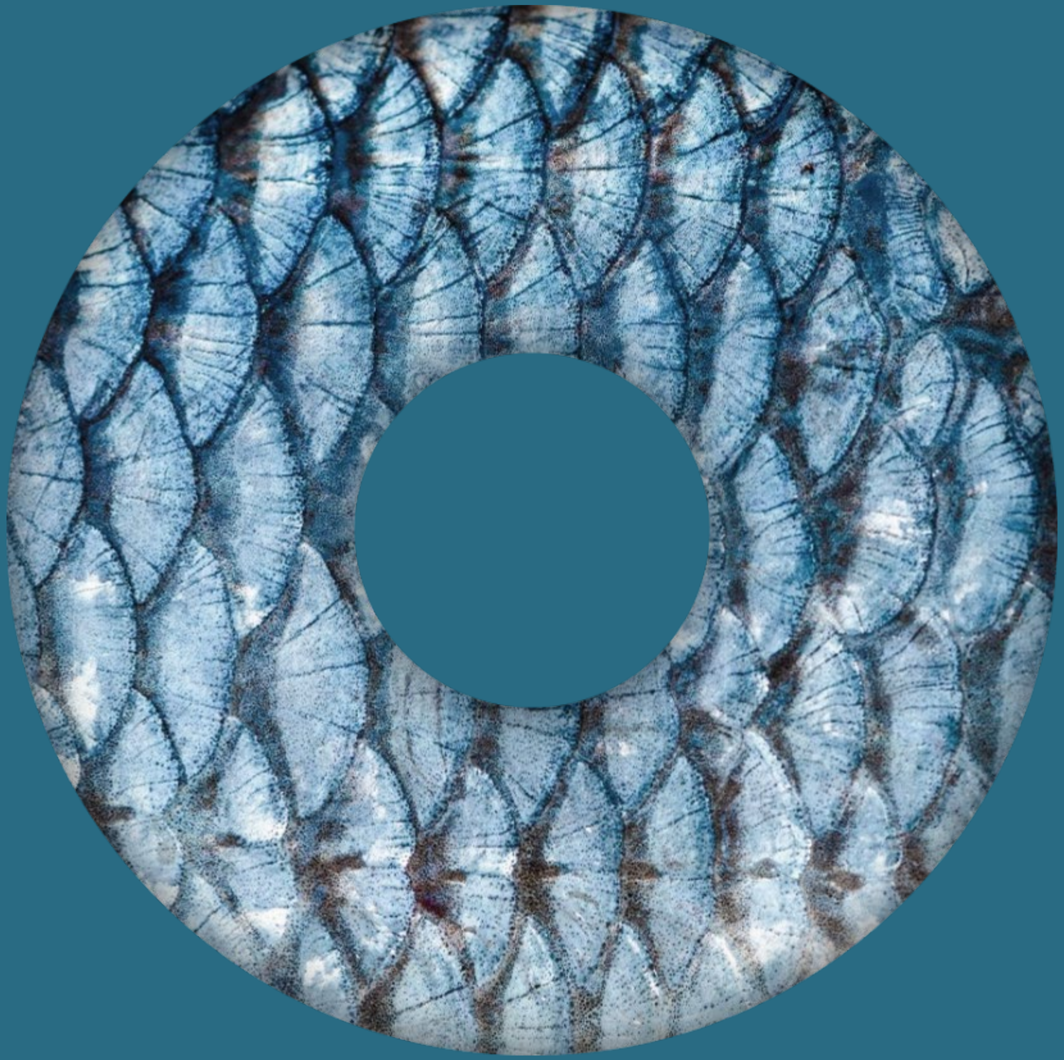


The Aotearoa Circle

Mā te Kaitiakitanga ko te Tōnuitanga
Prosperity Through Guardianship

Seafood Sector Integrated Scenarios

KPMG

Mihi

Tukua te wairua, māna e whakahaumanu, e whakaroa te rerehua o Aotearoa mō ngā uri whakaheke.

Hei arataki i ā mātou mahi me tā mātou whāinga matua kia hono ai te ira tangata ki te taiao.

Tōia mai rā te kaha me te ngākau pono kia hatutū tahi ai tātou ki ngā āwhā arahi kia ora aka te ao tukupū.

Kia poipoia mō āke tonu atu.

Whakamaua kia tina, Hui e! Tāiki e

Greeting

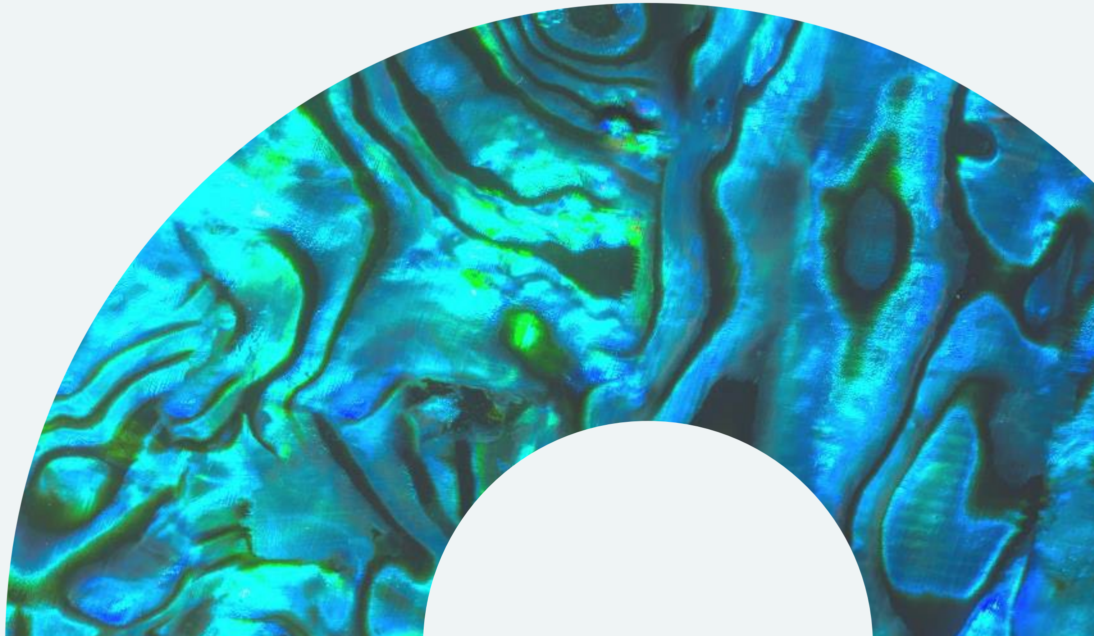
Release the spirit, to restore Aotearoa's beauty for future generations.

To guide our work and purpose in connecting people with the environment.

Let us draw in strength and integrity to meet the headwinds of today and lead for a better planet.

Ensuring it is nurtured forever.

United we affirm!



Foreword

Aotearoa New Zealand's seafood sector is a living expression of our connection to the ocean and our collective identity. With a legacy of resilience and innovation, the sector has consistently adapted to change, ensuring it remains a vital contributor to both our economy and our way of life.

Today, that legacy is being tested in new ways. Climate change is a defining force – accelerating and intersecting with growing expectations for action on nature, biodiversity and cultural inclusion. The challenges are not linear, nor are the policy and market pressures facing fisheries and aquaculture and the required response.

This report builds on the strong foundations laid in 2020 when The Aotearoa Circle and KPMG developed the first climate sector scenarios for the seafood sector. Since then, through the leadership of the Seafood Sector Climate Adaptation Implementation Group, the work has evolved in response to new regulatory standards and deeper understanding of sector interdependencies.

The result is a new generation of Integrated Scenarios – strategic tools aligned with the External Reporting Board (XRB)'s NZ Climate Standards (NZCS), and designed to support risk assessment, policy development, and long-term adaptation. These scenarios consider three futures: one aligned with 1.5°C of warming, one exceeding 3°C, and a third contextually relevant scenario. Critically, they also weave in climate, nature, and Te Ao Māori – reflecting a more holistic view of the sector's current state and future opportunities.

Incorporating Māori leadership and mātauranga Māori is more than a principle – it's a proven pathway to better outcomes. Research shows that co-designing environmental solutions with iwi and hapū leads to more locally grounded strategies, stronger community support, and healthier ecosystems. These approaches not only build resilience, they generate stronger returns and long-term value.

This report is a call to action – and a testament to leadership already underway. The seafood sector has an opportunity to shape a more resilient, nature-positive, and culturally grounded future – for our oceans, our economy and future generations.

Thank you to everyone who contributed to the development of this work. Your insight, dedication, and mahi are deeply appreciated.

Vicki Watson
CEO, The Aotearoa Circle

Why integrated scenarios?

The value of climate-nature integration to the seafood sector

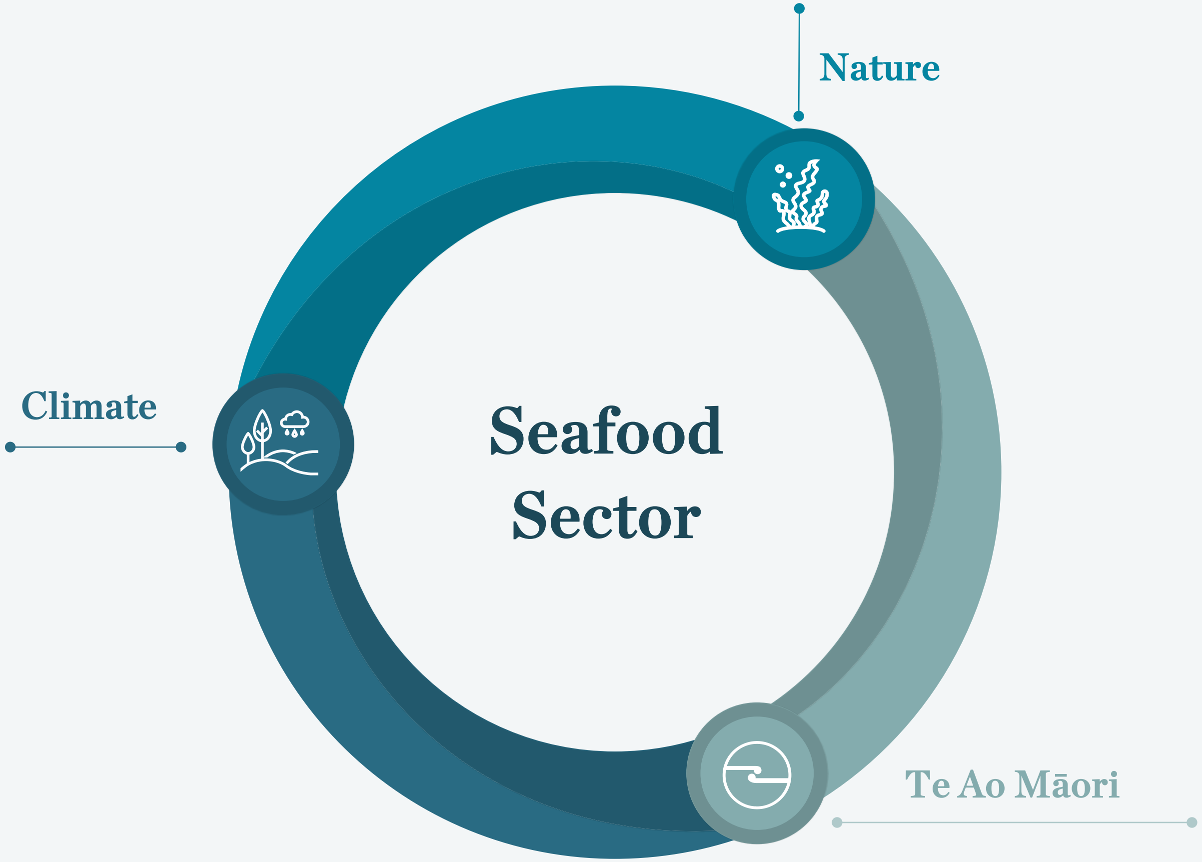
Climate and nature are fundamentally interrelated.

Nature, including marine ecology, ocean biogeochemistry, food webs and species interactions, is the backbone of the seafood sector. At the same time, the seafood sector is at the frontline of a joint climate and nature crisis. The effects of climate change cannot truly be understood in isolation from nature, especially in a marine environment.

Integration increases the value of scenarios as a strategic tool.

The strategic advantage of a pro-active approach to climate-nature integration

The climate-nature nexus is gaining recognition with standard-setters worldwide, necessitating an evolution of current standards and regulations to incorporate nature. Proactively integrating a nature lens into climate scenarios will better position the seafood sector by extending the lifespan of scenarios and reducing the frequency of required updates.



Embracing Ao Māori perspectives

Integrating Te Ao Māori with climate and nature perspectives creates a more holistic and culturally grounded framework for the sector's resilience planning. Informed by Māori perspectives, these integrated scenarios offer deeper insights into the complex relationships between people, place and natural resources. Integrating indigenous perspectives throughout the scenario process allowed for more meaningful engagement with Māori, opened pathways for more collaborative and culturally appropriate adaptation responses, and strengthened relationships with iwi/Māori.

Contents

Executive Summary

Executive summary

Overview

This report presents three distinct futures for Aotearoa New Zealand's seafood sector through 2050 and beyond, examining how climate change, nature and Māori considerations could interact to shape different challenging, but plausible futures. These scenarios are not predictions but are intended as tools to inform strategic planning and risk management in an increasingly uncertain, volatile, and ambiguous environment for government agencies, industry stakeholders, and iwi/Māori.

Key Findings

Across all scenarios, climate change emerges as the defining force reshaping Aotearoa New Zealand's seafood sector, but with varying intensity and response strategies:

1. **Climate impacts are unavoidable and transformative:** In all scenarios, warming waters drive species migration, create new disease pressures, and alter the fundamental ecological dynamics of Aotearoa New Zealand's marine territories. The sector must adapt, though the levels of uncertainty, pace and nature of this adaptation vary significantly.
2. **Nature and climate are inseparable:** The scenarios reinforce the opportunity for nature-positive approaches to create climate resilience, while indicating climate-only strategies that neglect wider ecological health could ultimately undermine long-term viability.
3. **Māori participation shapes outcomes:** The degree of Māori leadership and integration of mātauranga Māori significantly influences the sector's ecological and social resilience, with stronger partnerships yielding more sustainable and equitable results.
4. **Early, coordinated action yields positive outcomes:** The *Īnanga* Scenario demonstrates how proactive adaptation, collaborative governance, and strategic investment in innovation can transform climate challenges into opportunities for sustainable growth and ecological regeneration.
5. **Fragmented responses create winners and losers:** The *Pātiki* Scenario shows how uncoordinated adaptation leads to a two-tier industry where large operators thrive while smaller players, coastal communities, and many Māori interests are marginalised.
6. **Delayed action increases costs and reduces options:** The *Tāmure* Scenario illustrates how reactive responses to severe climate impacts result in higher adaptation costs, more extensive ecological damage, and diminished economic returns throughout the sector.

Strategic Implications

Competitive advantage: Aotearoa New Zealand can establish global leadership in sustainable seafood by embracing nature-positive practices and indigenous knowledge systems.

Nature integration: Nature-positive approaches create commercial advantages through premium pricing, reduced operational risks, and improved market access. Treating ecosystem health as core business delivers both ecological resilience and economic benefits.

Collaborative models: Collaborative models that meaningfully integrate Māori perspectives and prioritise ecosystem health create more resilient systems than extraction-focused management and enhance commercial opportunities.

Technology pathways: Balanced development of offshore, land-based, and modified traditional approaches creates a more adaptable sector than over-reliance on any single solution.

Policy Integration: Early engagement with regulators enables the creation of policies that integrate climate resilience, biodiversity protection, and indigenous rights alongside economic sustainability.

Social considerations: Proactive support for smaller operators and coastal communities maintains the sector's social license and increases efficacy.

Executive summary

Scenario Synopsis

Tāmure
High Temperature, Responsive

Accelerated climate change forces reactive, rather than strategic responses. By 2040, the seafood sector faces multiple crises as species exceed thermal thresholds, extreme weather disrupts operations, and ecosystems approach collapse. The government implements rapid regulatory reform, but many proactive opportunities have been lost. By 2050, offshore aquaculture, land-based systems, and deep-water fishing dominate as coastal areas become increasingly unviable. Māori interests are severely compromised, with governance structures failing to uphold Te Tiriti principles. By 2100, marine protein has become scarce and valuable, with the sector focused on managing decline rather than growth.

Pātiki
Low Temperature, Divergent

Despite similar climate trajectories to Tāmure, adaptation occurs unevenly in Pātiki, creating stark divisions within the sector. Well-capitalised operators successfully transition to new technologies and locations, while smaller players struggle. By 2050, the industry has consolidated around fewer, larger entities with diminished connections to coastal communities. Māori interests face significant decline in representation, with traditional knowledge systems marginalised despite their potential value for sustainable management. Nature considerations remain secondary to economic imperatives, limiting long-term resilience.

Īnanga
Low Temperature, Delayed Transition

In this scenario, warming occurs more gradually, allowing for a managed transition. The seafood sector successfully adapts through collaborative governance, integration of mātauranga Māori, and strategic investment in climate-resilient technologies. By 2050, Aotearoa New Zealand emerges as a global leader in sustainable seafood production where ecological health and economic prosperity advance together. The industry transforms from primarily extractive to regenerative operations, with aquaculture expansion, habitat restoration, and nature-positive practices becoming standard.

Scenario Design Overview

Tāmure
High temperature, responsive

SSP 3, RCP 7.0

Aotearoa New Zealand prioritises an adaptation strategy to build climate resilience. Global emissions reduction policies and investment falter, and current socio-economic trends continue, resulting in +2.1°C global warming by 2050 and more than +3.9°C by 2100 in a 'hot house world'.

Global Warming
2050: +2.1°C
2100: +3.9°C

Aotearoa New Zealand Warming
2050: +1.3°C
2100: +3.1°C

Nature-related assumptions

Changes to the state of nature	*Severe and accelerating degradation of marine ecosystems continues*
Changes in ecosystem service provision	*Rapid and widespread disruption*
Speed of nature change	*Very rapid, crashing speeds*

Te Ao Māori assumptions

Mātauranga Māori recognition	*Restricted recognition*
Te Tiriti o Waitangi integration	*Restricted integration*
Tino rangatiratanga	*Restricted enablement of tino rangatiratanga*

Pātiki
Low temperature, divergent

SSP 4, RCP 4.5

Global decarbonisation efforts are fragmented, but Aotearoa New Zealand leads. Varied progress towards international emission reductions reflect disparities in resources and capabilities. Nationally, policy and action mitigate the growth of transition risk, however less conducive international conditions slow some efforts leading to +2.0°C global warming by 2050, and +2.7°C by 2100.

Global Warming
2050: +2.0°C
2100: +2.7°C

Aotearoa New Zealand Warming
2050: +1.0°C
2100: +1.6°C

Nature-related assumptions

Changes to the state of nature	*Severe but geographically uneven degradation of marine ecosystems*
Changes in ecosystem service provision	*Variable disruption, unpredictable patterns*
Speed of nature change	*Variable speed with occasional sudden collapses*

Te Ao Māori assumptions

Mātauranga Māori recognition	*Poor acknowledgement*
Te Tiriti o Waitangi integration	*Poor integration*
Tino rangatiratanga	*Poor enablement of tino rangatiratanga*

Īnanga
Low temperature, delayed transition

SSP 1, RCP 2.6

Meaningful global action on decarbonisation is delayed until the early 2030s, followed by a sudden and globally uncoordinated economic transformation. Extensive and stringent government intervention both in Aotearoa New Zealand and overseas limits global warming to +1.7°C by 2100, but with higher socio-economic costs.

Global Warming
2050: +1.7°C
2100: +1.8°C

Aotearoa New Zealand Warming
2050: +0.75°C
2100: +0.8°C

Nature-related assumptions

Changes to the state of nature	*Low to moderate degradation of marine ecosystems*
Changes in ecosystem service provision	*Maintained or slow decline*
Speed of nature change	*Slower incremental change (some positive)*

Te Ao Māori assumptions

Mātauranga Māori recognition	*Significant recognition*
Te Tiriti o Waitangi integration	*Significant integration*
Tino rangatiratanga	*Strong enablement of tino rangatiratanga*

For more details on these scenarios and the architecture that underpins them, see Appendix A

Introduction

Introduction

Globally, seafood production has reached unprecedented heights.[1] However, this growth unfolds in the shadow of climate change's increasing impacts and the accelerating nature and biodiversity crisis. These environmental challenges highlight the necessity for collaborative planning, focused on the long-term resilience and sustainability of the seafood sector.

