

Population genetic analysis of
Chehalis River watershed coho
salmon (*Oncorhynchus kisutch*)


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Photo: Keith Brady

Partners/collaborators/funders/sample collectors

- WDFW field crews including Garrett Moulton, Megan Tuttle, and Patrick Landback
- Quinault Indian Nation field crews
- Alicia Terepocki WDFW MGL
- Hatchery staff at Humptulips, Wishkah, Lake Aberdeen, Bingham Creek, and Skookumchuck hatcheries
- Todd Kassler WDFW MGL
- Washington State Legislature Second Engrossed House Bill 1115
- Washington State RCO

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- Reduced representation of the published report
 - Presenting main findings
 - Figures and Tables taken from Seamons et al. 2019 report are labeled

Motivation for the study

- Understanding population structure is critical for planning and habitat modeling
- Previous genetic analyses were limited
 - Low-power markers
 - Incomplete sampling in space
 - No temporal replication



Objectives


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1. Determine the genetic relationship of Chehalis River coho salmon with other coho salmon populations in Washington State
 2. Evaluate the genetic population structure of coho salmon within the Chehalis River basin with regard to spawning location (sub-basin)
 3. Evaluate the genetic population structure of early and late runs of coho salmon within the Chehalis River basin

Figure 1

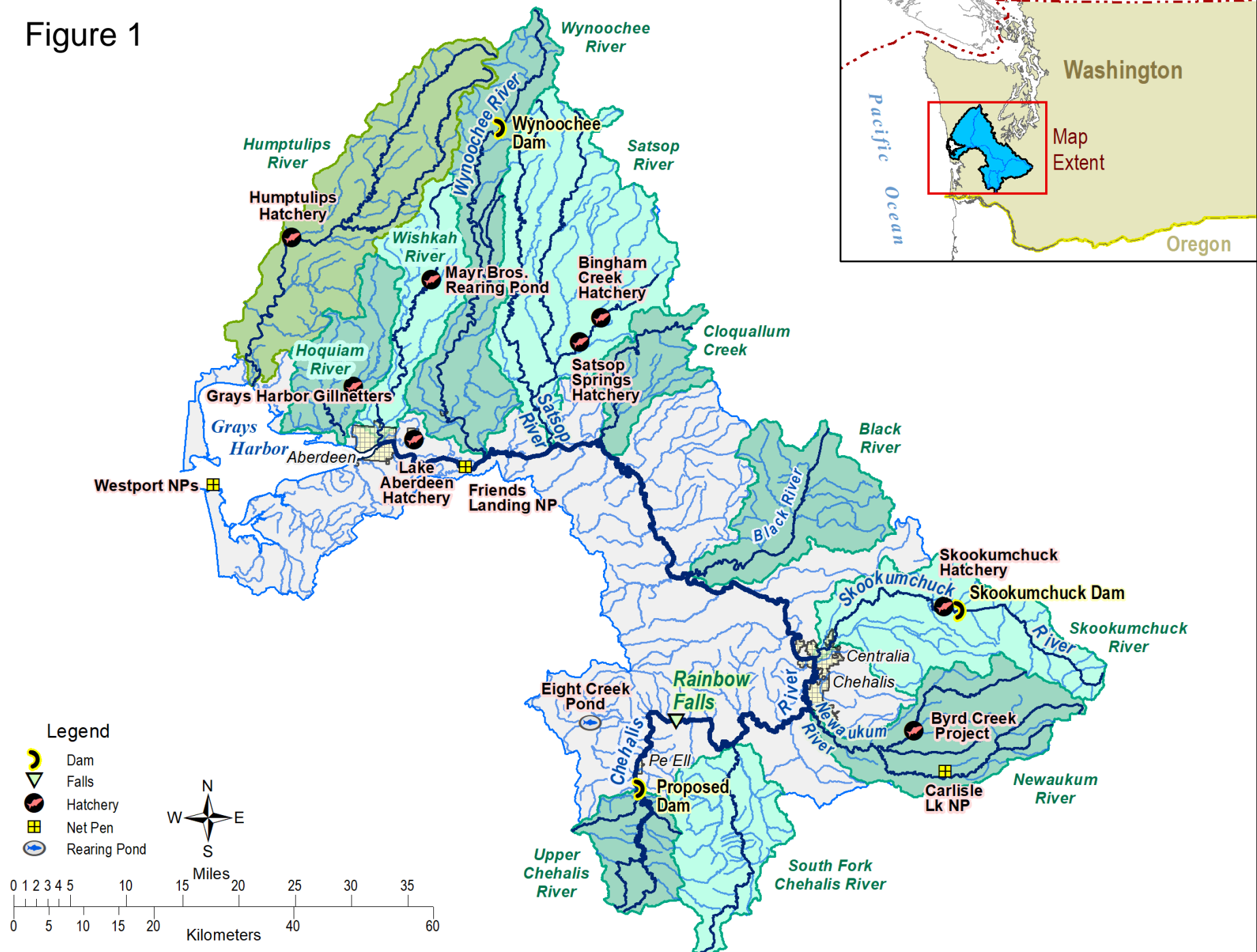
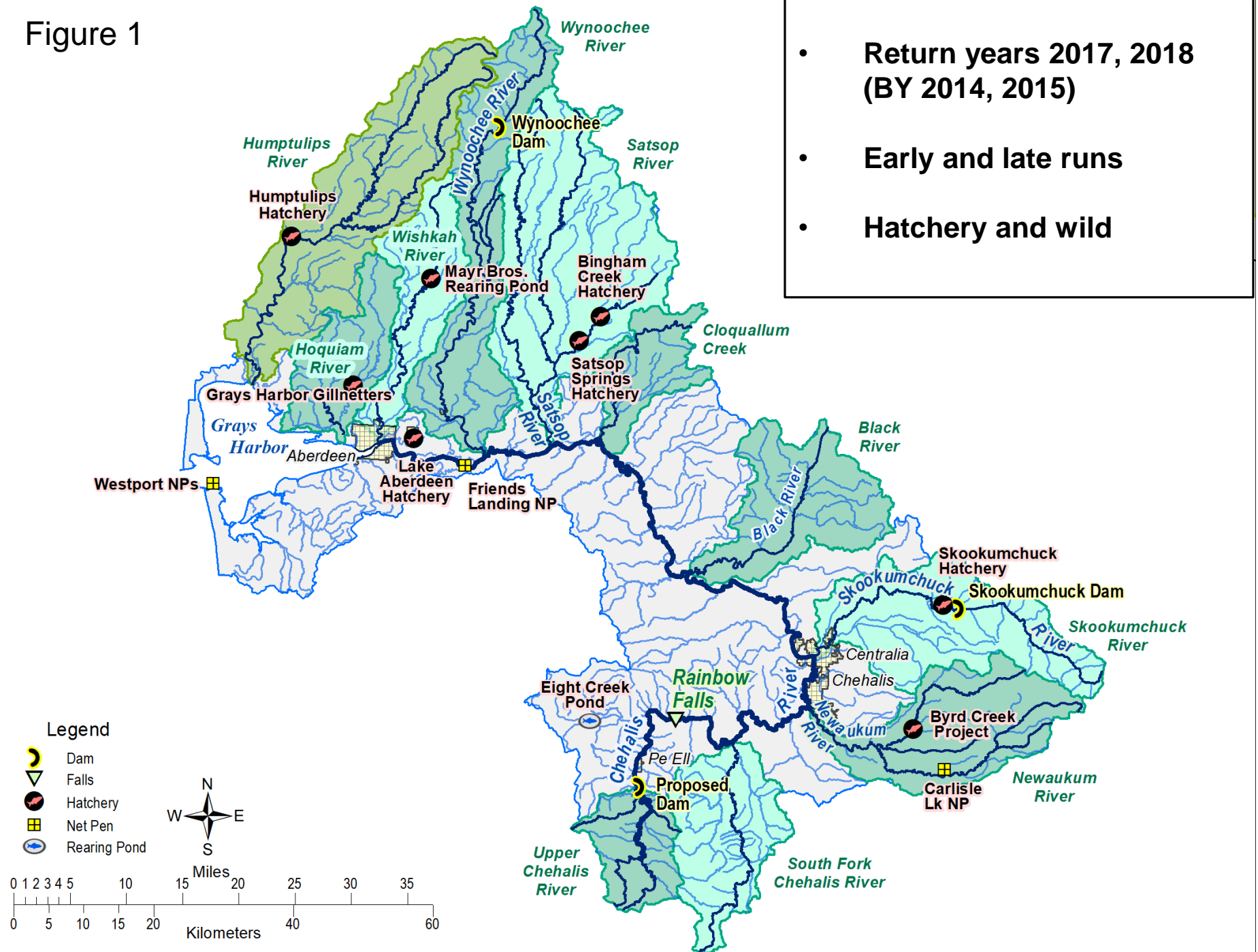


