

# Passage Behavior and Survival For Radio-tagged Subyearling Chinook Salmon at Ice Harbor Dam, 2007

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# 2007 Evaluation: *Passage and Survival*

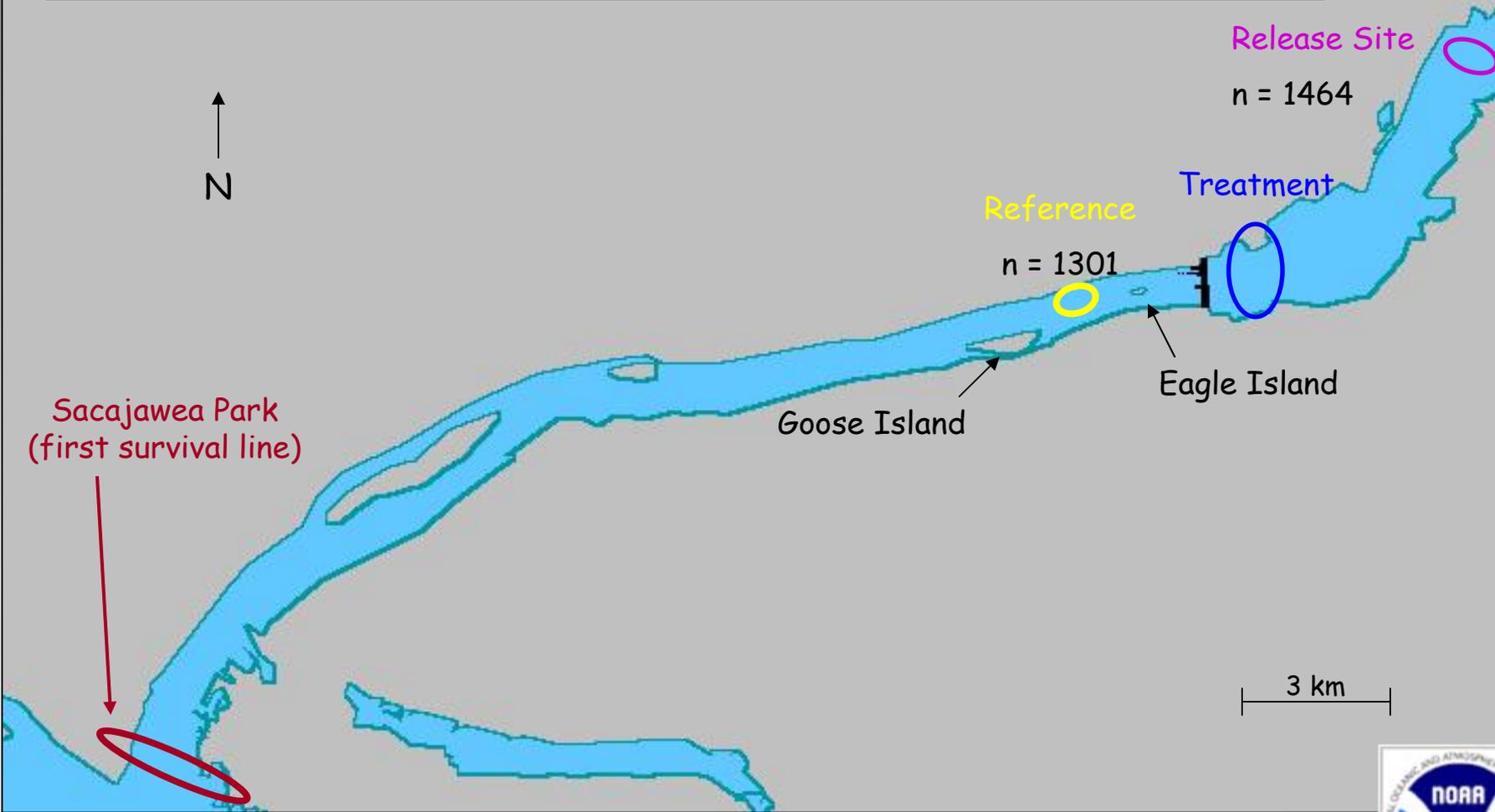
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- Evaluate two spill operations as they relate to the Removable Spillway Weir (RSW)
  - BiOp recommended spill (45 kcfs during day and gas cap at night)
  - Reduced spill
- Evaluate Passage Behavior
  - Forebay delay
  - Approach distribution
  - Passage distribution
  - Tailrace egress
- Estimate Survival
  - Relative dam survival
  - Relative concrete survival
  - Relative spillway survival
  - Relative RSW survival

