

Porter Creek Flow Augmentation and Effects on Coho Salmon Smolt Outmigration

Background and project overview

In Russian River tributaries, low spring streamflow has been identified as a potential bottleneck to coho salmon smolts migrating from tributaries through the Russian River to the ocean. This problem was first documented in Porter Creek, in Healdsburg, during April of 2015, when the mouth of the creek became dry during the coho salmon smolt migration season (March through June), creating a blockage in the migration corridor and trapping coho smolts. When this occurred, E & J Gallo Winery expressed their willingness to release water from a nearby water storage pond into Porter Creek to increase flow for the benefit of fish. Flow releases from E & J Gallo's water storage pond were attempted in order to reconnect Porter Creek to the Russian River and allow the trapped smolts to access the river and, ultimately, ocean. California Sea Grant (CSG) placed temporary fish tracking equipment near the mouth of Porter Creek and was able to determine that two pulsed flow releases provided passage for fish, and estimated that over 200 smolts were able to leave that otherwise would have remained trapped. This initial evidence of success was promising; however, there was still uncertainty about whether this approach would be feasible and effective in future years.

E & J Gallo was willing to conduct spring flow releases each year, but with a limited water supply they needed guidance as to when and how much water to release. With funding support from Sonoma Resource Conservation District and the Wildlife Conservation Board, CSG monitored coho smolt migration timing in relation to flow in Porter Creek from March 2017 through June 30, 2019 in order to help determine the timing, magnitude, and duration of flow augmentation that would have the highest probability of allowing coho smolt passage when spring flows become too low to support fish passage, while considering the constraints of water available for release.

Each fall between 2016 and 2018, the Russian River Coho Salmon Captive Broodstock Program (Broodstock Program) released approximately 5,000 to 6,000 juvenile coho salmon into Porter Creek as part of a coho salmon recovery effort in the Russian River watershed (Figure 1). A proportion of these juveniles were implanted with passive integrated transponder (PIT) tags, uniquely coded electronic tags that can be detected at stream locations using PIT tag detection systems (antennas and transceivers). These Broodstock Program releases served as a study population for tracking smolt outmigration.

A Biomark PIT tag detection system was installed near the mouth of Porter Creek, and operated from March 9, 2017 through June 30, 2019. The antennas were placed in a paired, channel-spanning arrangement (two upstream and two downstream) (Figure 3) so that detection efficiency could be estimated and the movement direction of individuals could be determined. When a PIT-tagged fish swam over an antenna, the individual tag number, data and time was logged. This allowed us to document the number and timing of coho smolts migrating out of Porter Creek and relate this data to stream flow levels and flow augmentation timing.

Streamflow data was collected by Trout Unlimited at four sites within the Porter Creek watershed (Figure 1) and a Spypoint trail camera was used to document the date and time of stream disconnection from the Russian River (Figure 4).

Porter Creek: Reference Map

Russian River Salmon and Steelhead Monitoring Program



Figure 1. Map of Porter Creek showing flow release site, monitoring sites, and stocking and snorkel survey reaches.



Figure 2. Flow augmentation site on Porter Creek.



Figure 3. PIT transceiver (left) and antenna array (right) located near the mouth of Porter Creek.



Figure 4. Spypoint camera images showing disconnection timing of Porter Creek from the Russian River on 6/18/19.

Effects of Augmentation on Coho Smolt Emigration

Although 2018 was the only year in which spring flows were low enough to warrant a flow release, we were able to demonstrate that spring flow augmentation can have a significant benefit to outmigrating coho salmon smolts. Between March 1 and June 30 of 2018, we detected a total of 340 unique coho salmon smolts passing over the PIT antenna array. With a tagging ratio of 0.29 for this cohort, we expanded that number to an estimated 1,172 smolts attempting to emigrate from Porter Creek during the spring of 2018. The number of unique individuals detected at the antenna array after the first known date of disconnection (May 3) was 130. Based on tagging proportions, this was an estimated total of 448 fish, or 38% of the smolt run. The augmentation reconnected Porter Creek intermittently from May 8 through May 13, allowing some of the fish that were trapped to emigrate from Porter Creek into the Russian River. We estimate that the total number of fish that were allowed passage as a result of the flow augmentation was 295 (84 unique PIT tagged fish) (Figure 5).