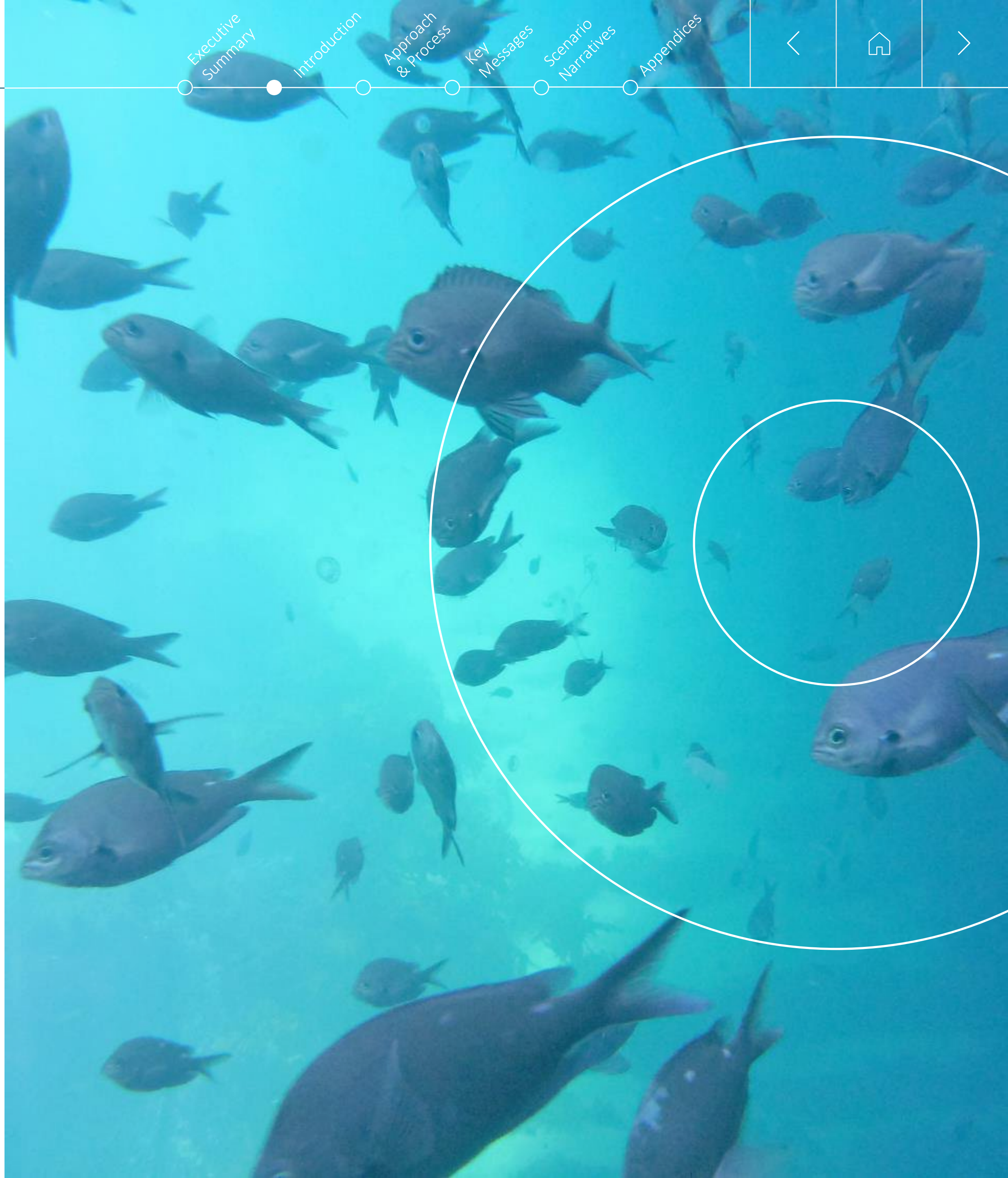
Context

In 2020, The Aotearoa Circle and KPMG worked together with the seafood sector ('the sector') to deliver a first iteration of climate-related scenarios for the sector.[2] Created prior to the introduction of the Aotearoa New Zealand Climate Standards (NZCS), the aim of the original sector scenarios was to inform the sector's decision-making and transition planning in light of climate-related physical and transition risks. Subsequently, these scenarios helped to inform the NZCS, through which scenario analysis became mandatory for defined 'climate reporting entities' (CREs).

Why update the original sector scenarios?

The current NZCS framework requires CREs to assess their climate-related risks and opportunities using "at a minimum, a 1.5°C climate-related scenario, a 3°C or greater climate-related scenario, and a third climate-related scenario".[3] Therefore, to ensure that CREs can conduct NZCS-aligned scenario analysis, it was necessary to introduce a third scenario, and a 1.5°C-aligned scenario. Additionally, to stay ahead of emerging global trends, the updated seafood sector scenarios integrate climate, nature, and Te Ao Māori (indigenous Māori worldview) considerations to further strengthen resilience building and adaptation measures. These updated seafood sector scenarios are referred to as **'Integrated Scenarios'**.

[1] FAO, (2024). Global fisheries and aquaculture production reaches a new record high
[2] The Aotearoa Circle & KPMG, (2020). Climate-related risk scenarios for the 2050s
[3] XRB, (2022). Aotearoa New Zealand Climate Standard 1



‘Climate-related’ and ‘integrated’ scenarios

The External Reporting Board (XRB) defines a ‘climate-related’ scenario as:

“A plausible, challenging description of how the future may develop based on a coherent and internally consistent set of assumptions about key driving forces and relationships covering both physical and transition risks in an integrated manner.” [1]

The Financial Markets Authority also notes that:

“To be challenging, assumptions should confront conventional wisdom and simplistic understandings of today’s environment. When thinking about the major sources of uncertainty, scenarios should explore assumptions that will significantly alter the basis for business-as-usual thinking.” [2]

These definitions have been used to inform the development and content of these integrated scenarios.

What these scenarios are not:

- *These scenarios are not rigid predictions,* nor do they assume greater likelihood of any one outcome. They are designed to prompt thought and conversation about how uncertain topics (such as climate change and nature loss) could affect the future in which organisations and businesses would need to operate.
- *These scenarios are not a roadmap* for transition or adaptation, nor a policy target. They are designed to explore the interplay between different uncertainties as the basis for a scenario analysis process, and should not be expected to deliver a step-by-step transition plan.

[1] XRB, (2022). Fact sheet: Scenario analysis and climate-related disclosures
[2] FMA, (2023). Information sheet: Climate-related disclosures – Scenario analysis

Key concepts & acronyms

Baseline forces	The drivers that are most influential and somewhat certain. Therefore, their influence can be expected to remain reasonably consistent, and represent trends and dynamics.[1]
Biodiversity	The variability among living organisms from all sources, including amongst other things, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.[2]
Climate Change	Climate change refers to a change in the state of the climate that can be identified (e.g. by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing, such as modulations of solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use.[3]
Critical Uncertainties	The driving forces that are most influential and most uncertain. These will define the range of scenarios required to explore the potential futures.[1]
Drivers	Broad scale, external factors that may affect the outcomes of the focal question(s).[1]
Ecosystem Services	The contributions of ecosystems to the benefits that are used in economic and other human activity.[2]
Nature	The natural world, with an emphasis on the diversity of living organisms (including people) and their interactions among themselves and with their environment.[2]
Scenario Analysis	A process for systematically exploring the potential impacts, affecting the entity, of the range of plausible futures described under the climate-related scenarios. While acknowledging the uncertainty of these futures, this process allows entities to better understand how climate-related risks and opportunities may impact their strategy and business model over time.[4]
Scenario Narratives	A plausible propagation of natural, macroeconomic, socio-economic and political factors occurring during each time frame of each scenario.[4]
Te Ao Māori	Māori worldview. Te Ao Māori emphasises the importance of relationships between nature and people. It is a holistic worldview that focuses on interconnections and is grounded in tikanga customary values and lore and mātauranga knowledge. Practices, values and principles from Te Ao Māori have been developed around marae to bring ancestors and communities together in one place in deep connection with whenua and taiao environment.[5]
Recirculating Aquaculture Systems	Recirculating aquaculture systems are self-contained, land-based production technology for aquatic organisms and high-value finfish.[6]
Exclusive Economic Zone	Aotearoa New Zealand's Exclusive Economic Zone (EEZ) is the area of sea and seabed that extends from 12 to 200 nautical miles offshore. It is the fifth largest EEZ (approximately 430 million hectares) in the world, about 15 times our land mass.[7]

AI	Artificial Intelligence
CCC	He Pou A Rangi, Aotearoa New Zealand's Climate Change Commission
CREs	Climate Reporting Entities
EEZ	Exclusive Economic Zone
IEA	International Energy Agency
NGO	Non-government Organisation
NZCS	Aotearoa New Zealand Climate Standards
RCP	Representative Concentration Pathway
SSP	Shared Socio-economic Pathway
TCFD	Taskforce on Climate-related Financial Disclosures
TNFD	Taskforce on Nature-related Financial Disclosures
XRB	External Reporting Board

[1] XRB, (2023). Staff Guidance Sector Scenario Development.
[2] TNFD, (2023). Glossary of Key Terms
[3] IPCC, (2018). Annex 1: Glossary
[4] XRB, (2022). Scenario Analysis and Climate-related Disclosure
[5] MBIE, (2023.). A Guide to Just Transitions
[6] NIWA, (n.d.). Recirculating aquaculture systems
[7] MfE, (2007). Improving Regulation of Environmental Effects in New Zealand's EEZ

Approach & Process

Approach & Process

Workshop-driven approach

Our approach was centred around collaborative stakeholder engagement. The project consisted of four phases: **Project Initiation, Drivers & Materiality, Pathways & Outcomes, and Scenario Narratives & Report.**

Phases 1 to 3 were workshop-driven. During the workshops, participants shared their insights, which provided the basis for building the scenario narratives. Phase 4 involved desk based feedback and review of the draft Scenario Narratives and this Report.

Framework for driver identification

During Phase 2, the PESTTLE framework was employed to ensure the holistic selection of drivers. The framework was adapted to suit the context of this project and the categories included: **Political, Environmental (including nature), Social, Te Ao Māori, Technological, Legal, and Economic.**

Identifying critical uncertainties

During Phase 2, following the broad identification of drivers, these were plotted on an influence-uncertainty matrix to determine the 'critical uncertainties' that would be explored in the 'Pathways & Outcomes' workshops (Phase 3) and, ultimately, our scenario narratives.

Please see Appendix B for the outcome of this exercise.

Pathways & Outcomes

This involved a systematic assessment of how the critical uncertainties could evolve under each scenario to produce various outcomes across the time horizons. This assessment formed the basis of the final scenario narratives.

	01 Project Initiation	02 Drivers & Materiality	03 Pathways & Outcomes	04 Scenario Narratives & Report
High-level process	*Kick-off workshop* **Purpose:** Collaboratively make scenario design decisions and develop a comprehensive project plan.	*Drivers & materiality workshop* **Purpose:** Identify the drivers across PESTTLE categories that plausibly, durably and materially influence Aotearoa New Zealand's Seafood sector.	*Pathways & outcomes workshop* **Purpose:** Understand how the drivers identified as 'critical uncertainties' may evolve under each of our three scenarios across time horizons.	*Scenarios and final report review* **Purpose:** To generate draft and final scenario narratives and report
Nature	• Identify local data and parameters which will underpin scenario narratives. • Establish baseline knowledge (Ao Māori, climate, nature). • Establish nature-related 'architecture' of scenarios.	• Articulate nature-related drivers under the 'E –Environmental' category of PESTTLE framework. • Integrate taiao lens to consider the interconnected Māori worldview where appropriate.	• Explore and understand how the 'E' drivers evolve under different scenarios. • Consider interactions between climate and nature considerations.	• Articulate how nature considerations change under different scenarios and time horizons in the scenario narratives.
Te Ao Māori	• Ensure integration of Māori knowledge experts onto to working group • Establish baseline knowledge (Ao Māori, climate, nature) • Establish Te Ao Māori 'architecture' of scenarios.	• Include an extra 'T' in PESTTLE framework for Te Ao Māori which includes Tiriti, mātauranga, and taiao lens (and others as advised). • Additional wānanga with Māori representatives.	• Explore and understand how the 'T' drivers evolve under different scenarios. • Additional wānanga with Māori representatives.	• Utilise Te Ao Māori 'architecture' to probe narratives more deeply • Additional wānanga with Māori representatives.

Scenario Design

A key step in the scenario narrative development process involved the collective agreement on various scenario design elements. These elements are detailed in the diagram opposite and encompass:

- The focal question;
- Geographic scope;
- Time horizons;
- System model;
- Scenario architecture; and
- Key parameters.

Out of scope

Through the scenario design process, the following aspects were considered to fall outside of the scope of the project:

1. Entity level assessment of risks and opportunities: It is expected that individual entities will need to tailor sector-level scenarios to the entity level to address their specific needs and disclosure requirements, where applicable.
2. Land-based aquaculture.

Scenario design

Focal Question

How could changes in climate, nature and Māori considerations affect Aotearoa New Zealand's seafood sector? What should we do, and when?

Geographic scope

Aotearoa New Zealand's Exclusive Economic Zone (EEZ).

Time horizons

Short term (2025 – 2030); medium term (2031 – 2040); long term (2041 – 2050); and exploratory longer term (2080-2100) for certain scenarios and drivers.

System model

Focused on fishing (deep sea & inshore), and marine aquaculture.

Scenario architecture

Outlined in the table below. For a full description, please see Appendix A.

Scenario	Short term 2025-2030	Medium term 2031-2040	Long term 2041-2050	Exploratory longer term 2080-2100
Īnanga	SSP 1 RCP 2.6	SSP 1 RCP 2.6	SSP 1 RCP 2.6	Nature & Te Ao Māori only – Primarily RCP 2.6
Pātiki	SSP 4 RCP 4.5	SSP 4 RCP 4.5	SSP 4 RCP 4.5	*N/A*
Tāmure	SSP 3 RCP 7.0	SSP 3 RCP 7.0	SSP 3 RCP 7.0	Nature & Te Ao Māori only – Primarily RCP 8.5

Key parameters

A combination of quantitative and qualitative parameters, including climate, nature, Ao Māori, and socio-economic parameters. For a full description, please see Appendix A.

Participants

How these scenarios were developed

Aotearoa New Zealand's seafood sector 'integrated scenarios' were convened by The Aotearoa Circle with KPMG New Zealand acting as the secretariat. The project was led by representatives from 10 organisations covering various elements of the seafood sector, who formed the 'Core Working Group' and 'Advisory Group'.

Scenario design decisions and narrative developments took place during a series of workshops from December 2024 to May 2025 with these groups.

Seafood sector scenarios working group members:

Core Working Group

Core participating organisations and individuals who attended workshops, made material decisions about the scenarios, and were responsible for socialising outputs and canvassing views from key stakeholders within their organisations.

Moana New Zealand	Michelle Cherrington
New Zealand King Salmon	Katie Bennett & Áine O'Neill
Sanford	Phillipa Avis & Shruti Suvarna
Sealord	Stuart Yorston & Charles Heaphy
Te Ohu Kaimoana	Kayla Martin & Kylie Grigg
Ngāi Tahu Holdings	Katy Glenie & Dean Fraser

Advisory Group

Participants in workshops, with the opportunity to provide feedback on these to support the Core Working Group's thinking.

Aquaculture New Zealand	Dave Taylor
Cawthron Institute	Jane Symonds
Ministry for Primary Industries | Fisheries New Zealand	Megan Linwood
NIWA	Vonda Cummings
Independent Seafood Sector Expert	Peter Longdill

Key Messages

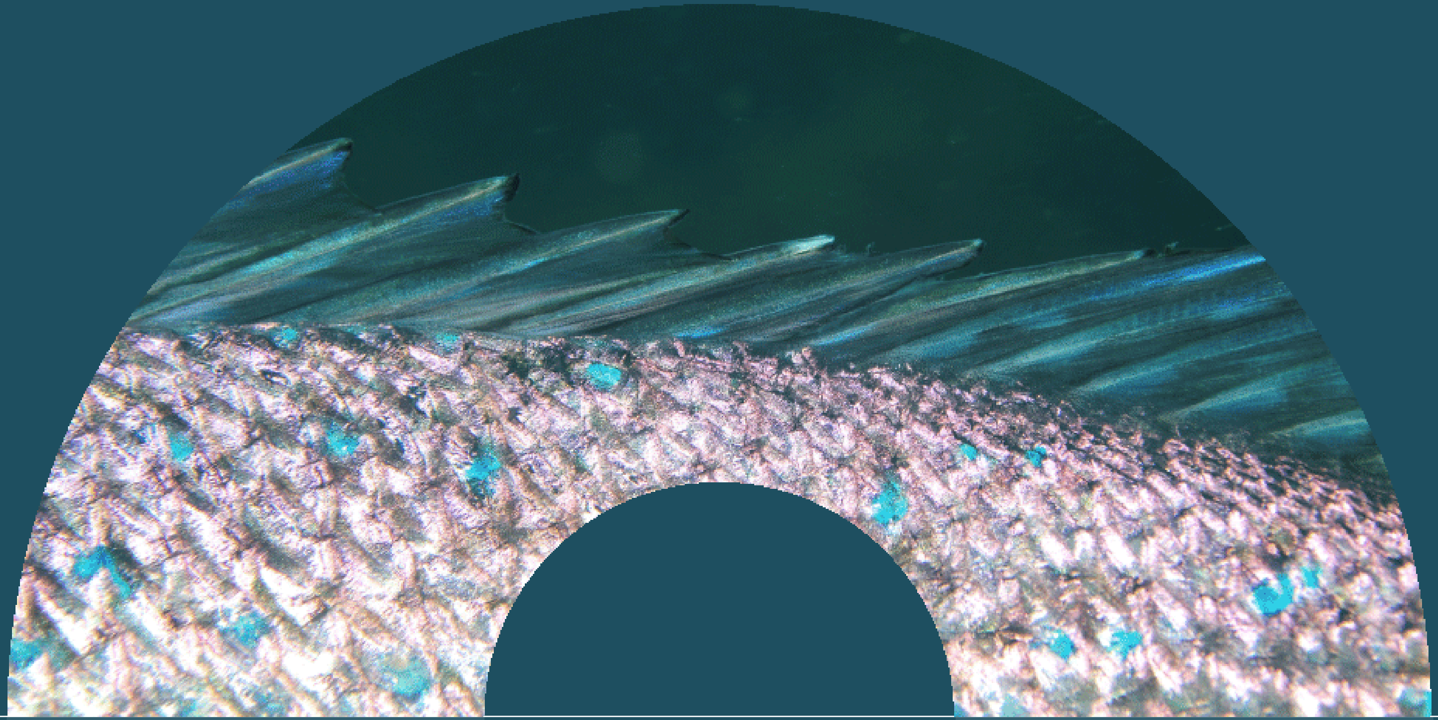
Key messages

	Tāmure: *High Temperature, Responsive*	Pātiki: *Low Temperature, Divergent*	Īnanga: *Low Temperature, Delayed Transition*
General	Policy shifts from minimal support for sustainable technologies to active incentivisation of alternative fuels as climate impacts intensify, ultimately prioritising survival as consumer preferences favour low-carbon protein sources.	The seafood sector transforms from facing fragmented climate ambition and minimal government support to developing a cohesive food and provenance strategy that positions Aotearoa New Zealand in global markets. This ultimately creates a permanently stratified sector, where larger, internationally-connected businesses thrive while smaller operators struggle to adapt or exist entirely.	The seafood sector transforms from recognising climate vulnerability to implementing proactive strategies, becoming a global leader in climate-responsive marine management that attracts investment, commands premium prices, and contributes significantly to Aotearoa New Zealand's economy.
Nature	Marine ecosystems deteriorate, from early species migration to habitat fragmentation. Eventually, critical ecological tipping points are reached leading to widespread collapse, with annual extinctions of threatened species despite increased conservation efforts.	Marine ecosystems degrade from early temperature stress and species movement, to severe disruption with visible impacts on commercially valuable species. This eventually leads to reactive biodiversity markets with geographically uneven recovery patterns, despite increasing economic valuation of ocean spaces for carbon and biodiversity offsets.	Nature considerations evolve from corporate reporting requirements to essential strategic frameworks, ultimately creating a net nature-positive economy where seafood operations enhance rather than deplete natural capital through integrated mountain-to-sea restoration approaches.
Māori	The relationship between Māori and the Crown deteriorates as the Te Tiriti partnership erodes, with mātauranga Māori and tikanga remaining marginalised despite proven effectiveness, ultimately creating a profound loss of cultural connection and environmental stewardship.	Māori involvement deteriorates from early economic and cultural challenges to profound erosion of Treaty settlement values, affecting iwi economies and ultimately leading to the displacement of traditional interests and weakened connections to historical fishing grounds. Only select iwi-led initiatives succeed through innovative adaptation in aquaculture and marine protected area management.	Māori leadership progresses from maintaining local customary practices to enabling commercial participation and co-management, eventually establishing globally recognised indigenous marine governance systems that merge traditional knowledge with innovation while achieving tino rangatiratanga.

