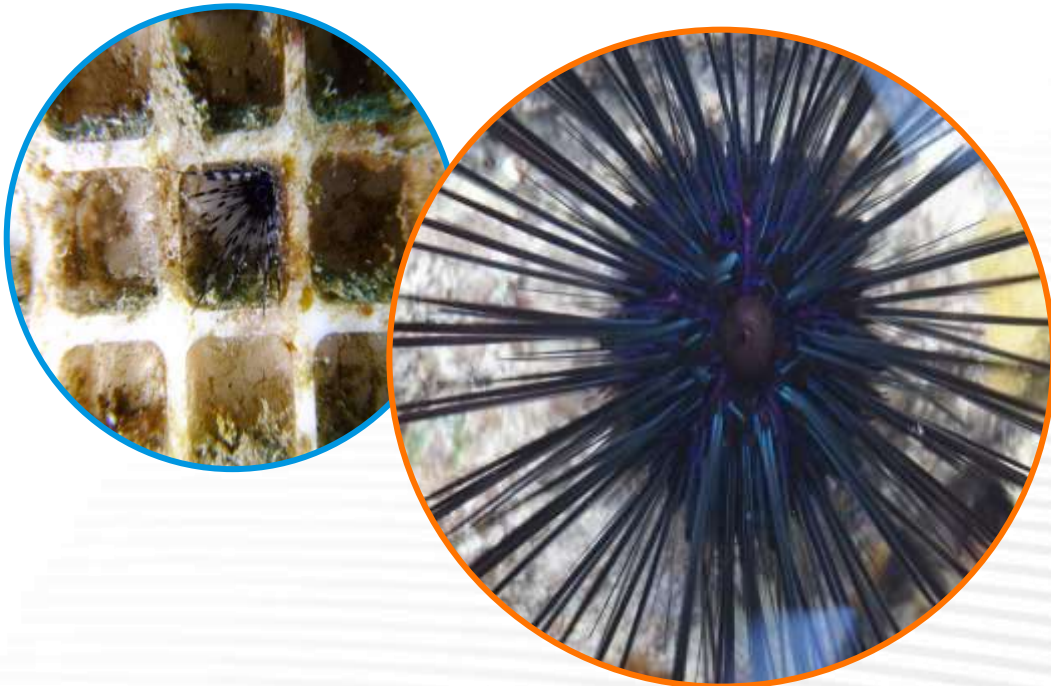


Restoring *Diadema antillarum* on Saba: A Work in Progress

Oliver Klokman ^{1,2}

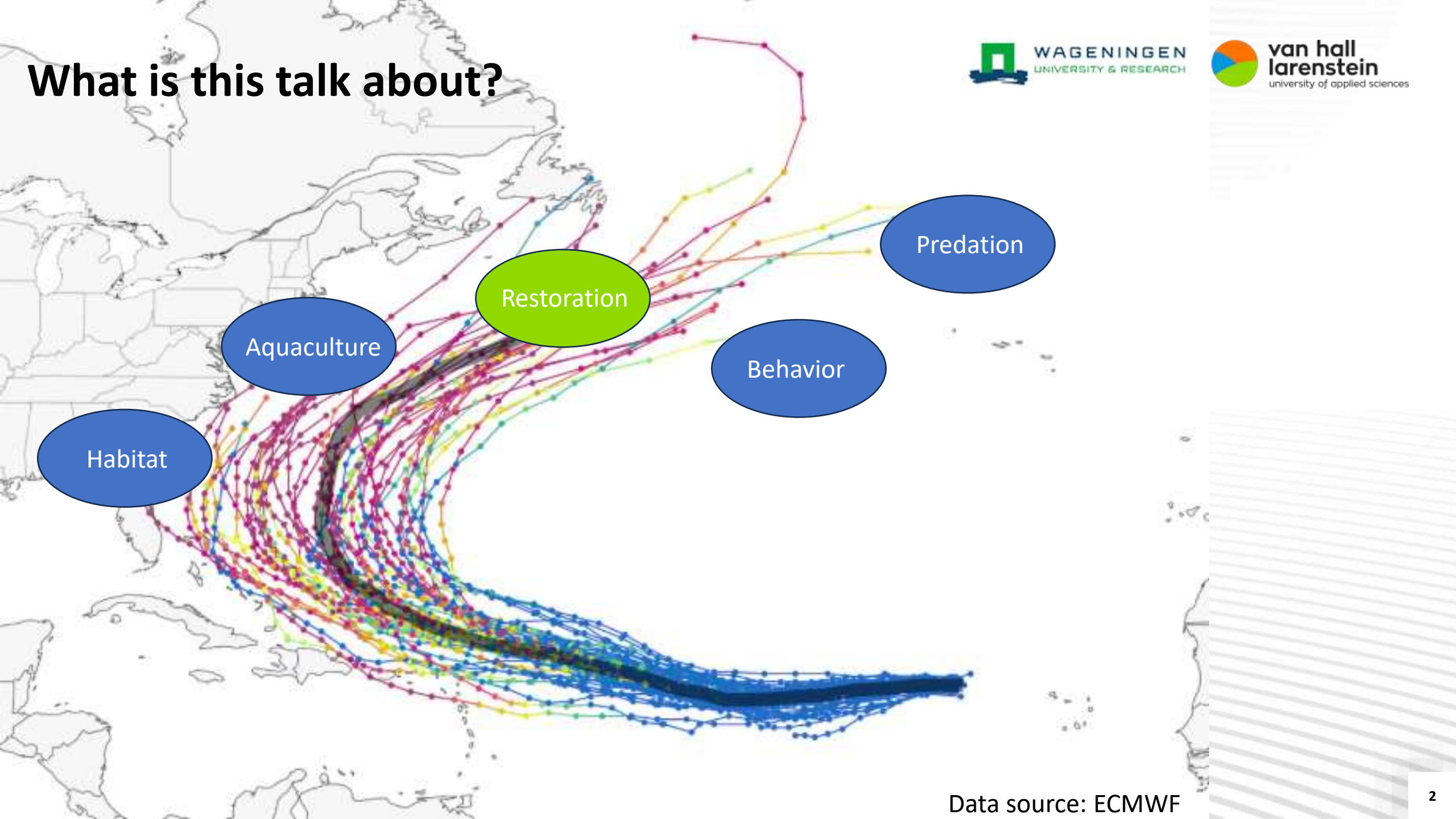
¹ Van Hall Larenstein University of Applied Sciences, P.O. Box 1528, 8901 BV Leeuwarden, the Netherlands

² Marine Animal Ecology group, Wageningen University, Wageningen University & Research, P.O. Box 338, 6700 AH Wageningen, The Netherlands

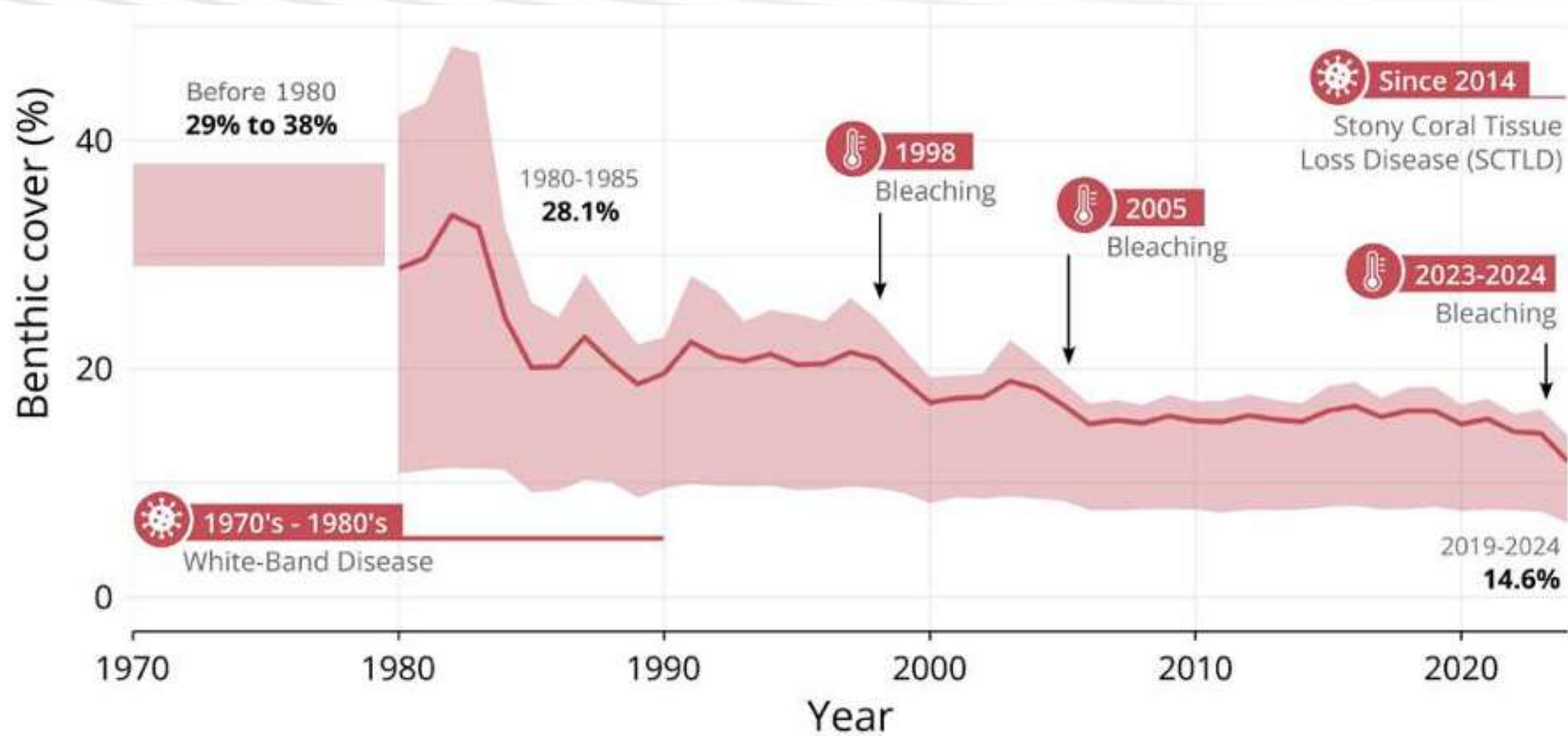


Oliver.Klokman@hvhl.nl

What is this talk about?



