WILLAMETTE PROJECT RESERVOIR DRAWDOWNS: WHAT HAVE WE LEARNED?

U.S. Army Corps of Engineers
Portland District
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Greg Taylor
Supervisory Fisheries Biologist, USACE

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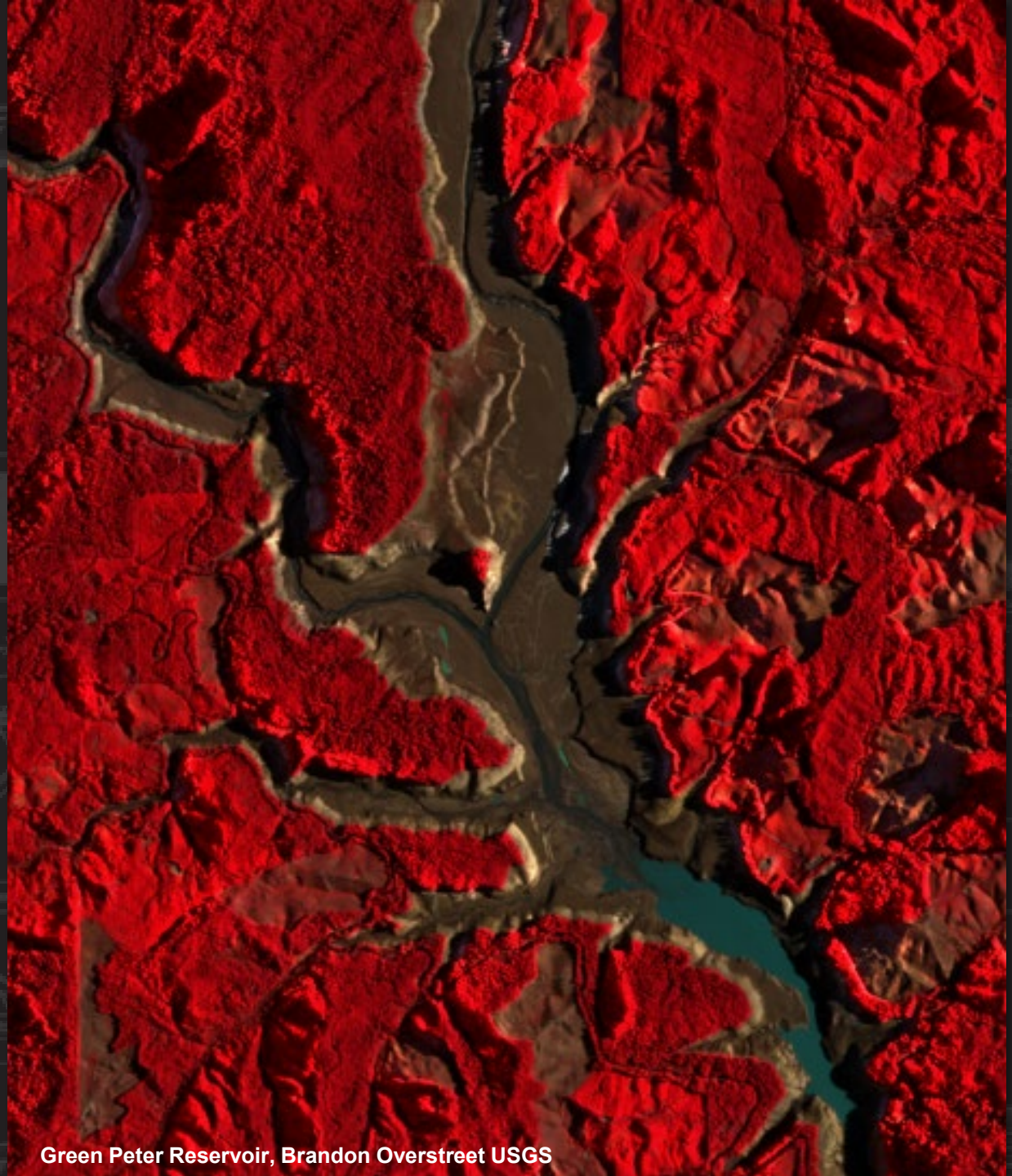

Green Peter Reservoir, Brandon Overstreet USGS

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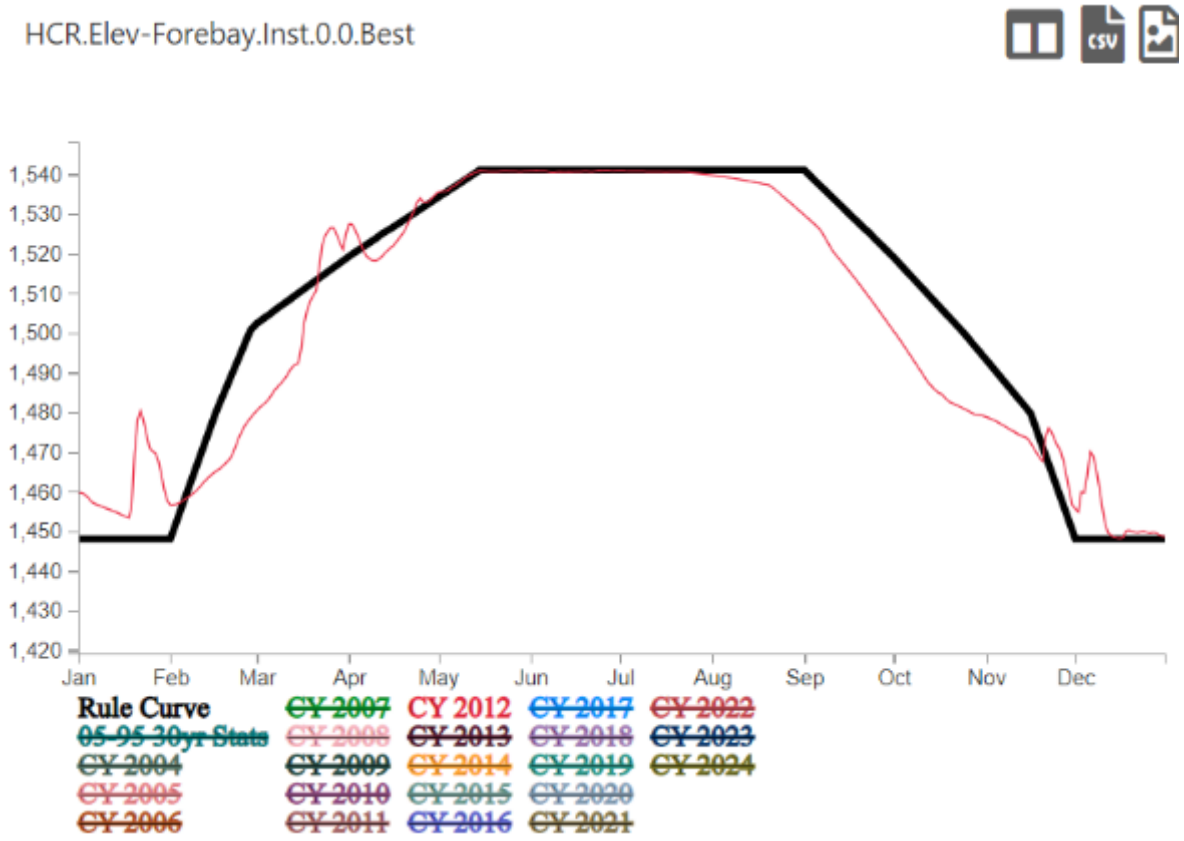
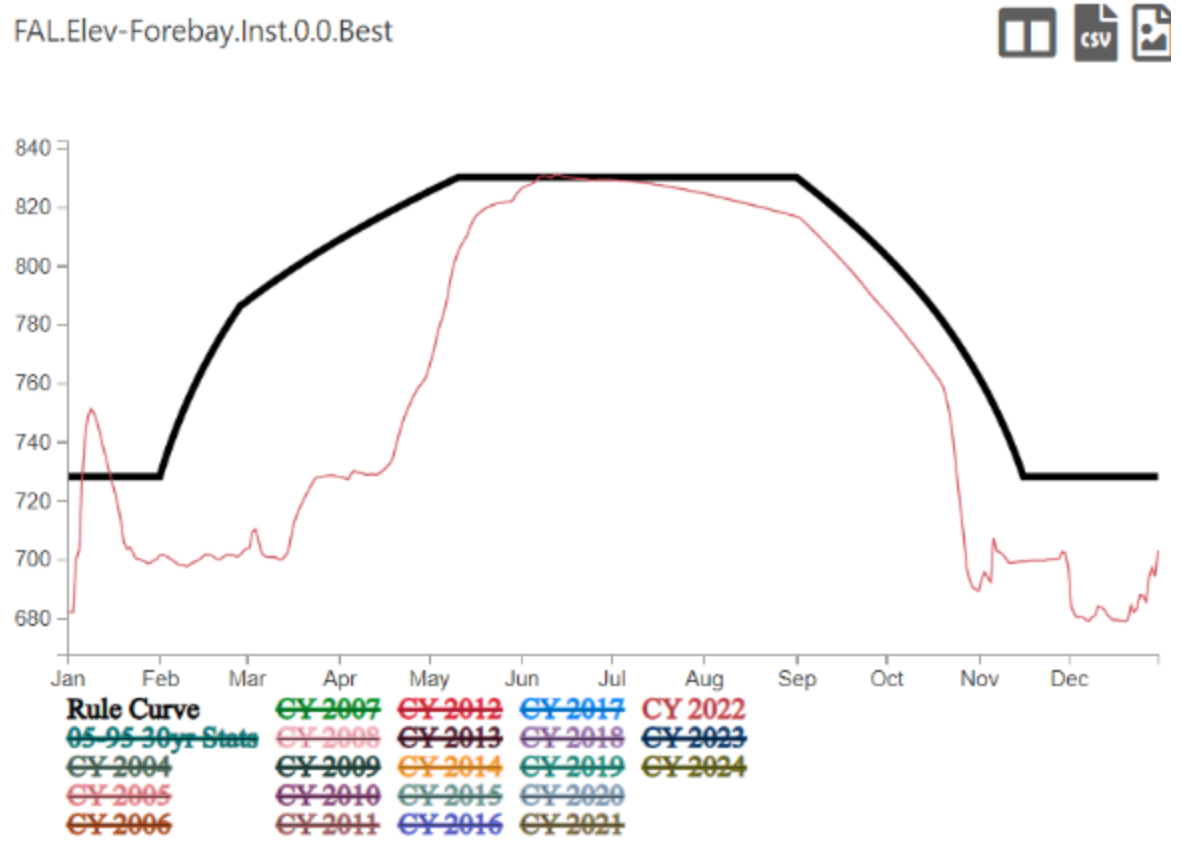
WHAT IS A RESERVOIR DRAWDOWN?

