



# The Evolution and Practicality of Fish Passage Standards at High-Head Dams

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WA-BC AFS 2019

# The Overview Slide

- Past
  - Salmon Mitigation
  - Hydro, Smolt Passage, and Assessment
- Present
  - FERC Licenses, BiOps, and Research
- Future
  - Improving passage and understanding shortcomings

SK 361 A2 S7 no.55  
A report upon the Grand Coulee



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UNITED STATES  
DEPARTMENT OF THE INTERIOR  
J. A. Krug, Secretary

FISH AND WILDLIFE SERVICE  
Albert M. Day, Director

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Special Scientific Report No. 55

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A REPORT UPON THE  
GRAND COULEE FISH-MAINTENANCE PROJECT 1939-1947

by

Frederic F. Fish  
and  
Mitchell G. Hanavan

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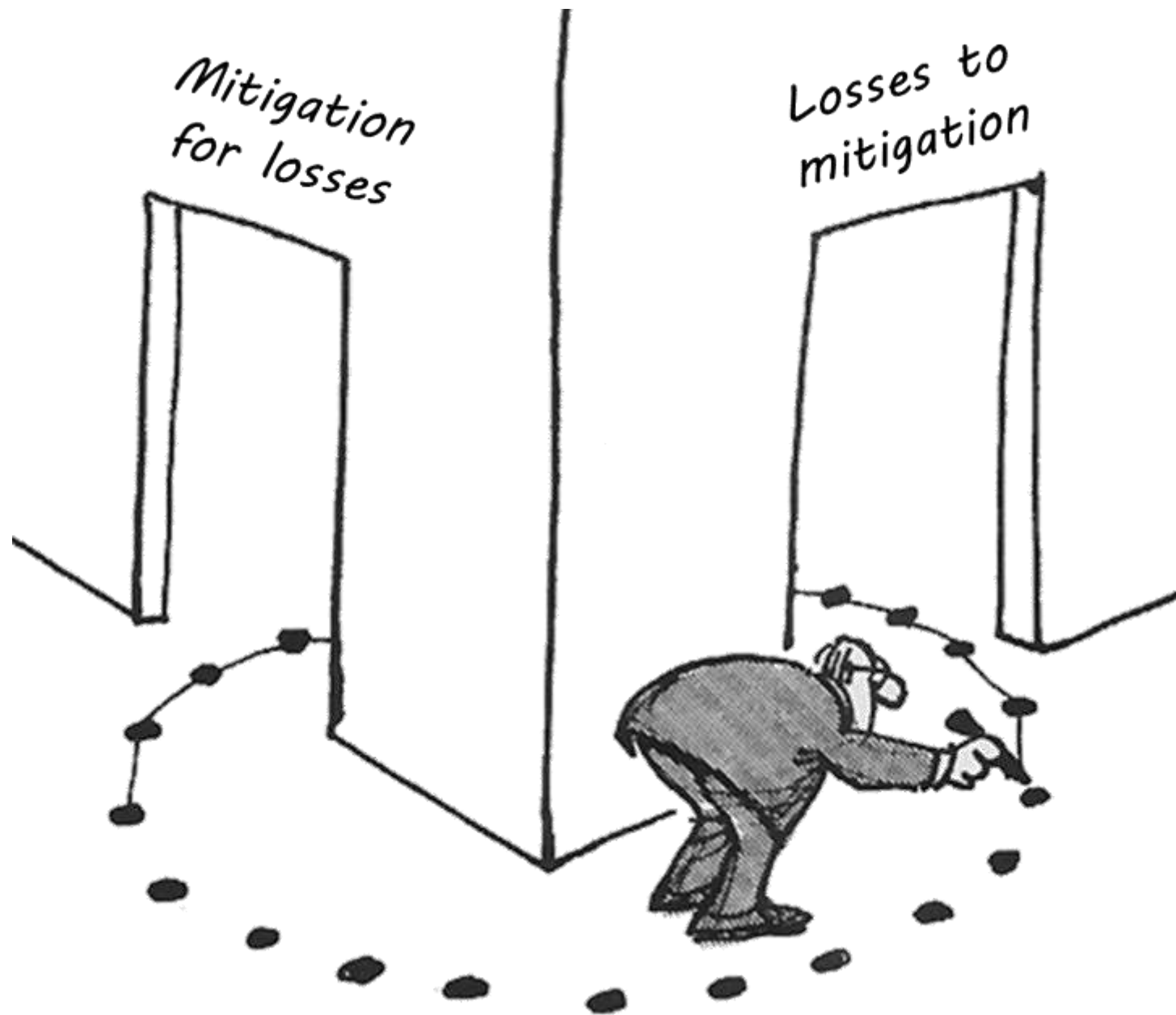
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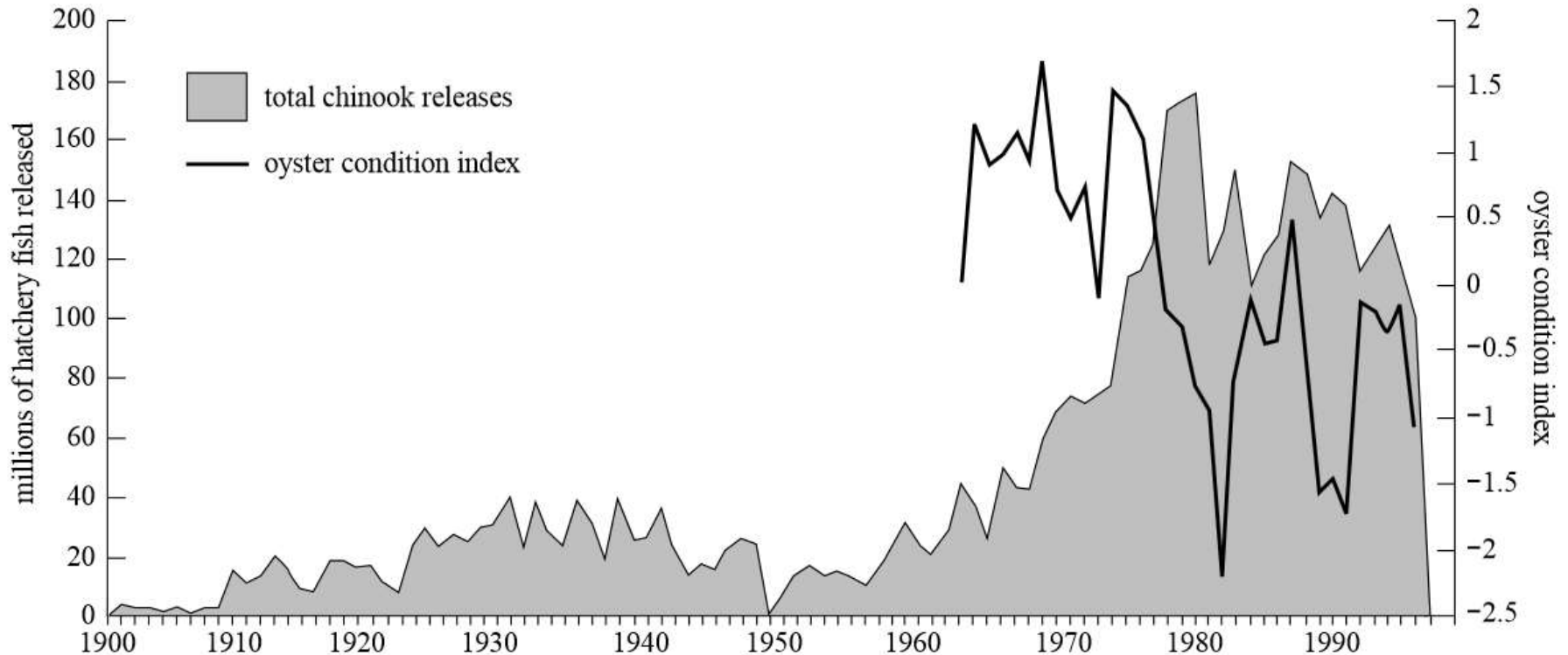
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### ABSTRACT

The construction of Grand Coulee Dam, on the upper Columbia River, involved the loss of 1,140 lineal miles of spawning and rearing stream to the production of anadromous fishes. The fact that the annual value of these fish runs to the nation was estimated at \$250,000 justified reasonable expenditures to assure their perpetuation. It



