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Water Quality Conditions During Klamath Dam Removal Drawdown

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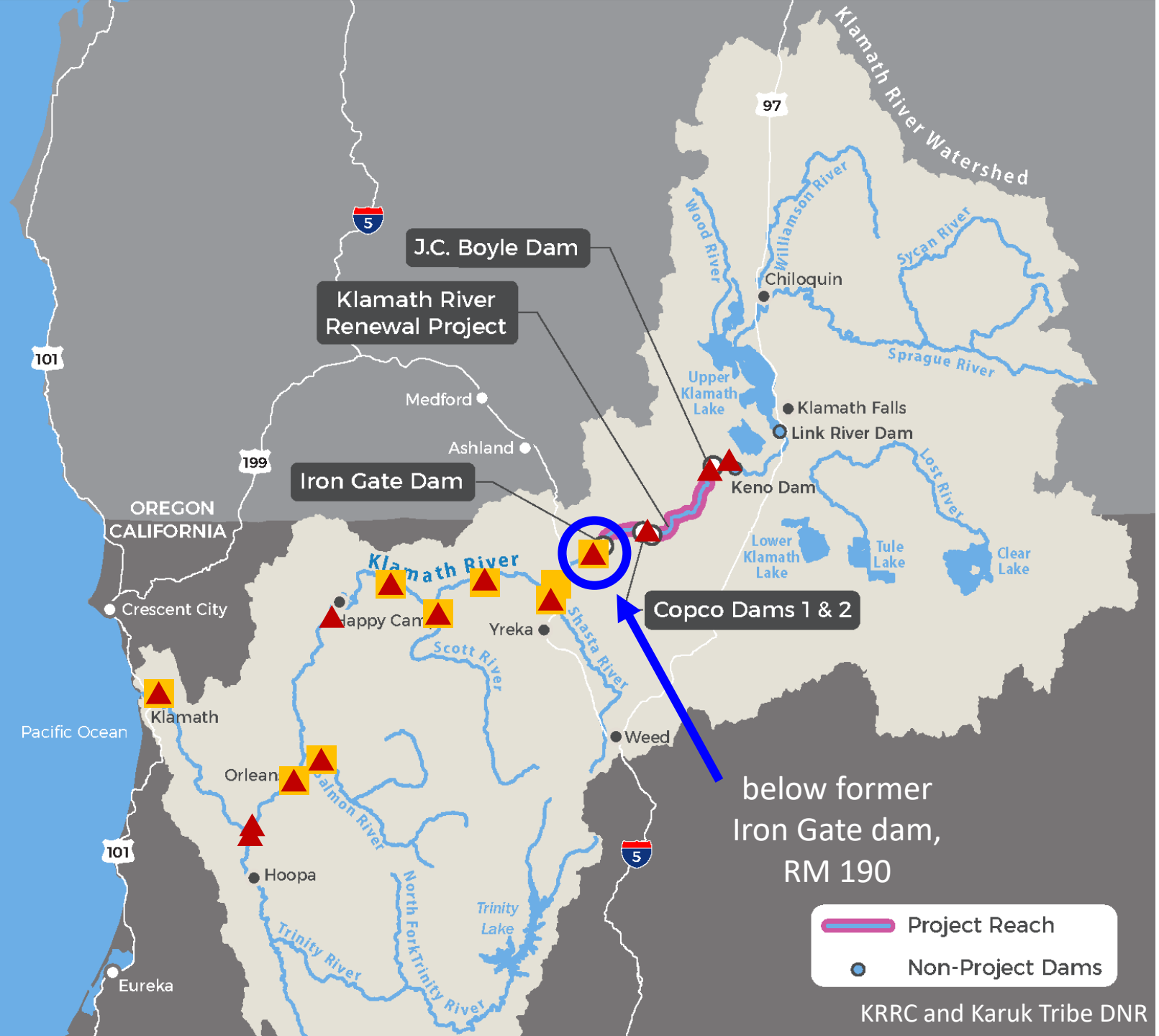
Klamath Dam Removal

- 4 dams
- 425 ft. combined height
- 420 miles of spawning habitat upriver
- 4.2 million tons sediment (dry weight) in reservoirs

Drained Copco reservoir

Iron Gate dam (left) and partially drained reservoir during 2024 drawdown



Water Quality Monitoring by Karuk Tribe, Yurok Tribe, USGS, and RES

- ■ 9 continuous monitoring stations (temperature, conductivity, dissolved oxygen, pH, turbidity)
- ▲ 14 grab sampling locations (nutrients, sediment, microcystin, heavy metals)
- Other monitoring data not presented here includes continuous monitoring in the reservoir reach (USGS)

KTDNR
WQ Staff

Temporary Impairments

("Short-term pains")

- Turbidity/suspended sediment, dissolved oxygen sags, minimal contaminants

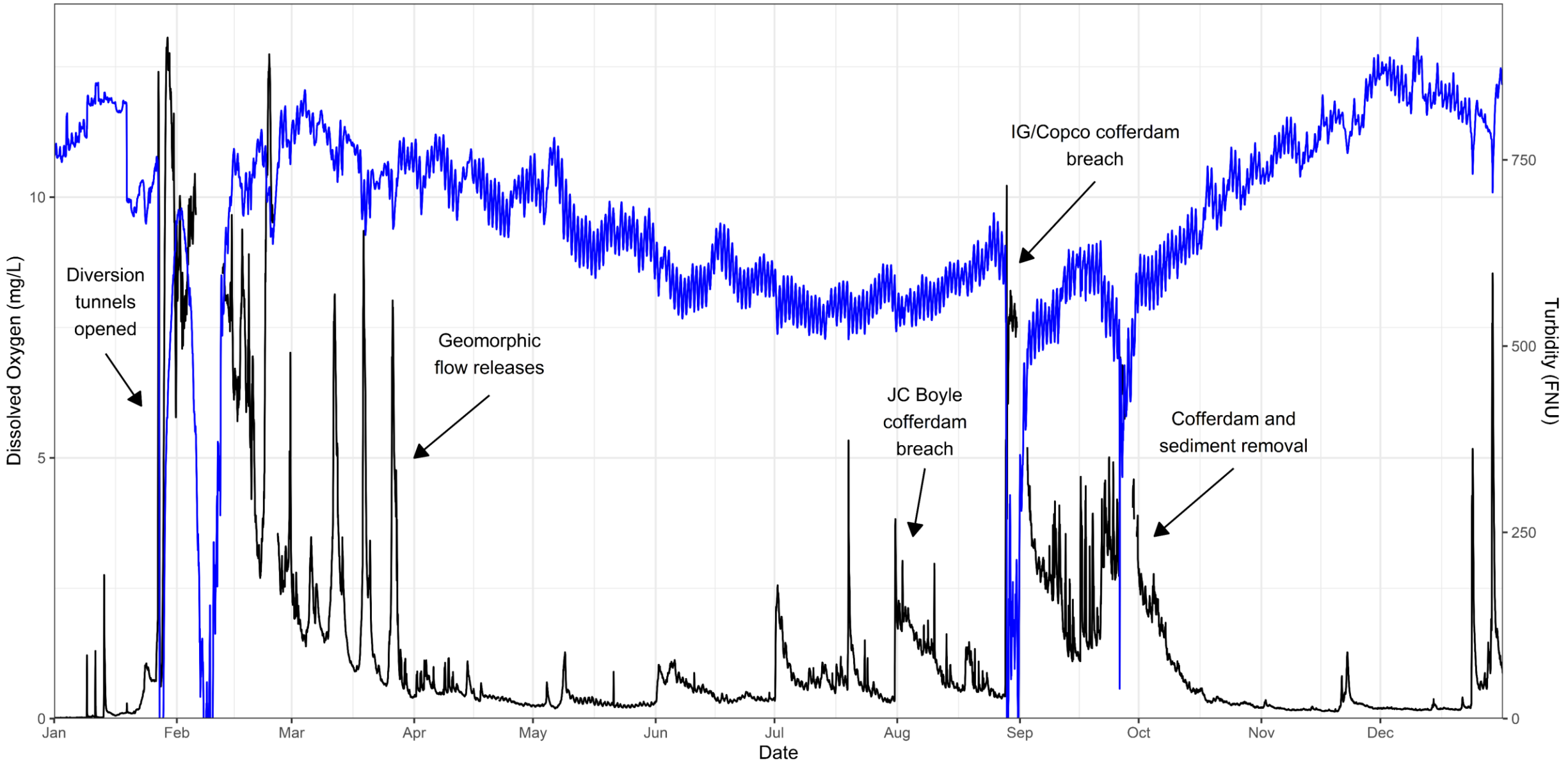
Immediate, Long-Term Improvements

("for long-term gains")

- Temperature, dissolved oxygen, pH, algal toxins, disturbance, fish disease, fish migration

