Survival and Behavior of Juvenile Chinook Salmon in the Lower Columbia River, Estuary, and Plume

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Pacific Northwest NATIONAL LABORATORY

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Outline

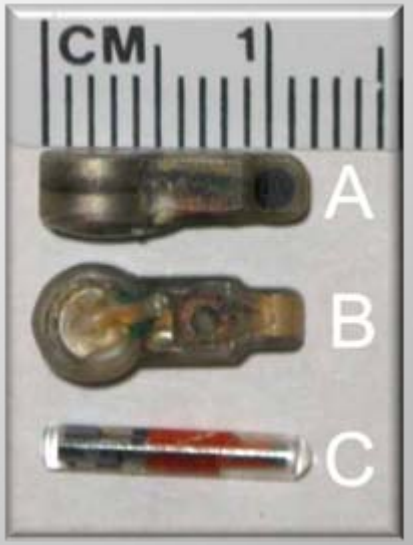
- Background
- JSATS equipment
- Summary of results to date
  - Behavior
  - Survival
- Future direction
- Conclusions and management implications

Background

- JSATS was developed to estimate survival between Bonneville Dam and the Pacific Ocean
- Results from 2005 and 2006 showed higher than expected losses in lower 235 km of CR (up to ~25 to 50%)
  - For context - min estimates of avian predation ~ 2 to 5%
- In 2007 and 2008 the LCR was partitioned into six reaches; found greatest losses in lower 50 km
- 2009 added an array at Astoria Bridge (RKM 22) and focused mobile effort (NOAA) to assess fate of fish that cease migration in lower 50 km

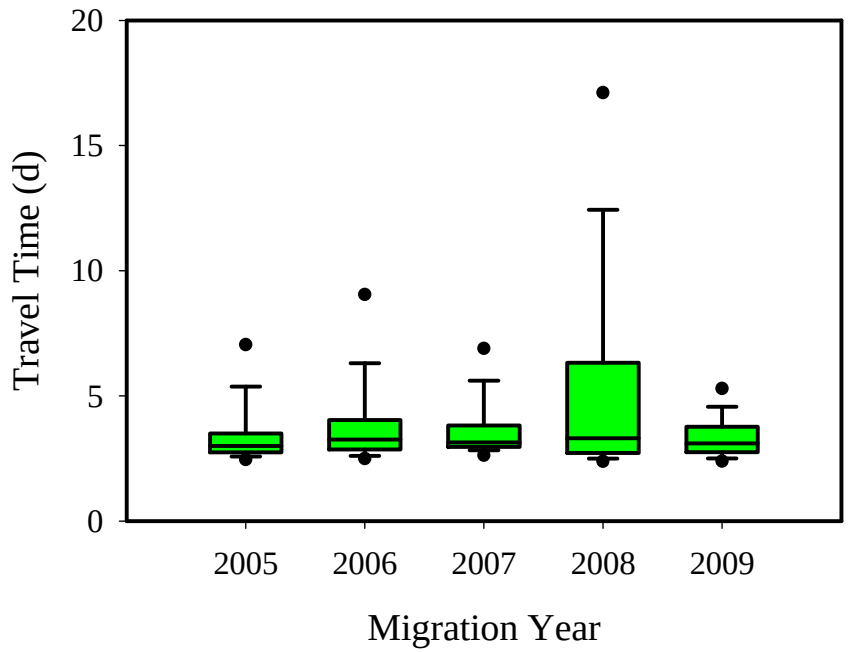
JSATS Equipment used in LCR and Estuary

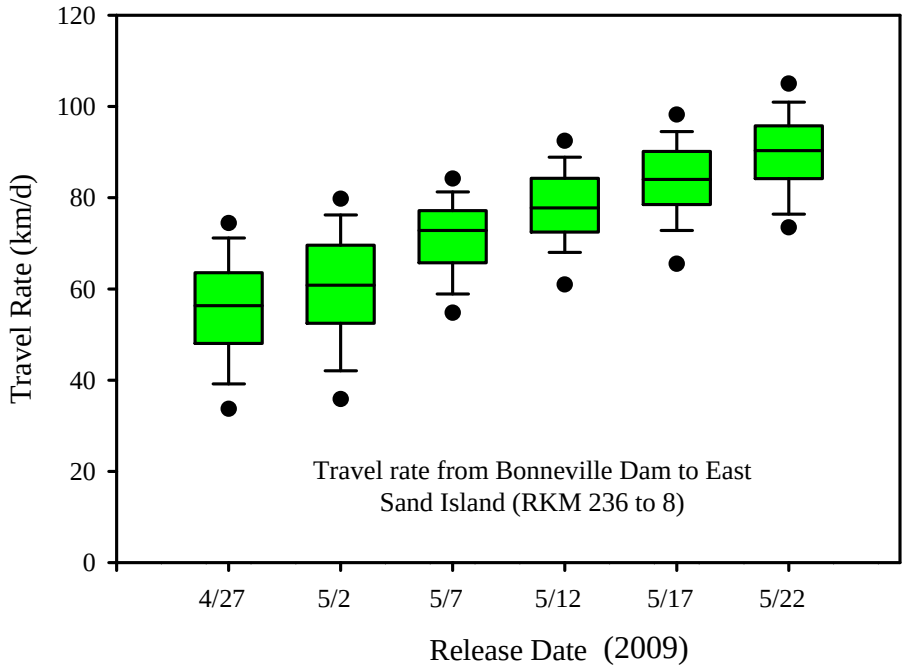
- Transmitters
  - Size
    - Weight = 0.43 g in air, 0.29 g in water
    - Length = 12 mm, same as PIT tag
  - Tag Life
    - 23 days (3 sec PRI)
    - 32 days (5 sec PRI)
  - Range
    - ~300 m
- Receivers
  - Autonomous
  - Mobile Tracker



