

Description of SWFSC Temperature-dependent Mortality Modeling Scenarios – May 19, 2021

Total number of scenarios simulated: 720

Model Start Date: May 19, 2021

1. Modeling framework used: “Full” models

Shasta:	CE-QUAL-W2
Keswick:	Linear model
Upper Sacramento River:	RAFT
Temperature-dependent mortality:	Stage independent (Martin et al, 2017)

2. Shasta Bypass Conditions

All scenarios assume no bypass in the forecast time period. Any bypass flow that occurs during the hindcast period are accounted for in the model.

3. Keswick Release Scenario Assumptions

		Keswick Releases (cfs)							
Label	Description	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BL	Baseline, USBR 90% Exceedance operational outlook dated 4/20/2021; with 100% bypass (see note in 2. Shasta Bypass Conditions)	8600	8750	10000	8000	5000	4570	3873	3250
Trans150	Same as baseline, but with 150 TAF cumulative reduction to May-Oct releases, & 37.5 TAF added to Aug & Sep release, & 75 TAF added to Oct releases	8600	8170	9415	8098	5277	5790	3873	3250
Flat7500	Same as baseline but with Jun, Jul, & Aug releases set to 7500 cfs	8600	7500	7500	7500	5000	4570	3873	3250
EOS1300	Same as baseline but with ending EOS set to 1300 TAF	8600	6765	6765	6775	5277	5250	3873	3250
EOS1300Alt	Same as baseline but with ending EOS set to 1300 TAF	8600	6765	6765	6775	5277	5790	3873	3250
Flat6000	Same as baseline but with Jun, Jul, & Aug releases set to 6000 cfs	8600	6000	6000	6000	5000	4570	3873	3250

4. Trinity imports via Spring Cr PP

		Trinity Imports via Spring Cr PP (cfs)							
Label	Description	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BL	Baseline, USBR 90% Exceedance operational outlook dated 4/20/2021	244	1513	1789	1464	1513	732	336	195
		Trinity Imports via Spring Cr PP (TAF)							
Label	Description	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BL	Baseline, USBR 90% Exceedance operational outlook dated 4/20/2021	15	90	110	90	90	45	20	12

5. Hydrology:

All simulations are run with a DWR Bulletin 120 90% exceedance hydrology taken from the May forecast for Shasta Reservoir inflow.

5. Meteorology:

All simulations are run with the meteorological time series taken from the historical record for year 2015 for simulation dates 5/5/2021-11/29/2021.

6. Inflow temperature:

All simulations are run with the inflow tributary temperatures to Shasta Reservoir from the historical record for year 2015 for simulation dates 5/5/2021-11/29/2021.

7. Initial Shasta conditions:

Variable	Value/description
Temperature profile date	5/12/2021
Initial storage (TAF)	2179
Initial storage date	5/12/2021
Initial elevation (ft)	967
Initial elevation date	5/5/2021

8. Temperature Target (Pattern/shaping) Parameters:

Model runs use all combinations of values given in the table below, along with the 4 release scenarios described in Section 3.

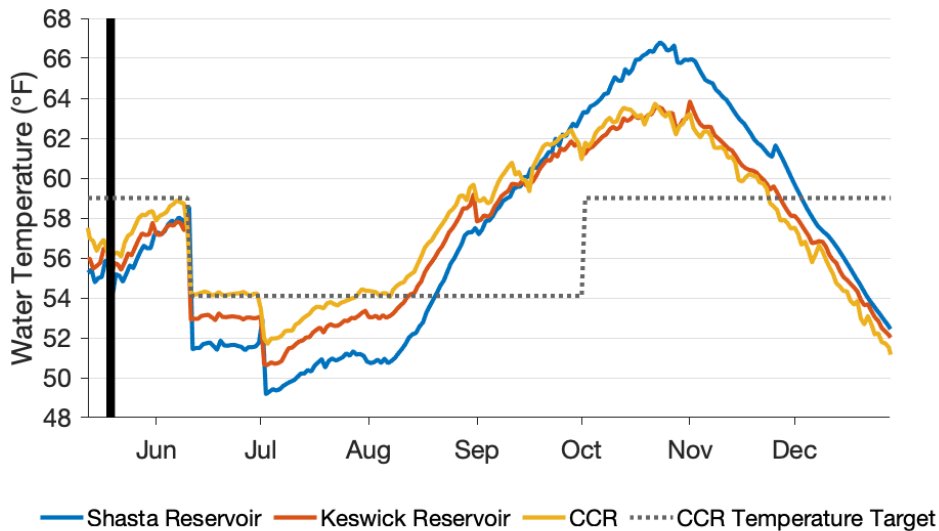
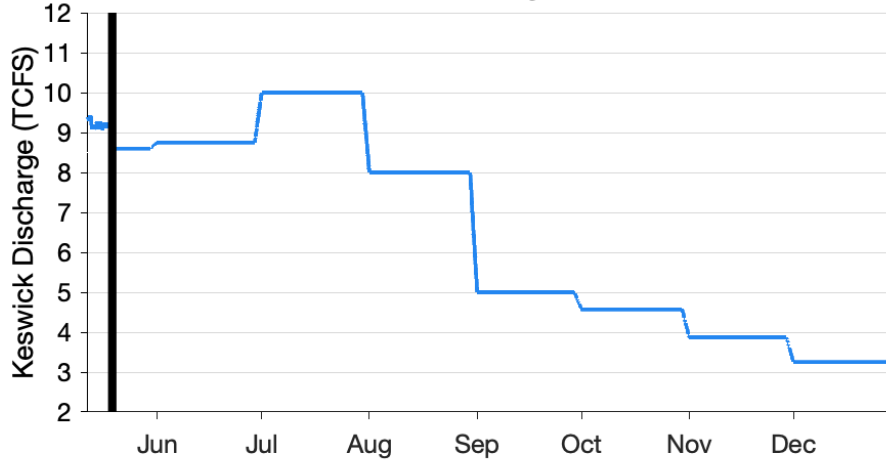
Variable	Value(s)	
Target location	CCR	
Target temperature (°C)	12.25, 12.5, 12.75, 13, 13.33	(°F) 54, 54.5, 55, 55.4, 56
Shoulder temperature (°C)	13.33, 15	(°F) 56, 59
Window length (weeks)	10, 16, 22	
Center date	8/6/2021, 8/13/2021, 8/20/2021, 8/27/2021	

DRAFT: NOT TO DISTRIBUTE

19-May-2021

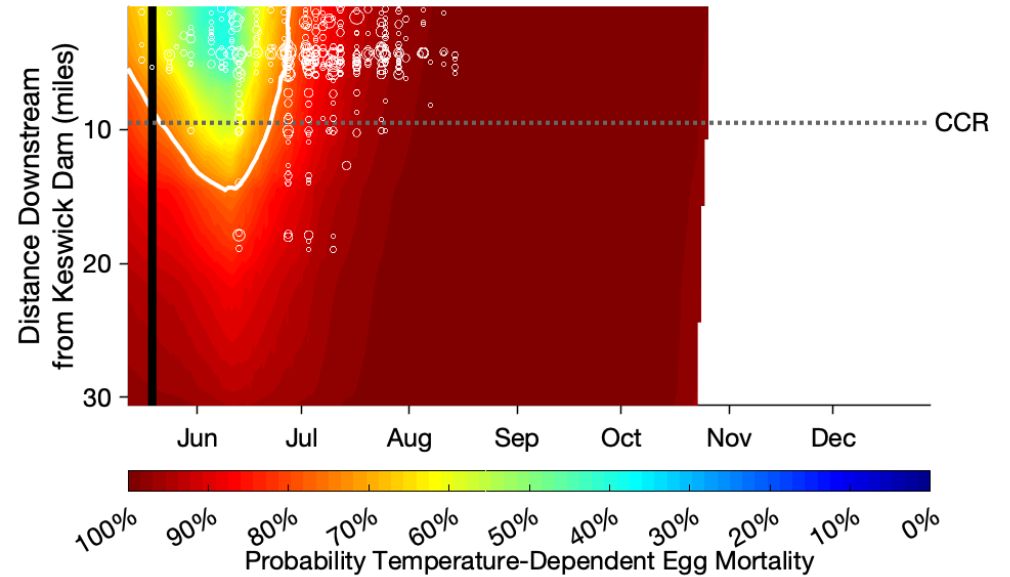
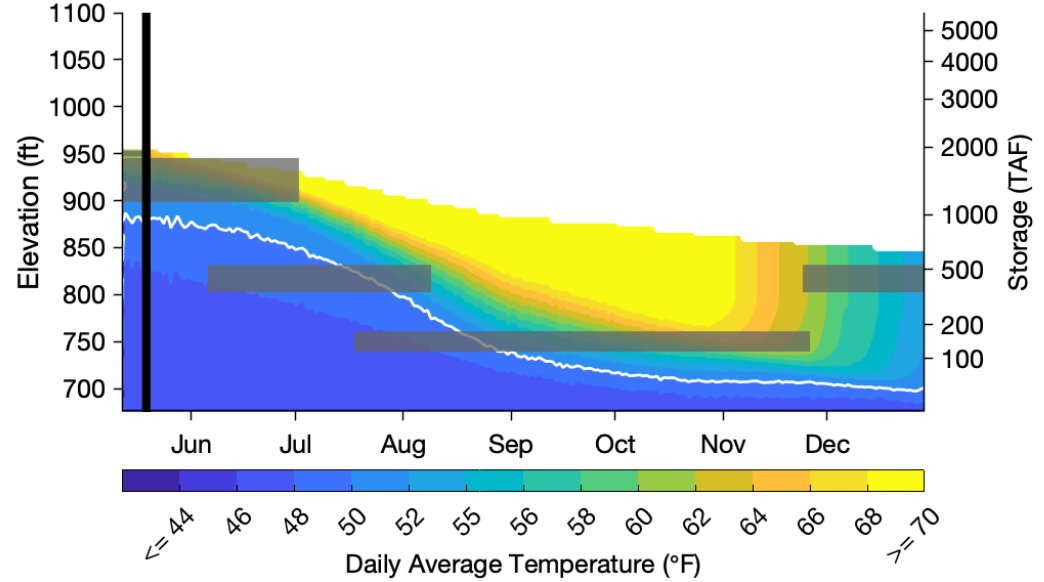
Hindcast | Forecast

Iteration = 91
Flow Reduction = Base
Center Date = 08/06/2021
Target Temperature = 54.1°F
Shoulder Temperature = 59°F
Window Length = 16 weeks



*Model output generated 19-May-2021; Note run details on model summary document

Mean annual TDM = 79%
Date first side gate = 18/Jul/2021
EOS storage = 0.97 MAF

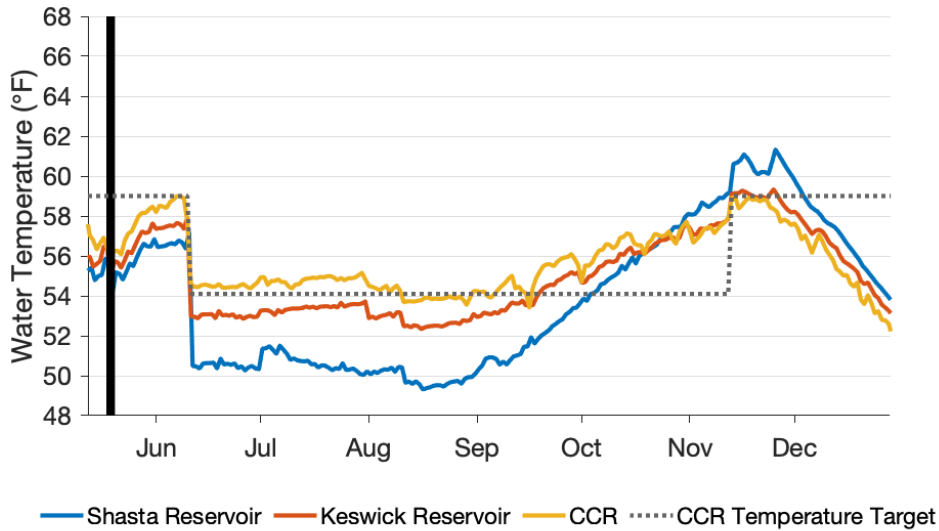
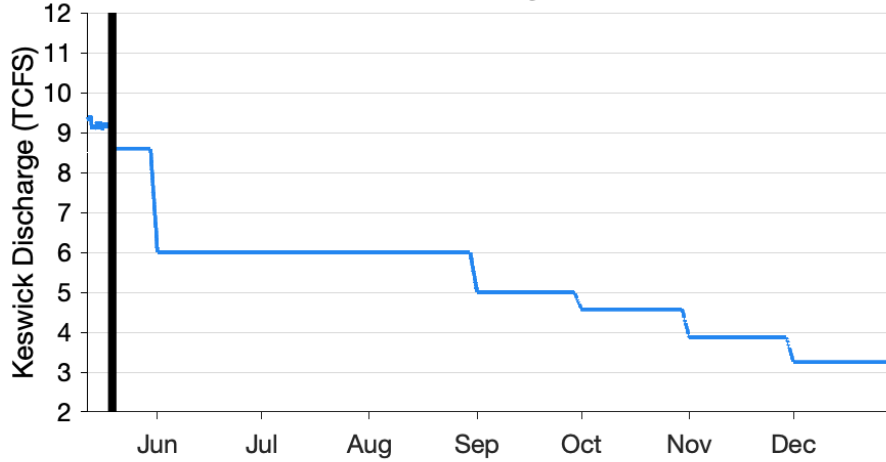


DRAFT: NOT TO DISTRIBUTE

Iteration = 696
Flow Reduction = Flat6000
Center Date = 08/27/2021
Target Temperature = 54.1°F
Shoulder Temperature = 59°F
Window Length = 22 weeks

