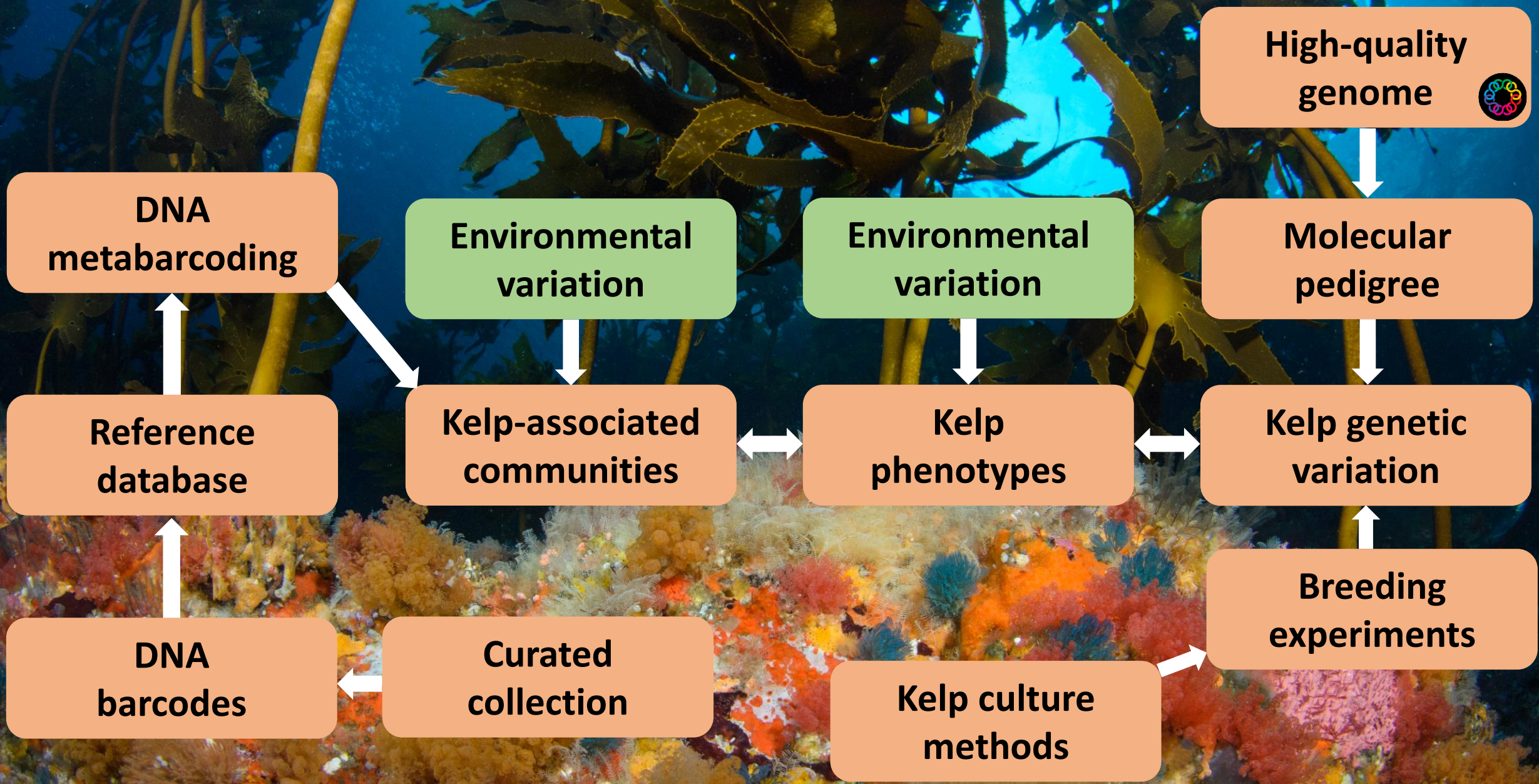
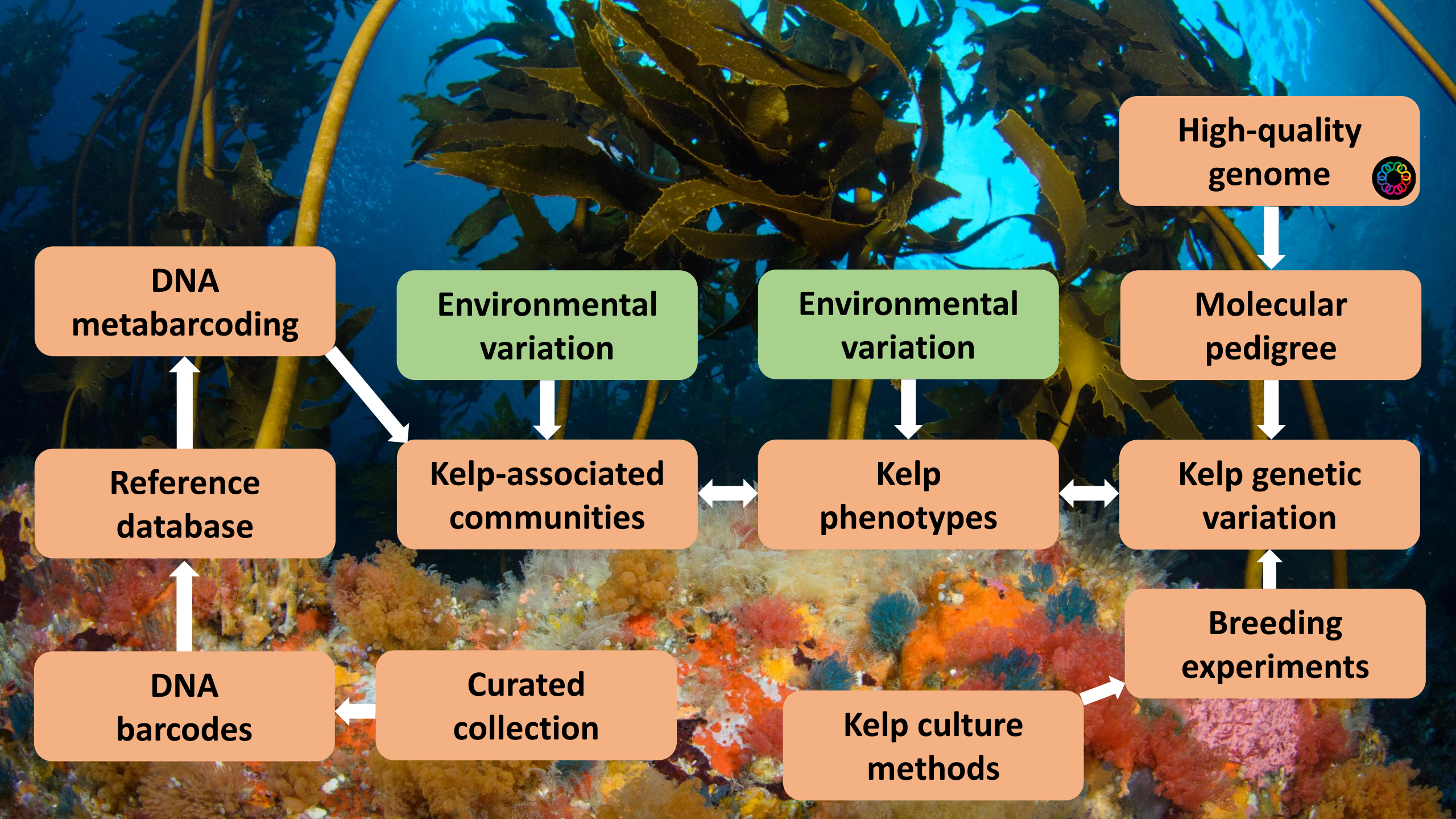


# Effects of wild kelp populations on the survival and growth of conspecifics cultured on artificial substrates.

**Beau Masters**

David Aguirre, Ella Lis, Hochang Yoo  
bmasters@massey.ac.nz







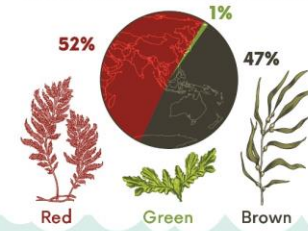




# A snapshot of the Global seaweed sector

## Seaweed/rimurimu types

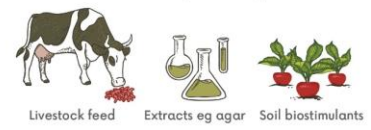
There are three types of seaweed: green, red, and brown, all of which are farmed or harvested in some manner. Red and brown seaweeds make up most of the global supply.



## Used for

**85% Human consumption**  
Most farmed seaweed is used for human consumption, either directly or as a food ingredient.

**15% Other markets, including:**

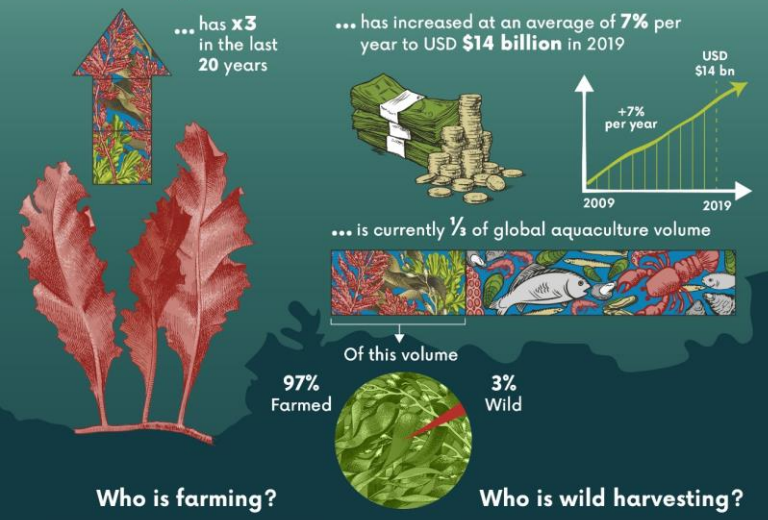


## Largest importers

Only a few countries have developed import markets. China and Japan represent more than 71% of the import market.



## Seaweed aquaculture



## Who is farming?

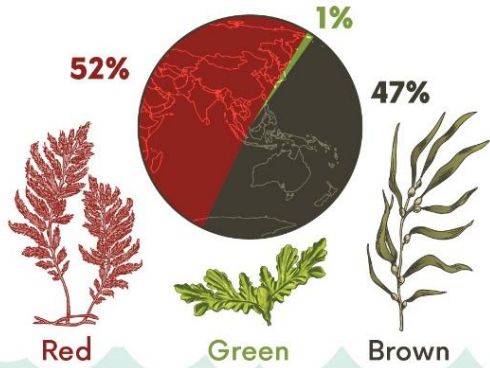


## Who is wild harvesting?



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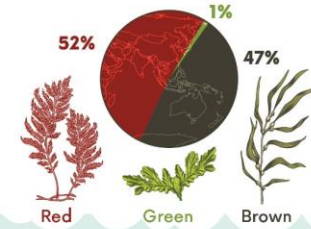
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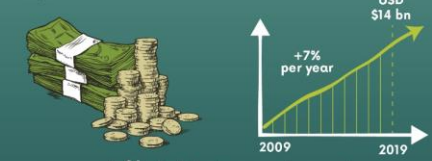
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## Seaweed aquaculture



... has increased at an average of **7%** per year to USD **\$14 billion** in 2019



... is currently **1/3** of global aquaculture volume



Of this volume

**97%** Farmed

**3%** Wild

## Who is farming?

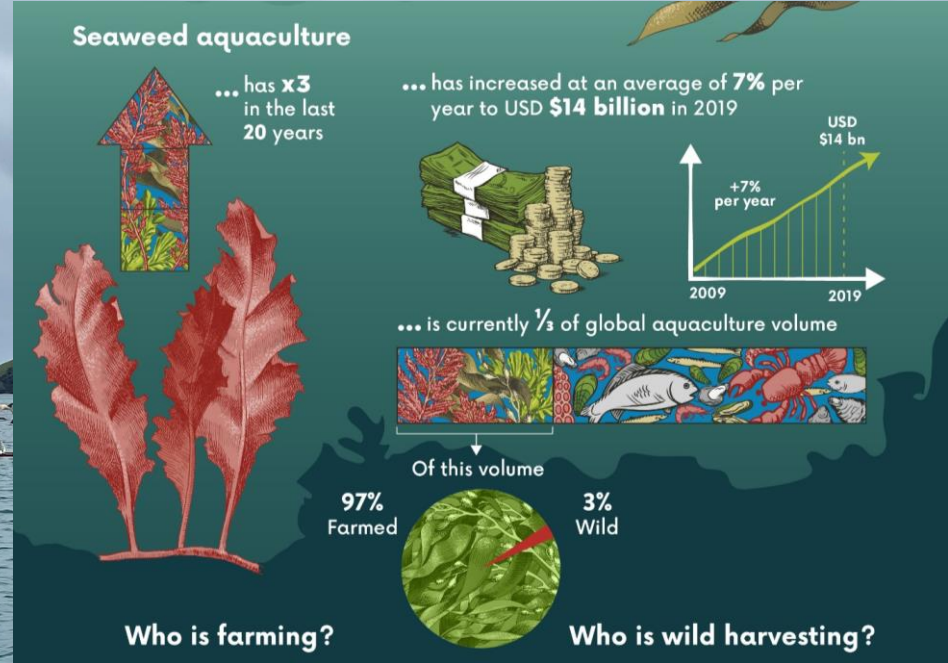


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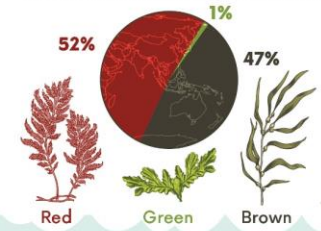
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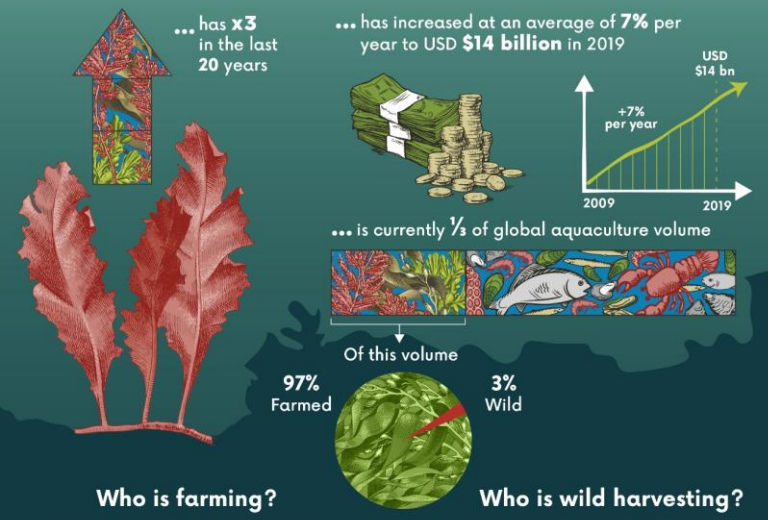


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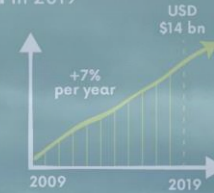


## Seaweed aquaculture



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Who is farming?

