	0	24	0	0	0	0	0	0	0	7.0	1.9	0.8

SNYDERMILL

2021	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	0	17	0	15	0	0	0	0	0	0	0	7.4	1.6	0.9
February	28	5	23	3	20	0	0	0	0	0	0	0	5.7	1.9	1.0
March	31	0	19	0	2	0	0	0	0	0	0	0	9.1	4.0	2.1
April	30	0	3	0	0	0	0	11	0	0	0	0	14.4	6.4	4.6
May	31	0	0	0	0	0	0	31	3	1	0	0	17.9	5.3	4.0
June	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
July	6	0	0	0	0	0	0	6	6	6	6	0	21.9	3.8	3.0
August	9	0	0	0	0	0	0	9	9	4	0	0	18.2	3.2	2.2
September	30	0	0	0	0	0	0	30	13	6	4	0	20.4	4.9	1.5
October	31	0	0	0	0	0	0	3	0	0	0	0	12.7	2.2	0.8
November	30	0	2	0	0	0	0	0	0	0	0	0	11.2	3.1	1.2
December	31	1	16	0	16	0	0	0	0	0	0	0	8.9	2.3	1.0

NOTE: All Temperatures and Ranges in degrees C,   -- Indicates No Available Data.

SNYDERMILL

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	5	31	3	31	0	0	0	0	0	0	0	4.5	1.3	0.6
February	28	4	28	1	27	0	0	0	0	0	0	0	5.0	2.3	1.1
March	31	0	9	0	1	0	0	0	0	0	0	0	10.4	2.5	1.8
April	30	0	6	0	1	0	0	0	0	0	0	0	10.0	3.7	2.4
May	31	0	0	0	0	0	0	9	0	0	0	0	13.4	3.1	2.0
June	30	0	0	0	0	0	0	30	8	3	0	0	18.6	4.7	2.8
July	6	0	0	0	0	0	0	6	6	1	0	0	18.4	4.1	2.9

Monday, March 27, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data. *Page 4 of 4*

Summit Creek Monthly Temperature Summaries (degrees C)

SUMITMOUTH

2016	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	8	31	8	29	0	0	0	0	0	0	0	5.3	1.5	0.7
February	29	0	20	0	14	0	0	0	0	0	0	0	6.7	2.1	1.2
March	31	0	10	0	0	0	0	0	0	0	0	0	8.8	3.9	1.7
April	30	0	1	0	0	0	0	0	0	0	0	0	11.9	4.7	3.4
May	31	0	0	0	0	0	0	10	0	0	0	0	14.1	4.8	3.4
June	30	0	0	0	0	0	0	25	8	1	0	0	18.5	5.4	3.7
July	31	0	0	0	0	0	0	31	17	7	5	0	19.8	5.2	4.0
August	31	0	0	0	0	0	0	31	15	4	0	0	18.2	4.7	3.8
September	30	0	0	0	0	0	0	11	0	0	0	0	14.0	4.4	2.7
October	31	0	1	0	0	0	0	0	0	0	0	0	12.3	4.0	1.5
November	21	0	5	0	5	0	0	0	0	0	0	0	9.1	2.1	1.3
December	31	24	31	22	31	0	0	0	0	0	0	0	4.6	2.6	0.6

SUMITMOUTH

2017	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	23	31	21	31	0	0	0	0	0	0	0	2.5	1.4	0.3
February	28	8	28	4	28	0	0	0	0	0	0	0	4.5	2.0	1.1
March	31	0	16	0	7	0	0	0	0	0	0	0	7.1	3.0	1.2
April	30	0	6	0	0	0	0	0	0	0	0	0	9.0	4.1	2.2
May	31	0	0	0	0	0	0	8	0	0	0	0	13.9	5.0	3.5
June	30	0	0	0	0	0	0	20	0	0	0	0	16.7	5.0	3.5
July	31	0	0	0	0	0	0	31	18	0	0	0	17.8	4.7	4.0
August	59	0	0	0	0	0	0	59	23	4	0	0	18.1	4.5	3.3
September	41	0	0	0	0	0	0	25	0	0	0	0	16.1	3.8	2.5
October	31	0	12	0	4	0	0	0	0	0	0	0	9.4	3.3	2.0
November	30	0	20	0	15	0	0	0	0	0	0	0	9.5	2.7	1.3
December	31	13	31	10	28	0	0	0	0	0	0	0	5.7	3.0	0.9

Monday, March 27, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data. *Page 1 of 4*

SUMITMOUTH

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	26	0	22	0	0	0	0	0	0	0	5.9	1.5	0.9
February	28	9	21	4	18	0	0	0	0	0	0	0	7.5	2.6	1.5
March	31	0	29	0	19	0	0	0	0	0	0	0	7.6	3.3	2.0
April	30	0	6	0	2	0	0	0	0	0	0	0	11.5	4.7	2.6
May	31	0	0	0	0	0	0	20	0	0	0	0	14.5	5.2	3.6
June	30	0	0	0	0	0	0	24	1	0	0	0	16.9	5.1	3.8
July	31	0	0	0	0	0	0	31	24	12	7	0	19.9	4.9	4.3
August	31	0	0	0	0	0	0	31	19	3	0	0	19.2	4.1	3.4
September	30	0	0	0	0	0	0	11	0	0	0	0	14.0	3.7	2.8
October	31	0	10	0	2	0	0	0	0	0	0	0	11.9	3.4	2.0
November	30	7	23	3	22	0	0	0	0	0	0	0	10.1	2.6	1.3
December	31	8	31	6	29	0	0	0	0	0	0	0	5.1	3.0	1.0

SUMITMOUTH

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	4	31	2	31	0	0	0	0	0	0	0	4.6	2.4	1.1
February	28	23	28	22	28	0	0	0	0	0	0	0	3.8	2.1	0.6
March	31	14	31	11	26	0	0	0	0	0	0	0	6.7	3.5	1.6
April	30	0	3	0	0	0	0	0	0	0	0	0	10.9	4.5	2.4
May	31	0	1	0	0	0	0	10	0	0	0	0	14.1	5.2	3.4
June	30	0	0	0	0	0	0	30	4	0	0	0	17.6	5.0	3.9
July	31	0	0	0	0	0	0	31	19	0	0	0	18.2	5.2	3.8
August	31	0	0	0	0	0	0	31	21	8	5	0	19.5	4.5	3.5
September	30	0	0	0	0	0	0	19	1	0	0	0	16.8	3.2	2.2
October	31	3	16	2	9	0	0	0	0	0	0	0	9.7	4.0	1.9
November	30	10	26	4	22	0	0	0	0	0	0	0	7.2	2.6	1.2
December	31	13	31	8	31	0	0	0	0	0	0	0	4.2	2.7	0.7

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

SUMITMOUTH

2020	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	6	30	4	25	0	0	0	0	0	0	0	6.9	2.8	1.1
February	29	6	26	2	25	0	0	0	0	0	0	0	6.9	3.2	1.7
March	31	5	28	0	21	0	0	0	0	0	0	0	7.8	3.3	2.3
April	30	1	13	0	3	1	1	7	7	3	2	0	86.3	113.4	6.9
May	31	0	1	0	0	0	0	7	0	0	0	0	16.7	5.0	3.2
June	30	0	0	0	0	0	0	30	7	0	0	0	19.1	5.5	3.2
July	31	0	0	0	0	0	0	31	19	12	7	0	20.2	4.3	3.4
August	31	0	0	0	0	0	0	31	17	4	3	0	18.8	3.5	2.6
September	30	0	0	0	0	0	0	24	0	0	0	0	16.1	3.1	1.9
October	31	2	10	0	8	0	0	0	0	0	0	0	11.9	4.2	2.1
November	30	0	27	0	25	0	0	0	0	0	0	0	10.2	4.5	1.5
December	31	15	29	8	28	0	0	0	0	0	0	0	6.7	3.2	0.8

SUMITMOUTH

2021	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	25	0	0	0	0	0	0	0	7.0	2.7	1.1
February	28	8	28	7	26	0	0	0	0	0	0	0	5.0	1.9	1.0
March	31	0	29	0	22	0	0	0	0	0	0	0	7.1	3.8	2.3
April	30	0	15	0	4	0	0	0	0	0	0	0	12.8	4.9	3.6
May	31	0	0	0	0	0	0	9	0	0	0	0	15.1	5.0	3.6
June	30	0	0	0	0	1	0	28	13	11	10	0	23.5	5.4	3.9
July	31	0	0	0	0	0	0	31	31	31	25	0	21.2	5.0	4.3
August	31	0	0	0	0	0	0	31	19	17	16	0	20.9	4.4	3.2
September	30	0	0	0	0	0	0	15	0	0	0	0	16.1	3.7	2.4
October	31	0	7	0	1	0	0	0	0	0	0	0	10.8	3.5	1.8
November	30	0	18	0	12	0	0	0	0	0	0	0	10.2	3.2	1.6
December	31	6	29	5	29	0	0	0	0	0	0	0	8.0	2.8	1.1

