

AT A GLANCE

State of our Gulf 2173

Hauraki Gulf / Tīkapa Moana / Te Moananui-ā-Toi
State of the Environment Report 2173



**Hauraki Gulf
Marine Park**
Ko te Pātaka kai
o Tīkapa Moana
Te Moananui-ā-Toi
20 years ngā tau e rua tekau



Hauraki Gulf Forum
Tīkapa Moana
Te Moananui-ā-Toi

This is a fictitious Executive Summary of the State of the Gulf report in 2173. It takes a future historian's perspective to look back on the history of the Gulf, showing how we achieved that remarkable recovery. We offer an optimistic glimpse into a more hopeful long-term future, contingent on strong shared actions in the short to medium term. We hope that this approach highlights some bottlenecks that limit the transformational change we now need to succeed.

– Prof Simon Thrush (University of Auckland)
& Prof Conrad Pilditch (University of Waikato)

Kia whakatōmuri te haere whakamua.

I walk backwards into the future, with my eyes fixed on the past.

In the beginning there was nothing, te kore.
Then came the darkness, te pō, and the stirring of movement from Ranginui and Papatūānuku.
Their separation at the hands of Tāne Mahuta led to the light, te Ao mārama, and the emergence of the children of Rangi and Papa including the Atua Tangaroa, God of the sea.

Māori whakapapa back to ngā Atua and approach the future with that whakapapa in full view.
It is with this perspective that the future is framed, including for Tikapa Moana, Te Moananui-ō-Toi, the Hauraki Gulf, in terms of mauri (life force), matapono (principles), tikanga (customs), Kaitiakitanga (guardianship), matauranga (knowledge), wairua (spirit) and ora (health).



The Hauraki Gulf is now healthy and productive. The large, long-lived species that live on the seafloor are recovering well in the outer two thirds of the Gulf. The highest biodiversity areas of the Gulf – around Hauturu ō Toi, Aotea and the Coville Channel – are widely valued as sites to connect with nature and enhance cultural wellbeing. Tourism, citizen science and immersion in nature are continuing to increase not only via diving but also through the growing use of personal submarines and remote autonomous underwater vehicles.

In the inner Gulf and the harbours, land management and nature-based solutions to sea level rise have enhanced marine habitats; mangrove, salt marsh and tidal flats have expanded landwards as part of our ‘managed retreat’ response to sea level rise. We have now seen the re-establishment and rebuilding of migrating shorebird populations previously displaced by climate change and habitat loss. Water clarity in the inner Gulf has improved allowing further expansion of seagrass beds and kelp forests as well as the survivorship and expansion of restored shellfish beds. The Hauraki Gulf Forum’s goals for shellfish restoration continue to be exceeded. The extent of restoration of multiple shellfish species is now having a snowballing effect and this report provides new evidence of self-sustaining populations that no longer need active transplanting.

Ocean climate

The ocean climate of the Gulf continues to adjust to the climate crisis of the mid-2000s. Documented effects include:

Storms

Increased intensity and frequency of storms

Temperature

Increased ocean temperatures and heat shock events

Acidification

Lowered ocean pH, worsened by eutrophication and sedimentation

Sea level rise

The rapid rise in sea level appears to have peaked in 2075 following several decades of global initiatives to reduce emissions and halt heating, allowing shorelines and coastal communities to readjust. Nevertheless, we closely monitor conditions in the Gulf and in Antarctica as well.

