



**SUMMER STEELHEAD STOCK COMPOSITION IN COLUMBIA
RIVER SPORT AND TRIBAL ZONE 6 FISHERIES**

JUNE 16, 2022 to DECEMBER 31, 2022

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This report categorizes the stock composition of the summer steelhead sport harvest in the Columbia River downstream of Bonneville Dam from June 16, 2022 to July 31, 2022 and in the Tribal Zone 6 fishery from August 1, 2022 to December 31, 2022. It was a cooperative effort among the Idaho Department of Fish and Game, Washington Department of Fish and Wildlife, and the Pacific States Marine Fish Commission. The authors wish to acknowledge the assistance of staff from all agencies that collected and genotyped the samples. The report that follows is a multi-agency product under the technical lead of Alan Byrne.

ABBREVIATIONS AND ACRONYMS

BON	Bonneville Dam
BWSALM	Big White Salmon River GSI reporting group
BY	Brood Year
CI(s)	Confidence Interval(s)
CRITFC	Columbia River Inter-Tribal Fish Commission
GSI	Genetic Stock Identification
IDFG	Idaho Department of Fish and Game
KLICKR	Klickitat River GSI reporting group
LOWCOL	Lower Columbia River GSI reporting group
lci	Lower Confidence Interval
MFSALM	Middle Fork Salmon River GSI reporting group
MGILCS	Mid-Columbia-Grande Ronde-Imnaha-Lower Snake-Lower Clearwater-Lower Salmon GSI reporting group
ODFW	Oregon Department of Fish and Wildlife
PBT	Parentage Based Tagging
PIT	Passive Integrated Transponder
SFCLWR	South Fork Clearwater River GSI reporting group
SFSALM	South Fork Salmon River GSI reporting group
SKAMAN	Skamania GSI reporting group
TAC	<i>U.S. v Oregon</i> Technical Advisory Committee
uci	Upper Confidence Interval
UPCLWR	Upper Clearwater (Lochsa River and Selway River) GSI reporting group
UPPCOL	Upper Columbia River GSI reporting group
UPSALM	Upper Salmon River GSI reporting group
WILLAM	Willamette River GSI reporting group
WDFW	Washington Department of Fish and Wildlife
YAKIMA	Yakima River GSI reporting group

ABSTRACT

The Lower Columbia River sport fishery was open for steelhead harvest in 2022 except from August 1 to October 31. We estimated the stock composition of the 2,938 hatchery adipose clipped steelhead harvested from June 16 to July 31, 2022 in the Lower Columbia River. We also estimated the adipose clipped and adipose unclipped steelhead stock composition during the Fall Management Period tribal Zone 6 fishery from fish sampled at commercial buyers. The tribal fall Zone 6 fishery harvested nearly 182,000 fall Chinook Salmon, 6,522 clipped steelhead, and 2,974 unclipped steelhead. About 45% of the Lower Columbia River sport samples could not be assigned with PBT and were likely from hatchery stocks downstream of Bonneville Dam whose broodstock are not included in the PBT baseline. The Snake River basin hatchery stocks made up 32% of the Lower Columbia River sport harvest. In the tribal Zone 6 fishery, Snake basin hatchery stocks made up 91% of the clipped harvest and 33% of the unclipped harvest. About 66% of the tribal Zone 6 unclipped harvest was from wild steelhead stocks. The MGLICS GSI stock made up 35% of the unclipped harvest and about 23% was from Snake basin GSI stocks. Since the MGLICS GSI stock includes rivers in the Snake basin, the percentage of wild steelhead harvested from the Snake basin was likely more than 23%.

INTRODUCTION

The run-timing of summer steelhead into the Columbia River overlaps the run-timing of spring, summer, and fall Chinook Salmon, sockeye, and to a lesser extent coho. Spring, summer, and fall Chinook Salmon are targeted by non-tribal commercial fisheries downstream of Bonneville Dam (BON); tribal commercial, tribal ceremonial and platform fisheries upstream of BON; and sport fisheries downstream and upstream of BON. All steelhead caught in non-tribal commercial fisheries must be released and only steelhead with a clipped adipose fin (hereafter referred to as clip or clipped) may be kept in sport fisheries. Steelhead, both clipped and those with an intact adipose fin (hereafter referred to as unclip or unclipped) may be retained in any tribal fishery. As defined in the *U.S. v Oregon Management Agreement (hereafter U.S. v Oregon)*, Chinook Salmon fisheries in the Columbia River are managed for three time periods: (1) Spring Management Period from January 1 to June 15, primarily targeting spring Chinook Salmon and Snake River summer Chinook Salmon; (2) Summer Management Period from June 16 to July 31, primarily targeting upper Columbia River summer Chinook Salmon; and (3) Fall Management Period from August 1 to December 31 primarily targeting fall Chinook Salmon. Steelhead run sizes, which are used to determine ESA and harvest impacts, are estimated at BON during three time periods: winter run from November 1 to March 31, Skamania run from April 1 to June 30, and the Upriver A-Index and B-Index run from July 1 to October 31. A-Index fish are defined as steelhead that are < 78 cm fork length and B-Index as steelhead that are ≥ 78 cm fork length that pass BON between July 1 and October 31.

Steelhead harvest is estimated for all tribal and non-tribal fisheries. In the Lower Columbia River sport fishery, steelhead harvest is estimated in-season with creel surveys and harvest is reported monthly. Sport steelhead harvest is reported as the number of fish kept. Preliminary steelhead and Chinook Salmon harvest estimates in the tribal Zone 6 fishery are made on a weekly basis beginning June 16. This allows managers to adjust seasons to keep steelhead impacts and harvest of summer and fall Chinook Salmon within the limits that are outlined in *U.S. v Oregon*. Final harvest estimates are reported by *U.S. v Oregon* Technical Advisory Committee (TAC) at the conclusion of the tribal fishery. Tribal fall season steelhead harvest estimates are reported as the number of clipped and unclipped fish kept that were <78 cm (Small or A-Index) and ≥ 78 cm (Large or B-Index).

All adipose clipped fish are known to be hatchery origin. Clipped hatchery fish from the Snake River and other hatcheries can be assigned to a hatchery stock and release group using Parentage Based Tagging (PBT) markers. Clipped steelhead that do not assign using PBT markers were a hatchery fish from an adult whose parents were not genotyped. These PBT unassigned hatchery origin fish were then assigned using Genetic Stock Identification (GSI) markers. Steelhead with an intact adipose fin could be a wild fish or hatchery origin fish released without a clipped adipose fin. Samples from unclipped steelhead were analyzed using PBT markers to determine if the fish was hatchery origin. Unclipped samples that did not assign to a PBT hatchery release group (putative wild fish) were assigned to a Columbia River GSI reporting group. The GSI reporting groups outside of the Snake River basin were developed using wild and hatchery origin steelhead. GSI reporting groups that lie entirely within Idaho in the Snake River basin were developed using wild fish only.

Hatcheries in the Snake River basin release the majority of summer steelhead smolts in the Columbia River basin. Usually over 70% of the total basin summer steelhead smolt releases and about 85% of the summer steelhead smolts released upstream of BON are from Snake River basin hatcheries. The Idaho Department of Fish and Game (IDFG) began collecting genetic samples from hatchery steelhead used for broodstock starting with Brood Year (BY) 2008 at all

hatcheries in Idaho. Beginning with BY2009 and continuing each year afterward, all hatchery steelhead used for broodstock in the Snake River basin have been sampled and genotyped by IDFG, Washington Department of Fish and Wildlife (WDFW), and Oregon Department of Fish and Wildlife (ODFW). The Columbia River Inter-Tribal Fish Commission (CRITFC) has worked with managers to collect samples to genotype steelhead broodstock from non-Snake River hatcheries in the Columbia River beginning with BY2012. Currently, nearly all summer steelhead broodstock from hatcheries upstream of BON are genotyped and in the PBT database and their offspring can be identified with Parental Based Tagging (PBT) methods. Most summer steelhead used for broodstock in hatcheries downstream of BON in the Columbia and Willamette rivers are not genotyped and their offspring can not be identified with PBT.

The stock composition of summer steelhead in the Columbia River sport and tribal fisheries has been estimated since 2011 (Byrne et al. 2023, Byrne et al. 2021, Byrne et al. 2020, Byrne et al. 2018a, Byrne et al. 2018b, Byrne 2018c, Byrne et al. 2016, Byrne et al. 2015, Byrne et al. 2014a and Byrne et al. 2014b). Until this study was initiated, there were no estimates of the harvest contribution of hatchery and wild stocks in the tribal and non-tribal fisheries in the Columbia River.

IDFG coordinated the sampling of steelhead harvested in the Lower Columbia River sport fishery (downstream of Bonneville Dam) and the tribal Zone 6 fishery in 2022. The cooperators of this effort in 2022 were IDFG, WDFW, and the Pacific States Marine Fish Commission. All dates used in this report are for the year 2022 unless specified otherwise.

METHODS

Steelhead Passage at Bonneville Dam

The daily count of clipped and unclipped steelhead at BON from July 1 to October 31 was obtained from the Fish Passage Center's website (available at https://www.fpc.org/webapps/adultsalmon/Q_adultcounts_dataquery.php). CRITFC personnel sampled steelhead at BON and recorded the fork length and the presence or absence of the adipose fin. Steelhead were designated in-season as hatchery or wild origin primarily based on the presence of fin clips or an eroded dorsal fin. If either was observed, the default designation was hatchery and if both were absent, the default designation was wild origin. Beginning in 2011, CRITFC obtained tissue samples from all steelhead that were handled and used PBT post-season to determine if any unclipped fish were hatchery origin. If an unclipped fish that was visually called wild was later determined to be hatchery origin using genetic analysis, we classified that fish as unclipped hatchery origin. TAC used the post-season data to estimate the percentage of A-Index and B-Index clipped hatchery fish using the clipped samples and the percentage of A-Index and B-Index wild and unclipped hatchery fish using the unclipped samples. These percentages were estimated in seven time strata in 2022. The clipped percentages were multiplied by the clipped steelhead dam count and the unclipped percentages were multiplied by the unclipped steelhead dam count in each time stratum to estimate the number of wild and clipped and unclipped hatchery origin A-Index and B-Index fish that passed the dam. The total A-Index and B-Index wild, clipped, and unclipped hatchery passage at BON was the sum of all time periods.

Steelhead Run-Timing at Bonneville Dam

All hatchery summer steelhead stocks in the Snake River basin and most non-Snake basin hatchery stocks upstream of BON are representatively Passive Integrated Transponder (PIT) tagged prior to release as smolts. Wild juvenile steelhead are also PIT-tagged throughout the Columbia River basin. We calculated the run timing of summer steelhead stocks passing BON in 2022 using the date of their first adult detection at BON. We obtained the daily number of adult summer steelhead detections at BON from April 1 to December 31 for wild and hatchery fish that were PIT-tagged upstream of BON, except in the Snake River basin. For Snake basin fish we obtained all adult steelhead detections at BON from June 1 to December 31. The detection data was obtained from the PTAGIS website (<https://www.ptagis.org>). We only used the adult detection data of hatchery and wild summer steelhead that were tagged as juveniles before July 1, 2021 and were returning to spawn in the spring of 2023 (most summer steelhead that spawned in the spring of 2023 passed BON in 2022). Some of the adults were determined to be kelts or smolts based on their detection history at main stem dams and tributary PIT arrays and were removed from the analysis. Repeat spawners were not used to calculate run timing as only fish on their first adult migration upstream were included for the run-timing analysis. There were no adult Snake basin summer steelhead detected at BON before June 1 and none were detected from other basins upstream of BON before April 1 from return year 2022.

The run-timing of each Snake River hatchery stock, except the Dworshak and Wallowa stocks, were calculated by combining detections from all of the stock's release groups and BYs. The Dworshak stock was split into two groups: fish reared at Dworshak or Clearwater hatcheries and released in the Clearwater drainage (Dwor-C) and those fish reared in the Hagerman Valley hatcheries and released in the Salmon drainage (Dwor-S). The Wallowa stock was split into two stocks. Wallowa-OR were Wallowa smolts released in Oregon and Wallowa-WA were Wallowa smolts released in Washington. All Wallowa-WA smolt releases were from broodstock collected at the Cottonwood Pond Adult Trap on the lower Grande Ronde River and reared at Lyons Ferry Hatchery. The Wallowa-WA stock includes fish that were released in the Walla Walla River basin. The Wallowa-OR smolt releases were from broodstock collected at Wallowa Hatchery and reared at Irrigon Hatchery. The Skamania stock run-timing was calculated using fish that were released in the Klickitat River. The middle Columbia River (Mid-C) hatchery run-timing was calculated by combining detections of all non-Snake River summer steelhead hatchery stocks (except Skamania) and BYs released from BON upstream to and including the Yakima River basin. The upper Columbia River (Up-C) hatchery run-timing was calculated by combining detections of all summer steelhead hatchery stocks and BYs released upstream of the Yakima River. The run-timing of wild steelhead from the Mid-C (BON to Yakima River, excluding the Snake River basin), Up-C (all rivers upstream of the Yakima River), and Snake (excluding fish tagged at Snake River mainstem dams) regions was calculated by combining detections from all release sites in each region that were coded as summer run in the PTAGIS database. Fall Chinook Salmon run timing was calculated using the daily adult window count at BON from August 1 to November 30. We estimated the cumulative passage proportion for each date of all wild and hatchery steelhead stocks and fall Chinook Salmon at BON.

Lower Columbia River Sport Harvest Estimates

Sport anglers could retain one adipose clipped hatchery origin steelhead per day in the Columbia River from Buoy 10 to BON from June 16 to July 31, 2022. The steelhead fishery was closed to retention from August 1 to October 31, 2022 and any steelhead that was caught had to be released.

The recreational sport fishery downstream of BON is divided into ten sampling sections. (Figure 1). Personnel from ODFW and WDFW conduct random angler interviews at their respective boat ramps, beaches, and on the river to determine catch rates for each species in each section. The total number of fish caught and released for each species, month, and section is estimated by combining total angler effort estimates derived from aerial surveys and bank angler counts with the observed angler catch rates in each section (Watts 2021 and TAC 2008). The steelhead sport harvest is not parsed into hatchery stocks by ODFW and WDFW. There was no catch quota on the harvest of clipped steelhead, however all non-tribal fisheries in the Columbia River from Buoy 10 upstream to the Highway 395 bridge near Pasco, Washington, must not exceed a 2% impact rate on wild A-Index and 2% on wild B-Index steelhead in July. An additional 2% impact on A-Index and B-Index fish is allowed from August 1 to October 31 from Buoy 10 to The Dalles Dam plus impacts from The Dalles Dam to the Highway 395 bridge from November 1 to March 31 the following year.

Tribal Zone 6 Harvest Estimates

The tribal Zone 6 fall fishery primarily targets fall Chinook Salmon. There were seven weekly open set net commercial seasons for tribal fishers from August 22 to October 6, 2022. In addition to the commercial set net seasons, platform and hook and line fisheries were open daily from August 1 through December 31, 2022. Tribal Zone 6 set net commercial fishing during the Fall Management Period can catch significant numbers of steelhead as both species are abundant in Zone 6 during the time period the set net commercial seasons are open.

The steelhead harvest rate for treaty fisheries in the Fall Management Period (August 1 to December 31) is based on a sliding scale of the abundance of upriver fall Chinook Salmon and total B-Index steelhead counted at Bonneville Dam as outlined in *U.S. v. Oregon*. There is no specific harvest rate limit on A-Index steelhead. The allowable harvest rate of total B-Index steelhead in the treaty fall period fishery was 15% in 2022.

