

Supplementary Material - Reimagining Coral Reef Futures

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Table S1. Seeds used as starting points for the visioning workshop. NfN: Nature for Nature, NfS: Nature for Society, NaC: Nature as Culture.

Seed	Description	Combination of nature values	Seed in mature form	Comment	References
Transition cost funding mechanism	This mechanism offsets short-term social costs of fully protected marine areas, where no extraction is allowed. It provides temporary funding that decreases over time as ecological and economic benefits spill over, ensuring a smoother transition for communities.	NfN - NfS	Demand-led locally driven transitional compensation for fully/highly protected MPAs		https://doi.org/10.1016/j.esg.2023.100184
Super Coral	An experiment that cultivates “super coral” capable of withstanding hotter, more acidic oceans caused by global warming. Using a process called assisted evolution, they expose resilient coral to stressful conditions and breed stronger strains, aiming to enhance their survival in the wild.	NfN - NfS	A functional diversity of climate-resilient corals are adapted to a changing environment are thriving and, while there is a reduction in coral diversity, the super corals maintain live coral cover that supports an abundance of edible fish species		https://doi.org/10.1111/gcb.14153
Marine spatial planning	Here, the marine spatial planning notion merges the principles of optimizing existing marine protected areas (Seed: Optimize over establish: Improving existing MPAs) with strategic zoning to enhance biodiversity outcomes and support sustainable resource use (Seed: Abrolhos marine national park and Cassuruba extractive reserve).	NfN - NfS	Effective and equitable ridge-to-reef management implemented and enforced across all coral reef social-ecological systems, including marine spatial planning and watershed management	A combination of two seeds identified by participants.	https://doi.org/10.1111/conl.13020
Sodium-ion battery	Sodium-ion batteries offer a promising alternative to lithium-ion technology, utilizing abundant and low-cost sodium instead of lithium. While currently less energy-dense, advances in materials and design are improving their performance, making them well-suited for large-scale energy storage. These batteries are environmentally friendly and have the potential to reduce reliance on critical raw materials, supporting a more sustainable and resilient energy future.	NfN - NaC	75% of energy production worldwide is renewable and stored in long-lasting, low-cost and socially just, and sustainable batteries	This was not originally identified as a seed by participants but was later highlighted as a promising idea for addressing systemic drivers impacting coral reefs.	
Scale to tail	This seed encourages people to diversify their seafood choices, eat fish whole and utilise waste products to increase the sustainability of seafood.	NfN - NaC	Fishing is almost a waste-free activity, as species caught are used to their full potential, while discards are virtually eliminated		
Local governance	Local governance combines the collaborative prioritization of short-term goals (Seed: What	NfN - NaC		A combination of two seeds	

	two things?) with the establishment of regional management initiatives to sustainably manage marine and coastal resources (Seed: Emerging Regional Management Initiatives).			identified by participants.	
Divestment	Divestment is a global movement that, in contrast to investment, consists of removing investment capital from stocks, bonds, or funds in the fossil fuel industry. This movement requires putting pressure on institutions to move their money out of oil, coal, and gas companies and into fossil-free funds for both moral and financial reasons.	NfS - NaC	Divestment campaigns have successfully forced the fossil fuel industry to abandon any new projects and shift into renewable energy projects.		https://divestmentdatabase.org/
Adaptive Release	Adaptive release is a conceptual framework for managing the inevitable transformation of at-risk heritage assets in response to accelerating climate and environmental changes. It involves iterative management over long timeframes, balancing some relinquishment of control with ongoing monitoring and interpretation.	NfS - NaC	Coral reef ecosystems are managed as cultural heritage, with community decisions being made about recognizing what aspects of the ecosystem will have to be let go and what can be adapted.		https://doi.org/10.1080/17567505.2021.1957263
Turning Tides	Turning Tides is a newly launched international facility dedicated to supporting the rights and tenure of coastal communities. Secure rights and tenure are an essential component of effective and equitable coral reef management.	NfS - NaC	Customary marine tenure systems are legally recognized, with the result that Indigenous and local knowledge lead the conservation and sustainable use of corals.		https://zenodo.org/records/11515141

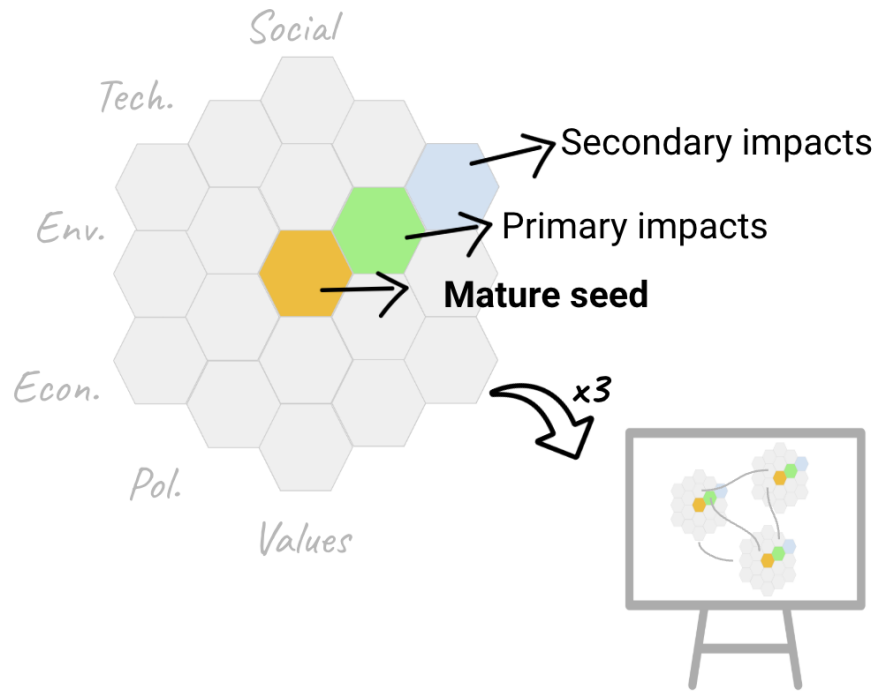


Figure S1. Future wheel-building process. A Future Wheel is read from the inside out, starting with a seed in its mature form, followed by first-order impacts (i.e. direct implications), and then secondary-order impacts (indirect implications). Impacts are spatially mapped across STEEP-V domains. The process is repeated independently three times, and finally, the Future Wheels are clashed.

