

Origin and Assignment of Hatchery and Wild Steelhead Spawning in Bakeoven and Buck Hollow Creeks, Deschutes River

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Introduction

- Data collected as a part of Deschutes Hatchery Stray Study (2011-2017).
- Excluded Adult Hatchery Steelhead at Bakeoven Creek (2011-2016), allowed to spawn in Buck Hollow Ck.
- Results are based on PBT results and observations at weir-traps and juvenile outmigrant traps located at the creek mouths.
 - Genetic Results for 1 yr of juveniles in 2012 (Age 0 & 1).
 - Genetic Results for all adult returns from 2012-2015.





COLUMBIA RIVER

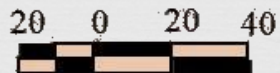
Mouth (RK 0)

Sherars Falls (RK 69)

Buck Hollow Ck.
Bakeoven Ck.

Warm Springs Hatchery

Pelton Trap (RK 161)



Kilometers





Buck Hollow Creek

Bakeoven Creek

Maupin

Sherars Falls

Deschutes River

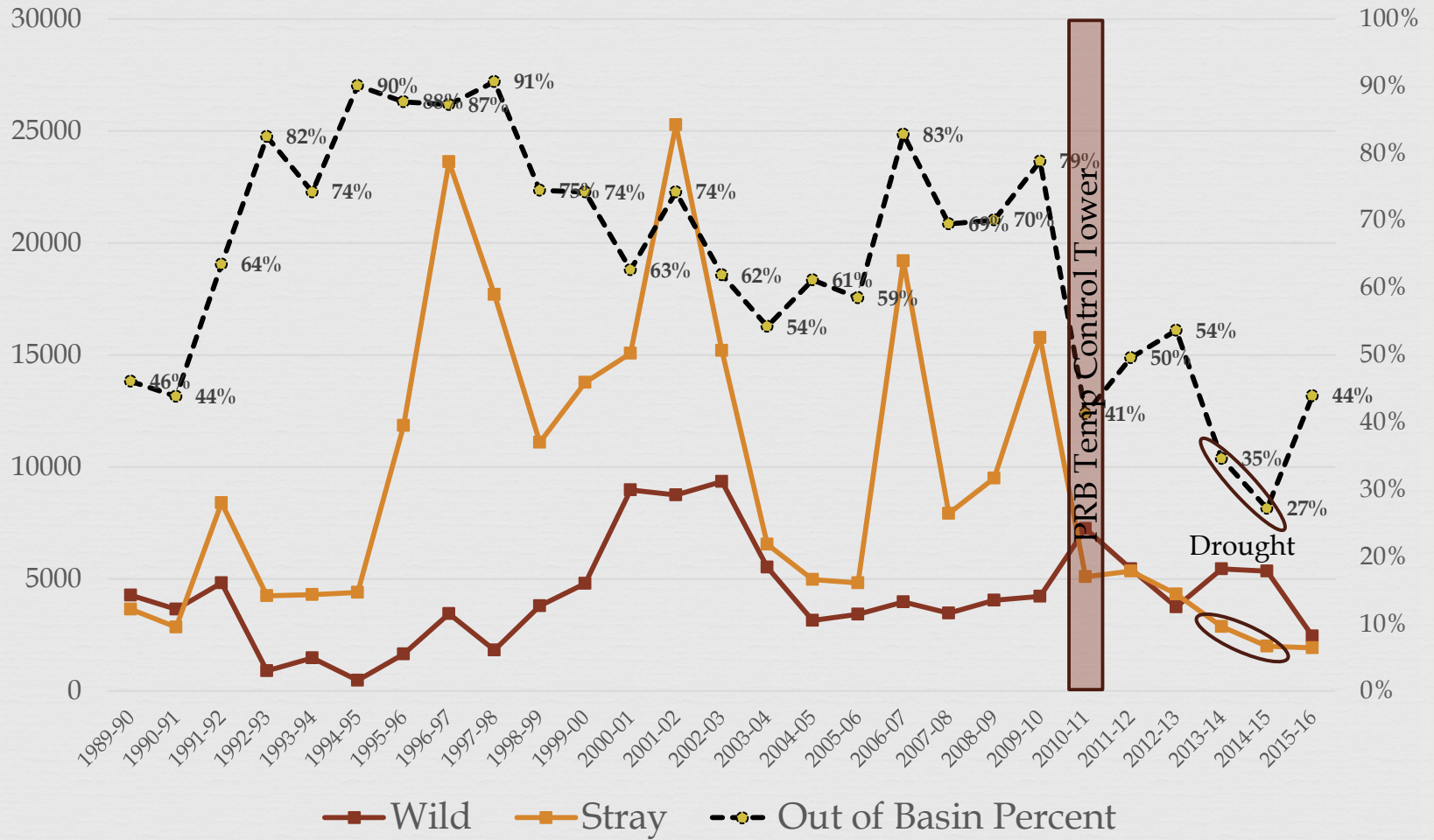


Hatchery Assignments



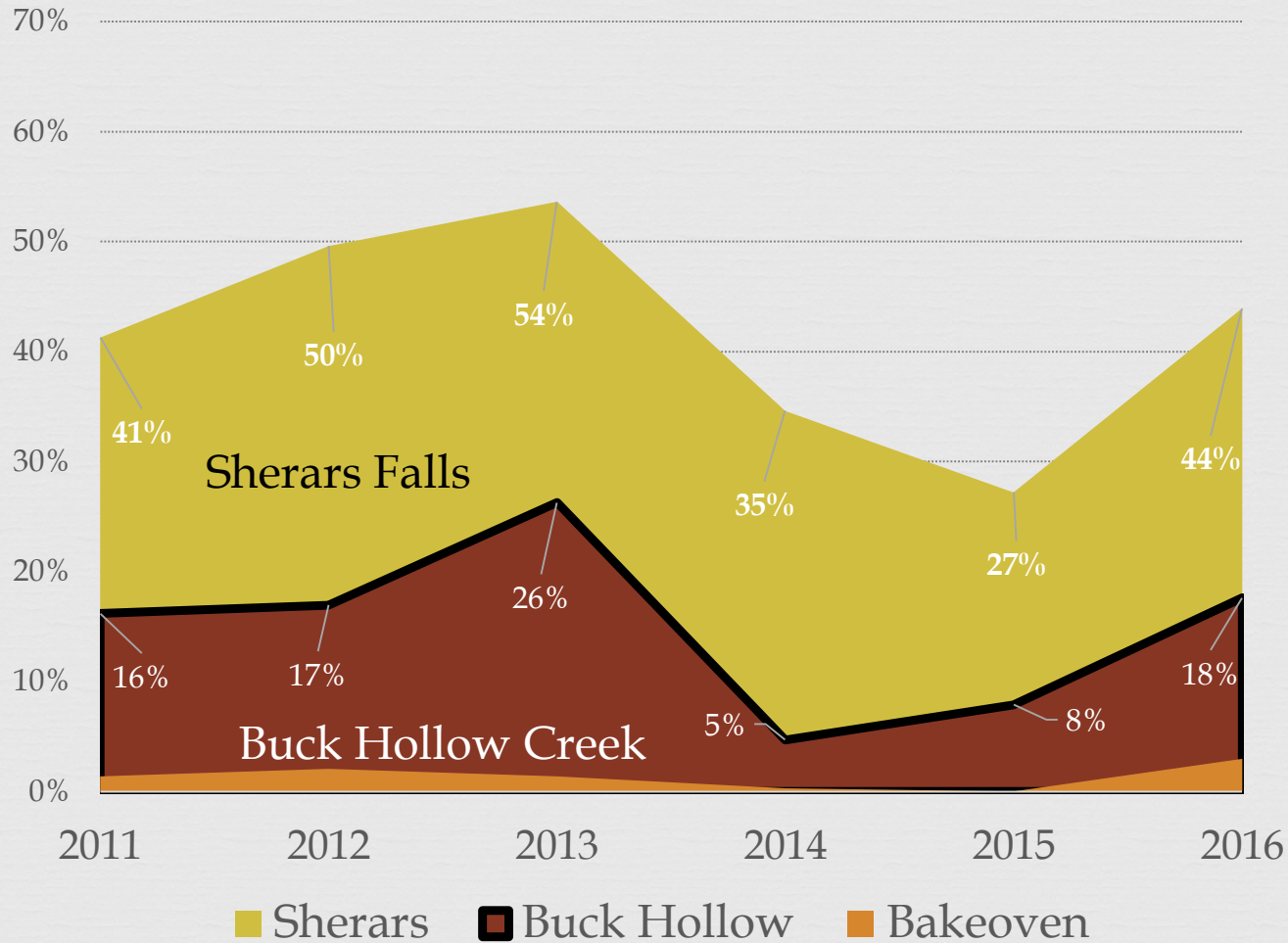


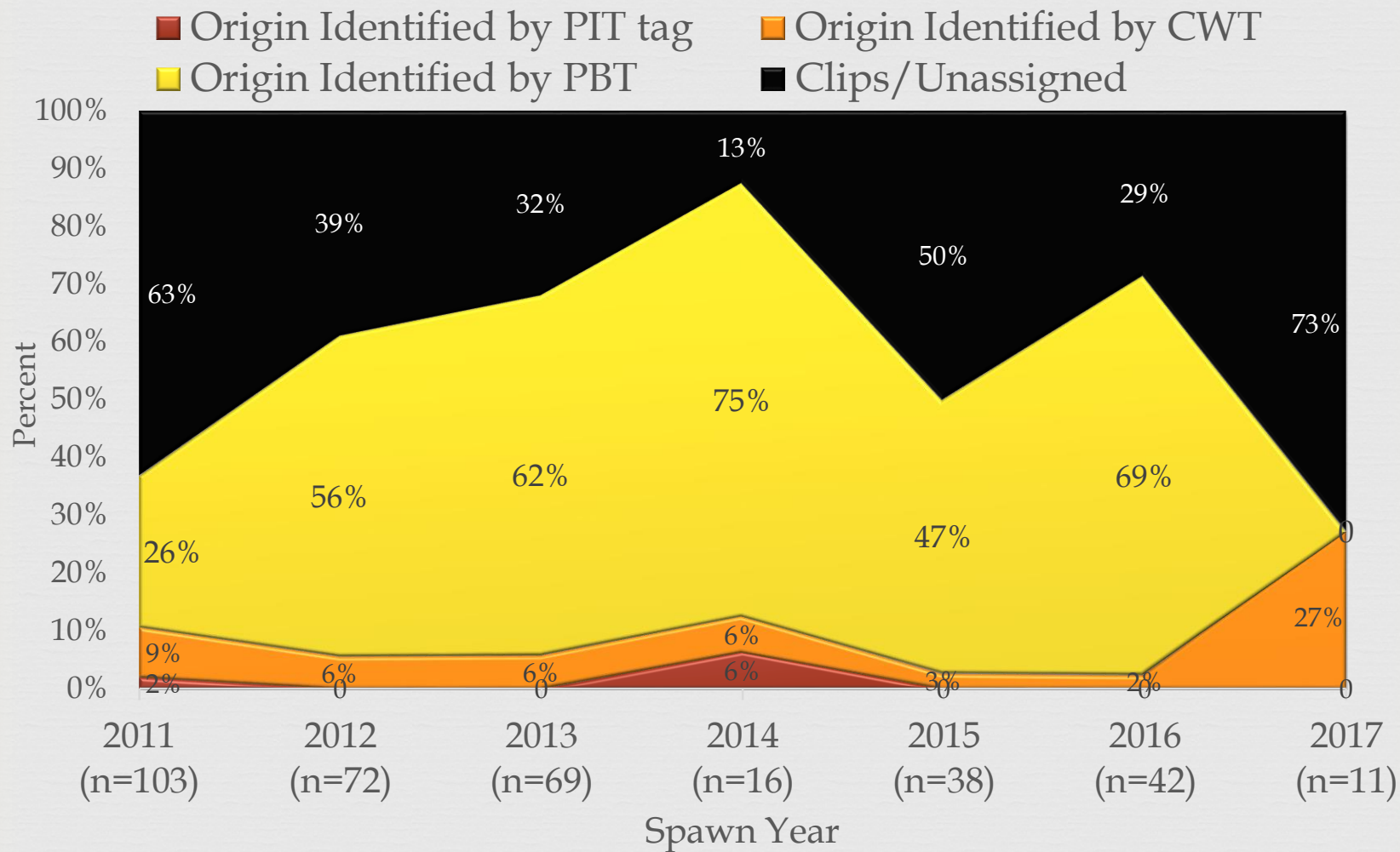
Sherars Stray Rates

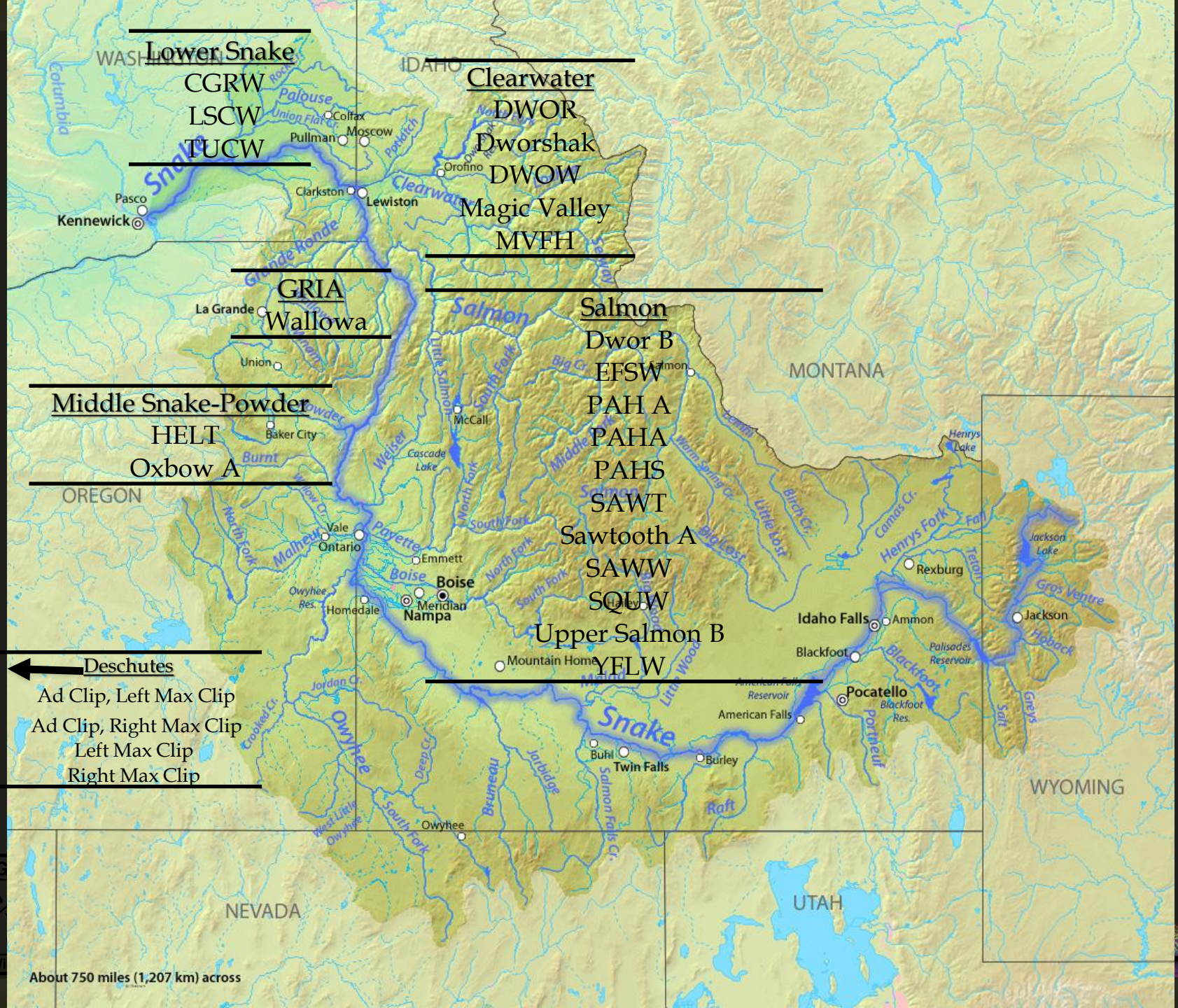




Out-of-Basin Hatchery Stray Rate

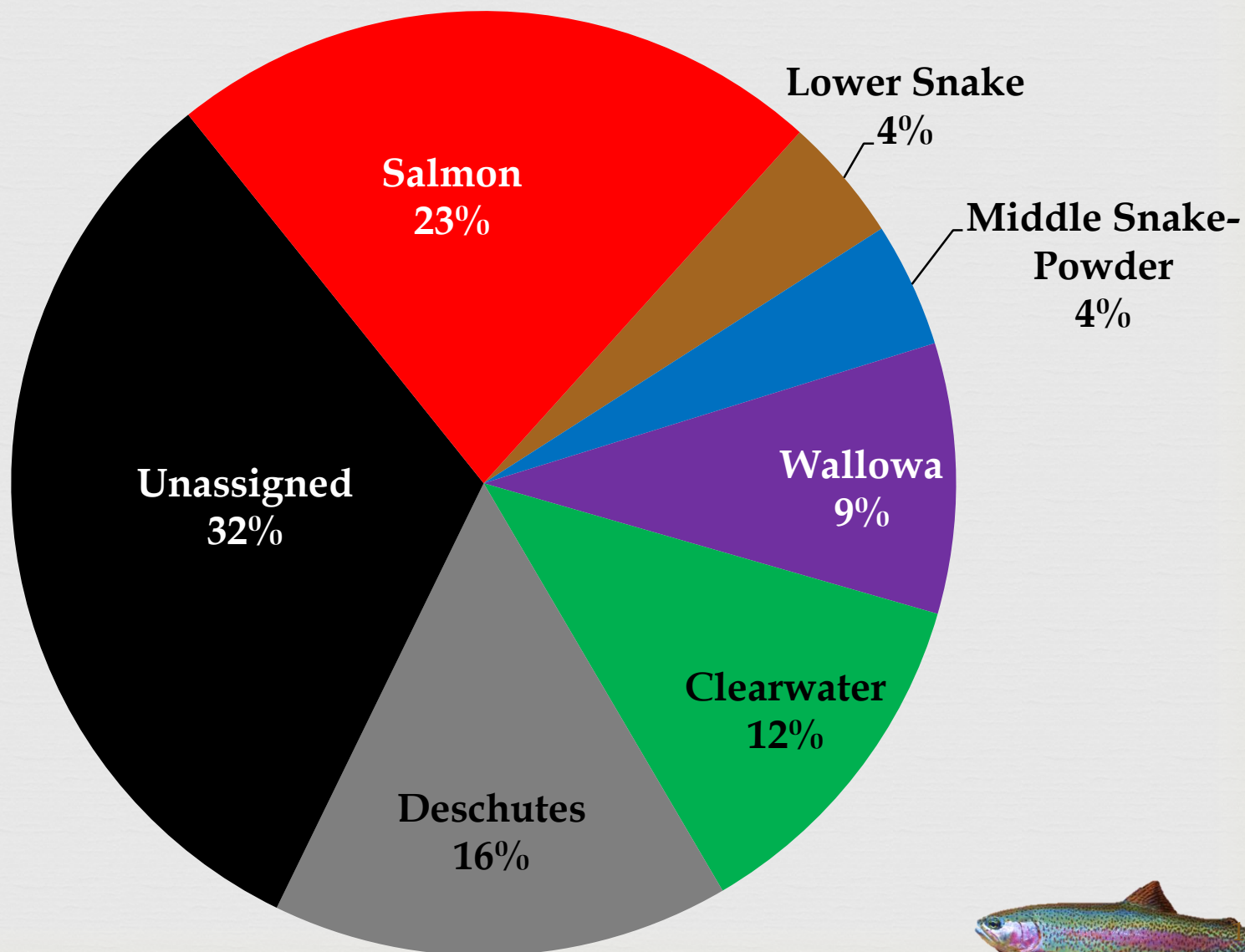


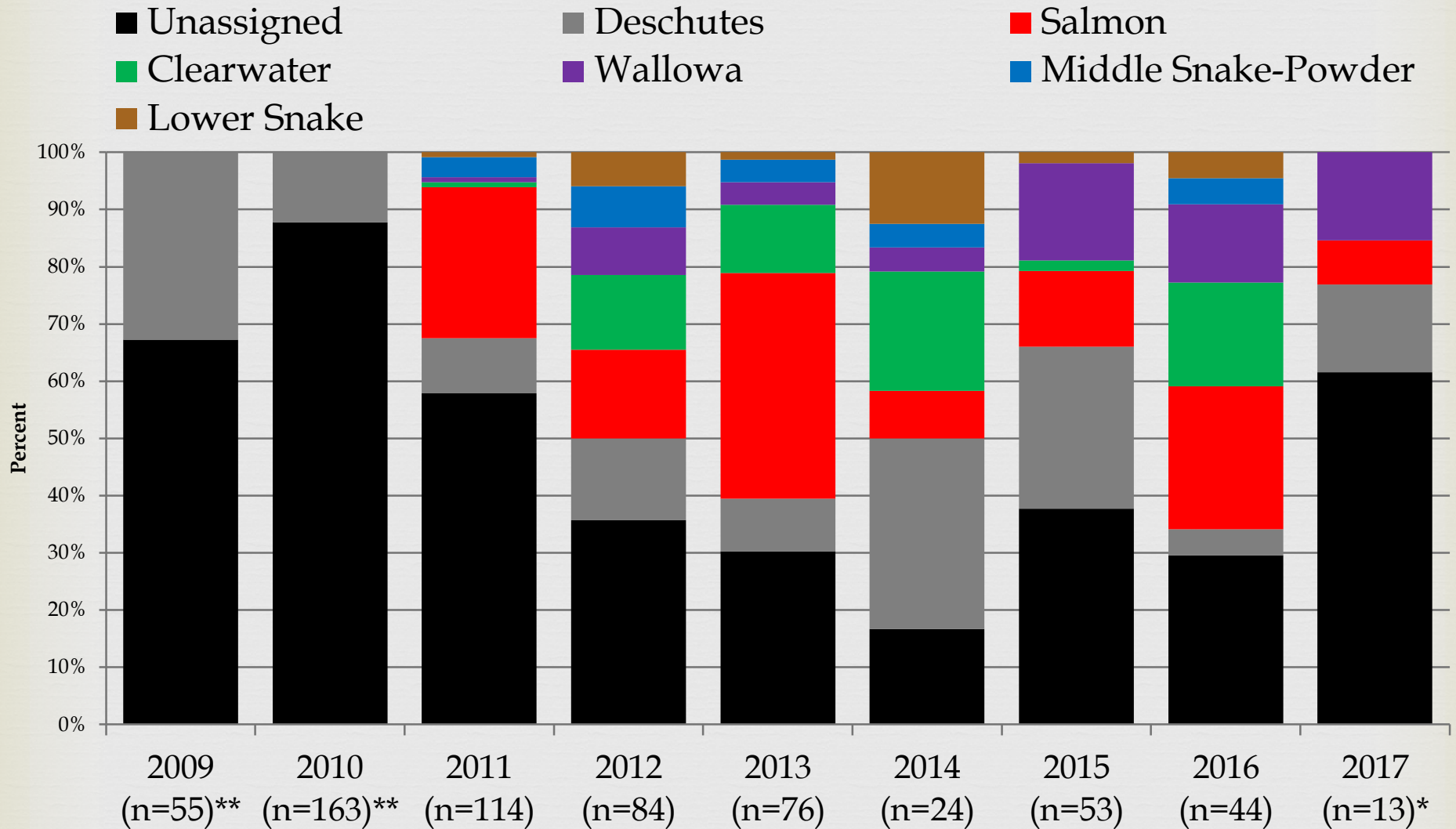






Out of Basin Steelhead Stays: 2012 to 2016 Pooled (n=281)