Figure 1



High coho hatchery production in the Chehalis Basin

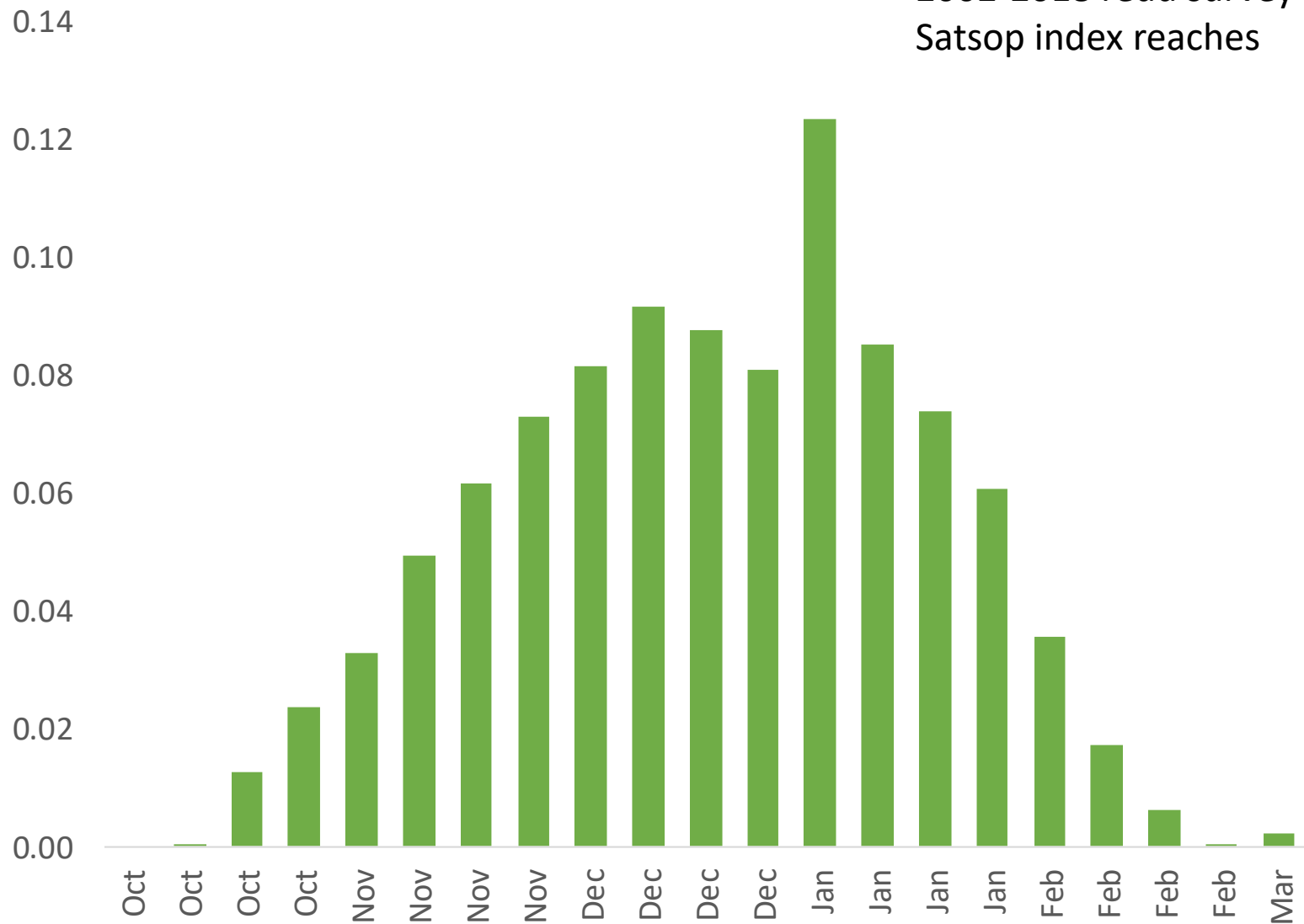
Nearly half of the coho smolts headed to sea were hatchery produced

Facility	Operator	Program spawn timing	Broodstock source	Release river	Avg PNI	Release n
Humptulips Hatchery	WDFW	early	Humptulips early	Humptulips	0.47	400,000
Humptulips Hatchery	WDFW	late	Humptulips late	Humptulips	0.33	100,000
Bingham Creek Hatchery	WDFW	early	Satsop early	Satsop	0.47	150,000
Satsop Springs Hatchery	WDFW	early	Satsop early	Satsop	NA	450,000
Friends Landing net pens	COOP	early	Satsop early	Lower Chehalis	NA	25,000
Westport net pens	COOP	early	Satsop early	Lower Chehalis	NA	100,000
Bingham Creek Hatchery	WDFW	late	Satsop late	Satsop	0.80	150,000
Skookumchuck Hatchery	WDFW	early	Skookumchuck early	Skookumchuck	0.54	50,000
Carlisle Lake	COOP	early	Skookumchuck early	SF Newaukum	0.78	50,000
Byrd Creek Project	COOP	early	Skookumchuck early	NF Newaukum	NA	25,000
Skookumchuck Hatchery	WDFW	late	Skookumchuck late	Skookumchuck	0.49	50,000
Carlisle Lake	COOP	late	Skookumchuck late	SF Newaukum	0.87	50,000
Eight Creek Pond	WDFW	late	Skookumchuck late	Upper Chehalis	NA	100,000
Mayr Brothers Rearing Pond	COOP	early	Wishkah early	Wishkah	0.03	300,000
Buzzard Creek	COOP	early	Wishkah early	Lower Chehalis	NA	25,000
Grays Harbor Gillnet	COOP	early	Wishkah early	Lower Chehalis	NA	190,000
Lake Aberdeen Hatchery	WDFW	early	Wynoochee early	Van Winkle Creek	1.00	30,000
					sum	2,245,000