Key messages

	Tāmure: *High Temperature, Responsive*	Pātiki: *Low Temperature, Divergent*	Īnanga: *Low Temperature, Delayed Transition*
Fishing	Fishing operations adapt by moving deeper and further south before completely reconfiguring their operational models, ultimately recognising that long-term viability depends on maintaining functional marine ecosystems rather than maximising extraction.	Fishing operations evolve from initial resistance to technological adoption and minimal decarbonisation, to southward relocation following species migration. This creates an industry with fewer, but larger, operations that utilise advanced technologies, but have a diminished connection to coastal communities. The quota management system undergoes substantial revision to accommodate new ecological realities.	Fishing methods advance from high-impact practices with basic monitoring to technology-enhanced precision systems, ultimately achieving near-zero environmental impact. Productivity is maintained through AI-enhanced targeting, fleet modernisation, and adaptive fisheries management.
Aquaculture	Aquaculture transitions from inshore operations to capital-intensive offshore ventures to completely land-based with recirculating aquaculture systems, creating a technological divide in the sector, benefitting well-resourced companies able to afford climate adaptation.	Aquaculture progresses from fragmented adaptation and early resilience breeding to strategic species selection and expanded infrastructure, including local feed mills. Eventually, climate-resilient species are established as an industry standard alongside emerging high-value lab-grown proteins, though benefits remain primarily concentrated among well-capitalised operations with international connections.	Aquaculture transforms from vulnerable coastal operations to climate-resilient systems through hatchery production, breeding programs and offshore expansion. Ultimately, these become integrated multi-trophic farms that actively restore marine ecosystems while producing premium seafood.

Scenario Narratives



Tāmure

High temperature, responsive

Short term 2025-2030

Medium term 2031-2040

Long term 2041-2050

Extension 2081-2100

Tāmure

SHORT TERM (2025-2030) **MEDIUM TERM** (2031-2040) **LONG TERM** (2041-2050) **EXTENSION** (2081-2100)

General

As the 2020s draw to a close, Aotearoa New Zealand's seafood sector finds itself operating in an increasingly challenging global environment. Rising nationalism and protectionist policies worldwide have created a landscape where countries prioritise domestic concerns over international cooperation. This global fragmentation manifests in mounting trade barriers, with Aotearoa New Zealand's seafood exports facing increasing tariffs and non-tariff obstacles as nations prioritise domestic production and food security.

With a domestic focus centred on cost of living pressures, environmental regulations are viewed as burdensome rather than protective. Under this political climate, the commercial seafood sector cautiously grows, though the gains are uneven - large operators with capital reserves fare better than smaller players struggling with rising operational costs.

This economic-first approach extends to climate policy, leading to minimal support for sustainable marine fuels or low-carbon technologies. Rather than investing in domestic solutions, Aotearoa New Zealand increasingly expects other countries to shoulder the burden of developing sustainable marine fuels, hoping to import technologies once they become cost-effective.

Paradoxically, as global trade networks fragment, growing populations and rising middle classes in developing nations drive increased demand for protein. This creates potential new markets for Aotearoa New Zealand's seafood sector, which positions itself as a crucial provider of high-quality and low carbon protein in an increasingly food-insecure world. Both wild-catch fisheries and aquaculture operations are emphasised as essential components of global nutrition security.

However, these market opportunities face repeated disruptions from unstable supply chains and fishery population collapse, as well as barriers introduced by environmental criticism and industry detractors.

By 2029, the combination of climate change impacts and diminished international cooperation creates fertile ground for new disease outbreaks, posing particular risks to shellfish and aquaculture operators.

When another pandemic emerges, weakened global coordination mechanisms prove inadequate, leading to prolonged supply chain disruptions that reinforce nationalist tendencies toward self-sufficiency.

Public perception of the sector remains relatively static during this period, cushioned by industry narratives emphasising jobs and food security. Yet beneath this surface stability, concerns begin to percolate as the impacts of unsustainable practices become more visible, shaping public opinion. As temperatures continue to rise, evidence of deteriorating marine ecosystems builds, but uncertainty about specific impacts provides convenient justification for inaction.

Nature

Marine ecosystems face mounting but largely unaddressed pressures as ocean temperatures rise and habitats transform. Whilst anecdotal evidence, preliminary research and fisheries operations suggest marine species are shifting their ranges southward, inaction continues.

Threatened species decline more rapidly than previously predicted, primarily due to climate-related impacts. The additional strain from unintended fishing activity further endangers already diminished populations of sea lions and dolphins from climate change.

Meanwhile, conservation efforts stagnate amid disagreements about efficacy and cost, creating a dangerous lag time before meaningful protection measures are implemented. Degradation of marine habitats continues as short-term economic imperatives consistently outweigh long-term ecosystem health.

The disconnect between deteriorating environmental conditions and policy responses widens, setting the stage for more severe ecological consequences in the coming decades. This disparity between short-term economic gain and long-term sustainability creates a precarious situation where apathy related to 'shifting baselines' prevents meaningful conservation action.

Māori

Commercial Māori fisheries, a significant component of the sector following the Māori Fisheries Settlement Acts, face mounting challenges as the relationship between iwi and the Crown deteriorates amid a shifting political landscape. The promised partnership embedded in Te Tiriti o Waitangi erodes as government agencies reassert centralised control over fisheries management, moving away from and dismantling co-management models developed in previous decades. Māori fisheries and aquaculture settlements become increasingly contentious, with several iwi turning to legal channels to address perceived Treaty breaches as economic pressures mount.

The application of mātauranga Māori and tikanga in fisheries management becomes increasingly marginalised despite their potential value for sustainable practices and excluded from decision making processes. While Western scientific methodologies dominate policy-making, traditional knowledge systems that could inform adaptation strategies, particularly for changing species distributions, remain largely untapped. Government documents occasionally reference these approaches, but meaningful integration into policy remains superficial, and insufficient funding for mātauranga-based research leaves valuable insights unrecognised.

At a local level, the exercise of kaitiakitanga continues to be upheld by hapū and iwi in coastal communities where Māori maintain strong connections to traditional fishing grounds.

However, these efforts remain fragmented in the absence of cohesive national support and encounters significant resistance when attempts are made to scale kaitiakitanga at a decision making level. Tensions intensify between kaitiaki and commercial operators as their approaches fundamentally diverge – kaitiakitanga emphasising the responsibilities of carrying and sharing intergenerational knowledge, and the sustainability of a healthy ecosystem, the other with a stronger focus on maximising extraction within legal limits. This conflict manifests in disputes over fishing grounds, harvest volumes, and operational timing in areas where customary and commercial activities overlap.

While communities strive to adapt to the pressures of climate change, the government's reluctance to incorporate indigenous perspectives into national policy frameworks leaves these tensions largely unresolved and local communities largely unsupported to respond to the climate crisis, further straining relationships between iwi, industry, and regulatory bodies.

Tāmure

Fishing

By 2028, fishing operations have adapted to changing fish distributions by moving deeper and further south. Some fishers discover new opportunities as certain species become more abundant in the waters of Aotearoa New Zealand, though these shifts create challenges for quota allocation and management.

Innovation in fishing technology stagnates due to limited investment and minimal regulatory pressure. While some larger companies experiment with modified gear designed to reduce seafloor impacts, adoption remains voluntary and inconsistent. Bycatch issues intensify as species ranges shift unpredictably, leading to increased incidental captures of both protected species and non-target commercial fish.

Observer coverage is reduced and is now insufficient to accurately quantify these impacts, creating data gaps that further complicate management efforts.

The fishing fleet itself continues to age, with most vessels operating with decades-old designs optimised for maximum catch rather than efficiency or environmental performance. Alternative fuels for fishing vessels remain largely at the pilot program stage, with traditional fossil fuel-powered boats dominating the fleet. The few hybrid or alternative fuel demonstration projects in operation are primarily publicly funded showcases rather than commercially viable models, reflecting the industry's reluctance to invest in significant fleet modernisation amid economic and regulatory uncertainty. Rising fuel costs push some smaller operators out of the industry, leading to further consolidation among larger companies with deeper financial reserves.

Aquaculture

Despite growing challenges, the government has redirected its priorities toward economic growth at almost any cost, implementing policies and aquaculture regulations to stimulate rapid expansion and boost short-term production, often favouring larger operators. Aquaculture operations begin expanding offshore to escape increasingly compromised coastal environments, pushed by terrestrial runoff, warming waters, and acidification. These offshore ventures require substantial capital investment, concentrating the industry among well-resourced companies and reducing opportunities for smaller-scale and community-based participation.

Innovation remains fragmented and opportunistic. While genomic advances show promise for creating more climate-resilient farmed species, insufficient funding and public scepticism hamper widespread implementation. Limited investment in recirculating aquaculture systems and alternative feed sources compounds the sector's vulnerability to climate stressors. Feed inputs for finfish farming face growing pressures as global wild fisheries decline, creating price volatility and supply uncertainties that particularly affect smaller operators.

The industry experiences growing tensions over freshwater access for salmon hatchery operations, with conflicts intensifying between aquaculture needs and other users. Disease risks escalate as warming waters create favourable conditions for pathogens, while invasive species introduce new biological threats to farm operations.

By 2030, the sector stands at a crossroads – expanding in response to growing protein demand while facing mounting climate and nature-related challenges and social license questions that threaten its long-term viability.

Tāmure

General

By the mid-2030s, the effects of climate change on Aotearoa New Zealand's marine environment become increasingly difficult to ignore. Ocean warming and acidification tangibly impact both wild fisheries and aquaculture operations. Social pressure mounts on the government to recognise these climate impacts, particularly as the fishing and aquaculture industry becomes more affected.

Extreme weather patterns dramatically increase operational costs through damaged equipment, lost fishing days, reduced productivity, and higher insurance premiums, while simultaneously decreasing harvest efficiency and creating cash flow challenges. Fuel costs climb as a result of vessels fishing farther offshore in search of commercially viable catches, while crew costs increase due to more demanding and dangerous working conditions. Insurance markets simultaneously restrict coverage availability for fishing vessels, aquaculture infrastructure, and seafood processing facilities in vulnerable zones, while substantially increasing premiums for remaining policies.

By the late 2030s, the marine transport sector begins seriously considering options for alternative fuels, driven by rising fossil fuel costs and growing market pressure. Alternative fuel-powered vessels enter commercial use, representing a technological breakthrough, but the supporting fuel supply chains remain critically underdeveloped, creating bottlenecks that limit widespread adoption.

Progress toward a sustainable fleet transition remains slow due to inadequate government support and infrastructure limitations. The government continues to focus primarily on economic returns, expecting the sector to provide its own science and research investment while offering minimal financial support. Significant pushback from traditional boat operators further hampers momentum for low-emission fleets, with established interests lobbying against regulatory changes that would accelerate the transition.

The resulting landscape features only a handful of early adopters of low-emission fuel vessels, primarily larger corporations with capital reserves to absorb the transition costs, while small-scale operators fall increasingly behind, unable to afford the substantial upfront investments required.

As climate impacts intensify globally, international trade agreements begin incorporating stricter environmental and emissions standards across many sectors, including seafood products, creating both barriers and opportunities for Aotearoa New Zealand exporters depending on their ability to document sustainable practices and low-carbon supply chains. As these challenges intensify, public scepticism about the industry's sustainability grows rapidly, resulting in inconsistent regulations and confusing labelling requirements across different markets, further complicating compliance for producers and creating consumer confusion. Despite these obstacles, some producers find new market opportunities by adapting quickly to changing conditions and investing in climate-resilient practices, creating potential wins in premium international markets that value demonstrated sustainability efforts.

Nature

The marine environment deteriorates steadily as multiple stressors compound and intensify. Nursery habitats for inshore species suffer from escalating land-based impacts, with sediment-laden runoff and forestry slash smothering critical spawning grounds. This habitat destruction is particularly severe for inshore species, where once-productive areas now lie buried under layers of terrestrial debris, dramatically reducing their ecological function and productivity.

As these habitats continue to decline, particularly those supporting key life cycle stages of commercial species, marine ecosystem fragmentation creates disconnected habitats for some species. This significantly reduces fisheries productivity and raises the cost of mitigating the risk of fisheries failure.

In this compromised environment, each incidental capture of protected species carries an increasingly significant impact on already-diminished populations, exacerbating conservation concerns.

Invasive species, facilitated by warming waters and increased shipping activities, introduce new diseases and disrupt long-established ecological relationships throughout marine ecosystems. Despite these visible negative outcomes prompting renewed social interest in coastal protection, initiatives to establish marine protected areas face growing resistance as food security concerns intensify among coastal communities and commercial stakeholders. The situation is further complicated by persistent global challenges from illegal, unreported, and unregulated fishing that undermines broader sustainability efforts across interconnected marine regions, with stocks in Aotearoa New Zealand facing escalating pressure from both foreign and domestic operators as rising global temperatures increasingly threaten worldwide food security. Meanwhile, limited investment in adaptive technologies leaves the sector increasingly vulnerable to escalating climate impacts, creating a cycle of degradation that becomes more difficult to reverse as environmental stressors multiply.

Māori

Throughout the 2030s, the relationship between the Crown and Māori over fisheries and aquaculture management grows increasingly strained and legally contested. The government's minimal responses to Māori concerns and limited commitment toward honouring Te Tiriti and the Māori Fisheries Settlements create a widening implementation gap that undermines tino rangatiratanga. Economic imperatives consistently override cultural and ecological considerations, effectively stalling the integration of tikanga and kawa into regulatory frameworks while prioritising commercial extraction over traditional stewardship approaches.

This economic-cultural divide manifests unevenly across the country. Some iwi successfully incorporate mātauranga Māori into their local fisheries and aquaculture management regimes, creating islands of innovative practice. These successfully demonstrate the value of traditional knowledge systems in enhancing ecological resilience and community wellbeing for the sector. Despite these localised successes, such initiatives struggle to gain traction beyond the regions from which they emerge. Persistent systemic barriers to wider national adoption including insufficient government funding for research into mātauranga Māori, the absence of supportive policy mechanisms, and institutional resistance, continue to prevent these models from influencing national policy and shaping the broader fisheries and aquaculture sectors. The result is a fragmented landscape where traditional knowledge remains marginalised despite its proven benefits for sustainable marine management.

Legal tensions intensify as iwi increasingly challenge government decisions through the courts. The judiciary becomes the primary arena for defining how Te Tiriti o Waitangi obligations apply to the marine space, with each case further highlighting the government's ineffective compliance efforts. This judicial pathway, while necessary, creates additional delays and costs for iwi already struggling with resource constraints. By the late 2030s, some iwi begin exploring international legal avenues, signalling that domestic remedies have failed to address fundamental breaches of Treaty obligations.

These governance conflicts play out at the local level through persistent tensions between Māori communities and commercial operators. The slow and inconsistent adoption of kaitiakitanga principles in national policy leaves Māori with limited formal authority to protect marine ecosystems and resources against commercial pressures. Disputes over decision making, harvesting and ecosystem health begin to reflect the deeper philosophical rift between indigenous models of ocean care and commercial extraction paradigms. This clash of worldviews cannot be resolved through economic pragmatism alone.

Tāmure

SHORT TERM (2025-2030) **MEDIUM TERM (2031-2040)** LONG TERM (2041-2050) EXTENSION (2081-2100)

Fishing

By 2040, fish stock abundance begins declining in some fisheries to the point where it becomes uneconomical to fish sustainably. Commercially important species shift their ranges in response to warming waters, while once-productive fishing grounds yield diminishing returns. This decline triggers renewed debate about the efficacy and cost of conservation efforts, with stakeholders increasingly divided over appropriate responses. A lack of available science, coupled with the size of Aotearoa New Zealand's EEZ, makes it challenging to identify/forecast where species may move, and becomes increasingly time consuming and expensive (fuel and crew). The fragmentation of marine habitats into disconnected patches significantly raises the risk of fisheries failure, particularly for species that require connectivity between breeding, nursery, and feeding grounds.

The value of fishing quotas varies significantly across species and geographic regions as these changes intensify, with some quota values declining were reduced stock abundance increases extraction costs, while others appreciate where scarcity drives higher market prices. This financial strain coincides with growing community awareness about fishing's impact on threatened species, fuelled by environmental advocacy and increased media coverage of declining marine biodiversity. The resulting public scrutiny creates market consequences as consumers increasingly demand verifiable sustainability credentials.

These compounding climate impacts make many fisheries uneconomical in their current form, forcing fishing companies to recognise the urgent need to break out of business-as-usual approaches and invest in more resilient and adaptable fishing strategies.

Aquaculture

By the mid-2030s, Aotearoa New Zealand's aquaculture sector faces mounting challenges as climate change alters marine ecosystems. Species welfare concerns intensify as climate-driven environmental stressors increase mortality rates and stress in farmed species. Rising ocean temperatures (both chronic and acute) trigger more frequent disease outbreaks and mortality events that spread rapidly through farm populations, while acidification threatens the development of shellfish and other shelled species, particularly in traditional inshore operations.

As these impacts intensify, aquaculture operations are forced to adapt or perish. Some inshore regions show indications of longer-term unsuitability for certain species, pushing the industry toward strategic relocation, species diversification, and more land-based operations. A significant breakthrough emerges with commercially viable offshore ocean aquaculture systems, opening access to vast new spaces beyond increasingly compromised nearshore environments. These offshore systems, while capital-intensive, offer refuge from coastal pollution and temperature fluctuations, but require substantial investment in resilient infrastructure that can withstand increasingly severe storm events.

The industry's response to these challenges creates a pronounced technological divide. Large-scale producers leverage costly innovations to develop climate-resilient stock while implementing advanced AI-powered monitoring systems that enable early detection of disease outbreaks and invasive species incursions. Meanwhile, small-scale farms and iwi-led initiatives struggle to afford these innovations, widening the gap between industrial and community-based operations. Insufficient government investment in research and development compounds this disparity, leaving the sector largely dependent on private funding for critical innovation at a time when public support could accelerate adaptation efforts across all scales of operation.

Feed security emerges as another critical challenge, with inputs for the finfish sector severely affected by declining global fisheries. Despite clear warmings, insufficient investment in developing local feed mills leaves the industry dependent on volatile global supply chains. This creates an intensifying push toward alternative feed sources that then raises new questions about sustainability and nutritional adequacy. As climate impacts intensify globally, international buyers and trade agreements increasingly demand documented environmental performance and low-carbon production methods, creating both market barriers and premium opportunities for producers who successfully adapt to changing conditions. Despite these headwinds, Aotearoa New Zealand's aquaculture sector shows remarkable resilience through technological innovation, though benefits remain unevenly distributed across the industry.

Tāmure

SHORT TERM (2025-2030) MEDIUM TERM (2031-2040) **LONG TERM (2041-2050)** EXTENSION (2081-2100)

General

By the early 2040s, Aotearoa New Zealand experiences a profound wake-up call as climate change impacts on its seafood sector intensify beyond the warning signs evident in the previous decade. The transformation that began as a choice for forward-thinking operators in the 2030s becomes essential for survival across the entire industry.

Operational challenges multiply dramatically as storm events increase in both frequency and severity, water temperatures continue to rise, and target species approach or exceed biological thresholds. Building upon the mounting social pressure seen in the late 2030s, public sentiment now demands comprehensive action rather than incremental change. The sector broadly acknowledges that rapid adaptation is imperative, though consensus on specific pathways remains elusive amid competing interests.

The future of inshore wild capture fisheries becomes highly uncertain as key species migrate to deeper, colder, southerly waters. Simultaneously, warm-water species from northern regions establish themselves in the waters of Aotearoa New Zealand, creating a complex mix of ecological challenges and potential new commercial opportunities. Fisheries management evolves to become more agile and responsive to species movement and productivity changes, with conservation efforts increasingly aligned with food production and biodiversity outcomes. Investment in ocean modelling expands to predict where, when, and what fisheries and aquaculture operations remain viable.

The mid-2040s mark a significant shift in government approach. Where support had been minimal in the 2030s with expectations that the industry would self-fund research and transition, policy now actively incentivises adoption of alternative fuels as fossil fuel availability decreases and costs continue their upward trajectory. International agreements to reduce fossil fuel use – which had been forming but remained relatively weak – finally gain meaningful traction.

With non-fossil fuel solutions increasingly mandated through government regulations, the fishing fleet undergoes transformation, and companies benefit from cross-transport sector initiatives as they update their vessels.

Aotearoa New Zealand faces significant challenges as trading partnerships weaken due to global nationalism, further exacerbating the international trade complications that began with stricter environmental standards in the previous decade. The government, confronted with undeniable evidence of ecological and economic damage, implements rapid regulatory reform to enable adaptation and support innovation – though many opportunities for proactive action have already been lost, continuing the pattern of reactive rather than preventive policy.

Consumer preferences, which had begun shifting toward sustainable options in the 2030s, now explicitly favour low-carbon protein sources. Demand for marine food increasingly depends on land-based aquaculture, recirculating aquaculture systems and offshore aquaculture and deepwater fishing as climate impacts devastate nearshore operations and inshore fisheries. The seafood industry faces public criticism for its contribution to marine species extinctions. Food security concerns rise as both domestic production and international trade face climate-related disruptions. Industry and public stakeholders pressure the government for more robust mitigation and adaptation policies as productivity declines, including expanded protection for habitats critical to fisheries, though implementation remains challenging in the face of competing economic priorities.

Nature

Marine environment deterioration accelerates toward critical ecological tipping points as multiple stressors compound beyond sustainable thresholds. As degraded habitats continue to decline, the fragmentation of marine ecosystems evolves from disconnected habitat patches into wholesale ecological transformation.

