Approach, Passage, and Survival of Juvenile Salmonids at Little Goose Dam in 2007

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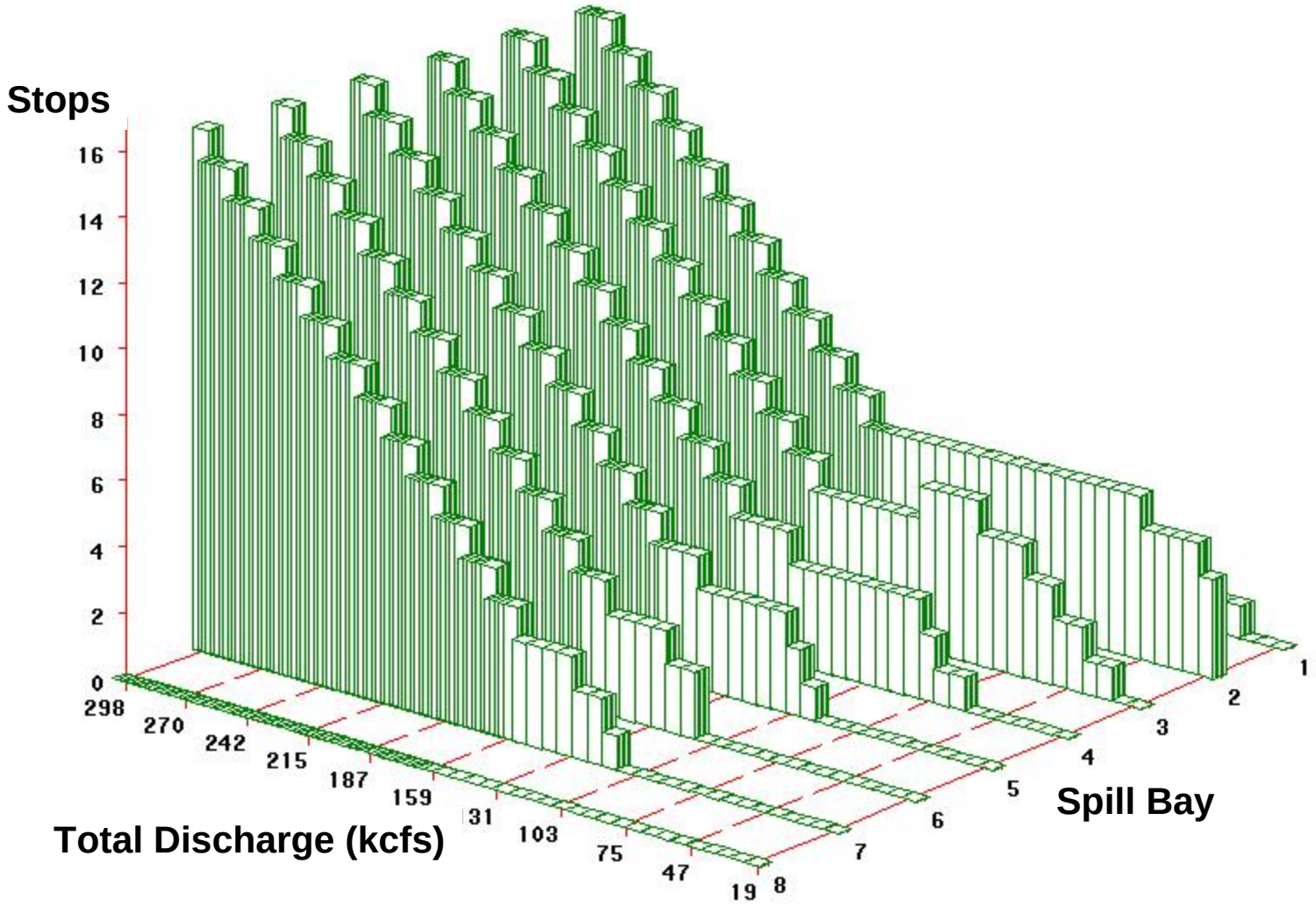
U.S. Department of the Interior
U.S. Geological Survey
Western Fisheries Research Center
Columbia River Research Laboratory

Background

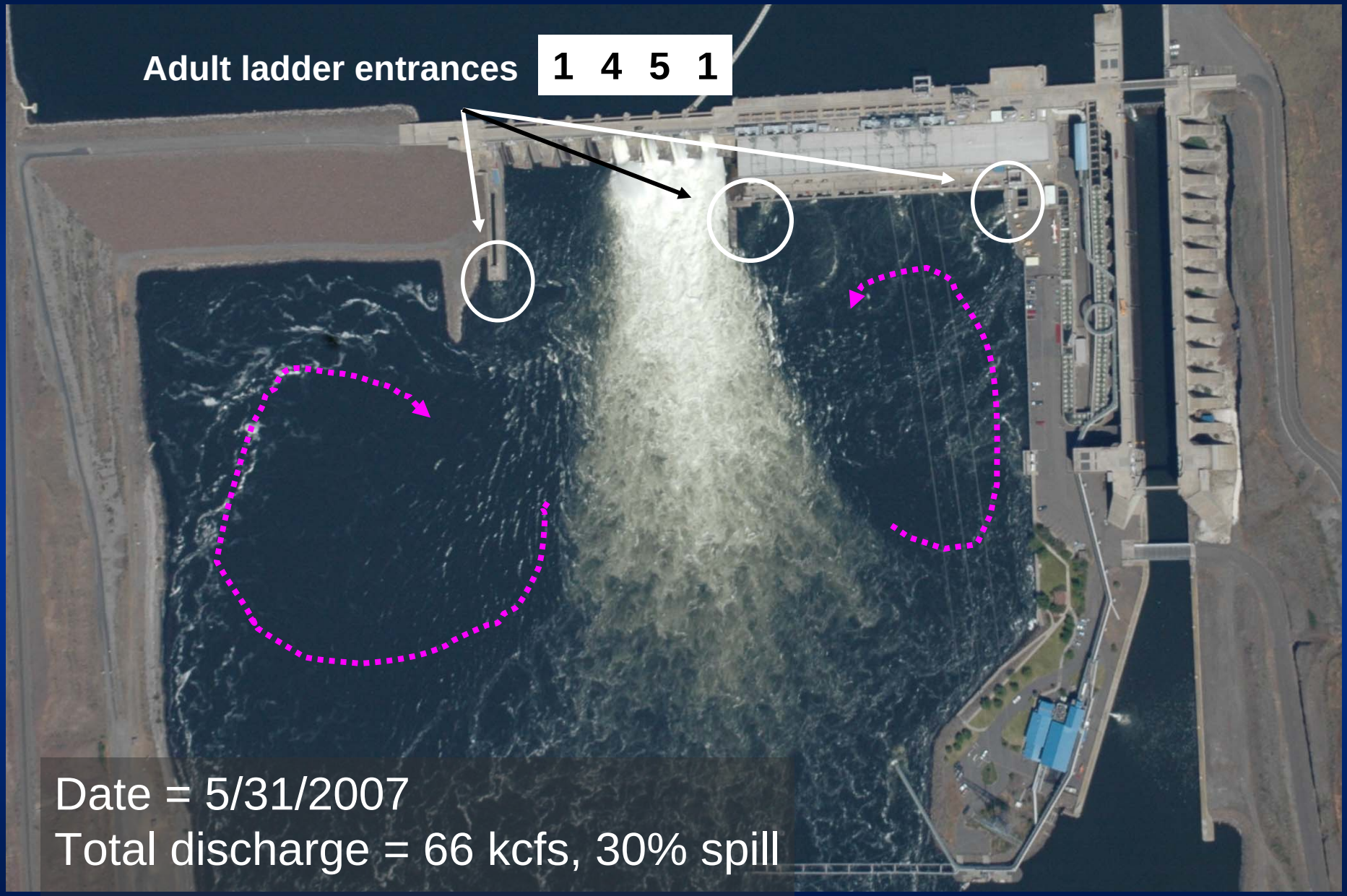
- Spillway weir coming in 2009
  - RSW changed to TSW in late 2007
- 2006 & 2007
  - pre-weir baseline
  - develop spill patterns, etc.
- 2007
  - Bulk spill pattern spring / uniform pattern summer
  - Three operation “periods” spring, one in summer

USGS

Tapered Bulk Spill Pattern, 2007



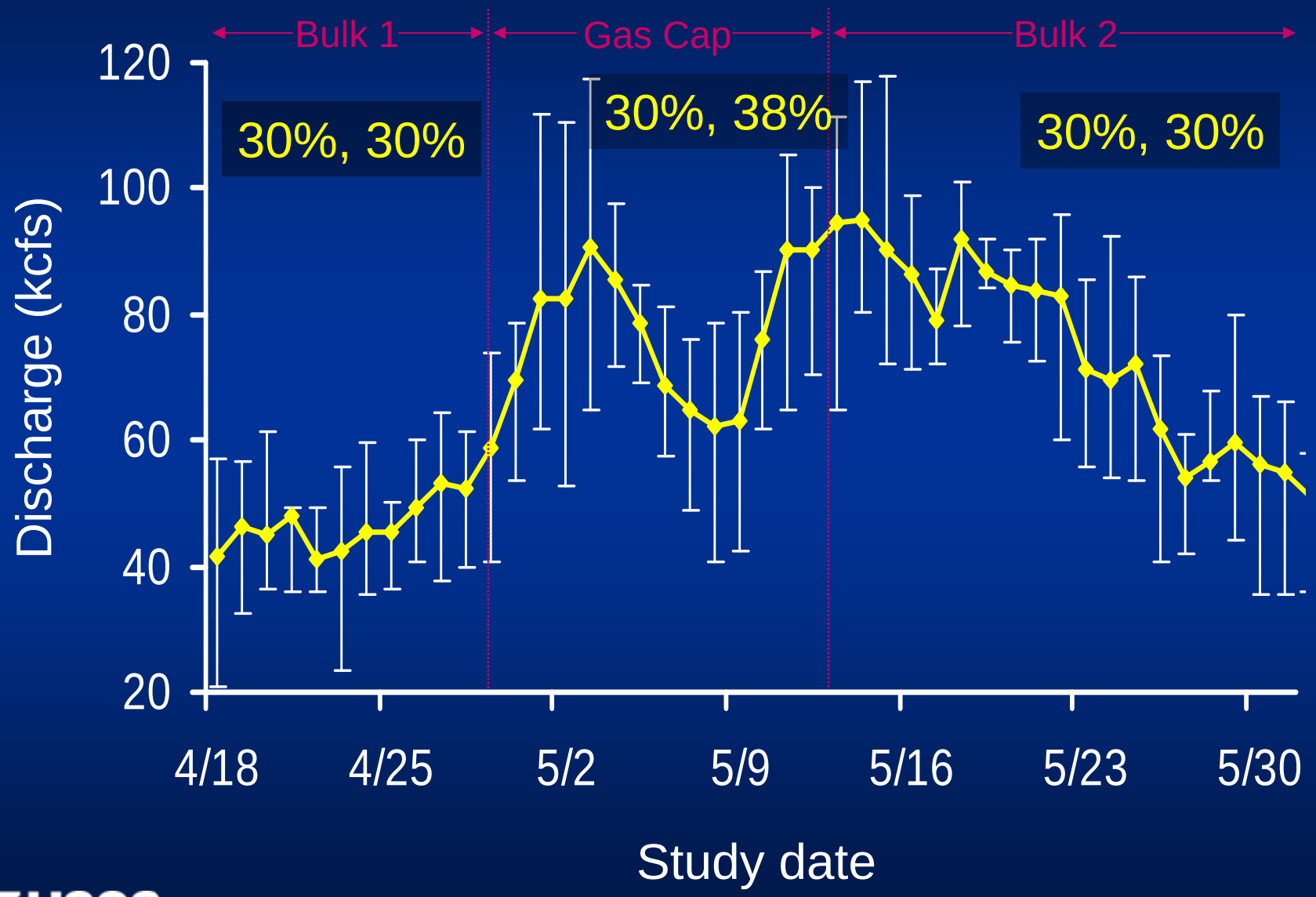
USGS



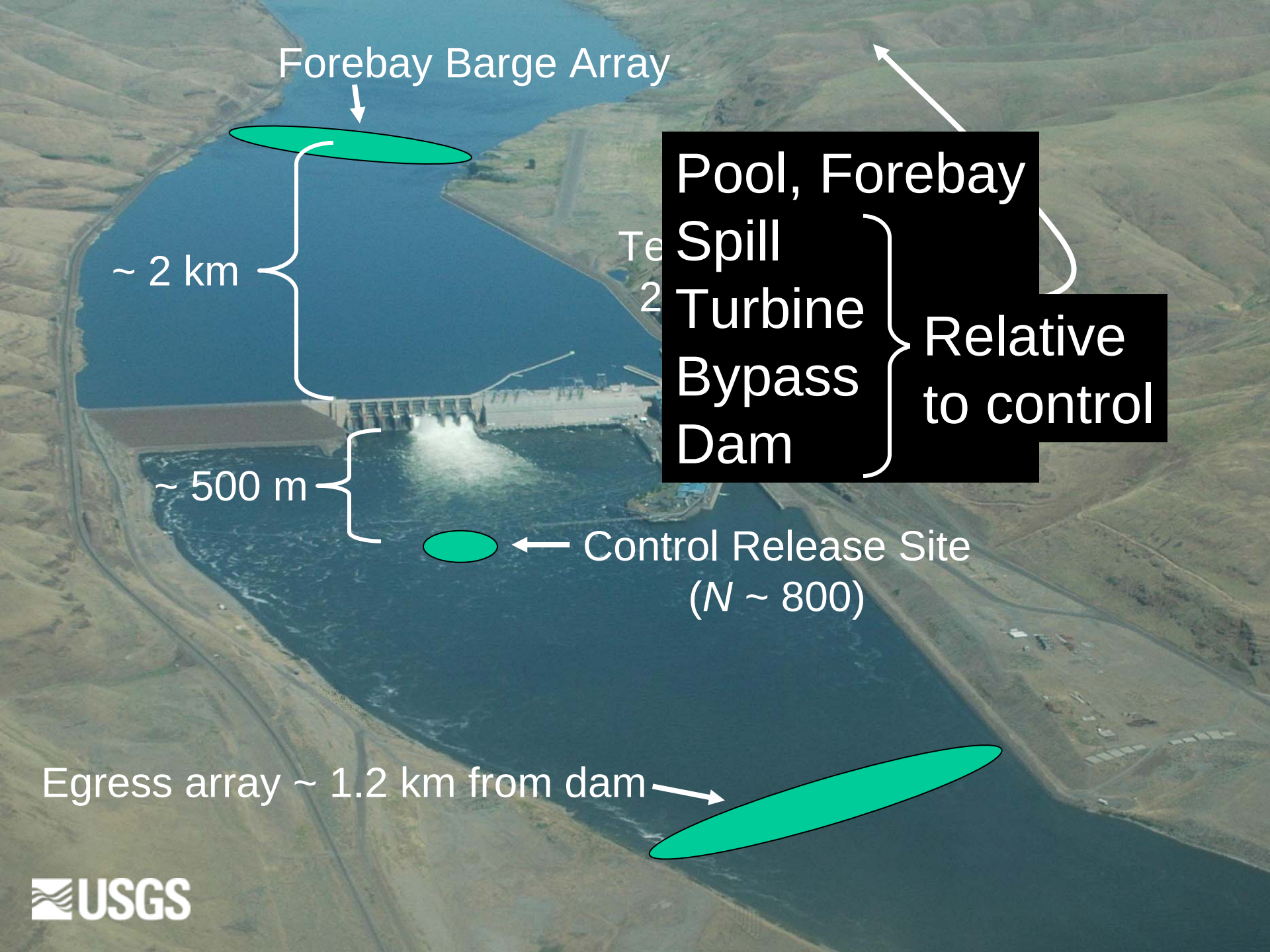
Date = 5/31/2007
Total discharge = 66 kcfs, 30% spill

USGS

Spring Conditions



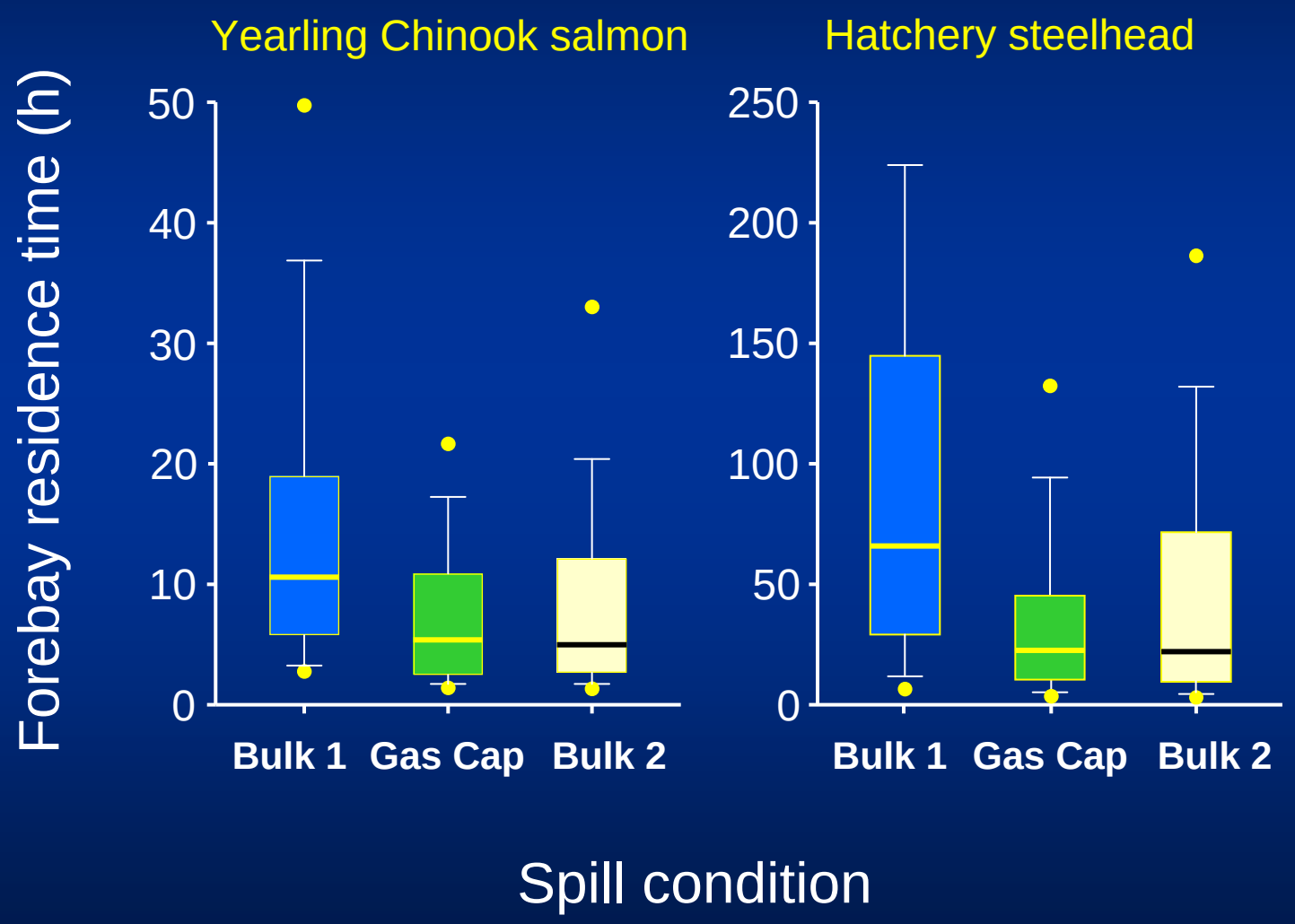
USGS


Forebay Barge Array
~ 2 km
~ 500 m
Pool, Forebay
Spill
Turbine
Bypass
Dam
Relative to control
Control Release Site
(N ~ 800)
Egress array ~ 1.2 km from dam
USGS

