

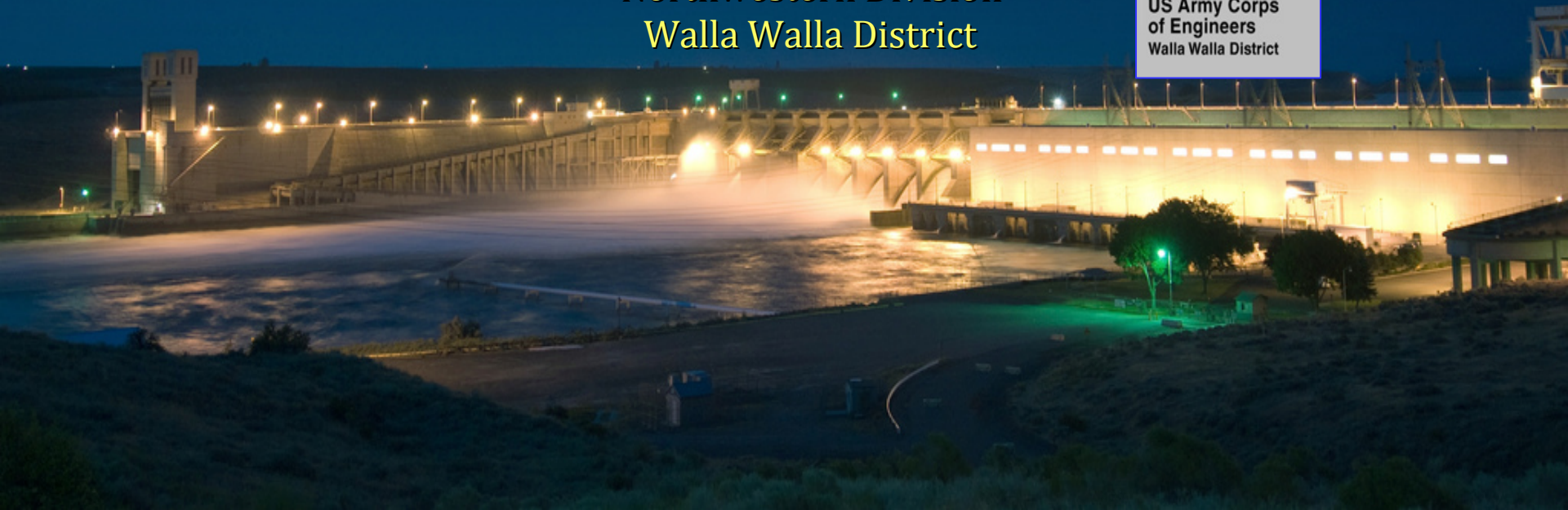
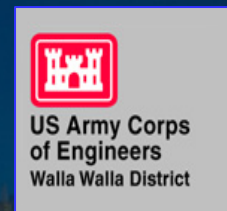
# Behavior and Survival for Yearling Chinook Salmon, Steelhead, and Fall Chinook Salmon Passing Ice Harbor Dam during Reduced and BiOp spill treatments, 2008

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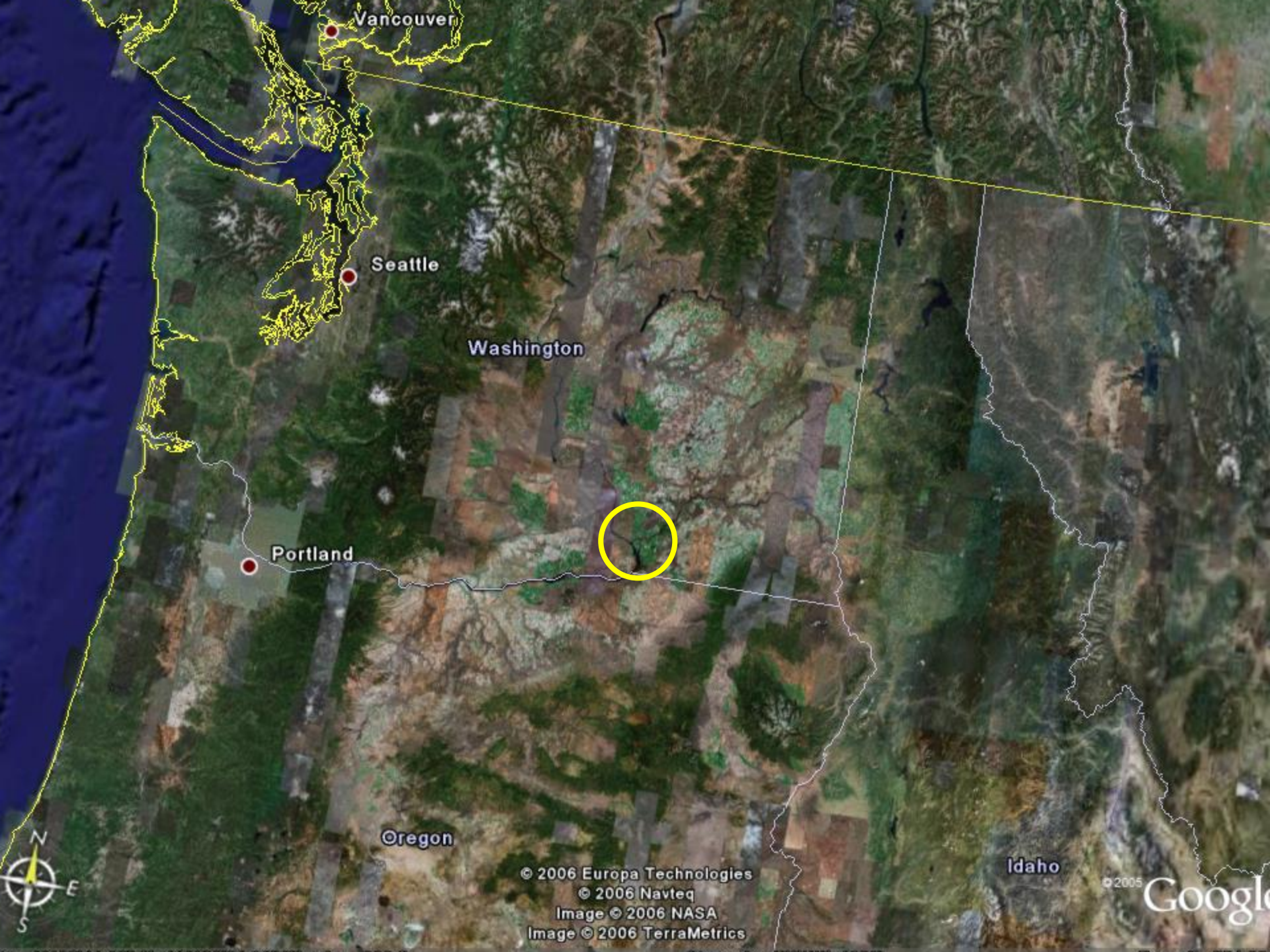


## Study objectives for Ice Harbor Dam, 2008

Evaluate two spill treatments:

Reduced spill (30-40%) vs. BiOp spill (45 kcfs day/Gas cap night)

- Identify approach and passage distribution for yearling Chinook salmon, juvenile steelhead, and fall Chinook salmon
- Determine passage metrics
- Estimate survival (single-release) for the dam and individual passage routes



