

TDM Modeling

April 20, 2022
SWFSC

Additional information available at:
<https://oceanview.pfeg.noaa.gov/CVTEMP/download>

DRAFT - Preliminary Results - For Discussion Purposes Only

Modeling Assumptions

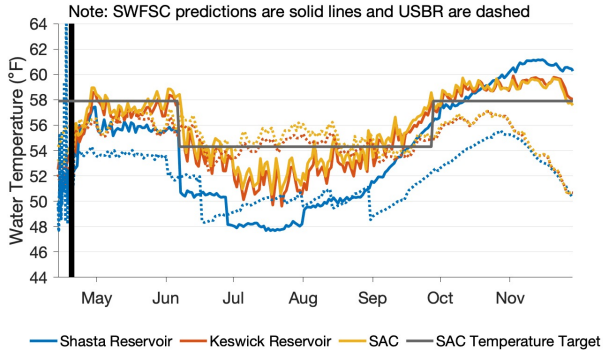
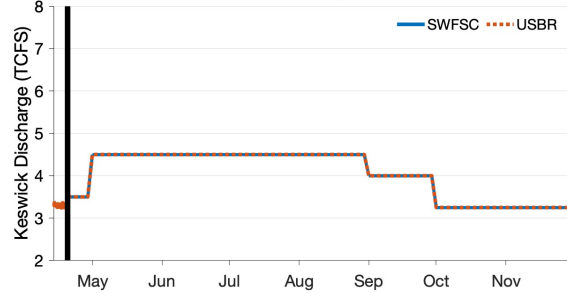
1. April 99% B120 Exceedance Forecast Shasta Inflow
2. April 14 Shasta initial profile
3. 2015 meteorology
4. Spring Creek PP contributions to Keswick as provided in USBR 90% exceedance operational outlook from April
5. SAC gage temperature target location (achieving target NOT guaranteed)
6. Redds distributed in time and space according to 2021 aerial redd surveys (a compressed distribution relative to historical variability; 2016-2019 for comparison)
7. Two scenarios considered (Target Temperature of 54.5F or 56F)
8. Combination of CE-QUAL-W2 models for Shasta and Keswick, and RAFT for temperature predictions

Model Outputs (Scenario 1, 54.5F Target)

DRAFT: FOR DISCUSSION PURPOSES

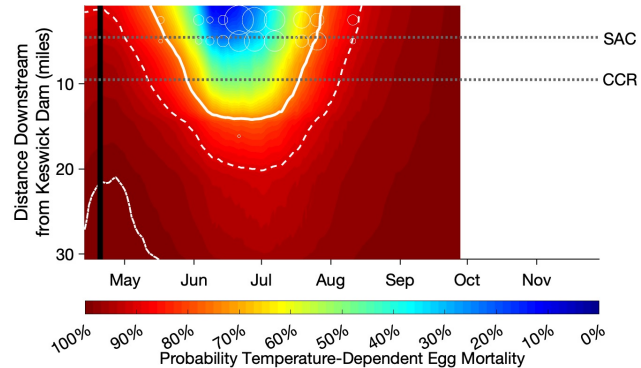
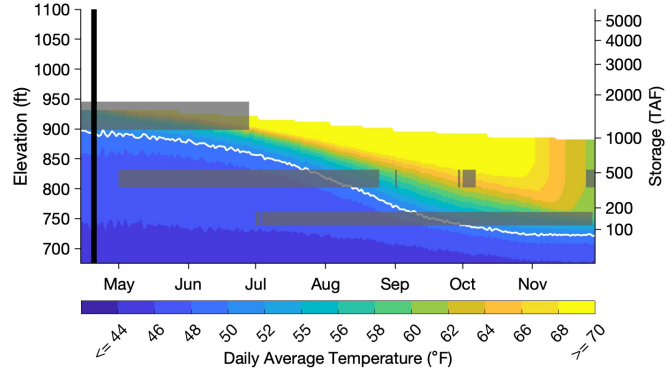
Scenario = 4500 cfs
 Center Date = 08/02/2022
 Target Temperature = 54.3°F
 Shoulder Temperature = 57.9°F
 Window Length = 16 weeks

