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Analysis of “A Forest Under The Sea”- Studying Giant Kelp’s Benefits to Ecosystems, and Evaluating Kelp Restoration

Natalie V. Boyd
Gettysburg College, boydna01@gettysburg.edu

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Analysis of “A Forest Under The Sea”- Studying Giant Kelp’s Benefits to Ecosystems, and Evaluating Kelp Restoration

Abstract

I wrote a research paper on how Giant Kelp needs to be restored due to the rising ocean temperatures. There are two methods that I specifically focused on and learned about which are "Super Kelp" and "Green Gravel." Giant Kelp is critical to our ecosystem and marine life specifically due to all the benefits that it supplies. For example, kelp forests can sequester up to 20 times more carbon than a land forest. Unfortunately, the kelp is dying off rapidly now because of climate change; specifically the rising temperatures and increased ocean acidification. In order to save the kelp, action must be taken now, and it is critical to the Earth's biodiversity that kelp remains as part of the ecosystem, or else it could be lost forever.

Disciplines

Environmental Sciences | Marine Biology | Plant Sciences

Comments

This poster was created based on work completed for FYS 157-2: Food, Water, Shelter, Song; Staying Human On A Planet In Transition, and presented as a part of the eighth annual CAFE Symposium on February 8, 2023.

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Analysis of “A Forest Under The Sea”- Studying Giant Kelp’s Benefits to Ecosystems, and Evaluating Kelp Restoration

Natalie Boyd, Research Paper Performed Under Professor Lane

Food, Water, Shelter, Song; Staying Human On A Planet In Transition (FYS 157-2) Gettysburg College, Gettysburg PA

Introduction

- Giant Kelp thrives in cooler waters, creating lush habitats rich in biodiversity. As ecosystems, they are critical to coral reefs and mangrove forests along with benefitting the overall health of the ocean.
- Kelp supports fisheries and cleans up waste. “Can rapidly absorb nutrient pollution caused by fertilizers running off from farmland into the sea. They use it to fuel their own growth, and this averts the development of algal blooms which are harmful to other marine life” (“Grover et alia”).
- Has immense value for coastal communities. Due to its rapid growth, it recovers quickly from winter storms and maintains a relatively stable habitat for animals. Wind, waves, and currents disperse kelp spores between reefs to recolonize them and send kelp to shore where many beach critters eat it and live in it.

Figure 1.

- Known as a foundational species. Supports the diverse assemblage of life that inhibits it. Fish that do not live in the kelp benefit from the critters that do live there.



Figure 1. Kelp forests provide food, nursery areas, and shelter; including protection from predators and storms.

Maintaining giant kelp as a species is critical because it has numerous benefits to the ocean and ecosystem at large. Healthy coastal ecosystems with kelp can sequester up to 20 times more carbon per acre than land forests, which slows ocean acidification. Kelp forests are some of the most productive habitats on Earth, sheltering hundreds of species and providing important sanctuaries for animals of all sizes.

My Research Question: Since losing wild kelp forests causes biodiversity loss, reduces the protection of coastal communities from storm surges, and removes a vital carbon sink, what methods can be implemented to restore the kelp?

Available Methods

1.) Planting “Super Kelp.” “Society must ‘future-proof’ kelp forests to be more resilient and adaptable to changing ocean conditions. Recent trials have shown selectively bred kelp with higher heat tolerance can be successfully replanted and used in restoration” (Layton, Coleman 2021).

2.) Upscaling with “Green Gravel.” “Scientists can create “seed patches” that are self-expanding and self-sustaining. “Small rocks are seeded with baby kelp, then tossed into the ocean from a boat” (Devitt 2022). The kelp establish themselves within a few years to the underground reef. Testing is currently underway under different coastal and ocean conditions in Europe, North America, and Australia.

