PRELIMINARY DATA: Redd Dewatering Estimates for Keswick Fall Flow Scenarios

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This script constructs real-time winter-run redd dewatering estimates based on most recent data available from CDFW (October 10, 2023) for winter-run data and dewatering estimates from USFWS (2006; see citation). Data are also available in 2023 Winter-run Data file.xls online at calfish.org.

Please note that all data are preliminary until data collection is finalized. Likewise, there are uncertainties with forecasts which may lead to changes in proposed operations.

Current Winter-run Chinook Salmon Redd Count

As of September 21, 2023, the unexpanded redd count is **354** Winter-run redds. It is important to note that until data collection is completed for the year these are the **minimum** number of possible redds. The Winter-run number will always expand upon final analysis but gives an in-season guard rail of the minimum number of redds this year.

Given that the number of Winter-run redds is always larger than the early season carcass counts, an expansion number based on historic data is multiplied by the carcass count to estimate the total number of redds for the season before the end of the season's final estimate is developed and the final redd count is known. These additional estimates of redd counts (shown in Table 1) help to inform decisions regarding possible redd dewatering.

Table 1. Estimated total number of Winter-run redds and resulting number of redds that represent 1% of the population. Estimated total redds are based on current count and expansion numbers representing 1) average 2005-2022 expansion, 2) year-specific expansion determined by the linear relationship between yearly expansions vs recapture rate of tagged female salmon, 3) maximum 2005-2022 expansion, and 4) minimum 2005-2022 expansion.

Name	Expansion Number	Total Redds	1%
Current Count	1.00	354	3.54
Average Expansion	1.98	701	7.01
Expected 2023 Expansion	3.00	1062	10.62
Maximum Expansion	3.45	1221	12.21
Minimum Expansion	1.25	442	4.42

Chinook Salmon Dewatered Redd Estimates

As of October 10, 2023, **7** Winter-run redds have **emerged** and **3** have been **dewatered**. This leaves **16** shallow water redds of concern.

There is no real time data on fall-run redd counts. Estimates are predicted based on estimated dewatering percentages from USFWS (2006) and spring-run and fall-run spawn timing based on fresh female carcasses encountered by week from 2003 through 2022. Estimated emergence dates are based on river water temperatures during fall-run period at the CCR gauge in 2011 that most closely mimics the 2023 summer water temperatures. Fall-run dewatered redd estimates range from **4.9** to **8.4%**.

Proposed Alternatives

Alternative	Description
Alt 1c	Draft September 50% forecast, representing a lower bound. Developed 9/26/23.
Alt 2e	Draft September 90% forecast, representing an upper bound. Developed 9/13/23.
Alt 3m	Developed to reflect operations decisions made at 9/26/23 USST meeting (drop to 6,400 cfs) but with further reductions to 6,100 cfs, and reflecting the possibility of returning to 6,500 cfs in mid-October for rice decomp needs, and then ramping down to 5,000 cfs in early November. Developed 9/26/23.
At 3r	Developed on 10/10 to update alternative 3m with additional information regarding the speed of reductions that are feasible in November. Above 6,000cfs, flows can be dropped by 15% per day. Between 6,000 cfs and 5,000 cfs, flows can be dropped by 200 cfs per day.
Alt 3s	Developed on 10/12 to account for a scenario in which an additional increase above 6,500 cfs is required for operations in October.

Table

Table 2. Average September and October Keswick (KES) Flow in cfs, total water volume of each alternative for August through October and September through February in TAF, estimated numbers of SRWC redds dewatered, and percent of population that would be lost under each of the proposed alternatives. KES Flow data uses actual flow-to-date as of 2023-08-31 and proposed flows for the remainder of the incubation period. Redd dewatering is considered at the actual or estimated dewatering flow and with a 250 cfs buffer applied to the actual/estimated dewatering flow. Percentage of the population lost is based on the September 21, 2023 count of 354 Winter-run redds and updated redd counts may be available soon. See Scenario Descriptions file for additional information on each scenario.