Caribbean Coral Reef Trends



Caribbean Coral Reef Trends

Discovery Bay (Jamaica) 1975

A



Carysfort Reef 1975

B



Discovery Bay (Jamaica) 2013

C



Carysfort Reef 2004

D



Jackson et al. 2014

Coral Reefs on Saba

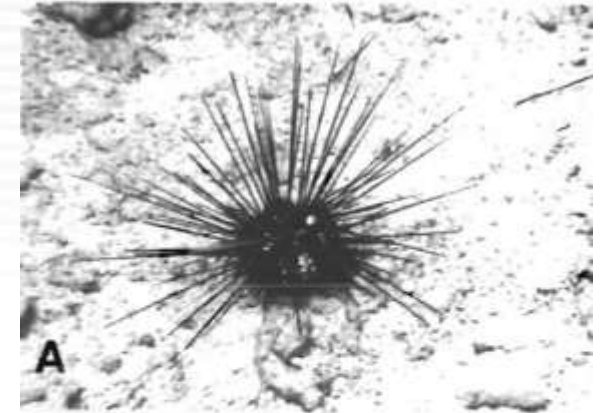


Diadema: Keystone Herbivore



Diadema: 1983 Mass Mortality and lasting effects

- 1983-84 mass mortality event
- Limited recovery in the 40 years since
- This is a key point in Caribbean reefs timelines since while the decline was already ongoing, it definitely sped up



Bak, Carpay & de Ruyter van Steveninck 1984

Some Hope: Reverse phase shifts

Diadema recovery sites have higher coral survivorship and recruitment!

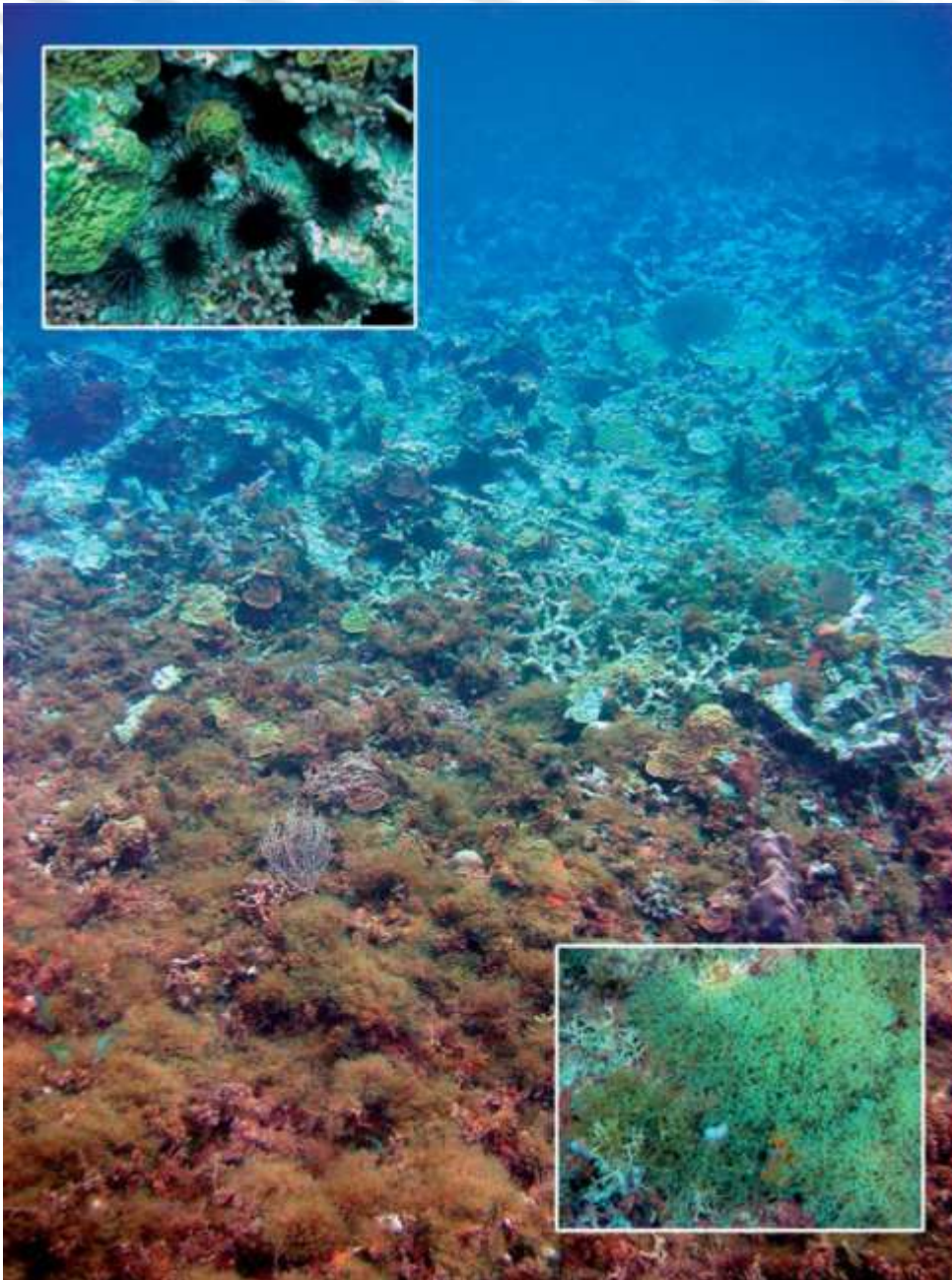
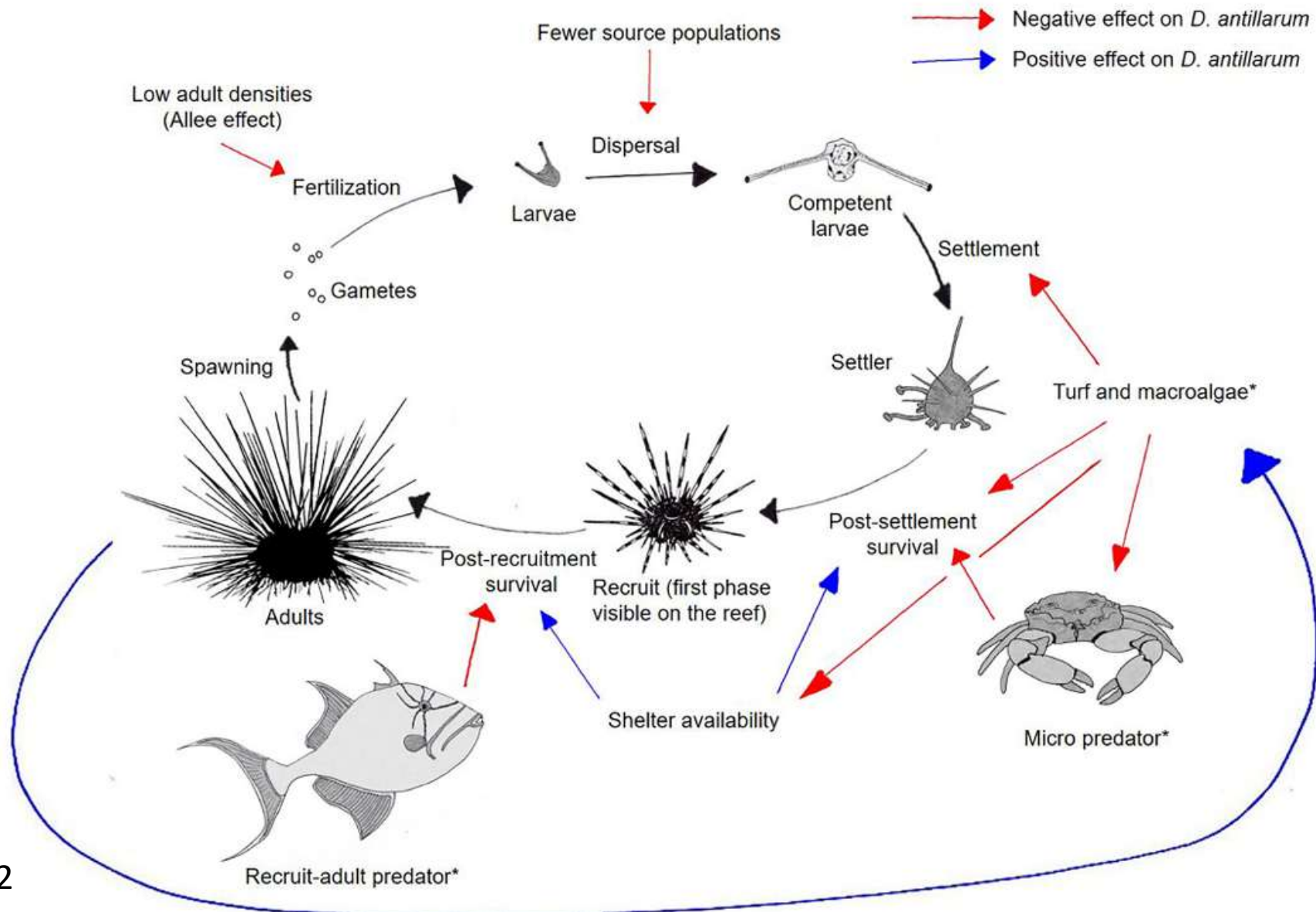