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

SUMITMOUTH

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	8	31	6	31	0	0	0	0	0	0	0	5.0	1.6	0.8
February	28	7	28	5	28	0	0	0	0	0	0	0	4.2	2.6	1.3
March	31	0	21	0	10	0	0	0	0	0	0	0	8.5	3.3	2.0
April	30	0	23	0	10	0	0	0	0	0	0	0	8.5	4.2	2.4
May	31	0	3	0	0	0	0	0	0	0	0	0	11.3	4.7	2.9
June	30	0	0	0	0	0	0	12	0	0	0	0	16.2	4.9	3.2
July	6	0	0	0	0	0	0	6	0	0	0	0	15.3	4.1	3.2

Monday, March 27, 2023

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

Surveyors Creek Monthly Temperature Summaries (degrees C)

SURVEYORSX

2016	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	4	31	4	31	0	0	0	0	0	0	0	4.0	1.1	0.5
February	29	0	29	0	29	0	0	0	0	0	0	0	4.7	1.0	0.6
March	31	0	31	0	24	0	0	0	0	0	0	0	5.6	2.1	0.9
April	30	0	9	0	0	0	0	0	0	0	0	0	8.0	2.6	1.7
May	31	0	0	0	0	0	0	0	0	0	0	0	10.1	3.3	2.1
June	30	0	0	0	0	0	0	7	0	0	0	0	13.6	3.4	2.5
July	31	0	0	0	0	0	0	13	0	0	0	0	14.3	2.9	2.1
August	31	0	0	0	0	0	0	14	0	0	0	0	13.3	2.4	1.6
September	30	0	0	0	0	0	0	0	0	0	0	0	10.6	1.3	0.8
October	31	0	0	0	0	0	0	0	0	0	0	0	8.9	1.3	0.6
November	30	0	12	0	5	0	0	0	0	0	0	0	8.1	1.4	0.8
December	31	10	31	2	31	0	0	0	0	0	0	0	4.5	1.5	0.9

SURVEYORSX

2017	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	13	31	12	31	0	0	0	0	0	0	0	3.4	1.9	0.5
February	28	4	28	0	28	0	0	0	0	0	0	0	4.2	2.0	0.9
March	31	0	31	0	27	0	0	0	0	0	0	0	5.3	1.4	0.7
April	30	0	20	0	4	0	0	0	0	0	0	0	6.4	2.1	1.3
May	31	0	1	0	0	0	0	0	0	0	0	0	11.0	3.0	2.2
June	30	0	0	0	0	0	0	4	0	0	0	0	12.7	3.4	2.2
July	31	0	0	0	0	0	0	31	0	0	0	0	13.6	3.2	2.7
August	42	0	0	0	0	0	0	41	0	0	0	0	14.2	3.1	2.2
September	30	0	0	0	0	0	0	10	0	0	0	0	13.2	2.6	1.8
October	31	0	11	0	5	0	0	0	0	0	0	0	7.9	2.8	1.5
November	30	0	26	0	24	0	0	0	0	0	0	0	6.8	1.6	0.8
December	31	8	31	3	31	0	0	0	0	0	0	0	3.7	1.7	0.7

Monday, March 27, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data. *Page 1 of 4*

SURVEYORSX

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	4.0	1.6	0.5
February	28	3	28	0	26	0	0	0	0	0	0	0	4.9	1.8	0.8
March	31	0	31	0	31	0	0	0	0	0	0	0	5.0	1.9	0.9
April	30	0	21	0	11	0	0	0	0	0	0	0	8.0	2.8	1.6
May	31	0	0	0	0	0	0	0	0	0	0	0	11.4	3.1	2.1
June	30	0	0	0	0	0	0	0	0	0	0	0	11.6	2.6	1.4
July	31	0	0	0	0	0	0	13	0	0	0	0	15.4	3.5	1.4
August	31	0	0	0	0	0	0	22	0	0	0	0	14.9	3.2	2.2
September	30	0	0	0	0	0	0	0	0	0	0	0	11.3	2.1	1.5
October	31	0	3	0	0	0	0	0	0	0	0	0	9.2	2.2	1.2
November	30	0	24	0	23	0	0	0	0	0	0	0	8.4	2.2	1.0
December	31	2	31	0	31	0	0	0	0	0	0	0	4.0	1.5	0.7

SURVEYORSX

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	7	31	2	31	0	0	0	0	0	0	0	3.4	2.4	1.0
February	28	12	28	10	28	0	0	0	0	0	0	0	3.3	1.4	0.8
March	31	8	31	3	31	0	0	0	0	0	0	0	4.6	1.6	1.0
April	30	0	23	0	15	0	0	0	0	0	0	0	7.4	2.7	1.5
May	31	0	1	0	0	0	0	0	0	0	0	0	10.6	3.4	2.1
June	30	0	0	0	0	0	0	4	0	0	0	0	13.1	3.0	2.2
July	31	0	0	0	0	0	0	16	0	0	0	0	13.5	3.9	2.2
August	31	0	0	0	0	0	0	31	0	0	0	0	14.8	3.4	2.5
September	30	0	0	0	0	0	0	6	0	0	0	0	13.1	2.6	1.5
October	31	0	14	0	8	0	0	0	0	0	0	0	7.7	2.6	1.4
November	30	0	22	0	21	0	0	0	0	0	0	0	5.9	1.5	0.7
December	31	0	31	0	31	0	0	0	0	0	0	0	3.2	1.5	0.5

Monday, March 27, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

SURVEYORSX

2020	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	2	31	1	31	0	0	0	0	0	0	0	4.2	0.8	0.5
February	29	0	29	0	29	0	0	0	0	0	0	0	4.3	1.4	0.7
March	31	1	31	0	30	0	0	0	0	0	0	0	5.4	2.2	1.5
April	30	0	17	0	8	0	0	0	0	0	0	0	8.7	3.3	2.1
May	31	0	3	0	0	0	0	0	0	0	0	0	12.6	4.1	2.5
June	30	2	2	0	0	1	1	15	0	0	0	0	14.1	3.9	2.2
July	31	0	0	0	0	0	0	19	0	0	0	0	15.3	3.5	2.6
August	31	0	0	0	0	0	0	25	0	0	0	0	14.1	2.8	2.1
September	30	0	0	0	0	0	0	6	0	0	0	0	12.9	2.7	1.6
October	31	0	9	0	8	0	0	0	0	0	0	0	10.5	3.0	1.8
November	30	2	27	0	26	0	0	0	0	0	0	0	8.6	3.4	1.2
December	31	9	31	2	31	0	0	0	0	0	0	0	3.9	1.8	1.0

SURVEYORSX

2021	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	1	31	0	31	0	0	0	0	0	0	0	4.2	1.9	0.8
February	28	5	28	2	28	0	0	0	0	0	0	0	3.9	1.6	0.8
March	31	0	31	0	31	0	0	0	0	0	0	0	4.9	1.7	1.2
April	30	0	22	0	14	0	0	0	0	0	0	0	8.6	3.0	1.9
May	31	0	0	0	0	0	0	0	0	0	0	0	11.5	3.9	2.5
June	30	0	0	0	0	0	0	13	0	0	0	0	16.9	3.9	2.8
July	31	0	0	0	0	0	0	31	0	0	0	0	15.7	3.9	3.1
August	31	0	0	0	0	0	0	20	0	0	0	0	15.2	3.4	2.3
September	30	0	0	0	0	0	0	0	0	0	0	0	12.4	3.0	2.0
October	31	0	9	0	3	0	0	0	0	0	0	0	9.3	3.0	1.7
November	29	0	21	0	19	0	0	0	0	0	0	0	7.6	2.2	1.0
December	31	6	29	5	29	0	0	0	0	0	0	0	6.4	1.4	0.8

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

SURVEYORSX

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	9	31	5	31	0	0	0	0	0	0	0	4.0	2.2	0.7
February	28	5	28	1	28	0	0	0	0	0	0	0	4.0	1.7	0.9
March	31	0	30	0	25	0	0	0	0	0	0	0	5.9	2.0	1.1
April	30	0	29	0	18	0	0	0	0	0	0	0	6.1	2.3	1.4
May	31	0	7	0	0	0	0	0	0	0	0	0	8.7	2.8	1.7
June	30	0	0	0	0	0	0	0	0	0	0	0	12.5	3.4	2.1
July	7	0	0	0	0	0	0	0	0	0	0	0	11.8	2.7	1.9

Monday, March 27, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data. *Page 4 of 4*

Swale Creek Monthly Temperature Summaries (degrees C)

SWALEMOUTH

2016	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	22	0	21	0	0	0	0	0	0	0	7.4	1.5	0.8
February	29	0	6	0	3	0	0	0	0	0	0	0	9.6	2.6	1.6
March	31	0	0	0	0	0	0	0	0	0	0	0	11.8	4.1	2.2
April	30	0	0	0	0	0	0	29	0	0	0	0	15.3	4.4	3.4
May	31	0	0	0	0	0	0	31	6	0	0	0	17.1	4.5	3.4
June	30	0	0	0	0	0	0	30	30	9	3	0	18.8	3.7	2.5
July	31	0	0	0	0	0	0	31	31	31	30	0	19.6	2.4	1.6
August	31	0	0	0	0	0	0	31	31	27	19	0	19.3	2.6	1.4
September	30	0	0	0	0	0	0	30	19	7	3	0	18.5	1.7	1.0
October	31	0	0	0	0	0	0	15	0	0	0	0	14.3	1.0	0.6
November	30	0	0	0	0	0	0	0	0	0	0	0	15.5	5.7	1.0
December	31	2	25	0	24	0	0	0	0	0	0	0	7.2	2.6	1.0

