Sacramento River Station Temperature Summary Report

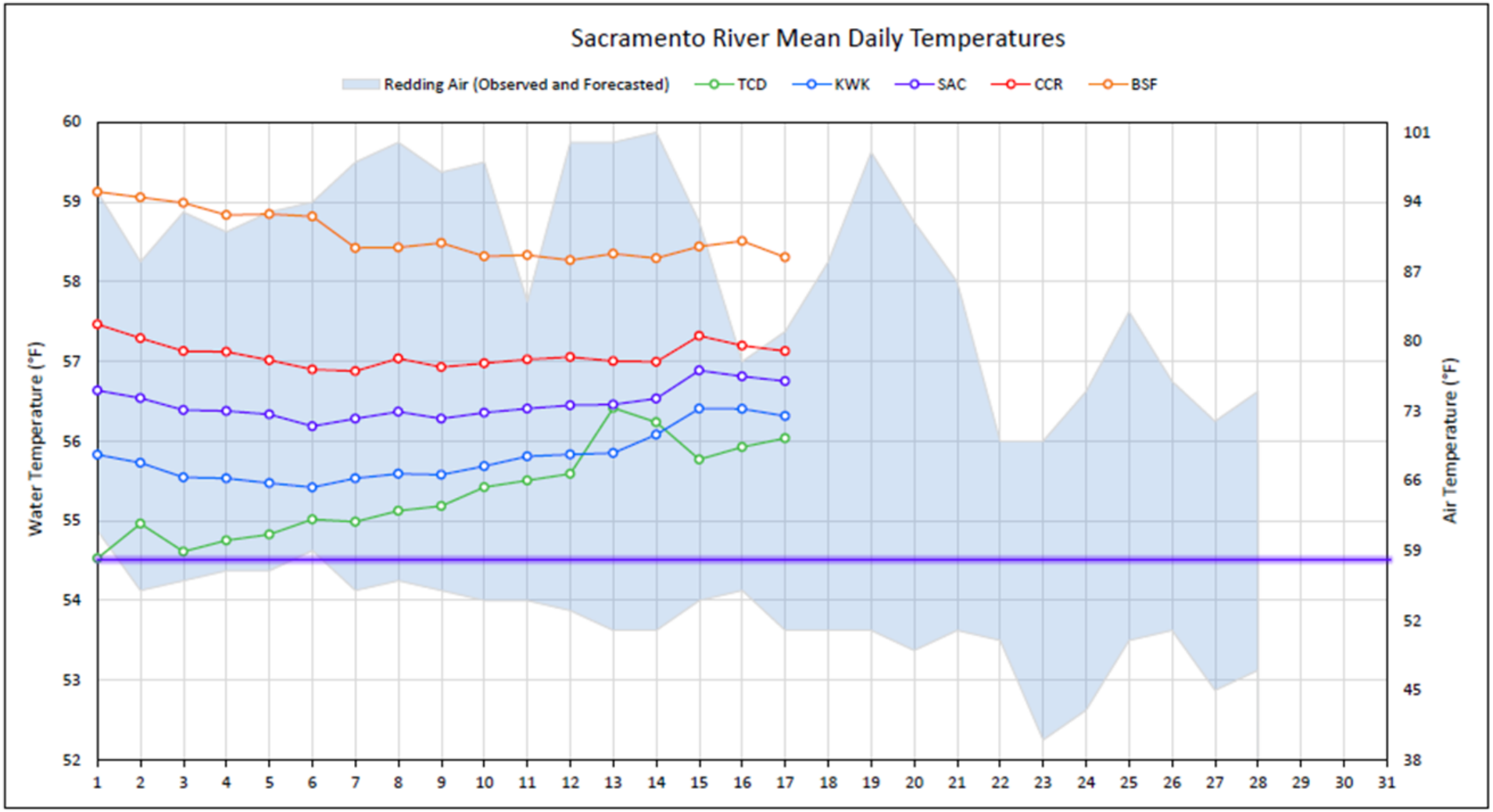
Date	MDWT TCD[1]	MDWT SHD	MDWT SPP[1]	MDWT KWK	MDWT SAC[2]	MDWT CCR	MDWT BSF	MDWT BND	MDWT RBD	MDWT IGO	MDWT LWS	MDWT DGC[3]	MDWT NFH	MDR Shasta Genera-tion	MDR Spring Creek PP	MDR Keswick Total	MDAT RDD	MDAT BSF	MDAT RDB
Sep	53.9	52.6	58.4	53.9	54.9	55.9	58.3	60.2	61.8	57.9	55.2	57.2	60.6	3684	62	4181	78.8	72.8	74.6
10/01	54.5[A]	55.6	60.4	55.8	56.6	57.5	59.1	60.2	61.5	56.1	53.0	55.2	58.9	4190	39	4105	78.0	69.6	72.7
10/02	55.0[A]	55.6	60.7	55.7	56.5	57.3	59.1	60.2	61.6	56.1	53.1	55.5	59.1	3494	39	4108	71.5	66.8	67.5
10/03	54.6[A]	54.4	60.6	55.5	56.4	57.1	59.0	60.2[A]	61.6	56.2	53.1	55.8	59.4	3625	39	4107	74.5	68.0	69.3
10/04	54.8[A]	54.2	60.6	55.5	56.4	57.1	58.8	60.1	61.6	56.2	53.2	55.6	59.4	3500	39	4132	74.0	68.1	69.8
10/05	54.8[A]	54.9	60.7	55.5	56.3	57.0	58.9	60.1	61.5	56.3	53.4	55.6	59.2	4019	39	4106	75.0	68.6	70.8
10/06	55.0[A]	54.9	60.9	55.4	56.2	56.9	58.8	60.0	61.4[A]	56.3[A]	53.6	55.7[A]	59.2	4023	51	4109	76.5	69.1	71.5
10/07	55.0	55.1	61.2	55.5	56.3	56.9	58.4	59.6[A]	61.1	56.1	53.6	55.5	59.0	3624	39	4115	76.5	68.6	71.9
10/08	55.1	56.2	61.1	55.6	56.4	57.0	58.4	59.4[A]	60.6	56.2	53.5	55.2	58.5	3703	39	4105	78.0	69.1	71.5
10/09	55.2[A]	56.0	61.3	55.6	56.3	56.9	58.5	59.4	60.7	56.2	53.7	55.0	58.1	3594	39	4107	76.0	68.7	71.6
10/10	55.4	55.9	61.5	55.7	56.4	57.0	58.3	59.2[A]	60.5	56.2	53.8	54.9	57.8	3764	39	4105	76.0	68.7	71.7
10/11	55.5	56.1	61.3	55.8	56.4	57.0	58.3	59.2	60.4	56.1	53.7	54.8	57.7	3568	39	4107	74.0	67.5	70.5
10/12	55.6[A]	56.4	61.0	55.8	56.5	57.1[A]	58.3	59.0	60.2	56.3	53.6	54.7[A]	57.7	3401	61	4041	76.5	67.8	71.9
10/13	56.4[A]	57.0	61.1	55.9	56.5[A]	57.0	58.4	59.1[A]	60.2	56.2	53.5	54.6	57.5	3394	73	4045	75.5	68.0	69.4
10/14	56.2[A]	56.4	61.1	56.1	56.5	57.0	58.3	59.1[A]	60.3	56.1	53.4	54.2	57.1	3522	73	3931	76.0	67.3	70.6
10/15	55.8[A]	56.4	61.1	56.4	56.9	57.3	58.4	59.1[A]	60.2	56.1	53.2	53.8	56.6	3297	73	3917	73.0	66.5	70.5
10/16	55.9[A]	57.1	61.2	56.4	56.8	57.2	58.5	59.4[A]	60.4	56.2	53.4	53.9	56.6	3371	73	3942	66.5	62.6	63.9
10/17	56.0[A]	56.9	60.8	56.3	56.8	57.1	58.3	58.8[A]	60.1	56.4	53.4	54.8	57.3	3175	50	3954	66.0	61.0	63.4
Apr	53.3	55.8	61.0	55.8	56.5	57.1	58.6	59.5	60.8	56.2	54.4	55.0	58.2	3604	50	4061	74.3	67.4	69.9

Sacramento River Station Temperature Summary Table

Totals	MDR Shasta Generation	MDR Spring Creek P.P	MDR Keswick Total
CFS	61264	844	69036
AF	121515	1674	136930

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

This figure shows mean Sacramento River daily temperatures in degrees Fahrenheit at Shasta Power Plant and various stations 0.8, 4.8, 9.7, and 25 miles downstream of Keswick Dam for the past 24 days. It also includes a shaded area depicting observed and forecasted air temperatures in degrees Fahrenheit in Redding California.

Station Details

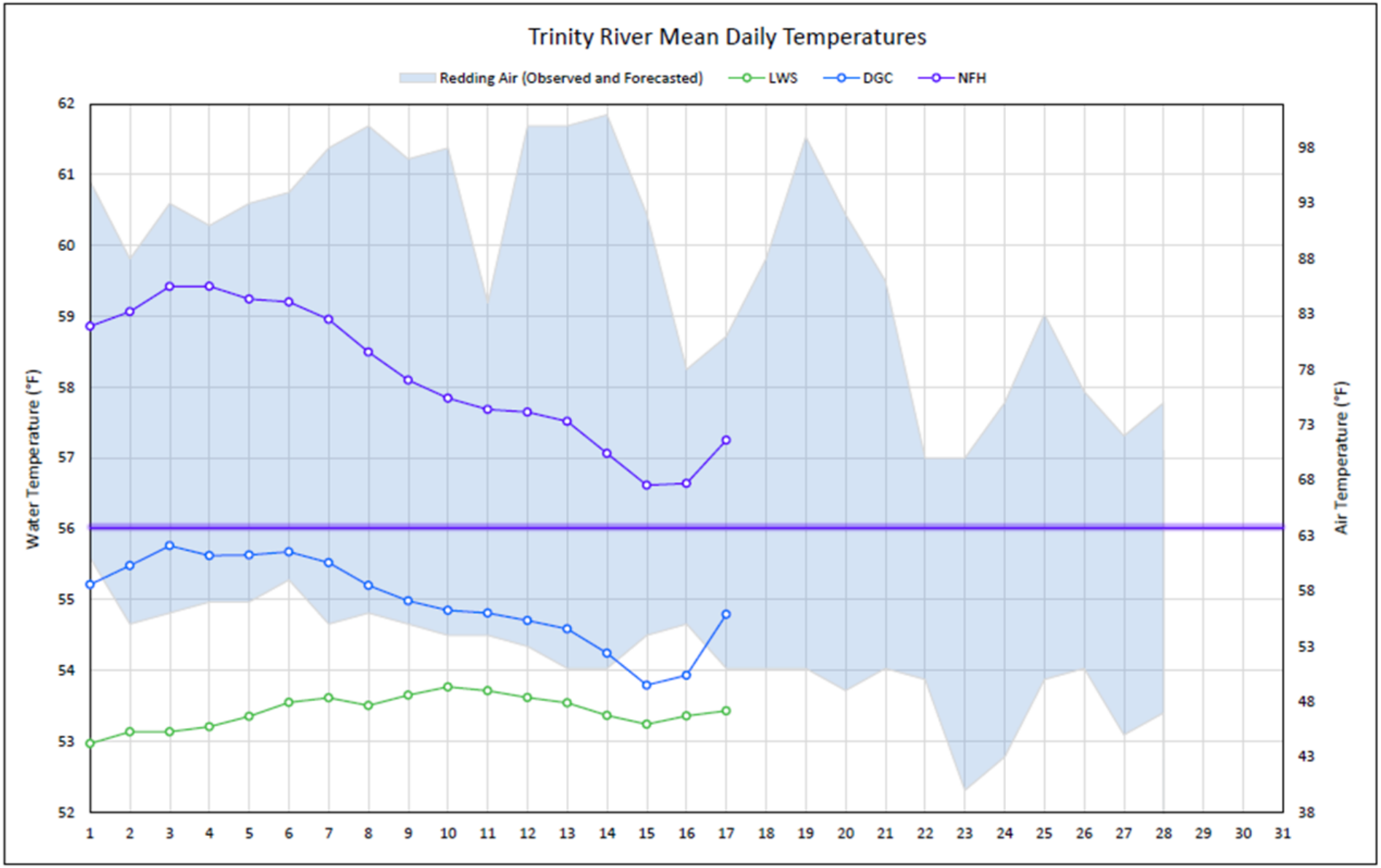
Code	Body of Water	Location[1]
TCD	N/A	Shasta Power Plant
SHD	Sacramento River	0.3 miles downstream of Shasta Power Plant
SPP	N/A	Spring Creek Power Plant
KWK	Sacramento River	0.8 miles downstream of Keswick Dam
SAC	Sacramento River	4.8 miles downstream of Keswick Dam
CCR	Sacramento River	9.7 miles downstream 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	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

This figure shows mean Trinity River daily temperatures in degrees Fahrenheit at stations 1.1, 19, and 37 miles downstream of Lewiston Dam for the past 24 days. It also includes a shaded area depicting observed and forecasted air temperatures in degrees Fahrenheit in Redding California.

