



RESTORATION BENEFITS BELOW THE SURFACE: DEVELOPING AN EMPIRICAL BASIS FOR CONNECTING SHORELINE RESTORATION TO SALMON RECOVERY

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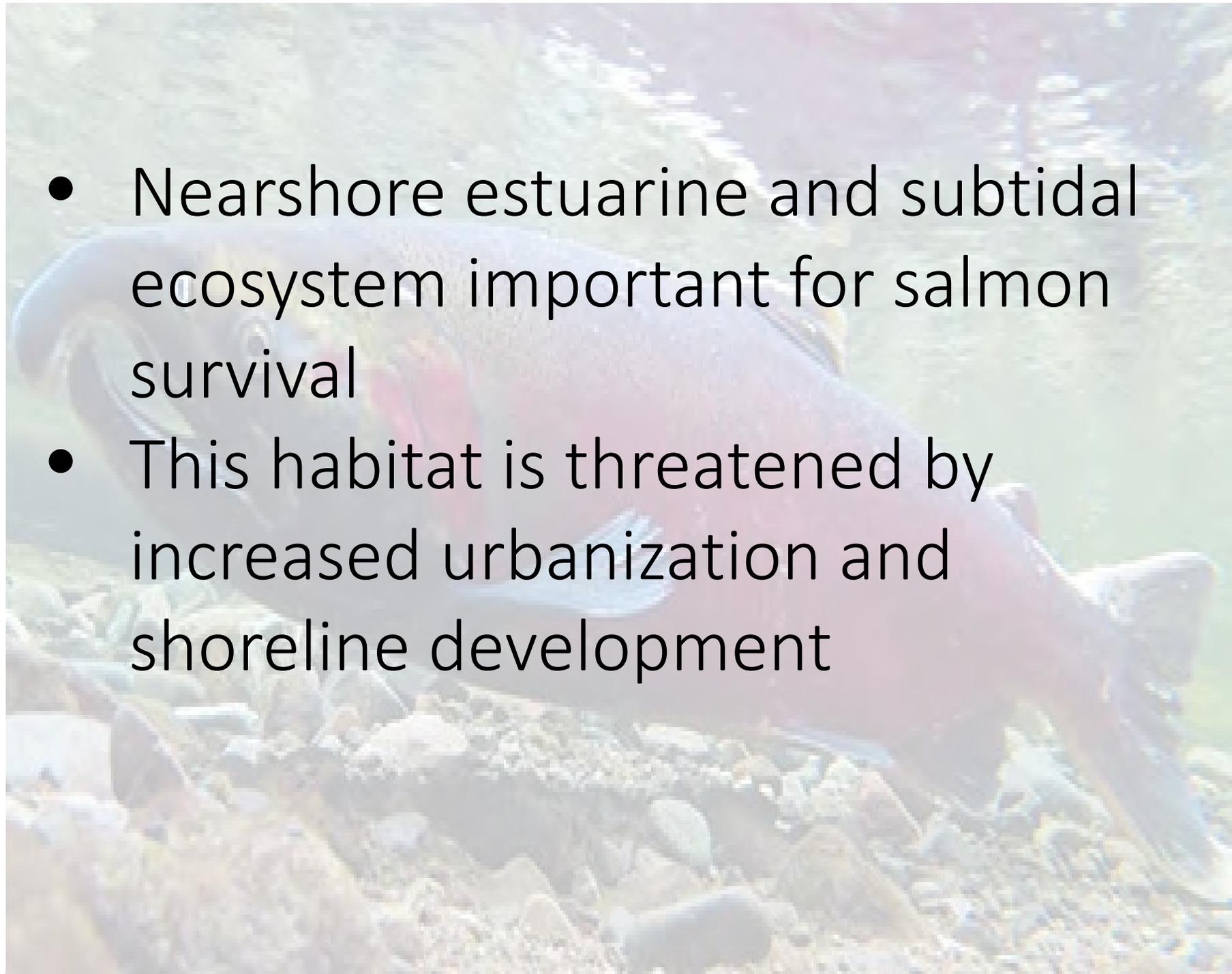
NOAA NWFSC¹, UW Tacoma- Puget Sound Institute²

Acknowledging this gathering and field work on traditional territory of the Coast Salish People

- Nisqually Tribe
- Puyallup Tribe
- Duwamish Tribe
- Skagit Tribe
- Swinomish Tribe
- Lummi Tribe
- Klallam Tribe
- Samish Tribe



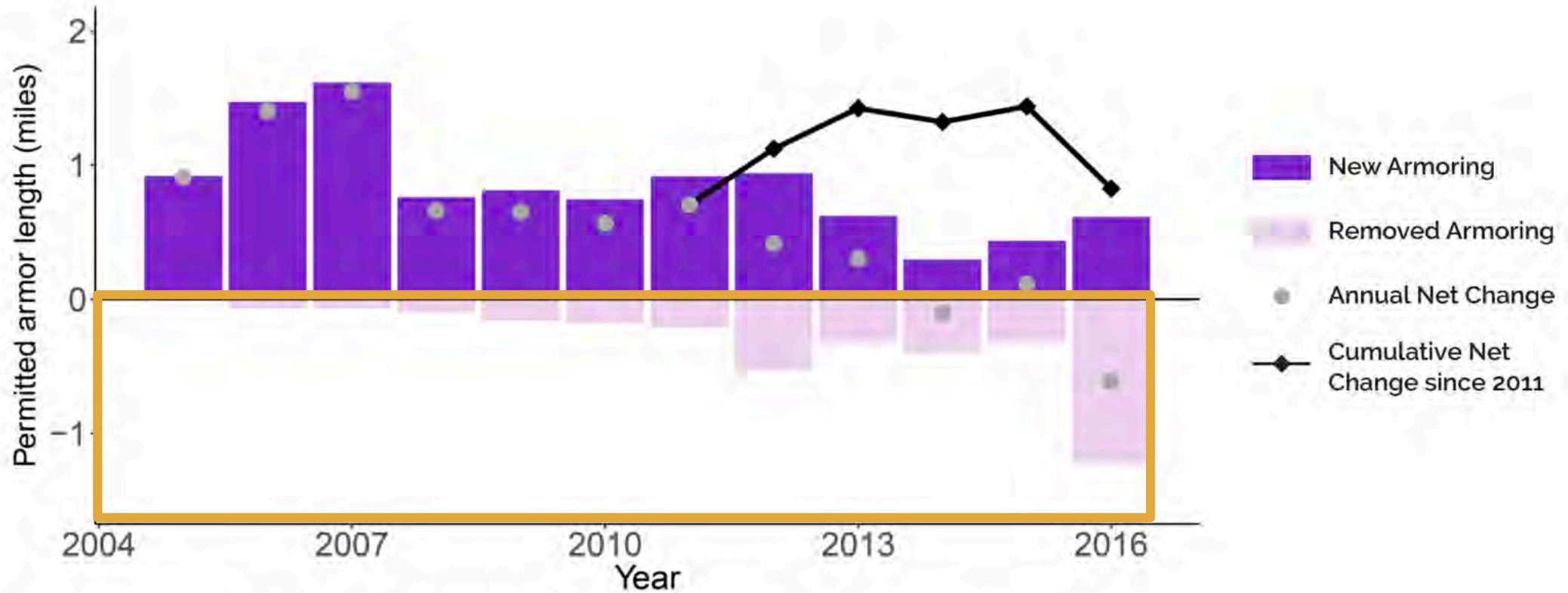
- Nearshore estuarine and subtidal ecosystem important for salmon survival
- This habitat is threatened by increased urbanization and shoreline development



