Filling data gaps for Skagit River steelhead recovery planning

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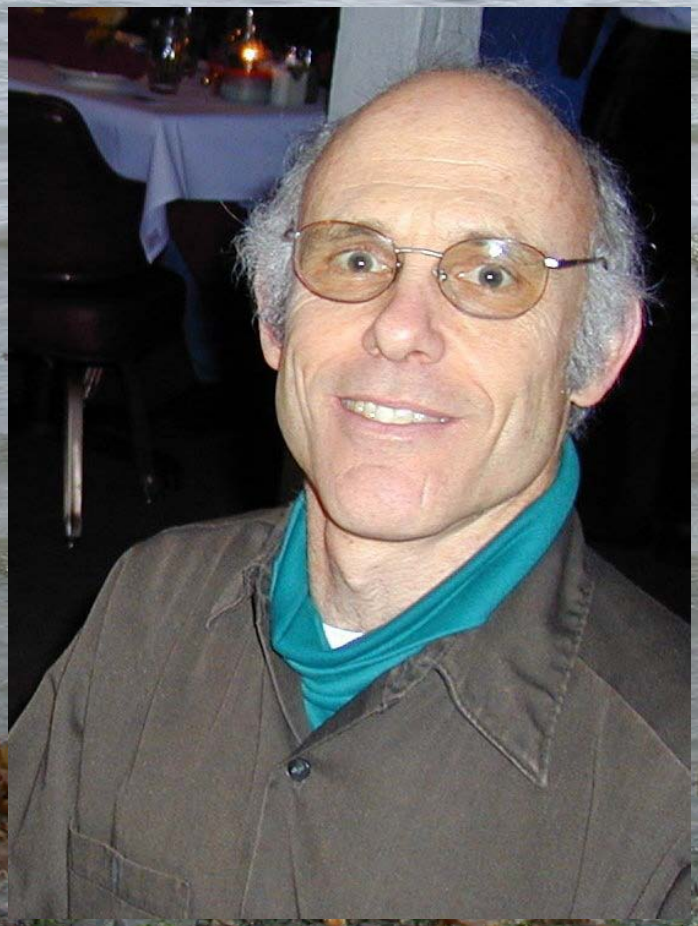
- Goal: Show how “our” field studies and ongoing monitoring efforts are linked to recovery planning
- Caveat: I am not the expert on any of these studies

The Saltonstall-Kennedy (S-K) study: Impact of Hatchery Steelhead Smolt Release Levels on Wild and Hatchery Steelhead Survival Rates

(Saltonstall-Kennedy Project # NA08NMF4270424)

- Skagit River System Cooperative
- Swinomish Planning Department
- Seattle City Light
- Upper Skagit Indian Tribe
- Washington Department of Fish and Wildlife
- Wild Fish Conservancy

Bob Hayman
The S-K mastermind



S-K study multiple objectives:

Using hatchery and natural origin juvenile and adult steelhead data:

- Ecological interaction (observed behavior)
- Genetic analysis
- Statistical analysis
  - Environmental factors
    - Floods
    - Ocean
  - Degree of hatchery steelhead influence.

Ecological Interaction Potential between hatchery and natural origin steelhead

- Smolt outmigration timing (freshwater & marine areas of Puget Sound)
- Predation during freshwater smolt migration
- Adult steelhead spawning migration behavior
- Hatchery steelhead adult straying and spawning

(Results found in chapters 3-7 of final report; primary author Dave Pflug, SCL)

Genetic Interaction

(based on juvenile and adult steelhead samples)

- Within the hatchery environment:
  - the segregated hatchery program does a good job excluding wild steelhead from reproducing with hatchery steelhead
- In the natural environment:
  - hatchery steelhead successfully reproduce with other hatchery fish and wild fish throughout the basin; spatial variability

(Genetic results found in chapters 8-10 of the final report; primary authors Todd Kassler & Ken Warheit of WDFW and Dave Pflug of SCL)

