



— BUREAU OF —
RECLAMATION

Sacramento River Temperature Task Group

Thursday, June 9, 2022, 1:00 pm – 2:15 pm

Conference Call:

+1(323) 457-6502 (US West)

Meeting ID: 657 079 320#

Join on your computer or mobile app: [Click here to join the meeting](#)

Agenda

1:00 pm	Welcome and Agenda Review	Terra Alpaugh, Kearns & West
1:05 pm	Purpose and Objective	Terra Alpaugh, Kearns & West
1:10 pm	Action Items Tracking	Adam Fullerton, Kearns & West
1:15 pm	River Fish Monitoring: 1) carcass surveys 2) Redd counts 3) stranding and dewatering surveys	Doug Killam, CDFW
1:25 pm	Fish Distribution/Forecasts: 1) Estimated percentage of the population upstream of Red Bluff Diversion Dam for steelhead, winter-run, and spring-run Chinook salmon 2) Sampling at rotary screw traps at Red Bluff Diversion Dam 3) Steelhead update 4) Livingston Stone Hatchery	Bill Poytress and Taylor Lipscomb, USFWS
1:35 pm	Hydrology, Operations, Forecasts, and Temperature Management <ul style="list-style-type: none">• Coordinated Operations Agreement Update	Tom Patton, Reclamation
1:45 pm	Temperature Management and Temperature Dependent Mortality Modeling <ul style="list-style-type: none">• Reclamation, SWFSC, SRSC Model Results• Modeling Assumptions Table	Tom Patton, Reclamation, Mike Deas, SRSC, Miles Daniels, SWFSC
2:55 pm	Review Action Items	Terra Alpaugh, Kearns & West
2:15 pm	Adjourn	

Actions Items from April 28, 2022

1. **Eric Danner, SWFSC**
 - a) Delete or caveat End of Storage (EOS) number

Action Items from May 26, 2022

2. **Tom Patton, Reclamation** – Will send out new temperature reservoir profiles to SRTTG next week.
3. **Adam Fullerton, Kearns and West** – Will update and distribute the Model Assumptions Table to the group

DATE	MDWT TCD ¹	MDWT SHD	MDWT SPP ¹	MDWT KWK	MDWT SAC ²	MDWT CCR	MDWT BSF	MDWT BND	MDWT RDB	MDWT IGO	MDWT LWS	MDWT DGC	MDWT NFH	MDR Shasta Generation	MDR Spring Creek P.P.	MDR Keswick Total	MDAT RDD	MDAT BSF	MDAT RDB		
May	53.5	51.7	52.6	54.5	55.3	56.2	58.8	60.8	61.9	53.9	51.0	53.8	55.3	3172	75	3504	68.5	65.5	67.7		
06/01	52.7	50	53.8	54.0	55.4	56.6	60.3	62.8	64.0	56.2	53.0	58.4	60.7	3281	358	3764	74.0	70.8	72.8		
06/02	54.1	50.5	53.6	53.4	54.8	56.1	60.1	63.3 ^A	65.2	57.0	53.4	59.4	61.7	2995	356	3773	76.5	73.5	76.5		
06/03	52.4 ^X	49.8	53.6	53.9	54.8	55.7	59.4	62.4	64.5	56.5	53.5	58.6	60.6	3123	358	3796	73.0	70.0	73.6		
06/04	51.4 ^B	-	53.7	54.1	54.8	55.4	58.0	60.5	62.4	56.0	53.0	56.5	58.4	3314	290	3959	67.0	64.9	65.7		
06/05	51.5 ^B	-	53.7	52.7	54.0	54.9	57.4	58.9 ^A	60.5	56.6	53.1	56.9	57.3	3468	374	3954	66.0	63.2	65.8		
06/06	51.6	49.5	53.7	52.6	54.0	55.1	58.4	60.7	61.6	57.6	52.7	58.6	59.4	3594	362	4017	72.5	70.7	71.6		
06/07	51.6	49.3	53.9	52.2	53.6	54.8	58.8	61.9	63.4	57.7	53.1	58.7	60.7	3171	355	3989	77.0	71.9	74.4		
Jun	52.2	49.8	53.7	53.3	54.5	55.5	58.9	61.5	63.1	56.8	53.1	58.2	59.8	3278	350	3893	72.3	69.3	71.5		
														Total CFS	22946	2453	27252				
														Total AF	45512	4865	54053				

