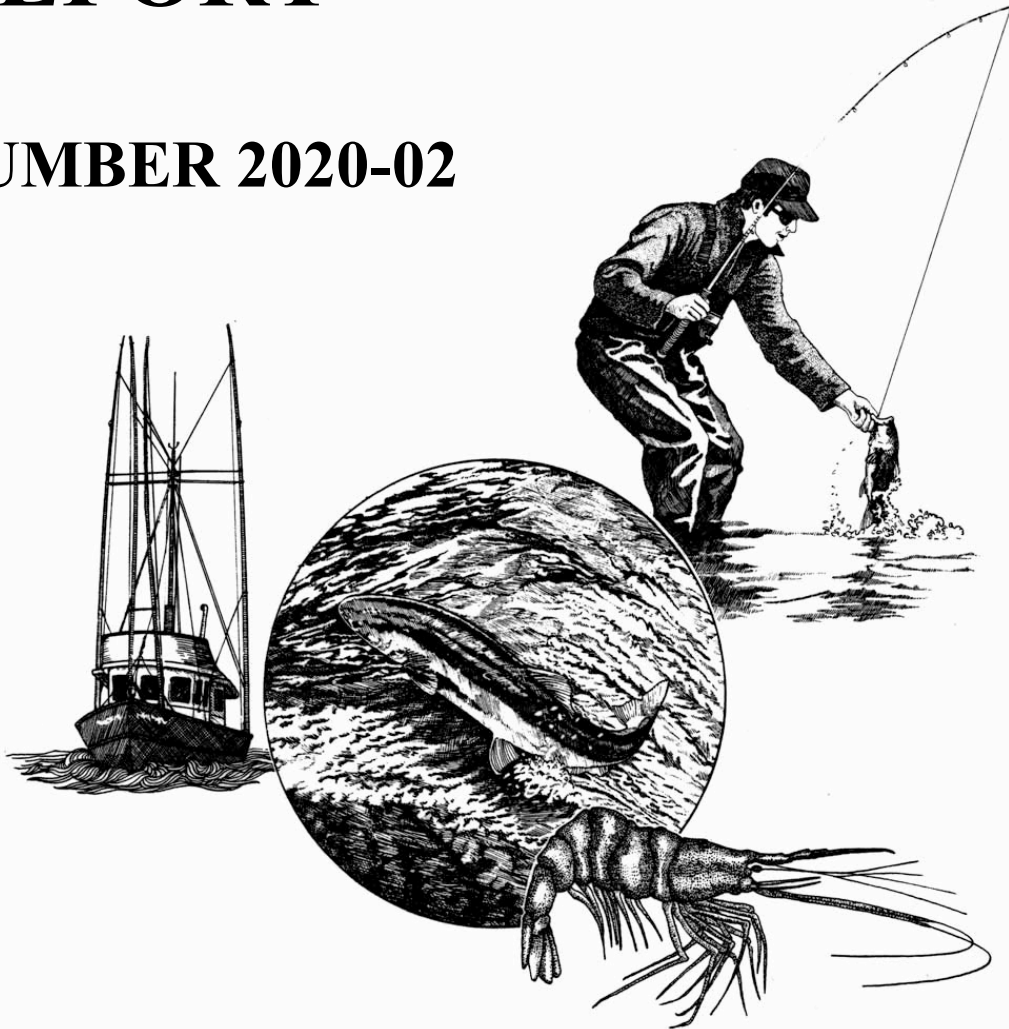


ODFW INFORMATION REPORT

NUMBER 2020-02



FISH DIVISION

Oregon Department of Fish and Wildlife

Evaluating the genetics of naturally produced Chinook salmon (*Oncorhynchus tshawytscha*) captured in the Lower Rogue River (OR) fishery

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Evaluating the genetics of naturally produced Chinook salmon (*Oncorhynchus tshawytscha*)
captured in the Lower Rogue River (OR) fishery

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May 2020

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INTRODUCTION

In the Rogue basin, the Oregon Department of Fish and Wildlife (ODFW) manages spring and fall Chinook salmon as distinct species management units (SMUs). Spring Chinook salmon in the lower river are defined as those adult Chinook salmon that enter freshwater during the period February through mid-July, and also pass Huntley Park (RM 8) by the end of Julian Week 29. The management goals and strategies for spring Chinook are documented in the [Rogue Spring Chinook Salmon Conservation Plan](#) which was adopted by the ODFW Fish and Wildlife Commission on September 7, 2007. The desired biological status for spring Chinook was defined during a stakeholder process associated with the development of the Conservation Plan and includes targets for abundance, migration time, age structure, spawner distribution and composition, and persistence.

To achieve this desired status, the conservation plan outlines management strategies for harvest, hatcheries, and habitat. Consistent with plan goals, ODFW's management strategy for the spring Chinook fishery in the Lower Rogue river protects the early run "spring" Chinook while providing harvest opportunity during this period on hatchery spring Chinook. To achieve this, current regulations prohibit retention of naturally produced (i.e. adipose fin intact) Chinook prior to June 1 from the river mouth upstream to Fishers Ferry boat ramp (old Gold Ray dam site). This date was chosen because it was believed the majority of early run spring Chinook would have passed the fishery by this time. Beginning June 1, and depending on run size projections, anglers are allowed to retain a limited number of naturally produced fish.

More recently, ODFW completed a Comprehensive Assessment and Update of the Conservation Plan in January 2019. The department concluded that the status of naturally produced spring Chinook relative to these targets had improved as a result of the management actions that were implemented. As a result of the improved status, ODFW proposed a framework for providing additional fishery opportunities if population abundance continues to increase. The proposed regulation changes would shift the date at which wild Chinook can be retained from June 1 to May 21, May 11, or April 1 (date and bag limit tied to abundance trigger-see pg. 32 of the plan review for details:

https://www.dfw.state.or.us/fish/CRP/docs/rogue_spring_chinook/Final%20Rogue%20Spring%20Chinook%20Salmon%20Conservation%20Plan%20Comprehensive%20Assessment%20and%20Update.pdf).