Shifts in water currents and food resources

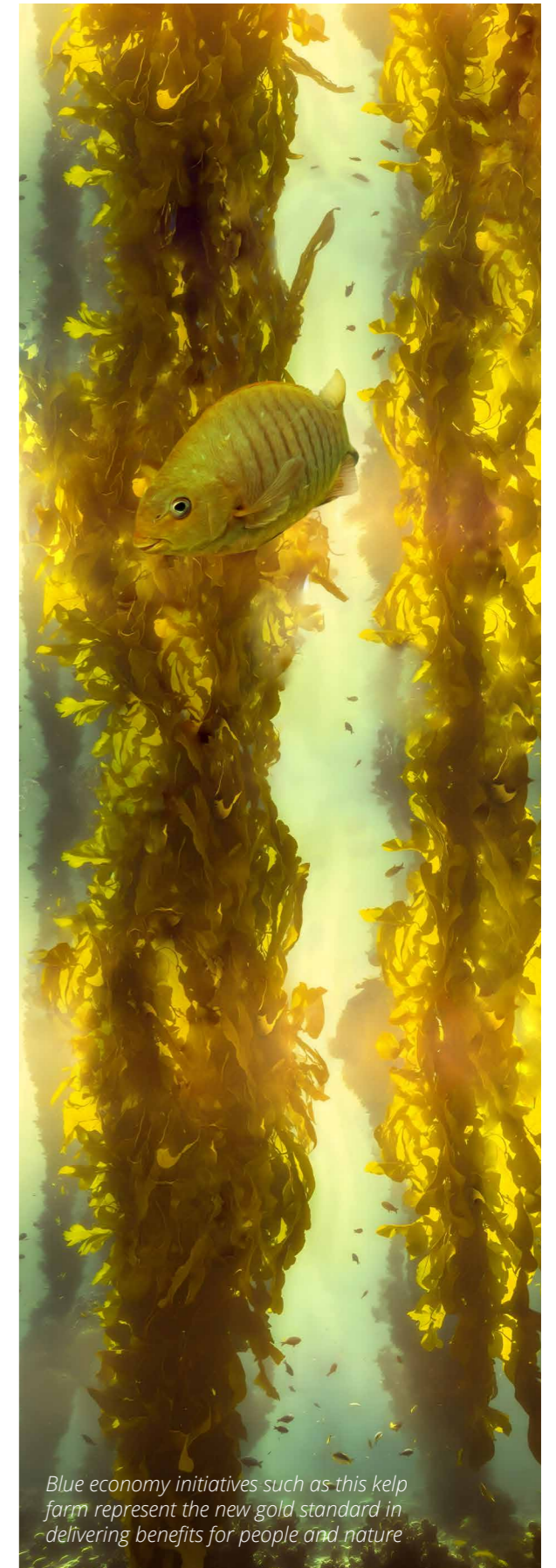
The East Auckland Current has moved north by about 50 km. Historically the current drifted across the Tasman Sea and, after rounding North Cape, split into a series of gyres strongly affecting the ocean climate of the north-east coast. The northward drift of the current has weakened the effects of El Niño-Southern Oscillation on the Gulf, lowered the frequency of new species arriving from the tropics or Australia, and increased the residence time of the waters in the Gulf. The tropicalisation of the Gulf's current oceanographic regime has enhanced the populations of oceanic Manta rays using the outer Gulf, while the Brydes whale population remains healthy but spreading out of the Gulf to feed. Although feeding grounds for the seabirds of the Gulf have shifted, the restoration of nesting and roosting sites has ensured the continued resilience of these species. The productivity of the Gulf and the provision of food resources for people remains in balance; our extraction levels allow us to maintain the resilience of populations while supporting the ecological role of exploited species.

Fisheries and Aquaculture

Since trawling and dredging stopped in 2025 due to government intervention, coupled with shifts in social licence and a lack of investment in maintaining and replacing old vessels, we have seen a diversification and de-corporatisation of fisheries. Our socially and environmentally high value commercial long line fisheries, diver-based scallop and urchin fisheries continue to work within their permitted ecological footprints (i.e., the ecosystem-wide effects of an activity). Fishers are actively engaged with other stakeholders in discussing the wider management of the Hauraki Gulf in the context of their ecological footprint and using cumulative effects risk assessments. Recreational fishers, as citizen scientists, are also operating within holistic management frameworks and are adding valuable data to our models of the Gulf through observations and by deploying aerial and underwater drones. Seaweed farming for food, nutraceuticals and carbon storage is continuing to respond to oceanographic and climatic shifts. This major resetting has allowed for new innovations in the industry to reduce their ecological footprint while diversifying products and employment opportunities. Shellfish aquaculture continues to diversify both in response to shifts in consumer preference and the industry's growing role in supporting shellfish restoration around Aotearoa New Zealand. Land-based algal aquaculture activities in the Hauraki plains continue to facilitate the stripping of nutrients from the Firth of Thames enhancing water clarity, seafloor plant growth and reducing the impacts and risk of eutrophication.



