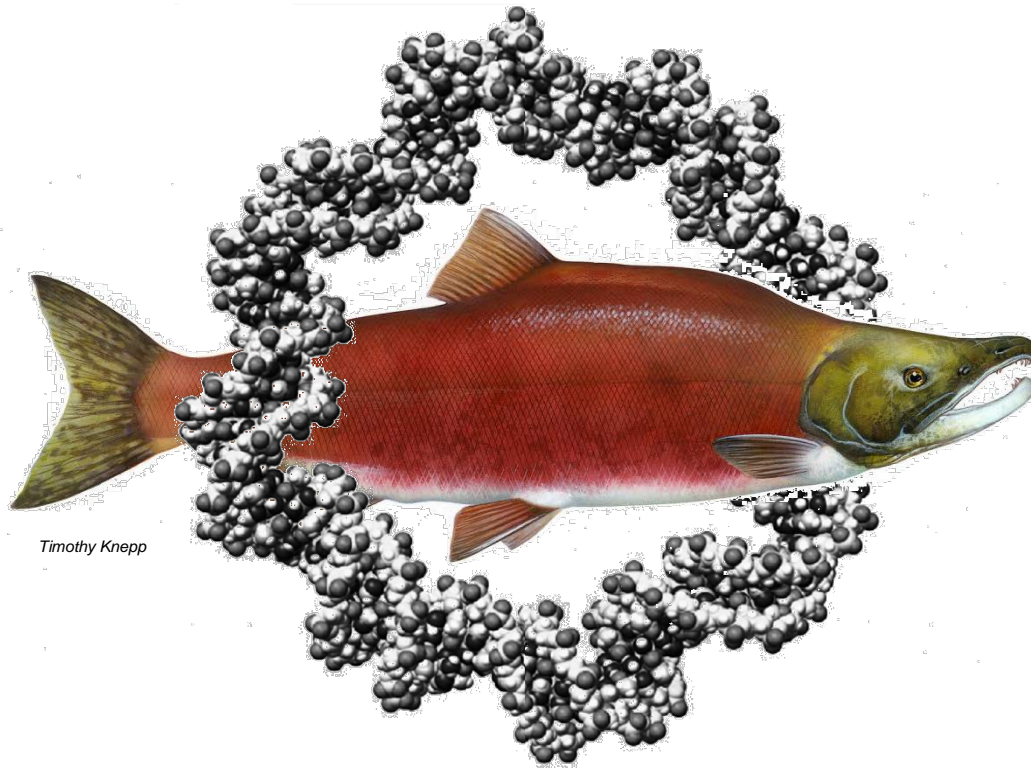


# Genetic monitoring of sockeye salmon reintroduction into Cle Elum Lake



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The Confederated Tribes and Bands of the Yakama Nation



# Genetic Methods:

## An exhaustive list of details & descriptions

- Molecular background
- Test statistics



...summary: 96 SNPs; assignment tests

# genetic M&E focus...

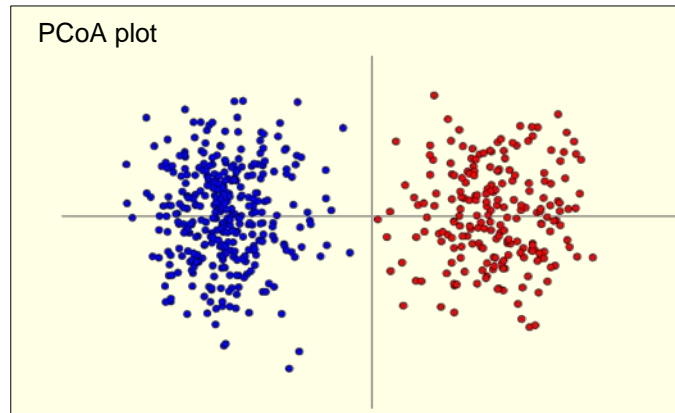
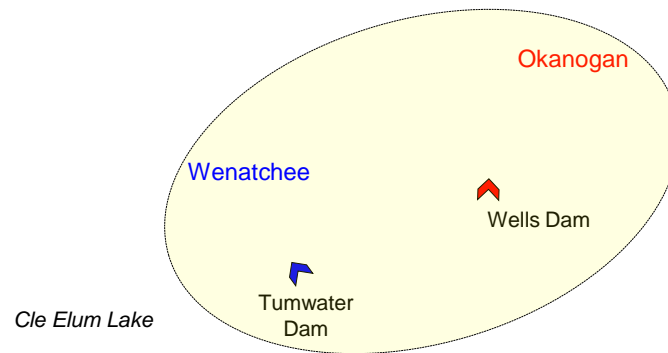
- Reproductive success between stocks measured at:
  - Juvenile stage?
  - Adult stage?
  - hybridization (outbreeding depression)
  - F2's
  
