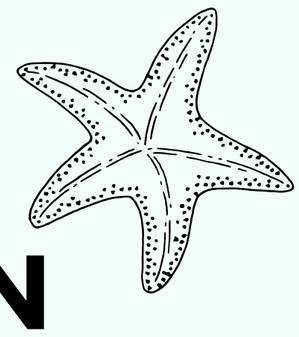
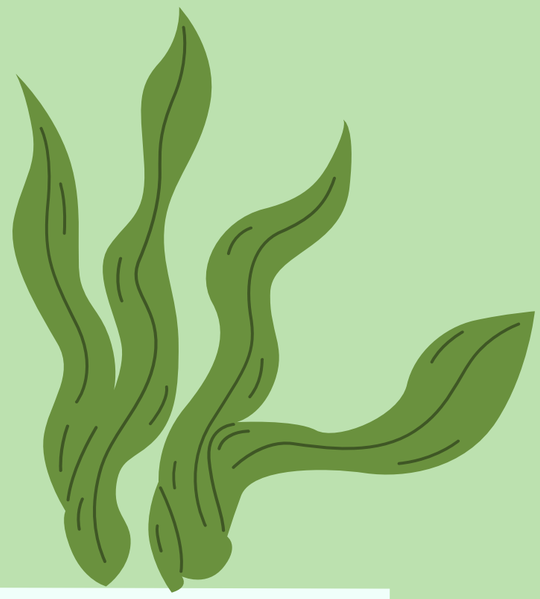
Ethel Wai (@_ch2ch3_)

THE URGENCY OF KELP FOREST MAINTENANCE AND RESTORATION IN BRITISH COLUMBIA



The Issue

With surface temperatures on the rise from increasing CO2 levels, kelp forests, composing of species like the giant kelp (*Macrocystis pyrifera*) and bullkelp (*Nereocystis luetkeana*), in British Columbia are constantly declining. This decrease caused by extreme heat domes on the west coast has raised concerns on biodiversity, community ecology, and aquaculture. Over 40% of what used to be expansive along the coast of Barkley Sound has been lost in the past 10 years from anthropogenic effects[1]. Currently, kelp forest loss is still reversible, but only if action is quick.



A Province Without Kelp Forests

1 Population and community decrease

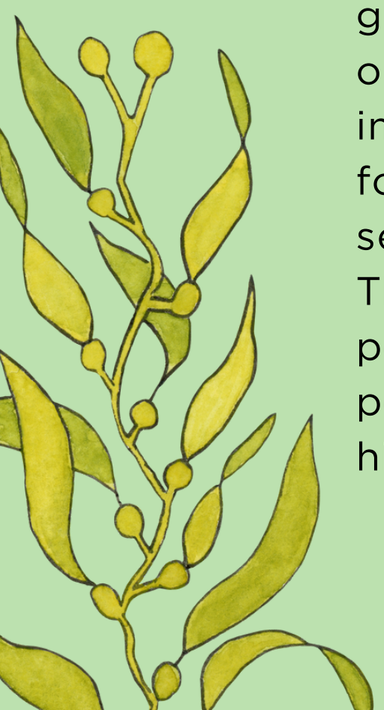
Kelp forests sustain the marine environment by providing food and shelter for organisms. If kelp forests were removed from the ecosystem, fish and invertebrates would no longer have a nesting site to lay their eggs[1]. Additionally, no new species would want to migrate into such sites due to unfavourable conditions. Decreased gene flow will result in decreased biodiversity.

2 Socioeconomic impacts

Many commercialised fish species, such as rockfish and bass, thrive in kelp forests[2]. Threats to forests will put artisanal and small-scale fishers at risk[2]. With species dying or migrating out of degraded kelp forests, fishers will struggle to sustain their livelihoods. This will also put marginalised communities in poverty, which will decrease the province's standard of living.

3 Food web disruption

There would be an imbalance in the ecosystem due to food web impacts[1]. A case study of the sunflower sea star is a great example of this[1]. This species relies on sea urchins as their main food source in British Columbian kelp forests. If kelp forests were eradicated, giant sunflower sea star populations will also decline. This would increase sea urchin populations. In turn, sea otter populations will also increase due to a higher abundance of sea urchins.



