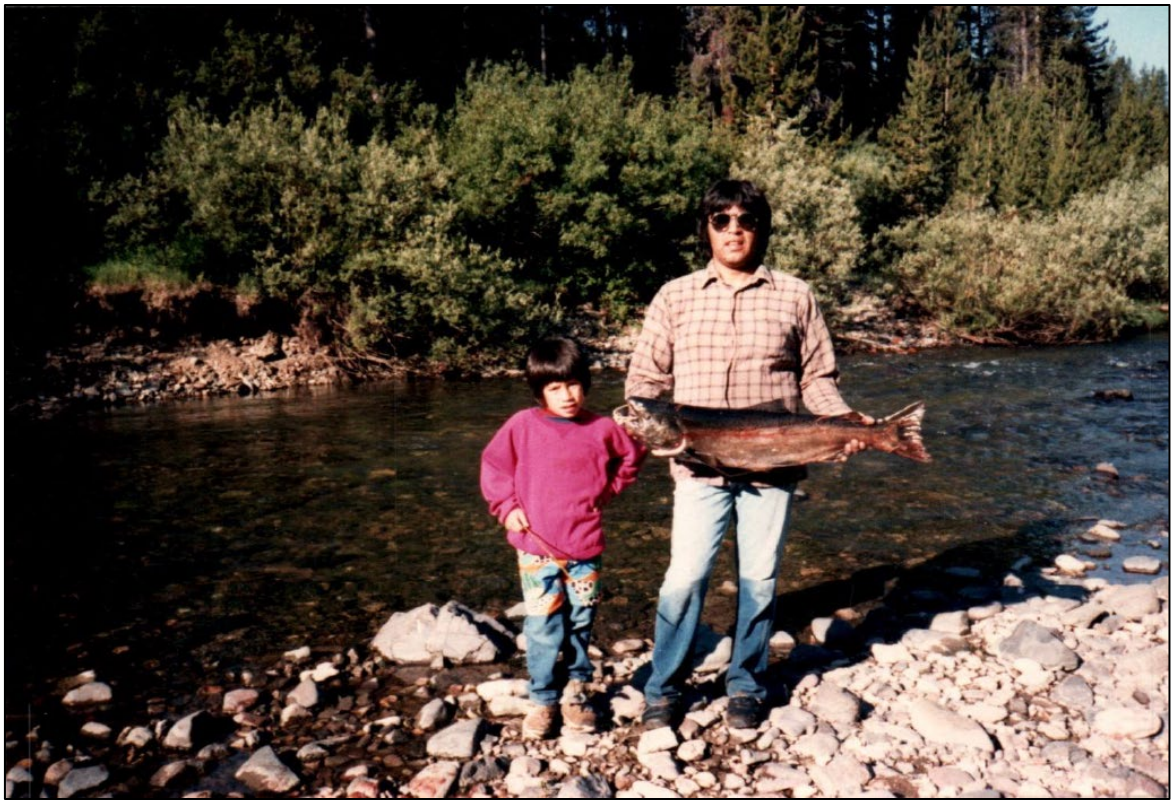
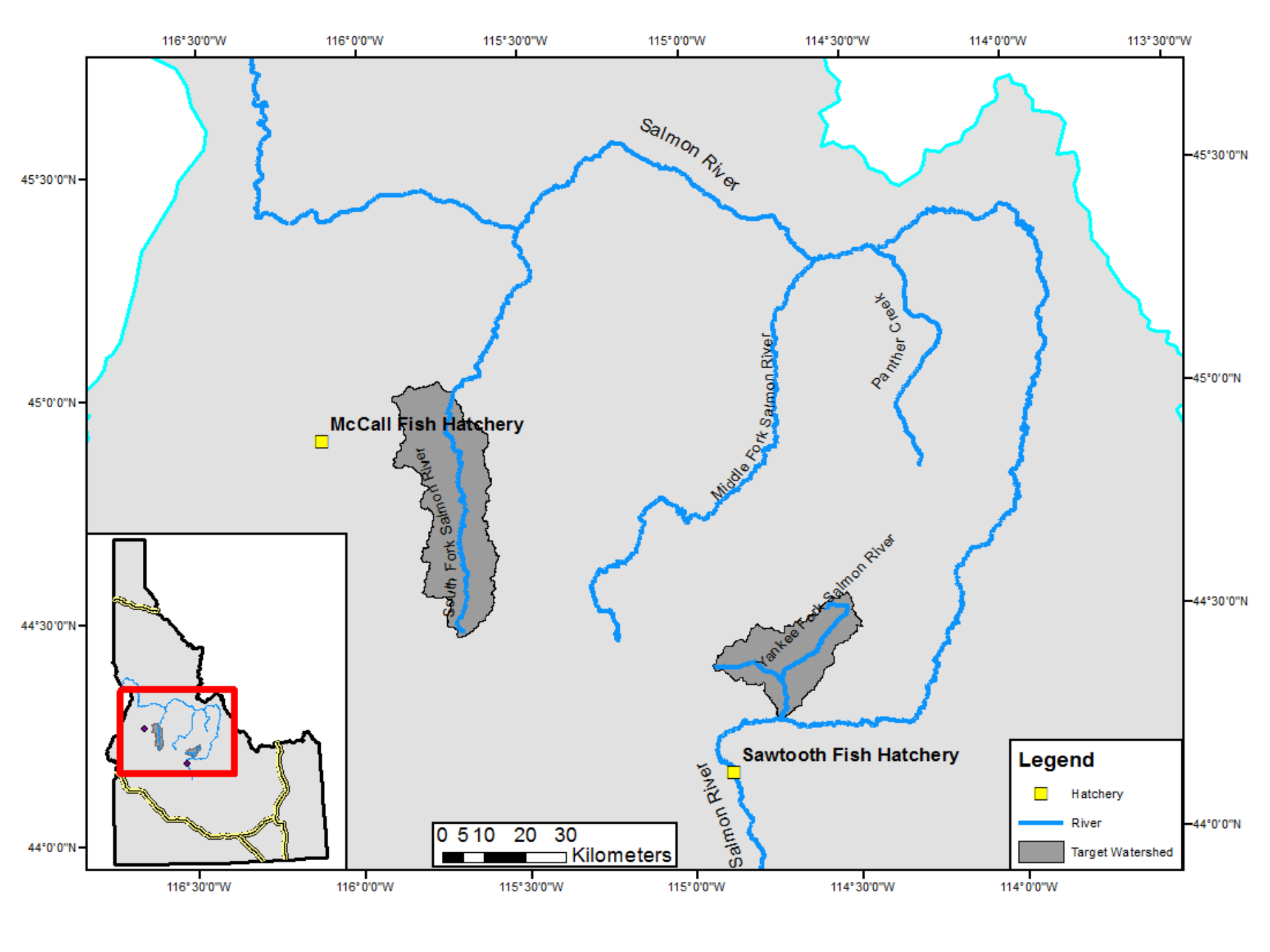
Yankee Fork Salmon River Chinook Program