Who is wild harvesting?

### Who is farming?



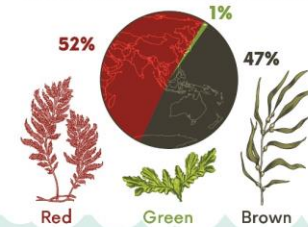
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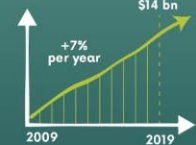


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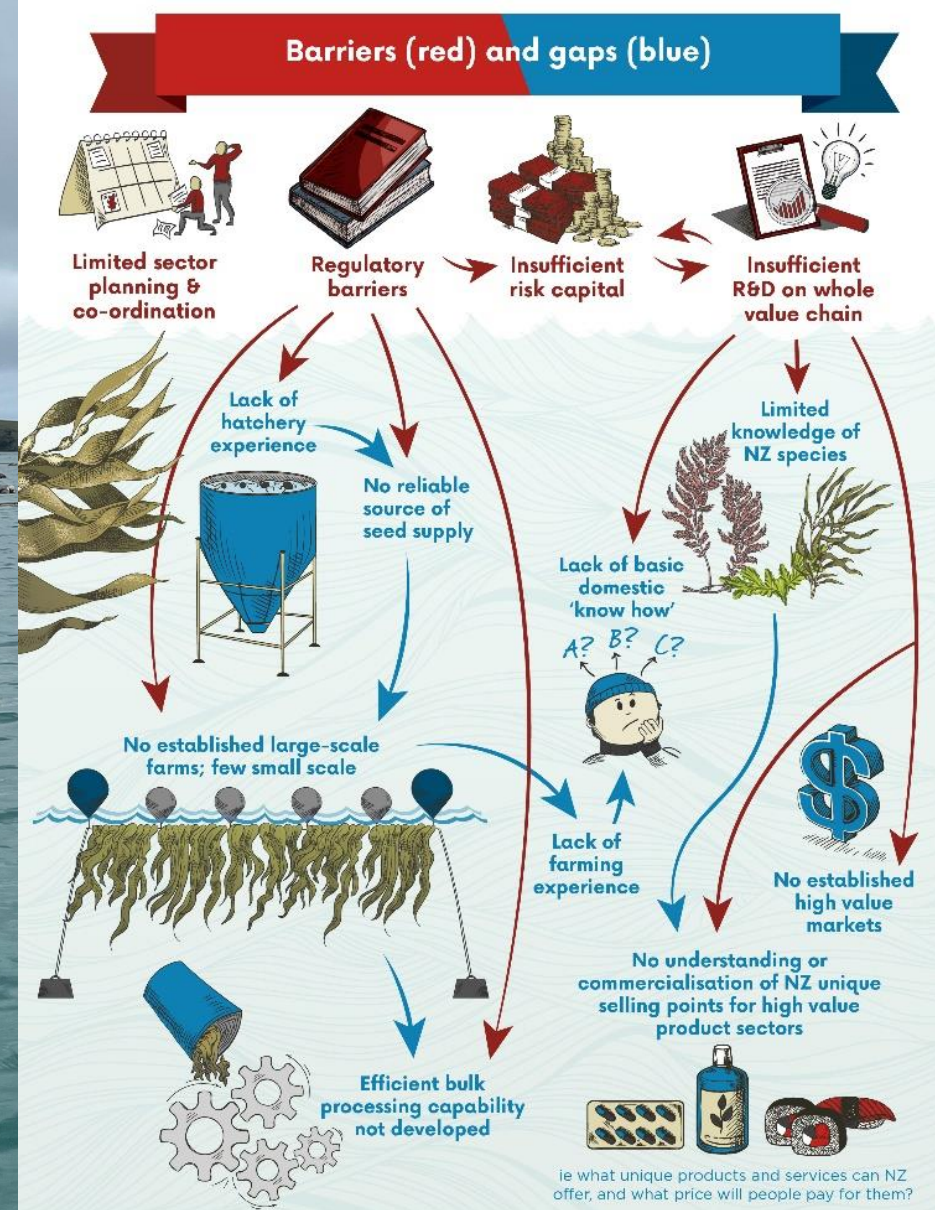


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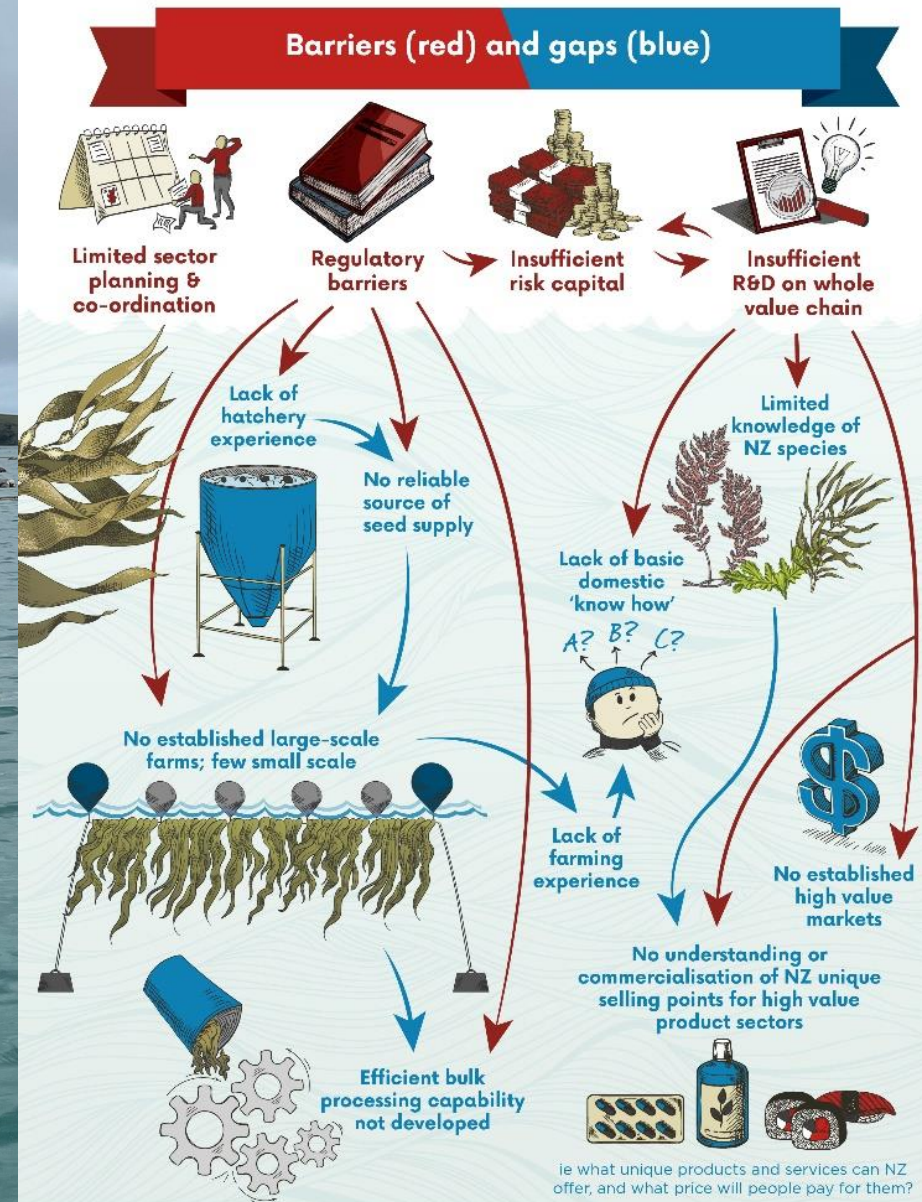


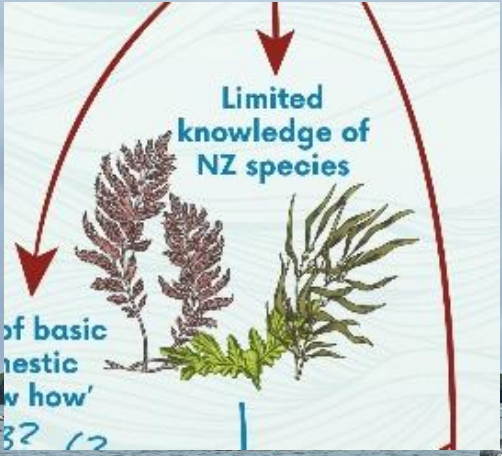
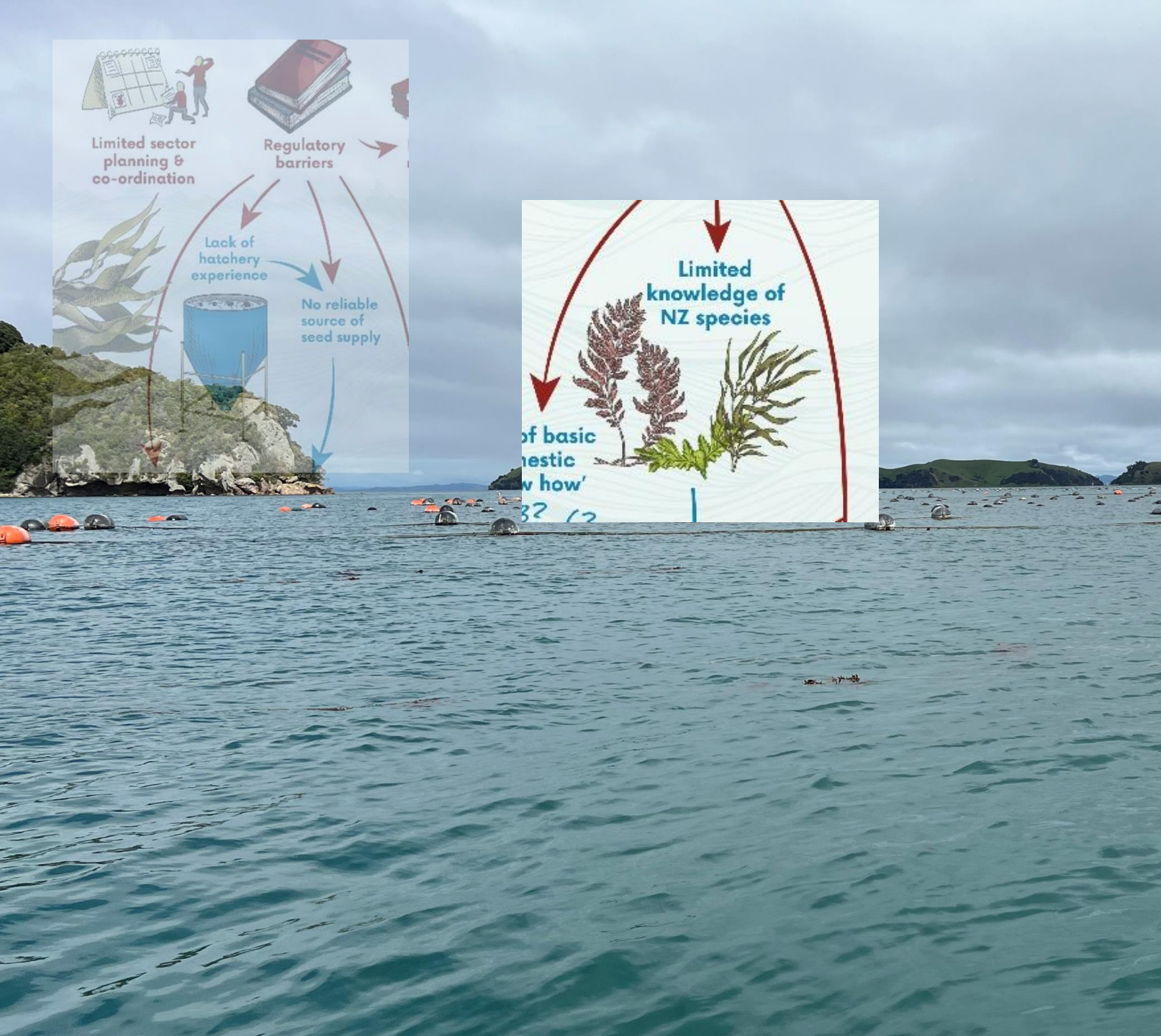
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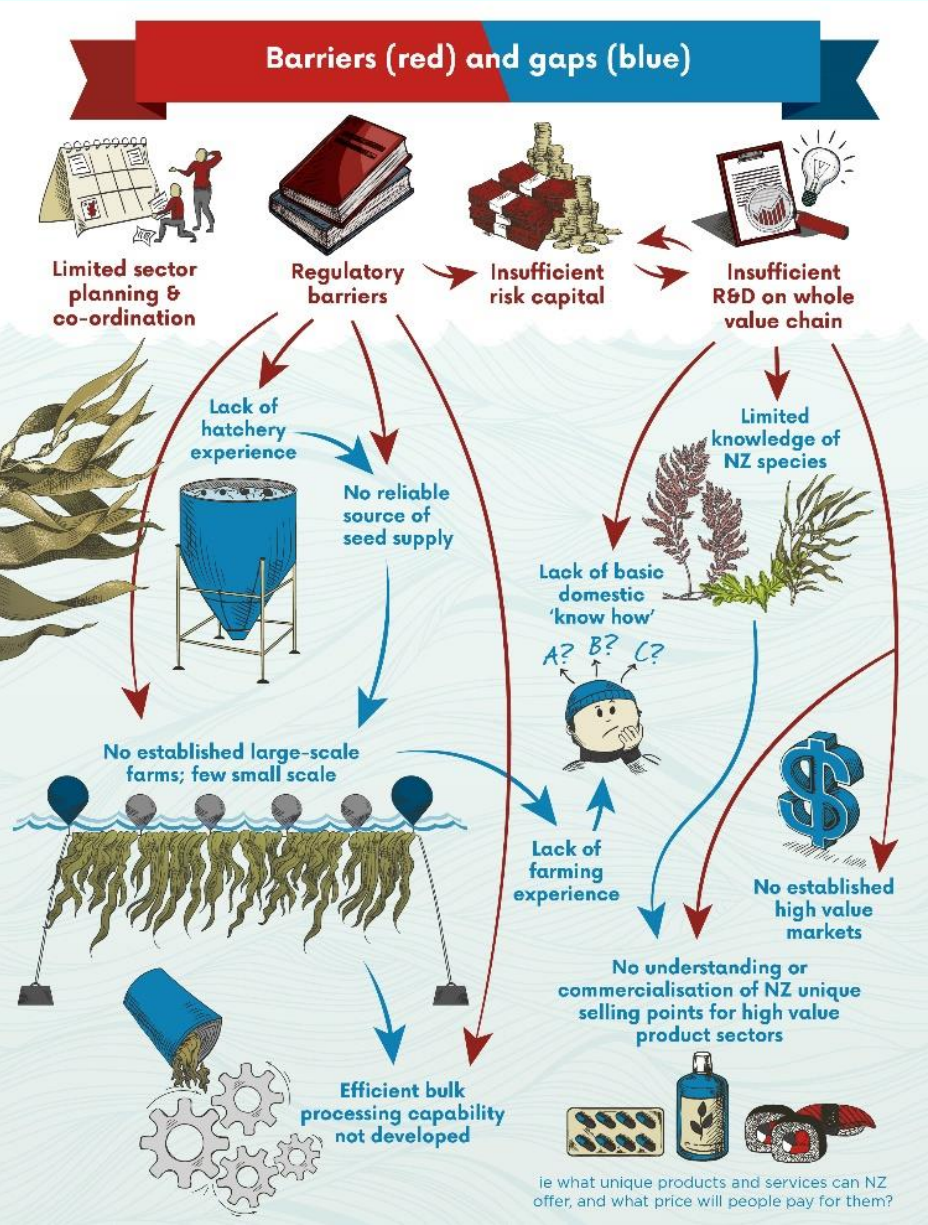