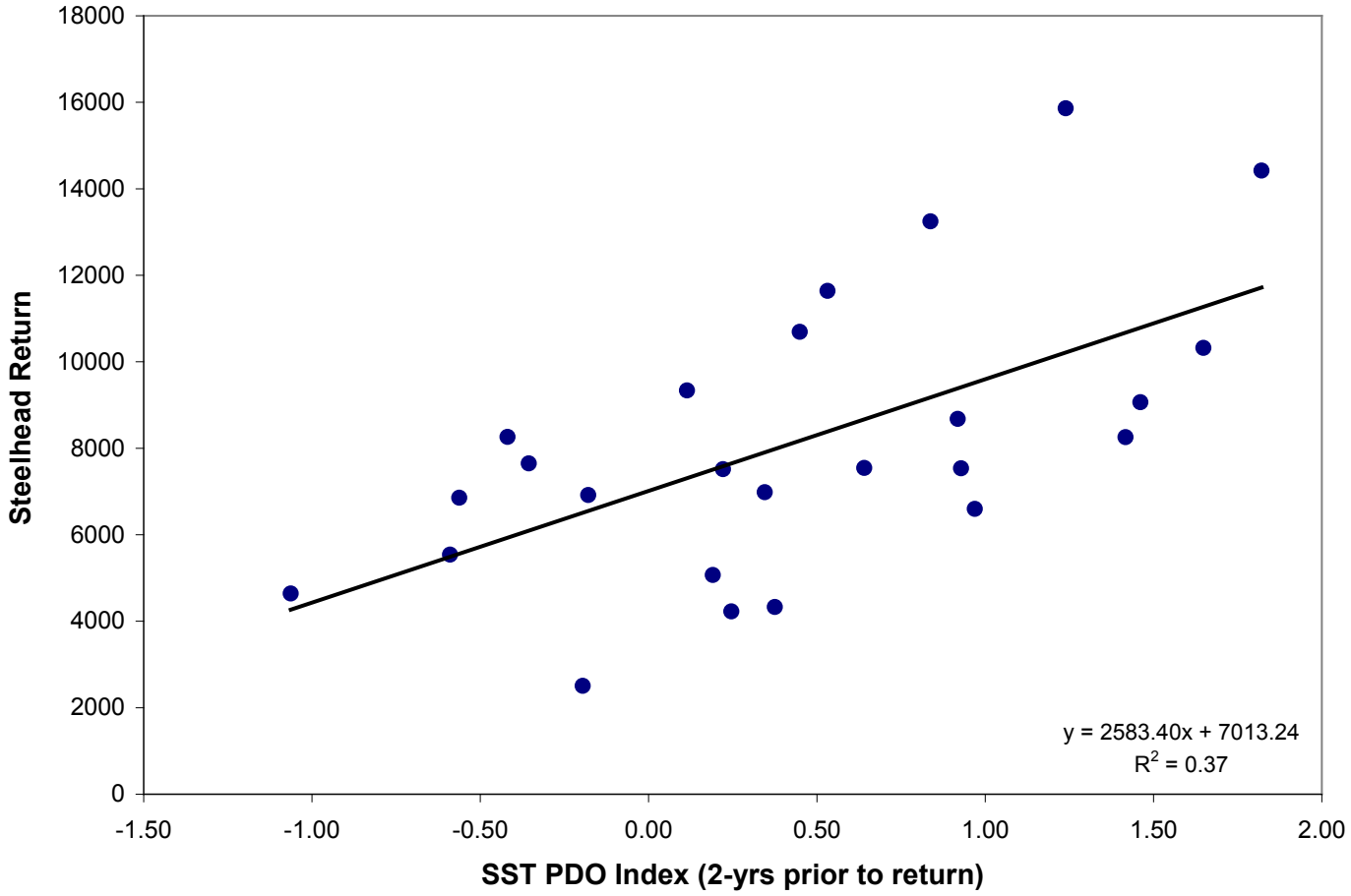
Statistical analysis: Hatchery Smolt Release and Environmental Factors on Natural Origin Skagit Steelhead Populations

(Results found in chapter 11 of final report; primary author Ed Conner, SCL)

Effect	Regression Coefficient	Standard Error	Standard Coefficient	Tolerance	t-Value	p-Value
Constant	16,660	1,955	0		8.52	0.000
PDO Index	2.707	0.54	0.603	0.819	5.017	0.000
Peak Flow	-0.044	0.013	-0.394	0.892	-3.424	0.002
Smolts Released	-1.230	0.344	-0.409	0.902	-3.576	0.001

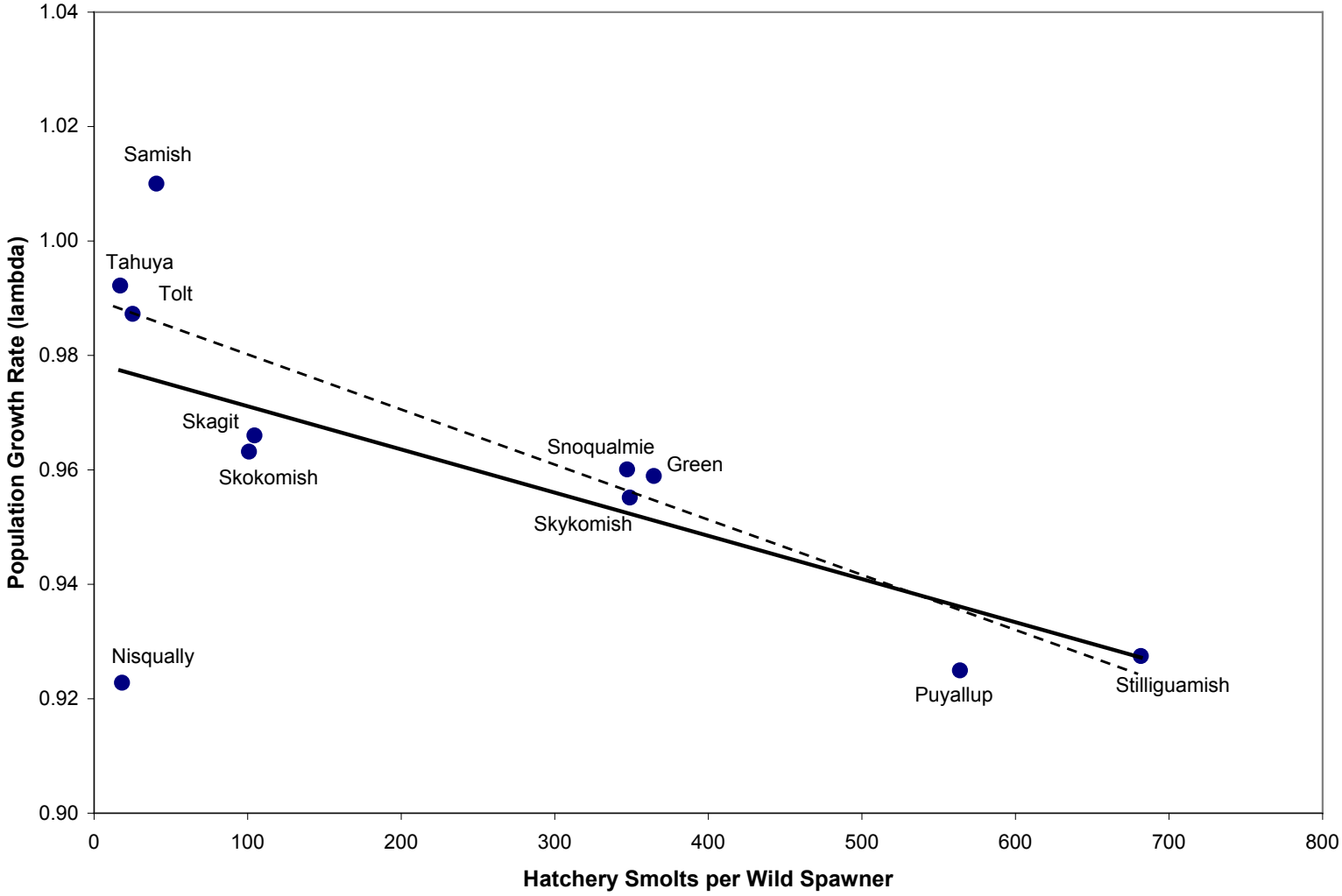
Marine survival influence on natural Skagit steelhead

