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RADIO TELEMETRY EVALUATION OF JUVENILE SALMONID PASSAGE AND SURVIVAL AT FOSTER DAM

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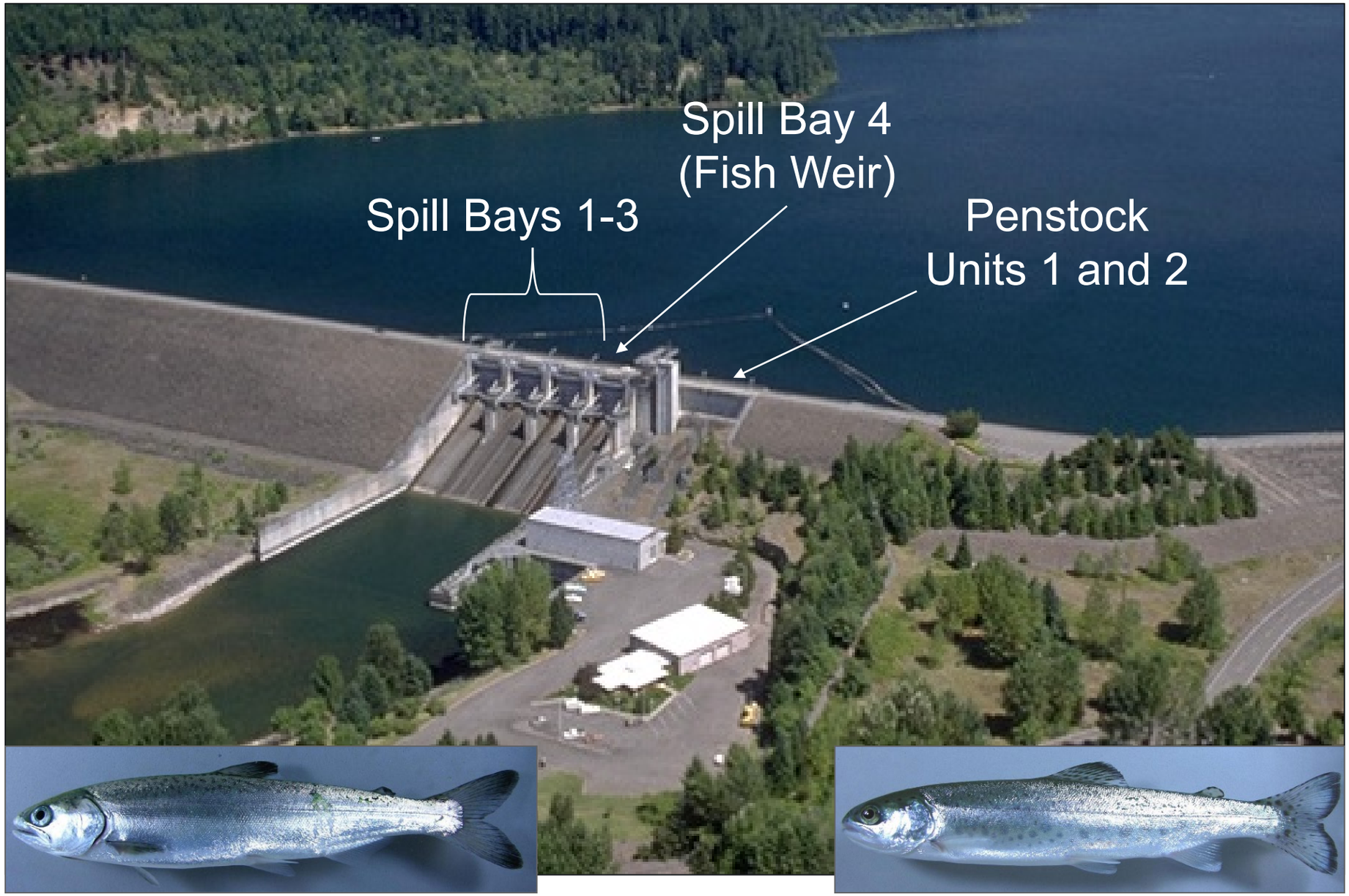
Foster Dam



Yearling Chinook Salmon

Winter Steelhead

New Fish Weir for Foster Dam

- Out with the old
- Wide and shallow
- Mean discharge: 250 cfs

- In with the new (March 2018)
- Narrow and deep
- Mean discharge: 530 cfs (300-860 cfs)

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Radio Telemetry Study Objectives

- Post-construction full project assessment for passage and survival
  - Compare 2018 with 2015 and 2016
- Radio- and PIT-tagged yearling Chinook salmon, age-2 wild surrogate winter steelhead and age-1.5 hatchery summer steelhead
- Two reservoir elevations
  - Low pool = 615 fmsl
  - High pool = 635 fmsl
- Estimate
  - Passage distributions
  - Route-specific and dam passage survival
    - Single-release/recapture model (Cormack-Jolly-Seber, CJS)
      - Compare 2018 with 2015 and 2016
    - Virtual Release with Dead Fish Correction (ViRDCt): 2018 only