- Will stocks acclimate to new environment – behaviors?
  - following outplanting: spawning?
  - growth, migration?
  - age structure & migration of adults
  
- How successful with the program be?
  - Parentage between returns and outplants?

# landmarks; sampling; “who’s who”

**Reference Populations**  
Wenatchee n = 344  
Okanogan n = 212



**Assignment tests**  
100% self; mean prob. = **0.98**  
100% self; mean prob. = **0.98**



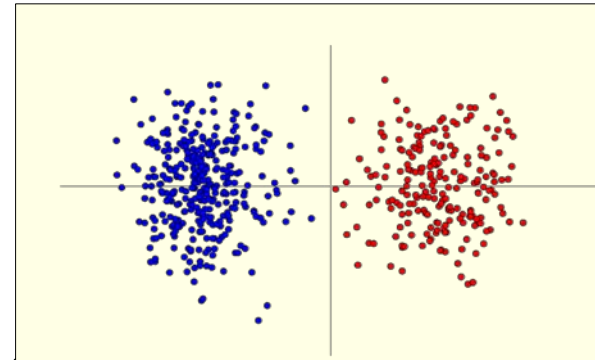
...therefore, stocks assign with a **high degree of accuracy** & we can determine stock proportions **confidently**.

# No apparent evidence of Hybridization between stocks

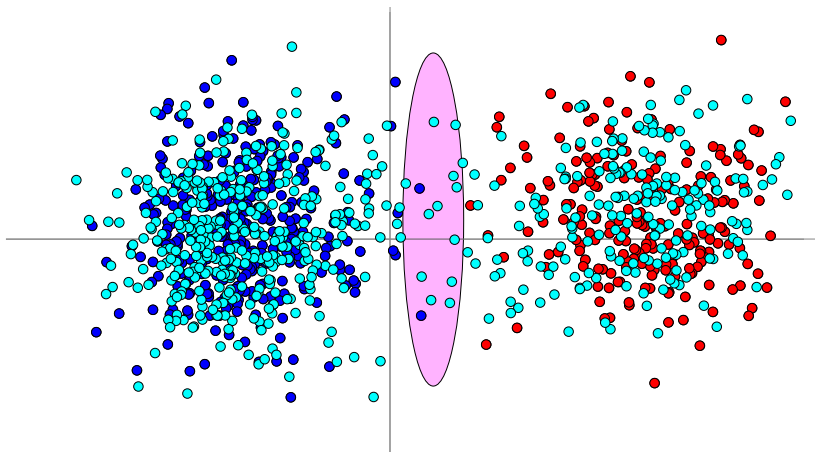
## Admixture proportions

<u>Group</u>	<u>W</u> mean (Q1)	<u>O</u> mean (Q2)
Chandler juveniles (2012)	96.8	90.0
Chandler juveniles (2013)	97.8	96.3
Roza juveniles (2012-13)	98.0	96.2
1st program returns (2013)	97.9	97.4