(Results found in chapter 11 of final report; primary author Ed Conner, SCL)



Segregated hatchery influence on natural steelhead productivity in Puget Sound

(Results found in chapter 11 of final report; primary author Ed Conner, SCL)



Skagit Yearling Salmonid Study

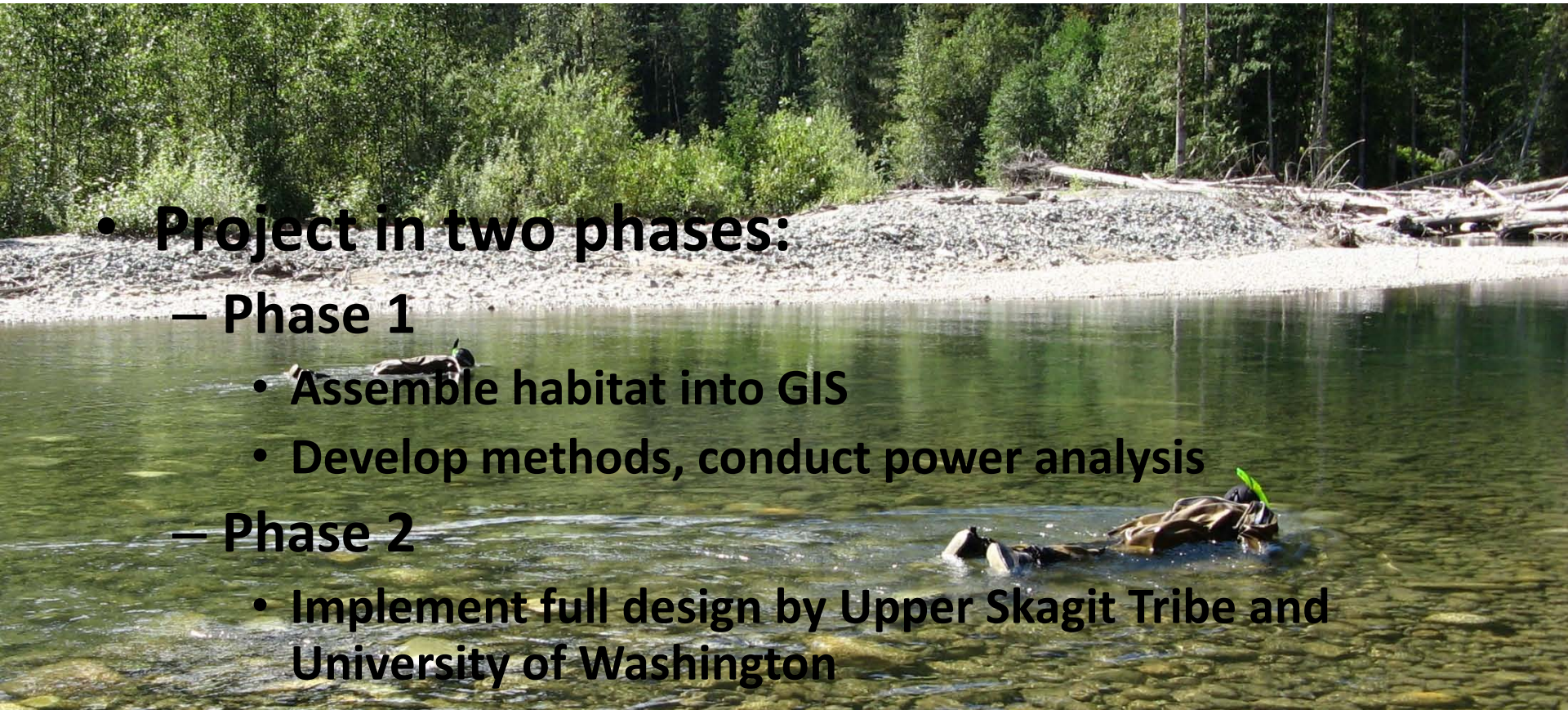
- Upper Skagit Indian Tribe
- Skagit River System Cooperative
- Seattle City Light
- University of Washington
- Oversight Committee, including NOAA, NPS, USFS members

