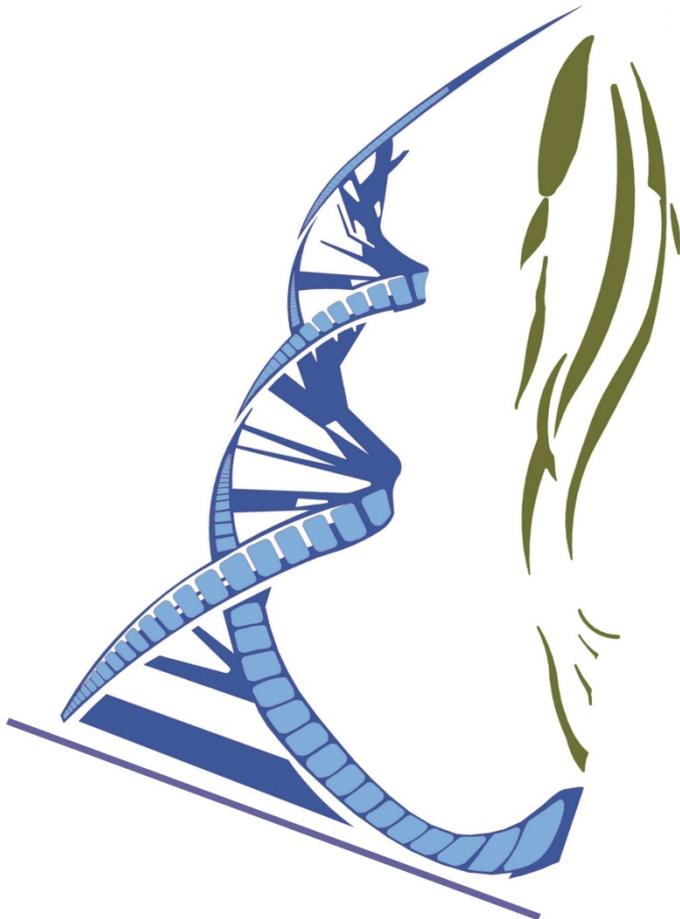


# Genetic Tagging & Monitoring of Fisheries



**Dr. Shawn Narum**

**Columbia River Inter-Tribal  
Fish Commission**



Hagerman, Idaho

# Primary Research Areas



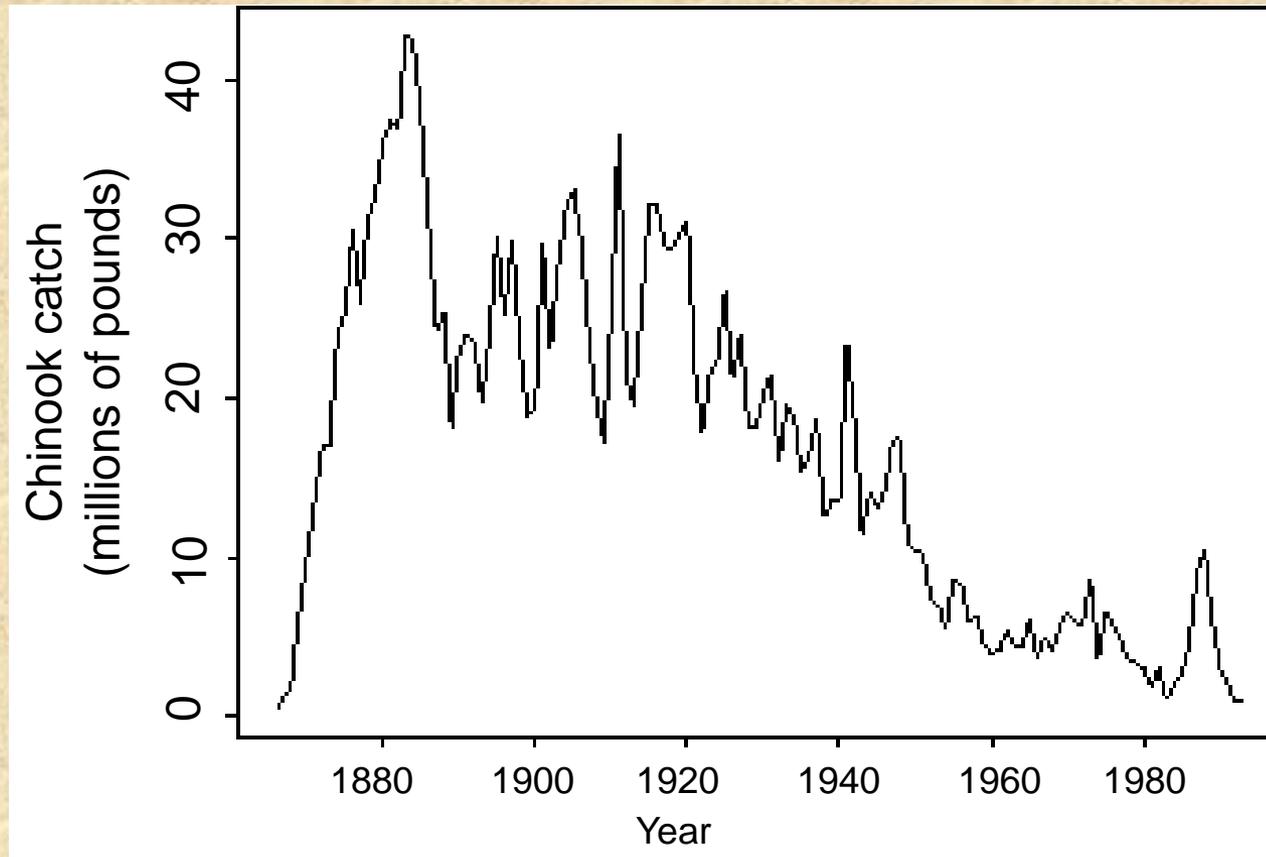
- 1) Genetic tagging and monitoring of fisheries**
  - stock specific abundance, harvest, and run-timing to assist fisheries management
- 2) Genetic effects of hatchery practices**
  - better understand how hatchery reform can be implemented to reduce genetic impacts on wild populations
- 3) Genetic adaptation to local environments**
  - investigate local adaptation and the genetic basis for traits (e.g., thermal adaptation)

# 1) Genetic tagging and monitoring of fisheries in the Columbia River

Project Leader: Jon Hess

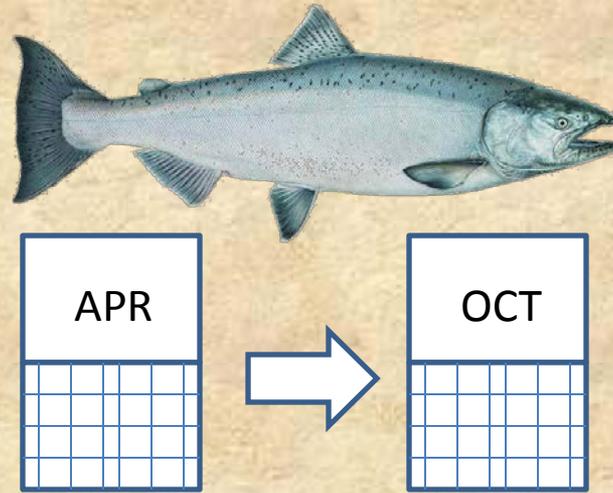


# Major Decline in Total Chinook catch in the Columbia River system



Anderson (1998) Sustainable Fisheries Conference Proceedings

# Genetic program to estimate composition of salmon runs during upstream migration



## Goal:

Allow managers to shape fishing seasons to target abundant populations while also protecting the weakest populations

