

**Oregon Chum Salmon Reintroduction:
Genetic Parentage and Diversity Analysis of the 2023 Spring Outmigrant Fry
& Adult Returns**

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Introduction

The Lower Columbia River Chum Salmon (*Oncorhynchus keta*) Evolutionary Significant Unit (ESU) is at a “moderate” risk of extinction (NOAA 2022). In Oregon, Chum Salmon are considered to be functionally extirpated from historically occupied tributaries of the Columbia River Basin (ODFW 2006). Although remnant individuals may be present in these tributaries, natural reoccupation (i.e., strays from Washington populations) is unlikely to occur in Oregon (NOAA 2022). Therefore, the Program to Restore Oregon’s Chum Salmon (PROCS) was established in 2010 to facilitate the reoccupation of self-sustaining populations of Chum Salmon to Oregon tributaries of the Lower Columbia River (LCR; Homel et al. 2021). The target Recovery Populations in Oregon include: Youngs Bay, Big Creek, Clatskanie River, Scappoose Creek, Clackamas River, Sandy River, Lower Gorge, and Upper Gorge (ODFW 2010; Figure 1).

The Big Creek Hatchery Conservation Broodstock and the strategic outplanting of Chum Salmon represent key efforts by PROCS to recover populations in the LCR, especially those in the coastal population group (i.e., Youngs Bay, Big Creek, and Clatskanie River). Outplanting efforts include releasing adult returns into nearby streams in order to spawn volitionally (Adult Outplants), spawning adult returns and transferring their eyed-eggs to remote site incubators (RSI Outplants), and spawning adult returns and releasing their unfed fry into nearby streams (Unfed Fry Outplants).

Both hatchery- and natural-origin Chum Salmon are incorporated into the conservation broodstock at Big Creek Hatchery, making it an integrated program. Natural-origin Chum Salmon are unmarked individuals that enter Big Creek Hatchery volitionally, while hatchery-origin Chum Salmon are individuals that have been produced at the hatchery and are identifiable via otolith thermal marks and/or through parentage-based tagging. Natural-origin Chum Salmon may be incorporated into the conservation broodstock annually as needed to meet reintroduction goals, especially if their removal does not affect self-sustaining populations. Since there are no self-sustaining populations of Chum Salmon on the Oregon side of the Columbia River, integration of variable numbers of natural-origin Chum Salmon into the conservation broodstock does not impact the status of naturally spawning Chum Salmon populations (i.e., all are considered functionally extirpated). For this reason, unmarked, natural-origin Chum Salmon that have returned volitionally to Big Creek Hatchery have been incorporated into the conservation broodstock since 2014 (Homel et al. 2021).

In part, the effectiveness of PROCS reintroduction efforts is assessed using parentage-based tagging to determine the origin of returning adults to Big Creek Hatchery. For instance, adult Chum Salmon returning to the hatchery could be identified as hatchery- or natural-origin fish, adults returning to a reintroduction location could be assigned to their outplanted parents, carcasses recovered during spawning ground surveys could be identified as strays, and genetic diversity of the Big Creek Hatchery conservation broodstock could be assessed. Though not collected in all years, samples from outmigrating Chum Salmon fry have also been used to determine the success of outplanted adults via parentage analysis. Previous reports have examined origin for outmigrating fry (Small et al. 2013; Small et al. 2015; Small et al. 2019b) and adult returns (Small et al. 2019a; Small et al. 2021; Loudon et al. 2023) as well as genetic

diversity of Big Creek Hatchery fish (broodstock or outplanted fish) relative to other Chum Salmon populations (Small et al. 2017, Small et al. 2019b, Small et al. 2021; Louden et al. 2023). As in previous assessments (Small et al. 2013; Small et al. 2015; Small et al. 2019b), outmigrant Chum Salmon fry were collected in the spring of 2023 from a rotary screw trap in the Clatskanie River to evaluate the success of different recovery efforts implemented in fall 2022.

Here, we conduct two distinct parentage analyses evaluating Chum Salmon in the LCR: 1) Outmigrant fry sampled from the Clatskanie River in spring of 2023 and 2) 2023 adults returning to Big Creek Hatchery that were incorporated in the broodstock, outplanted in Gnat Creek to spawn volitionally, spawned for RSI outplanting in Page Creek, spawned for unfed fry outplanting in Page, Gnat, and Carcus Creeks, and sampled during spawning ground surveys (Table 1). Furthermore, the current report extends previous assessments and examines genetic diversity of the 2023 Big Creek Hatchery broodstock.

Program Background

Big Creek Hatchery Chum Salmon Conservation Broodstock

The Chum Salmon conservation broodstock was started at Big Creek Hatchery, OR in 2010 with adults collected in Grays River, WA (Homel et al. 2021). From 2010-2013, adults were spawned at the Grays River Hatchery, fertilized eggs were transferred to Big Creek Hatchery, and subsequent fry were released each spring. Any adults returning to Big Creek Hatchery during broodstock establishment (2010-2013) were released and allowed to spawn volitionally in Big Creek. Beginning in 2014, age-3 and age-4 adults returning to Big Creek Hatchery were incorporated in the conservation broodstock. All 2014 adults used as broodstock were of known hatchery-origin. Starting in 2015 and for all subsequent years, the conservation broodstock has been derived from returning adults with known hatchery-origin (i.e., Big Creek thermal markings), natural-origin (i.e., wild fish with no marks), and unknown-origin (i.e., indeterminable mark). In 2016, very few Chum Salmon returned to Big Creek Hatchery and low returns continued in 2017. As a result, adults from Grays River supplemented the Big Creek Hatchery broodstock in 2018 and 2019 (Homel et al. 2021). Large adult returns to Big Creek Hatchery from 2020 – 2023 have allowed conservation broodstock goals to be met (i.e., ~44 females or 110,000 eggs to maintain the broodstock and ~88 females or 220,000 eggs needed to begin reintroduction). For all Chum Salmon spawned at Big Creek Hatchery, length, condition, sex, otoliths, scales, and a fin clip have been collected.

The 2018 – 2020 broodstock collections from both hatcheries were included as candidate parents in the parentage analysis of 2023 adult returns. Moreover, the current report extends previous assessments of genetic diversity in Big Creek and Grays River hatcheries in 2013 – 2022 by including the 2023 Big Creek Hatchery broodstock.

Outplant strategies for Big Creek Hatchery Adult Returns

Adult Outplants

Once conservation broodstock collection goals were met, excess adult Chum Salmon were transferred to nearby streams to spawn volitionally as part of recovery efforts in the Oregon portion of the LCR. In 2013, adult Chum Salmon were experimentally outplanted to Graham Creek and Stewart Creek (within the Clatskanie River Recovery Population). These fish were all

hatchery-origin, age-3 offspring from the 2010 Big Creek broodstock collection. Graham Creek proved to be ill-suited for adult outplanting primarily due to poor spawning habitat, so experimental outplanting continued only in Stewart Creek in 2014 and 2015. In 2014, all outplanted adults were hatchery-origin fish, while 2015 was comprised of both hatchery-origin and natural-origin outplanted adults. From 2016 to 2019 there were no adult outplants because of low overall adult returns to Big Creek Hatchery in those years (see Homel et al. 2021 for details). Since 2020, there has been a considerable increase in the number of adults returning to Big Creek Hatchery and adult outplanting resumed. In 2020, adults were externally tagged and outplanted to Bear and Little Bear Creeks near Big Creek Hatchery. Fin clips were not collected for these adults (although other biological data was), instead, all outmigrating fry from 2021 were genetically sampled. In fall 2021, adults were again externally tagged and outplanted near Big Creek Hatchery (Bear Creek, Little Bear Creek, and Gnat Creek) and in one additional creek within the Clatskanie River Recovery Population (Conyers Creek) and the Clatskanie River itself. For adults outplanted in 2021, length, condition, and sex were recorded for all fish, but because of the large return (>2,300 individuals), only a proportion were genetically sampled. In 2022, a total of 1,133 adults were outplanted to Bear, Little Bear, Gnat, Conyers, and Stewart Creeks, as well as the Clatskanie River; biological data and genetic samples were collected from all outplanted adults, but only a portion were genotyped ($n = 49$) and the rest were archived ($n = 1,084$) due to funding limitations. In 2023, fewer excess adults were available for outplanting, but 384 were transferred to Bear, Gnat, Stewart, and Conyers Creeks. All outplanted adults were genetically sampled, but like 2022, only a portion were genotyped ($n = 33$ from Gnat Creek) and the remainder were archived ($n = 351$) due to funding limitations. Otoliths and scales were opportunistically collected during spawning ground surveys if outplanted carcasses could be identified (i.e., retained external tags) and recovered. Adults outplanted 2021 – 2023 could serve as candidate parents in future parentage analyses of adult returns to reintroduction sites.

Eyed-Egg Outplants

In addition to adult outplanting, eyed-eggs have also been transferred to remote site incubators (RSIs) to reintroduce Chum Salmon to historically occupied streams. In 2014 and 2015, excess adults were spawned at Big Creek Hatchery and their offspring were transferred to RSIs in Perkins Creek (Clatskanie River Recovery Population). In 2014, all eggs collected for outplanting were from hatchery-origin adults. In 2015, outplanted eggs were either from hatchery-origin or natural-origin adults. No RSIs were operated from 2016 – 2019 due to low adult returns to Big Creek Hatchery (see Homel et al. 2021 for full details). In 2020 and 2021, it was not feasible to do any eyed-egg outplants due to high numbers of adult returns.

In 2022 and 2023 excess adults were spawned at Big Creek Hatchery and their offspring were transferred to RSIs in Page Creek, a tributary of the Clatskanie River. All fertilized eggs transferred to RSIs were given a unique thermal mark different from the eggs collected for the broodstock in those years. For all Chum Salmon spawned at Big Creek Hatchery, length, condition, sex, otoliths, scales, and a fin clip have been collected. The 2022 adult returns spawned for RSI outplanting were incorporated as candidate parents of 2023 outmigrant fry collected from the Clatskanie River. The 2022 and 2023 adult returns used for RSI outplanting could serve as candidate parents in future parentage analyses of adult returns.

