

An aerial photograph of a river winding through a dense forest. The river is the central focus, flowing from the upper left towards the lower right. The surrounding forest is lush and green, with some trees showing early autumn colors. The lighting suggests a bright day, with shadows cast across the water and the forest floor.

# Lower Cowlitz River Spawner Abundance Estimate Methods

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Washington Department of Fish and Wildlife  
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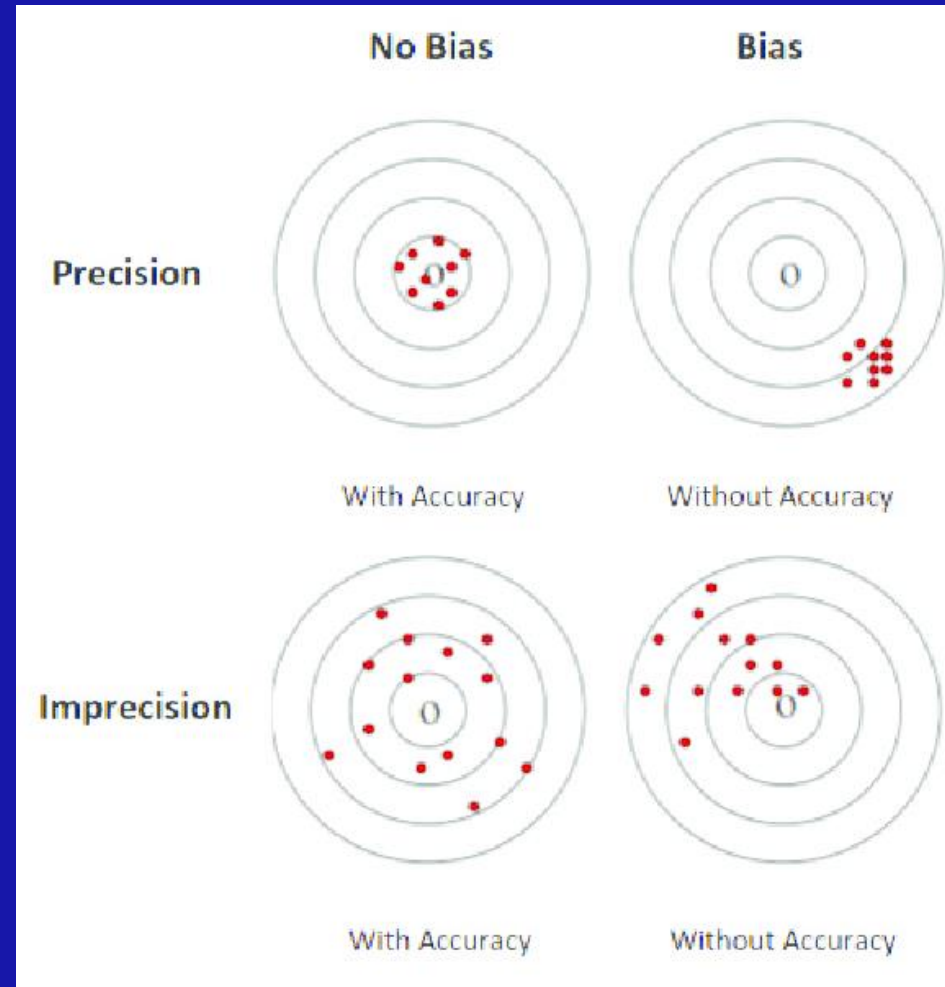
# Overview

- Purpose: To estimate the number of natural and hatchery spawners in the natural environment
- Coho and steelhead are monitored in tributary habitat
- Level of effort was increased with the implementation of the 2011 FHMP
- Chinook are monitored in the mainstem Cowlitz River habitat



# Monitoring Objectives

- Abundance of spawners
  - Unbiased, known precision\*
- Spawner composition by
  - Origin (Natural, Hatchery)
    - Also program, raceway, etc.
  - Age
- Spatial distribution of spawning



\* Following NOAA guidelines for monitoring of ESA-listed salmon and steelhead populations (Crawford & Rumsey 2011)

# Coho and Steelhead Methods



# Tributary Monitoring Overview

- Tributary Weirs
  - Mark-Recapture
  - Females per Redd
  - Control pHOS
- Spawner Surveys
  - Census and GRTS surveys
  - Redd Counts and Live Observations
  - Tag recovery
- Trends in Abundance Estimates



# Tributary Weir



# Methods: Tributary Weirs

- Daily operation in season, year-round
- Natural coho and steelhead
  - Enumerate
  - Sampled for biological information (e.g., origin, sex, length, age)
  - Tagged, marked, and released upstream to spawn
  - Weir wash-ups and kelts are checked for tags
- Hatchery salmon and steelhead are removed from the stream

# Methods: Spawner surveys

- October - January for Coho
- February - May for Steelhead
- Foot and raft
- Redds are flagged and georeferenced
- Live fish are counted
  - Tag or no tag, ad-clip, or unmarked
- Carcasses are biologically sampled
  - Tag vs. no tag
  - Sex, length, scale, age