## references

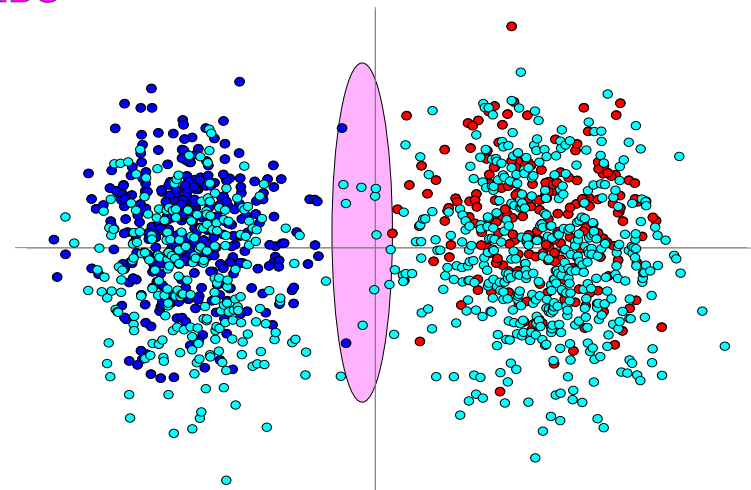


## Juveniles



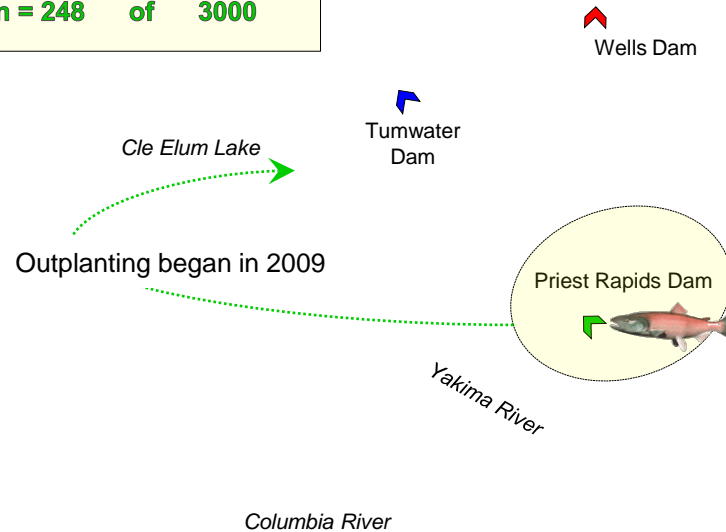
## HYBRIDS

## 1<sup>st</sup> returns (2013)

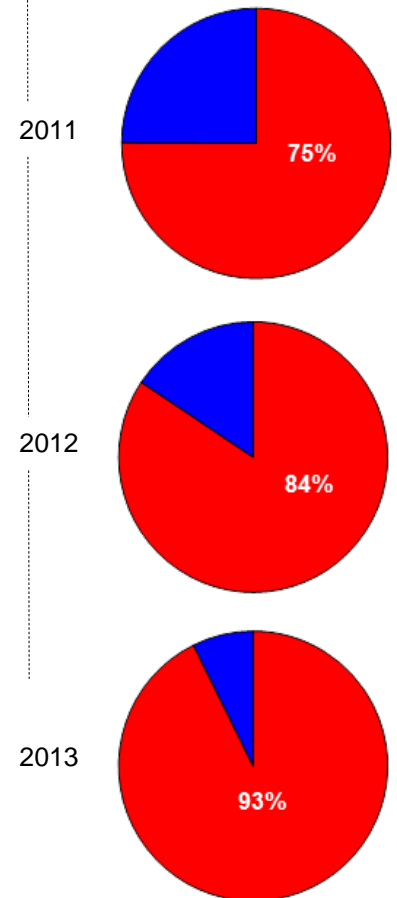


# landmarks; sampling; “who’s who”

Sampled OUTPLANTS			
2011	n = 274	of	4600
2012	n = 846	of	10000
2013	n = 248	of	3000



