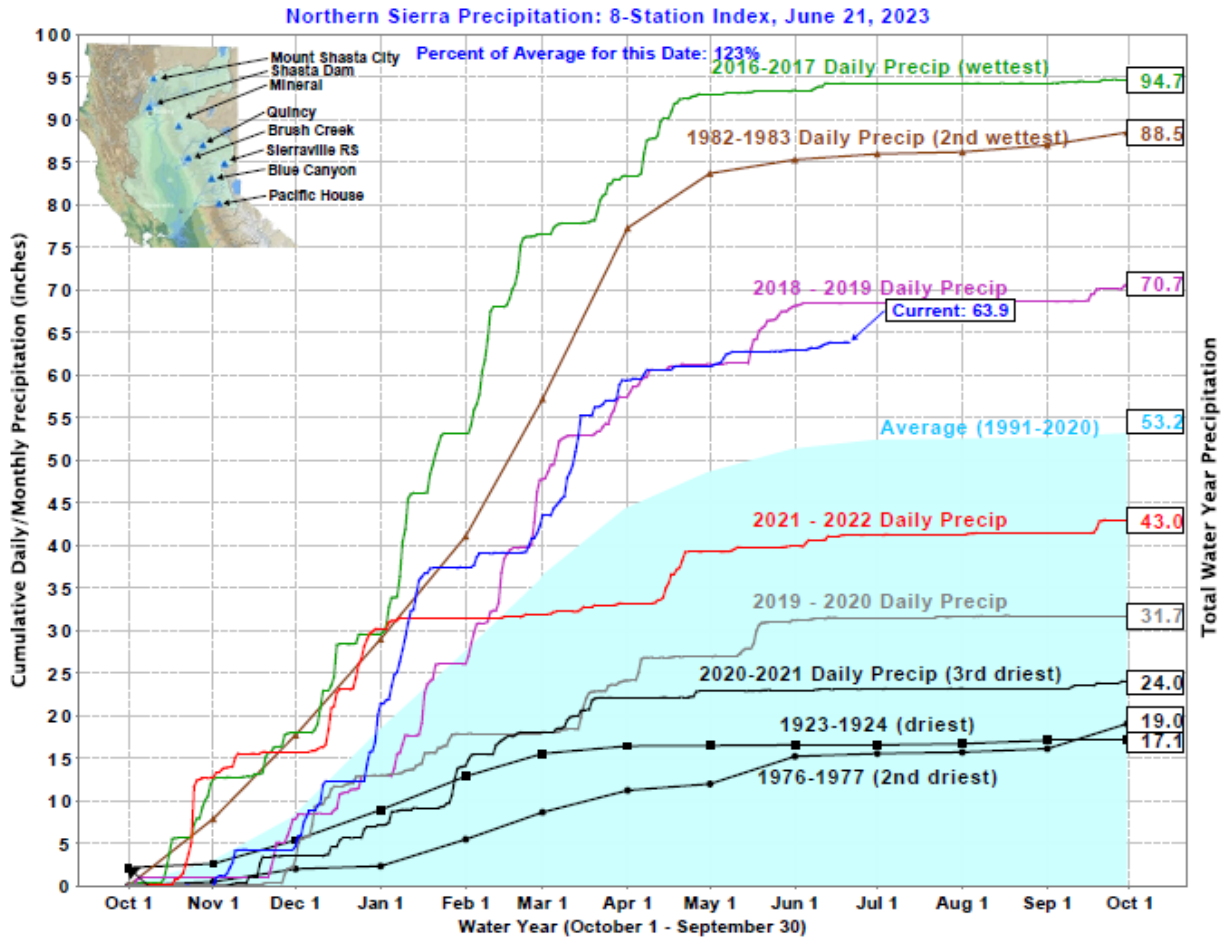




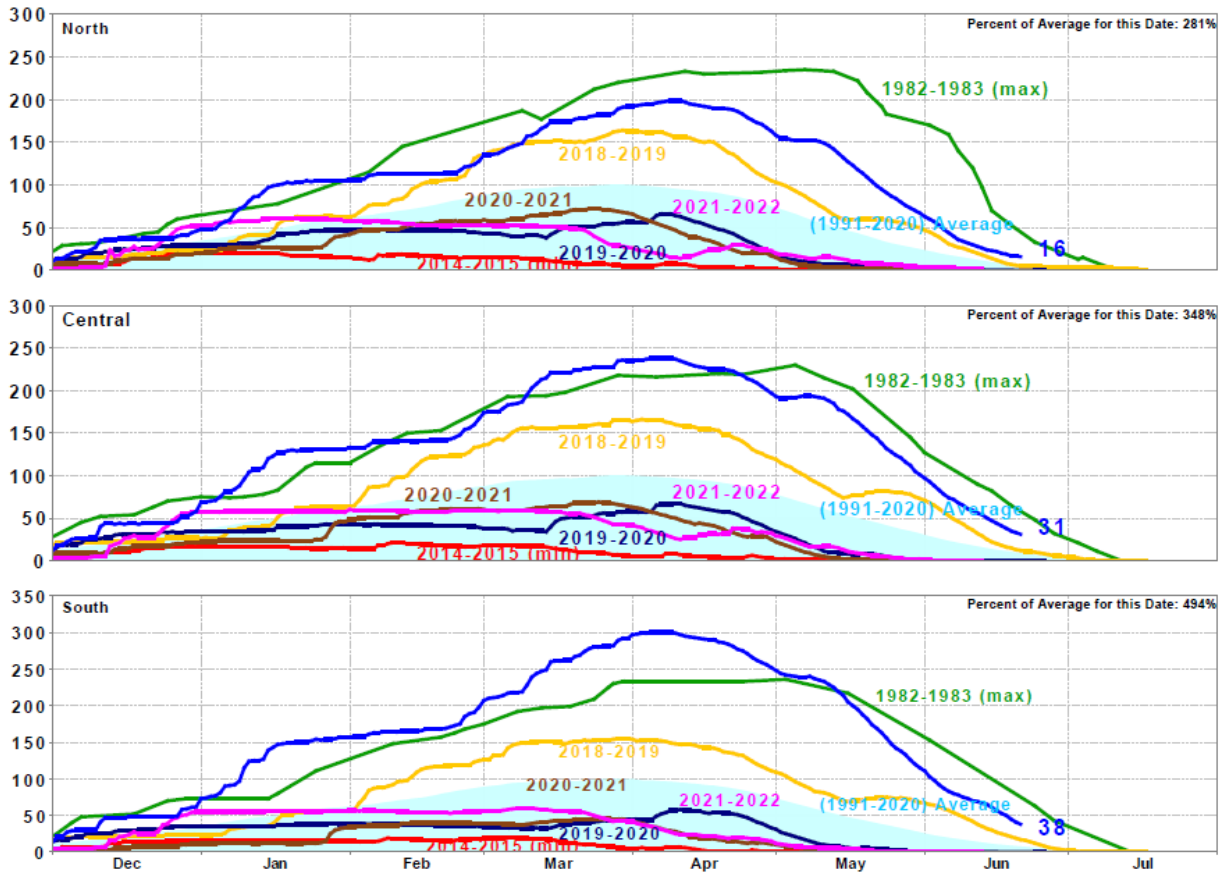
Sacramento River Temperature Task Group Meeting Packet

June 22, 2023



Northern Sierra Precipitation: 8-Station Index, June 21, 2023

California Snow Water Content, June 21, 2023, Percent of April 1 Average



Statewide Percent of April 1: 28%

Statewide Percent of Average for Date: 333%

California Snow Water Content, June 21, 2023, Percent of April 1 Average



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Daily Central Valley Project Water Supply Report

United States Department of the Interior
U.S. Bureau of Reclamation, Central Valley Project-California
Daily CVP Water Supply Report

June 20, 2023
Run Date: June 21, 2023

Table 1. Reservoir Releases in Cubic Feet Per Second

Reservoir	Dam	WY 2022	WY 2023	15-Year Median
Trinity	Lewiston	462	468	711
Sacramento	Keswick	3,883	8,994	10,256
Feather	Oroville (SWP)	3,500	3,500	3,300
American	Nimbus	2,260	5,089	3,328
Stanislaus	Goodwin	803	1,503	803
San Joaquin	Friant	1,643	3,029	410

Table 2. Storage in Major Reservoirs in Thousands of Acre-Feet

Reservoir	Capacity	15-Yr Avg	WY 2022	WY 2023	% O 15 Yr Avg
Trinity	2,448	1,626	726	1,410	87
Shasta	4,552	3,394	1,798	4,369	129
Folsom	977	777	853	925	119
New Melones	2,420	1,462	808	2,001	137
Fed. San Luis	966	477	291	964	202
Total North CVP	11,363	7,736	4,476	9,669	125
Millerton	521	396	361	404	102
Oroville (SWP)	3,538	2,507	1,809	3,536	141

Table 3. Accumulated Inflow for water Year to Date in Thousands of Acre-Feet

Reservoir	Current WY 2023	WY 1977	WY 1983	15-Yr Avg	% O 15 Yr Avg
Trinity	1,426	634	1,874	983	145
Shasta	4,903	2,851	8,141	4,131	119
Folsom	4,142	924	5,479	2,289	181
New Melones	1,929	NA	1,891	876	220
Millerton	3,091	574	2,232	1,212	255

Table 4. Accumulated Precipitation for Water Year to Date in Inches

Reservoir	Current WY 2023	WY 1977	WY 1983	Avg (N Yrs)	% of Avg	Last 24 Hours
Trinity at Fish Hatchery	36.28	21.79	38.73	29.65 (63)	122	0.00
Sacramento at Shasta Dam	72.21	32.94	83.71	58.08 (68)	124	0.00
American at Blue Canyon	77.92	NA	112.31	63.68 (49)	122	0.00
Stanislaus at New Melones	46.93	NA	36.55	26.59 (46)	176	0.00
San Joaquin at Huntington LK	65.94	11.50	65.40	39.62 (50)	166	0.00

Sacramento River Station Temperature Summary Report

Date	MDWT TCD ¹	MDWT SHD	MDWT SPP ¹	MDWT KWK	MDWT SAC ²	MDWT CCR	MDWT BSF	MDWT BND	MDWT RBD	MDWT IGO	MDWT LWS	MDWT DGC ³	MDWT NFH	MDR Shasta Genera- tion	MDR Spring Creek PP	MDR Keswick Total	MDAT RDD	MDAT BSF	MDAT RDB
May	51.1	49.7	49.5	50.9	51.2	51.7	53.8	55.5	55.3	52.9	48.8	49.7	51.7	9532	215	12119	69.1	66	66.6
1-Jun	50.6	48.7	50.8	50.4	51	51.8	55	57.8	59.9A	54.7	51.5	54.9	55.1	8249	37	10104	75.5	71.6	71
2-Jun	50.4	48.7	50.4	50.3	50.8	51.6	54.4	56.9	58.8	54.7	51.3	54.9	54.9	8271	37	10134	74.5	71.8	71.7
3-Jun	50.2	48.7	50.5	50.1	50.7	51.4	54.2	56.7	58.5A	55.1	51.4	54.7	55.9	8897	37	10059	79	76.2	74.8
4-Jun	50.4	48.7	50.1	50.2	50.8	51.6	54.5	57.2	58.9A	55.5	51.8	54.7	56.8	8104	166	10006	83	80	78.7
5-Jun	50.6	48.8A	51	50.2	50.6	51.2	53.8	56.6	58.8	54.2	51.7	54.9	56.6	8182	14	10054	83	76.3	79.8
6-Jun	50.7	48.9	51.1	50.1	50.7	51.4	53.8	55.8	57.4	55.3	51.8	55.3	56.6	7639	24	9111	73.5	69.2	68.9
7-Jun	50.7	48.9	50.7	50.3	51	51.7	54.7	57	58.7	55.2	52.3	55.6	56.3	7795	39	9048	73.5	69.4	68.2
8-Jun	50.2	48.6	50.6	50.4	51.1	51.9	55.1	57.5	59.6	55.3	52.5	55.9	57.7	7319	37	9070	75.5	71.5	70.9
9-Jun	50.7	48.9	50.6	50.3	51	51.9	55.1	57.7	59.7	56.4	53	56.3	57.4	7416	37	9036	76.5	72.7	71.7
10-Jun	50.8	48.7A	50.7	51	51.6	52.3	55	57.4	59.6	55.5	53	56.6	57.5	6935	37	9052	78	72.5	73
11-Jun	50.3	48.9A	50.7	50.8	51.5	52.4	55.3	57.8	59.8	56.1	53.2	57	58.9	7791	37	9057	79.5	74.7	75.8
12-Jun	50.5	49A	50.5	50.7	51.4	52.4	55.7	58.1	60.1	56.1	53.6	57.2	59.6	7787	57	9076	75.5	71.6	70.9
13-Jun	50.9	49.2A	50.7	50.7	51.5	52.3	55.6	58.3	60.6	55.9	54.1	57.7	60	7256	46	8982	78.5	74	73.3
14-Jun	51	49.3	50.8	51	51.6	52.4	55.4	58.1	60.3	55.5	54.4	58.1	60.1	7713	37	8999	81	77.9	77
15-Jun	50.6	48.8A	50.7	51	51.7	52.6	55.4	57.9	59.8	54.5	54.8	58.5	60.4	7890	38	8962	83.5	78	79.8
16-Jun	50.4	49.2A	50.8	50.8	51.6	52.5	55.5	57.9	59.9	53	55	58.8	61.1	9018	37	8992	87.5	82.8	84.5
17-Jun	50.8	49A	50.8	50.7	51.4	52.2	55.2	57.8	60.1	52.1	55.3	59.1	61.7	8891	37	8992	80.5	75.5	76
18-Jun	50.8	48.6A	51	51	51.7	52.5	55	57.5	59.6	51.8	55.5	59.5	60.6	7140	37	8970	76	73.8	76.4
19-Jun	50.7	49.3A	50.9	50.8	51.4	52.1	54.5	56.5	58.3A	51.1	55.5	59.8	58.5	8845	37	8991	66.5	64.3	63.5
Jun	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6
														Total CFS	151138	828	176695		
														Total AF	299776	1642	350467		

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.