Unfed Fry Outplants

The final reintroduction method used by PROCS is releasing unfed fry into reintroduction sites. The primary objective of rearing and releasing unfed fry was to test various reintroduction methods in the same location (e.g., unfed fry vs. RSI in Page Creek). Because egg-to-fry survival in the hatchery setting is high and effort to rear Chum Salmon during this period is low, producing unfed fry for reintroduction purposes may be more advantageous than other methods that are more time-consuming or costly (e.g., building and operating an RSI or trucking live adults to reintroduction sites). Although technically feasible in the past, PROCS only began experimenting with unfed fry releases in the spring of 2023 (i.e., broodyear 2022).

In fall 2022 and 2023, excess adult returns were spawned at Big Creek Hatchery, eggs were given a unique thermal mark and were raised to the fry stage (but given no feed) and released in various locations the following spring. In the spring of 2023, ~50,000 unfed fry were released into Page Creek to compare their survival with individuals reared in the RSI on Page Creek. An additional ~25,000 unfed fry were released into Gnat Creek to understand if volitional spawning by outplanted adults in Gnat Creek was more/less successful. In spring 2024, similar numbers of unfed fry were released again into Page and Gnat Creeks. An additional ~50,000 were released into Carcus Creek (a tributary of the Clatskanie River located just upstream of Page Creek) as a control. All unfed fry released in Page and Carcus Creeks in both years are subject to being captured by a rotary screw trap in the Clatskanie River, where they can be weighed, measured, and fin clipped. The 2022 adult returns spawned for unfed fry outplanting were incorporated as candidate parents of 2023 outmigrant fry collected from the Clatskanie River (the 2023 adult returns spawned for the 2024 outmigrating unfed fry will be included in the 2024 analysis). The 2022 and 2023 adult returns used for unfed fry outplanting could serve as candidate parents in future parentage analyses of adult returns.

Spawning Ground Surveys in the Oregon Portion of the Lower Columbia River

To monitor Chum Salmon natural re-colonization and reintroduction efforts, spawning ground surveys have been conducted in three recovery populations since 2017 (i.e., Youngs Bay, Big Creek, and Clatskanie River). Surveys prior to 2017 were largely exploratory or highly focused in reintroduction areas (e.g., surveys for outplanted adults spawning in Stewart Creek in 2013-2015) as the project developed. Surveys were completed by staff from the PROCS and the Oregon Adult Salmonid Inventory Sampling (OASIS) projects. Length, condition, sex, otoliths, scales, and a fin clip were collected from carcasses when possible. Streams are consistently sampled within three recovery populations: Youngs Bay, Big Creek, and Clatskanie River. In 2017, >30 miles of streams were surveyed, but only four Chum Salmon were observed, all in the Lewis and Clark River (Youngs Bay Recovery Population). In 2018, 16 Chum Salmon were observed in the Big Creek Recovery Population (15 in Big Creek, below the hatchery, and 1 in Mill Creek). In 2019, Chum Salmon were observed in both the Big Creek Recovery Population (n = 11) and the Youngs Bay Recovery Population (n = 1). With the large return in 2020, Chum Salmon were observed in both the Youngs Bay (n = 22) and Big Creek (n = 1,065) Recovery Populations, although none were encountered in the Clatskanie River Recovery Population. Due to another large return in 2021 and the intensive adult outplanting efforts, Chum Salmon were observed in all three recovery populations surveyed: Youngs Bay (n = 176; no outplanting effort), Big Creek (n = 580; most observed below the hatchery), and Clatskanie River (n = 76; large outplanting effort). All outplanted adults were externally tagged in 2020 – 2023; however,

it is possible that these tags were lost or missed during surveys. As such, Chum Salmon observed on spawning grounds could be natural-origin fish (i.e., no thermal mark and in a location on their own), outplanted natural-origin fish (i.e., no thermal mark, but moved to a location by PROCS), hatchery-origin fish (i.e., strays), or outplanted hatchery-origin fish (i.e., thermally marked and moved by PROCS). Individuals sampled on spawning grounds 2019 – 2020 were used as candidate parents in the parentage analysis of 2023 adult returns.

Methods

Sample Processing and Genotyping

Tissue samples were collected from 2023 outmigrant fry and 2023 adult returns and dried on Whatman blotter paper. Genomic DNA was extracted from outmigrant fry samples using Macherey-Nagel extraction kits and from adult return samples using the methods of Ivanova et al. (2006). Genotypes were generated with a GT-seq protocol (Campbell et al. 2015) using a 350 Chum Salmon SNP panel (Table 2). Briefly, template DNA from samples were subjected to an initial multiplex PCR reaction that amplifies target sites in DNA (amplicon), in a second PCR reaction unique barcode sequences were added, barcoded amplicons were pooled and sequenced on a next-generation sequencer. Samples were demultiplexed and genotyped using custom perl scripts.

We performed a series of quality control checks on all individuals and loci using the statistical software R (version 4.3.1; R Core Team 2023) and specific R packages. Markers genotyped in less than 70% of individuals were removed. Individuals were excluded from further analysis if they had more than 35% missing genotype data. We checked for duplicate genotypes using part of the GT-seq pipeline and with the ‘close_matching_samples’ command in the package *Rubias* with the ‘minimum fraction non-missing’ and ‘minimum fraction matching’ variables set to 0 and 0.97, respectively (Moran and Anderson 2019). When samples with identical or nearly identical genotypes were identified, we retained the sample with the most complete genotype and omitted the other from further analysis. We used the R package *hierfstat* to identify and remove loci that were missing data for the entirety of one or more collections (Goudet 2005). Finally, we used the R package *pegas* to identify and remove loci that had deviations from Hardy-Weinberg expectations (HWE) in a majority of collections after correcting for false discovery rates (FDR) for $\alpha=0.05$ significant threshold (Verhoeven et al. 2005).

Genetic Statistics

We computed basic population genetic statistics to assess changes in genetic diversity among Big Creek Hatchery broodstock and Grays River Hatchery broodstock (Table 3). We calculated pairwise F_{ST} and an estimate of uncertainty with the R package *hierfstat* using default parameters (Goudet 2005). To describe the difference in statistically expected and observed levels of within-population diversity, we estimated the observed and expected heterozygosity (H_O and H_E) and inbreeding coefficient (F_{IS}) using GENEPOP (Rousset 2008). We calculated the number of fixed loci manually and allelic richness (N_A), the average number of alleles per collection, with sample size correction using the R package *PopGenReport* (Adamack and Gruber 2014).

Parentage Analysis

We used the program COLONY (Jones and Wang 2010) to implement maximum likelihood algorithms to identify the likely parents of 2023 outmigrant fry and 2023 adult returns in separate analyses. In both parentage analyses, parameters were set to polygamy for mothers and fathers, a long length run, and no sibship prior for the combined Full-Likelihood – Pair-Likelihood Score (FPLS) method.

Spring 2023 Outmigrant Fry

To evaluate the success of different reintroduction efforts in producing the spring 2023 outmigrant fry, candidate parents consisted of the 2022 adult returns incorporated in RSI outplanting or unfed fry outplanting in fall 2022.

2023 Adult Returns

To determine the parentage of the broodstock for adult returns of age-3, -4, and -5 fish in 2023, potential female and male parents consisted of individuals from 2018, 2019, and 2020 broodstock collections from Big Creek Hatchery and Grays River Hatchery. Additionally, individuals sampled during spawning ground surveys in 2019 and 2020 were evaluated as potential parents of the 2023 adult returns (Table 1). The presumed origin (i.e., natural or hatchery) of 2023 adult returns as indicated by parentage-based tagging and otolith thermal marking was compared in individuals where both methods were available (i.e., Big Creek Hatchery broodstock, RSI outplant parents, and unfed fry parents).

Results

Sample Processing and Genotyping

For the 2023 outmigrant fry, 127 individuals were genotyped, but only 119 had sufficient data to be included in further analysis based on the 65% genotyping success threshold. All 428 adult returns sampled in 2023 had sufficient data to be included in further analysis. However, four pairs of duplicate samples were identified among the 2023 adult returns (23BR.041 - 23BR.141, 23BR.04 - 23BR.141, 23BR.102 - 23BR.103, 23UF.155 - 23UF.156) and the sample with the least complete genotype of the pair (23BR.141, 23BR.103, 23UF.156) was removed from further analyses. There were 14 markers genotyped in less than 70% of individuals, seven markers that deviated from HWE in the majority of collections, and three loci that had no genotype data in at least one of the collections. These 24 loci were removed from further analyses (Table 2).

Genetic Statistics

As in previous reports (Louden et al. 2023), within-population-diversity, assessed by H_O , H_E , and F_{IS} , was similar between the Big Creek Hatchery broodstock and Grays River Hatchery broodstock across years (Table 3). Allelic richness and the number of fixed alleles was also comparable between the two hatcheries, with the exception of 2016 when the returns to Big Creek Hatchery were low resulting in fewer individuals being included in the broodstock and ultimately more fixed loci (Table 3). Excess heterozygosity as indicated by negative F_{IS} values was apparent in the broodstock of both hatcheries across years. Negative F_{IS} values in these broodstocks may signal that parents were from a mix of different groups, which is common in a hatchery setting. In years where data was available for both broodstocks (2015, 2016, 2018 – 2022), pairwise F_{ST} estimates, an estimate of genetic distance, were low across years, ranging

from 0.0005 in 2020 to 0.0042 in 2016 (Table 4). Overall, the current results support previous findings suggesting there is little difference in genetic diversity and allelic richness between Chum Salmon from Big Creek Hatchery and Grays River Hatchery broodstock collections.

Parentage Analysis

Spring 2023 Outmigrant Fry

For the 2023 outmigrant fry collected from the Clatskanie River, 14 of 119 (12%) assigned to a parent pair (Table 5). Of the 14 assigned outmigrant fry, six were offspring of adult returns incorporated in RSI outplanting and eight were offspring of adult returns incorporated in the outplanting of unfed fry. The remaining 105 outmigrant fry were not assigned to either parent.

2023 Adult Returns

We compared the 2023 adult returns to possible parents from 2018, 2019, and 2020 broodstocks of both hatcheries and individuals sampled during spawning ground surveys in 2019 and 2020. COLONY identified parent pairs for 218 of 425 (51%) adult returns in 2023 (Table 6). Most parent pairs were from Big Creek Hatchery ($n = 212$), few were from Grays River Hatchery ($n = 6$), and no parent pairs were identified from carcasses sampled during spawning ground surveys. Of the 218 adult returns with both parents assigned, 112 were identified as age-3, 103 were identified as age-4, and three were identified as age-5. Of the remaining 207 adult returns, 14 were assigned to only a male parent, 11 were assigned to only a female parent, and 182 were not assigned to either parent.