At the time the plan was adopted, genetic data were not available to distinguish spring Chinook from fall Chinook. However, relatively recent research has identified genetic markers on chromosome 28 that are significantly associated with run timing (Prince et al. 2017; Thompson et al. 2019). Research is ongoing to determine which genes may be involved and the potential outcomes when early and late run fish spawning overlaps in time and space. To assess how the current and future angling regulations aligned with the genetic

composition of Chinook at the run timing markers, ODFW initiated this study in 2019 using angler captured fish in the Lower Rogue River.

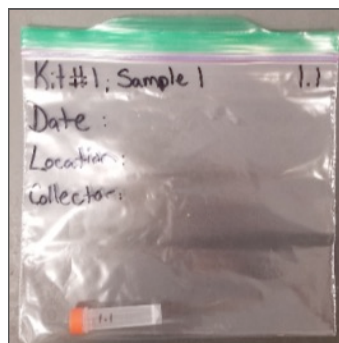
Objective

1. Determine the genetic composition, based on two run timing markers, of naturally produced Chinook salmon captured in the lower Rogue River fishery in 2019.

METHODS

The study period was between March 1 and July 15, 2019. Volunteer anglers were asked to take tissue samples from any naturally produced Chinook salmon captured during this period. The volunteer anglers were issued sampling kits containing written instructions, individually labeled vials containing ethanol, and a paper hole punch for extracting caudal fin tissue. Additionally, the kits contained the following instructions:

- Minimize handling (keep in net on side of boat in/very close to the water surface)
- Work with a partner (one person holds fish, other holds net and collects sample)
- Use paper hole punch to extract fin tissue sample from caudal fin (Imagine the tail fin is a piece of paper)
- Gently release fish back into river
- Very carefully remove tissue sample from the hole punch's "chip guard" and place into sample vial. Be sure that sample is completely immersed in the liquid and close the cap snugly.
- Place vial into resealable bag. With a sharpie, record date, angler (collector), and location on bag's exterior.



- Rinse the hole punch in clean water
- Store sample in safe place away from heat for the duration of the fishing trip

- Drop samples off with Gold Beach ODFW staff directly or at one of the five drop boxes* and then notify ODFW

*Drop boxes were located at Rogue Outdoor Store, ODFW Gold Beach office, Mill Site, Lobster Creek Campground, and Quosatana Creek Campgrounds.



The Drop boxes were setup prior to March 1. ODFW staff collected samples from the boxes daily, or, at a minimum, weekly during the study period. The returned sample vials were organized chronologically and stored at the Gold Beach ODFW office for the duration of the project. All samples were stored at room temperature away from sunlight. The ethanol in each vial was replaced one week after samples were collected. At that time, each vial was labeled externally with a sample-ID number. Additionally, a small piece of Rite-in-the-Rain paper with the sample-ID number recorded with pencil was placed inside the vial with the tissue sample. Data records for each sample were entered in to an Excel spreadsheet and included sample-ID number, collection date, collection area, collector, and collection method.

The 2019 samples were transferred to the State Fisheries Genomics Lab in Newport where DNA was extracted from the fin tissue samples using the method of Ivanova et al. (2006). Using the Genotyping-in-Thousands by sequencing method (GT-seq; Campbell et al. 2015), all samples were genotyped at 298 single nucleotide polymorphisms (SNPs) (Hess et al. 2015), a sex marker (Hess et al. 2015), and two SNPs (positions 640165 and 670329) that are ~30 kb apart and located just upstream of the *GrebIL* gene (Thompson et al. 2019). These latter two SNPs are hereafter referred to as *GrebIL* SNP1 and SNP2, respectively. *GrebIL* SNP1 is reportedly more diagnostic of adult migration phenotype than *GrebIL* SNP2 in Rogue River and Klamath River populations of Chinook salmon (T. Thompson, pers. comm.).

Twelve pairs of SNPs align within 10,000 bp of each other. To avoid possible linkage disequilibrium, we removed the SNP from each pair with a lower number of effective alleles calculated in GENALEX (Peakall and Smouse 2012). In addition, we removed 29 SNPs that had more than 20% missing data and 25 SNPs that were monomorphic in all samples. *Ots_111312-435* significantly deviated from Hardy-Weinberg proportions in the Genepop R package (Rousset 2008) after an FDR correction and was removed. Two pairs of SNPs (*Ots_crRAD12711-37* and *Ots_crRAD13725-51*; *Ots_crRAD48459-74* and *Ots_nkef-192*) showed significant linkage disequilibrium in the Genepop R package after an FDR correction, and the latter SNP from each pair was removed. The final marker set included 229 SNPs previously developed by Hess et al. (2015) and the two *Greb1L* SNPs identified by Thompson et al. (2019).

RESULTS

Sample Collection

Volunteer anglers captured and sampled 162 naturally produced Chinook salmon. The earliest capture date was March 19, 2019 and the last fish was captured July 8, 2019. The captures were distributed among 10 sites in the lower river (Table S1, Figure 1).