Tribal monitors from the Yakama Nation (YN) sample tribal catch at landing points on the Columbia River. Data are collected on number of fish per net, number of nets sampled, numbers of times per day nets are checked, and number of nets each sampled crew were fishing. Steelhead are measured and classified as A-Index (<78 cm) or B-Index (≥78 cm) fish and presence or absence of an adipose fin-clip is noted. WDFW crews sample the tribal catch for biological data at commercial buying stations (ticketed catch). Fork length and presence or absence of the adipose fin was recorded. In cases where the non-ticket catch is a large proportion of the total catch, the YN uses information from the WDFW sampled ticketed catch combined with the YN sampling data to estimate the number of steelhead that were harvested. All tribal steelhead harvest estimates were reviewed and then reported by TAC. Steelhead in-season harvest estimates were made weekly for fall Chinook Salmon and clipped and unclipped A-Index and B-Index steelhead (Yakama Nation and TAC, unpublished data). The final tribal Zone 6 steelhead and fall Chinook Salmon harvest estimates for the Fall Management Period were reported by TAC post-season (JSR 2023a and JSR 2023b).

Sample Collection in the Lower Columbia River Sport Fishery

Sport anglers were sampled by the WDFW creel survey crews that were used to estimate harvest from Buoy 10 upstream to BON. All steelhead that were encountered had a small piece of tissue removed for the genetic analysis. In addition to a tissue sample, crews also checked the

fish for a Coded Wire Tag, PIT tag, measured the fork length, and recorded the river section and date the fish was caught. Retention of steelhead was not permitted from August 1 to October 31, 2022. A total of 568 samples were successfully genotyped and used for the analysis of the sport fishery (Table 1). Five samples failed genotyping and were not used for the stock composition estimates. We estimated the stock composition and harvest contribution from June 16 to July 31, 2022 from these samples.

Sample Collection in the Tribal Zone 6 Fishery

WDFW crews collected samples from tribal caught steelhead in Zone 6 that were sold to commercial buyers on the Washington shore. The first samples were collected on August 23 and the last samples were collected on October 5. Crews measured the fork length, recorded if the fish was clipped or unclipped, and the location and date the fish was caught. A total of 468 clipped samples and 166 unclipped samples were successfully genotyped and used for the analysis of the tribal fishery (Table 2). Three clipped samples failed genotyping and were not used for the stock composition estimates. We assumed that the steelhead sold to commercial buyers were representative of the total tribal steelhead catch.

To estimate the stock composition in the tribal clipped and unclipped harvest for the entire fall season we used two strata: August 1 to September 4 and September 5 to the end of the season. We assumed that the samples collected during these two strata represented the stock composition during the time periods that samples were not obtained (August 1 to August 22 and October 6 to the end of the season). The sample sizes for the stock composition estimates were 88 clipped and 49 unclipped in Stratum 1 and 380 clipped and 117 unclipped in Stratum 2.

Estimating Composition Proportions

Clipped steelhead are known to be hatchery origin whereas unclipped steelhead could be an unclipped hatchery fish or wild fish. All fish were genotyped at 368 SNPs to inform an assignment to a GSI reporting group, a possible assignment to a hatchery release group and BY using PBT, and a sex-specific genetic assay for determining the sex of the fish. The genotyping was done at the IDFG genetics lab. The GSI methodology is detailed in Ackerman et al. (2016) along with the methods for extraction of genomic DNA from tissue samples, DNA amplification, and SNP genotyping. Steele et al. (2016) contains similar details for PBT analysis. If a fish was identified with PBT, we assigned the fish to its release group and BY. Unclipped steelhead that were not identified with PBT were either hatchery-origin fish whose parents were not in the PBT baseline or wild-origin fish. All PBT unassigned fish (clipped and unclipped) were assigned to their most probable GSI reporting group using the GSI baseline developed by CRITFC and described in Hess et al. 2013 (Figure 3). All adipose-clipped fish assigned to a GSI group were hatchery origin.

All Snake River basin hatchery release groups were classified by brood year, rearing hatchery, hatchery stock, and release site and the non-Snake River basin hatchery release groups were classified by brood year and stock. All PBT release groups and GSI reporting groups were assigned to a river basin. For the stock composition analysis, the Wallow-WA stock included fish released in the Walla Walla River basin, the Snake River at Lyons Ferry Hatchery, and the Grande Ronde River at the Cottonwood Acclimation Pond. Due to rearing space limitations at Lyons Ferry Hatchery, parental matings of the Wallowa-WA stock cannot be tracked to release site, hence all Wallowa-WA smolt releases were assigned to the Wallowa-WA stock and the

Snake basin. The Wallowa-OR stock was from broodstock collected at Wallowa Hatchery, reared at Irrigon Hatchery, and released in the Oregon portion of the Snake River basin. The MGILCS GSI group includes tributaries of the Columbia River from BON to the Snake River mouth, Snake River tributaries downstream of the Clearwater River, the Asotin, Grande Ronde, and Imnaha basins, tributaries of the Salmon River upstream to the Little Salmon River, and tributaries of the Clearwater River upstream to the confluence of the Lochsa and Selway rivers. The MGILCS GSI group spans more than one river basin so it was defined as a distinct basin. The SKAMAN GSI group was defined as natural origin steelhead that can trace their ancestry to the Skamania Hatchery stock. The SKAMAN GSI group and Skamania PBT release groups are closely related to each other and are found in the Willamette drainage and Columbia River tributaries upstream and downstream of BON. We defined the Skamania Hatchery stock and the SKAMAN GSI stock as a distinct basin (SKAMAN) since they are found in more than one river basin.

We analyzed the clipped and unclipped tribal samples separately. In sport fisheries, only adipose clipped fish can be retained. The actual count in each PBT release group was divided by its tagrate to get an adjusted count. The adjusted count can be thought of as the expected number of fish from each release group that would have been sampled if the release group had a tagrate of 1. Since fish were added to hatchery release groups after expanding for their tagrate, an equal number of fish must be subtracted from the fish that were assigned to GSI reporting groups. The composition proportions were calculated using the “accounting” estimator described by Delomas and Hess (2021) to incorporate the tagrates for each PBT release group using the R script *Scobi_duex* performed in the R programming environment (available at: <https://cran.r-project.org>).

The proportion of each hatchery stock’s composition by brood year was found by adding all of the stock’s release group BY’s proportions. The proportion of each hatchery stock was found by summing all of the stock’s release groups and BYs. We also present results at the river basin spatial scale for stock composition proportions. Basin level proportions were found by summing all PBT and GSI group proportions within each river basin. All proportions were reported as percentages rounded to the nearest tenth percent except the basin level percentages which were rounded to the nearest percent. Harvest estimates in the Lower Columbia River sport fishery and Zone 6 tribal fishery were calculated by multiplying the stock composition proportions by the reported total harvest estimate and rounding to the nearest fish.

We used one stratum to analyze the Lower Columbia River sport fishery and two strata to analyze the clipped and unclipped tribal Zone 6 fisheries. Since there was more than one stratum in the tribal fisheries, the adjusted count may not equal its actual count divided by its tagrate (as is the case when there is only one stratum). In the tribal fishery, the proportion of the total harvest for each PBT release group is:

$$p_r = \sum_{i=1}^2 h_i \left(\frac{a_{ri}}{t_r / s_i} \right)$$

where, p_r = proportion of the total harvest from release group r

h_i = proportion of the total harvest (clip or unclip) in stratum i

a_{ri} = actual number of samples from release group r in stratum i

t_r = PBT tagrate of release group r

s_i = total samples in stratum i

i = stratum 1 or 2.

The adjusted count for each release group for the entire season is: $p_r * s_t$ where, s_t is the total number of samples that were successfully genotyped in all strata.

Confidence Intervals for Group, Stock, and Basin Proportions

Confidence intervals (CIs) for the PBT release group's and GSI reporting group's estimates were generated using *Scobi_duex*. The script resamples with replacement from an original sample or set of data. For each iteration, the original group assignments were resampled within each stratum with replacement s number of times where s = the number of samples. Within each iteration, we then calculated the expanded PBT hatchery release group and adjusted GSI reporting group proportions as outlined in the previous section. We performed 10,000 iterations and sorted the proportions in ascending order. The $100(1-\alpha)\%$ CIs for the group proportions were the $(10,000 * \alpha/2)$ and $(10,000 * (1 - \alpha/2))$ values of the ordered bootstrap values. In the analysis we set $\alpha = 0.05$ and report the 90% lower CI (lci) and 90% upper CI (uci) for all proportions. The CIs for each PBT stock/BY and PBT stock, were found by summing all of the stock's release groups of each BY and all of the stock's release groups in each iteration and choosing the $(10,000 * \alpha/2)$ and $(10,000 * (1 - \alpha/2))$ ordered values. The CIs at the basin spatial scale were found by summing all PBT and GSI groups by their basin assignment in each iteration and choosing the $(10,000 * \alpha/2)$ and $(10,000 * (1 - \alpha/2))$ ordered values. All proportion CIs were reported as percentages rounded to the nearest tenth percent. The R code and data sets used to analyze the sport and tribal fisheries in 2022 can be found at <https://github.com/delomast/ABcompEstim2023>.

Ocean Age and Length Percentages

The percent of 1-ocean fish for all PBT assigned fish was calculated using the actual sum of BY2020 fish and the total actual count of all PBT assignments. The percent of 1-ocean fish was calculated for each hatchery stock and for all stocks in each basin using samples that were identified with PBT if the actual sample size was >10 . For this, we used the actual count of 1-ocean fish (BY2020) and the sum of the actual counts of all ocean ages, by stock and basin, that were PBT assigned. Ocean ages were not available for fish that assigned to GSI groups since scale samples were not taken from the sampled fish.

We estimated the number of large (≥ 78 cm or B-Index) and small (< 78 cm or A-Index) steelhead in each hatchery and GSI stock from each fishery by performing a maximum likelihood (ML) estimation of the length composition to estimate the proportions of large and small fish in

each stock while accounting for tagrates. The sum of small and large fish for the length analysis may not equal the expanded count for PBT assigned fish or the adjusted count of the GSI assigned fish used to calculate the stock composition proportions for two reasons: 1) the stock composition proportions were calculated using all genotyped samples whereas the length composition proportions were calculated using only samples with length data and 2) the estimators, while similar in logic, are different, and so the estimates will not be identical. The ML method used for length analysis was executed using the R package *fishCompTools* (available at: <https://github.com/delomast/fishCompTools>).

The counts of fish that were PBT assigned (PBT-tagged) to a given hatchery group, n_1, \dots, n_G , with tagrates of t_1, t_2, \dots, t_G or were PBT unassigned, u was considered to be a multinomial random variable,

$$\begin{aligned} (n_1, \dots, n_G, u) &\sim \text{mult}(N, \pi), \\ \pi &= (p_1 t_1, p_2 t_2, \dots, p_G t_G, y), \\ y &= w + \sum_{i=1}^G p_i (1 - t_i), \end{aligned}$$

where p_i is the probability that a fish is from hatchery group i (assigned with PBT), w is the probability a fish is from a PBT-untagged GSI group (a wild fish or a hatchery fish that was from an unsampled parents) and y is the probability that a fish is PBT-untagged. The probability that a fish is PBT-untagged is the sum (because the events are disjoint) of the probabilities that a fish is from a GSI stock (wild fish or an unsampled hatchery stock) or from a PBT-tagged group that had a tagrate < 1 .

Let the PBT-untagged group be composed of S different genetic stocks, and let u be a vector with u_j being the number of PBT-untagged fish that assign to GSI stock j for j in $1, 2, \dots, S$. The counts of PBT-tagged fish in each hatchery group and the counts of PBT-untagged fish assigned to each stock though GSI was again considered to be a multinomial random variable,

$$\begin{aligned} (n_1, \dots, n_G, u_1, \dots, u_S) &\sim \text{mult}(N, \pi), \\ \pi &= (p_1 t_1, p_2 t_2, \dots, p_G t_G, y_1, \dots, y_S), \\ y_j &= w_j + \sum_{i=1}^G p_i (1 - t_i) D_{ij}, \end{aligned}$$

where y_j is the probability a fish is PBT-untagged and assigns to stock GSI j , w_j is the probability a fish is from a PBT-untagged group and in GSI stock j , and D_{ij} is the probability a fish in hatchery group i assigns to GSI stock j .

The assigned stock of the PBT-tagged hatchery fish was also considered to be a multinomial random variable,

$$(O_{i1}, \dots, O_{iS}) \sim \text{mult}(n_i, (D_{i1}, \dots, D_{iS})), \quad (1)$$

where O_{ij} is the number of PBT-tagged fish in hatchery group i that assigned to GSI stock j .

Length was treated as a categorical variable, with fish less than 78 cm being “small” and fish greater than or equal to 78 cm being “large”. We used 78 cm since it is the basis of the A/B-

Index summer steelhead management used in *U.S. v. Oregon* fisheries, however a user can input any length desired. We assume that within a given hatchery group the length is independent of the GSI assigned stock. This is likely to be the case unless a hatchery group being estimated is a combination of genetically distinct strains that are only being estimated as one group because tagrates are not available for them separately. Let u now be such that u_{jk} is the number of PBT-untagged fish that assign to GSI stock j and are in length category k with k in $\{1,2\}$. The counts of PBT-tagged fish and PBT-untagged fish in each combination of stock and length category were considered to be a multinomial random variable,

$$\begin{aligned} (n_1, \dots, n_G, u_{11}, \dots, u_{S2}) &\sim \text{mult}(N, \pi), \\ \pi &= (p_1 t_1, p_2 t_2, \dots, p_G t_G, y_{11}, \dots, y_{S2}), \\ y_{jk} &= w_{jk} + \sum_{i=1}^G p_i (1 - t_i) D_{ij} V_{ik}, \end{aligned} \quad (2)$$

where y_{jk} is the probability a fish is PBT-untagged, assigns to GSI stock j , and is in length category k ; w_{jk} is the probability a fish is from a PBT-untagged group, in GSI stock j , and in length category k ; and V_{ik} is the probability a fish in hatchery group i is in length category k .

The number of PBT-tagged fish in a given hatchery group that are in a given length category was considered to be a multinomial random variable,

$$(Q_{i1}, \dots, Q_{iK}) \sim \text{mult}(n_i, (V_{i1}, \dots, V_{iK})), \quad (3)$$

where Q_{ik} is the number of PBT-tagged fish in hatchery group i that were in length category k . The likelihood of the data as a whole, $P(n, u, O, Q | \pi, D, V)$ is the product of three multinomial likelihoods (equations 1, 2, and 3) that can be maximized to infer p , w , D , and V .

The estimates for p , w , and V were multiplied as appropriate to estimate fishery composition by group and size. These estimates were then summed to calculate composition at different scales (stock, basin, and origin). Non-parametric bootstrapping with 10,000 iterations was utilized to calculate 90% lci and uci.

For the Lower Columbia River sport fishery and tribal Zone 6 clipped and unclipped samples, we report the percentage of the sampled fish and the 90% binomial CI that were large using the actual count of all samples with a valid length measurement. Next, we focus on large fish only, as *U.S. v. Oregon* managed fisheries are often constrained by the abundance of large steelhead. We report the percentage of the large fish from each stock using the large ML proportion estimates and the percentage of large fish within each stock using the ML estimates of large and small proportions within the stock. Non-parametric bootstrapping with 10,000 iterations was utilized to calculate the 90% lci and uci.

RESULTS

Steelhead Passage at Bonneville Dam

Steelhead passage from July 1 to October 31 was 116,969 total fish, of which 82,033 were clipped and 34,936 were unclipped. The estimated preliminary clipped passage components were 59,784 A-Index (Small) fish and 22,249 B-Index (Large) fish. The estimated preliminary wild passage was 25,684 A-Index fish and 4,242 B-Index fish. The estimated preliminary hatchery unclipped passage was 2,958 A-Index fish and 2,052 B-Index fish. TAC will adjust and finalize the BON components during the winter of 2023-24. An adjustment is necessary because the estimated passage of large hatchery clipped and unclipped steelhead at Lower Granite Dam from this return year was greater than estimated at BON.