Table 1

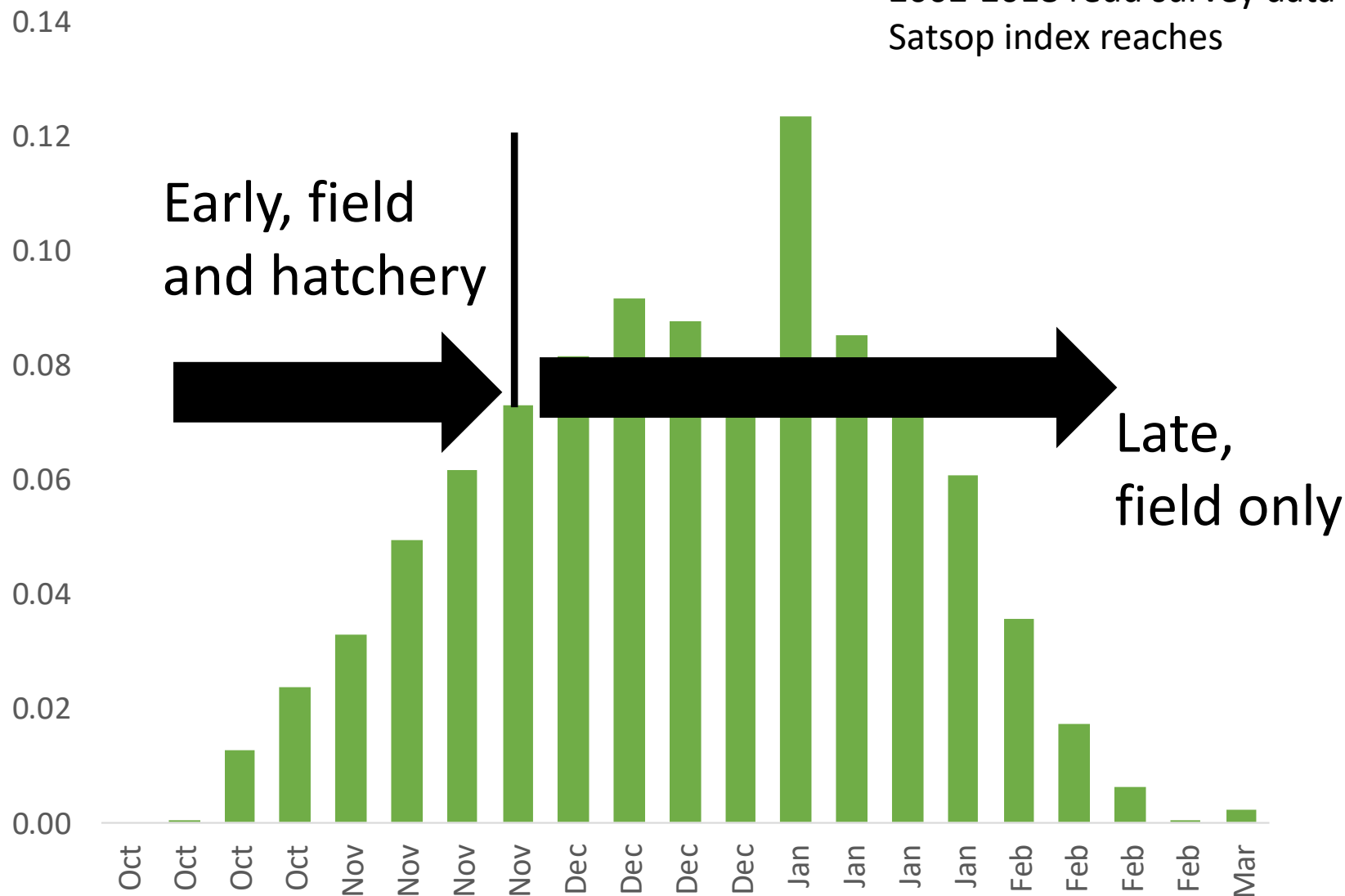
No clear spawn-timing distinction between early and late coho