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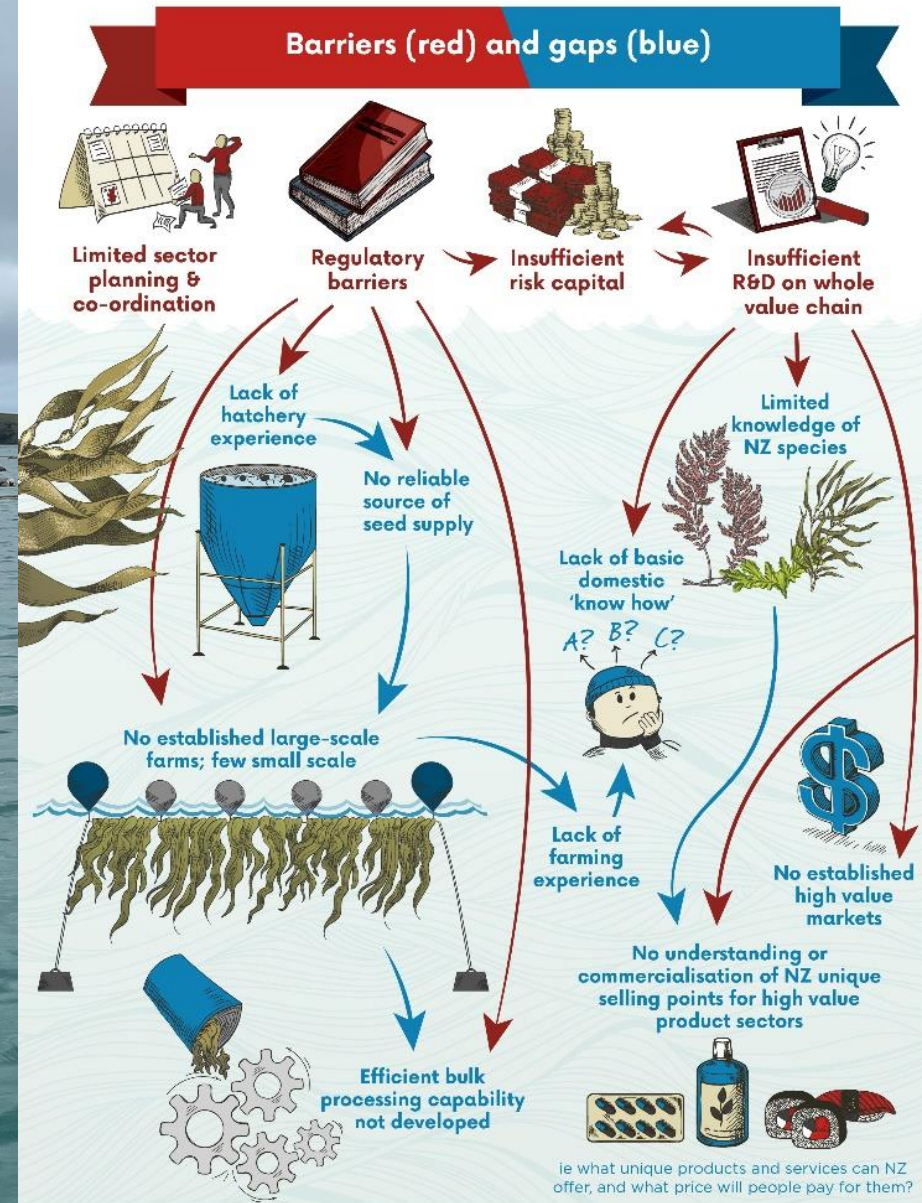
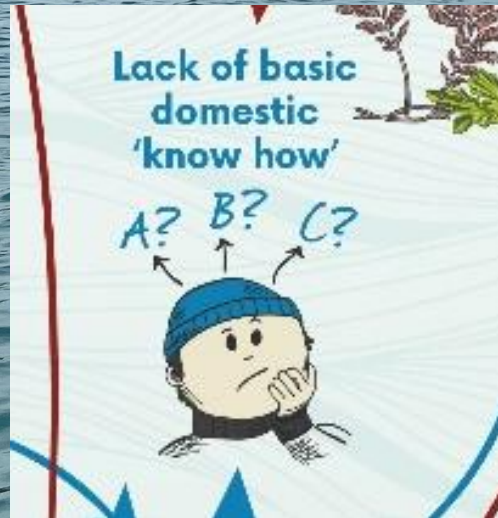
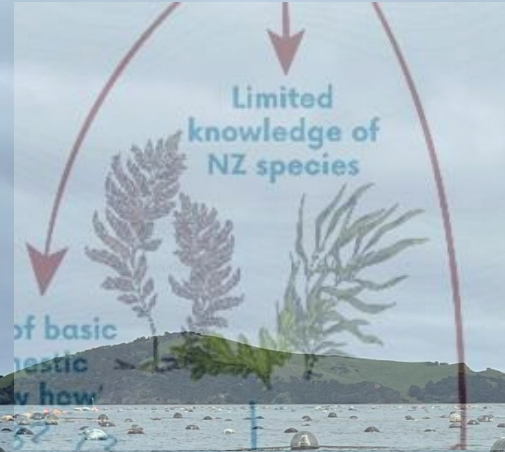


# What will enable Aotearoa New Zealand's seaweed sector?



ie what unique products and services can NZ offer, and what price will people pay for them?

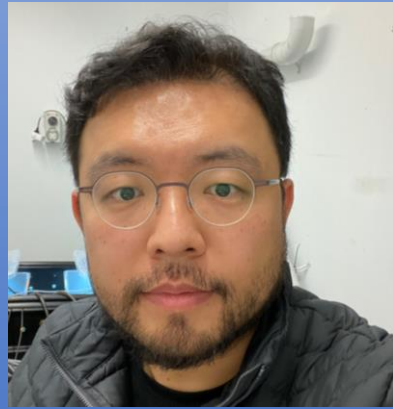
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# Developing cultivation techniques for *Ecklonia radiata*



Dr. Eun Hwang

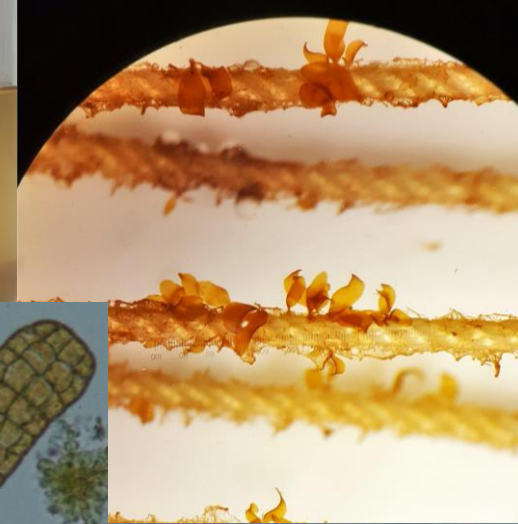


Hochang Yoo

Zoospore release via stress and desiccation of ripe sorus tissue

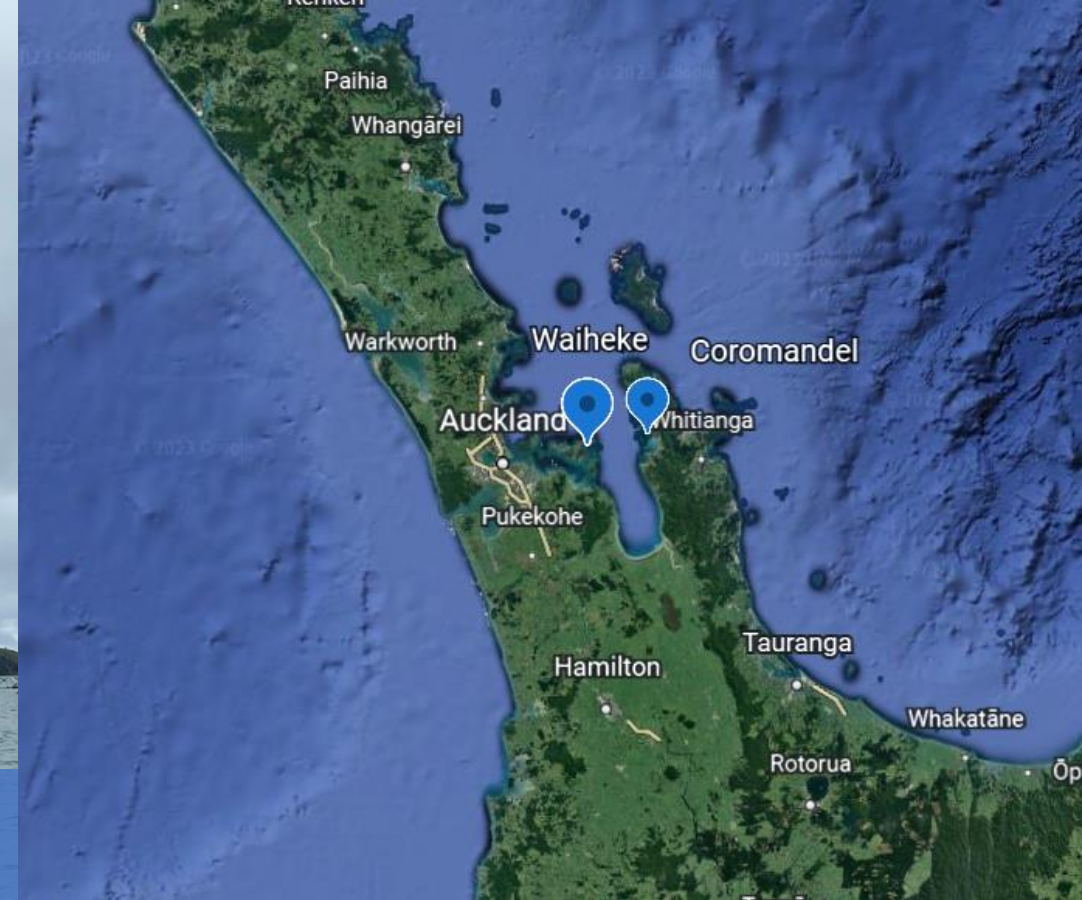
Settlement of zoospores onto seed string wound around frames

Seed frames are placed in temperature and light controlled water baths in filtered and autoclaved seawater





The Hauraki Gulf has a history of aquaculture <sup>1</sup>  
Farming Greenshell™ mussels since the 1970's <sup>1</sup>



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Farming Greenshell™ mussels since the 1970's <sup>1</sup>  
Two sites: Coromandel Harbour and Waiheke Island

<sup>1</sup>Kelly et al.,. (2014) Hauraki Gulf Forum

Nursery frame with Caged and Uncaged seed frames



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Caged seed frames protected seedlings from grazers



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The evidence suggested *Girella tricuspidata*



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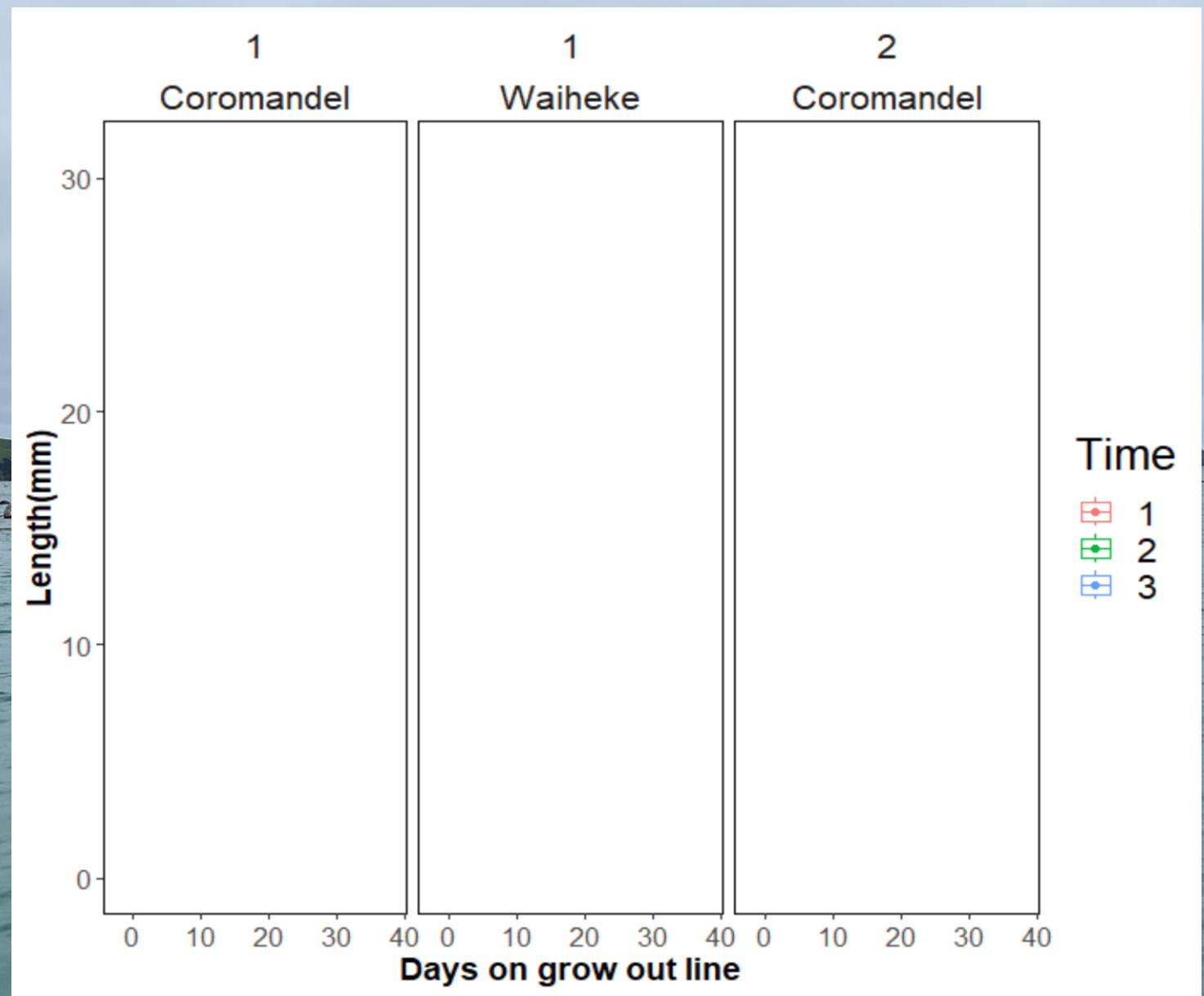