Fish Sources, Sample Sizes, Tags

Wild Fish Surrogate Program

Age-2 Winter Steelhead

n = 1,016

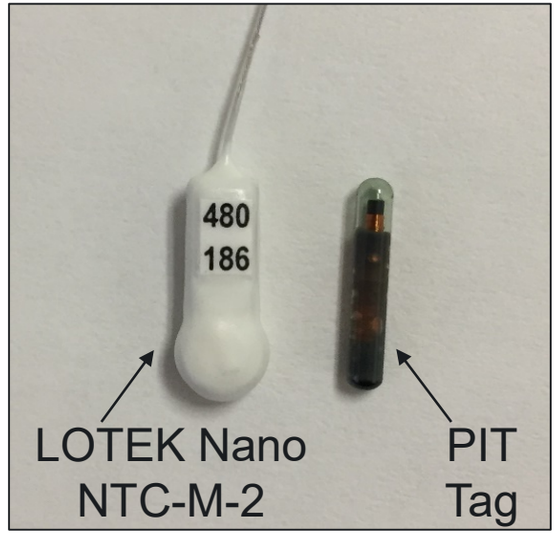
Yearling Chinook Salmon

n = 757

South Santiam Fish Hatchery

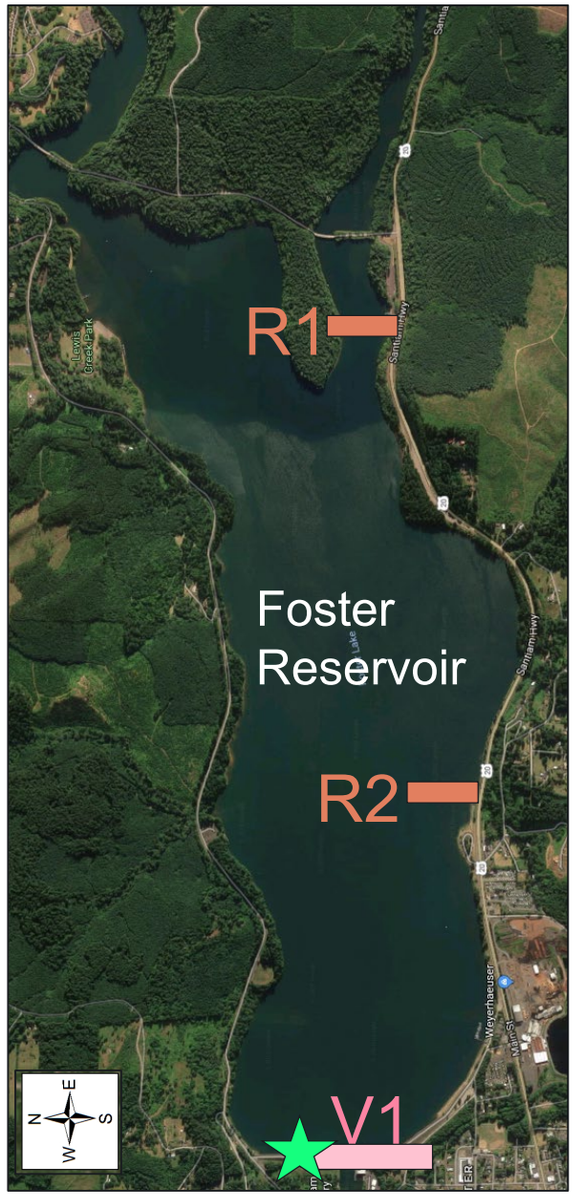
Age-1.5 Summer Steelhead

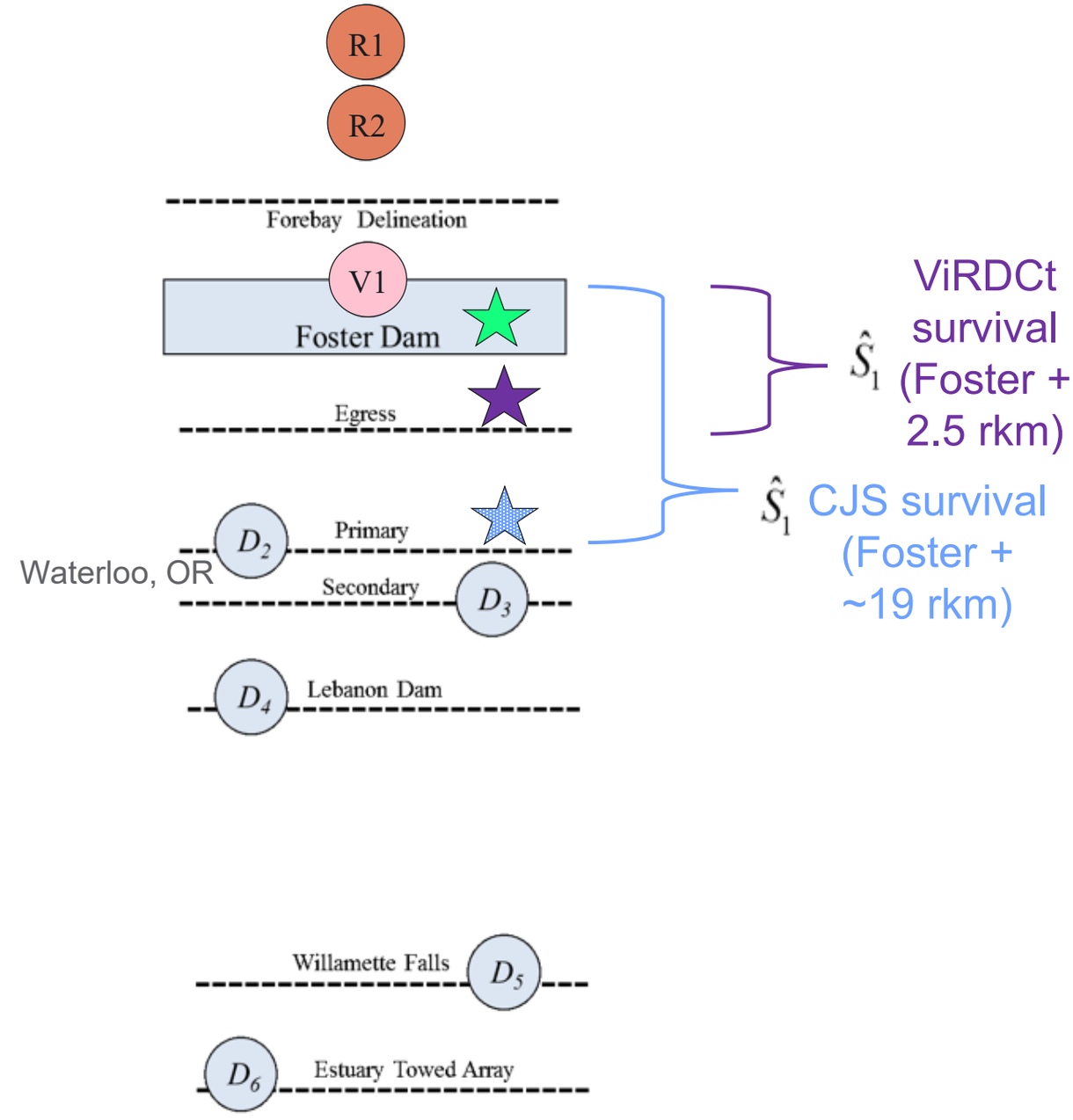
n = 683



- Orion Receivers (Sigma Eight Inc.)
- Multiprotocol Integrated Telemetry Acquisition System (MITAS)
- Tag Life = ~51 days

Releases and Survival Study Design





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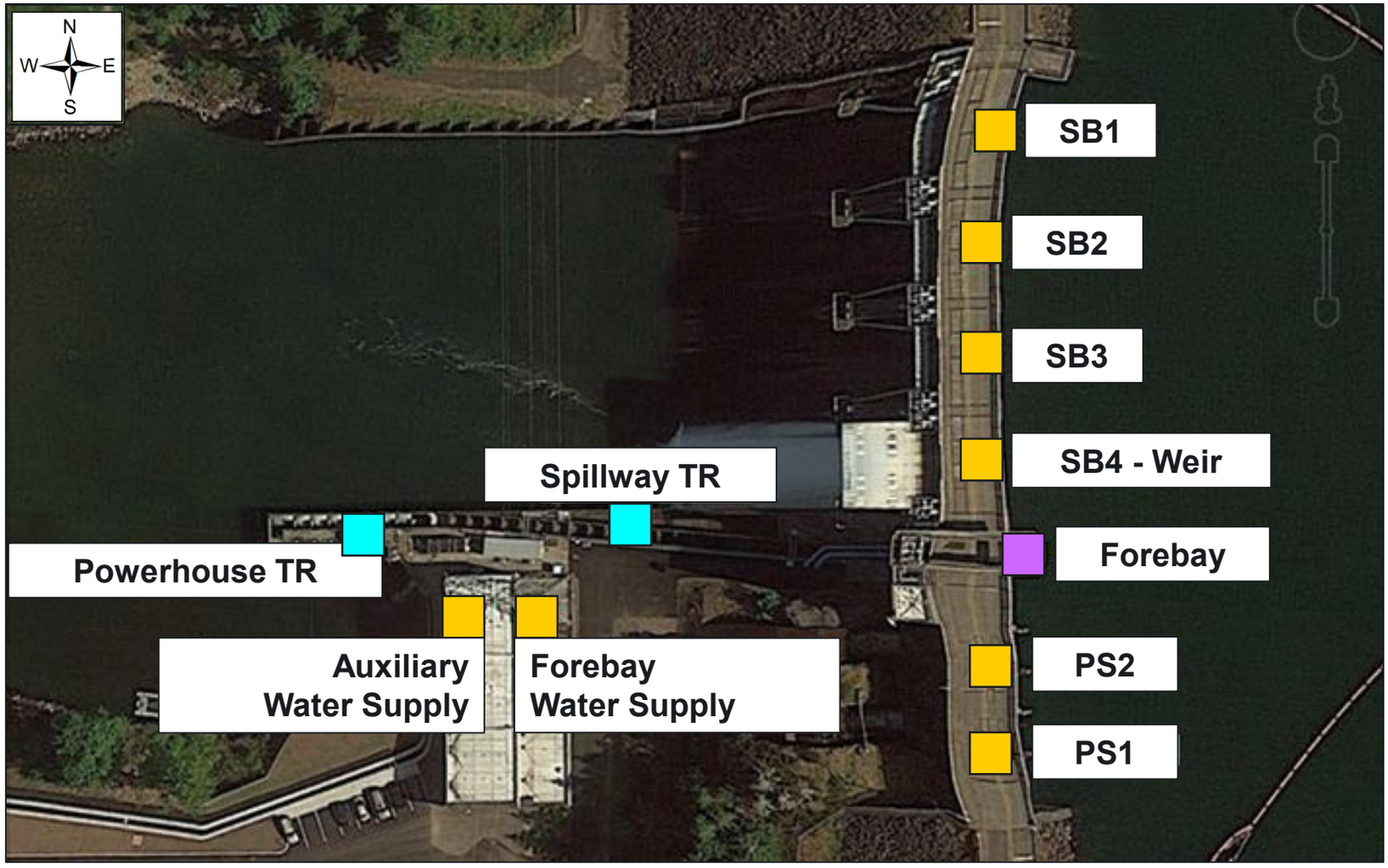
Foster Dam RT Detection Arrays