Steelhead Run-Timing at Bonneville Dam

The Skamania stock released in the Klickitat River was the earliest arriving stock at BON. The 25% and 50% arrival dates for Skamania stock were June 20 and July 7, respectively. The Tucannon and Oxbow stocks had the earliest 50% passage date of the Snake basin hatchery stocks. The 50% arrival dates for the Tucannon and Oxbow stocks were July 16 and July 27, respectively. The only stocks that attained their 50% arrival date in September were Dwor-C, Dwor-S, SF Clearwater, and Upper Salmon stocks. The 50% arrival date for the Snake River hatchery stocks spanned 67 days and ranged from July 16 to September 21. Wild fish from the Mid-C, Up-C, and Snake attained their 50% date on July 24, July 14, and August 2, respectively (Figure 3).

The BON passage of Dwor-C, Dwor-S, and SF Clearwater hatchery stocks on August 1, 2022, the day the Lower Columbia sport fishery closed and the tribal Fall Management Period fishery began, was 0% for all stocks. The Upper Salmon stock passage at BON on August 1 was 2%. The BON passage of all other Snake basin hatchery stocks, on August 1, ranged from 39% to 77% complete. The Mid-C and Up-C hatchery stocks were 57% and 53% complete on August 1 and the Skamania stock was 87% complete on August 1. The Snake River wild stock passage on August 1 was 48% complete compared to 72% for the Up-C and 69% for the Mid-C wild stocks.

The 2022 run-timing at BON for the Skamania stock was later than its recent five-year average, whereas all other stocks attained their 25%, 50%, and 75% cumulative passage date earlier than their recent five-year average from 2017 to 2021 (Figure 4 and Appendix A).

Lower Columbia River Sport Harvest Estimate

In the Lower Columbia River, sport anglers kept 2,938 steelhead from June 16 to July 31, 2022 (Table 1).

Tribal Zone 6 Fishery Harvest Estimate

During the Fall Management Period, the estimated tribal steelhead harvest was 6,522 clipped and 2,974 unclipped steelhead. About 89% and 92% of the total clipped and unclipped steelhead were harvested between August 22 and October 9, 2022 when set net commercial fishing was permitted and most of the samples were collected. Although tribal fishers could fish

from platforms and use hook and line gear until December 31, 2022, the estimated steelhead harvest after October 9 was only 260 clipped and 130 unclipped steelhead. Harvest in Stratum 1 was 997 clipped and 313 unclipped fish. Harvest in Stratum 2 was 5,525 clipped and 2,661 unclipped steelhead. In addition to steelhead, tribal fishers harvested 181,321 Chinook Salmon (includes jacks) from August 1 to October 9, 2022 (Table 2).

Estimating Composition Proportions And Harvest Contribution

Lower Columbia River Sport

We assigned fish to 24 distinct PBT release groups and four GSI reporting groups for the PBT unassigned fish (Table 3). We estimate that 54.5% of the fish were from the PBT assigned stocks (CI, 50.9% - 58.2%) and that the Snake River hatchery stocks made up 31.6% (CI, 28.3% - 35.0%) of the harvest. The Mid-C hatchery stocks made up 2.7% (CI, 1.6% - 4.0%) and the Up-C hatchery stocks made up 6.6% (CI, 4.8% - 8.4%) of the harvest. The Skamania stock from BY2019 made up 13.6% (CI, 11.2% - 16.0%) of the harvest and was the largest contributor to harvest at the stock/BY scale. The Wallowa-OR stock from BY2019 made up 8.5% (CI, 6.6% - 10.4%) of the harvest and was the largest contributor to harvest of the Snake basin stocks at the stock/BY scale. All other stock/BY assignments each made up less than 5% of the harvest except the Wallowa-WA BY2019 (5.3%) stock/BY (Table 4). When all BYs from each stock were combined, the largest contributors were the Skamania (13.6%), Wallowa-OR (10.1%), and Wells (6.1%) stocks (Table 5 and Figure 5).

We assigned 45.5% (CI, 41.8% - 49.1%) of the harvest to GSI stocks because they did not assign to a PBT release group. The SKAMAN GSI group was the largest contributor to the harvest (40.4%; CI, 36.9% - 43.9%). The remaining PBT unassigned fish were assigned to three GSI stocks that contributed from 0.2% to 3.4% of the harvest (Table 5 and Figure 6). The stock percentages and harvest estimates for each PBT release group can be found in Appendix B.

The SKAMAN and Snake basin stocks made up 54% and 33% of the harvest, respectively. All other basins contributed 7% or less of the harvested fish (Figure 7).

Twenty nine of 298 fish assigned with PBT were one-ocean fish (9.7%, CI 7.1% – 13.0%). Eight stocks had an actual sample size ≥ 10 . The percent 1-ocean fish ranged from 0% in the Skamania and Pahsimeroi stocks to 25% in the Imnaha stock using the actual counts from each BY (Table 5).

Fifty-one of the 573 sampled fish (includes five samples not used for stock composition proportions) were large fish (8.9%; CI, 7.0% - 11.1%). The SKAMAN GSI stock made up 57.8% (CI, 44.7% - 69.7%) of the large fish and 12.2% (CI, 3.3% - 15.9%) were from the Skamania PBT stock. We sampled large fish from eight other stocks: Imnaha, Pahsimeroi, Tucannon, Wallowa-OR, Wallowa-WA, Wells, and MGILCS, however each stock made up less than 9% of the total large fish. The percent of large fish within each stock with large fish present and an actual sample size of ≥ 10 ranged from 13.1% in the Wells and Pahsimeroi stocks to 0% in the Deschutes, Imnaha, and Sawtooth stocks (Table 4).

Tribal Zone 6

Adipose clipped fish

We assigned the clipped steelhead to 37 distinct PBT release groups and five GSI reporting groups for the PBT unassigned fish (Table 7). We estimate that 97% of the fish were from the PBT assigned stocks (CI, 94.5% - 98.9%) and that the Snake River hatchery stocks made up 91% (CI, 88.1% - 93.5%) of the harvest. The Up-C hatchery stocks made up 4.8% (CI, 3.1% - 6.5%) of the harvest. The Skamania and Mid-C hatchery stocks each made up less than 1% of the harvest. Nearly 60% of the harvest was from the BY2019 Dwor-C stock (48.9%, CI 44.8% - 52.8%) and the BY2019 SF Clearwater stock (10%, CI 7.7% - 12.4%) whereas, all other stock/BY assignments each made up less than 7% of the harvest (Table 8). When all BYs from each stock were combined, nearly half of the clipped harvest was from the Dwor-C (49.6%, CI 45.5% - 53.6%) stock. The SF Clearwater stock contributed 10% (CI 7.7% - 12.4%), Oxbow 7.1% (CI, 5.1% - 9.2%), Pahsimeroi 7% (CI, 5% - 9.1%) and all other stocks each contributed 7% or less of the total harvest. We assigned 3% (CI, 1.1% - 5.5%) of the clipped harvest to GSI stocks because they did not assign to a PBT release group. The SFCLWR GSI stock was the largest GSI stock contributor to the harvest (1.2%; CI, 0.4% - 2.3%). The other PBT unassigned fish were assigned to four GSI stocks that contributed from 0.1% to 0.9% of the harvest (Table 9 and Figures 8 and 9). The stock percentages and harvest estimates for each PBT release group can be found in Appendix C.

The Snake basin stocks made up 93% of the harvest and the Up-C basin made up 5% of the harvest. All other basins contributed 1% or less of the harvested fish (Figure 10).

Twenty-seven of 430 fish assigned with PBT were one-ocean fish (6.3%, CI 4.5% - 8.6%). Seven PBT assigned stocks had an actual sample size ≥ 10 . The percent 1-ocean fish in these seven stocks, using the actual counts of each BY, ranged from 0% to 33.3% in the SF Clearwater and Sawtooth stocks, respectively (Table 9).

Two hundred eighty seven of the 471 sampled fish (includes three samples not used for the stock composition) were large fish (60.9%; CI, 57.1% - 64.9%). Ten stocks had large fish sampled, however most of the large fish were from the Dwor-C and SF Clearwater stocks. The percent of the total large fish from the Dwor-C stock was 76.9% (CI, 73.6% - 80%) and 15.6% (CI, 12.3% - 19.5%) were from the SF Clearwater. None of the other eight stocks contributed more than 2% of the large fish. The percent of large fish within the Dwor-C and SF Clearwater stocks was 94.5% (CI 92.3% - 96.3%) and 95.5% (CI, 92.7% - 100%), respectively (Table 10).

Adipose unclipped fish

We assigned the unclipped steelhead to 11 distinct PBT release groups and nine GSI reporting groups for the PBT unassigned fish (Table 7). We assigned 54 fish to a PBT release group and all were from BY2019 (2 -ocean adults). We estimate that 34.3% of the unclipped harvest was from the PBT assigned stocks (CI, 27.8% - 41.2%) and that the Snake River hatchery stocks made up 33.4% (CI, 26.8% - 40%) of the harvest. The only non-Snake basin PBT assigned hatchery stock sampled was Winthrop (0.9%, CI 0% - 2.8%). Putative wild fish assigned with GSI made up 65.7% (CI, 58.8% - 83.7%) of the harvest. Most of the GSI assignments were to the MGILCS (35.1%, CI 28.6% - 42%), UPCLWR (10%, CI 6% - 14.3%), and SFCLWR (6.1%, CI 2.7% - 9.8%) stocks. The other six GSI stocks each contributed less than 5% to the harvest (Table 11 and Figure 11). The stock percentages and harvest estimates for each PBT release group can be found in Appendix D.

The MGILCS basin made up 35% and the Snake basin 56% of the unclipped steelhead harvest, respectively. All other basins each contributed 5% or less to the unclipped harvest (Figure 12). For the wild fish only, the MGILCS basin made up 54% and the Snake basin 35% of the wild steelhead harvest, respectively. All other basins each contributed 7% or less to the wild harvest (Figure 13). The MGILCS basin includes rivers within the Snake basin hence, the estimates for the Snake basin are likely a minimum value.

Eighty six of all 166 sampled unclipped fish were large fish (51.8%; CI, 45.1% - 58.4%), 49 of the 55 PBT assigned fish were large (89.1%, CI 79.6% - 95.1%), and 37 of the 111 GSI assigned wild fish were large (33.3%, CI 25.9% - 41.4%). Five PBT and eight GSI stocks had large fish sampled. The percent of the total large fish was; Dwor-C PBT stock 32.3% (CI, 25.6% - 37.8%), SF Clearwater PBT stock 20.1% (CI, 14.7% - 26.5%), MGILCS GSI stock 9.3% (CI, 4.3% - 20%), and the SFCLWR GIS stock 9.2% (CI, 3.9% - 12.8%). The remaining PBT and GSI stocks each made up less than 5% of the total large fish. Five stocks had an actual sample size of ≥ 10 . All fish that assigned to the Dwor-C and SF Clearwater PBT stocks were large fish. Within the SFCLWR GSI stock, 80% (CI 59.9% - 100%) were large fish, within the UPCLWR GSI stock 68.8% (CI 50% - 90.2%) were large, and within the MGILCS GSI stock 14.1% (CI 9.9% - 22.6%) were large fish (Table 12).

DISCUSSION

The majority of summer steelhead hatchery smolts released in the Columbia River basin are reared in Snake River basin hatcheries. Most returning hatchery origin adult steelhead are 1-ocean or 2-ocean fish. Clipped steelhead that were assigned to a GSI group are known to be hatchery origin (because of the clipped adipose fin), whereas unclipped GSI assigned fish are considered to be putative wild fish if they did not assign to a PBT release group. Nearly all broodstock from hatcheries upstream of BON are genotyped and in the PBT database and have high tagrates, therefore any unclipped fish that were assigned to GSI reporting groups located upstream of BON were likely wild origin. Most hatchery programs downstream of BON do not genotype their broodstock, hence hatchery origin adults from these programs that were sampled in the Lower Columbia River cannot be assigned to a PBT release group. Unclipped steelhead that assigned to GSI reporting groups located downstream of BON could be a wild or an unclipped hatchery origin fish. The SKAMAN GSI group is very closely related to the Skamania Hatchery summer steelhead stock. Over 99% of known Skamania Hatchery summer steelhead would assign to the SKAMAN GSI reporting group if their PBT assignment was not used. Most of the summer steelhead hatchery programs in the Lower Columbia (Cowlitz and Lewis rivers) and those in the Willamette River basin derived their broodstock from the Skamania summer run stock and their broodstock is not genotyped.

We expect that most adults that were assigned to the SKAMAN GSI group in the Lower Columbia River sport fishery were Skamania stock steelhead. If this is true, then the Skamania stock made up 54% of the kept steelhead in this fishery. The Snake basin stocks made up about 32% of the harvest in the Lower Columbia River sport fishery and was composed of the early arriving stocks. We did not assign any of the harvest to the Dwor-C, SF Clearwater, Upper Salmon, or Dwor-S stocks, which were the latest arriving hatchery steelhead stocks. In this fishery we have seen a consistent increase in the stock contribution from the Snake basin as the season progresses in all years since 2011. Had the river been open to harvest after July 31, most of the harvest would have shifted to Snake basin hatchery stocks based on prior years analysis of the

monthly stock composition of the catch. The early closure of this fishery weighted the catch to the earlier arriving stocks, primarily the Skamania PBT and SKAMAN GSI stocks.

Seventy percent of the large steelhead caught in the Lower Columbia River sport fishery were from the Skamania and SKAMAN GSI stocks. Typically, the number of large fish from Snake basin stocks caught in this fishery increases in August as the Dwor-C and SF Clearwater stocks arrive, however this year the season was closed on August 1 and no Dwor-C or SF Clearwater fish were sampled between June 16 and July 31.

Most of the steelhead were caught in the tribal Zone 6 fishery from August 22 to October 9, when set net commercial fishing was permitted. During this time period tribal fishers caught 89% and 92% of the clipped and unclipped steelhead that were harvested. All samples were obtained from fish sold to commercial buyers and we assumed that they represent the stock composition of steelhead that were not sold to commercial buyers (over-the-bank sales and personal use). The latest timed Snake basin hatchery stocks (Dwor-C, Dwor-S, SF Clearwater, and Upper Salmon) had the largest percentage of their BON passage during the time of tribal Zone 6 set net commercial fishing and made up the majority of the clipped harvest.

Nearly all hatchery origin steelhead caught in the tribal Zone 6 fishery were 2-ocean fish. All of the hatchery unclipped fish and 94% of the hatchery clipped fish were 2-ocean steelhead. The high percentage of 2-ocean fish and abundance of Dwor-C and SF Clearwater stocks is likely the reason 61% of the clipped and 52% of the unclipped tribal harvest were large steelhead. Most of the large clipped steelhead caught in the tribal Zone 6 fishery were from the Snake basin (about 97%) and most were from the Dwor-C (74%) and SF Clearwater (16%) stocks. We estimated that 57% of the unclipped large fish were hatchery origin and 43% were wild steelhead. Over 50% of the large unclipped harvest were unclipped Dwor-C (32%) and SF Clearwater (20%) hatchery stocks.

Wild fish made up about 43% of the tribal Zone 6 unclipped large fish harvest and were assigned to eight GSI stocks. When we consider the harvest of large wild fish only, the Snake basin GSI stocks contributed about 72% of the large wild steelhead. The UPCLWR GSI stock made up about 31% and the MGILCS and SFCLWR GSI stocks each made up about 22% of the large wild steelhead harvest in tribal fisheries. Since the MGILCS GSI stock includes rivers in the Snake basin, the contribution of wild large steelhead from the Snake basin is likely more than 72%. We assigned about 3% of the large wild steelhead to the KICKR and SKAMAN GSI stocks and did not assign any large wild steelhead to the UPPCOL GSI stock.

