Meadowdale Beach Park & Estuary Restoration: Lunds Gulch Creek Daylighting Study

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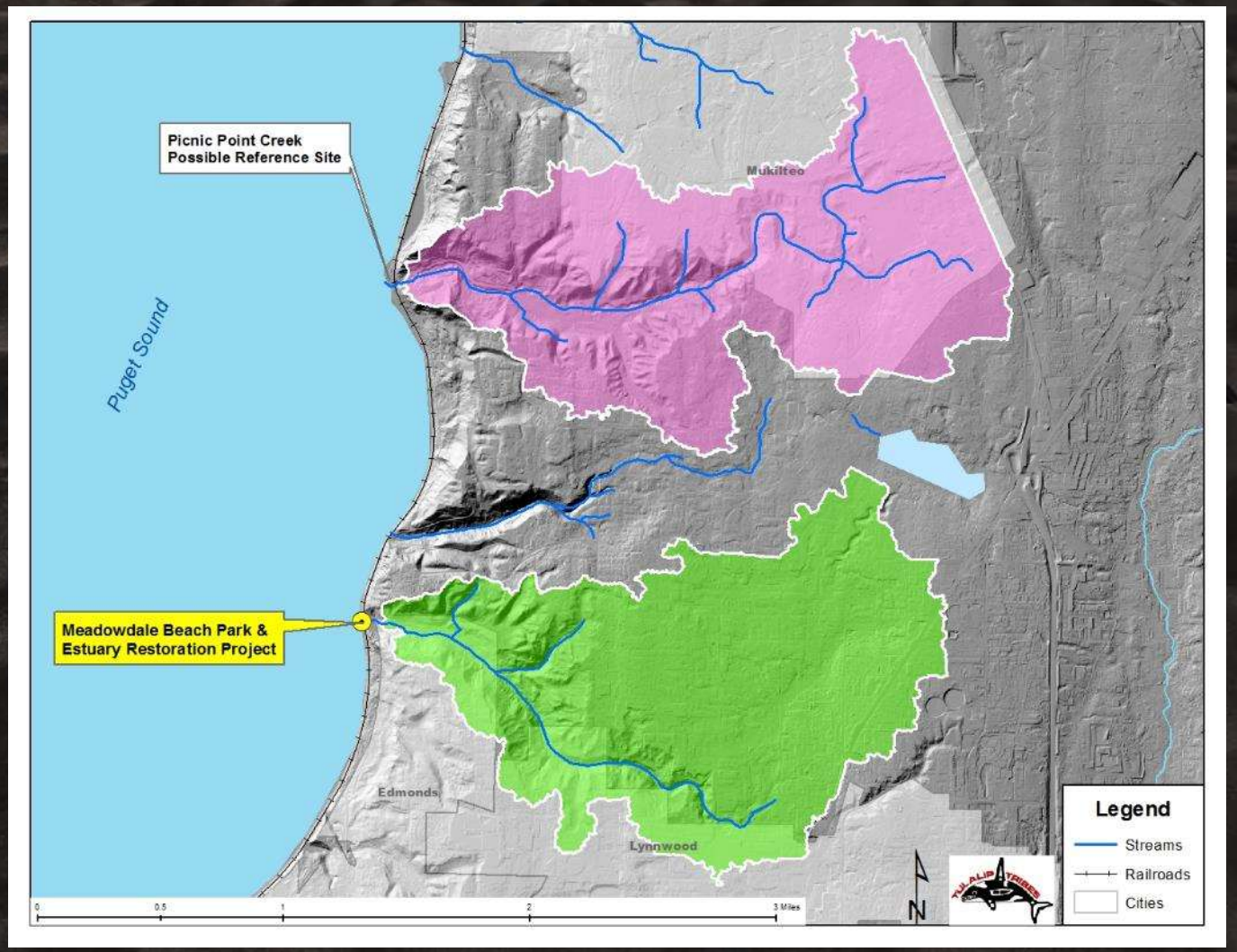
Tulalip Tribes[1], ESA[2], Sea Grant[3], USGS[4], Snohomish County Surface Water Management[5], Snohomish County Parks & Recreation[6], Students Saving Salmon[7]