Discussion

“Super Kelp Method”

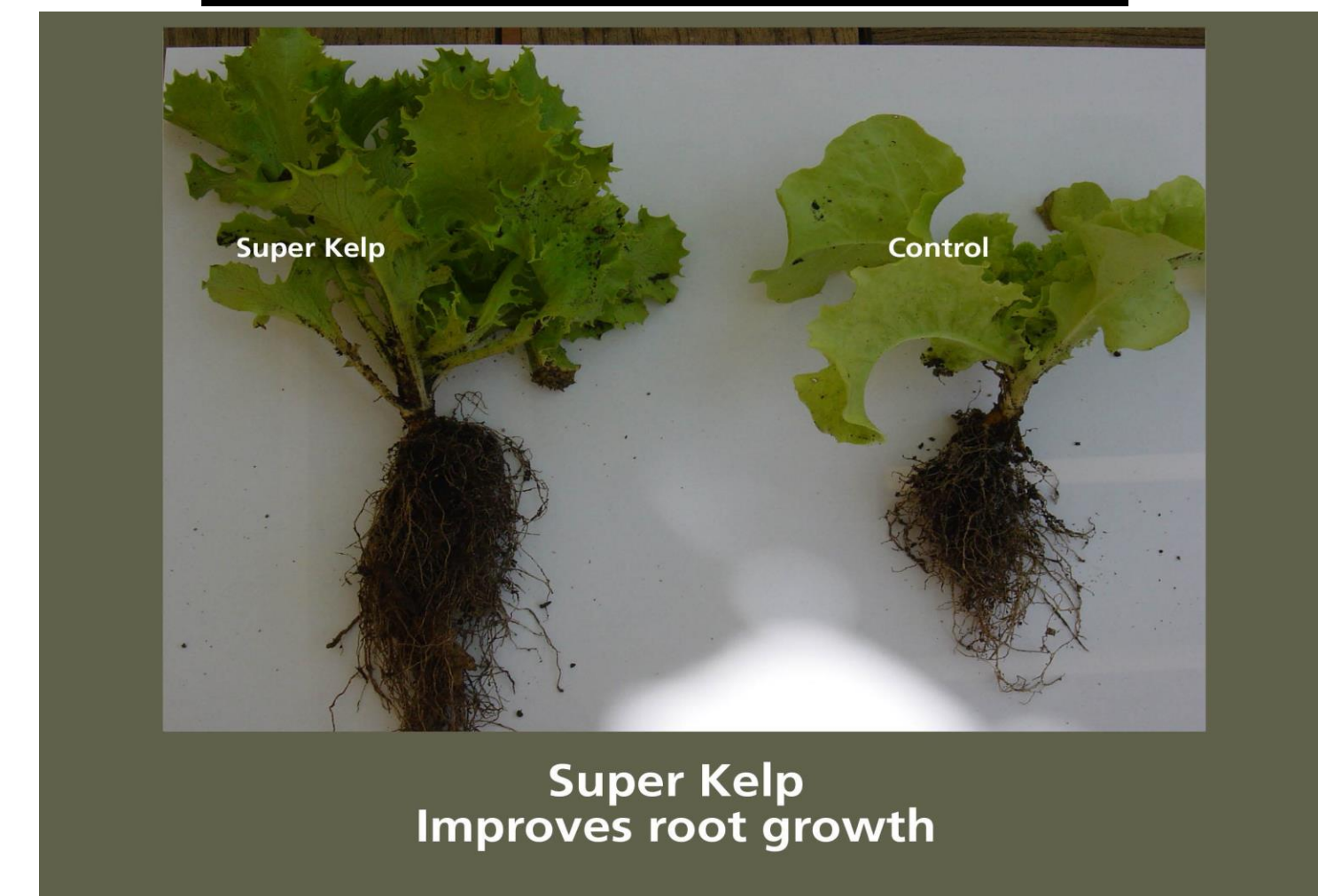


Figure 2. The control, (regular kelp) being compared to “Super Kelp.” Super Kelp is larger and healthier.



Figure 3. Image of a “Super Kelp” Forest in Tasmania, which is a key country in developing this restoration method.