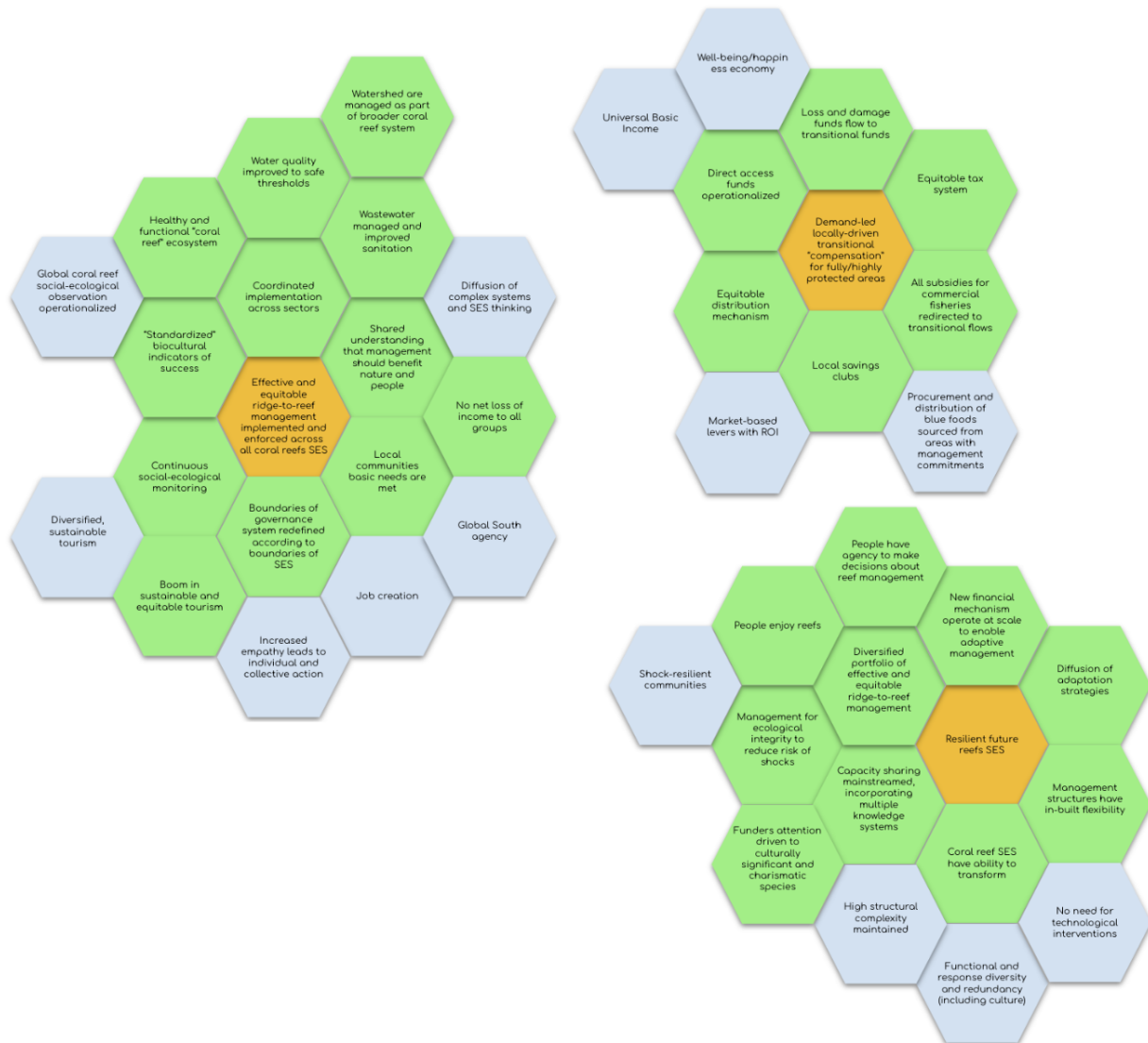


Figure S2. Future Wheels created by the breakout group responsible for developing the *Reeftopia* vision.