Summary Results- Yearling Chinook Salmon Behavior 2005-2009

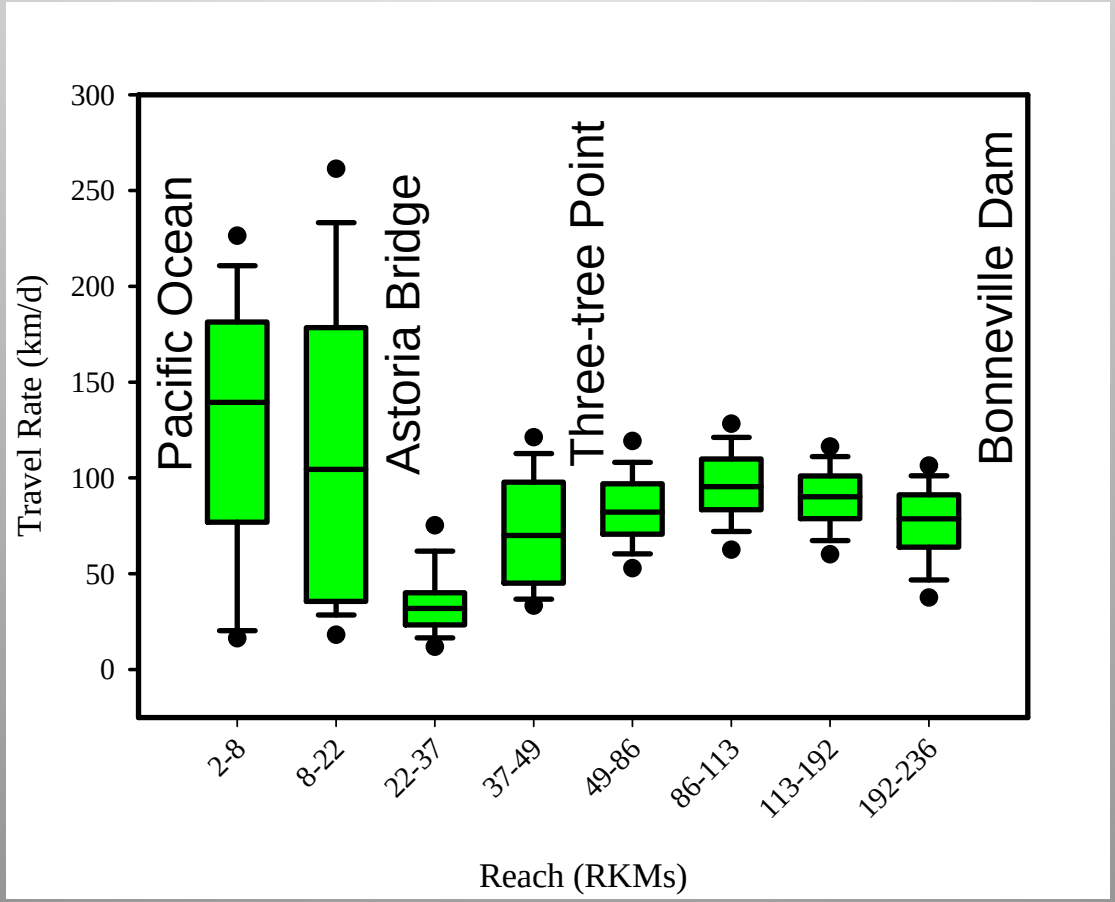
- Travel time from Bonneville to East Sand Island averaged less than 4 days – with more variability in 2008
- Fish travel faster later in the season

