

## RRS Project Review

**Project ID:** 2007-299-00<sup>1</sup>

**Title:** Investigation of Relative Reproductive Success of Stray Hatchery & Wild Steelhead & Influence of Hatchery Strays on Natural Productivity in Deschutes

**Short Description:** The purpose of this project is to provide a better understanding of the impacts of stray hatchery steelhead on the viability of Deschutes steelhead by assessing: 1) relative reproductive success of natural spawning stray hatchery and wild fish, 2) number and origin of strays in Bakeoven and Buck Hollow creeks, and 3) changes in survival, productivity and life history resulting from removal of stray hatchery spawners. This work is important because out of basin strays are a key threat to recovery of Deschutes steelhead populations.

**Sponsor:** Oregon Department of Fish & Wildlife

**BiOp association:**

RPA 64.2: Determine if artificial production contributes to recovery

**Is this an Accord project?** No

**Budget (2008 to present)**

BPA	Total	\$ 2,703,340
	FY16	\$ 335,000
Cost share	No cost share	

**Proposal from last Categorical Review:**

<https://www.cbfish.org/Proposal.mvc/Summary/RMECAT-2007-299-00>

**Most recent Council recommendation:**

<https://www.cbfish.org/Assessment.mvc/CouncilRecommendationAssessmentSummary/Assessment/2007-299-00-NPCC-20110124>

\*\*Sponsor has an outstanding deliverable, which was due in 2013. See Comments section below.

**Date of most recent annual report available on Pisces/cbfish?**

<https://pisces.bpa.gov/release/documents/DocumentViewer.aspx?doc=P148819>

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<sup>1</sup> This is one of the six exclusively RRS projects in the program.

**Short summary of project reporting compliance:** Generally good compliance as far as timeline and following the RM&E template.

**Summary of the scope of the project as it was reviewed by Council:** The goal of this project is to measure the effects of stray hatchery steelhead, released from hatcheries in other subbasins with the Columbia River, using a BACI manipulative experiment. The hypothesis held that stray hatchery steelhead enter the Deschutes River, apparently to seek refuge in the cool water, and an unknown number remain and spawn with wild Deschutes River steelhead. Initial assumptions were that out of basin hatchery steelhead abundance was 0.5 to 10 times the abundance of wild spawning steelhead, and the effects of this swamping were unknown. The investigators proposed to evaluate the relative reproductive success (RRS) of stray hatchery and wild steelhead in two eastside tributaries of the Deschutes River, and to remove hatchery strays from a treatment stream and compare the RRS of wild steelhead in the treatment stream to those in a control stream.

**Summary of the scope of the project now:** Essentially the same as when it began.

**Has the scope of this project changed significantly since it was reviewed?** No

**Link to ISRP/AB Critical Uncertainties Appendix D review:**

<http://www.nwcouncil.org/media/7149871/isabisrp2016-1appendixd.pdf#page=130>

**Comments:**

From an administrative perspective, the 2011 Council recommendation for this project included “In two years, the project proponents should provide a report on genotyping, success with the identification of stray hatchery fish, capture of adults and smolts in the target streams, and exclusion of hatchery adults in the target stream” - this report has not been submitted as of August 2016. From a policy perspective, results from this project may have little value to the decision makers and resource managers. For example, since implementation began in August 2010, the number of out of basin hatchery strays entering Deschutes River tributaries has not been sufficient (6% in most recent annual report) to meet the requirements of the study design (estimated at 50% or greater). Furthermore, results from the 2014 annual report suggest that there is very little difference between the control and treatment streams, which in turn makes evaluating RRS difficult or impossible for this study. In other words, the data are, and will likely remain insufficient to evaluate the genetic and demographic effects of out of basin straying as stated in the ISRP qualification for meeting scientific review criteria.

**Questions to all project sponsors with RRS studies:**

- How does this project inform (1) the Council’s Research Plan and (2) the Council’s Fish and Wildlife Program objectives?
- Can any results from this study be extrapolated to other geographic locations or other populations?
- How does the Idaho Supplementation Study inform this project?

- Does this project have any of the following elements:
  - (a) A scientific question
  - (b) A hypothesis
  - (c) A specific time frame within which to answer the question posed
- How was it determined which species or geographic area to study?
- How does this effort work or collaborate with other RRS projects on aspects of the study (methodology, data and conclusions)?
- How does **density dependence** factor in to this study moving forward?

**Questions relative to this project:**

- The original hypotheses for this RRS study presumed high proportions of out of basin steelhead strays, which is now known not to be the situation. Given this situation is it now time to end this RRS study?
- Why has the sponsor not addressed Council recommendations?
- Can the evaluation of RRS occur with little difference between treatment and control stream?
- What critical analysis of data could enable managers to assess whether or not the project can answer the questions originally proposed?
- What management actions might be informed by this research?
- Did the scope of this project change based on cumulative annual results to date?

# Deschutes Hatchery Stray Study

**Derrek Faber & Wayne Wilson** – *Oregon Department of Fish and Wildlife  
The Dalles Fish Research*

**Rich Carmichael & James Ruzycki** – *Oregon Department of Fish and Wildlife  
La Grande Fish Research*

**in collaboration with**

**Matt Smith** – *USFWS Abernathy Fish  
Technology Center*





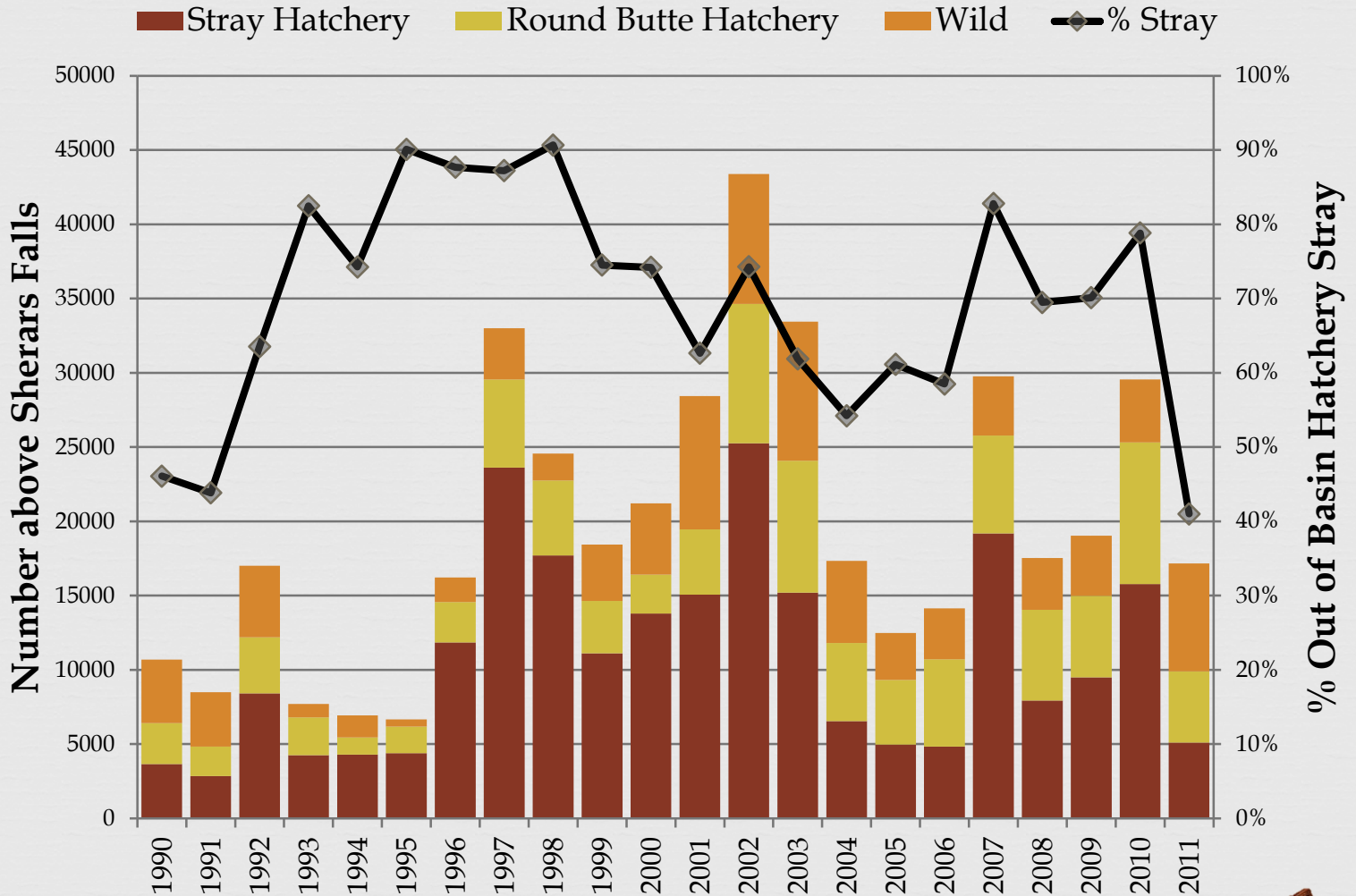
# Background

- Mid-Columbia steelhead as 'Threatened' under the ESA.
- Hatchery strays (Snake River steelhead) substantial proportion of the harvest and recoveries at collection sites on the Deschutes (Sherars, Round Butte, Warm Springs).
- Deschutes steelhead population considered at high risk of extinction due to abundance of stray hatchery fish (Chilcote 2001).





