

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

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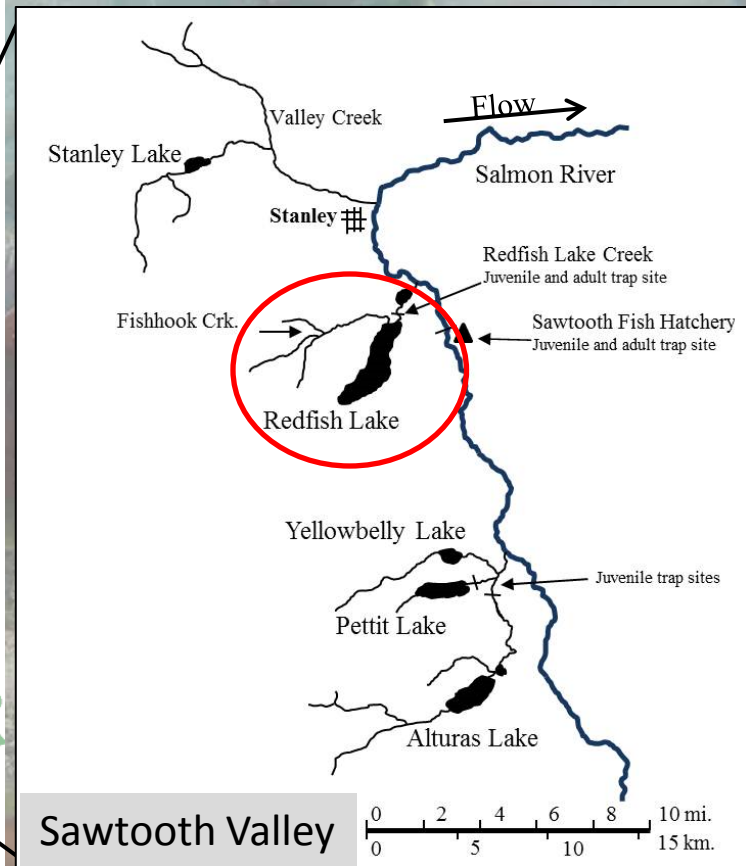