All photos by author unless noted

A year of drawdown: turbidity and DO below the former Iron Gate Dam in 2024



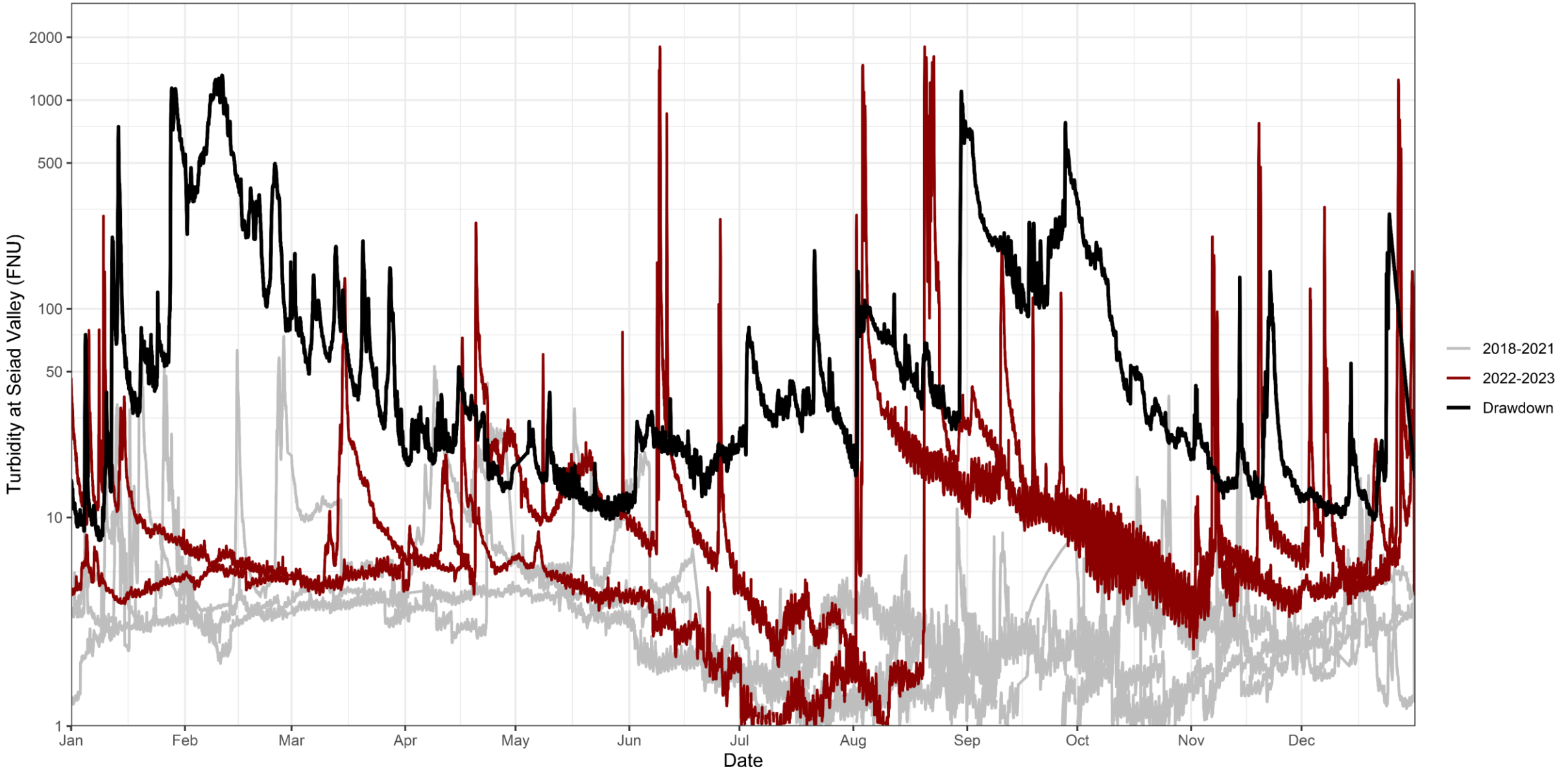
Dam Removal in Perspective: Larger Historic Disturbances