Seed frame covered by fouling invertebrates



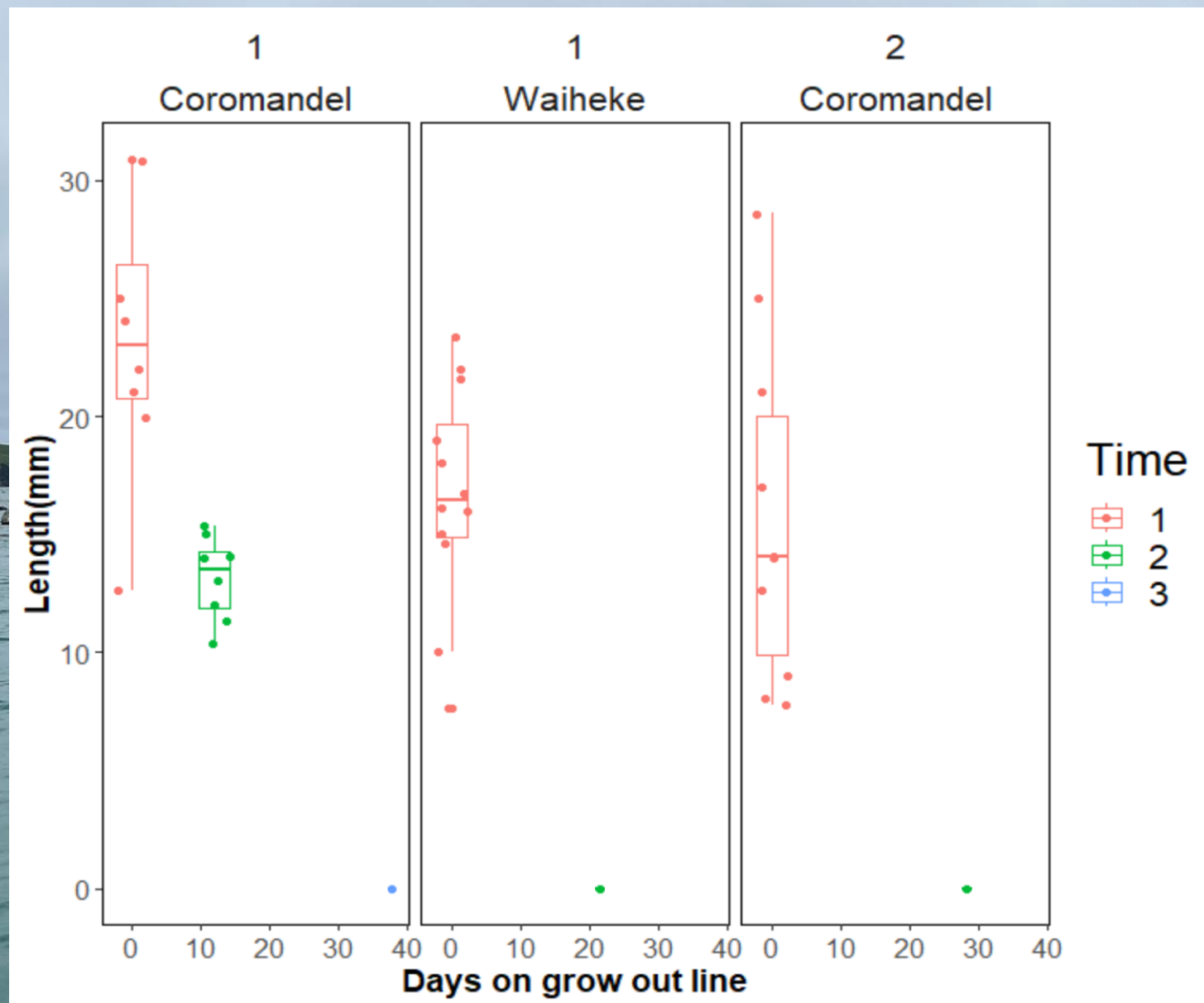
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Only 3 out of 4 trials progressed to sporophytes being transferred onto grow out lines after nursery frame period

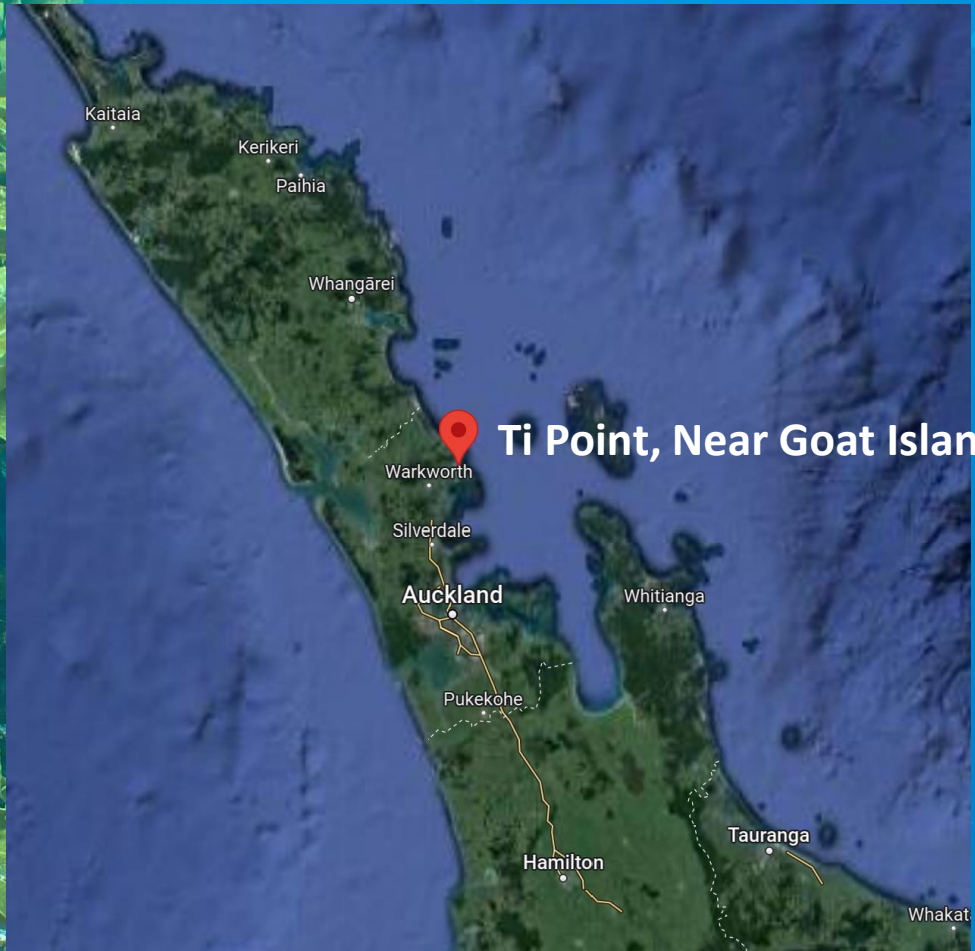
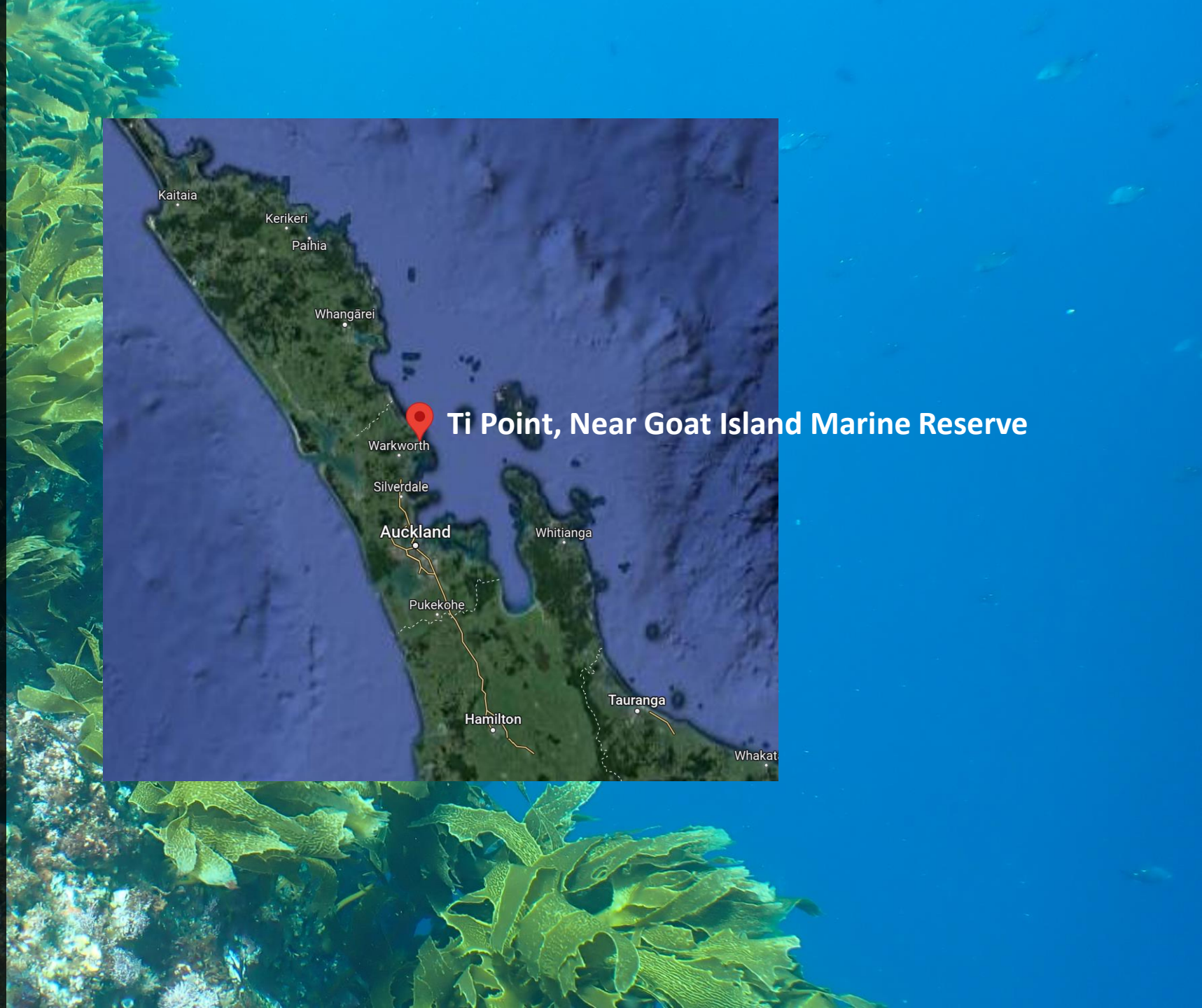


Only 3 out of 4 trials progressed to sporophytes being transferred onto grow out lines after nursery frame period

Sporophytes eroded, grazed or fouled to nothing in less than 40 days in all trials ...

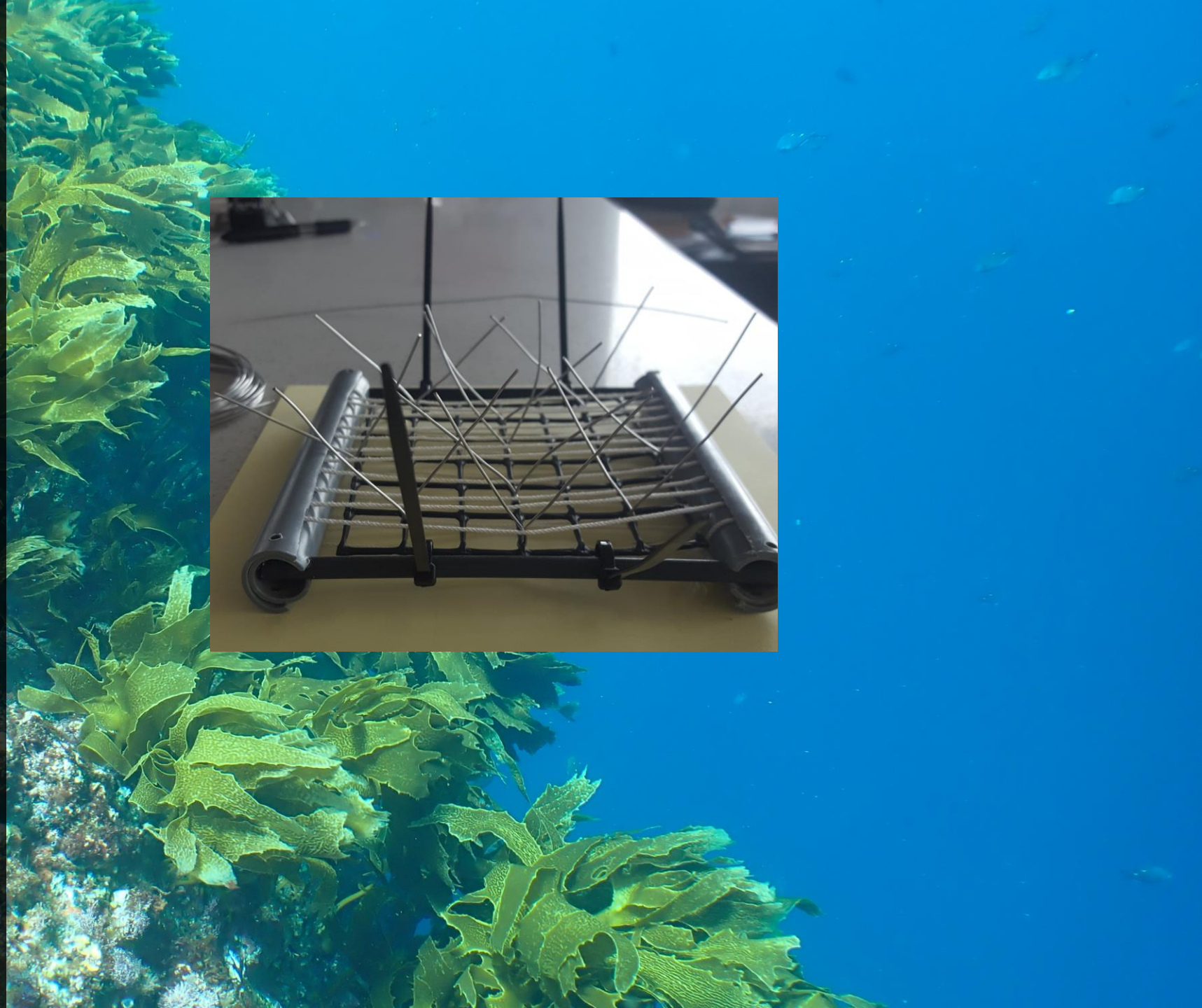
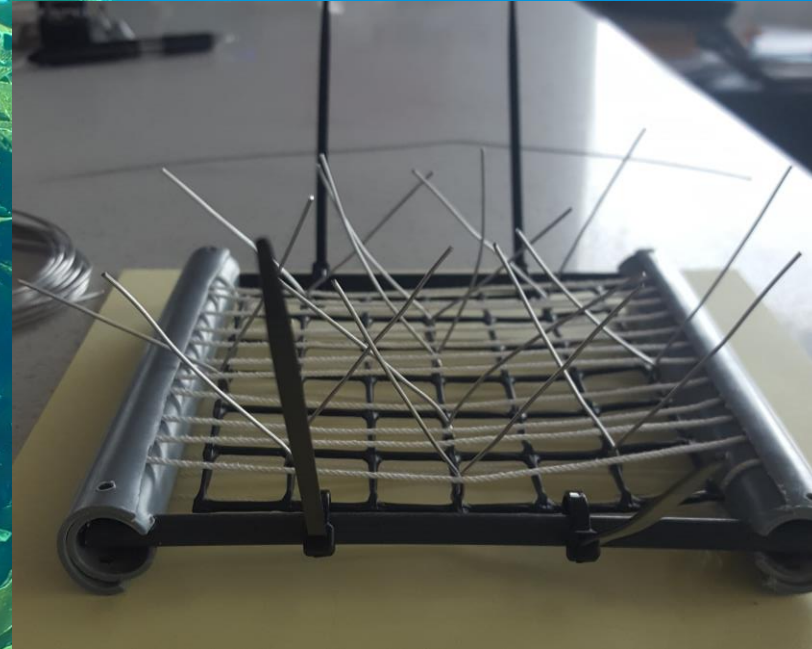


