



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

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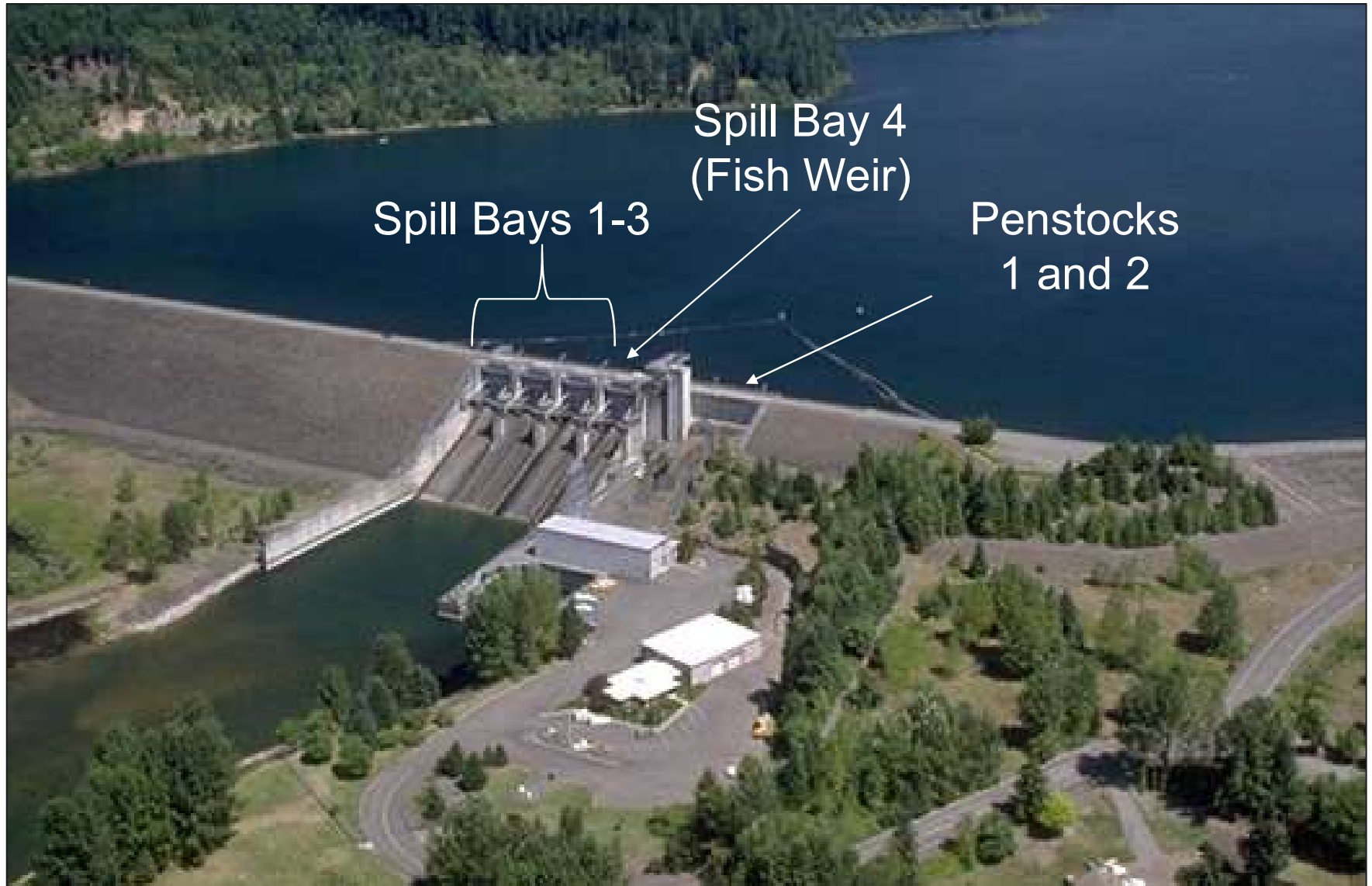




Study Objectives

- Post-construction evaluation for passage and survival
 - Compare 2018 with 2015 and 2016
- Radio- and PIT-tagged yearling Chinook salmon, age-2 wild surrogate winter steelhead and fall subyearling Chinook salmon
- Two reservoir elevations
 - Low pool = 615 fmsl (early spring and fall)
 - High pool = 635 fmsl (late spring and summer)
- Estimate
 - Passage distributions
 - Route-specific and dam passage survival
 - Single-release/recapture model (Cormack-Jolly-Seber, CJS)
 - Passage efficiencies

Foster Dam



New Fish Weir in 2018

- 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)