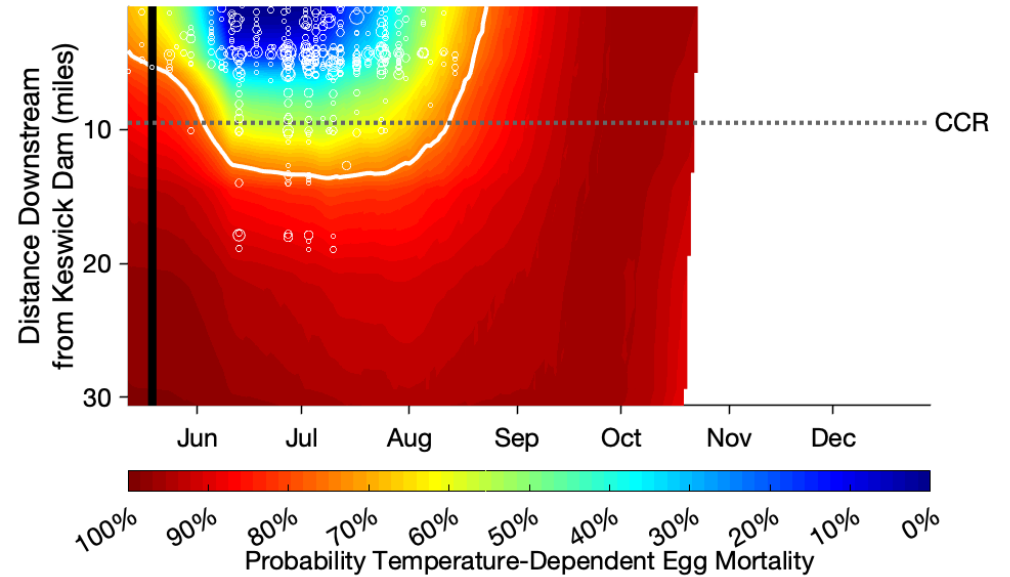
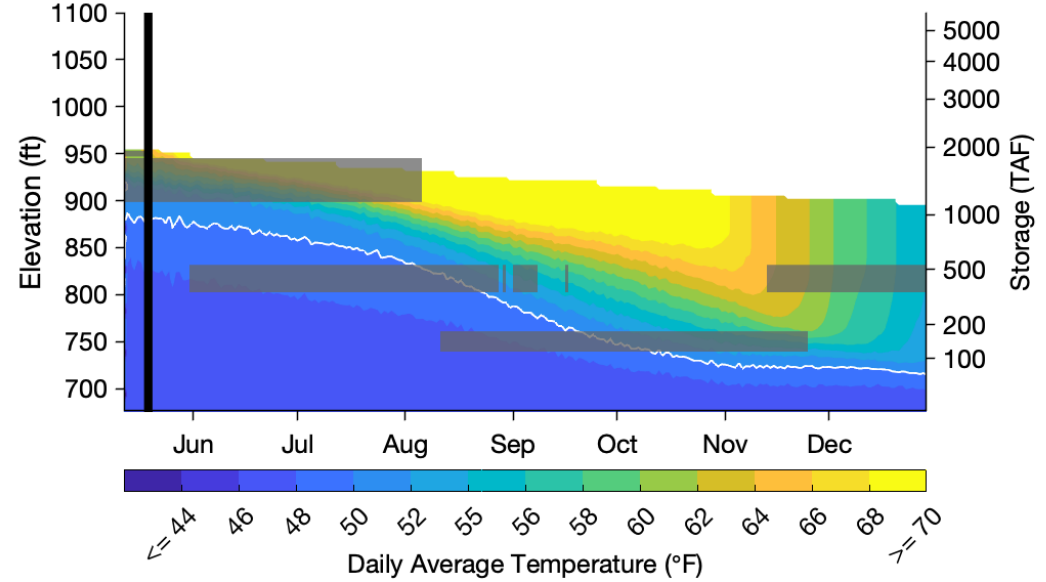
19-May-2021

Hindcast | Forecast



*Model output generated 19-May-2021; Note run details on model summary document

Mean annual TDM = 32%
Date first side gate = 11/Aug/2021
EOS storage = 1.47 MAF

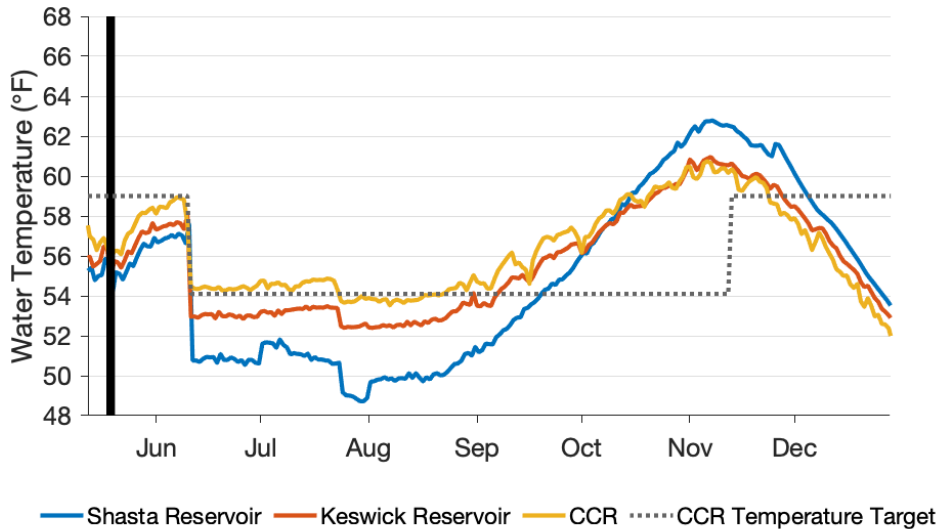
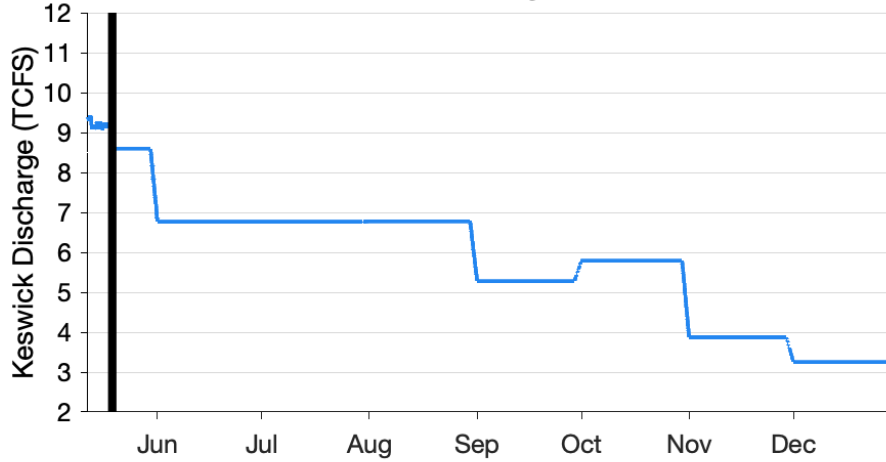


DRAFT: NOT TO DISTRIBUTE

Iteration = 695
Flow Reduction = EOS1300Alt
Center Date = 08/27/2021
Target Temperature = 54.1°F
Shoulder Temperature = 59°F
Window Length = 22 weeks

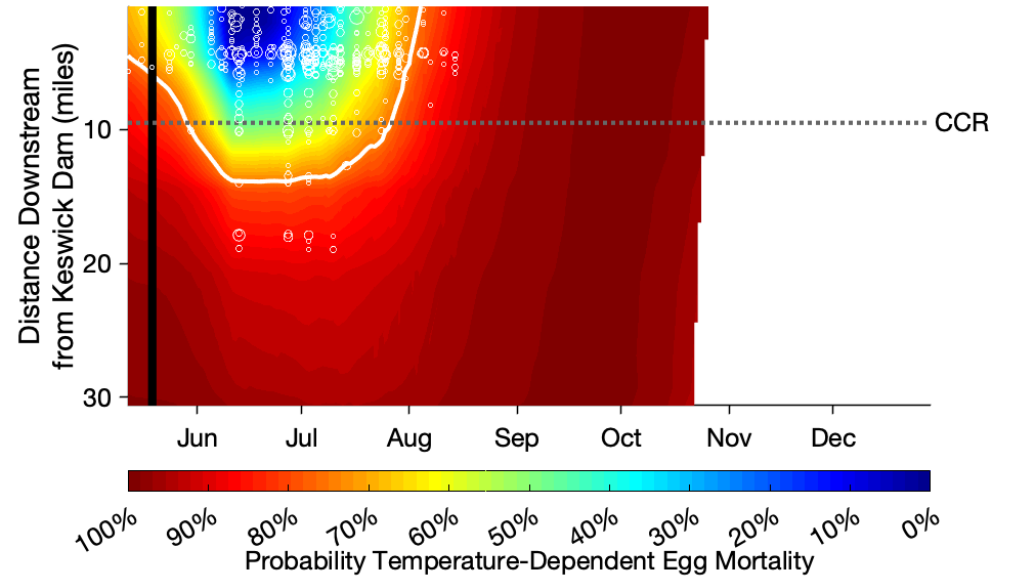
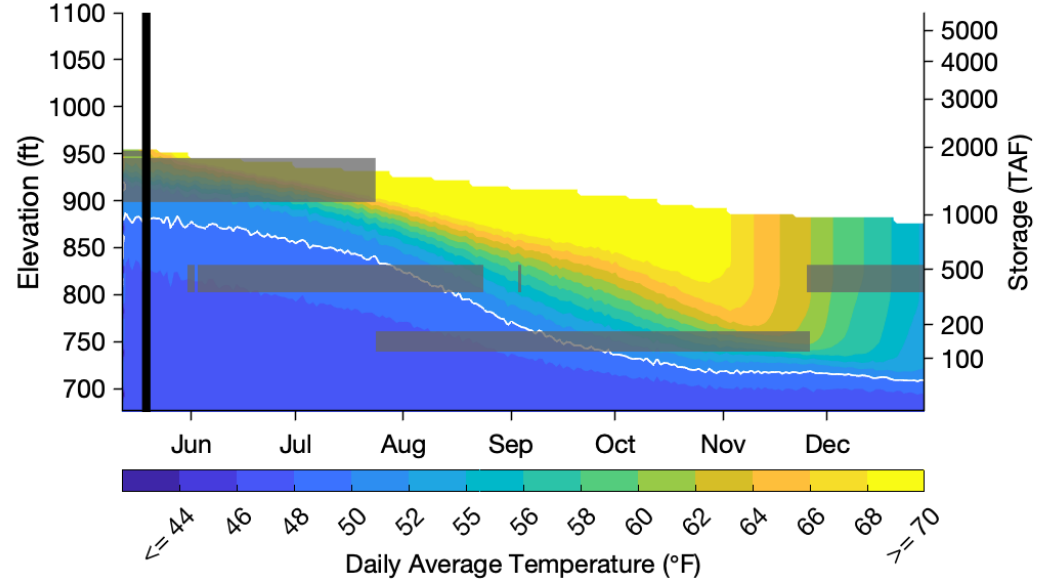
19-May-2021

Hindcast | Forecast



*Model output generated 19-May-2021; Note run details on model summary document

Mean annual TDM = 41%
Date first side gate = 24/Jul/2021
EOS storage = 1.33 MAF

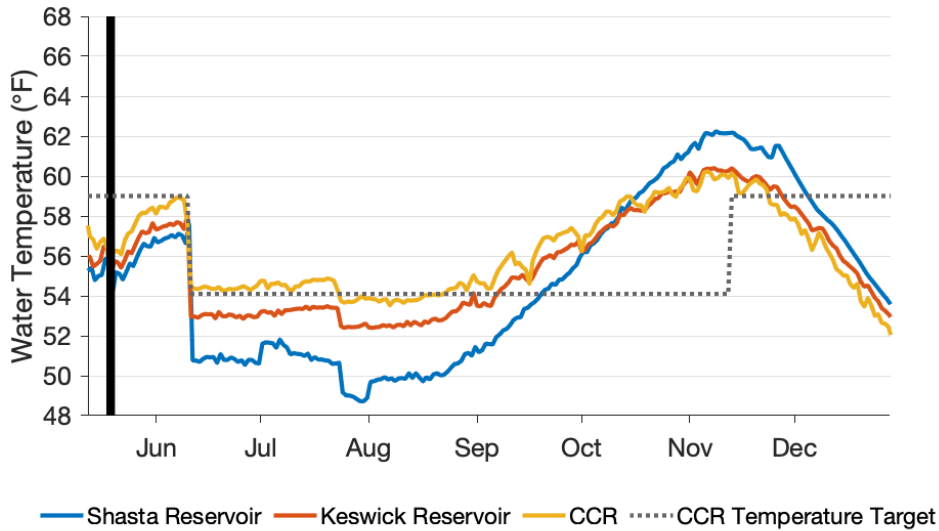
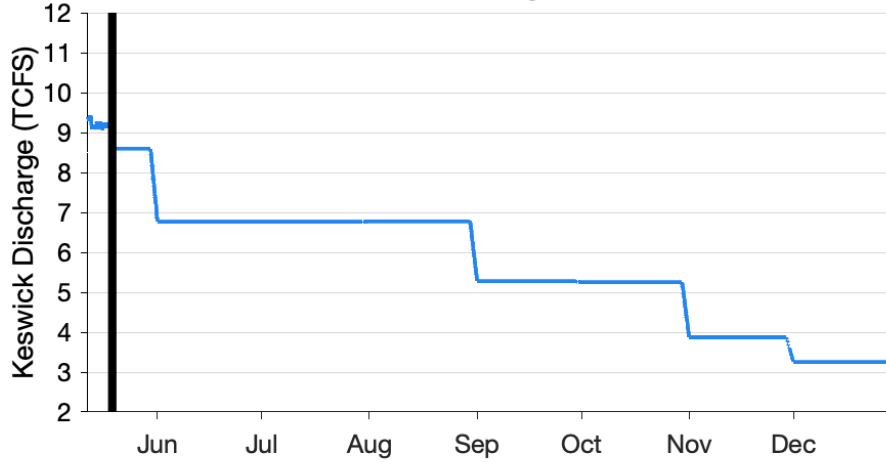


