Recovery of Wild Coho Salmon in Salmon River

2009 Annual Report

OWEB Project 208-803

Investigators:

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Research Support:

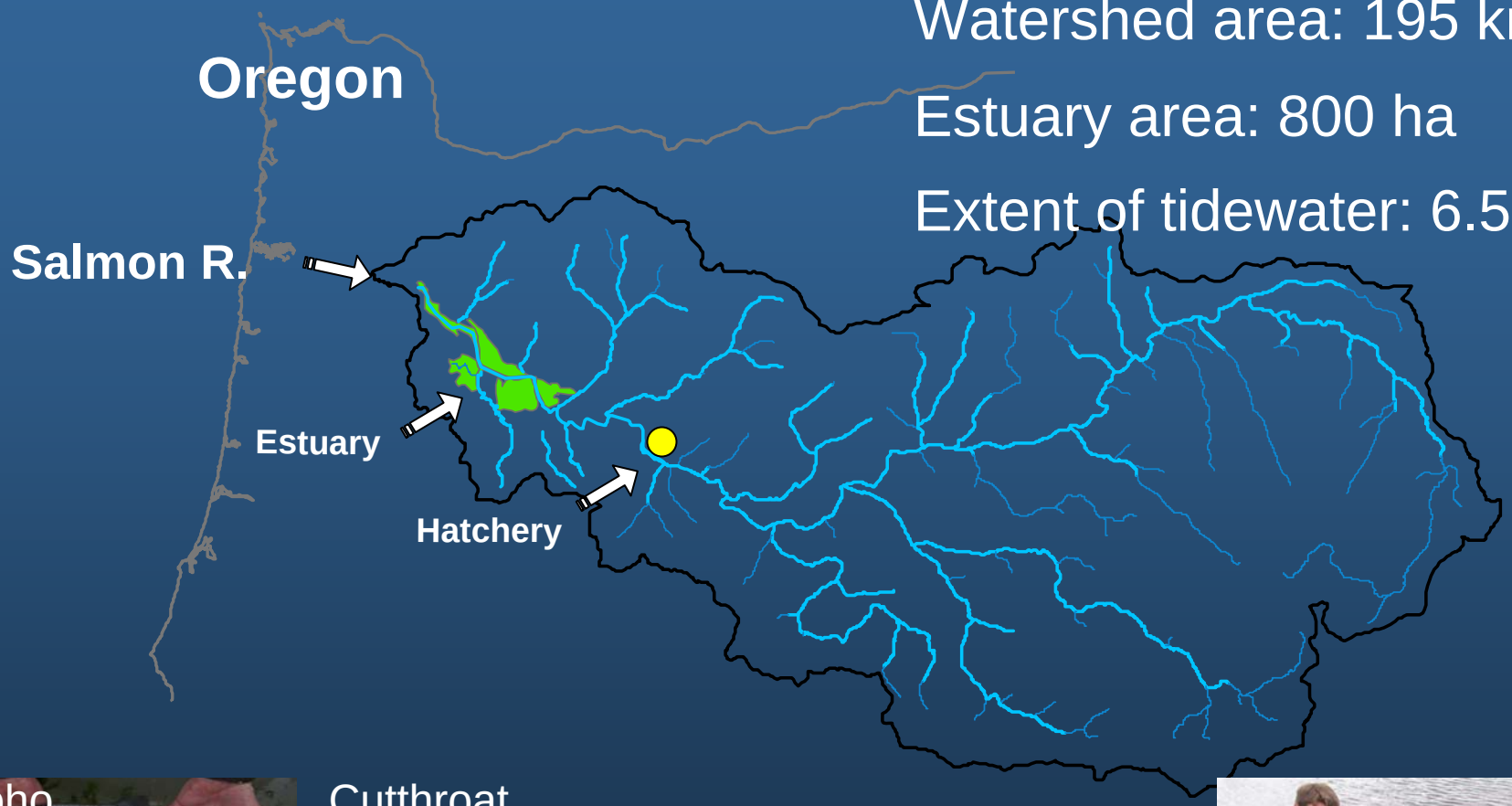
OR Watershed Enhancement Board
OR Dept Fish & Wildlife
NOAA Fisheries

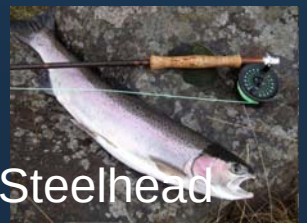
Salmon River Watershed and Estuary

Watershed area: 195 km^2

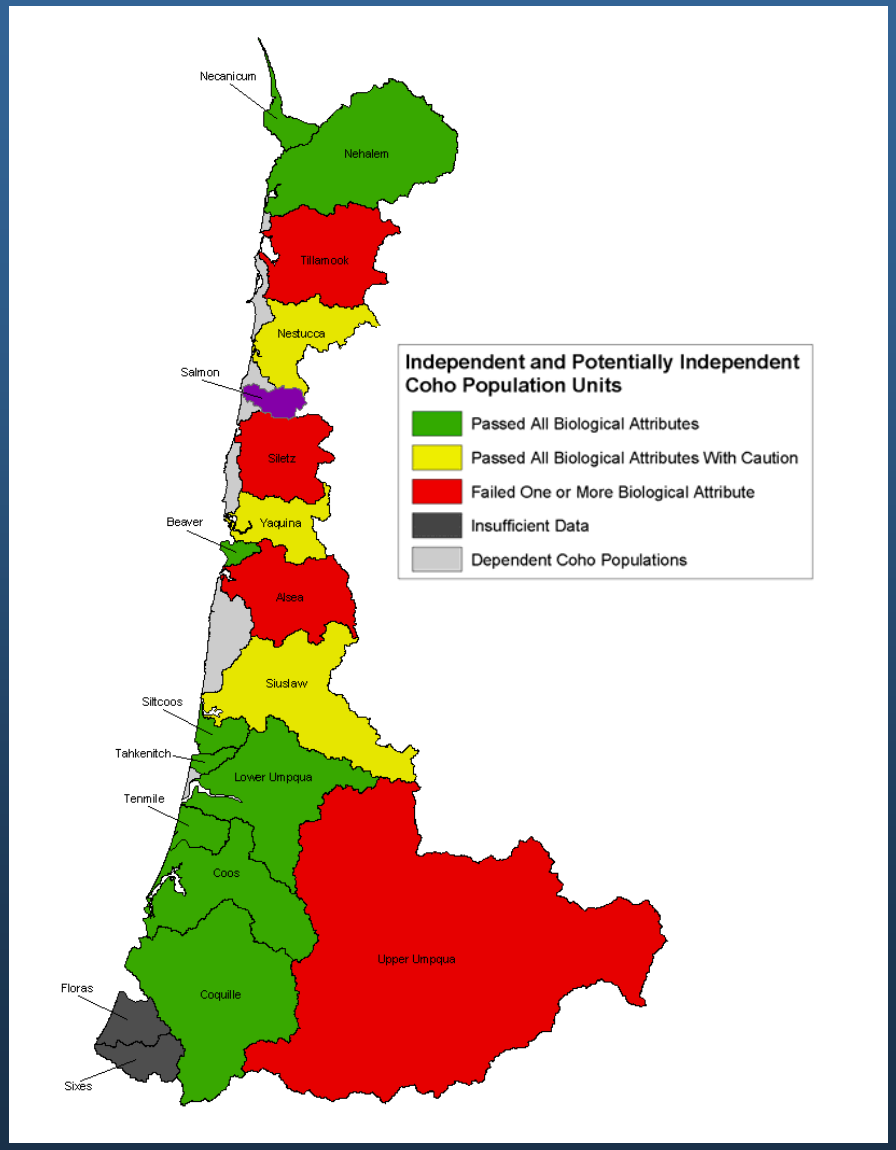
Estuary area: 800 ha

Extent of tidewater: 6.5 km





Assessment of Coho Populations in the Coastal ESU



Viability Measures

- Abundance
- Distribution
- Productivity
- Diversity
- Persistence
- Habitat

Limiting Factors

- Hatchery influence
- Stream complexity

Background of Coho Research

Coho salmon population in Salmon River failed the viability standards in the Coastal Coho assessment

Management actions

(Coastal Coho Conservation Plan 2006)

- Remove hatchery coho from system
  - Last smolt release spring 2007
- Recover additional tidal-freshwater wetlands
  - USFS & OWEB sponsored restoration
- Restore freshwater habitat

Research Goal

Determine the response of coho salmon to the cessation of hatchery influence and the restoration of wetland habitats.

Hypotheses:

- Naturally produced coho will contribute to the adult population and increase in abundance and resilience
- Coho salmon will exhibit a diversity of juvenile life histories that reflect the variety of alternative rearing opportunities throughout a river basin
- Estuarine habitats (natural and restored) will provide rearing habitat for coho salmon

Objectives

1. Quantify viability after hatchery coho salmon are removed from Salmon River through 2 generations of wild fish.

2. Describe the diversity of juvenile and adult life histories of coho salmon and estimate the relative contributions of alternate juvenile life history to adult returns.

