Parental Priming of Manila Clams for Ocean Acidification

Potential hatchery practices to build resilience for clam aquaculture

Larken Root, UW/NOAA
Mackenzie Gavery, NOAA
Ryan Crim, Puget Sound Restoration Fund
Graclyn Ham, Eckerd University

Ocean Acidification and Shellfish Aquaculture

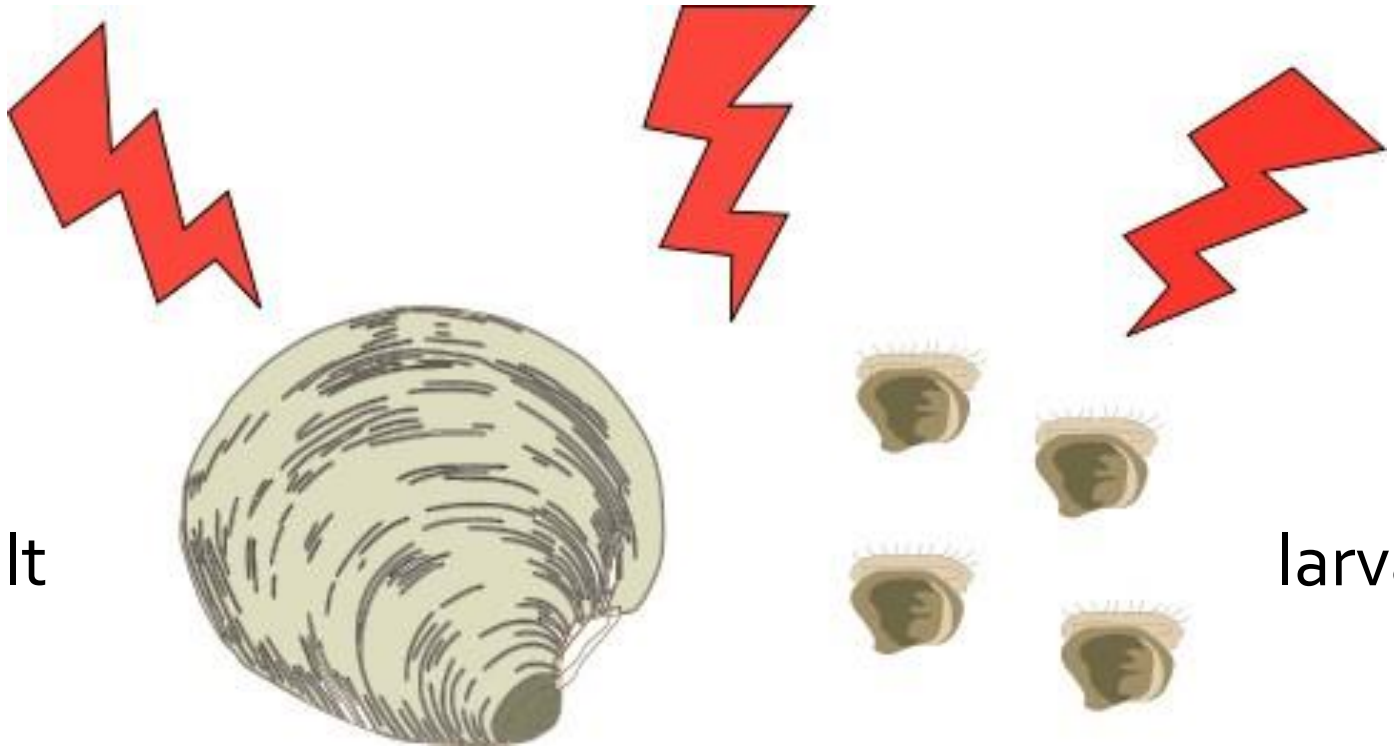
The Pacific Coast currently experiences acidified water conditions, and these are likely to get worse in the future

Shellfish are negatively impacted by acidification, especially in larval stages when they are growing rapidly

Methods are needed to enhance the ability of juvenile clams to survive OA stressors