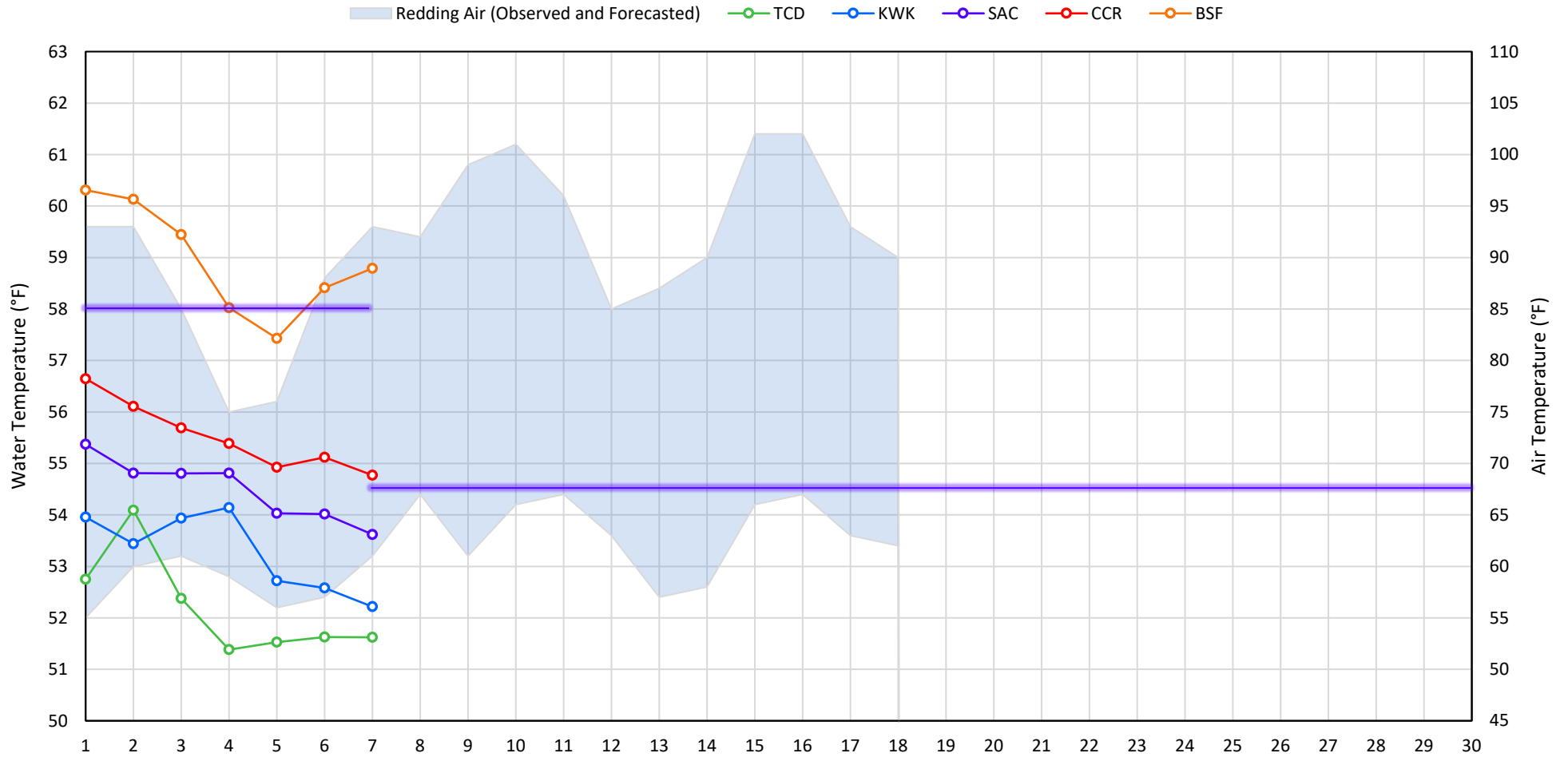
Legend

- A = 1-9 hours of data missing (Average includes estimations)
- B = 10 or more hours of data missing (Average not calculated)
- C = Station out of service
- D = Record high air temperature
- E = Record low air temperature
- MDWT = Mean Daily Water Temperature (Fahrenheit)
- MDR = Mean Daily Release (CFS)
- MDAT = Mean Daily Air Temperatures (Fahrenheit)

Notes

- ¹ Temperatures are weighted averages based on individual penstock flow and temperature
- ^X Highlighted cells in the TCD column indicate a TCD change was made on that day
- ² Current Sacramento River control point (see page 4 for more details)
- ³ Data is currently being collected locally and periodically downloaded. Once downloaded and certified by USGS, missing data will be added.

Sacramento River Mean Daily Temperatures



Station Details			
Code	Body of Water	Location ¹	CDEC Link
TCD	N/A	Shasta Power Plant	N/A
SHD	Sacramento River	0.3 miles downstream of Shasta Power Plant	SHD
SPP	N/A	Spring Creek Power Plant	N/A
KWK	Sacramento River	0.8 miles downstream of Keswick Dam	KWK
SAC	Sacramento River	4.8 miles downstream of Keswick Dam	SAC
CCR	Sacramento River	9.7 miles downstream of Keswick Dam	CCR
BSF	Sacramento River	25 miles downstream of Keswick Dam	BSF
JLF	Sacramento River	34 miles downstream of Keswick Dam	JLF
BND	Sacramento River	41 miles downstream of Keswick Dam	BND
RDB	Sacramento River	58 miles downstream of Keswick Dam	RDB
IGO	Clear Creek	7.3 miles downstream of Whiskeytown Dam	IGO

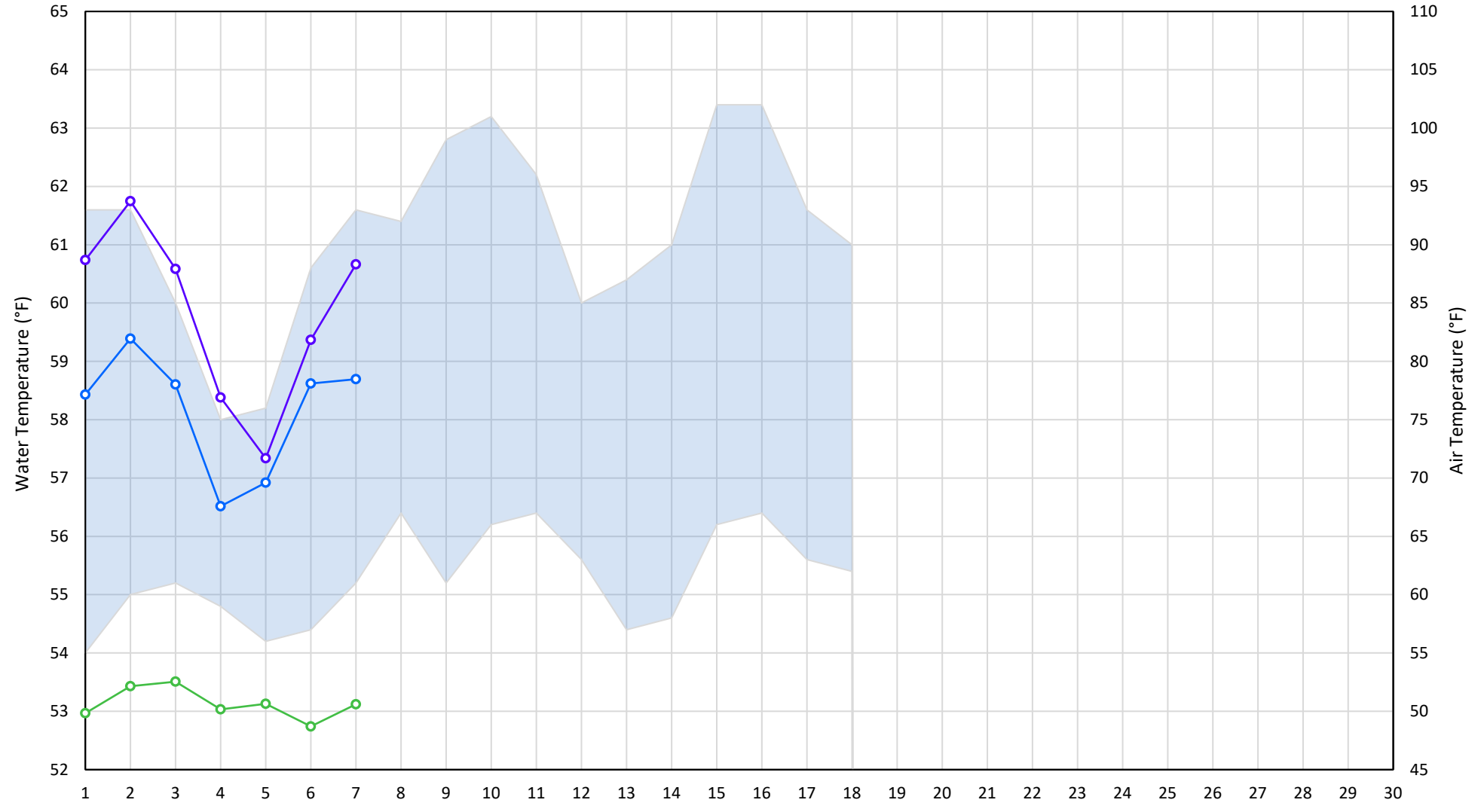
Water Right Temperature Control Points				
River	Point	Temp. (°F)	Begin Date	End Date
Sacramento	SAC	55	06/15/2021	05/02/2022
Sacramento	SAC	58	05/02/2022	06/07/2022
Sacramento	SAC	54.5	06/07/2022	TBD