Station Details

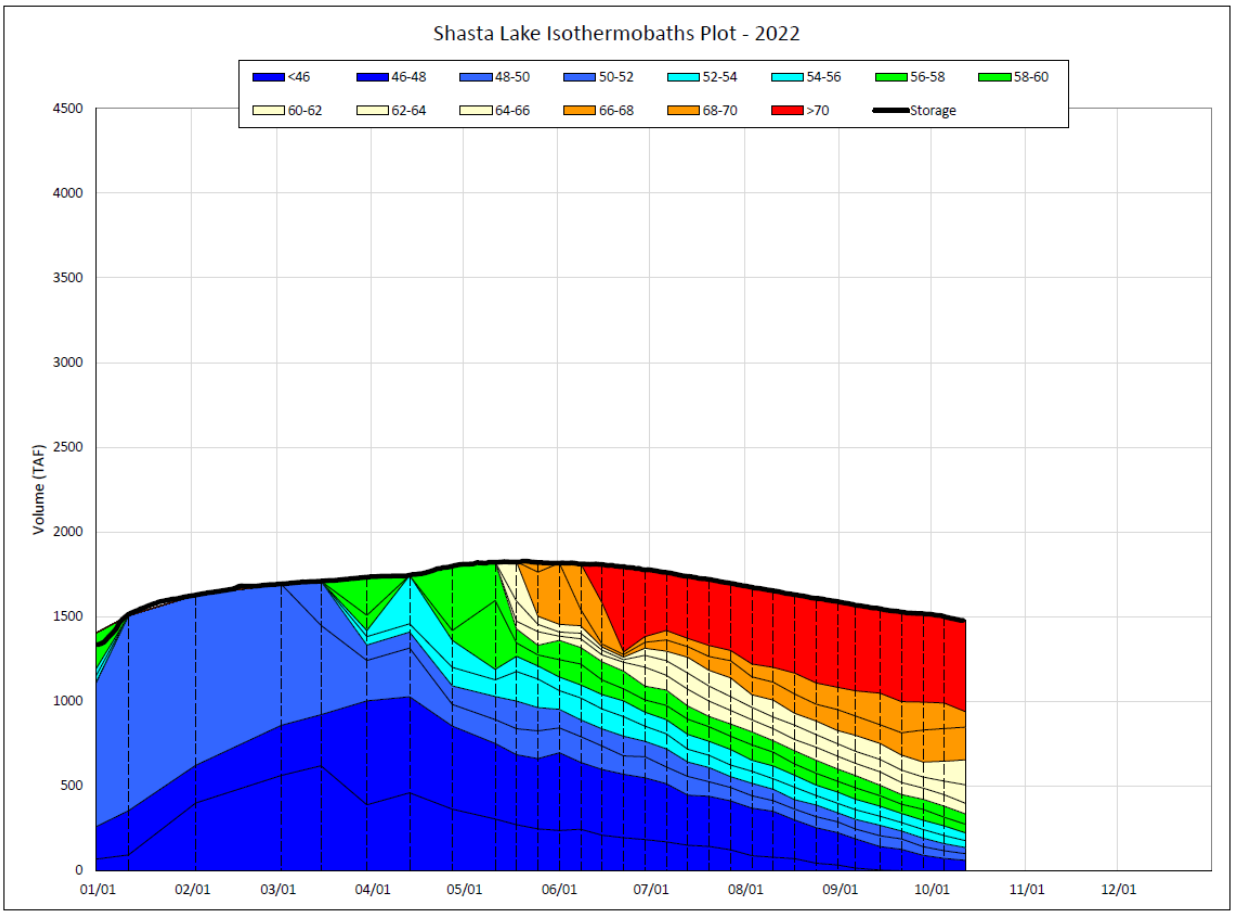
Code	Body of Water	Location[1]
LWS	Trinity River	1.1 miles downstream of Lewiston Dam
DGC	Trinity River	19 miles downstream of Lewiston Dam
NFH	Trinity River	38 miles downstream of Lewiston Dam

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

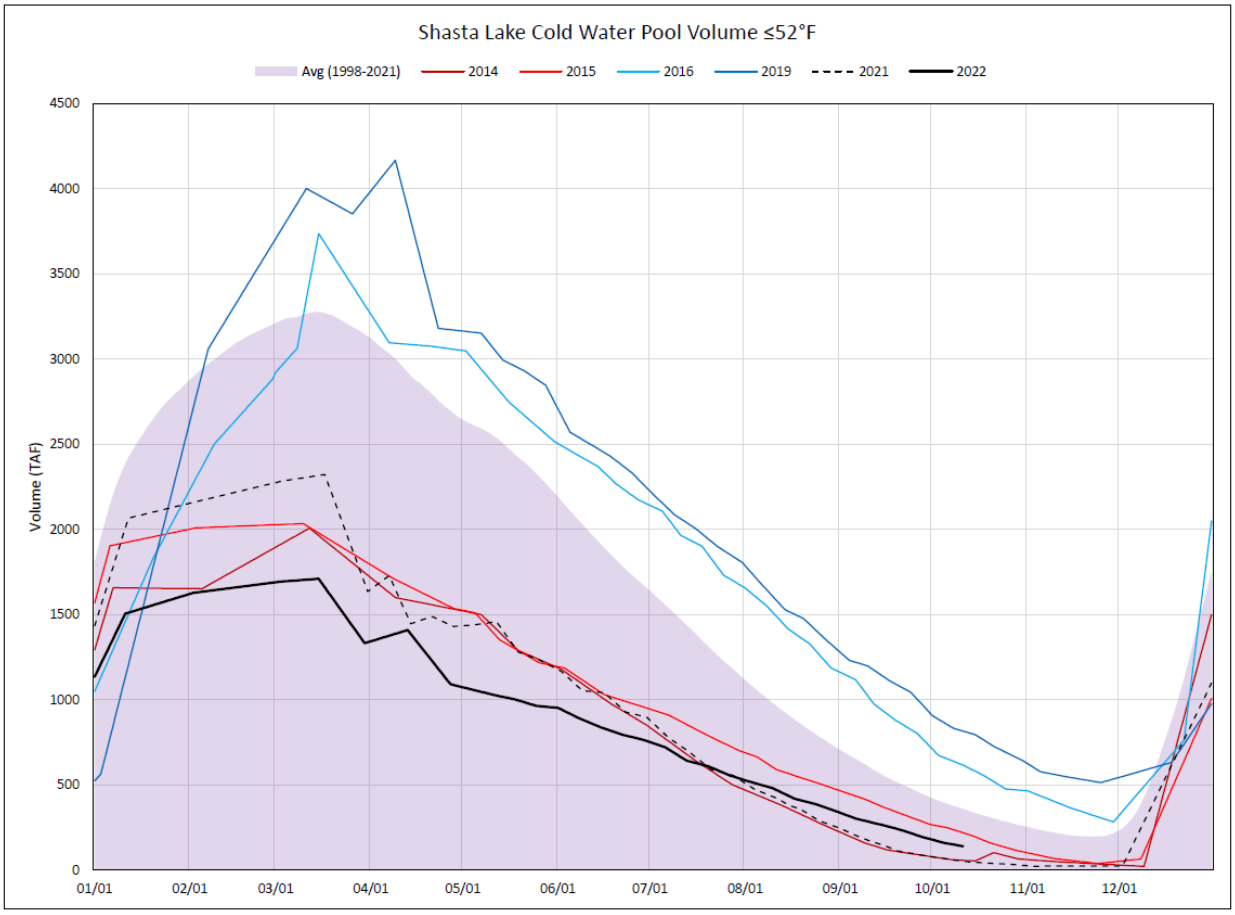
Notes

[1] Distances are approximate



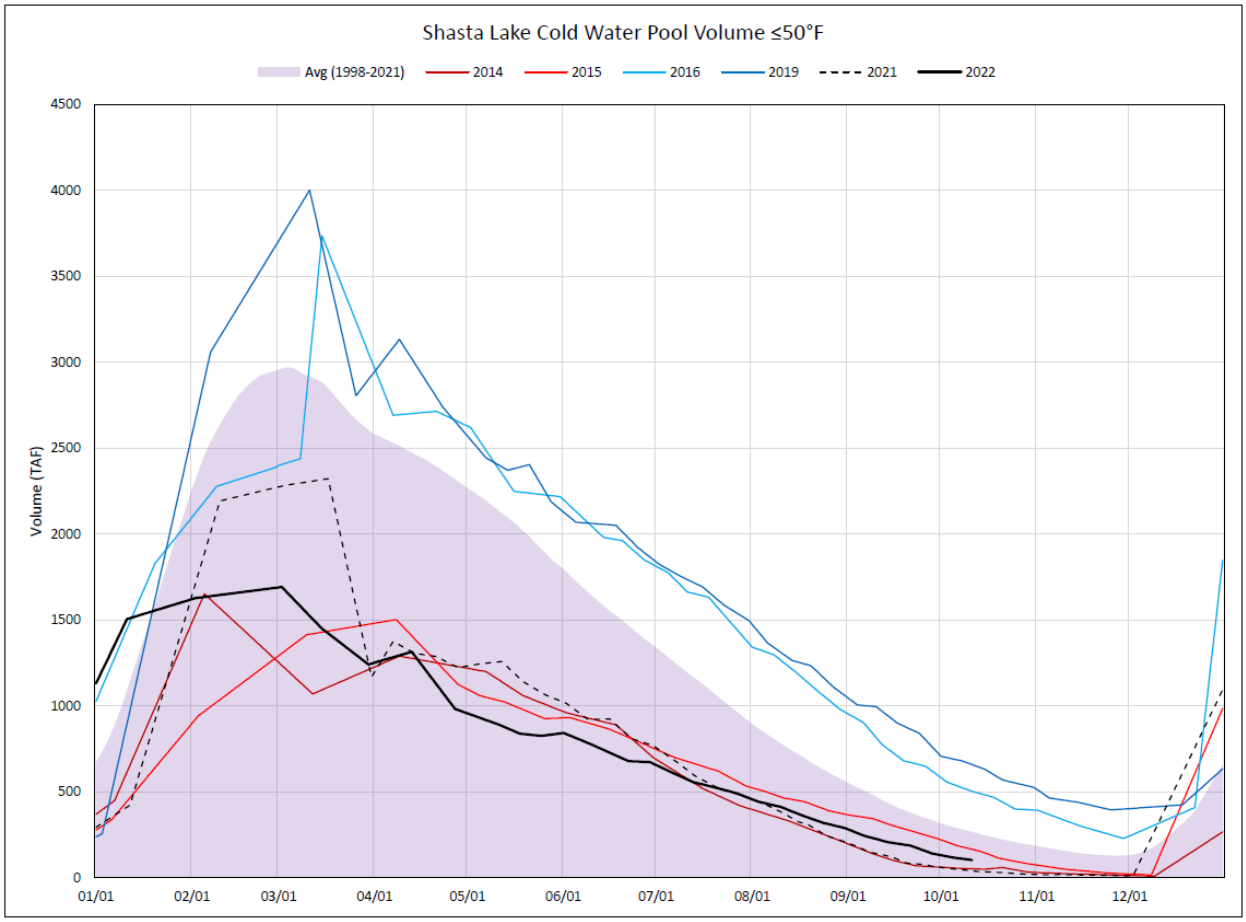
Shasta Lake Isothermobaths Plot – 2022

A chart that shows the temperature in degrees Fahrenheit and storage volume in thousands of acre-feet for 01/01 to 10/14 in Shasta Lake



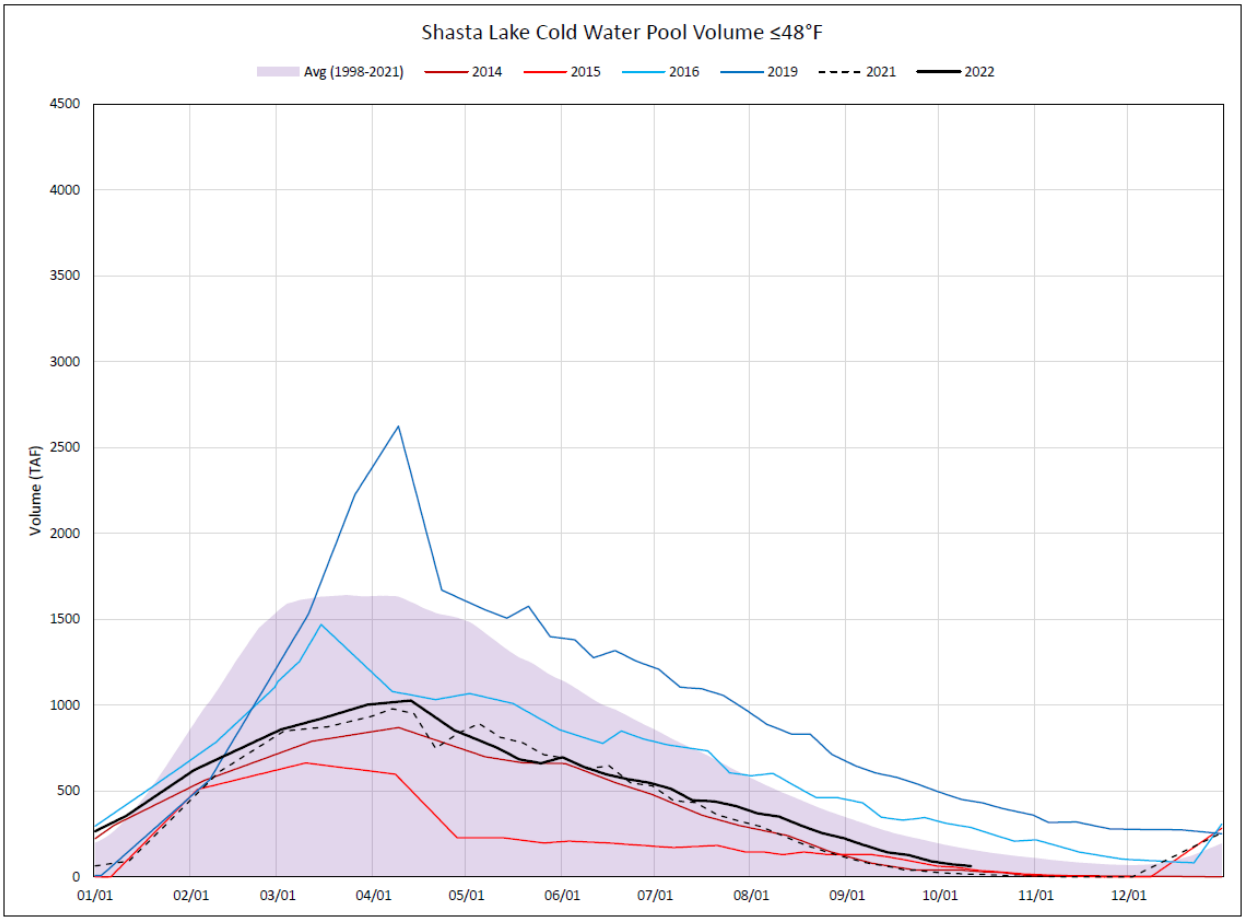
Shasta Lake Cold Water Pool Volume ≤52°F

This figure is a line graph showing Shasta Lake Cold Water Pool Volume equal to or less than 52 degrees Fahrenheit from 01/01 to 12/01. It includes a shaded area of the average 1998-2022 and lines depicting 2014, 2015, 2016, 2019, and 2022 data. The line showing 2023 data is from 01/01 to 10/14.