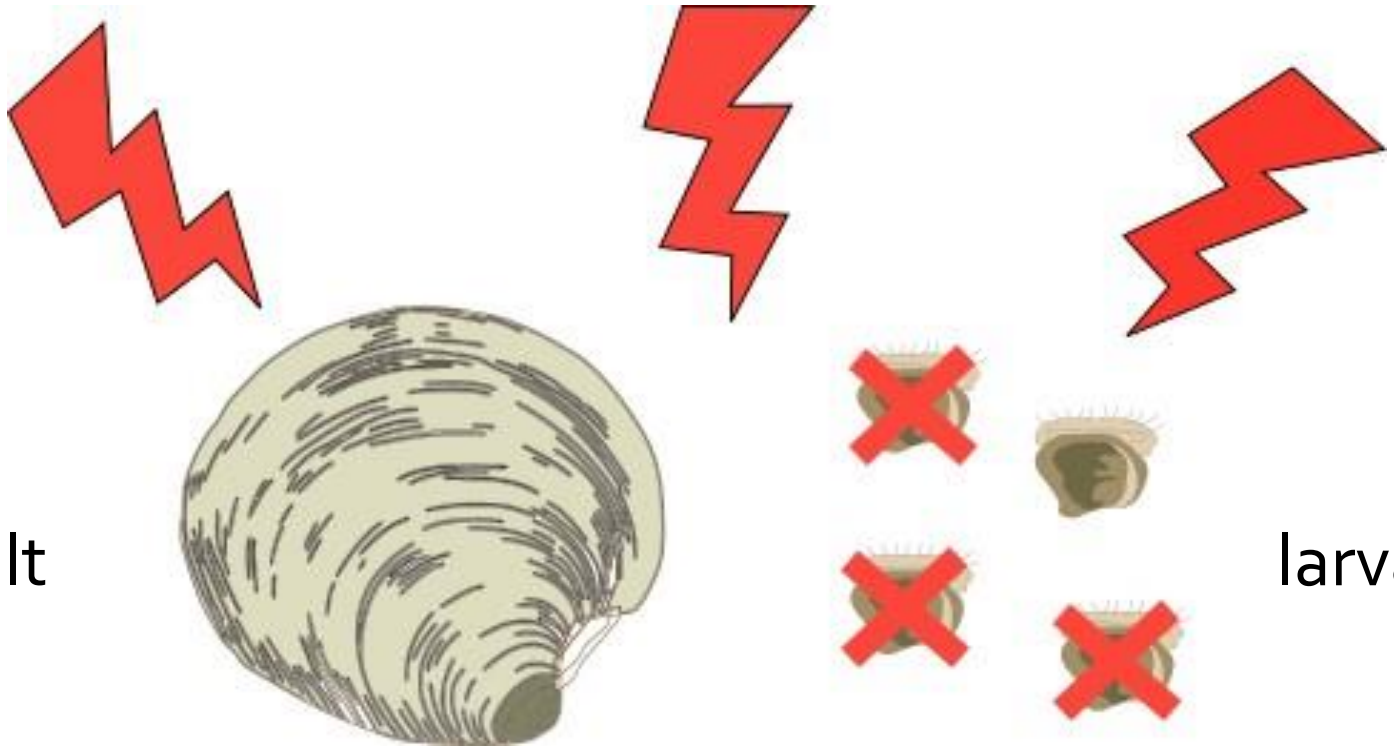
Parental Priming

Larvae are more sensitive to stressors such as OA than adult clams



Parental Priming

Mortality will be higher in larvae when a stressful event occurs

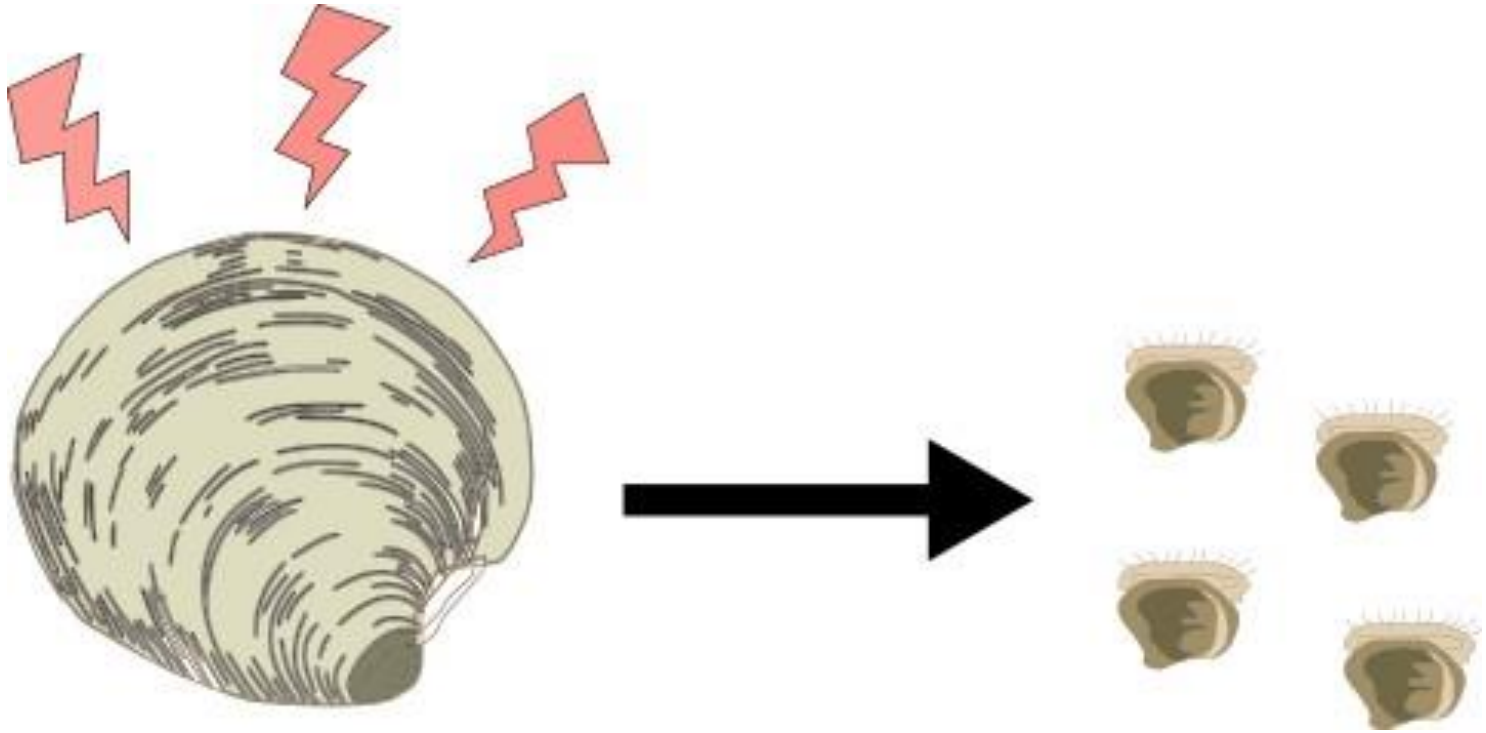


adult

larvae

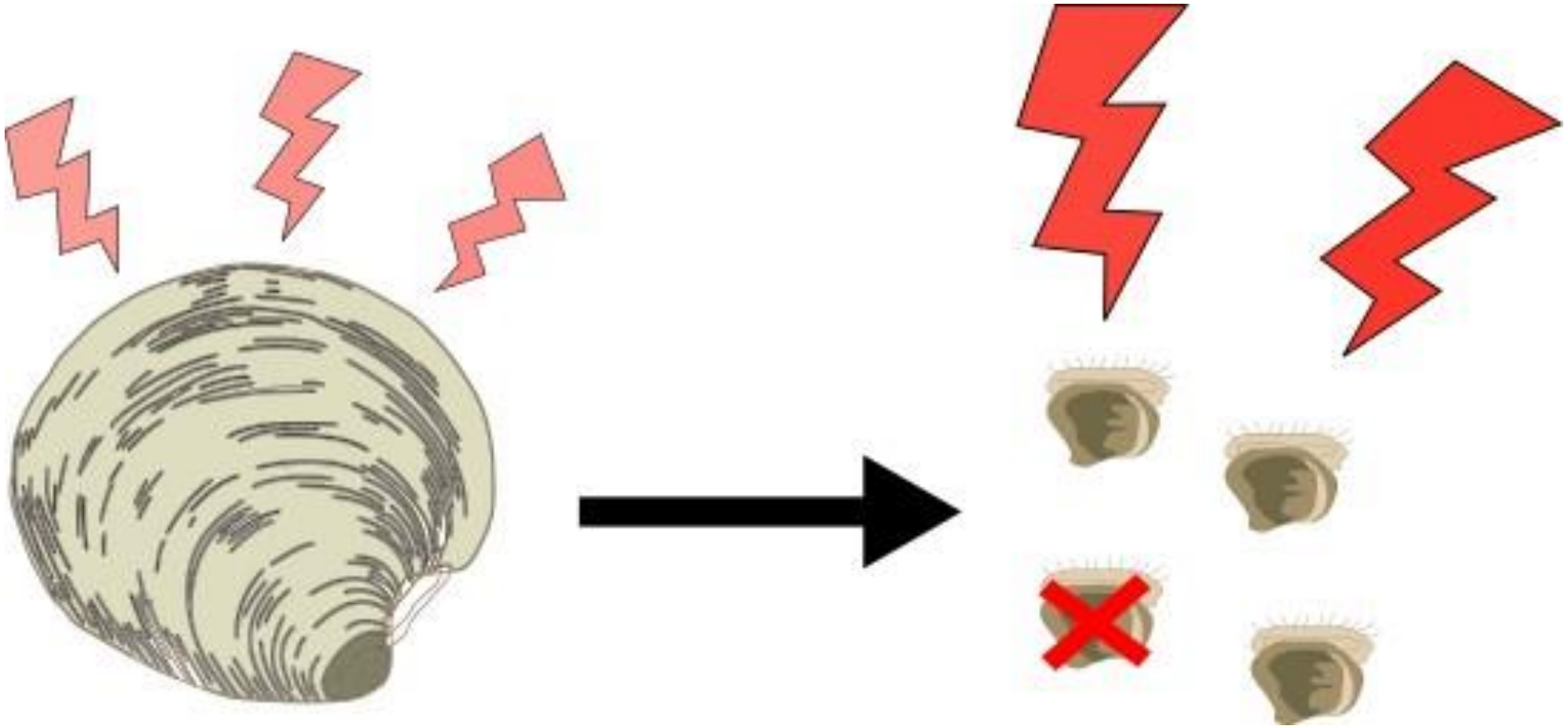
Parental Priming