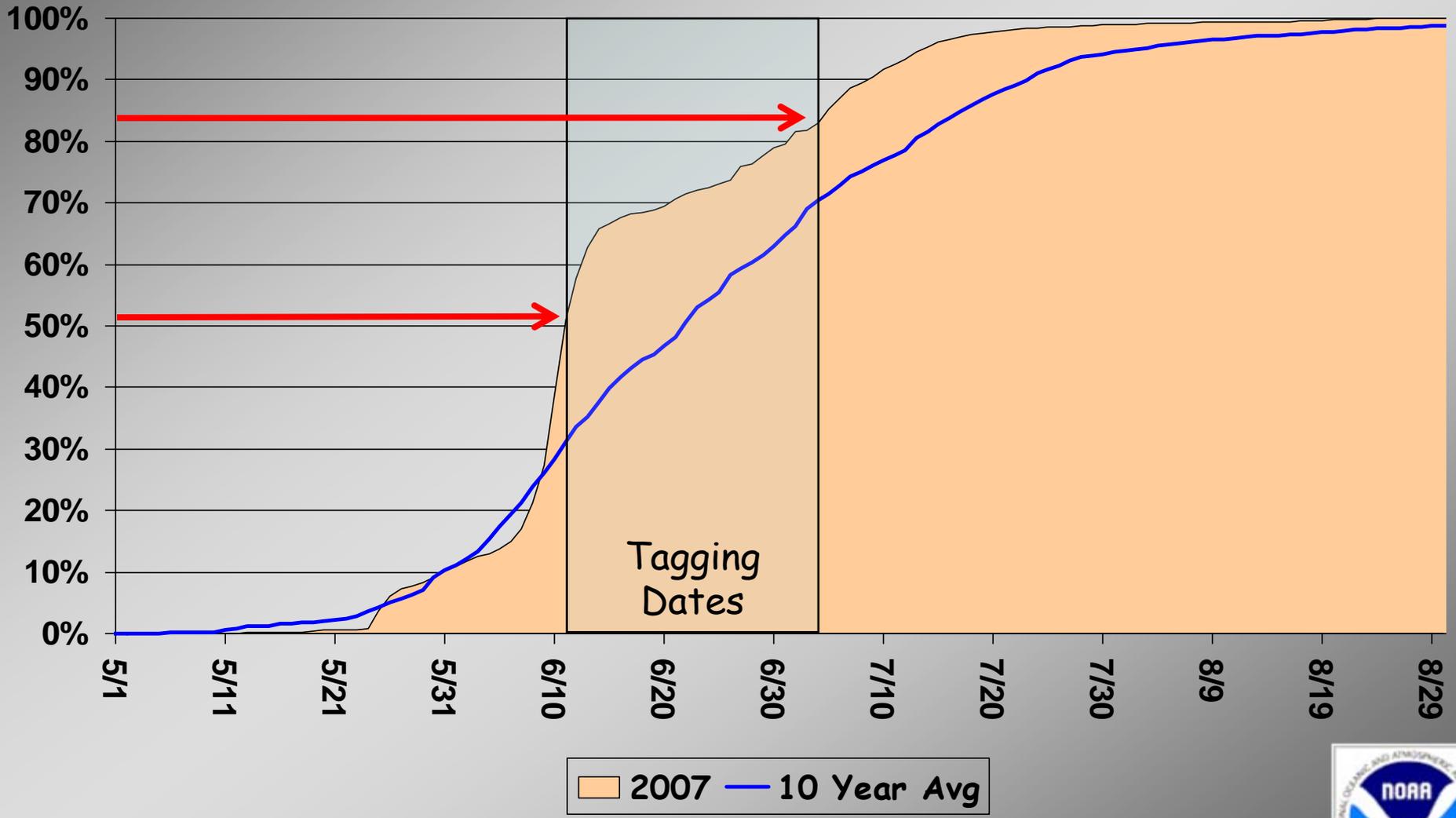


# 2007 Study Design: Ice Harbor "release" sites

## Lower Snake River between Ice Harbor Dam and the Columbia River



# 2007 Study Design: *Subyearling Chinook Salmon Passage Distribution at Lower Monumental Dam*



# 2007 Results: *Average operations by test*

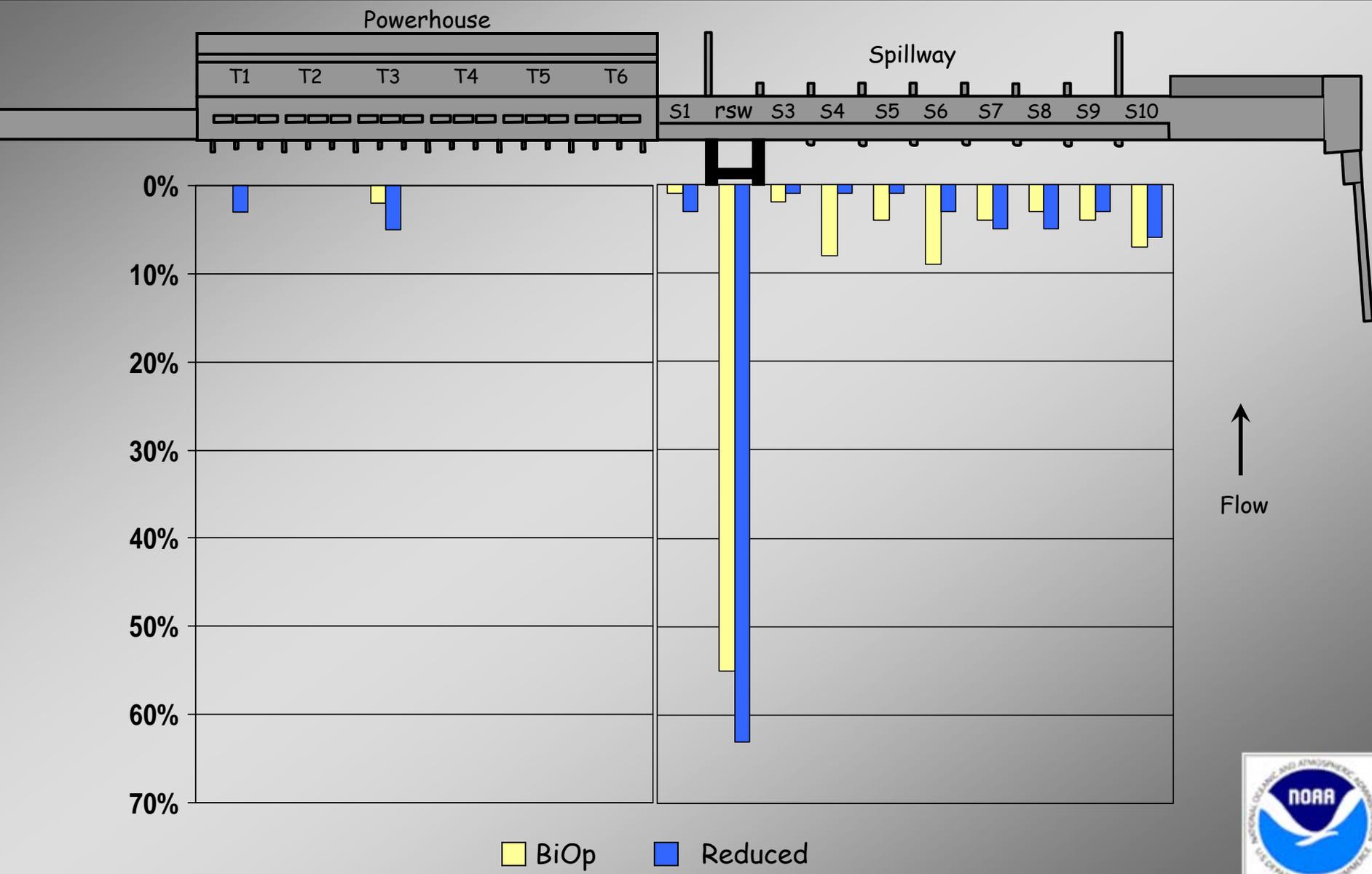
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	<u>BiOp</u>	<u>Reduced</u>
<u>Project Discharge (kcfs)</u>		
Mean	38.6	36.7
Range	24.1 - 79.2	24.1 - 75.2
<u>Spill Discharge (kcfs)</u>		
Mean	28.9	15.5
Range	15.1 - 70.1	14.6 - 22.1
Percent Spill (%kcfs)	73.4	44.4
RSW Mean (kcfs)	8.0	8.0

