Role of Tidal Saltwater Habitats for Juvenile Salmonids

(Myths vs Reality in the Columbia River Estuary)

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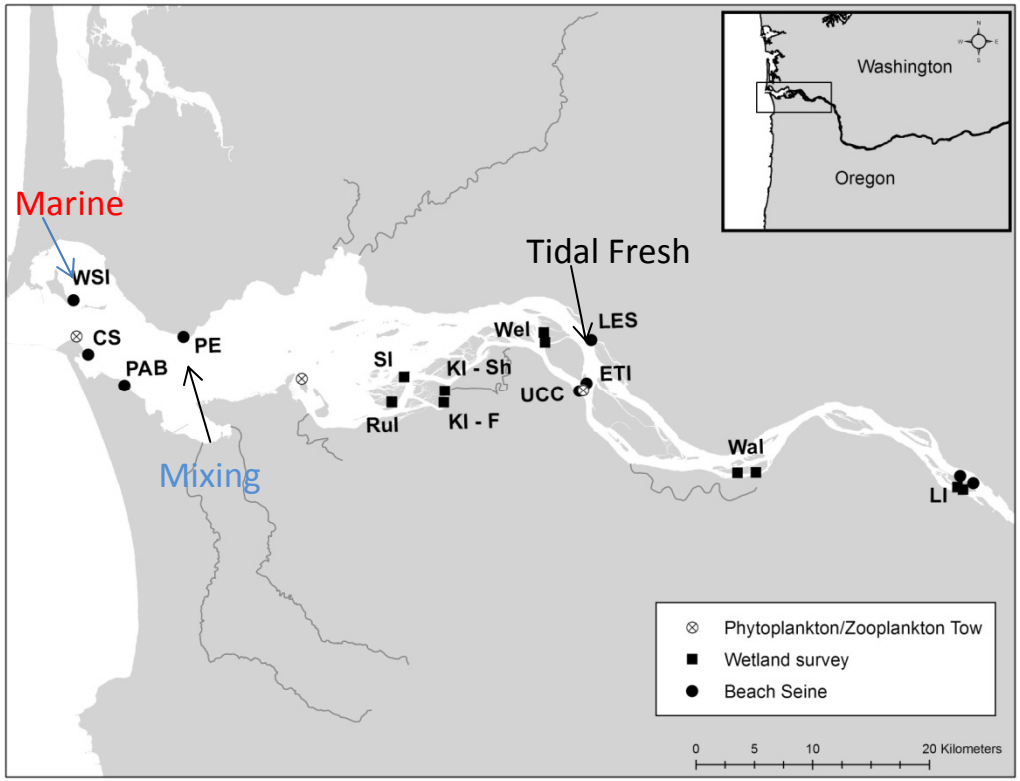
Role of Estuaries

Historical Drivers – Production, abundance, mortality

- Conduit – Connect upstream spawning and rearing areas to ocean habitat
- Transition to saltwater

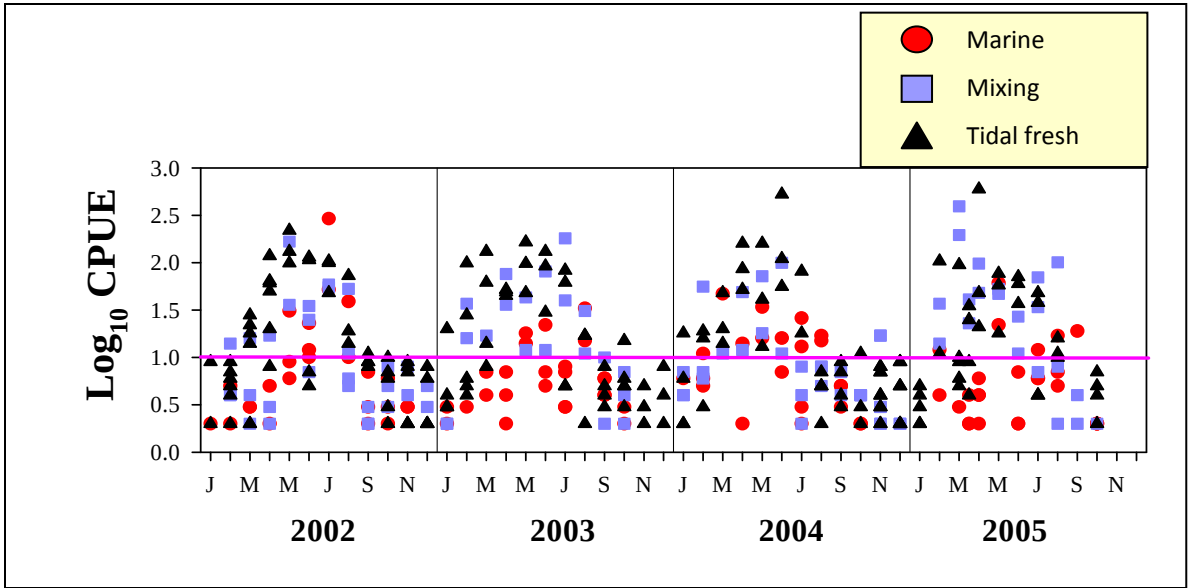
Current Drivers - Population viability & resilience, habitats salmon use and need

- Productive feeding area
- Refuge from predators



Myth - Juvenile salmon use the estuary for a short period of time (as individuals and as populations)

Reality - Juvenile salmon present in the estuary year around



Myth – Salmon populations predominantly use the subyearling and yearling strategy to succeed

Reality - All ESUs use a variety of juvenile life history strategies to succeed

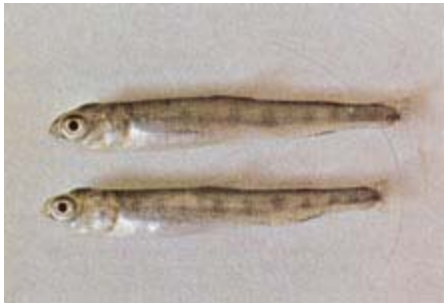
Subyearlings/Yearlings
100-200 mm

Size seen in the ocean, composed of juveniles using fry, fingerling, subyearling, and yearling strategy