# Genetic Monitoring Programs

- Estimate stock composition of salmon fisheries

Commercial



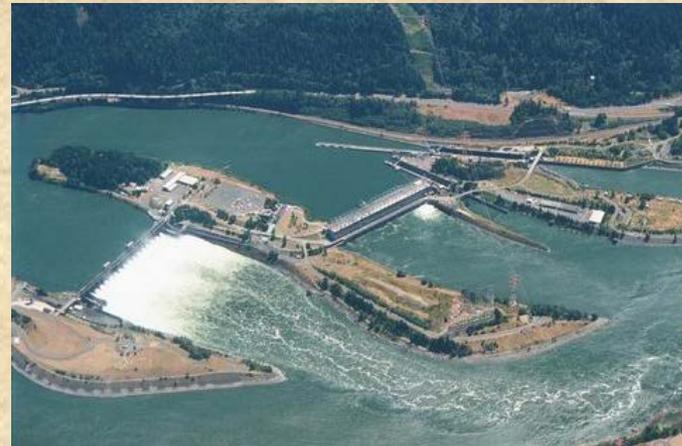
Tribal



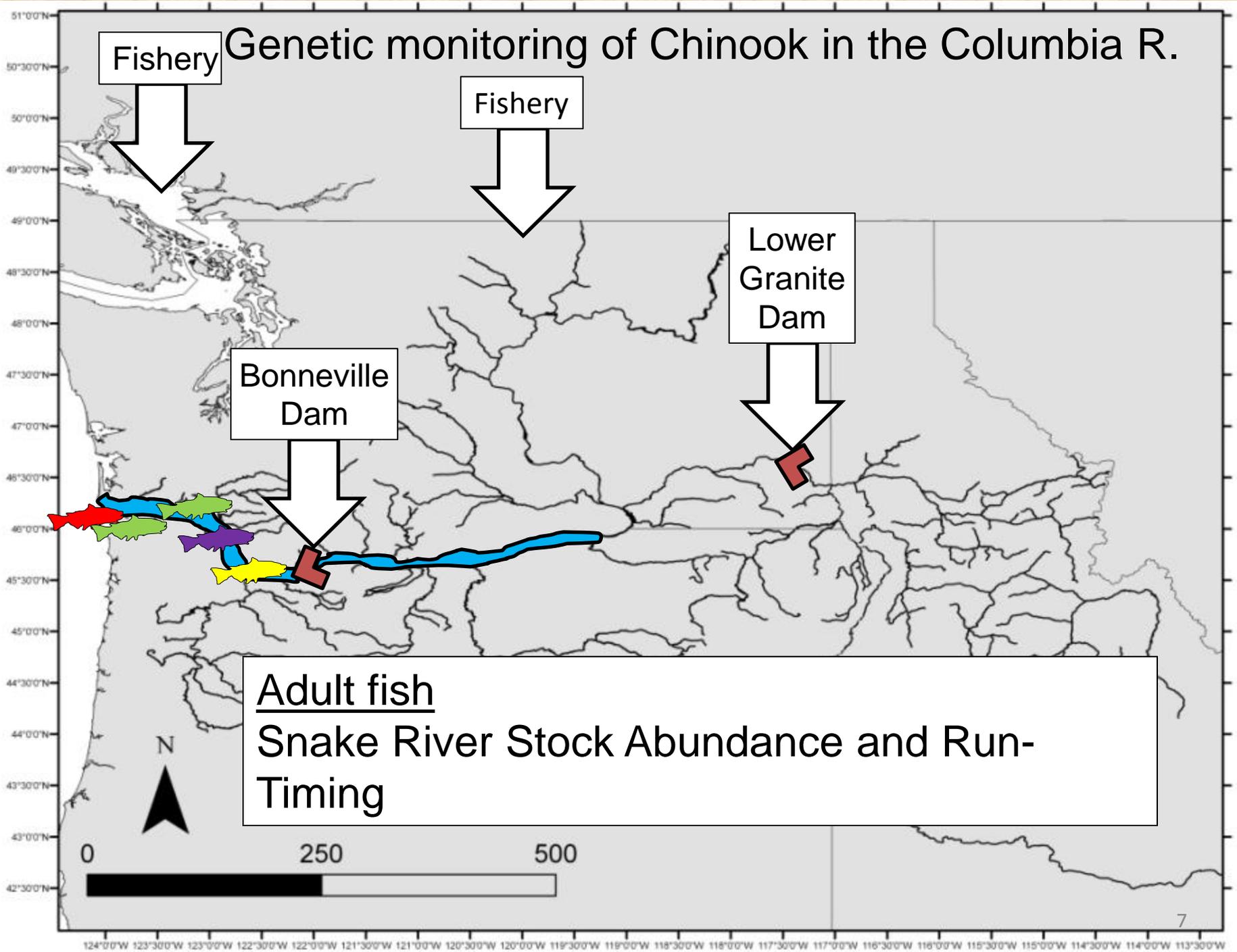
Sport

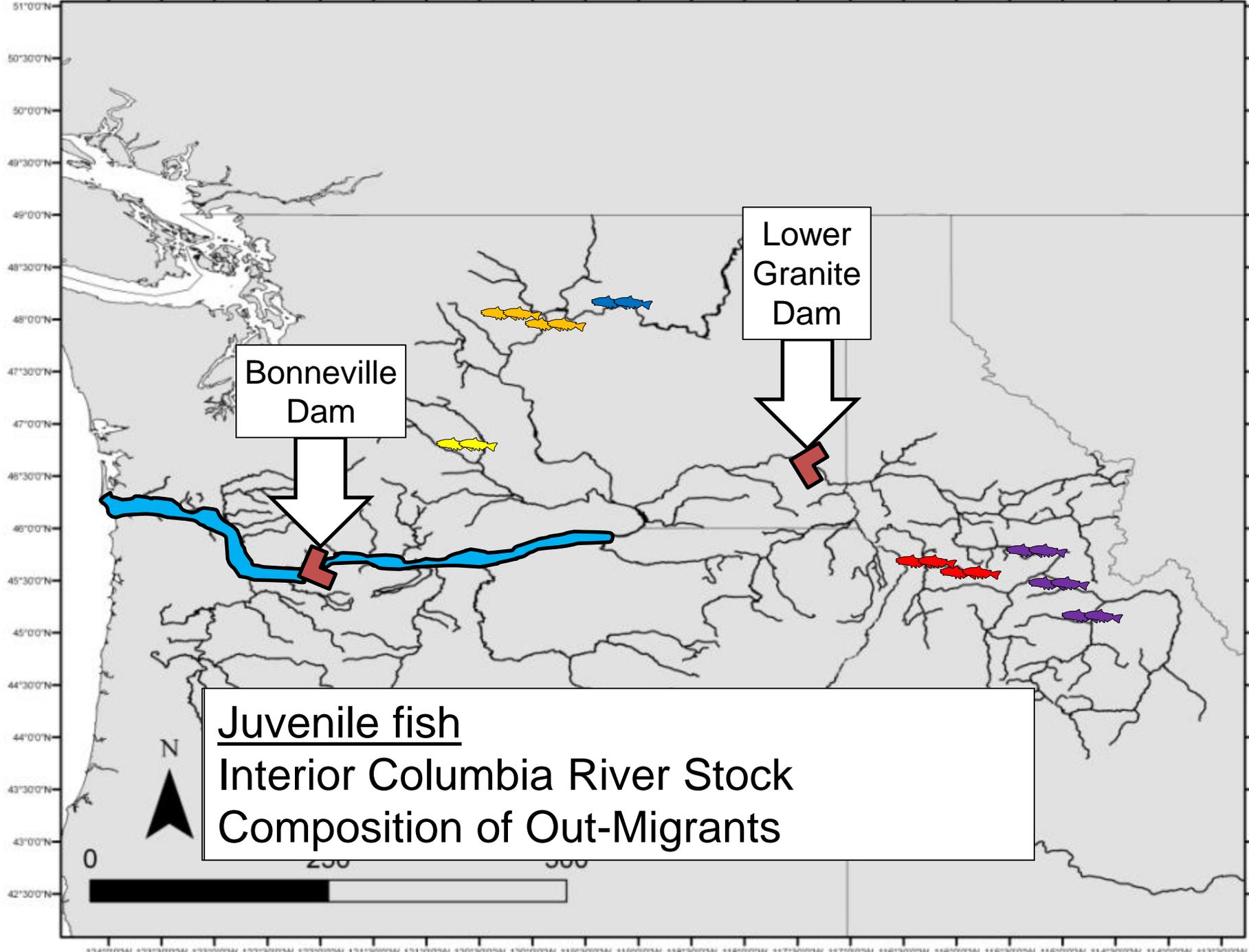


Bonneville Dam



# Genetic monitoring of Chinook in the Columbia R.





# Genetic Tools for Monitoring

## 1) Genetic Stock Identification (GSI):

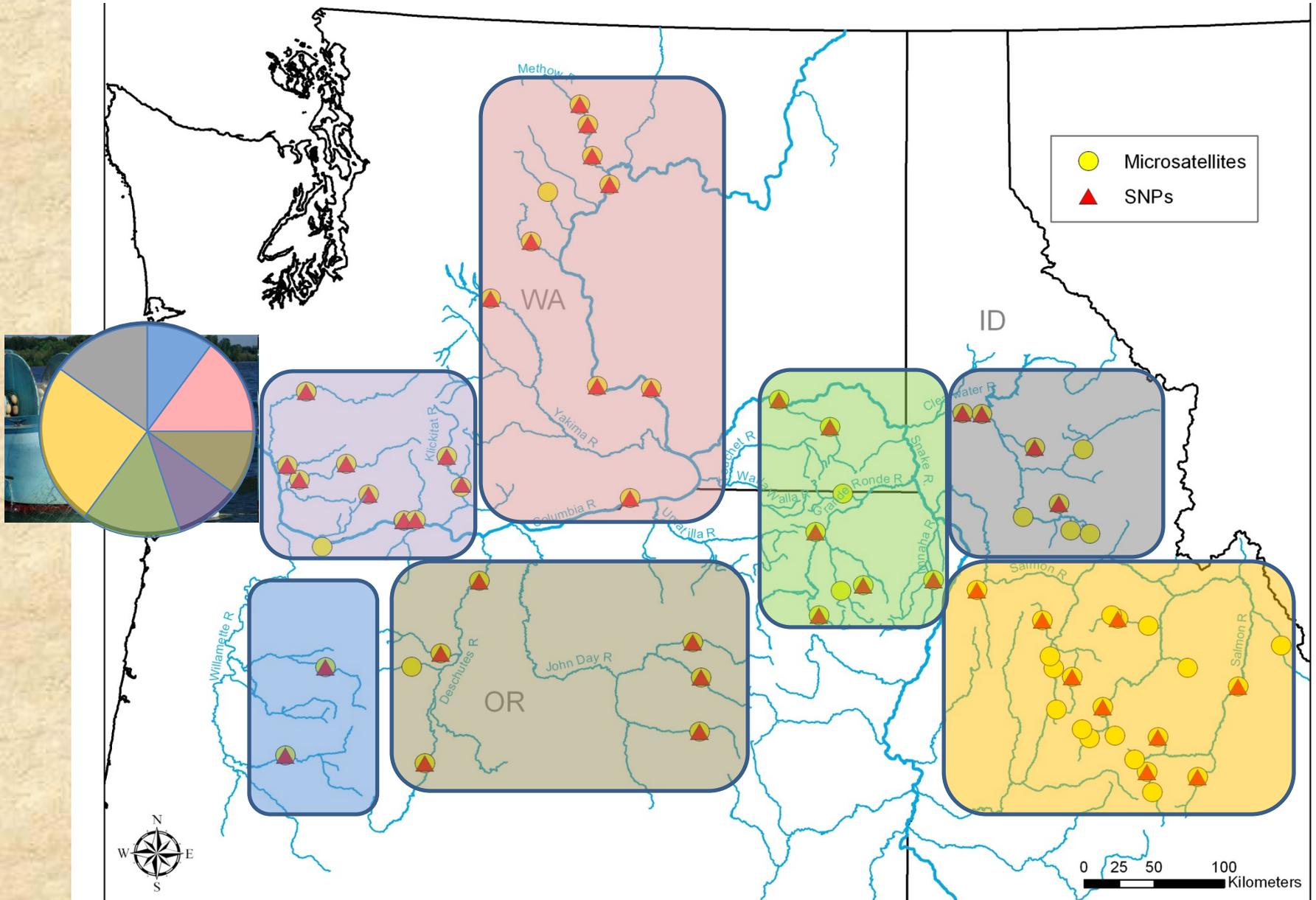
- Method in use for 30+ years in fisheries
- Baseline of population genetic data
- Identify the most likely origin of fish

## 2) Parentage Based Tagging (PBT):

- New technique based on parentage analyses
- Genotype all hatchery broodstock (parents)
- Allows identification of hatchery offspring by DNA
- Data obtained similar to CWT but with greatly improved tagging rate (~95-100% vs. 5-10%)
- No juveniles have to be handled or injected with physical tags