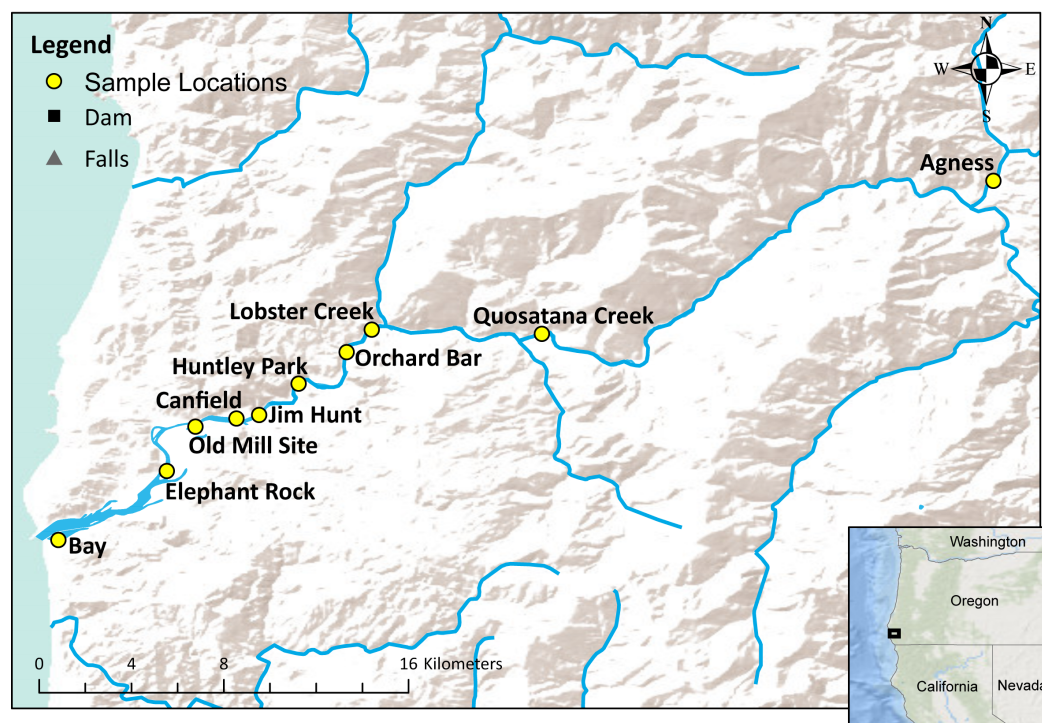


Figure 1. Map of the ten sample locations in the lower Rogue River.

The first sample was collected on March 19th by a guide targeting steelhead. Chinook fishing remained slow until record high river flows receded around the second week of April (Figure 2). Flows peaked at the USGS Agness

gauge at 90,000 cfs on April 9th and these high flows and turbid water resulted in the loss of fishing days from April 8th to April 14th. Once flows reduced to a weekly average of 12,000 cfs and the water temperature rose above 10°C, catch and sample collection rates increased. Fishing pressure remained consistent through the remainder of April. In May and June, fishing effort correlated with changes in water temperatures. For example, river temperatures decreased following rainfall in mid-May resulting in ideal fishing conditions, increased angling effort, catch, and sample collection over the last two weeks of that month.

Catch distribution of unmarked early run Chinook salmon generally began downstream and shifted upriver throughout the spring. During late March, April, and early May, the fishery was most concentrated in the lower stretches (below Lobster Creek) of the river. In mid-May, effort increased substantially at Quosatana Creek boat ramp, with a similar increase in the number of samples being deposited in the drop box at this location. Beginning June 1, angling regulations changed to allow for retention of unmarked Chinook. ODFW staff monitoring the fishery after this date collected tissue samples during surveys at boat ramps, cleaning stations, and in an angler creel. A number of samples were collected from the Rogue Bay fishery which became active in June, coincident with an increase in water temperature at Agness to above 66°F (19°C) in the morning. This increase in water temperature may increase the incidence of holding by Chinook in the bay. However, when the water temperature decreased below this level, most of the samples were provided by anglers upstream of tidewater suggesting that fish were migrating upstream.

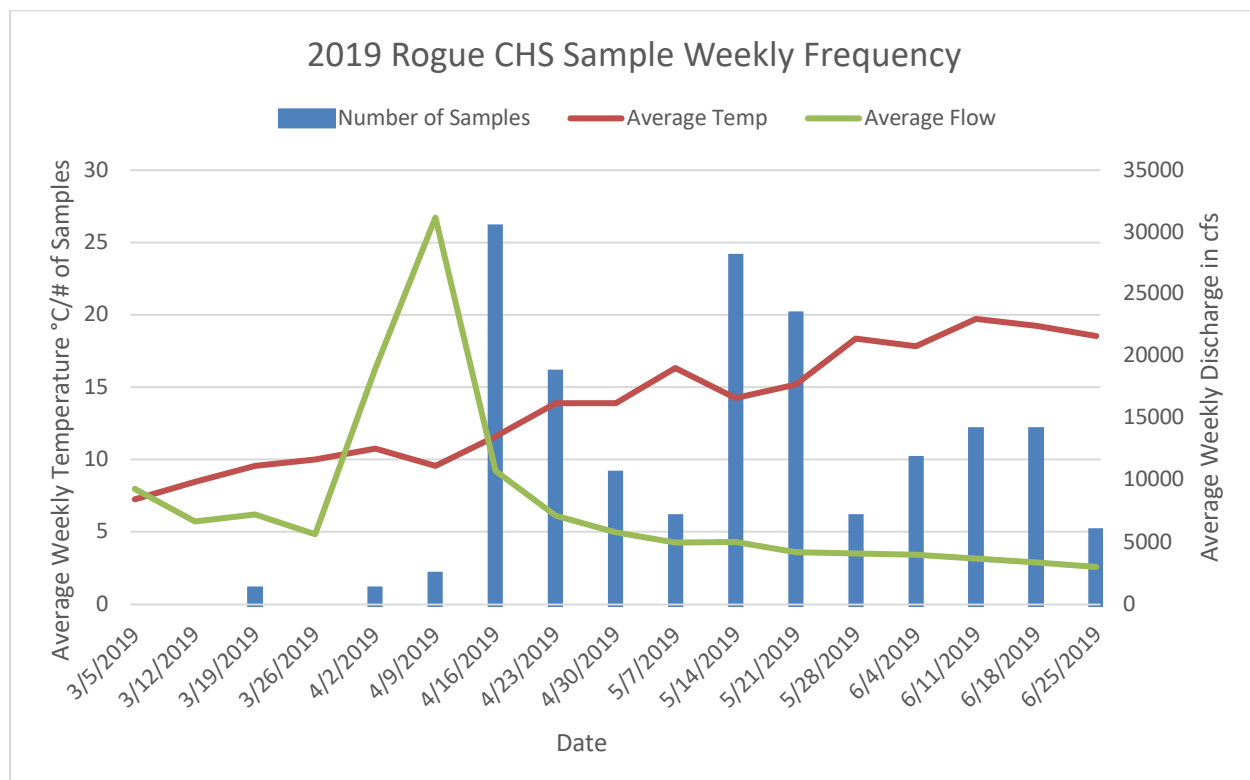


Figure 2. Number of Chinook salmon sampled from March 1st to July 15th relative to the average weekly river temperatures (°C) and average weekly discharge (cfs).