Hydraulic mining during gold rush
USGS

Christmas Flood of 1964

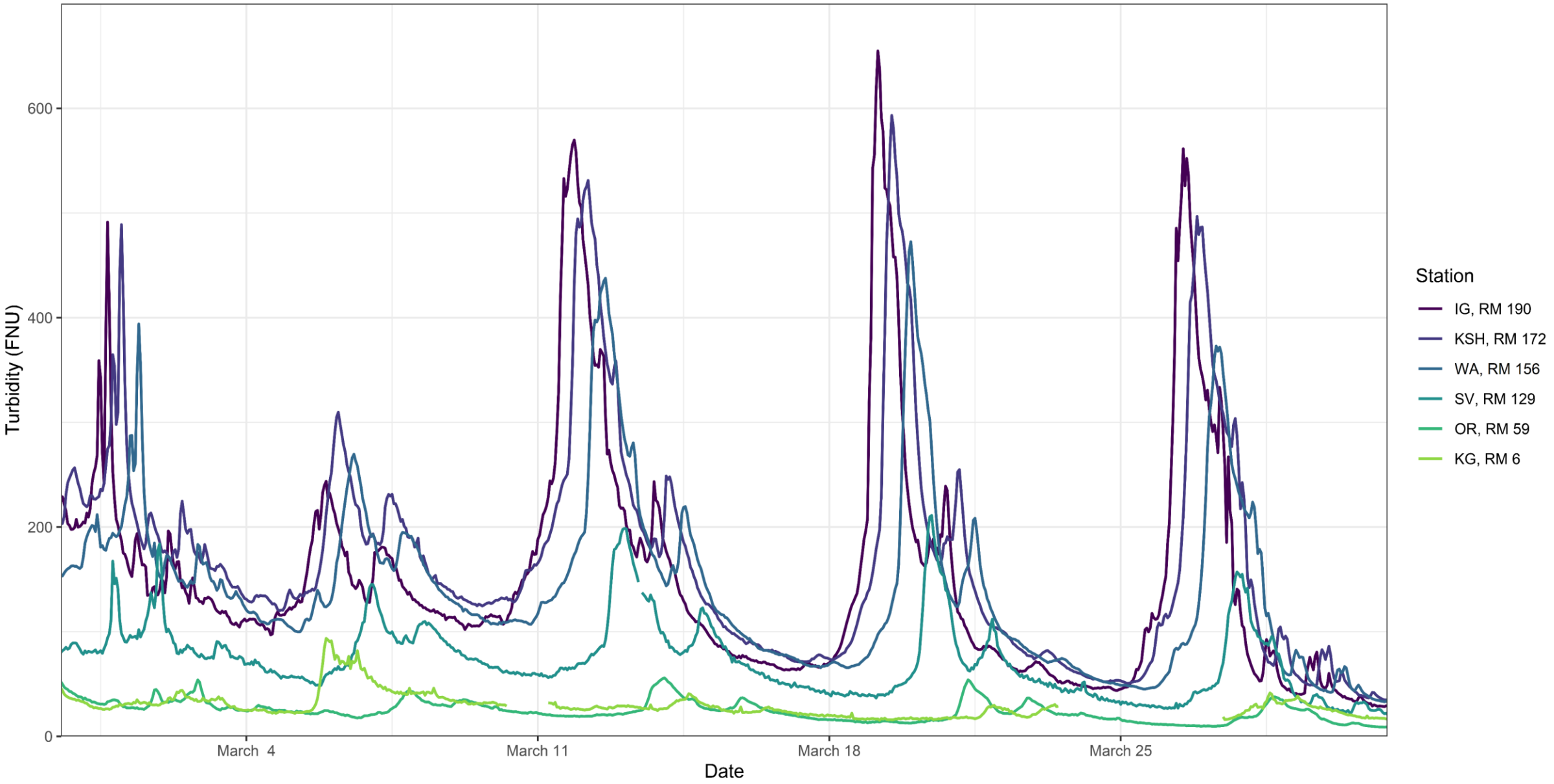
Eureka Newspapers

2022 McKinney Fire and impacts of catastrophic wildfire (log scale)



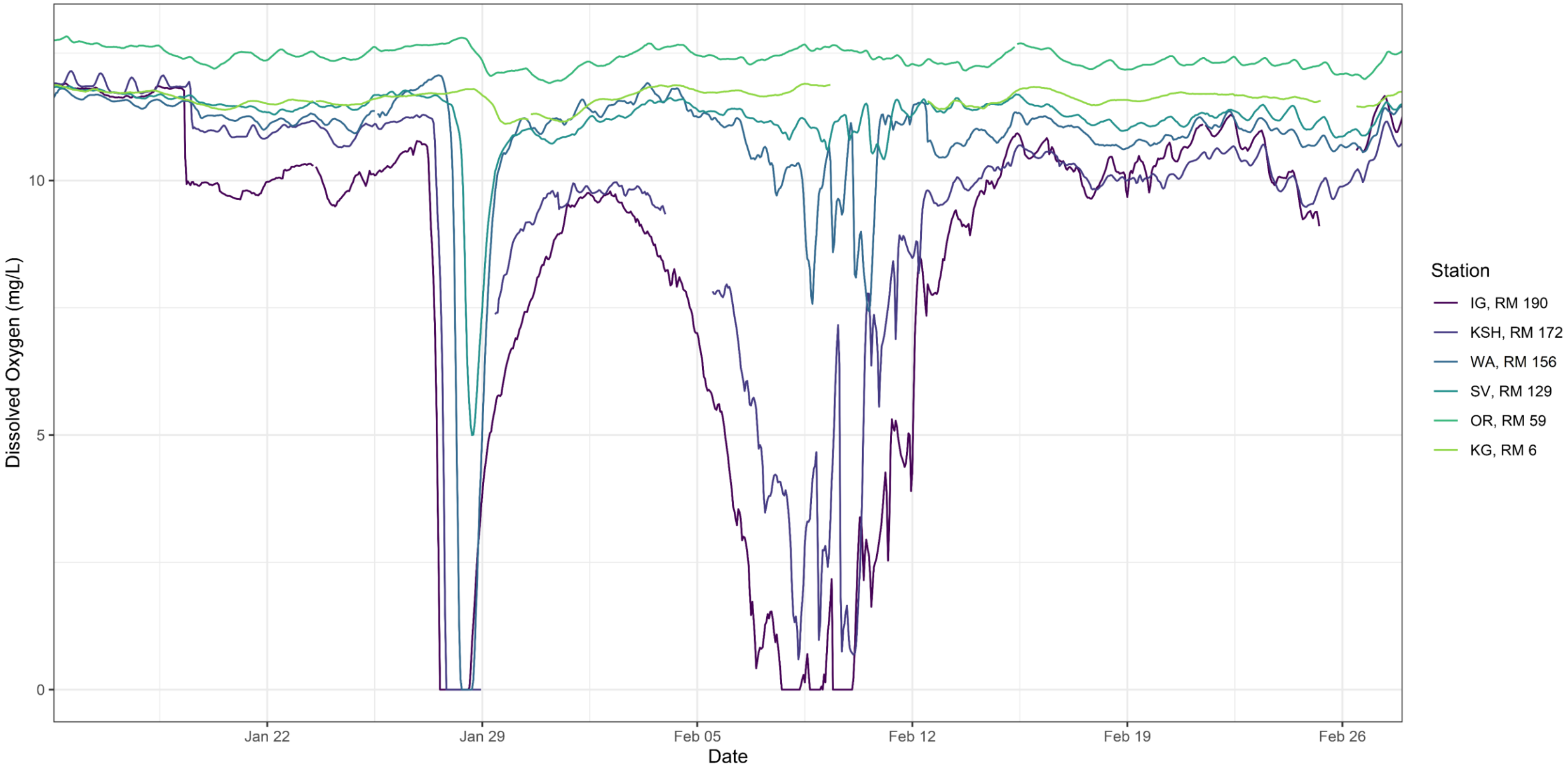
Dilution and Improvement of Water Quality Downriver

Dilution of turbidity from storms and geomorphic flow releases (March 2024)

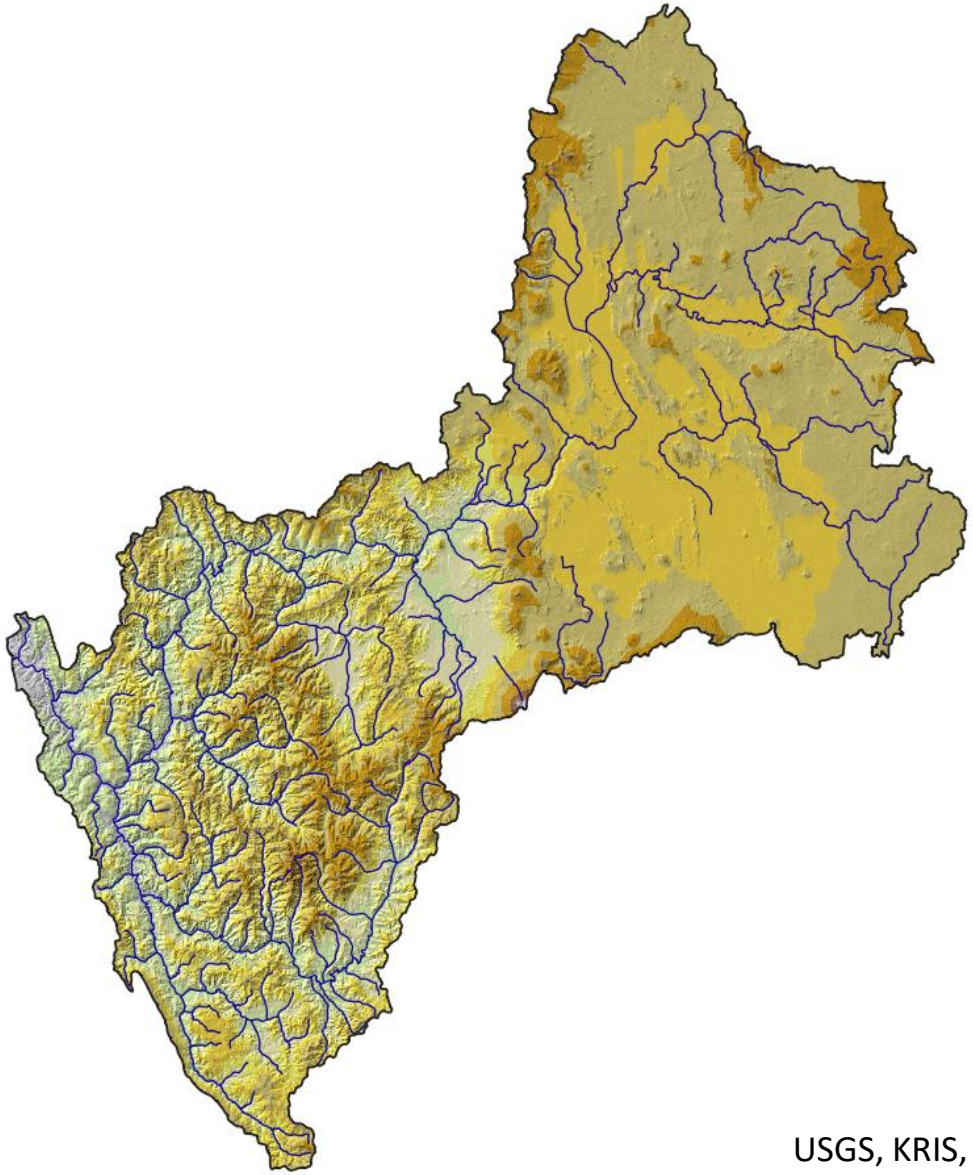


Dilution of suspended sediment concentration samples

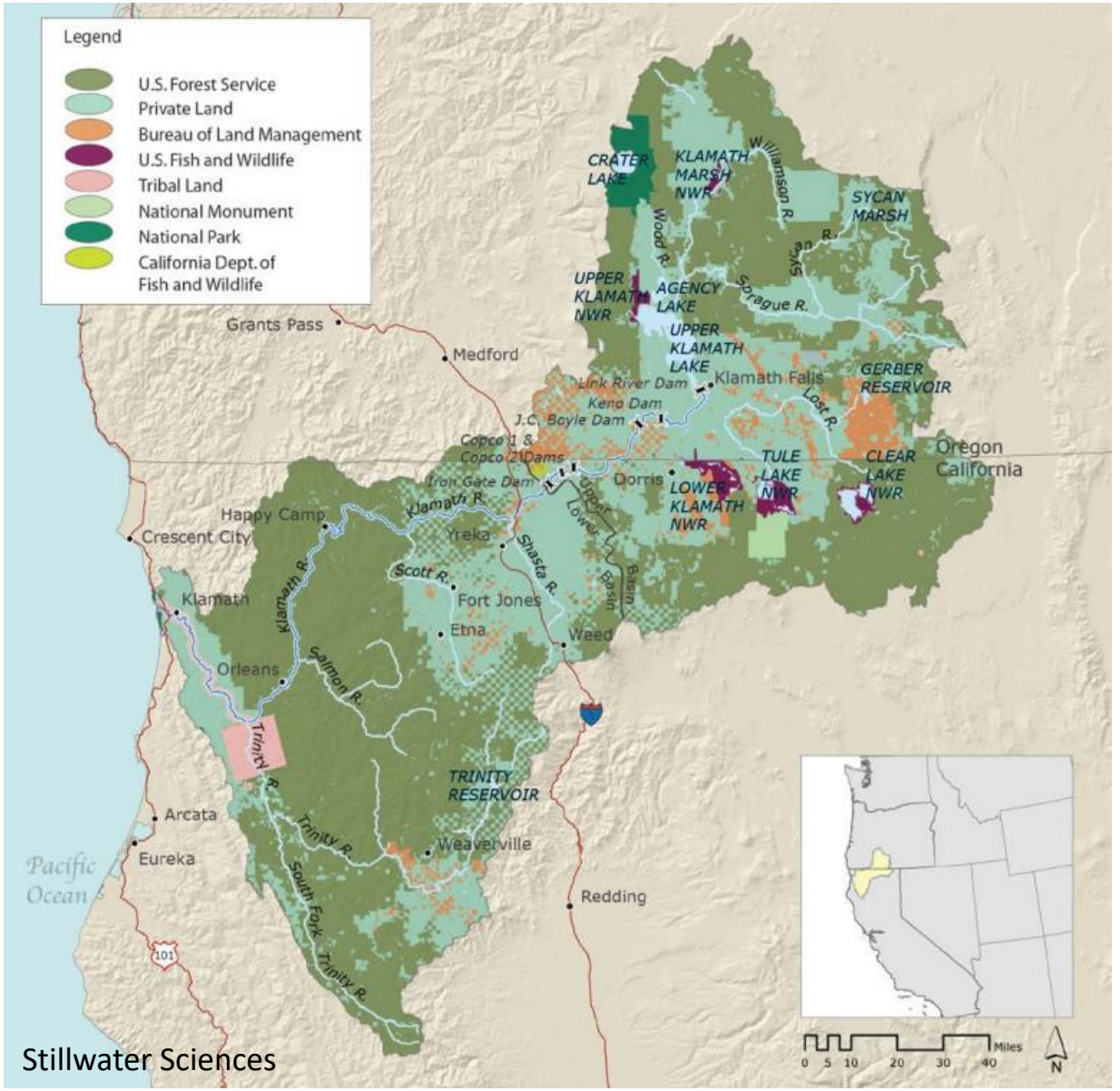
Recovery of dissolved oxygen sags (January-February 2024)