Lytle Denny

2022 Lower Snake River Compensation Plan
Spring/Summer Chinook Symposium
December 14, 2022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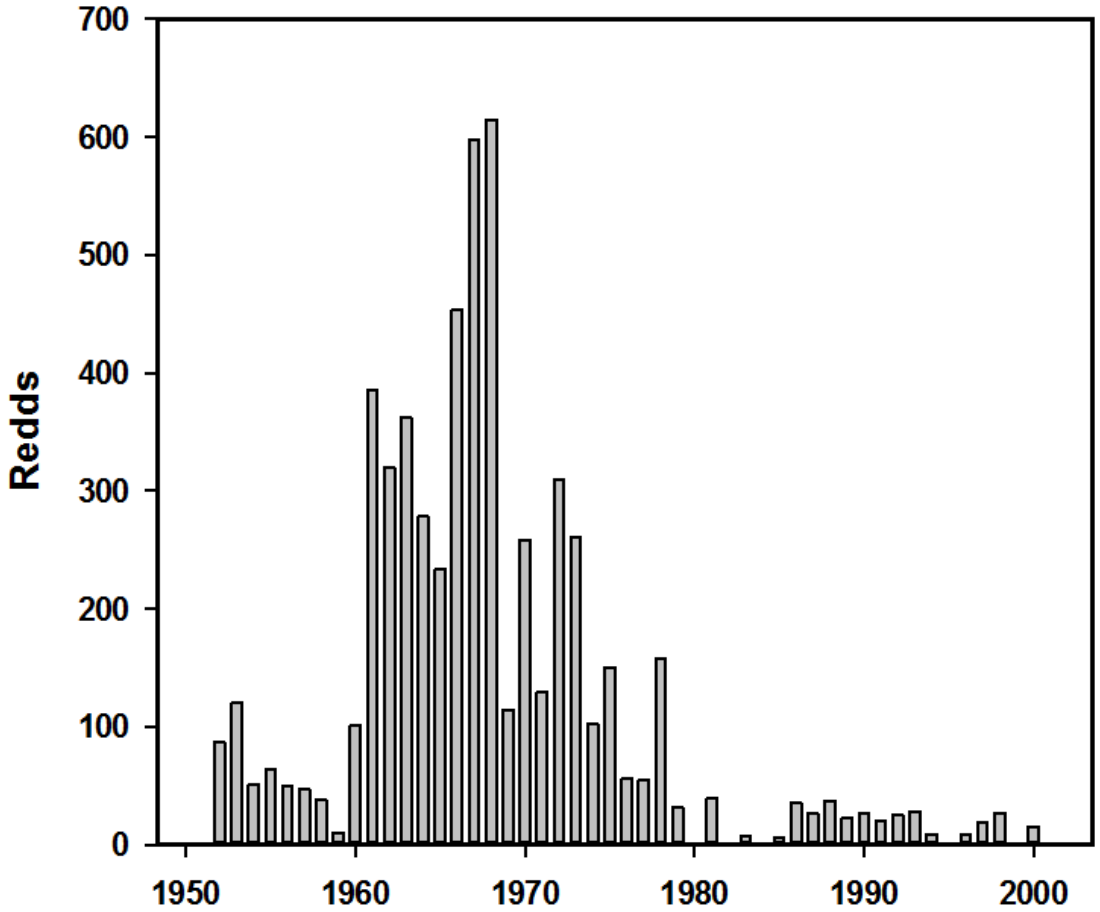
Salmon River
Middle Fork Salmon River
Panther Creek
South Fork Salmon River
Yankee Fork Salmon River
McCall Fish Hatchery
Sawtooth Fish Hatchery
Salmon River
0 5 10 20 30
Kilometers
Legend
Hatchery
River
Target Watershed

History

Shoshone-Bannock Fishery

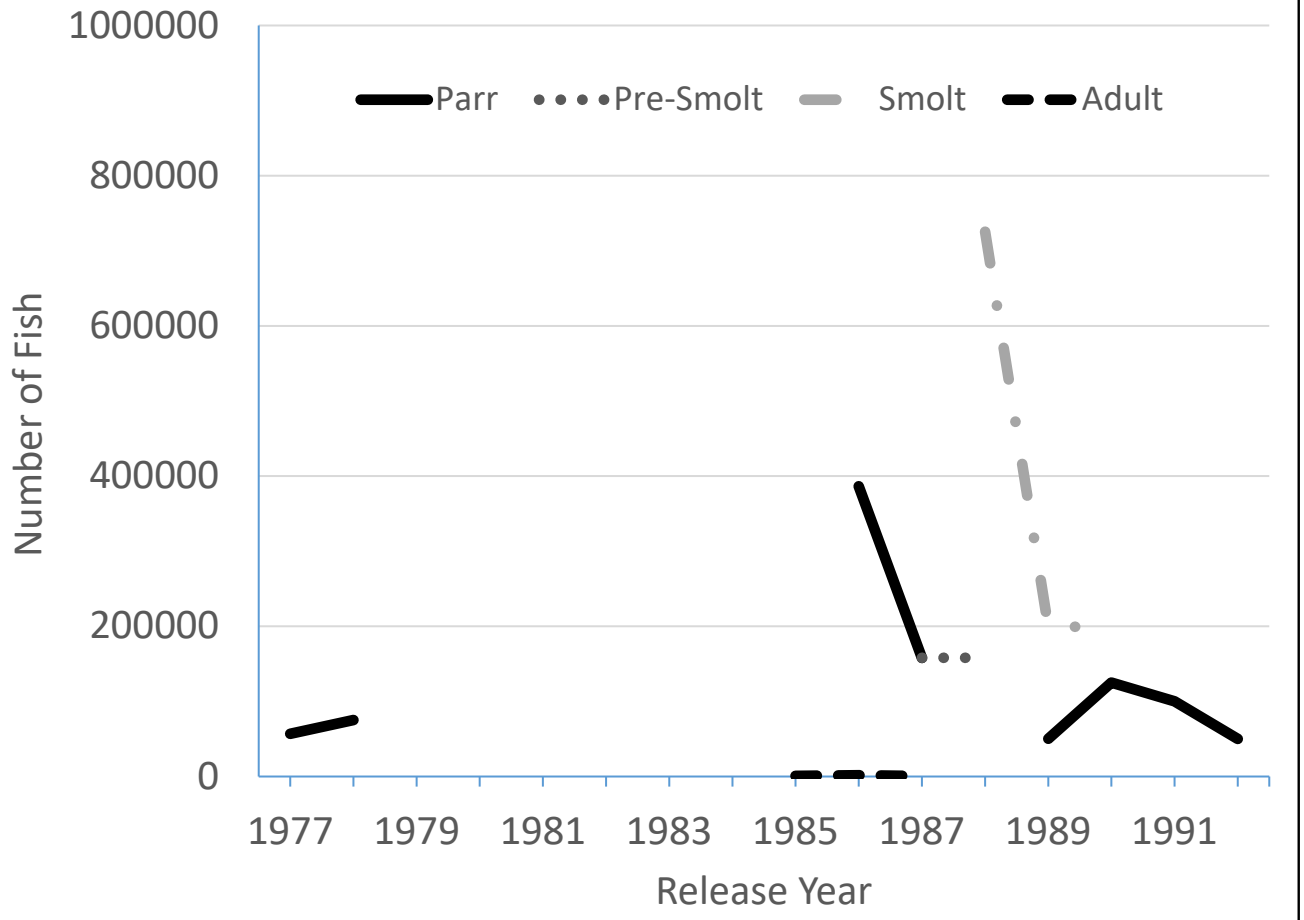
History

Abundance and Restoration



History

Artificial Propagation



- Multiple Releases of Various Life Stages
  - Parr – 1.0 million
  - Pre-Smolt – 807k
  - Smolt – 1.12 million
  - Adults – 2,886
- Multiple Stocks Released
  - Upper Salmon
  - Rapid River
  - Pahsimeroi
- Inconsistent

Background

Sawtooth Fish Hatchery

- Original Release Targets
  - Sawtooth 1.3 m
  - East Fork 0.7 m
  - Valley Creek 0.3 m
  - **Totals** **2.3 million**

- Sawtooth Fish Hatchery was constructed in 1985
- A satellite facility was also constructed on the East Fork Salmon River as part of this program
- Goal – 19,445 adults
- Objective – Rear and release ~2.3 million sp/su Chinook smolts
- No facilities were developed for Valley Creek
- East Fork component was terminated in 1998
- Harvest opportunities for the program have mostly limited to the mainstem Salmon River

Background

How a program in Yankee Fork came to be…

- The Shoshone-Bannock Tribes desire salmon fisheries in tributary habitats where the traditional practice of spear fishing is used

- Our aim is to help spread the benefits of Sawtooth, as originally planned
- We pushed for Yankee Fork as a surrogate for Valley Creek
- Program planning occurred from 2004 – 2007
- Smolts were released in 2006 but program planning was still ongoing
- Full implementation began in 2008

Yankee Fork Chinook

Goals and Objectives

- **Adult Goal** - Return 2,610 adult Chinook salmon to Yankee Fork
- **Objectives**
  - **Cultural**