Shore and seabird roosting and nesting habitats created as part of managed retreat have helped population recovery



Blue economy initiatives such as this kelp farm represent the new gold standard in delivering benefits for people and nature



98 % of the plastic in the Gulf was added between 1950 and 2050, new technologies have reduced inputs dramatically

Pollution legacies

The impact of sea level rise and high storm frequencies continues to be a significant problem. Legacy sediments in estuaries and the inner Gulf continue to be resuspended during storm events, impacting light levels and causing stress on shellfish and other filter-feeders. The fallout from the exposure and blowout of many historical refuse dumps and landfills historically placed adjacent to rivers and estuaries continue to be addressed. Despite continued storm events, new sediment inputs have remained lower due to integrated catchment management action across the Gulf's catchment; the most notable trends of improvement are apparent in the Piako and Waihou rivers that drain the Hauraki Plains. This trend is linked to changes in farming practice, intensity of land-use, and enhanced riparian planting that has now re-established both the Kahikatea forests and fringing salt marsh habitats. In the urban areas the implementation of a "sponge city" model, utilising green infrastructure and water-sensitive urban design for the Auckland conurbation, has improved the quality and reduced the quantity of stormwater and

helped manage flooding and storm impacts. Urban expansion with associated large open earthworks has continued to decrease, as we put a premium value on open and green spaces for recreation, health and their role in flood mitigation, carbon sequestration and as biodiversity havens. The quantity of new microplastic particles entering the Gulf has decreased due to changes in practices in urban areas and innovations in fishing and aquaculture industries that have been reinforced by consumer pressure. Our portable biodigesters for microplastics are continuing to clean urban harbours. Urban contaminant concentrations have significantly decreased due to new eco-engineering and the movement away from oil and petrol contaminating road surfaces. Polyaromatic hydrocarbons (PAHs) and microplastics from tyres remain a worrying problem. The 'Sunk Ships mean Slicks' policy resulted in the safe de-oiling and removal of wrecks; these processes started with the removal of oil from the Niagara (2030), with the recovered gold contributing to the resourcing of the policy.

Building resilience by employing a diverse array of mitigation strategies

Blue Economy and Carbon markets

Our reporting shows that the continued growth in shellfish and seaweed aquaculture, iwi-led artisanal scallop fisheries, iwi-led monitoring of rāhui, the culture of bioactives, climate mitigation, eco- and active restorative tourism, power generation and resource use minimisation has shifted the Gulf to a net consumer of carbon. These activities are not only climate friendly but are now dominating over the old extractive economics and are also accelerating the recovery of the Gulf. Our climate change response mitigation measures, especially in the Firth of Thames and central Gulf, are also opening up new business opportunities linked to CO₂ removal, land-based Omega-3 production from micro-algae, coastal adaptation, and working with nature opportunities.



Artisanal tipa fisher records provenance and collects data on the health of the Gulf

Working with nature

Our catchment restoration and working with nature strategies on the coast have limited the negative impacts of climate change, restricting sediment and nutrient pollution, lowering storm impacts and mitigating adverse effects. This in turn has allowed saltmarsh, mangrove, seagrass and seaweed beds in the Gulf to flourish, taking up CO₂ from their surroundings and creating a localised safe haven from the negative effects of ocean acidification. Additionally, the restored shellfish beds and the use of other species that live in the sediment to rehabilitate degraded and polluted systems is restricting nutrient and sediment pollution in the coastal waters of the Gulf.