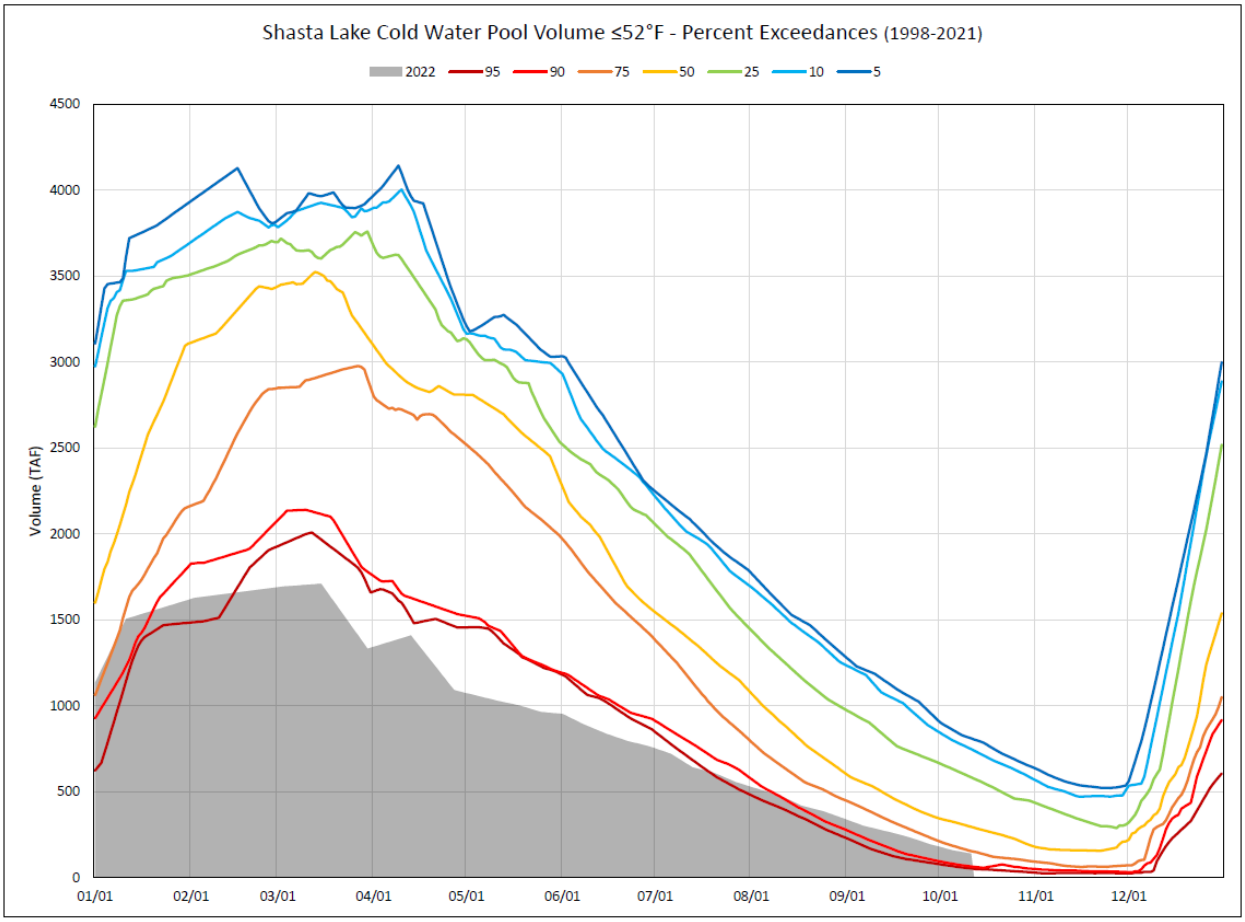
Shasta Lake Cold Water Pool Volume ≤50°F

This figure is a line graph showing Shasta Lake Cold Water Pool Volume equal to or less than 50 degrees Fahrenheit from 01/01 to 12/01. It includes a shaded area of the average 1998-2022 and lines depicting 2014, 2015, 2016, 2019, and 2022 data. The line showing 2023 data is from 01/01 to 10/14.



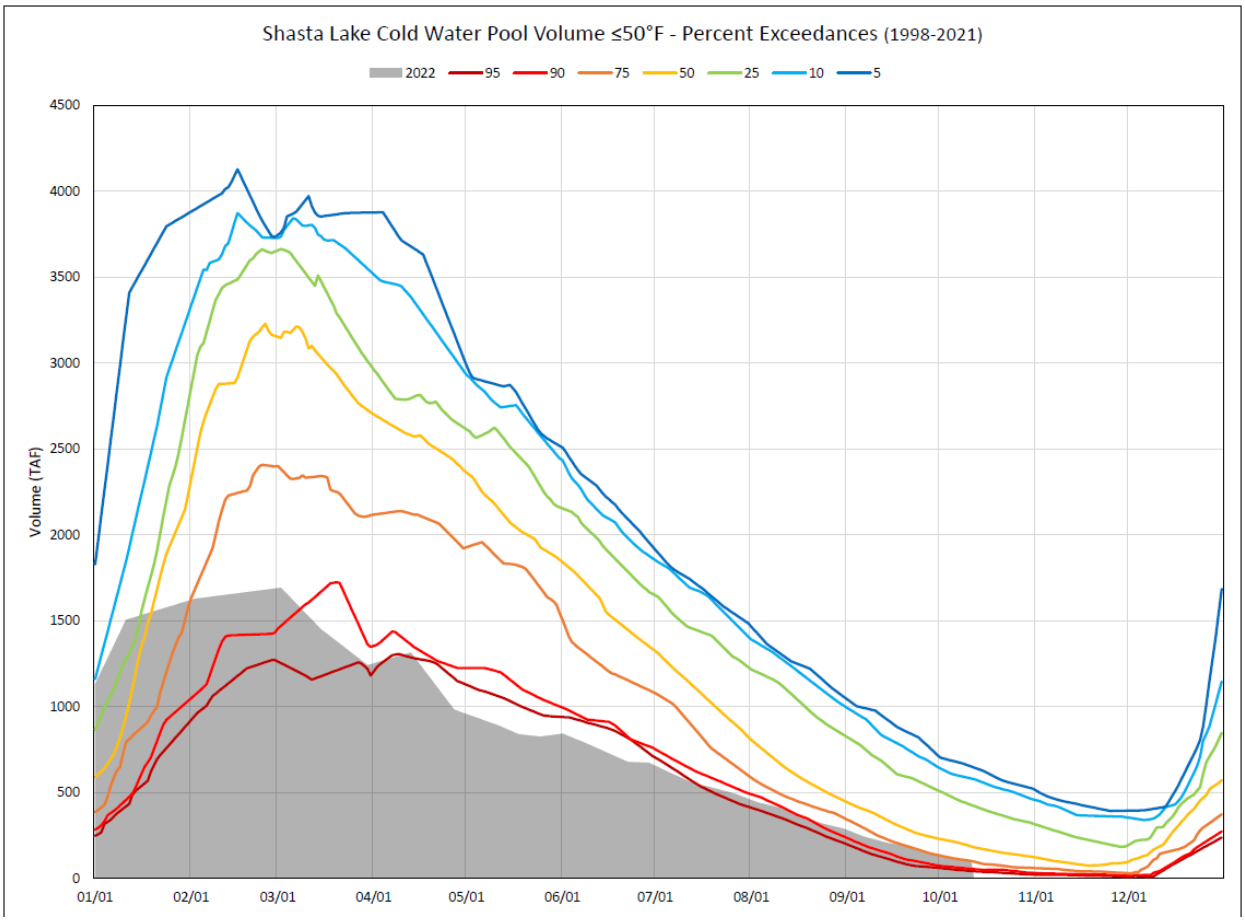
Shasta Lake Cold Water Pool Volume ≤48°F

This figure is a line graph showing Shasta Lake Cold Water Pool Volume equal to or less than 48 degrees Fahrenheit from 01/01 to 12/01. It includes a shaded area of the average 1998-2022 and lines depicting 2014, 2015, 2016, 2019, and 2022 data. The line showing 2023 data is from 01/01 to 10/14.



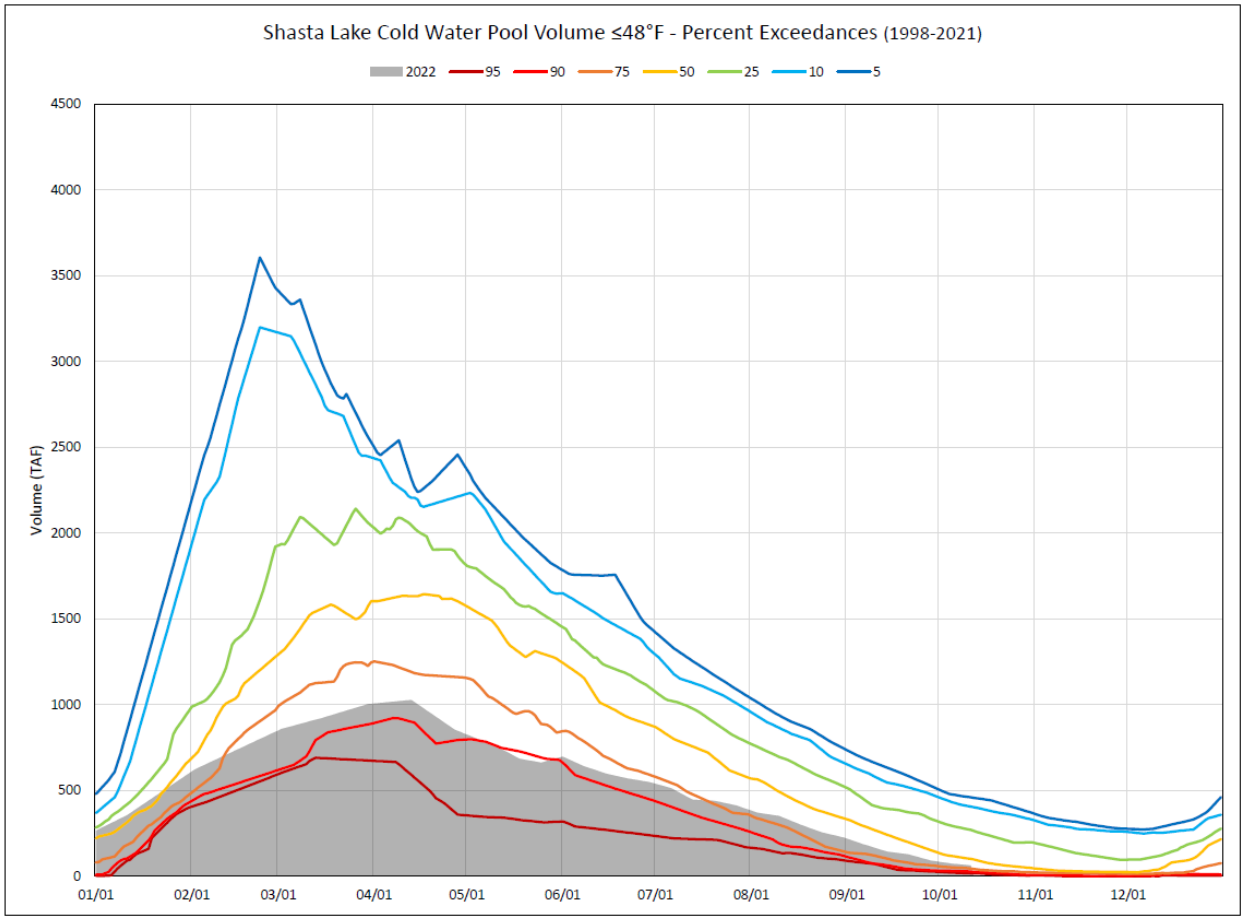
Shasta Lake Cold Water Pool Volume ≤52°F - Percent Exceedances (1998-2021)

This figure is a line graph showing Shasta Lake Cold Water Pool Volume less than or equal to 52 degrees Fahrenheit as percent exceedances from 01/01 to 12/01. It includes a shaded area for 2023 data from 01/01 to 10/14 and lines depicting 95, 90, 75, 50, 25, 10, and 5% exceedances.



Shasta Lake Cold Water Pool Volume ≤50°F - Percent Exceedances (1998-2021)

This figure is a line graph showing Shasta Lake Cold Water Pool Volume less than or equal to 50 degrees Fahrenheit as percent exceedances from 01/01 to 12/01. It includes a shaded area for 2023 data from 01/01 to 10/14 and lines depicting 95, 90, 75, 50, 25, 10, and 5% exceedances.

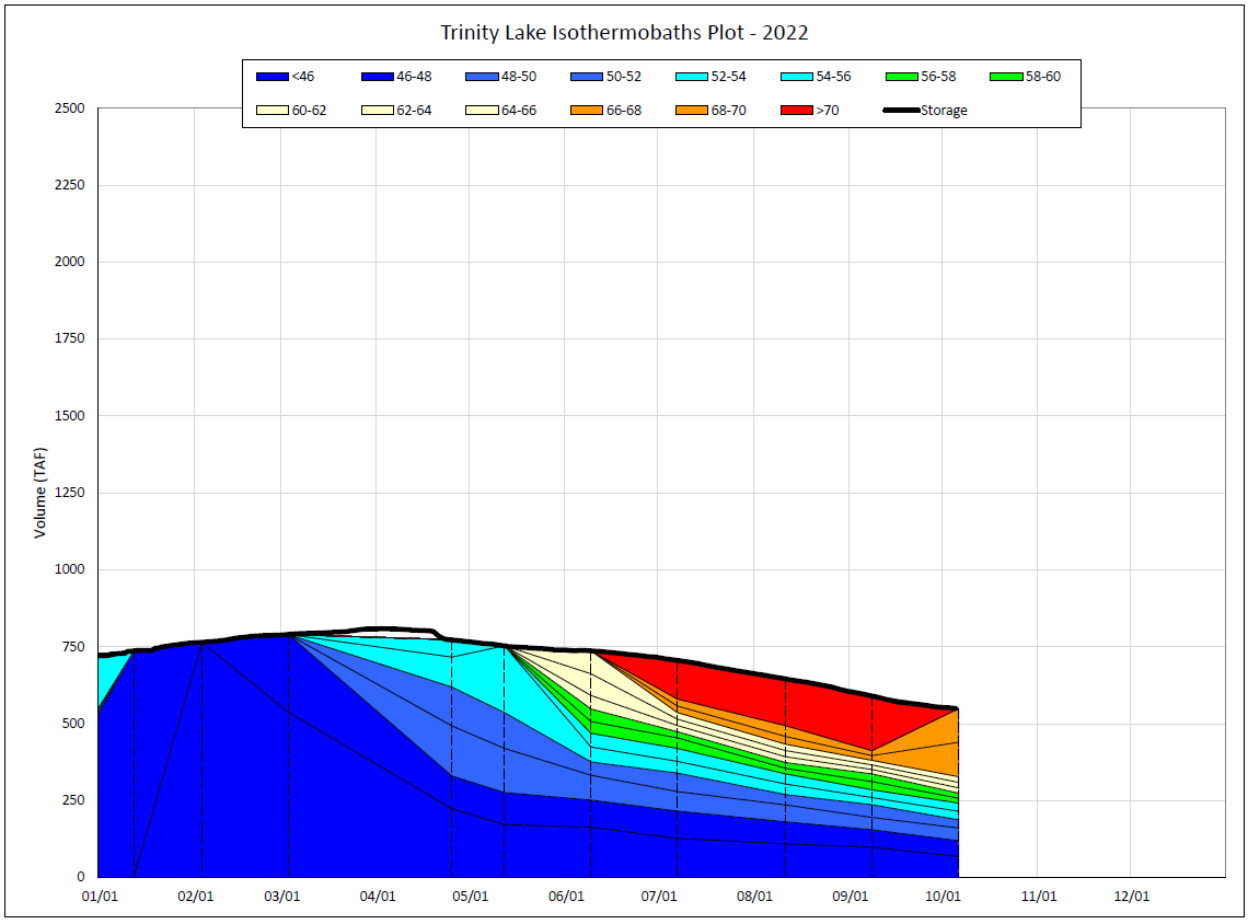


Shasta Lake Cold Water Pool Volume ≤48°F - Percent Exceedances (1998-2021)

This figure is a line graph showing Shasta Lake Cold Water Pool Volume less than or equal to 48 degrees Fahrenheit as percent exceedances from 01/01 to 12/01. It includes a shaded area for 2023 data from 01/01 to 10/14 and lines depicting 95, 90, 75, 50, 25, 10, and 5% exceedances.

