



200311400: An Acoustic Tracking Array for Studying Ocean Survival and Movements of Columbia River Salmon (POST)

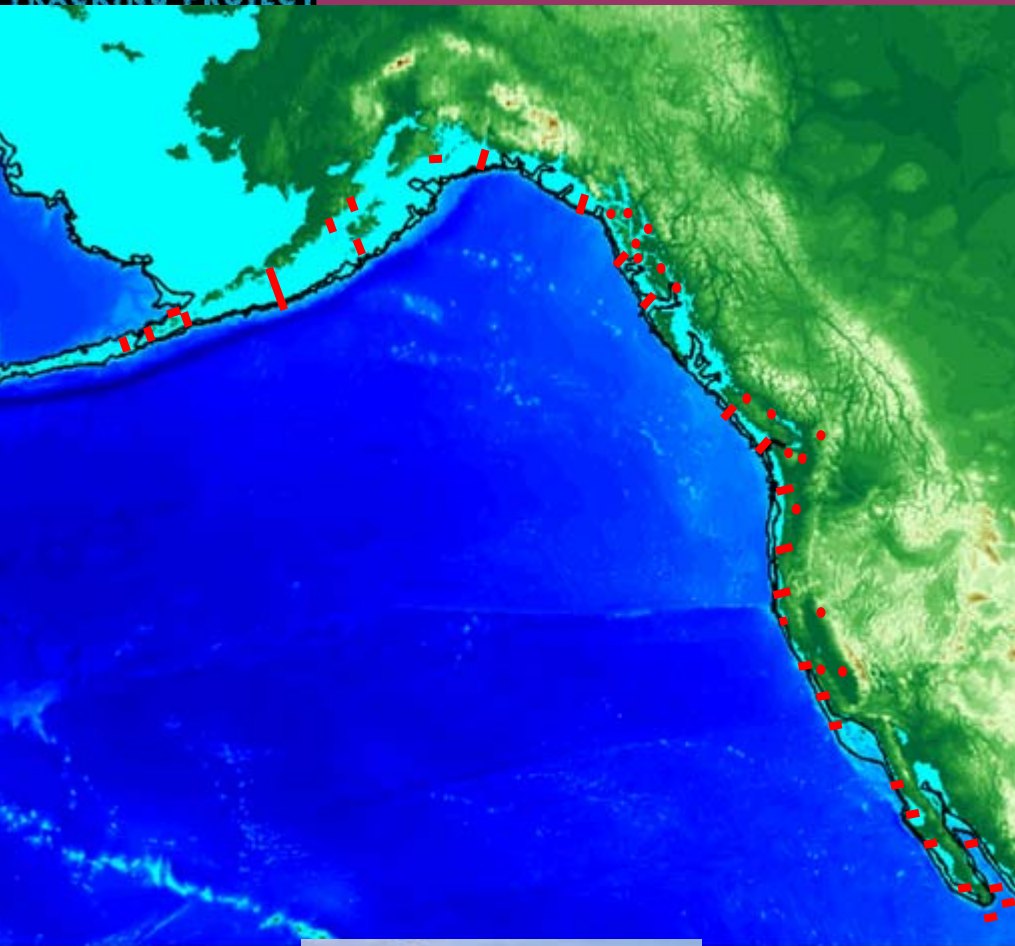
David Welch

BPA





Goals of the POST Project



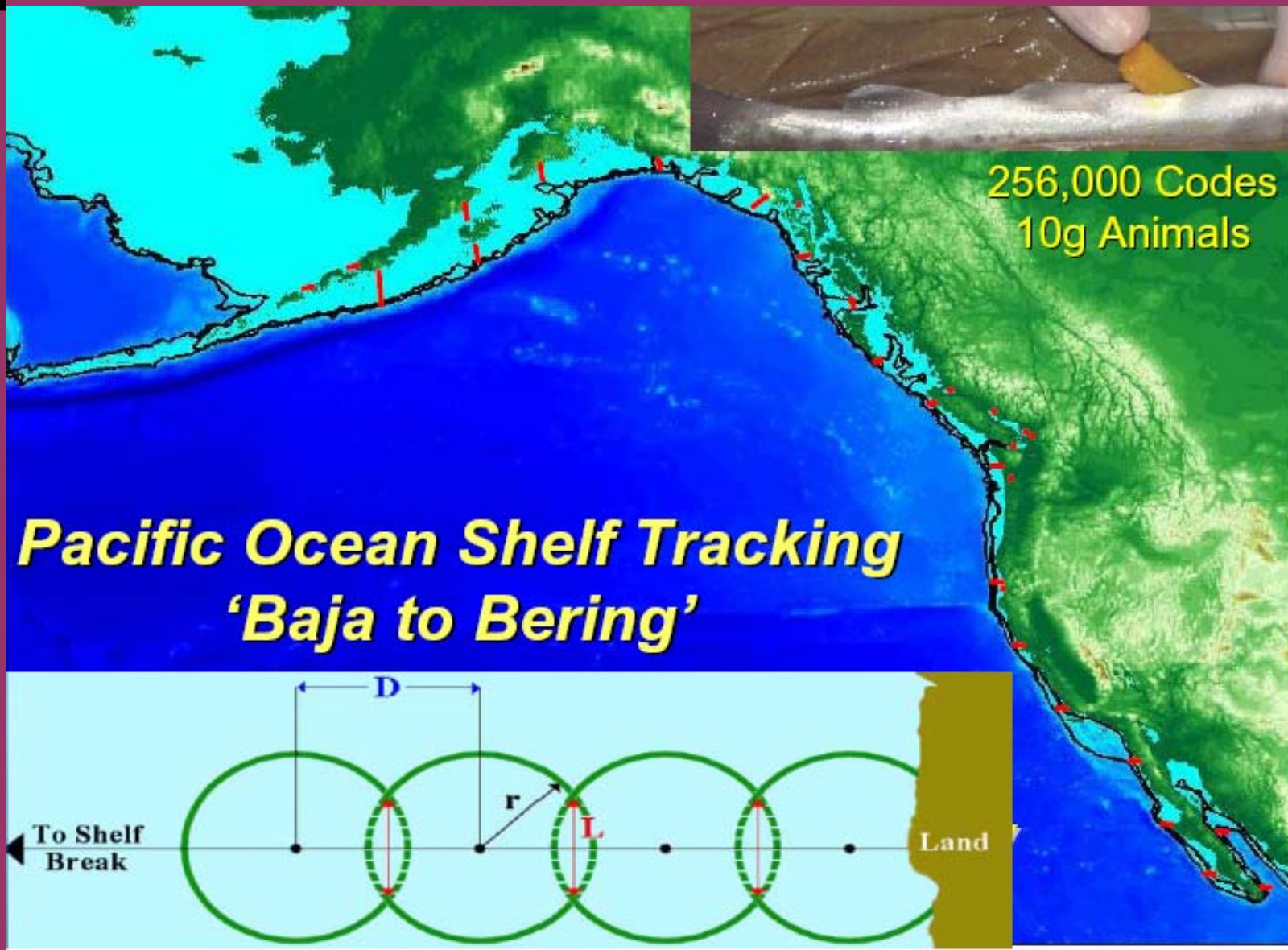
- A permanent continental-scale array
- Directly measure movement, distribution and survival of fish-including salmon- in continental shelf waters
- Develop the ability to follow individual fish– or separate stocks – for decades.
- (Expand the scientific observations to encompass a much wider range of oceanographic observations)