14% of U.S. shoreline is armored (Gittman et al 2015)
27% (675 miles) of Puget Sound shoreline is armored (EOPS)



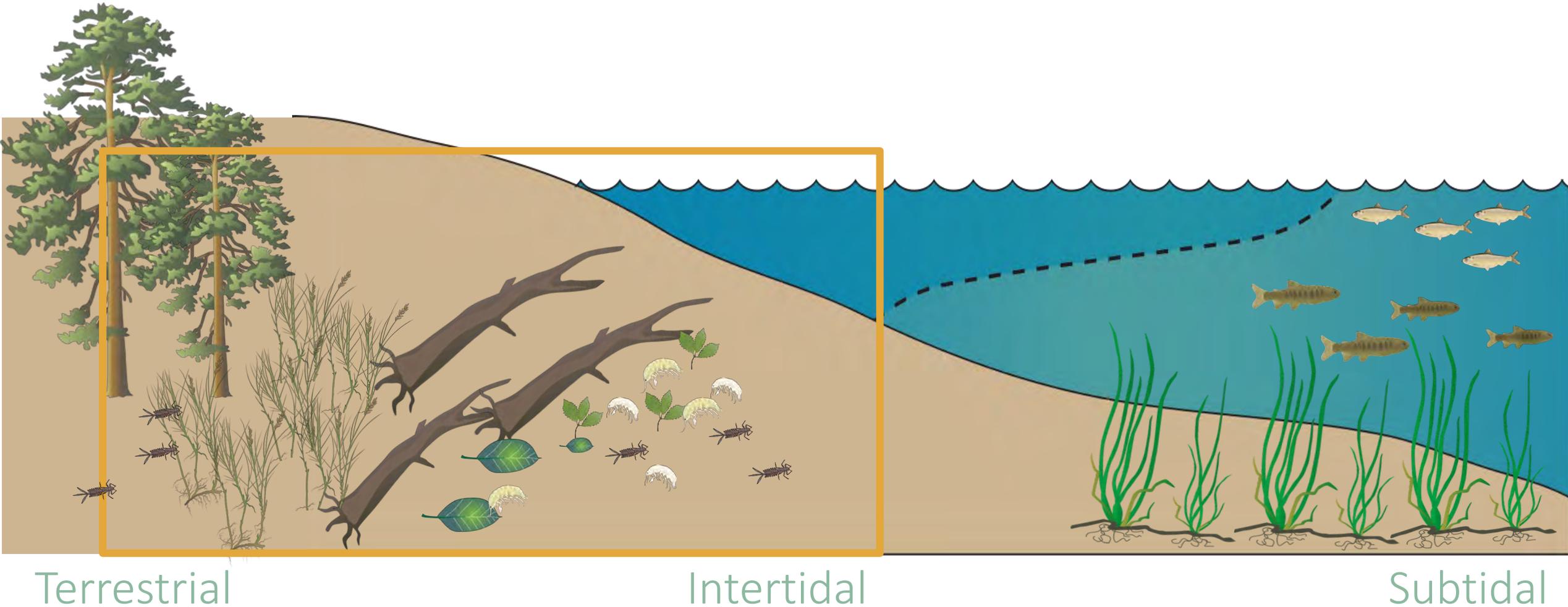
Increase in Shoreline Restoration Efforts



Permitted armor length in miles; Vital Sign indicator status measured from 2011 onwards.

SOURCE: Shoreline Implementation Strategy, 2018 (Data compiled from Hydraulic Project Approvals issued by Washington Department of Fish & Wildlife, Habitat Program)

Shoreline restoration can restore terrestrial and intertidal ecosystem function and linkages.

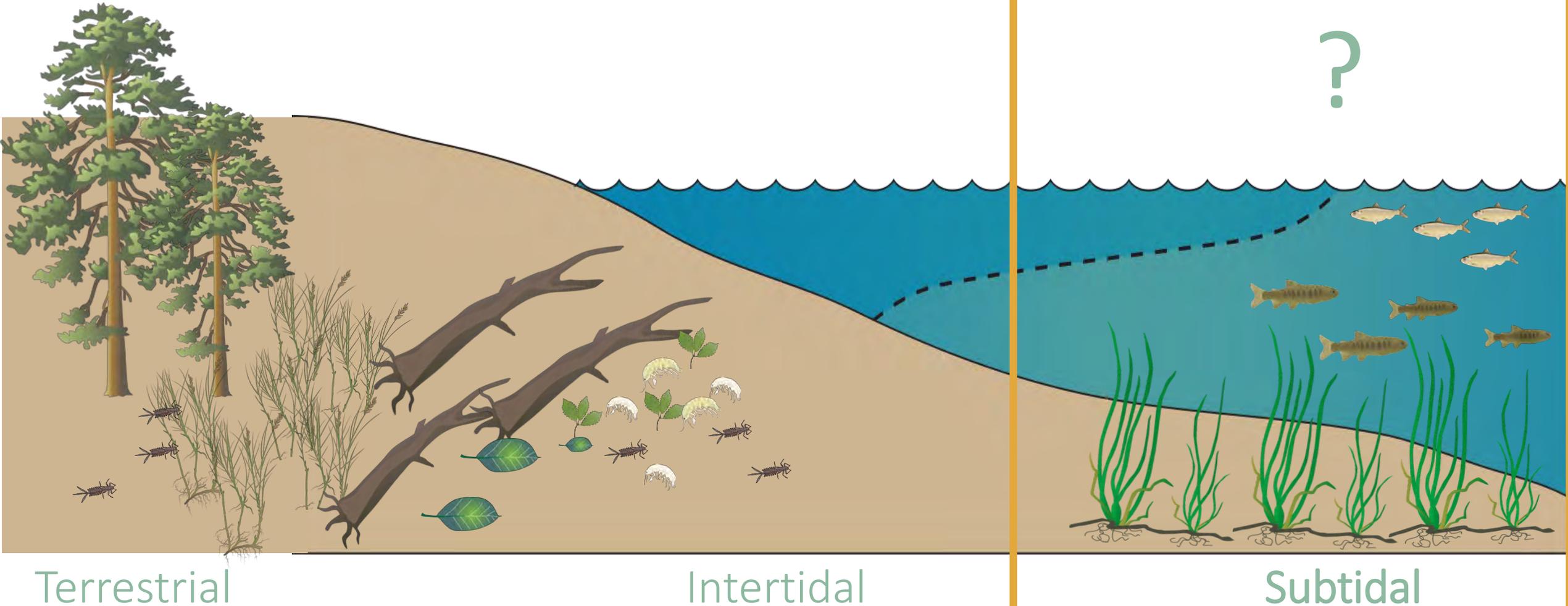


Terrestrial

Intertidal

Subtidal

Impacts of shoreline restoration to subtidal ecosystems?