Drawdown: Lowering the elevation of the reservoir to meet a specific authorized purpose or objective

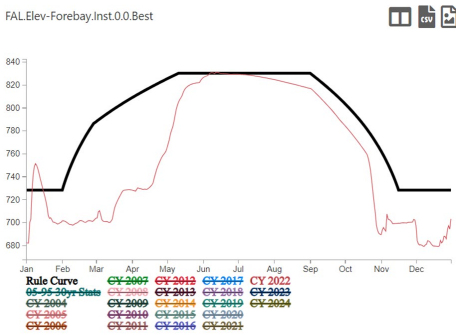




DRAWDOWN TYPES – FOR FISH PASSAGE

Full / Streambed

Below minimum conservation pool



Partial Reservoir

WHY?

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Goal: Sustain wild populations of Spring Chinook or Winter Steelhead in historic habitat above Dams (improve species status)

Biological Objectives:

Increased fish passage efficiency

Increased fish passage survival

Reduced predation and competition in the reservoirs

Assumptions / Rationale:

Passage metrics are better than current downstream passage structure or operations

Downstream passage improvements outweigh impacts to the reservoir and downstream environment

Fish migration behavior will follow patterns observed in previous monitoring (50 ft or less from intake for best passage efficiency)

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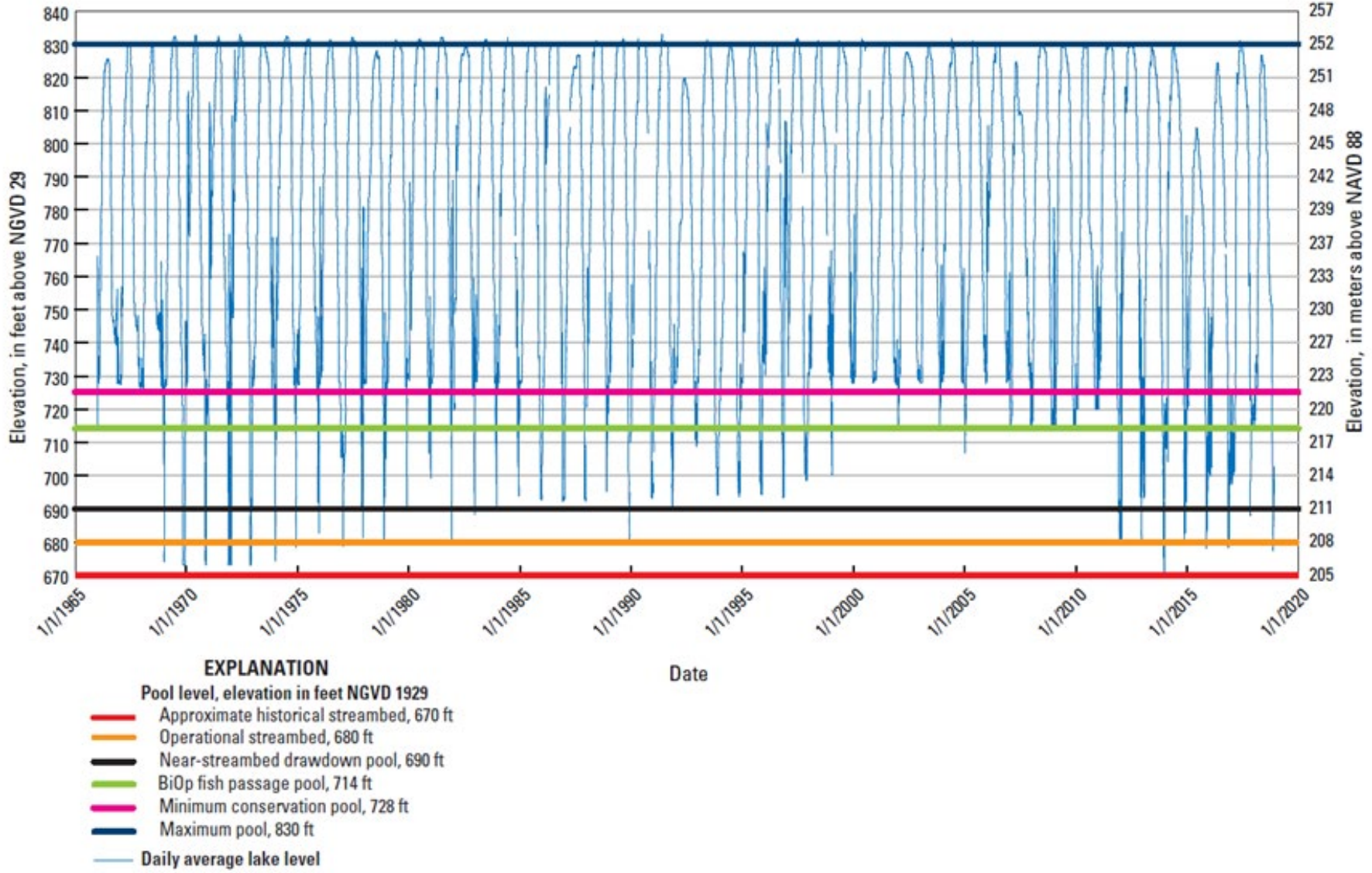
WILLAMETTE PROJECT DRAWDOWN HISTORY

DRAWDOWN HISTORY

In December 1968 and November 1969 the Corps complied with the Fish Commission's request to completely evacuate the reservoir to stream bed. We believe these drawdowns, which encompassed about 1 month of each year, successfully passed juvenile chinook from the reservoir via the regulating outlets.