Presentation Outline

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

Background

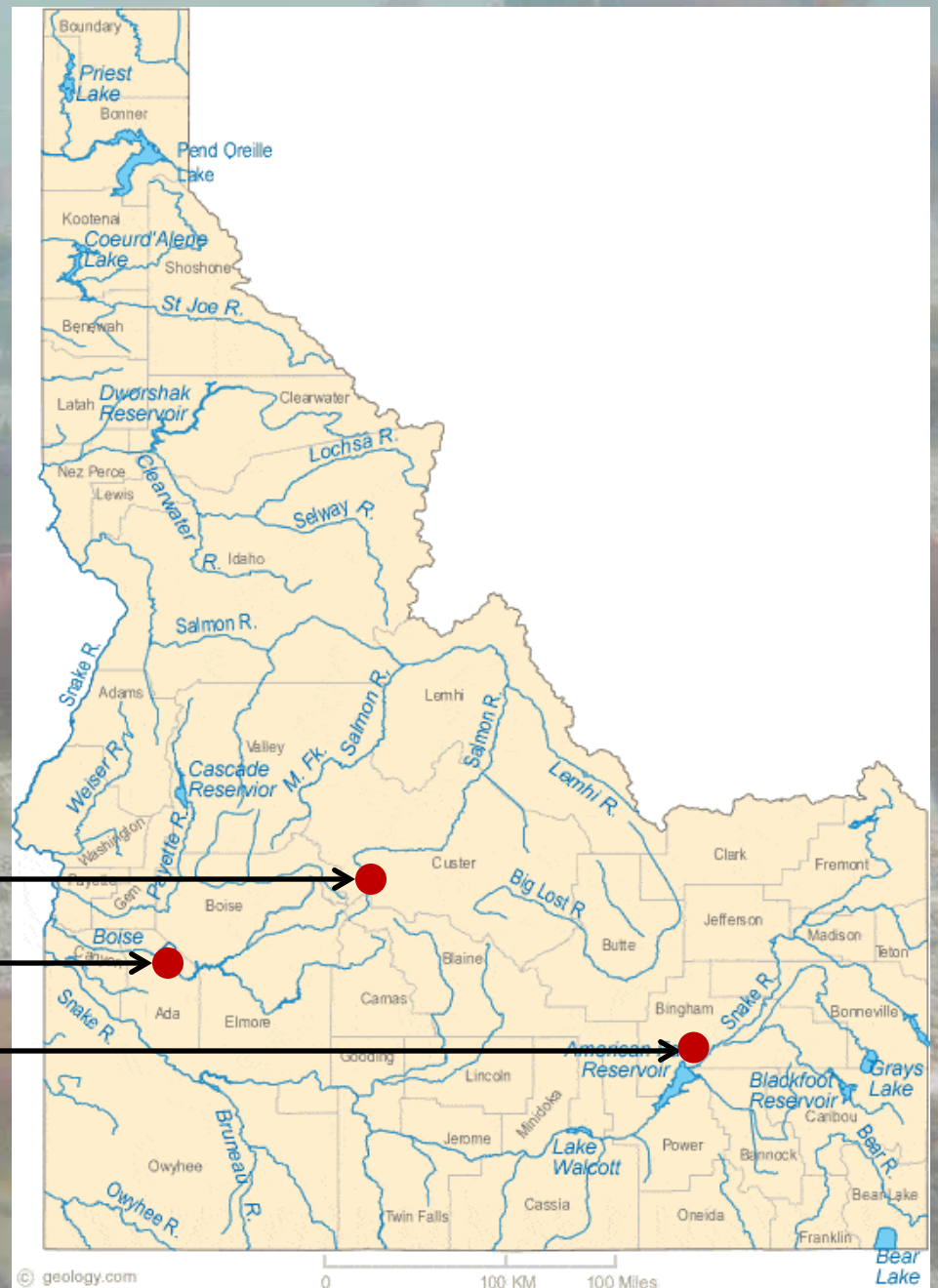


Background

Sawtooth Hatchery

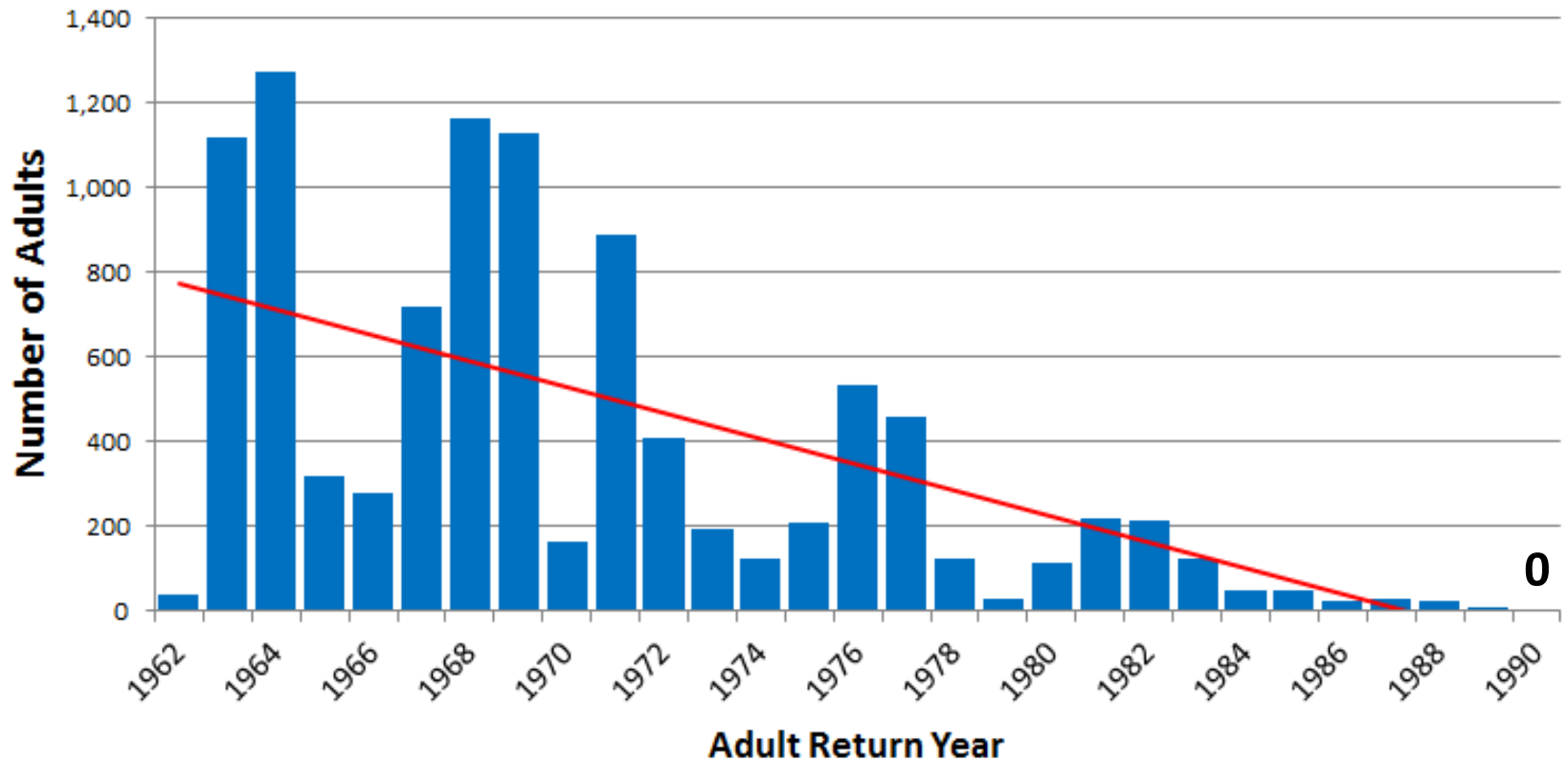
Eagle Hatchery

Springfield Hatchery



Population Status

Adult sockeye salmon returning to Idaho 1962 - 1990
(Snake River dam counts)



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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