Notes

¹ Distances are approximate

Trinity River Mean Daily Temperatures

Redding Air (Observed and Forecasted) LWS DGC NFH



Station Details

Code	Body of Water	Location ¹	CDEC Link
LWS	Trinity River	1.1 miles downstream of Lewiston Dam	LWS
DGC	Trinity River	19 miles downstream of Lewiston Dam	DGC
NFH	Trinity River	38 miles downstream of Lewiston Dam	NFH

Water Right Temperature Control Points

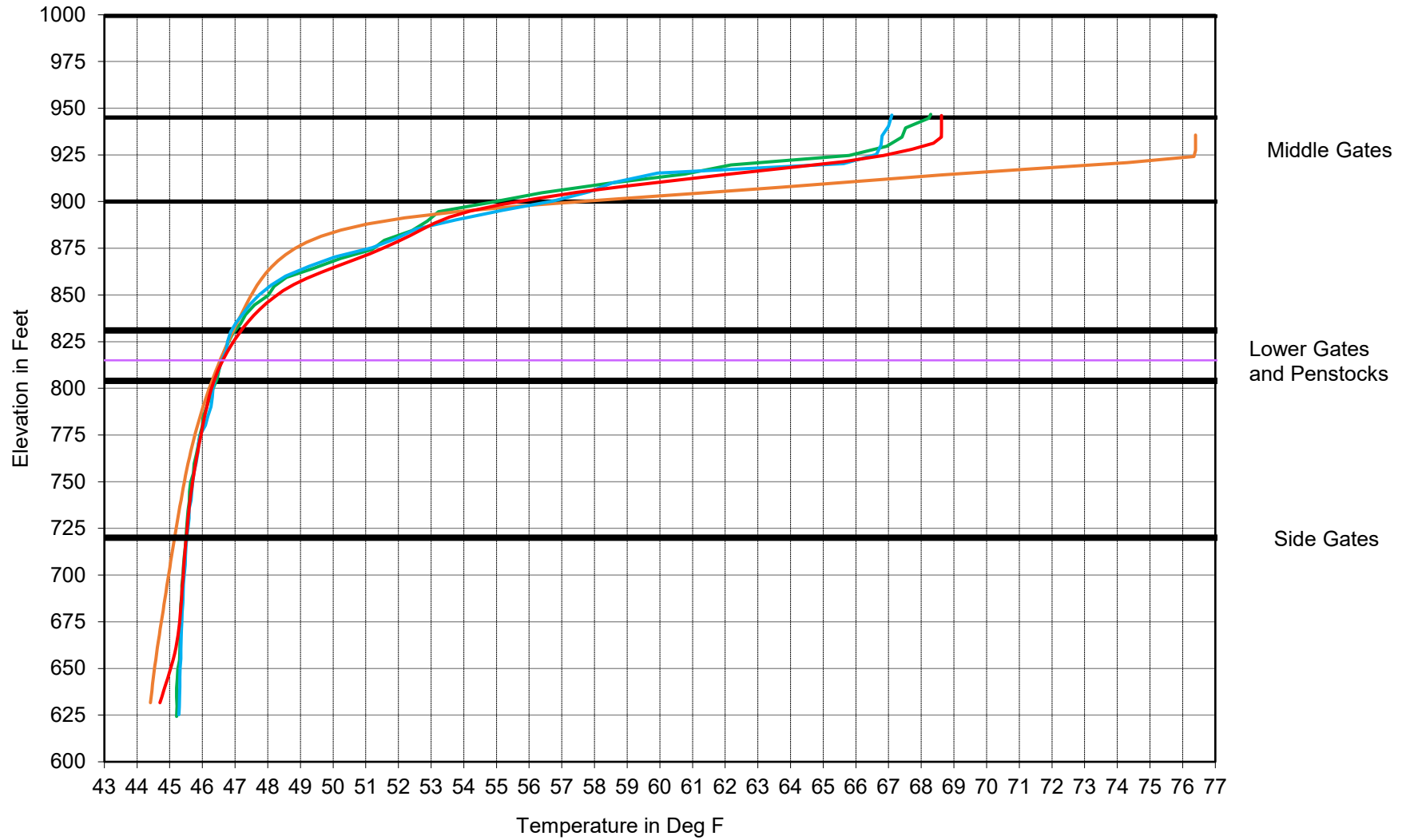
River	Point	Temp. (°F)	Begin Date	End Date
Trinity	DGC	56	Sep-15	Oct-01
Trinity	NFH	56	Oct-01	Dec-31

Notes

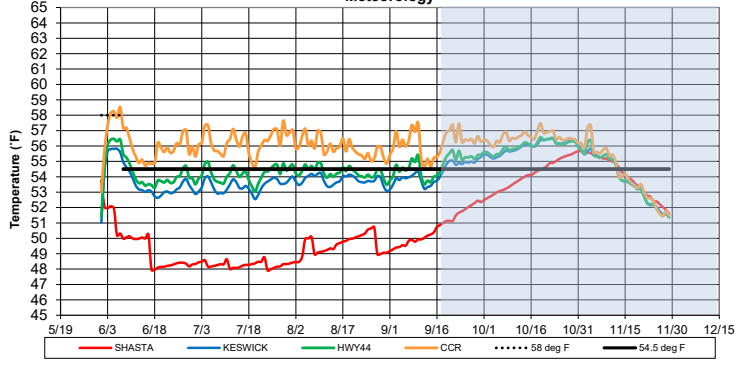
¹ Distances are approximate

Shasta Lake Profiles

5/25/2022 5/31/22 TMP modeled 6/1/2022 5/31/22 modeled in May



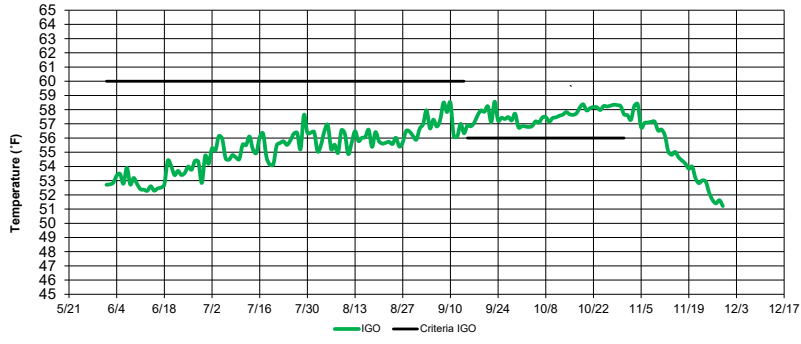
**Sacramento River Modeled Temperature
2022 May 90%-Exceedance Water Outlook - L3MTO 25%
Meteorology**