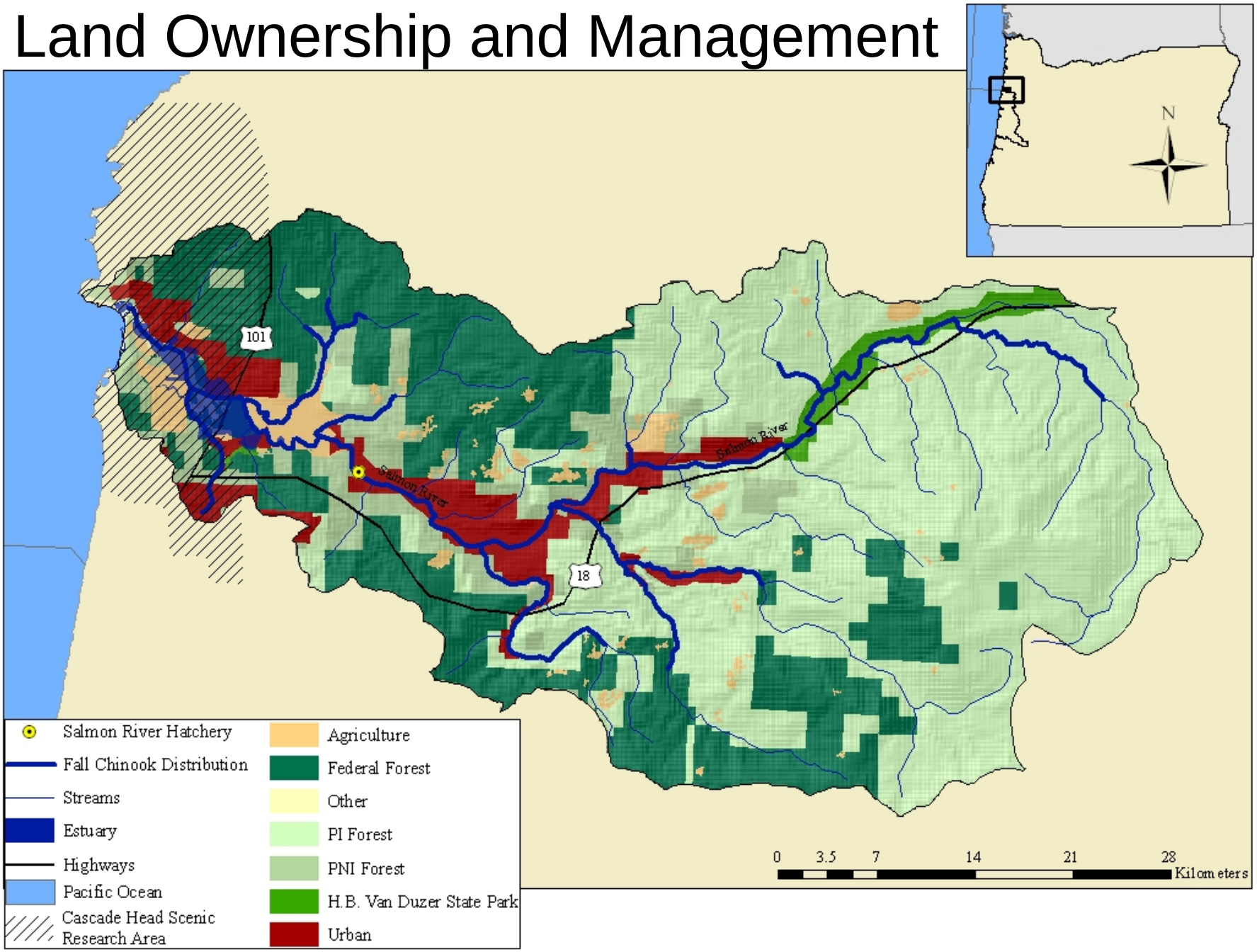
Tasks

1. Estimate abundance & distribution at each life stage – adult, juvenile, & smolt

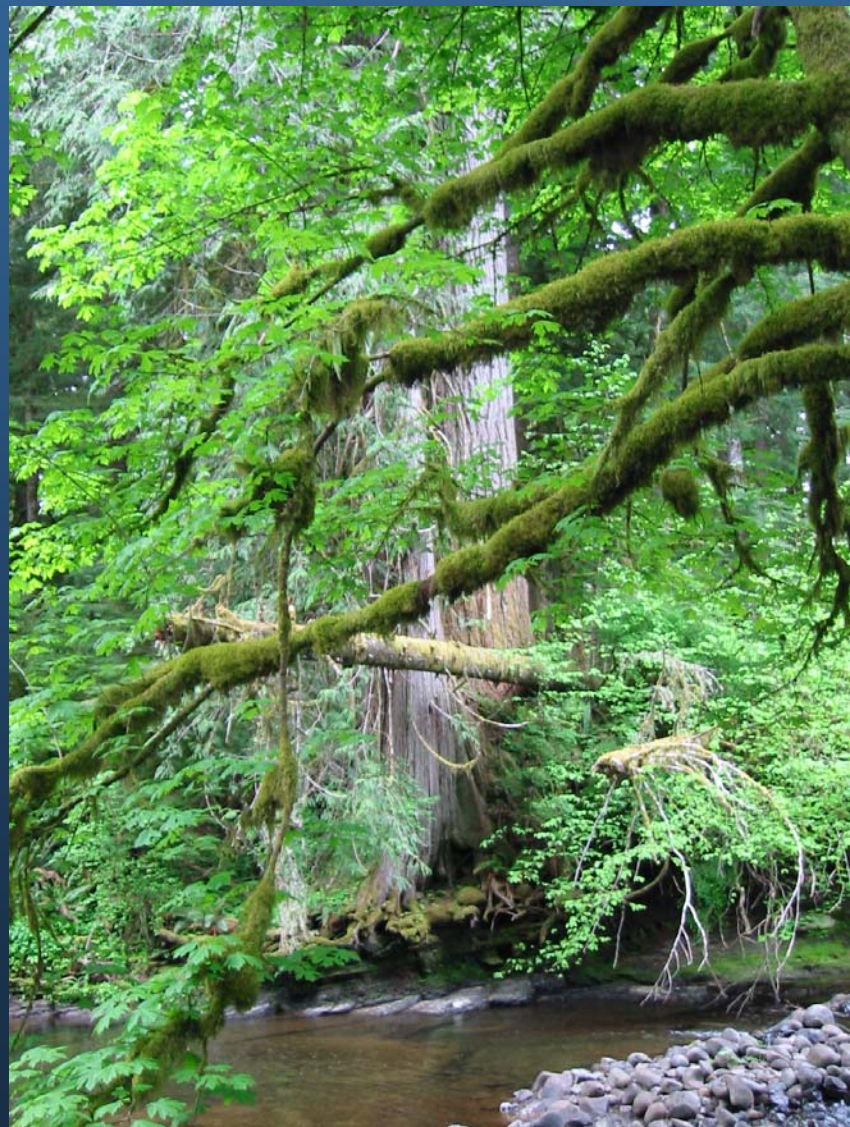
2. Describe size, growth, migration time, & age at return