Purpose: identify yearling salmonid seasonal, spatial, and habitat type preferences in freshwater

- What habitat types are used by fish seasonally?
- Where are fish located within the basin seasonally?
- Where are habitats (by type) within the basin

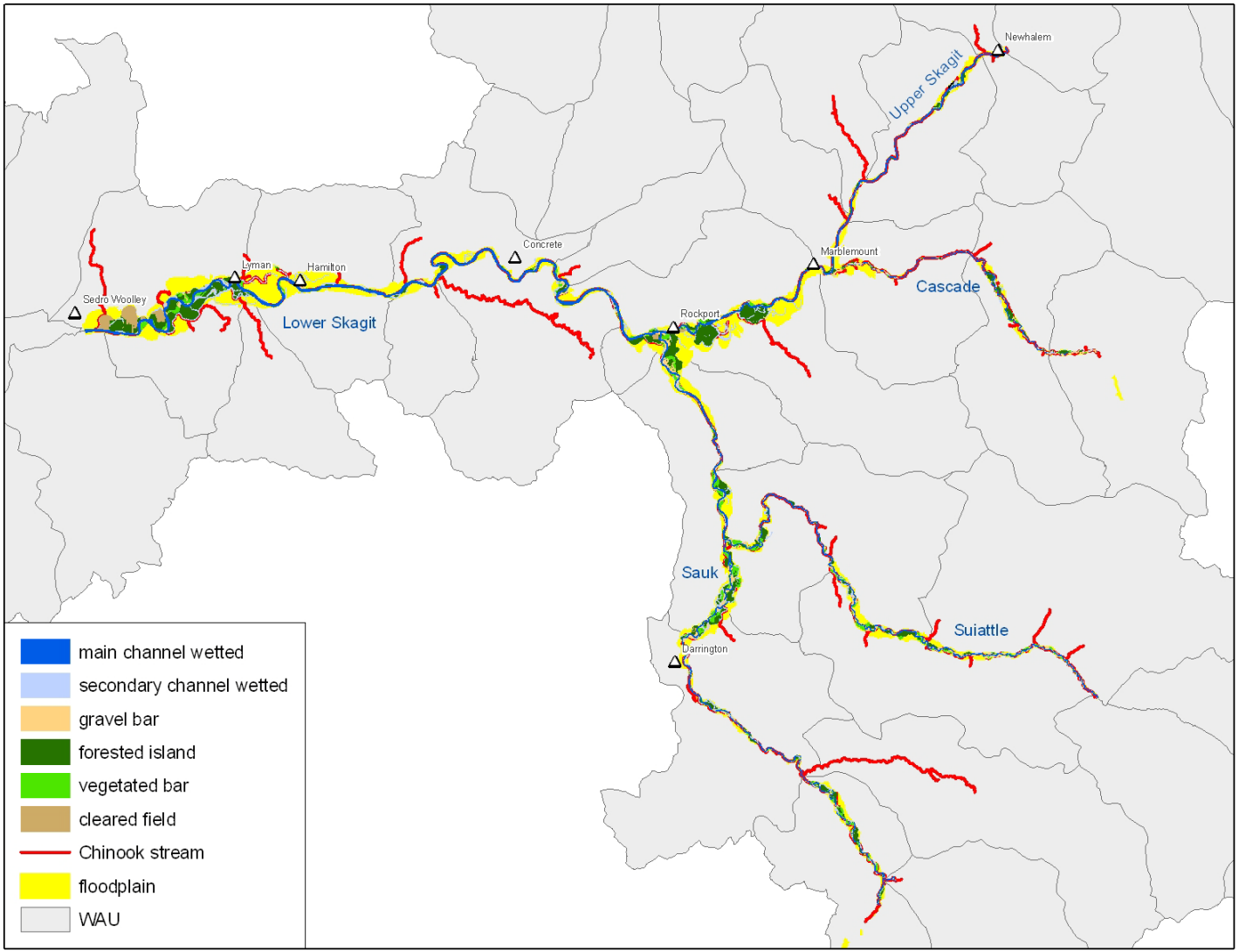
Study Design

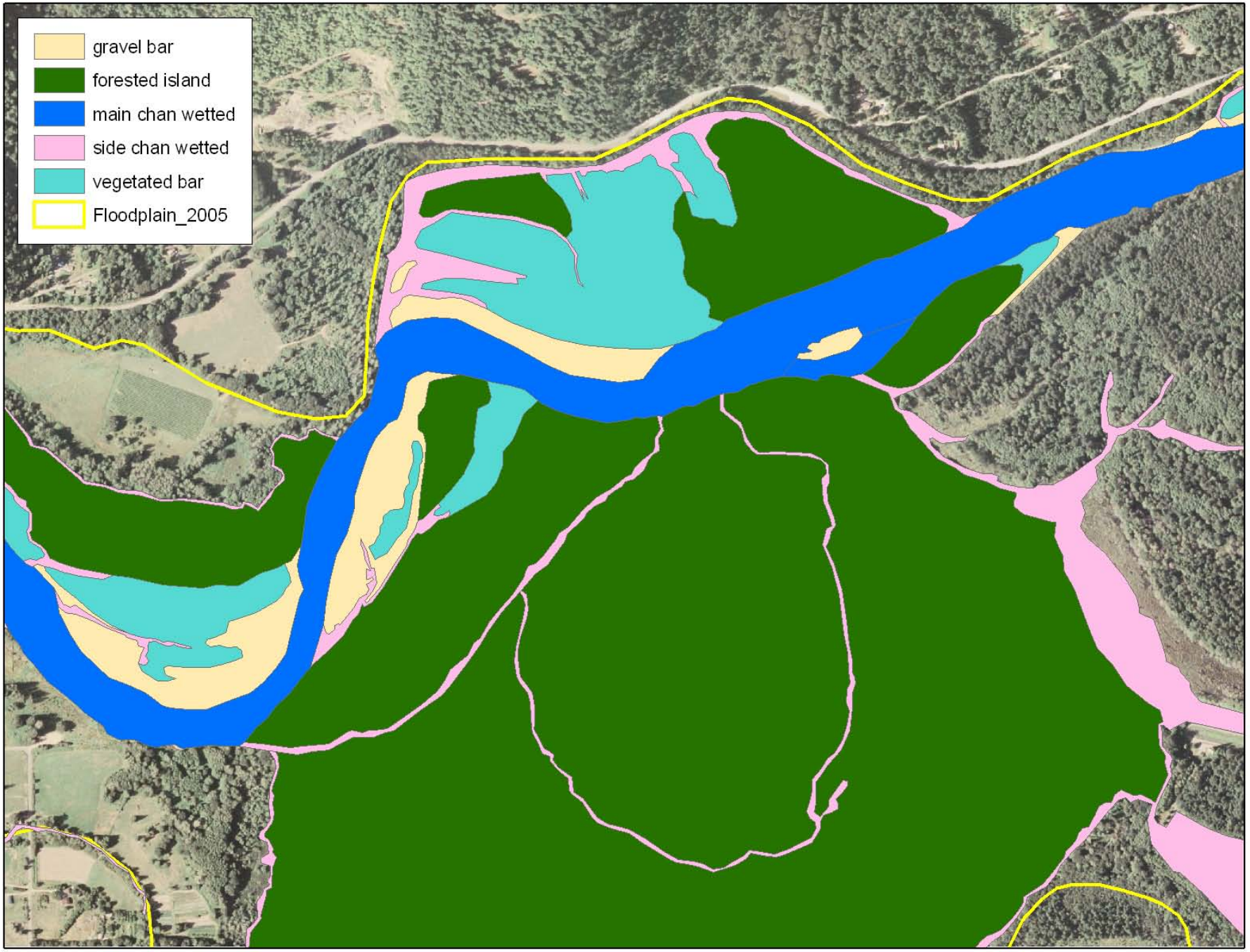
- Space (based on hydrograph)
- Habitat type (multiple scales)
- Time of year, correlated to fish life stages
- Night time snorkeling



- **Project in two phases:**
  - **Phase 1**
    - **Assemble habitat into GIS**
    - **Develop methods, conduct power analysis**
  - **Phase 2**
    - **Implement full design by Upper Skagit Tribe and University of Washington**

Beamer, E., J. P. Shannahan, E. Lowery, and D. Pflug. 2010. Freshwater habitat rearing preferences for stream type Juvenile Chinook salmon (*Oncorhynchus tshawytscha*) and Steelhead (*O. mykiss*) in the Skagit River Basin: Phase 1 study report. Skagit River System Cooperative, LaConner, WA.
Available at: http://www.skagitcoop.org/documents




gravel bar
forested island
main chan wetted
side chan wetted
vegetated bar
Floodplain_2005