Fish Sources, Sample Sizes, Tags



Wild Fish
Surrogate Program



Yearling Chinook Salmon

$n = 757$



Age-2 Winter Steelhead

$n = 1,016$

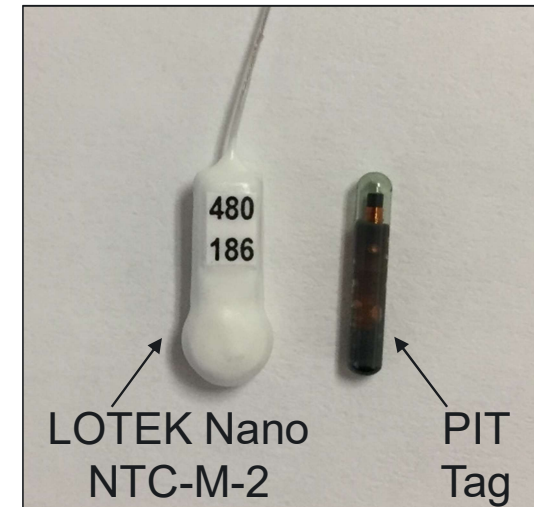


South Santiam
Fish Hatchery



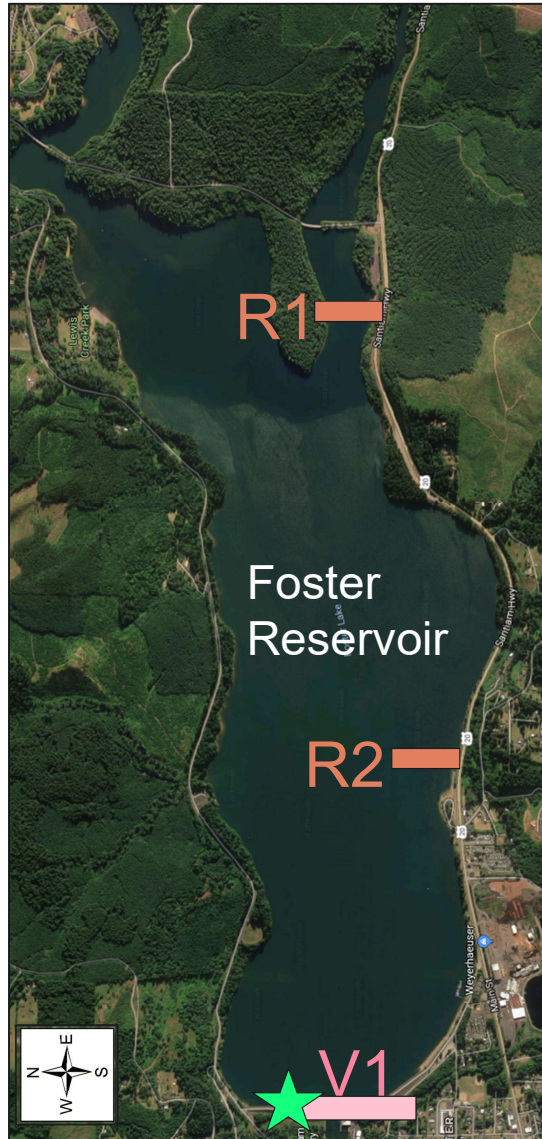
Subyearling Chinook Salmon

$n = 749$

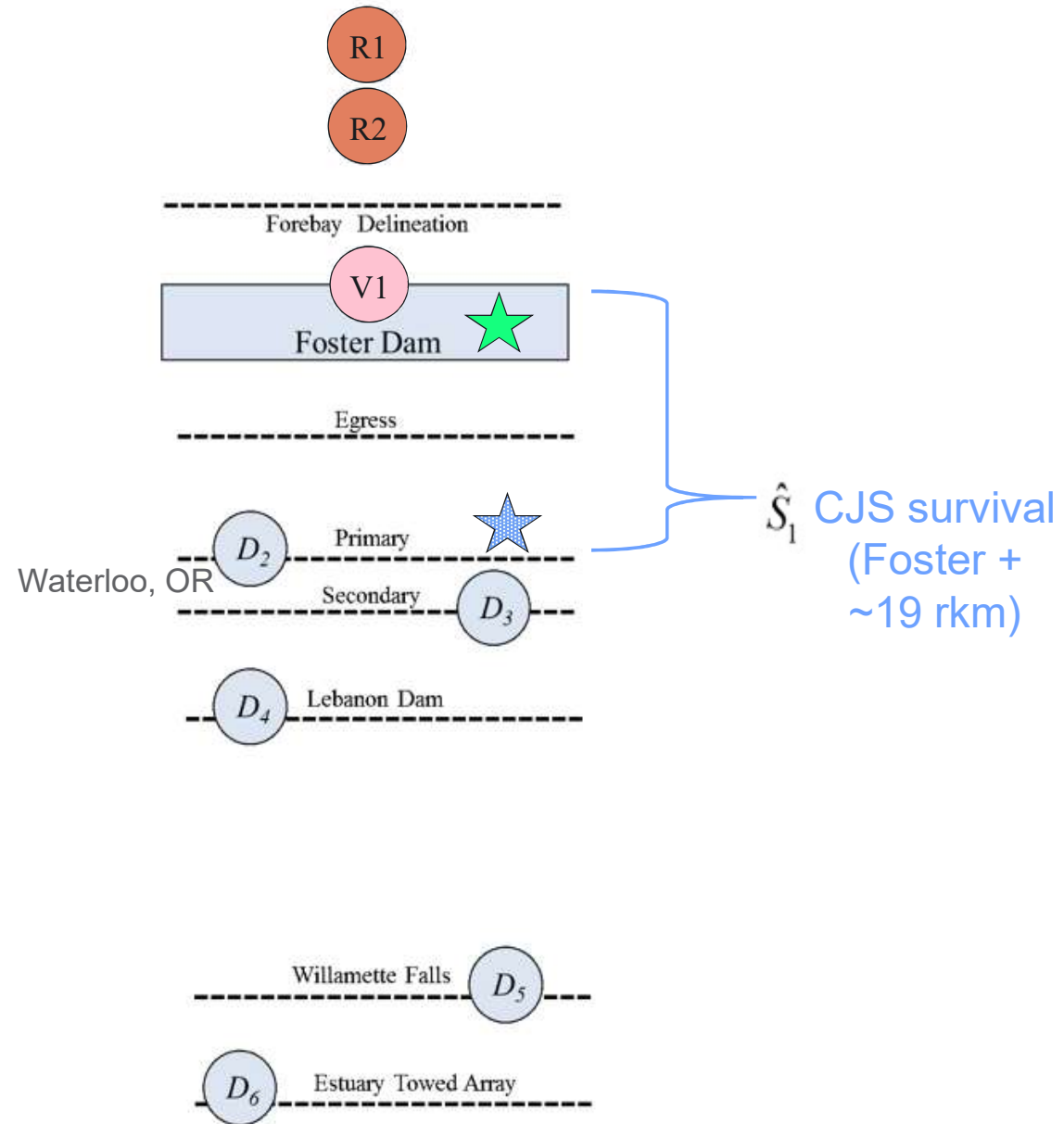


- Orion Receivers (Sigma Eight Inc.)
- Multiprotocol Integrated Telemetry Acquisition System (MITAS)
- Tag Life = ~51 days