USGS

Forebay Residence Time

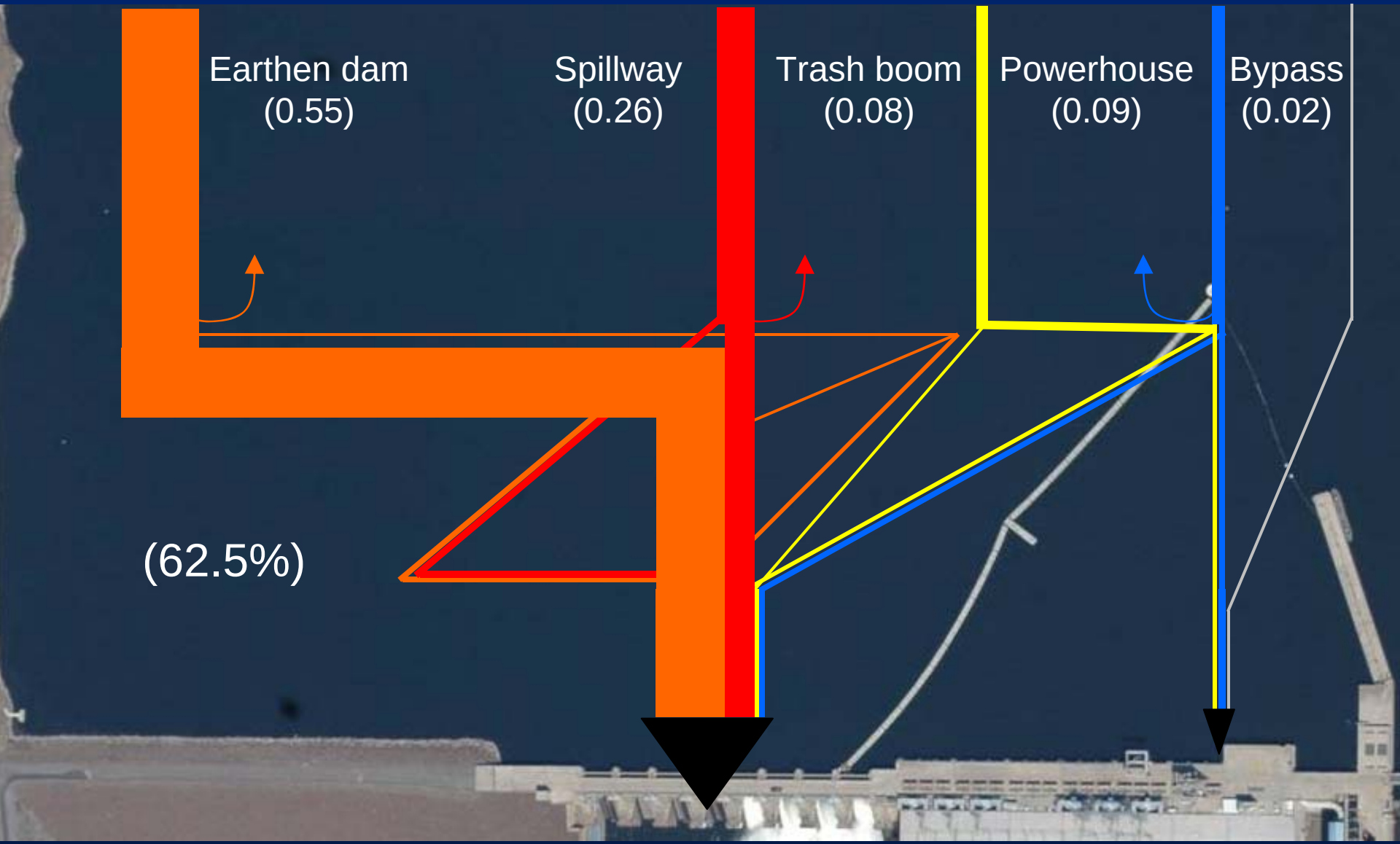
By Spill Condition



USGS

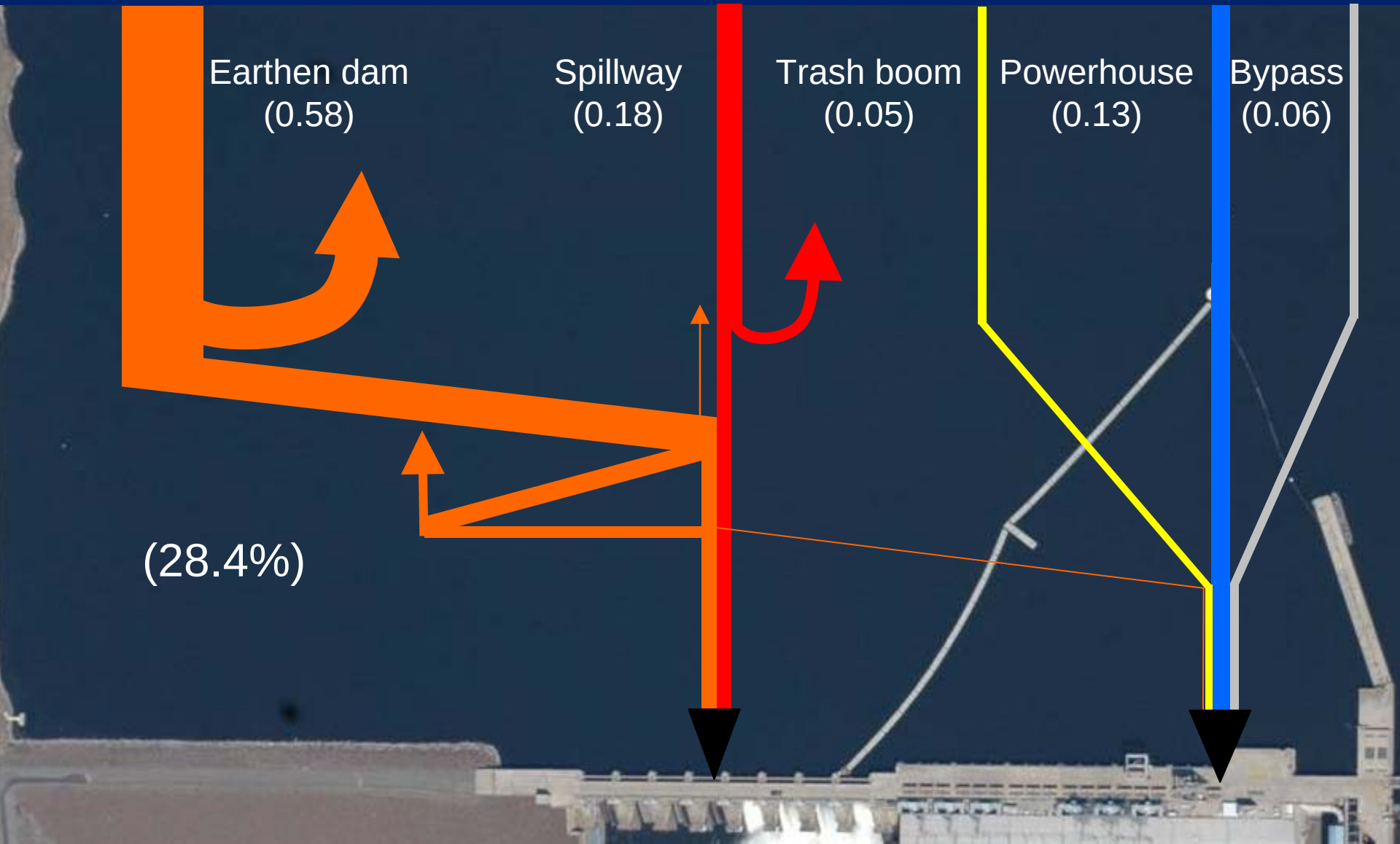
Forebay behavior

Yearling Chinook salmon

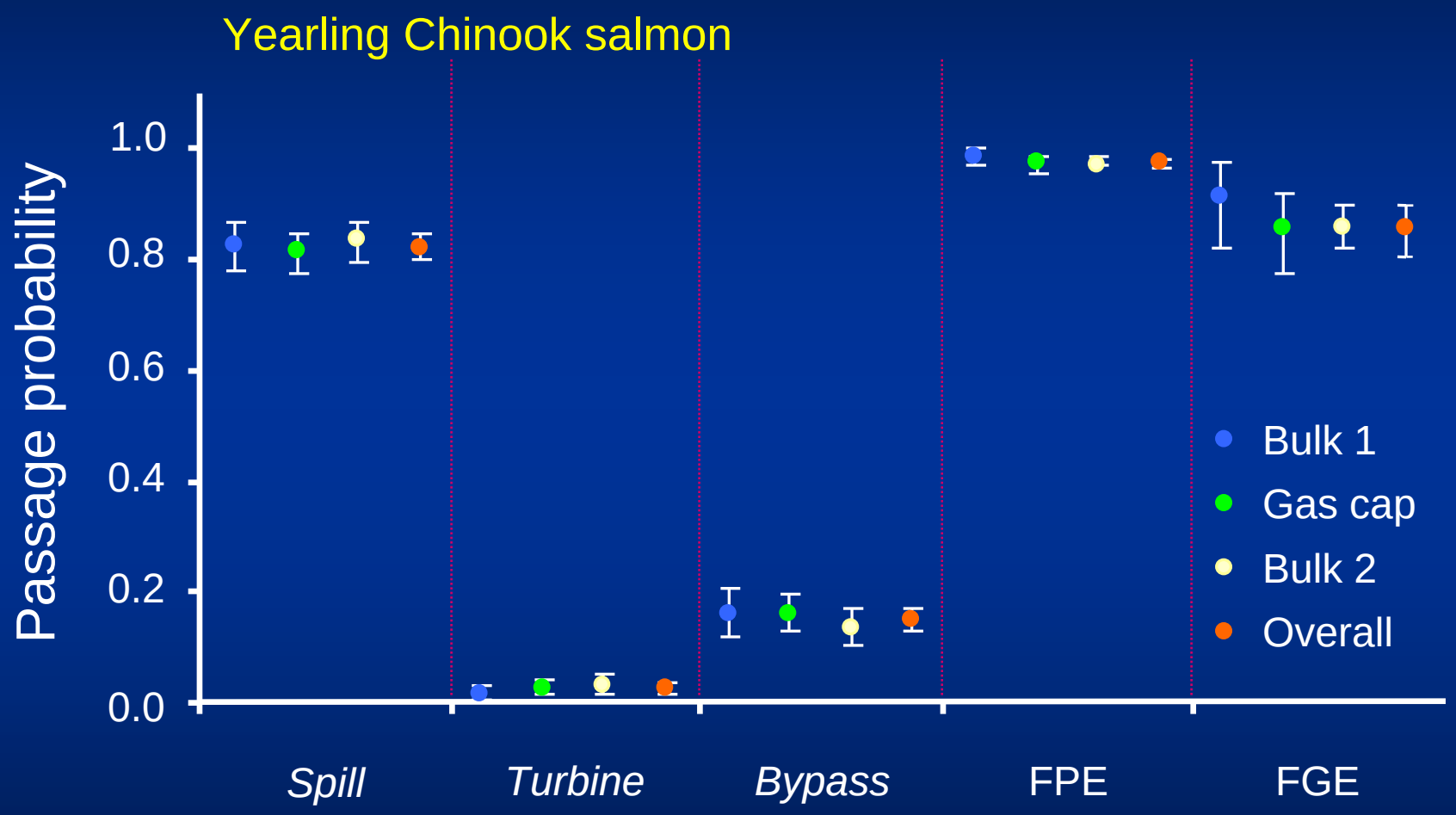


Forebay behavior

Juvenile steelhead

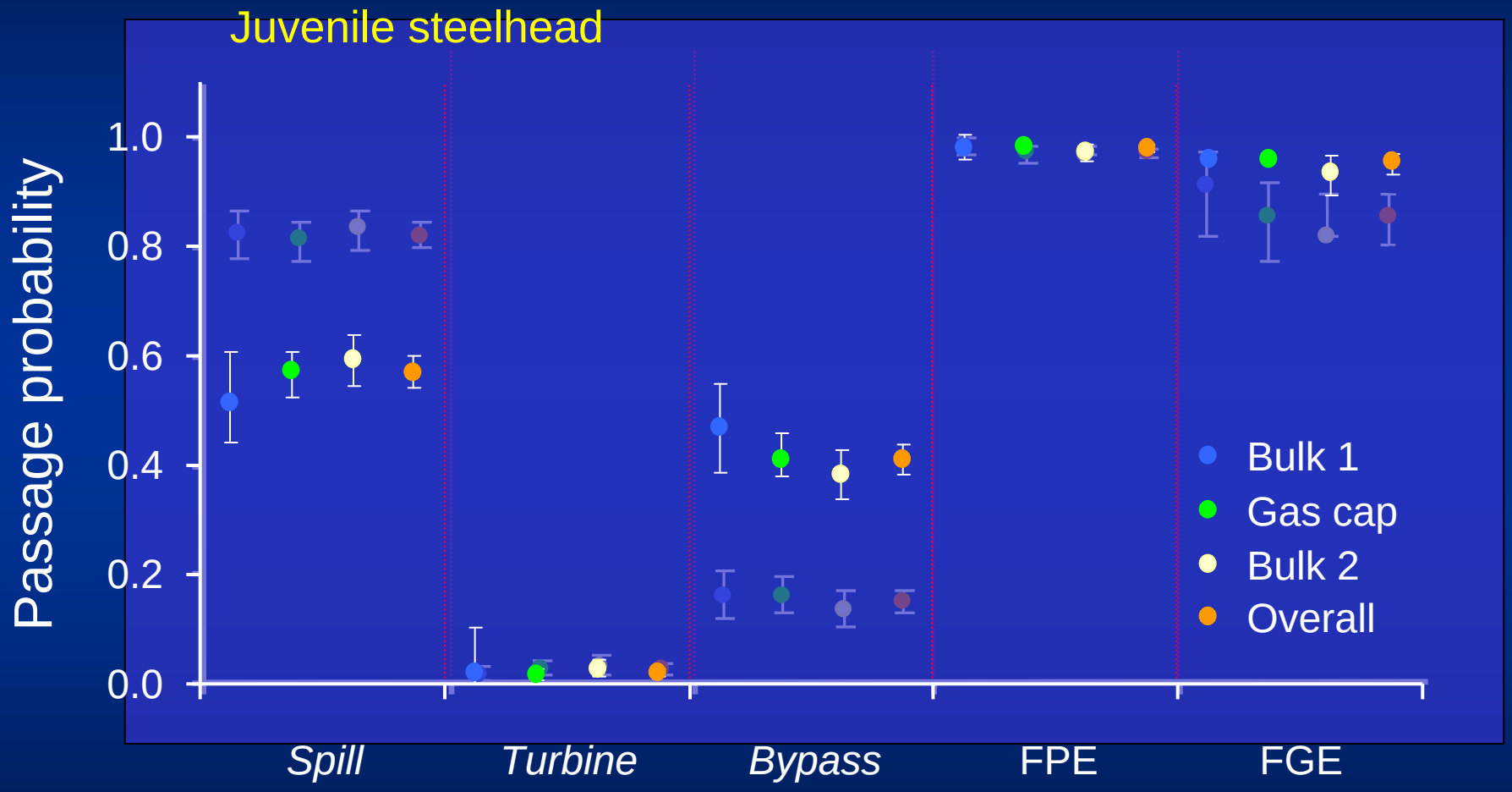


Passage Probability



USGS

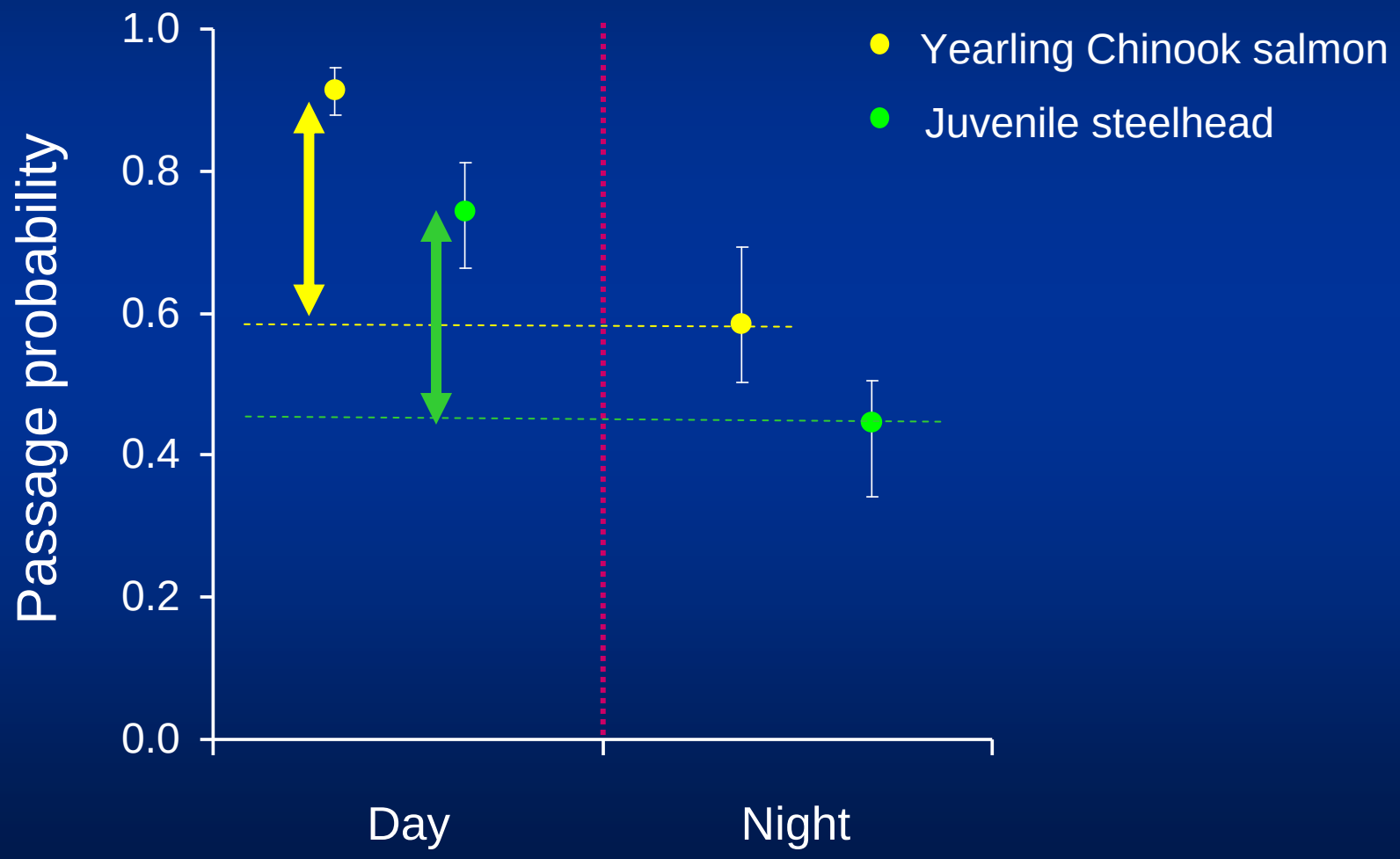
Passage Probability



USGS

Spillway Passage Probability

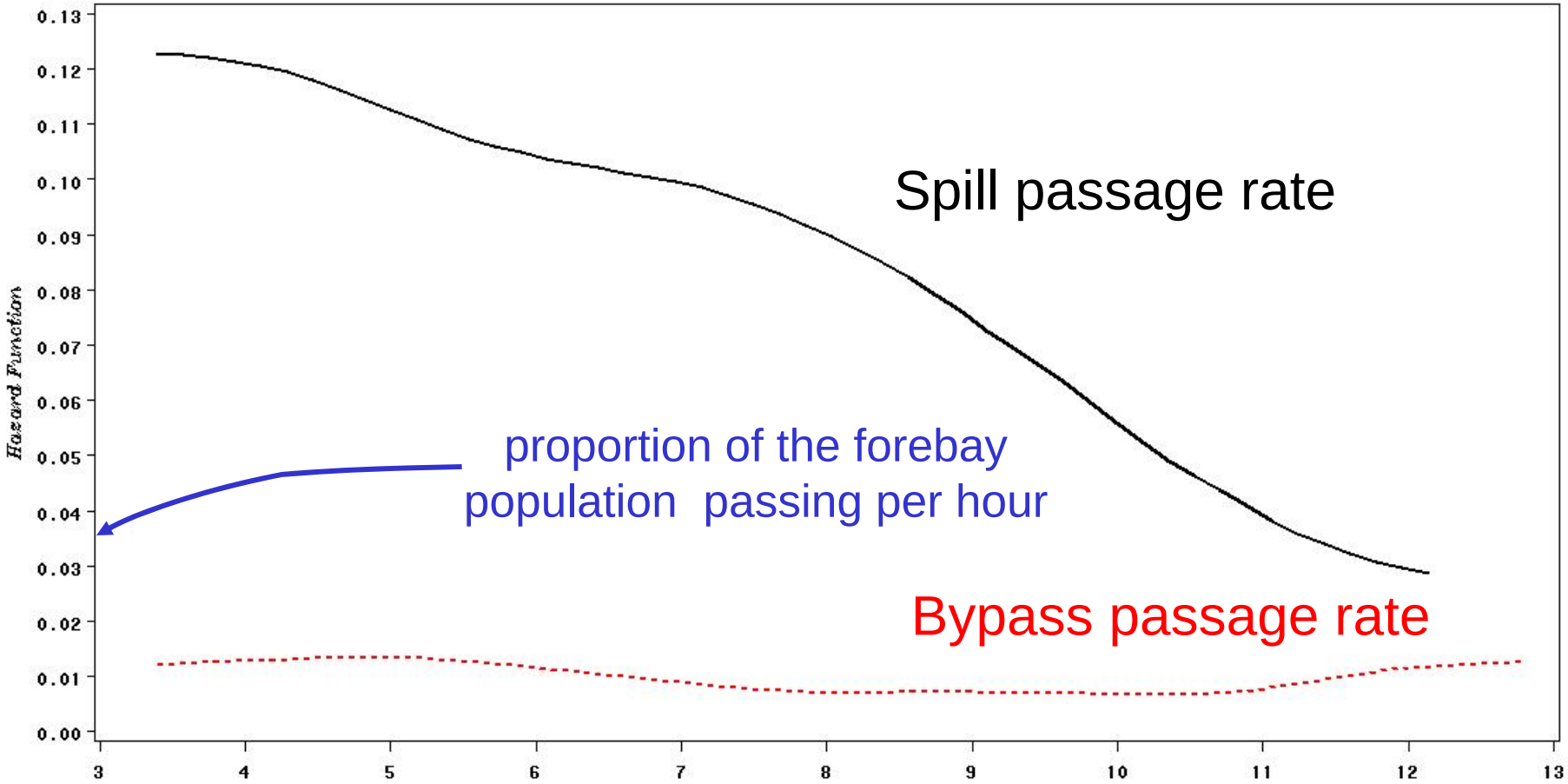
Day vs. Night



USGS

Yearling Chinook Salmon

Passage Rates Per Hour

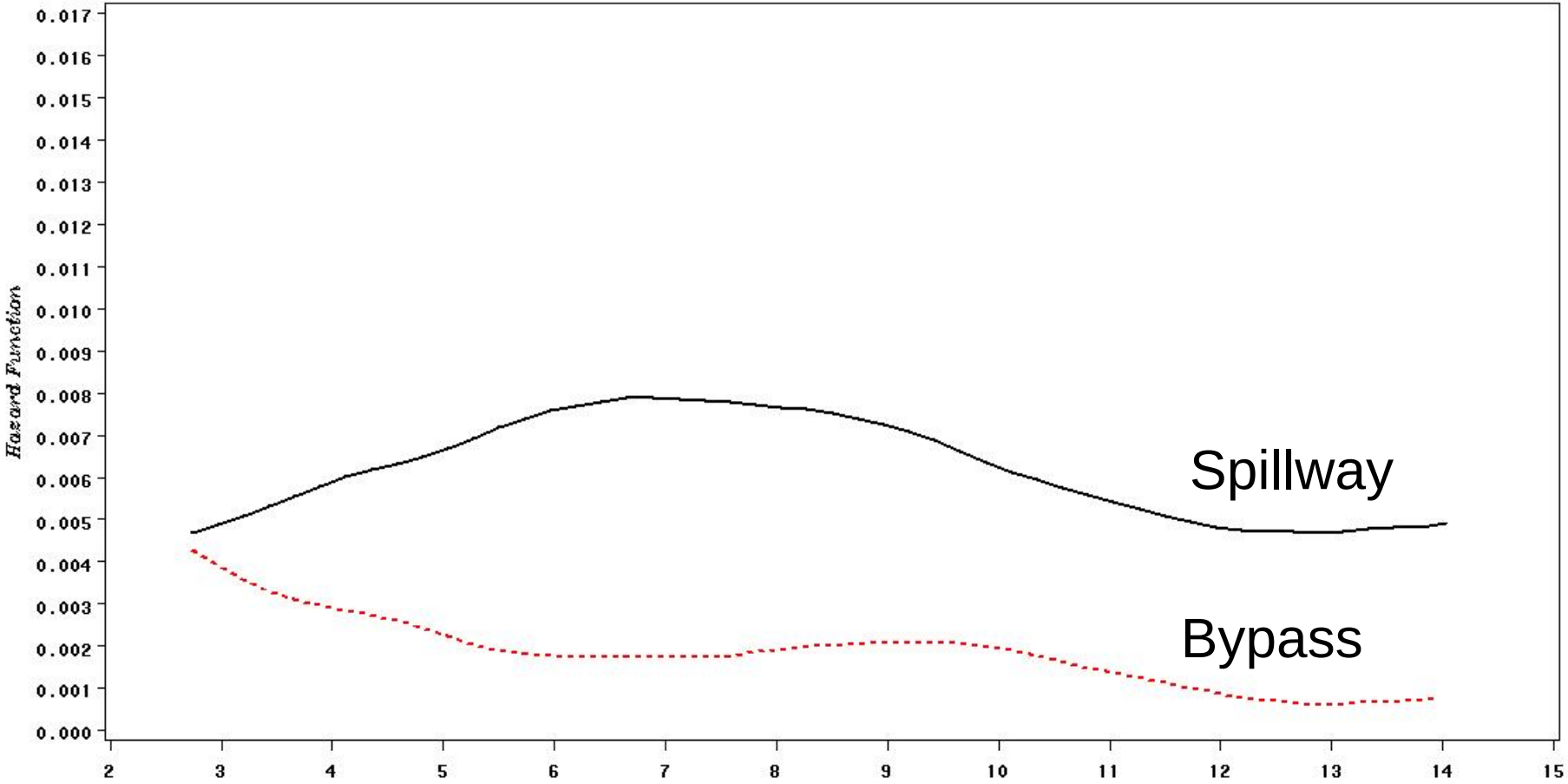


Hours Since Forebay Entrance

USGS

Juvenile Steelhead

Passage Rates Per Hour

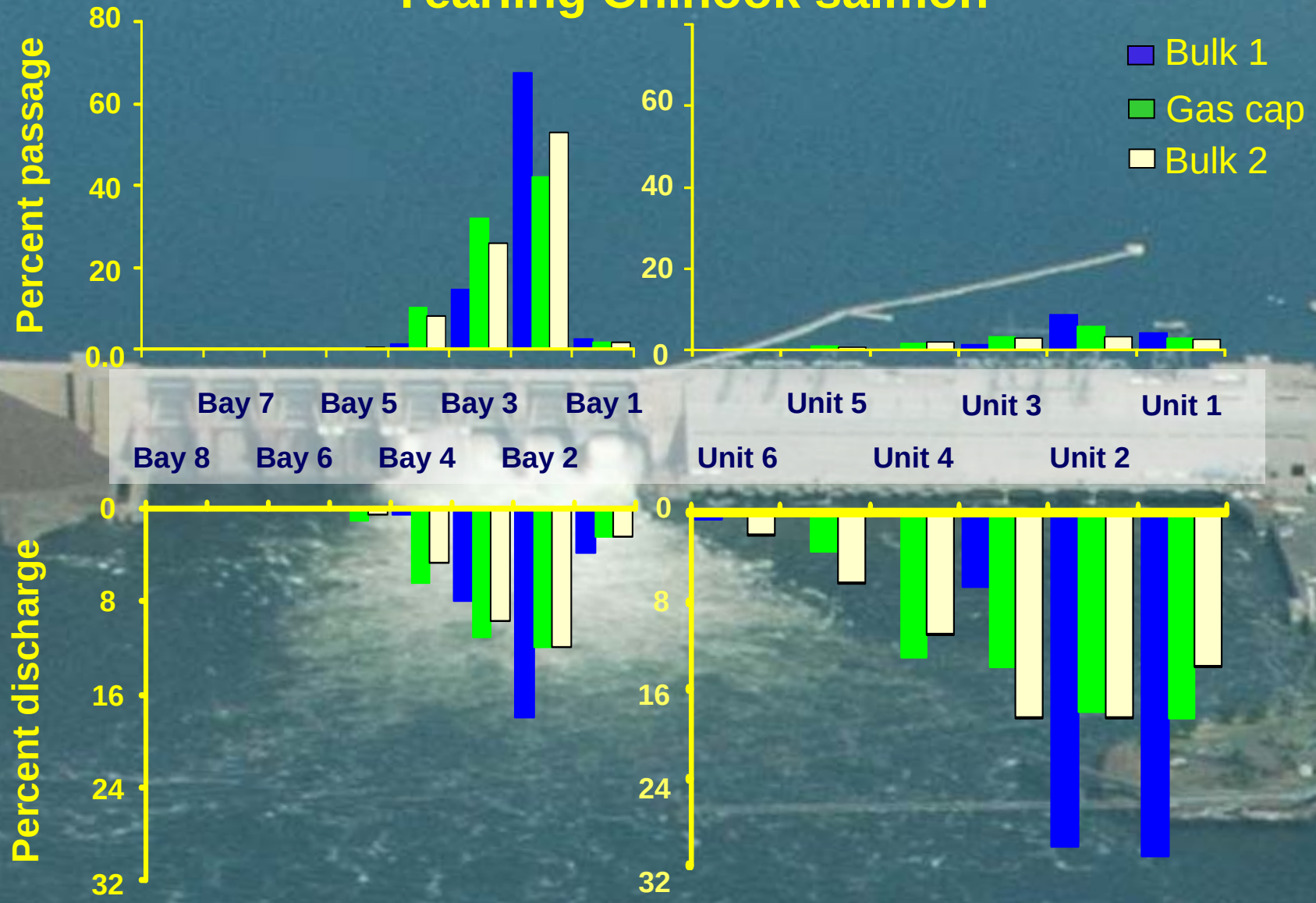


Hours Since Forebay Entrance

USGS

PASSAGE LOCATION

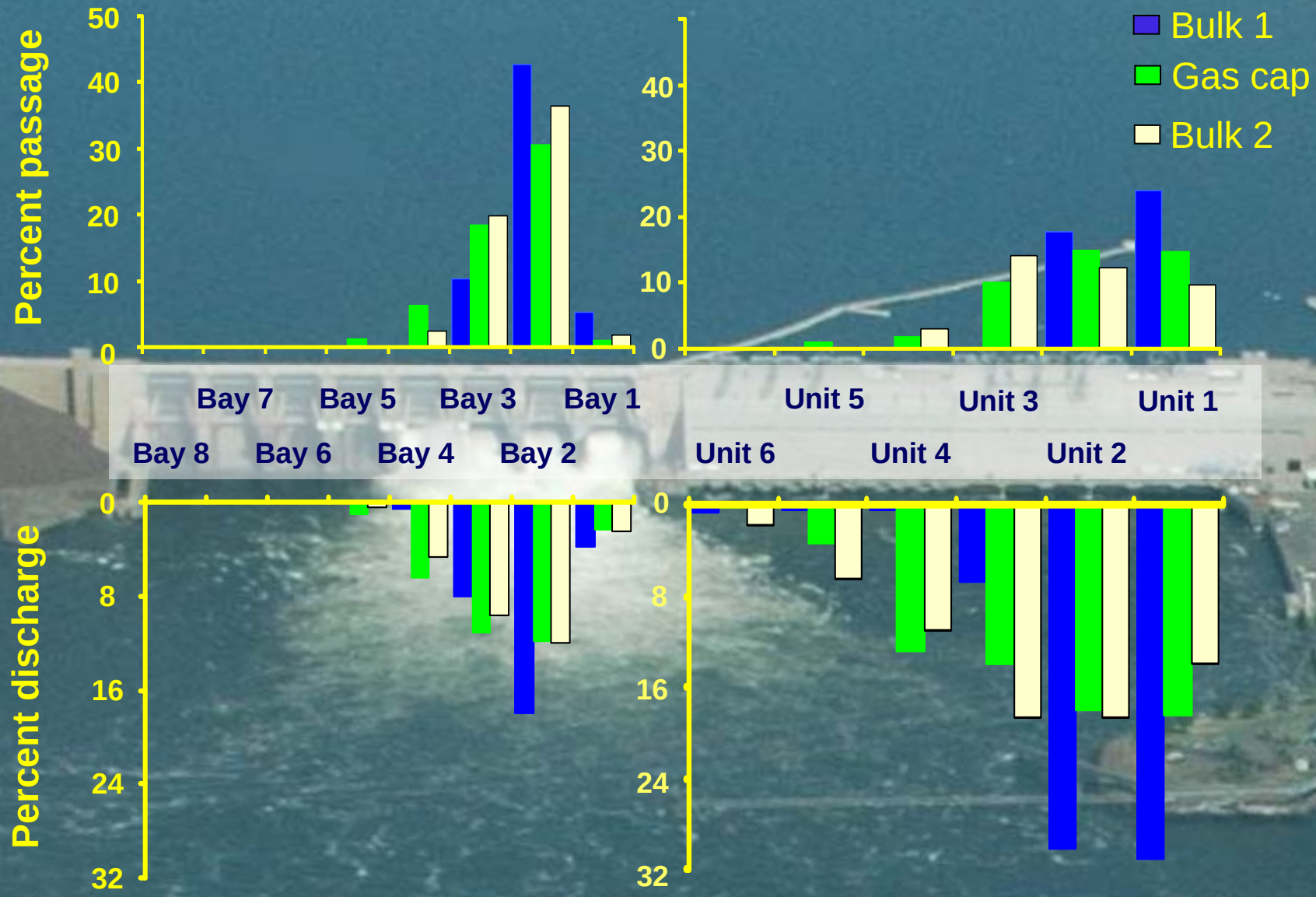
