Snake River Sockeye Salmon Recovery - Historical Perspective and Progress Towards Meeting Recovery Objectives

Paul Kline
Christine Kozfkay
Idaho Department of Fish and Game

Jesse Trushenski
EVAQUA FARMS

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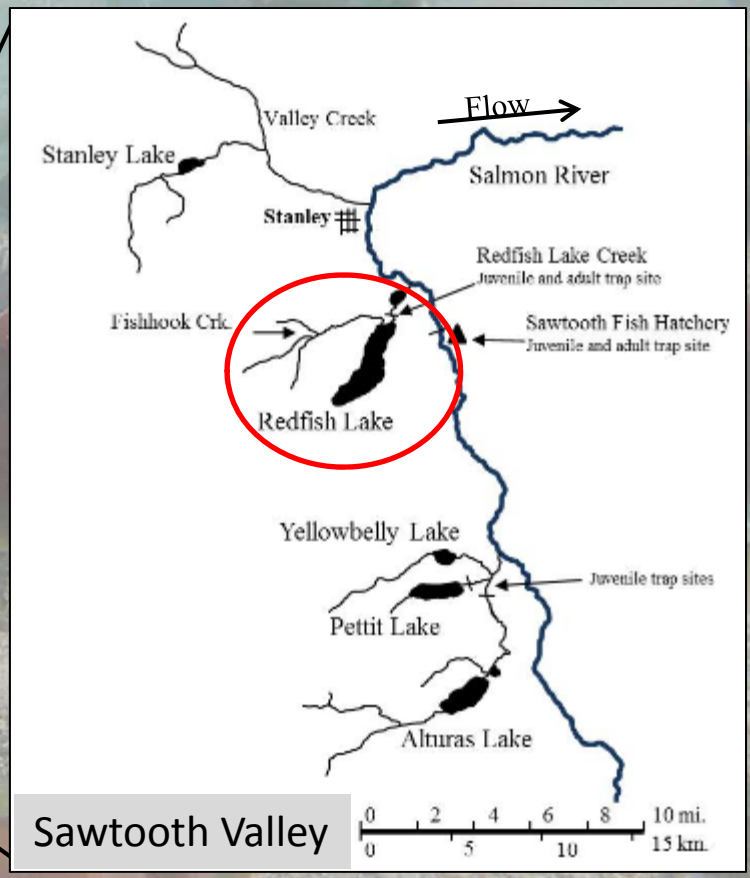
Presentation Outline

- Overview of recovery effort for Snake River (Redfish Lake) Sockeye Salmon
  - Background
  - Three-phase approach to implementation
  - Challenges following Program expansion