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

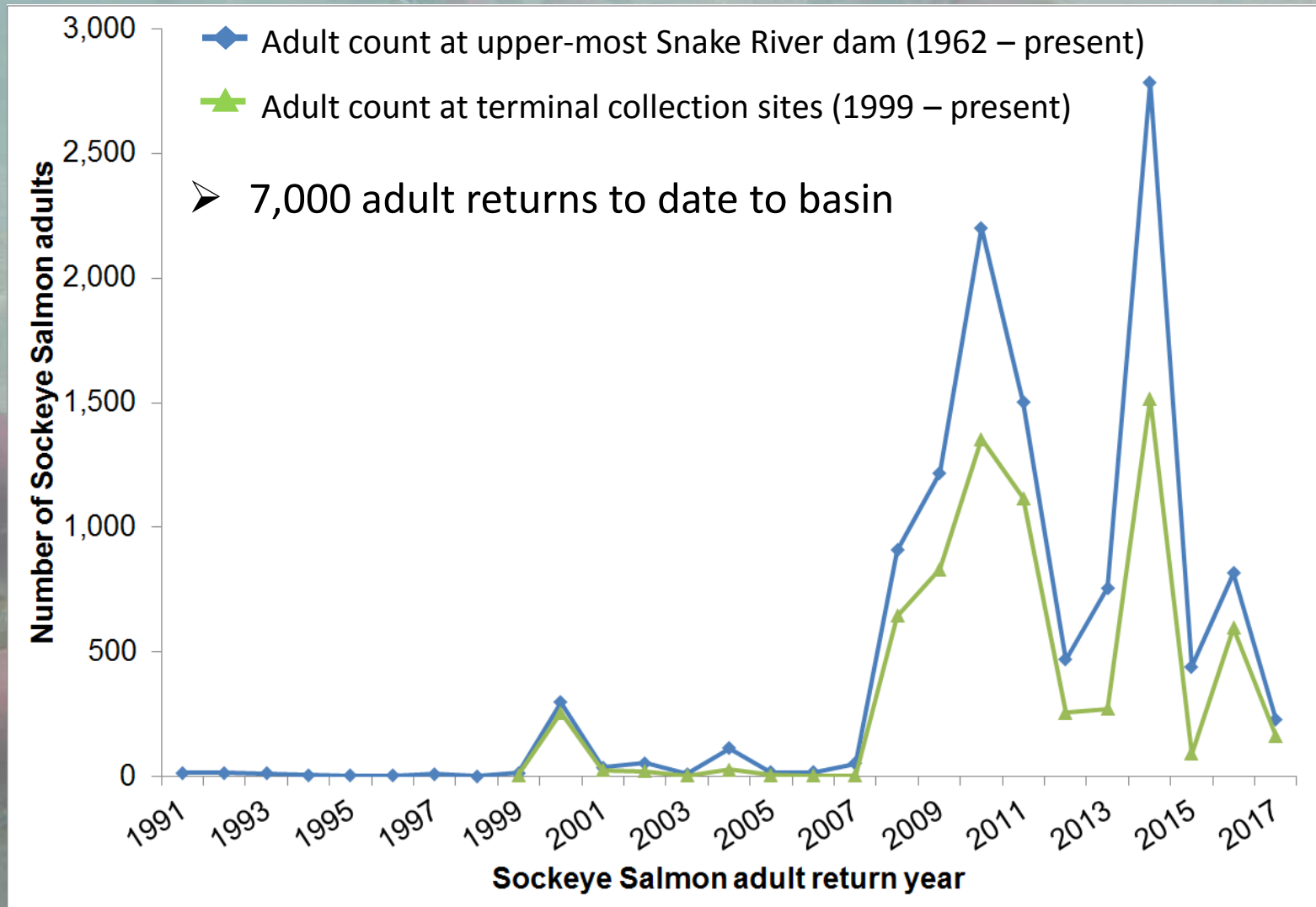


Captive Broodstock Phase

- 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

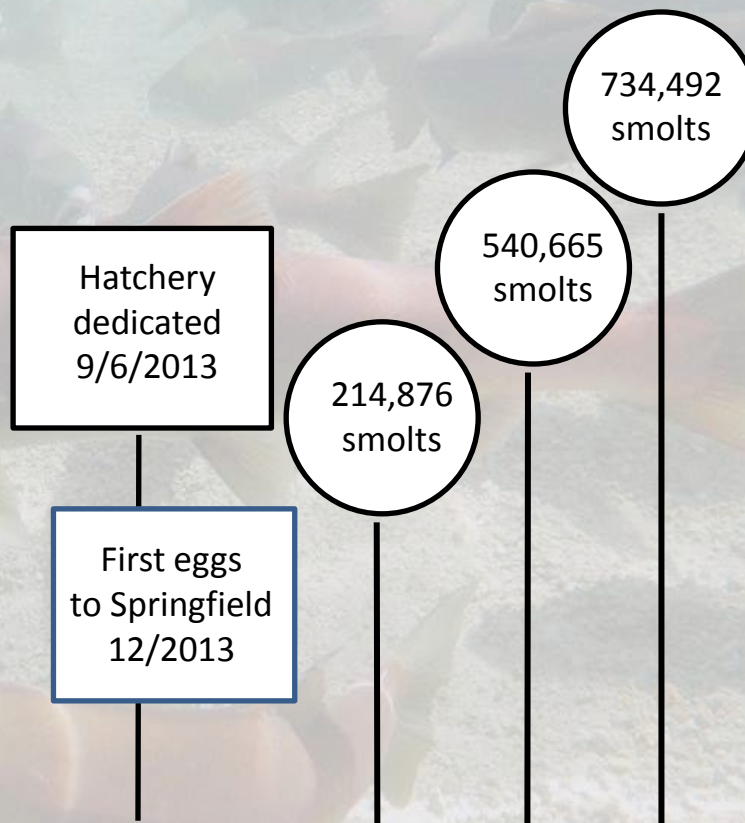
- Phase 3: Local Adaptation
- Objective to emphasize local adaptation and promote fitness gains through integrated program management that follows HSRG guidance for: pHOS, pNOB, and PNI¹
- Smolt production reduced to 400,000 to 600,000
- Test assumptions that local adaptation and integrated broodstock management can effectively grow the natural population to sustainable levels that effectively address recovery objectives