3. Describe use of estuarine habitats (natural and restored)

Land Ownership and Management



Freshwater habitat



Salmon River Estuary

Recovery of natural tidal and ecological functions of the system

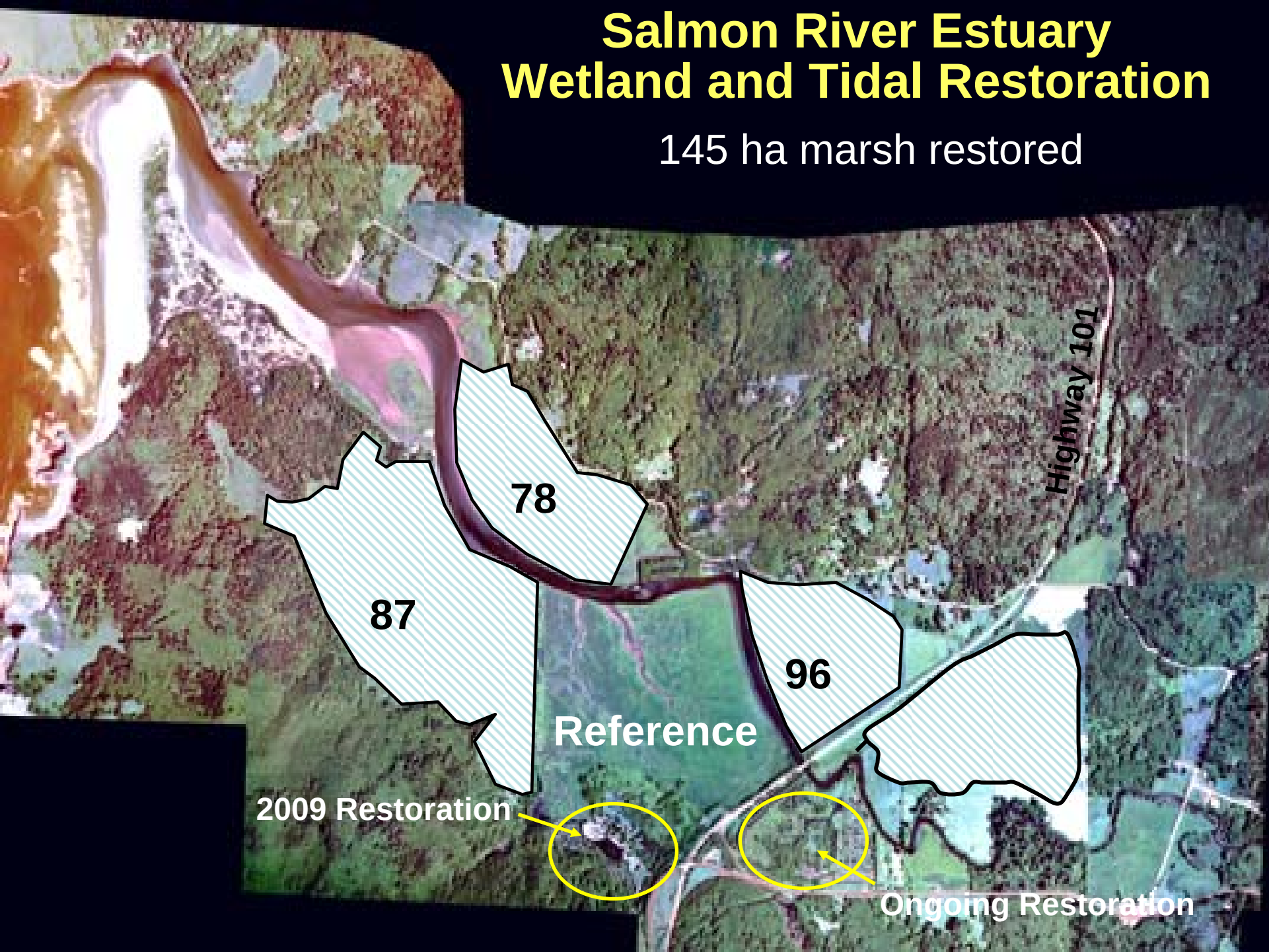
Pre-diking

Diked

Restored

Salmon River Estuary Wetland and Tidal Restoration

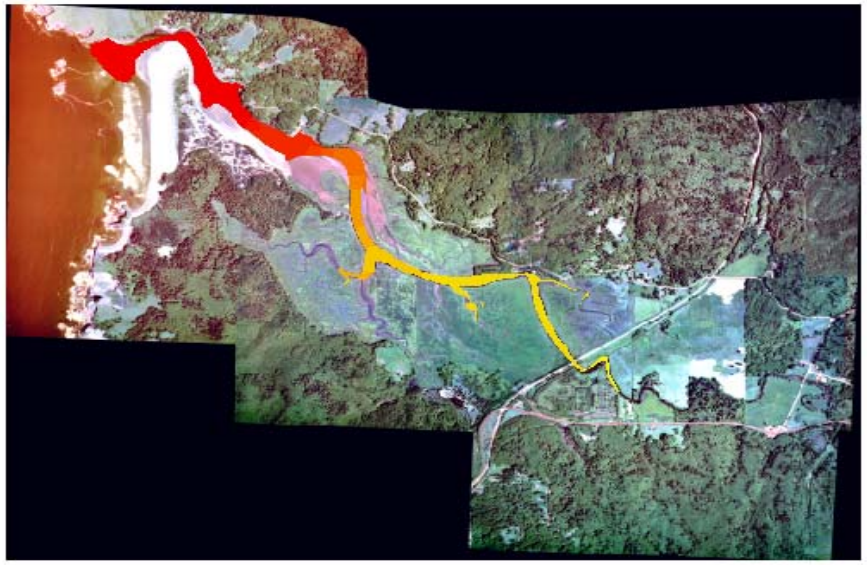
145 ha marsh restored



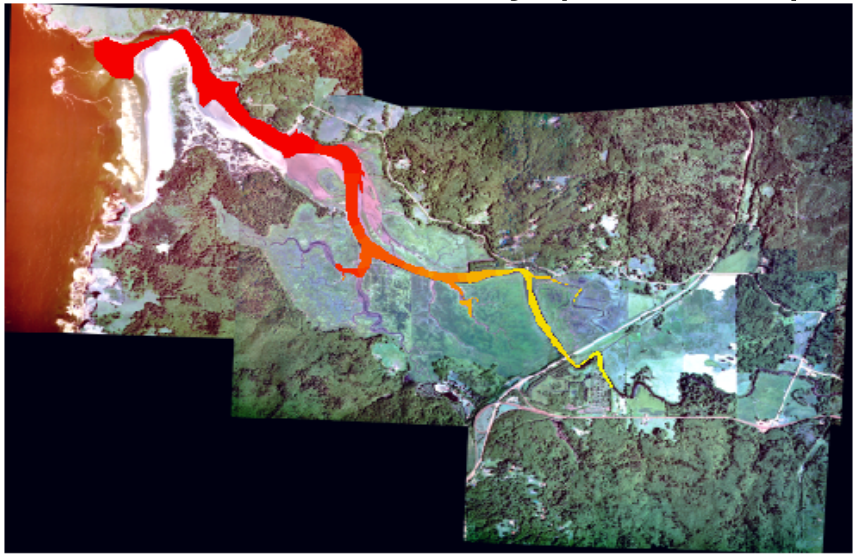
Estuarine habitat

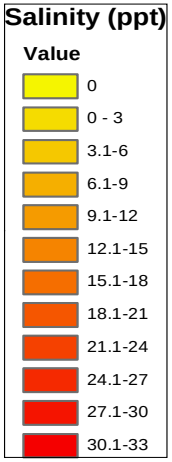
Spring High Tide Salinity

Surface Salinity



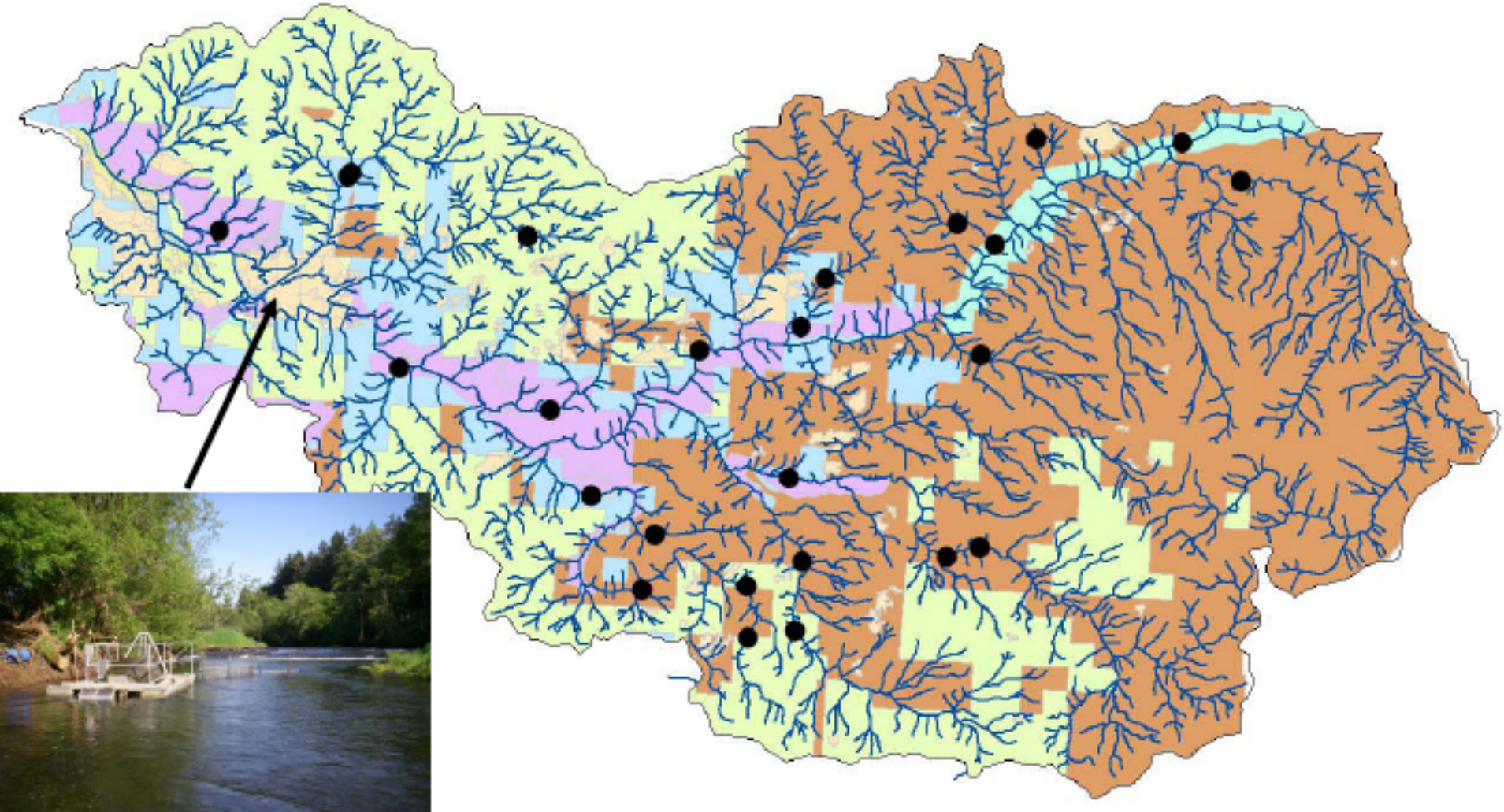
Below Surface Salinity (>0.5m depth)