DRAWDOWN HISTORY – STARTED AT FALL CREEK



DEEP RESERVOIR DRAWDOWNS

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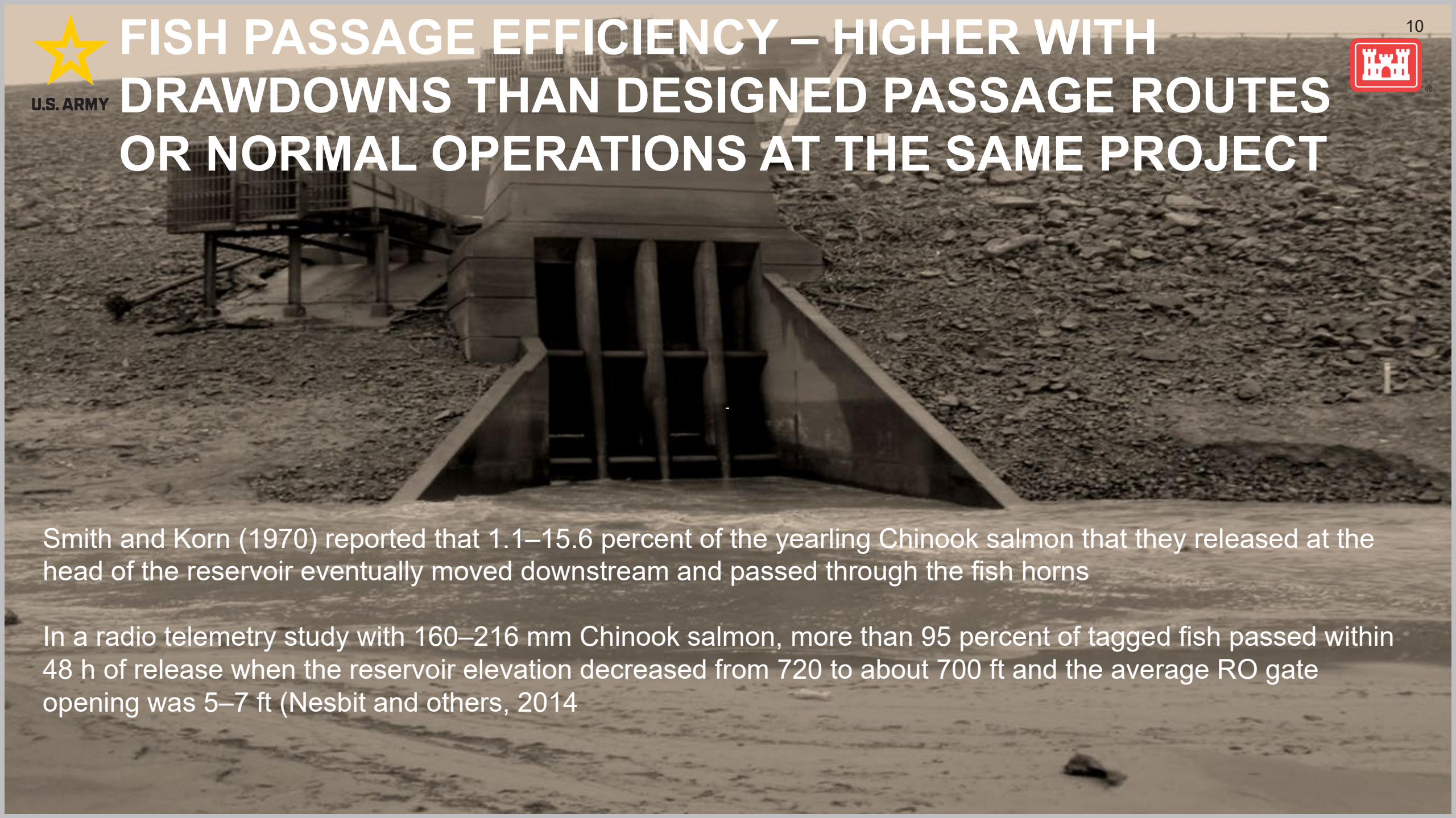
Dam:

- Fall Creek: A 43-foot drawdown to El. 685 ft., from 01 December – 15 January (injunction-ongoing)
- Cougar: A 132-foot drawdown to El. 1400 (2002)
- Cougar: A 82-foot drawdown to El. 1450 (2003-2005)
- Cougar: A 27-foot drawdown to El. 1505 ft., from 15 November – 15 December (injunction-ongoing)
- Lookout Point: A 75-foot drawdown to El. 750 ft., from 15 November – 15 December (injunction - ongoing)
- Green Peter: A 142-foot drawdown to El. 780 ft., from 15 November – 15 December (injunction - ongoing)

DOWNSTREAM FISH PASSAGE

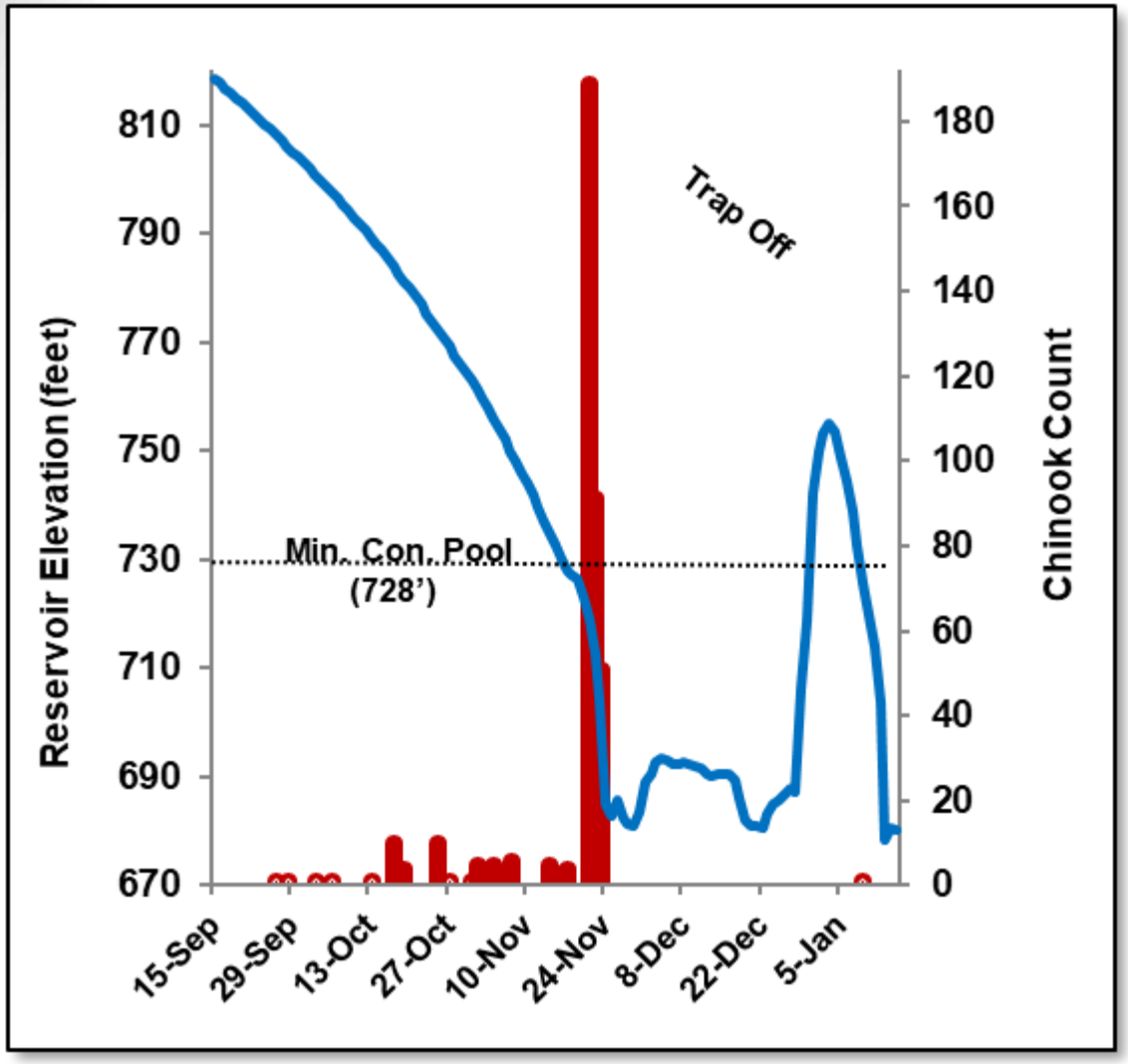
FISH PASSAGE EFFICIENCY – HIGHER WITH DRAWDOWNS THAN DESIGNED PASSAGE ROUTES OR NORMAL OPERATIONS AT THE SAME PROJECT