¹Paquet 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



2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018

BY13 BY14 BY15



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

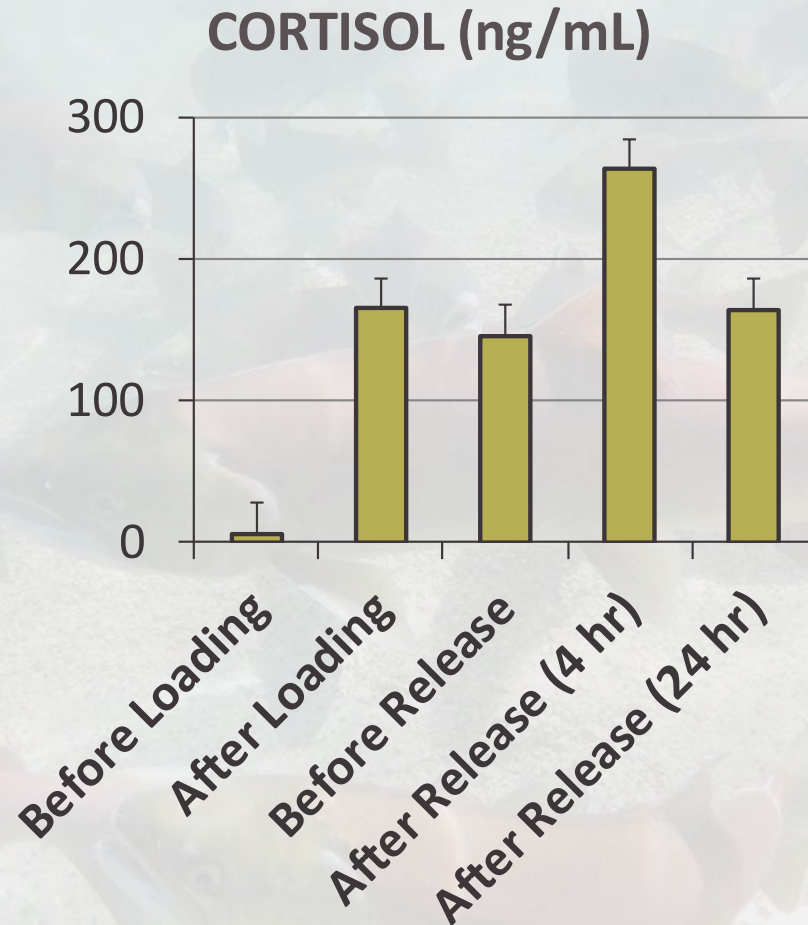
18% survival from Lower
Granite to Bonneville

Water quality - stress



Researching – Low Survival

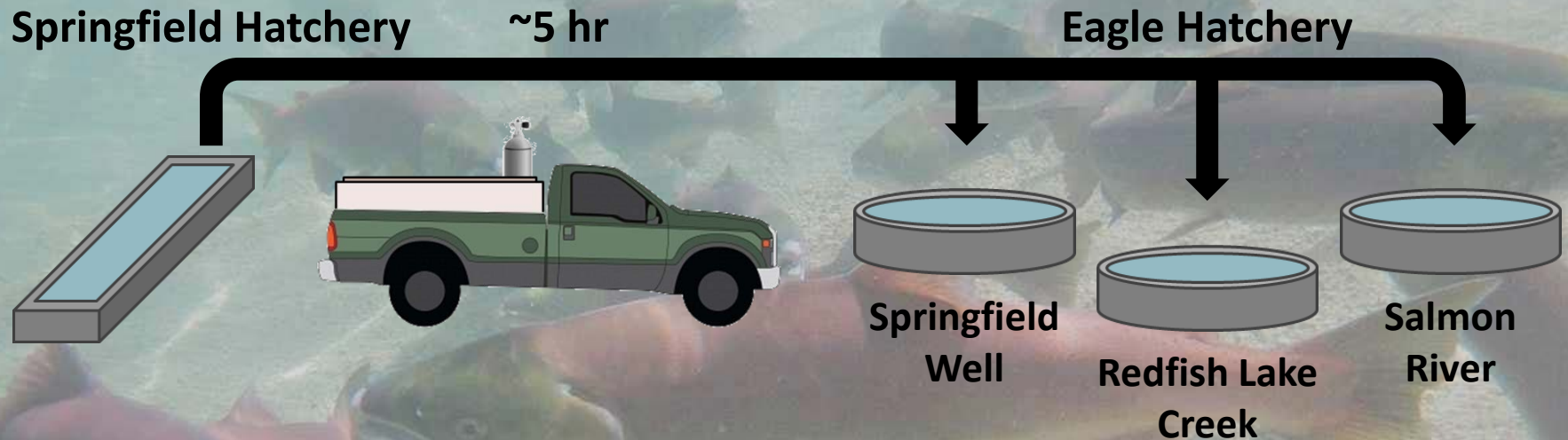
2017
Results



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

- Alkalinity = 188 mg/L
- Hardness = 232 mg/L
- pH = 8.18

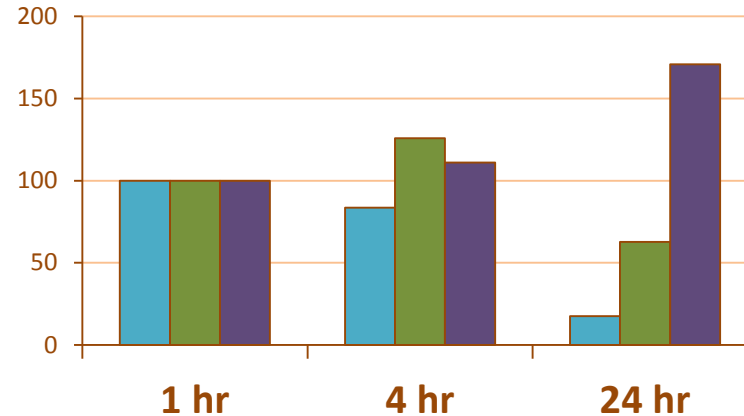
SALMON RIVER

- Alkalinity = 66 mg/L
- Hardness = 68 mg/L
- pH = 7.94

REDFISH LAKE CREEK

- Alkalinity = 17 mg/L
- Hardness = 11 mg/L
- pH = 7.33

CORTISOL (% 1 hr values)