SWALEMOUTH

2017	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	15	31	14	31	0	0	0	0	0	0	0	3.4	1.2	0.5
February	28	2	28	0	28	0	0	0	0	0	0	0	5.0	2.8	1.5
March	31	5	16	0	0	0	0	16	3	1	1	0	21.3	21.2	7.1
April	30	6	12	0	0	1	1	30	14	6	4	0	24.2	21.8	9.6
May	31	0	0	0	0	0	0	31	10	1	0	0	18.3	4.2	2.9
June	30	0	0	0	0	0	0	30	27	12	11	0	19.2	4.5	3.2
July	31	0	0	0	0	0	0	31	31	31	31	0	19.5	2.7	1.8
August	31	0	0	0	0	0	0	31	31	31	28	0	19.7	1.7	1.1
September	31	0	0	0	0	0	0	31	20	13	1	0	18.2	1.5	0.8
October	31	0	0	0	0	0	0	7	0	0	0	0	13.8	1.5	1.0
November	30	0	0	0	0	0	0	0	0	0	0	0	10.5	1.8	0.9
December	31	0	23	0	19	0	0	0	0	0	0	0	6.8	1.3	0.5

Monday, March 27, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data. *Page 1 of 4*

SWALEMOUTH

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	17	0	8	0	0	0	0	0	0	0	7.6	1.7	0.9
February	28	1	16	0	11	0	0	0	0	0	0	0	9.8	2.9	1.7
March	31	0	7	0	0	0	0	0	0	0	0	0	10.9	3.6	2.4
April	30	0	0	0	0	0	0	9	0	0	0	0	14.6	4.1	2.6
May	31	0	0	0	0	0	0	31	20	2	0	0	18.6	5.1	3.2
June	30	0	0	0	0	0	0	30	27	6	0	0	18.3	4.2	2.8
July	24	0	0	0	0	0	0	24	24	18	12	0	18.5	5.6	1.7
August	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
September	30	0	0	0	0	0	0	30	17	10	1	0	18.0	1.5	1.0
October	31	0	0	0	0	0	0	12	0	0	0	0	14.5	1.3	0.5
November	30	0	4	0	1	0	0	0	0	0	0	0	11.0	1.1	0.5
December	31	0	6	0	2	0	0	0	0	0	0	0	6.7	1.6	0.5

SWALEMOUTH

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	19	0	13	0	0	0	0	0	0	0	6.4	1.8	0.7
February	28	3	27	0	26	0	0	0	0	0	0	0	5.9	2.2	1.3
March	31	4	19	1	16	0	0	0	0	0	0	0	12.1	4.8	2.4
April	30	0	0	0	0	0	0	15	0	0	0	0	16.0	5.4	2.9
May	31	0	0	0	0	0	0	31	13	3	2	0	19.1	5.5	3.8
June	30	0	0	0	0	0	0	30	30	26	16	0	20.0	5.0	3.4
July	31	0	0	0	0	0	0	31	31	31	21	0	18.6	2.5	1.5
August	31	0	0	0	0	0	0	31	31	31	31	0	19.1	1.6	1.0
September	30	0	0	0	0	0	0	30	24	16	14	0	19.1	1.8	1.2
October	31	0	0	0	0	0	0	6	0	0	0	0	13.2	1.6	1.1
November	30	0	12	0	6	0	0	0	0	0	0	0	7.5	1.6	0.9
December	31	0	21	0	19	0	0	0	0	0	0	0	5.3	0.9	0.5

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

SWALEMOUTH

2020	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	0	13	0	9	0	0	0	0	0	0	0	7.3	1.4	0.8
February	29	0	19	0	8	0	0	0	0	0	0	0	8.2	2.9	1.7
March	31	0	9	0	0	0	0	0	0	0	0	0	10.9	4.0	2.7
April	30	0	0	0	0	0	0	22	0	0	0	0	15.0	5.6	3.9
May	31	0	0	0	0	0	0	31	0	0	0	0	15.6	4.3	2.4
June	30	0	0	0	0	0	0	30	7	0	0	0	16.5	3.1	1.4
July	31	0	0	0	0	0	0	31	31	12	4	0	19.9	1.8	1.3
August	31	0	0	0	0	0	0	31	31	31	27	0	19.7	1.9	1.3
September	30	0	0	0	0	0	0	30	23	14	8	0	18.6	1.5	1.0
October	31	0	0	0	0	0	0	21	0	0	0	0	14.9	1.3	0.6
November	30	0	0	0	0	0	0	0	0	0	0	0	8.3	1.3	0.6
December	31	0	20	0	16	0	0	0	0	0	0	0	7.3	1.4	0.6

SWALEMOUTH

2021	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	0	8	0	7	0	0	0	0	0	0	0	7.8	2.0	0.9
February	28	0	19	0	13	0	0	0	0	0	0	0	6.7	2.3	1.4
March	31	0	6	0	0	0	0	0	0	0	0	0	10.3	5.1	2.8
April	30	0	0	0	0	0	0	17	0	0	0	0	14.7	6.1	4.7
May	31	0	0	0	0	0	0	31	0	0	0	0	15.6	4.4	2.8
June	30	0	0	0	0	0	0	30	7	0	0	0	17.0	1.5	0.8
July	14	0	0	0	0	2	1	14	14	12	9	1	24.7	5.8	2.1
August	7	0	0	0	0	0	0	7	7	7	7	0	19.4	3.7	2.3
September	30	0	0	0	0	0	0	30	21	12	2	0	18.2	1.8	1.0
October	31	0	0	0	0	0	0	11	0	0	0	0	14.4	1.0	0.5
November	30	0	0	0	0	0	0	0	0	0	0	0	10.9	1.4	0.8
December	31	0	12	0	7	0	0	0	0	0	0	0	8.7	1.6	0.8

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

SWALEMOUTH

2022	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	26	3	26	1	25	0	0	0	0	0	0	0	5.1	1.7	1.0
February	12	1	11	0	8	0	0	0	0	0	0	0	6.2	2.6	1.9
March	31	0	4	0	0	0	0	0	0	0	0	0	12.9	4.3	2.6
April	30	0	0	0	0	0	0	5	0	0	0	0	12.5	5.3	3.3
May	31	0	0	0	0	0	0	29	0	0	0	0	15.4	4.5	3.0
June	30	0	0	0	0	0	0	30	13	7	0	0	18.4	4.0	2.8
July	6	0	0	0	0	0	0	6	6	4	0	0	18.1	2.5	1.7

Monday, March 27, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

Tepee Creek Monthly Temperature Summaries (degrees C)

TEPEEIXLRDX

2016	**# Days Recorded**	**# 1Day Min < 0.5**	**# 1Day Min < 4.4**	**# 1Day Avg <0.5**	**# 1Day Avg <4.4**	**# 1Day Max >23**	**# 1Day Max >24**	**#7Day Avg Daily Max >12**	**#7Day Avg Daily Max >16**	**#7Day Avg Daily Max >17.5**	**#7Day Avg Daily Max >18**	**#7Day Avg Daily Max >22**	**Monthly 1 Day Max**	**Monthly 1 Day Max Range**	**Monthly Avg Daily Range**
January	31	16	31	11	31	0	0	0	0	0	0	0	2.8	0.8	0.3
February	29	0	29	0	29	0	0	0	0	0	0	0	4.5	1.6	0.8
March	31	0	31	0	29	0	0	0	0	0	0	0	5.4	1.7	0.8
April	30	0	1	0	0	0	0	0	0	0	0	0	10.3	4.1	2.3
May	31	0	0	0	0	0	0	0	0	0	0	0	12.3	4.5	3.2
June	30	0	0	0	0	0	0	15	0	0	0	0	14.9	3.8	2.8
July	31	0	0	0	0	0	0	29	0	0	0	0	14.2	2.9	2.1
August	31	0	0	0	0	0	0	0	0	0	0	0	11.1	2.5	1.6
September	30	0	1	0	0	0	0	0	0	0	0	0	8.9	2.7	1.2
October	31	0	4	0	0	0	0	0	0	0	0	0	8.7	2.8	1.1
November	30	0	15	0	12	0	0	0	0	0	0	0	8.2	2.0	1.3
December	31	27	31	19	31	0	0	0	0	0	0	0	3.6	2.0	0.6