Estimated CVP Operations 90% Exceedance

Storages – Federal End of the Month Storage/Elevation (TAF/Feet)

Facility	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Trinity	1269	1441	1416	1336	1250	1236	1232	1253	1261	1279	1337	1412	1365
Trinity Elev.	N/A	2298	2296	2289	2281	2280	2279	2281	2282	2284	2289	2296	2292
Whiskeytown	235	238	238	238	238	206	206	206	206	206	206	238	238
Whiskeytown Elev	N/A	1209	1209	1209	1209	1199	1199	1199	1199	1199	1199	1209	1209
Shasta	4458	4230	3869	3527	3350	3216	3165	3177	3216	3391	3666	3743	3555
Shasta Elev.	N/A	1056	1043	1030	1023	1017	1015	1015	1017	1024	1035	1038	1031

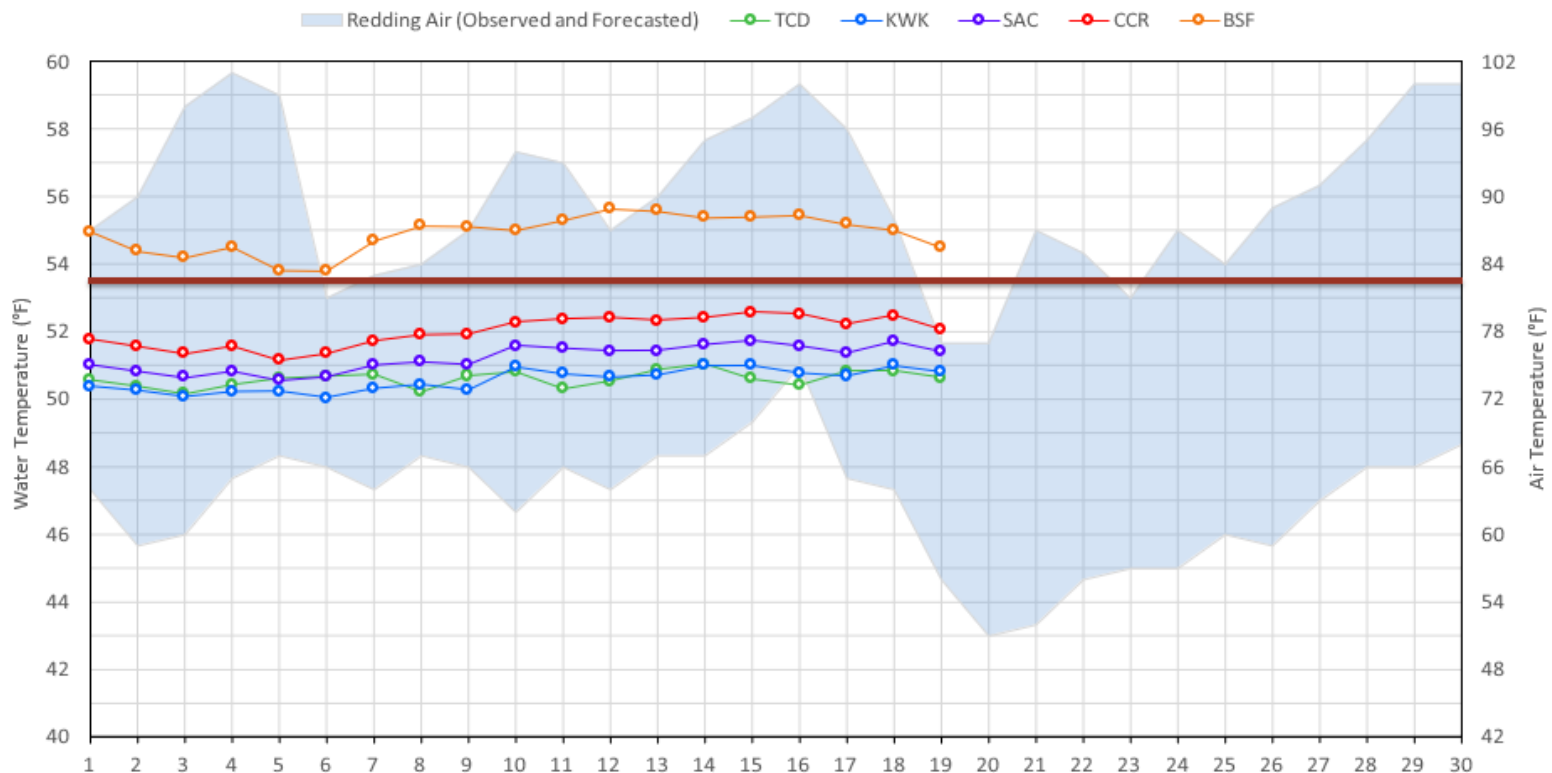
Monthly River Releases (TAF/cfs)

Facility	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Trinity (TAF)	38	28	53	52	23	18	18	18	17	18	32	180
Trinity (cfs)	639	450	857	870	373	300	300	300	300	300	540	2,924
Clear Creek (TAF)	14	9	9	9	12	12	12	12	11	22	12	18
Clear Creek (cfs)	242	150	150	150	200	200	200	200	200	363	200	291
Sacramento (TAF)	535	615	553	387	369	297	307	277	222	246	363	515
Sacramento (cfs)	9,000	10,000	9,000	6,500	6,000	5,000	5,000	4,500	4,000	4,000	6,104	8,383

Trinity Diversions (TAF)

Diversion Facility	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Carr PP	4	39	40	39	0	6	1	5	20	9	29	12
Spring Creek PP	0	30	30	30	22	0	1	0	20	6	0	0

Sacramento River Mean Daily Temperatures



Sacramento River Mean Daily Temperatures

Station Details

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

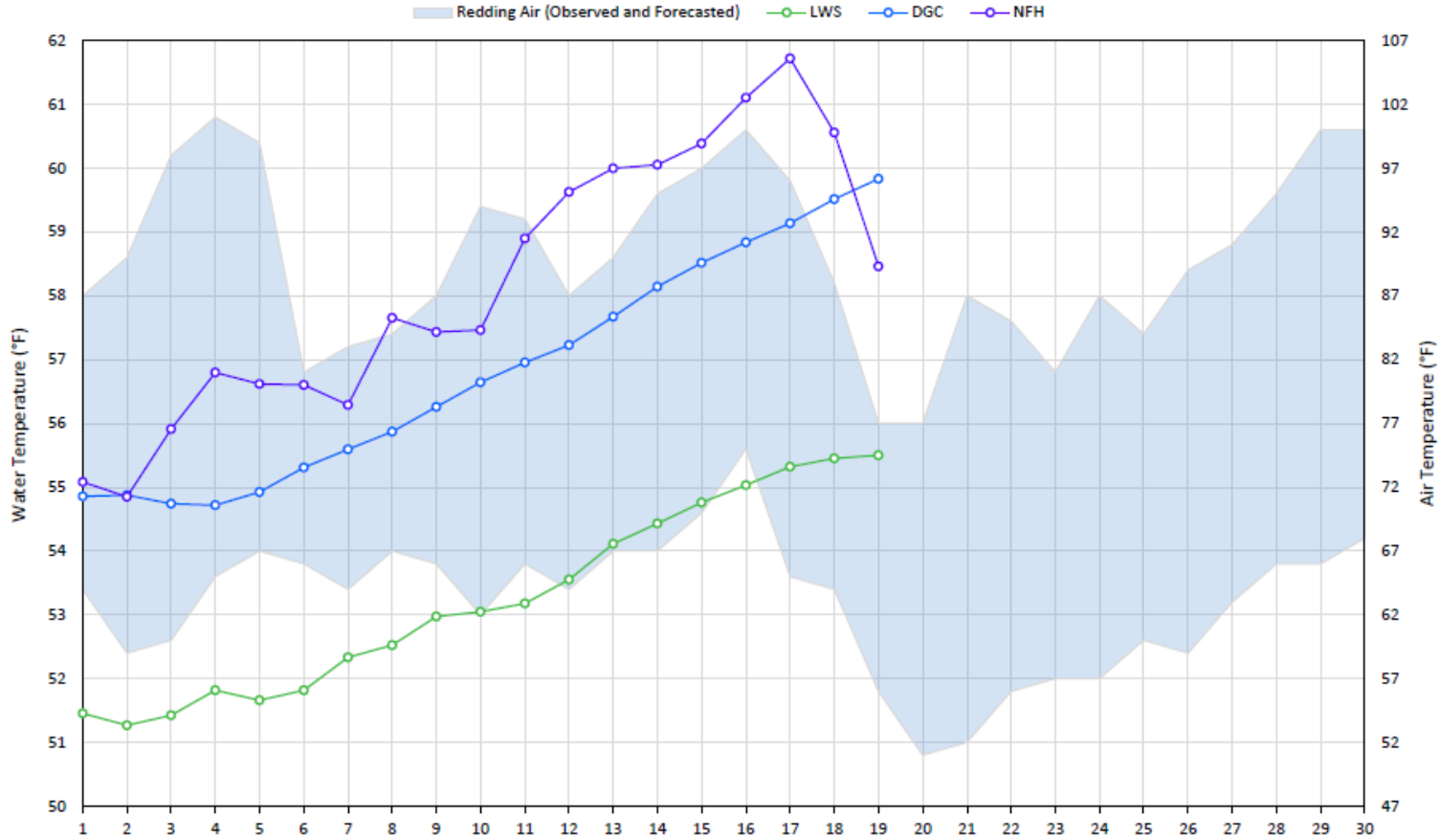
Water Right Temperature Control Points

River	Point	Temp. (°F)	Begin Date	End Date
Sacramento	SAC	54.5	06/07/2022	05/14/2023
Sacramento	CCR	53.5	05/14/2023	TBD

Notes

¹ Distances are approximate

Trinity River Mean Daily Temperatures



Trinity River Mean Daily Temperatures

Station Details

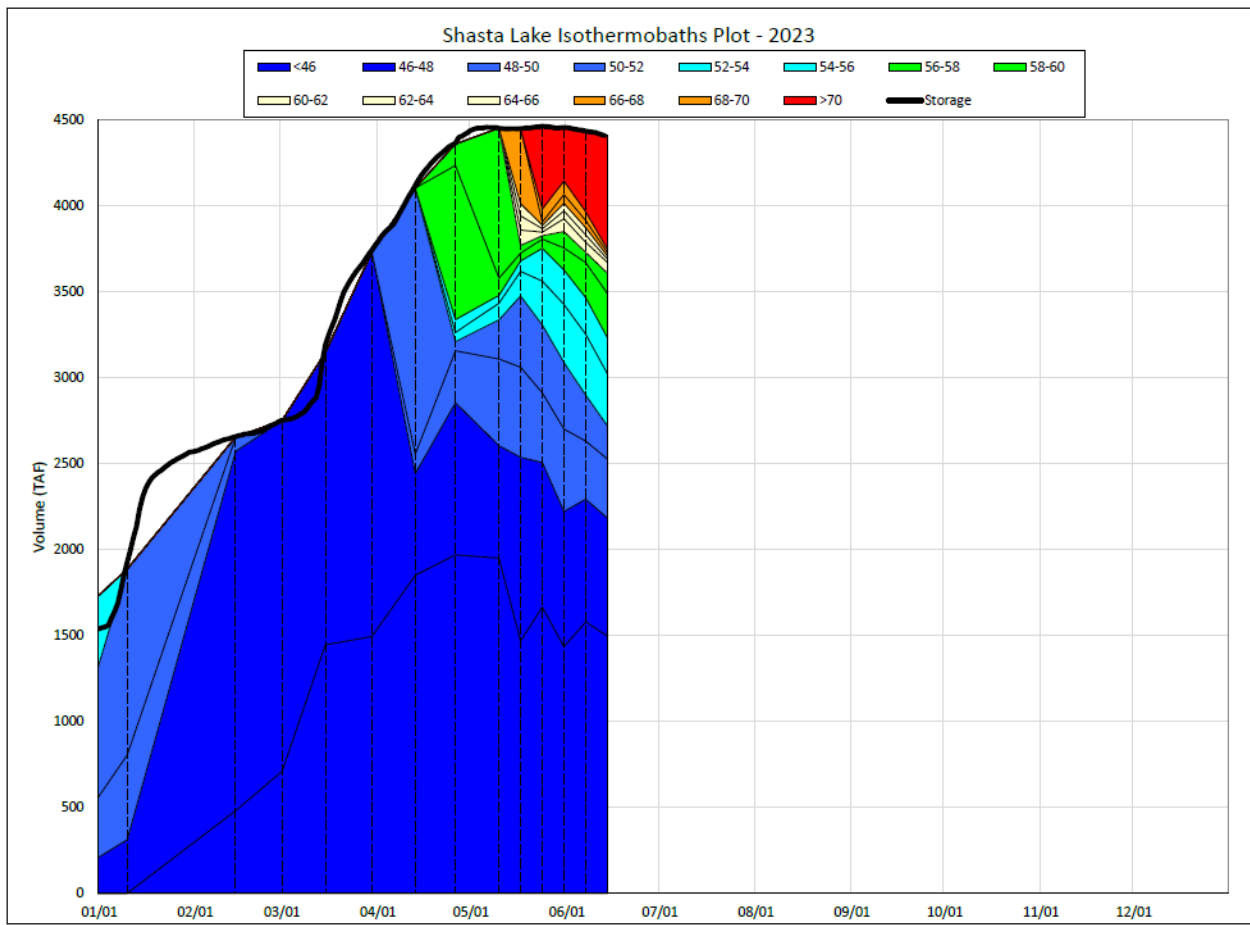
Code	Body of Water	Location ¹
LWS	Trinity River	1.1 miles downstream of Lewiston Dam
DGC	Trinity River	19 miles downstream of Lewiston Dam
NFH	Trinity River	38 miles downstream of Lewiston Dam

Water Right Temperature Control Points

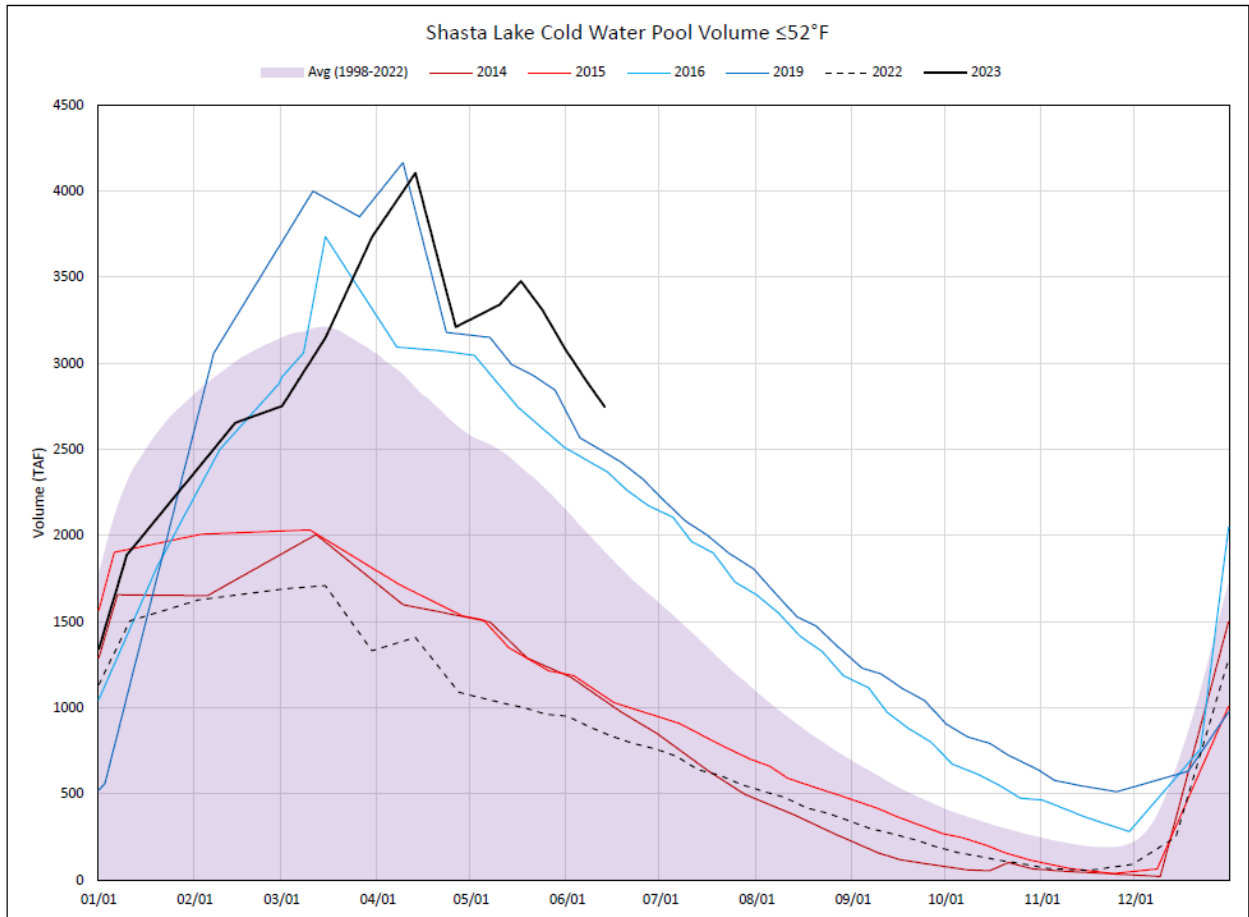
River	Point	Temp. (°F)	Begin Date	End Date
Trinity	DGC	56	Sep-15	Oct-01
Trinity	NFH	56	Oct-01	Dec-31

