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Puget sound habitat status and trends monitoring program: nearshore and large river delta geospatial data and habitat status and trends monitoring metrics

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Puget Sound Habitat Status and Trends Monitoring Program:

Nearshore and Large River Delta Metrics

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Northwest Fisheries Science Center

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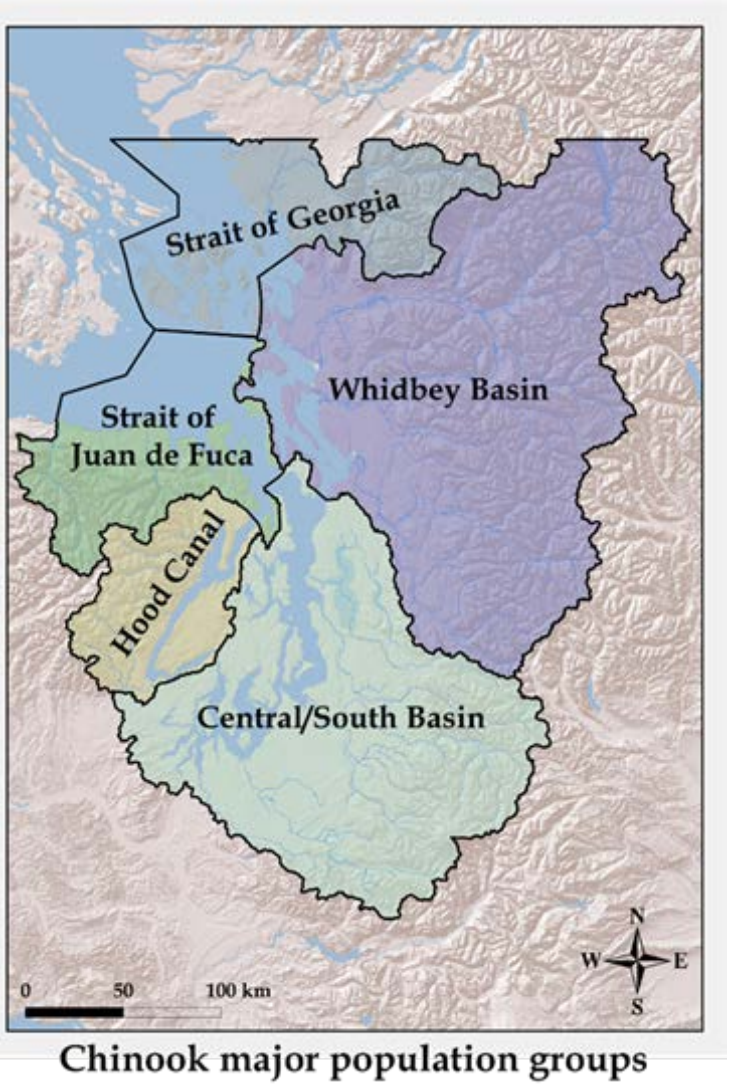
PSHSTM Program Objectives

1. **Provide consistent habitat metrics at threatened Chinook Salmon and steelhead MPG scales**