2002-2018 redd survey data for Satsop index reaches

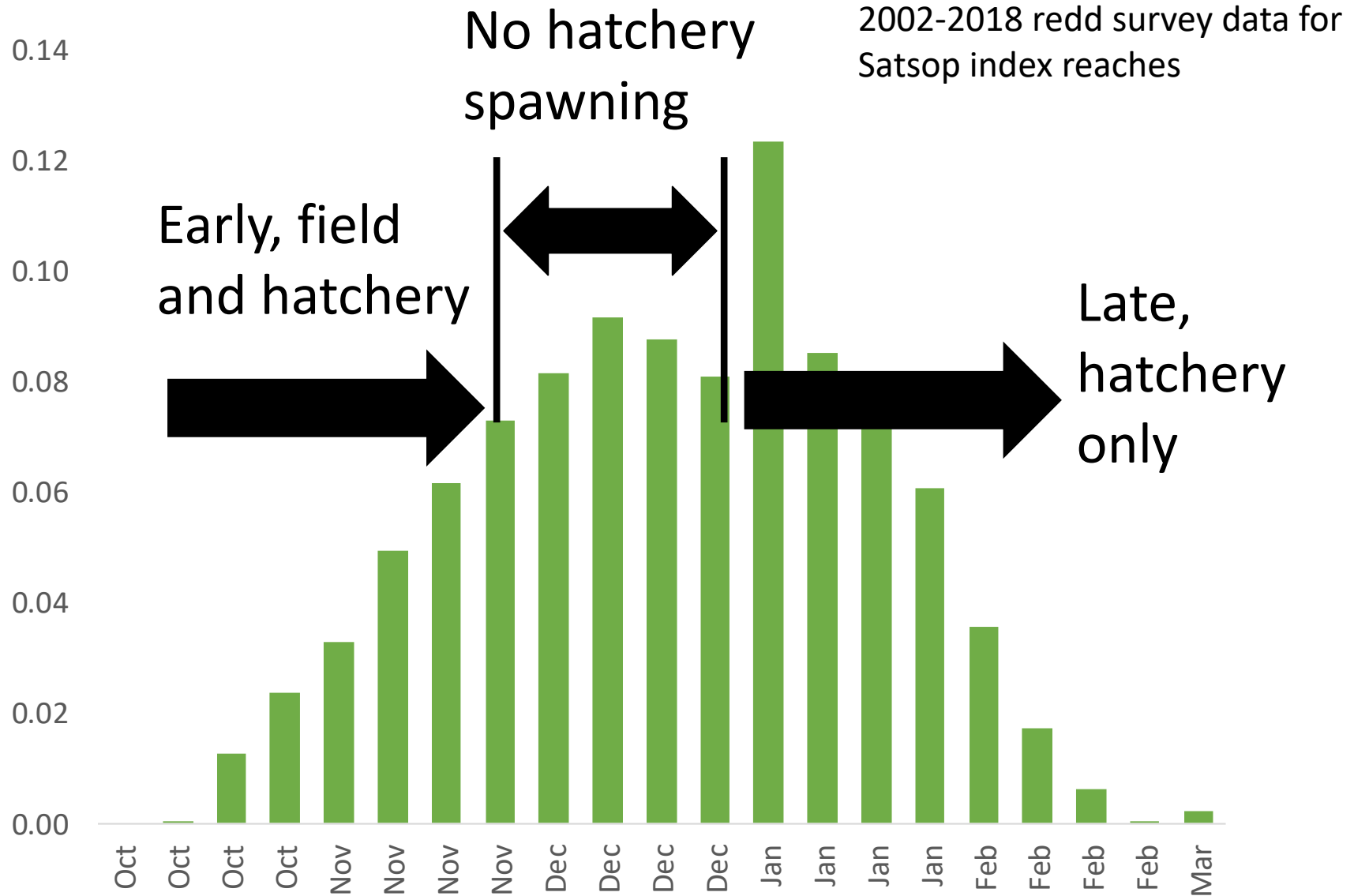


Field-used cutoff dates do not necessarily match spawning patterns

2002-2018 redd survey data for Satsop index reaches



Hatchery spawning cutoff dates do not match spawning patterns




Data comprised of a SNP panel

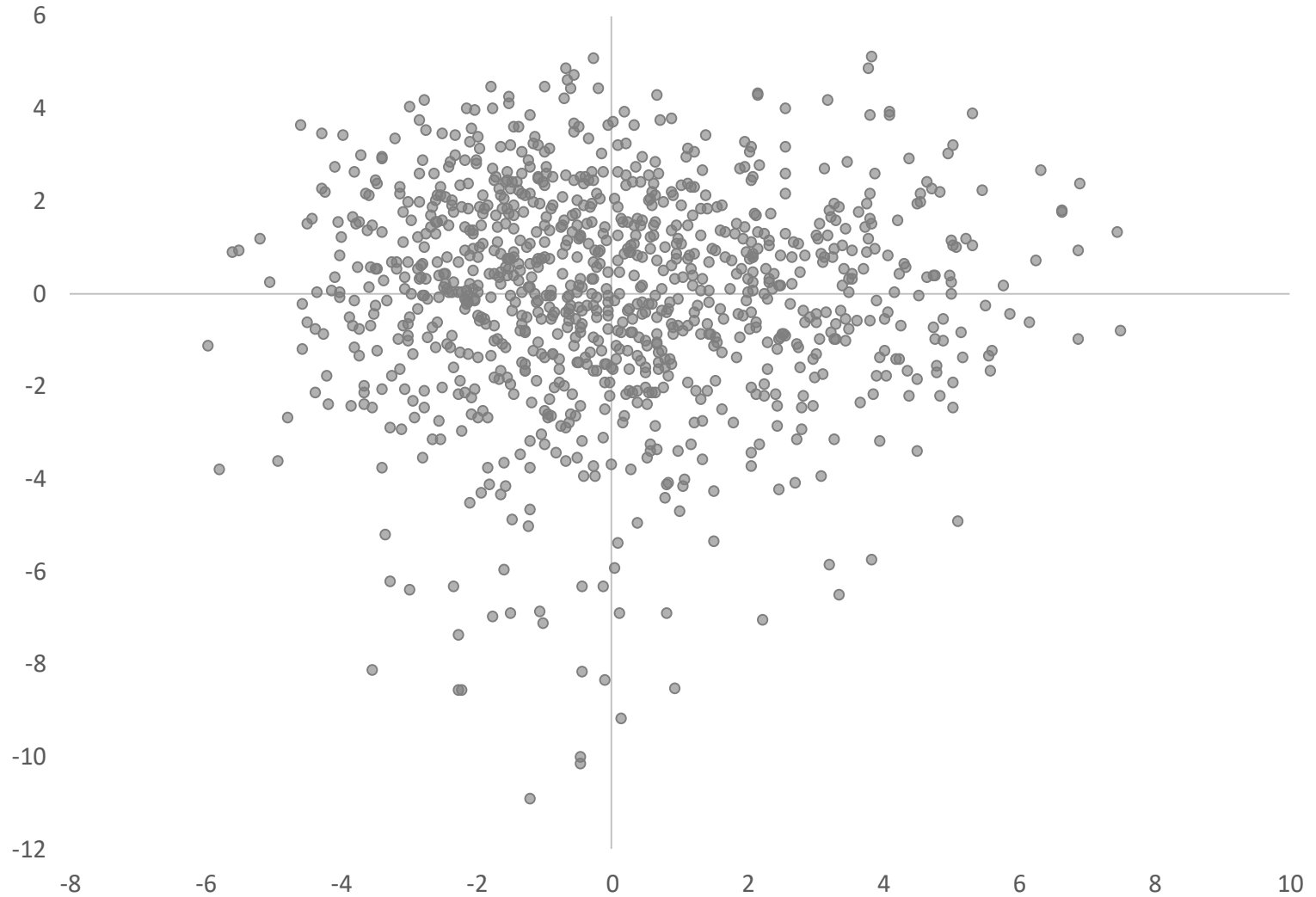
- A recently-developed 257-SNP panel
- Reference baseline is limited
 - A subset of Puget Sound populations only
 - other coho reference data currently available
- Standard population genetic analyses
 - Analysis at individual level
 - Analysis at collection level



Results

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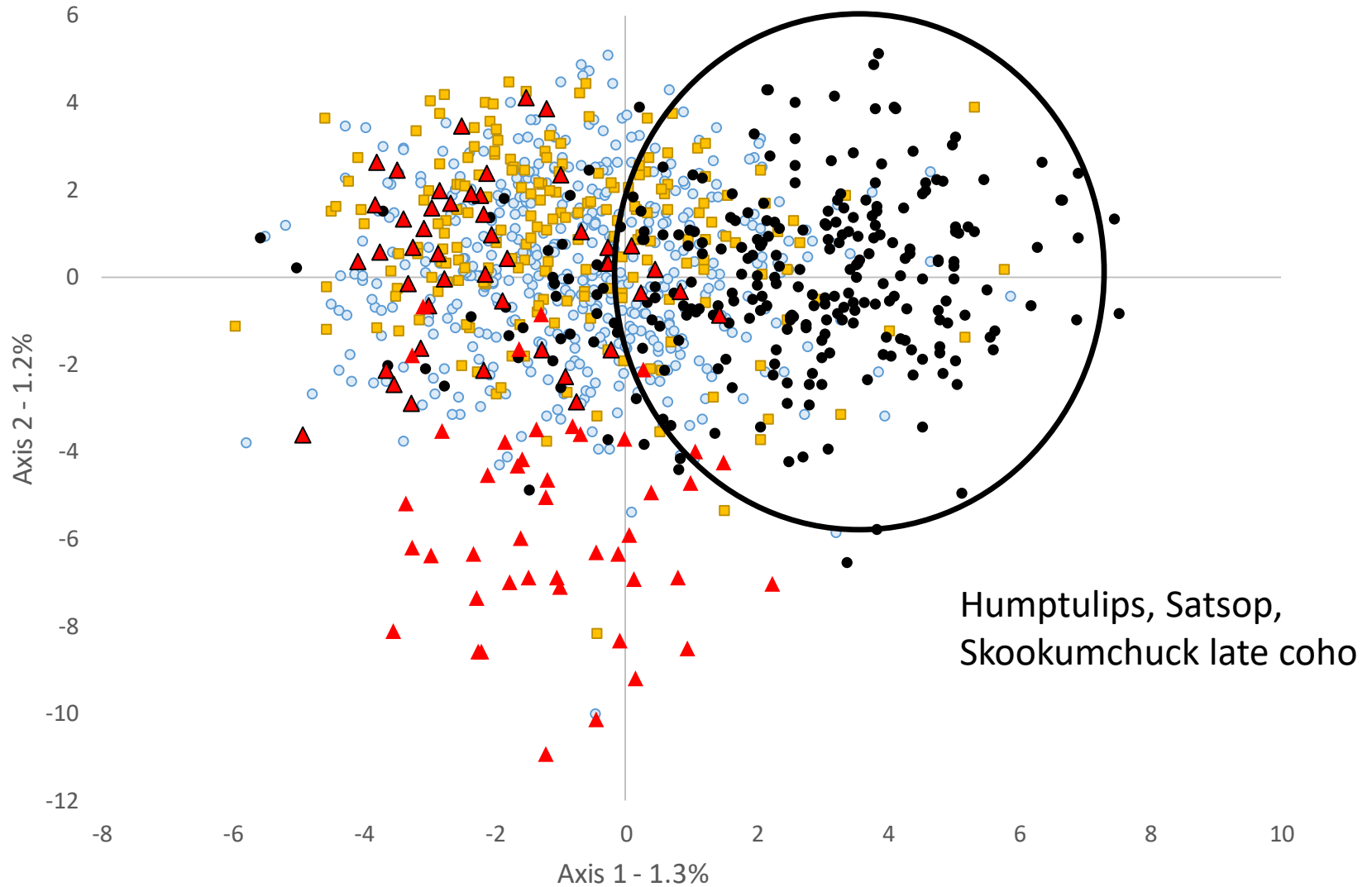


Figure 5

○ Other ■ Hatchery_early ● Hatchery_late ▲ Wishkah_17_E ▲ Wishkah_18_E

Adult Wishkah coho sampled in 2018 (brood year 2015) are different from all other coho in the Chehalis Basin

