

Assessing the Effectiveness of Sockeye Salmon Enhancement in Transboundary Alaska/Canada

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6 April 2022

Southeast Regional Planning Teams Meeting



Transboundary sockeye enhancement under PST

Cooperative enhancement:

- Canada conducts egg take & fertilization at lake
- Eggs are transported to Snettisham Hatchery for incubation
- **Integrated model**: fry are transplanted to lakes to feed, grow, migrate to ocean, and return to the natural lake system alongside wild fish
- Goal is still to produce extra fish for harvest

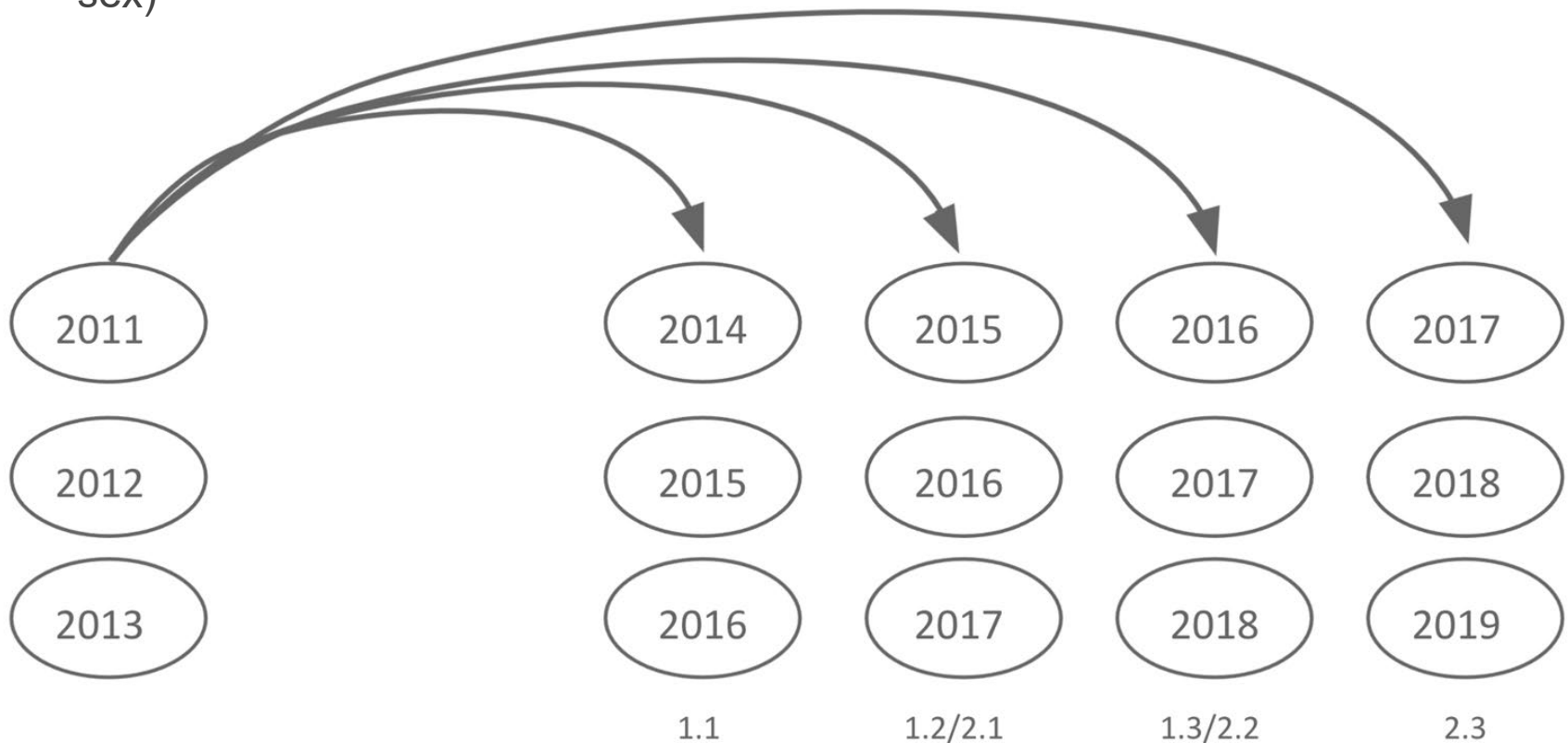


Questions:

- **Does this work? (Do hatchery fish produce more adult offspring than natural-spawning fish?)**
- **What are the effects of hatchery rearing on salmon traits?**
- What is the reproductive success of hatchery-born fish when they spawn in the natural system?