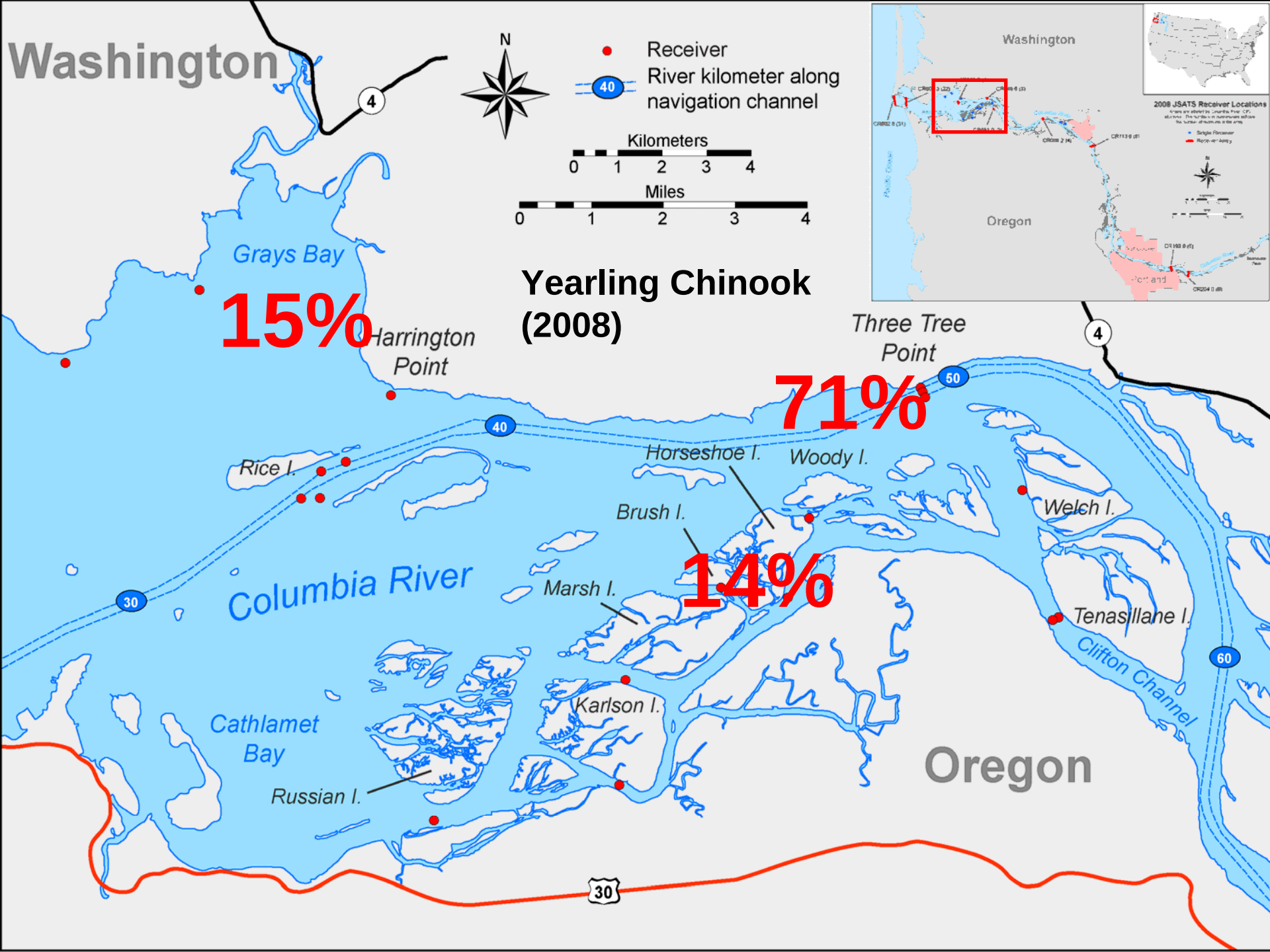




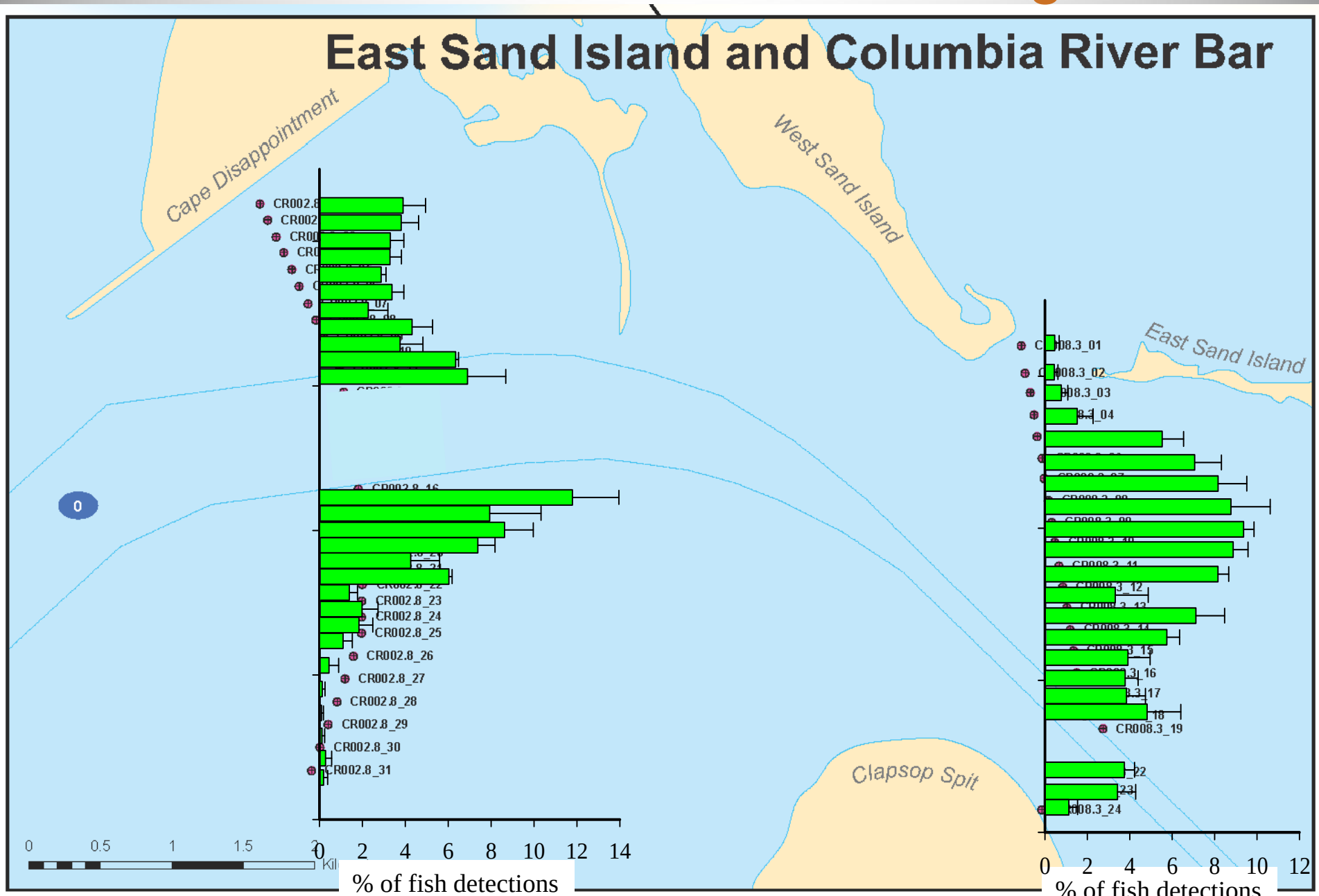
Summary Results- Yearling Chinook Salmon Behavior 2009