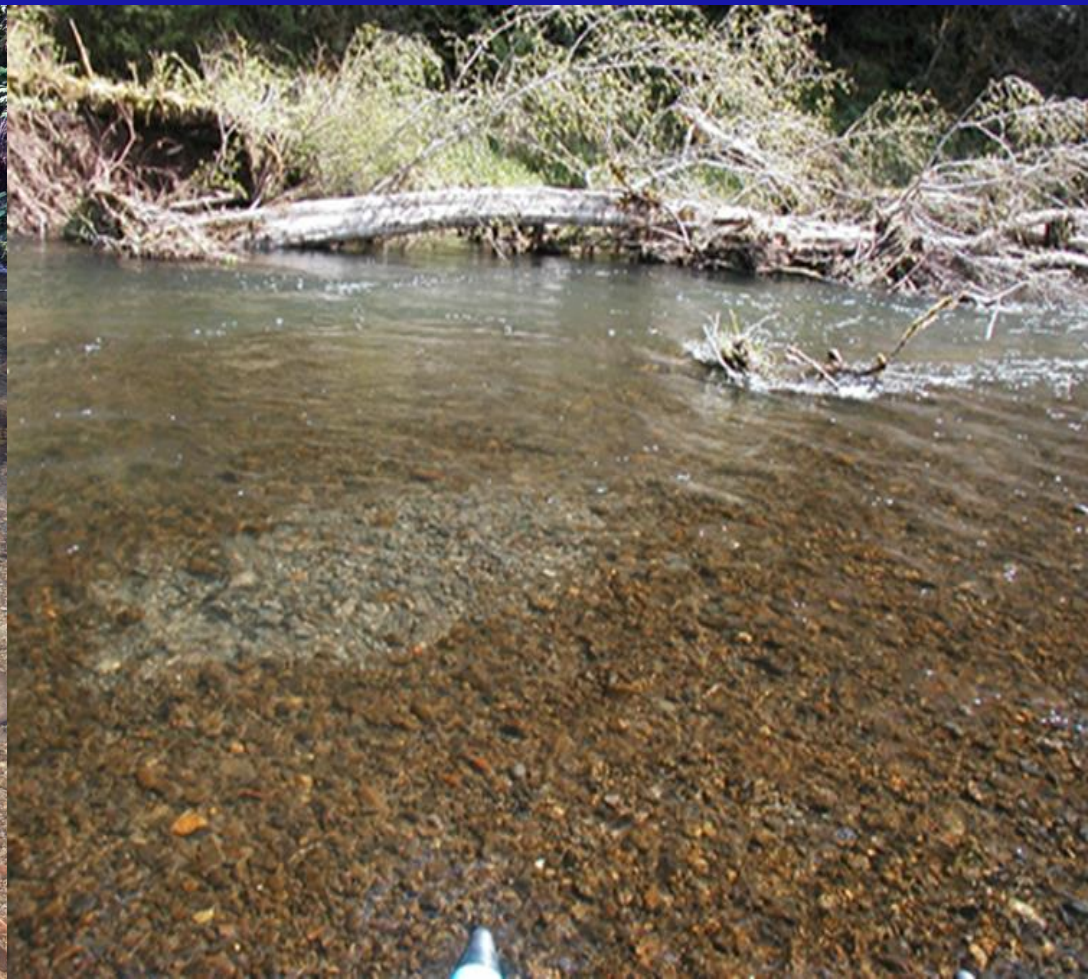


# Spawner Surveys:

Survey Types Differ in Spatial and Temporal Coverage

Type	Spatial Coverage	Survey Frequency	Locations
Census	All area is surveyed	Bi-weekly (steelhead) Weekly (coho)	Above weirs, outside weirs in high-density spawning areas (including Blue Creek)
Generalized Random Tessellation Stratified (GRTS)	Subset of areas are surveyed (random, 1-mile)	Bi-weekly (steelhead) Weekly (coho)	Outside weirs
Supplemental	All area is surveyed	Once (peak spawn timing)	Above weirs

# Spawner Surveys: Examples of Steelhead Redds



# Methods: Data Analysis

Mark-Recapture  
above tributary weirs

+

Redd expansion  
outside of tributary  
weirs

=

Total Spawners



# Methods: Data Analysis

**Mark-Recapture  
above tributary weirs**

+

Redd expansion  
outside of tributary  
weirs

=

Total Spawners

$$N = n1 * n2/m2$$

$n1$  = tagged and released  
above the weir

$n2$  = tagged and untagged  
observed above the weir

$m2$  = tagged observed above  
the weir

$N$  = abundance

# Methods: Data Analysis (2)

Mark-Recapture  
above tributary weirs

+

**Redd expansion  
outside of tributary  
weirs**

=

Total Spawners

$$R * RpF / pF = N$$

Redds (R) = observed +  
estimated

Redds per female (RpF) =  
tributary mark-recapture and  
redd counts

Proportion female (pF) = arrivals  
at tributary weirs

N = abundance

# Methods: Data Analysis (3)

Mark-Recapture  
above tributary weirs

+

Redd expansion  
outside of tributary  
weirs

=

**Total Spawners**

$$N = NOR + HOR$$

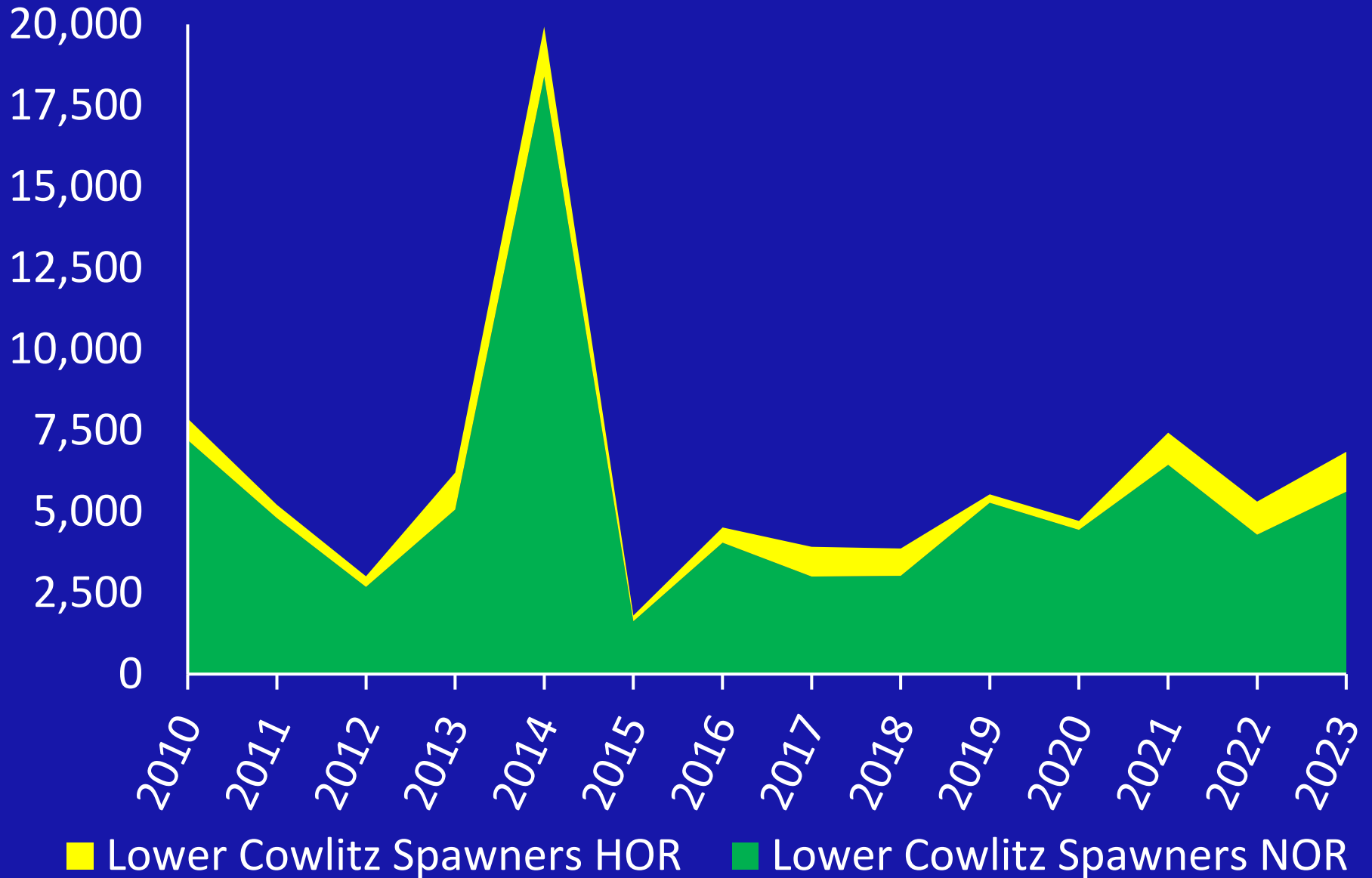
- Above tributary weirs
- Outside tributary weirs
- Outside tributary weirs  
(Blue/Mill Creek)