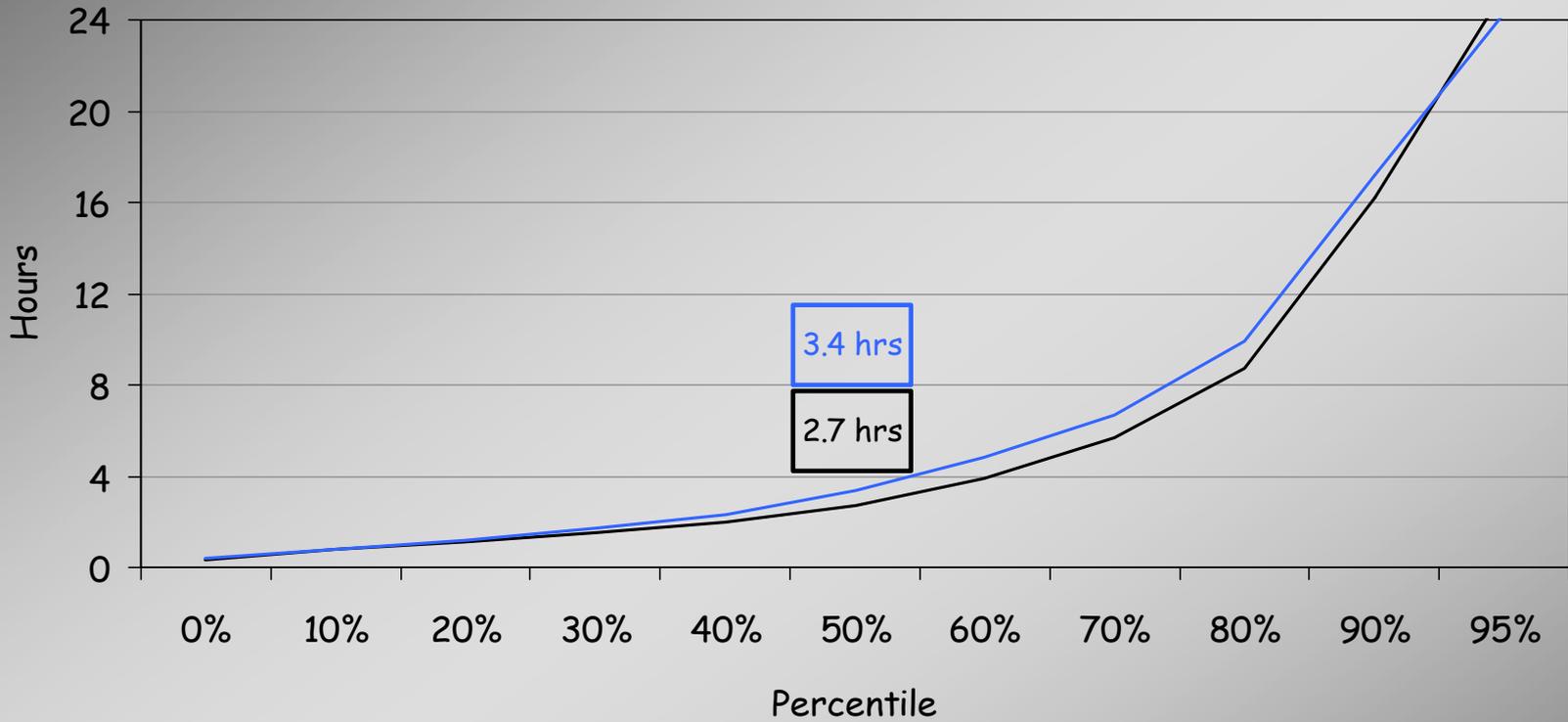
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# 2007 Results: Approach distribution