Background



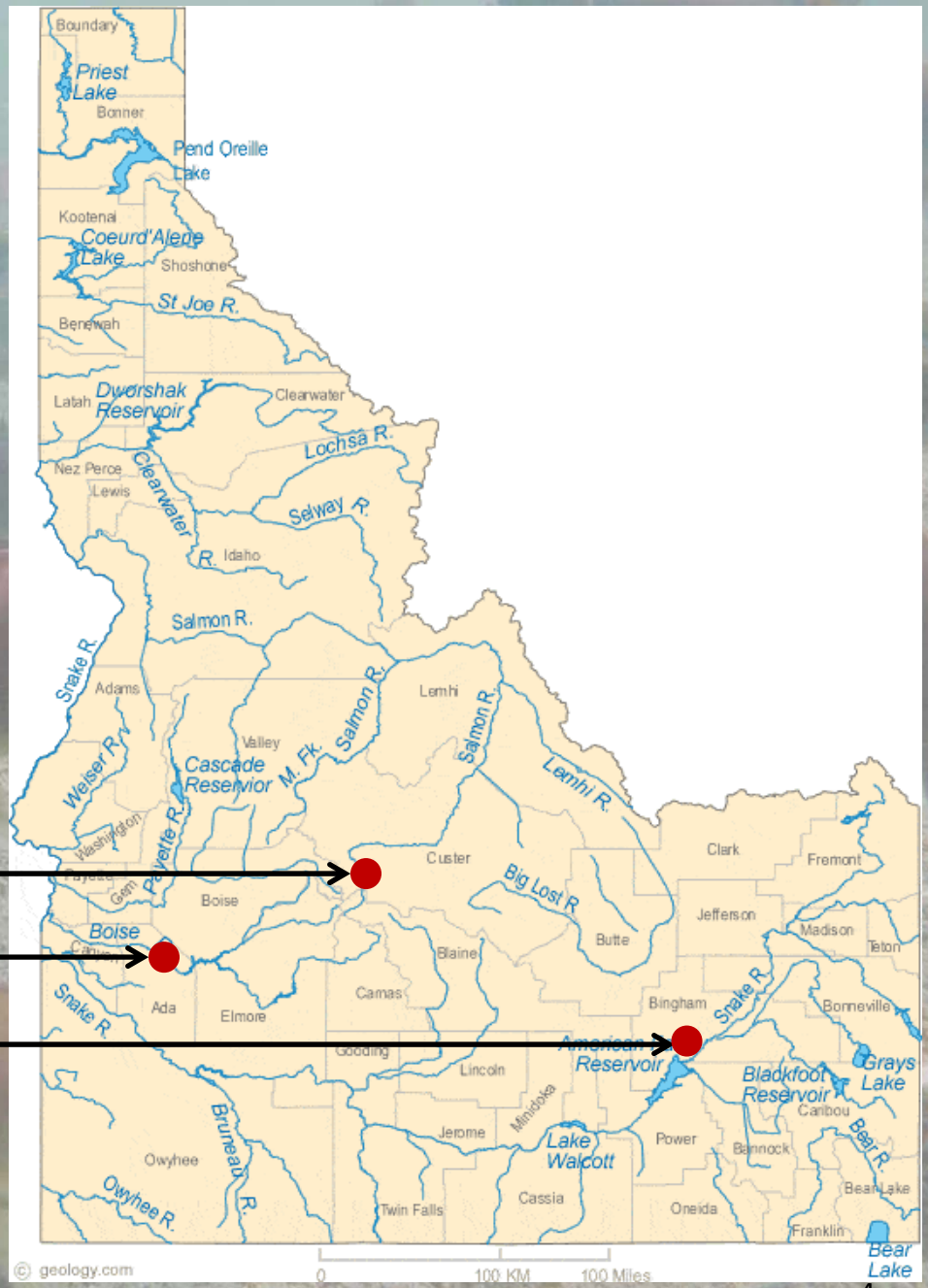
Sawtooth Valley

Background

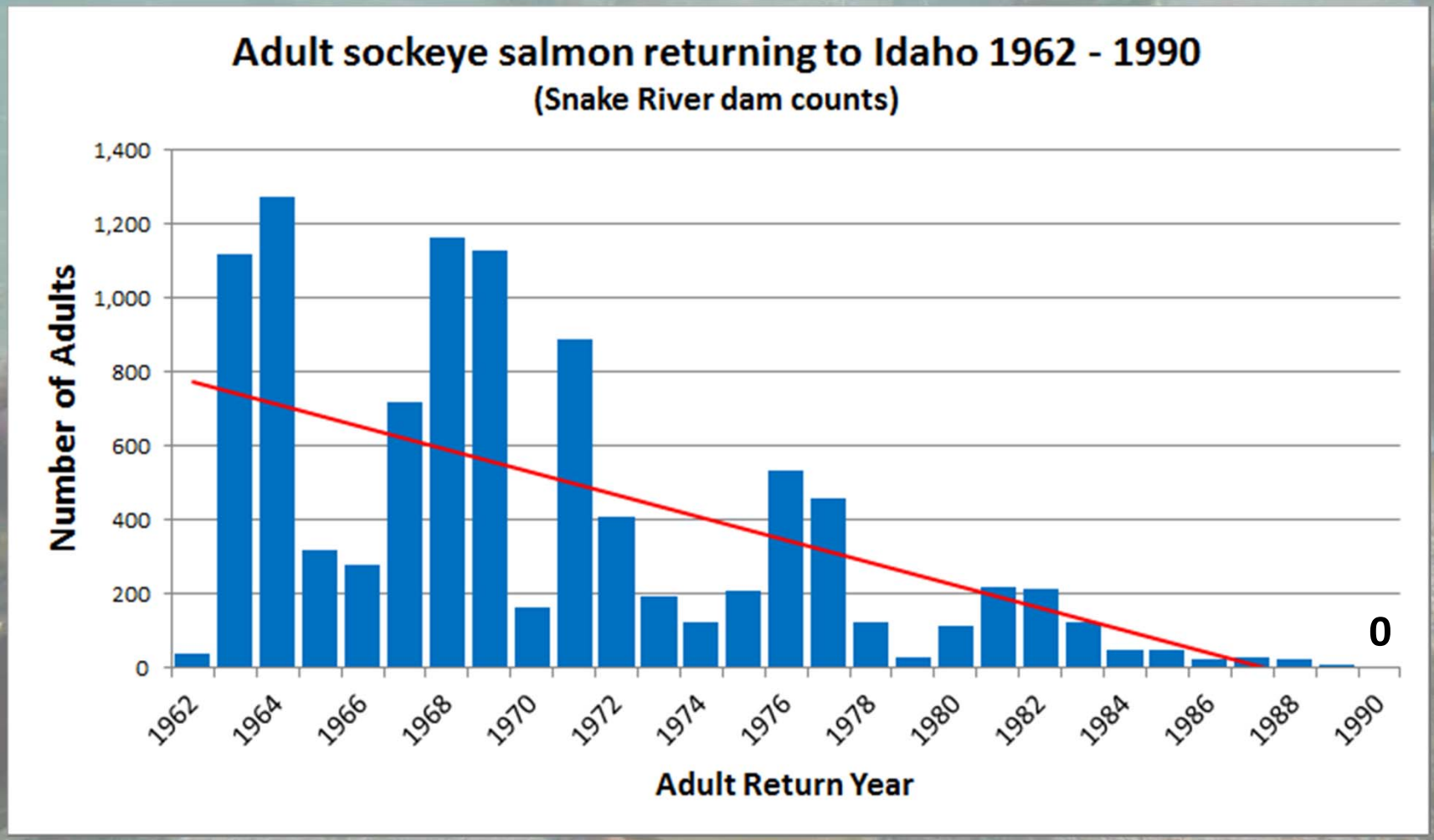
Sawtooth Hatchery

Eagle Hatchery

Springfield Hatchery



Population Status



Implementation

- Phase 1: Captive broodstock phase
- Phase 2: Re-colonization phase
- Phase 3: Local Adaptation phase

Captive Broodstock Phase

- In Phase 1, conservation hatchery protocols established early-on to protect the remnant population
- Protocols developed:
  - BMPs to rear sockeye in captivity
  - Redundant broodstocks (IDFG and NMFS)
  - Spawning plans that maintain genetic diversity and avoid inbreeding
  - Biosecurity & 100% fish health screening