    Operate production in a manner that ensures Tribal members are able to hunt and procure salmon using traditional methods
  - **Conservation**

    Contribute adults for natural spawning in Yankee Fork consistent with management for a “contributing” population
  - **Harvest**

    Provide a productive salmon fishery for Tribal and sport fisherman in the upper Salmon River
  - **Broodstock and Production**

    Collect broodstock to meet production strategy of releasing 300,000 smolts annually

General Approach

Broodstock Collection

- Broodstock is currently sourced from the upper Salmon segregated hatchery stock at Sawtooth FH
- Yankee Fork release group is raised at Sawtooth FH following standardized protocols (see Annual Operating Plan)

General Approach

Juvenile Rearing

- **Conducted at Sawtooth FH**
  - Eggs are incubated in heath trays
  - Swim-up fry are reared in vats inside the hatchery
  - Parr are transferred to outside rearing and final rearing is conducted outside in concrete raceways
  - Juveniles are overwintered and released as a full-term smolt the following spring

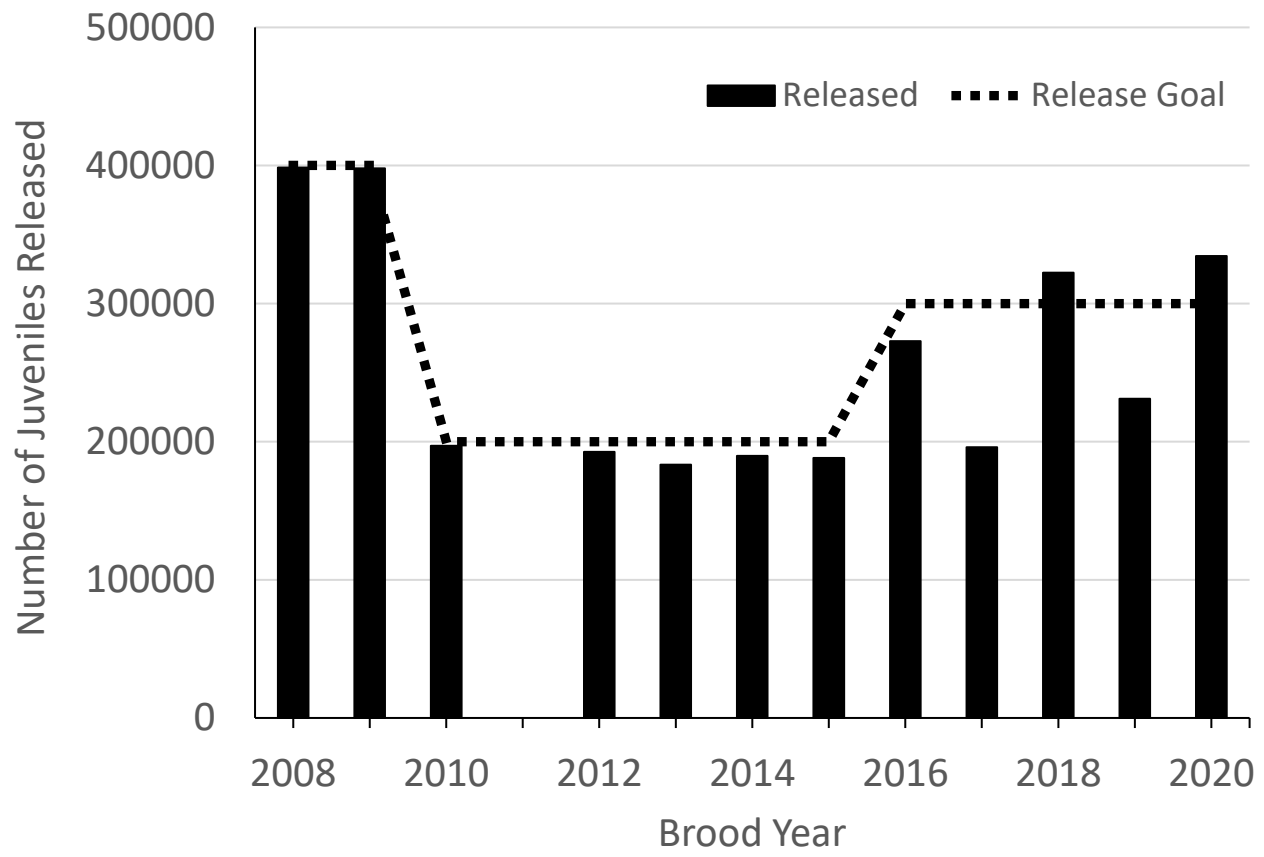
General Approach

Smolt Releases

- Smolts are crowded and pumped into a large tanker truck filled with well water
- Transported to Yankee Fork, which is located ~26 miles downriver
- Direct release into mainstem Yankee Fork or side-channel pond habitat

Numbers Released Annually

Smolt Releases



- Release objective has changed over time
  - Initially set at 400k, then dropped to 200k, then up to 300k (2 raceways)
- Insufficient adult returns in 2011
- Very close to meeting release objective in most years
- Yankee Fork smolts have two dedicated raceways at Sawtooth
- 8500 PIT tagged
- 100% PBT as of BY 2012

Release Dates

Smolt Releases

- Most releases occur in mid-to-late April
- The busy truck schedule largely dictates our release date
  - Generally accounts for environmental conditions and limitations
- Fish are generally released 15 km of confluence w/ Salmon River

Brood Year	Release Year	April																												
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
2004	2006																														
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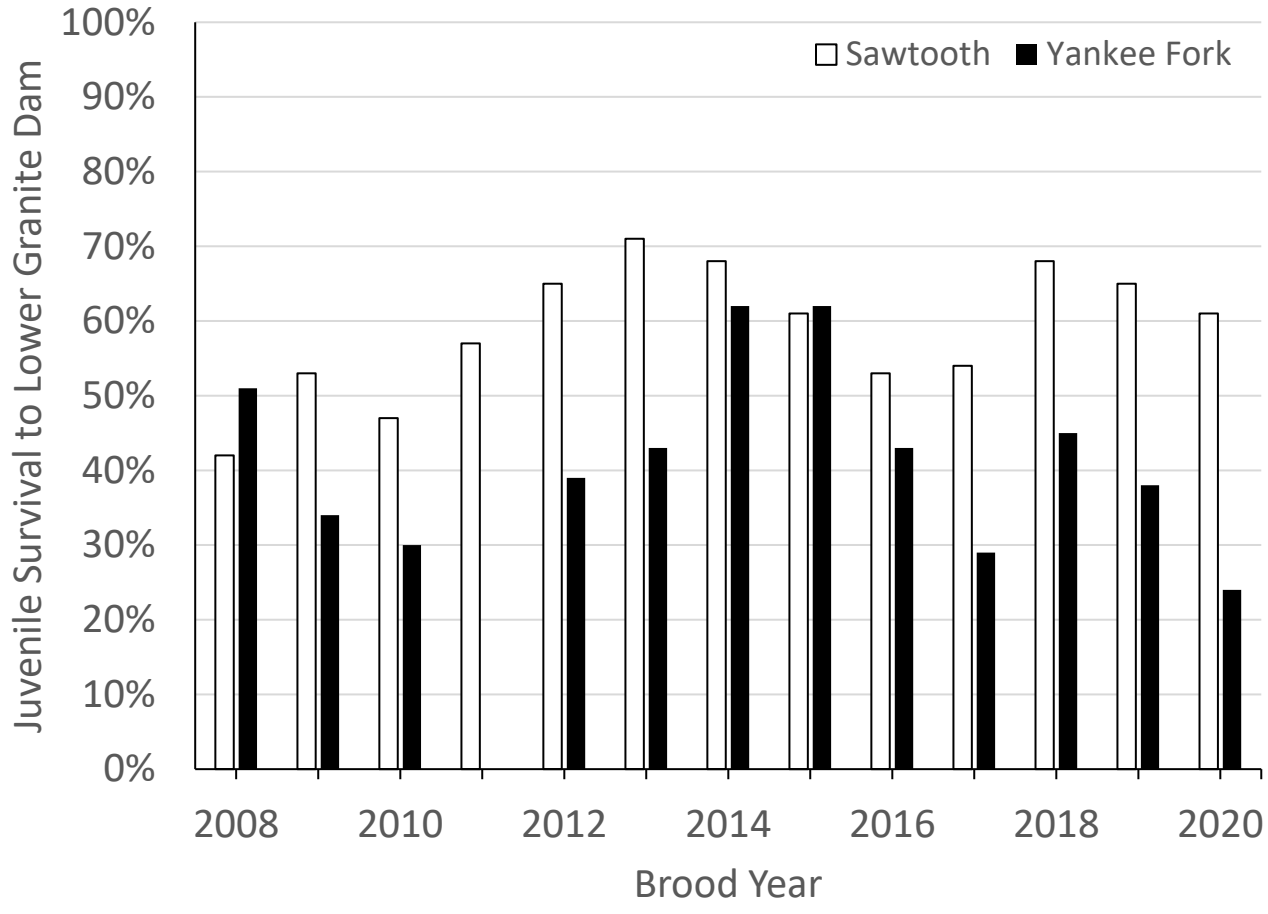
Smolt Survival to Lower Granite Dam