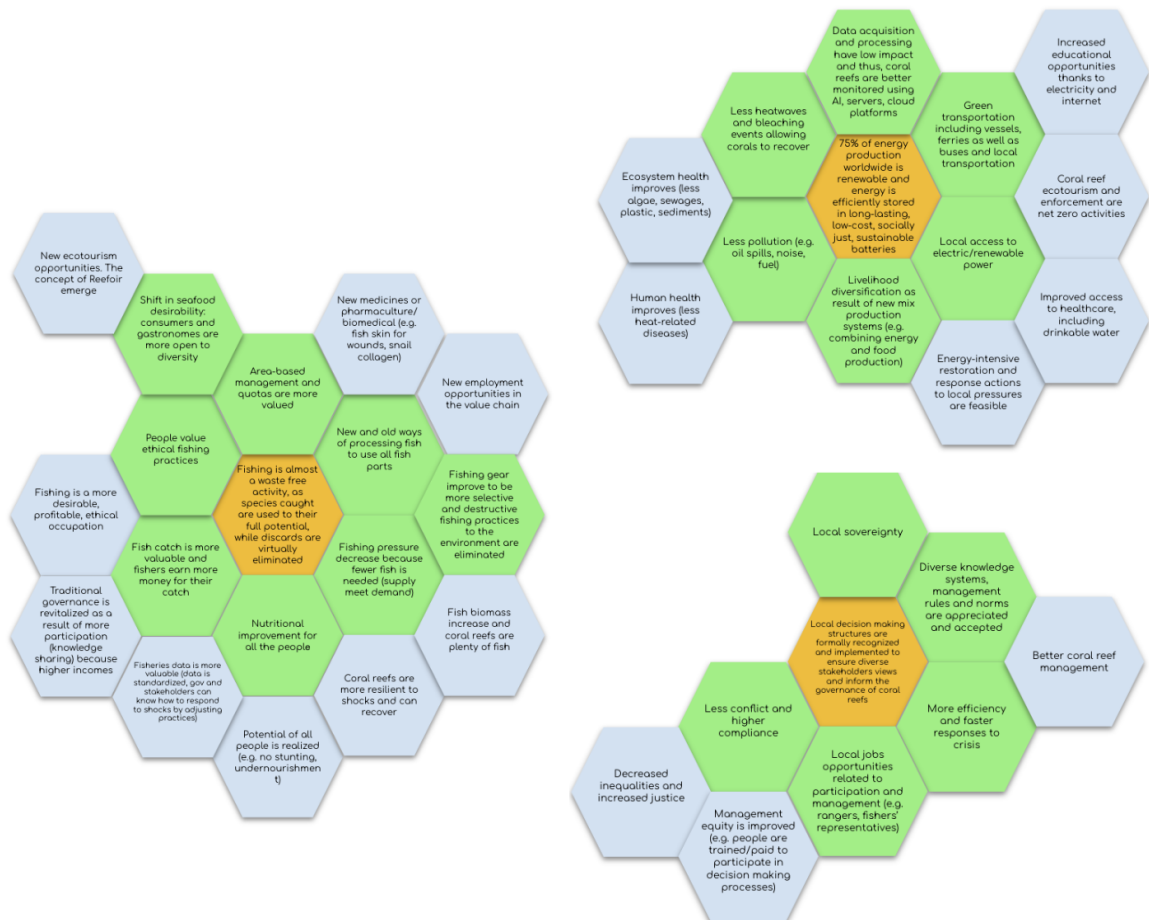


Figure S3. Future Wheels created by the breakout group responsible for developing the *Project Reefair* vision.



Figure S4. Future Wheels created by the breakout group responsible for developing *The Bay Revolution* vision.

Table S2. Guiding questions derived from the Ethnographic Future Framework (VERGE) used to help participants outline their visions.

Domain of experience	Guiding questions
Define Concepts, ideas, and paradigms we use to define ourselves and the world around us	What do people value? What does it mean to have a good life? How are people spending their time? Do we spend more hours at work or do we have more leisure time? Why do people work? How do people recreate? Do we emphasize the individual or the collective/community? What is the role of religion? And science? How do people define nature? Pristine? Modified? Engineered? What is a healthy coral reef? What do seascapes look like?
Relate Social structures and relationships that organize people and create organizations	Who is governing and how? Who makes the rules and decisions? What are some key policies in place? Are countries relevant for earth governance? Do countries still exist? Who has a voice? Who hasn't? How equal are societies? What inequalities exist? What is the space for customary systems of governance? Does nature have rights?
Connect Technologies and practices used to connect people, places, and things	How connected are people to each other? Personally? Through a metaverse? How do people communicate? e.g. language, means, media, AI How are people distributed? (urban-rural, inland-coastal)? How do people move? How much? What do transport networks look like? What does the trade of goods and services look like? Are people connected to nature? How? Is nature connected or fragmented?
Create Technology, manufacturing, processes, and arts through which we produce goods and services	What is the role of technology in infrastructure, food production, entertainment, and conservation? What is the role of arts? What type of art people are making? How do people make rules?
Consume How we consume and acquire the goods and services we produce	Is this a time of abundance or scarcity? Where does the energy come from? What do people eat? Where does the food and water come from? What are the consumer's preferences? What do we use to exchange goods and services? Money? How is tourism constituted?
Destroy How we destroy value and the reasons for doing so	How do people deal with conflict? How likely is conflict? Why and amongst whom? What happens to waste? What are the potential hazards for people and coral reefs?

Table S3. Online survey circulated among participants to gather their feedback after the workshop.

Question	Response type	Comments
Prior to the workshop, what were your thoughts and aspirations for the future of coral reefs?	Open-ended	
How did the use of creative, imaginative methods influence your thinking about the future of coral reefs?	Open-ended	
Did this process challenge any of your views or assumptions?	Open-ended	
What did you learn or take away from the visioning workshop?	Open-ended	
How comfortable are you with the resulting visions/narratives?	Open-ended	Recoded into a three-level categorical response: Very comfortable, Comfortable, and Slightly comfortable
Do you think you will use the insights you gained from working with these methods and desired futures in your future work? If so, how?	Open-ended	Recoded into a three-level categorical response: Widely applicable, Applicable, and To some extent
Do you see any elements of your own work or professional knowledge about coral reefs in the stories? If so, which ones?	Open-ended	Recoded into a four-level categorical response: Highly relatable, Relatable, Slightly relatable, Not sure
Do you think these narratives and visions can be an effective communication tool? Do you have any ideas on how they can be used to increase interest in or (emotional) connection to coral reefs among different audiences?	Open-ended	
What was the most enjoyable part of the workshop?	Open-ended	
What was the most challenging part of the workshop?	Open-ended	
Would you like to continue the co-creation process? e.g. to reflect on narratives, experiment with pathways, discuss new ideas	Open-ended	
In your opinion, which of the following features are central to the co-created visions for the future of coral reefs?	Multiple choice (up to 5 from a pool of 10 options)	Options were derived from the features and quality criteria for sustainability visions proposed by Wiek and Iwaniec (2014, p. 500).
Overall, how satisfied are you with the workshop?	Likert scale	
How satisfied are you with the outcomes (aspirational visions, pathways)?	Likert scale	