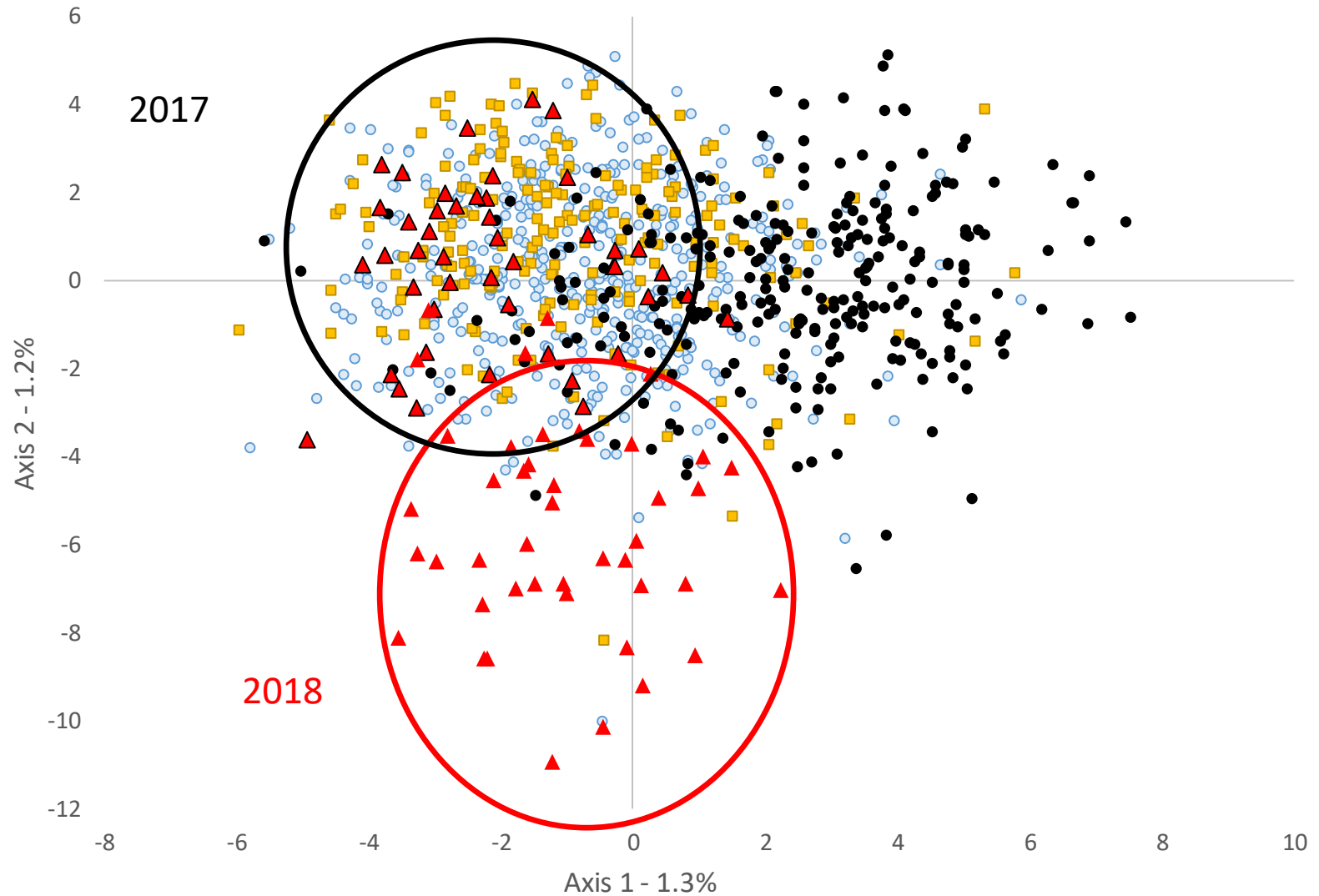


Figure 5

○ Other ■ Hatchery_early ● Hatchery_late ▲ Wishkah_17_E ▲ Wishkah_18_E

Spatial structure in Chehalis Basin, but strongest structure found in places with hatchery programs

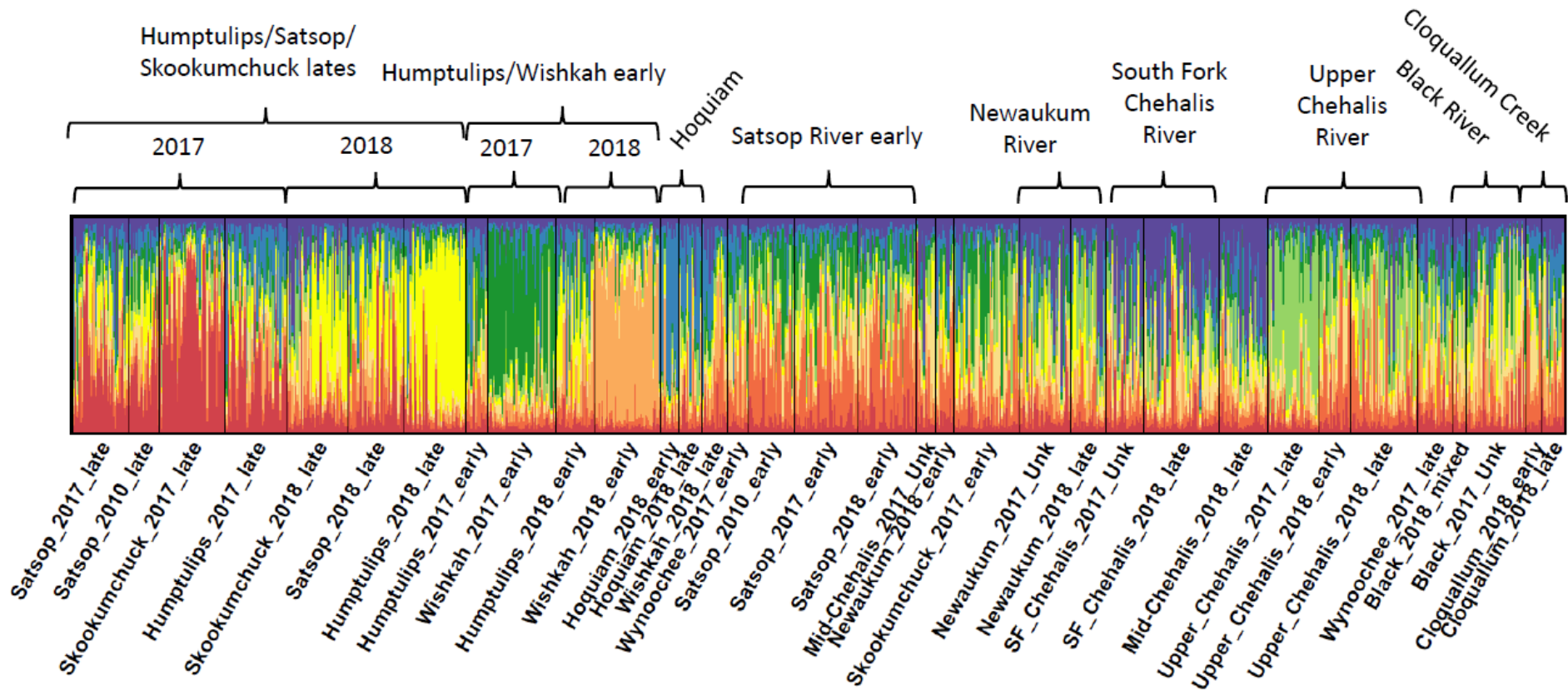


Figure 6

Chehalis Basin coho cluster by sub-basin, except hatchery late and Humptulips/Wishkah early

