

# Eulachon (*Thaleichthys pacificus*) Spawning Stock Biomass (SSB) for the Cowlitz River, 2014-2015



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## Background:

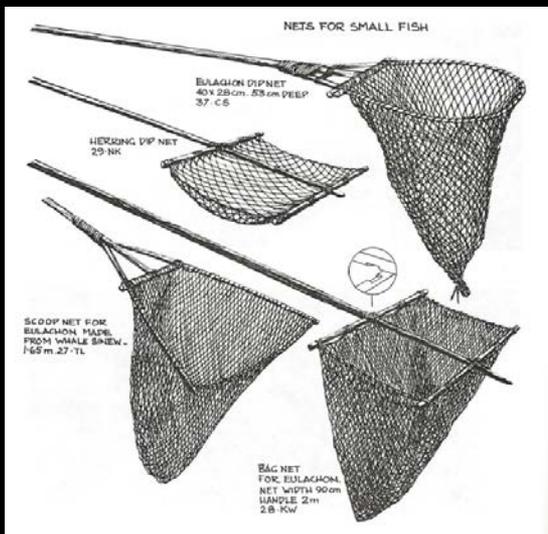
Eulachon are a culturally-important species for Indians and First Nations people all along the Northwest Coast

Declining Eulachon Abundance, post-1992, 97.7% reduction in median annual catch

Cowlitz Indian Tribe petition, November 2008

ESA Listing as Southern DPS as “Threatened”, May 2010

Critical Habitat established, October 2011



HARDWOOD OR BONE TEETH  
SET INTO DRILLED HOLES,  
OR HAMMERED IN FROM THE BACK.  
LENGTHS VARY FROM 2.5cm - 4.0cm.  
SPACING FROM 1.5 cm - 2.8 cm.



A VARIATION HAS ANGLED TEETH . 12 X  
WHEN NAILS BECAME AVAILABLE, THESE REPLACED  
TEETH OF WOOD AND BONE - RAKES ARE ALSO  
USED FOR TAKING SMELT AND EULACHON .



## Challenge:

Pre-listing abundance values were typically derived from commercial and recreational catch

Post-listing, needed a systematic method to assess eulachon population values of the Columbia River estuary,

Needed systematic method to assess reproductive proportions of contributing Columbia River tributary rivers; in particular the Cowlitz River

## Technique: Spawning Stock Biomass (SSB):

Calculation of SSB for eulachon in the Cowlitz River was accomplished via the following equation:

$$B = P/(F * R) \quad \text{Eq. 1}$$

where:

B = Biomass: total number of mature fish in the return

P = total Production of the population (larvae and egg flux)

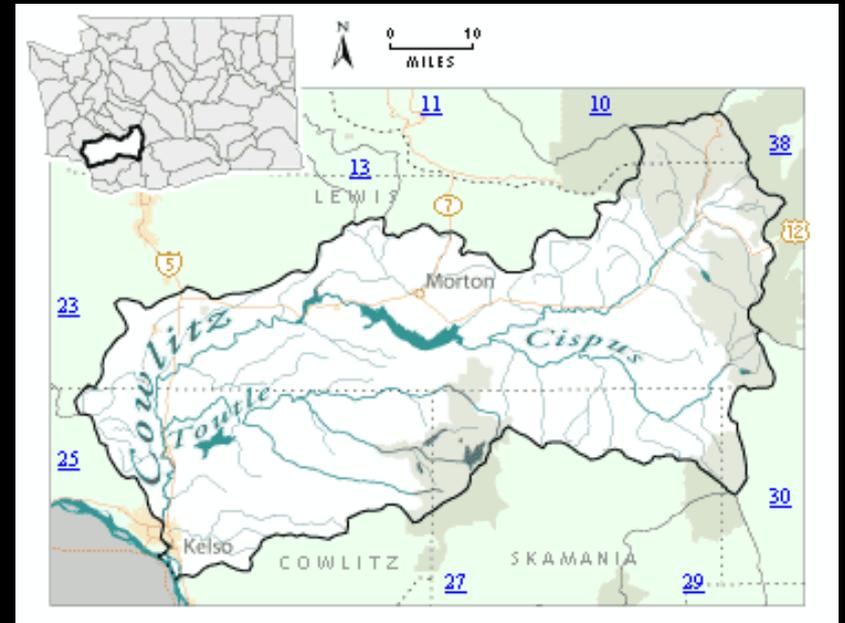
F = mean Fecundity (the number of eggs produced per female), and