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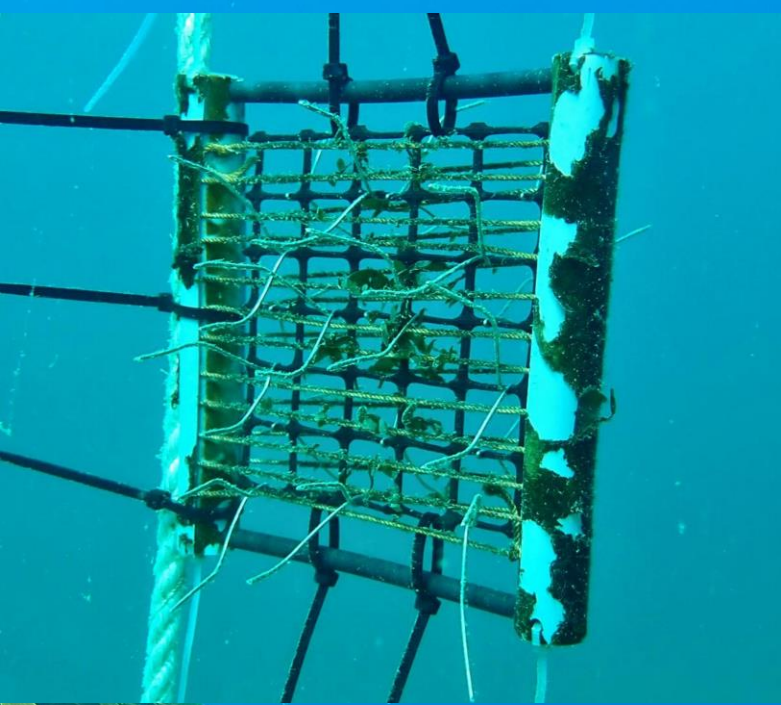
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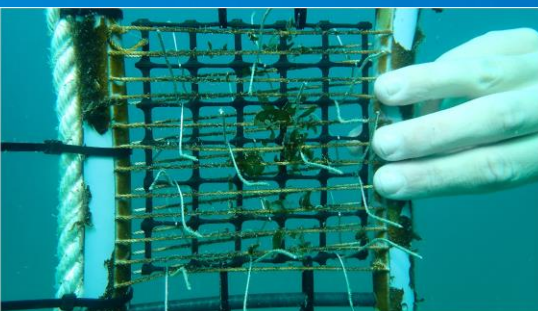
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1<sup>st</sup> month in the field



2<sup>nd</sup> month in the field

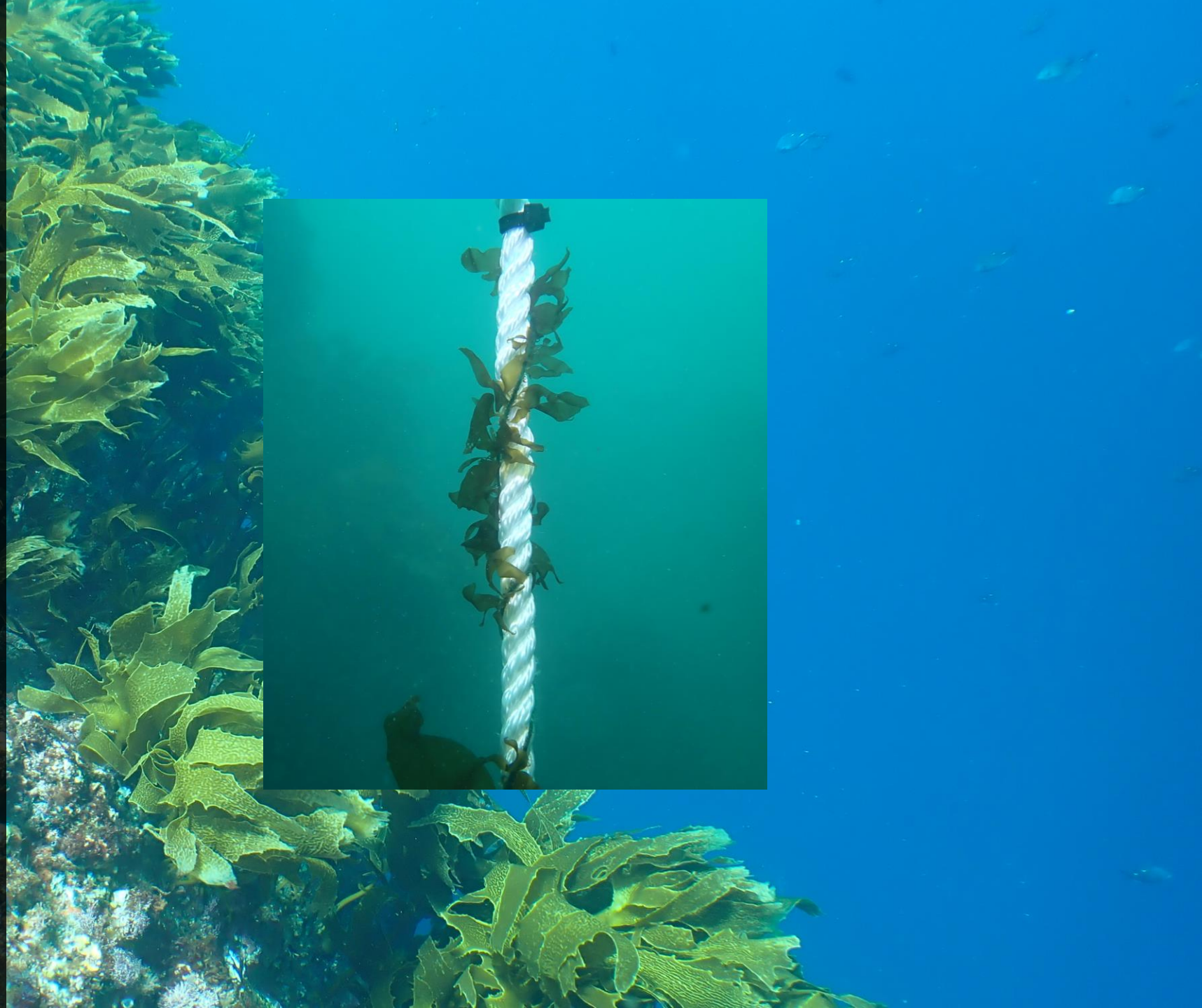


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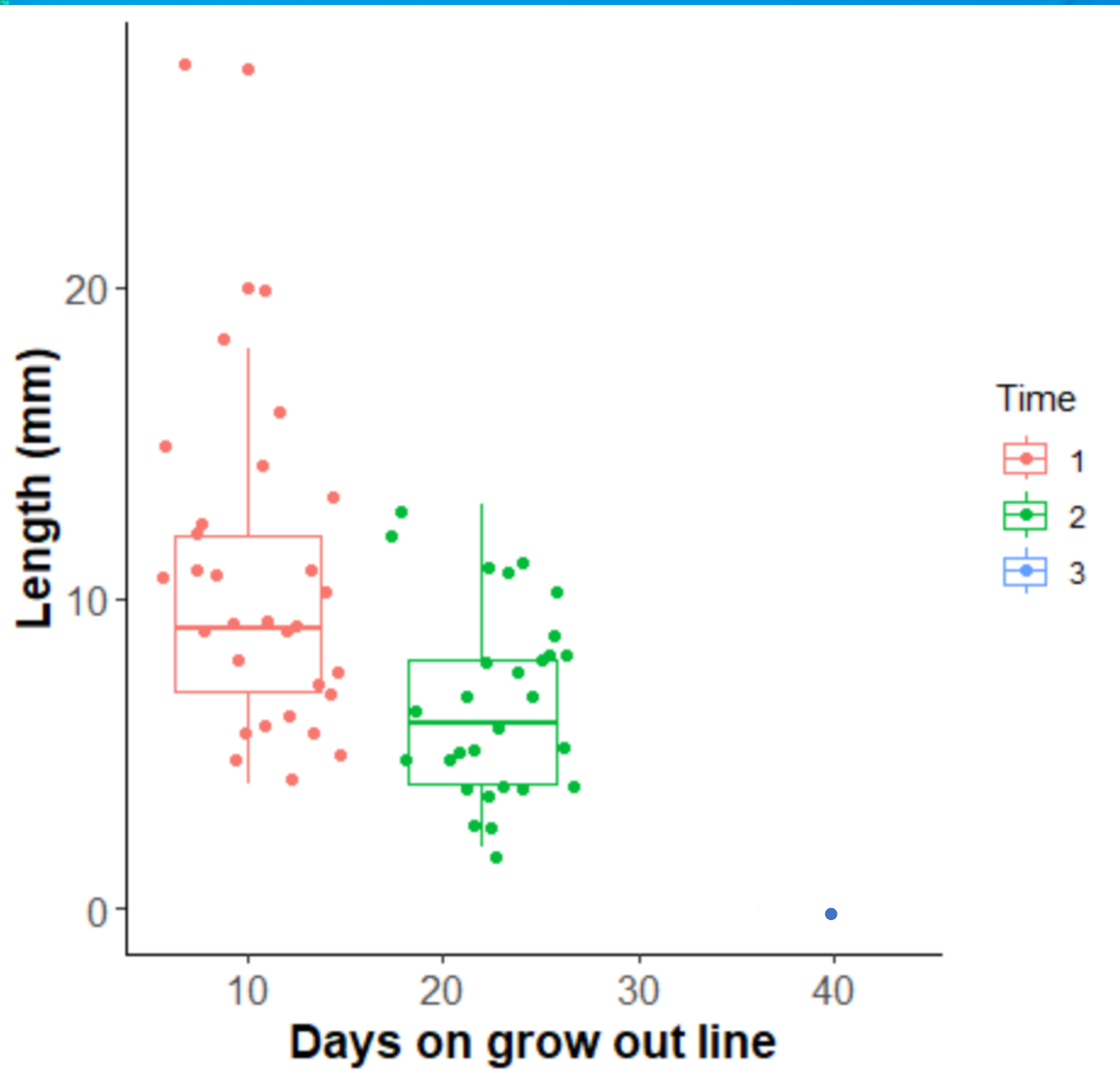
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Seed string with attached juvenile sporophytes were then transferred to a vertical grow out line in a sand flat habitat