Threatened species extinctions become an annual event from the combined impacts of climate change and fishing pressure.

Species respond differently to these intensifying pressures, creating unpredictable ecological dynamics. While some commercial species like snapper initially showed promising adaptability to warming waters, many now exhibit reproductive failure due to changing critical habitats as temperatures exceed thermal thresholds for successful spawning. This pattern – short-term gains followed by longer-term declines – becomes increasingly common across the waters of Aotearoa New Zealand, with more species experiencing population crashes than population booms.

Marine Protected Areas are insufficient in both size and management effectiveness. Planning and implementation approaches are inflexible to changing ocean conditions, failing to provide adequate ecological outcomes. The seafood sector recognises the necessity to invest in nature outcomes as climate impacts intensify, understanding that their long-term viability depends on ecosystem health.

Māori

By the 2040s, the combined effects of climate change and ongoing governance failures have transformed Aotearoa New Zealand's marine environment. Ocean warming, acidification, and ecosystem collapse have devastated fish stocks, with customary fisheries such as pāua and kōura (crayfish) among the hardest hit.

These ecological disruptions disproportionately impact Māori fisheries and aquaculture, undermining traditional harvest cycles and eroding the cultural and economic foundations of many coastal iwi and hapū. Existing fisheries and aquaculture settlements designed under static management frameworks prove unable to adapt to these dynamic ecological pressures. The lack of flexibility is compounded by economic priorities in policy-making continuing to erode Māori rangatiratanga over their marine resources and resist indigenous decision making.

Customary fisheries and aquaculture management approaches remain marginalised, with rāhui (temporary closures) and other customary fishing tools lacking meaningful government support for implementation. Economic interests consistently override cultural considerations, creating an environment where tikanga and kawa are only selectively implemented across the sector. This reinforces a system where Māori frameworks exist on the periphery of commercially dominated management regimes.

Western ecological models continue to dominate fisheries and aquaculture management while mātauranga Māori and tikanga Māori remain tokenistically acknowledged but rarely influential. Persistent underfunding of Māori-led research limits the development of traditional knowledge-based approaches, despite their proven effectiveness. Environmental legislation fails to meaningfully incorporate mātauranga, leaving valuable generational wisdom untapped.

The Crown maintains control over fisheries and aquaculture management, with co-governance remaining more rhetorical than real. Māori voices in consultation processes have become largely procedural rather than a meaningful partnership and their input is seldom acted upon. Māori continue seeking justice through slow-moving court processes while Te Tiriti principles are inconsistently applied, widening the gap between Treaty promises and reality.

Locally, tensions between Māori communities and commercial operators intensify as iwi and hapū struggle to protect fragile marine ecosystems and resources without adequate support. These conflicts represent more than just competing interests, they reveal a fundamental clash in worldviews: one rooted in short-term economic gain and resource commodification, and the other in intergenerational stewardship. With the regulatory environment now built around commercial priorities, the exercise of kaitiakitanga is left marginalised, limiting Māori efforts to uphold their responsibilities as kaitiaki.

Tāmure

SHORT TERM (2025-2030) MEDIUM TERM (2031-2040) **LONG TERM (2041-2050)** EXTENSION (2081-2100)

Fishing

Ocean modelling technologies advance significantly, allowing companies to assess operations and identify optimal fishing areas based on projected climate impacts. This data-driven approach helps the industry focus on climate-adapted species and develop more resilient harvesting strategies. As viable water space diminishes and inshore fishing areas become less viable, the sector undergoes a complete reconfiguration of its operational model. The companies that successfully navigate this transition are those that built adaptive capacity early and recognised the connection between ecosystem health and business sustainability. While conservation efforts remain primarily driven by regulatory requirements, leading operators increasingly understand that their long-term viability depends on maintaining functional marine ecosystems – a pragmatic realisation that gradually shifts industry attitudes toward environmental stewardship.

Aquaculture

Offshore and land-based aquaculture, as well as recirculating aquaculture systems become dominant as coastal areas experience more severe impacts from terrestrial runoff, warming, and acidification. However, a transition to offshore aquaculture of this scale required financial investment that exceeded some business capabilities. These operations employ advanced technology to withstand increased storm events while maintaining production. Climate-adapted species become the industry standard, with genomic advancements allowing the development of more resilient varieties capable of tolerating higher temperatures and variable ocean chemistry.

Technology plays a crucial role in adaptation, with operations using AI-powered monitoring systems to manage farms amid changing ocean conditions.

The industry faces continuing challenges with space allocation as coastal inundation impacts shoreside infrastructure. Many land-based systems for early life stages are relocated inland, creating new operational complexities. Feed security remains precarious with Aotearoa New Zealand still dependent on imported inputs, creating vulnerability to international supply chain disruptions and price volatility. Disease outbreaks related to climate change create periodic disruptions, though improved biosecurity protocols, early detection systems, and vaccine development help mitigate impacts.

Tāmure

Extension

By the 2090s, Aotearoa New Zealand's marine environment bears the scars of decades of temperature rise, acidification, and ecosystem collapse. The close to 4°C global warming scenario has created a world of scarcity and constant adaptation to deteriorating conditions.

The post-2050 deterioration of oceans surrounding Aotearoa New Zealand has created increasingly hostile conditions. Deep-water fishing operations continue but at tremendous cost, with vessels engineered to withstand previously unimaginable conditions. Fishing fleets from equatorial nations, driven southward by the collapse of their traditional grounds, create persistent tensions as competition for diminishing resources intensifies. International fishing agreements now function primarily as conflict management systems.

The future of seafood aquaculture presents a particularly complex landscape for Māori communities, where traditional rights, cultural approaches, and local autonomy have been severely compromised. Shareholder compositions have shifted dramatically, with offshore competitors gaining significant control, driven more by survival than sustainable management. The sector has been characterised by growing separatism and disconnection, with some iwi desperately trying to maintain tikanga-based approaches while being marginalised from decision-making processes.

Food security dominates national policy as global agricultural systems strain under changing climate patterns. Marine protein has become precious rather than plentiful, with availability fluctuating based on species adaptation to new conditions. The fishing industry has contracted severely, concentrating on viable deep-water stocks while abandoning once-productive inshore fisheries. What remains is concentrated in the hands of few corporations with capital to weather constant disruption.

Disease outbreaks occur regularly, each wave requiring costly adaptations and often resulting in mass mortality events. The biological arms race between pathogens and hosts accelerates with warming waters, with economic consequences that ripple through coastal communities already struggling with inundation. Local Māori communities have been particularly devastated, losing access to traditional kaimoana and employment opportunities, with the principles of Te Tiriti o Waitangi increasingly ignored in favour of economic survival.

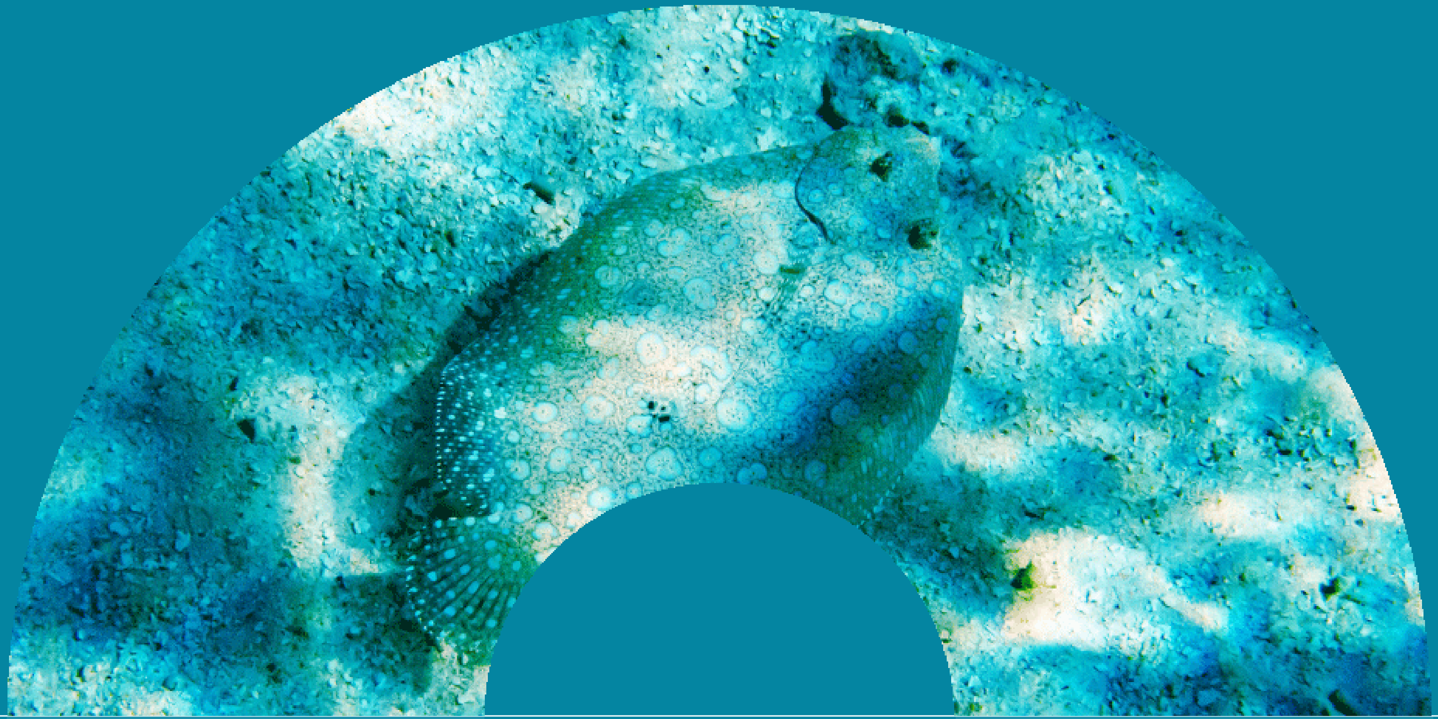
Aquaculture has survived by retreating – both offshore into stormier but cooler waters, and on land into energy-intensive recirculating aquaculture systems. These adaptations come at tremendous cost, making seafood increasingly inaccessible to many. Sustainable practices have largely given way to pragmatic approaches focused on maintaining minimum viable production, with a stark divide between Western scientific management and indigenous environmental perspectives.

Biodiversity loss continues despite increased conservation efforts. Invasive species create cascading effects through food webs already destabilised by warming and acidification. Reef systems that once supported diverse fisheries exist only as isolated pockets maintained through intensive intervention. The ecosystem fragmentation has been particularly challenging for iwi attempting to maintain traditional resource management approaches.

Consumer diets have changed through necessity. After 2050, people gradually started adapting to eating unfamiliar species and different parts of fish because preferred options have disappeared. Plant-based proteins dominate most diets, with marine proteins becoming luxury items. The seafood waste stream has been fully commercialised as an economic necessity, with pharmaceutical and nutraceutical applications creating essential income to keep otherwise marginal operations viable.

As the century closes, Aotearoa New Zealand's relationship with its marine territory is one of constant vigilance and management of decline.

The adaptation achievements represent not triumph but survival in a degraded world that continues to challenge human ingenuity and resilience – a cautionary tale of what happens when early warnings go unheeded and climate action comes too late. For Māori communities, this narrative is particularly poignant, representing a profound loss of cultural connection, environmental stewardship, and traditional ways of life.



Pātiki

Low temperature, divergent

Short term 2025-2030

Medium term 2031-2040

Long term 2041-2050

Pātiki

General

By 2030, Aotearoa New Zealand's seafood sector has notably experienced the early impacts of climate change. Domestic climate and nature ambition falters due to international fragmentation on multilateral initiatives such as the Paris Agreement, the Science Based Target Initiative and Taskforce on Nature-Related Financial Disclosures (TNFD). The government lacks a coherent long-term strategy for the marine economy, with no national alignment on whether Aotearoa New Zealand should position itself as a food producer, technology hub, or environmental leader. Political focus diverts to more immediate economic concerns, creating a widening gap between international commitments and domestic implementation.

Aotearoa New Zealand continues to struggle with its non-financial disclosure frameworks, with most companies viewing them as compliance burdens rather than strategic opportunities. Climate risk emerges as a factor in investment assessments, but primarily for internationally exposed companies, creating a two-tier system where larger export-focused operations face stricter scrutiny while domestic operators continue with minimal changes.

Operational challenges from extreme weather events increase, causing domestic disruptions through road closures and damaged infrastructure that impede harvest transport to processing facilities. These challenges affect export shipping and air freight as well, though the impacts remain manageable. Climate vulnerability assessments begin to identify at-risk fisheries and aquaculture resources, but comprehensive sector-wide planning remains limited.

Generation Alpha (born after 2010) begins driving greater climate awareness, but their influence remains limited due to insufficient political and economic leverage. Private sector financial constraints reduce business investment in sustainability initiatives, with most expenditure focused on maintaining existing operations rather than transformation.

Marine sector emissions reduction is primarily led by the freight industry rather than fishing or farm operators with a lack of tools or sustainable fuel options available. Wholesale purchasers increasingly expect sustainable fishing and aquaculture practices, though consumer demand shows less sensitivity to these issues. The impact on market demand remains minimal, with limited public pressure against current fishing and aquaculture methods. Further, the high level of regulation and Aotearoa New Zealand's quota management system is a buffer to significant environmental pressure from export markets.

Nature

Marine ecosystems show signs of stress as ocean temperatures rise. Primary production patterns shift, altering deepwater ecological dynamics, which affects species distribution. Current and nutrient flows change, driving modifications in food webs as traditional targeted species begin moving southward, following cooler waters. Ocean acidification causes observable thinning of shells in some species, impacting product quality and transportation viability.

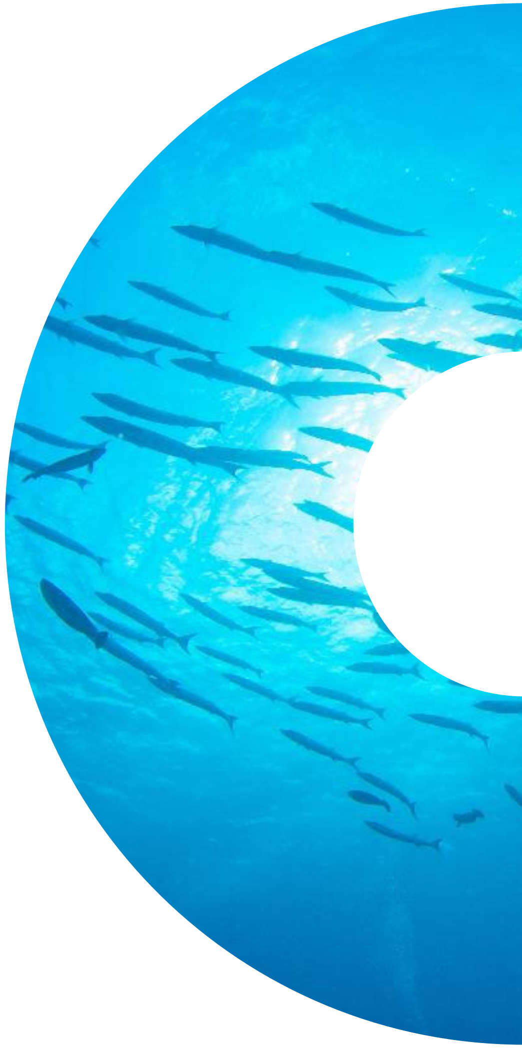
Nature-based solutions remain largely conceptual and symbolic rather than systemic. Land-based impacts on the seafood industry continue unabated, with minimal investment in riparian buffer zones, wetland restoration, or improved agricultural practices. Conservation efforts remain fragmented, with inadequate baseline measurements and little consensus on priority areas for intervention. Freshwater and sediment flows from land-based activities continue to degrade coastal habitats, exacerbated by increasing storm events. This ongoing deterioration of nursery habitats for inshore species leads to reduced recruitment, affecting both wild harvest and wild-capture aquaculture productivity. Driven by increased international obligations, forward-thinking companies begin exploring nature considerations in corporate reporting, but without a coordinated national approach.

Māori

For Māori fishing enterprises, these environmental changes represent both economic and cultural challenges. Species such as kōura (crayfish), are beginning to show early signs of vulnerability, placing strain on Treaty Settlement Agreements and iwi commercial ventures. The economic significance of these changes extends beyond direct revenue loss, affecting regional employment, community wellbeing, and the transmission of cultural practices connected to the ocean.

The integration of mātauranga Māori and tikanga Māori into fisheries and aquaculture management remains minimal at the institutional level, and in some cases, their value and relevance are increasingly challenged more. While customary fishing tools such as rāhui (temporary closures) are still placed in local fisheries to address declining species numbers, broader recognition of tikanga within national fisheries management frameworks remain limited and fragmented. With fisheries management policies focused on addressing short-term economic gains, Māori interests in the sector struggle to gain traction in wider policy discussions.

Some coastal Māori communities have secured legal protections for local kaimoana harvesting, but complex and often inconsistent engagement with the wider industry continues to undermine meaningful partnerships. Government interest to develop policy programs on tikanga, whakapapa, and kawa is dwindling, and the few programmes that are still active are underfunded and lack long term commitment by the government.



Pātiki

Fishing

The deep-water fishing industry shows little movement toward decarbonisation due to limited options. Some operators explore precision harvesting techniques that can identify fish in nets and optimise fishing locations. These technologies aim to reduce bycatch and improve catch efficiency, with corresponding reductions in carbon emissions and operational costs.

Efforts to reduce benthic impact remain limited, with minimal industry-wide testing of modified gear designs or collaboration with researchers to quantify environmental benefits. Progress on reducing bottom trawling damage lags significantly, similar to the slow adoption seen with previous innovations like precision seafood harvesting technology.

The fishing industry shows resistance to camera deployment requirements on vessels due to concerns about data management, privacy, and review protocols. Early AI systems to help fishers determine composition prior to hauling (and minimise unwanted bycatch) see limited adoption, with the industry divided between proactive early adopters and those resistant to technological change.

Aquaculture

The industry's adaptation remains fragmented, with systematic identification of vulnerable operations and strategic transitions happening primarily among larger, better-resourced companies. This included the adoption of genomic selection for resilience by the larger companies.

Shellfish farmers concerned about the impacts of acidification, increasing temperature, and reduced spat supply begin exploring hatchery-produced spat selected for resilience.

Investment in recirculating aquaculture systems for salmon hatchery production increases but remains concentrated among larger-scale operators, creating a growing technology gap within the sector. Open ocean farming expands slowly but still battles against poor public support and restrictive government regulations. The aquaculture sector's exploration of mutual benefits with conservation occurs only in isolated projects, lacking the collaborative research programs. Partnerships between marine farmers, research institutions, and conservation groups remain limited and ad hoc. This creates an uneven approach to environmental management across the industry, which as a result, fails to get traction with key regulators.

Pātiki

General

By 2040, changes to the climate, combined with more frequent storms, severely stress coastal infrastructure essential to fishing and aquaculture operations. Central government, regional councils, and industry struggle increasingly to maintain access to critical facilities including coastal roads, rail connections, and port infrastructure.

Political ambition for sustainable fisheries and aquaculture management grows, with increasing recognition of the economic opportunity for Aotearoa New Zealand to meet growing global demands for sustainable proteins. However, the seafood sector struggles to secure substantive government support, which is starting to turn its focus to land-based climate change adaptation. In response, the seafood sector puts a collaborative effort on creating a cohesive food, nutrition and provenance strategy that clearly articulates the opportunity for Aotearoa New Zealand. This strategy marks a turning point for the sector and a greater focus on the veracity of its sustainability credentials, across climate, nature and nutrition, as a key point of differentiation in global markets. This is assisted by increased consumer demand for sustainably sourced products internationally.

Research investment addresses the gaps in basic ocean, climate, and fisheries science as well as its commercial application. This enables gradual adaptation of vessels, fishing and farming methods, digital and processing technologies, but without strategic coordination. This means, technology advancements spread unevenly across the sector, with innovative aquaculture systems and improvements in live transport, husbandry and breeding, processing, and product development primarily benefiting larger companies with international connections and access to capital.

By 2040, industry consolidation occurs as a major trend with smaller operators that own quota turning to lease annual catch entitlement to big operators rather than catch themselves due to increased costs and difficulty in sourcing labour.

Some inshore fishing fleets, aquaculture operations, and their supporting communities begin relocating southward, following commercially valuable species distributions and cooler water. However, this migration reinforces existing inequalities as only well-capitalised operations can successfully make this transition. New fisheries and aquaculture opportunities, such as kingfish farming, emerge in the north of Aotearoa New Zealand as tropical species extend their range southward, though access to these resources becomes primarily concentrated among a small subset of operators, further widening existing disparities in the seafood sector.

The financial landscape evolves unevenly across the sector. Financial instruments for sustainability transitions emerge selectively, primarily benefiting mid-sized and larger operators with proven credit histories while excluding the smallest fishers. Lending institutions incorporate sustainability metrics comprehensively for export-oriented businesses but minimally for domestic operators. Financial reporting standards now include climate and nature-related disclosures, though these are still primarily seen as compliance exercises rather than strategic tools. Rising insurance premiums in climate-vulnerable areas create coverage gaps rather than widespread adaptation.