Month	Shasta deg F	Keswick deg F	Hwy44 deg F	CCR deg F	Igo deg F	Trinity deg F	Lewiston deg F
Jun	49.6	53.7	54.3	56.1	53.2	47.3	53.7
Jul	48.3	53.4	54.2	56.3	55.4	48.0	55.0
Aug	49.5	53.8	54.3	55.9	55.9	49.0	53.2
Sep	50.7	54.3	54.8	56.2	57.3	51.0	54.2
Oct	54.1	55.9	56.0	56.6	57.7	52.4	54.4
Nov	54.0	53.8	53.8	54.1	54.9	52.3	52.4

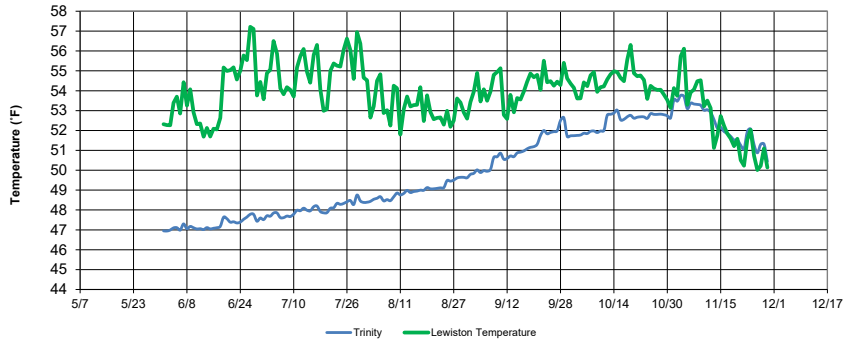
Run date: 6/1/22
EOM Sept storage: 1.32 MAF
 Trinity profile date: 5/12/22
 Whiskeytown profile date: 5/10/22
 Shasta profile date: 6/1/22
 Projected Side gates: First Jun 26 Full Aug 29
 Shaded area denotes period of model limitations - see Fall Temperature Index
End of September Cold-Water-Pool less than 56 deg F: 221 TAF

**Clear Creek - Igo Modeled Temperature
2022 May 90% Exceedance Outlook - L3MTO 25% Meteorology**



Month	Igo deg F
Jun	53.2
Jul	55.4
Aug	55.9
Sep	57.3
Oct	57.7
Nov	54.9

**Trinity - Lewiston Modeled Temperature
2022 May 90%-Exceedance Water Outlook- L3MTO 25% Meteorology**



Month	Trinity deg F	Lewiston deg F
Jun	47.3	53.7
Jul	48.0	55.0
Aug	49.0	53.2
Sep	51.0	54.2
Oct	52.4	54.4
Nov	52.3	52.4

Summary Document for Shasta/Keswick Operational Scenarios
 Prepared by the Southwest Fisheries Science Center (SWFSC) on June 7th, 2022

Below are results for one USBR scenario ran June 7th 2022. The scenario has hydrology (Input 90% exceedance) and air temperature (25% exceedance of L3MTO) as inputs. Outputs from the scenarios are used to generate daily average Sacramento River water temperatures using the RAFT model and associated temperature-dependent egg mortality and survival estimates using the NMFS stage-independent temperature mortality model (Martin et al. 2017) for the 2022 temperature management season.

Further details of modeling methods are at the CVTEMP website:
<https://oceanview.pfeg.noaa.gov/CVTEMP/>

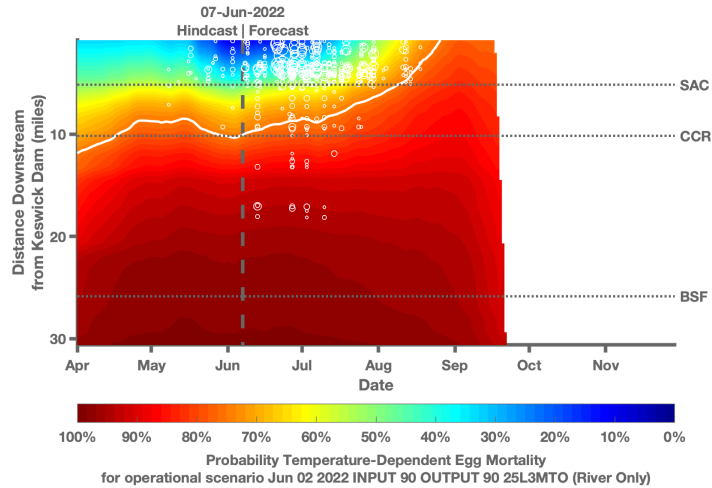


Figure 1: Estimated temperature-dependent egg mortality produced by the NMFS stage-independent temperature mortality model under the June 2nd 2022 scenario. RAFT was used for water temperatures and the 2016-2021 redd distributions were used TDM estimates.

Table 1: Estimated temperature-dependent egg mortality under different scenarios assuming a 2016-2021 spatial and temporal redd distribution using output from the RAFT water temperature model.