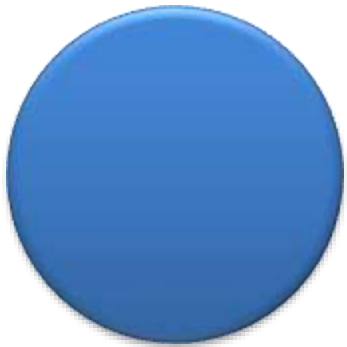
# Columbia River Hatchery Chinook



> 130 Hatcheries (plot from Levin et al. 2001)

# The “No Net Impact” Concept

Pre-project



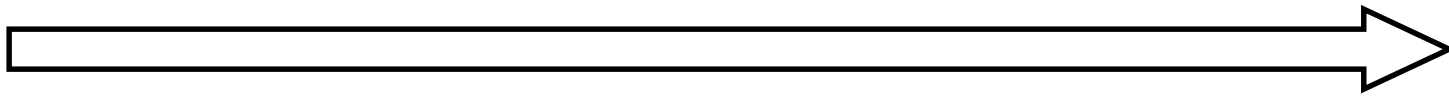
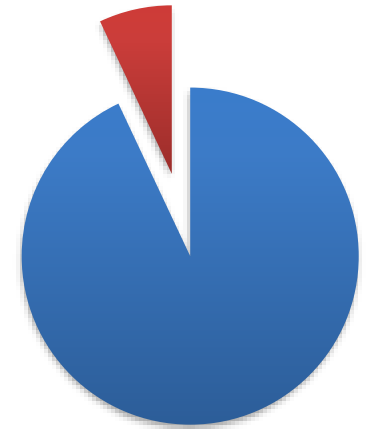
Unavoidable loss



Mitigation



Post-project



# Take-Home Points

1. Mitigation and survival should be parallel discussions



# Facilities & Assessments

## Fishways in the USA

Pawtuxet Falls Dam - 1880  
Great Falls Fishway - 1892  
Clackamas River - 1907

## Columbia River

Rock Island - 1933  
Bonneville - 1938  
Grand Coulee - 1942

## Juvenile Collection

Mud Mountain FSC - 1957  
Baker Dam FSC - 1960  
Merwin FSC - 1963

## Snake River

Ice Harbor JBS - 1967  
L. Monumental - 1969  
Little Goose - 1970  
Lower Granite - 1975

## FERC Relicensing

Round Butte - 2010  
Swift FSC - 2013  
Cushman FSC - 2014  
North Fork FSC - 2015  
Cowlitz Falls NSC - 2016

1900

1950

2010

**FISH-PASSAGE RESEARCH PROGRAM  
REVIEW OF PROGRESS 1964**

**VOLUME III**

**COLLECTION OF JUVENILE MIGRANTS  
FROM RIVERS AND RESERVOIRS**

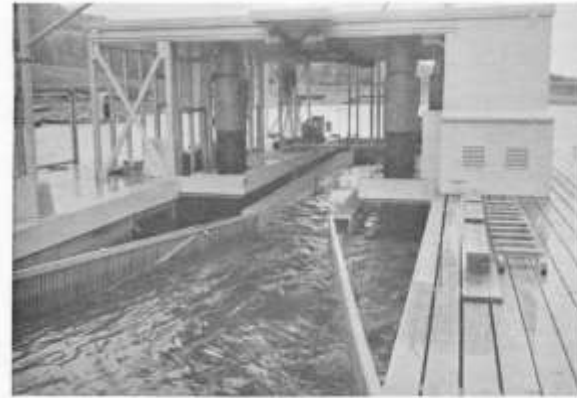


Plate 2.