Can shoreline restoration link to salmon recovery?

Shoreline type [Armored, Reference, Restored]



Armored



Natural



Restored



Can shoreline restoration link to salmon recovery?

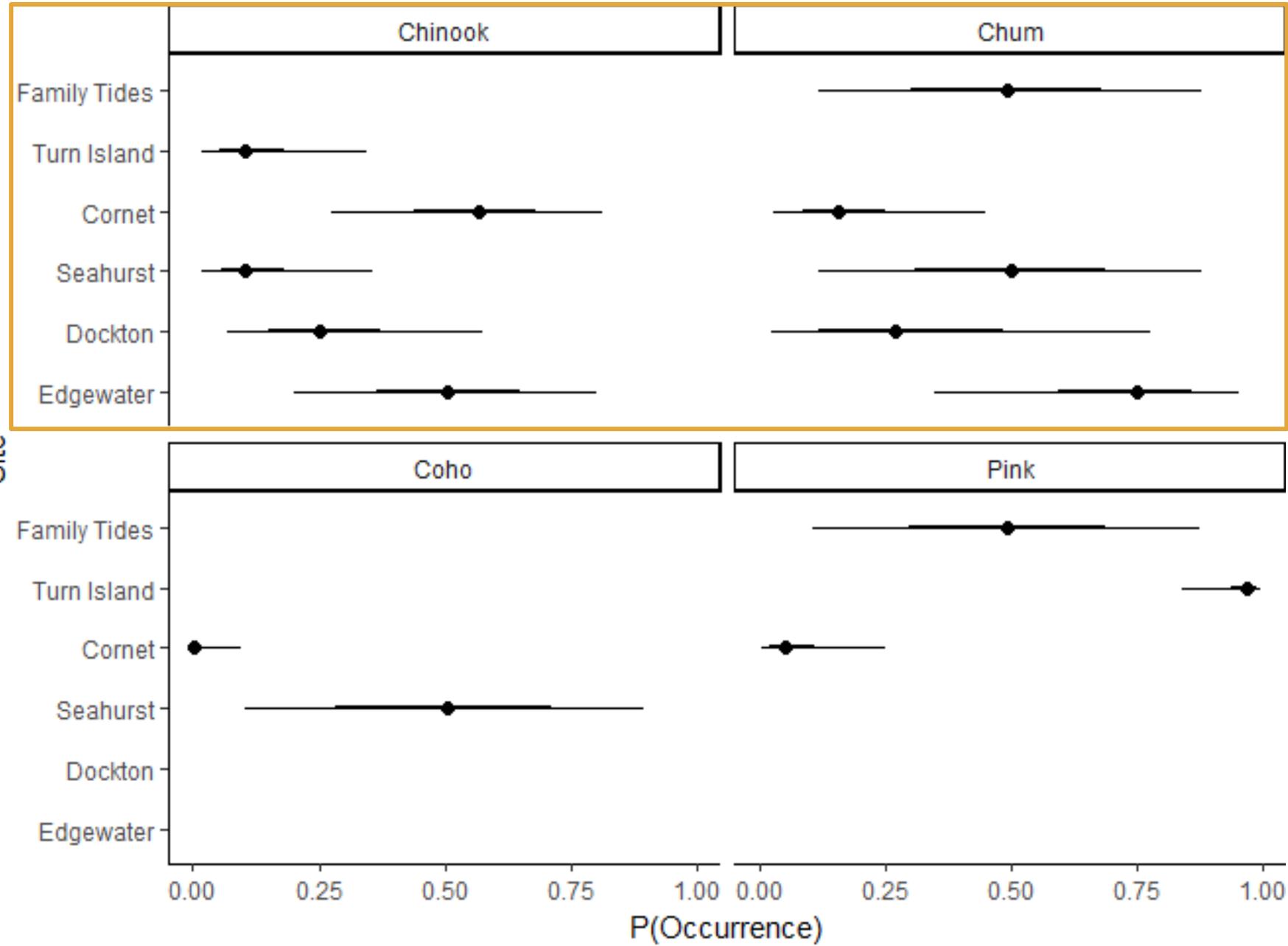
Data Analysis

What is the probability of observing a salmon across site and shoreline types?

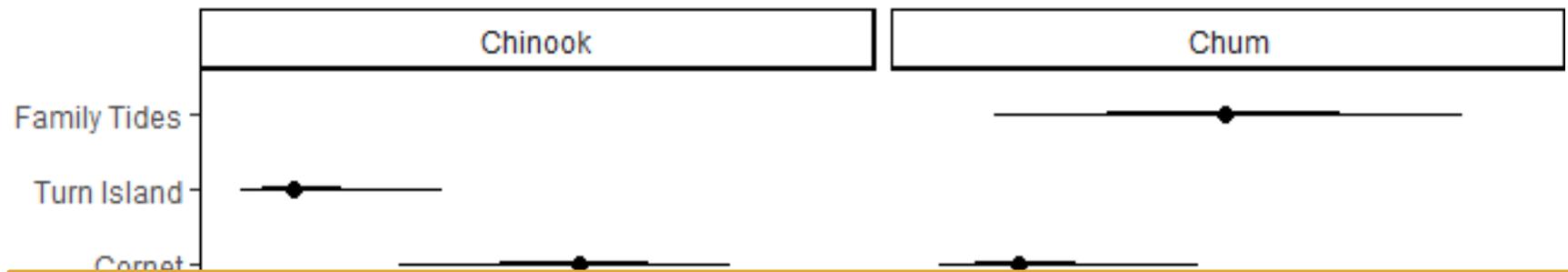
- Bayesian framework: GLM
- Presence/absence of species- combination of visual and direct survey detection methods
- Separate model for each species.



