

Big Creek Hatchery Chum Salmon Broodstock

Fall Plan for 2020

In brief

In the last 4 years, returns of Chum Salmon to Big Creek Hatchery have been very low. Only with supplementation from the Grays River Hatchery in 2018 and 2019 were we able to achieve releases above 100,000 fry. It is likely that returns will be extremely low this year, given the small number of three year olds observed in 2019 ($n = 5$), and the small fry releases from the 2016 and 2017 brood years. To meet Big Creek collection goals, up to 220,000 eggs will be collected from a combination of (1) marked and unmarked Chum Salmon returns to Big Creek Hatchery and (2) transfer of up to 50,000 eggs from the Grays River Hatchery, the source of the Big Creek broodstock through 2014. All efforts to meet collection goals, including incorporating unmarked fish or transferring eggs from Washington, are described in the approved Big Creek and Grays River Chum Salmon HGMPs.

It is not likely that 220,000 eggs will be collected this fall and no outplanting efforts are planned. Should the return to Big Creek be significantly larger than expected, up to 300,000 eggs would be collected and reared at Big Creek Hatchery and any excess adults would be outplanted in Stewart Creek, in accordance with our HGMP and recovery strategy.

In an effort to increase marine survival rates of Chum Salmon, release timing has been advanced to late March/ early April the last two years (compared to mid- April to early May previously). Concurrently, fry are being released at a smaller size (1- 1.5 g). The goal for the 2020 brood is to continue those early releases of smaller fry. In particular, the goal is to release fry:

- Before the Columbia River temperatures reach 10 °C.
- On an outgoing tide
- In low light
- In large groups so that they can school and act as a buffer against predation; released on one or two dates, as fish size and scheduling permits
- To avoid temporal overlap with when hatchery smolts (e.g., Coho or Steelhead) are released.

Depending on the conditions in March, it may be difficult to achieve all of these release considerations. In that case, the Chum Reintroduction Coordinator and the Big Creek Hatchery supervisor can identify which of these release considerations are feasible to maximize fry survival in the Columbia River.

Background

The Big Creek Hatchery Chum Salmon broodstock is derived from marked and unmarked Chum Salmon in the Grays River, WA; transfers of eyed-eggs to Big Creek Hatchery occurred annually from 2010 – 2014, until the Big Creek broodstock was self-sustaining. The Big Creek Hatchery broodstock is integrated, and both marked and unmarked Chum Salmon are spawned to meet egg collection goals. As all populations of Chum Salmon on the Oregon side of the Columbia River are considered functionally extirpated, integration of variable numbers of unmarked Chum Salmon into the broodstock does not impact the current status of naturally spawning Chum Salmon (i.e., populations remain functionally extirpated). In the HGMP, it states, “Naturally produced Chum Salmon will be integrated annually as available and as needed to meet the goals of the re-introduction program as long as their removal from

the naturally spawning population does not jeopardize efforts to restore self-sustaining populations.” Efforts to restore self-sustaining populations rely on the Big Creek conservation broodstock, so removal of unmarked individuals that volitionally enter the hatchery contributes to the success of recovery efforts.

Expected adult returns

In fall 2020, age-3 (2017 brood year), age-4 (2016 brood year) and age-5 (2015 brood year) Chum Salmon will return to Big Creek from prior releases at Big Creek Hatchery. There will also be an unknown number of unmarked Chum Salmon entering the hatchery. Returns to the hatchery in 2016 and 2017 were much lower than expected and egg collection goals were not met, despite excellent returns to the Columbia River ESU in 2016 (> 43,000) and good returns in 2017 (> 10,000). Returns of hatchery Chum Salmon in 2018 were lower than would be expected based on the number of fry released. A component of the low returns is attributed to Big Creek Chum Salmon straying back to Washington. Research is underway to determine what other factors may be affecting survival of this broodstock. Persistently low returns to the hatchery present significant challenges for maintaining and expanding the Big Creek Broodstock.

Egg collection goals

The minimum egg collection goal to maintain the broodstock is 110,000 eggs, but the minimum collection goal to have excess returns for reintroduction work is 220,000. For BY 2016, only 37,000 fry were released and for BY 2017, 80,000 were released. As a result of better than expected returns of unmarked Chum Salmon to the hatchery and 50,000 eyed-eggs transferred from Grays River Hatchery, 171,649 fry were released in BY 2018 and 120,189 were released in BY 2019. This year, it will be critical to maximize releases to offset the poor returns expected from BY 2016 and 2017. To do so, we will collect all marked and unmarked Chum Salmon that enter Big Creek Hatchery (up to our permitted limit). Those returns will be supplemented by additional releases of Grays River-origin fry from Big Creek Hatchery (see **Approach: Grays River** below for details on adult collection and egg transfer).

Egg collection schedule:

If Chum Salmon returns are plentiful, collection will proceed with weekly goals meant to reflect natural run timing (Table 1). If Chum Salmon returns are poor, then all fish arriving at the hatchery after the last week in October will be spawned, regardless of arrival date. Occasional early arrivals (e.g., in September) are released back into Big Creek.

Table 1. The Big Creek Chum Salmon broodstock collection schedule with weekly goals assuming average fecundity of 2500 eggs to achieve a fry release goal of 200,000 fry (and egg collection goal of 220,000).

