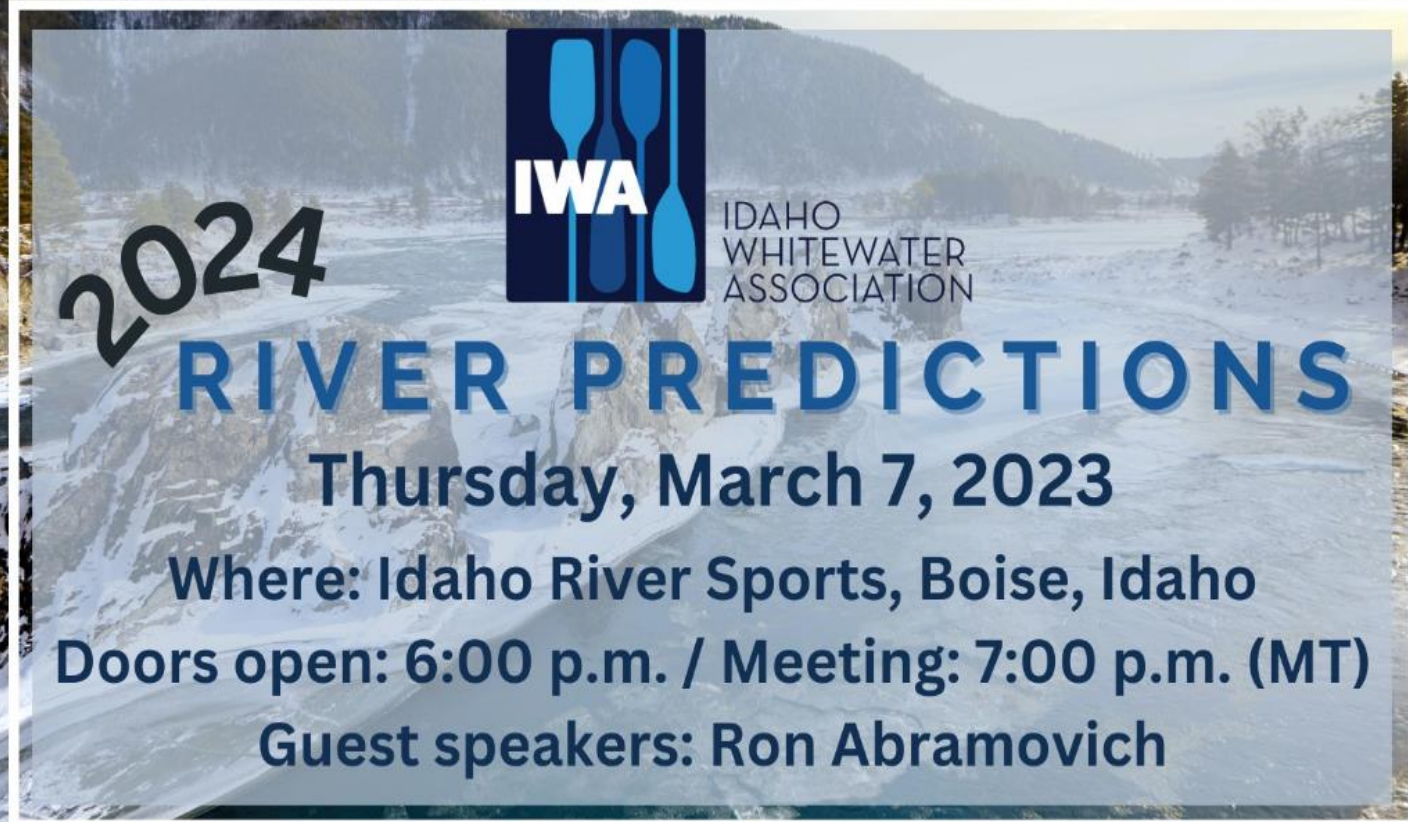


# 2024 Snow Update & River Predictions

February was great for precip and March is following – with a Brundage storm Tues and potential for another in mid-March

**This talk will be posted and more here:**

**<https://snowweatherandflow.blog/>**

A poster for the 2024 River Predictions event. The background is a scenic view of a river flowing through a snowy, mountainous landscape. In the top left, the year '2024' is written in a large, black, stylized font. In the top right, the IWA logo is displayed, consisting of two blue paddles and the letters 'IWA' in white. To the right of the logo, the text 'IDAHO WHITEWATER ASSOCIATION' is written in a smaller, white, sans-serif font. The main title 'RIVER PREDICTIONS' is written in large, bold, blue, sans-serif capital letters across the center. Below the title, the date 'Thursday, March 7, 2023' is written in a smaller, white, sans-serif font. Further down, the location 'Where: Idaho River Sports, Boise, Idaho' is written in a white, sans-serif font. Below that, the event times 'Doors open: 6:00 p.m. / Meeting: 7:00 p.m. (MT)' are written in a white, sans-serif font. At the bottom, the guest speaker 'Guest speakers: Ron Abramovich' is written in a white, sans-serif font.

**2024**

**IWA** IDAHO WHITEWATER ASSOCIATION

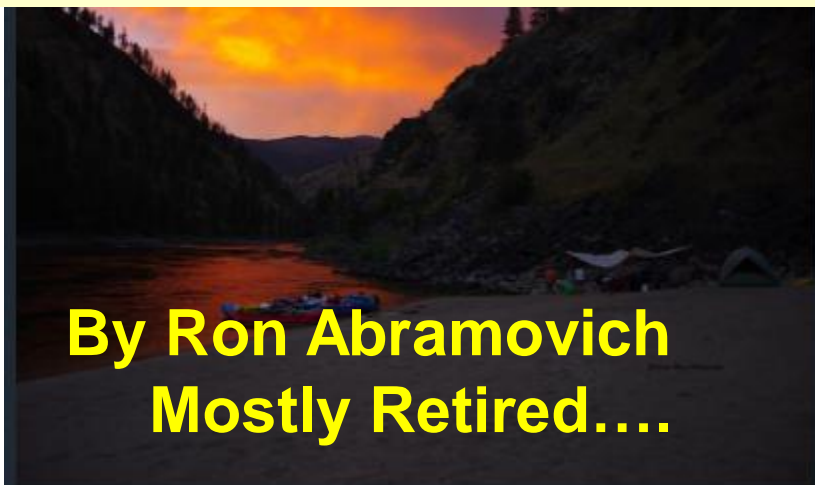
**RIVER PREDICTIONS**

Thursday, March 7, 2023

Where: Idaho River Sports, Boise, Idaho

Doors open: 6:00 p.m. / Meeting: 7:00 p.m. (MT)

Guest speakers: Ron Abramovich



**By Ron Abramovich  
Mostly Retired....**

Photo Credit: Christine Riggs Photography

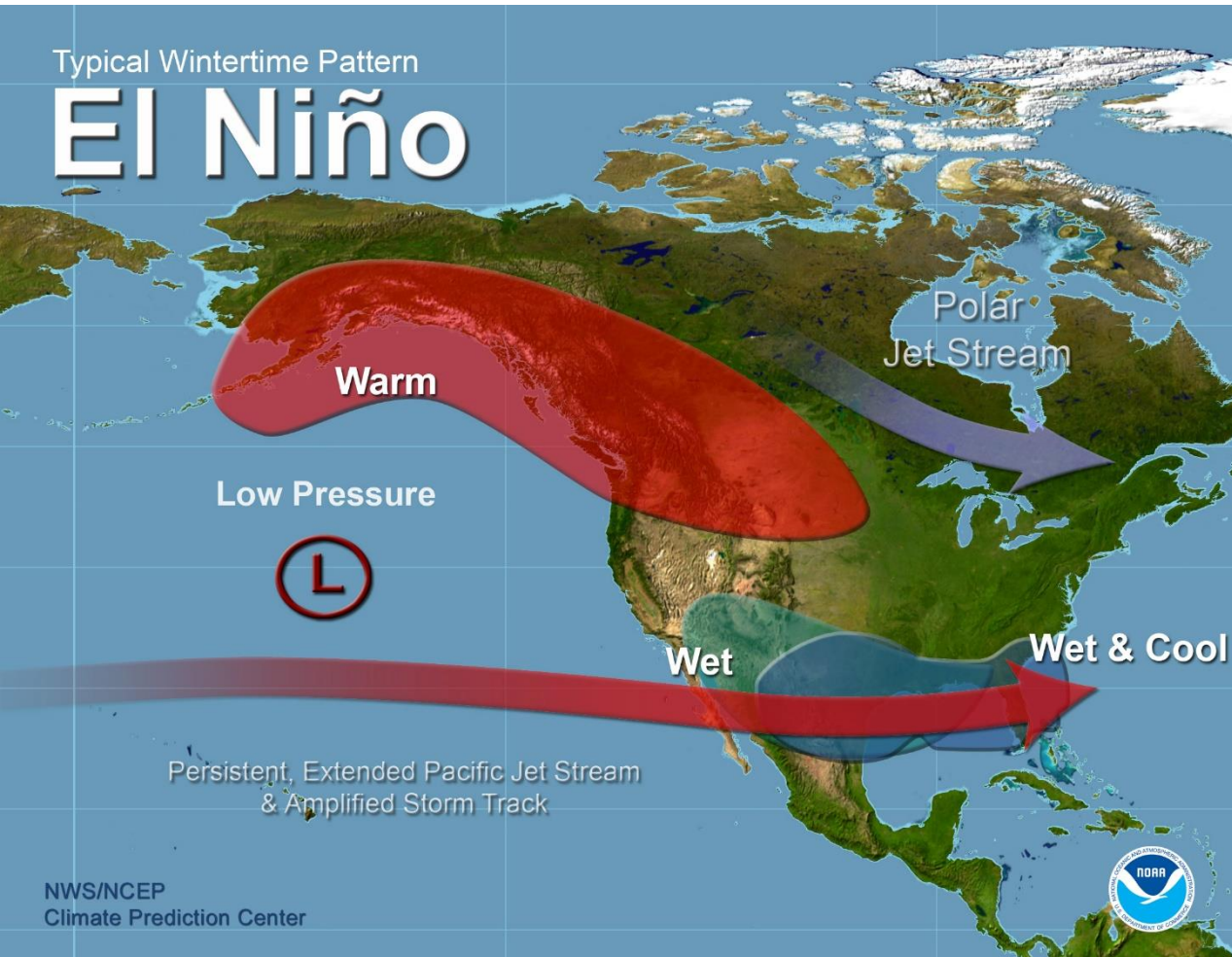
## Idaho Whitewater Association

A Non-profit Organization for Idaho Whitewater Enthusiasts



# Quick Review

**El Nino 2023-24**



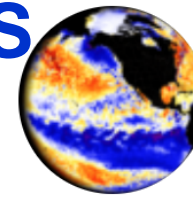
**La NinaS**

**2024-25**

**2022-23**

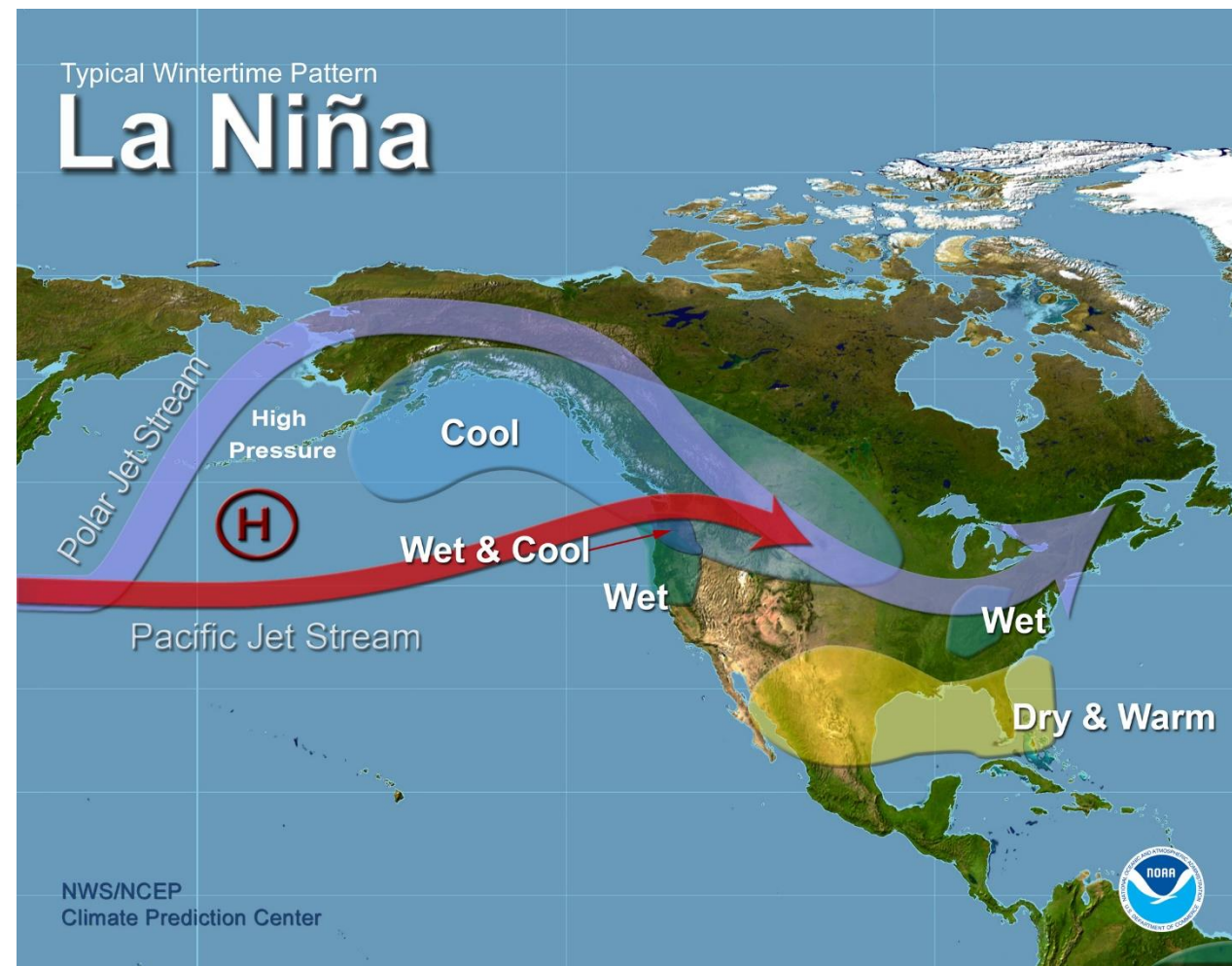
**2021-22**

**2020-21**



An early La Niña watch has been issued by NOAA, as the shift into a Cold ENSO phase is now forecast, impacting the 2024/2025 Weather patterns

Rapid changes in the oceanic and atmospheric patterns have prompted NOAA to release an official La Niña watch. This means that La Niña is expected ...



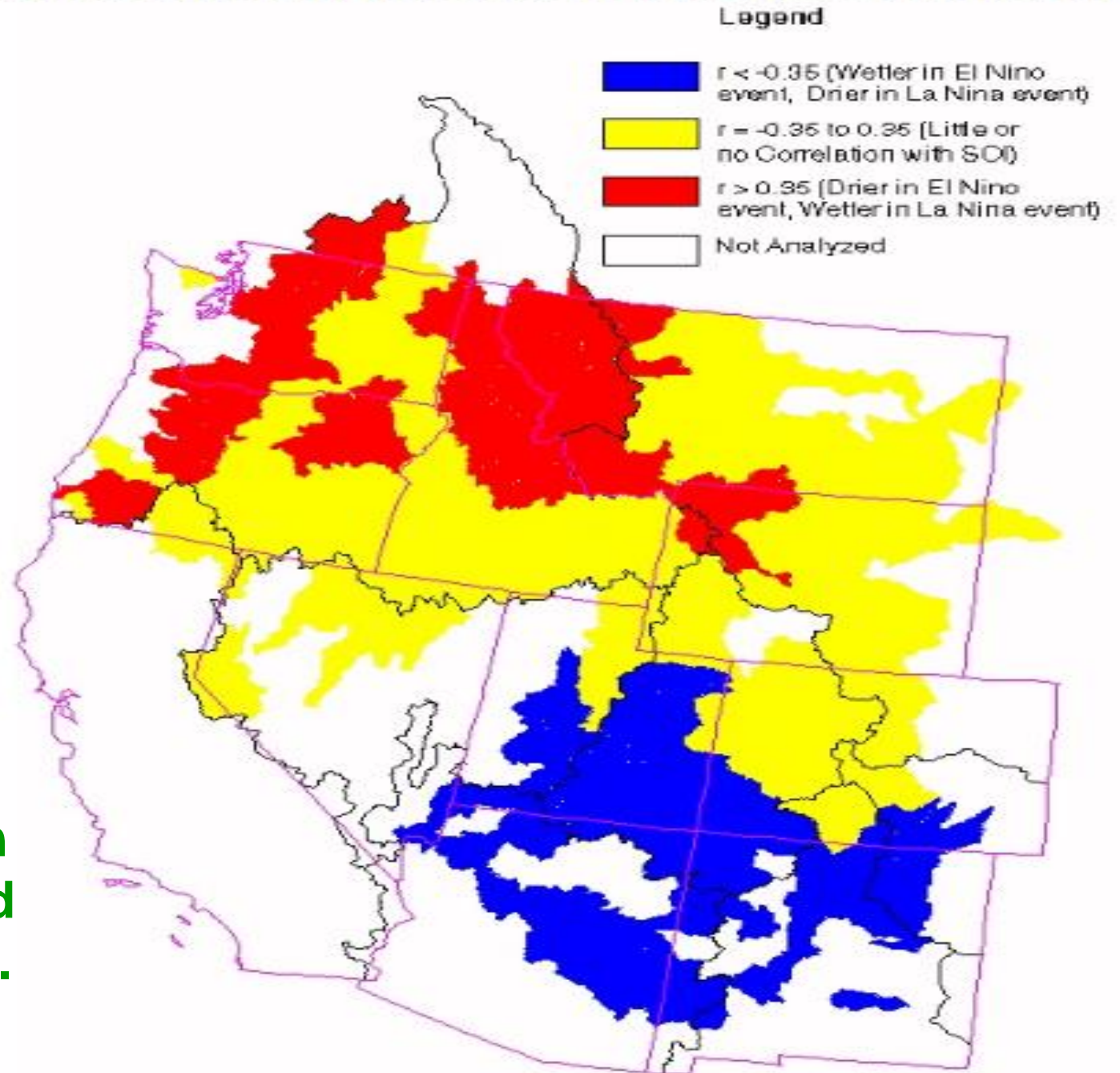
# Correlation Map of Southern Oscillation Index (SOI) with Spring-Summer Streamflow

Red wetter in La Nina years.

Blue wetter in El Nino years.

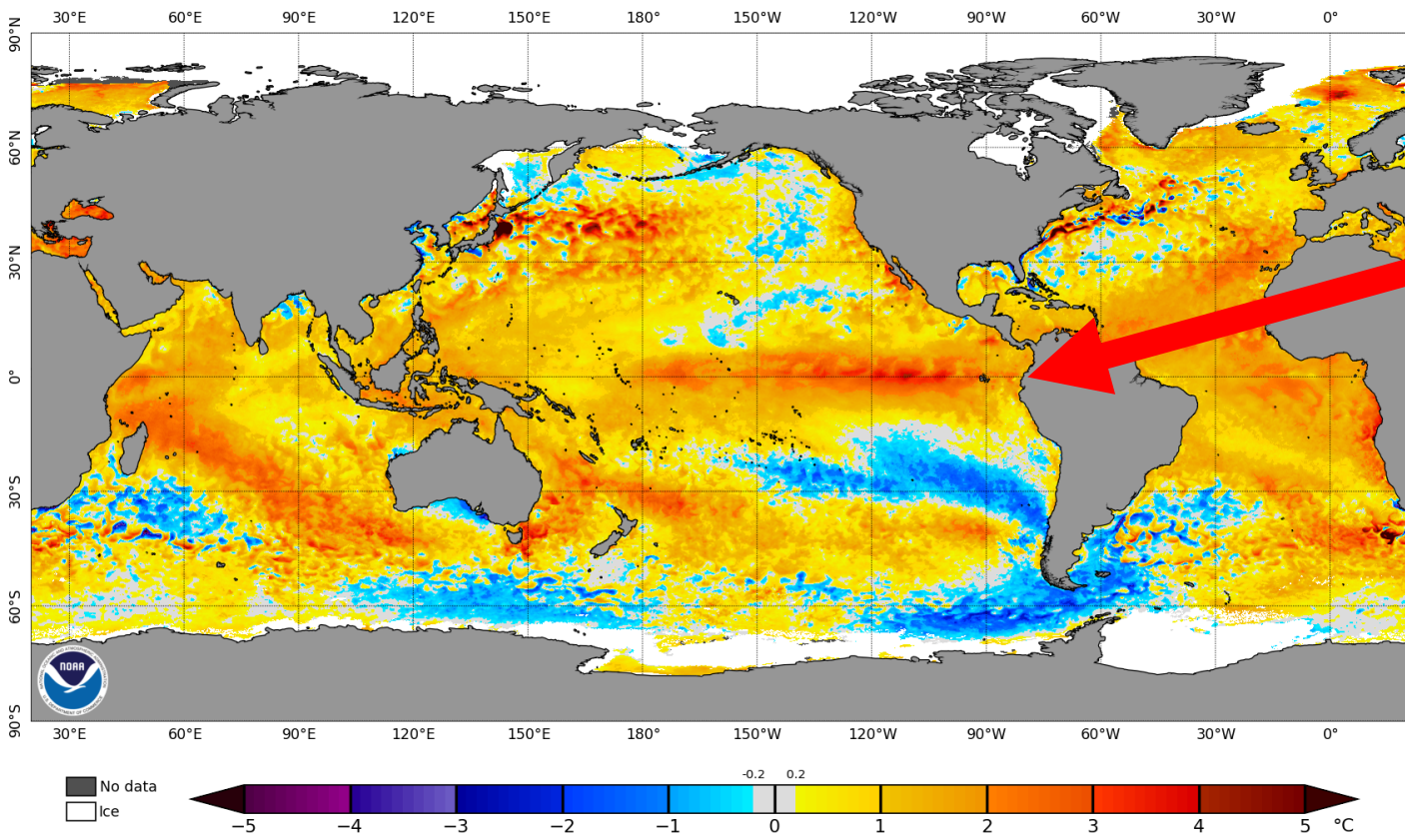
Key is – what happens July-Nov in Pacific correlates with snowfall and summer streamflow in Western US.

Figure 1. Correlation Map of the Southern Oscillation Index (SOI) with spring and s



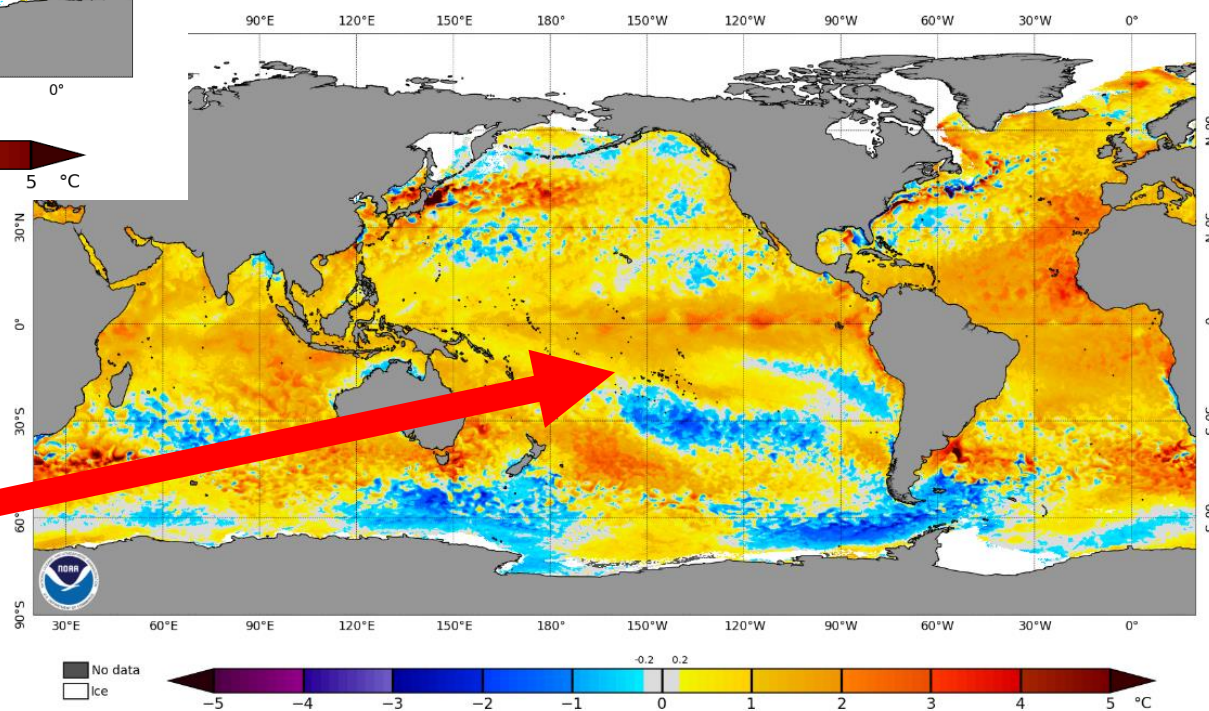


NOAA Coral Reef Watch Daily 5km SST Anomalies (v3.1) 1 Jan 2024



**El Niño Conditions  
Jan 1, 2024**

NOAA Coral Reef Watch Daily 5km SST Anomalies (v3.1) 21 Feb 2024



**El Niño is Breaking  
Up Feb 21, 2024**



**Analysis of  
Streamflow  
in Strong  
El Nino  
Years (SE)  
like 2016**

Year	ENSO	PDO	Streamflow as % of 1981-2010 Average				
			Feb-Sep	Apr-Sep	Apr-Sep	Apr-Sep	Apr-Sep
			Owyhee River blw Dam	Salmon Falls Creek	Big Wood River blw Magic Dam	SNAKE River nr Heise	Spokane River nr Post Falls
1994	SE Strong El Nino	pos or neg	23	36	12	61	51
1988	SE	pos	30	65	24	70	71
1941	SE	pos	83	53	69	73	45
1966	SE	neg	28	39	51	78	90
1973	SE	pos / neg	61	114	51	79	45
1942	SE	pos	122	173	117	86	77
1947	SE	pos / neg	44	50	59	108	90
1952	SE	neg	246	178	263	116	123
1995	SE	pos	124	135	195	118	70
1998	SE	pos	135	138	161	119	82
1983	SE	pos	221	157	282	132	91
1978	SE	pos	110	112	140	133	99
2016	SE	pos	82	122	70	80	66
sorted							
				<60			
				60-90			
				90-110			
				~111-130			
				>130			

Analysis of Streamflow for a year like 2017 that follows a Strong El Nino Year like 2016

					sorted				
					Streamflow as % of 1981-2010 Average				
	ENSO		ENSO	Feb-Sep	Apr-Sep	Apr-Sep	Apr-Sep	Apr-Sep	Apr-Sep
Year	SE Strong El Nino	Year Following a Strong El Nino		Owyhee River blw Dam	Salmon Falls Creek	Boise River nr Boise	Big Wood River blw Magic Dam	SNAKE River nr Heise	Spokane River nr Post Falls
1978	SE	1979	N	97	116	63	34	90	105
1941	SE	1942	SE	122	173	91	117	86	77
1988	SE	1989	SL	145	100	97	75	102	116
1966	SE	1967	N	69	88	105	151	109	113
1947	SE	1948	LN	58	86	105	66	97	176
1952	SE	1953	N	56	76	124	92	92	108
1998	SE	1999	SL	100	108	135	158	131	129
1994	SE	1995	SE	124	135	138	195	118	70
1995	SE	1996	N	124	115	152	132	148	116
1983	SE	1984	N	363	369	158	206	133	112
1973	SE	1974	SL	120	111	181	184	147	193
1942	SE	1943	N	137	150	209	259	144	150
2016	SE	2017	LN	155	161	180	266	163	112
12 years									
					Color coded streamflow as % of average				
						<60			
						60-90			
						90-110			
						~111-130			
						>130			

1998/1999 Mt Baker set word snowfall with 95 feet of snowfall



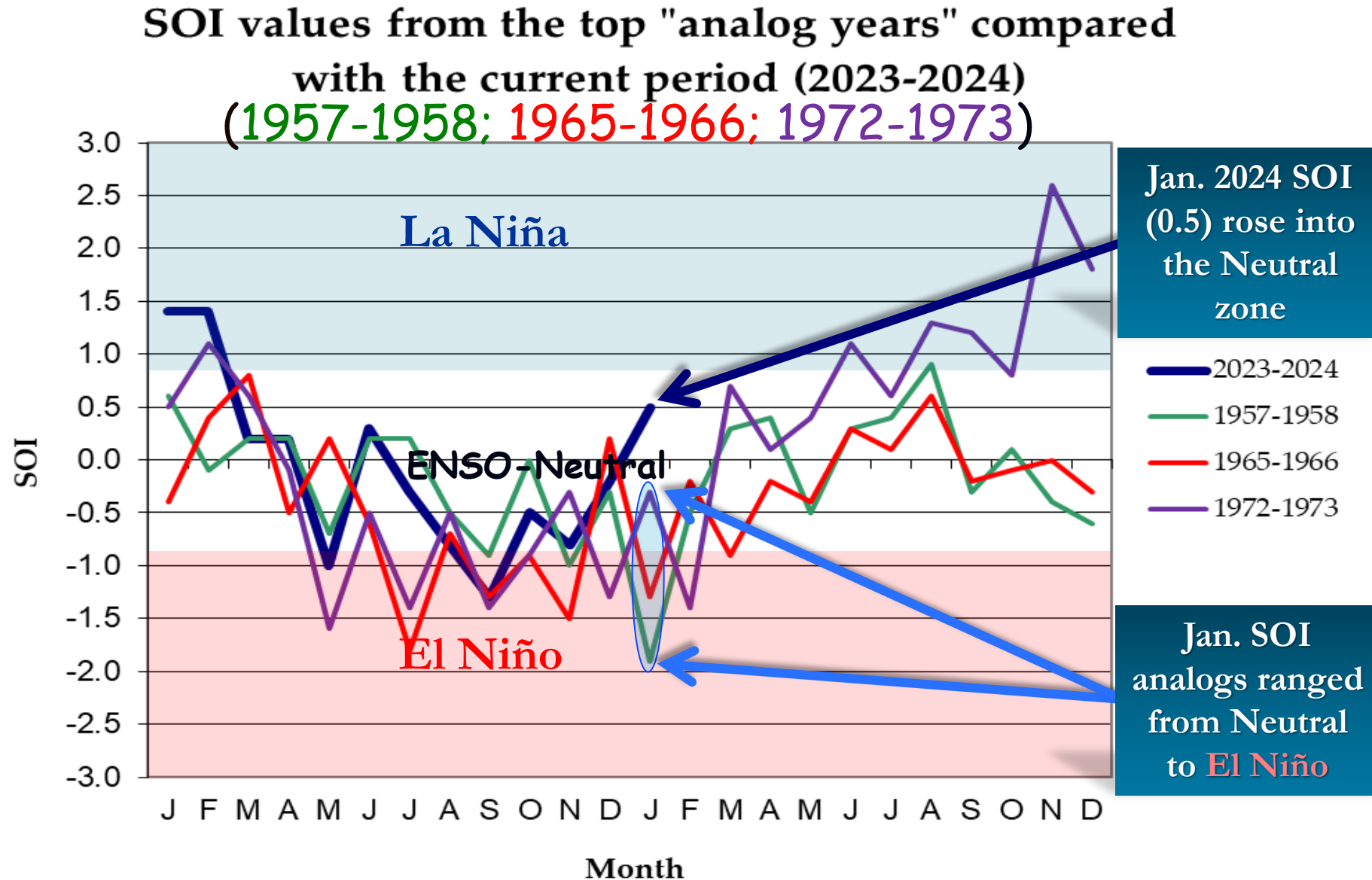
# From Oregon Department of Forestry Meteorologist