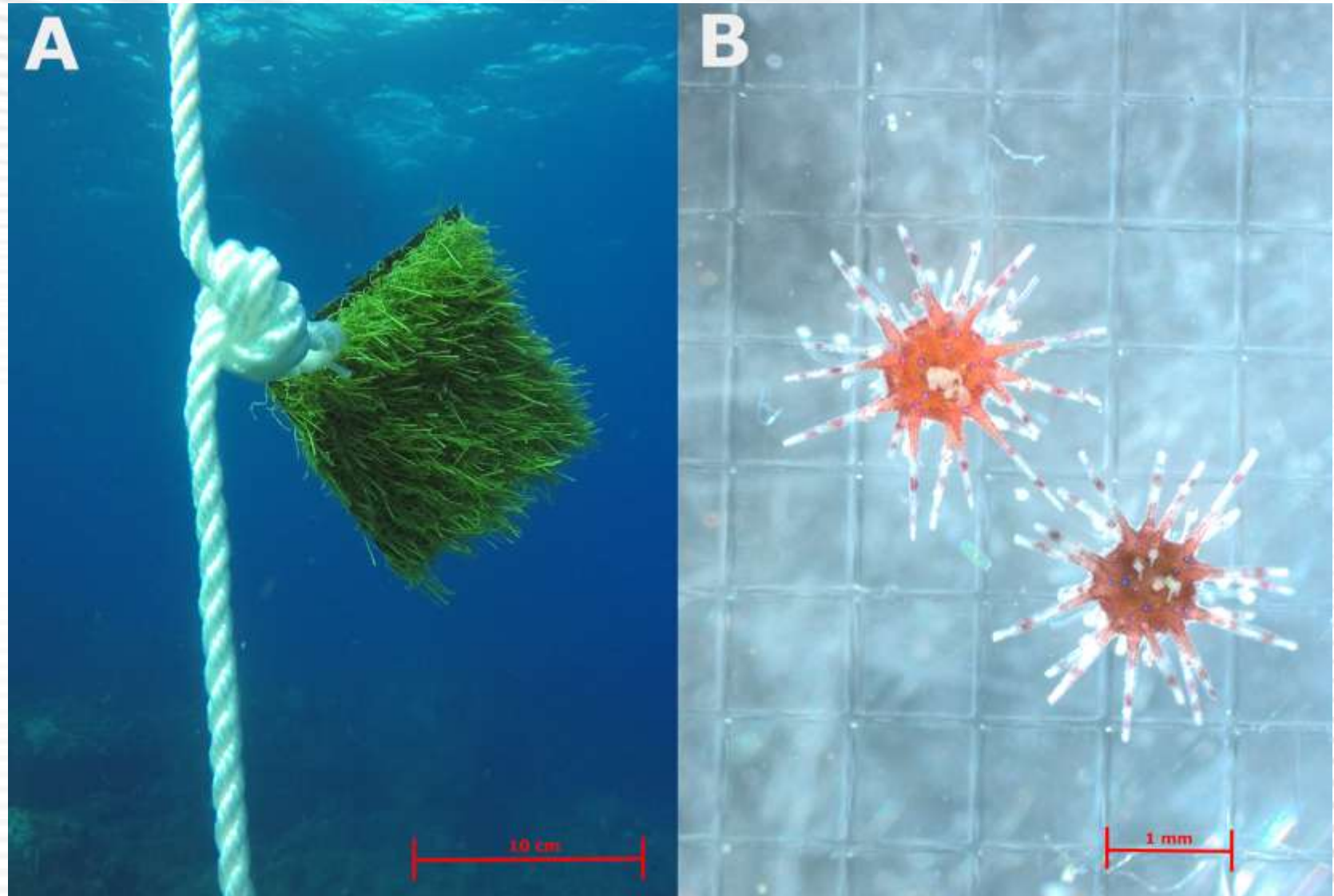
Image credit: Idjadi, Haring & Precht 2010

Why aren't they recovering naturally?



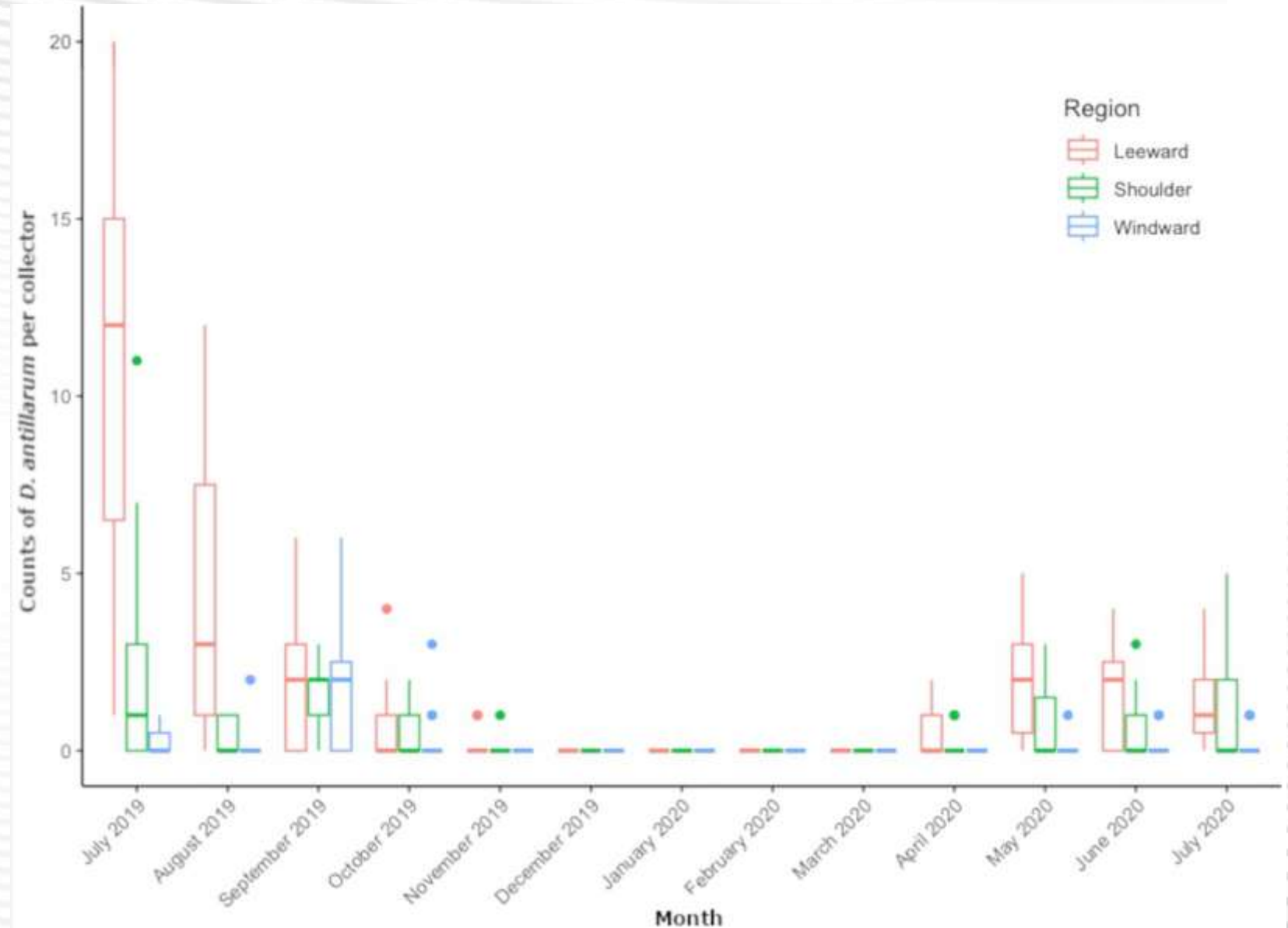
Larval limitation on Saba?

- Measured settlement around Saba



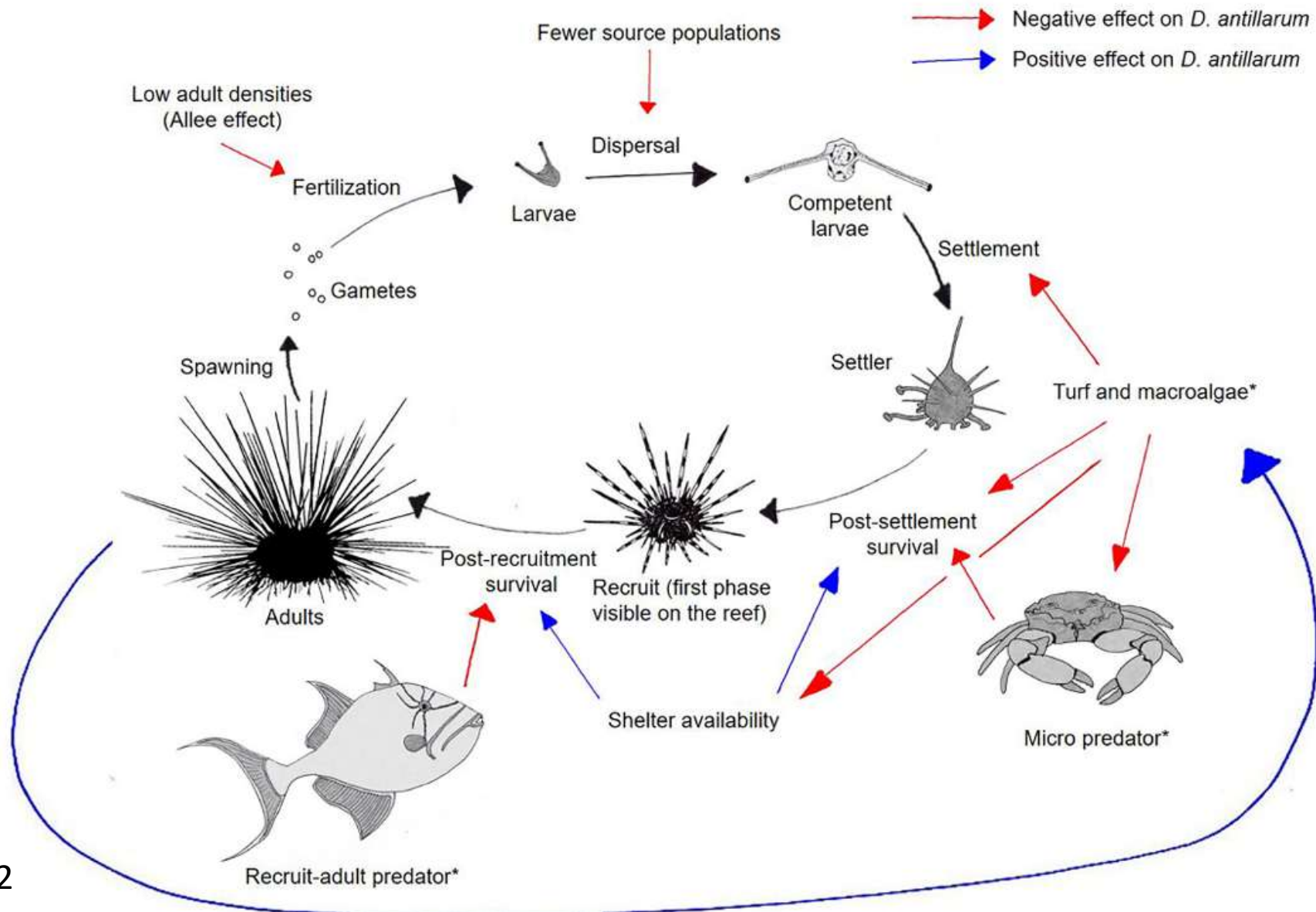
Laraval Settlement on Saba

- Settlement favors leeward sites
- Very seasonal
- Rates comparable to pre die-off



Klokman & Hylkema 2024

Why aren't they recovering naturally?



Maybe recruitment is the bottleneck?

