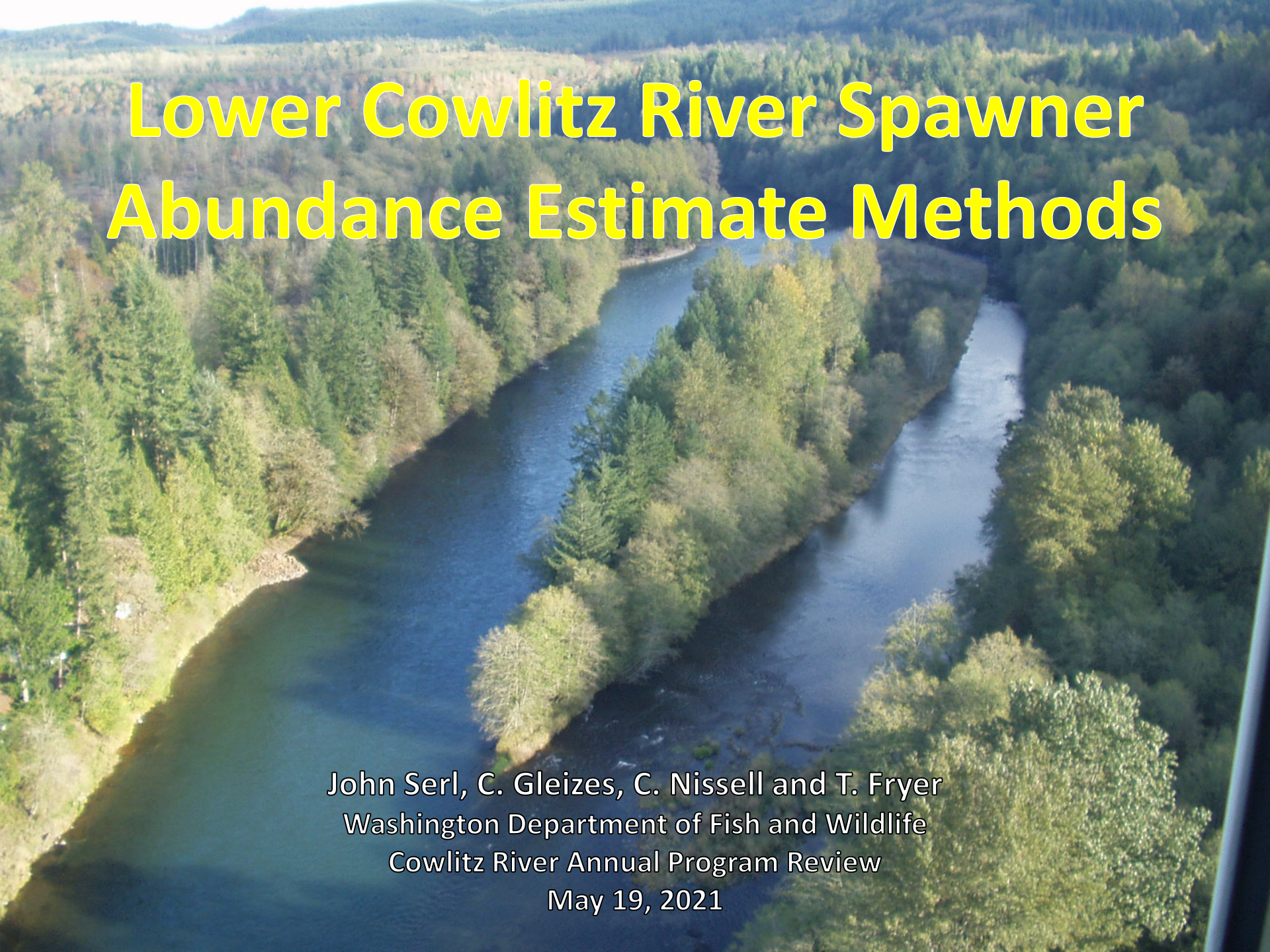
Lower Cowlitz River Spawner Abundance Estimate Methods



John Serl, C. Gleizes, C. Nissell and T. Fryer
Washington Department of Fish and Wildlife
Cowlitz River Annual Program Review
May 19, 2021

Overview

- Purpose: To estimate the number of natural and hatchery spawners in the natural environment
- Chinook are monitored in the mainstem Cowlitz River habitat
- Coho and steelhead are monitored in tributary habitat

Monitoring Objectives

- Abundance of spawners
  - Unbiased, known precision*
- Spawner composition by
  - Age
  - Origin (Natural, Hatchery)
- Spatial distribution of spawning