4 Poor water quality

Kelp forests are known to affect water chemistry and microbial communities. Microbes play a crucial role in the nutrient cycling process of nitrogen, and carbon in marine systems[3]. These organisms reside on the surfaces of kelp blades as conditions are the most favourable[3]. Without standing kelp forests, there will be limited nutrient availability. Oceans will also exhibit a lower pH from the lack of photosynthesis done by kelp[1].

Current State of Management

Installation of MPAs

The establishment of MPAs have served as a series of conservation regulations in kelp forest sites[4]. There are various no-take zones and marine reserves distributed along BC's coastline to limit human activity and species removal[4]. Destructive fishing and boat traffic is also limited at kelp forest sites to mitigate damage from gear entanglement and vessel pollution.

UN Decade on Ecosystem Restoration[5]

The Kelp Forest Challenge is a global program that aims to restore one million and protect 3 million hectares of kelp forests by 2040. This initiative focuses on public engagement and coastal city funding to resolve destructive anthropogenic behaviours and re-seed declining forests. This project also involves research groups such as the Kelp Rescue Initiative, who have ongoing projects to analyse kelp conditions and restoration progress. With a field and data-based approach, their efforts contribute to the UN Decade mission

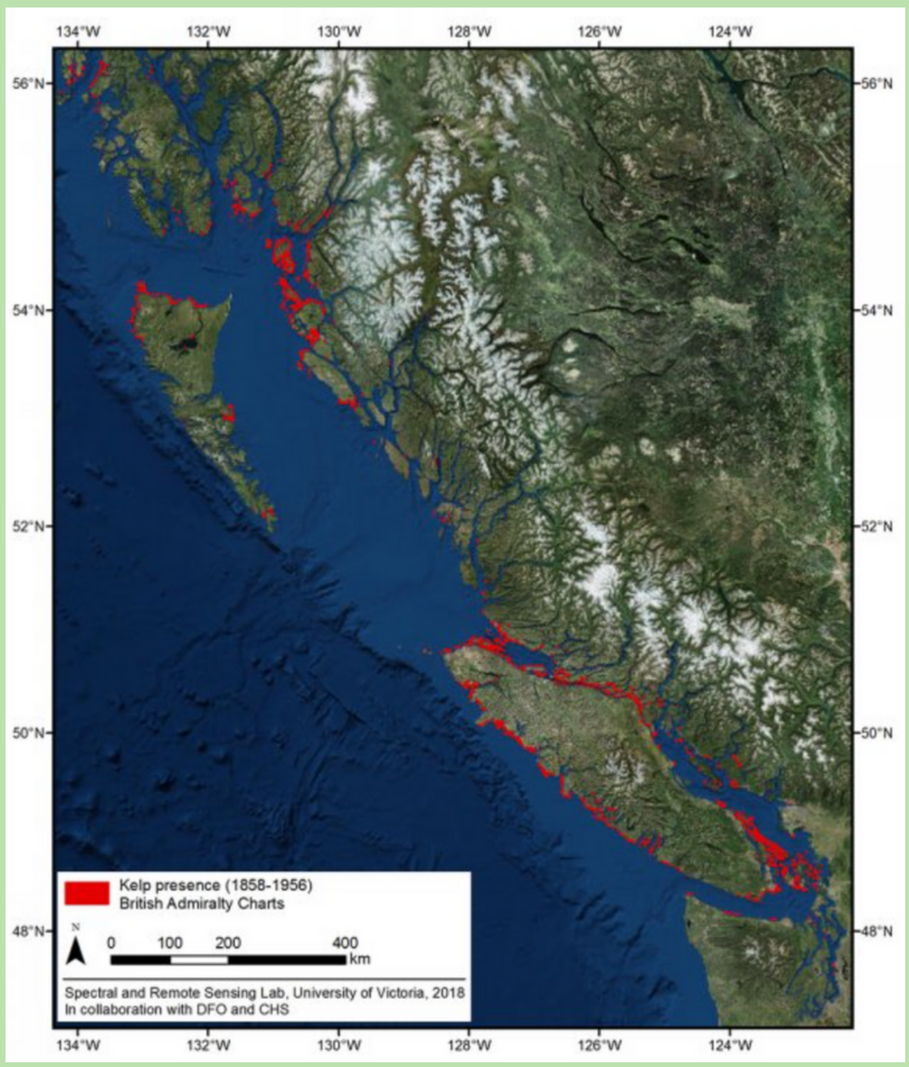


Fig. 1. Historic distribution of kelp forests on British Columbia from 1858-1956. Currently, only a portion of this remains due to overwhelming temperatures and climate change stressors[6].

