

Chinook salmon reintroduction above Cougar Dam: Insights from genetic parentage assignments



Bob Heims, U.S. Army Corps of Engineers



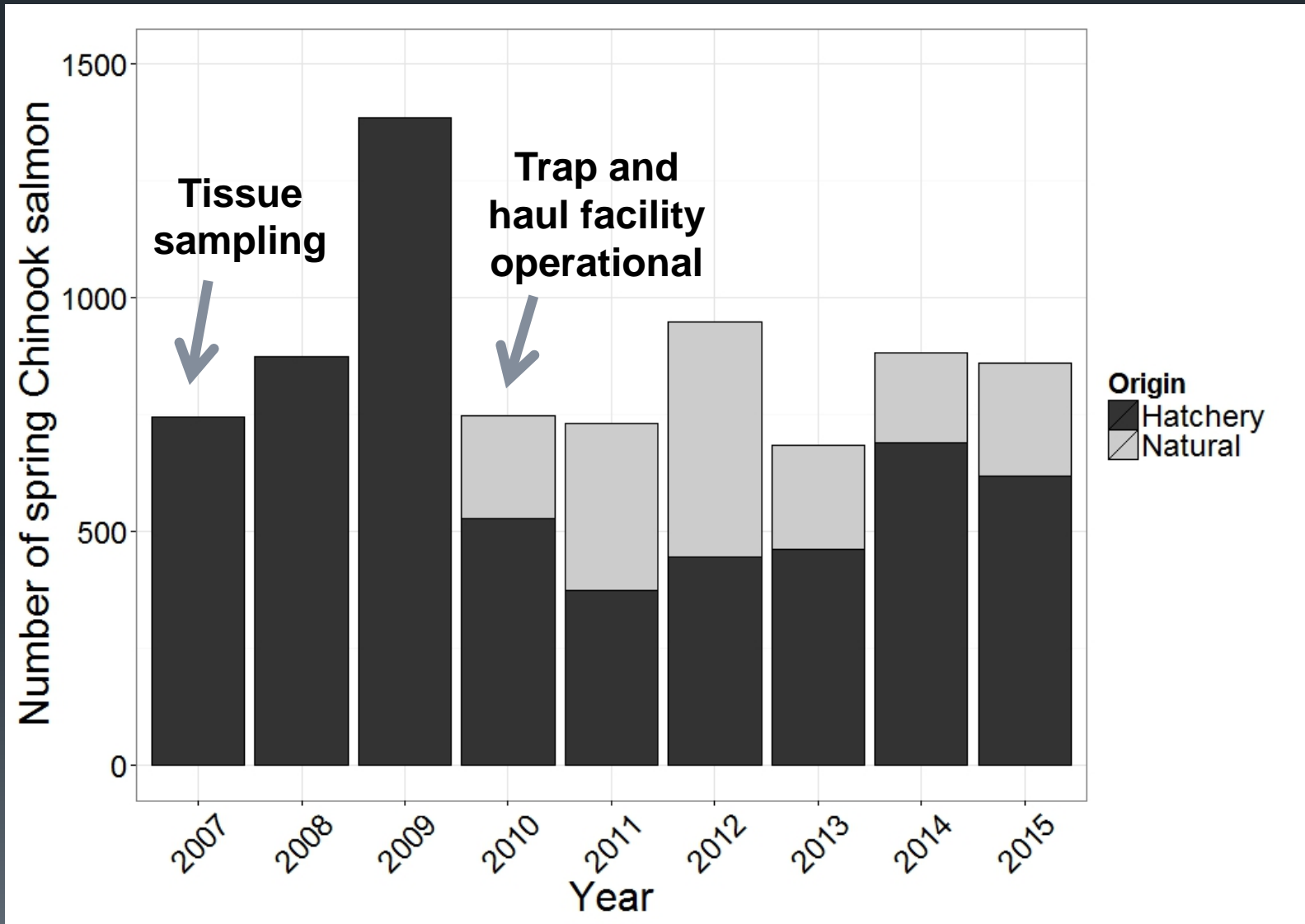
Nick Sard, Dave Jacobson, Michael Hogansen,
Kathleen O'Malley, Marc Johnson, Michael Banks

Topics



- Fitness differences between hatchery and natural origin adults
- Assignment rates for adults returning to the trap and transport facility at the base of the dam
- Cohort replacement rates calculated for adults reintroduced from 2007 to 2010
- Genetic evidence that suggest some unsampled Chinook salmon contribute to the population