20-Apr-2022
 Hindcast | Forecast



*Model output generated 20-Apr-2022

Mean annual TDM = 42%
 Date first side gate = 01/Jul/2022
 EOS storage = 1.1 MAF



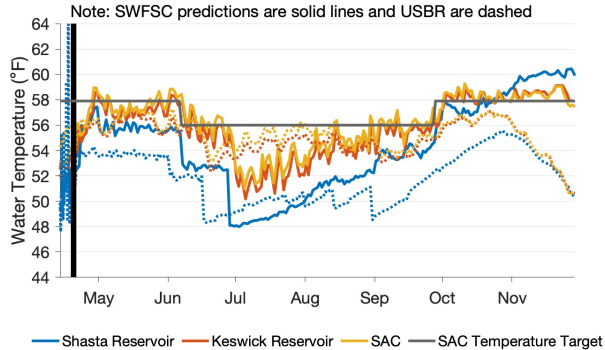
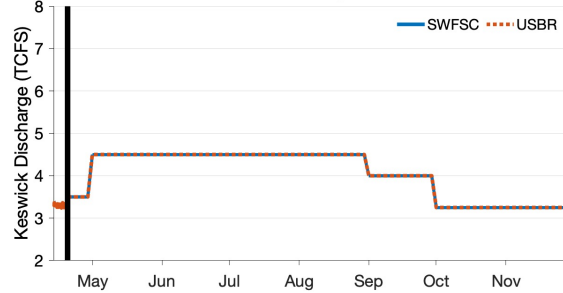
DRAFT - Preliminary Results - For Discussion Purposes Only

Model Outputs (Scenario 2, 56F Target)

DRAFT: FOR DISCUSSION PURPOSES

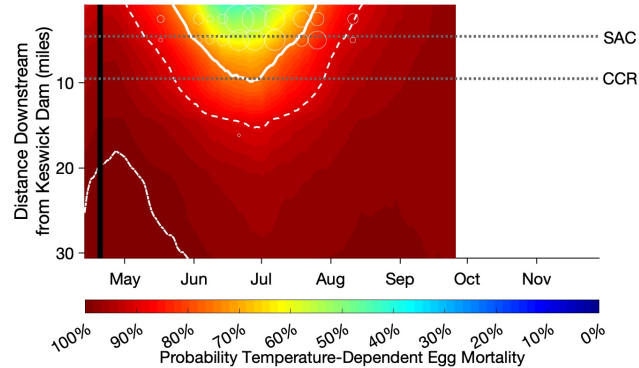
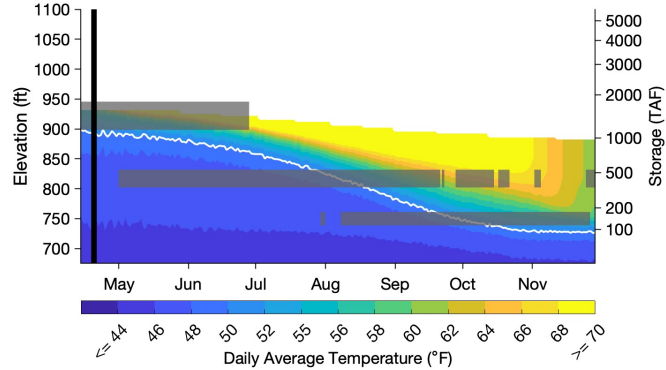
Scenario = 4500 cfs
 Center Date = 08/02/2022
 Target Temperature = 56°F
 Shoulder Temperature = 57.9°F
 Window Length = 16 weeks

20-Apr-2022
 Hindcast | Forecast



Model output generated 20-Apr-2022

Mean annual TDM = 66%
 Date first side gate = 30/Jul/2022
 EOS storage = 1.1 MAF



DRAFT - Preliminary Results - For Discussion Purposes Only

Model Outputs (Variation by Redd Year)