DRAFT: NOT TO DISTRIBUTE

19-May-2021

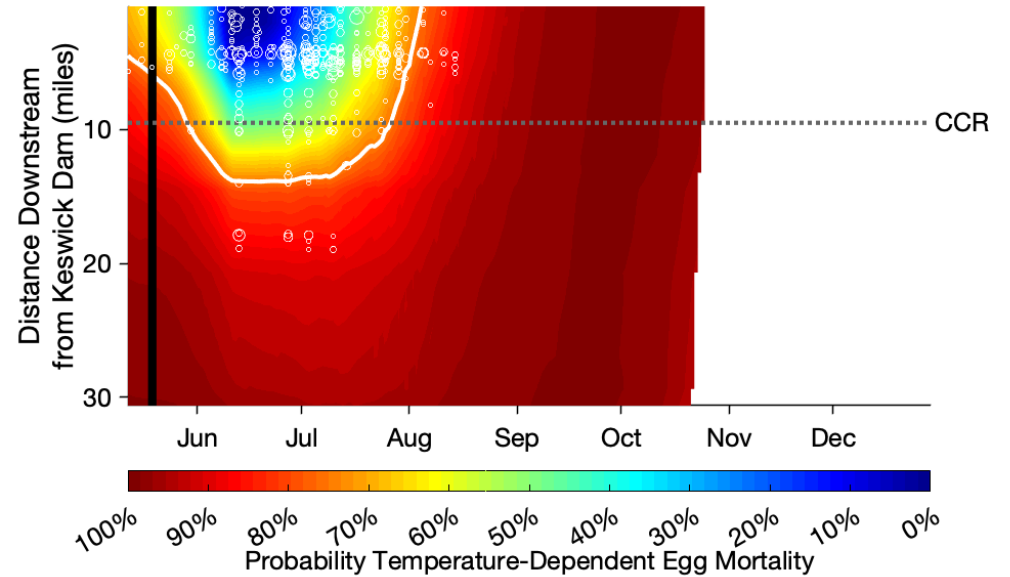
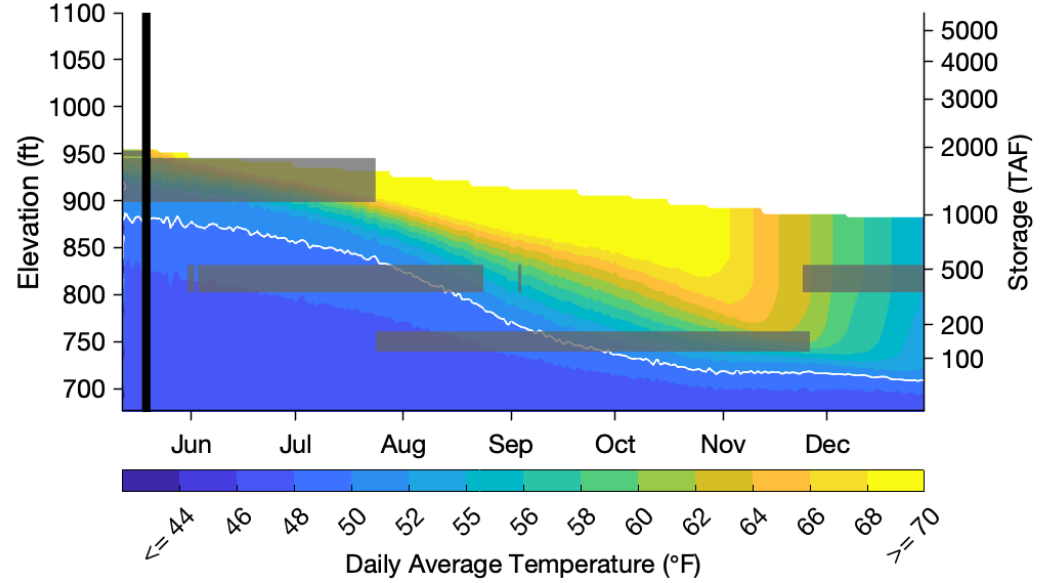
Hindcast | Forecast

Iteration = 694
Flow Reduction = EOS1300
Center Date = 08/27/2021
Target Temperature = 54.1°F
Shoulder Temperature = 59°F
Window Length = 22 weeks



*Model output generated 19-May-2021; Note run details on model summary document

Mean annual TDM = 41%
Date first side gate = 24/Jul/2021
EOS storage = 1.33 MAF



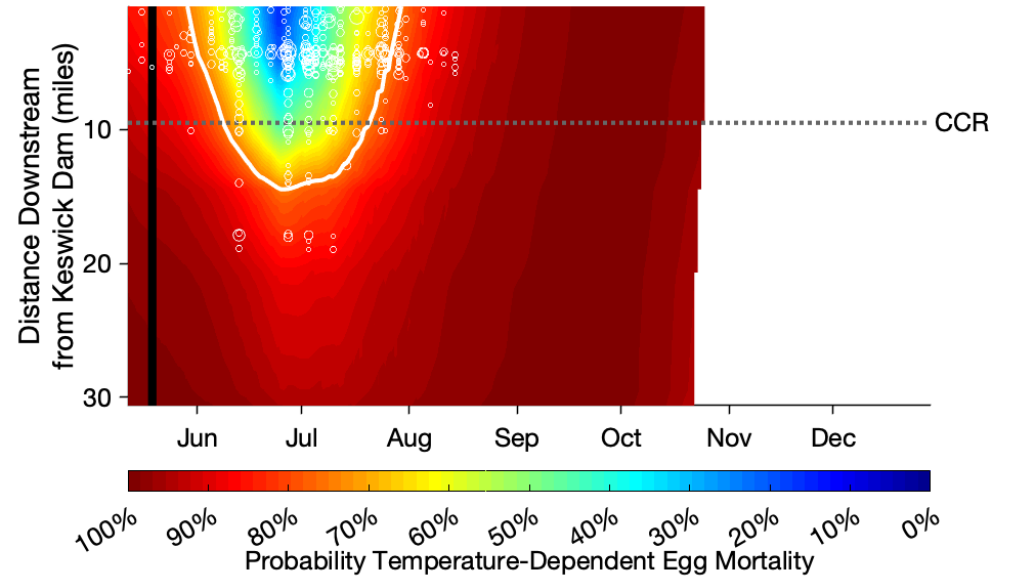
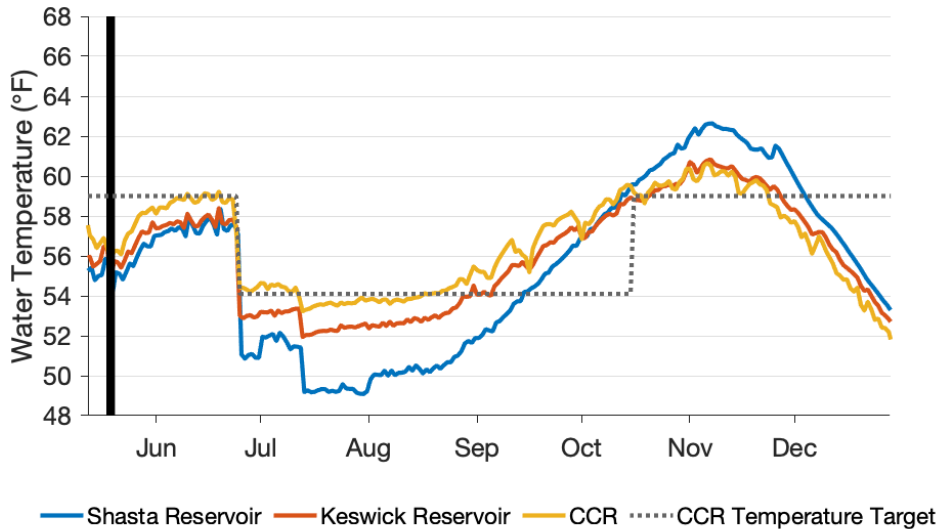
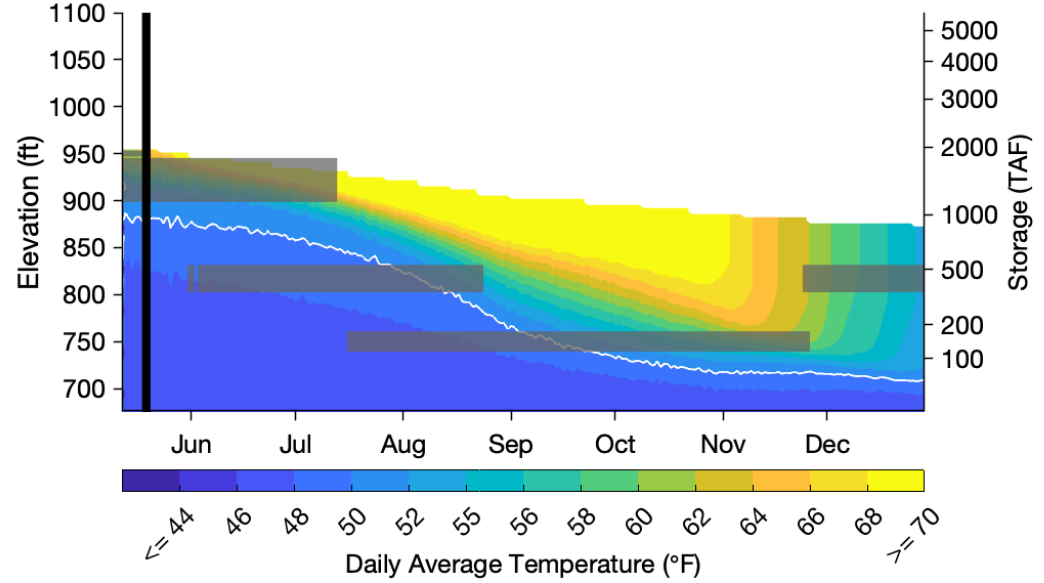
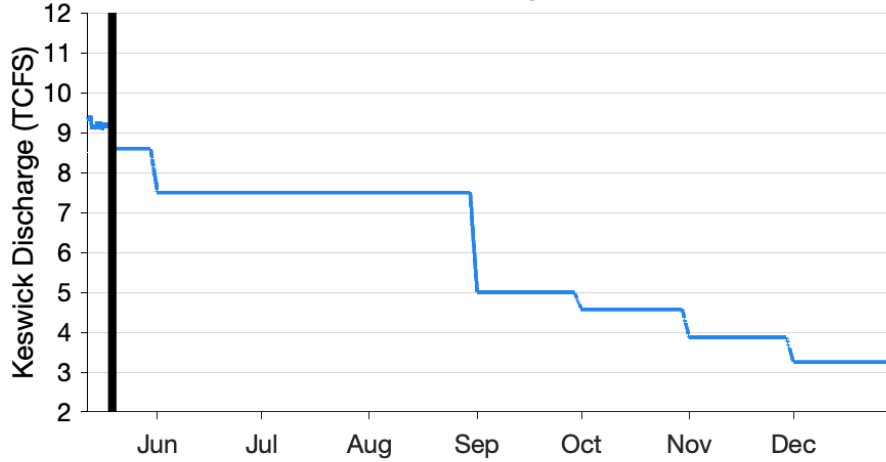
DRAFT: NOT TO DISTRIBUTE

19-May-2021

Hindcast | Forecast

Iteration = 453
Flow Reduction = Flat7500
Center Date = 08/20/2021
Target Temperature = 54.1°F
Shoulder Temperature = 59°F
Window Length = 16 weeks

Mean annual TDM = 53%
Date first side gate = 16/Jul/2021
EOS storage = 1.2 MAF



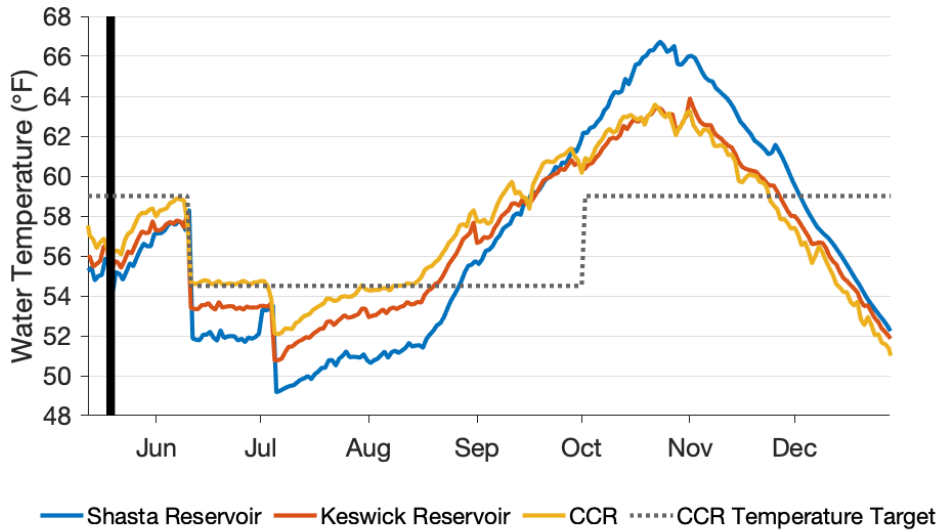
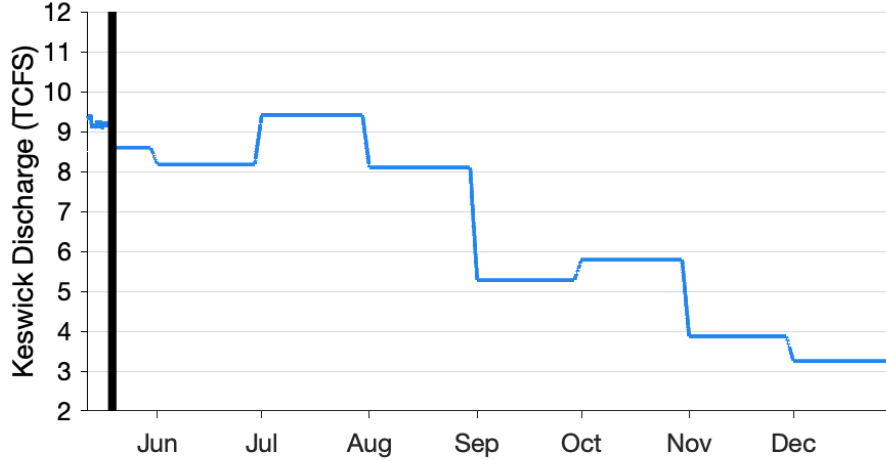
*Model output generated 19-May-2021; Note run details on model summary document

DRAFT: NOT TO DISTRIBUTE

Iteration = 98
Flow Reduction = Transfer150
Center Date = 08/06/2021
Target Temperature = 54.5°F
Shoulder Temperature = 59°F
Window Length = 16 weeks