Genotyping

Four of the 162 samples failed to genotype at both *GrebIL* SNPs. Of the remaining 158 samples, nine samples had discordant genotypes (Figure 3). For instance, an individual was genotyped as heterozygous at one SNP and homozygous spring at the other SNP. Of the remaining 149 samples, 115 samples were genotyped homozygous spring, 32 samples were genotyped heterozygous, and 2 samples were genotyped homozygous fall (Table S1, Figure 3).

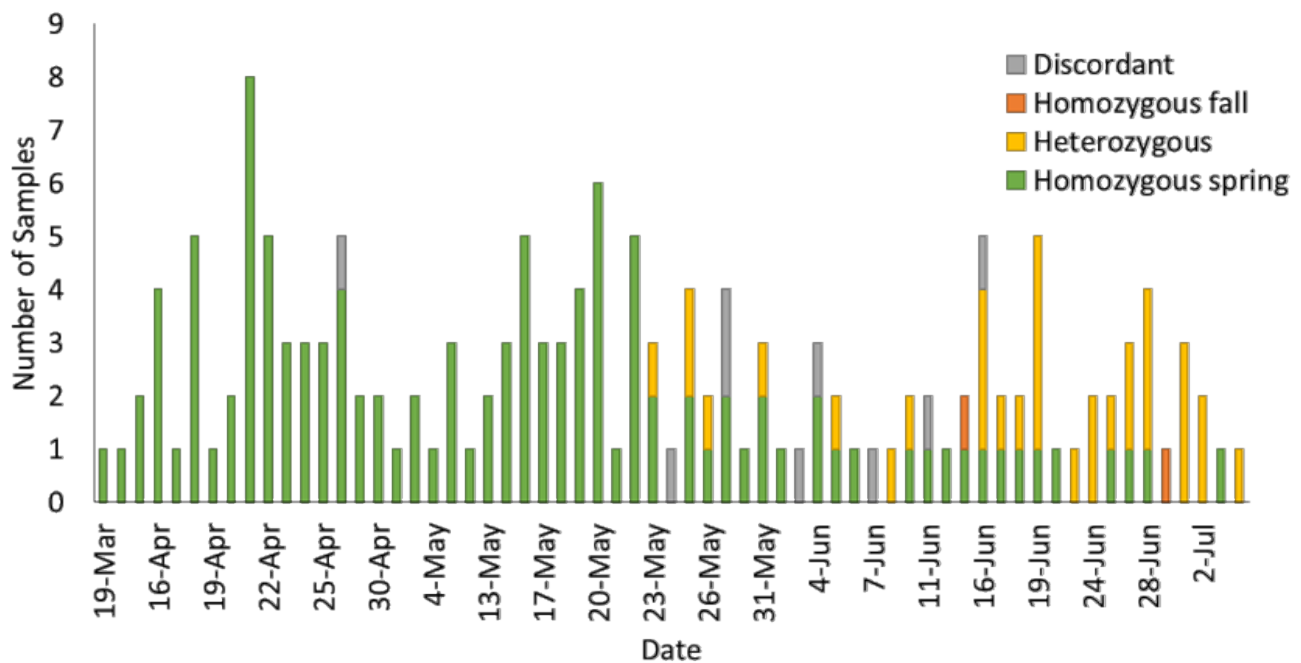


Figure 3. *GrebIL* SNP1 (snp640165) and SNP2 (snp670329) genotypes of Chinook salmon caught in the lower Rogue River in 2019 from March 19th to July 8th. Discordant genotypes are indicated by the gray bars.

As mentioned above, *GrebIL* SNP1 is reportedly more diagnostic of adult migration phenotype than *GrebIL* SNP2 in Rogue River and Klamath River Chinook salmon populations (T. Thompson, pers. comm.). Focusing only on SNP1, 117 samples were homozygous spring, 30 samples were heterozygous, and two samples were homozygous fall (Figure 4). The first heterozygous sample was collected on April 26th while the second heterozygous sample was collected on May 23rd. The two homozygous fall samples were collected on June 15th and June 30th. Both the total number of homozygous spring Chinook salmon and the daily proportion of samples that were homozygous spring Chinook salmon decreased after May 23rd; however, Chinook salmon that were homozygous for the spring allele were collected through July 5, 2019.