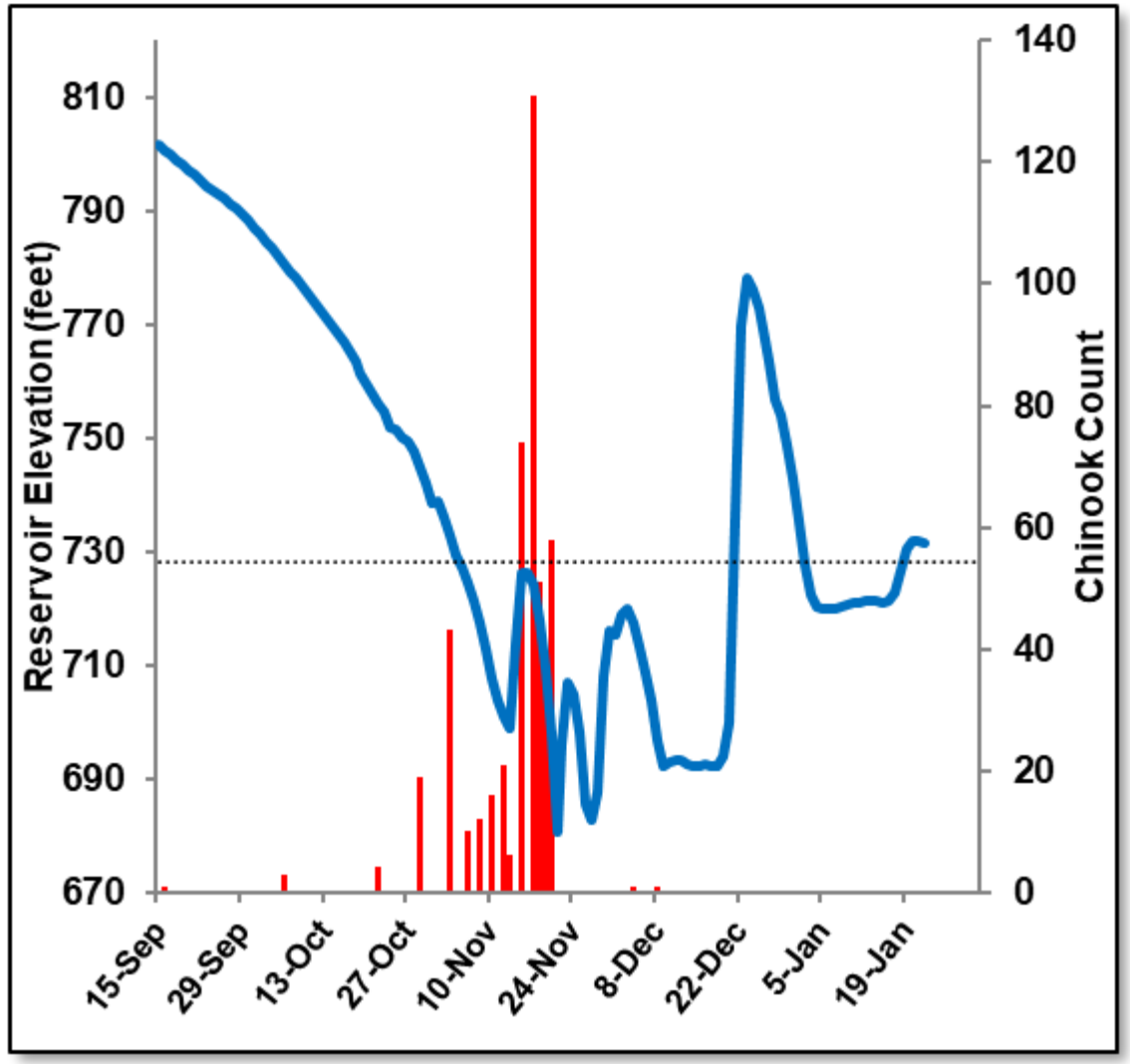


Smith and Korn (1970) reported that 1.1–15.6 percent of the yearling Chinook salmon that they released at the head of the reservoir eventually moved downstream and passed through the fish horns

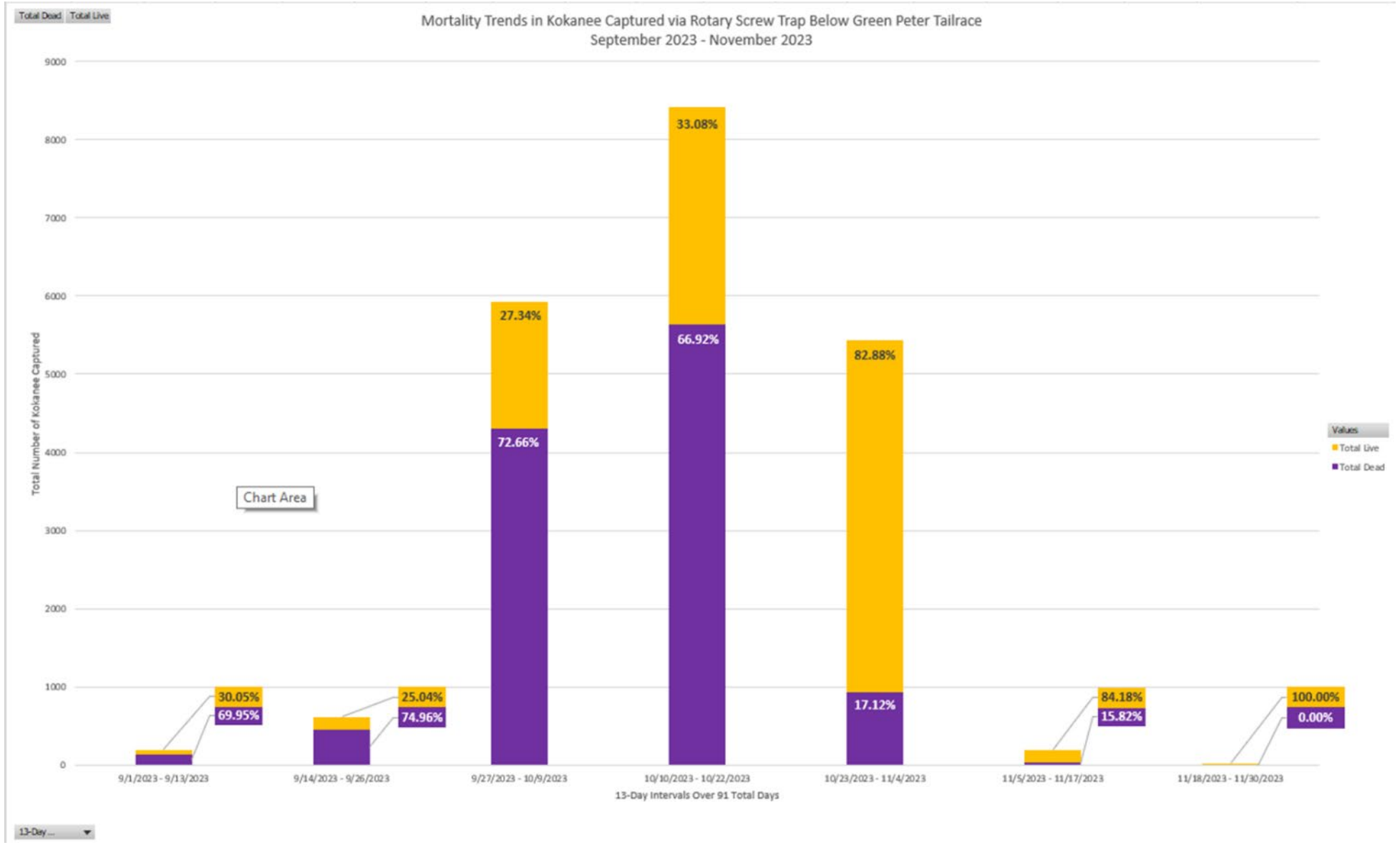
In a radio telemetry study with 160–216 mm Chinook salmon, more than 95 percent of tagged fish passed within 48 h of release when the reservoir elevation decreased from 720 to about 700 ft and the average RO gate opening was 5–7 ft (Nesbit and others, 2014