Captive Broodstock Phase

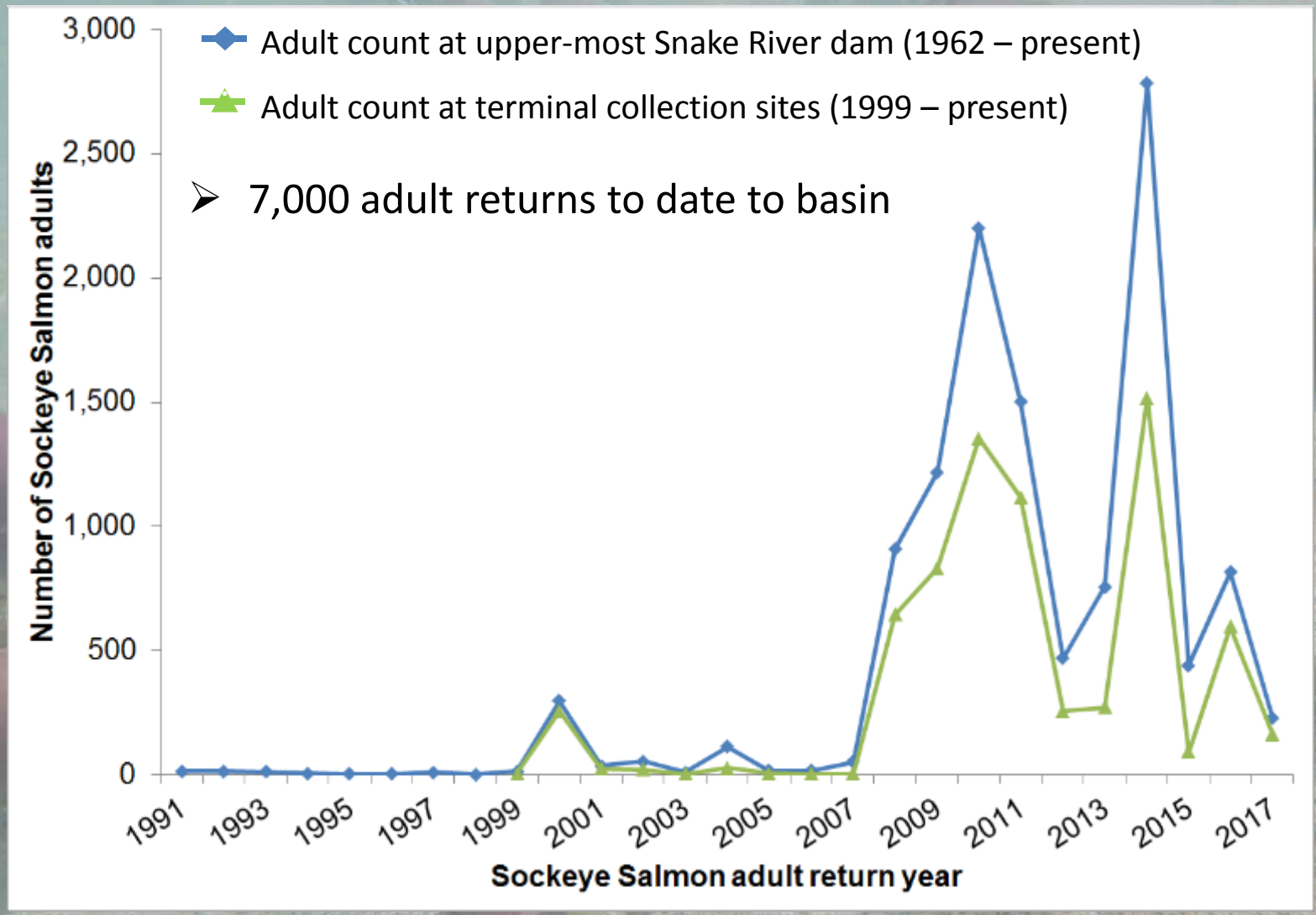
- High egg survival to the eyed-stage of development (about 80%)
- High in-hatchery life-cycle survival (about 70% fry to adult)
- Effectively maintained population genetic variability (about 95%)[1]
- Identified smolt releases as the most successful strategy to return anadromous adults

[1]Kalinowski et al. 2012. Conserv. Genet. 13:1183-1193

Captive Broodstock Phase

- Releases to date include:
  - ~ 1.1M eyed eggs
  - ~ 1.6M pre-smolts
  - ~2.9M smolts
  - ~13K pre-spawn adults

Captive Broodstock Phase



Program expansion

- Phase 1: Captive broodstock phase
- Phase 2: Re-colonization phase
- Phase 3: Local Adaptation phase

Program Expansion

Springfield Hatchery - 2013

Re-colonization Phase

- Phase 2: Re-colonization phase
  - Smolt production to increase ~ 5-fold to 1M
  - Objective to re-colonize habitat by producing greater numbers of smolts and returning greater numbers of anadromous adults
  - Anadromous adults used to re-seed the habitat and to replace captive adults in hatchery spawning designs