BPA



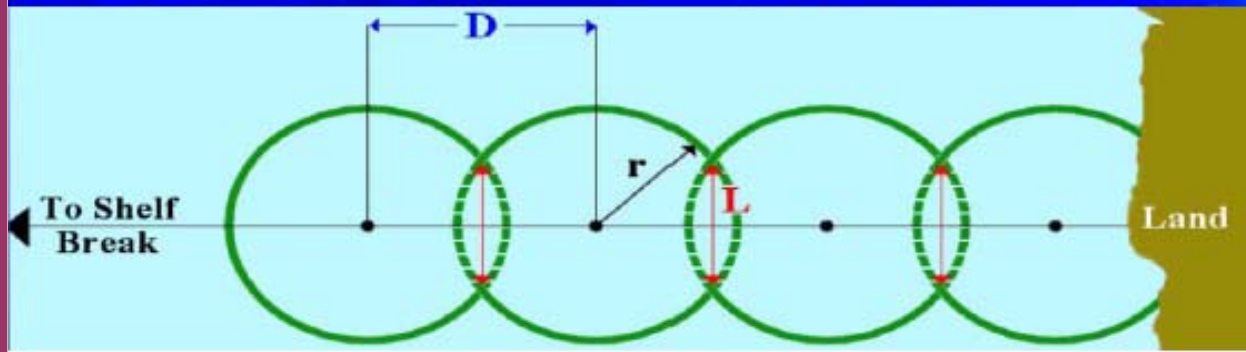


POST's Objectives



256,000 Codes
10g Animals

*Pacific Ocean Shelf Tracking
'Baja to Bering'*



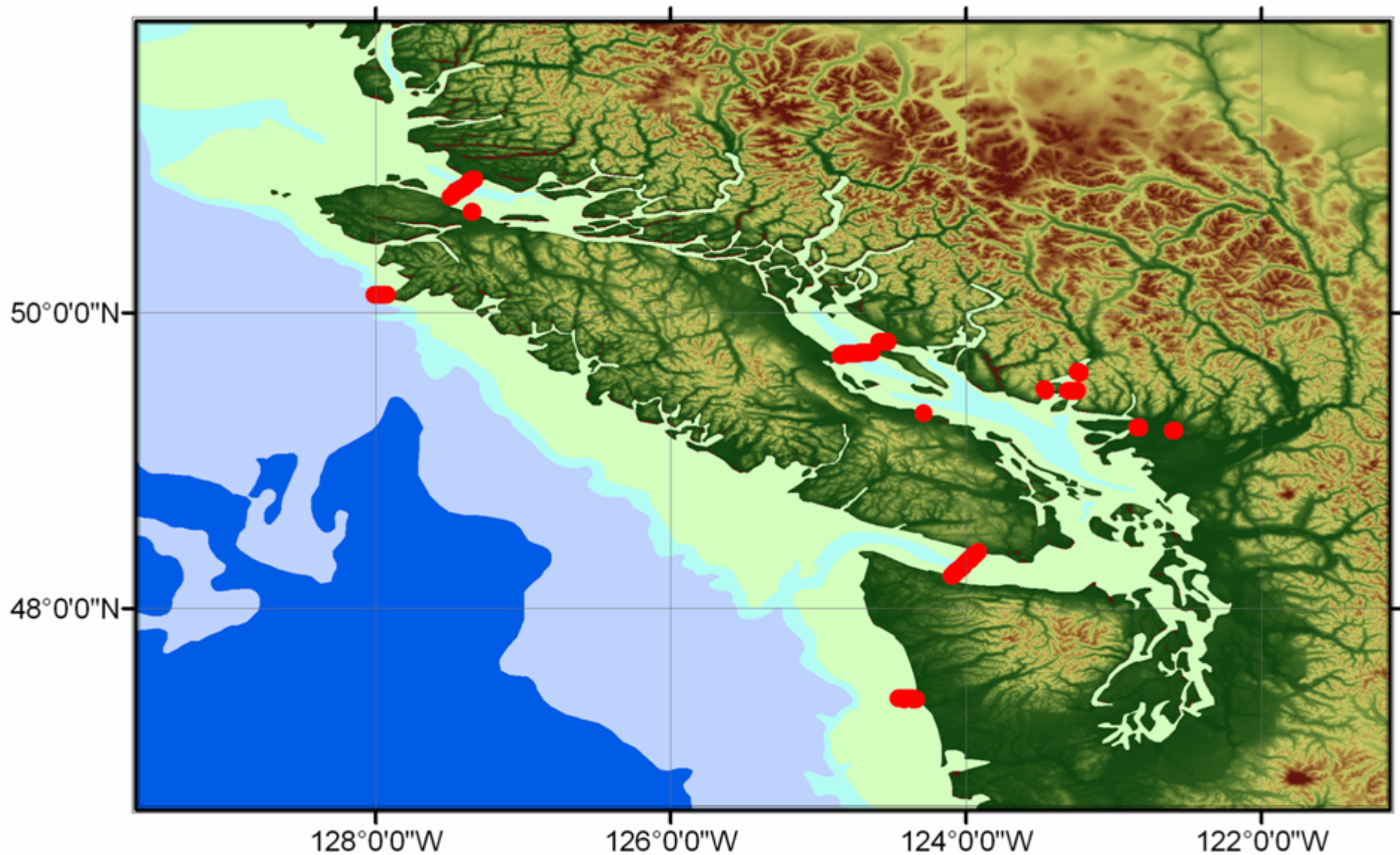


2004 & 2005 POST Tagging





2005 POST Tagging



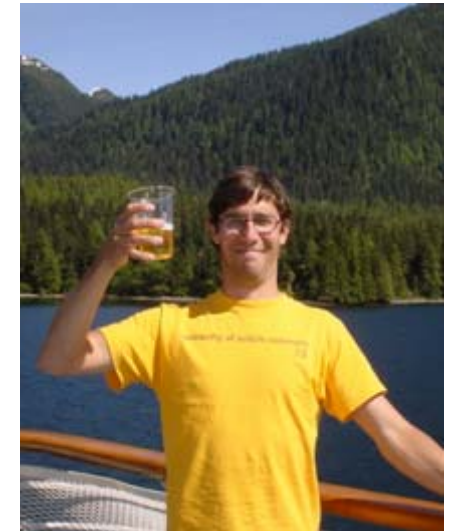


POST Team at Work





POST Team at Work



Deployment of Listening Lines



Deployment of pop-up moorings with receivers & acoustic releases



POST's 2004-05 Field Seasons

- Deployed 120 km of acoustic listening lines (135 seabed nodes)
- Ran array for 5 months (April-Sept. 2004 & 2005)
- Both freshwater & marine lines
- Measured population-specific residence time & speed of movement
- Measured fish survival directly (never before done on this scale-- and the real reason for all the work)



Progress in Year 2

2004	2005
8 River Systems	16 River Systems
14 salmon stocks tagged	19 salmon stocks tagged
1,051 smolts tagged	>2,700 smolts tagged (+257%)
91% detection rate in ocean (10 out of every 11 fish detected per line)	95.5% detection rate in ocean (19 out of every 20 fish detected per line)
Established movements	Established movements
<i>Measured marine survival</i>	<i>Measured marine survival</i>