R = the proportion of mature females in the population (sex Ratio)

# Columbia River Watershed



# Cowlitz River Watershed



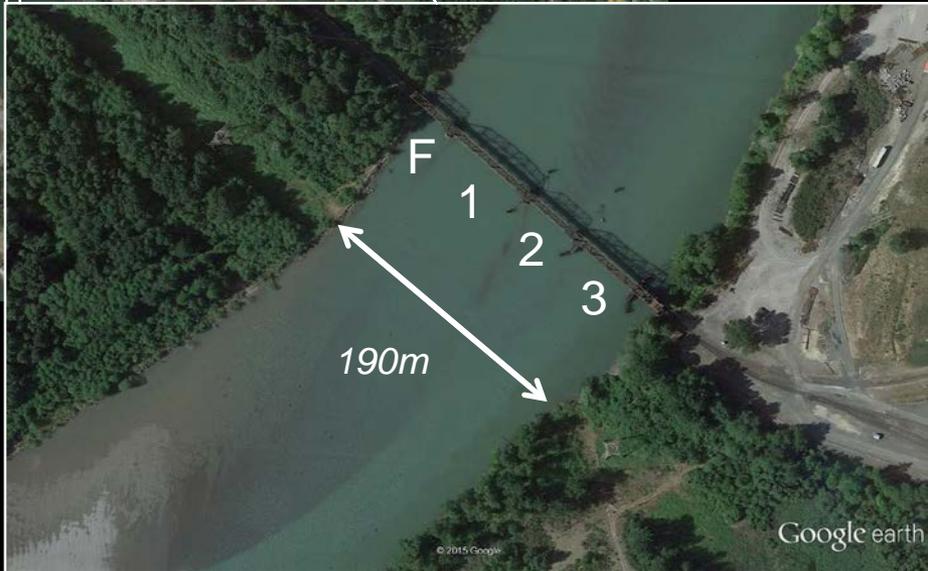
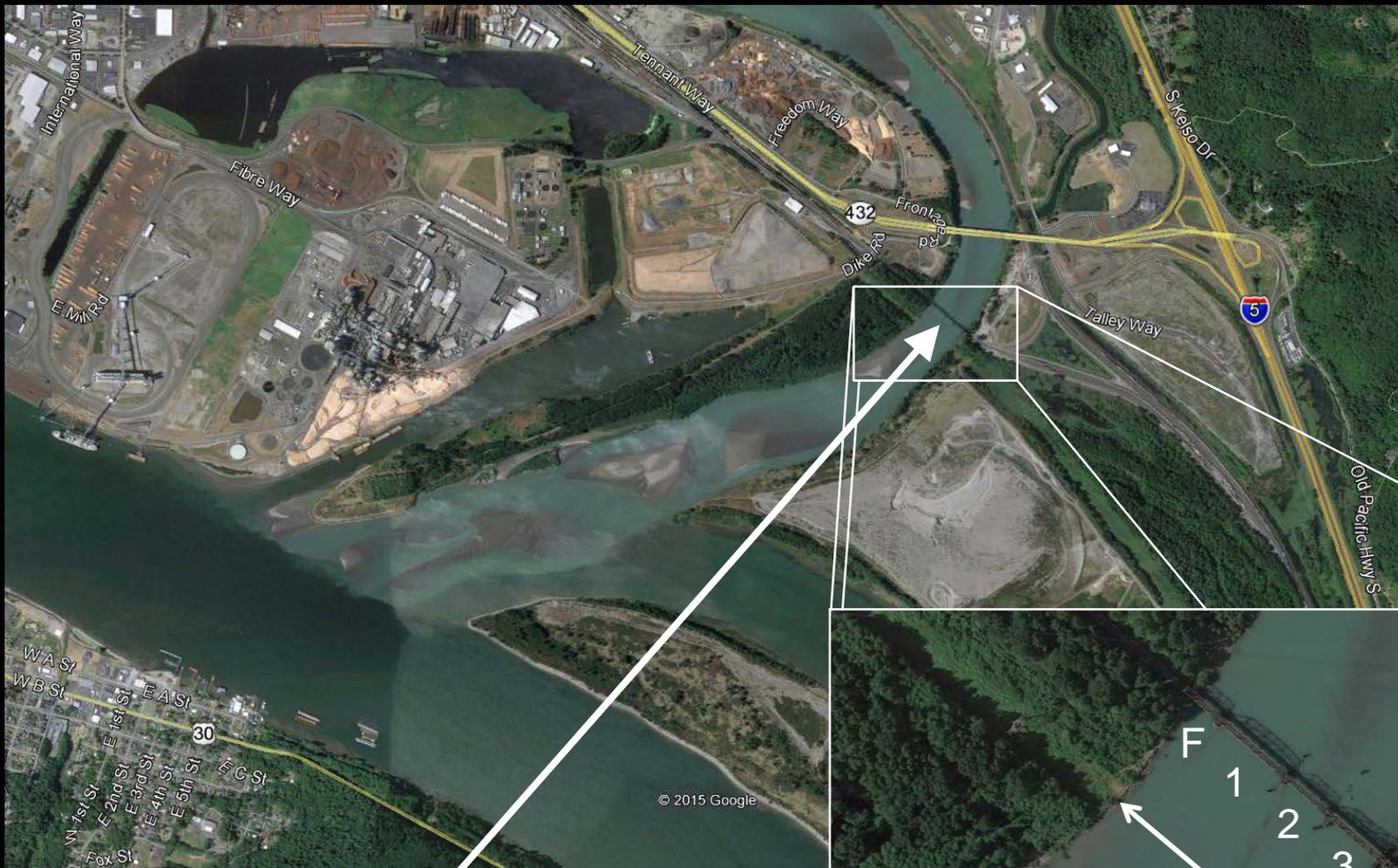
## Sampling Days:

