Ecology of Place: What salmon need Eric Beamer Skagit River System Cooperative

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#### Acknowledgements NOAA Fisheries NW Fisheries Science Center I Tim Beechie George Pess Correigh Greene

#### **Talk overview**

- A simplification of what salmon need
- **Focus mostly on physical habitats required by salmon**
- Using a few coho salmon examples
  - ... and even fewer steelhead examples
- **... but more Chinook salmon examples**

#### **Coho Salmon** From G. Pess

**Steelhead** From B. McMillian **Chinook Salmon** From C. Geene







### What do salmon need?

- Abundant, productive, and diverse populations (fish).
- Abundant, productive, and diverse habitat within our landscape.

# What do salmon need? Healthy processes working within our landscape.



### **Our Landscape is large and diverse!**



### Habitat complexity & connectivity Increased fish species diversity







### Examples of Freshwater Diversity







Skagit River Non-tidal Delta

98% loss of area where freshwater rearing habitat could form

Agriculture land use shifting to urbanized



Kilometer

Palustrine wetland

Mainstem and floodplain channels



# **Example of Estuary Diversity**

### **Skagit Estuary Habitat Change**

- Skagit tidal delta habitats smaller and more fragmented.
- Rearing opportunity of tidal delta rearing Chinook reduced 88%
- Restoration
  opportunities exist at historic delta sites.

![](_page_12_Picture_4.jpeg)

![](_page_12_Figure_5.jpeg)

estuarine emergent marsh zone estuarine scrub shrub zone riverine tidal zone Cree

Sediment Source Beach

ccretion

Beach

#### **Drowned Stream Channel**

Tidal Channels

Lagoon

**Accretion Beaches** 

Bedrock

**Example of Nearshore Complexity** 

## Pocket Estuary Change

- Pocket estuaries are much smaller and more fragmented than historically.
  - Rearing opportunity for fry migrants Chinook in pocket estuary habitat has been greatly reduced (86% loss in habitat fish use <u>directly</u>).
  - Restoration opportunities exist at pocket estuary sites.

![](_page_14_Figure_4.jpeg)

### The Fish

**Coho Salmon** From G. Pess **Steelhead** From B. McMillian **Chinook Salmon** From C. Geene

![](_page_15_Picture_4.jpeg)

![](_page_15_Picture_5.jpeg)

### Our Fish are Diverse! Chinook Salmon

![](_page_16_Figure_1.jpeg)

After Wissmar and Simenstad 1998

### Juvenile life history variation

	Subyearlings (ocean type)			Yearlings (stream type)
	Delta fry	Fry migrants	Parr migrants	
River residency (mos.)	1-2	<1	3	16
Delta residency (mos.)	0.5-2			
Size at outmigration (mm)	65-85	40-50	65-85	120-130

## Why do we care?

![](_page_18_Picture_1.jpeg)

Mt St. Helens, 1980

Life history variation buffers population from catastrophes

![](_page_18_Picture_4.jpeg)

#### Erika oil spill, 1999

## Spawning and egg incubation

![](_page_19_Picture_1.jpeg)

![](_page_19_Picture_2.jpeg)

### Spawning: What do the fish tell us? coho Chinook

![](_page_20_Figure_1.jpeg)

~33% of the historic forced pool-riffle channel types have converted to plane-bed channel types due to a lack of wood.

## Forced Pool Riffle

![](_page_21_Picture_1.jpeg)

## Plane Bed

![](_page_22_Picture_1.jpeg)

## Freshwater rearing by juveniles

![](_page_23_Picture_1.jpeg)

## Freshwater Rearing Juvenile Chinook

Gravel bar edge: 0.44 fish/m<sup>2</sup>

Mid-channel: 0.001 fish/m<sup>2</sup>

Bank edge: 0.97 fish/m<sup>2</sup> (natural) 0.4 fish/m2 (hydro mo

Slough: 0.07 fish/m<sup>2</sup>

> Backwater pool : 1.68 fish/m<sup>2</sup>

![](_page_25_Picture_0.jpeg)

#### Juvenile Coho

![](_page_25_Picture_2.jpeg)

Edge Cover Type	Summer Parr	Winter Presmolt
No Cover	0.0	0.0
Boulder	0.5	0.0
Cobble	1.5	0.0
Plants	NA	0.0
Rip rap (larger rocks)	1.0	1.0
Rip rap (smaller rocks)	0.2	0.1
Wood (all types combined)	3.7	1.6
bankroots	1.9	0.0
debris piles	1.9	2.2
single logs	0.5	0.2
rootwads	17.9	4.2

![](_page_26_Picture_0.jpeg)

Juvenile Steelhead Age 0+

![](_page_26_Picture_2.jpeg)

Cover Type	Summer	Winter
No Cover	0.9	0.0
Boulder	1.2	0.0
Cobble	6.9	0.4
Plants	NA	0.0
Rip rap (larger rocks)	1.0	1.0
Rip rap (smaller rocks)	1.8	0.3
Wood (all types combined)	2.1	0.8
bankroots	1.2	0.3
debris piles	2.6	1.8
single logs	0.8	0.2
rootwads	3.9	1.7

#### Estuary use by Chinook salmon and Does restoration work?

## Deepwater Slough Juvenile Chinook Salmon Response

![](_page_28_Figure_1.jpeg)

### Use of habitat by species is diverse

![](_page_29_Picture_1.jpeg)

### **Perspective for Chinook Recovery**

![](_page_30_Figure_1.jpeg)

### Pie chart of selected "H's" for meeting the Skagit Chinook Recovery Plan Goals

![](_page_31_Figure_1.jpeg)

# The End

Photo by Todd Bennett