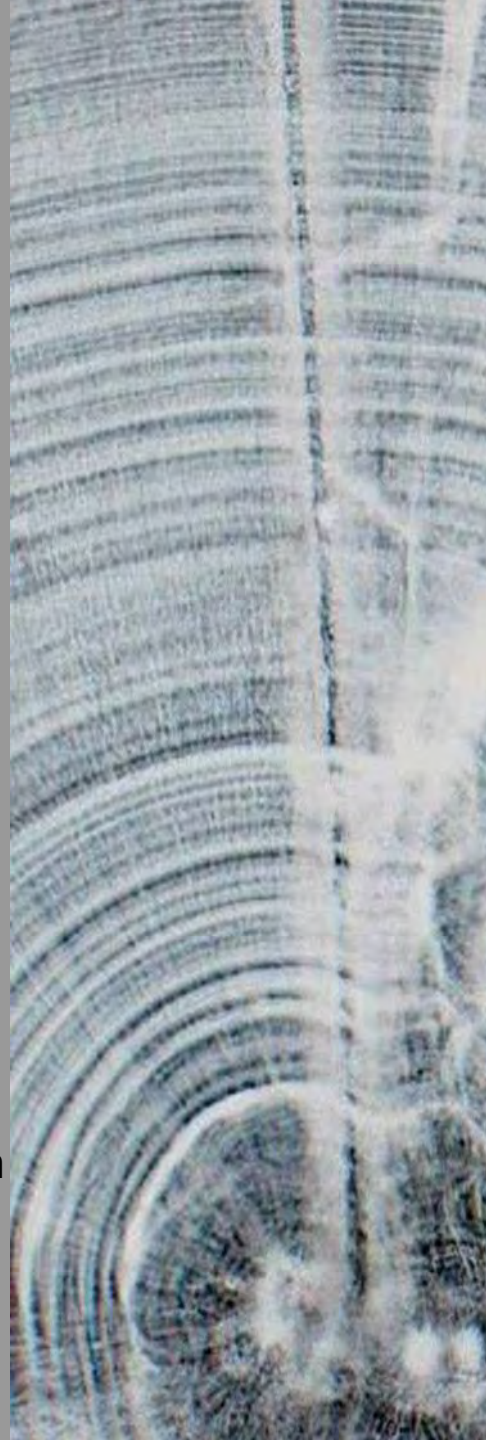
Life History Strategies of Salish Sea Chinook Salmon as Inferred from Otolith Microchemistry



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Funding/Support/Collaboration Provided by:

Long Live the Kings
King County/WRIA 9
Lummi Nation
Tulalip Tribes
Muckleshoot Indian Tribe
Nisqually Indian Tribe
British Columbia Conservation Foundation
Department of Fisheries and Oceans Canada
Washington Department of Fish and Wildlife
Oregon Department of Fish and Wildlife
NOAA Fisheries

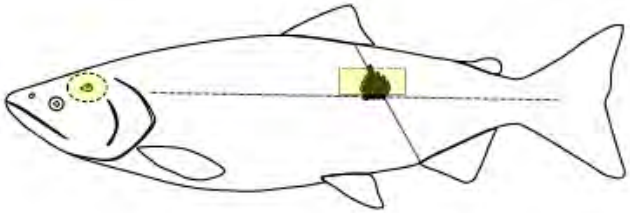
Salish Sea Marine Survival Project (4):

Successful juvenile life history strategies in returning adult Chinook from five Puget Sound populations (4.1)

Lance A. Campbell
Andrew M. Claiborne

Age and growth of Chinook salmon in selected Puget Sound and coastal Washington watersheds (4.2)

Andrew M. Claiborne
Lance A. Campbell
Joseph H. Anderson



2017 Annual Report

Washington Department of Fish and Wildlife
Fish Program, Science Division

June 2017

Successful Juvenile Life History Strategies of Salish Sea Chinook Salmon

1. What outmigration patterns/ life history strategies do we observe in Chinook populations (Salish S.)?

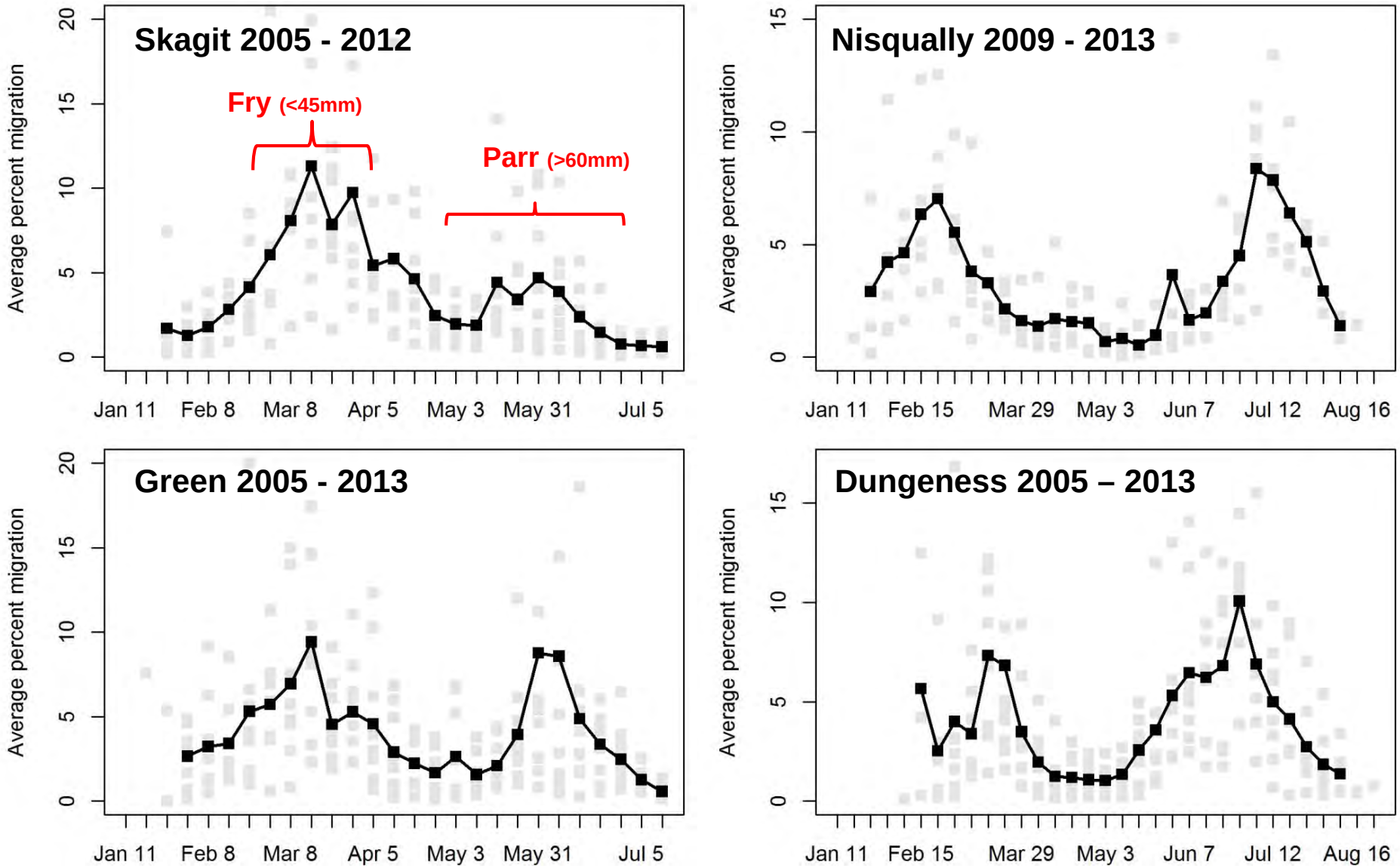
2. What life histories contribute to the naturally reproducing population (Fry/Parr/Yearlings)?