Pete Parsons Feb 15, 2024

## Forecast Highlights

- The November – January Oceanic Niño Index (ONI  $+2.0^{\circ}\text{C}$ ) remained in the **strong El Niño** range. This index lags real-time sea surface temperatures (SSTs), which show **El Niño** weakening.
- NOAA's Climate Prediction Center (CPC) expects a rapid transition from **El Niño** to **ENSO-neutral** this spring and to **La Niña** this summer.
- **Analog years for this year are water years 1958, 1966 & 1973.**

# Southern Oscillation Index (SOI)

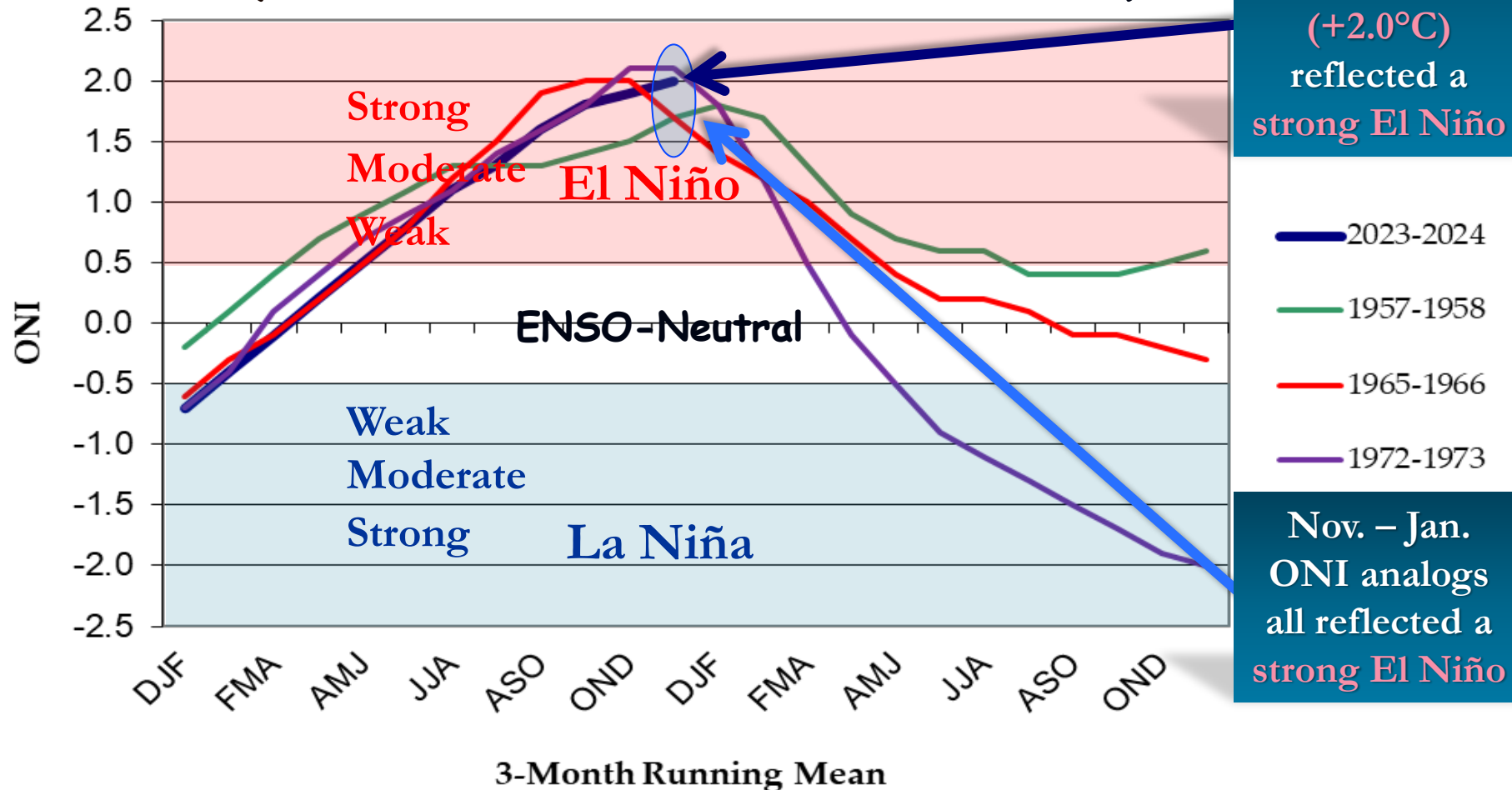


SOI data courtesy <https://www.cpc.ncep.noaa.gov/data/indices/soi>



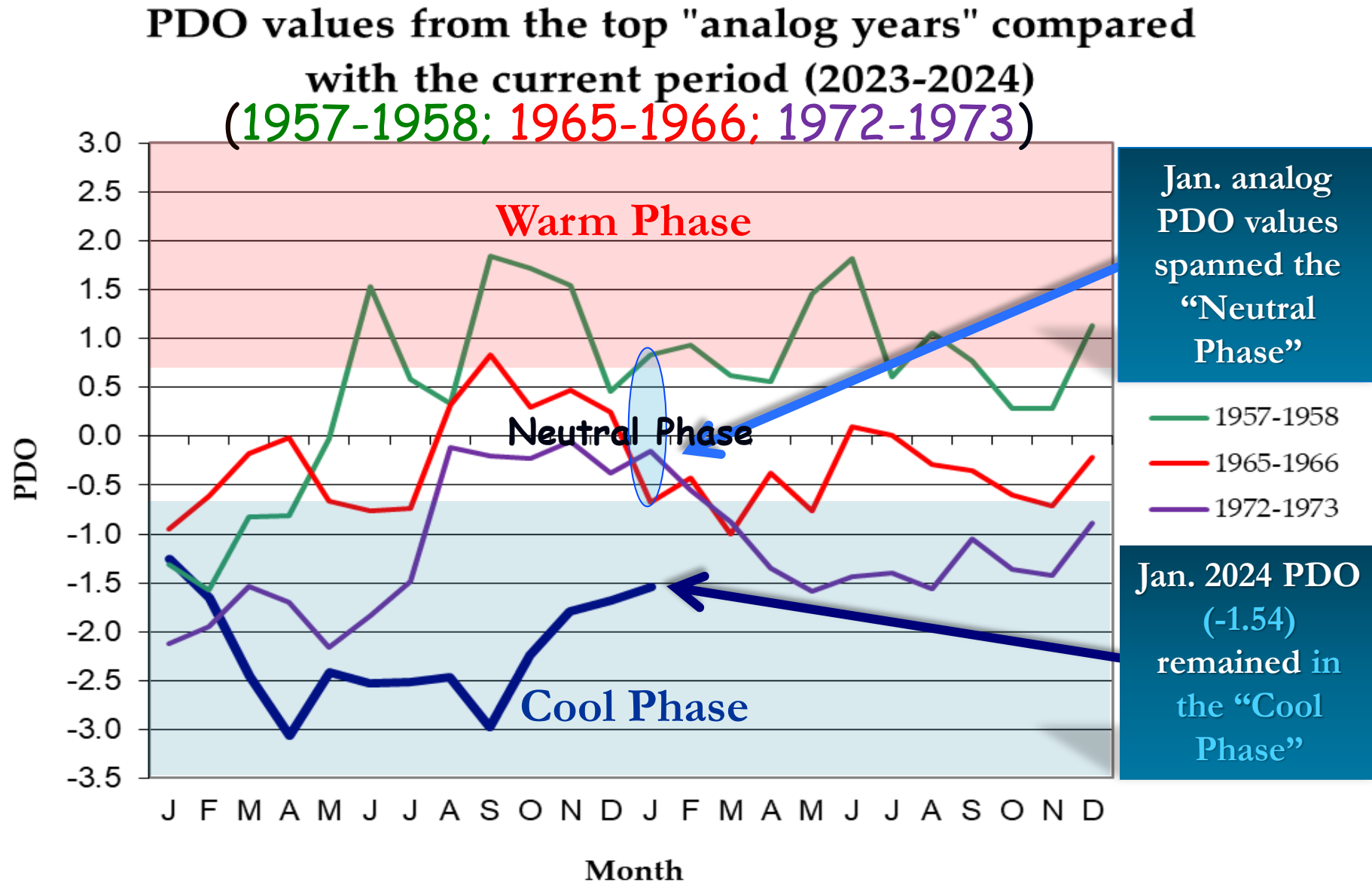
# Oceanic Niño Index (ONI)

ONI values from the top "analog years"  
compared with the current period (2023-2024)  
(1957-1958; 1965-1966; 1972-1973)

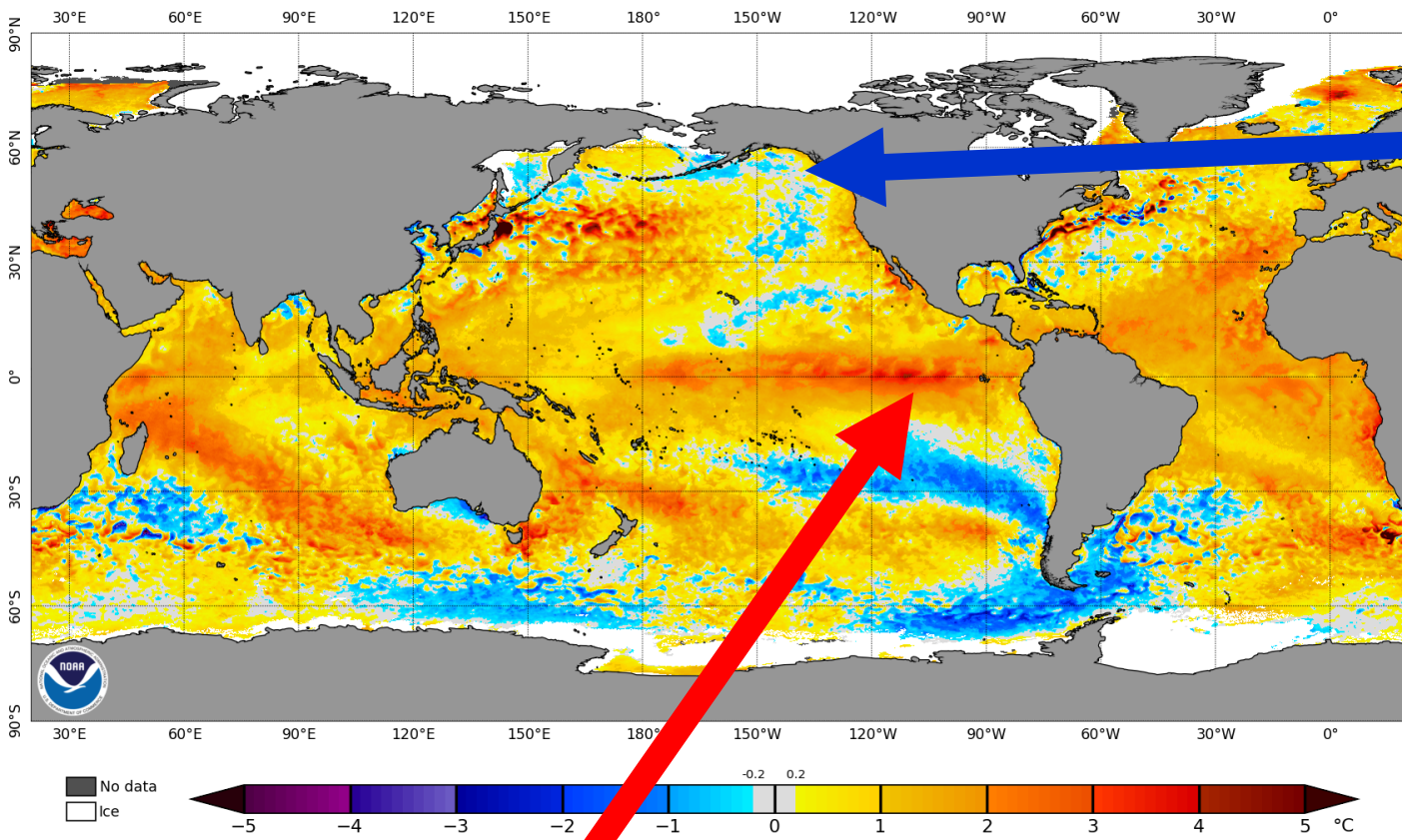


# North Pacific Ocean

(Poleward of 20°N Latitude)





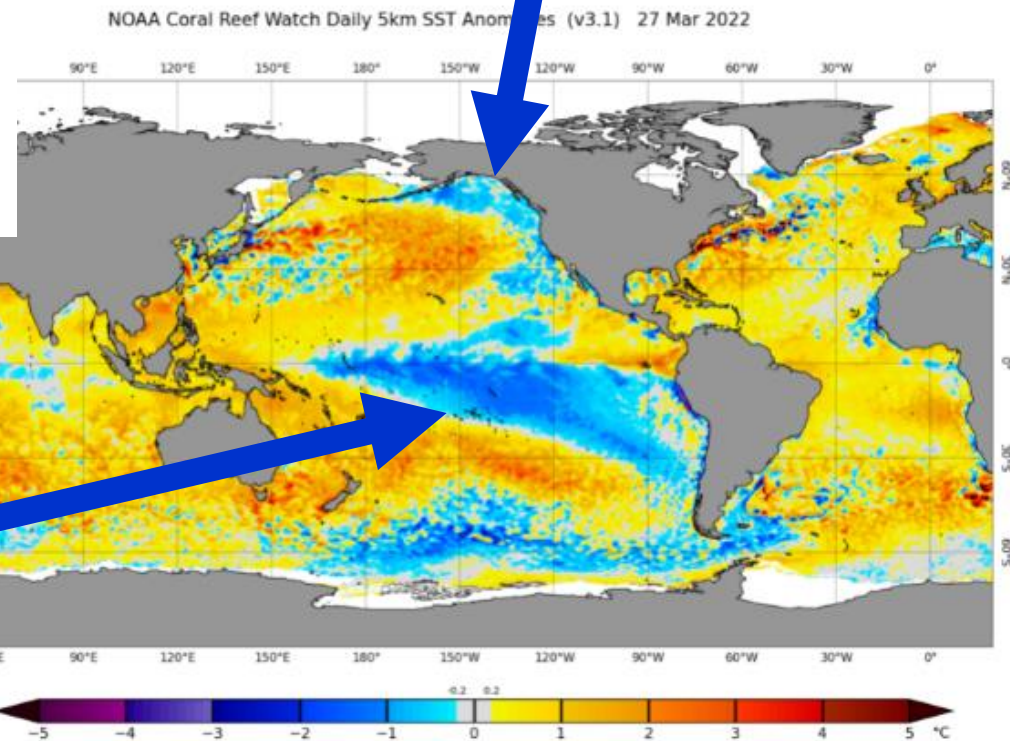


**El Niño conditions  
Jan 1, 2024**

**La Nina conditions  
Mar 27, 2022**

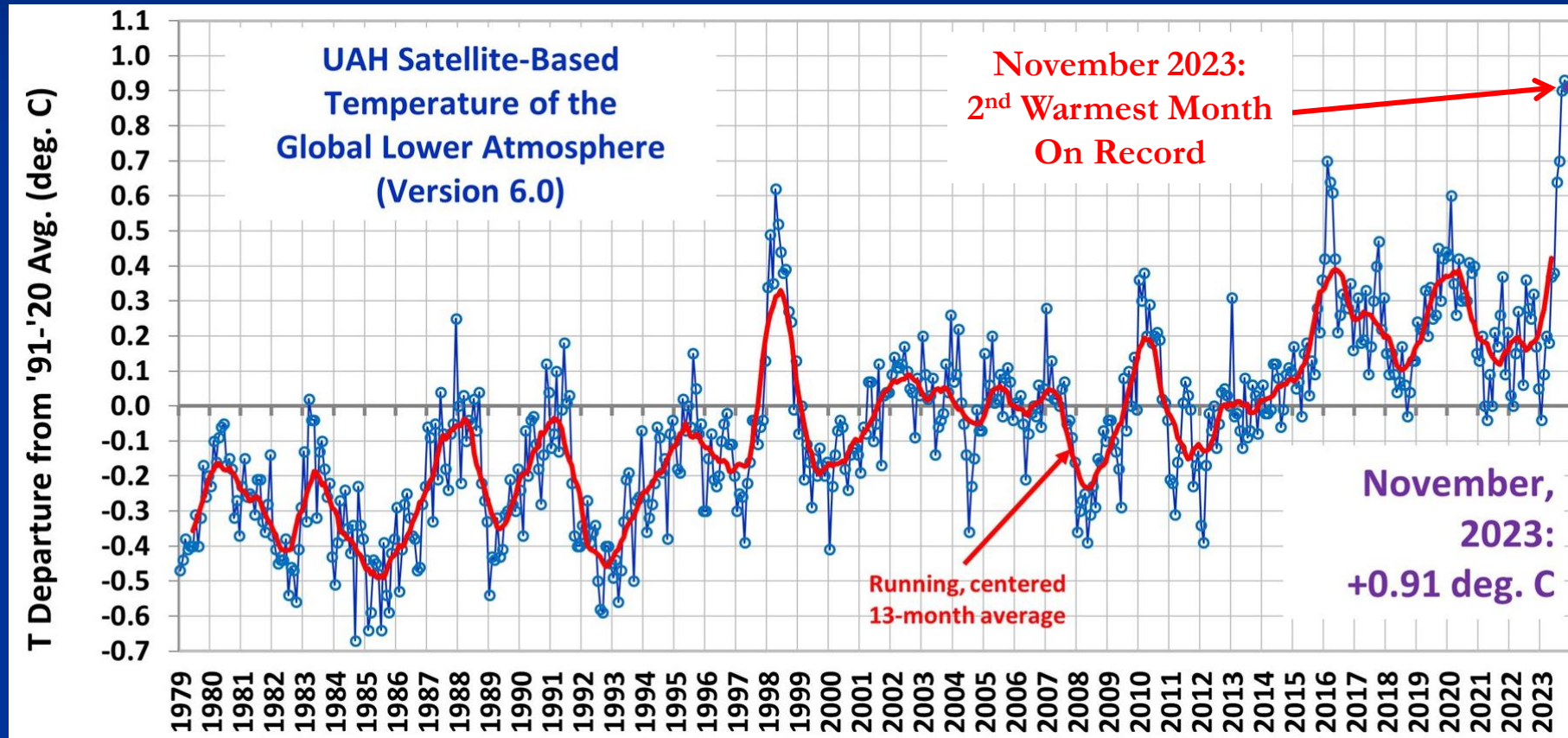
**PDO Cool Phase  
Winter 2023-24**

**Winters 2023 & 2024**



# Global Temperature Changes

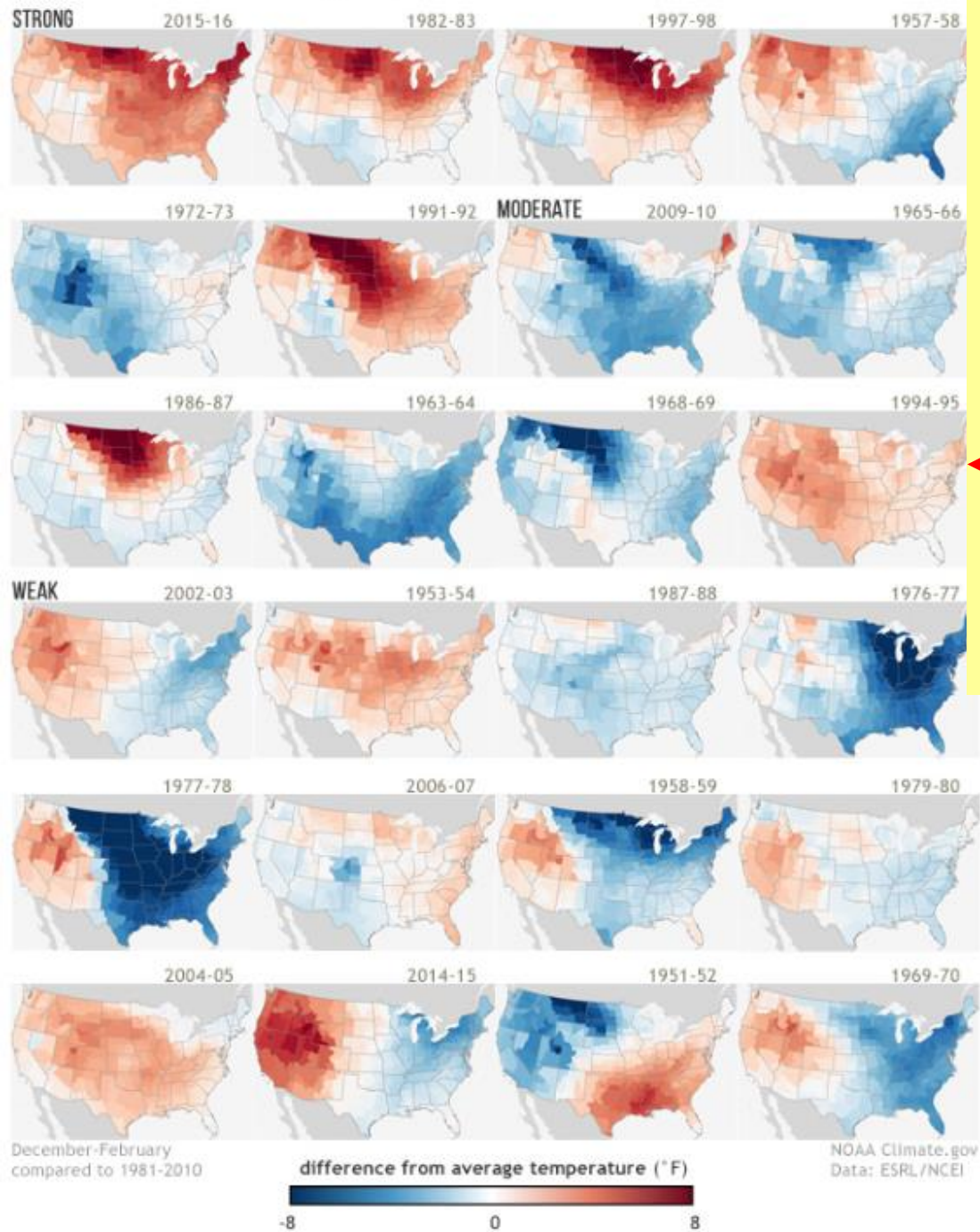
## Increase Error in Analog Forecasts!