In tribal fisheries, most large hatchery steelhead were from the Dwor-C and SF Clearwater hatchery stocks and most large wild steelhead were from Snake basin GSI stocks. The stocks that contribute most of the large steelhead have a run-timing that is similar to fall Chinook Salmon, hence steelhead encountered in sport or commercial fisheries from late August through October will more likely be from these later timed stocks and more large steelhead will likely be caught compared to fisheries prosecuted in June, July, and early August.

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Table 1. The number of Lower Columbia River sport fishery steelhead samples from June 16 to July 31, 2022 that were used for stock composition analysis and the estimated harvest. Five samples failed genotyping and were not used for the stock composition estimates.

Period	Harvest	Samples collected	Percent of	
			Harvest	Samples
June 16 - June 30	626	121	21.3%	21.3%
July 1 - July 31	2,312	447	78.7%	78.7%
Total	2,938	568	--	--

Table 2. The estimated weekly steelhead and Chinook Salmon harvest and the number of clipped and unclipped steelhead samples used for the stock composition in the tribal Zone 6 fishery from August 1 to the end of the Fall Management Period and the weekly percentage of the total clipped and unclipped steelhead harvest and samples. Three clipped samples failed genotyping and were not used for the stock composition estimates. The Chinook Salmon harvest estimate includes jacks. The harvest and sample size in the two stratum used for the clip and unclip analysis is also shown.

Monday start	Clip harvest	Clip samples	Percent of clip		Unclip harvest	Unclip samples	Percent of unclip		Chinook harvest
			Harvest	Samples			Harvest	Samples	
8/1 to 8/21 ^a	450	0	6.9%	0.0%	110	0	3.7%	0.0%	569
8/22	170	7	2.6%	1.5%	45	7	1.5%	4.2%	3,139
8/29	377	81	5.8%	17.3%	158	42	5.3%	25.3%	23,129
9/5	809	115	12.4%	24.6%	450	47	15.1%	28.3%	53,107
9/12	1,020	128	15.6%	27.4%	472	32	15.9%	19.3%	62,471
9/19	1,302	38	20.0%	8.1%	609	5	20.5%	3.0%	26,379
9/26	1,343	35	20.6%	7.5%	709	7	23.8%	4.2%	9,516
10/3	791	64	12.1%	13.7%	291	26	9.8%	15.7%	3,011
10/10 ^a	100	0	1.5%	0.0%	40	0	1.3%	0.0%	295
≥ 10/17 ^a	160	0	2.5%	0.0%	90	0	3.0%	0.0%	187
Total	6,522	468			2,974	166			181,803
Stratum 1 ^b	997	88	15.3%	18.8%	313	49	10.5%	29.5%	26,837
Stratum 2 ^c	5,525	380	84.7%	81.2%	2,661	117	89.5%	70.5%	154,966

^a Commercial set net fishing was not allowed. The estimated harvest was from hook and line and platform fishing.

^b Stratum 1 was from August 1 to September 4.

^c Stratum 2 was from September 5 to December 31.

Table 3. All distinct PBT release groups with their stock assignment, basin assignment, brood year (BY), and tagrate that were sampled in the Lower Columbia River sport fishery from June 16 to July 31, 2022. The GSI stock assignment was used for fish that were not assigned to a PBT release group. All harvested steelhead were adipose clipped.

PBT release group	Stock	Basin	BY	Tagrate
2019-HNFH-SAWT-SawtoothFH-AdClip	Sawtooth	Snake	2019	0.8824
2019-IRRI-IMNA-Imnaha	Imnaha	Snake	2019	0.9683
2019-IRRI-WALL-WallowaR	Wallowa-OR	Snake	2019	0.9959
2019-LYON-TUCA-TucannonR-WA	Tucannon	Snake	2019	0.9706
2019-LYON-WALL-CottonWoodGR/LyonsFerry/Touchet-WA	Wallowa-WA	Snake	2019	1
2019-MVFH-PAHS-LittleSalmonR-AdClip	Pahsimeroi	Snake	2019	0.9753
2019-MVFH-SAWT-SawtoothFH-AdClip	Sawtooth	Snake	2019	0.9242
2019-MVFH-USAL-LittleSalmonR-AdClip	Upper Salmon	Snake	2019	1
2019-NIAG-OXBO-LittleSalmonR-AdClip	Oxbow	Snake	2019	0.9643
2019-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	Oxbow	Snake	2019	0.9159
2019-NIAG-PAHS-LittleSalmonR-AdClip	Pahsimeroi	Snake	2019	0.7631
2019-NIAG-PAHS-PahsimeroiR-AdClip	Pahsimeroi	Snake	2019	0.9557
2020-HNFH-SAWT-SawtoothFH-AdClip	Sawtooth	Snake	2020	0.9915
2020-IRRI-IMNA-Imnaha	Imnaha	Snake	2020	0.968
2020-IRRI-WALL-WallowaR	Wallowa-OR	Snake	2020	1
2020-LYON-WALL-CottonWoodGR/LyonsFerry/Touchet-WA	Wallowa-WA	Snake	2020	0.98
2020-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	Oxbow	Snake	2020	0.8658
Winthrop2018	Winthrop	Up-C	2018	0.97
Wenatchee2019	Wenatchee	Up-C	2019	0.9322
Deschutes2019	Deschutes	Mid-C	2019	0.9583
Skamania2019	Skamania	SKAMAN	2019	0.9869
Umatilla2020	Umatilla	Mid-C	2020	1

Table 3 (continued)

PBT release group	Stock	Basin	BY	Tagrate
Wells2019	Wells	Up-C	2019	0.8468
Wells2020	Wells	Up-C	2020	0.9876
PBT unassigned, GSI assignment was used	LOWCOL	Low-C	--	--
PBT unassigned, GSI assignment was used	MGILCS	MGILCS	--	--
PBT unassigned, GSI assignment was used	SKAMAN	SKAMAN	--	--
PBT unassigned, GSI assignment was used	UPSALM	Snake	--	--

Table 4. Stock composition and harvest estimates by stock and brood year (BY) in the Lower Columbia sport fishery, June 16 to July 31, 2022. All fish were adipose clipped. The GSI assignment was used for fish that did not assign to a PBT release group. The total estimated harvest was 2,938. The sum of the stock and BY harvest components may not equal the total or basin percent and harvest estimates due to rounding error.

Stock	BY	Sample size		Percent by stock and BY			Harvest by stock and BY		
		Actual	Adjust	Estimate	90% lci	90% uci	Estimate	90% lci	90% uci
<i>All PBT assigned</i>		298	309.79	54.5%	50.9%	58.2%	1,602	1,496	1,710
Skamania	2019	76	77.01	13.6%	11.2%	16.0%	398	330	471
<i>Mid-C basin</i>		15	15.61	2.7%	1.6%	4.0%	81	48	118
Deschutes	2019	14	14.61	2.6%	1.5%	3.7%	76	43	108
Umatilla	2020	1	1.00	0.2%	0.0%	0.5%	5	0	16
<i>Snake basin</i>		174	179.62	31.6%	28.3%	35.0%	929	833	1,028
Imnaha	2019	12	12.39	2.2%	1.3%	3.3%	64	37	96
Imnaha	2020	4	4.13	0.7%	0.2%	1.3%	21	5	38
Oxbow	2019	21	22.65	4.0%	2.7%	5.5%	117	78	161
Oxbow	2020	3	3.47	0.6%	0.0%	1.2%	18	0	36
Pahsimeroi	2019	22	23.16	4.1%	2.7%	5.5%	120	81	163
Sawtooth	2019	11	12.31	2.2%	1.2%	3.3%	64	35	98
Sawtooth	2020	2	2.02	0.4%	0.0%	0.9%	10	0	26
Tucannon	2019	7	7.21	1.3%	0.5%	2.2%	37	16	64
Upper Salmon	2019	1	1.00	0.2%	0.0%	0.5%	5	0	16
Wallowa-OR	2019	48	48.20	8.5%	6.6%	10.4%	249	193	306
Wallowa-OR	2020	9	9.00	1.6%	0.7%	2.5%	47	21	73
Wallowa-WA	2019	30	30.00	5.3%	3.7%	6.9%	155	109	201
Wallowa-WA	2020	4	4.08	0.7%	0.2%	1.4%	21	5	42

Table 4 (continued)

Stock	BY	Sample size		Percent by stock and BY			Harvest by stock and BY		
		Actual	Adjust	Estimate	90% lci	90% uci	Estimate	90% lci	90% uci
<i>Up-C basin</i>		33	37.55	6.6%	4.8%	8.4%	194	141	248
Wells	2019	24	28.34	5.0%	3.3%	6.7%	147	98	196
Wells	2020	6	6.08	1.1%	0.4%	1.8%	31	10	53
Wenatchee	2019	1	1.07	0.2%	0.0%	0.6%	6	0	17
Winthrop	2018	2	2.06	0.4%	0.0%	0.9%	11	0	27
<i>PBT Unassigned</i>		270	258.21	45.5%	41.8%	49.1%	1,336	1,228	1,442

Table 5. The percentage of harvest and harvest estimate by hatchery stock, and percentage of the harvest that was from 1-ocean fish (Percent 1 ocean) in the Lower Columbia sport fishery, June 16 to July 31, 2022. All fish were adipose clipped. The GSI assignment was used for fish that did not assign to a PBT release group. The stock percent and harvest estimates may not equal the sum of the BY components in Table 4 or the basin estimate due to rounding error.

Stock	Sample size		Percent by stock			Harvest by stock			Percent 1 ocean
	Actual	Adjust	Estimate	90% lci	90% uci	Estimate	90% lci	90% uci	
Skamania	76	77.01	13.6%	11.2%	16.0%	398	330	471	0%
<u>Mid-C basin</u>	15	15.61	2.7%	1.6%	4.0%	81	48	118	6.7%
Deschutes	14	14.61	2.6%	1.5%	3.7%	76	43	108	0%
Umatilla	1	1.00	0.2%	0.0%	0.5%	5	0	16	--
<u>Snake basin</u>	174	179.62	31.6%	28.3%	35.0%	929	833	1,028	12.6%
Imnaha	16	16.53	2.9%	1.8%	4.2%	85	53	123	25%
Oxbow	24	26.12	4.6%	3.1%	6.1%	135	90	181	12.5%
Pahsimeroi	22	23.16	4.1%	2.7%	5.5%	120	81	163	0%
Sawtooth	13	14.33	2.5%	1.4%	3.7%	74	41	109	15.4%
Tucannon	7	7.21	1.3%	0.5%	2.2%	37	16	64	--
Upper Salmon	1	1.00	0.2%	0.0%	0.5%	5	0	16	--
Wallowa-OR	57	57.20	10.1%	8.0%	12.2%	296	235	358	15.8%
Wallowa-WA	34	34.08	6.0%	4.4%	7.7%	176	129	227	11.8%
<u>Up-C basin</u>	33	37.55	6.6%	4.8%	8.4%	194	141	248	18.2%
Wells	30	34.42	6.1%	4.3%	7.9%	178	126	231	20%
Wenatchee	1	1.07	0.2%	0.0%	0.6%	6	0	17	--
Winthrop	2	2.06	0.4%	0.0%	0.9%	11	0	27	--

Table 5 (continued)

	Sample size		Percent by stock			Harvest by stock			Percent
Stock	Actual	Adjust	Estimate	90% lci	90% uci	Estimate	90% lci	90% uci	1 ocean
<i>Hatchery origin assigned with GSI</i>									
<i>All GSI stocks</i>	<i>270</i>	<i>258.21</i>	<i>45.5%</i>	<i>41.8%</i>	<i>49.1%</i>	<i>1,336</i>	<i>1,228</i>	<i>1,442</i>	--
LOWCOL	1	0.96	0.2%	0.0%	0.5%	5	0	15	--
MGILCS	20	19.13	3.4%	2.2%	4.6%	99	64	134	--
SKAMAN	240	229.52	40.4%	36.9%	43.9%	1,187	1,084	1,290	--
UPSALM	9	8.61	1.5%	0.7%	2.4%	45	20	70	--

Table 6. The maximum likelihood (ML) estimates of the percentage of the total number of large fish from each stock and the ML percentage of large fish within each stock in the Lower Columbia River sport fishery from June 16 to July 31, 2022.

Stock	Actual number sampled	Actual number of large fish	ML percent of total large	ML total 90% lci	ML total 90% uci	ML percent large within stock	ML within 90% lci	ML within 90% uci
All samples^a	573	51	--	--	--	--	--	--
Skamania	76	6	12.2%	3.3%	15.9%	7.9%	2.2%	12.0%
Deschutes	14	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Umatilla	1	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Imnaha	16	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Oxbow	24	1	2.1%	0.0%	4.5%	4.0%	0.0%	9.5%
Pahsimeroi	22	3	6.0%	1.8%	11.2%	13.1%	4.7%	28.4%
Sawtooth	13	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Tucannon	7	1	2.0%	0.0%	3.5%	14.2%	0.0%	19.9%
Upper Salmon	1	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Wallowa-OR	57	1	2.0%	0.0%	4.4%	1.8%	0.0%	3.8%
Wallowa-WA	34	3	6.0%	0.0%	12.7%	8.8%	0.0%	17.7%
Wells	30	4	8.7%	1.9%	21.2%	13.1%	4.0%	30.7%
Wenatchee	1	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Winthrop	2	1	2.0%	0.0%	6.1%	50.0%	0.0%	100.0%
<u>Hatchery clipped assigned with GSI</u>								
LOWCOL	1	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
MGILCS	20	1	1.1%	0.0%	5.7%	3.8%	0.0%	15.7%
SKAMAN	240	29	57.8%	44.7%	69.7%	12.1%	8.2%	15.5%
UPSALM	9	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

^a Five samples (one large fish) failed genotyping and were excluded from the ML length analysis.

Table 7. All distinct PBT release groups with their stock assignment, basin assignment, and brood year (BY), that were sampled in the clipped and unclipped tribal Zone 6 fisheries in 2022. The GSI stock assignment was used for fish that were not assigned to a PBT release group. Unclipped fish assignments from release groups designated as AdClip were likely mis-clipped when fish were marked before being released.