Yearling Chinook salmon



USGS

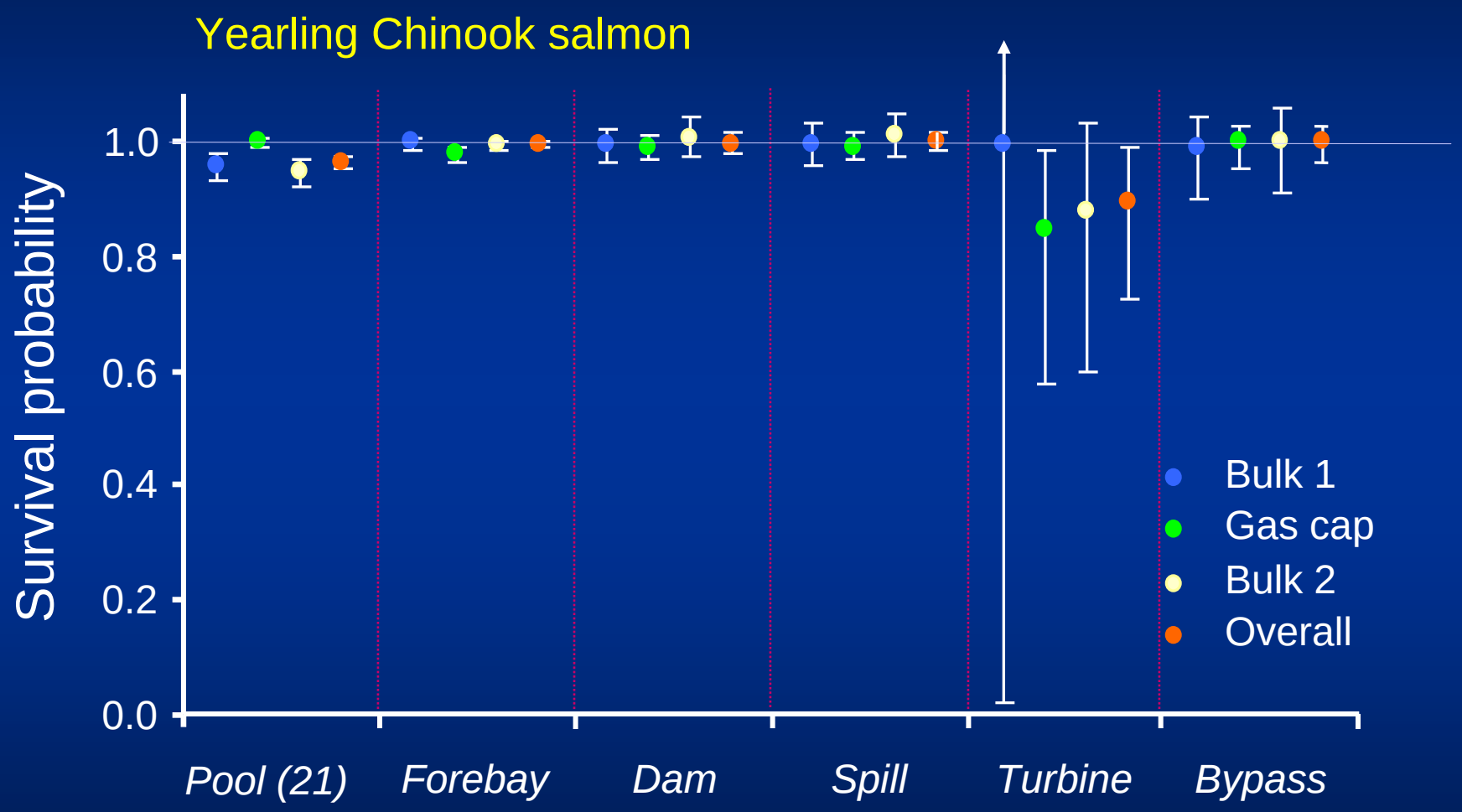
PASSAGE LOCATION

Juvenile steelhead



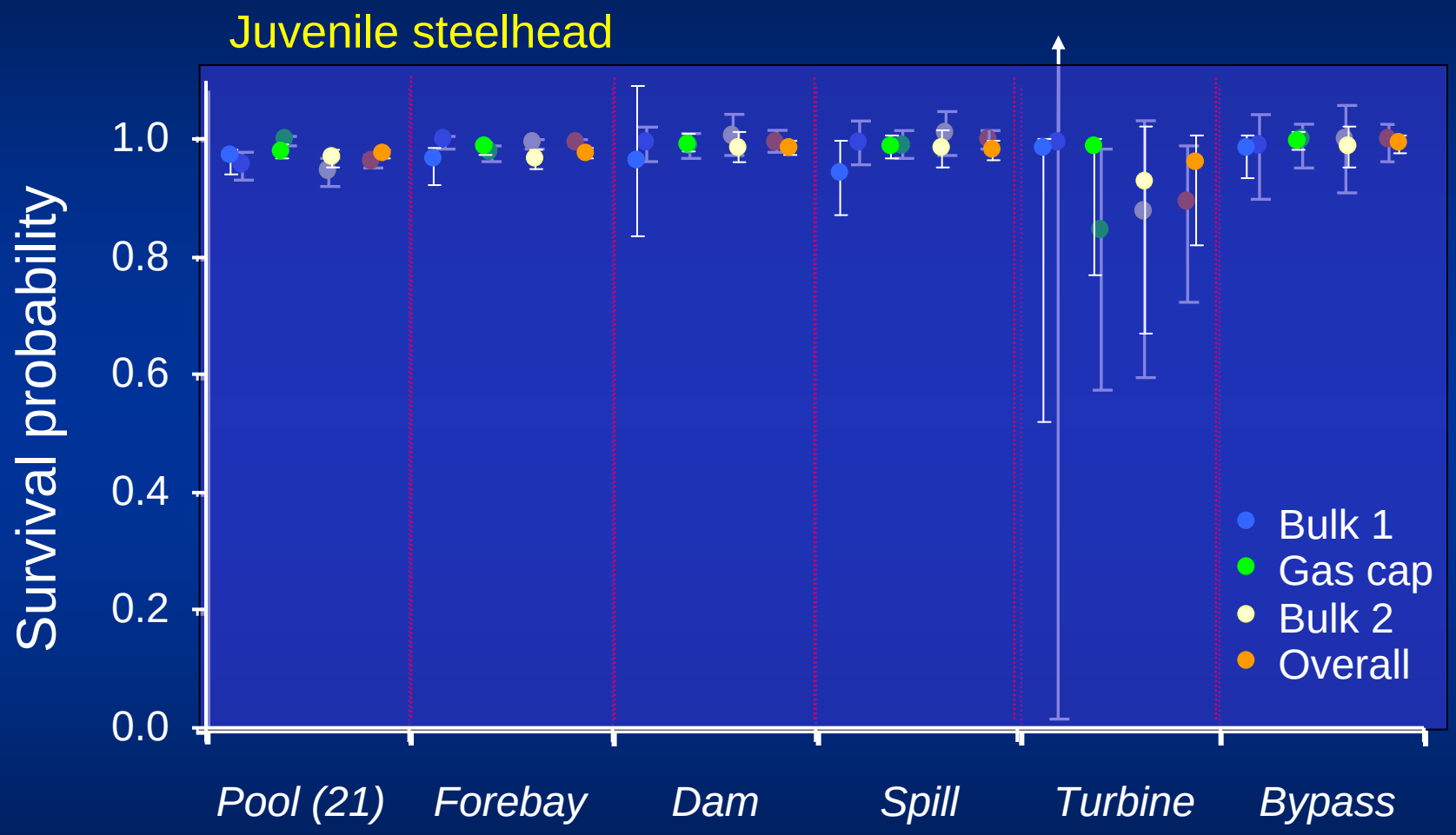
USGS

Survival



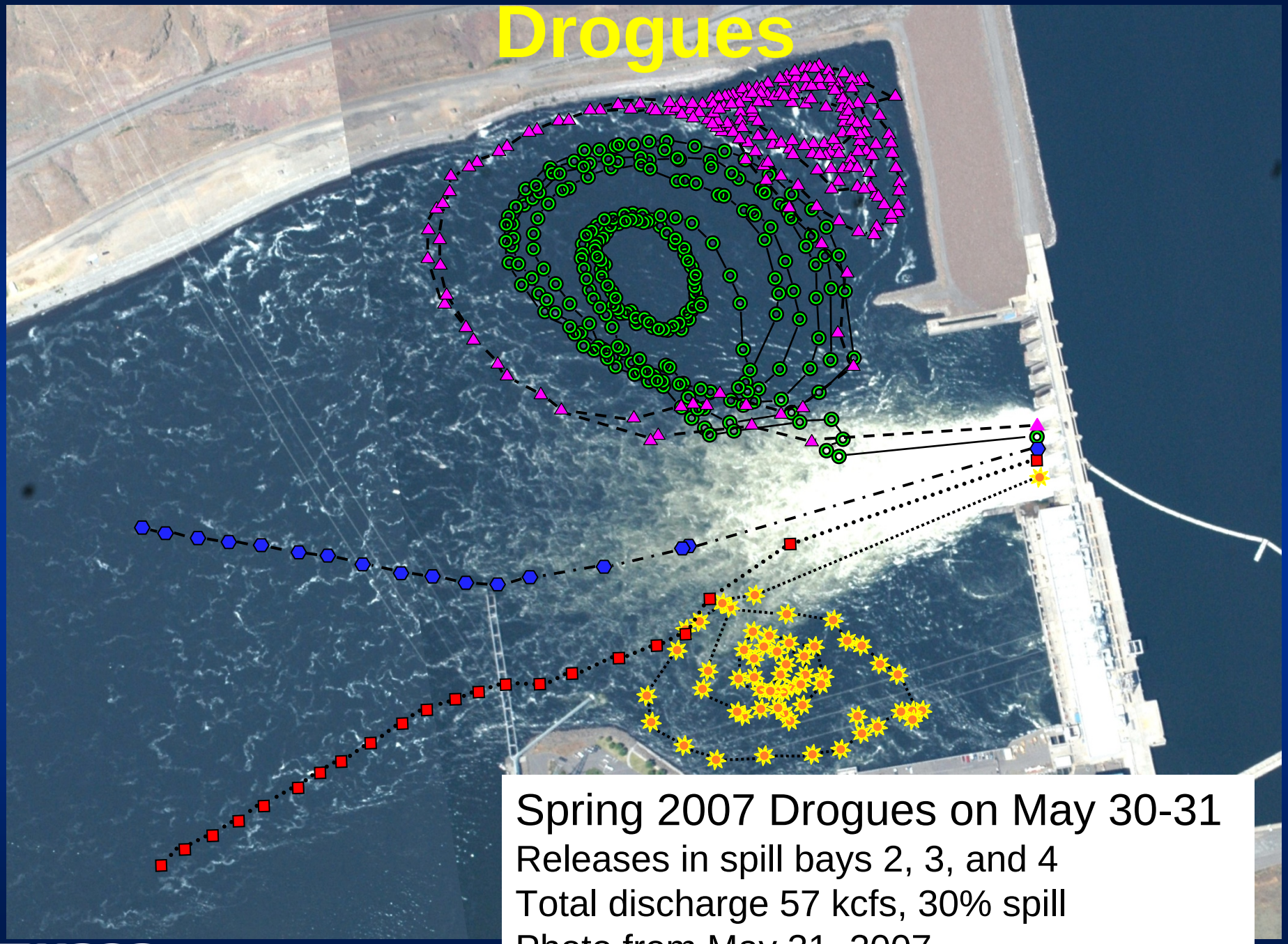
USGS

Survival



USGS

Drogues



Spring 2007 Drogues on May 30-31

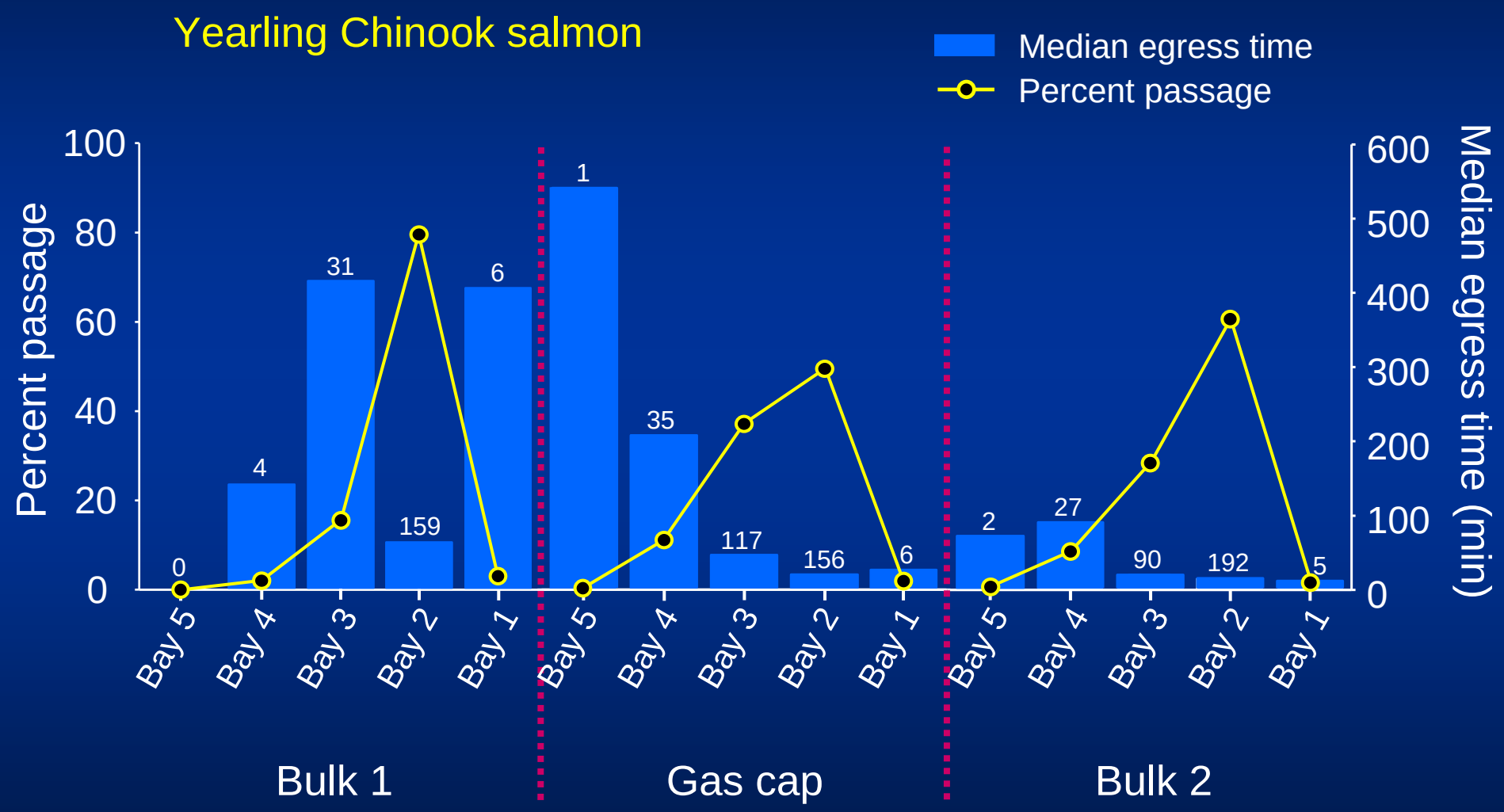
Releases in spill bays 2, 3, and 4

Total discharge 57 kcfs, 30% spill

Photo from May 31, 2007

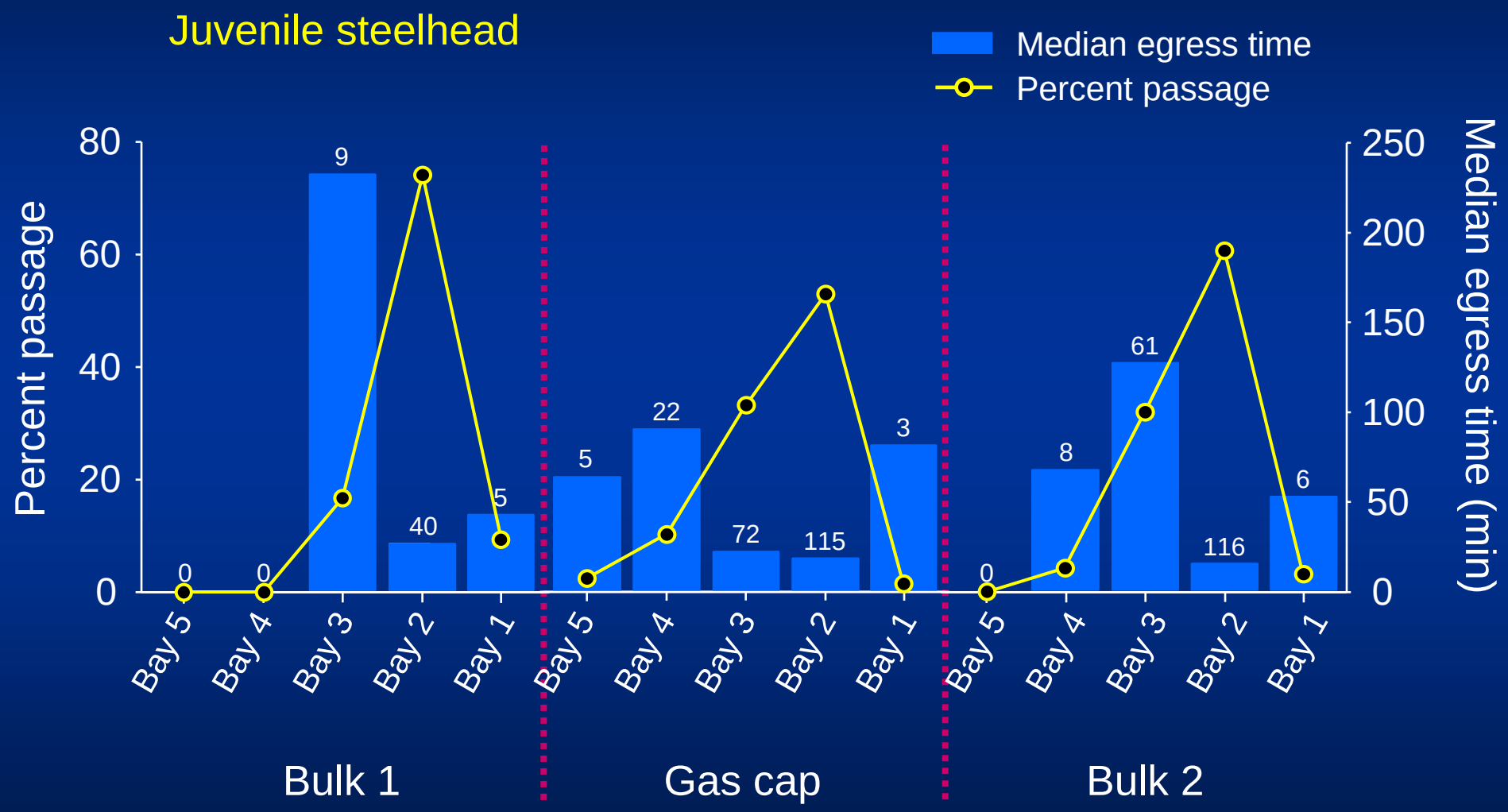
USGS

Egress from the Spillway



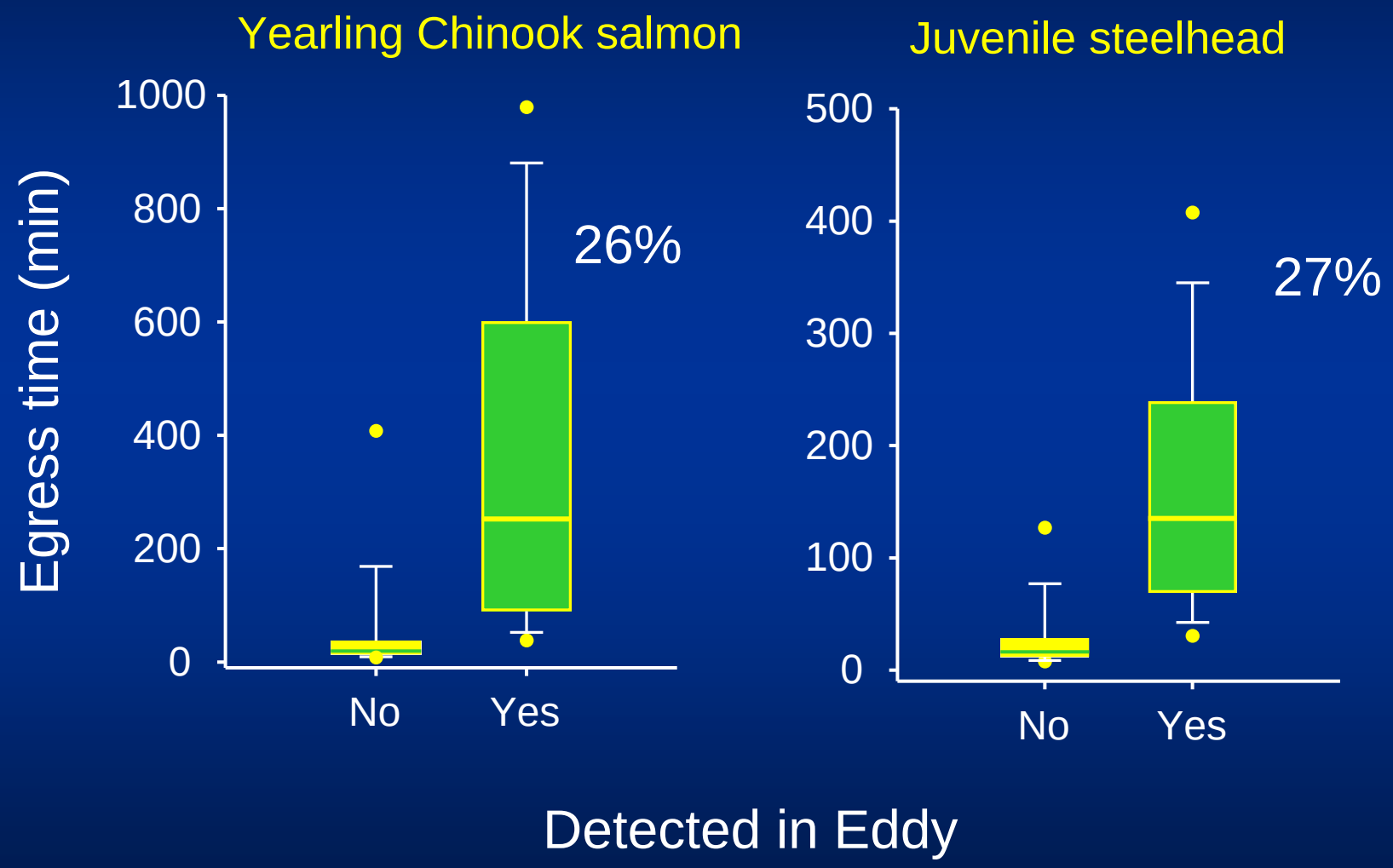
USGS

Egress from the Spillway

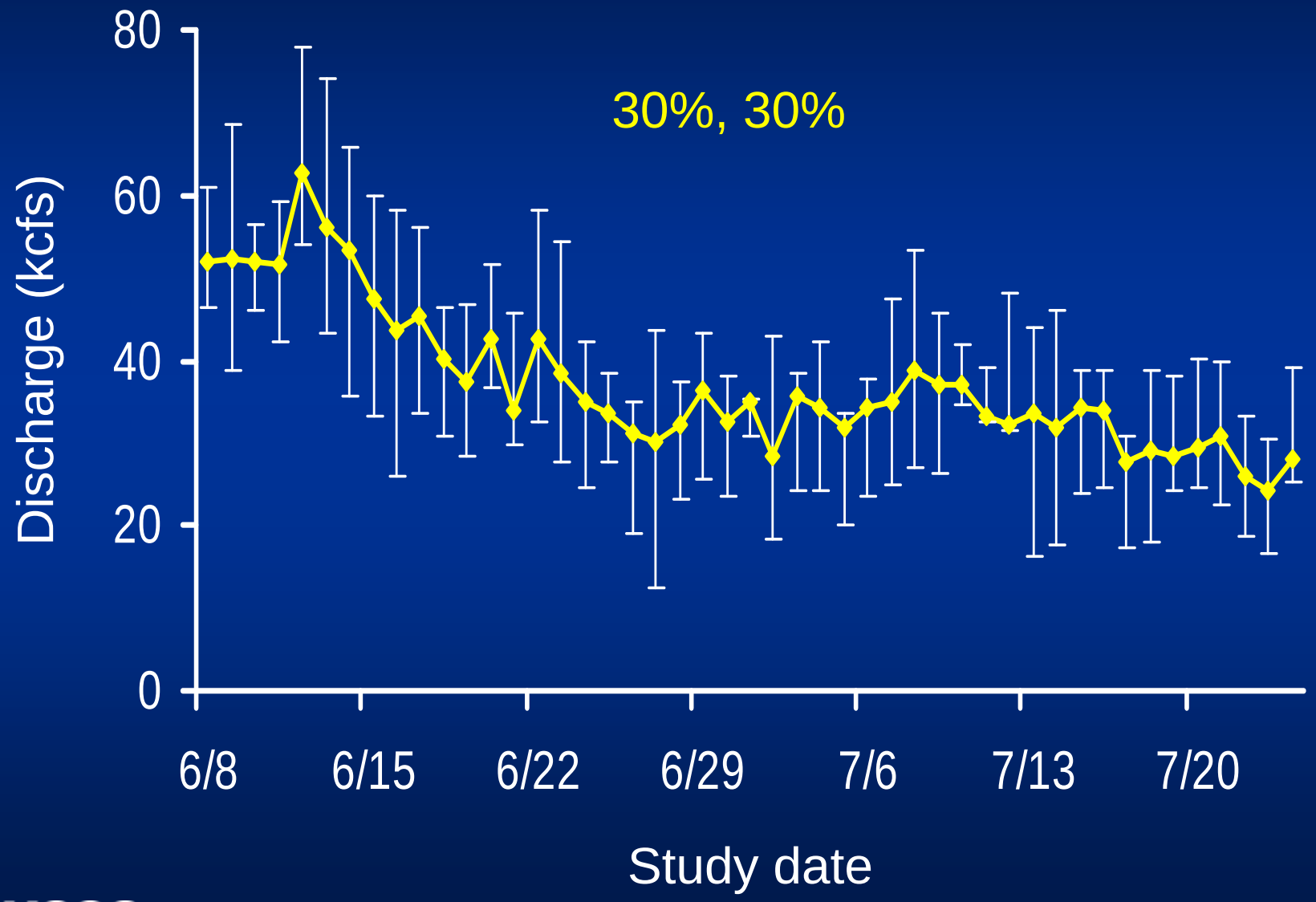


USGS

Egress from the Spillway



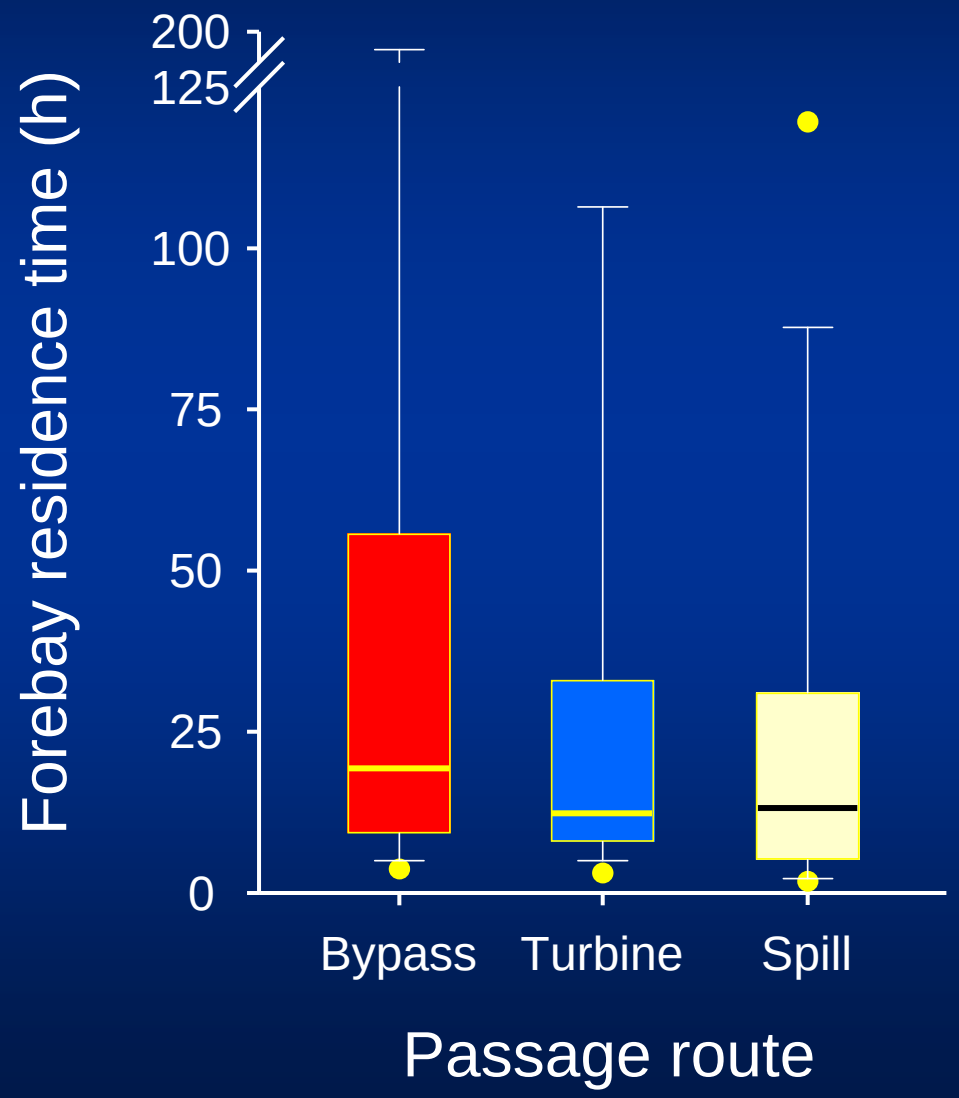
Summer Conditions



USGS

Forebay Residence Time

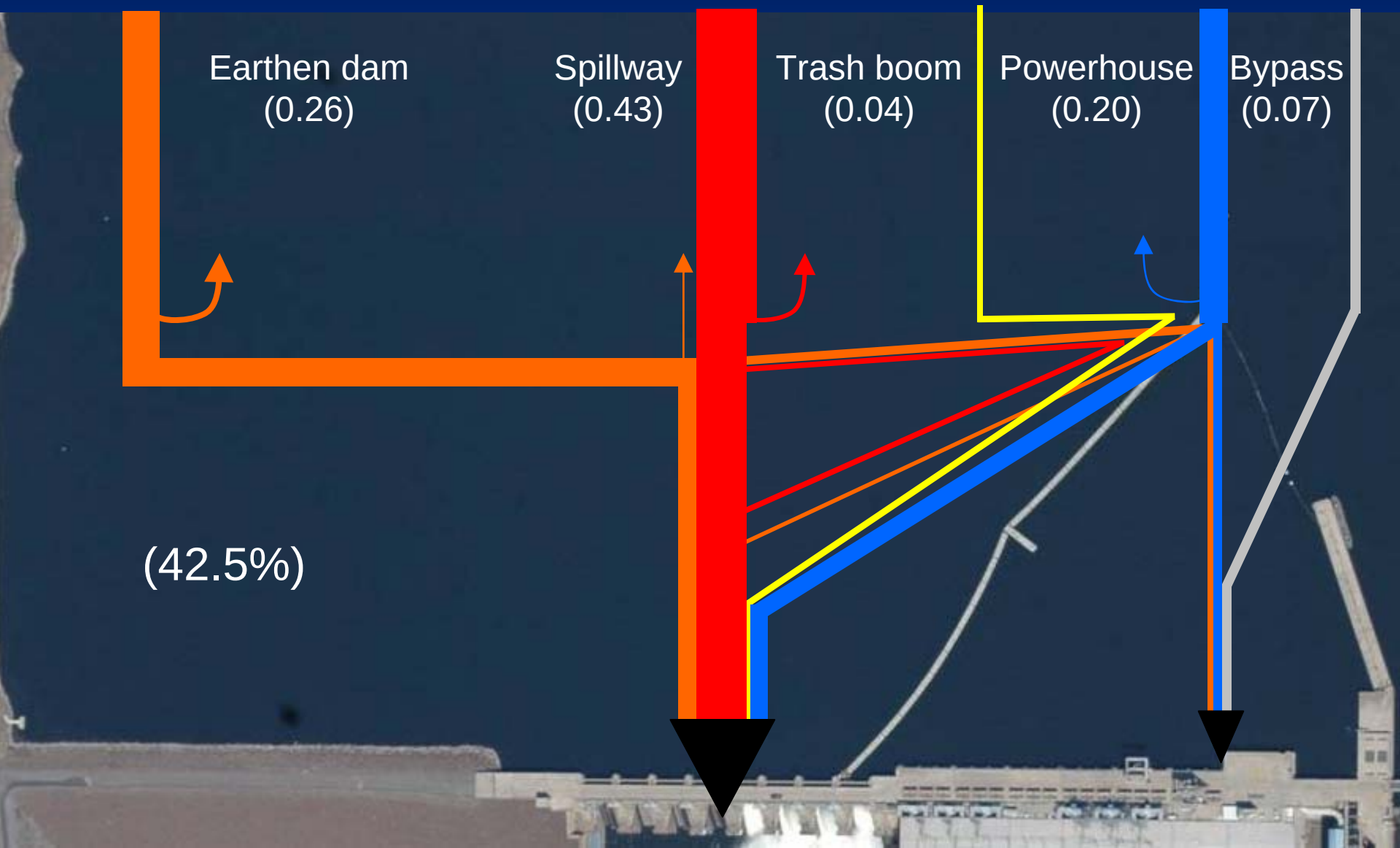
Subyearling Chinook salmon