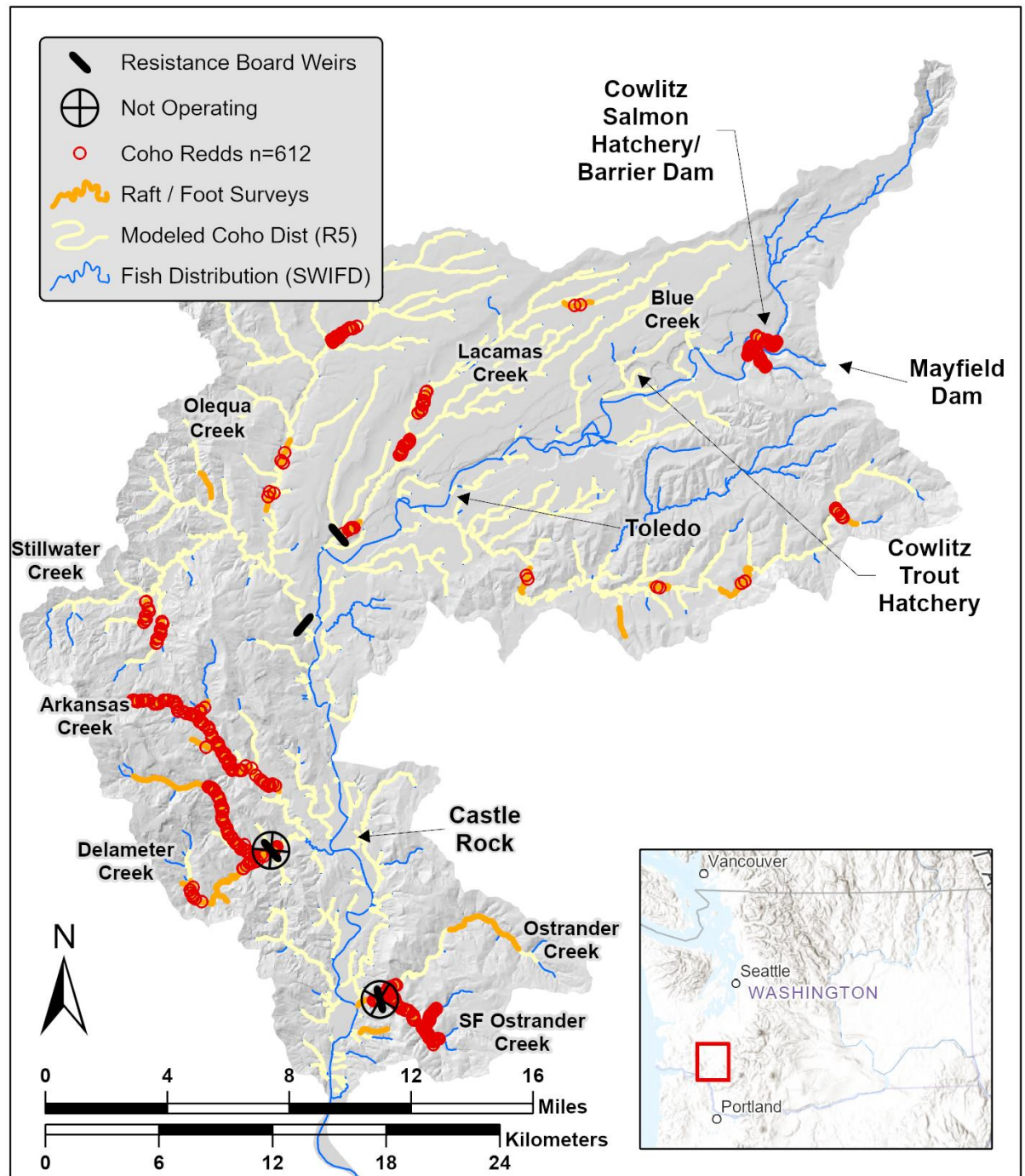
Lower Cowlitz  
Coho

# Lower Cowlitz Tributary Coho





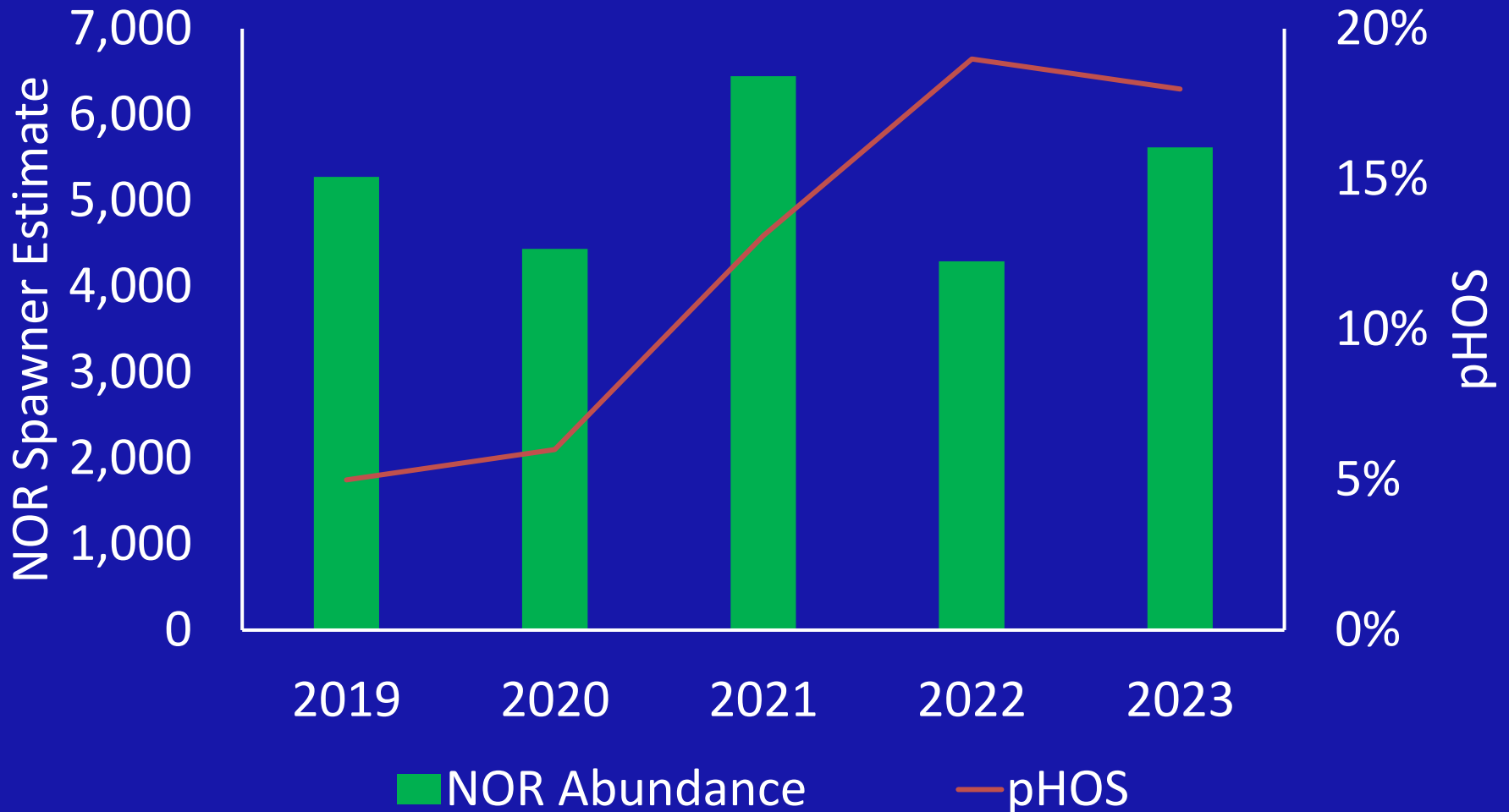