Presentation Outline

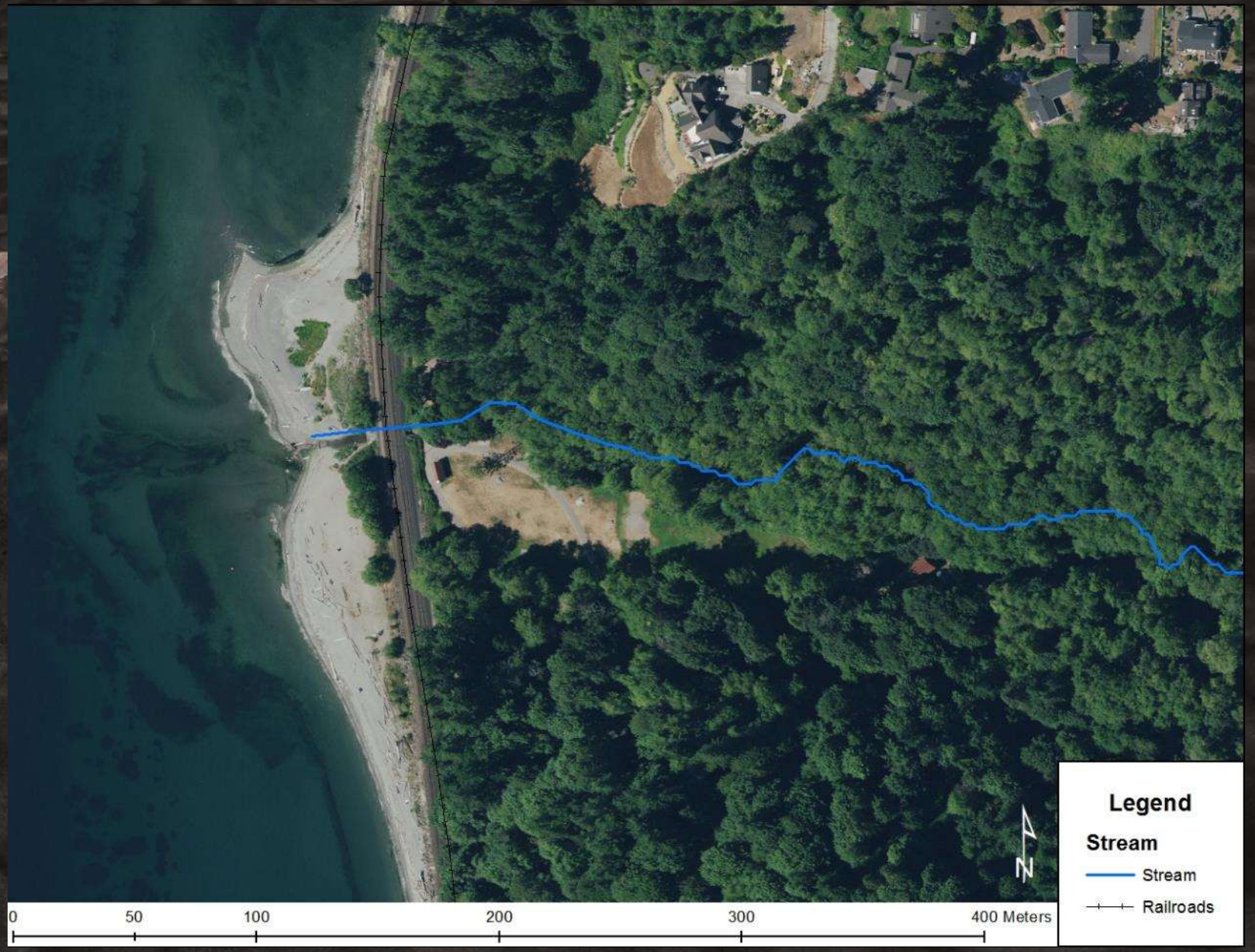
- Overview of Meadowdale Beach and Estuary Restoration Project
- Overview of previous work informing study effort and design
- Overview of study design, hypotheses, method and implications
- How the study will inform restoration design, planning, and effectiveness questions

