

Does acclimation and
spawning site affect
reproductive success
of Upper Yakima
River spring
Chinook?

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Project Collaborators



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Project Objective

- In the Yakima basin, hatchery-origin Chinook demonstrate lower reproductive success than natural-origin Chinook (spawn years 2007-2011; Koch et al., 2022).
- In other systems, reduced reproductive success by hatchery-origin fish has been linked to spawning in suboptimal habitat that is adjacent to smolt release sites (Hoffnagle et al., 2008; Williamson et al. 2010; Ford et al., 2016; Hughes & Murdoch, 2017).
- If we could link spawn/acclimation site carcass data with reproductive success data, then we may uncover a potential mechanism for reduced productivity in the Upper Yakima.

Methods

- Received DNA from carcasses sampled in 2007-2010 by Andy Dittman & crew
- Then matched these individual samples to the RRS dataset by:
  1. PIT tags
  2. Genetic duplicate
    - a. Only “goo factor” = 1 (i.e., least degraded)
- Ran GLM models to determine if spawning site predicts reproductive success



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Yakima River Acc Sites

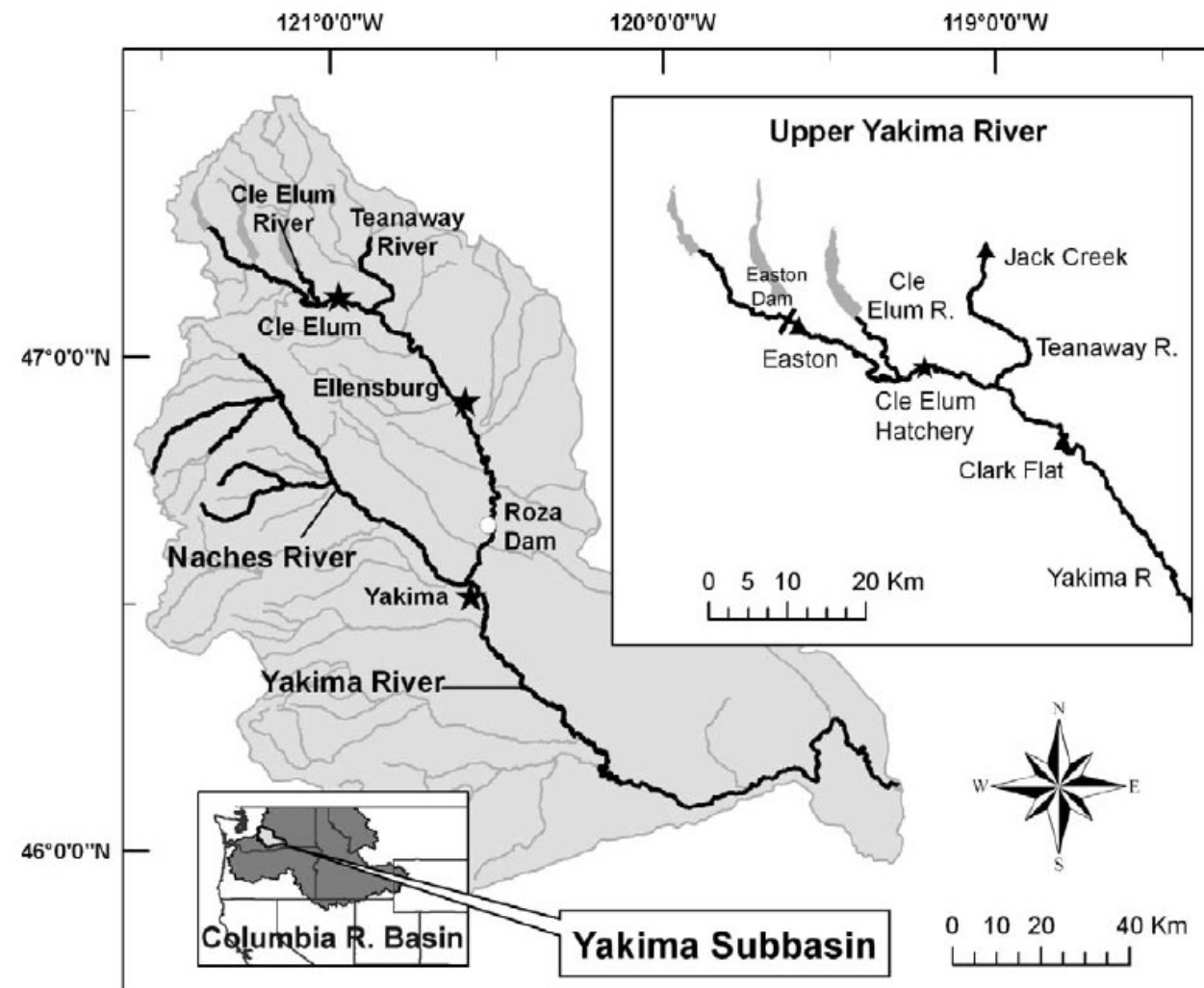


Figure 1, Dittman et al., 2010

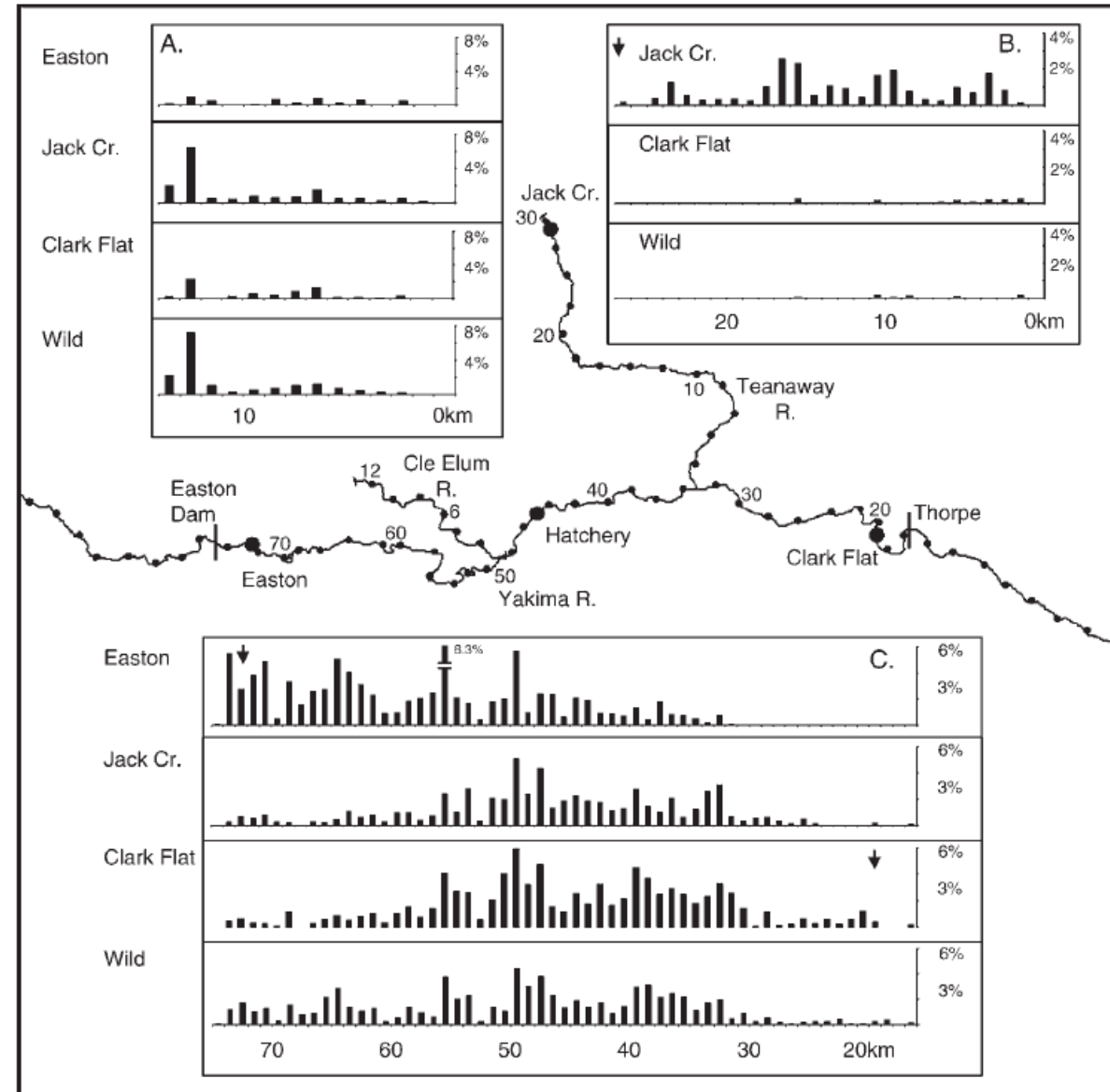
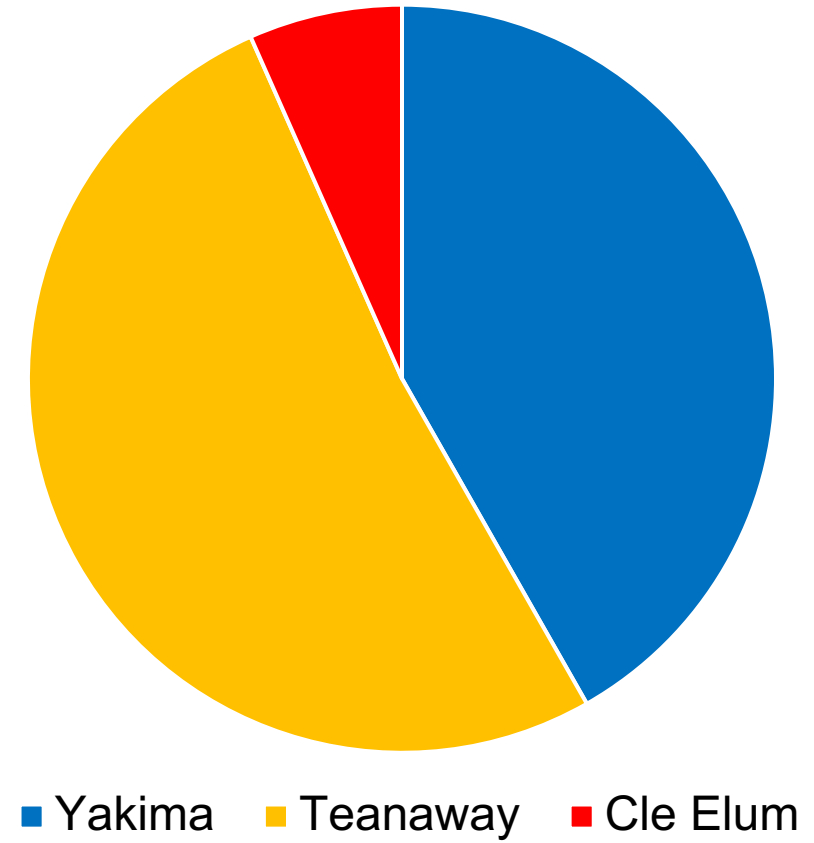