Week	Dates	Collection (# females)	Cumulative egg count
1	Oct 26 - 30	5	12,500
2	Nov 2 - 6	18	57,500
3	Nov 9 - 13	34	142,500
4	Nov 16 - 20	22	197,500
5	Nov 23 - 27	9	220,000

Approach: Big Creek Hatchery

1. Chum Salmon will be spawned once/ week, depending on fish condition and how many have arrived
2. Fish will be crowded and sorted as we prepare to spawn the fish (not prior to spawn days)
3. All fish will be checked for marks (see Table 2). Marks can be otolith marks, coded wire tags (CWT), adipose clips, or genetic marks (parentage-based tagging, PBT).
4. During and after spawning, the following bio data will be collected: length, scales, condition, genetics, total egg weight and eggs per ounce, otoliths, and presence of mark, along with required pathology samples.
5. Eggs will be either batch reared in baskets in Canadian troughs or reared in Heath Trays, depending on space requirements.

Table 2. Big Creek Chum Salmon marks by brood year and the expected years the marks could be observed in returns, assuming returns at ages 3-5. Marks that may appear in 2019 are highlighted in gray.

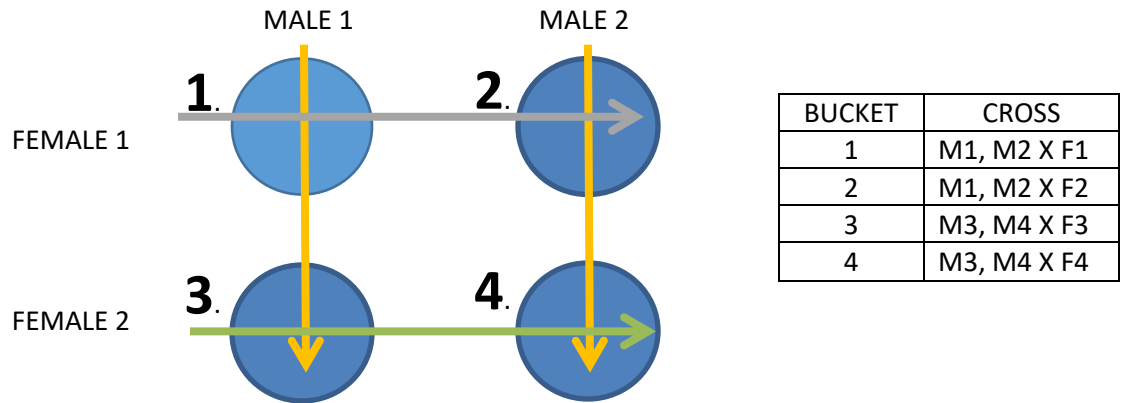
Brood year	Marks	Years marks observed in returns
2010	Pre-hatch thermal, CWT	2013–2015
2011	Pre-hatch thermal, CWT	2014–2016
2012	Pre-hatch thermal, CWT	2015–2017
2013	Pre-hatch thermal, CWT	2016–2018
2014	Pre and post-hatch thermal, CWT, Ad-Clip (test group)	2017–2019
2015	Pre and post-hatch thermal, Ad-Clip	2018–2020
2016	Pre and post-hatch thermal, Ad-Clip	2019–2021
2017	Pre and post-hatch thermal, PBT	2020–2022
2018	Pre and post-hatch thermal, PBT	2021–2023
2019	Pre and post-hatch thermal, PBT	2022–2024

Approach: Grays River collection

The collection schedule for the Grays River will be set by WDFW in accordance with the Grays River Chum Salmon HGMP requirements. Collection of adults occurs throughout the entire run to avoid selecting for a return timing. Staff from ODFW and other volunteers will assist WDFW with capturing adult Chum Salmon at several sites in the Grays River Basin. WDFW personnel will conduct all spawning activities at Beaver Creek Hatchery and will coordinate with Big Creek Hatchery on transfer of gametes to Big Creek Hatchery. Gametes will be placed in coolers on the day they are collected from adults and immediately driven to Big Creek Hatchery. Hatchery staff will fertilize the eggs on site and place them into either Heath Trays or baskets in Canadian Troughs, depending on space availability.

Factorial Cross for Broodstock

During egg take, factorial crosses will be used to maximize the number of parent combinations. This will be done with a 2mX2f cross.



Marking Chum Salmon

All eggs collected at Big Creek receive a pre-hatch thermal mark, and eggs that will be reared to the fry stage also receive a post-hatch thermal mark. These marks indicate the brood year (2020) and release site (Big Creek). Eggs transferred from Washington will be otolith marked at Big Creek.

- The WDFW otolith lab in Olympia generates the temperature cycles needed to create the otolith marks, and provides this schedule weekly (updated as needed for multiple groups of eggs developing at different rates).
- A temp logger should be placed with each group of eggs to measure the actual temperatures that fish are subjected to.
- A small number of fry will be reared to a larger size and sacrificed to provide voucher samples for the thermal marks.
- Thermal marking will happen once the eggs reach the “strong-eye” stage. Eggs will be shocked and picked and then immediately start the pre-hatch thermal mark.

Parentage based tagging (i.e., genetic data) will be used as a secondary mark for broodstock. Genetic samples will be collected from all adults and the resulting genotype will be compiled in a database of all Columbia Basin Chum.

- For the broodstock, genetics and otolith information are used to determine broodstock composition (wild v hatchery; program origin) and the diversity of the broodstock.