DRAWDOWN PASSAGE TIMING – DEPTH TO INTAKE AND FLOW ARE KEY VARIABLES

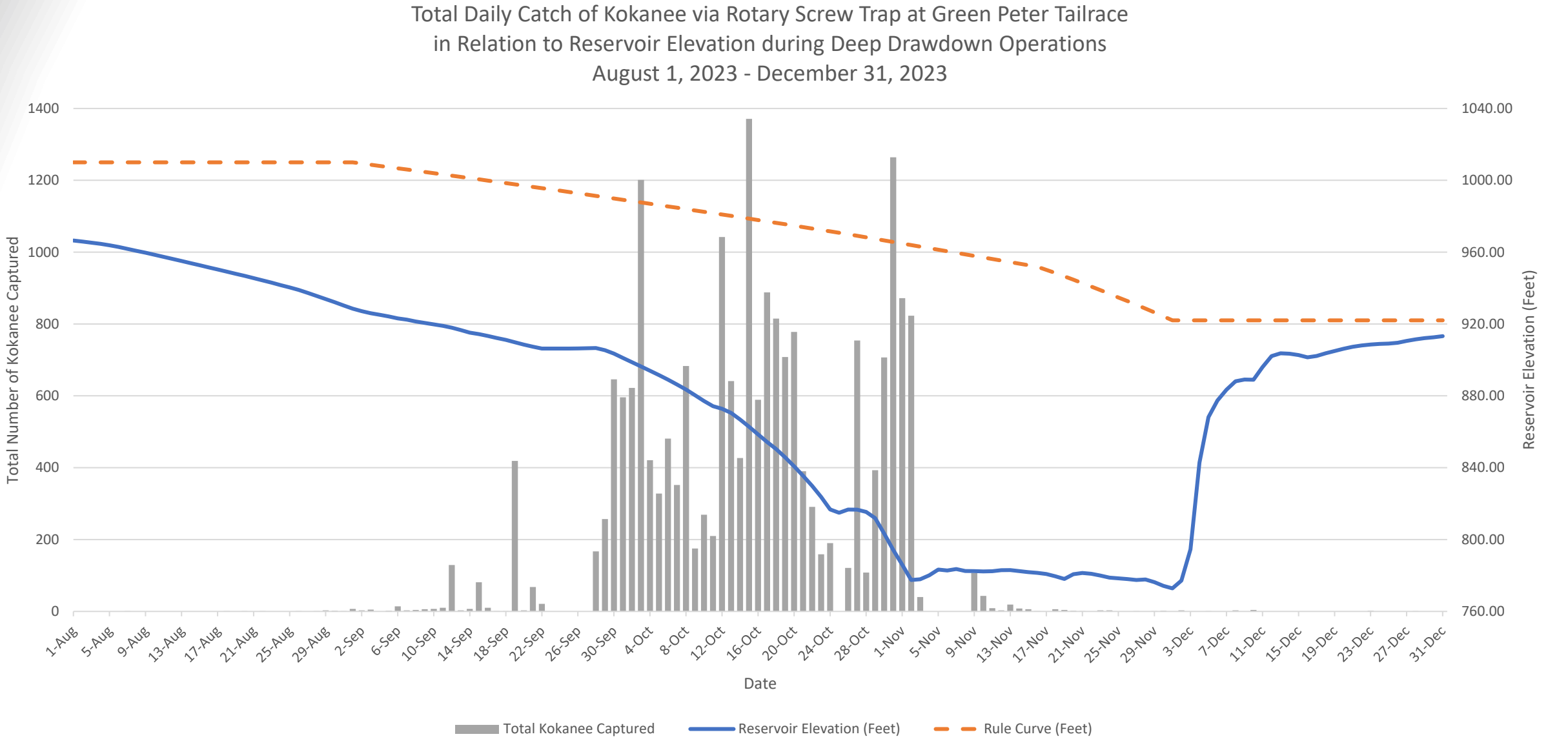




DRAWDOWN SURVIVAL - INCREASES WITH DECREASING HEAD AND HIGHER GATE OPENINGS



PASSAGE BEHAVIOR DIFFERENCES BETWEEN SPECIES



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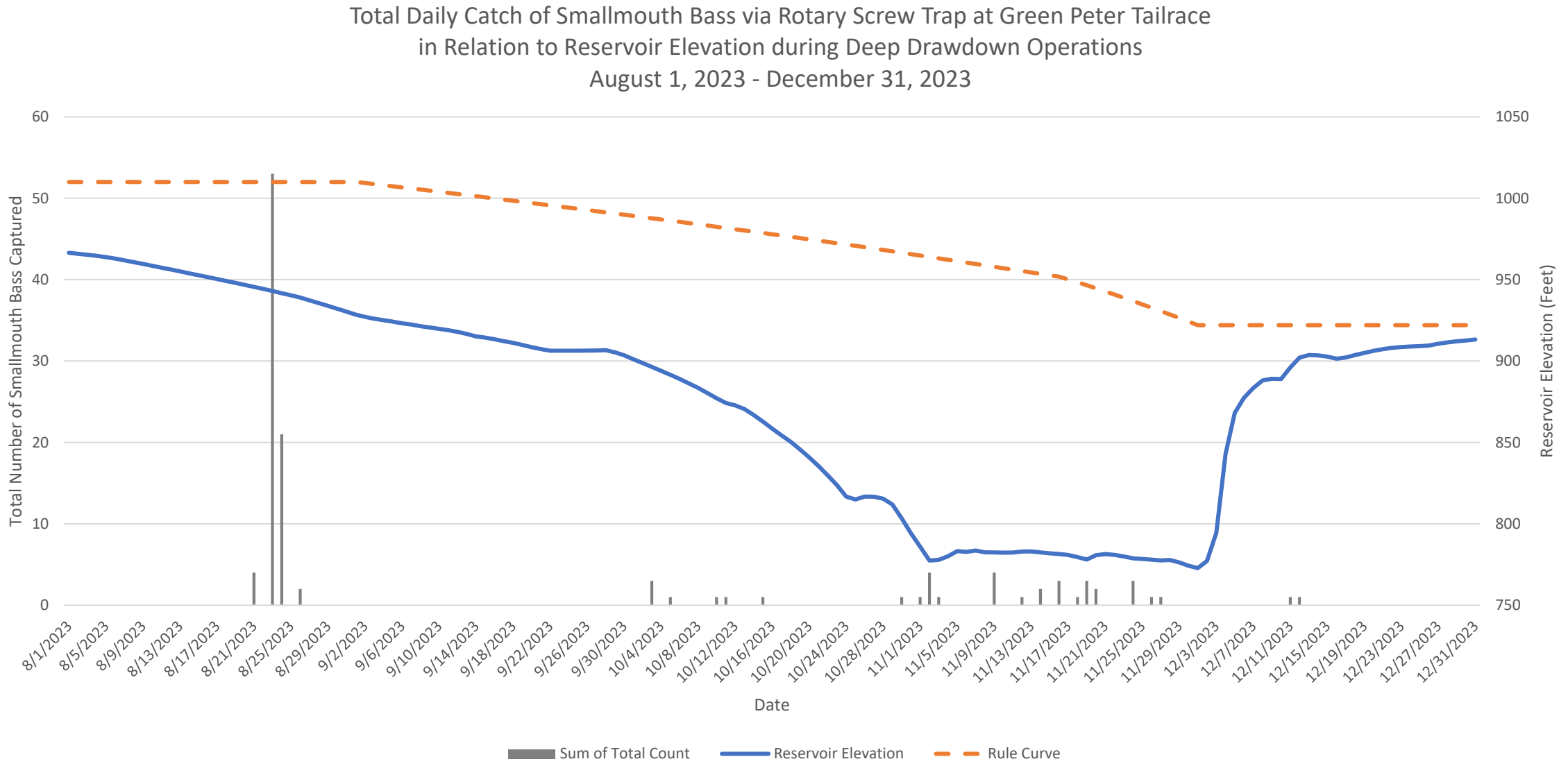