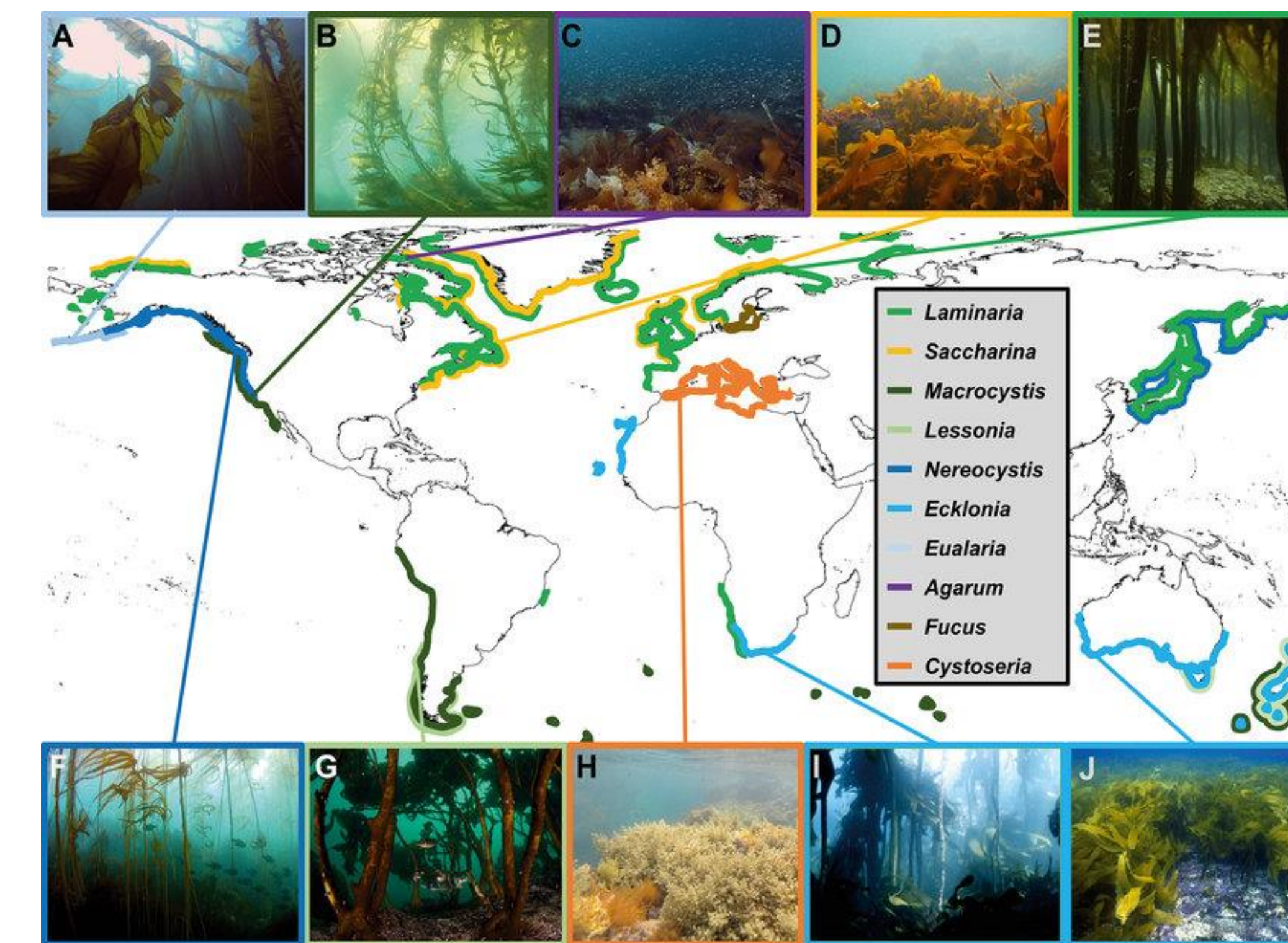


Figure 4. Map displaying different kelp species locations. “Super Kelp” (*Macrocystis*) is found in Tasmania, the Western coast of South America, and the Western Coast of the US.