- Fish slow down as they enter the ‘wide part’ of the estuary – until they commit




Washington
N
Receiver
40
River kilometer along navigation channel
Kilometers
0 1 2 3 4
Miles
0 1 2 3 4
Yearling Chinook (2008)
Grays Bay
15%
Harrington Point
Three Tree Point
71%
Rice I.
Horseshoe I.
Woody I.
Brush I.
Welch I.
14%
Columbia River
Marsh I.
Tenasillane I.
Clifton Channel
Karlson I.
Cathlamet Bay
Russian I.
Oregon
4
40
50
30
60
Washington
Oregon
2008 JSATS Receiver Locations

Cross-Channel Distribution - Yearlings



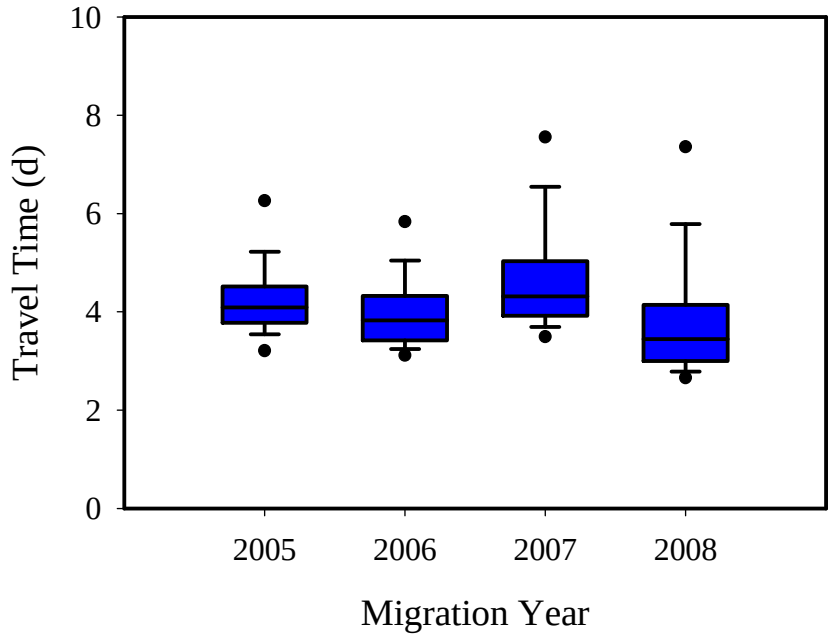
Yearling Chinook Salmon Survival Lowest in Final 50 km of Columbia River Estuary

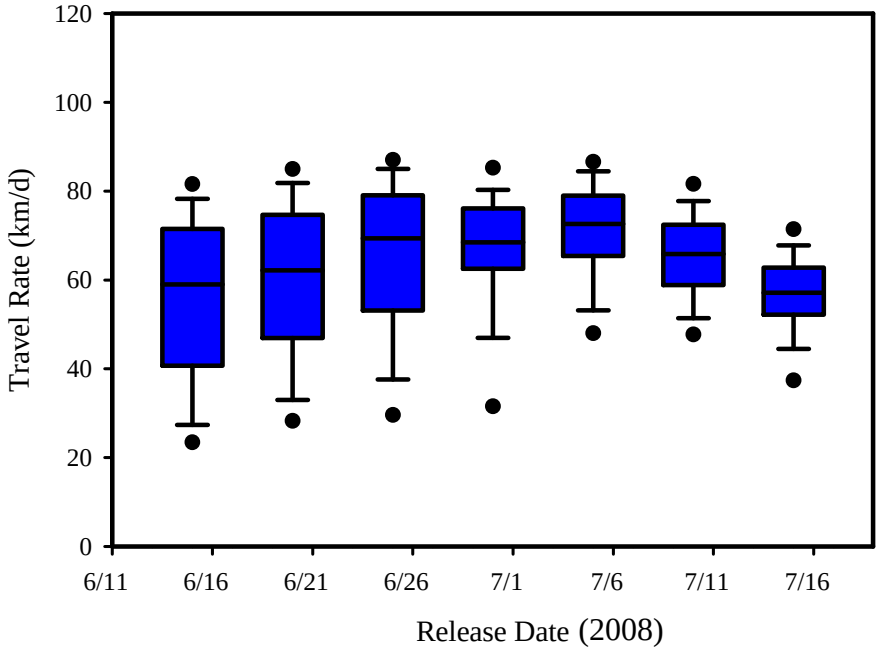
*Minimum loss due to avian predation ~ 2.5%