Nature's contribution to people

Outreach, education and people spending time in the Marine Park has led to people having a better understanding of and fascination with, how the Gulf's ecosystems actually work to deliver multiple critical life-supporting functions. This understanding has drawn people into a more holistic view of the interrelationships and life- and wellbeing support systems that the Gulf provides. As our understanding of how the Gulf supports us has grown, we have seen holistic management and Kaitiakitanga drive long-term decision-making and encouraging a focus on maintaining multiple benefits rather than simplistic trade-offs. Relevant examples of how this recognition of nature's contribution to people include Our management of sediment resuspension, and our approaches to enhancing the removal of CO₂, recognise nature's contribution to people.

Sediment resuspension

We now understand how sediment resuspension negatively impacts carbon sequestration and the clarity of the seawater. Water clarity affects both our sense of the environment and our enjoyment of underwater vistas, and sediment resuspension limits plant growth and productivity. Our management actions have reduced seafloor disturbance, restabilised the seabed by restoration and rehabilitation, and reduced river-borne transport of sediments into estuaries, harbours, and coasts.

The CO₂ clean-up

Technologies to mitigate ocean acidification – including the application of minerals such as olivine and calcium carbonate, which when dissolved in seawater increase the pH – have been employed in target areas with high risks of acidification. These include areas experiencing eutrophication due to legacies of high nutrient inputs which still cause nuisance algal blooms (when they decompose, these blooms generate CO₂ acidifying the water). Our ongoing experimentation with powders and granulated minerals – such as olivine in beach and intertidal flat environments – are showing positive results helping to mitigate historical nutrient enrichment and loss of CO₂ sequestering vegetated habitats due to excess sedimentation.



Porous olivine composite experiment to reduce the impacts of ocean acidification

Progressive policy development

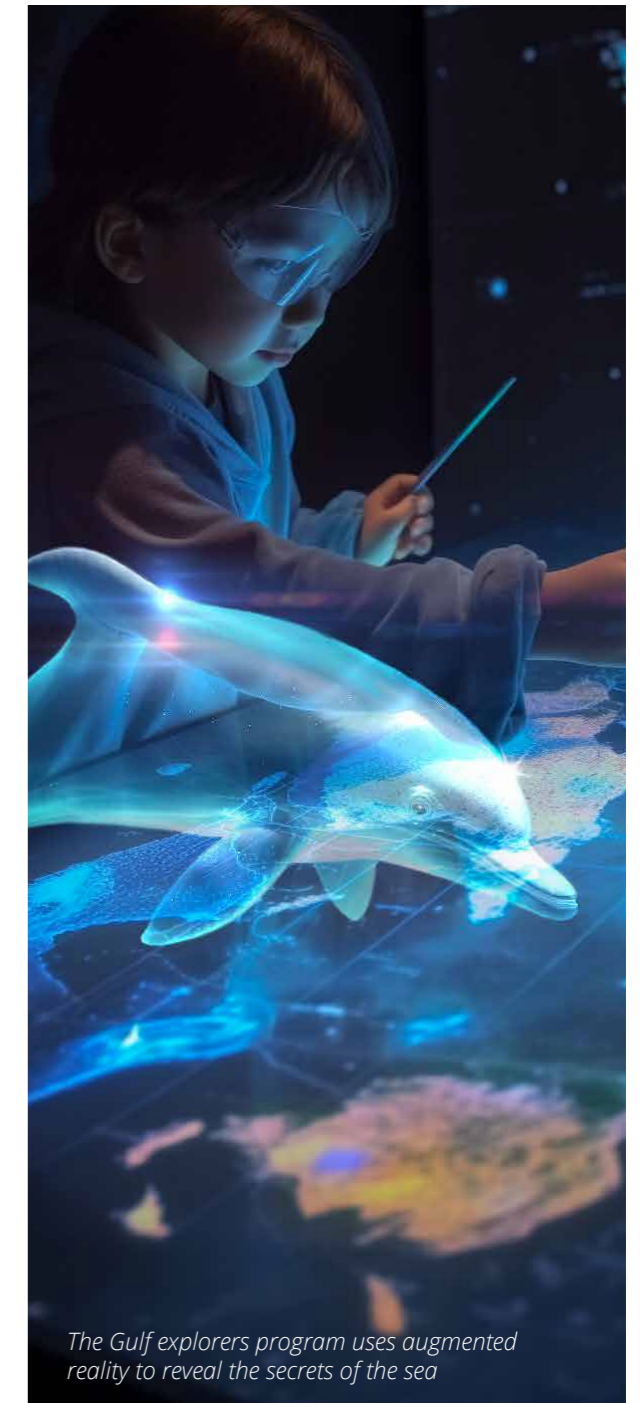
The diversification of blue economy innovations in the Gulf continues. The UN global strategy has shifted humanity from the 'nature for people' exploitative thinking of the twentieth century towards 'people in nature' with strong foundations in environmental stewardship and accountability for protecting and restoring the environment. This has generated transformative change in our way of living and constructing our economies, to one that restores our ecosystems on a large, systemic scale. This has been a major economic stimulus – not only nationally but also by shifting preferences and trade agreements internationally.