2. **Detect differences in habitat status AND trends**

3. **Relate metrics to Viable Salmon Population (VSP) parameters**



Chinook major population groups

PSHSTM Program Approach

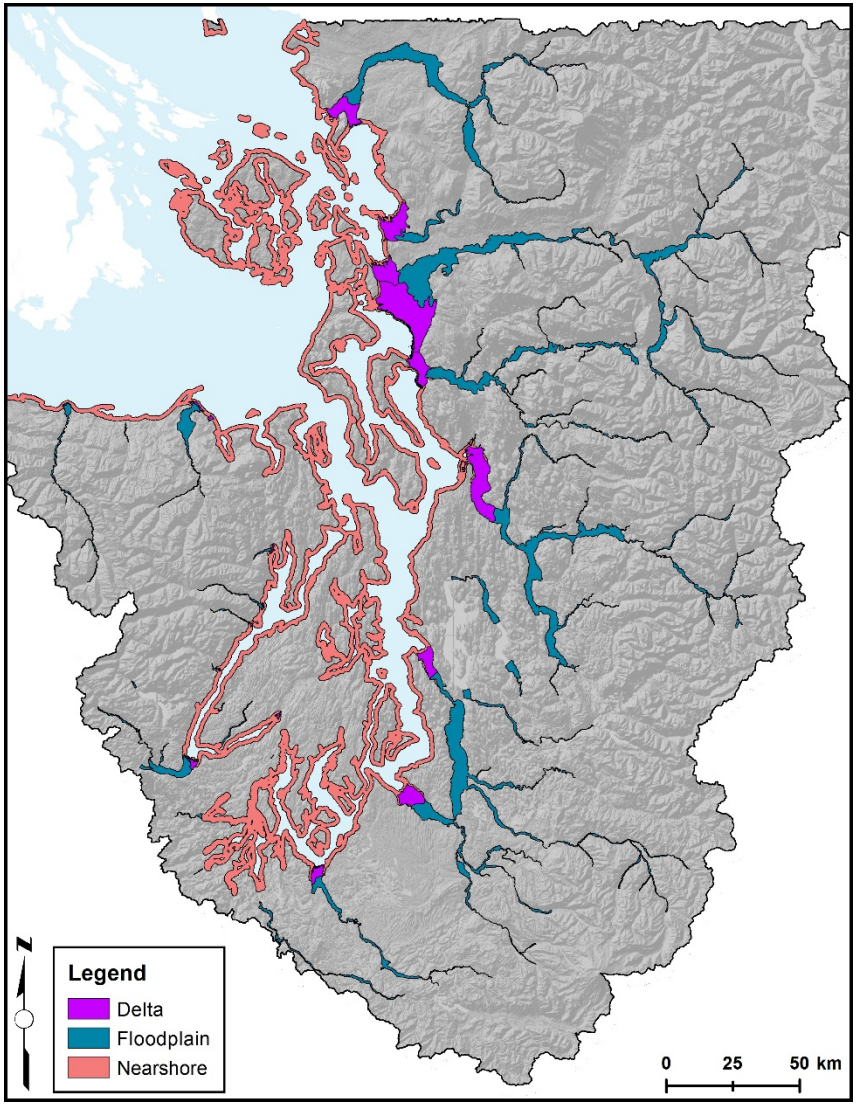
1. Sampling strata

- Large rivers & floodplains
- **Large river deltas**
- **Nearshore**

2. Monitoring approach

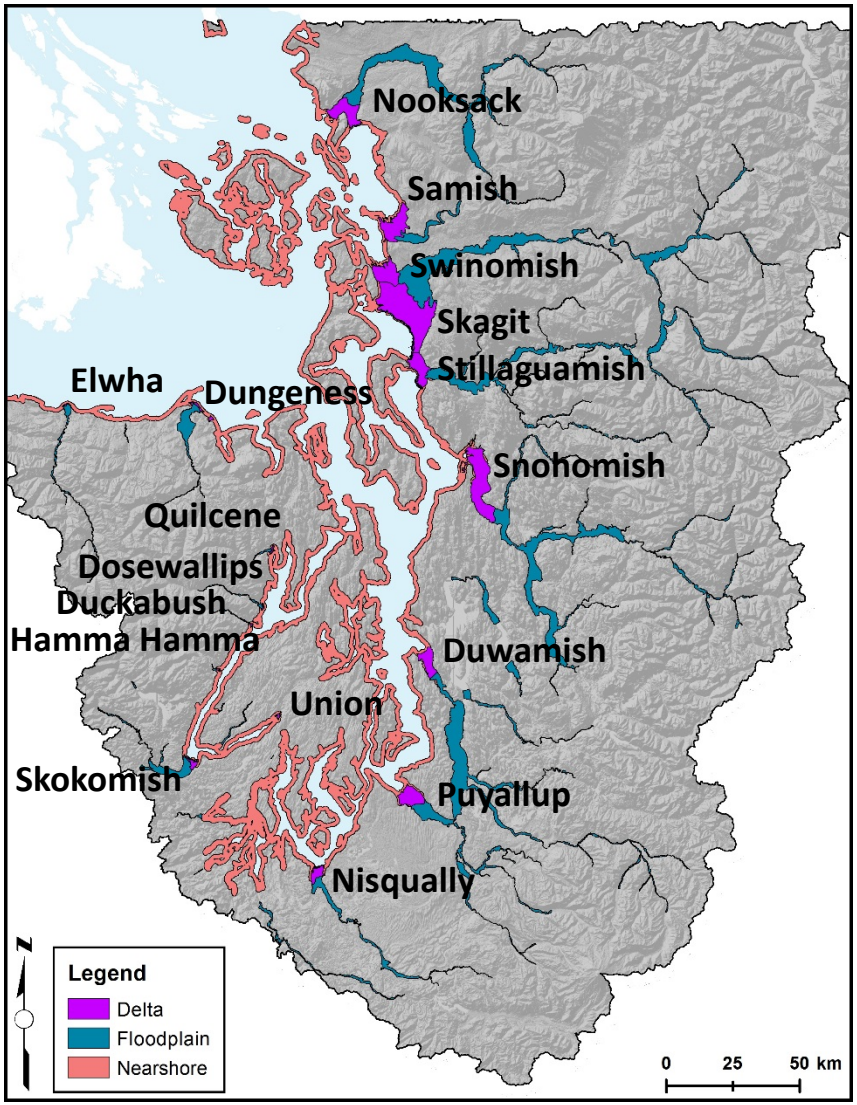
- Complete census of habitat
- Primarily rely on readily available and frequently updated aerial imagery
- Metrics selected through expert panel reviews and evaluation
- Repeat every 3-5 years?