TEPEEIXLRDX

2017	**# Days Recorded**	**# 1Day Min < 0.5**	**# 1Day Min < 4.4**	**# 1Day Avg <0.5**	**# 1Day Avg <4.4**	**# 1Day Max >23**	**# 1Day Max >24**	**#7Day Avg Daily Max >12**	**#7Day Avg Daily Max >16**	**#7Day Avg Daily Max >17.5**	**#7Day Avg Daily Max >18**	**#7Day Avg Daily Max >22**	**Monthly 1 Day Max**	**Monthly 1 Day Max Range**	**Monthly Avg Daily Range**
January	31	24	31	22	31	0	0	0	0	0	0	0	2.5	1.9	0.4
February	28	11	28	8	28	0	0	0	0	0	0	0	3.0	1.8	0.7
March	31	0	31	0	31	0	0	0	0	0	0	0	4.8	1.6	0.9
April	30	0	14	0	4	0	0	0	0	0	0	0	6.8	2.9	1.4
May	31	0	0	0	0	0	0	0	0	0	0	0	10.8	2.7	1.8
June	30	0	0	0	0	0	0	0	0	0	0	0	12.0	1.9	1.4
July	31	0	0	0	0	0	0	19	0	0	0	0	12.8	2.1	1.7
August	31	0	0	0	0	0	0	31	0	0	0	0	15.2	4.1	3.1
September	30	0	0	0	0	0	0	8	0	0	0	0	13.0	3.6	2.5
October	31	0	22	0	9	0	0	0	0	0	0	0	7.7	3.4	2.3
November	30	1	29	0	25	0	0	0	0	0	0	0	7.3	2.5	1.1
December	31	19	31	12	31	0	0	0	0	0	0	0	4.0	1.4	0.7

Monday, March 27, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

TEPEEIXLRDX

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	3.7	1.9	0.8
February	28	11	28	6	28	0	0	0	0	0	0	0	4.9	2.6	1.1
March	31	6	31	0	31	0	0	0	0	0	0	0	5.8	3.1	1.8
April	30	0	25	0	10	0	0	0	0	0	0	0	9.3	4.8	2.6
May	31	0	2	0	0	0	0	6	0	0	0	0	13.3	5.7	4.0
June	30	0	0	0	0	0	0	15	0	0	0	0	15.2	6.0	4.6
July	31	0	0	0	0	0	0	31	0	0	0	0	16.1	5.8	4.8
August	31	0	0	0	0	0	0	21	0	0	0	0	14.3	4.9	3.7
September	30	0	4	0	0	0	0	0	0	0	0	0	11.0	3.9	3.0
October	31	0	18	0	6	0	0	0	0	0	0	0	8.9	2.7	2.0
November	30	0	25	0	24	0	0	0	0	0	0	0	8.0	2.2	0.9
December	31	18	31	16	31	0	0	0	0	0	0	0	3.0	1.1	0.5

TEPEEIXLRDX

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	31	31	29	31	0	0	0	0	0	0	0	0.9	0.7	0.3
February	28	28	28	27	28	0	0	0	0	0	0	0	0.8	0.6	0.1
March	31	23	31	23	31	0	0	0	0	0	0	0	4.5	2.7	0.6
April	30	0	25	0	15	0	0	0	0	0	0	0	8.6	4.4	2.4
May	31	0	3	0	0	0	0	1	0	0	0	0	12.5	5.2	3.4
June	30	0	0	0	0	0	0	21	0	0	0	0	15.8	5.5	4.2
July	31	0	0	0	0	0	0	26	0	0	0	0	14.7	4.5	2.9
August	31	0	0	0	0	0	0	13	0	0	0	0	14.0	2.4	1.1
September	30	0	0	0	0	0	0	0	0	0	0	0	12.4	2.5	1.0
October	31	0	4	0	4	0	0	0	0	0	0	0	6.2	2.5	0.4
November	30	0	29	0	29	0	0	0	0	0	0	0	4.5	0.4	0.2
December	31	16	31	14	31	0	0	0	0	0	0	0	1.9	0.9	0.2

 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

TEPEEIXLRDX

2020	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	24	31	21	31	0	0	0	0	0	0	0	4.0	2.1	0.4
February	29	6	29	2	29	0	0	0	0	0	0	0	4.1	2.0	1.2
March	31	12	31	4	31	0	0	0	0	0	0	0	5.0	2.8	1.7
April	30	1	20	0	11	0	0	0	0	0	0	0	10.1	4.7	3.2
May	31	0	4	0	0	0	0	5	0	0	0	0	15.0	5.8	3.7
June	30	0	0	0	0	0	0	12	0	0	0	0	14.9	5.0	2.9
July	31	0	0	0	0	0	0	15	0	0	0	0	15.6	2.3	1.5
August	31	0	0	0	0	0	0	20	0	0	0	0	15.5	2.2	1.7
September	30	0	0	0	0	0	0	18	0	0	0	0	14.1	6.3	3.0
October	31	0	2	0	0	0	0	0	0	0	0	0	8.3	1.3	0.4
November	30	0	22	0	18	0	0	0	0	0	0	0	5.4	0.5	0.1
December	31	5	31	3	31	0	0	0	0	0	0	0	3.4	1.9	0.2

TEPEEIXLRDX

2021	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	9	31	5	31	0	0	0	0	0	0	0	3.7	1.5	0.9
February	28	14	28	12	28	0	0	0	0	0	0	0	2.7	1.5	0.6
March	31	3	31	0	31	0	0	0	0	0	0	0	4.7	3.1	1.7
April	30	0	23	0	14	0	0	0	0	0	0	0	10.8	4.4	3.1
May	31	0	6	0	0	0	0	2	0	0	0	0	13.5	6.2	4.4
June	30	0	0	0	0	0	0	22	0	0	0	0	15.9	6.6	2.7
July	31	0	0	0	0	0	0	31	0	0	0	0	15.3	2.7	1.7
August	31	0	0	0	0	0	0	19	0	0	0	0	15.9	2.7	1.6
September	30	0	0	0	0	0	0	0	0	0	0	0	12.1	2.7	1.5
October	31	0	0	0	0	0	0	0	0	0	0	0	7.6	2.1	0.4
November	29	0	15	0	12	0	0	0	0	0	0	0	6.5	2.5	0.5
December	31	12	27	12	27	0	0	0	0	0	0	0	5.5	2.0	0.3

Monday, March 27, 2023

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

TEPEEIXLRDX

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	20	31	14	31	0	0	0	0	0	0	0	3.3	2.1	0.6
February	28	15	28	8	28	0	0	0	0	0	0	0	2.9	1.9	1.0
March	31	1	30	0	27	0	0	0	0	0	0	0	5.6	2.4	1.3
April	30	1	29	0	23	0	0	0	0	0	0	0	6.3	3.3	1.9
May	31	0	4	0	0	0	0	0	0	0	0	0	10.0	3.1	1.8
June	30	0	0	0	0	0	0	7	0	0	0	0	13.7	3.9	2.6
July	7	0	0	0	0	0	0	5	0	0	0	0	12.9	3.4	2.4

Monday, March 27, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data .

Trapper Creek Monthly Temperature Summaries (degrees C)

TRAPPERRDX

2016	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	3.9	0.9	0.4
February	29	0	29	0	29	0	0	0	0	0	0	0	4.1	0.8	0.4
March	31	0	31	0	31	0	0	0	0	0	0	0	4.5	1.4	0.5
April	30	0	29	0	17	0	0	0	0	0	0	0	6.4	2.7	1.4
May	31	0	5	0	0	0	0	0	0	0	0	0	7.9	2.8	1.6
June	30	0	0	0	0	0	0	0	0	0	0	0	8.6	2.0	1.3
July	31	0	0	0	0	0	0	0	0	0	0	0	8.9	2.1	1.4
August	31	0	0	0	0	0	0	0	0	0	0	0	8.4	1.9	1.4
September	30	0	0	0	0	0	0	0	0	0	0	0	7.3	1.8	1.1
October	31	0	4	0	1	0	0	0	0	0	0	0	6.6	1.2	0.7
November	30	0	16	0	15	0	0	0	0	0	0	0	5.9	1.3	0.6
December	31	0	31	0	31	0	0	0	0	0	0	0	3.8	1.3	0.7

TRAPPERRDX

2017	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	3.6	1.9	0.7
February	28	0	28	0	28	0	0	0	0	0	0	0	3.7	1.9	0.9
March	31	0	31	0	31	0	0	0	0	0	0	0	4.7	1.4	0.6
April	30	0	30	0	30	0	0	0	0	0	0	0	5.0	1.4	0.9
May	31	0	25	0	8	0	0	0	0	0	0	0	9.1	4.6	2.8
June	30	0	1	0	0	0	0	0	0	0	0	0	8.8	3.6	2.0
July	31	0	0	0	0	0	0	0	0	0	0	0	8.5	2.1	1.6
August	30	0	0	0	0	0	0	0	0	0	0	0	8.4	2.3	1.5
September	30	0	0	0	0	0	0	0	0	0	0	0	8.0	1.8	1.1
October	31	0	20	0	8	0	0	0	0	0	0	0	6.2	1.9	1.1
November	30	0	30	0	28	0	0	0	0	0	0	0	5.1	1.1	0.5
December	31	0	31	0	31	0	0	0	0	0	0	0	4.2	1.3	0.7