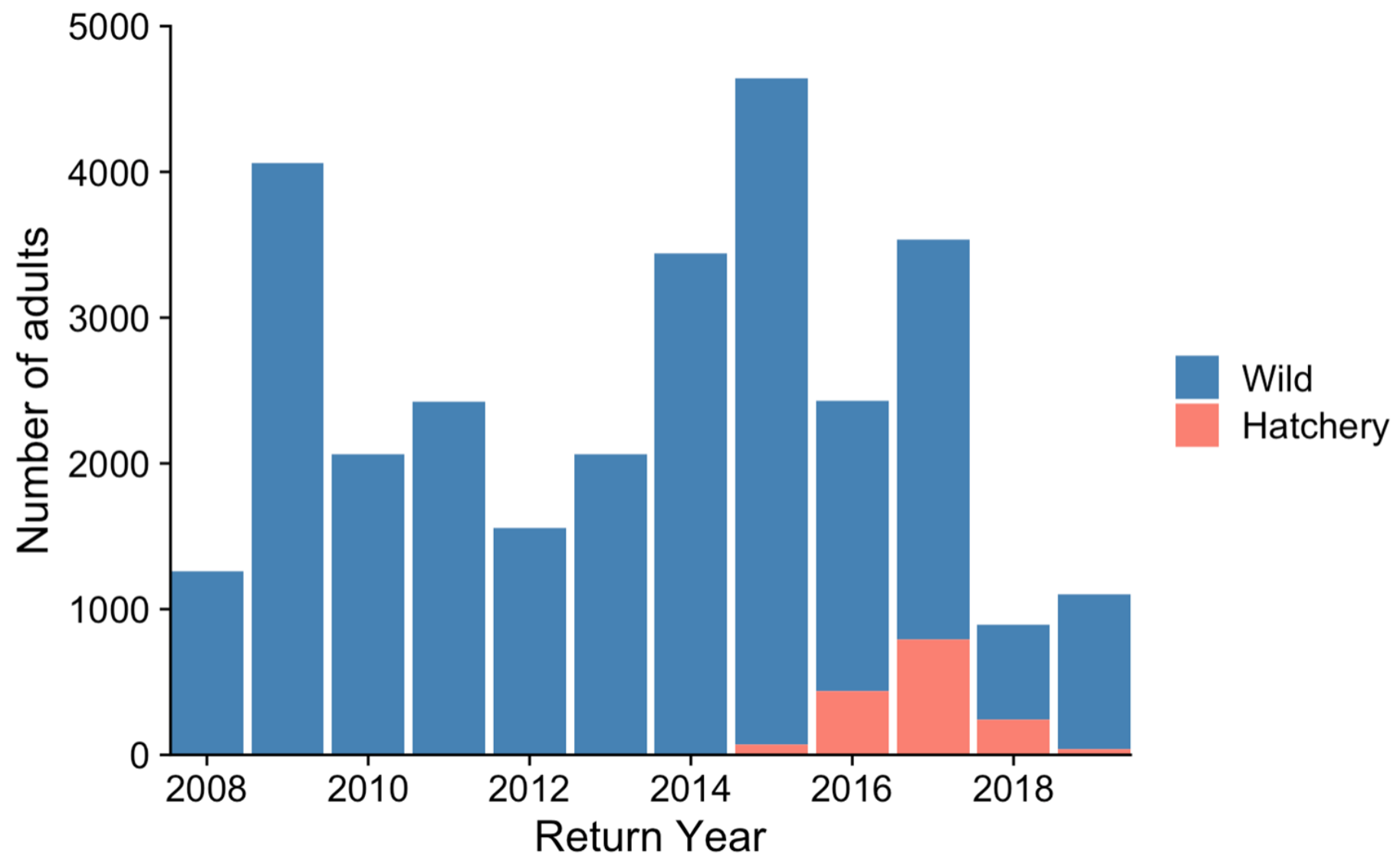
Three brood years of experimental hatchery enhancement in Auke Lake