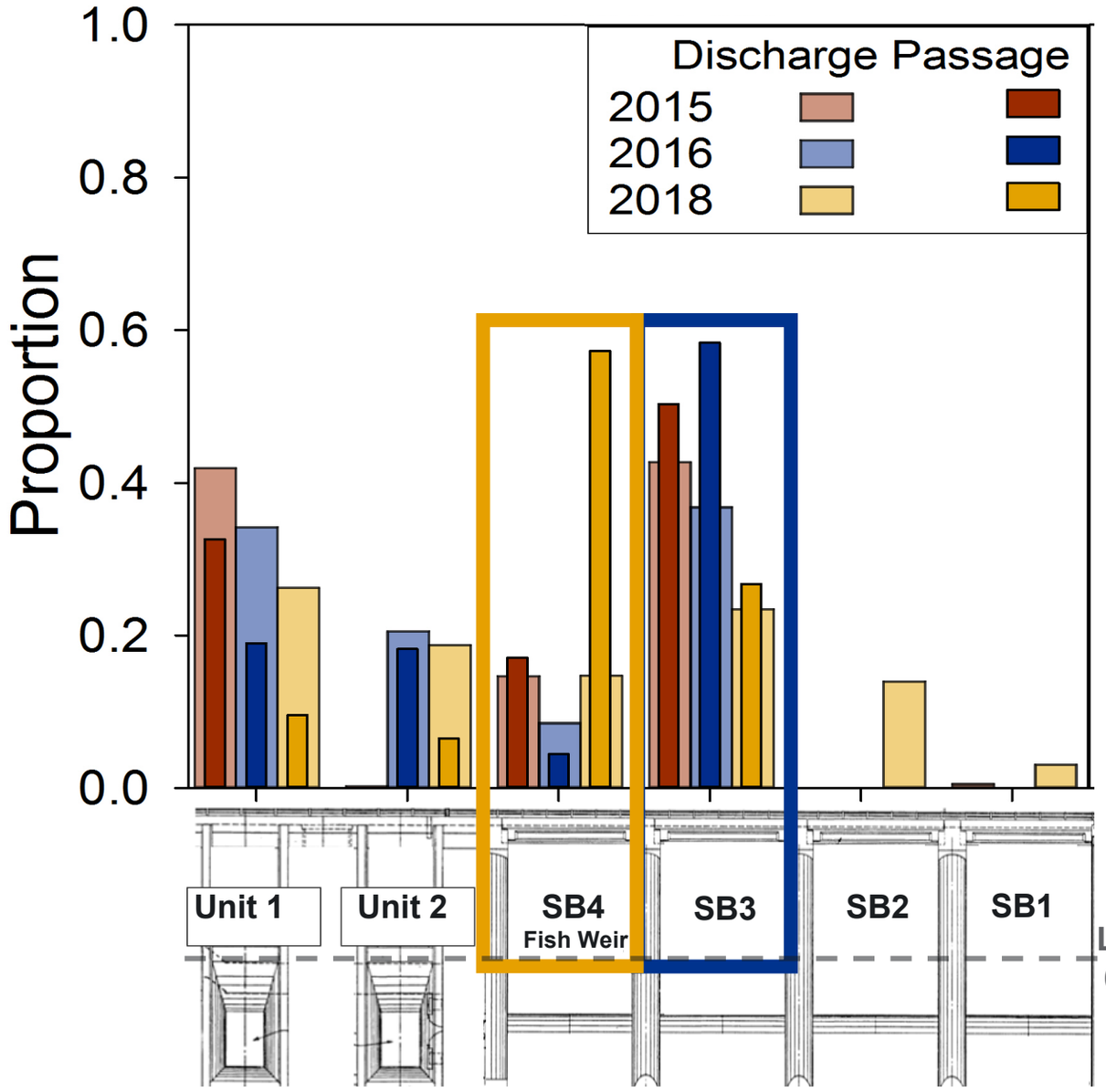
Detection Zones

- Route-Specific
- General – Upstream
- Tailrace (TR) – Passage



Passage Distributions
Low Pool
Greatest through Weir in 2018

Chinook Salmon



Chinook Salmon Passage (*n*)