Government support for sustainable fuels and low-carbon technologies improves incrementally and unevenly within and across sectors. Infrastructure for alternative maritime fuels develops driven primarily by global market requirements (largely sea freight) and pricing rather than domestic policy. Carbon pricing affects fisher operational costs (including fuel), creating additional pressure on operators already facing climate-related challenges.

Whilst the blue economy experiences significant growth, following the refocus on sustainability and provenance, conflicts emerge between fisheries and aquaculture operators, offshore energy development, and seabed mining interests as they compete for marine space. There is a widening gap between businesses able to meet these sustainability standards and those that cannot.

Nature

Marine ecosystem impacts become increasingly pronounced as climate change advances due to the lack of early action. Species distributions continue shifting southward, with biological effects visible across trophic levels. Disease outbreaks in commercially important species increase, while shell thickness in many shellfish species, such as pāua and kōura (crayfish,) decreases further due to ocean acidification, compromising product quality and handling procedures. Land-based impacts continue largely unabated, with freshwater runoff and sedimentation degrading coastal habitats essential for fisheries and inshore farming recruitment.

While nature-related financial disclosures become more common throughout the sector, implementation varies significantly between operations. Large export-oriented companies fully integrate these frameworks to meet international market requirements and the opportunities presented by a renewed focus on sustainability and provenance, while smaller domestic operations see limited benefits. Early in this time horizon, and as a result of efforts to draw together a cohesive food, nutrition and provenance strategy, the seafood sector recognises that the lack of coordinated sector-wide nature assessment initiatives means nature considerations are fragmented and inconsistently applied across the industry. It is also recognised that the seafood sector is increasingly operating as a two-tier industry where export-oriented businesses gain market advantages and premium pricing thanks to the transparency around nature-related impacts, while smaller operators lease their quotas to large-scale operators or continue operating but face diminishing returns and fall behind.

Drawing the sector together is seen as a key requirement for Aotearoa New Zealand to leverage the opportunities of being a leader in sustainable seafood production. Conservation and restoration initiatives exist but remain localised and fragmented. The need for a comprehensive national strategy to guide and coordinate conservation efforts, and maximise synergies is increasingly recognised.

This could include the use of aquaculture hatchery technologies and breeding programs to support restocking initiatives for threatened species.

Continued climate impacts on stock performance, habitat degradation, and species loss mean the sector experiences increased variability in harvests and production, creating potential challenges for supply chain and revenue planning. The need for greater co-ordination between conservation and commercial interest is also seen as a critical part of the sector's ability to position itself as part of the solution to marine ecosystem challenges, particularly as climate pressures increase on both wild fisheries and farming operations.

Offshore data centres and other carbon-intensive sectors seeking offset opportunities create a growing market for blue carbon initiatives in the marine environment. However, implementation focuses primarily on commercial gain rather than integrated ecological benefits, leading to uneven ecosystem health improvements. Projects tend to prioritise carbon sequestration metrics over broader biodiversity goals, missing opportunities to deliver multiple environmental benefits through more holistic approaches to marine ecosystem management. The narrow focus on carbon metrics fails to address water quality, disease resilience and ecological stability that directly impact production capacity. This approach leaves the sector vulnerable to ecosystem degradation despite blue carbon initiatives.

Pātiki

SHORT TERM (2025-2030) **MEDIUM TERM (2031-2040)** LONG TERM (2041-2050)

Māori

Despite broad recognition of the benefits of a cohesive food, nutrition and provenance strategy, its rapid development in response to escalating climate pressures meant that Māori interests were not adequately recognised or considered. As a result, meaningful integration of mātauranga Māori and tikanga Māori across the seafood sector is therefore still increasingly challenged and limited throughout this period.

As ocean warming accelerates and land-based impacts on coastal waters grow, species health and biomass significantly decline, particularly in areas of importance to Māori communities. The limited understanding and support in iwi and community-based responsive management approaches persists, leaving fisheries and aquaculture governance inflexible and ill equipped to respond to rapid environmental changes. This ecological deterioration directly erodes the values of Māori fisheries and aquaculture settlements, with commercial catch volumes and values declining steadily within in-shore fisheries. These reduced returns have profound social implications, particularly for smaller iwi where fisheries dividends represent a major source of income. The diminishing financial performance impacts tribal economies, weakening social services, educational opportunities, and cultural revitalisation efforts across many communities.

As a consequence of delayed and hurried climate response, Māori commercial aquaculture and fishing industry interests are also affected. This impacts Māori representation within the sectors, and limits the integration of diverse cultural perspectives in industry decision-making. Coastal Māori communities, increasingly dissatisfied with the seafood sector's direction, begin challenging the social license of commercial fishers, particularly in inshore waters, rising tensions over marine resource control.

Government funding constraints necessitate increased public-private partnerships, including Crown-iwi collaborations for critical infrastructure investment.

However, these partnerships often prioritise economic outcomes over cultural integrity, deepening mistrust and further straining relationships between Māori and both industry and government. The sector's struggle to secure substantive government support contributes to declining commercial and recreational stocks in many areas, compounding challenges for communities reliant on these resources for both economic and cultural wellbeing.

Fishing

New fisheries emerge with warm-water species like tuna extending their range into waters of Aotearoa New Zealand. Fishing fleets from other jurisdictions increasingly venture southward following these migration patterns operating closer to Aotearoa New Zealand's EEZ and gradually intensifying resource competition and creating management tensions in the region. The absence of global consensus on trawling methods allows divergent practices to continue, widening the divide between operations serving environmentally conscious markets and those targeting less discerning customers.

Growing interest in seabed mining and offshore energy creates both opportunities and conflicts with traditional fishing grounds, further complicating spatial management.

Fisheries management systems struggle to adapt to these rapid distributional changes, remaining rigid and slow to respond. The sector struggles to secure government support, remaining 'out of sight, out of mind' as policy and funding priorities focus on land-based adaptation challenges. While fisheries are acknowledged as important, on-land climate pressures consistently divert investment and policy ambition away from marine priorities, meaning industry needs to lead and collaborate more intentionally in order to leverage the opportunity for more sustainable seafood.

The government's approach to fisheries regulation lacks clear timelines for vessel transitions and low-emission standards. Large export-oriented companies acquire second-hand vessels from jurisdictions with stricter emissions standards.

This represents incremental improvement rather than transformation, while smaller operators maintain ageing fleets with minimal modifications due to financial constraints and uncertain returns. The operational efficiency gap widens between fleet segments, with current vessels having ten to fifteen years of remaining service life and significant investment in new vessel technology remaining at least five years away.

Technology adoption follows similar patterns of divergence. AI technologies and other innovations that enhance transparency and reduce bycatch are implemented primarily by larger operators with access to capital. Traditional high-impact fishing methods continue in many operations, especially those serving domestic markets where consumer pressure for environmental improvement remains limited.

By 2040, some in-shore fishing fleets and their supporting communities begin relocating southward, following commercially valuable species distributions. However, this migration occurs unevenly, with well-capitalised operations able to make the transition while smaller, capital-constrained businesses struggle to adapt, further reinforcing the divide between industry leaders and followers.

Aquaculture

In aquaculture, both small and large-scale operations are beginning to transition to electric or hybrid vessels for short-range transport. Technology advancements offer incremental improvements. Aquaculture operations implement AI systems to enhance efficiency. Many established aquaculture operations, specifically mussels and salmon, face growing challenges from warming waters. The sector's reliance on wild mussel spat from Taitokerau Northland makes it especially vulnerable, as rising water temperatures put this primary source location for mussel spat at risk.

Public support for aquaculture innovation grows as climate awareness increases and economic focus shifts toward protein exports in global markets, creating growth opportunities for operations aligned with export demands.

Aquaculture's adaptation is driven primarily by private capital and market forces, creating uneven development. Well-funded operations successfully transition while smaller producers remain in increasingly stressed near-shore environments. Research work on genetic gains matures by 2040, delivering site-specific applications where areas becoming unsuitable for traditional species find commercial viability with adapted species.

Land-based grow out of species such as kingfish provides additional opportunity. These advances remain largely proprietary, or require significant new capital, benefiting established companies rather than the broader industry.

Genomics research produces more climate-resilient farmed fish and shellfish with improved efficiency and disease resistance. In parallel, high-value, lab-grown seafood emerges in premium market segments, initially focusing on valuable species like kōura (crayfish) and scampi. These technologies primarily benefit companies with international connections and investment capacity, further stratifying the industry between technology leaders and followers.

Aotearoa New Zealand's geographic location provides some buffer by delaying the arrival of certain diseases and pests, but the lack of a coordinated response means impacts are managed reactively rather than proactively.

While public perception of aquaculture continues to improve as environmental benefits of seaweed and shellfish farming become visible, support remains inconsistent across regions. Community backing for newer approaches like open ocean farming and recirculating aquaculture systems materialises primarily in areas with active engagement programs and economic benefits.

Technology adoption widens the divergence within the sector. Well-capitalised operations implement advanced feeding methodologies, health management protocols, and low-emission systems, while smaller operators make incremental improvements that deliver less competitive advantage, expanding the economic gap between industry leaders and followers.

Pātiki

General

The cumulative effects of decades of warming have fundamentally reshaped marine ecosystems and maritime industries. Consumer preferences have evolved significantly toward nature-positive products, with policy focus shifting from decarbonisation to biodiversity conservation. Aotearoa New Zealand's focus on sustainability and provenance in the previous decade places it in a prime position to capitalise on these shifts. A biodiversity credit market has emerged, though reactively rather than proactively.

Marine spaces are increasingly valued for carbon and biodiversity offsetting, creating both economic opportunities and access conflicts. Water space allocation frameworks have solidified, establishing clear rights for different uses including aquaculture, carbon offsetting, and energy production. Competition for these spaces has intensified as their economic value increased, particularly in areas most protected from climate extremes. Rights for water space have become valuable assets, primarily controlled by well-capitalised entities with access to sophisticated legal and financial resources.

The divergence between internationally connected and domestically focused businesses has solidified into permanent structural separation. Leading companies have fully transformed their operations with advanced technologies, climate-resilient business models, and comprehensive sustainability credentials. Meanwhile, smaller operators that survived have largely consolidated or found specialised niches, with many traditional fishing communities forced to transition away from maritime livelihoods entirely.

The financial system has integrated climate and nature considerations, but primarily as risk management tools rather than transition enablers. Financial products for sustainability investment are widely available but designed primarily for larger businesses with strong balance sheets.

Insurance for climate-vulnerable coastal operations has become prohibitively expensive in many areas. Government investment continues to prioritise agricultural emissions reduction over marine sector initiatives, reflecting persistent land-based focus despite the growing importance of the blue economy. Policy support for fisheries and aquaculture remains opportunistic rather than strategic.

By 2050, the seafood sector has undergone significant but uneven transformation. The industry captures new opportunities through blue economy diversification and environmental market participation, but these changes have come at substantial cost to traditional fishing communities and practices, reflecting the broader pattern of unequal adaptation.

Nature

A biodiversity credit market emerges in response to visible physical impacts on terrestrial ecosystems. This market development is reactive rather than proactive, coming after significant ecological changes have already occurred. Marine biodiversity faces severe but geographically uneven degradation, with variable disruption and unpredictable patterns of ecosystem service provision. Areas with active management show modest recovery, while neglected regions experience continued decline. This is especially relevant for the country's in-shore fisheries.

Despite the efforts to draw together a cohesive food, nutrition and provenance strategy, the seafood sector struggles to achieve meaningful and large-scale ecological improvements. The uptake of nature-based solutions, although increased, has not delivered significant results. Sedimentation and nutrient loading continue to impact coastal areas, in particular causing degradation to the nursery habitats and kelp habitats and leading to limited recruitment of targeted inshore species and negatively impacting inshore farms. Terrestrial and marine conservation efforts remain largely disconnected despite their ecological interdependence.

Ocean spaces historically used for fishing are increasingly repurposed for kelp farming and other forms of aquaculture. These areas generate biodiversity credits traded in emerging markets, but their ecological effectiveness varies widely due to inconsistent management standards and land-based inputs.

Māori

By 2050, the challenges faced by Māori in the fishing industry have intensified significantly. The ecological deterioration that directly eroded the Māori fisheries and aquaculture settlements in previous decades has led to the profound displacement of Māori economic interests in the sector. Some coastal settlements dependent on traditional fishing grounds must diversify or relocate. This pattern mirrors changes across the seafood sector, where ecological pressures are forcing widespread adaptation and geographic shifts in operations.

Traditional kaitiakitanga practices continue but its expression is limited by systemic barriers, risking loss of valuable fisheries knowledge as connections to historical fishing grounds and local ecosystems weaken. The lack of integration of mātauranga Māori and tikanga Māori with traditional ecological Western knowledge and scientific monitoring has resulted in a poor understanding of subtle ecosystem shifts, leading to crisis management rather than measured responses. An inadequate application of traditional knowledge is a lost opportunity for the sector that otherwise could have benefited from having diverse management approaches in responding to complex ecological challenges.

In this challenging landscape, some iwi-led initiatives succeed through resilience, adaptation and innovation, particularly in novel aquaculture methods and in co-managing marine protected areas that generate biodiversity or blue carbon credits, but these successes remain the exceptions rather than the norm.

Smaller Māori operators maintain fishing activities in specialised fisheries, particularly targeting valuable species like crayfish or pāua that can be harvested with minimal bycatch.

The majority of Māori fishing assets have either consolidated within larger iwi corporate structures or transitioned to different forms of investment entirely.

Pātiki

SHORT TERM (2025-2030) MEDIUM TERM (2031-2040) **LONG TERM** (2041-2050)

Fishing

Despite, a delayed domestic policy response, vessels with low-carbon propulsion have become a new standard. The technology transition that began with small vessels in aquaculture finally reaches the deep-sea fleet.

Species traditionally targeted by the fishing industry have shifted their ranges significantly, following the southward migration pattern. Most fishing operations have either relocated to follow these shifts or transitioned to different target species that have become more abundant in the waters of Aotearoa New Zealand. The quota management system, which struggled to adapt to rapid distributional changes in previous decades, has undergone substantial revision to accommodate the new ecological reality.

The fishing sector has adapted to its transformed operating environment, finding economic viability through significant operational changes and business model evolution. However, this adaptation has come with substantial social costs, particularly for traditional fishing communities unable to make the capital-intensive transitions required. The industry now comprises fewer but larger operations with higher technological sophistication and greater vertical integration, but diminished connections to coastal communities and cultural fishing traditions.

Aquaculture

Climate-resilient aquaculture species become predominant as research identifies optimal farming species for new environmental conditions. Building on the genomics research of the 2030s that produced more disease-resistant variants, these adapted species now form the backbone of Aotearoa New Zealand's aquaculture industry. After years of unpredictability, climate patterns have stabilised sufficiently to allow more strategic planning for future aquaculture species and locations.

The sector expansion now includes developed infrastructure such as local feed mills, though these benefits remain unevenly distributed across the industry.

Technological innovations within the aquaculture sector continue to accelerate, with advancements in climate-resilient species development expand production capabilities for forward-thinking operations. High-value, lab-grown fish proteins have established market niches. These approaches have expanded from experimental to commercial scale, primarily benefiting companies with international connections and investment capacity.

While public perception of aquaculture has improved as environmental benefits of certain farming types have become more visible, community engagement remains inconsistent across regions, reflecting the uneven development patterns.

Īnanga

Low temperature, delayed transition

Short term 2025-2030

Medium term 2031-2040

Long term 2041-2050

Extension 2081-2100

Īnanga

General

In the late 2020s, Aotearoa New Zealand continues to experience the signs of both climate change impacts and a growing global commitment to sustainability. Climate vulnerability assessments identify at-risk fisheries and aquaculture resources and habitats. Climate risk emerges as a critical factor in investment assessments across the sector, with rising insurance premiums and lenders increasingly integrating sustainability metrics into their lending requirements.

The government takes a bipartisan approach to marine reserves and quota management, recognising the strategic importance of the blue economy and evidence-based setting and enforcement of catch limits. Aotearoa New Zealand's Climate Change Response Act is reaffirmed by all parties and amended to provide a platform for the seafood sector to address both climate and nature considerations, though implementation remains challenging with climate impacts often outpacing regulatory responses.

Ocean science and climate change research gains momentum, though the science sector still struggles to obtain sufficient funding to carry out the ongoing research. Growing pushback from the public and Māori communities against perceived inaction and insufficient response catalyses a political shift as increasing environmental impacts influence decisions more directly. Key research programs are established to monitor changes in marine ecosystems and assist the aquaculture industry in adapting. Adaptation planning funding increases, including support for local place-based responses, and development of sustainable fuels and low-carbon tech continues. The government and the science sector strengthen international relationships to support innovation aspirations, forging strategic partnerships with leading marine research institutions abroad.

The efforts between the seafood industry, NGOs, and the government led to the creation of a collaborative ocean and blue economy research platform, though ongoing funding constraints limit its initial impact.

Demand for sustainably sourced seafood grows as consumers globally become increasingly focused on the provenance, health benefits and environmental practices of food production. Aotearoa New Zealand's seafood industry proactively responds to these demands by increasing transparency, and working closely with NGO's to balance approaches to marine protection areas. Investigation into technologies to minimise the environmental impacts of bottom trawling practices also commences with government and science support.

Nature

After successfully navigating the waters of climate disclosure, forward-thinking companies now begin exploring how to incorporate nature considerations into their planning and corporate reporting frameworks, with many developing comprehensive nature-positive transition pathways to guide their journey toward future-resilient operations. Recognising the significant market benefit of its natural assets, Aotearoa New Zealand sets sail on an ambitious journey to transform itself into a net nature-positive economy, preparing to make bold commitments that will redefine how its natural ecosystems are valued, protected, and enhanced across every sector. This bold vision gives the seafood sector confidence, as it recognises its vulnerable position on the frontlines of potential ecological decline and the direct consequences it would face from continued inaction on the nature crisis.

While land-based impacts on waterways connected to the moana remain significant, the first nature-based solutions are being implemented in key watersheds to reduce the impacts of terrestrial runoff on the coastal habitats. These initial projects – including riparian buffer zones, wetland restoration, and improved agricultural practices – show promising early results in reducing freshwater runoff and sedimentation, especially after storm events.

However, restoration efforts across the marine domain notably lag behind terrestrial initiatives due to a combination of factors such as the vast scale, ecological complexity, ownership and access challenges, and incomplete understanding of marine ecological processes and recovery mechanisms. Government agencies and industry have begun to establish baseline measurements for nature-based solutions and identify priority areas for intervention to achieve the net positive goal. Small-scale pilot projects begin to document the economic and ecological benefits of restoration initiatives, creating case studies that help secure additional funding.

Māori

Māori leadership in the sector continues to strengthen, with many iwi expanding their participation in the industry through their Treaty settlements and commercial investments. For some iwi, traditional marine rights, such as local hapū eco-system management of customary fishing and access, are actively maintained and legally secured.

As an example of this customary fishing tools such as rāhui (temporary closures), are increasingly recognised as an important way to respond to local marine management issues, particularly to support the regeneration of declining species. Across key locations throughout Aotearoa New Zealand, agreements and strategies informed by mātauranga Māori are being designed to implement in both fishing and aquaculture approaches, with a focus on protection and restoration rather than short-term extraction.

Coastal Māori communities, whose livelihoods depend on kaimoana and the ocean, are beginning to see stronger legal protections to support sustainable fishing practices at a local level.

Government agencies are exploring the integration of tikanga, whakapapa, and kawa into fisheries and aquaculture policy frameworks, reflecting the growing recognition of the value of Māori knowledge in sector. Collaborative partnerships with iwi continue to improve. Māori interests and values in aquaculture development is more evident particularly in shared water governance arrangements, taonga species protection, and recirculating aquaculture system opportunities within iwi-led economic development frameworks.

Īnanga

SHORT TERM (2025-2030) | MEDIUM TERM (2031-2040) | LONG TERM (2041-2050) | EXTENSION (2081-2100)

Fishing

With warmer and more productive waters, some fish species grow in abundance in Te Ika-a-Māui North Island. Species such as snapper, gemfish and kingfish continue to spread across Te Waipounamu South Island as sea waters get warmer. These geographic shifts create both opportunities and challenges for quota holders in different regions. Ocean acidification begins to impact the quality of shelled species such as kōura (crayfish) and pāua, and mitigation measures are trialled in key catchments.

The fishing industry is taking initial steps to reduce the benthic impact of practices like bottom-trawling, with some operators testing modified gear designs and working with researchers to quantify the environmental benefits. Many fishers struggle to balance two competing priorities: reducing their carbon footprints to produce low carbon protein products while also minimising their broader nature impacts. The challenge lies in the fact that available technologies that enable carbon footprint reduction often still require significant bottom contact. Forward-thinking operators who have sufficient capital are beginning to explore win-win technological advancements that would address climate impacts, reduce nature degradation and deliver economic benefits.

The ethical use of technology to better identify target species is also being developed, with early AI systems that help fishers distinguish between similar-looking species while respecting quota management boundaries and conservation priorities. Basic technological, AI-informed solutions to improve reporting and minimise bycatch are being tested, including enhanced vessel monitoring systems and simplified electronic reporting tools.