USGS

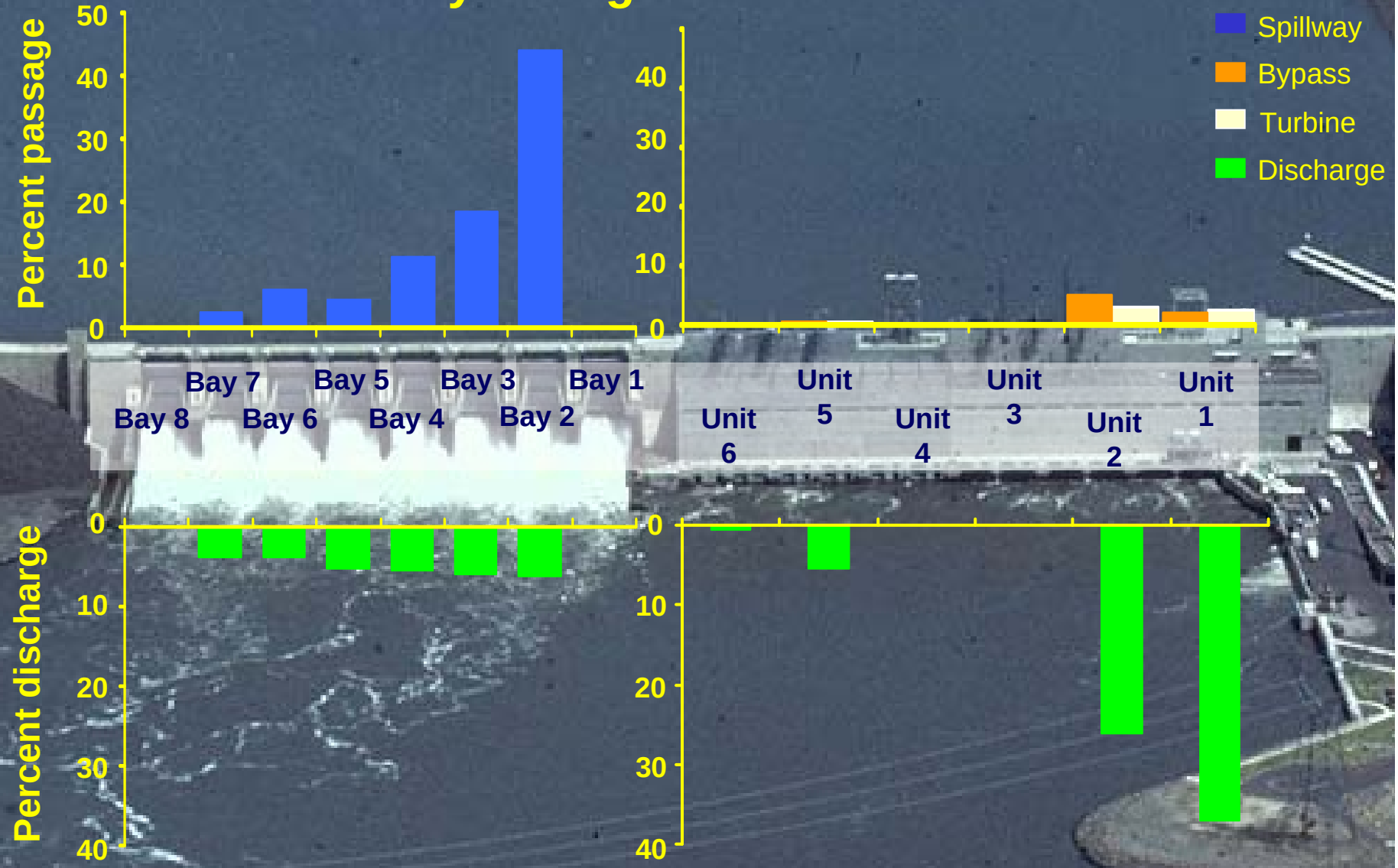
Forebay behavior

Subyearling Chinook salmon



PASSAGE LOCATION

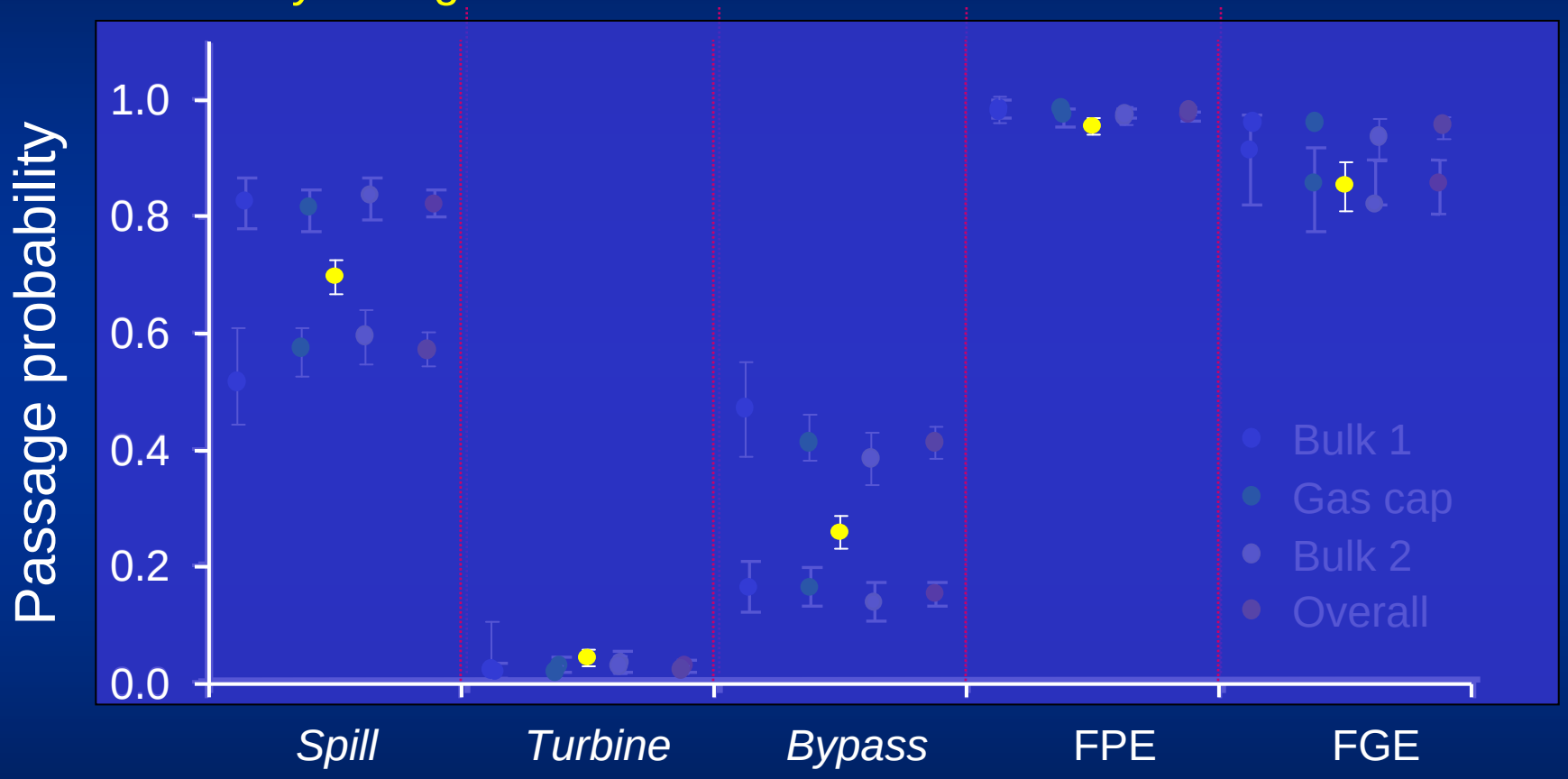
Subyearling Chinook salmon



USGS

Passage Probability

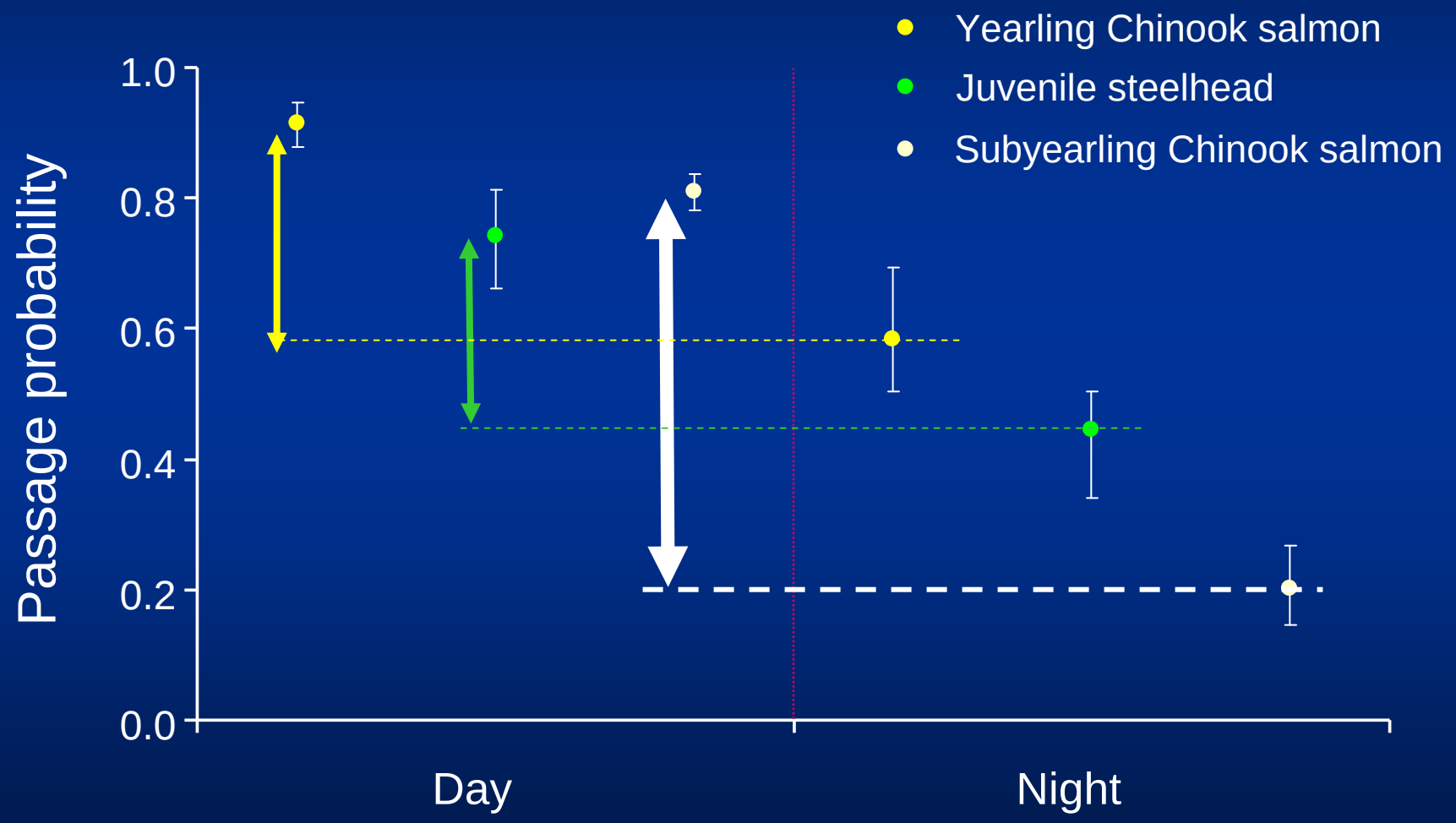
Subyearling Chinook salmon



USGS

Spillway Passage Probability

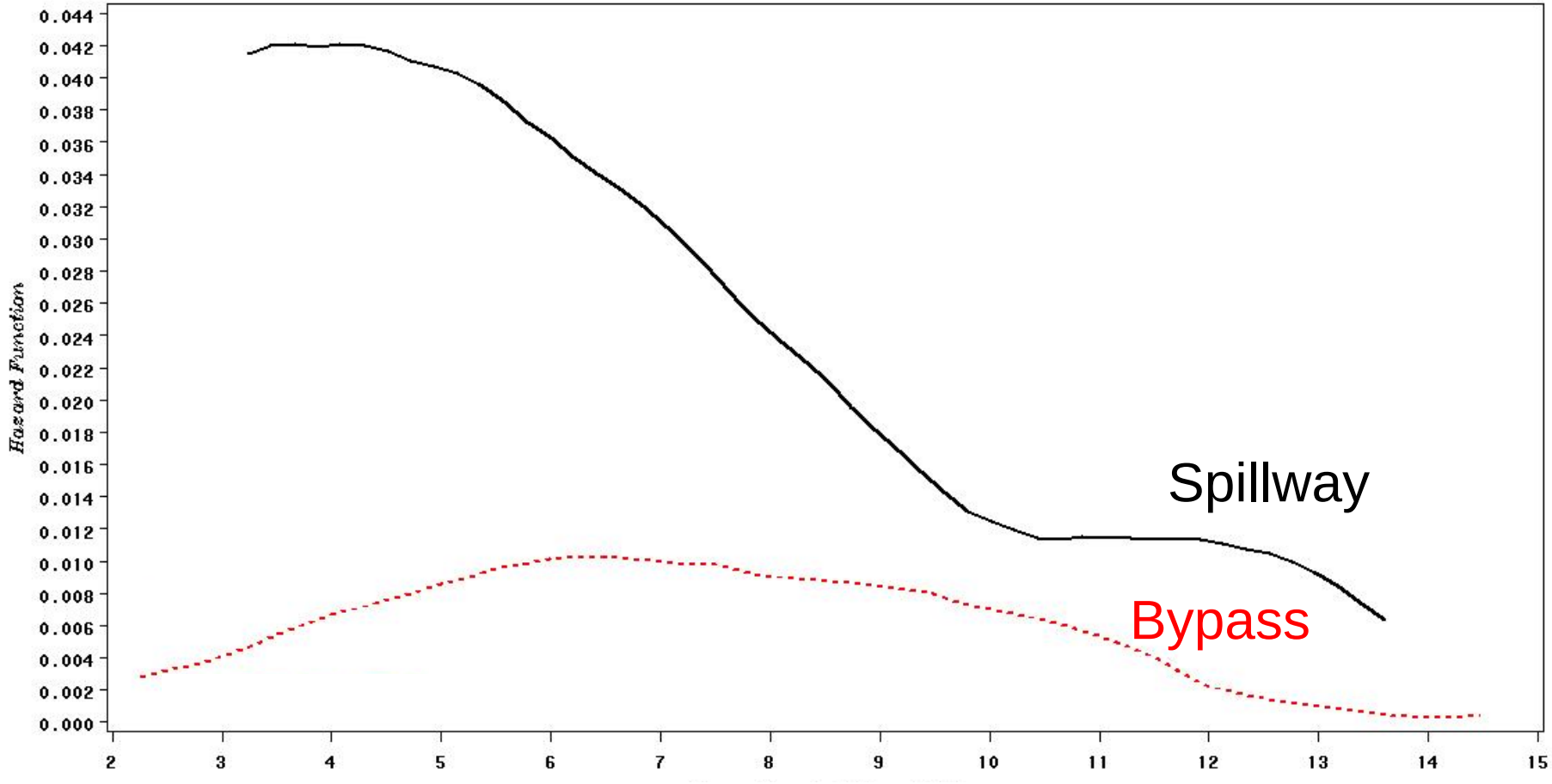
Day vs. Night



USGS

Subyearling Chinook Salmon

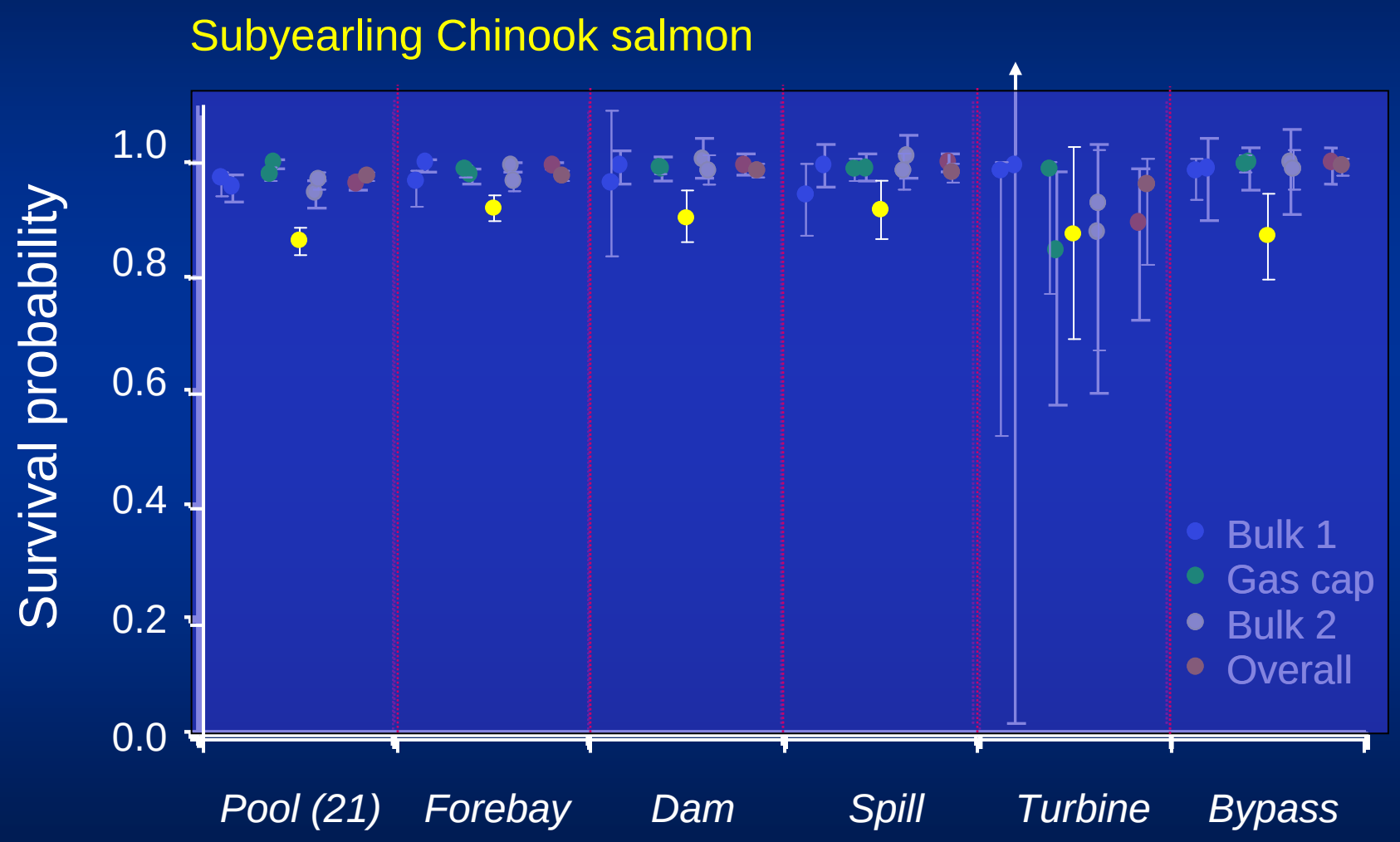
Passage Rates Per Hour



Hours Since Forebay Entrance

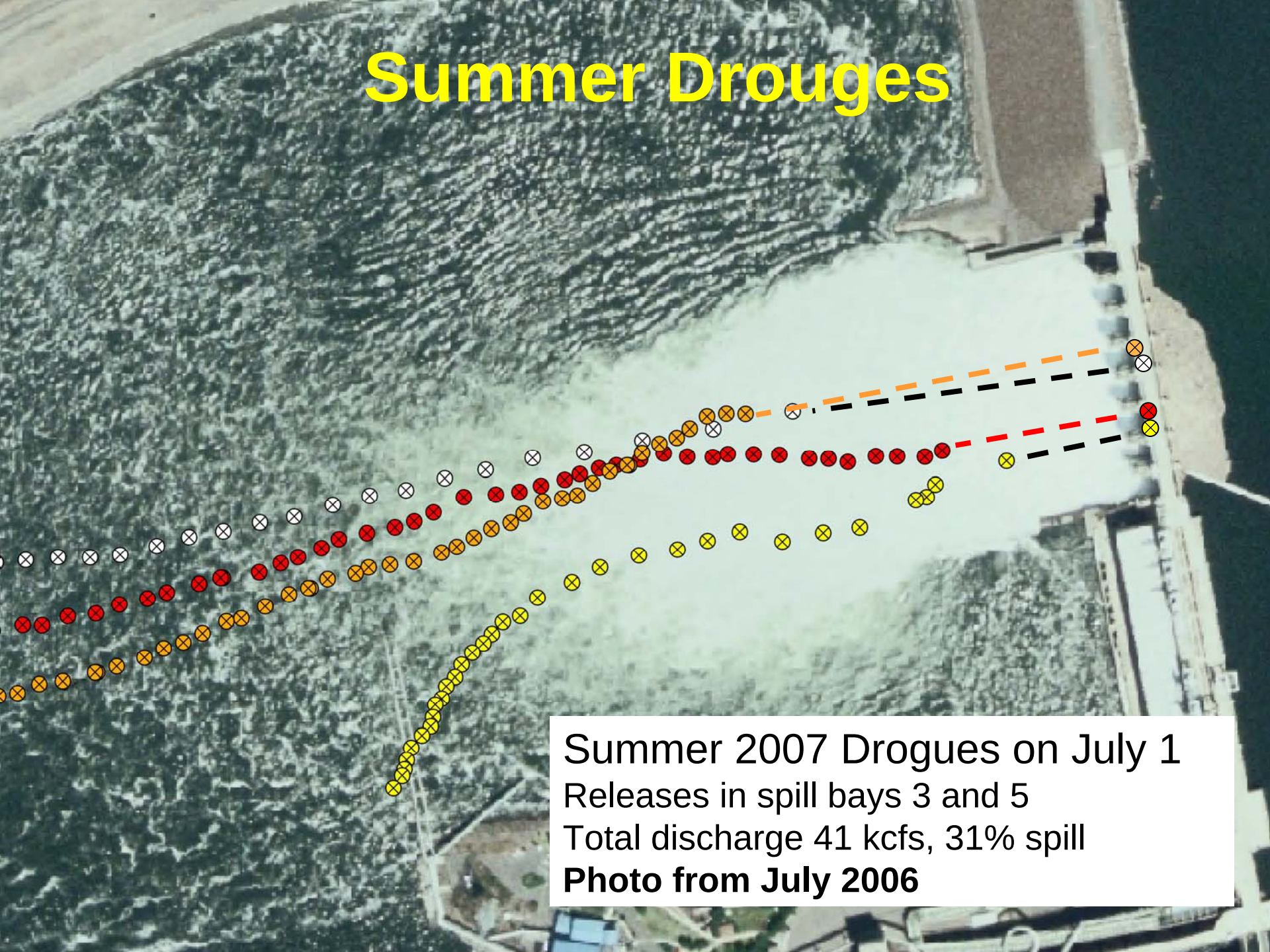
USGS

Survival



USGS

Summer Drouges



Summer 2007 Drogues on July 1

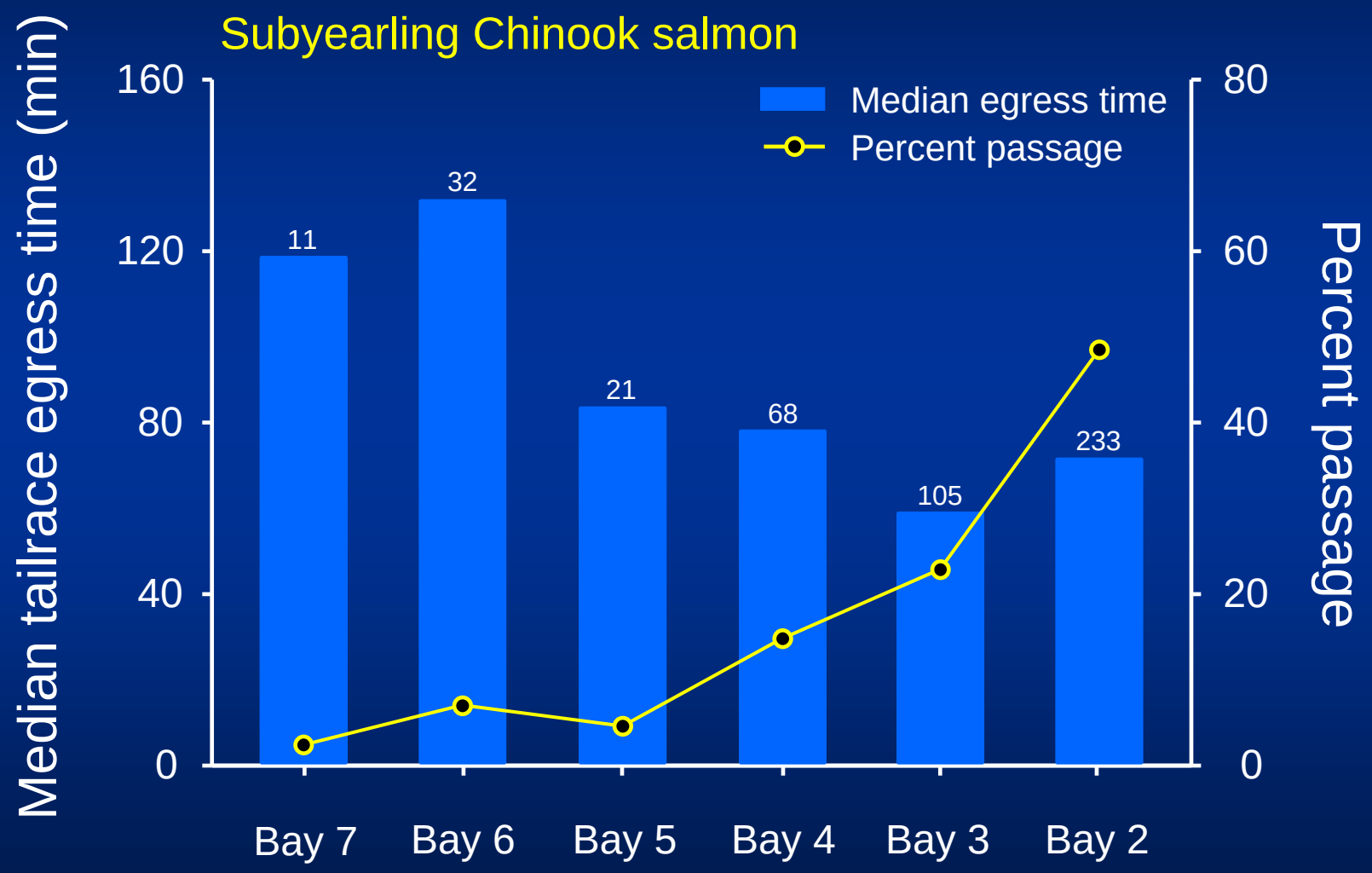
Releases in spill bays 3 and 5

Total discharge 41 kcfs, 31% spill

Photo from July 2006

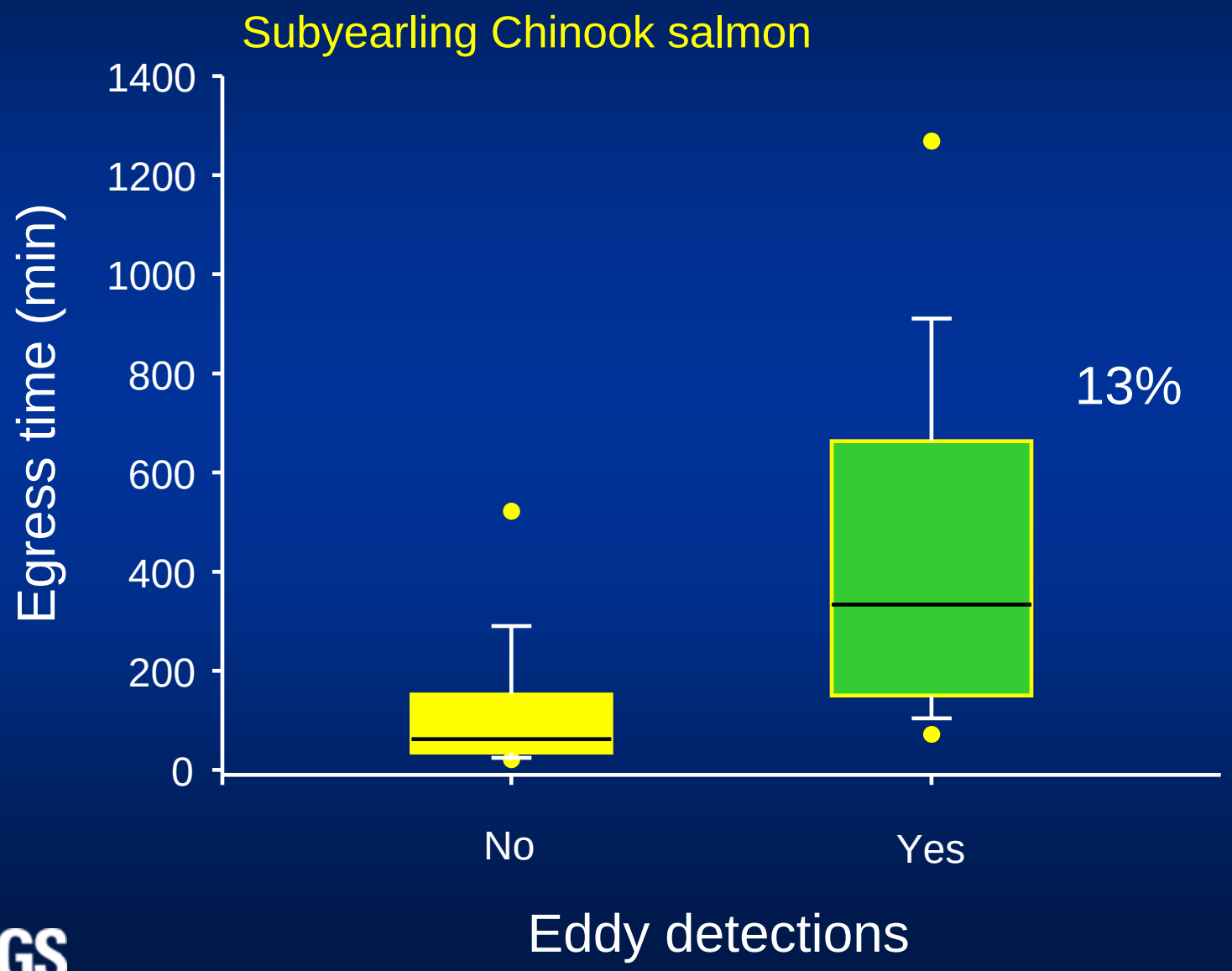
Tailrace Egress

By Spillbay



USGS

Tailrace Egress



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Summary

- Fish show a variety of approach behaviors, but few approach at powerhouse
  - Data suggests a north-to south approach pattern is common in spring
  - Steelhead make many more trips through the forebay than Chinook
- Most fish approach and pass the spillway near southern bays
  - Bulk spill pattern not required for attraction
- Few pass via turbines
- Survival high and similar among routes other than the turbines
  - Subyearling Chinook about 6% lower than spring migrants
- Presence in tailrace eddy prolongs egress time
- Need a “spillway weir” operation good for both juveniles and adults
  - (still looking)
  - Bulk spill has been problematic in Little Goose tailrace