Large Log Jams
Bar-apex and meander jams are potential "rare" habitat


N
E
W
S
237 meters long
126 meters long
54 meters long

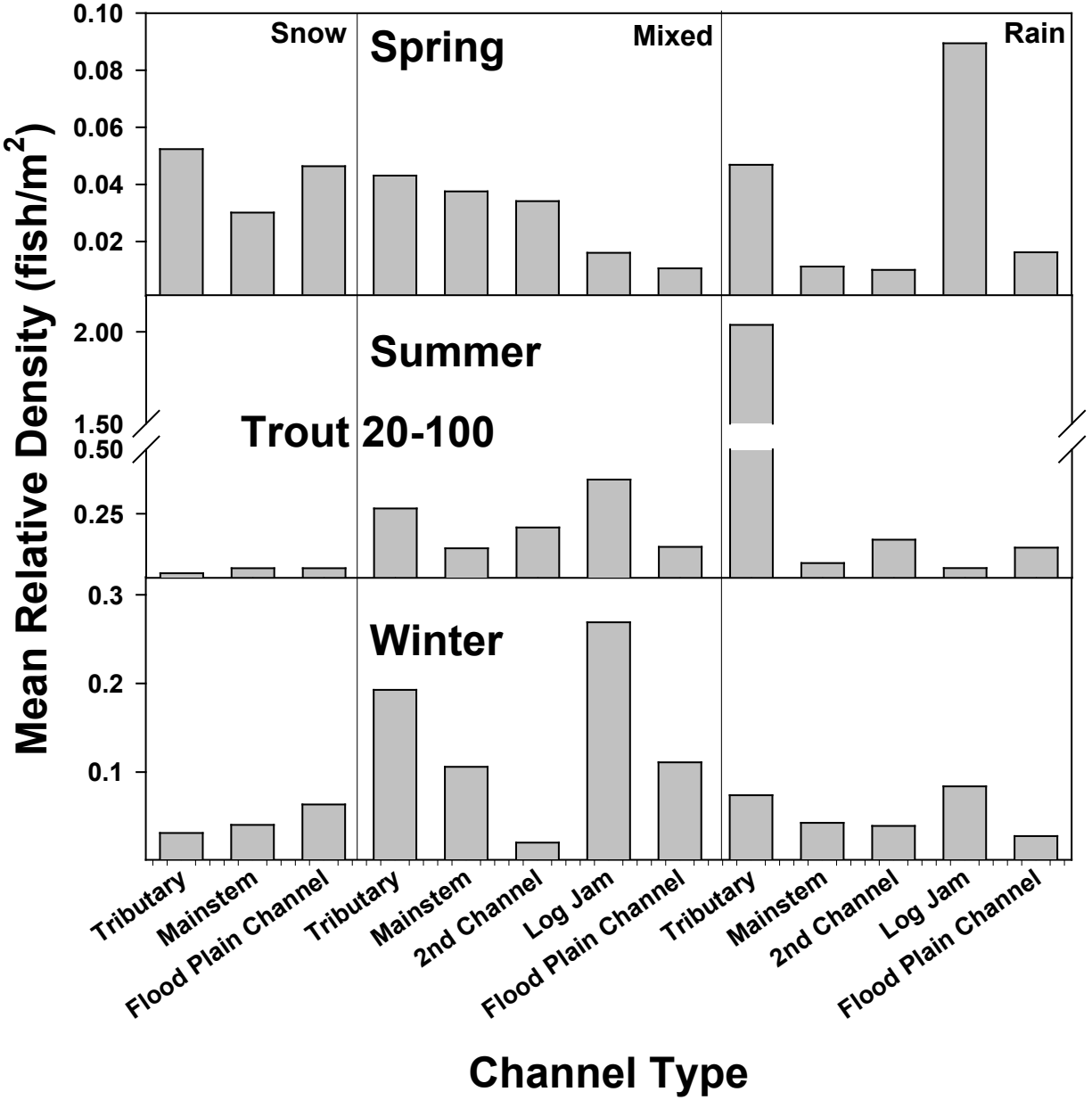
Phase 2 effort:
26 sites, 4 channel types, 1 rare habitat type, 4 seasons

(From draft report, lead author Erin Lowery of UW)

Total channels surveyed							
Hydro-Region	Season	Total Sites	Tributary	Mainstem (edge)	Side Channel	Flood Plain Channel	Large Log Jam
Rain	Spring '11	6	4	2	2	2	1
	Summer '11	6	3	2	2	2	1
	Winter '12	6	4	2	2	3	1
	Spring '12	3	2	1	1	1	1
Mixed	Spring '11	15	5	11	2	7	2
	Summer '11	15	6	9	1	2	1
	Winter '12	15	5	11	2	6	2
	Spring '12	5	1	4	1	1	1
Snow	Spring '11	3	1	2	-	2	-
	Summer '11	5	2	3	-	1	-
	Winter '12	4	1	3	-	1	-
	Spring '12	2	-	2	-	1	-

Example results

(From draft report, lead author Erin Lowery of UW)



Where do our field study results (and ongoing monitoring) go?

Develop a steelhead life cycle model

(reflecting, in part, on lessons learned from Chinook recovery planning)