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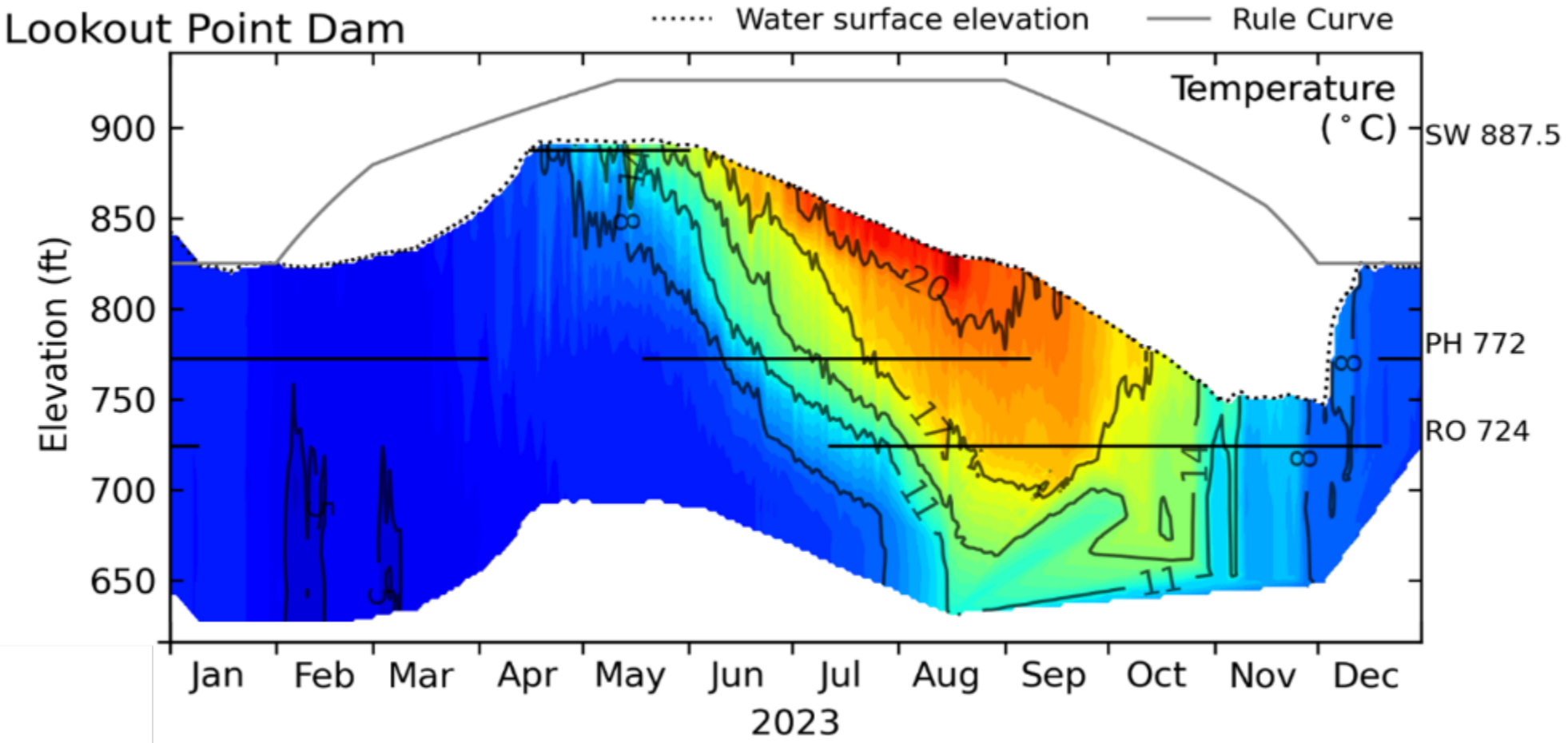
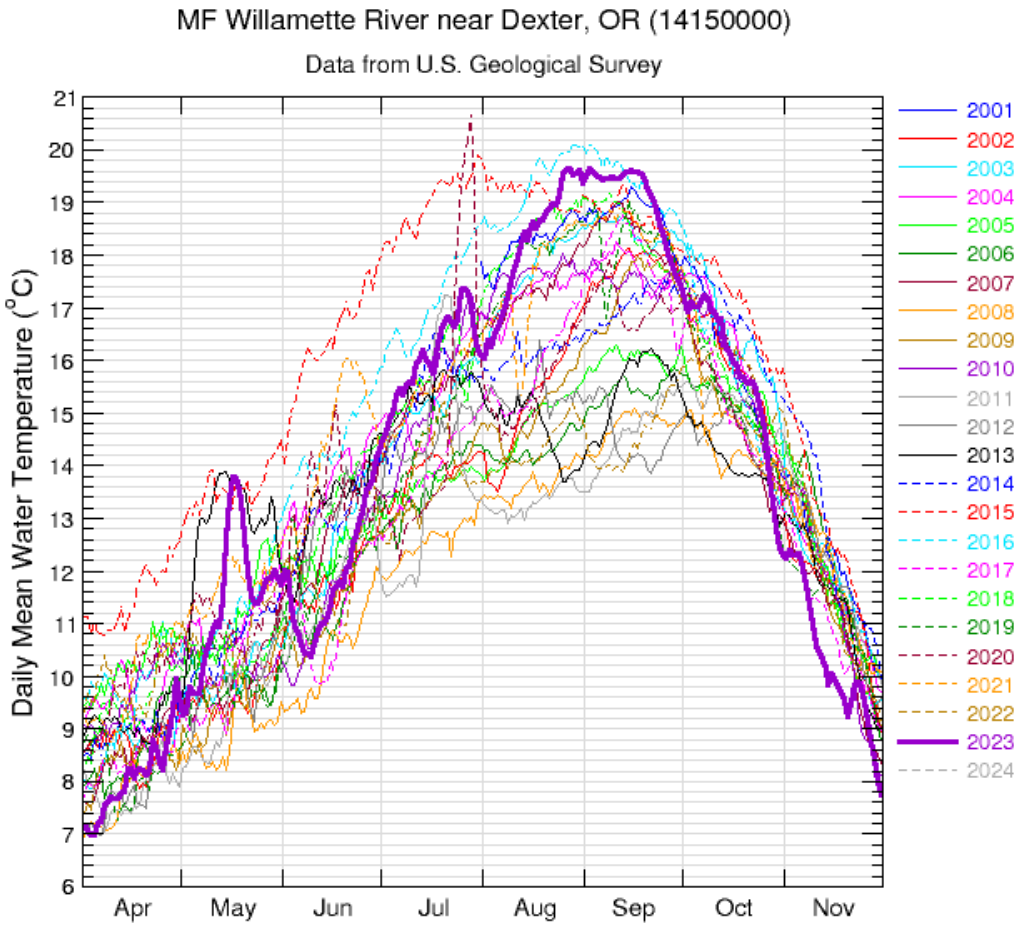
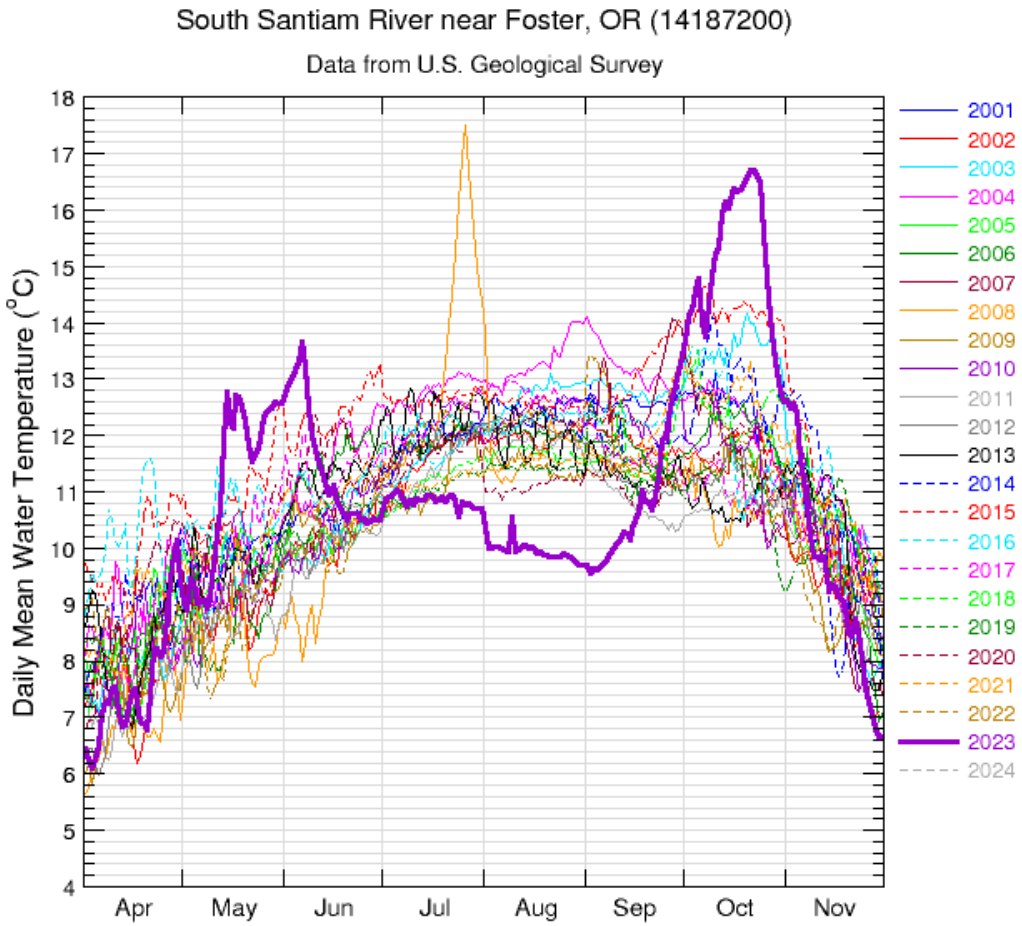
WATER QUALITY: TEMPERATURE AND SEDIMENT