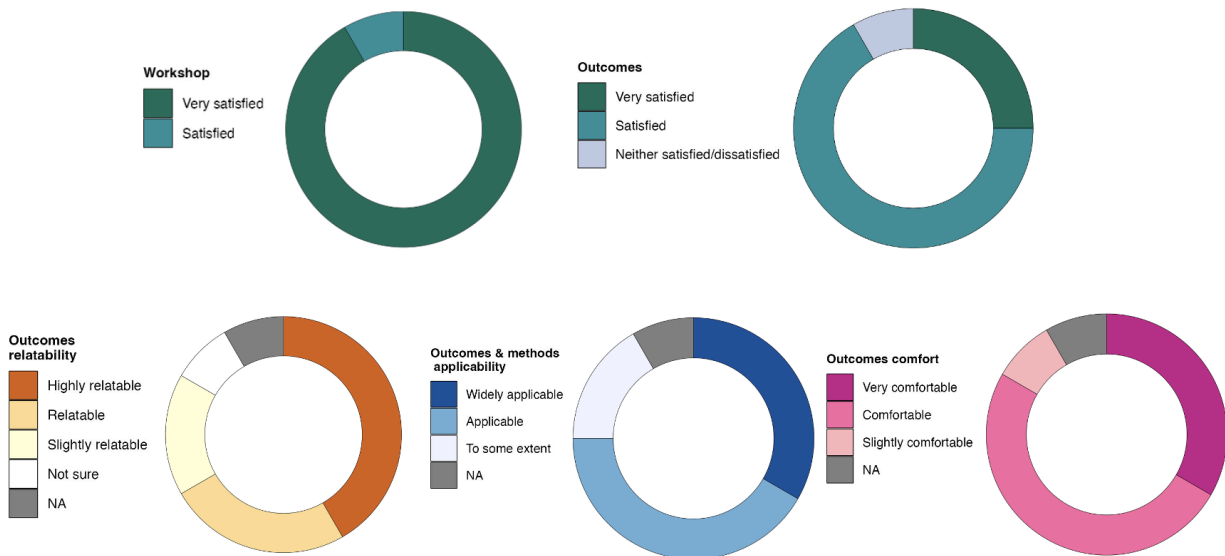


Figure S6. Participants' satisfaction, relevance, and applicability of workshop outcomes.

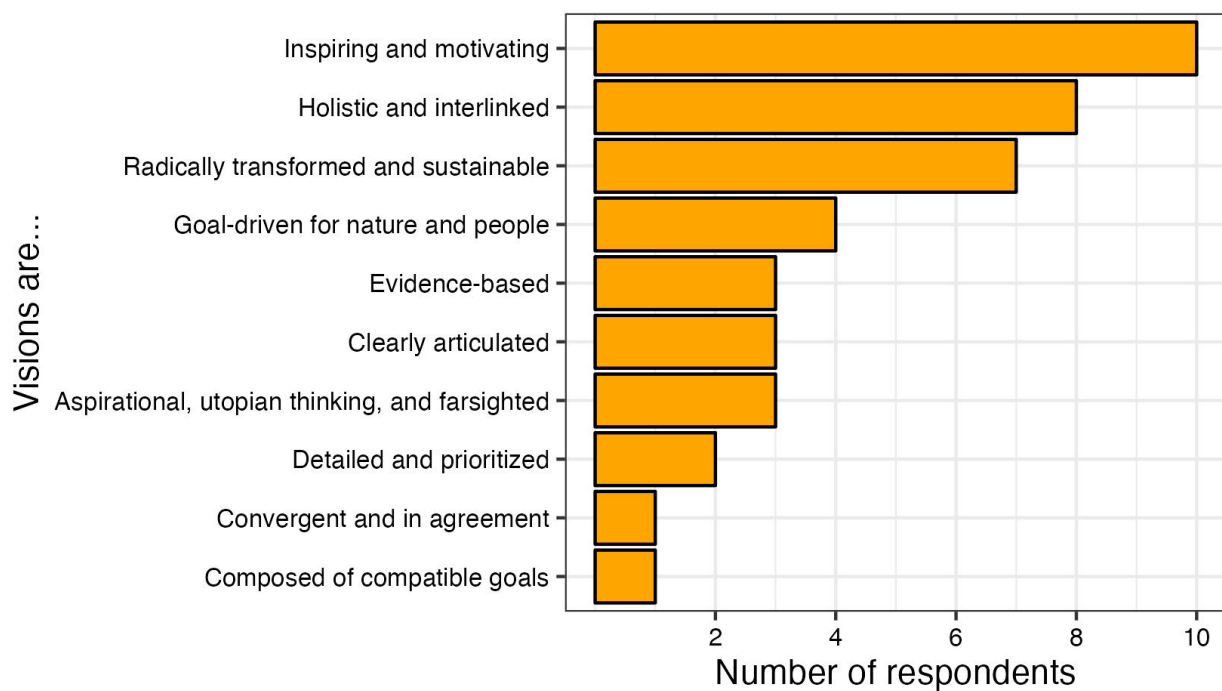


Figure S7. Ranking of key features in envisioned coral reef futures, based on frequency of features prioritized by workshop participants.

Full storylines

Reeftopia



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“Māramaia Raukawa, right?” said the woman, extending her arms toward me. “Thank you so much for accepting the invitation. I hope you had a pleasant sail.”

“The trickster blessed this voyage with smooth sailing on Amiri. Thank you for the invitation, it’s an honor to be here.”

“Welcome to the Coralarium. This floating platform off the coast of Jigurru was specially designed for the task ahead, timed to coincide with one of the most magnificent natural events in our ocean: the annual coral spawning,” explained the chatty woman.

“Last night was a full moon, and the water temperature is now just right. We can expect magic both below and above the surface in the coming days, if you know what I mean,” she added, a cheeky smile flashing across her face.

"Please follow the others who are gathering for refreshments after their journey. I still have a few more delegates to welcome before we begin."

Approaching the bubble-like platform, my bones silently complained. I no longer had the energy or vitality I once did, but I didn't mind. I welcomed the feeling of simply being here...present at a momentous occasion that had been set in motion ages ago, back when I was still a tempestuous youth fighting for the *Universal Happiness Index*. This was the next step...

"It's good to see someone else who looks as nervous as I feel," said a young man. *"Co-creating a global constitution? Could it get any harder?"* He laughed nervously.

"At least the views aren't too bad," I replied, pointing to the vibrant reef below.

"Indeed, it is exquisite! I'm Sango, the representative from Zoanta Islands. We're not far from here, actually. I usually don't brag, but I dare say our people are sustained by one of the healthiest lagoons around."