PSHSTM Program Sampling Strata



Puget Sound's Large River Deltas

Puget Sound's 17 large river deltas



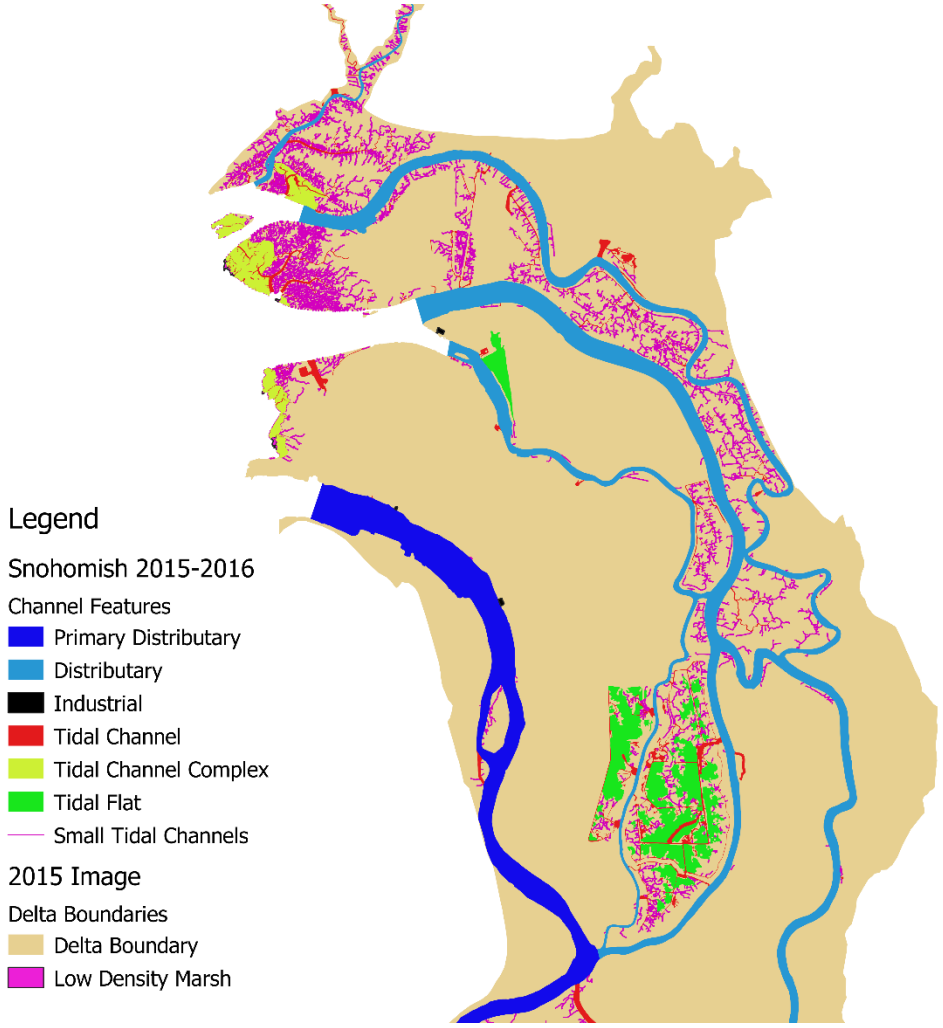
Selected Large River Delta Metrics

Scale/ Resolution	Delta Metric
Satellite	% land cover by type
	Area by tidal wetland type
Aerial	Area, length, & edge of tidally influenced channels
	Channel node density
	Tidal barriers
	Area of disconnected delta
Field	Length of shoreline armoring, levees, & dikes

Digitized Large River Delta Features

- **Delta boundary**
  - *Geomorphic tidal floodplain*
  - *Low & High Density veg edge*
- **Digitized features**
  - *Distributaries*
  - *Industrial Waterways*
  - *Large Tidal Channels (>2-5 m)*
  - *Small Tidal Channels (<2-5 m)*
  - *Tidal Channel Complexes*
  - *Interior Tidal Flats*
  - *Current & Potential wetlands*
  - *Tidal barriers*

2015 Snohomish River Delta Example

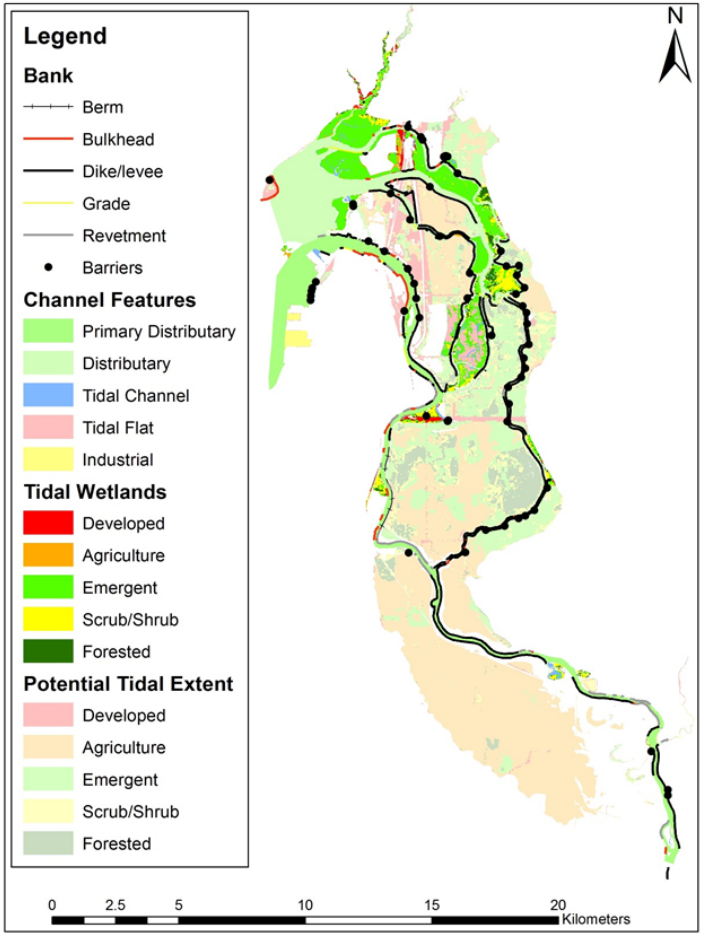


Large River Delta Metrics Scorecard & Layers

Example large river delta metric scorecard for the Snohomish River delta with updated protocol