Donor stock proportions

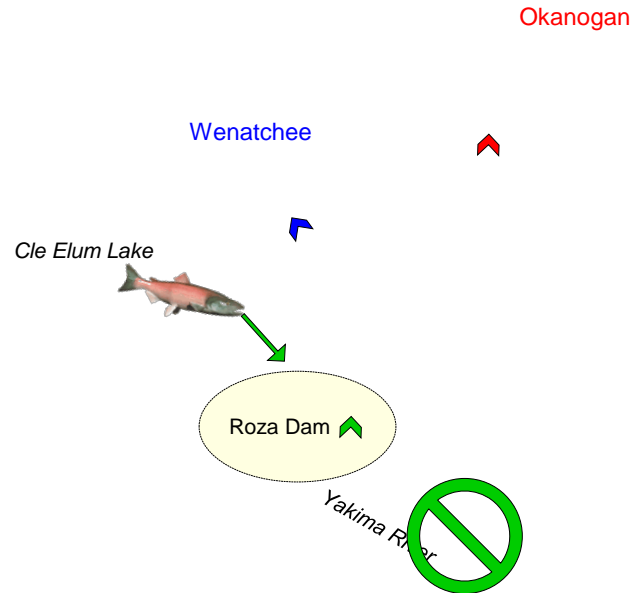
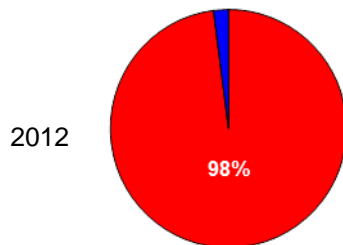
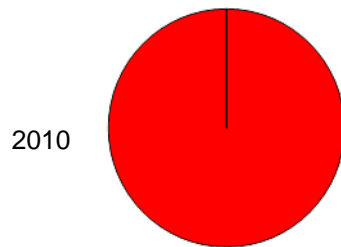
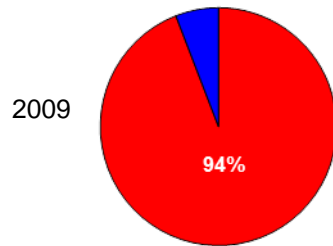


...Reflective of source stock abundances, Okanogan origin sockeye dominate outplants (with inter-annual variability)