Metric	Alt.1c	Alt.2e	Alt.3m	Alt.3r	Alt.3s
Avg Sept Flow (cfs)	7363	7300	7347	7347	7347
Avg Oct Flow (cfs)	5645	6500	6361	6361	6590
Sept-Feb Total Volume (TAF)	2395	2063	2038	2034	2048
Aug-Oct Total Volume (TAF)	1392	1441	1435	1435	1449
Winter-run Redds dewatered	6	3	3	3	3
Winter-run Percent Lost (based on current count)	1.7	0.8	0.8	0.8	0.8
Winter-run Percent Lost (based on this year's anticipated expansion of 3)	0.6	0.3	0.3	0.3	0.3
Winter-run Percent Lost (based on average expansion of 1.98)	0.9	0.4	0.4	0.4	0.4
Winter-run Percent Lost (based on maximum expansion of 3.45)	0.5	0.2	0.2	0.2	0.2
Winter-run Percent Lost (based on minimum expansion of 1.25)	1.4	0.7	0.7	0.7	0.7
Winter-run Redds Dewatered (w/ 250 cfs buffer)	4	3	3	3	3
Winter-run Percent Lost (w/ 250 cfs buffer)	1.1	0.8	0.8	0.8	0.8
Fall-run dewatered (%)	4.9	8.4	7.4	7.2	7.5

References

Gard, Mark. 2006. Relationships between flow fluctuations and redd dewatering and juvenile stranding for Chinook Salmon and Steelhead in the Sacramento River between Keswick Dam and Battle Creek. 94 pages.

Plots

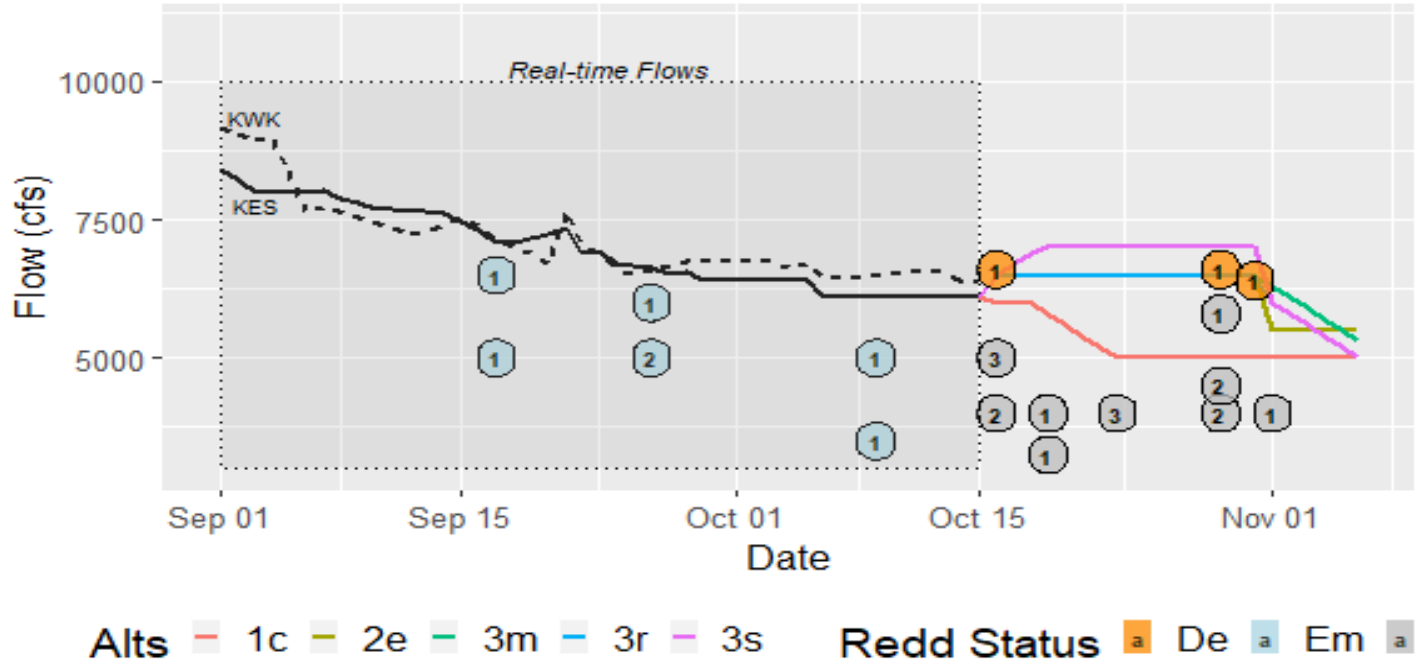

Figure 1. Actual or estimated emergence dates of SRWC redds and actual or estimated dewatering flow for the September-October estimated redd emergence dates as compared to Keswick flow (in cfs) of proposed management alternatives. Points represent dewatered (De), emerged (Em), or remaining (Re) redds. Numbers inside of points indicate how many redds share that estimated emergence date and actual/estimated dewatering flow. Points that fall above/to the right of a flow alternative line are expected to be dewatered given that management alternative is followed. Points that fall below/to the left of/on a flow alternative line are not expected to be dewatered, given that management alternative is followed. Shaded gray box shows period of real-time flow data; dashed black line equals KWK gauge flow and solid black line equals KES flow (from SacPas).