WATER TEMPERATURES: IN-RESERVOIR TEMPERATURES ARE WARMER AND VOLUMES OF COLD WATER ARE EXHAUSTED QUICKLY (REARING IS A CONCERN)



WATER TEMPERATURES: DOWNSTREAM TEMPERATURES ARE WARMER AND IN SOME CASES ABOVE IMPORTANT THRESHOLDS





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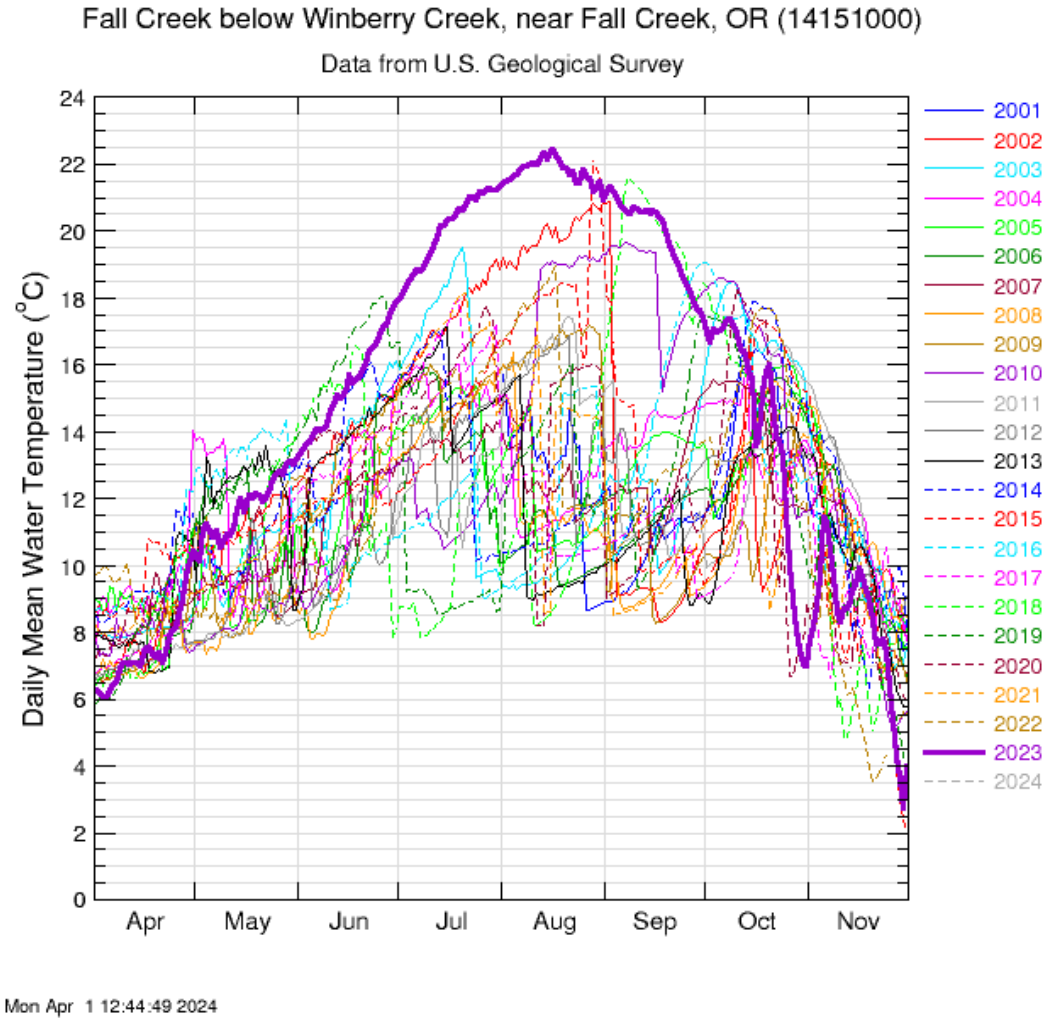
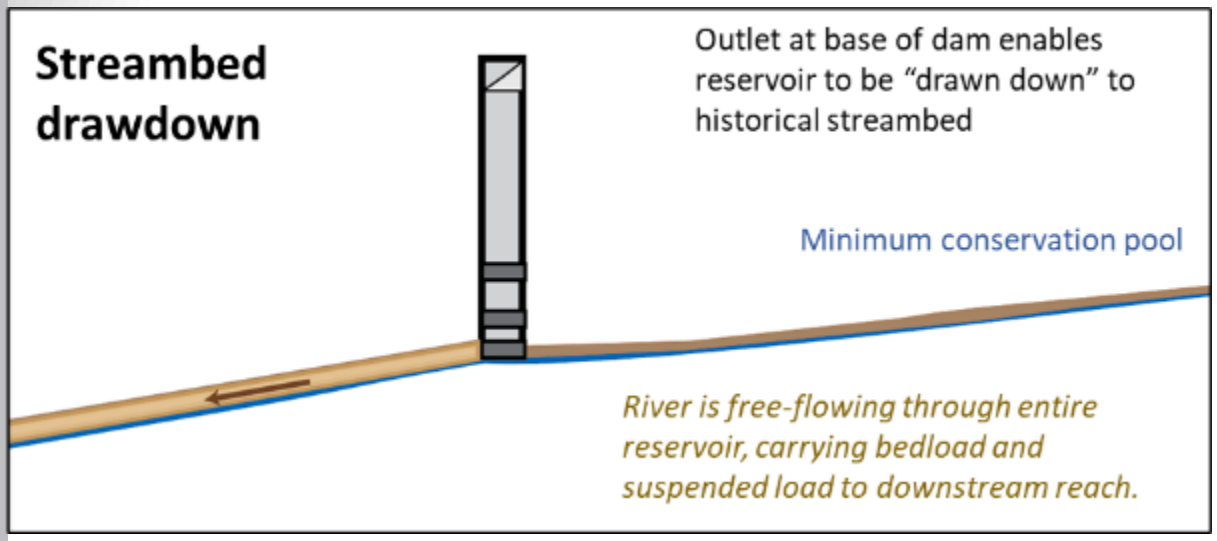
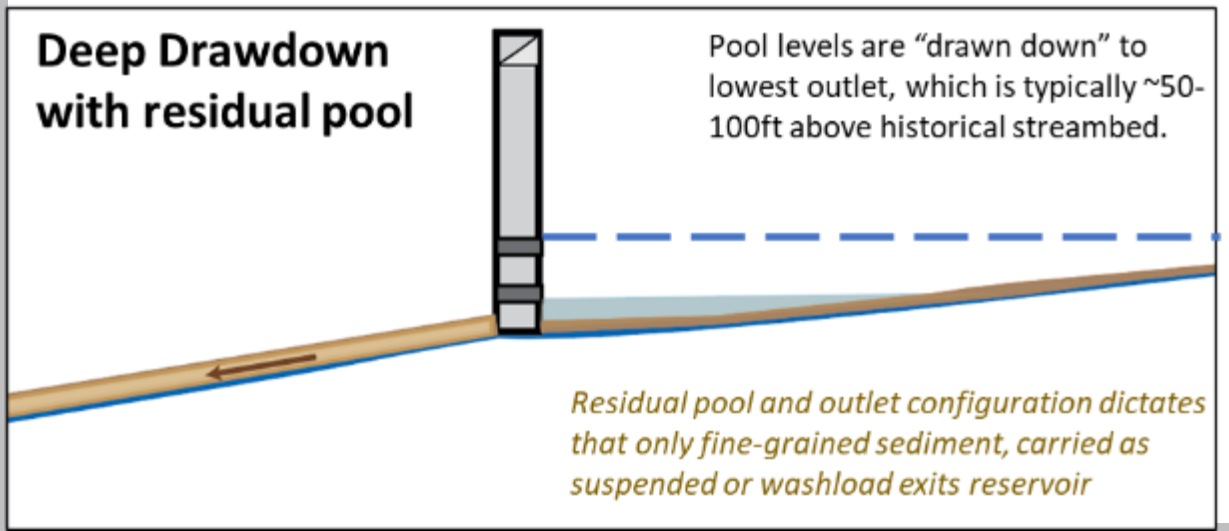


SEDIMENT – HIGH TURBIDITY, DIFFERENT SEDIMENT DEPOSITION AND REDUCTION OVER TIME





Schematic courtesy of USGS

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RESERVOIR COMPETITION AND PREDATION