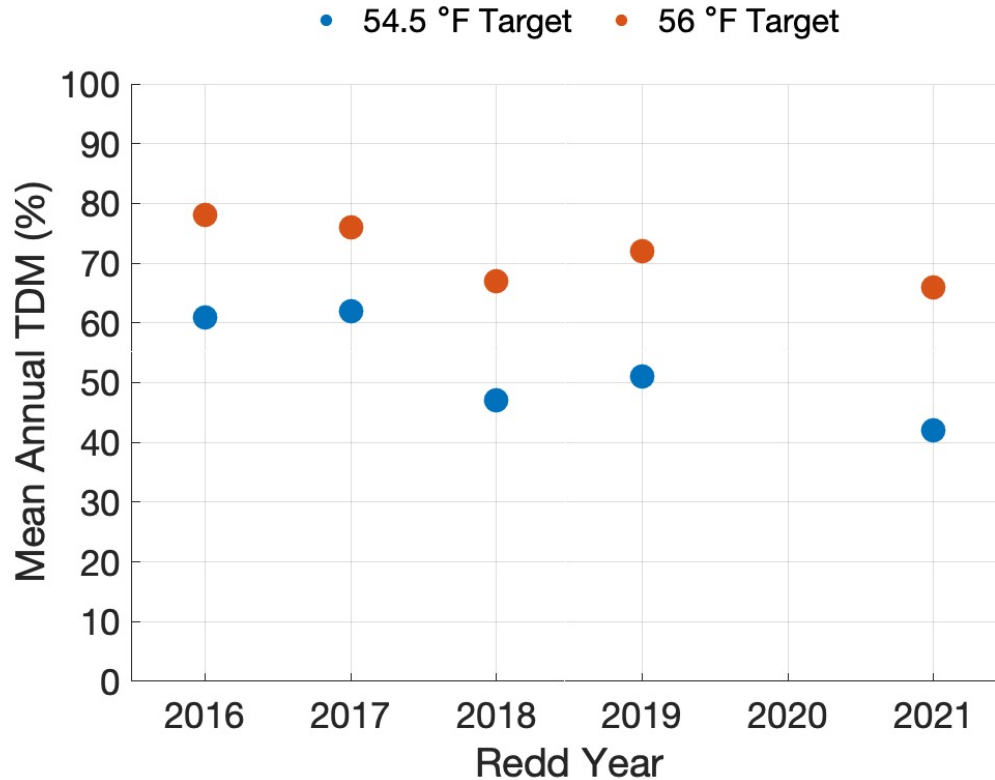
