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Kelp Farms in Southern California: The Future of Sustainable Fisheries **Caylin Mobley**

Just offshore of Santa Barbara, an industry that's new to California is emerging, establishing itself in waters that have been long defined by oil rigs and commercial fishing boats. Construction hasn't started for an offshore drilling project or a sudden boom in halibut spawning— this new industry revolves around kelp. Kelp's potential as both a regenerative aid for failing marine ecosystems and an economic bolster for the fight against rising costs of living in southern California make it a fantastic choice for the future of fisheries, and California's endless coastline serves as the perfect backdrop for the broadening of kelp farming. The support and scaling of kelp farming in southern California should become a core strategy for sustainable fisheries management, ecosystem restoration, and coastal economic resilience.

Modern kelp harvesting in southern California first became economically viable during World War I, when chemicals used to manufacture gunpowder became sparse. As a result, *Macrocystis pyrifera* (giant kelp) was farmed as a source of both potash and acetone (Neushel, 1989). However, this kelp was harvested from the wild, not farmed. Natural kelp forests were desiccated, leaving the biodiversity that relied on these forests to suffer. A continually changing climate, starting during the Industrial Revolution, also had detrimental effects on natural kelp forests.

Giant kelp is highly sensitive to environmental conditions. It thrives in nutrient-rich, cold water, it requires rocky substrate for attachment, and it depends on sufficient light penetration to support its rapid growth (Dayton, 1985; Graham et al., 2007). California's seasonal coastal upwelling along the California Current has historically supplied the correct nitrate concentrations to sustain the extensive kelp canopy forests that support the biodiversity in species that we see today (Graham et al., 2007). When ocean temperatures rise, the availability of nutrients declines, leading to a decline in kelp growth and an increase in mortality; in the same vein, as storm frequency increases, kelp growth slows (Edwards & Estes, 2006). In recent decades, marine heatwaves and constantly shifting oceanographic conditions have disrupted these necessary growth requirements, which further contributes to the decline of kelp forests along California's coast (Reed et al., 2016; Rogers-Bennett & Catton, 2019). Cascading ecological consequences follow the loss of kelp forests; rockfish, invertebrates, and commercially important species that depend on kelp for habitat, foraging, and spawning grounds lose their refuge, and increased sea urchin populations create "urchin barrens" that support little life other than their own species (Ling et al., 2015; Rogers-Bennett & Catton, 2019). The harvesting of natural kelp forests is not

sustainable for biodiversity or ecosystem health; however, the benefits of farmed kelp and its economic and environmental potential can exist while being of service to natural forests.

At the forefront of the kelp industry in southern California is Ocean Rainforest, a seaweed company operating off of the coasts of both Santa Barbara and Ventura counties. Ocean Rainforest recently ended a pilot farm experiment off of the coast of Santa Barbara in order to research production of high-quality seaweed (NOAA, 2024). I was lucky enough to be able to sit down for an interview with Kaira Wallace, Ocean Rainforest's Regulatory and Engagement Lead. Wallace shared where the company started, where they are now, and where they are planning to go in the near future. Ocean Rainforest's journey began in Denmark in 2010, and expanded to southern California in 2019 with a grant from the Department of Energy regarding research into biomass energy sources. Ocean Rainforest spearheaded the only seaweed farm fully funded by this grant, and concluded its pilot project in 2023. Wallace told me that since then, the company has been going through the permitting process to begin construction of a commercial kelp farm off of the coast of Ventura.

Wallace's insight into the actual establishment of kelp farms was invaluable— she outlined just how difficult obtaining permits is, as well as the many obstacles in gaining social license amidst community engagement and pushback. Ocean Rainforest's proposed farm is around 2,000 acres, though only 500-600 acres would actually be used for kelp farming in order to account for cultivation space and navigation lanes. Choosing an area was difficult, as the Santa Barbara Channel hosts crucial shipping lanes, rich fisheries, and ecologically sensitive marine protected areas that all have strong advocates behind them. Wallace also mentioned that California's approach to aquaculture is not usually welcoming, though seaweed farms are generally seen as the “best-case scenario.” So— why begin this process, if there are so many challenges to face?

Ocean Rainforest has a goal in mind: the company wants to sell biostimulants made from kelp to agricultural industries. Kelp use within the agricultural realm is not a new topic, but Ocean Rainforest hopes to manufacture a new product that can provide health and yield boosts to a number of different crops. In order to make the kelp farm economically feasible, Ocean Rainforest had to determine their product lineup before the farm was even created, which helps with financial stability down the line, as permitting and construction are both very expensive processes.

Aside from Ocean Rainforest's goals, kelp's potential for biofuel, environmental restoration, and cleaner fertilizer all support its case for a place within the future of sustainable fisheries. Ecologically, farmed kelp can be harvested and replanted in areas that are in danger of “deforestation,” saving California's unique biodiversity and contributing to coastal erosion management through wave deflection. More kelp forests will benefit the other fisheries in the area, as species numbers will increase with more area to thrive. Kelp farms will also contribute to carbon sequestration, as the fast-growth abilities of kelp help take carbon out of the atmosphere at incredible rates. Economically, the use of kelp in cosmetics, food, fertilizers, and future energy production will help jumpstart California's goals of a greener tomorrow. California's unique oceanographic conditions, like the California Current and the upwelling it creates, makes

southern California the perfect place to begin implementing a new forefront in sustainability. However, in order to move forward with kelp farms, permitting and construction processes need to be revised in order to become more accessible while also facilitating conversation and feedback from involved parties. Kelp cultivation and farming is poised to become an invaluable cornerstone of southern California's sustainable fisheries strategy, and thus offers a rare opportunity to align economic resilience with ecological restoration.

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