# 2007 Results: *Forebay delay time (hours)*

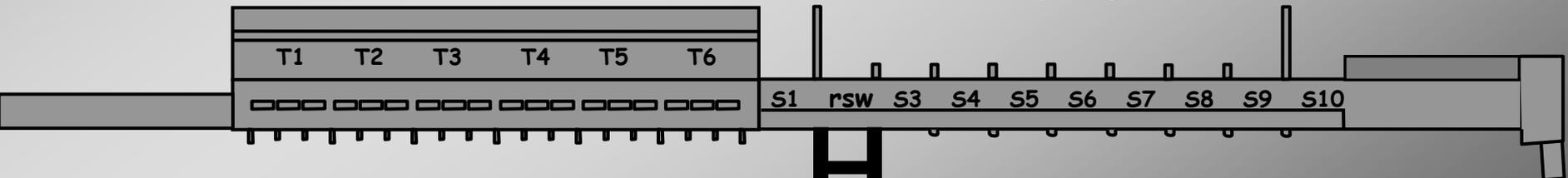
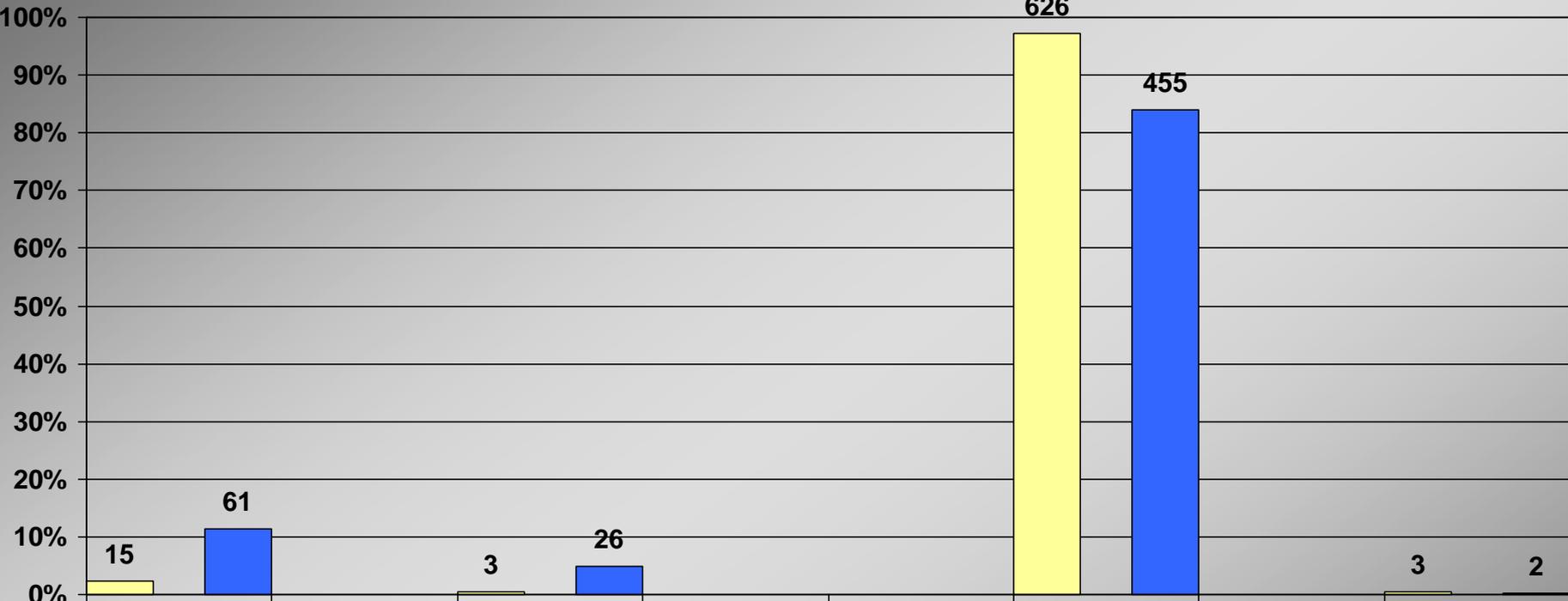