Courtesy: <http://www.drroyspencer.com/latest-global-temperatures/>



U.S. winter temperature during every El Niño since 1950

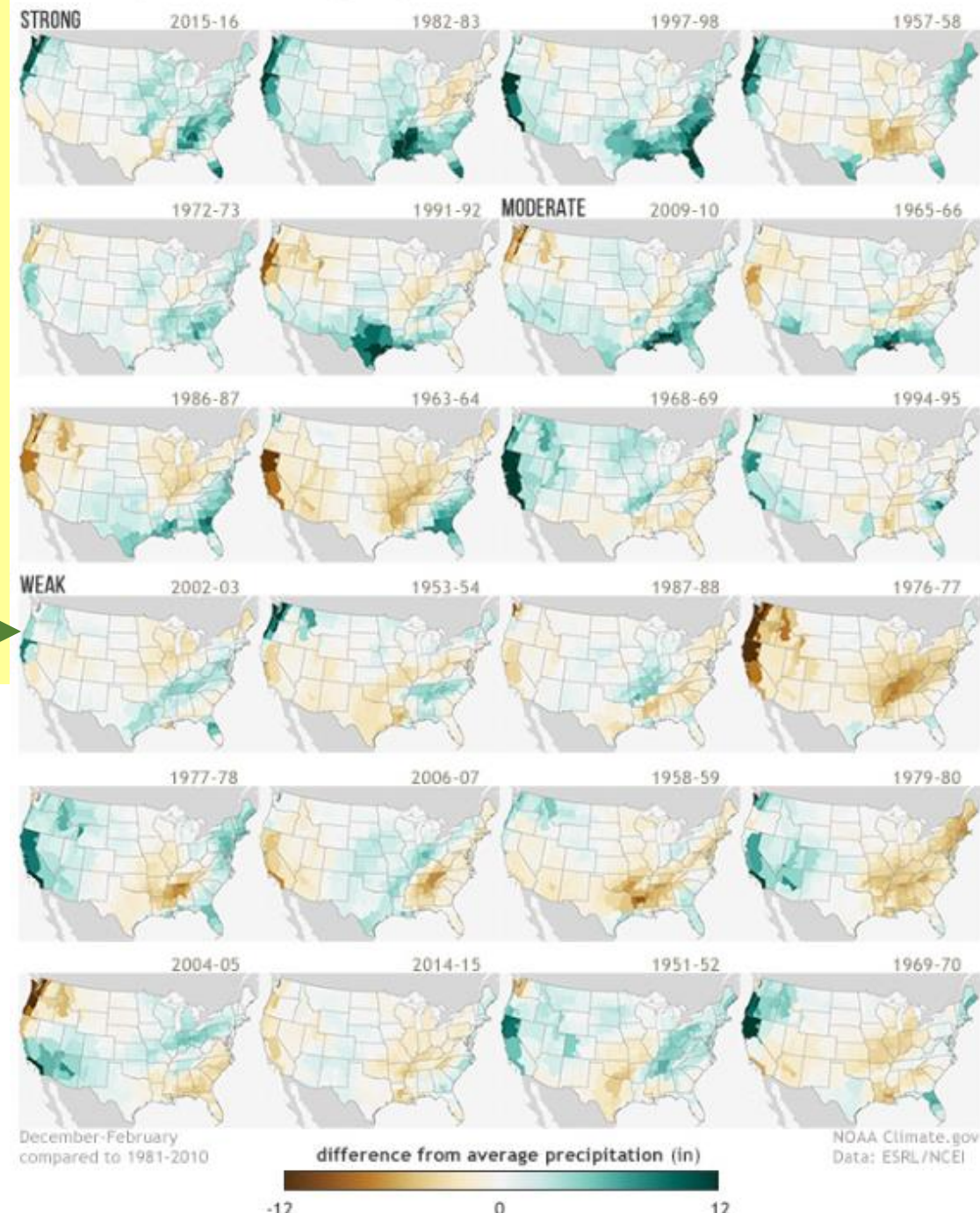


Every  
El Niño  
year  
since  
1950

← Temperature

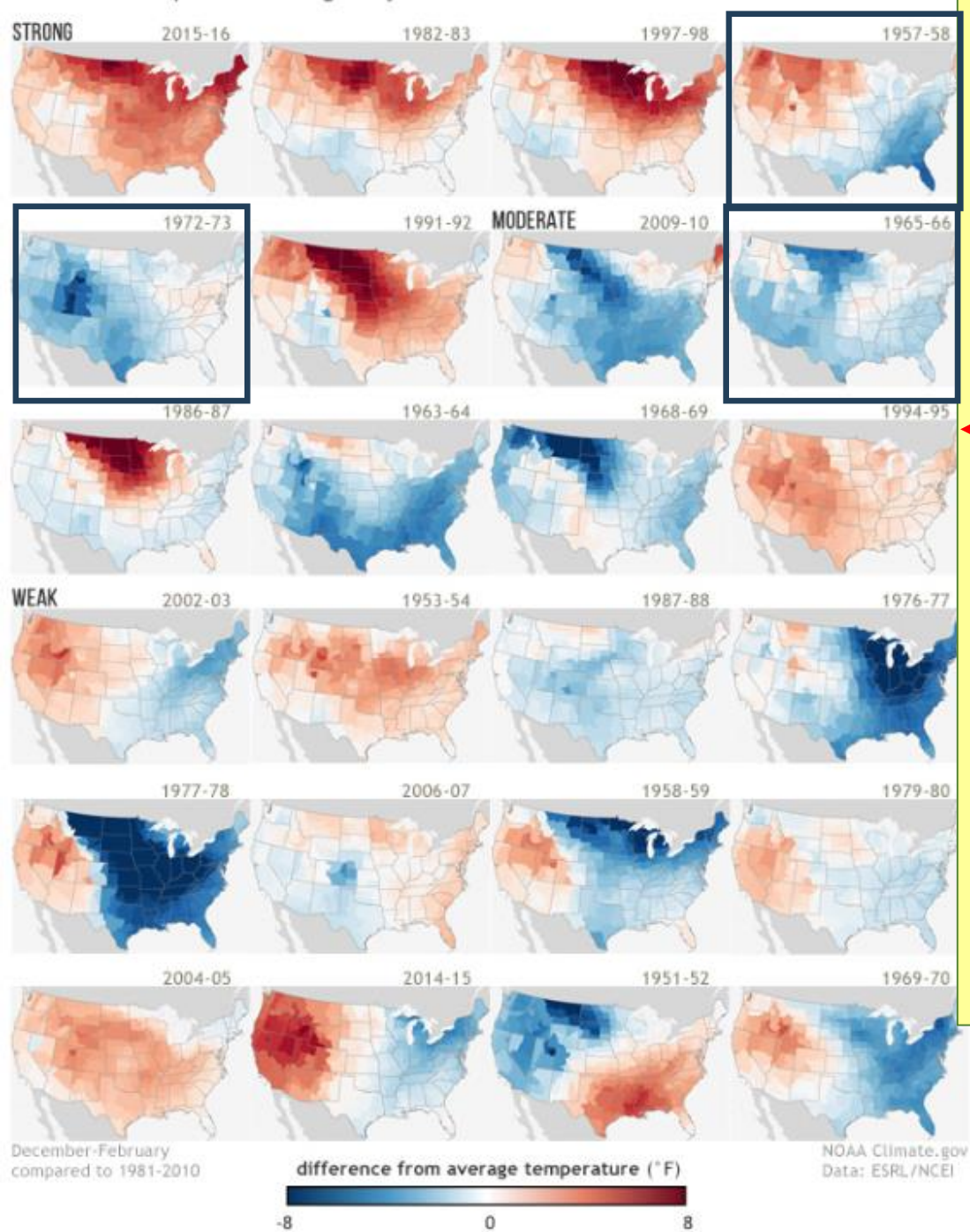
Precipitation →

U.S. winter precipitation during every El Niño since 1950





U.S. winter temperature during every El Niño since 1950



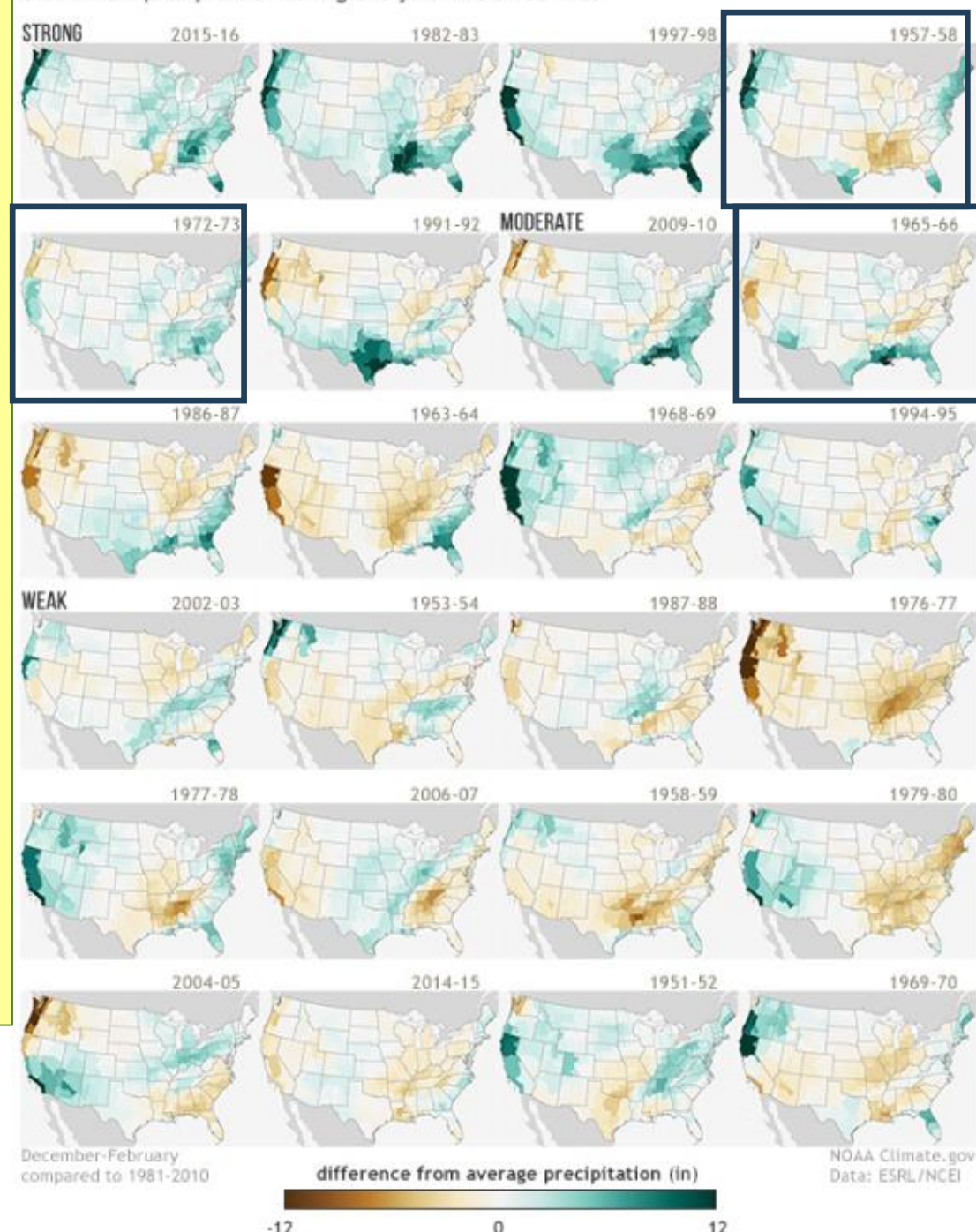
Every  
El Niño  
year since  
1950

Temperature

Dec - Feb  
Precipitation

Pete's Analog  
Years winter  
of:  
1957-58  
1965-66  
1972-73

U.S. winter precipitation during every El Niño since 1950





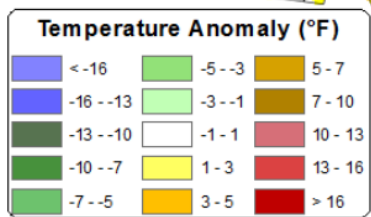
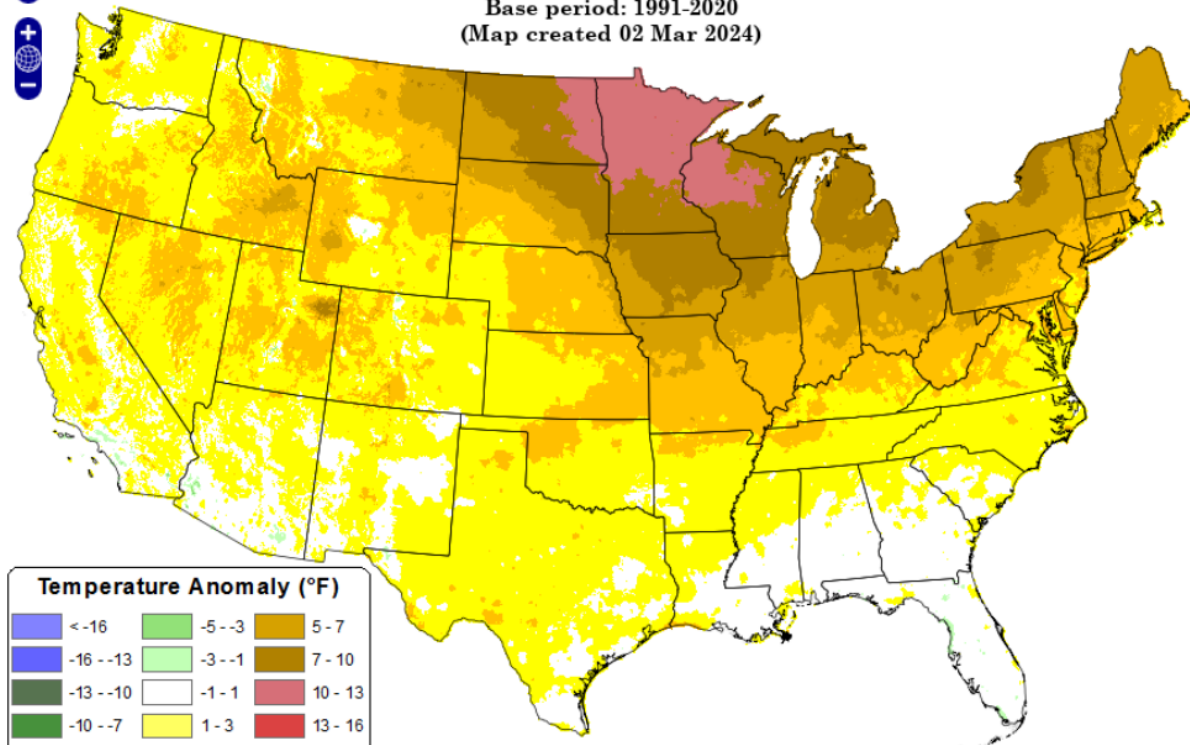


# Daily Mean Temperature Anomaly: Dec 2023 - Feb 2024

Period ending 7 AM EST 29 Feb 2024

Base period: 1991-2020

(Map created 02 Mar 2024)



Copyright (c) 2024, PRISM Climate Group, Oregon State University

## Temperature Dec – Feb

## Precipitation Dec – Feb

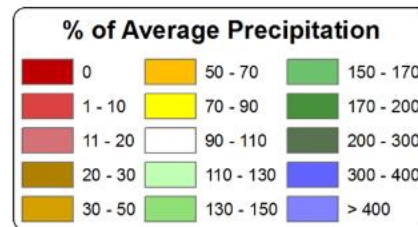
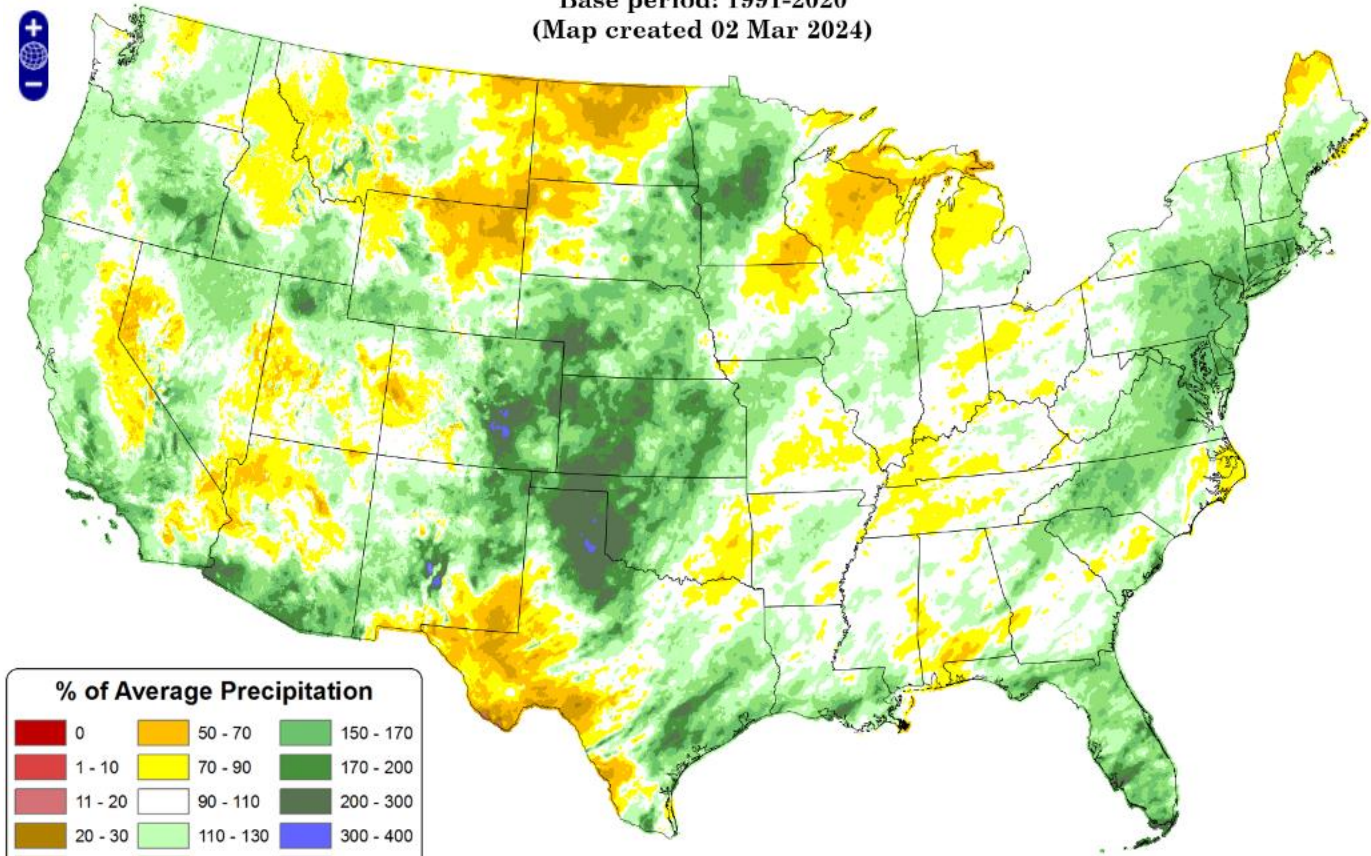


# Total Precipitation Anomaly: Dec 2023 - Feb 2024

Period ending 7 AM EST 29 Feb 2024

Base period: 1991-2020

(Map created 02 Mar 2024)

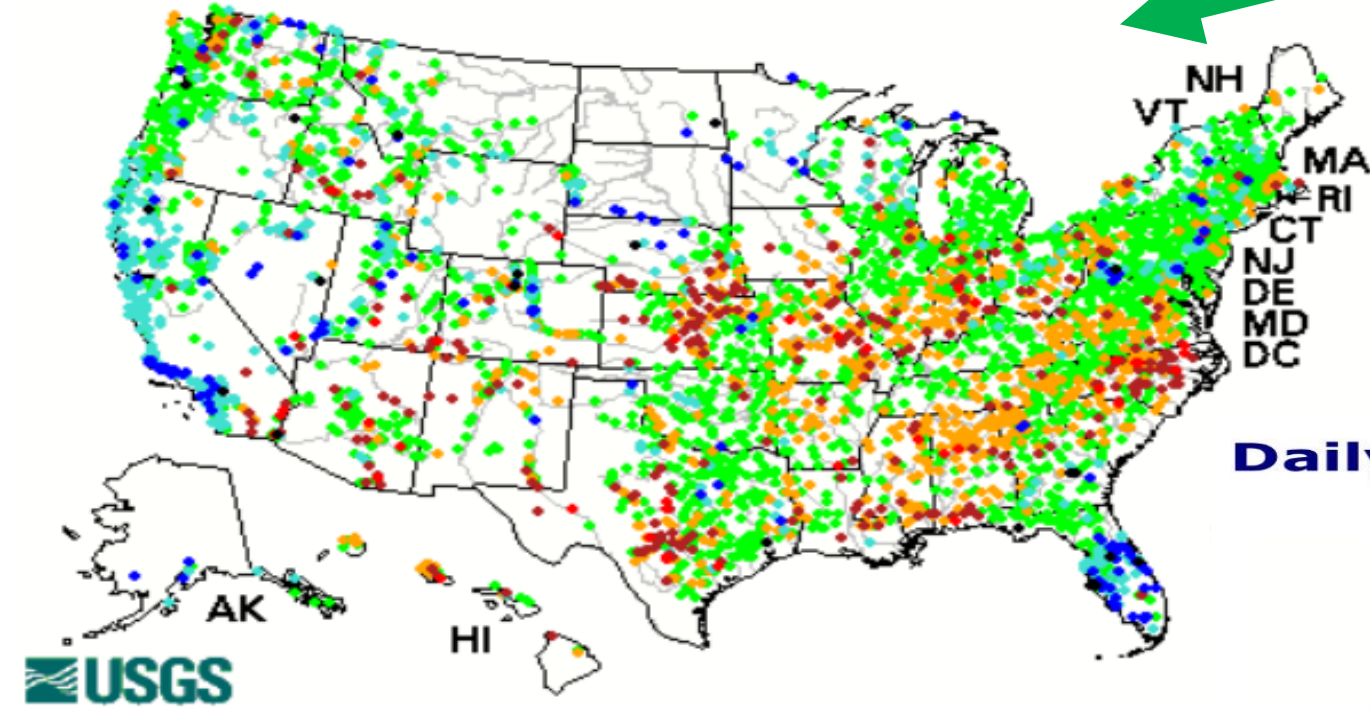


Copyright (c) 2024, PRISM Climate Group, Oregon State University



# Daily Streamflow Conditions

Thursday, February 22, 2024 23:30ET

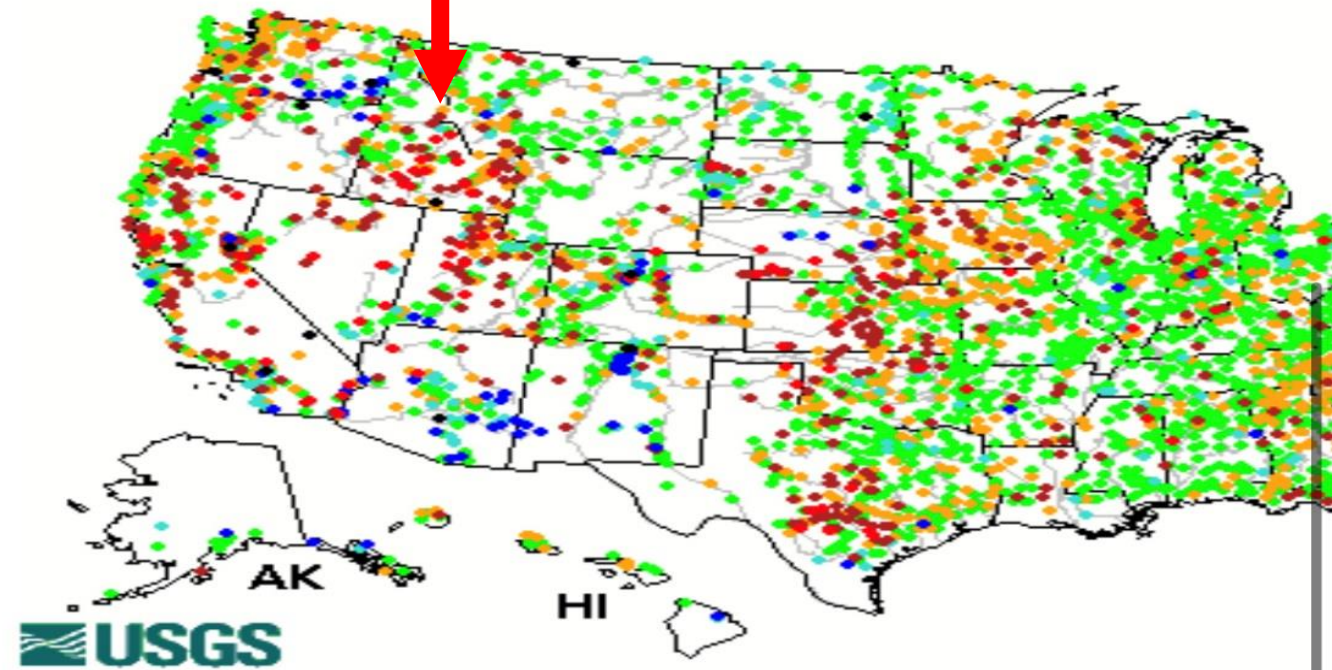


Feb 22, 2024 Streamflow  
Idaho flows are near normal since Nov 1

Fall 2022 flows were near record low  
because of cold temps & early snowfall.  
Nov 3, 2022 Fall Base Flows

## Daily Streamflow Conditions

Thursday, November 03, 2022 10:30ET

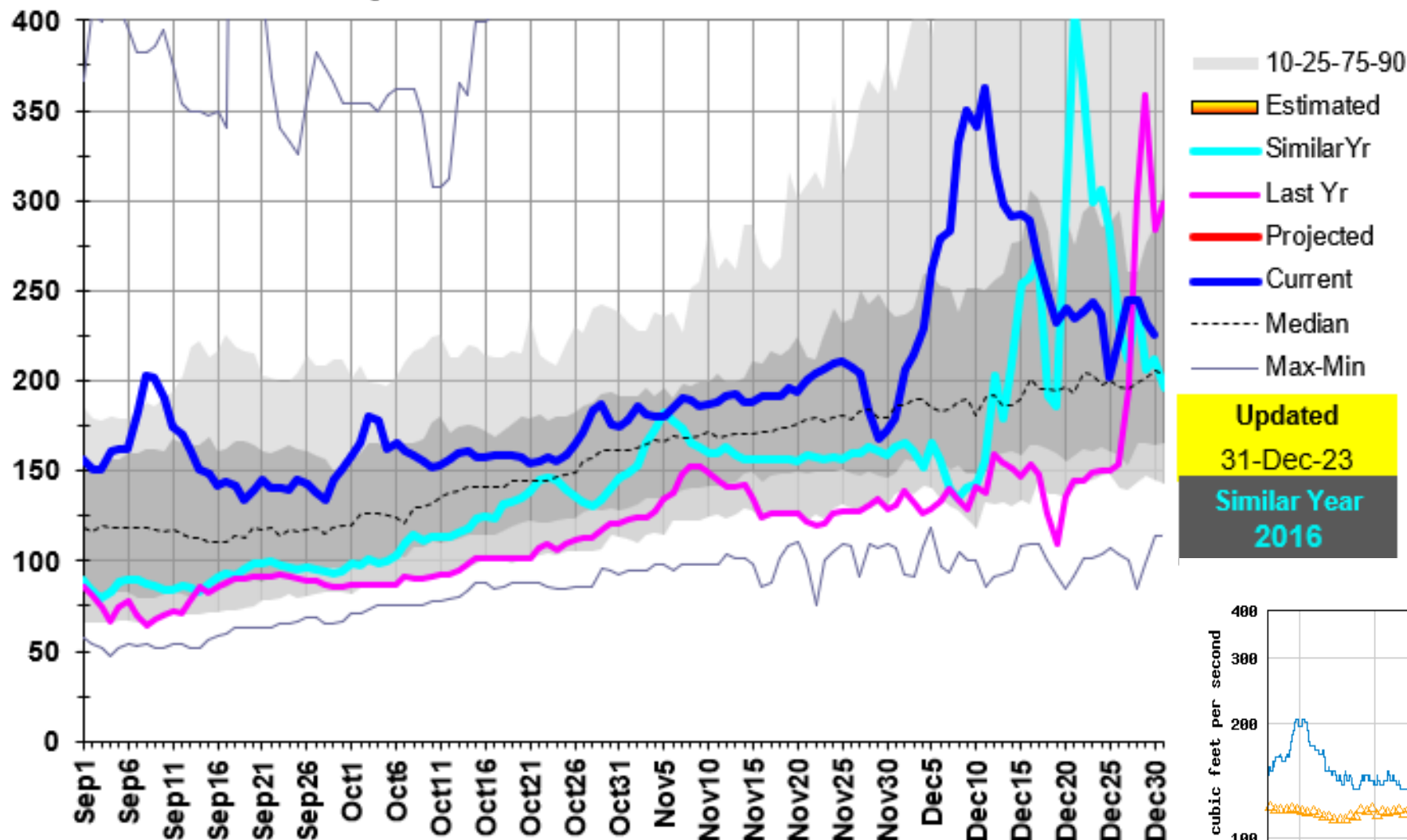


### Explanation

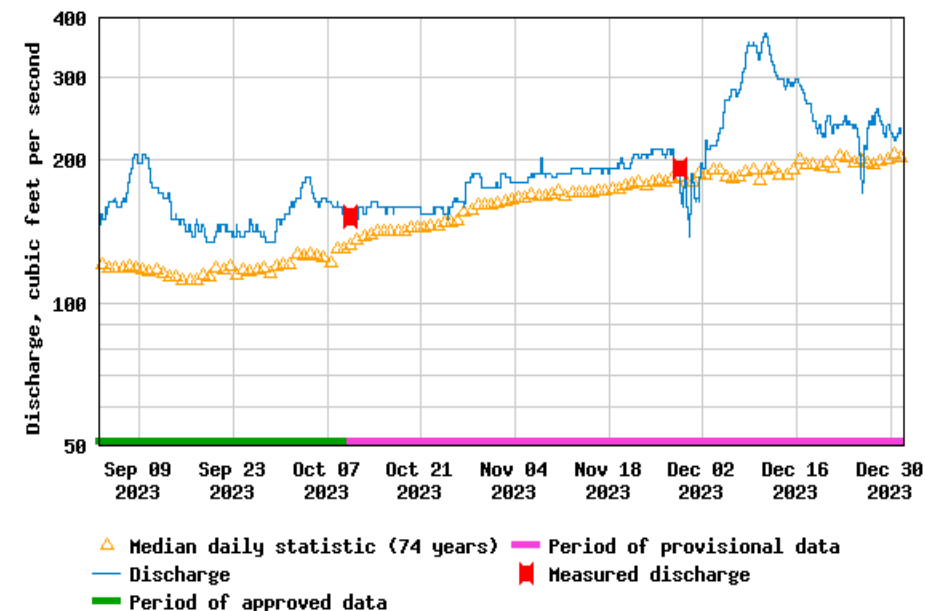
- High
- > 90th percentile
- 76th - 90th percentile
- 25th - 75th percentile
- 10th - 24th percentile
- < 10th percentile
- Low
- Not ranked

# 13181000: Owyhee R near Rome, OR

Mean Daily CFS



USGS 13181000 OWYHEE RIVER NR ROME OR





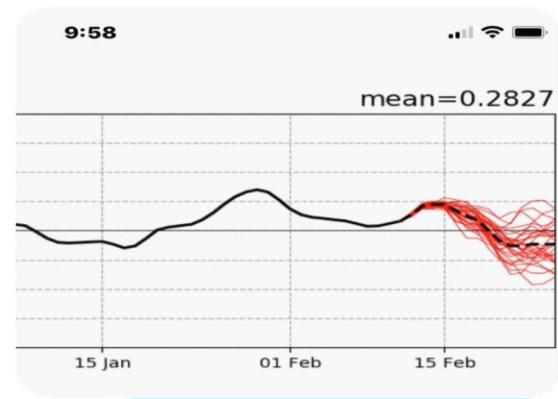
Before we talk  
Snow & Flow  
lets talk about  
Past & Future  
Weather...



## The Powder Buoy is in Park City, UT.

Feb 16 · 🌐

This is the 30ft buoy pop I previewed about a week ago on the experimental future buoy forecast map.. biggest pop of the year, should last a few days. Sometimes giant pops don't mean huge storms, but I have notices that longer pops lead to multi-day storms, so that's fun. Still vibing from yesterday, so good! [#yeahbuoy](#)

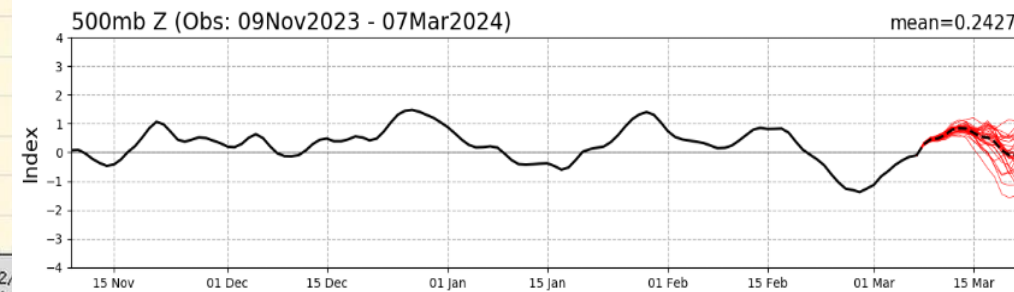


But PNA is finally tracking and going negative !

Come on march

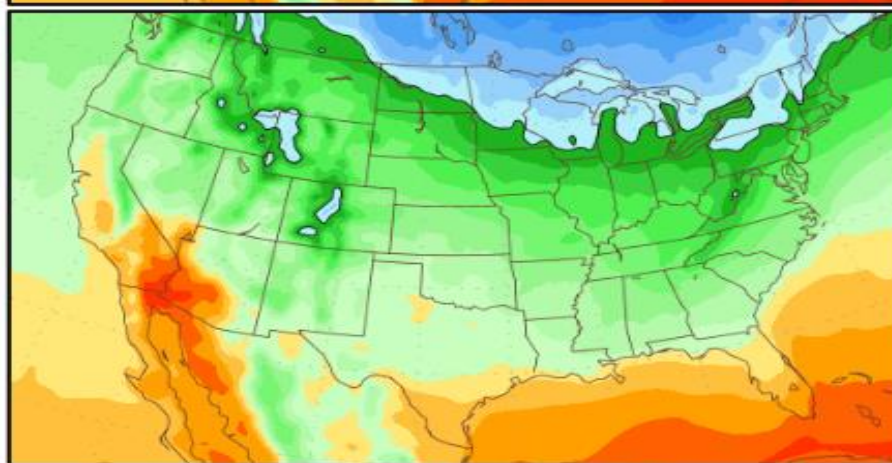
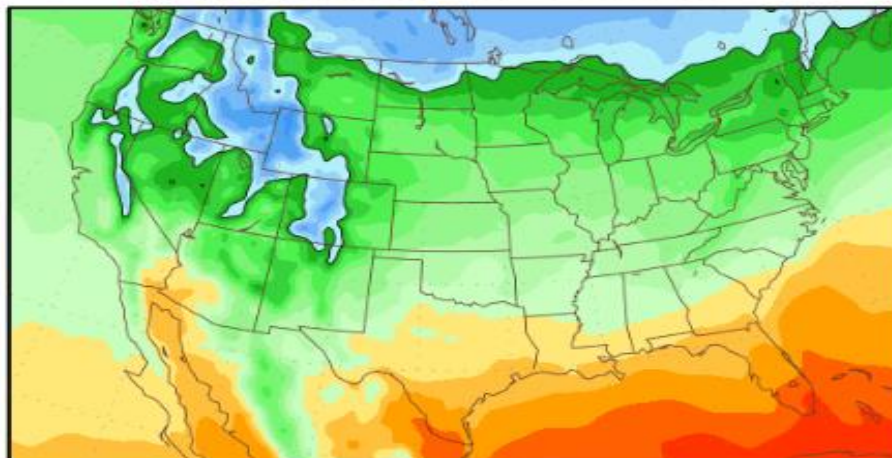
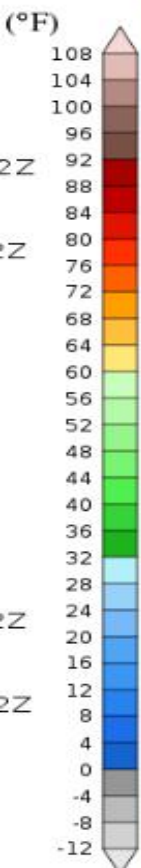
Tue, Feb 13 at 10:40 AM

### PNA Index: Observed & GEFS Forecasts





# Temperature Forecasts



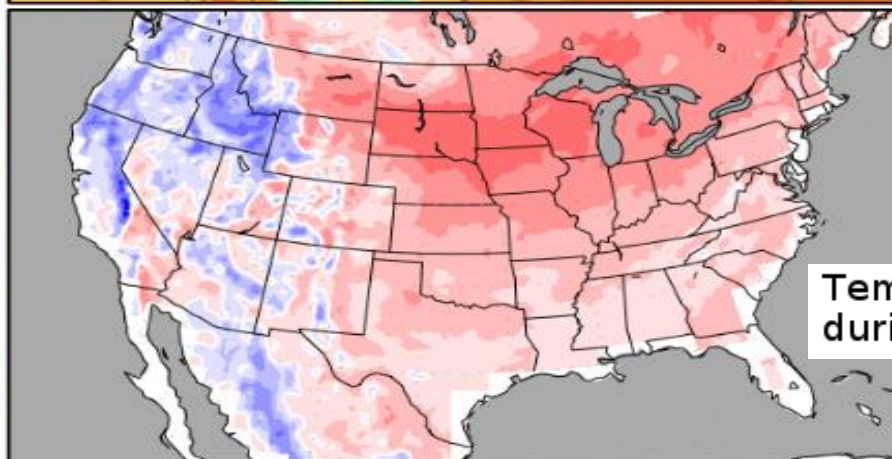
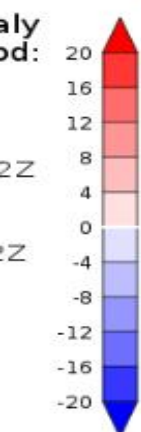
**Mar 7 - 15**

**Mar 17 - 23**

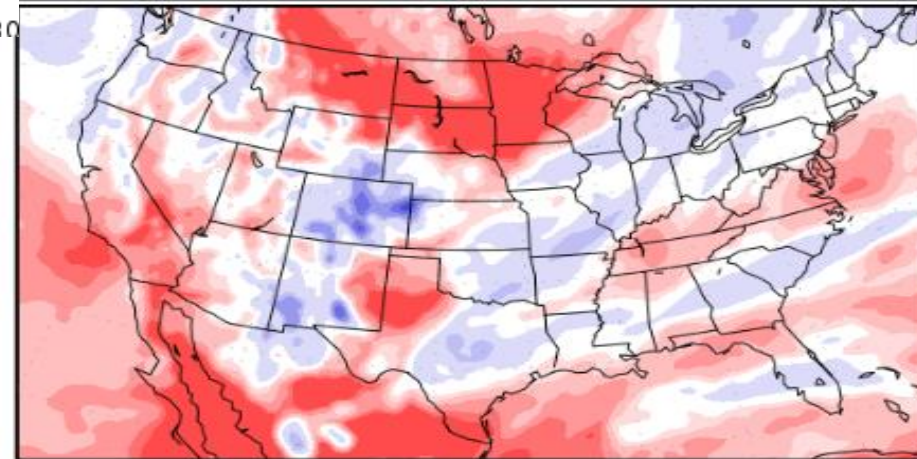
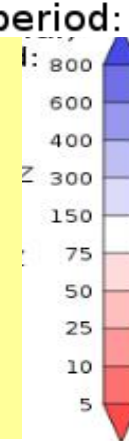
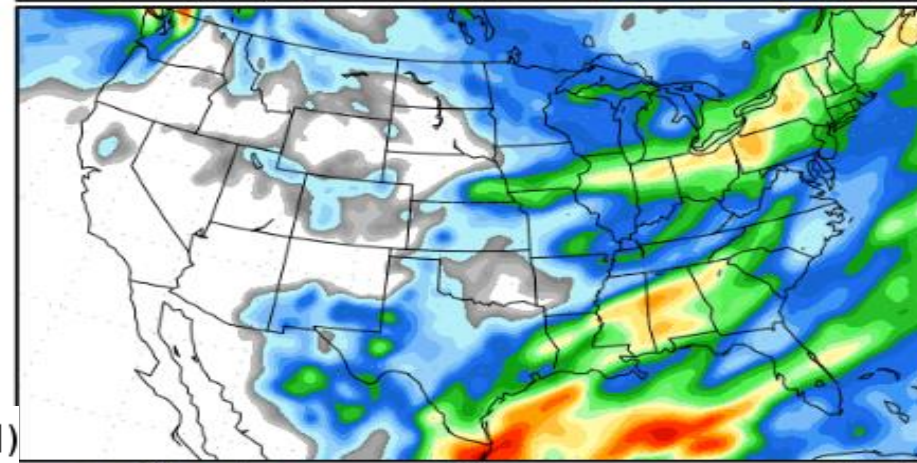
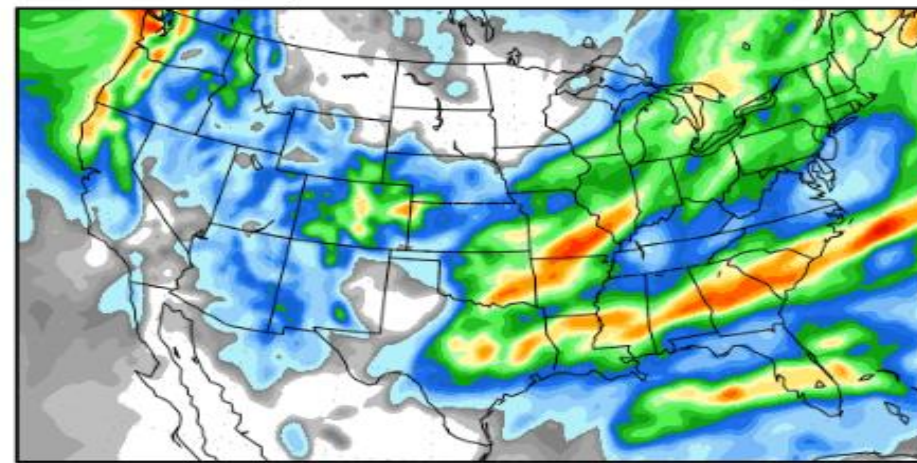
Precipitation (% of normal)  
during the first period:

**Mar 7 - 15**

Temperature Anomaly  
during the first period:



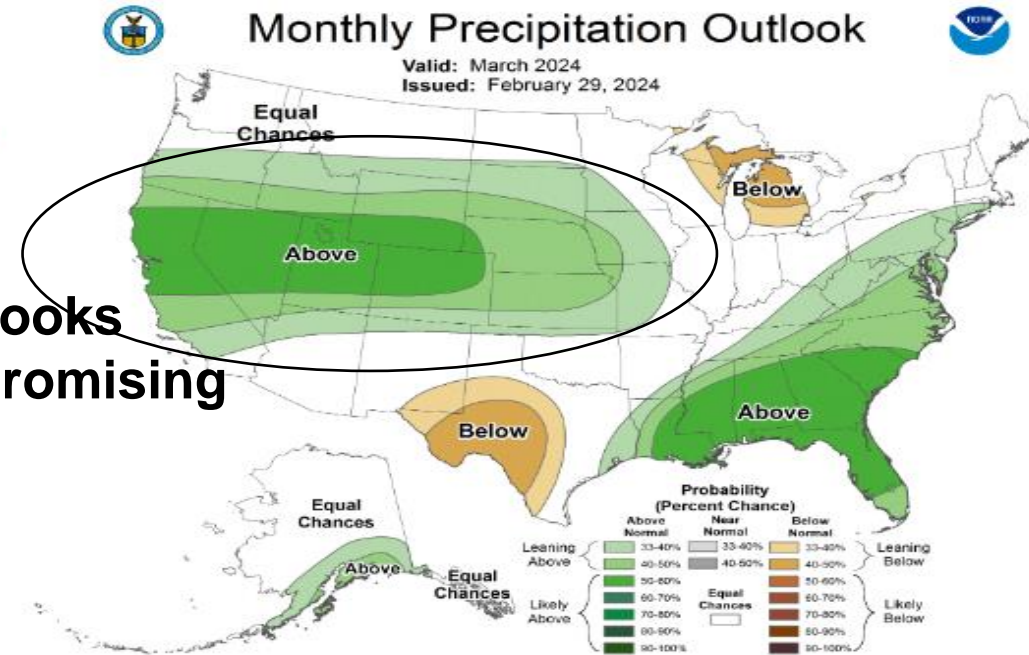
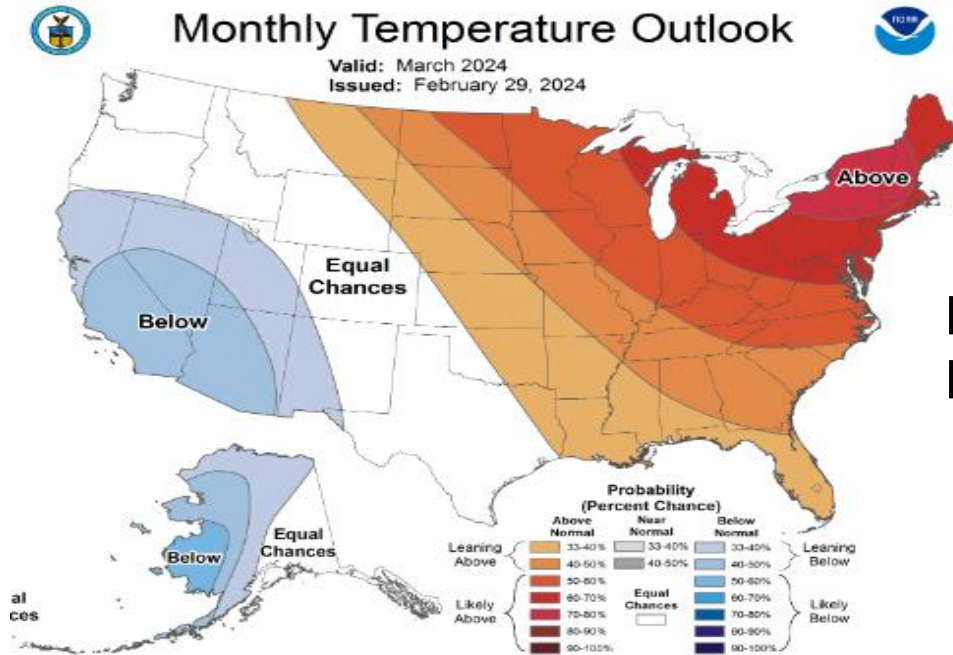
# Precipitation Forecasts





# March Outlook

## Temp & Precip

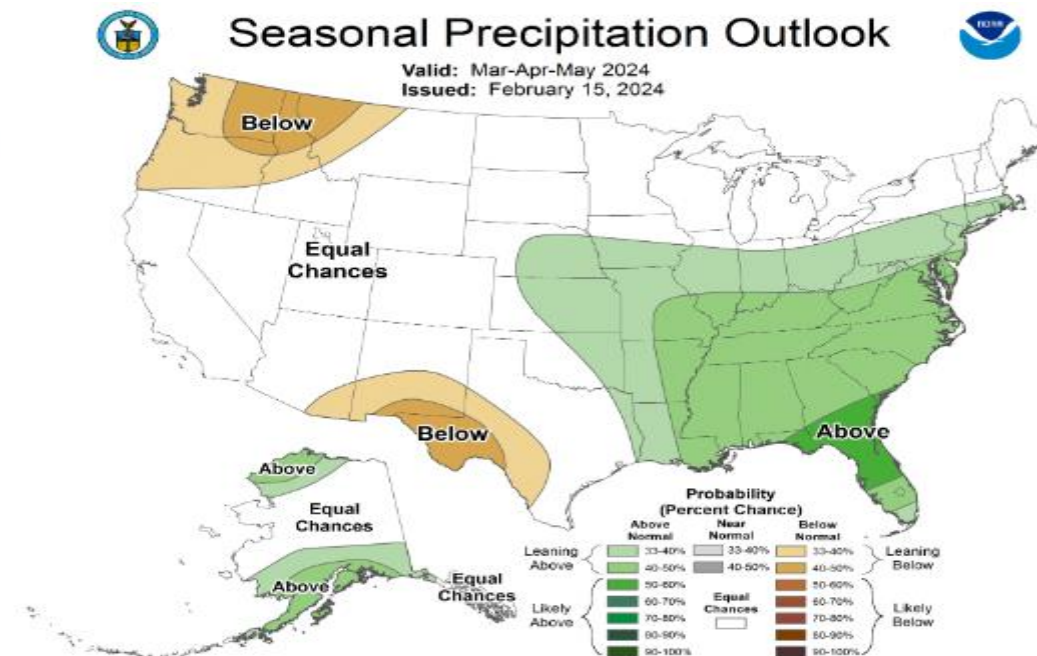
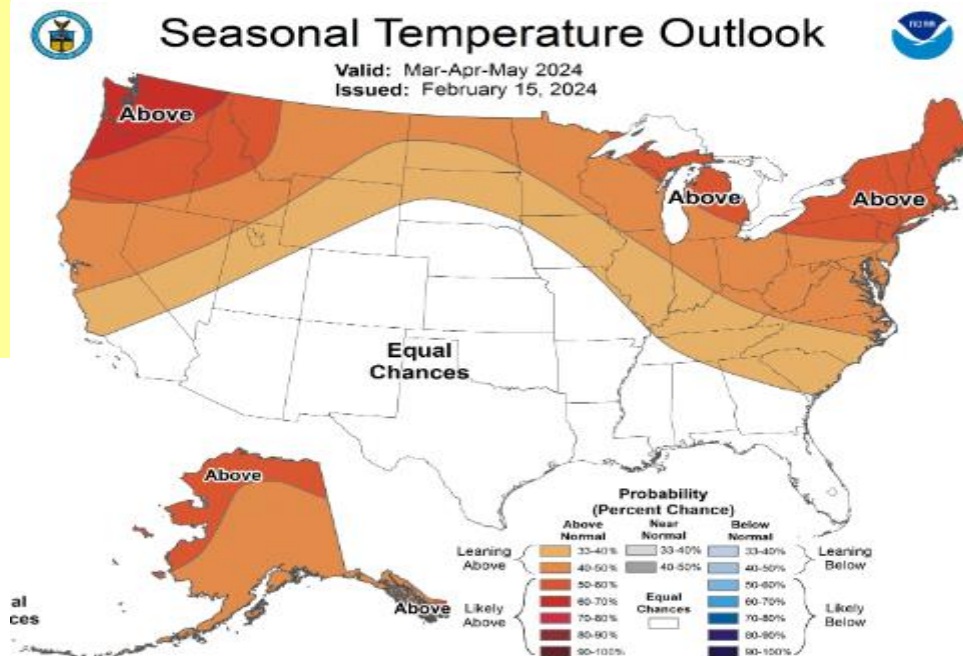


Looks Promising

# Seasonal Outlook

## Mar - Apr - May

## Temp & Precip

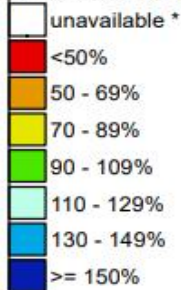




# Westwide SNOTEL Current Snow Water Equivalent (SWE) % of Normal

Feb 28, 2024

Current Snow Water Equivalent (SWE) Basin-wide Percent of 1991-2020 Median

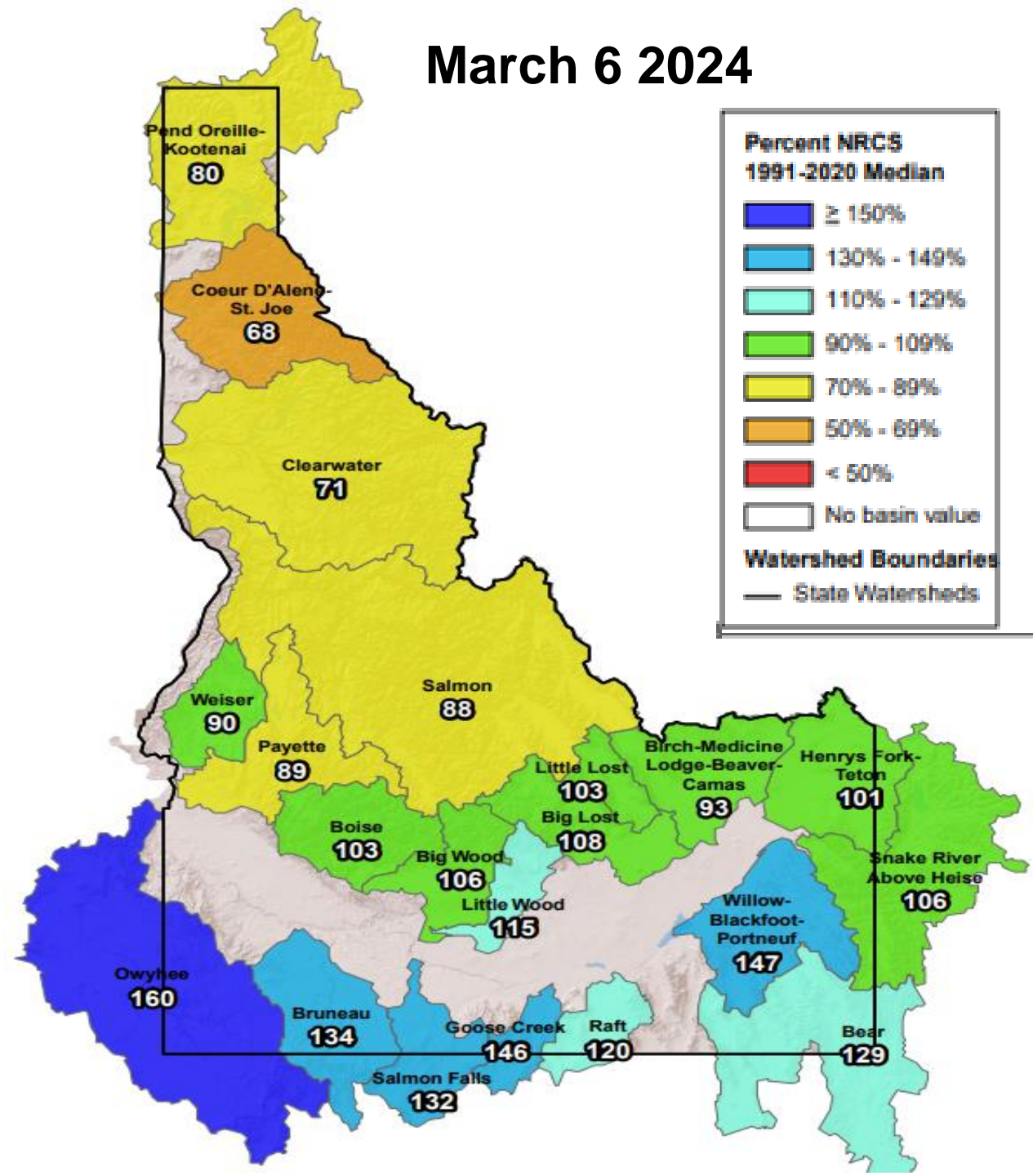


\* Data unavailable at time of posting or measurement is not representative at this time of year

Provisional data subject to revision

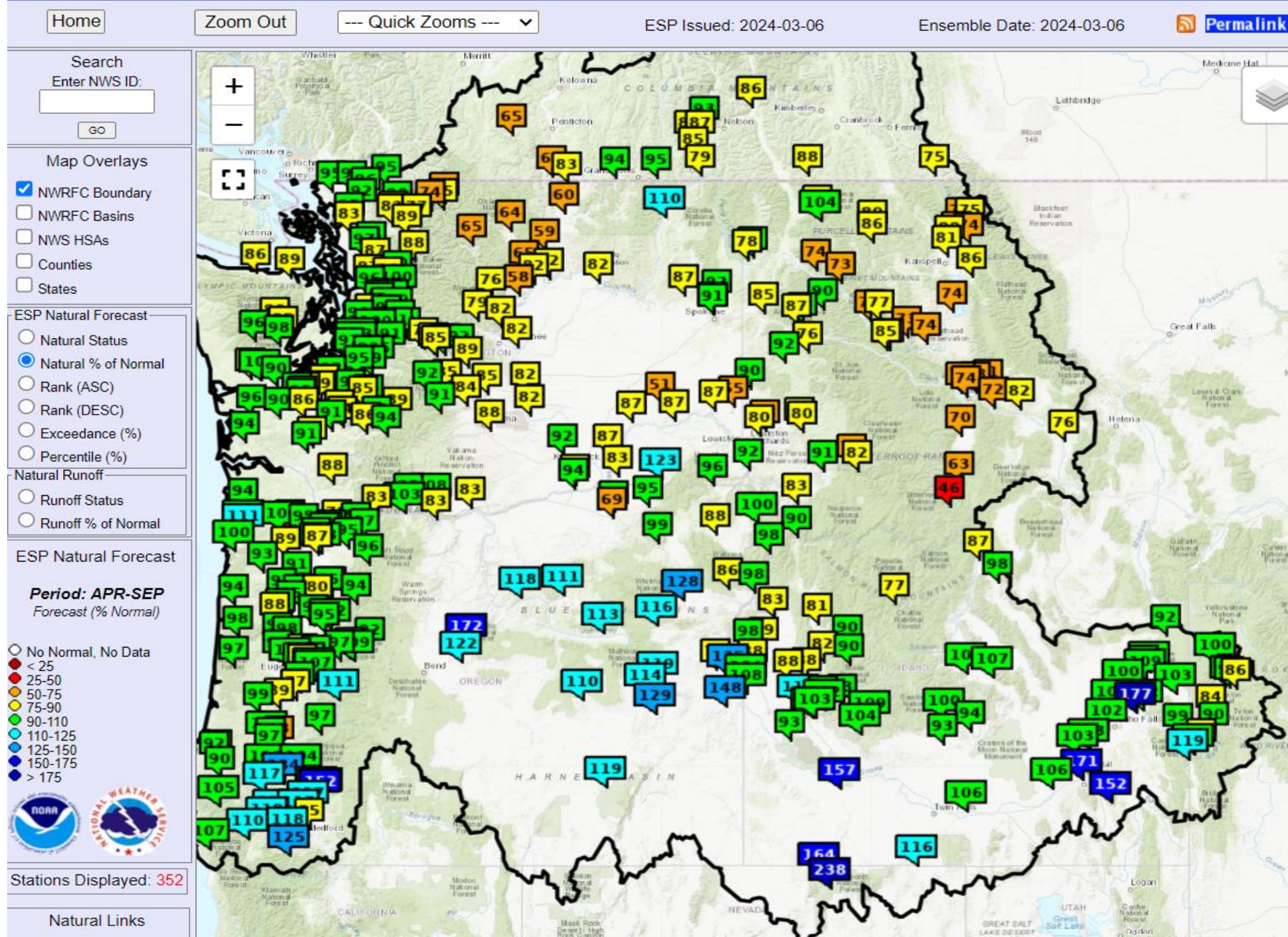


March 6 2024



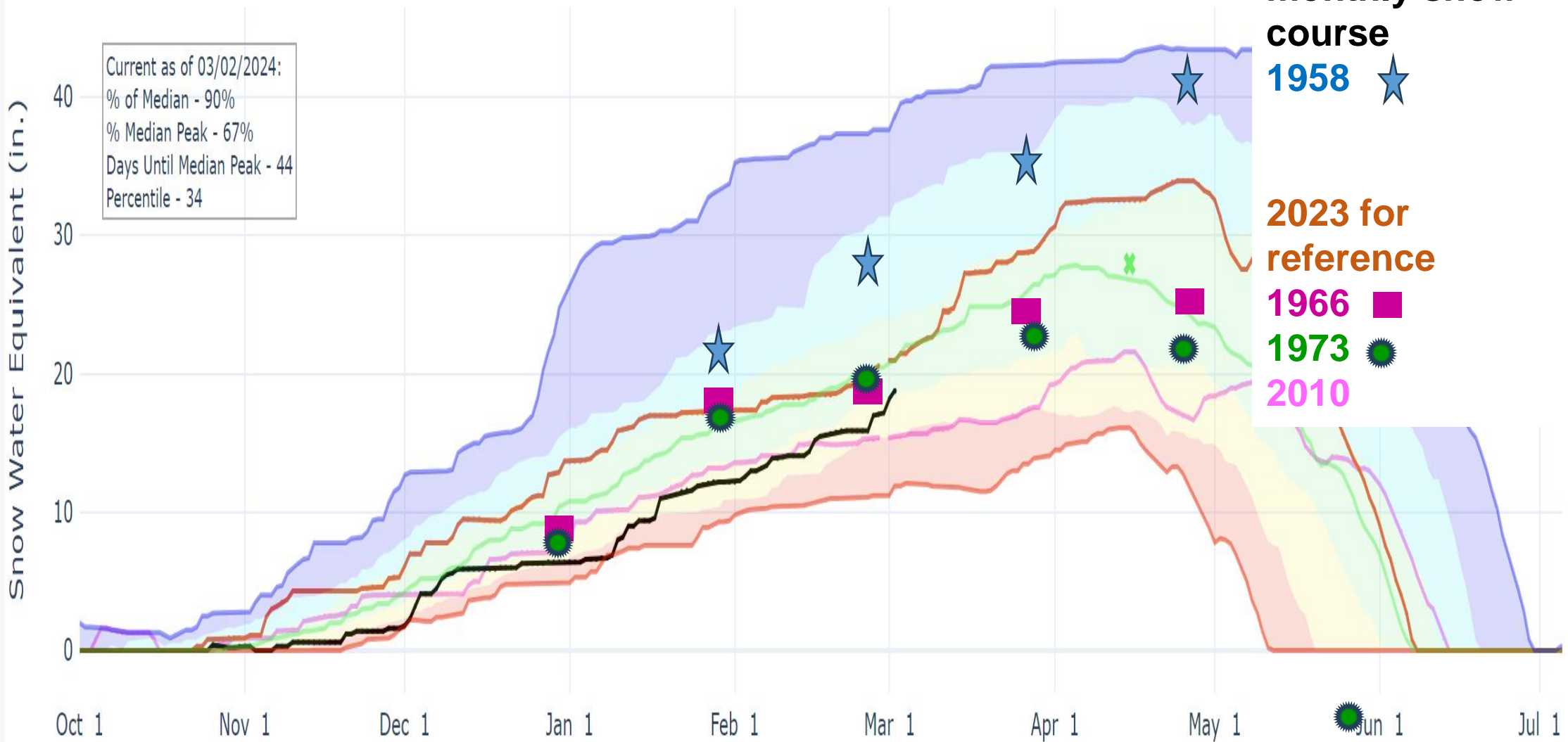


# NWS Volume Streamflow Forecasts March 6, 2024





# JACKSON PEAK, ID (550) SNOW WATER EQUIVALENT



**Analog Years  
SWE based on  
Jackson Peak  
monthly snow  
course**

**1958** ★

**2023 for  
reference**

**1966** ■

**1973** ●

**2010** ■

✕ Median Peak SWE

— Max

— Median ('91-'20)

— Min

— Stats. Shading

— 2024

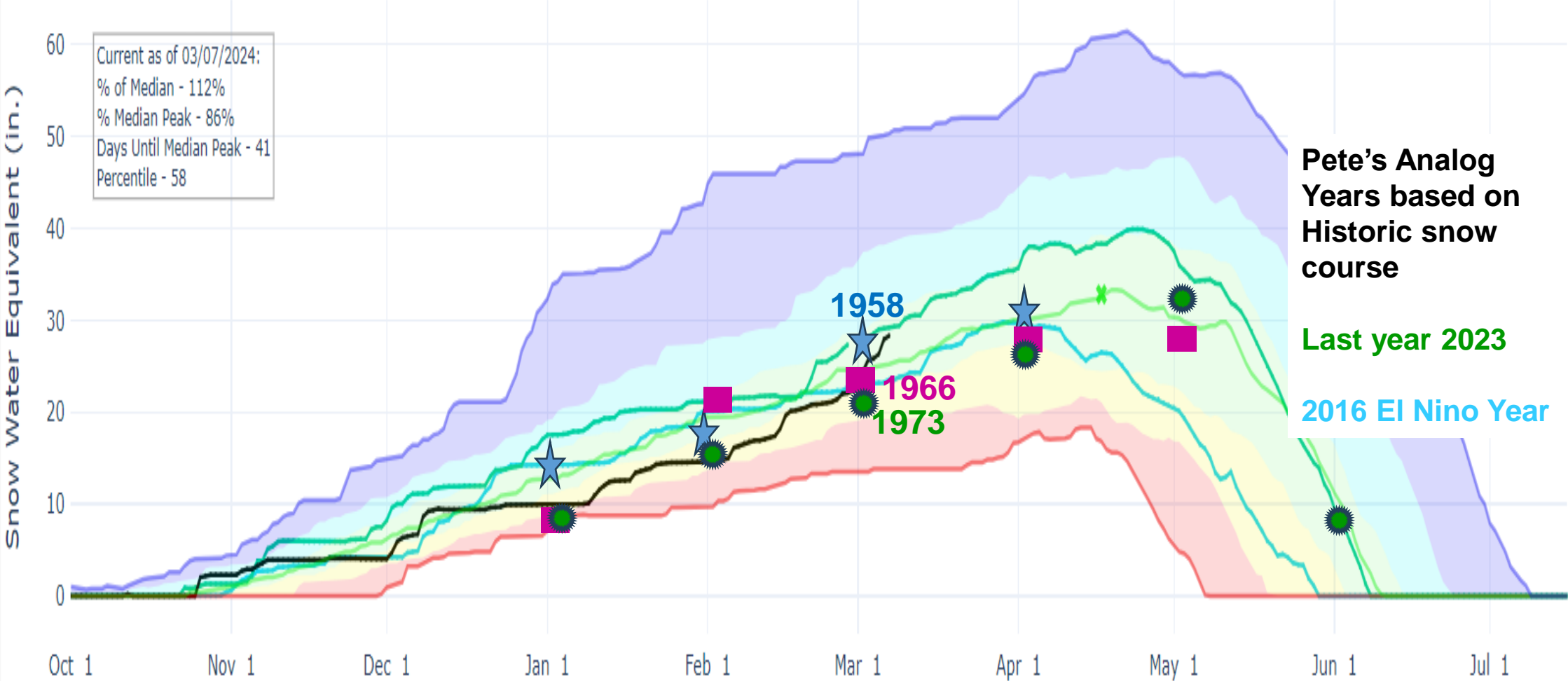
— 2023

— 2010





# LEWIS LAKE DIVIDE, WY (577) SNOW WATER EQUIVALENT

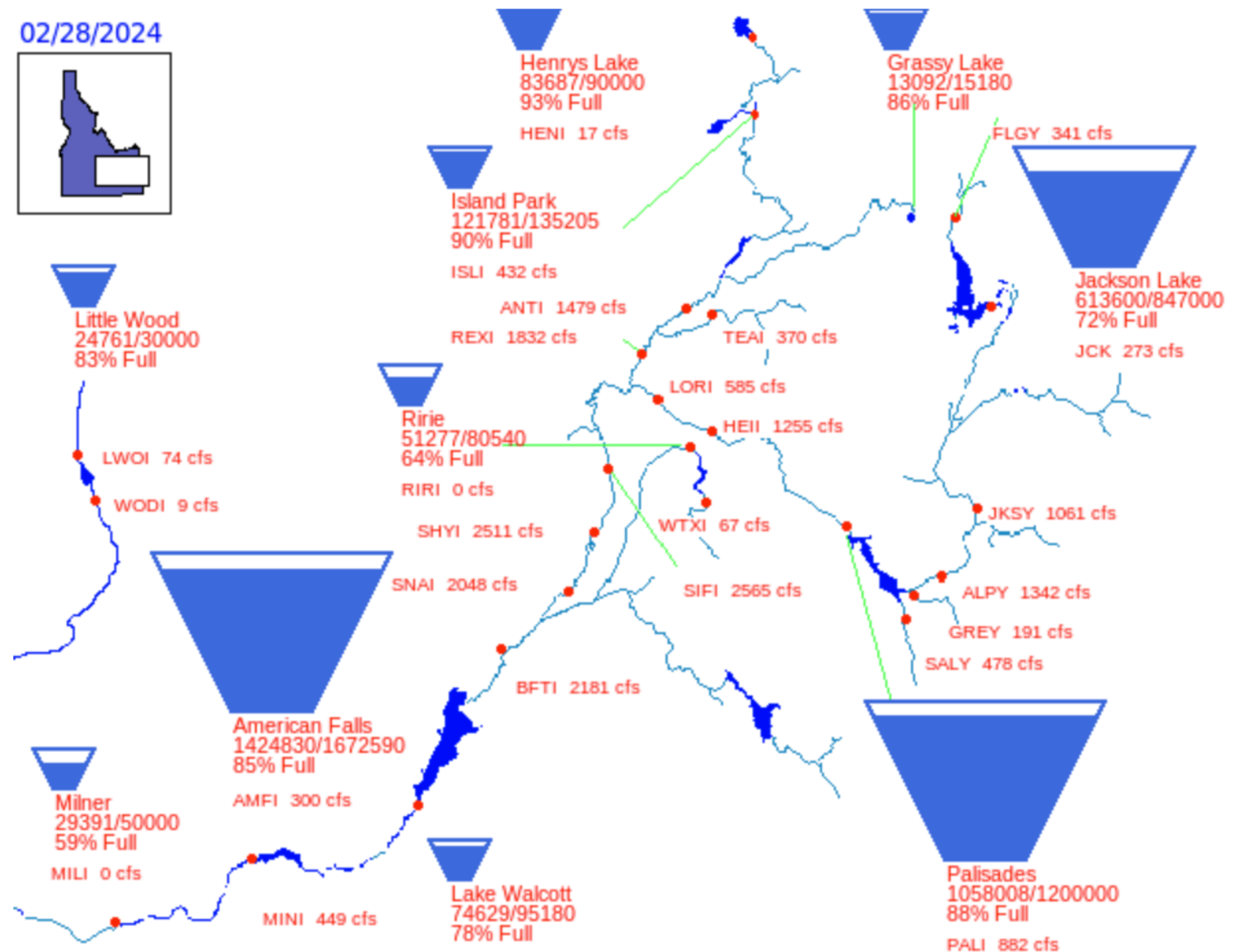


# Major Storage Reservoirs in the Upper Snake River Basin

83% of capacity

USBR meeting this week to determine releases from Jackson/Palisades and American Falls.

Water should be flowing past Milner Section...