The fishing industry continues increasing transparency through the deployment of cameras on a subset of vessels.

After smaller inshore operators which initiated the movement earlier in the decade, larger deepwater operators and higher-risk fisheries begin to consider the business case for increased transparency.

Implementation challenges of data management, privacy concerns, and establishing appropriate review protocols are slowly worked through. This technology also exhibits significant potential to improve data collection and data inputs for fisheries science and fisheries management. Communication of these efforts remains primarily within industry forums and stakeholder meetings, with standardised public reporting frameworks still under development. Early adopters are working with regulators to demonstrate how these technologies can support compliance.

Despite increasing awareness, clear and nationwide directionality and stated ambition, substantial action is delayed. Within inshore fisheries, the trend of declining profitability for small operators continues, along with the exit of family-run enterprises from the industry. This ongoing decline stems from a lack of actionable and coordinated responses focused on supporting these vulnerable groups.

Aquaculture

Climate vulnerability assessments revealed that wild shellfish spat supply for aquaculture is a significant challenge. The acute water warming events, such as severe marine heatwaves, affect the ecology of coastal waters. Exacerbated by chronic temperature rise, aquaculture faces increased mortality due to new disease and pest challenges. The industry responds through systematic identification of vulnerable operations, strategic transitions, and adaptation planning to reduce event impacts. Government and industry collaborate to fund research for developing hatchery-based production, breeding programs, species diversification, and health and nutrition solutions to improve resilience.

These solidify aquaculture as a sector with vast potential to transition to new methods, technologies, and infrastructure that can better withstand changing environmental conditions.

Site, logistic, and cost considerations delay the deployment of renewable energy systems at scale within the marine salmon farming, reducing their timeframe to transition in case of customers prioritising low-carbon seafood. Renewable energy access challenges paired up with concerns around increasing ocean acidification prompt shellfish farmers to accelerate transitioning to hatchery-produced spat selected for resilience. Investment in recirculating aquaculture systems for salmon increases, especially for freshwater hatcheries.

The aquaculture sector starts to explore the possibility of achieving mutual benefits with conservation and starts collaborative research programs focussed on how production techniques might support species restoration. Early partnerships between marine farmers, research institutions, and conservation groups lay the groundwork for a more comprehensive approach in subsequent decades.

Alongside these adaptation efforts, the aquaculture sector continues investing in improved management of marine mammal and seabird interactions. New monitoring technology, while still in early implementation phases, helps farms document wildlife interactions more systematically, identify potential risk patterns and action mitigation methods.

Īnanga

SHORT TERM (2025-2030) **MEDIUM TERM (2031-2040)** LONG TERM (2041-2050) EXTENSION (2081-2100)

General

Ocean warming and associated effects such as acidification, oxygen reductions, and changing ocean currents and circulation patterns continue in a steady sense while acute events such as short term heat waves become ever more extreme. The frequency of tropical species appearing in northern waters of Aotearoa New Zealand increases significantly. This shift results in diminished catch values as fisheries encounter growing numbers of non-target species in their hauls, causing a decrease in the catch values. This also poses new biosecurity risks across the sector.

The government increasingly recognises the seafood sector, despite its continued heavy reliance on fossil fuels, as an important low-emissions food production industry and continues to increase funding for climate-friendly innovations. The seafood sector's growing income potential unlocks access to green and blue bonds, significantly improving capital availability for sustainable projects. Continued and escalating global demand for low-carbon, nutritious foods drives investment interest in Aotearoa New Zealand's seafood operations that transitioned early, while financial markets increasingly favour ethical and socially responsible investments, benefiting companies with strong environmental (climate and nature-related) credentials.

Specially designed financial instruments emerge to support smaller fishers through transition periods, providing manageable repayment structures aligned with the payback timelines of their sustainability investments. However, these instruments come too little too late as many of small-scale family-based operators are out of market. Lending institutions revise their requirements to incorporate sustainability metrics for businesses of all sizes, as financial reporting standards evolve to include climate and nature-related disclosures.

Meanwhile, rising insurance premiums for operations in climate-vulnerable areas encourage further adaptation and risk mitigation strategies across the industry.

Both the aquaculture and fisheries sectors advance collaborative research initiatives. While creating some regulatory uncertainty, the sector demonstrates remarkable adaptability to both climate and policy changes. Simultaneously, deeper conversations emerge about equitable resource allocation between commercial, recreational, and customary interests, reflecting Aotearoa New Zealand's evolving understanding of marine stewardship under a changing climate.

As an early mover, the country's products command premium prices in global markets, particularly those with verified sustainability credentials and transparent environmental practices. International buyers increasingly value Aotearoa New Zealand's reputation for maintaining high environmental standards while delivering quality protein with a comparatively low carbon footprint.

Through these complementary adaptations, the seafood industry maintains its economic and environmental viability despite changing oceanic conditions. The sector's embrace of innovation, supported by responsive government policy, positions Aotearoa New Zealand as a leader in climate-resilient seafood production with robust international market connections.

Nature

In parallel, building on Aotearoa New Zealand's early ambitions to become a net nature-positive economy, by the 2030s the seafood sector has undertaken a sector-wide assessment of nature-related impacts and dependencies. Nature-related financial disclosures become business as usual, though companies still struggle to deliver meaningful benefits to nature from these frameworks. The industry capitalises on Aotearoa New Zealand's growing reputation as a 'net nature positive' economy, creating market advantages for its exports.

As nature-based solutions take root on land, the seafood industry experiences a reduction in harmful runoff and sedimentation from freshwater catchments, particularly in storm events. These ecosystem interventions prove their worth as restoration and conservation initiatives yield tangible benefits for marine environments. The government establishes a comprehensive 'Conservation and Restoration Strategy' focused on accelerating this positive trajectory by providing dedicated funding streams for community groups and local hapū, empowering grassroots participation in ecosystem recovery efforts. In a few areas, wild mussel spat populations show promising signs of recovery, serving as a visible indicator of improving habitat health.

The demonstrated success of these conservation efforts catalyses a virtuous cycle of increased investment and broader implementation. While some habitat degradation and species loss remain unavoidable consequences of climate change, their rates decline significantly less under this more proactive management approach. A particularly valuable synergy emerges as aquaculture expertise is applied to conservation efforts, with hatchery technologies and breeding programs supporting restocking initiatives for threatened species. This cross-sector collaboration strengthens both the economic and ecological resilience of Aotearoa New Zealand's coastal ecosystems. However, the sector becomes increasingly embroiled in criticism from those seeking to attribute ecosystem or species-level changes to the actions of the industry, irrespective of conclusive evidence or not.

Māori

In 2040, Te Tiriti o Waitangi principles are increasingly recognised as essential components of fisheries and aquaculture management. Māori involvement in larger-scale aquaculture and commercial development increases. Evolving partnership models more deliberately reflect a commitment to rangatiratanga and kaitiakitanga.

As a result, iwi take more active roles in decision-making processes. Māori commercial fishing businesses are finding growing success by highlighting environmental stewardship and indigenous knowledge in their operations. This values-based approach is resonating in both local and international markets, though it continues to be refined and expanded. Some Māori-owned enterprises are disproportionately impacted by these changes. Increasingly these enterprises are leaning into partnership models, arrangements to mitigate negative effects and to explore new opportunities. Collaborative partnerships with iwi continue to improve.

Te Ao Māori perspectives are being progressively embedded in law and management systems, supported by pilot projects that are demonstrating tangible benefits at the community level. These initiatives are showing promising outcomes for species and ecosystem health, though implementation remains uneven across regions. The evidence from successful projects is being documented and communicated, gradually building traction and public support as the benefits become more widely understood by industry, government and the public.

For inshore fisheries, a shift toward more localised management is underway, with more iwi and community partnerships emerging to enable stronger regional involvement and oversight roles in several regions. The sector is gaining cross-party political recognition for its sustainability efforts, particularly those that integrate mātauranga Māori and tikanga with other nature-based solutions. Tikanga is being incorporated more into conservation and restocking plans in selected areas, providing promising models of success for wider application. Coastal communities are seeing modest but meaningful growth as they develop improved access to kaimoana through various initiatives, including the early development of marae-based aquaculture. These initiatives serve dual purposes by supporting local food security and creating commercial opportunities, though the full potential of these initiatives is still emerging.

Īnanga

Fishing

Scientific understanding has evolved significantly, with improved climate and species modelling now driving adaptive management approaches throughout the deep and inshore fisheries. Changes are made to the quota management system to ensure it is more responsive to climate-related ecological shifts in fish stocks (such as location, availability, and health), with granular, locally applied total allowable catch limits that utilise nature-based indicators to adjust quickly to changing conditions.

The seafood industry embraces proactive mitigation strategies as evidence mounts for their environmental and economic benefits. The government mandates reductions in fossil fuel, which includes the seafood sector, establishing a clear timeline for vessel transitions while implementing stringent low-emission standards for new builds. Fishing operators are beginning to adopt alternative fuel technologies, though this transformation progresses gradually due to the extended lifecycle and substantial capital investment required for commercial fishing vessels.

AI technologies gain wider adoption across the industry, enhancing transparency and significantly reducing bycatch, which strengthens the sector's social license to operate. The successful implementation of diverse technological advances drives both measurable growth and improved sustainability outcomes throughout the sector. Fishing methods also evolve steadily, with technology now actively reducing environmental impacts while supporting more comprehensive research. By 2040, traditional high-impact fishing methods, including bottom trawling methods, are being transformed through the deep water sector, with more adoption of precision technologies, enhanced monitoring systems, and habitat-conscious protocols that dramatically reduce seabed disturbance while maintaining harvest productivity.

Aquaculture

Whilst climatic changes have resulted in the arrival of new pathogens and pests, thanks to Aotearoa New Zealand's geographic location these incursions are more delayed, providing time for adaptation and control. As climate concerns mount through the 2030s, aquaculture undergoes a significant transformation, strategically increasing expansion offshore into cooler, deeper waters, but still remain heavily reliant on fossil fuels to power energy systems on the farms. This crucial transition receives substantial government infrastructure investment, recognising the sector's importance to food security and economic resilience. In parallel, husbandry improvements (e.g. health surveillance, vaccine development, optimised nutrition), adoption of digital technologies and AI, and genomic selection for climate resilience becomes standard practice within aquaculture, with strong government backing, earning widespread public acceptance as consumers increasingly understand the environmental benefits of responsible aquaculture.

Shifting marine conditions manifest in more frequent mortality events among aquaculture stocks, as changing ocean temperatures and ecological disruptions impact coastal operations. This challenge drives urgent innovation across the industry. Breeding programs advance rapidly, delivering improvements in survival rates and species welfare under evolving environmental stressors. Through this adaptive research, Aotearoa New Zealand is among the world leaders on aquaculture resilience and climate adaptation techniques.

The industry's growth attracts significant technological investment. Innovations in feeding methodologies, health management protocols, advanced breeding techniques, digital innovation, and low-emission fuel systems collectively help producers mitigate climate impacts while improving productivity. Cross-industry collaboration emerges for utilising deep-sea processing waste (fish meal) as a valuable input for aquaculture feed production.

This circular economy approach converts fishery offal into insect-based protein, which then serves as high-quality feed for salmon farming. As Aotearoa New Zealand's aquaculture sector expands, and finfish sector reaches a critical mass, two domestic feed mills are established, catalysing a virtuous cycle of diet optimisation, feed technology advancement, and reduced dependence on imported ingredients. This localisation strengthens supply chain resilience, reduces both costs and emissions, and insulates the industry from international disruptions.

Public perception improves further and undergoes a favourable shift as seaweed, and shellfish farming demonstrate measurable environmental benefits alongside their economic contributions. Communities increasingly support newer approaches like integrated multi-trophic aquaculture, open ocean farming and recirculating aquaculture systems for hatchery operations and grow-out production, recognising their reduced environmental footprint compared to traditional methods. This public confidence supports further industry expansion and investment.

Īnanga

SHORT TERM (2025-2030) | MEDIUM TERM (2031-2040) | **LONG TERM (2041-2050)** | EXTENSION (2081-2100)

General

By mid-century, Aotearoa New Zealand's seafood sector has transformed into a well-adapted industry with proactive mitigation strategies firmly embedded in its operations. What began as occasional sightings of tropical species in the 2030s has evolved into permanent populations throughout the coastal environments of Te Ika-a-Māui North Island. The rate of species geographical shifts continues to accelerate in direct response to rising water temperatures. Adaptation is now a multi-stakeholder approach thoroughly incorporating science-based methodologies. The industry's early investments in research, technology, and collaborative governance have positioned Aotearoa New Zealand as a global leader in climate-responsive fisheries and aquaculture.

Global dialogue on climate and nature has intensified dramatically following decades of gradual progress, with Aotearoa New Zealand's seafood sector emerging as a compelling case study in successful adaptation. Building upon the government's earlier recognition of seafood as an important low-emissions industry, sustained investment in climate-friendly innovations has accelerated the sector's transformation into a model that draws international attention. As global investors increasingly prioritise sustainable food systems, Aotearoa New Zealand's seafood sector has emerged as a preferred destination for capital, offering both strong financial returns and climate and nature credentials that align perfectly with modern investment mandates.

Financial institutions have evolved their approaches, with lending criteria now rewarding ecological performance and insurance premiums linked directly to climate resilience measures. After an adjustment period, these frameworks have strengthened the industry's sustainability focus while ensuring economic viability. The sector's scale now supports significant self-funded research through industry levies, which drives innovation and environmental restoration.

Globally, Aotearoa New Zealand's early adoption of sustainable practices proved advantageous when international environmental accountability mechanisms were implemented. As taxes, penalties, and incentives rewarding positive ecological outcomes became standard worldwide, producers in Aotearoa New Zealand easily demonstrated compliance while competitors struggled to adapt. This market advantage reinforced the economic case for sustainability, accelerating further investments in low-impact fishing technologies and ecosystem restoration.

The transformation reflects a remarkable shift in relationships across the sector. Environmental NGOs, once adversaries to commercial fishing, now direct crowd-funded resources toward industry-led conservation initiatives – a testament to the sector's commitment to operating within ecological boundaries. This partnership approach has accelerated habitat restoration throughout the waters of Aotearoa New Zealand, with commercial operators actively participating in rebuilding marine ecosystems. Behind this evolution is the ongoing collaboration of industry, indigenous partners, researchers, and government, who together maintain a shared roadmap for ocean health that balances ecological and economic priorities.

Aotearoa New Zealand has emerged as a global hub for blue economy and ocean research innovation. The seafood sector thrives with sustained government investment, growing into a significant pillar of the national economy. International recognition of the industry's low emissions profile and vital contributions to global food security has further strengthened demand for seafood products from Aotearoa New Zealand.

This integration of environmental stewardship into business planning has positioned Aotearoa New Zealand's seafood industry as a global exemplar of sustainable food production that enhances rather than depletes natural capital.

Nature

What began as mandatory nature-related assessments and reporting requirements in the 2030s has evolved into an essential strategic framework embraced throughout Aotearoa New Zealand's seafood industry. Along the way, thoughtful government reforms have created balanced regulatory frameworks that make compliance achievable for businesses of all sizes while maintaining robust ecological safeguards. These assessments now provide meaningful information that drives planning and operational decisions, effectively channelling investment toward sustainable practices while building genuine consumer confidence. Habitat restoration and conservation now stand as core pillars of the sector's strategy, with fishing and aquaculture companies recognising that their long-term success is inextricably linked to healthy marine ecosystems.

Late in 2050s, the nationwide embrace of Ki Uta Ki Tai – the Māori principle of managing environments from mountains to sea – has transformed the country's approach to marine stewardship. The deliberate government and industry shift toward ecosystem-based management in the 2030s created visible improvements throughout Aotearoa New Zealand's waterways. Through coordinated land and sea management approaches, coastal waters have gradually cleared as sediment and nutrient runoff decreased. This improved water quality has supported healthier inshore fisheries and aquaculture. The connection between land management practices and marine ecosystem health became increasingly evident.

The strategic expansion of marine protected areas, combined with a new flexible approach to planning and implementation that adapts to changing conditions, has improved ecological integrity throughout the waters of Aotearoa New Zealand. What began as conservation measures ultimately benefited the seafood sector through spillover effects, with protected zones replenishing adjacent fishing grounds. By mid-century, the industry actively supported these protected areas, recognising them as essential investments in long-term fisheries productivity and climate resilience.

By embracing restoration as a core business, the seafood sector demonstrates how economic prosperity, and environmental health can advance together when guided by a long-term vision.

Māori

The importance of Western science combined with mātauranga Māori is now widely recognised, with Aotearoa New Zealand acknowledged internationally for embracing indigenous thinking in fisheries and aquaculture practices. Māori investment in aquaculture has grown significantly, marae-based aquaculture operations have expanded throughout coastal regions, and this is recognised by the seafood industry as a key driver of increased workforce awareness, skill, and interest within the aquaculture and fisheries sector. Developments such as these reflect the movement towards achieving tino rangatiratanga, as the empowerment of Māori effectively addresses long-standing social-economic inequities. Communities now feel empowered as co-decision makers in managing kaimoana within their rohe, in line with Te Tiriti principles, fostering genuine social harmony.

This collaborative approach has proven valuable in navigating the gradual yet persistent climate changes affecting marine ecosystems. The integration of mātauranga Māori and tikanga Māori with traditional ecological knowledge, and scientific monitoring has provided a comprehensive understanding of subtle ecosystem shifts, allowing for measured responses rather than crisis management.

Īnanga

Fishing

Changes in marine primary production have fundamentally shifted deepwater ecological dynamics, requiring substantial adjustments to species mix and quota allocations. What could have been a crisis for the industry has instead become manageable through the adaptive, agile management systems established in previous decades, allowing the sector to respond quickly and effectively to these environmental changes

The steady and consistent development of fishing methods through technology and innovation that began in the 2030s has led to significant improvements in environmental impact with minimal benthic disturbance – a challenge once considered impossible to overcome. These innovations, developed through collaborative trials between industry, government, and research institutions, have effectively eliminated a major ecological concern about Aotearoa New Zealand's fishing practices.

Vessel modernisation has accelerated under new environmental standards, while the industry's exemplary compliance record in environmental management, species welfare, and transparency has become a strategic market advantage rather than merely a cost of doing business. Concerns around data privacy and information storage have been actively managed through robust protocols, strengthening trust between operators and regulators.

Comprehensive vessel transition plans are also implemented across the entire fleet, supported by government initiatives that recognise the seafood sector's critical importance to national food security and regional economic stability. This transition has been carefully orchestrated to ensure that vessels of all sizes, from small inshore operators to large deepwater fleets, can access appropriate technologies and financial support mechanisms.

Aquaculture

By 2050, Aotearoa New Zealand's aquaculture sector has expanded dramatically, generating over NZ$20 billion in annual revenue and becoming a cornerstone of regional economic development. This growth was facilitated by innovative financial instruments that ensured smaller companies weren't left behind during the transition. The industry has cultivated a global reputation for premium, sustainable seafood, positioning it perfectly to meet the rising international demand for nutritious, low-carbon protein sources.

Aotearoa New Zealand has established itself as a global hub for aquaculture innovation, with world-leading technologies in hatchery and ocean farming systems, monitoring and digital technologies, breeding, nutrition, and disease management attracting substantial international investment. This technological edge ensures the country maintains its competitive advantage in sustainable production methods. Government support for innovation has propelled the industry forward, with open ocean farming, hatchery spat production, and genomic selection now a routine practice. Breeding programs develop stock varieties with enhanced climate resilience, disease resistance, and growth efficiency – allowing farms to stay ahead of environmental changes rather than merely reacting to them. Species diversification adds further resilience as access to new species in Aotearoa New Zealand through southerly migration provides new opportunities.

Integrated multi-trophic systems have emerged as successful farming systems. There is a growing number of commercial operators that incorporate habitat enhancement, combining multiple species such as finfish, seaweed, crustaceans, and shellfish to reduce environmental impacts and create multiple value streams. Commercial operations incorporate habitat enhancement elements, creating networks of mussel reefs and kelp forests that support wild fisheries and enhance biodiversity. These restoration efforts yield tangible economic benefits as enhanced habitats strengthen the entire marine food web.

Aquaculture's role in Aotearoa New Zealand's nature-positive movement was evident and industry expertise was increasingly applied to marine restoration efforts. As the sector grew more profitable through the 2030s and 2040s, aquaculture operators are now able to channel more resources into active restoration programmes, recognising that ecological health directly influenced their bottom line. These initiatives involved collaboration with local communities and iwi, who brought valuable mātauranga Māori perspectives to restoration work. The combined efforts led to the protection of critical spawning grounds and the creation of habitat corridors that enhanced recruitment into inshore species. Shellfish farming in particular demonstrated dual benefits, both providing economic returns and improving water quality through natural filtration processes.

Public perception of aquaculture has broad social acceptance and support, particularly in regional economies. Once viewed with scepticism by the public, the industry now enjoys broad social acceptance. This shift stems from robust assessments, transparent practices, and demonstrated environmental and nutritional benefits. The visible habitat restoration projects have been particularly effective in ensuring public support, as people witness first-hand how modern aquaculture can enhance rather than harm marine ecosystems.