Reintroduced adults have been tissue sampled for genetic analysis since 2007

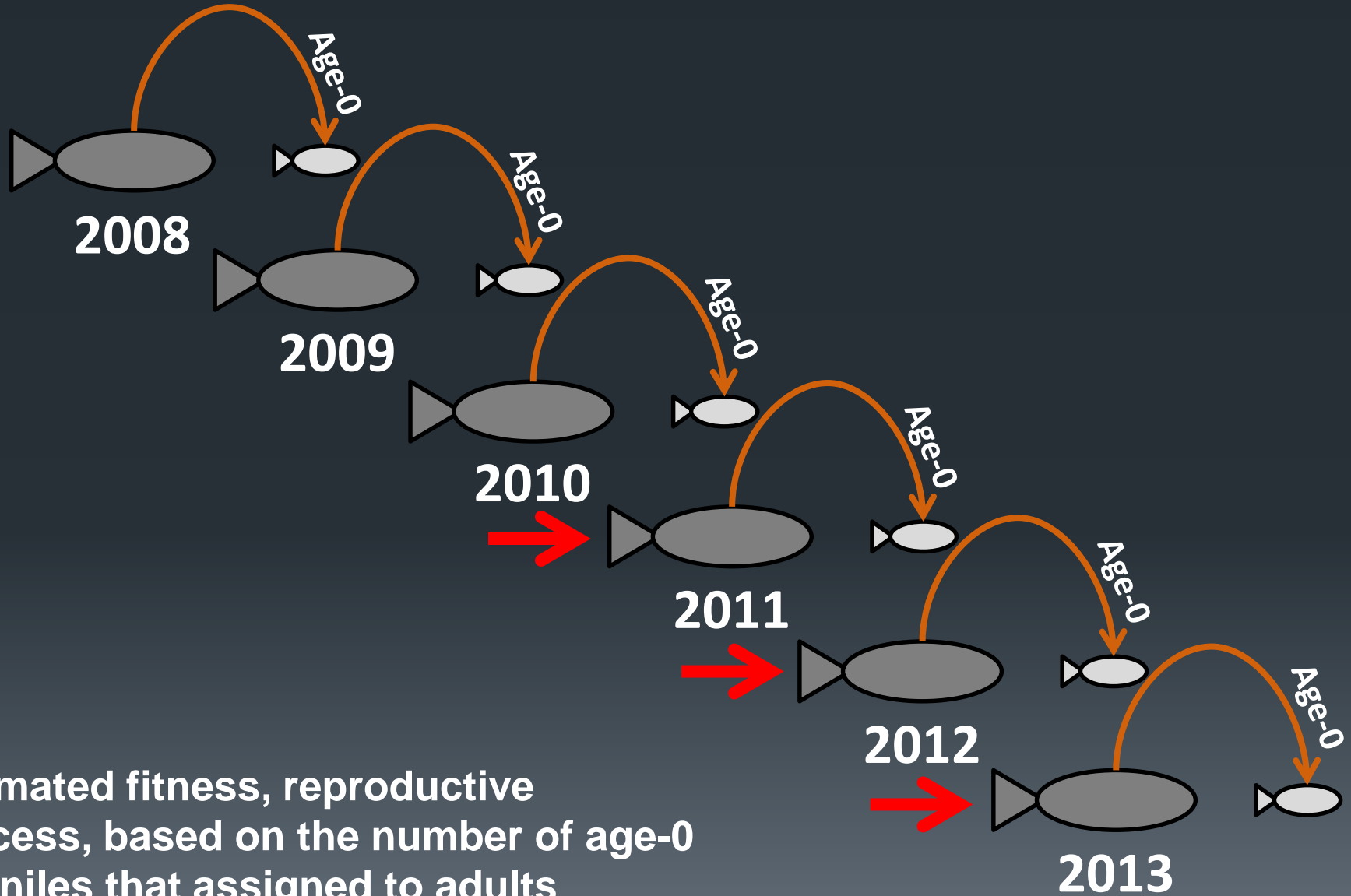


Topics

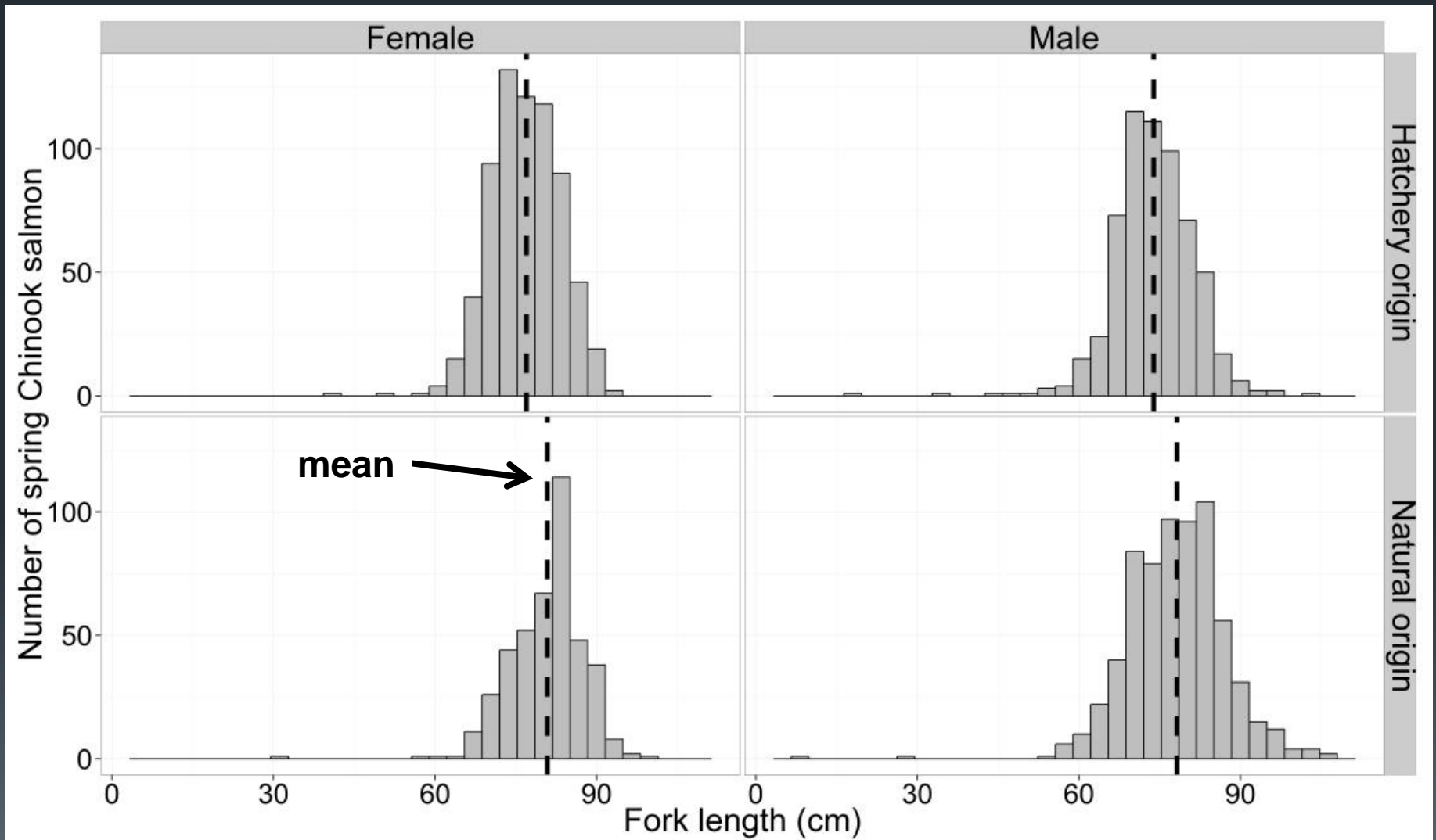


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Adults were assigned to age-0 juveniles sampled above the dam the following year



Hatchery origin adults were, on average, smaller



Analysis based results from a two-way ANOVA

Natural origin adults were, on average, more fit

Year	Coefficients	Est.	SE	Z-value	Pr(> z)	95% CIs
2011	Origin - NOR	0.38	0.17	2.28	0.02	1.05 - 2.04
2012	Origin - NOR	0.47	0.12	4.01	<0.01	1.27 - 2.02
2013	Origin - NOR	0.70	0.18	3.98	<0.01	1.44 - 2.88

Fork length partially explained fitness differences between HOR and NOR adults

Year	Coefficients	Est.	SE	Z-value	Pr(> z)	95 CIs
2011	Fork-length	0.01	0.00	4.42	< 0.001	1.00 – 1.01
	Origin - NOR	0.16	0.17	0.93	0.35	0.83 – 1.64
2012	Fork-length	0.01	0.00	11.45	< 0.001	1.01 – 1.01
	Origin - NOR	0.19	0.11	1.75	0.08	0.98 – 1.51
2013	Fork-length	0.01	0.00	4.55	< 0.001	1.00 – 1.01
	Origin - NOR	0.39	0.18	2.13	0.03	1.05 – 2.11