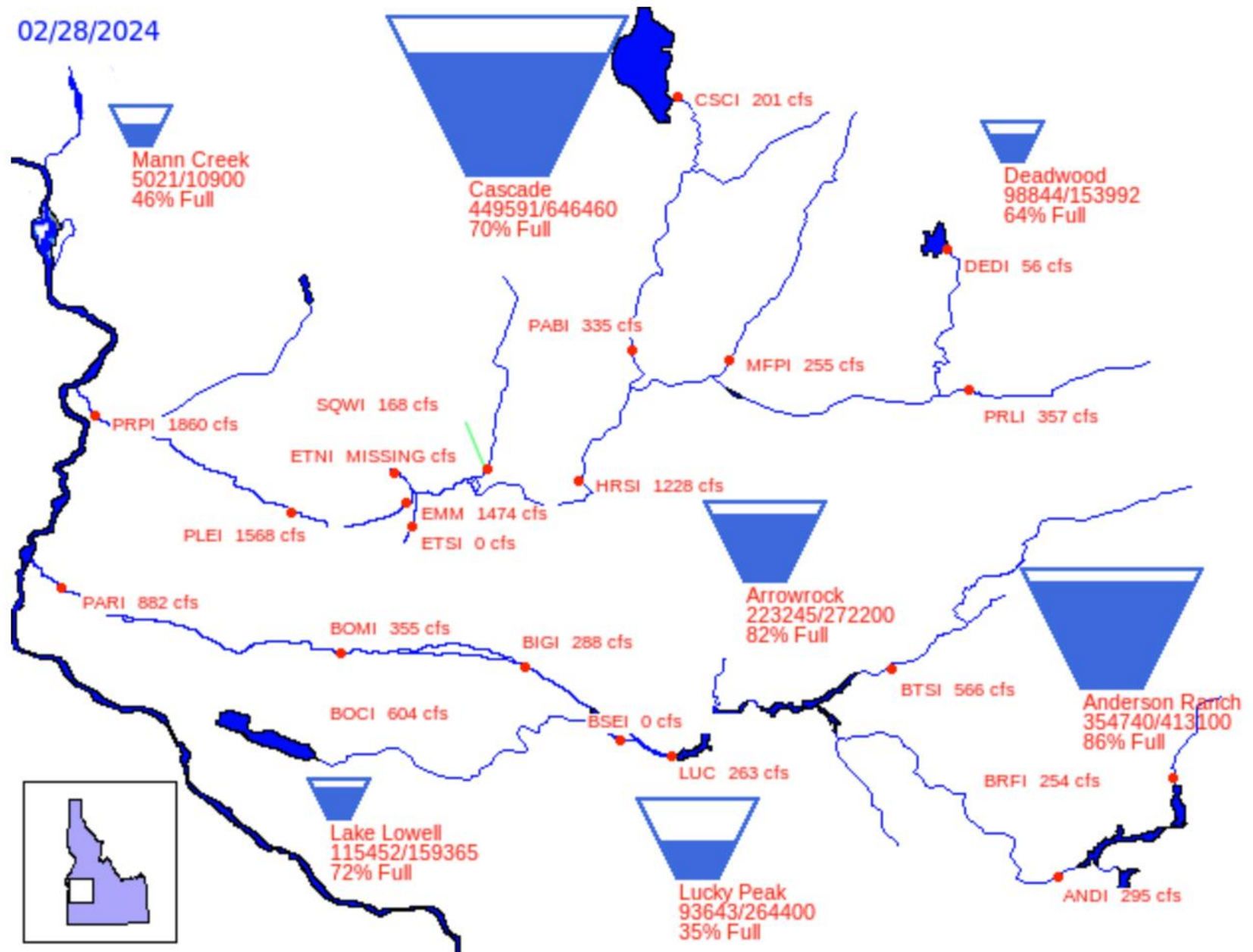
# Major Storage Reservoirs in the Boise & Payette River Basins

**Payette System**  
**69% of capacity**

**Boise System**  
**71% of capacity**

**Releases likely**  
**on Boise System**

**Jerry there will**  
**be a tubing**  
**season on the**  
**Boise.**





**Guess  
Where ?**

**Today at  
9:53 AM**

**0 degrees F**



# Howard's Plunge

**There's that  
oar grabber  
rock on the  
left and poor  
over on the  
right !!**



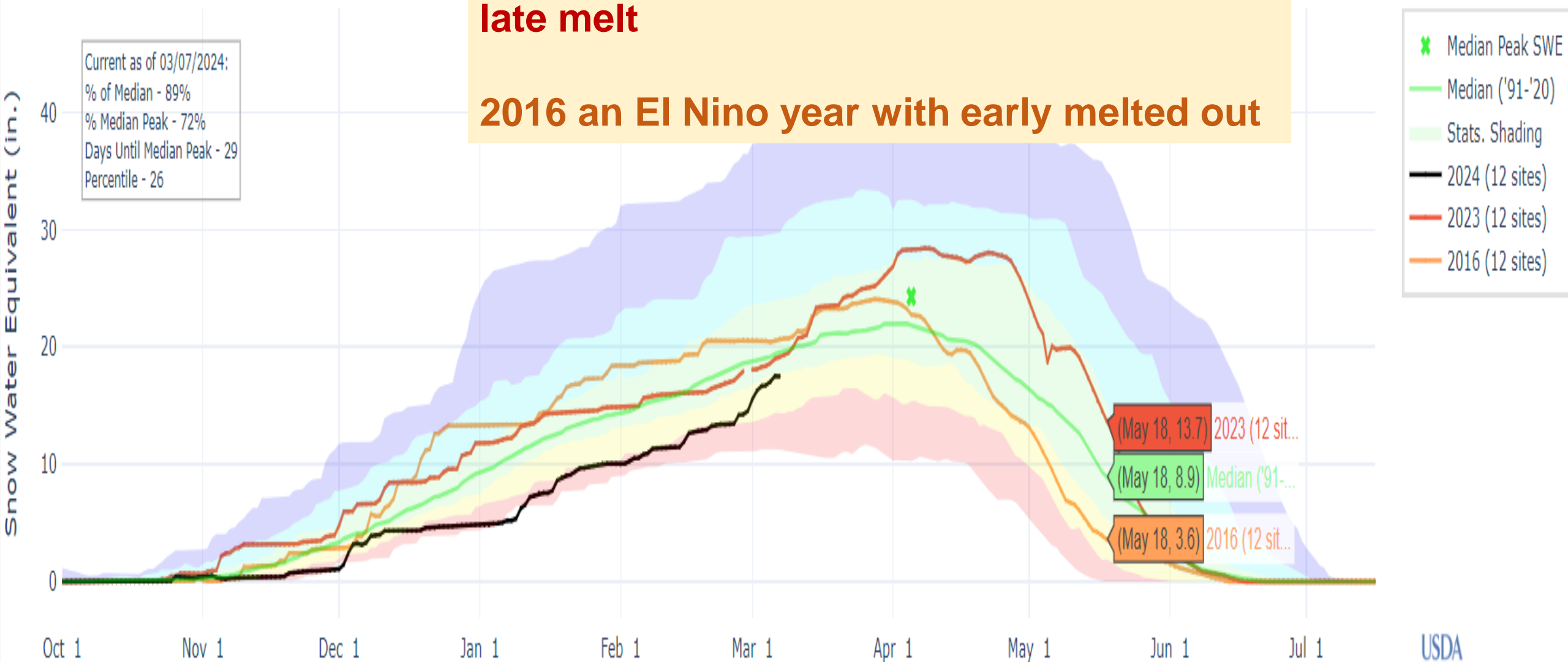


## SNOW WATER EQUIVALENT IN PAYETTE

**2024 Payette Snow is 89% of Median**

**Just less than 2023 – good late precip and late melt**

**2016 an El Nino year with early melted out**





# SF PAYETTE - AT LOWMAN (PRL1)

## Forecasts for Water Year 2024

### Natural Forecast

ESP with 10 Days QPF Ensemble: 2024-03-07 Issued: 2024-03-07

Forecast Period	Forecasts Are in KAF				30 Year Average (1991-2020)
	90 %	50 %	% Average	10 %	
APR-SEP	346	406	89	491	458
APR-JUL	304	355	87	435	408

Lowman Forecast A-J  
87% 355 KAF

Horseshoe Bend Forecast A-J  
87% 1298 KAF

# PAYETTE - NEAR HORSESHOE BEND (HRSI1)

## Forecasts for Water Year 2024

### Natural Forecast

ESP with 10 Days QPF Ensemble: 2024-03-07 Issued: 2024-03-07

Forecast Period	Forecasts Are in KAF				30 Year Average (1991-2020)
	90 %	50 %	% Average	10 %	
APR-SEP	1159	1418	88	1755	1614
APR-JUL	1063	1298	87	1623	1499

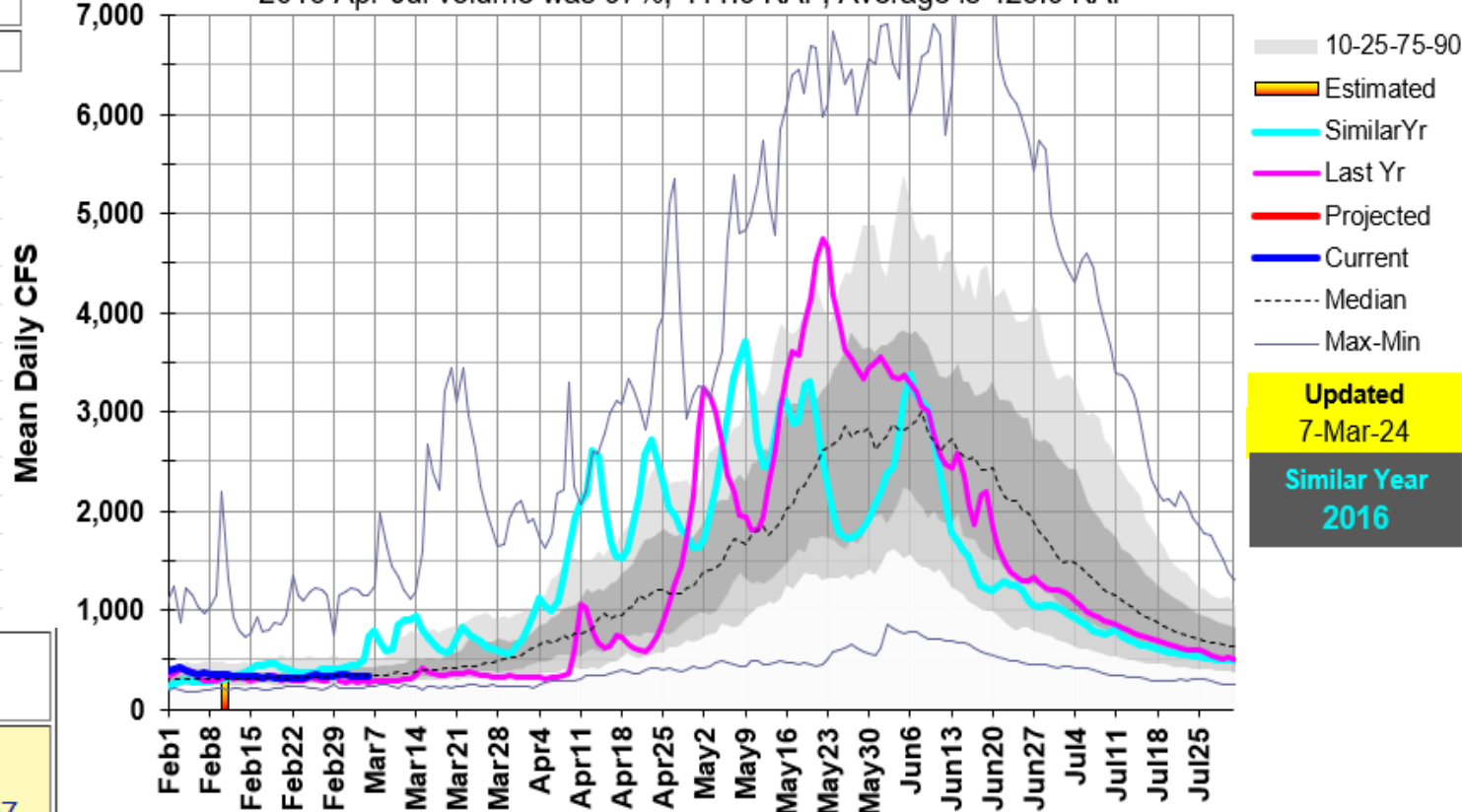
## 2024 Lowman

2016 Runoff was 411 KAF Similar Year

2023 Runoff was 421 KAF Last Year

## 13235000: SF Payette R at Lowman, ID

2016 Apr-Jul volume was 97%, 411.9 KAF, Average is 425.9 KAF







\* Payette will be fun like always and runnable year around for some...

Feb 15, 2023

\* 62<sup>nd</sup> consecutive months running Staircase Section for Matt, Harlan & Ted



+12 months = 74 consecutive months











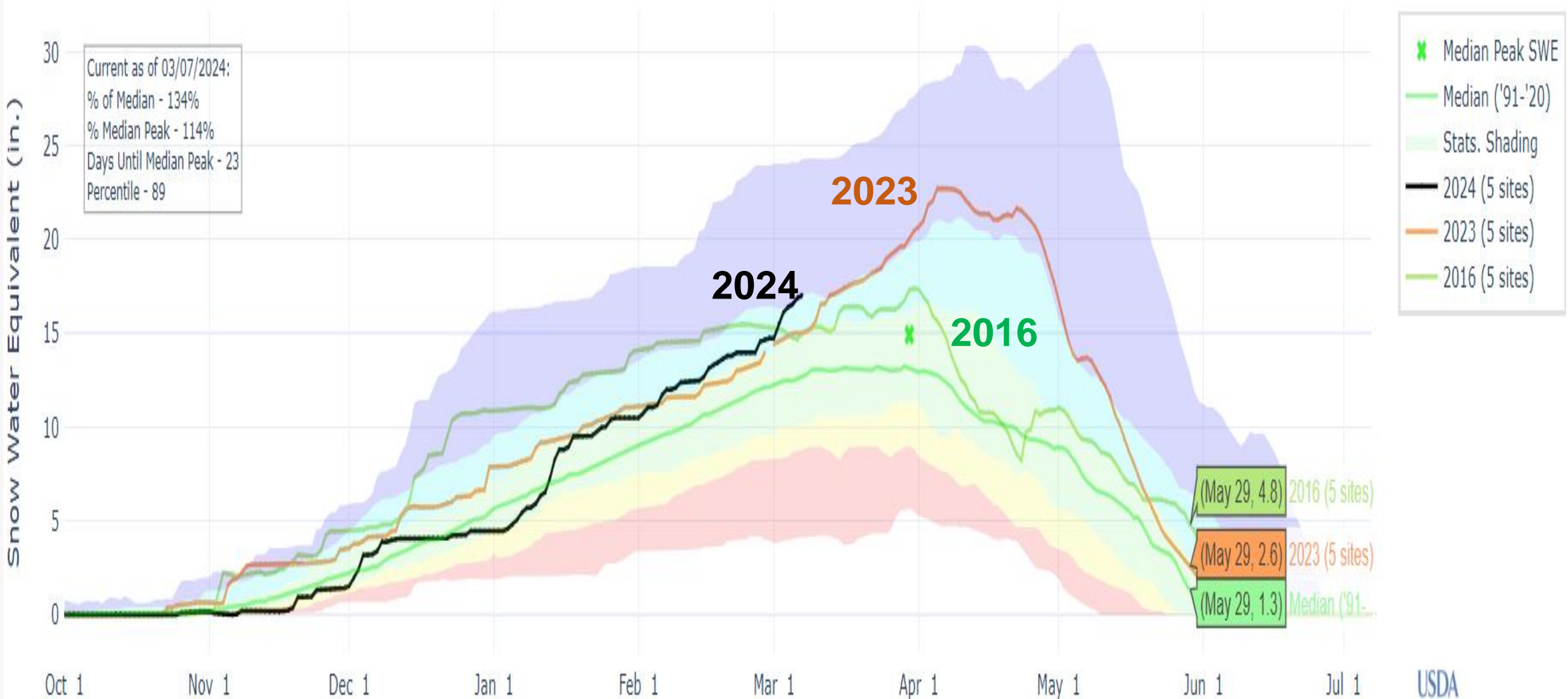


# SNOW WATER EQUIVALENT IN BRUNEAU

**2024 Bruneau Snow is 134% of Median**

**2023 – good late precip and late melt**

**2016 - El Nino year with peak same as today's SWE**



# BRUNEAU - NEAR HOT SPRINGS (HOT11) Forecasts for Water Year 2024

## Natural Forecast

ESP with 10 Days QPF   Ensemble: 2024-03-07   Issued: 2024-03-07

Forecast Period	Forecasts Are in KAF				30 Year Average (1991-2020)
	90 %	50 %	% Average	10 %	
APR-SEP	242	292	160	367	183
APR-JUL	232	277	158	345	175

2024 Bruneau

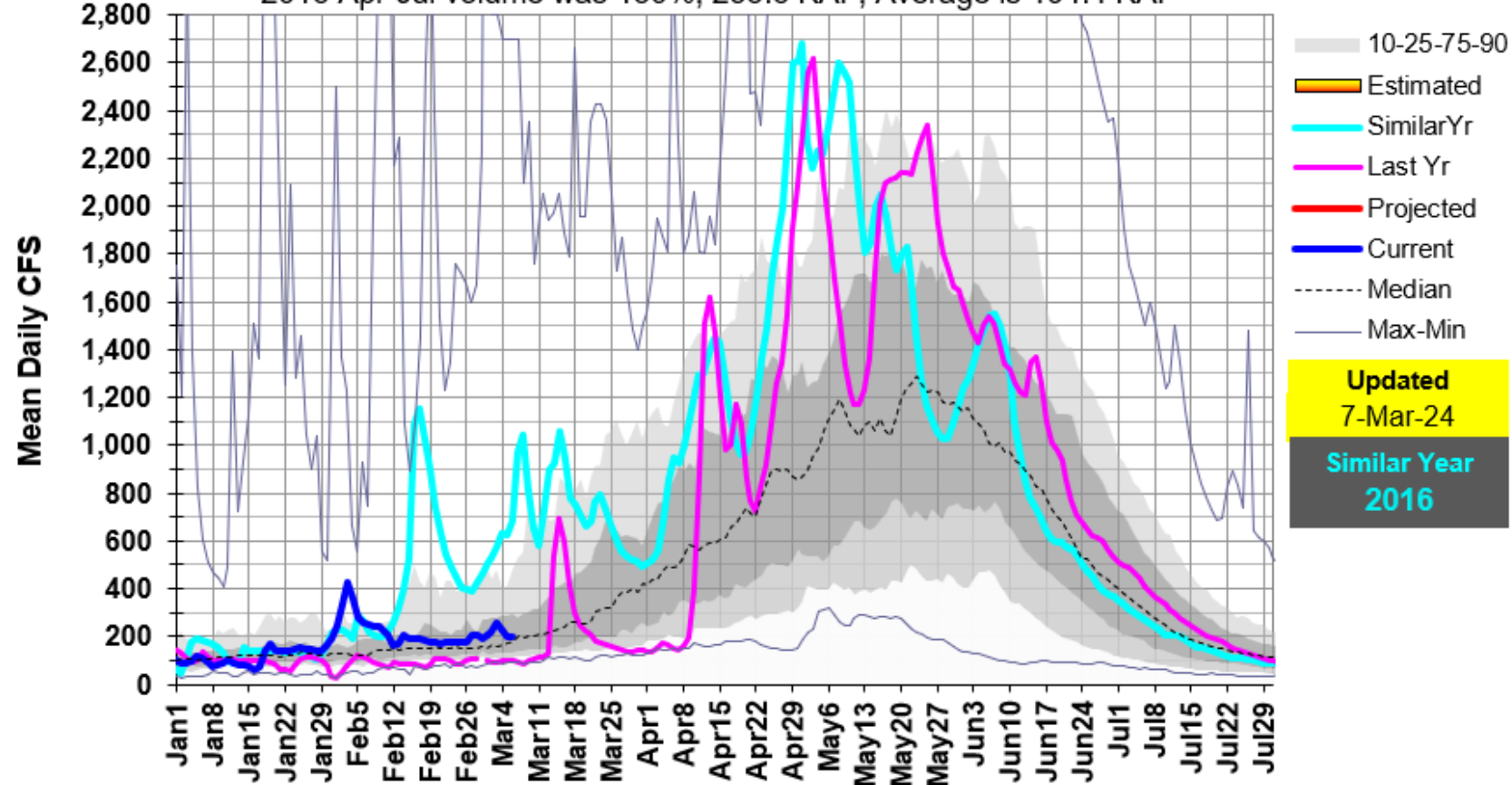
2016 Runoff was 253 KAF Similar Year

2023 Runoff was 250 KAF last Year

Bruneau Forecast Apr – Jul  
158% 277 KAF

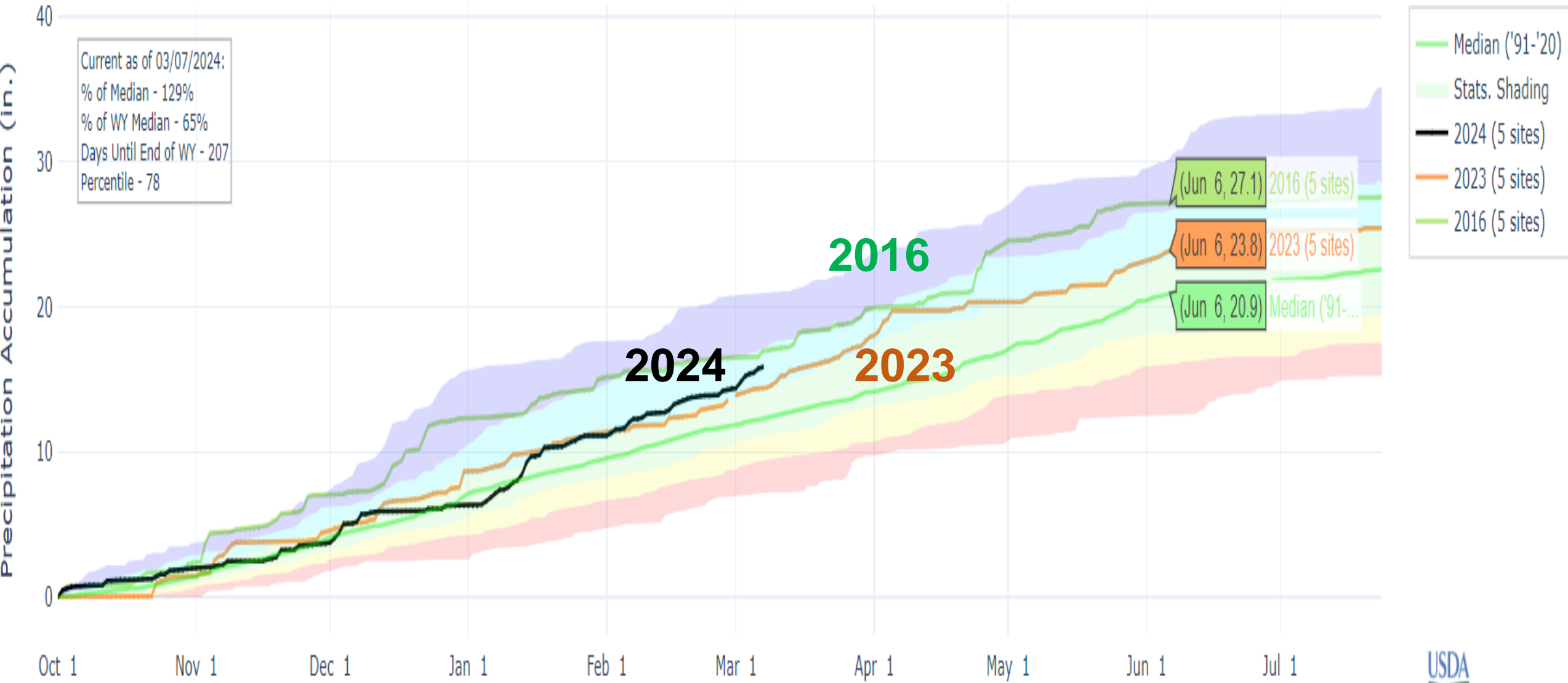
## 13168500: Bruneau R near Hot Spring, ID

2016 Apr-Jul volume was 130%, 253.6 KAF, Average is 194.4 KAF





# Bruneau Precip 2024, 2023 & 2016 about the same



**Lessons Learned from Peter Palmer & others:**  
**Bear Creek usually needs about 20" of SWE to have**  
**an adequate floating season or wet spring.**  
**We are there !!**



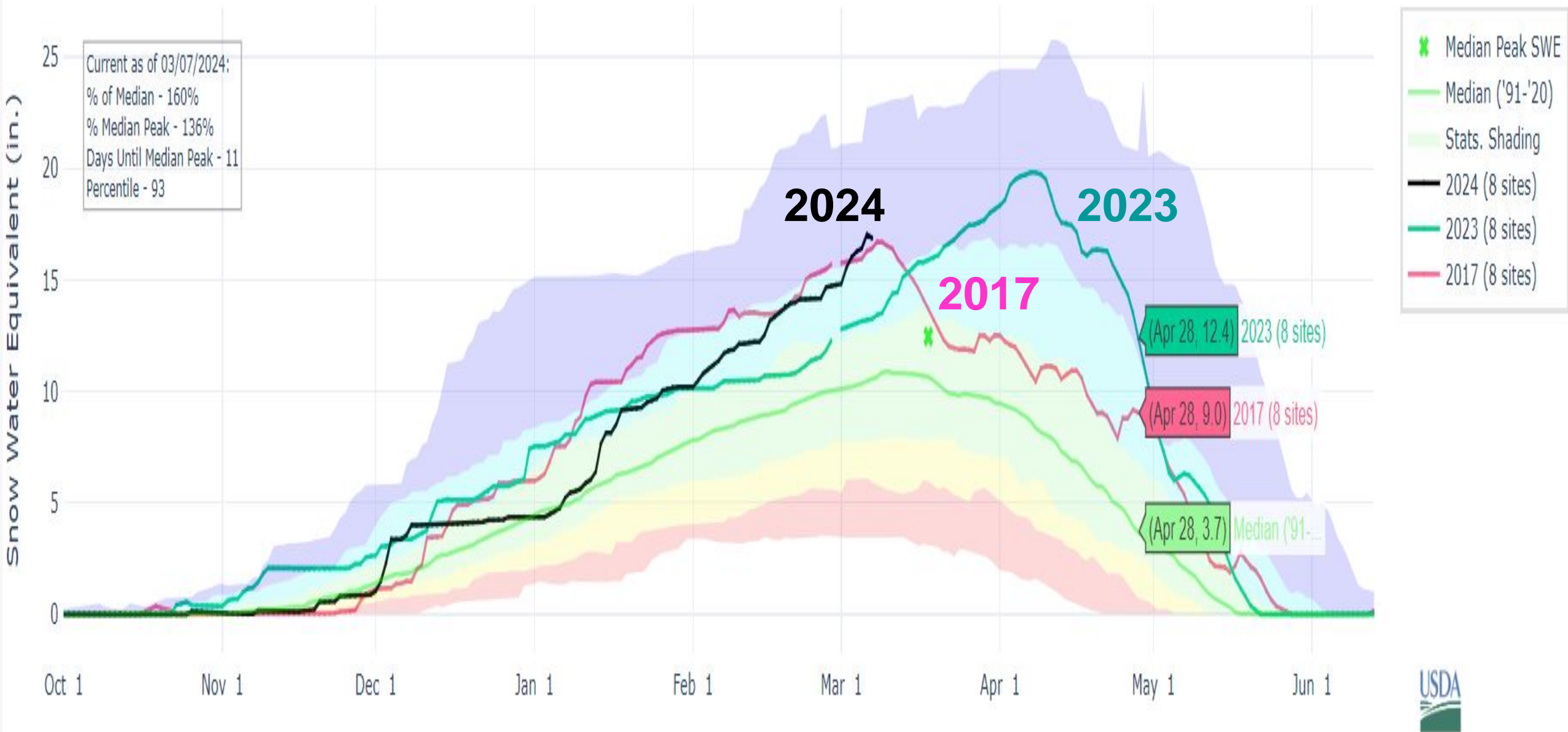






# SNOW WATER EQUIVALENT IN OWYHEE

**2024 Owyhee Snow is 160% of Median**  
**2023 – good late precip and late melt**  
**2017 similar snow year but wetter**

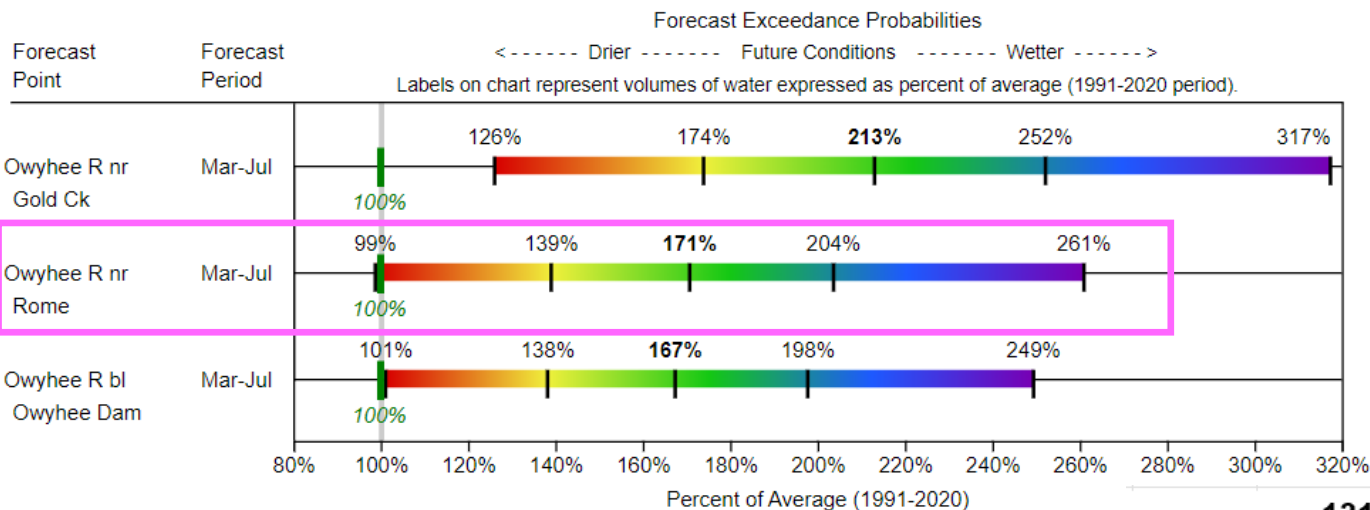




# OWYHEE

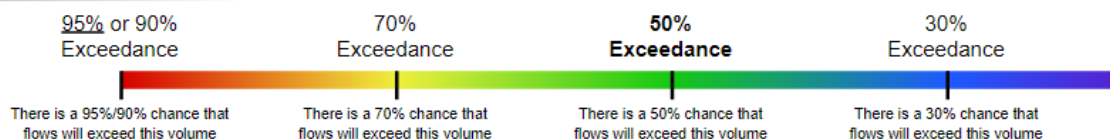
## Water Supply Forecasts

### March 1, 2024



**2024 Owyhee**  
**2017 Runoff was 689 KAF Similar Year**  
**2023 Runoff was 585 KAF last Year**

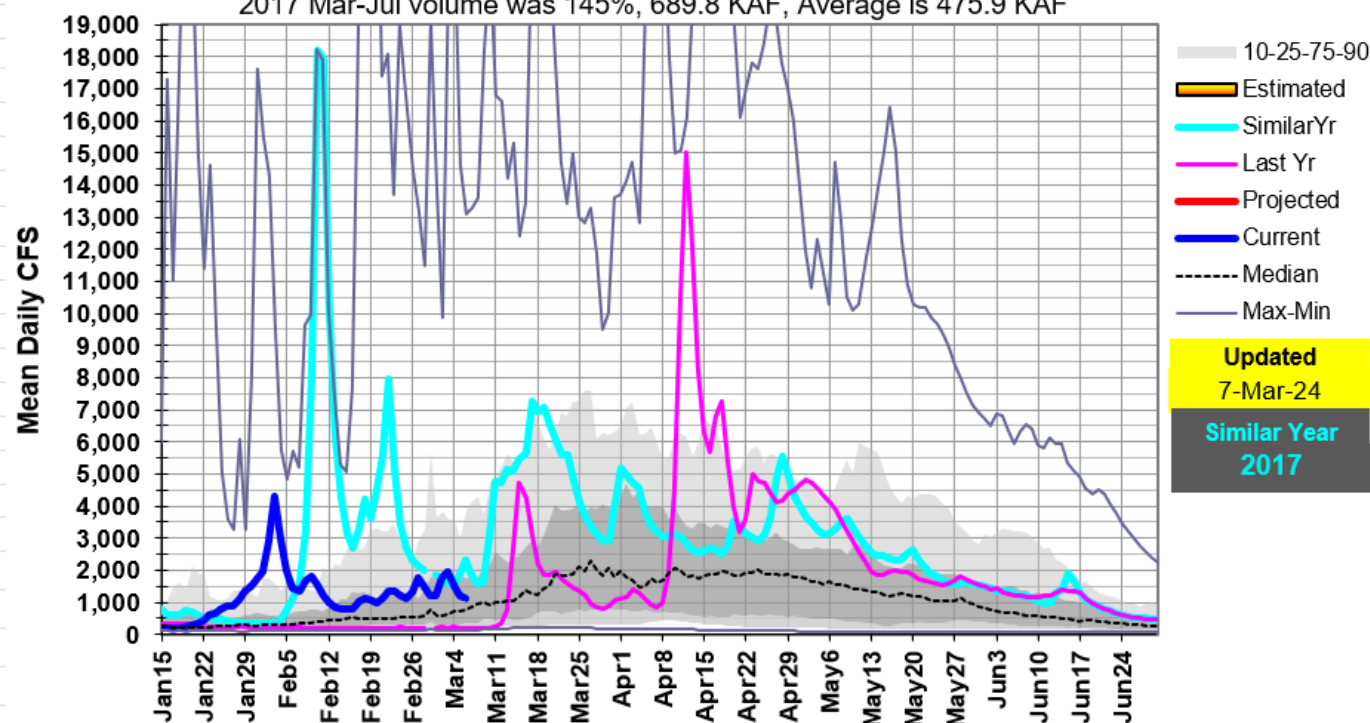
#### Legend



**Rome Forecast Mar – Jul**  
**171% 700 KAF**

#### 13181000: Owyhee R near Rome, OR

2017 Mar-Jul volume was 145%, 689.8 KAF, Average is 475.9 KAF

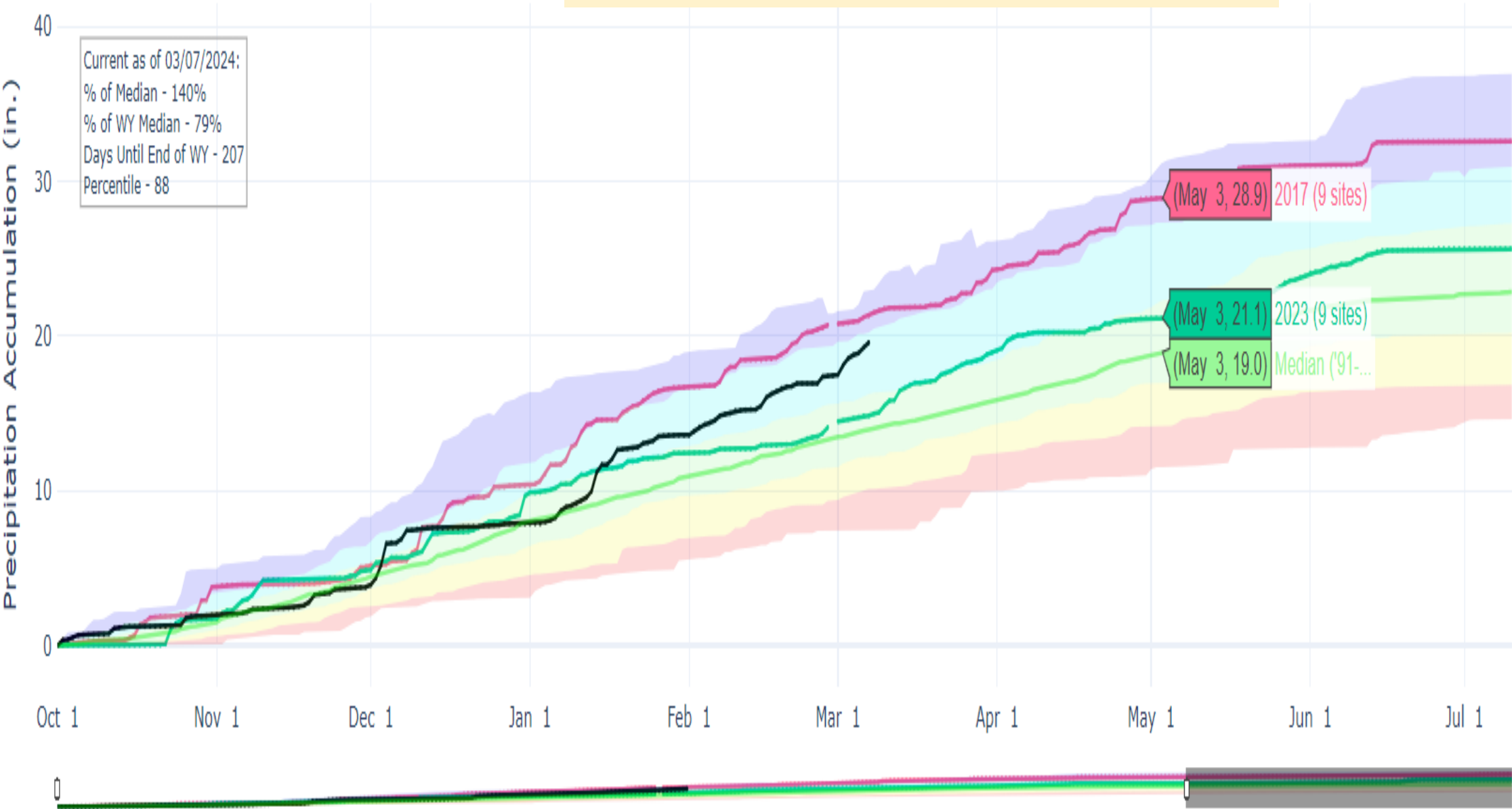


PRECIPITATION ACCUMULATION IN OWYHEE

2024 Owyhee Precip in the Middle  
2023 – lower  
2017 – wetter than this year

Reset Range

Current as of 03/07/2024:  
% of Median - 140%  
% of WY Median - 79%  
Days Until End of WY - 207  
Percentile - 88