USGS

Assistance and Support Provided by

US Army Corps of Engineers
Walla Walla District

Fred Higginbotham
John Herrell
Greg Moody
George Melanson
Bill Spurgeon

OREGON Fish & Wildlife

Pat Keniry
Annie Dowdy
Ruth Shearer
Ron Vauple

USGS
science for a changing world

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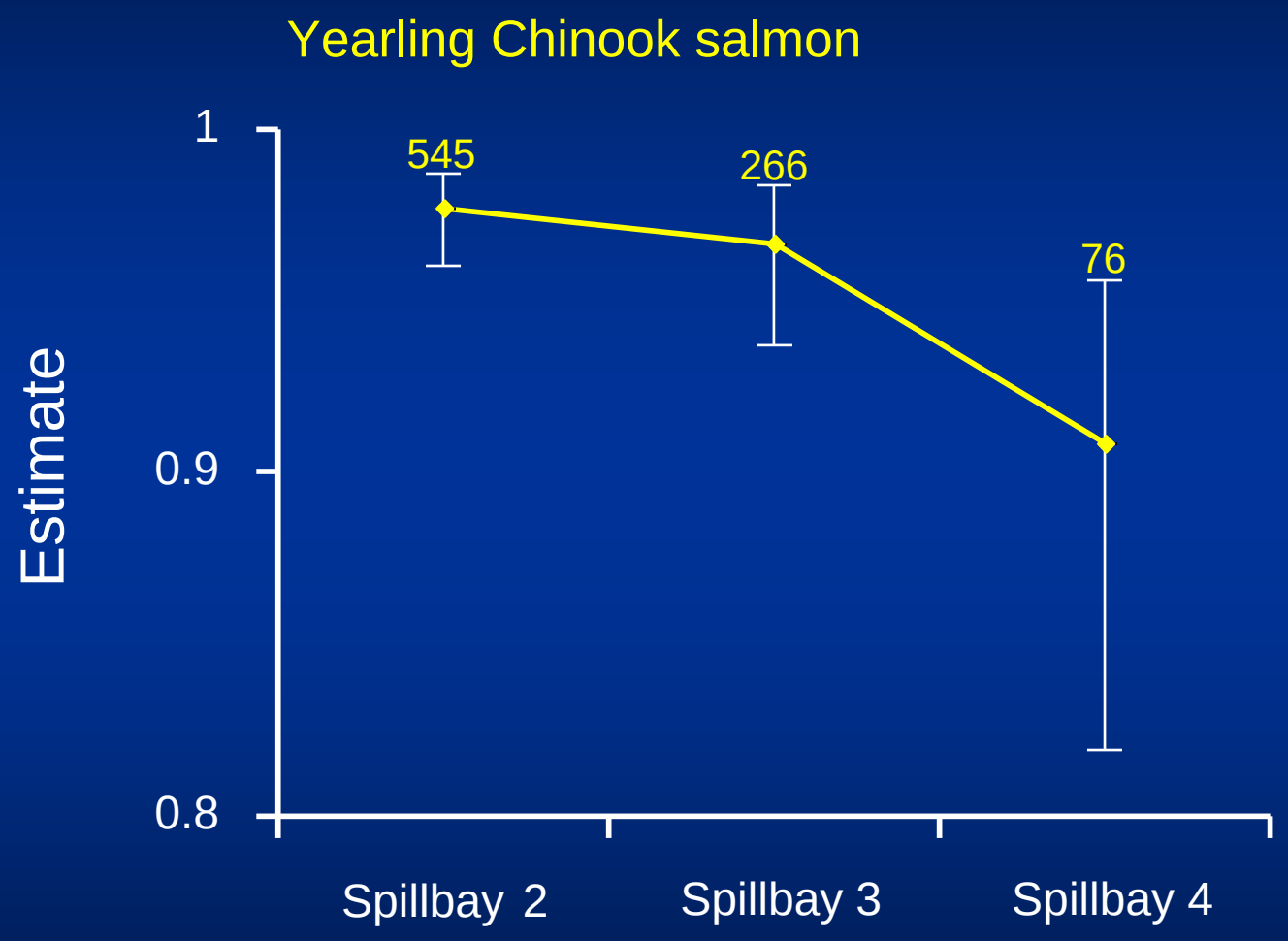
Israel Duran
Wendy Edwards
Mark Fox
Gery Gudgell
Cory Humphreys
Tedi Humphreys
Brad Liedtke
Tyler Mitchell
Eric Myers
Jesse Nitz
Chuck Robinson
Ryan Tomka
Christopher Walker
Matt Walker

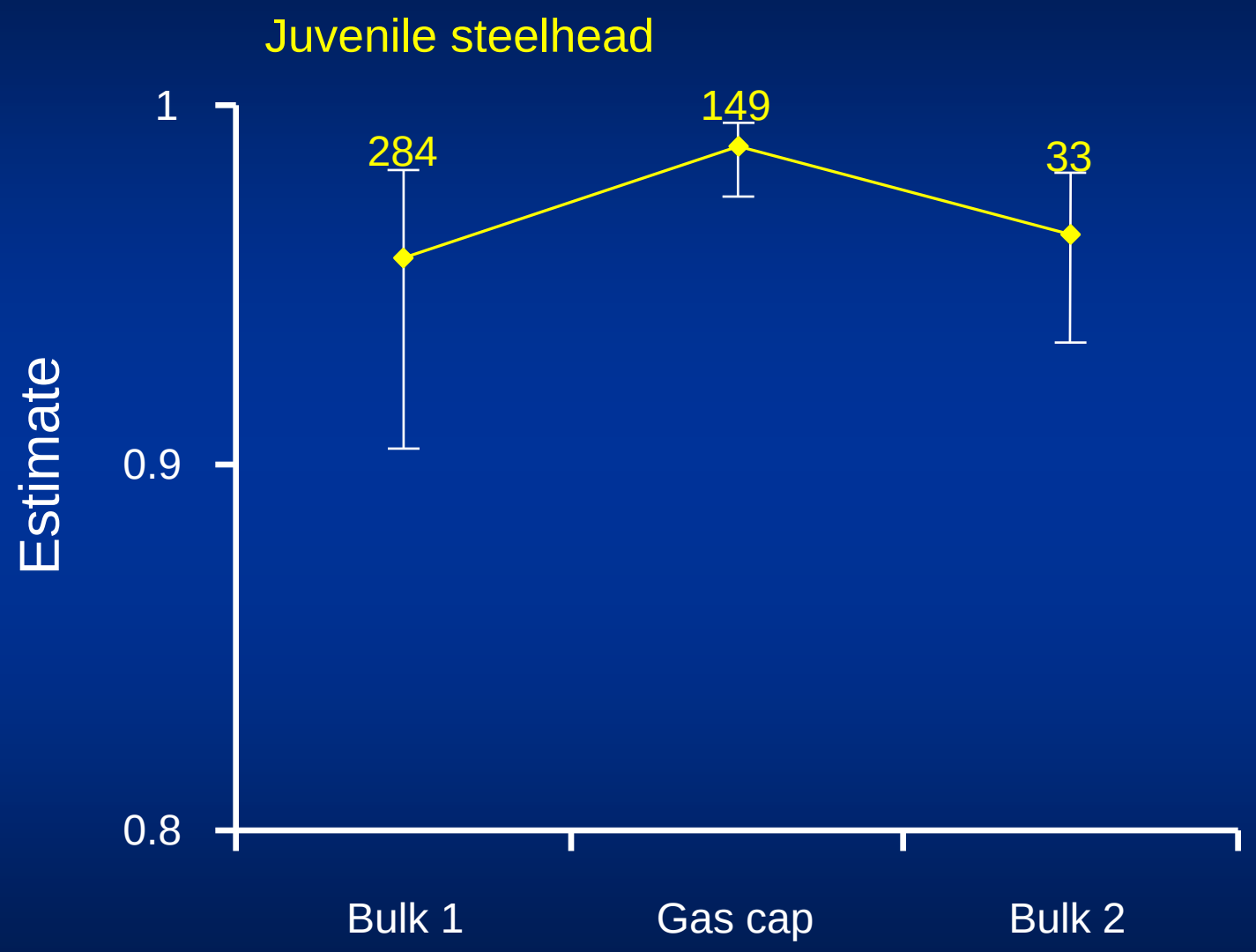
Spillway Survival by Bay



CJS single-release model from spill passage to a site 29 km downstream

USGS

Spillway Survival by Spill Pattern



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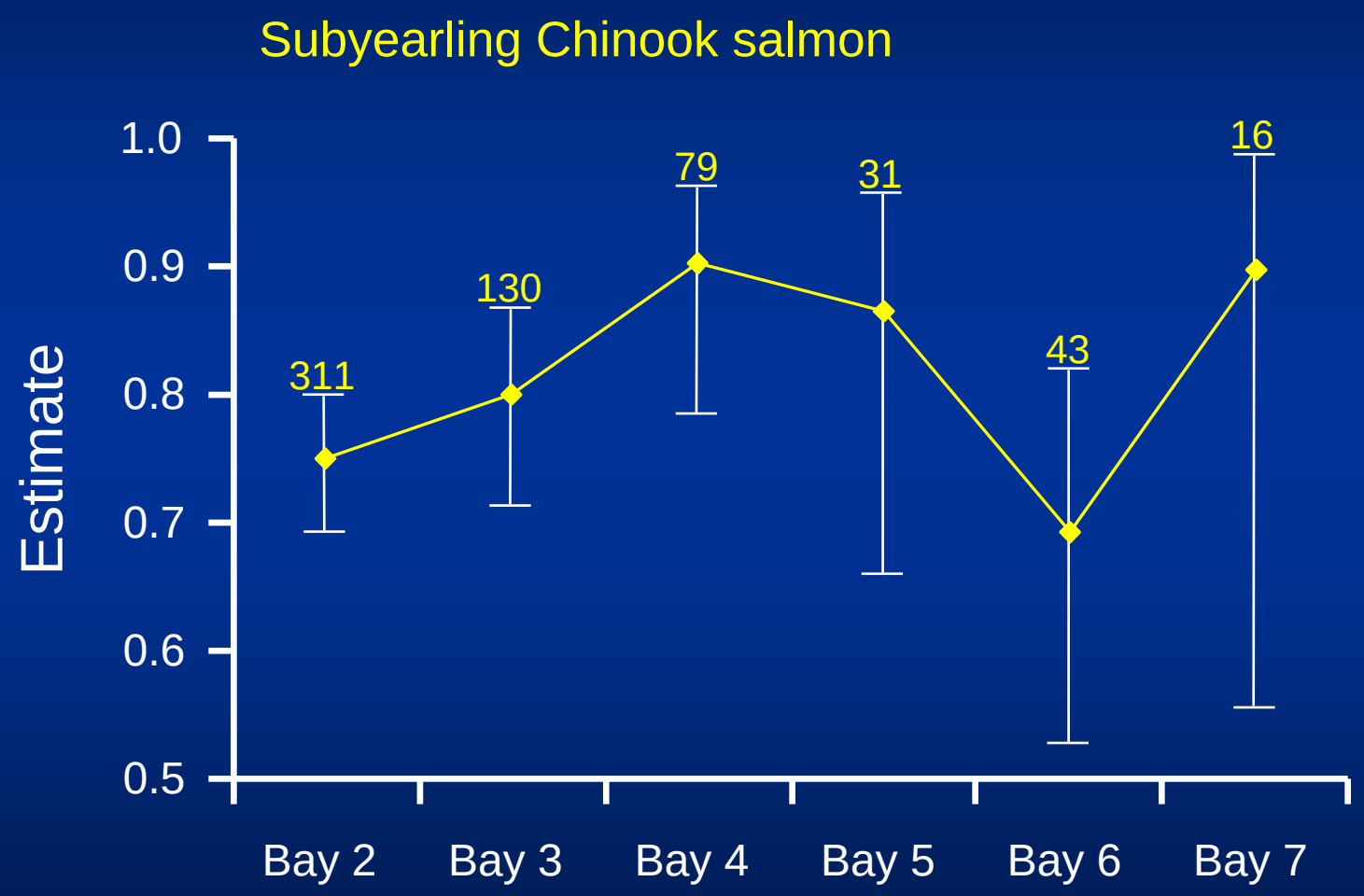
USGS

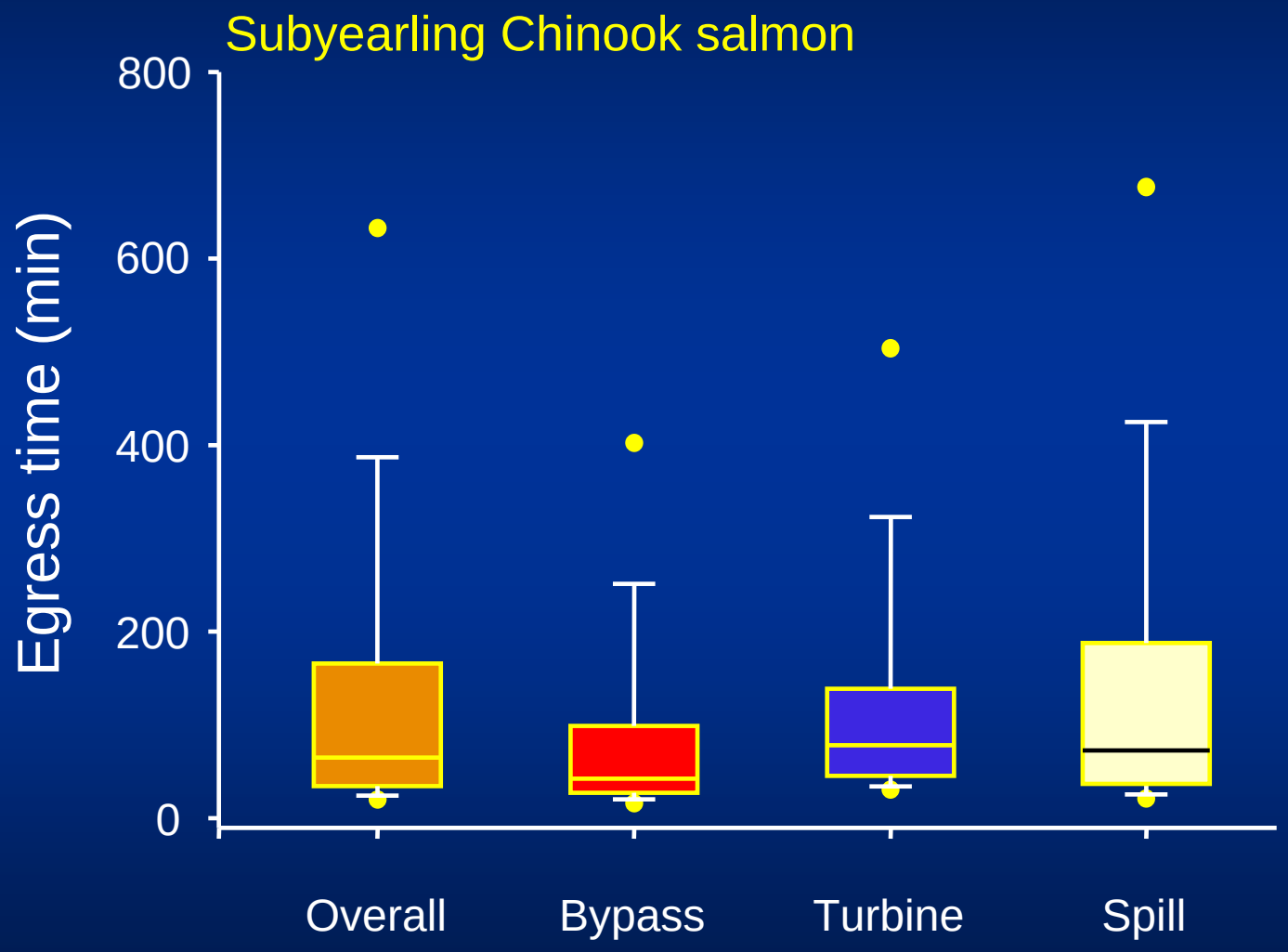
Spillway Survival by Bay



CJS single-release model from spill passage to a site 29 km downstream

USGS

Tailrace Egress



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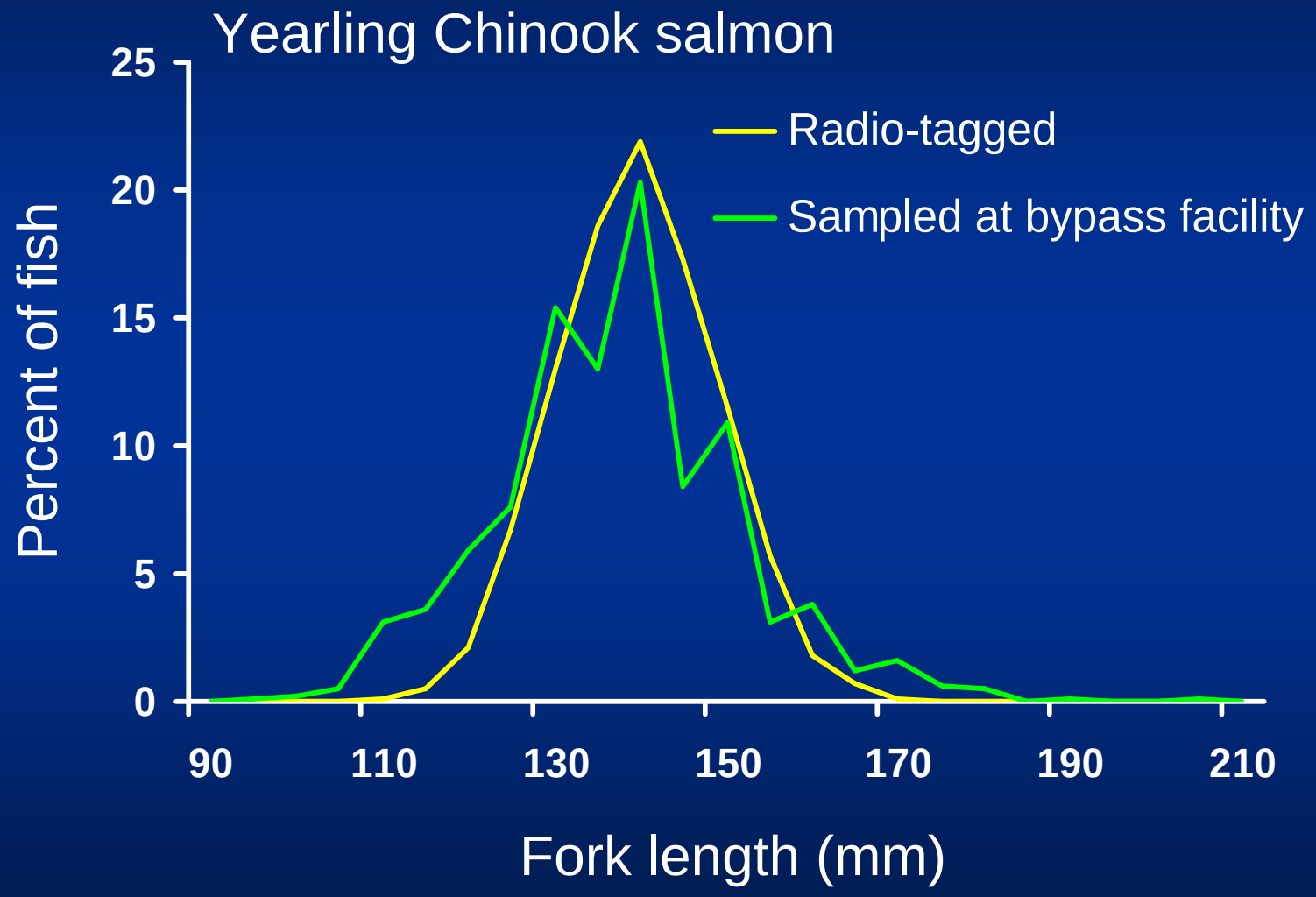
Size Distribution