Figure 4, Dittman et al., 2010

Sample Sizes

- 239 samples matched via PIT tag
- Successfully genotyped 55% of the least degraded samples (n=177).
  - Out of 177, we genetically matched 168 to fish in Roza database with RS estimate
- Samples that matched via PIT + genetics with an RS value = 407 total:
  - 2007 = 59
  - 2008 = 22
  - 2009 = 48
  - 2010 = 278

No. Samples per Spawn Site

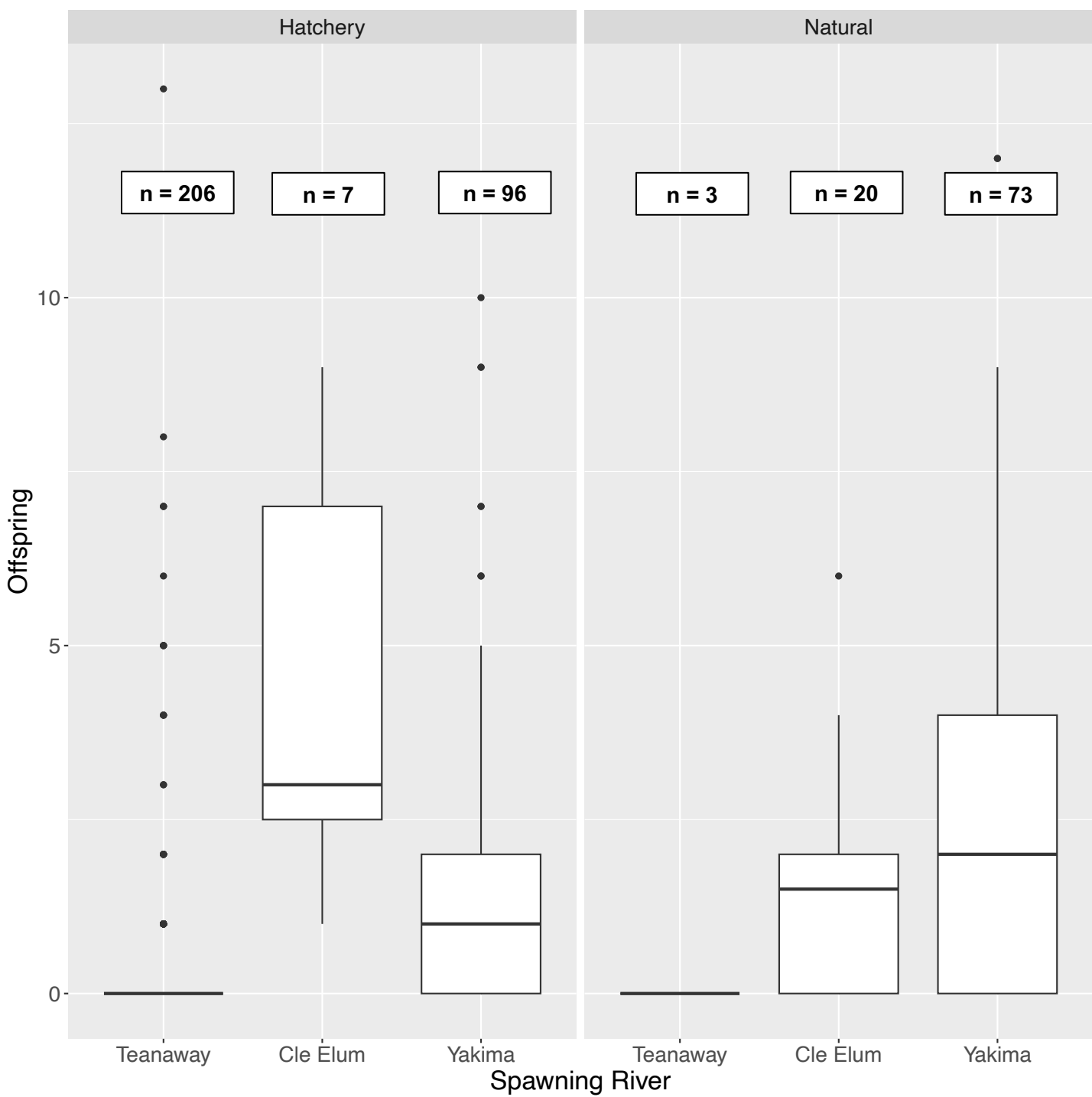


Results – Spawn Site

- Best fitting GLM for predicting reproductive success included terms:
  - Spawning River (Teanaway significantly lower than other rivers)
  - Sampling Year (2007 significantly higher than all other years)
  - Sex & Origin (neither significant)