We estimate that 25% of the 2018 smolt run (295 fish) were provided access to the Russian River because of the flow augmentation, and would most likely have perished had the flow augmentation not

occurred. Although it is possible for trapped fish to residualize and spend an additional year in freshwater, the rapidly dropping flows in the lowest pools where the trapped fish were observed would almost certainly have prevented them from migrating back upstream to perennial stream reaches, and it is most likely that they would have become stranded in pools and died.

By testing two different augmentation levels during spring of 2018, we learned that it was necessary to release the maximum amount of water (390gpm) in order to reconnect Porter Creek with the mainstem of the Russian River. At that maximum level, reconnection only lasted for six days. While this may not seem long, if it occurs during the peak of the smolt run as it did in 2018, augmentation can still have a great benefit to migrating smolts. We recommend that if surface flow disconnection occurs between March 1 and June 15, that E & J Gallo initiate a flow release at the maximum capacity and let it run until the stream disconnects even with the augmentation. We anticipate that the length of time that Porter Creek will remain connected with future augmentations will vary, depending on water table levels, weather, and the level of the Russian River at the time of the augmentation.

This study concluded that when disconnection occurs between March 1 and June 15, conducting a flow release will benefit outmigrating coho salmon smolts. If the migration corridor can be kept open even for a few extra days during the peak of the smolt outmigration, this has the potential to greatly improve the chances that a cohort of fish will be successful at completing their life cycle.

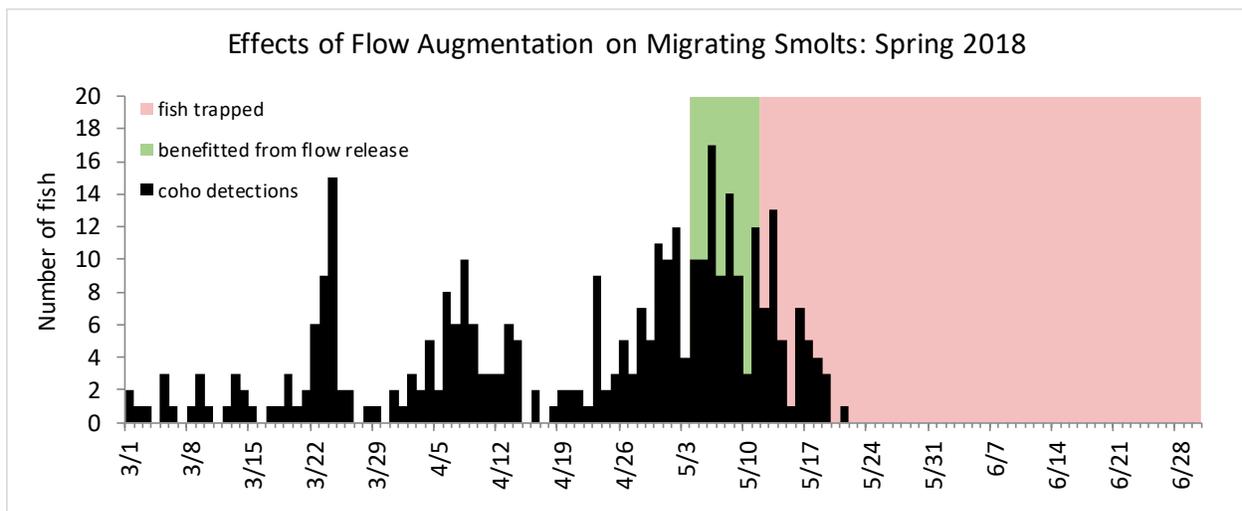


Figure 5. Detection of coho salmon smolts between March 1 and June 30, 2019 in Porter Creek. Green shading indicates the time during which migrating fish may have benefitted from the flow augmentation and red shading indicates the time during which coho smolts were trapped.



Figure 6. Confluence of Porter Creek and the Russian River; disconnected in spring 2015 (left) and connected to allow for full smolt passage into the river in spring 2017 (right).

Project partners

- Wildlife Conservation Board (funding)
- E & J Gallo
- Sonoma Resource Conservation District
- California Sea Grant
- Trout Unlimited
- UC Berkeley
- California Department of Fish and Wildlife
- National Marine Fisheries Service
- US Army Corps of Engineers