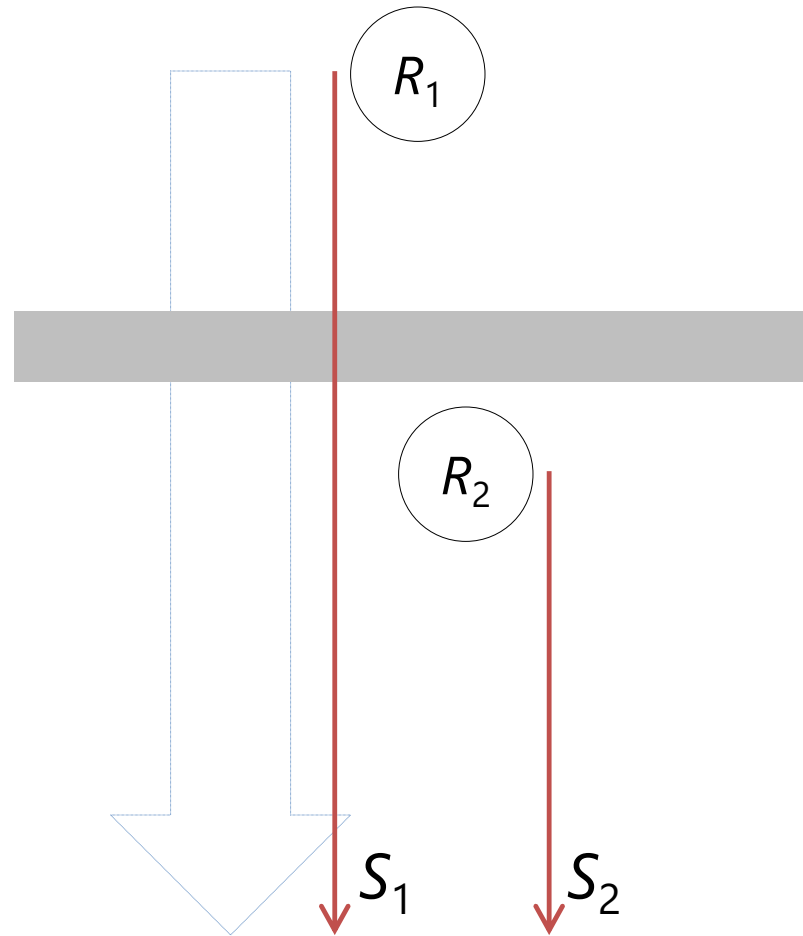
Interior of the collector showing vertical louvers of main flume, secondary separation channel and the two primary pumps.



Figure 3.--Migrant dipper trap and lead net extensions as seen from Oregon shore, Brownlee Reservoir.

# Advent of Survival Evaluations

- Test group is exposed to project passage
- Relative survival implies project mortality
  - i.e.,  $S_1 \div S_2$

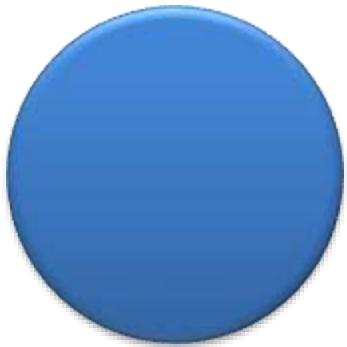


# “Passage Standards”

- Mid-Columbia PUD Habitat Conservation Plans
  - 93% Project Survival (Juveniles)
- Federal Columbia River Power System
  - 93% (Sub-yearling) and 96% (Yearling) Dam Survival
- High Head Dams
  - 75%-95% for varying metrics

# “No Net Impact” Concept

Pre-project



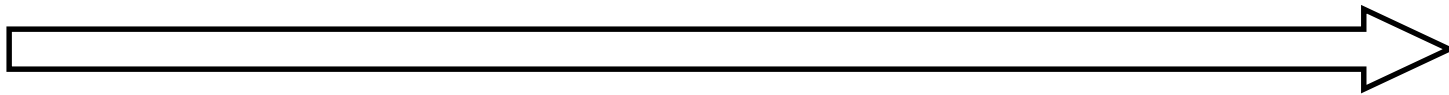
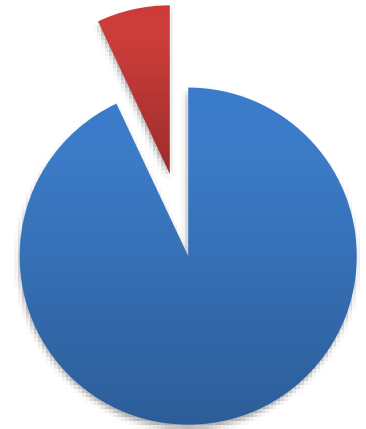
Unavoidable loss



Mitigation



Post-project



# Simplified Mitigation Calculation

- Juvenile survival = 93%
- Returns = 46,500 wild fish
  - Shortage of 3,500 adults
- Hatchery SAR = 0.5%
- 700,000 smolts to mitigate loss