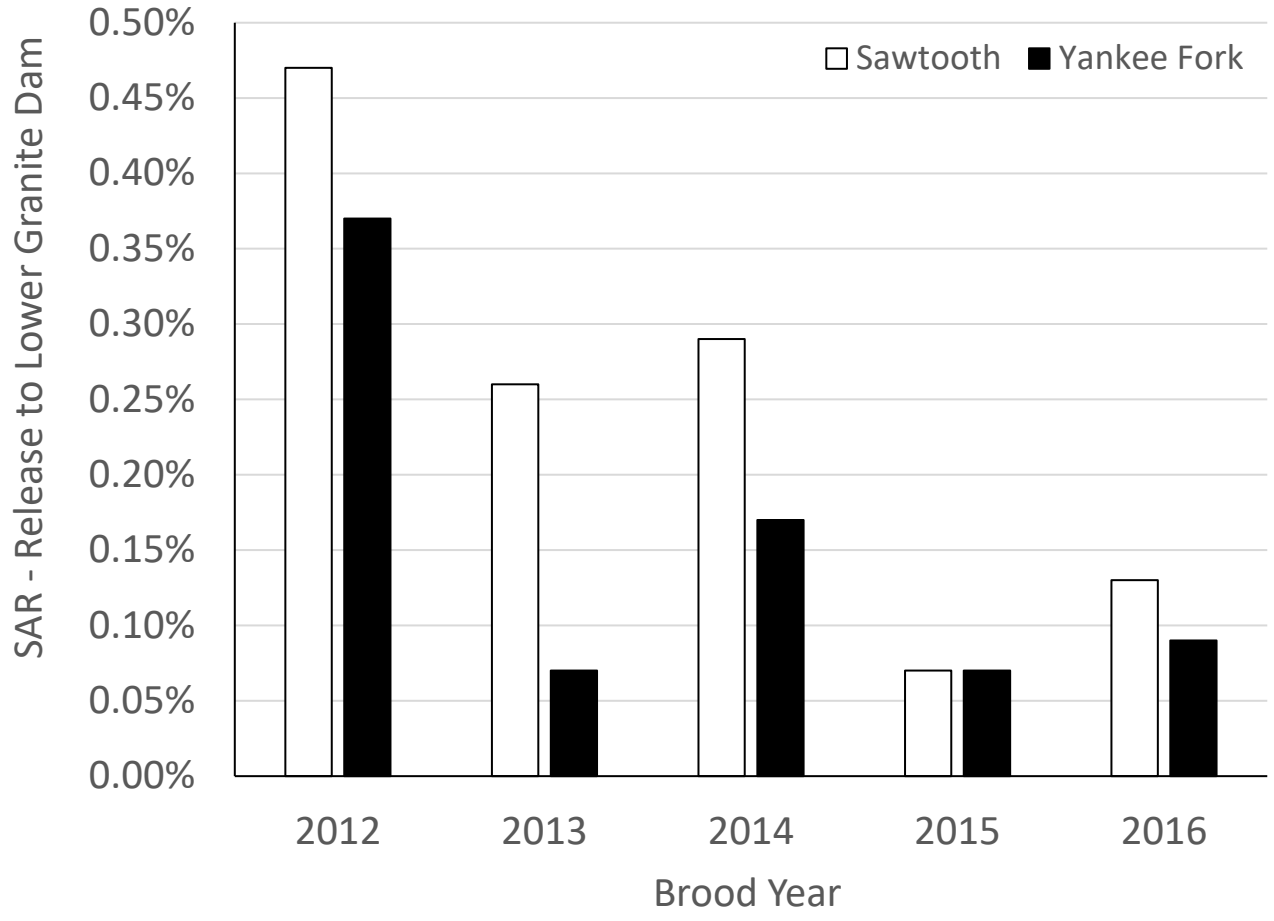
Juvenile Fish Performance



- High of 62% for BY2014 & BY 2015
- Low of 24% BY 2020
- Yankee Fork Mean: 42%
- Sawtooth Mean: 59%
- Survival has been lower than Sawtooth ~ 85% of the time

Smolt-to-Adult Return at Lower Granite Dam

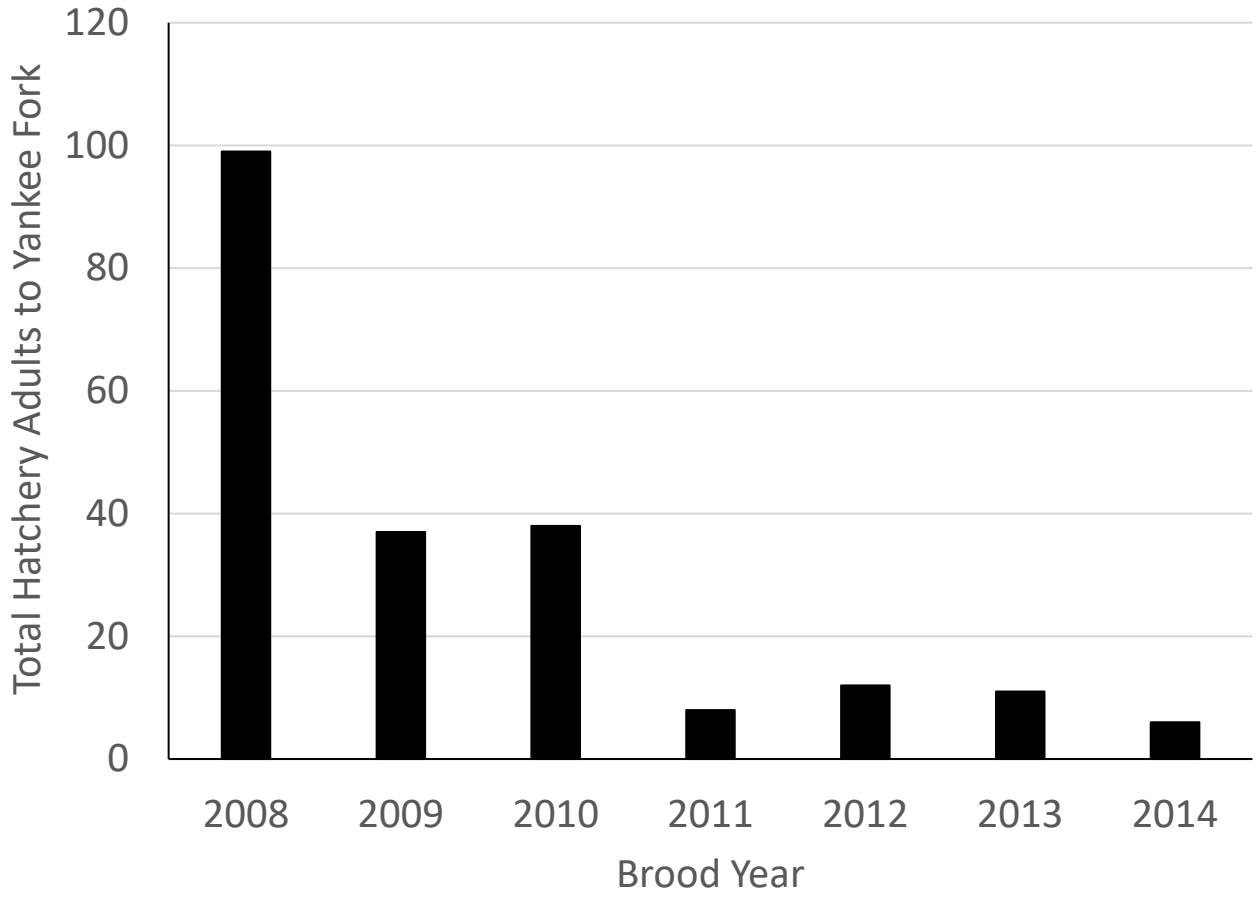
Adult Fish Performance



- Starting w/ BY 2012 we've been able to use PBT to estimate returns to LGD
- YF Mean: 0.16%
- Sawtooth Mean: 0.24%
- YF SARs have been lower than Sawtooth in most years and is generally decreasing
- BY 2015 was similarly low for both programs