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Oregon

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Google



Pasco

Kennewick

Strawberry Island

Goose Island

**Ice Harbor Dam**

Indian Island

Foundation Island

Casey Island

Tanglefoot Island

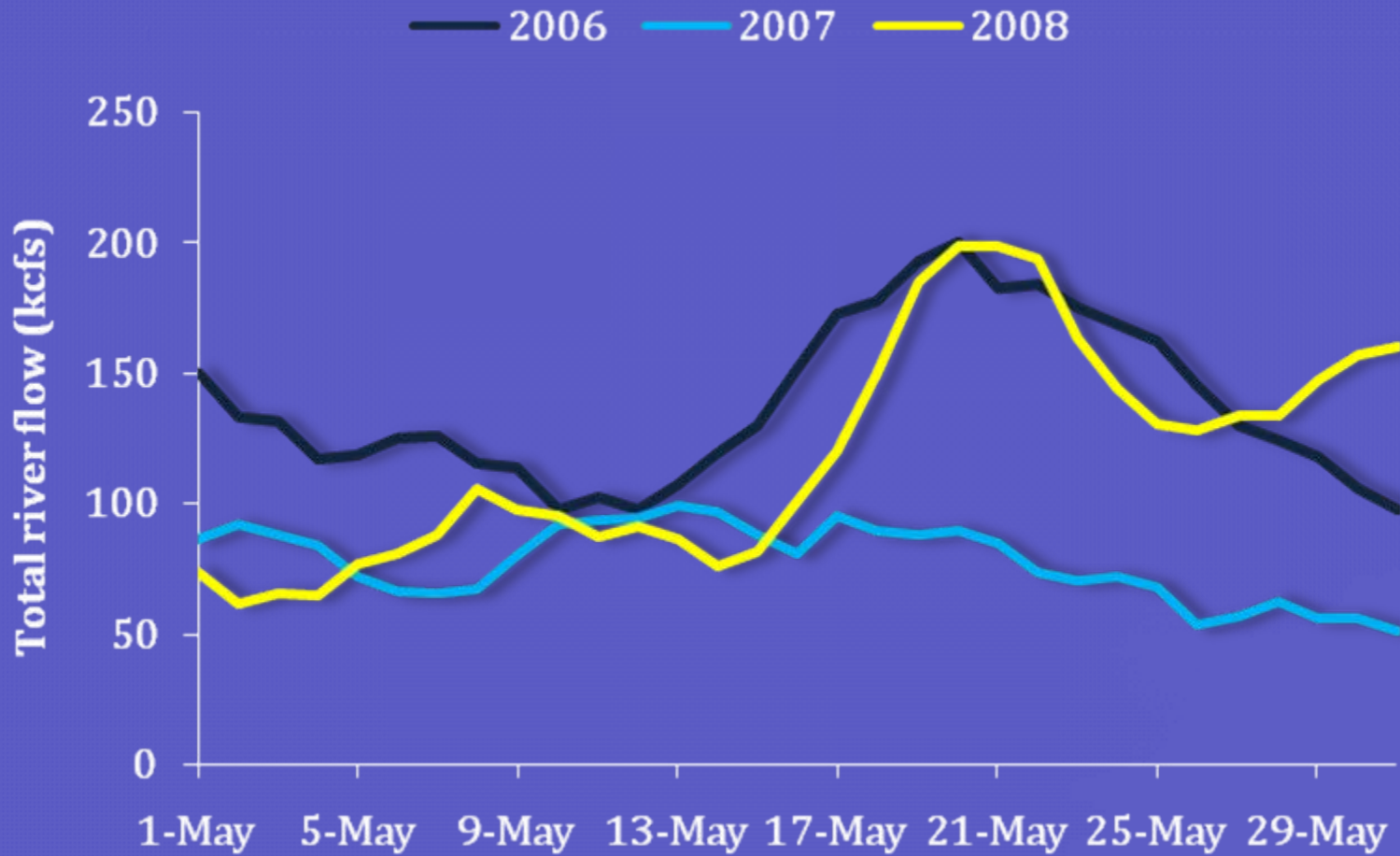
Peavine Island

Two Rivers Islands

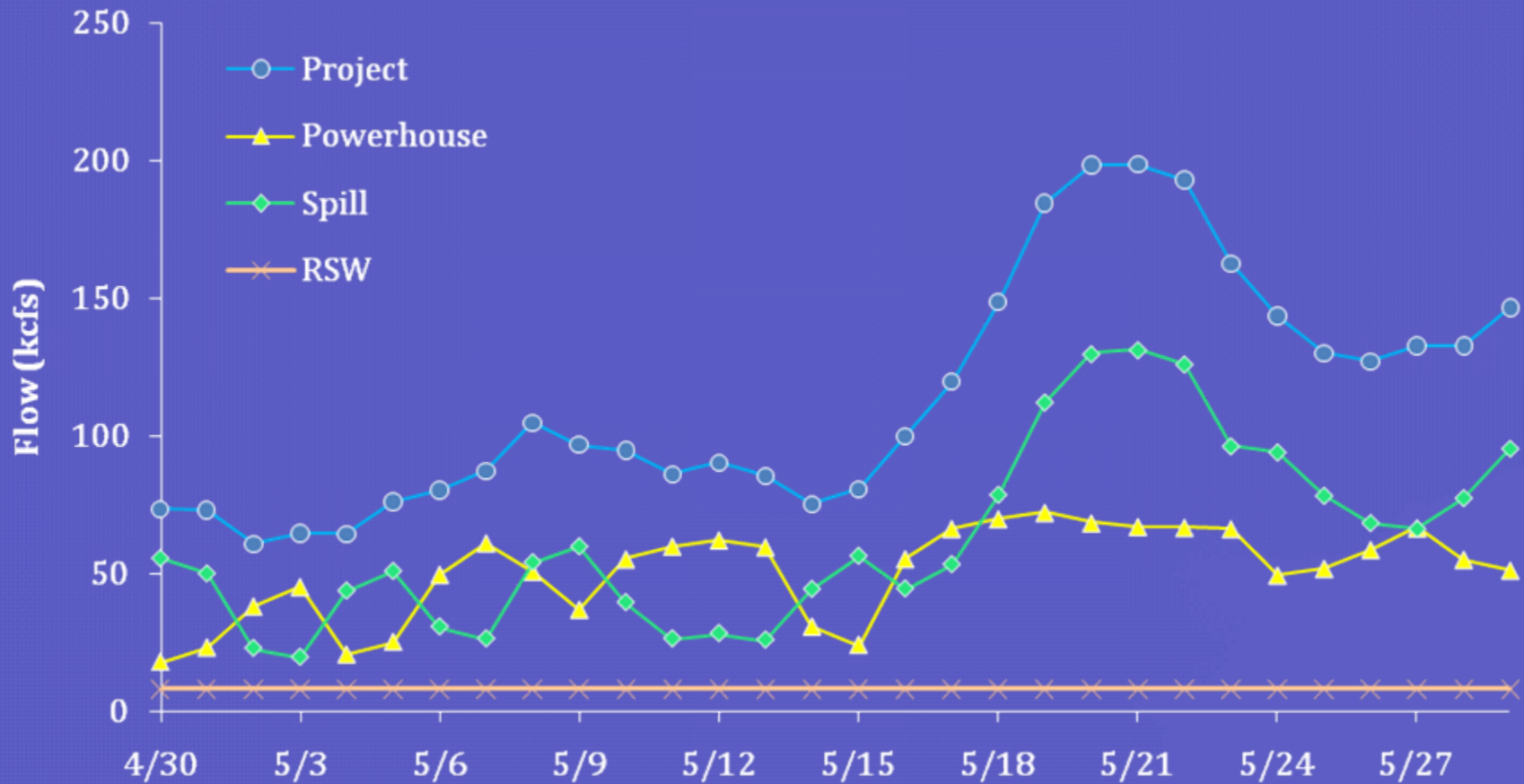
Badger Island

Crescent Island

# Results - *Ice Harbor Dam Spring River Flows*

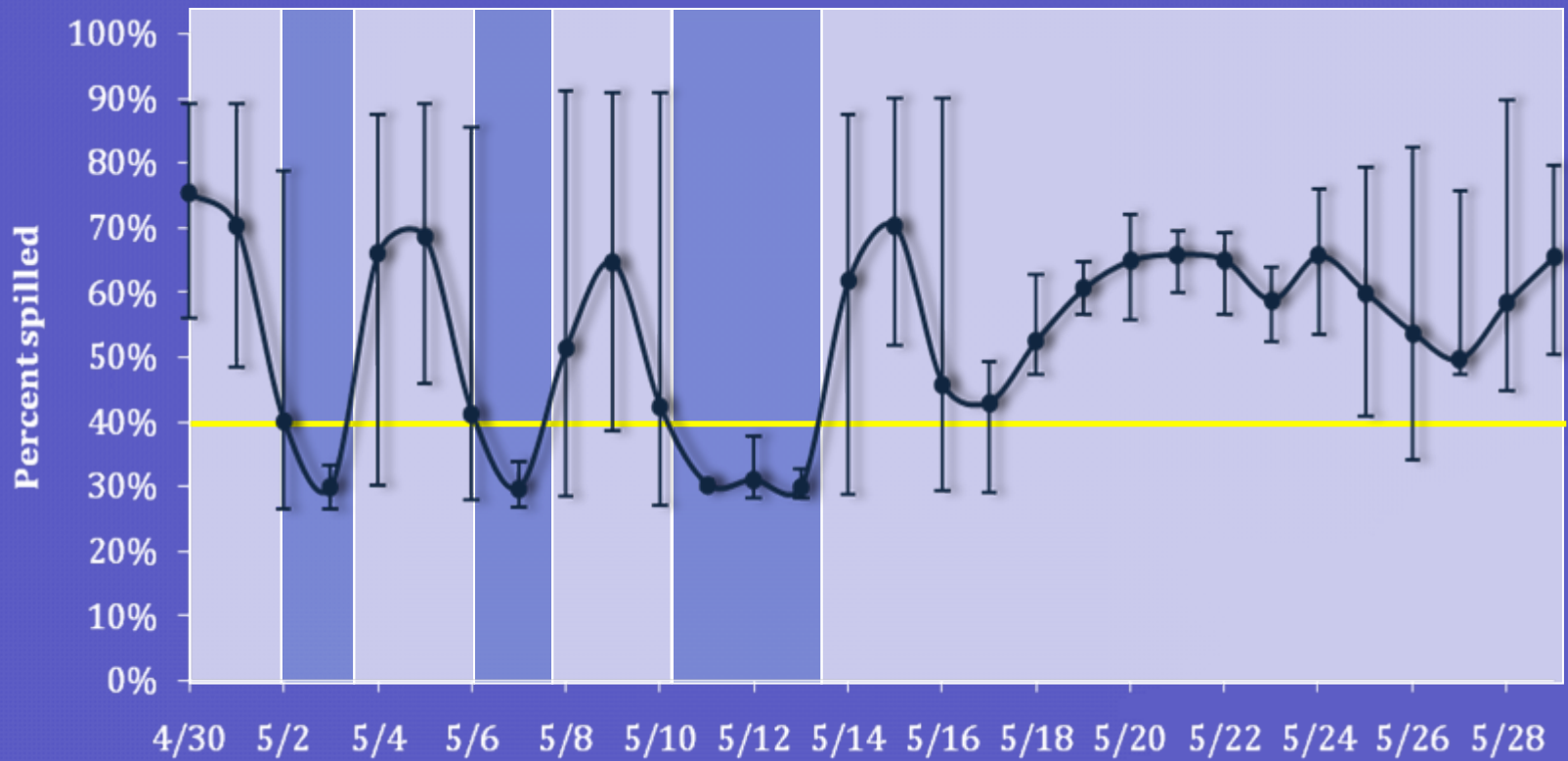


# Results - *Ice Harbor Dam Spring Operations*

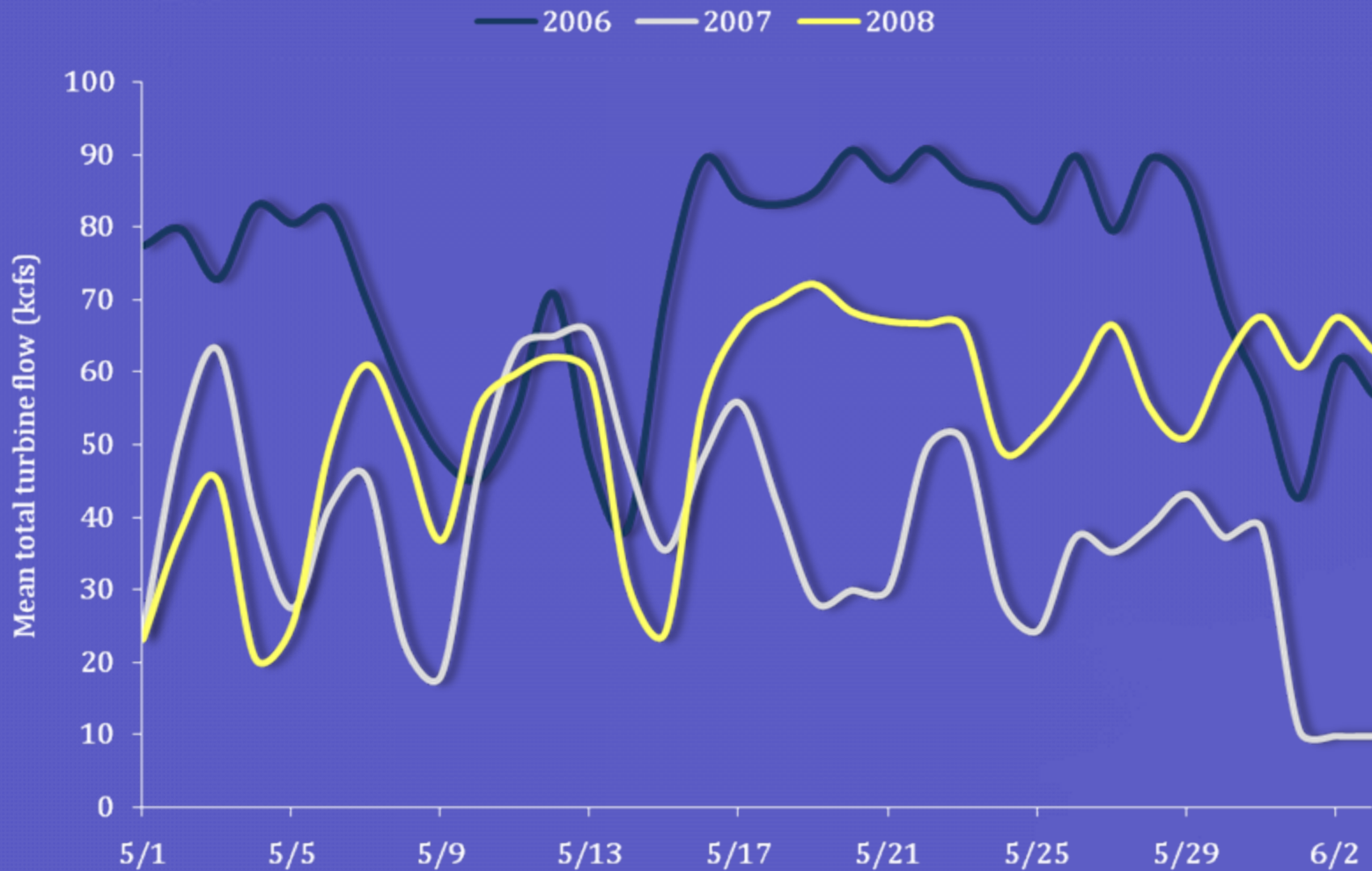


# Results - Ice Harbor Dam Spring Treatments

- BiOp Spill
- Reduced Spill



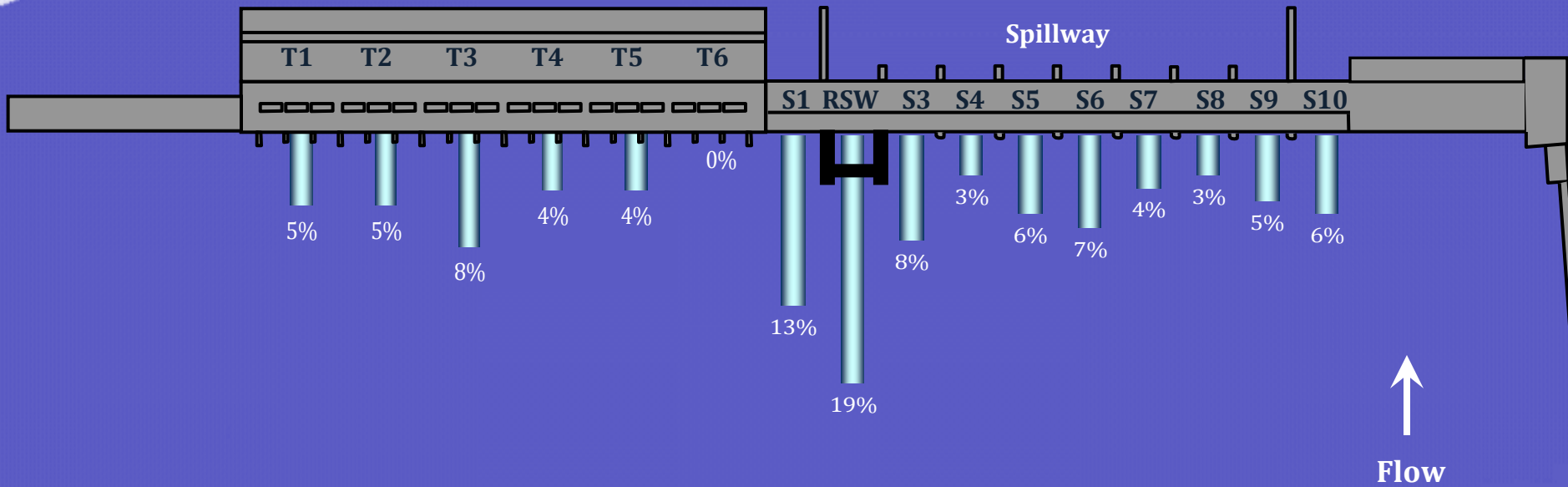
# Results - *Ice Harbor Dam Spring Turbine Flows*