Conclusions

The results of these analyses identify the likely parents of 2023 Chum Salmon outmigrant fry sampled from the Clatskanie River and adult Chum Salmon returning in 2023 that were incorporated into the Big Creek Hatchery conservation broodstock. Furthermore, the current results support previous findings indicating there is little difference in genetic diversity between broodstock collections of Chum Salmon from the Big Creek and Grays River hatcheries in years when both were sampled (i.e., 2015, 2016, and 2018 – 2022).

- The majority of the 2023 outmigrant fry sampled in the Clatskanie River (105/119; 88%) were not assigned either parent. Outmigrant fry with neither parent assigned may be the offspring of ungenotyped adult returns outplanted by PROCS in 2022.
- Of the 14 outmigrant fry with both parents assigned, six were offspring of adult returns incorporated in RSI outplanting and eight were offspring of adult returns incorporated in the outplanting of unfed fry.
- Half of the 2023 adult returns incorporated into the conservation broodstock were the offspring of parent pairs from Big Creek Hatchery broodstock in 2018 – 2020 (212/425; 50%).
- Of the 218 adult returns incorporated into the conservation broodstock with both parents assigned, most were age-3 (112/218; 51%) or age-4 (103/218; 47%), and only a few were age-5 (3/218; 2%).

- Presumed origin (i.e., natural or hatchery) was highly concordant in assessments based on parentage-based tagging and otolith thermal marking. Of the 198 adult returns assessed with both methods and had both parents assigned, presumed origin indicated by parentage-based tagging matched that of otolith thermal marks in 98% of instances (194/198).

Glossary

2023 Chum Salmon outmigrant fry – Juvenile Chum Salmon fry sampled in the spring of 2023 to evaluate the success of different recovery efforts implemented in 2022.

Adult Outplants – Once Big Creek Hatchery broodstock collection goals were met, additional adult Chum Salmon returns transferred to nearby streams to spawn volitionally.

RSI Outplant Parents – Once Big Creek Hatchery broodstock collection goals were met, additional adult Chum Salmon returns spawned at Big Creek Hatchery and the resulting eyed-eggs incorporated in remote site incubators.

Unfed Fry Outplant Parents – Once Big Creek Hatchery broodstock collection goals were met, additional adult Chum Salmon returns spawned at Big Creek Hatchery and the resulting unfed fry transferred to nearby streams.

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Table 1. Sample numbers for 2023 Chum Salmon outmigrant fry and 2013 – 2023 adult returns incorporated in Big Creek Hatchery broodstock, Grays River Hatchery broodstock, adult outplanting (Outplant), remote site incubator outplanting (RSI Outplant), unfed fry outplanting (Unfed Fry Outplant), or carcasses recovered from spawning ground surveys (SGS). Differences between N samples and N analyzed indicate the number of samples dropped due to poor genotyping success or duplicate genotypes.

Collection	Year	N samples	N analyzed	WDFW code
Grays River Broodstock	2013	167	163	13LL
Grays River Broodstock	2014	103	97	14OW
Big Creek Broodstock	2015	57	36	15TN
Grays River Broodstock	2015	91	90	15PO
Adult Outplant	2015	40	28	15TM, 15TL
Big Creek Broodstock	2016	15	10	16OU
Grays River Broodstock	2016	82	82	16ND
Grays River Broodstock	2017	88	87	17MA
Big Creek Broodstock	2018	104	90	18NF
Grays River Broodstock	2018	250	237	18OD
Big Creek Broodstock	2019	55	53	19QH
Grays River Broodstock	2019	179	165	19MW
SGS	2019	4	3	19QI
Big Creek Broodstock	2020	320	311	20LP
Grays River Broodstock	2020	195	187	20MW
SGS	2020	115	101	20NB
Big Creek Broodstock	2021	337	225	21MH
Grays River Broodstock	2021	192	175	21NR
Adult Outplant	2021	316	239	21MH
SGS	2021	76	41	21MI
Big Creek Broodstock	2022	350	335	22LZ
Grays River Broodstock	2022	194	176	22OV
Adult Outplant	2022	49	48	22MD
RSI Outplant Parent	2022	40	36	22MA
Unfed Fry Outplant Parent	2022	68	67	22MB
SGS	2022	2	2	22MC
Outmigrant fry	2023	127	119	22ME

Big Creek Broodstock	2023	255	253	23BR
Adult Outplant	2023	33	33	23OU
RSI Outplant Parent	2023	40	40	23RS
Unfed Fry Outplant Parent	2023	98	97	23UF
SGS	2023	2	2	SGS.G23

Table 2. List of 350 markers in the Chum Salmon GT-seq panel. Note, the “Oke_” prefix has been removed from all marker names. The 24 markers highlighted in yellow were removed from analyses due to either poor genotyping success, deviations from Hardy-Weinberg equilibrium, or missing data in one or more collections.

ACOT_100	RAD14962 45	RAD7936 41	RDDFW36545 52	RDDFW64969 46	RDDFW92671 68	U2037 76
APOB_60	RAD16205 61	RAD8018 38	RDDFW36920 78	RDDFW65679 48	RDDFW92833 41	U2041 84
ATP5L_105	RAD1635 77	RAD8326 32	RDDFW37304 51	RDDFW65809 61	RDDFW93115 22	U2043 51
AhR1_278	RAD16763 78	RAD8335 79	RDDFW37547 71	RDDFW65817 59	RDDFW93316 60	U2045 43
CATB_60	RAD16805 31	RAD8372 31	RDDFW37906 35	RDDFW6606 46	RDDFW945 50	U2048 91
CD123_62	RAD17085 70	RAD8698 82	RDDFW37977 64	RDDFW66307 18	RDDFW94768 76	U2049 99
CKS1_70	RAD17316 60	RAD8799 30	RDDFW38189 70	RDDFW66740 41	RDDFW95768 60	U2053 60
CKS_389	RAD17332 67	RAD8814 56	RDDFW38998 48	RDDFW67033 73	RDDFW96549 63	U2054 58
CO1A1_72	RAD19121 72	RAD8930 48	RDDFW39056 71	RDDFW6714 54	RDDFW97046 68	U2056 90
CTR2_82	RAD19883 47	RAD905 85	RDDFW39550 74	RDDFW67894 45	RDDFW97566 28	U2057 80
DBLOH_79	RAD21307 43	RAD9273 49	RDDFW41741 28	RDDFW68590 61	RDDFW97971 30	U305 307
DCXR_87	RAD2158 44	RAD9447 73	RDDFW41894 64	RDDFW6872 56	RDDFW98640 53	U504 228
DM20_548	RAD22662 43	RDDFW10186 42	RDDFW41968 67	RDDFW69367 28	RDDFW9886 52	U506 110
EF2_394	RAD2414 54	RDDFW112 17	RDDFW44691 36	RDDFW69501 76	RFC2 618	U507 087
GNMT_100	RAD24191 34	RDDFW13161 74	RDDFW45450 75	RDDFW69741 55	RH1op 245	U507 286
GPDH_191	RAD2522 75	RDDFW13803 76	RDDFW46094 46	RDDFW69778 62	RS9 379	U509 219
H2AX_72	RAD27585 82	RDDFW14498 66	RDDFW4669 39	RDDFW69792 54	RSPRY1 106	U511 271
HP_182	RAD27616 72	RDDFW14591 59	RDDFW46886 62	RDDFW70556 28	TCP1 78	U514 150
IL8r2_406	RAD2772 76	RDDFW14903 53	RDDFW47500 38	RDDFW70829 40	TCTA 99	arf 319
IL8r_272	RAD2812 43	RDDFW15717 46	RDDFW47666 40	RDDFW70902 20	U1002 165	brd2 118
KPNA2_87	RAD2827 56	RDDFW16518 29	RDDFW47763 68	RDDFW71171 55	U1002 262	brp16 65
LAMP2_186	RAD3131 64	RDDFW16781 68	RDDFW47838 76	RDDFW71319 78	U1008 83	ccd16 77
METK2_97	RAD3143 30	RDDFW16886 37	RDDFW48220 71	RDDFW71747 19	U1015 255	cjo57 86
MLRN_63	RAD3223 33	RDDFW17423 60	RDDFW48558 66	RDDFW71866 73	U1017 52	ctgf 105
PDIA3_082	RAD3480 76	RDDFW17478 56	RDDFW48576 24	RDDFW72082 30	U1019 218	e2ig5 50
PDIA3_475	RAD3664 73	RDDFW18411 78	RDDFW48705 55	RDDFW72091 54	U1020 75	eif4ebp2 64
PPA2_635	RAD3693 30	RDDFW19534 51	RDDFW49372 62	RDDFW72178 38	U1021 102	eif4g1 43
RAD10028_44	RAD369 38	RDDFW19665 62	RDDFW50553 28	RDDFW72464 65	U1023 147	f5 71
RAD10173_41	RAD3715 76	RDDFW19805 61	RDDFW50712 39	RDDFW72515 22	U1024 113	glrx1 78
RAD10459_85	RAD3762 78	RDDFW19807 50	RDDFW51270 33	RDDFW72580 61	U1028 100	hsc71 199