Proposed 1/week sampling between 15-Nov-2014 and 1-June-2015, Adaptive 2/week sampling for 8 weeks depending on run timing and abundance

Sampled 28 weeks, including 9 weeks of 2/week  
17-Nov-2014 through 31-May-2015

Typically deployed fyke nets on Mondays and retrieved them on Tuesdays; Plankton net samples collected on Mondays.

During 2/week sampling, Fyke nets deployed Monday and Thursday, retrieved Tues and Fri; plankton net samples collected Mondays and Thursdays



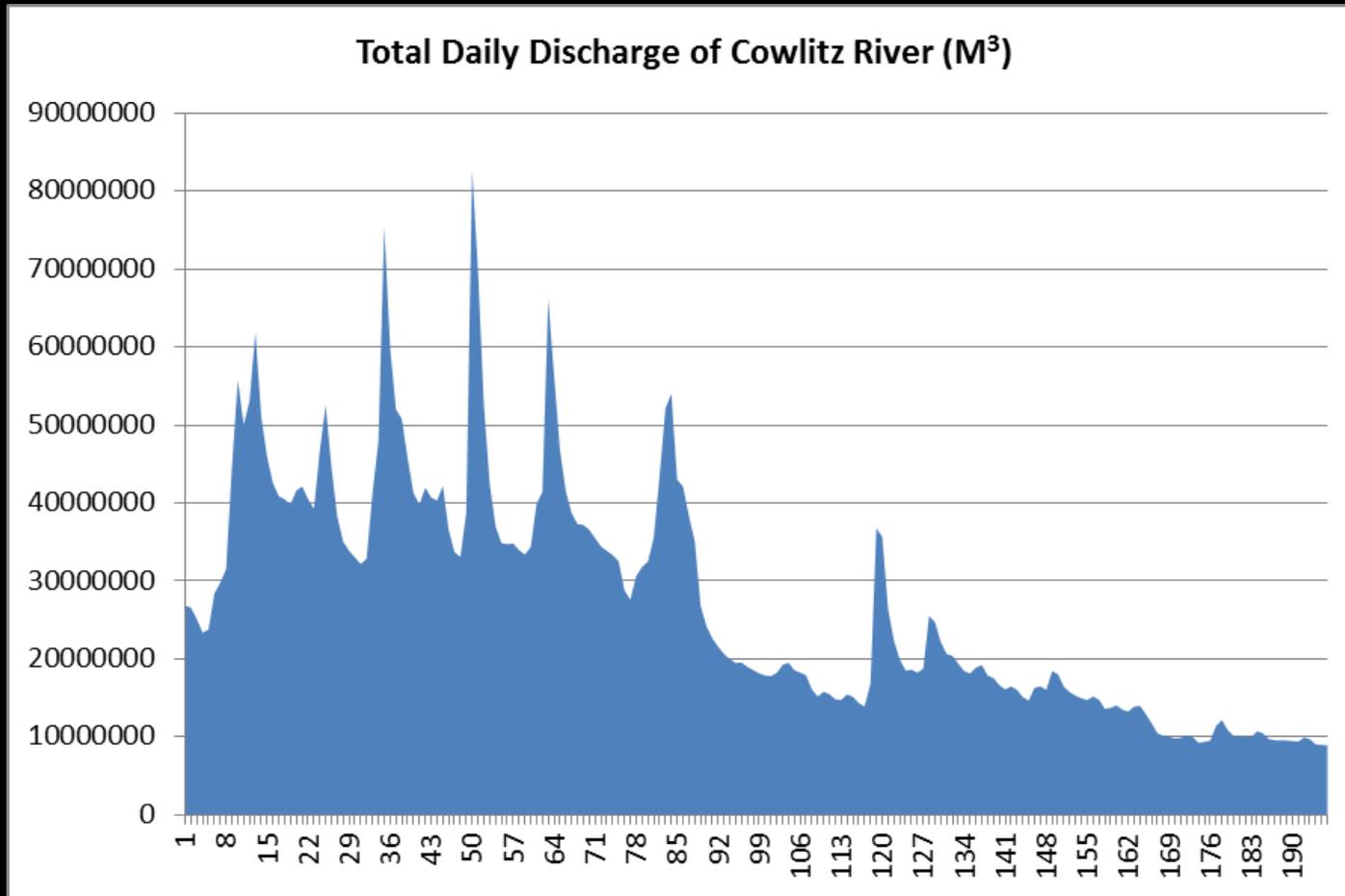
Methods: Sample Location RM 1

## Methods: Finding “P” Production (Plankton Flux )

Entire Cowlitz River Flow obtained by summing values obtained from:

- USGS Cowlitz River gage at Castle Rock, WA
- WA Dept. of Ecology gage for the Coweeman River, (trib to Cowlitz below Castle Rock)