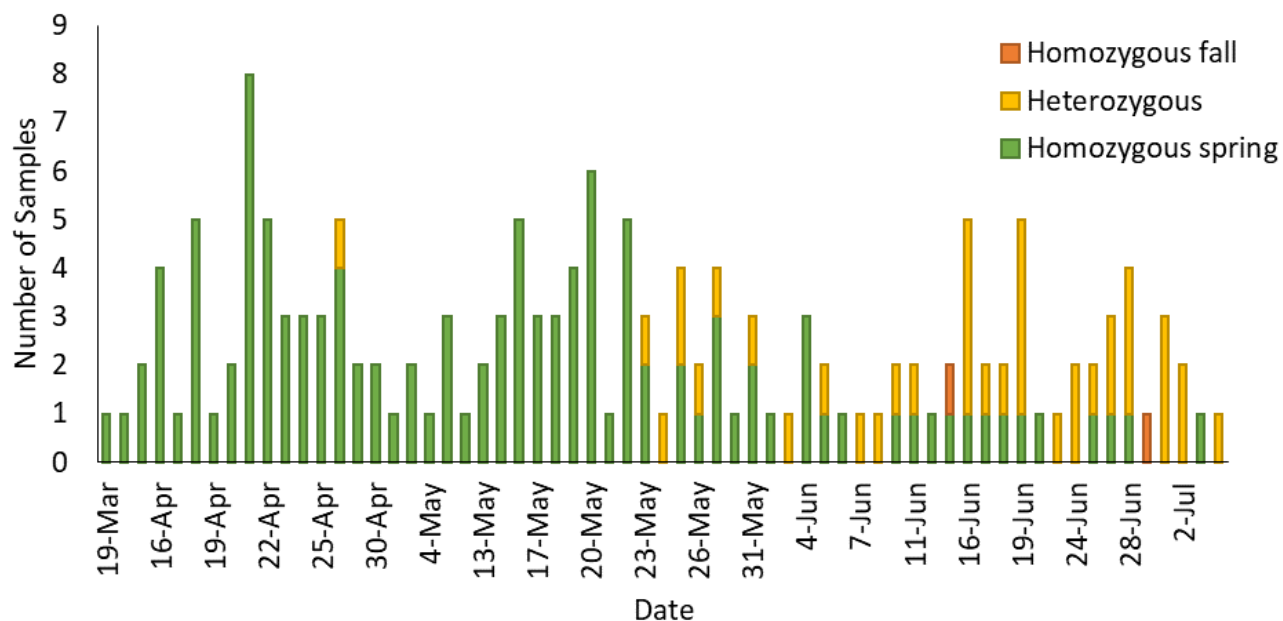


Figure 4. *Greb1L* SNP1 (snp640165) genotypes of Chinook salmon caught in the lower Rogue River in 2019 from March 19th to July 8th.

DISCUSSION

The main findings of the study:

1. All except one naturally produced Chinook salmon caught on or before May 23rd were homozygous spring at both *Greb1L* SNPs
2. Based on *Greb1L* SNP1, the majority of naturally produced homozygous spring Chinook salmon (83.8%; 98 out of 119 fish) genotyped in this study were captured during the period when retention of unmarked Chinook salmon was prohibited (Mar 1-Jun 1). Thus, the current angling regulations are protective of the early run life history genetics.
3. Based on *Greb1L* SNP1, anglers were primarily capturing and retaining heterozygous fish during the period June 1 - July 8 (31 out of 52 fish; or 59.6% of total catch). Of the remaining fish, 19 were homozygous spring and two were homozygous fall.
4. The sample collection protocol, which primarily relied upon volunteer anglers, was an effective way to collect fin clips from naturally produced Chinook salmon in the lower Rogue River.
5. A single seasonal employee was able to collect and manage samples with assistance from District personnel.

Acknowledgments

We appreciate the effort from all participating anglers. Without your contributions, this project would not have been as successful. We thank the Oregon State University Center for Genome Research and Biocomputing for sequencing our samples. This report benefitted from review by Shaun Clements of ODFW. The project was funded by an Oregon Department of Fish and Wildlife Restoration and Enhancement Program Grant (Project #17-065).

References

- Hess, J.E., Campbell, N.R., Matala, A.P., Hasselman, D.J., Narum, S.R. (2015) Genetic assessment of Columbia River Stocks, 4/1/2014 -3/31/2015 Annual Report, 2008-907-00, <https://www.critfc.org/wp-content/uploads/2016/04/16-03.pdf>.
- Ivanova, N., Dewaard, J.R., Hebert, P.D.N. (2006) An inexpensive, automation-friendly protocol for recovering high-quality DNA. *Molecular Ecology Notes* 6: 998–1002.
- Prince, D.J., O'Rourke, S.M., Thompson, T.Q., Ali, O.A., Lyman, H.S., Saglam, I.K., Hotaling, T.J., Spidle, A.P., Miller, M.R. (2017) The evolutionary basis of premature migration in Pacific salmon highlights the utility of genomics for informing conservation. *Science Advances* 3(8): 2375-2548.
- Rousset, F. (2008) genepop'007: a complete re-implementation of the genepop software for Windows and Linux. *Molecular Ecology Resources* 8:103-106.
- Thompson, T.Q., Bellinger, M.R., O'Rourke, S.M., Prince, D.J., Stevenson, A.E., Rodrigues, A.T., Sloat, M.R., Speller, C.F., Yang, D.Y., Butler, V.L., Banks, M.A., and Miller, M.R. (2019) Anthropogenic habitat alteration leads to rapid loss of adaptive variation and restoration potential in wild salmon populations. *Proceedings of the National Academy of Sciences* 116: 177-186.

Table 51.