# Results - *Ice Harbor Dam Operations* *Spring*

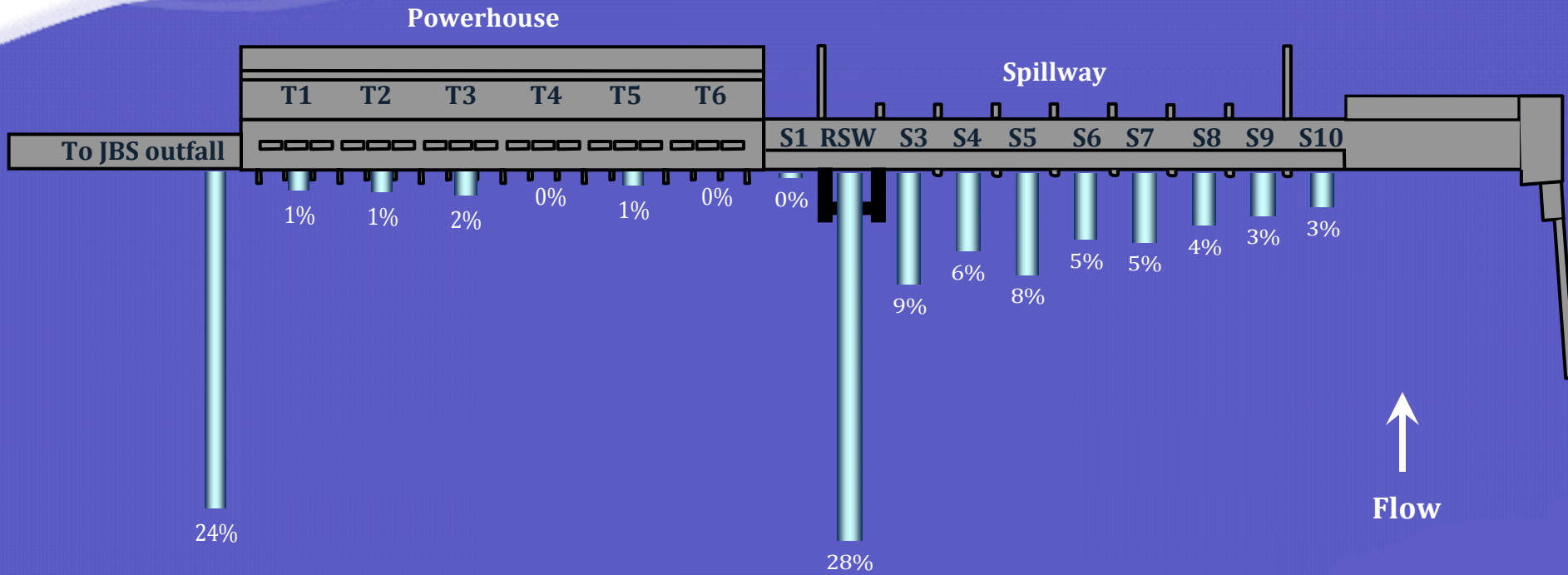
	2006	2007	2008
Total river flow	133 kcfs	77 kcfs	118 kcfs
Percent spill	33 – 58%	31 – 68%	56%
Percent RSW flow	6 – 7%	10 – 11%	7%

# Results - Ice Harbor Dam Approach Distribution Yearling Chinook Salmon



N = 1,609

# Results - *Ice Harbor Dam Passage Distribution* *Yearling Chinook Salmon*

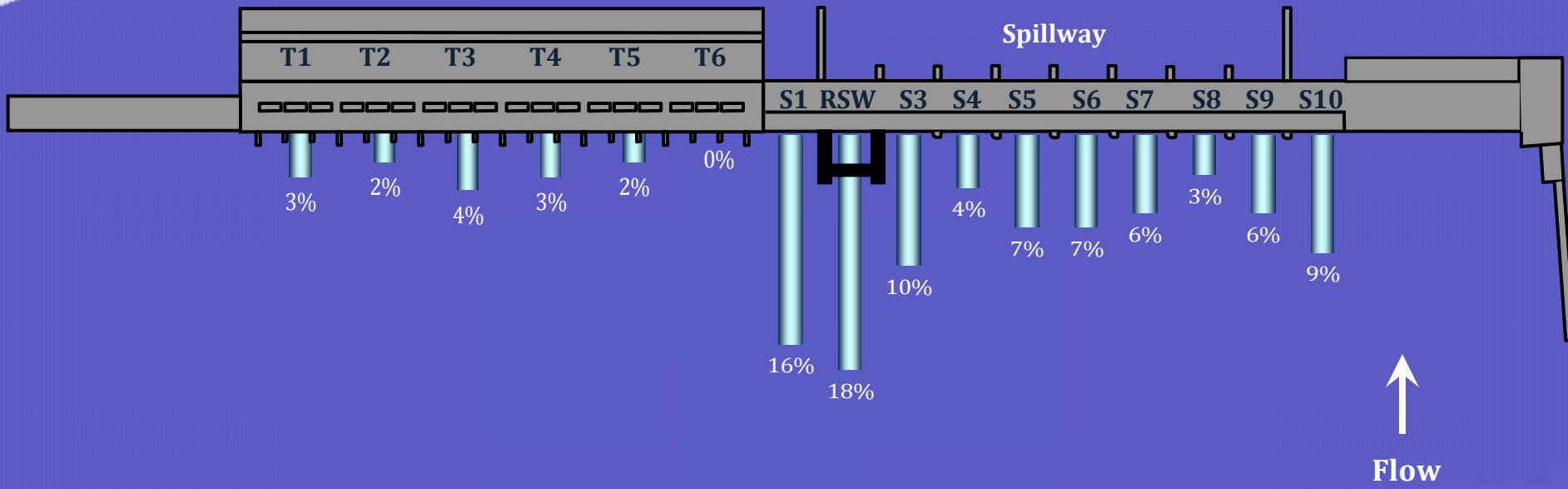


N = 1,589

## Results – *Fish passage metrics* *Yearling Chinook Salmon*

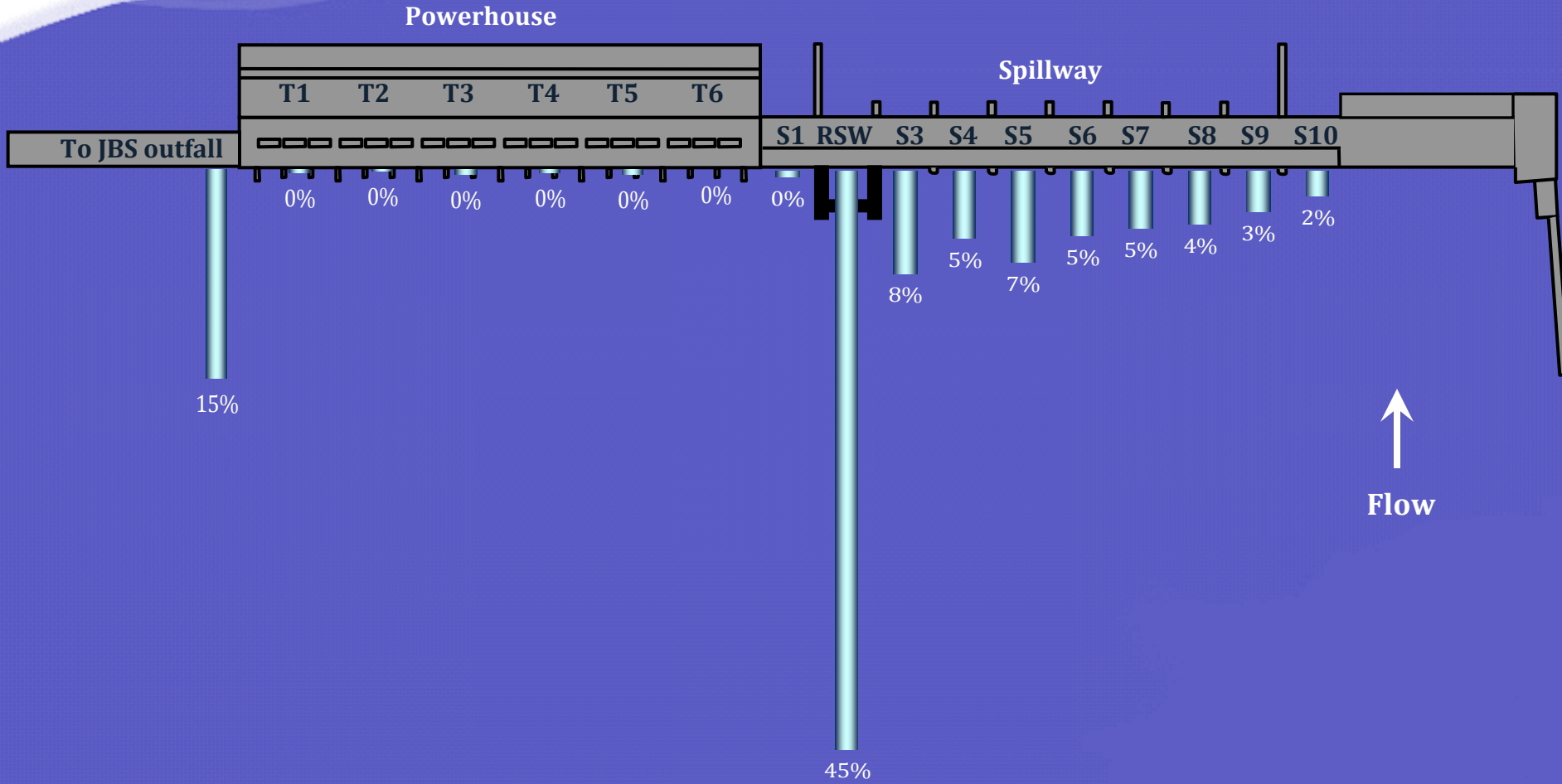
	<u>2006</u>		<u>2007</u>		<u>2008</u>
	Reduced	BiOp	Reduced	BiOp	
Forebay delay	2 h	1 h	2 h	2 h	2 h
% Spill passage	73%	80%	75%	93%	71%
% PH passage	17%	20%	25%	7%	29%
FPE	92%	95%	91%	98%	95%
RSW effectiveness	5.8	5.7	5.5	4.2	4.2
Tailrace egress	9 min		10 min		8 min