3. Linkage between life history expression, habitat restoration, and stock recovery

4. Hatchery identification using otolith microchemistry

Juvenile Chinook salmon migration timing

Figure courtesy: Wild Salmon Evaluation and Production Unit (WDFW)

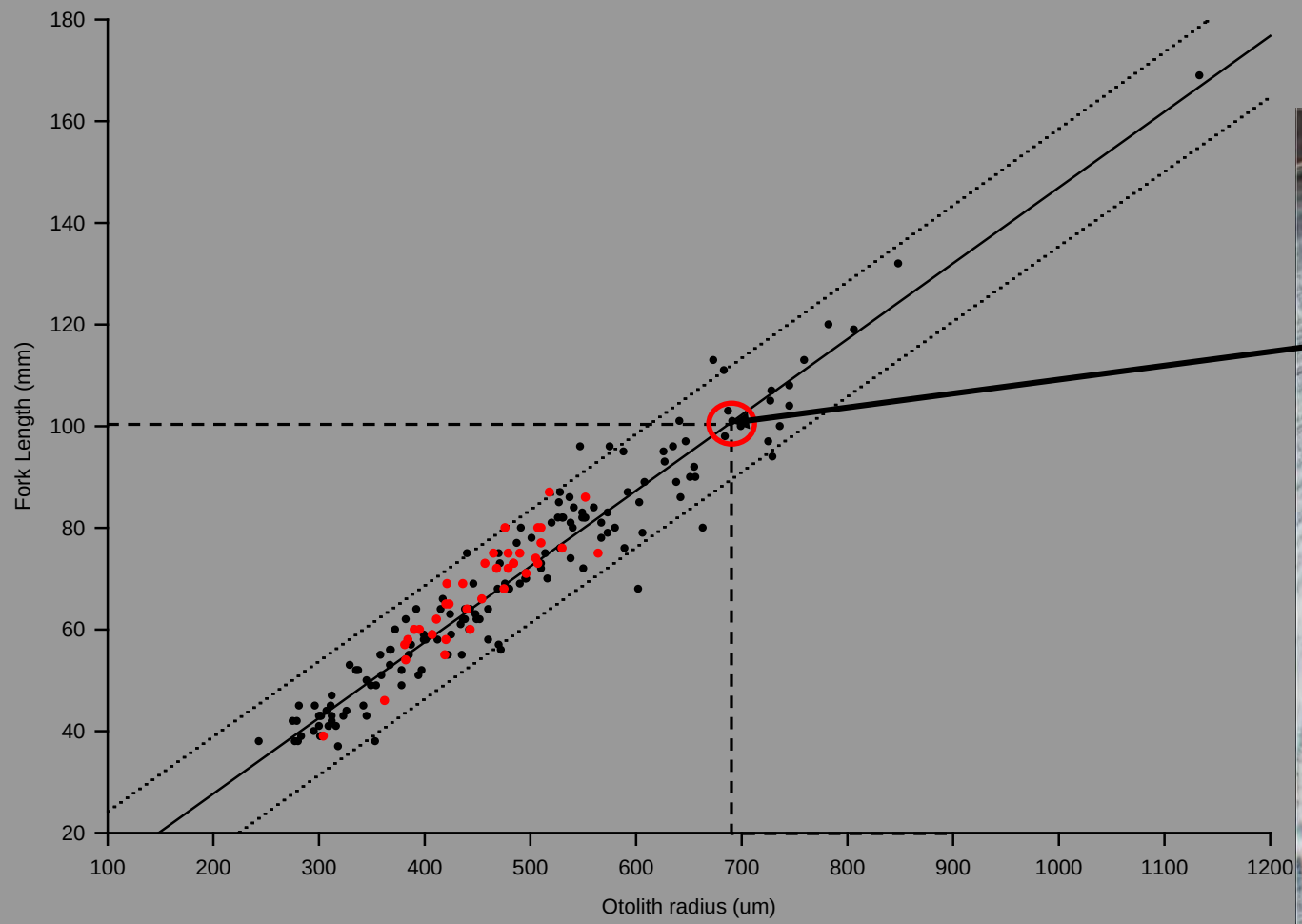


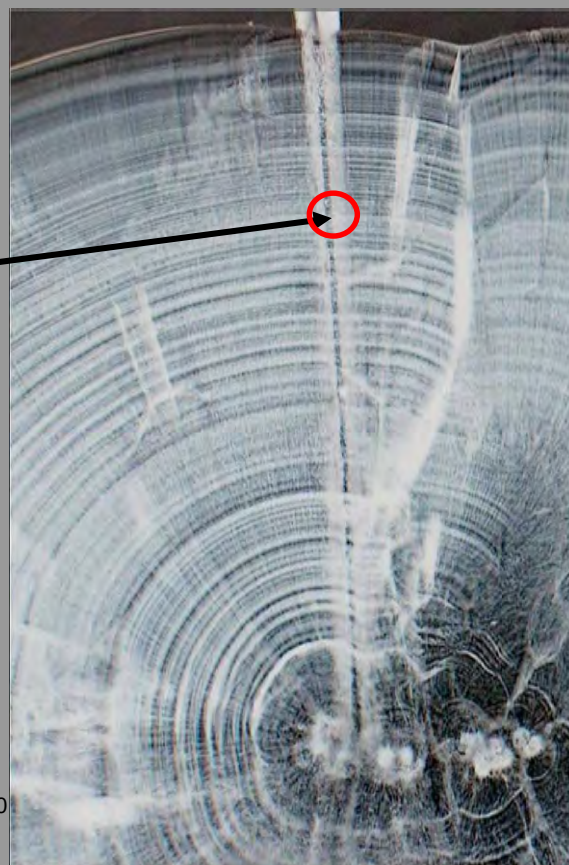
Methods:

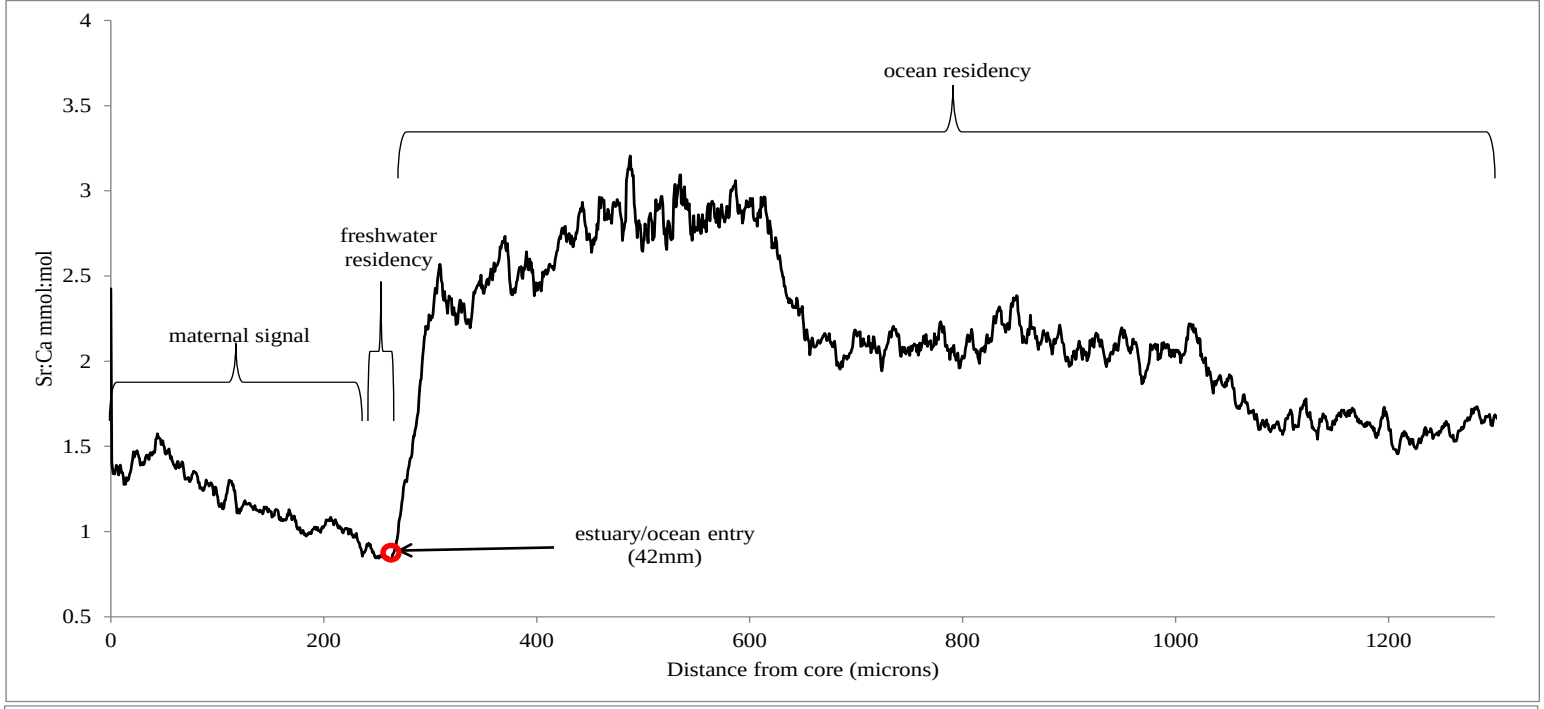
1.) Fish size/otolith size relationship

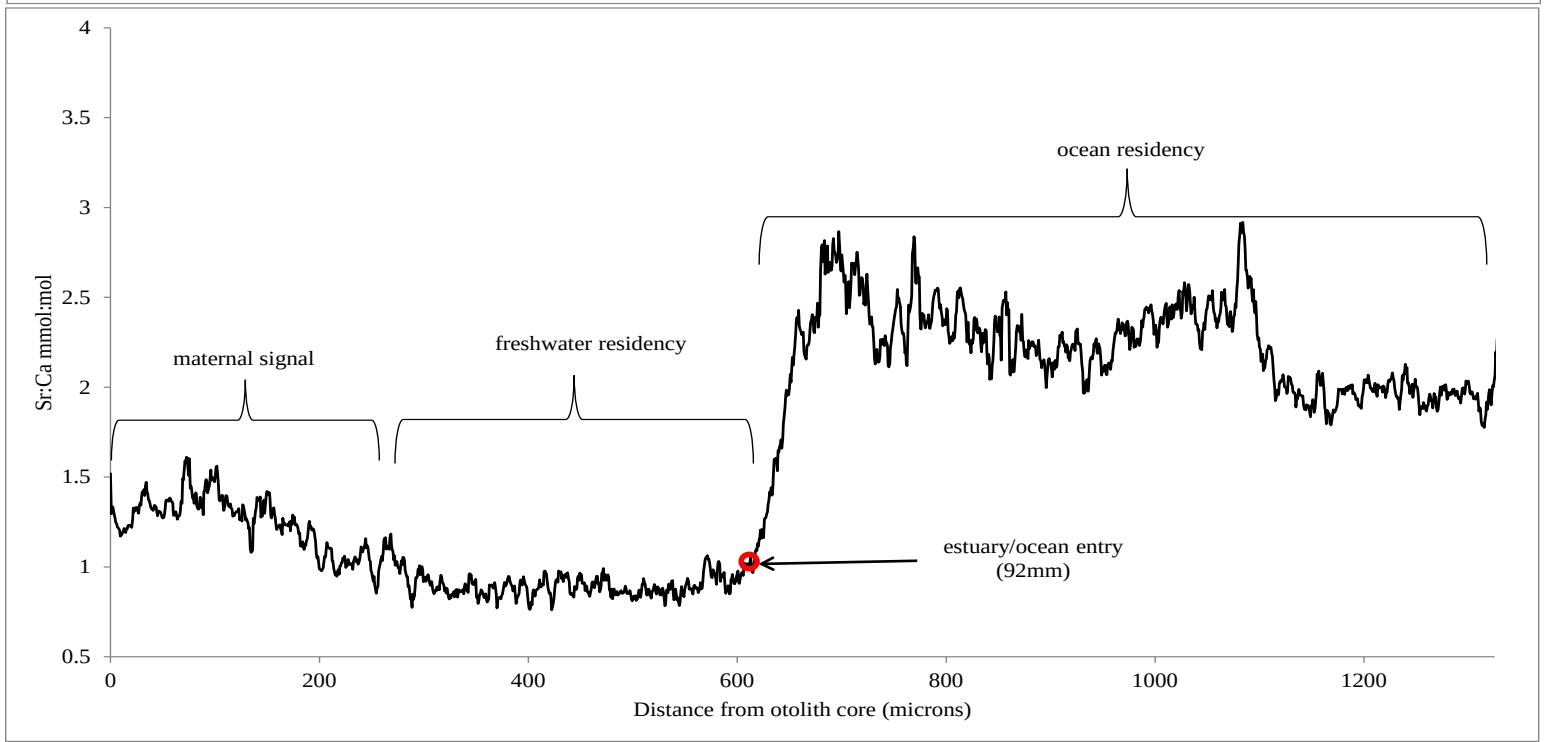
2.) Elemental analysis (LA-ICPMS)
Sr:Ca

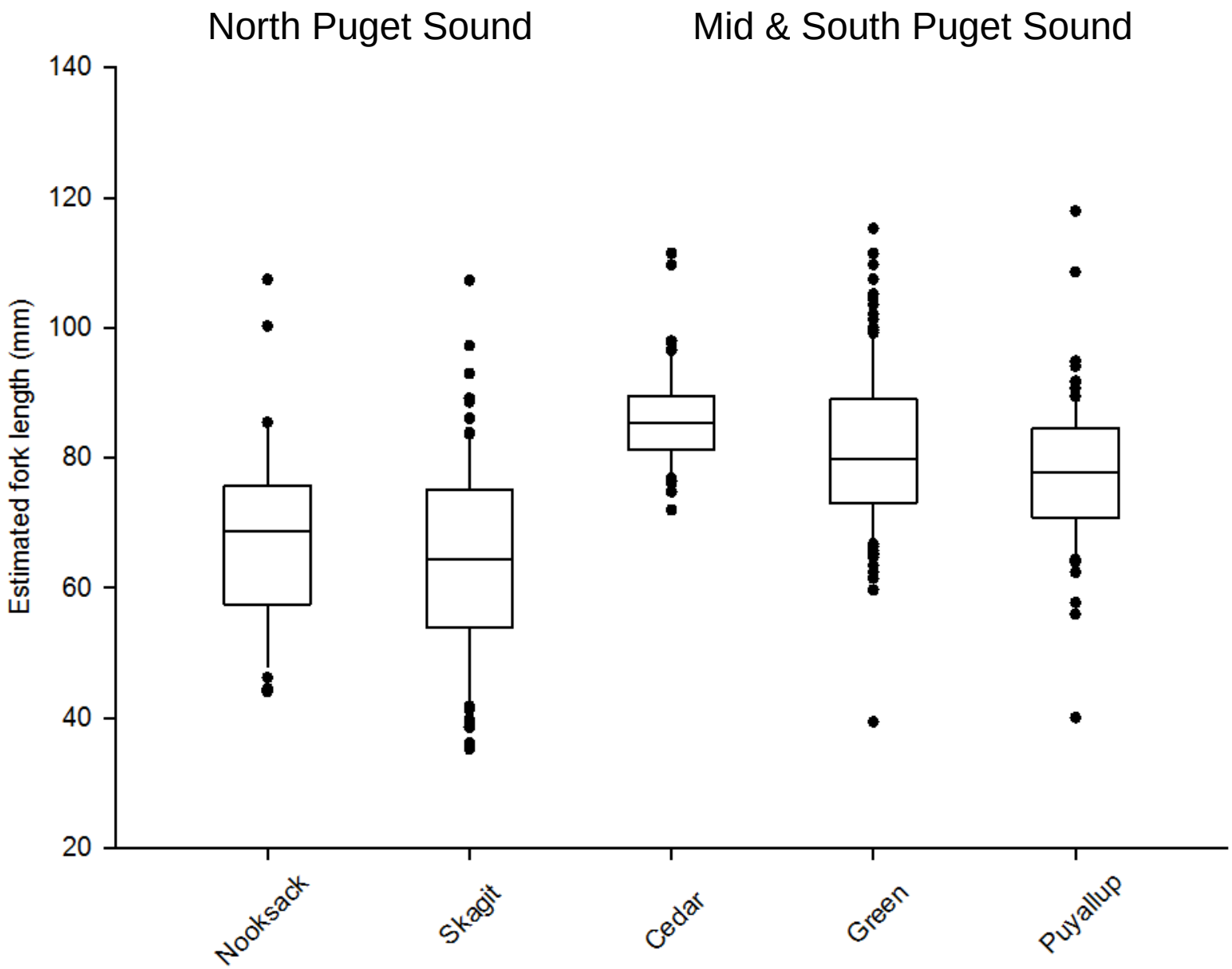
3.) Relationship between salinity and Sr