# landmarks; sampling; “who’s who”

## Sampled ADULTS

Roza 2009 n = 18  
Roza 2010 n = 41  
Roza 2012 n = 148

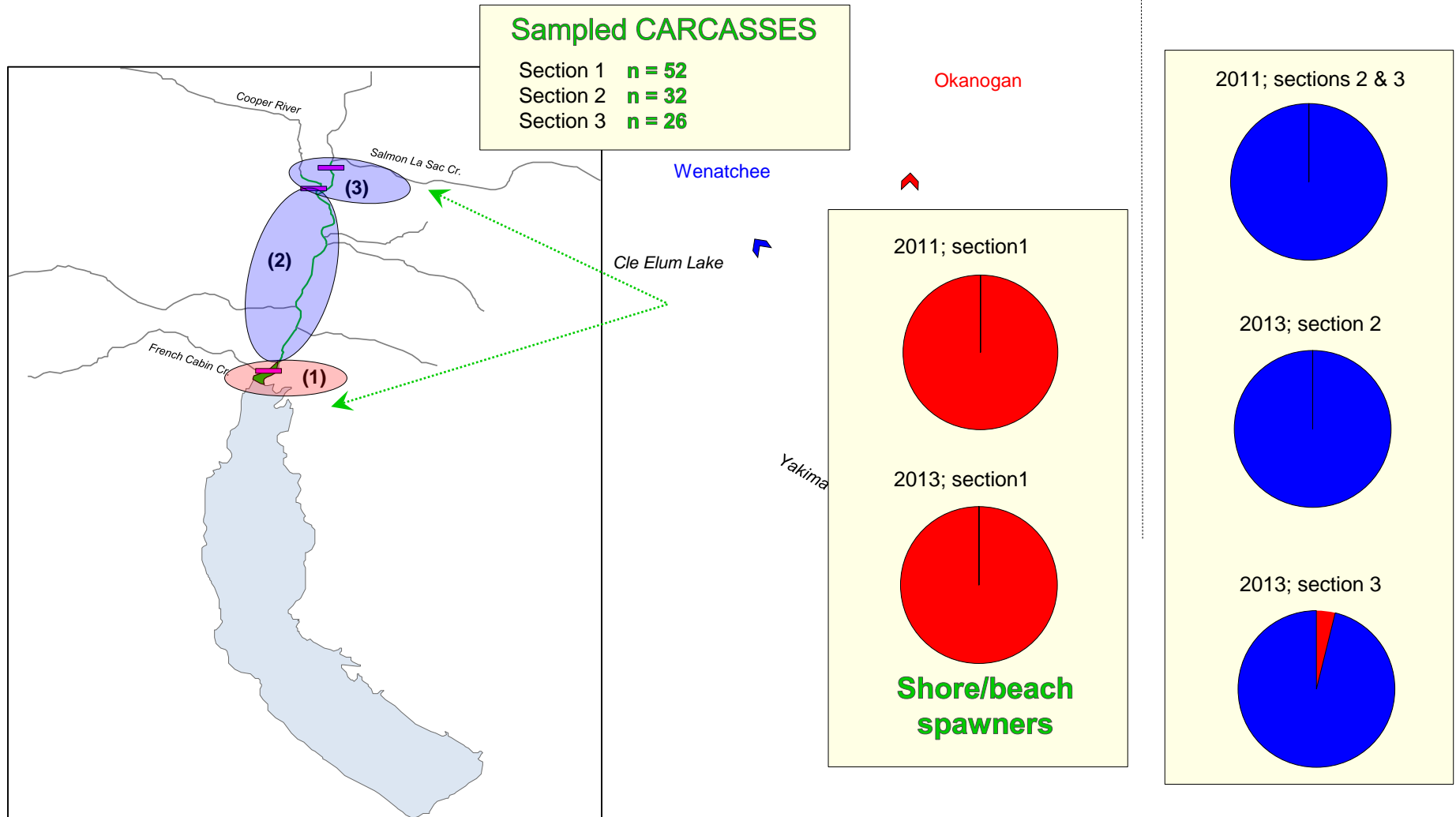


9 fish outplanted in **2012** were subsequently sampled at Roza in **2012**

5 fish identified as **2013** returns were subsequently sampled at Roza in **2013**

therefore...these fish exited the lake (“fall-backs” vs. strays)

# location; landmarks; sample sizes



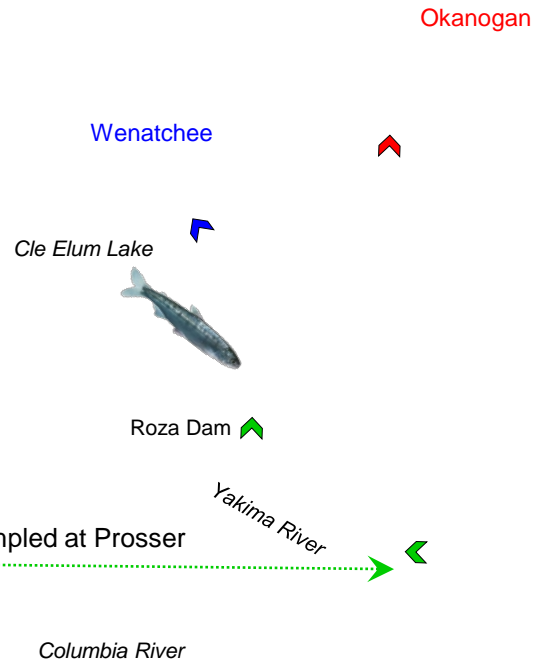
Spatial segregation during spawning



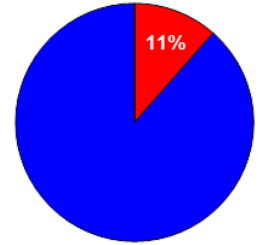
# landmarks; sampling; “who’s who”

## Outmigrating SMOLTS

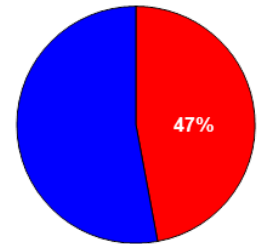
Chandler 2012     **n = 193**  
Chandler 2013     **n = 379**  
Roza 2012 - 2013     **n = 49**



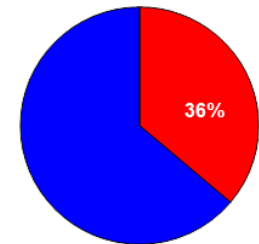
Chandler 2012



Chandler 2013



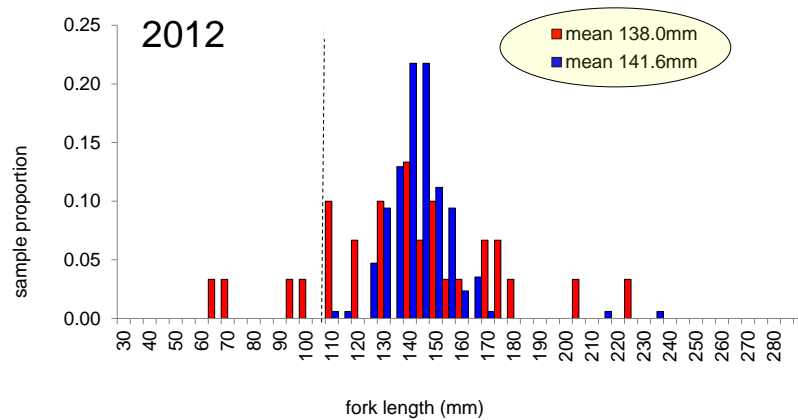
Roza 2012-2013



...Large inter-annual variability? Some behavioral characteristics may play a role (or sampling)