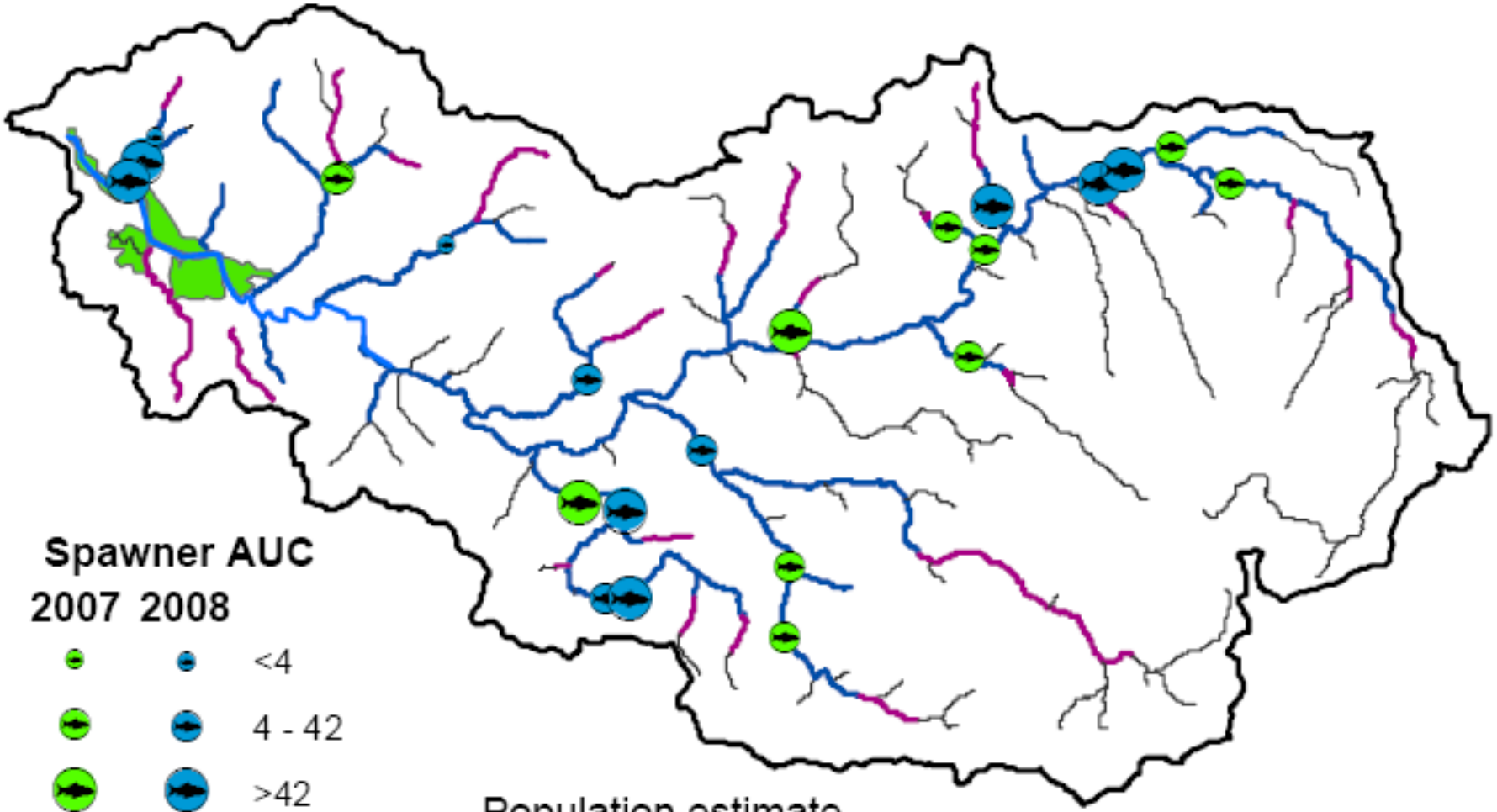


Estimate abundance & distribution at each life stage

- Randomly selected, spatially balanced sites
- Screw trap in lower river



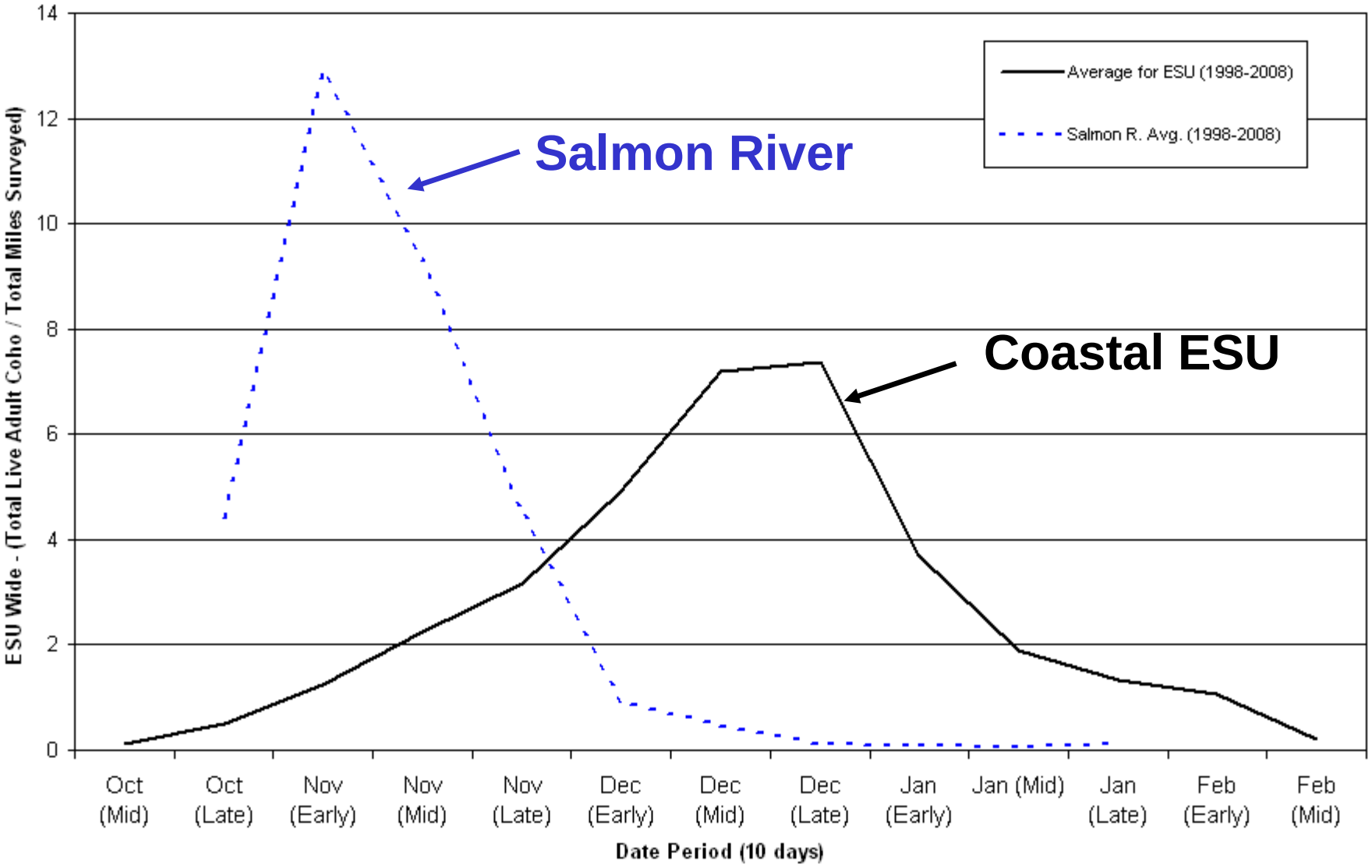
Adult Coho Salmon



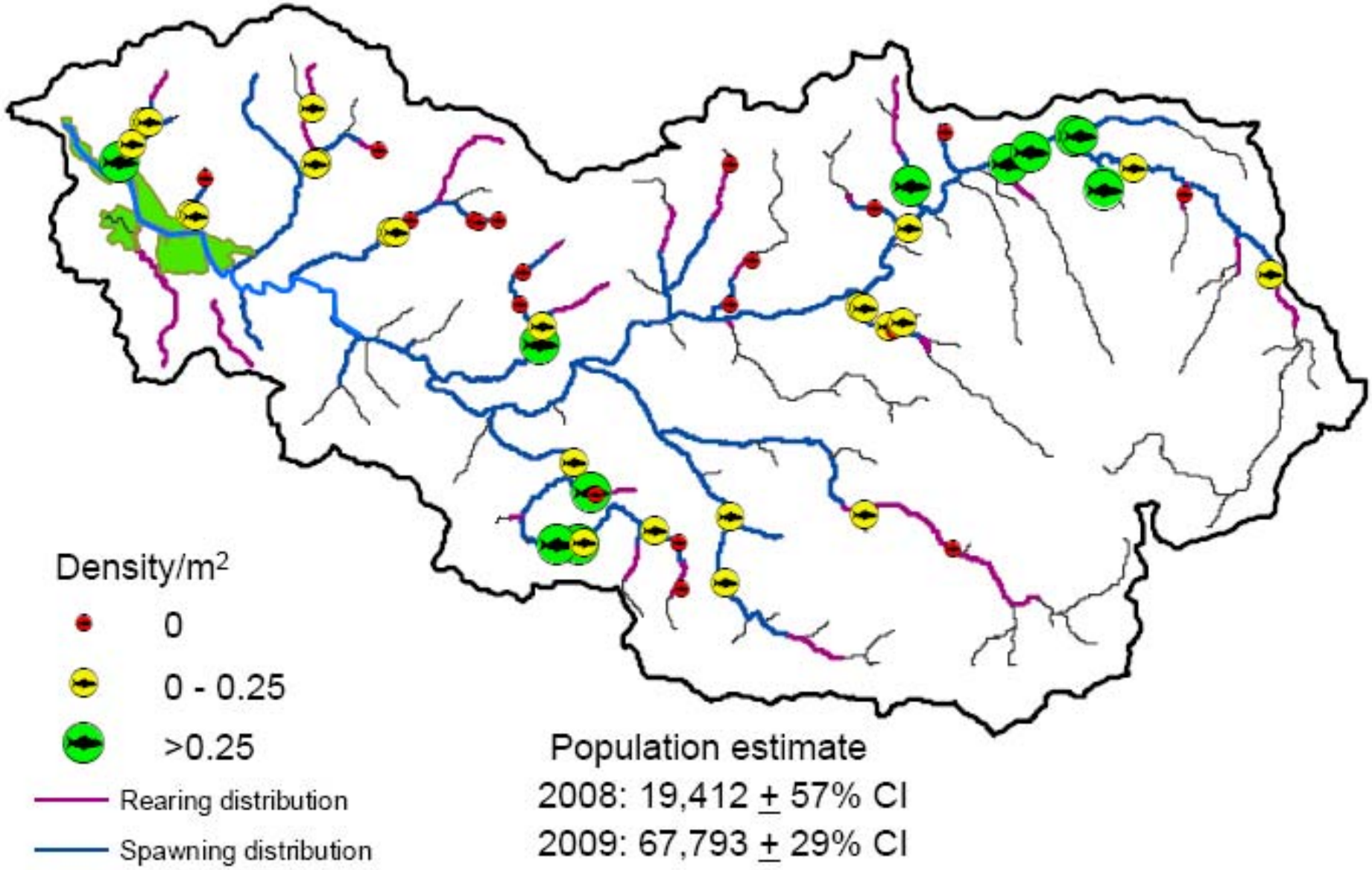
Population estimate
2007: 993 (~5% wild)
2008: 3853 (~20% wild)

