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December 23, 2016

Mr. Barry Thom
Regional Administrator, West Coast Region
National Marine Fisheries Service
7600 Sand Point Way Northeast
Seattle, WA 98115

Dear Mr. Thom:

Updated Revised Winter-run Chinook Salmon Escapement Estimates for 2016

The Winter Run Chinook Salmon Escapement Estimate has been updated and revised below. The estimates have increased by 1 fish. The California Department of Fish and Wildlife (Department) has developed Sacramento River winter-run Chinook Salmon escapement estimates for 2016. These estimates were developed from data collected in the Upper Sacramento River Winter-run Chinook Salmon Escapement Survey (carcass survey) by Department and U.S. Fish and Wildlife Service (USFWS) personnel.

Escapement estimates based on the application of the Cormack-Jolly-Seber (CJS) mark-recapture population model to the carcass survey data for 2016 are shown below:

Estimated Total In-river Escapement (hatchery and natural origin)	1,409
Estimated In-river Escapement (hatchery origin)	357
Estimated Number of In-river Adult Females (hatchery and natural origin)	658

These estimates include naturally spawning winter-run Chinook Salmon (winter-run) in the upper Sacramento River. In addition, **137** winter-run were collected at the Keswick trap site upstream from RBDD for spawning at Livingston Stone National Fish Hatchery (LSNFH). These fish are not included in the above estimate of naturally spawning winter-run. The total winter-run spawning escapement estimate in 2016, including in-

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river spawners and fish collected for hatchery broodstock, is **1,546** fish. The 90% confidence interval on this total estimate is from **329 to 2,763** fish.

This year, the escapement estimate was again calculated from the carcass survey data using a CJS model. The CJS model has been used from 2012 to present. From 2003-2011, the escapement estimate had been based on application of the Jolly-Seber model. In 2012, based on the recommendations of the *Central Valley Chinook Salmon In-River Escapement Monitoring Plan*, the winter-run carcass survey used field and analysis methods consistent with application of the CJS model. In simulation studies performed in the development of the Monitoring Plan, the CJS model was shown to more accurately estimate escapement based on mark-recapture data than any other available model. Due to its similarity to the Jolly-Seber model previously used to estimate winter-run escapement, we consider the data from 2012- 2016 to be directly comparable for trend analysis with escapement estimates from 2003 through 2011. The CJS model allows the calculation of confidence intervals; we began reporting confidence intervals on our total estimate for the first time in 2012 and continue doing so this year. The total escapement number above is the winter-run total estimate modeled to date and is a final number subject to revision. This estimate is subject to revision if additional data becomes available after the date of this letter. The additional data would then be used in the CJS model to recalculate the final escapement number. The most up to date modelled estimate calculation can be found in the GrandTab spreadsheet which is updated periodically after this letter is sent in the event that new information is received (<https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=84381&inline=1>).

In 2016 the Fisheries Agency's recognized that continuing poor survival conditions from the ongoing drought were resulting in low returns of natural origin fish to the hatchery. This was anticipated from conditions the 2013 juvenile brood year experienced. In order to meet hatchery supplementation goals a small number of hatchery origin fish were actively collected to augment the low numbers of natural origin broodstock available. Low numbers of 3-year old females available resulted in the need to include 2-year old females into the hatchery production. A large portion (62%) of the female broodstock was hatchery origin 2-year old females. In general two year old fish produce fewer eggs resulting in a smaller number of juvenile hatchery origin fish produced in 2016 compared to other more typical years.

We look forward to further discussion and collaboration with NOAA Fisheries staff regarding the application of this information. Inquiries regarding the methodology and development of the estimates in this letter should be directed to Mr. Douglas Killam, Doug.Killam@wildlife.ca.gov or Mr. Daniel Kratville, Daniel.Kratville@wildlife.ca.gov and at the address and phone number above.

Sincerely,

Kevin Shaffer, Branch Chief

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