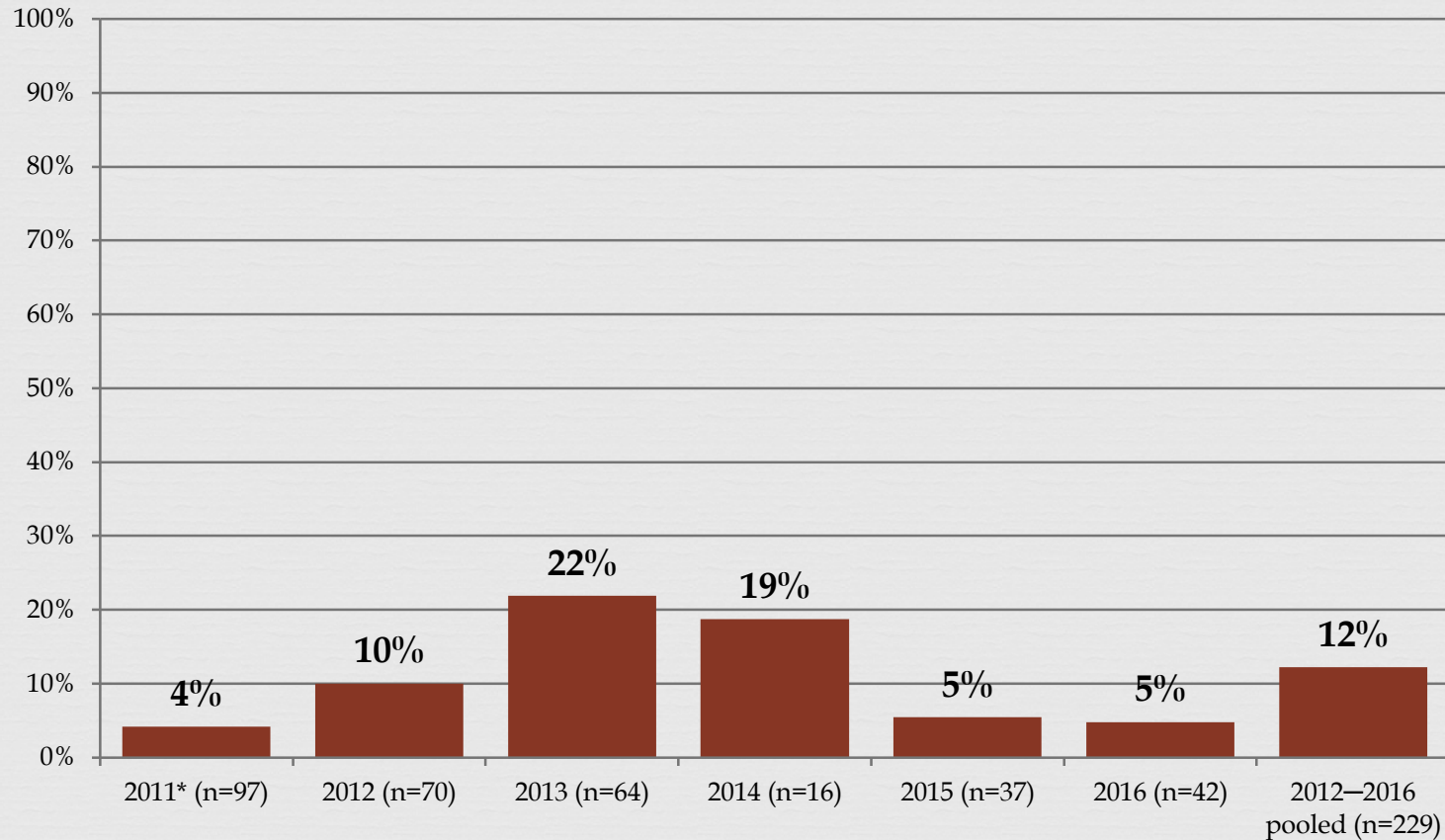


Spawn Year



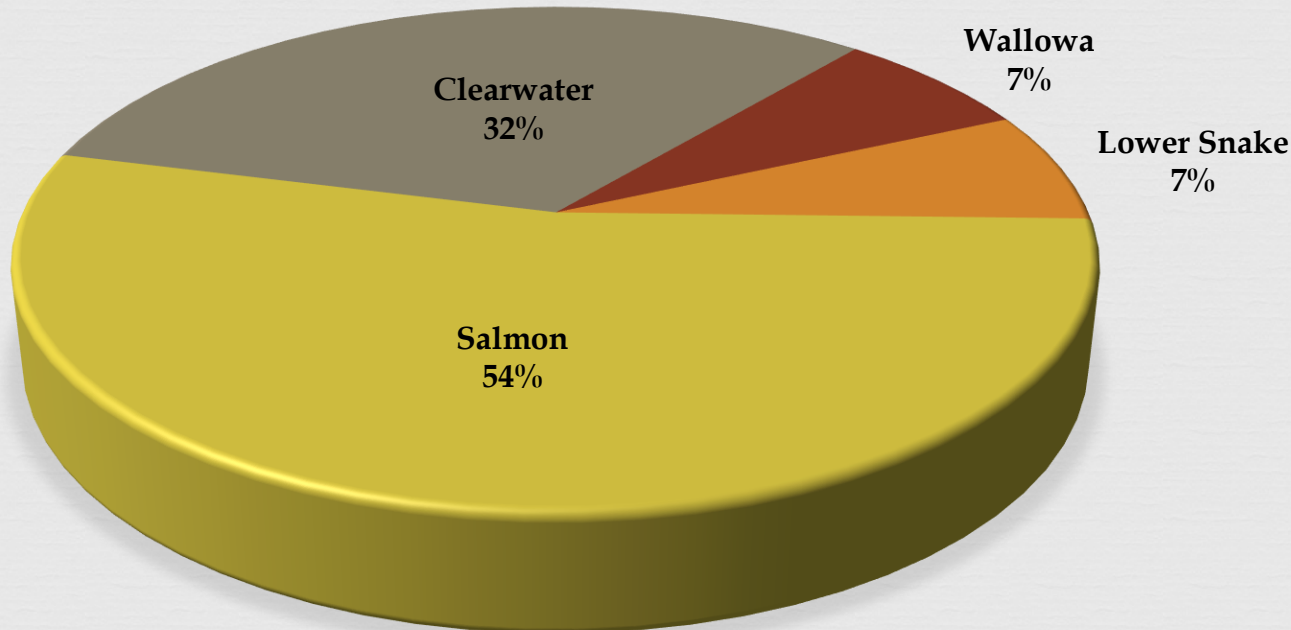


Percent of out-of-basin hatchery fish with no ad clip based on PBT





**SOURCE BASINS OF STRAY HATCHERY
FISH WITHOUT FIN CLIPS, 2012–2016
(N=28)
BASED ON PBT ASSIGNMENT**



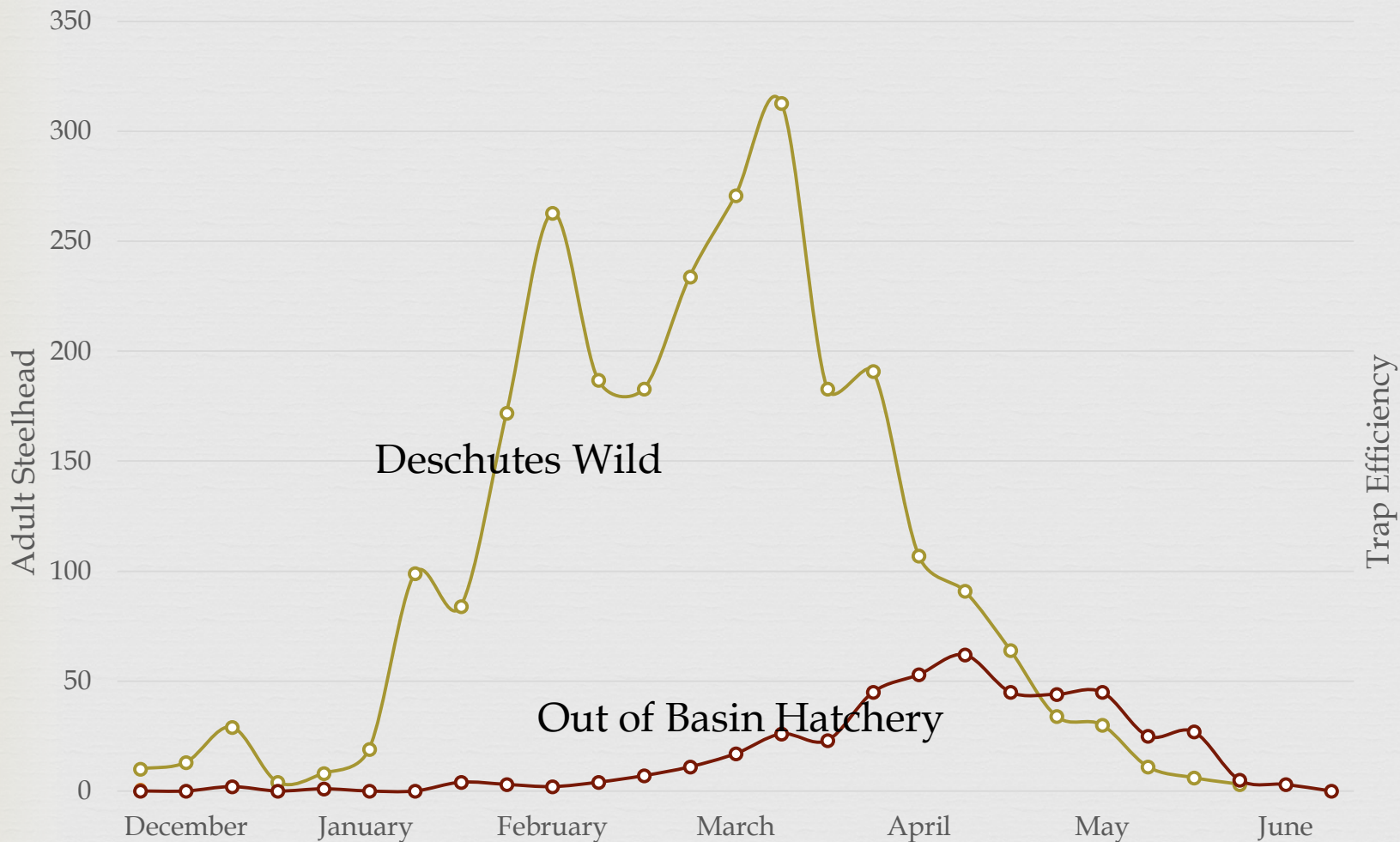


Run Timing