The “upside-down” river



USGS, KRIS, NWS



Stillwater Sciences


Dillon Creek dilutes Klamath River, February 27, 2024
Klamath River
Dillon Creek


Klamath River dilutes Trinity River, December 15, 2024
Trinity River
Klamath River

Misinformation about Klamath Dam Removal

~~“river of death”~~

~~“superfund site”~~

~~“collapse of the Klamath River ecosystem”~~

~~“conditions of disaster or extreme peril”~~

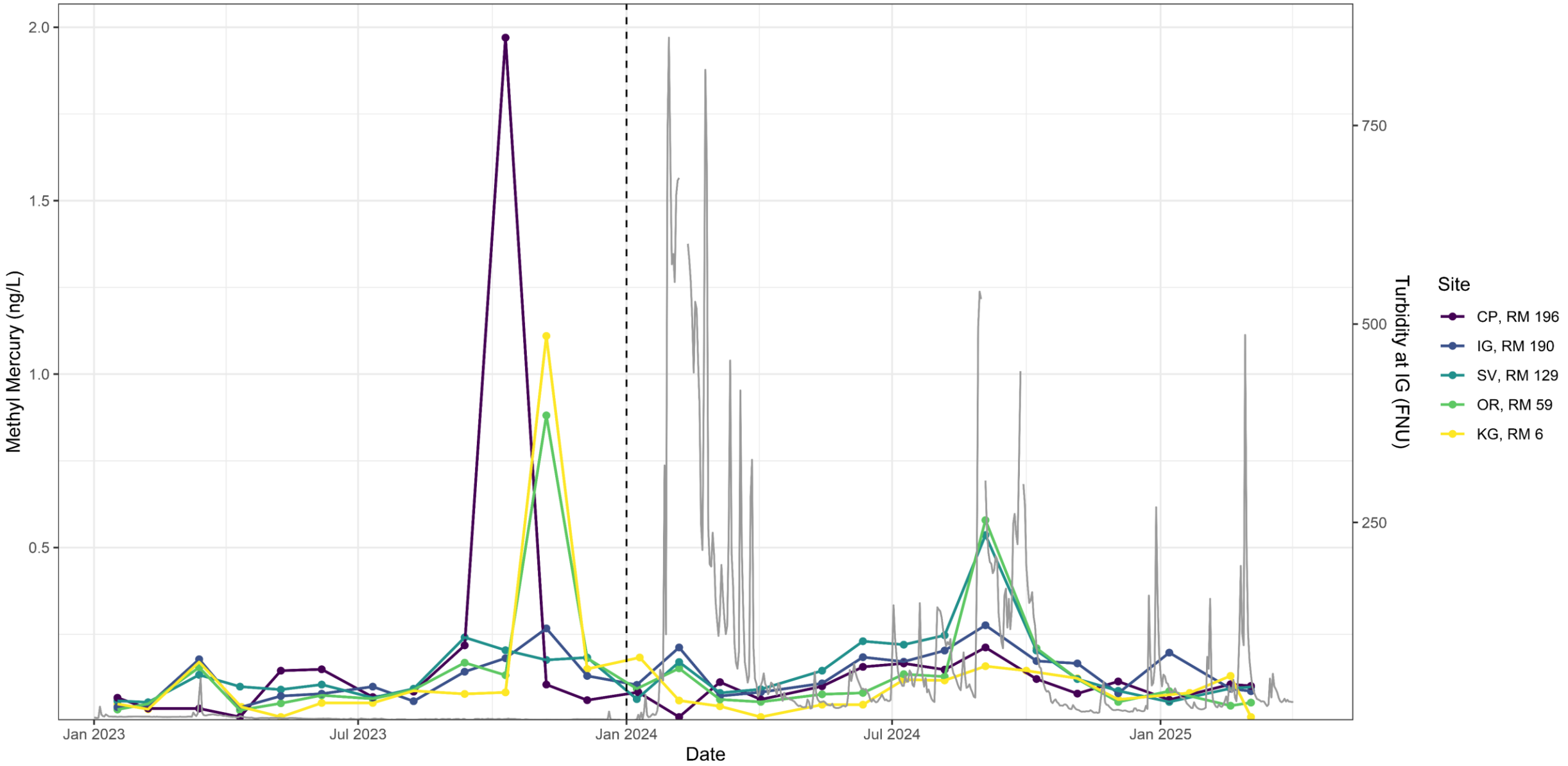
Facts about Klamath Dam Removal

- The Klamath River is used for drinking water in only one location, a rest stop on I-5. It was supplied with water by KRRC for the duration of the project.
- Drawdown was timed for winter to avoid recreation impacts as well as salmonid impacts. With winter water temperatures that reach 3 °C, recreation is… limited.
- Volcanic geology creates naturally high background levels of heavy metals.
- Other ongoing water quality concerns (i.e., catastrophic wildfire) have greater long-term impacts.

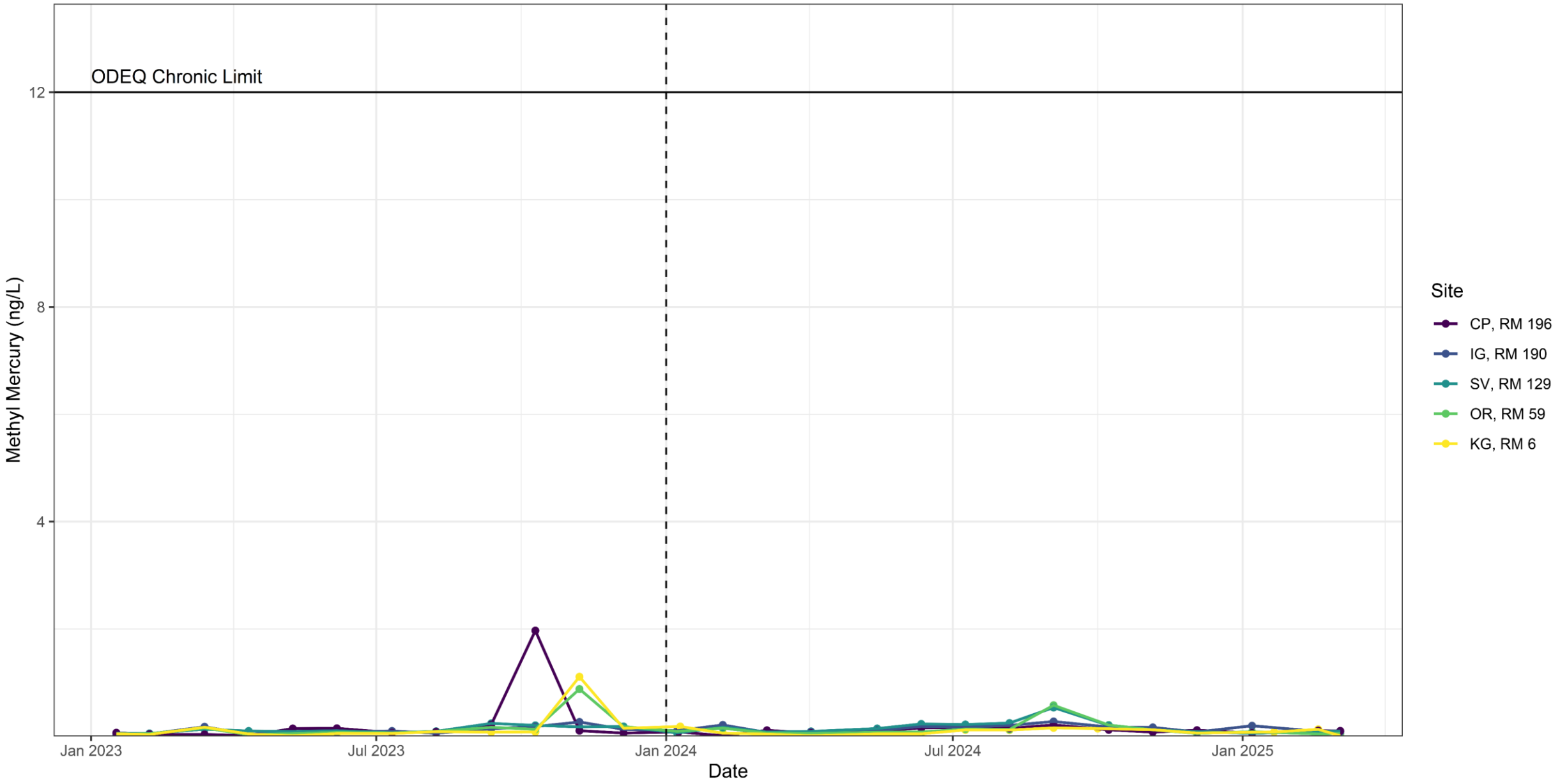
Fish Mortality

- Nearly 250 overwintering juvenile Coho were rescued from the mainstem Klamath and relocated to off-channel ponds by Tribal and RES staff prior to drawdown
- Some juvenile salmonid and sucker mortality observed during anoxic events caused by initial drawdown (January, extending 40 miles downriver) and cofferdam removal (September, extending 15 miles downriver)
- Hatchery juvenile mortality event was not caused by water quality (still produced more than the scheduled 3.25 million for last year)
- Majority of mortality observed was non-native reservoir fishes (e.g., perch)