# GSI - Baseline of Reference Populations

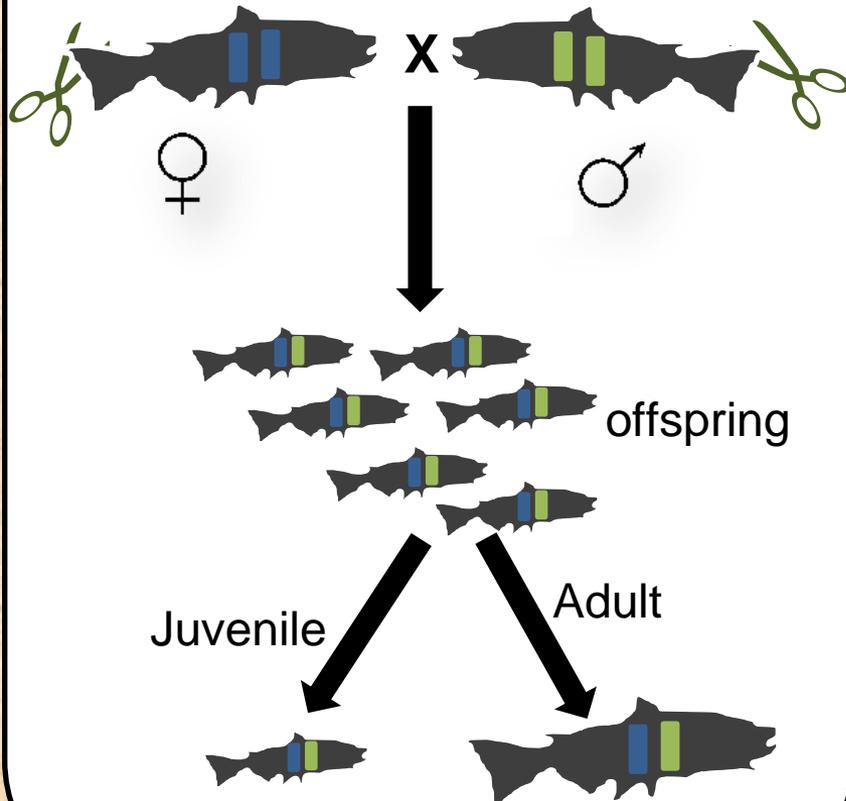


Baselines described in Hess et al. 2011 Mol. Ecol. Res.; Matala et al. 2011 TAFS

# Parentage Based Tagging (PBT)

Genetic “tags” based on DNA

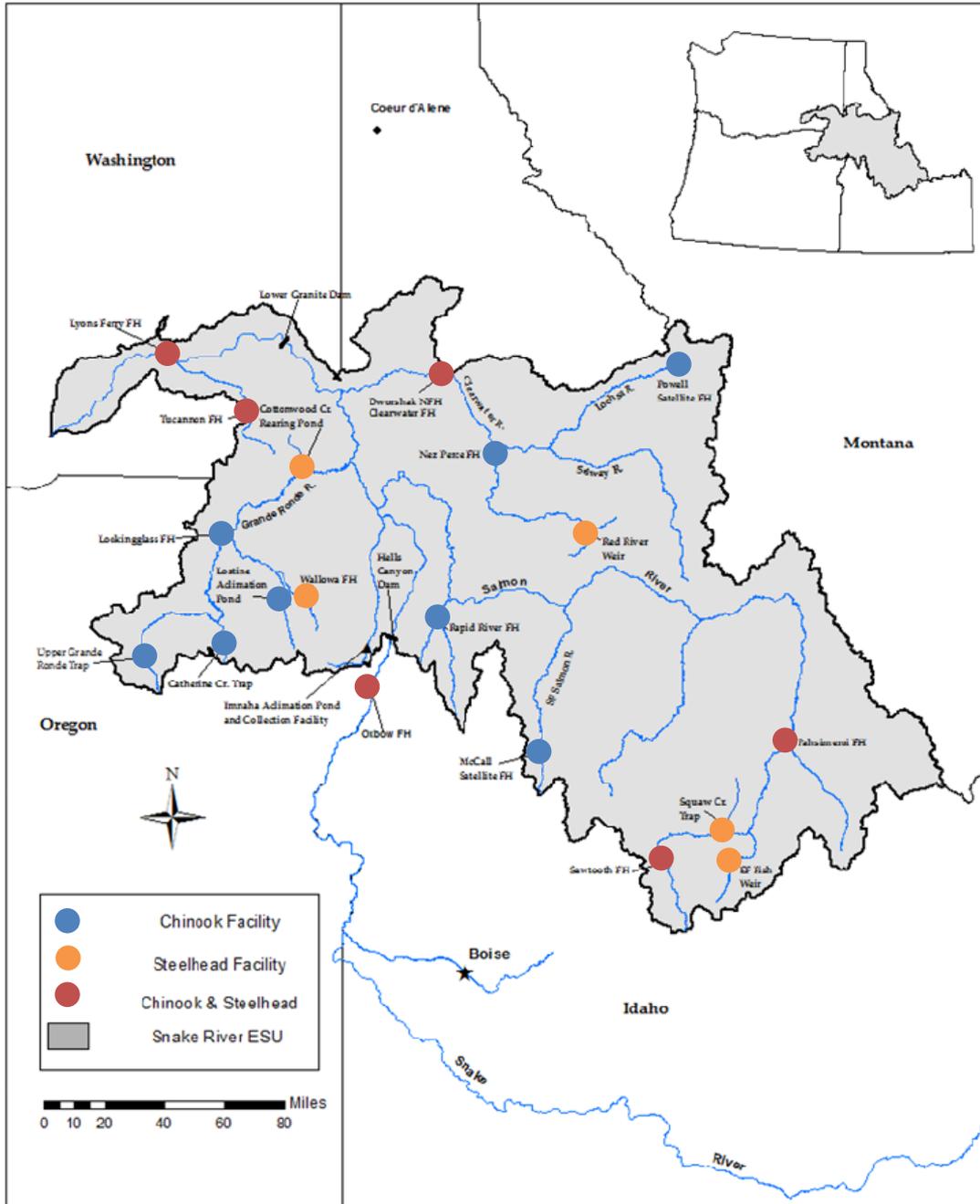
Hatchery broodstock



- Genetic tagging of hatchery broodstock can identify hatchery offspring produced

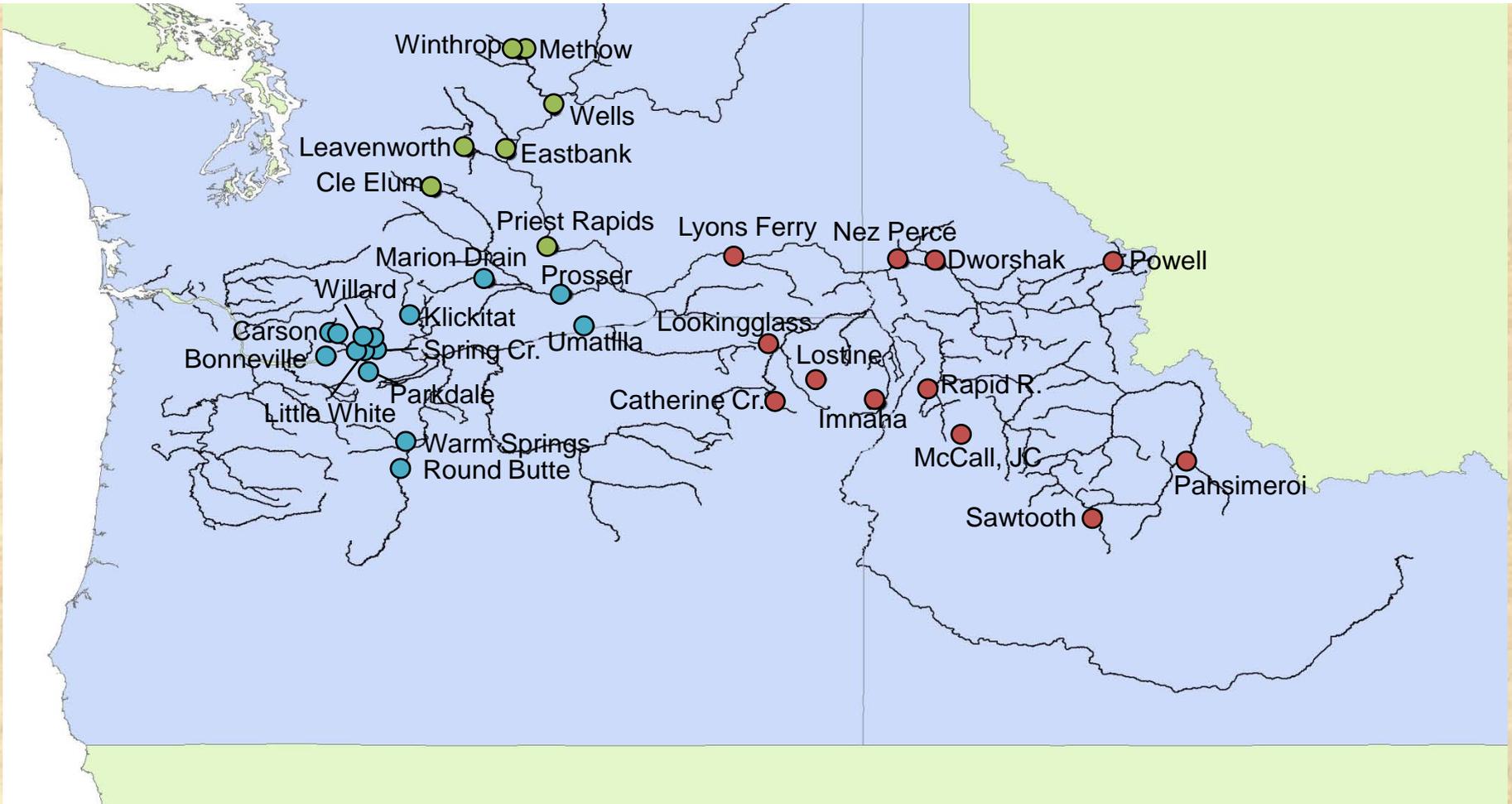
- Passive mark (no handling of juveniles)
- Eliminates issues with tag loss, tag detection, handling mortality
- Non-lethal sample to recover tag from offspring
- Nearly 100% tagging rate of hatchery fish
- Dramatic increase in the number of tags recovered (improved estimates of stock composition)