- 30 females x 15 males each year, 2011-2013, PST/integrated model
- all adults (hatchery & wild) and offspring genotyped at 54 genetic markers (45 SNPs & 9 microsatellites)
- offspring assigned to parents and tallied by parent type (hatchery/wild, sex)

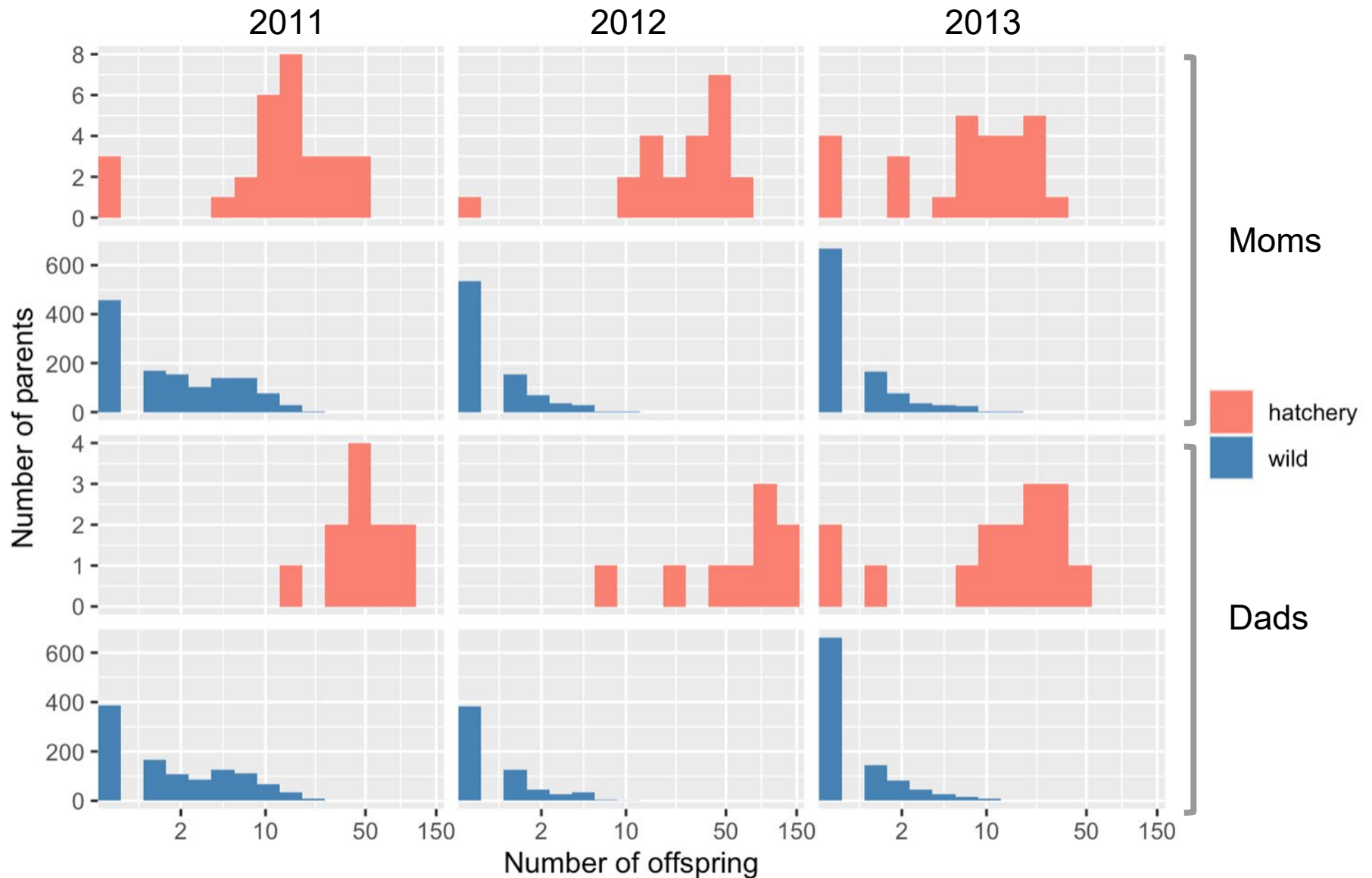




Results: lots of hatchery babies came back!