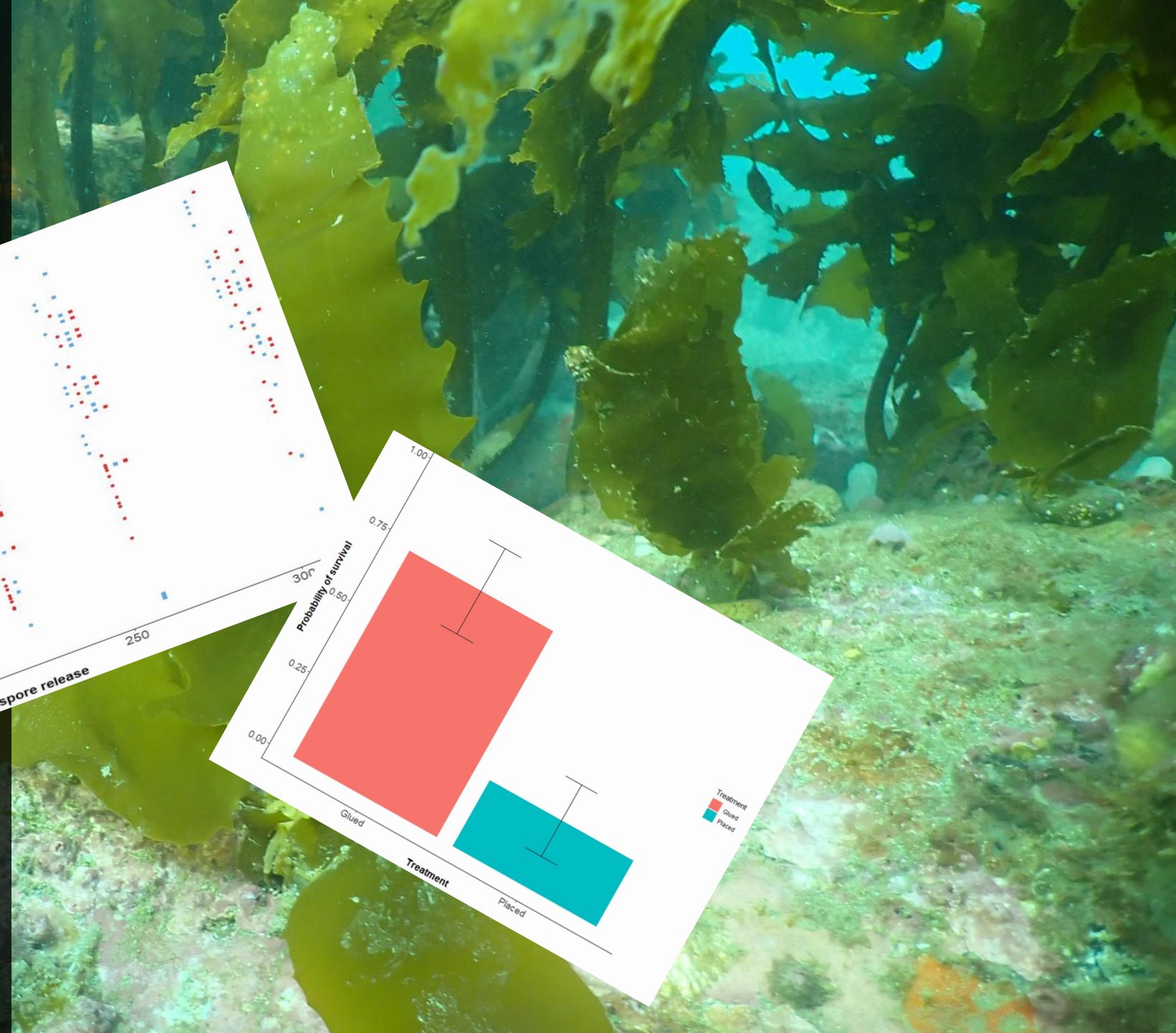
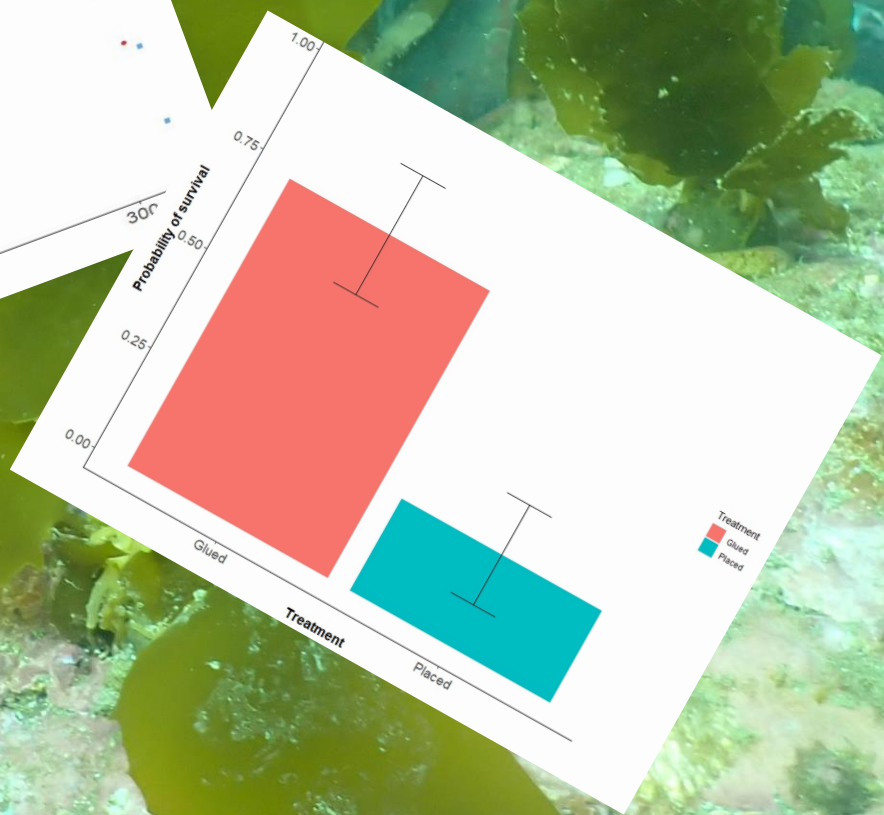
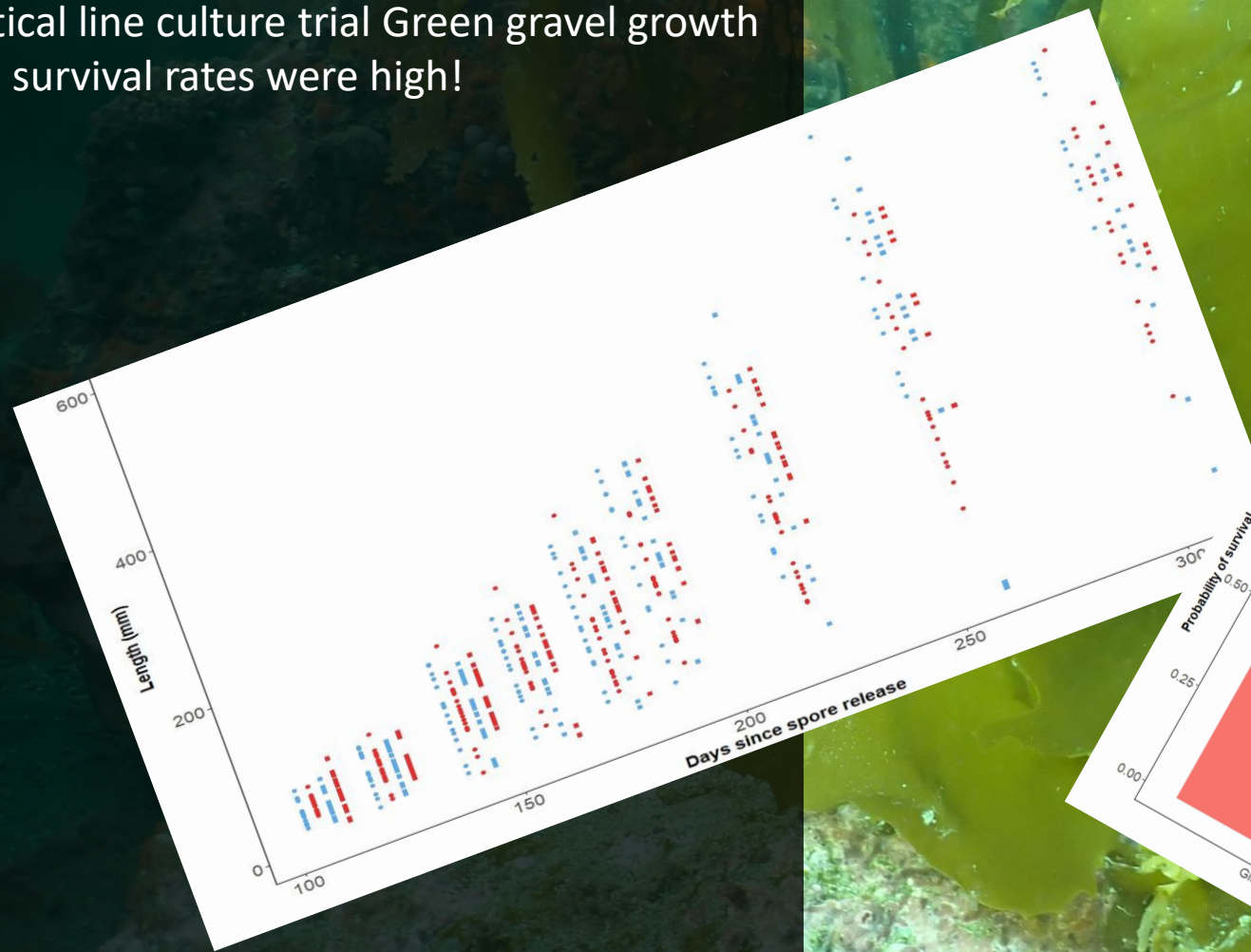
After 40 days on the grow out line all of the sporophytes had completely eroded or had been consumed



Meanwhile,



Meanwhile, on the rocky reef adjacent to our vertical line culture trial Green gravel growth and survival rates were high!



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Why?



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The substrate was different

Green gravel sites are located within the boundaries of an existing kelp population



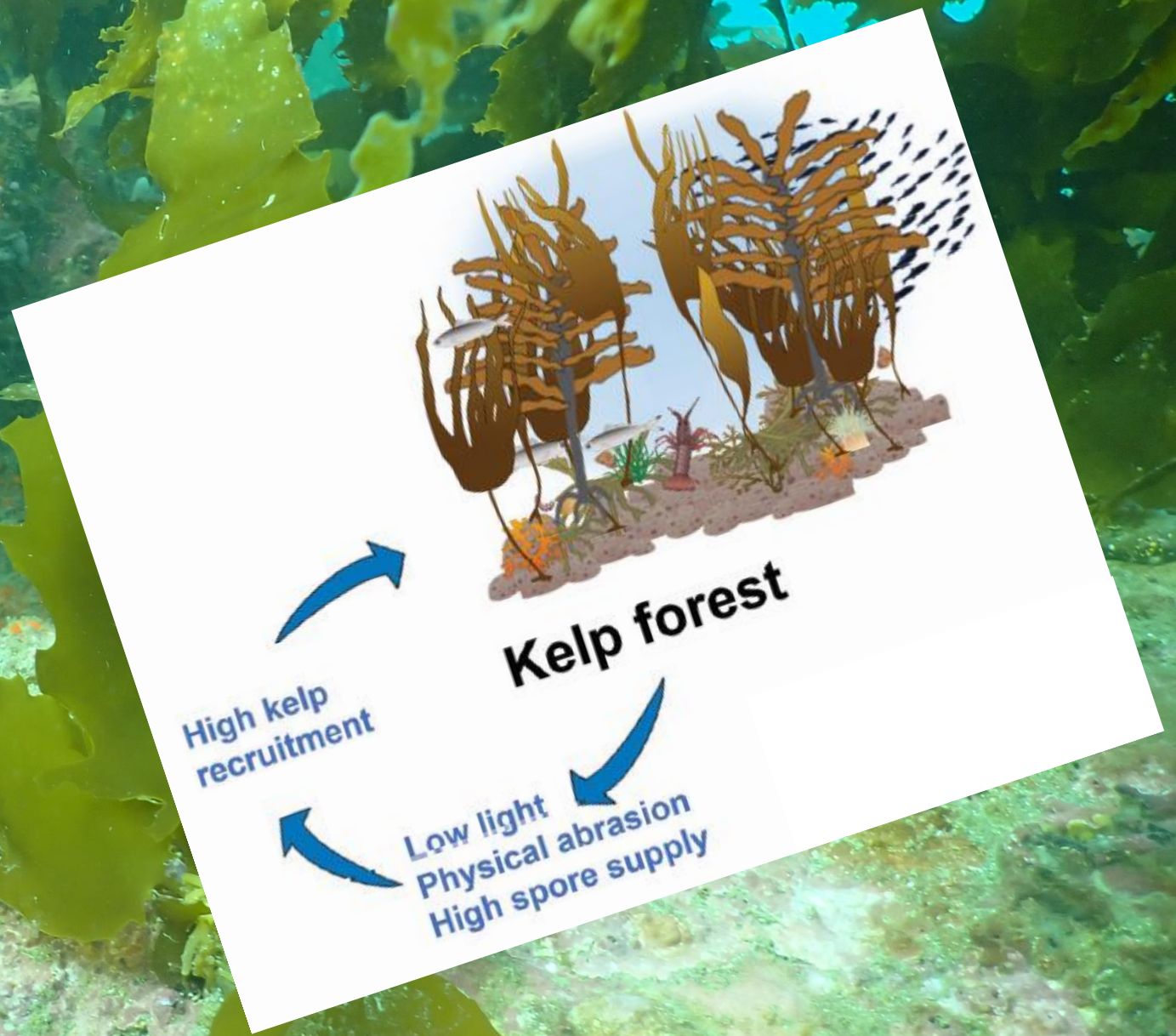
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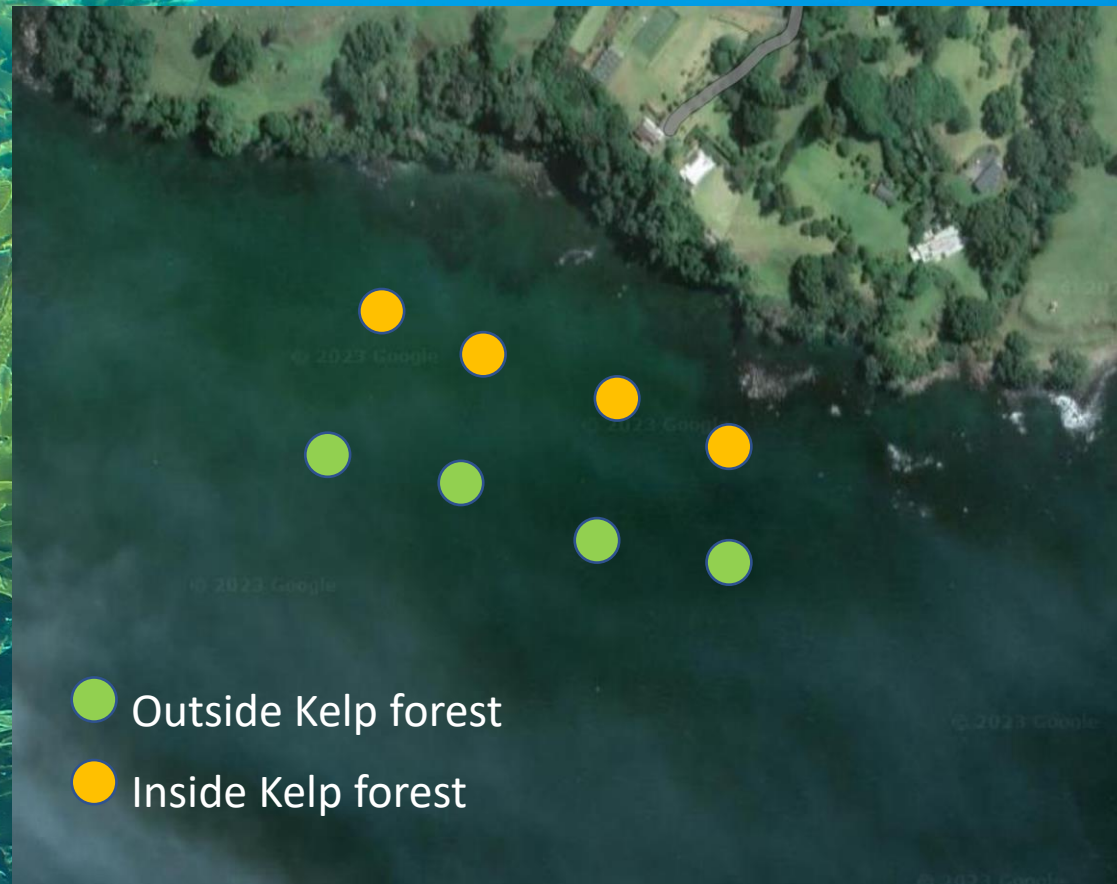
Were our transplanted kelp missing the nursery effect of an established kelp forest?