Yankee Fork Trap

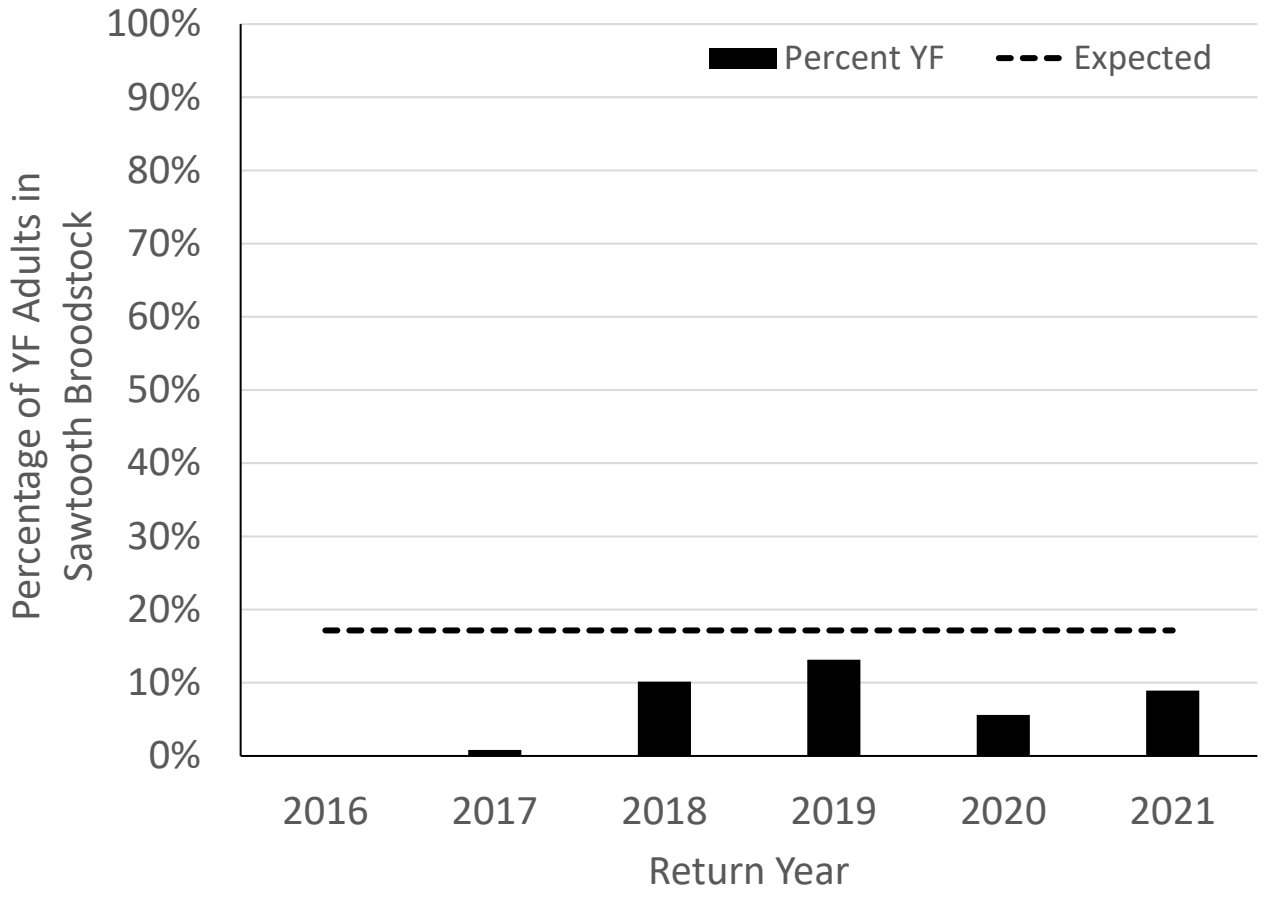
Adult Fish Performance



- Hatchery returns have been very low: ~30 adults/yr
- Returns have been insufficient for local broodstock collection
- Unable to meet harvest objectives in Yankee Fork
- Disappointed membership and employees
- Membership/families continue to be disconnected from harvesting salmon in their homelands

This has raised some ???

Are Yankee Fork releases going back to Sawtooth?



- Used PBT data to determine the proportion of YF adults that were used for broodstock at Sawtooth
- Annual broodstock needs at Sawtooth are about ~765 adults (range 586-966)
- If Yankee Fork adults are homing back to Sawtooth, we would expect <17% of the adults to be from YF releases
- No YF adults were detected in 2016, a high of 13% were detected in 2019
- Average has been 6.4%

This has raised some more ???

What's going on with the smolt releases?

- We know that rearing out-of-basin and release timing may affect homing fidelity
- We know that loading, transport and release are stressors that can affect post release performance
- To get at the latter, we conducted a study to look at stress physiology, acute mortality, smolt index, precocity, and downstream survival of smolt released into Yankee Fork
- The study was conducted in 2019 with BY 2017 Chinook salmon reared at Sawtooth Fish Hatchery

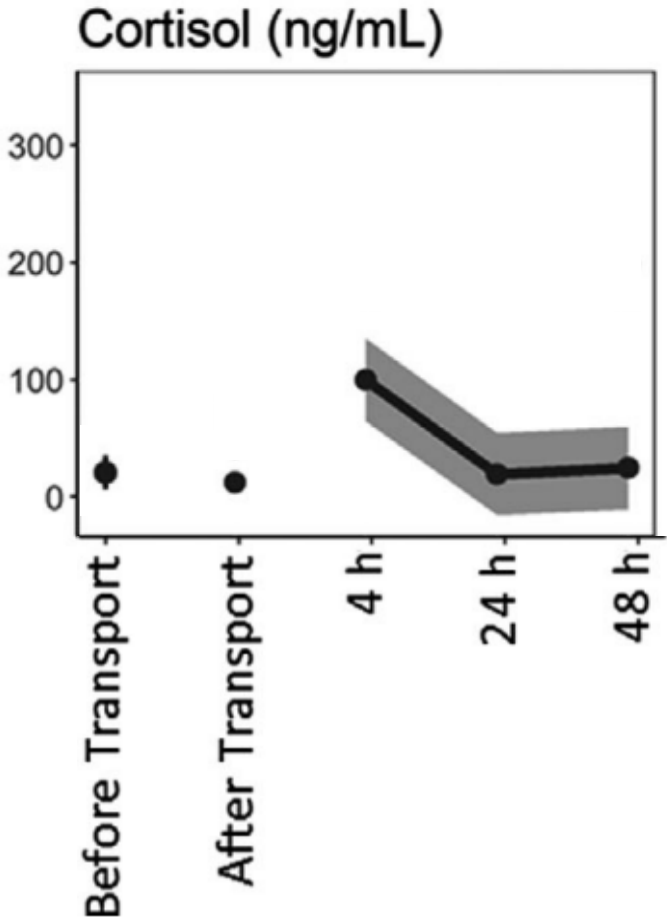
General Approach

- We wanted to look at the potential impacts that might be arising from fish being crowded, pumped and loaded, transported, and finally released into a foreign environment
- BY 2017 smolts were released on April 25, 2019
  - Smolt – 94,462
- Measured stress-related physiological parameters (before transport, after transport, 4h, 24h, & 48h after transport)
  - Plasma cortisol
  - Plasma glucose and Blood lactate
  - Hematocrit
  - Blood sodium (Na^+) and Blood chloride (Cl^-)
- Acute Mortality
- Smolt Index
- Sex and Precocity
- Downstream Survival