Notes

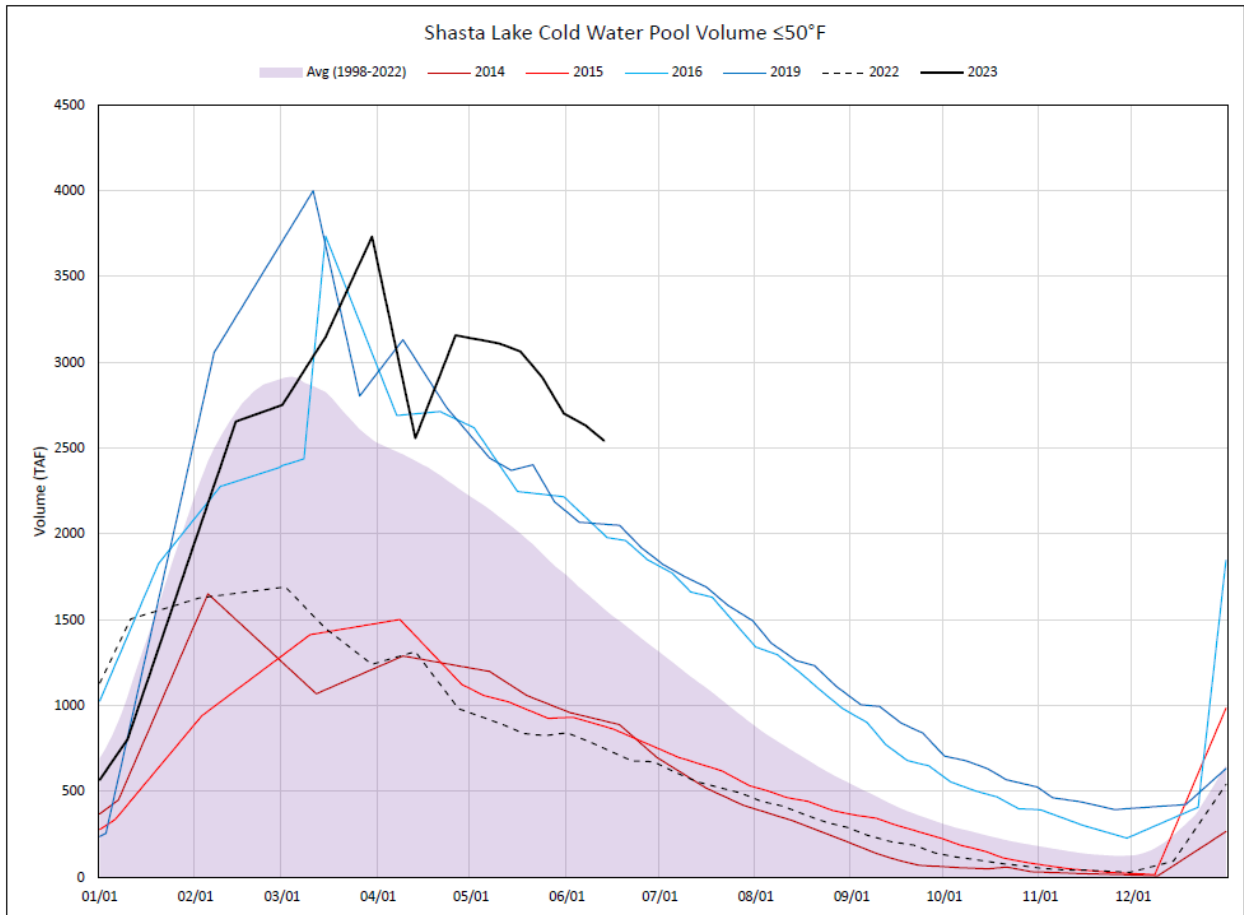
¹ Distances are approximate



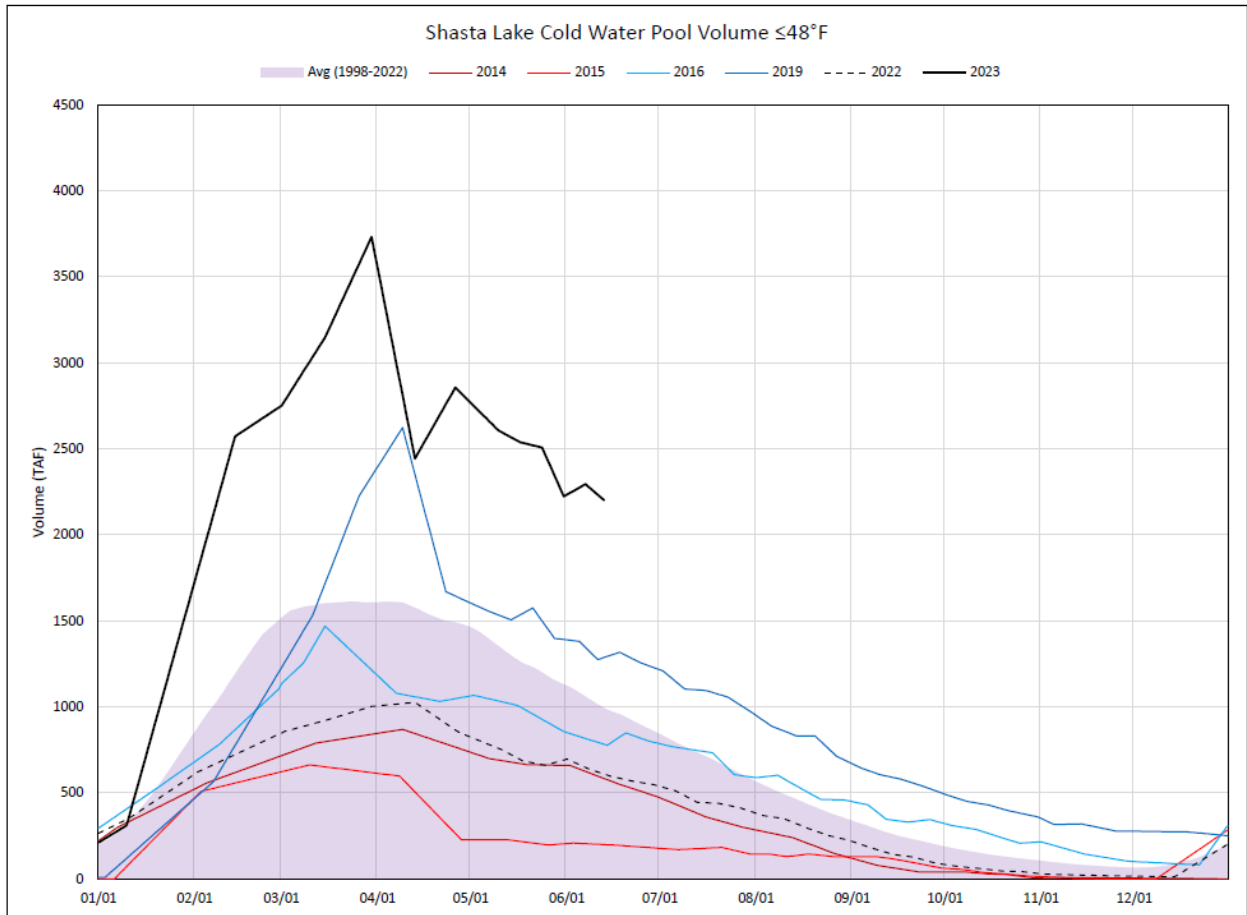
Shasta Lake Isothermobaths Plot - 2023



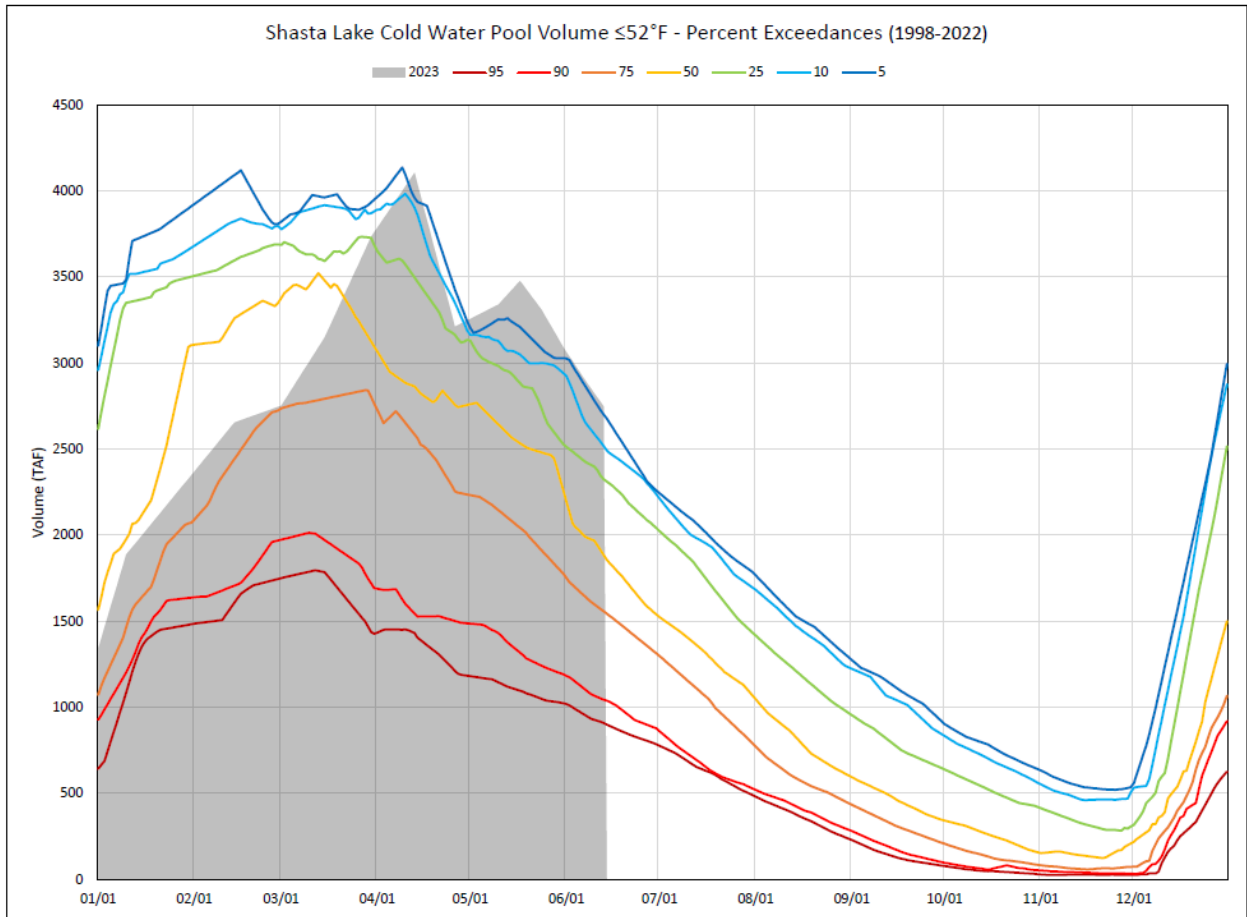
Shasta Lake Cold Water Pool Volume $\leq 52^{\circ}\text{F}$



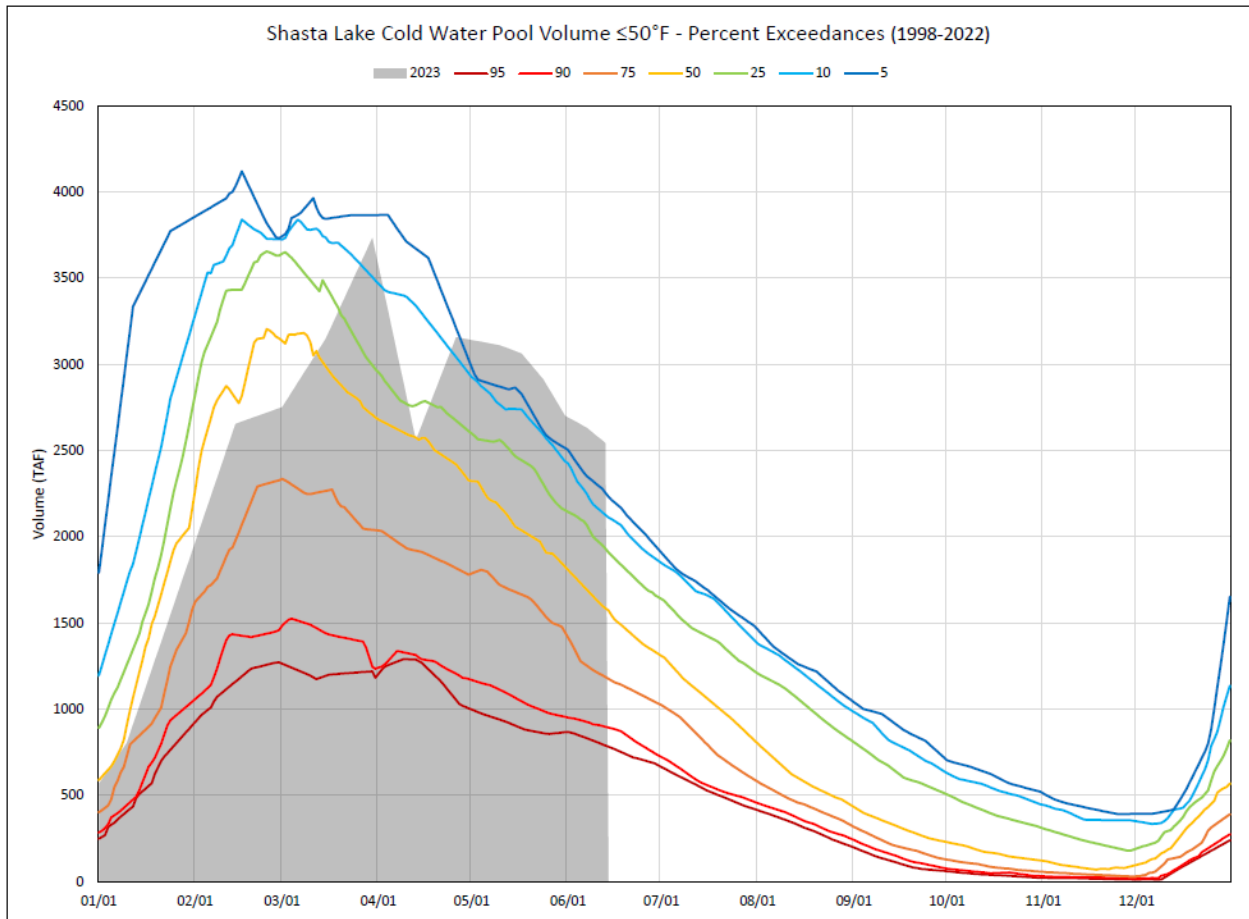
Shasta Lake Cold Water Pool Volume ≤50°F