# Sherars Falls Catch Composition







Buck Hollow Creek

Bakeoven Creek

Deschutes River

Sherars Falls



Maupin





# Study Objectives:

“Deschutes Hatchery Stray Study”



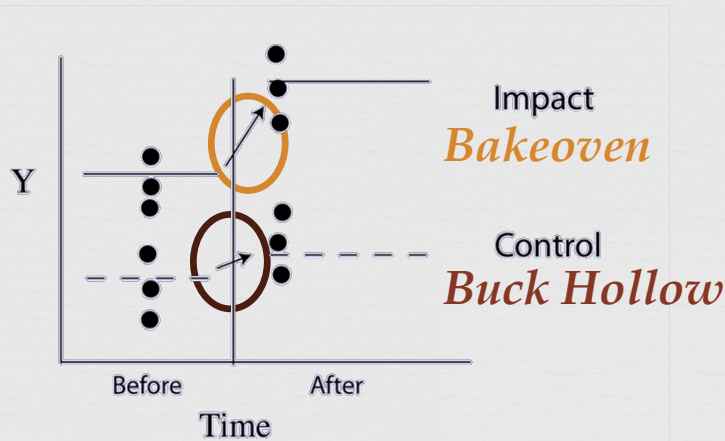
- ❧ Ideal for Before-After-Control Impact (BACI) Design
- ❧ Determine spawning success of hatchery steelhead crosses
  - ❧ Parentage tracking
  - ❧ Population Dynamics
- ❧ Determine origin of hatchery strays spawning in creeks





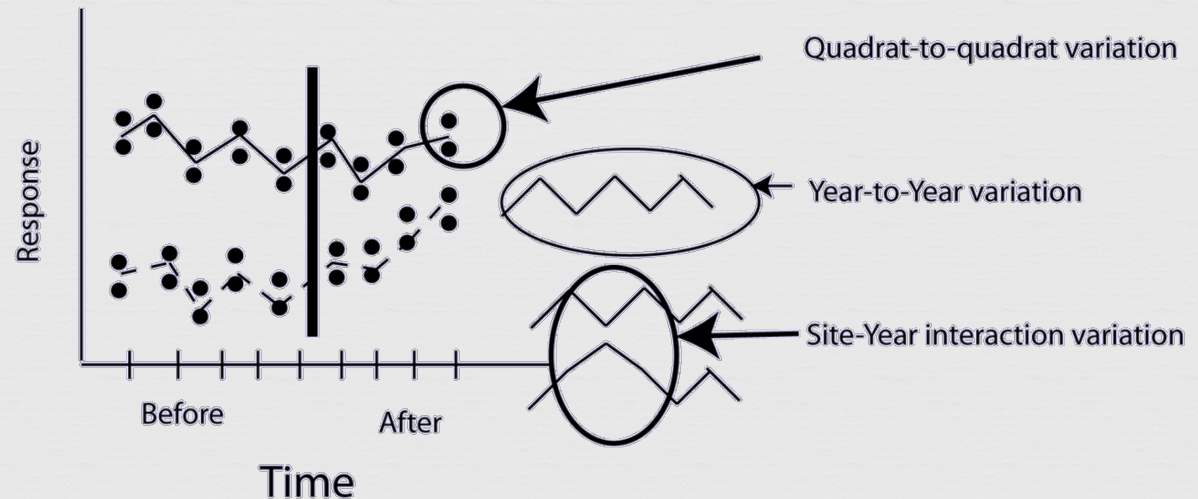


# BACI Experimental Design\*



Difference in magnitude of change

- Recruitment
- Smolt Production



\*Schwarz, CS. 2012, "Design and Analysis of BACI Experiments", Simon Fraser University.  
<http://people.stat.sfu.ca/~cschwarz/Stat-650/Notes/MyPrograms/BACI/BACITalk-2012-10-15-UBC/baci.pdf>.





Operate Weir-traps and Smolt-traps daily

- Collect adult steelhead for genetics
- Collect juvenile steelhead to estimate production of parent pairs/SAR



Trap Box

Resistance-  
Panel  
Weir

Kelt Trap

Buck Hollow Creek Setup





# Data Collected/ Analyzed

- Species
- Length
- Weight
- Sex
- PIT Tag code
- Genetic ID
- Scale ID
- Life History Type
- Anomalies - Pathogens
- Instream PIT Arrays

Steelhead Trapping and Tagging

13257 New Tags Trapping and Tagging Migration Year 12 TAG Date/Time 05/03/2012 9:57  
Recaptures Water Temp (C) 11 Release Date/Time 05/03/2012 8:00:00 PM

TAG SITE BAKEOC SPECIES 3 STU  
TAGGER RINEARSON L RUN 2 STS  
Dorsal Score (1-5, good-bad) 0 D Length/Height (mm) 0 0 RBT  
REARING W COU  
PIT TAG 1 TRAP TYPE BTRAP CUT

**3D9.1C2DB0BF18**  
Forklength Weight  
Length? 193.41 75.5  
Condition Factor 1.044

Scale-Card Barcode or Number ODFW\_TDA\_2012\_009407 GENETICS BOX & VIAL # 2471 521  
Adult New Adult Recap Resident (Redband) Juvenile Parr/Fry Other Male Female Unknown

