Delta Smelt Life Cycle Model with Entrainment (LCME) for the Re-initiation of Consultation 2021-2023

# Summary

This document outlines the components of the github repository and the order of operations for scripts found within.

Upon receival of the CalSim3 model output, the first folder to use is the “Hydro model output”, followed by “X2\_salinity\_analysis”, and then “Salinity\_Zooplankton\_analysis”. Once flow and zooplankton datasets have been formatted properly for running the LCME, datasets were then sent to U.S. Fish and Wildlife Service to run the LCME for all alternatives. Once results have been received, they were then processed using scripts under the folder “DeltaSmeltLCME\_output” to create the final tables and figures. The folders “X2\_salinity\_analysis\_original” and “Zooplankton\_input\_original” were not used and only serve as references. “X2\_salinity\_analysis\_original” contains the original files and scripts used for the Collaborative Science and Adaptive Management Program (CSAMP) Delta Smelt Structured Decision Making (SDM) process. “Zooplankton\_input\_original” folder contains the original files and scripts used for the construction of the LCME.

# Hydro model output

This is the first folder to use. The R file “R\_DSS\_read\_DeltaSmeltLCM\_CalSim3” was used to read information from the DSS file output from CalSim3 so that they can be used for the LCME and for the Bashevkin zooplankton-salinity model. This script was used to produce the summer Delta outflow and Old and Middle River (OMR) parameters used in the LCME, along with the X2 parameter needed to calculate salinity for the zooplankton-salinity models. The flow data necessary for the LCME is produced as “FlowData\_2022ROC\_EffectsAnalysis\_CohortYear.csv”.

# X2\_salinity\_analysis

Scripts in this folder were used to convert the X2 values produced from CalSim3 into salinity values for each region used in the Delta Smelt Individual-Based Model in R (IBMR) as seen in the CSAMP Delta Smelt SDM process. The R file “R\_salinity\_base\_data” was used to create the baseline salinity data. The R file “R\_X2\_salinity\_conversion” was used to load the salinity-X2 model created by Brian Crawford for the CSAMP Delta Smelt SDM group and apply it based on the X2 values produced by CalSim3. Output was then saved as “converted\_salinity\_data.csv”.

# Salinity\_Zooplankton\_analysis

Scripts in this folder were used to 1) construct the zooplankton-salinity model, and 2) convert results that were originally meant for the IBMR to fit the LCME. The scripts were in Rmd format just as the original scripts developed by Sam Bashevkin. “Zooplankton salinity models” Rmd file should be run first, as this file create the zooplankton-salinity models and provide the conversion factors needed to estimate the zooplankton changes based on salinity. Afterwards, “Zooplankton data input for LCM” Rmd file can then by run to create the predictions and then convert the results to the proper format for the LCME. Note that there were limitations when the data were converted for the purpose of Delta Smelt LCME (e.g., some missing species and/or life stages in the aggregate LCME zooplankton groups).

# DeltaSmeltLCME\_output

This folder contains the “DeltaSmeltLCME\_figstables” Rmd file used to produce the figures and tables to better visualize results from the LCME. The xlsx file “BoR Reinitiation LCME results\_09-18-2023” is the output produced by William Smith (U.S. Fish and Wildlife Service).

# X2\_salinity\_analysis\_original

This folder contains the original files and scripts from Brian Crawford used for the Collaborative Science and Adaptive Management Program (CSAMP) Delta Smelt Structured Decision Making (SDM) process.

Zooplankton\_input\_original

This folder contains the original files and scripts used by Polansky et al. for the construction of the LCME. This was used to better understand how to convert the zooplankton data meant for IBMR to the proper format for the LCME.

Disclaimer for use/modification of pre-existing code:

U.S. Bureau of Reclamation created and modified data formatting and model code with the purpose of comparing alternative operations as part of the LTO Reinitiation of Consultation for the CVP. The changes to the code mean that the revised models, resulting output, and any summary does not represent views of individual members of the CSAMP SDM group. Although this code has been processed successfully on a computer system at the U.S. Bureau of Reclamation, no warranty expressed or implied is made regarding the display or utility of the code for other purposes, nor on all computer systems, nor shall the act of distribution constitute any such warranty. The U.S. Bureau of Reclamation or the U.S. Government shall not be held liable for improper or incorrect use of the code described and/or contained herein.