(Letter B on the map displays an image of “Super Kelp”)

“Green Gravel Method”

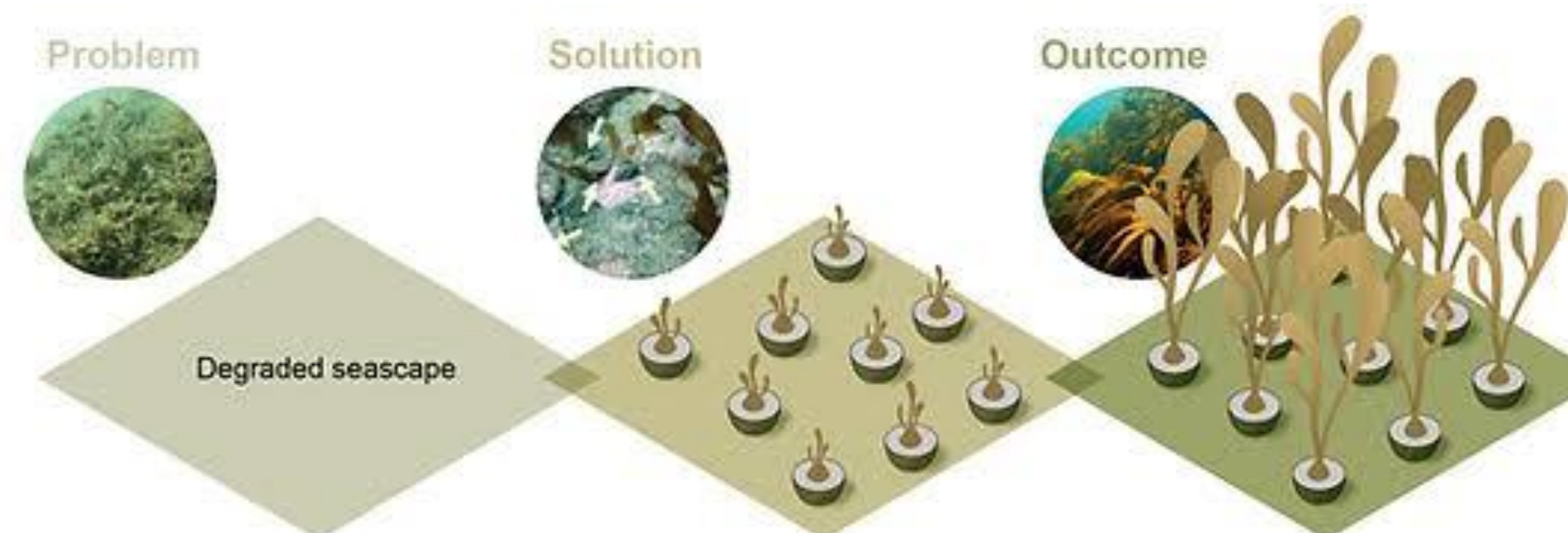


Figure 5. A model of “Green Gravel” demonstrating how the growth process works.