*2009 survival estimates are preliminary

Summary Results- Subyearling Chinook Salmon Behavior 2005-2008

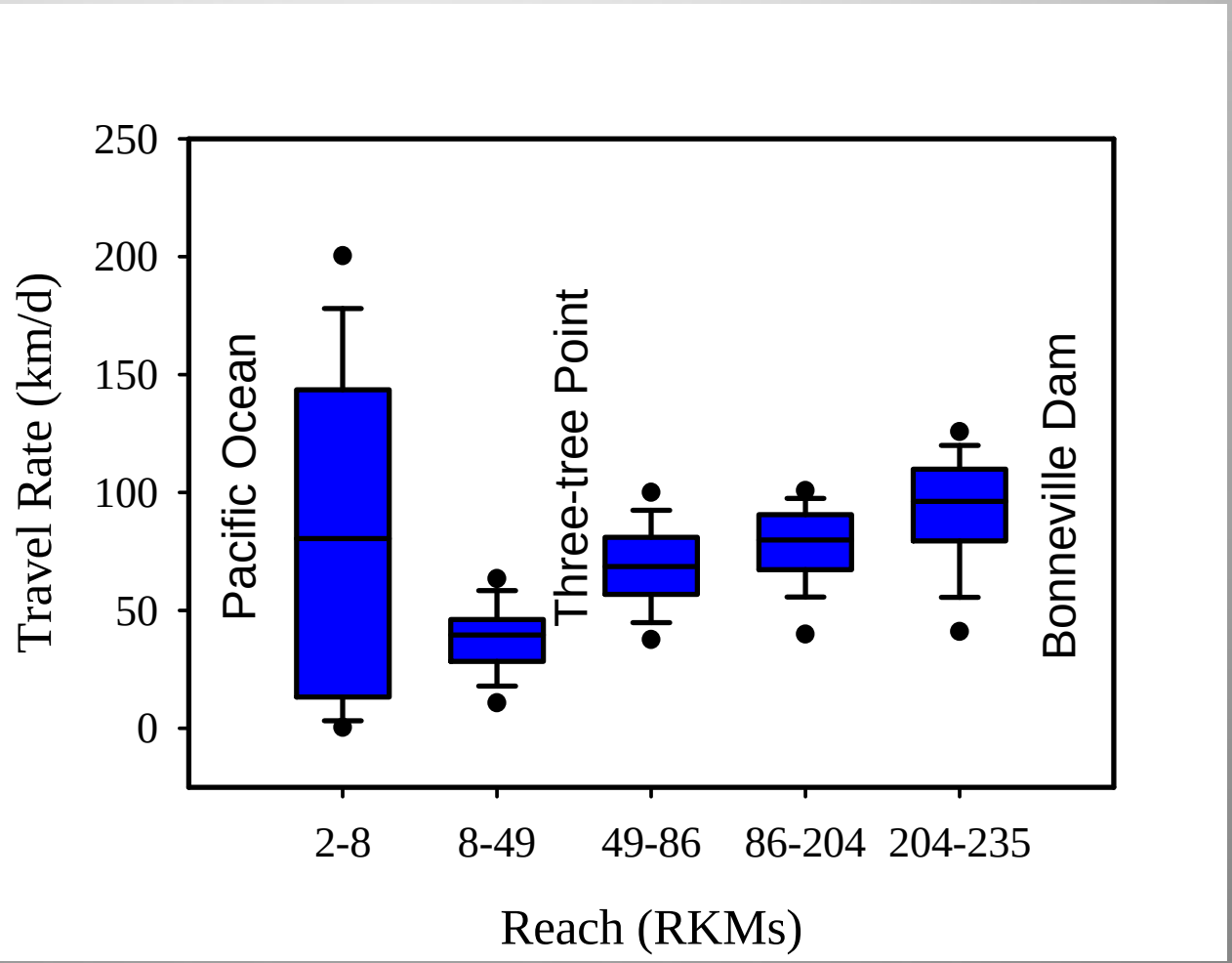
- Travel time from Bonneville to the ocean averages 4 to 5 days
- Fish travel faster as season progresses – then slow down late