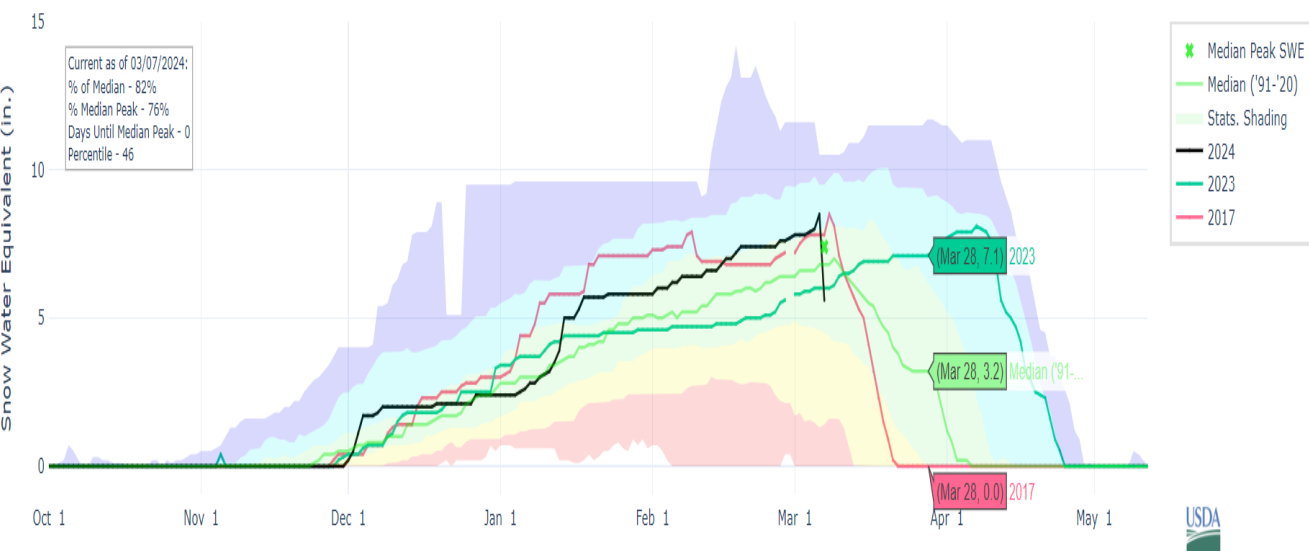
Station List

- Median ('91-'20)
- Stats. Shading
- 2024 (9 sites)
- 2023 (9 sites)
- 2017 (9 sites)





MUD FLAT, ID (654) SNOW WATER EQUIVALENT



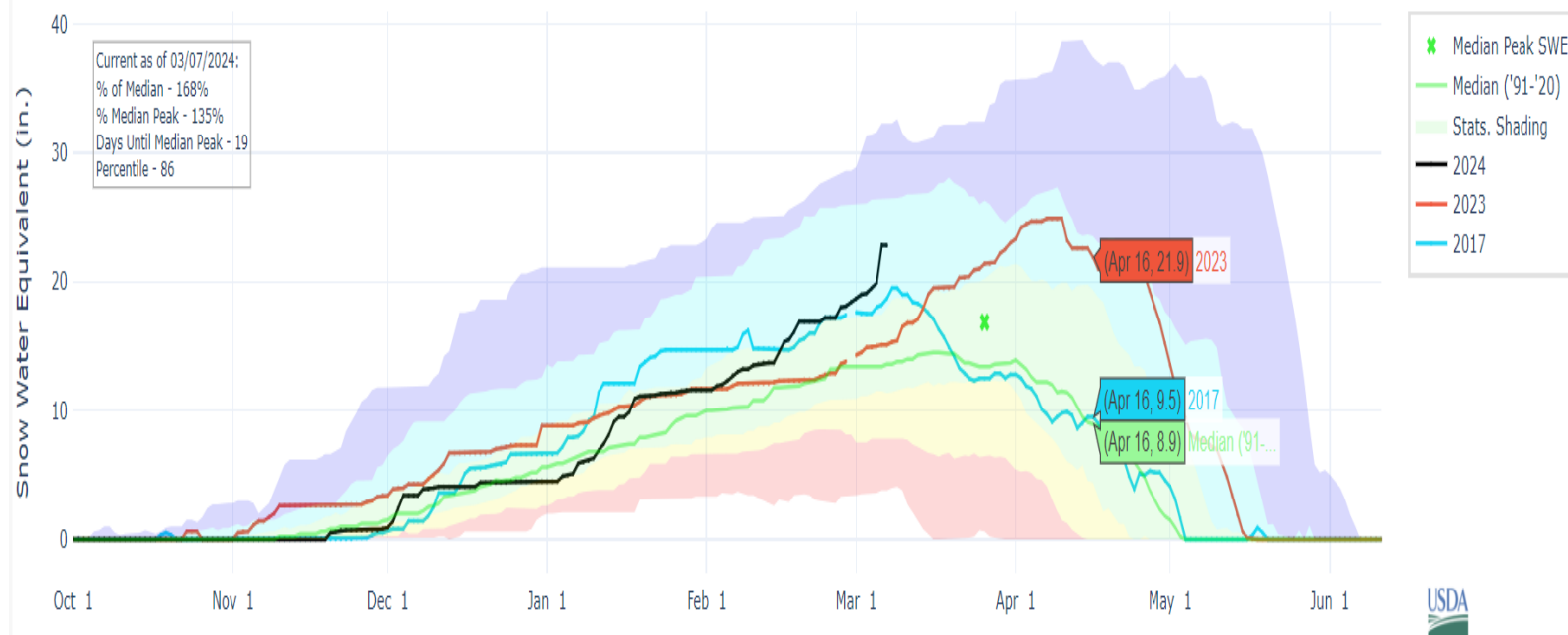
## From Kara Ferguson BSU Thesis

### Owyhee River snowmelt peak occurs when:

- **Mud Flat is ~15% melted (canopy changed) and / or**
- **South Mnt is ~30% melted (BETTER to USE)**

**March weather will determine if SWE keeps increasing or starts melting.**

SOUTH MTN., ID (774) SNOW WATER EQUIVALENT







# Hells Canyon

Idaho Power started drafting Brownlee Reservoir for flood risk management and environmental needs.

Boaters can expect flows near 20,000 cfs at Hells Canyon Dam over the coming weeks, with occasional periods of lower flows in the 10,000-12,000 cfs range.

Flows are likely to remain elevated through the spring runoff season.



SNAKE - AT HELLS CANYON DAM (HCDI1)  
Forecasts for Water Year 2024

## **Natural Forecast**

ESP with 10 Days QPF Ensemble: 2024-03-07 Issued: 2024-03-07

Forecast Period	Forecasts Are in KAF				30 Year Average (1991-2020)
	90 %	50 %	% Average	10 %	
APR-SEP	6730	8513	102	10844	8326



# Selway & Lochsa Rivers

**Selway Falls**  
**June 14, 2022**  
**about 20,000 CFS**



**Selway Falls**  
**May 19, 2006**  
**30,000 CFS**



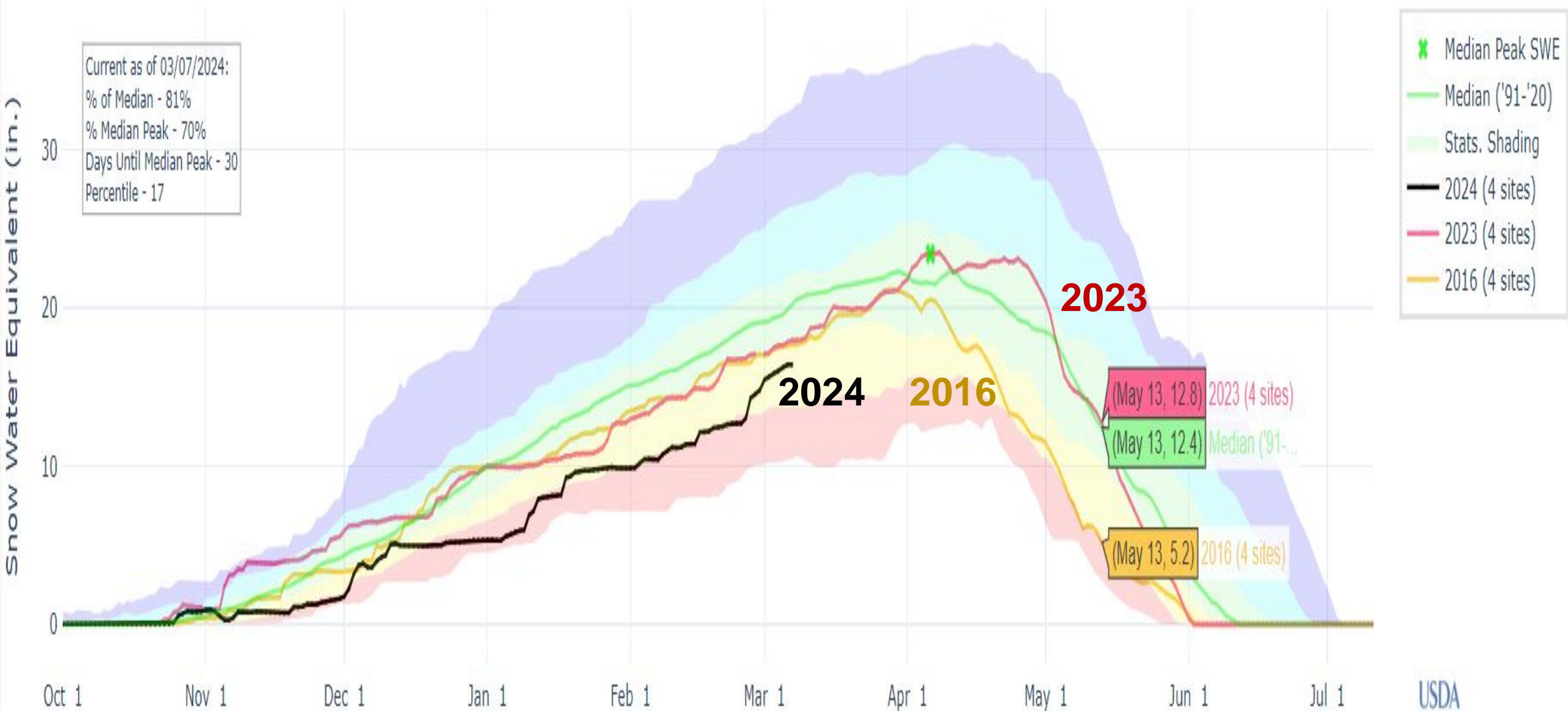


# SNOW WATER EQUIVALENT IN SELWAY

**2024 Selway 81% of Median**

**2023 - normal melt**

**2016 - El Nino year with early melt**





# SELWAY - NEAR LOWELL (SEL11)

## Forecasts for Water Year 2024

### Natural Forecast

ESP with 10 Days QPF Ensemble: 2024-03-07 Issued: 2024-03-07

Forecast Period	Forecasts Are in KAF				30 Year Average (1991-2020)
	90 %	50 %	% Average	10 %	
APR-SEP	1388	1700	81	2042	2099
APR-JUL	1312	1609	80	1937	2004

### 2024 Selway

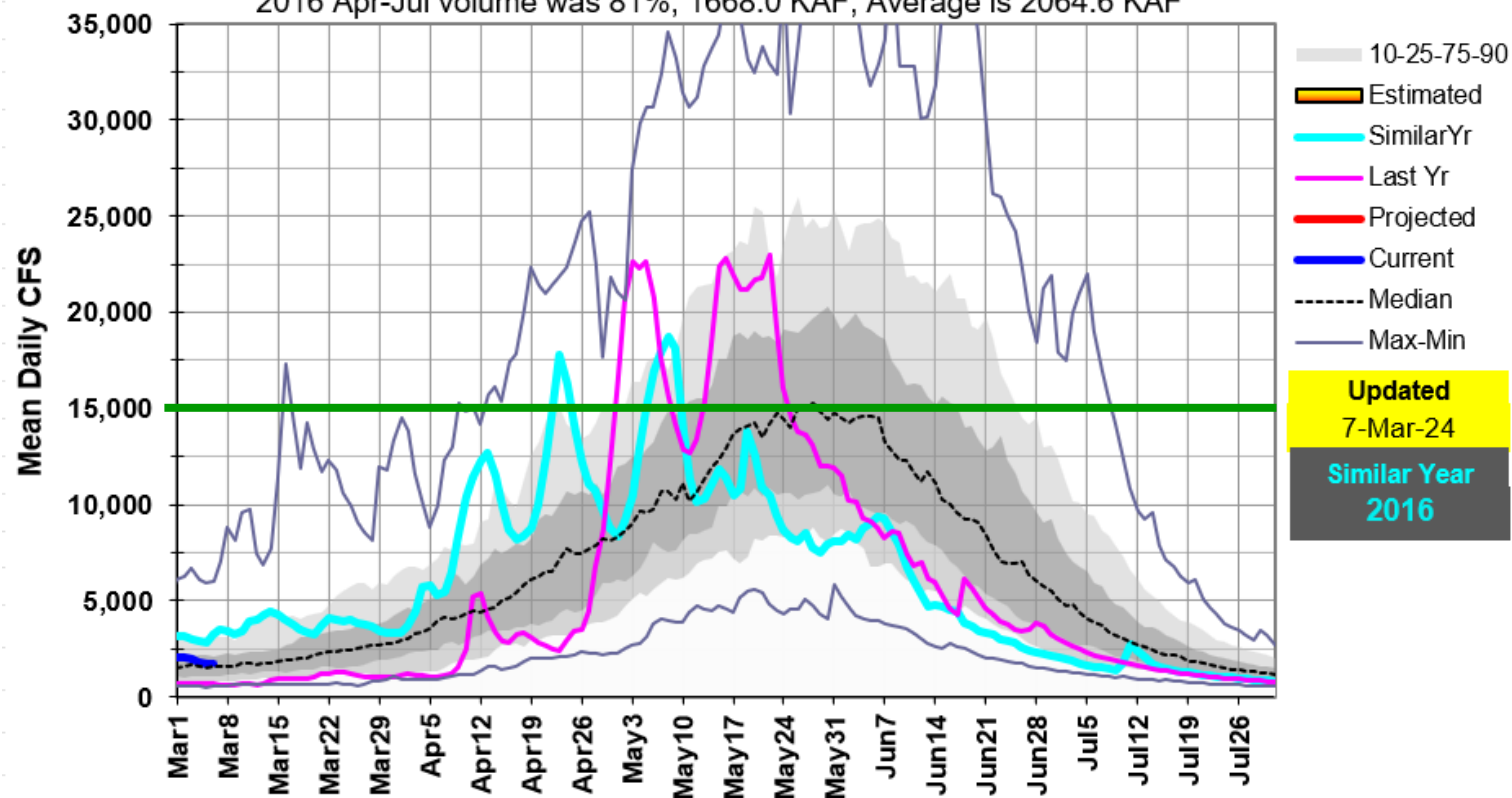
2016 Runoff was 1668 KAF Similar Year

2023 Runoff was 1747 KAF last Year

Selway Forecast Apr – Jul  
80% 1609 KAF

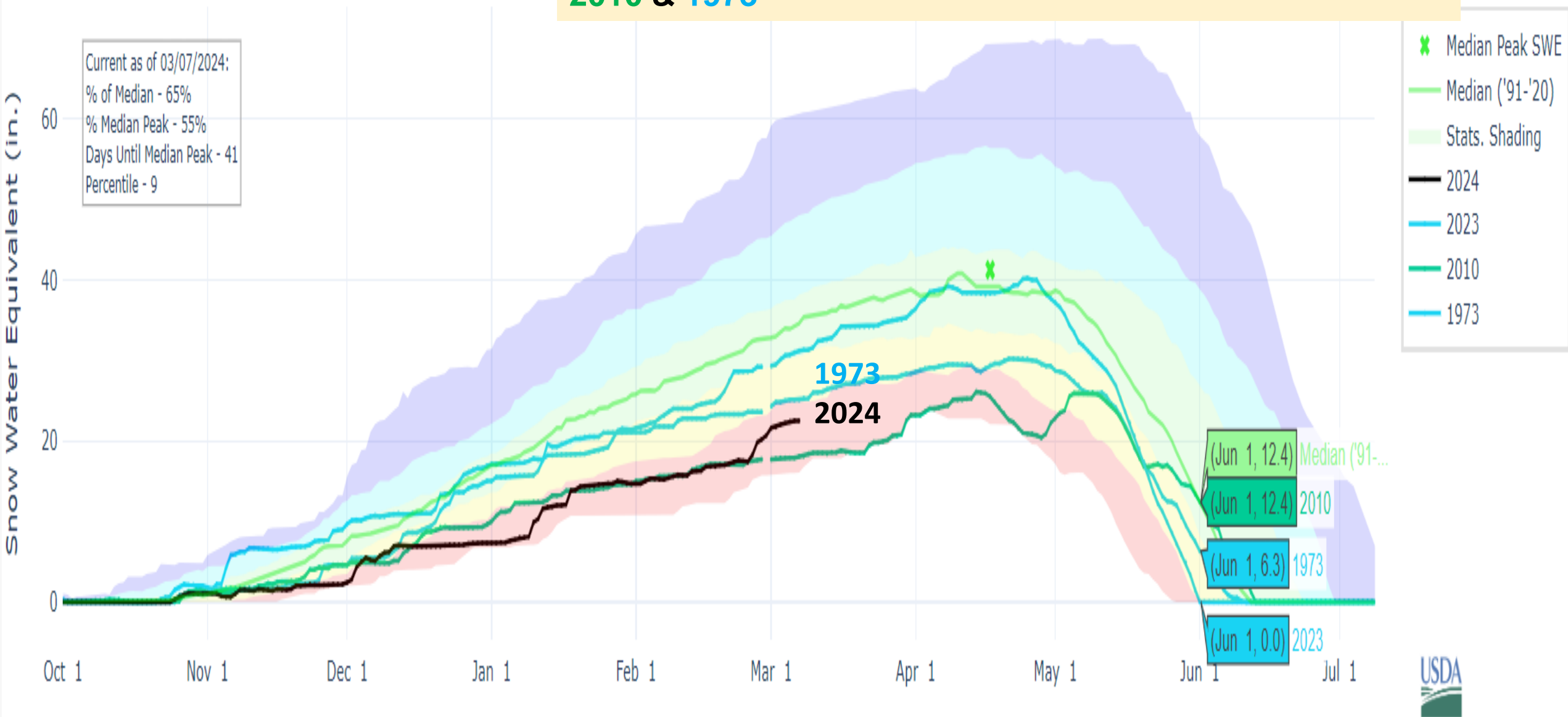
### 13336500: Selway R near Lowell, ID

2016 Apr-Jul volume was 81%, 1668.0 KAF, Average is 2064.6 KAF



# TWIN LAKES, MT (836) SNOW WATER EQUIVALENT

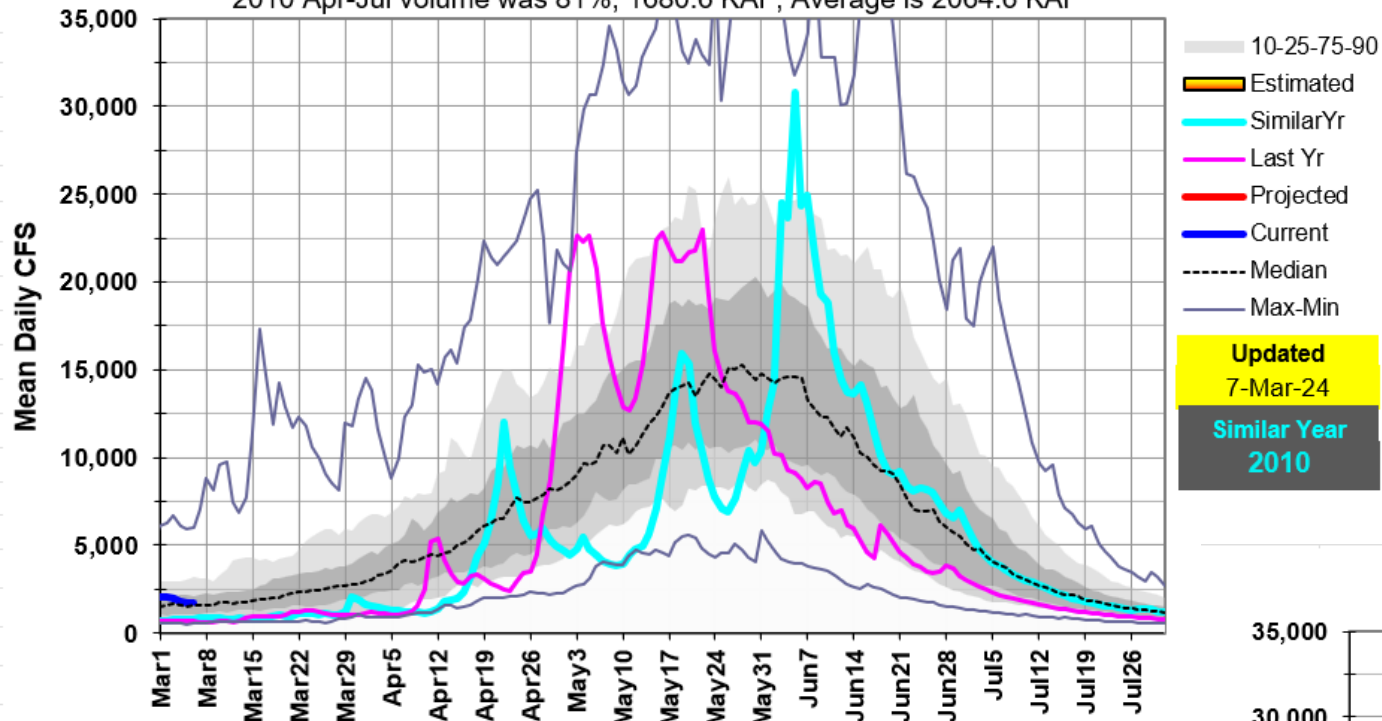
**2024 Twin Lakes 65% of Median**  
**2023 – with normal melt**  
**and Analog Years**  
**2010 & 1973**





### 13336500: Selway R near Lowell, ID

2010 Apr-Jul volume was 81%, 1680.6 KAF, Average is 2064.6 KAF



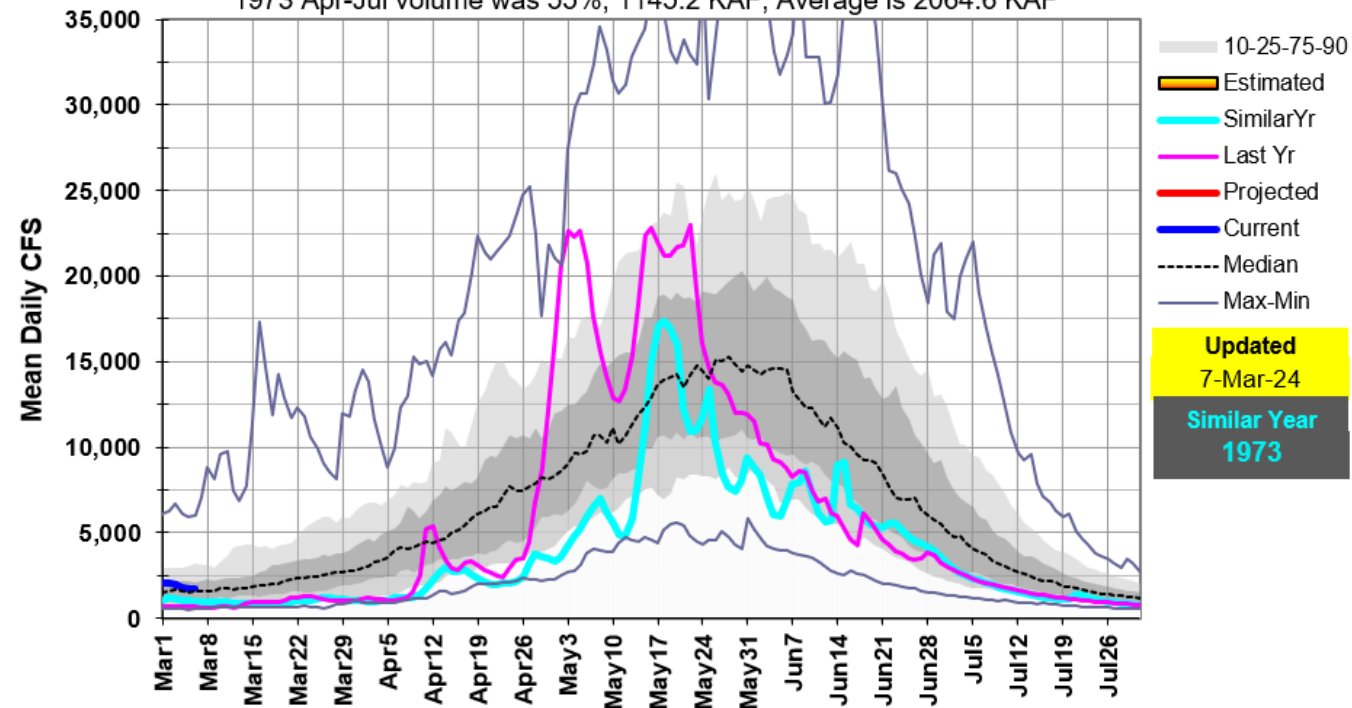
**2024 Selway Forecast Apr – Jul**  
**80% 1609 KAF**