RESULTS SUPPORT WORKING HYPOTHESIS RELATED TO WATER CHEMISTRY

Next Steps

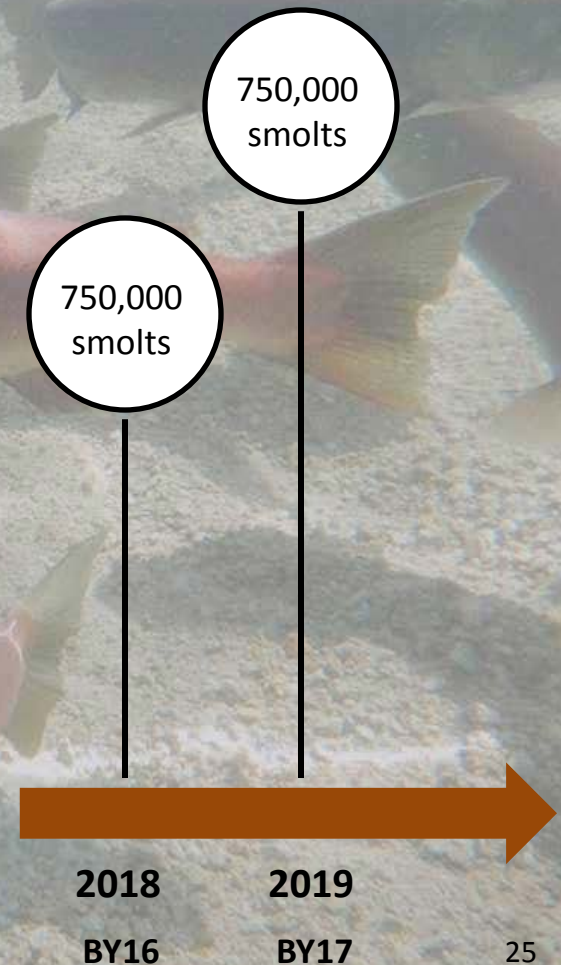


Moving Forward – 2018 Release

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)



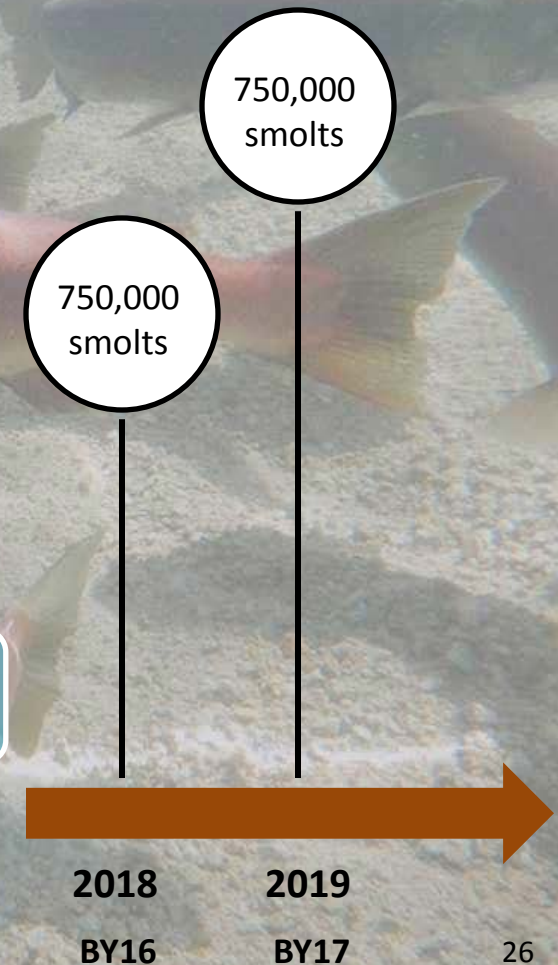
Moving Forward – 2019 Release

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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Time for questions?