Testing the nursery effect of kelp forests  
on survival of seeded strings:

4 sites

2 treatments (Inside Kelp forest, Outside  
Kelp forest)

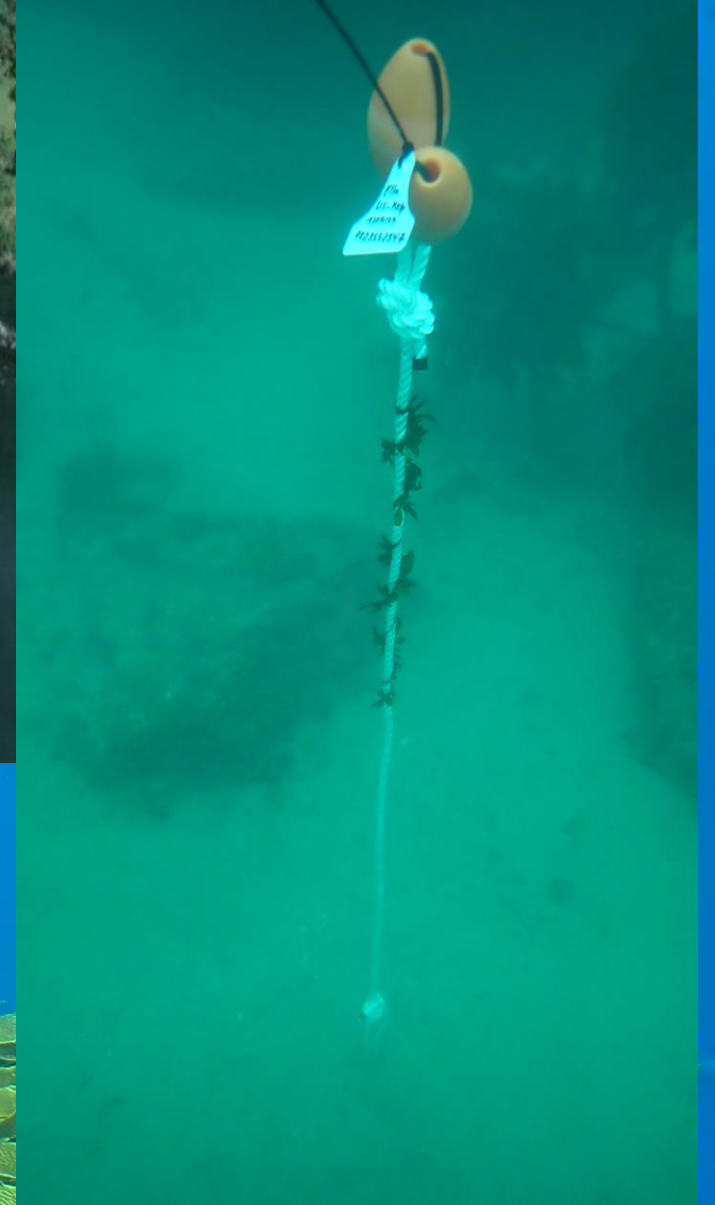
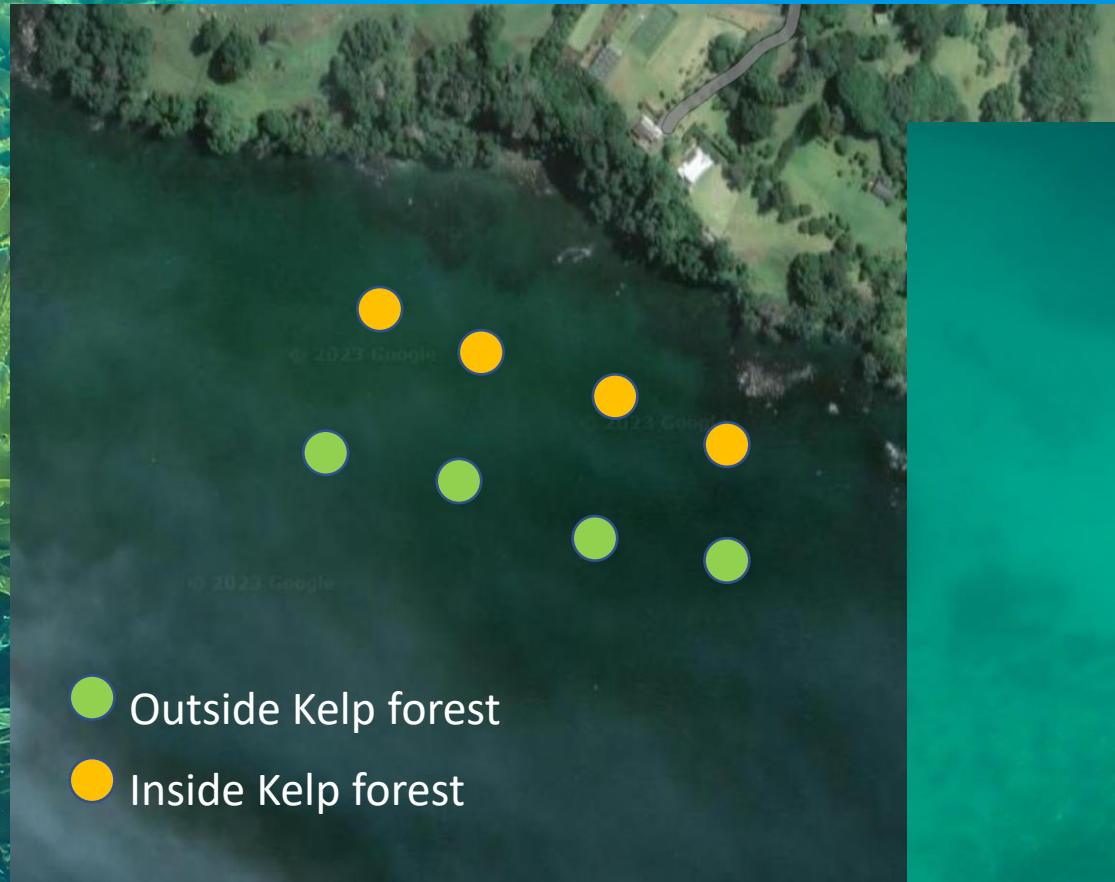