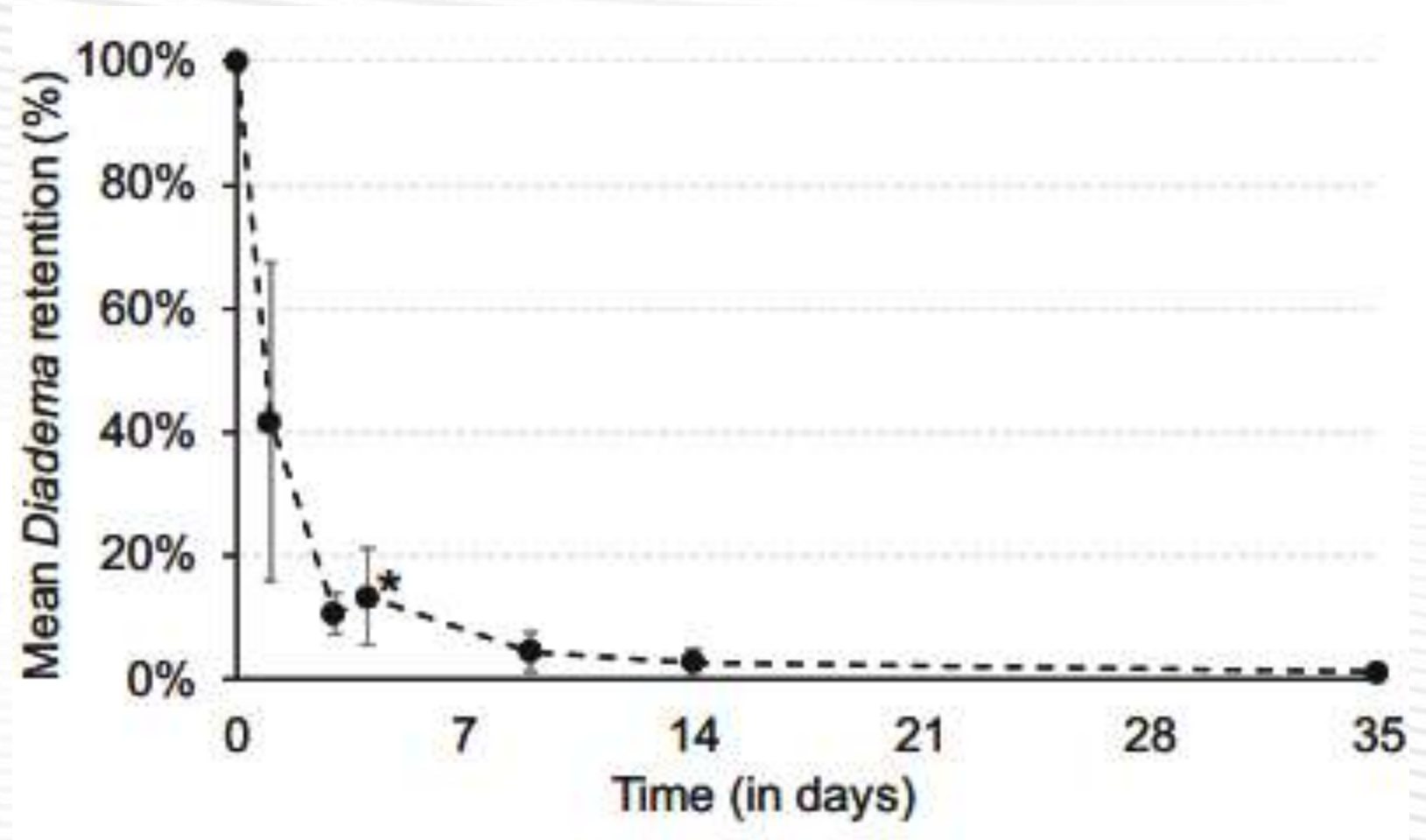


Headstarting past small vulnerable
sizes (1-2mm -> 2-3 cm)



Restocking

- 200 individuals placed (avg 2cm)



- What happened?

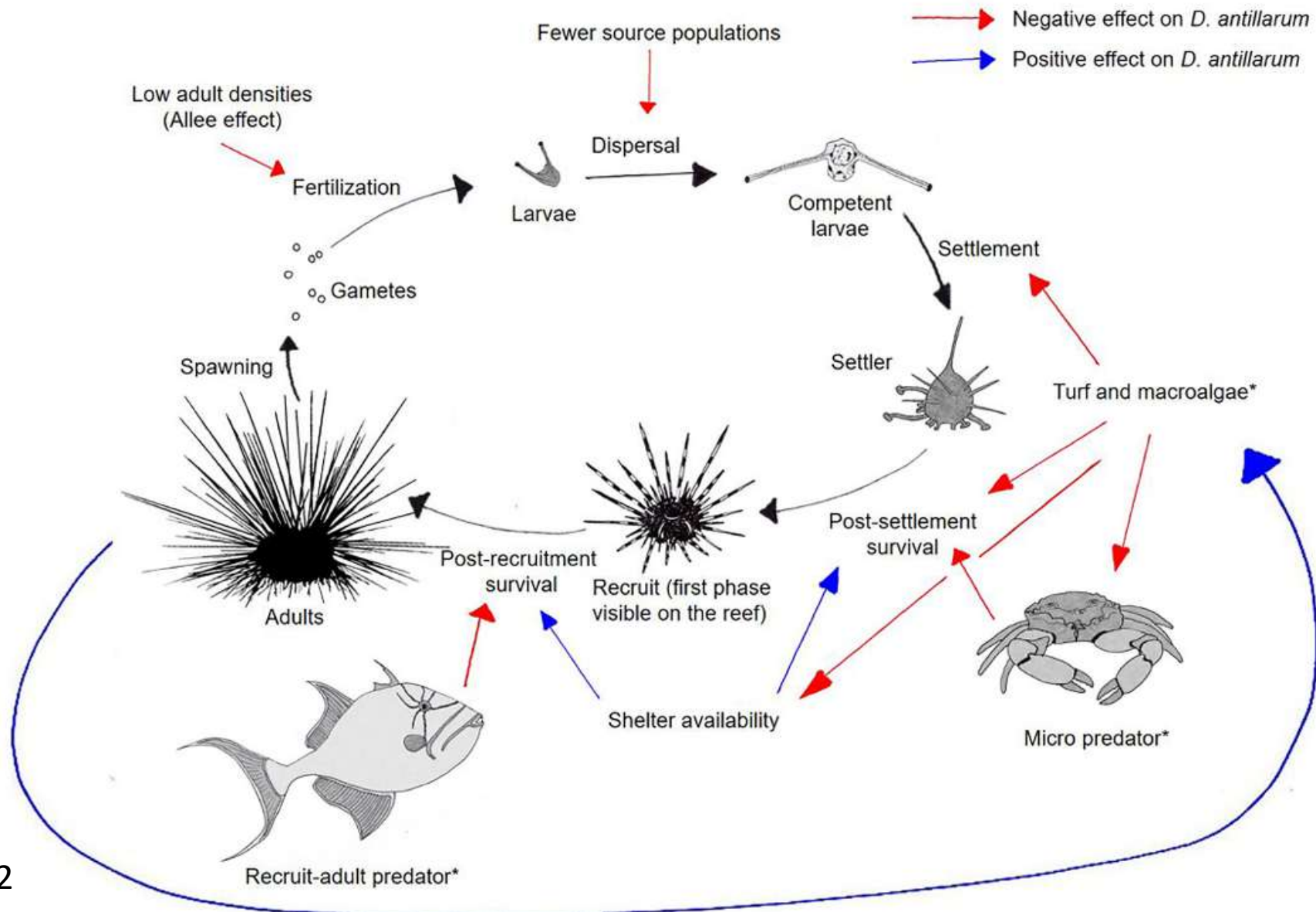
Wijers et al. 2024



Just in case you didn't catch that:

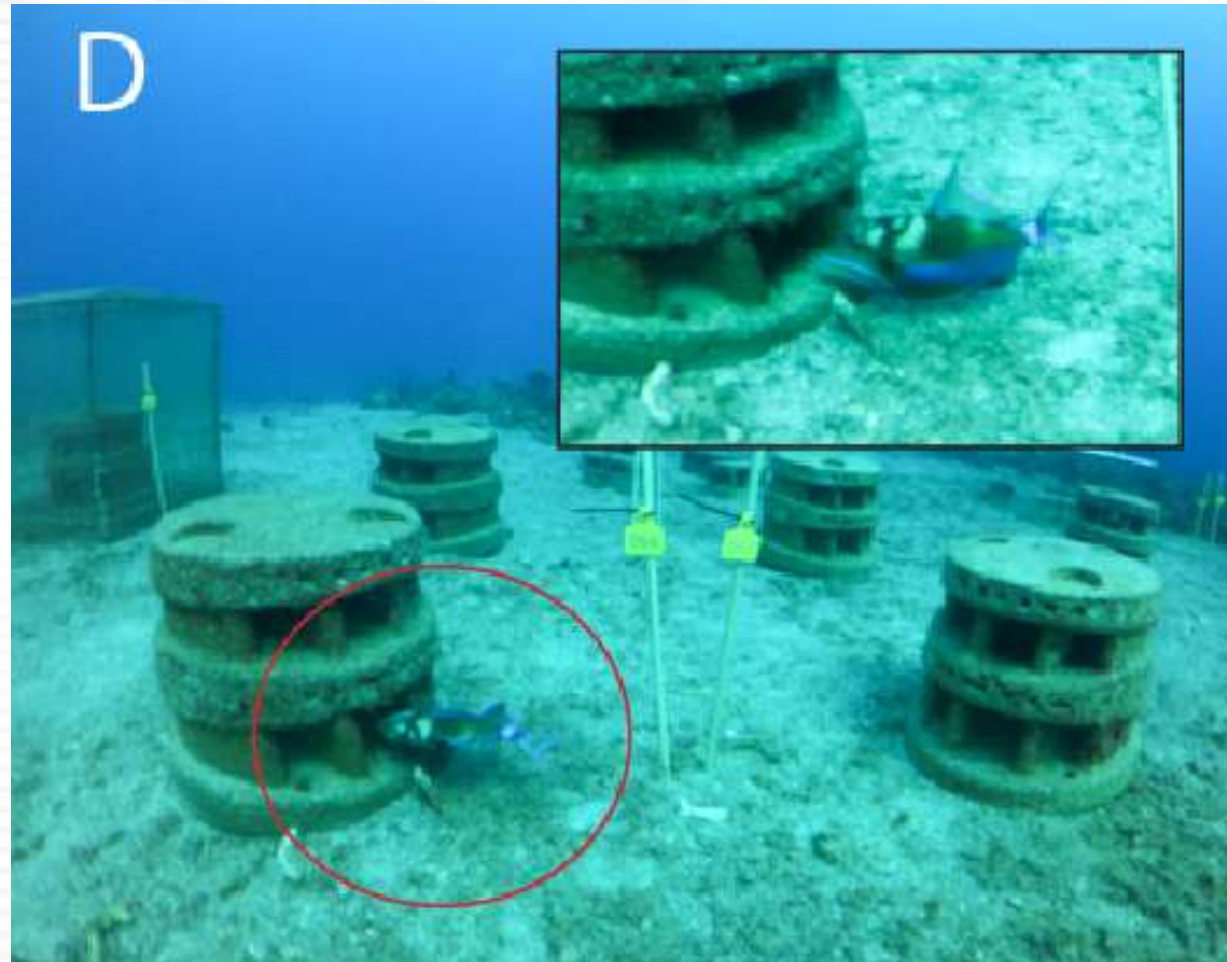


Why aren't they recovering naturally?