RECAP KELT Carcass CW Tag FLOY Tag Loose Tag  
RE KL CAW CWT FLOY TRAP N/A

ACQUSTIC TAG Code/CRC  
AT Ping Rate

Other Species

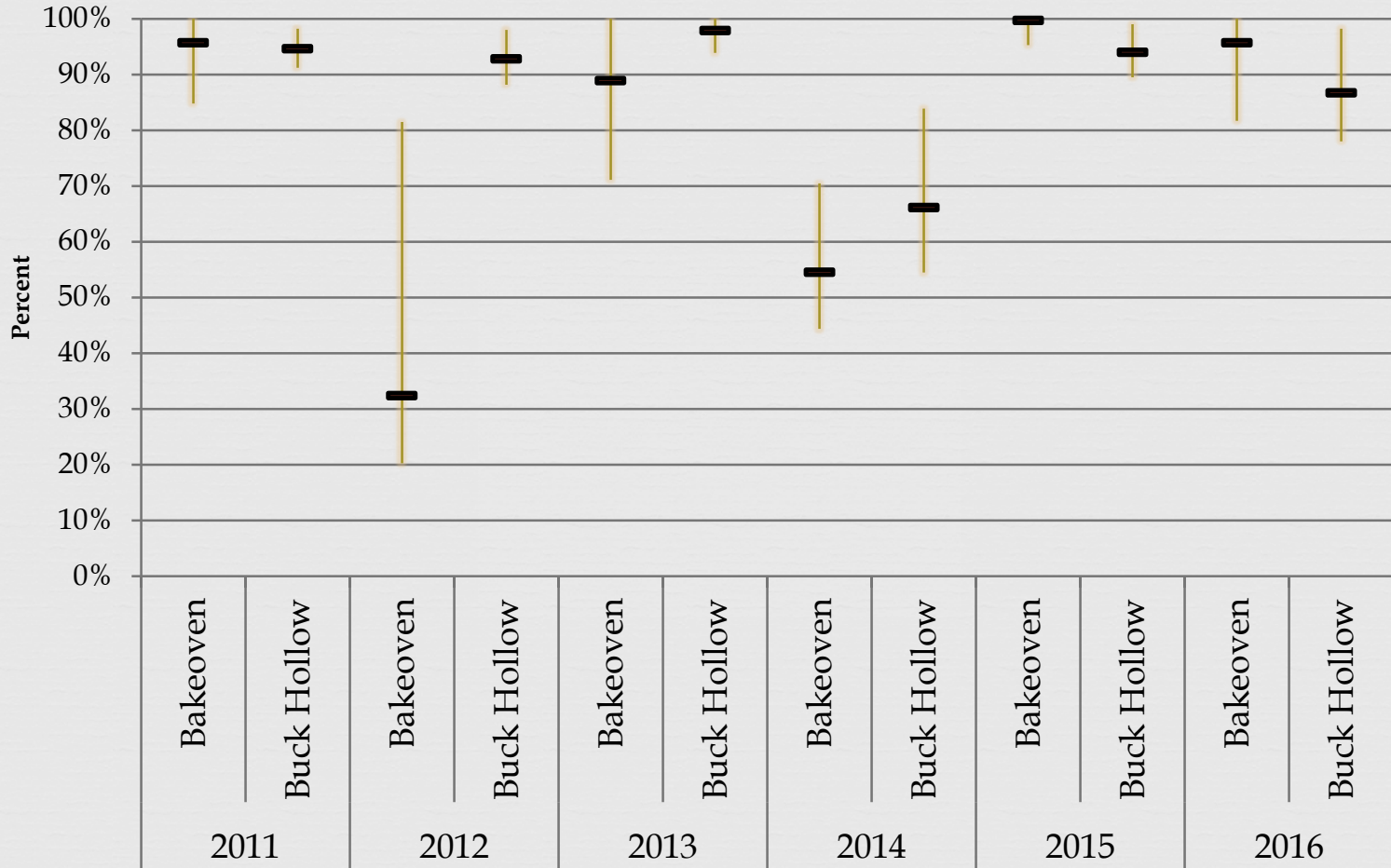
Accept/New Record







# Steelhead Trapping Efficiency



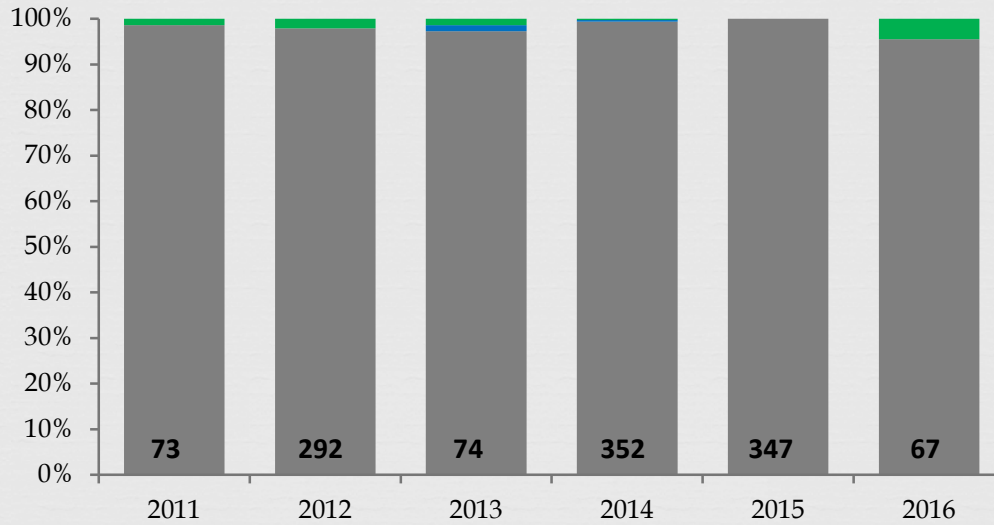


# Demographic Results

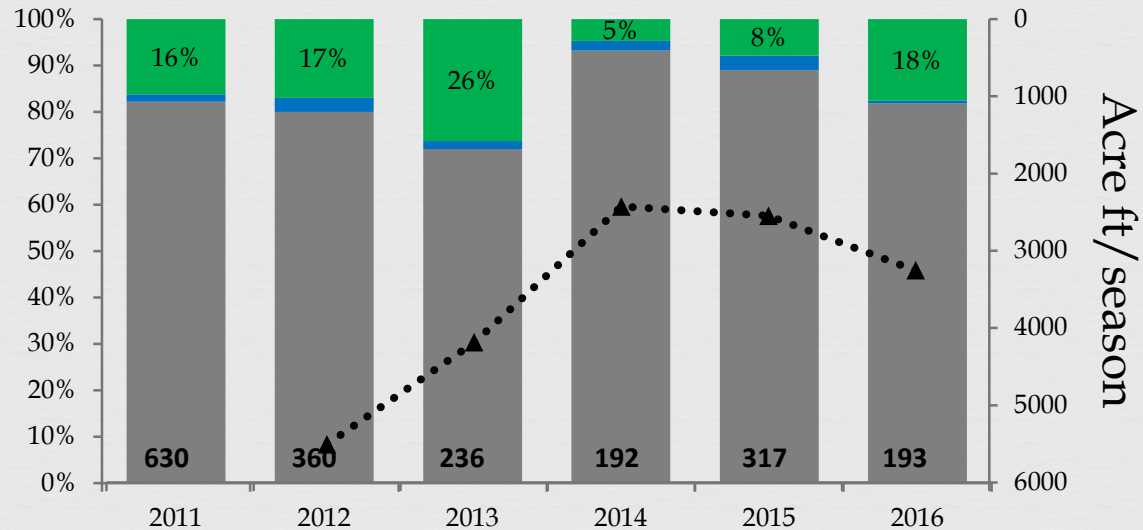


# Anadromous *O. mykiss*

Bakeoven  
Creek  
(Treatment)



Buck Hollow  
Creek  
(Control)



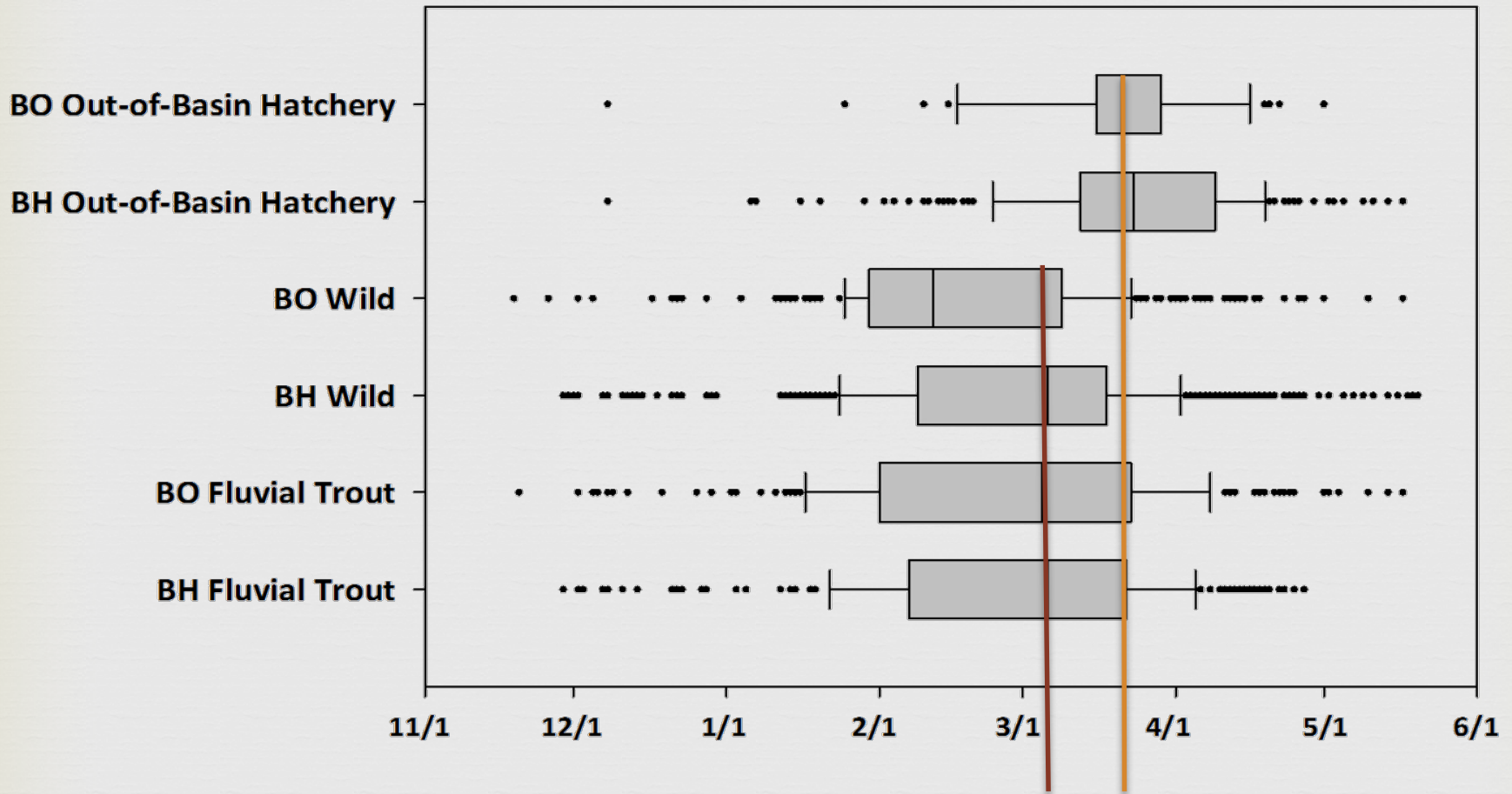
■ Wild Anadromous ■ In-Basin Stray ■ Out-of-Basin Stray