The excitement above the platform mirrored the buzzing activity in the reef. I approached the edge to better appreciate the coral reef, unconsciously attempting to ease the thoughts that roamed my mind like a triggerfish searching for food in the crevices of the reef.

"Welcome!" a familiar voice interrupted.

"You have come together from all over the world. No distinctions of religion or ethnicity, no arbitrary boundaries. Youth and elders alike. Here, everyone represents their communities and the ecosystems that sustain them," said the same woman who had welcomed me moments ago.

"Your presence here means you have accepted the responsibility of creating something that, hopefully, will resonate for generations to come. You are aware of the magnitude of the challenge ahead, but you haven't been briefed on instructions, procedures, or protocols," she said, pausing briefly.

"Delegates, I have news for you...there are none," she added with a smile.

"From this point on, the co-creation of an inclusive, globally-reaching constitution is in your hands. May your creativity, your balance, and the inspiration drawn from the beauty of the reef surrounding you, guide you forward."

Before anyone could dare to speak or raise their hands, the woman quickly slipped out of the platform, leaving behind only a medium-sized blue sphere. On its equator, in elegant letters, were the words *'Reeftopia'*.

The silence was deafening. No one really knew what to do next. I caught Sango's gaze—this time, it wasn't nervousness in his eyes, but complete disorientation.

Suddenly, the structure wobbled. Everything felt unstable.

"I guess we should try to open the sphere," said a voice from the far side of the dome, dressed in the distinctive ceremonial robes of the *Daramaki* people.

As a small group from the opposite side of the platform walked toward the mysterious sphere, the entire structure suddenly swayed. The floor beneath our feet seemed to sink, and several people on the far side stumbled forward, nearly falling.

"Please stay still," I said loudly, realizing that whoever had designed the *Coralarium* had a surprise in store for us.

"I think that to move around, we need to coordinate ourselves. This isn't meant to be just another convention...this will be an interconnected dance, where every action matters."

"The perfect metaphor," mumbled *Sango*.

At first, we were clumsy. The platform bounced back and forth so often that it felt as though we might never stabilize, let alone co-create a global constitution.

But eventually, we learned. We figured out that mirroring behaviour and effective communication, no matter our languages, were key. We began moving in sync, staying fully present to anticipate the next move. Bit by bit, by compensating for the center of gravity, we managed to find balance.

Yet, it didn't take long for disagreements and frustration to creep in, threatening to unravel the delicate balance we had worked so hard to build.

I should've seen it coming. With such a diverse group, how could we ever hope to reach a consensus? As had happened so many times before, the Universal Happiness Index became the flashpoint.

"Measure happiness? Impossible!"

Voices clashed. Delegates from regions grounded in ancestral wisdom and holistic worldviews questioned the very premise.

"You cannot quantify the spirit," one declared.

"If we can't measure it, how can we improve it?" another countered.

The room simmered with tension. Worldviews colliding, centuries of cultural divergence compressed into a single debate.

And just when it felt like the divide might fracture us beyond repair, it happened...As if the ocean floor had become a cosmic canvas, billions of gametes erupted in synchronized motion, swirling upward in a luminous dance, like galaxies being born beneath our feet.

The raw power of nature's display humbled every delegate. And just like that, as if touched by some deep, oceanic spell, the impossible began to give way to the imaginable. Like a shoal of green-blue damselfish, we gradually became one. Confusion gave way to joy.

Surprisingly, we needed much less time than we had imagined. As if the urgency of what we had been tasked to do had softened our edges, we functioned as a true unit. We were representing

our people - *Reefoir, Zoanta Islands, Daramak, and so many others* - but above all, we were stewards of our shared ocean. Such a simple realization made all the difference.

Just as the annual spawning came to an end, we opened the sphere and slipped inside a single-page document.

The Global Constitution of *Reeftopia* didn't need more than that.



Reeftopia Assembly

*Coast of Jigurru
56th Coral Spawning after Climate Wars*

*First Convention of Inter Social-ecological Units on outlining the
Preamble of a Global Constitution for Reeftopia*

PREAMBLE

The Units to this Agreement,

We, the people of Reeftopia, united in our shared vision of a harmonious and sustainable world, hereby declare our commitment to renounce capitalism, disaggregate nation-states, and build a global well-being economy founded on ecological balance and social equity.

Recognizing the interconnectedness of all life and the profound importance of preserving our natural environments, we establish this Constitution to guide our collective efforts in fostering a just, peaceful, and thriving society. We commit to the principles of universal ecological stewardship, social justice, and economic sustainability, ensuring that the rights and well-being of all beings are respected and protected.

Inspired by the beauty and resilience of our coral reefs and natural ecosystems, we adopt the Universal Reef Happiness Index (URHI) as our guiding measure of prosperity and progress. Through this index, we will continuously evaluate and enhance the health of our environment and the well-being of our communities.

In pursuit of these noble goals, we establish the global Ecoharmony Council, a body dedicated to equitable governance, conflict resolution, and the fair distribution of resources. This Council will serve as the guardian of our shared values, promoting education, innovation, and the integration of diverse knowledge systems.

Together, we pledge to cultivate a culture of care, cooperation, and creativity, where every individual has the opportunity to flourish and contribute to the common good. We affirm our commitment to a post-growth economic paradigm, where well-being and happiness are the true indicators of success, and where the preservation of our planet is paramount.

With unwavering resolve, we, the people of Reeftopia, enact this Constitution as the foundation of our global community, dedicated to the flourishing of all life and the enduring health of our precious Earth.

Project Reefoir



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Maya is impatient. Full moon was only a few days ago, and the *Daramak* could arrive at any moment. She almost can't believe it. After dragging her little brother Timon out of sleep, they had gone down together to the beach, excited to be the first to witness their arrival.

After all these years of waiting, every minute feels like an eternity. Wrapped in a light piña cloth made for the occasion, Timon starts to fall back asleep on the sand. They need to get used to the lower temperatures again, and despite the warm air, he is shivering slightly. To keep herself busy, she examines the seeding units once more. The whole community spent weeks getting them ready, following the guidelines they deciphered through the *Macro-Rhizal Network*.