Study Design



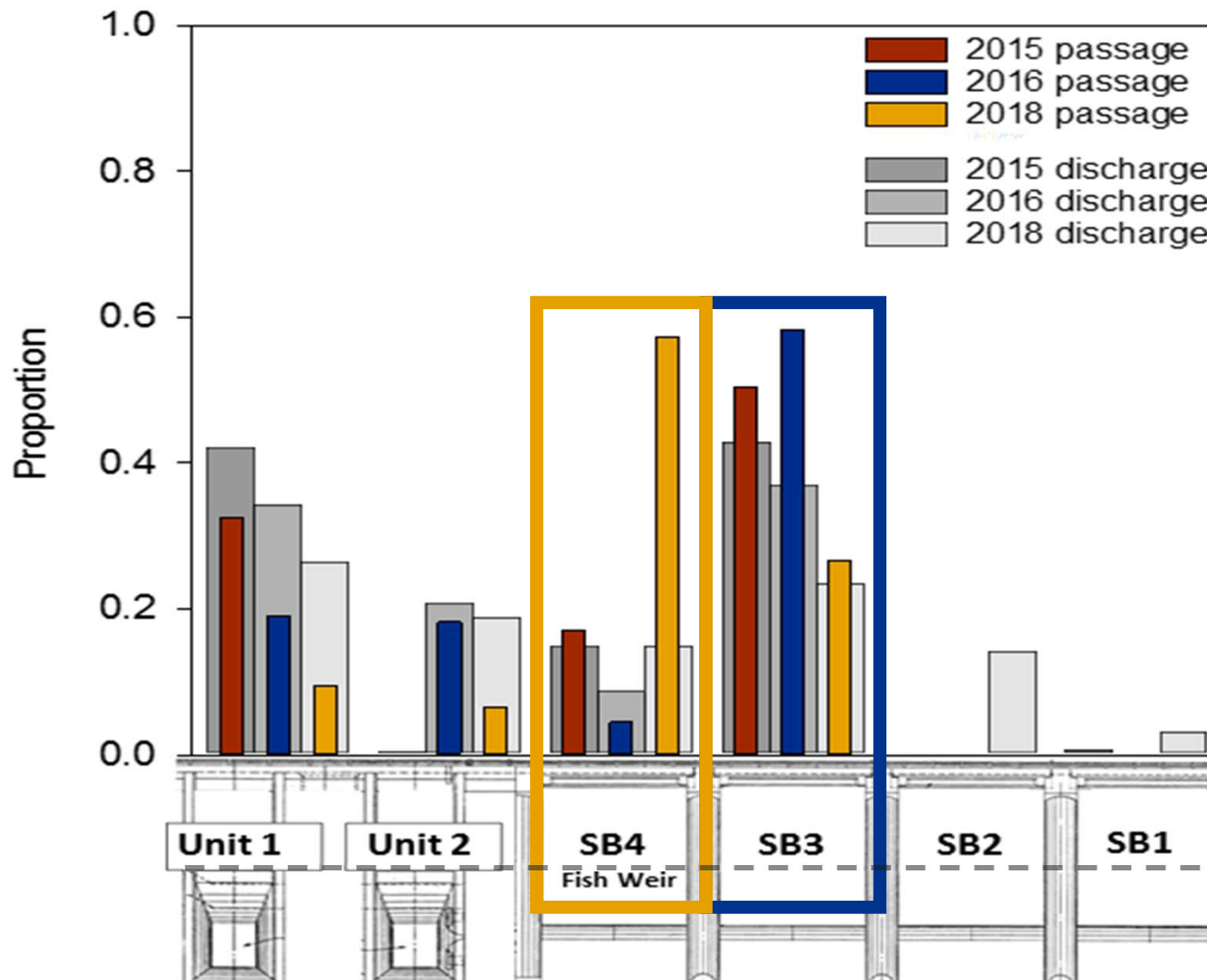
↓
FLOW



Passage Distributions Low Pool Greatest through Weir in 2018



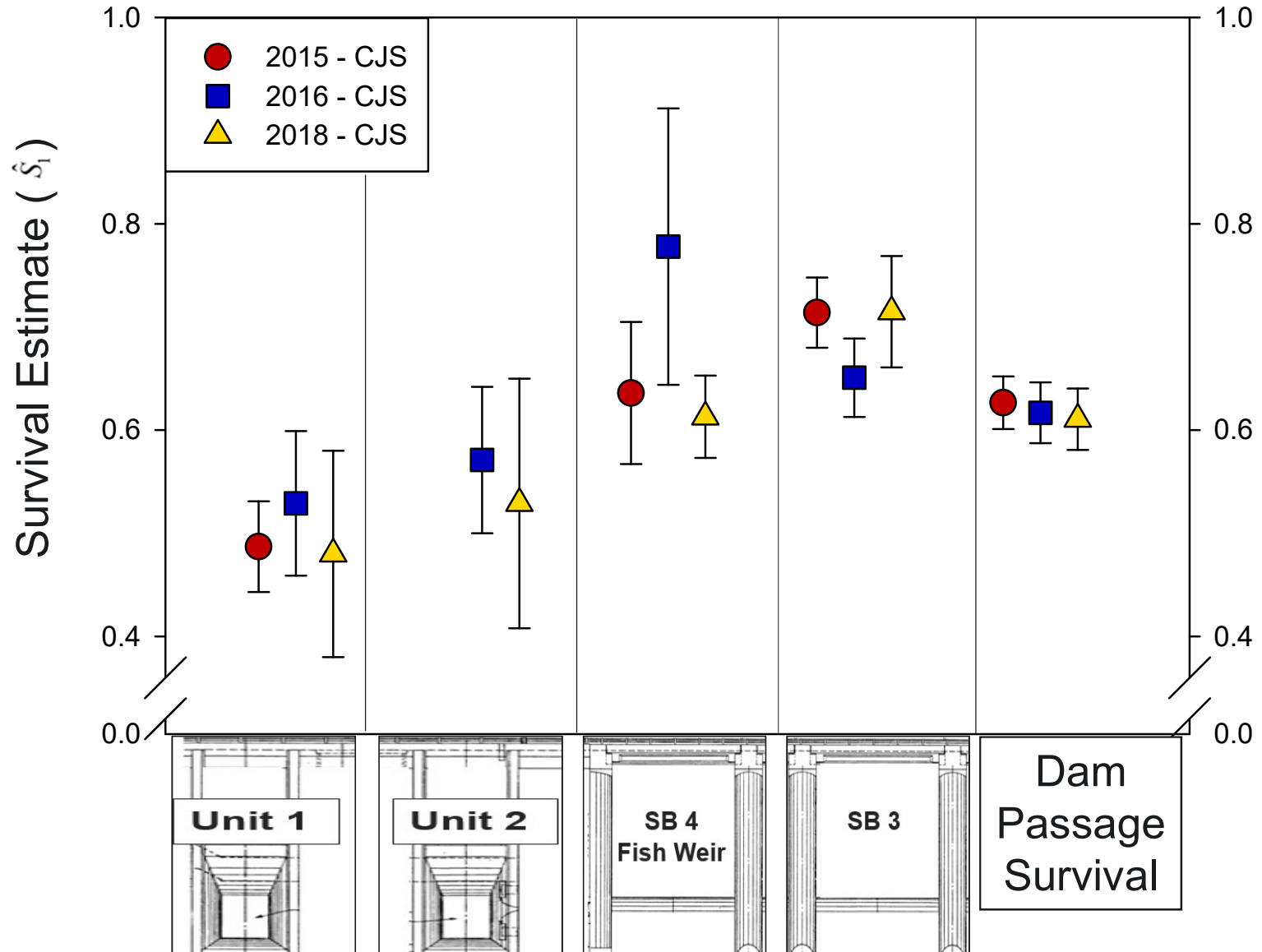
Yearling Chinook Salmon



Chinook
Salmon
Passage (n)
2015 = 457
2016 = 269
2018 = 262

Low Pool
615 fmsl

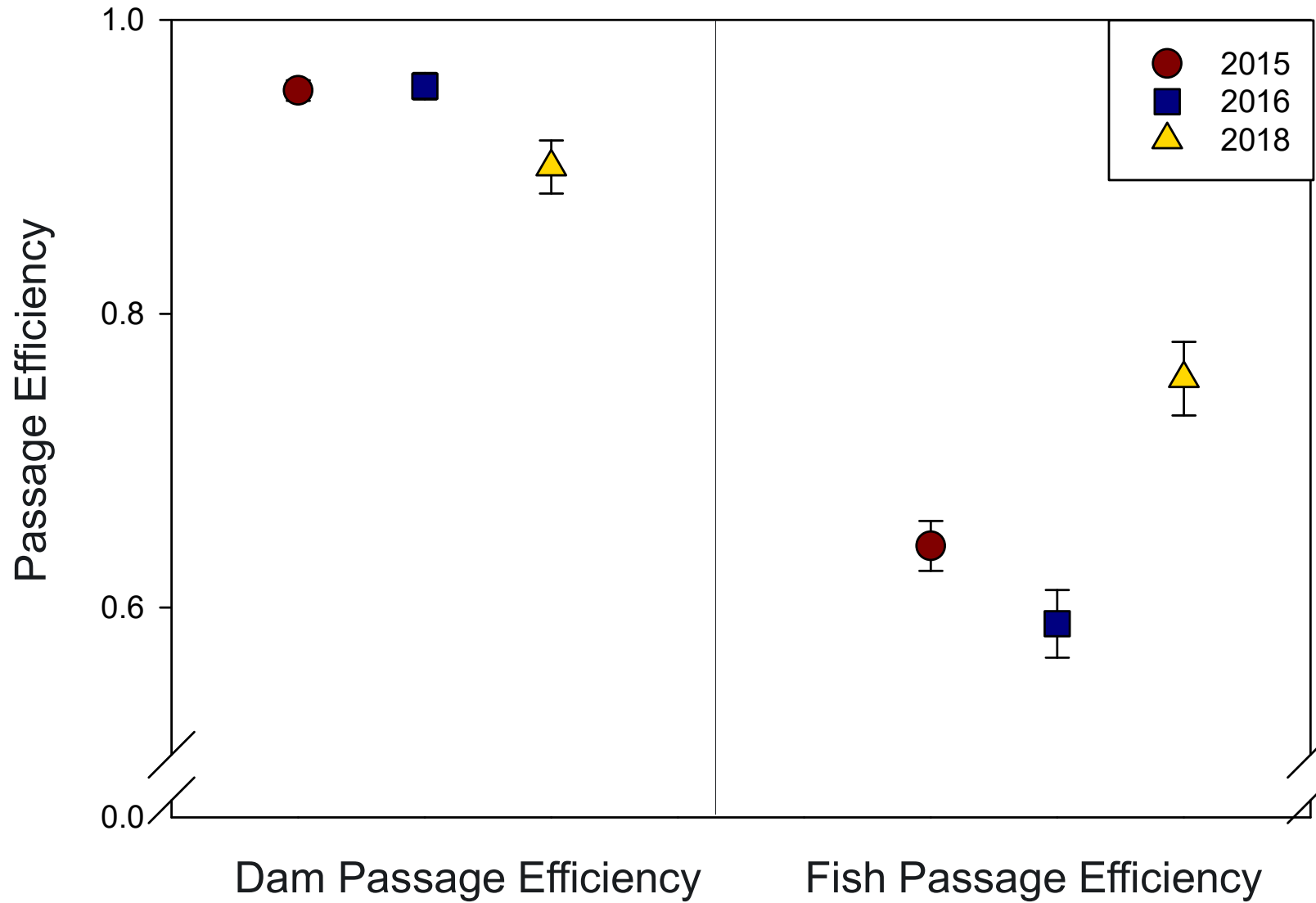
Survival: Route-Specific Low Pool Comparable through Weir among Years





Yearling Chinook Salmon

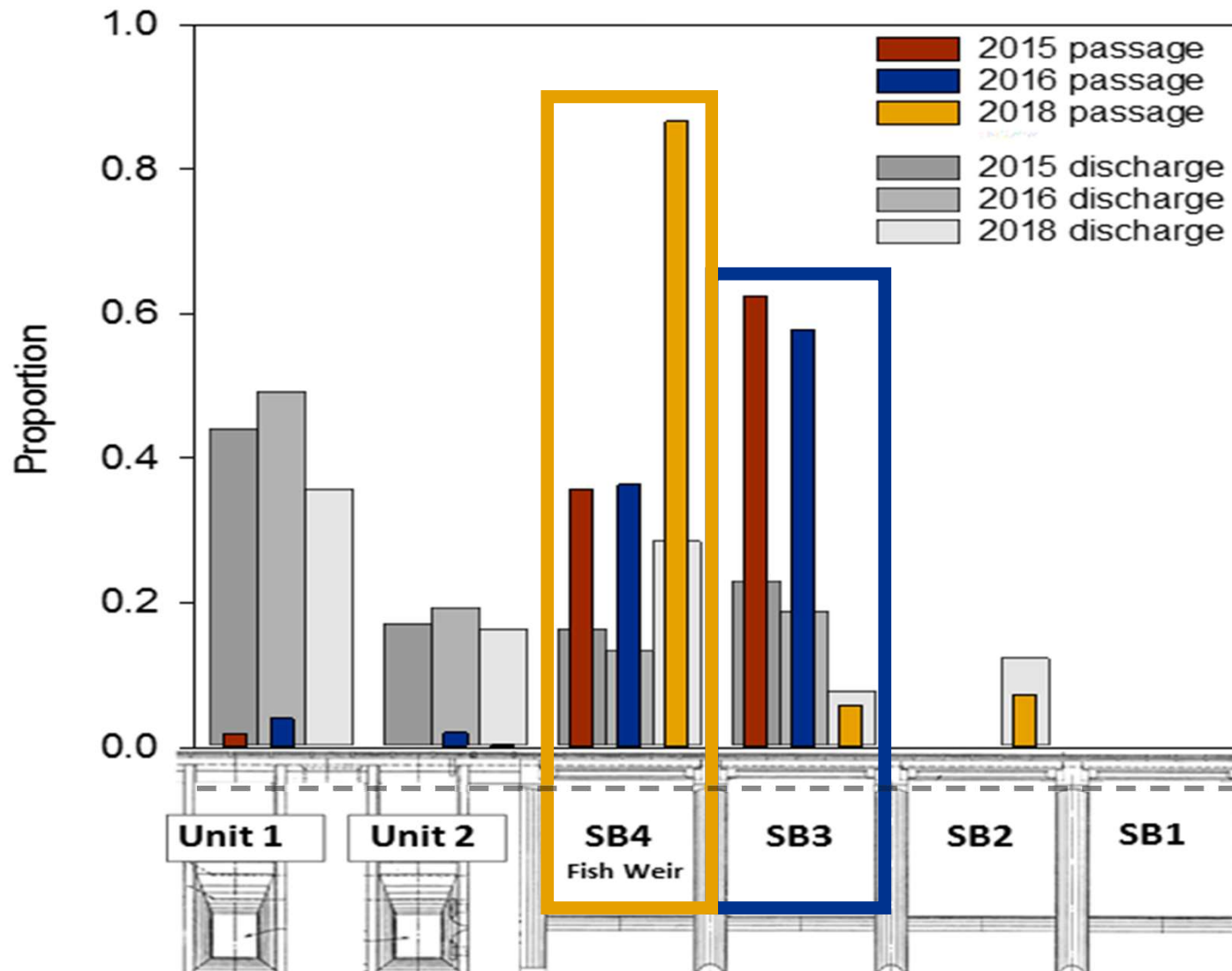
Low Pool Fish Passage Efficiencies



Passage Distributions High Pool Greatest through Weir in 2018



Yearling Chinook Salmon



Chinook Salmon

Passage (*n*)