Background

Meadowdale Beach Park & Estuary Restoration Project

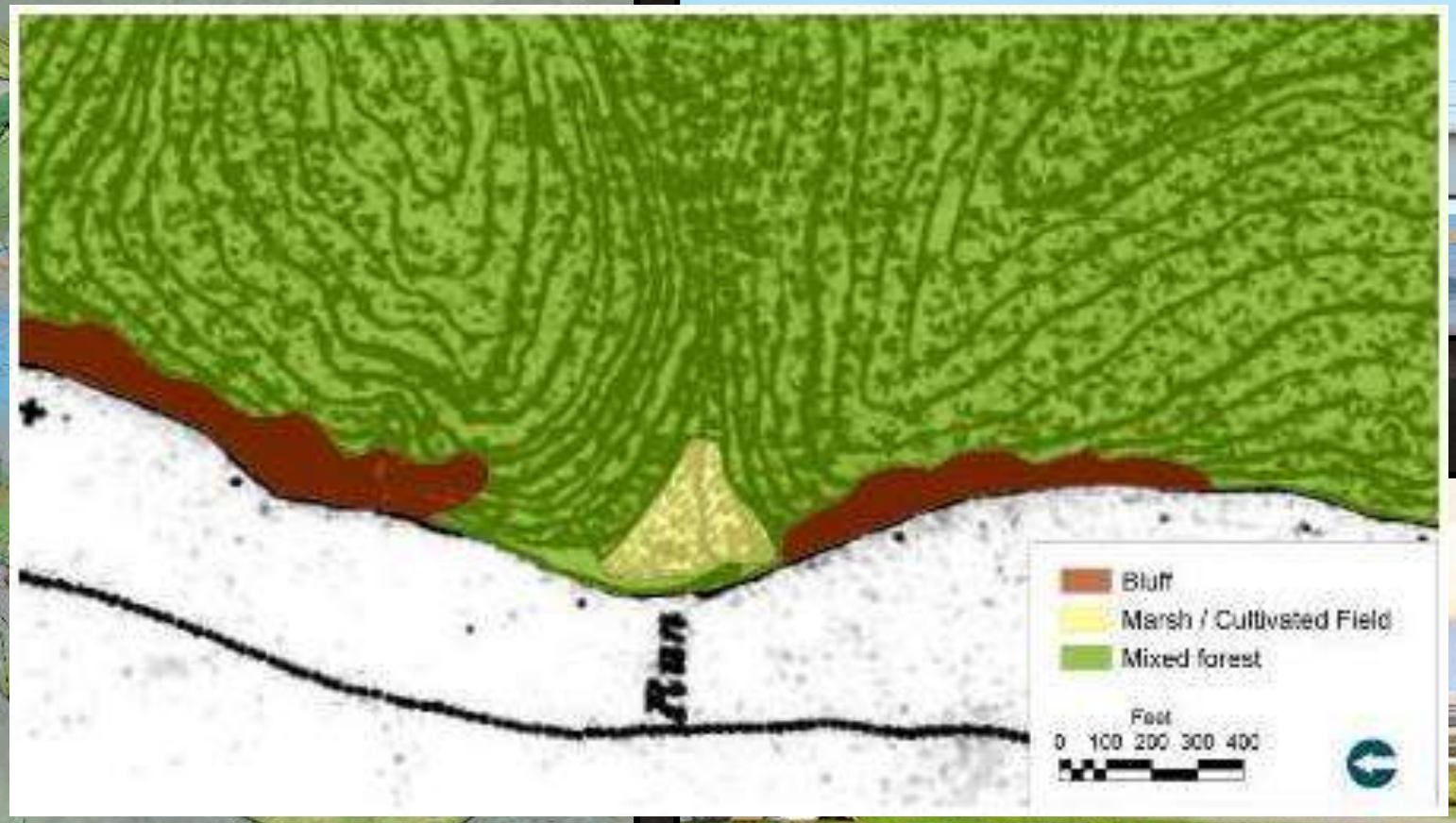


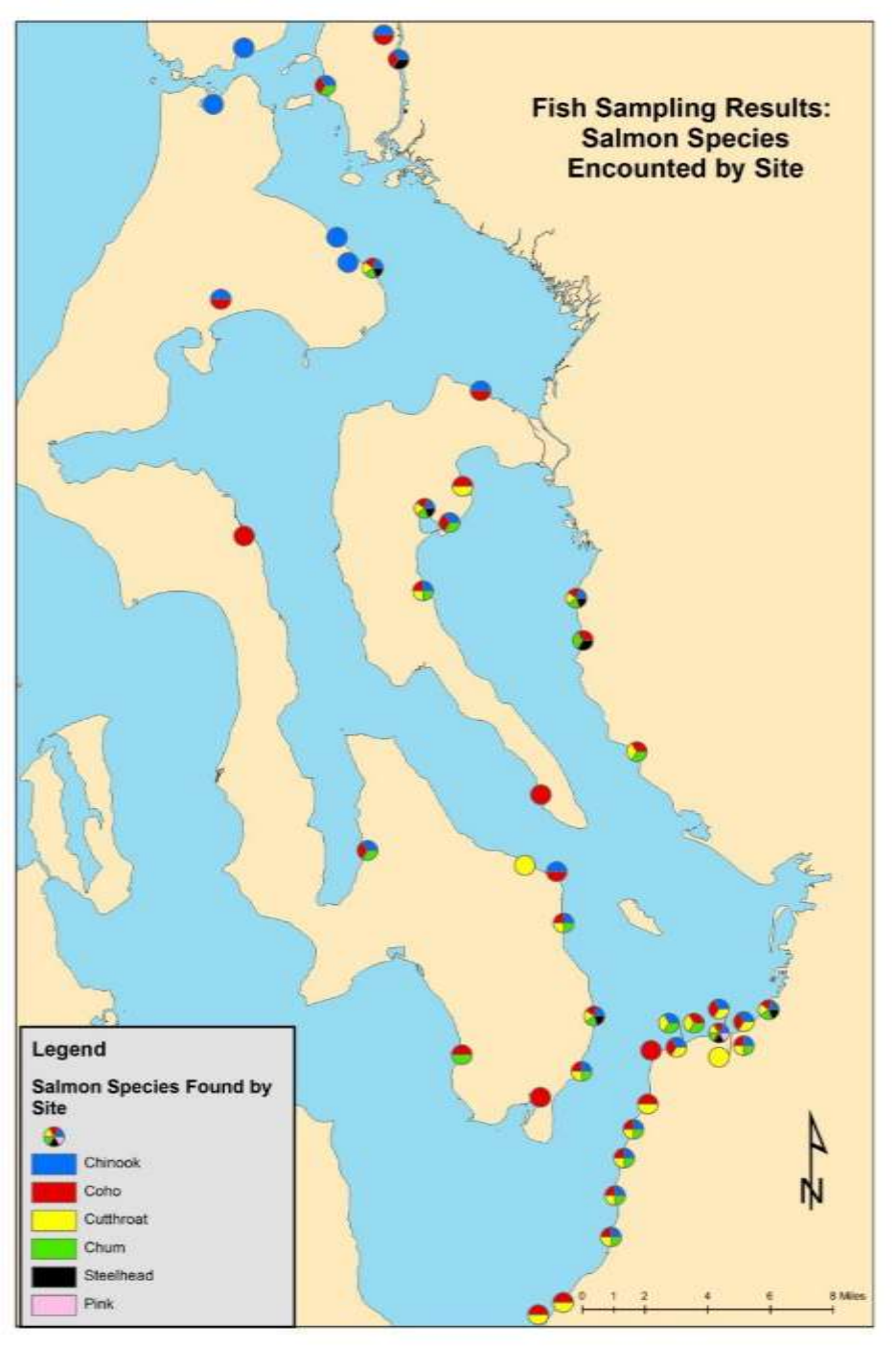
Project Site Existing Conditions



Undersized Culvert; Restricted Estuary; Sediment Deposition; Park Flooding

Meadowdale Restoration





Stream Sampling

- 63 Streams Sampled
- 61 Habitat Surveys
- Sampled intertidal and stream channel

Stream Sampling Results

Salmonid Species	Number of streams	
	Present	Not found
Chinook salmon	32	31
Steelhead trout	9	54
Coho salmon	31	32
Cutthroat trout	23	40
Chum salmon	23	40
Pink salmon	2	61

Stream Crossings included in Framework (n=196)