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

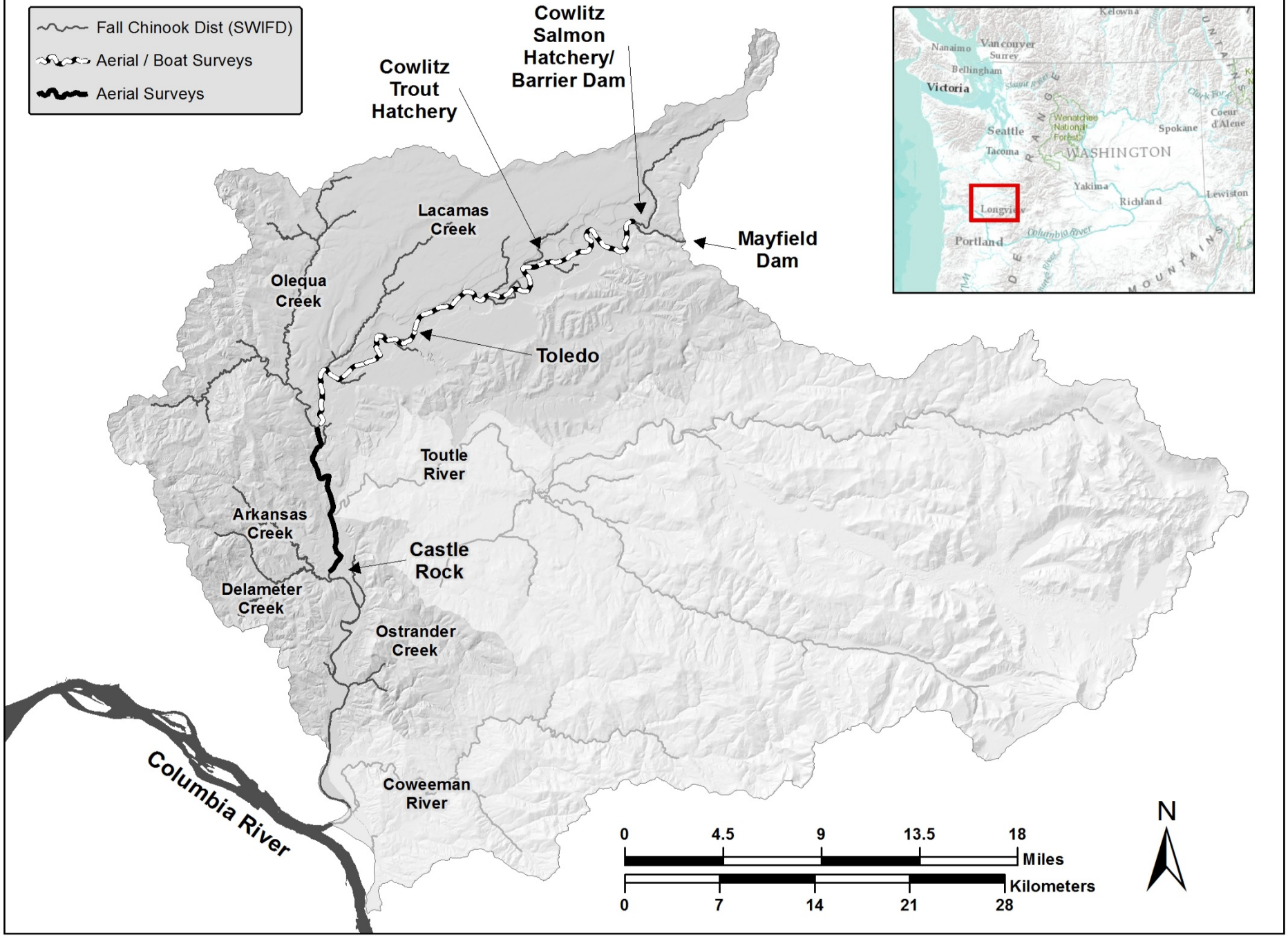
Chinook Monitoring Overview

- Current Abundance Estimate Method
  - Peak Redd Count Expansion
- Data Collection
  - Aerial Redd Counts
  - Carcass Surveys
- Trends in Abundance Estimates
  - 2010-2020 Fall Chinook Estimates
  - 2019 Fall Chinook Spawner Distribution
- Trends

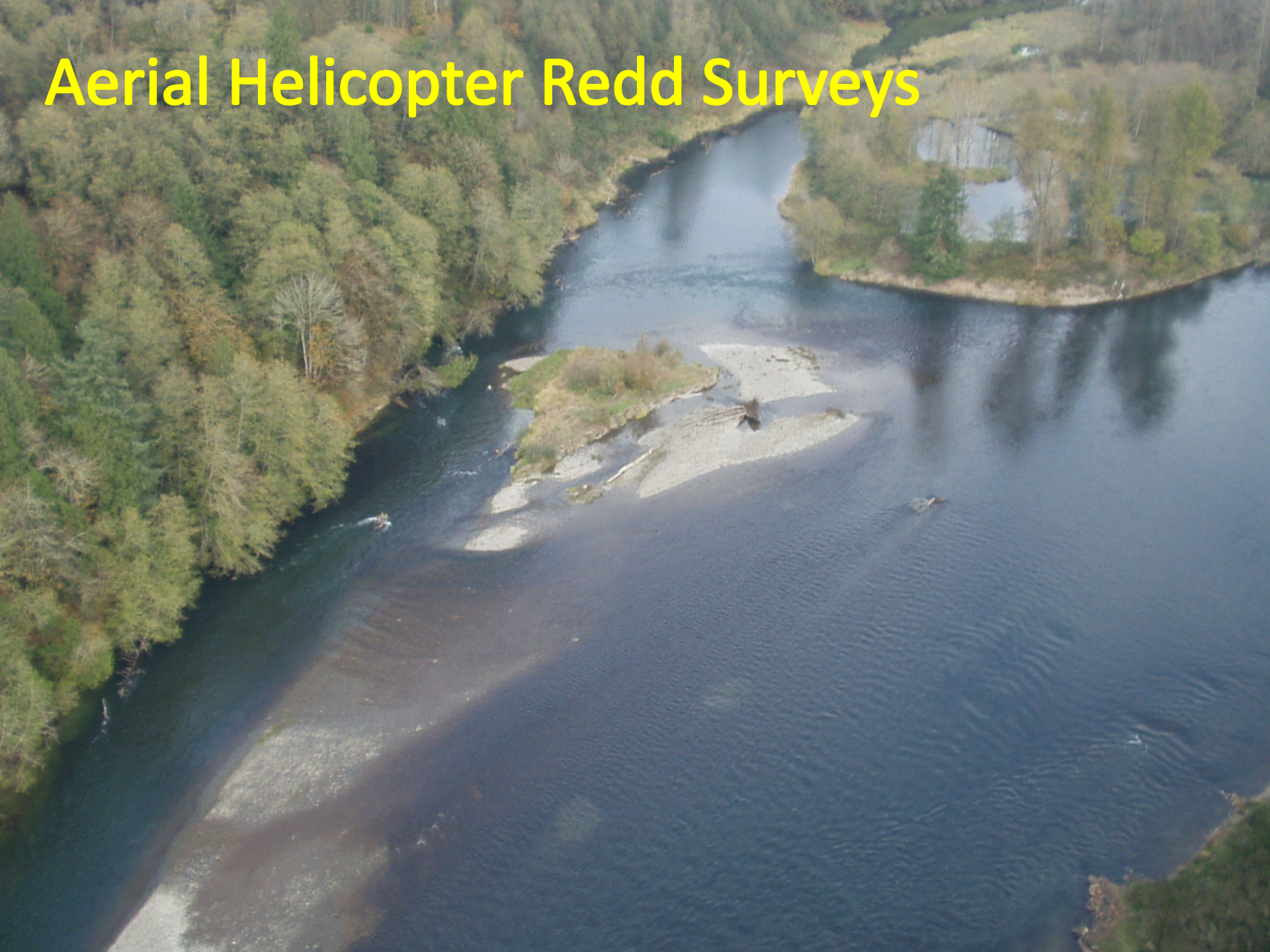
Data Collection

Aerial Surveys

- Bi-weekly Flights (Sept. - Dec.)
- Redd Counts
- Castle Rock to Barrier Dam
- 10 Index Reaches