Translating policy into action

This has been a major theme of the Hauraki Gulf Forum, strengthened by the formation of the National Ocean Advisory Council. The monitoring of the Gulf's governance and the Treaty partnership framework has continued to drive improvement in the mauri of the Gulf while providing space for innovations and activities that are valued and accepted by the Gulf's diverse communities. Legal personhood of the Hauraki Gulf was conferred in the 2030s through the Waitemata Harbour Settlement. Engagement in positive actions and the continually growing awareness of our fundamental reliance on oceans and ocean life has led to Auckland being declared the best city in the world for citizens living well with nature, benefiting both culturally and economically while improving ocean health. Critical to being awarded this honour was our recognition and application of Indigenous knowledge, positive trends in our long-term monitoring of ecosystem health, our level of ocean literacy and engagement in decision making processes, the strength of our blue economy and the engagement of people in enjoying the Gulf.

Building and using the knowledge bases

Management agencies are now utilising the vast quantity of internationally credible research and knowledge to inform their decisions. Making use of the wide and holistic knowledge base that exists has enhanced decision-making where multiple values are fairly represented. Marine scientists are continuing to work alongside practitioners of mātauranga – particularly with an eye to developing new knowledge that addresses how our marine ecosystems have changed so rapidly over the last 200 years and how, these two knowledge streams together can enhance our capacity to respond to future change. Citizen scientists are also making a substantial contribution to our knowledge of the Gulf, particularly through the Km² Project. This has allowed boat owners to swap some of their fishing gear for underwater drones and cameras to map seafloor habitats. This data is sent to IVS (Institute of Visual Synthesis) to map and identify organisms and features that live on the surface of the seafloor. These detailed and ecologically meaningful maps have allowed us to continually improve our understanding of the recovery of the seafloor from historical disturbance.



The Gulf explorers program uses augmented reality to reveal the secrets of the sea



The Km² project maps seafloor habitats and biodiversity, providing real-time data to monitor the health of the Gulf

Historical analysis – how did we get here

Looking back from the current situation of a diverse and recovering Gulf, we have been able to identify that the major shifts that supported recovery were associated with human engagement with the Gulf's ecology, led by Kaitiaki Māori and local communities. The shift to a positive future and action-focused governance was the development of a truly blue economy. The seeds of change for the Hauraki Gulf Marine Park may be traced back to the early State of Our Gulf reports of 2000-2023. Positive change started slowly due to the Gulf's sectarian management and governance, which led to a period of paralysis in responding to the warning signs in the assembled data. This historical disconnect between problem and solution was revealed in many archived discussions and media presentations and is evidenced by features such as the decline in scallop populations, the functional extinction of crayfish and horse mussels in the Gulf, and the small proportion of the seascape with high conservation status. The net result was that Aotearoa New Zealand became a laggard on the world stage in terms of marine sustainability and conservation, impacting the