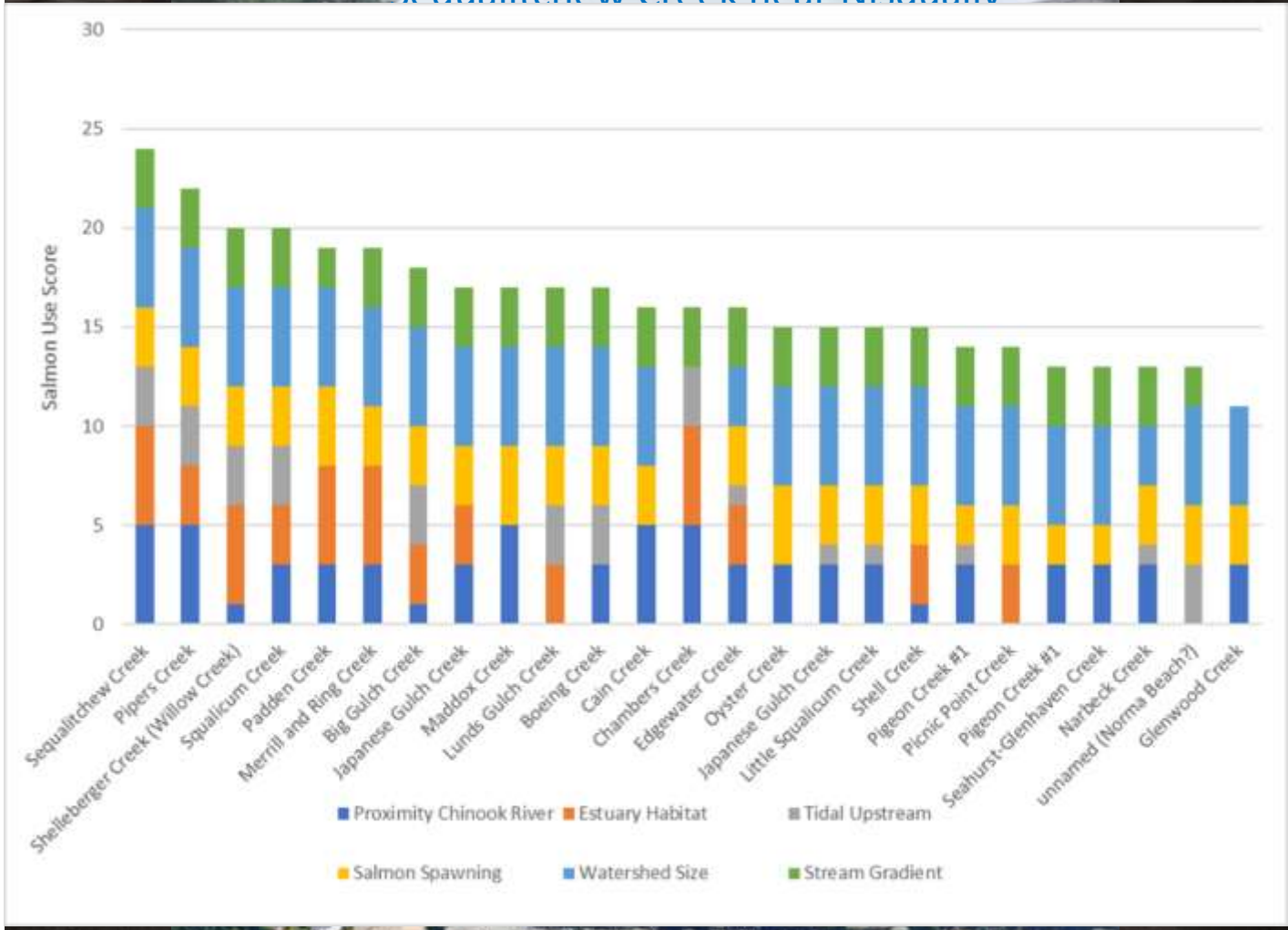
N

0 5 10 20 Miles

CONFLUENCE ENVIRONMENTAL COMPANY

Examples of other sites in planning stage of restoration of railroad crossing

Sequalitchew Creek near Nisqually