The lagoon seems quiet. It is hard to imagine the chaos that once reigned: boiling muddy seas, the foul smell of dead animals and algae washing ashore with all sorts of plastic contraptions, plants drying out and the coral reef falling silent. Thick air, violent cyclones followed by terrible floods, repeated epidemics. Eventually, they all had to leave.

Maya and Timon were born on the *Solastalgia Islands*. So were their parents and grandparents. Four generations ago, most inhabitants of *Reef Island* had found refuge in higher altitudes, leaving the shores of their homeland behind.

To overcome the guilt, the shame, the pain, and to hold onto the hope of return, the people of *Reef Island* had kept the memory of the sea alive. Through songs, rituals, and stories, they celebrated the open ocean, the mangrove forests, the lagoon, and the reef. Bright corals, swirls of fusiliers, flying rays she had never seen, dried octopus she had never tasted, long days spent at sea in the breeze. These existed vividly only in dreams, handed down over time from one generation to the next.

In a fog of toxic fumes, Maya and Timon's forebears had escaped the heat to reach the mountains of the *Solastalgia Islands*. By necessity, they had to reinvent themselves, surviving off the scraps that remained, relearning to take care of the scarce sources of life they could still feed on: small insects, mushrooms, dried plants, and roots.

From their heights, the people of *Reef Island* kept celebrating the endless water. While the rest of the planet's civilizations also collapsed, bringing human life almost to a standstill, they held on. By clinging to their memories and clearing the springs and waterways of suffocating waste, little by little, renewed freshwater slowly cascaded back down towards the sea.

It would take decades, perhaps centuries, for the toxicity and heat to stabilize and retreat completely, assuming humanity didn't choose to go back down the path of self-destruction. Yet temperatures had begun to fall.

One day, they received a message from a remote island community calling themselves the *Daramak*. Remoteness and favorable currents had allowed chunks of their reef to survive. Using seeding devices left by scientists before the collapse, they held onto an assisted restoration technique, developing it over the years, monitoring and treasuring the most resilient coral reefs alive.

With the heat receding, the *Daramak* had decided to reach out by sending long-distance messages through an experimental device named the *Macro-Rhizal Network*.

When the message reached *the Solastalgia Islands*, a small group of those most keen on biology and communication had gathered and spent months trying to decrypt it.

"Eureka! Help is coming. We are going home!" People cheerfully exclaimed.

The news, at first, had fractured the community. Some were skeptical; some had grown accustomed to mountain life. But a small group was ready to return. Maya's family was among them, convinced they stood a chance of actively restoring the reef and their culture: seeding corals and living with the ocean again. *Project Reefoir* carried so much promise.

"But what if we fail again?" Maya finds herself doubting.

Looking out at the horizon for any sign of the *Daramak* people, Maya recalls the story of her lineage and everything that brought them to this point. Timon mumbles in his sleep. The stars are fading one by one. Night's darkness is ready to give way to the morning.

"It can't be long anymore," Maya thinks anxiously.

She gradually makes out her surroundings. The colourful sand around her still bears traces of microplastic and remnants of humanity's industrial past lie around, covered in barnacles and plants despite all the cleaning.

"Nature is truly amazing!" she thinks, unable to help smiling.

Upon their descent, they had been surprised to find that not all life had vanished. Amongst the old reef structures covered in algae, there were still some small weedy corals... and fish! Damselfishes and wrasses had survived, even showing signs of adaptation. So did the vegetation on land, growing over the waste. Evolution and reclamation were ongoing.

"And now we have chep tu," Maya thinks. Since their descent, they had to adapt to reigning scarcity. *Chep tu*, grilled goatfish eyeballs, had become one of their staple foods, and Maya had prepared some to welcome the Daramak and their coral larvae. The remains of every fish were now turned into *fishaliser* to nourish the soil of their gardens.

The small signs of resilience were comforting but they didn't soften the weight of what it meant to return. Descending had been frightening. They had to start from scratch, relearning, reviving ancient practices as best they could, and taking care not to disturb the fragile populations of species just beginning to rebound. They had to be cautious, observant, quiet.

"Careful, we have to be care-ful."

Everything was in place now. They had followed the Daramak's guidelines to the letter: the power source, the restoration devices, and the monitoring systems...ready for the reef and its people to rebound together. She unconsciously dips her hand into the seeding units, stroking the familiar, rugged surfaces of the coral settlements.

"We are ready," Maya reassures herself

A faint glow on the horizon, rapidly brightening. Then suddenly, in a burst of light, the *Daramak* fleet appears, propelled by bioluminescent solar sails.

"This time, it will be different."

The Bay Revolution



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The office was different from what I had imagined. For such a renowned scientist, I'd expected something grand, I suppose. Instead, the space felt homely and modest, yet a large window opened onto a spectacular view of the lagoon. The wind carried the smell of seaweed into the office, and one could see her life's work in the distance: the *AetherReefs*.

I was nervous and couldn't believe I was finally meeting Professor Aria, the woman who had sparked my passion for the ocean and led me into sustainable innovation.

A back door opened, and an elderly lady with thick, bright red glasses came in, pulling me out of my thoughts.

"Hello, sorry I made you wait," she said with a smile.

"I... uh... that's fine," I stuttered. "It's a huge honour to meet you, Professor! Thank you for taking the time to meet with me. I have heard and... read so much about you! I... I'm a student at the Insular Polytechnic University. As I mentioned in my holo-note, I'm currently in my final year, and as part of my thesis, I'm researching the creation and history of AetherReef and the context in which it all happened."

I took out the wireless lavalier microphone and placed it on the table.

"What did you say your name was?" the professor asked.

"Excuse me, I didn't introduce myself. I'm Jomari Mendoza."

"Mendoza, that sounds familiar."

"Yes, my mom was one of your first students back then. Do you mind if I record our conversation?"

"Not at all, go ahead."

I handed over the microphone. While she was attaching the device to her blouse, I had difficulty hiding my excitement. Once she was set up, I turned my headphones on and pressed record.

"Well then, Jomari, it all began in Makani Bay, in August 2030, during an event that history would remember as The Big Storm."