Kit number	Sample #	Date	Feeder	Main Fishing Locations	Location	Angler/Guide	Collection Method	Origin	Genotypic Sex	Grebl1 SNP1	Grebl1 SNP2	Both SNPs
0SAC19R0GR 0001	6.1	3/19/19		Mill Site	Willows	John Anderson	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0002	25.2	4/3/19		Elephant Rock	Elephant Rock	Gene Garner	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0003	17.1	4/15/19		Huntley	Huntley	Burley Williams	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0004	17.2	4/15/19		Huntley	Huntley	Grant Brown	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0005	17.4	4/16/19		Huntley	Huntley	Grant Brown	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0006	8.1	4/16/19		Lobster Creek	Lobster Creek	Shaun Carpenter	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0007	8.3	4/16/19		Lobster Creek	Lobster Creek	Shaun Carpenter	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0008	8.4	4/16/19		Lobster Creek	Lobster Creek	Shaun Carpenter	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0009	17.3	4/17/19		Huntley	Huntley	Steve Crawford	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0010	17.5	4/18/19		Huntley	Huntley	Ron Spiece	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0011	21.1	4/18/19		Lobster Creek	Lobster Creek	Ross Bell	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0012	5.1	4/18/19		Lobster Creek	Lobster Creek	Andrew Wells	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0013	24.1	4/18/19		Canfield Bar	Canfield Bar	Robin Orsler	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0014	20.3	4/20/19		Quosata	Quosata	Greg Eide	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0015	36.5	4/20/19		Huntley	Huntley	Steve Bigg	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0016	11.1	4/21/19		Mill Site	Clay Banks	John Weber	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0017	11.2	4/21/19		Quosata	Quosata	Greg Eide	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0018	25.1	4/21/19		Elephant Rock	Elephant Rock	Gene Garner	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0019	25.3	4/21/19		Elephant Rock	Elephant Rock	Gene Garner	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0020	25.4	4/21/19		Elephant Rock	Elephant Rock	Gene Garner	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0021	25.5	4/21/19		Elephant Rock	Elephant Rock	Gene Garner	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0022	21.4	4/21/19		Canfield Bar	Canfield Bar	Robin Orsler	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0023	11.5	4/21/19		Quosata	Quosata	Greg Eide	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0024	5.7	4/22/19		Lobster Creek	Lobster Creek	Glenn Carpenter	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0025	8.5	4/22/19		Lobster Creek	Lobster Creek	Shaun Carpenter	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0026	8.6	4/22/19		Lobster Creek	Lobster Creek	Shaun Carpenter	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0027	15.1	4/22/19		Canfield Bar	Canfield Bar	Sam Ziegler	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0028	6.2	4/22/19		Bay	Bay	John Anderson	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0029	24.3	4/23/19		Canfield Bar	Canfield Bar	Robin Orsler	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0030	25.8	4/23/19		Elephant Rock	Elephant Rock	Gene Garner	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0031	21.1	4/23/19		Lobster Creek	Lobster Creek	Steve Mazur	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0032	24.5	4/24/19		Canfield Bar	Canfield Bar	Robin Orsler	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0033	1.5	4/24/19		Mill Site	Rip Rap	John Weber	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0034	8.7	4/24/19		Lobster Creek	Lobster Creek	Shaun Carpenter	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0035	37.1	4/25/19		Mill Site	Mill Site	Shane Blair	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0036	37.2	4/25/19		Mill Site	Mill Site	Shane Blair	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0037	39.1	4/25/19		Orchard Bar	Gillespie (Lower River)	John Olsen	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0038	24.2	4/26/19		Canfield Bar	Canfield Bar	Robin Orsler	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0039	40.1	4/26/19		Jim Hunt	Jim Hunt	Jim Beck	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0040	6.5	4/26/19		Bay	225	John Anderson	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0041	6.4	4/26/19		Bay	225	John Anderson	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0042	6.3	4/26/19		Bay	225	John Anderson	angler	NOR	Male	Heterozygous	Homozygous spring	Discordant
0SAC19R0GR 0043	11.4	4/27/19		Quosata	Quosata	Greg Eide	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0044	24.6	4/27/19		Canfield Bar	Canfield Bar	Robin Orsler	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0045	28.1	4/30/19		Mill Site	Clay Banks	Joe Martin	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0046	33.1	4/30/19		Mill Site	Willows	Jay Martin	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0047	23.2	4/31/19		Mill Site	Willows	Jay Lander	angler	NOR	Failed	Failed	Failed	Failed
0SAC19R0GR 0048	23.3	4/31/19		Mill Site	Willows	Jay Lander	angler	NOR	Failed	Failed	Failed	Failed
0SAC19R0GR 0049	41.1	5/1/19		Orchard Bar	Jimmy Davis	Travis Bowman	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0050	8.8	5/1/19		Quosata Creek	Q Creek	Shaun Carpenter	angler	NOR	Failed	Failed	Failed	Failed
0SAC19R0GR 0051	6.6	5/1/19		Quosata Creek	226	John Anderson	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0052	8.9	5/2/19		Quosata Creek	Q Creek	Shaun Carpenter	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0053	24.7	5/4/19		Quosata Creek	Woodruff	Robin Orsler	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0054	11.7	5/9/19		Quosata Creek	226	Greg Eide	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0055	11.9	5/9/19		Quosata Creek	226	Greg Eide	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0056	11.0	5/9/19		Quosata Creek	226	Greg Eide	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0057	11.1	5/10/19		Quosata Creek	226	Greg Eide	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0058	11.8	5/13/19		Quosata Creek	226	Greg Eide	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0059	8.10	5/13/19		Quosata Creek	Q Creek	Shaun Carpenter	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0060	11.6	5/14/19		Quosata Creek	226	Greg Eide	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0061	11.11	5/14/19		Quosata Creek	226	Greg Eide	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0062	24.8	5/14/19		Elephant Rock	Elephant Rock	Robin Orsler	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0063	8.11	5/15/19		Quosata Creek	Q Creek	Shaun Carpenter	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
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0SAC19R0GR 0067	24.9	5/15/19		Elephant Rock	Elephant Rock	Robin Orsler	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0068	28.2	5/17/19		Quosata Creek	Q Creek	Joe Martin	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0069	21.1	5/17/19		Elephant Rock	Lowery	Ross Bell	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0070	6.7	5/17/19		Bay	225	John Anderson	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0071	28.3	5/18/19		Lobster Creek	Lobster Creek	Joe Martin	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0072	8.13	5/18/19		Quosata Creek	Q Creek	Shaun Carpenter	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0073	11.14	5/18/19		Quosata Creek	226	Shane Blair	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0074	37.5	5/19/19		Elephant Rock	Elephant Rock	Shane Blair	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0075	8.14	5/19/19		Quosata Creek	Q Creek	Shaun Carpenter	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0076	8.14	5/19/19		Quosata Creek	226	Greg Eide	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0077	11.16	5/19/19		Quosata Creek	226	Greg Eide	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring

Table 51.