# Results - Ice Harbor Dam Approach Distribution Steelhead



N = 1,859

# Results - *Ice Harbor Dam Passage Distribution* *Steelhead*



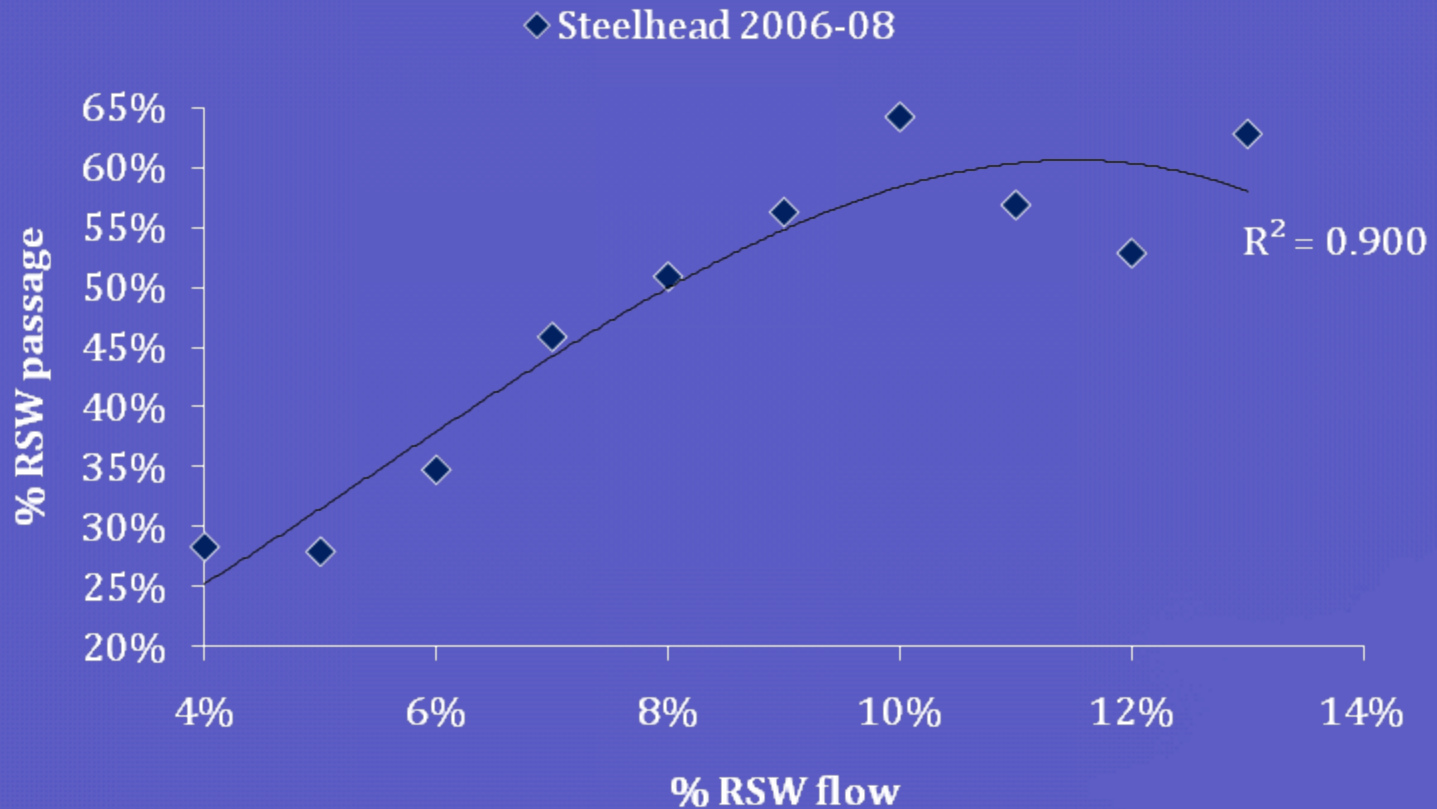
N = 1,834

# Results – *Fish passage metrics*

## *Steelhead*

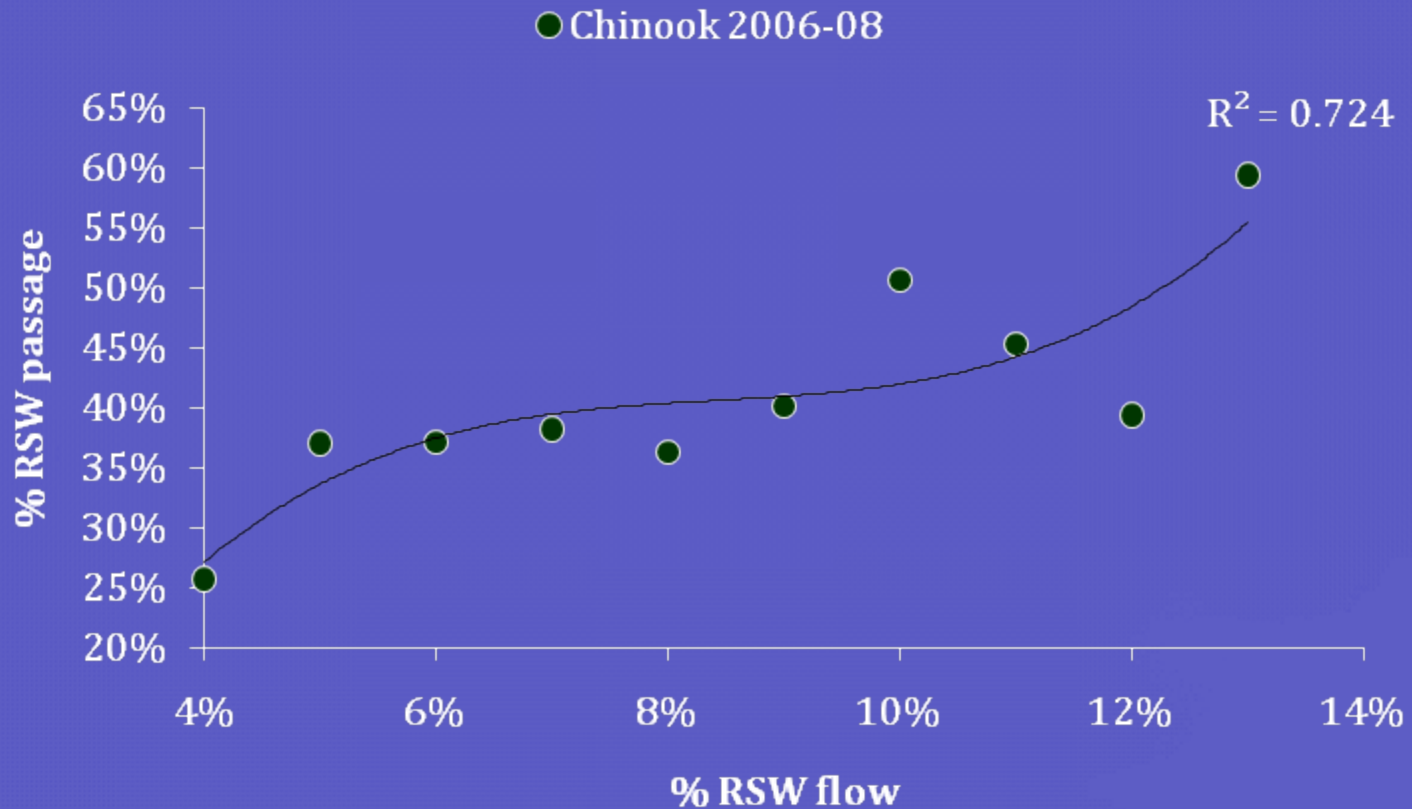
	<u>2006</u>		<u>2007</u>		<u>2008</u>
	Reduced	BiOp	Reduced	BiOp	
Forebay delay	2 h	1 h	2 h	2 h	3 h
% Spill passage	61%	81%	86%	95%	84%
% PH passage	39%	19%	14%	5%	16%
FPE	98%	99%	91%	98%	95%
RSW effectiveness	5.6	5.6	7.0	5.3	6.6
Tailrace egress	9 min		9 min		8 min