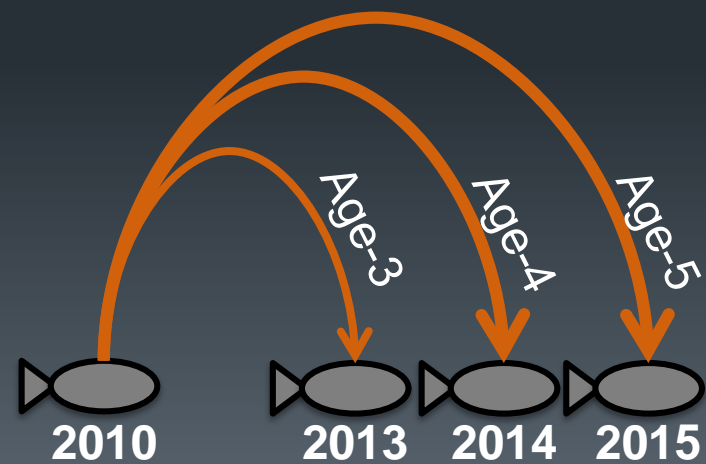
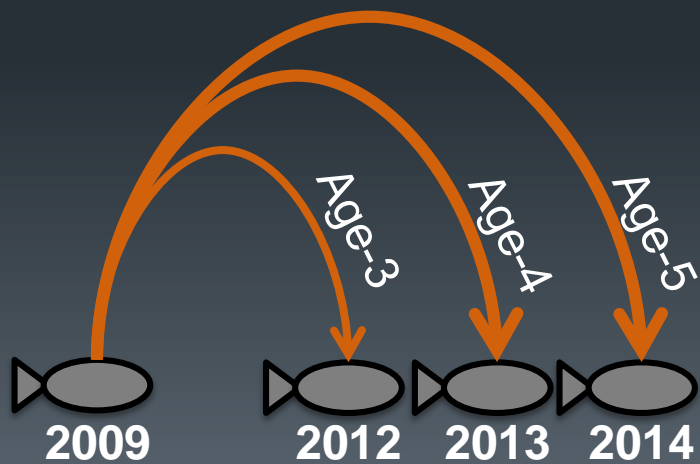
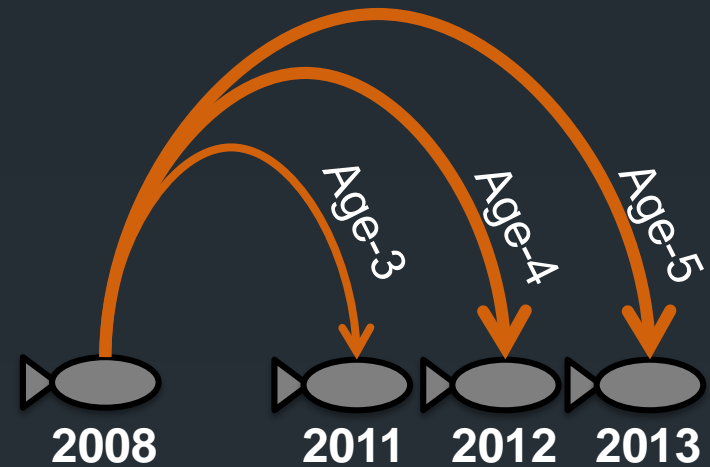
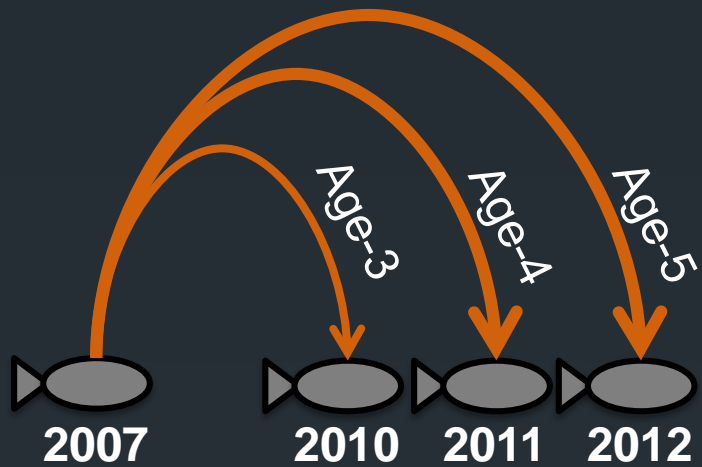
Estimates based on generalized linear mixed effects regression

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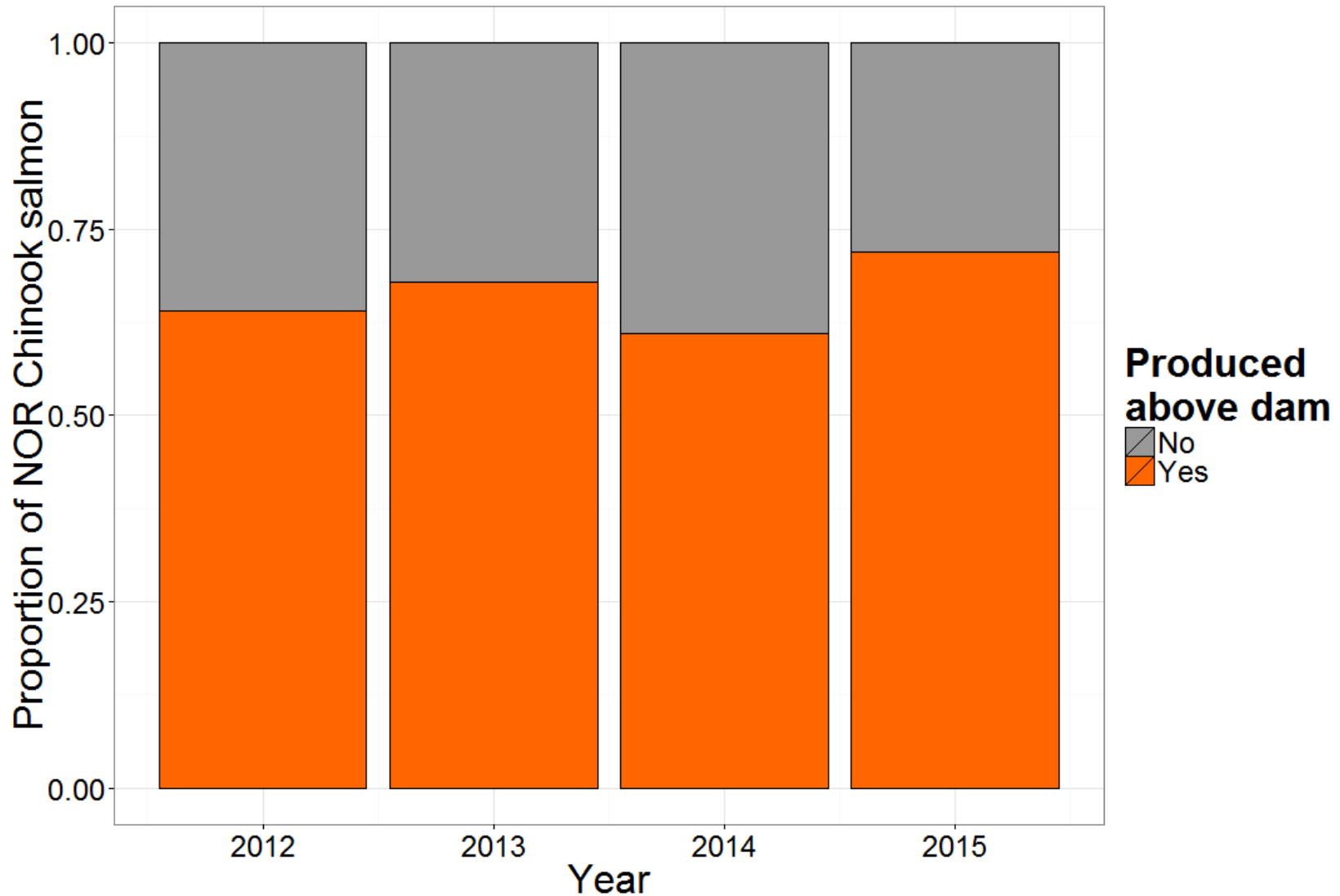
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Adult cohorts were assigned to age-3 to -5 NOR adult returns