Scenario	Upstream input to RAFT Model	Mean Annual TDM (%)
JUN_02_2022_INPUT_90_OUTPUT_90_25L3MTO	USBR HEC-5Q	47

TDM Modeling

June 09, 2022
SWFSC

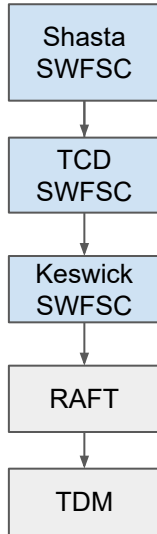
Additional information available at:
<https://oceanview.pfeg.noaa.gov/CVTEMP/download>

Planning vs implementation phases of temperature management

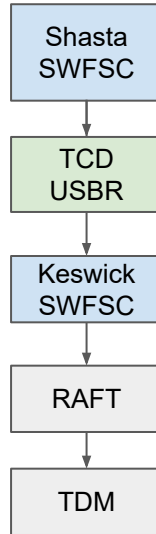
- During planning phases (before “active temperature management”) SWFSC assisted with identifying strategies to reduce TDM
 - Window shaping (temperature target, location, timing)
 - Release scenario comparison
 - Redd distribution sensitivity analysis
- During implementation phases (“active temperature management”) SWFSC can assist with updating estimates of TDM based on USBR’s planned operations. This is what is on CVTEMP

Planning vs implementation phases of temperature management

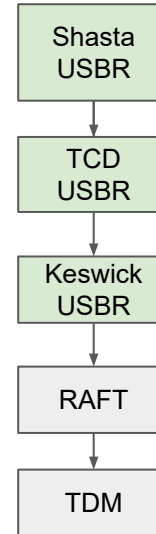
Planning



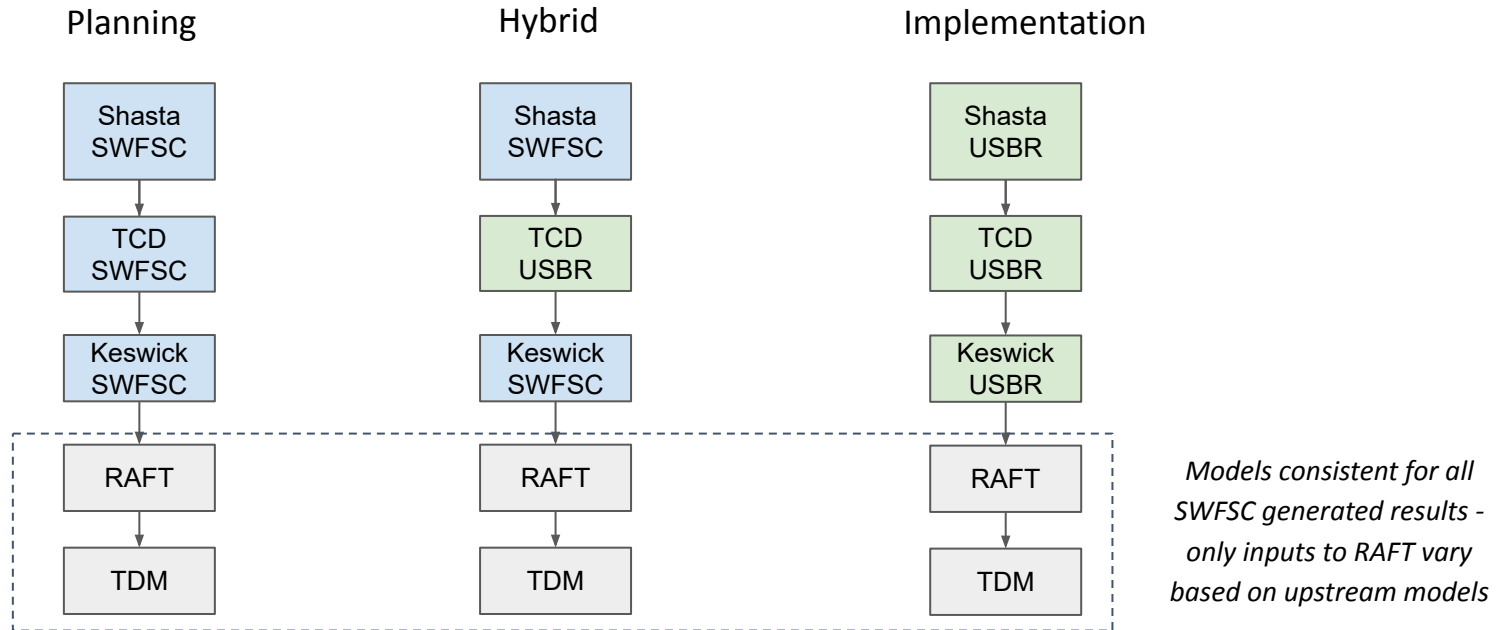
Hybrid



Implementation



Planning vs implementation phases of temperature management



How does the planning, implementation, and hybrid approach relate to what is on CVTEMP?

- The planning approach is NOT currently represented on CVTEMP.
- The implementation approach is represented on CVTEMP under the model type “USBR_NO_W2”. This name reflects that we are using USBR temperature predictions from Keswick Dam and NOT using any of the SWFSC reservoir temperature models.
- The hybrid approach is represented on CVTEMP under the model type “NOAA_Leakage”. This name is to reflect that we are using the SWFSC reservoir models with a calibrated TCD leakage and gate operation representation.

Planning Phase

- Use planned temperature target and release operations and run these through the Science Center's temperature and TDM models.
- This requires SWFSC to run a version of the Shasta reservoir model that selects how to blend TCD gates to meet a temperature target.
- The SWFSC blending routine is not the prescribed schedule for TCD gate operations.

Planning phase outputs

Modeling Assumptions

1. May 99% B120 Exceedance Forecast Shasta Inflow
2. June 08 Shasta initial profile
3. 2015 meteorology
4. Spring Creek PP contributions to Keswick as provided in USBR 90% exceedance operational outlook from June 2
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; 2016-2021 for comparison)
7. One scenarios considered (Target Temperature of 54.5F)
8. Combination of CE-QUAL-W2 models for Shasta and Keswick, and RAFT for temperature predictions
9. USBR predicted temperatures plotted are from June 2 scenario.

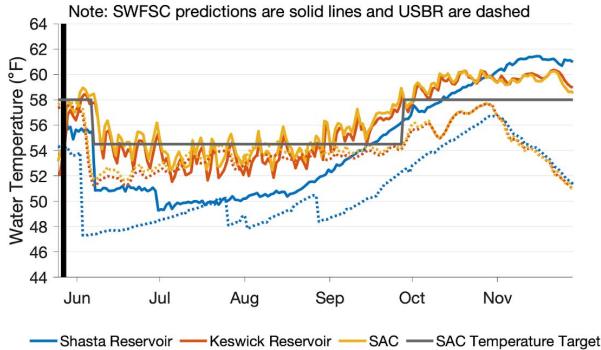
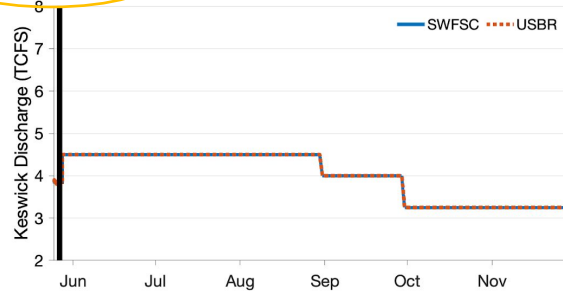
Planning phase model outputs (from last meeting)