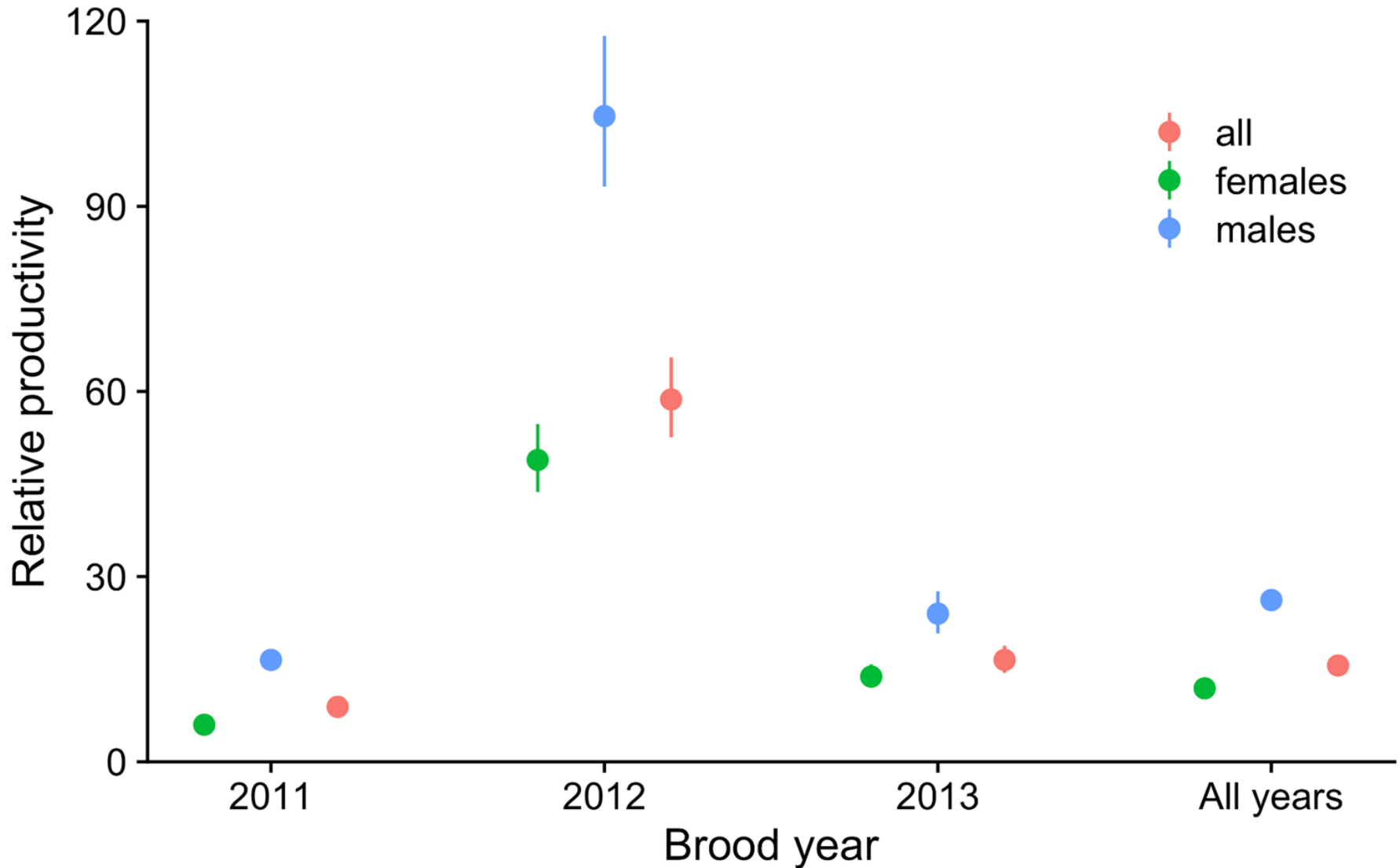


Hatchery parents produced a lot of offspring...