RAD10591_67	RAD3861 38	RDDFW19817 73	RDDFW51705 44	RDDFW73626 31	U2001 629	il 1racp 67
RAD10676_50	RAD3907 37	RDDFW19905 31	RDDFW52567 35	RDDFW73828 41	U2003 142	lactb2 71
RAD10719_31	RAD3938 71	RDDFW20179 61	RDDFW52773 67	RDDFW74107 70	U2005 62	mcfid2 86
RAD11183_63	RAD3995 44	RDDFW20811 77	RDDFW53380 67	RDDFW75268 70	U2006 109	mgll 49
RAD11379_85	RAD4286 77	RDDFW20999 31	RDDFW54241 69	RDDFW75348 40	U2010 94	nc2b 148
RAD11444_75	RAD4538 78	RDDFW21285 59	RDDFW57028 36	RDDFW76878 51	U2011 107	ndub3 58
RAD11500_80	RAD4787 63	RDDFW21890 73	RDDFW57213 78	RDDFW78157 36	U2016 118	pgap 92
RAD11690_33	RAD4875 62	RDDFW23444 56	RDDFW58551 52	RDDFW78789 24	U2017 87	pnrc2 78
RAD11918_57	RAD5156 68	RDDFW24615 60	RDDFW58967 48	RDDFW80059 43	U2019 112	psmd9 057
RAD11928_30	RAD5276 66	RDDFW24690 58	RDDFW59084 41	RDDFW80154 68	U2020 51	psmd9 188
RAD11999_36	RAD5434 50	RDDFW25476 76	RDDFW59113 30	RDDFW80662 52	U2022 101	rab5a 117
RAD12038_34	RAD5457 49	RDDFW25539 63	RDDFW6089 75	RDDFW89343 75	U2024 93	ras1 249
RAD12294_71	RAD5615 34	RDDFW27843 66	RDDFW61097 36	RDDFW89357 49	U2025 86	serpin 140
RAD12377_41	RAD5734 46	RDDFW28182 57	RDDFW61270 26	RDDFW89443 55	U2026 64	slc1a3a 86
RAD12415_71	RAD5951 44	RDDFW28560 20	RDDFW61351 74	RDDFW90259 25	U2029 79	sylc 90
RAD12909_51	RAD7067 53	RDDFW29139 38	RDDFW61394 55	RDDFW90437 74	U2031 37	thic 84
RAD13522_47	RAD715 49	RDDFW29994 56	RDDFW62184 66	RDDFW91049 44	U2032 74	txnrd1 74
RAD14303_73	RAD7431 40	RDDFW30681 49	RDDFW63326 23	RDDFW91108 63	U2033 122	u1 519
RAD14679_56	RAD7512 33	RDDFW32214 64	RDDFW63766 37	RDDFW9156 37	U2034 55	u200 385
RAD14852_56	RAD7883 49	RDDFW35061 72	RDDFW64078 73	RDDFW92495 48	U2035 54	u216 222

Table 3. Within-population diversity, estimated by the expected and observed heterozygosity (H_E and H_O), inbreeding coefficient (F_{IS}), allelic richness (N_A), and number of fixed loci (#Fixed Loci) of Grays River Hatchery broodstock from 2013 to 2022 and Big Creek Hatchery broodstock from 2015, 2016, and 2018 - 2023.

Collection	Year	#Individuals	H_E	H_O	F_{IS}	N_A	# Fixed Loci
Grays River Broodstock	2013	163	0.303	0.299	-0.015	1.789	12
Grays River Broodstock	2014	97	0.309	0.290	-0.062	1.777	13
Grays River Broodstock	2015	90	0.299	0.297	-0.005	1.783	14
Big Creek Broodstock	2015	36	0.309	0.291	-0.060	1.768	22
Grays River Broodstock	2016	82	0.301	0.297	-0.011	1.780	15
Big Creek Broodstock	2016	10	0.286	0.282	-0.011	1.734	61
Grays River Broodstock	2017	87	0.301	0.299	-0.005	1.787	14
Big Creek Broodstock	2018	90	0.302	0.303	0.003	1.793	11
Grays River Broodstock	2018	237	0.310	0.293	-0.057	1.783	13
Grays River Broodstock	2019	165	0.306	0.298	-0.027	1.789	14
Big Creek Broodstock	2019	53	0.301	0.300	-0.005	1.788	18
Big Creek Broodstock	2020	311	0.305	0.301	-0.014	1.787	10
Grays River Broodstock	2020	187	0.307	0.296	-0.035	1.781	12
Big Creek Broodstock	2021	225	0.295	0.300	0.018	1.788	9
Grays River Broodstock	2021	175	0.308	0.296	-0.039	1.785	12
Big Creek Broodstock	2022	335	0.303	0.298	-0.017	1.788	9
Grays River Broodstock	2022	176	0.307	0.300	-0.021	1.790	13
Big Creek Broodstock	2023	253	0.316	0.303	-0.043	1.793	9

Table 4. Intra-annual pairwise F_{ST} estimates between Grays River Hatchery broodstock and Big Creek hatchery broodstock in years when both hatcheries were sampled. 95% lower and upper confidence limits estimated with 1,000 bootstraps.

Broodstock	Year	F_{ST}	Lower CL	Upper CL
Grays River – Big Creek	2015	0.0011	-0.0010	0.0033
Grays River – Big Creek	2016	0.0042	-0.0014	0.0107
Grays River – Big Creek	2018	0.0018	0.0009	0.0028
Grays River – Big Creek	2019	0.0006	-0.0005	0.0018
Grays River – Big Creek	2020	0.0005	0.0001	0.0010
Grays River – Big Creek	2021	0.0009	0.0002	0.0016
Grays River – Big Creek	2022	0.0008	0.0002	0.0014

Table 5. Parentage Assignments for 2023 Chum Salmon outmigrant fry of the Clatskanie River detected by COLONY. To determine parentage, the 2023 outmigrant fry (n = 119) were compared against 2022 adult returns spawned and incorporated in remote site incubators (RSI Outplant Parent) or spawned and incorporated in unfed fry outplants (Unfed Fry Outplant Parent) (total candidate parents n = 103).

Offspring ID	2023 Status	Father ID	Father Origin	Mother ID	Mother Origin
22ME-001	Outmigrant Fry	22MB0398	Unfed Fry Outplant Parent	22MB0433	Unfed Fry Outplant Parent
22ME-002	Outmigrant Fry	22MB0413	Unfed Fry Outplant Parent	22MB0446	Unfed Fry Outplant Parent
22ME-003	Outmigrant Fry				
22ME-004	Outmigrant Fry	22MB0412	Unfed Fry Outplant Parent	22MB0446	Unfed Fry Outplant Parent
22ME-005	Outmigrant Fry	22MB0407	Unfed Fry Outplant Parent	22MB0441	Unfed Fry Outplant Parent
22ME-006	Outmigrant Fry	22MB0429	Unfed Fry Outplant Parent	22MB0463	Unfed Fry Outplant Parent
22ME-007	Outmigrant Fry	22MB0405	Unfed Fry Outplant Parent	22MB0438	Unfed Fry Outplant Parent
22ME-008	Outmigrant Fry				
22ME-009	Outmigrant Fry				
22ME-010	Outmigrant Fry				
22ME-011	Outmigrant Fry				
22ME-012	Outmigrant Fry				
22ME-013	Outmigrant Fry	22MA0212	RSI Outplant Parent	22MA0192	RSI Outplant Parent
22ME-014	Outmigrant Fry				
22ME-015	Outmigrant Fry				
22ME-016	Outmigrant Fry	22MA0208	RSI Outplant Parent	22MA0187	RSI Outplant Parent
22ME-017	Outmigrant Fry				
22ME-018	Outmigrant Fry				
22ME-019	Outmigrant Fry	22MB0429	Unfed Fry Outplant Parent	22MB0464	Unfed Fry Outplant Parent
22ME-020	Outmigrant Fry				
22ME-021	Outmigrant Fry				
22ME-022	Outmigrant Fry				
22ME-023	Outmigrant Fry				
22ME-024	Outmigrant Fry				
22ME-025	Outmigrant Fry				
22ME-026	Outmigrant Fry				
22ME-027	Outmigrant Fry				
22ME-028	Outmigrant Fry				
22ME-029	Outmigrant Fry				
22ME-030	Outmigrant Fry				
22ME-031	Outmigrant Fry	22MA0210	RSI Outplant Parent	22MA0190	RSI Outplant Parent
22ME-032	Outmigrant Fry				
22ME-033	Outmigrant Fry				
22ME-034	Outmigrant Fry	22MA0207	RSI Outplant Parent	22MA0186	RSI Outplant Parent
22ME-035	Outmigrant Fry				
22ME-036	Outmigrant Fry				

22ME-037	Outmigrant Fry	22MA0226	RSI Outplant Parent	22MA0205	RSI Outplant Parent
22ME-038	Outmigrant Fry				
22ME-039	Outmigrant Fry				
22ME-040	Outmigrant Fry				
22ME-041	Outmigrant Fry				
22ME-042	Outmigrant Fry				
22ME-043	Outmigrant Fry				
22ME-044	Outmigrant Fry				
22ME-045	Outmigrant Fry				
22ME-046	Outmigrant Fry	22MA0212	RSI Outplant Parent	22MA0191	RSI Outplant Parent
22ME-047	Outmigrant Fry	22MB0429	Unfed Fry Outplant Parent	22MB0463	Unfed Fry Outplant Parent
22ME-048	Outmigrant Fry				
22ME-049	Outmigrant Fry				
22ME-050	Outmigrant Fry				
22ME-051	Outmigrant Fry				
22ME-052	Outmigrant Fry				
22ME-053	Outmigrant Fry				
22ME-054	Outmigrant Fry				
22ME-055	Outmigrant Fry				
22ME-056	Outmigrant Fry				
22ME-057	Outmigrant Fry				
22ME-058	Outmigrant Fry				
22ME-059	Outmigrant Fry				
22ME-060	Outmigrant Fry				
22ME-063	Outmigrant Fry				
22ME-064	Outmigrant Fry				
22ME-065	Outmigrant Fry				
22ME-066	Outmigrant Fry				
22ME-067	Outmigrant Fry				
22ME-068	Outmigrant Fry				
22ME-069	Outmigrant Fry				
22ME-070	Outmigrant Fry				
22ME-071	Outmigrant Fry				
22ME-072	Outmigrant Fry				
22ME-073	Outmigrant Fry				
22ME-074	Outmigrant Fry				
22ME-075	Outmigrant Fry				
22ME-076	Outmigrant Fry				
22ME-077	Outmigrant Fry				
22ME-078	Outmigrant Fry				
22ME-079	Outmigrant Fry				
22ME-080	Outmigrant Fry				
22ME-081	Outmigrant Fry				