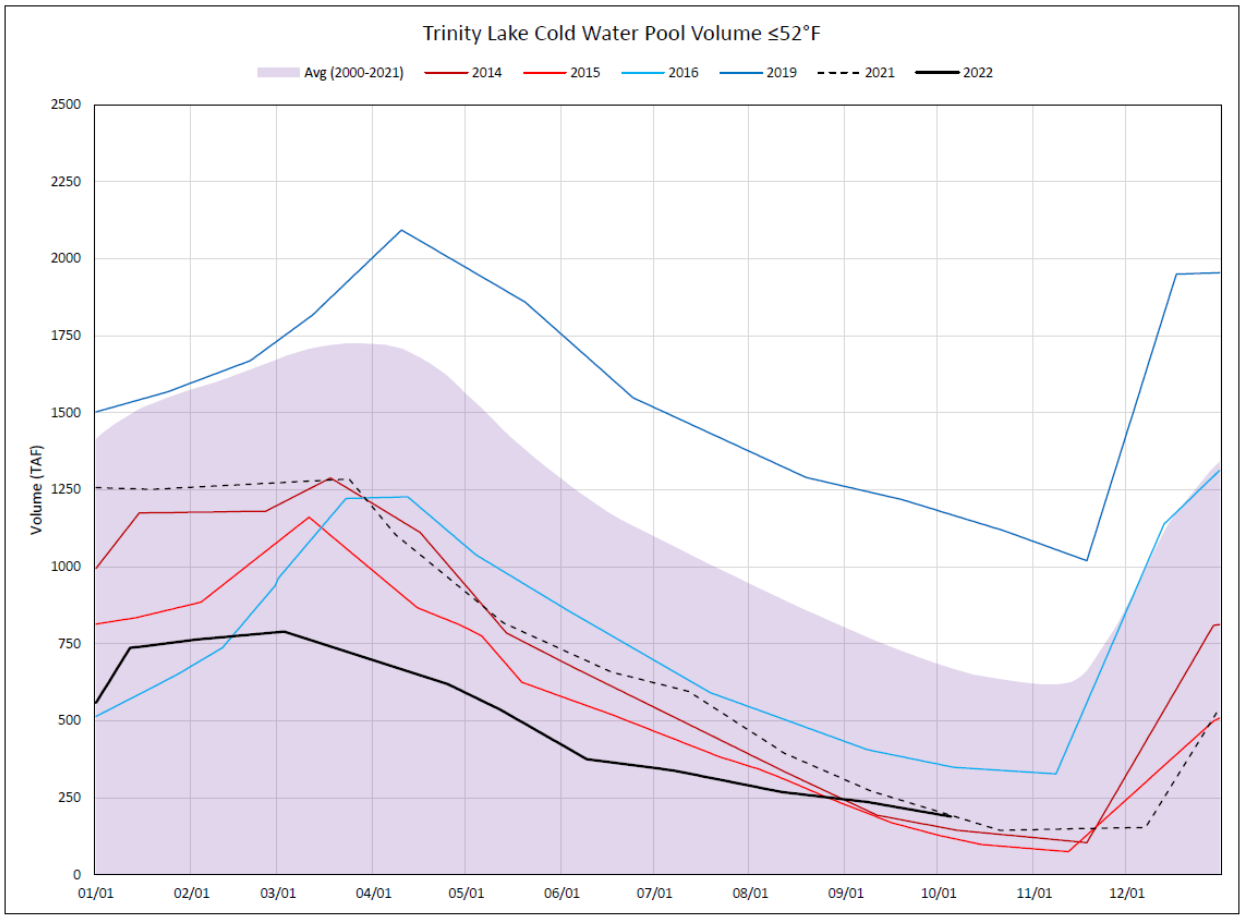
Shasta Lake Cold Water Pool Comparison by Year (for Specified Date)

Oct-12 2022	Difference in TAF: ≤ 52°F	Difference in TAF: ≤ 50°F	Difference in TAF: ≤ 48°F	Difference in TAF: Absolute Average	Percent Difference: ≤ 52°F	Percent Difference: ≤ 50°F	Percent Difference: ≤ 48°F	Percent Difference: Absolute Average
1998	76	-10	-44	43	54	-10	-70	45
1999	472	397	306	392	335	384	484	401
2000	163	75	-16	84	116	72	-25	71
2001	89	72	57	73	64	69	90	74
2002	253	229	147	210	180	221	232	211
2003	268	88	-26	127	190	85	-40	105
2004	14	-1	-8	8	10	-1	-13	8
2005	12	-20	-24	18	8	-19	-38	22
2006	259	207	117	194	184	200	185	190
2007	19	24	19	21	13	23	31	22
2008	-66	-43	-17	42	-47	-42	-28	39
2009	4	-1	12	6	3	-1	19	8
2010	502	327	153	328	357	317	243	306
2011	654	527	403	528	465	509	637	537
2012	361	319	233	304	257	308	368	311
2013	133	136	118	129	94	131	187	137
2014	-83	-51	-27	54	-59	-49	-43	50
2015	79	63	-19	54	56	61	-30	49
2016	476	400	225	367	339	387	356	361
2017	562	431	303	432	399	417	480	432
2018	242	181	61	161	172	175	97	148
2019	675	556	379	537	480	538	600	539
2020	148	80	-6	78	106	78	-10	64
2021	-88	-62	-46	65	-62	-60	-73	65
2022	0	0	0	0	0	0	0	0



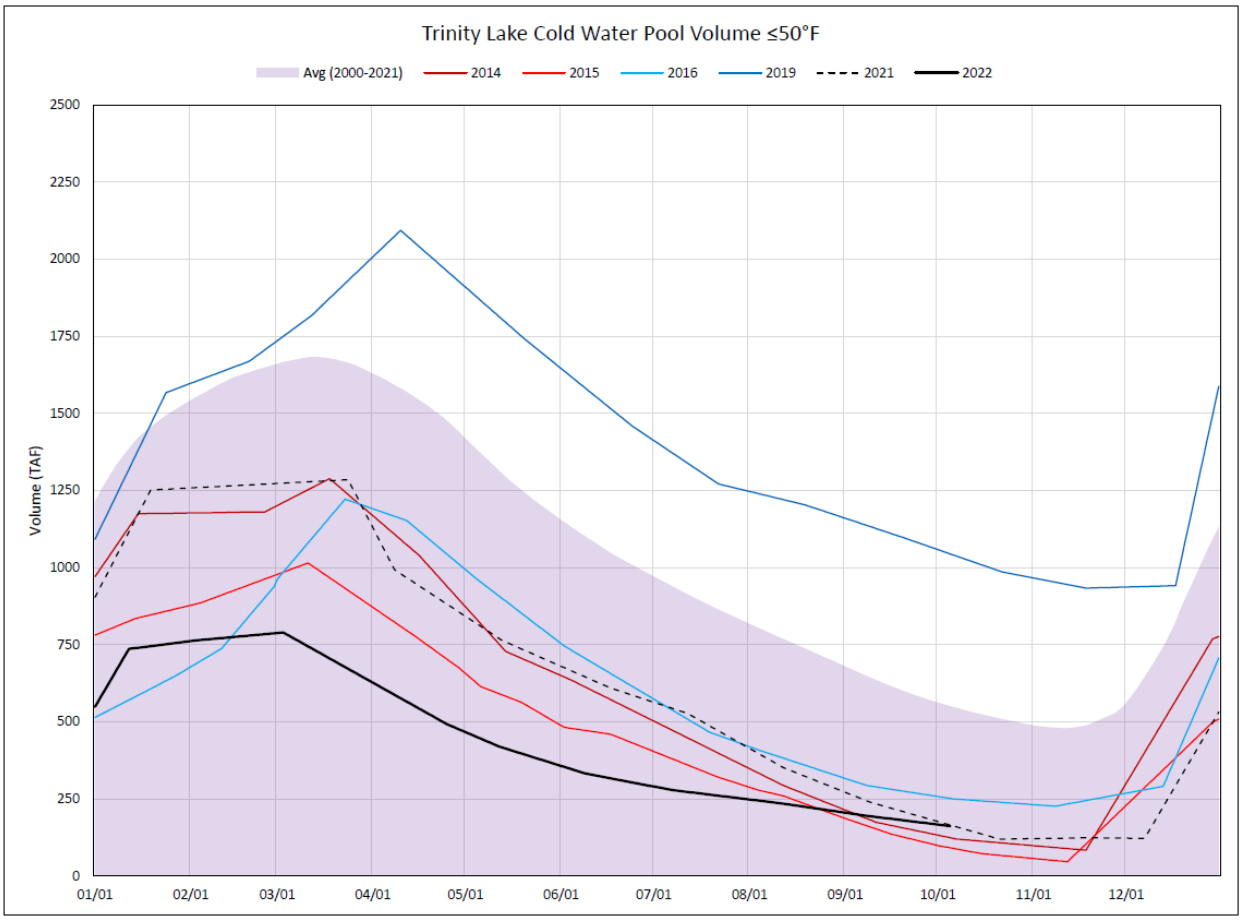
Trinity Lake Isothermobaths Plot – 2022

A chart that shows the temperature in degrees Fahrenheit and storage volume in thousands of acre-feet for 01/01 to 10/01 in Shasta Lake.



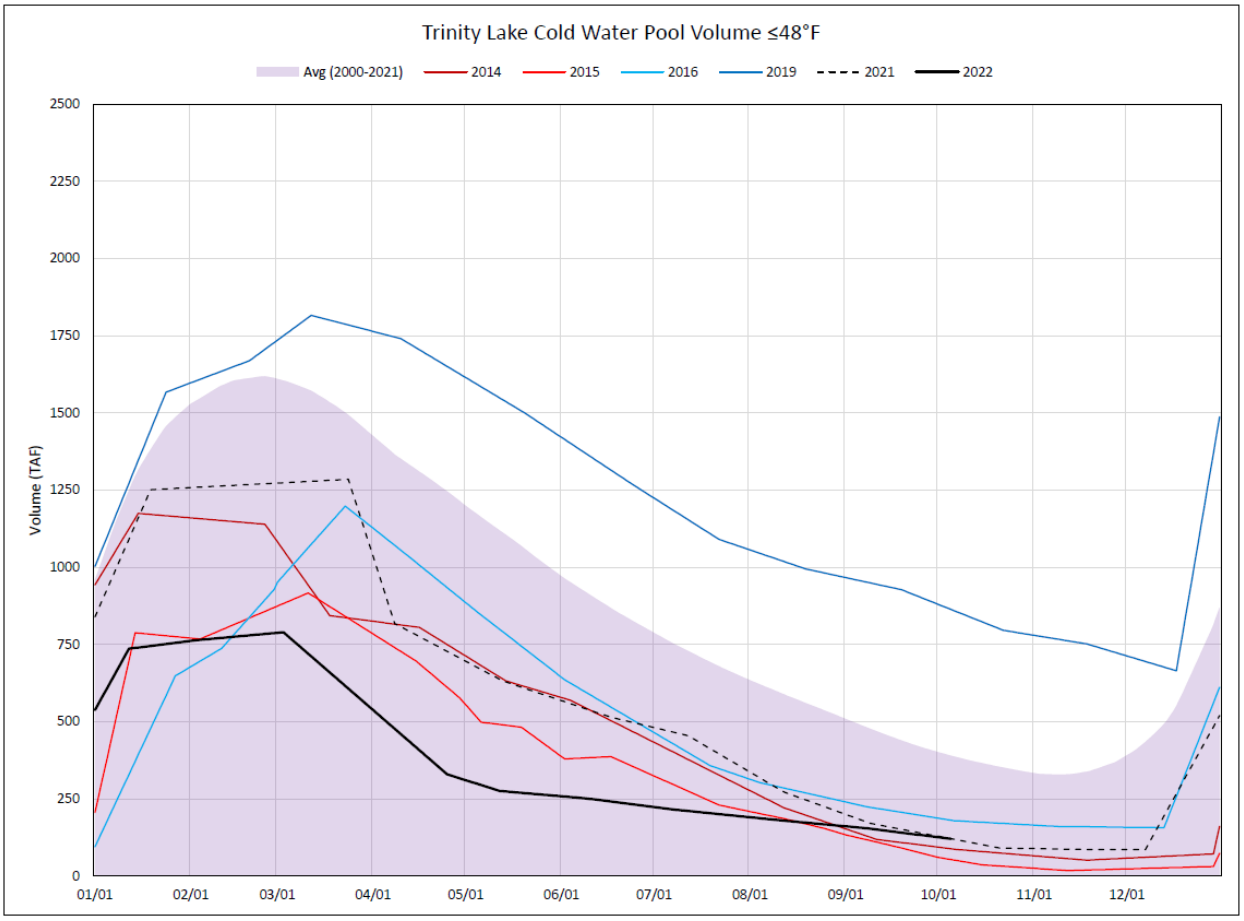
Trinity Lake Cold Water Pool Volume ≤52°F

This figure is a line graph showing Trinity Lake Cold Water Pool Volume equal to or less than 52 degrees Fahrenheit from 01/01 to 12/01. It includes a shaded area of the average 1998-2022 and lines depicting 2014, 2015, 2016, 2019, and 2022 data. The line showing 2023 data is from 01/01 to 10/14.