Fall Chinook Dist (SWIFD)
Aerial / Boat Surveys
Aerial Surveys
Cowlitz Salmon Hatchery/ Barrier Dam
Cowlitz Trout Hatchery
Lacamas Creek
Mayfield Dam
Olequa Creek
Toledo
Toutle River
Arkansas Creek
Castle Rock
Delameter Creek
Ostrander Creek
Columbia River
Coweeman River
Kelowna
Nanaimo
Vancouver
Surrey
Bellingham
Victoria
Seattle
Tacoma
Wenatchee National Forest
Spokane
Coeur d'Alene
WASHINGTON
Yakima
Richland
Lewiston
Longview
Portland
Columbia River
0 4.5 9 13.5 18
Miles
0 7 14 21 28
Kilometers
N

Aerial Helicopter Redd Surveys



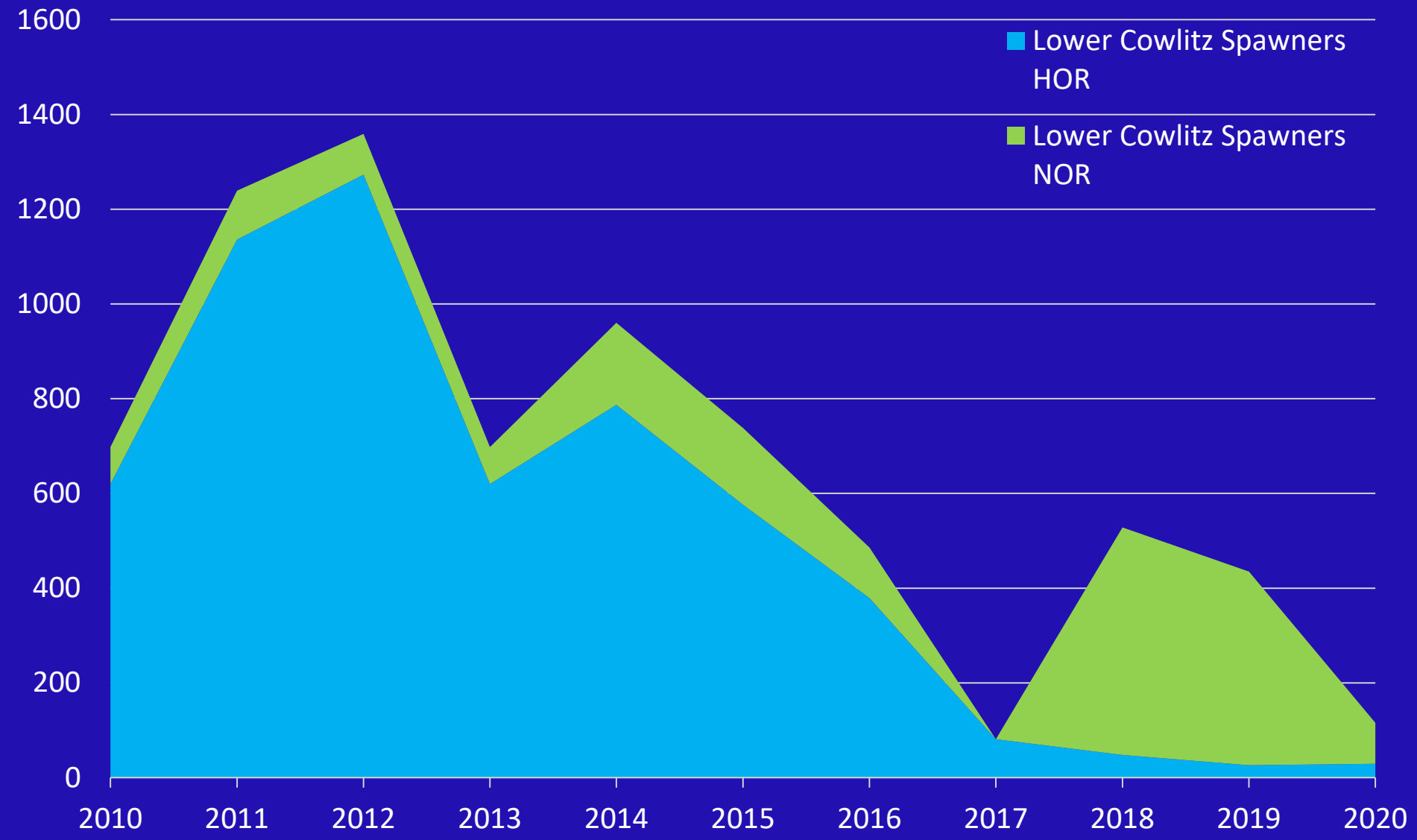
Data Collection

Boat Carcass Surveys

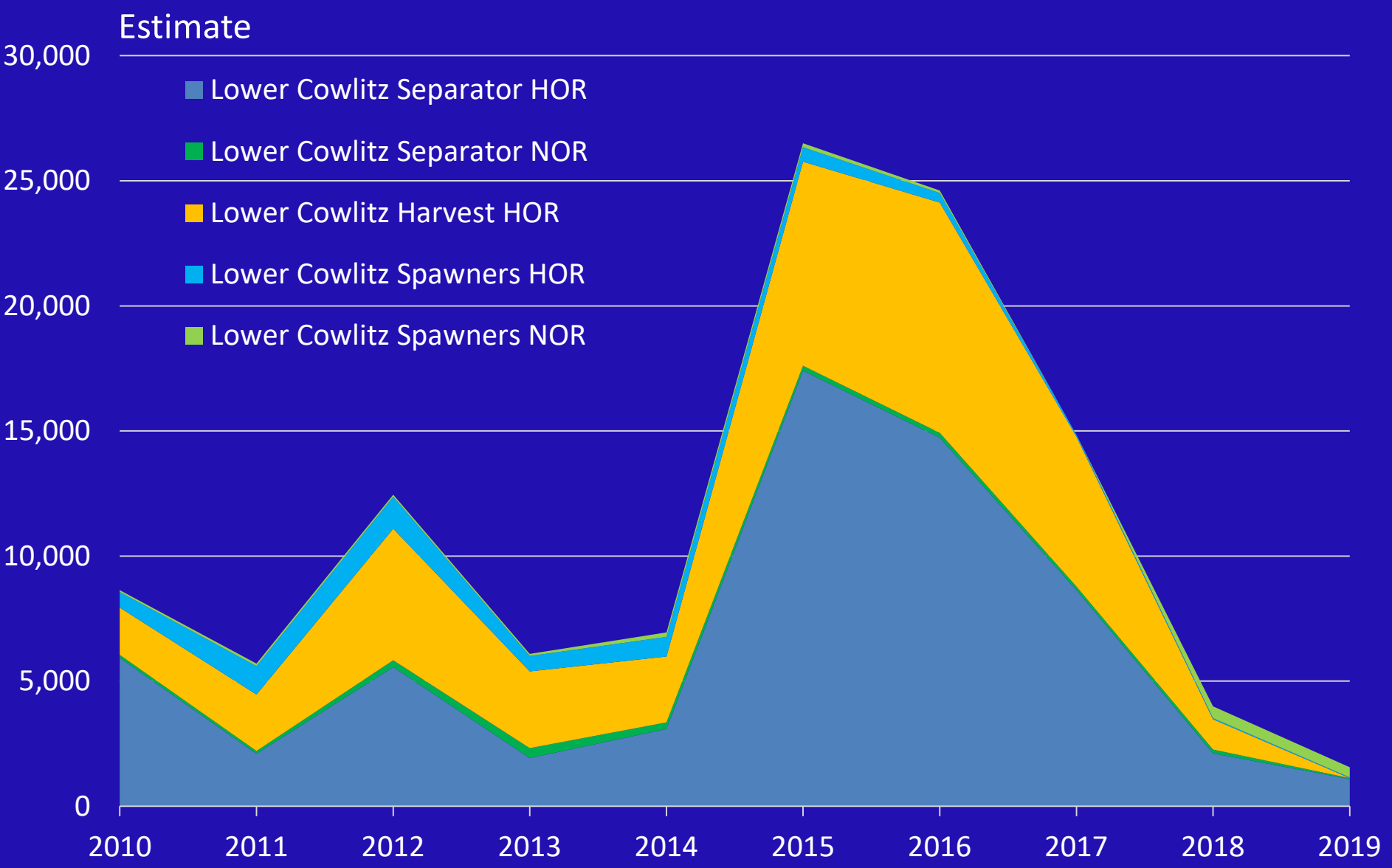
- Sept. – Nov.
- 2 to 5 days/week
- Collect Carcasses
- Bio Sample Carcasses
  - Mark status
  - Natural or Hatchery
  - Coded wire snout tags
  - Scale samples