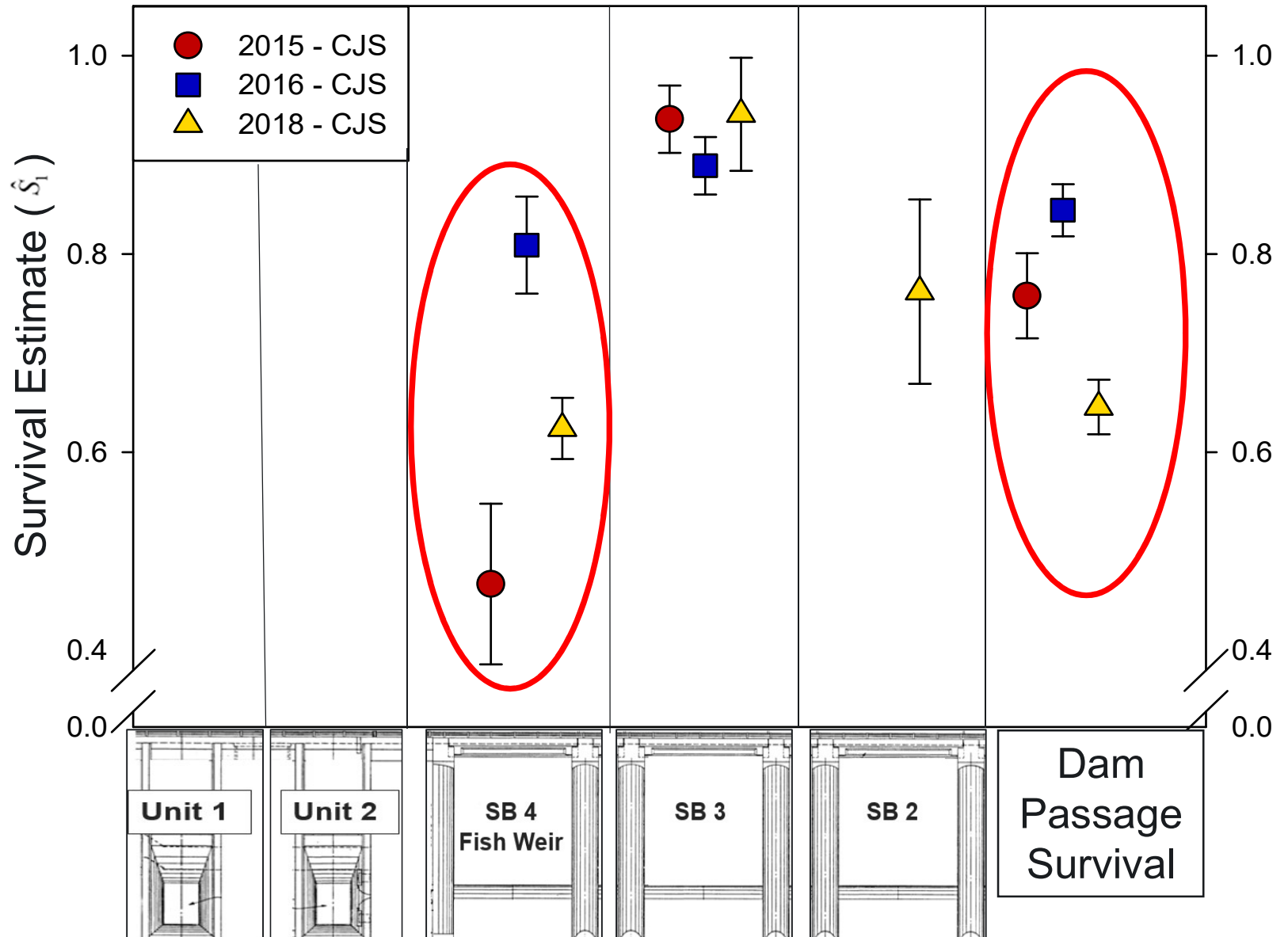
2015 = 109

2016 = 201

2018 = 291

High Pool
635 fmsl

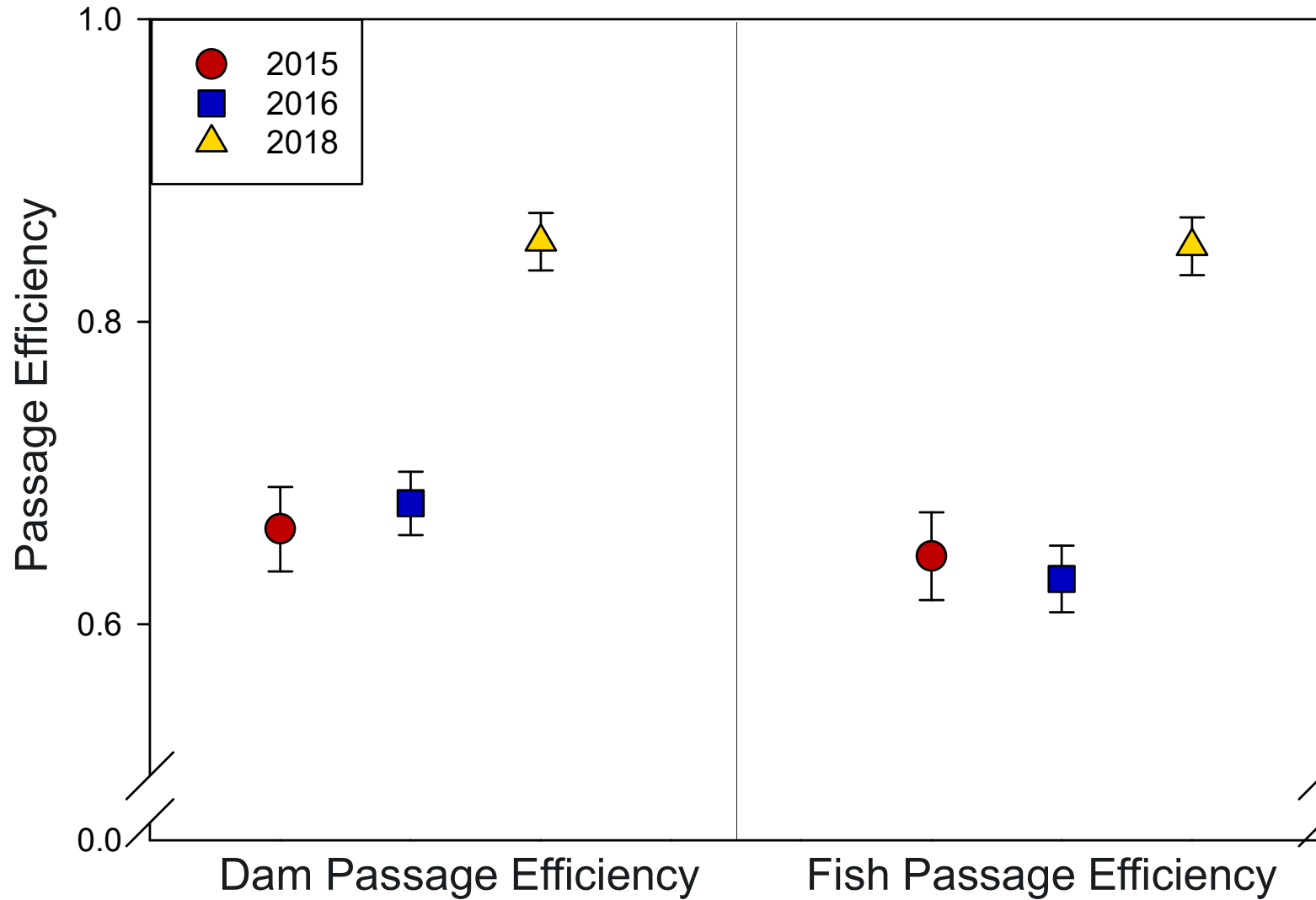
Survival: High Pool Moderate through Weir in 2018