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

TRAPPERRDX

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	4.2	1.4	0.5
February	28	0	28	0	28	0	0	0	0	0	0	0	4.7	1.4	0.8
March	31	0	31	0	31	0	0	0	0	0	0	0	4.9	1.7	1.1
April	30	0	28	0	19	0	0	0	0	0	0	0	6.3	2.2	1.3
May	31	0	2	0	0	0	0	0	0	0	0	0	7.9	2.6	1.5
June	30	0	0	0	0	0	0	0	0	0	0	0	8.3	2.3	1.4
July	31	0	0	0	0	0	0	0	0	0	0	0	9.1	2.0	1.5
August	31	0	0	0	0	0	0	0	0	0	0	0	9.0	1.8	1.4
September	30	0	3	0	0	0	0	0	0	0	0	0	7.6	2.1	1.2
October	31	0	18	0	1	0	0	0	0	0	0	0	6.7	1.7	1.1
November	30	0	24	0	23	0	0	0	0	0	0	0	6.7	1.5	0.7
December	31	0	31	0	31	0	0	0	0	0	0	0	4.0	1.1	0.7

TRAPPERRDX

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	4.0	1.3	0.7
February	28	0	28	0	28	0	0	0	0	0	0	0	4.0	1.4	0.8
March	31	0	31	0	31	0	0	0	0	0	0	0	4.9	1.7	1.1
April	30	0	30	0	23	0	0	0	0	0	0	0	6.3	2.3	1.4
May	31	0	10	0	2	0	0	0	0	0	0	0	8.0	2.9	1.7
June	30	0	1	0	0	0	0	0	0	0	0	0	8.8	2.7	1.7
July	31	0	0	0	0	0	0	0	0	0	0	0	8.7	2.0	1.5
August	31	0	0	0	0	0	0	0	0	0	0	0	8.7	1.8	1.3
September	30	0	3	0	2	0	0	0	0	0	0	0	8.0	1.6	0.9
October	31	0	23	0	14	0	0	0	0	0	0	0	6.4	2.2	1.2
November	30	0	26	0	18	0	0	0	0	0	0	0	6.1	1.4	0.9
December	31	0	31	0	31	0	0	0	0	0	0	0	4.3	1.0	0.6

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

TRAPPERRDX

2020	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	4.3	1.2	0.7
February	29	0	29	0	29	0	0	0	0	0	0	0	4.3	1.6	0.9
March	31	0	31	0	31	0	0	0	0	0	0	0	4.9	1.7	1.1
April	30	0	27	0	12	0	0	0	0	0	0	0	6.5	2.6	1.7
May	31	0	7	0	0	0	0	0	0	0	0	0	8.7	2.8	1.7
June	30	0	0	0	0	0	0	0	0	0	0	0	9.0	2.5	1.5
July	31	0	0	0	0	0	0	0	0	0	0	0	9.4	2.4	1.6
August	31	0	0	0	0	0	0	0	0	0	0	0	8.9	2.1	1.4
September	30	0	0	0	0	0	0	0	0	0	0	0	8.3	2.0	1.2
October	31	0	9	0	7	0	0	0	0	0	0	0	7.5	1.9	1.2
November	30	0	28	0	26	0	0	0	0	0	0	0	6.5	1.8	0.9
December	31	0	31	0	31	0	0	0	0	0	0	0	4.4	1.5	0.8

TRAPPERRDX

2021	# Days Recorded	# 1Day Min < 0.5	< 4.4	# 1Day Avg <0.5	<4.4	# 1Day Max >23	>24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	4.0	1.8	0.8
February	28	0	28	0	28	0	0	0	0	0	0	0	4.1	1.3	0.7
March	31	0	31	0	31	0	0	0	0	0	0	0	5.0	2.1	1.2
April	30	0	30	0	21	0	0	0	0	0	0	0	6.1	2.4	1.7
May	31	0	13	0	3	0	0	0	0	0	0	0	8.2	2.8	1.9
June	30	0	0	0	0	0	0	0	0	0	0	0	9.9	2.4	1.7
July	31	0	0	0	0	0	0	0	0	0	0	0	9.2	2.1	1.7
August	31	0	0	0	0	0	0	0	0	0	0	0	9.0	2.0	1.4
September	30	0	0	0	0	0	0	0	0	0	0	0	8.0	2.1	1.3
October	31	0	13	0	5	0	0	0	0	0	0	0	6.8	2.4	1.1
November	29	0	25	0	20	0	0	0	0	0	0	0	6.5	2.2	0.8
December	31	0	30	0	29	0	0	0	0	0	0	0	5.9	1.7	0.8

Tuesday, April 4, 2023　　NOTE: All Temperatures and Ranges in degrees C,　-- Indicates No Available Data.　　

TRAPPERRDX

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	4.3	1.9	0.9
February	28	0	28	0	28	0	0	0	0	0	0	0	4.6	1.7	1.0
March	31	0	31	0	25	0	0	0	0	0	0	0	5.3	2.2	1.1
April	30	0	30	0	29	0	0	0	0	0	0	0	5.2	2.2	1.3
May	31	0	24	0	8	0	0	0	0	0	0	0	7.1	2.5	1.6
June	30	0	0	0	0	0	0	0	0	0	0	0	8.7	2.9	1.7
July	7	0	0	0	0	0	0	0	0	0	0	0	7.9	2.2	1.5

Tuesday, April 4, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

Trout Creek Monthly Temperature Summaries (degrees C)

TROUTRVRTRDX

2016	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	15	31	14	31	0	0	0	0	0	0	0	4.3	1.5	0.5
February	29	0	25	0	18	0	0	0	0	0	0	0	5.7	1.4	0.9
March	31	0	13	0	1	0	0	0	0	0	0	0	7.9	3.2	1.5
April	30	0	0	0	0	0	0	0	0	0	0	0	11.3	4.1	3.0
May	31	0	0	0	0	0	0	15	0	0	0	0	13.6	3.9	3.0
June	30	0	0	0	0	0	0	28	9	1	0	0	18.6	4.3	3.1
July	31	0	0	0	0	0	0	31	18	9	7	0	20.7	4.0	3.2
August	31	0	0	0	0	0	0	31	25	11	7	0	19.5	4.1	3.6
September	30	0	0	0	0	0	0	17	0	0	0	0	14.0	3.6	2.6
October	31	0	0	0	0	0	0	0	0	0	0	0	12.0	2.6	1.2
November	30	0	7	0	6	0	0	0	0	0	0	0	8.3	1.8	1.0
December	31	25	31	25	31	0	0	0	0	0	0	0	4.0	1.4	0.3

TROUTRVRTRDX

2017	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	22	31	22	31	0	0	0	0	0	0	0	2.9	1.8	0.3
February	28	9	28	7	28	0	0	0	0	0	0	0	4.3	2.1	1.0
March	31	0	22	0	15	0	0	0	0	0	0	0	6.6	2.3	1.1
April	30	0	4	0	0	0	0	0	0	0	0	0	8.6	3.9	2.1
May	31	0	0	0	0	0	0	11	0	0	0	0	14.6	4.7	3.4
June	30	0	0	0	0	0	0	26	5	0	0	0	17.6	3.9	3.0
July	31	0	0	0	0	0	0	31	29	2	0	0	18.2	3.6	3.0
August	59	0	0	0	0	0	0	59	37	25	20	0	19.8	3.4	2.7
September	36	0	0	0	0	0	0	21	14	0	0	0	17.0	4.1	2.0
October	31	0	16	0	11	0	0	0	0	0	0	0	8.6	2.2	1.5
November	30	0	28	0	26	0	0	0	0	0	0	0	7.8	2.3	1.0
December	31	21	31	17	31	0	0	0	0	0	0	0	4.0	2.3	0.6

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

TROUTRVRTRDX

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	4.6	1.9	0.7
February	28	6	26	1	24	0	0	0	0	0	0	0	5.8	2.0	1.2
March	31	0	31	0	25	0	0	0	0	0	0	0	6.7	3.0	1.7
April	30	0	7	0	2	0	0	0	0	0	0	0	10.7	4.4	2.5
May	31	0	0	0	0	0	0	26	0	0	0	0	14.8	4.6	3.0
June	30	0	0	0	0	0	0	30	5	0	0	0	17.5	3.8	2.8
July	31	0	0	0	0	0	0	31	26	21	17	0	21.3	4.1	3.6
August	31	0	0	0	0	0	0	31	22	16	12	0	20.5	3.8	3.3
September	30	0	0	0	0	0	0	12	0	0	0	0	15.0	3.6	2.7
October	31	0	11	0	9	0	0	0	0	0	0	0	12.0	2.9	1.8
November	30	18	25	16	25	0	0	0	0	0	0	0	9.4	2.0	0.9
December	31	19	31	15	31	0	0	0	0	0	0	0	3.5	1.8	0.6

TROUTRVRTRDX

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	20	31	15	31	0	0	0	0	0	0	0	2.2	1.1	0.6
February	28	25	28	24	28	0	0	0	0	0	0	0	2.3	1.7	0.2
March	31	22	31	21	31	0	0	0	0	0	0	0	5.6	2.8	0.6
April	30	0	6	0	0	0	0	0	0	0	0	0	10.1	3.8	2.3
May	31	0	0	0	0	0	0	16	0	0	0	0	14.7	4.2	2.9
June	30	0	0	0	0	0	0	30	7	1	0	0	18.7	4.1	3.3
July	31	0	0	0	0	0	0	31	29	13	8	0	19.2	4.8	3.7
August	31	0	0	0	0	0	0	31	31	17	13	0	20.7	4.5	3.6
September	30	0	0	0	0	0	0	23	7	0	0	0	17.5	3.4	2.2
October	31	3	16	1	12	0	0	0	0	0	0	0	8.5	2.7	1.7
November	30	19	30	18	29	0	0	0	0	0	0	0	5.1	1.8	0.8
December	31	31	31	30	30	0	0	0	0	0	0	0	0.3	0.3	0.1