Parental priming involves exposing broodstock to a moderate stress before and/or during reproductive maturation

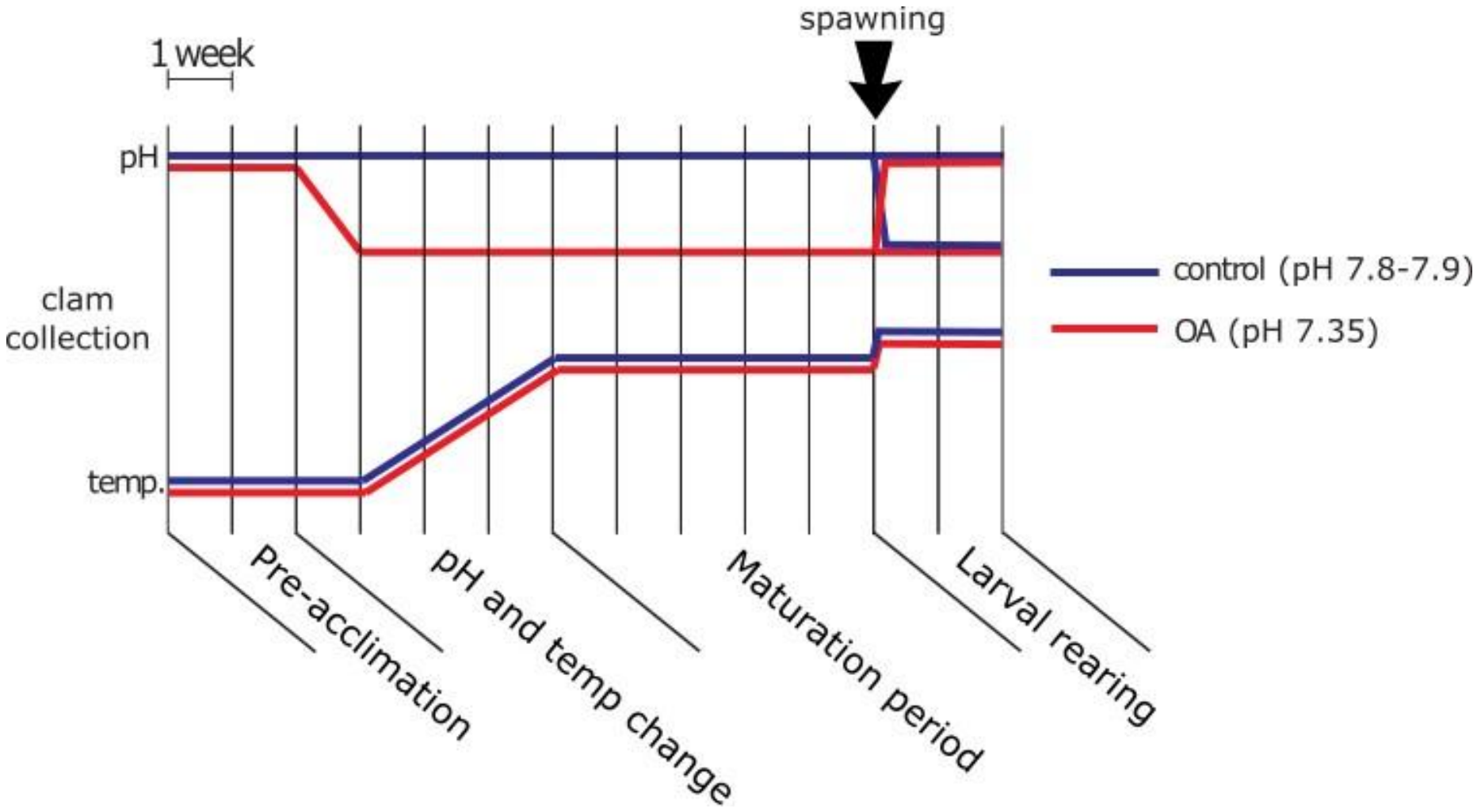


Parental Priming

Larval offspring from primed broodstock may have higher tolerance to stress and lower mortality



Acclimation



Spawning

Spawning was induced by temperature shock with all clams of each sex/treatment held in a common tray