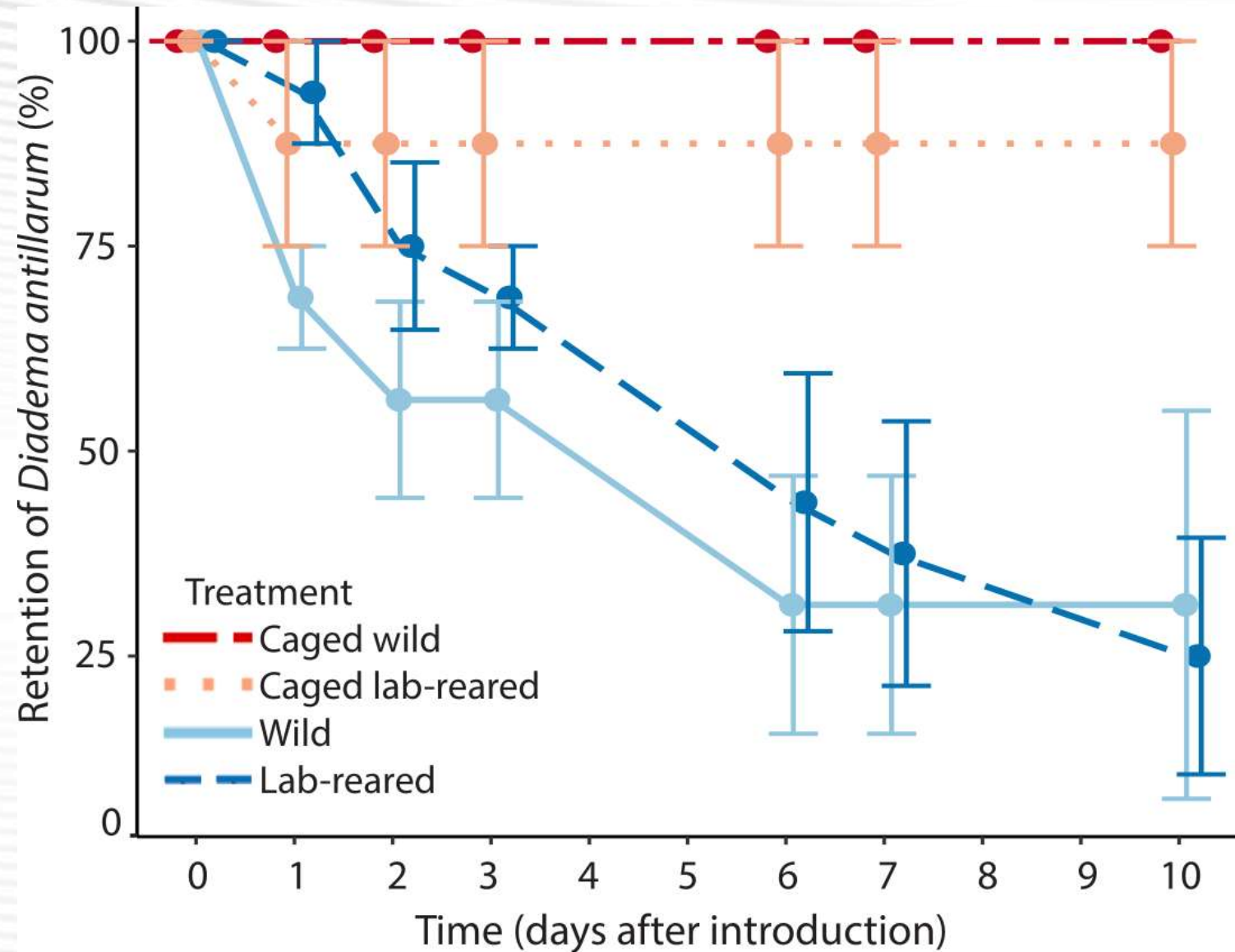
Restocking

- Maybe the habitat is the problem: **Not enough shelter?**



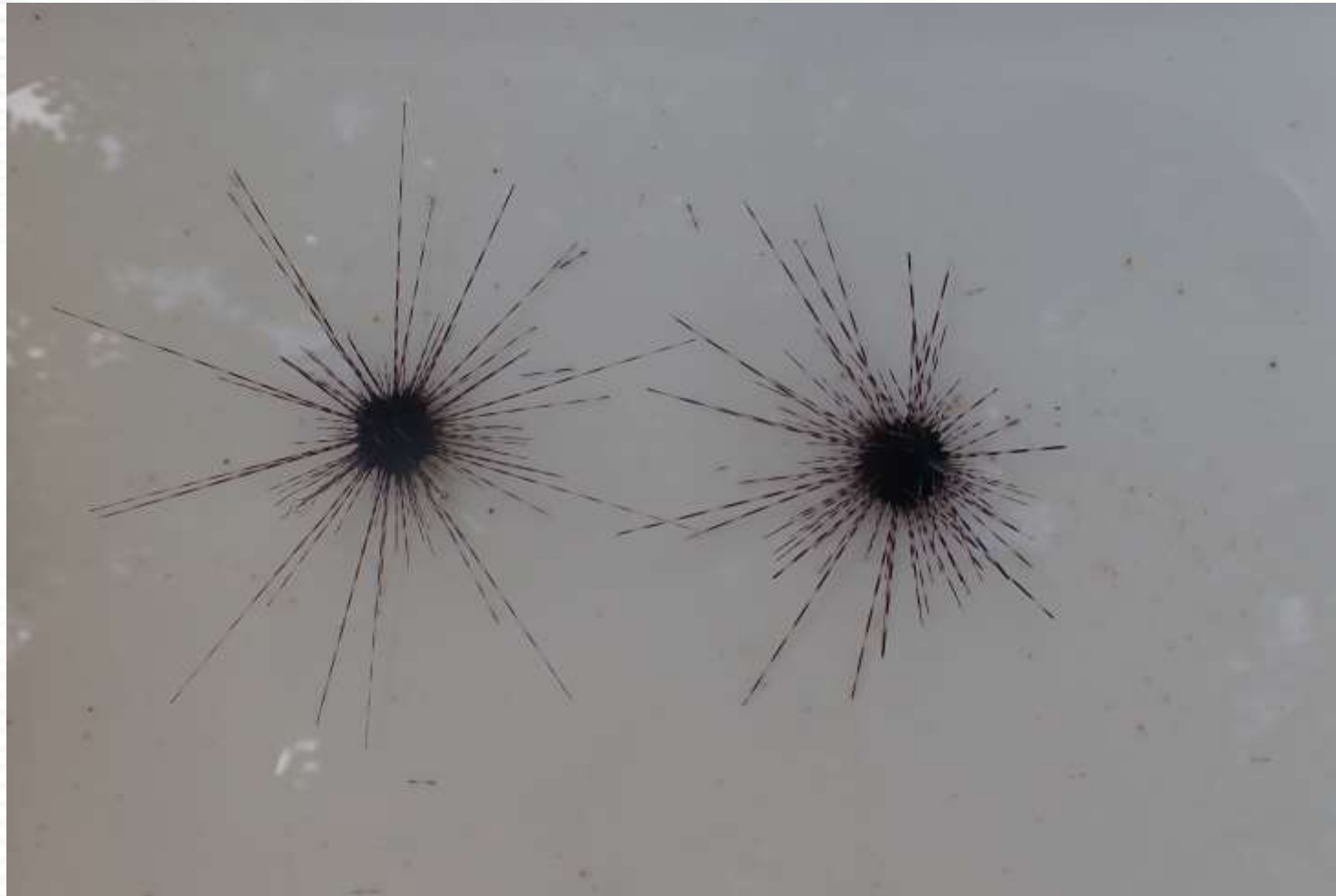
Restocking

- No observed predation this time, but still poor retention in the uncaged group



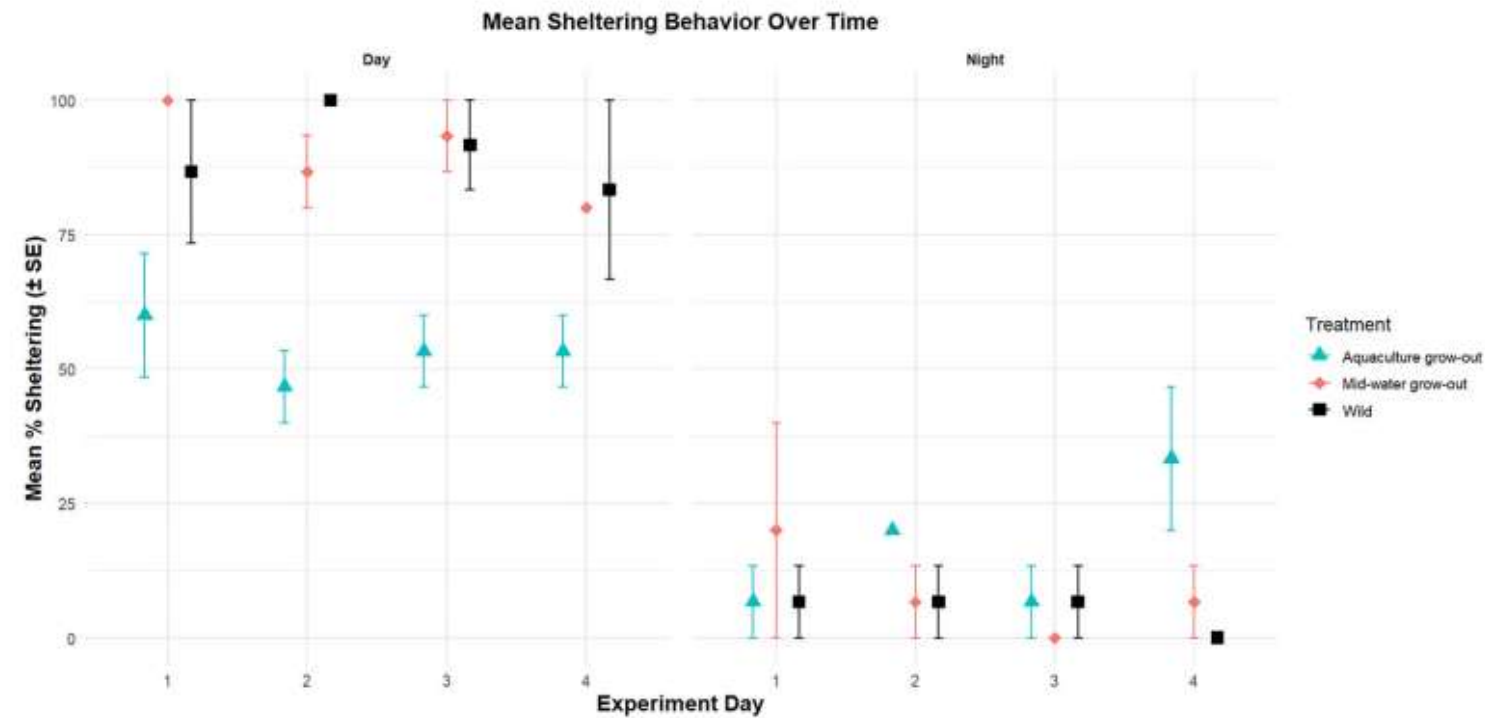
What is causing low retention?