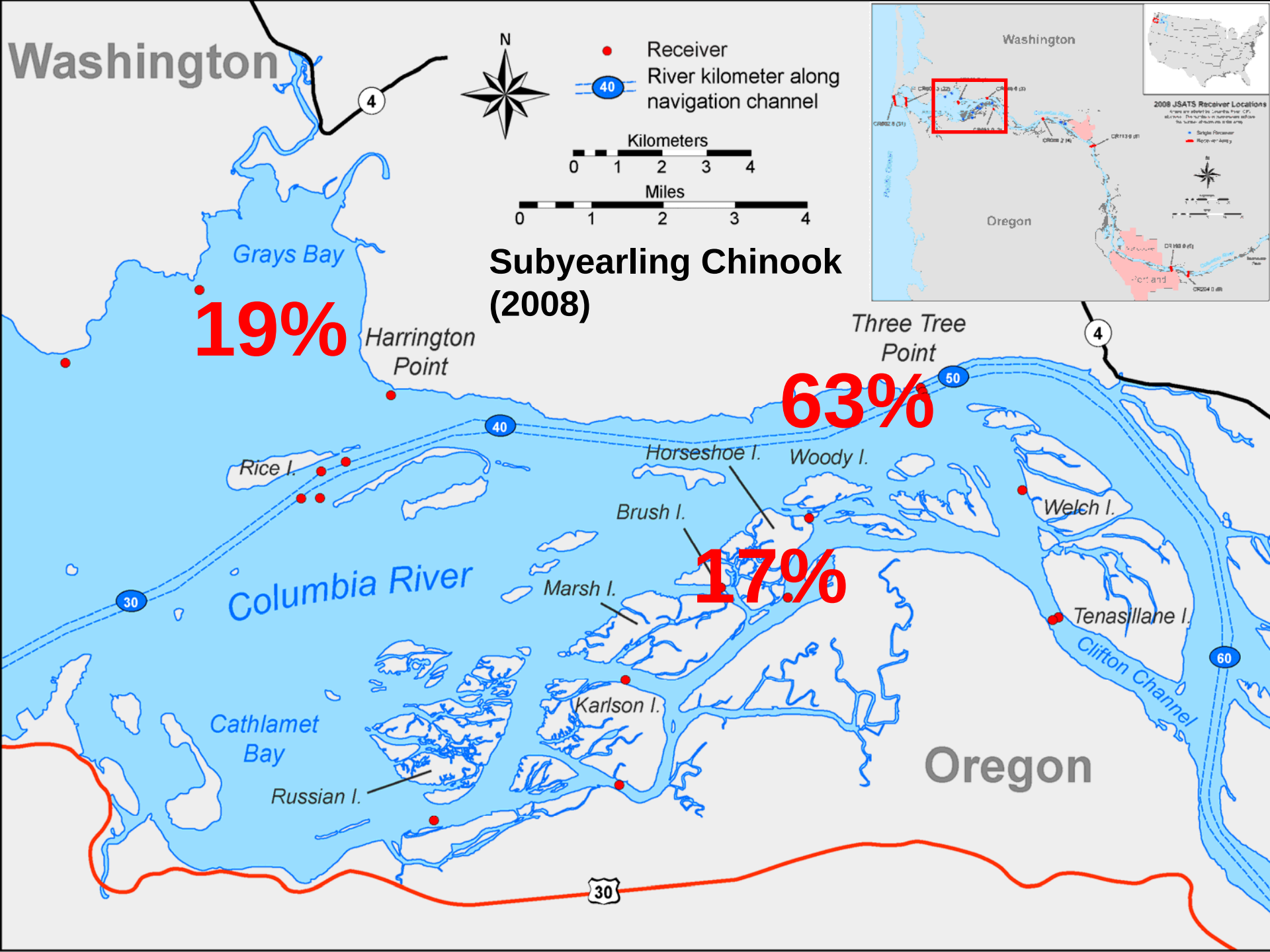




Summary Results- Subyearling Chinook Salmon Behavior 2008

- Fish slow down as they enter the ‘wide part’ of the estuary

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Oregon
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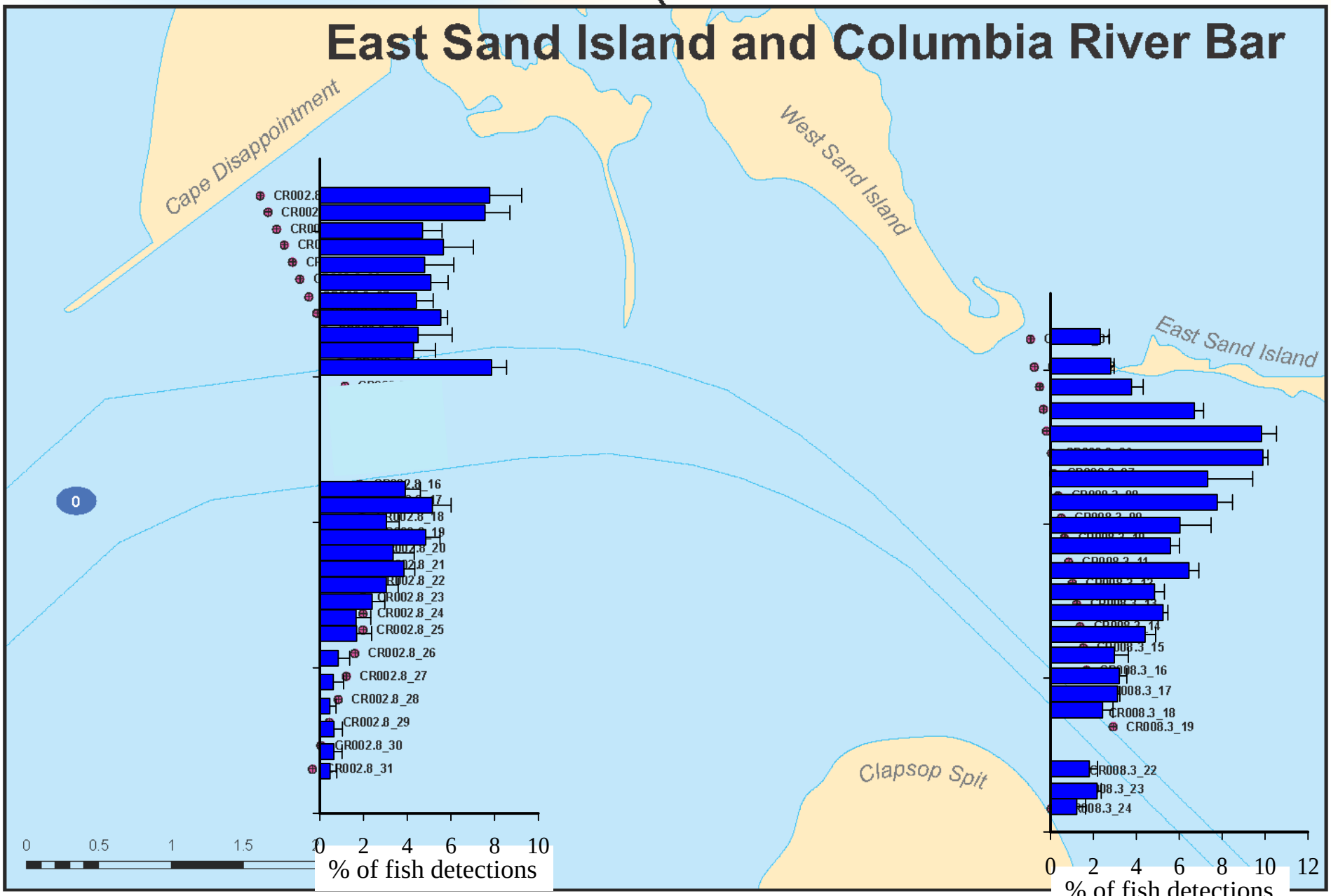