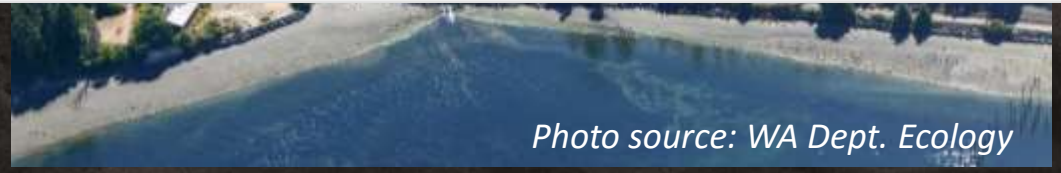


Photo source: WA Dept. Ecology

Conceptual Models

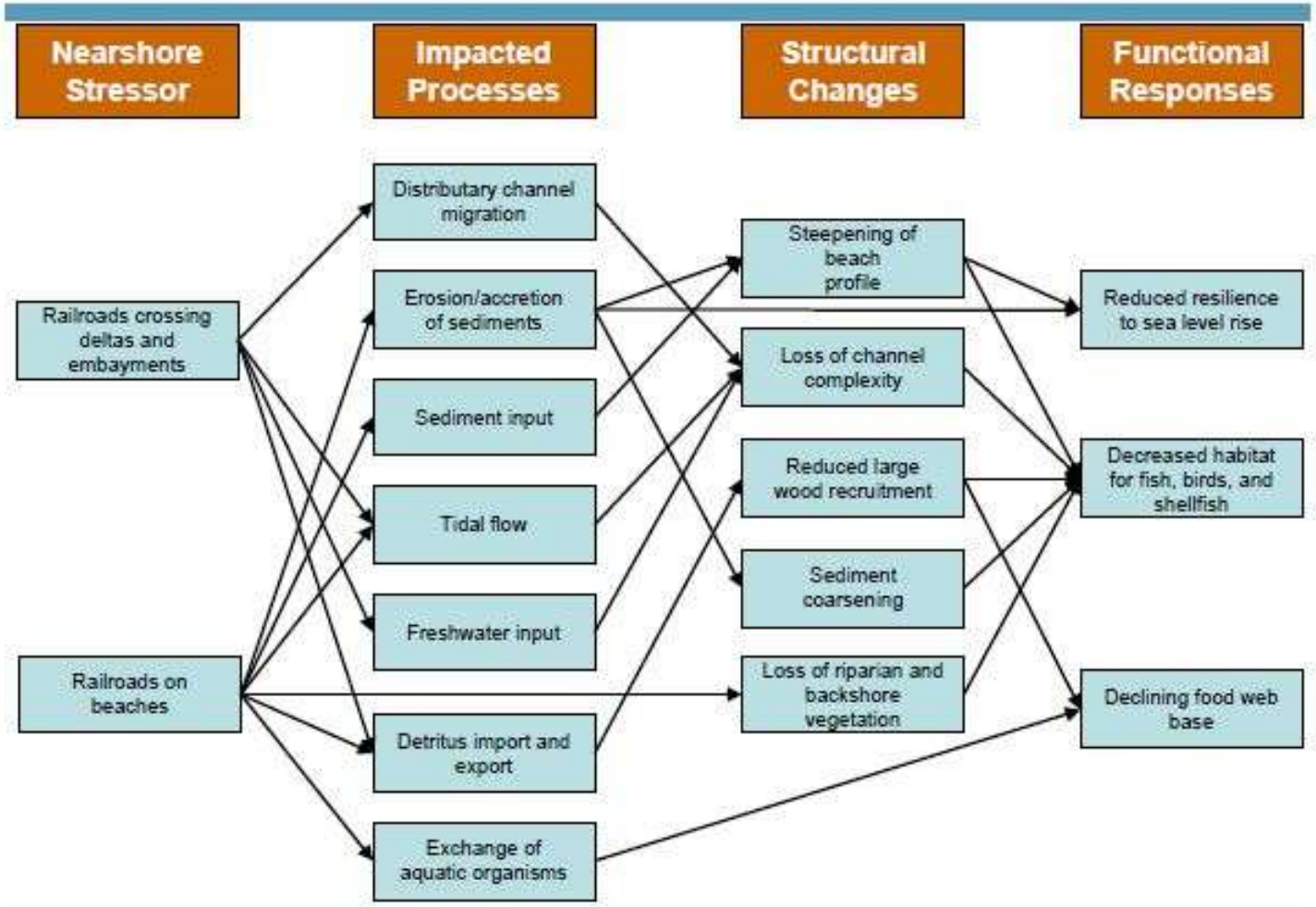
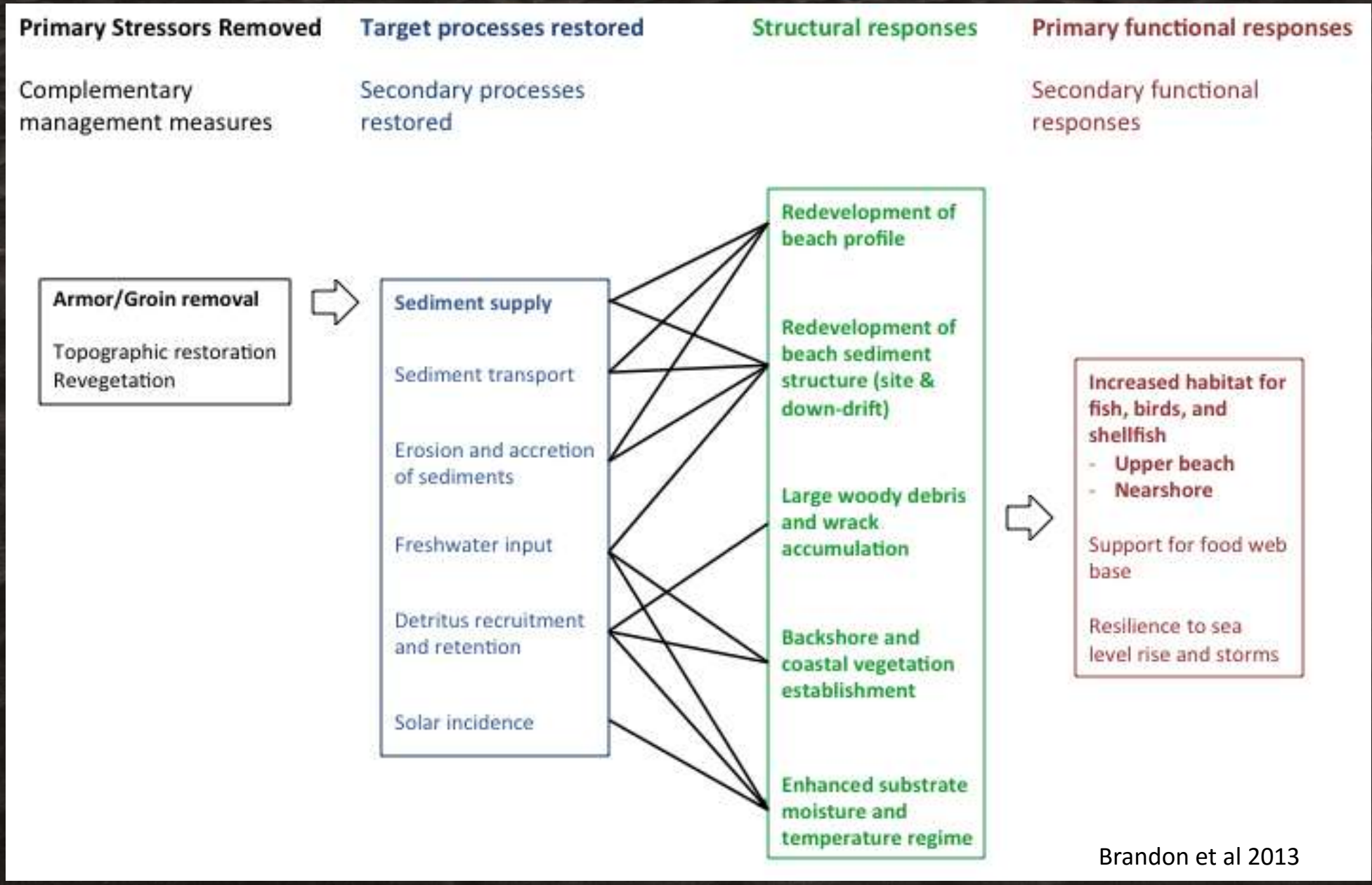