Re-colonization Phase

- In this Phase, the proportion of hatchery to natural fish released to the habitat (pHOS) will not be strictly controlled
- To maintain genetic continuity between hatchery and natural spawning components 10% of the broodstock will be comprised of natural-origin anadromous adults

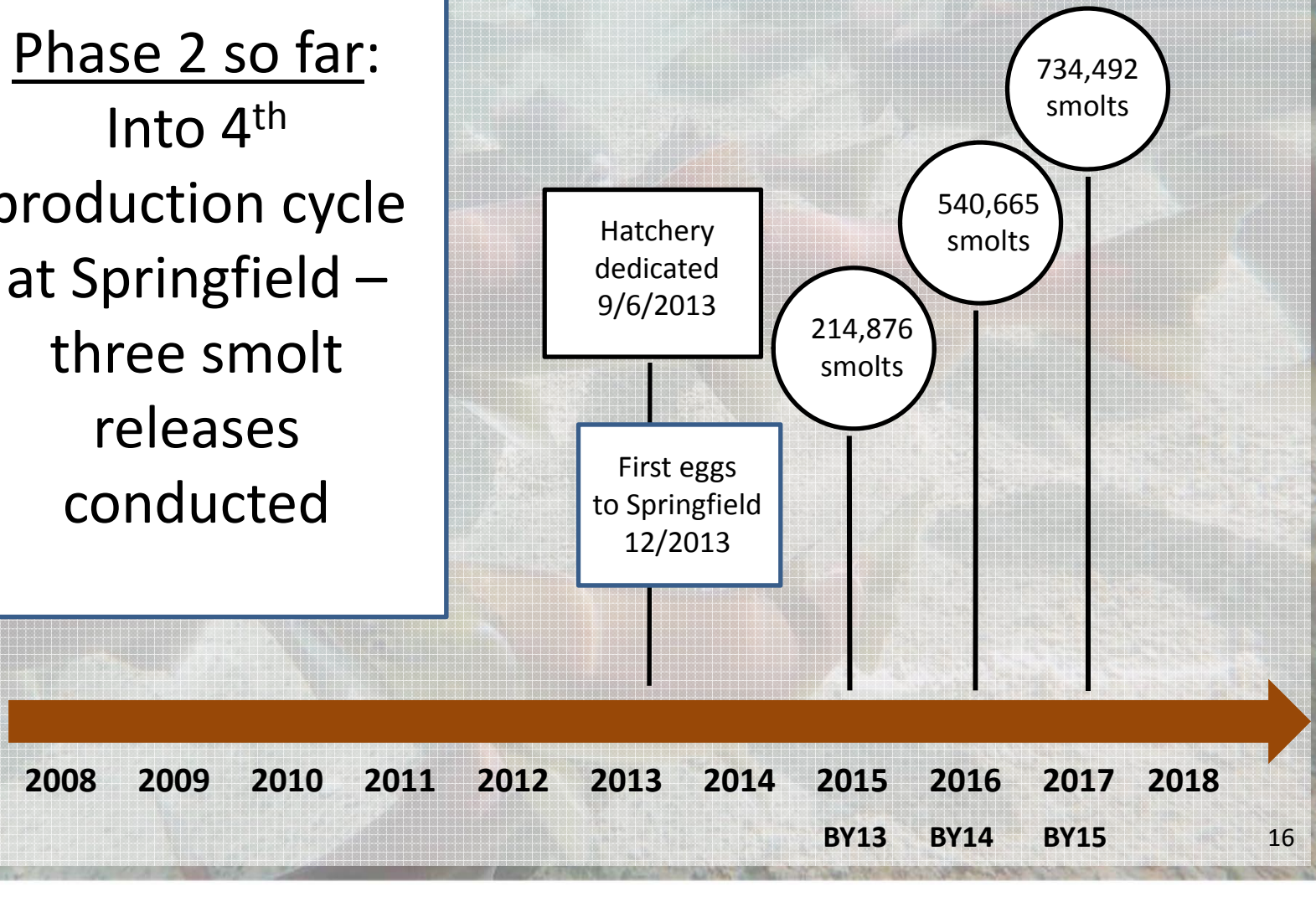
Local Adaptation Phase

- Phase 3: Local Adaptation
- Objective to emphasize local adaptation and promote fitness gains through integrated program management that follows HSRG guidance for: pHOS, pNOB, and PNI[1]
- Smolt production reduced to 400,000 to 600,000
- Test assumptions that local adaptation and integrated broodstock management can effectively grow the natural population to sustainable levels that effectively address recovery objectives