Methylmercury before and during drawdown

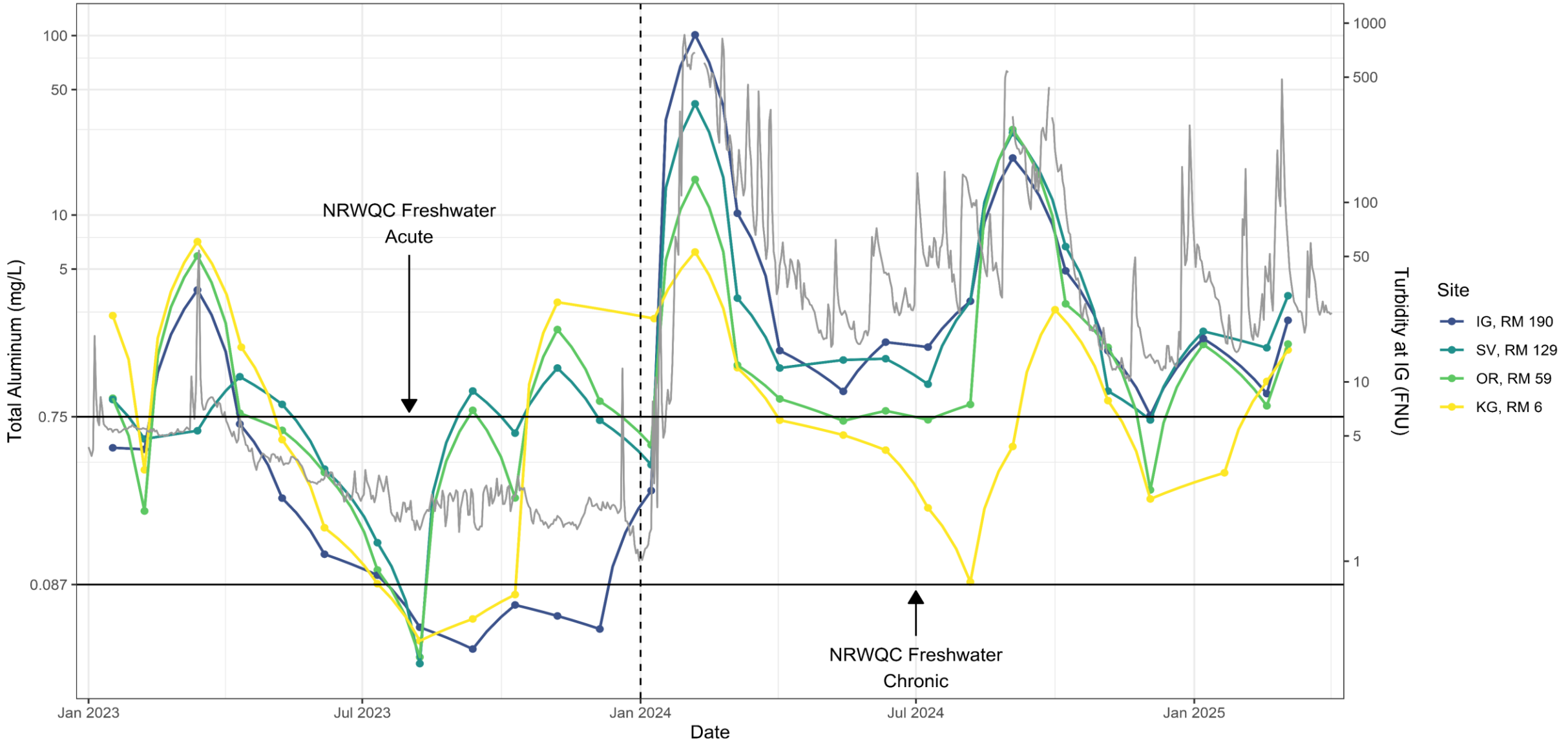


Methylmercury compared to lowest applicable water quality standard



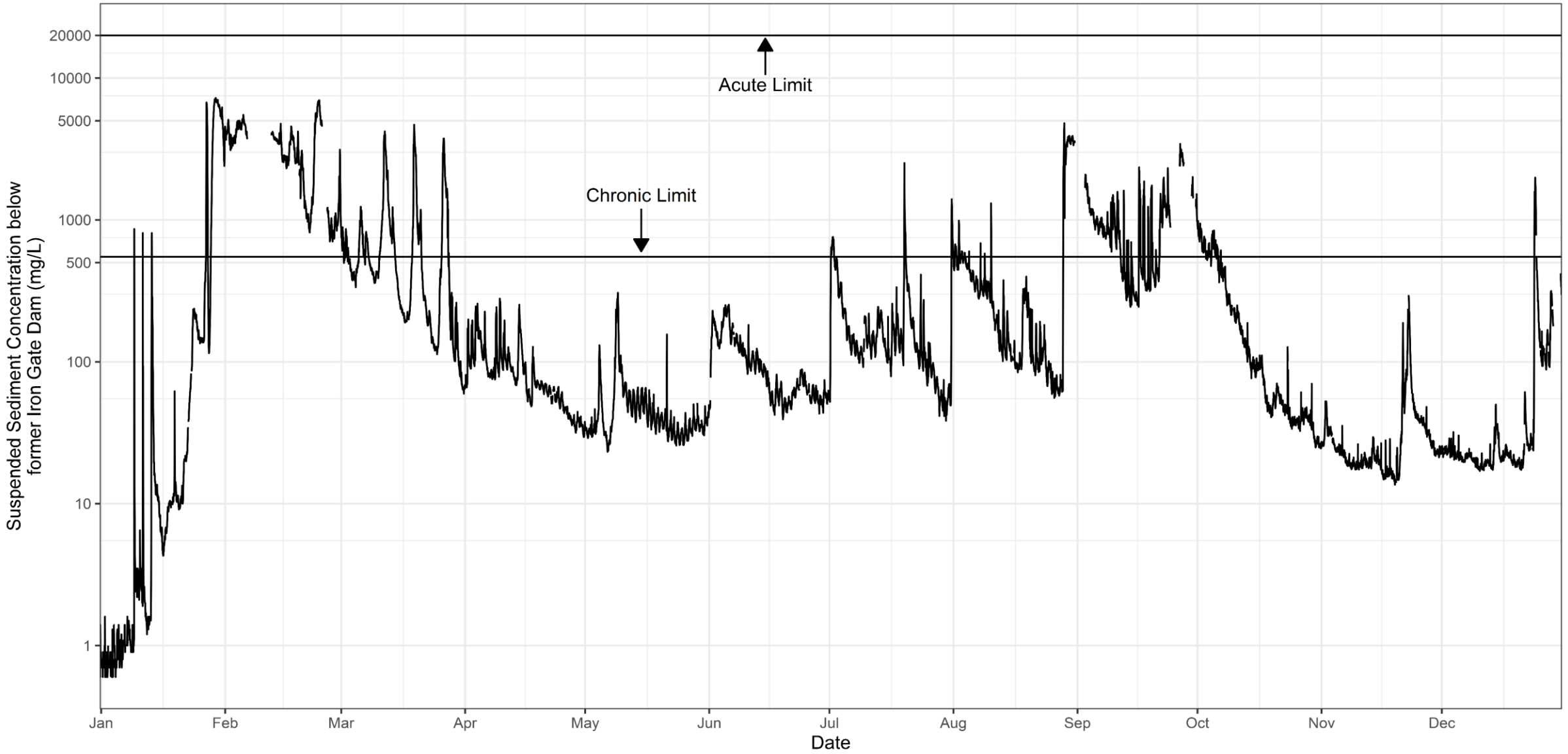
Total aluminum before and during drawdown (log scale)

*Klamath, Shasta, Scott, and Trinity Rivers are already on the 303(d) list as impaired by aluminum pollution (NCRWQCB)