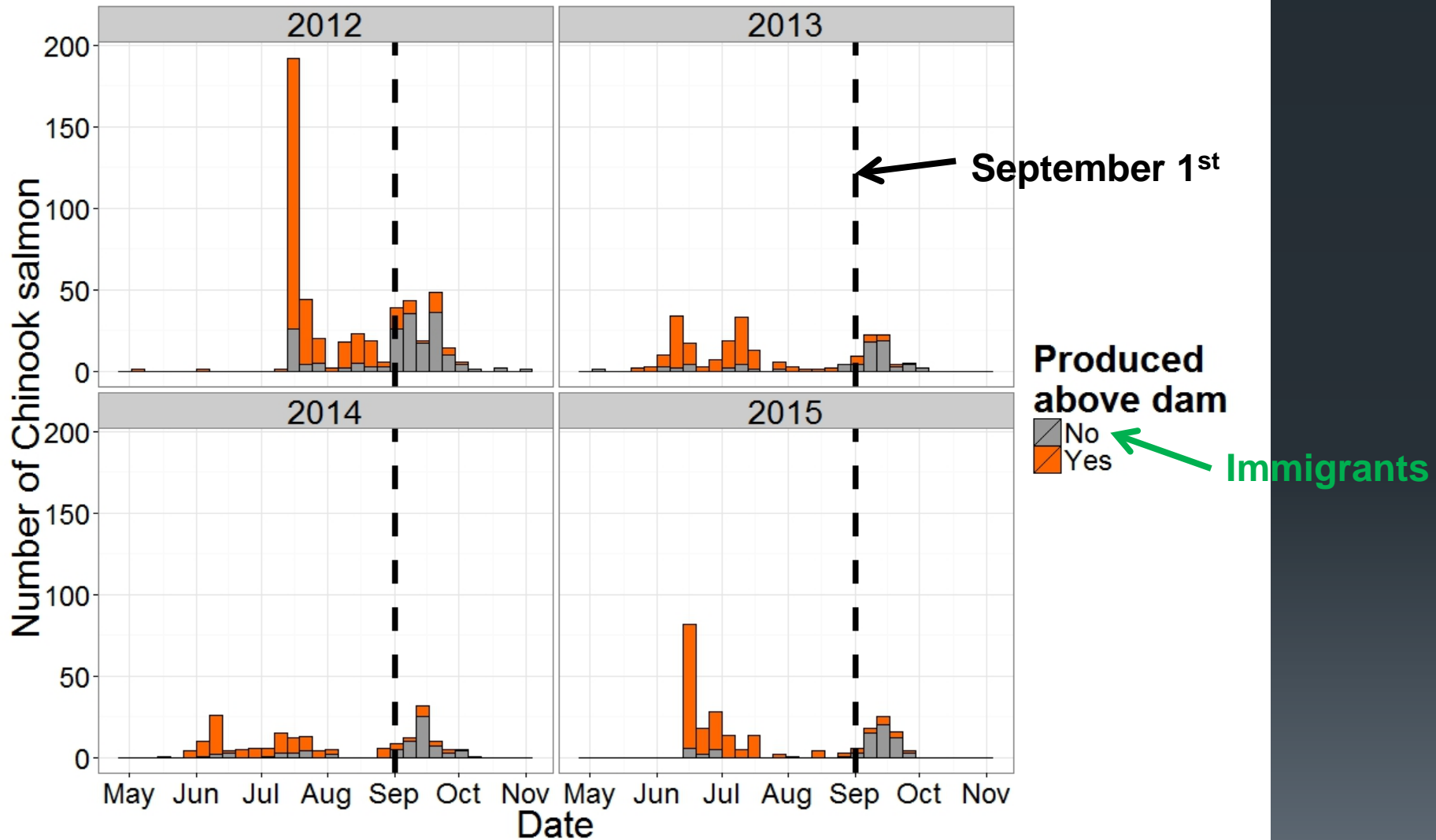


Offspring – NOR Chinook captured at trap and haul facility

Most NOR Chinook salmon returning to the trap and haul facility were produced above the dam



Most NOR Chinook salmon returning later in the spawning season were *immigrants*

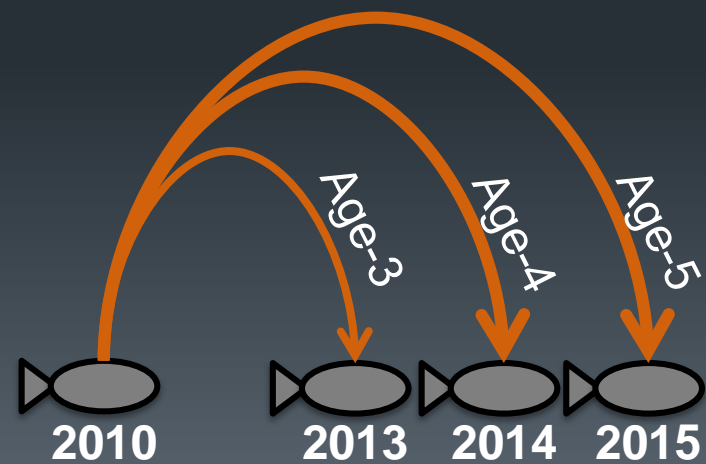
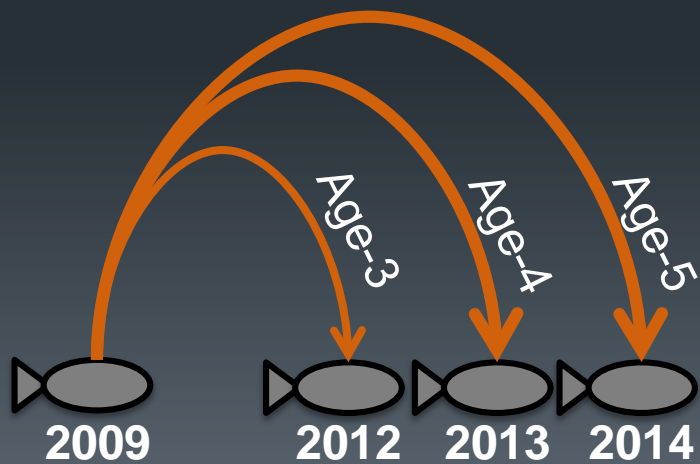
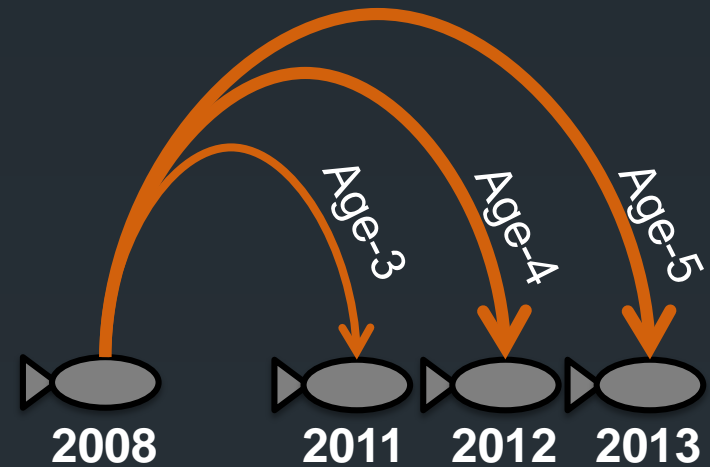
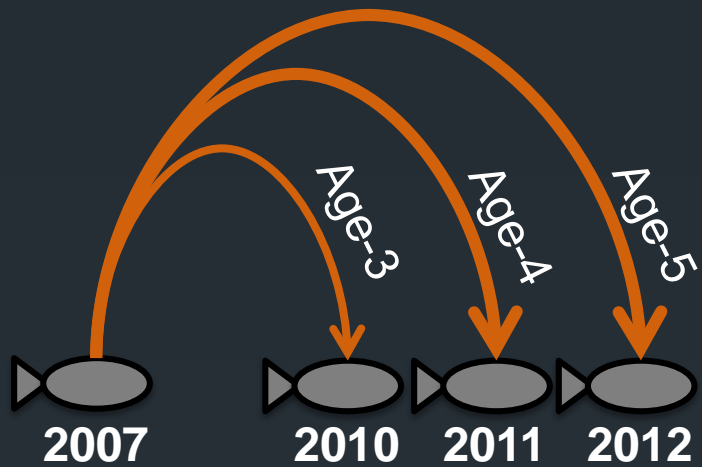