# Juvenile size distribution

Both stocks larger than 2013 counterparts

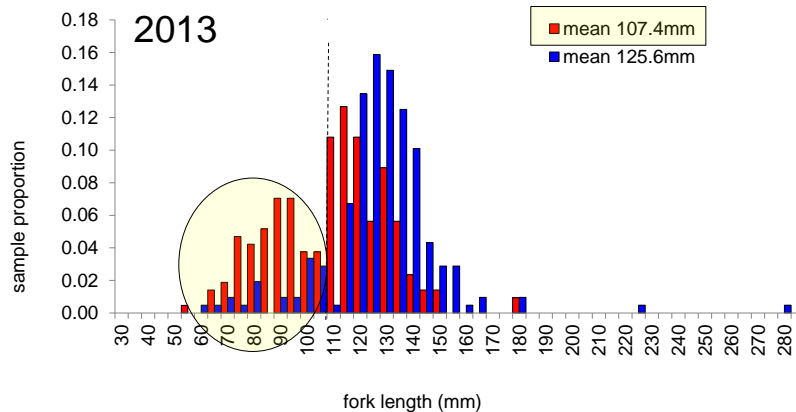


Scale ages for 60 adult returns

All had FW age of 1 winter

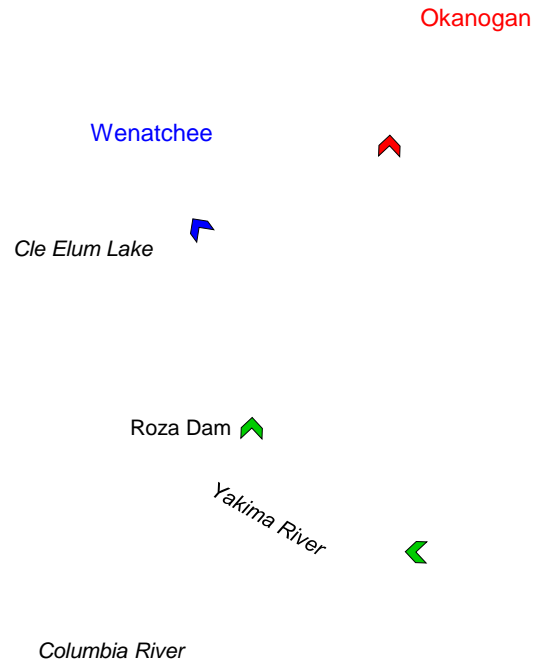
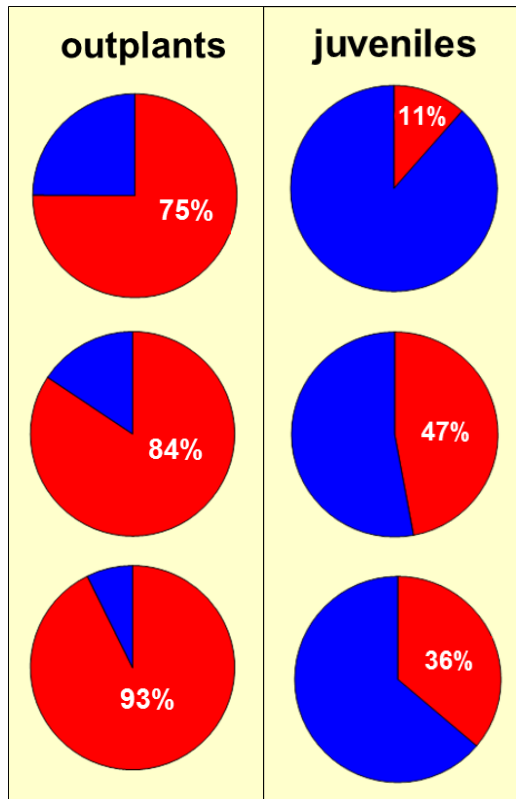
Okanogan progeny are smaller overall,  
& more small fish in 2013 (4x outplants)