22ME-082	Outmigrant Fry
22ME-083	Outmigrant Fry
22ME-084	Outmigrant Fry
22ME-085	Outmigrant Fry
22ME-086	Outmigrant Fry
22ME-087	Outmigrant Fry
22ME-088	Outmigrant Fry
22ME-089	Outmigrant Fry
22ME-090	Outmigrant Fry
22ME-091	Outmigrant Fry
22ME-092	Outmigrant Fry
22ME-093	Outmigrant Fry
22ME-094	Outmigrant Fry
22ME-095	Outmigrant Fry
22ME-096	Outmigrant Fry
22ME-097	Outmigrant Fry
22ME-098	Outmigrant Fry
22ME-099	Outmigrant Fry
22ME-100	Outmigrant Fry
22ME-101	Outmigrant Fry
22ME-102	Outmigrant Fry
22ME-103	Outmigrant Fry
22ME-104	Outmigrant Fry
22ME-105	Outmigrant Fry
22ME-106	Outmigrant Fry
22ME-107	Outmigrant Fry
22ME-108	Outmigrant Fry
22ME-109	Outmigrant Fry
22ME-110	Outmigrant Fry
22ME-111	Outmigrant Fry
22ME-112	Outmigrant Fry
22ME-113	Outmigrant Fry
22ME-114	Outmigrant Fry
22ME-115	Outmigrant Fry
22ME-116	Outmigrant Fry
22ME-117	Outmigrant Fry
22ME-118	Outmigrant Fry
22ME-119	Outmigrant Fry
22ME-120	Outmigrant Fry
22ME-127	Outmigrant Fry

Table 6. Parentage Assignments for 2023 Oregon Chum Salmon adult returns detected by COLONY. The 2023 adult returns (n = 425) were compared against Grays River Hatchery and Big Creek Hatchery broodstock from 2018 – 2020, and 2019 – 2020 spawning ground survey adults to determine parentage (candidate parents n = 1,147). The 2023 status of each genotyped individual is listed: incorporated in Big Creek Hatchery broodstock (Broodstock), outplanted to spawn volitionally in Gnat Creek (Adult Outplant), spawned and incorporated in remote site incubators (RSI Parent), spawned and incorporated in unfed fry outplants (Unfed Fry Parent), or recovered on a spawning ground survey (SGS). The presumed origin of adult returns as indicated by otolith thermal marks is listed (Hatchery - H, Natural - N, or Unknown - U). Four discrepancies between parentage-based tagging and otolith thermal marks in presumed origin are highlighted.

Offspring ID	2023 Status	Father ID	Father Origin	Mother ID	Mother Origin	Otolith Origin
23BR.001	Broodstock					H
23BR.002	Broodstock	20LP0259	Big Creek Hatchery	20LP0271	Big Creek Hatchery	H
23BR.003	Broodstock	19QH0025	Big Creek Hatchery	19QH0013	Big Creek Hatchery	H
23BR.004	Broodstock	19QH0033	Big Creek Hatchery	19QH0022	Big Creek Hatchery	H
23BR.005	Broodstock	19QH0028	Big Creek Hatchery	19QH0015	Big Creek Hatchery	H
23BR.006	Broodstock	19QH0026	Big Creek Hatchery	19QH0013	Big Creek Hatchery	H
23BR.007	Broodstock	20LP0309	Big Creek Hatchery	20LP0323	Big Creek Hatchery	N
23BR.008	Broodstock	19QH0034	Big Creek Hatchery	19QH0022	Big Creek Hatchery	H
23BR.009	Broodstock					H
23BR.010	Broodstock	19QH0027	Big Creek Hatchery	19QH0016	Big Creek Hatchery	H
23BR.011	Broodstock	20LP0266	Big Creek Hatchery	20LP0278	Big Creek Hatchery	H
23BR.012	Broodstock					N
23BR.013	Broodstock					H
23BR.014	Broodstock					H
23BR.015	Broodstock	20LP0108	Big Creek Hatchery	20LP0055	Big Creek Hatchery	H
23BR.016	Broodstock	19QH0031	Big Creek Hatchery	19QH0020	Big Creek Hatchery	U
23BR.017	Broodstock	20LP0081	Big Creek Hatchery	20LP0030	Big Creek Hatchery	H
23BR.018	Broodstock					H
23BR.019	Broodstock			19QH0040	Big Creek Hatchery	H
23BR.020	Broodstock					H
23BR.021	Broodstock	20LP0095	Big Creek Hatchery	20LP0044	Big Creek Hatchery	H
23BR.022	Broodstock					H
23BR.023	Broodstock	19QH0025	Big Creek Hatchery	19QH0013	Big Creek Hatchery	H
23BR.024	Broodstock	19QH0056	Big Creek Hatchery	19QH0045	Big Creek Hatchery	H
23BR.025	Broodstock					H
23BR.026	Broodstock					H
23BR.027	Broodstock	19QH0056	Big Creek Hatchery	19QH0045	Big Creek Hatchery	H
23BR.028	Broodstock					N
23BR.029	Broodstock	19QH0008	Big Creek Hatchery	19QH0001	Big Creek Hatchery	H
23BR.030	Broodstock					H
23BR.031	Broodstock	19QH0034	Big Creek Hatchery	19QH0022	Big Creek Hatchery	H

23BR.032	Broodstock	20LP0011	Big Creek Hatchery			H
23BR.033	Broodstock	19QH0034	Big Creek Hatchery	19QH0022	Big Creek Hatchery	H
23BR.034	Broodstock	20LP0095	Big Creek Hatchery	20LP0043	Big Creek Hatchery	H
23BR.035	Broodstock	19QH0027	Big Creek Hatchery	19QH0015	Big Creek Hatchery	H
23BR.036	Broodstock	20LP0078	Big Creek Hatchery	20LP0025	Big Creek Hatchery	H
23BR.037	Broodstock					H
23BR.038	Broodstock					H
23BR.039	Broodstock	19QH0034	Big Creek Hatchery			H
23BR.040	Broodstock					H
23BR.041	Broodstock					N
23BR.042	Broodstock					H
23BR.043	Broodstock					H
23BR.044	Broodstock	19QH0030	Big Creek Hatchery	19QH0017	Big Creek Hatchery	H
23BR.045	Broodstock	20LP0243	Big Creek Hatchery	20LP0228	Big Creek Hatchery	H
23BR.046	Broodstock					N
23BR.047	Broodstock					N
23BR.048	Broodstock					H
23BR.049	Broodstock					H
23BR.050	Broodstock	18NF0064	Big Creek Hatchery			H
23BR.051	Broodstock					H
23BR.052	Broodstock	19QH0007	Big Creek Hatchery	19QH0001	Big Creek Hatchery	H
23BR.053	Broodstock	19QH0011	Big Creek Hatchery	19QH0006	Big Creek Hatchery	H
23BR.054	Broodstock					N
23BR.055	Broodstock					H
23BR.056	Broodstock					N
23BR.057	Broodstock	19QH0034	Big Creek Hatchery			H
23BR.058	Broodstock	19QH0028	Big Creek Hatchery	19QH0015	Big Creek Hatchery	H
23BR.059	Broodstock					N
23BR.060	Broodstock	19QH0033	Big Creek Hatchery			H
23BR.061	Broodstock	19QH0050	Big Creek Hatchery	19QH0040	Big Creek Hatchery	H
23BR.062	Broodstock	20LP0265	Big Creek Hatchery	20LP0279	Big Creek Hatchery	H
23BR.063	Broodstock					H
23BR.064	Broodstock					N
23BR.065	Broodstock	20LP0074	Big Creek Hatchery	20LP0022	Big Creek Hatchery	H
23BR.066	Broodstock	19QH0033	Big Creek Hatchery	19QH0022	Big Creek Hatchery	H
23BR.067	Broodstock	20LP0120	Big Creek Hatchery	20LP0070	Big Creek Hatchery	H
23BR.068	Broodstock					N
23BR.069	Broodstock					N
23BR.070	Broodstock					N
23BR.071	Broodstock	19QH0034	Big Creek Hatchery			H
23BR.072	Broodstock					N
23BR.073	Broodstock	20LP0103	Big Creek Hatchery	20LP0052	Big Creek Hatchery	H
23BR.074	Broodstock	20LP0013	Big Creek Hatchery	20LP0004	Big Creek Hatchery	H

23BR.075	Broodstock	19QH0030	Big Creek Hatchery	19QH0017	Big Creek Hatchery	H
23BR.076	Broodstock	20LP0094	Big Creek Hatchery	20LP0041	Big Creek Hatchery	H
23BR.077	Broodstock	19QH0026	Big Creek Hatchery	19QH0013	Big Creek Hatchery	H
23BR.078	Broodstock					N
23BR.079	Broodstock	19QH0025	Big Creek Hatchery	19QH0014	Big Creek Hatchery	H
23BR.080	Broodstock	20LP0013	Big Creek Hatchery	20LP0004	Big Creek Hatchery	H
23BR.081	Broodstock					H
23BR.082	Broodstock	19QH0010	Big Creek Hatchery	19QH0003	Big Creek Hatchery	H
23BR.083	Broodstock					H
23BR.084	Broodstock					H
23BR.085	Broodstock	19QH0027	Big Creek Hatchery	19QH0016	Big Creek Hatchery	H
23BR.086	Broodstock					N
23BR.087	Broodstock					N
23BR.088	Broodstock	19QH0025	Big Creek Hatchery	19QH0014	Big Creek Hatchery	H
23BR.089	Broodstock	19QH0011	Big Creek Hatchery	19QH0005	Big Creek Hatchery	H
23BR.090	Broodstock	20LP0119	Big Creek Hatchery	20LP0067	Big Creek Hatchery	H
23BR.091	Broodstock	19QH0025	Big Creek Hatchery	19QH0013	Big Creek Hatchery	H
23BR.092	Broodstock	19QH0034	Big Creek Hatchery	19QH0023	Big Creek Hatchery	H
23BR.093	Broodstock	20LP0084	Big Creek Hatchery	20LP0032	Big Creek Hatchery	H
23BR.094	Broodstock	20LP0185	Big Creek Hatchery	20LP0174	Big Creek Hatchery	H
23BR.095	Broodstock	19QH0007	Big Creek Hatchery	19QH0001	Big Creek Hatchery	H
23BR.096	Broodstock	19QH0007	Big Creek Hatchery	19QH0002	Big Creek Hatchery	H
23BR.097	Broodstock			19QH0040	Big Creek Hatchery	H
23BR.098	Broodstock	19QH0011	Big Creek Hatchery	19QH0006	Big Creek Hatchery	H
23BR.099	Broodstock	20LP0255	Big Creek Hatchery	20LP0267	Big Creek Hatchery	H
23BR.100	Broodstock	19QH0050	Big Creek Hatchery	19QH0039	Big Creek Hatchery	H
23BR.101	Broodstock	19QH0029	Big Creek Hatchery	19QH0017	Big Creek Hatchery	H
23BR.102	Broodstock					N
23BR.104	Broodstock	19QH0028	Big Creek Hatchery	19QH0016	Big Creek Hatchery	H
23BR.105	Broodstock					H
23BR.106	Broodstock	19QH0028	Big Creek Hatchery	19QH0015	Big Creek Hatchery	H
23BR.107	Broodstock	20LP0013	Big Creek Hatchery	20LP0004	Big Creek Hatchery	H
23BR.108	Broodstock	20LP0313	Big Creek Hatchery	20LP0328	Big Creek Hatchery	H
23BR.109	Broodstock	20LP0017	Big Creek Hatchery	20LP0007	Big Creek Hatchery	H
23BR.110	Broodstock	19QH0025	Big Creek Hatchery	19QH0013	Big Creek Hatchery	H
23BR.111	Broodstock	19QH0047	Big Creek Hatchery	19QH0037	Big Creek Hatchery	H
23BR.112	Broodstock					N
23BR.113	Broodstock					H
23BR.114	Broodstock	20LP0155	Big Creek Hatchery	20LP0164	Big Creek Hatchery	H
23BR.115	Broodstock	20LP0095	Big Creek Hatchery	20LP0044	Big Creek Hatchery	H
23BR.116	Broodstock					H
23BR.117	Broodstock	19QH0009	Big Creek Hatchery	19QH0003	Big Creek Hatchery	H
23BR.118	Broodstock					N