- Are our *Diadema* urchins deficient somehow?
- Urchins are known to be phenotypically plastic



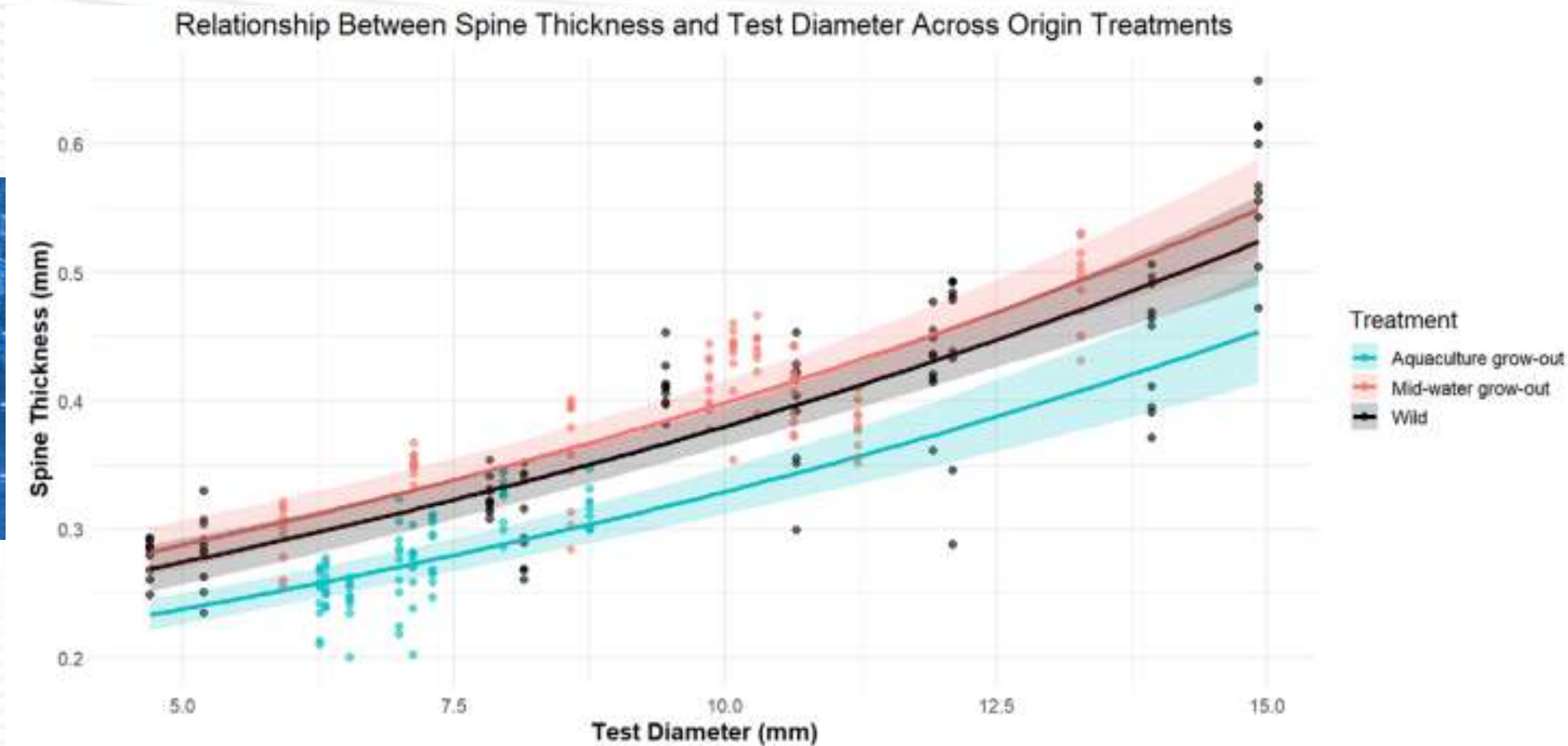
If they are deficient, can we fix that?

- Conditioned at sea for 6 weeks and compared behavior



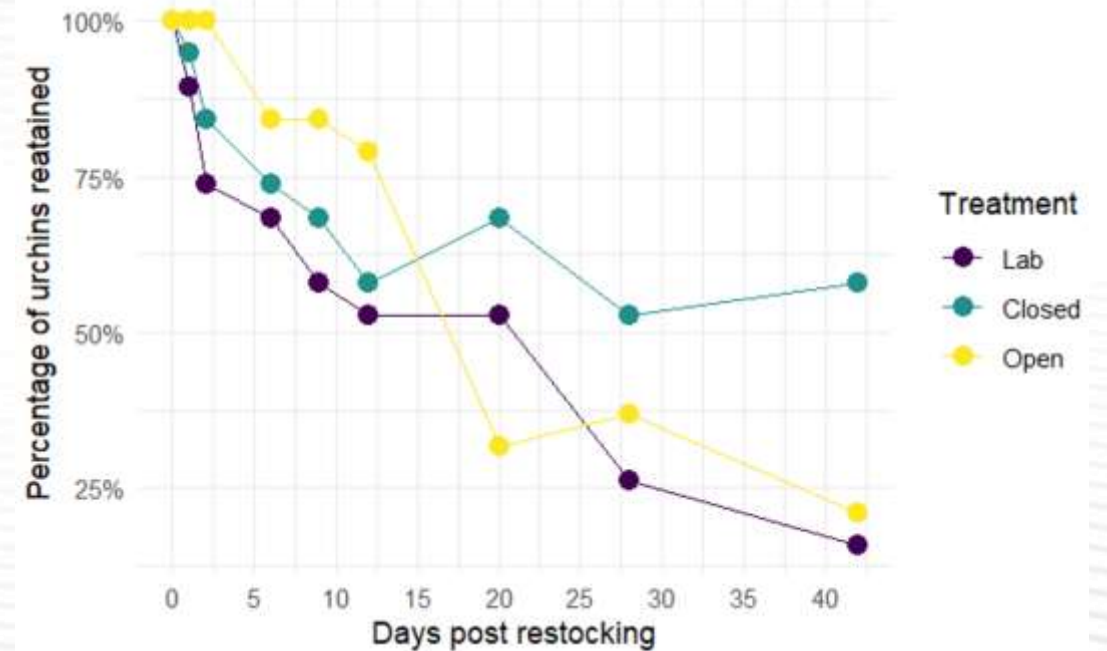
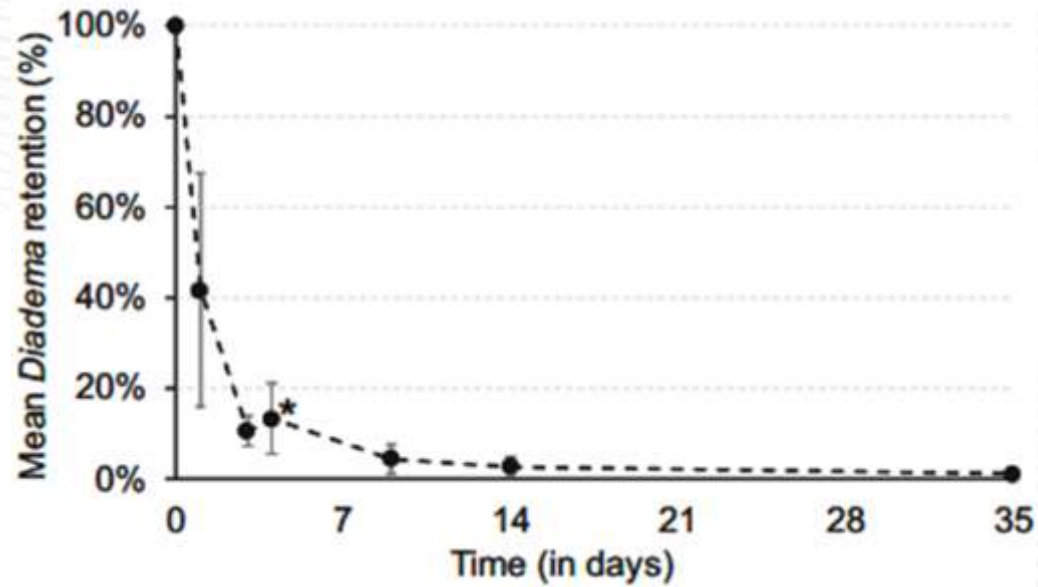
If they are deficient, can we fix that?

- Conditioned at sea for 6 weeks and compared morphology



Does conditioning improve retention?