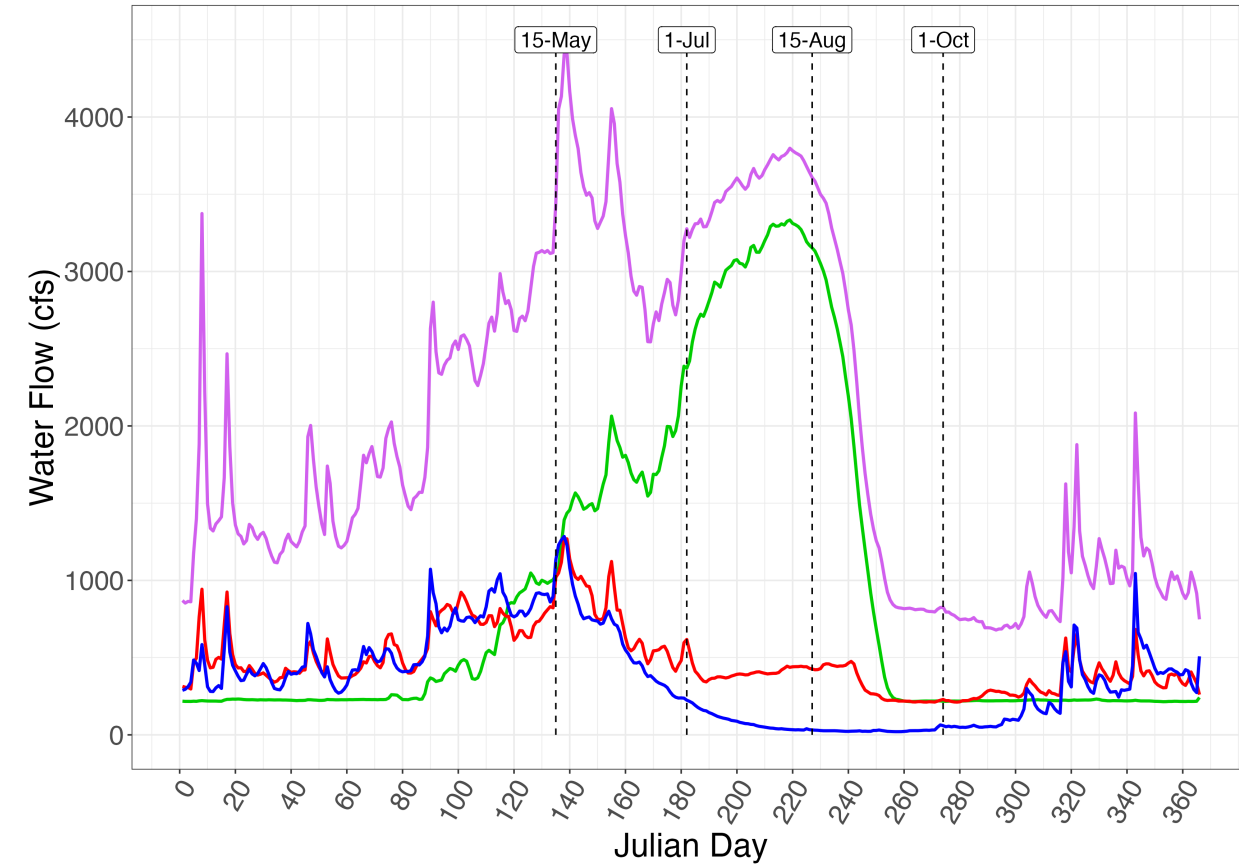
Mean RS by Spawn Site & Origin

	Teanaway	Cle Elum	Yakima
Hatchery	0.64	4.57	1.68
Natural	0.00	1.55	2.40

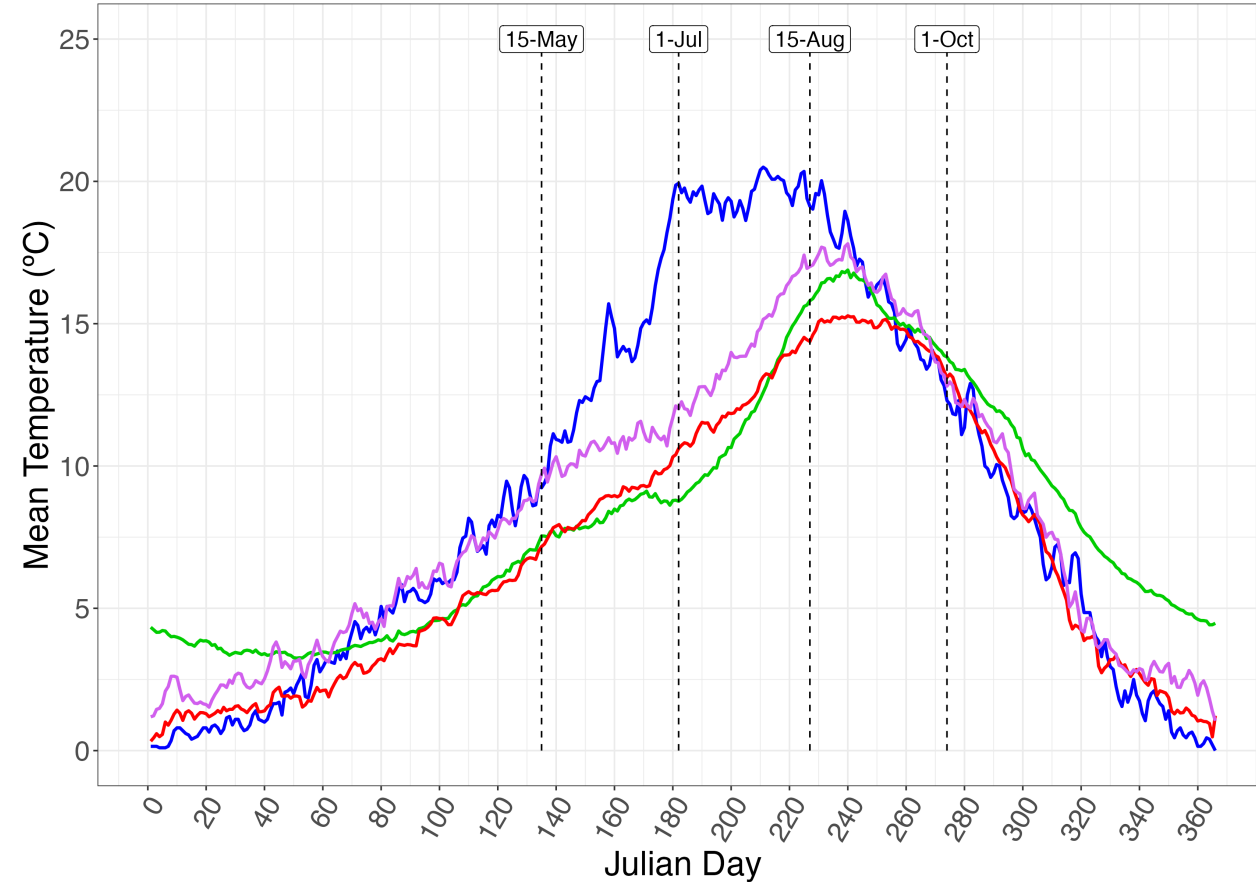


Teanaway River – Environmental Conditions

Mean Daily Water Flow - Averaged per day, per station for 2007-2016



Mean Daily Temperature - Averaged per day, per station



— Cle Elum River — Yakima at Easton — Teanaway River at Forks/Red Bridge — Yakima River at Horlick

Results – Acc Site

- Teanaway River largely used by Jack Creek acclimated fish (N=198):
  - 28 spawned in Yakima main
  - 3 spawned in Cle Elum River