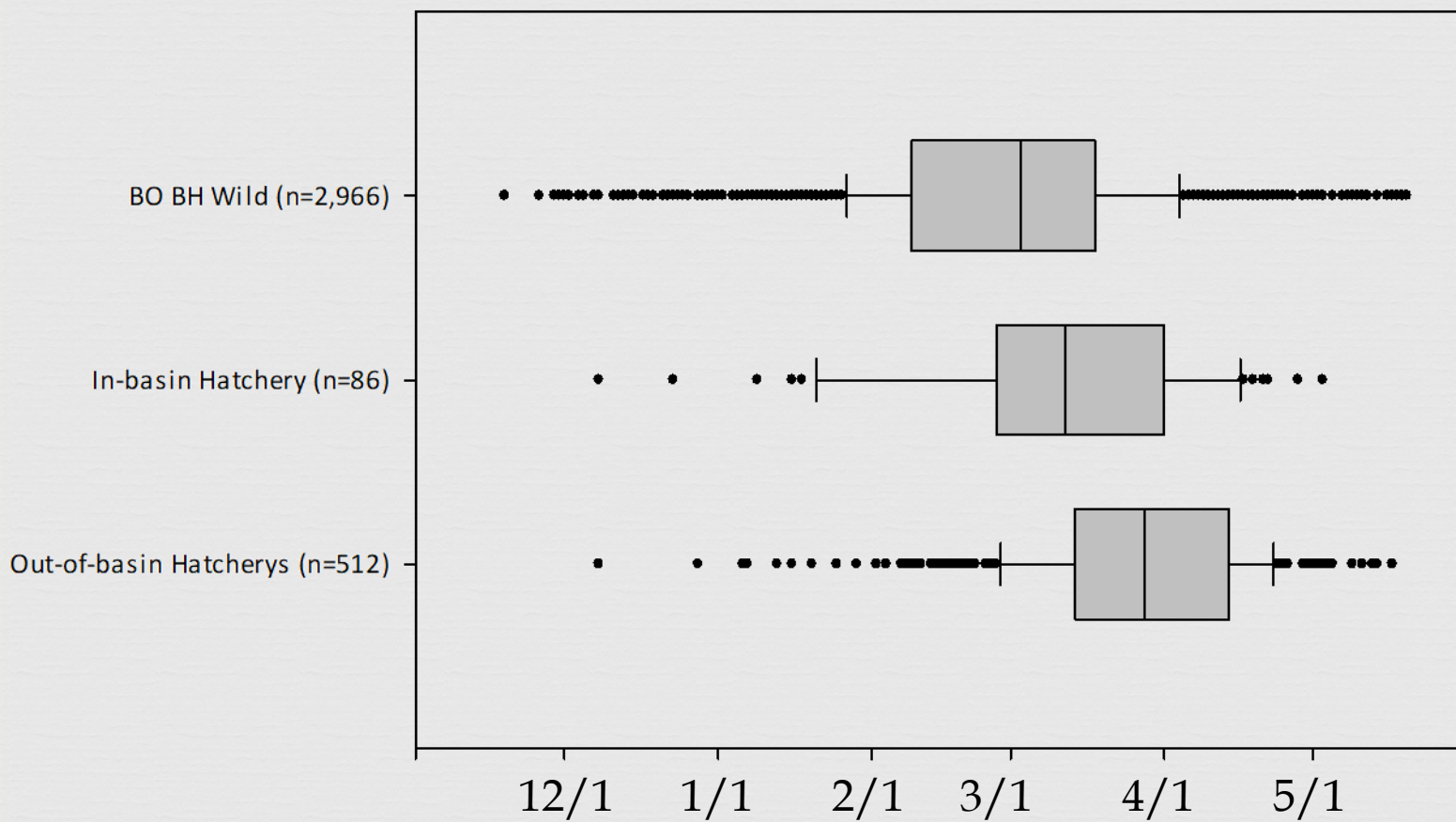


Average Run-Timing (2011-2015)



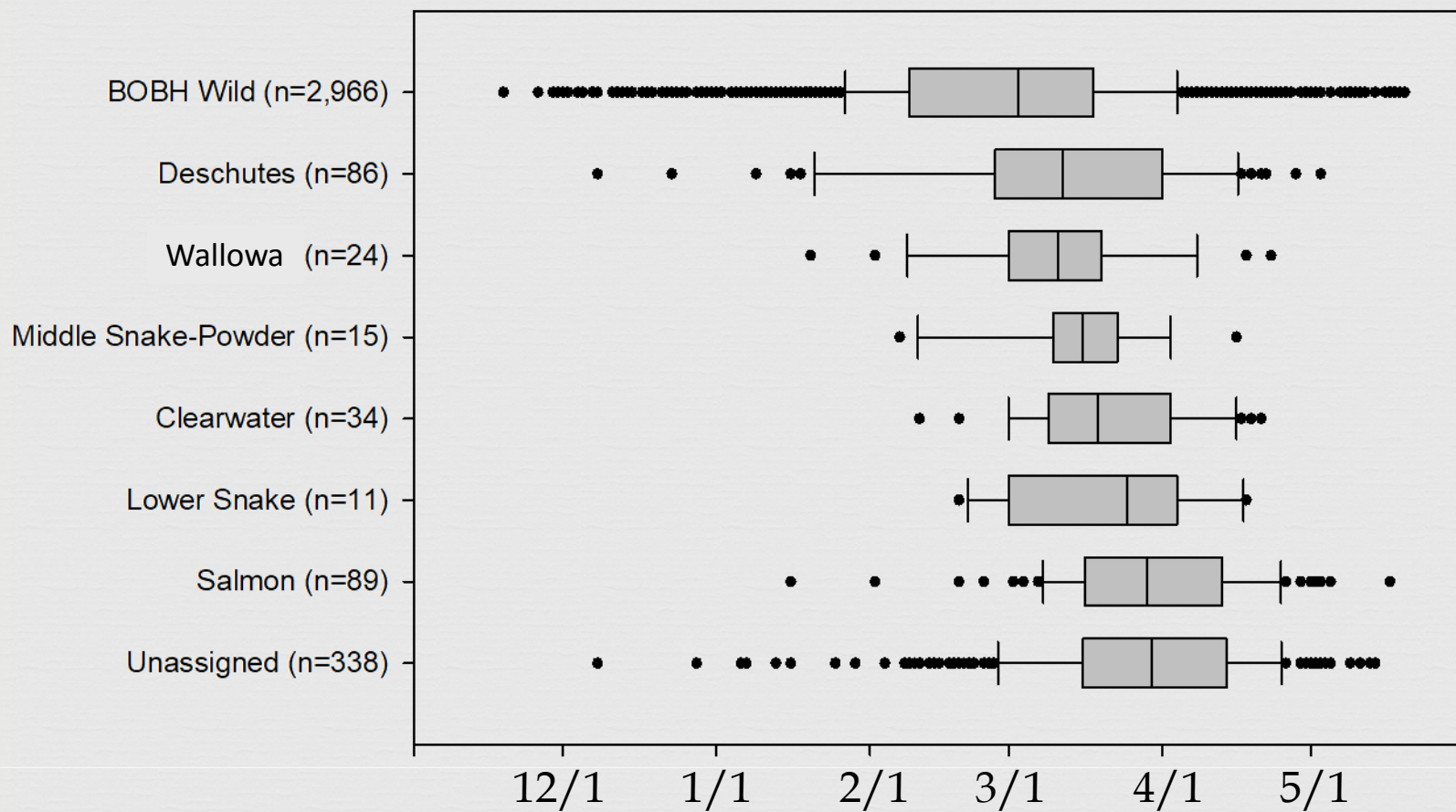


BO BH Pooled weir arrival 2009 to 2017





Weir Arrival BO and BH 2009 to 2017



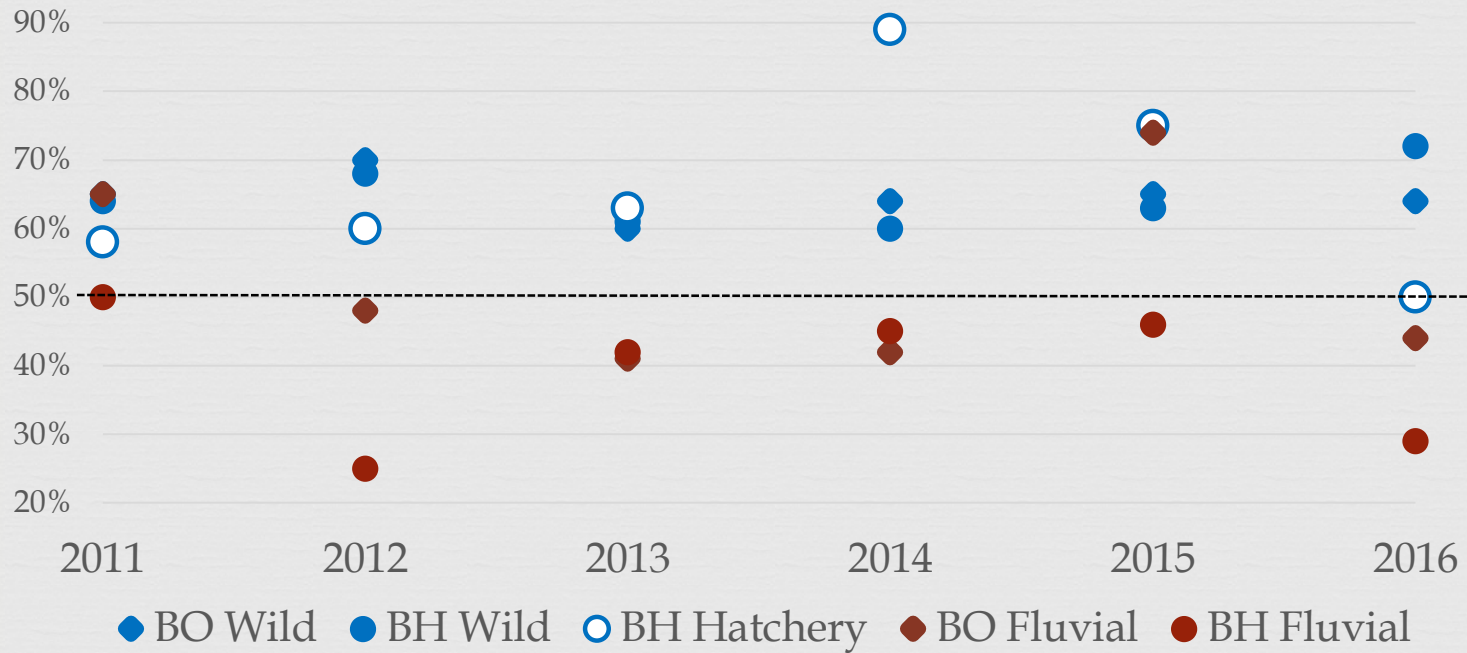


Wild Assignments





Sex Ratio % Female



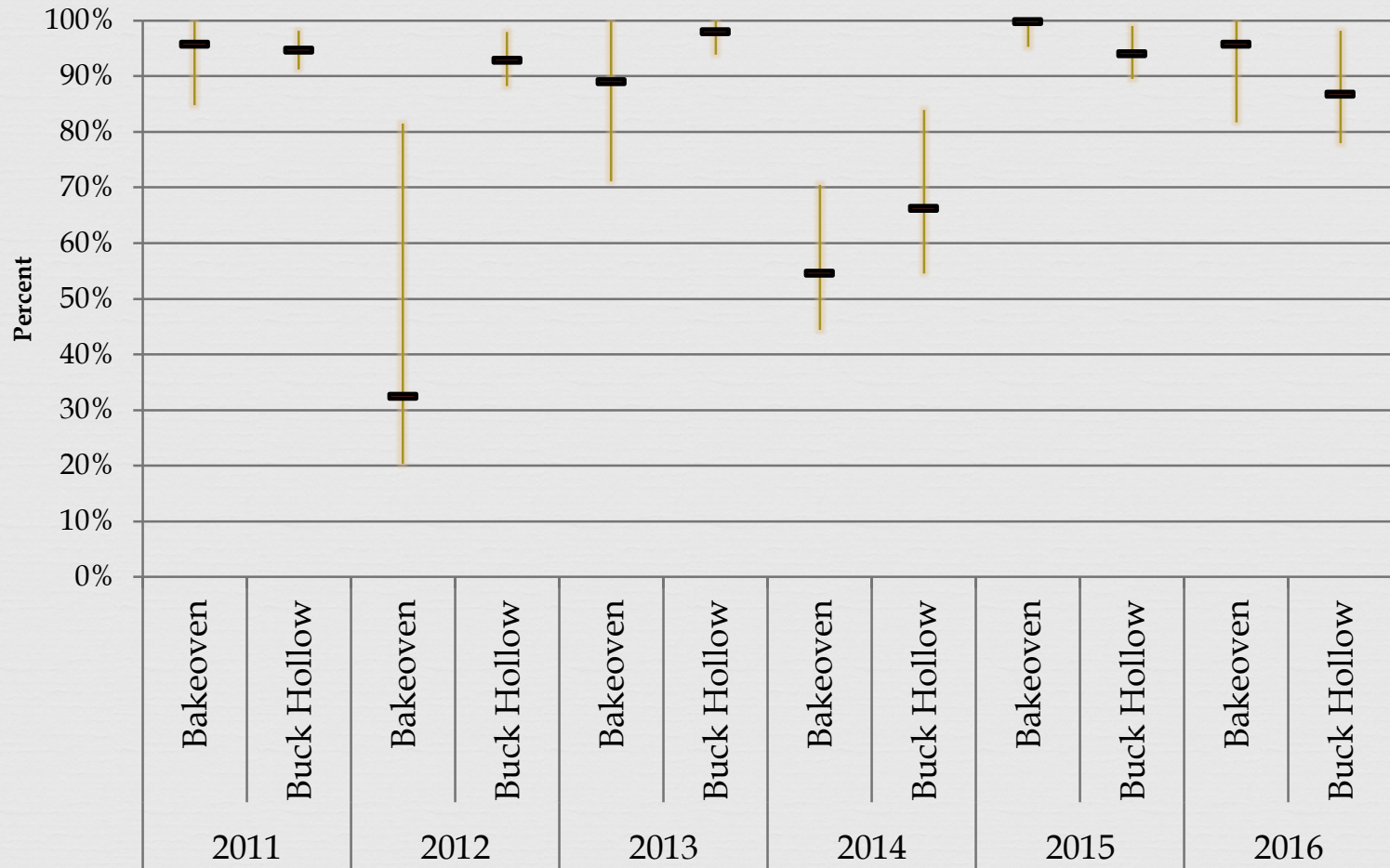
Outmigrant Age (mean 2011-2015)