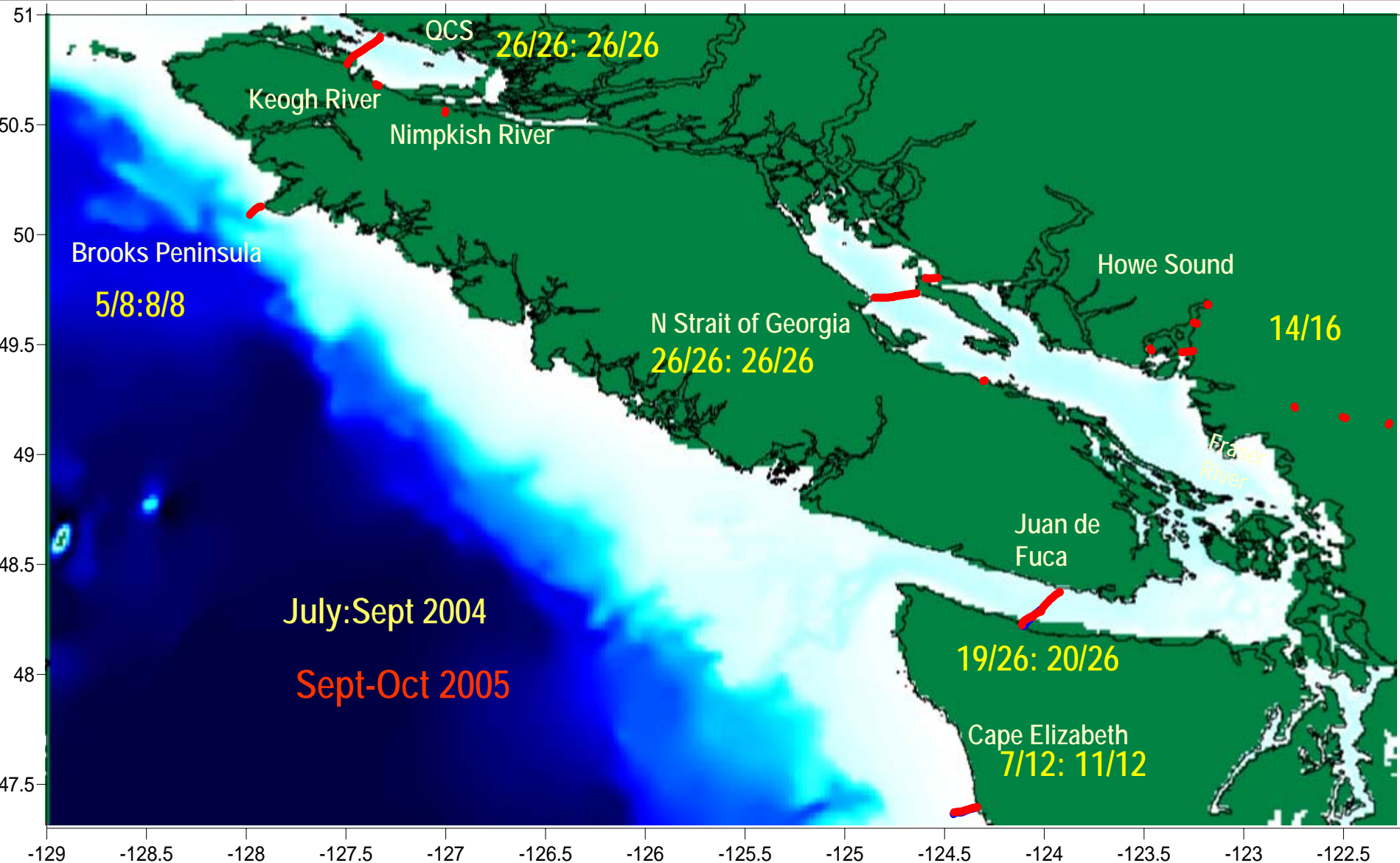


What POST Added in 2005 (Field Season)

- ✓ Developed (& validate) long-lived underwater modem units (3 field trials)
- ✓ Establish deployment technology for these units
- ✓ Validated Satellite-Linked Units working in Fraser River (Real-time fish management)
- ✓ (Improved on 2004 detection rate of 91%)