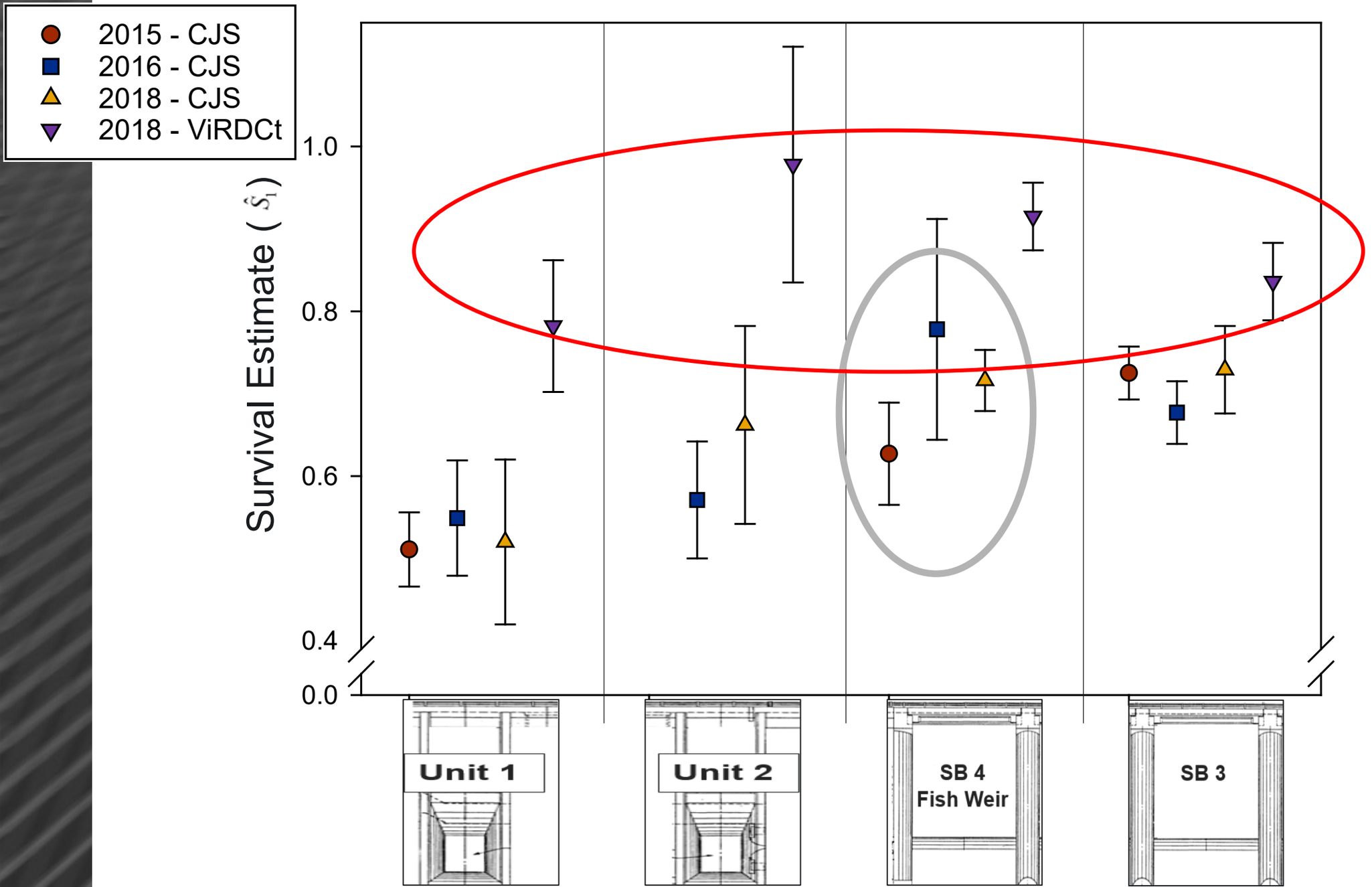
2015 = 457

2016 = 269

2018 = 262

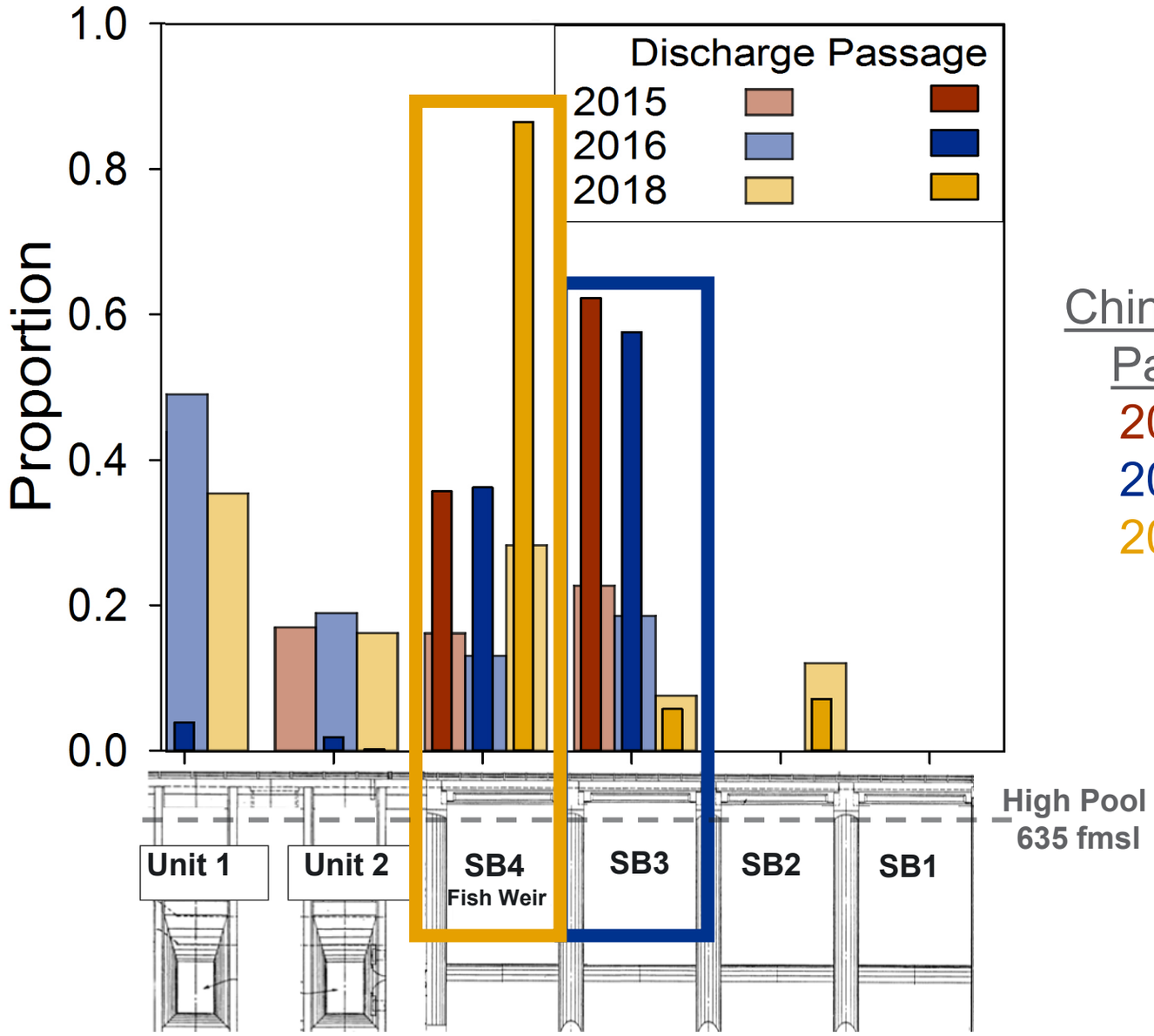
Survival: Route-Specific
Low Pool
Comparable through Weir among Years

Chinook Salmon



Passage Distributions
High Pool
Greatest through Weir in 2018

Chinook Salmon



Chinook Salmon Passage (*n*)