Transmitter = 0.64 + 0.07 = 0.71 g in air

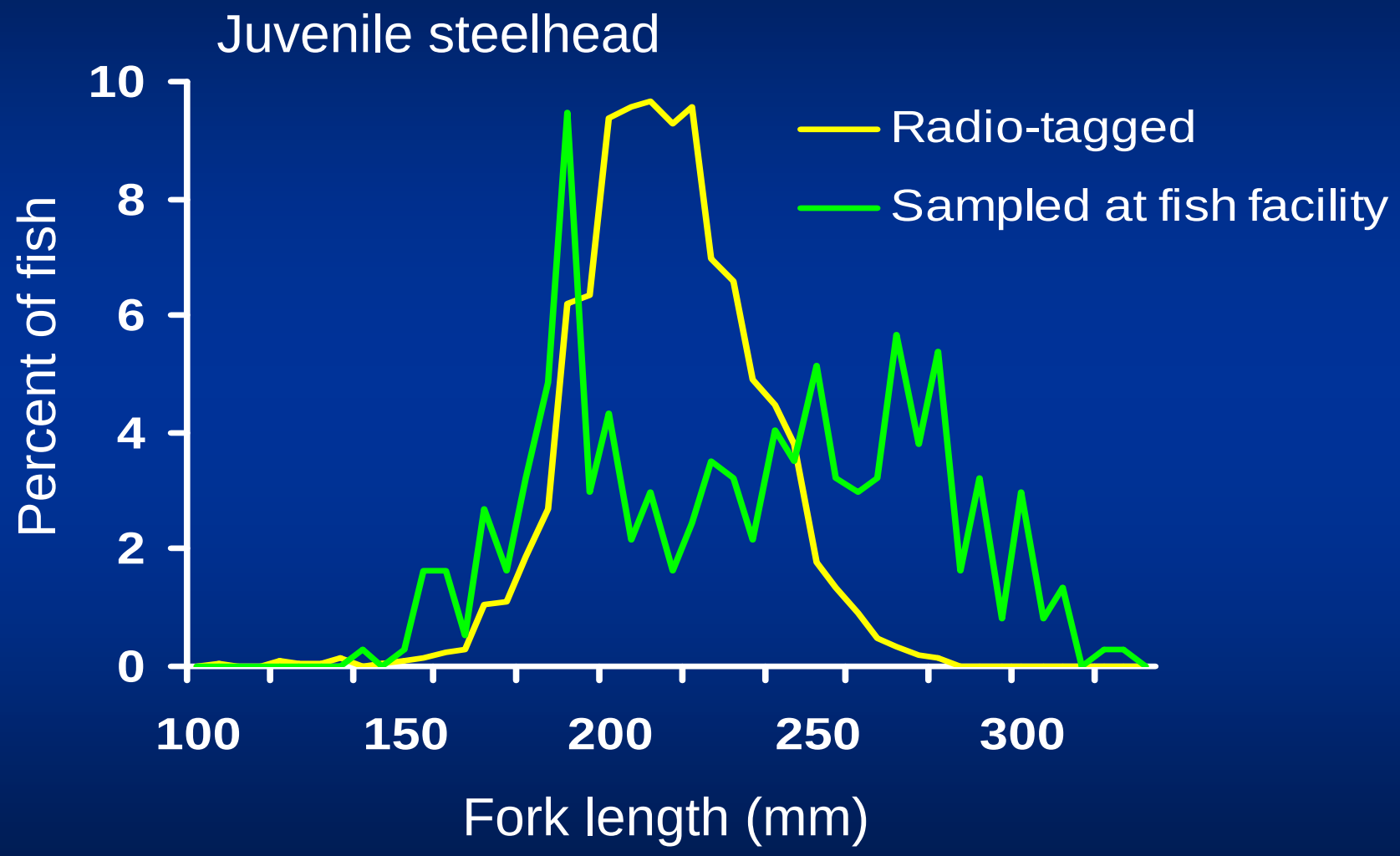


CH1: Radio-tagged fish = 103-182mm, sampled fish = 95-205mm

USGS

Size Distribution

Transmitter = 0.64 + 0.07 = 0.71 g in air

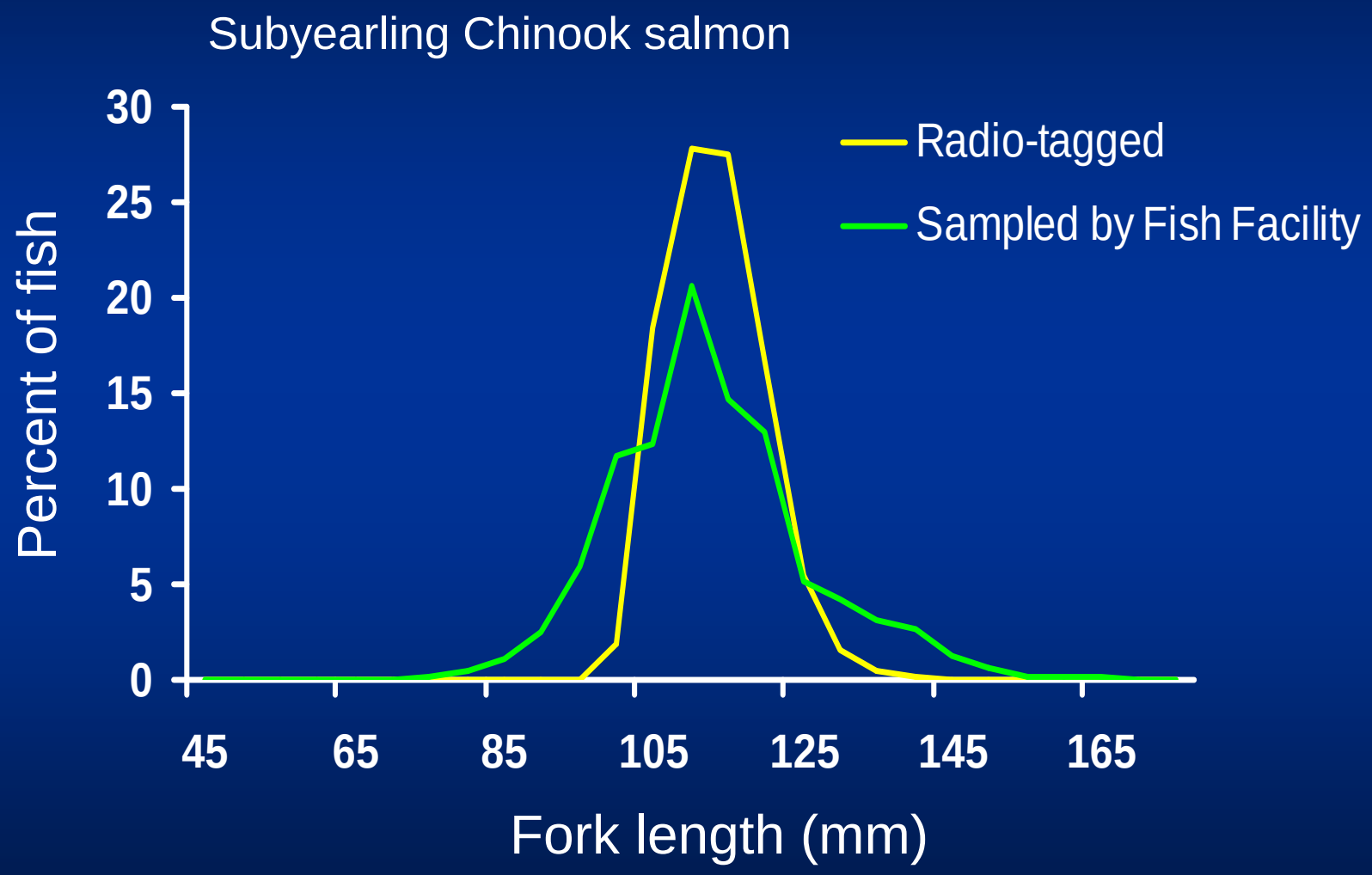


HST: Radio-tagged fish = 101-280mm, sampled fish = 140-325mm

USGS

Size Distribution

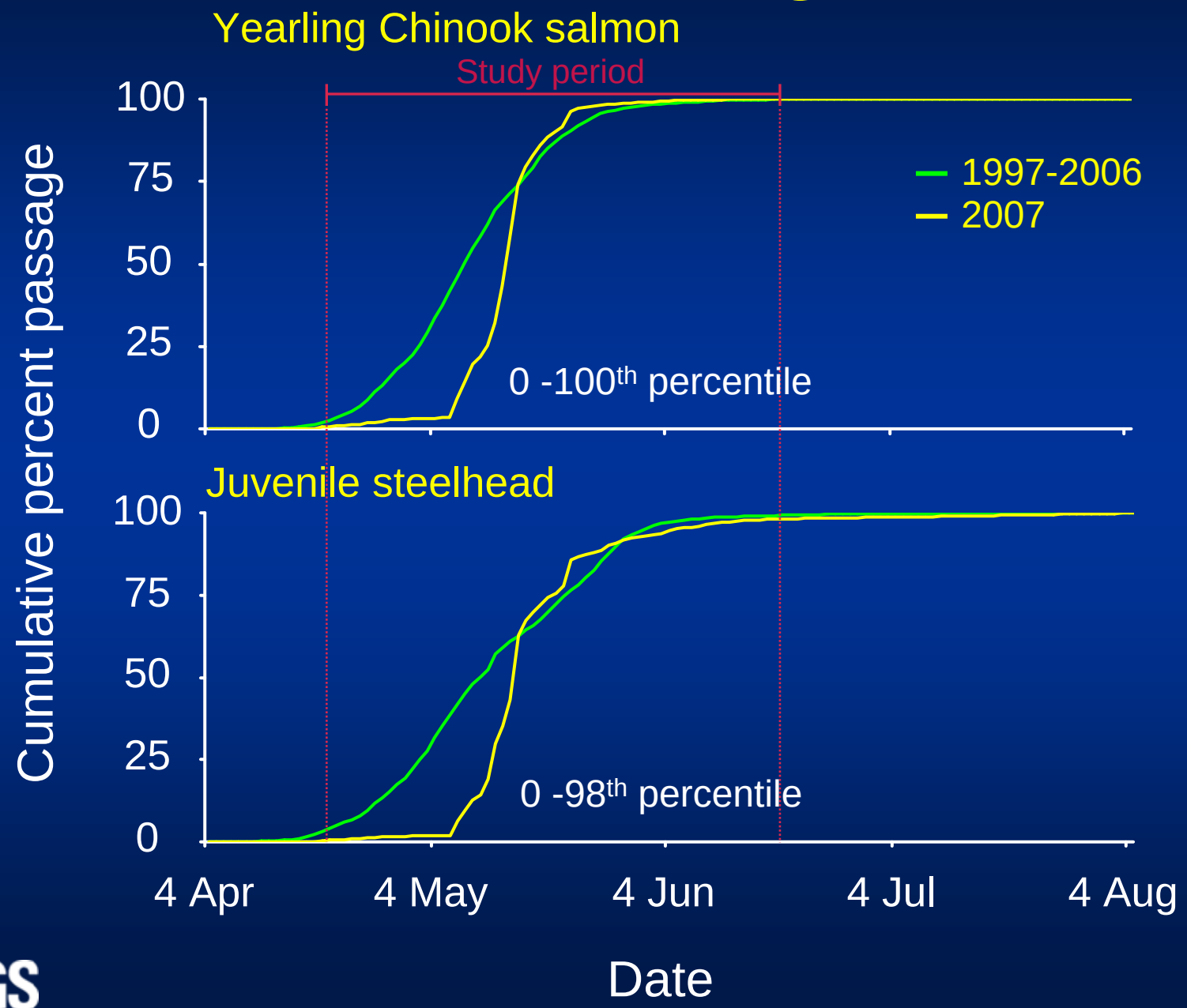
Transmitter = 0.43 + 0.07 = 0.50 g in air



CH0: Radio-tagged fish = 98-140mm, sampled fish = 45-175mm

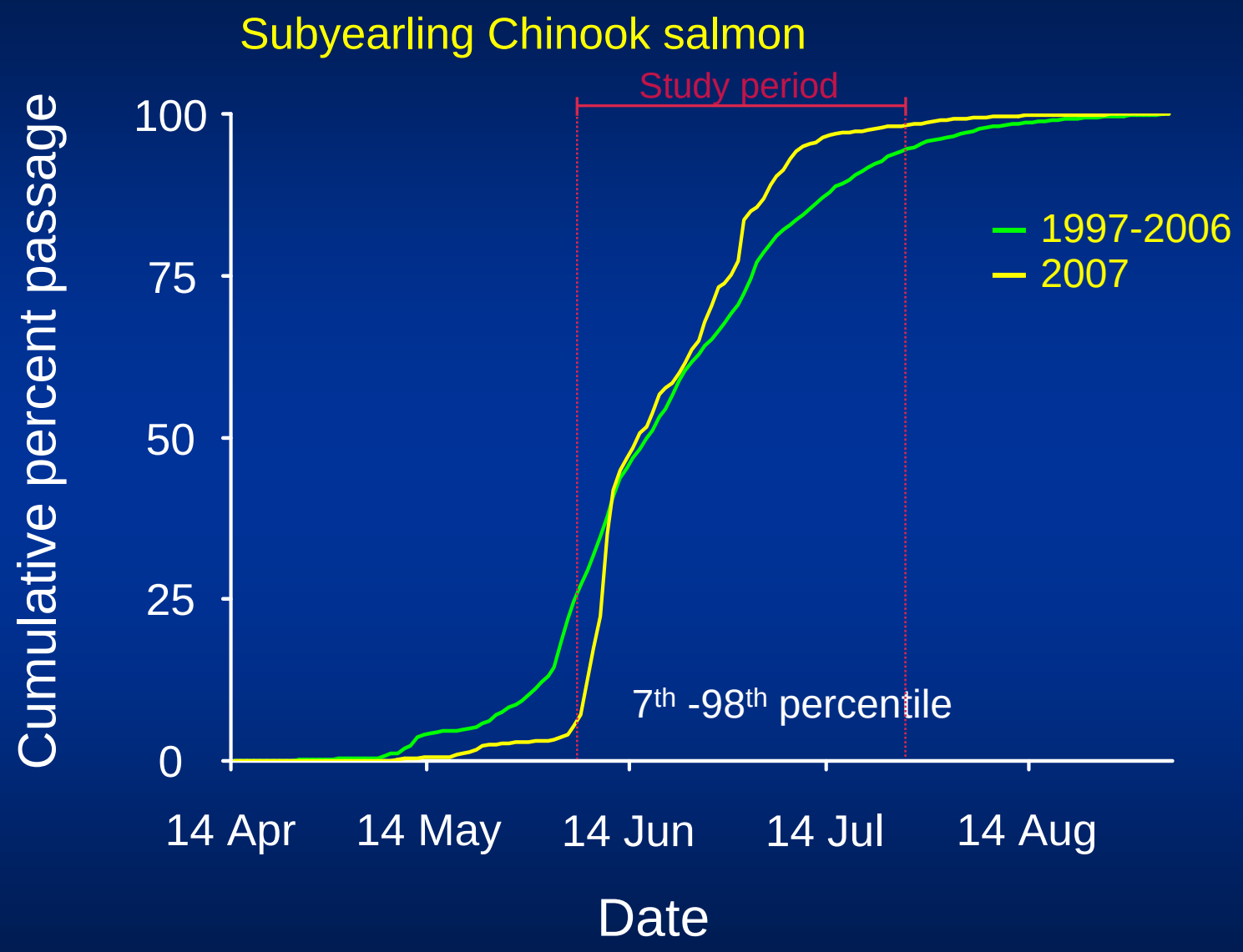
USGS

Run Timing



USGS

Run Timing



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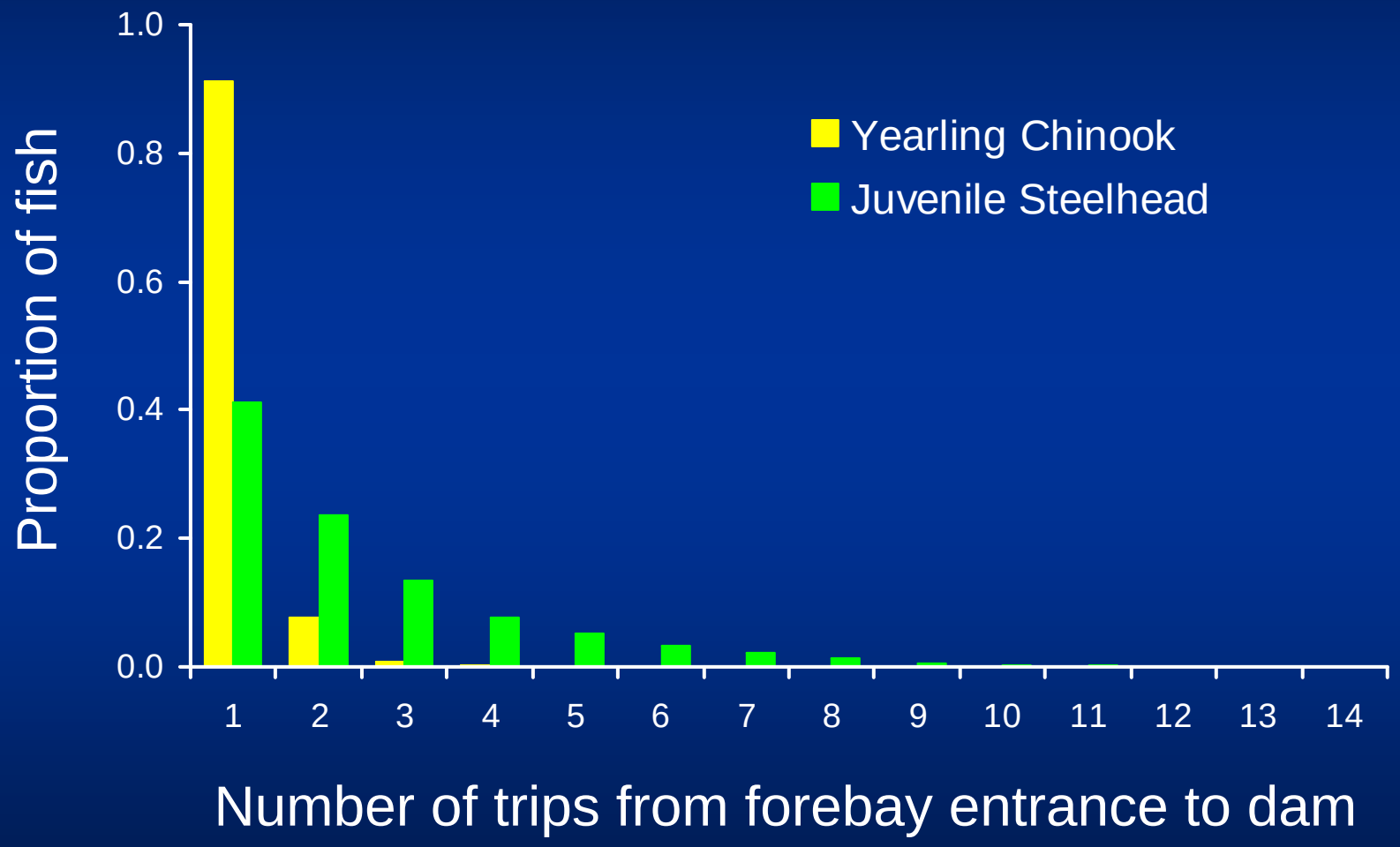
Forebay Passage Behavior



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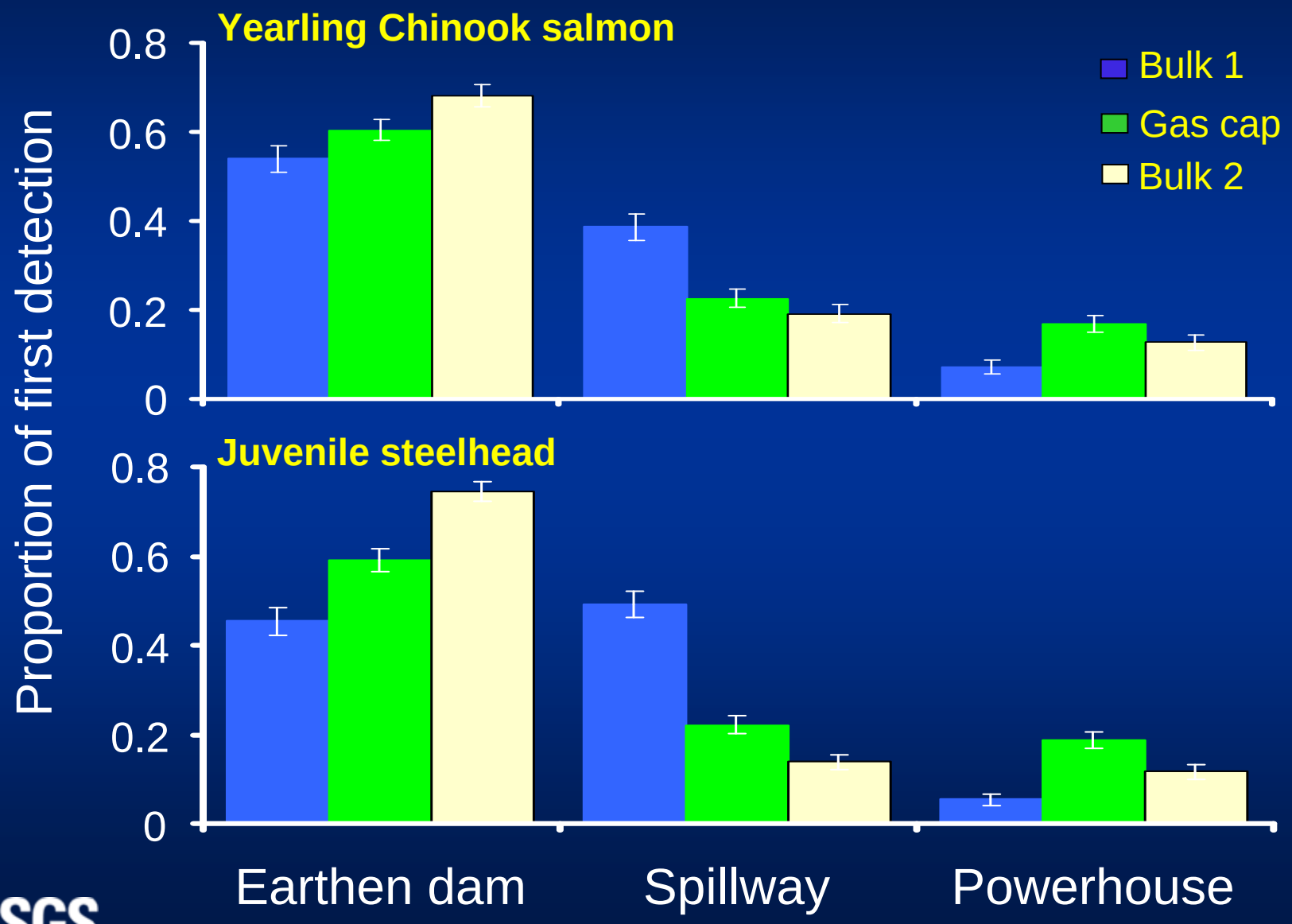
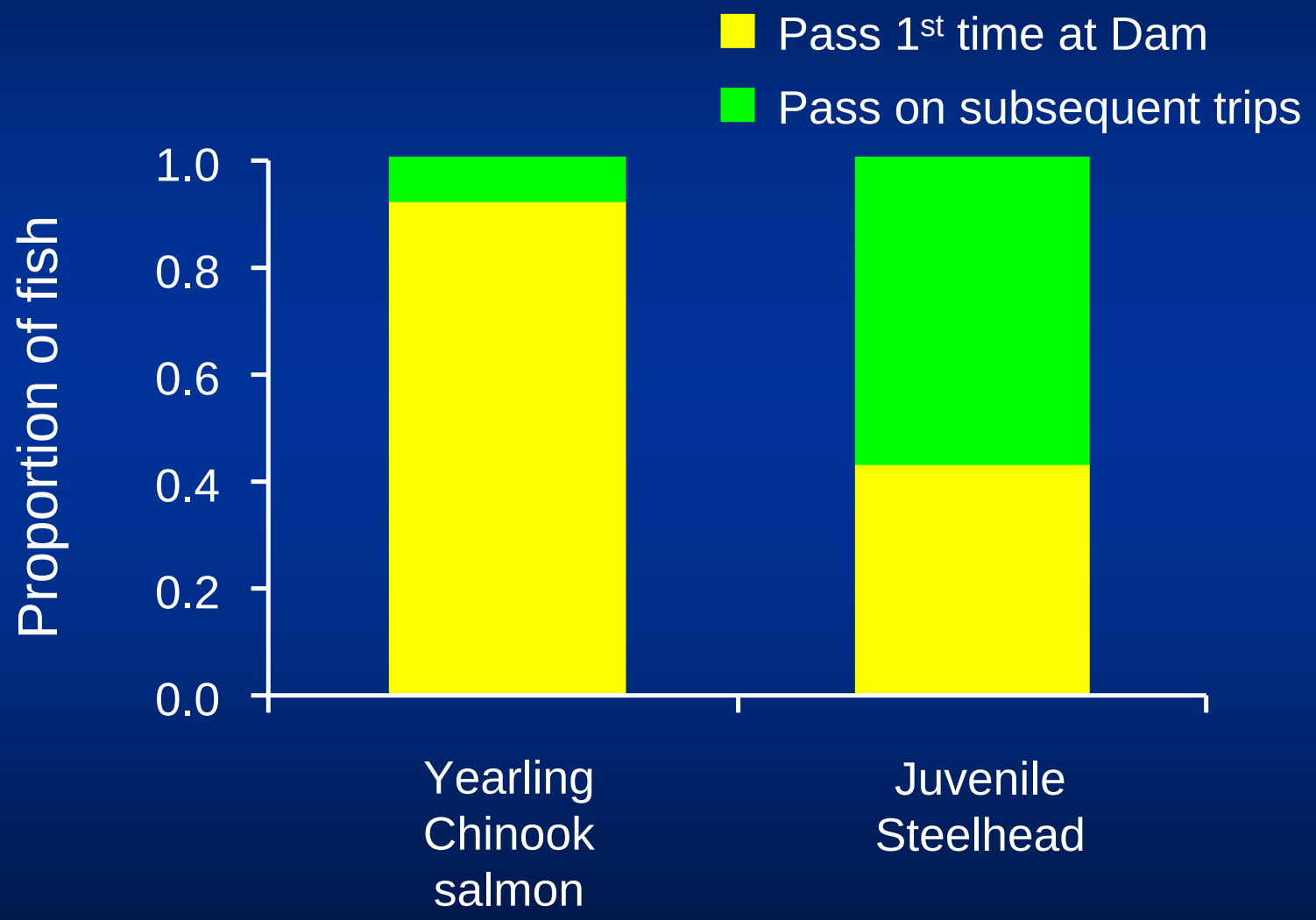
Approach