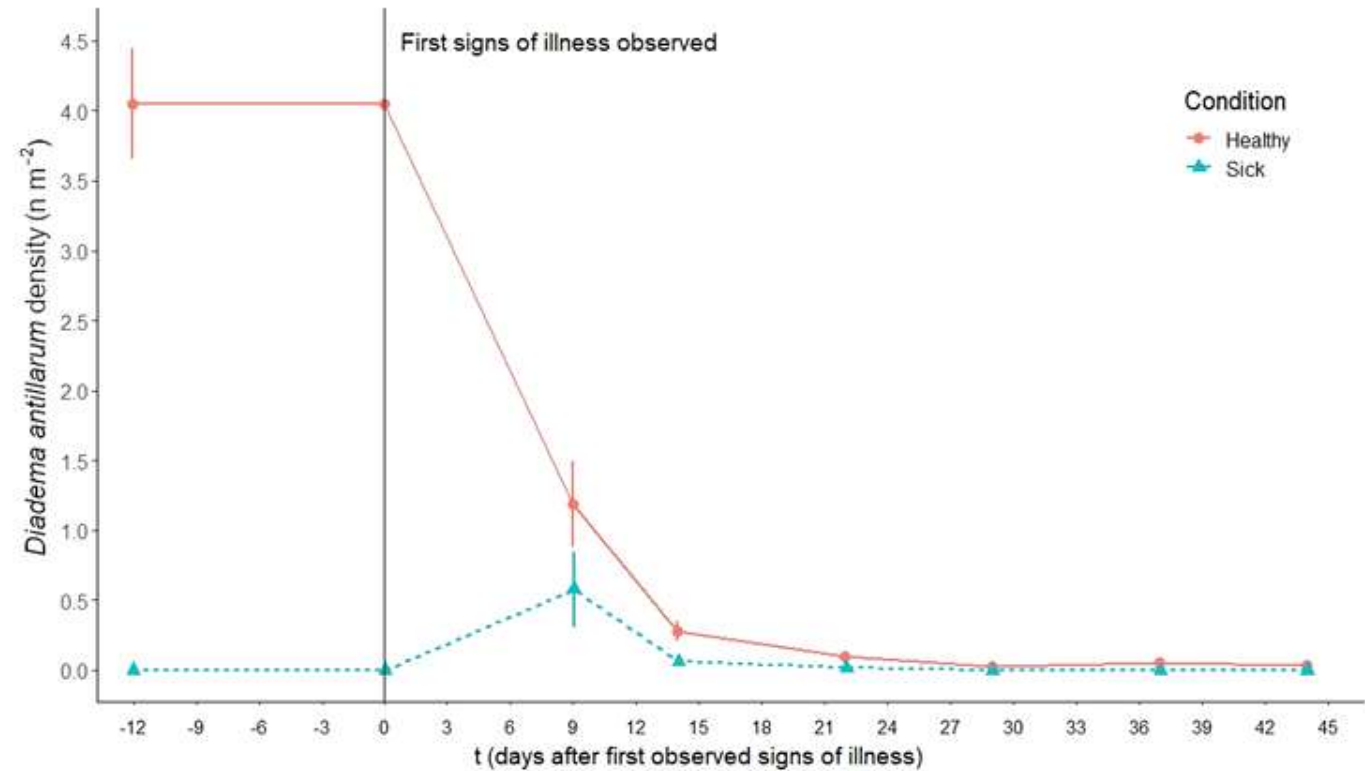
- Pilot: Conditioned at sea for 8 weeks and released



A bit better!

2022 die-off

- Implications for larval supply and headstarting potential



Hylkema et al. 2023

Can we produce them ourselves?

Yes! We and our Florida partners developed aquaculture methods that can pretty consistently produce settlers



Pilnick et al. 2021



Wijers et al. 2023

But capacity is limited, how can we produce higher numbers?

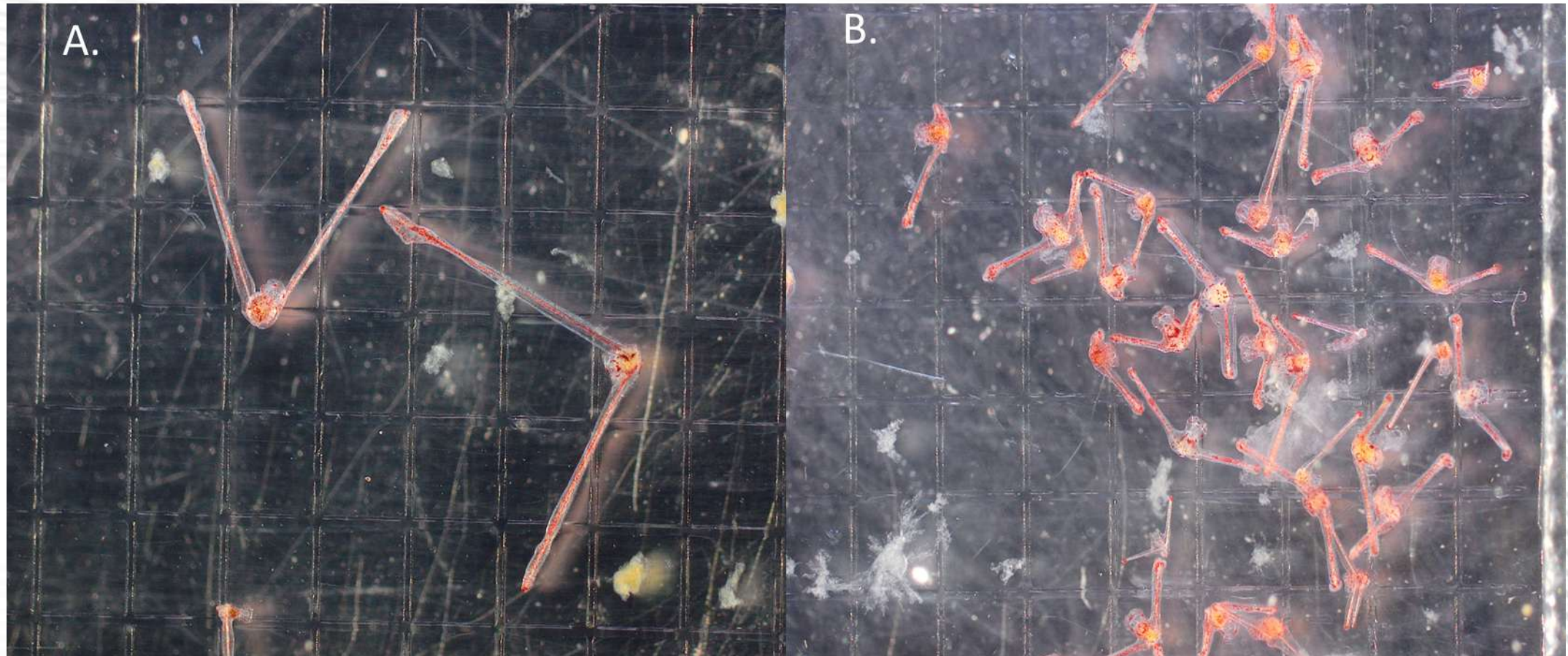


Shaker tables: ~1,000 larvae = ~100 settlers

Conical tank: ~140,000 larvae = >10,000 settlers

Work in progress....

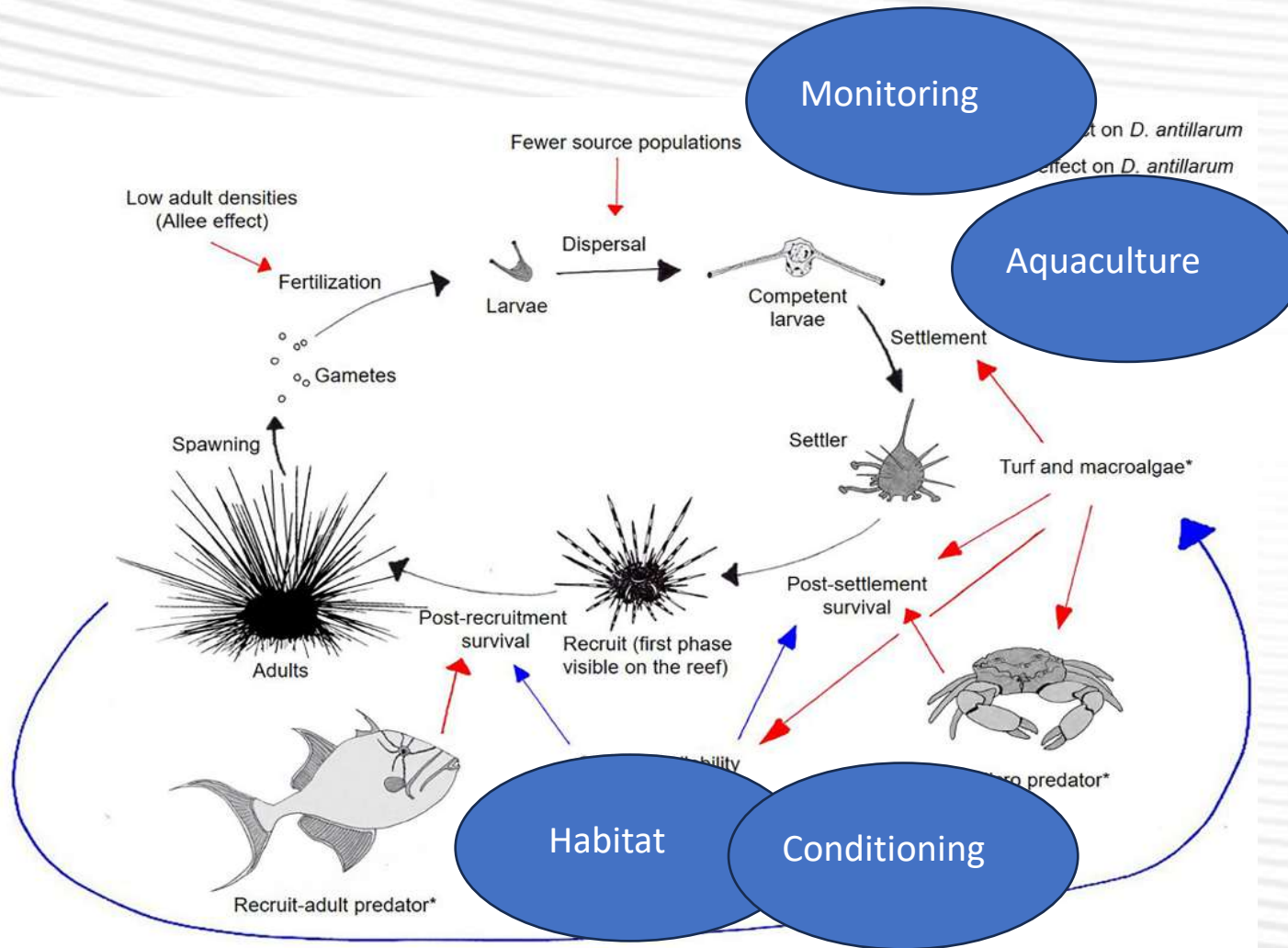
New method, New questions:



New method, New questions:



What are we doing to promote recovery?