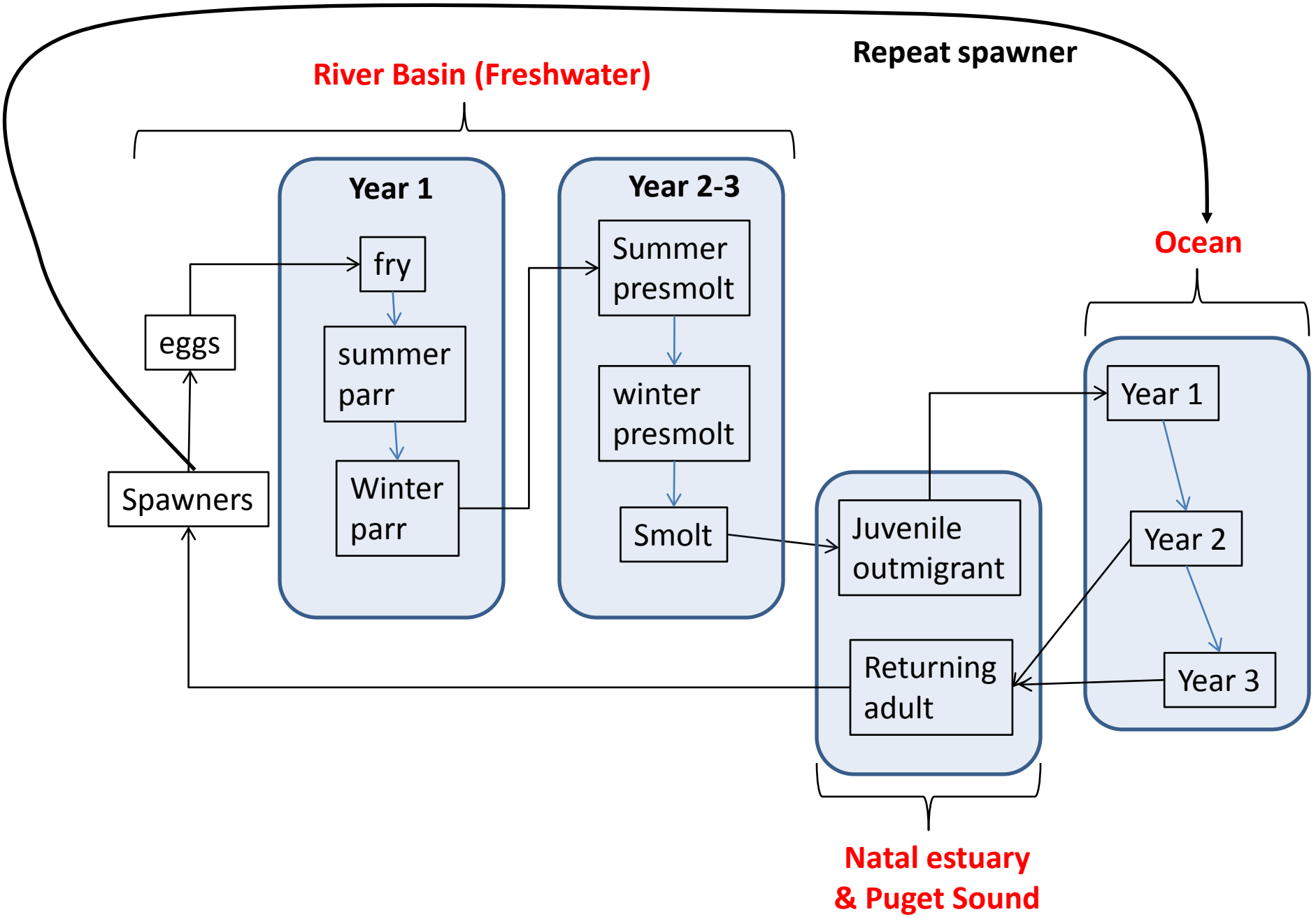
Needs to:

- Be life stage and life history type based (present/hypothesized in watershed)
- Reflect population dynamic functions (present/hypothesized in watershed)
- Be adaptable as we learn
- Link to habitat in GIS
- Link to “H” drivers
- Be relatively simple (and cost effective)
- Track cohorts & deal with uncertainty

Model Uses

- Develop steelhead recovery goals
- Develop a finite suite of steelhead recovery actions that are likely to achieve the goals

Using SLAM (http://www.nwfsc.noaa.gov/trt/slam/slam.cfm)


Repeat spawner
River Basin (Freshwater)
Year 1
Year 2-3
Ocean
fry
Summer presmolt
eggs
summer parr
winter presmolt
Spawners
Winter parr
Smolt
Juvenile outmigrant
Year 1
Year 2
Returning adult
Year 3
Natal estuary & Puget Sound

River Basin (Freshwater)