— BiOp (n = 617)    — Reduced (n = 536)

Median time: 2005 - 5 hrs    2006 - 2 hrs



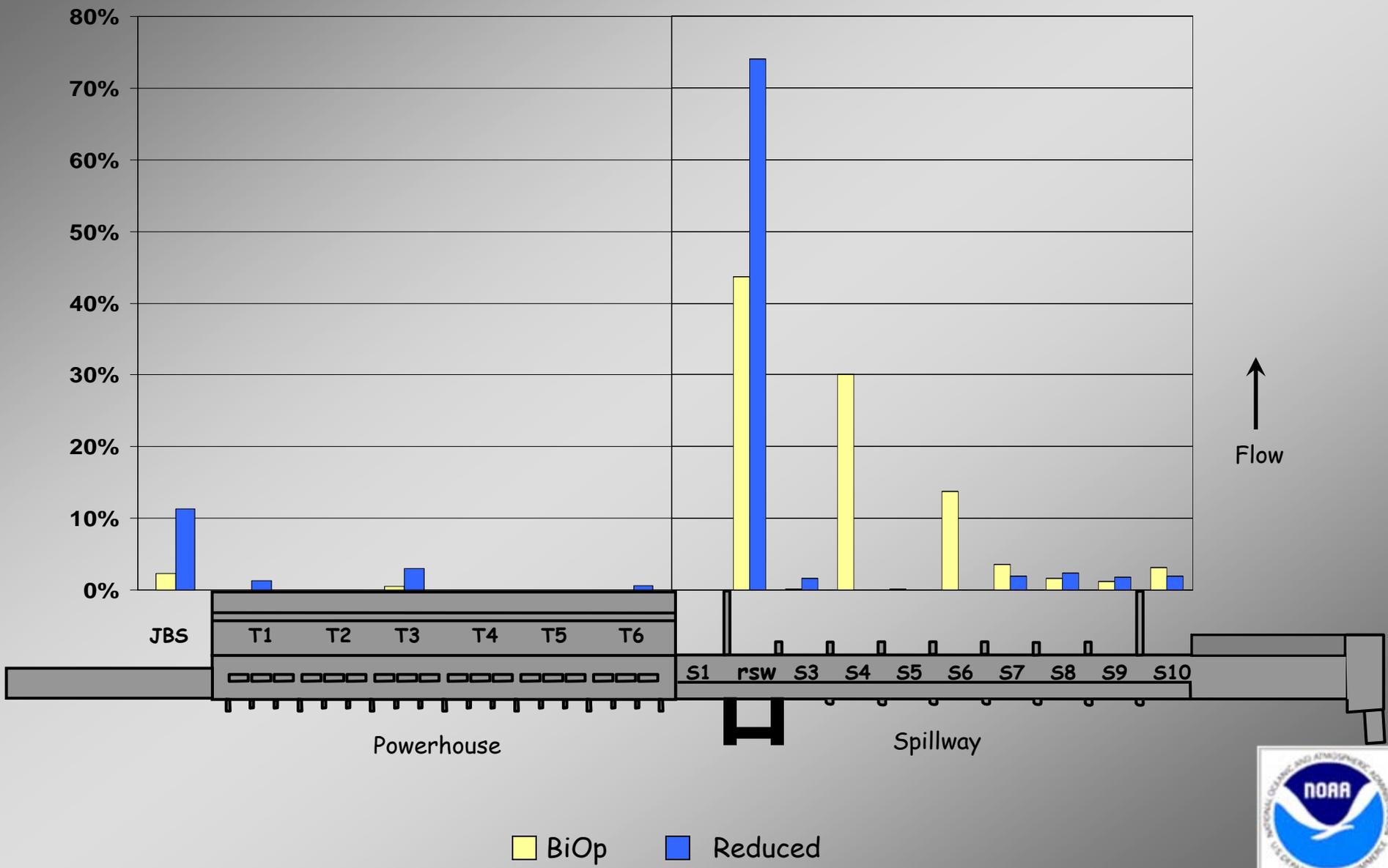
# 2007 Results: *Passage Distribution*



BiOp
  Reduced
  Flow



# 2007 Results: *Passage Distribution*



## 2007 Results: *Passage metrics*

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	<u>BiOp Spill</u>	<u>Reduced Spill</u>
Mean Spill Volume	73.4%	44.4%
Spill Efficiency	97.2% (95.9 - 98.5%)	83.9% (80.7 - 87.1%)
Fish Guidance Efficiency	83.3% (78.3 - 88.3%)	70.1% (64.5 - 75.7%)
Fish Passage Efficiency	99.5% (99.0 - 100.0%)	95.2% (94.0 - 96.4%)