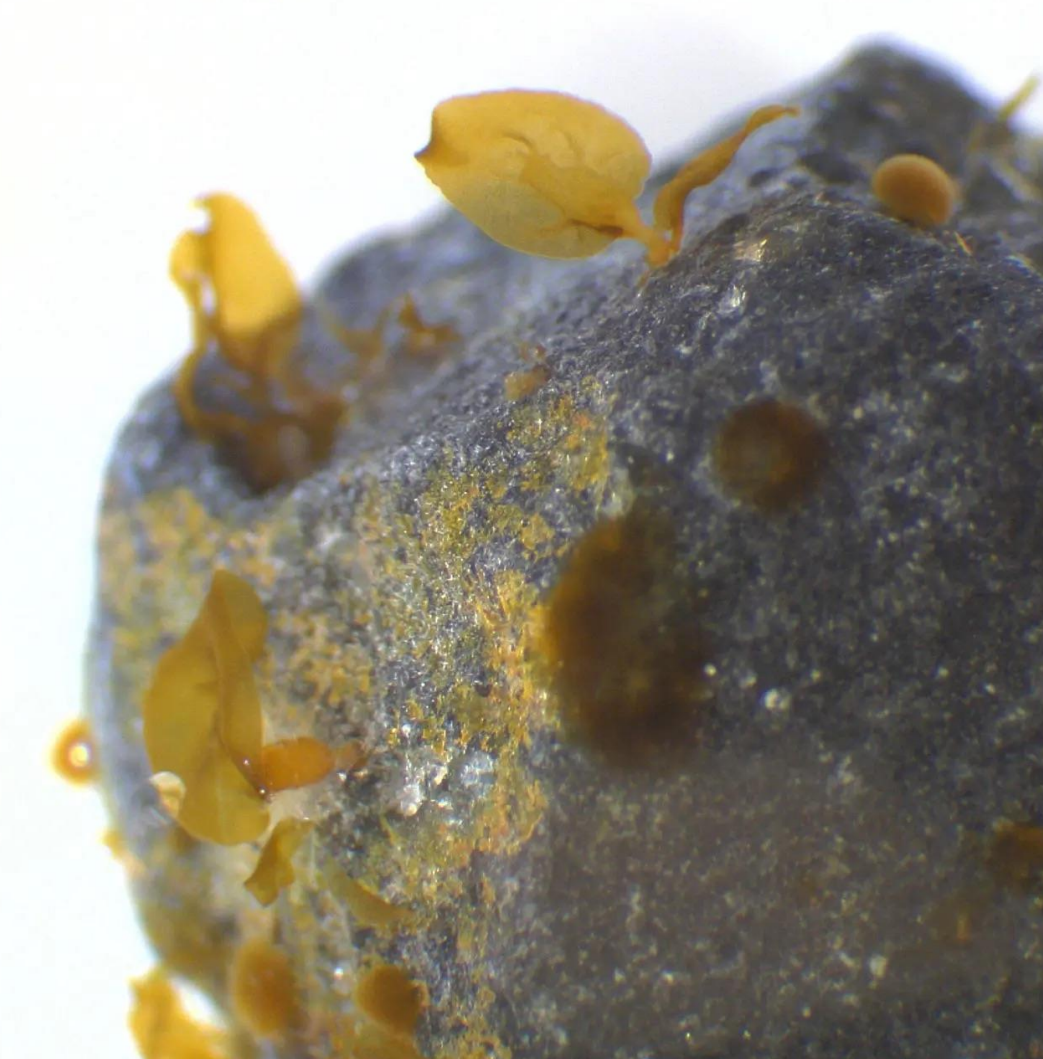


Figure 6. Image of “Green Gravel” and how the kelp is attached to the seed patch.