**2010 Runoff 1680 KAF**  
**Late Melt**

**1973 Runoff 1145 KAF**  
**Low Runoff**

### 13336500: Selway R near Lowell, ID

1973 Apr-Jul volume was 55%, 1145.2 KAF, Average is 2064.6 KAF





**Fish Creek  
below Lochsa  
put in June  
14, 2022**



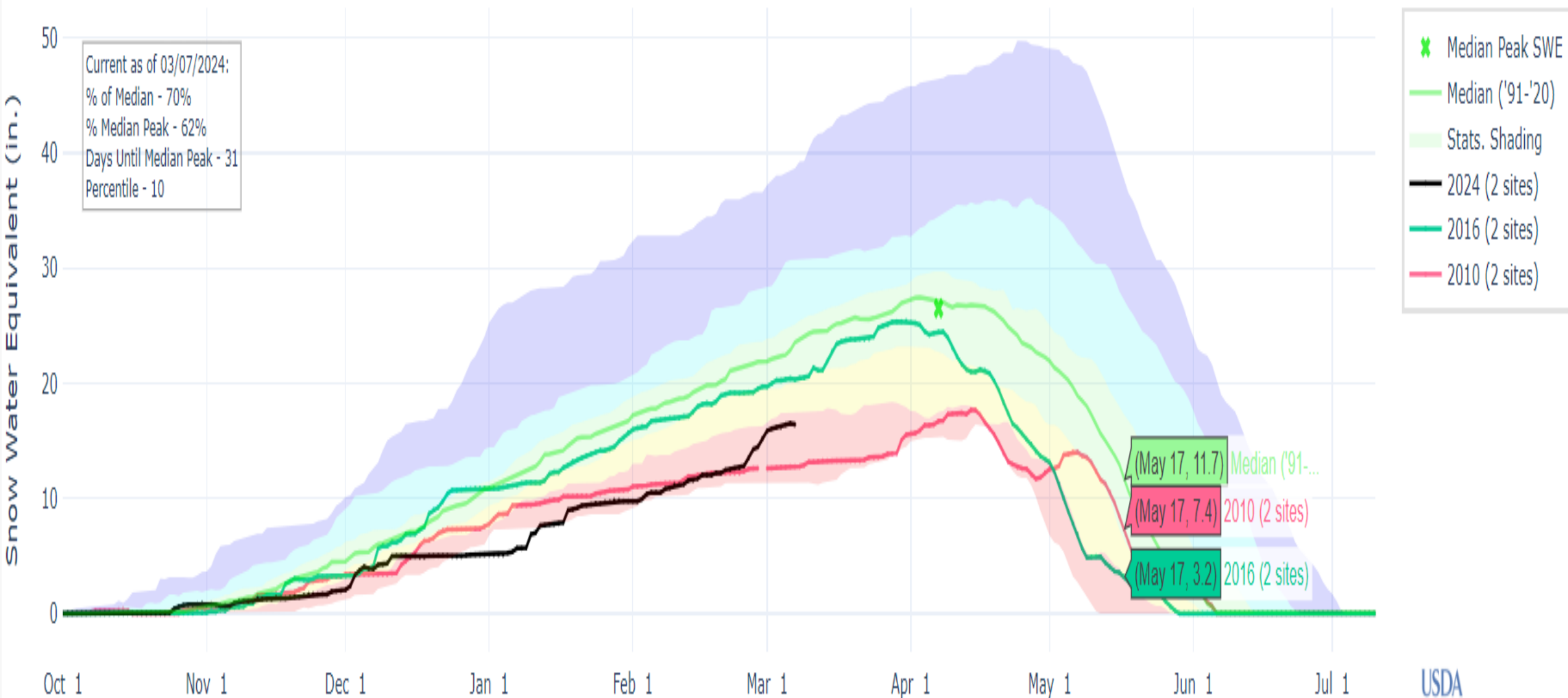


# SNOW WATER EQUIVALENT IN LOCHSA

**2024 Lochsa 70% of Median**

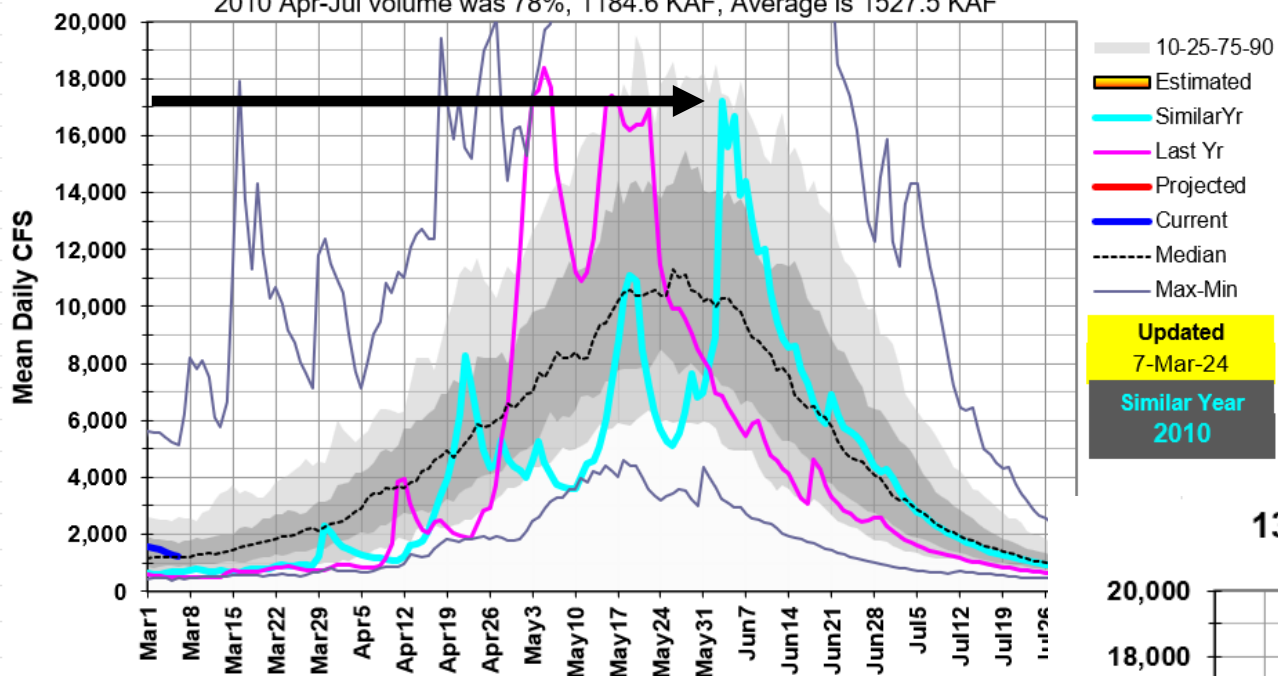
**2010 – with a funny melt from wet spring**

**2016 - El Nino year with early melt**



# 13337000: Lochsa R near Lowell, ID

2010 Apr-Jul volume was 78%, 1184.6 KAF, Average is 1527.5 KAF



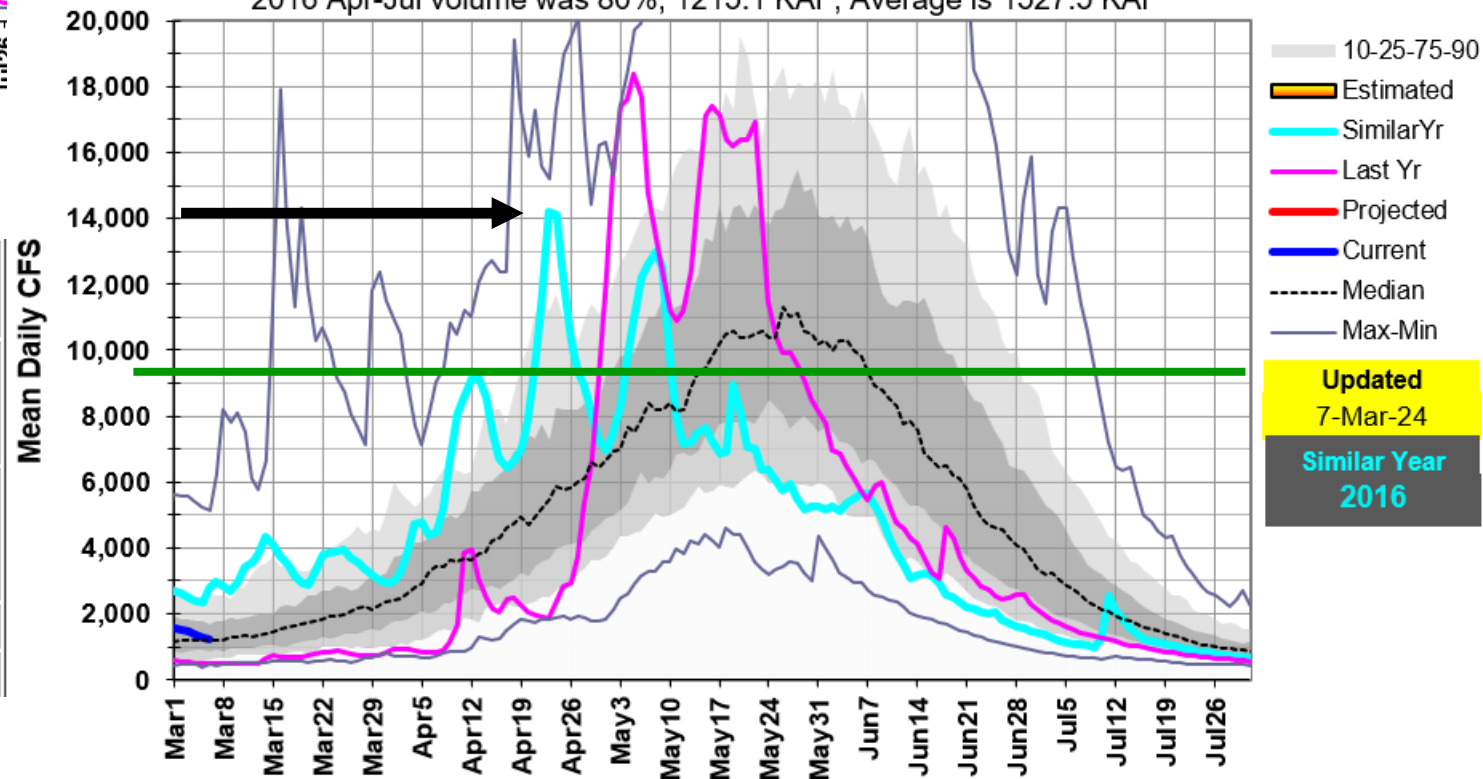
**2024 Lochsa Forecast Apr – Jul**  
**72% 1046 KAF**

**2010 Runoff 1184 KAF**  
**Late Melt**

**2016 Runoff 1215 KAF**

## 13337000: Lochsa R near Lowell, ID

2016 Apr-Jul volume was 80%, 1215.1 KAF, Average is 1527.5 KAF



## LOCHSA - NEAR LOWELL (LOC11) Forecasts for Water Year 2024

### Natural Forecast

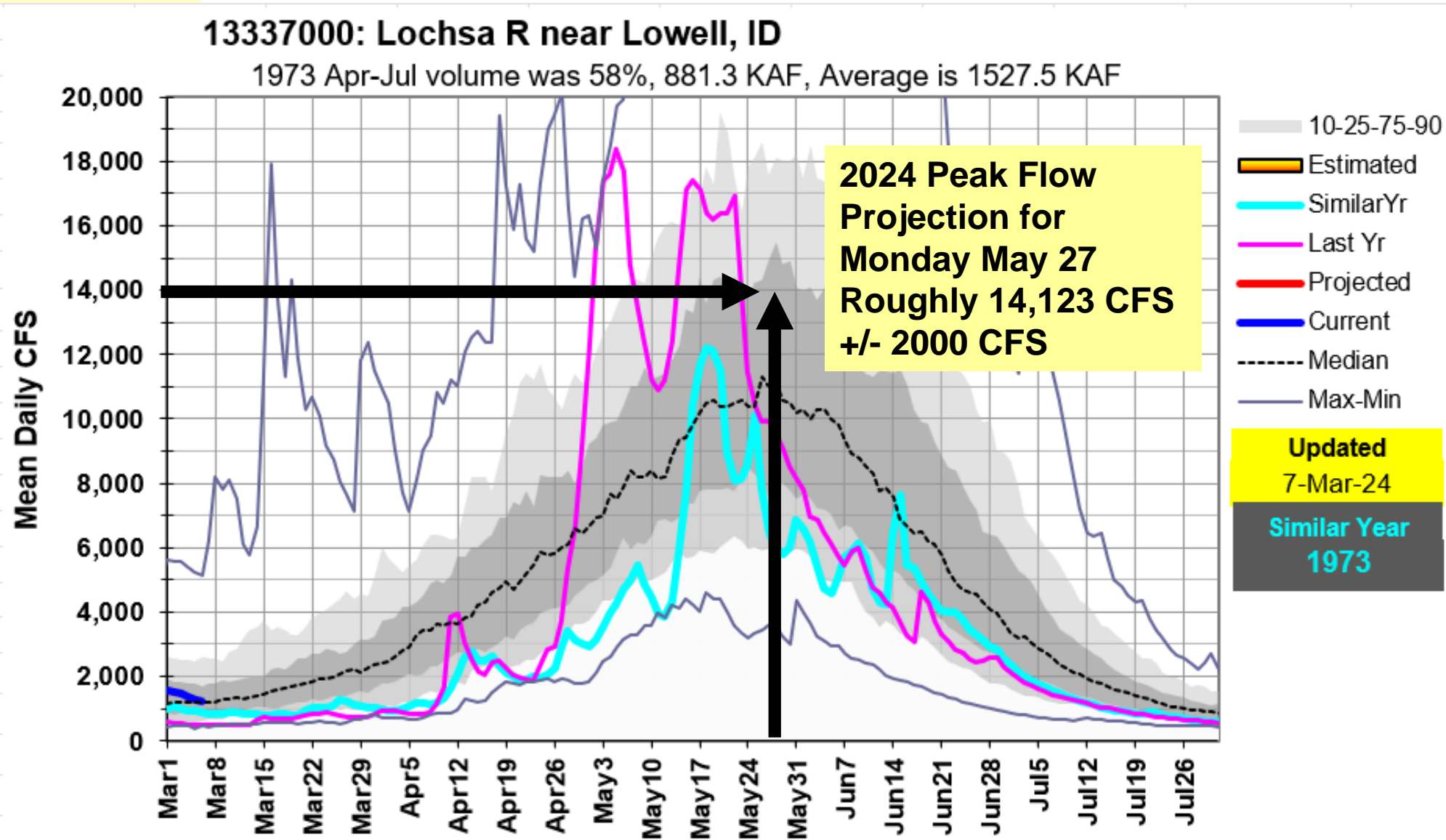
ESP with 10 Days QPF Ensemble: 2024-03-07 Issued: 2024-03-07

Forecast Period	Forecasts Are in KAF				30 Year Average (1991-2020)
	90 %	50 %	% Average	10 %	
APR-SEP	900	1101	72	1297	1525
APR-JUL	847	1046	72	1239	1458



2024 Lochsa Forecast Apr – Jul  
72% 1046 KAF

Analog Year  
1973 Runoff 881 KAF  
Low Runoff







**The  
Salmon**

**Middle**

**Main**

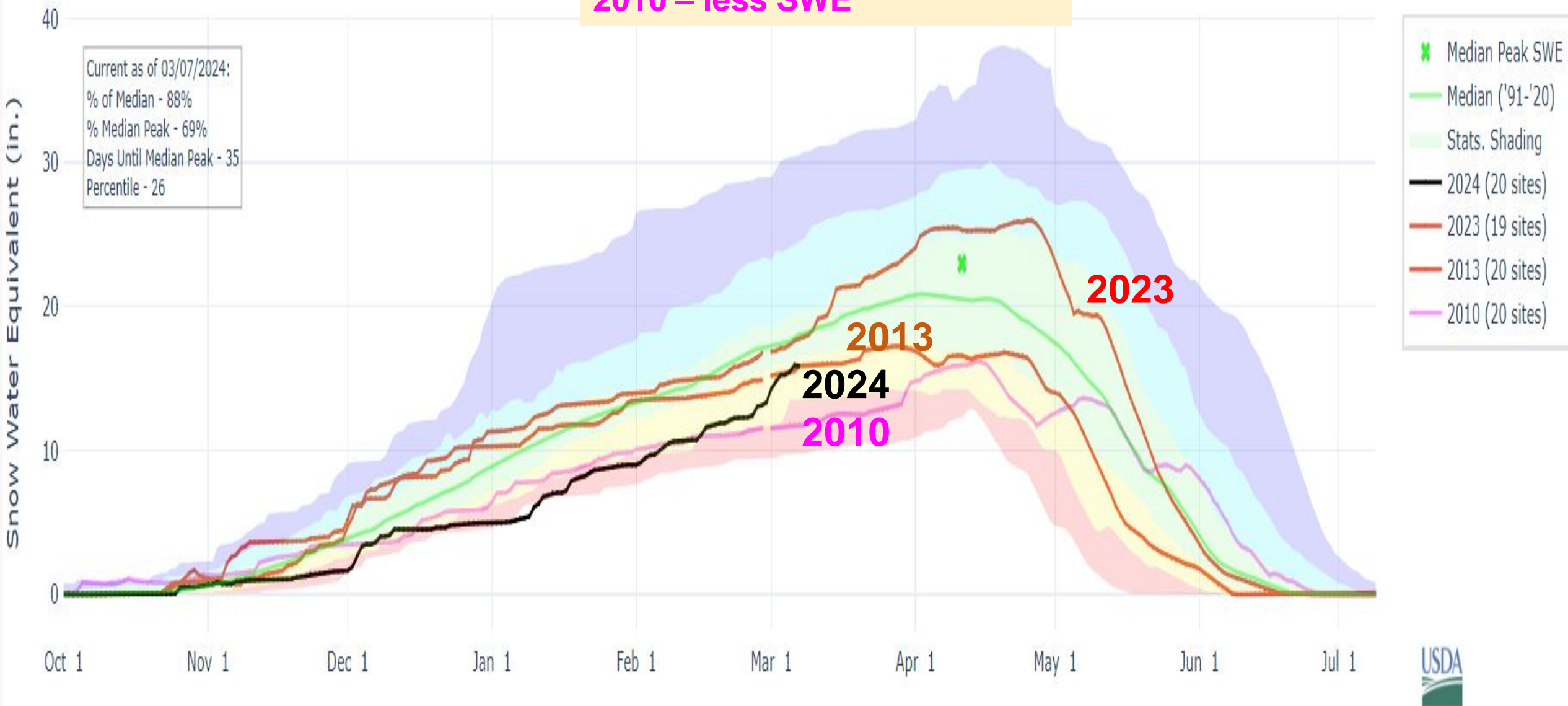
**Lower**





# SNOW WATER EQUIVALENT IN SALMON

**2024 Salmon 88% of Median**  
**2023 – wet spring**  
**2013 – similar SWE**  
**2010 – less SWE**



# SALMON - AT WHITEBIRD (WHBI1) Forecasts for Water Year 2024

## Natural Forecast

ESP with 10 Days QPF Ensemble: 2024-03-07 Issued: 2024-03-07

Forecast Period	Forecasts Are in KAF				30 Year Average (1991-2020)
	90 %	50 %	% Average	10 %	
APR-SEP	4276	5135	82	6421	6264
APR-JUL	3734	4554	80	5736	5668

## 2024 Salmon

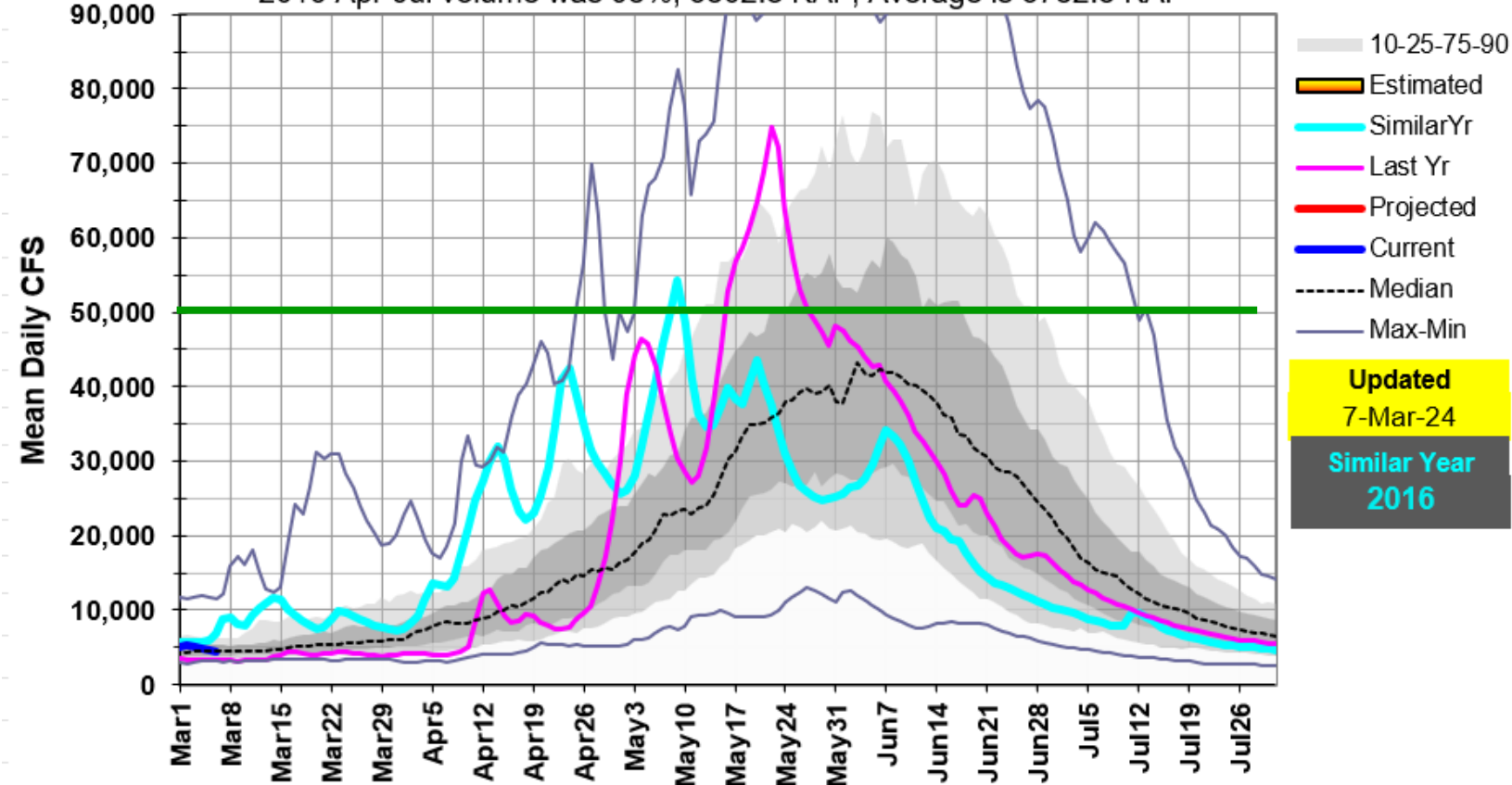
2016 Runoff was 5302 KAF Similar Year

2023 Runoff was 5735 KAF last Year

Whitebird Forecast Apr – Jul  
80% 4554 KAF

## 13317000: Salmon R at White Bird, ID

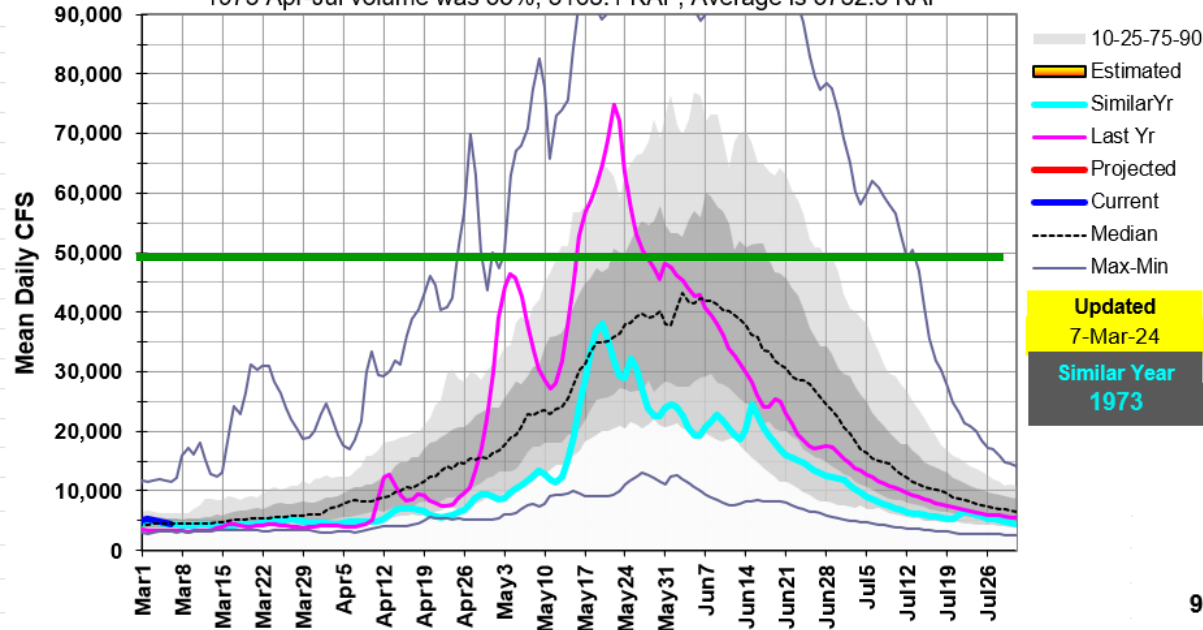
2016 Apr-Jul volume was 93%, 5302.8 KAF, Average is 5732.3 KAF





### 13317000: Salmon R at White Bird, ID

1973 Apr-Jul volume was 55%, 3163.1 KAF, Average is 5732.3 KAF



**2024 Whitebird Forecast Apr – Jul**  
**80% 4554 KAF**

**1973 Runoff 3163 KAF**

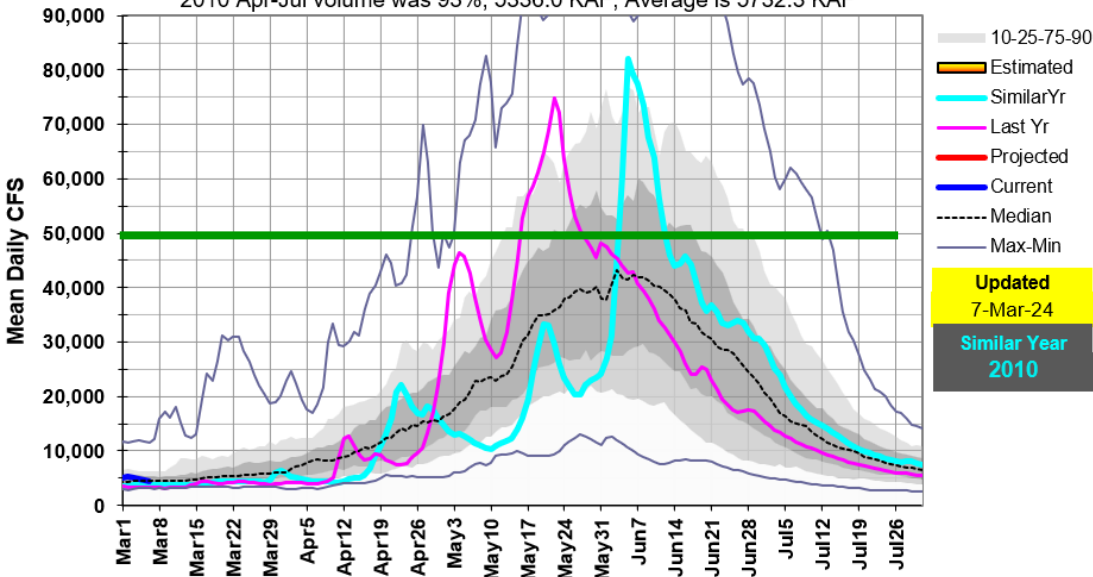
**2010 Runoff 5336 KAF late melt**

**2013 Runoff 4401 KAF**

**If hits 50,000  
CFS, won't be  
for many  
days**

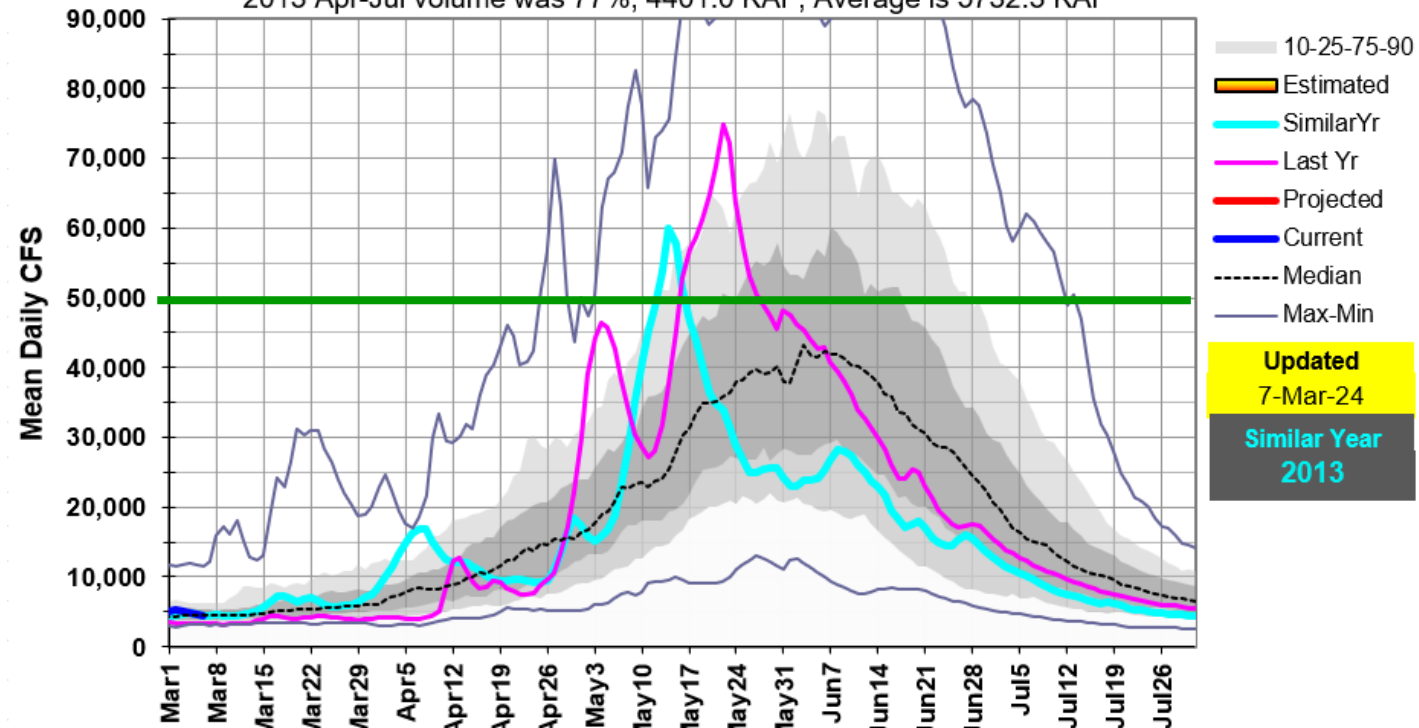
### 13317000: Salmon R at White Bird, ID

2010 Apr-Jul volume was 93%, 5336.0 KAF, Average is 5732.3 KAF



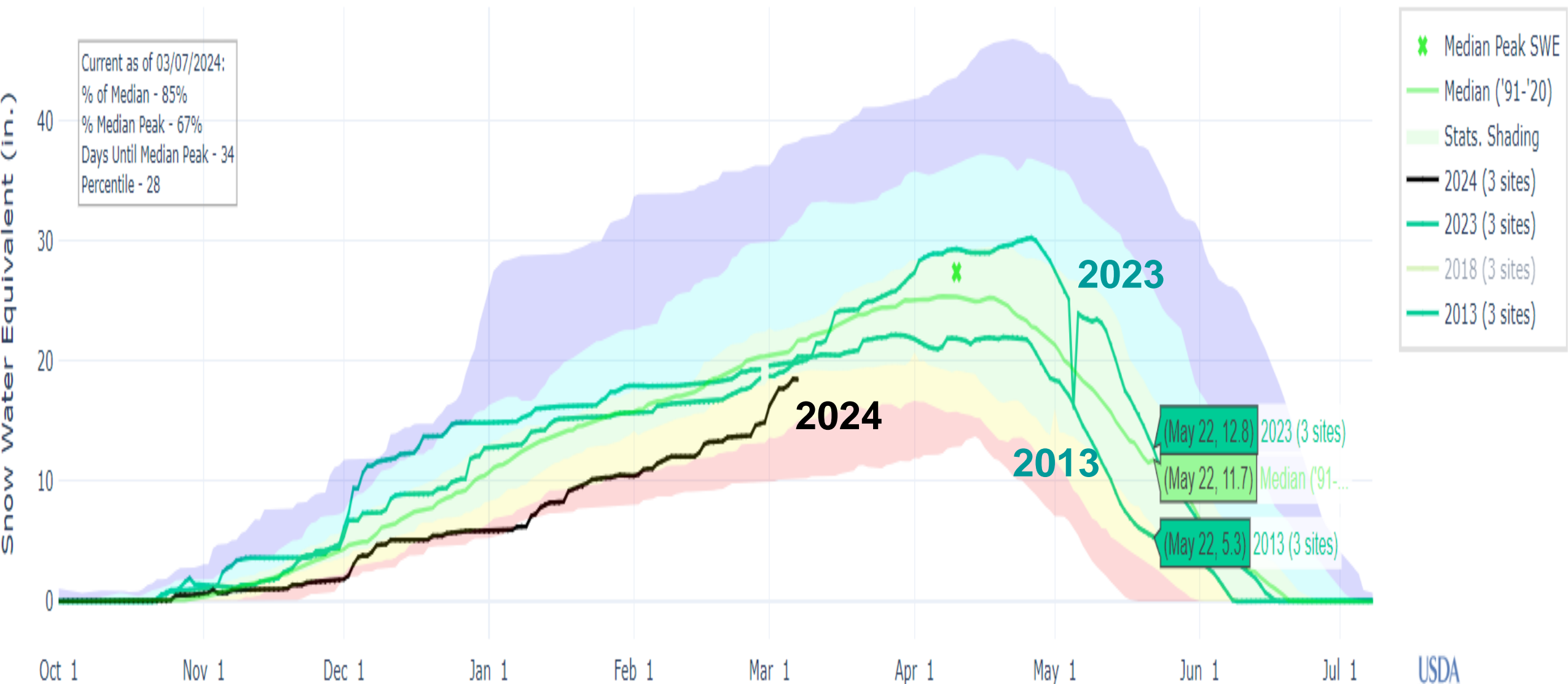
### 13317000: Salmon R at White Bird, ID