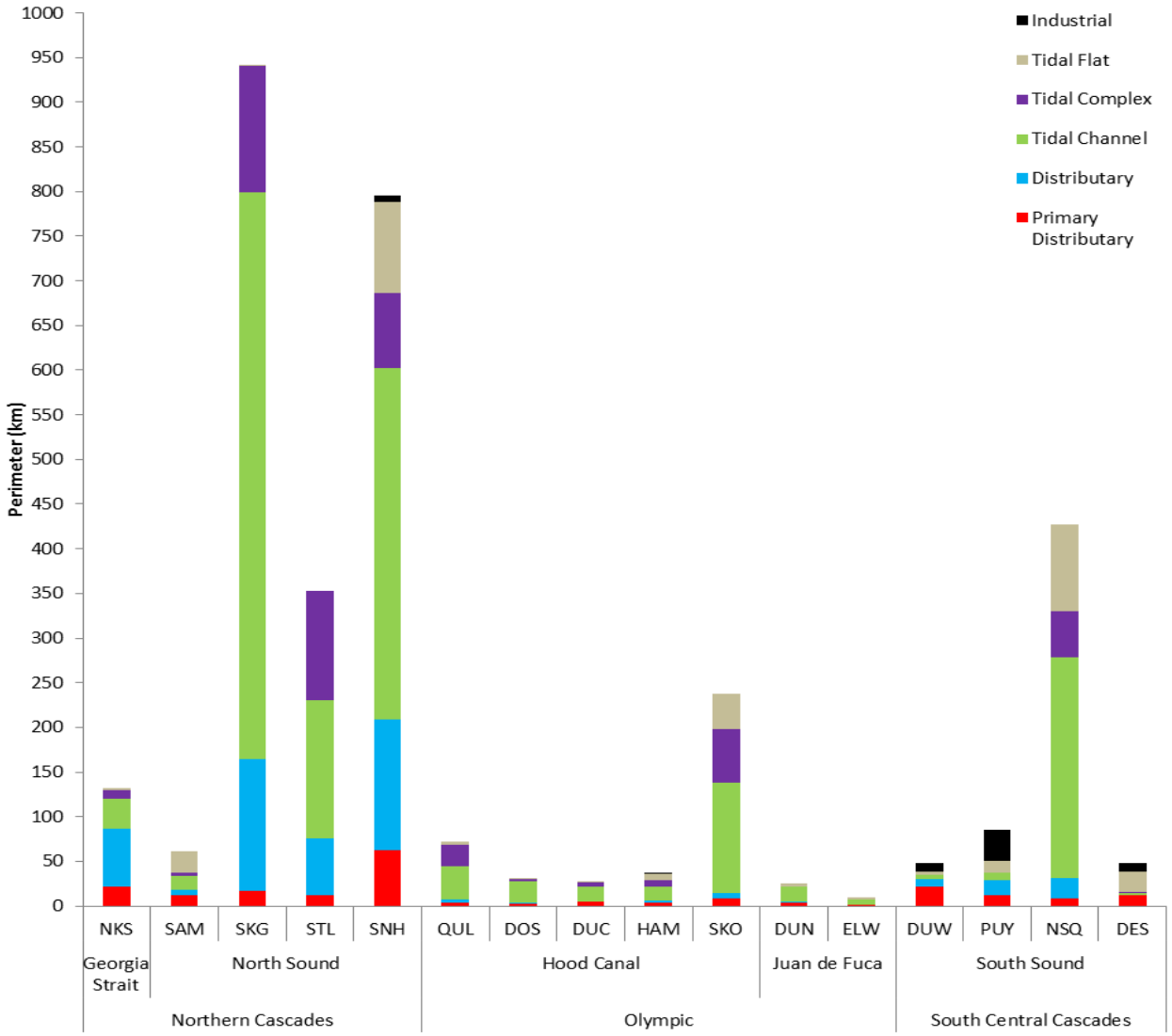
	May 2015 Aerial Image, CCAP 2011, and 50% Tidal Exceedence Model	**Historic Tidal Wetland Area (ha)**	**Tidal Wetland Area (ha)**	**Potential Tidal Wetland Area (ha)**	**Disconnected Area (ha)**	
Land Cover by Type and Connectivity	Emergent	1103.29	486.31	1485.99	999.68	
	Scrub/Shrub	6550.94	110.55	508.41	397.86	
	Forested	6575.77	50.19	459.02	408.83	
	Agriculture	0.00	18.32	2603.97	2585.65	
	Developed	0.00	32.48	295.31	262.83	
	May 2015 Aerial Image	**Area (ha)**	**Edge (km)**	**Length (km)**	**Nodes (within type)**	**Barriers**
Unvegetated Tidal Features	Primary Distributary	1338.88	98.93	49.46	NA	10
	Distributary	1561.33	146.24	73.12	9	24
	Tidal Channel	91.24	124.49	62.25	188	18
	Tidal Channel Restored	38.90	63.78	31.89	127	0
	Small Tidal Channel	27.80	278.10	278.10	4651	5
	Small Tidal Channel Restored	2.90	29.00	29.00	201	0
	Tidal Flat	164.58	49.61	24.80	NA	0
	Industrial	77.10	6.98	3.49	NA	3
	2004 Field Surveys	**Length (km)**	**Armored Length (km)**		**Length (km)**	**Armored Length (km)**
Modified Banks, Dikes, and Levees	Dike/levee	50.66	16.65	Bulkhead	0.26	6.52
	Graded	0.21	1.84	Revetment	0.64	8.64
	Berm	1.87	0.00			