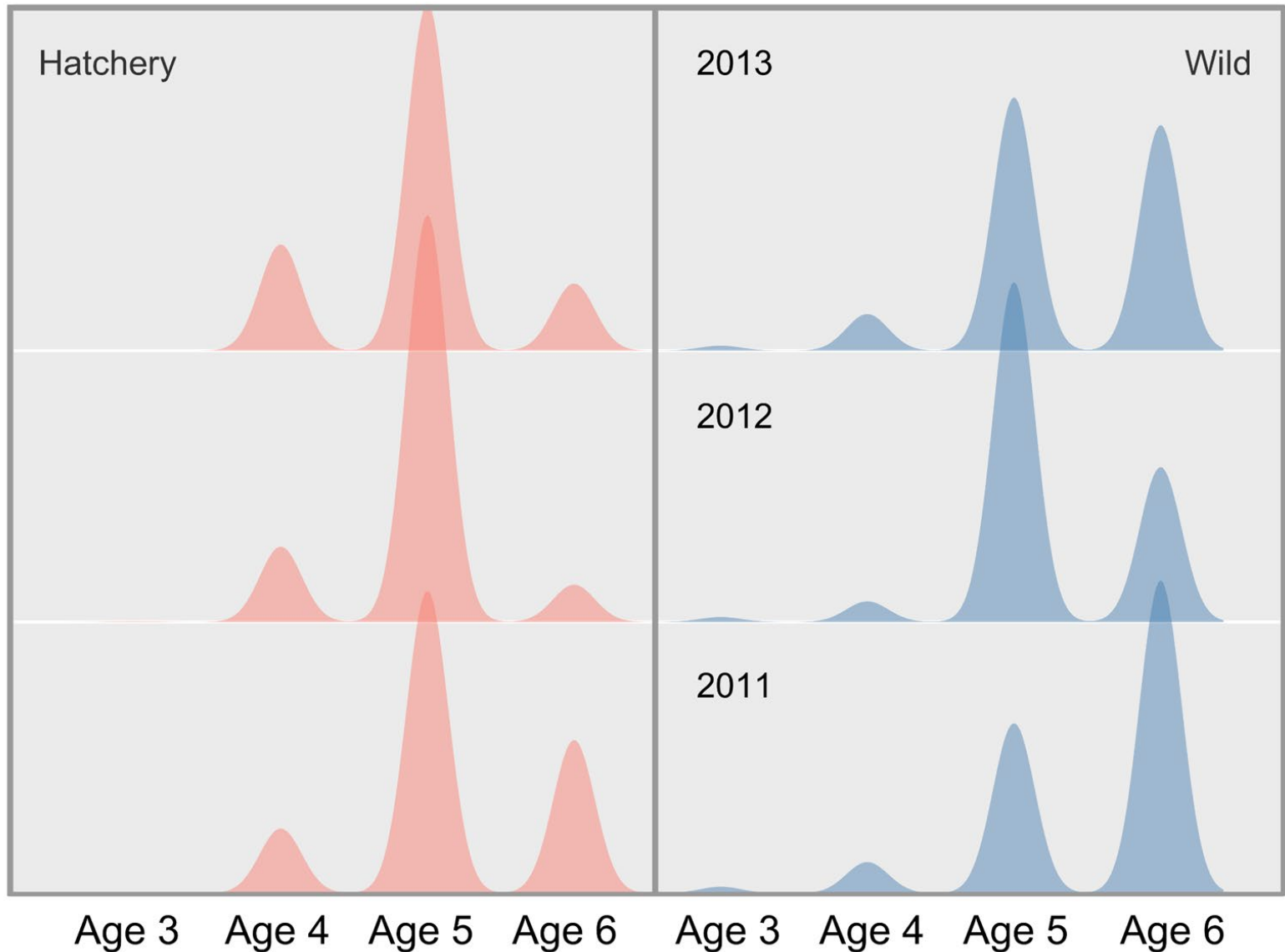


$$\text{Relative productivity} = \frac{\text{offspring/hatchery parent}}{\text{offspring/wild parent}}$$