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## 2007 Results: *Passage metrics*

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	<u>BiOp Spill</u>	<u>Reduced Spill</u>
Mean Spill Volume	73.4%	44.4%
Spill Effectiveness	1.30 (1.28 - 1.31)	1.99 (1.94 - 2.04)
RSW Effectiveness	2.08 (2.05 - 2.10)	3.39 (3.33 - 3.44)
Training Spill Effectiveness	1.00 (0.98 - 1.02)	0.49 (0.42 - 0.56)

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# 2007 Results: *Passage metrics*

	<u>2005</u>	<u>2006</u>	<u>2007</u>	
	RSW		BiOp	Reduced
Mean Spill Volume	46%	54%	73%	44%
Spill Efficiency	87%	94%	97%	84%
Fish Guidance Efficiency	62%	70%	83%	70%
Fish Passage Efficiency	95%	98%	99%	95%
Spill Effectiveness	1.9	2.0	1.3	2.0
RSW Effectiveness	3.4	4.6	2.1	3.4
Training Spill Effectiveness	0.4	0.8	1.0	0.5

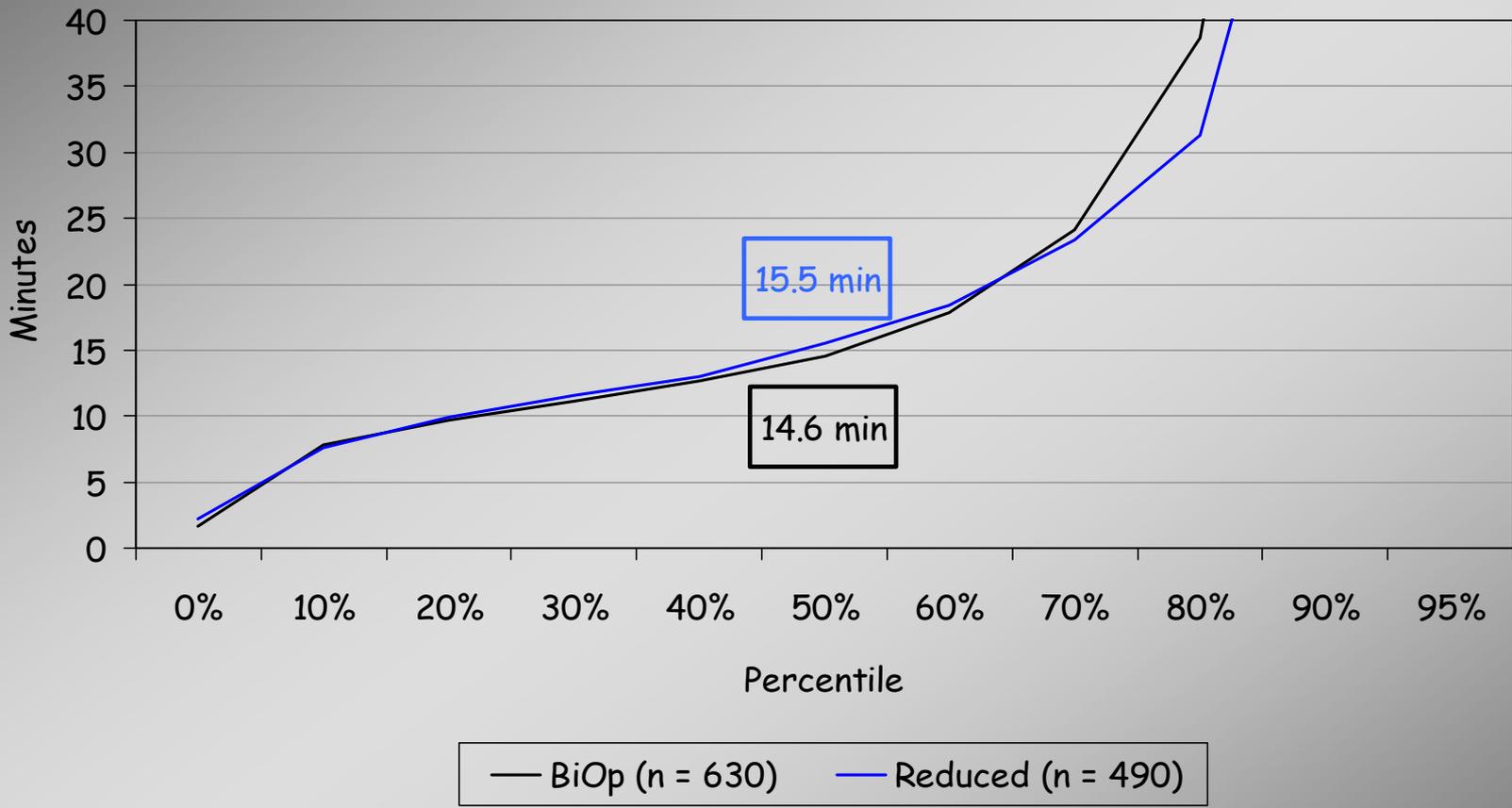


# 2007 Results: RSW passage

	<u>Subs</u>		<u>Yearlings</u>		<u>Steelhead</u>	
	BiOp	Reduced	BiOp	Reduced	BiOp	Reduced
Spill passage efficiency	97.2%	83.9%	93.3%	75.0%	95.2%	86.2%
Average project discharge (kcfs)	38.6	36.7	78.9	74.5	78.9	74.5
Average RSW Discharge (kcfs)	8.0 (21%)	8.0 (22%)	8.0 (10%)	8.0 (11%)	8.0 (10%)	8.0 (11%)
RSW effectiveness	2.08	3.39	4.16	5.51	5.27	6.92



# 2007 Results: *Tailrace egress times (minutes)*



Median time: 2005 - 5 min    2006 - 11 min



# 2007 Results: *Relative Survival*

Operation	Relative Survival	S.E.	95% C.I.	<i>t</i>	<i>P</i>
	Dam (forebay BRZ to tailrace)				
BiOp	0.956	0.024	0.932 - 0.980	0.02	0.988