Example GIS products for the Snohomish River delta



Large River Deltas
Channel edge habitat by feature & delta

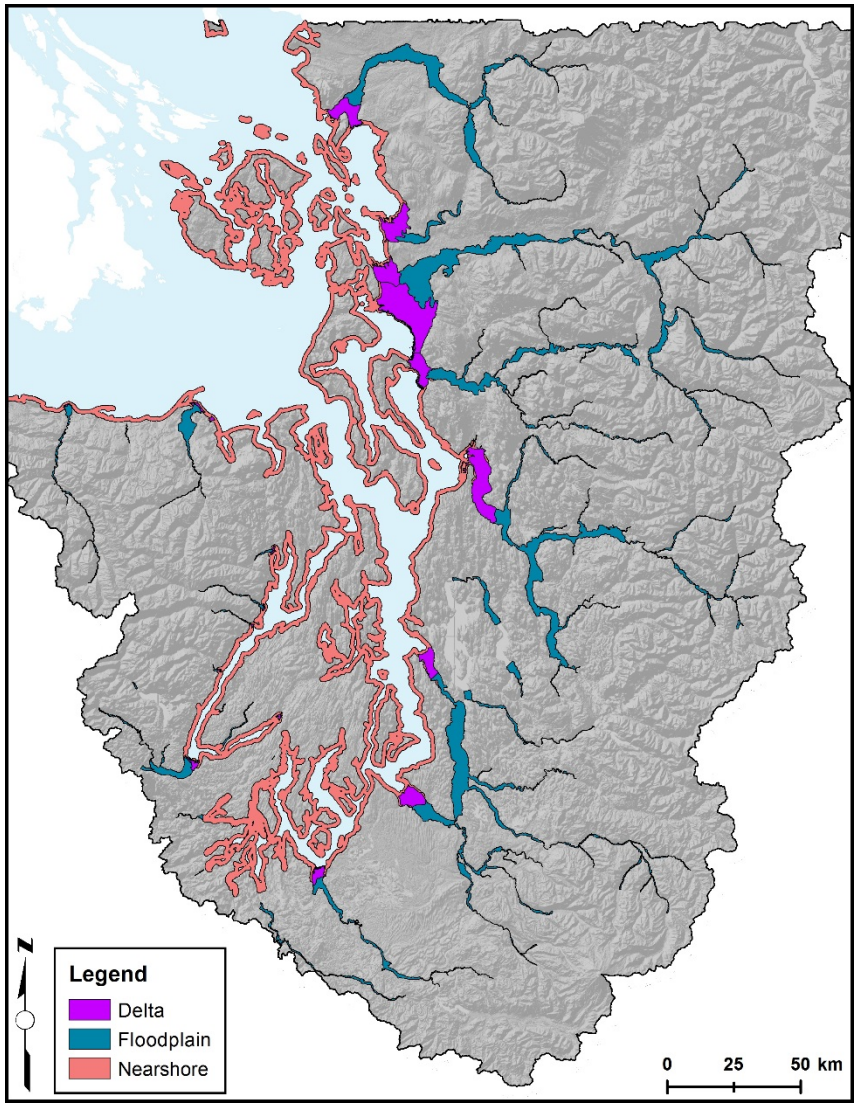
- **Example summary from 2011 image analysis**
- **To be updated with new boundaries and protocols**
- **Shows differences in habitat quantity & complexity**



Puget Sound's Nearshore Habitat

- **Census of ≈4,000 km of shoreline**
- **Nearshore aerial image metrics**
  - *Length of forested shoreline*
  - *Embayment area*
  - *Connectivity of embayments*
  - *Overwater structure area*
- **Forested shoreline & embayment metrics underway**
- **Overwater structures completed**