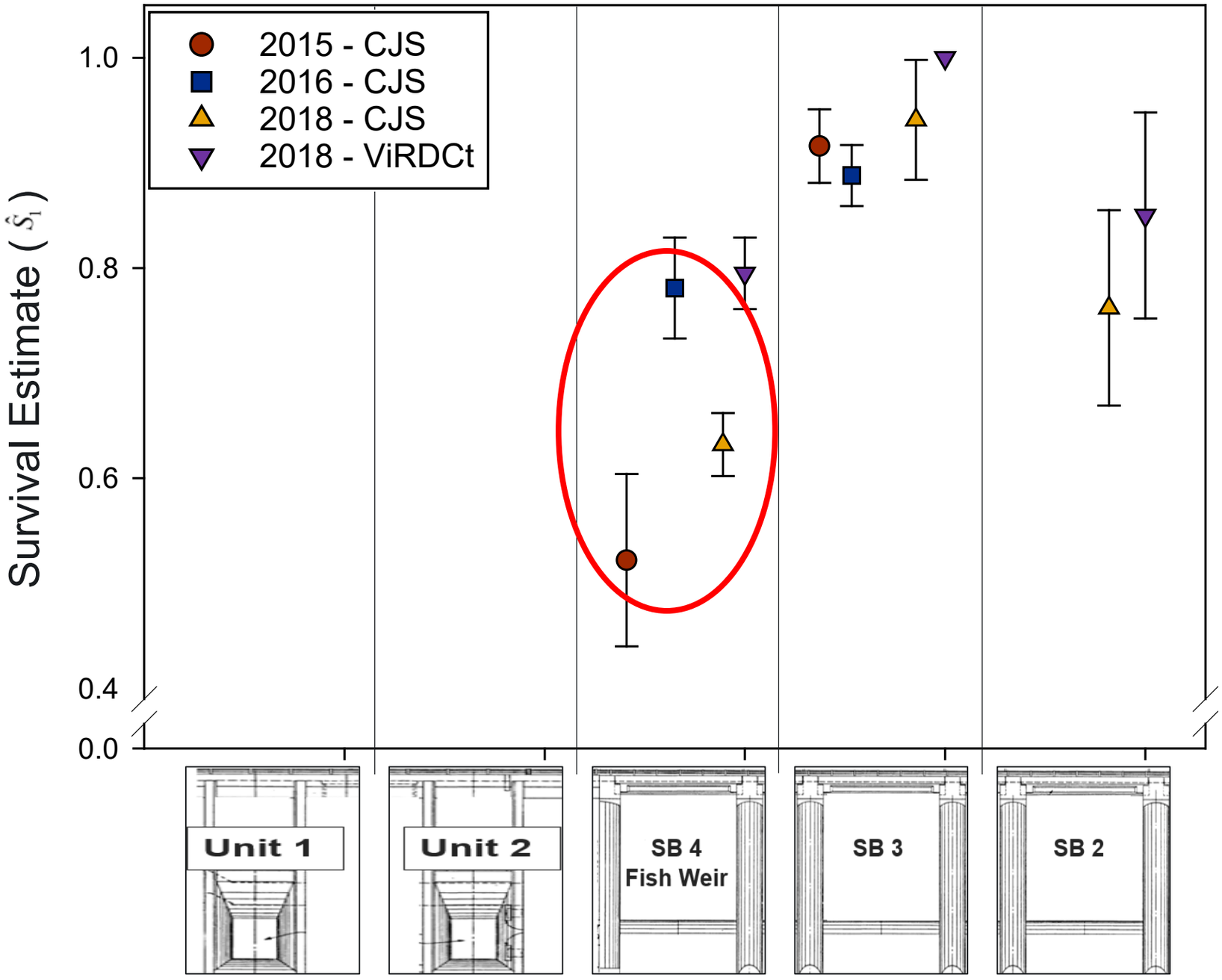
2015 = 109

2016 = 201

2018 = 291

Survival: Route-Specific
High Pool
Moderate through Weir in 2018

Chinook Salmon



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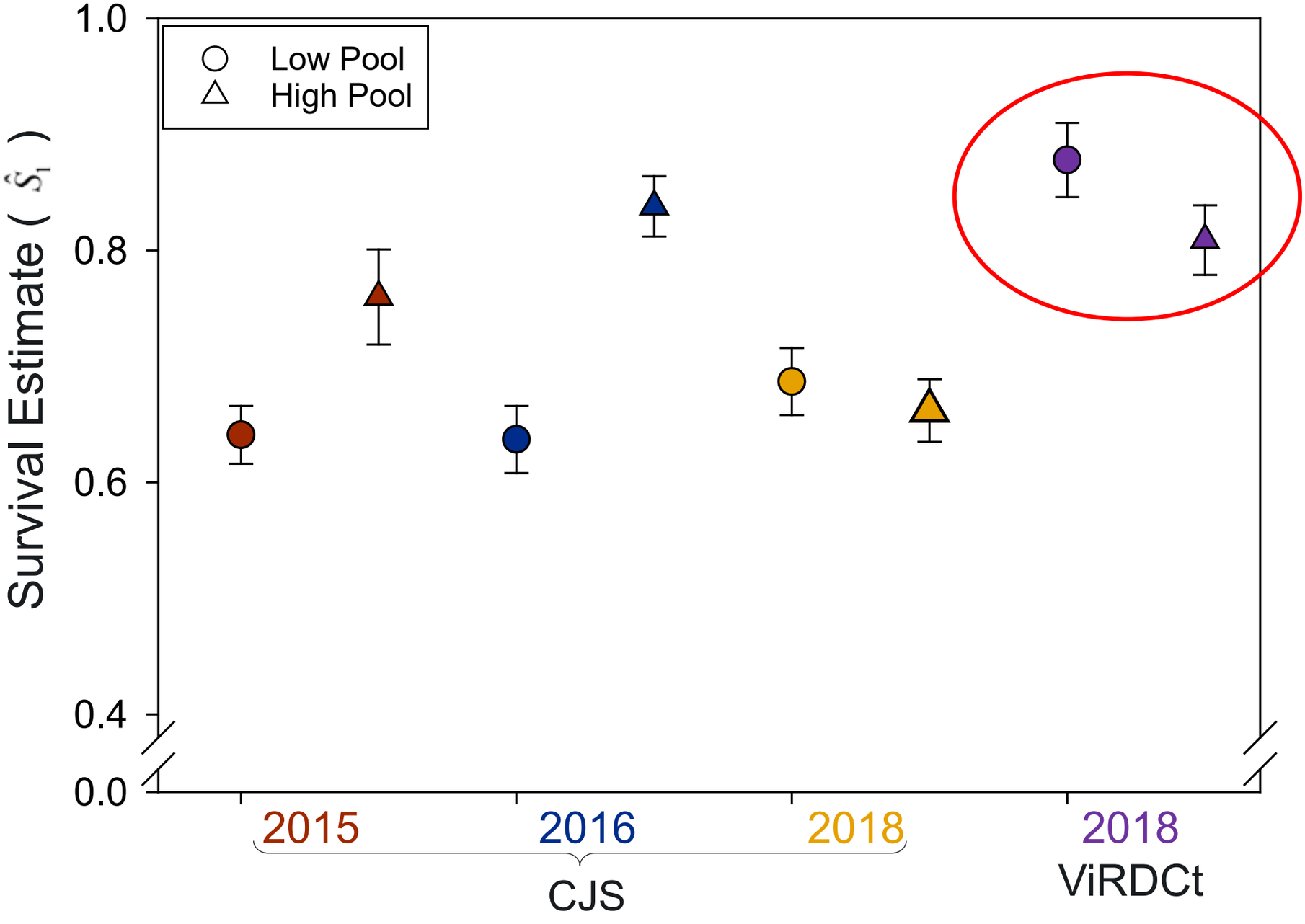
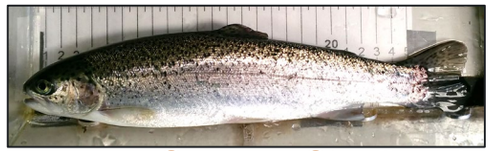
Chinook Salmon