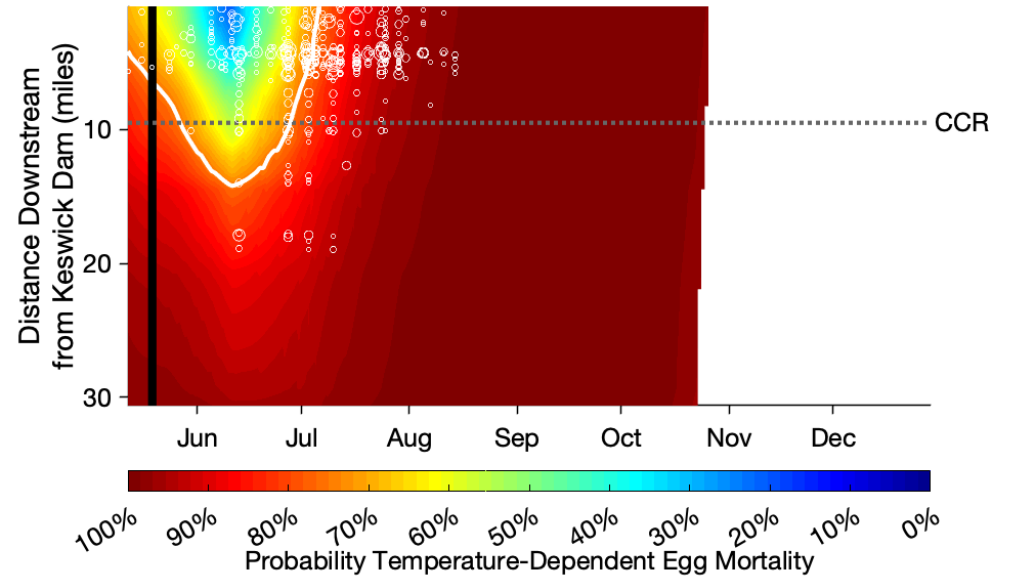
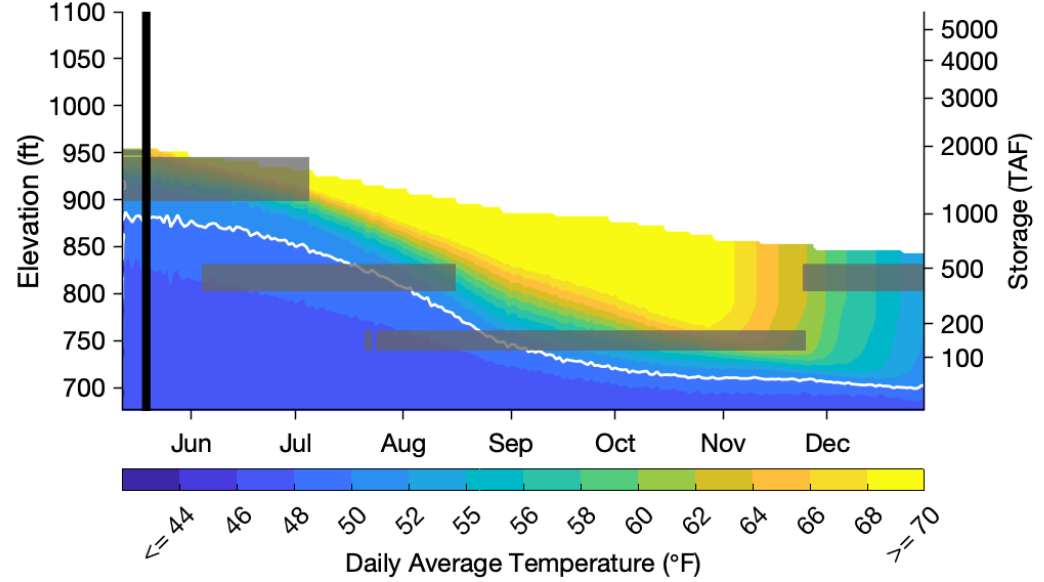
19-May-2021

Hindcast | Forecast



*Model output generated 19-May-2021; Note run details on model summary document

Mean annual TDM = 73%
Date first side gate = 21/Jul/2021
EOS storage = 0.99 MAF



Description of SWFSC Temperature-dependent Mortality Modeling Scenarios – April 30, 2021

Total number of scenarios simulated: 480

1. Modeling framework used: “Full” models

Shasta:	CE-QUAL-W2
Keswick:	Linear monthly model
Upper Sacramento River:	RAFT
Temperature-dependent mortality:	Stage independent (Martin et al, 2017)

2. Shasta Bypass Conditions

All scenarios assume the upper bypass operations are occurring at Shasta dam, with 100% of release volume going through the upper river outlet starting on 4/23/2021. Blending between the upper river outlet and middle TCD gate is not implemented in this set of runs. Rather, the model logic is set up so that if the release temperature at CCR exceeds 60°F, the bypass is ended, regardless of whether the prescribed end date of 5/31/2021 has been reached. If temperature below CCR stays below 60°F through May, the 100% bypass condition runs through 5/31/2021.

3. Keswick Release Scenario Assumptions

		Keswick Releases (cfs)								
Label	Description	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BL	Baseline, USBR 90% Exceedance operational outlook dated 4/20/2021; with 100% bypass (see note in 2. Shasta Bypass Conditions)	6000	7379	8750	10000	8000	5000	4570	3873	3250
Trans150	Same as baseline, but with 150 TAF cumulative reduction to May-Oct releases, & 37.5 TAF added to Aug & Sep release, & 75 TAF added to Oct releases	6000	6940	8170	9415	8098	5277	5790	3873	3250
Flat7500	Same as baseline but with Jun, Jul, & Aug releases set to 7500 cfs	6000	7379	7500	7500	7500	5000	4570	3873	3250
Flat6000	Same as baseline but with Jun, Jul, & Aug releases set to 6000 cfs	6000	7379	6000	6000	6000	5000	4570	3873	3250

4. Trinity imports via Spring Cr PP

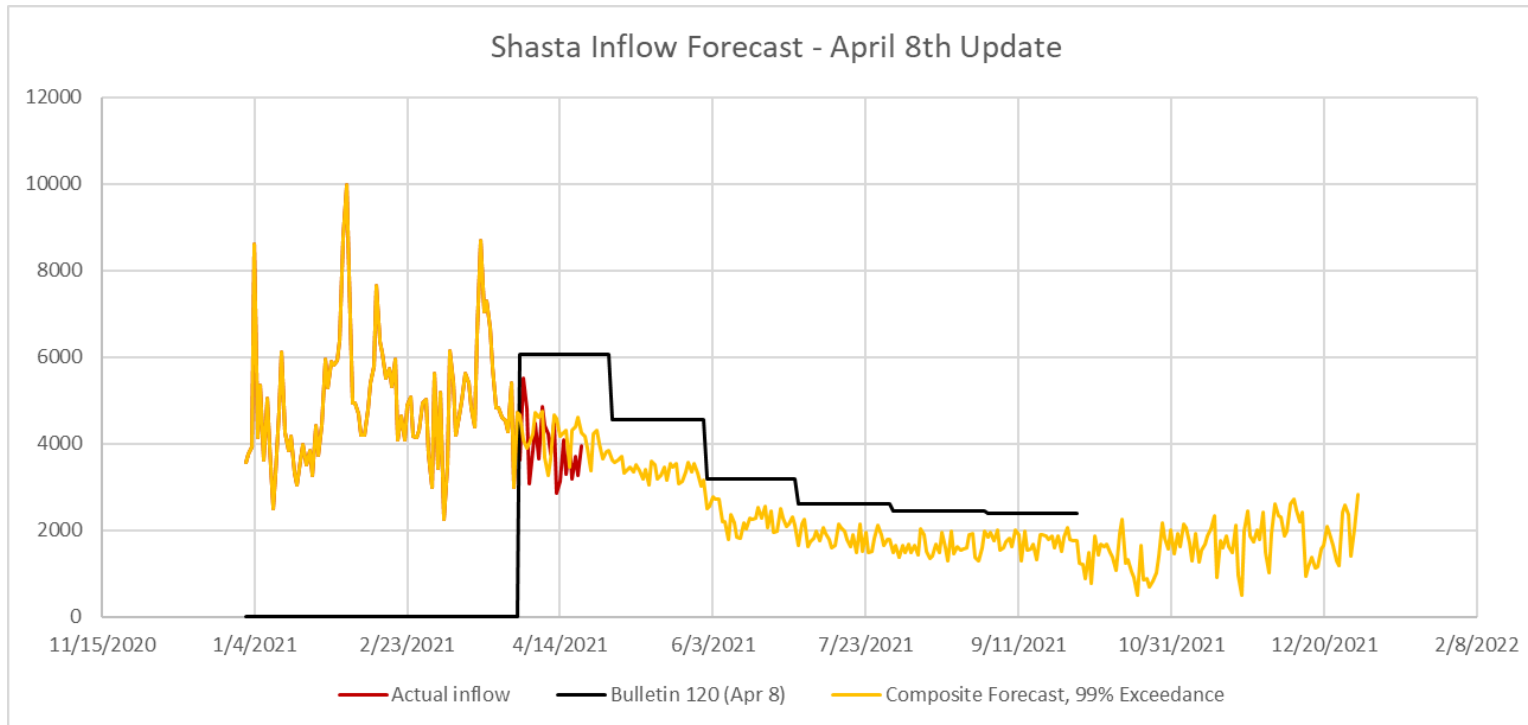
		Trinity Imports via Spring Cr PP (cfs)								
Label	Description	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BL	Baseline, USBR 90% Exceedance operational outlook dated 4/20/2021	252	244	1513	1789	1464	1513	732	336	195
		Trinity Imports via Spring Cr PP (TAF)								
Label	Description	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BL	Baseline, USBR 90% Exceedance operational outlook dated 4/20/2021	15	15	90	110	90	90	45	20	12

5. Hydrology:

All simulations are run with a composite 99% exceedance hydrology taken as an average (mean) from two sources. These are:

1. California DWR Bulletin 120, Shasta inflow 99% exceedance forecast, April 8, 2021, with estimate of flow by month
2. 99% exceedance of 1000 time series resampled (with replacement) from historic daily Shasta inflow time series (1920-2020) using antecedent (Oct 1- Mar 31) Shasta inflow to conditionally weight probability of Apr 1- Dec 31 Shasta inflow

The mean of time series 1 & 2 are used as values for the April – September period. Time series 2 is used directly for dates October 1, 2021 – December 31, 2021. A comparison of the composite 99% exceedance forecast, the April 8 Bulletin 120 forecast, and the actual April 2021 inflows is shown in the figure below:



5. Meteorology:

All simulations are run with the meteorological time series taken from the historical record for year 2015 for simulation dates 4/21/2021-11/29/2021.

6. Initial Shasta conditions:

Variable	Value/description
Temperature profile date	4/21/2021
Initial storage (TAF)	2349
Initial storage date	4/21/2021
Initial elevation (ft)	976
Initial elevation date	4/21/2021

7. Temperature Target (Pattern/shaping) Parameters:

Model runs use all combinations of values given in the table below, along with the 4 release scenarios described in Section 3.