Oregon Coast Coho ESU

Timing of Fish on Spawning Grounds

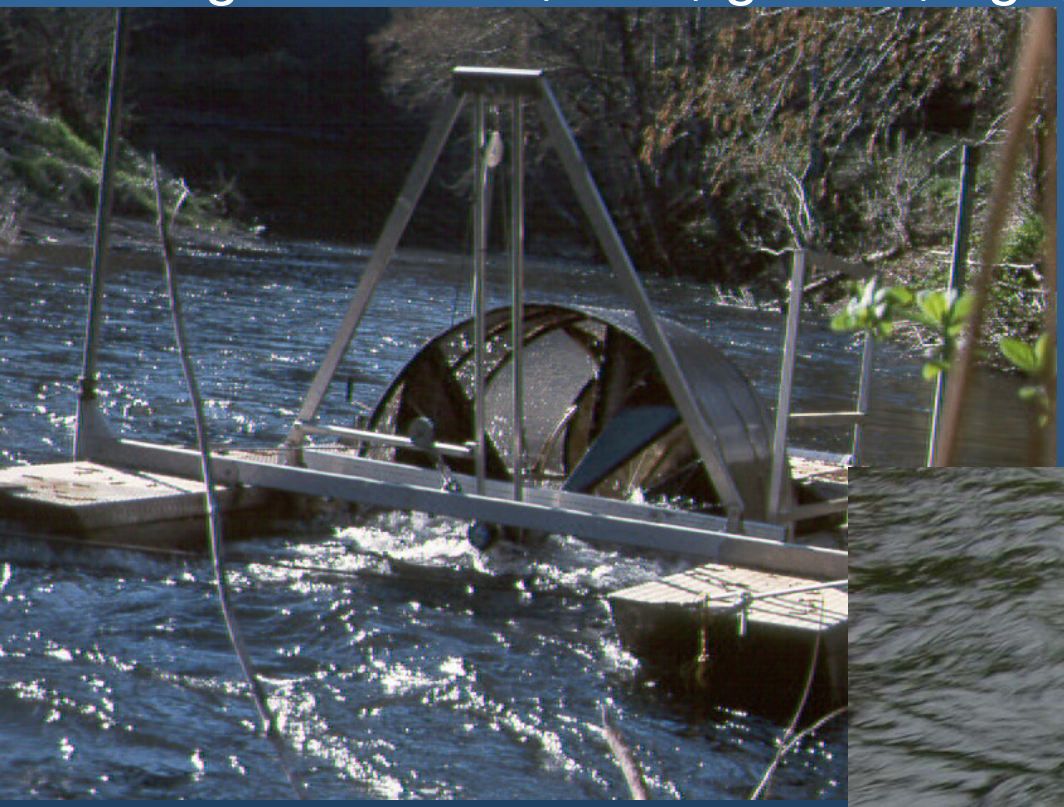


Juvenile Coho Salmon



Describe Life history diversity

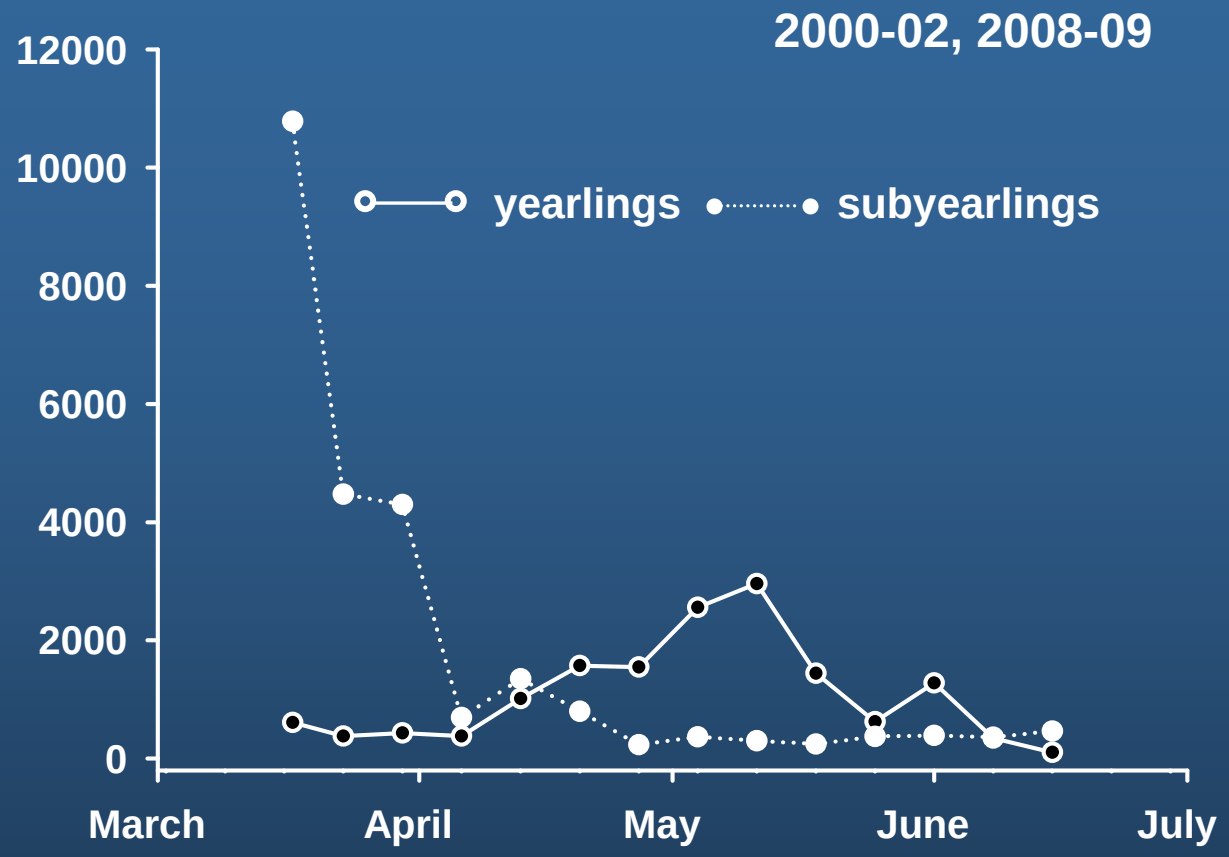
- migration time, size, growth, age, habitat use in freshwater



Screw Trap in Lower River

Operated late March - June

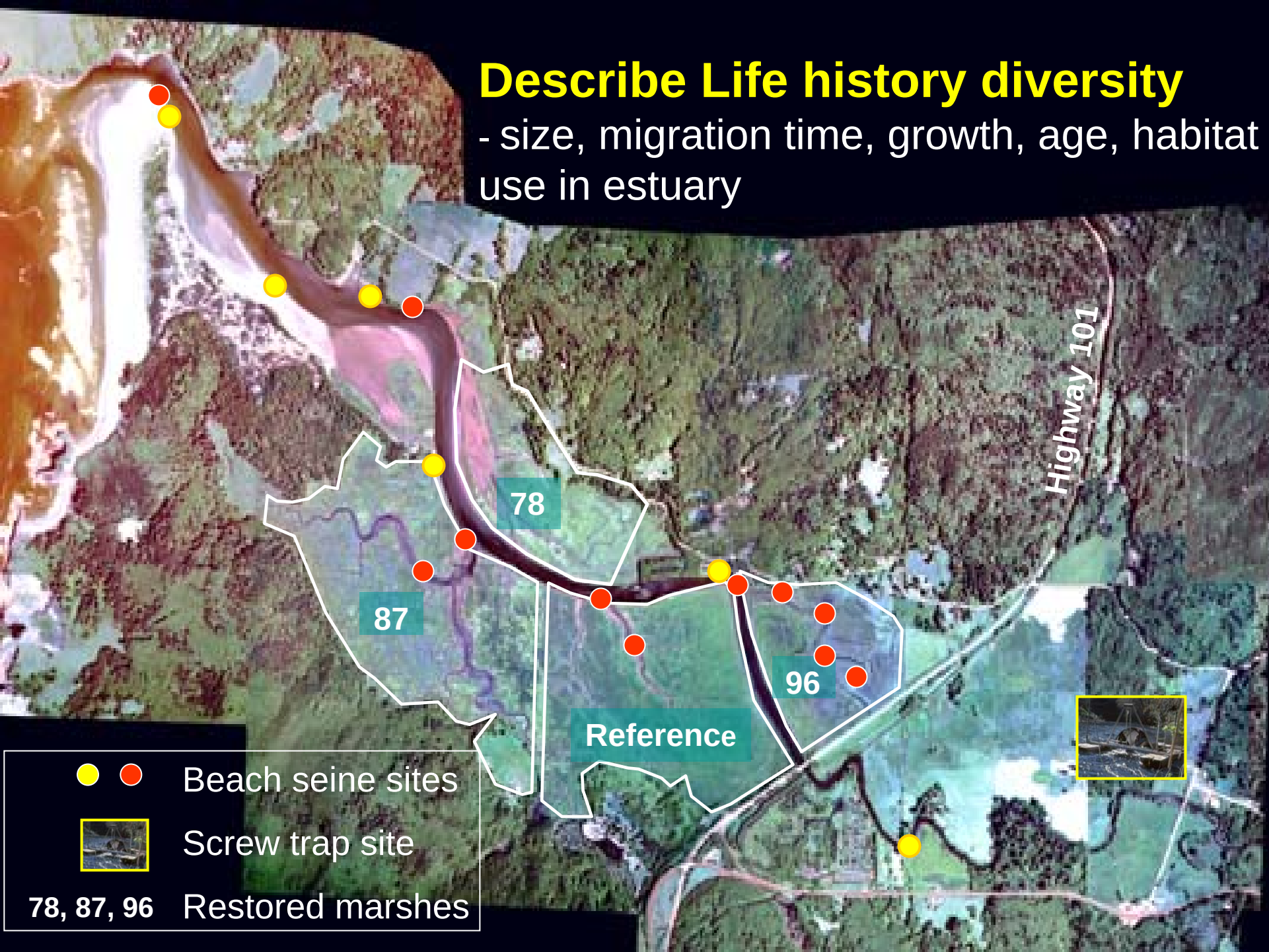
Out-migration from Salmon River



Year	Subyearlings	Yearlings
2000	979	8,268
2001	11,621	6,982
2002	5,367	16,387
2008	55,201	25,806
2009	42,032	18,361

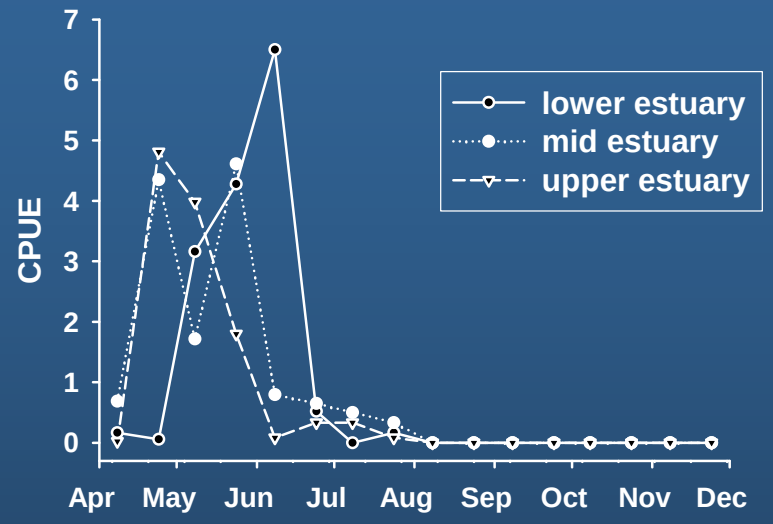
Describe Life history diversity

- size, migration time, growth, age, habitat use in estuary

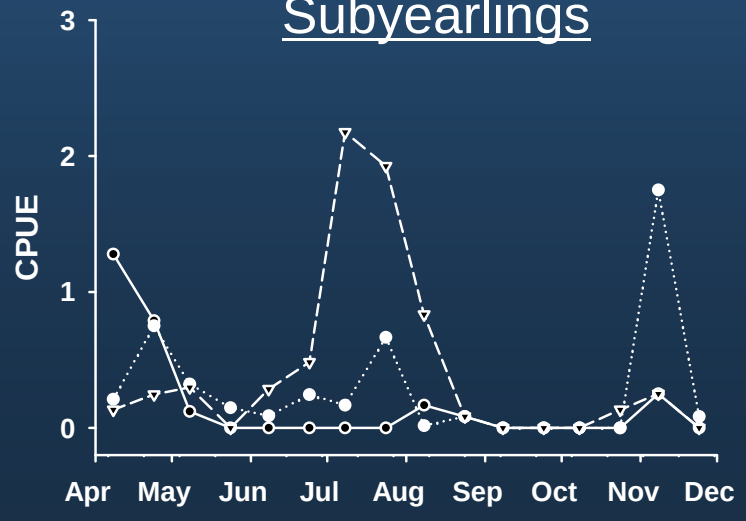


Main channel seine
(1999 – 2002, 2008, 2009)