Once spawning initiated, individual clams was moved to a 1L container

5 Brood-groups were created for each broodstock treatment with eggs from 5 females and sperm from 4 males

Spawning Results

Spawning rate increases in OA

Sex	Spawned		Spawn Rate
	Yes	No	
Males	24	18	**57.1%**
Females	29	45	**32.9%**

Sex	Spawned		Spawn Rate
	Yes	No	
Males	33	3	**91.7%**
Females	47	24	**66.2%**

Spawning rate was significantly higher for broodstock in the OA priming treatment

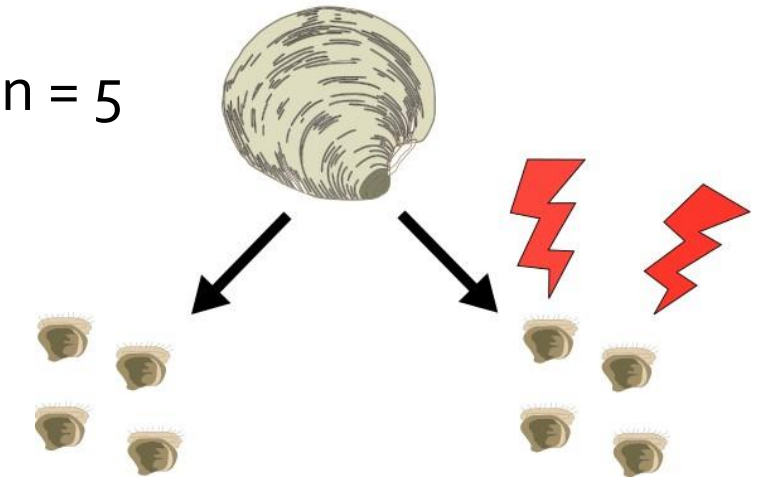
Egg size was not different between treatments

Larval rearing

Larvae were held for 14 days post fertilization (dpf) in sealed, static containers in ambient or OA conditions with sampling at 2, 7 and 14 dpf

Four Treatments:

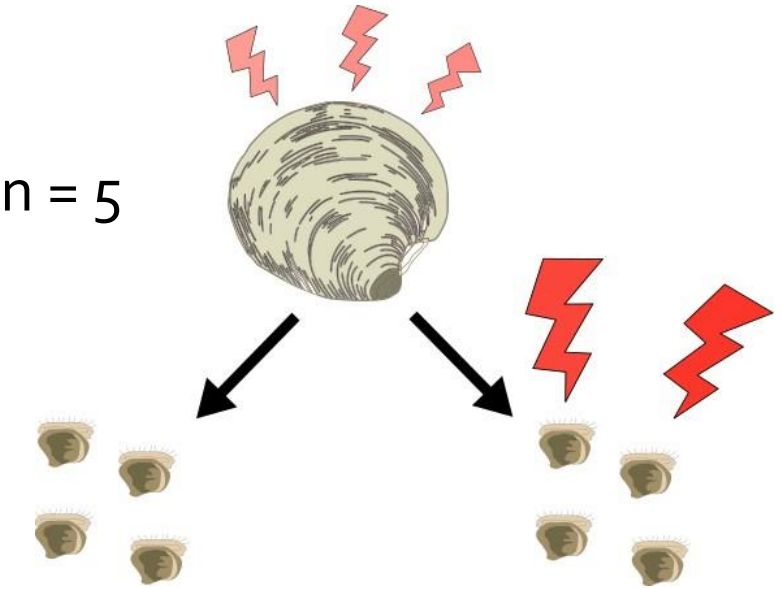
n = 5



Am-Am

Am-OA

n = 5

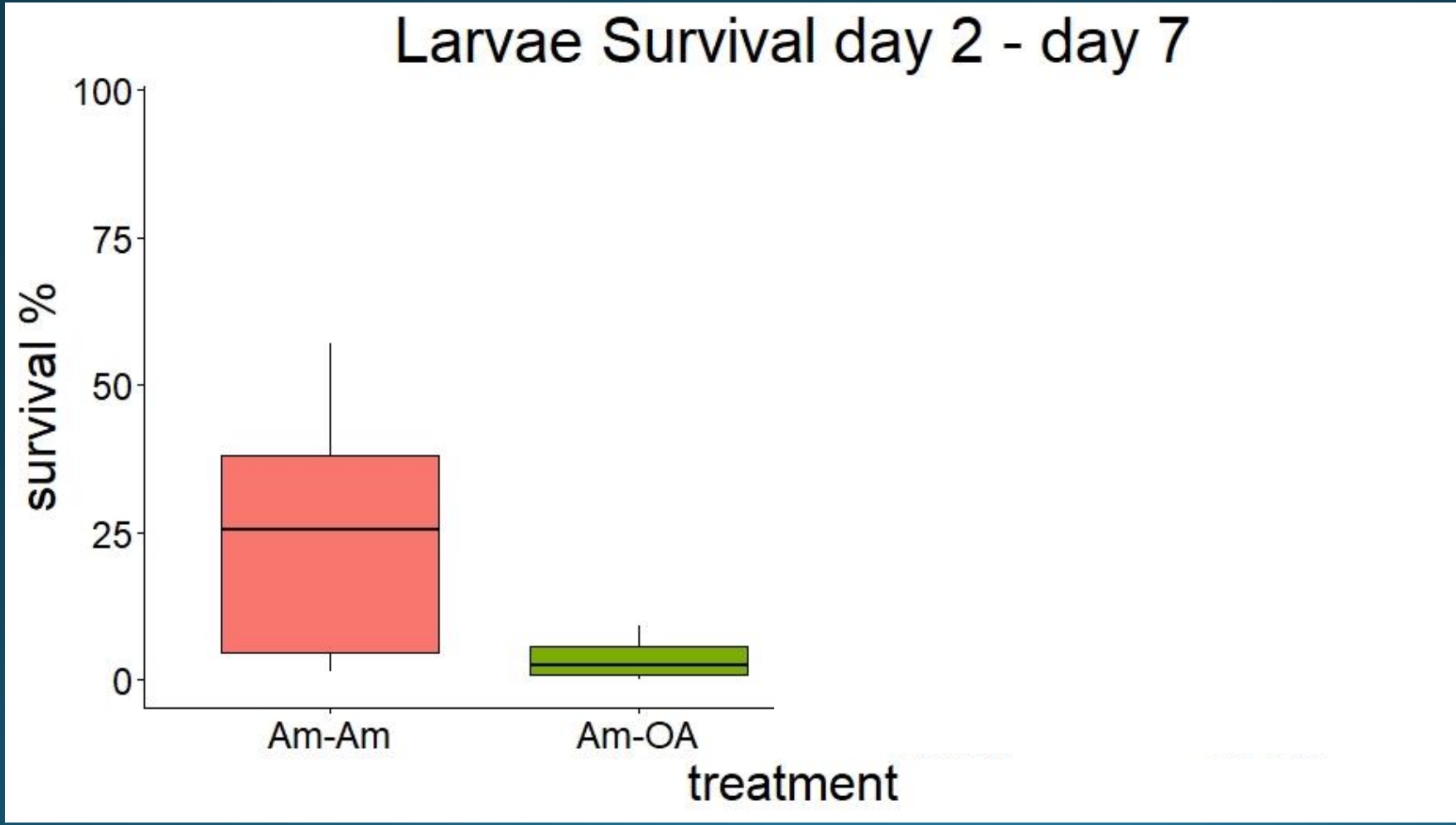


OA-Am

OA-OA

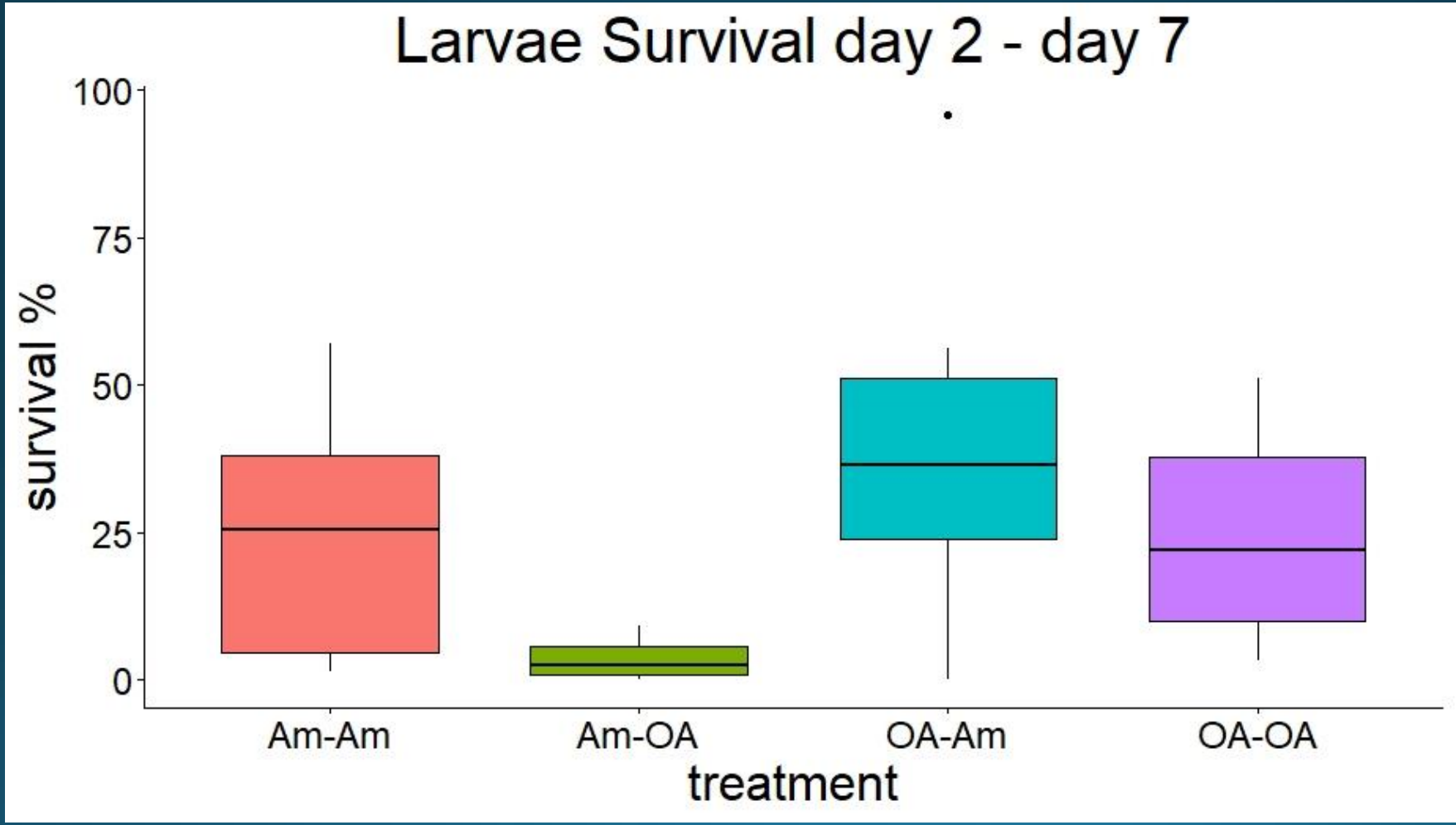
Larvae Results – 7 days

OA reduces larval survival