- +3.63% volume modifier calculated for Arkansas Creek, Ostrander Creek and other small unnamed creeks below Castle Rock (WDFW flow analysis, 2015)

# Results: Cowlitz River Flow



## Methods: Finding “P” Production (Plankton Flux)

Deployed plankton nets from boat at 3 locations on transect across Cowlitz River

Plankton nets equipped with a General Dynamics Flow meter to record volume of sampled water.

Plankton washed into cod end of nets and collected in sample bottles.



## Methods: Finding “P” Production (Plankton Flux)

Bottles taken to NRD lab and plankton counted using 4x magnifying lamp



Water volume of sample calculated from flow meters to generate density values of Eggs and Larvae/m<sup>3</sup>

sample values combined to derive daily Mean and CI values

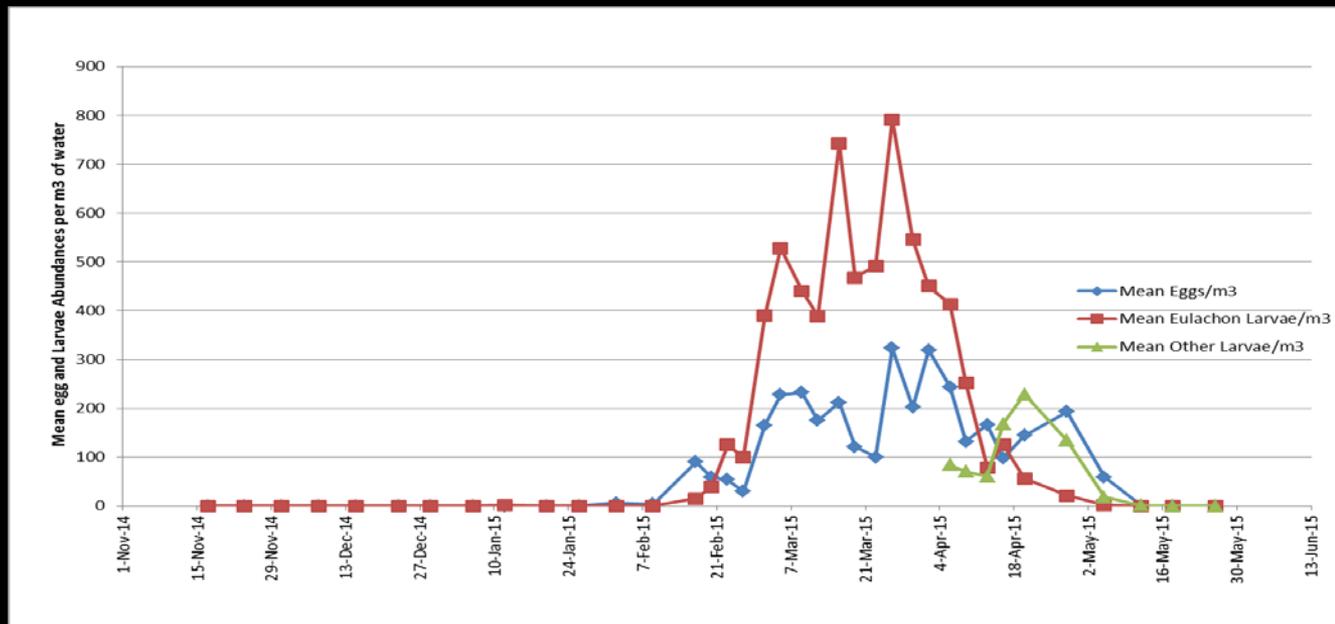
# Results: Finding “P” Production (Plankton Flux)