Yearlings

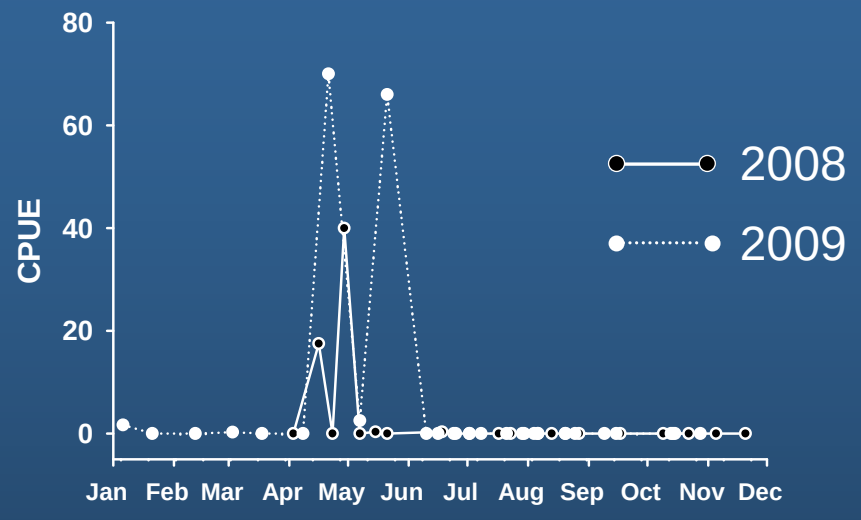


Subyearlings

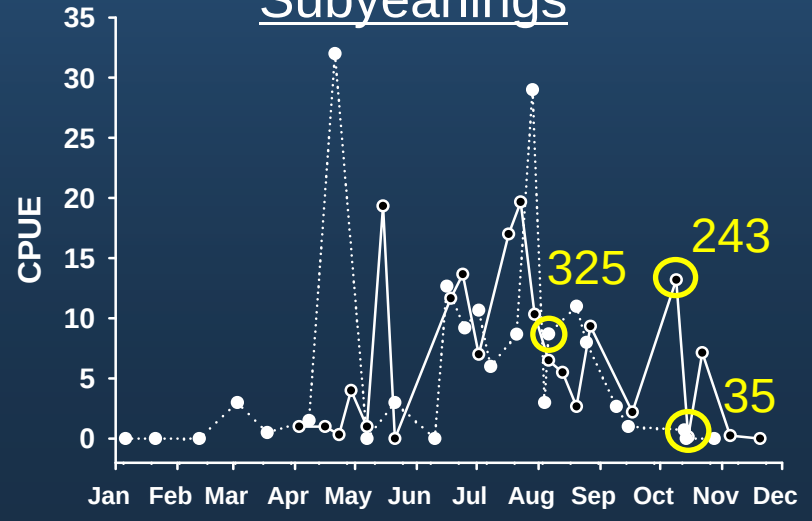


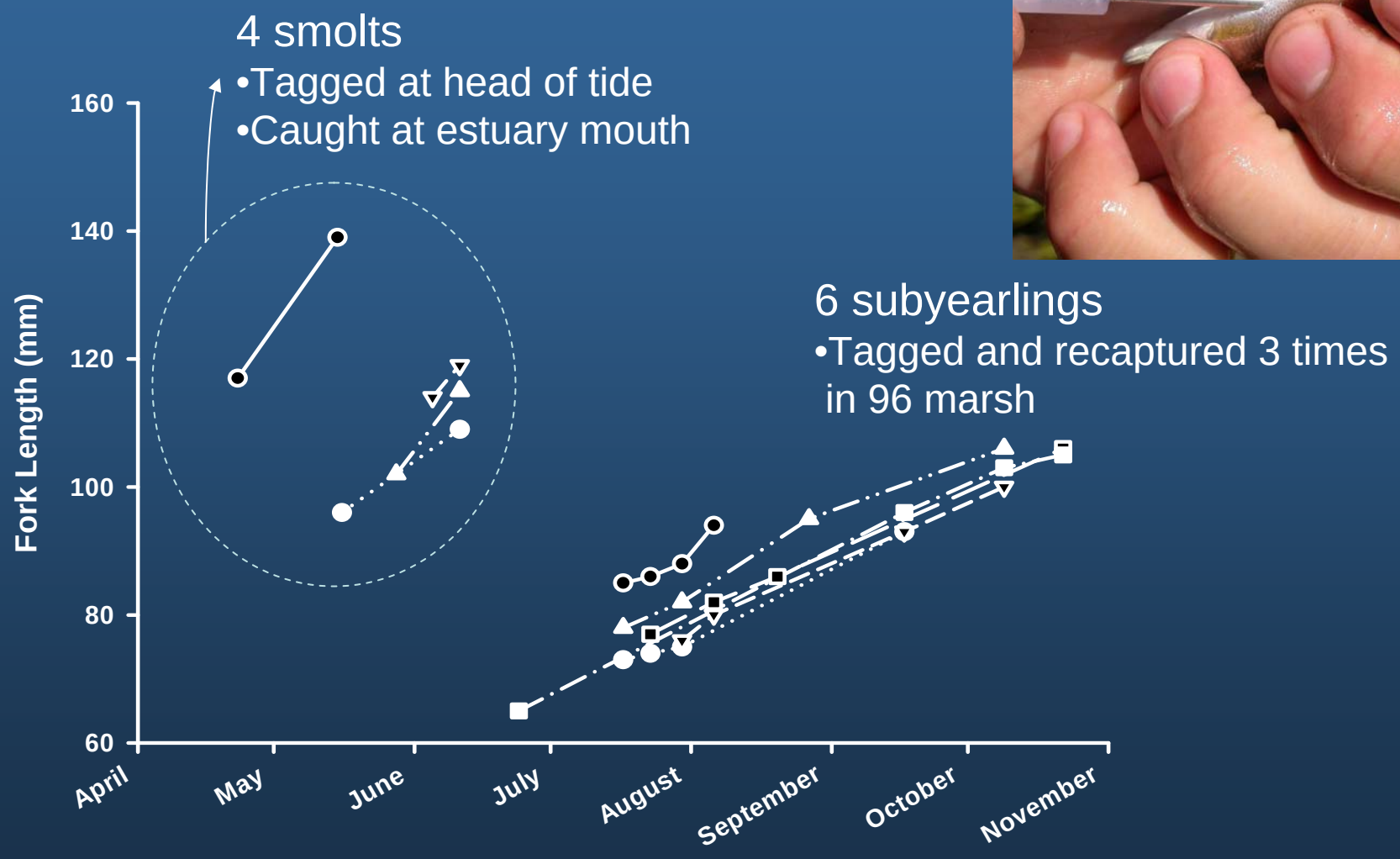
96 marsh seine
(2008,2009)