Carcasses

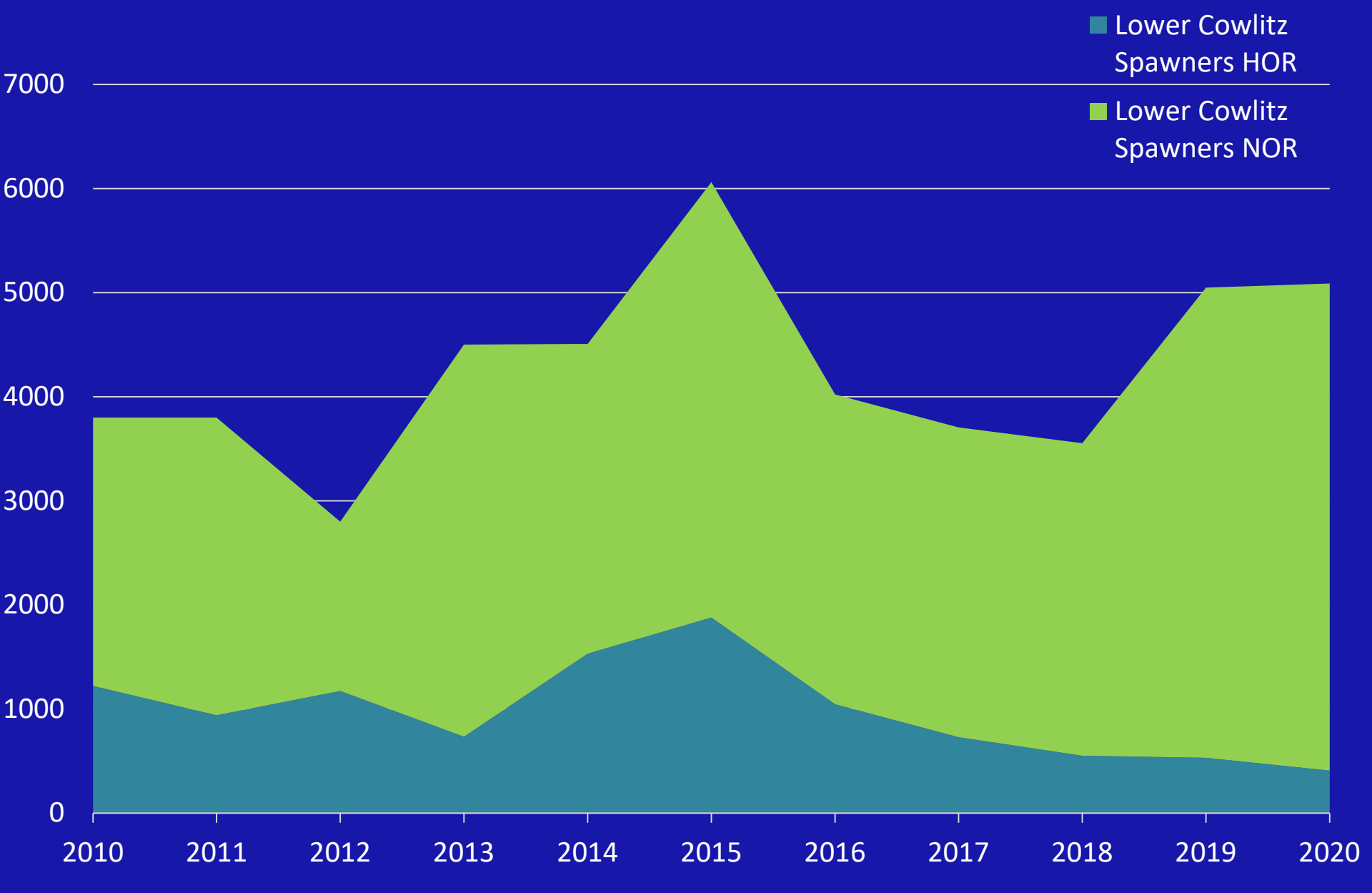
Lower Cowlitz Spring Chinook



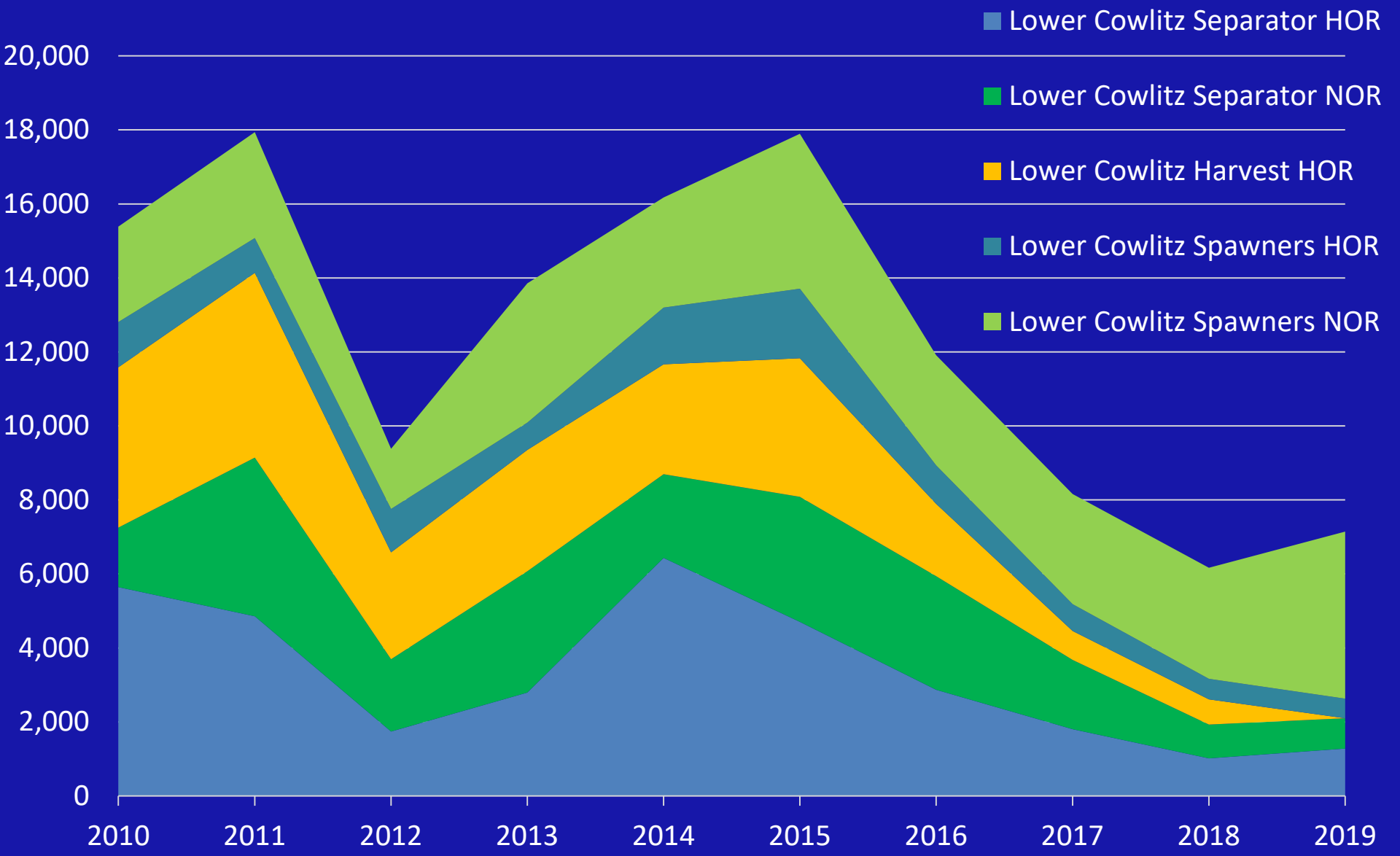
Lower Cowlitz Spring Chinook



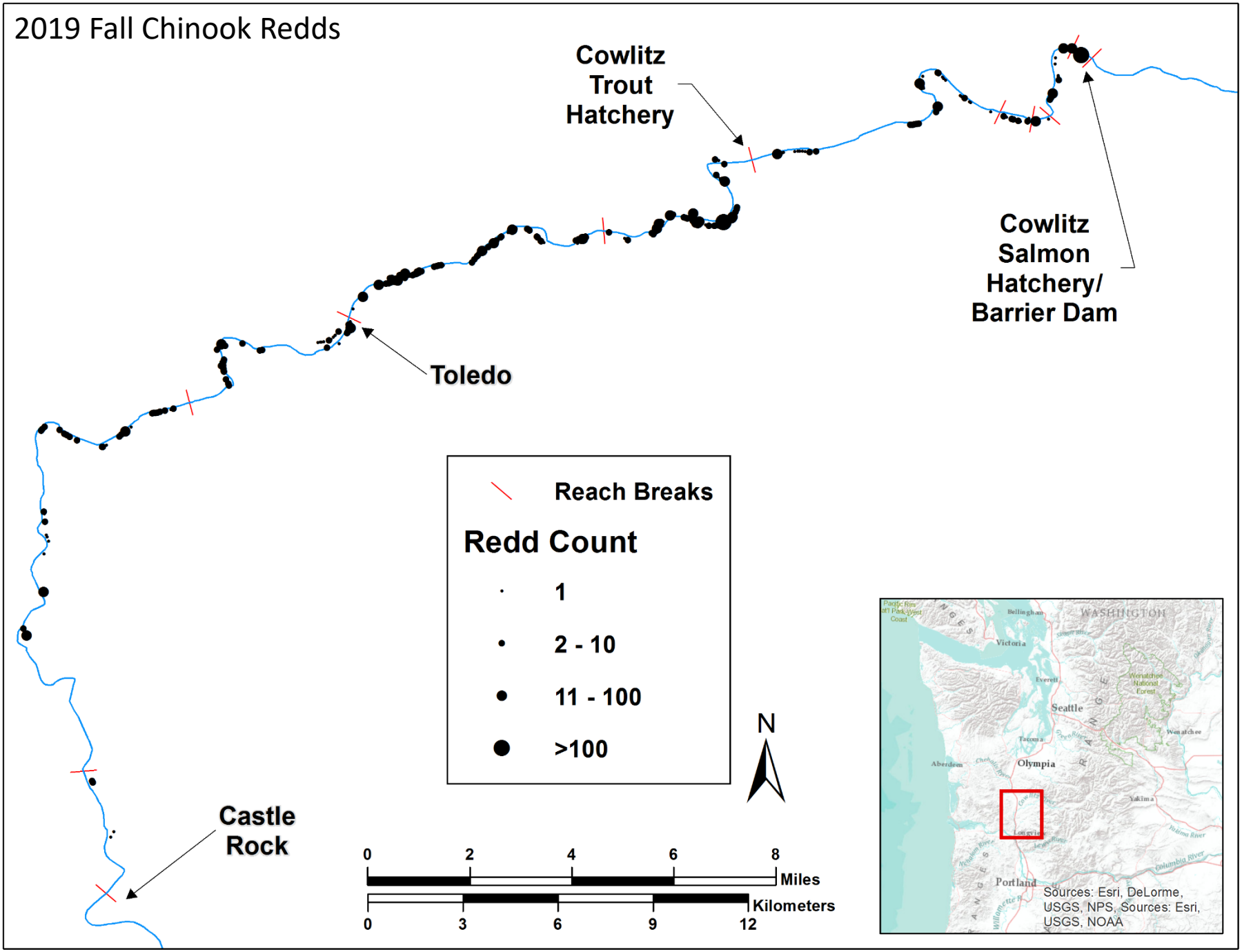
Lower Cowlitz Fall Chinook



Lower Cowlitz Fall Chinook



2019 Fall Chinook Redds



Conclusion

Current Method

- Peak Redd Count Expansion
  - Bias is likely but unknown
  - Precision is unknown

Alternate Method Proposed

- Carcass Tagging Mark-Recapture
  - Unbiased (if assumptions are met)
  - Measure of precision
  - Retrospectively compare carcass tagging estimates to current method