Collected and counted 111 Samples

Identified 14,648 Eggs (SSB includes all)

Identified 24,268 probable Eulachon Larvae

Identified and excluded 3,249 “other” larvae



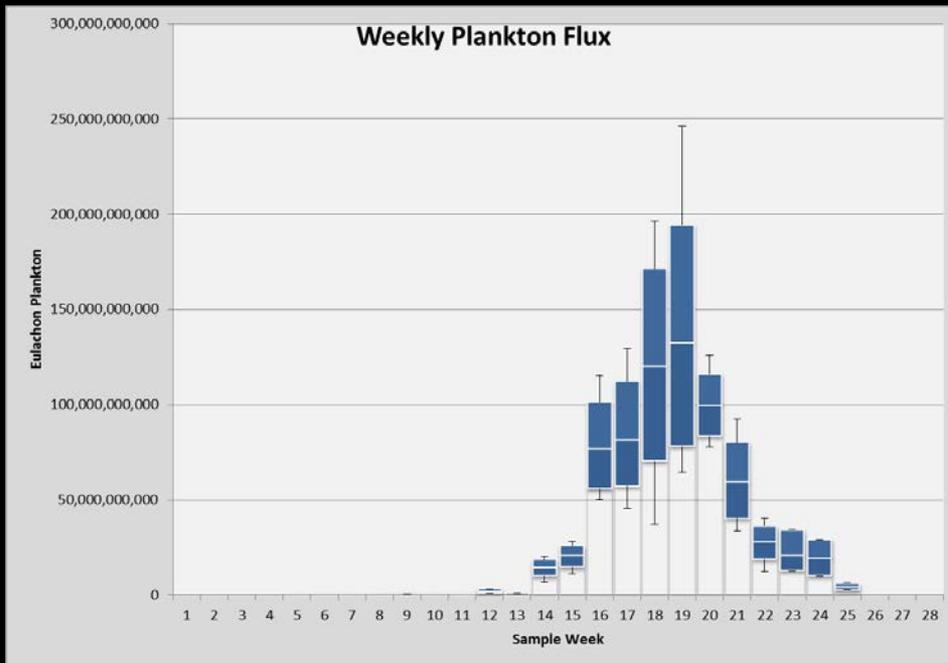
## Methods: Bootstrap Procedure for weekly plankton flux density

Weekly Bootstrap analysis randomly re-picks sample values ( $n=3$  for 28,  $n=6$  for 9) from within from weekly blocks to derive means and variability.

Bootstrap iterations set 1000 for each weekly block

Weekly plankton flux density values applied against Cowlitz River weekly flow totals