23BR.119	Broodstock	20LP0087	Big Creek Hatchery	20LP0035	Big Creek Hatchery	H
23BR.120	Broodstock					N
23BR.121	Broodstock	19QH0031	Big Creek Hatchery	19QH0020	Big Creek Hatchery	H
23BR.122	Broodstock	20LP0078	Big Creek Hatchery	20LP0025	Big Creek Hatchery	H
23BR.123	Broodstock	20LP0114	Big Creek Hatchery	20LP0063	Big Creek Hatchery	H
23BR.124	Broodstock	20LP0294	Big Creek Hatchery	20LP0282	Big Creek Hatchery	H
23BR.125	Broodstock					N
23BR.126	Broodstock	19QH0034	Big Creek Hatchery	19QH0023	Big Creek Hatchery	H
23BR.127	Broodstock	20LP0013	Big Creek Hatchery	20LP0003	Big Creek Hatchery	H
23BR.128	Broodstock					H
23BR.129	Broodstock	19QH0027	Big Creek Hatchery	19QH0016	Big Creek Hatchery	H
23BR.130	Broodstock	19QH0028	Big Creek Hatchery	19QH0015	Big Creek Hatchery	H
23BR.131	Broodstock	19QH0029	Big Creek Hatchery	19QH0017	Big Creek Hatchery	H
23BR.132	Broodstock					H
23BR.133	Broodstock	20LP0265	Big Creek Hatchery	20LP0278	Big Creek Hatchery	H
23BR.134	Broodstock	20LP0147	Big Creek Hatchery	20LP0157	Big Creek Hatchery	U
23BR.135	Broodstock	20LP0108	Big Creek Hatchery	20LP0057	Big Creek Hatchery	H
23BR.136	Broodstock	20LP0119	Big Creek Hatchery	20LP0067	Big Creek Hatchery	H
23BR.137	Broodstock					H
23BR.138	Broodstock	20LP0120	Big Creek Hatchery	20LP0069	Big Creek Hatchery	H
23BR.139	Broodstock	20LP0090	Big Creek Hatchery	20LP0037	Big Creek Hatchery	H
23BR.140	Broodstock	19QH0025	Big Creek Hatchery	19QH0014	Big Creek Hatchery	H
23BR.142	Broodstock	20LP0265	Big Creek Hatchery	20LP0279	Big Creek Hatchery	H
23BR.143	Broodstock	20LP0095	Big Creek Hatchery	20LP0044	Big Creek Hatchery	H
23BR.144	Broodstock	19QH0056	Big Creek Hatchery	19QH0045	Big Creek Hatchery	H
23BR.145	Broodstock					N
23BR.146	Broodstock					N
23BR.147	Broodstock	20LP0298	Big Creek Hatchery	20LP0287	Big Creek Hatchery	H
23BR.148	Broodstock			20LP0045	Big Creek Hatchery	H
23BR.149	Broodstock	20LP0017	Big Creek Hatchery	20LP0008	Big Creek Hatchery	H
23BR.150	Broodstock	19QH0034	Big Creek Hatchery	19QH0023	Big Creek Hatchery	H
23BR.289	Broodstock					N
23BR.290	Broodstock	19QH0047	Big Creek Hatchery	19QH0037	Big Creek Hatchery	H
23BR.291	Broodstock					H
23BR.292	Broodstock	20LP0247	Big Creek Hatchery	20LP0232	Big Creek Hatchery	H
23BR.293	Broodstock	20LP0296	Big Creek Hatchery	20LP0285	Big Creek Hatchery	N
23BR.294	Broodstock					N
23BR.295	Broodstock	20LP0243	Big Creek Hatchery	20LP0227	Big Creek Hatchery	H
23BR.296	Broodstock					H
23BR.297	Broodstock					H
23BR.298	Broodstock					N
23BR.299	Broodstock	20LP0259	Big Creek Hatchery	20LP0272	Big Creek Hatchery	H
23BR.300	Broodstock	19QH0056	Big Creek Hatchery	19QH0045	Big Creek Hatchery	H

23BR.301	Broodstock					N
23BR.302	Broodstock					H
23BR.303	Broodstock			20LP0174	Big Creek Hatchery	H
23BR.304	Broodstock	19QH0011	Big Creek Hatchery	19QH0005	Big Creek Hatchery	H
23BR.305	Broodstock					N
23BR.306	Broodstock					H
23BR.307	Broodstock	20LP0178	Big Creek Hatchery	20LP0166	Big Creek Hatchery	H
23BR.308	Broodstock					N
23BR.309	Broodstock	18NF0064	Big Creek Hatchery	18NF0055	Big Creek Hatchery	H
23BR.310	Broodstock					H
23BR.311	Broodstock					N
23BR.312	Broodstock					H
23BR.313	Broodstock					H
23BR.314	Broodstock	19QH0027	Big Creek Hatchery	19QH0016	Big Creek Hatchery	H
23BR.315	Broodstock	19QH0027	Big Creek Hatchery	19QH0015	Big Creek Hatchery	H
23BR.316	Broodstock	19QH0046	Big Creek Hatchery	19QH0035	Big Creek Hatchery	H
23BR.317	Broodstock					N
23BR.318	Broodstock	20LP0296	Big Creek Hatchery	20LP0284	Big Creek Hatchery	H
23BR.319	Broodstock					H
23BR.320	Broodstock	18NF0073	Big Creek Hatchery	18NF0094	Big Creek Hatchery	H
23BR.321	Broodstock					N
23BR.322	Broodstock	20LP0244	Big Creek Hatchery	20LP0230	Big Creek Hatchery	H
23BR.323	Broodstock	19QH0050	Big Creek Hatchery	19QH0040	Big Creek Hatchery	H
23BR.324	Broodstock					H
23BR.325	Broodstock					N
23BR.326	Broodstock					N
23BR.327	Broodstock					N
23BR.328	Broodstock					N
23BR.329	Broodstock			20LP0211	Big Creek Hatchery	H
23BR.330	Broodstock	20LP0265	Big Creek Hatchery	20LP0277	Big Creek Hatchery	H
23BR.331	Broodstock	19QH0026	Big Creek Hatchery	19QH0014	Big Creek Hatchery	H
23BR.332	Broodstock					N
23BR.333	Broodstock					N
23BR.334	Broodstock	19QH0030	Big Creek Hatchery	19QH0018	Big Creek Hatchery	H
23BR.335	Broodstock	19MW0052	Grays River Hatchery	19MW0041	Grays River Hatchery	H
23BR.336	Broodstock	19QH0030	Big Creek Hatchery	19QH0018	Big Creek Hatchery	H
23BR.337	Broodstock					H
23BR.338	Broodstock					N
23BR.339	Broodstock	20LP0107	Big Creek Hatchery	20LP0055	Big Creek Hatchery	H
23BR.340	Broodstock	19QH0055	Big Creek Hatchery	19QH0044	Big Creek Hatchery	H
23BR.341	Broodstock					N
23BR.342	Broodstock					H
23BR.343	Broodstock	19QH0046	Big Creek Hatchery	19QH0035	Big Creek Hatchery	H

23BR.344	Broodstock	19QH0028	Big Creek Hatchery	19QH0016	Big Creek Hatchery	H
23BR.345	Broodstock					N
23BR.346	Broodstock					N
23BR.347	Broodstock					N
23BR.348	Broodstock					N
23BR.349	Broodstock	20LP0296	Big Creek Hatchery	20LP0284	Big Creek Hatchery	H
23BR.350	Broodstock					N
23BR.351	Broodstock					N
23BR.352	Broodstock	20LP0194	Big Creek Hatchery	20LP0206	Big Creek Hatchery	H
23BR.353	Broodstock					N
23BR.354	Broodstock	20LP0243	Big Creek Hatchery	20LP0227	Big Creek Hatchery	H
23BR.355	Broodstock	20LP0316	Big Creek Hatchery	20LP0330	Big Creek Hatchery	H
23BR.356	Broodstock					N
23BR.357	Broodstock					N
23BR.358	Broodstock	20LP0190	Big Creek Hatchery	20LP0204	Big Creek Hatchery	H
23BR.359	Broodstock					N
23BR.360	Broodstock	19QH0048	Big Creek Hatchery	19QH0038	Big Creek Hatchery	H
23BR.361	Broodstock					H
23BR.362	Broodstock	20LP0300	Big Creek Hatchery	20LP0288	Big Creek Hatchery	H
23BR.363	Broodstock					H
23BR.364	Broodstock					H
23BR.365	Broodstock	19QH0046	Big Creek Hatchery	19QH0035	Big Creek Hatchery	H
23BR.366	Broodstock					H
23BR.367	Broodstock					N
23BR.368	Broodstock					H
23BR.369	Broodstock					H
23BR.370	Broodstock	19QH0052	Big Creek Hatchery	19QH0042	Big Creek Hatchery	H
23BR.371	Broodstock					N
23BR.372	Broodstock					N
23BR.373	Broodstock	20LP0247	Big Creek Hatchery	20LP0231	Big Creek Hatchery	H
23BR.374	Broodstock					H
23BR.375	Broodstock					H
23BR.376	Broodstock					N
23BR.377	Broodstock					N
23BR.378	Broodstock					N
23BR.379	Broodstock					N
23BR.380	Broodstock	19QH0055	Big Creek Hatchery	19QH0044	Big Creek Hatchery	H
23BR.381	Broodstock					H
23BR.382	Broodstock					H
23BR.383	Broodstock					N
23BR.384	Broodstock	19QH0026	Big Creek Hatchery	19QH0013	Big Creek Hatchery	H
23BR.385	Broodstock	19QH0047	Big Creek Hatchery	19QH0035	Big Creek Hatchery	H
23BR.386	Broodstock					H