Larvae Results – 7 days

Priming likely increases larval survival if exposed to OA



Larvae Results – 7 days

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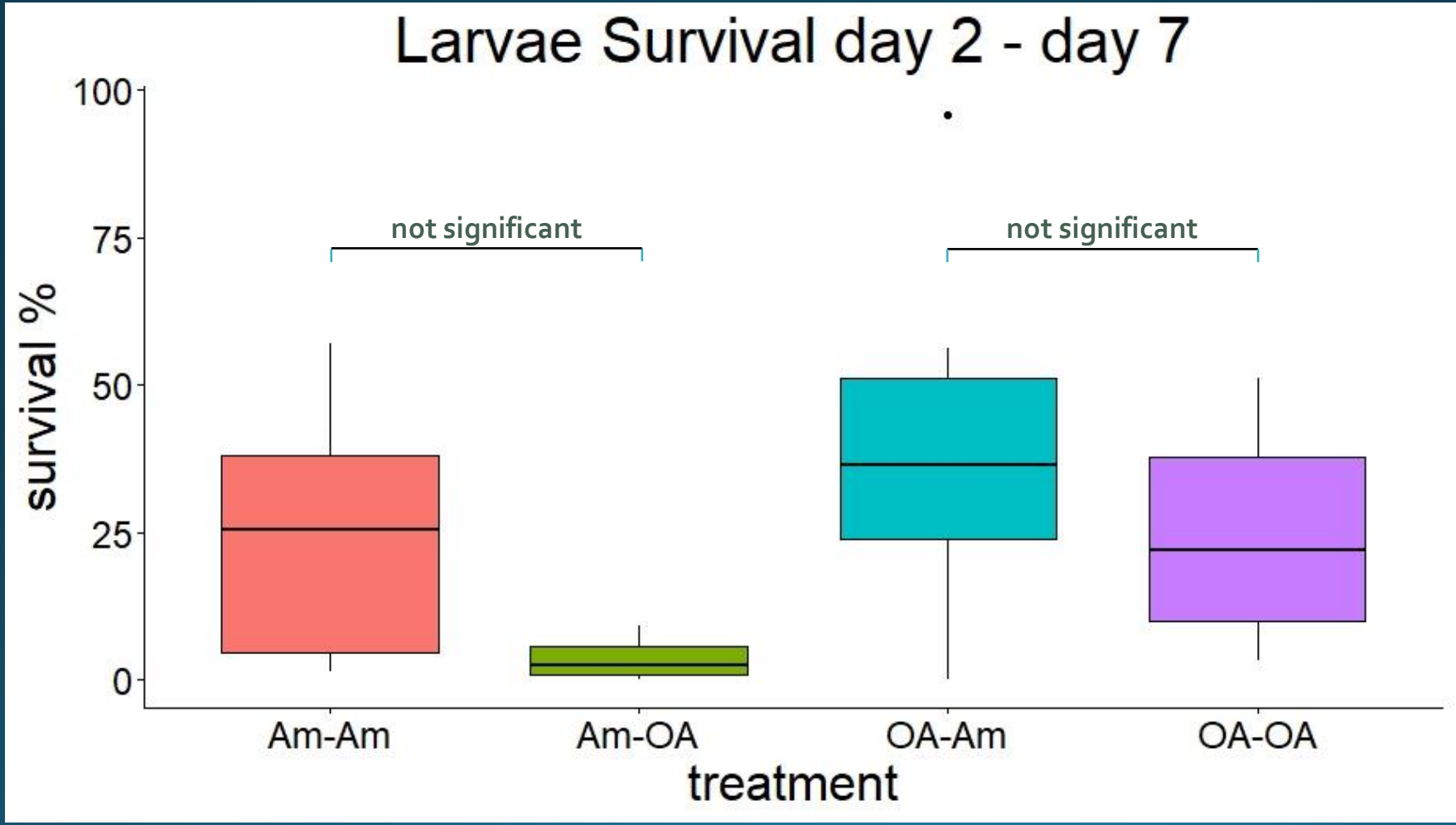
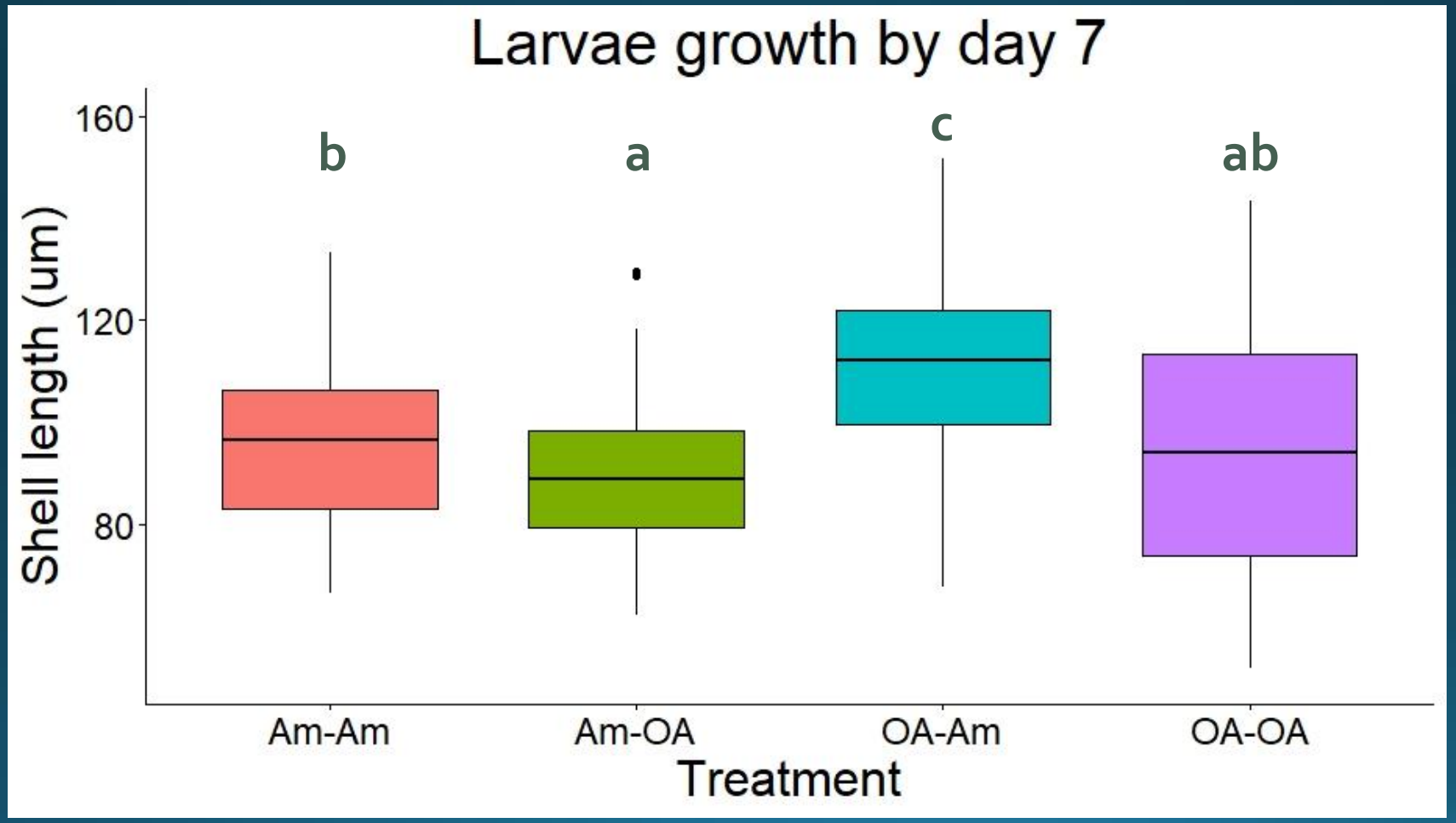