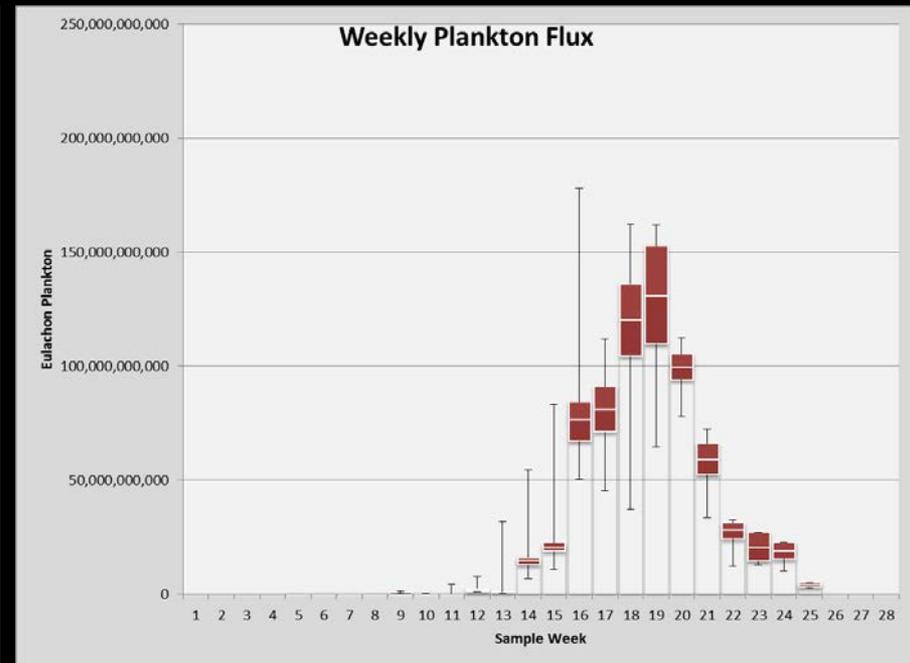
# Results: Bootstrap Procedure



Mean

95% CI

Min/Max

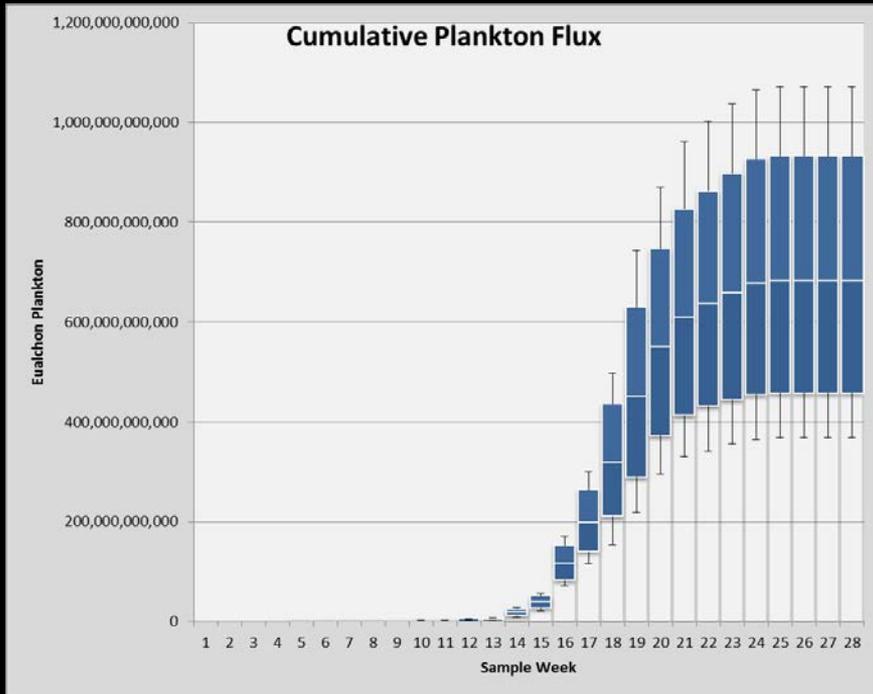


Median

Q1-Q3

Min/Max

# Results: Bootstrap Procedure (Cumulative)



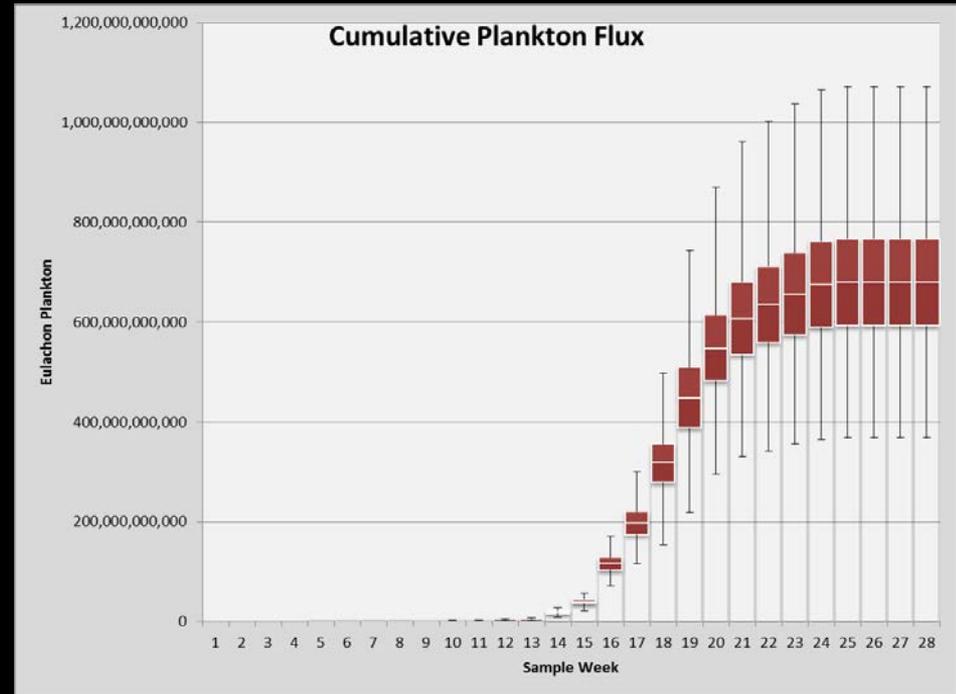
Max: 1,077,582,000,000

+95CI 938,587,000,000

Mean 690,395,000,000

-95% CI 463,294,000,000

Min 381,083,000,000



Max: 1,077,582,000,000

3Q 774,790,000,000

Median 687,924,000,000

1Q 600,623,000,000

Min 381,083,000,000

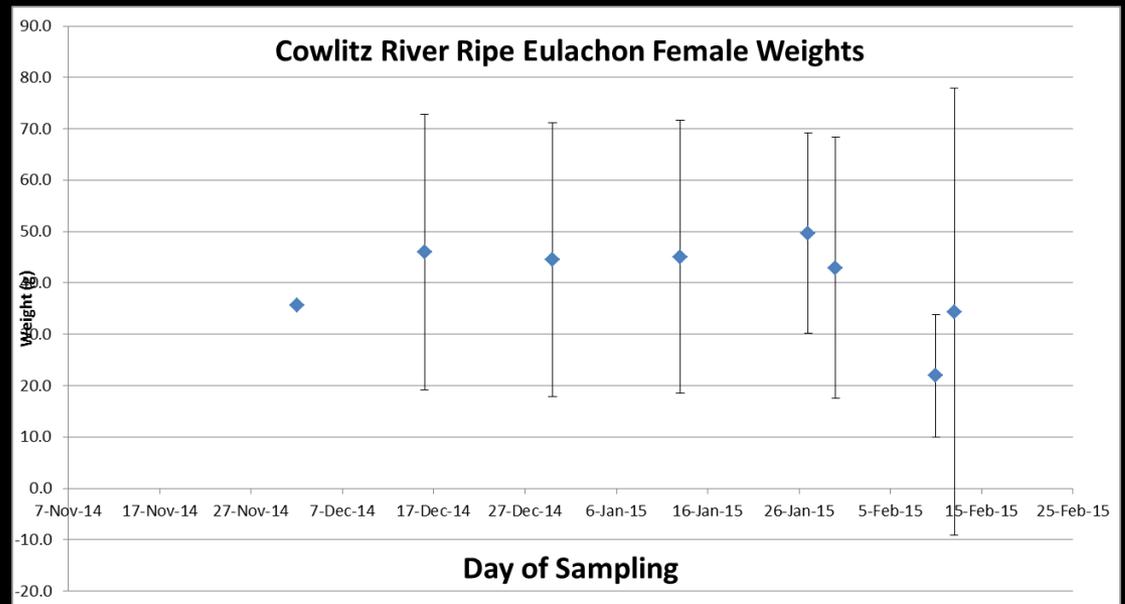
## Results: Finding “P” Production (Plankton Flux)

Cowlitz River Plankton mean cumulative flux of 690 Billion is 34.2% of 2.014 Trillion calculated for the Columbia River (WDFW, 2015)

# Methods: Finding “F” Fecundity

Whereas States obtained an average 40.84 g of Female fish weight, we used a fyke net and electronic scale to collect weights specific to the Cowlitz River throughout the duration of the run (Mean = 43.82g, SD = 13.77, n=90).

WDFW creel samples on 7 and 14 Feb 2015 revealed 10.21 fish per lb. or 44.43g/fish (n = 8,835, but combined M/F, also spent fish), verifies larger fish in Cowlitz R.



## Results: Finding “F” Fecundity

We used the mean value of 802.255 eggs/g of ripe Female fish obtained by NMFS and States (WDFW 2015).