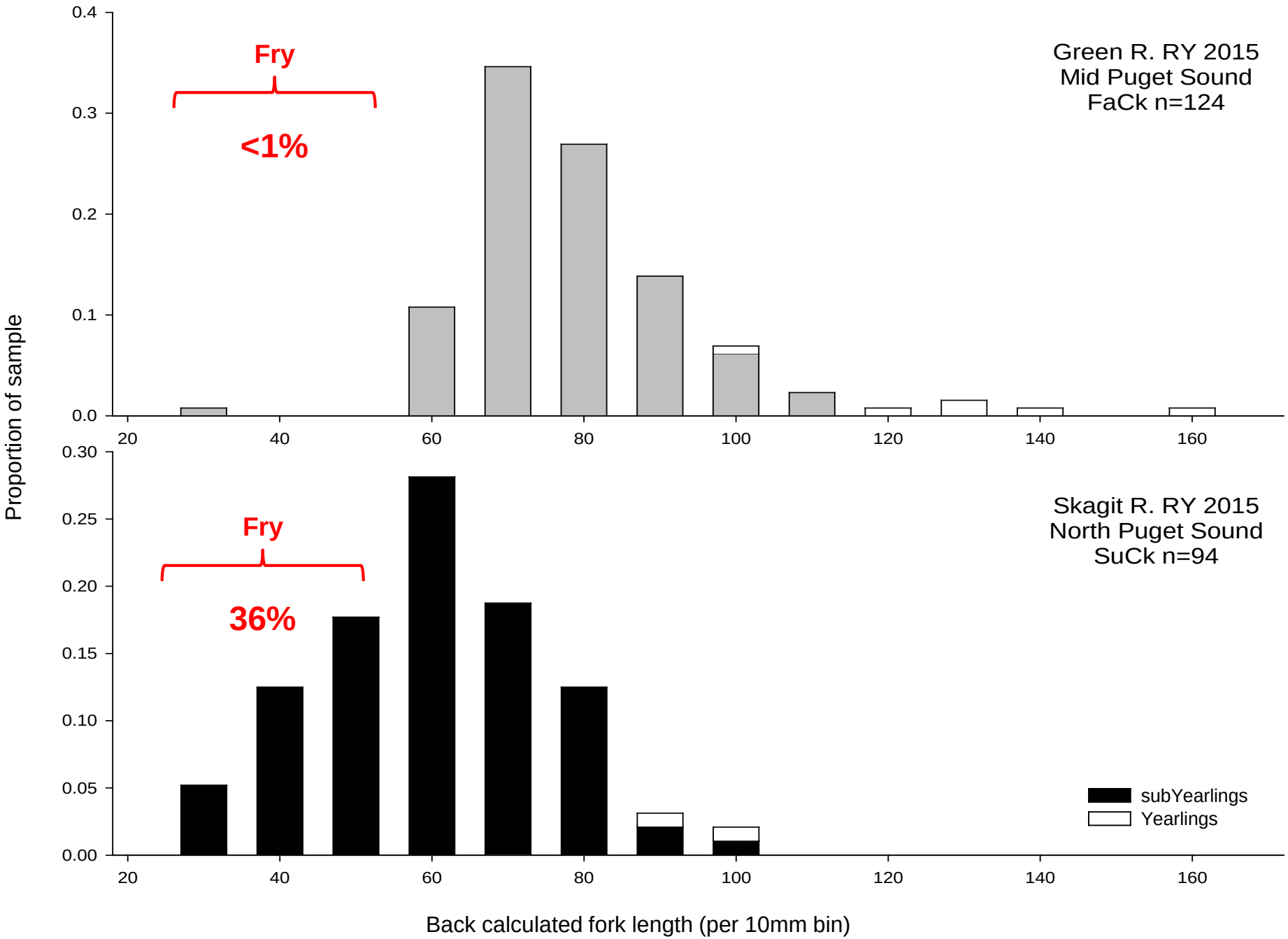


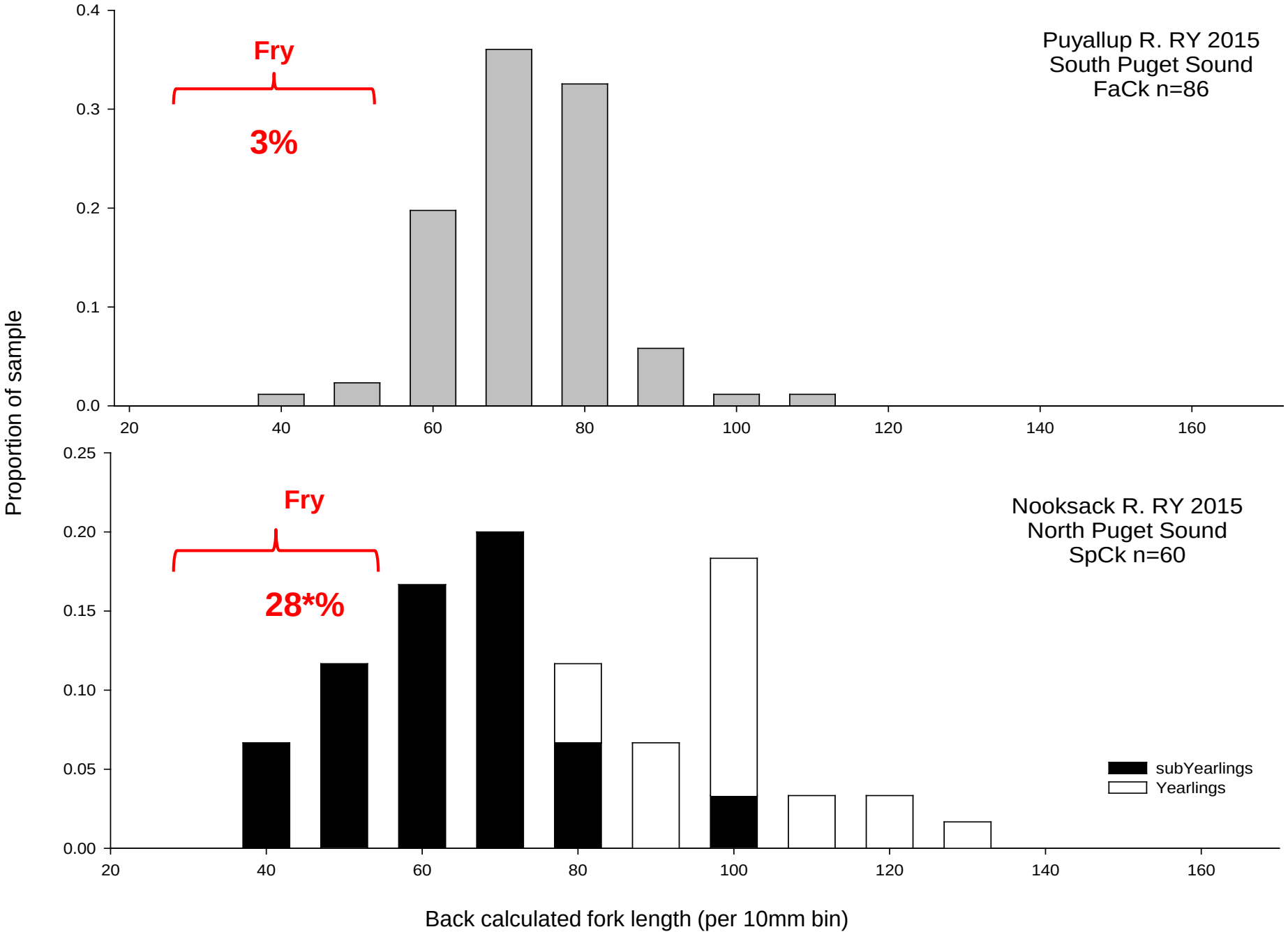


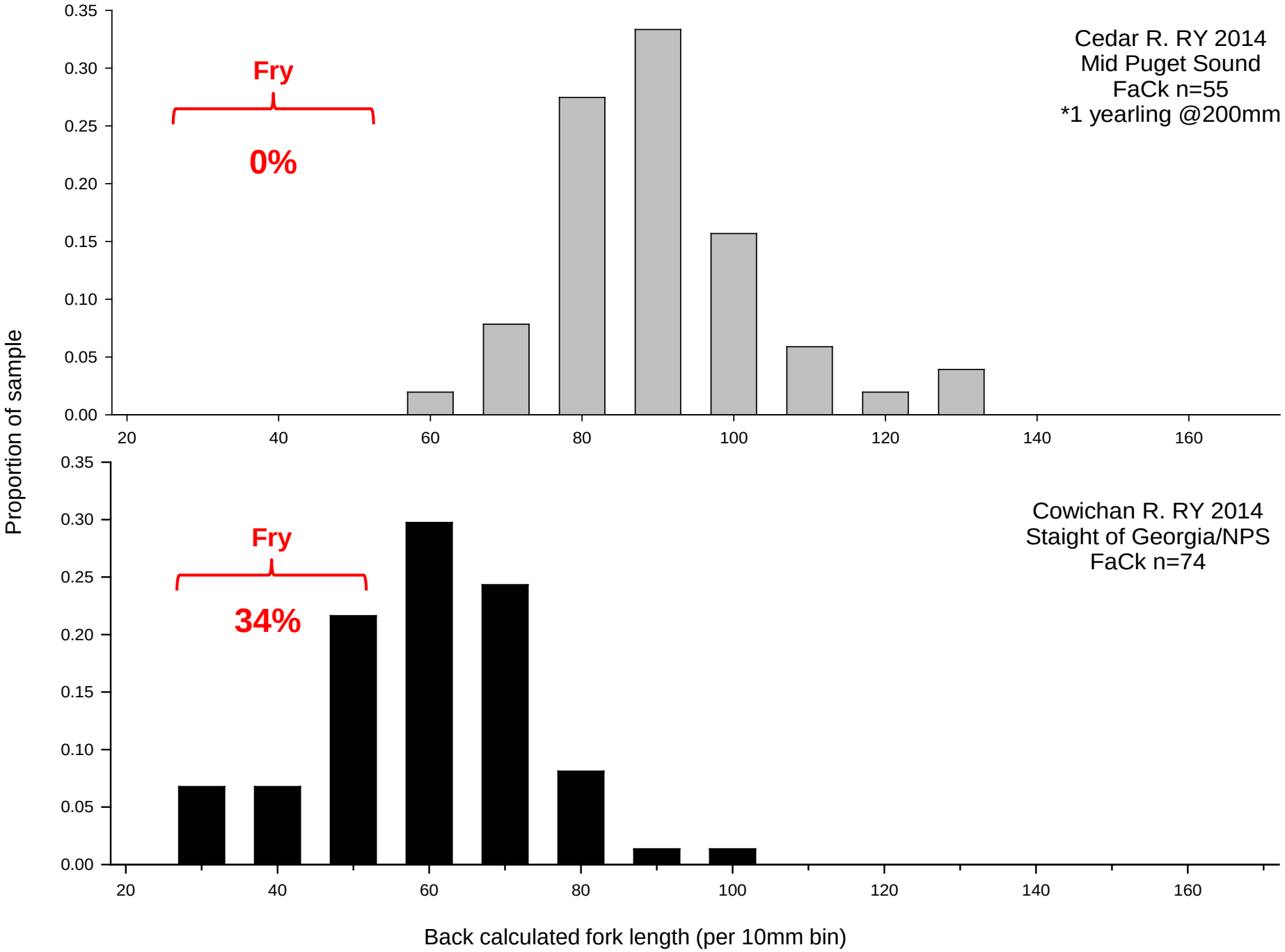

ocean residency
freshwater residency
maternal signal
estuary/ocean entry (42mm)
Sr:Ca mmol:mol
Distance from core (microns)
FRY

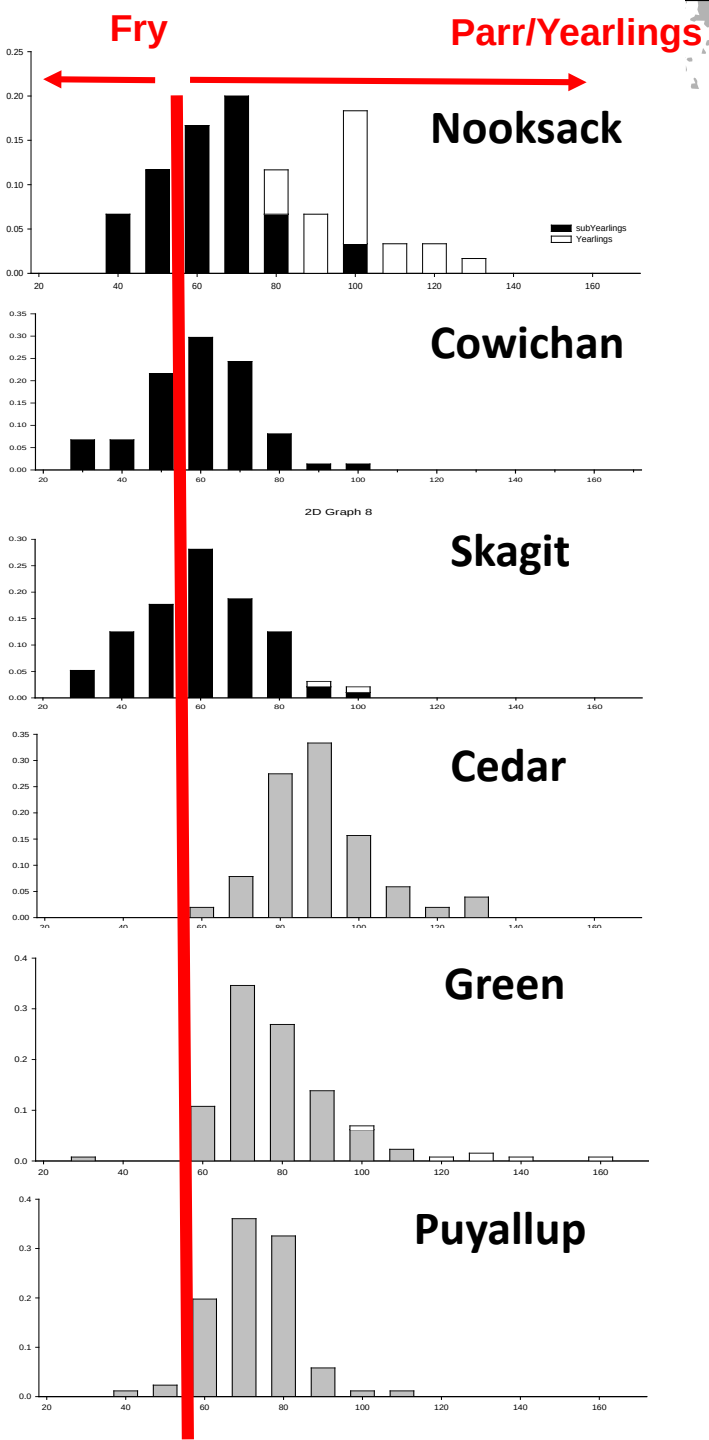