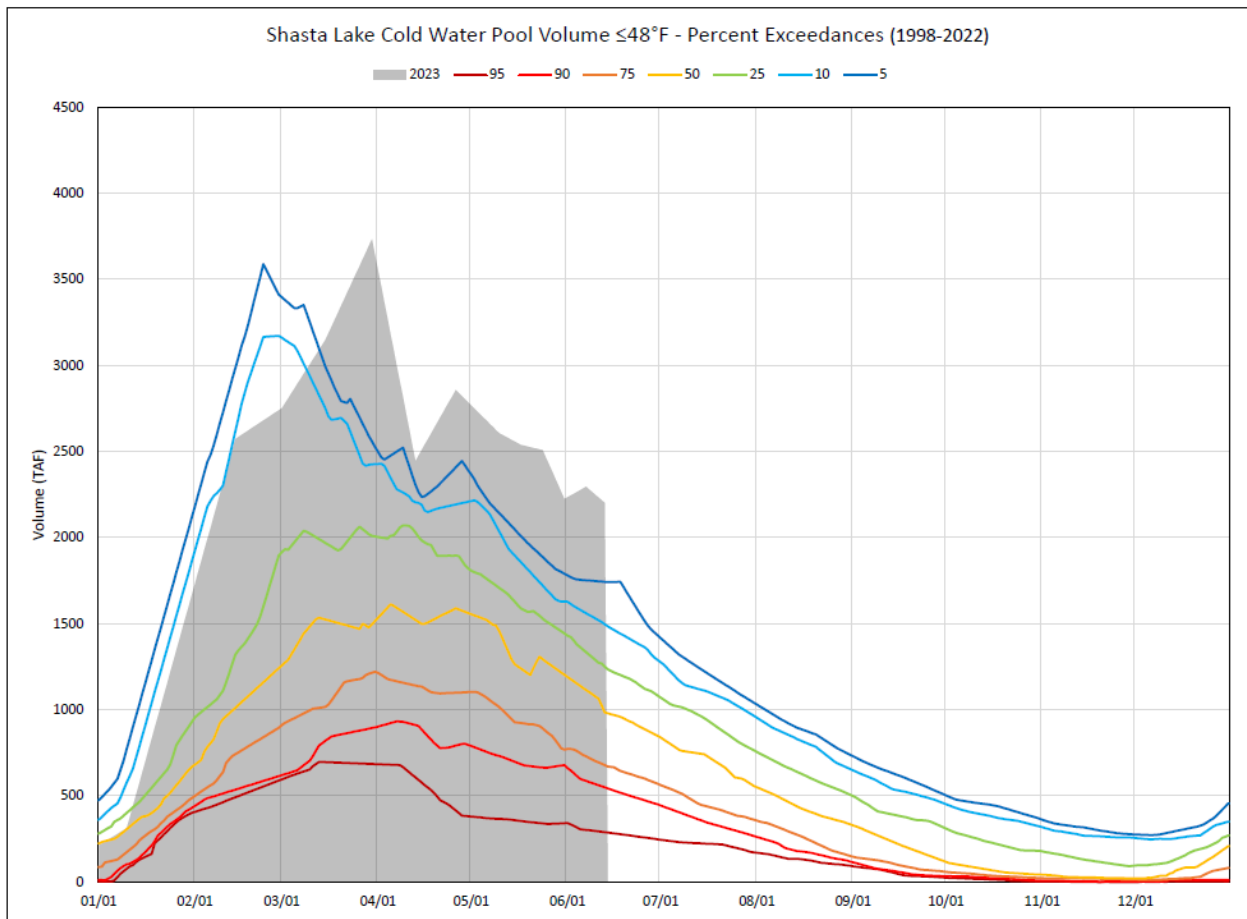
Shasta Lake Cold Water Pool Volume ≤48°F



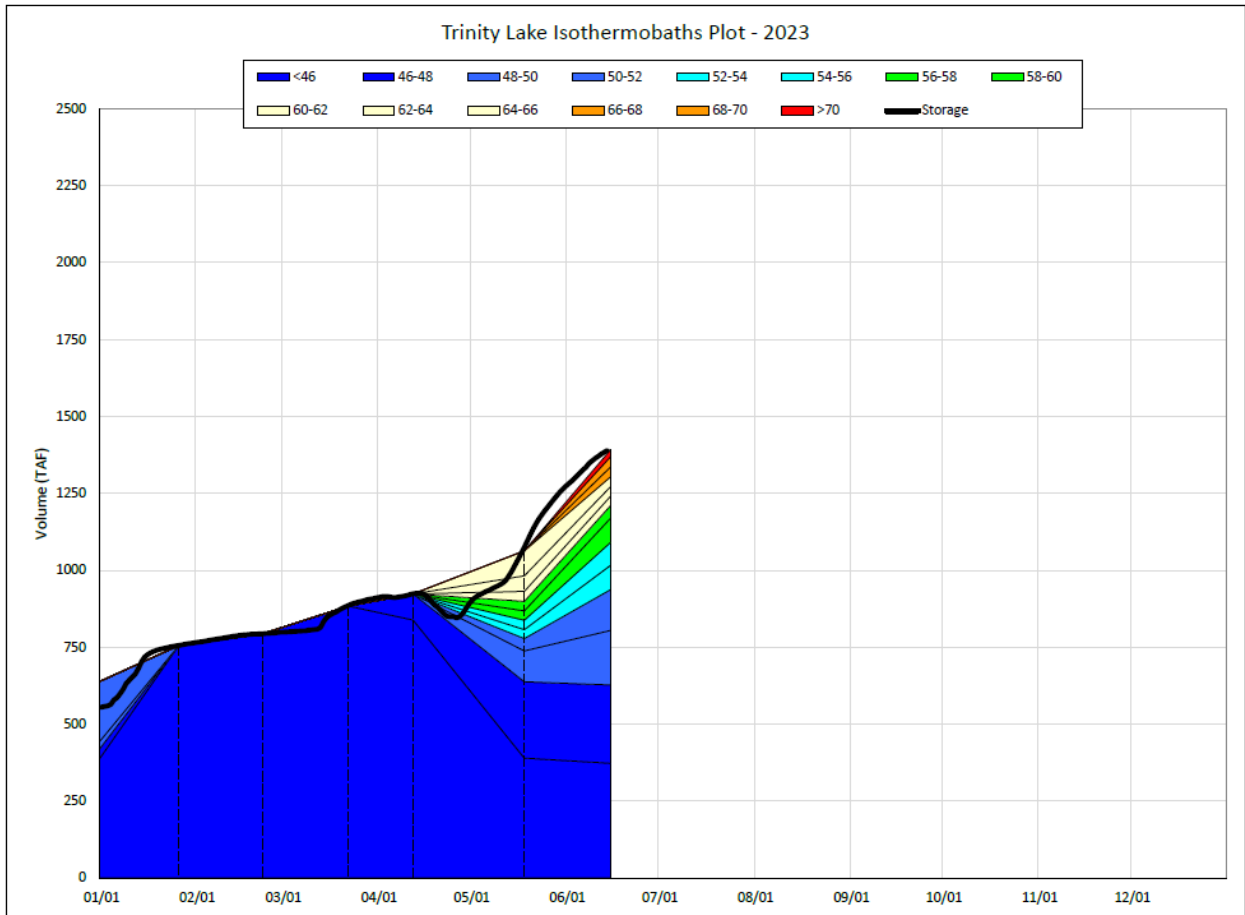
Shasta Lake Cold Water Pool Volume ≤52°F – Percent Exceedances (1998-2022)



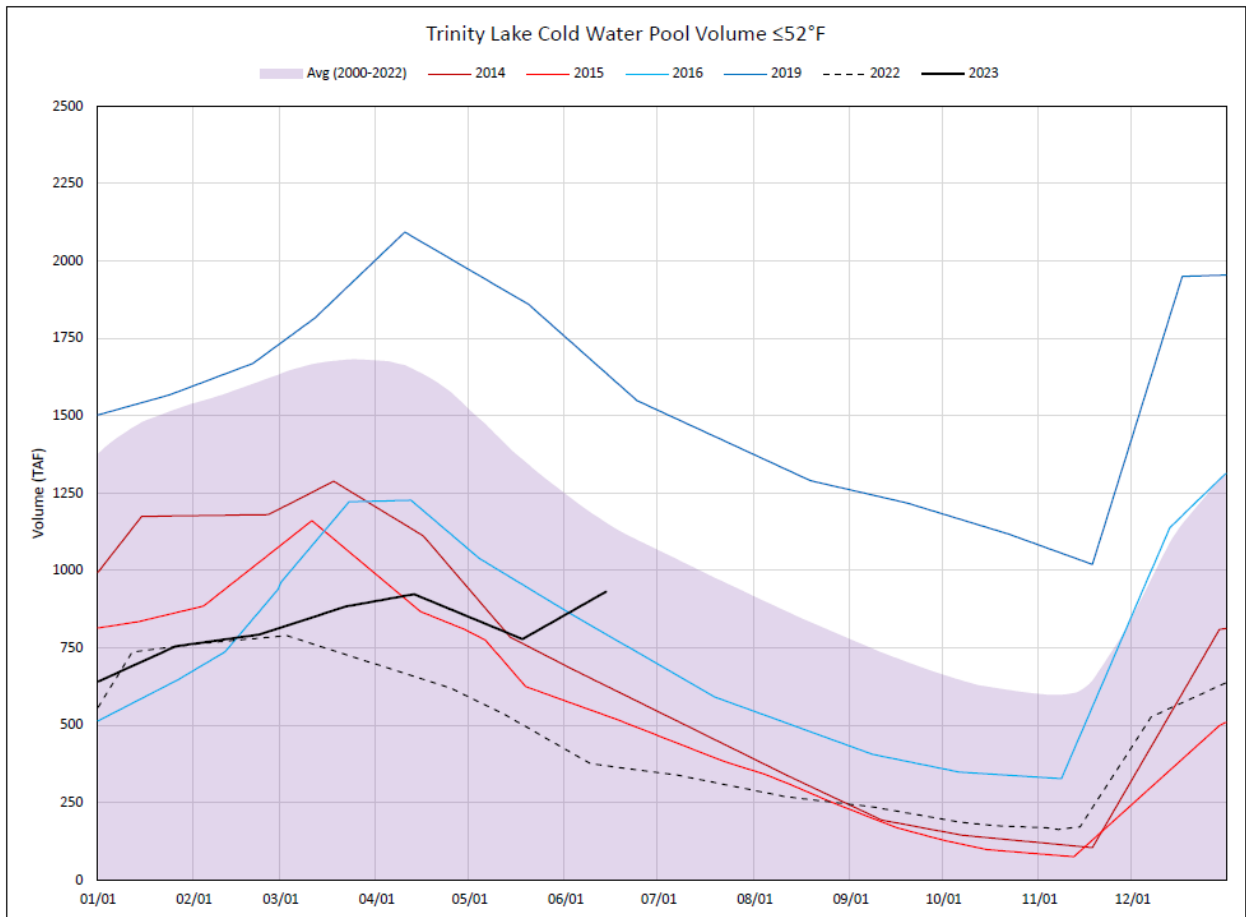
Shasta Lake Cold Water Pool Volume ≤50°F – Percent Exceedances (1998-2022)



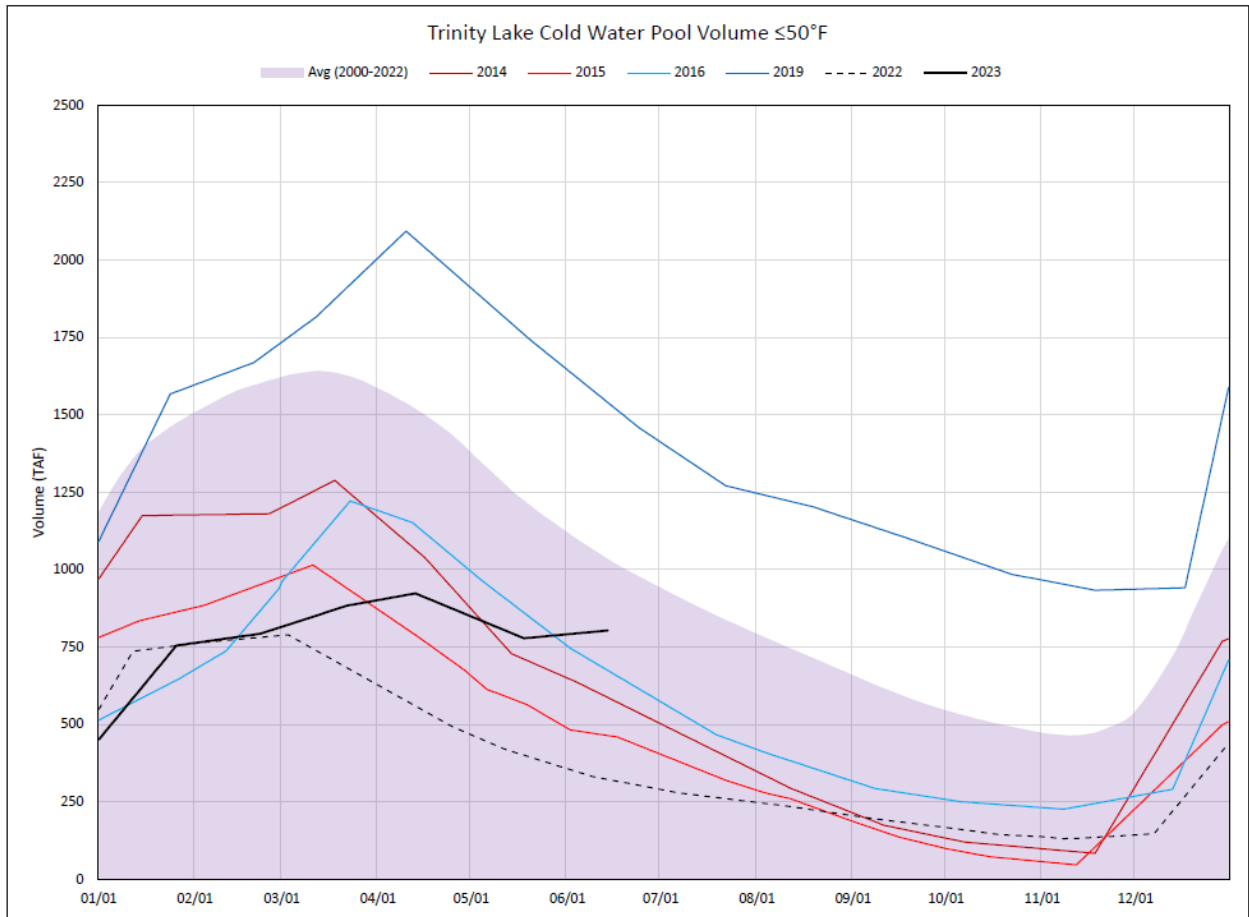
Shasta Lake Cold Water Pool Volume ≤48°F – Percent Exceedances (1998-2022)