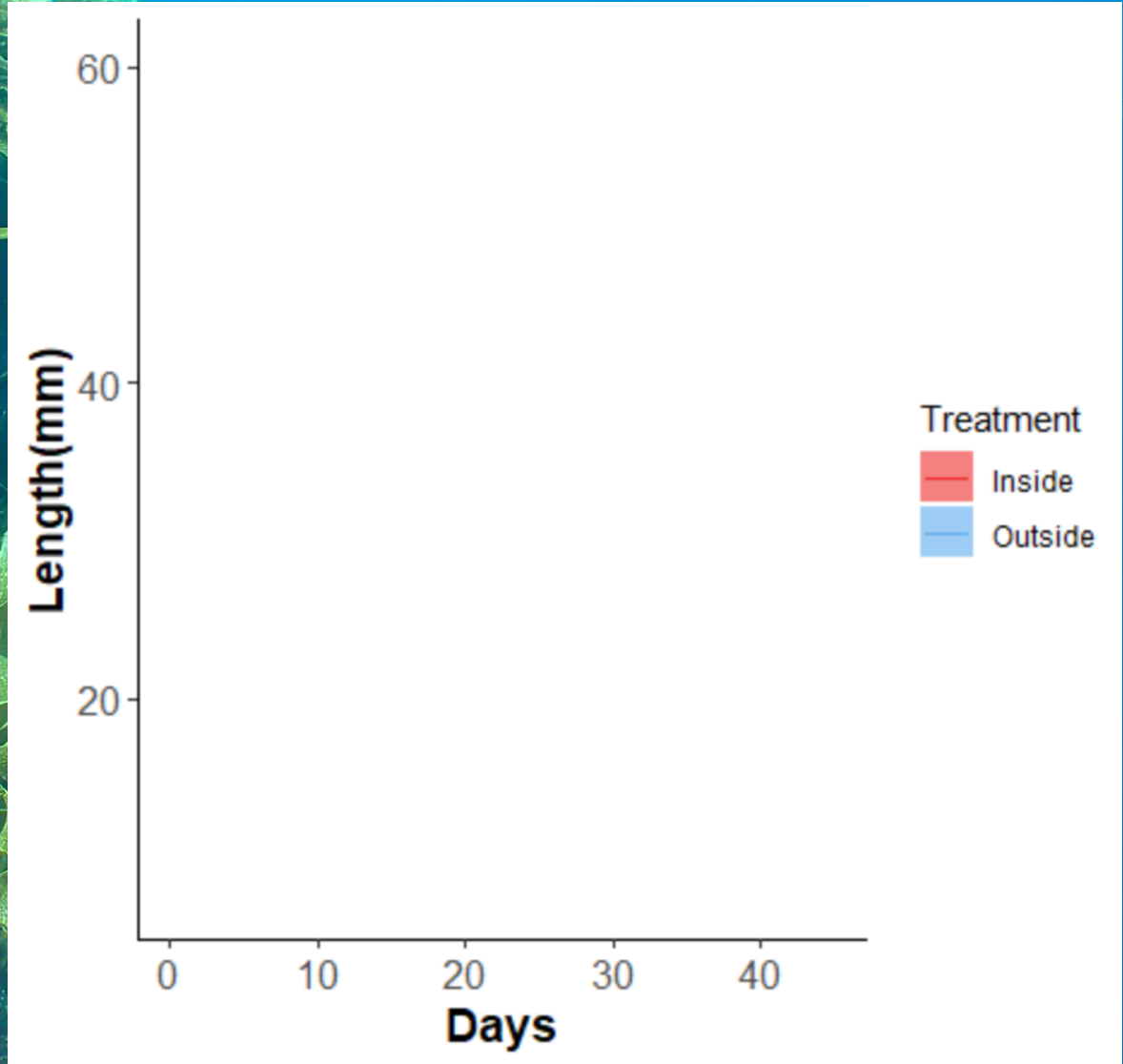
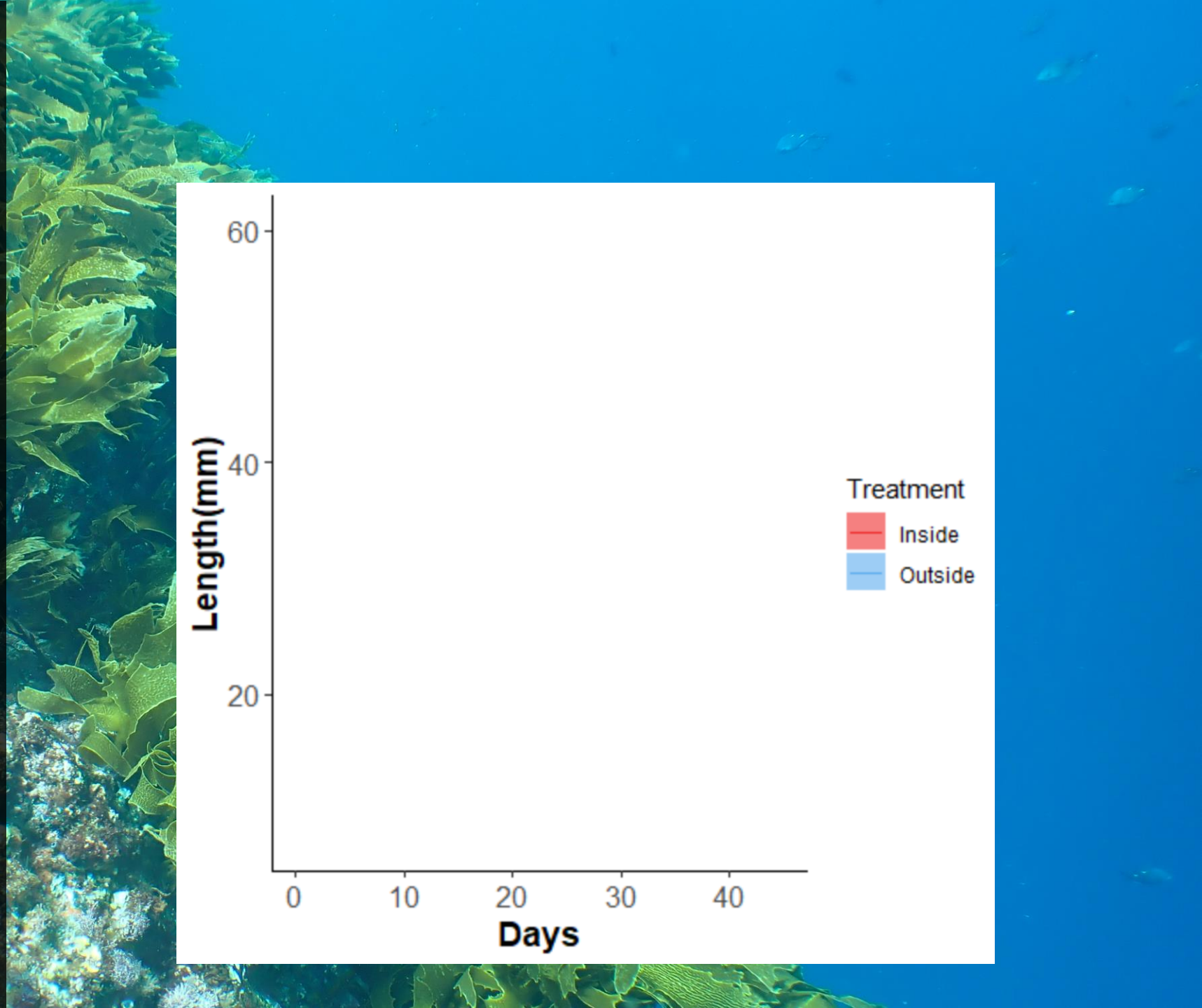
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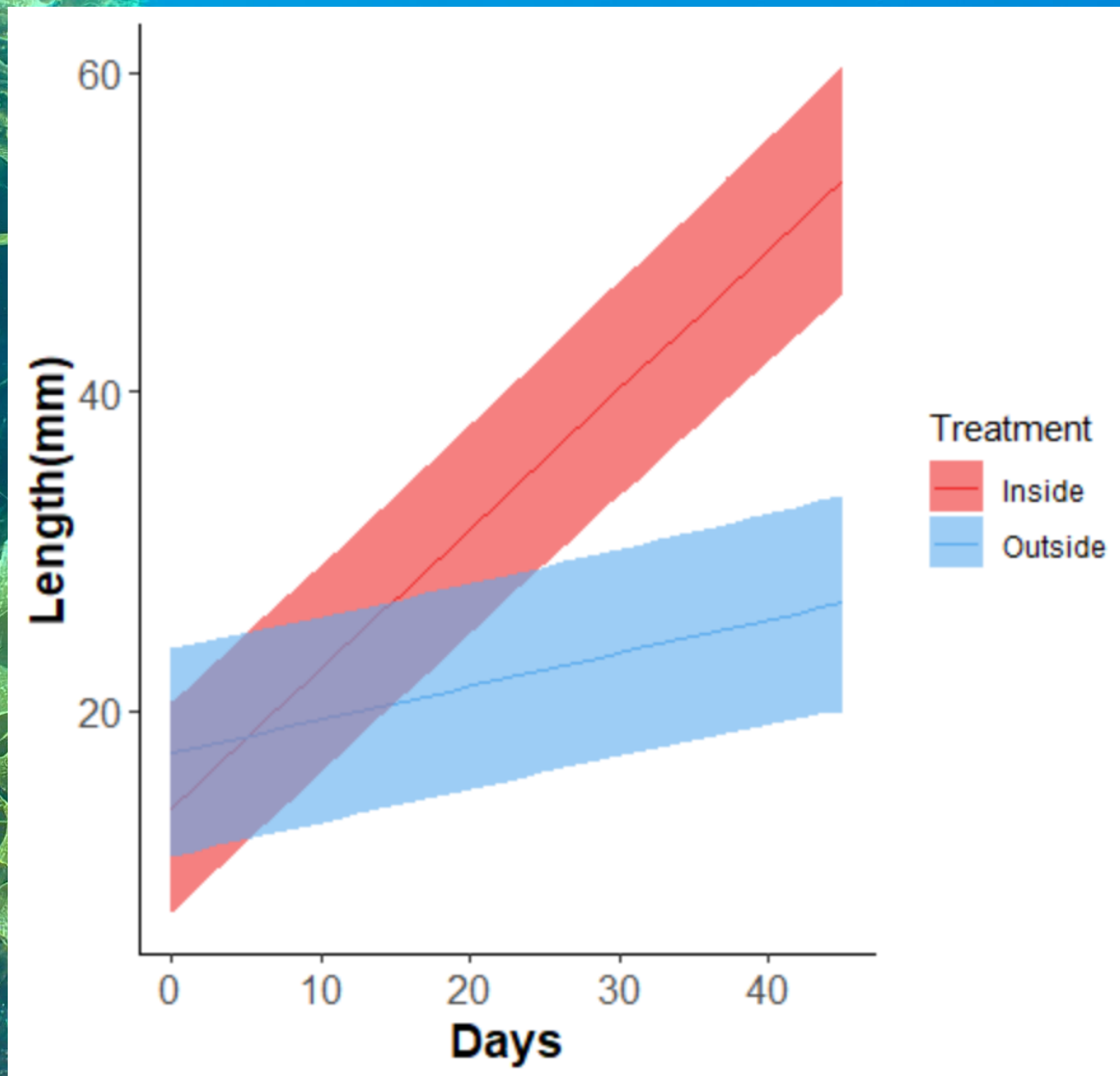
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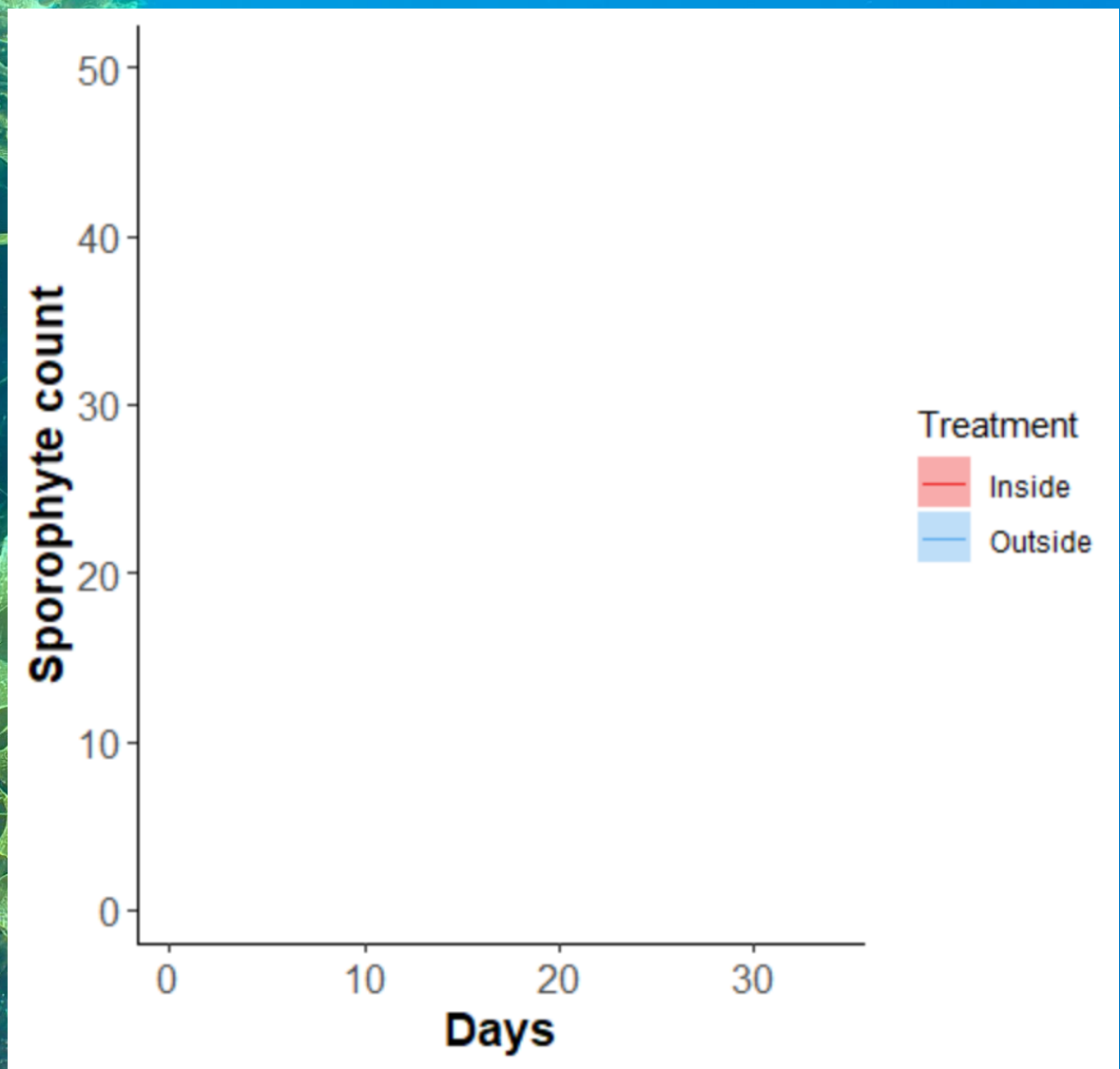
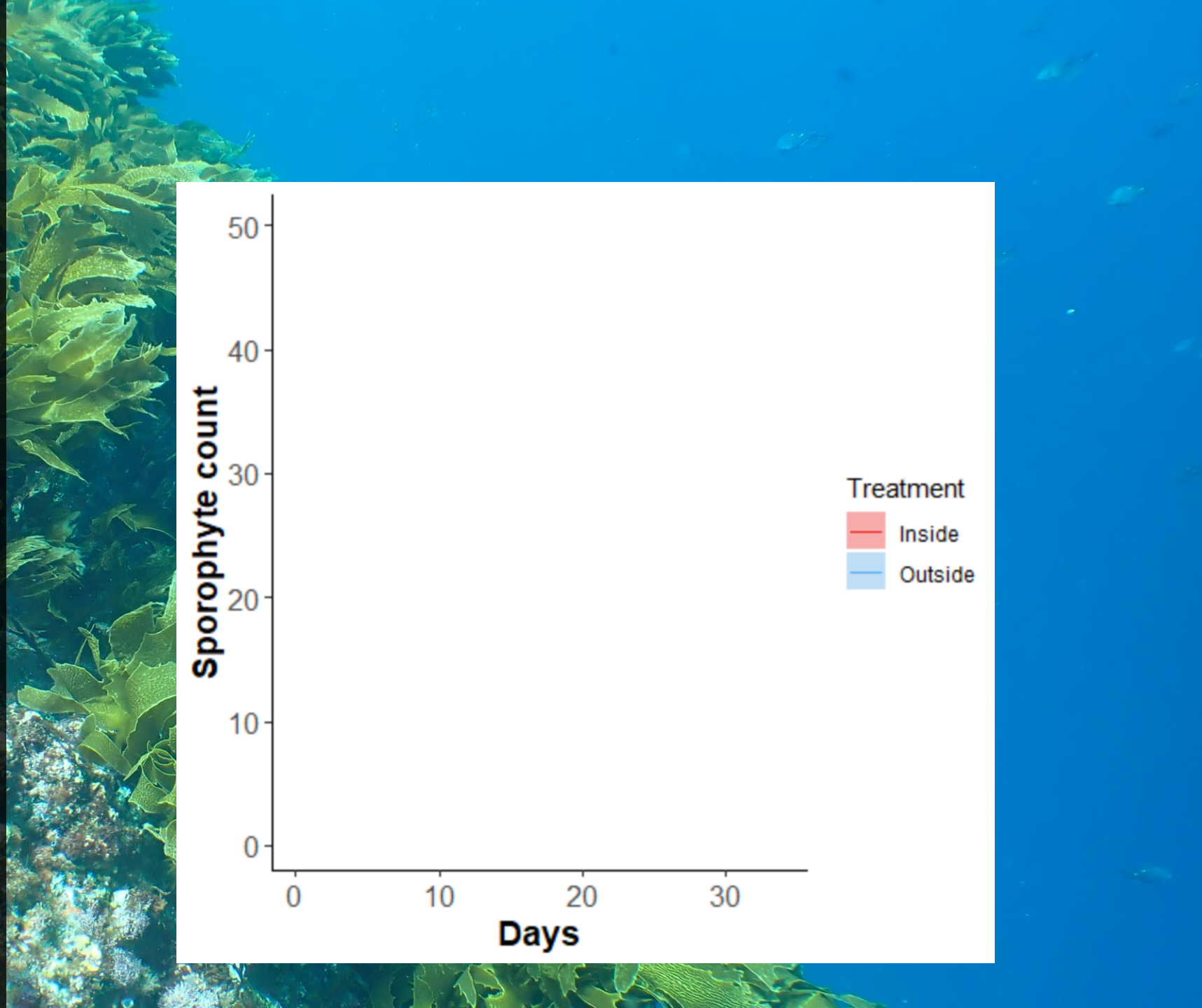
3 replicate experimental units per plot



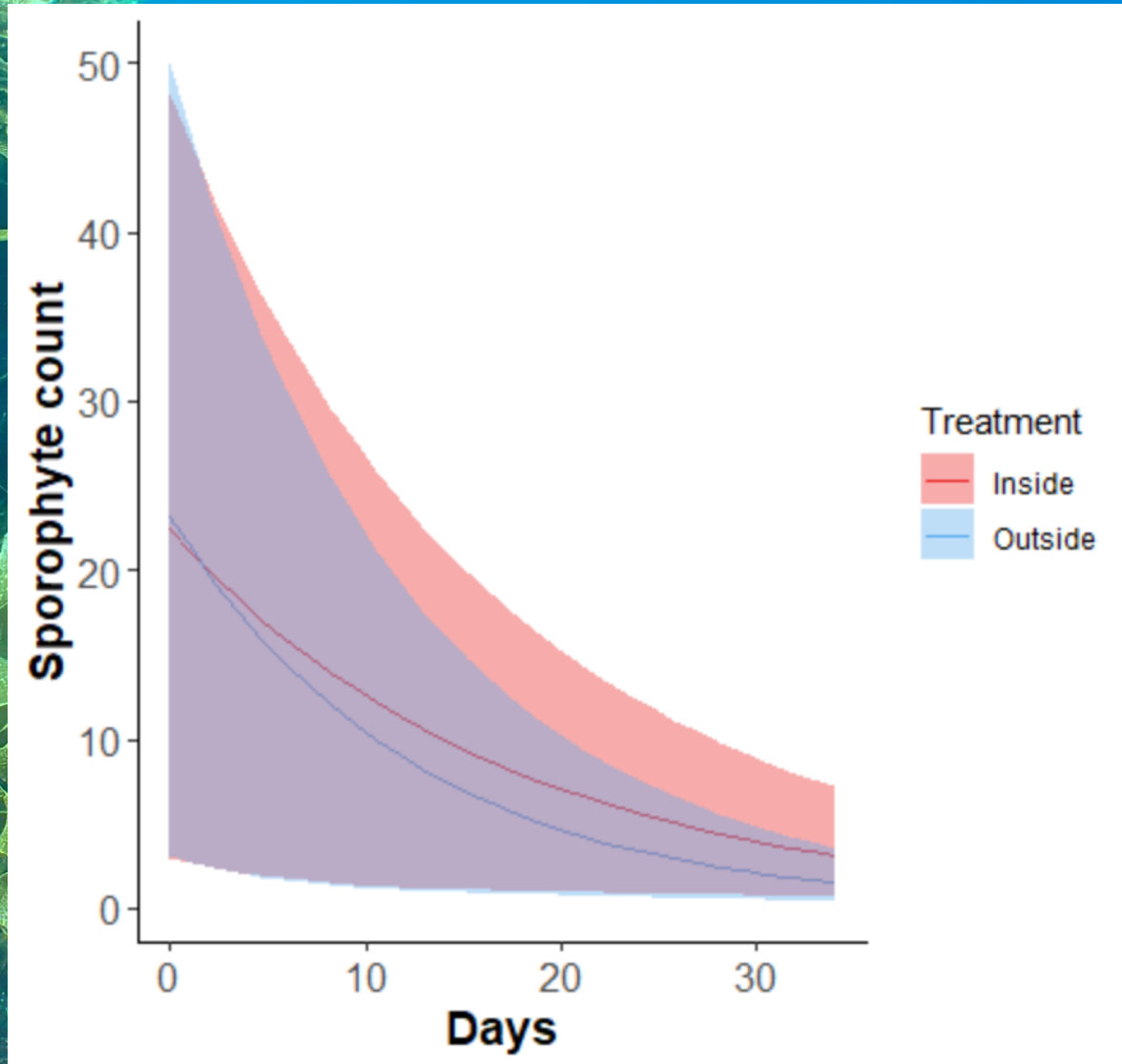



Greater growth inside Kelp forest than outside Kelp forest





Low survival of sporophytes and no difference between inside and outside Kelp forest





There is relatively little information about *Ecklonia radiata* cultivation in New Zealand

While exploring cultivation techniques that best suit New Zealand environments we were faced with the challenge of finding sites, substrates and methods that lead to the success of seedlings cultivated in a nursery

Nursery habitats are an important part of the success of many marine species

The presence of adult kelp appear to positively influence the growth of lab cultured seedlings during initial phase of growth in the field but overall survival rates are still very low

Thank you

Questions??



MASSEY  
UNIVERSITY

MARSDEN FUND

TE PŪTEA RANGAHAU  
A MARSDEN

Dr. Eun Kyoung Hwang, National Institute of Fisheries Science, South Korea

Peter and Jason Bull for access to the farm site at Waiheke

Goldridge mussel farms for access to the farm site at Coromandel

Ngāti Manuhiri for permission to carry our work in their rohe moana at Ti point

Field assistants: Kelsey Miller, Fiona McKechnie, Emma Betty and David DuPavillon

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