Larvae Results – 7 dpf (preliminary)

Priming increases larval size



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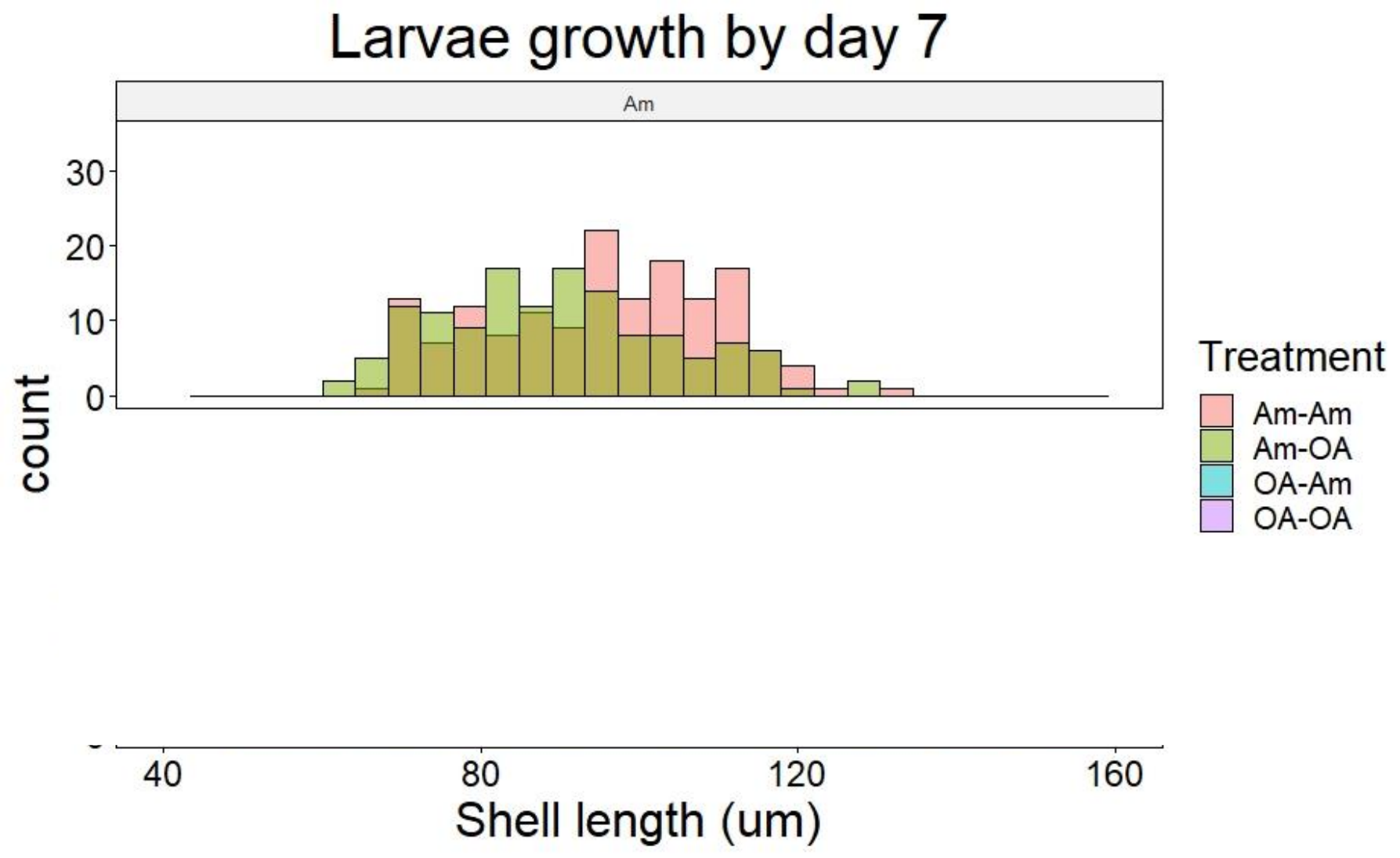

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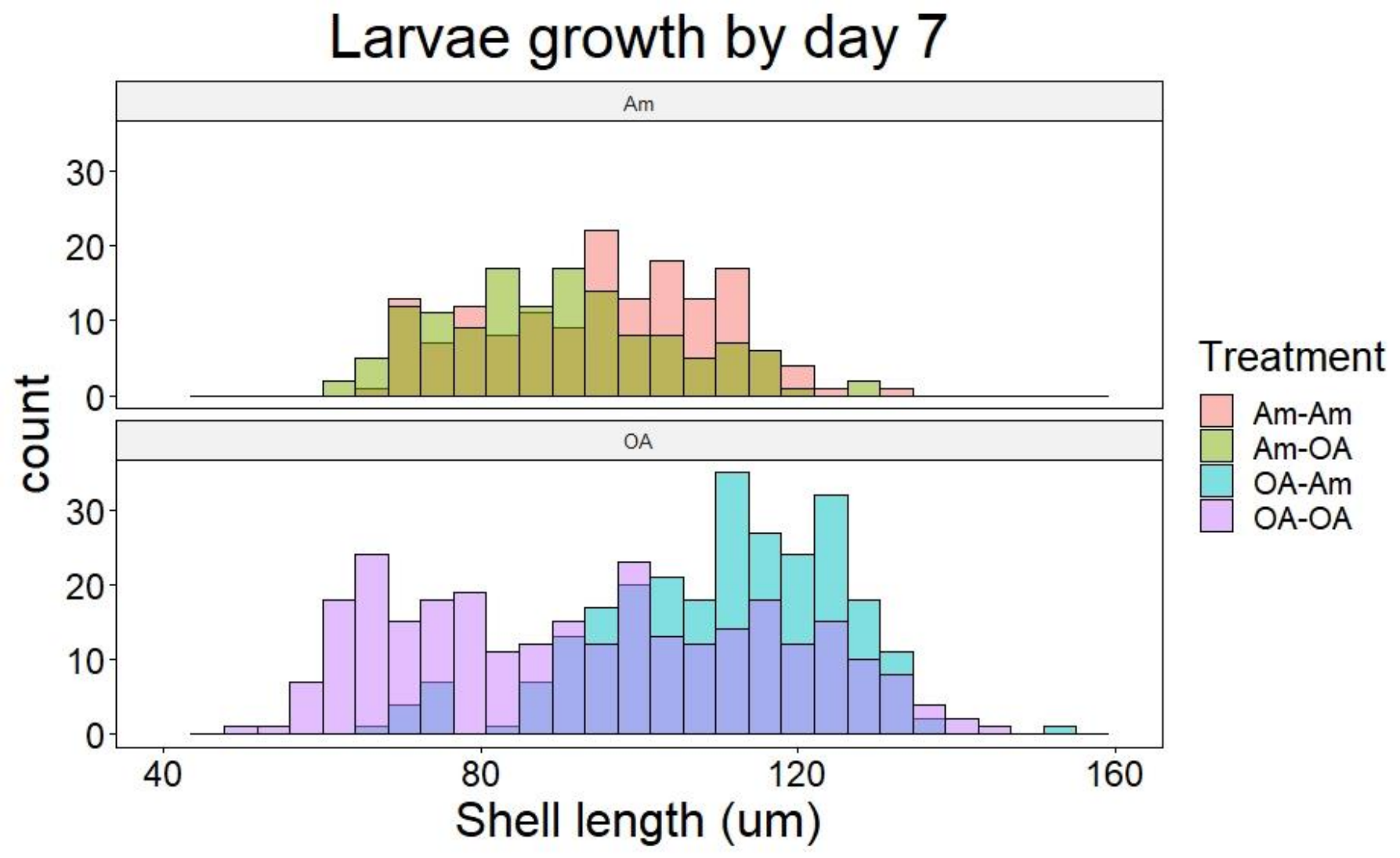