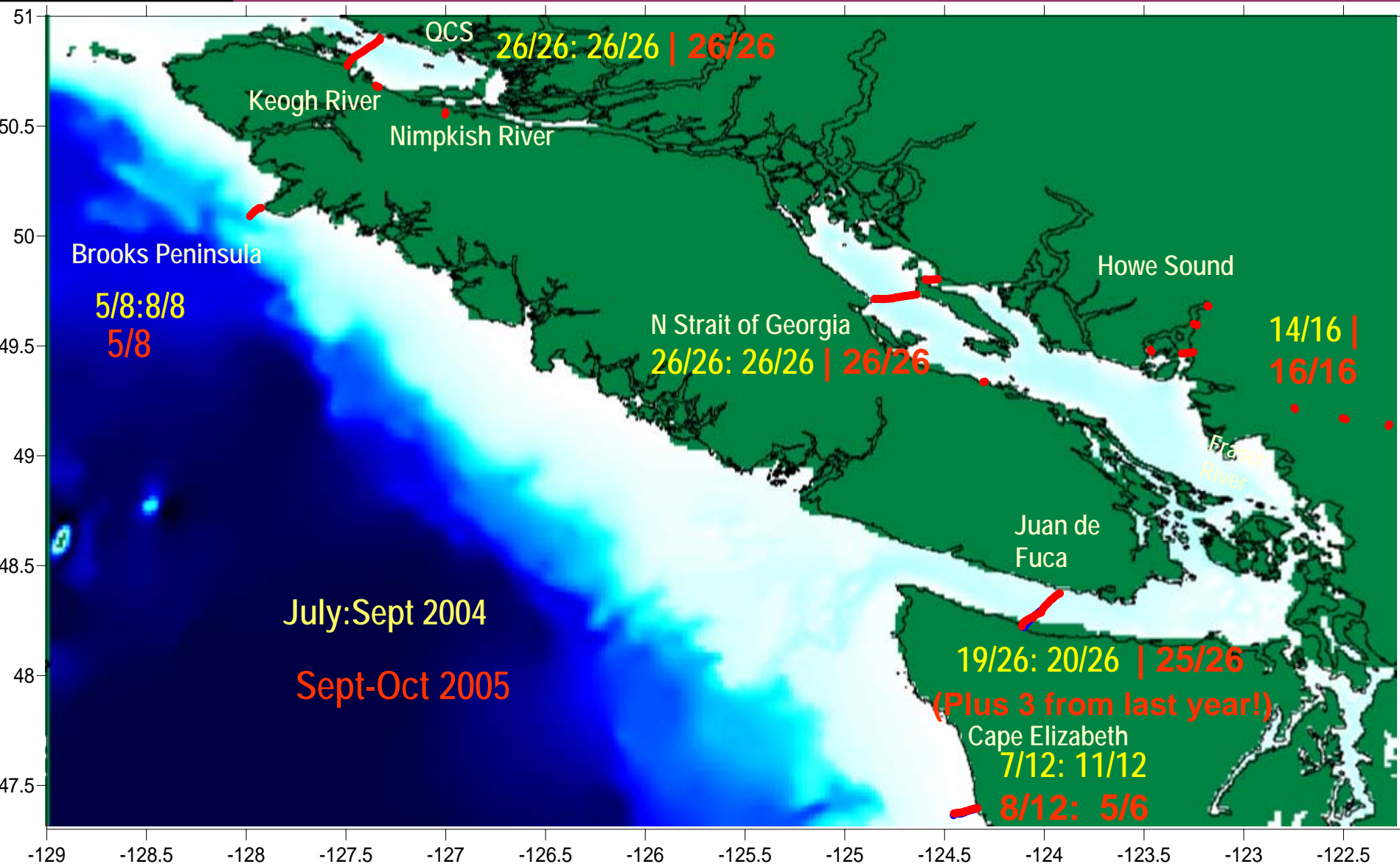


2004 vs 2005 Array Recovery Rates





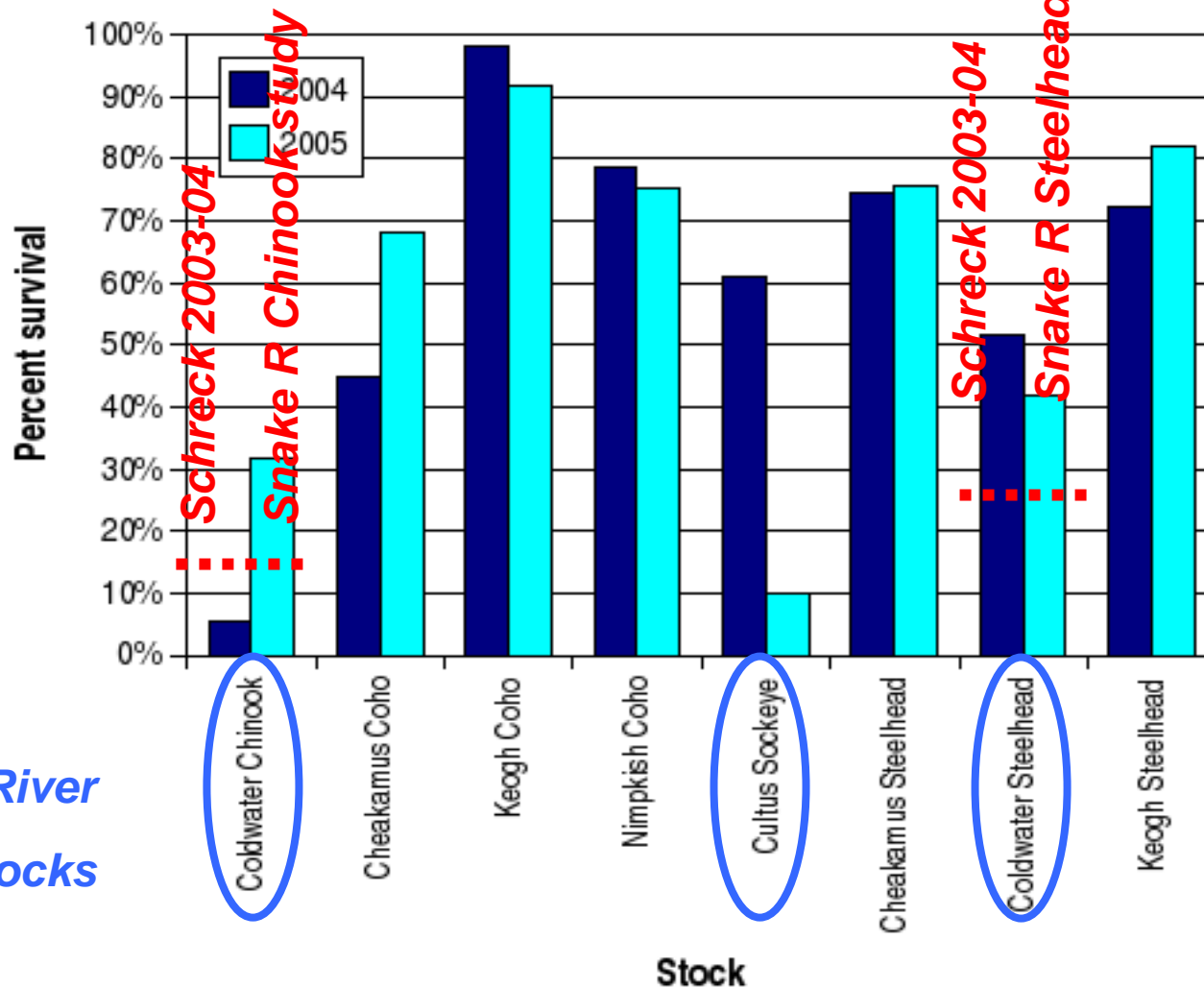
2004 vs 2005 Array Recovery Rates





BC Salmon Survival to River Exit (Comparison with Columbia R)