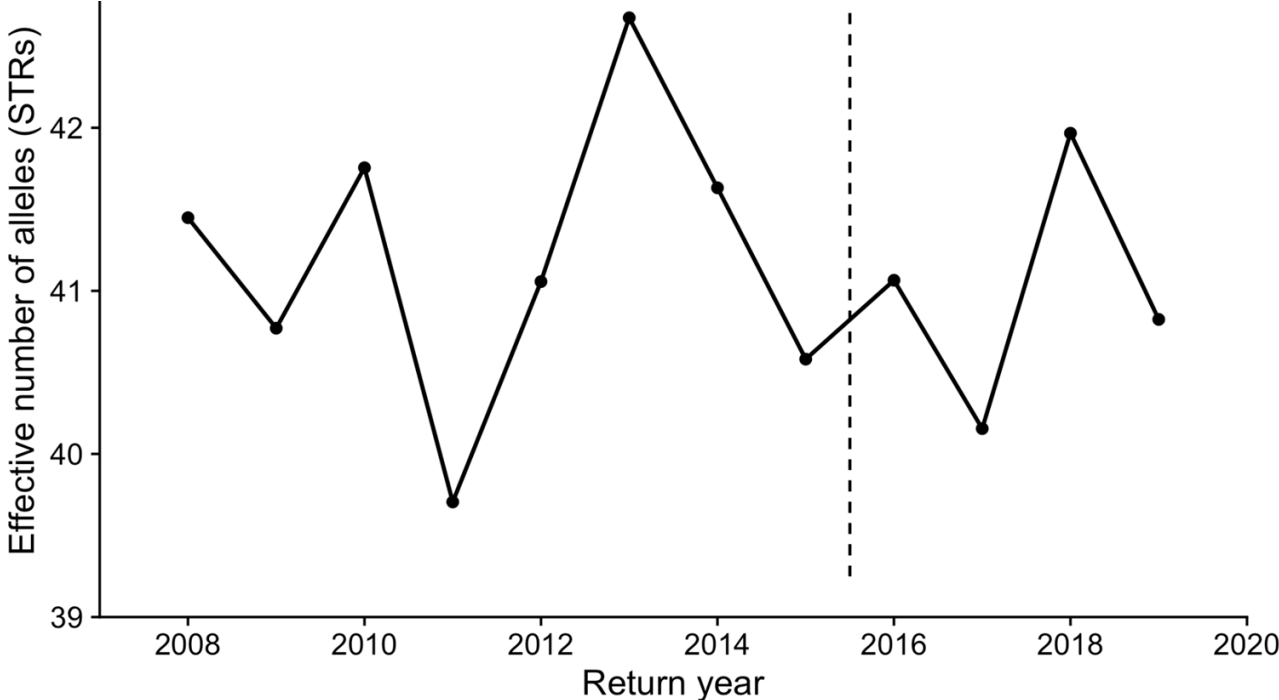
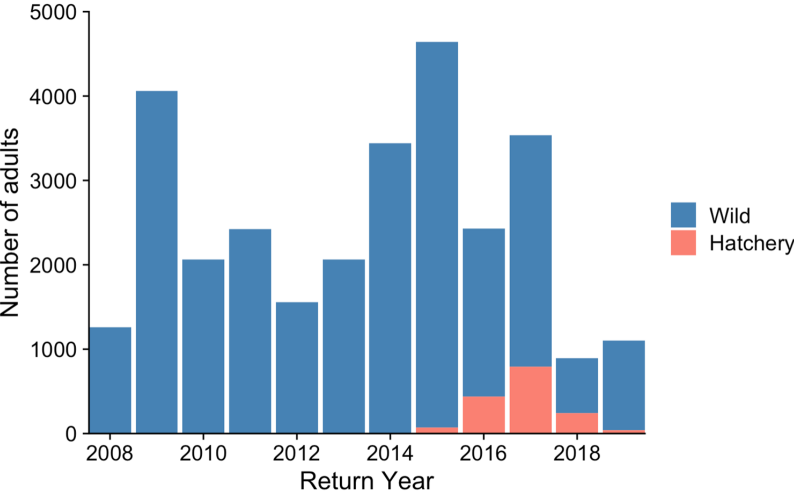
if hatchery = wild, RP = 1