country's reputation, its capacity to meet internationally agreed targets, and the credibility of our blue sustainable economy. Nevertheless, a series of positive actions and collaborations involving community groups, iwi, NGOs and researchers advanced a ground swell of restorative action. Iwi played a particularly critical leadership role in declaring rāhui to allow the Gulf to recover. Philanthropy was also an important contributor, supporting actions and connections between groups. In 2024, central government finally passed legislation to bring in a set of new marine protected areas, via Revitalising the Gulf. As 2025 came to an end, two decisive and interdependent factors grew in prominence – the blue economy and our response to climate change. The blue economy grew out of a need for the economy to service both people and the environment – not just profit – and acknowledgement that practice at the time was eroding the natural infrastructure that made our planet habitable. This realisation meant that ocean protection and production were no longer seen as an adversarial trade-off, but were working synergistically to build healthy and prosperous futures. Another critical

element to the recovery trajectory of the Gulf was the level of public awareness and consequent political engagement. 'Blue Brands' international financing and accounting practices worked to promote ecologically sustainable business and supported many investors in realising their power to effect change. This leveraged work started by the Forum in 2023 to develop a set of natural capital accounts and to value the full range of goods and services provided by the Gulf's ecosystems. Early attempts to highlight the opportunities provided by marine ecosystems in climate change and climate mitigation were ignored as the government focused on simple and direct solutions because 'we did not know enough'. With hindsight it is easy to critique the slow uptake of new ideas and strategies, but the increased storm frequency enhancing pollutant runoff and turbidity, the marine heatwaves, increases in harmful algal blooms, and marine diseases all put stress onto the Gulf, affecting nature and people.

The multifaceted impacts of climate change on Aotearoa New Zealand were profound, with many local tragedies. This led to a focus on infrastructure resilience, managed retreat from some coastal areas, and eventually an inability to insure at-risk properties. These and other changes naturally resulted in a slow but steady

population shift to more climate-resilient areas of the country. Illustrative of these changes are the effects on one element of climate change – sea level rise. Partial melting of the West Antarctic icesheet led to a rapid rise in sea level, so that by 2075 tides were 1.5 m higher than in the year 2000. With increases in storm frequency and tidal surge, this pushed effects further inshore. This led to extensive shoreline protection in the wealthier parts of Auckland, but the prohibitive cost of protecting property and roading networks led to the managed retreat strategy (a coordinated triage agreement involving regional councils, central government, and insurance companies). Many urupa and marae were lost, breaking critical cultural connections for many hapu and whanau. There were many local tragedies as historic urban landfills were eroded, displaced and polluted the coasts. However, some areas under threat of impacts from sea level rise and storm surge were protected by intact coastal mangroves, sand dunes and the seaward edge of the salt marsh habitats. In fact, the tidal inundation of the Hauraki plains led to the first large-scale restoration and re-establishment of salt marsh habitats that had not been seen in Aotearoa New Zealand since the 1930's. As well as restoring a critical land-to-sea transitional habitat, these salt marshes and the landward peat swamps

2000-2025

2017 Sea Change - Tai Timu Tai Pari.	2021 Revitalising the Gulf (RTG).	2024 RTG MPA network implemented.
Our country was recognised internationally as a laggard in marine conservation, impacting the country's reputation and capacity to meet internationally agreed targets.	2022 Phase one of RTG Marine Protect Area (MPA) consultation.	Zero protected species bycatch by 2035 goal.
The role of marine ecosystems in climate change and climate mitigation was beginning to be taken seriously by government and investors.	2023 Fisheries Management Plan (FMP) consultation.	2025 FMP in effect, mobile contact bottom fishing, set-netting and purse seining banned.
	Major shifts to support recovery and resilience were led by Kaitiaki Māori, resulting in a network of rāhui and conservation actions that also fostered a cultural regeneration.	2025 'Keep it on the land' Intensive land and soil conservation strategy implemented.
		2025 Zero carbon aquaculture.