Results – Stress Physiology

Smolt Study

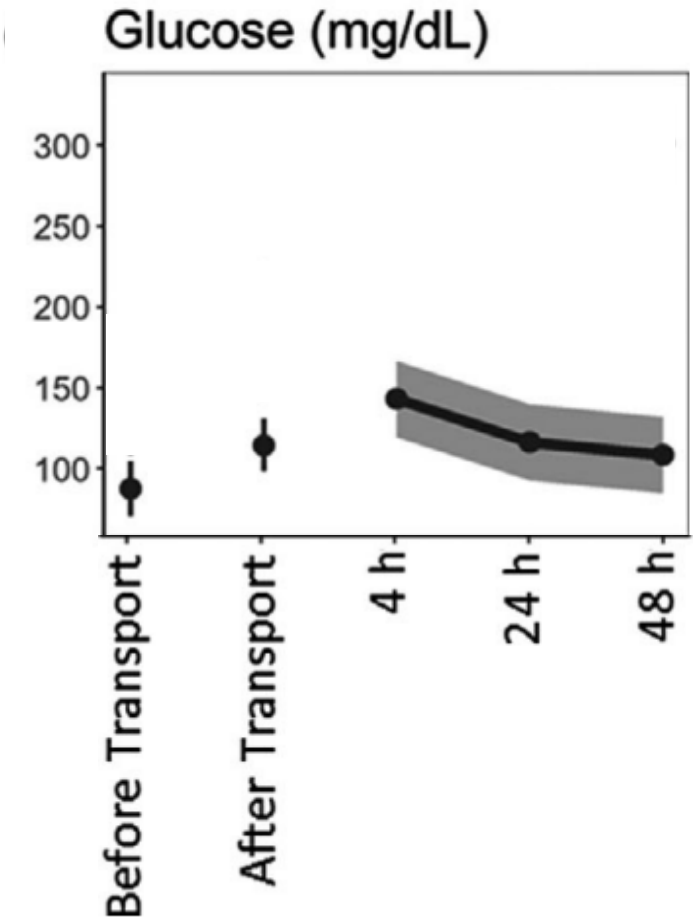
- Plasma cortisol is fight or flight response
- Cortisol levels spiked 4 hours after being transported/released
- After 24 hours, cortisol dropped to before transport levels and remained there



Results – Stress Physiology

Smolt Study

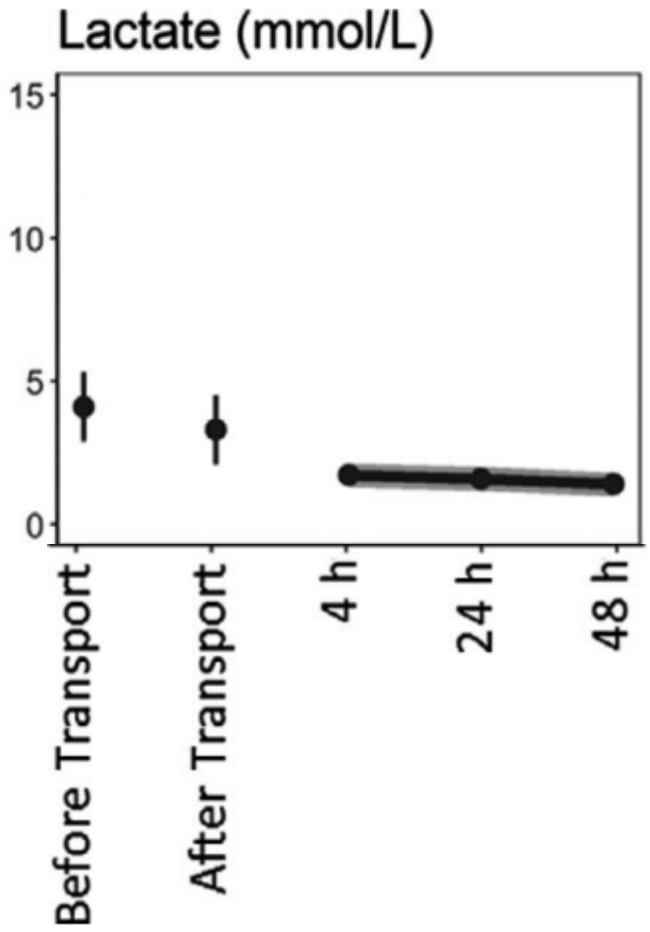
- Plasma glucose is a secondary stress response of energy mobilization
- Glucose levels increased after transport
- Were 63% higher at 4 hours post-transport, but decreased after that



Results – Stress Physiology

Smolt Study

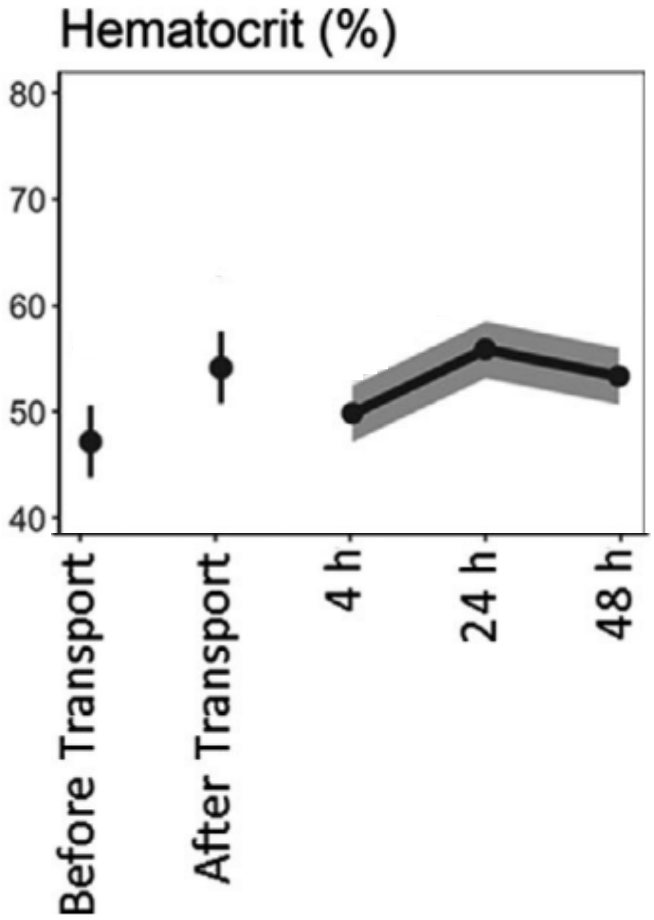
- Blood lactate is a secondary stress response of energy mobilization
- Lactate decreased after release, then stabilized