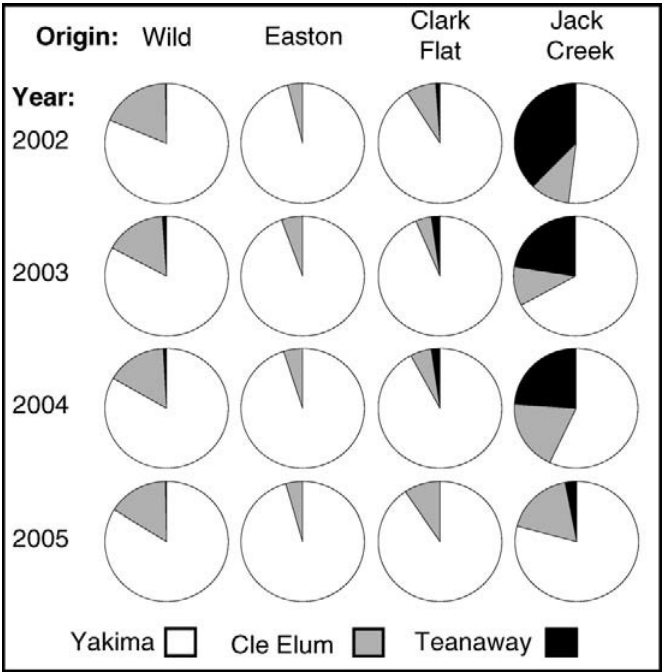
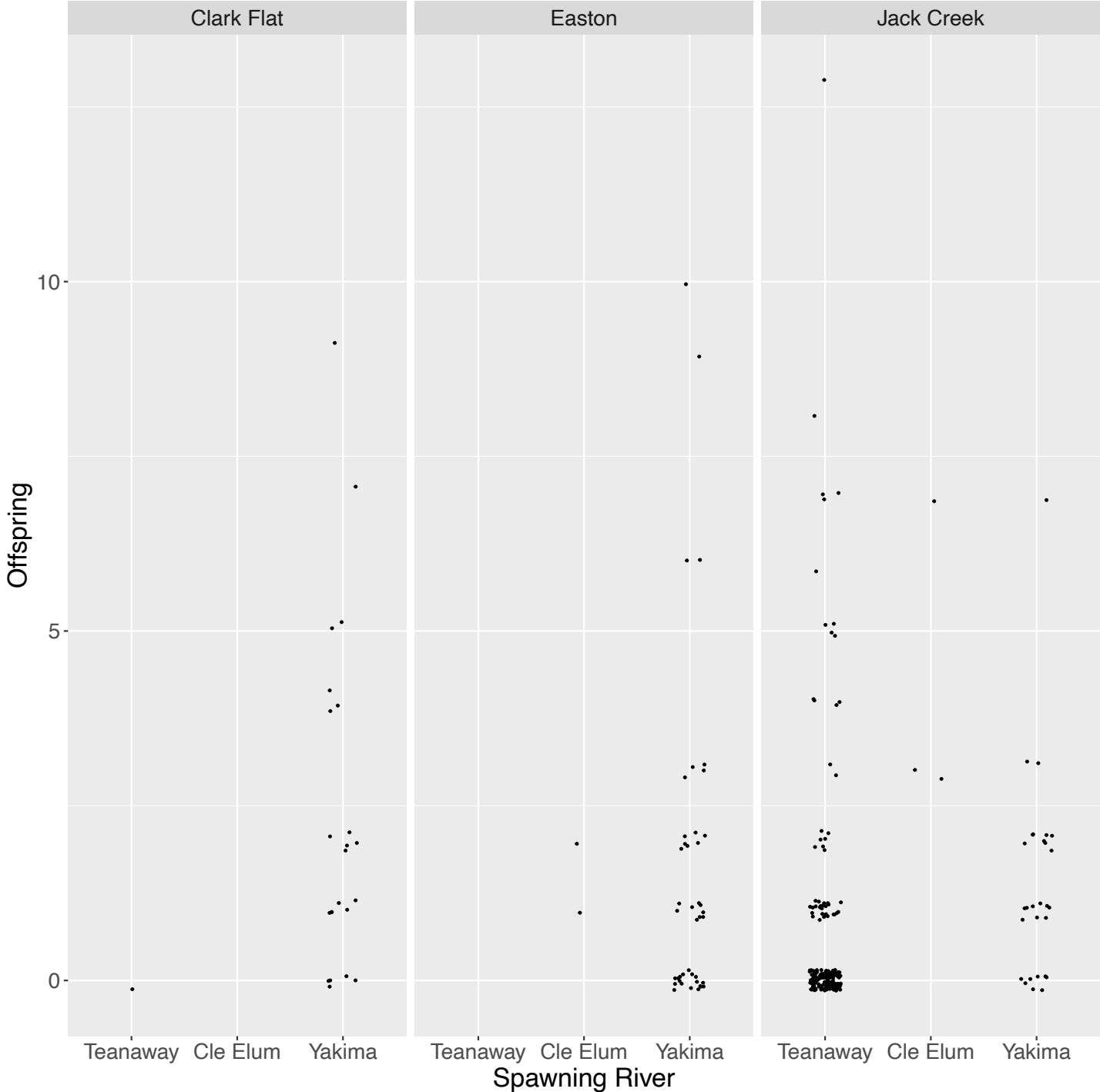


Figure 3, Dittman et al., 2010



Did Teanaway spawners
affect the RS of hatchery-
origin fish?