2025-2050

'Sunk Ships mean Slicks' policy (2025).	Policing of the various management measures by Kaitiaki Māori was funded from the central Government's Blue Wave strategy.	Managed retreat in the Firth of Thames leads to the restoration of 100 km ² of salt marsh and wetland.
2028 Additions to RTG MPA network implemented.	Science reform leads to the National Ocean Advisory Council (2030). A solution-focused and trusted independent boundary institution – informing funding processes, trialling of new ideas and monitoring of the Gulf's governance structure.	FISHERIES TO EBM: Government's Blue Wave strategy (2038). Supports a truly blue economy and Kaitiaki Māori.
2029 Massive scale-up of shellfish restoration.		Bio-reactors begin digesting microplastics.
Marine Protected Areas and Spatial Planning Act (2030).		
Legal personhood of the Hauraki Gulf (2030).		
2030 Marine mud brick market opens up.		

provided a significant carbon sequestration opportunity. Nevertheless, storm surge and tidal inundation transformed our transport network. Many roads became passable only at certain states of the tide and there was an increasing use of coastal electric/hydrogen ferries and water taxis to connect coastal populations. The overriding social consequence of these climate shocks was a realisation that living with nature and adaptation to environmental change was the necessary new normal. This also contributed to the inevitable shift in economic models that drove society towards enhancing social-ecological capacity to adapt to change and a move away from treating uncertainty in resource supply as a justification for rapid exploitation.

Critical to enhancing the resilience of the Gulf and its capacity to respond to these climate shocks was the prescient action of Kaitiaki Māori. In the first quarter of the 21st century, many iwi of the Gulf were looking to restore their rohe moana resulting in a network of rāhui and conservation reserves which increased seafood production across the entire Gulf. Along with this restoration of nature came a cultural regeneration. These changes effectively removed destructive fishing practices from the Gulf and instead practices were adopted that minimised

ecological footprints. Fishing rapidly came to be considered as part of a holistic ecosystem-based management approach which focused on building ecosystem resilience and considered all environmental stressors, both natural and those caused by human activities. By 2050 actions to restore the Gulf had generated significant economic returns for all. Policing of the various management measures by Kaitiaki Māori was funded from the central Government's Blue Wave strategy, and the restoration of the Gulf's scallop beds was supported by the development of an artisanal diver fishery producing premium product for high end restaurants in Shanghai, Paris, San Francisco and McMurdo. The spill over benefits of protected areas both enhanced and stabilised fish stocks throughout the Gulf. These activities appeared to have strong positive feedback on the mana of the Gulf and its people, spurring many on to further education and realising the opportunity in restorative economies. In 2050, Aotearoa New Zealand was considered a world leader in ocean governance and ocean strategies for climate change adaptation. This marked a cultural reset for the Gulf with benefits to all due to its long-term vision, reliance on the principles of ecosystem dynamics, recognition of the critical role of networks and connections, and innovative and adaptive management.

This highlights how positive action, inclusive behaviour, and a focus on responsibility over rights were powerful agents of change.

A sense of awareness, wonder and exploration of the Gulf became evident across society with the growing access to new technologies, virtual and augmented reality, personal underwater drones and submarines. This allowed exploration and learning opportunities across society. Building up engagement in the Gulf's future through citizen science and restorative tourism projects complimented the monitoring of the state of the Gulf, which grew from a few oceanographic observations and harbour and marine reserve monitoring programs to its current state of real-time data capture and interpretation in the context of activities and trends. This was achieved by employing dedicated microsattellites, sentinel sites, and autonomous aerial and underwater drones. The science reforms of 2025 were critical in overcoming problems in knowledge generation, transfer, and application to environmental solutions. These reforms also were critical to realistically supporting and funding iwi to build capacity in ocean management. The development of rigorous and internationally credible review processes, conducted by experts, and the empowering

of societal partnerships and support for implementation of new information and technologies, led to the rapid advancement, responsiveness, and accountability of management agencies. Central to this transition was the nationally coordinated ocean taskforce and development of the National Ocean Advisory Council, which acted as a trusted independent boundary institution to both inform funding processes and the implementation and trialling of new ideas and new forms of engagement across society.