Riverine Survival

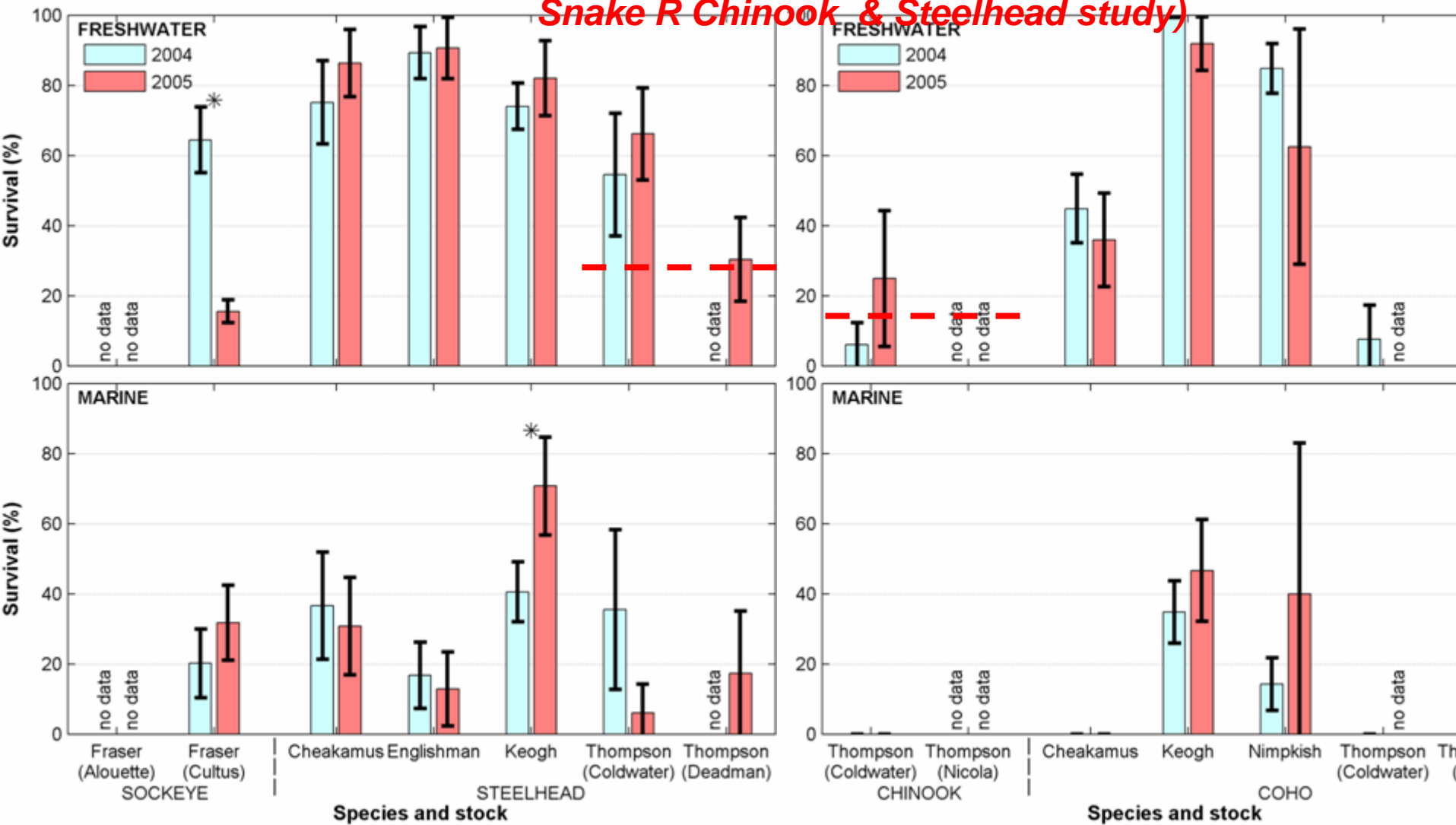


Fraser River
Stocks



BC Salmon Freshwater & Marine Survival–Error Bars (2 SE)

(Carl Schreck's 2003-04 Snake R Chinook & Steelhead study)





Snake River Spring Chinook, 2005

(Dworshak/Kooskia Hatchery)

- ✓ 198 Snake R chinook surgically implanted at Kooskia Hatchery, May 2005