Figure 4-7

Conceptual Model Diagram Showing the Impacts of Railroads on Nearshore Processes, Structures, and Functions

Schlenger et al 2011

Conceptual Models



Brandon et al 2013

Draft Hypotheses

Geomorphic Hypothesis 1 :

Restoration of the upper estuary will deposit sediment in the salt marsh/pocket estuary landward of the railroad and reduce the amount of sediment delivered to the beach

Method/s

- Track movement and distribution of sediment
  - cross sections of stream & embayment
  - Track tagged gravel in stream, embayment, & beach
  - Beach profile surveys of beach
  - UAS flights

Implications

- Restoration of sub estuaries may result in reduced sediment inputs into armored RR corridor/sediment starvation
- Loss of beach on waterward side of railroad

Geomorphic Hypothesis 2:

Restoration of the upper estuary will allow the creek mouth to migrate and distribute sediment across the wider beach/delta expanding amount of upper beach habitat waterward of the railroad.

Methods

- Cross section surveys of beach and channel profile
- UAS flights
- ARGUS monitoring camera/ time lapse cameras

Implications

- Over long-term, beach becomes more elongated along RR rather than semi-circular in nature.
- Over long-term, stream mouth may intermittently close due to longshore transport vs fluvial processes, Spit cuts off stream mouth

Ecological Hypothesis 1:

Post restoration fish assemblages in the lower portion of the stream/saltmarsh/beach will change and become more diverse

Method

- Electrofishing and beach seining.
- 2018 & 2021 Electro fishing data for Lunds Gulch vs. 2022 +
- reference site (Picnic Point)

Implications

- If relative abundance as restoration site is greater, it can identify a successful method for salmon recovery in Salish Sea.
- Site restoration increases diversity and abundance of fish use in multiple areas within restoration site.

Ecological Hypothesis 2:

Post-restoration, the restoration site will provide rearing habitat for juvenile salmonids above and below the railroad.

Method

- Electrofishing
- DNA samples taken from salmon caught while electrofishing
- DNA samples analyzed for re-caught individuals

Implications

- Evidence juvenile salmon/chinook rear in restored stream/sub-estuary = important rearing habitat
- DNA data could also be used to determine river of origin for juvenile chinook

Ecological Hypothesis 3:

Post restoration macroinvertebrate assemblage overall, and the subset preyed upon by juvenile Chinook/salmon will increase in abundance, richness, and diversity.

Method

- Neuston tow, fallout traps and sample preservation during sampling days, comparison between restored site, marine waters, reference site, and reference marine waters. may need to be later analysis due to funding.

Implications

- Restored stream/sub-estuary are more productive than non-daylighted streams restoring stream/sub-estuaries is ecologically beneficial
- More salmon food in restored site = important for salmon recovery efforts.

Sampling Effort (Biotic)

Fish Sampling – changes in assemblages, changes/differences in relative abundance, & presence/absence

Electrofishing in stream and low tide channel

Small beach seines – pocket estuary sampling method

- DNA samples to track residence time and growth rates

Invertebrate Sampling

Neuston plankton tow

Fall out traps

Stream habitat surveys – lower reach

Spawner surveys – High school student club Students Saving Salmon

Forage fish egg surveys - Snohomish Marine Resources Committee

Optional - Marine aquatic vegetation mapping

Sampling Effort (Abiotic)

Geomorphic

Changes in beach profile pre & post restoration – RTK GPS

Beach sediment type & distribution changes - pre & post restoration

- Time lapse camera/ ARGUS
- UAS flights

Sediment movement and dispersion tracking – pit tagged rocks

Stream channel & Embayment cross-section surveys

Fluvial

Stream volume and velocity – data loggers

How will this study help inform restoration

Confirmation of restoration effectiveness

Restoration ecological benefit – juvenile salmon utilization (connectivity)

Inform restoration design and implementation – bridge span vs culvert, embayment vs channel

Help develop standard methods for evaluating stream mouth restoration projects

– what are key parameters to monitor and most cost effective way to monitor?