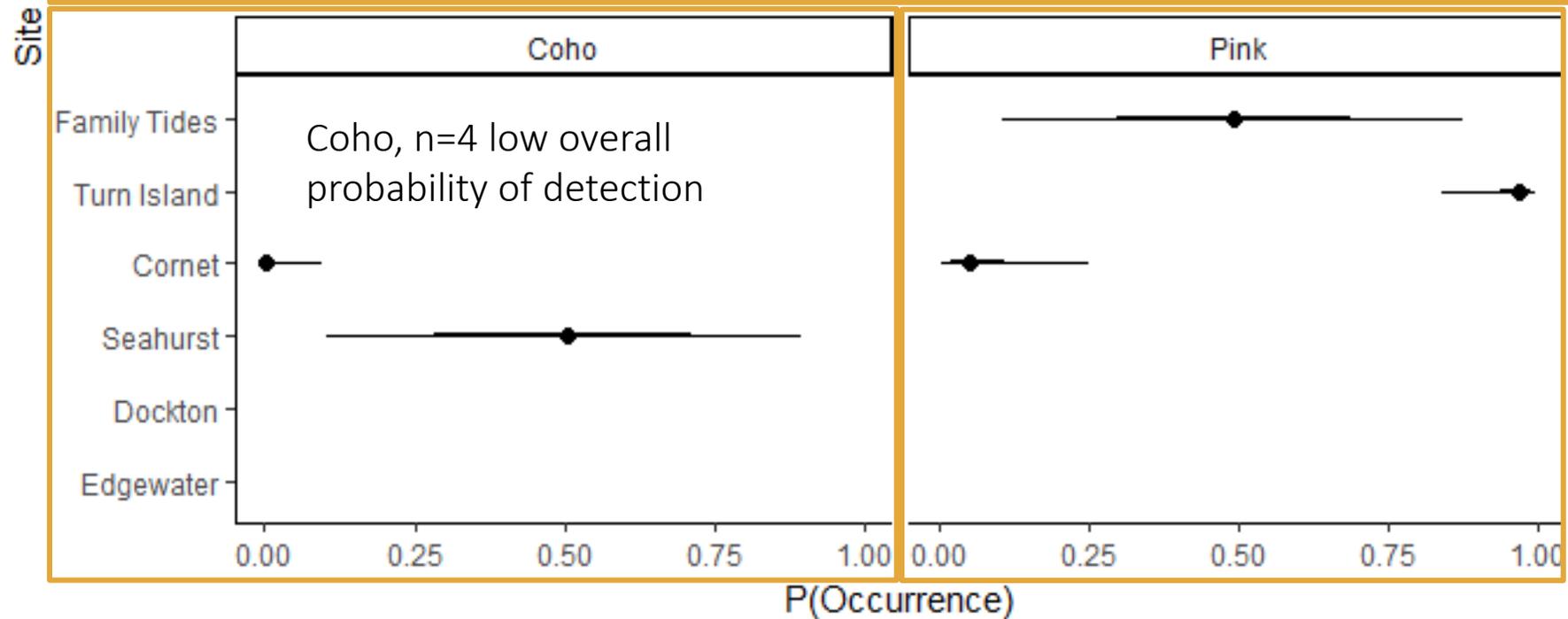
Salmon presence varies by site, variability not consistent among species



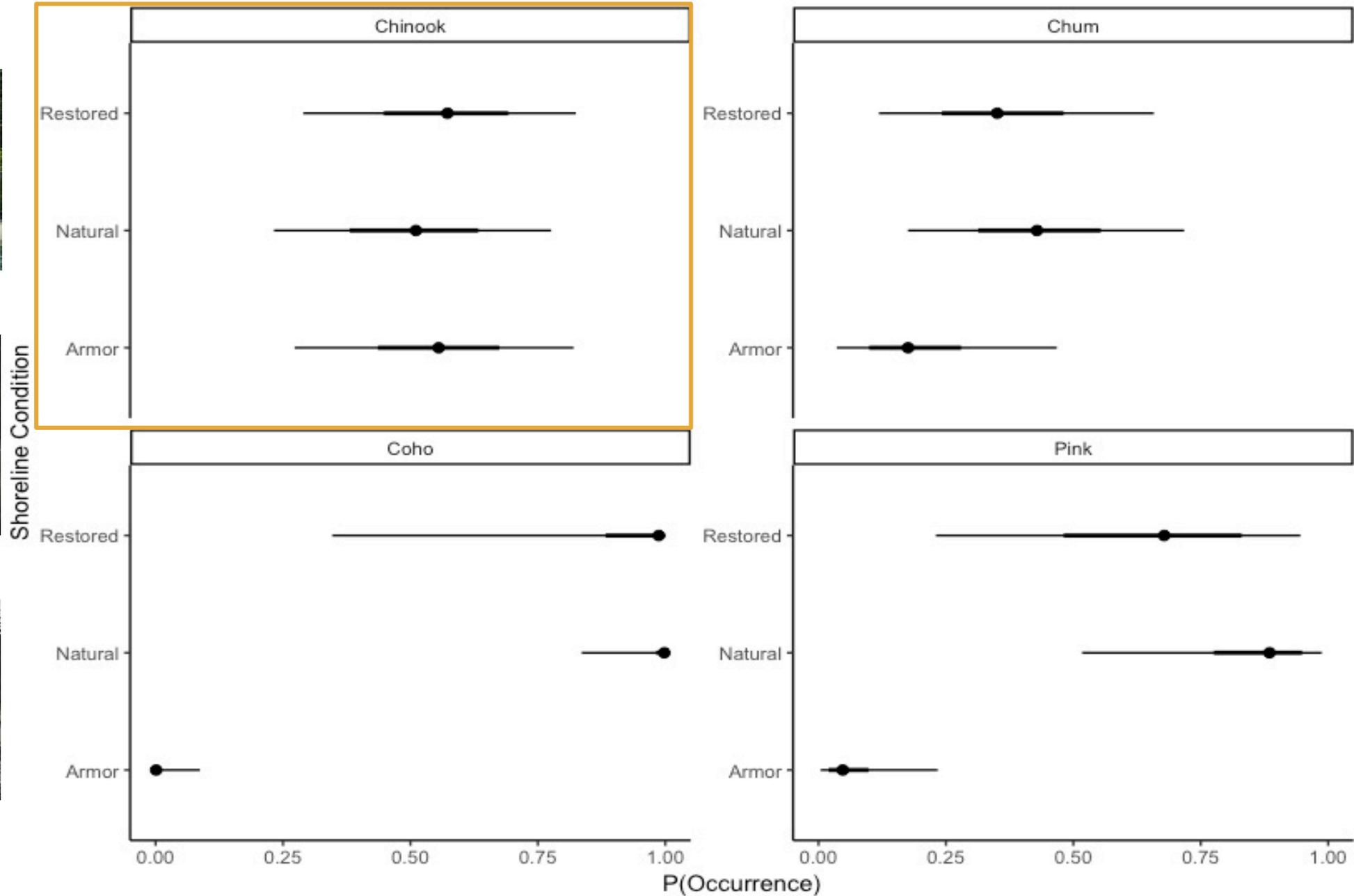
Salmon presence varies by site, variability not consistent among species