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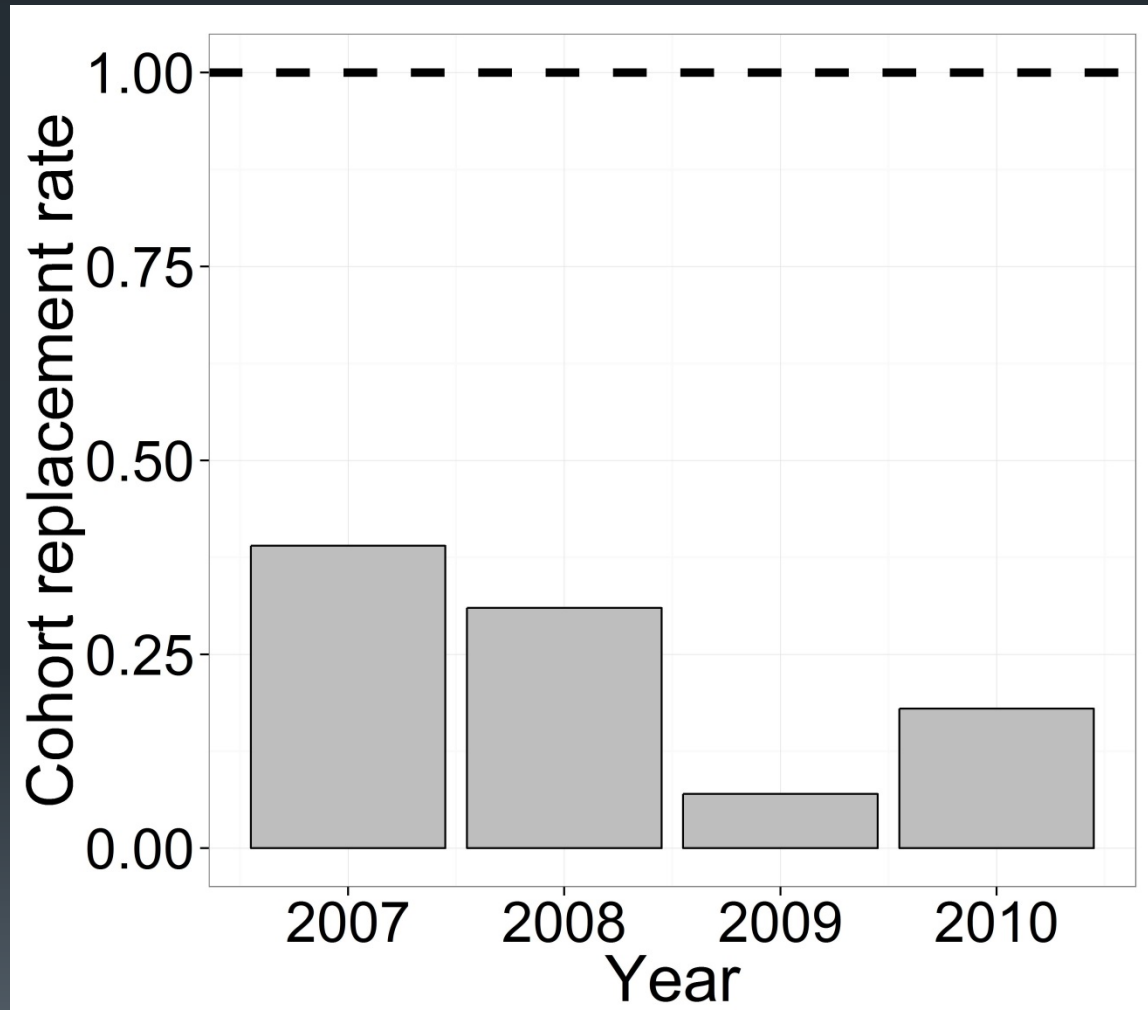
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Offspring – NOR Chinook captured at trap and haul facility

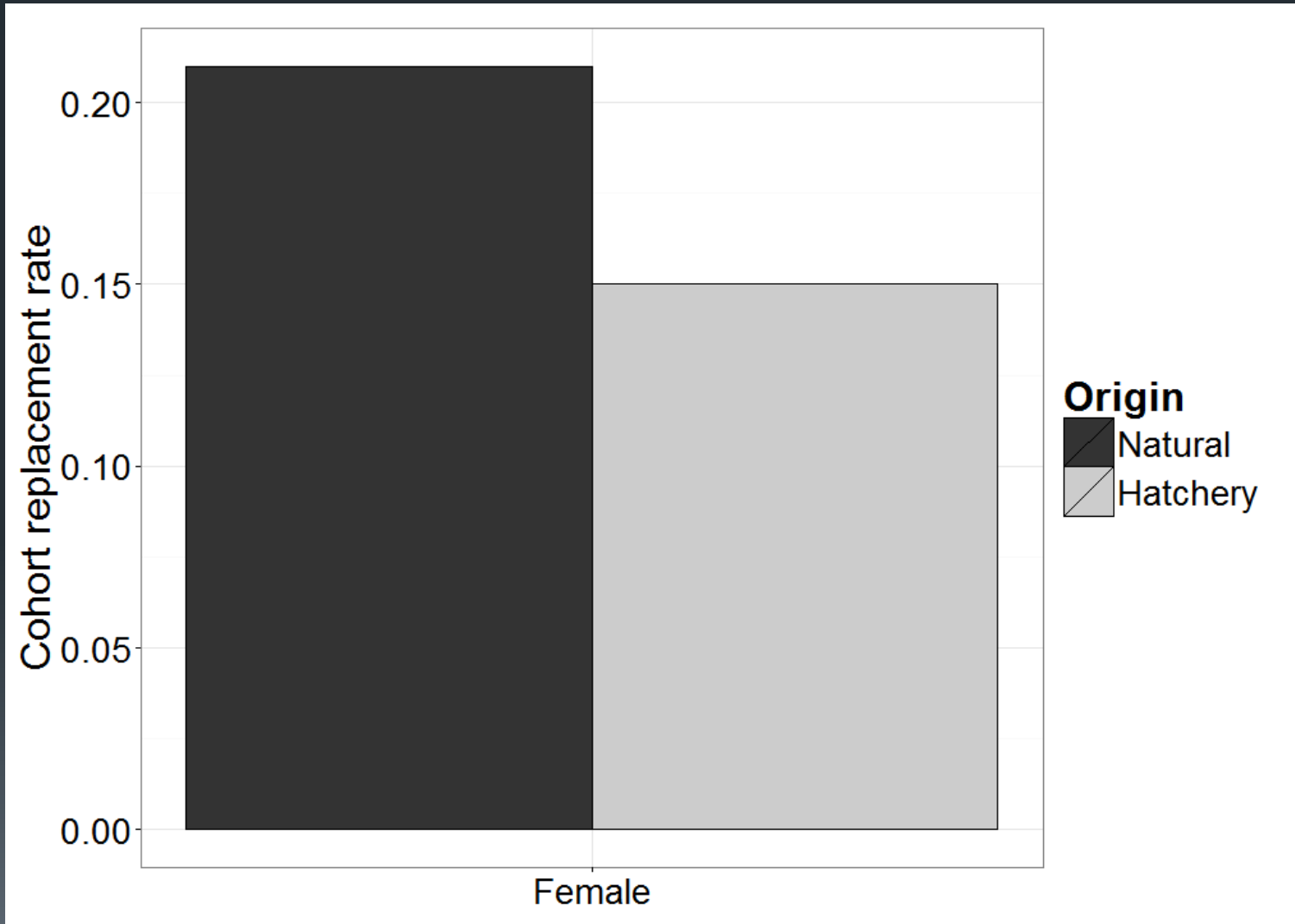
Cohorts are not meeting demographic replacement