Fry – distributes throughout the river, estuary and ocean
Fingerlings – rears near spawning area for 1-2 months, then distributes throughout river, estuary, and ocean
Subyearling/Yearling – rears in river, then migrates to the ocean

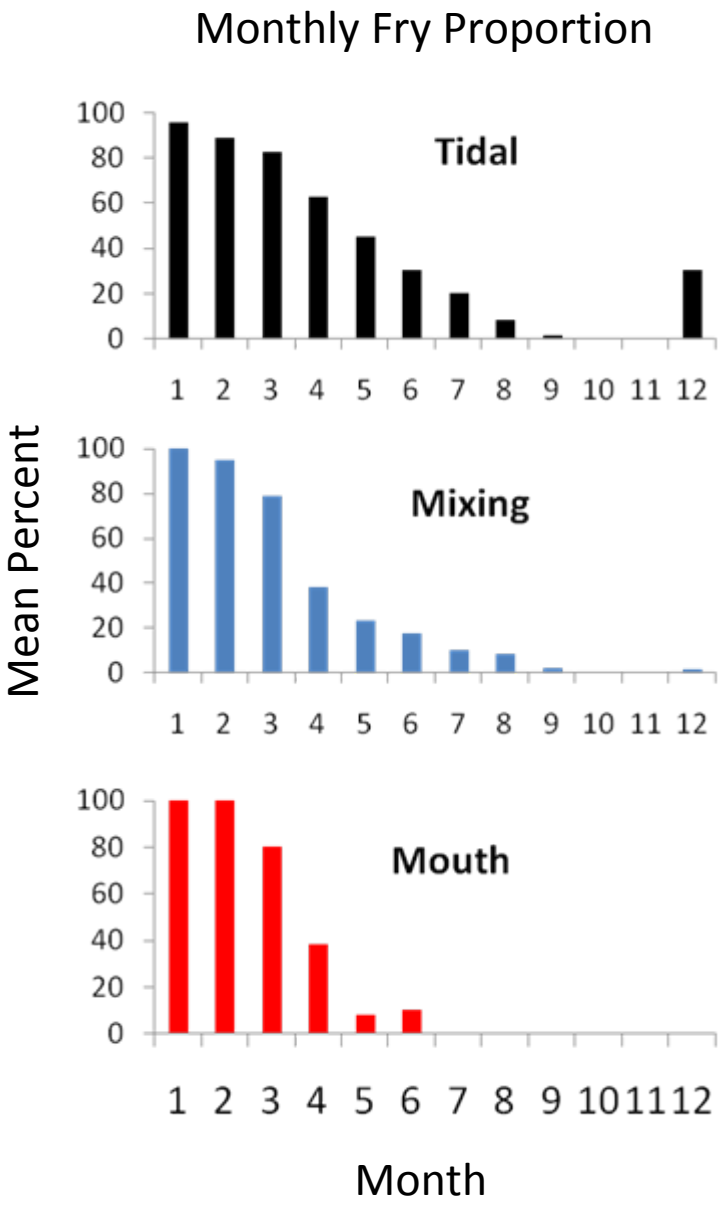
Alevins

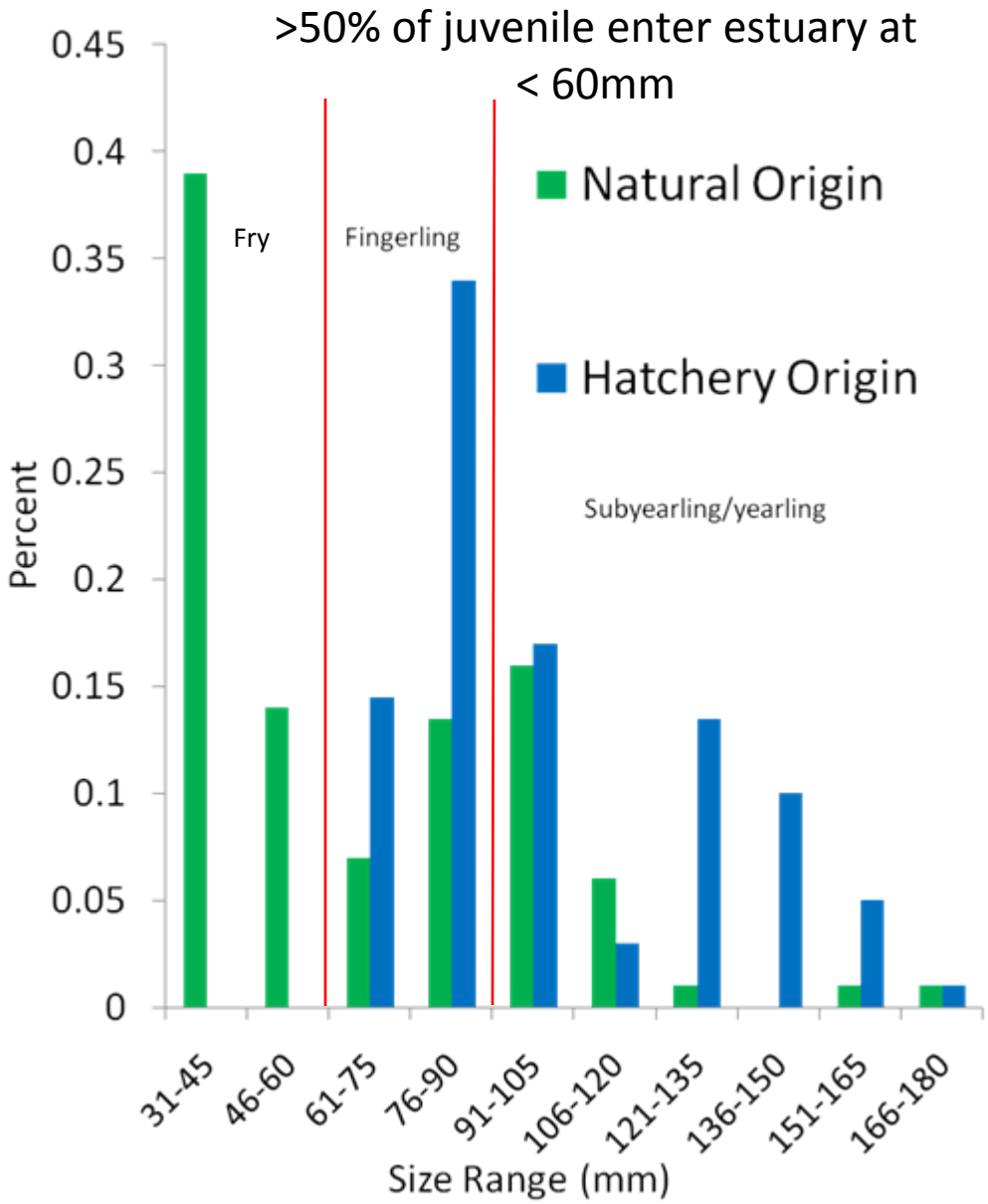
Fry 40-60mm