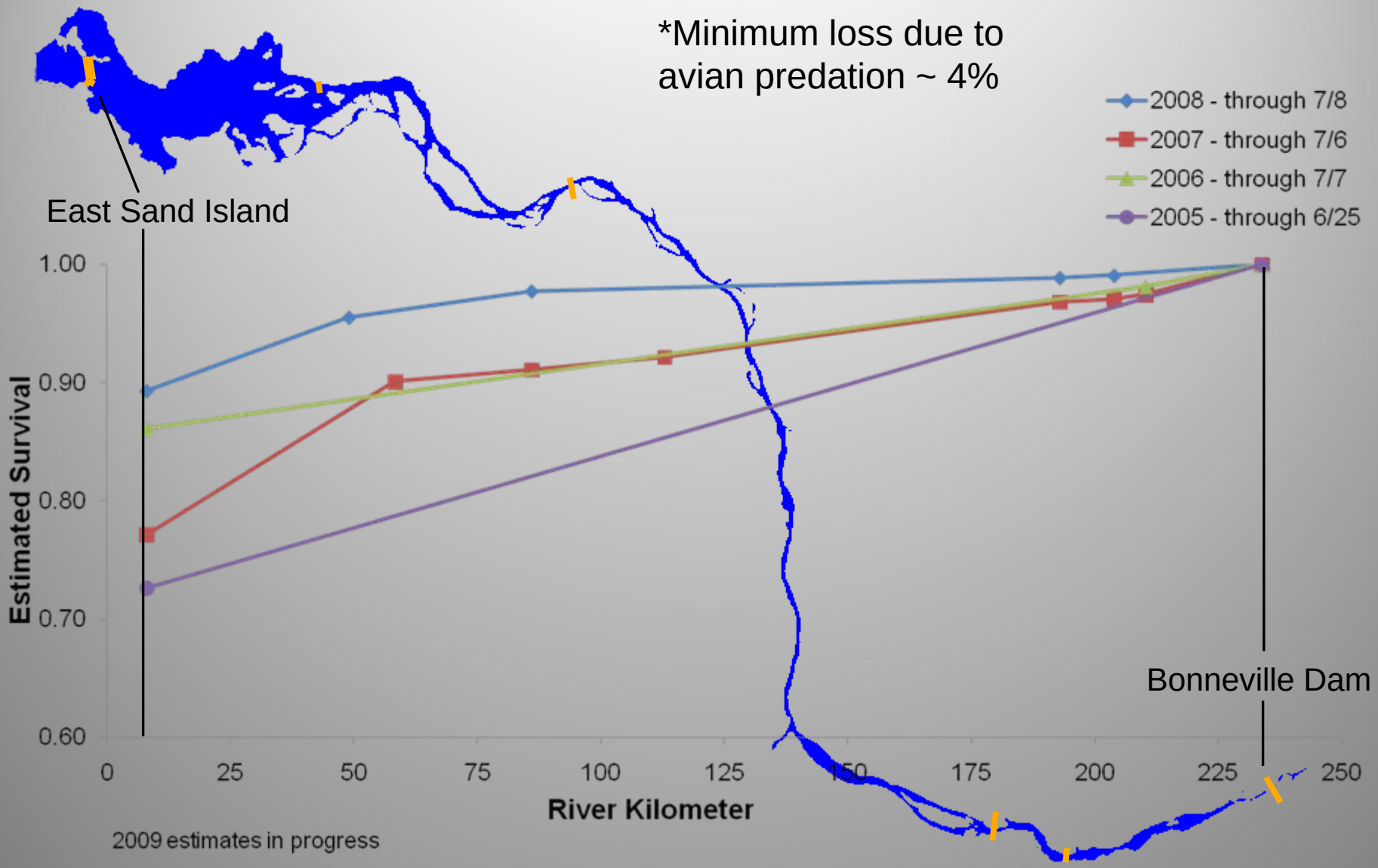
Grays Bay
19%
Harrington Point
Three Tree Point
63%
Rice I.
Horseshoe I.
Woody I.
Brush I.
Welch I.
17%
Columbia River
Marsh I.
Tenasillane I.
Clifton Channel
Karlson I.
Cathlamet Bay
Russian I.
Oregon
4
50
40
30
60
30