# Snake River Basin PBT

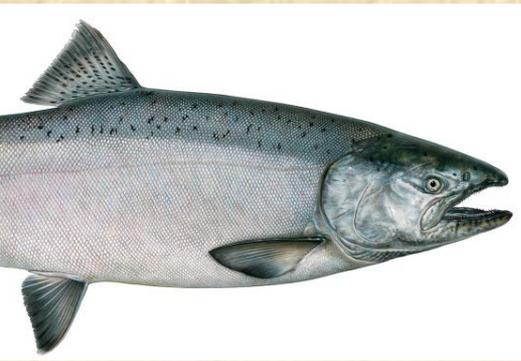


- Sample all hatchery broodstock  
~5,000 steelhead/yr  
~9,000 Chinook salmon/yr
- Genetically “tag” ~20 million smolts/yr
- All hatcheries record spawn dates and sex (many provide lengths and spawn cross)

# Goal 2012-ongoing: Chinook salmon, PBT hatcheries



-Potential to include wild stocks in PBT approach if wild parents can be sampled at weirs



# Spring/Summer Chinook

	Spawn Year			
	2008	2009	2010	2011
Broodstock sampled	10,836	8,849	8,290	8,466
Genotyped	10,630	8,493	8,235	8,324
“Tagging” Rate of Offspring	96.2%	92.1%	98.7%	98.3%
Smolts Produced *	~18.96 mil	~15.49 mil	~14.51 mil	~14.82 mil
Smolts “Tagged”	~18.25 mil	~14.26 mil	~14.32 mil	~14.56

\* Assuming 3,500 smolts produced per broodstock pair

# Sampling PBT-tagged offspring

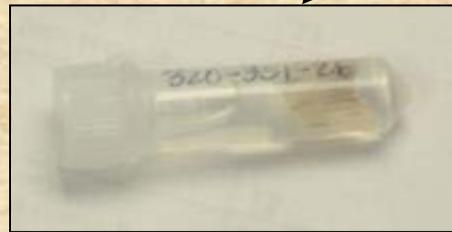


juveniles

or



adults



Non-lethal  
tissue  
sample

**Age**

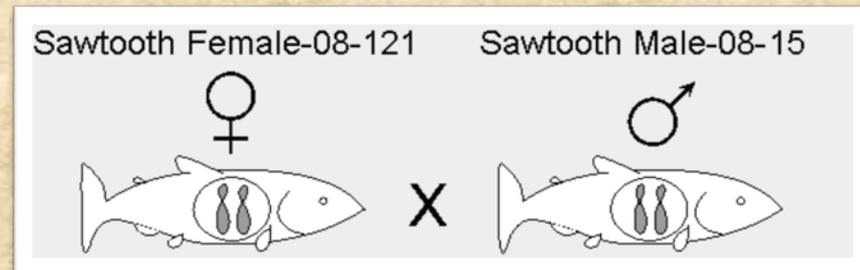
**Hatchery**

**Parents**

**BY2008**



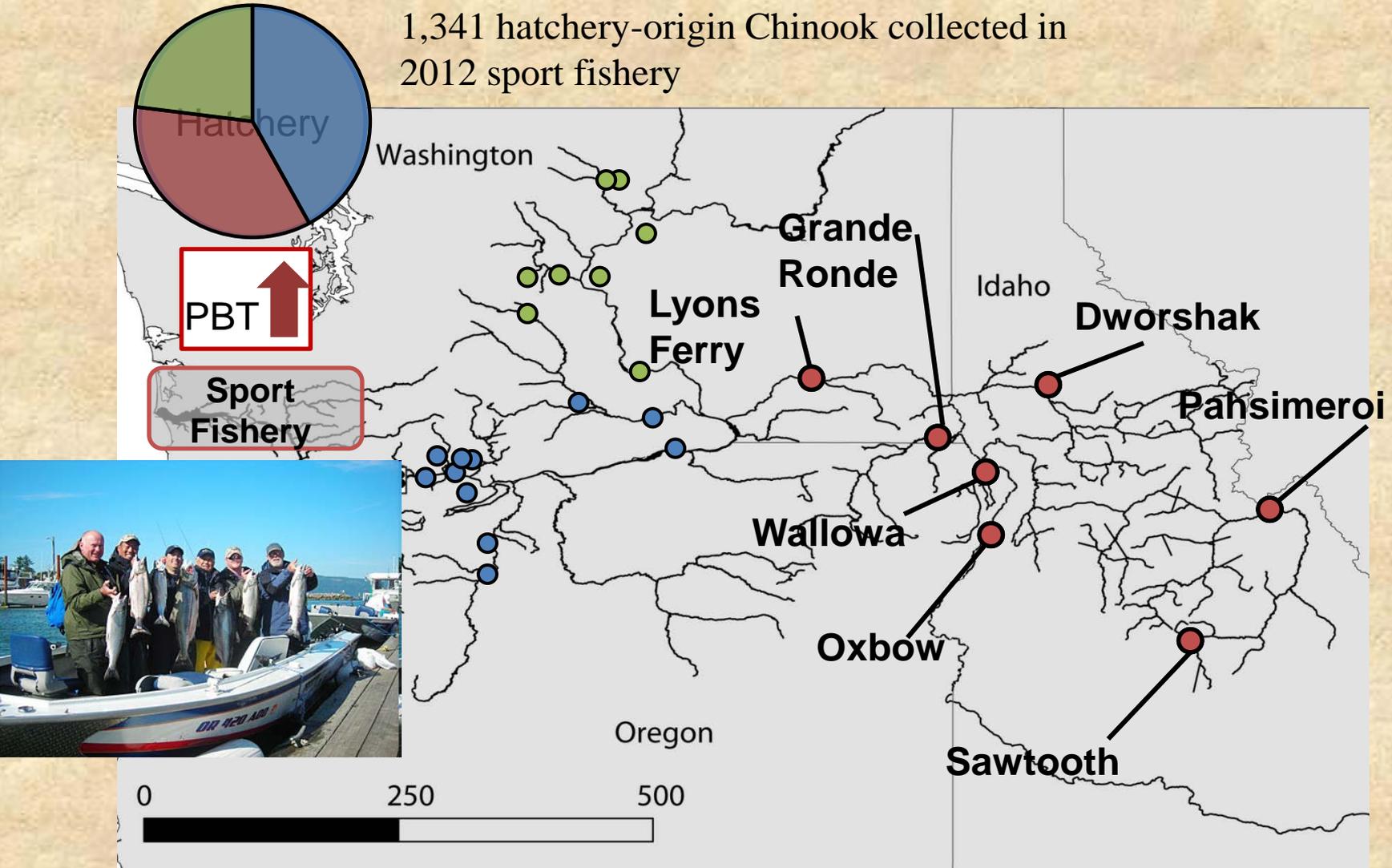
**Sawtooth Hatchery**



# Fishery application:

## Origin and age of harvest fishery?

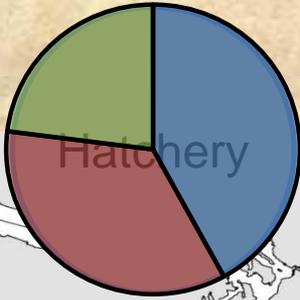
1,341 hatchery-origin Chinook collected in 2012 sport fishery