Yearling Chinook Salmon

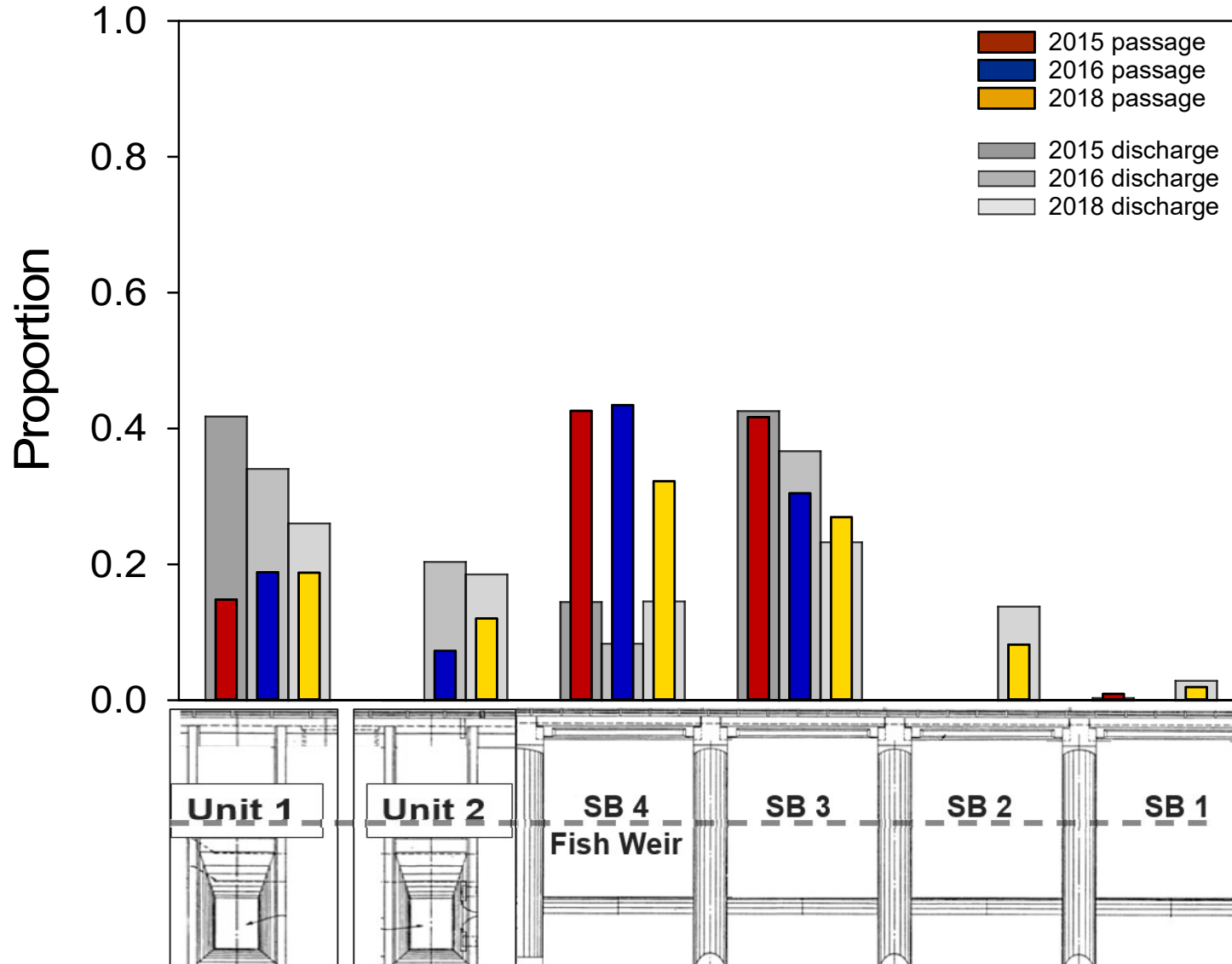
High Pool Fish Passage Efficiencies



Passage Distributions Low Pool Comparable for Weir and SB3



Winter Steelhead



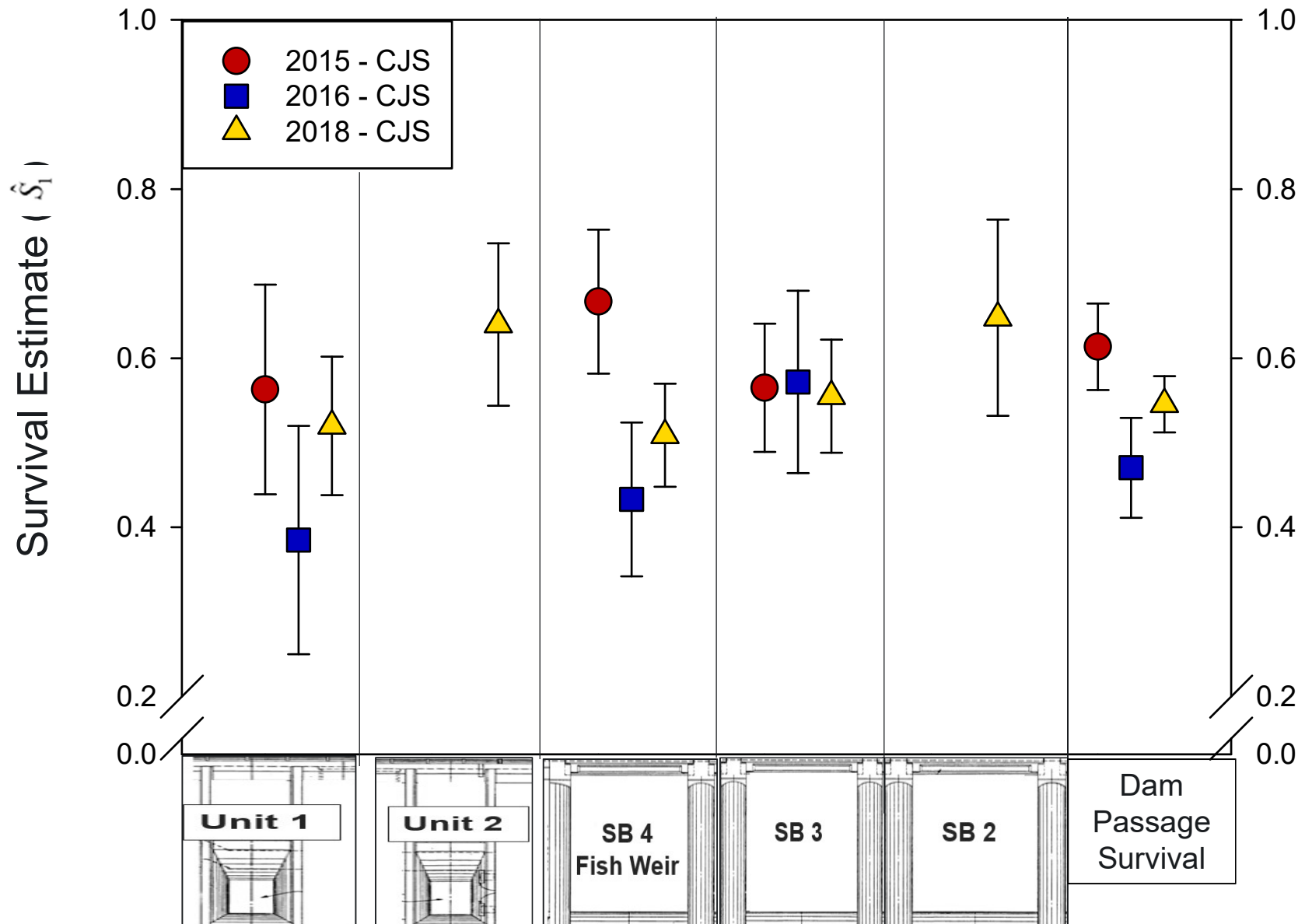
Steelhead
Passage (n)
2015 = 108
2016 = 69
2018 = 208