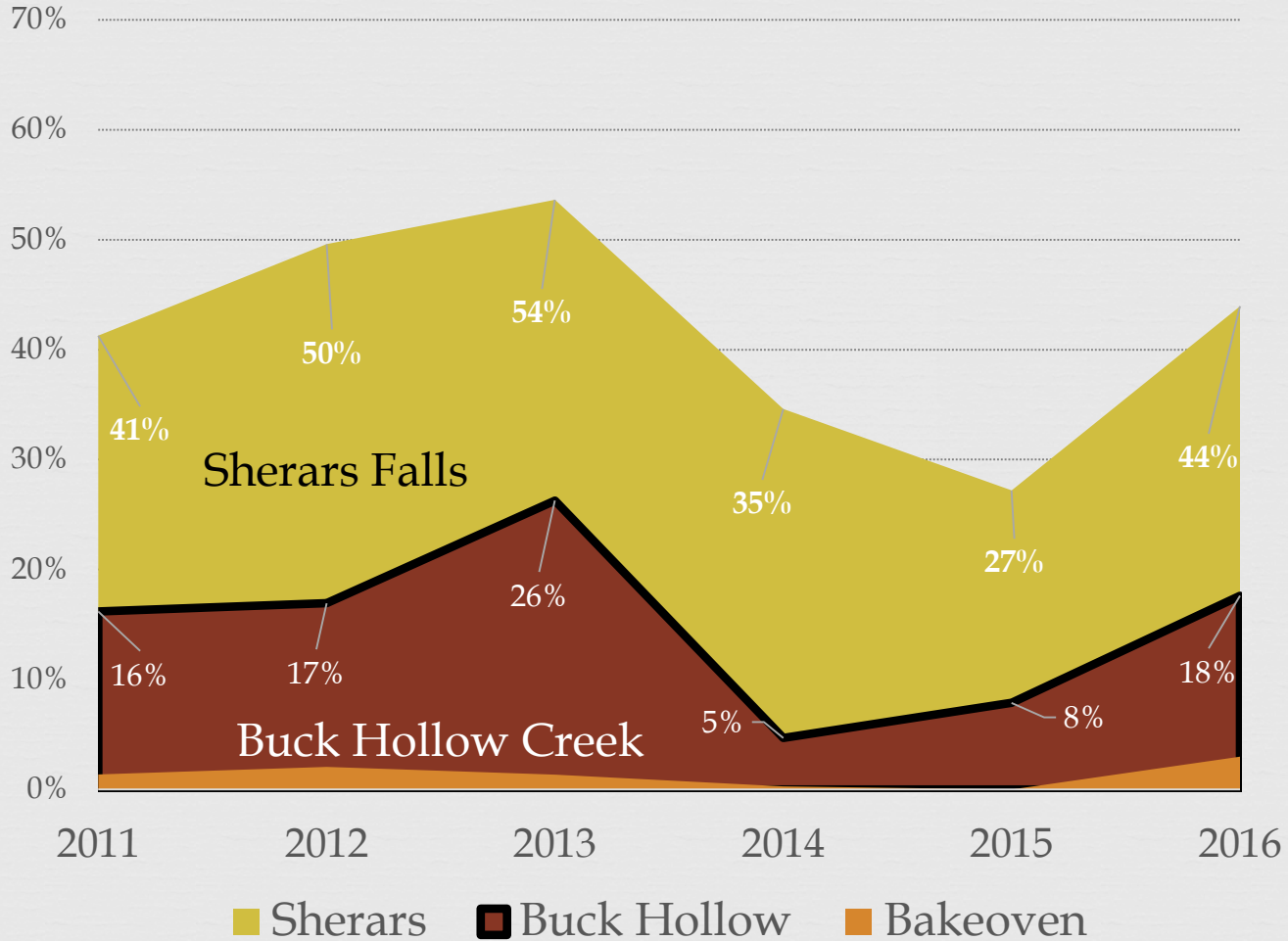


# Spawn-Run Timing 2011-2016



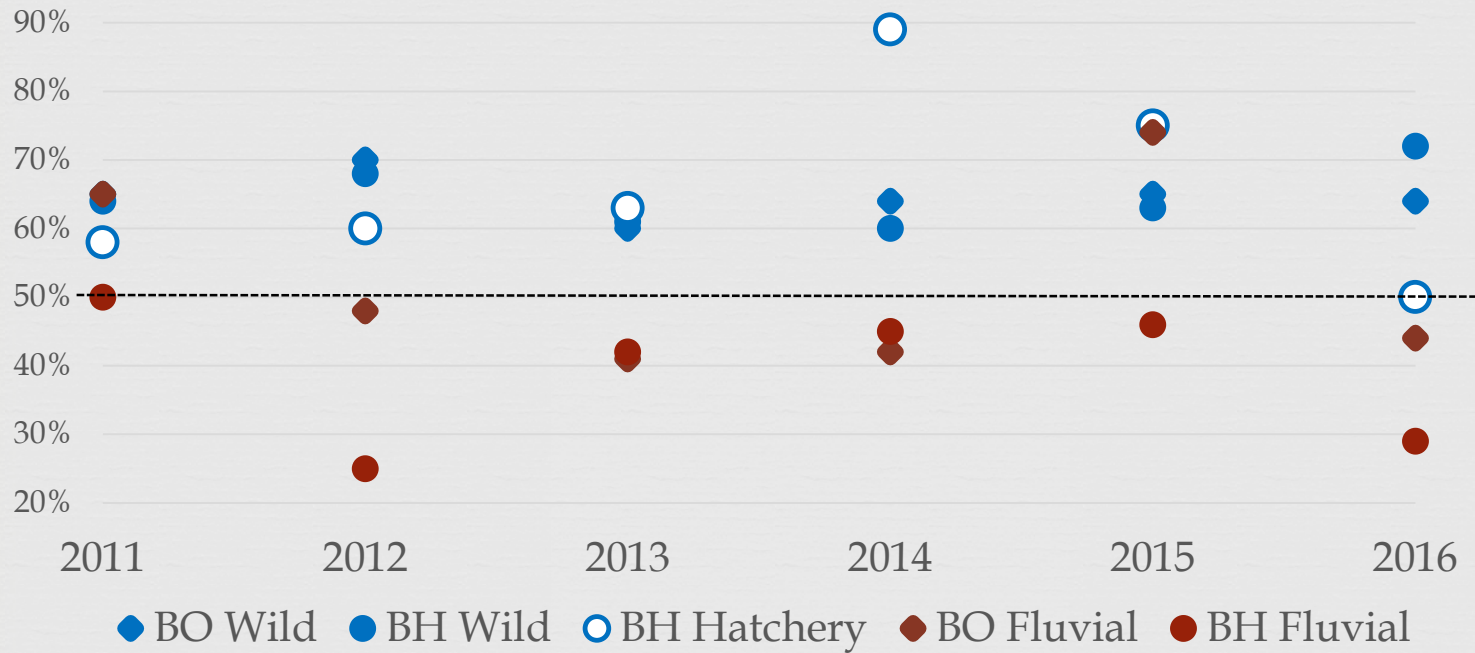


# Out-of-Basin Hatchery Stray Rate





## Sex Ratio % Female



## Outmigrant Age (mean 2011-2015)

	Age-1	Age-2	Age-3
Bakeoven Creek	91.4%	8.3%	0.3%
Buck Hollow Creek	93.2%	6.8%	0.0%







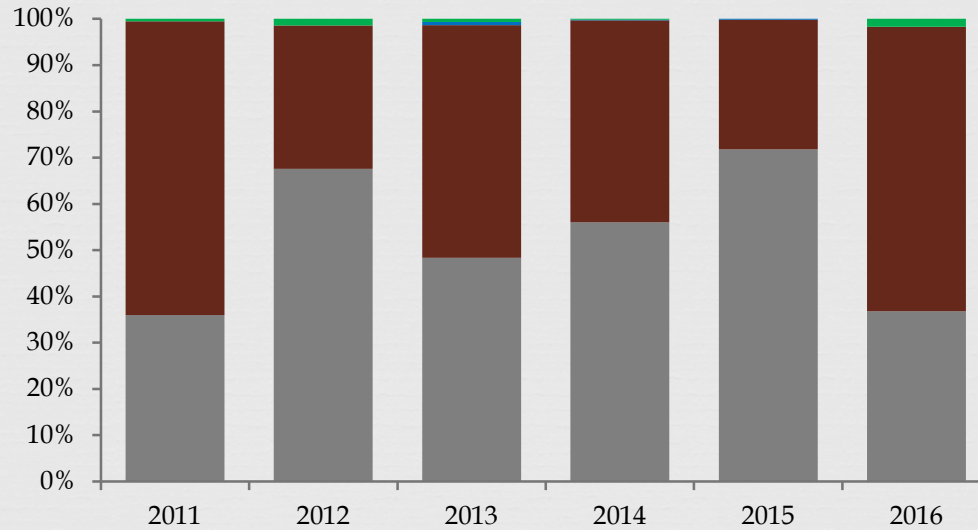
# Adult Age Structure

	Origin	n	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8
<b>Bakeoven</b>	Wild	714	17.1%	56.4%	24.0%	2.5%	0.0%	0.0%
<b>Buck Hollow</b>	Wild	1296	19.6%	51.6%	26.6%	2.3%	0.0%	0.0%
<b>Buck Hollow</b>	Out-of-basin Hatchery	282	57.4%	38.4%	4.3%	0.0%	0.0%	0.0%
<b>Bakeoven</b>	Fluvial Trout	386	45.8%	38.9%	12.7%	1.8%	0.4%	0.3%
<b>Buck Hollow</b>	Fluvial Trout	307	40.1%	48.1%	8.5%	3.0%	0.3%	0.0%