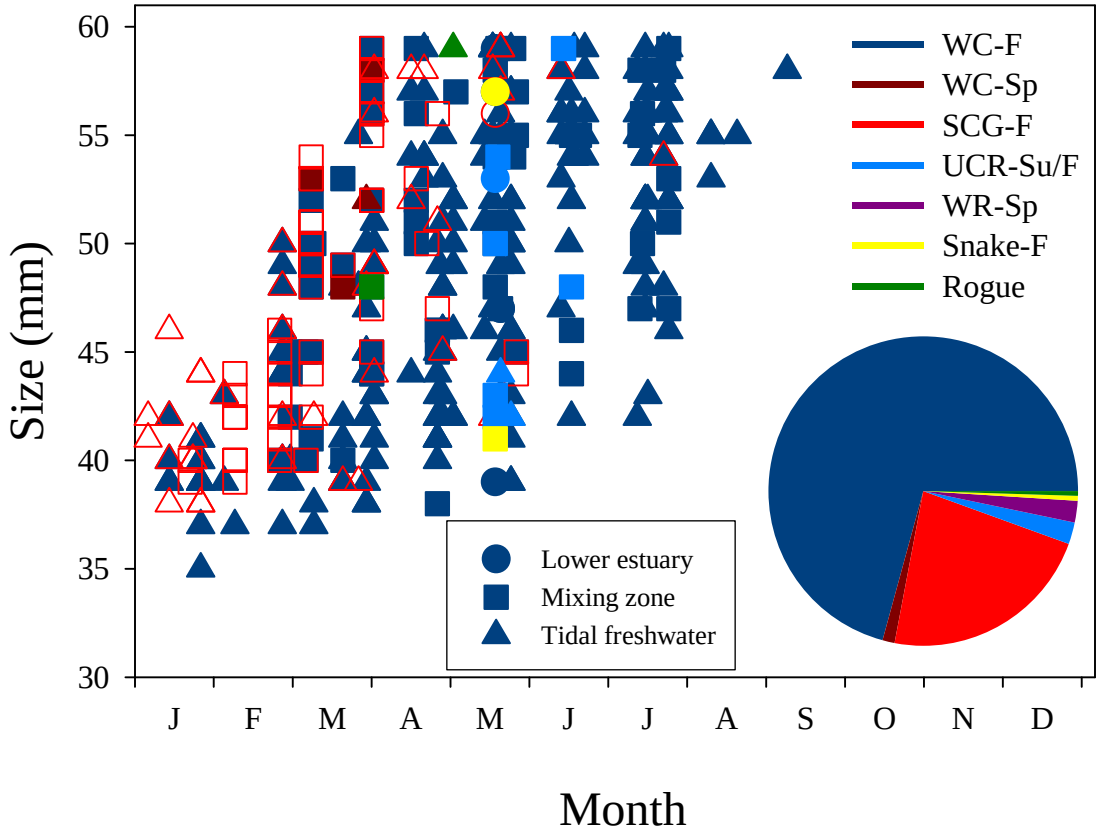
Fingerlings 60-90mm

Fry a Dominant Strategy in the Columbia River Estuary



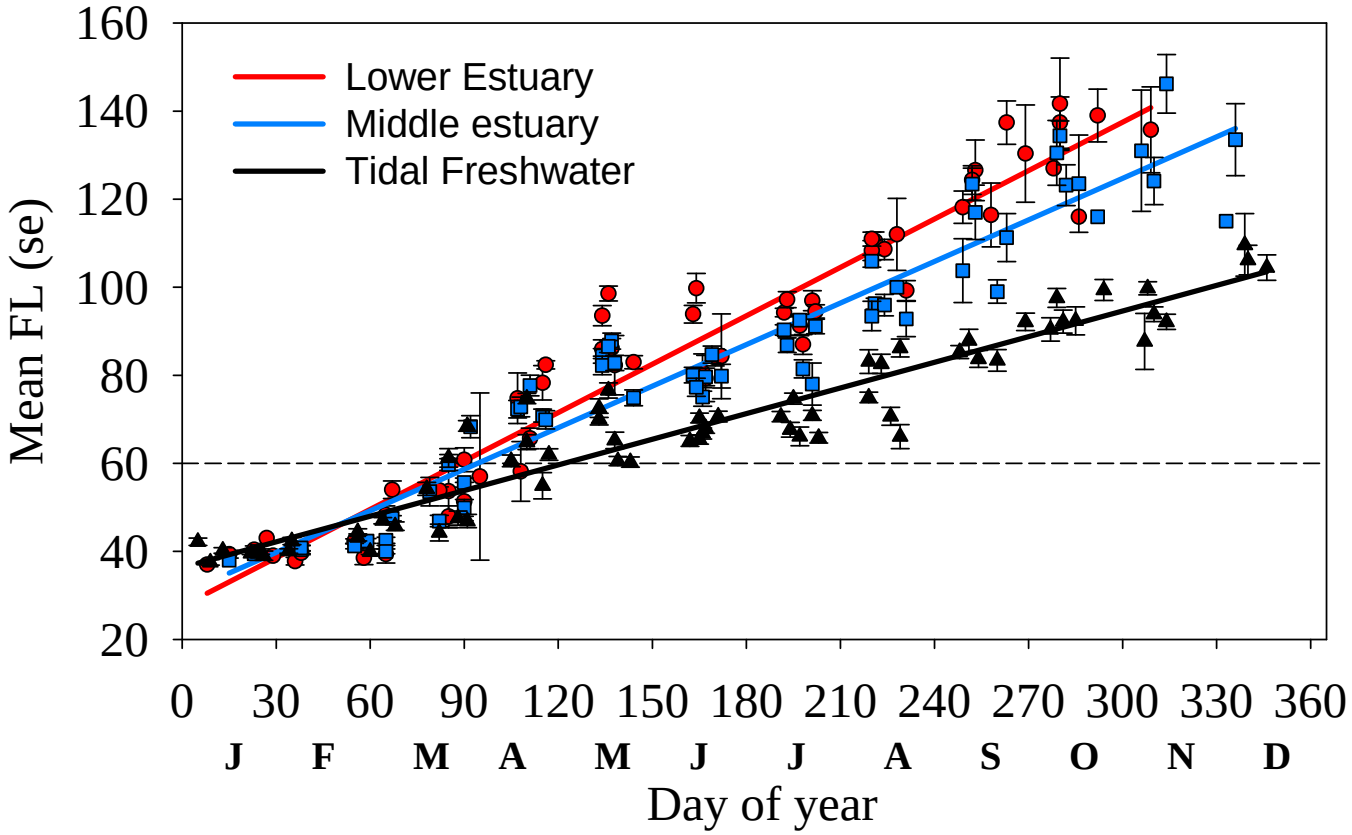


Fry Strategy Used by Many Chinook ESUs in the Columbia River



Myth - Juveniles only use the estuary to transit to the ocean

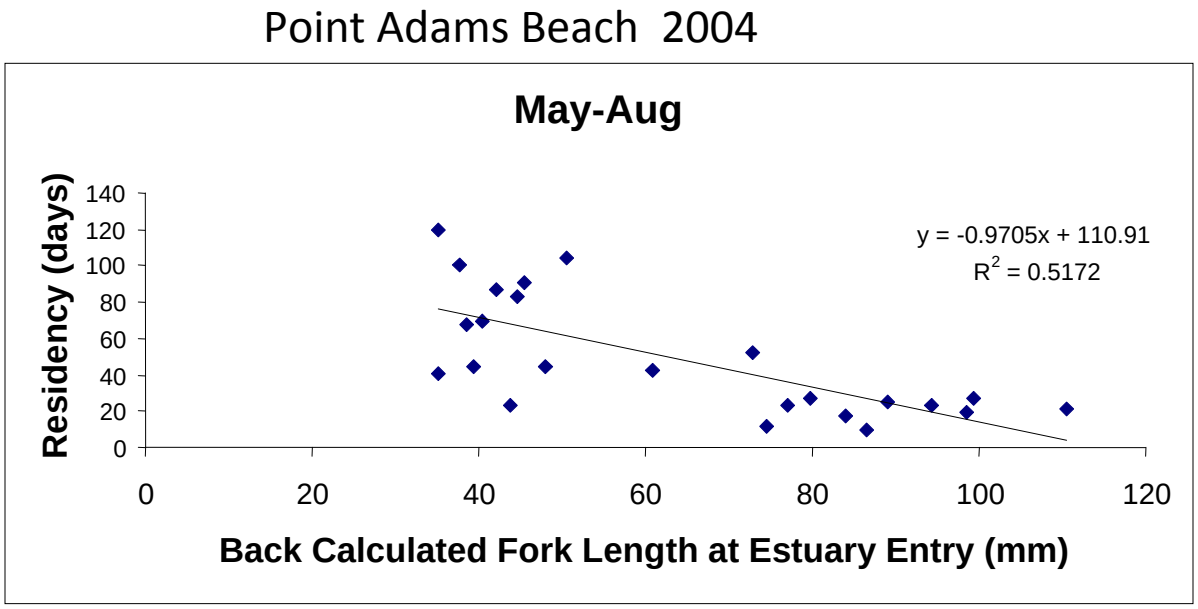
Reality – Juveniles grow in the estuary



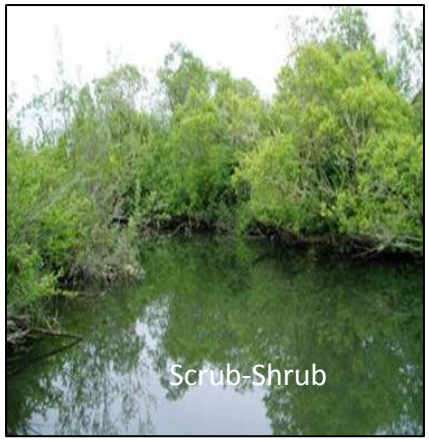
Corollary – If juveniles grow in the estuary, they then must reside in the estuary

Estuary habitat use and residency is size related

- Juveniles enter the estuary over a wide range of sizes
- Residence time decreases with size at estuary entry