ocean residency
maternal signal
freshwater residency
estuary/ocean entry (92mm)
Sr:Ca mmol:mol
Distance from otolith core (microns)
PARR

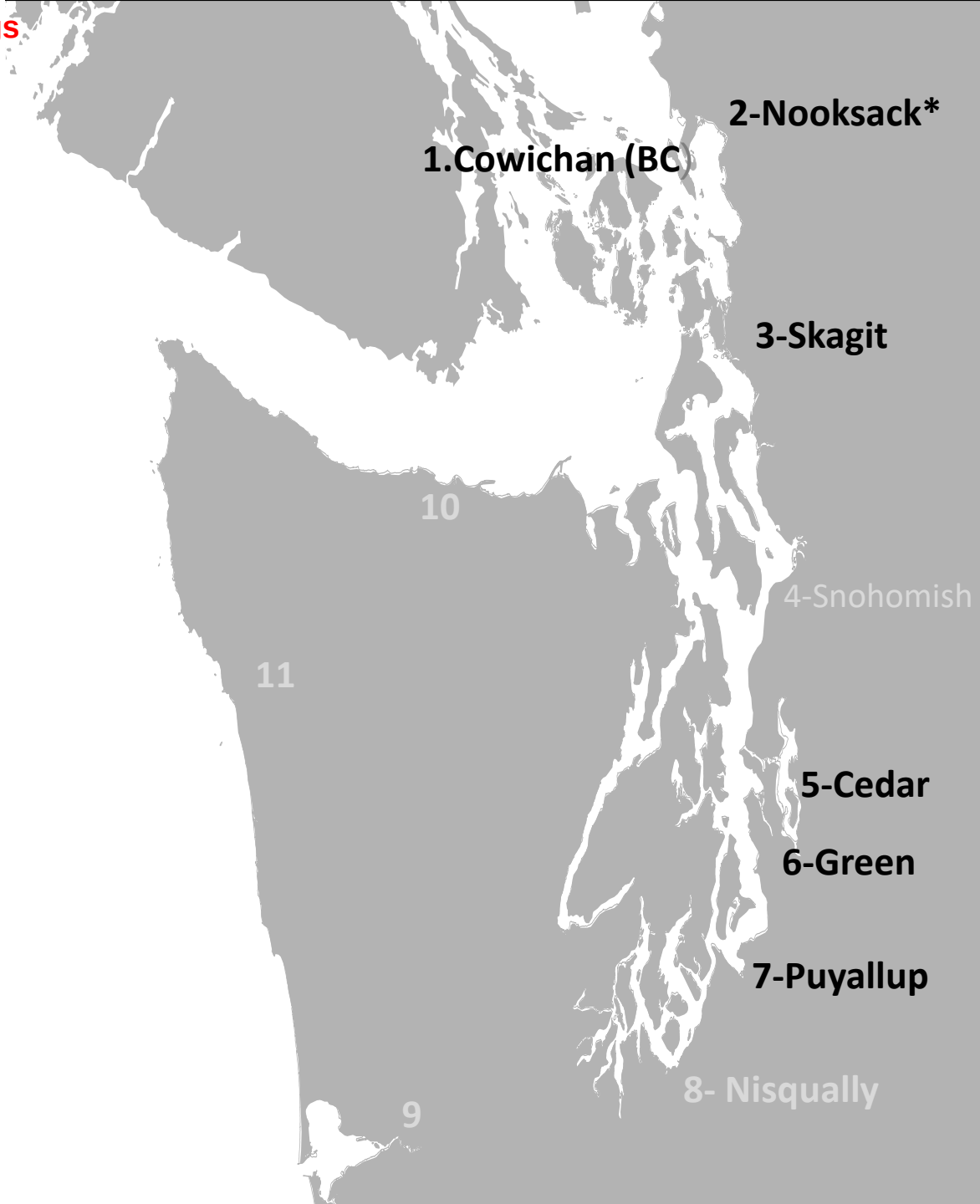

North Puget Sound
Mid & South Puget Sound
Estimated fork length (mm)
140
120
100
80
60
40
20
Nooksack
Skagit
Cedar
Green
Puyallup