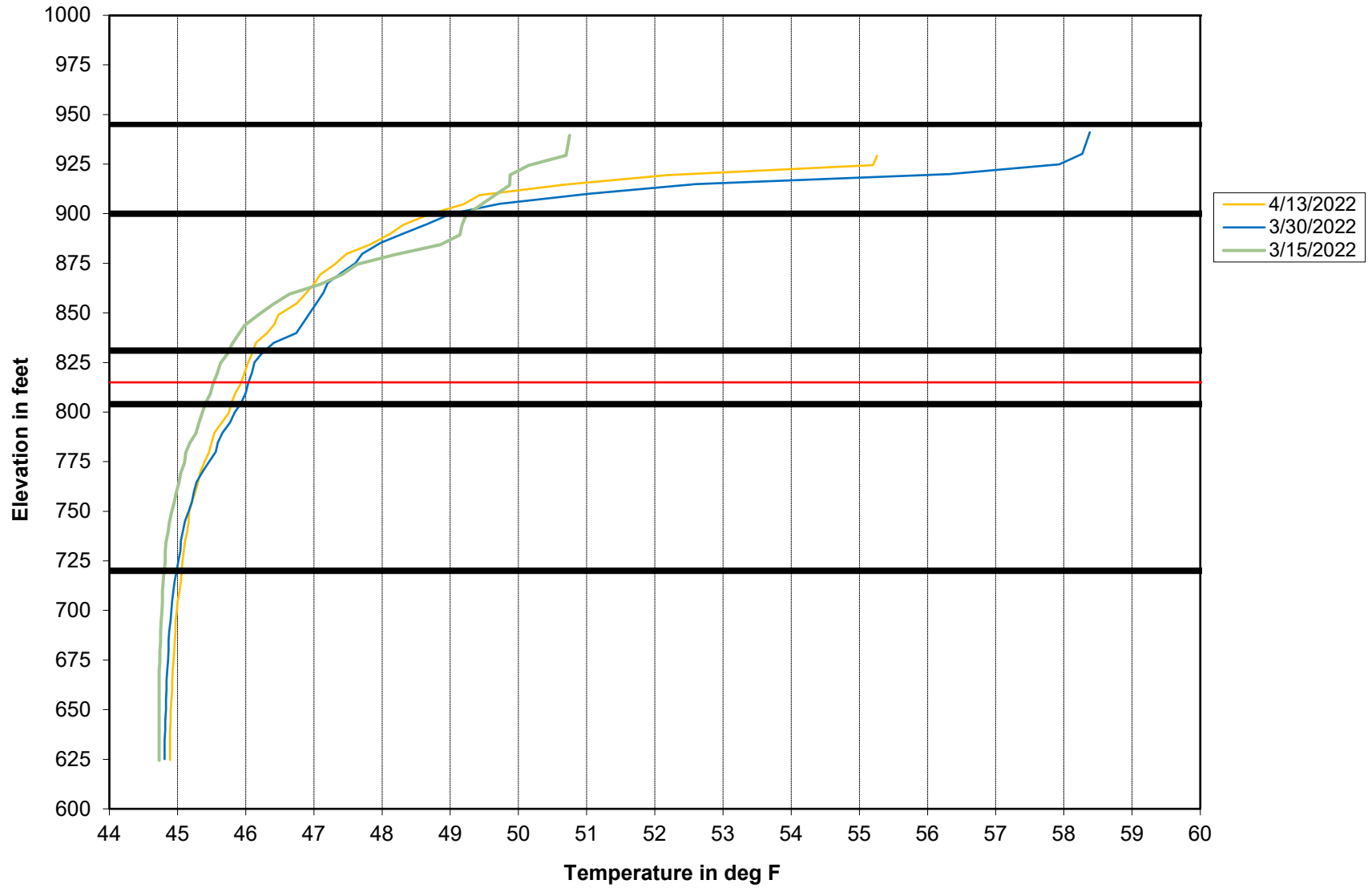