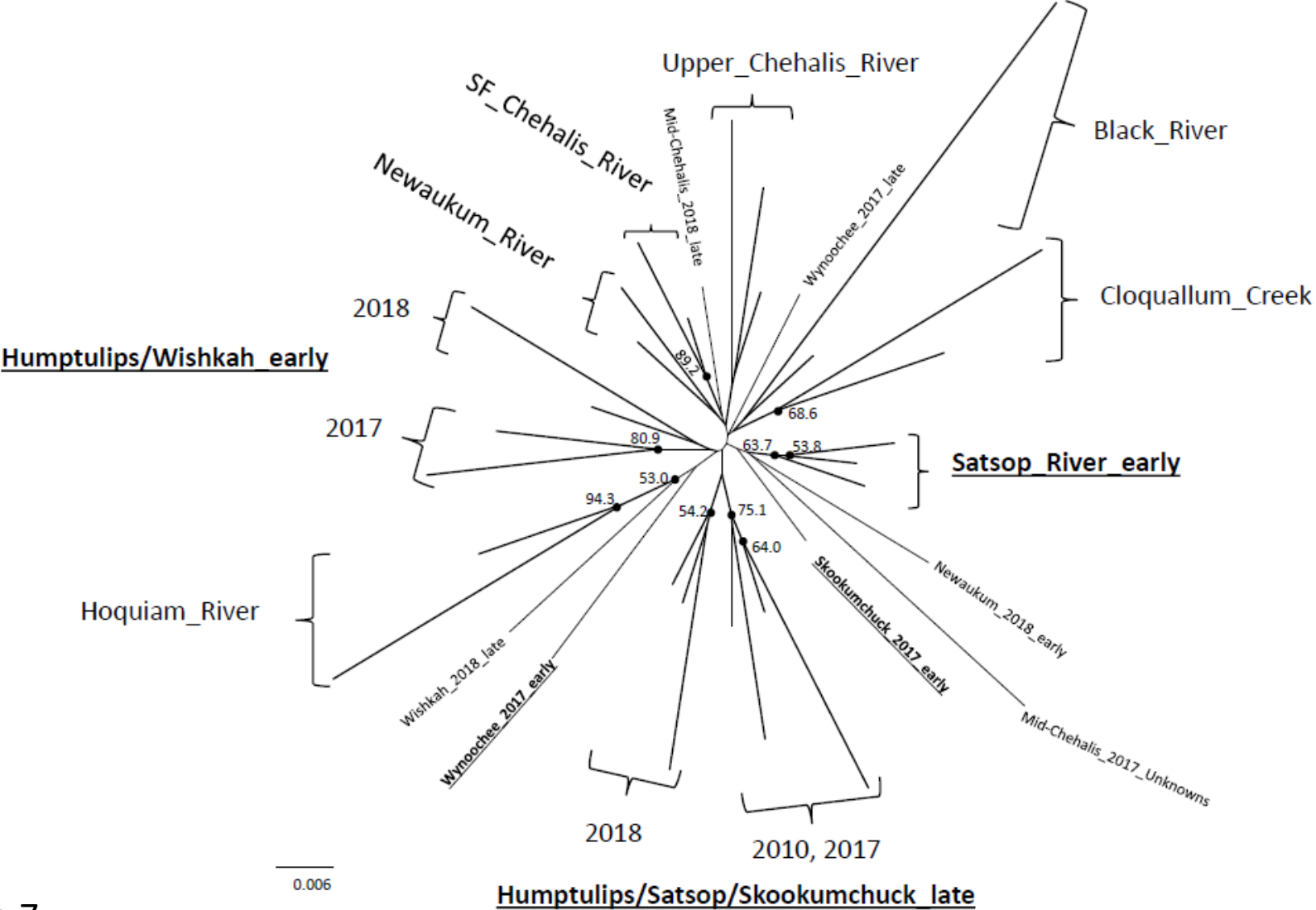


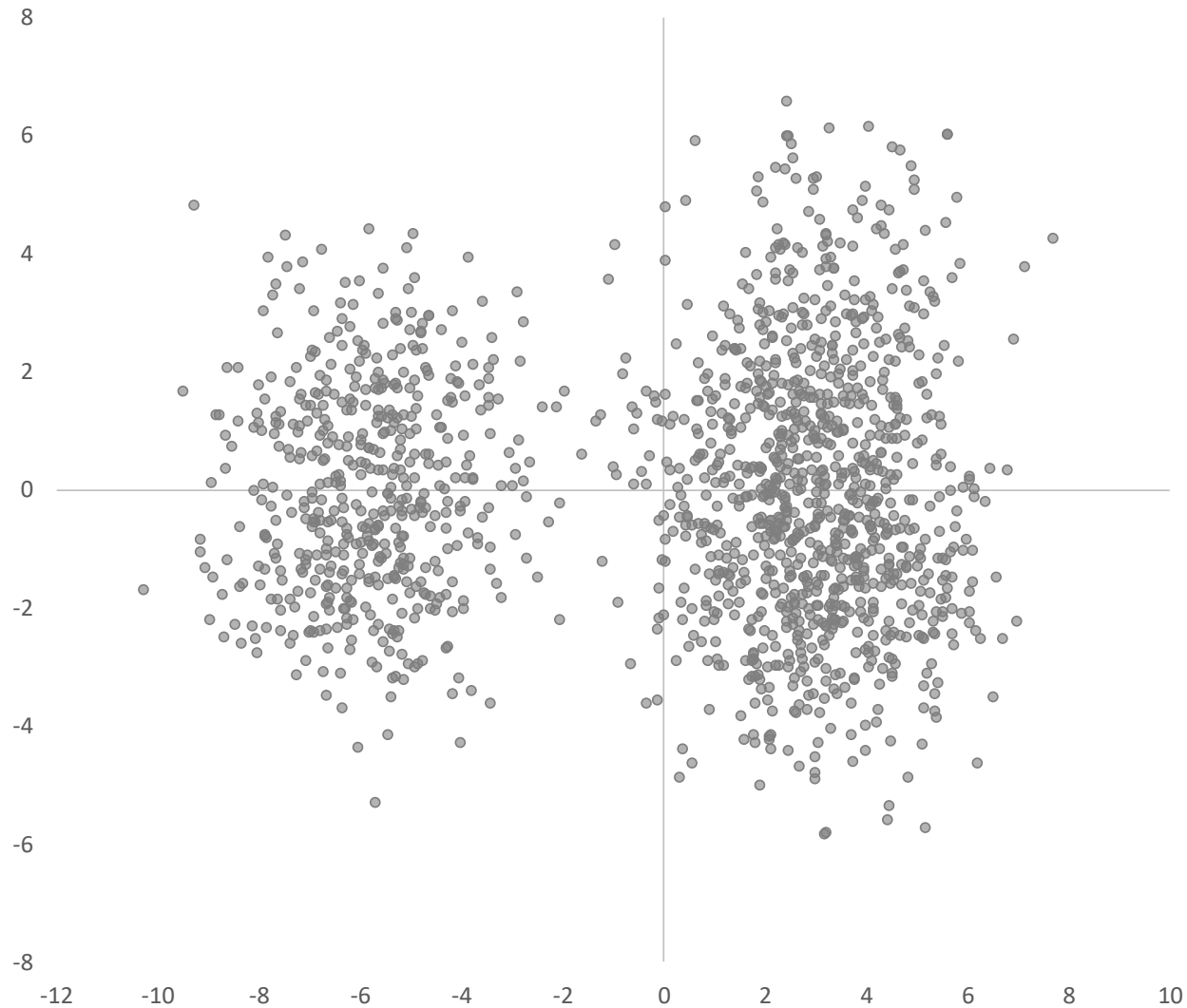
Figure 7

Results



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Chehalis River coho salmon are different from Puget Sound coho