Green R. RY 2015
Mid Puget Sound
FaCk n=124
Fry
<1%
Skagit R. RY 2015
North Puget Sound
SuCk n=94
Fry
36%
subYearlings
Yearlings
Proportion of sample
Back calculated fork length (per 10mm bin)
0.0
0.1
0.2
0.3
0.4
0.00
0.05
0.10
0.15
0.20
0.25
0.30
20
40
60
80
100
120
140
160


Puyallup R. RY 2015
South Puget Sound
FaCk n=86
Fry
3%
Nooksack R. RY 2015
North Puget Sound
SpCk n=60
Fry
28*%
subYearlings
Yearlings
Proportion of sample
Back calculated fork length (per 10mm bin)


Cedar R. RY 2014
Mid Puget Sound
FaCk n=55
*1 yearling @200mm
Fry
0%
Cowichan R. RY 2014
Staight of Georgia/NPS
FaCk n=74
Fry
34%
Proportion of sample
Back calculated fork length (per 10mm bin)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
20
40
60
80
100
120
140
160


Fry
Parr/Yearlings
Nooksack
subYearlings
Yearlings
Cowichan
2D Graph 8
Skagit
Cedar
Green
Puyallup

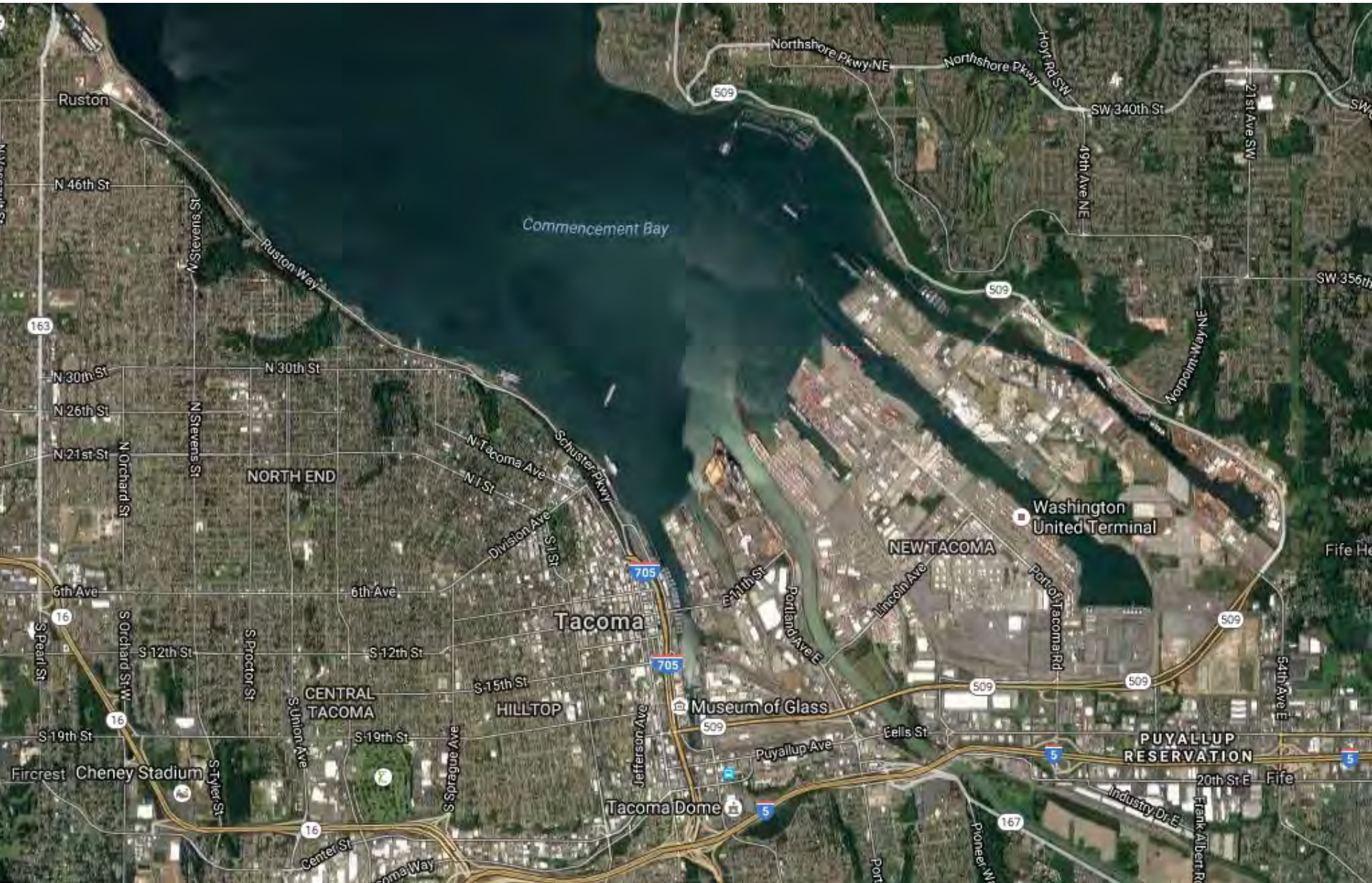

1.Cowichan (BC)
2-Nooksack*
3-Skagit
10
4-Snohomish
11
5-Cedar
6-Green
7-Puyallup
8- Nisqually
9

Salmon River (Oregon)

2.78 Natural

Puyallup River (Washington)

1.00 Developed

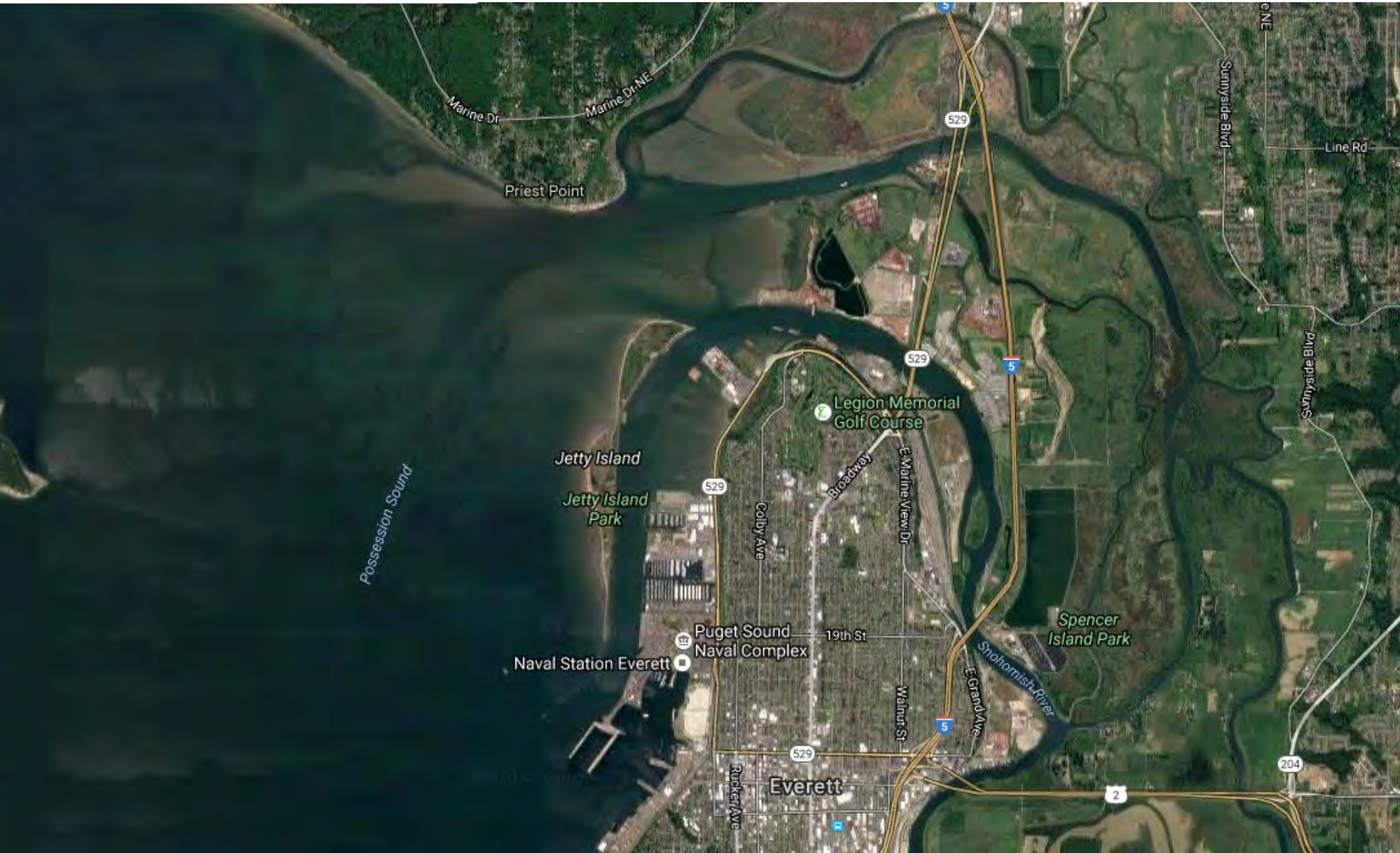


Duwamish River (Washington) **1.00 Developed**

Cedar River/Lake Wa (Washington) **1.04 Developed**

Snohomish River (Washington)