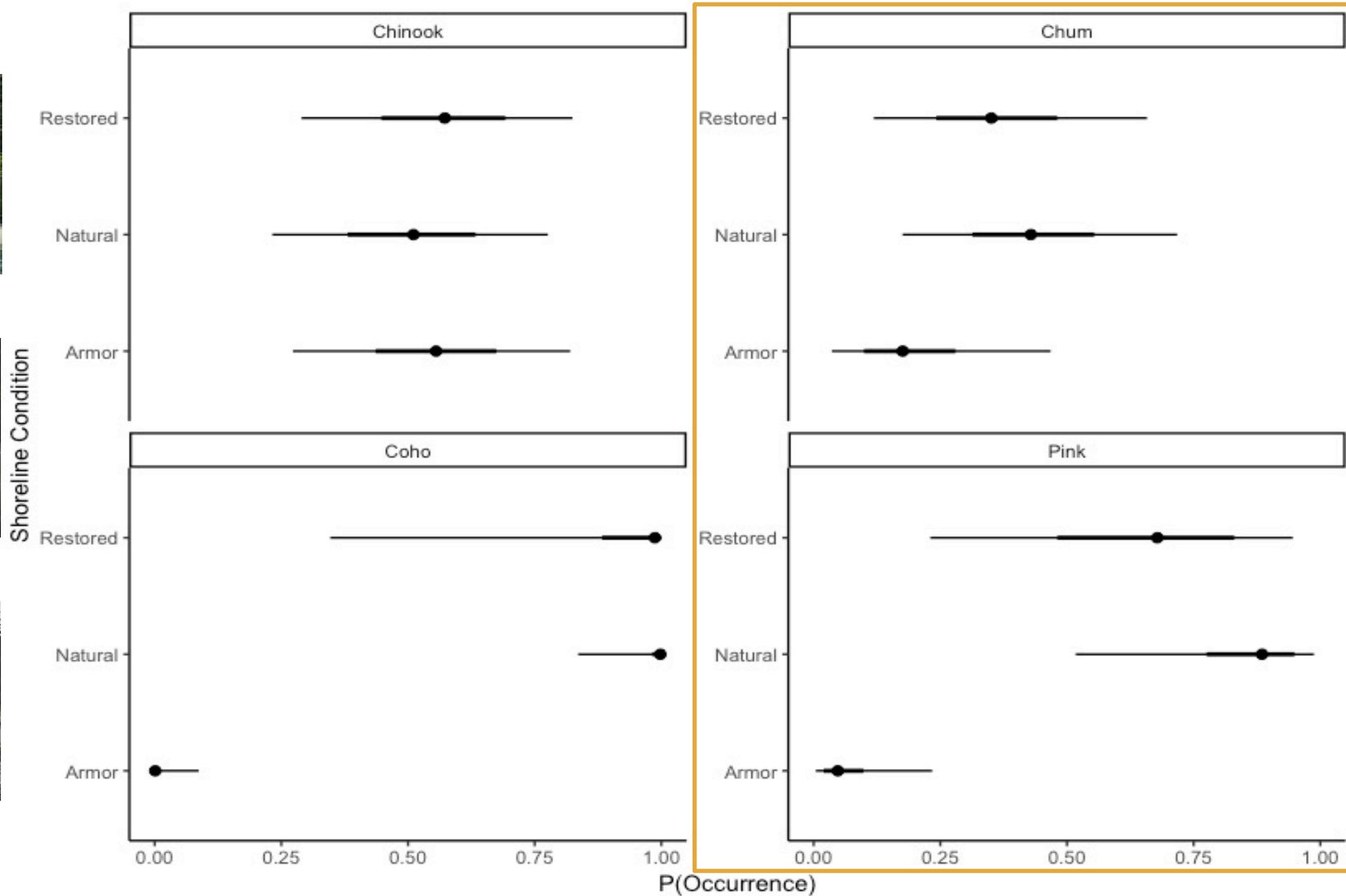
Variability driven by:
-Geography?
-Intrinsic site differences?



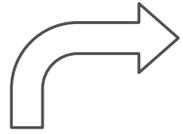
Probability of seeing a salmon along a shoreline varies by species



More likely to see Chum and Pink at natural and restored shorelines

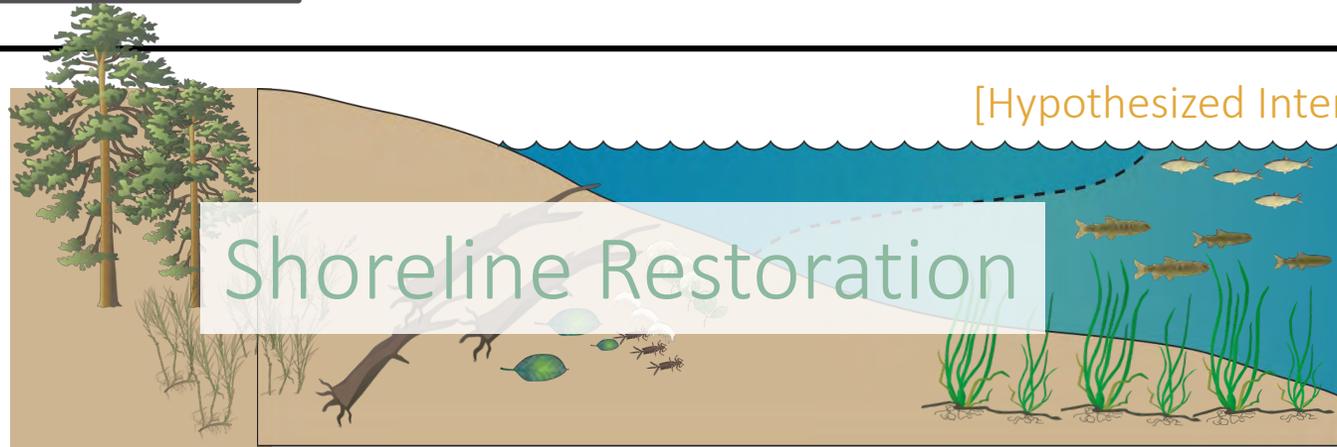
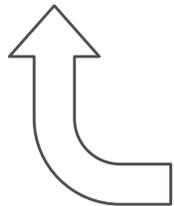
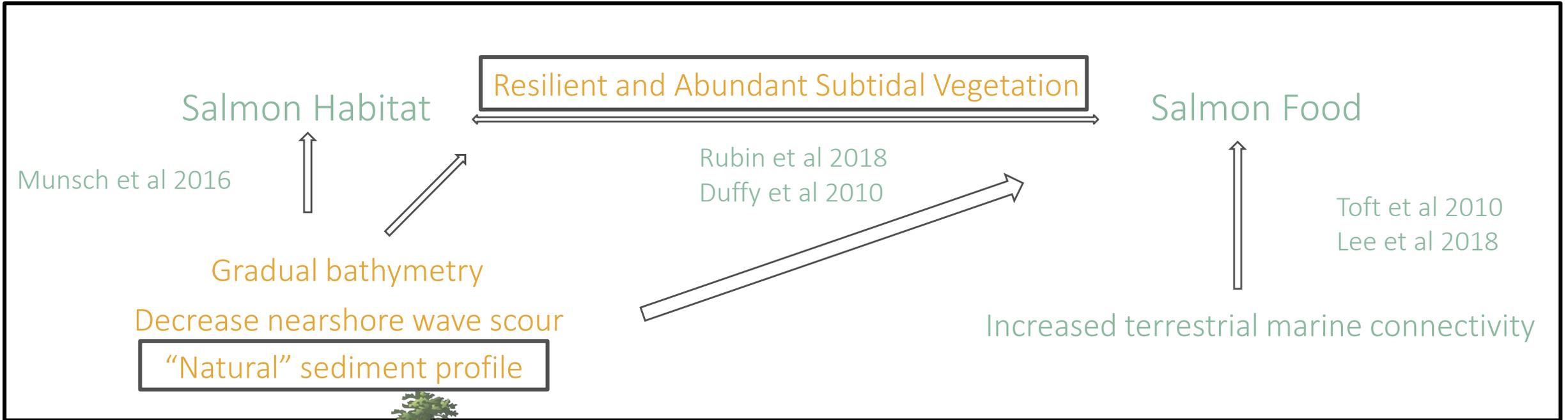


Nearshore mechanisms that link shoreline restoration to salmon recovery?