23BR.387	Broodstock	19QH0047	Big Creek Hatchery	19QH0037	Big Creek Hatchery	H
23BR.388	Broodstock	20LP0263	Big Creek Hatchery	20LP0275	Big Creek Hatchery	H
23BR.389	Broodstock	19QH0050	Big Creek Hatchery	19QH0040	Big Creek Hatchery	H
23BR.390	Broodstock					H
23BR.391	Broodstock					N
23BR.392	Broodstock			19QH0039	Big Creek Hatchery	H
23BR.393	Broodstock	19MW0128	Grays River Hatchery	19MW0119	Grays River Hatchery	N
23UF.249	Unfed Fry Parent	20LP0244	Big Creek Hatchery	20LP0230	Big Creek Hatchery	U
23UF.250	Unfed Fry Parent	19QH0046	Big Creek Hatchery	19QH0035	Big Creek Hatchery	H
23UF.251	Unfed Fry Parent					H
23UF.252	Unfed Fry Parent	20LP0090	Big Creek Hatchery	20LP0038	Big Creek Hatchery	H
23UF.253	Unfed Fry Parent	19QH0049	Big Creek Hatchery			U
23UF.254	Unfed Fry Parent					U
23UF.255	Unfed Fry Parent					N
23UF.256	Unfed Fry Parent	19QH0012	Big Creek Hatchery	19QH0006	Big Creek Hatchery	U
23UF.257	Unfed Fry Parent	20LP0149	Big Creek Hatchery	20LP0156	Big Creek Hatchery	H
23UF.258	Unfed Fry Parent					H
23UF.259	Unfed Fry Parent					H
23UF.260	Unfed Fry Parent	20LP0294	Big Creek Hatchery	20LP0282	Big Creek Hatchery	H
23UF.261	Unfed Fry Parent	19QH0046	Big Creek Hatchery	19QH0035	Big Creek Hatchery	H
23UF.262	Unfed Fry Parent					H
23UF.263	Unfed Fry Parent	19MW0075	Grays River Hatchery	19MW0065	Grays River Hatchery	H
23UF.264	Unfed Fry Parent	19QH0049	Big Creek Hatchery			H
23UF.265	Unfed Fry Parent	20LP0125	Big Creek Hatchery	20LP0136	Big Creek Hatchery	H
23UF.266	Unfed Fry Parent					H
23UF.267	Unfed Fry Parent					H
23UF.268	Unfed Fry Parent	19QH0030	Big Creek Hatchery	19QH0017	Big Creek Hatchery	H
23UF.269	Unfed Fry Parent					H
23UF.270	Unfed Fry Parent	19QH0049	Big Creek Hatchery			H
23UF.271	Unfed Fry Parent	20LP0073	Big Creek Hatchery	20LP0022	Big Creek Hatchery	H
23UF.272	Unfed Fry Parent	18NF0083	Big Creek Hatchery	18NF0104	Big Creek Hatchery	H
23UF.273	Unfed Fry Parent					U
23UF.274	Unfed Fry Parent	20LP0266	Big Creek Hatchery	20LP0278	Big Creek Hatchery	H
23UF.275	Unfed Fry Parent					H
23UF.276	Unfed Fry Parent	19MW0174	Grays River Hatchery	19MW0168	Grays River Hatchery	H
23UF.277	Unfed Fry Parent					N
23UF.278	Unfed Fry Parent	20LP0266	Big Creek Hatchery	20LP0279	Big Creek Hatchery	H
23UF.279	Unfed Fry Parent			18NF0051	Big Creek Hatchery	H
23UF.280	Unfed Fry Parent					N
23UF.281	Unfed Fry Parent	19QH0026	Big Creek Hatchery	19QH0014	Big Creek Hatchery	H
23UF.282	Unfed Fry Parent					U
23UF.283	Unfed Fry Parent					H
23UF.284	Unfed Fry Parent					N

23UF.285	Unfed Fry Parent	20LP0181	Big Creek Hatchery	20LP0171	Big Creek Hatchery	H
23UF.286	Unfed Fry Parent					N
23UF.287	Unfed Fry Parent	20LP0254	Big Creek Hatchery	20LP0239	Big Creek Hatchery	H
23UF.288	Unfed Fry Parent	20LP0264	Big Creek Hatchery	20LP0276	Big Creek Hatchery	H
23OUT.207	Adult Outplant	19QH0026	Big Creek Hatchery	19QH0013	Big Creek Hatchery	
23OUT.208	Adult Outplant					
23OUT.210	Adult Outplant	20LP0296	Big Creek Hatchery	20LP0284	Big Creek Hatchery	
23OUT.211	Adult Outplant	20LP0073	Big Creek Hatchery	20LP0022	Big Creek Hatchery	
23OUT.212	Adult Outplant	20LP0081	Big Creek Hatchery	20LP0030	Big Creek Hatchery	
23OUT.213	Adult Outplant	20LP0265	Big Creek Hatchery	20LP0279	Big Creek Hatchery	
23OUT.214	Adult Outplant	19QH0049	Big Creek Hatchery			
23OUT.215	Adult Outplant	20LP0310	Big Creek Hatchery			
23OUT.216	Adult Outplant	20LP0294	Big Creek Hatchery	20LP0283	Big Creek Hatchery	
23OUT.218	Adult Outplant	20LP0248	Big Creek Hatchery	20LP0233	Big Creek Hatchery	
23OUT.219	Adult Outplant					
23OUT.220	Adult Outplant	19MW0070	Grays River Hatchery	19MW0059	Grays River Hatchery	
23OUT.221	Adult Outplant					
23OUT.222	Adult Outplant	20LP0263	Big Creek Hatchery	20LP0275	Big Creek Hatchery	
23OUT.223	Adult Outplant	20LP0304	Big Creek Hatchery	20LP0323	Big Creek Hatchery	
23OUT.224	Adult Outplant	20LP0155	Big Creek Hatchery	20LP0164	Big Creek Hatchery	
23OUT.225	Adult Outplant					
23OUT.226	Adult Outplant	19MW0070	Grays River Hatchery			
23OUT.227	Adult Outplant	19QH0034	Big Creek Hatchery			
23OUT.228	Adult Outplant					
23OUT.229	Adult Outplant	20LP0092	Big Creek Hatchery	20LP0039	Big Creek Hatchery	
23OUT.230	Adult Outplant	19QH0049	Big Creek Hatchery			
23OUT.231	Adult Outplant	20LP0119	Big Creek Hatchery	20LP0068	Big Creek Hatchery	
23OUT.232	Adult Outplant	20LP0254	Big Creek Hatchery	20LP0239	Big Creek Hatchery	
23OUT.233	Adult Outplant	19QH0008	Big Creek Hatchery	19QH0001	Big Creek Hatchery	
23OUT.235	Adult Outplant	20LP0254	Big Creek Hatchery	20LP0239	Big Creek Hatchery	
23OUT.236	Adult Outplant	19QH0029	Big Creek Hatchery	19QH0017	Big Creek Hatchery	
23OUT.349	Adult Outplant	19QH0010	Big Creek Hatchery	19QH0003	Big Creek Hatchery	
23OUT.350	Adult Outplant					
23OUT.351	Adult Outplant			19QH0040	Big Creek Hatchery	
23OUT.353	Adult Outplant					
23OUT.354	Adult Outplant					
23OUT.356	Adult Outplant	20LP0098	Big Creek Hatchery	20LP0046	Big Creek Hatchery	
23UF.151	Unfed Fry Parent	19QH0055	Big Creek Hatchery	19QH0044	Big Creek Hatchery	H
23UF.152	Unfed Fry Parent					H
23UF.153	Unfed Fry Parent					H
23UF.154	Unfed Fry Parent					H
23UF.155	Unfed Fry Parent					H
23UF.157	Unfed Fry Parent	20LP0108	Big Creek Hatchery	20LP0057	Big Creek Hatchery	H