Yearlings



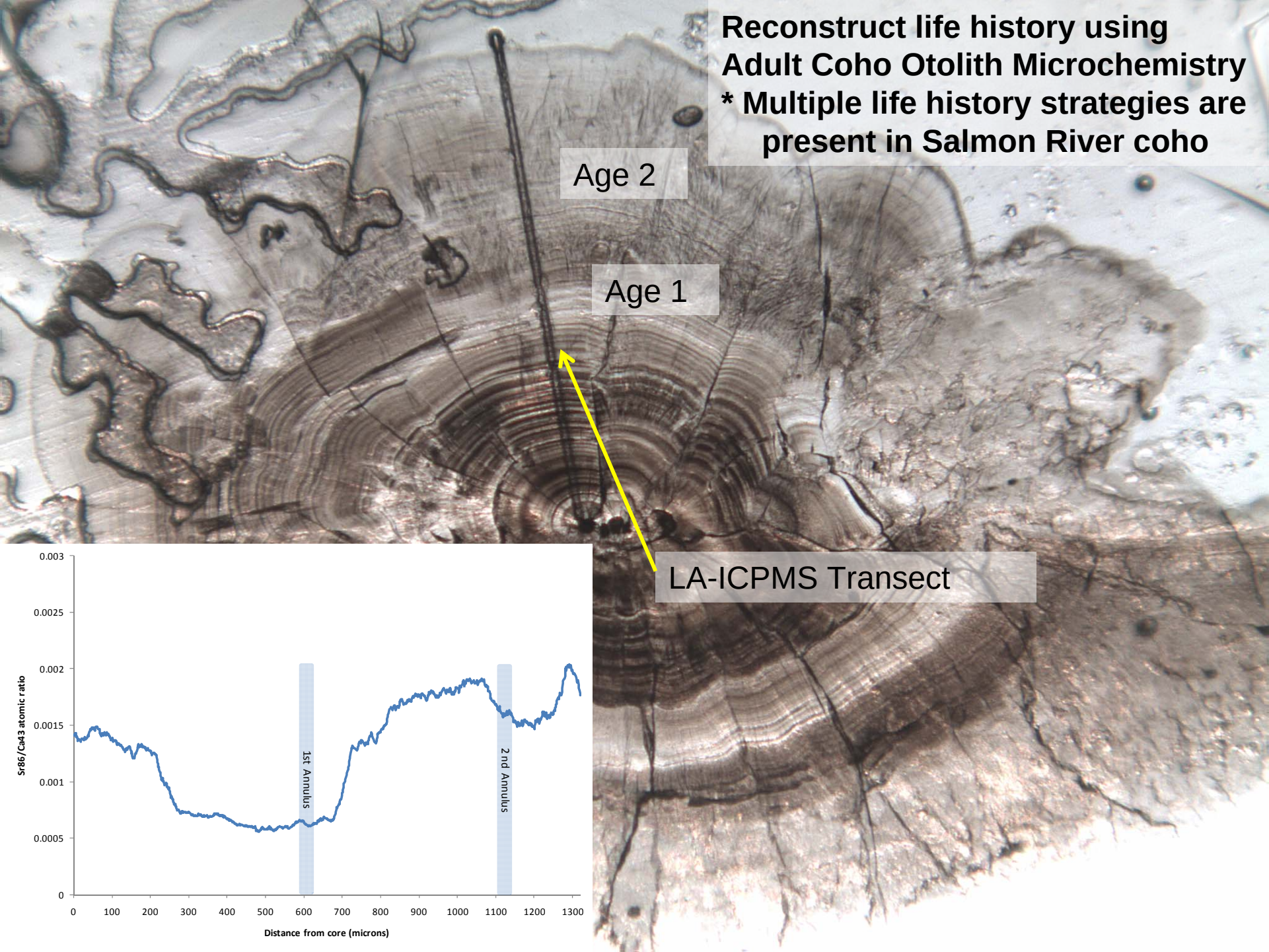
Subyearlings

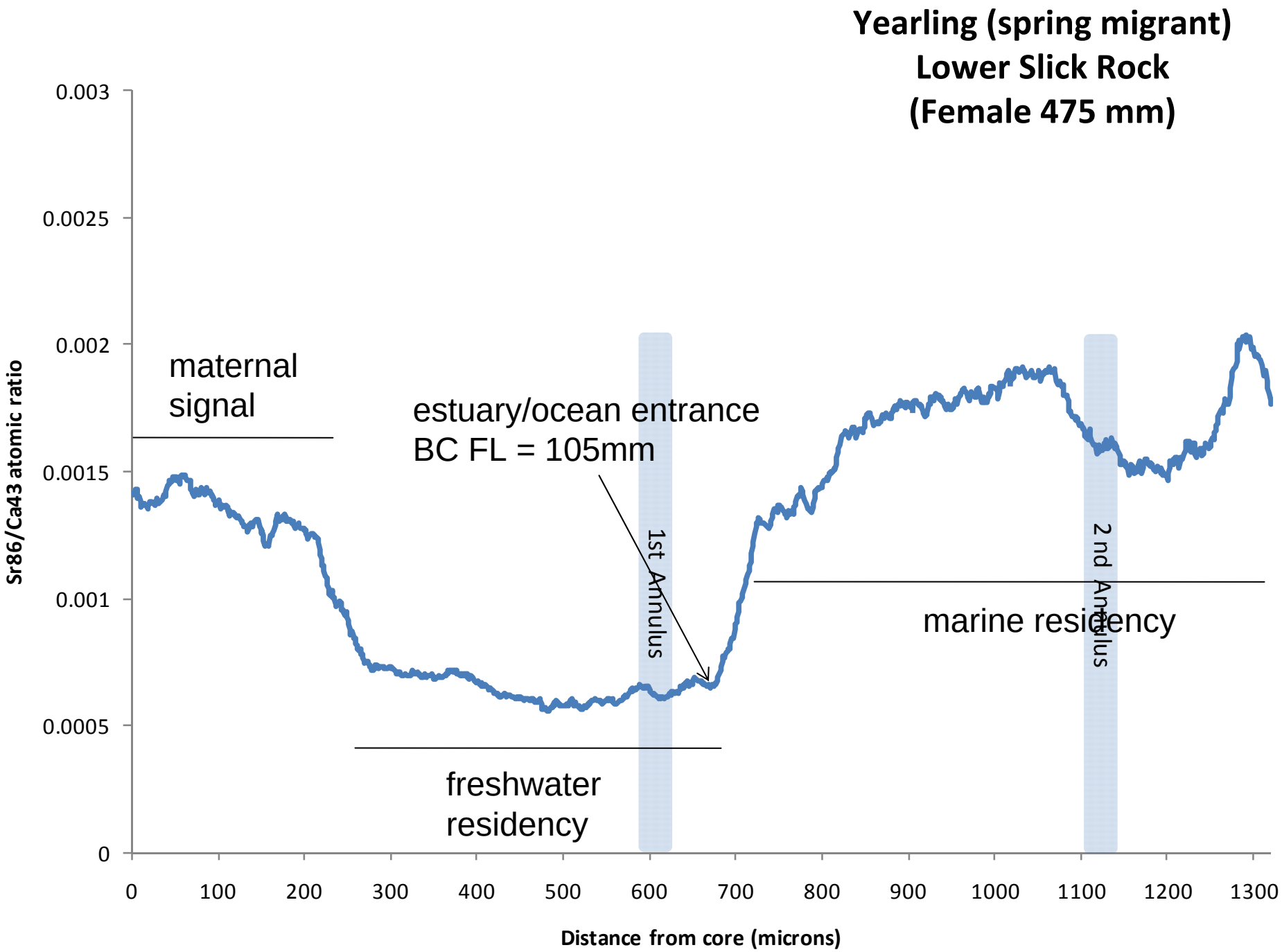


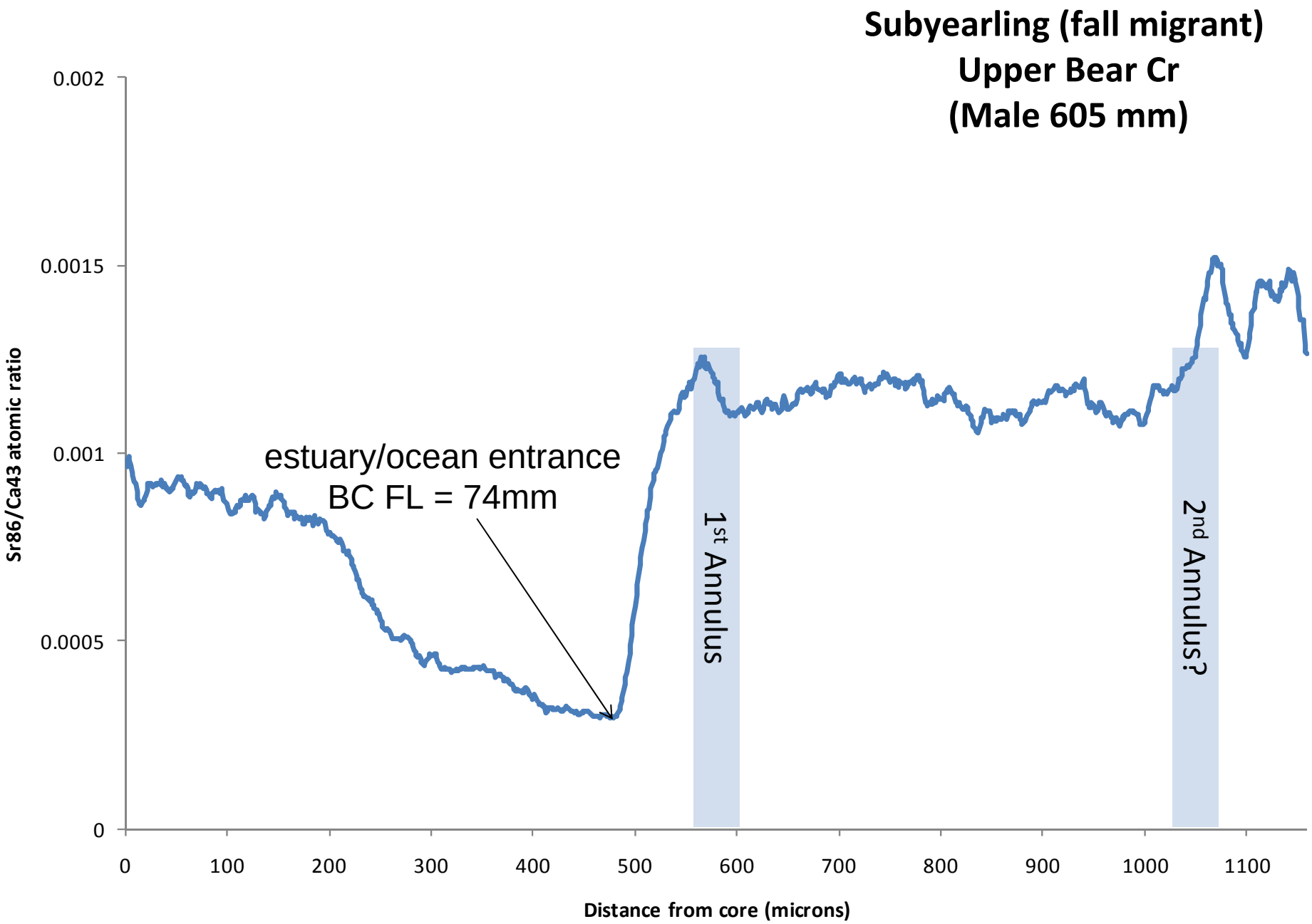

4 smolts
•Tagged at head of tide
•Caught at estuary mouth
6 subyearlings
•Tagged and recaptured 3 times in 96 marsh
Fork Length (mm)
160
140
120
100
80
60
April
May
June
July
August
September
October
November