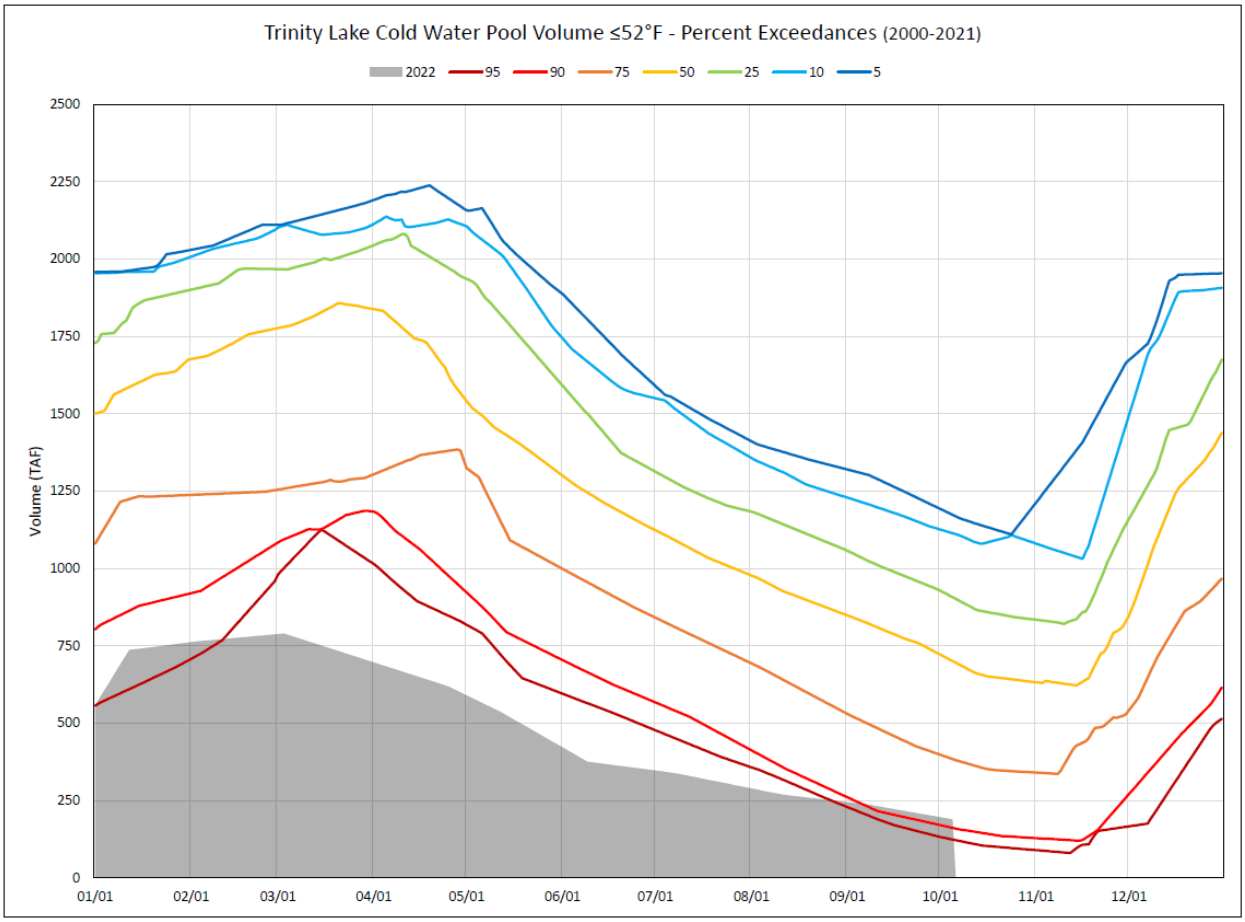
Trinity Lake Cold Water Pool Volume ≤50°F

This figure is a line graph showing Trinity Lake Cold Water Pool Volume equal to or less than 50 degrees Fahrenheit from 01/01 to 12/01. It includes a shaded area of the average 1998-2022 and lines depicting 2014, 2015, 2016, 2019, and 2022 data. The line showing 2023 data is from 01/01 to 10/14.



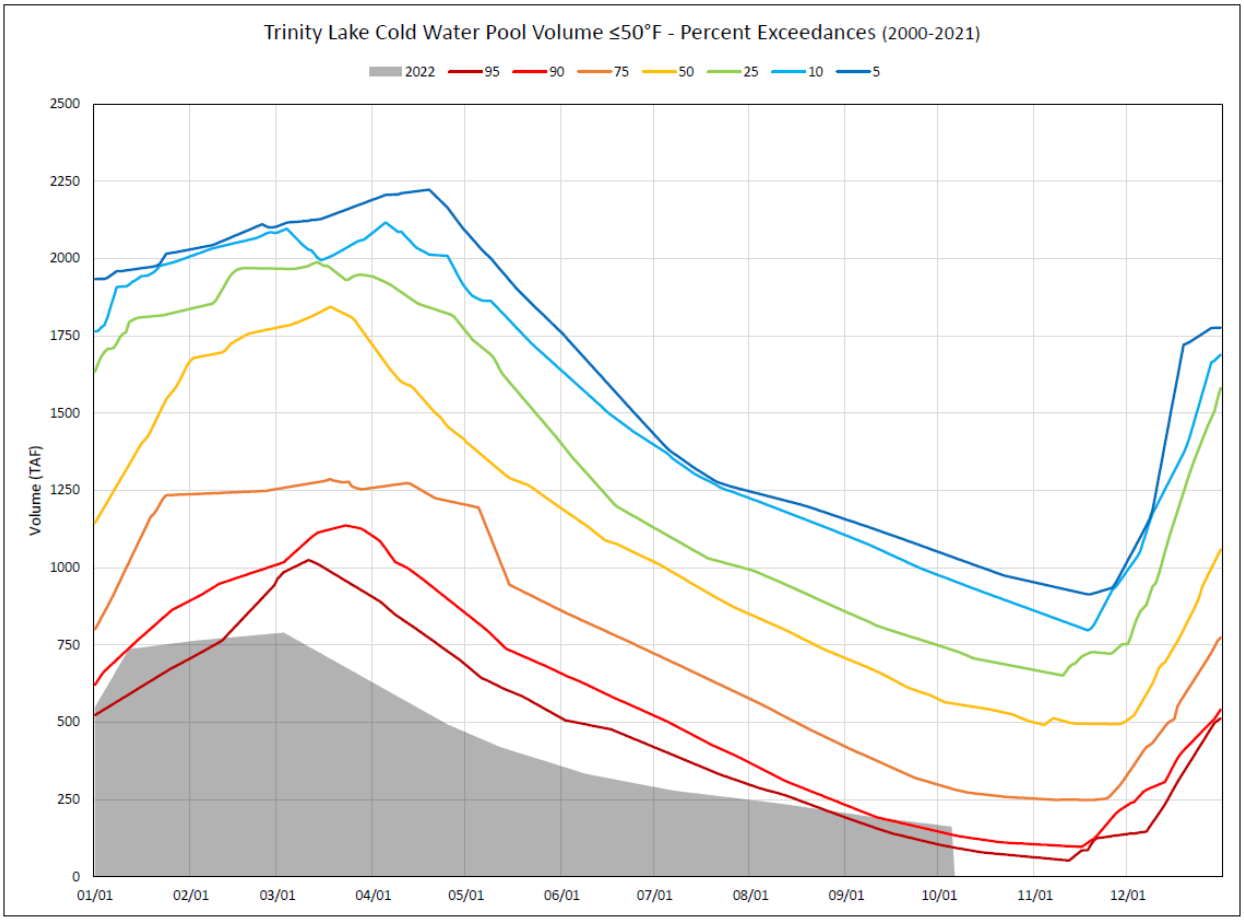
Trinity Lake Cold Water Pool Volume ≤48°F

This figure is a line graph showing Trinity Lake Cold Water Pool Volume equal to or less than 48 degrees Fahrenheit from 01/01 to 12/01. It includes a shaded area of the average 1998-2022 and lines depicting 2014, 2015, 2016, 2019, and 2022 data. The line showing 2023 data is from 01/01 to 10/14.



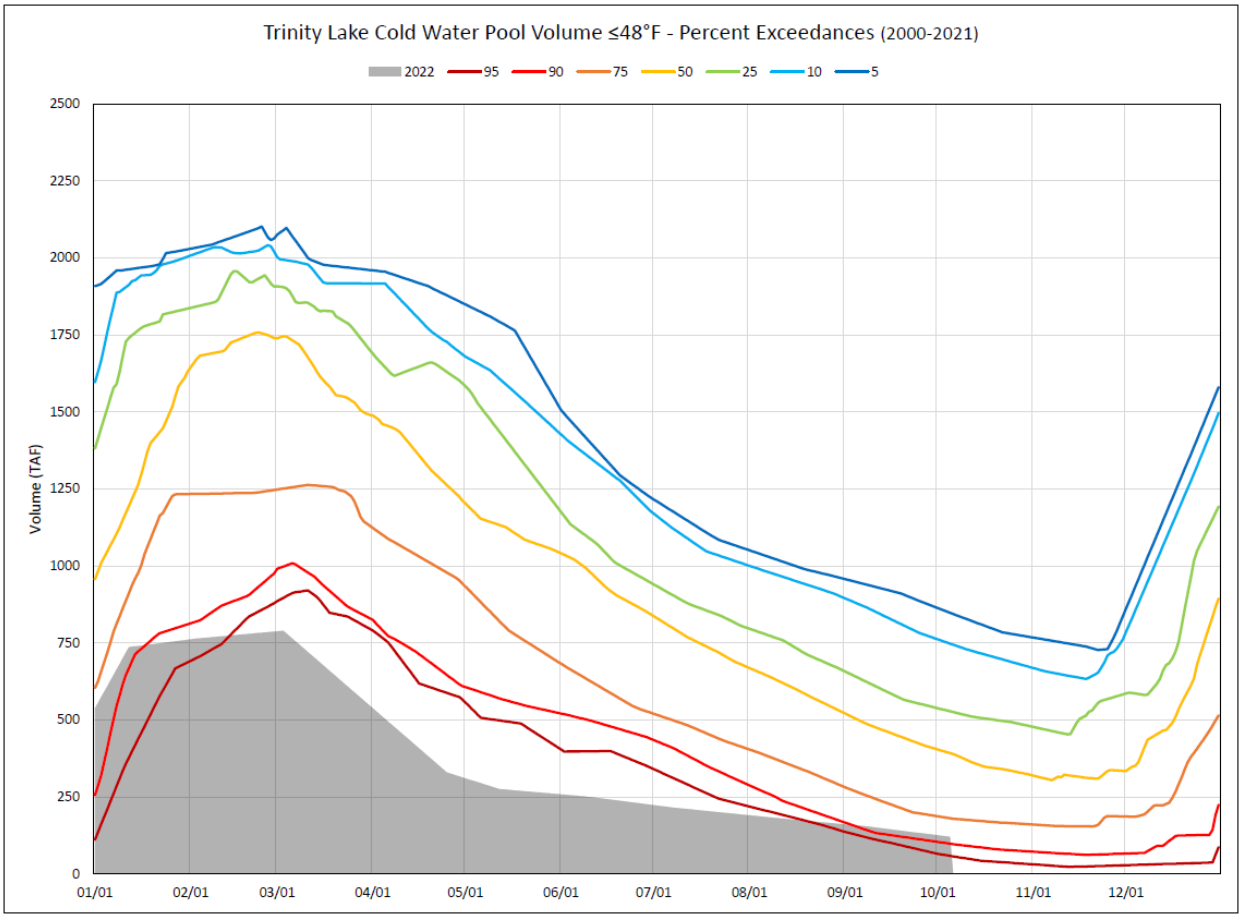
Trinity Lake Cold Water Pool Volume ≤52°F - Percent Exceedances (2000-2021)

This figure is a line graph showing Trinity Lake Cold Water Pool Volume less than or equal to 52 degrees Fahrenheit as percent exceedances from 01/01 to 12/01. It includes a shaded area for 2023 data from 01/01 to 10/04 and lines depicting 95, 90, 75, 50, 25, 10, and 5% exceedances.



Trinity Lake Cold Water Pool Volume ≤50°F - Percent Exceedances (2000-2021)

This figure is a line graph showing Trinity Lake Cold Water Pool Volume less than or equal to 50 degrees Fahrenheit as percent exceedances from 01/01 to 12/01. It includes a shaded area for 2023 data from 01/01 to 10/04 and lines depicting 95, 90, 75, 50, 25, 10, and 5% exceedances.

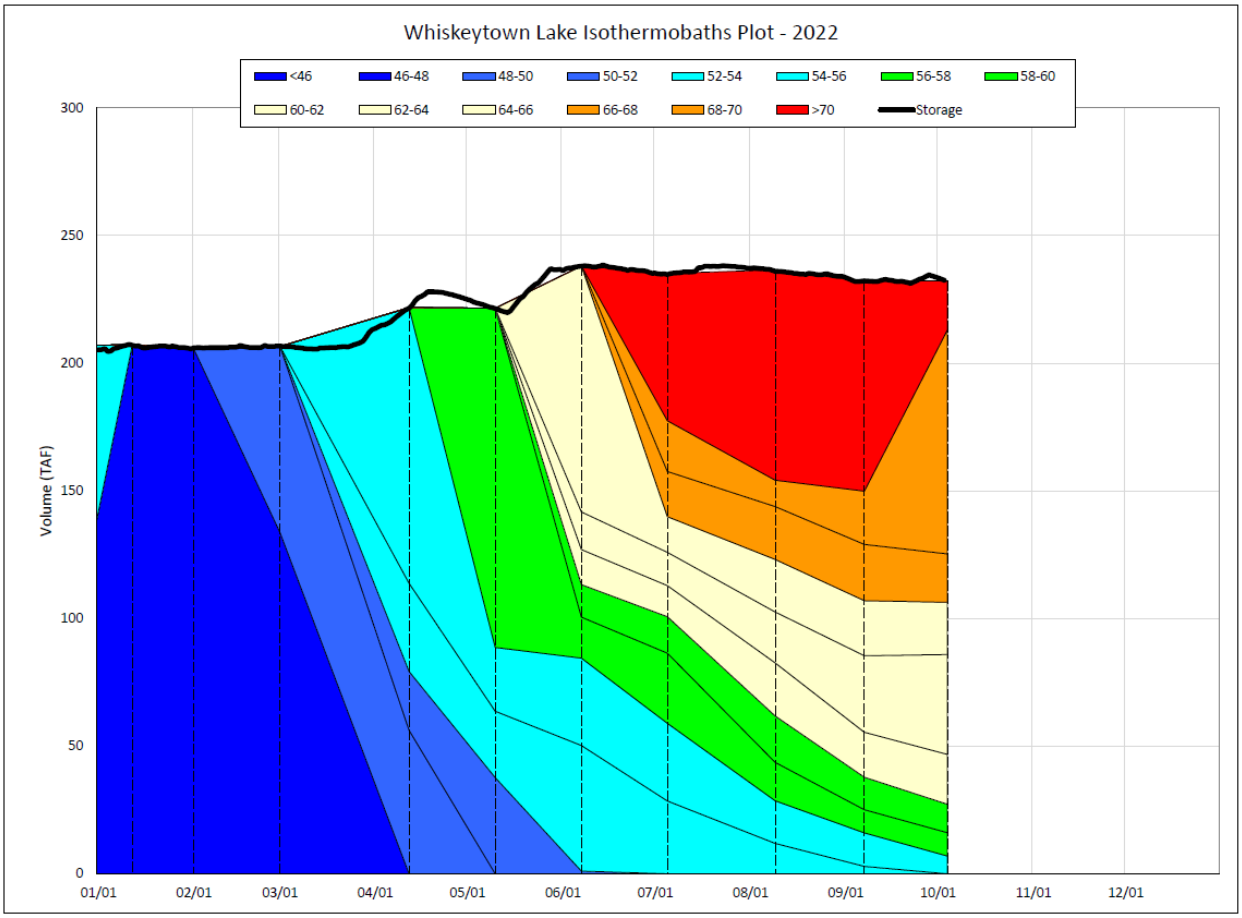


Trinity Lake Cold Water Pool Volume ≤48°F - Percent Exceedances (2000-2021)

This figure is a line graph showing Trinity Lake Cold Water Pool Volume less than or equal to 48 degrees Fahrenheit as percent exceedances from 01/01 to 12/01. It includes a shaded area for 2023 data from 01/01 to 10/04 and lines depicting 95, 90, 75, 50, 25, 10, and 5% exceedances.