Low Pool
615 fmsl

Survival: Low Pool 2018 Comparable to 2015 and 2016



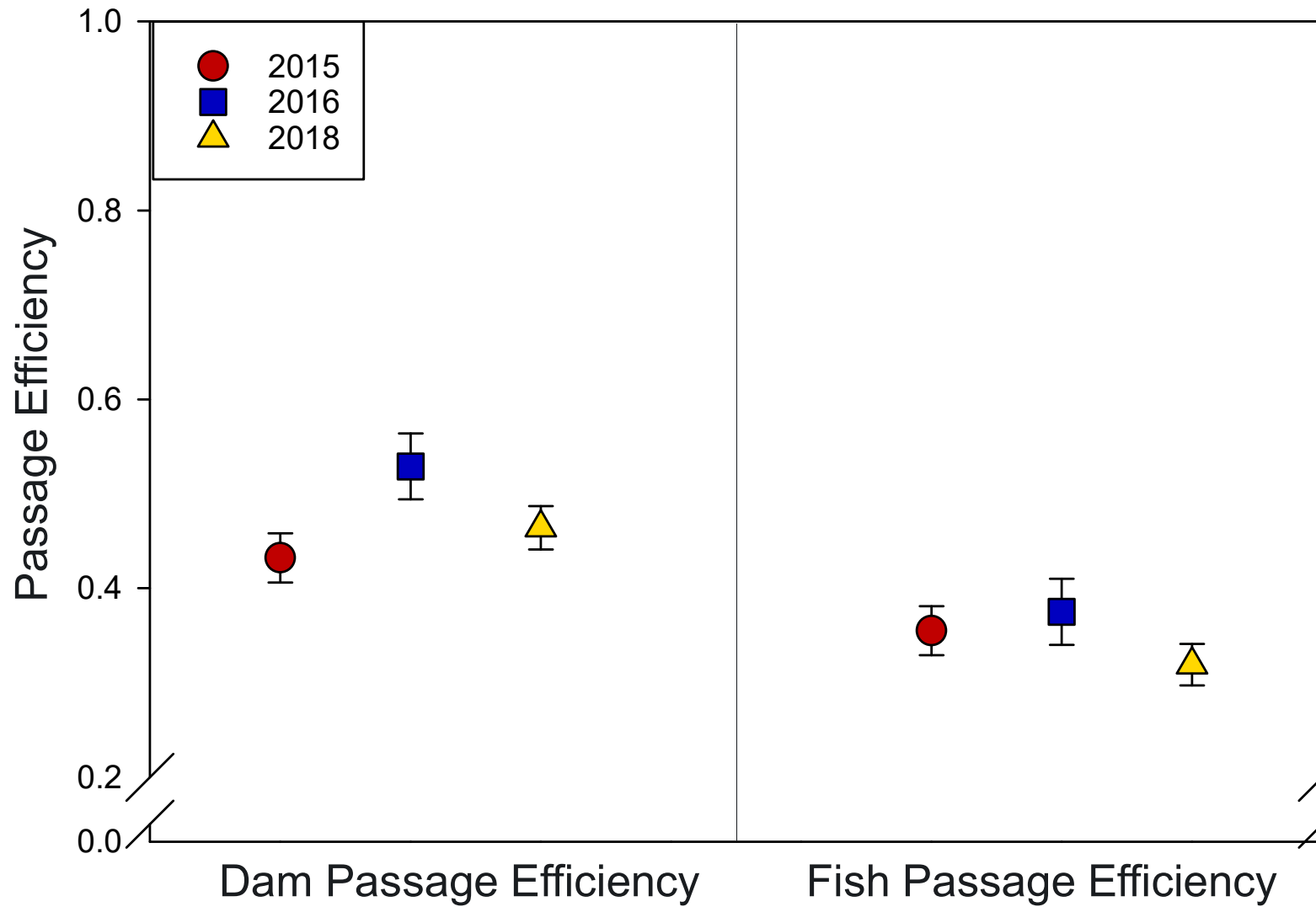
Winter Steelhead





Winter Steelhead

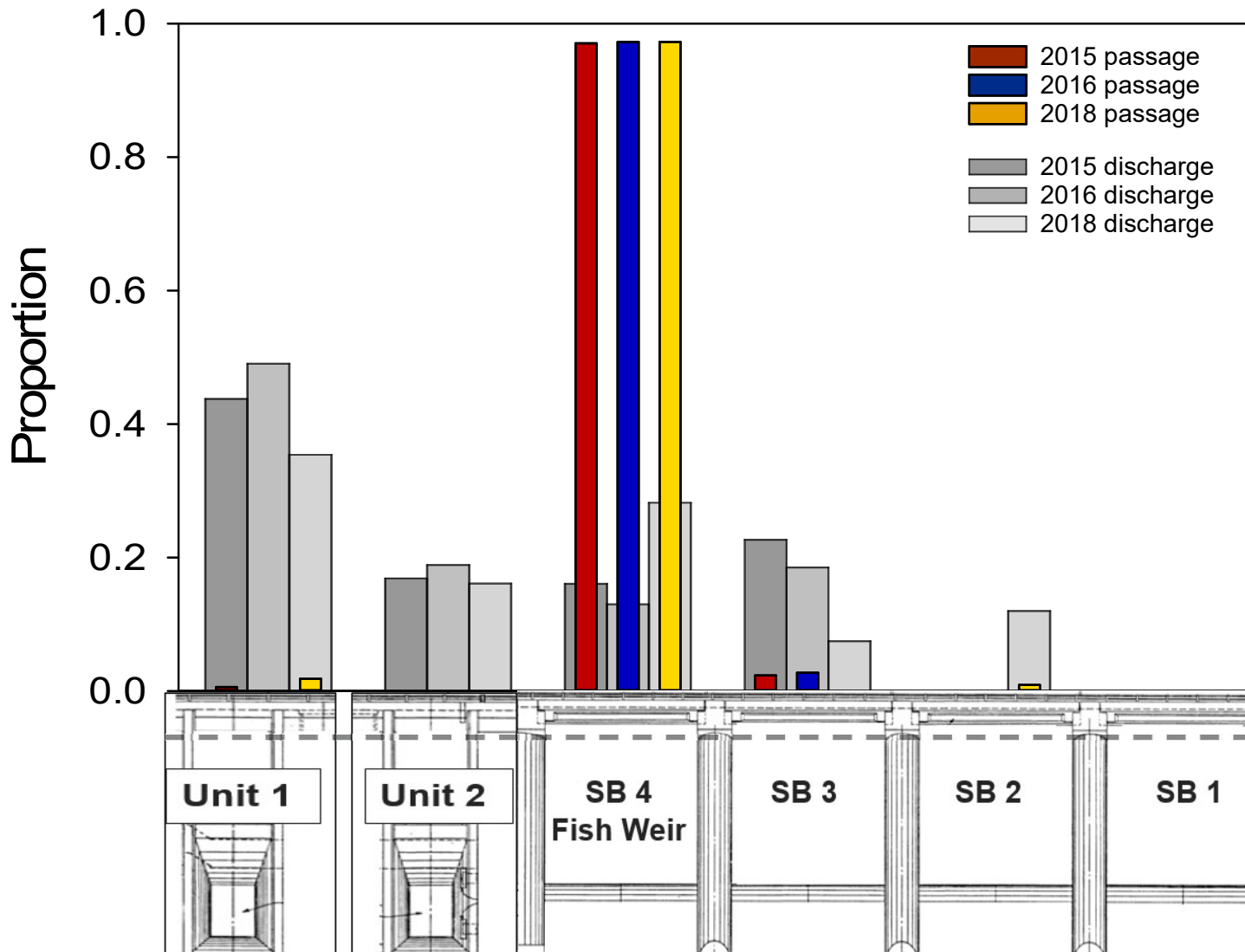
Low Pool Fish Passage Efficiencies



Passage Distributions High Pool >90% Steelhead through the Weir



Winter Steelhead



Steelhead
Passage (n)
2015 = 171
2016 = 146
2018 = 110

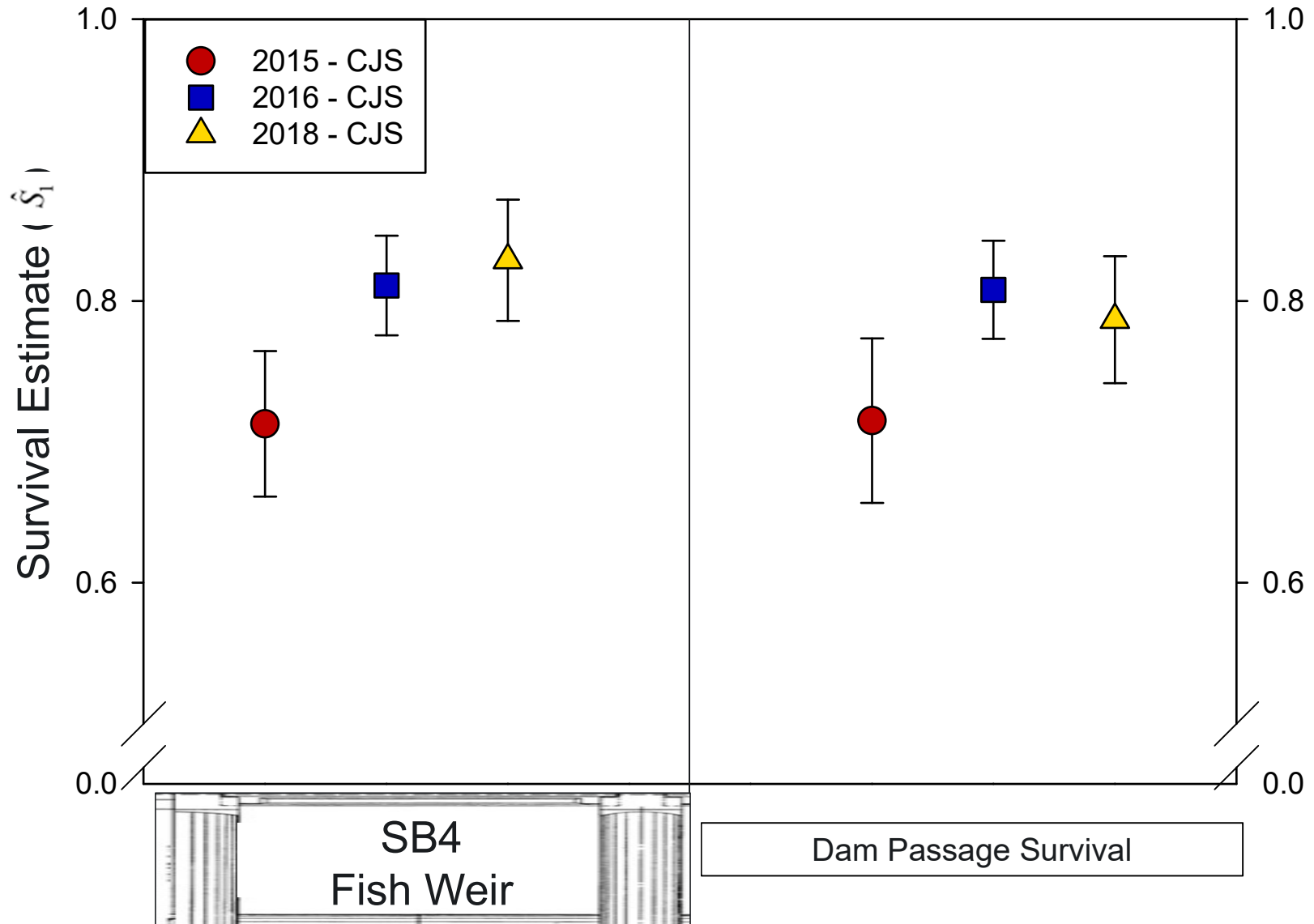
High Pool
635 fmsl