# Results - *Ice Harbor Dam RSW Passage Steelhead*



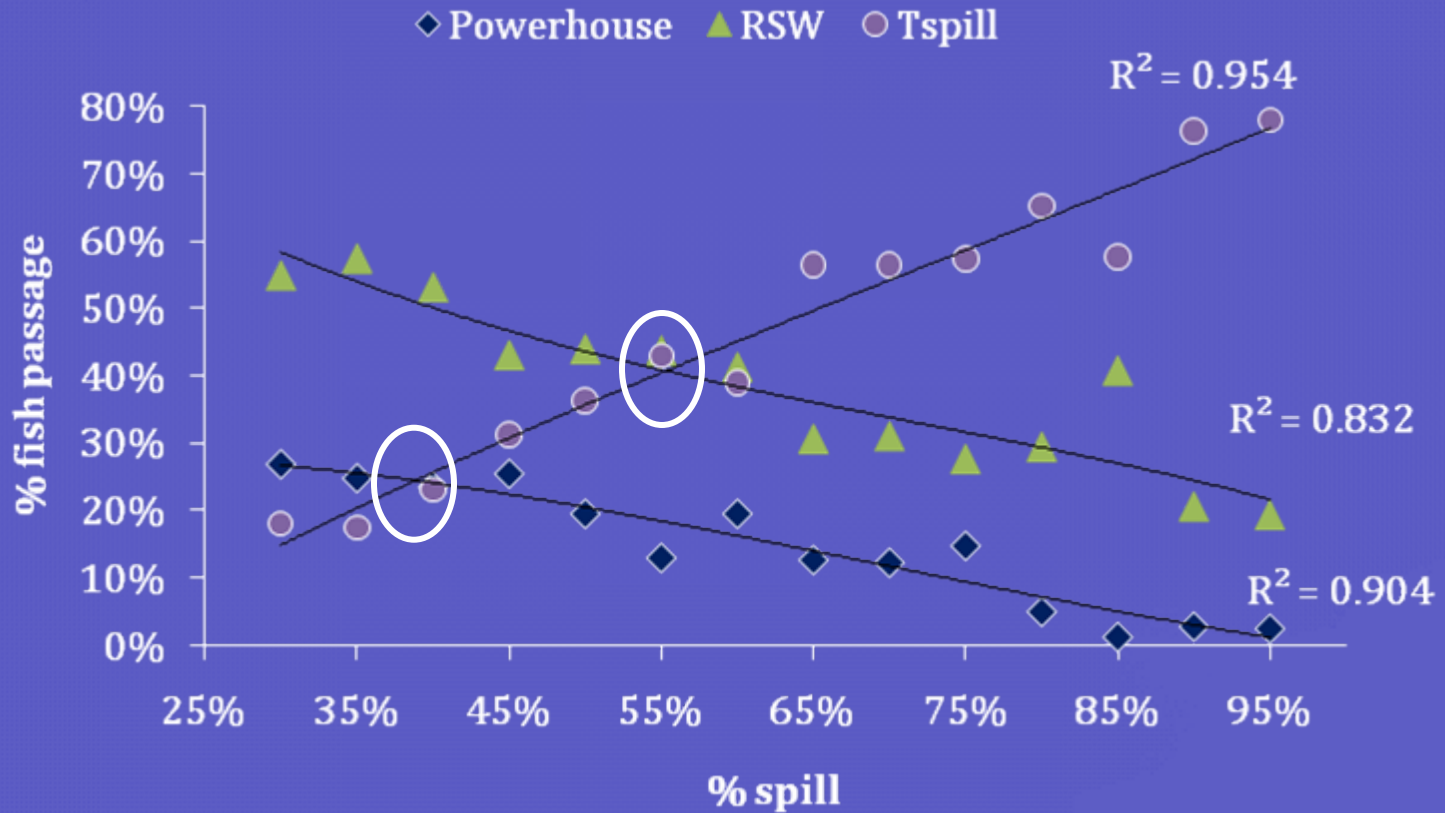
N = 4,470

# Results - *Ice Harbor Dam RSW Passage* *Yearling Chinook Salmon*



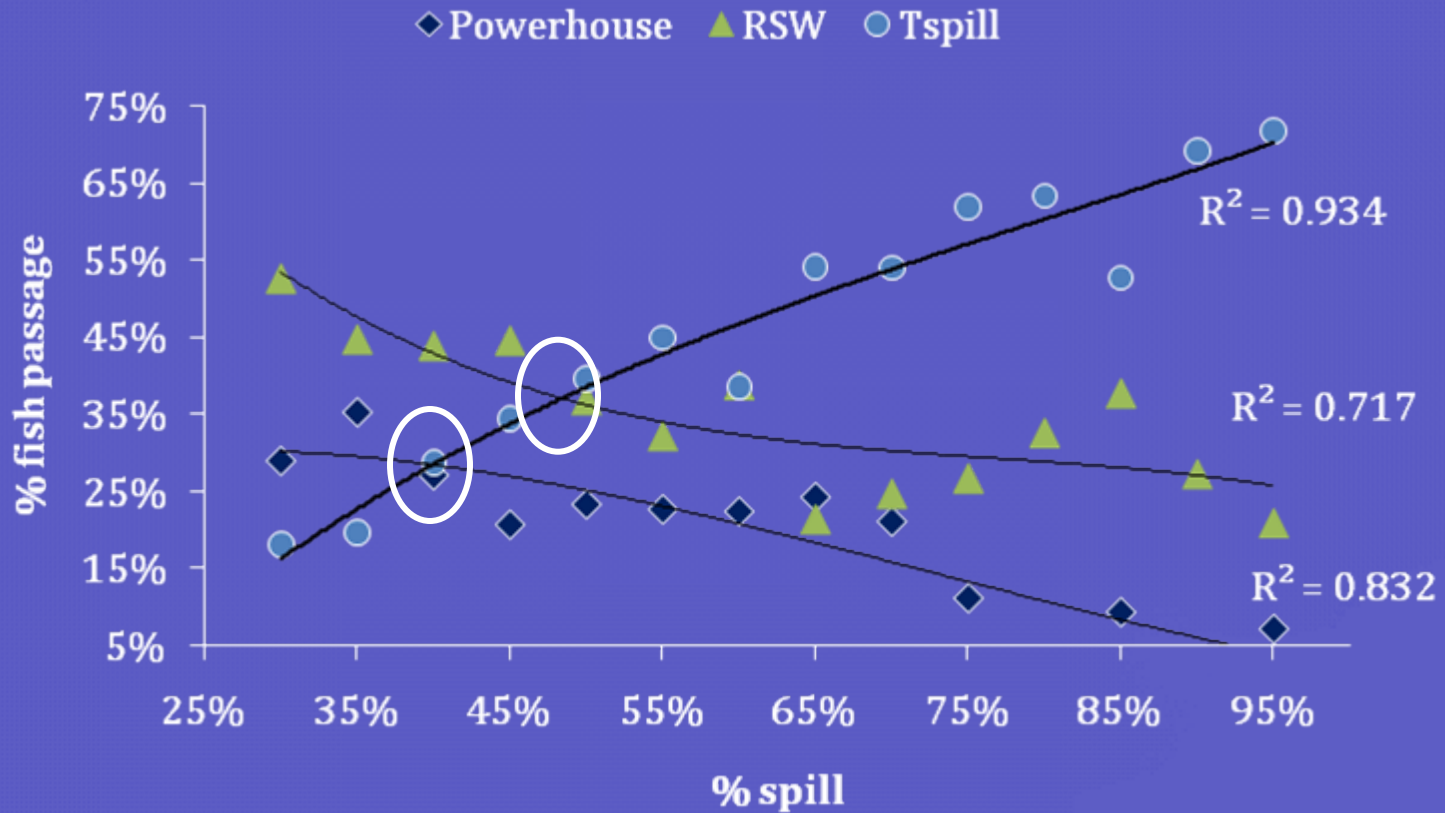
N = 4,876

# Results - Ice Harbor Dam Passage Distribution Steelhead



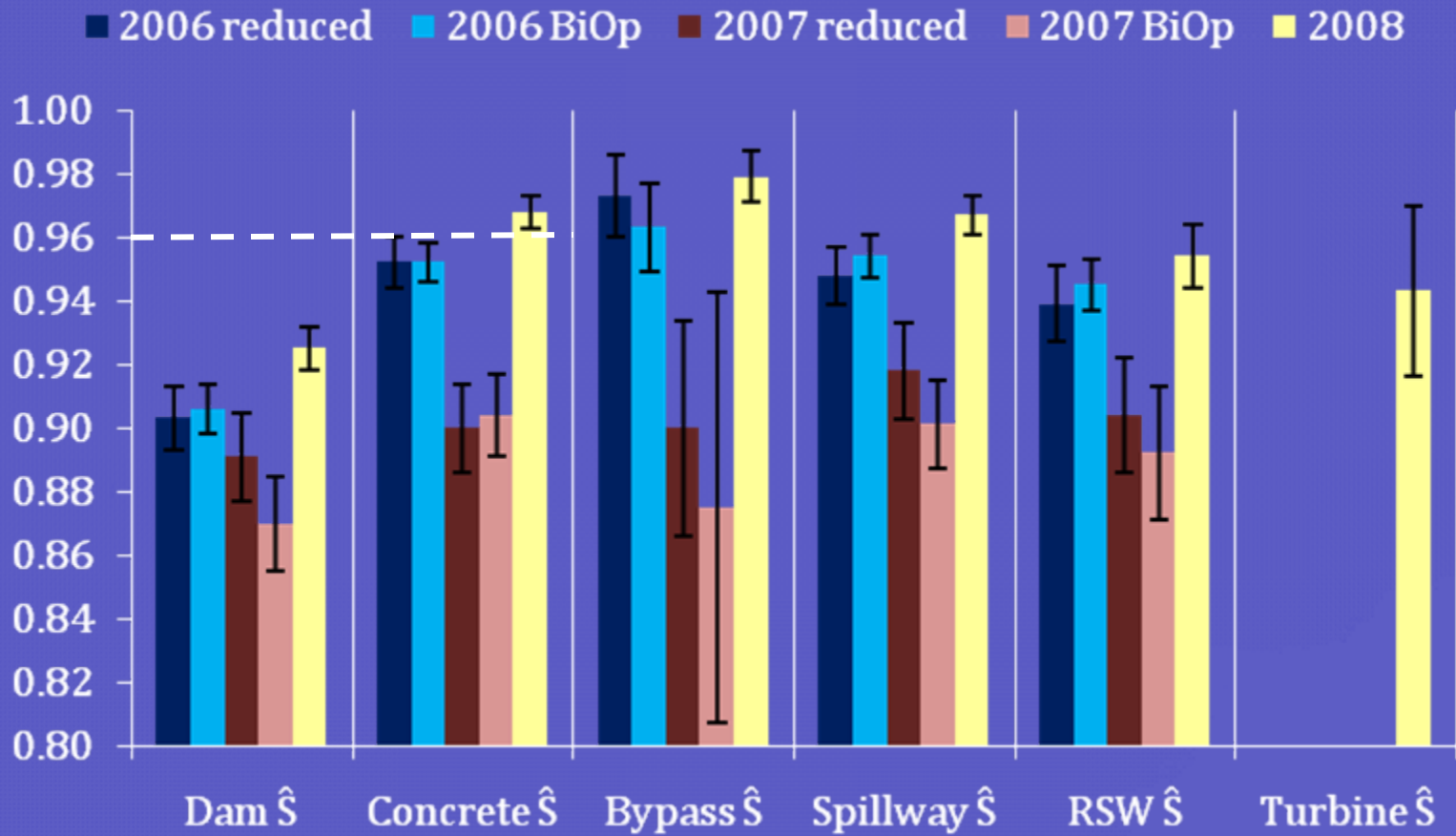
N = 4,470

# Results - Ice Harbor Dam Passage Distribution Yearling Chinook Salmon

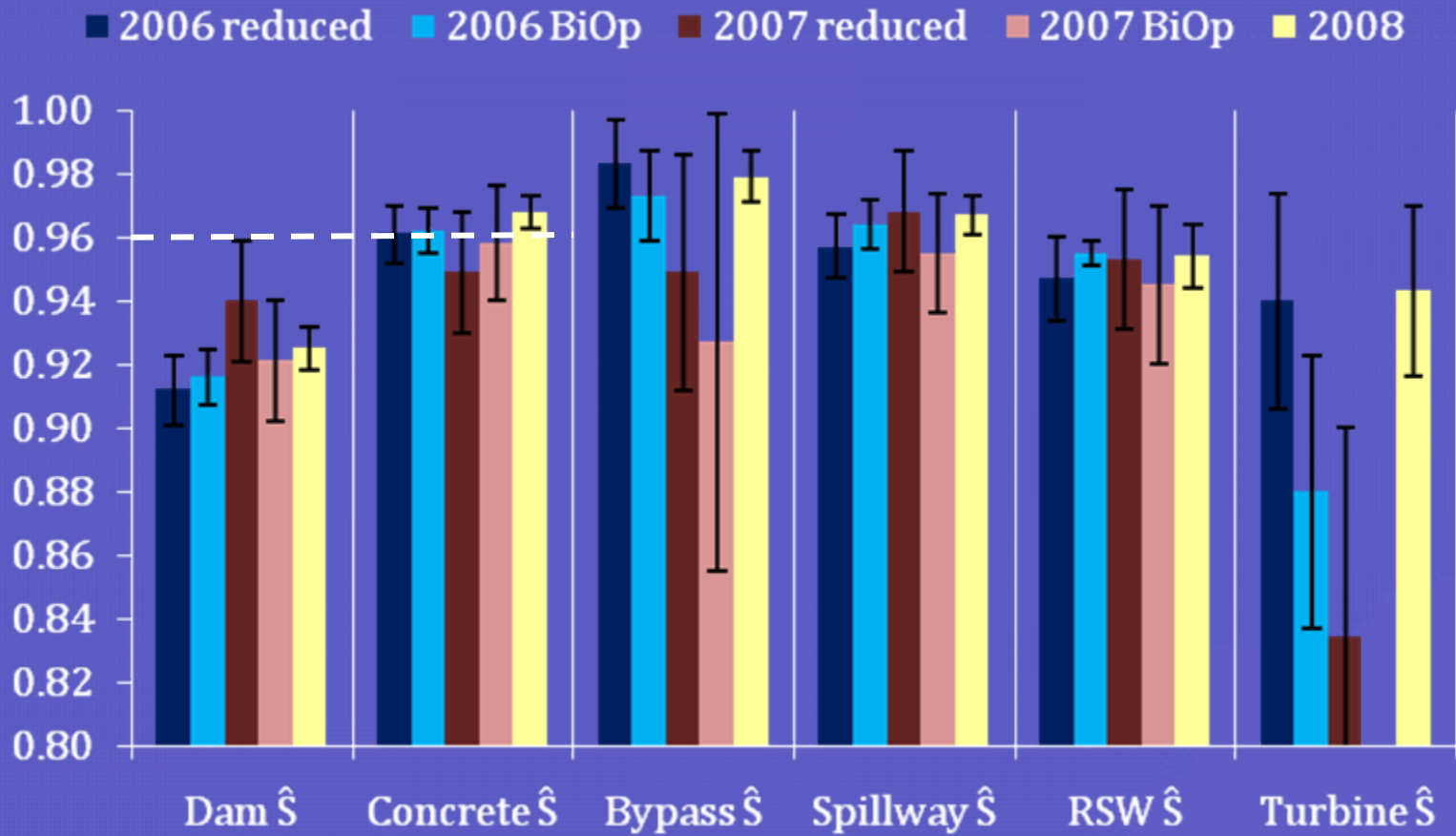


N = 4,876

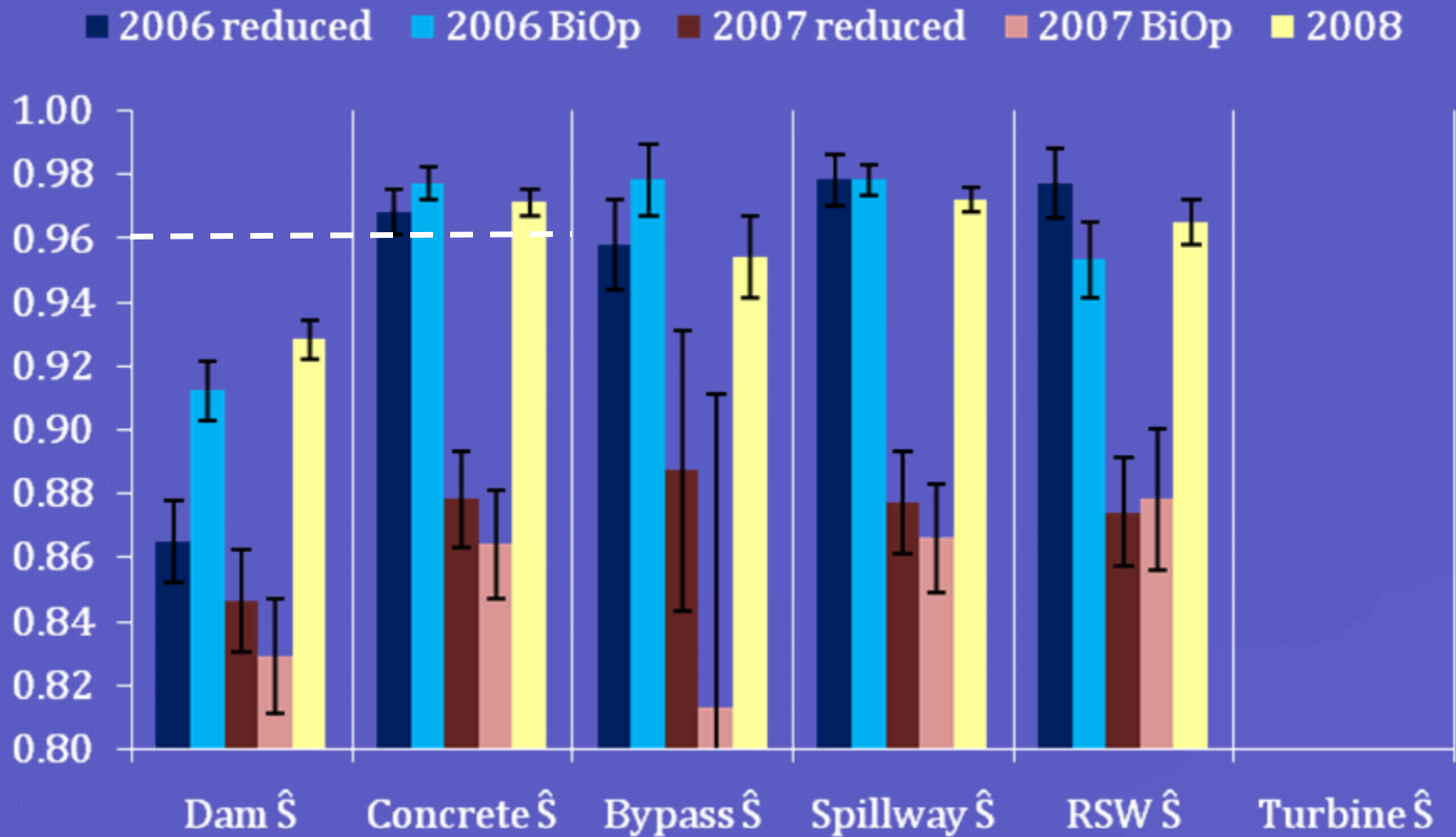
# Survival Results – Yearling Chinook Salmon (Single Release estimates)