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



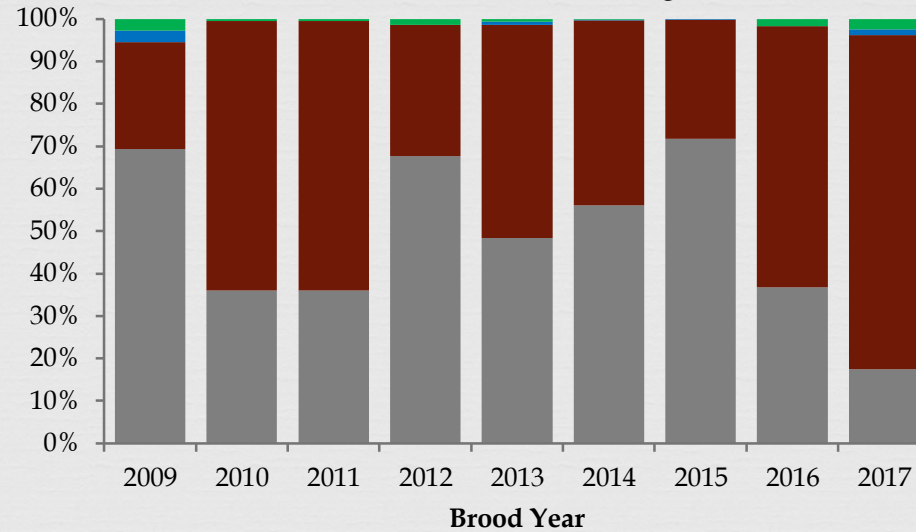


Steelhead Trapping Efficiency

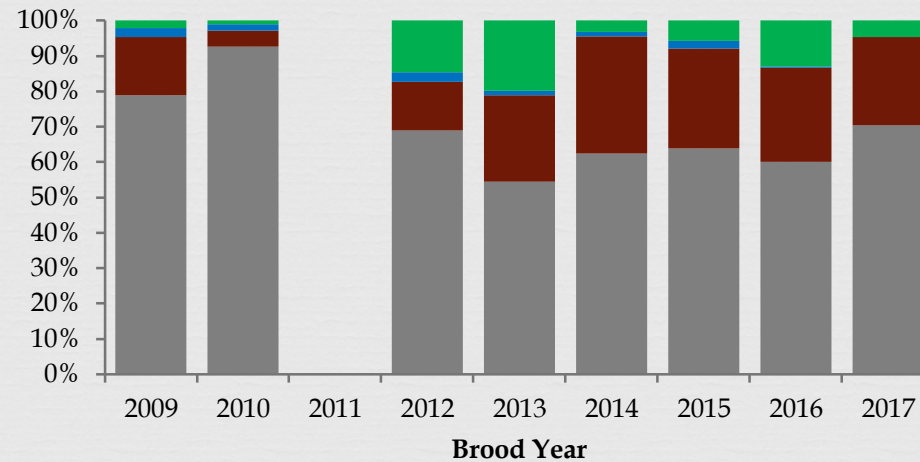


Anadromous + Fluvial *O. mykiss*

Bakeoven Creek



Buck Hollow Creek



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

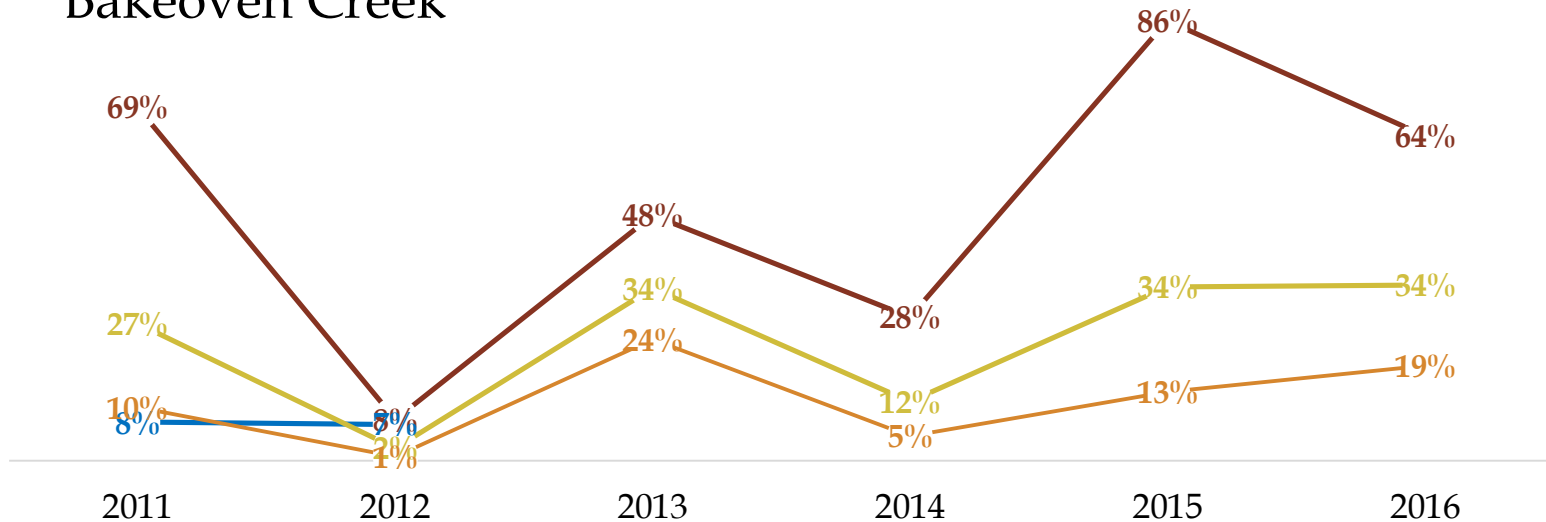




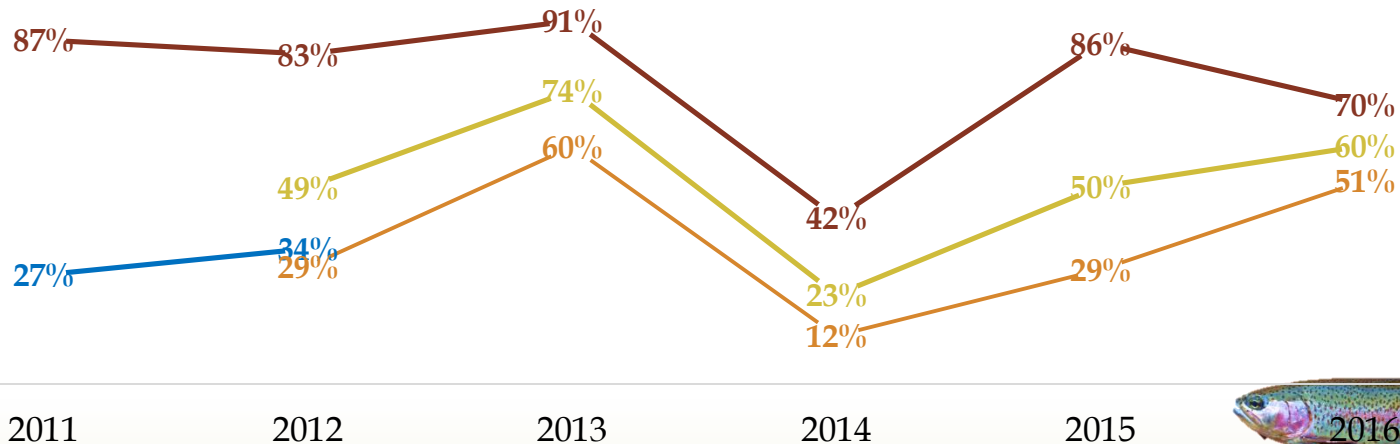
Expected Assignment Rate given Trap Efficiency of Parents

— Steelhead Only — PBT Assignment % — STS+Fluvial (Male) — STS + Fluvial

Bakeoven Creek



Buck Hollow Creek





We are observing low assignment rates for adult returns (BY2011, BY2012, BY2013 so far):

- Potential sources of the difference between assigned and expected:
 - Rejection of true parent pairs in genetic analysis (false negative, low %).
 - Out-of-basin wild strays.
 - Unsampled in-basin Steelhead (from mainstem Deschutes).
 - Unsampled in-tributary resident rainbow.
 - Male contribution – PBT needs both parents.

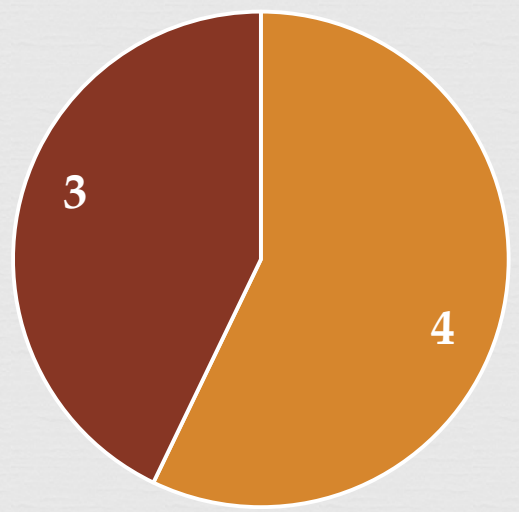


Bakeoven 2012 – Juvenile Assignments to Parents



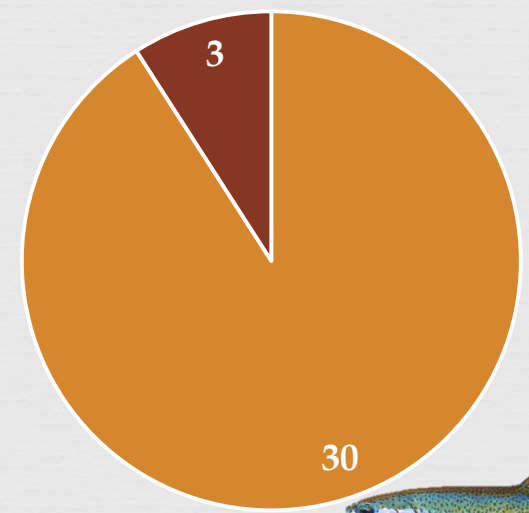
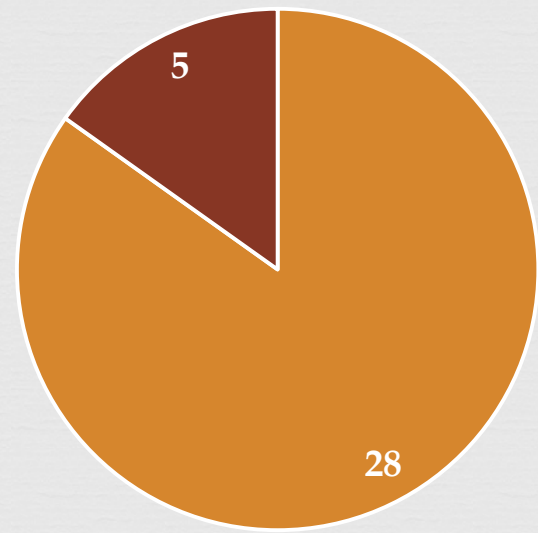
Male