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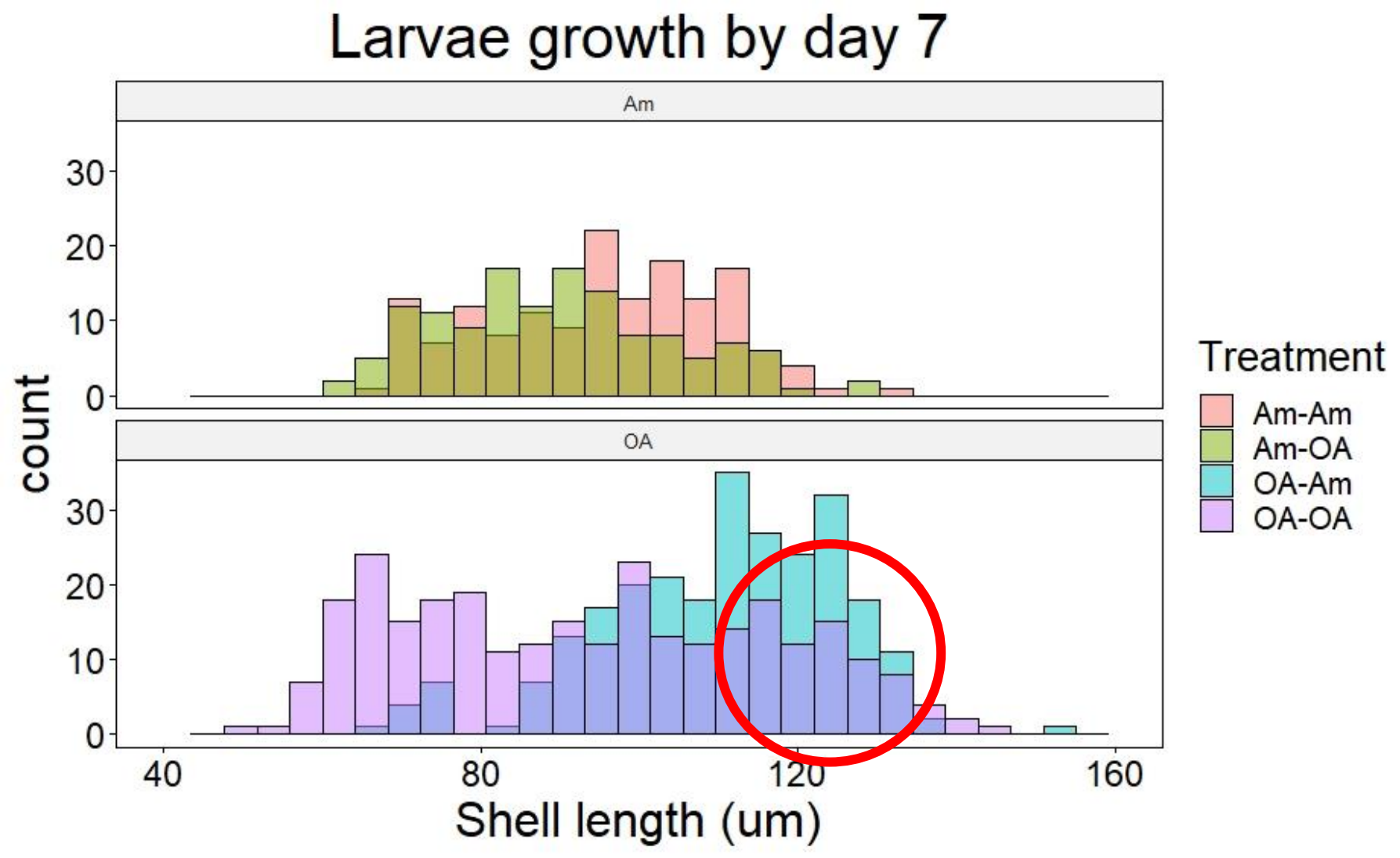

Takeaways

Priming for OA has potential as a clam husbandry practice.

1. OA priming had no negative physiological impacts on adult clams from our protocol
2. OA priming can stimulate reproduction and produce more spawning animals
3. Larvae from OA primed adults grew faster and showed trend of higher survival, but were still susceptible to OA exposure

Ongoing research

Parental Priming: how does it work?

- Transcriptomics of gametes – role of gene expression survival and size differences
- Lipidomics of eggs – indicate potential role of nutrition

Interviews with producers about the feasibility of implementing parental priming in hatcheries.

Acknowledgements

We received invaluable support and guidance from:

Elizabeth Unsell, Suquamish Tribe
Alexa Romersa, Pacific Hybreed
Matt George, WDFW
Eileen Bates, UW SAFS
Steven Roberts, UW SAFS
Ariana Huffmyer, UW/URI
Mollie Middleton, NOAA
Kate Rovinski, NOAA
Abby Piegols, PSRF
Teighan Shore, PSRF
Jess Capista, PSRF
Malise Yun, PSRF

This research was made possible with funding from the NOAA Ocean Acidification Program