2013 Apr-Jul volume was 77%, 4401.0 KAF, Average is 5732.3 KAF



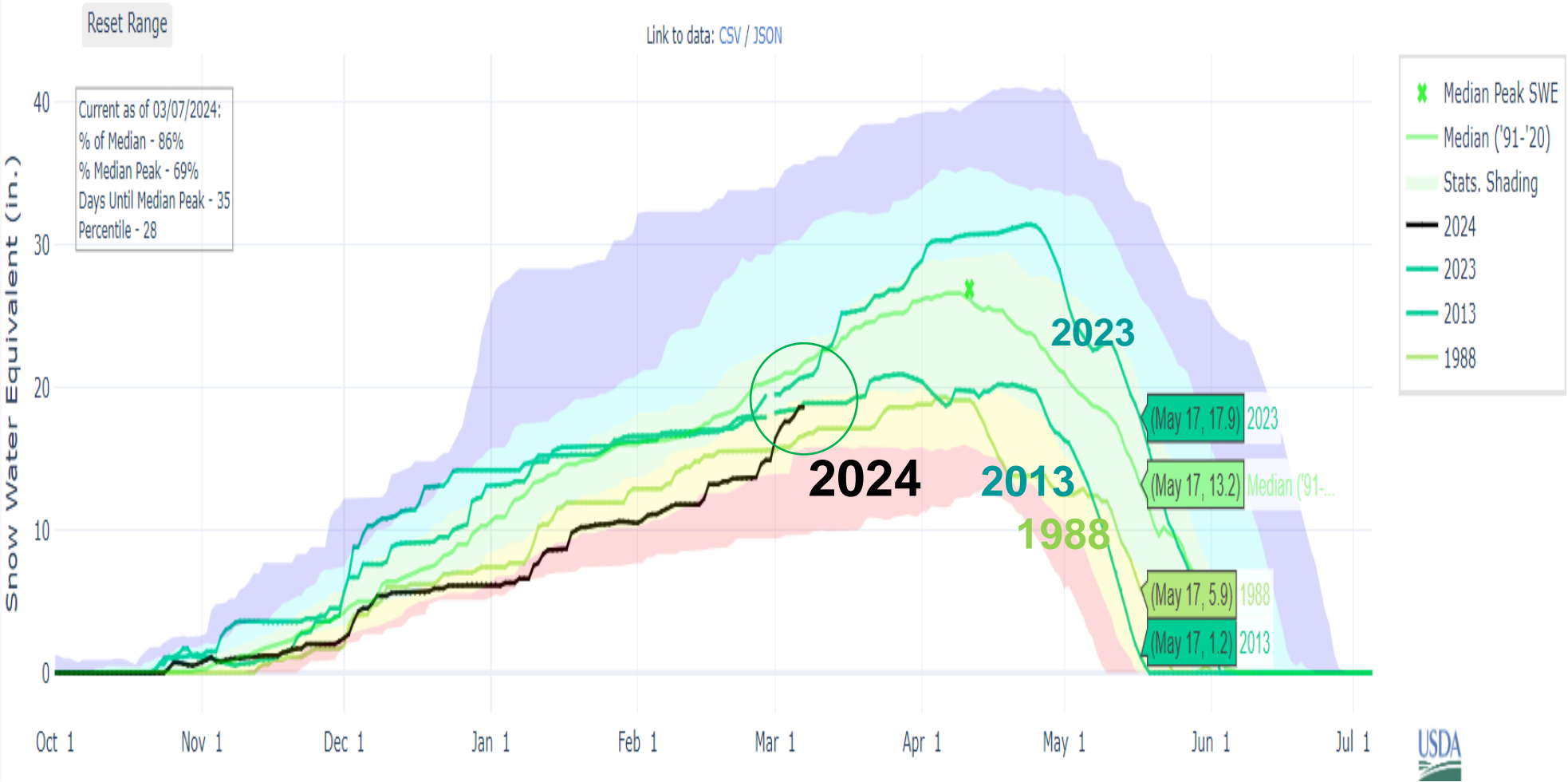
# SNOW WATER EQUIVALENT IN MIDDLE FORK SALMON

**2024 MF Salmon 85% of Median**  
**2023 – wet spring**  
**2013 – similar SWE**





BANNER SUMMIT, ID (312) SNOW WATER EQUIVALENT



**Today Banner Summit is 86% of Median same as 2013**

On average, MF peaks when Banner is about 60% melted.

# MF SALMON - MIDDLE FORK LODGE (MIDI1) Forecasts for Water Year 2024

## Natural Forecast

ESP with 10 Days QPF Ensemble: 2024-03-07 Issued: 2024-03-07

Forecast Period	Forecasts Are in KAF				30 Year Average (1991-2020)
	90 %	50 %	% Average	10 %	
APR-SEP	566	694	77	967	905
APR-JUL	494	614	75	864	819

## 2024 MF Salmon

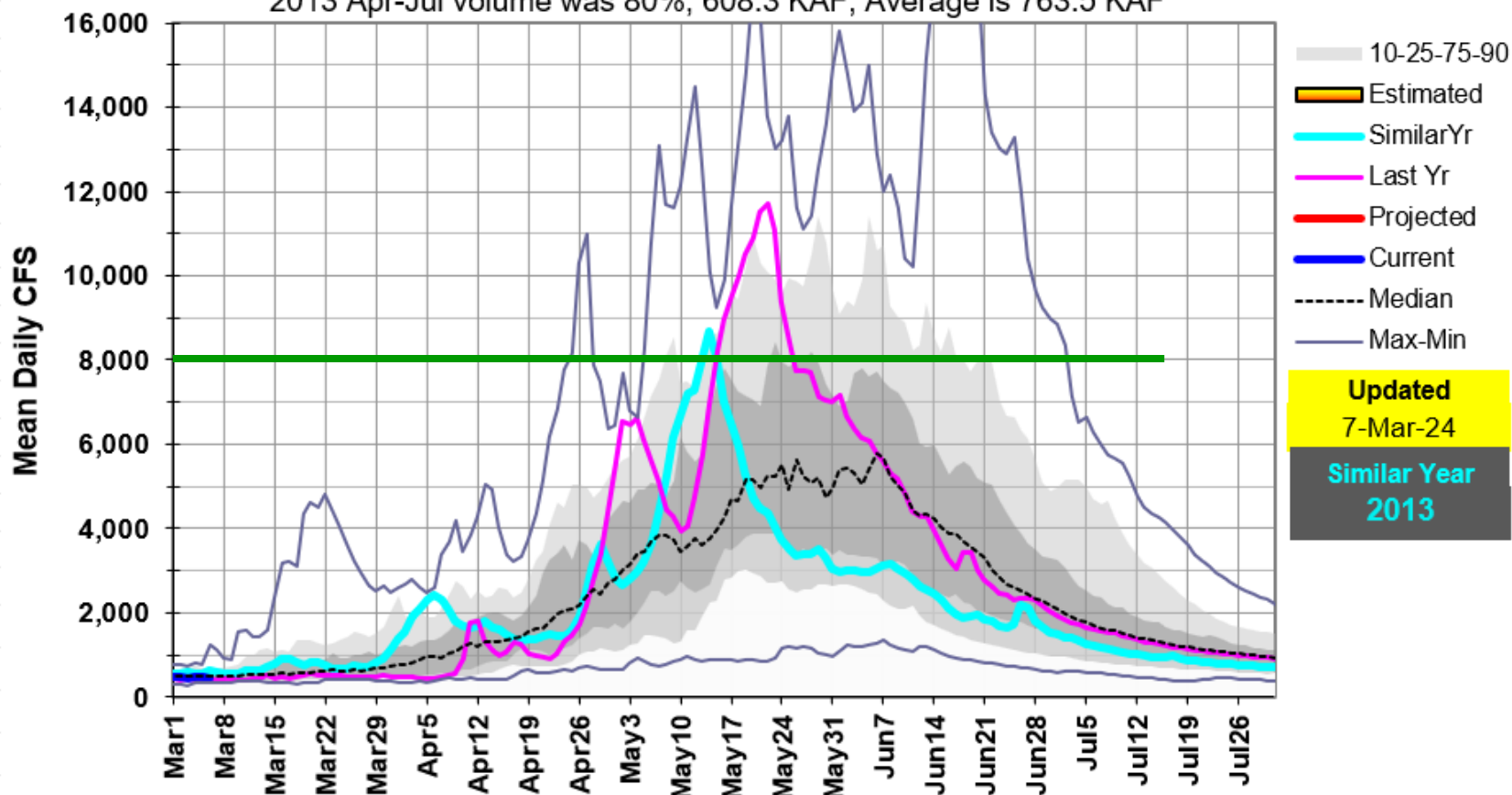
2013 Runoff was 608 KAF Similar Year

2023 Runoff was 847 KAF Last Yr

MF Salmon Forecast Apr – Jul  
75% 615 KAF

## 13309220: MF Salmon R at MF Lodge near Yellow Pine, ID

2013 Apr-Jul volume was 80%, 608.3 KAF, Average is 763.5 KAF



Updated  
7-Mar-24

Similar Year  
2013





**MF Salmon River blowout  
August 17, 2022  
Velvet Falls and near  
Ramshorn Creek**







**MF  
Salmon  
Blowout  
August  
2023**

**Pic from  
Aug 16  
Velvet  
Falls**





# **Marsh Creek Avalanche Path**

**August  
2023**





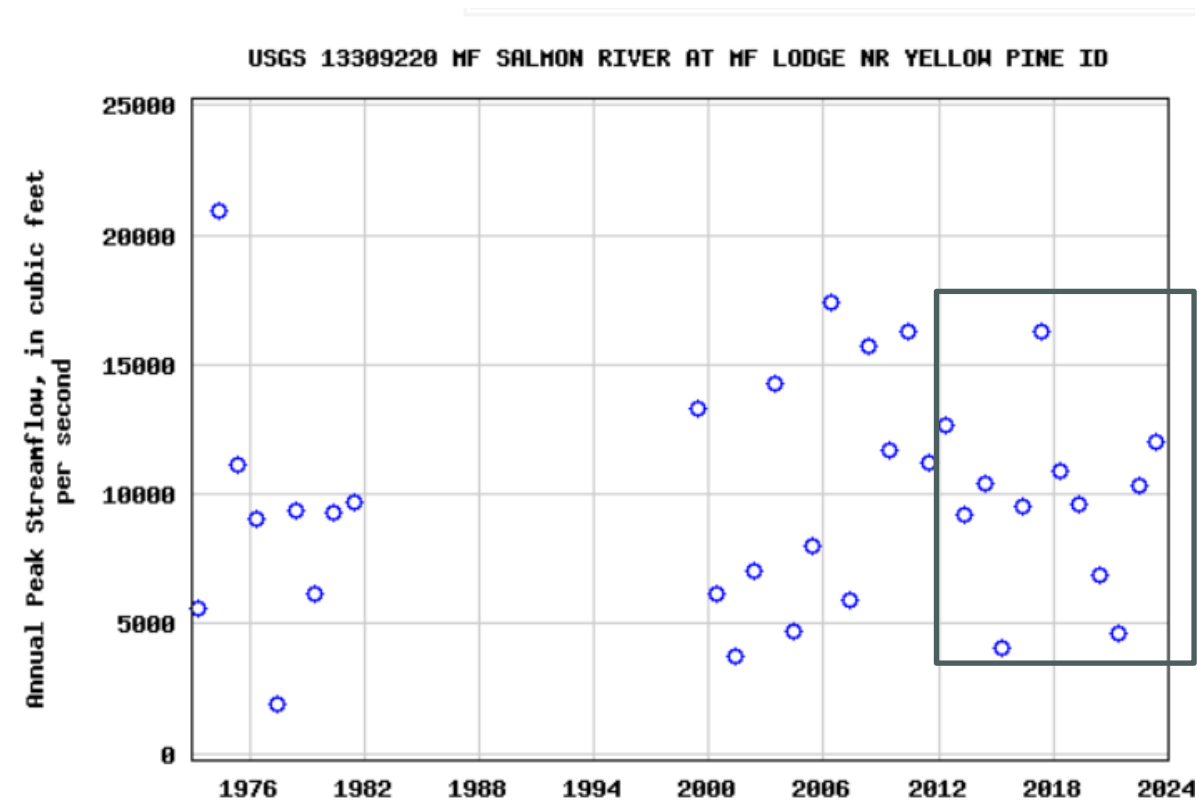
# Peak Streamflow for Idaho

Click to hide state-specific text

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## USGS 13317000 SALMON RIVER AT WHITE BIRD ID

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1983	1983-05-31	31.04	91,100
1984	1984-05-31	30.93	90,200
1985	1985-05-25	24.75	48,000
1986	1986-06-01	32.56	97,200
1987	1987-05-01	21.50	30,900
1988	1988-05-26	22.43	35,600
1989	1989-05-11	24.34	45,800
1990	1990-05-30	22.36	34,700
1991	1991-06-13	23.52	41,300
1992	1992-05-09	20.69	27,300
1993	1993-05-21	27.46	65,100
1994	1994-05-13	21.68	31,900
1995	1995-06-05	28.27	70,500
1996	1996-06-10	31.69	96,300
1997	1997-05-18	32.26	101,000

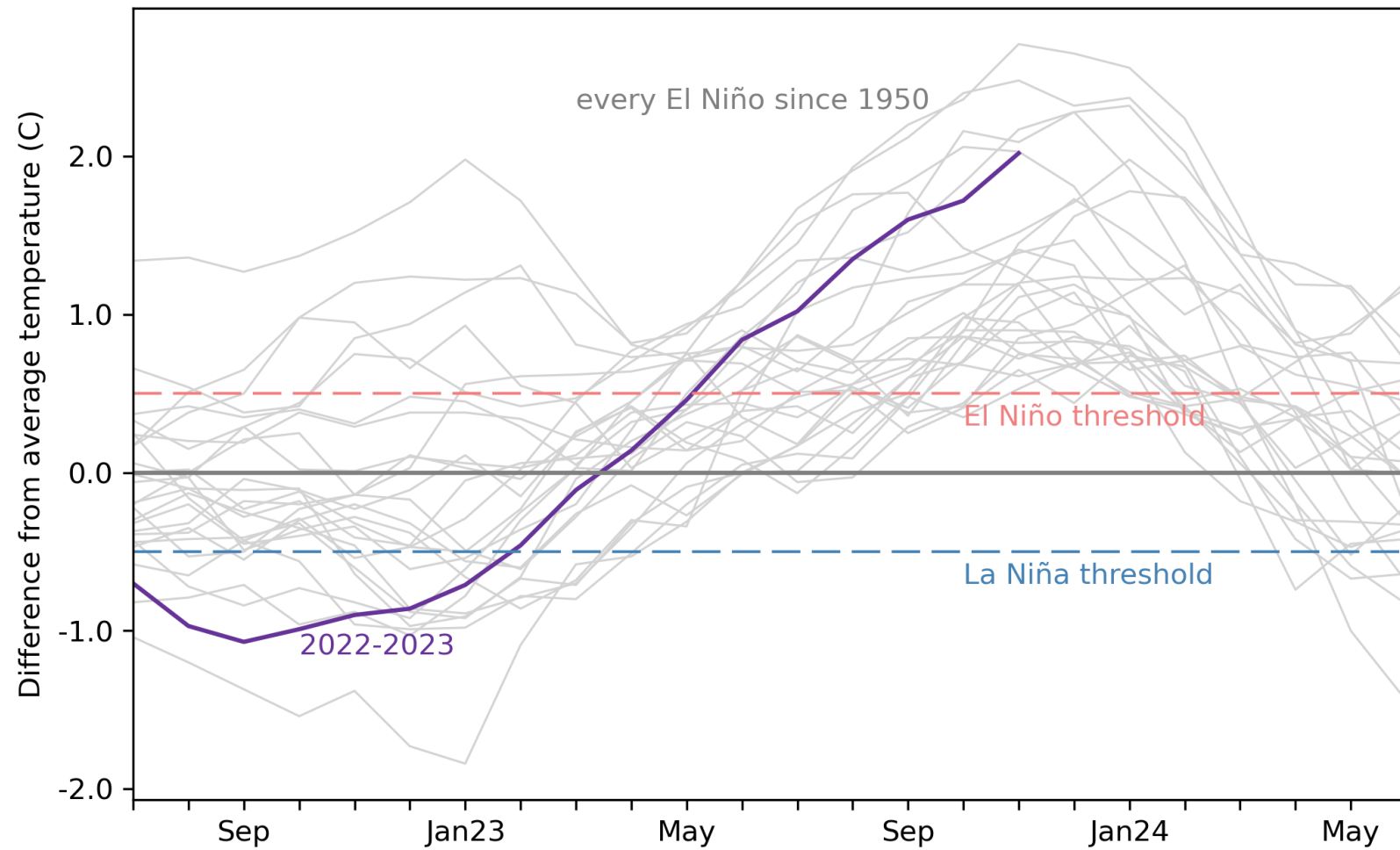




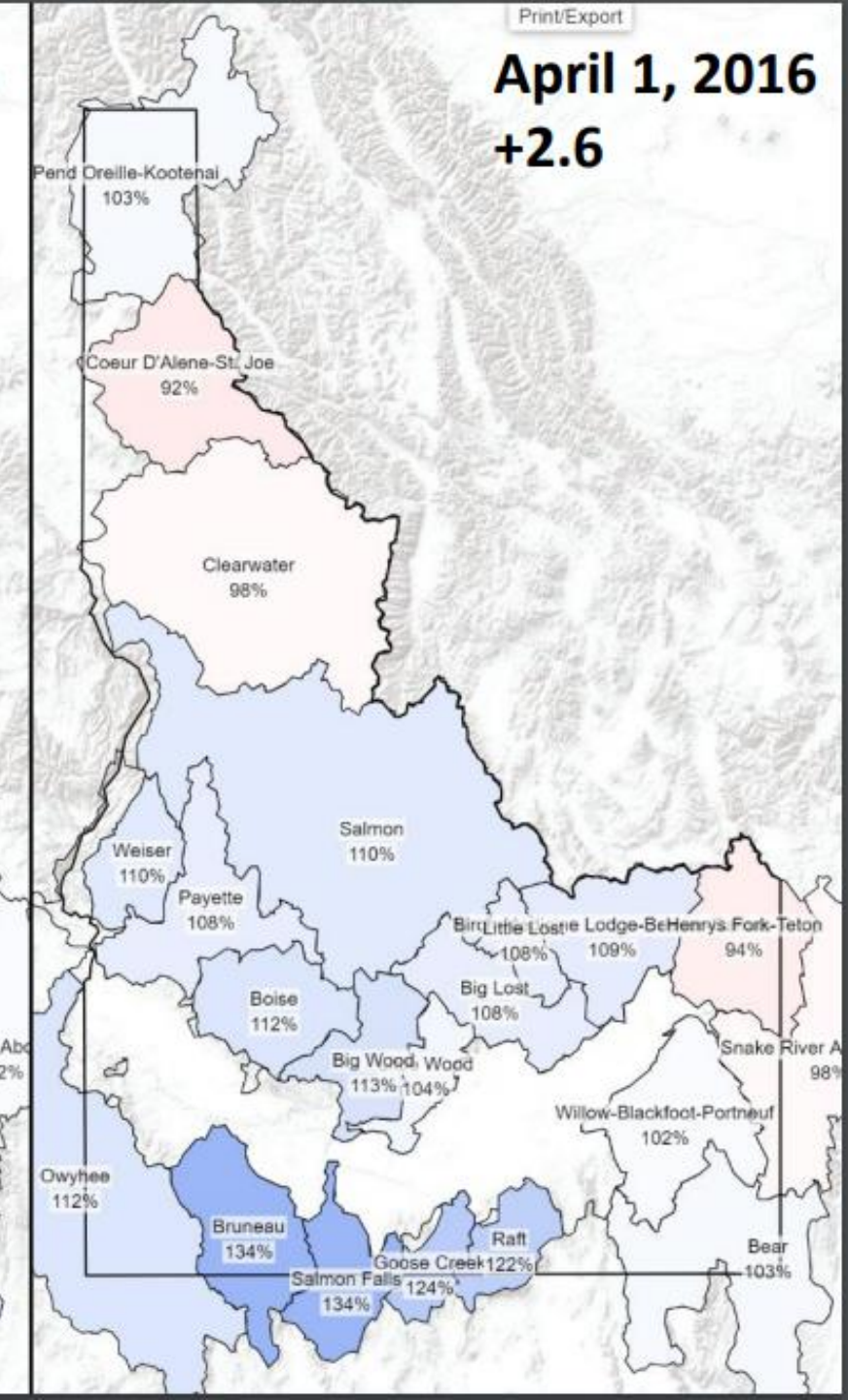
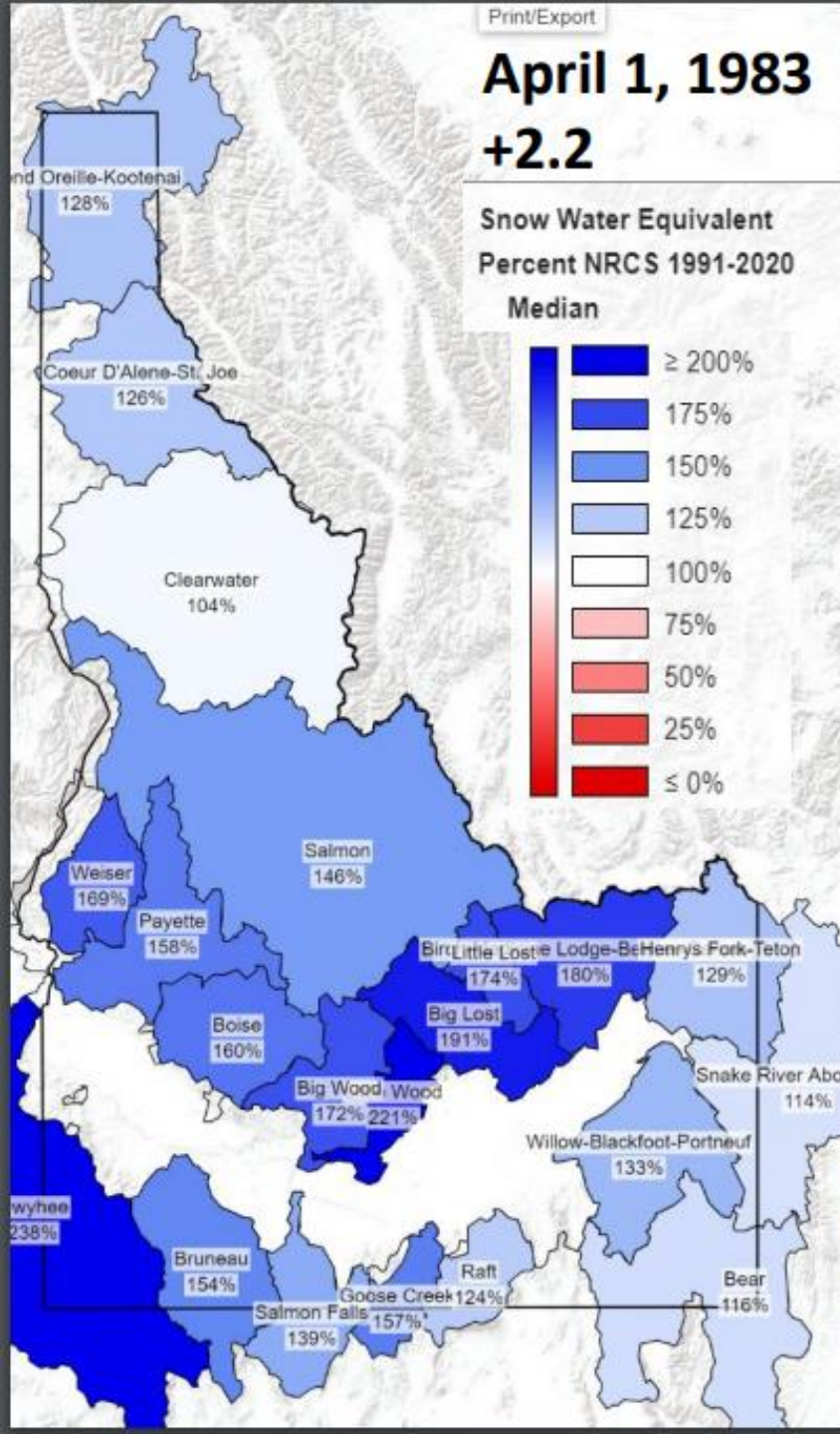
# Looking for that Strong El Nino...



Monthly sea surface temperature Niño3.4 Index values









**Analysis of  
Streamflow  
in Strong  
El Nino  
Years (SE)  
like 2016**

Year	ENSO	PDO	Streamflow as % of 1981-2010 Average				
			Feb-Sep	Apr-Sep	Apr-Sep	Apr-Sep	Apr-Sep
			Owyhee River blw Dam	Salmon Falls Creek	Big Wood River blw Magic Dam	SNAKE River nr Heise	Spokane River nr Post Falls
1994	SE Strong El Nino	pos or neg	23	36	12	61	51
1988	SE	pos	30	65	24	70	71
1941	SE	pos	83	53	69	73	45
1966	SE	neg	28	39	51	78	90
1973	SE	pos / neg	61	114	51	79	45
1942	SE	pos	122	173	117	86	77
1947	SE	pos / neg	44	50	59	108	90
1952	SE	neg	246	178	263	116	123
1995	SE	pos	124	135	195	118	70
1998	SE	pos	135	138	161	119	82
1983	SE	pos	221	157	282	132	91
1978	SE	pos	110	112	140	133	99
2016	SE	pos	82	122	70	80	66
sorted							
				<60			
				60-90			
				90-110			
				~111-130			
				>130			

Analysis of Streamflow for a year like 2017 that follows a Strong El Nino Year like 2016

					sorted				
					Streamflow as % of 1981-2010 Average				
	ENSO		ENSO	Feb-Sep	Apr-Sep	Apr-Sep	Apr-Sep	Apr-Sep	Apr-Sep
Year	SE Strong El Nino	Year Following a Strong El Nino		Owyhee River blw Dam	Salmon Falls Creek	Boise River nr Boise	Big Wood River blw Magic Dam	SNAKE River nr Heise	Spokane River nr Post Falls
1978	SE	1979	N	97	116	63	34	90	105
1941	SE	1942	SE	122	173	91	117	86	77
1988	SE	1989	SL	145	100	97	75	102	116
1966	SE	1967	N	69	88	105	151	109	113
1947	SE	1948	LN	58	86	105	66	97	176
1952	SE	1953	N	56	76	124	92	92	108
1998	SE	1999	SL	100	108	135	158	131	129
1994	SE	1995	SE	124	135	138	195	118	70
1995	SE	1996	N	124	115	152	132	148	116
1983	SE	1984	N	363	369	158	206	133	112
1973	SE	1974	SL	120	111	181	184	147	193
1942	SE	1943	N	137	150	209	259	144	150
2016	SE	2017	LN	155	161	180	266	163	112
12 years					Color coded streamflow as % of average				
					<60				
					60-90				
					90-110				
					~111-130				
					>130				

1998/1999 Mt Baker set word snowfall with 95 feet of snowfall



Remember winter of 2016 / 2017

45 Atmospheric Rivers made landfall on West Coast

The atmospheric river activity was unprecedented in the 70-year record



Take Home Point – Oceans & Atmosphere are very active following Strong El Nino Years and have a lot of energy to get rid of... and that's what happened

### Distribution of Landfalling Atmospheric Rivers on the U.S. West Coast (From 1 Oct 2016 to 31 March 2017)

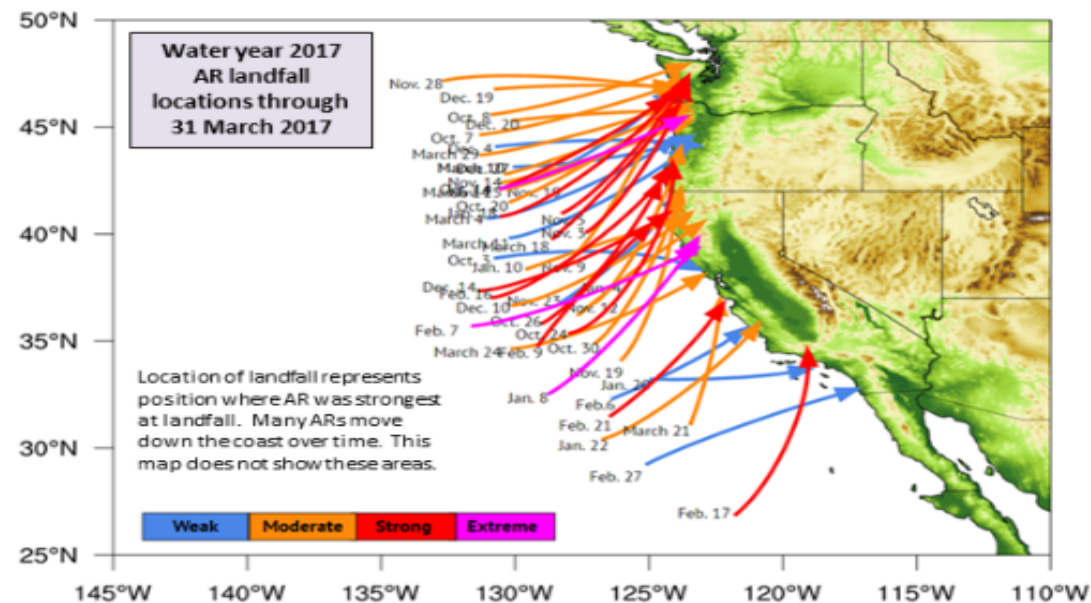
AR Strength	AR Count*
Weak	11
Moderate	20
Strong	12
Extreme	3

#### Ralph/CW3E AR Strength Scale

Weak	IVT=250–500 $\text{kg m}^{-1} \text{s}^{-1}$
Moderate	IVT=500–750 $\text{kg m}^{-1} \text{s}^{-1}$
Strong	IVT=750–1000 $\text{kg m}^{-1} \text{s}^{-1}$
Extreme	IVT>1000 $\text{kg m}^{-1} \text{s}^{-1}$

\*Radiosondes at Bodega Bay, CA indicated the 10–11 Jan AR was strong (noted as moderate based on GFS analysis data) and 7–8 Feb AR was extreme (noted as strong)

- 45 Atmospheric Rivers have made landfall on the West Coast thus far during the 2017 water year (1 Oct. – 31 March 2017)
- This is much greater than normal
- 1/3 of the landfalling ARs have been “strong” or “extreme”



Center for Western Weather  
and Water Extremes

SCRIPPS INSTITUTION OF OCEANOGRAPHY  
AT UC SAN DIEGO

By F.M. Ralph, B. Kawzenuk, C. Hecht, J. Kalansky

Experimental





Enjoy &  
have fun

Floating  
or hiking  
Idaho's  
Rivers!

<https://airflare.com/>



AIR  FLARE

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HAVE A RESCUE LOCATOR.