Future Steps

Herbivore Removal

Sea urchins rely on kelp as their primary food source. With the eradication of sunflower stars, their populations are exponentially increasing while kelp communities are decreasing. **By placing policies to allow for regulated sea urchin removal, kelp forests are given more time to regrow.** This method has been proven a success in kelp revitalisation efforts in Southern California and Australia[7].

Habitat Creation

In Japan, additions of concrete have been used to create **artificial reef habitats** to encourage kelp settlement in degrading communities[7]. Habitat creation through **re-seeding and replantation** have also been successful in Japan[7]. Similar efforts should be implemented in B.C. as these ecosystem-based approaches are cost-efficient.

Competition Control

Invasive algae species, such as the *Sargassum muticum* or *Codium fragile,* can inhibit kelp regrowth through toxin exertion and resource overexploitation[8]. Turf algae can also outcompete kelp due to spatial limitation and sediment accumulation[7]. **Removal of toxic and competitive species will allow kelp forests to better flourish.**

References

[1] Starko, S., Neufeld, C. J., Gendall, L., Timmer, B., Campbell, L., Yakimishyn, J., Druehl, L., & Baum, J. K. (2022). Microclimate predicts kelp forest extinction in the face of direct and indirect marine heatwave effects. *Ecological Applications*, *32*(7), 2-5.

[2] Piñeiro-Corbeira, C., Barrientos, S., Barreiro, R., & de la Cruz-Modino, R. (2022). Assessing the importance of kelp forests for small-scale fisheries under a global change scenario. *Frontiers in Marine Science, 9*, 2.

[3] Clasen, J. L., & Shurin, J. B. (2015). Kelp forest size alters microbial community structure and function on vancouver island, canada. *Ecology (Durham), 96*(3), 862-872.

[4] Oceana. (n.d.). *Kelp Forests.* https://oceana.ca/en/marine-life/kelp-forests/.

[5] United Nations Decade on Ecosystem Restoration. (n.d.). *4 MILLION HECTARES OF KELP FORESTS NEED SAVING BY 2040, AND WE NEED YOUR HELP.* https://www.decadeonrestoration.org/4-million-hectares-kelp-forests-need-saving-2040-and-we-need-your-help#:~:text=The%20Kelp%20Forest%20Challenge,provide%2C%20thrive%20into%20the%20future.

[6] Costa, M., Le Baron, N., Tenhunen, K., Nephin, J., Willis, P., Mortimor, J. P., Dudas, S., & Rubidge, E. (2020). Historical distribution of kelp forests on the coast of british columbia: 1858–1956. *Applied Geography (Sevenoaks)*, *120*, 102230.

[7] Miller, K. I., Blain, C. O., & Shears, N. T. (2022). Sea urchin removal as a tool for macroalgal restoration: A review on removing “the spiny enemies”. *Frontiers in Marine Science, 9,* 1-4.

[8] Félix-Loaiza, A. C., Rodríguez-Bravo, L. M., Beas-Luna, R., Lorda, J., de La Cruz-González, E., & Malpica-Cruz, L. (2022). Marine heatwaves facilitate invasive algae takeover as foundational kelp. *Botanica Marina, 65*(5), 315-319.

CONTACTS

Honourable George Heyman
Minister of Environment and Climate Change Strategy
ENV.Minister@gov.bc.ca

David Eby
Premier of British Columbia
MLA David Eby's Community Office
2909 West Broadway
Vancouver, BC V6K 2G6
david.eby.MLA@leg.bc.ca

The Kelp Rescue Initiative
Bamfield Marine Sciences Centre
100 Pachena Road
Bamfield, BC V0R 1B0

Carlos Drews
Ocean Wise EVP, Conservation
101-440 Cambie St, Vancouver, BC, V6B 2N5, Canada
linkedin.com/in/drewscarlos