Model Run date

DRAFT: FOR DISCUSSION PURPOSES

Scenario = 4500 cfs
 Center Date = 08/02/2022
 Target Temperature = 54.5°F
 Shoulder Temperature = 58°F
 Window Length = 16 weeks

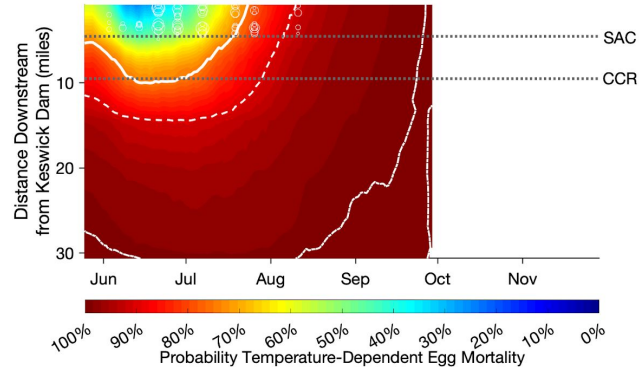
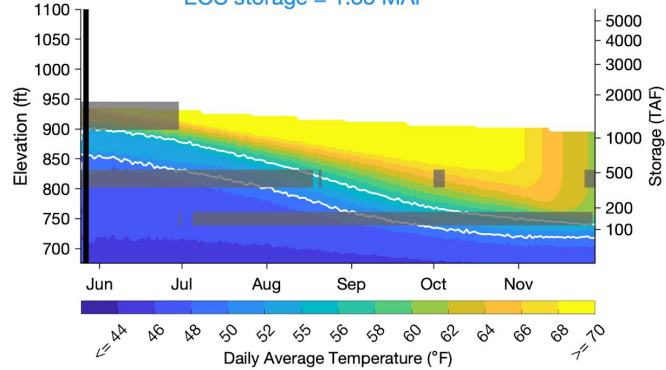
27-May-2022
 Hindcast | Forecast



*Model output generated 27-May-2022

Mean annual TDM Redd Yr 2021= 54%
 Mean annual TDM Redd Yr 2016-2021= 60%
 Date first side gate = 30/Jun/2022
 EOS storage = 1.33 MAF

*Redd year specified



DRAFT - Preliminary Results - For Discussion Purposes Only

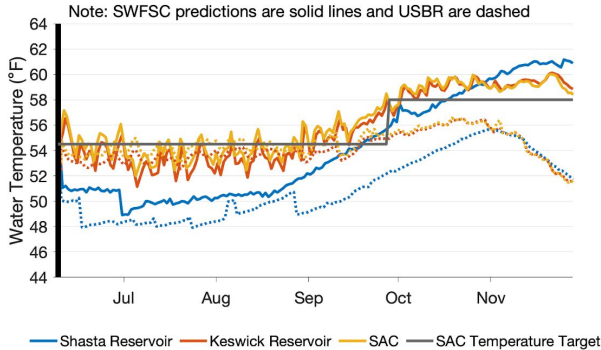
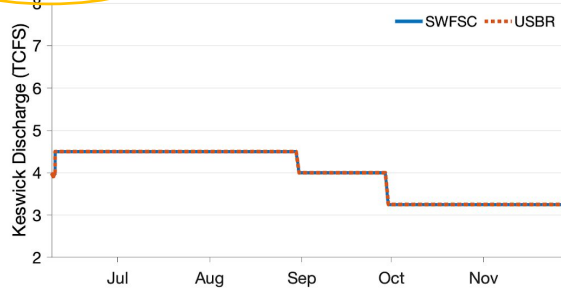
Planning phase model outputs (Scenario 1, 54.5F Target)

Model Run date

DRAFT: FOR DISCUSSION PURPOSES

09-Jun-2022
Hindcast | Forecast

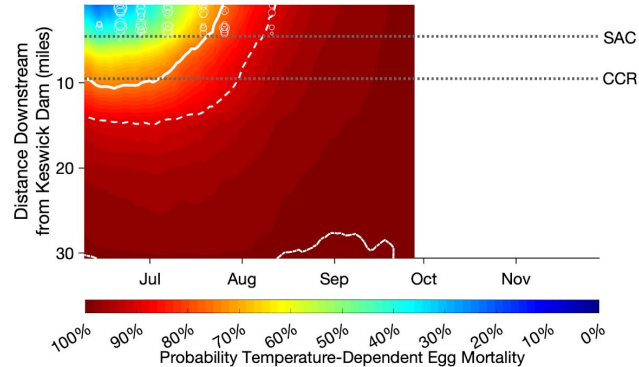
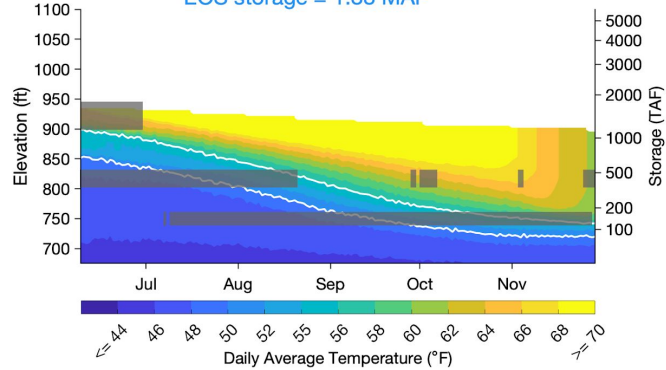
Scenario = 4500 cfs
Center Date = 08/02/2022
Target Temperature = 54.5°F
Shoulder Temperature = 58°F
Window Length = 16 weeks
Profile Date = Jun-08-2022