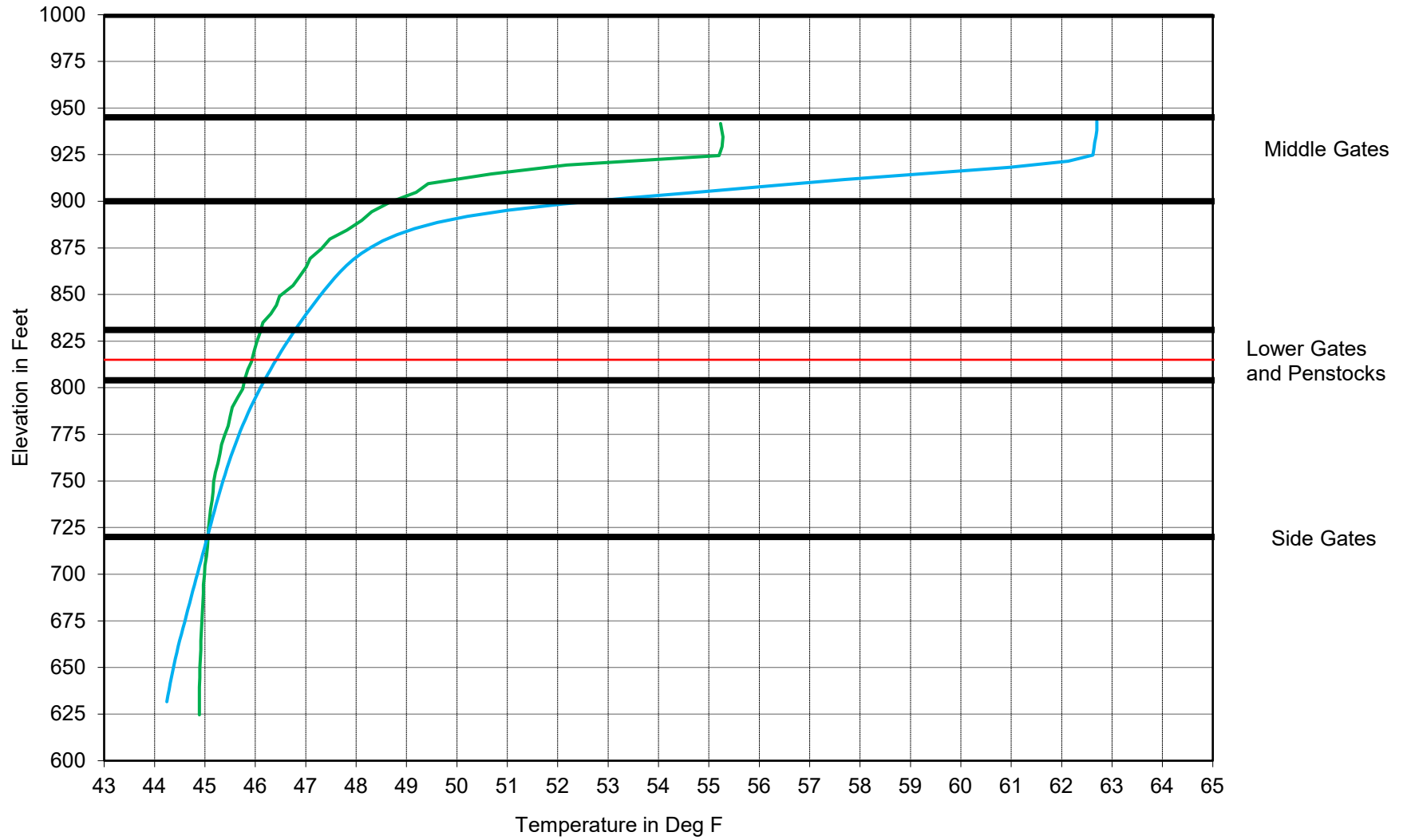
Figure showing how TDM estimate changes as a function of redd year distribution