# Take-Home Points

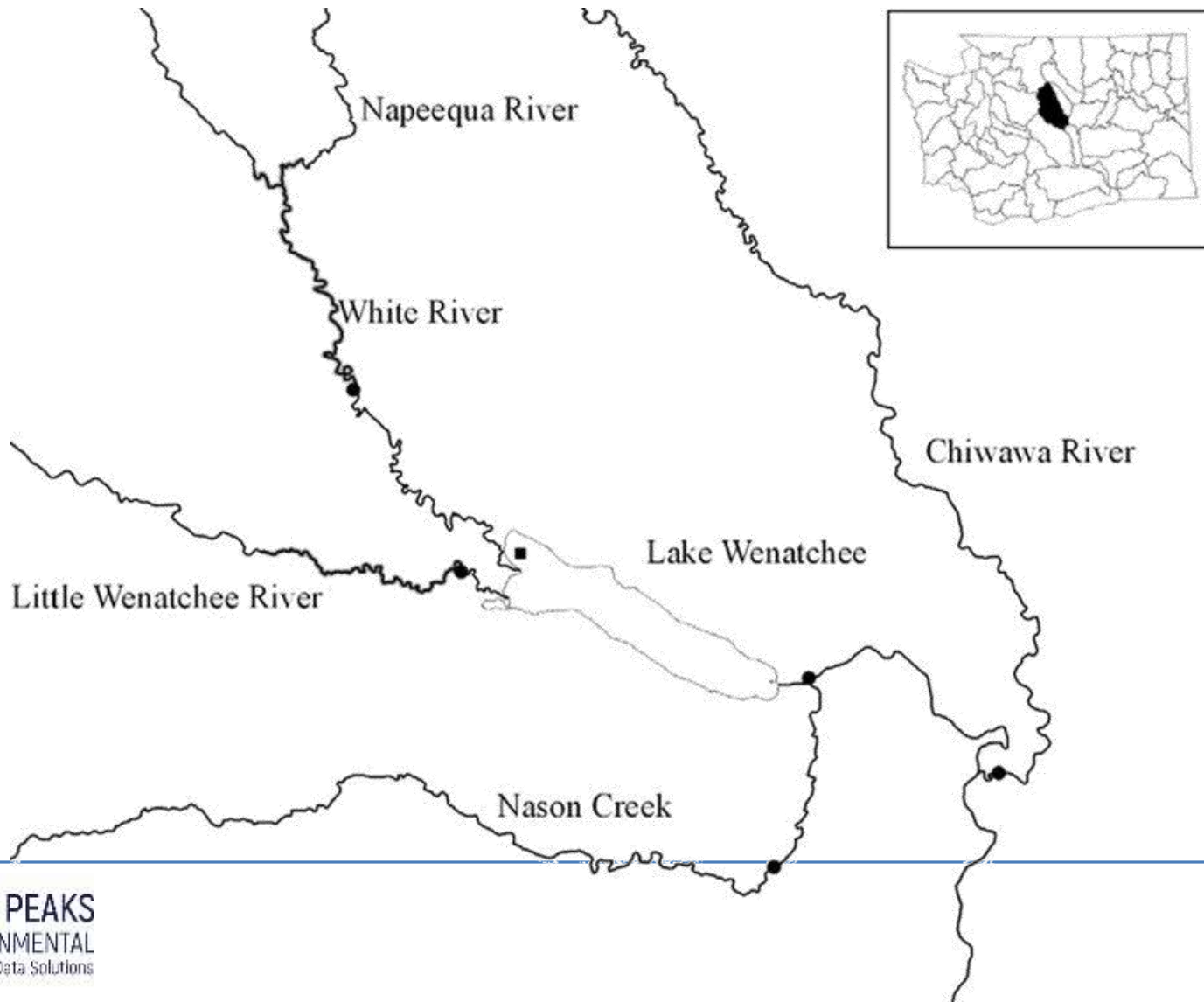
1. Mitigation and survival should be parallel discussions
2. The purpose of quantifying project effects has been lost in the evolution of passage standards. Standards at high-head dams are rooted in precedents and negotiations