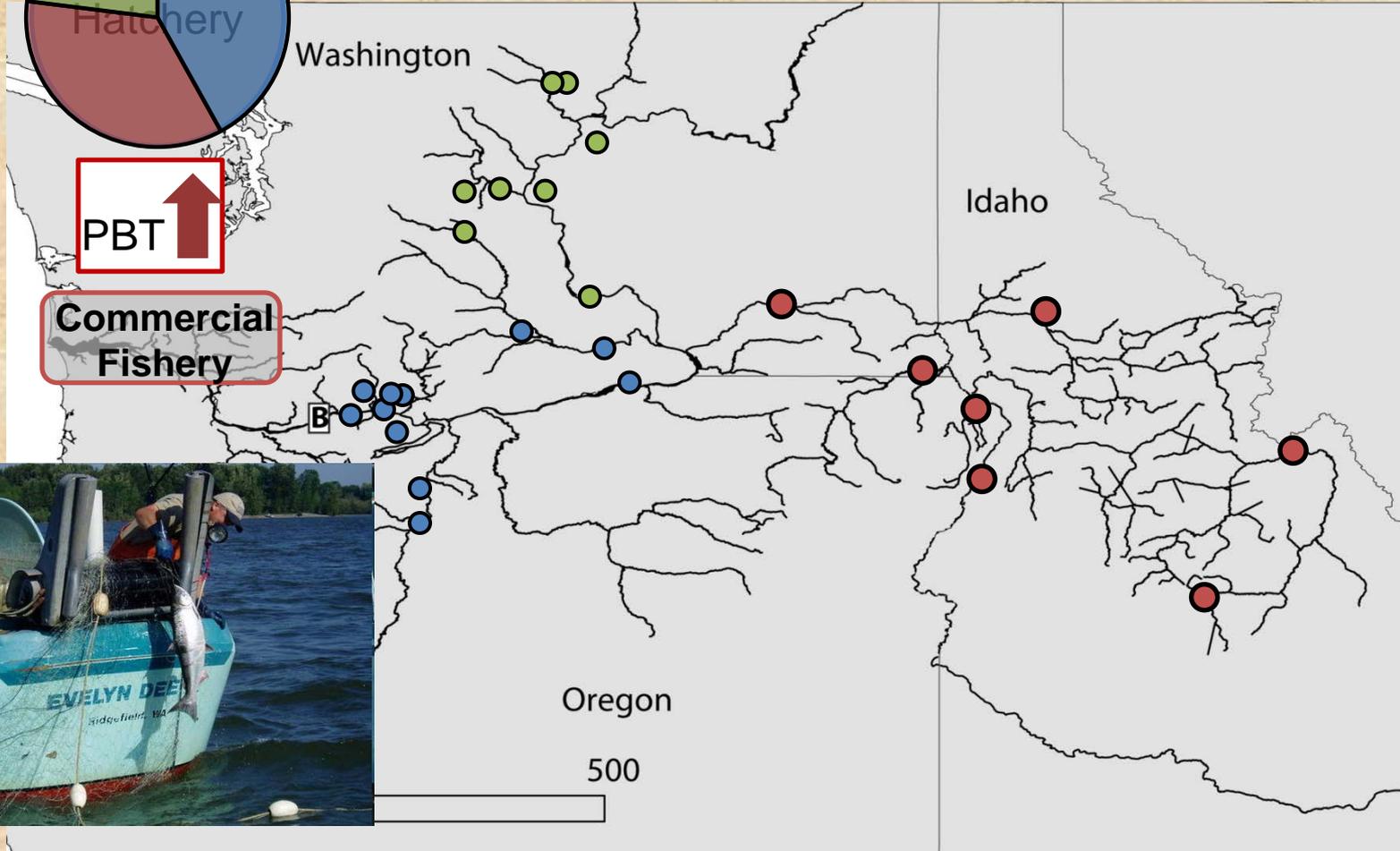
# Fishery application:

## Origin and age of harvest fishery?

886 hatchery-origin Chinook collected  
in 2012 commercial fishery

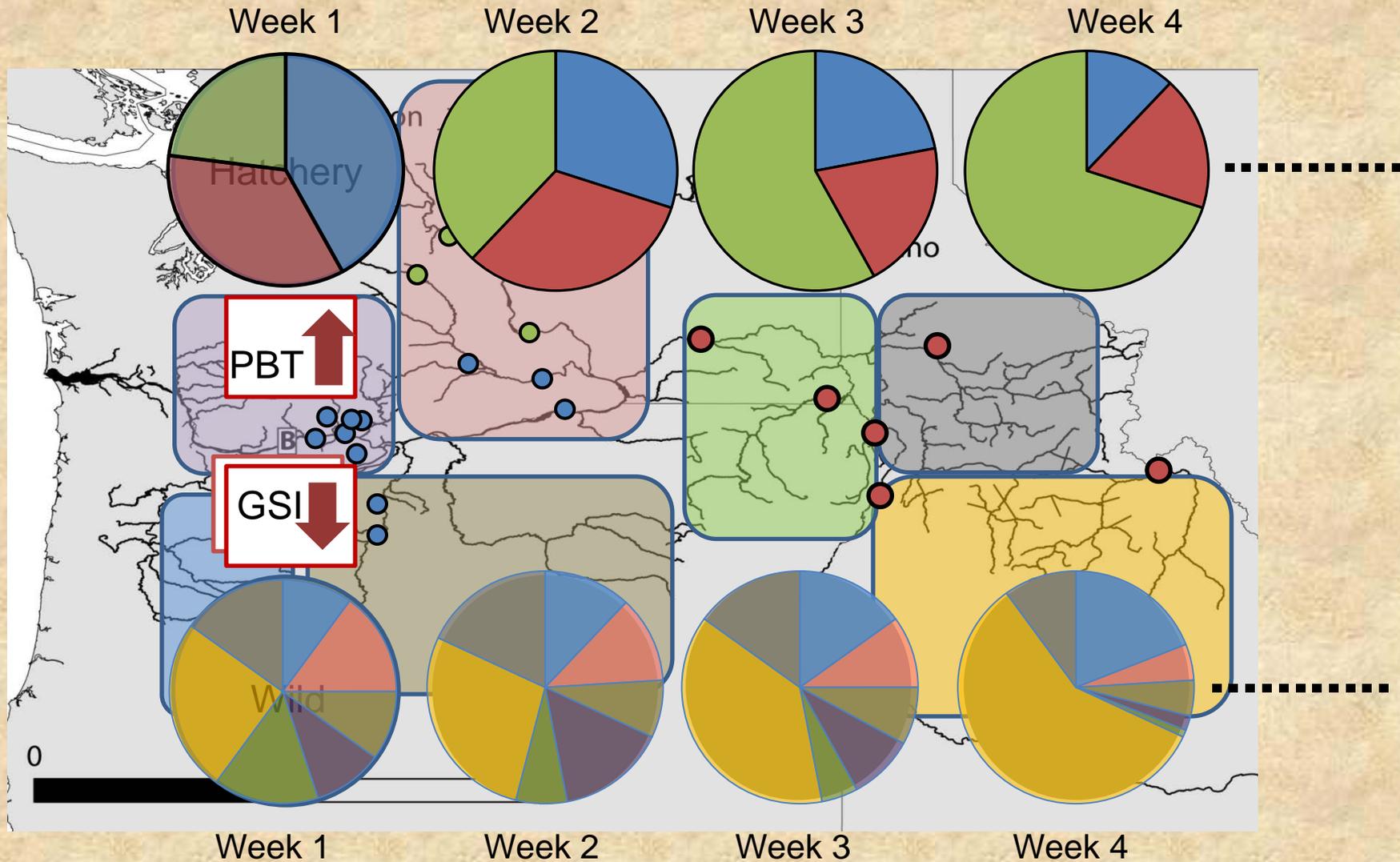


Commercial  
Fishery



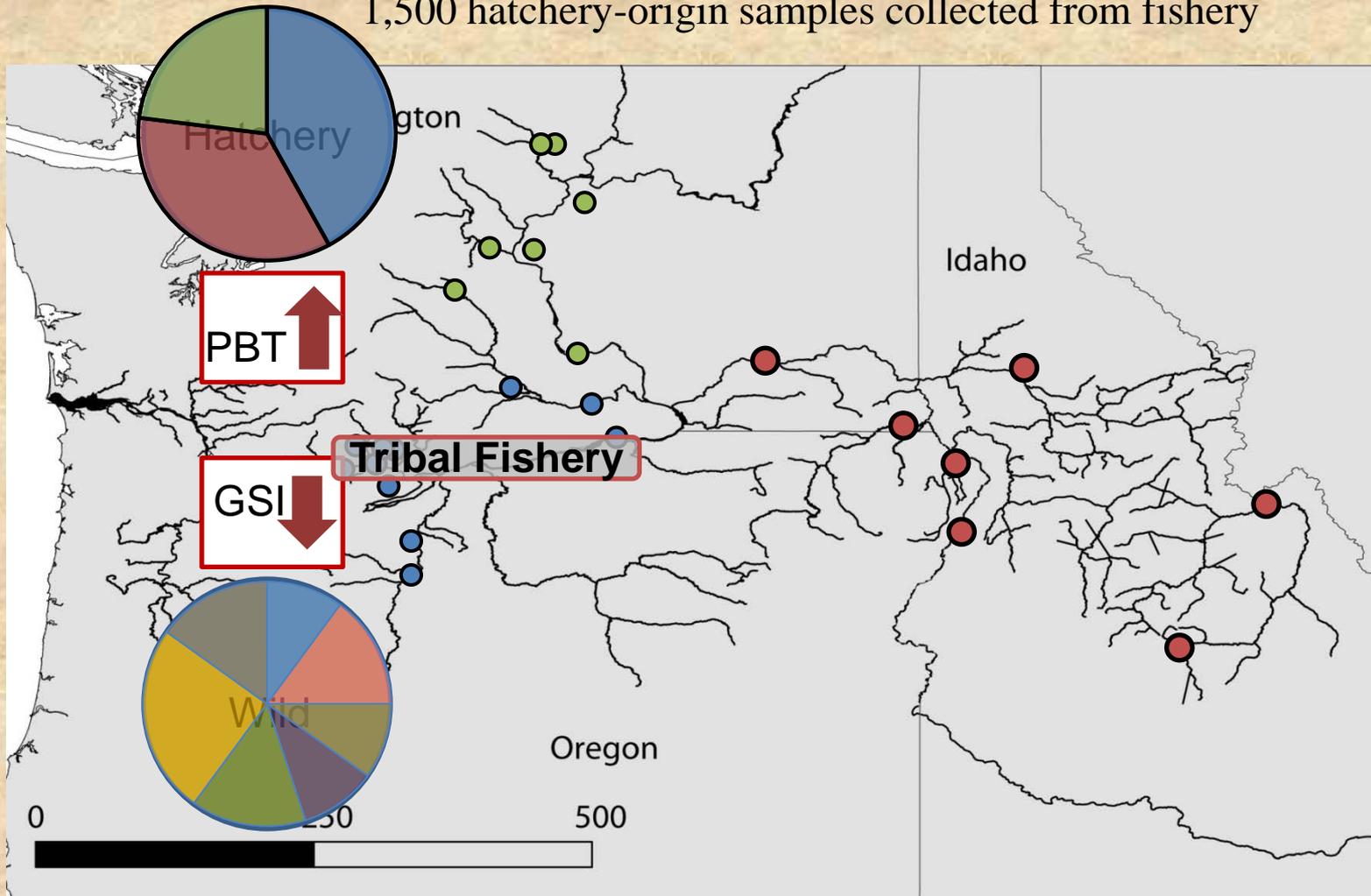
# Bonneville Dam:

- Weekly sampling April - October
- Stock specific return timing



# Example application: Origin and age of harvest fishery?

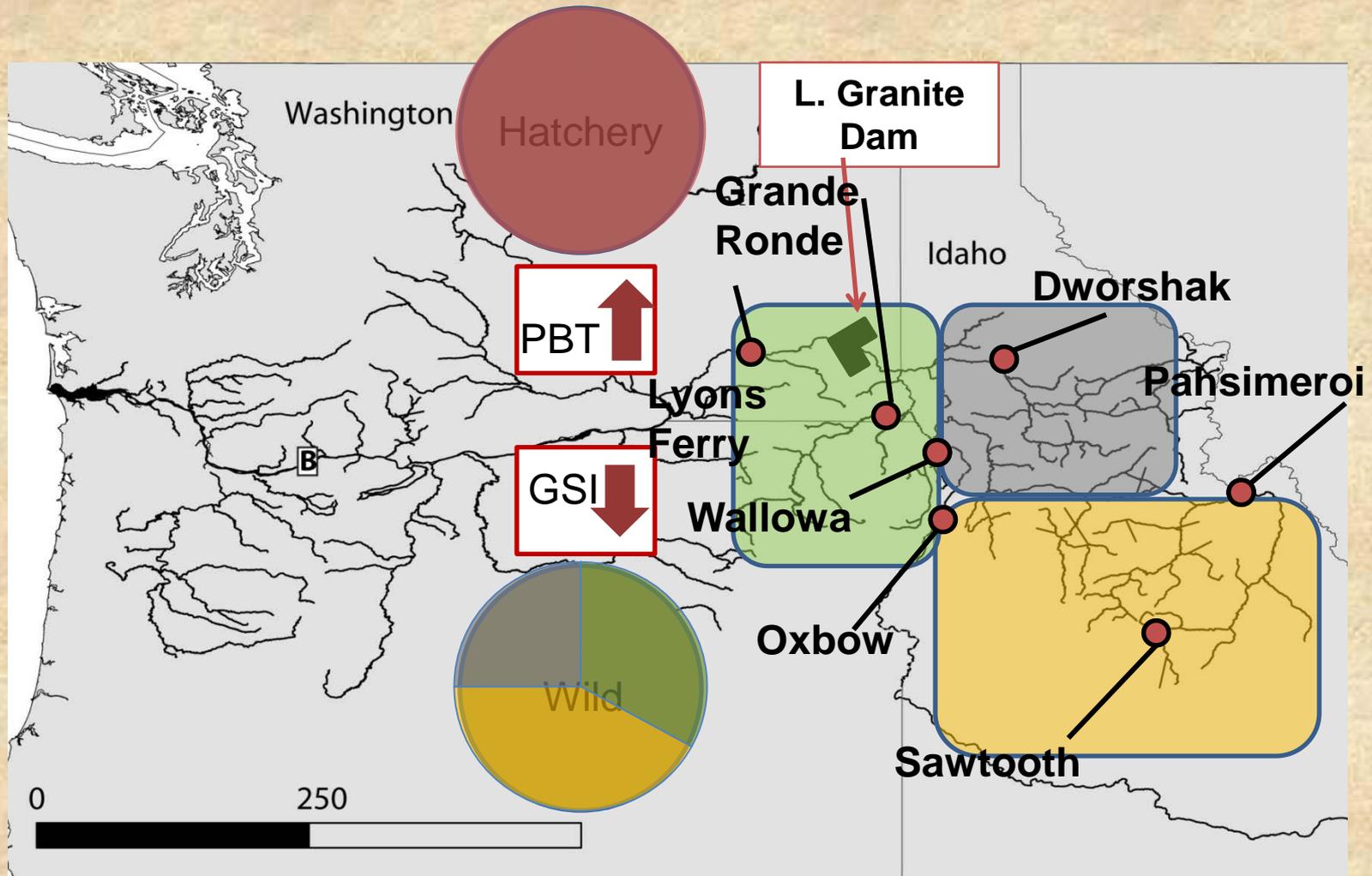
1,500 hatchery-origin samples collected from fishery