2022 Shasta Temperature Profiles



Shasta Lake Profiles

4/13/2022 4/30/22 modeled



April 21, 2022

SRTTG Meeting- Temperature mortality modeling assumption information

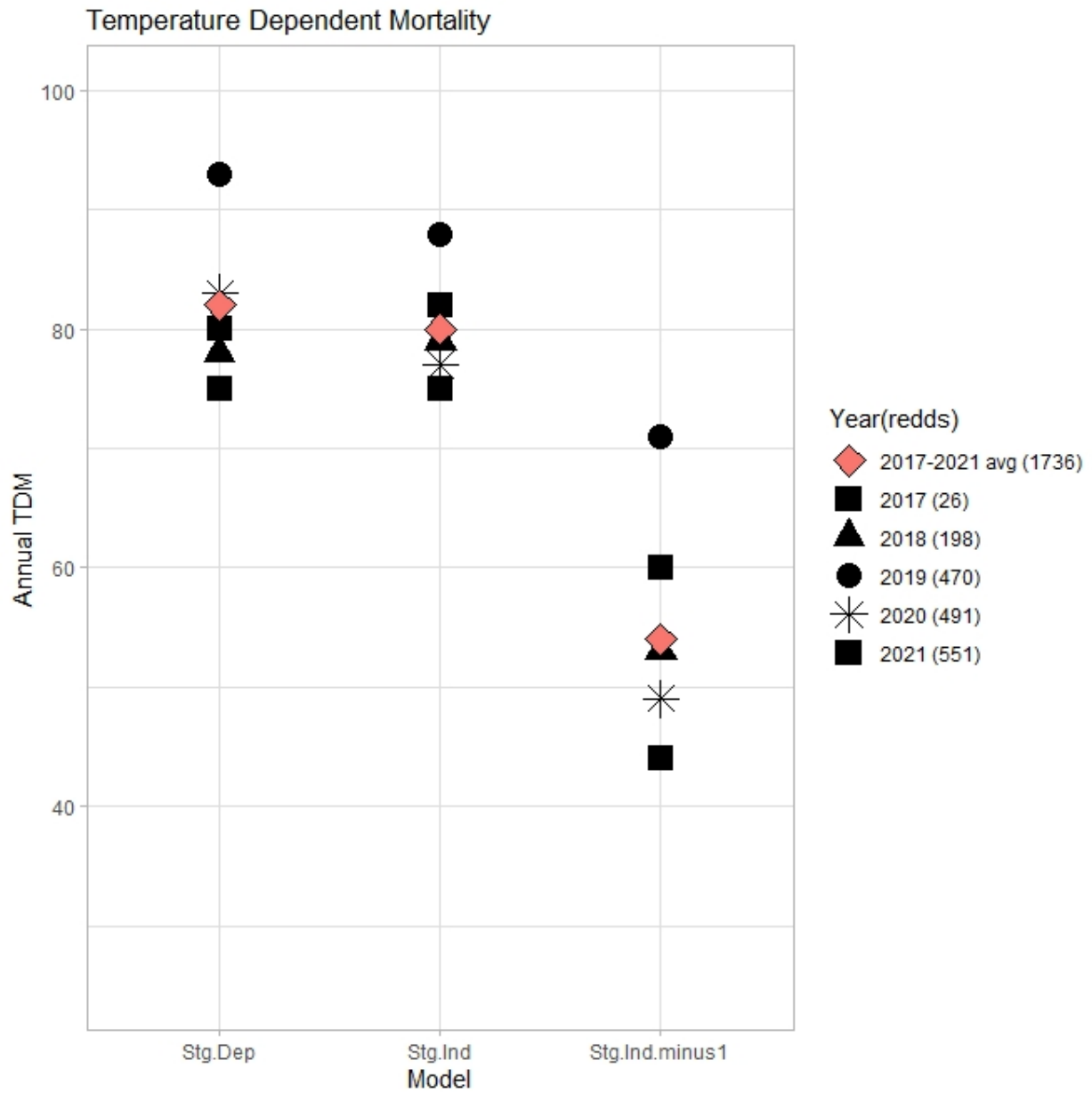


Figure 1. Temperature dependent mortality estimated for 2017-2021 independently and cumulatively.

April 21, 2022

SRTTG Meeting- Temperature mortality modeling assumption information

Parameter	April 21, 2022 Model Runs
Meteorology source	Historical Meteorology 25%
Time period	1/1/21-3/30/21: Observed temperature 3/31/22-11/29/22: Simulated
Reservoir Model used	HEC-5Q
River Model used	HEC-5Q
Shasta Profile date	3/30/22
TCD Gate operations	HEC-5Q
Sacramento water temperatures used	April 4, 2022 HEC-5Q output at Keswick, Highway 44, and Balls Ferry. (Stg.Ind and Stg.Dep) April 4, 2022 HEC-5Q output at Keswick, Highway 44, and Balls Ferry minus 1°F (Stg.Ind.minus1)
Biological Model used	Temperature mortality models on SacPAS Fish Model Version 2.7.4
Temperature Mortality Models	Stage-independent mortality (Stg.Ind and Stg.Ind.minus1) Stage-dependent mortality (Stg.Dep)
Egg emergence timing model	Linear. 958 ATUs (degrees C), as indicated for Zeug et al. 2012
TDM redd time distribution	Aerial Surveys 2017-2021, individual and cumulative
TDM redd space distribution	Aerial Surveys 2017-2021, individual and cumulative
TDM Tcrit	Stage-independent mortality: 12.14°C Stage-dependent mortality: 11.98°C
TDM bT	Stage-independent mortality: 0.023°C ⁻¹ d ⁻¹ Stage-dependent mortality: 0.436°C ⁻¹ d ⁻¹
Critical Days	Stage-independent mortality: All Stage-dependent mortality: 3 days
TDM estimates	See Figure