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

TROUTRVRTRDX

2020	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	17	31	16	31	0	0	0	0	0	0	0	4.7	1.9	0.6
February	29	3	29	0	27	0	0	0	0	0	0	0	5.0	1.8	1.1
March	31	2	29	0	26	0	0	0	0	0	0	0	7.1	2.6	1.7
April	30	0	11	0	5	0	0	0	0	0	0	0	12.5	3.9	2.7
May	31	0	0	0	0	0	0	23	0	0	0	0	18.5	4.4	3.2
June	30	0	0	0	0	0	0	30	11	7	5	0	20.5	4.5	3.1
July	31	0	0	0	0	0	0	31	31	18	16	0	21.7	5.1	4.3
August	31	0	0	0	0	0	0	31	25	15	10	0	20.1	4.7	3.6
September	30	0	0	0	0	0	0	25	5	0	0	0	17.2	4.3	2.6
October	31	3	10	0	9	0	0	0	0	0	0	0	11.7	3.1	2.0
November	30	15	27	13	27	0	0	0	0	0	0	0	7.0	2.8	1.0
December	31	29	31	28	31	0	0	0	0	0	0	0	3.0	1.8	0.3

TROUTRVRTRDX

2021	# Days	# 1Day Min		# 1Day Avg		# 1Day Max		#7Day Avg Daily Max					Monthly 1	Monthly 1 Day	Monthly Avg
	Recorded	< 0.5	< 4.4	<0.5	<4.4	>23	>24	>12	>16	>17.5	>18	>22	Day Max	Max Range	Daily Range
January	31	4	31	3	31	0	0	0	0	0	0	0	4.8	2.2	0.8
February	28	9	28	7	28	0	0	0	0	0	0	0	3.6	1.4	0.7
March	31	0	31	0	25	0	0	0	0	0	0	0	6.2	3.2	1.7
April	30	0	14	0	3	0	0	0	0	0	0	0	12.5	4.0	3.1
May	31	0	0	0	0	0	0	13	0	0	0	0	15.6	4.4	3.2
June	30	0	0	0	0	4	3	30	19	12	11	5	25.1	5.3	3.9
July	31	0	0	0	0	1	0	31	31	31	31	3	23.2	5.5	4.7
August	31	0	0	0	0	0	0	31	20	18	17	0	22.3	4.6	3.5
September	30	0	0	0	0	0	0	16	0	0	0	0	16.0	3.6	2.4
October	31	0	11	0	2	0	0	0	0	0	0	0	10.2	2.7	1.7
November	30	2	21	0	18	0	0	0	0	0	0	0	8.4	3.1	1.2
December	31	16	29	12	29	0	0	0	0	0	0	0	7.5	3.0	0.7

Monday, March 27, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

TROUTRVRTRDX

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	12	31	12	31	0	0	0	0	0	0	0	3.3	1.6	0.4
February	28	7	28	3	28	0	0	0	0	0	0	0	3.6	2.4	0.9
March	31	0	25	0	15	0	0	0	0	0	0	0	7.3	2.6	1.6
April	30	0	24	0	7	0	0	0	0	0	0	0	7.9	3.6	2.3
May	31	0	0	0	0	0	0	0	0	0	0	0	11.0	4.2	2.6
June	30	0	0	0	0	0	0	14	0	0	0	0	16.7	3.8	2.5
July	6	0	0	0	0	0	0	6	0	0	0	0	16.3	3.4	2.4

Monday, March 27, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data. *Page 4 of 4*

West Fork Klickitat River Monthly Temperature Summaries (degrees C)

WESTFORKRX

2016	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	3	31	2	31	0	0	0	0	0	0	0	3.8	1.9	0.8
February	29	0	29	0	29	0	0	0	0	0	0	0	4.2	1.3	0.8
March	31	0	31	0	31	0	0	0	0	0	0	0	5.3	2.3	1.3
April	30	0	29	0	16	0	0	0	0	0	0	0	6.2	2.6	1.9
May	31	0	1	0	0	0	0	0	0	0	0	0	9.4	3.2	2.1
June	30	0	0	0	0	0	0	0	0	0	0	0	12.1	3.6	2.6
July	31	0	0	0	0	0	0	0	0	0	0	0	11.3	3.7	2.7
August	31	0	0	0	0	0	0	0	0	0	0	0	10.5	3.3	2.8
September	30	0	1	0	0	0	0	0	0	0	0	0	8.6	3.1	1.9
October	31	0	3	0	1	0	0	0	0	0	0	0	7.4	1.9	1.0
November	30	0	15	0	15	0	0	0	0	0	0	0	6.6	1.3	0.8
December	31	5	31	0	31	0	0	0	0	0	0	0	3.7	1.7	0.9

WESTFORKRX

2017	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	9	31	6	31	0	0	0	0	0	0	0	3.5	2.1	0.8
February	28	3	28	0	28	0	0	0	0	0	0	0	3.3	2.2	1.1
March	31	0	31	0	31	0	0	0	0	0	0	0	4.6	1.8	1.0
April	30	0	30	0	29	0	0	0	0	0	0	0	5.4	2.2	1.5
May	31	0	19	0	6	0	0	0	0	0	0	0	9.7	3.2	2.3
June	30	0	0	0	0	0	0	0	0	0	0	0	11.2	3.5	2.3
July	31	0	0	0	0	0	0	0	0	0	0	0	11.2	3.4	3.0
August	59	0	0	0	0	0	0	0	0	0	0	0	10.5	3.3	2.6
September	60	0	0	0	0	0	0	0	0	0	0	0	9.5	2.8	1.8
October	62	0	46	0	16	0	0	0	0	0	0	0	6.3	2.1	1.3
November	37	0	35	0	35	0	0	0	0	0	0	0	5.2	1.6	0.7
December	31	1	31	0	31	0	0	0	0	0	0	0	4.1	1.6	0.8

Monday, March 27, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

WESTFORKRX

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	3.7	1.5	0.7
February	28	1	28	0	28	0	0	0	0	0	0	0	4.2	1.7	1.0
March	31	0	31	0	31	0	0	0	0	0	0	0	5.2	2.0	1.4
April	30	0	30	0	20	0	0	0	0	0	0	0	6.9	3.2	1.8
May	31	0	2	0	0	0	0	0	0	0	0	0	11.0	3.3	2.2
June	30	0	0	0	0	0	0	0	0	0	0	0	11.5	3.9	2.8
July	31	0	0	0	0	0	0	0	0	0	0	0	11.9	4.0	3.4
August	31	0	0	0	0	0	0	0	0	0	0	0	11.4	3.6	2.9
September	30	0	3	0	0	0	0	0	0	0	0	0	9.3	3.2	2.1
October	31	0	18	0	2	0	0	0	0	0	0	0	7.2	2.2	1.5
November	30	0	25	0	23	0	0	0	0	0	0	0	7.3	2.0	1.0
December	31	0	31	0	31	0	0	0	0	0	0	0	3.7	1.4	0.8

WESTFORKRX

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	1	31	0	31	0	0	0	0	0	0	0	3.7	1.8	1.0
February	28	9	28	3	28	0	0	0	0	0	0	0	3.5	2.2	1.1
March	31	7	31	0	31	0	0	0	0	0	0	0	5.2	2.6	1.8
April	30	0	30	0	24	0	0	0	0	0	0	0	6.0	2.6	1.8
May	31	0	4	0	1	0	0	0	0	0	0	0	9.8	3.2	2.0
June	30	0	0	0	0	0	0	0	0	0	0	0	11.8	3.8	2.8
July	31	0	0	0	0	0	0	0	0	0	0	0	11.0	4.1	3.0
August	31	0	0	0	0	0	0	0	0	0	0	0	11.6	3.9	2.9
September	30	0	3	0	1	0	0	0	0	0	0	0	9.9	3.0	1.7
October	31	1	25	0	14	0	0	0	0	0	0	0	6.7	2.8	1.6
November	30	2	28	1	21	0	0	0	0	0	0	0	6.3	2.0	1.1
December	31	1	31	0	31	0	0	0	0	0	0	0	4.0	1.7	0.8

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

WESTFORKRX

2020	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	3	31	1	31	0	0	0	0	0	0	0	3.8	1.8	0.9
February	29	0	29	0	29	0	0	0	0	0	0	0	4.0	1.9	1.0
March	31	0	31	0	31	0	0	0	0	0	0	0	5.3	2.4	1.5
April	30	0	29	0	12	0	0	0	0	0	0	0	6.5	3.3	2.2
May	31	0	7	0	0	0	0	0	0	0	0	0	12.0	3.8	2.2
June	30	0	0	0	0	0	0	0	0	0	0	0	12.5	4.0	2.5
July	31	0	0	0	0	0	0	0	0	0	0	0	12.3	4.1	3.3
August	31	0	0	0	0	0	0	0	0	0	0	0	11.4	4.0	3.1
September	30	0	0	0	0	0	0	0	0	0	0	0	10.4	3.7	2.2
October	31	0	10	0	7	0	0	0	0	0	0	0	8.3	2.5	1.6
November	30	0	28	0	27	0	0	0	0	0	0	0	7.0	2.3	1.1
December	31	2	31	0	31	0	0	0	0	0	0	0	4.0	1.8	1.0