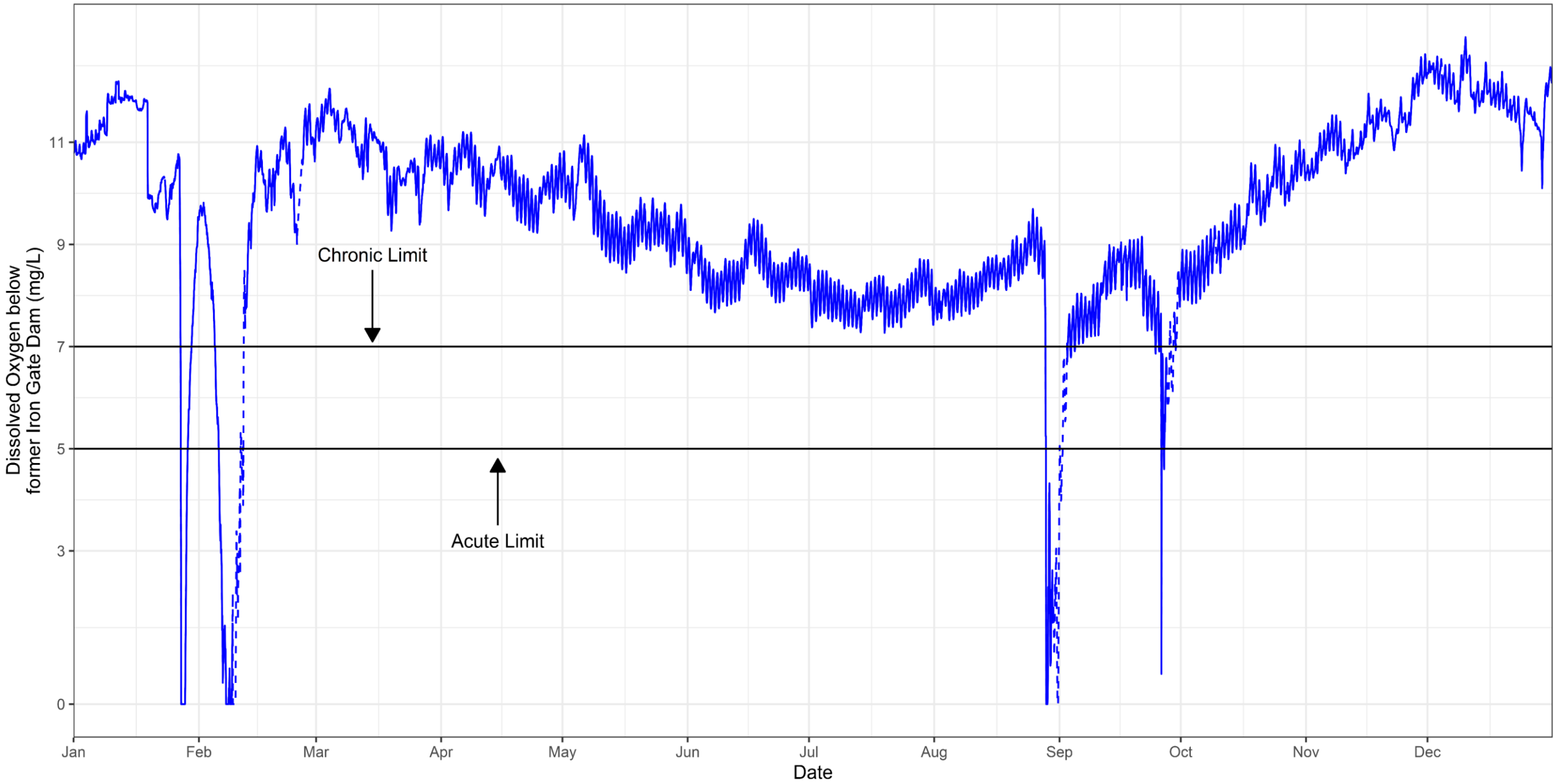


Modeled max SSC: **~20,000** mg/L vs. actual: **7,290** mg/L (log scale)

Turbidity to SSC regression by USGS



Modeled DO < 7 mg/L: **53** days vs. actual: **6** days



Modeled Expectations vs. Measured Results

Parameter	Modeled	Actual
Maximum SSC (mg/L)	15,000-30,000	**7,290**
Days above 1,000 mg/L SSC	56	**52**
Days above 5,000 mg/L SSC	14	**4.3**
Days below 7 mg/L DO	53	**6.2**
Days below 5 mg/L DO	12	**3.6**


2024


2021
Reconnect Klamath

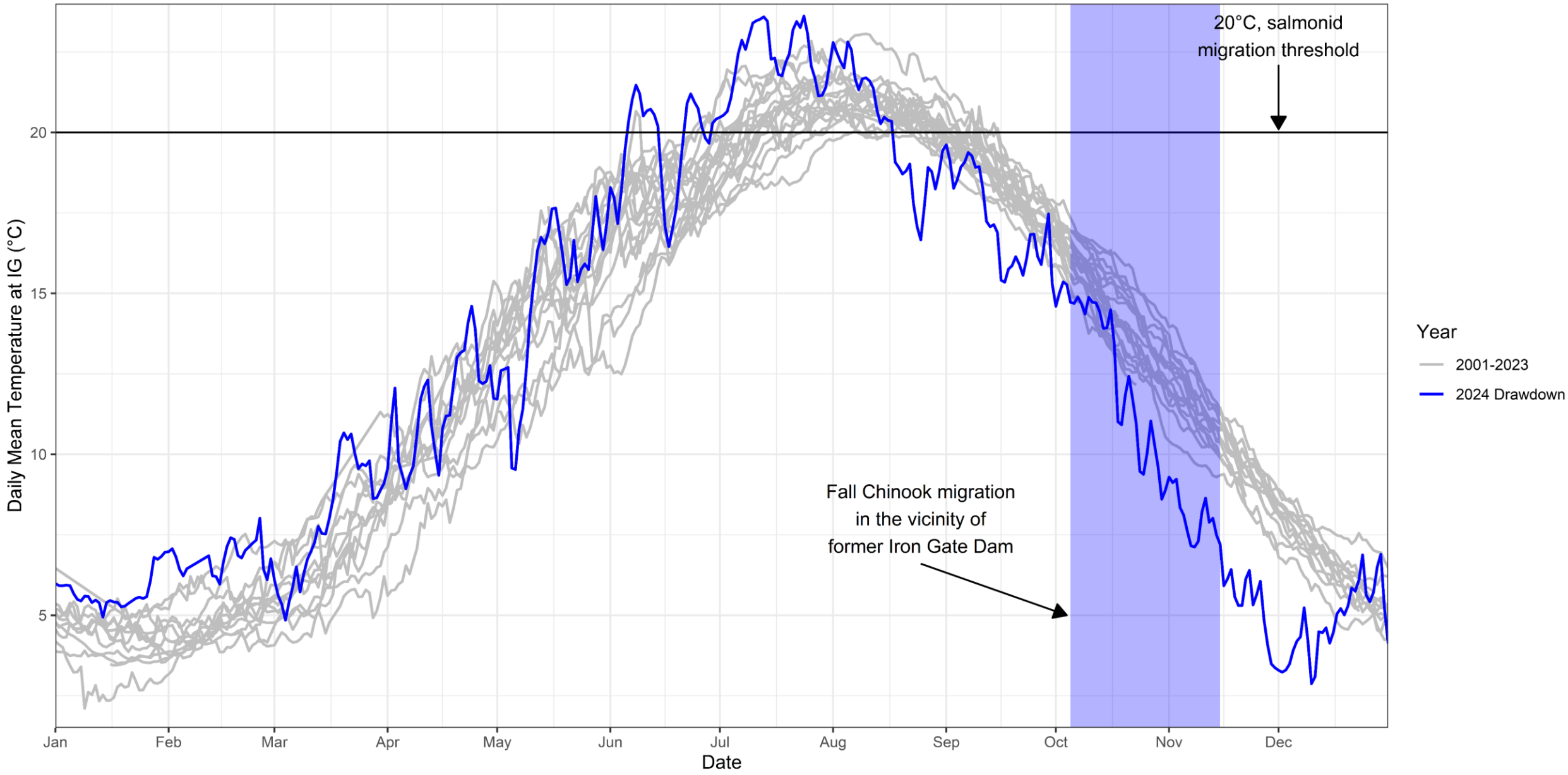

2025

Short-Term Drawdown WQ Impacts

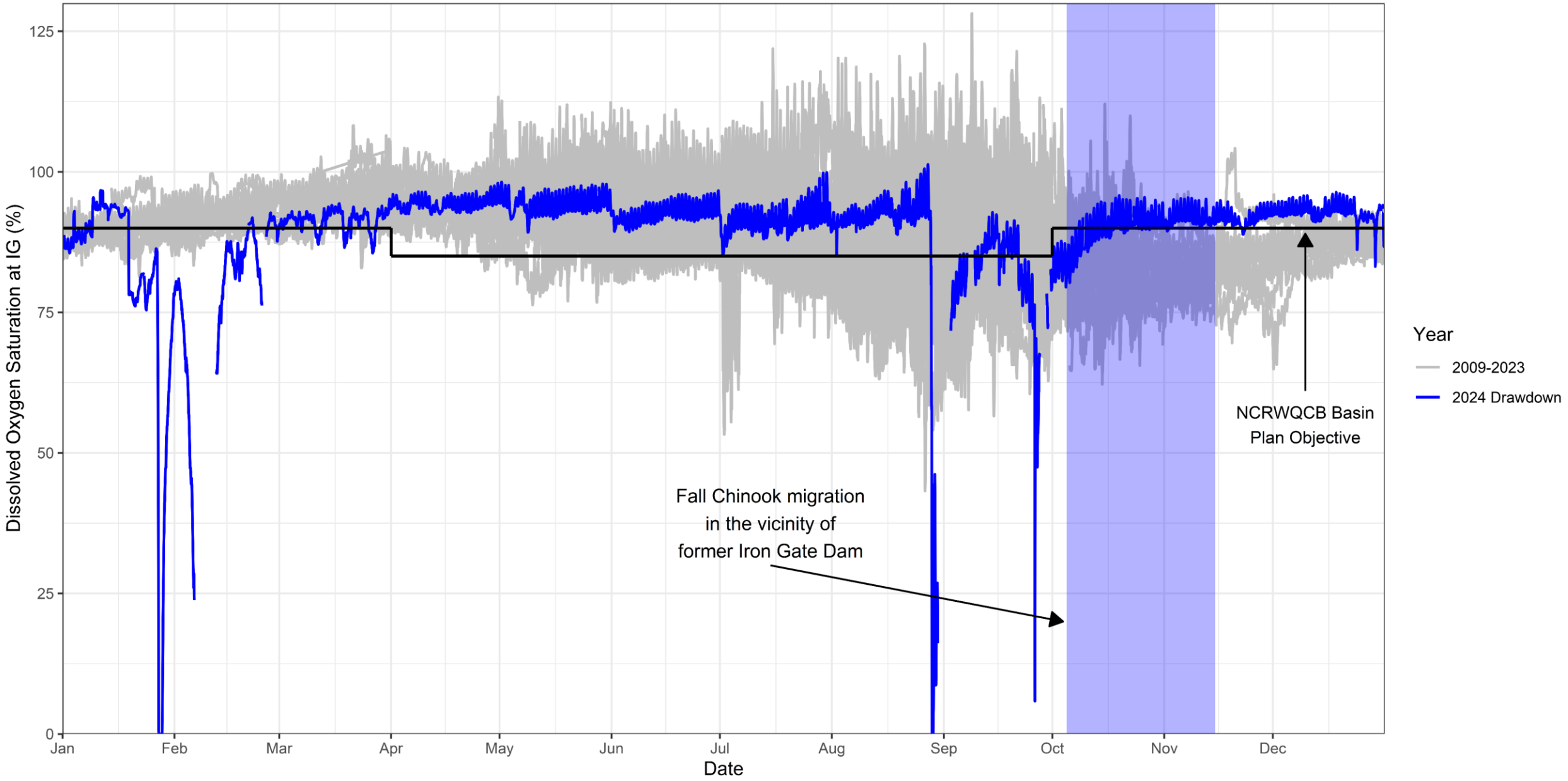
- DO sags, including several hours of anoxia, during initial drawdown, cofferdam breach, and cofferdam removal
- SSC below salmonid stress thresholds during 86% of the year
- DO above salmonid stress thresholds during 98% of the year
- SSC and DO impairments much less severe than modeled