Survival: Dam Passage
ViRDCt = More Representative of Dam Survival

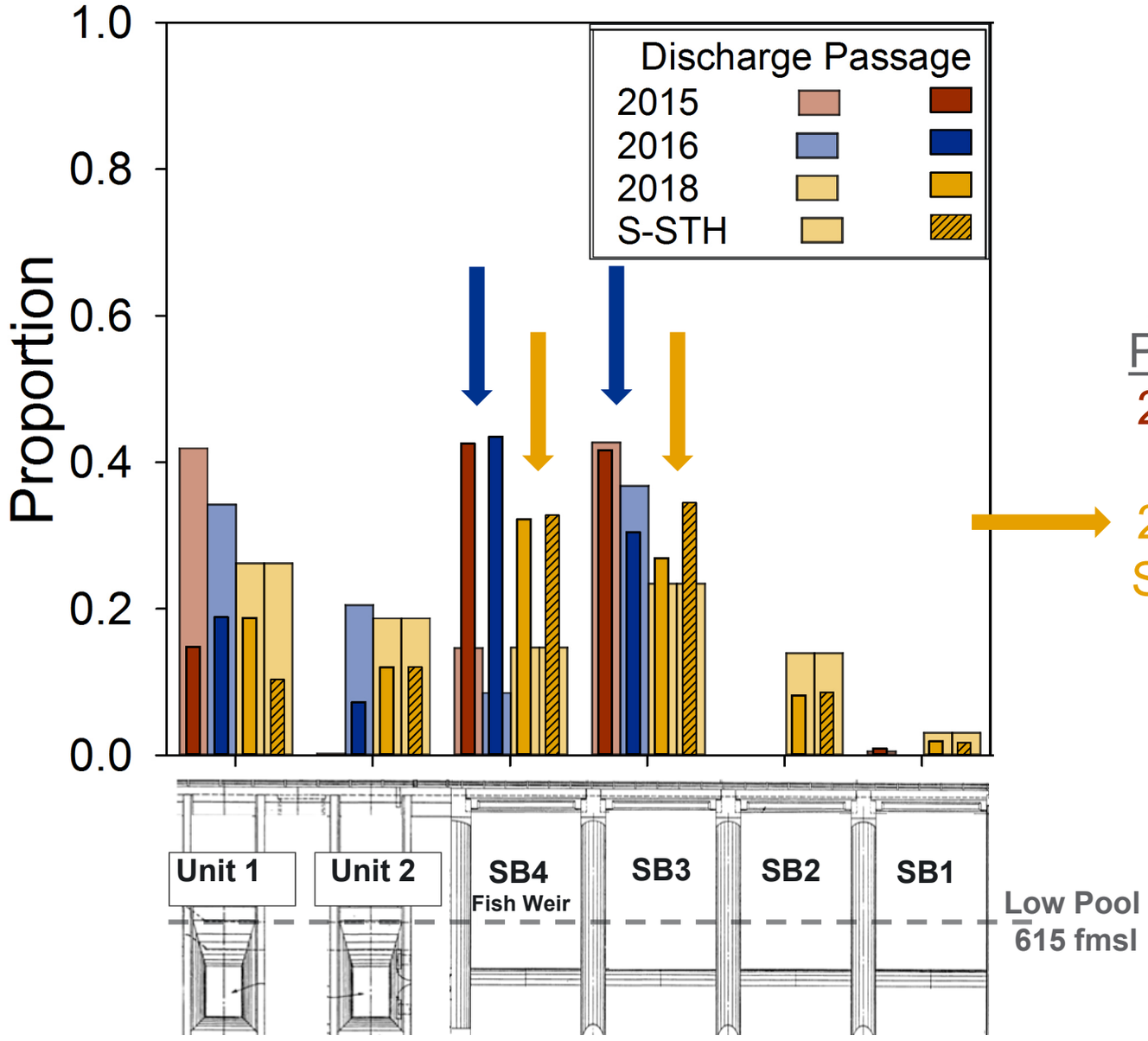


Passage Distributions
Low Pool
Comparable for Weir and SB3

Winter Steelhead



Summer Steelhead



Steelhead Passage (*n*)

2015 = 108

2016 = 69

2018 = 208

S-STH = 58

Survival: Route-Specific
Low Pool
2018 Comparable to 2015 and 2016

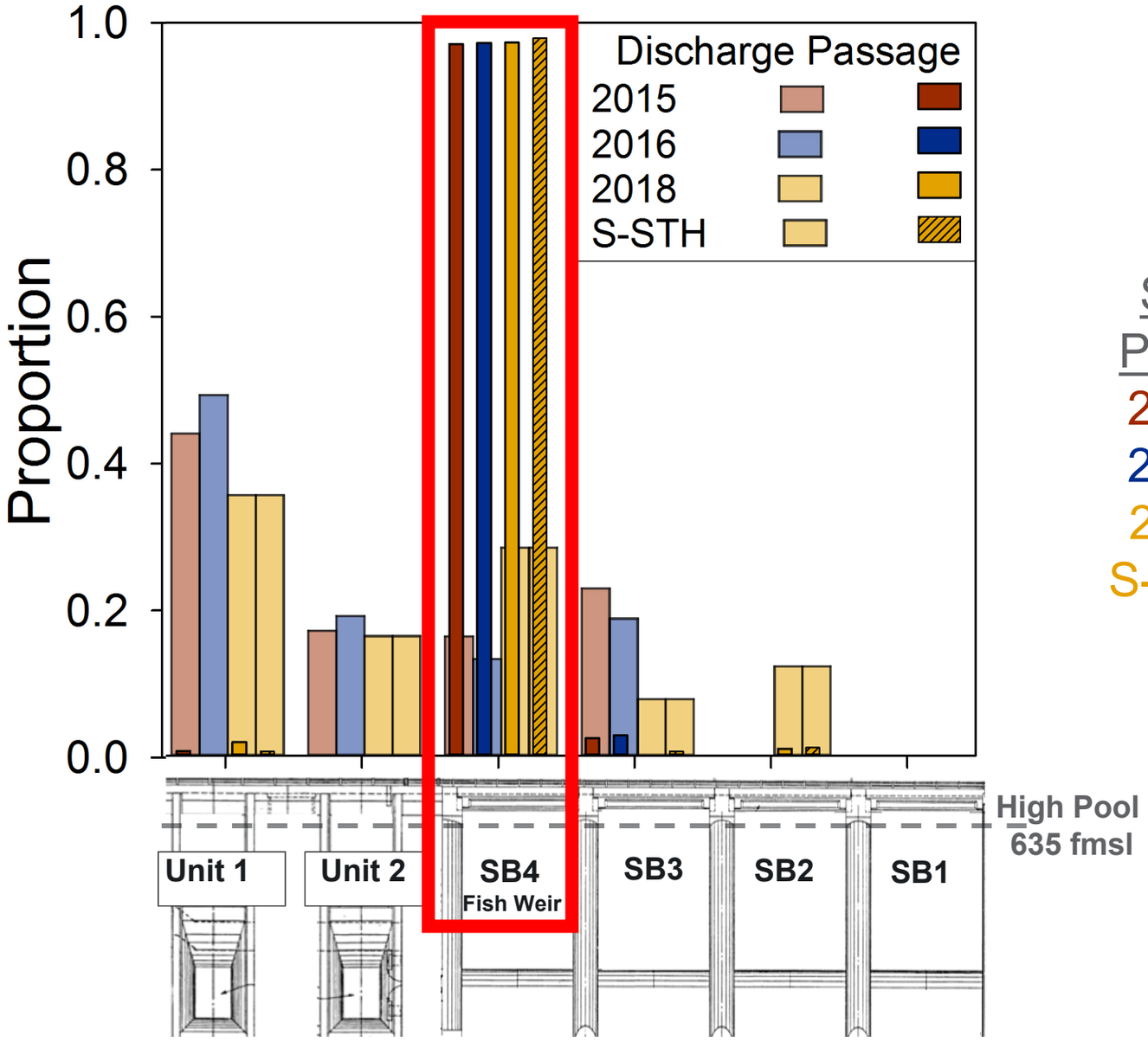
Winter Steelhead

Summer Steelhead

Passage Distributions
High Pool
>90% Steelhead through the Weir

Winter Steelhead

Summer Steelhead



Steelhead Passage (*n*)