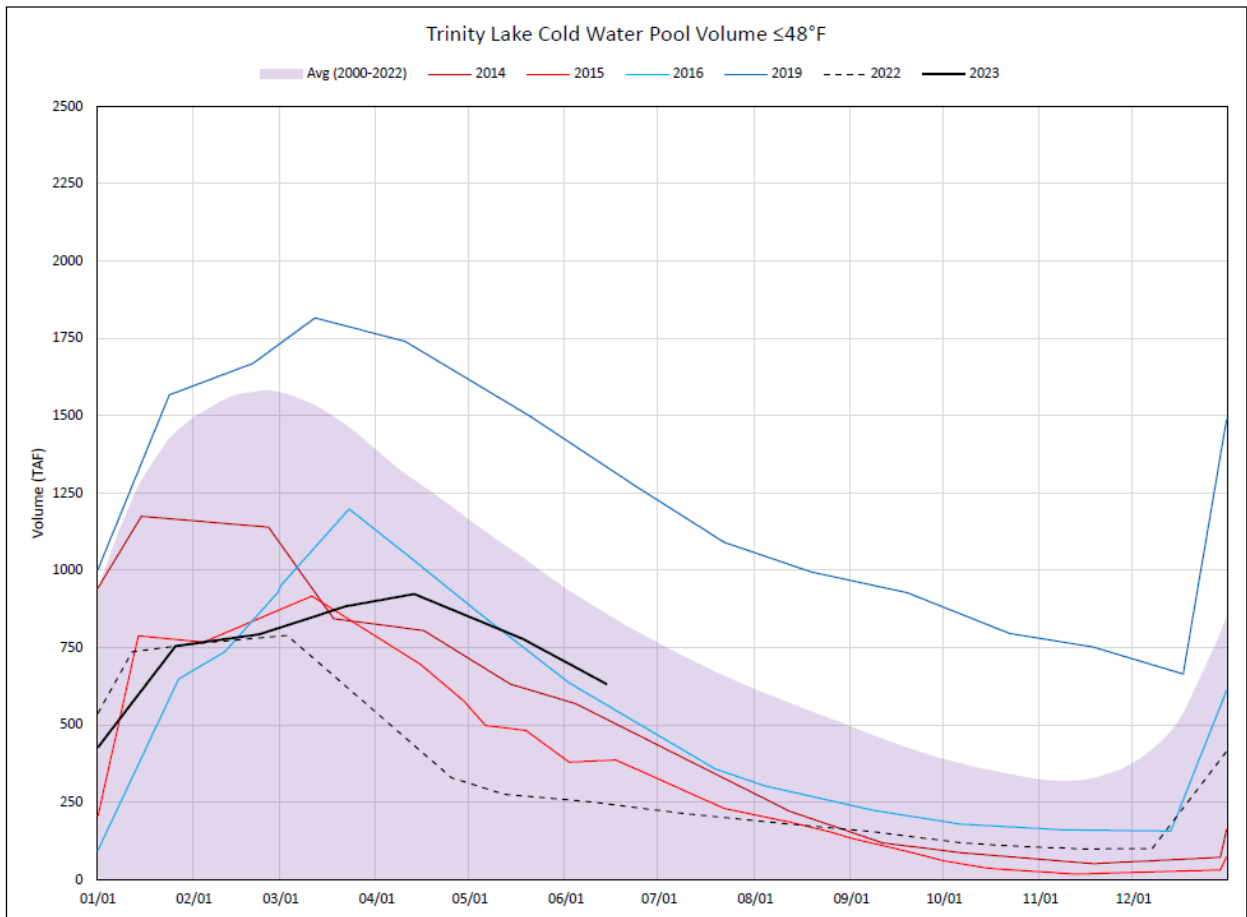
Trinity Lake Isothermobaths Plot - 2023



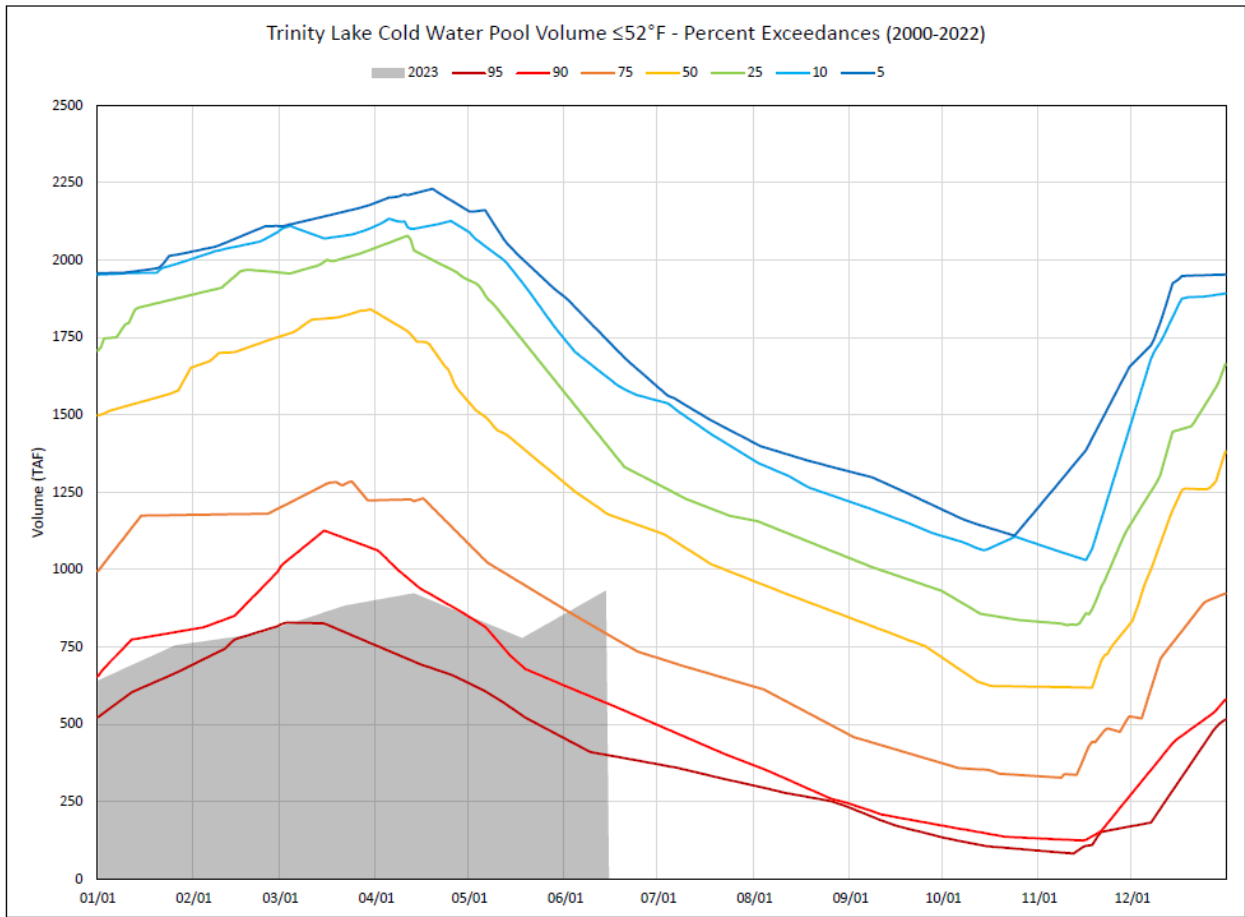
Trinity Lake Cold Water Pool Volume ≤52°F



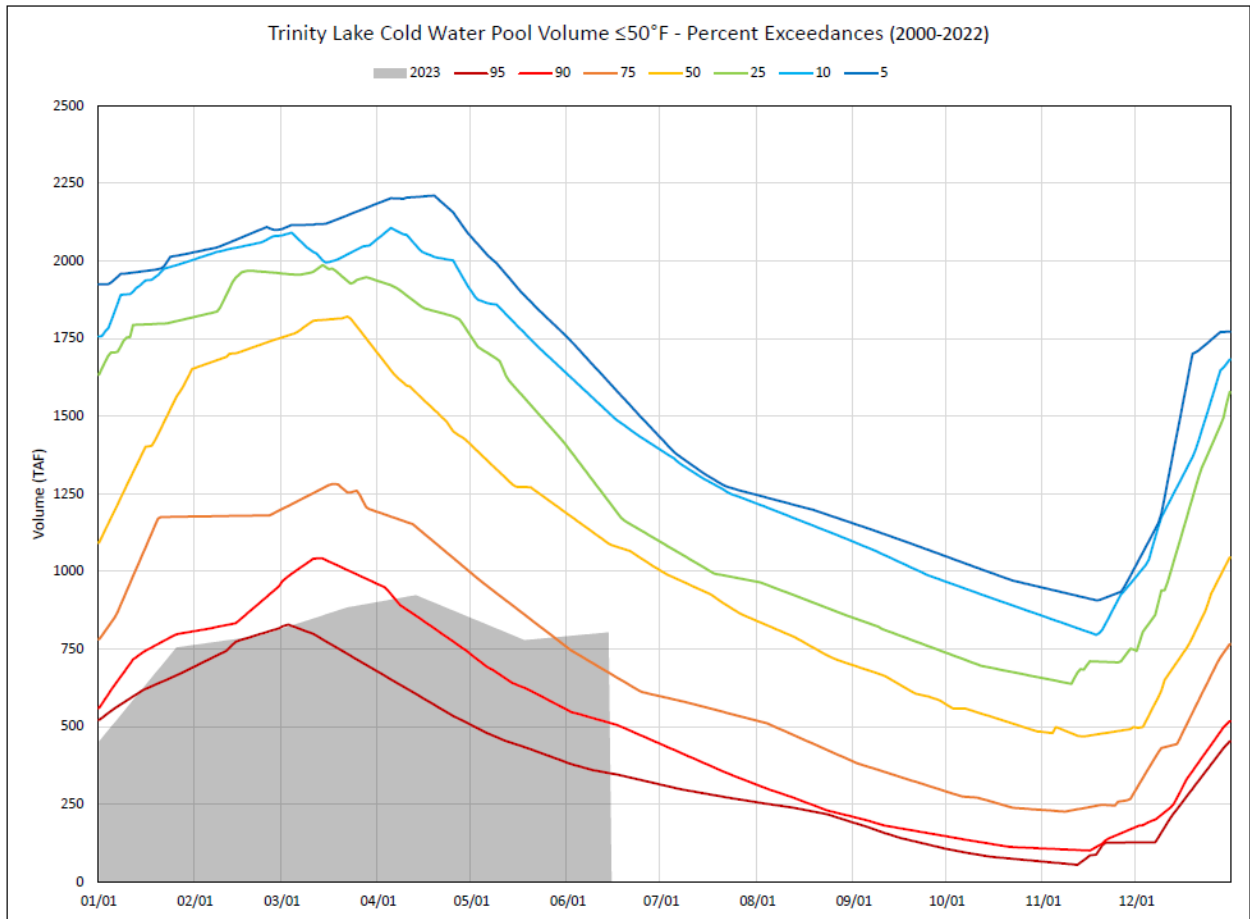
Trinity Lake Cold Water Pool Volume ≤50°F



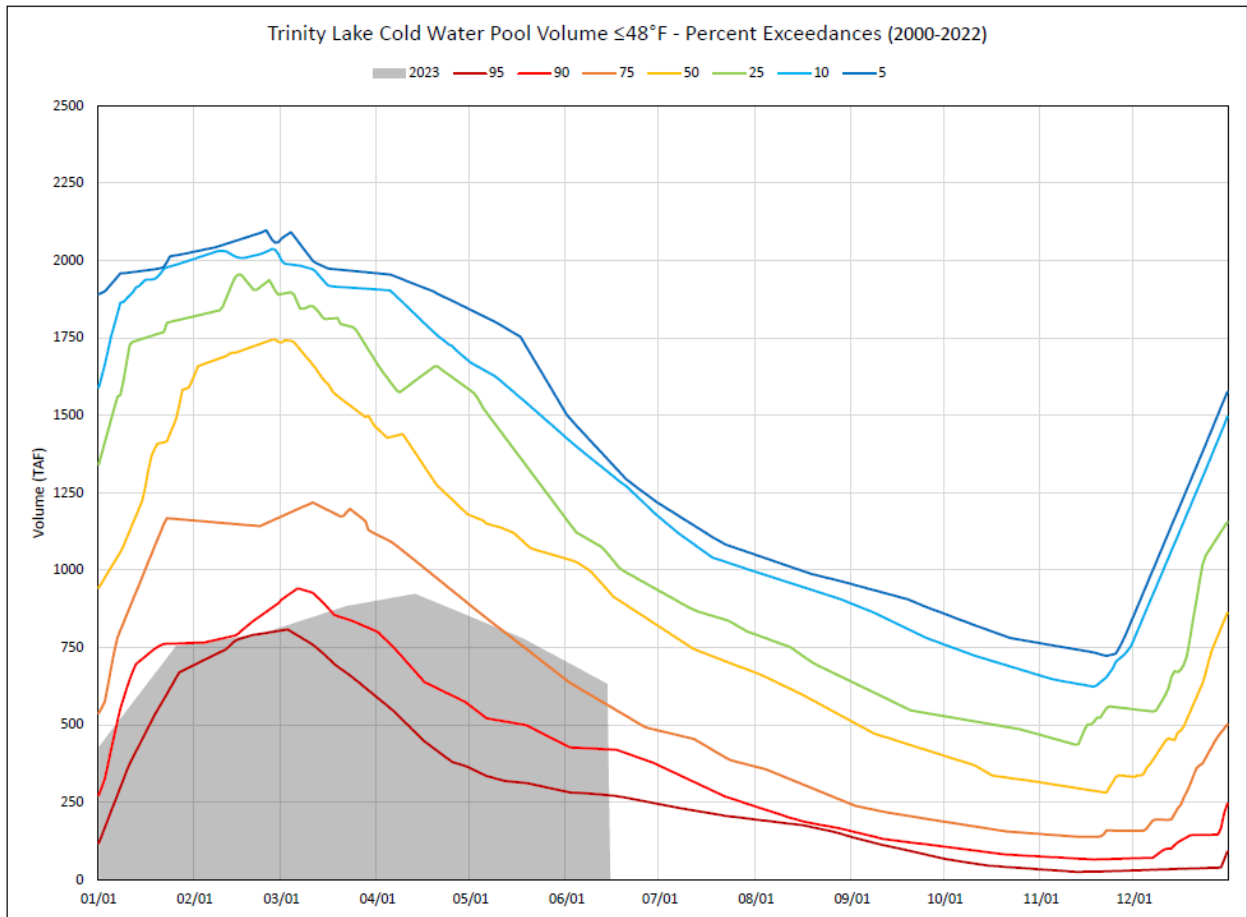
Trinity Lake Cold Water Pool Volume ≤48°F



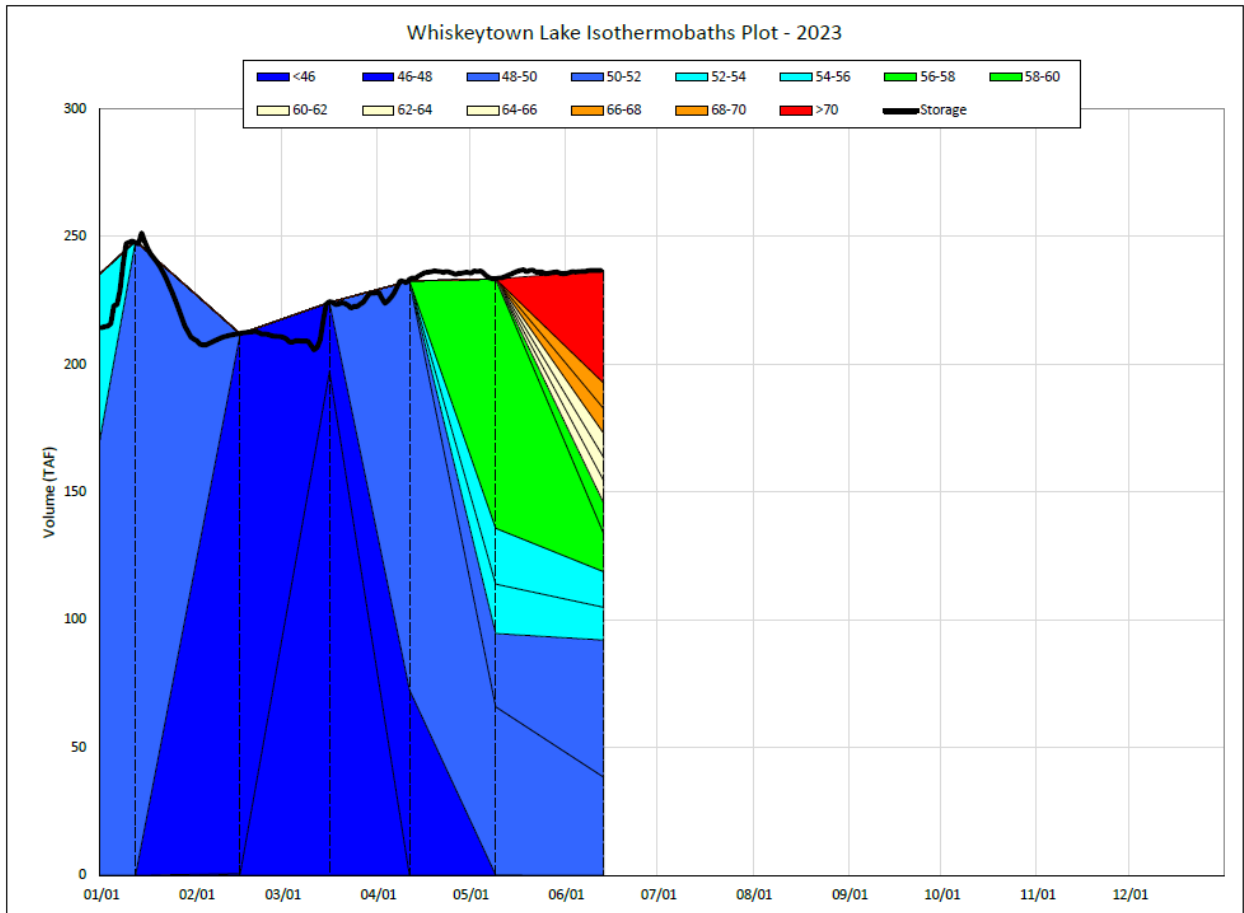
Trinity Lake Cold Water Pool Volume $\leq 52^{\circ}\text{F}$ - Percent Exceedances (2000-2022)