RESERVOIR COMPETITION / PREDATION – FULL STREAM BED RESULTS IN CHANGES TO SPECIES COMPOSITION

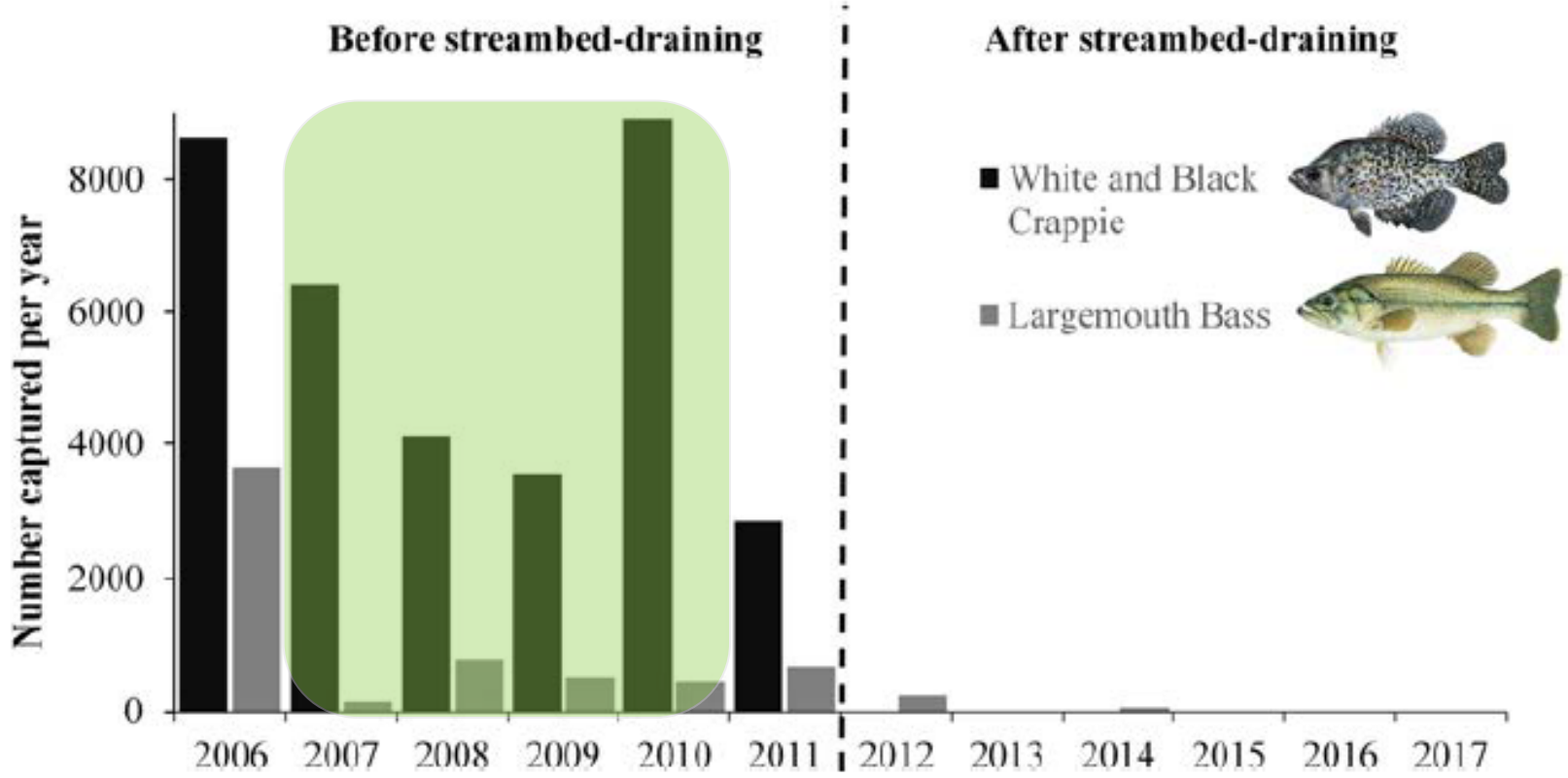
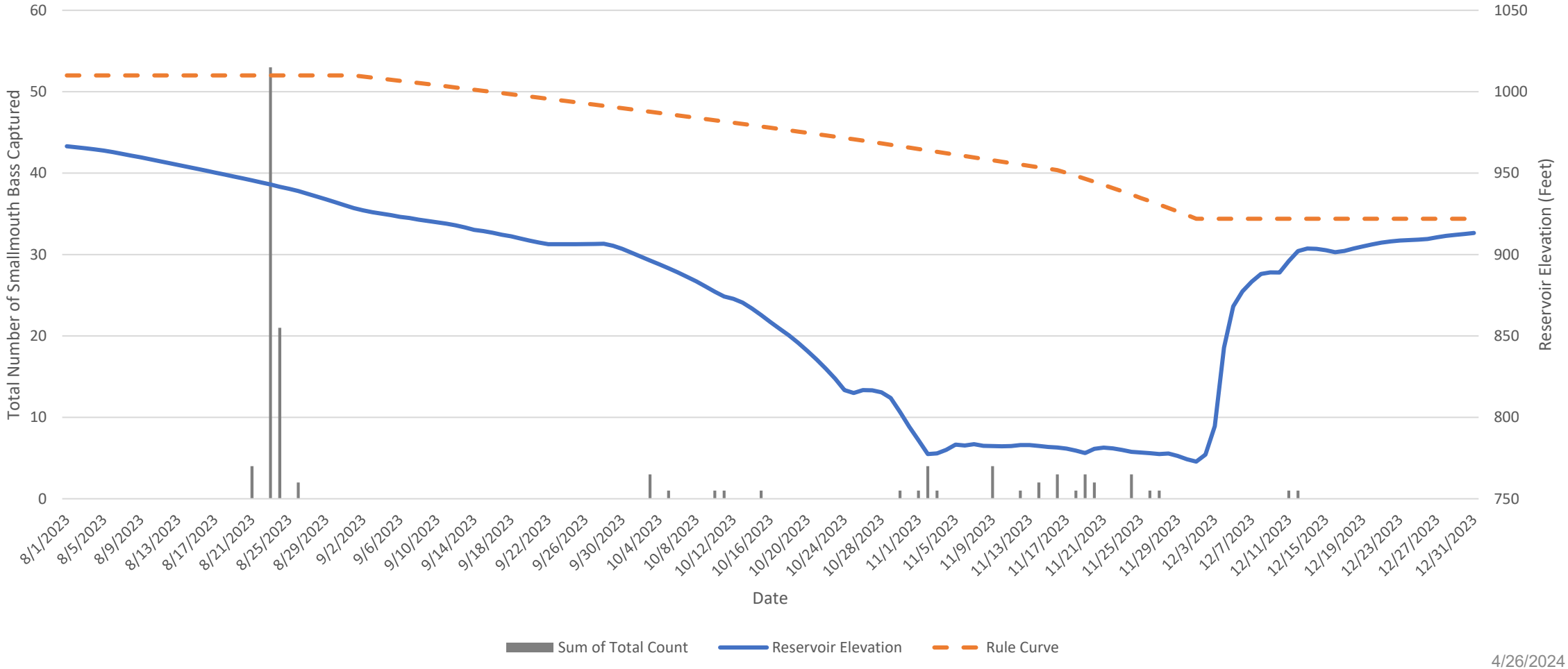


FIGURE 6 Total number of invasive piscivores captured in the screw trap below Fall Creek Reservoir by year before and after the initiation of reservoir draining to streambed events (dashed line). Fish images © Joseph R. Tomelleri, used with permission

RESERVOIR COMPETITION / PREDATION – PARTIAL RESERVOIR DRAWDOWN MAY NOT RESULT IN CHANGES TO SPECIES COMPOSITION

Total Daily Catch of Smallmouth Bass via Rotary Screw Trap at Green Peter Tailrace
in Relation to Reservoir Elevation during Deep Drawdown Operations
August 1, 2023 - December 31, 2023



SUMMARY

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Drawdowns are an important tool to sustain wild populations of Spring Chinook or Winter Steelhead in historic habitat above Dams (improve species status)

Drawdowns improve fish passage timing, efficiency, and survival

Full / streambed reservoir drawdowns can reduce/eliminate predation and competition. Partial reservoir drawdowns may or may not

Partial reservoir drawdowns have significant negative impact on in-reservoir and downstream water temperatures which need to be addressed to the greatest extent possible while still achieving downstream passage benefits

Sediment and turbidity associated with drawdowns will reduce in duration and magnitude over time, but is a significant issue for fish and people