Her voice carried the calm authority of an experienced lecturer, drawing me in with her composed, soothing rhythm, awakening my imagination.

"The citizens of Makani Bay were holding on, but the incessant rain and several storms had left the island without power for several weeks. It was the third storm of the season to wreck the reef and the coastline. The rubble of crushed coral and the many landslides blocked access to the channel, making it too dangerous for large oil tankers to go through. Deprived of oil, the island's energy reserves quickly ran out. Without electricity, without fridges, food began to rot. Schools and hospitals could not function properly. Many of the island's infrastructures were damaged, and worst of all, the national water and sewage systems were off. Clean water supplies ran short." Her eyes darkened by the memory.

"From that moment, people began to entirely depend on small traditional boats, capable of navigating the labyrinth of treacherous reefs, carrying diesel and gasoline to the island. It was meant to be a temporary fix, but the oil companies realized that scarcity would force people to pay. Transporting petroleum in small quantities was twice as profitable. With no alternatives in sight, prices began to surge, leading to general inflation on the island. For many, their wages were insufficient to afford the new costs of living, and they had to leave the island to look for work elsewhere."

"It must have been terrible. How did they make it through without food and water?" I asked.

Professor Aria lowered her gaze and murmured, *"They barely did."*

"We need to jump a few years ahead," warned the professor, eyeing me intensely over the rim of her bright red glasses, *"...to a period that was later defined as The Awakening."*

"The consequences of more frequent and intense storms hit heavily on the island. Houses and infrastructures needed to be rebuilt. Power outages were frequent, and large reef areas were damaged. During these crises, when most households were already struggling to make ends meet, the loss of coral led to depletion of the local fish populations, on which

many were increasingly relying to feed their families. Monitoring and restoration squads had been deployed nationally, but their efforts only had minor effects considering the magnitude of the destruction.” She paused, addressing herself to me now.

“You know why this place is called Makani Bay, don’t you?”

“Because of the strong easterly winds,” I said, sitting up straight like a conscientious student. “Makani means wind. We all knew that.”

“Exactly,” she answered with satisfaction. “It should have been obvious, right? Actually, it was one of these squads that grasped the true power of the wind.”

I took a deep breath, attempting to remain silent to avoid interrupting her flow and the recording. It was so precious to capture the professor herself recalling these historical milestones.

“It’s the story of two friends,” Professor Aria grinned mysteriously, leaning back in her desk chair. “Tuane and Sefina were two friends from the local community working together in one of the squads. One day, they were both out on the reef, over there, you see, just at the edge of the bay’s estuary and the mangrove forests.” She pointed out of the window to where the first rows of AetherReefs were standing tall, oscillating slightly in the continuous trade wind.

“They were working on a restoration project, collecting data on a potentially undocumented coral species of the Acropora genus. But that day, the scorching midday sun, intense wind, and the waves were making the task almost impossible—and Tuane was struggling to deploy FUCUS, the seabed walker data collector, which was running out of battery.”

“As Tuane was getting more and more frustrated with the device, the wind blew off his cap into the sea, over a patch of recently grown coral. Sefina was witnessing the scene in silence, while in her mind an idea was taking shape.”

Professor Aria was staring right at me, her gaze sparkling in delight. She was obviously rejoicing in the moment. I could sense the nostalgia from her days at the university. I wondered if she missed it...being a lecturer in a room full of savvy students.

“Back on land, Sefina shared her idea with Tuane. It seemed a bit out there, one must admit, but youth and the critical situation of the time fueled their optimism. They knew there was only one person capable of helping them bring the plan to fruition. If they could convince her...”

“Aterori,” she continued, her voice softening. “...was a frustrated engineer they had seen in the media a couple of times. For years, she had been trying to convince the science community and the government about innovative offshore wind farm ideas. But due to her eccentric personality and the reigning gender biases, no one took her seriously. Exhausted, she had gone into early retirement and was living with her dog, Betty, on the outskirts of town.”

“As expected, Aterori was first reluctant to listen. Over the years, she had become bitter. But Tuane and Sefina were more determined than ever.”

Professor Aria paused, talking more to herself now, soaking in her memories.

“It really was a crazy idea... Guess we had nothing to lose... or else we would have had to migrate too... hmm...” She looked out of the window, seemingly unaware or unbothered by what she had let slip. Coming back to the present moment, she continued her story as if nothing had happened.

“For over a month, Sefina and Tuane visited Aterori almost every day. They just wouldn’t give up, until she eventually gave in and agreed to sit down with them. Together, they confirmed Sefina’s belief: producing renewable energy while helping coral reefs withstand climate stress WAS possible! At least, theoretically...” She was smiling again.

“But how was it supposed to work?” I asked.

“At its simplest...” she explained, *“The idea for AetherReefs was to build offshore windmills combined with photovoltaic panels in a hybrid microgrid that would produce energy all year round for the islands, while providing an artificial structure for corals to regenerate. The whole structure would also protect the coastline from heavy waves.”*

“But that wasn’t all. For the plan to be effective, they had to convince the whole community to buy into the idea. As expected, people were at first reluctant to listen to another of Aterori’s theories. But with Tuane and Sefina’s enthusiasm, they soon won everyone over. To be honest, while a handful of people might have truly supported them, most simply needed something to believe in. Hope is a powerful motivator. The plan definitely succeeded in uplifting people’s mood at the time. The more they talked about it, the more momentum they gathered.”

Her eyes were gleaming with excitement now.

“The whole community came together. Local fishers, diving instructors, tour operators, and researchers began by identifying partially degraded, flattened reefs that had served as larval sinks, where coral recruits typically settled, as places to install AetherReefs.”

“Meanwhile, the trio united a team around them and began prototyping. The whole community invested their meagre savings into the endeavour. Working day and night, while kids, adults, neighbours and extended family members were regularly popping in, bringing food or helping to source materials.”

“It took less than five years to develop the first successful prototype. Which is actually a remarkably short time! Much thought and work went into design and material innovation to make the AetherReefs sustainable in the long term. To develop a technology that would not harm biodiversity, but rather enhance it by using bladeless oscillation systems for energy generation and underwater artificial reef structures for the corals to grow onto. In

collaboration with local craftsmen, scientists developed ingenious materials that could be either repurposed entirely or composted in the long run. The windmills also had to be silent to avoid harming sensitive marine life, and robust enough to resist the yearly storms. Every aspect of the plan was thought through, involving every member of the community."