***Females
only**

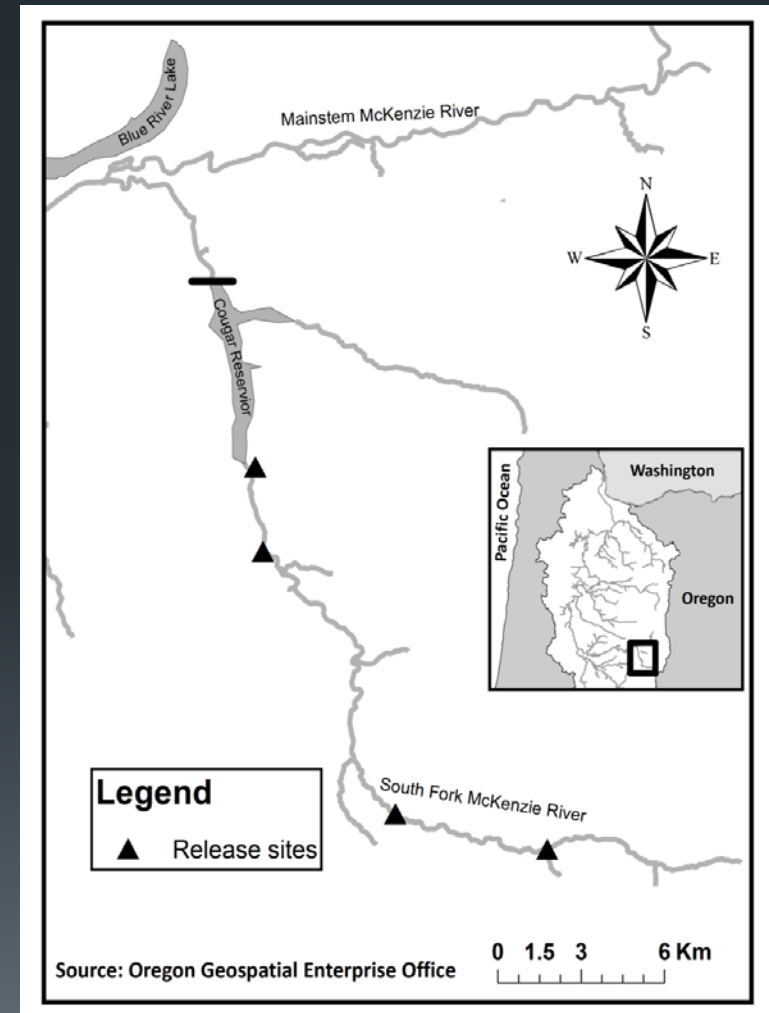
CRR = Number of daughters / Number of potential mothers

NOR females had higher cohort replacement rates in 2010



Minor contribution to below dam population

Year	Carcasses	Genotyped	Offspring
2011	60	45	1
2012	14	10	1
2013	8	5	0
2014	21	6	0
2015	55	26	2

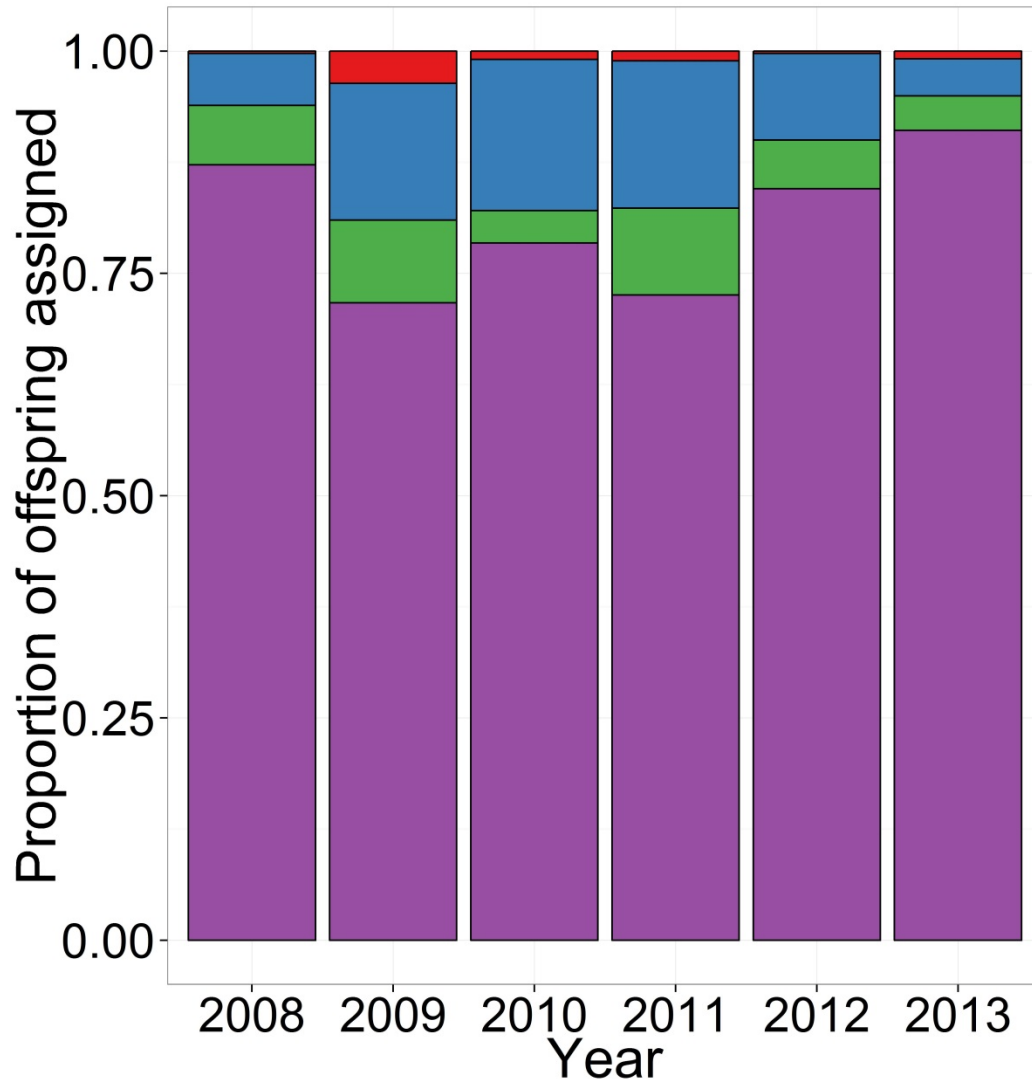


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Some juvenile offspring did not assign to parents – why?



Assignment type

- No parent assigned
- Mother unassigned
- Father unassigned
- Both parents assigned

9% ± 5% of juveniles with one unassigned parent remain unexplained after accounting for human error

Are there unsampled Chinook salmon above Cougar Dam?