PBT release group	Stock	Basin	BY	Tagrate
<u>Distinct groups in both clipped and unclipped fisheries</u>				
2019-CLWH-SFCR-MeadowCr-NoClip	SF Clearwater	Snake	2019	0.9848
2019-DWOR-DWOR-NFClearwaterR-AdClip	Dwor-C	Snake	2019	0.9389
2019-DWOR-DWOR-RedHouse-AdClip	Dwor-C	Snake	2019	0.9324
2019-HNFH-SAWT-SawtoothFH-AdClip	Sawtooth	Snake	2019	0.8824
2019-MVFH-USAL-PahsimeroiR-NoClip	Upper Salmon	Snake	2019	0.9811
2019-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	Oxbow	Snake	2019	0.9159
2019-NIAG-PAHS-PahsimeroiR-AdClip	Pahsimeroi	Snake	2019	0.9557
Winthrop2019	Winthrop	Up-C	2019	0.8115
PBT unassigned, GSI stock assignment was used	MGILCS	MGILCS	--	--
PBT unassigned, GSI stock assignment was used	SFCLWR	Snake	--	--
PBT unassigned, GSI stock assignment was used	SKAMAN	SKAMAN	--	--
PBT unassigned, GSI stock assignment was used	UPCLWR	Snake	--	--
PBT unassigned, GSI stock assignment was used	UPSALM	Snake	--	--
<u>Distinct groups the clipped fishery</u>				
2019-CLWH-SFCR-MeadowCr-AdClip	SF Clearwater	Snake	2019	0.9747
2019-CLWH-SFCR-RedHouse-AdClip	SF Clearwater	Snake	2019	0.9508
2019-DWOR-DWOR-ClearCr-AdClip	Dwor-C	Snake	2019	1
2019-IRRI-IMNA-Imnaha	Imnaha	Snake	2019	0.9683
2019-IRRI-WALL-WallowaR	Wallowa-OR	Snake	2019	0.9959

Table 7 (continued)

PBT release group	Stock	Basin	BY	Tagrate
2019-LYON-TUCA-TucannonR-WA	Tucannon	Snake	2019	0.9706
2019-LYON-WALL-CottonWoodGR/LyonsFerry/Touchet-WA	Wallowa-WA	Snake	2019	1
2019-MVFH-PAHS-LittleSalmonR-AdClip	Pahsimeroi	Snake	2019	0.9753
2019-MVFH-SAWT-SawtoothFH-AdClip	Sawtooth	Snake	2019	0.9242
2019-MVFH-USAL-LittleSalmonR-AdClip	Upper Salmon	Snake	2019	1
2019-MVFH-USAL-YankeeForkR-AdClip	Upper Salmon	Snake	2019	1
2019-NIAG-OXBO-LittleSalmonR-AdClip	Oxbow	Snake	2019	0.9643
2019-NIAG-PAHS-LittleSalmonR-AdClip	Pahsimeroi	Snake	2019	0.7631
2020-DWOR-DWOR-NFClearwaterR-AdClip	Dwor-C	Snake	2020	0.9491
2020-DWOR-DWOR-RedHouse-AdClip	Dwor-C	Snake	2020	0.826
2020-HNFH-SAWT-SawtoothFH-AdClip	Sawtooth	Snake	2020	0.9915
2020-IRRI-IMNA-Imnaha	Imnaha	Snake	2020	0.968
2020-IRRI-WALL-WallowaR	Wallowa-OR	Snake	2020	1
2020-LYON-WALL-CottonWoodGR/LyonsFerry/Touchet-WA	Wallowa-WA	Snake	2020	0.98
2020-MVFH-USAL-YankeeForkR-AdClip	Upper Salmon	Snake	2020	1
2020-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	Oxbow	Snake	2020	0.8658
2020-NIAG-PAHS-LittleSalmonR-AdClip	Pahsimeroi	Snake	2020	0.951
2020-NIAG-PAHS-PahsimeroiR-AdClip	Pahsimeroi	Snake	2020	0.8159
Deschutes2019	Deschutes	Mid-C	2019	0.9583
Skamania2019	Skamania	SKAMAN	2019	0.9869
Umatilla2020	Umatilla	Mid-C	2020	1
Wells2019	Wells	Up-C	2019	0.8468
Wenatchee2019	Wenatchee	Up-C	2019	0.9322

Table 7 (continued)

PBT release group	Stock	Basin	BY	Tagrate
Winthrop2018	Winthrop	Up-C	2018	0.97
<u>Distinct groups the unclipped fishery</u>				
2019-CLWH-DWOR-NewsomeCr-NoClip	Dwor-C	Snake	2019	1
2019-DWOR-DWOR-LoloCr-NoClip	Dwor-C	Snake	2019	0.9744
2019-MVFH-DWOR-YankeeForkR-AdClip	Dwor-S	Snake	2019	0.9474
PBT unassigned, GSI stock assignment was used	KLICKR	Mid-C	--	--
PBT unassigned, GSI stock assignment was used	MFSALM	Snake	--	--
PBT unassigned, GSI stock assignment was used	SFSALM	Snake	--	--
PBT unassigned, GSI stock assignment was used	UPPCOL	Up-C	--	--

Table 8. Stock composition and harvest estimates by stock and brood year (BY) of clipped steelhead in the tribal Zone 6 fishery during the 2022 Fall Management Period. All fish were adipose clipped. The GSI assignment was used for fish that did not assign to a PBT release group. The estimated clipped harvest was 6,522. The sum of the stock and BY harvest components may not equal the total or basin percent and harvest estimates due to rounding error.

Stock	BY	Sample size		Percent by stock and BY			Harvest by stock and BY		
		Actual	Adjust	Estimate	90% lci	90% uci	Estimate	90% lci	90% uci
<i>All PBT assigned</i>		430	453.76	97.0%	94.5%	98.9%	6,324	6,165	6,453
Skamania	2019	3	2.70	0.6%	0.0%	1.2%	38	0	78
<i>Mid-C basin</i>		3	2.94	0.6%	0.2%	1.3%	41	11	85
Deschutes	2019	1	1.09	0.2%	0.0%	0.7%	15	0	46
Umatilla	2020	2	1.86	0.4%	0.0%	0.9%	26	0	59
<i>Snake basin</i>		404	425.87	91.0%	88.1%	93.5%	5,935	5,747	6,100
Dwor-C	2019	216	228.67	48.9%	44.8%	52.8%	3,187	2,919	3,445
Dwor-C	2020	3	3.46	0.7%	0.2%	1.5%	48	15	98
Imnaha	2019	3	2.76	0.6%	0.2%	1.2%	38	11	77
Imnaha	2020	1	1.08	0.2%	0.0%	0.7%	15	0	45
Oxbow	2019	25	27.27	5.8%	4.0%	7.7%	380	262	505
Oxbow	2020	5	5.76	1.2%	0.4%	2.2%	80	29	144
Pahsimeroi	2019	28	30.53	6.5%	4.6%	8.5%	425	299	556
Pahsimeroi	2020	2	2.38	0.5%	0.0%	1.2%	33	0	79
Sawtooth	2019	8	8.88	1.9%	0.9%	3.1%	124	58	201
Sawtooth	2020	4	4.21	0.9%	0.2%	1.6%	59	15	104
SF Clearwater	2019	45	46.83	10.0%	7.7%	12.4%	653	504	812
Tucannon	2019	1	1.07	0.2%	0.0%	0.7%	15	0	45
Upper Salmon	2019	6	6.05	1.3%	0.4%	2.2%	84	29	144

Table 8 (continued)

Stock	BY	Sample size		Percent by stock and BY			Harvest by stock and BY		
		Actual	Adjust	Estimate	90% lci	90% uci	Estimate	90% lci	90% uci
Upper Salmon	2020	1	1.04	0.2%	0.0%	0.7%	15	0	44
Wallowa-OR	2019	26	26.54	5.7%	3.9%	7.5%	370	257	487
Wallowa-OR	2020	3	2.67	0.6%	0.2%	1.1%	37	11	75
Wallowa-WA	2019	21	20.99	4.5%	3.0%	6.1%	292	194	399
Wallowa-WA	2020	6	5.68	1.2%	0.5%	2.1%	79	30	135
<i>Up-C basin</i>		20	22.25	4.8%	3.1%	6.5%	310	203	422
Wells	2019	17	19.02	4.1%	2.5%	5.7%	265	165	370
Wenatchee	2019	1	0.87	0.2%	0.0%	0.6%	12	0	36
Winthrop	2018	1	1.08	0.2%	0.0%	0.7%	15	0	45
Winthrop	2019	1	1.29	0.3%	0.0%	0.8%	18	0	54
<i>PBT Unassigned</i>		38	14.24	3.0%	1.1%	5.5%	198	69	357

Table 9. The percentage of harvest and harvest estimate by hatchery stock, and percentage of the harvest that was from 1-ocean fish (Percent 1 ocean) in the tribal Zone 6 fishery during the Fall Management Period. All fish were adipose clipped. The GSI assignment was used for fish that did not assign to a PBT release group. The stock percent and harvest estimates may not equal the sum of the BY components in Table 8 or the basin estimate due to rounding error.

Stock	Sample size		Percent by stock			Harvest by stock			Percent 1 ocean
	Actual	Adjust	Estimate	90% lci	90% uci	Estimate	90% lci	90% uci	
Skamania	3	2.70	0.6%	0.0%	1.2%	38	0	78	--
<u>Mid-C basin</u>	3	2.94	0.6%	0.2%	1.3%	41	11	85	--
Deschutes	1	1.09	0.23%	0.00%	0.70%	15	0	46	--
Umatilla	2	1.86	0.40%	0.00%	0.90%	26	0	59	--
<u>Snake basin</u>	404	425.87	91.0%	88.1%	93.5%	5,935	5,747	6,100	6.2%
Dwor-C	219	232.13	49.6%	45.5%	53.6%	3,235	2,970	3,493	1.4%
Imnaha	4	3.83	0.8%	0.2%	1.5%	53	12	99	--
Oxbow	30	33.03	7.1%	5.1%	9.2%	460	329	598	16.7%
Pahsimeroi	30	32.91	7.0%	5.0%	9.1%	459	327	596	6.7%
Sawtooth	12	13.09	2.8%	1.6%	4.2%	182	102	275	33.3%
SF Clearwater	45	46.83	10.0%	7.7%	12.4%	653	504	812	0%
Tucannon	1	1.07	0.2%	0.0%	0.7%	15	0	45	--
Upper Salmon	7	7.09	1.5%	0.7%	2.5%	99	44	162	--
Wallowa-OR	29	29.21	6.2%	4.4%	8.1%	407	289	530	10.3%
Wallowa-WA	27	26.67	5.7%	4.0%	7.5%	372	261	490	22.2%
<u>Up-C basin</u>	20	22.25	4.8%	3.1%	6.5%	310	203	422	0%
Wells	17	19.02	4.1%	2.5%	5.7%	265	165	370	0%
Wenatchee	1	0.87	0.2%	0.0%	0.6%	12	0	36	--

Table 9 (continued)

Stock	Sample size		Percent by stock			Harvest by stock			Percent
	Actual	Adjust	Estimate	90% lci	90% uci	Estimate	90% lci	90% uci	1 ocean
Winthrop	2	2.36	0.5%	0.0%	1.2%	33	0	78	--
<i>Hatchery origin assigned with GSI</i>									
<i>All GSI assigned</i>	38	14.24	3.0%	1.1%	5.5%	198	69	357	
MGILCS	12	4.31	0.9%	0.3%	1.9%	60	18	121	--
SFCLWR	15	5.61	1.2%	0.4%	2.3%	78	24	151	--
SKAMAN	1	0.43	0.1%	0.0%	0.3%	6	0	20	--
UPCLWR	3	1.29	0.3%	0.0%	0.7%	18	0	43	--
UPSALM	7	2.59	0.6%	0.1%	1.2%	36	9	77	--

Table 10. The maximum likelihood (ML) estimates of the percentage of the total number of large clipped fish from each stock and the ML percentage of large clipped fish within each stock in the 2022 Fall Management Period tribal Zone 6 fishery.

Stock	Actual number sampled	Actual number of large fish	ML percent of total large	ML total 90% lci	ML total 90% uci	ML percent large within stock	ML within 90% lci	ML within 90% uci
All samples^a	471	287	--	--	--	--	--	--
Deschutes	1	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Dwor-C	219	207	76.9%	73.6%	80.0%	94.5%	92.3%	96.3%
Imnaha	4	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Oxbow	30	3	1.1%	0.3%	1.8%	9.3%	2.7%	16.2%
Pahsimeroi	30	1	0.4%	0.0%	1.0%	3.1%	0.0%	8.3%
Sawtooth	12	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SF Clearwater	45	43	15.6%	12.3%	19.5%	95.5%	92.7%	100.0%
Skamania	3	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Tucannon	1	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Umatilla	2	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Upper Salmon	7	4	1.4%	0.4%	2.0%	57.3%	22.8%	96.0%
Wallowa-OR	29	1	0.4%	0.0%	1.0%	3.4%	0.0%	10.4%
Wallowa-WA	27	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Wells	17	5	2.0%	0.8%	3.0%	28.8%	12.6%	48.5%
Wenatchee	1	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Winthrop	2	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<u>Hatchery clipped assigned with GSI</u>								
MGILCS	12	4	1.1%	0.0%	2.1%	40.5%	0.0%	97.1%
SFCLWR	15	14	0.3%	0.0%	1.8%	100.0%	0.0%	100.0%
SKAMAN	1	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
UPCLWR	3	3	1.0%	0.3%	2.2%	100.0%	100.0%	100.0%
UPSALM	7	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

^a Three samples (two large fish) failed genotyping and were excluded from the ML length analysis.

Table 11. Stock composition and harvest estimates by stock and brood year (BY) of unclipped steelhead in the tribal Zone 6 fishery during the 2022 Fall Management Period. The GSI assignment was used for fish that did not assign to a PBT release group and are putative wild fish. The estimated unclipped harvest was 2,973. The sum of the stock and BY harvest components may not equal the total or basin percent and harvest estimates due to rounding error. HNC = unclipped hatchery origin.

Stock	BY	Sample size		Percent by stock and BY			Harvest by stock and BY		
		Actual	Adjust	Estimate	90% lci	90% uci	Estimate	90% lci	90% uci
<i>All PBT assigned (HNC)</i>		55	57.00	34.3%	27.8%	41.2%	1,021	825	1,224
<i><u>Snake basin HNC fish</u></i>		54	55.44	33.4%	26.8%	40.0%	993	798	1,191
Dwor-C	2019	27	29.63	17.8%	12.6%	23.4%	531	375	696
Dwor-S	2019	1	0.38	0.2%	0.0%	0.7%	7	0	20
Oxbow	2019	2	0.78	0.5%	0.0%	1.2%	14	0	35
Pahsimeroi	2019	1	1.33	0.8%	0.0%	2.4%	24	0	71
Sawtooth	2019	1	1.44	0.9%	0.0%	2.6%	26	0	77
SF Clearwater	2019	17	16.35	9.9%	6.0%	14.1%	293	177	419
Upper Salmon	2019	5	5.54	3.3%	1.0%	5.9%	99	30	175
Winthrop	2019	1	1.56	0.9%	0.0%	2.8%	28	0	84
<i><u>Wild fish--GSI assigned</u></i>		111	109.00	65.7%	58.8%	72.2%	1,953	1,750	2,149
KLICKR		7	7.97	4.8%	2.0%	7.9%	143	58	234
MFSALM		4	2.34	1.4%	0.2%	2.9%	42	6	87
MGILCS		57	58.35	35.1%	28.6%	42.0%	1,045	851	1,249
SFCLWR		11	10.05	6.1%	2.7%	9.8%	180	80	290
SFSALM		4	3.25	2.0%	0.2%	4.0%	58	6	120
SKAMAN		5	3.61	2.2%	0.4%	4.3%	65	13	126
UPCLWR		16	16.66	10.0%	6.0%	14.3%	298	178	425
UPPCOL		1	1.27	0.8%	0.0%	2.3%	23	0	68
UPSALM		6	5.50	3.3%	1.0%	6.0%	98	28	179

Table 12. The maximum likelihood (ML) estimates of the percentage of the total number of large unclipped fish from each stock and the ML percentage of large unclipped fish within each stock in the 2022 Fall Management Period tribal Zone 6 fishery. HNC = unclipped hatchery origin assigned with PBT.