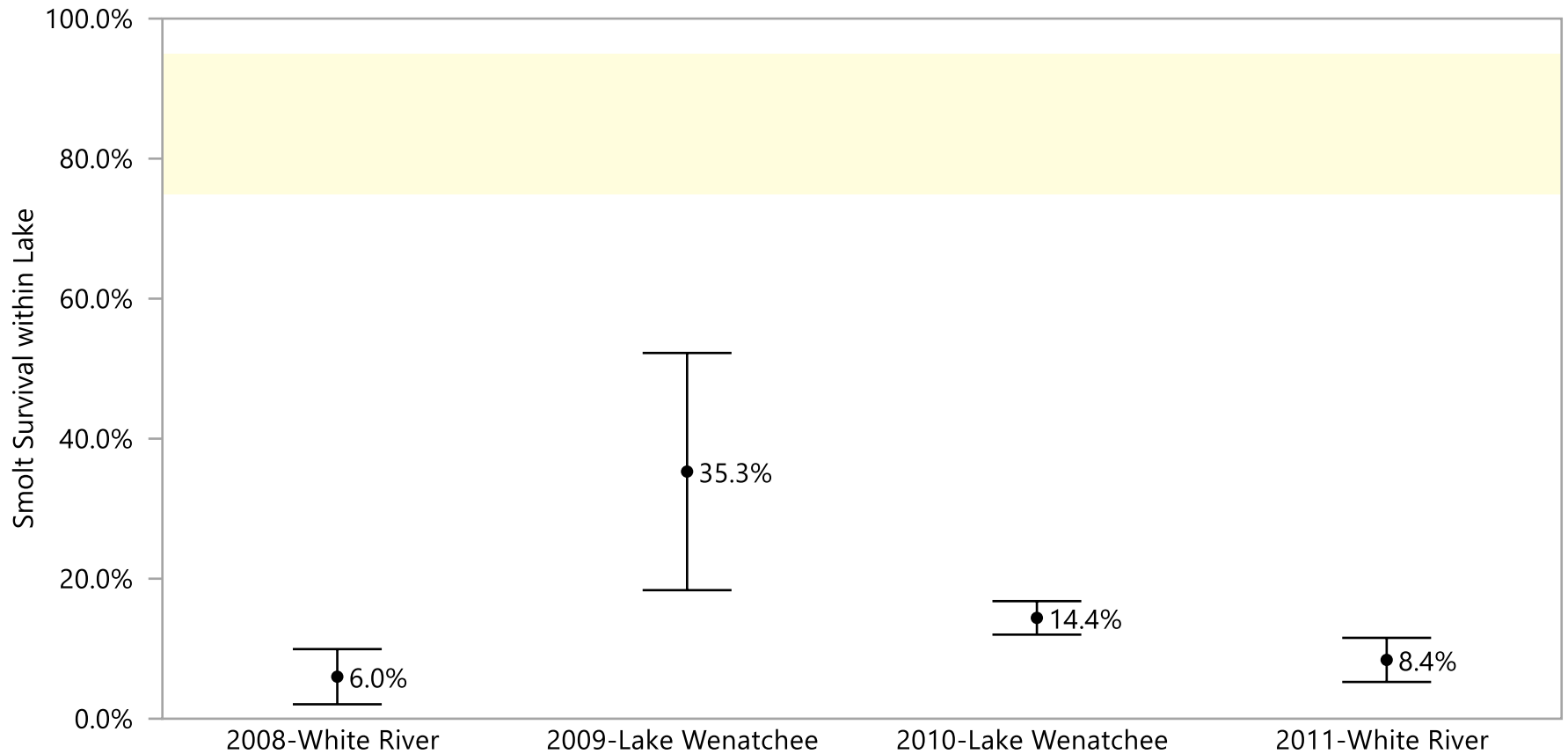
# High Head Dams

- No baseline information
- Limitations on paired-release evaluations
- Extreme variation in ecology and physical aspects