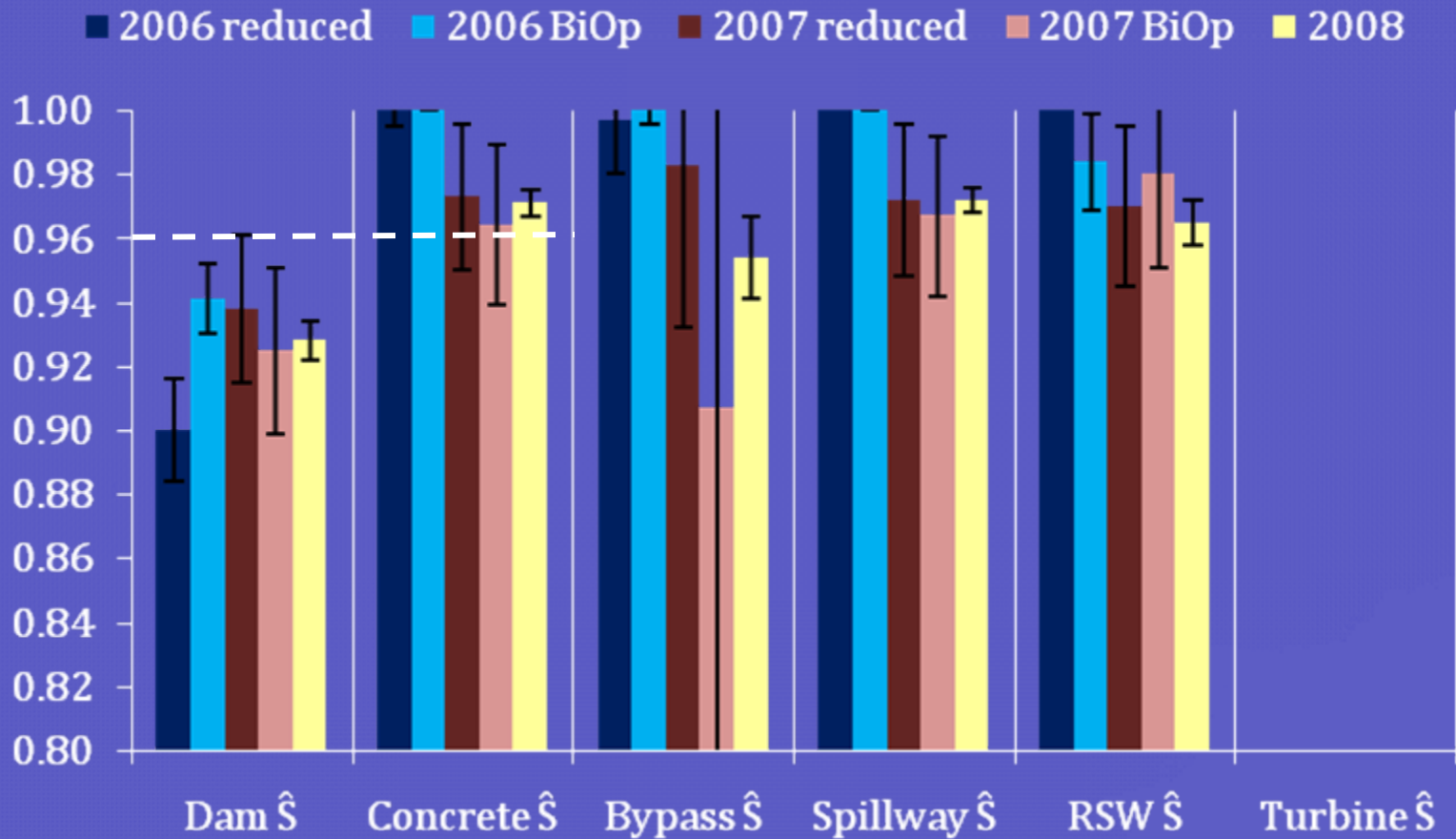
# Survival Results – Yearling Chinook Salmon (Paired Release estimates)



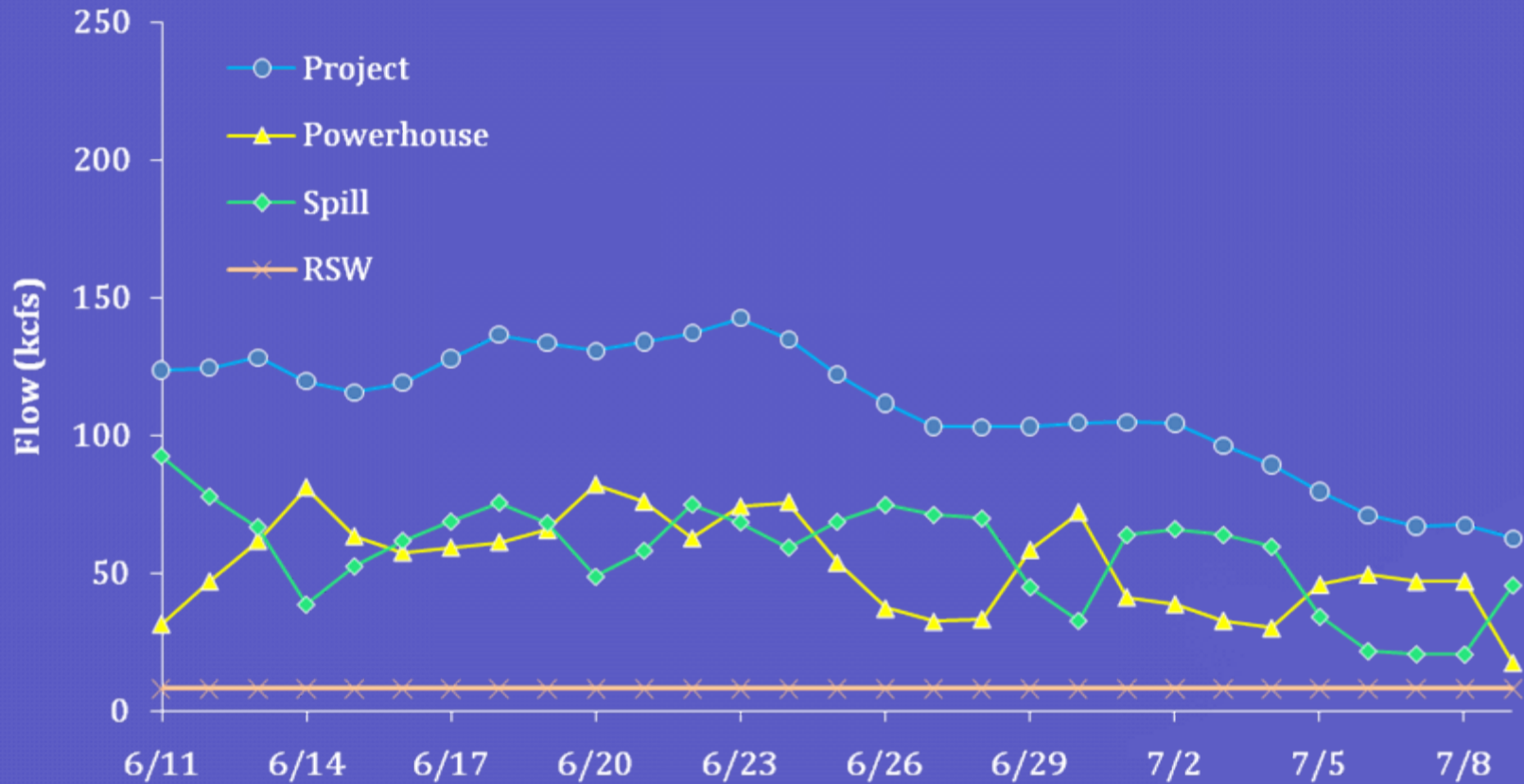
# Survival Results – *Steelhead* (Single Release estimates)