# 2023 Lower Cowlitz Redd Locations



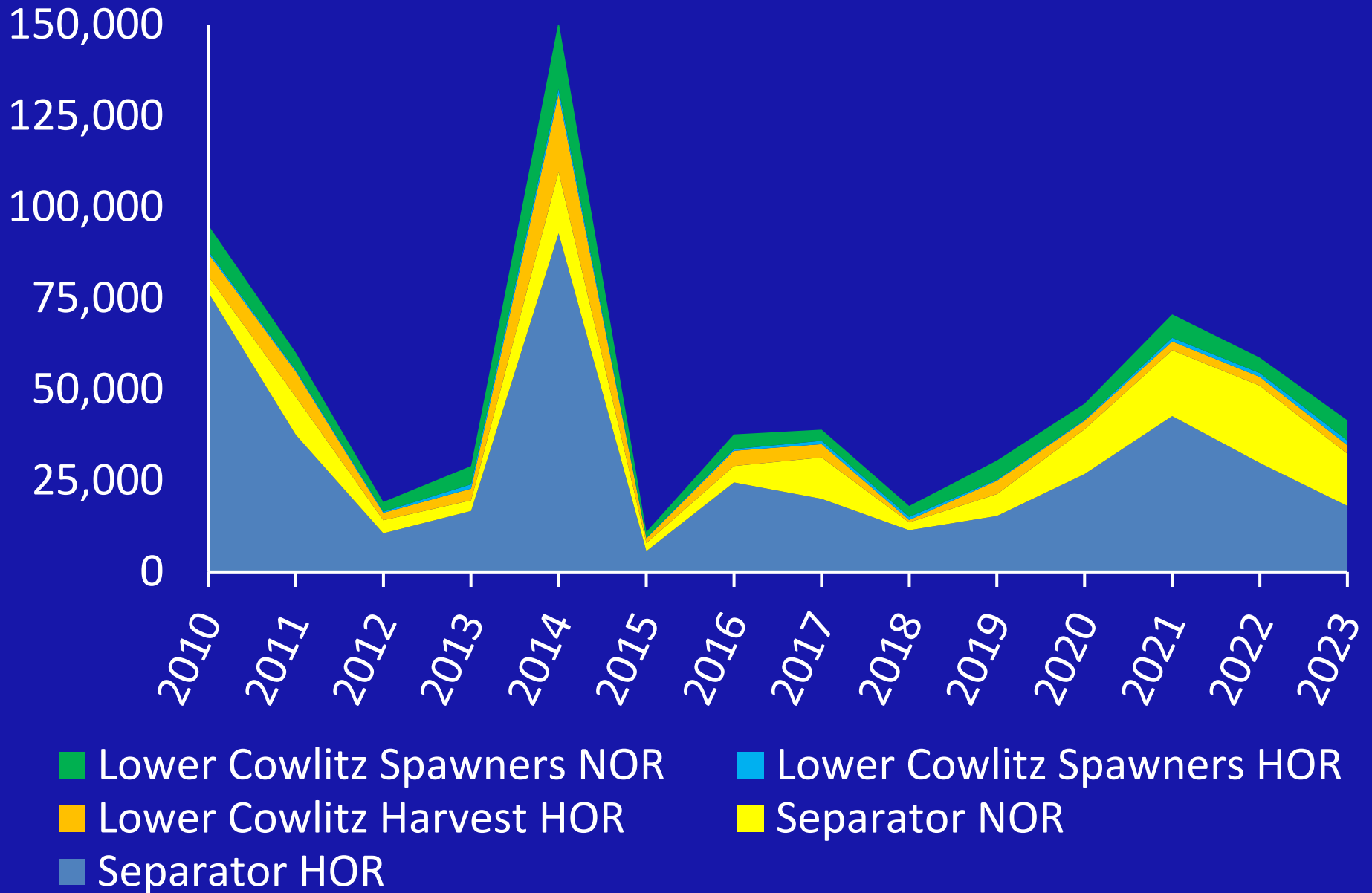


# Lower Cowlitz Tributary Coho

## Lower Cowlitz Coho



# Lower Cowlitz Coho