Age 0



Female

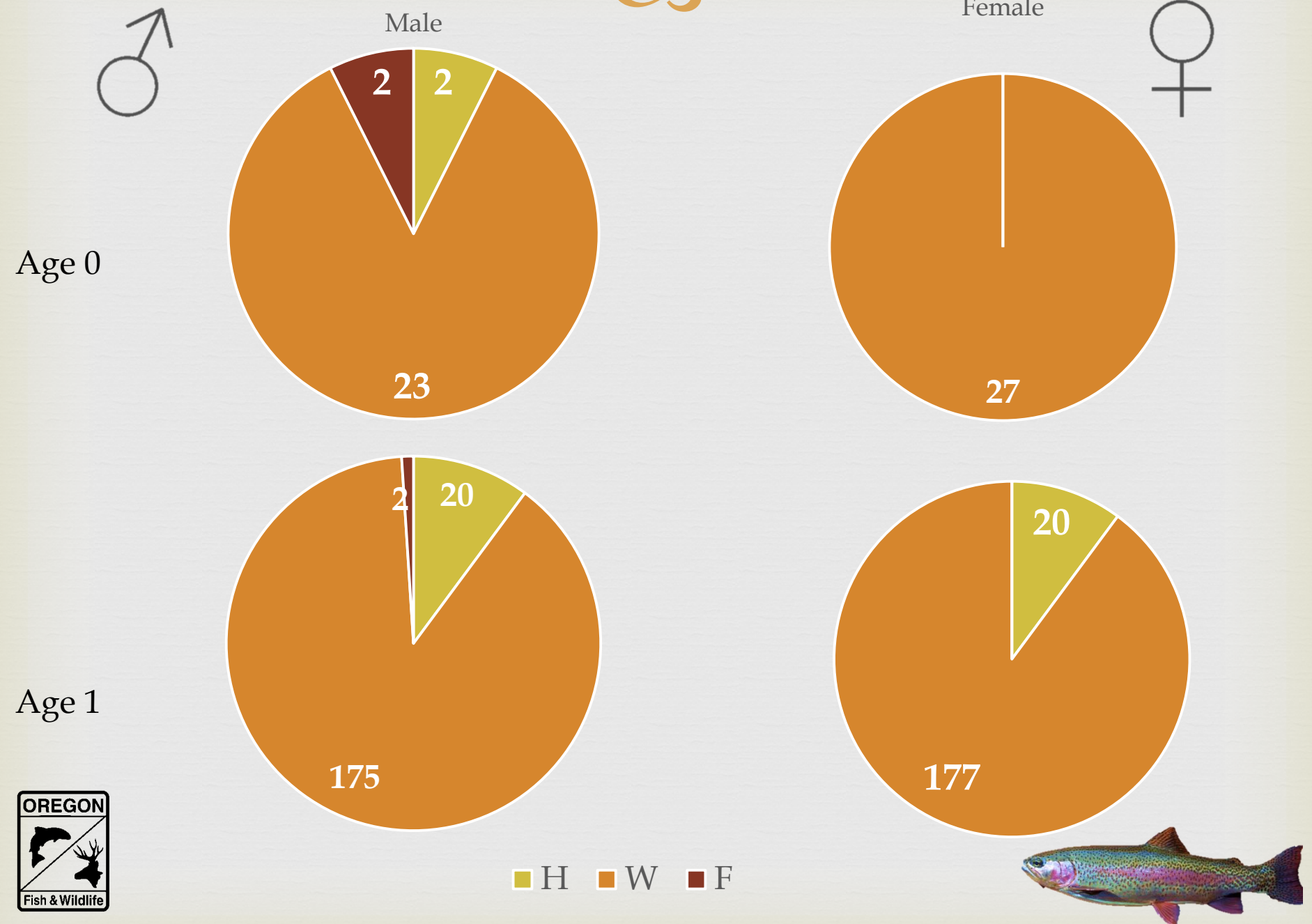
Age 1



W F



Buck Hollow 2012 – Juvenile Assignments to Parents



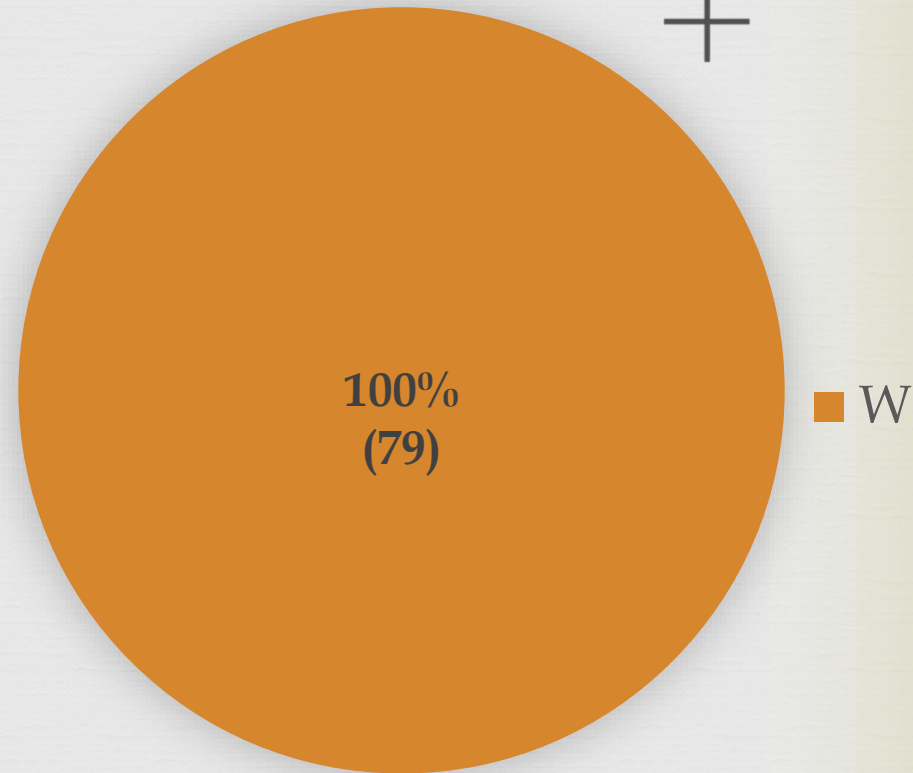
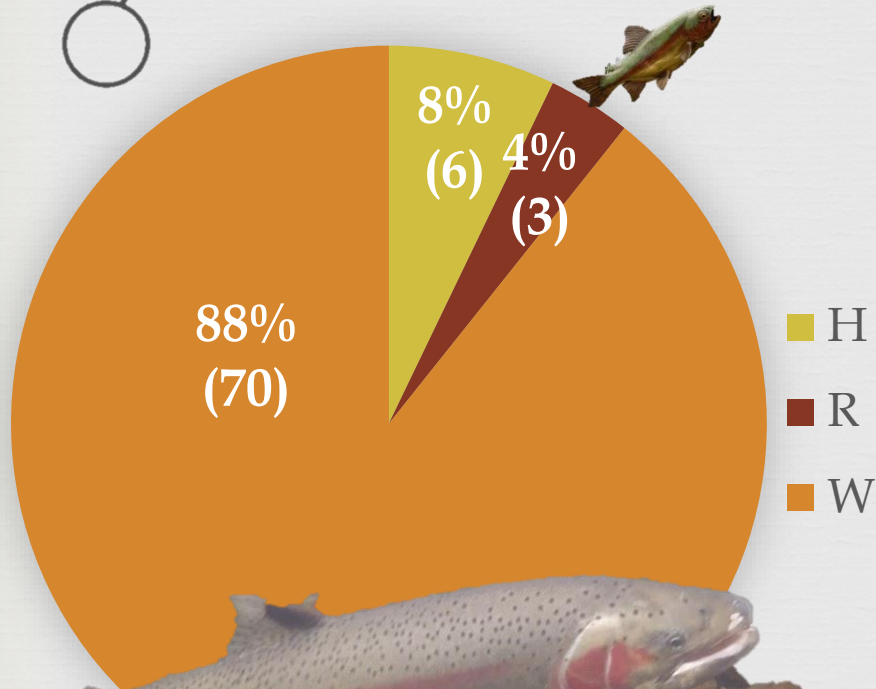


Adult Returns and Genetic Assignment



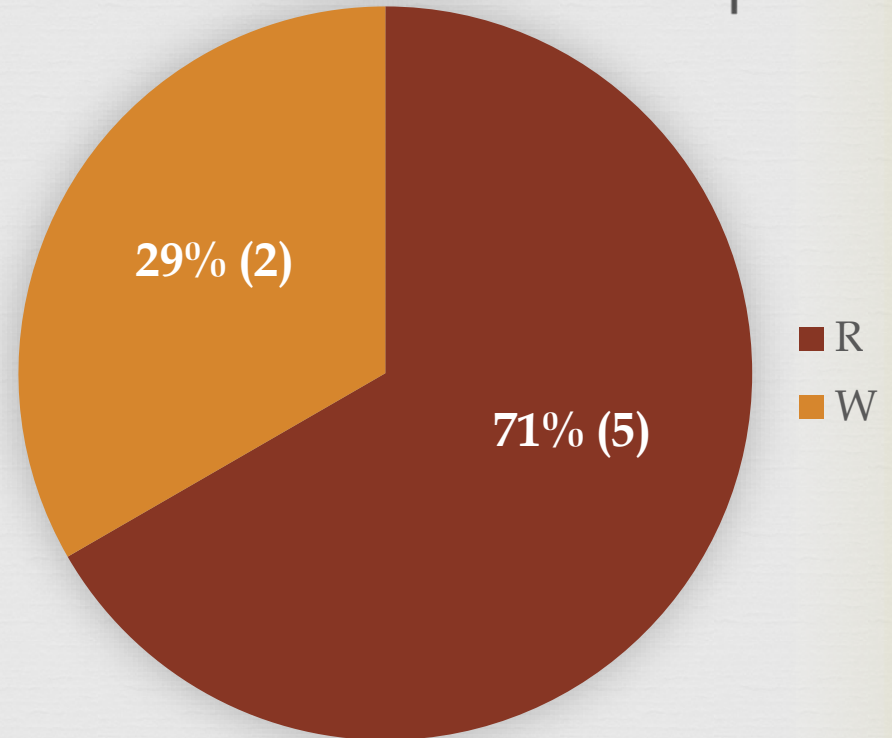
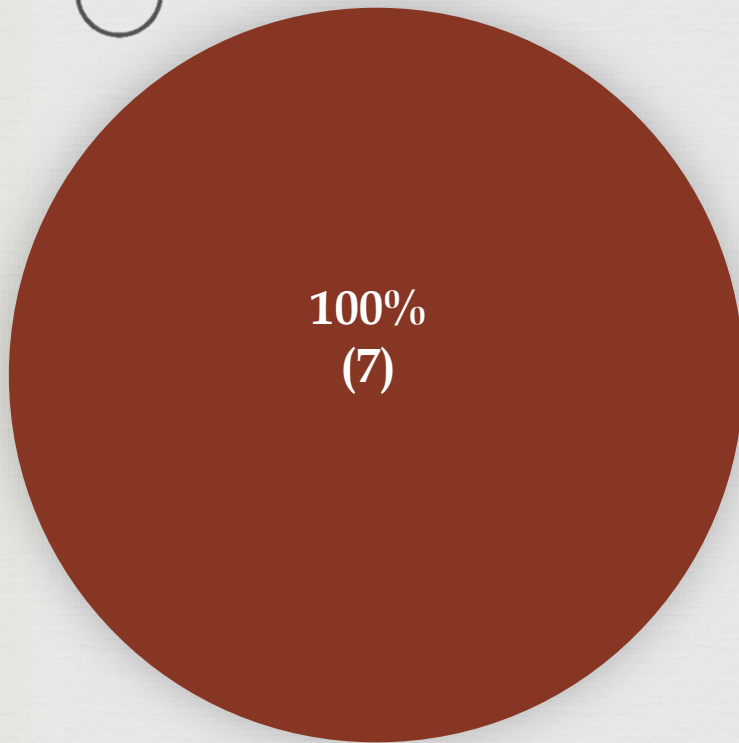


Wild Anadromous Adult Offspring – Parents (79 Total Pairs) of 2149 potential parents





Resident Adult Offspring – Parents (7 total pairs)