Understand project effects in the

Characterize project effects (ecosystem structures/functions) outside project footprint (e.g., beach downdrift

Help advance modeling of habitat responses within the context of physical processes influencing project outcomes

Draft Tasks

Pre-restoration monitoring (<u>Non-ESRP funds</u>)

- Develop Quality Assurance Project Plan (QAPP)
- Conduct Beach and stream surveys Fall 2020 & Spring 2021
- Conduct Fish sampling Feb-June 2021
- Install data logging equipment

ESRP Funded Study

Task 1 – Project Management and contracting

Task 2 - Form advisory group to provide feedback and direction for study (Optional)

Task 3 – Beach and stream surveys

Task 4 – Install data logging equipment and sensors

Task 5 – Fish sampling Feb-Jun, 2021 & 2022

Task 6 – Data QA/QC and analysis

Task 7 – Final report and possible publication

Deliverables

- Four years of fish sampling data (2 years pre-restoration, 2 years post restoration)
- Beach and stream survey data, pre and post restoration
- Aerial imagery of the site pre and post restoration (multiple flights pre and post restoration, target is 3-4 flight per year)
- Timelapse or ARGUS imagery of post restoration beach evolution
- Spawner survey data
- Invertebrate assemblage data – pre and post restoration
- Final Report on ecological and geomorphic response of stream mouth restoration and recommendations for future design, implementation, and planning of stream mouth restoration projects
- Possible professional journal publication on study findings

Budget

Salaries -	$100,000
Contracting -	$57,000
Supplies -	$4,338
Travel -	$1,500
Equipment -	$12,000
Indirect (19.05%) -	$20,162

Total Request = $195,000

Match = $59,000

Project Total = $254,000

Questions?

HABITAT AND FISH USE OF POCKET ESTUARIES IN THE WHIDBEY BASIN AND NORTH SKAGIT COUNTY BAYS, 2004 AND 2005

January 16, 2006



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Karen Wolf, Skagit River System Cooperative

[1] Working on behalf of the Samish Nation at the time of field data collection for this project

Coastal Streams and Embayments Prioritization along Puget Sound Shores with a Railroad
PRIORITIZATION FRAMEWORK TECHNICAL REPORT

Prepared for:

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December 31, 2019

Confluence (Confluence Environmental Company), ESA (Environmental Science Associates), CGS (Coastal Geologic Services) and Tulalip Tribes Natural Resources. 2019 Coastal streams and embayments prioritization along Puget Sound shores with a railroad: prioritization framework technical report. Prepared for Washington Department of Fish and Wildlife, Olympia, Washington, by Confluence, Seattle, Washington.

146 N Canal St. Suite 111 • Seattle, WA 98103 • www.confenv.com

JUVENILE CHINOOK SALMON
REARING IN SMALL NON-NATAL STREAMS
DRAINING INTO THE WHIDBEY BASIN

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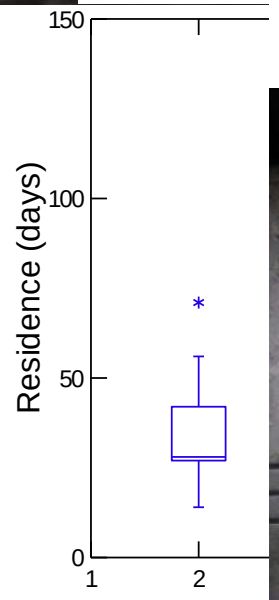
December 3, 2013

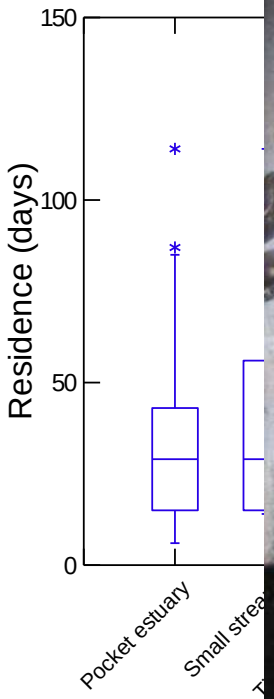
Strawberry Point N Creek, photo by Rich Henderson

[1] Skagit River System Cooperative, LaConner, WA
[2] Tulalip Tribes, Tulalip, WA
[3] NOAA Fisheries, Seattle, WA

Data from Chinook DNA Samples

Chinook





tween starting and ending location	
ime	Distance
cket estuary system	
4 days	0.2 km
estuary system	
days	5.1 km
ore	
1 days	8.1 km
days	5.9 km
days	19.4 km

Environmental Conditions

- Historic marsh (sediment conveyance?)
- Net northward transport
- Tri-modal wind/wave regime* generates XX m annual high waves

**Paine Field winds commonly biased low relative to winds over water*