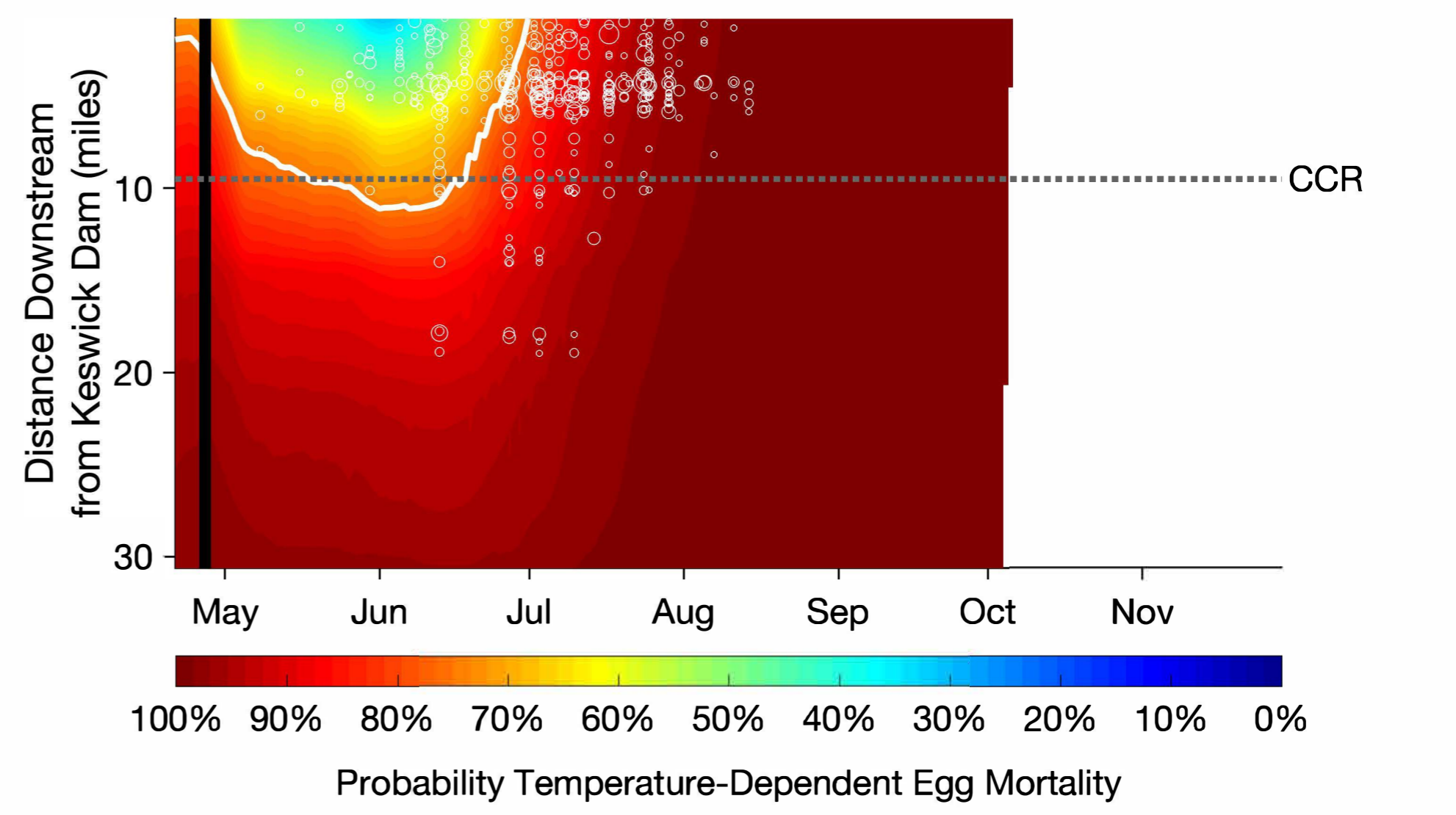
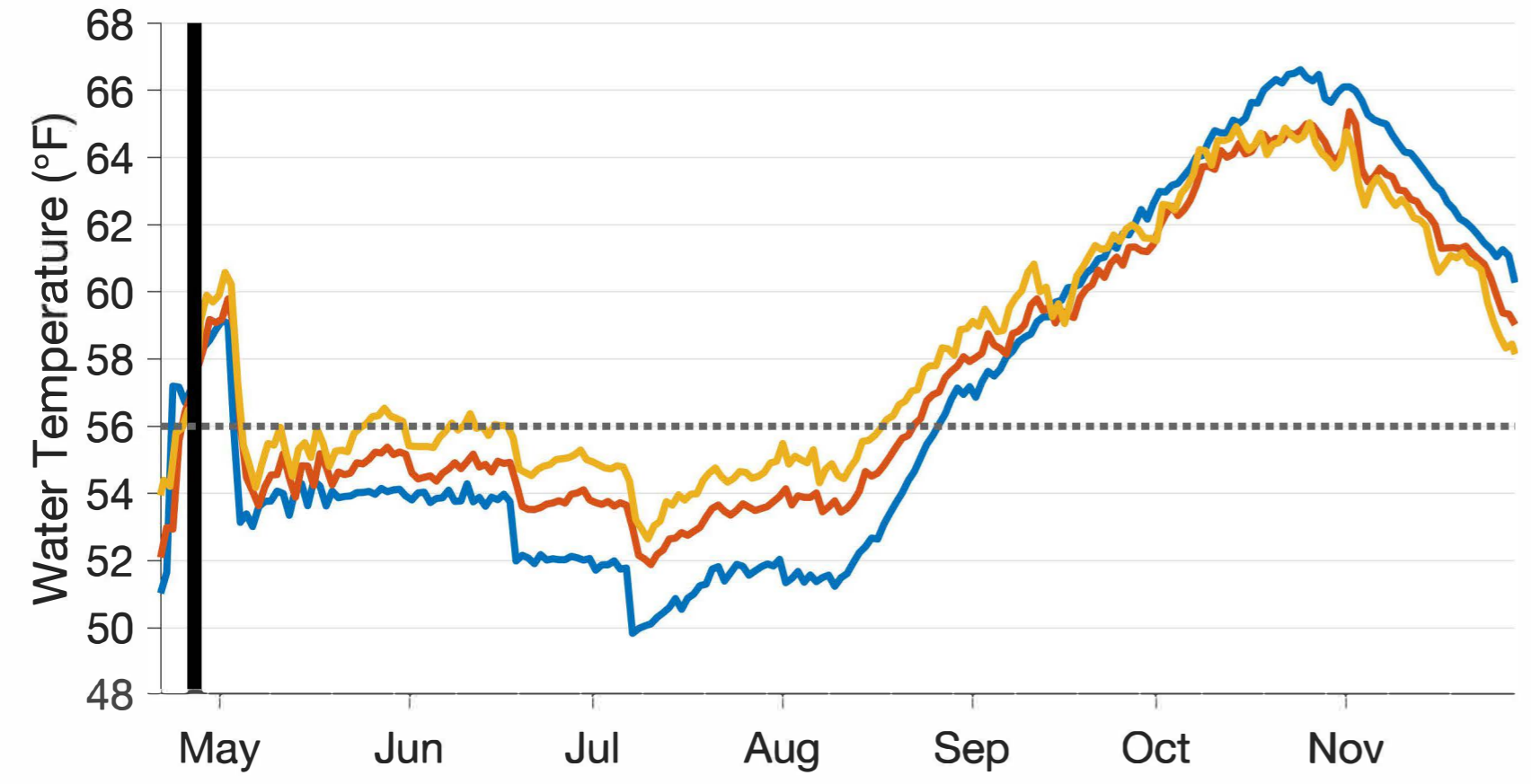
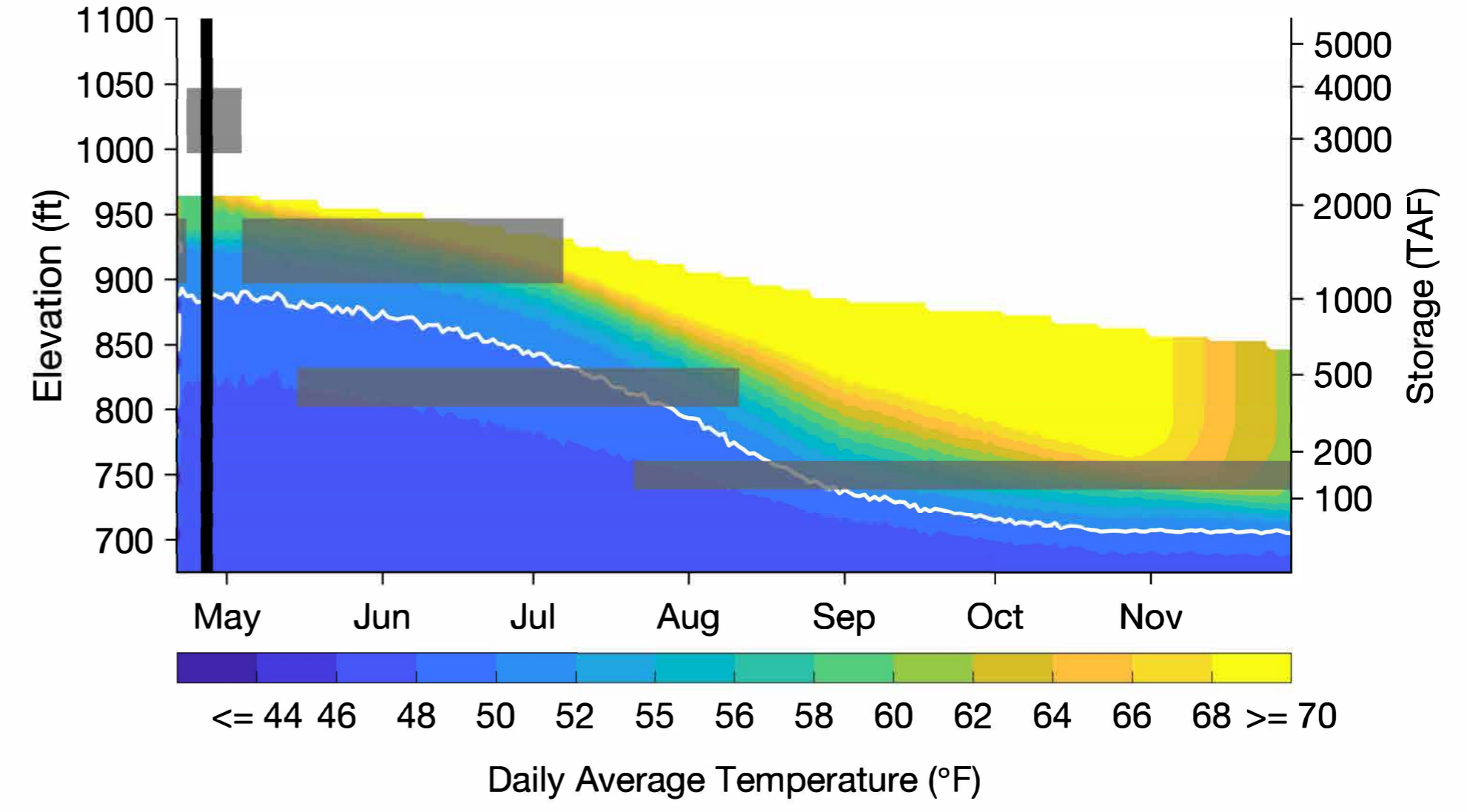
Variable	Value(s)	
Target location	CCR	
Target temperature (°C)	12.25, 12.5, 12.75, 13, 13.33	(°F) 54, 54.5, 55, 55.4, 56
Shoulder temperature (°C)	13.33, 15	(°F) 56, 59
Window length (weeks)	10, 16, 22	
Center date	8/6/2021, 8/13/2021, 8/20/2021, 8/27/2021	

27-Apr-2021
Hindcast | Forecast

Flow Reduction = Base
Center Date = NA
Target Temperature = 56°F
Shoulder Temperature = 56°F
Window Length = NAweeks



Mean annual TDM = 80%
Date first side gate = 21/Jul/2021
EOS storage = 0.97 MAF



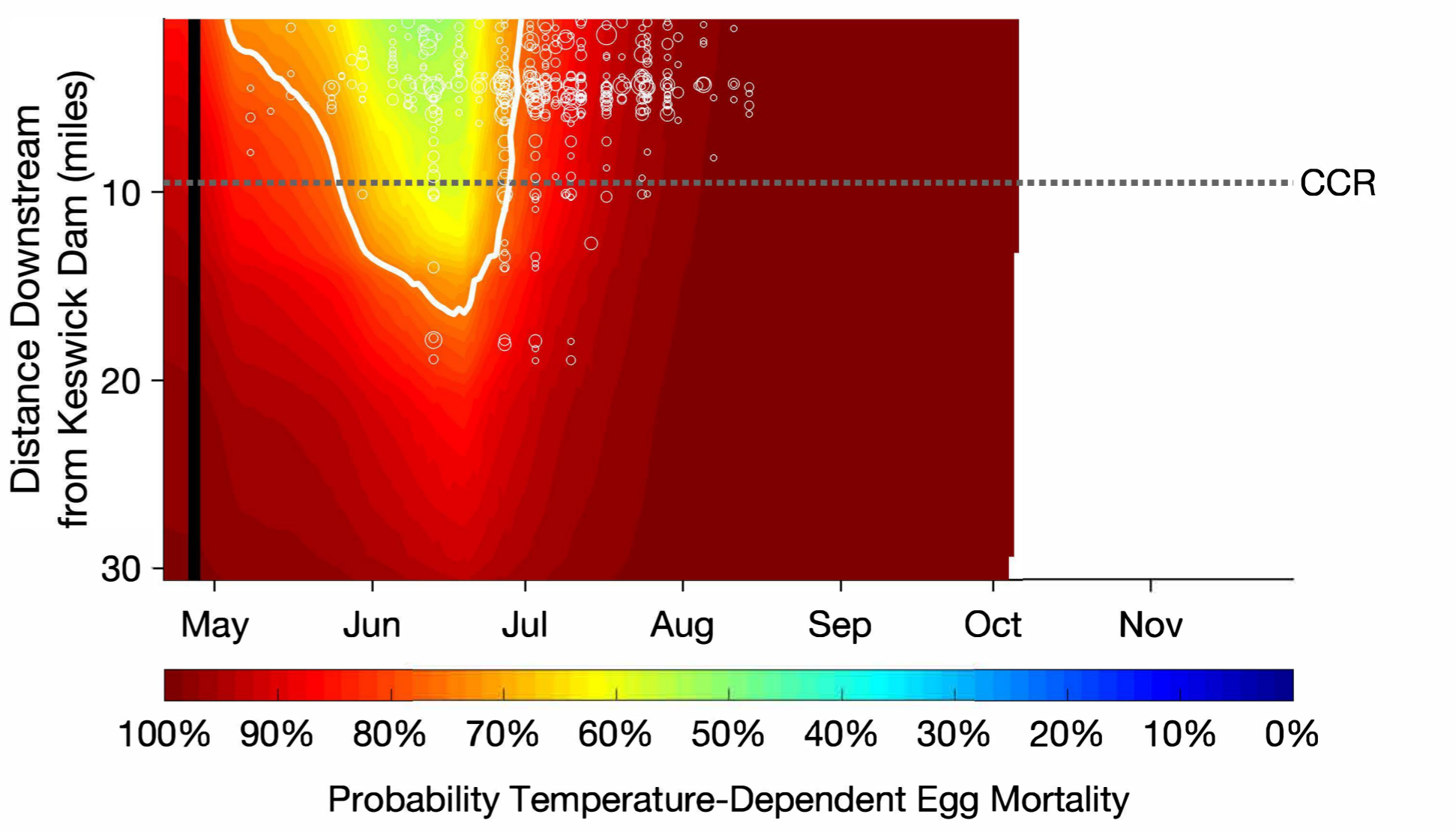
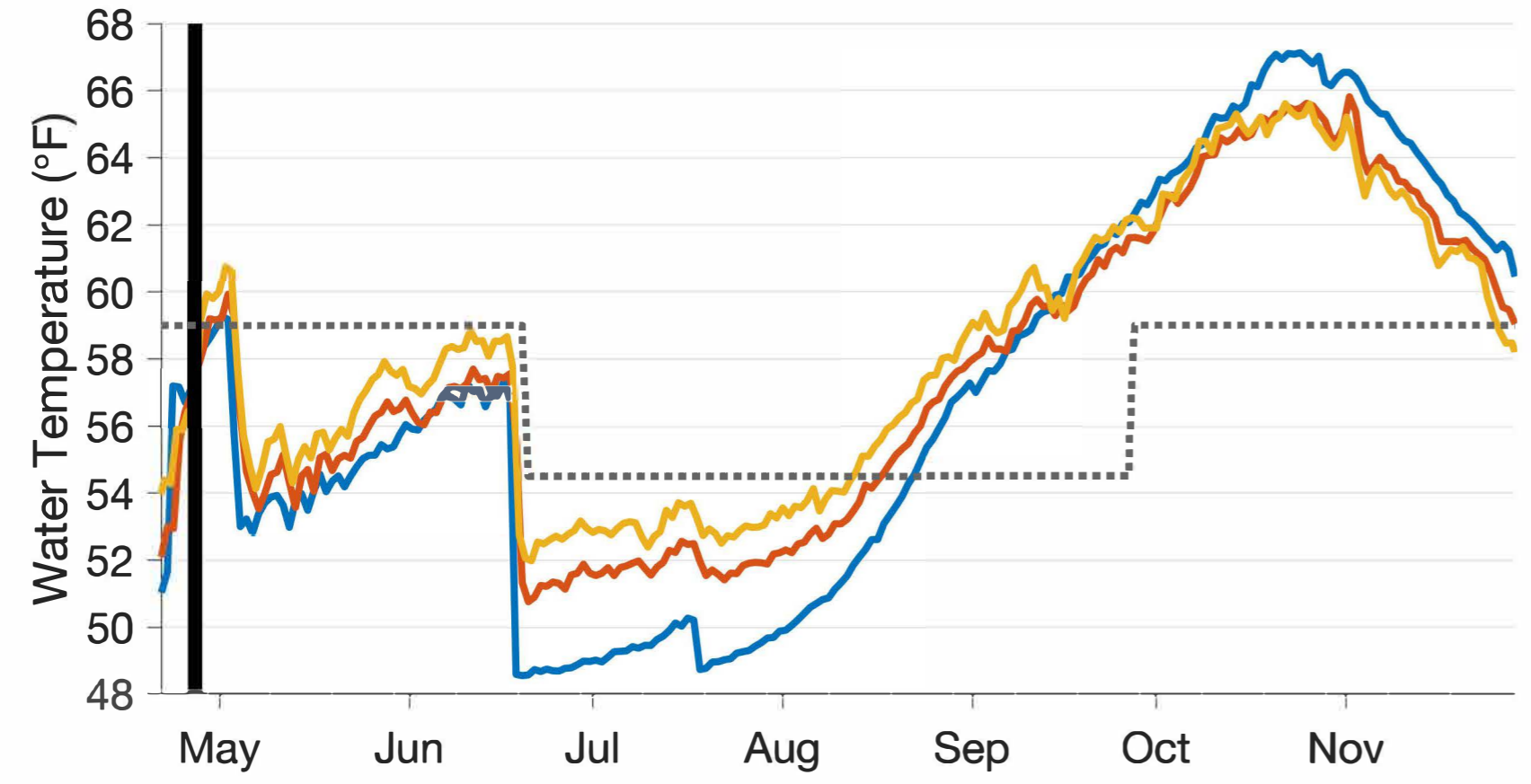
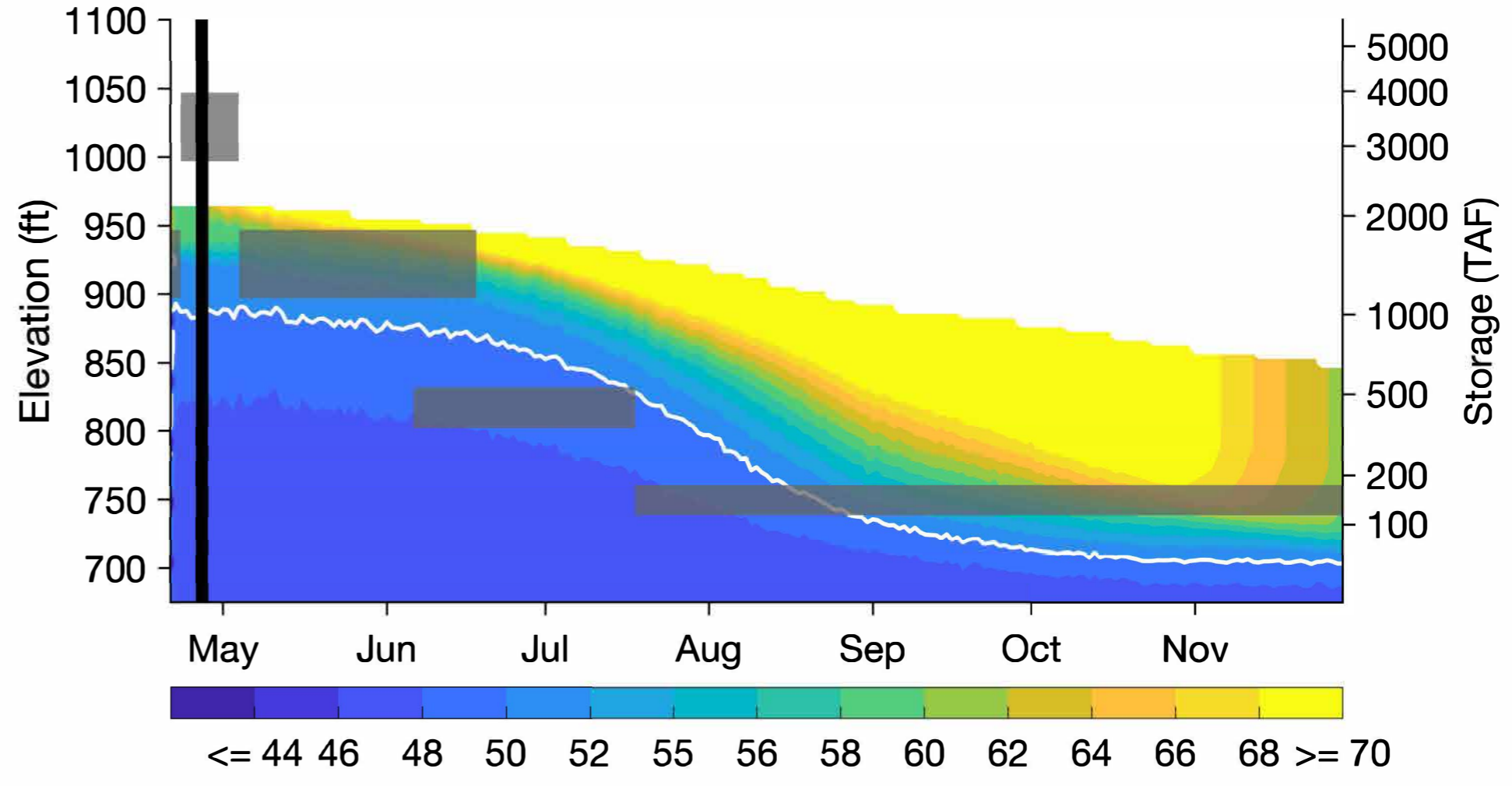
— Shasta Reservoir — Keswick Reservoir — CCR CCR Temperature Target