[a piece in the very large puzzle of...]

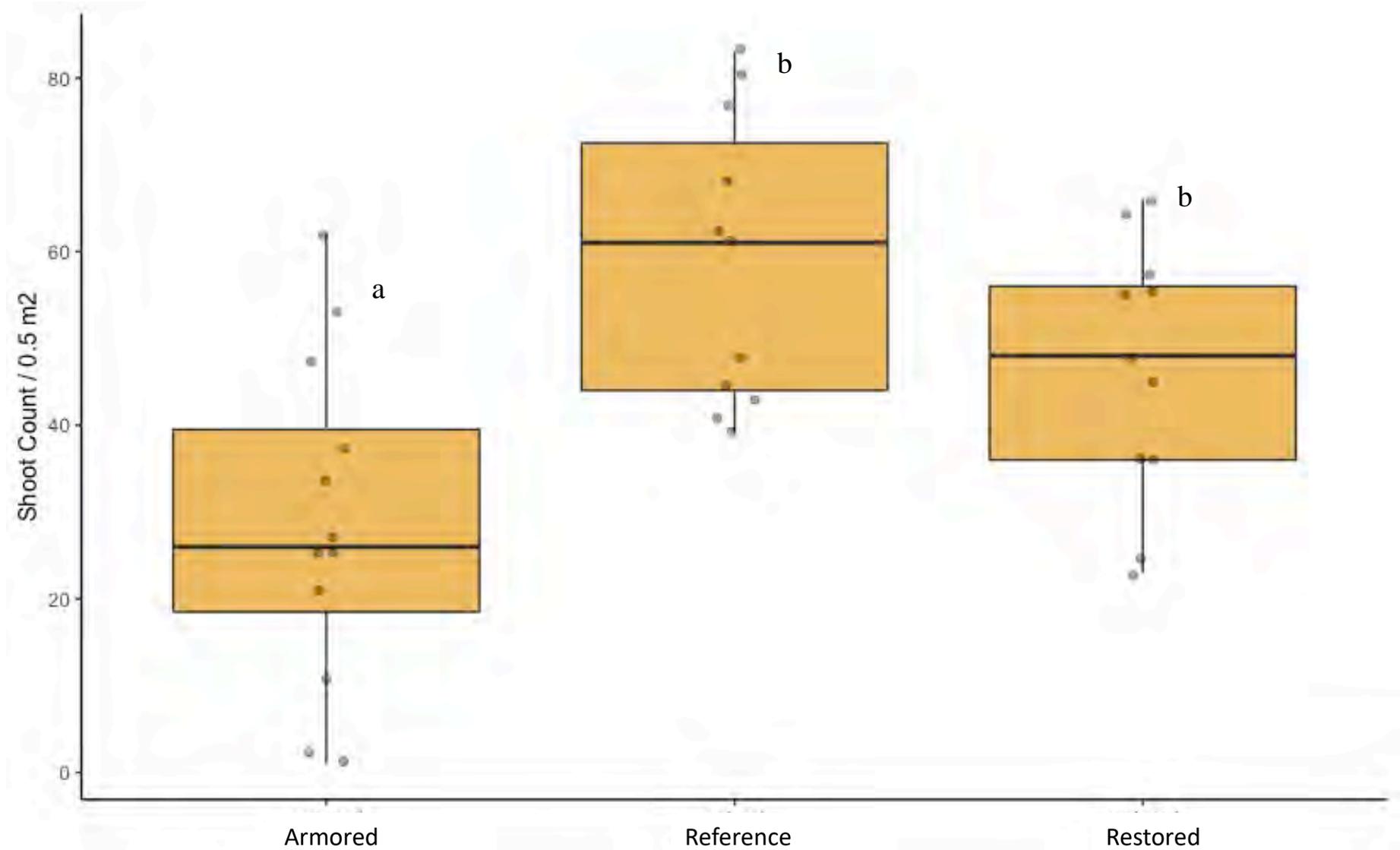
Salmon Recovery



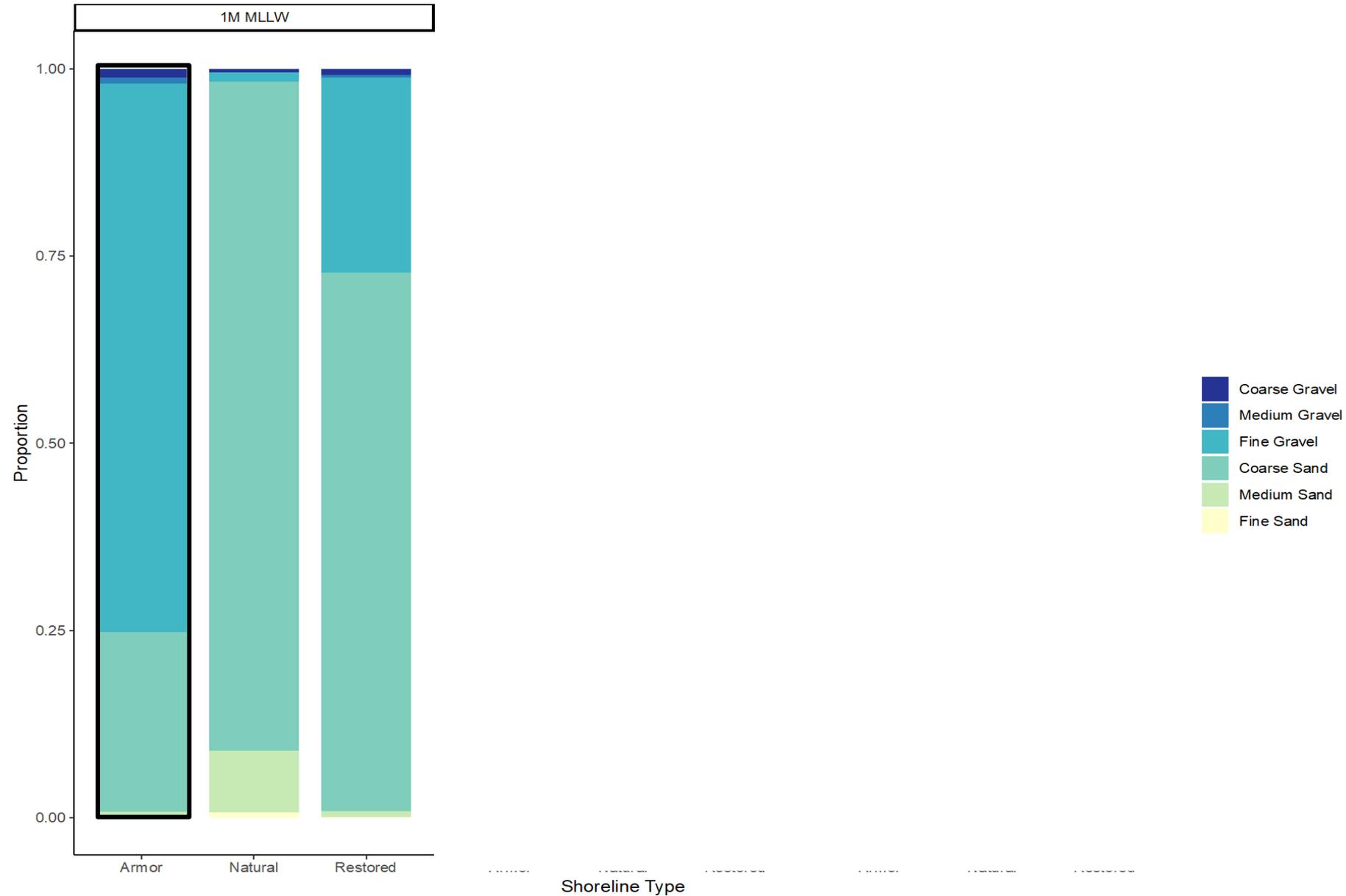
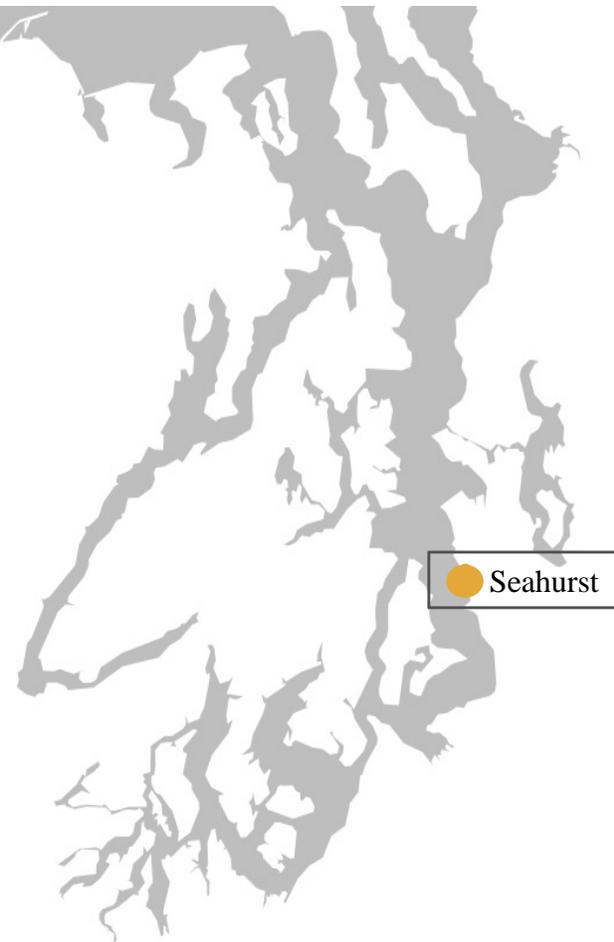
[Hypothesized Interaction or Research In Progress]