Year 1

Year 2-3

fry

summer parr

Winter parr

eggs

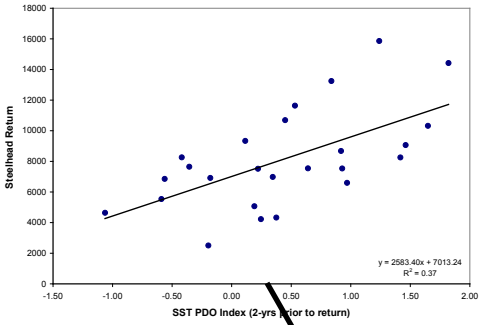
Spawners

Summer presmolt

winter presmolt

Smolt

Hatchery influence



Ocean

Year 1

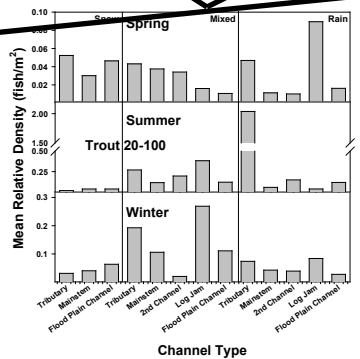
Year 2

Year 3

Juvenile outmigrant

Returning adult

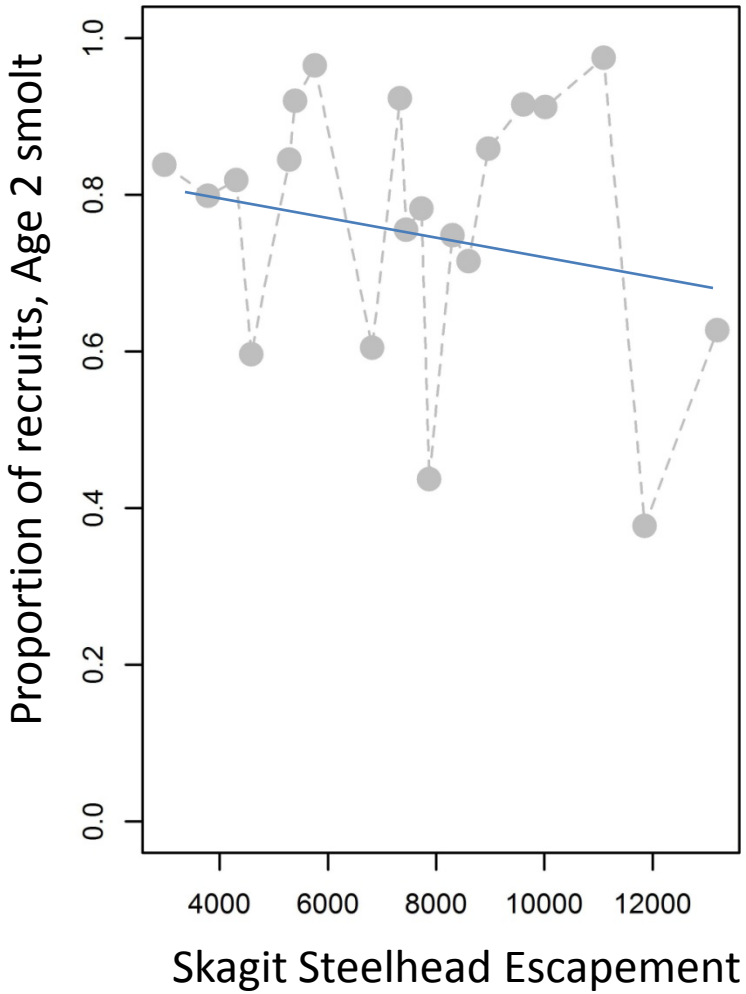
Natal estuary & Puget Sound

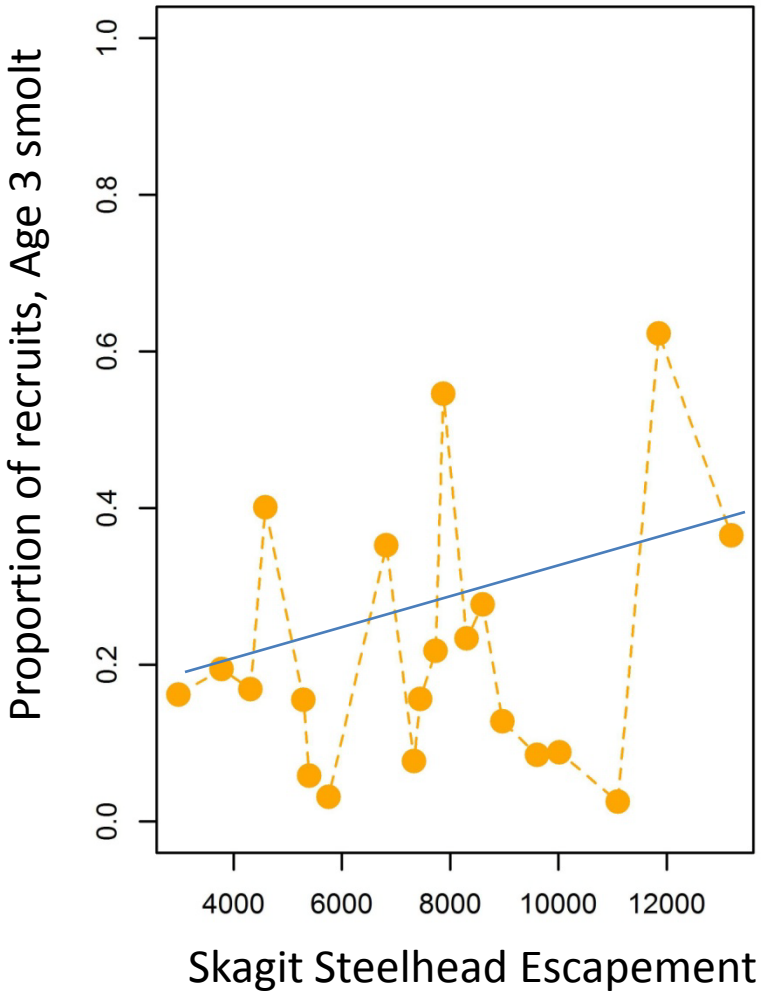


Ongoing Monitoring (cohort abundance, calc survival functions)

How will our model handle steelhead population dynamics?

Needs to be flexible to incorporate observed or hypothesized density dependence mechanisms including responses of: lowered survival, migration to the next lifestage, or shifts in life history type (example below)





Two Parting Thoughts

1. The science and tool development comes first in salmon & steelhead recovery planning
2. Plan on spending lots of time & money to fill data gaps with your own data