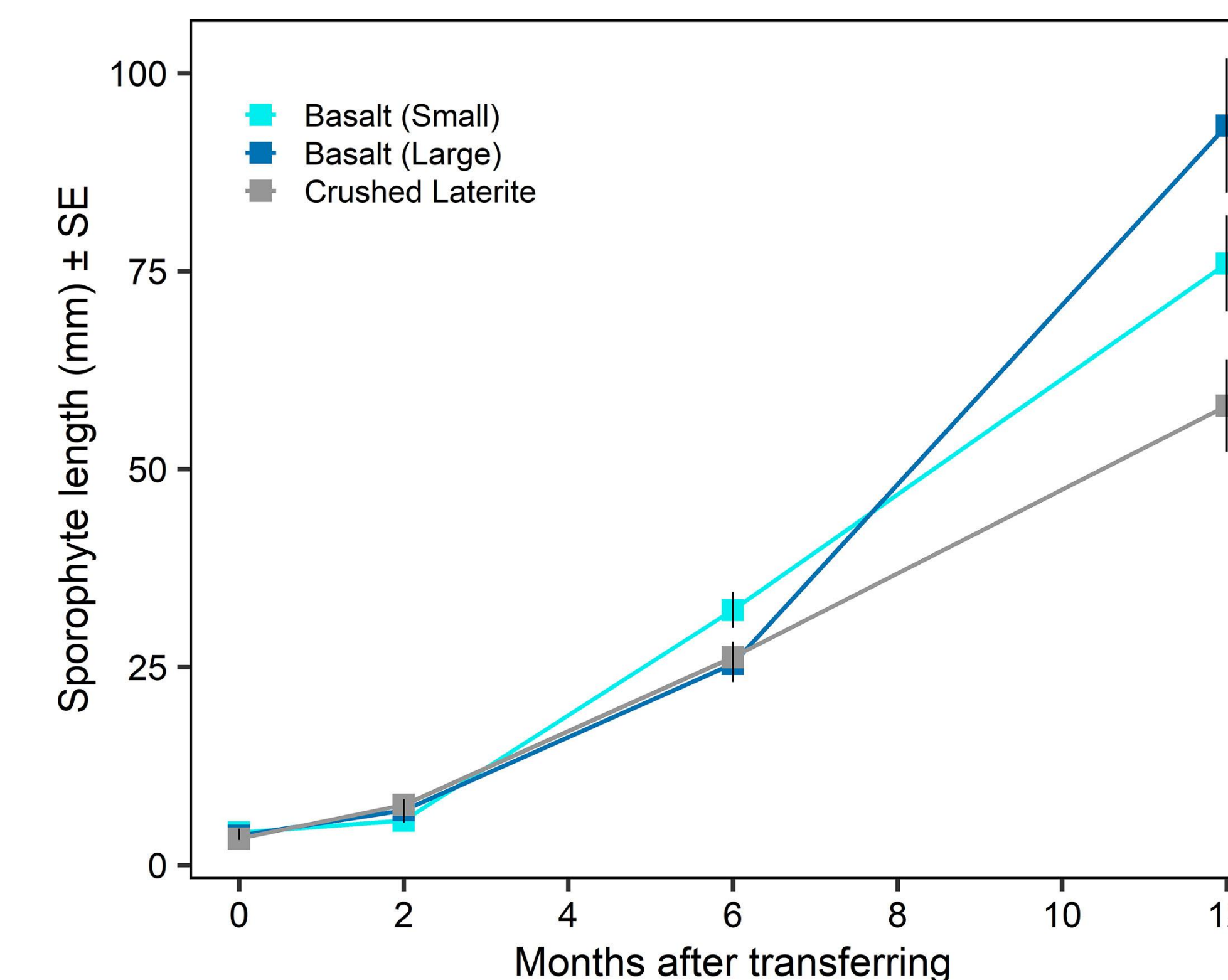


Figure 7. Large Basalt used as the “gravel” piece is most effective after a year (12 mo.) of tracking kelp growth.

(The model of the “Green Gravel” showing the growth process pattern in Fig. 5 is for demonstration purposes only.)

Conclusions

Both methods are beneficial ways to restore the natural kelp forests. Without kelp forests, many species will be left without a habitat and shelter, leading to extremely low populations of many species of fish, invertebrates, birds, and even large mammals. If these marine animals were to go extinct, their entire food chain would be unbalanced. We can address climate change, but we must vastly increase our efforts before it is too late. As ocean temperatures rise, the kelp will continue to suffer if something isn’t done to reverse the existing damage.

Future Directions

- Investigate “Super Kelp” and “Green Gravel” thoroughly to ensure that they are being implemented into ecosystem restoration efforts. (Not just viewed as “good ideas,” with no action being taken.)
- Assess whether it is more effective to use the “Super Kelp”, or “Green Gravel” method based on pros and cons. Super Kelp may have quicker growth time, but “Green Gravel” may be more cost effective since it does not have to be hand planted by professional divers. There are several variables to consider.
- Perform these methods of restoration and see what works the best or utilize both in order to get the highest chance of reviving the kelp before it is too late.