WESTFORKRX

2021	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	1	31	0	31	0	0	0	0	0	0	0	3.6	2.0	0.8
February	28	6	28	2	28	0	0	0	0	0	0	0	3.9	1.8	1.0
March	31	0	31	0	31	0	0	0	0	0	0	0	5.4	2.7	1.7
April	30	0	30	0	23	0	0	0	0	0	0	0	6.5	3.3	2.4
May	31	0	11	0	2	0	0	0	0	0	0	0	10.7	3.5	2.4
June	30	0	0	0	0	0	0	11	0	0	0	0	14.4	4.1	2.8
July	31	0	0	0	0	0	0	5	0	0	0	0	13.1	4.4	3.6
August	31	0	0	0	0	0	0	0	0	0	0	0	11.8	4.1	2.8
September	30	0	0	0	0	0	0	0	0	0	0	0	9.8	3.3	2.2
October	31	0	14	0	6	0	0	0	0	0	0	0	7.2	2.2	1.5
November	3	0	2	0	2	0	0	0	0	0	0	0	4.8	0.9	0.5
December	31	2	30	0	29	0	0	0	0	0	0	0	5.7	1.8	0.9

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

WESTFORKRX

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	5	31	1	31	0	0	0	0	0	0	0	3.9	1.8	0.9
February	28	5	28	1	28	0	0	0	0	0	0	0	4.2	2.0	1.1
March	31	0	31	0	31	0	0	0	0	0	0	0	5.3	2.2	1.3
April	30	0	30	0	28	0	0	0	0	0	0	0	5.8	2.9	1.8
May	31	0	21	0	9	0	0	0	0	0	0	0	7.5	3.1	1.9
June	30	0	0	0	0	0	0	0	0	0	0	0	11.9	3.5	2.2
July	7	0	0	0	0	0	0	0	0	0	0	0	11.3	2.9	1.9

Monday, March 27, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data. *Page 4 of 4*

White Creek Monthly Temperature Summaries (degrees C)

WHITEMOUTH

2016	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	6	31	4	31	0	0	0	0	0	0	0	4.0	1.8	0.6
February	29	0	28	0	22	0	0	0	0	0	0	0	5.7	1.3	0.8
March	31	0	12	0	1	0	0	0	0	0	0	0	8.0	2.9	1.4
April	30	0	0	0	0	0	0	0	0	0	0	0	12.0	3.6	2.6
May	31	0	0	0	0	0	0	29	0	0	0	0	15.2	4.2	2.9
June	30	0	0	0	0	0	0	30	19	12	7	0	19.9	5.0	3.8
July	31	0	0	0	0	0	0	31	31	31	30	0	20.5	5.0	4.2
August	31	0	0	0	0	0	0	31	31	28	23	0	19.4	4.4	3.7
September	30	0	0	0	0	0	0	30	3	0	0	0	16.4	3.5	2.5
October	31	0	0	0	0	0	0	10	0	0	0	0	13.1	2.0	1.0
November	30	0	2	0	2	0	0	0	0	0	0	0	9.4	1.5	0.9
December	31	16	31	5	31	0	0	0	0	0	0	0	4.8	1.4	0.7

WHITEMOUTH

2017	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	25	31	22	31	0	0	0	0	0	0	0	1.9	0.8	0.3
February	28	6	28	3	28	0	0	0	0	0	0	0	3.6	1.5	0.8
March	31	0	24	0	19	0	0	0	0	0	0	0	6.7	2.4	1.1
April	30	0	2	0	0	0	0	0	0	0	0	0	9.7	3.6	1.9
May	31	0	0	0	0	0	0	12	0	0	0	0	15.9	4.2	3.0
June	30	0	0	0	0	0	0	30	11	5	3	0	18.8	4.1	3.0
July	31	0	0	0	0	0	0	31	31	31	31	0	19.8	4.3	3.9
August	59	0	0	0	0	0	0	59	59	39	29	0	19.6	4.0	3.2
September	38	0	0	0	0	0	0	38	18	0	0	0	17.7	3.7	1.9
October	31	0	0	0	0	0	0	2	0	0	0	0	12.5	1.7	1.3
November	30	0	6	0	3	0	0	0	0	0	0	0	7.7	1.5	0.8
December	31	4	31	3	31	0	0	0	0	0	0	0	4.6	1.3	0.6

Monday, March 27, 2023

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

WHITEMOUTH

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	28	0	0	0	0	0	0	0	5.4	1.2	0.6
February	28	7	23	2	20	0	0	0	0	0	0	0	6.6	1.8	1.1
March	31	0	28	0	23	0	0	0	0	0	0	0	7.0	2.5	1.5
April	30	0	4	0	1	0	0	0	0	0	0	0	11.1	3.6	2.1
May	31	0	0	0	0	0	0	27	0	0	0	0	16.4	4.1	2.9
June	30	0	0	0	0	0	0	30	14	11	5	0	19.1	4.6	3.7
July	31	0	0	0	0	0	0	31	31	25	24	0	19.3	4.0	3.4
August	31	0	0	0	0	0	0	31	31	13	10	0	18.9	3.1	2.4
September	30	0	0	0	0	0	0	30	0	0	0	0	15.9	2.5	1.8
October	31	0	0	0	0	0	0	3	0	0	0	0	13.2	1.4	1.1
November	30	0	10	0	9	0	0	0	0	0	0	0	10.2	1.0	0.7
December	31	0	30	0	28	0	0	0	0	0	0	0	4.9	1.2	0.6

WHITEMOUTH

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	3.9	1.5	0.8
February	28	9	28	3	28	0	0	0	0	0	0	0	3.8	1.7	0.9
March	31	7	31	3	31	0	0	0	0	0	0	0	5.4	3.1	1.8
April	30	0	2	0	0	0	0	0	0	0	0	0	11.2	3.3	1.9
May	31	0	0	0	0	0	0	23	0	0	0	0	15.4	3.9	2.7
June	30	0	0	0	0	0	0	30	17	6	3	0	18.7	4.7	3.7
July	31	0	0	0	0	0	0	31	31	19	11	0	18.7	4.4	3.5
August	31	0	0	0	0	0	0	31	31	19	15	0	19.1	4.1	3.2
September	30	0	0	0	0	0	0	28	9	0	0	0	17.5	3.2	1.9
October	31	0	2	0	0	0	0	0	0	0	0	0	11.6	2.1	1.4
November	30	0	18	0	11	0	0	0	0	0	0	0	7.0	1.3	0.9
December	31	0	31	0	31	0	0	0	0	0	0	0	3.8	1.0	0.6

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

WHITEMOUTH

2020	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	1	31	0	31	0	0	0	0	0	0	0	4.6	1.5	0.7
February	29	3	29	0	28	0	0	0	0	0	0	0	5.8	4.0	1.3
March	31	0	28	0	24	0	0	0	0	0	0	0	7.6	3.4	2.1
April	30	0	7	0	3	0	0	3	0	0	0	0	13.1	4.3	3.1
May	31	0	0	0	0	0	0	29	0	0	0	0	15.9	4.8	3.2
June	30	0	0	0	0	0	0	30	10	0	0	0	17.7	4.2	2.8
July	31	0	0	0	0	0	0	31	30	0	0	0	18.1	4.0	3.4
August	31	0	0	0	0	0	0	31	27	0	0	0	17.3	3.1	2.6
September	30	0	0	0	0	0	0	30	1	0	0	0	16.2	2.6	1.7
October	31	0	0	0	0	0	0	11	0	0	0	0	13.0	1.8	1.3
November	30	0	12	0	9	0	0	0	0	0	0	0	7.9	1.4	0.7
December	31	0	29	0	29	0	0	0	0	0	0	0	5.4	1.6	0.6

WHITEMOUTH

2021	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	0	31	0	31	0	0	0	0	0	0	0	5.0	1.5	0.7
February	28	8	28	4	28	0	0	0	0	0	0	0	3.9	1.4	0.8
March	31	0	31	0	23	0	0	0	0	0	0	0	6.2	2.6	1.6
April	30	0	9	0	0	0	0	0	0	0	0	0	13.1	3.8	2.8
May	31	0	0	0	0	0	0	27	0	0	0	0	15.7	4.5	3.4
June	30	0	0	0	0	0	0	30	17	10	7	0	19.3	4.6	3.6
July	31	0	0	0	0	0	0	31	31	31	18	0	18.7	4.0	3.6
August	31	0	0	0	0	0	0	31	26	11	0	0	18.5	3.6	2.8
September	30	0	0	0	0	0	0	30	0	0	0	0	15.9	3.0	2.0
October	31	0	0	0	0	0	0	4	0	0	0	0	12.4	2.0	1.2
November	30	0	3	0	1	0	0	0	0	0	0	0	8.5	1.3	0.7
December	31	1	22	0	21	0	0	0	0	0	0	0	7.2	1.4	0.6