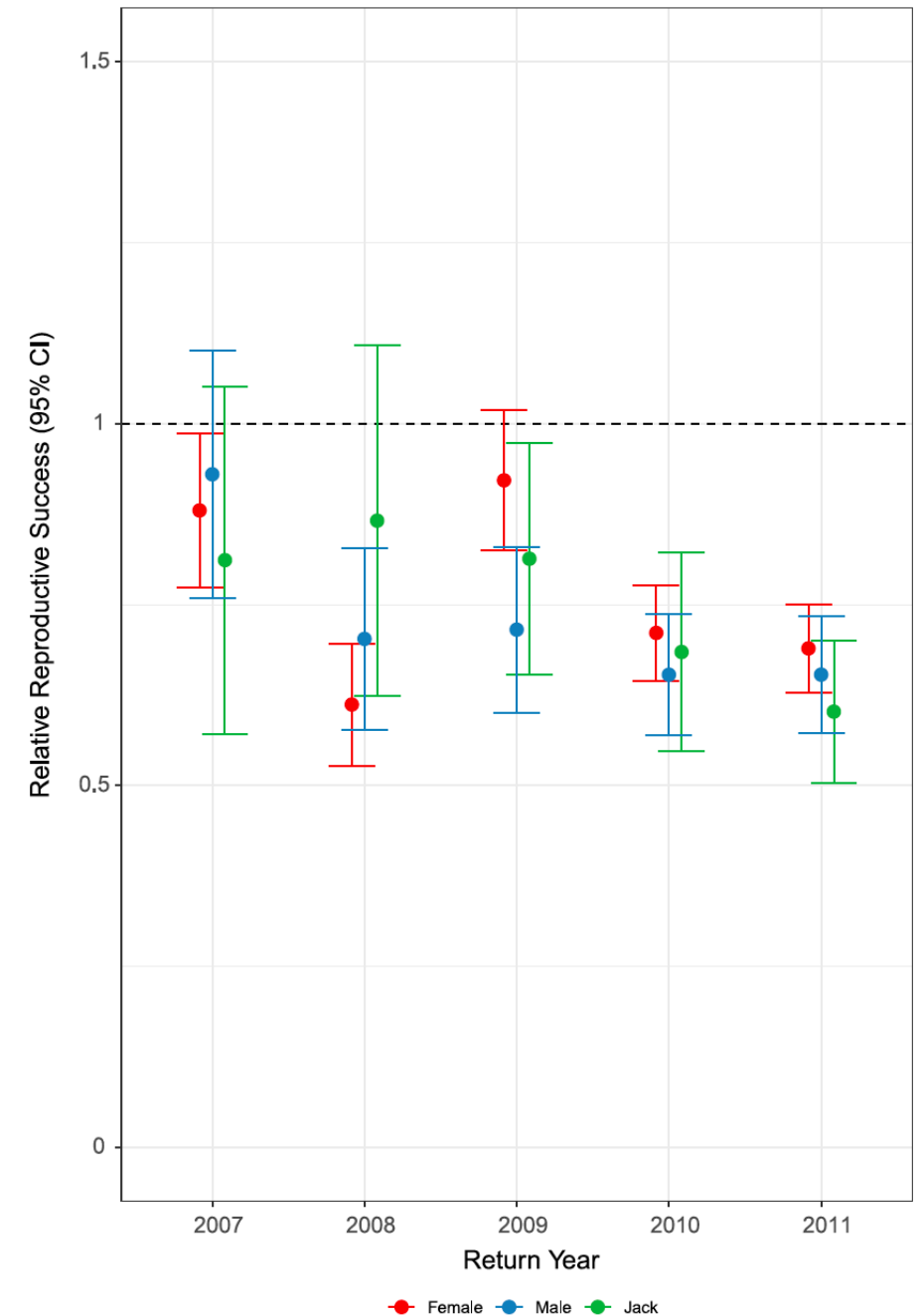
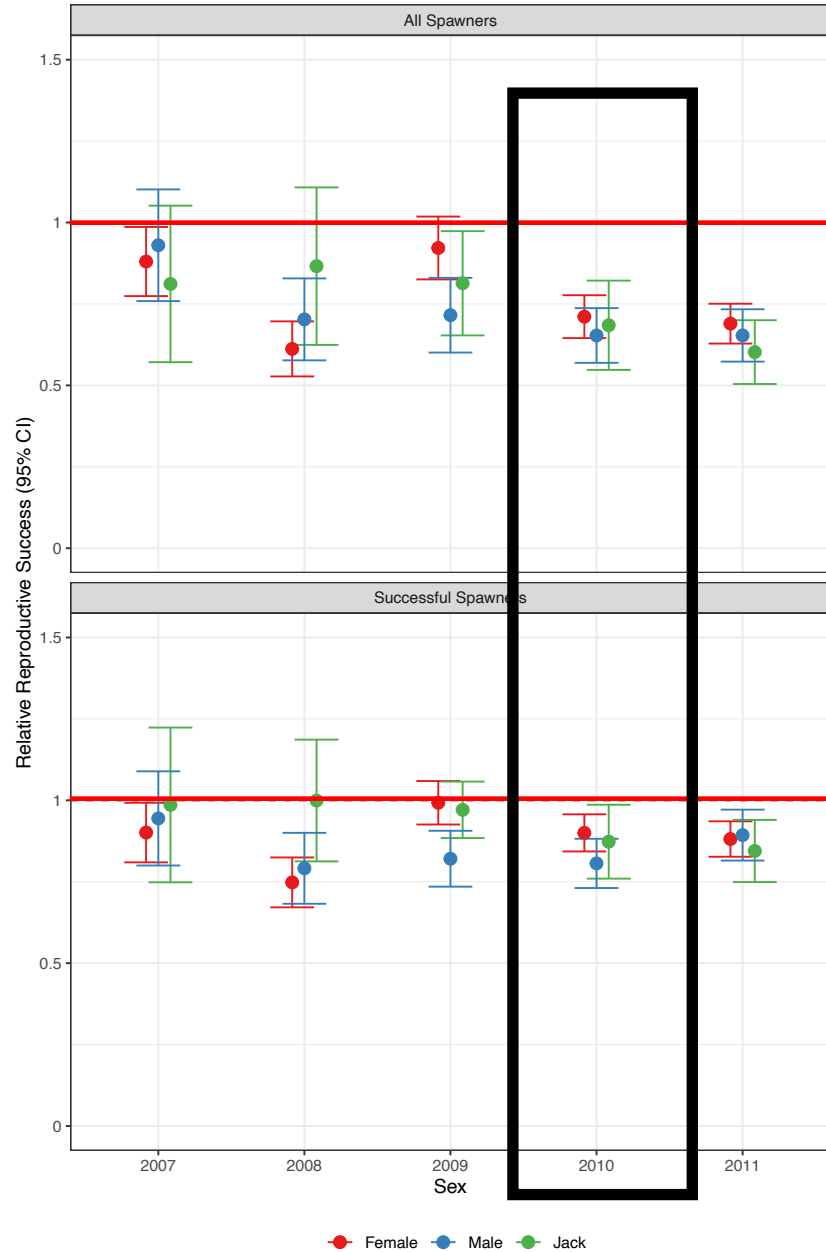