- ✓ No compatible array at mouth of Columbia River this year
- ✓ Partial listening line at Cape Elisabeth/Greys Harbor
- ✓ Multiple listening lines further north



Snake River Spring Chinook, 2005

- Animation

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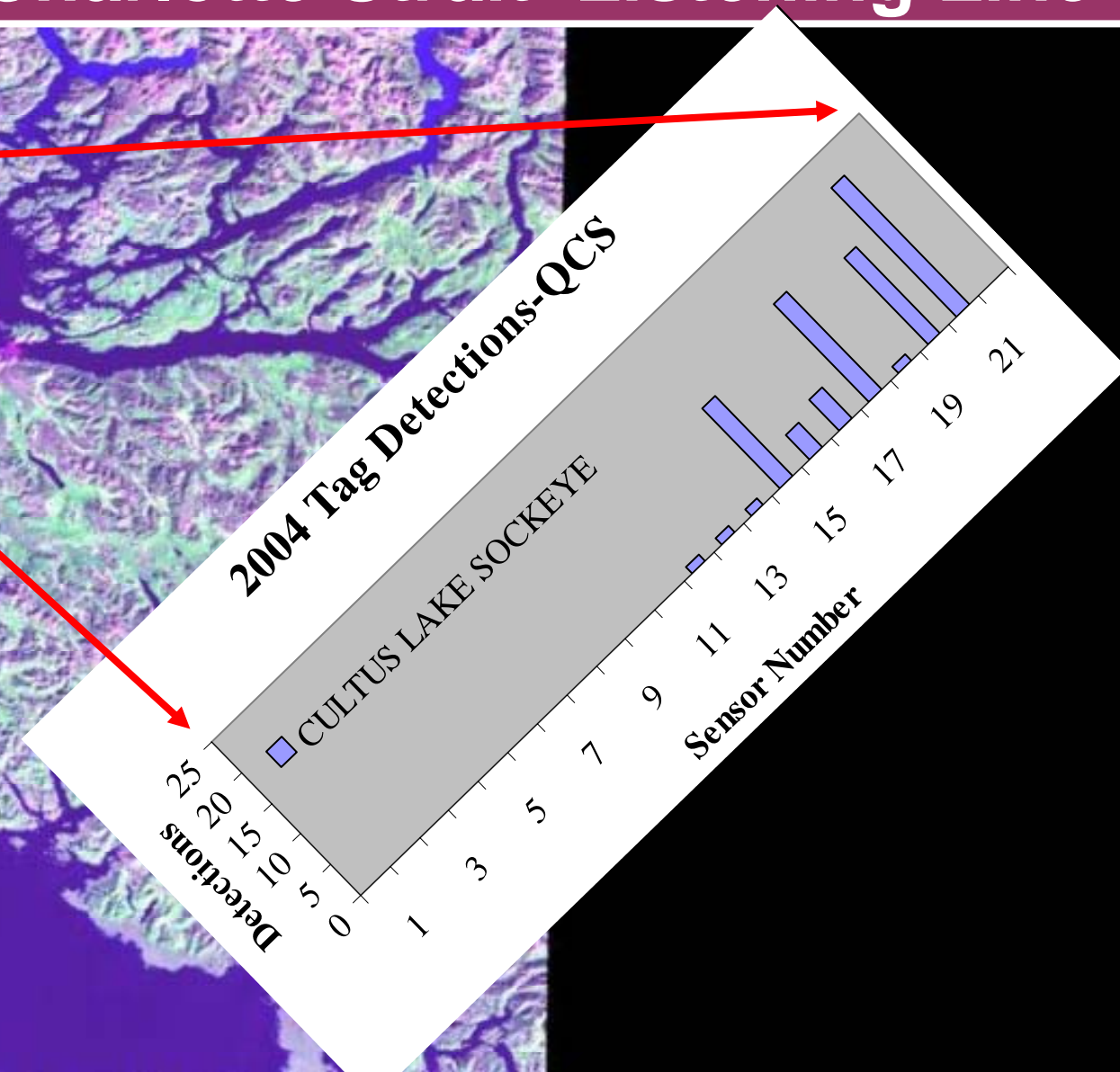