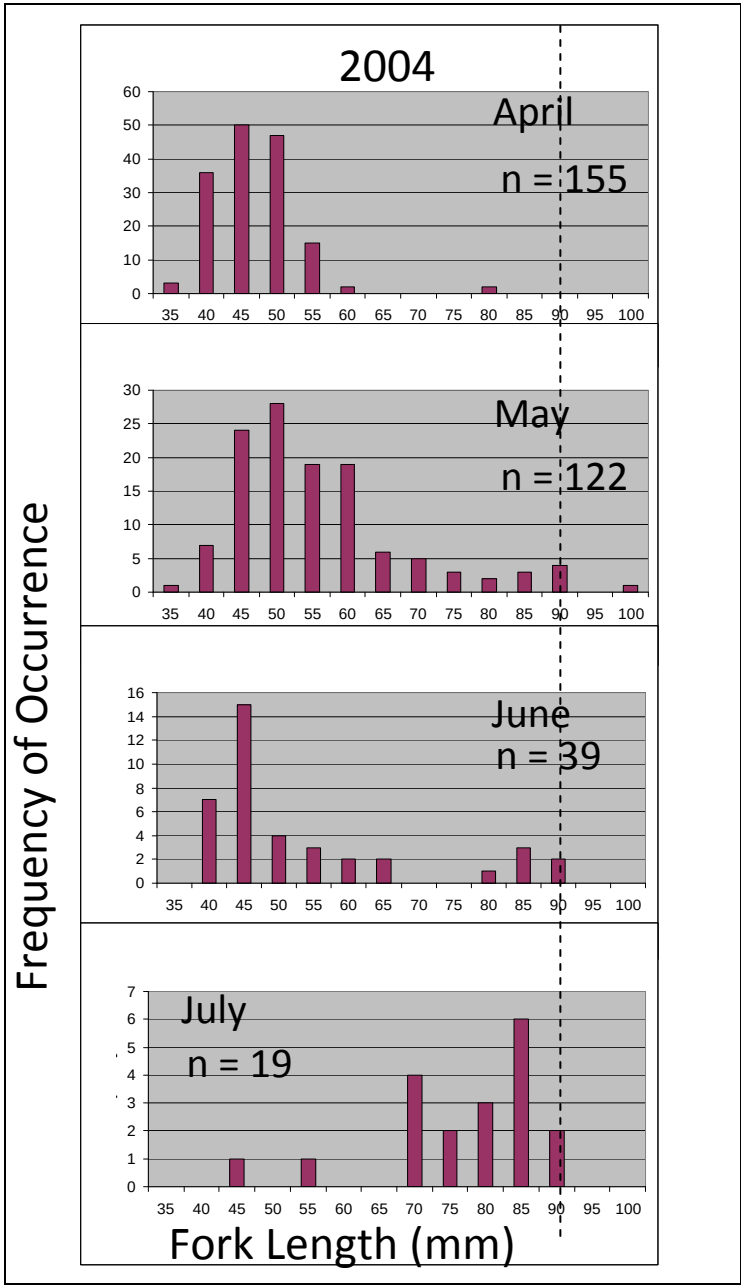


Which Habitats are Used by Juvenile Salmon



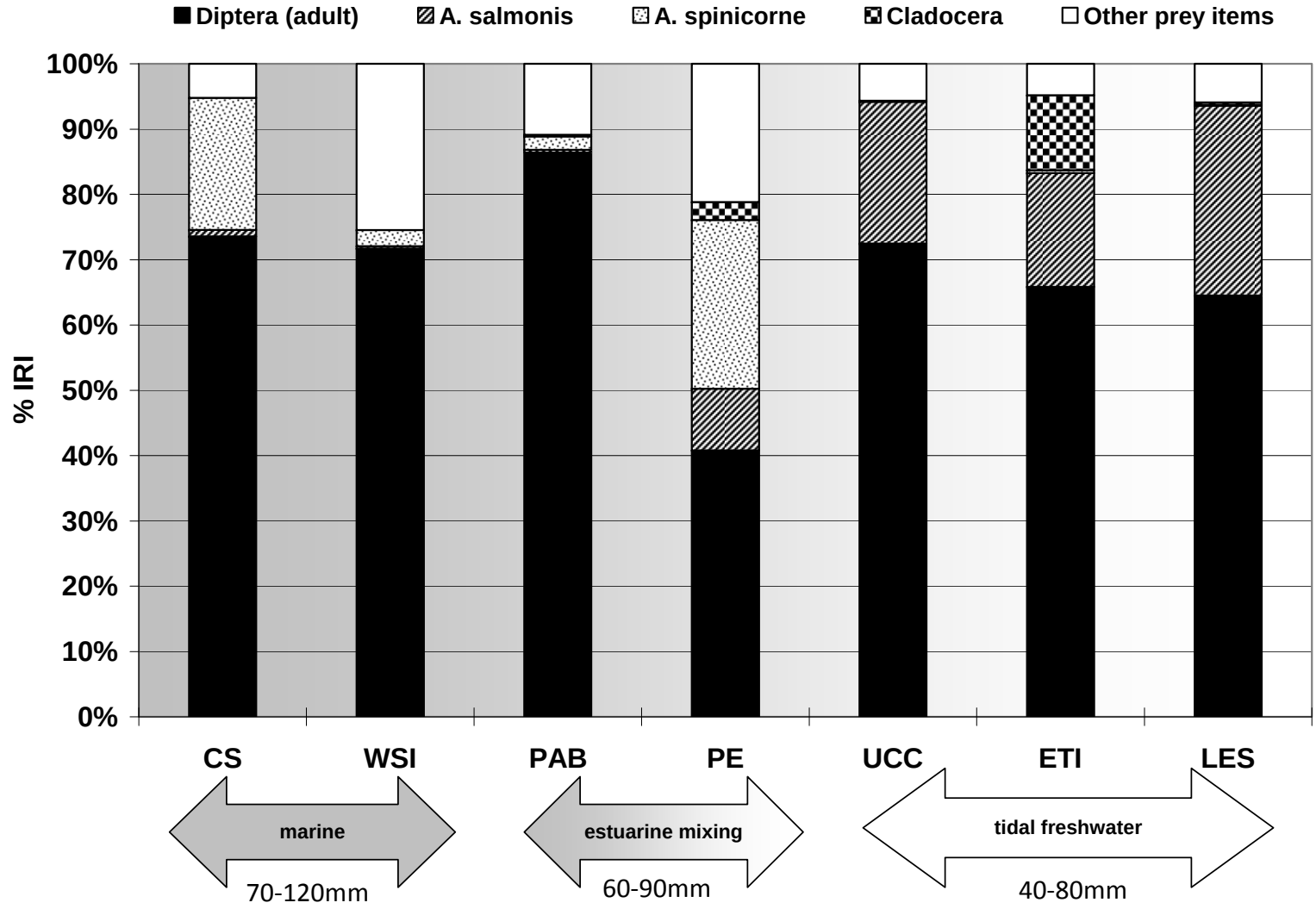
- Small size classes frequent shallow, nearshore and wetland habitats
- Few juveniles > 90 mm enter or remain in interior marsh channels