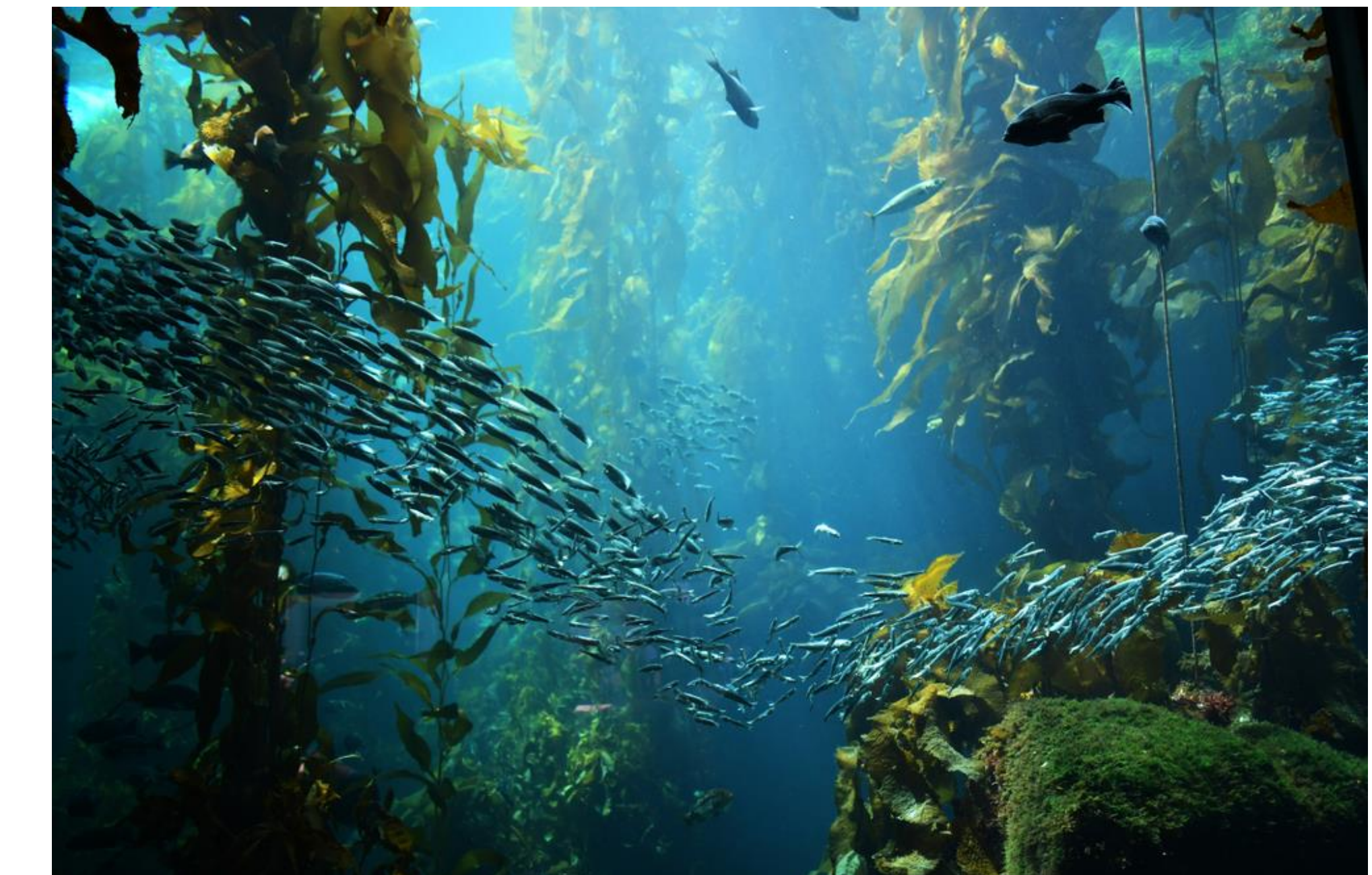


Figure 8. A Thriving Kelp Forest

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