23UF.158	Unfed Fry Parent	19QH0027	Big Creek Hatchery	19QH0015	Big Creek Hatchery	H
23UF.159	Unfed Fry Parent					H
23UF.160	Unfed Fry Parent	19QH0030	Big Creek Hatchery	19QH0017	Big Creek Hatchery	H
23UF.161	Unfed Fry Parent	20LP0130	Big Creek Hatchery	20LP0138	Big Creek Hatchery	H
23UF.162	Unfed Fry Parent					H
23UF.163	Unfed Fry Parent	20LP0013	Big Creek Hatchery	20LP0004	Big Creek Hatchery	H
23UF.164	Unfed Fry Parent					N
23UF.165	Unfed Fry Parent	20LP0098	Big Creek Hatchery	20LP0045	Big Creek Hatchery	H
23UF.166	Unfed Fry Parent	20LP0089	Big Creek Hatchery	20LP0037	Big Creek Hatchery	H
23UF.167	Unfed Fry Parent	19QH0008	Big Creek Hatchery	19QH0001	Big Creek Hatchery	H
23UF.168	Unfed Fry Parent	19QH0047	Big Creek Hatchery	19QH0037	Big Creek Hatchery	H
23UF.169	Unfed Fry Parent	20LP0078	Big Creek Hatchery	20LP0025	Big Creek Hatchery	H
23UF.170	Unfed Fry Parent	19QH0050	Big Creek Hatchery	19QH0039	Big Creek Hatchery	H
23UF.171	Unfed Fry Parent					N
23UF.172	Unfed Fry Parent					H
23UF.173	Unfed Fry Parent					H
23UF.174	Unfed Fry Parent					N
23UF.175	Unfed Fry Parent					H
23UF.176	Unfed Fry Parent					H
23UF.177	Unfed Fry Parent					H
23UF.178	Unfed Fry Parent					H
23UF.179	Unfed Fry Parent	19QH0026	Big Creek Hatchery	19QH0013	Big Creek Hatchery	H
23UF.180	Unfed Fry Parent	20LP0248	Big Creek Hatchery	20LP0233	Big Creek Hatchery	H
23UF.181	Unfed Fry Parent	19QH0050	Big Creek Hatchery	19QH0039	Big Creek Hatchery	H
23UF.182	Unfed Fry Parent	20LP0087	Big Creek Hatchery	20LP0035	Big Creek Hatchery	H
23UF.183	Unfed Fry Parent					N
23UF.184	Unfed Fry Parent	20LP0124	Big Creek Hatchery	20LP0136	Big Creek Hatchery	H
23UF.185	Unfed Fry Parent	20LP0244	Big Creek Hatchery	20LP0230	Big Creek Hatchery	N
23UF.186	Unfed Fry Parent	20LP0124	Big Creek Hatchery	20LP0136	Big Creek Hatchery	H
23UF.187	Unfed Fry Parent					H
23UF.188	Unfed Fry Parent	19QH0030	Big Creek Hatchery	19QH0017	Big Creek Hatchery	H
23UF.189	Unfed Fry Parent					H
23UF.190	Unfed Fry Parent					N
23UF.191	Unfed Fry Parent	20LP0291	Big Creek Hatchery	20LP0280	Big Creek Hatchery	H
23UF.192	Unfed Fry Parent	20LP0259	Big Creek Hatchery	20LP0272	Big Creek Hatchery	H
23UF.193	Unfed Fry Parent	19QH0047	Big Creek Hatchery	19QH0037	Big Creek Hatchery	H
23UF.194	Unfed Fry Parent					H
23UF.195	Unfed Fry Parent					N
23UF.196	Unfed Fry Parent					H
23UF.197	Unfed Fry Parent	20LP0073	Big Creek Hatchery	20LP0021	Big Creek Hatchery	H
23UF.198	Unfed Fry Parent	20LP0073	Big Creek Hatchery	20LP0021	Big Creek Hatchery	H
23UF.199	Unfed Fry Parent			19QH0039	Big Creek Hatchery	H
23UF.200	Unfed Fry Parent	20LP0078	Big Creek Hatchery	20LP0025	Big Creek Hatchery	H

23UF.201	Unfed Fry Parent	20LP0241	Big Creek Hatchery	20LP0226	Big Creek Hatchery	H
23UF.202	Unfed Fry Parent					H
23UF.203	Unfed Fry Parent	20LP0256	Big Creek Hatchery	20LP0267	Big Creek Hatchery	H
23UF.204	Unfed Fry Parent	19QH0028	Big Creek Hatchery	19QH0015	Big Creek Hatchery	H
23UF.205	Unfed Fry Parent	20LP0255	Big Creek Hatchery	20LP0267	Big Creek Hatchery	H
23UF.206	Unfed Fry Parent					H
23UF.207	Unfed Fry Parent	19QH0029	Big Creek Hatchery	19QH0018	Big Creek Hatchery	H
23UF.208	Unfed Fry Parent					H
23RSI.209	RSI Parent	20LP0093	Big Creek Hatchery	20LP0041	Big Creek Hatchery	H
23RSI.210	RSI Parent					N
23RSI.211	RSI Parent					H
23RSI.212	RSI Parent	19QH0025	Big Creek Hatchery	19QH0014	Big Creek Hatchery	H
23RSI.213	RSI Parent					N
23RSI.214	RSI Parent	20LP0241	Big Creek Hatchery	20LP0226	Big Creek Hatchery	H
23RSI.215	RSI Parent					N
23RSI.216	RSI Parent					U
23RSI.217	RSI Parent					U
23RSI.218	RSI Parent					H
23RSI.219	RSI Parent	20LP0074	Big Creek Hatchery	20LP0022	Big Creek Hatchery	H
23RSI.220	RSI Parent	20LP0077	Big Creek Hatchery	20LP0025	Big Creek Hatchery	H
23RSI.221	RSI Parent	20LP0018	Big Creek Hatchery	20LP0008	Big Creek Hatchery	U
23RSI.222	RSI Parent					U
23RSI.223	RSI Parent	19QH0049	Big Creek Hatchery	19QH0038	Big Creek Hatchery	H
23RSI.224	RSI Parent					H
23RSI.225	RSI Parent	19QH0027	Big Creek Hatchery	19QH0015	Big Creek Hatchery	U
23RSI.226	RSI Parent	19QH0025	Big Creek Hatchery	19QH0013	Big Creek Hatchery	H
23RSI.227	RSI Parent	20LP0081	Big Creek Hatchery	20LP0030	Big Creek Hatchery	U
23RSI.228	RSI Parent	19QH0030	Big Creek Hatchery	19QH0017	Big Creek Hatchery	H
23RSI.229	RSI Parent			20LP0330	Big Creek Hatchery	U
23RSI.230	RSI Parent	19QH0049	Big Creek Hatchery	19QH0038	Big Creek Hatchery	H
23RSI.231	RSI Parent					N
23RSI.232	RSI Parent			18NF0053	Big Creek Hatchery	H
23RSI.233	RSI Parent					H
23RSI.234	RSI Parent	20LP0296	Big Creek Hatchery	20LP0285	Big Creek Hatchery	U
23RSI.235	RSI Parent					H
23RSI.236	RSI Parent	19QH0046	Big Creek Hatchery	19QH0037	Big Creek Hatchery	H
23RSI.237	RSI Parent					U
23RSI.238	RSI Parent					H
23RSI.239	RSI Parent	20LP0108	Big Creek Hatchery	20LP0056	Big Creek Hatchery	H
23RSI.240	RSI Parent					N
23RSI.241	RSI Parent	20LP0291	Big Creek Hatchery	20LP0280	Big Creek Hatchery	U
23RSI.242	RSI Parent					N
23RSI.243	RSI Parent	19QH0046	Big Creek Hatchery	19QH0035	Big Creek Hatchery	U

23RSI.244	RSI Parent					H
23RSI.245	RSI Parent					U
23RSI.246	RSI Parent	20LP0240	Big Creek Hatchery	20LP0226	Big Creek Hatchery	H
23RSI.247	RSI Parent					H
23RSI.248	RSI Parent	20NB0133	Grays River Hatchery	20NB0123	Grays River Hatchery	H
SGS.G23.0078	SGS	19QH0008	Big Creek Hatchery	19QH0001	Big Creek Hatchery	
SGS.G23.0077	SGS					

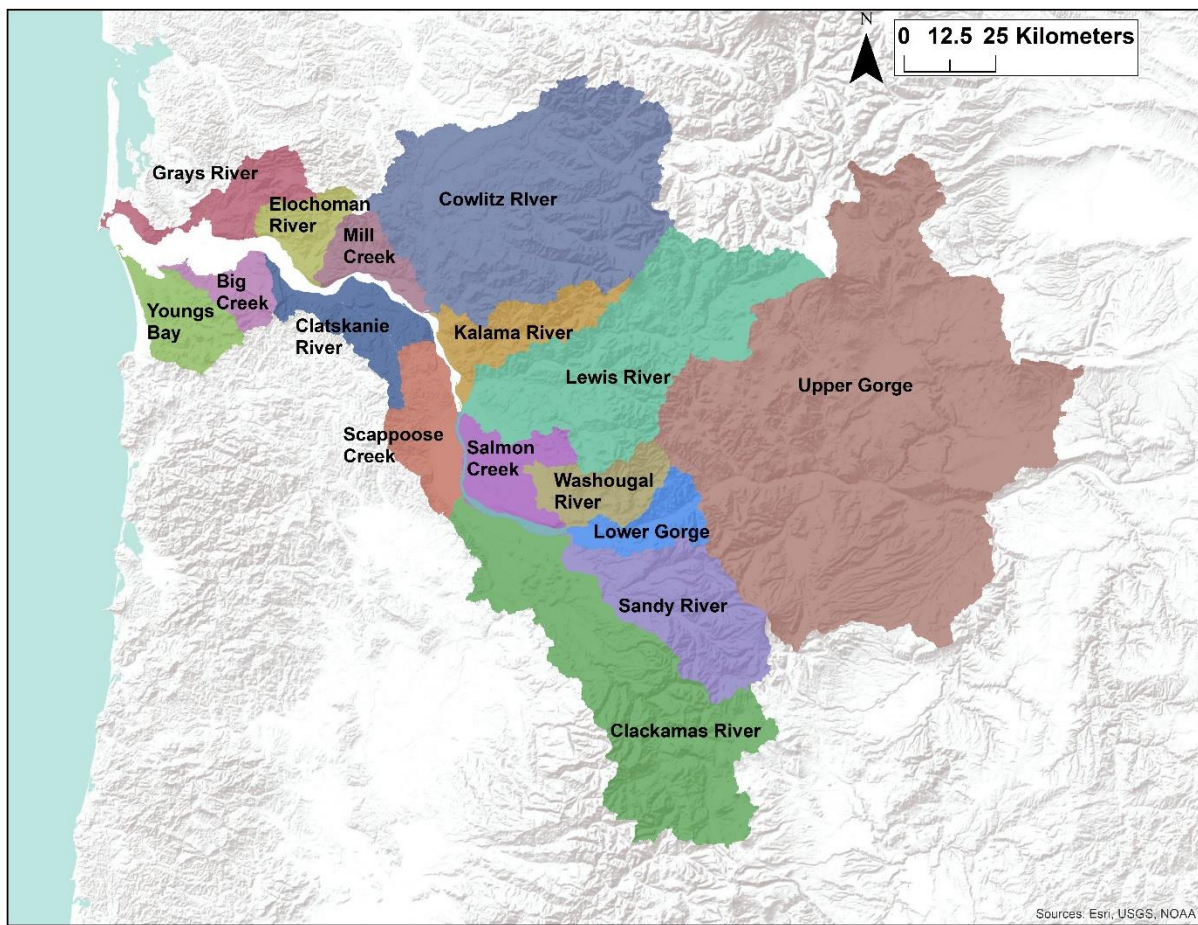


Figure 1. Map of the 16 recovery populations that comprise the Chum Salmon (*Oncorhynchus keta*) Lower Columbia River Evolutionary Significant Unit. There are six recovery populations in Oregon, eight in Washington, and two that are jointly monitored (i.e., Lower and Upper Gorge).