27-Apr-2021
Hindcast | Forecast

Flow Reduction = Transfer150
Center Date = Aug-08
Target Temperature = 54.5°F
Shoulder Temperature = 59°F
Window Length = 14weeks



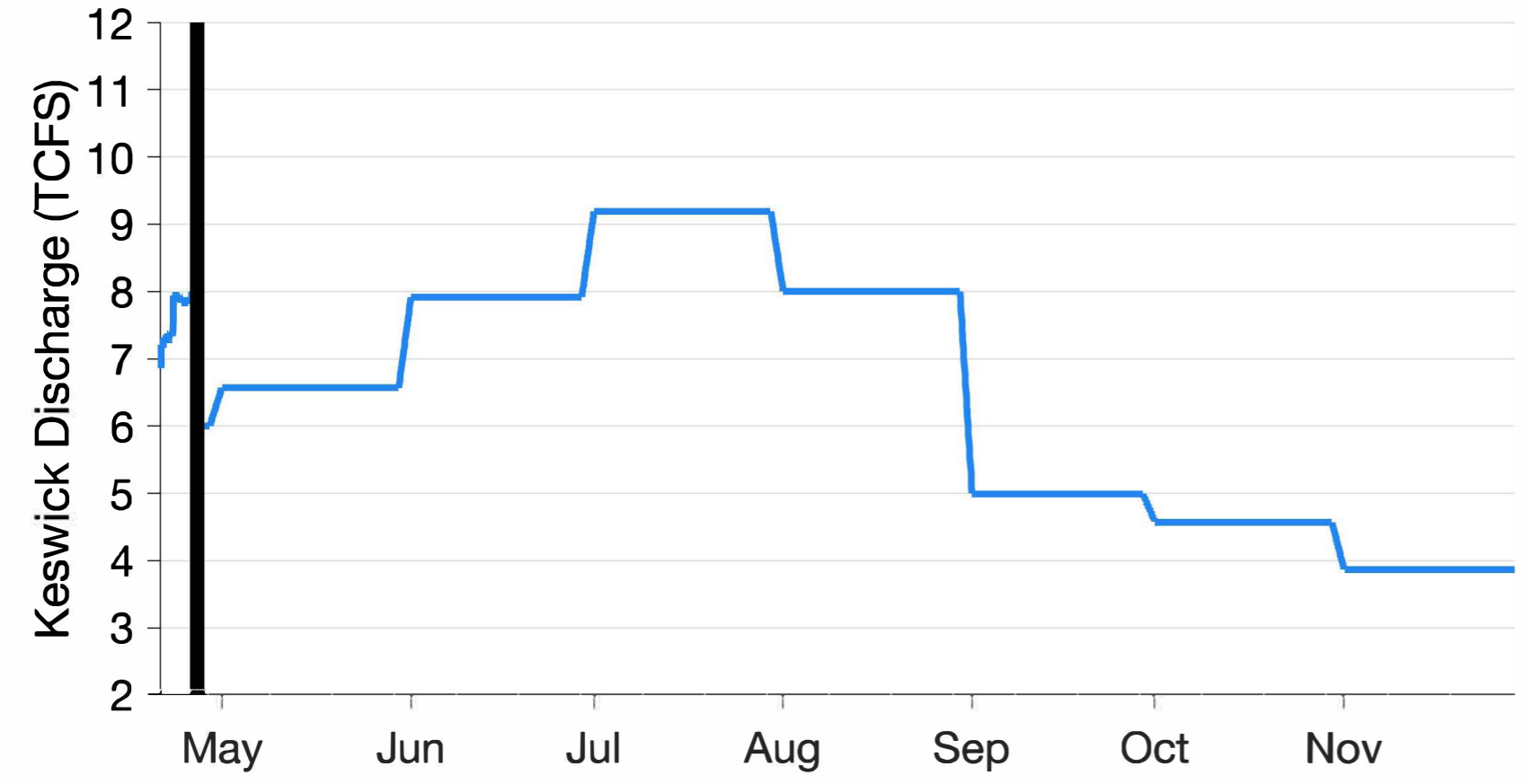
Mean annual TDM = 79%
Date first side gate = 18/Jul/2021
EOS storage = 0.99 MAF



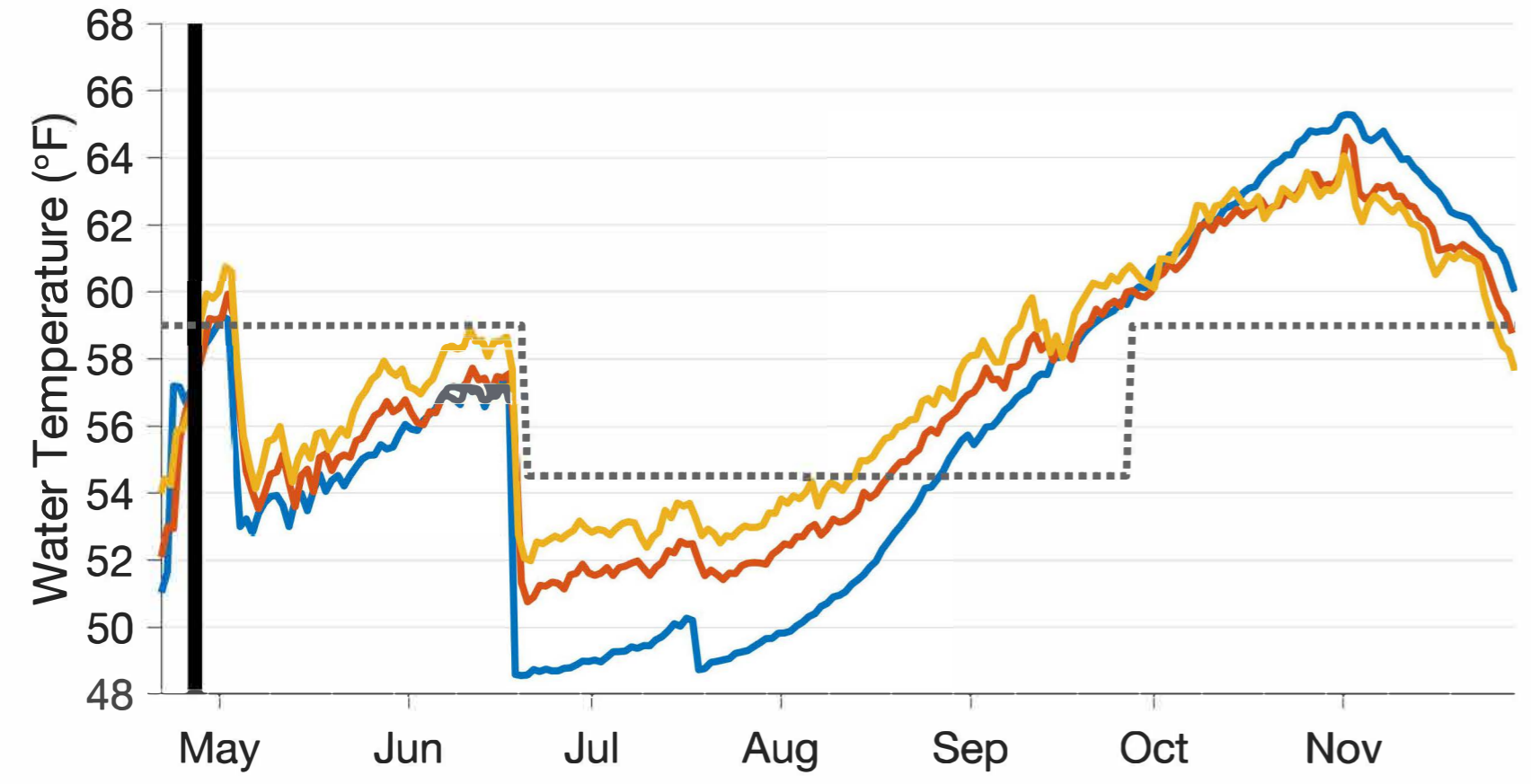
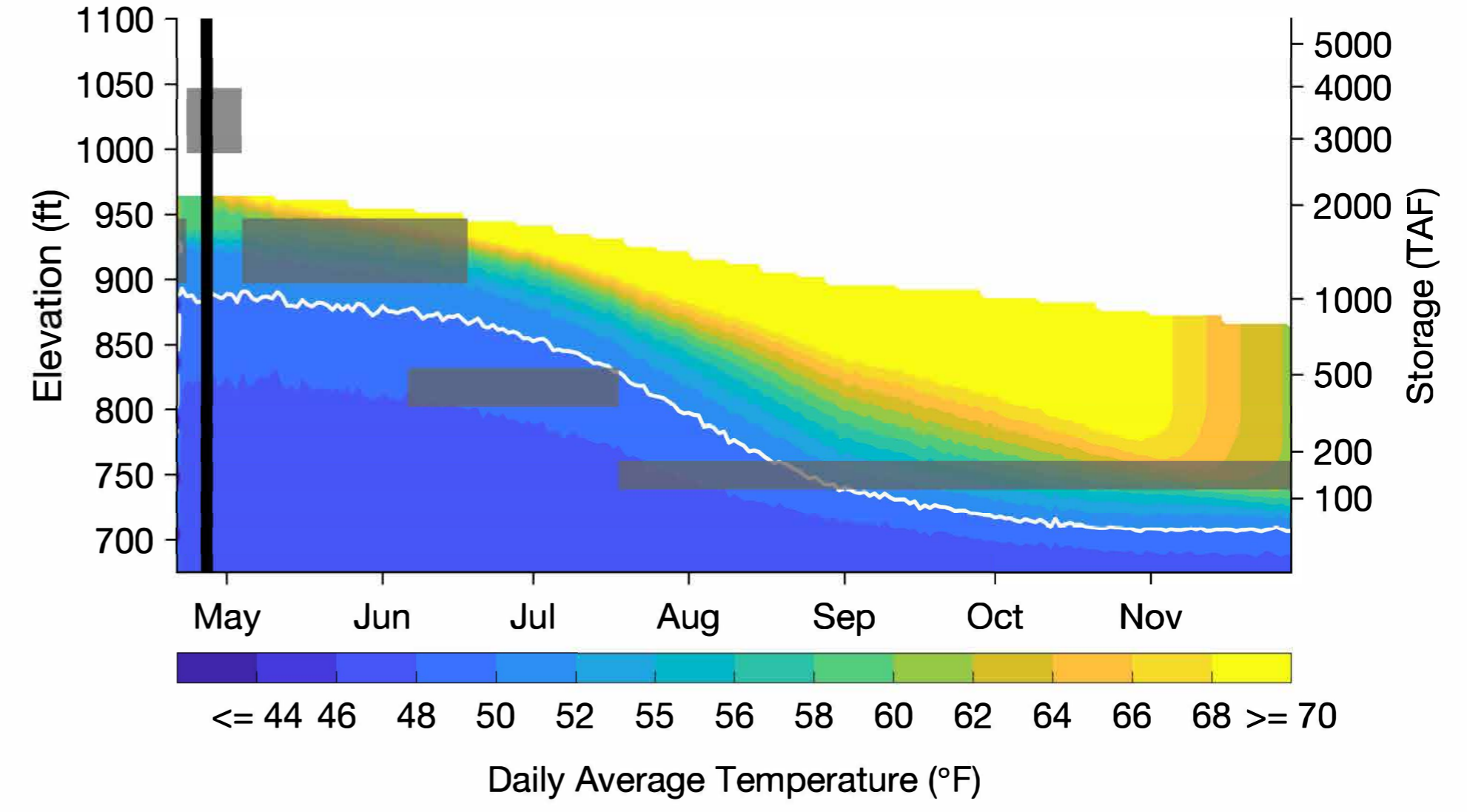
— Shasta Reservoir — Keswick Reservoir — CCR CCR Temperature Target