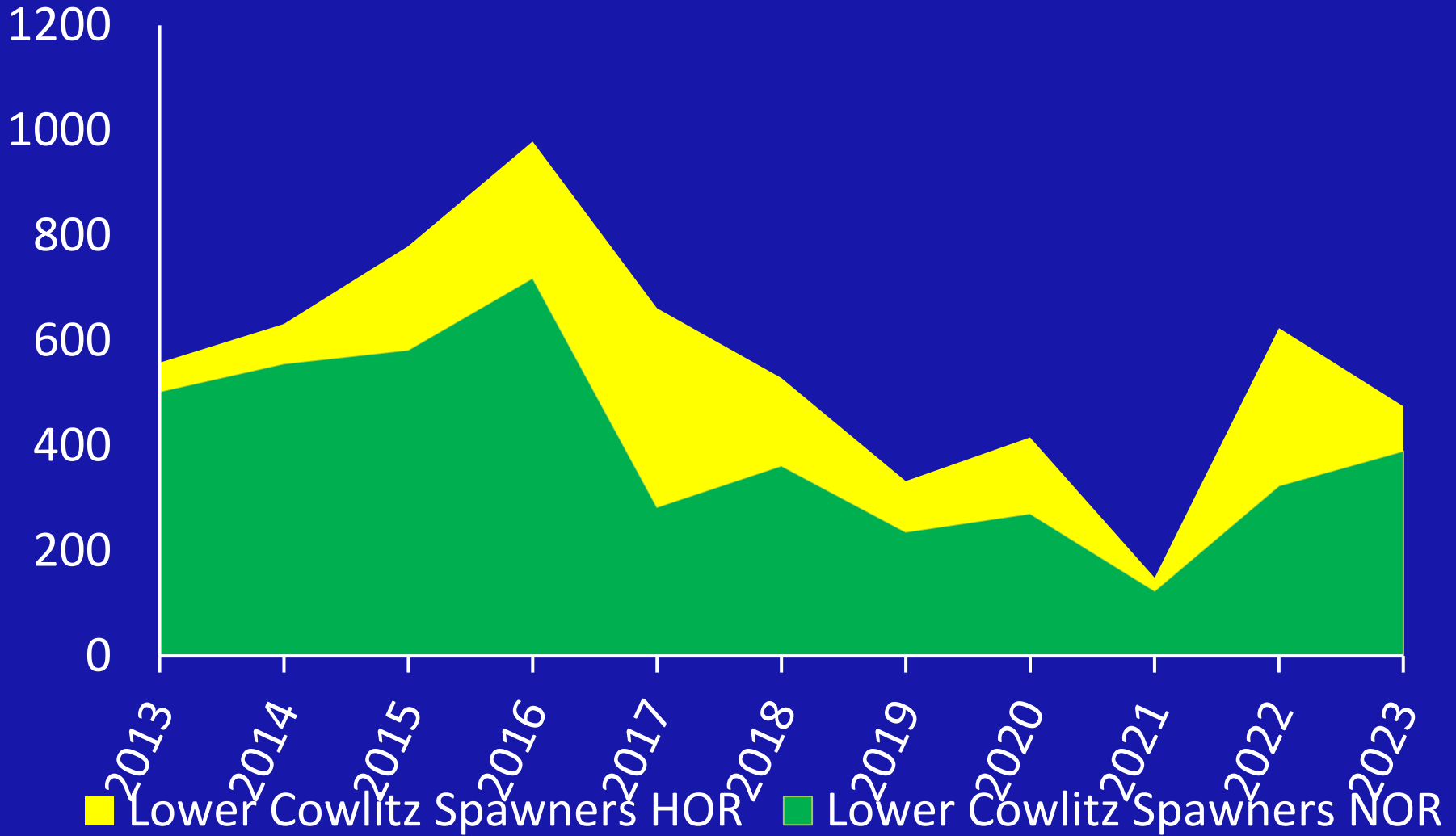


# Lower Cowlitz Steelhead

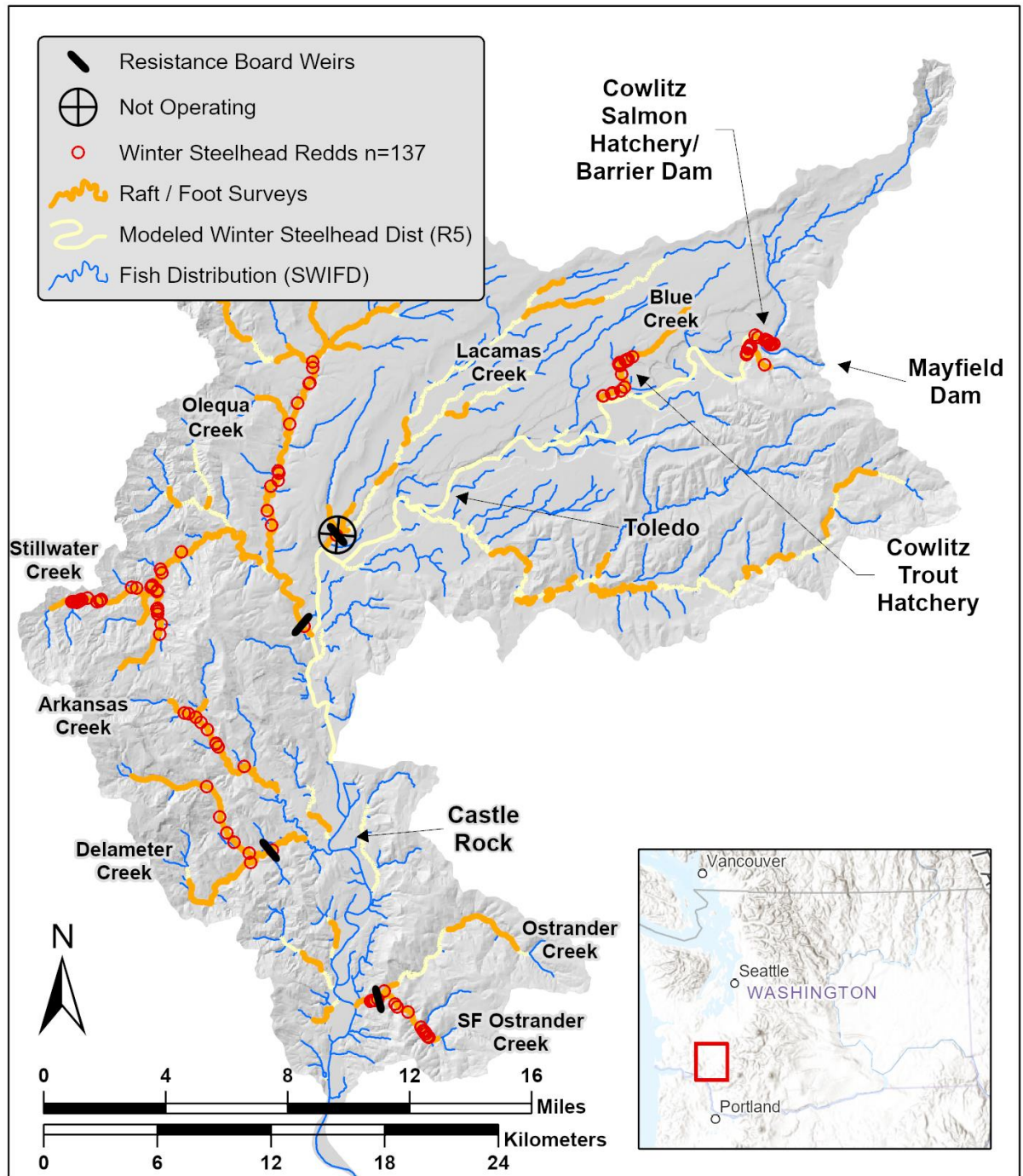




# Lower Cowlitz Tributary Steelhead