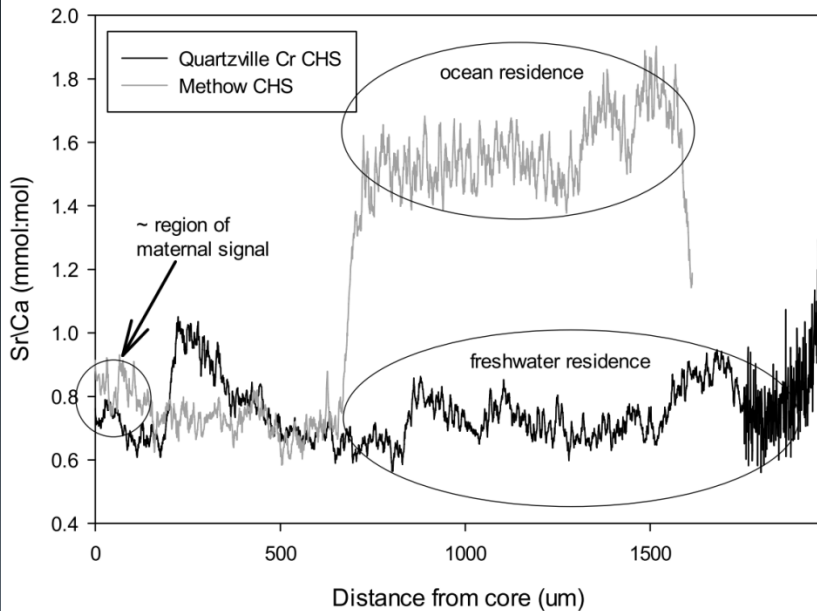
North American Journal of Fisheries Management 34:885–891, 2014
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 ISSN: 0275-5947 print / 1548-8675 online
 DOI: 10.1080/02755947.2014.923073

MANAGEMENT BRIEF

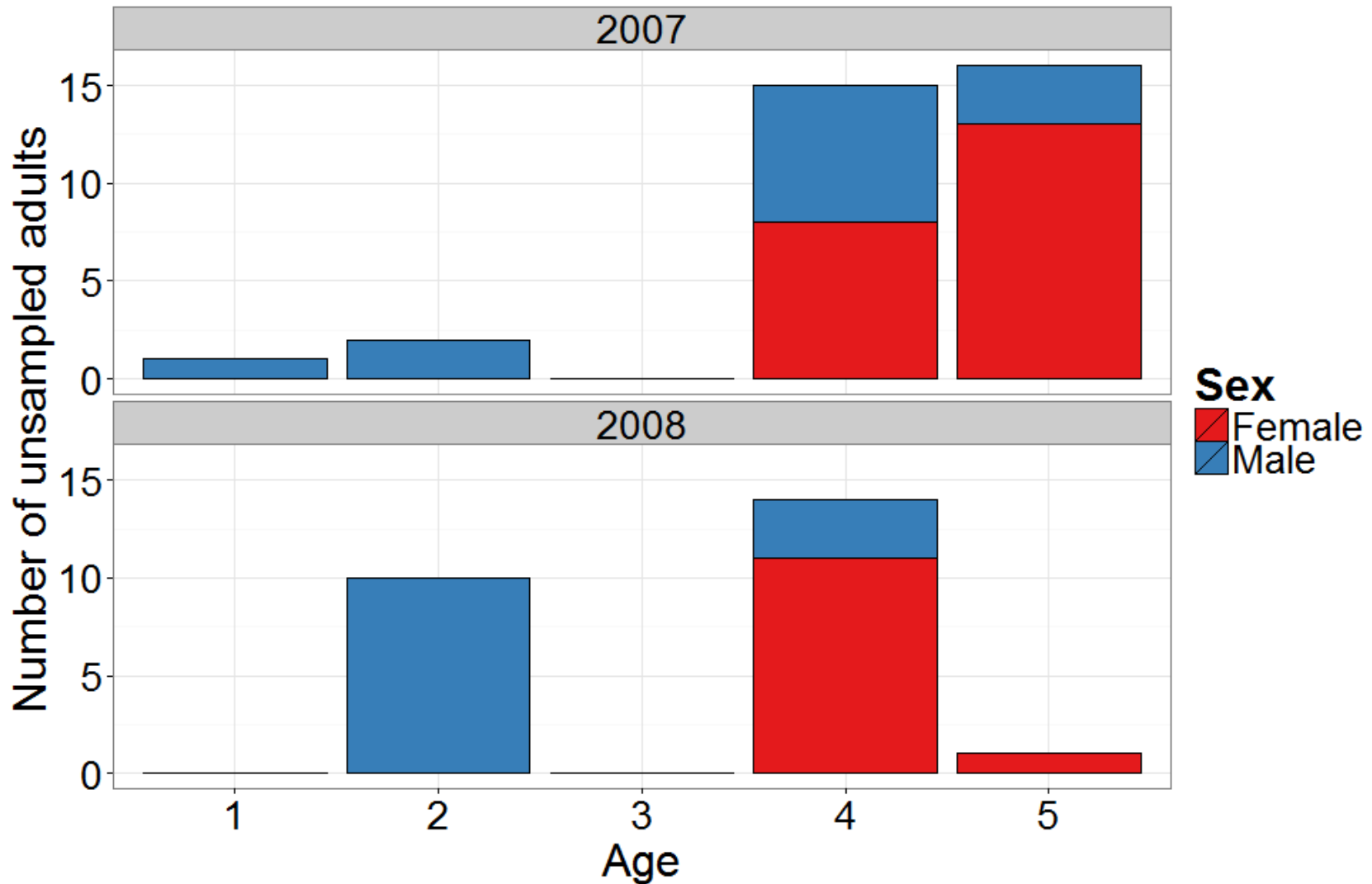
Adfluvial Life History in Spring Chinook Salmon from Quartzville Creek, Oregon

Jeremy D. Romer* and Fred R. Monzyk

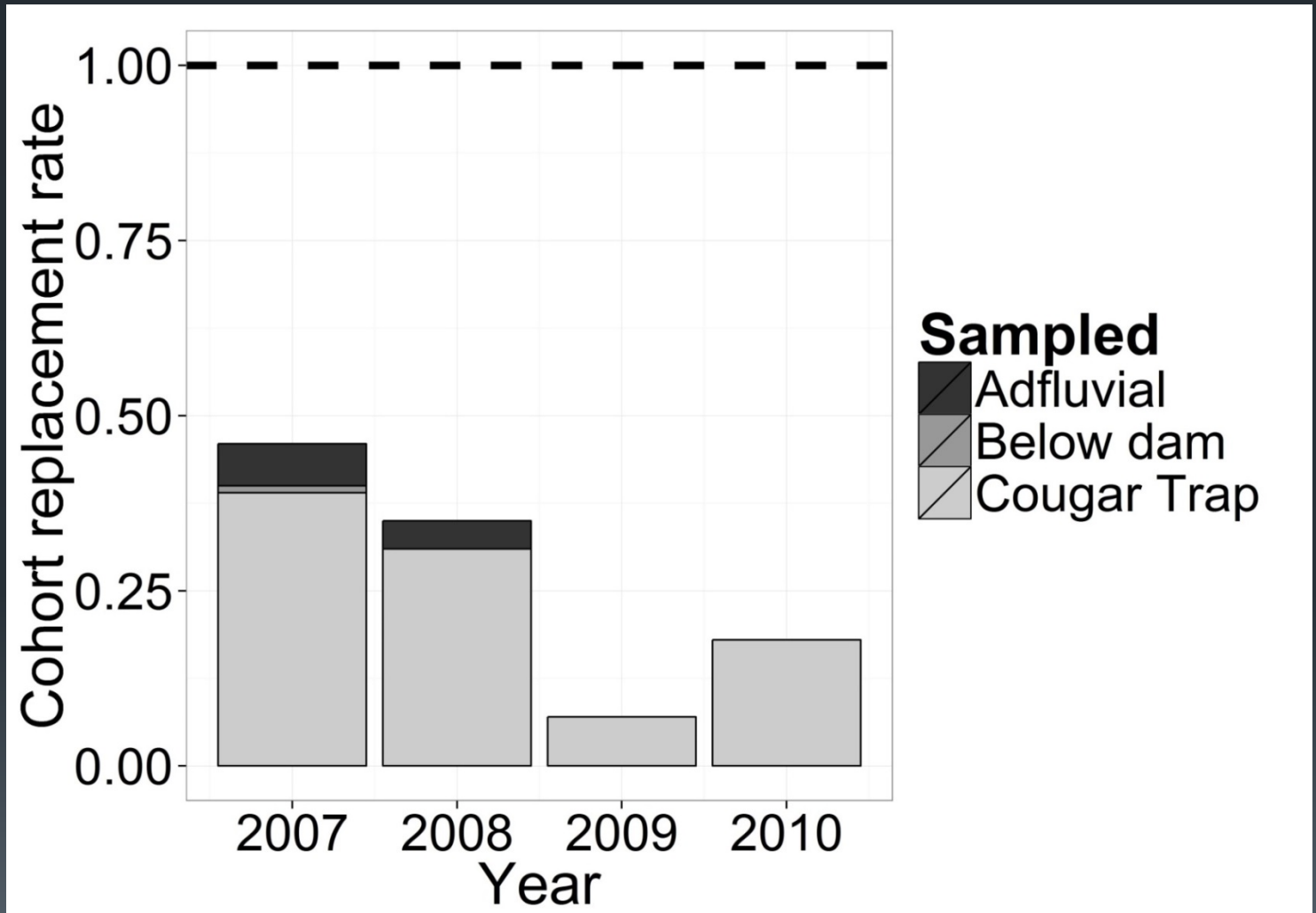
Oregon Department of Fish and Wildlife, 28655 Highway 34, Corvallis, Oregon 97333, USA