*Model output generated 09-Jun-2022

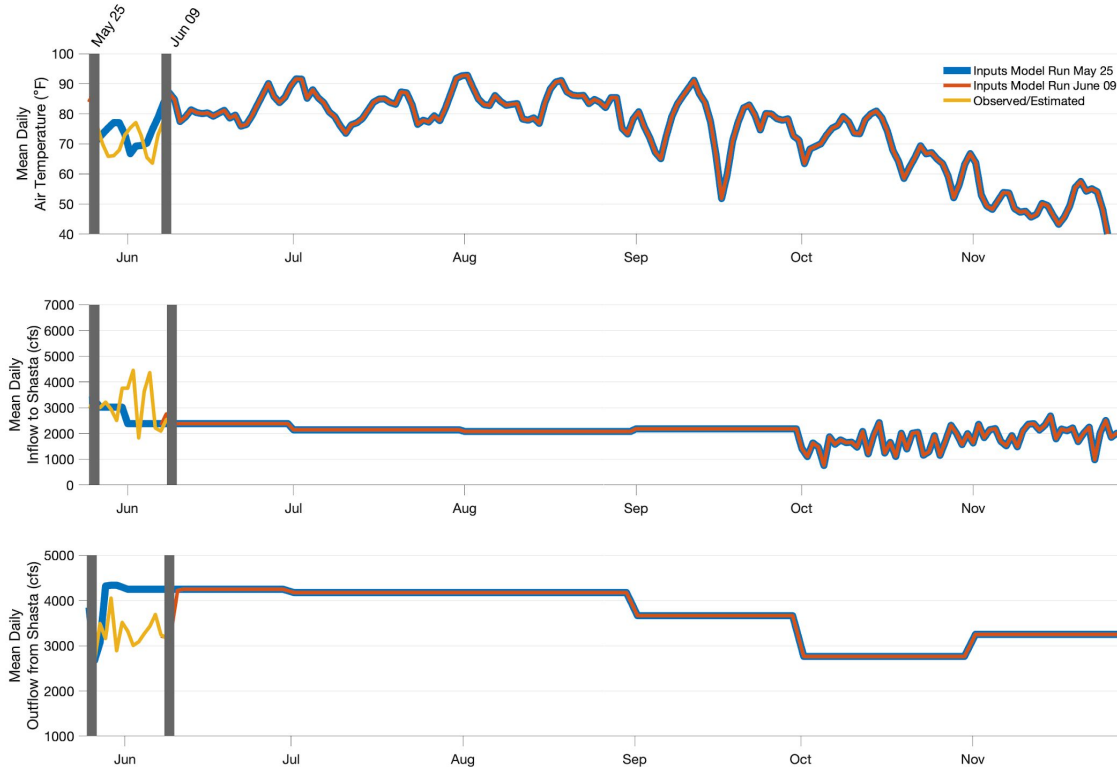
Mean annual TDM Redd Yr 2021= 50%
Mean annual TDM Redd Yr 2016-2021= 56%
Date first side gate = 07/Jul/2022
EOS storage = 1.38 MAF

*Redd year specified



DRAFT - Preliminary Results - For Discussion Purposes Only

Example of what has changed between model runs

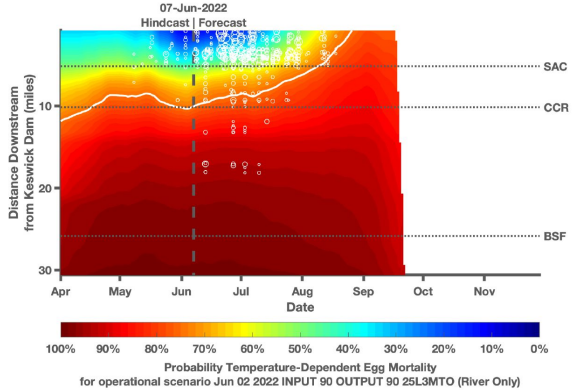
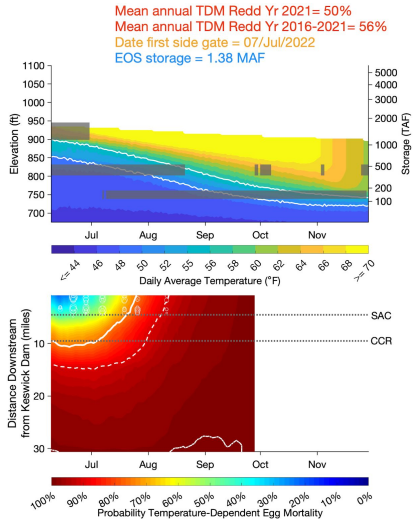
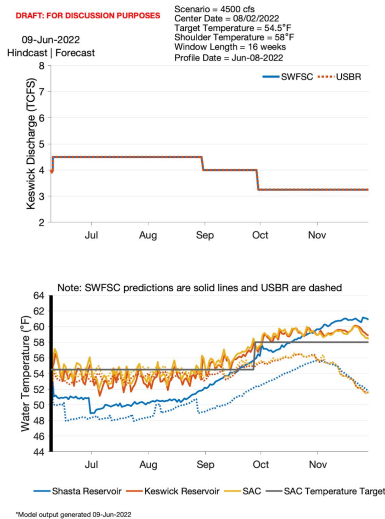


DRAFT - Preliminary Results - For Discussion Purposes Only

Implementation Phase

- Use USBR's operational plan to estimate TDM.
 - Includes release schedules and TCD gate operations from HEC-5Q.
- This requires SWFSC to run the RAFT river temperature model with USBR's predicted Keswick release temperatures.
- This approach does not use the SWFSC reservoir models upstream.
 - *There is a version of the SWFSC models on CVTEMP.

Implementation phase outputs



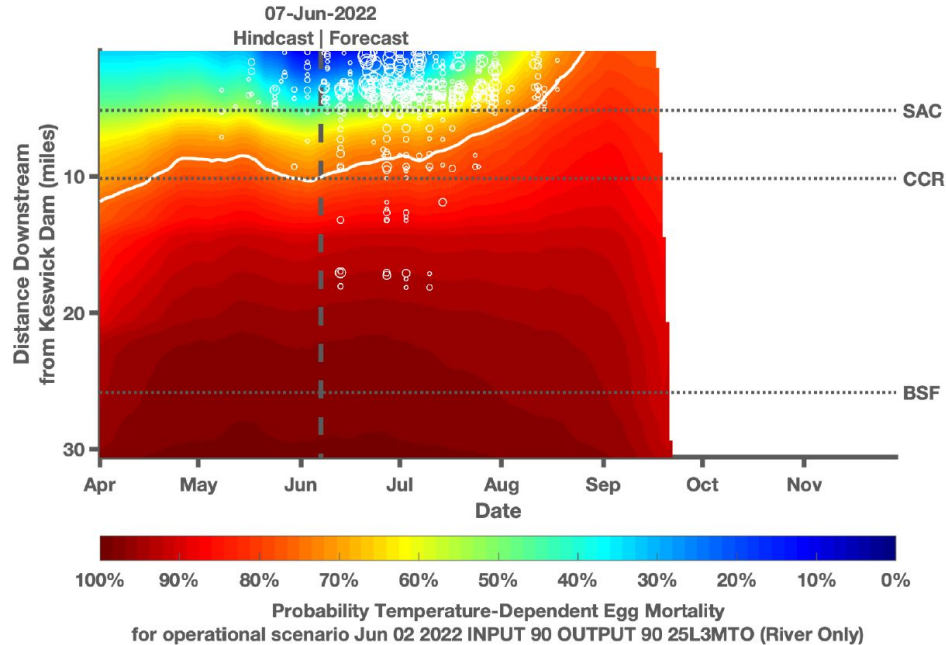
SWFSC model results. USBR is not using these for operations

So SWFSC uses USBR Keswick temps to generate new TDM results of Implementation

Which model is correct?