Īnanga

Extension

Looking back from the 2080s, Aotearoa New Zealand's seafood sector has undergone not just adaptation but a complete metamorphosis - becoming virtually unrecognisable from its early 21st century origins. What was once mostly an extractive industry has evolved into what is now known globally as the 'Living Ocean Economy' – a regenerative system where the boundaries between conservation, production, and cultural identity have dissolved.

The deep oceanographic modelling systems pioneered in the 2040s have evolved into a real-time adaptive management network that functions as a 'digital twin' of Aotearoa New Zealand's entire marine ecosystem. This living digital ecosystem – jointly overseen by AI systems and indigenous knowledge keepers – can predict not just fish populations but entire ecosystem cascades months in advance, allowing for truly dynamic stewardship

Climate changes have been partially moderated through marine ecosystem restoration. The expansion of regenerative ocean farming has created vast 'climate buffer zones' that have slowed ocean warming in the region. While subtropical species now dominate in northern waters, the careful cultivation of complex habitat networks has allowed for unprecedented species diversity, with recovery of populations once thought lost to climate change.

Developed in Aotearoa New Zealand, an internationally recognised protocol for indigenous-led marine governance is now being implemented in over 40 coastal nations. Under this system, the concept of marine 'ownership' has been replaced with layered stewardship responsibilities that recognise the interconnected rights of ecosystems, species, local communities, and future generations. This protocol has positioned Aotearoa New Zealand as the global centre for indigenous blue economy leadership.

Māori-led enterprises now export not just premium seafood but advanced ecosystem regeneration services, indigenous governance systems, and marine biotechnology innovations based on traditional knowledge that have transformed global aquaculture. The integration of cultural values with commercial activities has generated a thriving sector where prosperity is measured in both ecosystem vitality and community wellbeing.

The most profound transformation has been philosophical: Aotearoa New Zealand's marine territories are no longer viewed as separate from the land or human communities. The once-radical concept of 'marine personhood' – extending from the legal recognition of rivers decades earlier, now underpins the entire blue economy. The ocean is recognised as a living ancestor with its own rights and representation in governance structures.

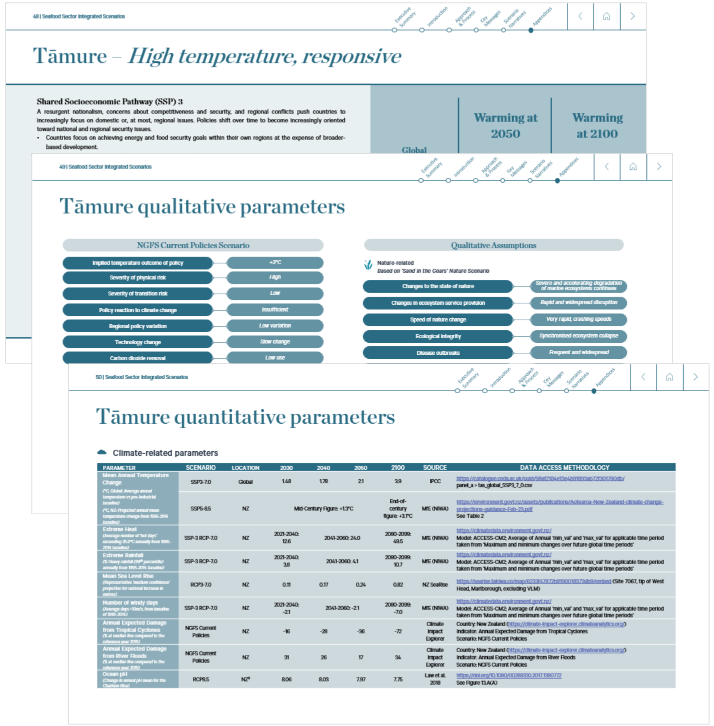
What began as a gradual shift toward sustainability in the 2020s has culminated in an entirely new relationship with the ocean - one where seafood sector doesn't just minimise harm but actively regenerate the mauri (life force) of marine systems. Aotearoa New Zealand's example has become a blueprint for coastal nations worldwide, demonstrating how indigenous wisdom combined with technological innovation can transform crisis into regenerative prosperity.

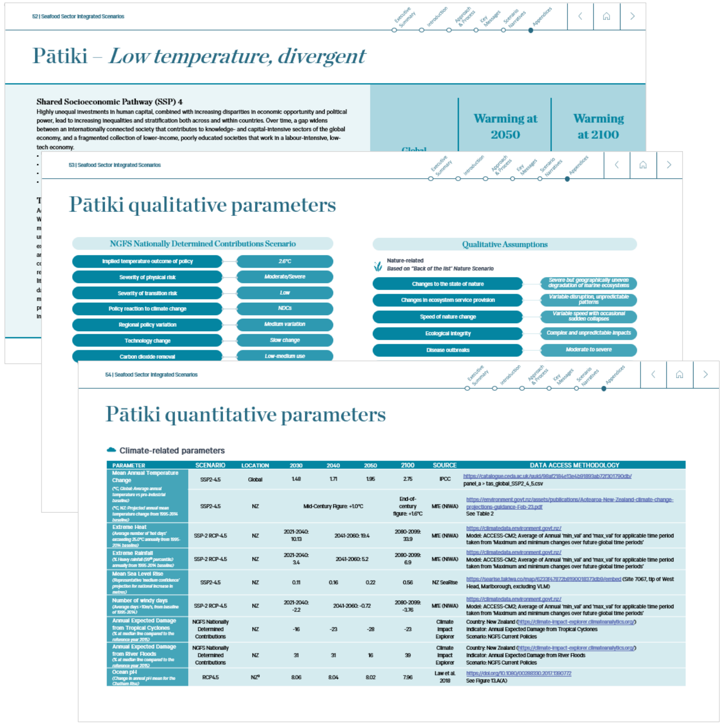
Technical Appendices

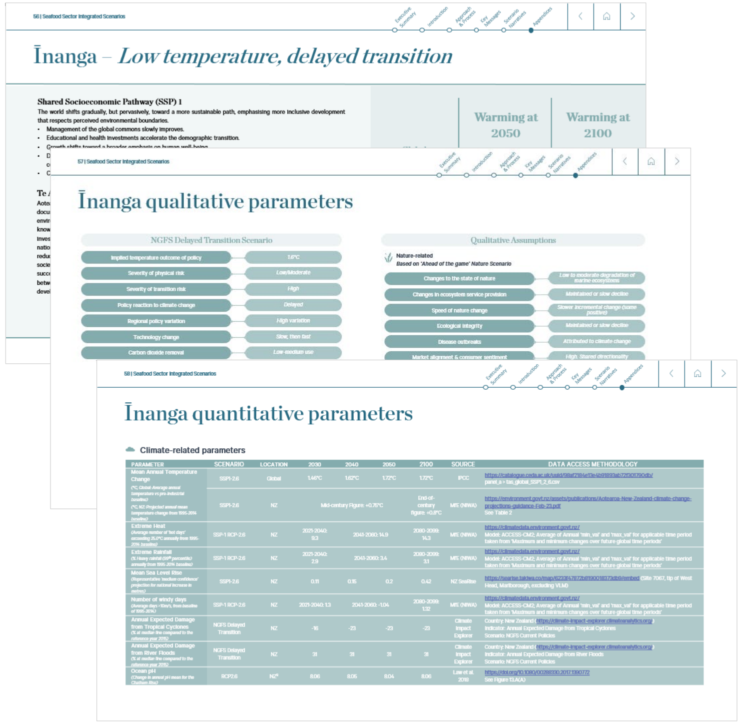
Appendix guide

Appendix A: Scenario architecture

Appendix A includes scenario architecture for the three scenarios: **Tāmure – High temperature, responsive**; **Pātiki – Low temperature, divergent** & **Īnanga – Low temperature, delayed transition**.







Tāmure – *High temperature, responsive*

Shared Socioeconomic Pathway (SSP) 3

A resurgent nationalism, concerns about competitiveness and security, and regional conflicts push countries to increasingly focus on domestic or, at most, regional issues. Policies shift over time to become increasingly oriented toward national and regional security issues.

- Countries focus on achieving energy and food security goals within their own regions at the expense of broader-based development.
- Investments in education and technological development decline.
- Economic development is slow, consumption is material-intensive, and inequalities persist or worsen over time.
- Population growth is low in industrialised countries and high in developing ones.
- A low international priority for addressing environmental concerns leads to strong environmental degradation in some regions.

Te Ao Māori Pathway (TAMP) 3

Progress towards a more inclusive society and the integration of Te Tiriti o Waitangi principles into governance and everyday life is limited. Although the Treaty remains a symbol of partnership, its principles are often sidelined or inconsistently applied. Efforts to merge Western knowledge with mātauranga Māori (Māori knowledge systems) encounter frequent obstacles, and the use of mātauranga Māori is largely symbolic rather than substantive. Investment in Māori education, health, and tribal development is sporadic and insufficient, failing to address deep-seated historical inequities. There is a lack of cohesive commitment to achieving equity among tangata whenua and tangata Tiriti, with efforts often being fragmented and uncoordinated. As a result, socio-economic and health disparities between Māori and non-Māori communities persist, with only marginal improvements. Aotearoa New Zealand's attempts at fostering inclusivity and equity are largely unnoticed on the global stage due to the lack of substantive progress. Relationships between iwi (tribes) and the Crown are strained and often ineffective, with collaboration efforts frequently falling short. Aotearoa New Zealand makes only nominal progress towards incorporating Te Tiriti principles and Māori knowledge into governance and societal structures, resulting in limited improvements and continued disparities.

	Warming at 2050	Warming at 2100
Global 	+2.1°C	+3.9°C
Aotearoa New Zealand 	+1.3°C *MfE/NIWA mid-century estimate*	+3.1°C *MfE/NIWA end-of-century estimate*

Tāmure qualitative parameters

NGFS Current Policies Scenario

Implied temperature outcome of policy	*+3°C*
Severity of physical risk	*High*
Severity of transition risk	*Low*
Policy reaction to climate change	*Insufficient*
Regional policy variation	*Low variation*
Technology change	*Slow change*
Carbon dioxide removal	*Low use*

Qualitative Assumptions

Nature-related

Based on 'Sand in the Gears' Nature Scenario

Changes to the state of nature	*Severe and accelerating degradation of marine ecosystems continues*
Changes in ecosystem service provision	*Rapid and widespread disruption*
Speed of nature change	*Very rapid, crashing speeds*
Ecological integrity	*Synchronised ecosystem collapse*
Disease outbreaks	*Frequent and widespread*
Market alignment & consumer sentiment	*Low. conflicting directionality*
Marine Protected Areas	*Insufficient*

Please note that these assumptions are informed by and interpreted from the Nature Scenario Guidance developed by the Taskforce on Nature-related Financial Disclosures (TNFD). They are not direct quotations from the TNFD materials.

Te Ao Māori-related parameters

Mātauranga Māori recognition	*Restricted recognition*
Te Tiriti o Waitangi integration	*Restricted integration*
Tino rangatiratanga	*Restricted enablement of tino rangatiratanga*

Tāmure quantitative parameters

Climate-related parameters

PARAMETER	SCENARIO	LOCATION	2030	2040	2050	2100	SOURCE	DATA ACCESS METHODOLOGY
Mean Annual Temperature Change *(°C, Global: Average annual temperature vs pre-industrial baseline)* *(°C, NZ: Projected annual mean temperature change from 1995-2014 baseline)*	SSP3-7.0	Global	1.48	1.78	2.1	3.9	IPCC	https://catalogue.ceda.ac.uk/uuid/98af2184e13e4b91893ab72f301790db/ panel_a > tas_global_SSP3_7_0.csv
	SSP5-8.5	NZ	Mid-Century Figure: +1.3°C			End-of-century figure: +3.1°C	MfE (NIWA)	https://environment.govt.nz/assets/publications/Aotearoa-New-Zealand-climate-change-projections-guidance-Feb-23.pdf See Table 2
Extreme Heat *(Average number of 'hot days' exceeding 25.0°C annually from 1995-2014 baseline)*	SSP-3 RCP-7.0	NZ	2021-2040: 12.6	2041-2060: 24.0		2080-2099: 49.5	MfE (NIWA)	https://climatedata.environment.govt.nz/ Model: ACCESS-CM2; Average of Annual 'min_val' and 'max_val' for applicable time period taken from 'Maximum and minimum changes over future global time periods'
Extreme Rainfall *(% Heavy rainfall (99th percentile) annually from 1995-2014 baseline)*	SSP-3 RCP-7.0	NZ	2021-2040: 3.8	2041-2060: 4.1		2080-2099: 10.7	MfE (NIWA)	https://climatedata.environment.govt.nz/ Model: ACCESS-CM2; Average of Annual 'min_val' and 'max_val' for applicable time period taken from 'Maximum and minimum changes over future global time periods'
Mean Sea Level Rise *(Representative 'medium confidence' projection for national increase in metres)*	RCP3-7.0	NZ	0.11	0.17	0.24	0.82	NZ SeaRise	https://searise.takiwa.co/map/6233f47872b8190018373db9/embed (Site 7067, tip of West Head, Marlborough, excluding VLM)
Number of windy days *(Average days >10m/s, from baseline of 1995-2014)*	SSP-3 RCP-7.0	NZ	2021-2040: -2.1	2041-2060: -2.1		2080-2099: -7.0	MfE (NIWA)	https://climatedata.environment.govt.nz/ Model: ACCESS-CM2; Average of Annual 'min_val' and 'max_val' for applicable time period taken from 'Maximum and minimum changes over future global time periods'
Annual Expected Damage from Tropical Cyclones *(% at median line compared to the reference year 2015)*	NGFS Current Policies	NZ	-16	-28	-36	-72	Climate Impact Explorer	Country: New Zealand (https://climate-impact-explorer.climateanalytics.org/) Indicator: Annual Expected Damage from Tropical Cyclones Scenario: NGFS Current Policies
Annual Expected Damage from River Floods *(% at median line compared to the reference year 2015)*	NGFS Current Policies	NZ	31	26	17	34	Climate Impact Explorer	Country: New Zealand (https://climate-impact-explorer.climateanalytics.org/) Indicator: Annual Expected Damage from River Floods Scenario: NGFS Current Policies
Ocean pH *(Change in annual pH mean for the Chatham Rise)*	RCP8.5	NZ[9]	8.06	8.03	7.97	7.75	Law et al. 2018	https://doi.org/10.1080/00288330.2017.1390772 See Figure 13.A(A)

Tāmure quantitative parameters

Socio-economic parameters

PARAMETER	SCENARIO	LOCATION	2030	2040	2050	2100	SOURCE	DATA ACCESS METHODOLOGY
Population *(million)*	SSP3	Global	8565.79	9360.98	10093.37	13058.98	SSP database	SSP Scenario Explorer 3.1.0 (https://data.ece.iiasa.ac.at/ssp/) Basic drivers across the SSPs > Population trends across the SSPs > Region: World
	SSP3	NZ	5.3	5.54	5.75	5.59	SSP database	SSP Scenario Explorer 3.1.0 (https://data.ece.iiasa.ac.at/ssp/) Basic drivers across the SSPs > Population trends across the SSPs > Region: New Zealand
GDP *(Real 09/10 NZ$billion*	Current Policy Reference	NZ	319.36	375.13	435.47	-	CCC	https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.climatecommission.govt.nz%2Fpublic%2FInaia-tonu-nei-a-low-emissions-future-for-Aotearoa%2FModelling-files%2FScenarios-dataset-2021-final-advice.xlsx&wdOrigin=BROWSELINK
Carbon Price *($/tonne (2024$))*	Low projection	NZ	Present-2030: 99	2031-2050: 164		Beyond 2050: 238	NZ Treasury	https://www.treasury.govt.nz/sites/default/files/2024-10/cbax-tool-climate-environmental-impacts-oct24.pdf See Table 2
Oil Demand *(Million barrels per day)*	STEPS	Global	101.5	-	97.4	-	IEA	https://iea.blob.core.windows.net/assets/86ede39e-4436-42d7-ba2a-edf61467e070/WorldEnergyOutlook2023.pdf#page=276 See Table 3.5
Oil Price *(US$/bbl – Current Policy)*	Current Policy Reference	Global	60	60	60	-	CCC	https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.climatecommission.govt.nz%2Fpublic%2FInaia-tonu-nei-a-low-emissions-future-for-Aotearoa%2FModelling-files%2FScenarios-dataset-2021-final-advice.xlsx&wdOrigin=BROWSELINK

Supplementary nature-related parameters

(Law et al. 2018, for NZ, based on RCP8.5)

PARAMETER		PRESENT DAY MEAN	MEDIUM/LONG (2036-2055)	EXTRA-LONG (2080-2100)
Dissolved Surface Nutrients *(Mean change in concentration (mmol m^{-3}))*	Nitrate	5.31	5.1	4.9
	Phosphate	0.5	0.48	0.45
	Silicate	3.2	3.0	2.55
	Iron	0.13	0.14	0.16
Detrital Flux *(Projected absolute and proportional change (%))*		50.2	-4.4	-12.0

PARAMETER	PRESENT DAY MEAN	MEDIUM/LONG (2036-2055)	EXTRA-LONG (2080-2100)
Net Primary Production (NPP) *(Mean change in net rate (mmol $m^{-2}d^{-1}$))*	33.52	33.0	32.0
Surface Chlorophyll (Chl-a) *(Mean change (mg m^{-3}))*	0.2	0.19	0.185
Mixed Layer Depth (MLD) *(Mean change (m))*	91	83.2	77.0
Sea Surface Temperature (SST) *(Mean change (°C))*	15.84	16.8	18.3

Note: The medium- and long-term time horizons have been combined for this data source as it only provides Mid-century (2036-2055) and End-century (2081-2100) figures. An extra-long time horizon has been added to provide further comparison.

Pātiki – *Low temperature, divergent*

Shared Socioeconomic Pathway (SSP) 4

Highly unequal investments in human capital, combined with increasing disparities in economic opportunity and political power, lead to increasing inequalities and stratification both across and within countries. Over time, a gap widens between an internationally connected society that contributes to knowledge- and capital-intensive sectors of the global economy, and a fragmented collection of lower-income, poorly educated societies that work in a labour-intensive, low-tech economy.

- Social cohesion degrades and conflict and unrest become increasingly common.
- Technology development is high in the high-tech economy and sectors.
- The globally connected energy sector diversifies.
- Environmental policies focus on local issues around middle- and high-income areas.

Te Ao Māori Pathway (TAMP) 4

Aotearoa New Zealand faces significant setbacks in achieving an inclusive society, with the principles of Te Tiriti o Waitangi largely disregarded in governance and societal frameworks. Efforts to integrate Māori perspectives and mātauranga Māori (Māori knowledge systems) are minimal, and initiatives to support Māori development are severely underfunded or neglected altogether. The integration of mātauranga Māori into policy and governance is almost non-existent, with Māori knowledge and perspectives given little to no consideration. Investment in Māori education, health, and tribal development is minimal, leading to a continuation or worsening of historic inequities. There is little to no commitment from the government or broader society to achieving equity among tangata whenua and tangata Tiriti. As a result, socio-economic and health disparities between Māori and non-Māori communities become more pronounced, with little to no positive change. Aotearoa is criticised globally for its lack of progress in fostering inclusivity and equity, damaging its international reputation. Relationships between iwi (tribes) and the Crown are deeply strained, marked by mistrust and conflict, resulting in ineffective collaboration and advocacy. Aotearoa struggles to make any meaningful progress toward incorporating Te Tiriti principles and Māori knowledge into governance and societal structures, resulting in worsening disparities and dysfunctional relationships.

	Warming at 2050	Warming at 2100
Global 	+2.0°C	+2.7°C
Aotearoa New Zealand 	+1.0°C *MfE/NIWA mid-century estimate*	+1.6°C *MfE/NIWA end-of-century estimate*

Pātiki qualitative parameters

NGFS Nationally Determined Contributions Scenario

Implied temperature outcome of policy	*2.6°C*
Severity of physical risk	*Moderate/Severe*
Severity of transition risk	*Low*
Policy reaction to climate change	*NDCs*
Regional policy variation	*Medium variation*
Technology change	*Slow change*
Carbon dioxide removal	*Low-medium use*

Qualitative Assumptions

Nature-related

Based on "Back of the list' Nature Scenario

Changes to the state of nature	*Severe but geographically uneven degradation of marine ecosystems*
Changes in ecosystem service provision	*Variable disruption, unpredictable patterns*
Speed of nature change	*Variable speed with occasional sudden collapses*
Ecological integrity	*Complex and unpredictable impacts*
Disease outbreaks	*Moderate to severe*
Market alignment & consumer sentiment	*Low alignment. Efforts focused on climate*
Marine Protected Areas	*Fragmented*

Please note that these assumptions are informed by and interpreted from the Nature Scenario Guidance developed by the Taskforce on Nature-related Financial Disclosures (TNFD). They are not direct quotations from the TNFD materials.