Survival: Route-Specific High Pool

2018 Comparable to 2015 and 2016



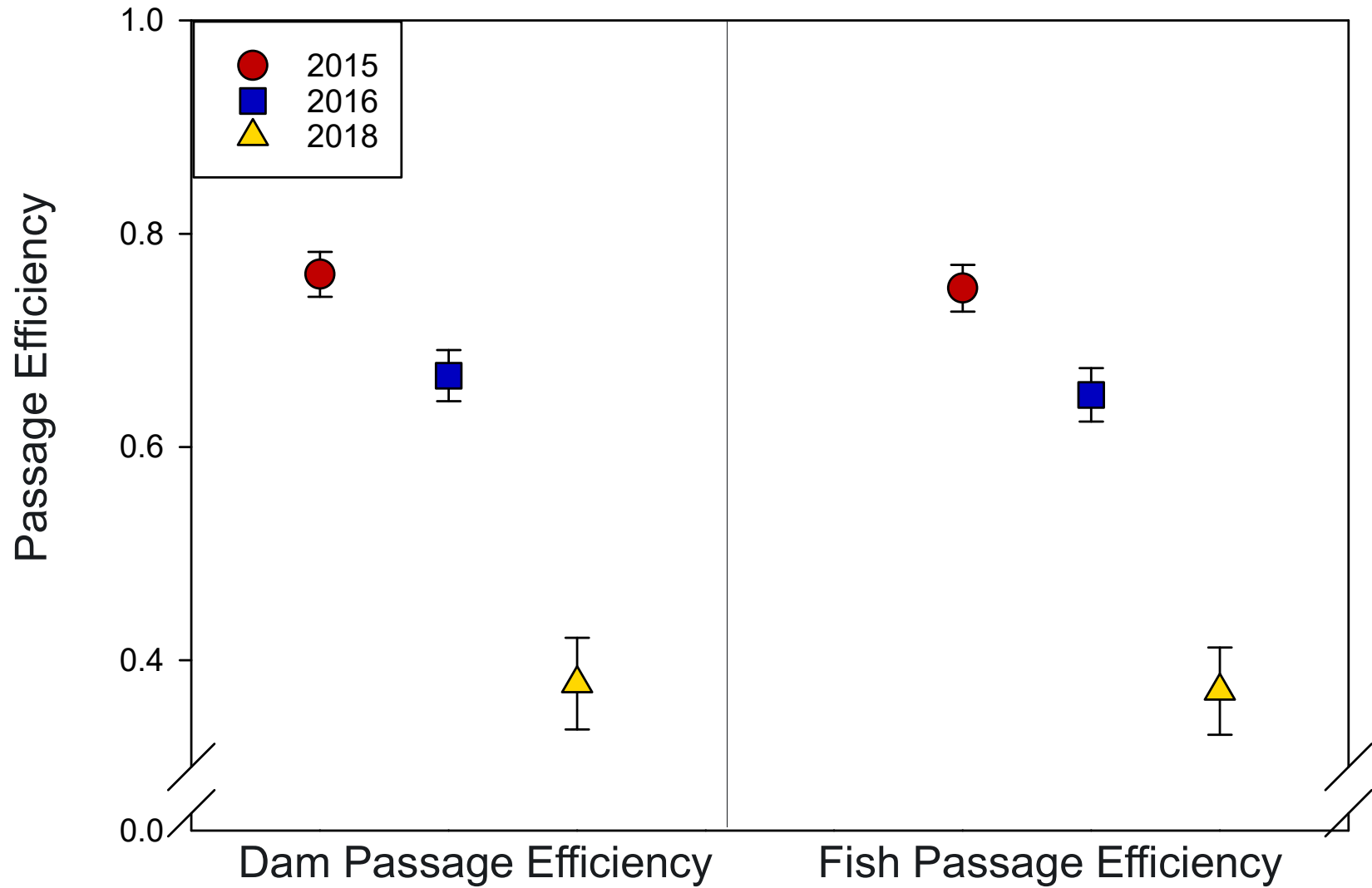
Winter Steelhead





Winter Steelhead

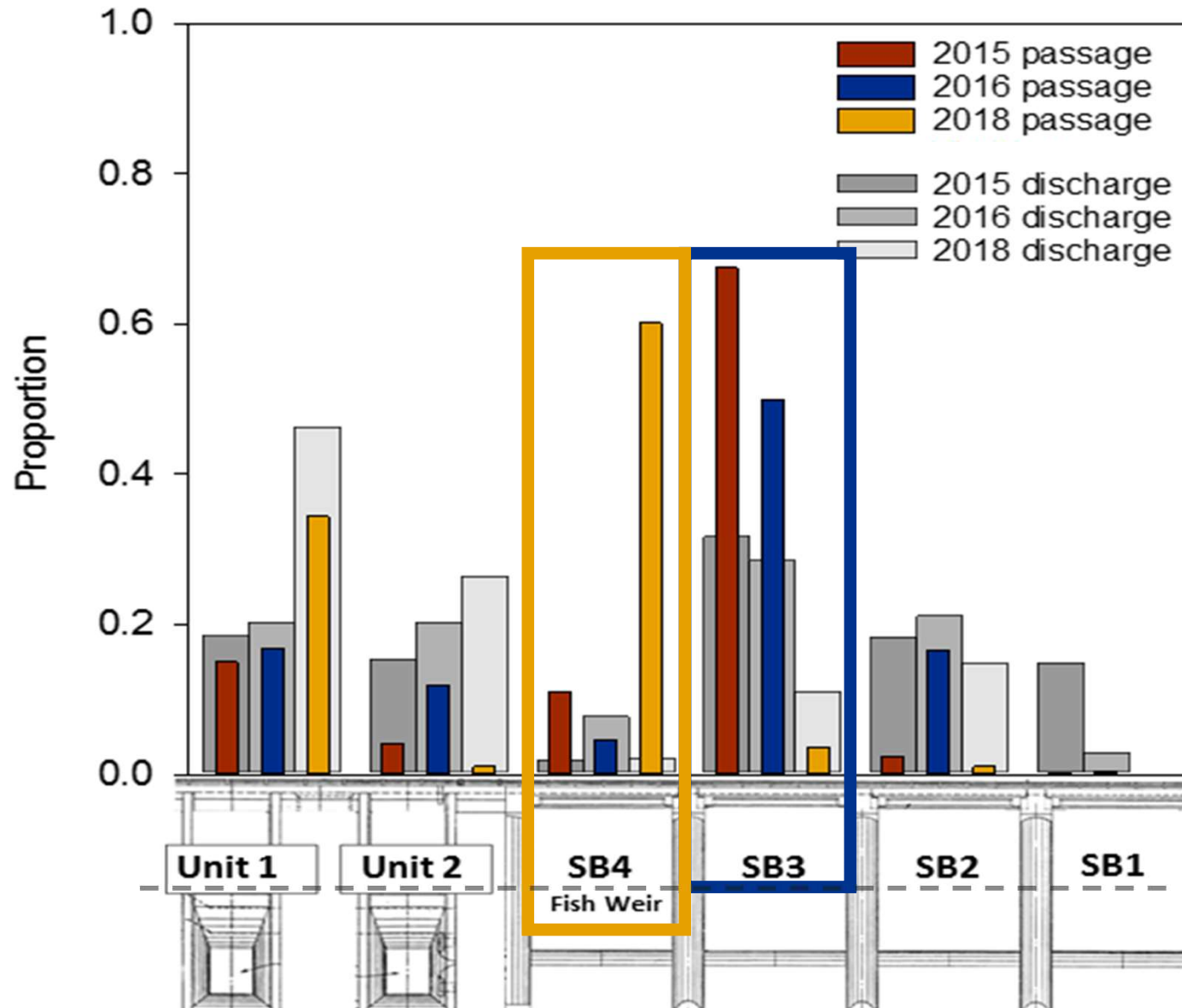
High Pool Fish Passage Efficiencies



Passage Distributions Low Pool Greatest through the Weir in 2018



Subyearling Chinook Salmon



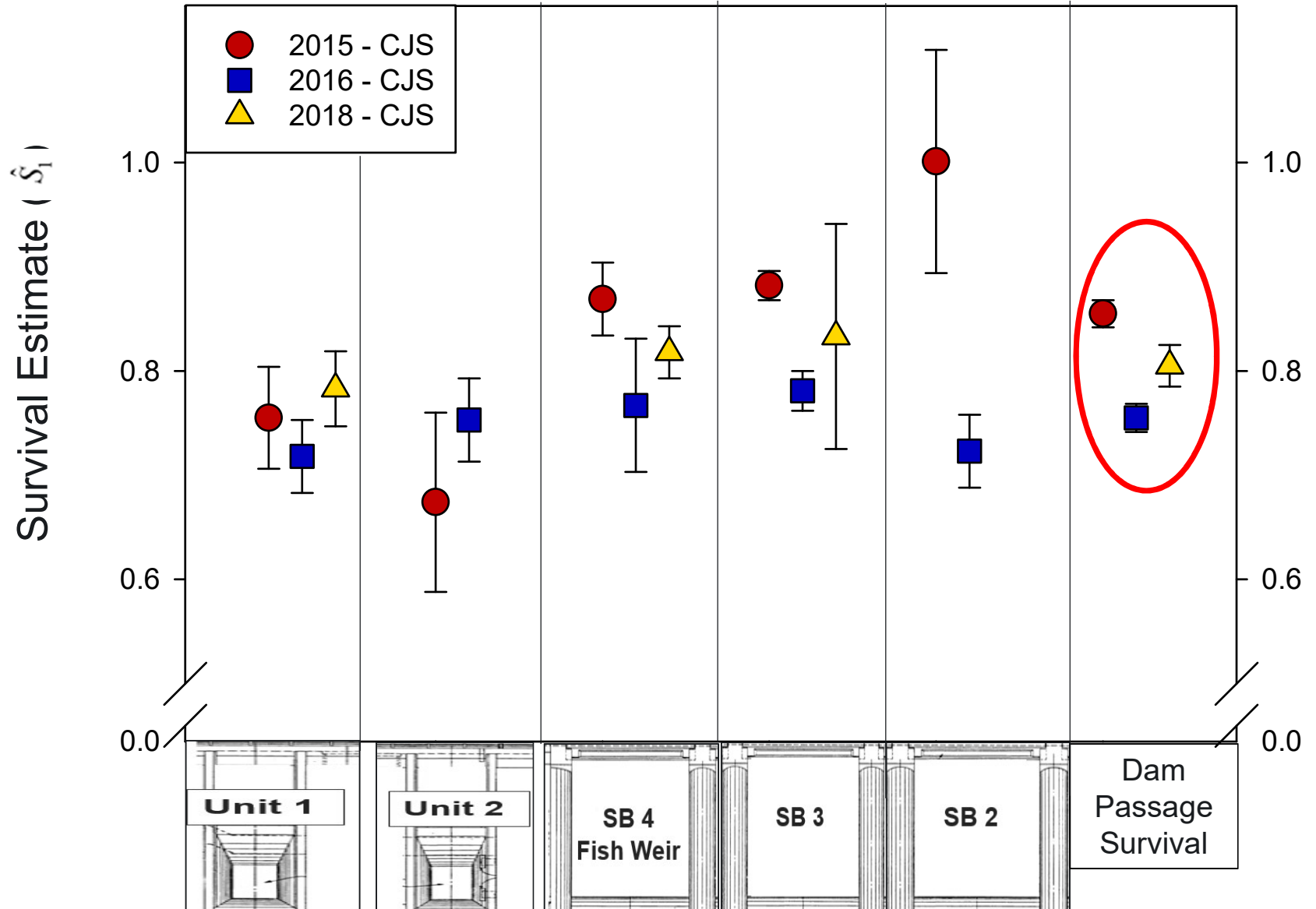
Subyearling
Passage (n)
 2015 = 823
 2016 = 981
 2018 = 392