Reduced	0.953	0.024	0.929 - 0.977		
	Concrete (all fish passing the dam)				
BiOp	0.958	0.024	0.934 - 0.982	0.10	0.925
Reduced	0.955	0.024	0.931 - 0.979		



# 2007 Results: *Relative Survival*

Operation	Relative Survival	S.E.	95% C.I.	<i>t</i>	<i>P</i>
	<b>Spillway</b> (fish passing through the spillway)				
BiOp	1.002	0.024	0.978 - 1.026	0.83	0.446
Reduced	1.021	0.024	0.997 - 1.045		
	<b>RSW</b> (fish passing only through the RSW)				
BiOp	1.014	0.031	0.983 - 1.045	0.56	0.598
Reduced	1.029	0.025	1.004 - 1.054		



# 2007 Results: *Relative Survival*

	<u>2005</u>	<u>2006</u>	<u>2007</u>	
	RSW		BiOp	Reduced
<b>Dam</b> (forebay BRZ to tailrace)	95%	95%	96%	95%
<b>Concrete</b> (all fish passing the dam)	99%	98%	96%	96%
<b>Spillway</b> (fish passing through the spillway)	99%	99%	100%	102%
<b>RSW</b> (fish passing only through the RSW)	100%	98%	101%	103%



# 2007 Results Summary

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- RSW had the highest first approach for both spill treatments.
- Forebay residence time was similar between the spill treatments.
- Most fish passed through the spillway for both spill treatments, with the RSW passing the highest percentage of fish for both spill treatments.
- Differences between BiOp and Reduced spill treatments for all passage metrics.
- Tailrace egress time was similar for both spill treatments.
- No difference in relative survival between BiOp and Reduced spill treatments.



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