Stock	Actual number sampled	Actual number of large fish	ML percent of total large	ML total 90% Ici	ML total 90% uci	ML percent large within stock	ML within 90% Ici	ML within 90% uci
All samples	166	86	--	--	--	--	--	--
<u>All HNC</u>	55	49						
Dwor-C	27	27	32.3%	25.6%	37.8%	100.0%	100.0%	100.0%
Dwor-S	1	1	1.2%	0.0%	3.7%	100.0%	100.0%	100.0%
Oxbow	2	1	1.3%	0.0%	3.3%	50.0%	0.0%	100.0%
Pahsimeroi	1	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Sawtooth	1	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SF Clearwater	17	17	20.1%	14.7%	26.5%	100.0%	100.0%	100.0%
Upper Salmon	5	3	3.6%	1.0%	8.4%	60.0%	44.3%	100.0%
Winthrop	1	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<u>All Wild fish</u>	111	37						
KLICKR	7	1	1.2%	0.0%	2.3%	14.3%	0.0%	31.7%
MFSALM	4	2	2.3%	0.0%	4.7%	50.0%	0.0%	100.0%
MGILCS	57	8	9.3%	6.0%	15.4%	14.1%	9.9%	22.6%
SFCLWR	11	9	9.2%	3.9%	12.8%	80.0%	59.9%	100.0%
SFSALM	4	4	4.7%	1.3%	7.1%	100.0%	100.0%	100.0%
SKAMAN	5	1	1.2%	0.0%	2.5%	20.0%	0.0%	60.0%
UPCLWR	16	11	12.8%	7.4%	17.4%	68.8%	50.0%	90.2%
UPPCOL	1	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
UPSALM	6	1	1.1%	0.0%	3.3%	16.1%	0.0%	56.4%

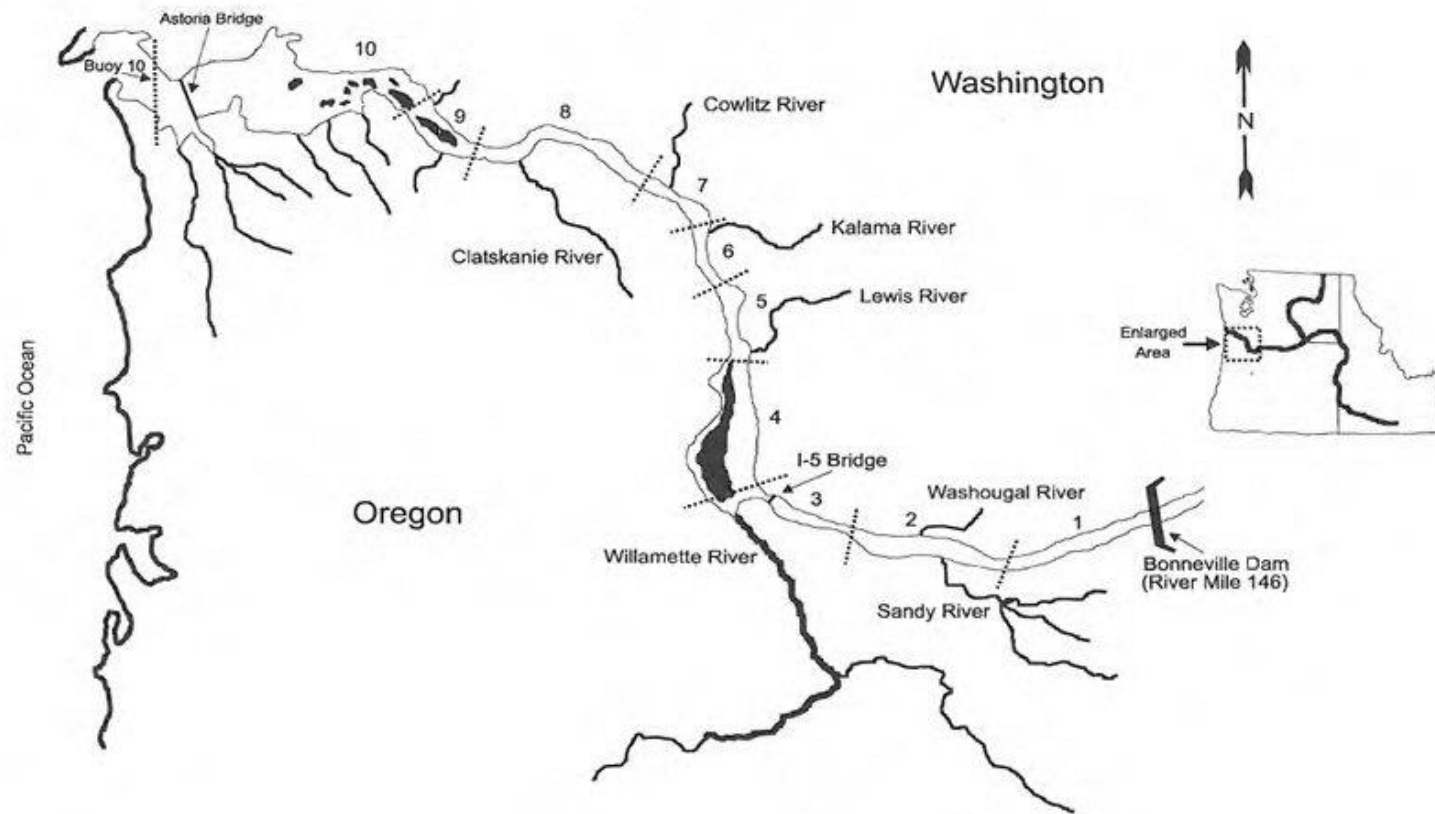


Figure 1. Map of the Lower Columbia River showing the 10 creel survey sections that were used to estimate sport harvest.

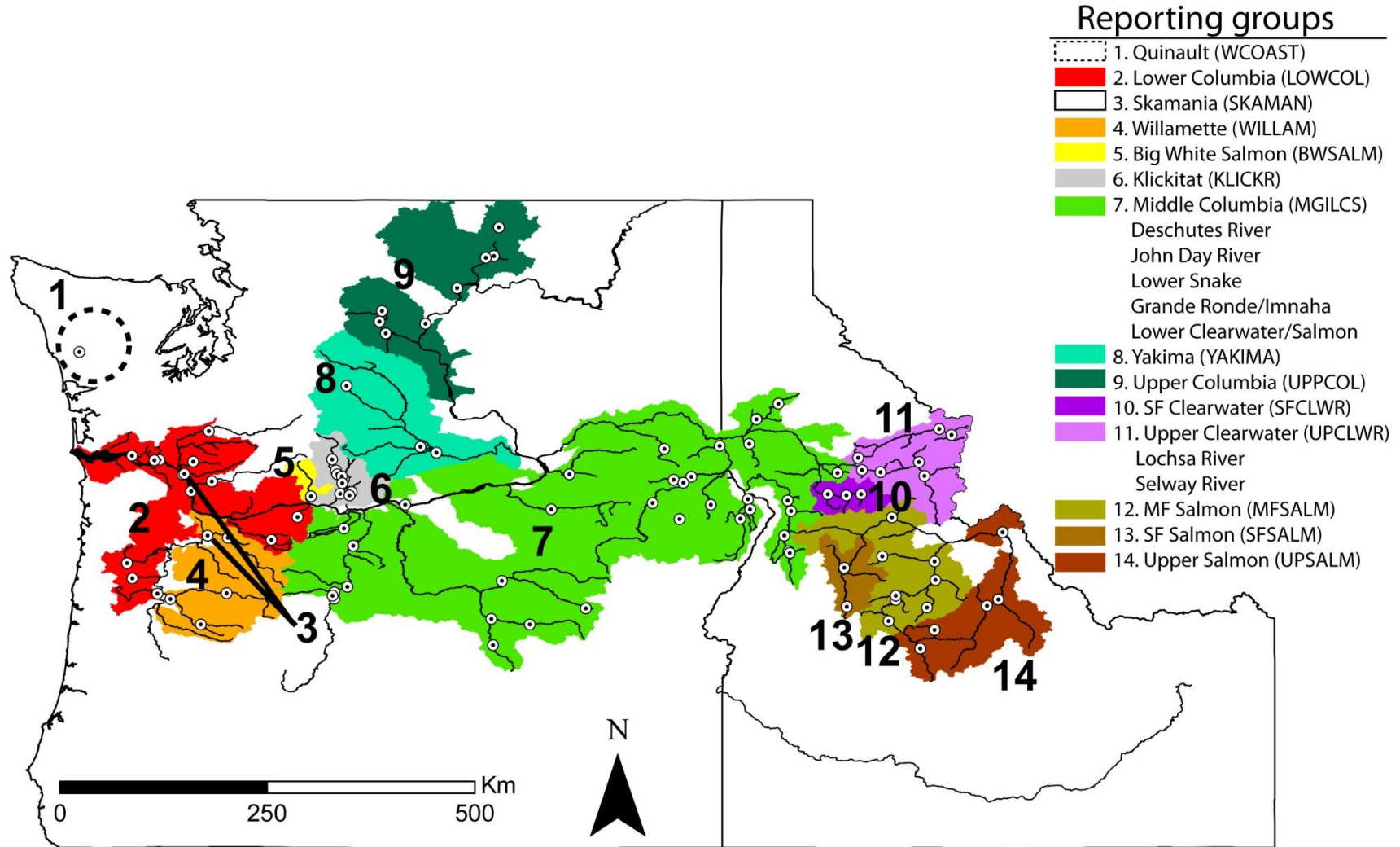


Figure 2. Map of the GSI reporting groups that were developed by CRITFC. These groups were used to assign adipose clipped and adipose unclipped steelhead that were not identified with PBT.

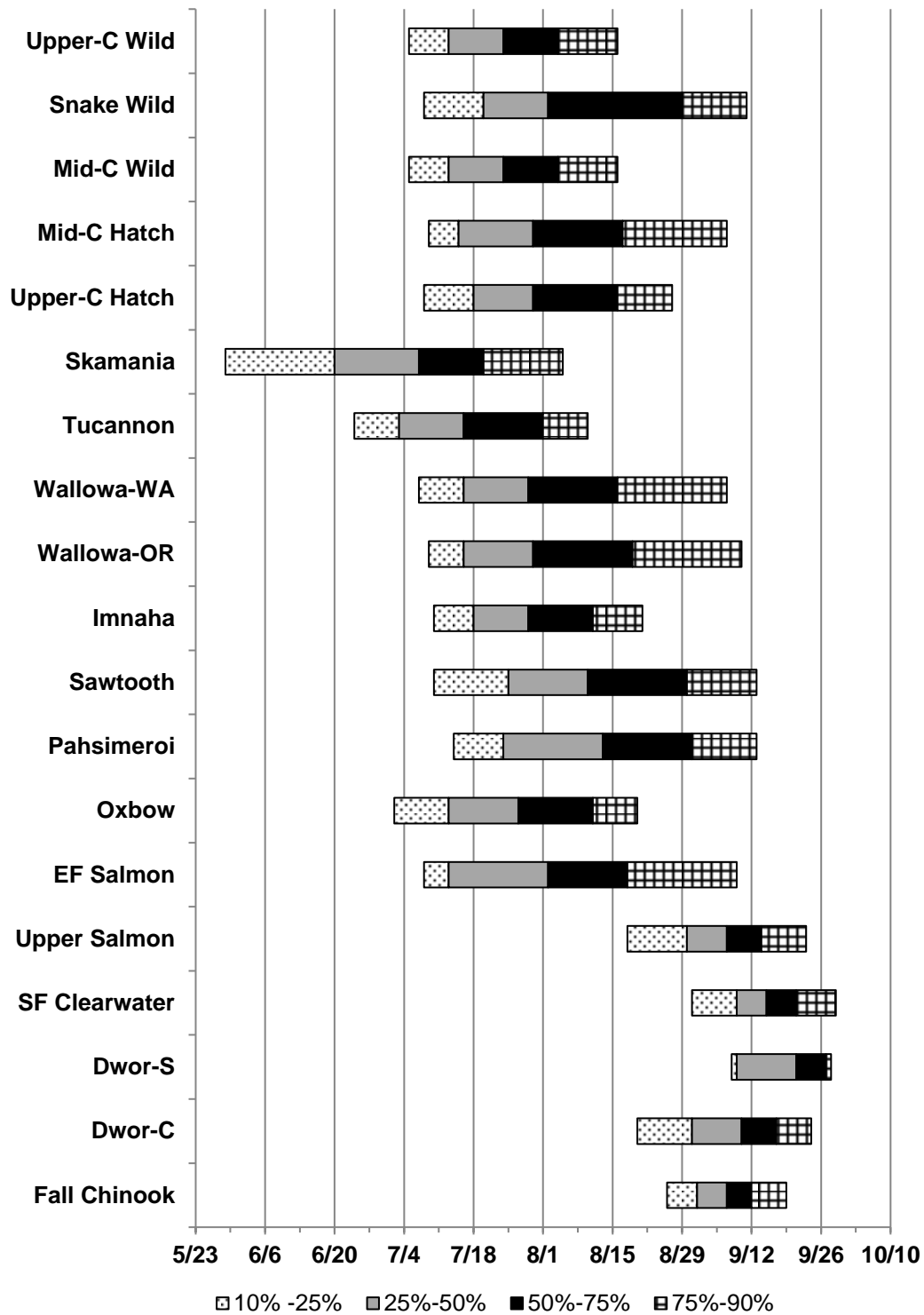


Figure 3. Run-timing of hatchery and wild steelhead stocks and fall Chinook Salmon at Bonneville Dam in 2022. The Skamania stock run timing is for fish released in the Klickitat River. The Snake River wild stock excludes fish tagged at Snake River dams.

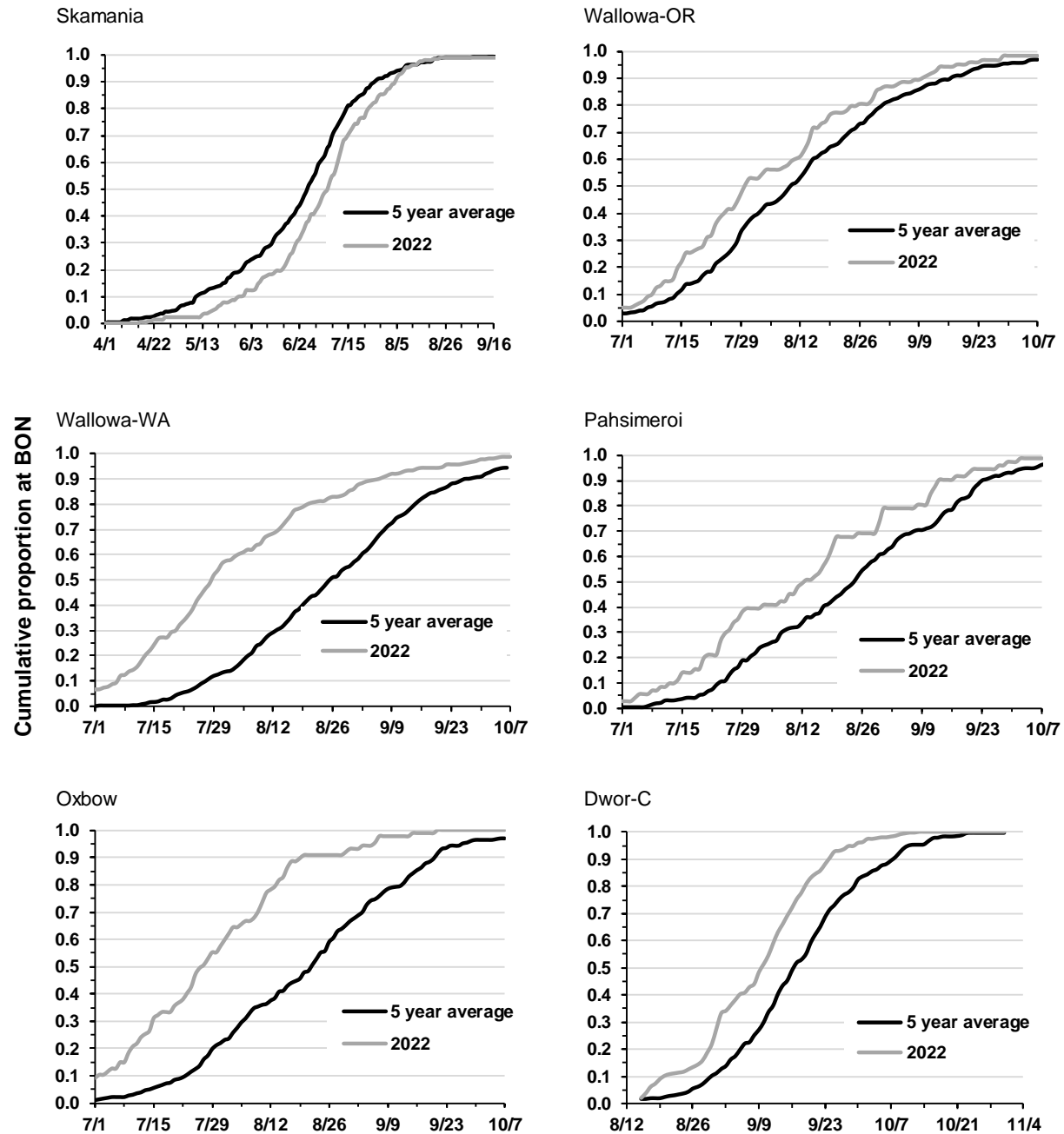


Figure 4. The proportion of the cumulative passage by date of selected steelhead stocks at Bonneville Dam in 2022 compared with their recent five-year average from 2017 to 2021.