# Survival Results – *Steelhead* (*Paired Release estimates*)

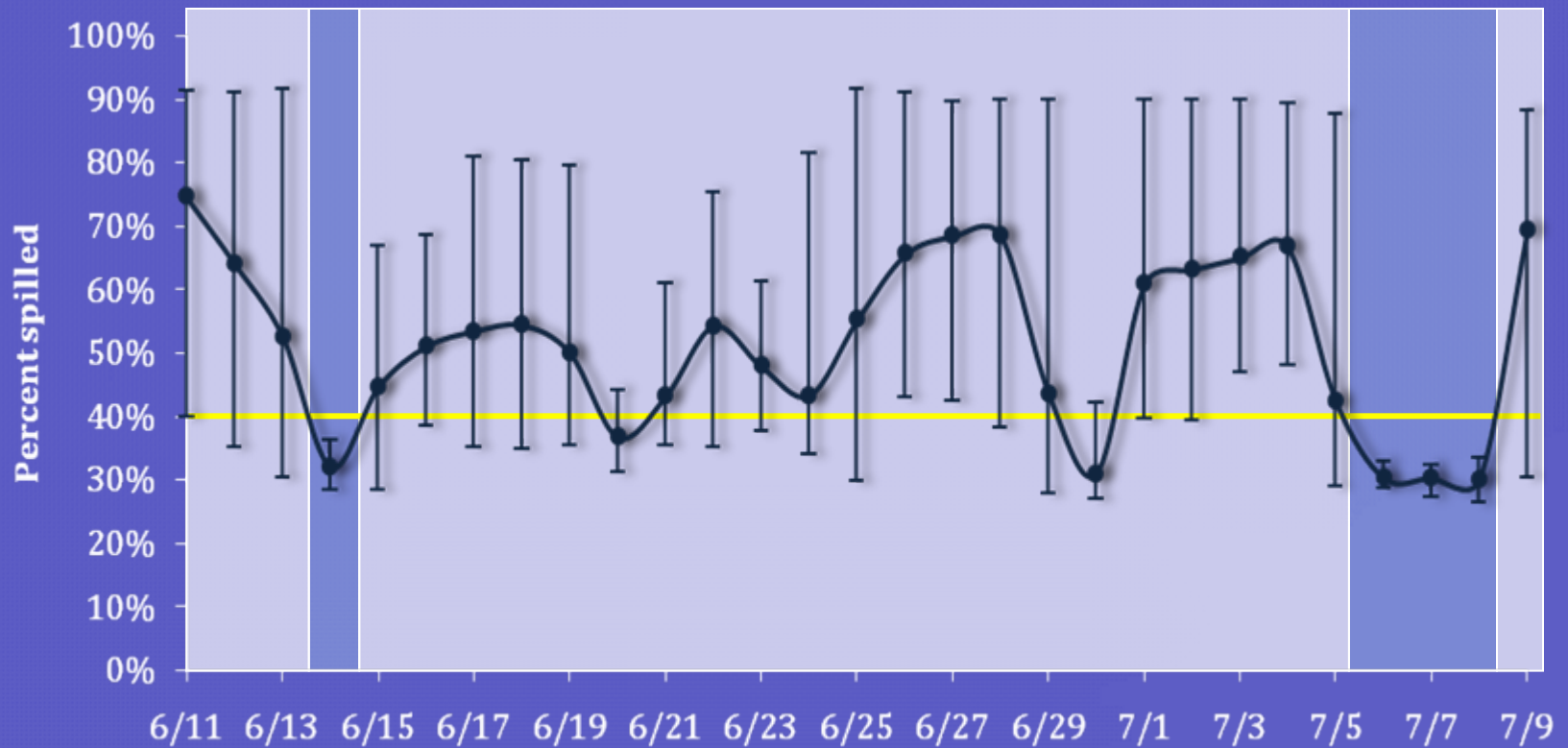


# Results - *Ice Harbor Dam Summer Operations*

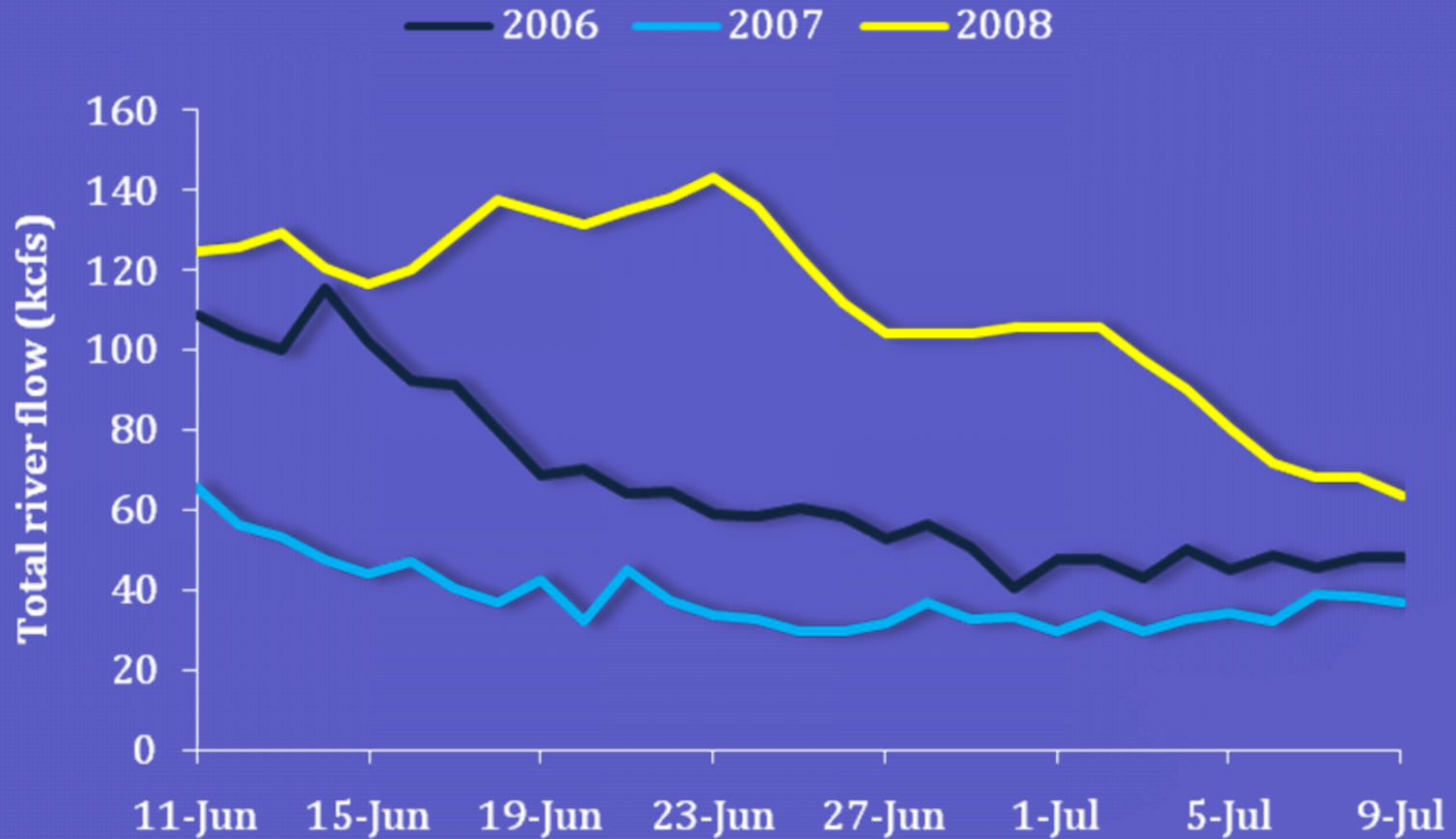


# Results - *Ice Harbor Dam Summer Treatments*

- BiOp Spill
- Reduced Spill



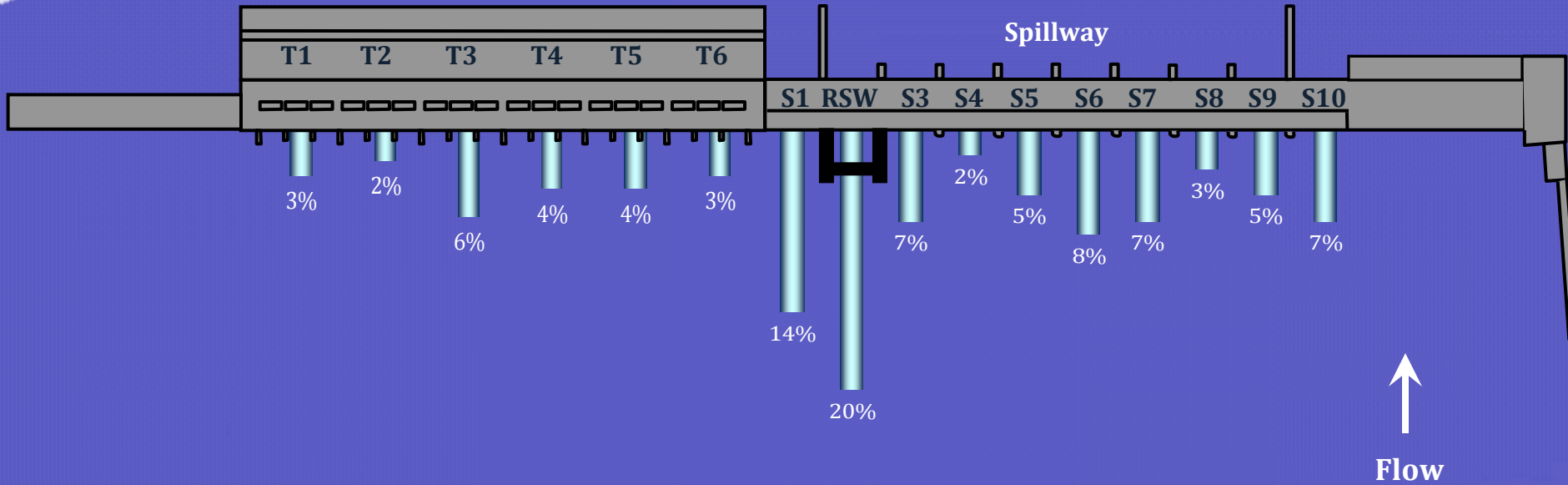
# Results - *Ice Harbor Dam Summer River Flows*



## Results - *Ice Harbor Dam Summer Operations*

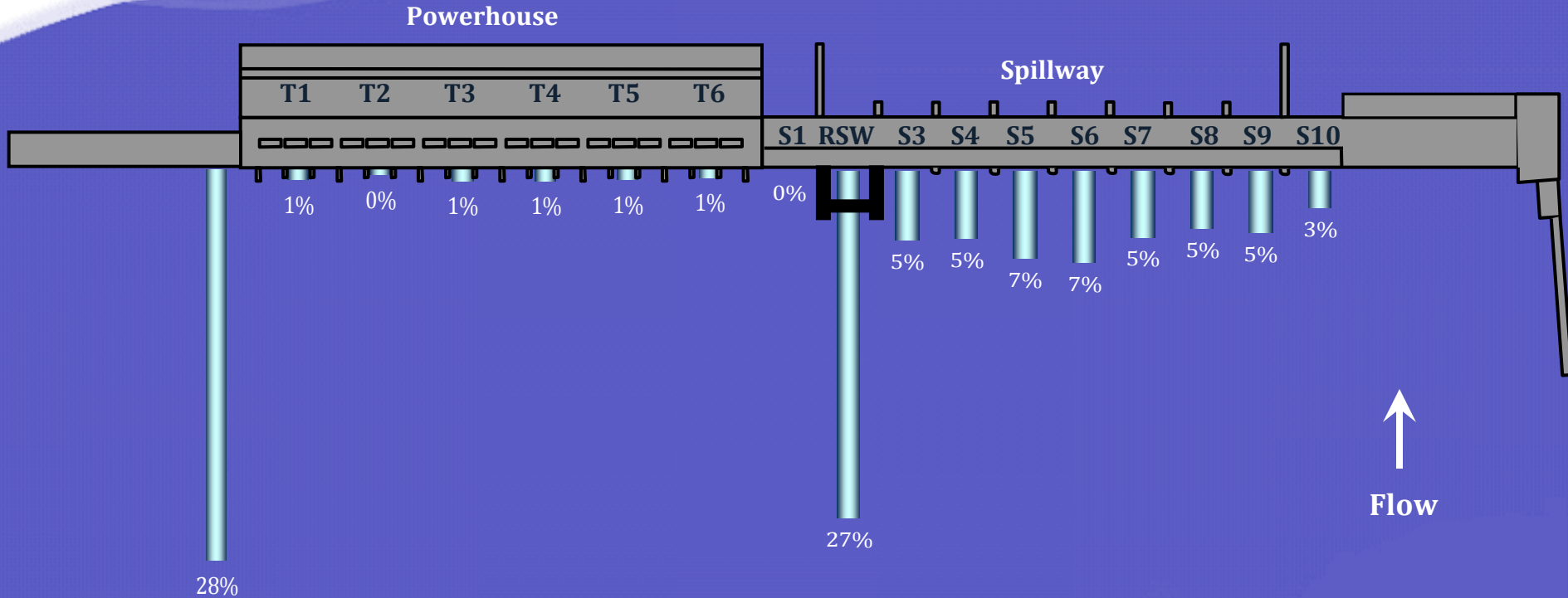
	2006	2007	2008
Total river flow	53 kcfs	38 kcfs	96 kcfs
Percent spill	54%	44 – 73%	56%
Percent RSW flow	15%	21 – 22%	8%