What’s ahead for a free(-er) Klamath?

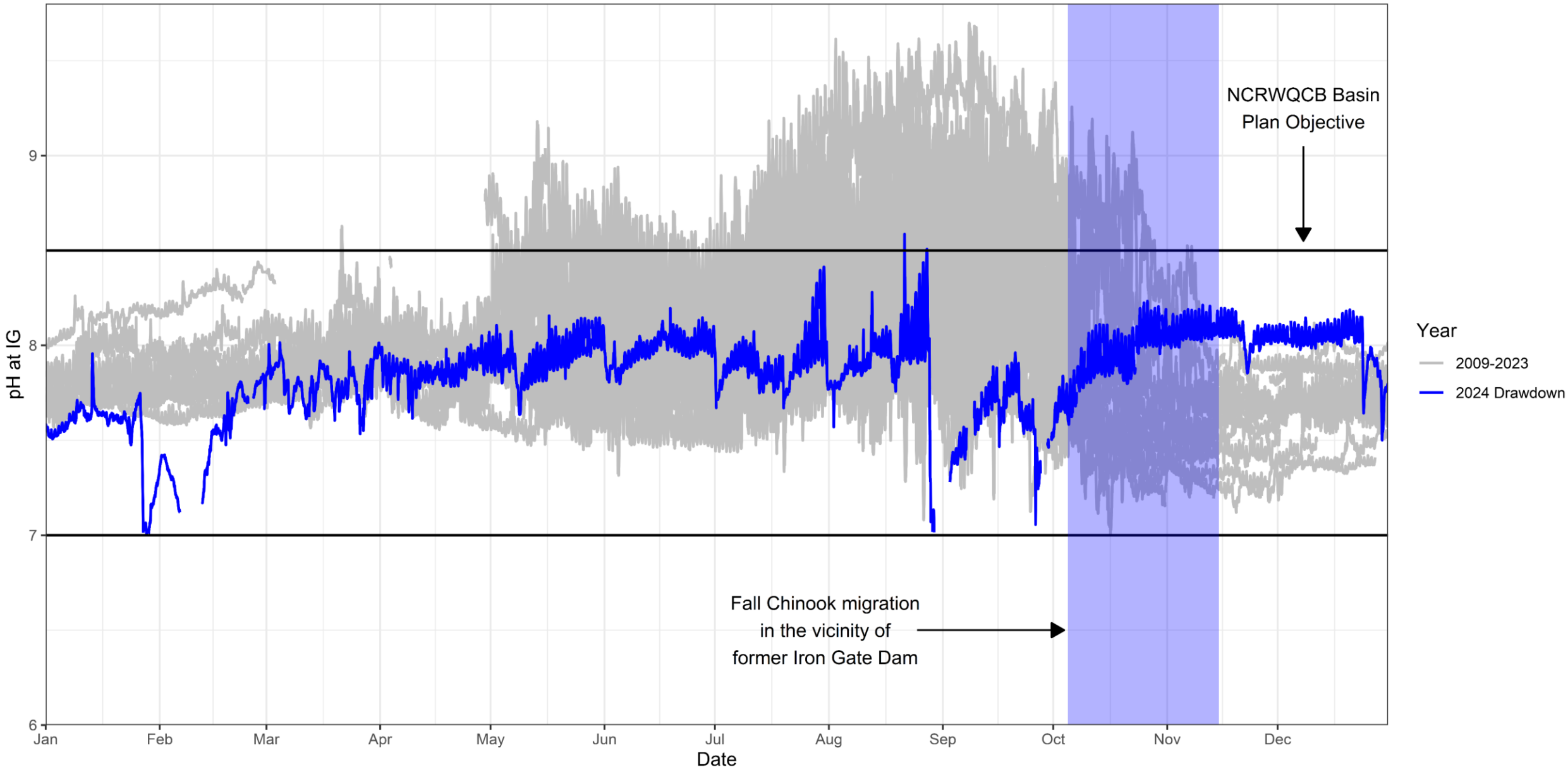
Immediate improvements in temperature



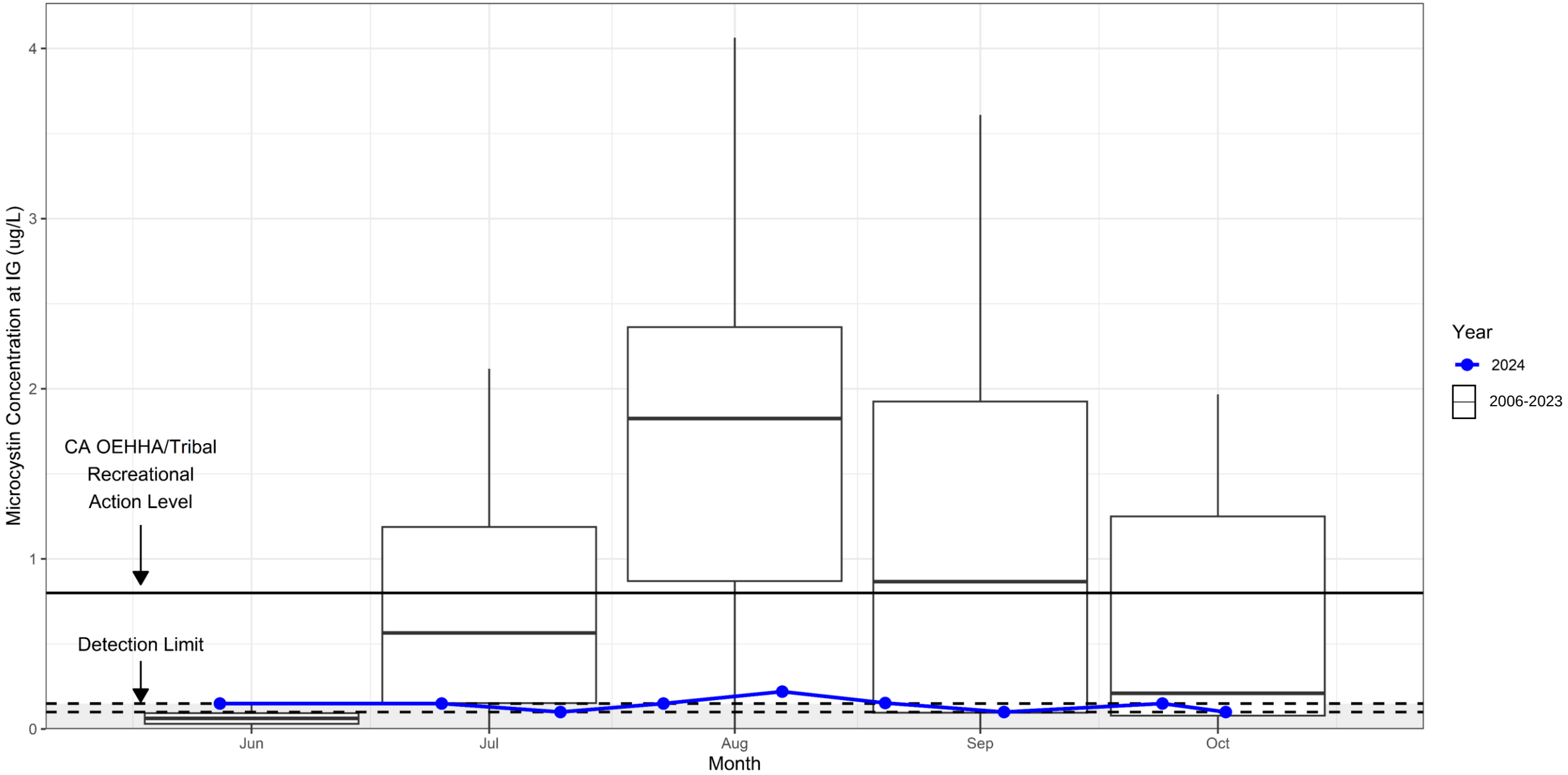
Immediate improvements in dissolved oxygen