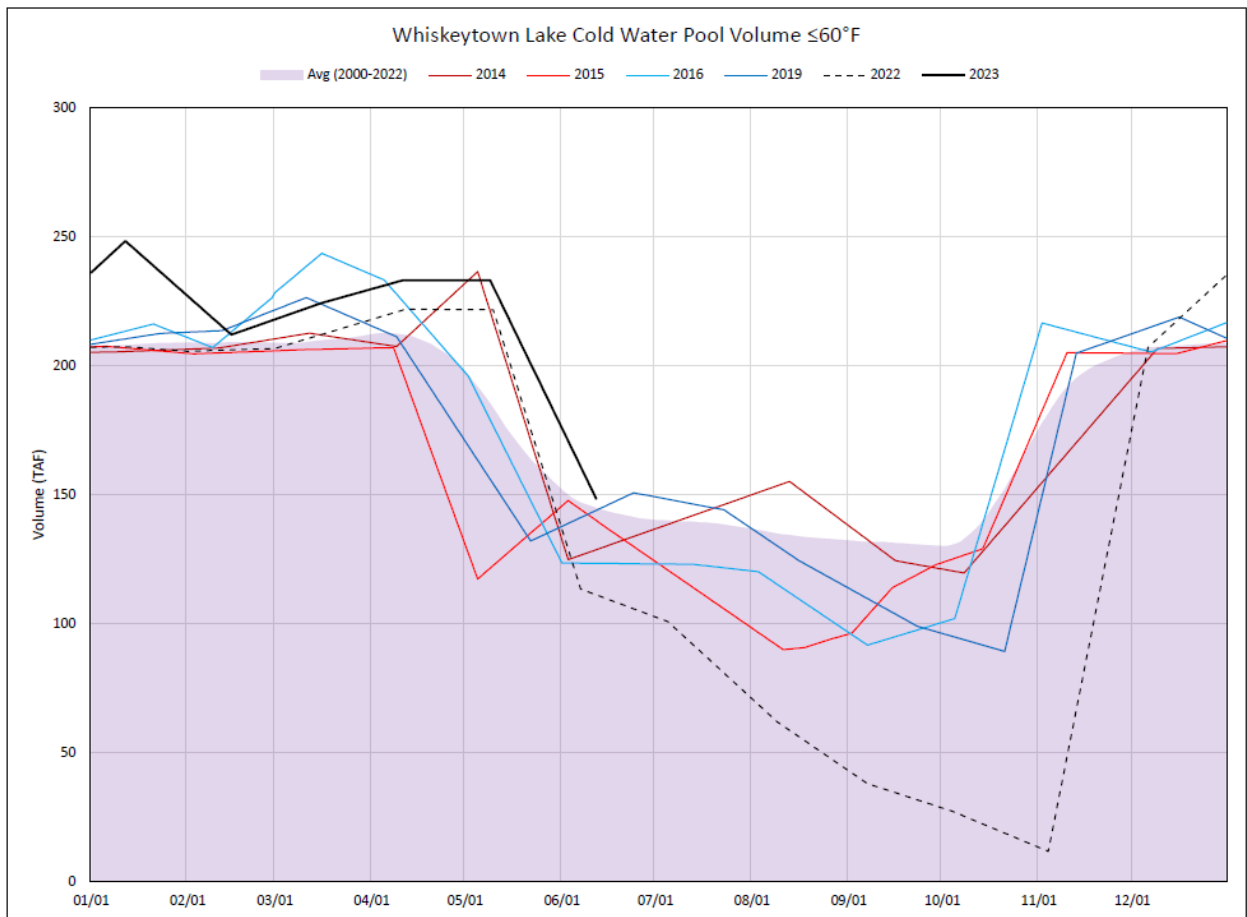
Trinity Lake Cold Water Pool Volume ≤50°F - Percent Exceedances (2000-2022)



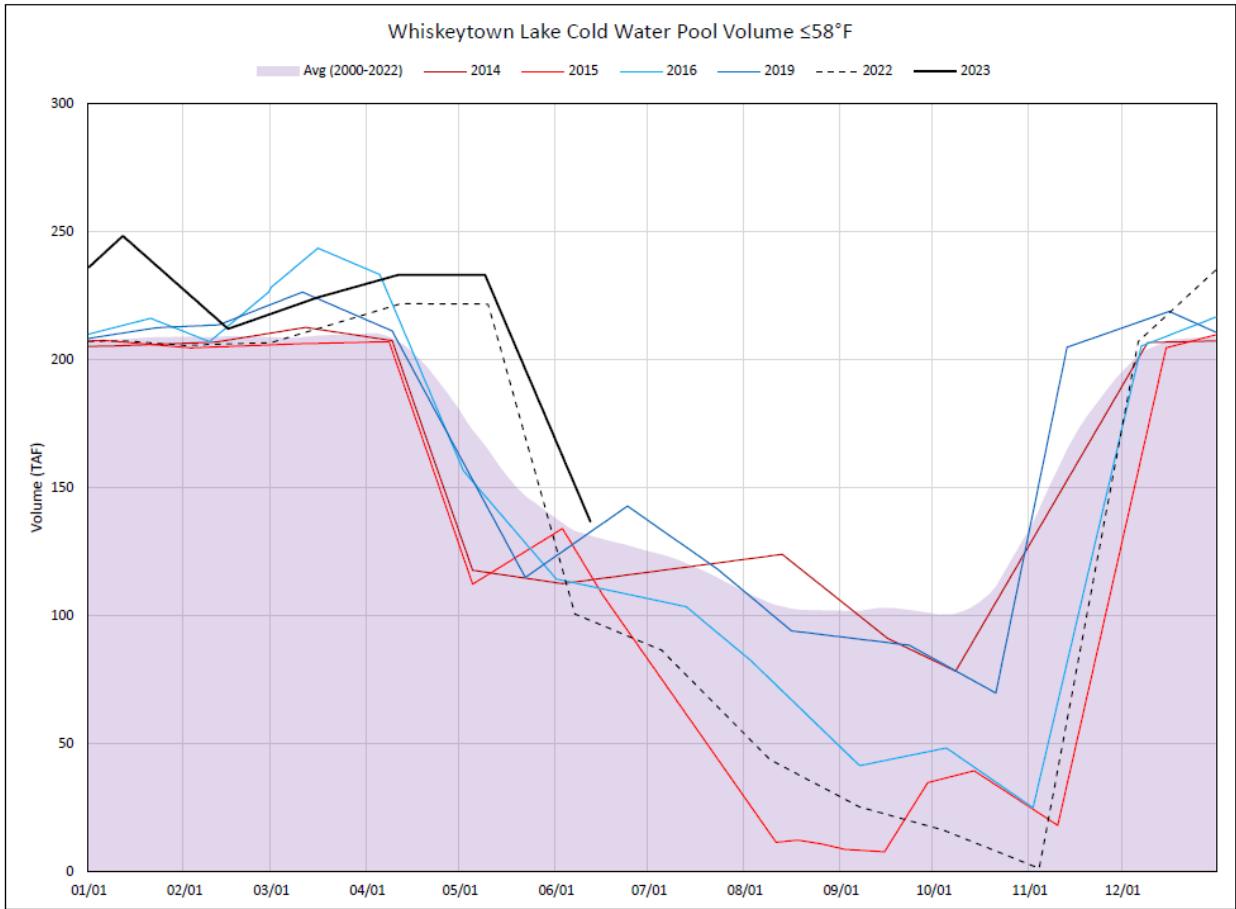
Trinity Lake Cold Water Pool Volume $\leq 48^{\circ}\text{F}$ - Percent Exceedances (2000-2022)



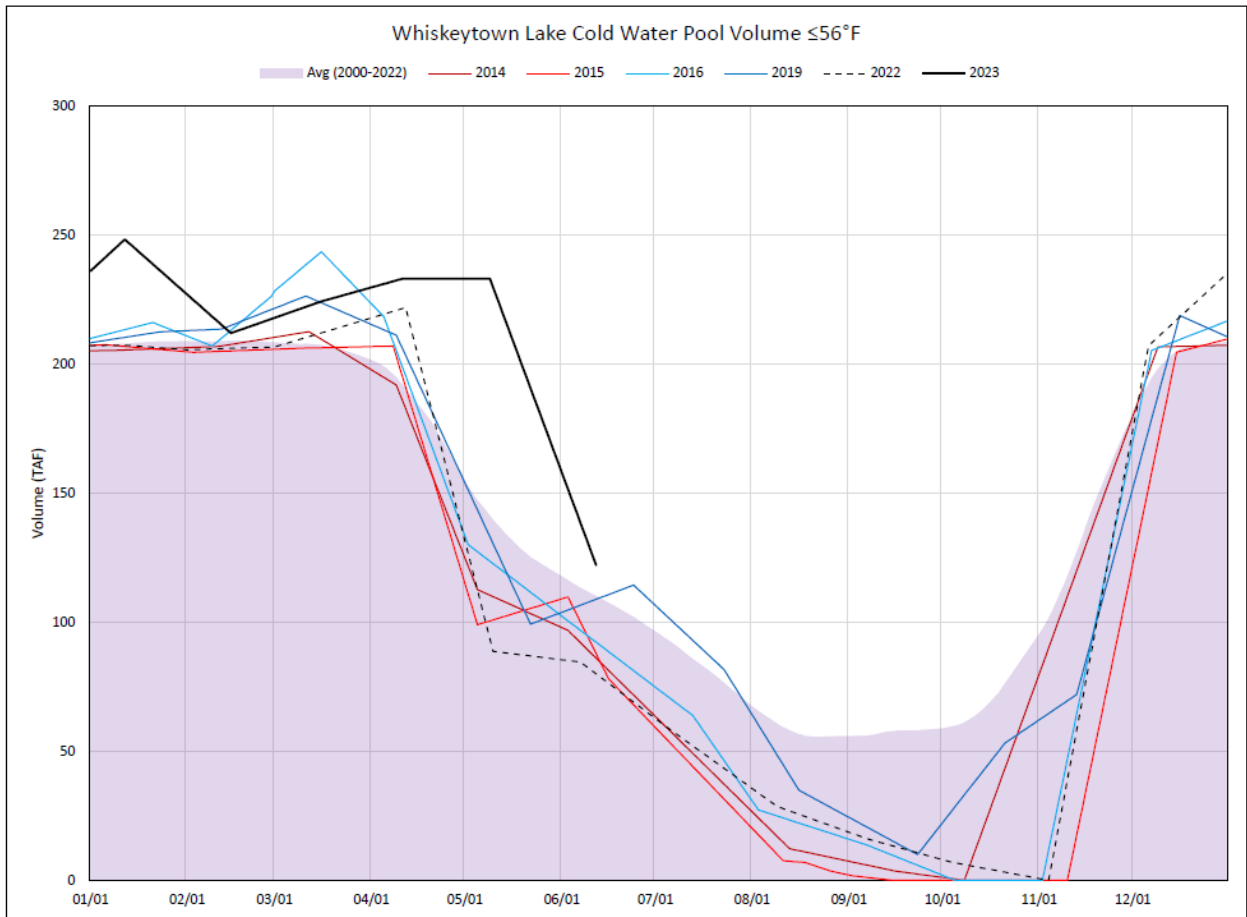
Whiskeytown Lake Isothermobaths Plot – 2023



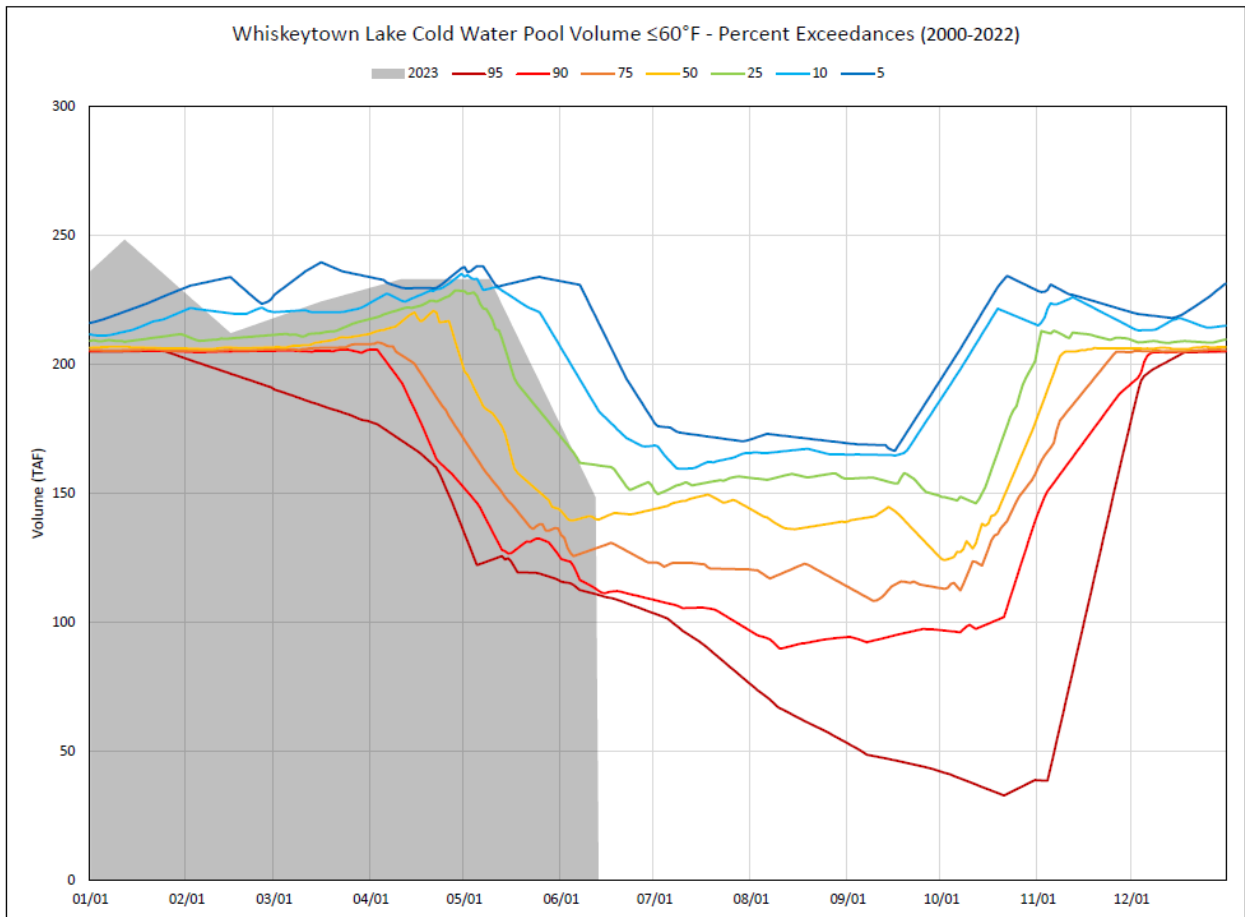
Whiskeytown Lake Cold Water Pool Volume ≤60°F