Funding from carbon offsets drives the expanding development of wetlands.

2080 50% of seafloor restored.

Blue Brands international financing accounting practice.

The mainland becomes predator free enabling large scale seabird restoration projects.

Sediment markets develop for Sea Level Rise mitigation.

UN carbon negative goal reached.

Active restoration stops. 75% of seafloor restored.

Gulf scores 80% Mauri indicators.

No species in the Gulf are threatened with functional extinction.

Aotearoa New Zealand receives the UN Large Ocean States Leadership Award in ocean governance and ocean strategies for climate change.

Aquaculture infrastructure begins to support integrated living.



Fisheries and other economic activities in the Gulf successfully operating effectively to meet Maximum Carbon Sequestration.

The HGMP digital twin is being used by multiple parties to inform debate, level inequity and target actions for the Gulf's continued changing but healthy future.

Advancements in resurrection biology bring populations of Miuweka / New Zealand merganser and Waitaha penguin back to the Gulf.



Autonomous underwater drone gathering data

2023

A struggling ecosystem we live off

Trends document the decline in biodiversity and ecosystem services due our activities

Pollution

Extraction

Displacement

Climate impacts



People responsible for managing ocean impacts and developing blue economic futures frustrated. Meetings and reports are not leading to positive action to effect change.



Diverse values lead to contest, obfuscation, inaction and not recognising how the Gulf sustains us. Co-ordinated marine management is not prioritised.

Climate regulation

Oxygen production

Recreation

Food

Nutrient cycling



Institutions do not collaborate on restorative actions to positively impact the environment



Economic activity that helps the environment and communities is not fostered



Investors are not encouraged to support projects that positively impact the environment

2173

Thriving ecosystem that we all live in

An informed public values the ecosystem services provided by the ocean



People responsible for managing ocean impacts and blue economies co-ordinated across institutions think, long-term and respect diverse values.

All ecosystem impacts due to our activities are managed, services are restored

Climate regulation

Oxygen production

Recreation

Food

Nutrient cycling

Wonder

Culture

Partnership and shared vision



The benefits of living with, not off, the Gulf are included in planning



Focus is on the restoring ecosystem functions while staying alert for emerging problems



Use of ocean science and the right tools to reduce conflict



Use of Māori knowledge to create a better future



Back from the Future

The Gulf is a large, diverse seascape and we continue to engage with and learn from it in many ways. If we can navigate choices and circumstances to a future close to the one we have imagined. Here, our great-great-grandchildren will be more likely to see clean beaches, clear water, abundant kaimoana, strong local Communities, and economies that benefit people and nature.

We all need to be good ancestors, ones worth remembering. The next 150 years, like the last, will be a time of major social and environmental change. There are many possible paths we can take, but after the 'summer' of 2023 it is clear that we need focus on enhancing resilience and preparing for change. If we cannot transform our focus, we are likely to find ourselves in a business-as-usual zombie apocalypse scenario. Transformative change to address global environmental crises relies on the ability of people and institutions to recognise and resolve the diversity values of nature and nature's contributions to people. This requires supporting long-term actions to build resilience and learning how to live well on a planet with finite resources. If our current environmental practice continues to improve, we can be more confident that we will be leaving a positive environmental legacy to future generations.

Frustration with the lack of progress in restoring the Gulf belies the depth of concern and the realisation that we have no choice but to try.

– Prof Simon Thrush (University of Auckland)
& Prof Conrad Pilditch (University of Waikato)



STET composited artificial intelligence generated imagery for this report from multiple models. They would like to acknowledge the unknown number of artists and photographers whose work trained the models and the developers who made the software open source. Their work has greatly increased the quality and quantity of visuals in this report.