[1]Paquet et al. 2011. Fisheries 36(11):547-561

Re-colonization Phase

Phase 2 so far:
Into 4th production cycle at Springfield – three smolt releases conducted



Challenges – Low Survival

2015 Releases (BY13)

- 214K+ smolts released
- Fish in poor condition, gaping mouths, frayed fins, embolisms
- 37% survival from Lower Granite to Bonneville

MORTALITY RELATED TO GAS SUPERSATURATION?

2016 Releases (changes)

- Degassing addressed at Springfield
- Water-up night before hauling to reduce TDG levels
- New Transport route – lower elevation

Challenges – Low Survival

2016 Releases (BY14)

- 540K+ smolts released
- Fish in poor condition, signs of physical trauma
- Substantial descaling observed
- 12% survival from Lower Granite to Bonneville

MORTALITY RELATED TO PUMPING TRAUMA, (DE)SMOLTIFICATION? WATER QUALITY?

2017 Releases (BY15)

- New 6” fish pump purchased
- Stock fish earlier, add salt
- Look at water quality differences
- Develop study design to evaluate smoltification/transport stress

Challenges – Low Survival

Water quality parameters measured

Hardness

Alkalinity

pH

Gill ATPase

Plasma Glucose

Plasma Cortisol

Hematocrit

	Springfield Hatchery	Redfish Lake Creek	Salmon River
Alkalinity	194-202 mg/L	1-8 mg/L	66 mg/L
Hardness	234-248 mg/L	11-12 mg/L	68 mg/L
pH	7.70-7.75	7.41-7.72	7.94

Researching – Low Survival

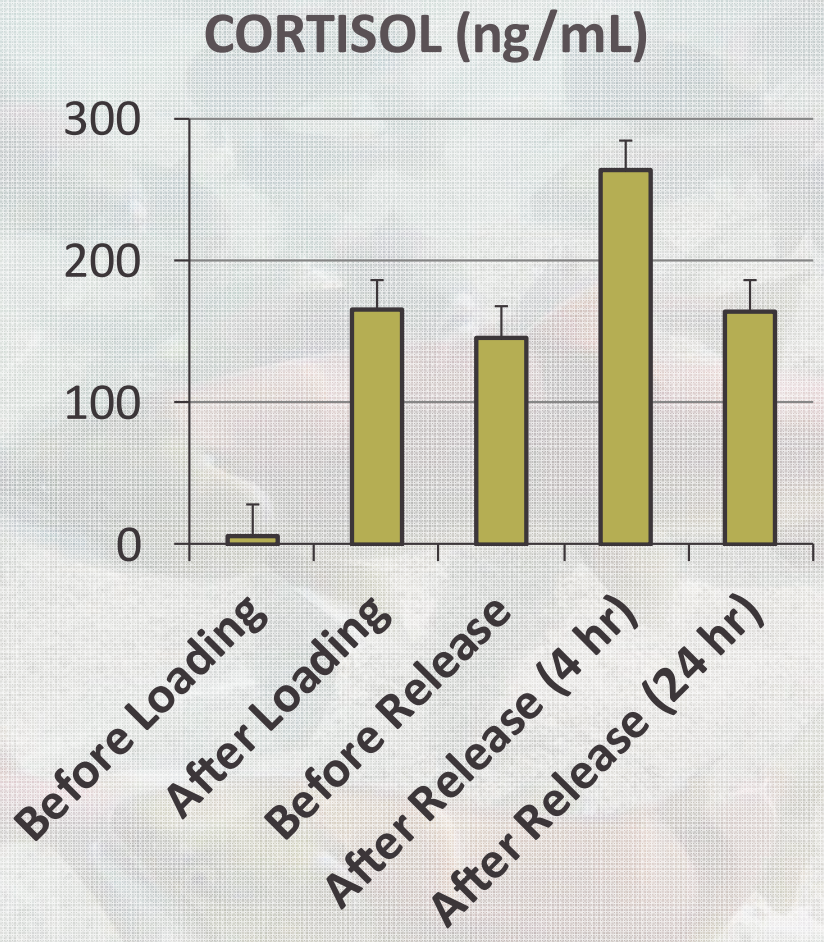
2017 Releases (BY15)