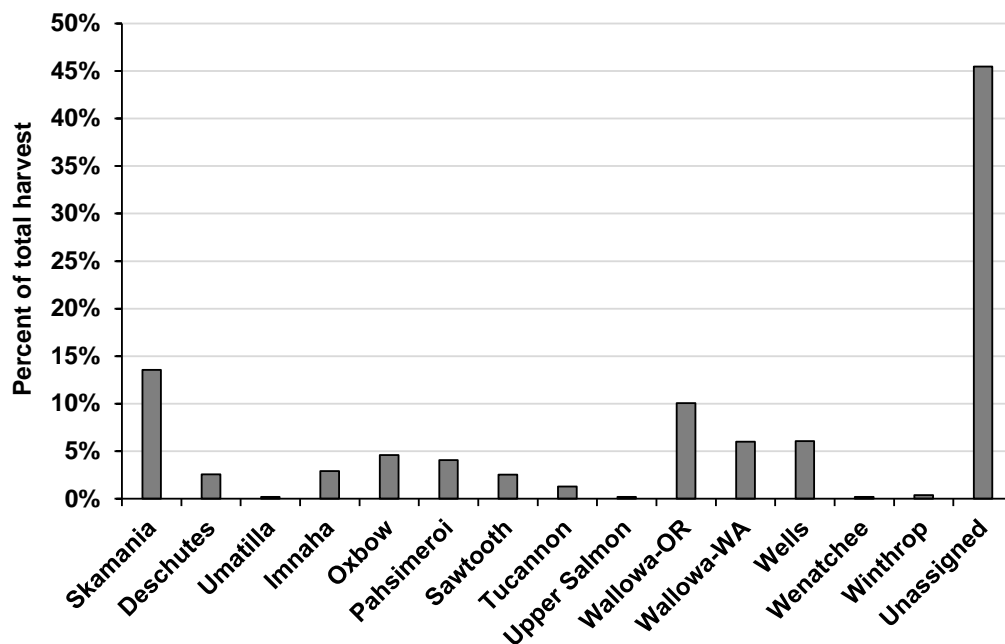


Figure 5. Stock composition percentages of the total harvest in the Lower Columbia River sport fishery that were assigned to PBT assigned stocks, June 16 to July 31, 2022.

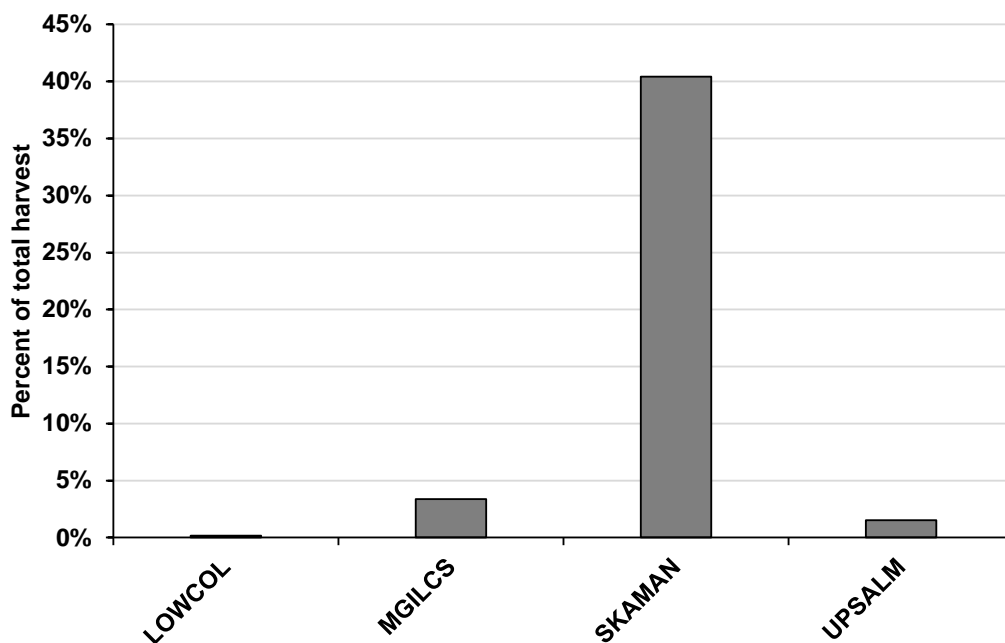


Figure 6. Stock composition percentages of the clipped hatchery origin fish that were assigned to GSI reporting groups in the Lower Columbia River sport fishery, June 16 to July 31, 2022.

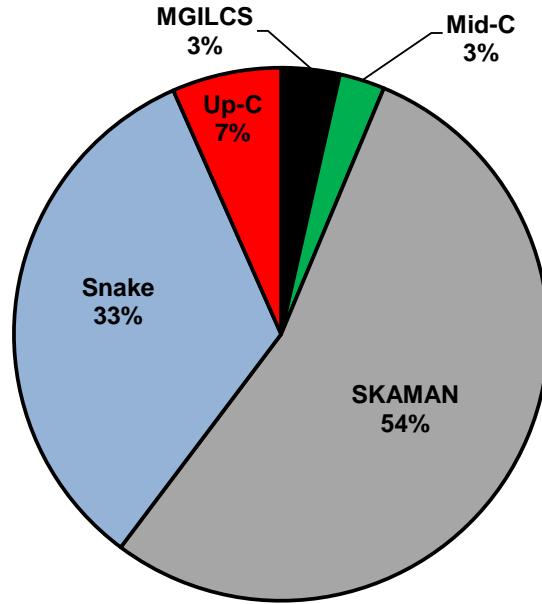


Figure 7. Harvest contribution by basin in the Lower Columbia River sport fishery, June 16 to July 31, 2022. The Low-C harvest contribution was 0.2% and is not shown.

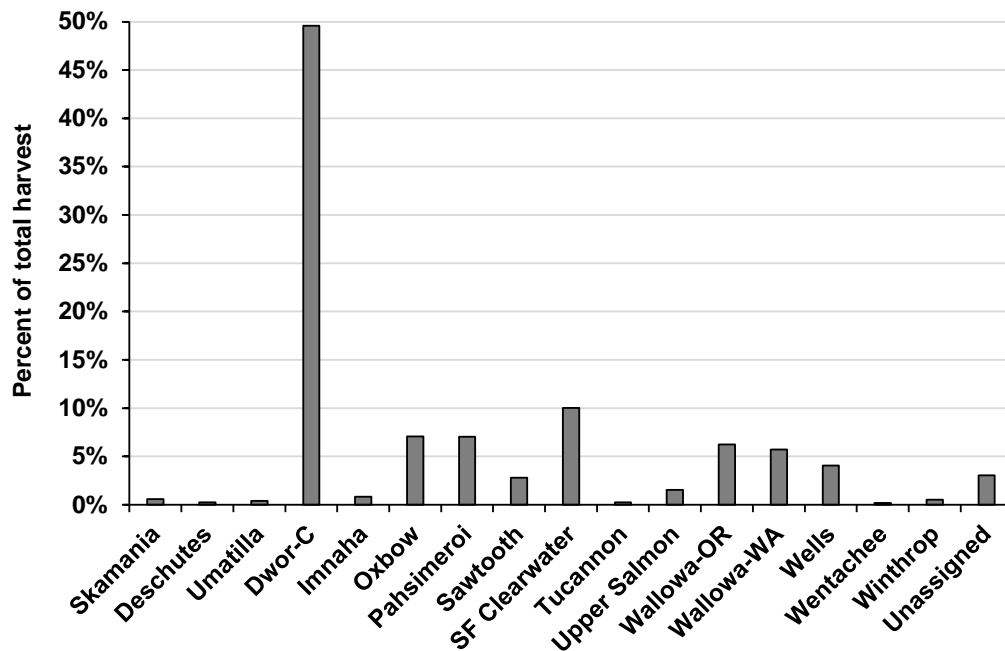


Figure 8. Stock composition percentages of the clipped hatchery origin fish in the tribal Zone 6 Fall Management Period fishery, 2022.

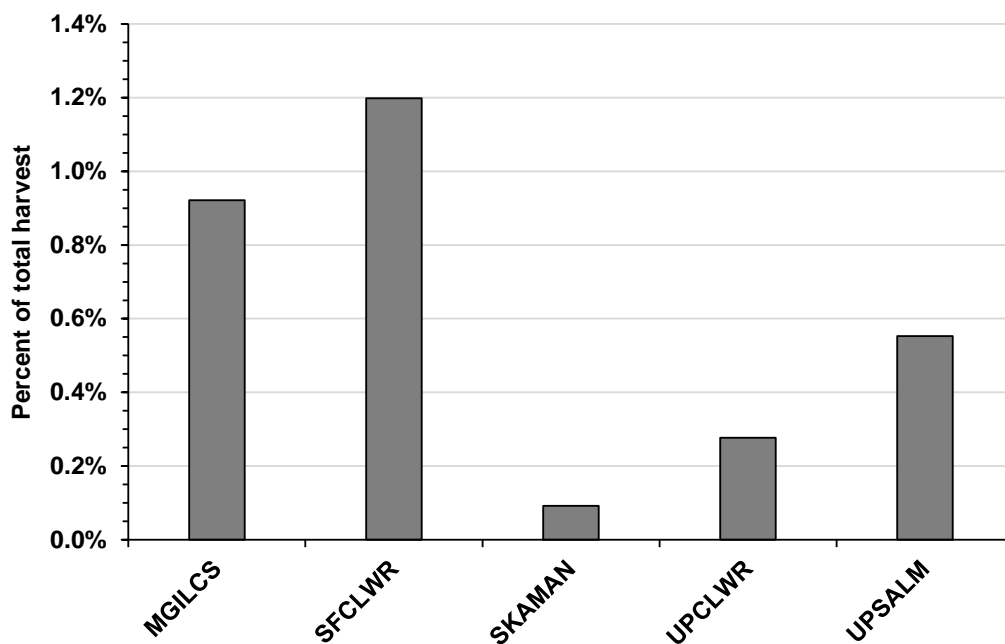


Figure 9. Stock composition percentages of the clipped hatchery origin fish that were assigned to GSI reporting groups in the tribal Zone 6 Fall Management Period fishery, 2022.

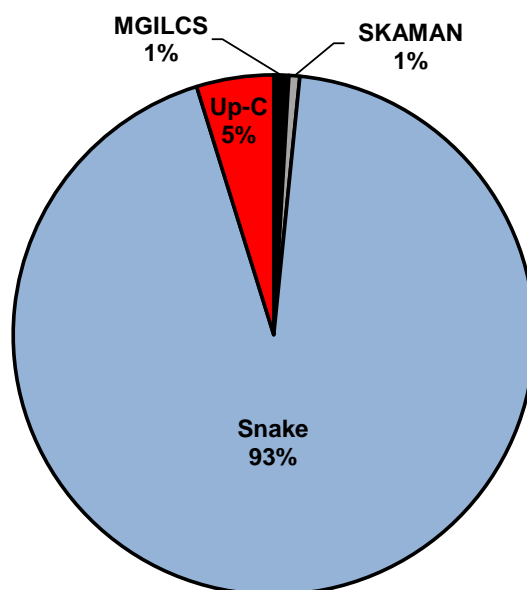


Figure 10. Harvest contribution by basin in the clipped tribal Zone 6 Fall Management Period fishery, 2022. The Low-C and Mid-C harvest contribution was 0% and 0.6%, respectively and is not shown.

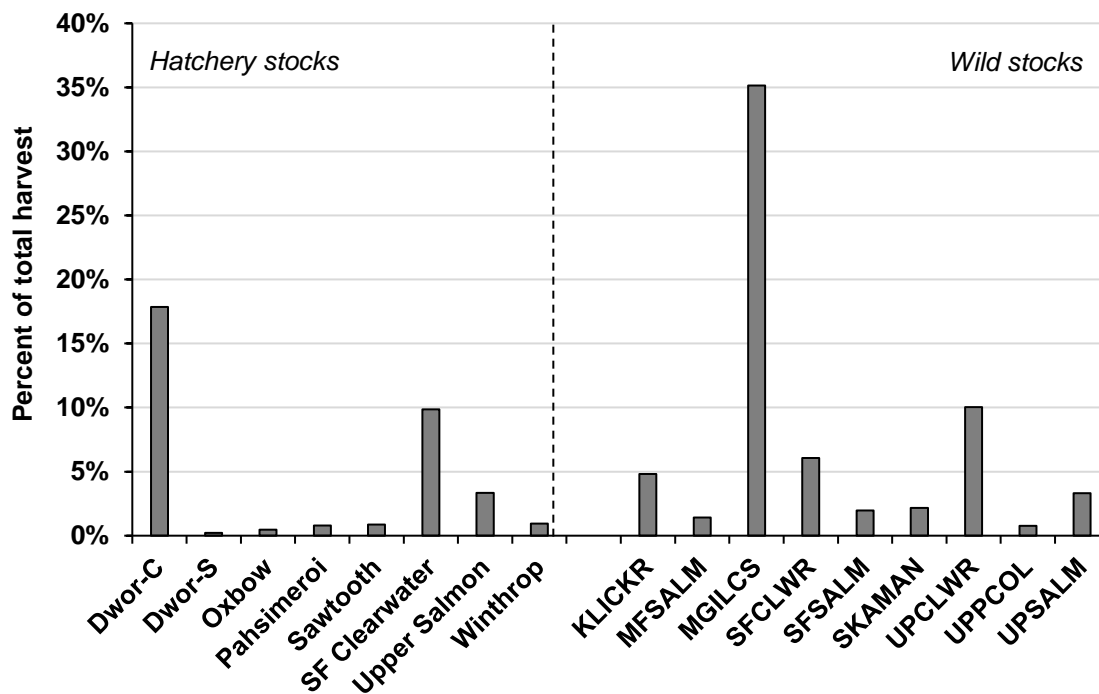


Figure 11. Stock composition percentages of the unclipped fish in the tribal Zone 6 Fall Management Period fishery, 2022. Unclipped hatchery origin fish are left of dashed line and wild fish are right of dashed line.

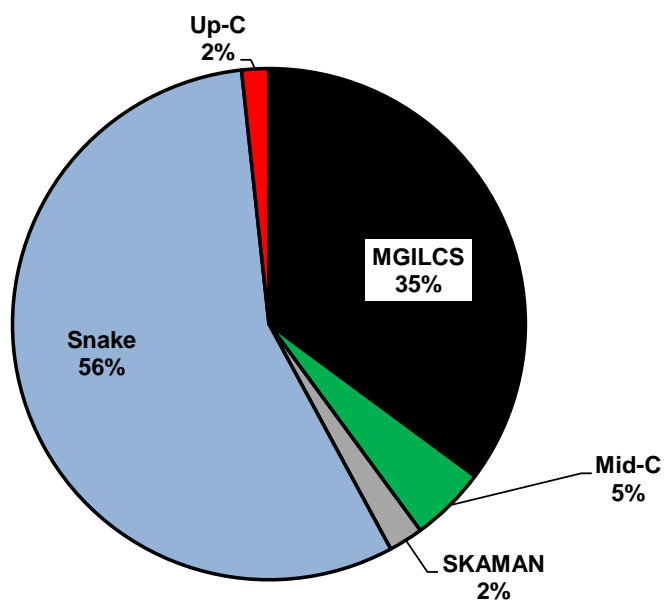


Figure 12. The percentage of unclipped steelhead harvest by basin in the tribal Zone 6 Fall Management Period fishery, 2022.