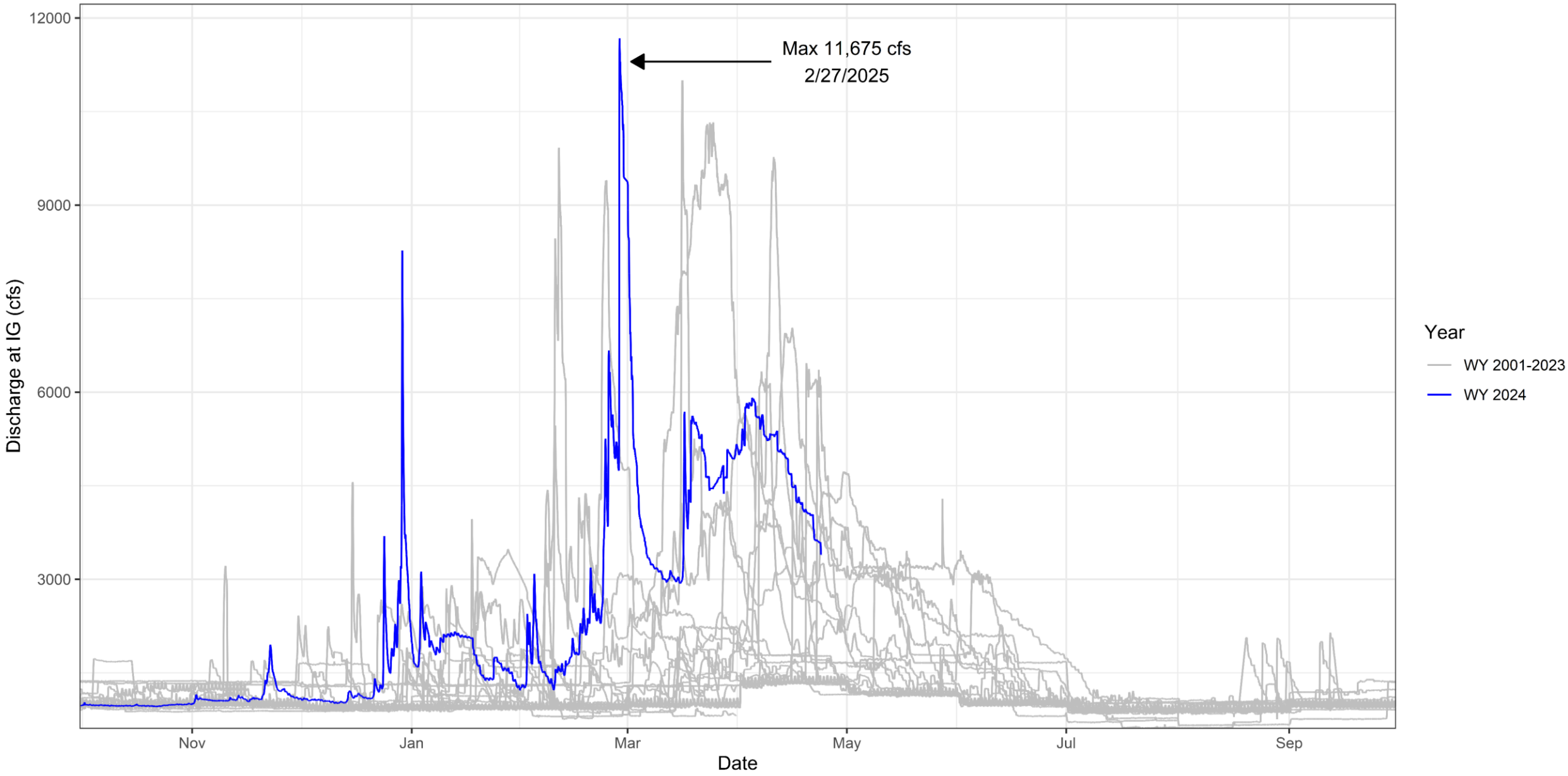
Immediate improvements in pH



Microcystin samples mostly nondetect in 2024



Increased disturbance in free-flowing reaches (data from USGS)



Before and After June-October Water Quality

% of continuous data below former Iron Gate dam

Parameter	2001-2011[1]	2012-2023[2]	2024
DO Sat. < 90%	33	62	**40**
DO Sat. < 85%	22	41	**19**
pH > 8.5	23	24	**<1**
pH > 9.0	2	7	**0**
Temp. > 22 °C	9	1	**19**

1 Asarian, E., & Kann, J. 2013. Synthesis of Continuous Water Quality Data for the Lower and Middle Klamath River, 2001-2011. Prepared by Kier Associates and Aquatic Ecosystem Sciences for the Klamath Basin Tribal Water Quality Work Group. 50 pp. + appendices.

2 Iron Gate curtain used starting 2015 (water released from lower in the reservoir)

Long-Term Dam Removal Water Quality Improvements

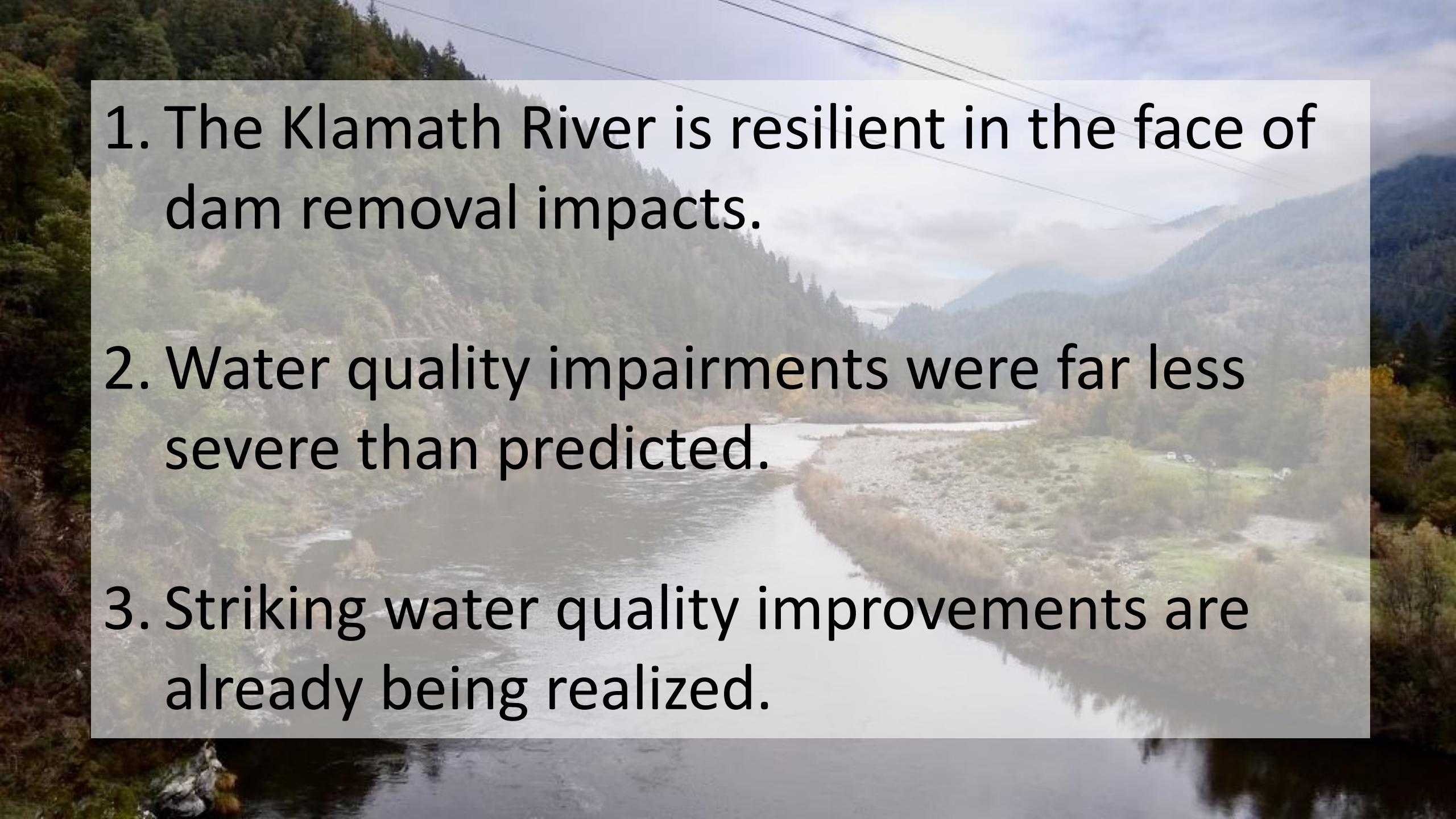
- Lower late summer and fall temperatures
- Higher dissolved oxygen
- Lower and less variable pH
- Almost no microcystin detected
- Restored flow regime and sediment transport regime


Klamath River at Seiad Valley

Water Quality Leads to…

- Reduced fish disease
- Habitat availability, diversity
- Safety for cultural, ceremonial, and recreational use
- Access to healthy traditional foods and other cultural resources
- Healthy communities and economies

Ron & Jason Reed dipnet fishing at Ishi Pishi Falls (Photo: Noel DiBenedetto)



1. The Klamath River is resilient in the face of dam removal impacts.

2. Water quality impairments were far less severe than predicted.

3. Striking water quality improvements are already being realized.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Yêeship!