Not for today's discussion

Mortality landscape and TDM estimate for June Scenario



- Mean annual TDM based on 2016-2021 redd distribution = **47%**.
- SWFSC planning estimate = **56%**.
- There are bound to be differences in TDM when using different modeling platforms.

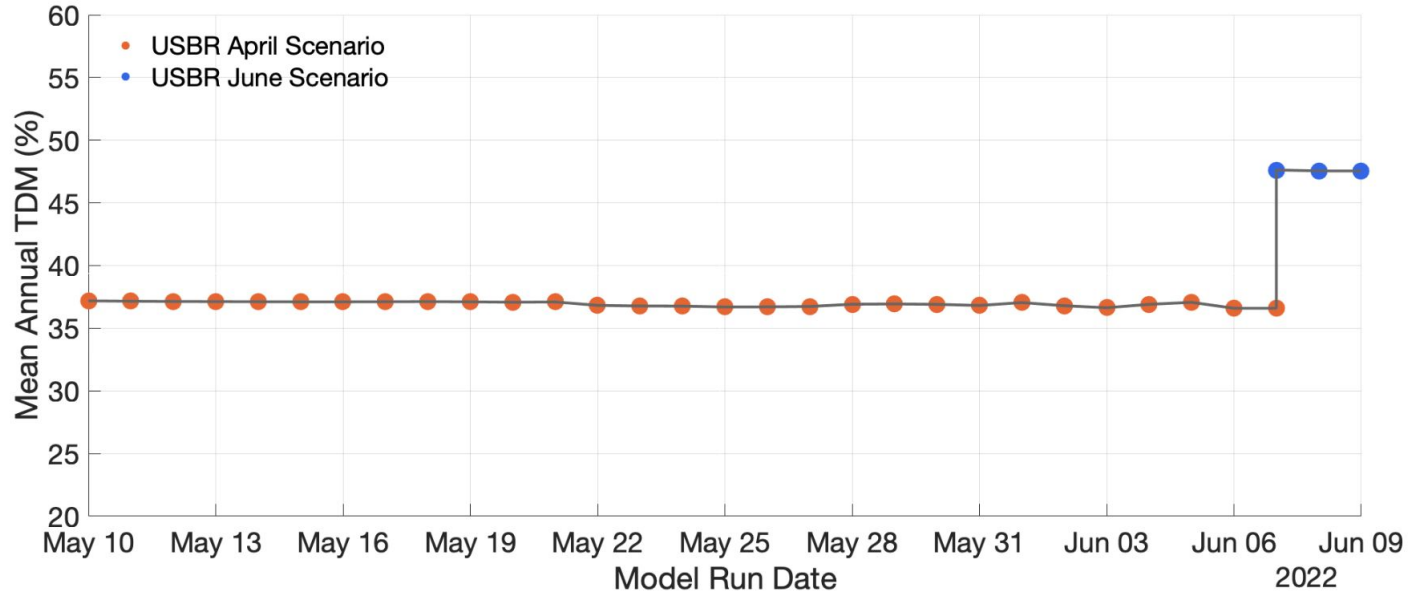
**CVTEMP displays this exact information*

DRAFT - Preliminary Results - For Discussion Purposes Only

On CVTEMP (Implementation) we run USBR's scenarios daily with updated information

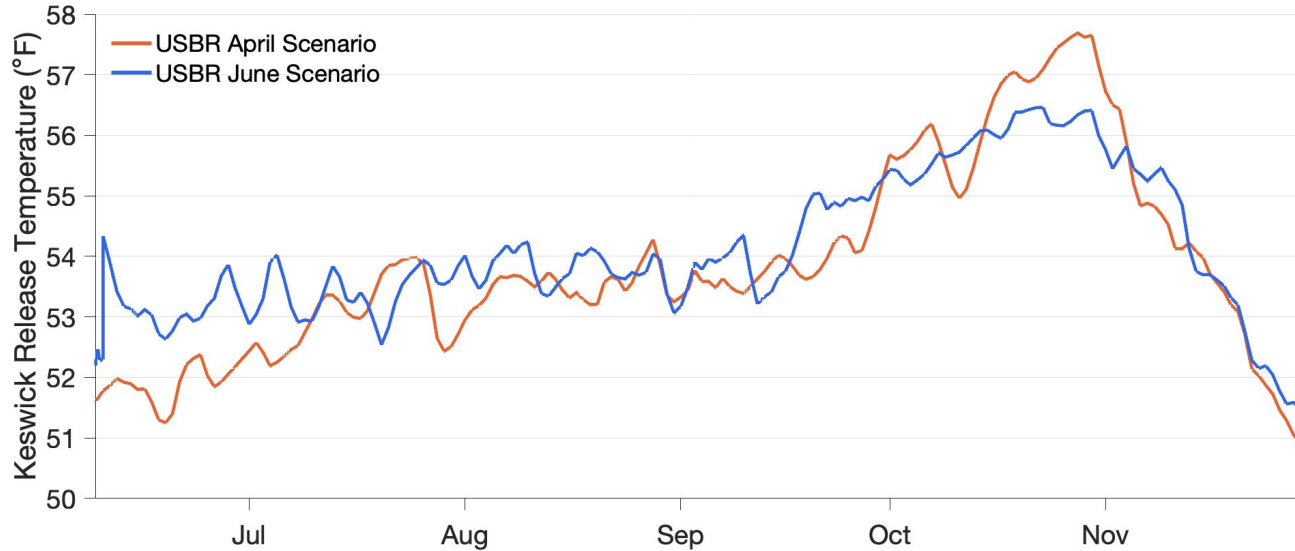
- There are often slight changes in TDM estimates as new data (i.e. observed river temperature) are ingested by the model.
- There are often larger changes in TDM when a new USBR operational forecast is released.

Example of TDM change over time



* See: <https://oceanview.pfeg.noaa.gov/CVTEMP/river/survival> for data

Example of what changed between USBR's forecast



* Updated scenario has slightly warmer release temperatures in June.

Conclusions

- For the planning output: Mean annual TDM estimated to be between 56% using the 2016-2021 redd distribution.
- For the implementation output: Mean annual TDM estimated to be 47% using the 2016-2021 redd distribution.
- Discussion: the utility of continuing to produce the planning output (SWFSC models) going forward