Our 43.82g mean ripe female fish weight results in an expanded mean of 35,155 eggs per female

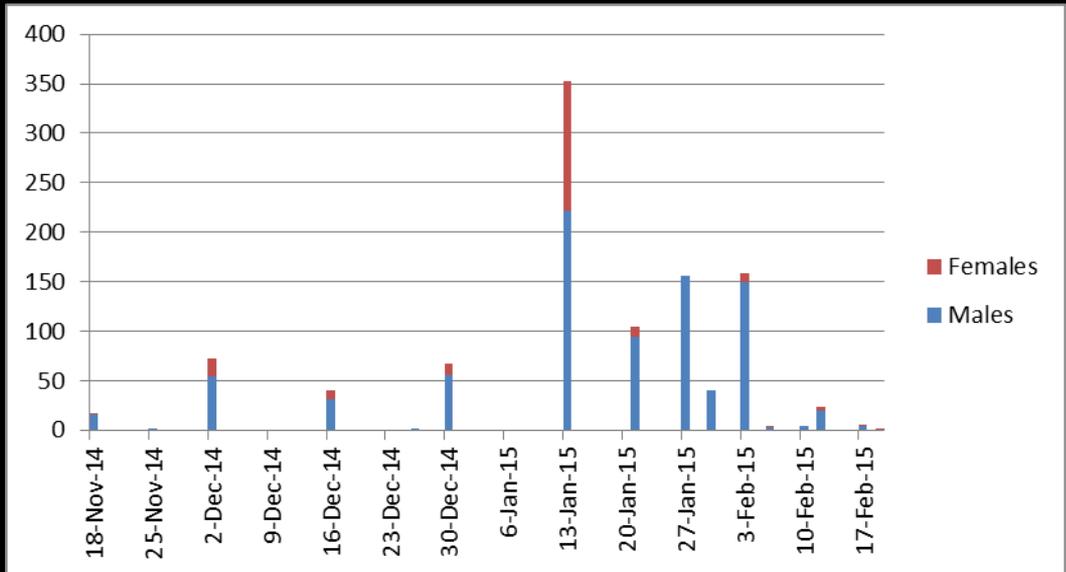
# Methods/Results: Finding “R” Sex Ratio

Fyke net samples also allowed us to examine M/F Sex ratio specific to the Cowlitz River return throughout the course of the 2014-2015 return.

Results: 853 males, 193 females, cumulative sex Ratio of 4.33

(WDFW creel samples on 7 and 14 Feb 2015 revealed 7382 males and 1613 females caught. Female proportion was 21.85% or Ratio of 4.59:1)

Combined into a Weighted Average sex Ratio of 4.53:1 (22.08% Female)



# Results: Spawning Stock Biomass (SSB):

Substituting values into the SSB equation :

$$B = P/(F*R)$$

Eq. 1

$$B = 690,395,000,000 \text{ Plankton} / (35,155 \text{ eggs per } F * 22.08\% F)$$

SSB Values for:	Number of Female Fish	Number of Male Fish	Total Fish	SSB (lbs)	SSB (kg)
Max	30,652,000	138,854,000	169,506,000	15,183,000	6,886,900
Upper CI	26,699,000	120,946,000	147,645,000	13,225,000	5,998,800
Mean	19,639,000	88,965,000	108,604,000	9,728,000	4,412,600
Lower CI	13,179,000	59,701,000	72,880,000	6,528,000	2,961,100
min	10,840,000	49,105,000	59,945,000	5,370,000	2,435,800
SSB Values for:	Number of Female Fish	Number of Male Fish	Total Fish	SSB (lbs)	SSB (kg)
Max	30,652,000	138,854,000	169,506,000	15,183,000	6,886,900
3rd Quartile	22,039,000	99,837,000	121,876,000	10,917,000	4,951,900
Median	19,568,000	88,643,000	108,211,000	9,693,000	4,396,700
1st Quartile	17,085,000	77,395,000	94,480,000	8,463,000	3,838,800
min	10,840,000	49,105,000	59,945,000	5,370,000	2,435,800

## Cowlitz Tribe NRD Mission Statement:

*To protect, conserve, restore and promote culturally-relevant species and landscapes integral to the unique identity of the Cowlitz People. To further educate the community and inspire future leaders and participants in this vision.*

### Project Staff:

PI: Cowlitz NRD Director Taylor Aalvik

Co-PI: Erik White

Technical coordinator: Nathan Reynolds

Project Field Staff: Dalton Fry, Stuart Freitas

Research Funded by Species Recovery Grant to Tribes,

CFDA NUMBER: 11.472, Unallied Science Program

Award# NA14NMF4720013