1.96 Mixed

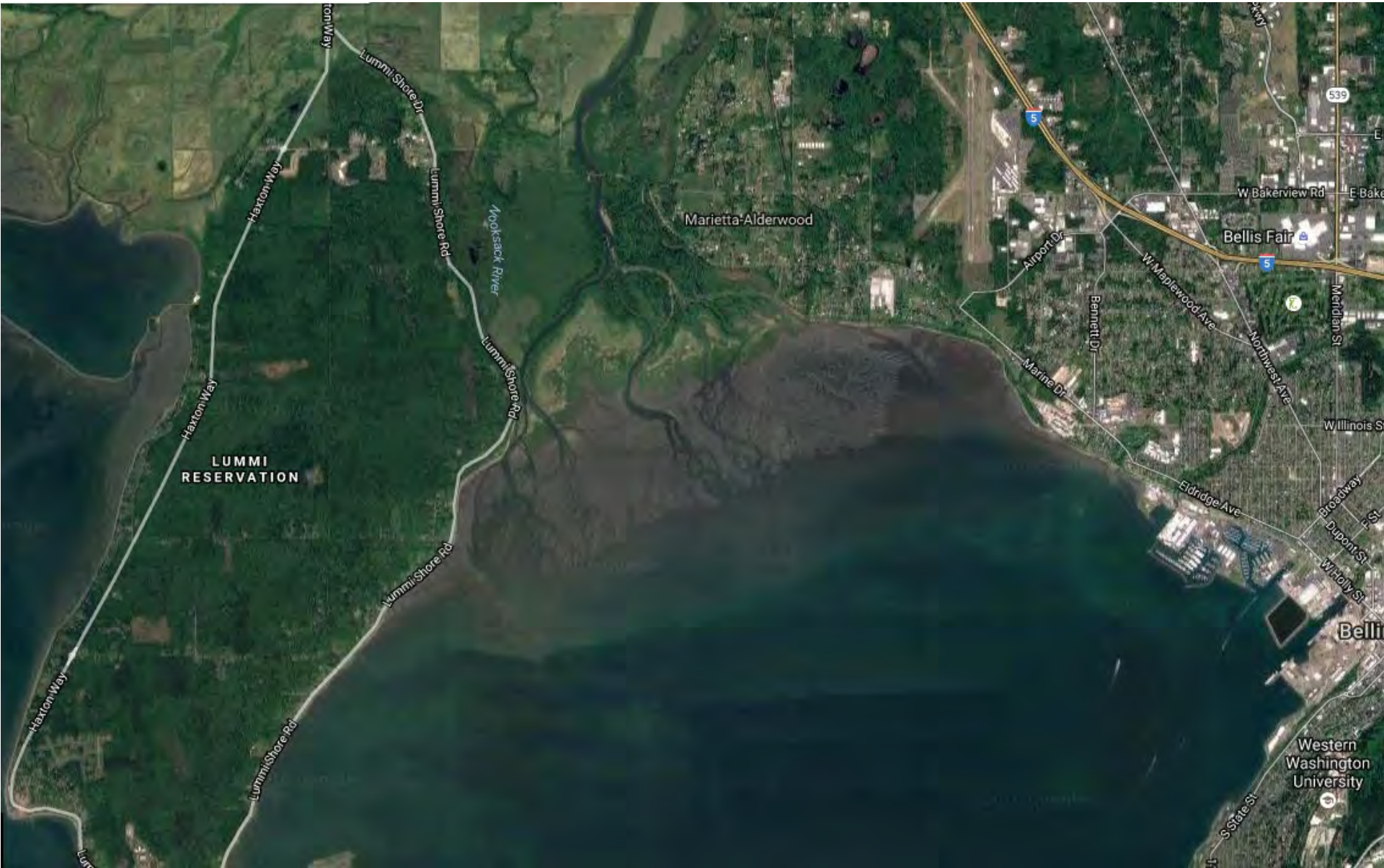


Skagit River (Washington)

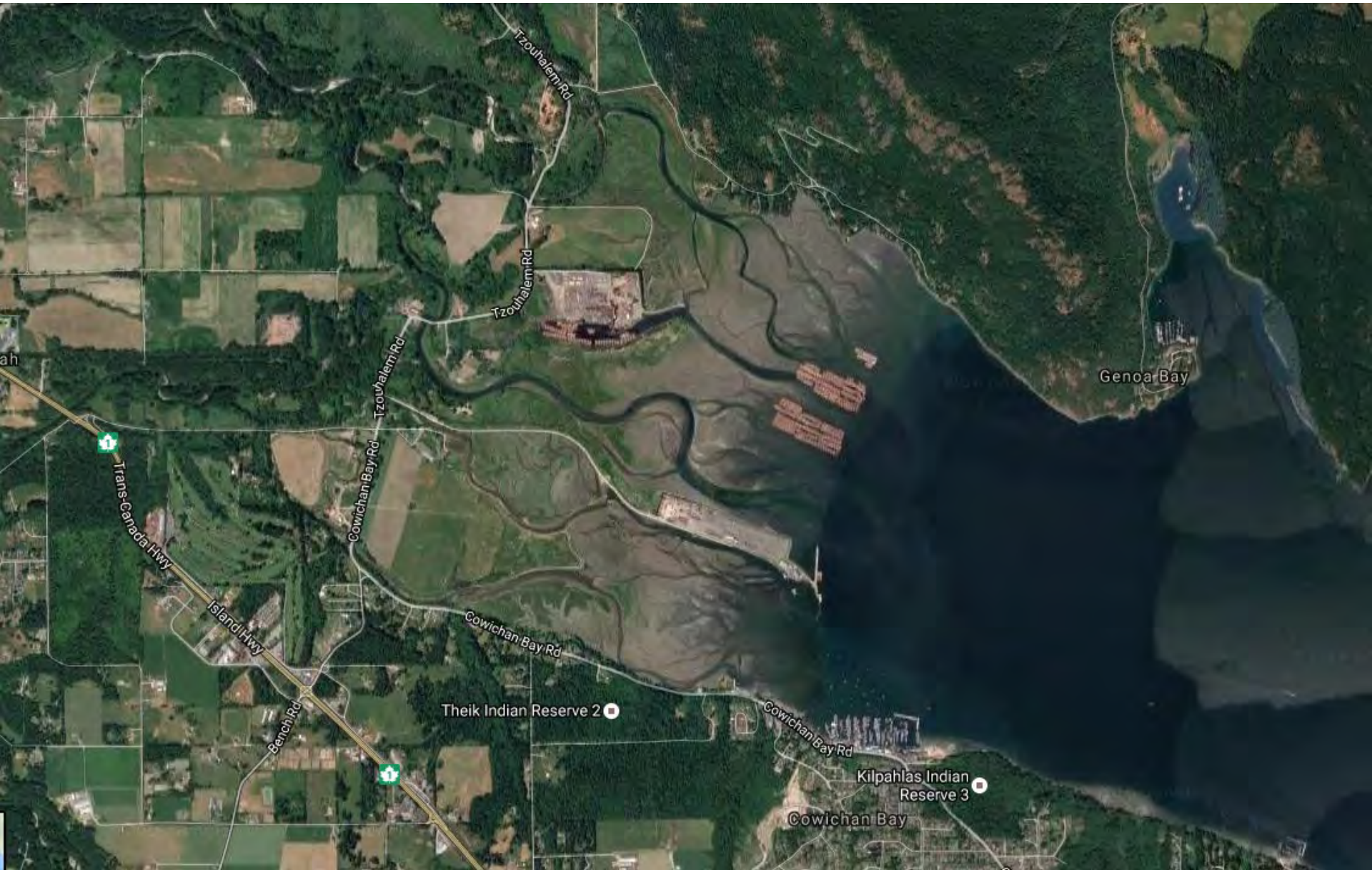
2.04 Mixed

Nooksack River (Washington)