Snake River Spring Chinook, 2005

- Results

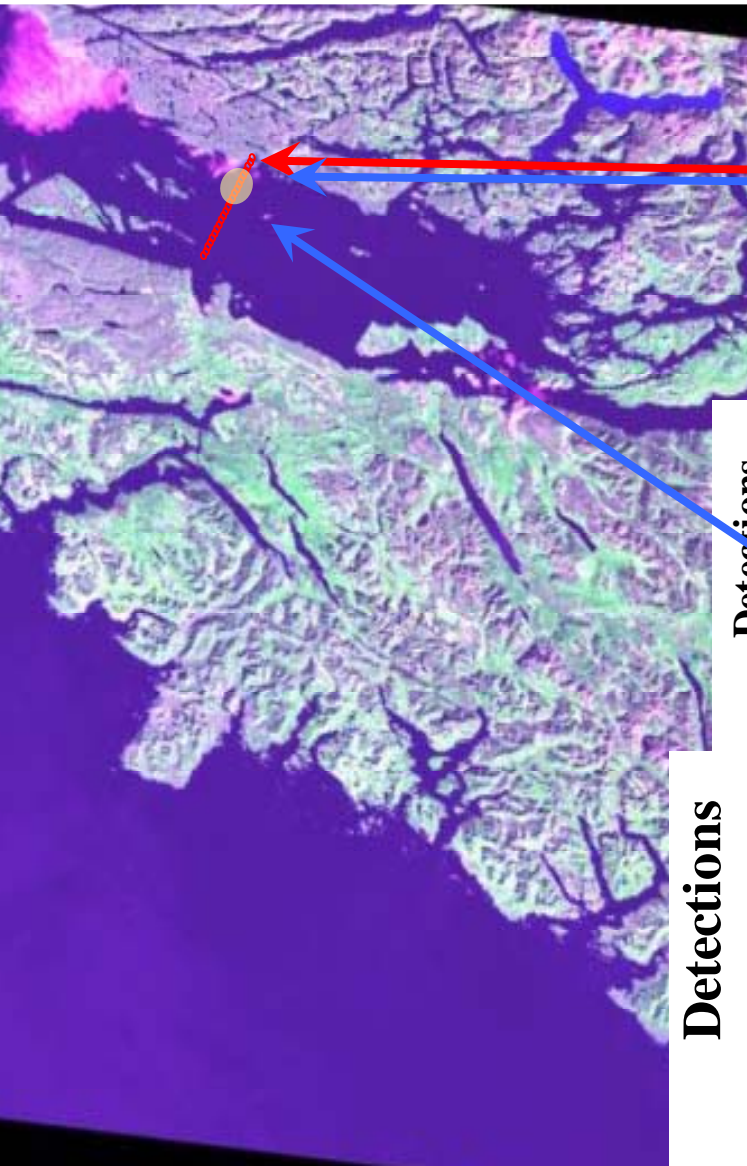
- POST tagged Snake River smolts migrated north at 20-25 kms/day (about 2 body lengths a second)
- Detected on shelf as far offshore as we had equipment
- Survival from Bonneville to N Vancouver Island was probably 15% (1 in 7 fish)
- Survival to adult return from 1977-98 was ~0.5%
- This suggests that only 1 in 30 Snake R chinook reaching Vancouver Island will survive to return