- 730K+ smolts released
- Smolts looked good but mortality increased
- 18% survival from Lower Granite to Bonneville

Water quality - stress

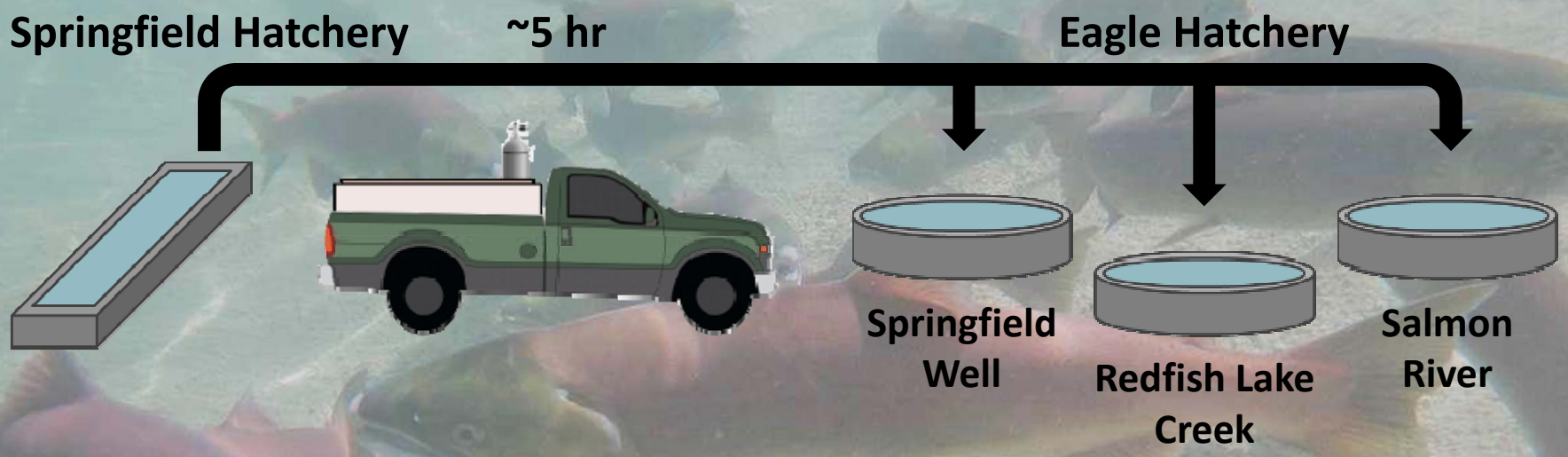
Researching – Low Survival

2017 Results



RESULTS SUGGEST STRESS FACTOR(S) REMAINS POST-RELEASE

Researching – Low Survival

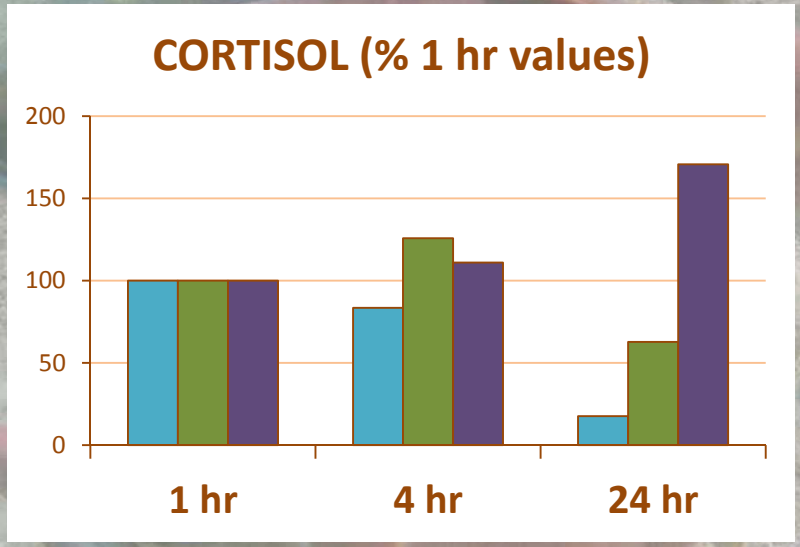


EXPERIMENT CONDUCTED W/PRE-SMOLTS OCTOBER 2017

SAMPLED BLOOD CHEMISTRY BEFORE AND AFTER TRANSPORT AND RELEASE TO DIFFERENT WATER SOURCES

Researching – Low Survival

SPRINGFIELD WELL	SALMON RIVER	REDFISH LAKE CREEK
• Alkalinity = 188 mg/L • Hardness = 232 mg/L • pH = 8.18	• Alkalinity = 66 mg/L • Hardness = 68 mg/L • pH = 7.94	• Alkalinity = 17 mg/L • Hardness = 11 mg/L • pH = 7.33



RESULTS SUPPORT WORKING HYPOTHESIS RELATED TO WATER CHEMISTRY

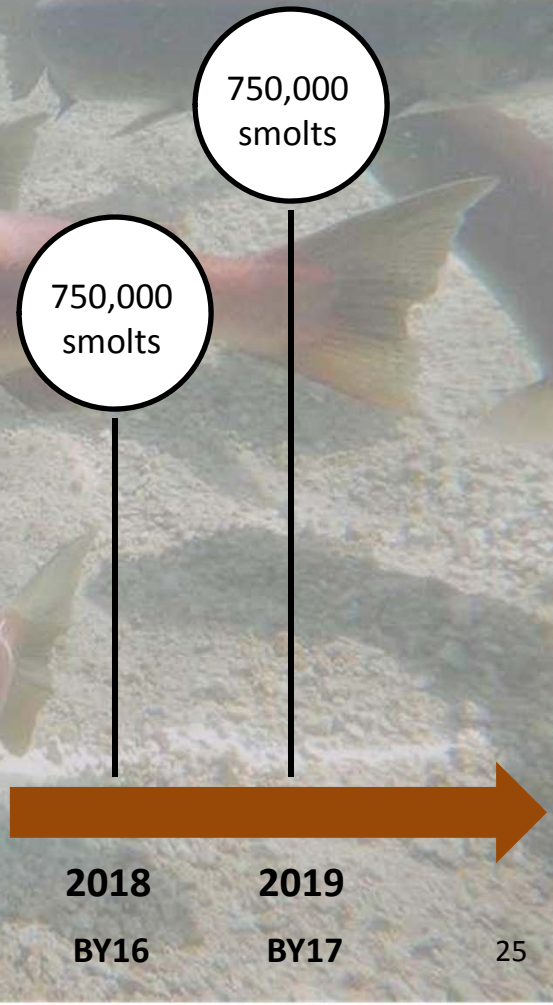
Next Steps

Moving Forward – 2018 Release

250K pre-smolts released to Redfish Lake in October, 2017

~700K smolts to acclimate at Sawtooth Hatchery
½ to be released in Redfish Lake Creek
½ to be released in the Salmon River

~50K smolts to be released to Redfish Lake Creek as control (no acclimation)



Moving Forward – 2019 Release

Release strategies TBD – based on 2018 findings

300K smolts to be reared full term at Sawtooth Hatchery to be released to Redfish Lake Creek

Experiment with in-route water softening

Hope we found the smoking gun!

Acknowledgements

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Northwest Power and Conservation Council

- Northwest Power and Conservation Council's Fish and Wildlife Program
- Bonneville Power Administration

- Thanks – Fish Production and Evaluation staff

Time for questions?