Results – Stress Physiology

Smolt Study

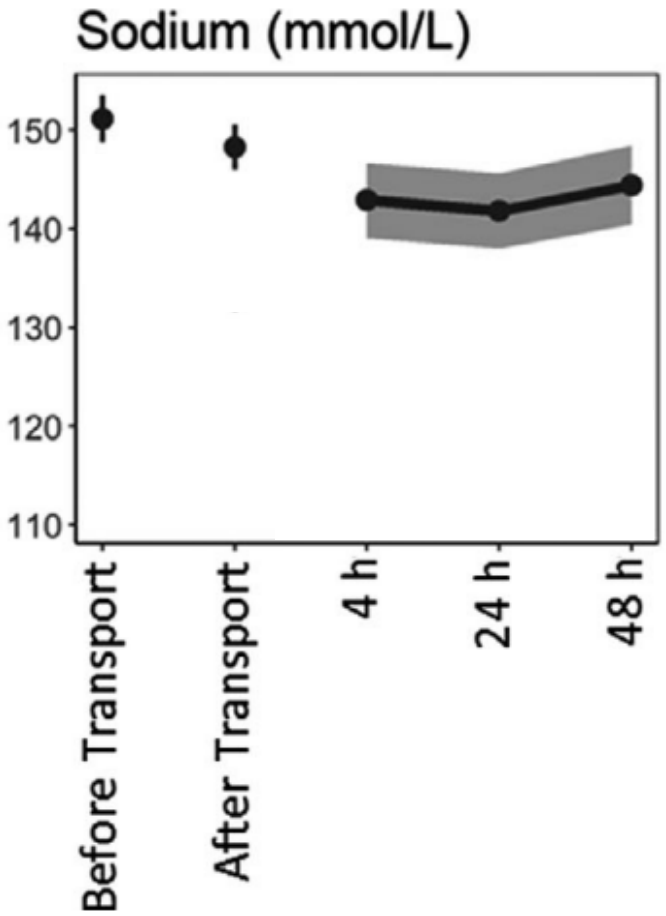
- Hematocrit reflects swelling in blood cell size
- Reached its highest measured concentration at 24 h post release
- Levels were 18% higher at 24 h post release as compared to before transport



Results – Stress Physiology

Smolt Study

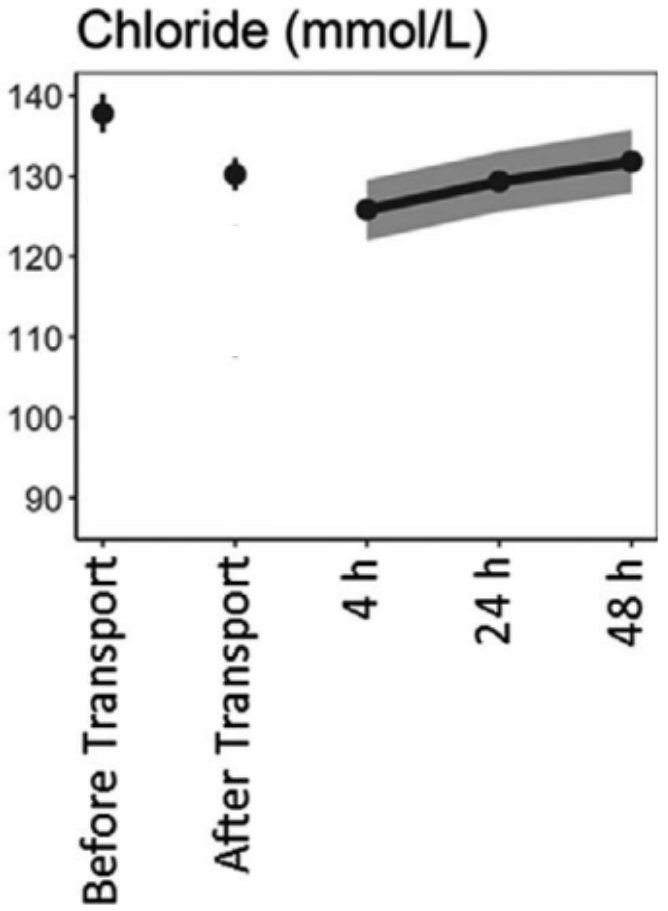
- Blood sodium (Na^+) reflects plasma ion homeostasis
- Dropped after transport and remained lower than pre-transport levels at all measurement intervals



Results – Stress Physiology

Smolt Study

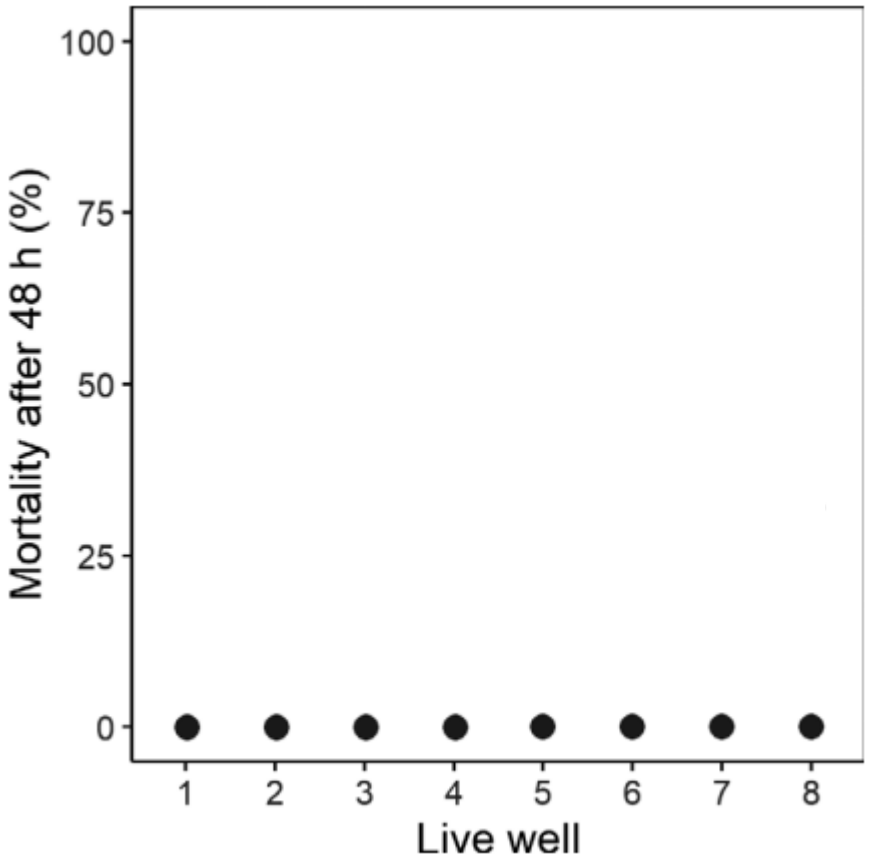
- Blood chloride (Cl^-) reflects plasma ion homeostasis
- Decreased after transport and remained depressed at 48 h