Chinook Length Frequency in Wetland Channels



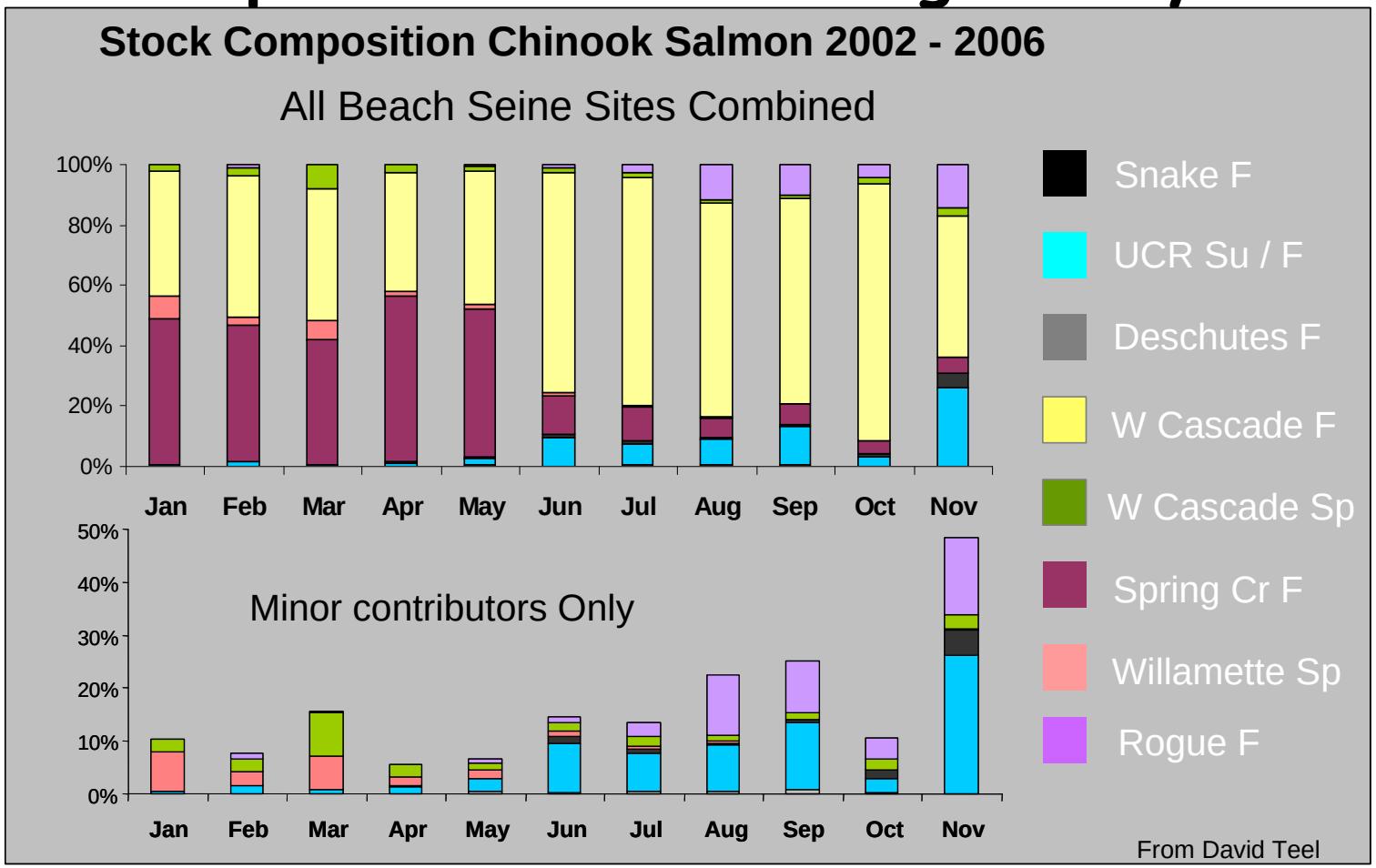
Myth – Juvenile salmon feed primarily on benthic aquatic organisms

Reality – Juvenile salmon feed dominantly on terrestrially derived insects



Myth – The Columbia River Estuary Benefits Lower River stocks only

Reality - Most all ESUs use estuarine habitats - Stock composition varies through the year



Myth – Only subyearling from lower river stocks use wetland habitats

Reality – Subyearlings and yearlings from interior basin also use wetland shallow water habitats