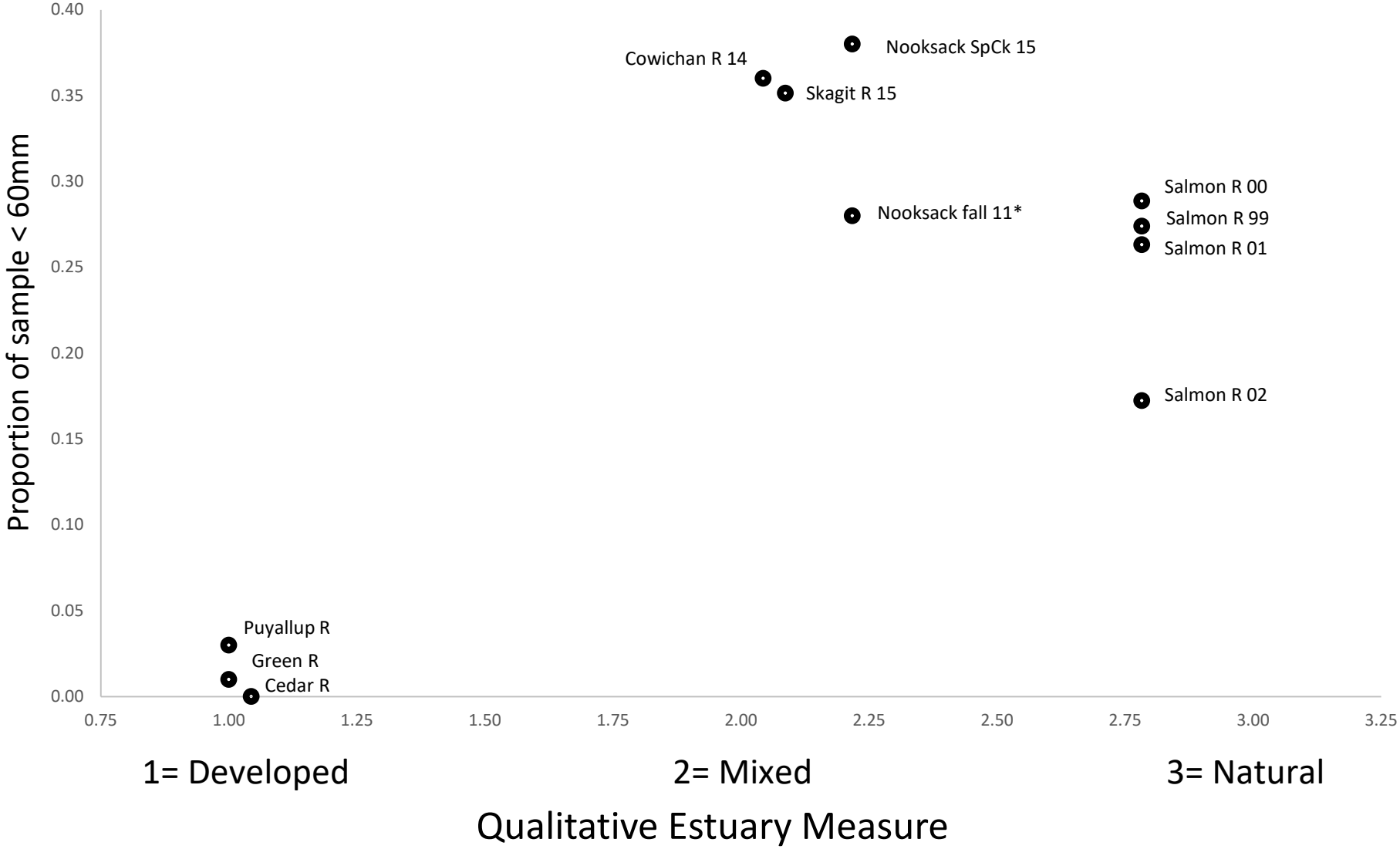
2.22 Mixed



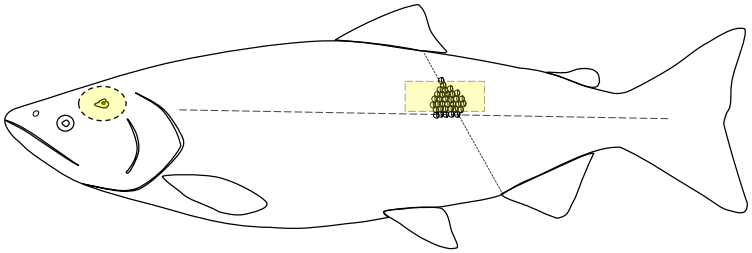
Cowichan River (British Columbia) **2.09 Mixed**



Estuary Habitat Quality and Life History Expression



Take Away



- Small juvenile Chinook (40-60mm) are leaving their natal streams (see juvenile outmigration data) and are surviving and contributing to adult Chinook populations in a significant way (~ 20-30%)*.

- Geographic difference in survival and life history expression (**Estuarine Habitat Availability**, Contaminants, Early Marine Survival, Pathogens)

- Linkage between life history expression, habitat restoration, and stock recovery

- Next Steps.

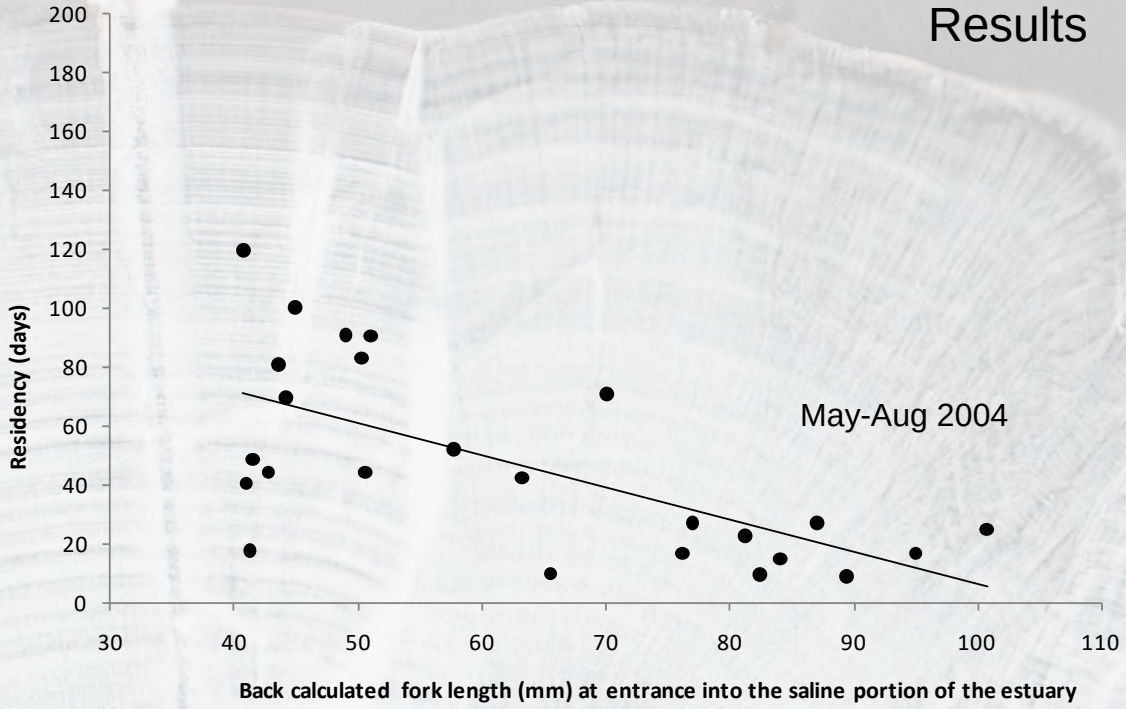
Fin

Special Thanks to:

Oregon State Universities Keck Collabratory for Mass Spectrometry (Adam Kent and Andy Ungerer)

The Washington Department of Fish and Wildlife Fish Ageing and Otolith Laboratories: Anna Hildebrandt**,** Lang Nguyen, Stefanie Karney, John Sneva, Lucinda Morrow, Dana Anderson, Eugene Sandborn.

Relationship between size at estuary entry and residency by time of capture



Year	Time of Capture	n	Mean Residency (days)	R^2	P-value
	Jan-April	6	35	0.2	0.37
2003	May-Aug	51	49	0.46	<.001
	Sept-Dec	14	78	0.68	<.001
	Jan-April	15	51	0.02	0.61
2004	May-Aug	25	63	0.47	<.001
	Sept-Dec	26	100	0.02	0.51
	Jan-April	39	33	0.09	0.07
2005	May-Aug	38	25	0.35	<.001
	Sept-Dec	4	44	0.62	0.21