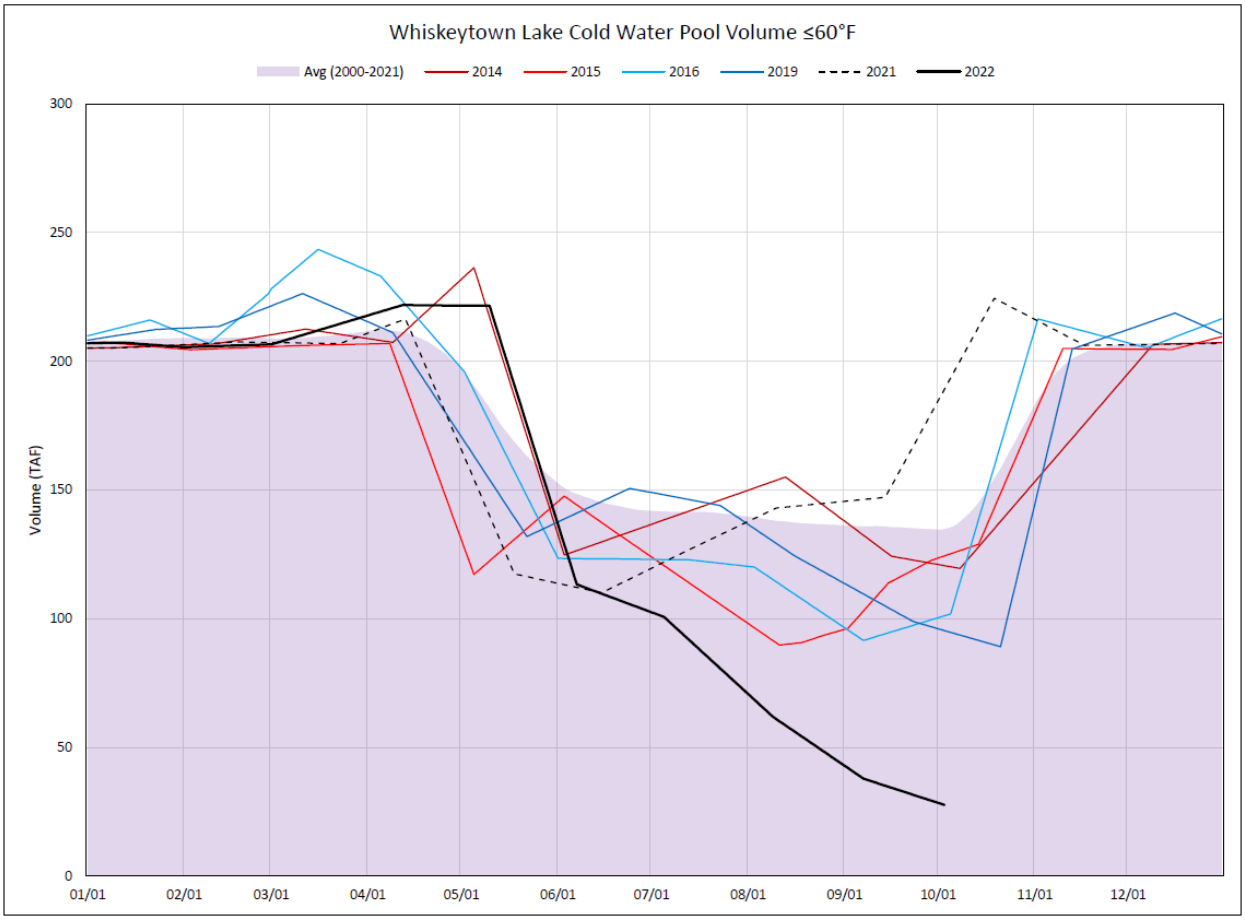
Trinity Cold Water Pool Comparison by Year (for Specified Date)

Oct-06 2022	Difference in TAF: ≤ 52°F	Difference in TAF: ≤ 50°F	Difference in TAF: ≤ 48°F	Difference in TAF: Absolute Average	Percent Difference: ≤ 52°F	Percent Difference: ≤ 50°F	Percent Difference: ≤ 48°F	Percent Difference: Absolute Average
2000	586	396	230	404	310	244	191	248
2001	441	380	278	366	233	234	230	232
2002	471	402	324	399	249	248	269	255
2003	715	505	281	501	378	311	233	307
2004	497	382	221	367	263	236	183	227
2005	727	560	266	518	384	345	221	317
2006	772	621	430	608	408	383	356	382
2007	542	479	400	474	287	295	331	304
2008	203	126	60	130	107	78	50	78
2009	172	116	49	112	91	71	40	67
2010	527	360	142	343	279	222	118	206
2011	985	823	600	803	521	507	497	508
2012	795	738	639	724	420	455	429	468
2013	337	280	192	270	178	172	159	170
2014	-41	-38	-32	37	-21	-23	-26	24
2015	-69	-70	-67	69	-37	-43	-55	45
2016	162	90	60	104	85	55	50	64
2017	681	488	332	500	360	301	275	312
2018	665	612	501	593	352	377	415	381
2019	980	882	743	869	518	544	615	559
2020	443	413	280	379	234	255	232	240
2021	4	3	1	3	2	2	0	2
2022	0	0	0	0	0	0	0	0



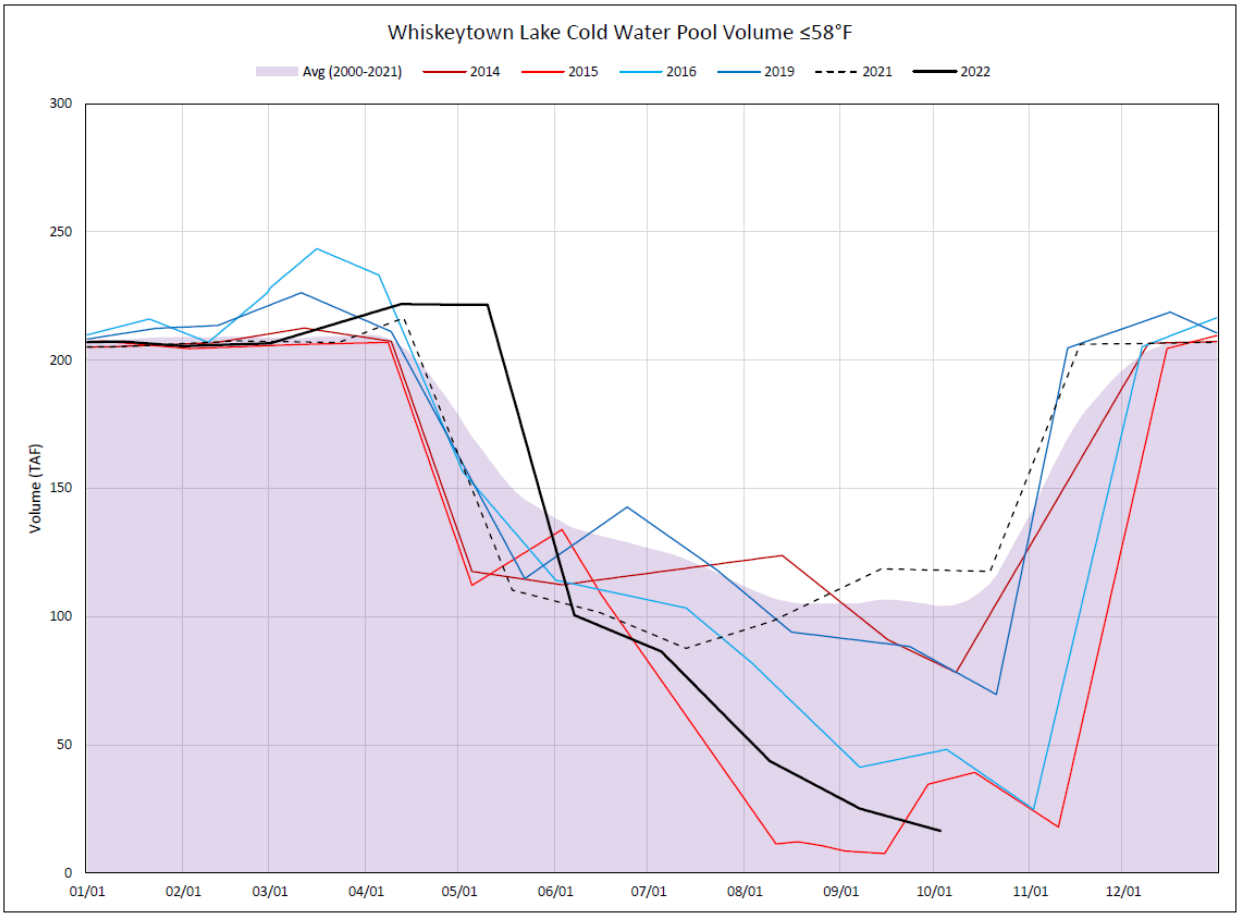
Whiskeytown Lake Isothermobaths Plot – 2022

A chart that shows the temperature in degrees Fahrenheit and storage volume in thousands of acre-feet for 01/01 to 10/01 in Whiskeytown Lake.



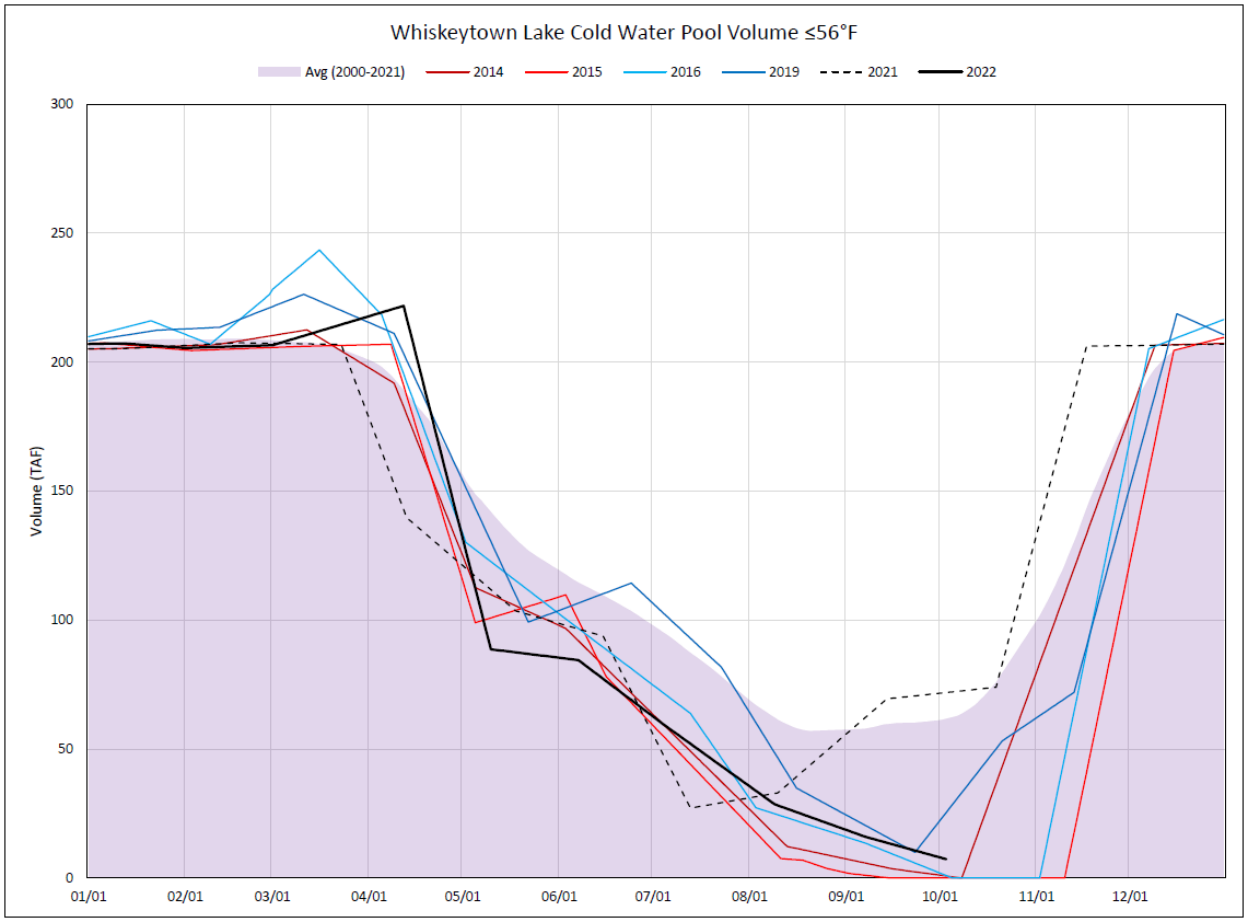
Whiskeytown Lake Cold Water Pool Volume ≤60°F

This figure is a line graph showing Whiskeytown Lake Cold Water Pool Volume equal to or less than 60 degrees Fahrenheit from 01/01 to 12/01. It includes a shaded area of the average 1998-2022 and lines depicting 2014, 2015, 2016, 2019, and 2022 data. The line showing 2023 data is from 01/01 to 10/04.