Pit tag detector array in secondary wetland channel

2009 Detections

Lower Columbia River Chinook salmon, N=32

Lower Columbia River coho salmon, N=5

Snake River fall Chinook salmon, N=1

Snake River spring Chinook salmon, N=1

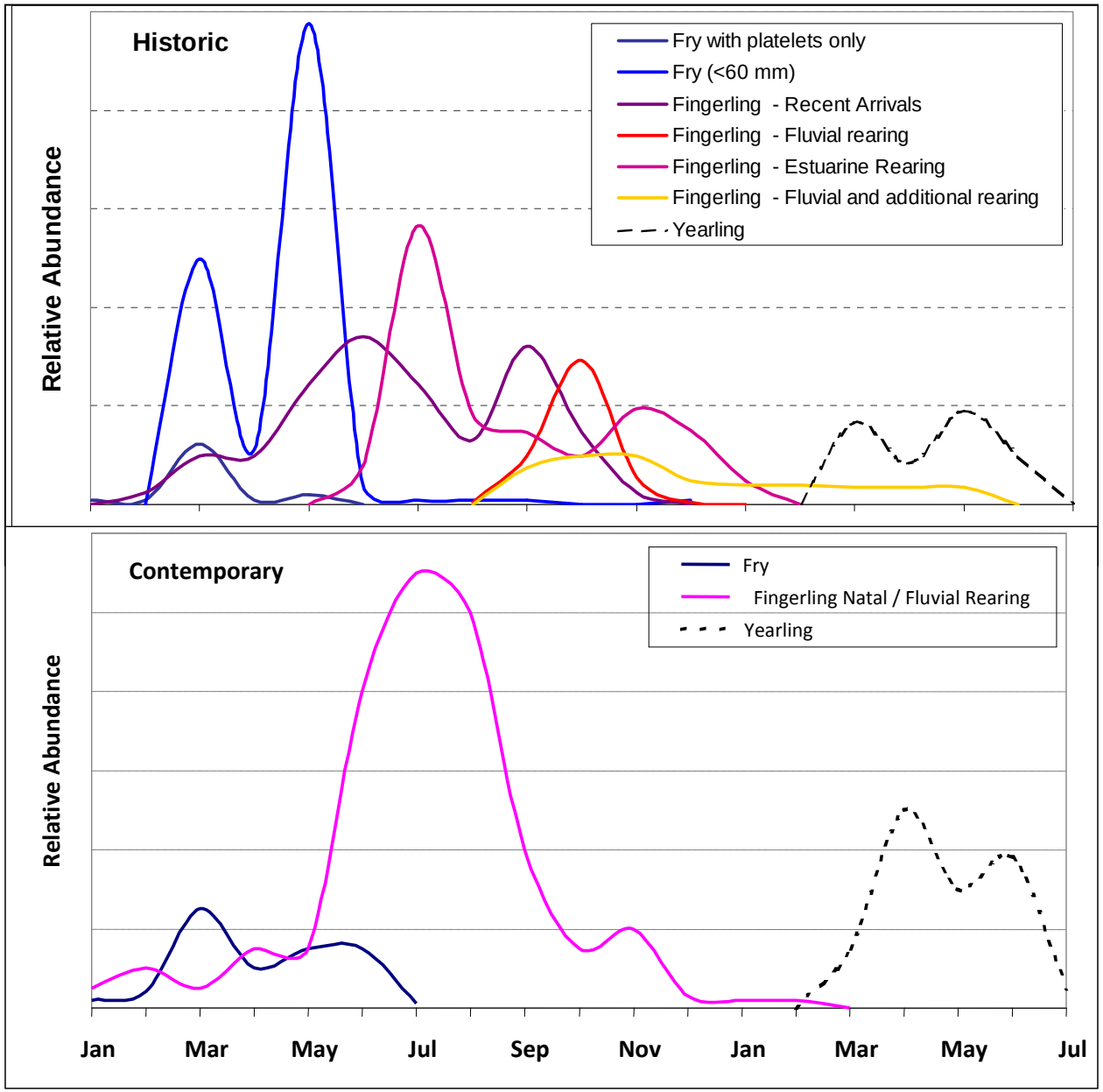
Snake River summer steelhead, N=3

If estuaries provide opportunity for diversification of life history strategies and diversity is an attribute of healthy salmon populations, how does the Columbia River system fare?

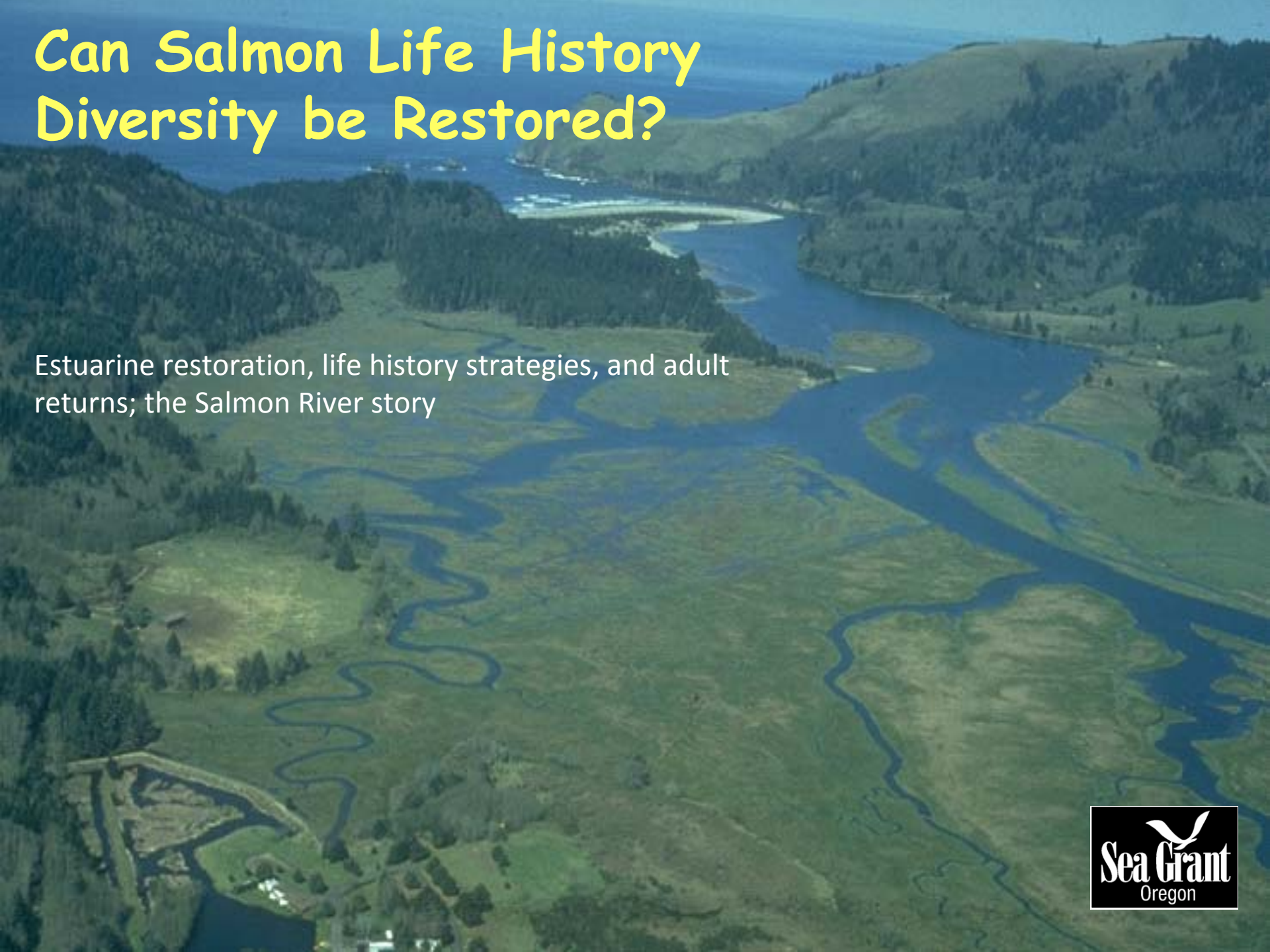
Estimated changes in the relative proportions of juvenile salmon life histories

From Burke, 2005. Data from Rich (1920) & Dawley et al. (1985)

Simplication of life histories may undermine resilience and recovery of Columbia River Chinook salmon



Can Salmon Life History Diversity be Restored?