Low Pool
615 fmsl

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

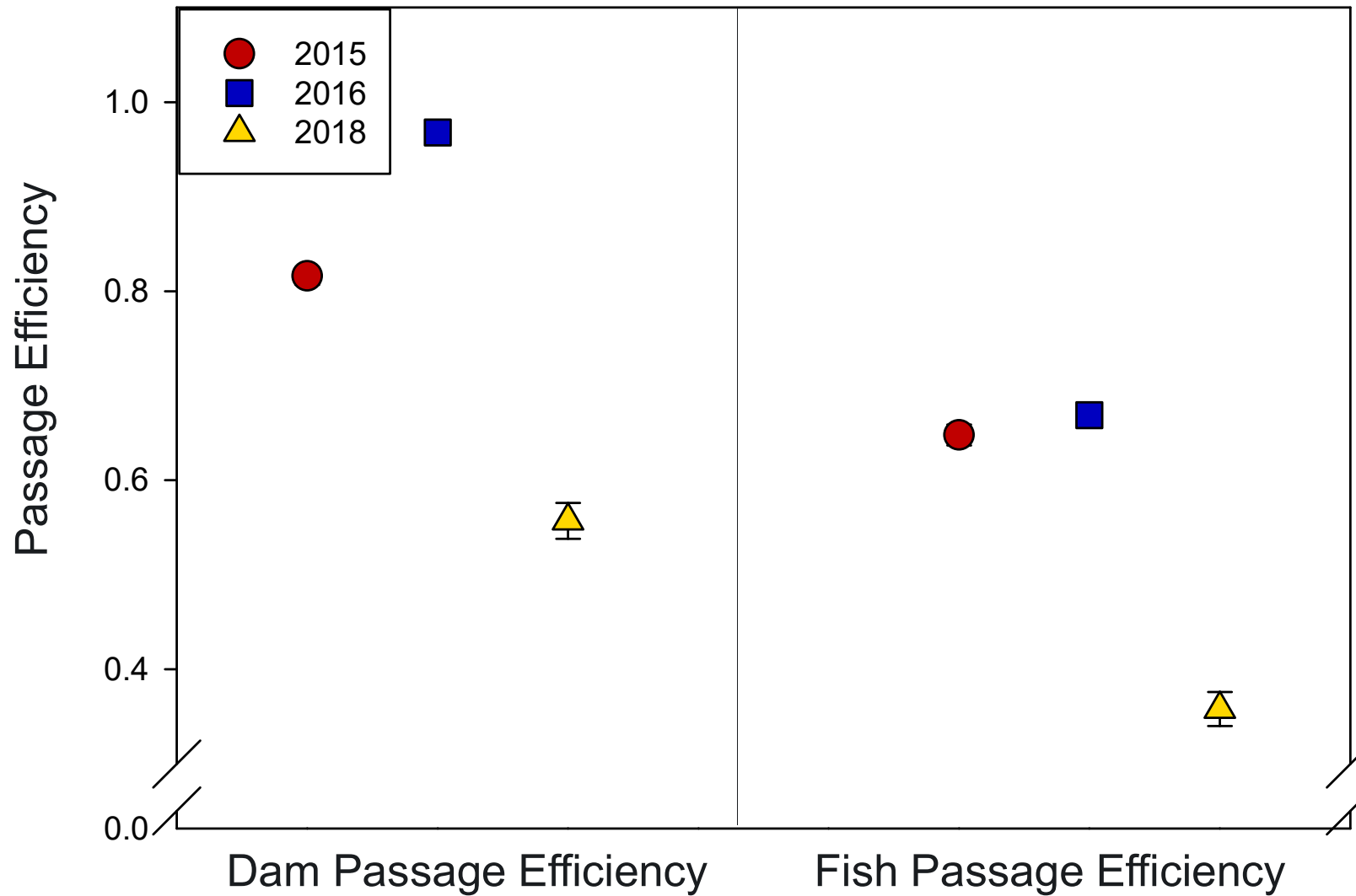


Subyearling Chinook Salmon





Low Pool Fish Passage Efficiencies



Summary Results: 2018 to 2015 and 2016

Species	Forebay Elevation	Weir Passage	Weir Survival	Dam Passage Survival	DPE/FPE
Yearling Chinook	Low pool	+	=	=	+

Summary Results: 2018 to 2015 and 2016

Species	Forebay Elevation	Weir Passage	Weir Survival	Dam Passage Survival	DPE/FPE
Yearling Chinook	Low pool	+	=	=	+
	High pool	+	-	-	+

Summary Results: 2018 to 2015 and 2016

Species	Forebay Elevation	Weir Passage	Weir Survival	Dam Passage Survival	DPE/FPE
Yearling Chinook	Low pool	+	=	=	+
	High pool	+	-	-	+
Steelhead	Low pool	=	=	=	=

Summary Results: 2018 to 2015 and 2016

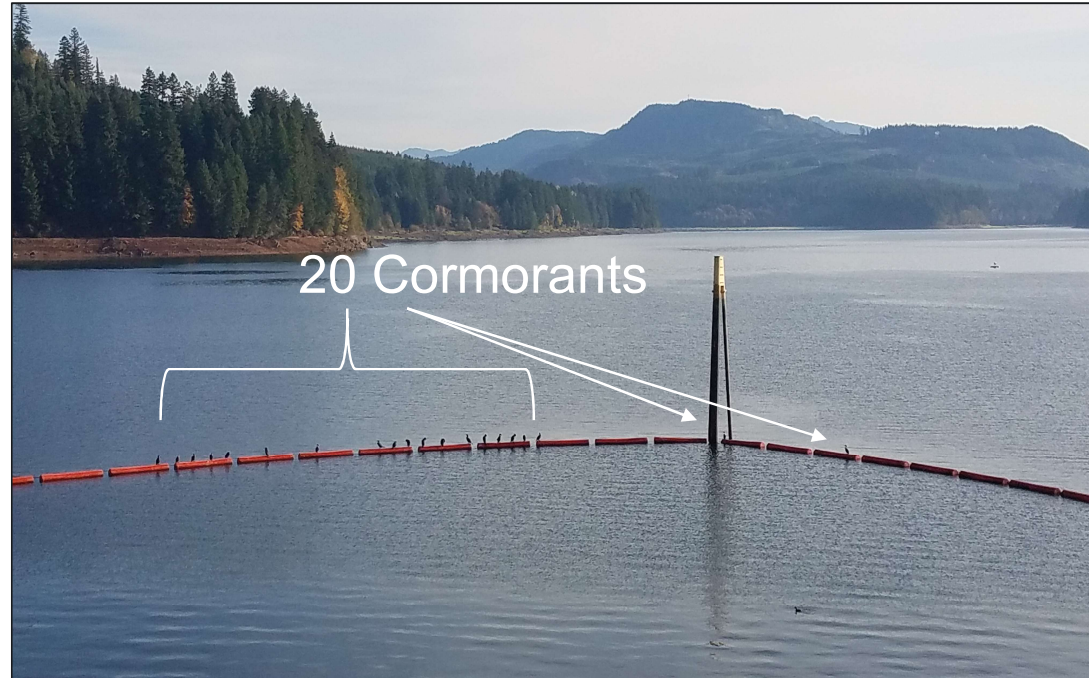
Species	Forebay Elevation	Weir Passage	Weir Survival	Dam Passage Survival	DPE/FPE
Yearling Chinook	Low pool	+	=	=	+
	High pool	+	-	-	+
Steelhead	Low pool	=	=	=	=
	High pool	=	=	=	-

Summary Results: 2018 to 2015 and 2016

Species	Forebay Elevation	Weir Passage	Weir Survival	Dam Passage Survival	DPE/FPE
Yearling Chinook	Low pool	+	=	=	+
	High pool	+	-	-	+
Steelhead	Low pool	=	=	=	=
	High pool	=	=	=	-
Subyearling Chinook	Low Pool	+	=	=	-

Avian Predation

- **Minimum predation estimates**
 - Spring – 2.9%
 - Fall – 1.8%
- Avian predation influences recovery of ESA-listed salmonid populations¹
- Piscivorous birds consume significant numbers of juvenile Chinook salmon and steelhead at dams in the PNW
 - Significant mortality in the Snake and Columbia rivers²
 - Lower predation rates in the Willamette River than in Columbia River³



¹NOAA 2008
²Evans et al. 2016
³Evans et al. 2012

Conclusions and Path Forward

- New Weir

- Upstream = 

- ✓ Successfully attracting fish and has become the preferred route of passage for all species evaluated

- Downstream = 

- ✓ Spring and Fall 2018 dam passage survival estimates comparable to 2015 and 2016

- Yearling Chinook high pool is the exception

- ✓ However, higher rates of severe events and fish injuries compared to other similar structures were noted as a result of the Sensor Fish and Balloon Tag evaluations

- Foster PDT currently evaluating options to reduce injury and increase survival through new fish weir



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Questions?