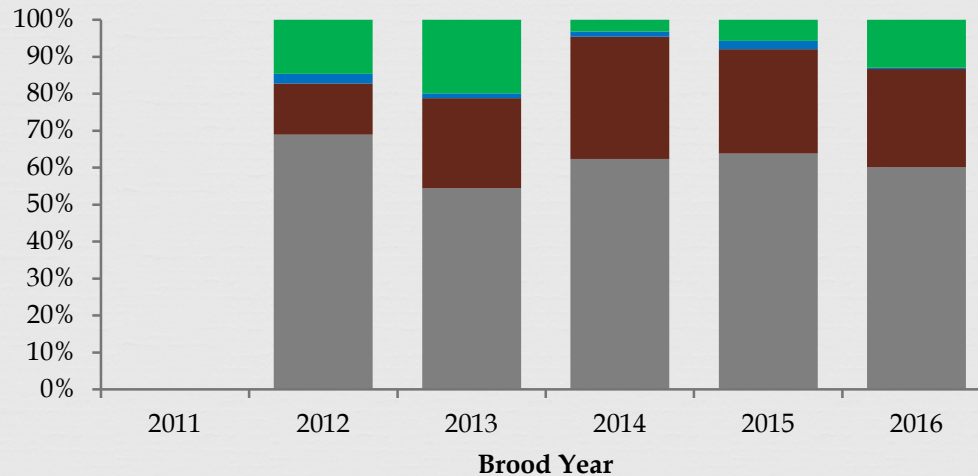


# Anadromous + Fluvial *O. mykiss*

## Bakeoven Creek



## Buck Hollow Creek

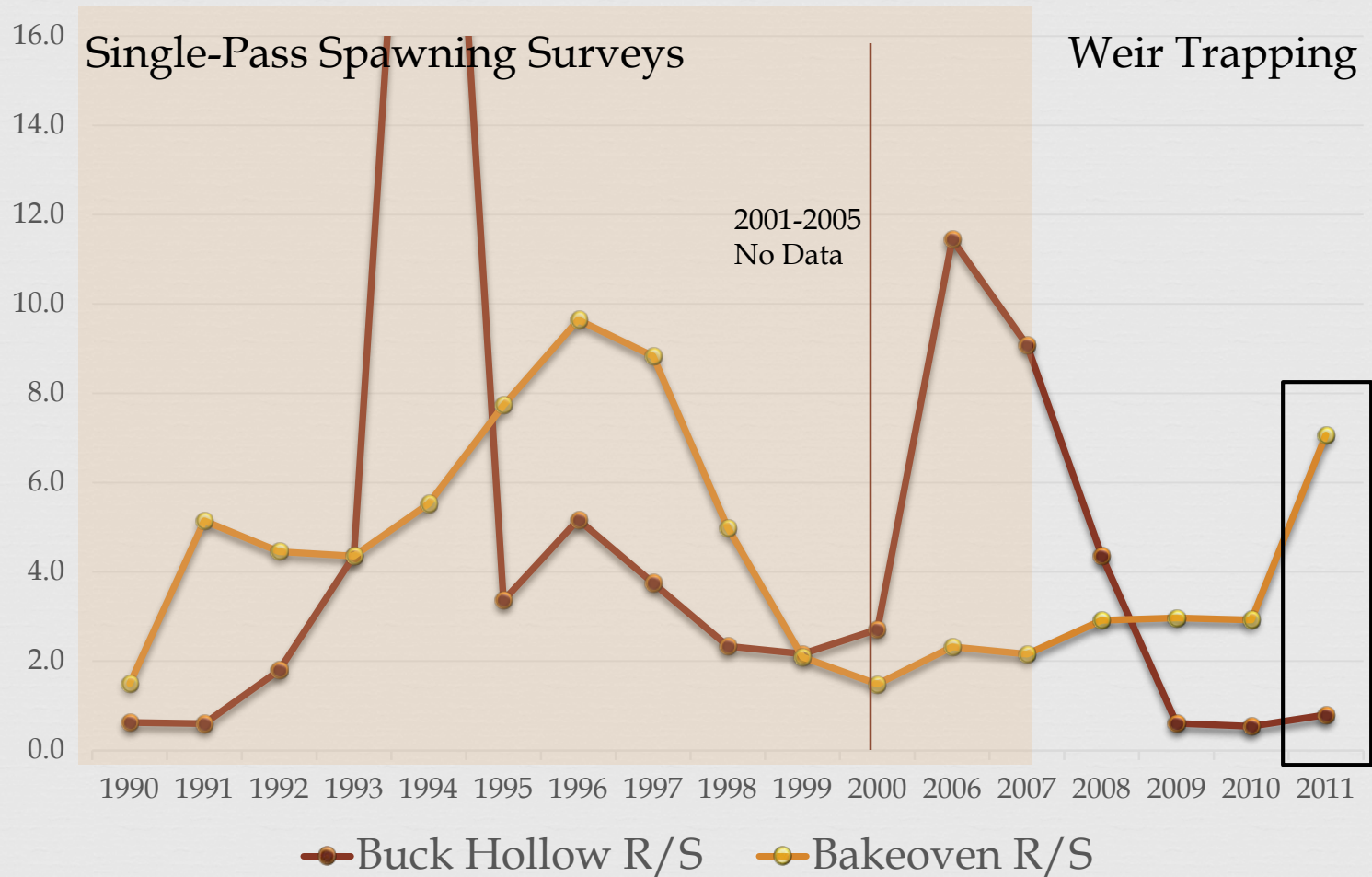


- Wild Anadromous
- Wild Fluvial Trout
- In-Basin Stray
- Out-of-Basin Stray





# Recruits per Spawner





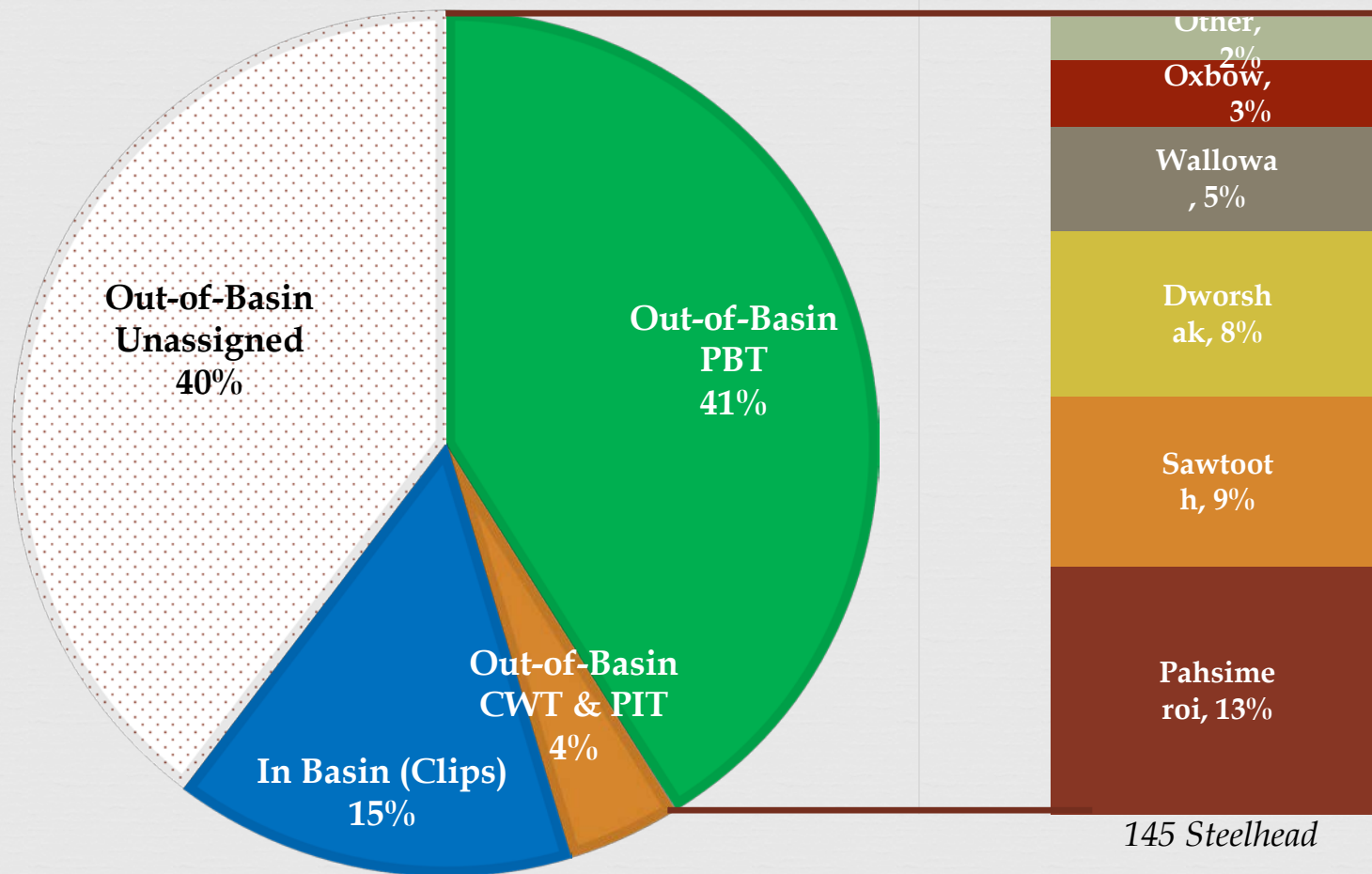


# Genetic Results





## HATCHERY ASSIGNMENTS - 2011 TO 2015

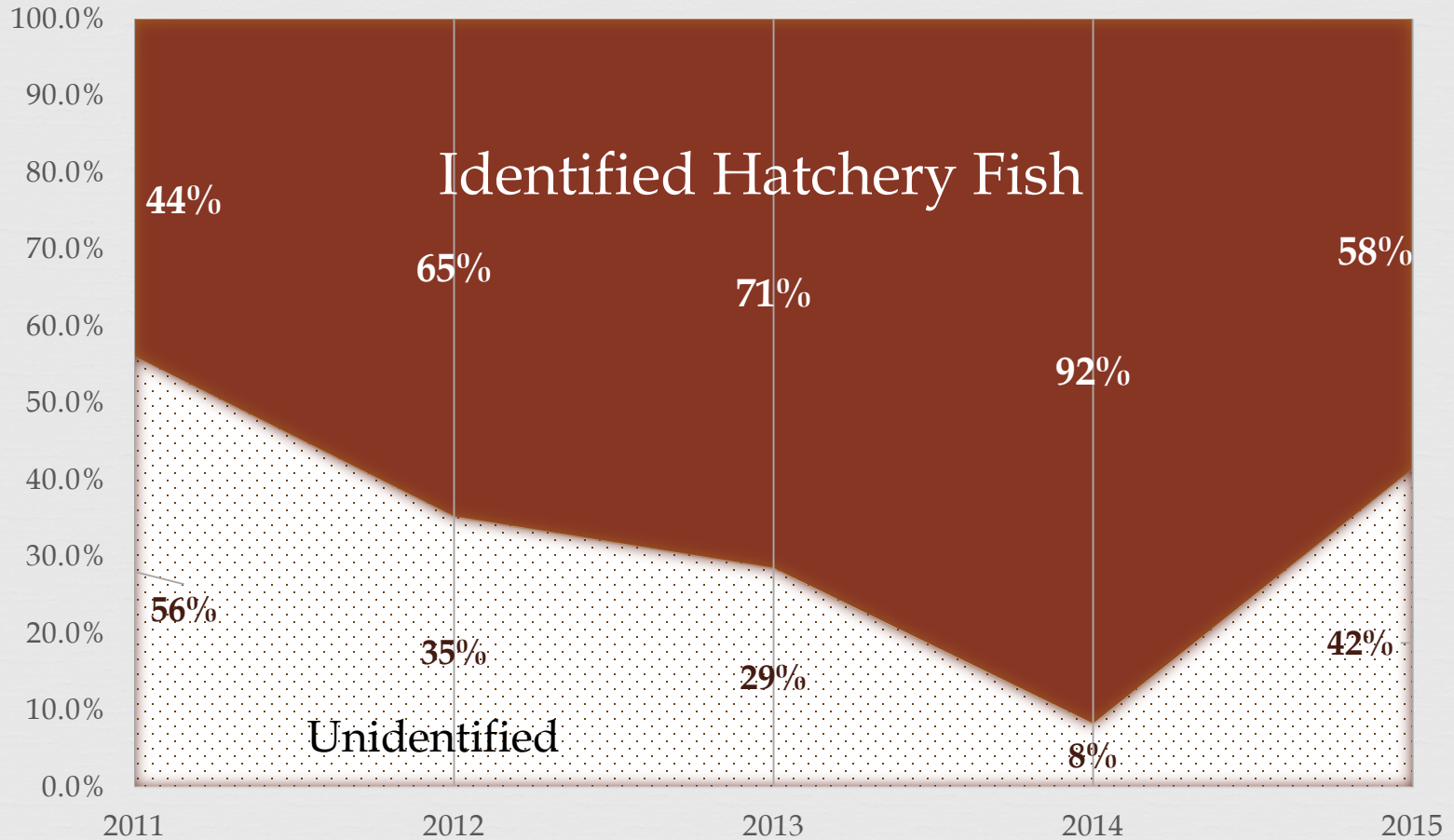