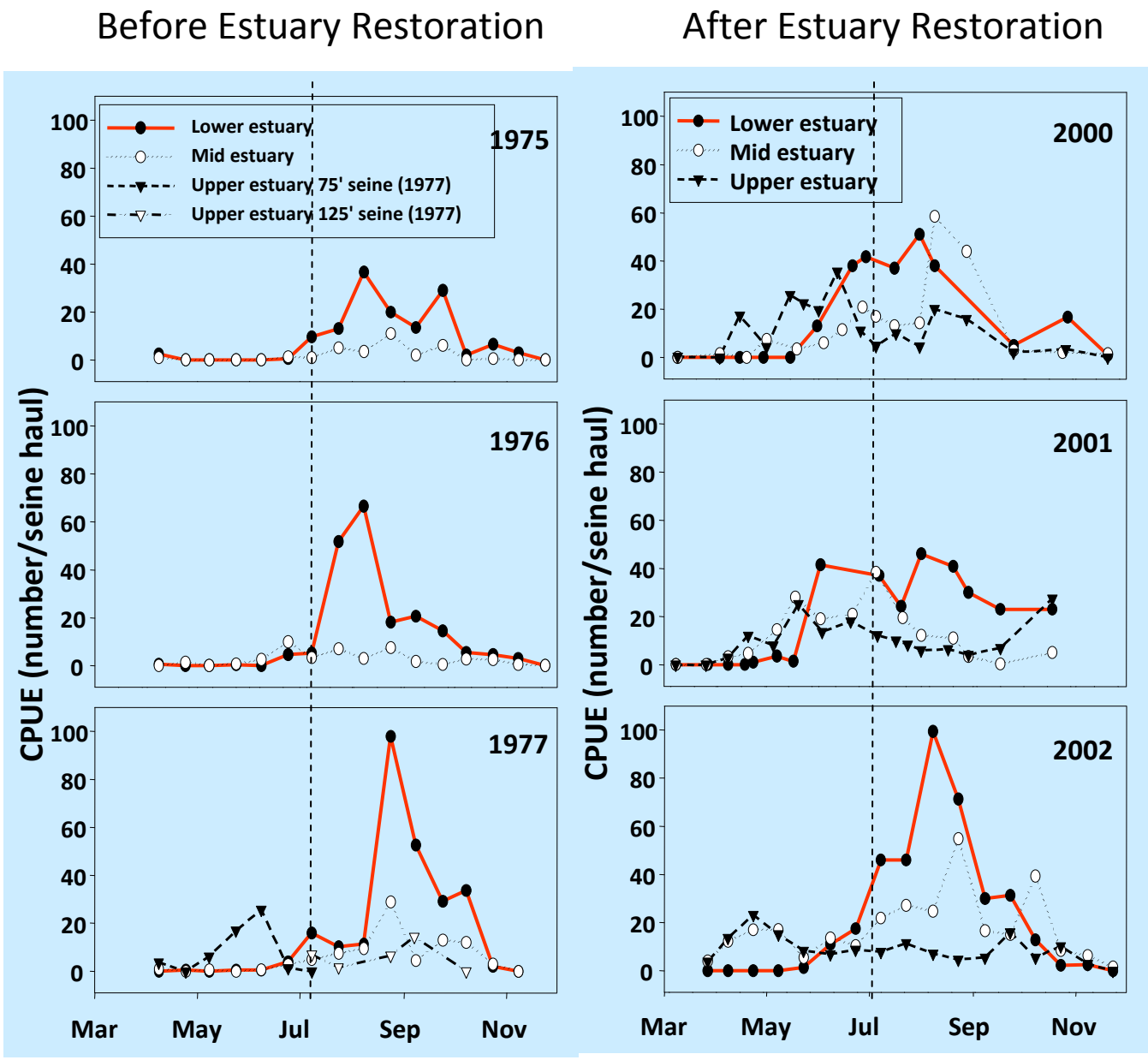


Estuarine restoration, life history strategies, and adult returns; the Salmon River story

Sea Grant
Oregon

Can Life History Diversity be Restored?

- Life history diversity has expanded with increased wetland opportunity

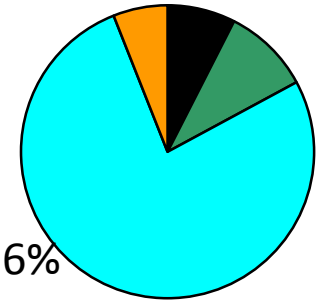


Myth – Estuarine restoration does not affect adult returns

Reality – Recovered life history strategies contribute to adult returns

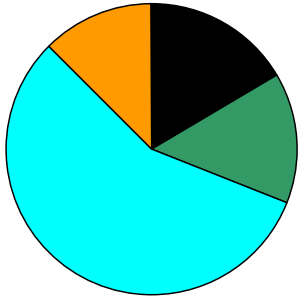
Size at Estuary Entry for Juveniles at Mouth (BY 2001 & 02)

Emergent Fry	< 45mm	7%
Spring (MAM)	47 – 64 mm	10%
Summer (JJA)	55 – 96 mm	77%
Fall (SON)	97 – 109 mm	6%



Size at Estuary Entry for Adults (2004 RY; n=145)

Emergent Fry	< 45 mm	17%
Spring (MAM)	47-64 mm	14%
Summer (JJA)	65-96 mm	57%
Fall (SON)	97-110 mm	12%



Summary – Estuary as Salmon Habitat

- Based on distribution preferences and growth characteristics, estuary a habitat for smaller juvenile salmon to grow
- Shallow water, low velocity, and low salinity surface environments with associated wetland vegetation are features that define habitat
- Diverse distribution of habitat a surrogate for diversity and spatial structure of salmon population
- All juveniles benefit from estuary habitat through food webs and predator refuge
- **Preservation and restoration of shallow water, low velocity, and low salinity environments an important strategy for recovery of salmon and to mitigate for anthropogenic modifications**

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