Conclusions

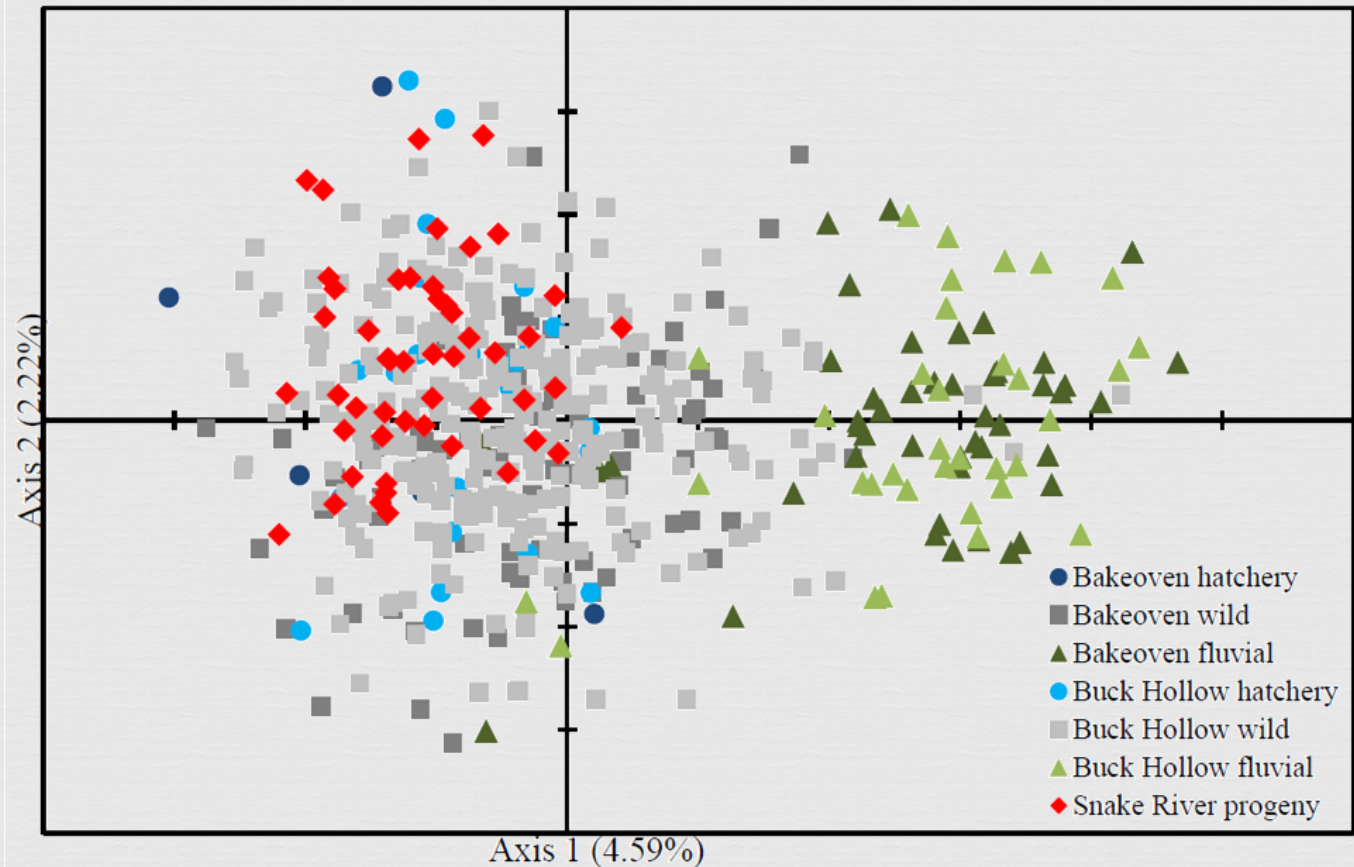
- PBT invaluable for identifying majority of out-of-basin stray hatchery steelhead for adaptive management.
- Run timing suggests breeding separation between hatchery stray steelhead and native steelhead, although stock of origin also appears important.
- Parent sources for Deschutes Steelhead are unaccounted for and likely diverse. We know they include resident and fluvial redband trout. Rates not consistent (lower) than observed.
- Also soliciting ideas. Robust dataset of two steelhead and Fluvial generations, but need better assignment rates to increase our sample size. Single parent assignments necessary.