2. Differences in Migration Routes- Queen Charlotte Strait Listening Line

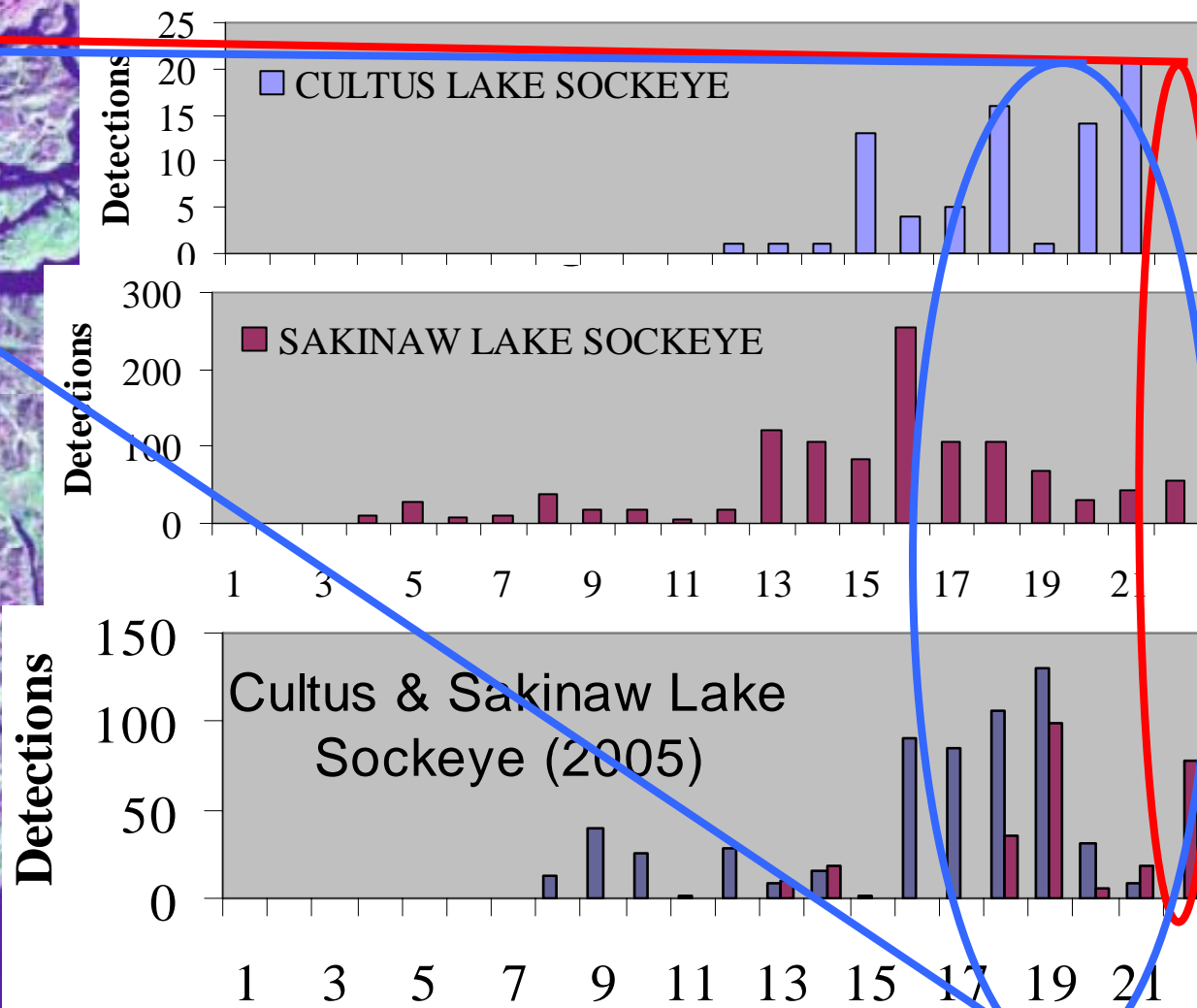




2. Differences in Migration Routes- Queen Charlotte Strait Listening Line

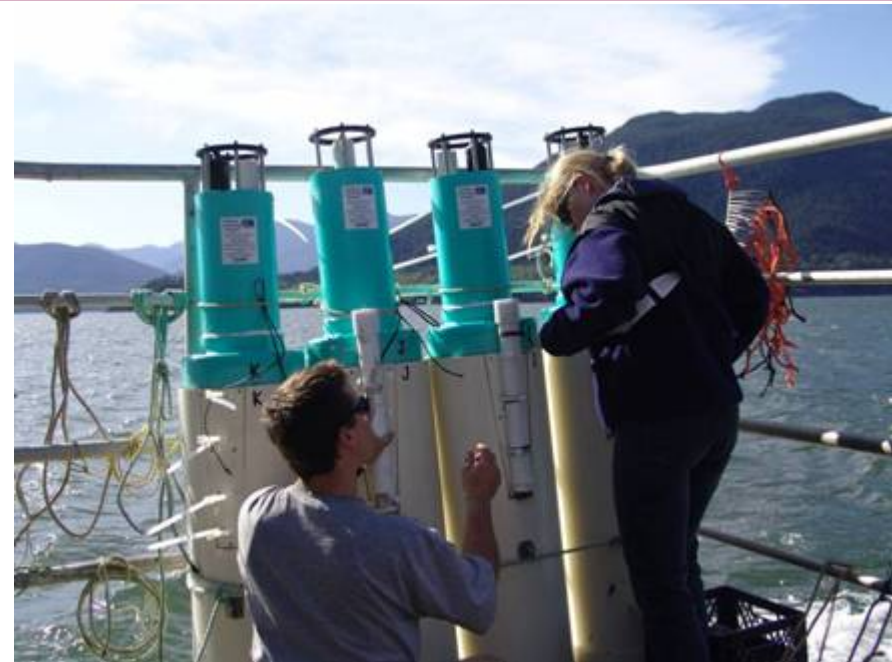


2004 Tag Detections-QCS





Where POST is Going: Final Testing of Modem-Equipped Sub-Array





Where POST is Going:

Current Testing Phase: Rivers

Satellite-Linked Acoustic Sensors

Above water antennae allows tagged smolts to email their departure times (and survival!)

Ability to measure survival out of large rivers

Two beta-test units deployed in the mouth of the Fraser River

Antennae and surface floats for marine component of array is unrealistic





Where POST is Going:

Longer-Term Plans

✓ In the Near Term:

Modem-Equipped Tracking Sensors

- Provide 5-7 Yr Projected Lifespan
- Ability to provide year-round fish
 - ◆ Survival data
 - ◆ Migration pathways
 - ◆ Timing of migrations
 - ◆ Accurate return forecasts?

✓ In the Long-Term:

Modem-Equipped Ocean Observing Systems Provide:

- ◆ Fish Tracking Sensor
- ◆ Temp, Salinity, Currents
- ◆ Fish, plankton abundance...
- ◆ *... And how they determine Columbia salmon survival???*





POST's Findings:

- I. The ocean migration behaviour of different salmon species is not the same**
- II. There are differences in migration pathways (speed, route, distribution) of different populations of the same species**
- III. There may even differences between hatchery & wild fish from the same genetic stock**



A Personal Perspective on Freshwater & Ocean Studies on Salmon

- Columbia R in-river survival “seem” reasonable (to me)
- Adult chinook returns from the ocean are unreasonable (~0.5% vs the 2-4% needed)
- These differences are evident in BC as well
- We need to understand ocean survival so we can determine what freshwater changes are important- and can be manipulated successfully
- POST can inform that process



Where POST is Going:

Summary

A permanent tracking system for salmon and other marine animals is now feasible

- For young salmon, 4 mo~2 year tags are feasible*
- For larger animals, tags can have 10-20 yr lifespans*
- A complete census of fish (salmon & sturgeon) moving in & out of large rivers is now feasible*
- A wide range of other ocean sensors can be supported off this observation system.*
- Ocean survival can now be measured directly*

Where is POST Going?