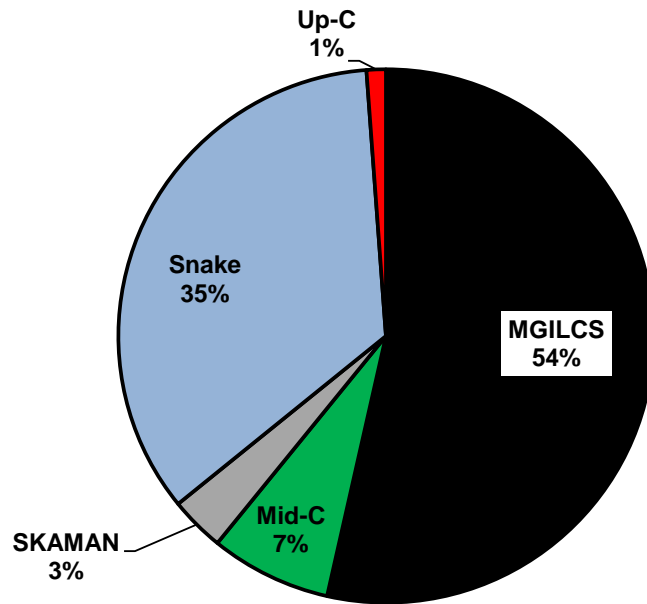


Figure 13. The percentage of wild steelhead harvest by basin in the tribal Zone 6 Fall Management Period fishery, 2022.

Appendix A. Date of arrival at Bonneville Dam (BON) of summer steelhead stocks and fall Chinook Salmon in 2022, the percentage of the stock's passage on August 1, and the recent 5-year average passage date (2017 – 2021) of the 25%, 50%, and 75% arrival quantiles. The stocks shaded in grey contribute most of the large hatchery origin steelhead during the A/B-Index steelhead passage period at Bonneville Dam.

Stock	Number	Date arrival quantile attained at Bonneville Dam						8/1 BON	5-year average passage date		
		10%	25%	50%	75%	90%	95%	passage	25%	50%	75%
Fall Chinook	504,080	8/26	9/1	9/7	9/12	9/19	9/24	--	9/1	9/9	9/18
Dwor-C	343	8/20	8/31	9/10	9/17	9/24	9/30	0%	9/8	9/16	9/25
Dwor-S	12	9/8	9/9	9/21	9/27	9/28	11/10	0%	9/19	9/24	10/2
SF Clearwater	210	8/31	9/9	9/15	9/21	9/29	10/4	0%	9/10	9/20	9/28
Upper Salmon	48	8/18	8/30	9/7	9/14	9/23	9/26	2%	9/5	9/16	9/27
EF Salmon	12	7/8	7/13	8/2	8/18	9/9	10/12	42%	8/4	8/18	9/6
Oxbow	87	7/2	7/13	7/27	8/11	8/20	9/6	60%	8/7	8/19	9/5
Pahsimeroi	71	7/14	7/24	8/13	8/31	9/13	9/27	39%	8/9	8/22	9/8
Sawtooth	70	7/10	7/25	8/10	8/30	9/13	9/28	43%	8/7	8/22	9/7
Imnaha	181	7/10	7/18	7/29	8/11	8/21	9/4	56%	7/27	8/9	8/23
Wallowa-OR	123	7/9	7/16	7/30	8/19	9/10	9/18	53%	8/2	8/14	8/30
Wallowa-WA ^a	297	7/7	7/16	7/29	8/16	9/7	9/22	58%	7/31	8/14	8/30
Tucannon	73	6/24	7/3	7/16	8/1	8/10	8/17	77%	7/25	8/8	8/21
Skamania	219	5/29	6/20	7/7	7/20	8/5	8/9	87%	6/6	6/26	7/10
Mid-C Hatch	143	7/9	7/15	7/30	8/17	9/7	9/22	57%	7/30	8/14	8/27
Upper-C Hatch	289	7/8	7/18	7/30	8/16	8/27	9/1	53%	7/30	8/13	8/27
Mid-C Wild	248	7/5	7/13	7/24	8/4	8/16	9/2	69%	7/19	7/31	8/15
Upper-C Wild	35	6/26	7/6	7/14	7/31	8/26	9/8	77%	7/22	8/4	8/13
Snake Wild	231	7/8	7/20	8/2	8/29	9/11	9/20	48%	7/25	8/9	8/27
MIN Snake hatchery		6/24	7/3	7/16	8/1	8/10	8/17	0%	--	--	--
MAX Snake hatchery		9/8	9/9	9/21	9/27	9/29	11/10	77%	--	--	--
Snake duration (days)		76	68	67	57	50	85	--	--	--	--

^a Includes fish released in the Walla Walla basin.

Appendix B. Harvest and stock composition estimates by PBT release groups in the Lower Columbia River sport fishery, June 16 to July 31, 2022. All fish were adipose clipped. The total harvest estimate was 2,938. The sum of the components may not equal the total harvest due to rounding error.

PBT Release Group	Percent of harvest			Harvest by groups		
	Estimate	90% lci	90% uci	Estimate	90% lci	90% uci
2019-HNFH-SAWT-SawtoothFH-AdClip	1.60%	0.80%	2.59%	47	23	76
2019-IRRI-IMNA-Imnaha	2.18%	1.27%	3.27%	64	37	96
2019-IRRI-WALL-WallowaR	8.49%	6.58%	10.43%	249	193	306
2019-LYON-TUCA-TucannonR-WA	1.27%	0.54%	2.17%	37	16	64
2019-LYON-WALL-CottonWoodGR/LyonsFerry/Touchet-WA	5.28%	3.72%	6.85%	155	109	201
2019-MVFH-PAHS-LittleSalmonR-AdClip	1.08%	0.36%	1.81%	32	11	53
2019-MVFH-SAWT-SawtoothFH-AdClip	0.57%	0.19%	1.14%	17	6	34
2019-MVFH-USAL-LittleSalmonR-AdClip	0.18%	0.00%	0.53%	5	0	16
2019-NIAG-OXBO-LittleSalmonR-AdClip	0.91%	0.36%	1.64%	27	11	48
2019-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	3.08%	1.92%	4.41%	90	56	130
2019-NIAG-PAHS-LittleSalmonR-AdClip	0.23%	0.00%	0.69%	7	0	20
2019-NIAG-PAHS-PahsimeroiR-AdClip	2.76%	1.66%	4.03%	81	49	118
2020-HNFH-SAWT-SawtoothFH-AdClip	0.36%	0.00%	0.88%	10	0	26
2020-IRRI-IMNA-Imnaha	0.73%	0.18%	1.29%	21	5	38
2020-IRRI-WALL-WallowaR	1.58%	0.71%	2.47%	47	21	73
2020-LYON-WALL-CottonWoodGR/LyonsFerry/Touchet-WA	0.72%	0.18%	1.43%	21	5	42
2020-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	0.61%	0.00%	1.22%	18	0	36
Deschutes2019	2.57%	1.47%	3.68%	76	43	108
Skamania2019	13.56%	11.24%	16.03%	398	330	471
Umatilla2020	0.18%	0.00%	0.53%	5	0	16
Wells2019	4.99%	3.34%	6.66%	147	98	196
Wells2020	1.07%	0.36%	1.79%	31	10	53

Appendix B (continued)

PBT Release Group	Percent of harvest			Harvest by groups		
	Estimate	90% Ici	90% uci	Estimate	90% Ici	90% uci
Wenatchee2019	0.19%	0.00%	0.57%	6	0	17
Winthrop2018	0.36%	0.00%	0.90%	11	0	27
All PBT assigned	54.54%	50.94%	58.19%	1,602	1,496	1,710
PBT Unassigned-LOWCOL	0.17%	0.00%	0.51%	5	0	15
PBT Unassigned-MGILCS	3.37%	2.18%	4.57%	99	64	134
PBT Unassigned-SKAMAN	40.41%	36.89%	43.90%	1,187	1,084	1,290
PBT Unassigned-UPSALM	1.52%	0.68%	2.37%	45	20	70
All PBT unassigned	45.46%	41.81%	49.06%	1,336	1,228	1,442

Appendix C. Harvest and stock composition estimates by PBT release groups of clipped steelhead in the tribal Zone 6 fishery from August 1 to November 30, 2022. The harvest estimate was 6,522 clipped steelhead. The sum of the components may not equal the total harvest due to rounding error.

PBT Release Group	Percent of harvest			Harvest by groups		
	Estimate	90% lci	90% uci	Estimate	90% lci	90% uci
2019-CLWH-SFCR-MeadowCr-AdClip	6.89%	5.02%	8.96%	449	328	584
2019-CLWH-SFCR-MeadowCr-NoClip	0.23%	0.00%	0.68%	15	0	44
2019-CLWH-SFCR-RedHouse-AdClip	2.89%	1.64%	4.25%	189	107	277
2019-DWOR-DWOR-ClearCr-AdClip	6.14%	4.36%	8.05%	401	284	525
2019-DWOR-DWOR-NFClearwaterR-AdClip	31.05%	27.36%	34.69%	2,025	1,784	2,262
2019-DWOR-DWOR-RedHouse-AdClip	11.66%	9.14%	14.22%	761	596	927
2019-HNFH-SAWT-SawtoothFH-AdClip	1.66%	0.70%	2.73%	108	46	178
2019-IRRI-IMNA-Imnaha	0.59%	0.17%	1.18%	38	11	77
2019-IRRI-WALL-WallowaR	5.67%	3.94%	7.47%	370	257	487
2019-LYON-TUCA-TucannonR-WA	0.23%	0.00%	0.69%	15	0	45
2019-LYON-WALL-CottonWoodGR/LyonsFerry/Touchet-WA	4.48%	2.97%	6.11%	292	194	399
2019-MVFH-PAHS-LittleSalmonR-AdClip	1.78%	0.86%	2.89%	116	56	188
2019-MVFH-SAWT-SawtoothFH-AdClip	0.24%	0.00%	0.72%	16	0	47
2019-MVFH-USAL-LittleSalmonR-AdClip	0.62%	0.17%	1.25%	40	11	81
2019-MVFH-USAL-PahsimeroiR-NoClip	0.23%	0.00%	0.68%	15	0	44
2019-MVFH-USAL-YankeeForkR-AdClip	0.45%	0.00%	1.11%	29	0	72
2019-NIAG-OXBO-LittleSalmonR-AdClip	1.80%	0.87%	2.93%	117	57	191
2019-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	4.03%	2.52%	5.65%	263	165	369
2019-NIAG-PAHS-LittleSalmonR-AdClip	1.17%	0.29%	2.32%	76	19	151
2019-NIAG-PAHS-PahsimeroiR-AdClip	3.58%	2.21%	5.08%	233	144	331
2020-DWOR-DWOR-NFClearwaterR-AdClip	0.47%	0.00%	1.17%	31	0	76
2020-DWOR-DWOR-RedHouse-AdClip	0.27%	0.00%	0.81%	18	0	53

Appendix C (continued)

PBT Release Group	Percent of harvest			Harvest by groups		
	Estimate	90% lci	90% uci	Estimate	90% lci	90% uci
2020-HNFH-SAWT-SawtoothFH-AdClip	0.90%	0.22%	1.59%	59	15	104
2020-IRRI-IMNA-Imnaha	0.23%	0.00%	0.69%	15	0	45
2020-IRRI-WALL-WallowaR	0.57%	0.17%	1.14%	37	11	75
2020-LYON-WALL-CottonWoodGR/LyonsFerry/Touchet-WA	1.21%	0.45%	2.08%	79	30	135
2020-MVFH-USAL-YankeeForkR-AdClip	0.22%	0.00%	0.67%	15	0	44
2020-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	1.23%	0.45%	2.20%	80	29	144
2020-NIAG-PAHS-LittleSalmonR-AdClip	0.23%	0.00%	0.70%	15	0	46
2020-NIAG-PAHS-PahsimeroiR-AdClip	0.27%	0.00%	0.82%	18	0	53
Deschutes2019	0.23%	0.00%	0.70%	15	0	46
Skamania2019	0.58%	0.00%	1.20%	38	0	78
Umatilla2020	0.40%	0.00%	0.90%	26	0	59
Wells2019	4.06%	2.54%	5.68%	265	165	370
Wenatchee2019	0.19%	0.00%	0.56%	12	0	36
Winthrop2018	0.23%	0.00%	0.69%	15	0	45
Winthrop2019	0.27%	0.00%	0.82%	18	0	54
PBT Unassigned-MGILCS	0.92%	0.28%	1.86%	60	18	121
PBT Unassigned-SFCLWR	1.20%	0.37%	2.31%	78	24	151
PBT Unassigned-UPSALM	0.55%	0.13%	1.18%	36	9	77
PBT Unassigned-SKAMAN	0.09%	0.00%	0.31%	6	0	20
PBT Unassigned-UPCLWR	0.28%	0.00%	0.66%	18	0	43

Appendix D. Harvest and stock composition estimates by PBT release groups and GSI stocks of unclipped steelhead in the tribal Zone 6 fishery from August 1 to November 30, 2022. The harvest estimate was 2,974 unclipped steelhead. The sum of the components may not equal the total harvest due to rounding error.


PBT Release Group/GSI stock	Percent of harvest			Harvest by groups		
	Estimate	90% lci	90% uci	Estimate	90% lci	90% uci
<u>Hatchery unclipped fish assigned with PBT</u>						
2019-CLWH-DWOR-NewsomeCr-NoClip	5.57%	2.51%	9.18%	166	75	273
2019-CLWH-SFCR-MeadowCr-NoClip	9.85%	5.97%	14.07%	293	177	419
2019-DWOR-DWOR-LoloCr-NoClip	7.38%	4.02%	11.08%	220	120	330
2019-DWOR-DWOR-NFClearwaterR-AdClip	3.26%	0.81%	5.70%	97	24	170
2019-DWOR-DWOR-RedHouse-AdClip	1.64%	0.00%	4.10%	49	0	122
2019-HNFH-SAWT-SawtoothFH-AdClip	0.87%	0.00%	2.60%	26	0	77
2019-MVFH-DWOR-YankeeForkR-AdClip	0.23%	0.00%	0.68%	7	0	20
2019-MVFH-USAL-PahsimeroiR-NoClip	3.34%	1.00%	5.89%	99	30	175
2019-NIAG-OXBO-SnakeR-HellsCanyon-AdClip	0.47%	0.00%	1.17%	14	0	35
2019-NIAG-PAHS-PahsimeroiR-AdClip	0.80%	0.00%	2.40%	24	0	71
Winthrop2019	0.94%	0.00%	2.83%	28	0	84
<u>Wild fish assigned with GSI</u>						
KlickR	4.80%	1.96%	7.86%	143	58	234
MFSALM	1.41%	0.21%	2.94%	42	6	87
MGILCS	35.15%	28.61%	42.01%	1,045	851	1,249
SFCLWR	6.05%	2.70%	9.75%	180	80	290
SFSALM	1.96%	0.21%	4.04%	58	6	120
SKAMAN	2.17%	0.43%	4.25%	65	13	126
UPCLWR	10.04%	6.00%	14.29%	298	178	425
UPPCOL	0.76%	0.00%	2.29%	23	0	68
UPSALM	3.31%	0.96%	6.02%	98	28	179

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