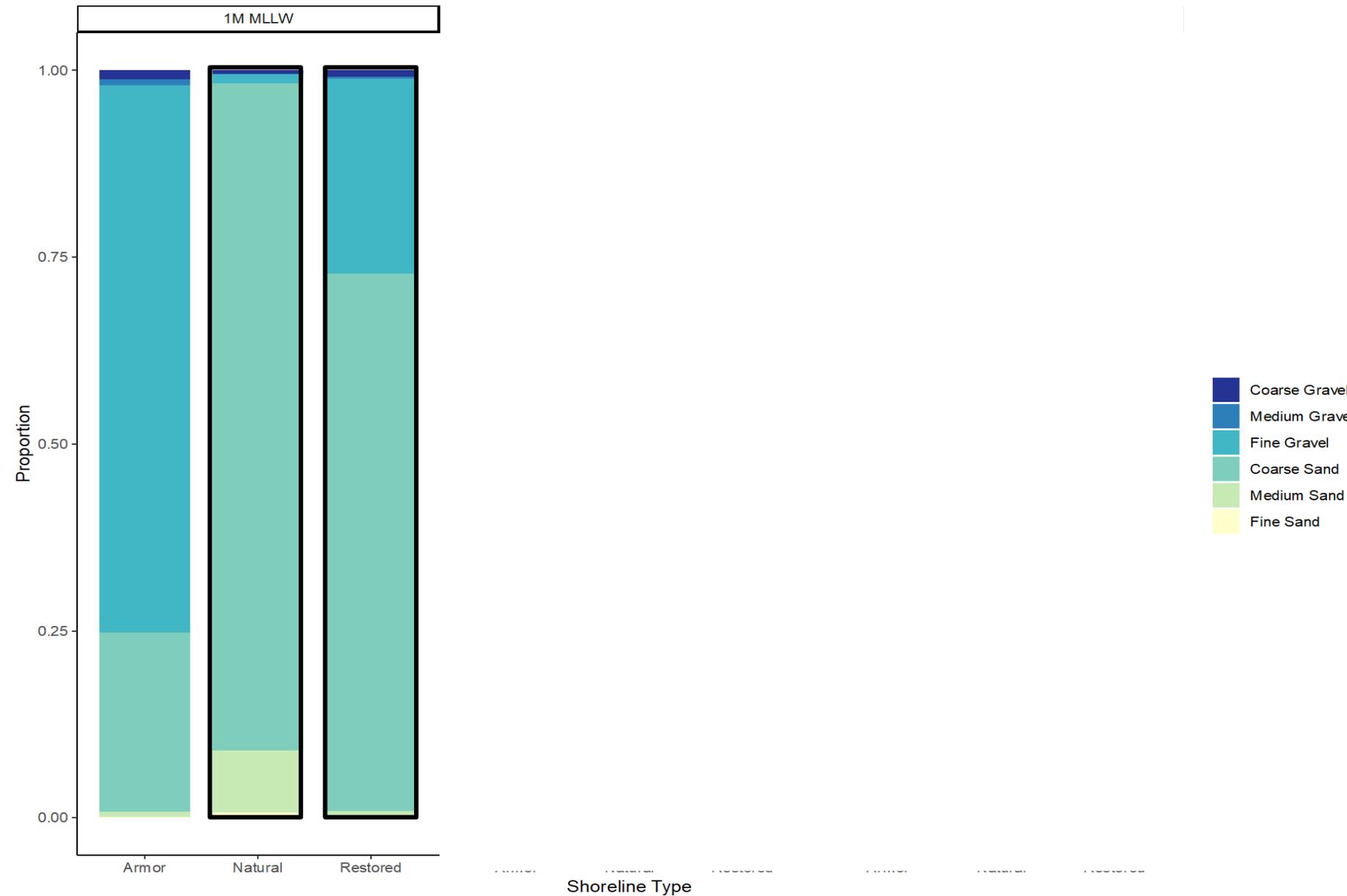
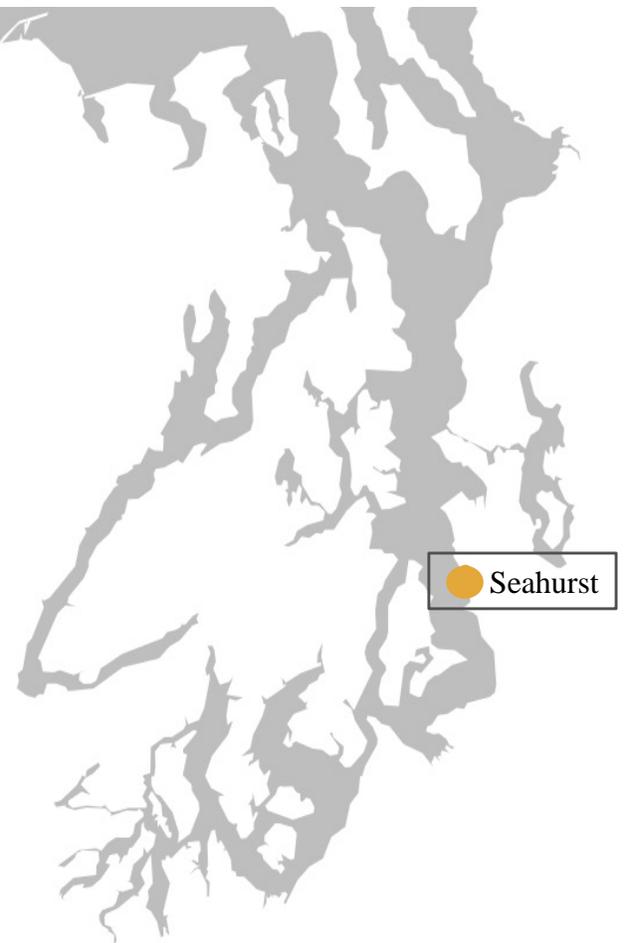
Mean eelgrass shoot count greater at natural and restored shorelines than armored shorelines [preliminary data]