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

WHITEMOUTH

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	8	31	3	31	0	0	0	0	0	0	0	3.5	1.6	0.6
February	28	5	28	3	28	0	0	0	0	0	0	0	3.4	2.0	1.0
March	31	0	21	0	15	0	0	0	0	0	0	0	8.2	2.2	1.5
April	30	0	15	0	6	0	0	0	0	0	0	0	8.2	3.4	2.0
May	31	0	0	0	0	0	0	0	0	0	0	0	12.4	3.4	2.2
June	30	0	0	0	0	0	0	28	6	0	0	0	17.5	4.0	2.6
July	6	0	0	0	0	0	0	6	6	0	0	0	17.7	3.9	3.1

Monday, March 27, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data. *Page 4 of 4*

White Creek Monthly Temperature Summaries (degrees C)

WHITEUPPER

2016	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	15	31	11	31	0	0	0	0	0	0	0	1.5	1.3	0.2
February	29	0	29	0	29	0	0	0	0	0	0	0	2.9	0.6	0.3
March	31	0	31	0	31	0	0	0	0	0	0	0	3.4	0.6	0.3
April	30	0	20	0	13	0	0	0	0	0	0	0	8.2	3.3	1.9
May	31	0	0	0	0	0	0	0	0	0	0	0	10.9	3.6	2.5
June	30	0	0	0	0	0	0	10	0	0	0	0	14.2	3.9	2.8
July	31	0	0	0	0	0	0	26	0	0	0	0	15.9	4.1	3.0
August	31	0	0	0	0	0	0	29	0	0	0	0	14.9	3.9	2.9
September	30	0	0	0	0	0	0	0	0	0	0	0	10.9	3.4	2.3
October	31	0	5	0	1	0	0	0	0	0	0	0	9.2	2.7	1.3
November	30	0	16	0	15	0	0	0	0	0	0	0	7.1	1.8	1.1
December	31	22	31	19	31	0	0	0	0	0	0	0	2.6	1.5	0.4

WHITEUPPER

2017	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	20	31	20	31	0	0	0	0	0	0	0	2.0	1.1	0.3
February	28	8	28	6	28	0	0	0	0	0	0	0	3.0	1.8	0.7
March	31	0	31	0	31	0	0	0	0	0	0	0	4.2	1.6	0.7
April	30	0	29	0	17	0	0	0	0	0	0	0	6.5	3.2	1.8
May	31	0	5	0	0	0	0	0	0	0	0	0	12.0	4.2	3.0
June	30	0	0	0	0	0	0	6	0	0	0	0	13.2	3.4	2.5
July	31	0	0	0	0	0	0	31	0	0	0	0	14.9	4.9	3.5
August	30	0	0	0	0	0	0	30	0	0	0	0	15.6	4.6	2.9
September	30	0	0	0	0	0	0	11	0	0	0	0	14.4	3.3	2.1
October	31	0	24	0	17	0	0	0	0	0	0	0	7.3	2.8	1.6
November	30	7	30	5	30	0	0	0	0	0	0	0	4.9	1.4	0.7
December	31	28	31	28	31	0	0	0	0	0	0	0	2.0	0.7	0.1

Monday, March 27, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

WHITEUPPER

2018	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	11	31	5	31	0	0	0	0	0	0	0	2.6	1.4	0.6
February	28	8	28	5	28	0	0	0	0	0	0	0	3.7	1.8	0.7
March	31	3	31	0	31	0	0	0	0	0	0	0	3.5	1.3	0.8
April	30	0	25	0	21	0	0	0	0	0	0	0	8.1	3.0	1.4
May	31	0	1	0	0	0	0	0	0	0	0	0	12.1	3.6	2.6
June	30	0	0	0	0	0	0	1	0	0	0	0	12.8	3.3	2.3
July	31	0	0	0	0	0	0	24	2	0	0	0	16.9	4.0	2.7
August	31	0	0	0	0	0	0	25	0	0	0	0	16.9	4.2	3.1
September	30	0	1	0	0	0	0	0	0	0	0	0	12.5	3.7	2.5
October	31	0	21	0	16	0	0	0	0	0	0	0	8.9	3.0	1.7
November	30	20	26	15	25	0	0	0	0	0	0	0	7.4	1.9	0.5
December	31	30	31	29	31	0	0	0	0	0	0	0	1.0	0.4	0.1

WHITEUPPER

2019	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	29	31	26	31	0	0	0	0	0	0	0	0.8	0.5	0.1
February	28	27	28	27	28	0	0	0	0	0	0	0	0.8	0.6	0.1
March	31	23	31	15	31	0	0	0	0	0	0	0	1.9	0.7	0.3
April	30	0	30	0	24	0	0	0	0	0	0	0	6.3	2.8	1.3
May	31	0	3	0	0	0	0	0	0	0	0	0	11.7	4.2	2.6
June	30	0	0	0	0	0	0	9	0	0	0	0	14.5	4.0	3.1
July	31	0	0	0	0	0	0	29	0	0	0	0	14.5	4.3	3.1
August	31	0	0	0	0	0	0	31	0	0	0	0	16.2	3.8	2.9
September	30	0	2	0	2	0	0	9	0	0	0	0	13.9	3.0	1.8
October	31	2	29	1	23	0	0	0	0	0	0	0	6.6	2.8	1.3
November	30	18	30	17	30	0	0	0	0	0	0	0	4.3	1.8	0.4
December	31	31	31	31	31	0	0	0	0	0	0	0	0.6	0.3	0.1

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

WHITEUPPER

2020	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	22	31	20	31	0	0	0	0	0	0	0	2.2	1.0	0.2
February	29	4	29	2	29	0	0	0	0	0	0	0	2.5	1.0	0.5
March	31	5	31	4	31	0	0	0	0	0	0	0	3.1	1.2	0.7
April	30	0	20	0	17	0	0	0	0	0	0	0	7.3	1.9	1.2
May	31	0	2	0	0	0	0	0	0	0	0	0	11.8	2.6	1.6
June	30	0	0	0	0	0	0	5	0	0	0	0	13.4	2.3	1.5
July	31	0	0	0	0	0	0	18	0	0	0	0	15.7	2.3	1.7
August	31	0	0	0	0	0	0	27	0	0	0	0	15.5	2.2	1.5
September	30	0	0	0	0	0	0	7	0	0	0	0	13.1	2.1	1.0
October	31	0	10	0	10	0	0	0	0	0	0	0	9.7	2.0	1.0
November	30	12	29	9	27	0	0	0	0	0	0	0	6.4	2.7	0.4
December	31	31	31	31	31	0	0	0	0	0	0	0	0.4	0.0	0.0

WHITEUPPER

2021	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	>16	>17.5	>18	>22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	16	31	9	31	0	0	0	0	0	0	0	2.5	1.7	0.5
February	28	13	28	9	28	0	0	0	0	0	0	0	1.6	0.8	0.3
March	31	4	31	0	31	0	0	0	0	0	0	0	3.0	1.3	0.7
April	30	0	26	0	18	0	0	0	0	0	0	0	8.4	2.8	1.7
May	31	0	2	0	0	0	0	0	0	0	0	0	11.3	3.5	2.6
June	30	0	0	0	0	0	0	14	6	0	0	0	18.4	4.8	3.1
July	31	0	0	0	0	0	0	31	7	0	0	0	17.2	4.4	3.6
August	31	0	0	0	0	0	0	21	8	0	0	0	17.3	3.5	2.6
September	30	0	0	0	0	0	0	0	0	0	0	0	12.7	3.0	2.0
October	31	0	17	0	13	0	0	0	0	0	0	0	8.2	2.5	1.4
November	29	11	29	4	26	0	0	0	0	0	0	0	5.8	2.8	1.0
December	31	27	31	24	31	0	0	0	0	0	0	0	4.7	1.6	0.3

NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data.

WHITEUPPER

2022	# Days Recorded	# 1Day Min < 0.5	# 1Day Min < 4.4	# 1Day Avg <0.5	# 1Day Avg <4.4	# 1Day Max >23	# 1Day Max >24	#7Day Avg Daily Max >12	#7Day Avg Daily Max >16	#7Day Avg Daily Max >17.5	#7Day Avg Daily Max >18	#7Day Avg Daily Max >22	Monthly 1 Day Max	Monthly 1 Day Max Range	Monthly Avg Daily Range
January	31	15	31	13	31	0	0	0	0	0	0	0	1.5	0.8	0.2
February	28	7	28	7	28	0	0	0	0	0	0	0	1.8	0.9	0.2
March	31	2	31	0	31	0	0	0	0	0	0	0	4.8	2.4	1.1
April	30	1	30	0	29	0	0	0	0	0	0	0	5.2	2.1	1.4
May	31	0	16	0	4	0	0	0	0	0	0	0	8.9	3.4	2.0
June	30	0	0	0	0	0	0	0	0	0	0	0	12.8	3.7	2.5
July	27	0	0	0	0	0	0	18	0	0	0	0	14.5	3.3	2.6

Monday, March 27, 2023 NOTE: All Temperatures and Ranges in degrees C, -- Indicates No Available Data. *Page 4 of 4*