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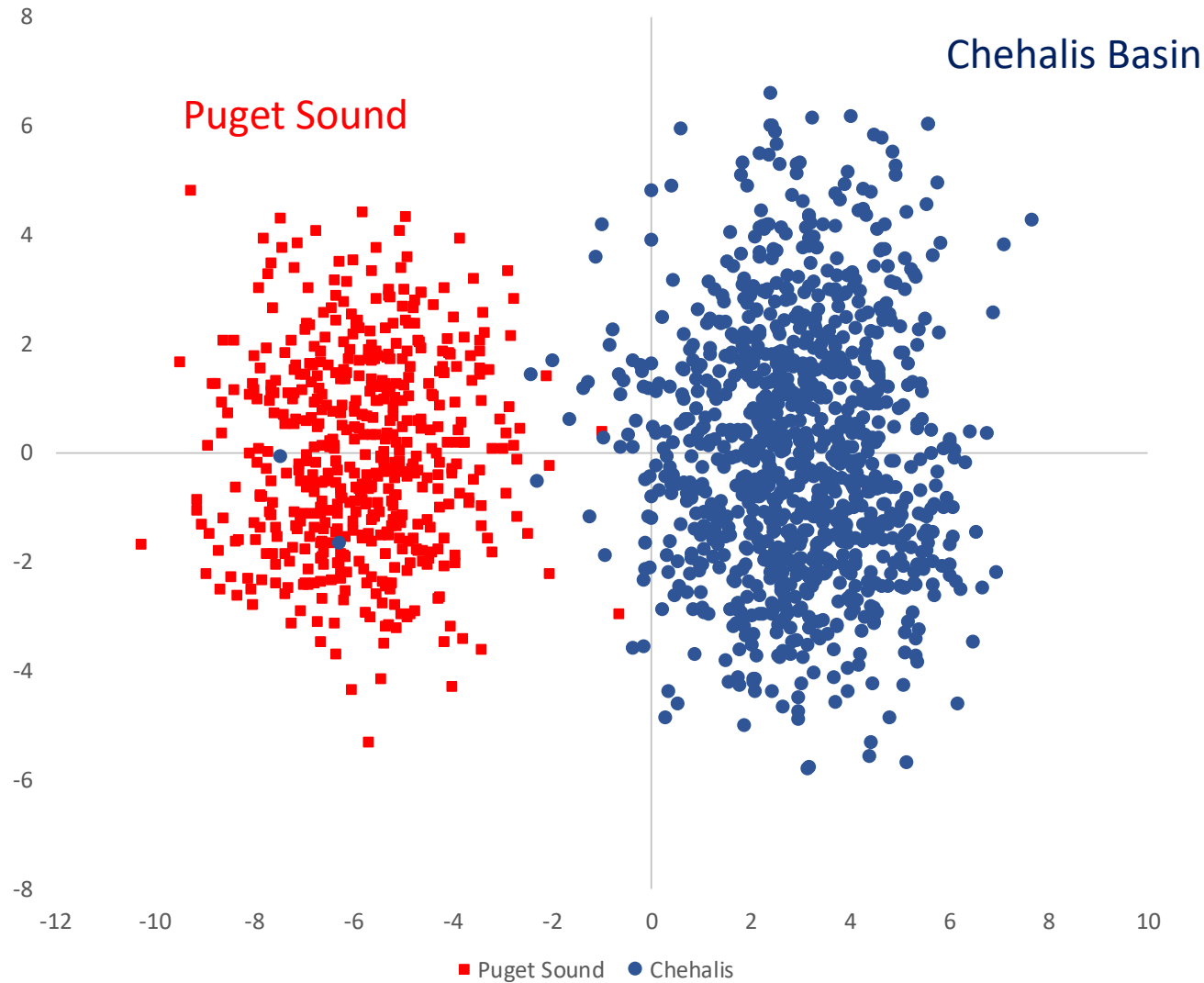