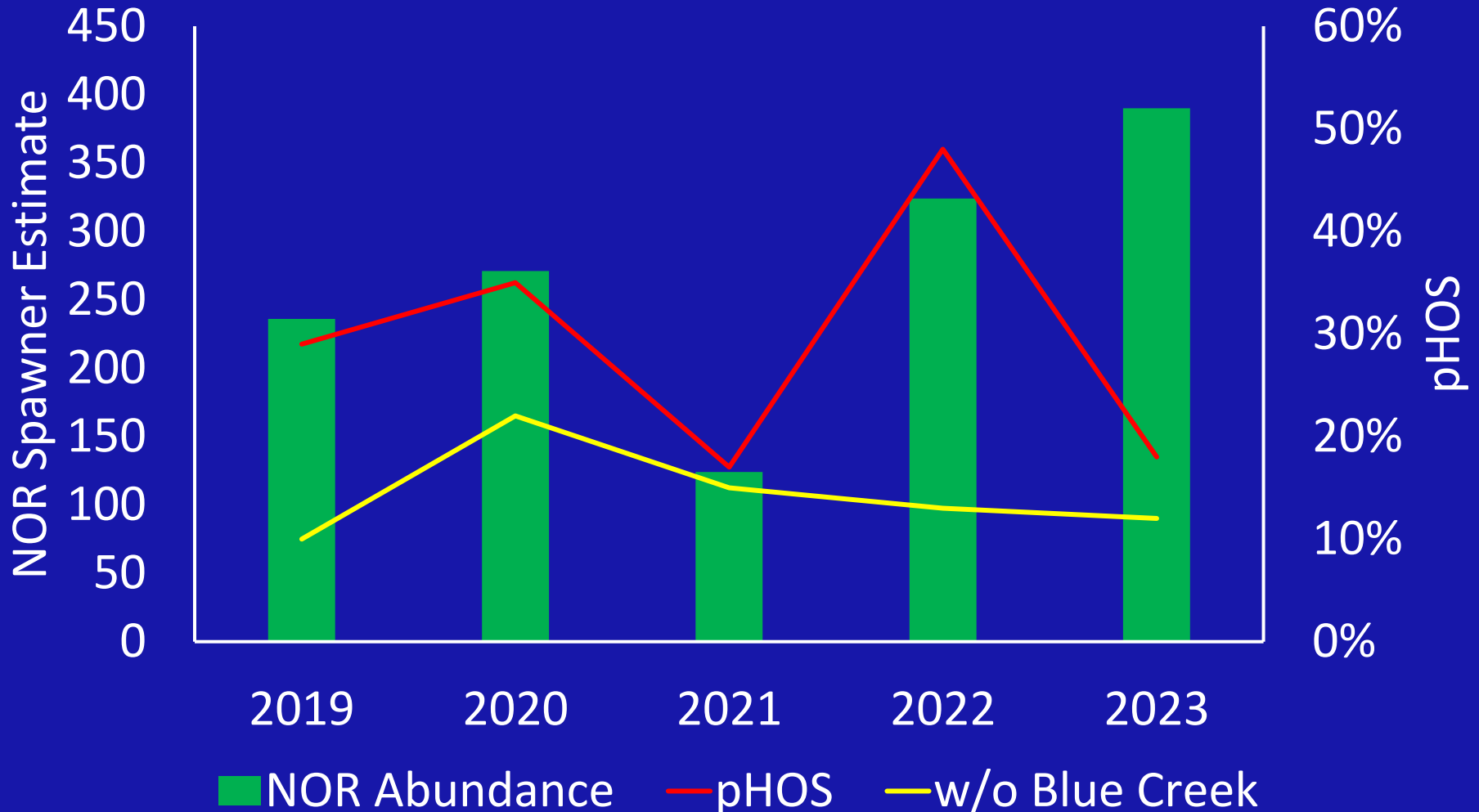


# Lower Cowlitz Steelhead Redd Locations



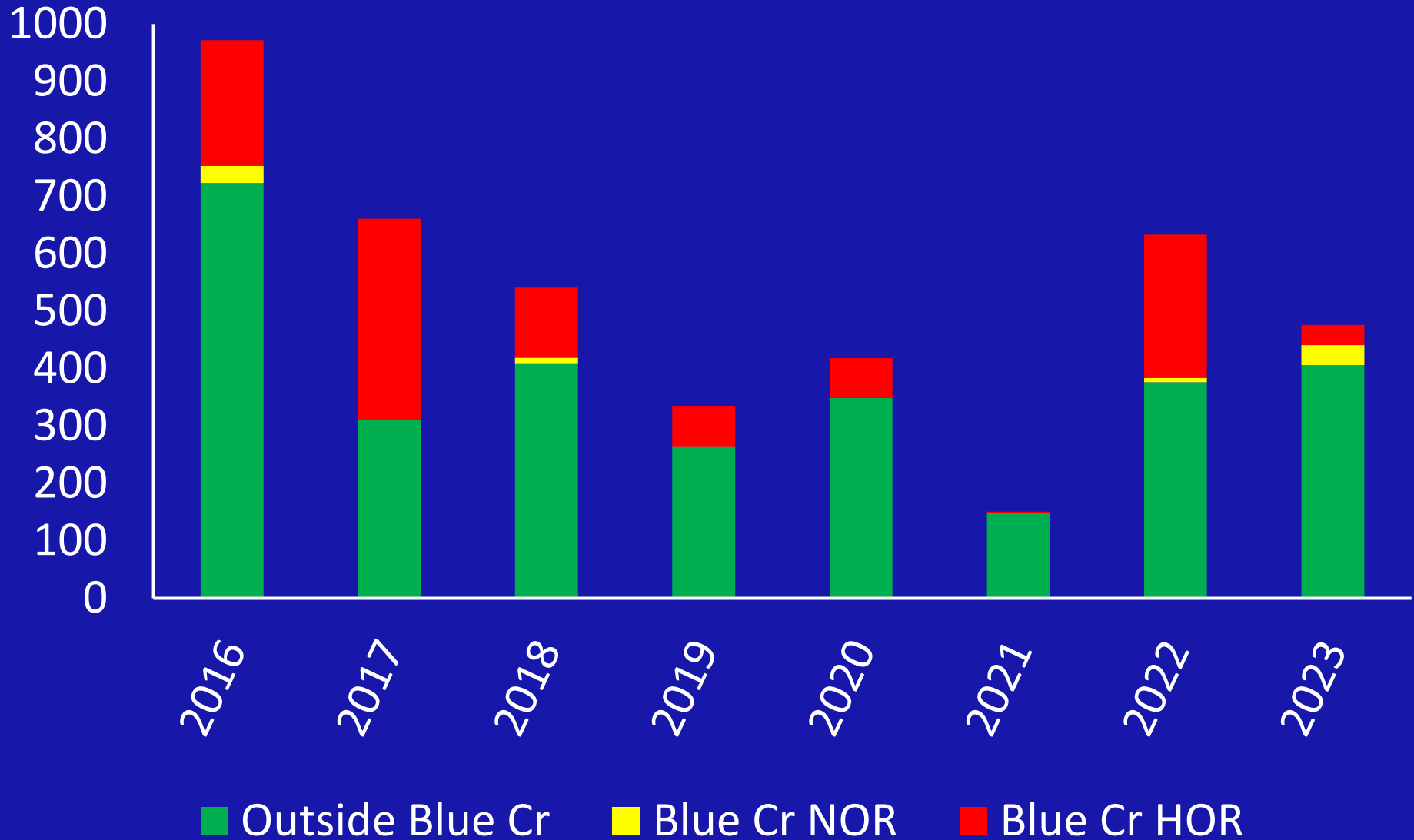