Sediment structure varies by shoreline type [preliminary data]



Impacts of shoreline type on sediment structure limited to the nearshore



Can shoreline restoration link to salmon recovery?

- Small scale restoration may benefit Chum and Pink.
- Restoration can impact salmon habitat and food resources
 - Increased eelgrass abundance and “natural” subtidal sediment profiles in the nearshore subtidal.



Future Directions

What is the role of restoration size-can we think about restoration in a landscape context rather than shoreline parcel to maximize the ecological gain?

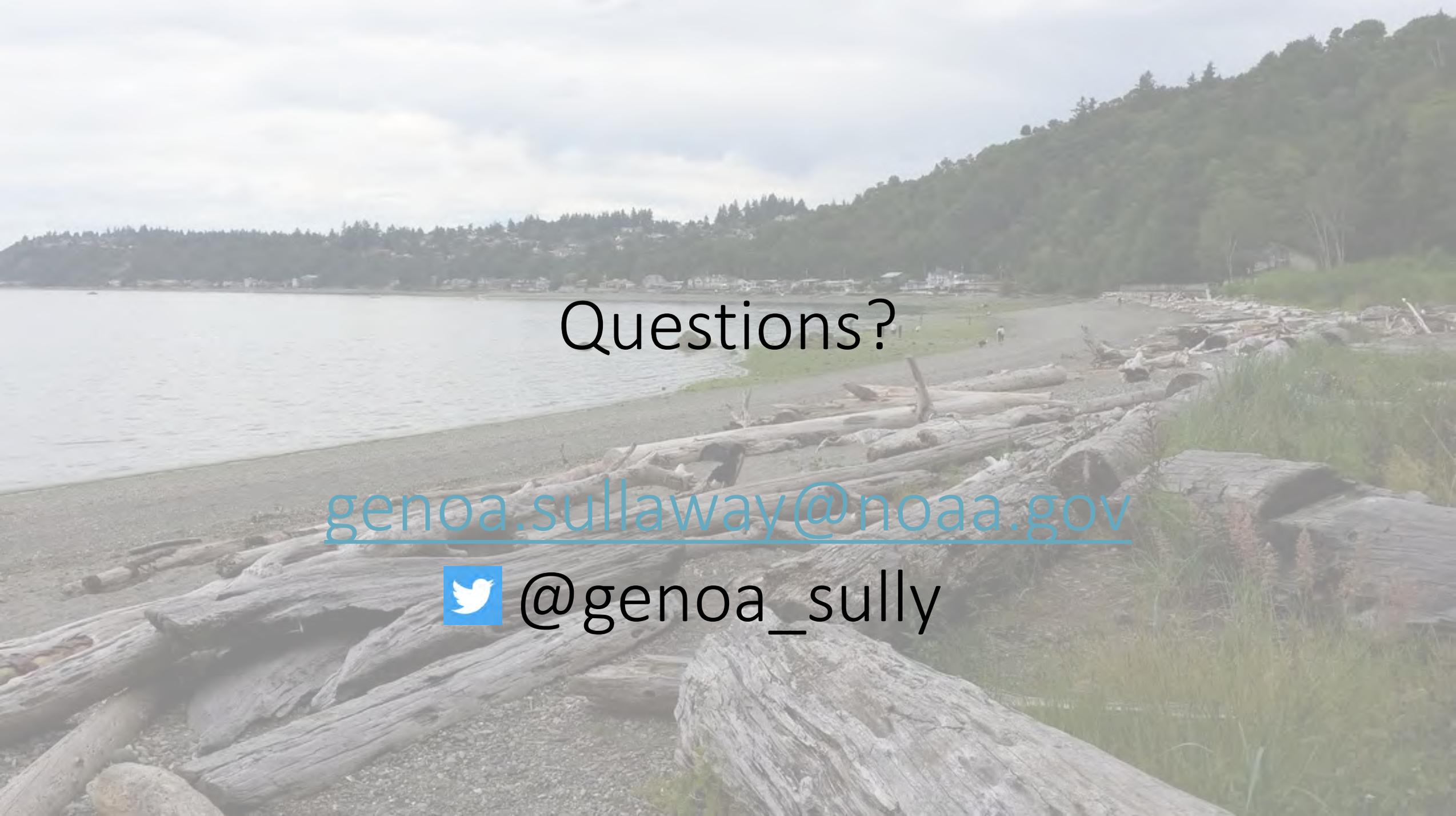


Thank you!

One team one dream:

- Kelly Andrews
- Paul Chittaro
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- Blake Feist
- Kinsey Frick
- Chris Harvey
- Gary Longo
- Alex Mesher
- Ole Shelton
- Megsie Siple
- Nick Tolimieri
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Questions?

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