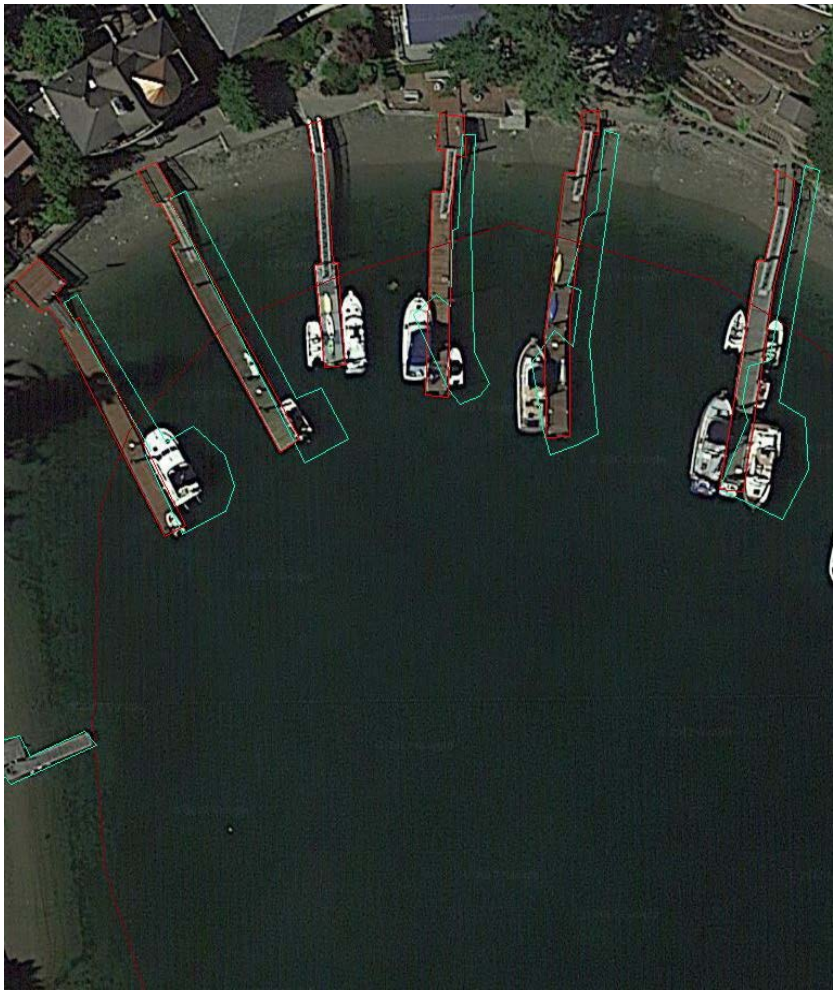
Puget Sound's Large River Deltas



Overwater Structures

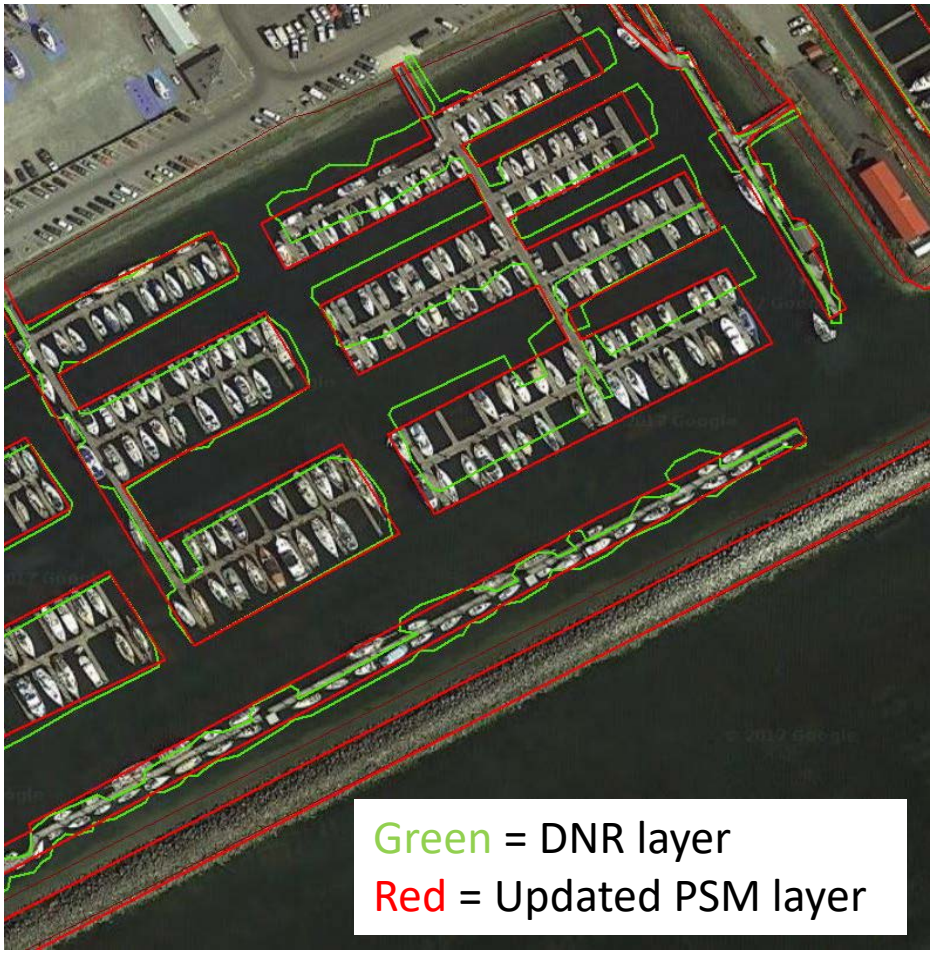
- **Numerous potential OWS impacts**
  - *Migration, shading, noise, water quality*
- **No consistent/updated layers**
- **Started with 2006 DNR Layer…**
  - *Digitize new & update existing features*
  - *Improve accuracy/consistency*
  - *Consider docks/piers, boat rails, buoys/floats, bridges, aquaculture, & log booms*
  - *Not considering fill structures & boats*