*n = 353 Total Hatchery Steelhead*





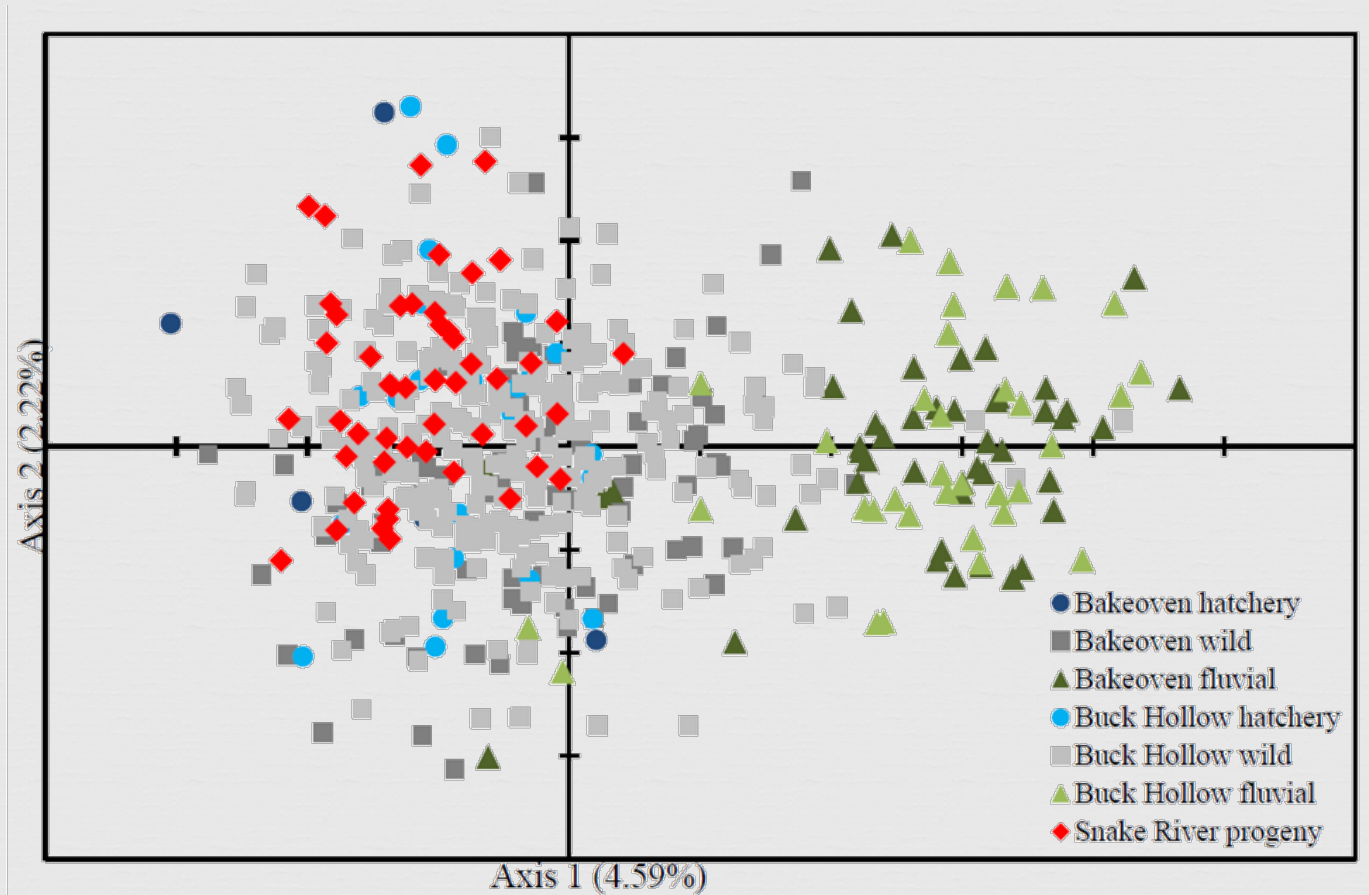
## HATCHERY ASSIGNMENT RATE BY YEAR





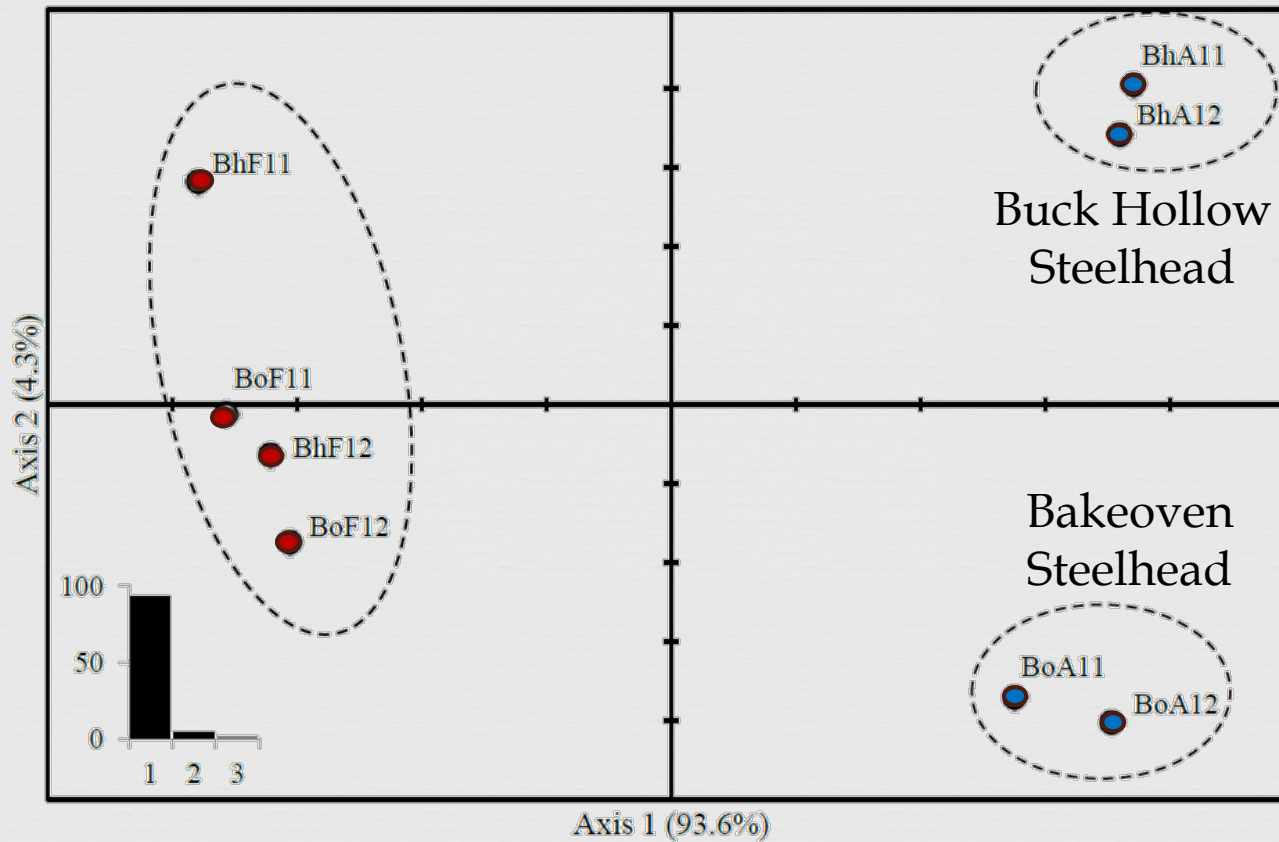


## Correspondence Analysis of Genotype



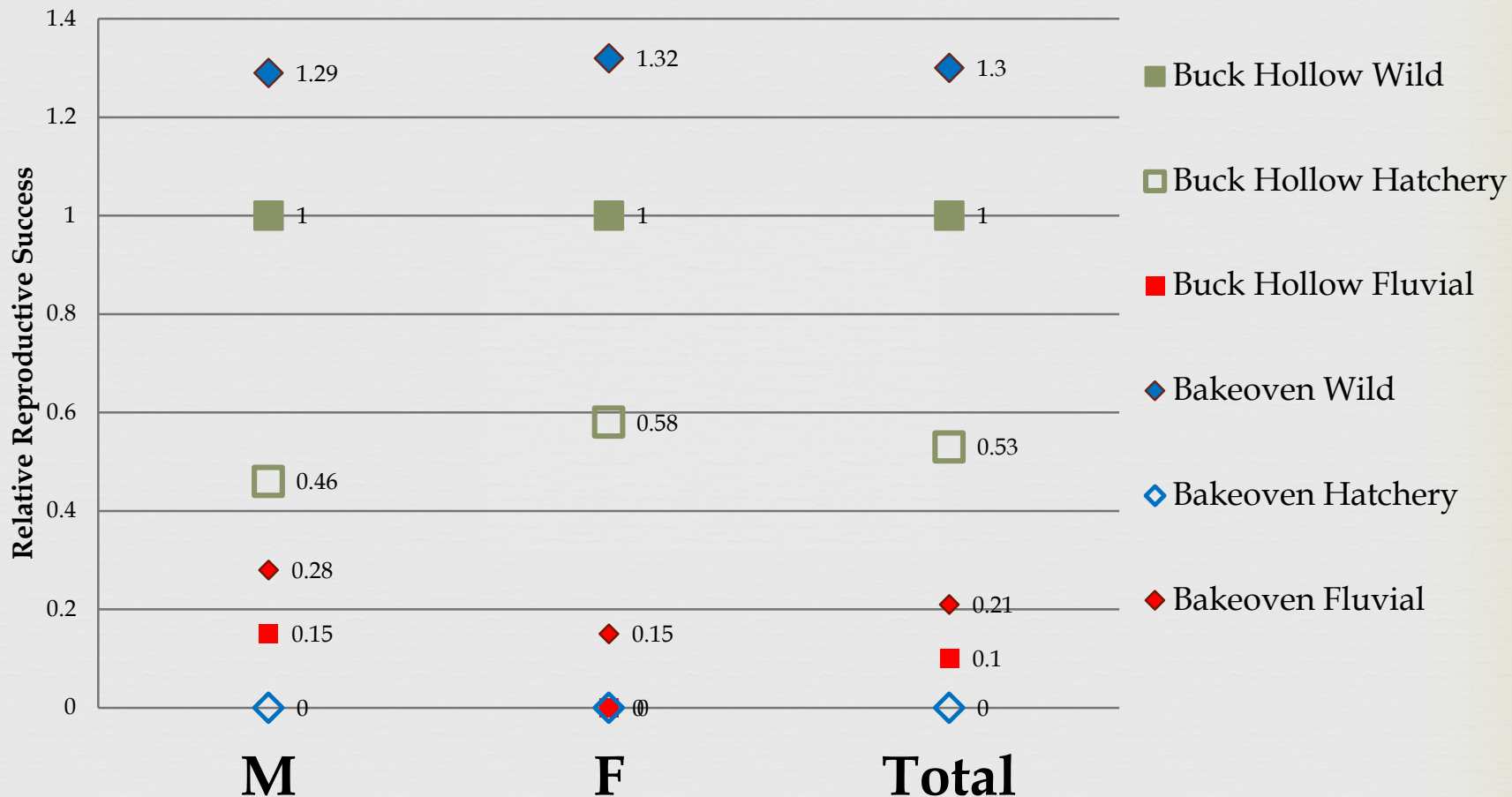


# Principal Coordinate Analysis of Pairwise $F_{ST}$





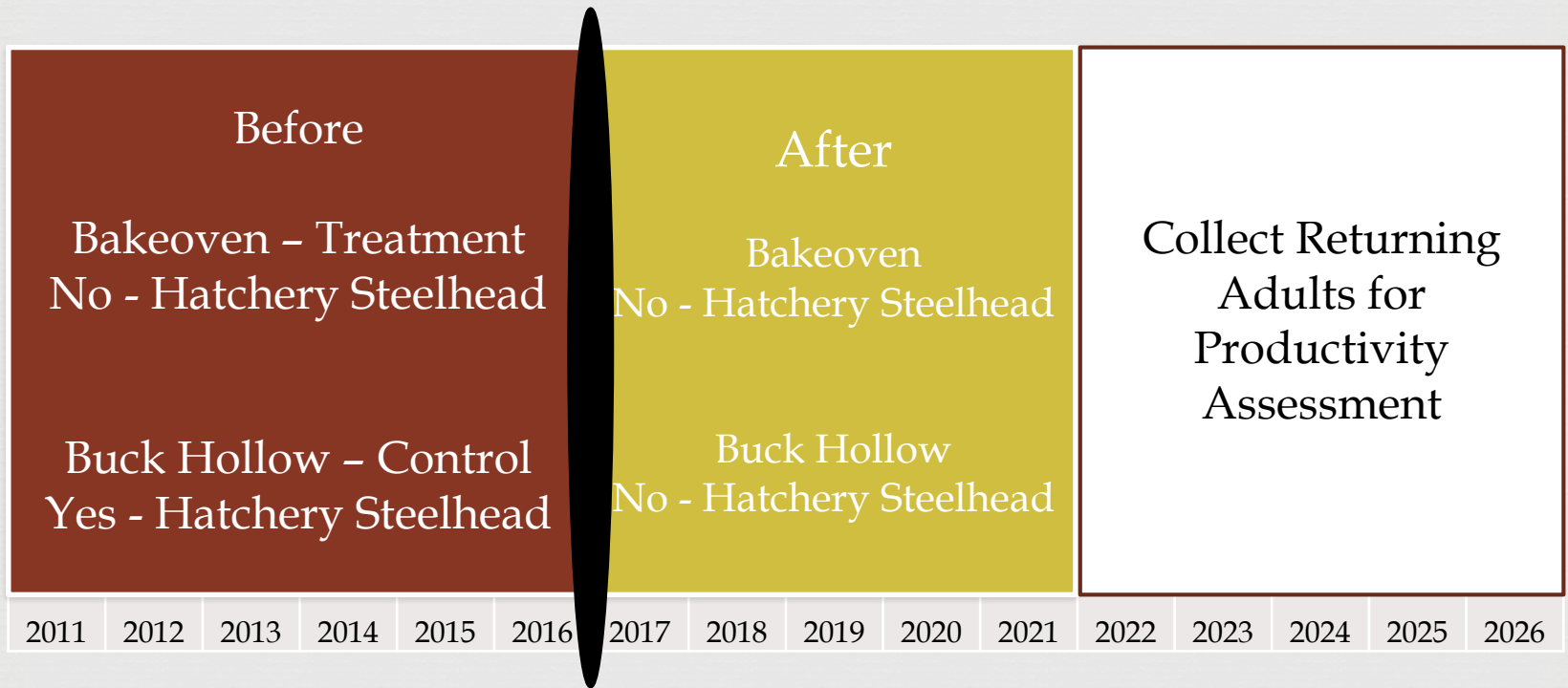
## Relative Success at Producing 1-yr old outmigrant (for all potential spawners)







# Study Timeline





# Summary

- Hatchery Fraction of Out-of-Basin Strays well above viability criteria.
- Sherars Falls still tallies elevated Hatchery to Wild percentages.
- Study is successful at identifying the majority of Hatchery Stray fish that enter or attempt to enter the creeks.
- We are *only now* beginning to collect adults from the first treatment year, for which the study was designed.