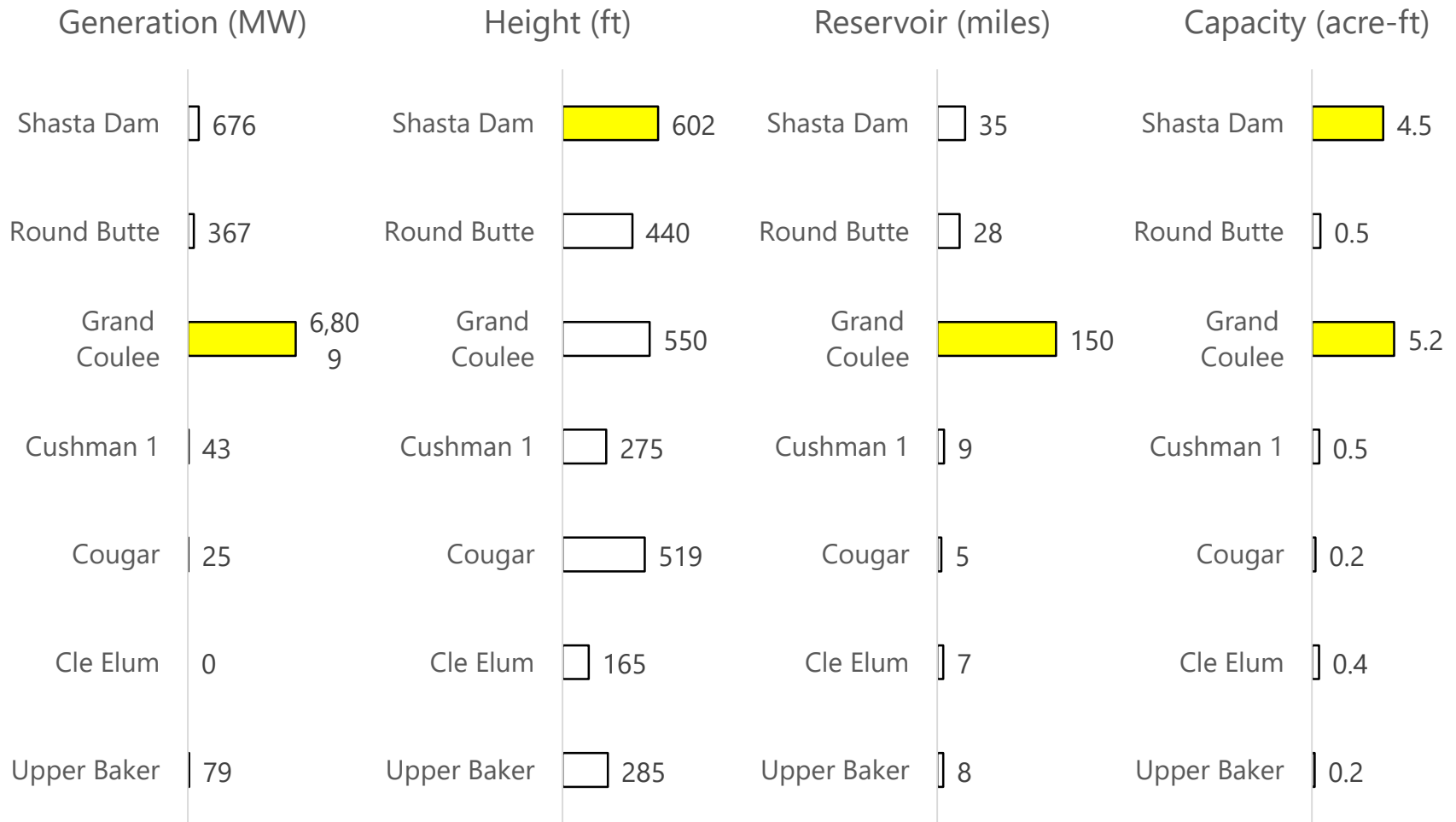
# Lake Survival?





Yearling Spring Chinook, n > 200,000 PIT-tagged smolts

**< 30 Age 4 adults detected from all four years**



**Incredible Variation across Projects!**

# “Other” Aspects

- Varying levels of extirpation
- Non-native species
- Atypical life history strategies
- Predation
- New facilities and operations
- Evolving technologies

# Take-Home Points

1. Mitigation and survival should be parallel discussions
2. The purpose of quantifying project effects has been lost in the evolution of passage standards. Standards at high-head dams are rooted in precedents and negotiations
3. Many aspects must be carefully considered when establishing and interpreting performance metrics

# Questions or Comments?

1. Mitigation and survival should be parallel discussions
2. The purpose of quantifying project effects has been lost in the evolution of passage standards. Standards at high-head dams are rooted in precedents and negotiations
3. Many aspects must be carefully considered when establishing and interpreting performance metrics