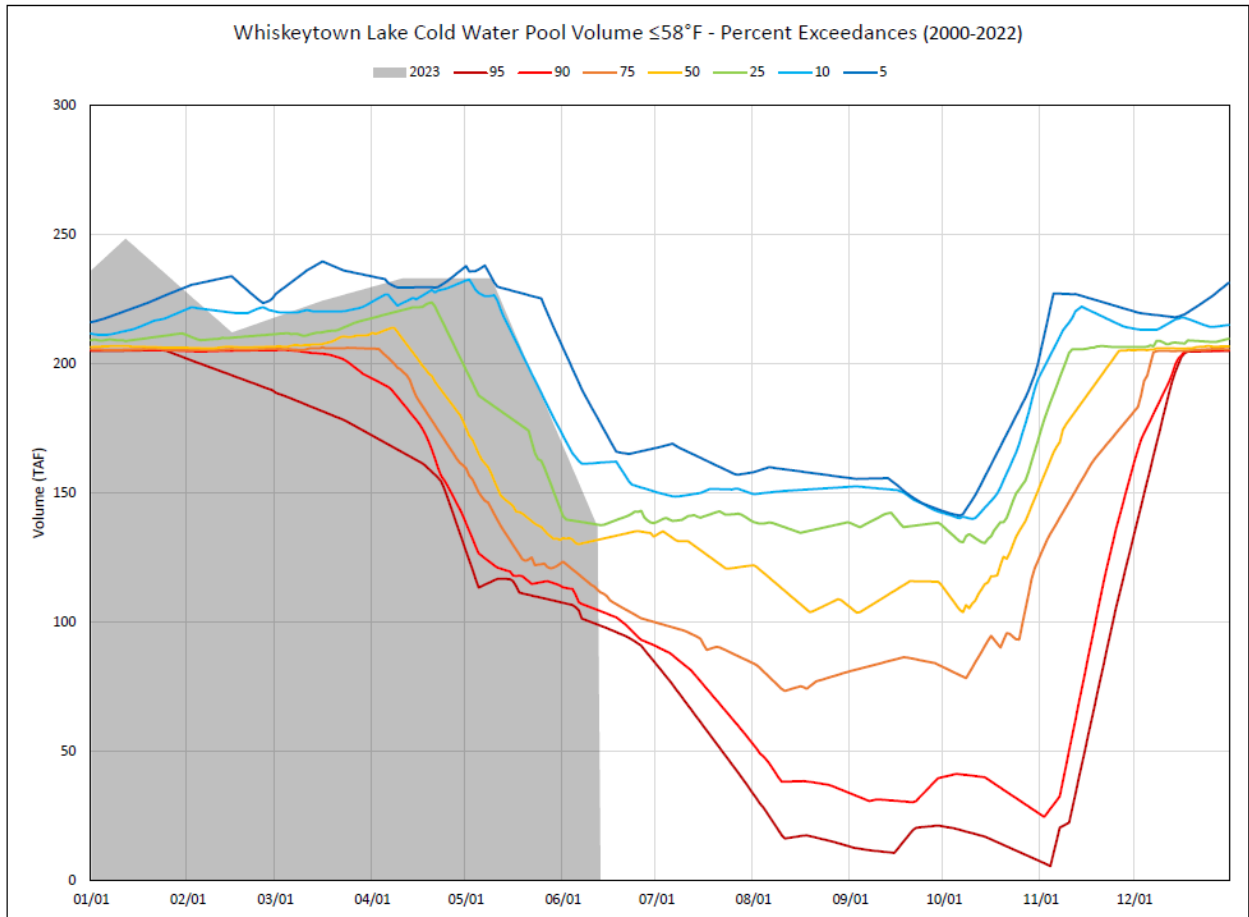
Whiskeytown Lake Cold Water Pool Volume $\leq 58^{\circ}\text{F}$



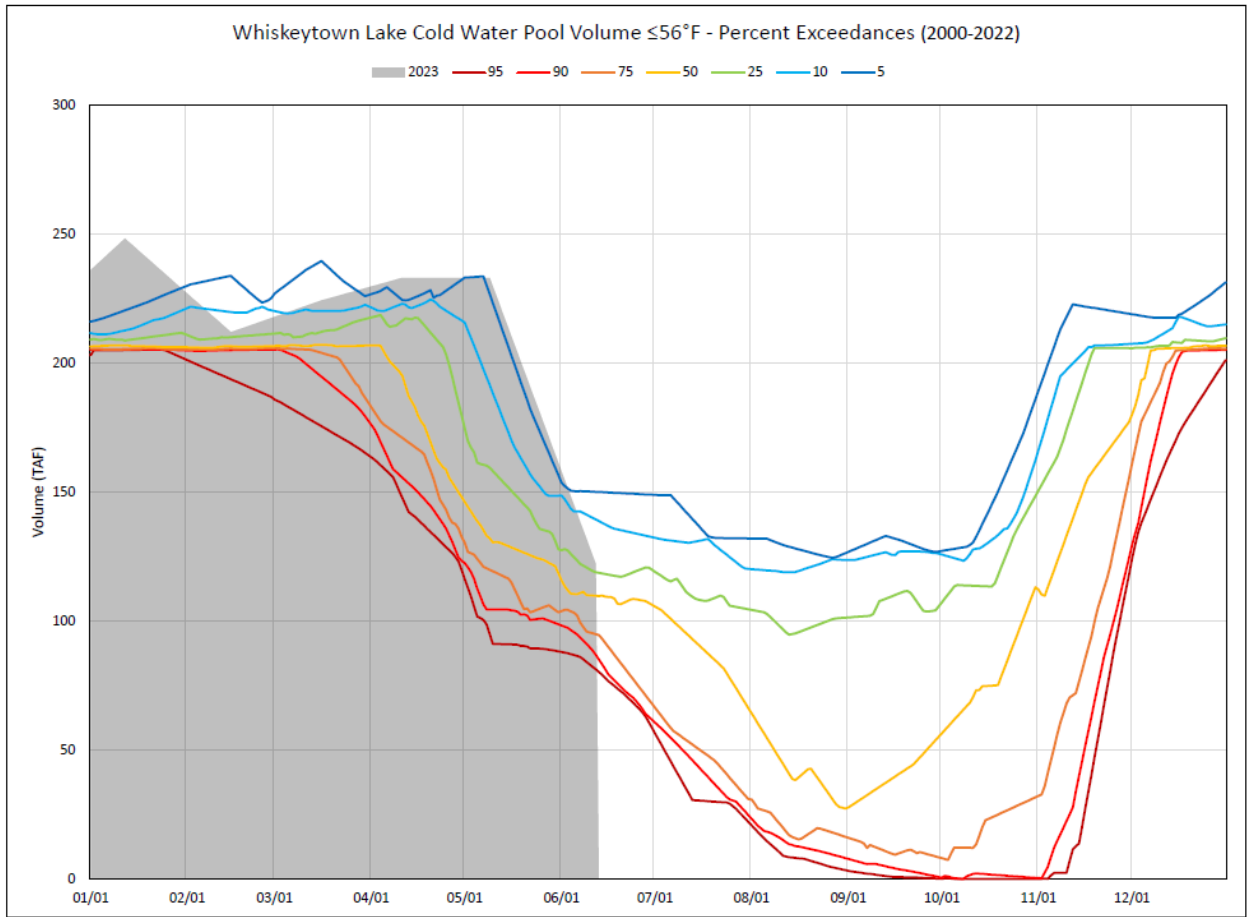
Whiskeytown Lake Cold Water Pool Volume $\leq 56^{\circ}\text{F}$



Whiskeytown Lake Cold Water Pool Volume ≤60°F – Percent Exceedances (2000-2022)

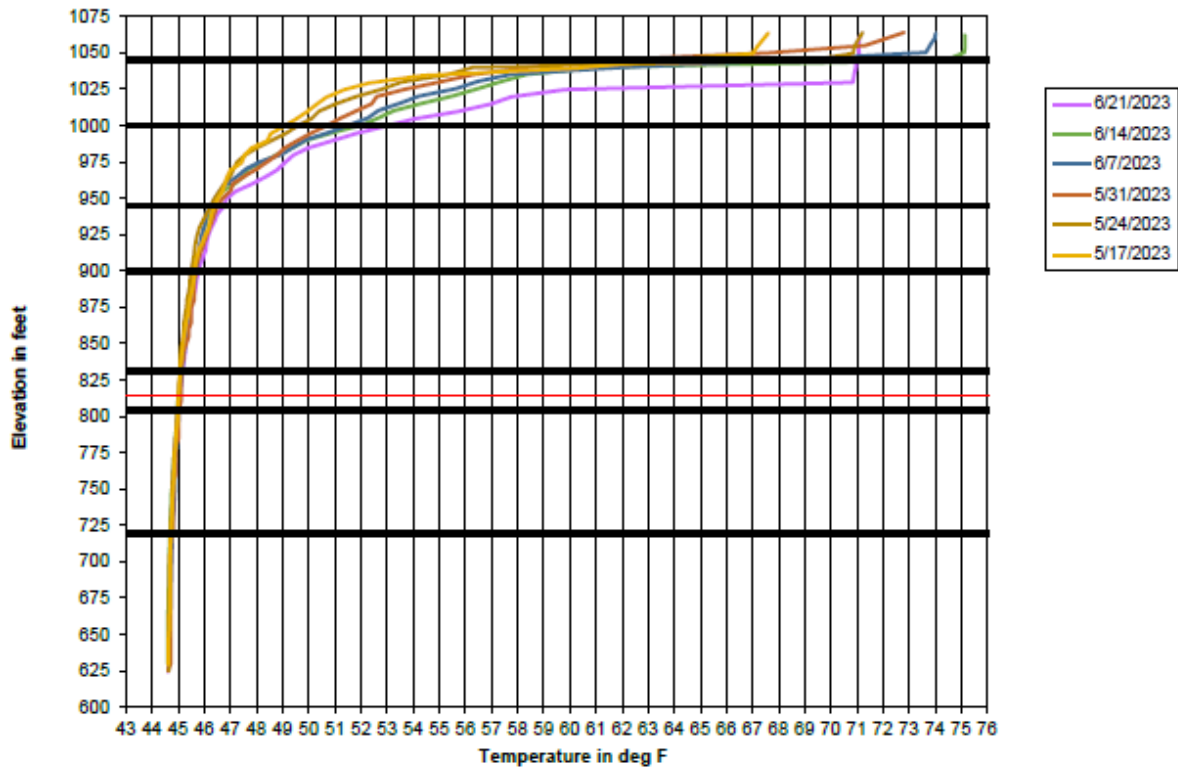


Whiskeytown Lake Cold Water Pool Volume $\leq 58^{\circ}\text{F}$ – Percent Exceedances (2000-2022)



Whiskeytown Lake Cold Water Pool Volume ≤56°F – Percent Exceedances (2000-2022)