Dock features from 2006 DNR layer vs. Updated PSHSTM Layer



Single Docks/Piers vs. Marinas/Slips

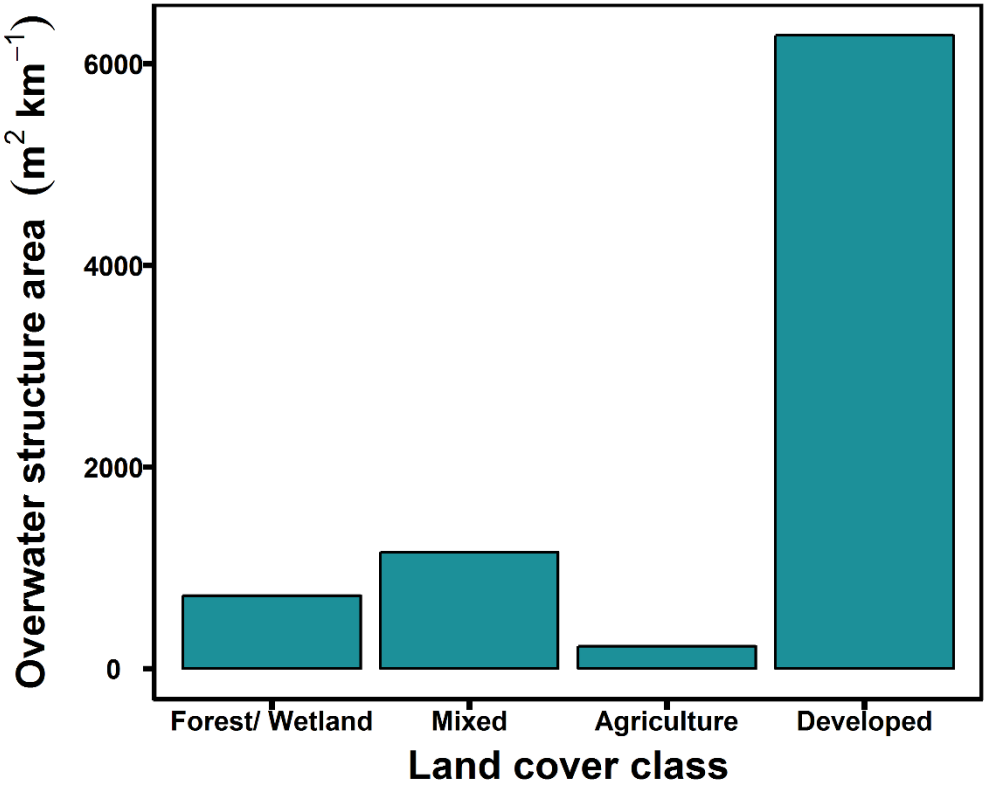
Marinas: Minimum bounding slip area



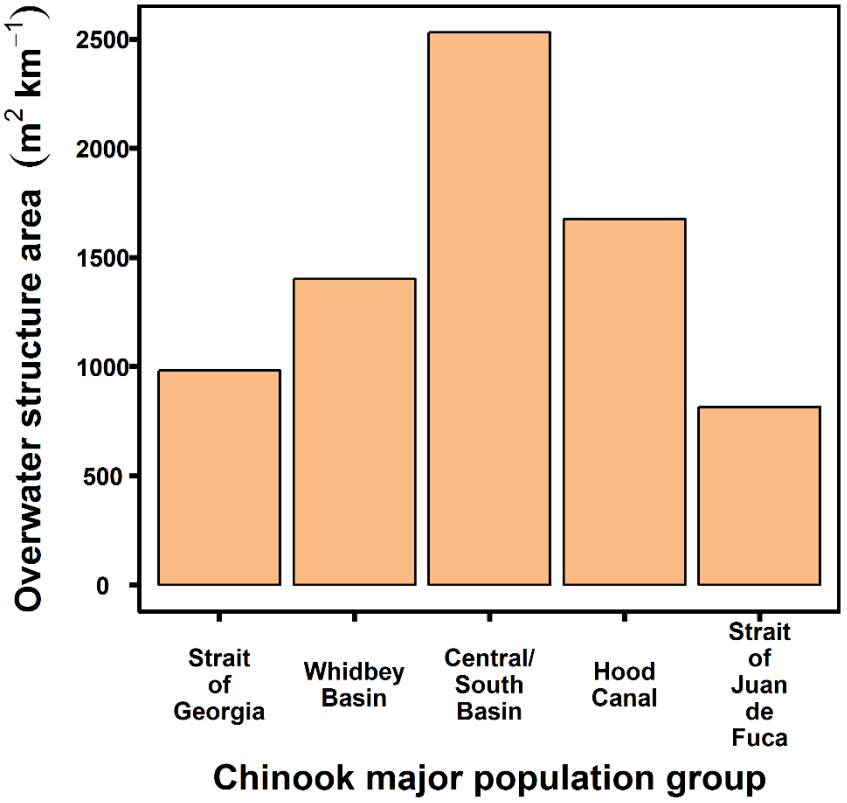
Exclude boats on individual docks/piers

Overwater Structure Results

Area of overwater structures by shoreline land cover type



Area of overwater structures by Chinook Major Population Group (MPG)



**Initial field validation indicates omission error ≈30 structures per 100 km of shoreline*

Future Directions

- **Update and complete the following:**
  - *Update deltas with new boundaries & protocols (2011 & 2015)*
  - *Complete forested shoreline and embayment components*
- **Field validation:**
  - *Swales vs. channels, forested cover omissions, barrier effects & presence, connectivity classifications, OWS types & presence…*
- **Analyze trends:**
  - *Natural, restoration, and degree of modification*
- **Share GIS products and summary reports!**

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- Lots of input from many agencies/groups…ODFW, CHaMP, CDFW, Univ of Montana, Univ of WA, PSP, USGS, WDFW, Numerous tribes throughout Puget Sound, County governments, consultants, various divisions throughout NOAA.

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Questions? Contact me at
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Supplemental Slides