"What was the role of the government in this?" I asked.

"Oh, you know," she replied with a bitter tone, *"There is no victory without a battle, is there? Equipped with plans, preliminary results, and boundless passion, they presented the AetherReefs concept to the government only to be completely dismissed."*

"The government refused to allow them to install and test-run the first AetherReefs prototype. Oil companies had a powerful lobbying influence over the authorities, and the project posed a clear threat to their interests. But the citizens of Makani Bay wouldn't let themselves be deceived so easily... they were prepared to fight back," fire flickering behind her calm expression.

"Little did the government suspect the trio's stubborn resolve. Aterori herself had become a different woman. Galvanized by the recent recognition and the support that the project had gathered locally, she was ready for everything!" Professor Aria laughed at the recollection of the late engineer.

"They campaigned across the whole archipelago, forming a coalition with other local communities to protest against the government's barriers and the monopoly that the oil companies had built up over time."

"But it was only when they did the unthinkable that they got taken seriously: They went on strike to halt tourism. For weeks, no one went to work. We were sitting in front of parliament every single day for 90 days. We didn't falter, we didn't give in. Since no one was going to work, all the schools were closed, and entire families were camping in front of the President's office day and night. People were doing shifts to cook meals and distribute food to the protesters. At times, the mood was even joyful. Planes weren't flying anymore, the entire economy was on hold."

"After a while, though, tensions began to build up. People's mood was starting to shift. At one point, we were almost on the brink of a civil war! Until finally, the government gave in. Forced to confront our demands to legalize our customary tenure rights over the Bay and allow the installation of the first AetherReefs!"

She took a breath, quietly gleaming with pride.

"What happened next?!" I almost yelled, totally caught up in the story. I wasn't even thinking about the recording anymore.

"Eight years after the revolution, the AetherReefs network was fully operational and was a model adopted across the entire archipelago. The technology proved successful in providing

energy independence and supporting coral reef restoration, creating climate-resilient habitats for coral life. AetherReefs also created an artificial rim protecting the island's coastline from storms and erosion, providing a critical defence against the ravages of growing climate impacts."

The professor's enthusiasm was growing with each word.

"The rest was a cascade of positive effects...with access to cheap, renewable energy, households had more money to meet other needs. Young people no longer had to migrate for work as highly skilled jobs were being created to maintain AetherReefs. At that time, there was a strong global push for sustainable tourism. With coral life rebounding and the advent of zero-emission touristic experiences, sustainable tourism flourished."

"Most businesses were locally owned, meaning that there was an increased flow of financial resources within the local community. Fishers had been involved in the process of establishing and managing AetherReefs, leading to more sustainable and respectful fishing practices, reviving traditional methods as the marine life population replenished. With the economy flourishing, the citizens of Makani Bay added pressure on the authorities to ban all industrial fishing practices in the region. A very bold and affirmative moratorium was passed, enabling the entire trophic pyramid to bounce back."

A shiver ran down my spine. Small tears were shining in her wrinkled eyes, a small layer of fog clouded her glasses. She took them off, putting them gently on the table. Her emotion was tangible.

"It still moves me every time I think of it. It was incredible to see the reef growing back, to witness turtles and young sharks and rays returning to the shores... See, we would never have thought such a miracle to be possible. But we fought hard, we held our position, despite all the attempts made by powerful corporations to intimidate us, to stop us. We made it! You youngsters are lucky not to have had to experience the hardship we went through, but my generation will remember this shift of fate forever. It still makes me so proud!"

"But what about the storms? They didn't go away, did they?" I asked.

"True. The storms continued striking, but AetherReefs had been designed to mimic local plant species and mangroves, which have the ability to resist strong winds. In extreme scenarios, they can also be dismantled and reinstalled relatively easily."

Remembering the purpose of my visit, I still had to ask her a few questions.

"Could you tell me a bit more about the emergence of the Pacific Island Network?"

"PIEN, the Pacific Islander Energy Network, you mean... Well, Sefina was the mastermind behind it. Inspired by the first prototype and how the revolution had unfolded, she conceptualized a financial mechanism to expand the idea, using community-based savings

funded by tourism expenditures to replicate AetherReefs across the region. Then, she leveraged novel global funding for climate change mitigation and adaptation to scale the technology.”

“It was not easy, but over time, with AetherReefs being open source, they spread throughout the Pacific Islands, becoming a runaway success. By 2049, an astonishing number of 3,000 AetherReefs networks had been built, and for the first time, energy sovereignty was achieved throughout the Pacific,” she concluded with a proud, youthful smile.

“Oh, I almost forgot about the other hero of the story,” she continued hastily as I was about to respond. *“It’s the years catching up, don’t mind me.”*

“For decades, Aterori had been campaigning tirelessly to establish the first Polytechnic University of the Pacific, dedicated to training young people in maintaining and improving AetherReefs. In 2041, she fulfilled her dream. As part of the Makani Bay Memorandum, which secured marine tenure over the coral reef for local and Indigenous communities, Aterori became the first director of the University.”

“What happened to Tuane and Sefina?” I asked.

She smiled mysteriously at me and answered,

“Jomari, don’t you know it already? They became faculty members at the university to carry on the legacy. Aiming to inspire young creative minds to keep pushing the boundaries of sustainable innovations that cater not only to humans but to the wider community of life on Earth.”

“You are Sefina, aren’t you? Why keep such a mystery around it all these years?”

“It’s barely a secret, isn’t it? I guess I’m old now, it’s okay. Tuane and I didn’t want to become heroes. We thought we’d leave the center stage to Aterori to celebrate her life’s work. She died before seeing the whole network being fully deployed, and we thought she deserved more of a legacy than us.”

“The Bay Revolution also centered the community, and how collective effort can change established power dynamics. This is what we wanted this era to be remembered for. None of us would have achieved any of it all alone.”