27-Apr-2021
Hindcast | Forecast

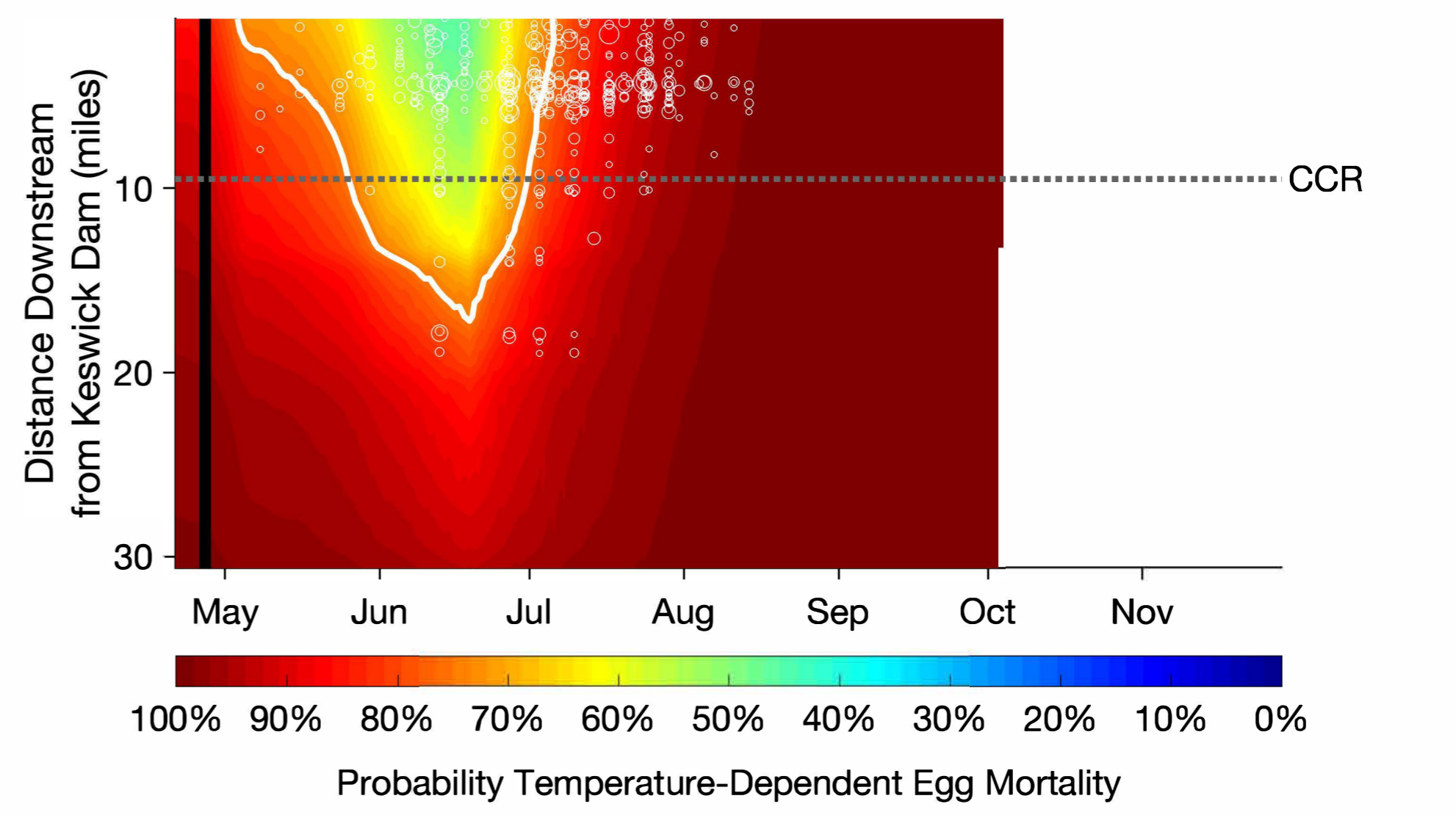
Flow Reduction = Retain150
Center Date = Aug-08
Target Temperature = 54.5°F
Shoulder Temperature = 59°F
Window Length = 14weeks



Mean annual TDM = 74%
Date first side gate = 18/Jul/2021
EOS storage = 1.1 MAF



— Shasta Reservoir — Keswick Reservoir — CCR CCR Temperature Target

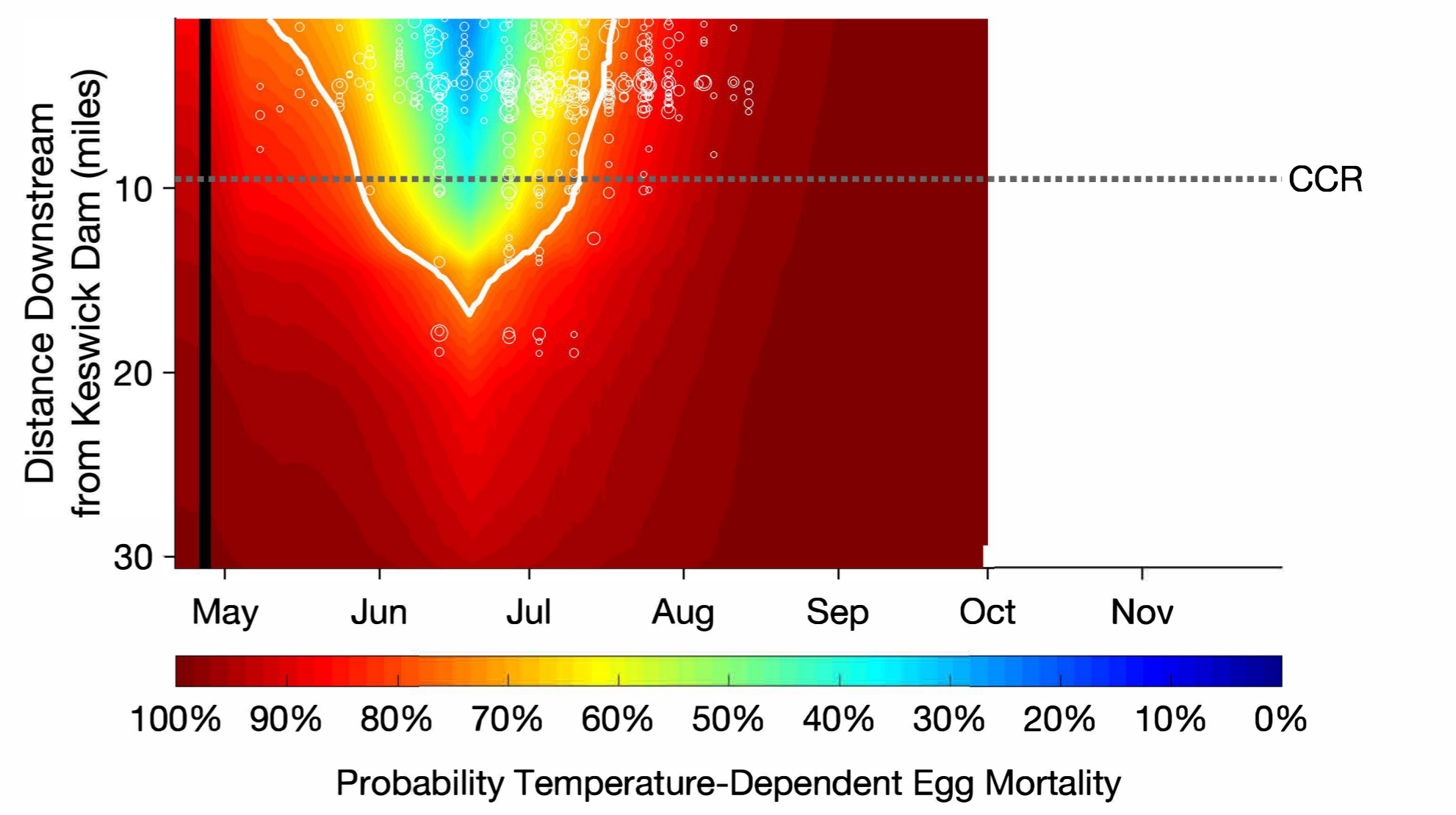
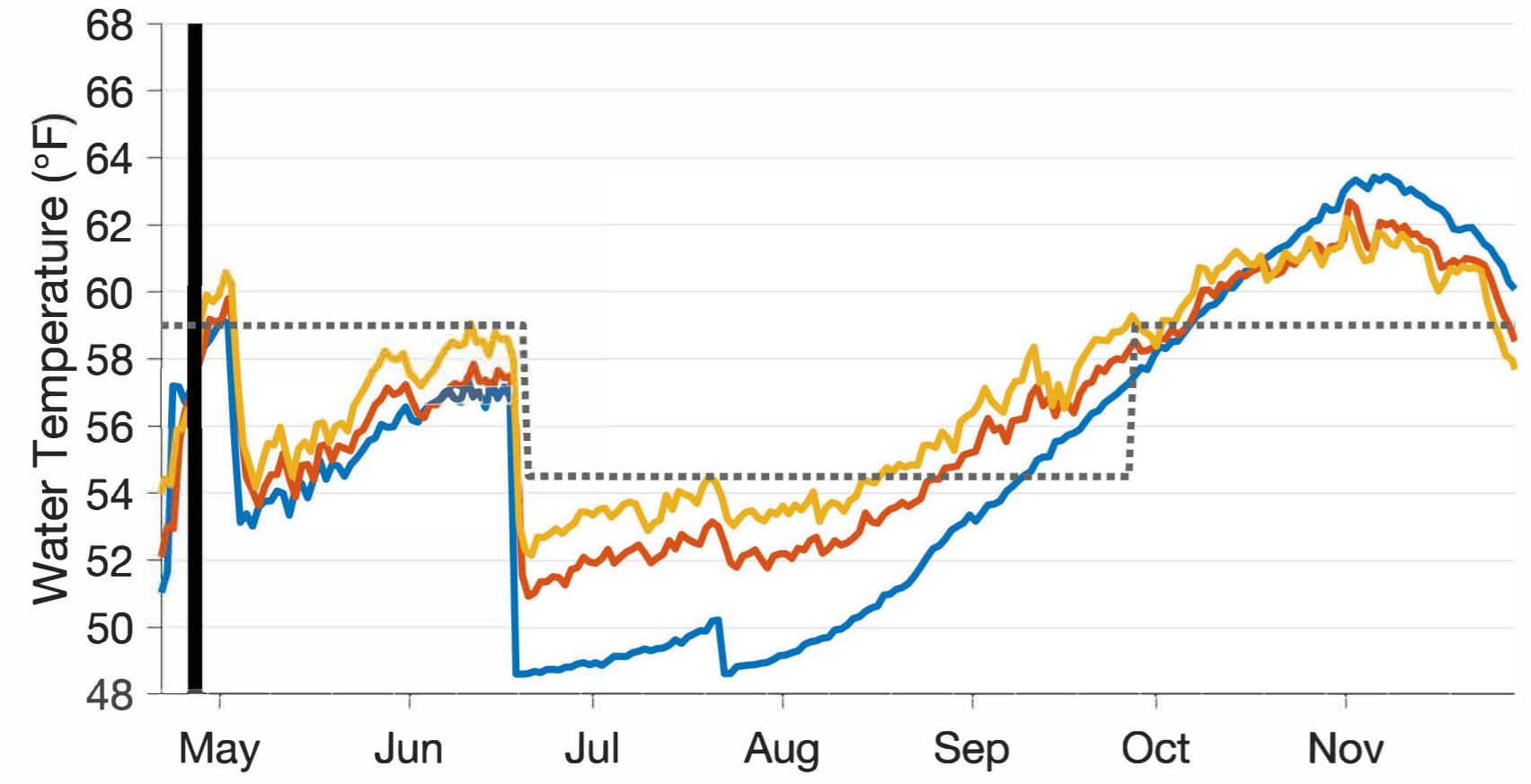
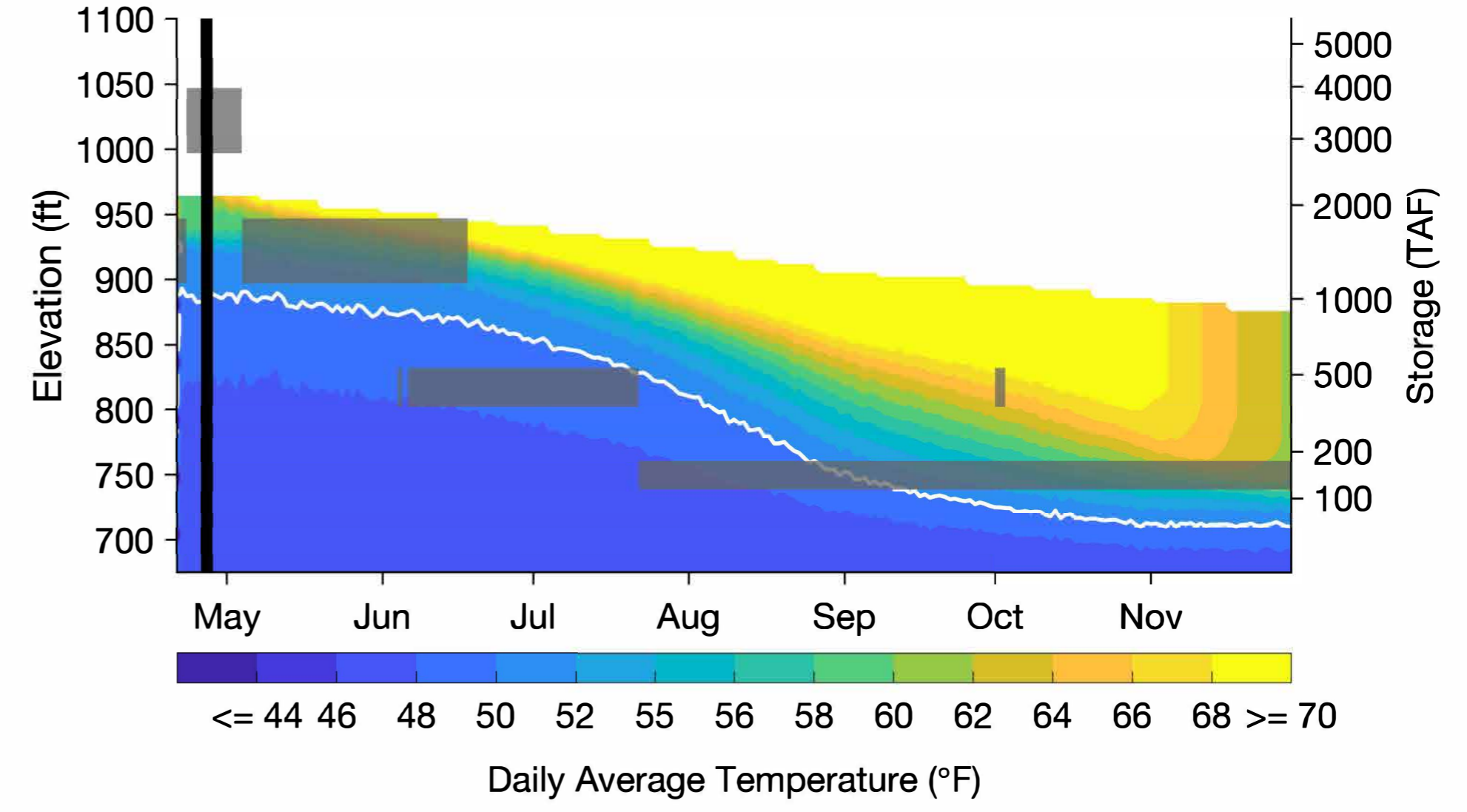