Scale ager noted 7 adults with  
“huge” FW growth

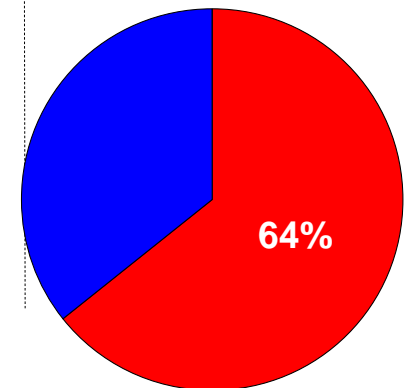


# 1<sup>st</sup> program returns (2013): Age-4

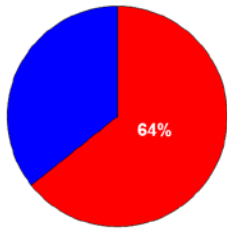
## RECALL...



First Returns (n ~ 700);  
counts from Prosser

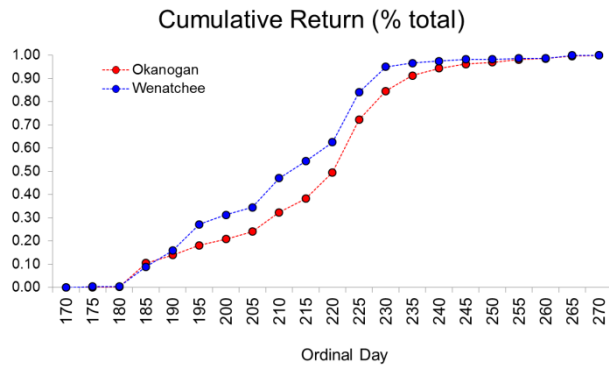


...there is an obvious disparity between juveniles & returning adults (proportions by donor origin)

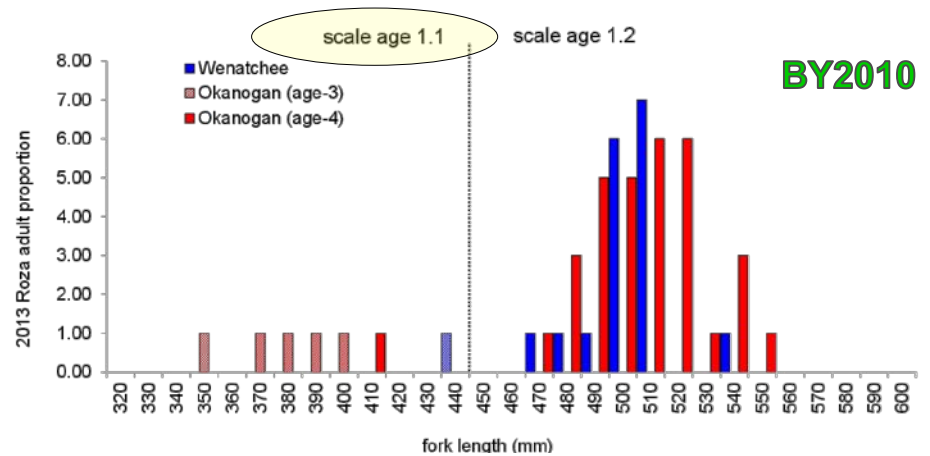
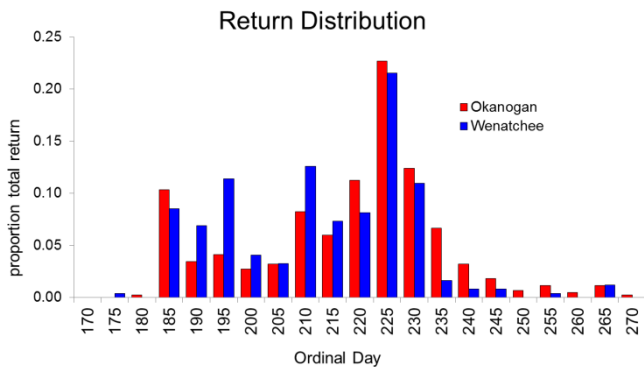
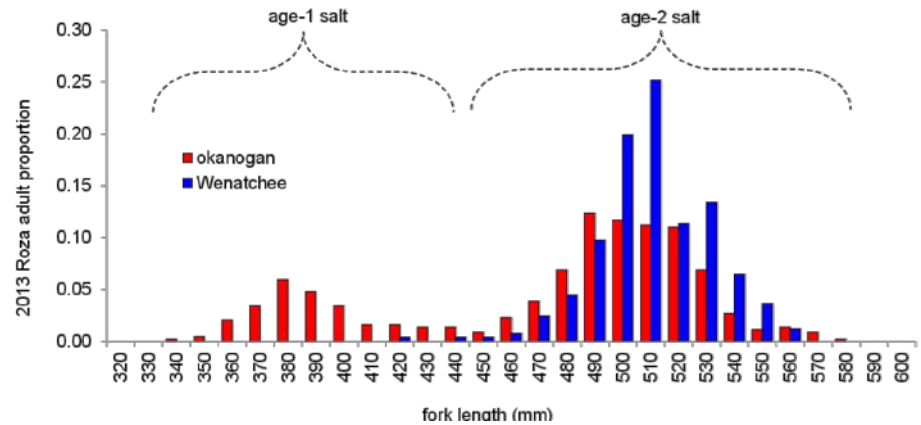