2023 Shasta Temperature Profiles



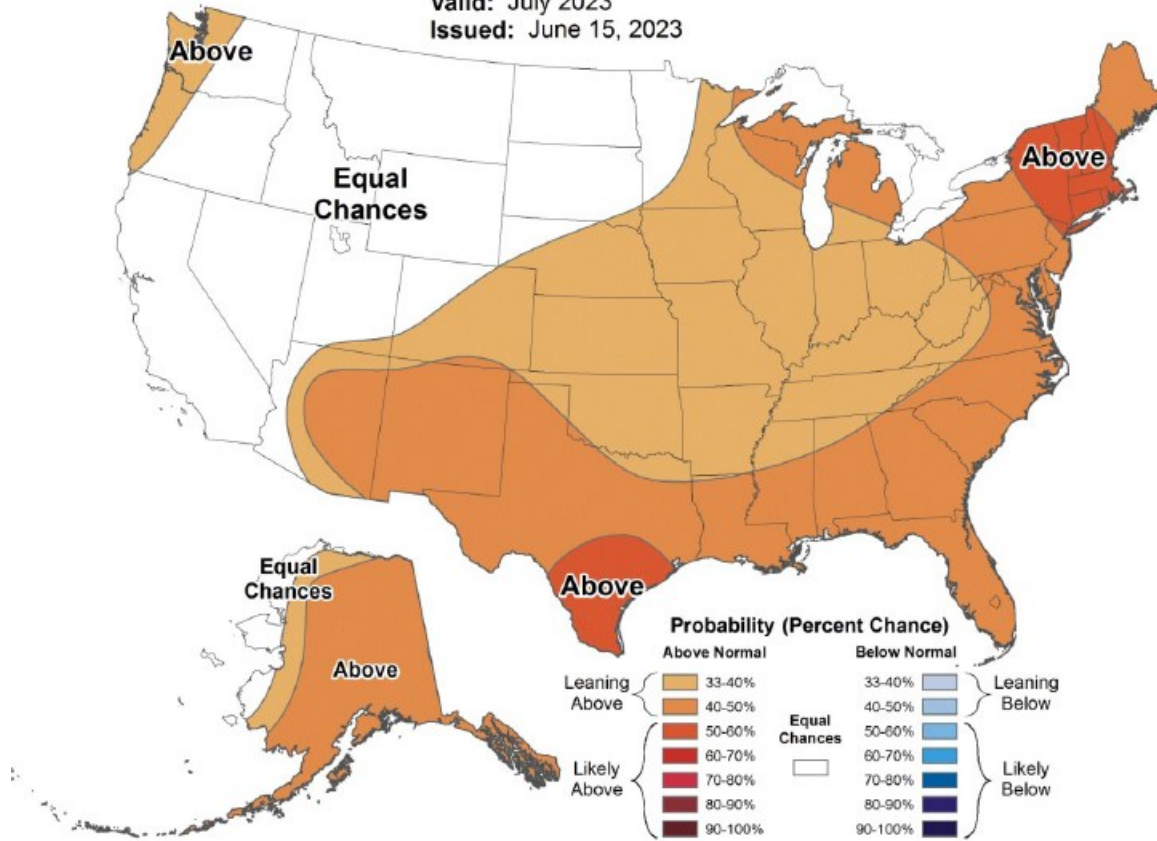
2023 Shasta Temperature Profiles



Monthly Temperature Outlook



Valid: July 2023
Issued: June 15, 2023



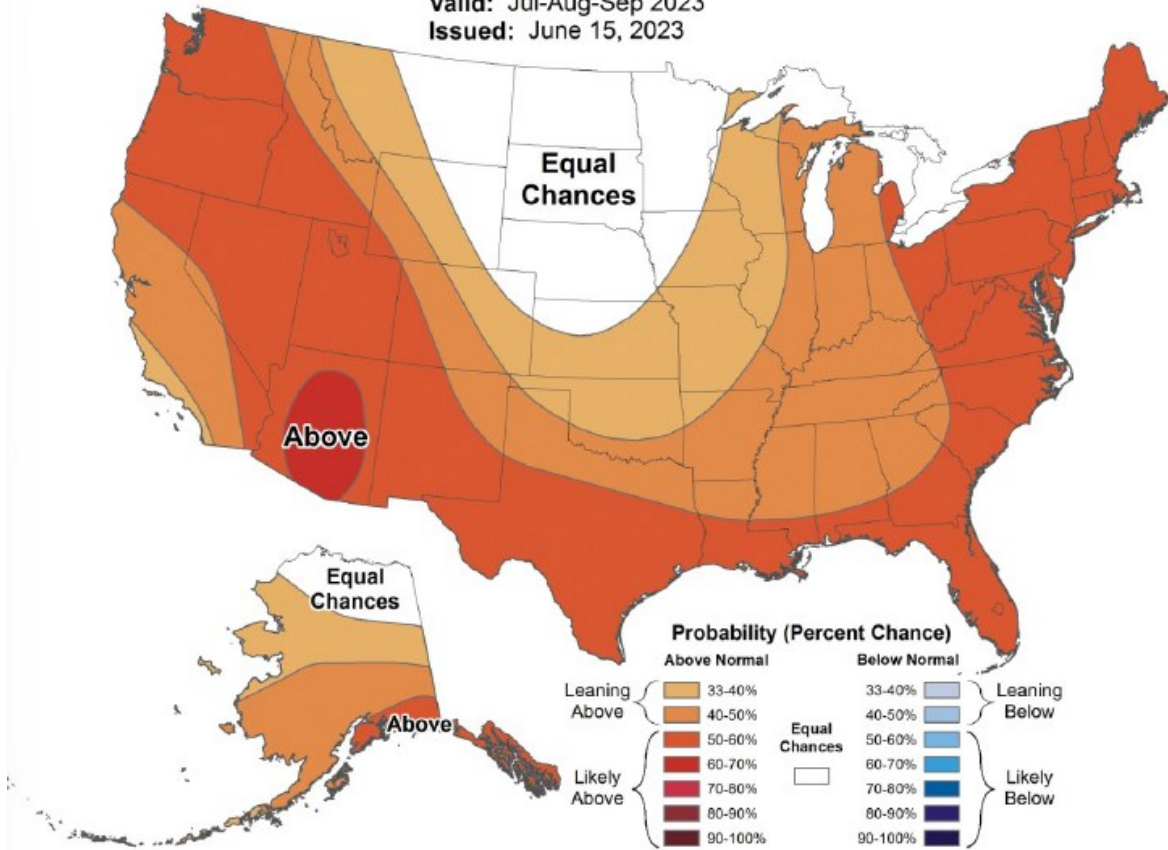
Official Monthly Temperature Outlook



Seasonal Temperature Outlook



Valid: Jul-Aug-Sep 2023
Issued: June 15, 2023



Seasonal Temperature Outlook



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Table 1. Facility Temperature Outlook in Degrees Fahrenheit

Month	Shasta	Keswick	CCR	Igo	Trinity	Lewiston
July	49.2	51.6	52.7	52.6	45.0	51.0
August	49.2	51.3	52.5	52.7	45.4	49.2
September	49.8	52.1	53.0	53.3	45.9	48.5
October	50.0	51.6	52.3	55.1	46.4	50.8
November	49.9	50.5	50.2	51.2	46.2	47.5

Run date: 6/21/23

EOM September Storage: 3.35 MAF

Trinity profile date: 6/15/23

Whiskeytown profile date: 6/13/23

Shasta profile date: 6/21/23

Projected side gates: First n/a Full n/a

Shaded area denotes period of model limitations – see Fall Temperature Index

End of September Cold-Water-Pool less than 56 degrees Fahrenheit: 1.58 MAF

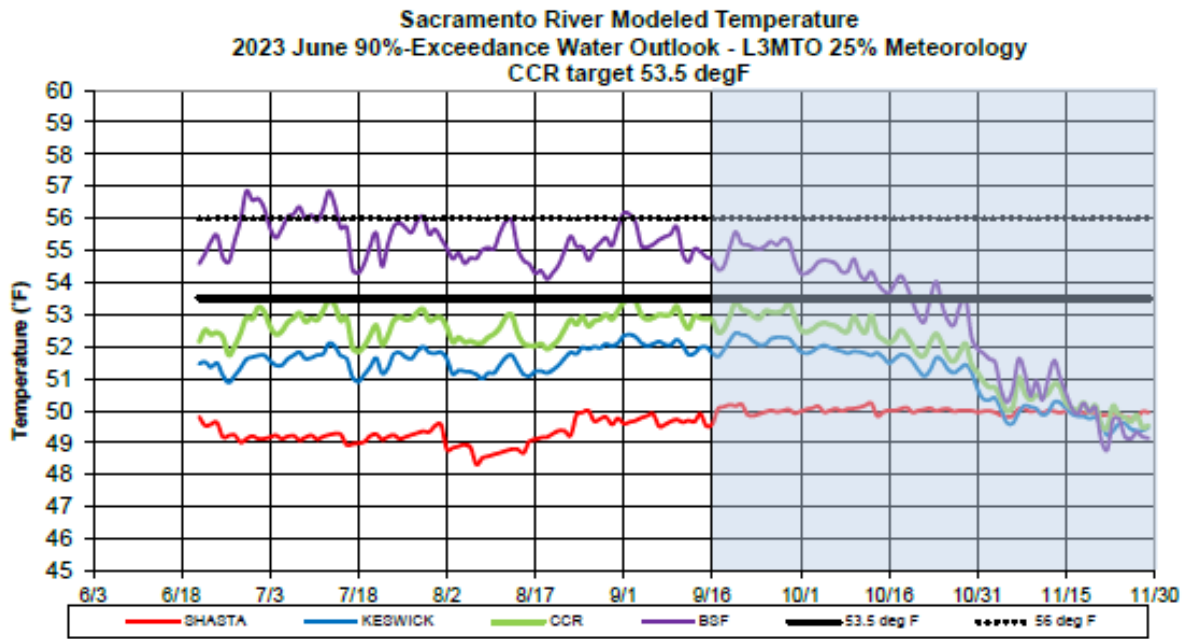


Figure 1: Sacramento River Modeled Temperature – June 2023 90%-Exceedance Water Outlook Historical 25% Meteorology

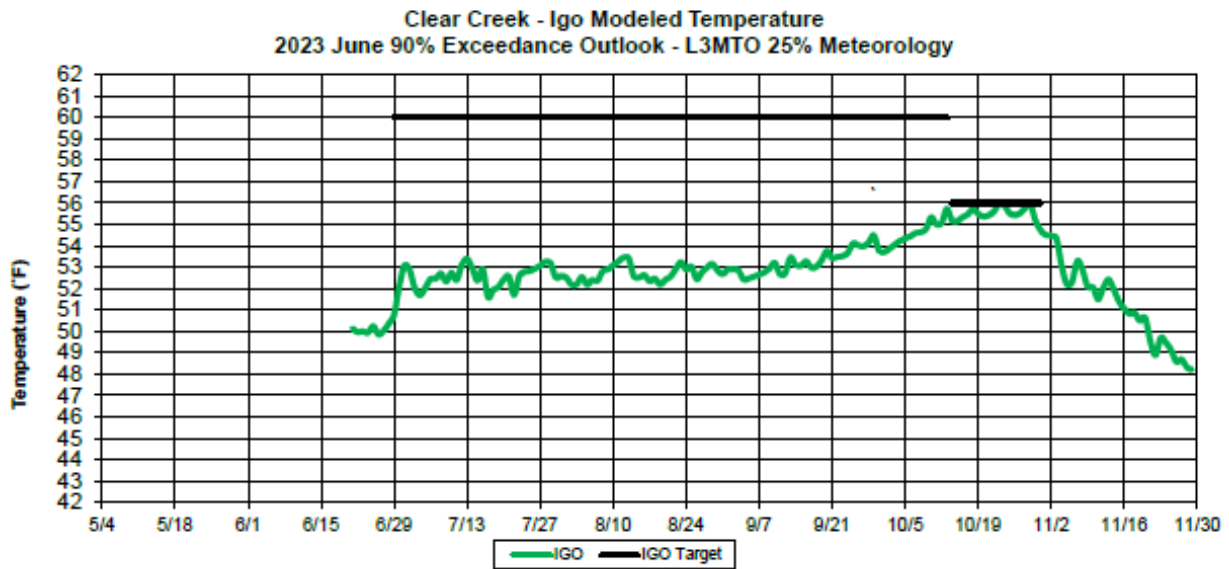


Figure 2: Clear Creek Igo Modeled Temperature – March 2023 90%-Exceedance Water Outlook- L3MTO 25% Meteorology

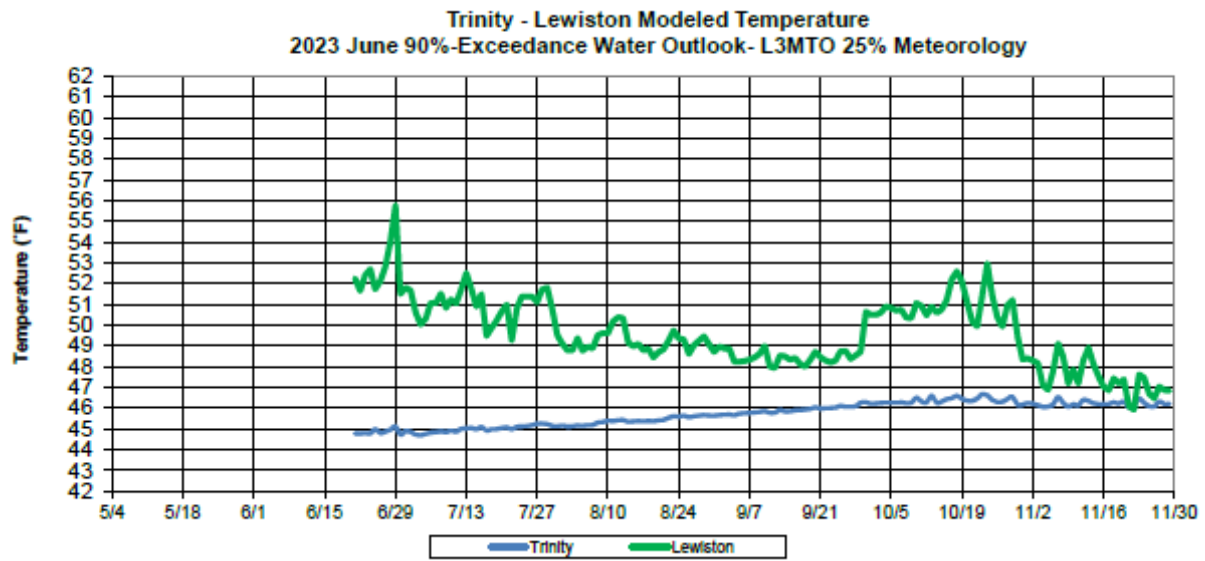
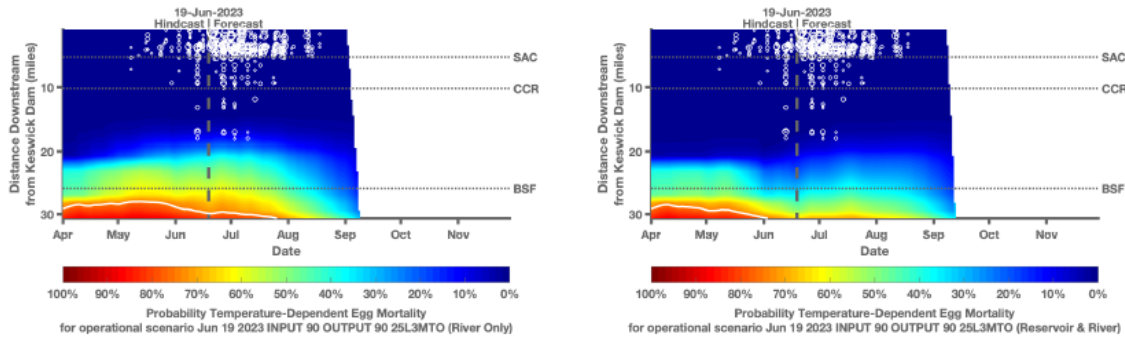


Figure 3: Trinity – Lewiston Modeled Temperature – June 2023 90%-Exceedance Water Outlook- L3MTO 25% Meteorology

Summary Document for Shasta/Keswick Operational Scenarios

Prepared by the Southwest Fisheries Science Center (SWFSC) on June 19th, 2023.

Below are results for one USBR scenario run June 19th 2023. 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 2023 temperature management season. Two approaches were used to provide temperature inputs from Keswick for the RAFT model. Approach 1 (River Only; left plot Figure 1) used the USBR HEC-5Q predicted temperatures as inputs, while approach 2 (Reservoir & River; right plot Figure 1) used the SWFSC CE-QUAL-W2 predicted temperatures as inputs. Differences in upstream inputs can be seen in Figure 2.



Note: 2016-2022 redd distribution shown as white circles, scaled to the number of redds observed during the survey and 75% mortality contour shown. Reservoir model initialized on April 1, 2023

Figure 1: Estimated temperature-dependent egg mortality produced by the NMFS stage-independent temperature mortality model under the June 6th 2023 scenario. 2016-2022 redd distributions are used for all plots. Left plot uses HEC-5Q reservoir model and right plot uses CE-QUAL-W2 reservoir model as upstream boundary for RAFT river temperature model.

Table 1: Estimated temperature-dependent egg mortality under different scenarios assuming a 2016-2022 spatial and temporal redd distribution using output from the RAFT water temperature model.

Scenario	Upstream input to RAFT model	Mean (%)	Median (%)
JUN_06_2023_INPUT_90_OUTPUT_90_25L3MTO	Approach 1: USBR HEC-5Q	2	1
JUN_06_2023_INPUT_90_OUTPUT_90_25L3MTO	Approach 2: SWFSC CE-QUAL-W2	2	0

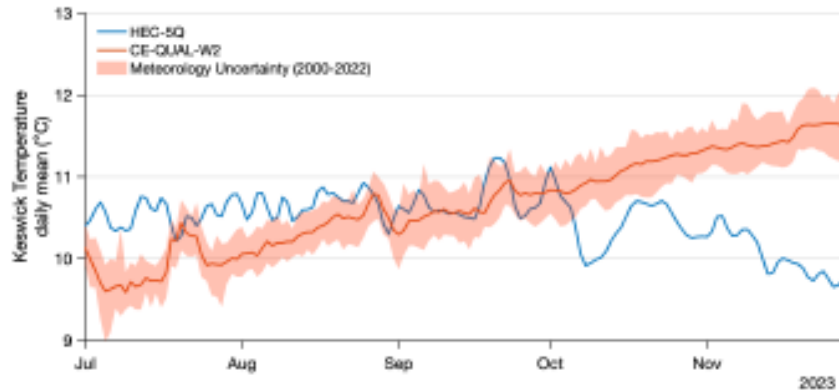


Figure 2: Predicted temperature from Keswick from the HEC-5Q and CE-QUAL-W2 models under the June 6th 2023 scenario. Note the HEC-5Q model is predicting warmer early season temperatures and the CE-QUAL-W2 model is predicting warmer late season temperatures. Effect of meteorology uncertainty is shown for the CE-QUAL-W2 model by running over an 23 year ensemble. Note that cooler CE-QUAL-W2 predictions in the early season may be due to mismatch between planned and actual TCD gate operations.

Reference: Martin, B. T., Pike, A., John, S. N., Hamda, N., Roberts, J., Lindley, S. T. and Danner, E. M. (2017), Phenomenological vs. biophysical models of thermal stress in aquatic eggs. *Ecology Letters* 20: 50-59. doi:10.1111/ele.12705