Coho and Steelhead Methods

Methods: Tributary Weirs

- Daily operation, 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

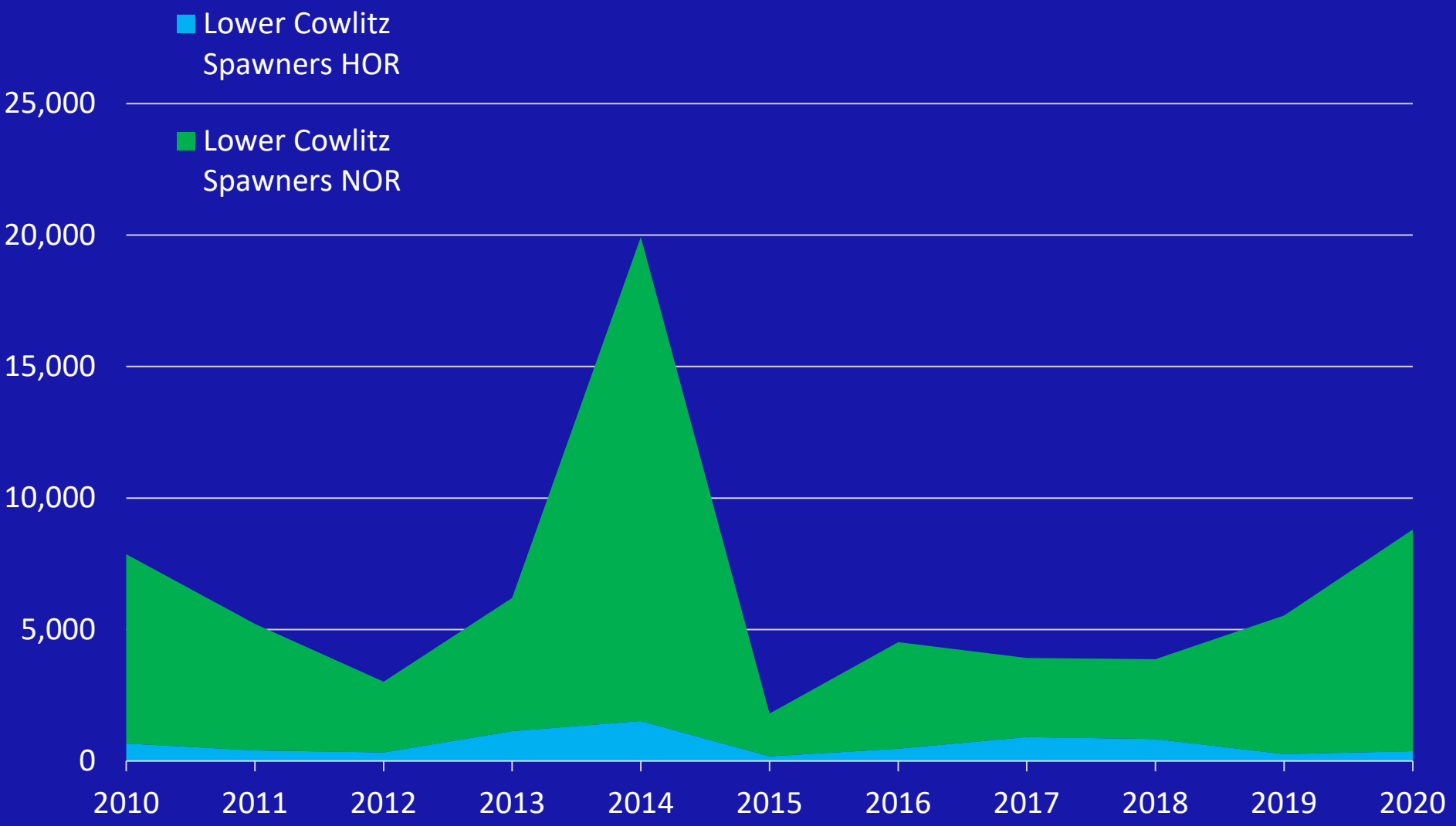
=

Total Spawners

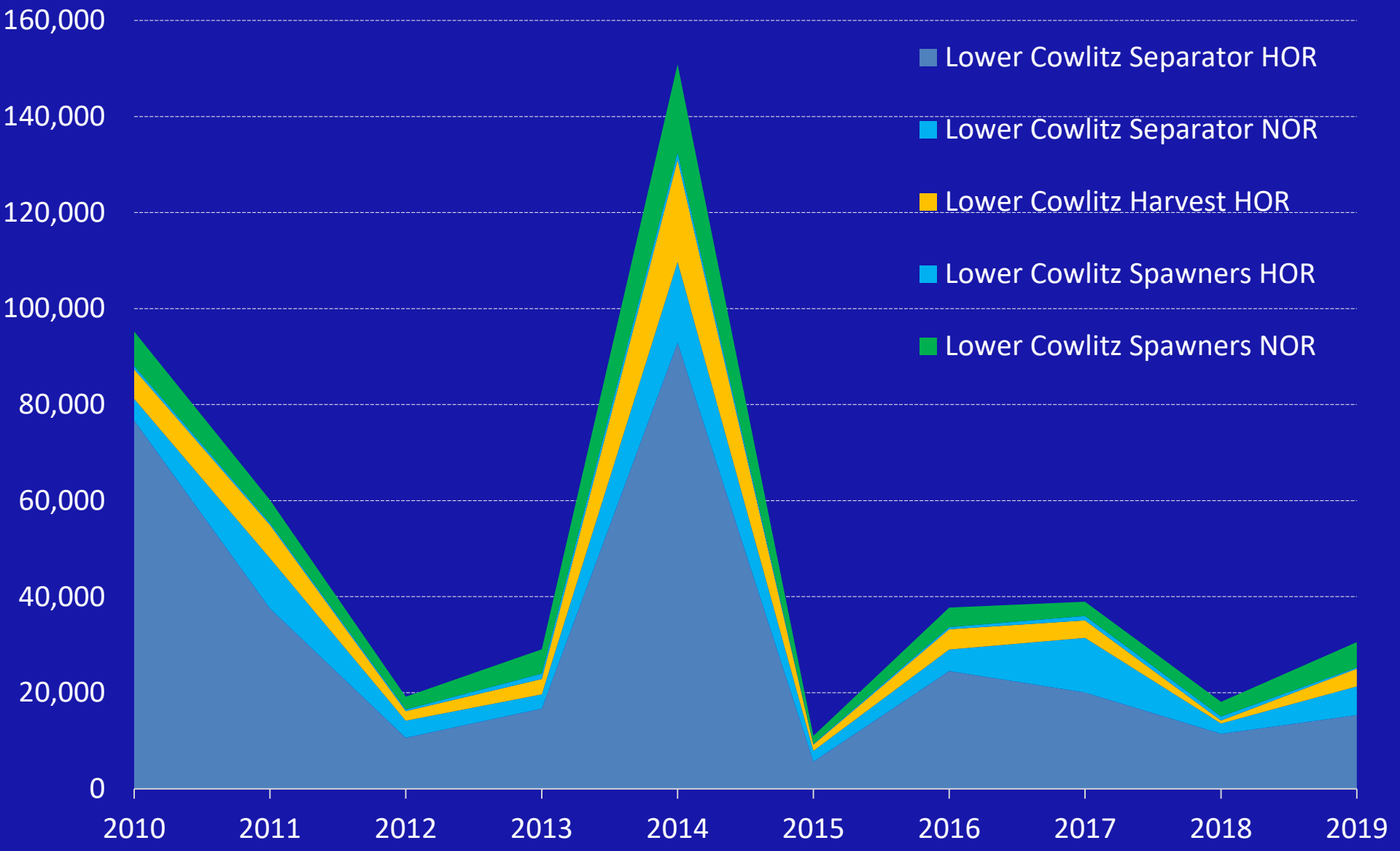