2015 = 171

2016 = 146

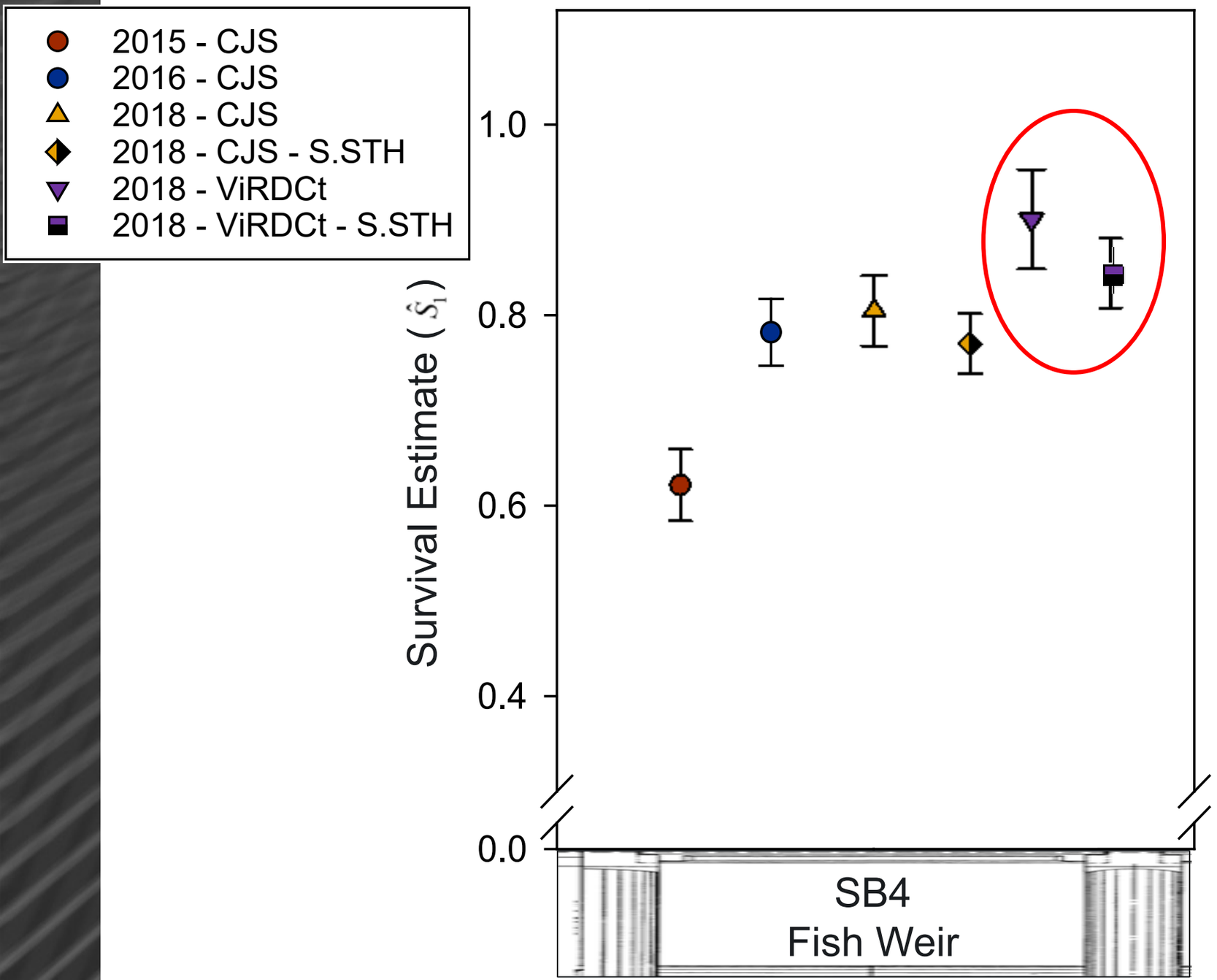
2018 = 110

S-STH = 187

Survival: Route-Specific
High Pool
2018 Comparable to 2015 and 2016

Winter Steelhead

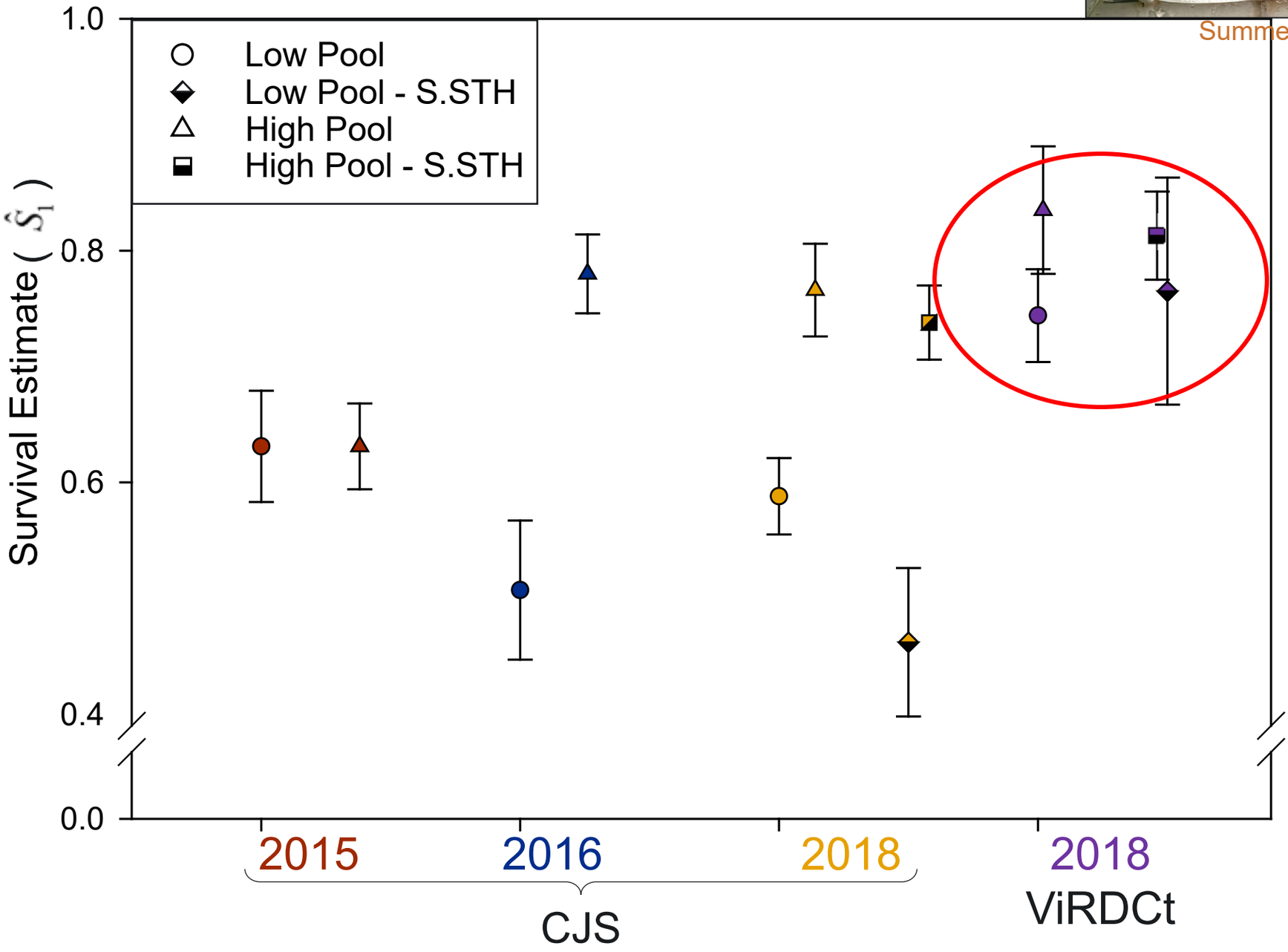
Summer Steelhead



Survival: Dam Passage
Similar Survival Among Pools

Winter Steelhead

Summer Steelhead



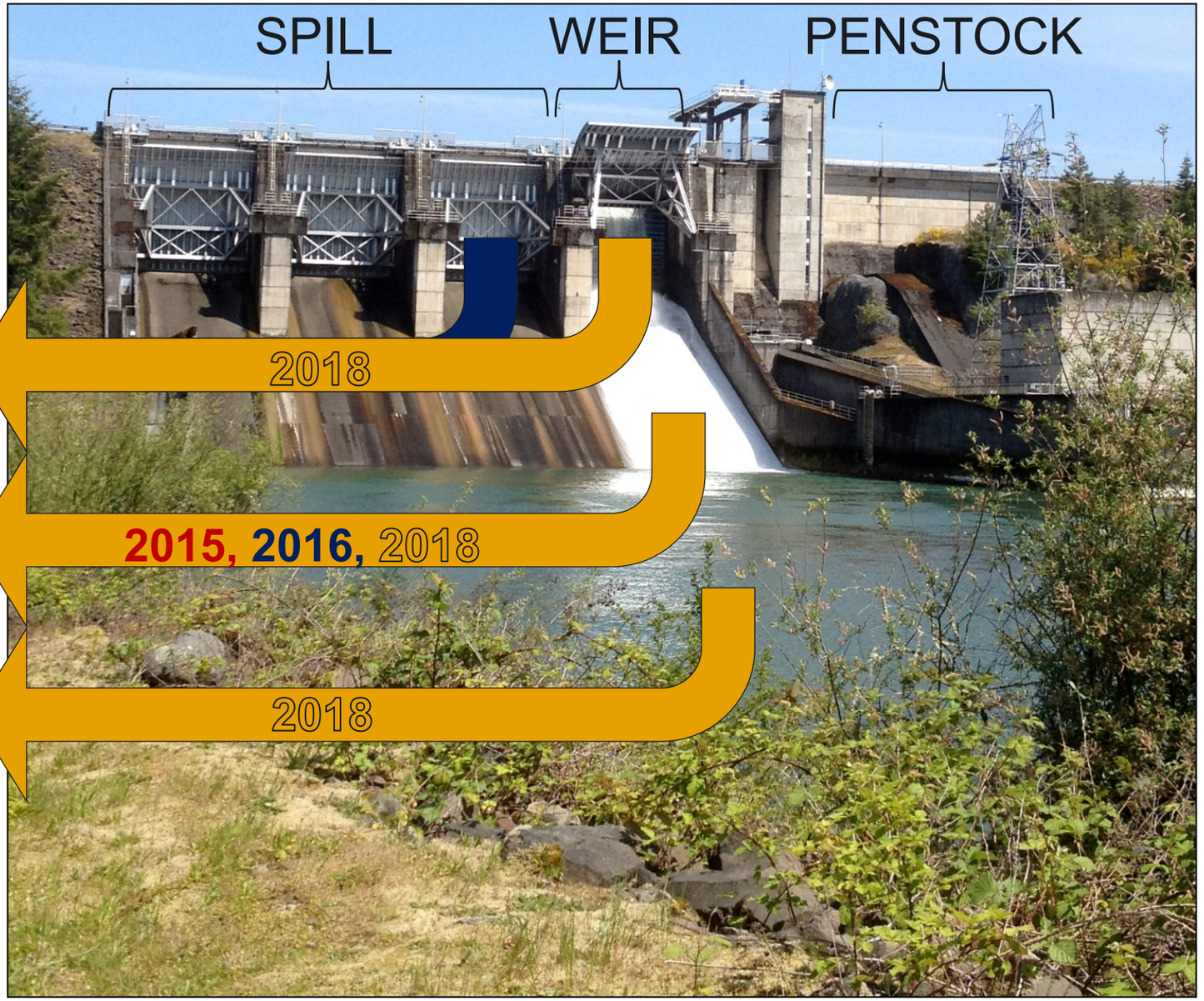
Post-Construction Weir Evaluation: Upstream Side of the Weir Successfully Attracting Fish

- Preferred routes of passage

Chinook Salmon

Winter Steelhead

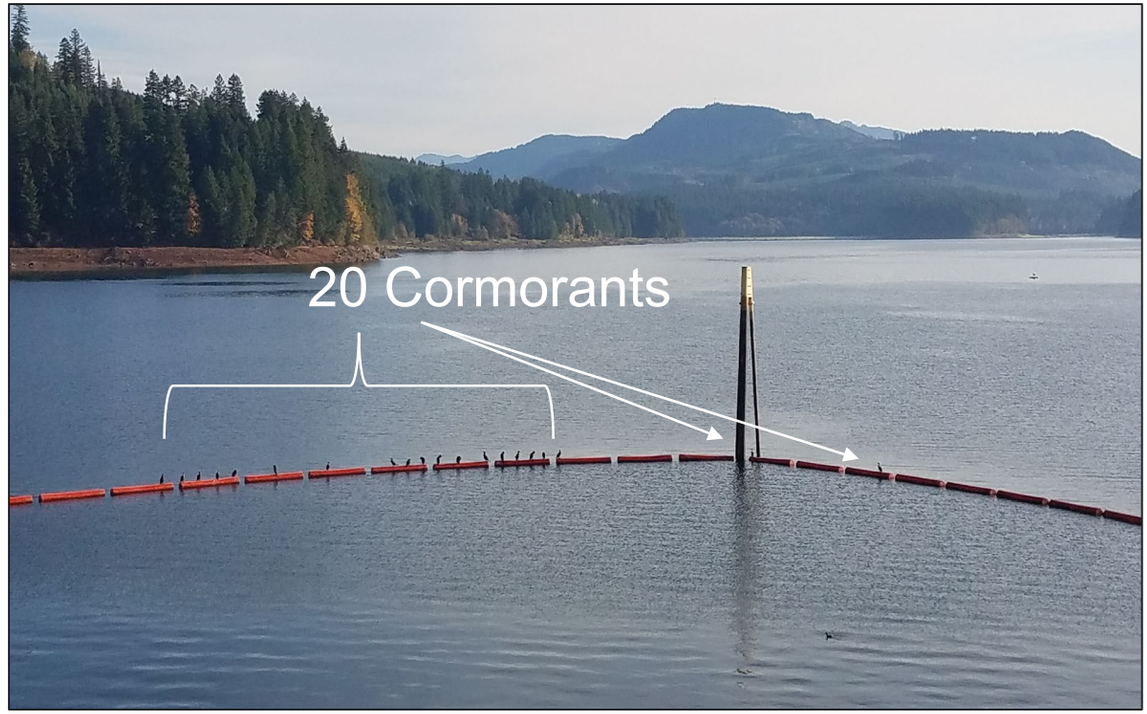
Summer Steelhead



- ViRDCt = more representative of dam passage survival

Avian Predation

- 2.9% of 2018 detected study fish preyed upon by birds
  - Minimum estimate
- Avian predation influences recovery of ESA-listed salmonid populations[1]
- Piscivorous birds consume significant numbers of juvenile Chinook salmon and steelhead at dams in the PNW
  - Significant mortality in the Snake and Columbia rivers[2]
  - Lower predation rates in the Willamette River than in Columbia River[3]



[1]*NOAA 2008*
[2]*Evans et al. 2016*
[3]*Evans et al. 2012*

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Conclusions

- New Weir Design
  - Upstream = 
    - ✓ Successfully attracting fish and has become the preferred route of passage for all species evaluated
  - Downstream = 
    - ✓ Spring 2018 CJS survival estimates comparable to 2015 and 2016
    - ✓ However, higher rates of severe events in the chute and fish injuries compared to other similar structures were noted as a result of the Sensor Fish and Balloon Tag evaluations
    - ✓ Alternatives are being considered to improve weir survival and decrease injury rates
- Determine whether avian predation is a cause for concern

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This research was conducted in compliance with a protocol approved by PNNL's Institutional Animal Care and Use Committee.

Questions?