Large River Delta Boundaries

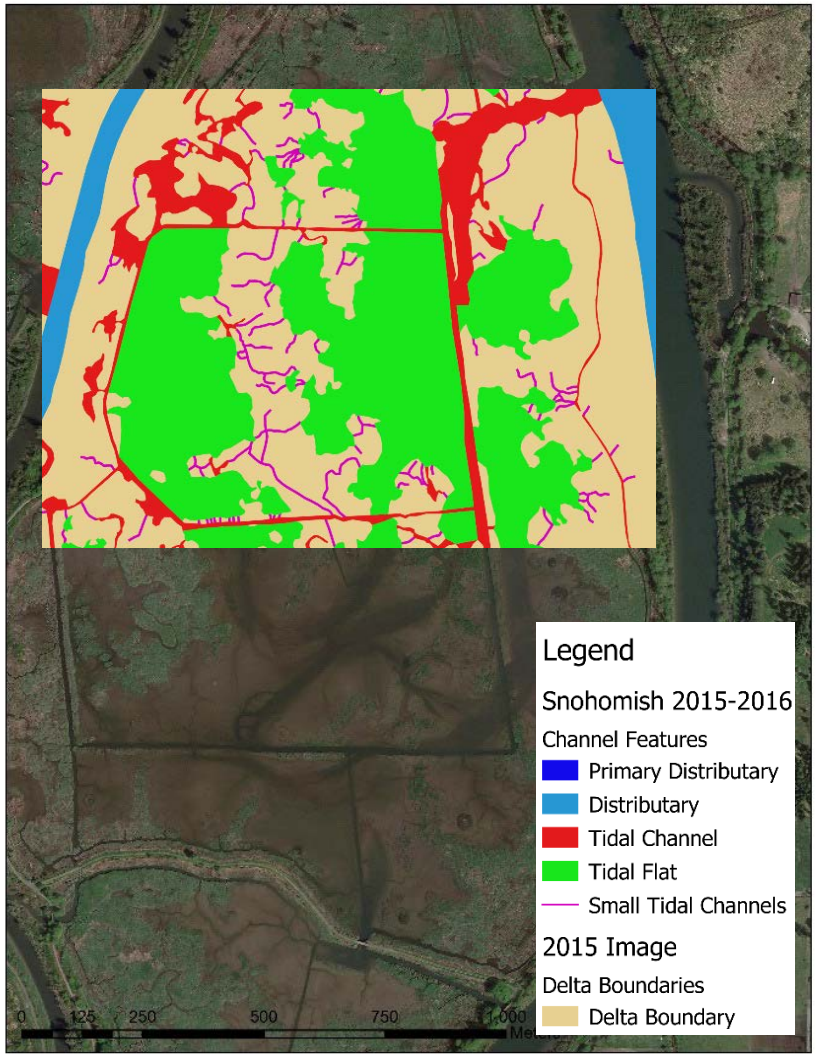
- **Landward =** Geomorphic 2-year tidal floodplain extent
- **Seaward =** Low/High density vegetation boundary

Elwha example showing geomorphic 2-year tidal floodplain extent

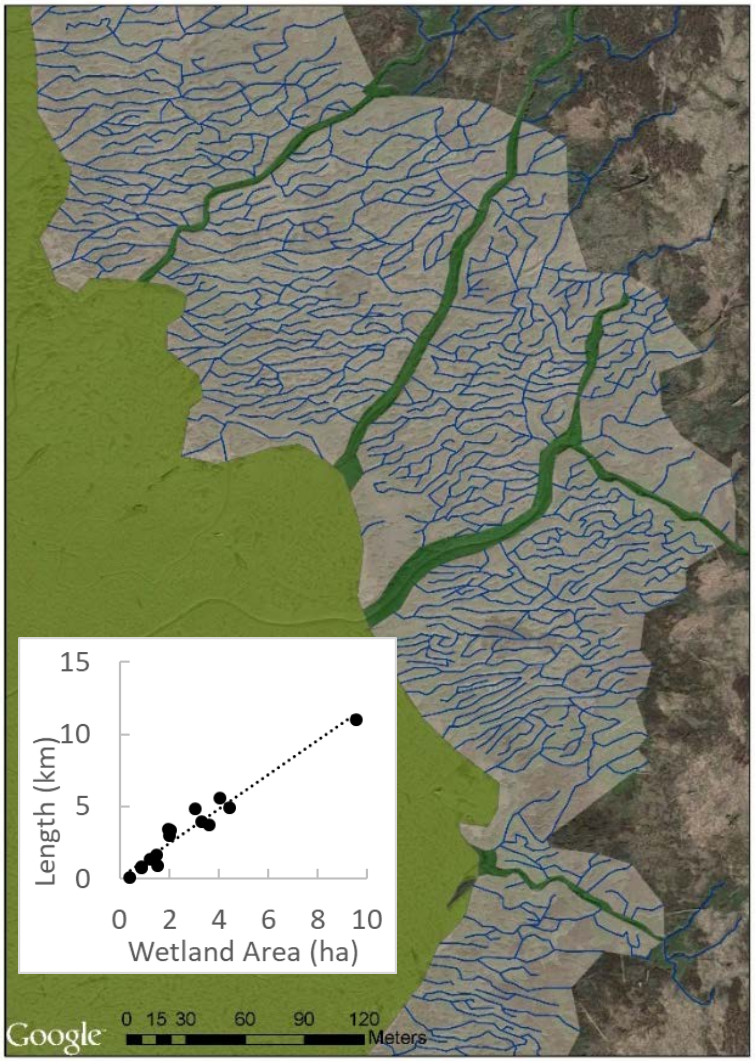
Stillaguamish example showing Low/High density Veg Boundary and old dike footprint

Tidal Complexes and Interior Tidal Flats

Example of unvegetated mud flats common in restoration sites



Dense channel networks common at marsh fringes



Tidal Wetland Classifications and Connectivity

- **CCAP to classify cover**
- **Potential extent from 2-year tidal FRI**
- **Aerial photos inform connectivity from…**
  - *Tidal channels*
  - *Dikes/levees*
  - *Tide gates, culverts, causeways, etc…*
  - *Muted vs complete barriers?*

2015 Tidal Wetlands in the Snohomish River delta