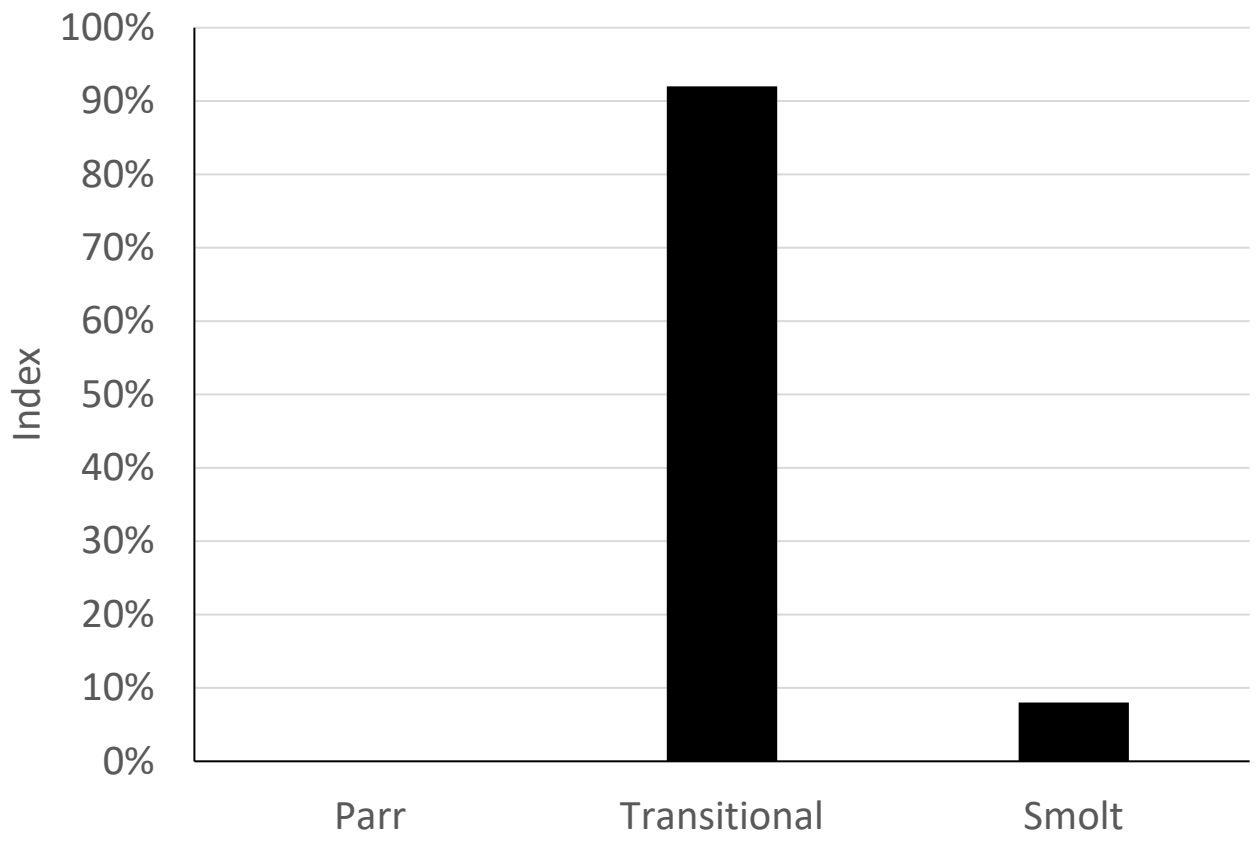
Results – Acute Mortality

Smolt Study

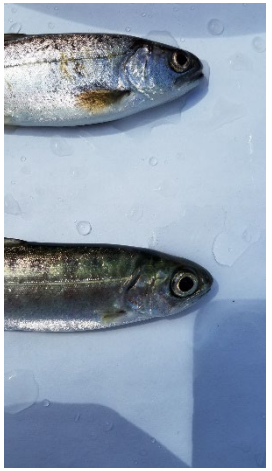
- We observed no mortality in any of our live wells



Results – Smolt Index



- 100 fish were visually inspected
  - 8% received a smolt index
  - 92% received a transitional index
  - No fish were classified at parr

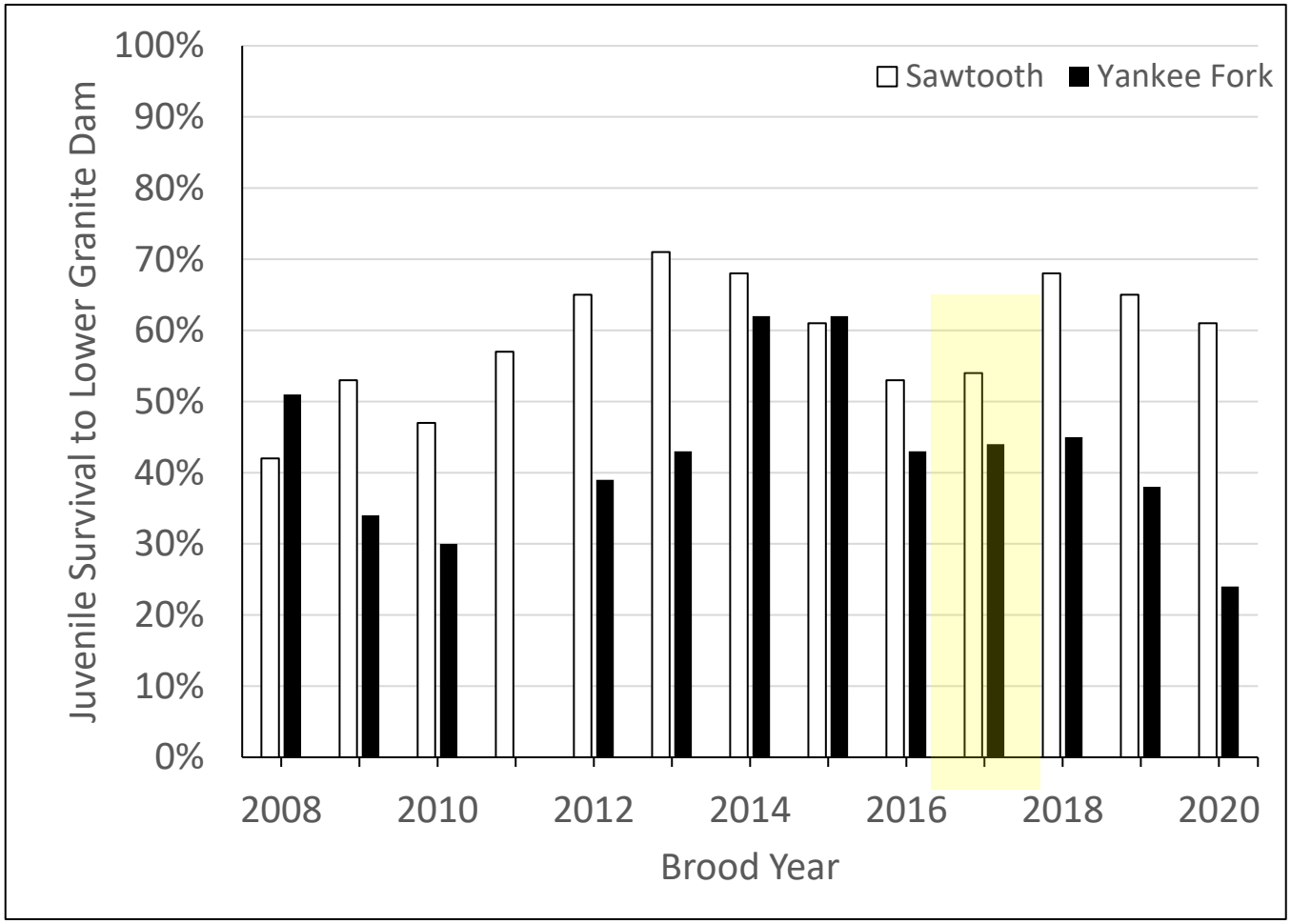


Results – Sex and Precocity

- 100 fish were visually inspected
- 45% were males, 55% females
- Visual assessments of testes morphology indicated that 40% of the males initiated maturation as an age-2 mini-jack

Results - Survival

Smolt Study



- Survival 44 ±2%
- *n*=1,267 PIT tag detections

Conclusions

- Sawtooth reared smolts released into Yankee Fork displayed signs of stress following release.
  - Cortisol peaked 24 h after release
  - Plasma glucose remained low but did increase after release
  - Plasma lactate decreased after release and may be reflective of mobilization and exhaustion of lactate levels following transport
  - Hematocrit levels were higher post release and may be indicative of cell hypertrophy, which can lead to hemolysis and eventual loss of O_2 carrying capacity and asphyxiation
- Taken together, these physiological measurements indicate a stress response that maybe decreasing survival
- We didn't observe acute morality, but physiological stressors may have delayed impacts, which could result in lower survival
- Similar survival to Lower Granite Dam as that of previous years' releases, but typically lower than fish released on-station at Sawtooth

Adaptive Management

Recommendations

- Our study brings to light the importance of understanding the potential trade-offs that arise from releasing fish off-station, and how this potentially impacts survival and the effectiveness of the program.
- If we want to reduce the impacts associated with trucking and transporting smolts to Yankee Fork, we need a controlled environment in Yankee Fork.
- Although this study did not specifically address homing fidelity, it helped us understand why adults might not be returning to Yankee Fork. In fact, 92% of the smolts we released were in the transitional phase, indicating they were already fully undergoing smoltification on upper Salmon water.
- If we are too improve homing fidelity we need to be able to release smolts into Yankee Fork prior to the transitional phase.
- Taken together, efforts are underway to design an acclimation facility in Yankee Fork.

Acknowledgements

- Shoshone-Bannock Tribes
  - Fish and Wildlife Department
- USFWS– Lower Snake River Compensation Plan Program
- Idaho Department of Fish and Game
  - Sawtooth Fish Hatchery
- Bonneville Power Administration
- U.S. Forest Service
  - Salmon-Challis National Forest
- NOAA-Fisheries

Questions