Sample #	Kit number	Sample #	Date	Feeder	Main Fishing Locations	Location	Angler/Guide	Collection Method	Origin	Genotypic Sex	GrebL SNP1	GrebL SNP2	Both SNPs
0SAC19R0GR 0078	21.4	78	5/20/19		Quosatana Creek	Bacon Flat	Ross Bell	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0079	28.4	79	5/20/19		Agness	Agness	Joe Martin	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0080	11.7	80	5/20/19		Quosatana Creek	226	Greg Eide	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0081	24.1	81	5/20/19		Cardfield Bar	Camery	Robbi Griser	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0082	5.3	82	5/20/19		Orchard Bar	Gillespie (Lower River)	Travis Bowman	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0083	8.6	83	5/20/19		Bay	225	John Anderson	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0084	41.4	84	5/21/19		Lobster Creek	Lobster Creek	Mike Becker	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0085	40.2	85	5/22/19		Orchard Bar	Cardfield	Rich Burgess	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0086	41.2	86	5/22/19		Orchard Bar	Gillespie (Lower River)	Travis Bowman	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0087	41.5	87	5/22/19		Orchard Bar	Gillespie (Lower River)	Travis Bowman	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0088	25.6	88	5/22/19		Elephant Rock	Elephant Rock	Gene Garner	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0089	8.5	89	5/23/19		Quosatana Creek	Q Creek	Shawn Carpenter	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0090	8.3	90	5/23/19		Quosatana Creek	Q Creek	Shawn Carpenter	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0091	21.3	91	5/23/19		Quosatana Creek	Bacon Flat	Ross Bell	angler	NOR	Male	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0092	37.6	92	5/23/19		Mill Site	Mill	Shane Blair	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0093	34.7	93	5/24/19		Elephant Rock	Elephant Rock	Robbi Griser	angler	NOR	Male	Heterozygous	Homozygous spring	Discordant
0SAC19R0GR 0094	37.1	94	5/25/19		Elephant Rock	Elephant Rock	Shane Blair	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0095	43.2	95	5/25/19		Quosatana Creek	226	Verne Tarwater	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0096	11.18	96	5/25/19		Quosatana Creek	226	Greg Eide	angler	NOR	Female	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0097	11.20	97	5/25/19		Quosatana Creek	226	Greg Eide	angler	NOR	Male	Heterozygous	Homozygous spring	Heterozygous
0SAC19R0GR 0098	11.26	98	5/26/19		Quosatana Creek	226	Greg Eide	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0099	11.21	99	5/26/19		Quosatana Creek	226	Greg Eide	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0100	11.21	100	5/27/19		Quosatana Creek	226	Greg Eide	angler	NOR	Male	Homozygous spring	Heterozygous	Discordant
0SAC19R0GR 0101	11.22	101	5/27/19		Quosatana Creek	226	Greg Eide	angler	NOR	Female	Homozygous spring	Heterozygous	Discordant
0SAC19R0GR 0102	11.27	102	5/27/19		Quosatana Creek	226	Greg Eide	angler	NOR	Female	Heterozygous	Homozygous spring	Discordant
0SAC19R0GR 0103	21.7	103	5/27/19		Quosatana Creek	Q Creek	Ross Bell	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0104	26.1	104	5/29/19		Lobster Creek	Lobster Creek	Jeff Bonatto	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0105	8.21	105	5/31/19		Quosatana Creek	Q Creek	Shawn Carpenter	angler	NOR	Male	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0106	11.28	106	5/31/19		Quosatana Creek	226	Greg Eide	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0107	11.23	107	5/31/19		Quosatana Creek	226	Greg Eide	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0108	8.22	108	6/3/19		Quosatana Creek	Q Creek	Shawn Carpenter	angler	NOR	Female	Heterozygous	Homozygous spring	Discordant
0SAC19R0GR 0109	5.4	109	6/3/19	**BAY**	Bay	Rogue Bay	Shawn Carpenter	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0110	5.5	110	6/4/19	**BAY**	Bay	Rachals	Wells	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0111	8.23	111	6/4/19		Quosatana Creek	Q Creek	Shawn Carpenter	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0112	8.24	112	6/4/19		Quosatana Creek	Q Creek	Shawn Carpenter	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0113	17.6	113	4/18/19		Huntley	Huntley	Steve Crawford	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0114	17.9	114	4/19/19		Huntley	Huntley	Ron Speck	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0115	8.25	115	6/5/19		Quosatana Creek	Q Creek	Shawn Carpenter	angler	NOR	Female	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0116	8.26	116	6/5/19		Quosatana Creek	Q Creek	Shawn Carpenter	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0117	8.16	117	6/6/19		Quosatana Creek	Q Creek	Shawn Carpenter	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0118	21.6	118	6/7/19		Lobster Creek	Lobster Creek	Ross Bell	angler	NOR	Female	Heterozygous	Homozygous spring	Discordant
0SAC19R0GR 0119	8.17	119	6/8/19		Quosatana Creek	Q Creek	Shawn Carpenter	angler	NOR	Male	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0120	17.8	120	6/10/19		Cardfield Bar	Cardfield	Wells	angler	NOR	Female	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0121	8.18	121	6/10/19		Quosatana Creek	Q Creek	Shawn Carpenter	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0122	41.3	122	6/11/19		Lobster Creek	Below Lobster	Travis Bowman	angler	NOR	Female	Heterozygous	Homozygous spring	Discordant
0SAC19R0GR 0123	11.25	123	6/11/19	**BAY**	Quosatana Creek	226	Greg Eide	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0124	43.4	124	6/14/19	**BAY**	Bay	226	Verne Tarwater	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0125	11.24	125	6/15/19		Quosatana Creek	226	Greg Eide	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0126	8.2	126	6/15/19		Quosatana Creek	Q Creek	Shawn Carpenter	angler	NOR	Female	Homozygous fall	Homozygous fall	Homozygous fall
0SAC19R0GR 0127	11.29	127	6/16/19		Quosatana Creek	226	Greg Eide	angler	NOR	Female	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0128	8.27	128	6/16/19		Quosatana Creek	Q Creek	Shawn Carpenter	angler	NOR	Female	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0129	50.4	129	6/16/19	**BAY**	Bay	225	Shawn Carpenter (Joey Lefebvre)	angler	NOR	Male	Homozygous spring	Homozygous spring	Discordant
0SAC19R0GR 0130	50.5	130	6/16/19	**BAY**	Bay	225	Ryan Gervasi (Joey Lefebvre)	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0131	50.1	131	6/16/19	**BAY**	Bay	225	Ryan Gervasi (Cleaning Station Barrel)	angler	NOR	Male	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0132	50.2	132	6/17/19	**BAY**	Bay	225 (downstream from Cat Town)	Ryan Gervasi	angler	NOR	Male	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0133	45.1	133	6/17/19	**BAY**	Quosatana Creek	Q Creek	Joe Martin	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0134	8.29	134	6/18/19	**BAY**	Quosatana Creek	Q Creek	Shawn Carpenter	angler	NOR	Female	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0135	50.6	135	6/18/19	**BAY**	Bay	Rogue Bay	Wells (cleaning station)	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0136	50.7	136	6/19/19	**BAY**	Bay	Rogue Bay	Wells (cleaning station)	angler	NOR	Female	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0137	11.30	137	6/19/19	**BAY**	Quosatana Creek	226	Greg Eide	angler	NOR	Female	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0138	11.31	138	6/19/19	**BAY**	Quosatana Creek	226	Greg Eide	angler	NOR	Female	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0139	11.32	139	6/19/19	**BAY**	Quosatana Creek	226	Greg Eide	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0140	8.31	140	6/19/19	**BAY**	Quosatana Creek	Q Creek	Shawn Carpenter	angler	NOR	Male	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0141	50.3	141	6/20/19	**BAY**	Bay	Rogue Bay	Ryan Gervasi	angler	NOR	Failed	Failed	Failed	Failed
0SAC19R0GR 0142	11.34	142	6/21/19	**BAY**	Quosatana Creek	226	Greg Eide	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0143	50.4	143	6/23/19	**BAY**	Bay	Rogue Bay	Wells	angler	NOR	Female	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0144	50.5	144	6/24/19	**BAY**	Mill Site	Willows	John Anderson	angler	NOR	Female	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0145	50.6	145	6/24/19	**BAY**	Mill Site	Willows	John Anderson	angler	NOR	Female	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0146	6.9	146	6/26/19	**BAY**	Mill Site	Willows	John Anderson	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0147	50.7	147	6/26/19	**BAY**	Mill Site	Willows	John Anderson	angler	NOR	Male	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0148	35.1	148	6/27/19	**BAY**	Mill Site	Willows	John Anderson	angler	NOR	Female	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0149	35.2	149	6/27/19	**BAY**	Mill Site	Willows	John Anderson	angler	NOR	Female	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0150	35.3	150	6/27/19	**BAY**	Bay	Rogue Bay	Wells	angler	NOR	Female	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0151	6.10	151	6/28/19	**BAY**	Mill Site	Clay Banks	John Anderson	angler	NOR	Female	Heterozygous	Heterozygous	Heterozygous
0SAC19R0GR 0152	6.11	152	6/28/19	**BAY**	Mill Site	Clay Banks	John Anderson	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
0SAC19R0GR 0153	6.12	153	6/28/19	**BAY**	Mill Site	Clay Banks	John Anderson	angler	NOR	Female	Heterozygous	Heterozygous	Heterozygous