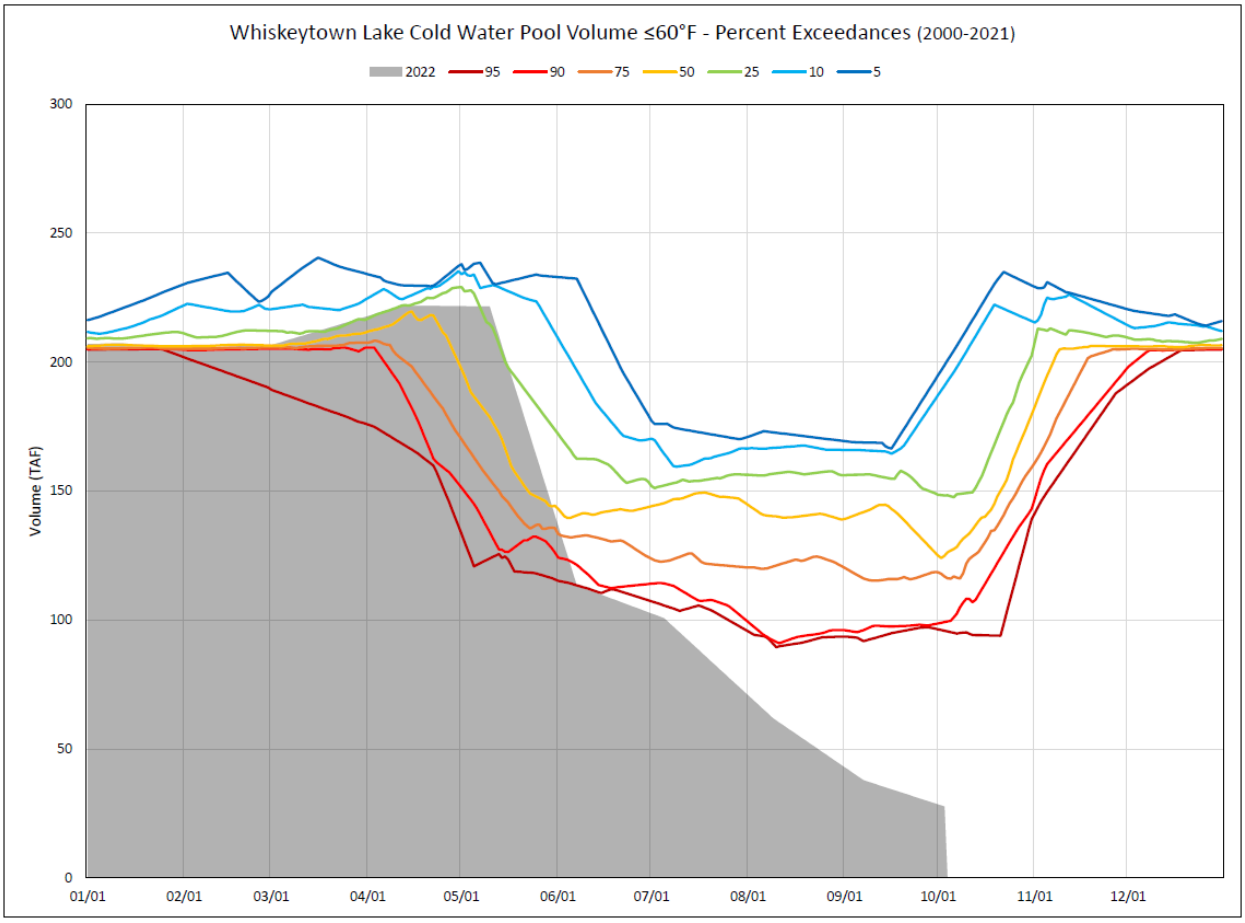
Whiskeytown Lake Cold Water Pool Volume ≤58°F

This figure is a line graph showing Whiskeytown Lake Cold Water Pool Volume equal to or less than 58 degrees Fahrenheit from 01/01 to 12/01. It includes a shaded area of the average 1998-2022 and lines depicting 2014, 2015, 2016, 2019, and 2022 data. The line showing 2023 data is from 01/01 to 10/04.



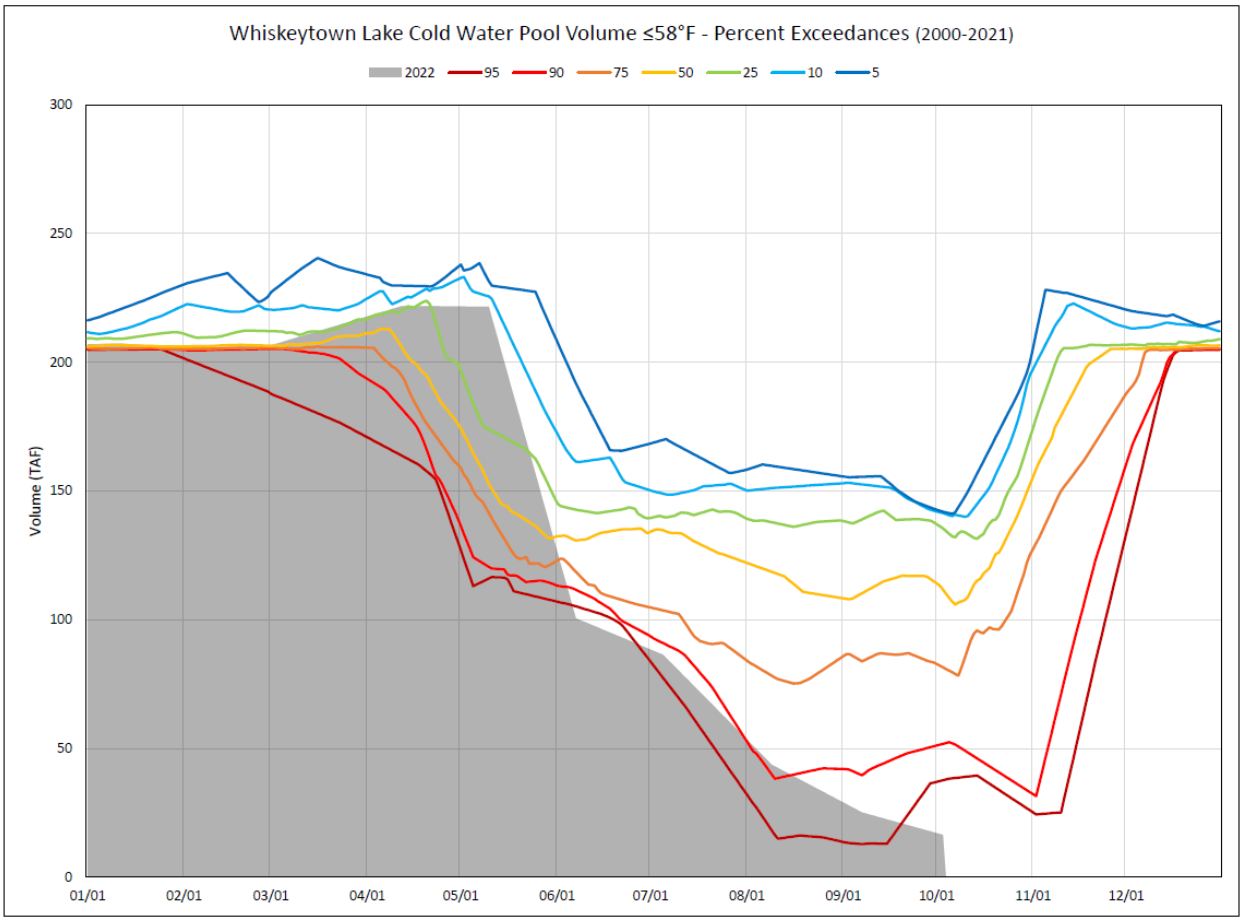
Whiskeytown Lake Cold Water Pool Volume ≤56°F

This figure is a line graph showing Whiskeytown Lake Cold Water Pool Volume equal to or less than 56 degrees Fahrenheit from 01/01 to 12/01. It includes a shaded area of the average 1998-2022 and lines depicting 2014, 2015, 2016, 2019, and 2022 data. The line showing 2023 data is from 01/01 to 10/04.



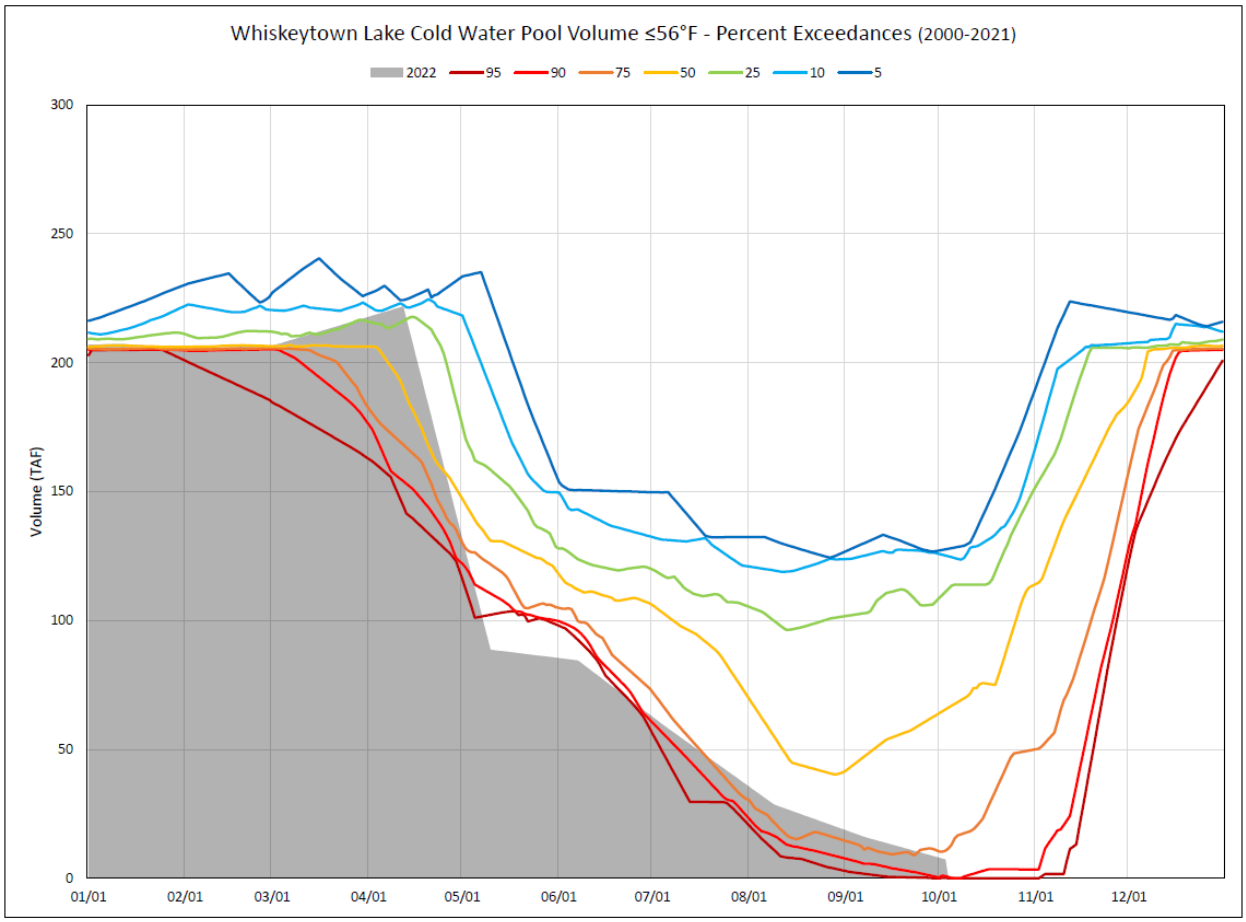
Whiskeytown Lake Cold Water Pool Volume ≤60°F - Percent Exceedances (2000-2021)

This figure is a line graph showing Whiskeytown Lake Cold Water Pool Volume less than or equal to 60 degrees Fahrenheit as percent exceedances from 01/01 to 12/01. It includes a shaded area for 2023 data from 01/01 to 10/04 and lines depicting 95, 90, 75, 50, 25, 10, and 5% exceedances.



Whiskeytown Lake Cold Water Pool Volume ≤58°F - Percent Exceedances (2000-2021)

This figure is a line graph showing Whiskeytown Lake Cold Water Pool Volume less than or equal to 58 degrees Fahrenheit as percent exceedances from 01/01 to 12/01. It includes a shaded area for 2023 data from 01/01 to 10/04 and lines depicting 95, 90, 75, 50, 25, 10, and 5% exceedances.



Whiskeytown Lake Cold Water Pool Volume ≤56°F - Percent Exceedances (2000-2021)

This figure is a line graph showing Whiskeytown Lake Cold Water Pool Volume less than or equal to 56 degrees Fahrenheit as percent exceedances from 01/01 to 12/01. It includes a shaded area for 2023 data from 01/01 to 10/04 and lines depicting 95, 90, 75, 50, 25, 10, and 5% exceedances.

Whiskeytown Cold Water Pool Comparison by Year (for Specified Date)

Oct- 12 2022	Difference in TAF: ≤ 52°F	Difference in TAF: ≤ 50°F	Difference in TAF: ≤ 48°F	Difference in TAF: Absolute Average	Percent Difference: ≤ 52°F	Percent Difference: ≤ 50°F	Percent Difference: ≤ 48°F	Percent Difference: Absolute Average
2000	90.5	93.0	82.9	88.8	327.1	565.3	1133.3	675.2
2001	119.2	124.1	118.5	120.6	431.0	753.8	1620.7	935.2
2002	123.0	125.5	106.3	118.3	444.7	762.4	1453.5	886.8
2003	116.7	125.4	120.6	120.9	421.8	761.7	1648.7	944.1
2004	120.5	122.6	102.9	115.3	435.5	744.6	1407.1	862.4
2005	70.7	52.8	9.2	44.2	255.6	320.9	125.8	234.1
2006	112.4	117.9	116.4	115.6	406.3	716.3	1591.2	904.6
2007	97.8	105.0	66.3	89.7	353.5	637.8	906.1	632.5
2008	102.5	105.1	97.0	101.5	370.6	638.4	1325.6	778.2
2009	85.6	77.6	-0.7	54.6	309.5	471.4	-9.1	263.3
2010	94.8	44.8	-6.2	48.6	342.8	272.2	-84.3	233.1
2011	85.0	84.7	38.5	69.4	307.3	514.6	526.4	449.5
2012	121.2	99.1	45.2	88.5	438.1	601.8	617.5	552.5
2013	172.4	122.3	106.7	133.8	623.1	743.0	1458.6	941.6
2014	93.0	64.7	-6.5	54.7	336.1	392.8	-89.0	272.6
2015	96.7	19.4	-7.3	41.2	349.8	118.0	-100.0	189.3
2016	73.5	31.3	-6.3	37.0	265.6	189.9	-86.7	180.8
2017	163.9	97.5	74.5	111.9	592.5	592.2	1017.8	734.2
2018	92.7	66.3	4.8	54.6	335.2	403.1	65.8	268.0
2019	67.7	65.2	18.1	50.3	244.9	396.2	247.1	296.1
2020	95.2	82.3	51.7	76.4	344.2	500.0	707.3	517.1
2021	161.5	101.6	64.6	109.2	583.7	617.4	883.0	694.7
2022	0	0	0	0	0	0	0	0