Area of first forebay detection



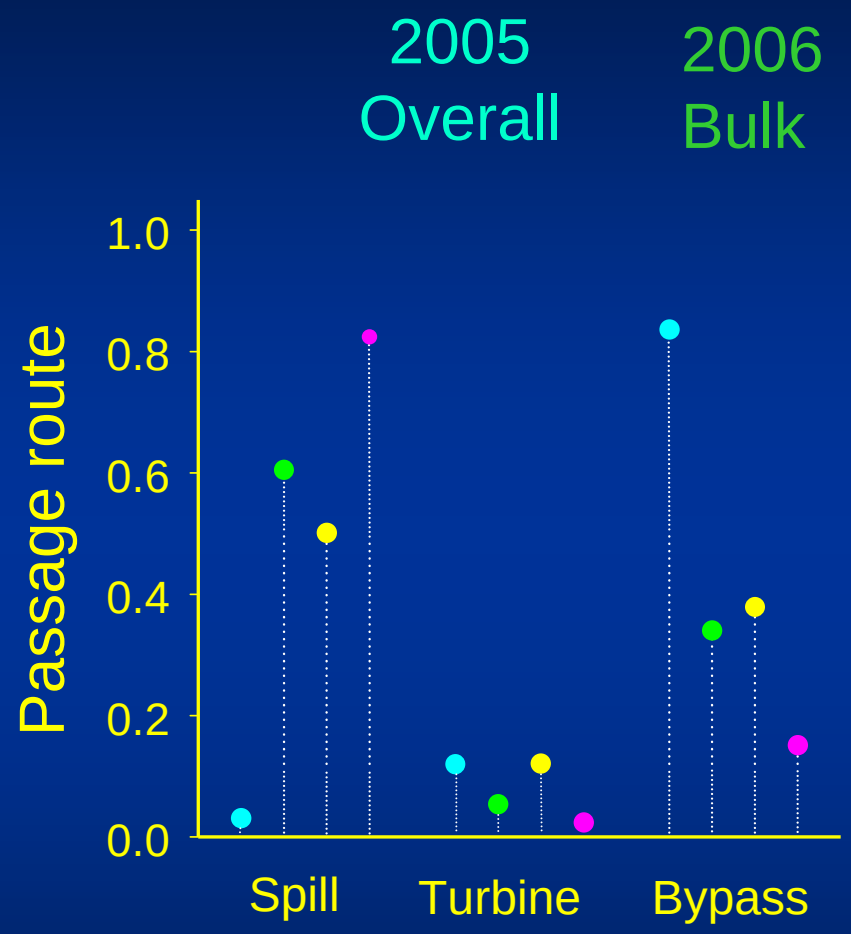
USGS

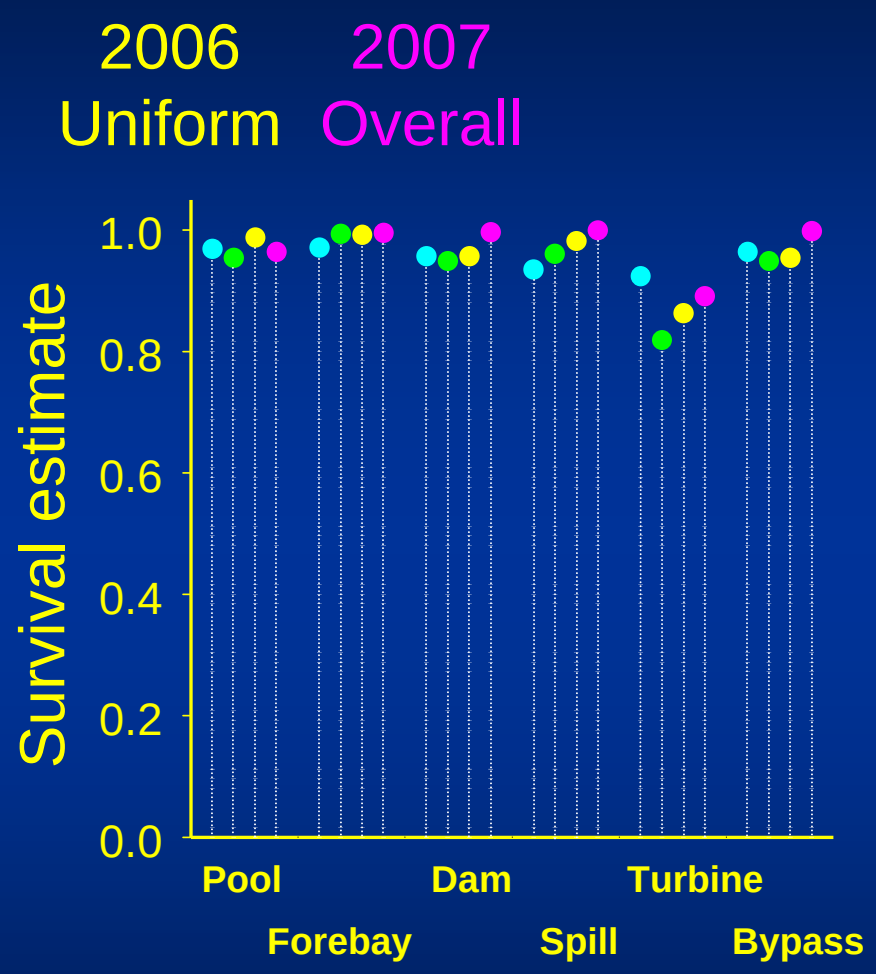
Forebay Passage Behavior



USGS

Passage and Survival





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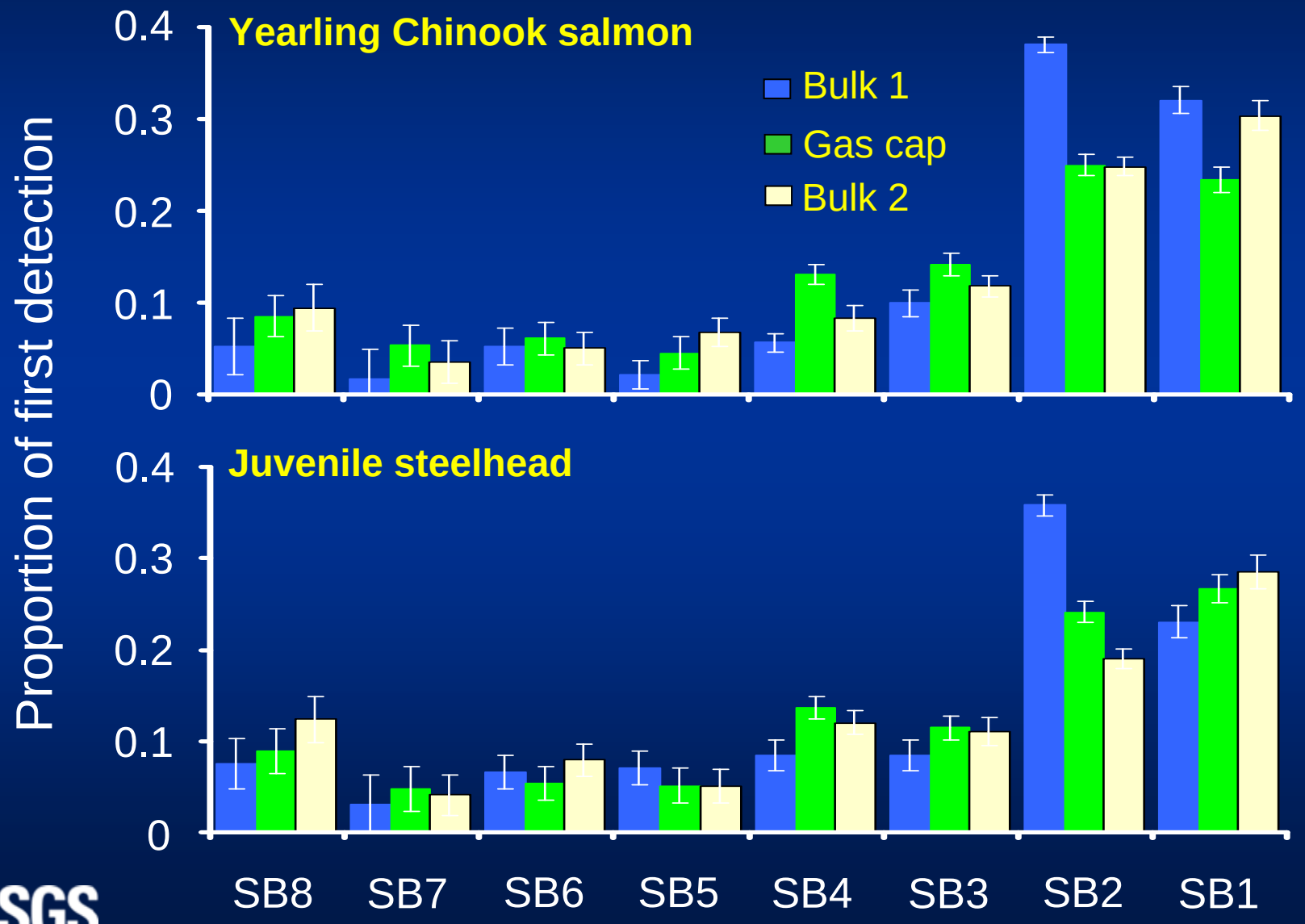
First Detections

at Spillway Underwater Antennas, depth = 11.4 m.



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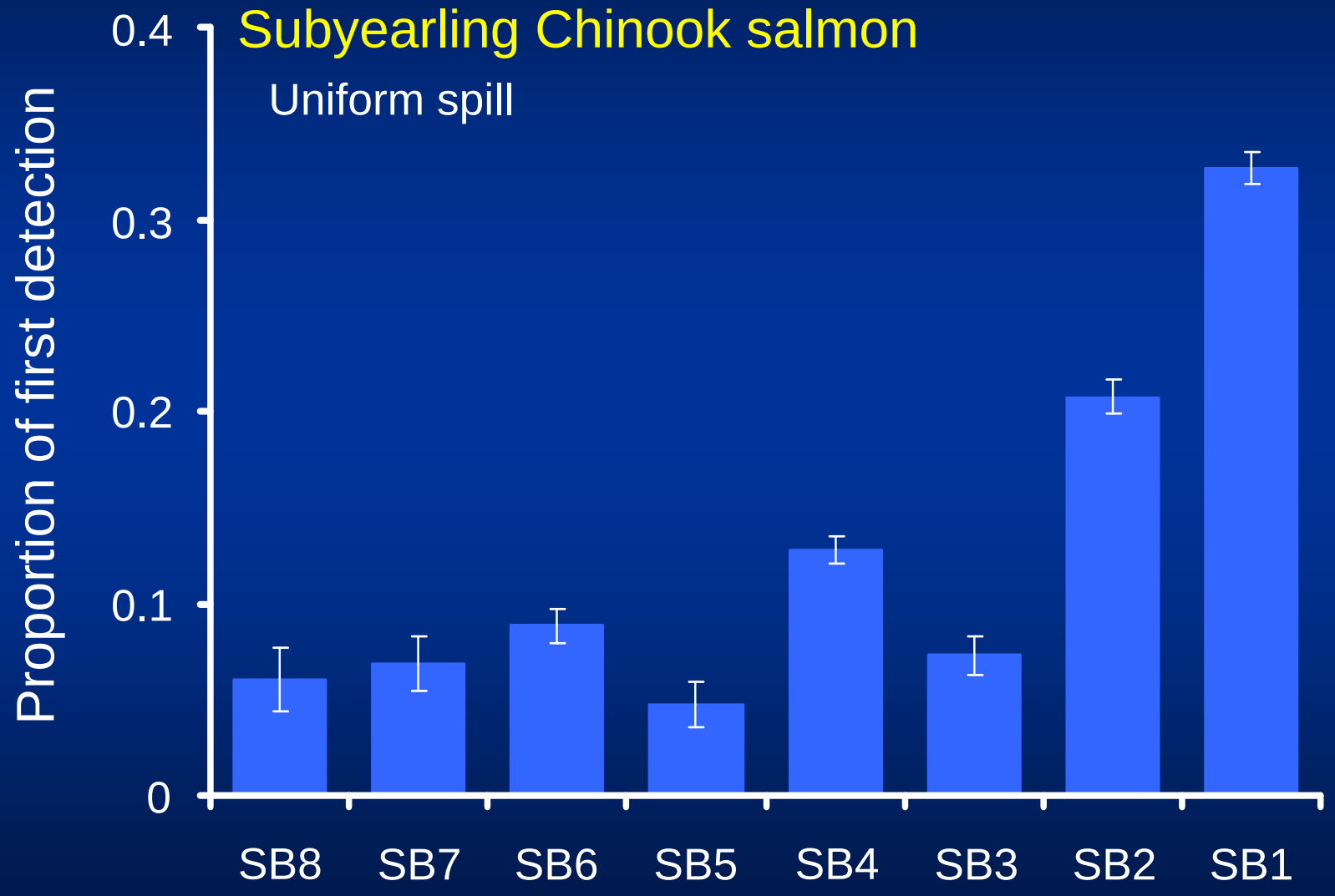

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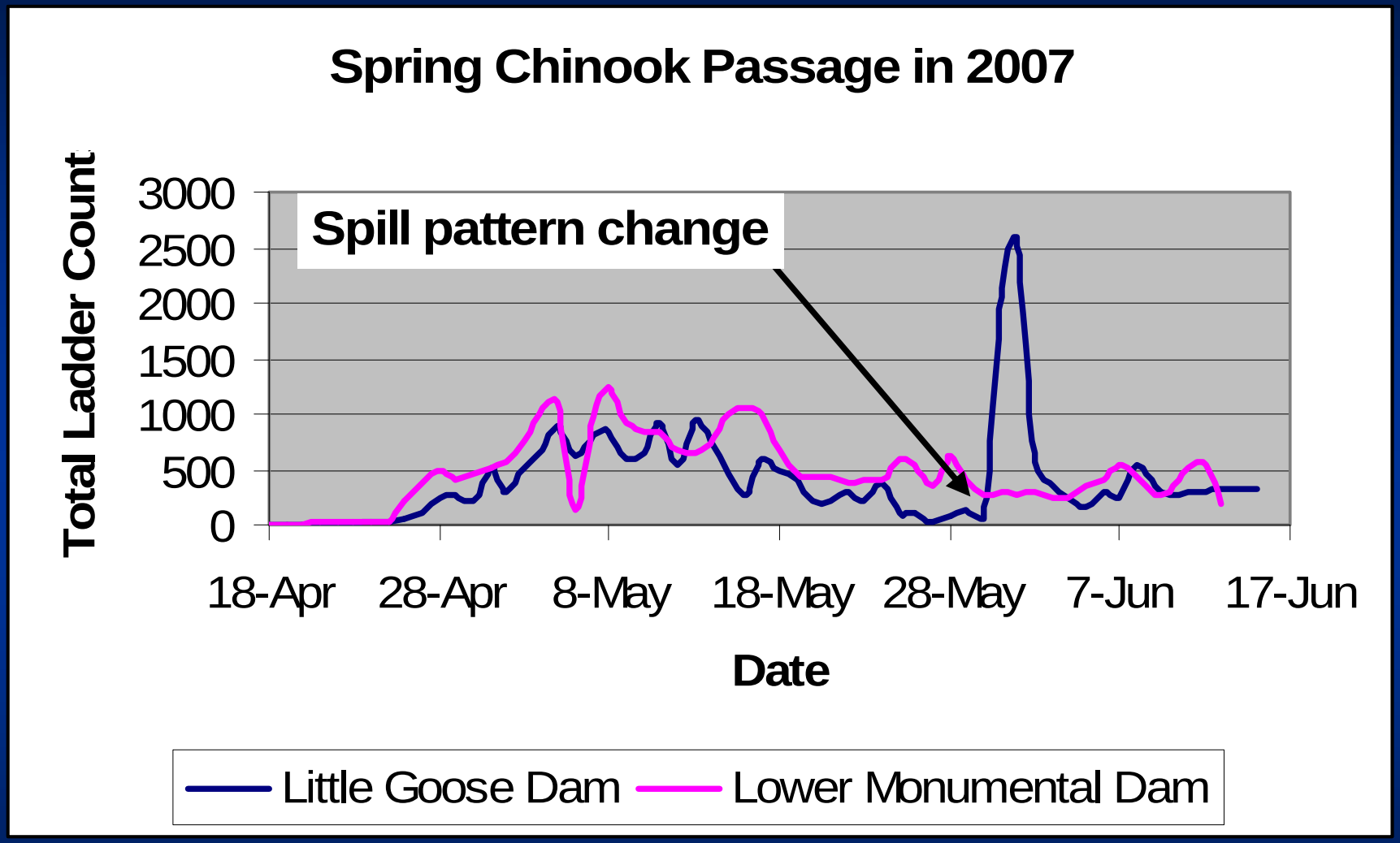
Study Area

- Hydroelectric Dams
- Release Sites
- Detection Arrays

Central Ferry releases
- 1198 Yearling Chinook salmon
- 1167 Juvenile Steelhead
- 1161 Subyearling Chinook salmon

Little Goose Dam releases
- 797 Yearling Chinook salmon
- 797 Juvenile Steelhead
- 784 Subyearling Chinook salmon
- Not including euthanized control fish

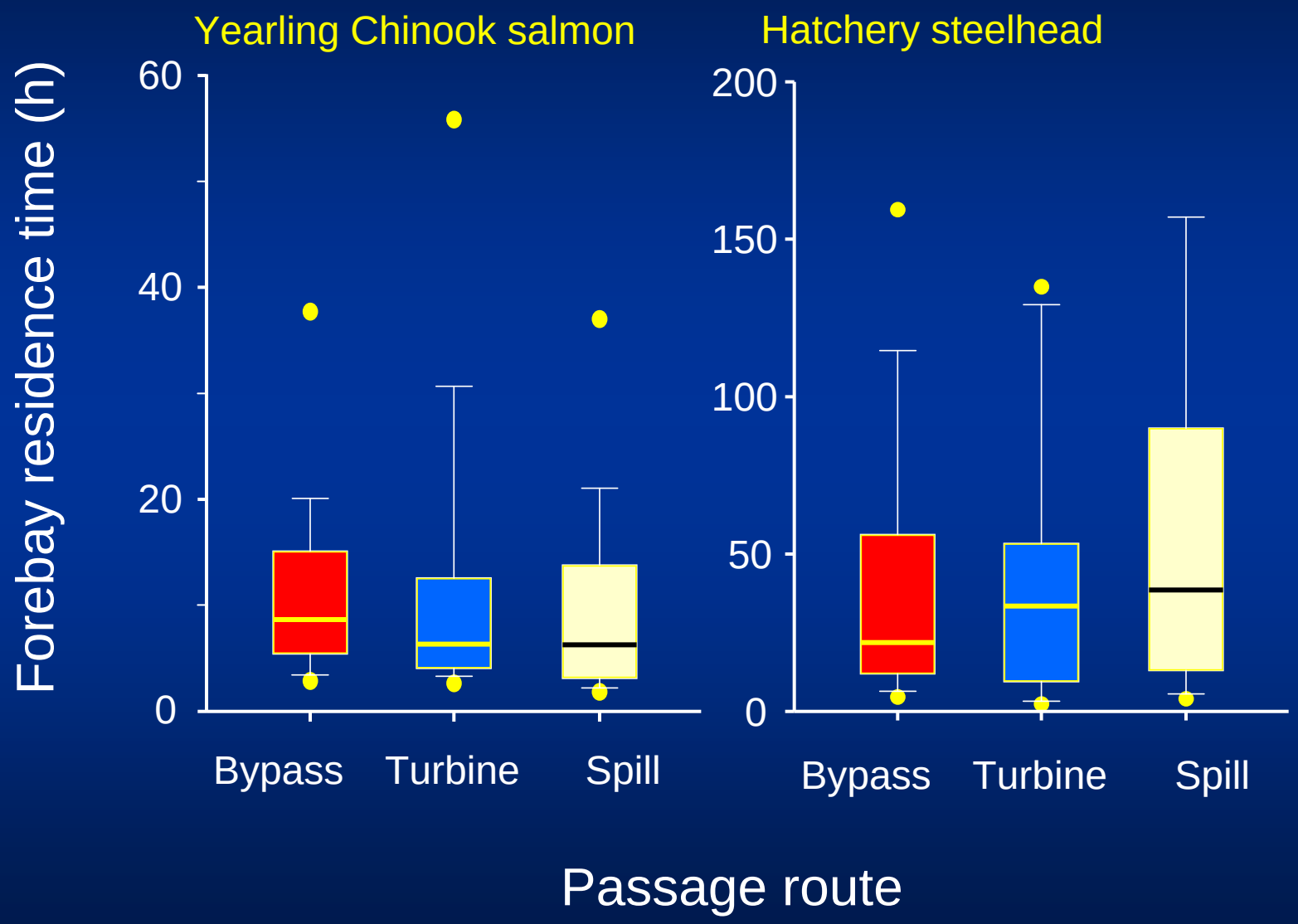
USGS


Spring Chinook Passage in 2007
Total Ladder Count
3000
2500
2000
1500
1000
500
0
Spill pattern change
18-Apr
28-Apr
8-May
18-May
28-May
7-Jun
17-Jun
Date
Little Goose Dam
Lower Monumental Dam

USGS

Forebay Residence Time

By route



USGS