Grandparentage assignments identified unsampled age-1 to -5 adults



Change CRRs?



*Females only

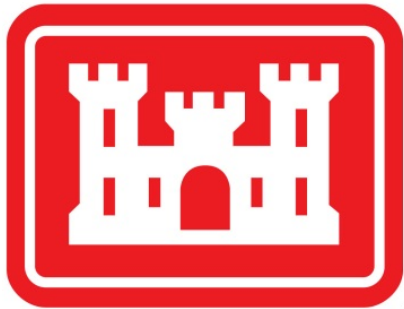
CRR = Number of daughters / Number of potential mothers

Summary of topics covered



- Fitness differences between hatchery and natural origin adults
 - Hatchery fish may be less fit because they are smaller, and potentially, return at a younger age
- Assignment rates for adults returning to the trap and transport facility at the base of the dam
 - Most adults returning to the trap were produced above the dam
 - Adults returning later in the season are more likely to be immigrants
- Cohort replacement rates calculated for adults reintroduced from 2007 to 2010
 - Cohorts are not meeting demographic replacement
- Genetic evidence that suggest some unsampled Chinook salmon contribute to the population
 - Some unsampled age-1 to age-5 adults may contribute offspring to the population above the dam

Acknowledgements



SM

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and Rich Piaskowski



Dissertation chapters

- 1. Sard, N.M.,** K.G, O'Malley, D.P, Jacobson, M.J., Hogansen, M.A., Johnson, and M.A., Banks. 2015. Factors influencing spawner success in a spring Chinook salmon (*Oncorhynchus tshawytscha*) reintroduction program. *Canadian Journal of Fisheries and Aquatic Sciences*, 79(9):1390-1397
- 2. Sard, N.M.,** M.A., Johnson, D.P., Jacobson, M.J., Hogansen, K.G., O'Malley and M.A., Banks. *Revision submitted*. Genetic monitoring guides adaptive management of a migratory fish reintroduction program. *Animal Conservation*.
- 3. Sard, N.M.,** D.P., Jacobson, and M.A., Banks. *Submitted*. Grandparentage assignments identify unexpected adfluvial life history contributing offspring to a reintroduced population. *Evolutionary Applications*.
- 4. Sard, N.M.,** Evans, M.L., D.P, Jacobson, K.G, O'Malley, and M.A., Banks. *In prep*. Assessing genetic diversity among potential parents, offspring, and immigrants for two spring Chinook salmon reintroduction programs. *Conservation Genetics*.

Known grandparent pairs can be used to identify missing parents

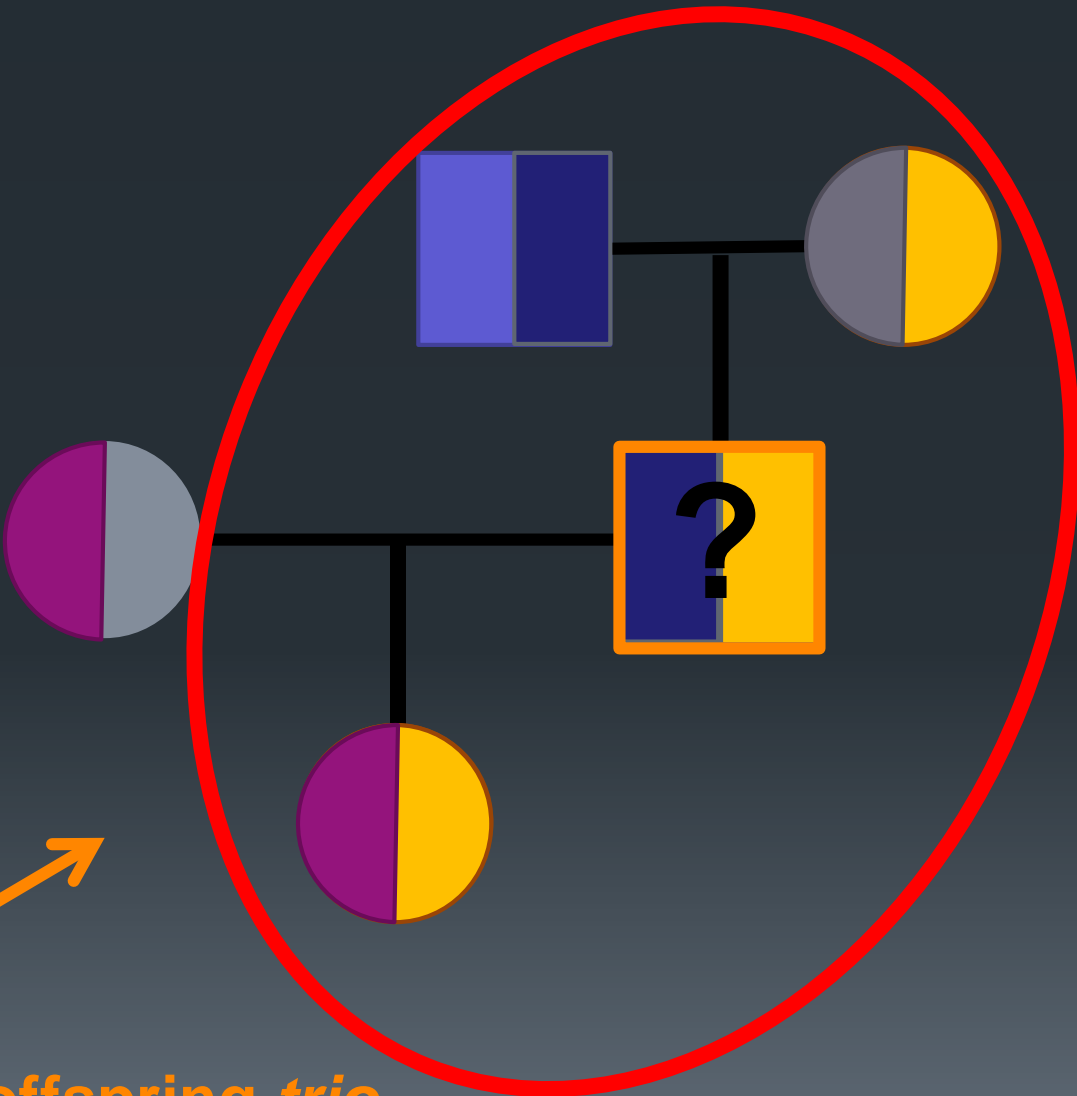


Grandparent pair

Parent

- *Our study:*
 - 11 loci
 - 35 alleles/locus

Grandoffspring (Juveniles)



Grandparent pair – grandoffspring *trio*