# Lower Cowlitz Tributary Steelhead

## Lower Cowlitz Steelhead

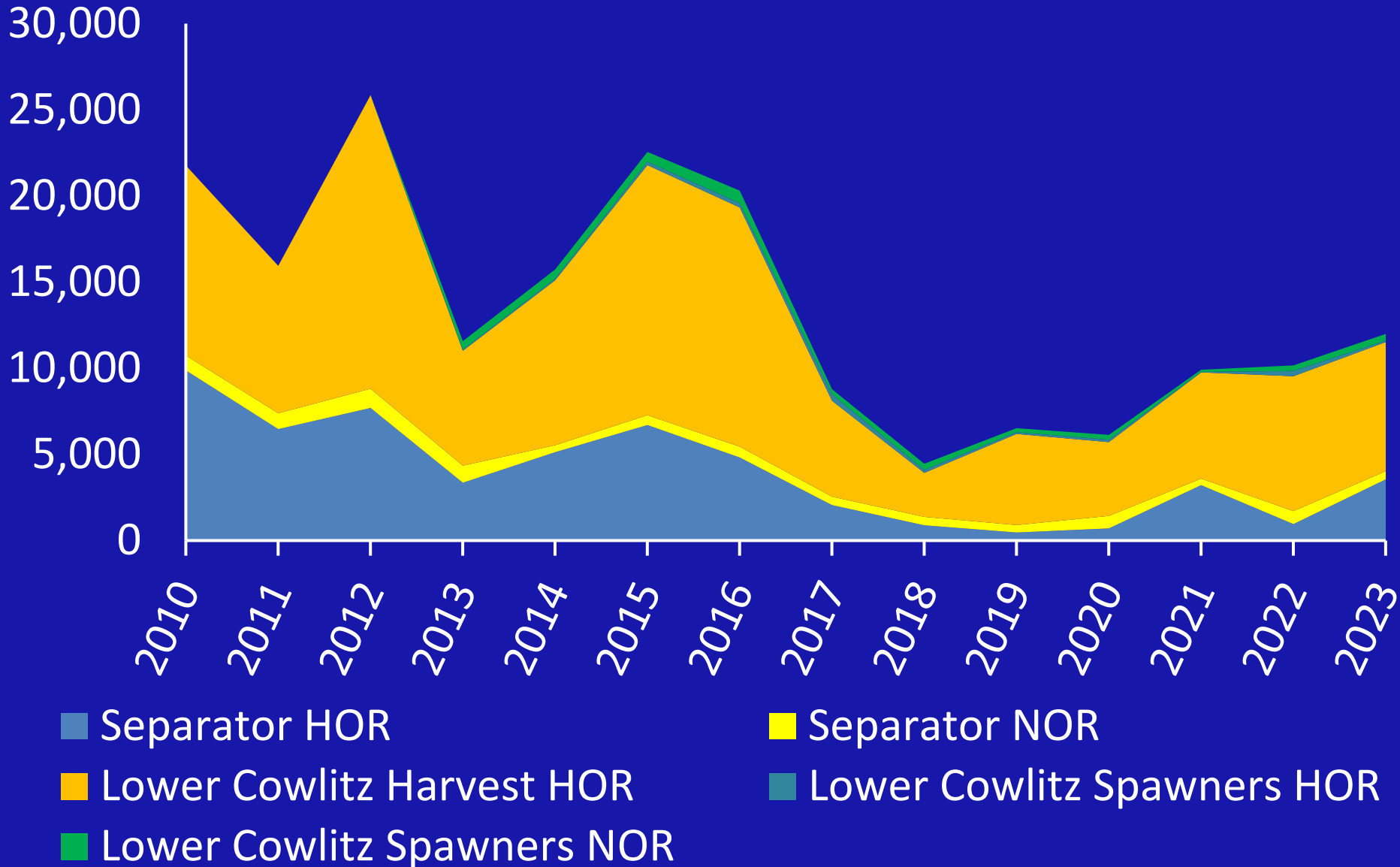




# Abundance of Steelhead Spawners Relative to Blue Creek