N = NOR + HOR

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

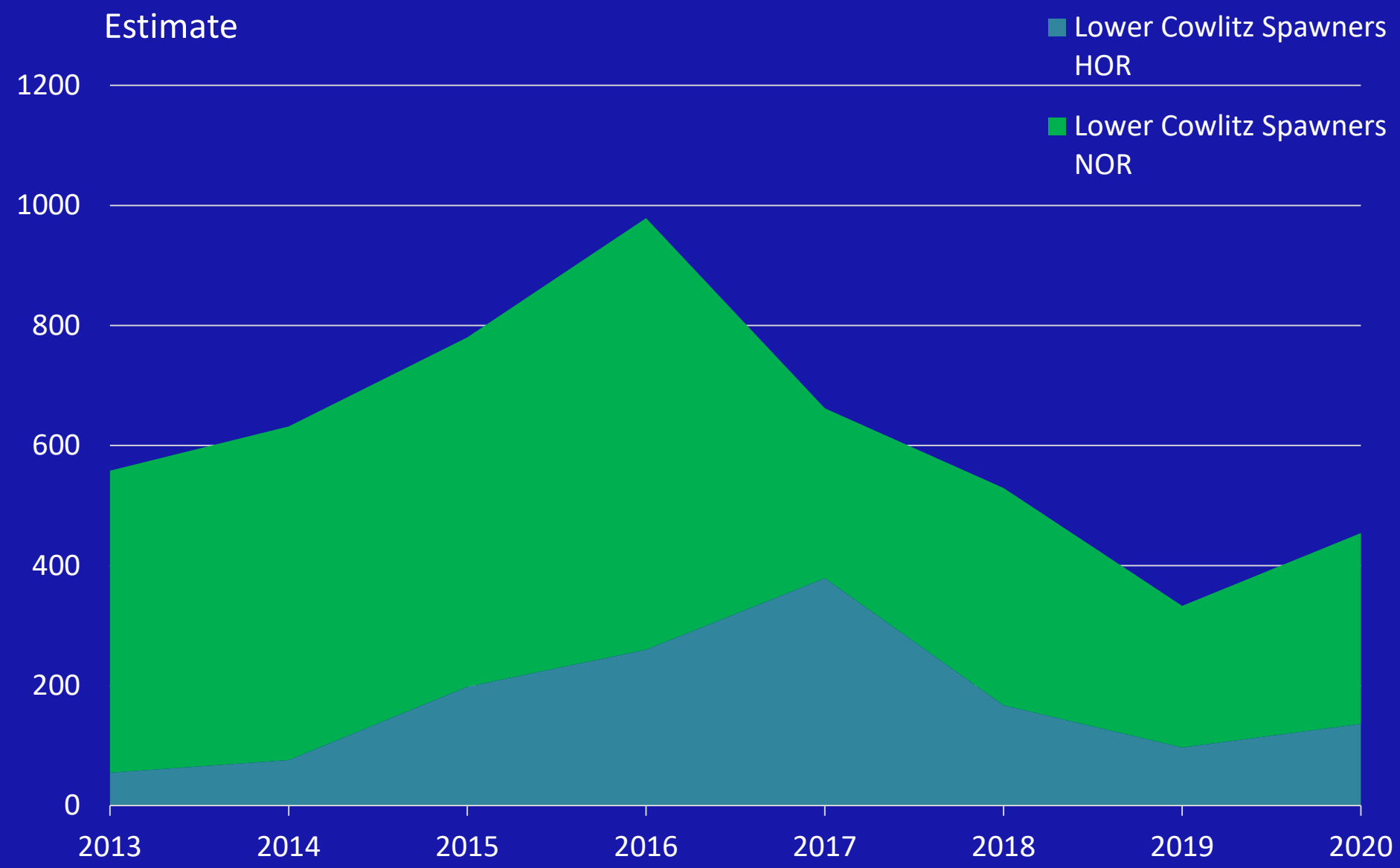
Lower Cowlitz Tributary Coho



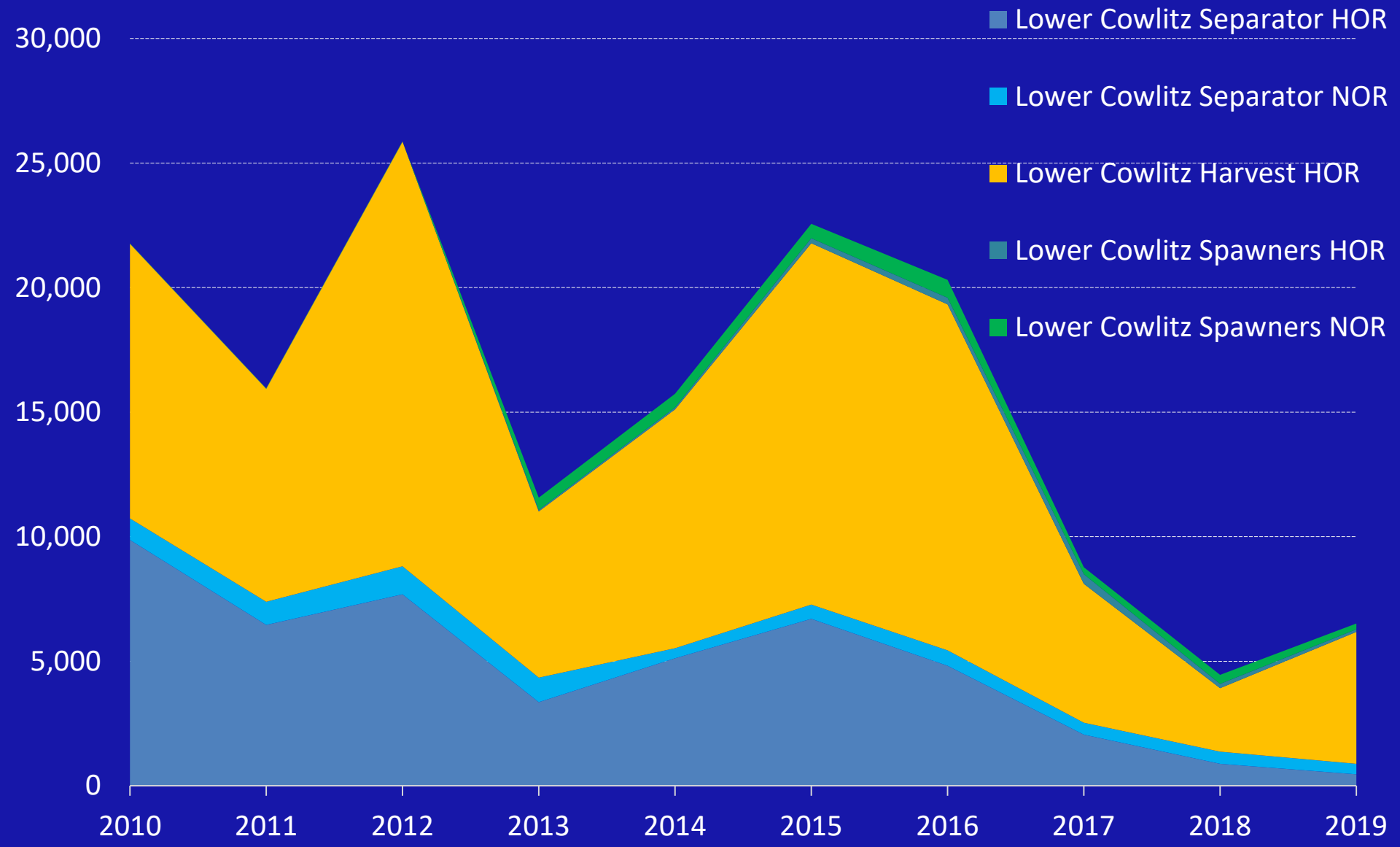
Lower Cowlitz Tributary Coho



Lower Cowlitz Tributary Steelhead



Lower Cowlitz Tributary Steelhead



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  - Danny Warren (Database Manager)
  - Steve Vanderploeg (GIS Manager)


Questions?