Table S1.

SFGL ID	Kit number	Sample #	Date	Feeder	Main Fishing Locations	Location	Angler/Guide	Collection Method	Origin	Genotypic Sex	Greb1L SNP1	Greb1L SNP2	Both SNPs
OSAC19ROGR 0154	6.13	154	6/28/19		Mill Site	Clay Banks	John Anderson	angler	NOR	Male	Heterozygous	Heterozygous	Heterozygous
OSAC19ROGR 0155	11.35	155	6/30/19		Queasatana Creek	226	Greg Eide	angler	NOR	Female	Homozygous fall	Homozygous fall	Homozygous fall
OSAC19ROGR 0156	11.36	156	7/1/19		Queasatana Creek	226	Greg Eide	angler	NOR	Male	Heterozygous	Heterozygous	Heterozygous
OSAC19ROGR 0157	11.37	157	7/1/19		Queasatana Creek	226	Greg Eide	angler	NOR	Male	Heterozygous	Heterozygous	Heterozygous
OSAC19ROGR 0158	11.38	158	7/1/19		Queasatana Creek	226	Greg Eide	angler	NOR	Female	Heterozygous	Heterozygous	Heterozygous
OSAC19ROGR 0159	11.4	159	7/2/19		Queasatana Creek	226	Greg Eide	angler	NOR	Male	Heterozygous	Heterozygous	Heterozygous
OSAC19ROGR 0160	11.41	160	7/2/19	**BAY**	Queasatana Creek	226	Greg Eide	angler	NOR	Female	Heterozygous	Heterozygous	Heterozygous
OSAC19ROGR 0161	49.4	161	7/5/19	**BAY**	Bay	Rogue Bay	Ryan Gervasi	angler	NOR	Male	Homozygous spring	Homozygous spring	Homozygous spring
OSAC19ROGR 0162	49.2	162	7/8/19	**BAY**	Bay	Rogue Bay	Ryan Gervasi	angler	NOR	Male	Heterozygous	Heterozygous	Heterozygous



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