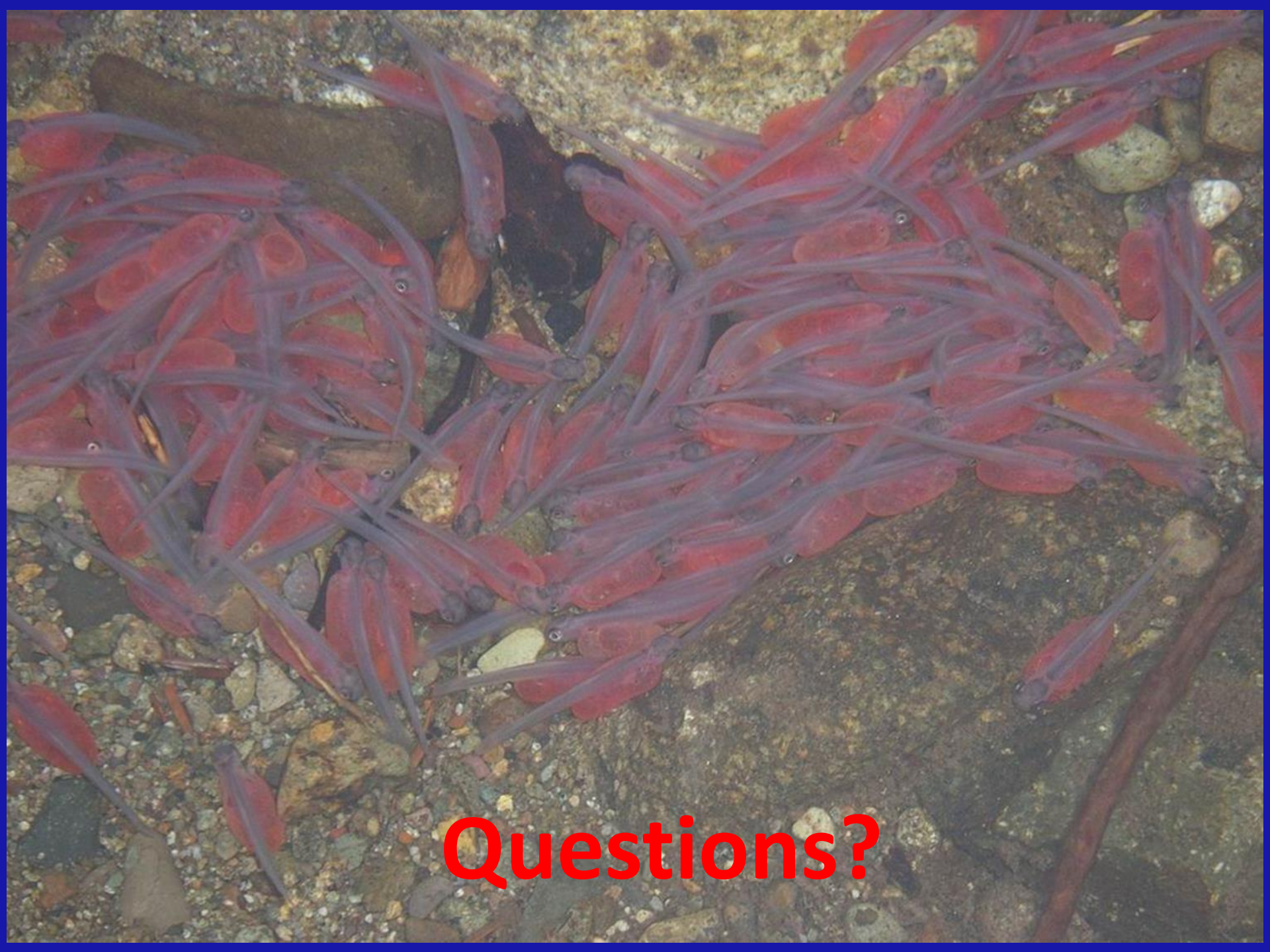
# Lower Cowlitz Tributary Steelhead



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**Questions?**