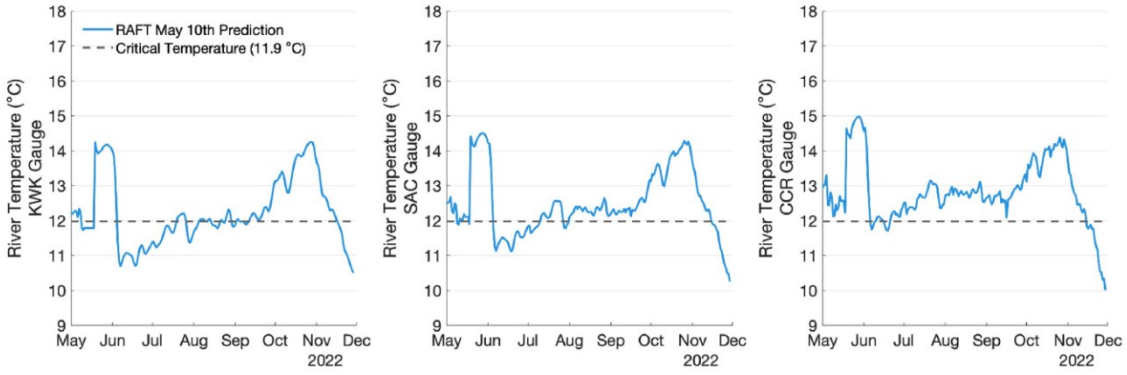
TDM Modeling

October 13, 2022
SWFSC
DRAFT

Additional information available at:

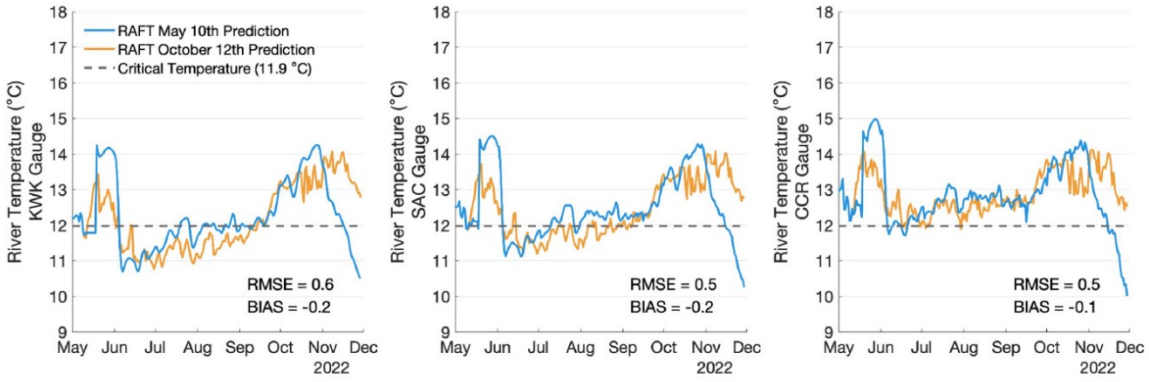
https://oceanview.pfeg.noaa.gov/CVTEMP/download

DRAFT - Preliminary Results - For Discussion Purposes Only



Science Center's Predicted Temperature at beginning of season (May 10, 2022)

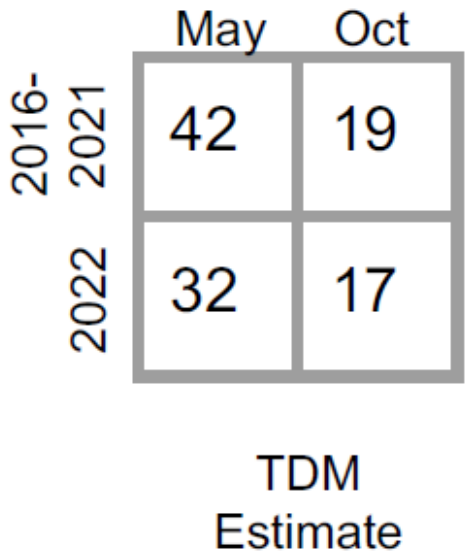
This figure shows three different line graphs showing RAFT May 10th River Temperature predictions for Keswick, Sacramento, and Clear Creek Gauges from May – December 2022 in degrees Celsius. The graphs also include the critical temperature of 11.9 degrees Celsius.



Science Center's Predicted Temperature near end of season (Oct 12, 2022)

This figure shows three different line graphs showing RAFT May 10th and October 12th River Temperature predictions for Keswick, Sacramento, and Clear Creek Gauges from May – December 2022 in degrees Celsius. RMSE is 0.6 and BIAS is -0.2 The graphs also include the critical temperature of 11.9 degrees Celsius.

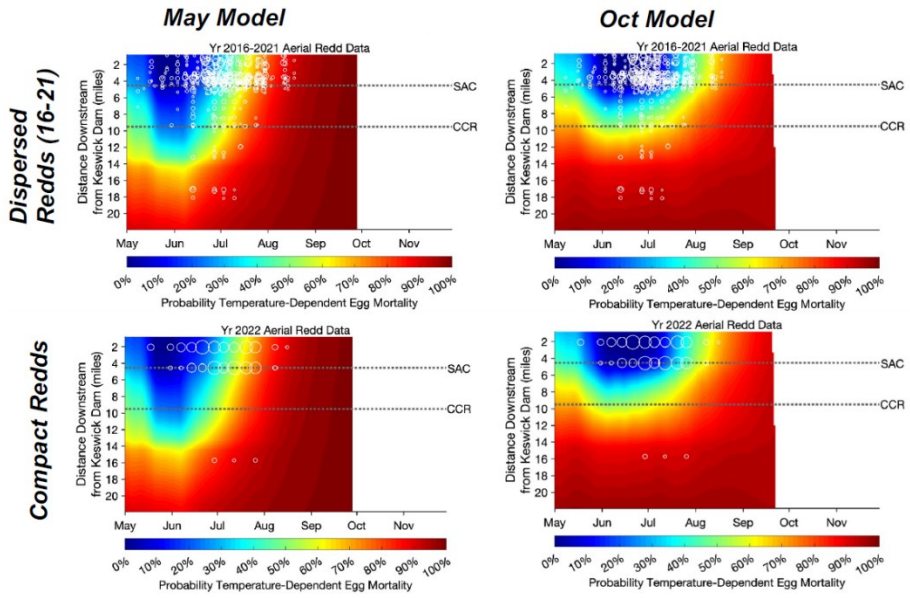
Temperatures were lower than forecasted in May and were often just below the critical temperature at the SAC gauge.



Changes in temperature-dependent mortality (TDM) over season

Image shows TDM Estimates: 2016-2021: May, 42; Oct, 19; 2022: May, 32; Oct, 17

Table reflects two factors we did not know at the start of season (temperature and redd distribution)



Changes in temperature-dependent mortality (TDM) over season due to temperature and redd assumptions

This figure shows a matrix of contour maps of modeled changes in temperature-dependent mortality using a May and October model for dispersed redds (2016-2021) and compact redds. The graphs depict the distance from Keswick Dam in miles highlighting the Sacramento and Clear Creek temperature gauges, and modeled probability temperature-dependent egg mortality 0-100%.

* Note: 2020 redds not fully digitized to RAFT grid and assumes CDFW reach ~ lowest RAFT Grid.

Summarizing TDM

Factors leading to differences between May and October TDM estimates:

- Cooler water temperatures
- Upstream redd distributions

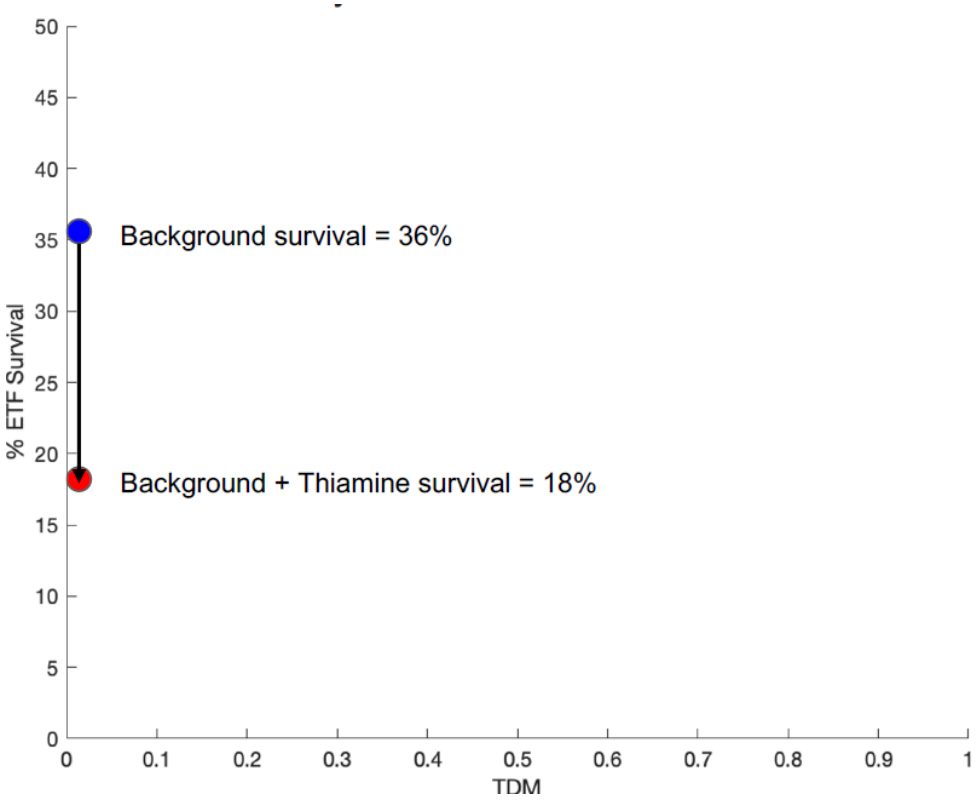
This resulted in a lowering of our TDM estimate from a high of 42% in May, to a low of 17% in October.

However, the ETF survival estimates are likely to be significantly lower due to the impacts of Thiamine deficiency.

$$ETF = (S_o \times DD) \times (1 - TDM) \times TDS$$

- S_o = Background survival w/out temperature and density dependence effects, ~36%
- DD = Background survival w/ density dependence
- TDM = Temperature-dependent egg mortality (TDM)
- TDS = Thiamine-dependent survival (TDS)

Equation calculating ETF using background survival without temperature and density dependence effects (~36%), background survival with density dependence, temperature-dependent egg mortality, and Thiamine-dependent survival.



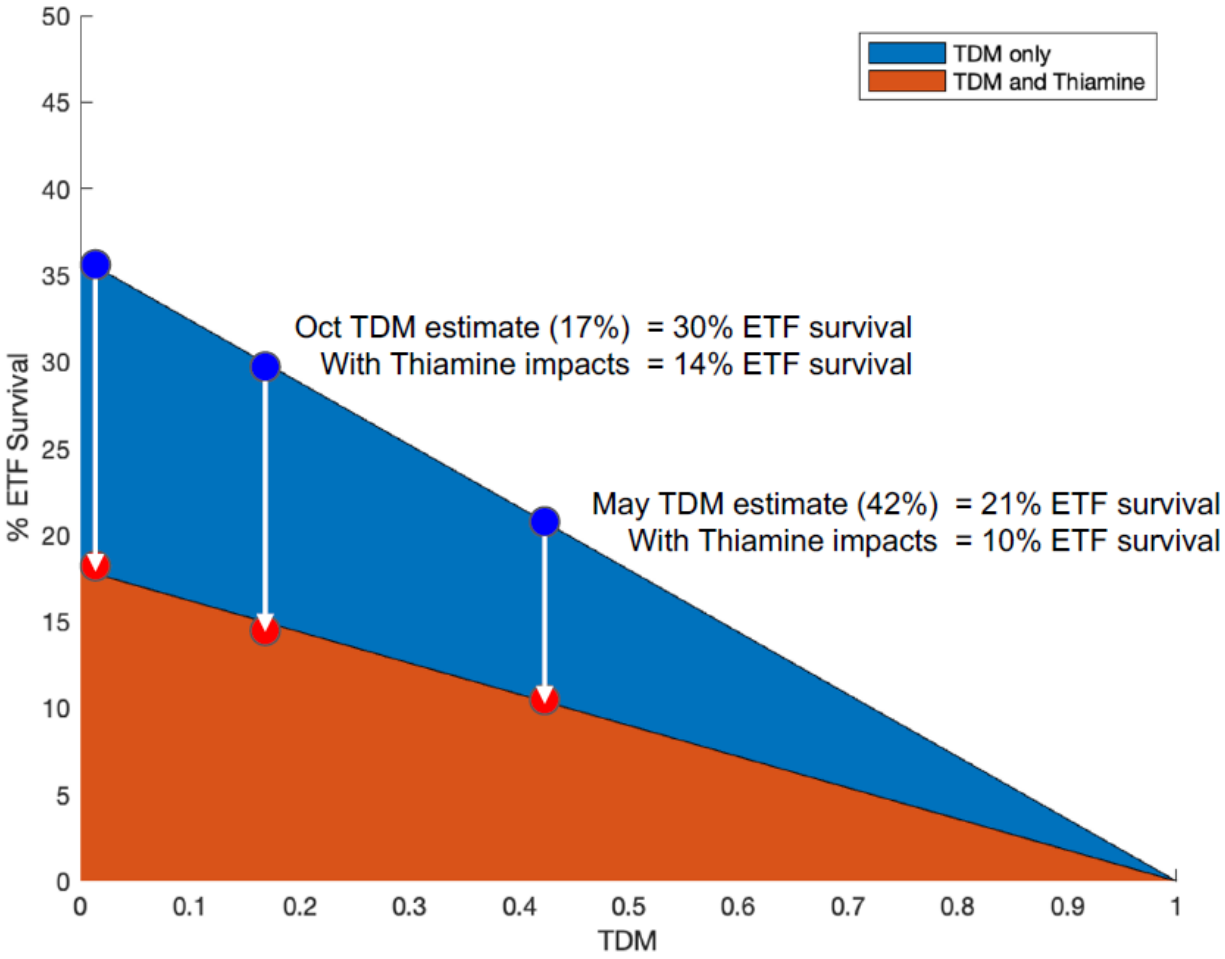
The interaction of Thiamine deficiency and TDM on ETF survival

A line graph plotting percent ETF survival against TDM showing the effect of Thiamine survival. Without considering Thiamine survival, background survival is 36%. Survival drops to 18% when Thiamine effects are considered.

Under ideal temperature conditions (TDM=0)

Assumptions:

- 50% thiamine-dependent survival
- No density-dependent survival



The interaction of Thiamine deficiency and TDM on ETF survival

A line graph plotting percent ETF survival against TDM showing the effect of Thiamine survival on October and May TDM estimates. A TDM estimate of 17% in October and 42% in May resulted in 30% and 21% ETF survival, respectively. ETF survival drops to 14% in October and 10% in May when Thiamine impacts are considered.

Conclusions

- Cooler river temperatures reduced TDM. Work as ongoing to describe this, but some information has been shared at previous meetings, such as:
    - Lower than expected seasonal releases from Shasta
    - Greater than expected inflows to Shasta
    - Lower than expected warming in Keswick
    - Others…
- Thiamine-dependent survival is still being estimated. Draft value used here is 50% for conceptual purposes.
- An assessment of the Science Center's temperature modeling for the season is still underway.