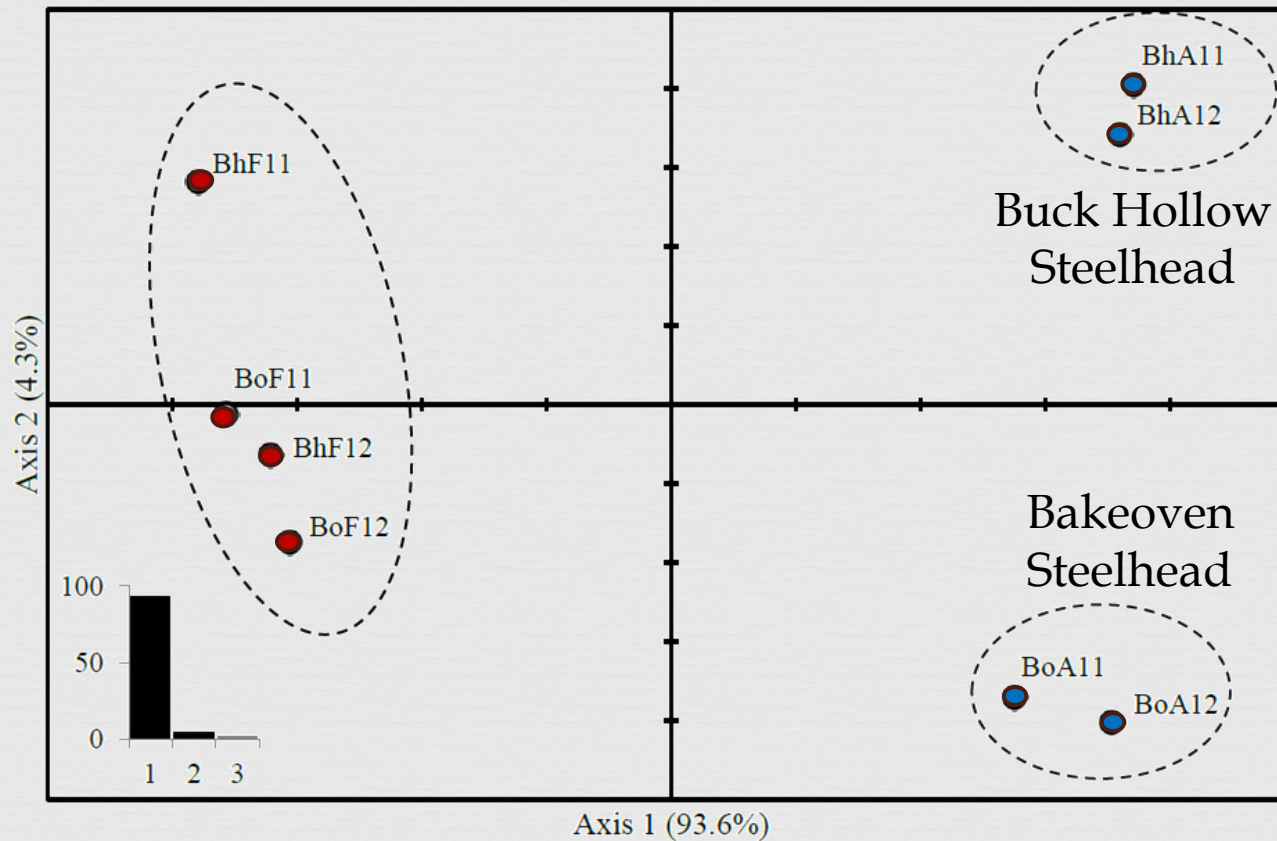


Correspondence Analysis of Genotype



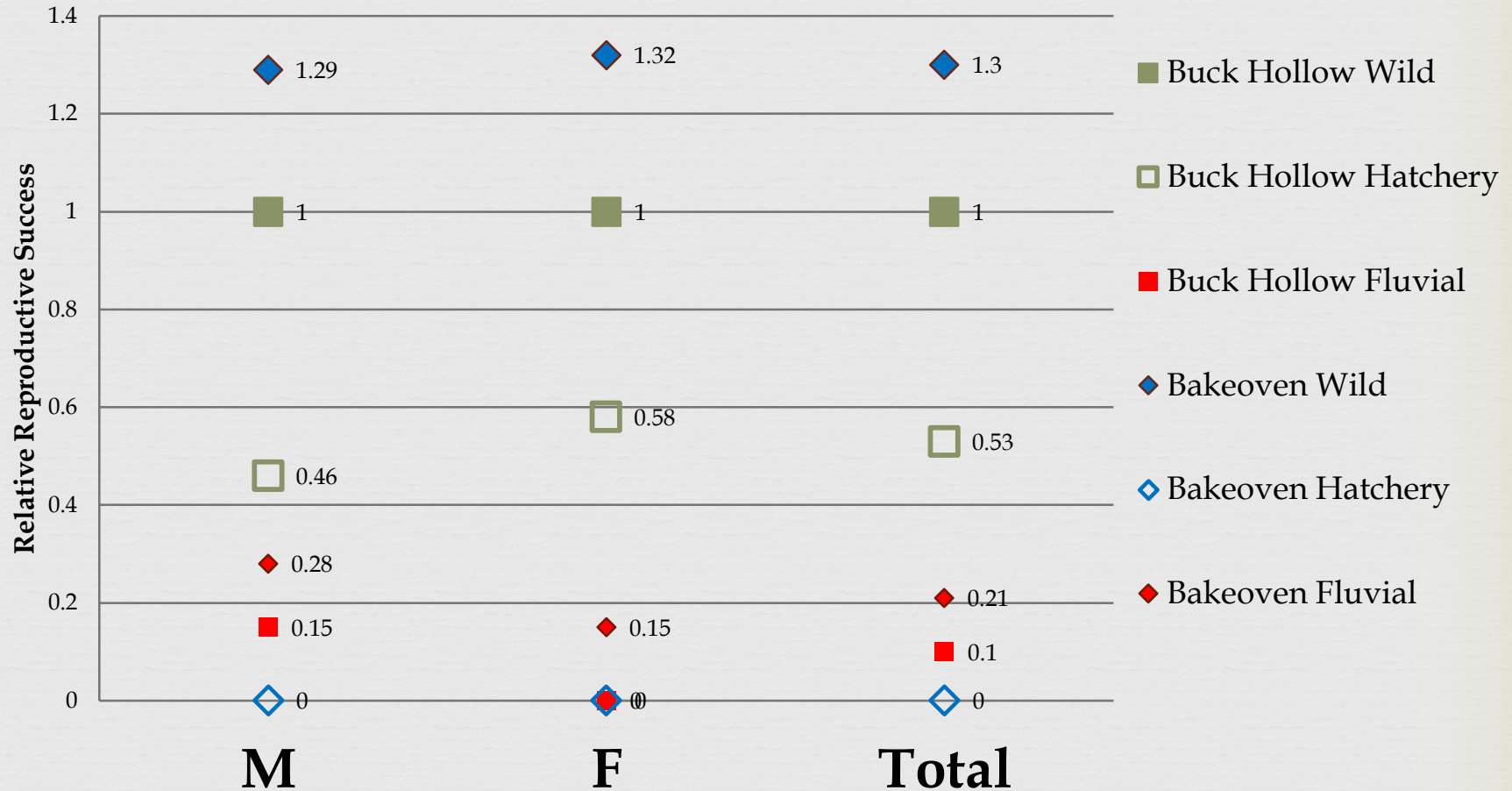


Principal Coordinate Analysis of Pairwise F_{ST}





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





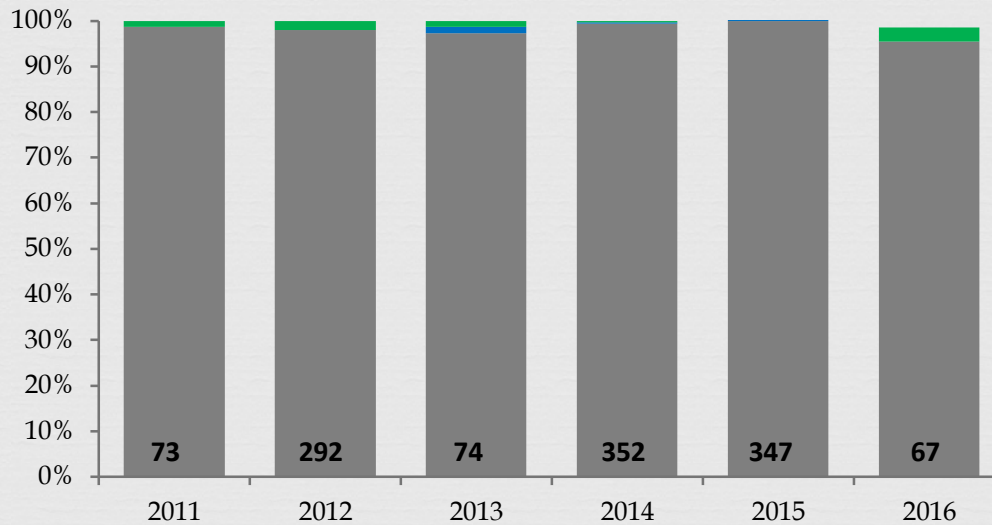
Adult Age Structure

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

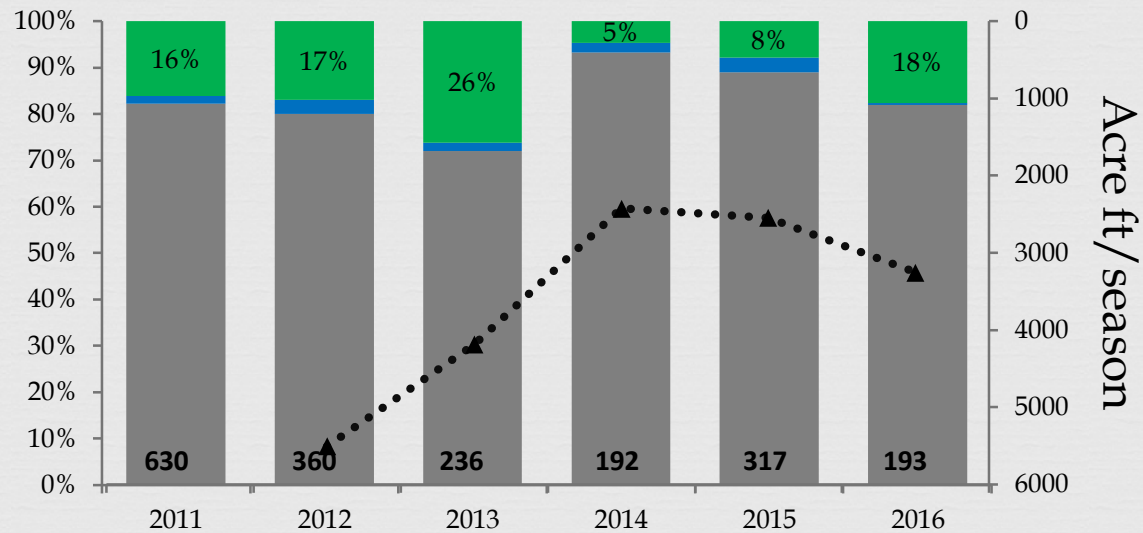


Anadromous *O. mykiss*

Bakeoven
Creek
(Treatment)



Buck Hollow
Creek
(Control)



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

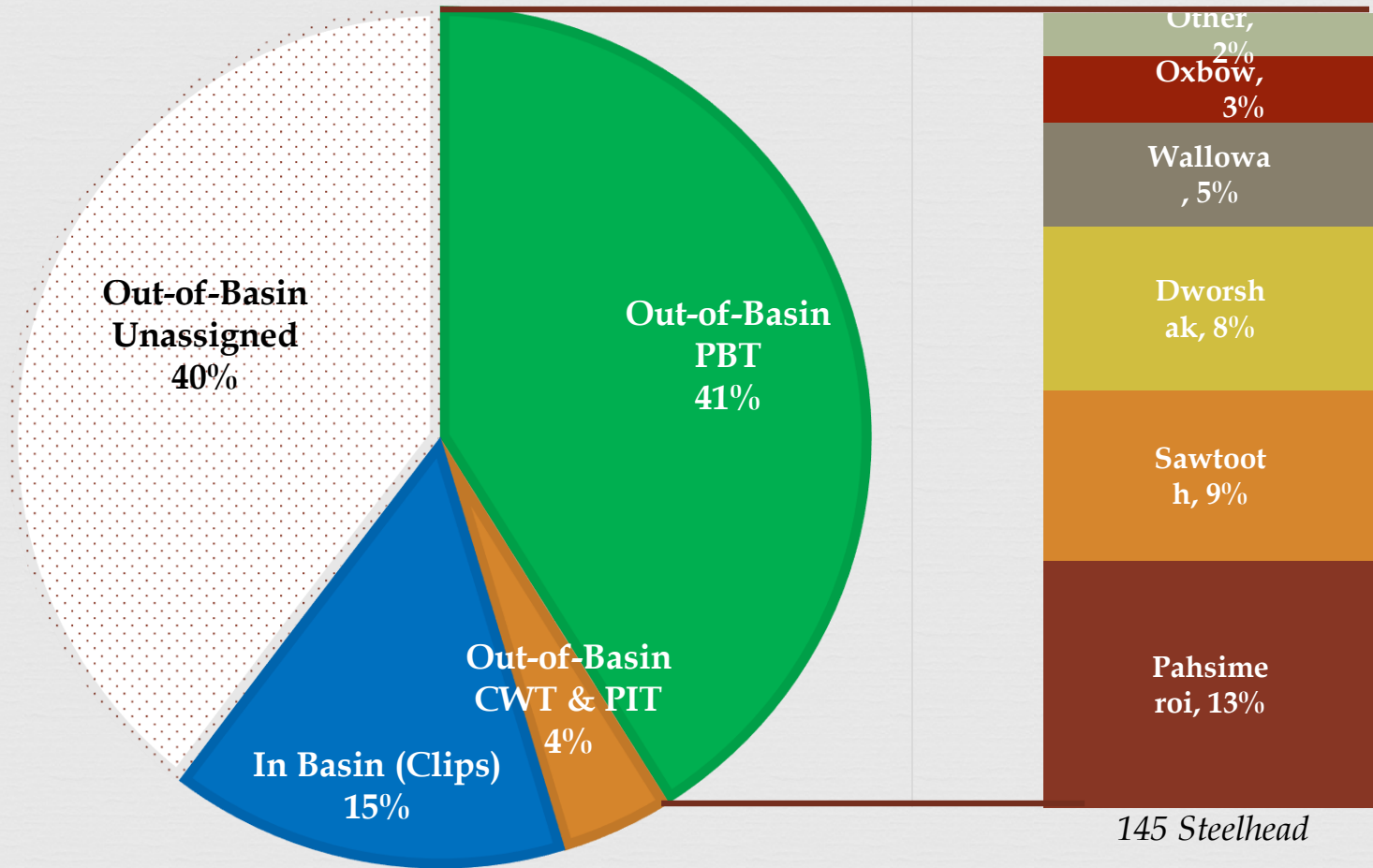


Buck Hollow mouth under drought conditions





HATCHERY ASSIGNMENTS - 2011 TO 2015

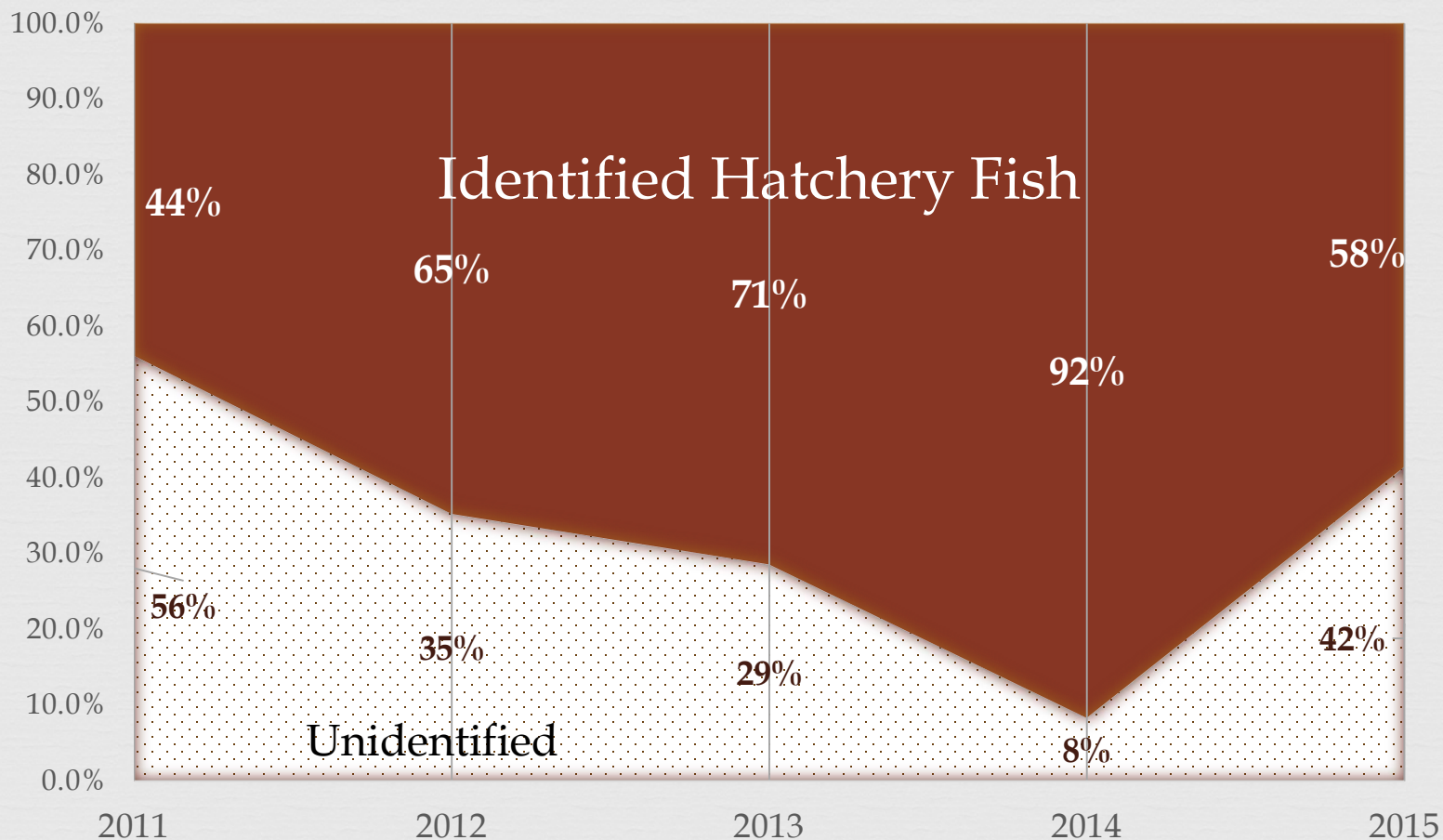


n = 353 Total Hatchery Steelhead





HATCHERY ASSIGNMENT RATE BY YEAR





Reminder: this study is not only about RRS, but is specifically trying to address the - *influence of hatchery steelhead on wild steelhead production.*

❧ Genetic differences (Hatchery/Wild) can manifest in a reduction in fitness (RRS).

❧ Fish Health – mere presence of hatchery fish can influence production

❧ Fish sampled from 2012-2015 in Buck Hollow have the following diseases:

❧ *Myxobolus cerebralis* - Whirling Disease

❧ 3.9% in Wild BH Adult Steelhead Sampled (n=51)

❧ 15% in Hatchery BH sampled (n=40)

❧ *Ceratomyxa shasta* - myxosporean parasite

❧ 31.8% in Wild BH Adult Steelhead Sampled (n=44)

❧ 53.6% in Hatchery BH Adult Steelhead Sampled (n=28)

❧ We are observing reproductive separation between Hatchery and Wild Steelhead given differences in run-timing.

❧ Implications for reproductive success.

❧ Can the objectives in the original proposal be met?

❧ Power analysis is mixed, we won't know until we measure the effects. Primary influence on power are the site-year variation and the year-to-year interaction between creeks.