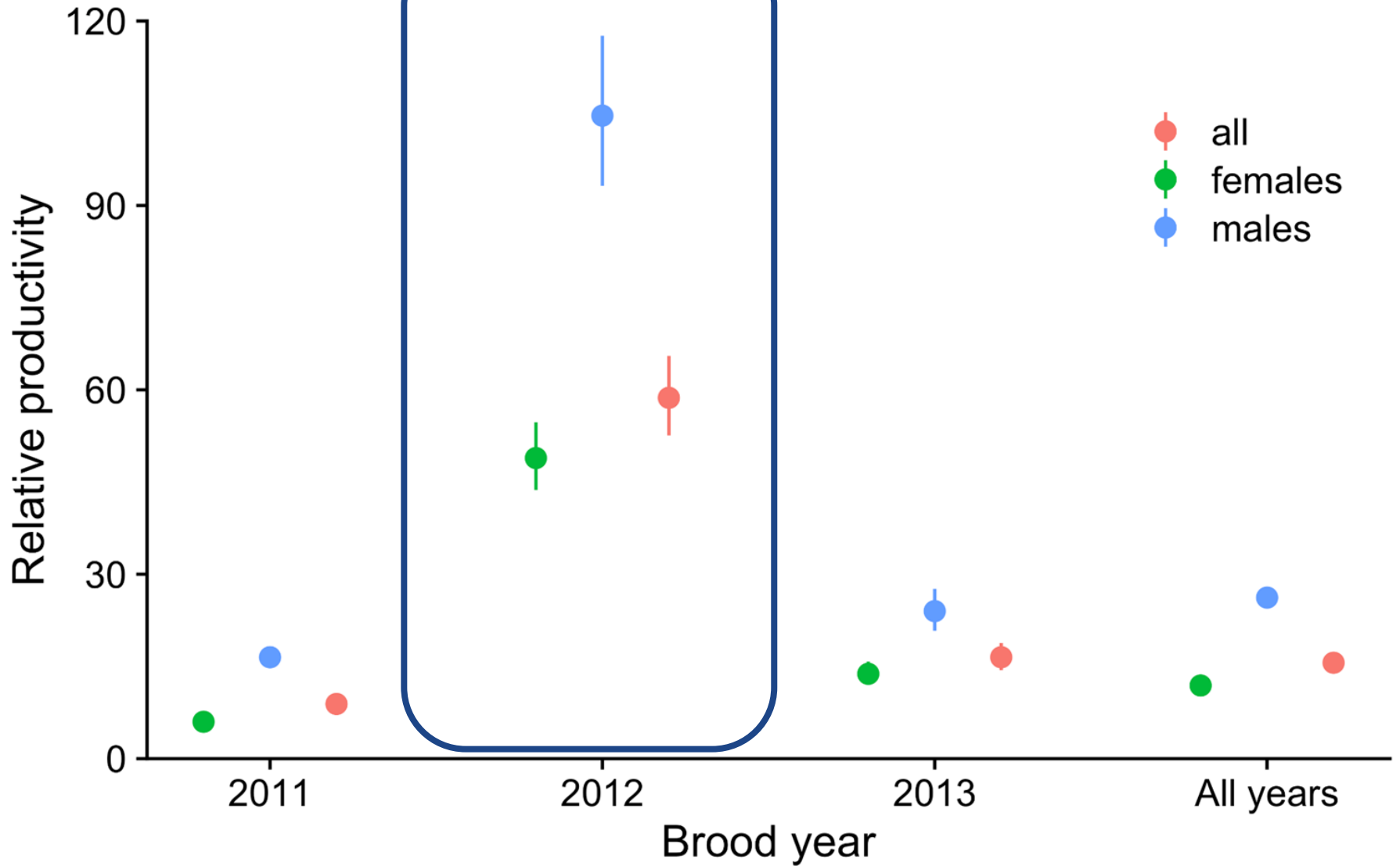
But... hatchery offspring came back at a younger age



Effects on genetic diversity?



What happened in 2012?!



Conclusions


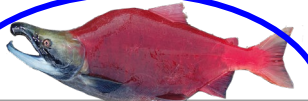




- Sockeye salmon enhancement as conducted under the integrated/PST model successfully produced returning adults
 - effective when spawning/incubation habitat is limiting
 - could backfire if lake habitat is limiting
- However: enhancement also caused trait changes (younger at maturity)
 - role of early feeding/lake rearing period?
 - epigenetic effects of hatchery environment?
- Second-generation effects could be negative if hatchery-origin fish have lower reproductive success in the wild (*stay tuned! - last F2 return year is 2025*)

Extra slides





How does parent assignment work?

Offspring	Locus 1		Locus 2		Locus 3		Locus 4		Locus 5	
	A	A	T	C	A	T	T	T	A	A
Potential parents										
	C	A	C	C	T	T	T	T	A	G
	A	A	T	T	A	A	T	T	A	G
	C	A	C	C	A	T	T	T	C	C
	C	C	C	C	T	T	T	C	A	A
	C	C	C	T	A	T	C	C	A	A