Figure 2

Likely escapees from Puget Sound coho reared for a time at Skookumchuck Hatchery

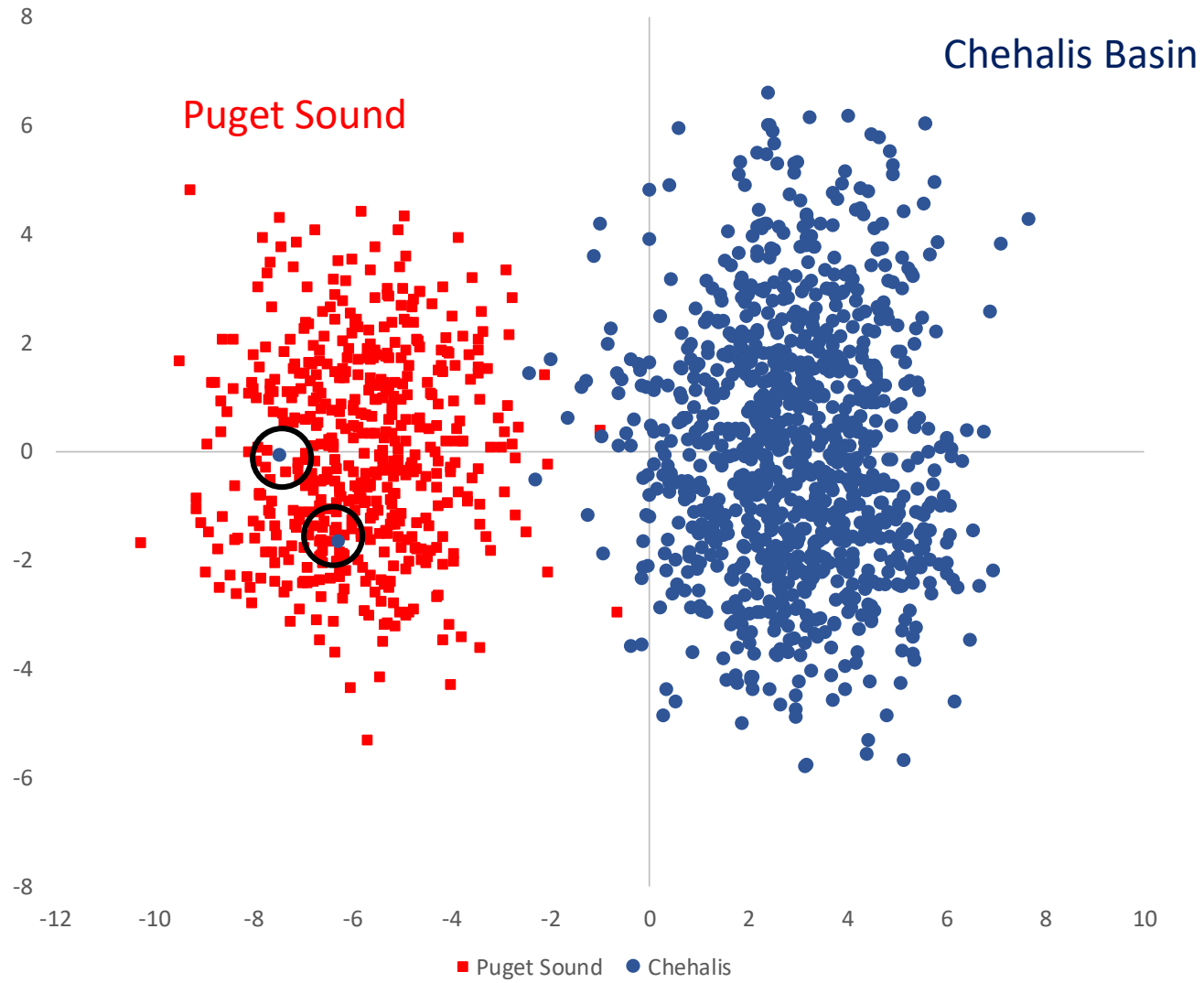


Figure 2

Stronger among population diversity in Chehalis than Puget Sound coho

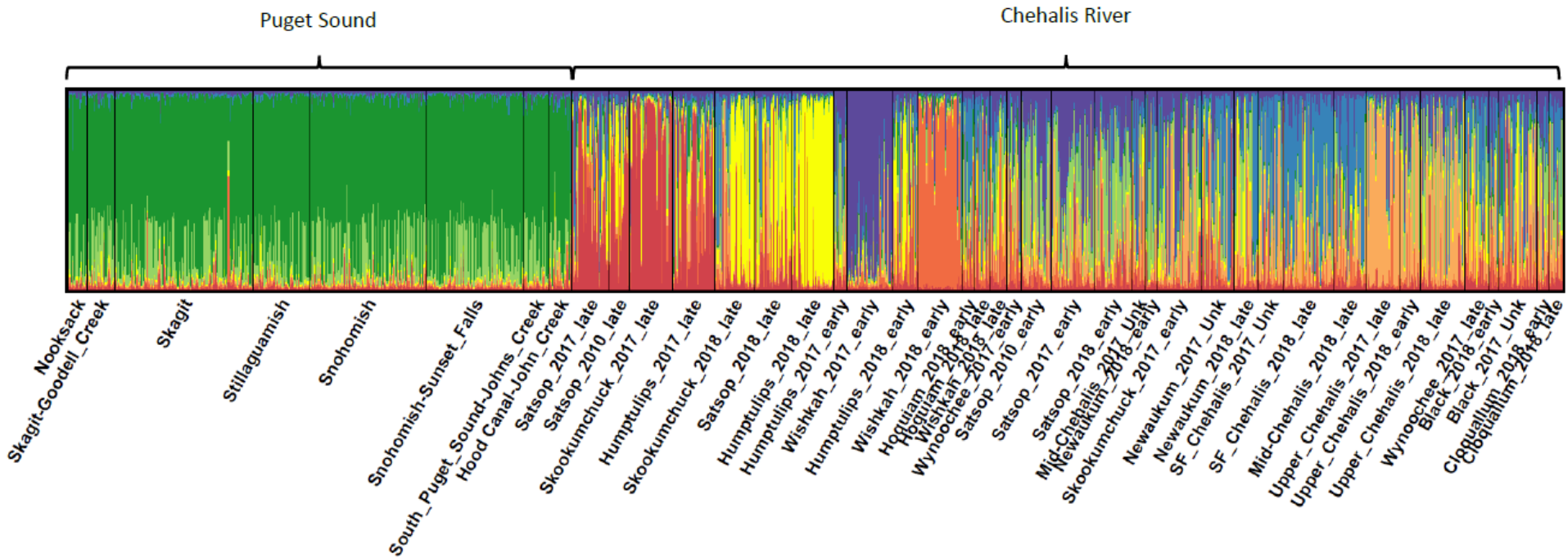


Figure 3

Main conclusions

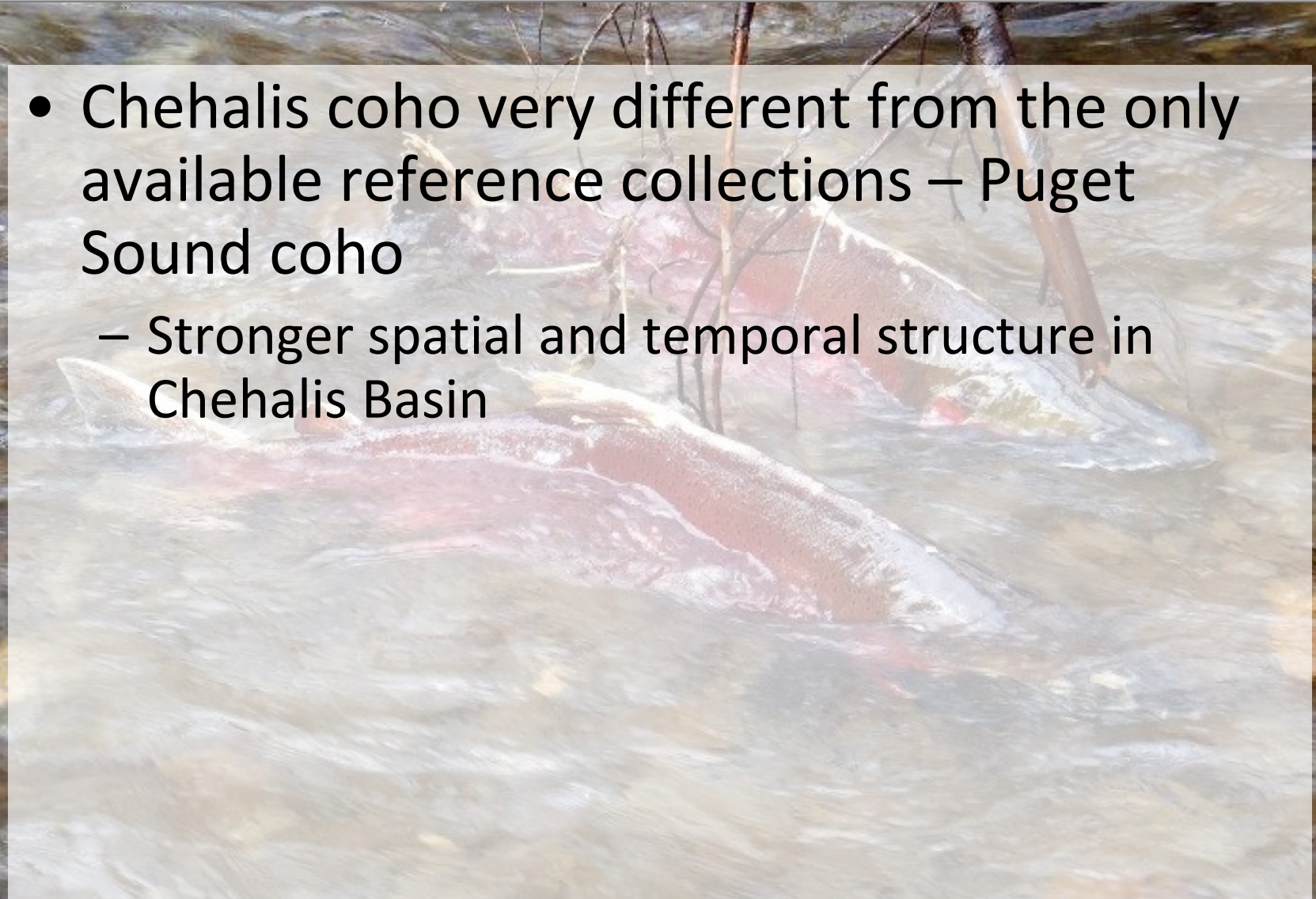
- Chehalis coho diversity and structure impacted by hatchery practices
 - Wishkah – multiple things going on there
 - Limited inter-cohort mixing – basically very little input from jacks
 - Late hatchery coho all similar
 - Late and early fish most strongly differentiated where hatchery programs exist for both

Main conclusions

- There is significant population structure in Chehalis coho
 - Differences among sub-basins
 - including upper Chehalis
 - Some differences among cohorts
 - Mainly in locations with significant hatchery activity
 - Some differences between early and late coho
 - Mainly in locations with significant hatchery activity

Main conclusions

- Chehalis coho very different from the only available reference collections – Puget Sound coho
 - Stronger spatial and temporal structure in Chehalis Basin



Future work

- Additional sampling in lower southern Grays Harbor tributaries and small mainstem tributaries
- Sampling of the third cohort, especially in the Wishkah sub-basin
- Adding Chehalis to larger reference baseline