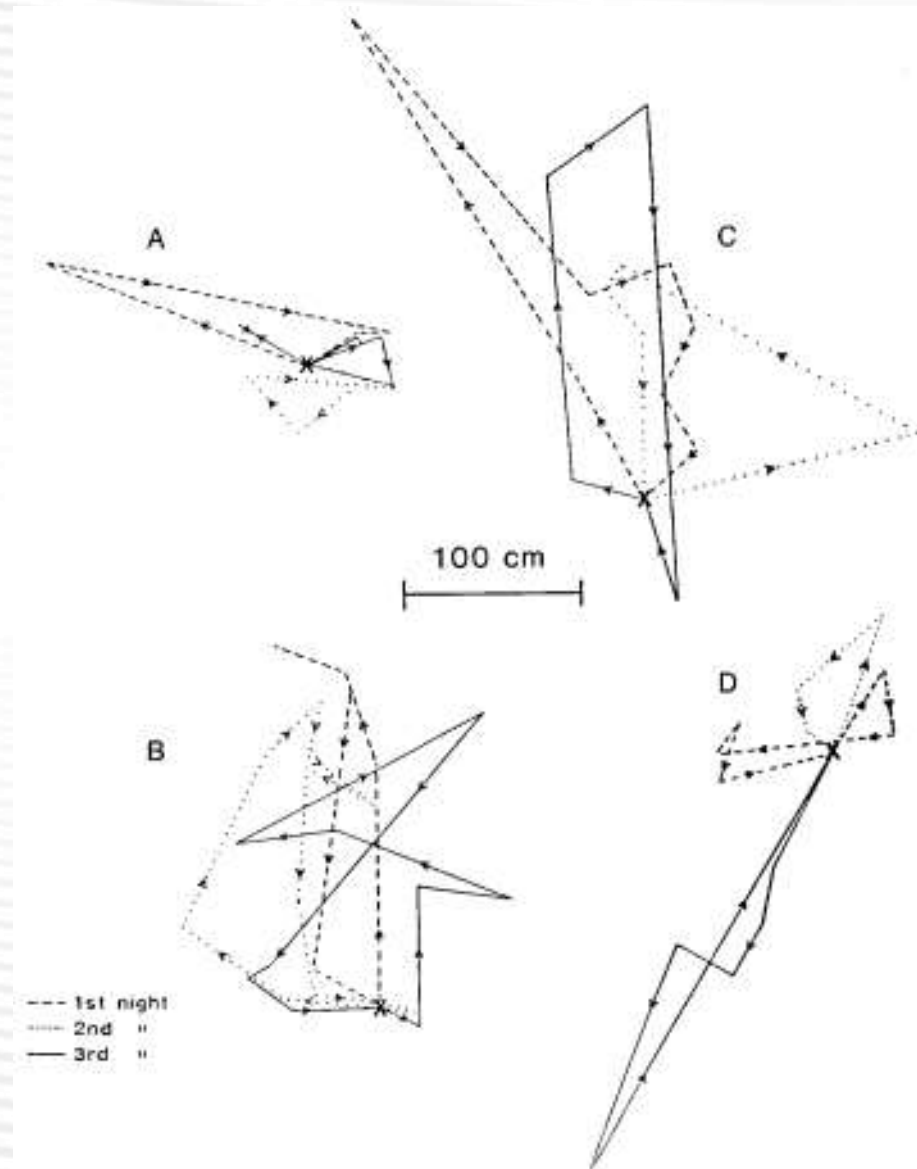


But especially in how
habitat and conditioning
function we're realizing
that there's much going on!

Physiology Response

Complex Behavior Responses

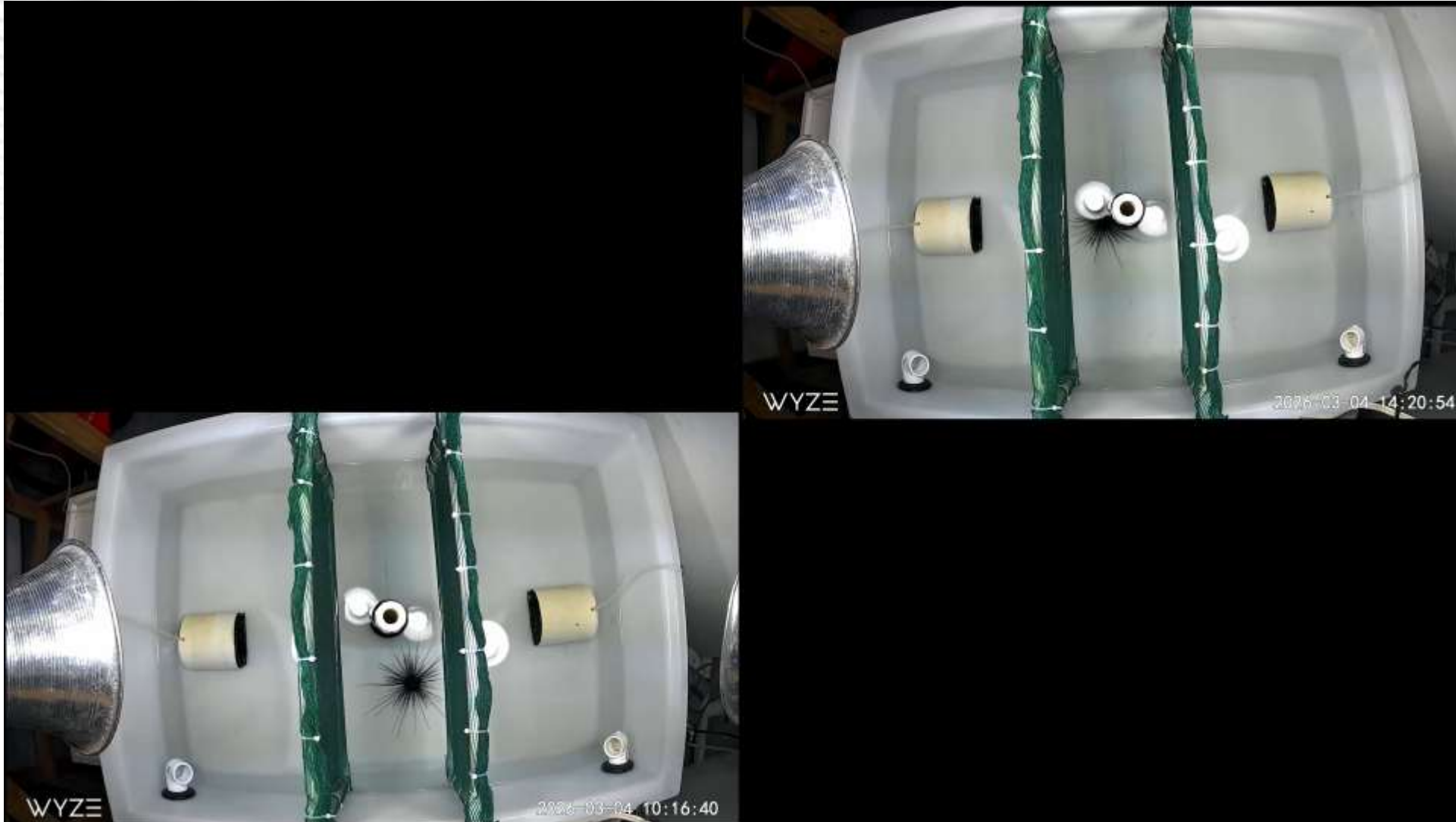
- Homing Behavior



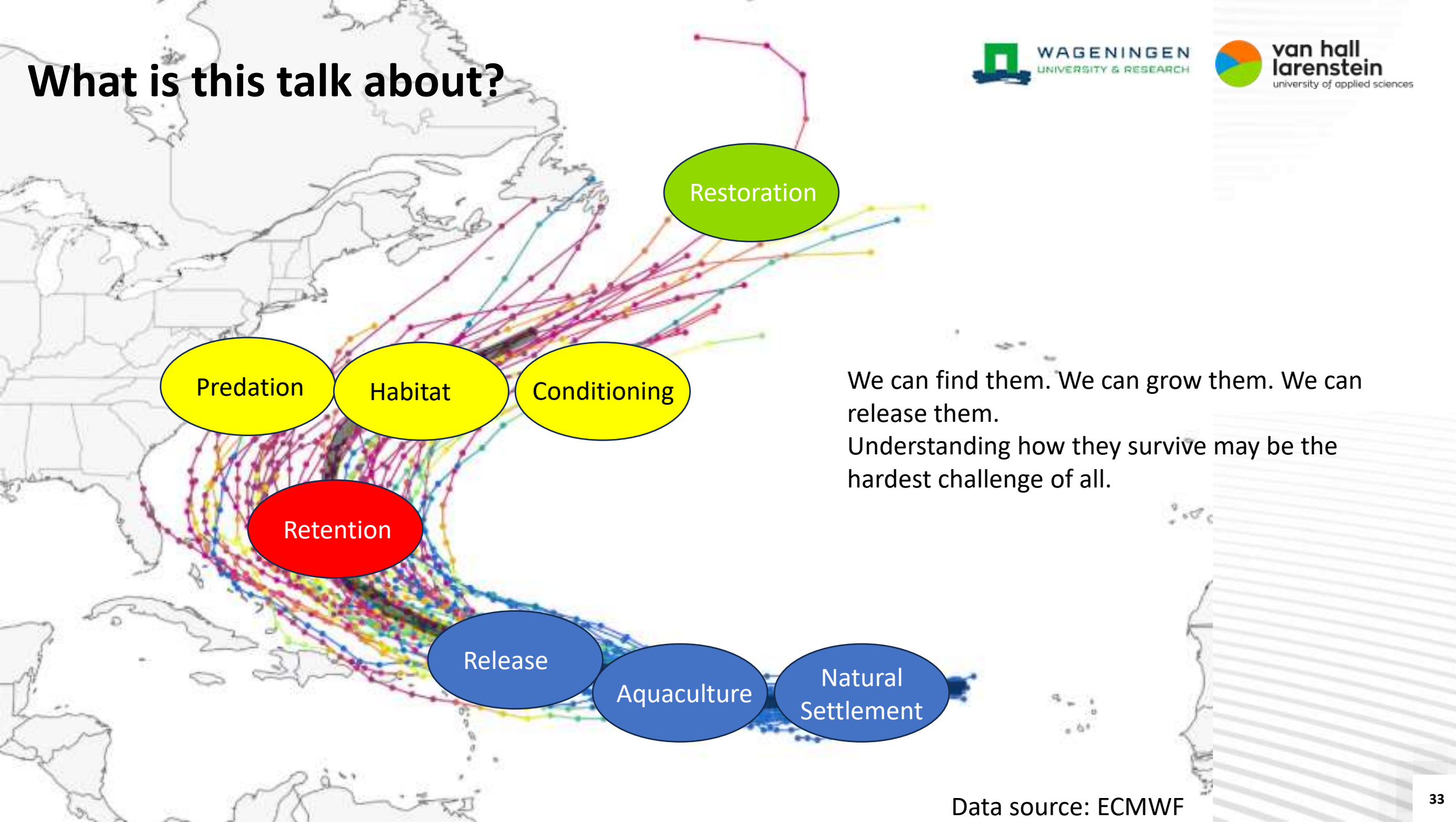
Carpenter 1984

Complex Behavior Responses

- Cue responses



What is this talk about?



We can find them. We can grow them. We can release them.

Understanding how they survive may be the hardest challenge of all.



DUTCH CARIBBEAN NATURE ALLIANCE



Thanks to all partners, colleagues, students, and volunteers!

Questions?

*Follow us
on LinkedIn*