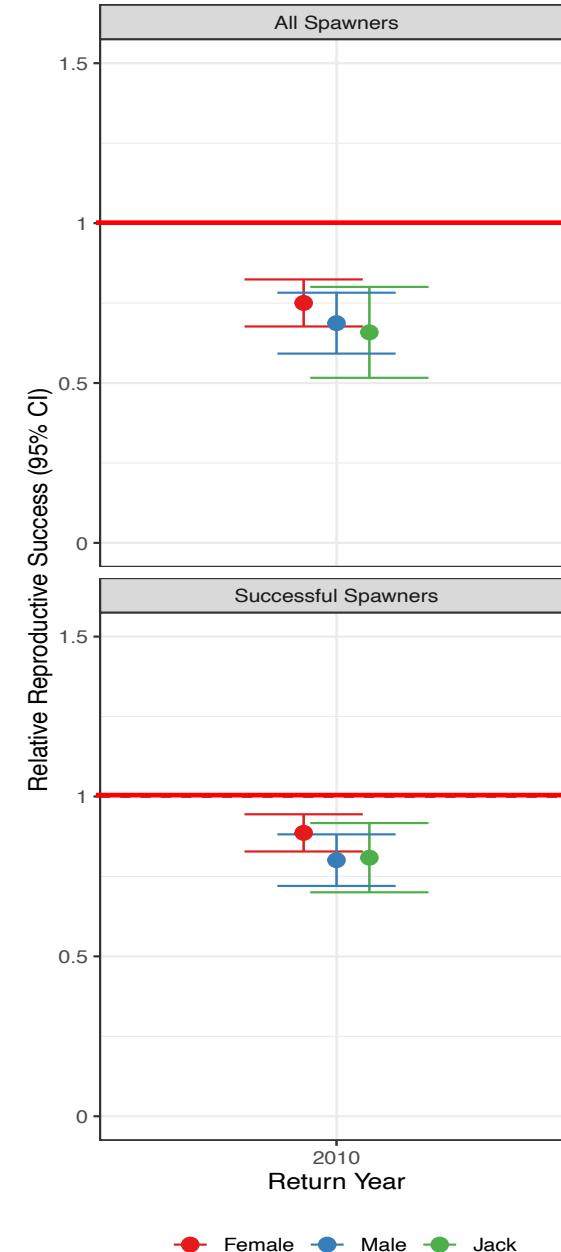
Figure 3, Koch et al., 2022

2022 Publication



$$RRS = \frac{HOR\ RS}{NOR\ RS}$$

After removing Jack Creek Fish



Conclusions

- Fish spawning in the Teanaway demonstrate lower reproductive success.
  - However, sample sizes were small and unbalanced.
- Removal of Jack Creek fish in SY2010 did not affect RRS inference.
- Additional mechanisms and/or interactions may be important
  - Spawn site x spawn year
  - Length
  - Return day
- Patterns post restoration?





Questions?

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River Gauge Info

Name	Lat	Long	WA DOE Station	BOR Station	Source	Water Temp Years
Yakima River near Horlick Siphon	47.124	-120.74	39A073	YRWW	BOR & WA DOE	9/19/11 - 4/1/16
Yakima River near Easton	47.2401	-121.18	39A095	EASW	BOR & WA DOE	4/1/07 - 4/1/16
Teanaway at Forks near Cle Elum	47.2456	-120.86	NA	TNAW	BOR	NA
Teanaway at Red Bridge Road	47.2007	-120.78	39D110	NA	WA DOE	7/14/14 - 10/5/14, 2/25/15 - 12/31/15, 2016, 1/1/17 - 10/1/17
Cle Elum Reservoir, River & Weather Station	47.2456	-121.07	NA	CLE	BOR	4/1/07 - 4/1/16