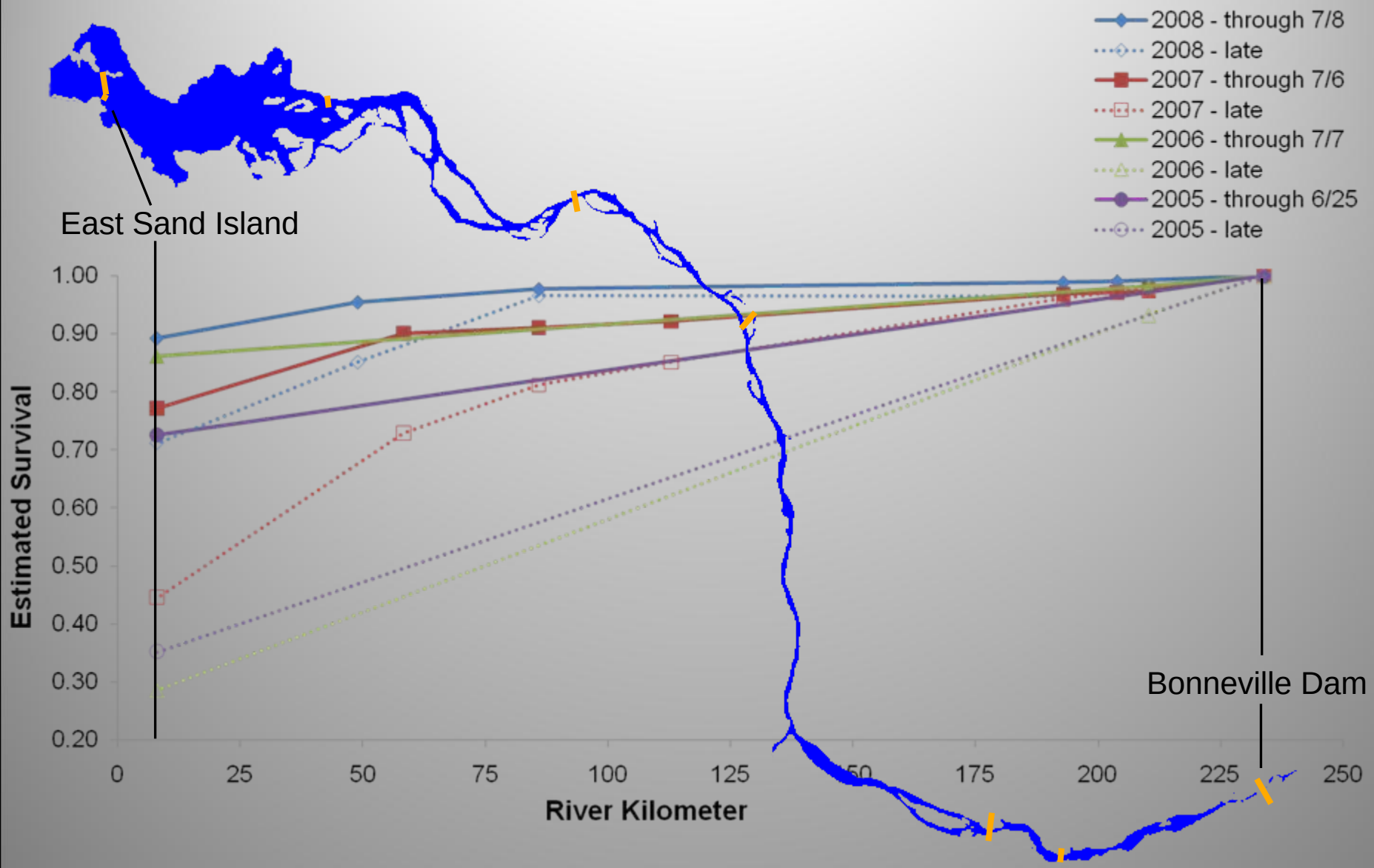
Cross-Channel Distribution - Subyearlings



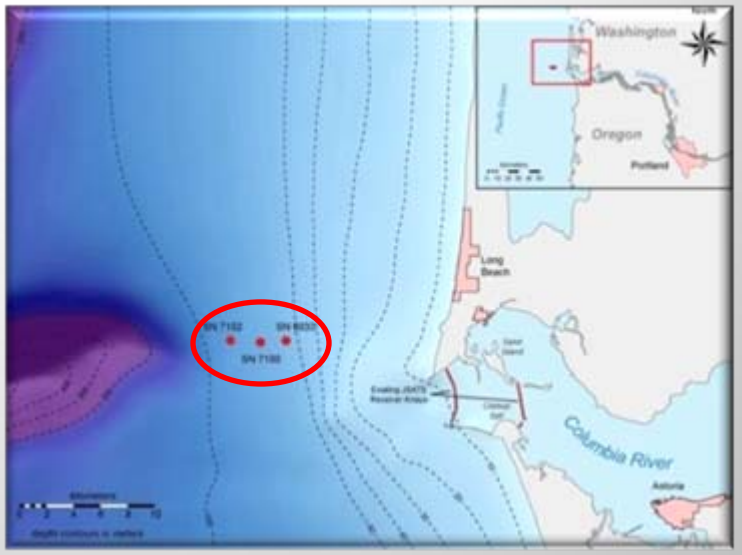
Subyearling Chinook Salmon Survival lowest in final 50 km



Subyearling Chinook Salmon – Late groups “survive” poorly



2009 Plume Test:
3 receivers; 6/23-7/21
72 fish Detected



- 1 yearling Chinook salmon (JDA Pool)
- 6 subyearling Chinook salmon (Grant County)
- 65 subyearling Chinook salmon (JDA Pool)
  - Travel time from JDA Pool to RKM 8 = 7.5 d (±0.20)
    - 46 km/d
  - Travel time from RKM 8 to Plume = 1.3 d (±0.26)
    - 13 km/d

Future Direction

- 2010+ Plans
  - Estuary/Plume work will be closely integrated with BiOp Performance Standards assessments at lower three dams and mobile tracking effort proposed by NOAA
  - Assess reach survival and behavior, with focus on lower 50 km
  - Assess LCR/Estuary survival of early vs. late transported groups
  - Assess passage-route-specific mortality in LCR and Estuary
  - Collect behavioral data in plume to guide future survival assessment
  - Increase collaboration with other researchers to address critical uncertainties regarding effects of the FCRPS and habitat mitigation activities on fishes using the LCR and estuary

Conclusions/Management Implications

- The monitoring capability that has been developed around JSATS technology can be applied and extended to assess the success of FCRPS mitigation strategies and other management actions in the LCR, estuary, and plume.
- Coordinated/collaborative efforts in 2010+ will take advantage of ~25k JSATS-tagged fish released upstream and present the first opportunity to assess the effects of different FCRPS passage experiences on behavior and survival downstream of the dams
- Plume tests (2008 and 2009) have been successful and a pilot-scale plume array (20 nodes) is proposed to expand the time/space over which to assess effects of FCRPS mitigation strategies and other estuary management actions on survival to ocean entry

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