600 wild samples collected from fishery

# Lower Granite Dam:

- Weekly sampling June - October
- Stock specific return timing

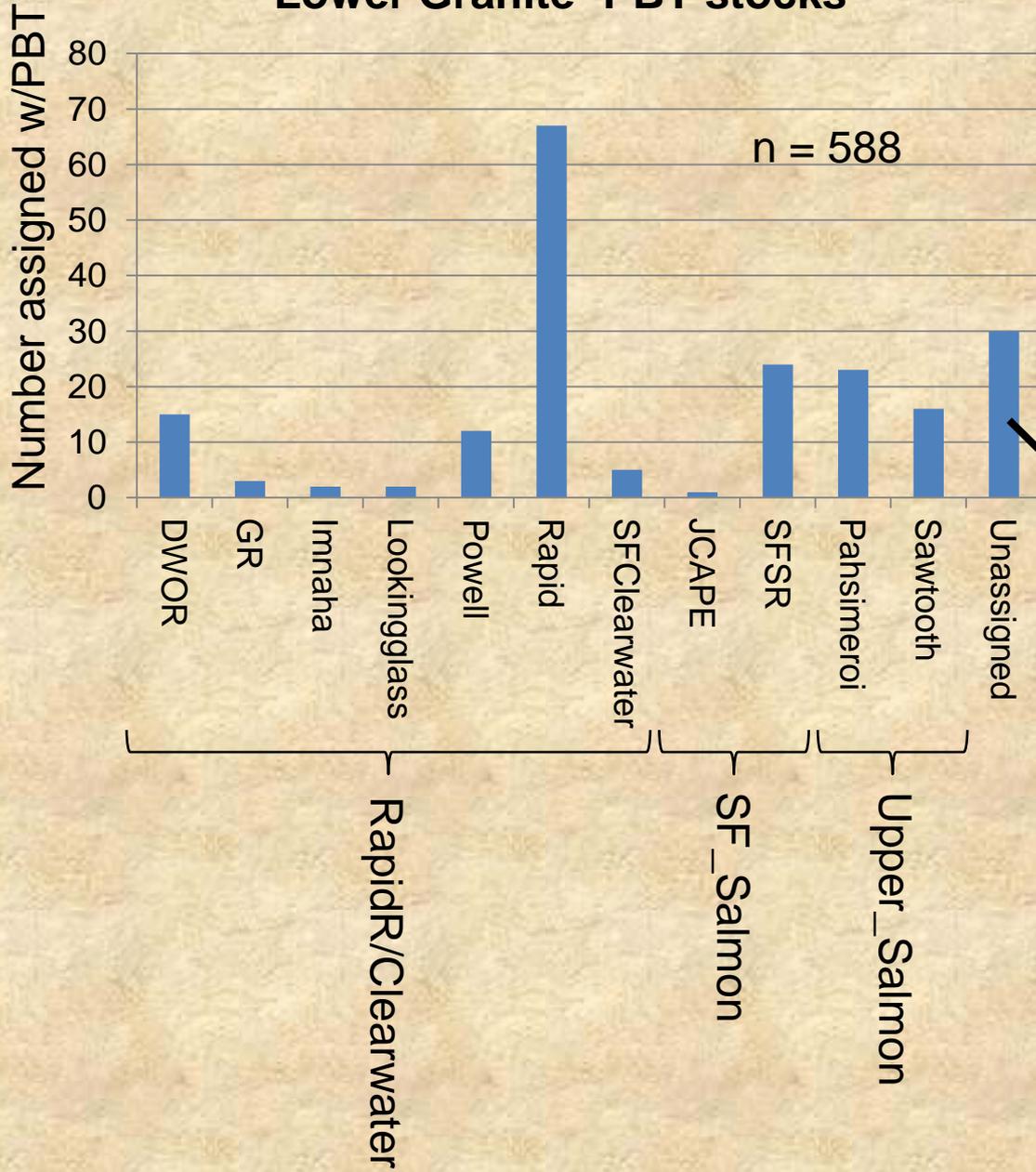


# Juvenile Monitoring

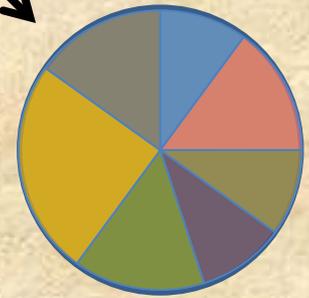
- **Run-of-river Chinook smolts**
- **Collected at Bonneville and Lower Granite dams**
- **Both adipose intact and ad-clipped (hatchery) fish**
- **Small non-lethal tissue clip for SNP markers for PBT & GSI**
- **Relate stock survival and abundance to migration patterns from other physical tags (i.e. PIT tags)**



# Lower Granite- PBT stocks



GSI for unassigned fish



# Genetic Tagging & Monitoring

- Adult return timing by stock (dams)
  - What stocks are most abundant in the river over the course of their migration seasons
- Stock specific harvest information
  - Highly relevant for allocation agreements between lower and upriver partners
- Juvenile stock monitoring
  - Non-lethal sampling, provides stock abundance information for out-migrating juveniles
  - Can link stock info to migration data (i.e. PIT tags)

# Acknowledgements

- Field sampling: NPT, YN, CTUIR, CTWSIR, IDFG, WDFW, ODFW, NOAA
- Laboratory: Vanessa Morman, Lori Maxwell, Amanda Matala, Stephanie Harmon, Megan Moore, Nick Hoffman, Travis Jacobson, Jeff Stephenson
- CRITFC Project Leader: Dr. Jon Hess
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