# Discussion

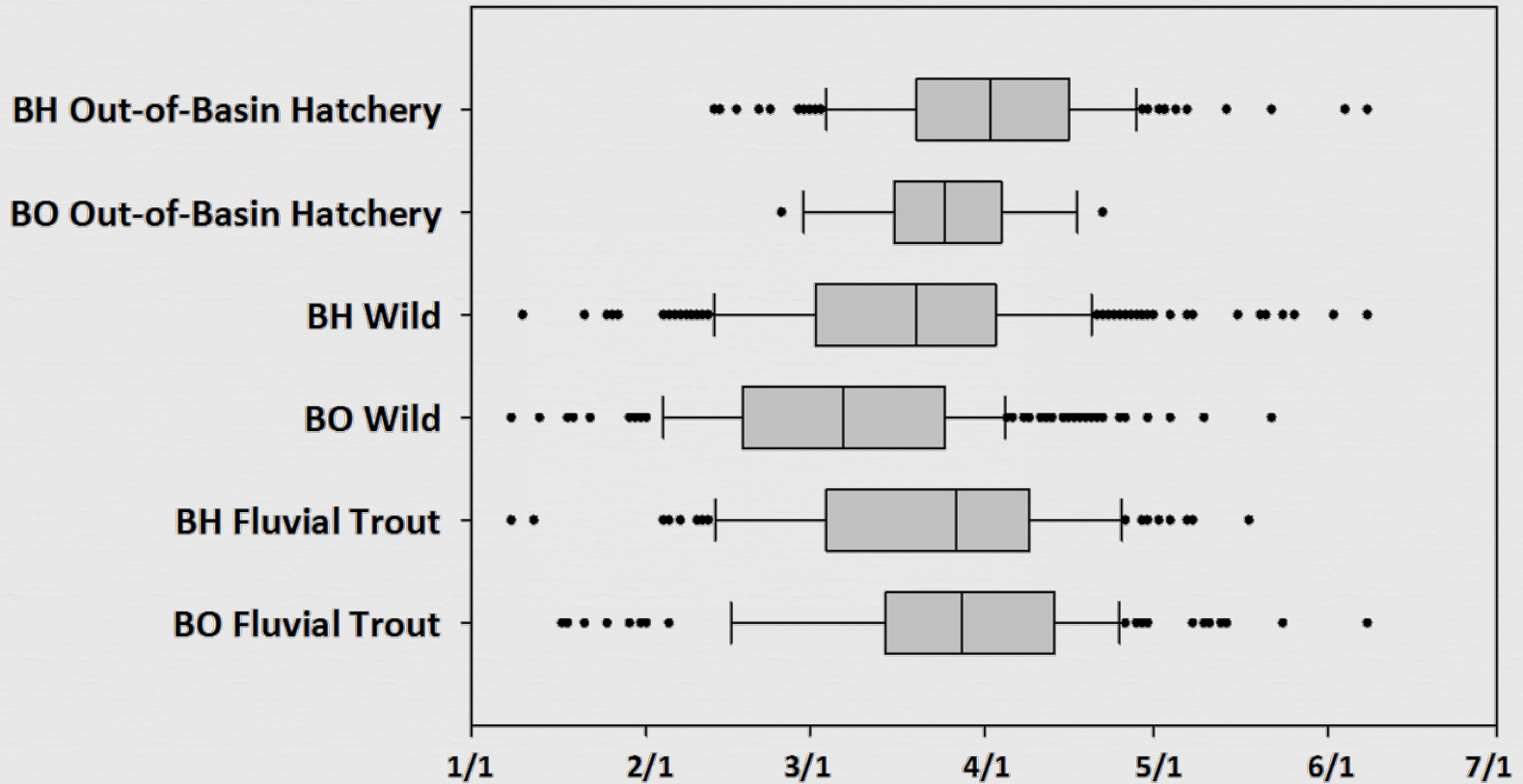
30,511 genetic samples of *O. mykiss*

- 2,167 wild adult steelhead
- 338 hatchery adult steelhead
- 1,369 fluvial or resident adult rainbow
- 7,040 smolt
- 18,612 juvenile/fry

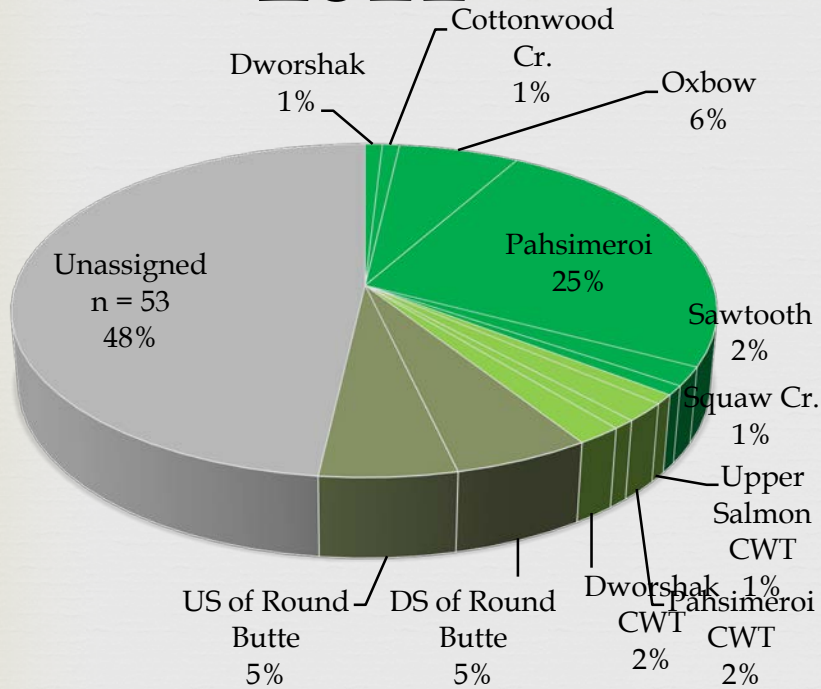




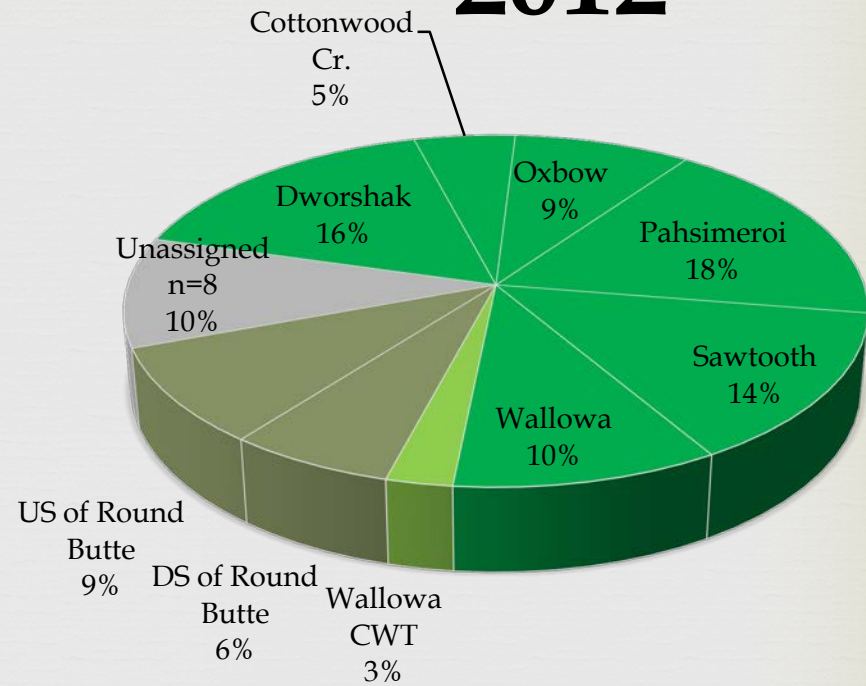
## Last Day in Creek as Kelt



# 2011



# 2012



# 2013