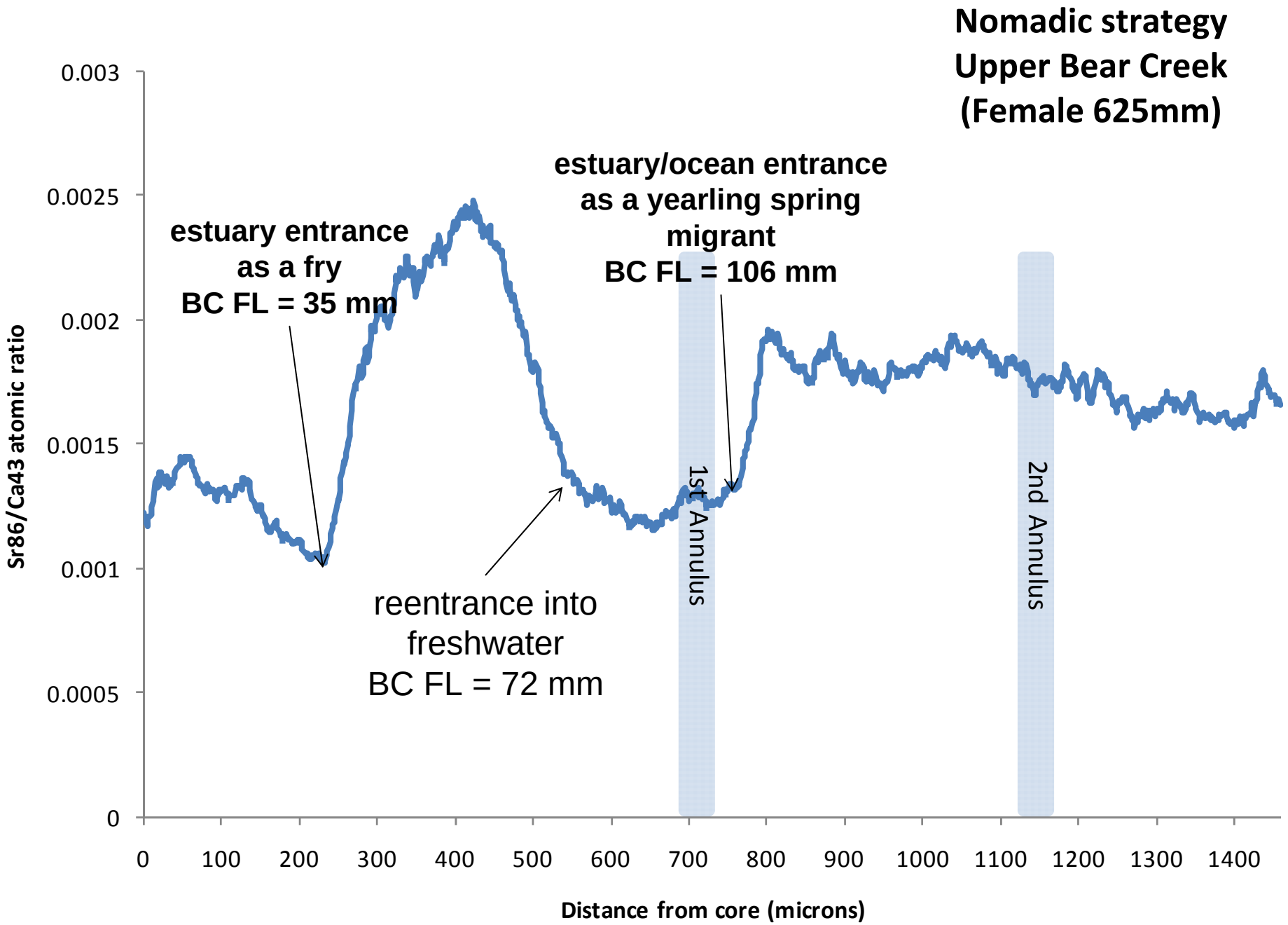
Reconstruct life history using Adult Coho Otolith Microchemistry

*** Multiple life history strategies are present in Salmon River coho**




Yearling (spring migrant)
Lower Slick Rock
(Female 475 mm)
Sr86/Ca43 atomic ratio
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
maternal signal
estuary/ocean entrance
BC FL = 105mm
1st Annulus
2 nd Annulus
marine residency
freshwater residency
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
Distance from core (microns)


Subyearling (fall migrant)
Upper Bear Cr
(Male 605 mm)
Sr86/Ca43 atomic ratio
0.002
0.0015
0.001
0.0005
0
estuary/ocean entrance
BC FL = 74mm
1st Annulus
2nd Annulus?
0
100
200
300
400
500
600
700
800
900
1000
1100
Distance from core (microns)

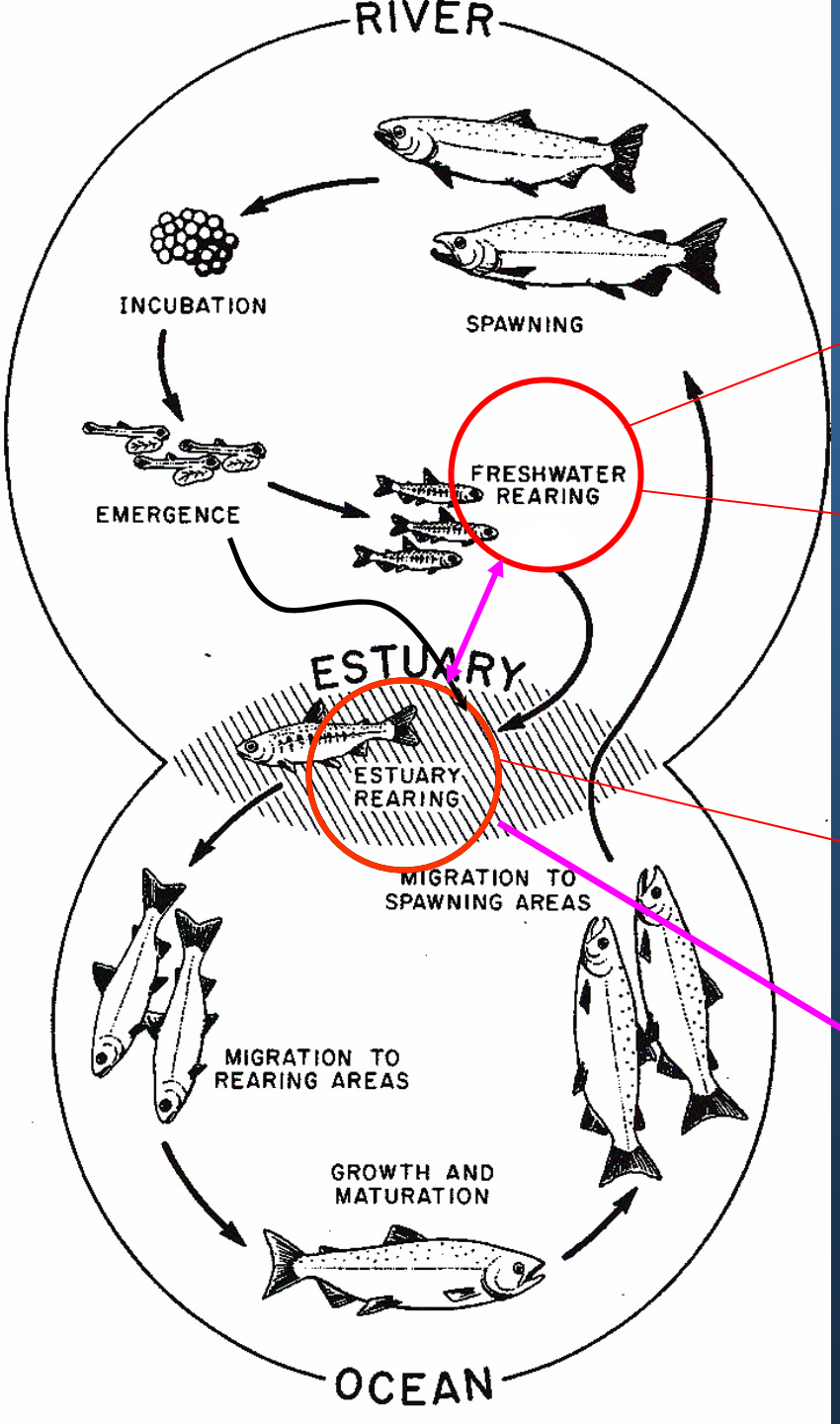

Nomadic strategy
Upper Bear Creek
(Female 625mm)
estuary entrance
as a fry
BC FL = 35 mm
reentrance into
freshwater
BC FL = 72 mm
estuary/ocean entrance
as a yearling spring
migrant
BC FL = 106 mm
1st Annulus
2nd Annulus
Sr86/Ca43 atomic ratio
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
Distance from core (microns)

Age Class Composition and Survival of Wild Coho Salmon in the Salmon River

Spawning Season	Total* H & W	SS+1 migrants	SS+2 migrants	SS+3 Adults (3)	Brood Year	Survival (%) (Wild)	SS+2 Adults (%)
1998	432			192			
1999	173			124			17.8
2000	394	979	8268	32			3.1
2001	877	11621	6982	97	1998	1.2	6.2
2002	1572	5367	16387	372	1999	5.3	1.0
2003	2133		na	0	2000	0.0	4.3
2004	5094			2374	2001		2.0
2005	817			79	2002		na
2006	1160			513	2003		na
2007	993	na		59	2004		na
2008	3853	55201	25806	784	2005		0.0
2009	na	42032	18361	na	2006		

* good estimates starting in 2007

Salmon River Coho



- Subyearling migrants
- **Yearling migrants**
- Subyearling migrants
- Yearling migrants

Conclusions

1) Naturally produced coho will contribute to the adult population, and lead to recovery

- **Majority of spawning adult coho were of hatchery origin in 2007 and 2008, similar to previous years**
- **Smolt to adult survival was low**
- **Spawning timing was early compared to other populations**
- **Starting in 2009, all returning adult coho will be from natural spawn origin**

2) Diversity of juvenile life histories reflect the variety of alternative rearing opportunities throughout a river basin

- **Juvenile distribution was patchy and density was low in streams**
- **Egg to parr survival was very low**
- **Yearling coho grew quickly in the estuary, spent an average of two weeks before migrating to the ocean**
- **Some of the subyearlings stayed in the upper wetland over the summer, some moved into the estuary in fall**
- **Four life histories were observed; relative contributions to adults unknown**

Additional thanks to:

Bob Mullen, retired ODFW

Oregon Sea Grant

Salmon River Hatchery

Miami Corporation

ODFW Spawning Survey and Life Cycle Projects

Papers related to Salmon River coho and chinook published in 2009

Hering, D. K., D. L. Bottom, E. F. Prentice, K. K. Jones, and I. A. Fleming. 2010. Tidal movements and residency of subyearling Chinook salmon (*Oncorhynchus tshawytscha*) in an Oregon salt marsh channel. Canadian Journal of Fisheries and Aquatic Sciences 67: 524–533.

Hering, D. K. 2010. Growth, Residence, and Movement of Juvenile Chinook Salmon within Restored and Reference Estuarine Marsh Channels in Salmon River, Oregon. Oregon State University, MS Thesis, Corvallis.

Jones, K. K., T. J. Cornwell, D. L. Bottom, D. K. Hering, and S. Stein. 2009. Recovery of Wild Coho Salmon in Salmon River Basin, 2008. Monitoring Program Report Number OPSW-ODFW-2009-10, Oregon Department of Fish and Wildlife, Salem, OR.

Volk, E. C., D. L. Bottom, K. K. Jones, and C. A. Simenstad. 2010. Reconstructing Juvenile Chinook Salmon Life History in the Salmon River Estuary, Oregon, Using Otolith Microchemistry and Microstructure. Transactions of the American Fisheries Society 139:535–549.