27-Apr-2021
Hindcast | Forecast

Flow Reduction = Flat7500
Center Date = Aug-08
Target Temperature = 54.5°F
Shoulder Temperature = 59°F
Window Length = 14weeks



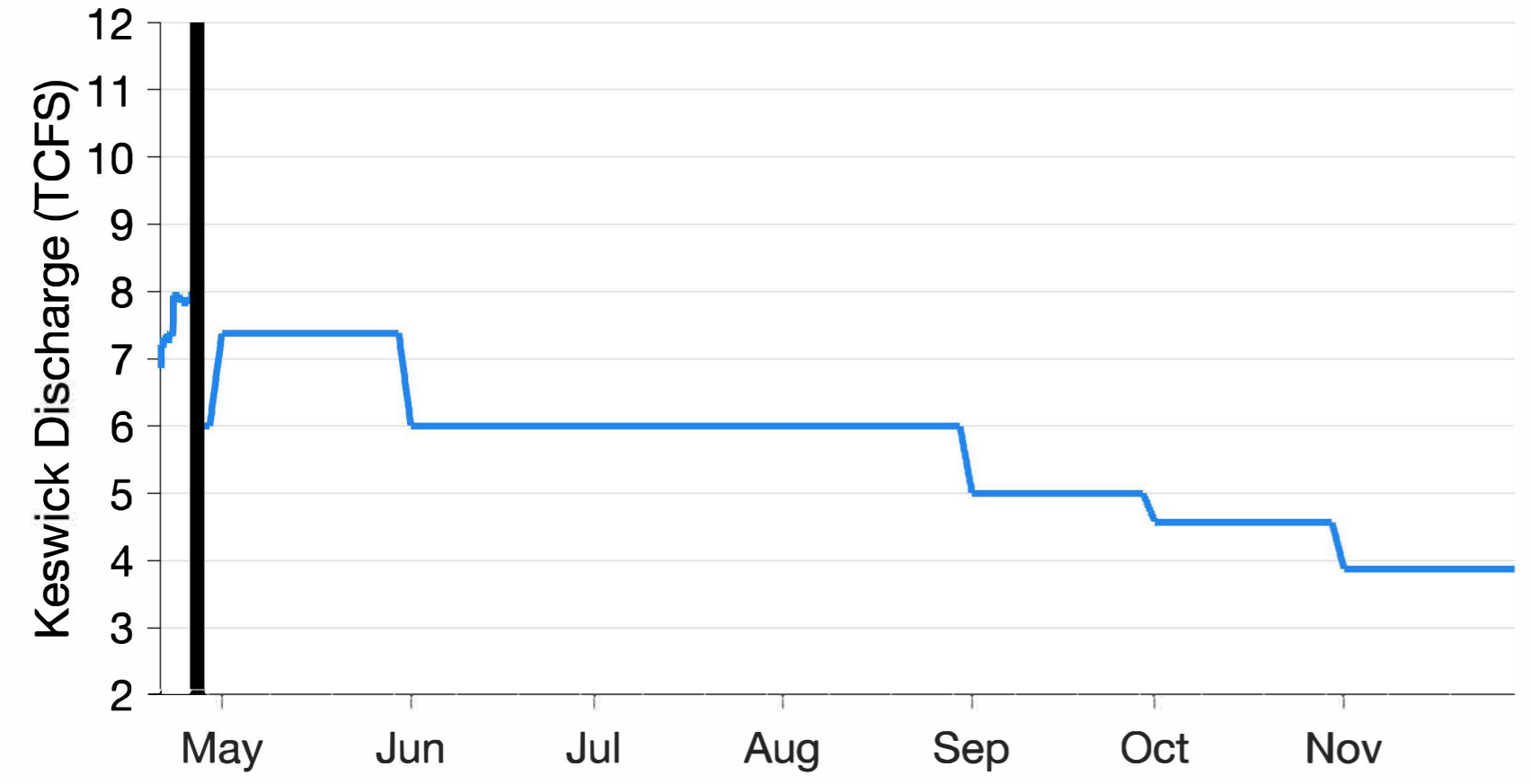
Mean annual TDM = 62%
Date first side gate = 22/Jul/2021
EOS storage = 1.2 MAF



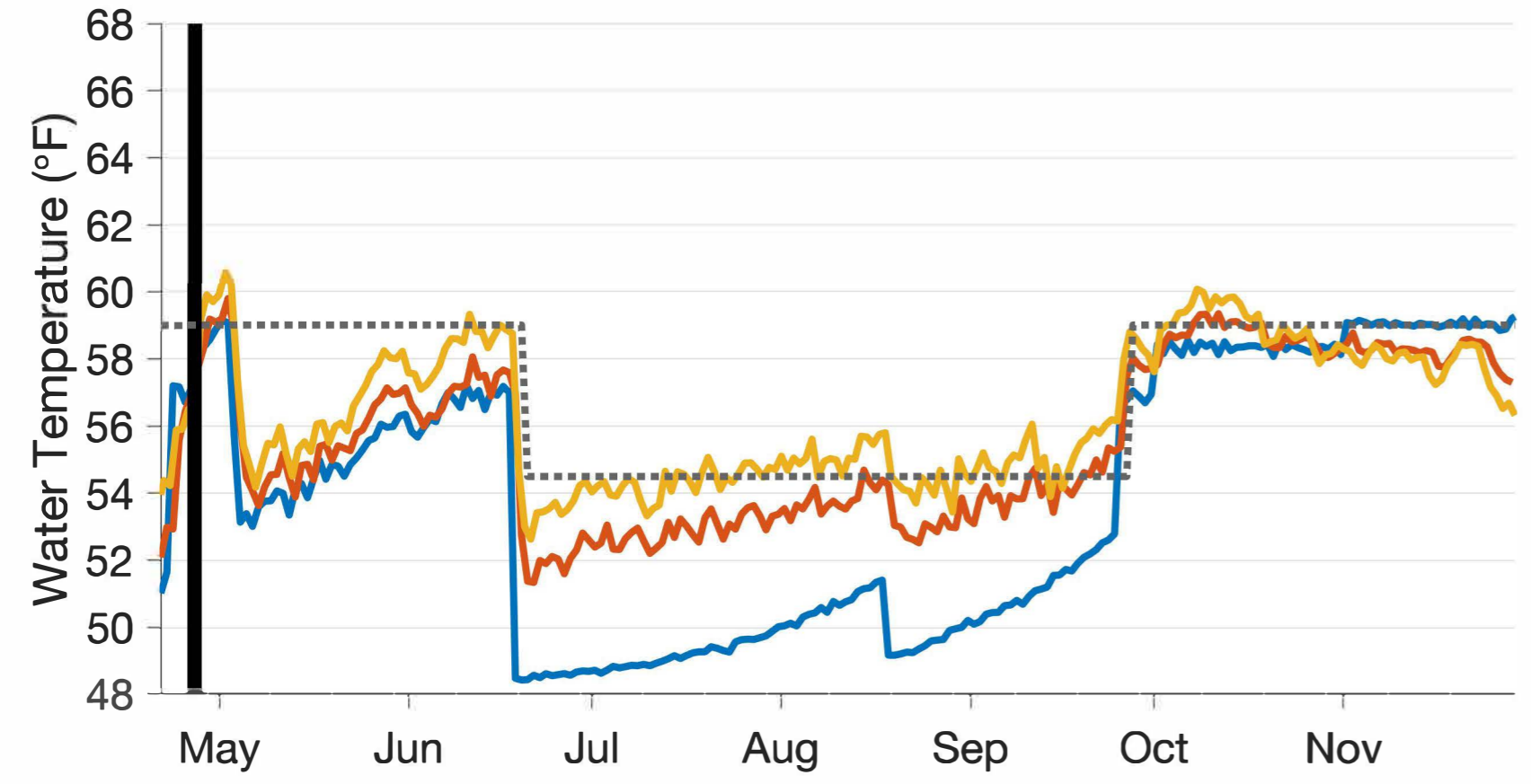
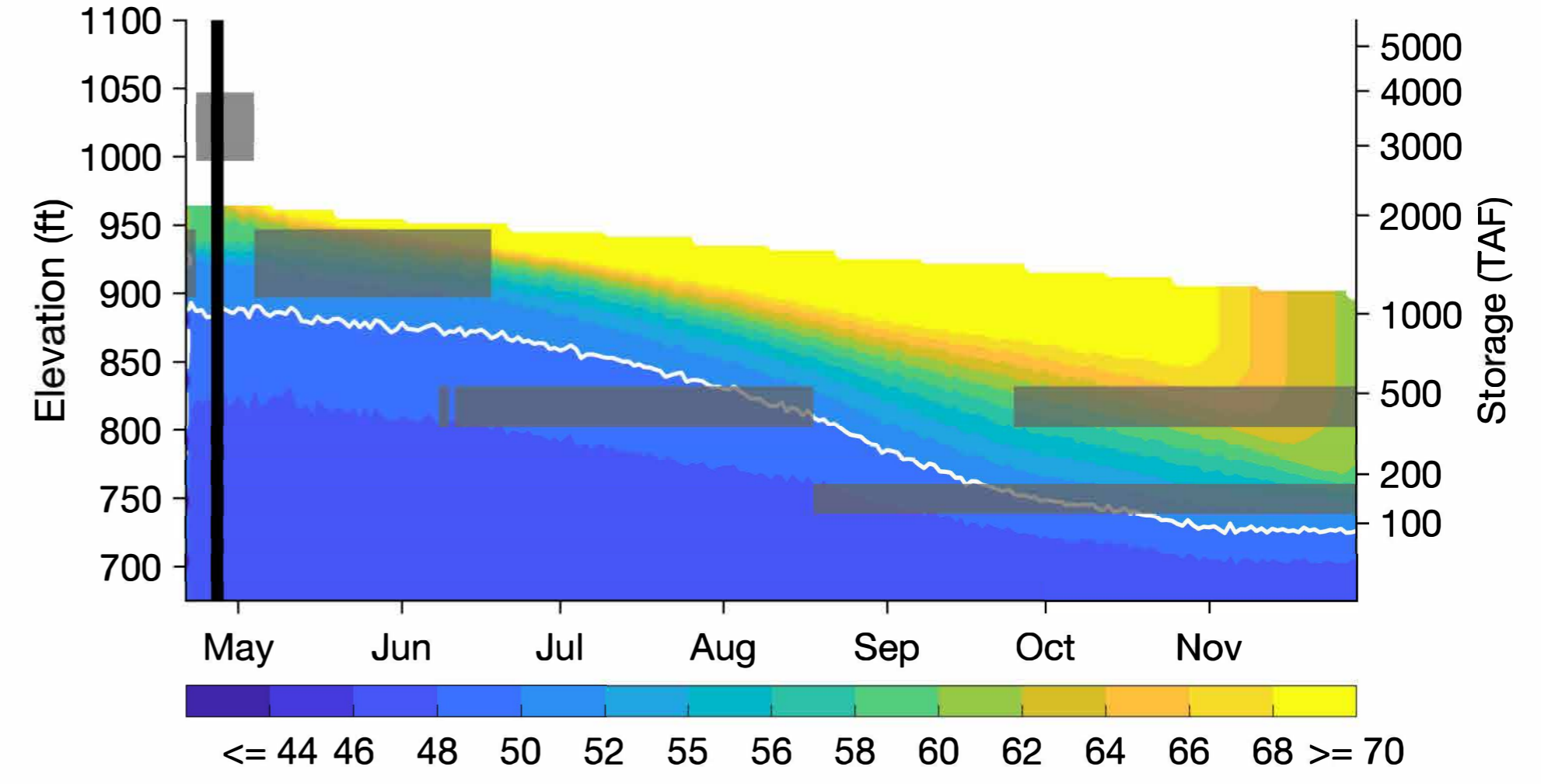
— Shasta Reservoir — Keswick Reservoir — CCR CCR Temperature Target

27-Apr-2021
Hindcast | Forecast

Flow Reduction = Flat6000
Center Date = Aug-08
Target Temperature = 54.5°F
Shoulder Temperature = 59°F
Window Length = 14weeks



Mean annual TDM = 50%
Date first side gate = 18/Aug/2021
EOS storage = 1.47 MAF



— Shasta Reservoir — Keswick Reservoir — CCR CCR Temperature Target