# Results - Ice Harbor Dam Approach Distribution Fall Chinook Salmon



N = 2,323

# Results - *Ice Harbor Dam Passage Distribution* *Fall Chinook Salmon*

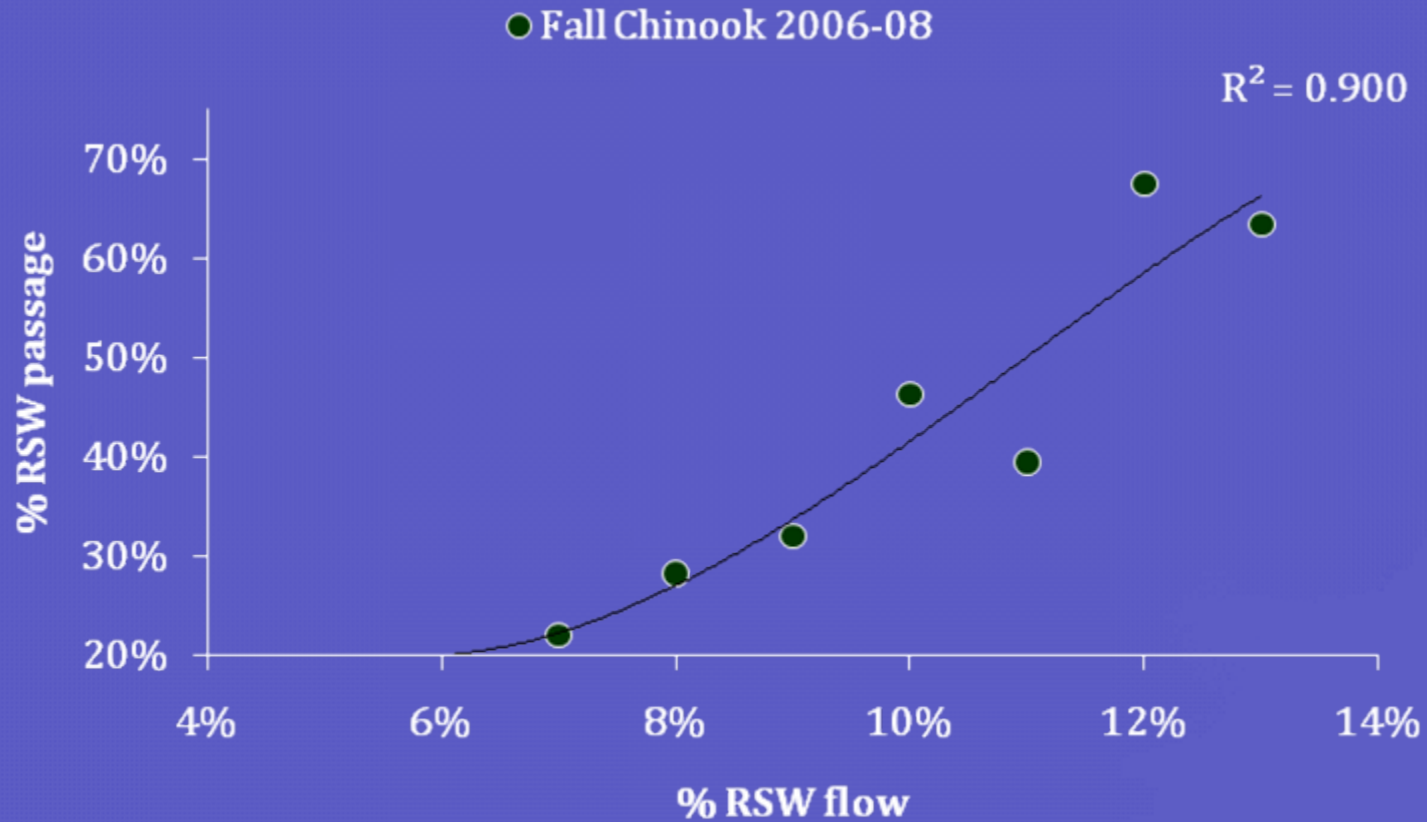


N = 2,092

## Results – *Fish passage metrics* *Fall Chinook Salmon*

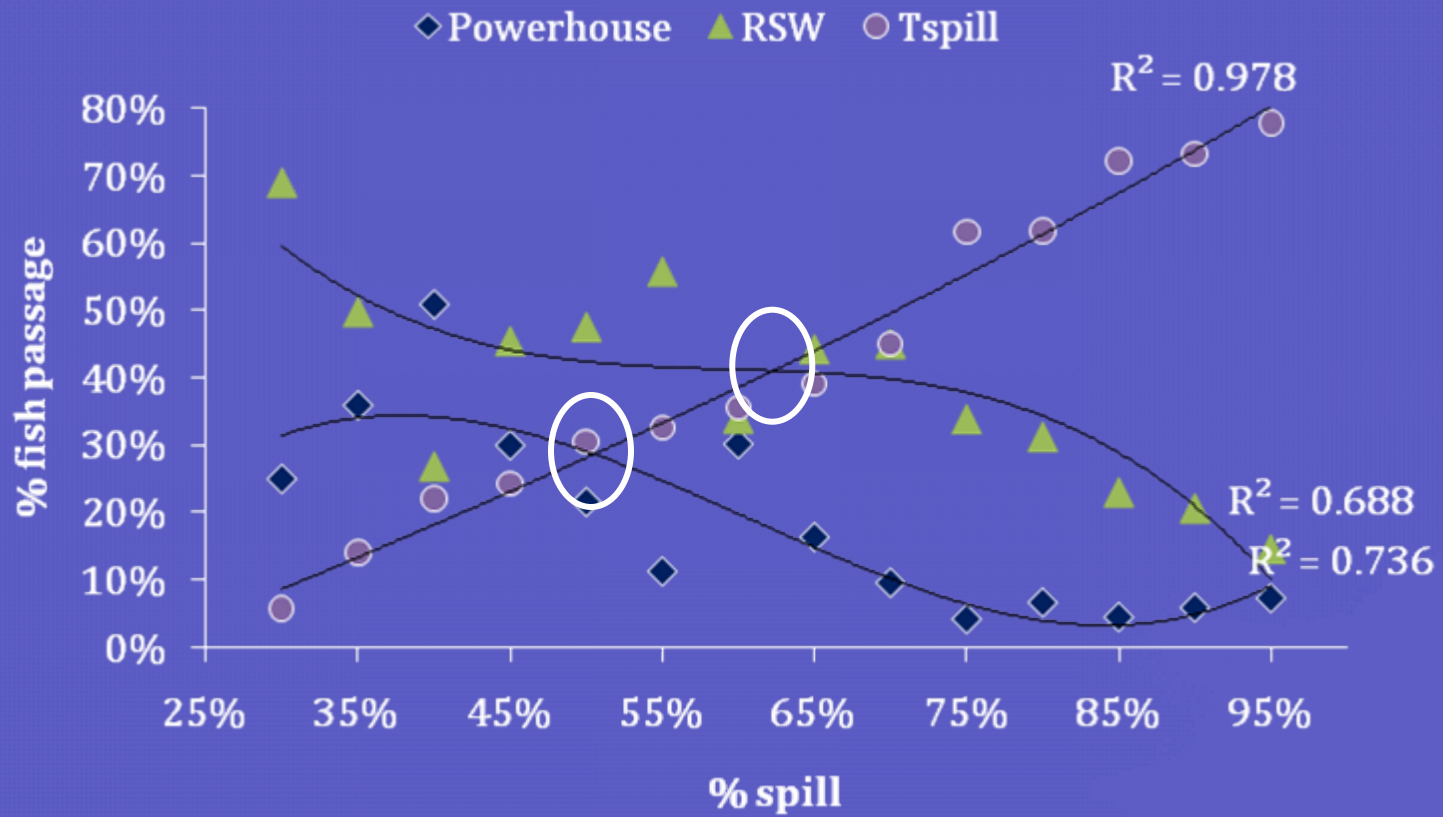
	<u>2006</u>	<u>2007</u>		<u>2008</u>
		Reduced	BiOp	
Forebay delay	2 h	3 h	3 h	2 h
% Spill passage	92%	84%	97%	67%
% PH passage	8%	16%	3%	33%
FPE	98%	95%	98%	96%
RSW effectiveness	4.6	3.4	2.1	3.0
Tailrace egress	11 min	15 min		9 min

# Results - *Ice Harbor Dam RSW Passage* *Fall Chinook Salmon*



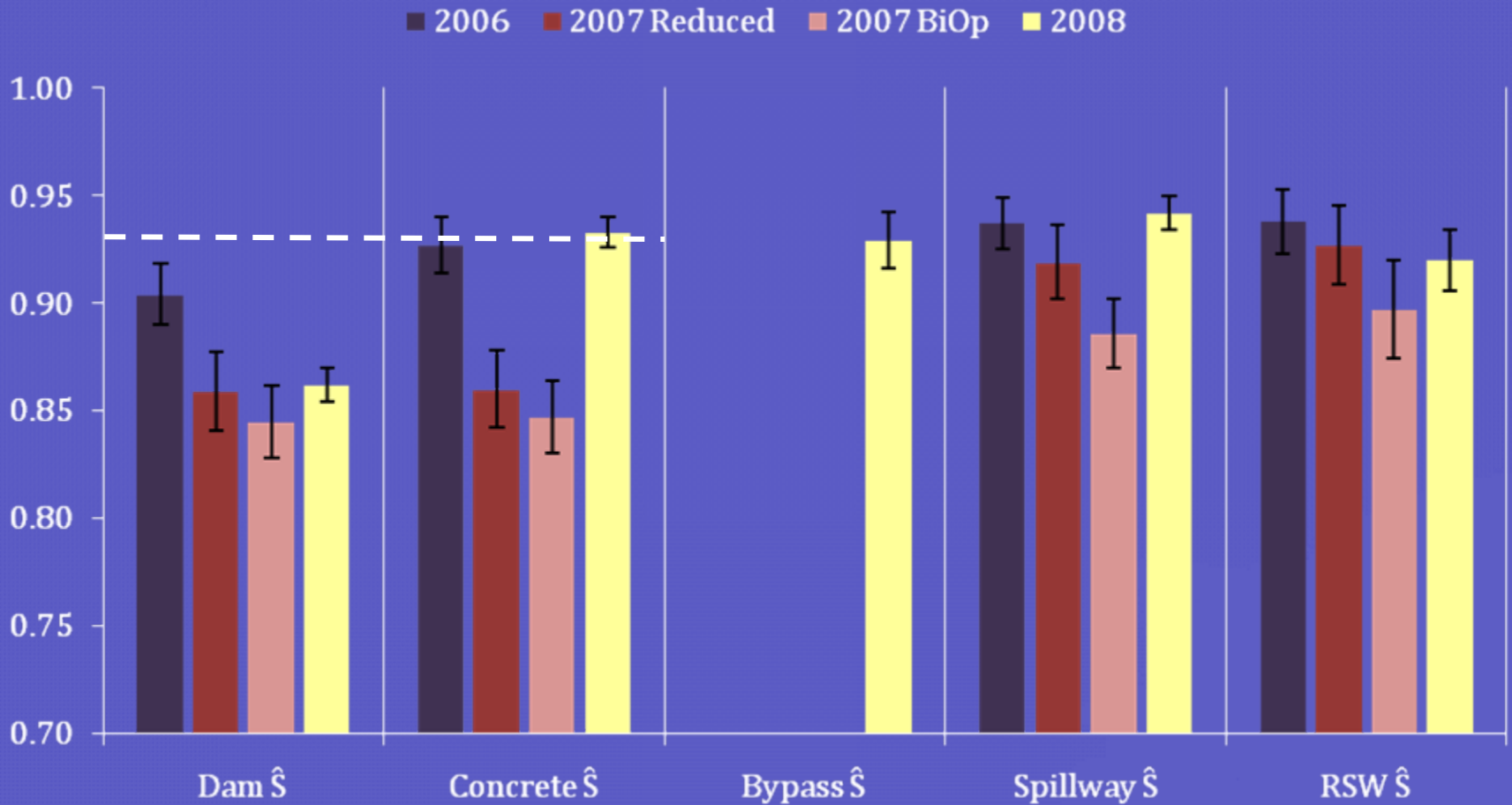
N = 4,095

# Results - Ice Harbor Dam Passage Distribution Fall Chinook Salmon

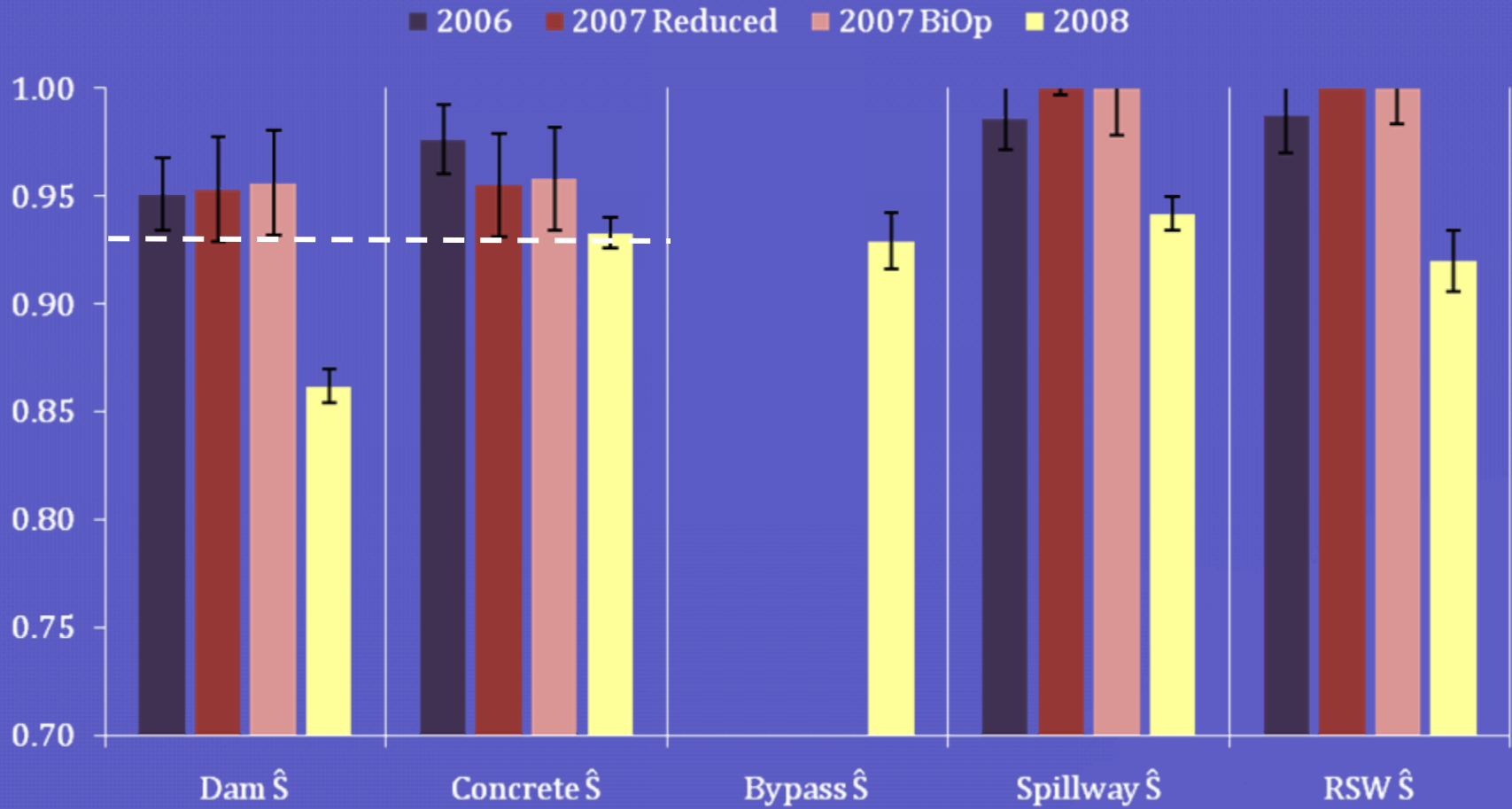


N = 4,095

# Survival Results – *Fall Chinook Salmon* *Single Release Estimates*



# Survival Results – *Fall Chinook Salmon* *Paired Release Estimates*



# Summary

- Survival estimates at Ice Harbor Dam remained high for yearling Chinook salmon, steelhead, and fall Chinook salmon
- Percentage of flow over the RSW directly correlates to steelhead utilization while yearling Chinook have a slightly weaker response
- Fall Chinook display behavior closer to steelhead where increased percentages of river flow over the RSW will move fish toward the RSW and away from the powerhouse
- Increasing the forebay depth by one foot at Ice Harbor could increase percentage of flow through the RSW by 2% during a high flow year and 3% during a low flow year

# Acknowledgements

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