# 1<sup>st</sup> program returns (2013)

...no apparent run-timing difference among stock of origin



...however, big difference in size distribution

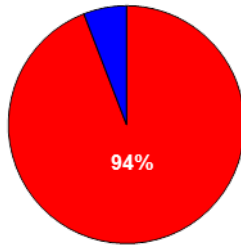


# (side note), similarly.....

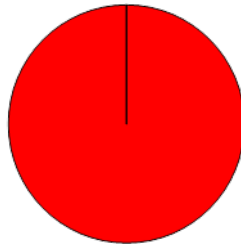
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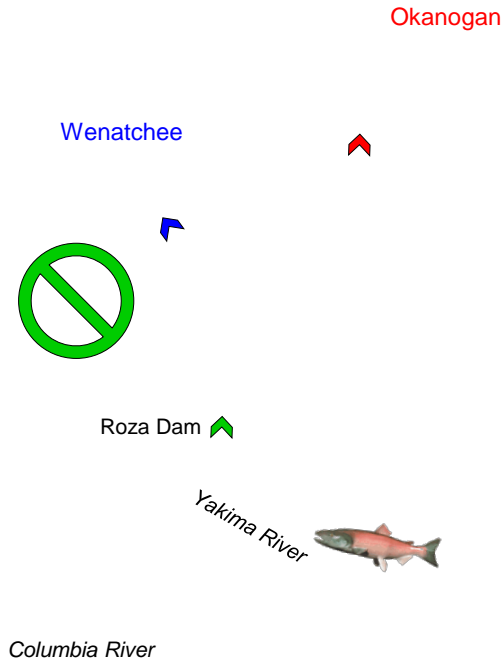
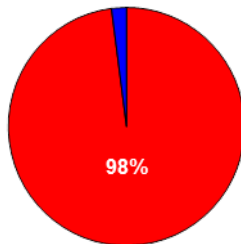
Roza 2009



Roza 2010



Roza 2012



Includes age-3 returns from 2009?  
identified 10% 1-salt fish based on scale ages of 2013 adults

# Review....what I think we know

- Outplant origins distinguished with high accuracy; donors comprised of larger proportion Okanogan
- All groups evaluated (e.g., juveniles, returns) definitively “pure” stock: Wenatchee or Okanogan
- Distinct spatial distribution on spawning grounds is likely cause for lack of introgression (i.e. **NO Hybrids**)
- Proportionally more Wenatchee progeny among outmigrating juveniles
- The first program returns are dominated by Okanogan
- Appears age-structure among both juvenile and adult progeny differs by donor stock of origin; characteristic of respective adaptations in natal regions: Wenatchee or Okanogan?
- Many aspects may favor overall viability of reintroduction: utilizing all available habitat, high genetic variability, and....  
**both stocks appear to be reproductively successful**



# Acknowledgements

Mark Johnston, YN field technical staff,  
Roza and Chandler technical staff



Supplementation ACCORDS project  
- (Peter Galbreath)



Nick Hoffman & Travis Jacobson  
Shawn Narum: Lead Geneticist



Hey Peter, grab that!