Te Ao Māori-related parameters

Mātauranga Māori recognition	*Poor acknowledgement*
Te Tiriti o Waitangi integration	*Poor integration*
Tino rangatiratanga	*Poor enablement of tino rangatiratanga*

Pātiki quantitative parameters

Climate-related parameters

PARAMETER	SCENARIO	LOCATION	2030	2040	2050	2100	SOURCE	DATA ACCESS METHODOLOGY
Mean Annual Temperature Change *(°C, Global: Average annual temperature vs pre-industrial baseline)*	SSP2-4.5	Global	1.48	1.71	1.95	2.75	IPCC	https://catalogue.ceda.ac.uk/uuid/98af2184e13e4b91893ab72f301790db/ panel_a > tas_global_SSP2_4_5.csv
(°C, NZ: Projected annual mean temperature change from 1995-2014 baseline)	SSP2-4.5	NZ	Mid-Century Figure: +1.0°C			End-of-century figure: +1.6°C	MfE (NIWA)	https://environment.govt.nz/assets/publications/Aotearoa-New-Zealand-climate-change-projections-guidance-Feb-23.pdf See Table 2
Extreme Heat *(Average number of 'hot days' exceeding 25.0°C annually from 1995-2014 baseline)*	SSP-2 RCP-4.5	NZ	2021-2040: 10.13	2041-2060: 19.4		2080-2099: 33.9	MfE (NIWA)	https://climatedata.environment.govt.nz/ Model: ACCESS-CM2; Average of Annual 'min_val' and 'max_val' for applicable time period taken from 'Maximum and minimum changes over future global time periods'
Extreme Rainfall *(% Heavy rainfall (99th percentile) annually from 1995-2014 baseline)*	SSP-2 RCP-4.5	NZ	2021-2040: 3.4	2041-2060: 5.2		2080-2099: 6.9	MfE (NIWA)	https://climatedata.environment.govt.nz/ Model: ACCESS-CM2; Average of Annual 'min_val' and 'max_val' for applicable time period taken from 'Maximum and minimum changes over future global time periods'
Mean Sea Level Rise *(Representative 'medium confidence' projection for national increase in metres)*	SSP2-4.5	NZ	0.11	0.16	0.22	0.56	NZ SeaRise	https://searise.takiwa.co/map/6233f47872b8190018373db9/embed (Site 7067, tip of West Head, Marlborough, excluding VLM)
Number of windy days *(Average days >10m/s, from baseline of 1995-2014)*	SSP-2 RCP-4.5	NZ	2021-2040: -2.2	2041-2060: -0.72		2080-2099: -3.76	MfE (NIWA)	https://climatedata.environment.govt.nz/ Model: ACCESS-CM2; Average of Annual 'min_val' and 'max_val' for applicable time period taken from 'Maximum and minimum changes over future global time periods'
Annual Expected Damage from Tropical Cyclones *(% at median line compared to the reference year 2015)*	NGFS Nationally Determined Contributions	NZ	-16	-23	-28	-23	Climate Impact Explorer	Country: New Zealand (https://climate-impact-explorer.climateanalytics.org/) Indicator: Annual Expected Damage from Tropical Cyclones Scenario: NGFS Current Policies
Annual Expected Damage from River Floods *(% at median line compared to the reference year 2015)*	NGFS Nationally Determined Contributions	NZ	31	31	16	39	Climate Impact Explorer	Country: New Zealand (https://climate-impact-explorer.climateanalytics.org/) Indicator: Annual Expected Damage from River Floods Scenario: NGFS Current Policies
Ocean pH *(Change in annual pH mean for the Chatham Rise)*	RCP4.5	NZ[9]	8.06	8.04	8.02	7.96	Law et al. 2018	https://doi.org/10.1080/00288330.2017.1390772 See Figure 13.A(A)

Pātiki quantitative parameters

Socio-economic parameters

PARAMETER	SCENARIO	LOCATION	2030	2040	2050	2100	SOURCE	DATA ACCESS METHODOLOGY
Population *(million)*	SSP4	Global	8546.26	9286.2	9939.52	11994.71	SSP database	SSP Scenario Explorer 3.1.0 (https://data.ece.iiasa.ac.at/ssp/) Basic drivers across the SSPs > Population trends across the SSPs > Region: World
	SSP3	NZ	5.28	5.43	5.51	4.84	SSP database	SSP Scenario Explorer 3.1.0 (https://data.ece.iiasa.ac.at/ssp/) Basic drivers across the SSPs > Population trends across the SSPs > Region: New Zealand
GDP *(Real 09/10 NZ$billion*	Current Policy Reference	NZ	319.36	375.13	435.47	-	CCC	https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.climatecommission.govt.nz%2Fpublic%2FInaia-tonu-nei-a-low-emissions-future-for-Aotearoa%2FModelling-files%2FScenarios-dataset-2021-final-advice.xlsx&wdOrigin=BROWSELINK
Carbon Price *($/tonne (2024$))*	Central projection	NZ	Present-2030: 149	2031-2050: 246		Beyond 2050: 444	NZ Treasury	https://www.treasury.govt.nz/sites/default/files/2024-10/cbax-tool-climate-environmental-impacts-oct24.pdf See Table 2
Oil Demand *(Million barrels per day) - World*	Announced Pledges	Global	92.5	-	54.8	-	IEA	https://iea.blob.core.windows.net/assets/86ede39e-4436-42d7-ba2a-edf61467e070/WorldEnergyOutlook2023.pdf#page=276 See Table 3.5
Oil Price *(US$/bbl – Current Policy)*	Current Policy Reference	Global[6]	60	60	60	-		https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.climatecommission.govt.nz%2Fpublic%2FInaia-tonu-nei-a-low-emissions-future-for-Aotearoa%2FModelling-files%2FScenarios-dataset-2021-final-advice.xlsx&wdOrigin=BROWSELINK

Supplementary nature-related parameters

(Law et al. 2018, for NZ, based on RCP4.5)

PARAMETER		PRESENT DAY MEAN	MEDIUM/LONG (2036-2055)	EXTRA-LONG (2080-2100)
Dissolved Surface Nutrients *(Mean change in concentration (mmol m^{-3}))*	Nitrate	5.31	5.1	5.0
	Phosphate	0.5	0.49	0.47
	Silicate	3.2	3.1	2.7
	Iron	0.13	0.16	0.17
Detrital Flux *(Projected absolute and proportional change (%))*		50.2	-1.3	-4.5

PARAMETER	PRESENT DAY MEAN	MEDIUM/LONG (2036-2055)	EXTRA-LONG (2080-2100)
Net Primary Production (NPP) *(Mean change in net rate (mmol $m^{-2}d^{-1}$))*	33.52	33.2	33.1
Surface Chlorophyll (Chl-a) *(Mean change (mg m^{-3}))*	0.2	0.19	0.19
Mixed Layer Depth (MLD) *(Mean change (m))*	91	86.5	85.0
Sea Surface Temperature (SST) *(Mean change (°C))*	15.84	16.6	16.9

Note: The medium- and long-term time horizons have been combined for this data source as it only provides Mid-century (2036-2055) and End-century (2081-2100) figures. An extra-long time horizon has been added to provide further comparison.

Īnanga – *Low temperature, delayed transition*

Shared Socioeconomic Pathway (SSP) 1

The world shifts gradually, but pervasively, toward a more sustainable path, emphasising more inclusive development that respects perceived environmental boundaries.

- Management of the global commons slowly improves.
- Educational and health investments accelerate the demographic transition.
- Growth shifts toward a broader emphasis on human well-being.
- Driven by an increasing commitment to achieving development goals, inequality is reduced both across and within countries.
- Consumption is oriented toward low material growth and lower resource and energy intensity.

Te Ao Māori Pathway (TAMP) 1

Aotearoa moves toward a more inclusive future where Te Tiriti o Waitangi is firmly established as the foundational document of the nation, with its principles embedded in all aspects of governance and society. This fosters an environment where co-development between Māori and the Crown is practised extensively, leveraging both Western knowledge and mātauranga Māori (Māori knowledge systems) to guide decision-making processes. Significant investments are made into Māori education, health, and iwi development to address historic inequities, reflecting a nationwide commitment to achieving equity between tangata whenua and tangata Tiriti. These efforts lead to a tangible reduction in socio-economic and health disparities between Māori and non-Māori, resulting in a fairer and more just society. Aotearoa New Zealand's model of inclusivity and equity becomes a global beacon of inspiration, showcasing the success of committed partnership and respect for indigenous knowledge. The strong and enduring partnerships between iwi (tribes) and the Crown drive continuous improvement and mutual understanding, ensuring sustainable development for all.

	Warming at 2050	Warming at 2100
Global 	+1.7°C	+1.7°C
Aotearoa New Zealand 	+0.75°C *MfE/NIWA mid-century estimate*	+0.8°C *MfE/NIWA end-of-century estimate*

Īnanga qualitative parameters

NGFS Delayed Transition Scenario

Implied temperature outcome of policy	*1.6°C*
Severity of physical risk	*Low/Moderate*
Severity of transition risk	*High*
Policy reaction to climate change	*Delayed*
Regional policy variation	*High variation*
Technology change	*Slow, then fast*
Carbon dioxide removal	*Low-medium use*

Qualitative Assumptions

Nature-related

Based on 'Ahead of the game' Nature Scenario

Changes to the state of nature	*Low to moderate degradation of marine ecosystems*
Changes in ecosystem service provision	*Maintained or slow decline*
Speed of nature change	*Slower incremental change (some positive)*
Ecological integrity	*Maintained or slow decline*
Disease outbreaks	*Attributed to climate change*
Market alignment & consumer sentiment	*High. Shared directionality*
Marine Protected Areas	*Some expansion*

Please note that these assumptions are informed by and interpreted from the Nature Scenario Guidance developed by the Taskforce on Nature-related Financial Disclosures (TNFD). They are not direct quotations from the TNFD materials.

Te Ao Māori-related

Mātauranga Māori recognition	*Significant recognition*
Te Tiriti o Waitangi integration	*Significant integration*
Tino rangatiratanga	*Strong enablement of tino rangatiratanga*

Īnanga quantitative parameters

Climate-related parameters

PARAMETER	SCENARIO	LOCATION	2030	2040	2050	2100	SOURCE	DATA ACCESS METHODOLOGY
Mean Annual Temperature Change *(°C, Global: Average annual temperature vs pre-industrial baseline)* *(°C, NZ: Projected annual mean temperature change from 1995-2014 baseline)*	SSP1-2.6	Global	1.46°C	1.62°C	1.72°C	1.72°C	IPCC	https://catalogue.ceda.ac.uk/uuid/98af2184e13e4b91893ab72f301790db/ panel_a > tas_global_SSP1_2_6.csv
	SSP1-2.6	NZ	Mid-century Figure: +0.75°C			End-of-century figure: +0.8°C	MfE (NIWA)	https://environment.govt.nz/assets/publications/Aotearoa-New-Zealand-climate-change-projections-guidance-Feb-23.pdf See Table 2
Extreme Heat *(Average number of 'hot days' exceeding 25.0°C annually from 1995-2014 baseline)*	SSP-1 RCP-2.6	NZ	2021-2040: 9.3	2041-2060: 14.9		2080-2099: 14.3	MfE (NIWA)	https://climatedata.environment.govt.nz/ Model: ACCESS-CM2; Average of Annual 'min_val' and 'max_val' for applicable time period taken from 'Maximum and minimum changes over future global time periods'
Extreme Rainfall *(% Heavy rainfall (99th percentile) annually from 1995-2014 baseline)*	SSP-1 RCP-2.6	NZ	2021-2040: 2.9	2041-2060: 3.4		2080-2099: 3.1	MfE (NIWA)	https://climatedata.environment.govt.nz/ Model: ACCESS-CM2; Average of Annual 'min_val' and 'max_val' for applicable time period taken from 'Maximum and minimum changes over future global time periods'
Mean Sea Level Rise *(Representative 'medium confidence' projection for national increase in metres)*	SSP1-2.6	NZ	0.11	0.15	0.2	0.42	NZ SeaRise	https://searise.takiwa.co/map/6233f47872b8190018373db9/embed (Site 7067, tip of West Head, Marlborough, excluding VLM)
Number of windy days *(Average days >10m/s, from baseline of 1995-2014)*	SSP-1 RCP-2.6	NZ	2021-2040: 1.3	2041-2060: -1.04		2080-2099: 1.32	MfE (NIWA)	https://climatedata.environment.govt.nz/ Model: ACCESS-CM2; Average of Annual 'min_val' and 'max_val' for applicable time period taken from 'Maximum and minimum changes over future global time periods'
Annual Expected Damage from Tropical Cyclones *(% at median line compared to the reference year 2015)*	NGFS Delayed Transition	NZ	-16	-23	-23	-23	Climate Impact Explorer	Country: New Zealand (https://climate-impact-explorer.climateanalytics.org/) Indicator: Annual Expected Damage from Tropical Cyclones Scenario: NGFS Current Policies
Annual Expected Damage from River Floods *(% at median line compared to the reference year 2015)*	NGFS Delayed Transition	NZ	31	31	31	31	Climate Impact Explorer	Country: New Zealand (https://climate-impact-explorer.climateanalytics.org/) Indicator: Annual Expected Damage from River Floods Scenario: NGFS Current Policies
Ocean pH *(Change in annual pH mean for the Chatham Rise)*	RCP2.6	NZ[9]	8.06	8.05	8.04	8.06	Law et al. 2018	https://doi.org/10.1080/00288330.2017.1390772 See Figure 13.A(A)

Īnanga quantitative parameters

Socio-economic parameters

PARAMETER	SCENARIO	LOCATION	2030	2040	2050	2100	SOURCE	DATA ACCESS METHODOLOGY
Population *(million)*	SSP1	Global	8546.26	9286.2	9939.52	11994.71	SSP database	SSP Scenario Explorer 3.1.0 (https://data.ece.iiasa.ac.at/ssp/) Basic drivers across the SSPs > Population trends across the SSPs > Region: World
	SSP3	NZ	5.28	5.43	5.51	4.84	SSP database	SSP Scenario Explorer 3.1.0 (https://data.ece.iiasa.ac.at/ssp/) Basic drivers across the SSPs > Population trends across the SSPs > Region: New Zealand
GDP *(Real 09/10 NZ$billion*	Current Policy Reference	NZ	319.36	375.13	435.47	-	CCC	https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.climatecommission.govt.nz%2Fpublic%2FInaia-tonu-nei-a-low-emissions-future-for-Aotearoa%2FModelling-files%2FScenarios-dataset-2021-final-advice.xlsx&wdOrigin=BROWSELINK
Carbon Price *($/tonne (2024$))*	High projection	NZ	Present-2030: 149	2031-2050: 246		Beyond 2050: 444	NZ Treasury	https://www.treasury.govt.nz/sites/default/files/2024-10/cbax-tool-climate-environmental-impacts-oct24.pdf See Table 2
Oil Demand *(Million barrels per day - World)*	NZE	Global	77.5	-	24.3	-	IEA	https://iea.blob.core.windows.net/assets/86ede39e-4436-42d7-ba2a-edf61467e070/WorldEnergyOutlook2023.pdf#page=276 See Table 3.5
Oil Price *(US$/bbl – Current Policy)*	Current Policy Reference	Global[6]	60	60	60	-	CCC	https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.climatecommission.govt.nz%2Fpublic%2FInaia-tonu-nei-a-low-emissions-future-for-Aotearoa%2FModelling-files%2FScenarios-dataset-2021-final-advice.xlsx&wdOrigin=BROWSELINK

Supplementary nature-related parameters

The source used for these parameters does not provide data that aligns with the architecture used in this scenario (Cliff et al. 2018)

Appendix B: Driver Descriptions & Matrix

This section provides an overview of the drivers identified by the participants in *Phase 2 - Drivers & Materiality*. Along with driver descriptions, it also shows the uncertainty and influence matrix that was developed during the same phase.

The drivers placed in the top right quadrant were classified as 'critical uncertainties', while those in the top left became 'baseline forces'.

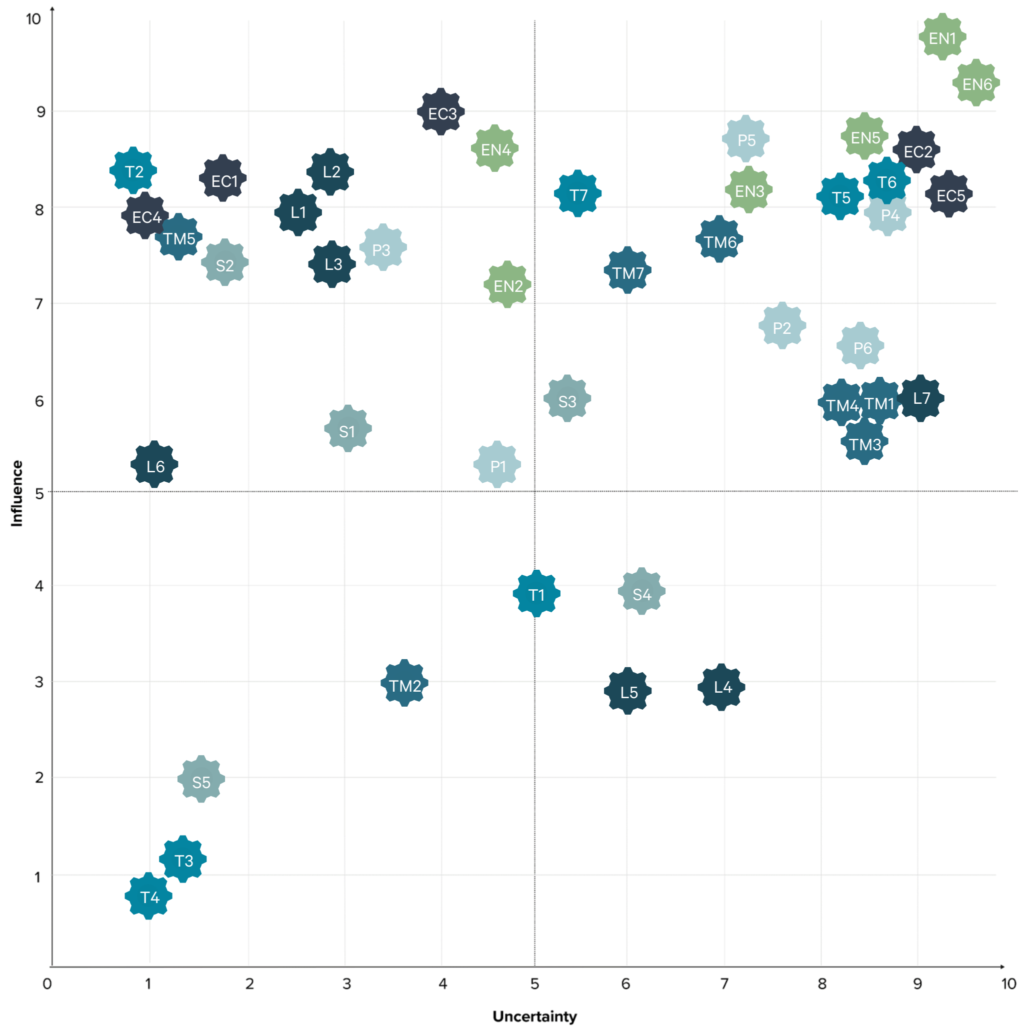
Political

P1	**International climate and nature ambition** Includes the Paris Agreement and other global climate and nature commitments such as the Global Biodiversity Framework targets or 30x30 Targets.
P2	**Domestic climate and nature ambition*** National policies on climate action and ecosystem management, such as Aotearoa New Zealand's initiatives.
P3	**International trade and market access** Increasing protectionism, trade barriers, and tariffs affecting international trade, e.g. Carbon Border Adjustment Mechanisms & changing international climate-related requirements for market access.
P4	**Government support for sustainable fuels and low-carbon technologies*** Government support and mandates for sustainable aviation fuels and other low-carbon technologies.
P5	**Political ambition for sustainable fisheries management and aquaculture development*** International and national commitments and regulations that support and advance sustainable aquaculture and fisheries.
P6	**Government investment in science, research, and innovation*** Government investment in scientific research and technological innovation.

Environment

EN1	**Chronic and acute impacts of climate change on oceans*** Including rising sea water temperatures, frequency and intensity of extreme weather events and marine heatwaves and their impact on marine ecosystems.
EN2	**Ocean acidification and pollution** Changes in ocean chemistry due to acidification and pollution affecting marine life.
EN3	**Changes in species distribution*** Shifts in the distribution of fished species and their populations due to environmental changes such as disease outbreaks, invasive species, and biosecurity risks.
EN4	**Sedimentation and freshwater runoff** Impact of runoff and sedimentation on marine ecosystems, specifically concerning inshore fisheries and aquaculture.
EN5	**Conservation and habitat restoration efforts*** Initiatives focused on restoring and protecting marine and coastal ecosystems including nature-based solutions such as saltmarshes, forestry, and restorative aquaculture practices.
EN6	**Changes in habitat connectivity, ecosystems integrity and functional resilience*** Changes in ecosystem service provision, diversity and species richness across trophic levels.

* = Critical Uncertainty



Appendix B: Driver Descriptions & Matrix

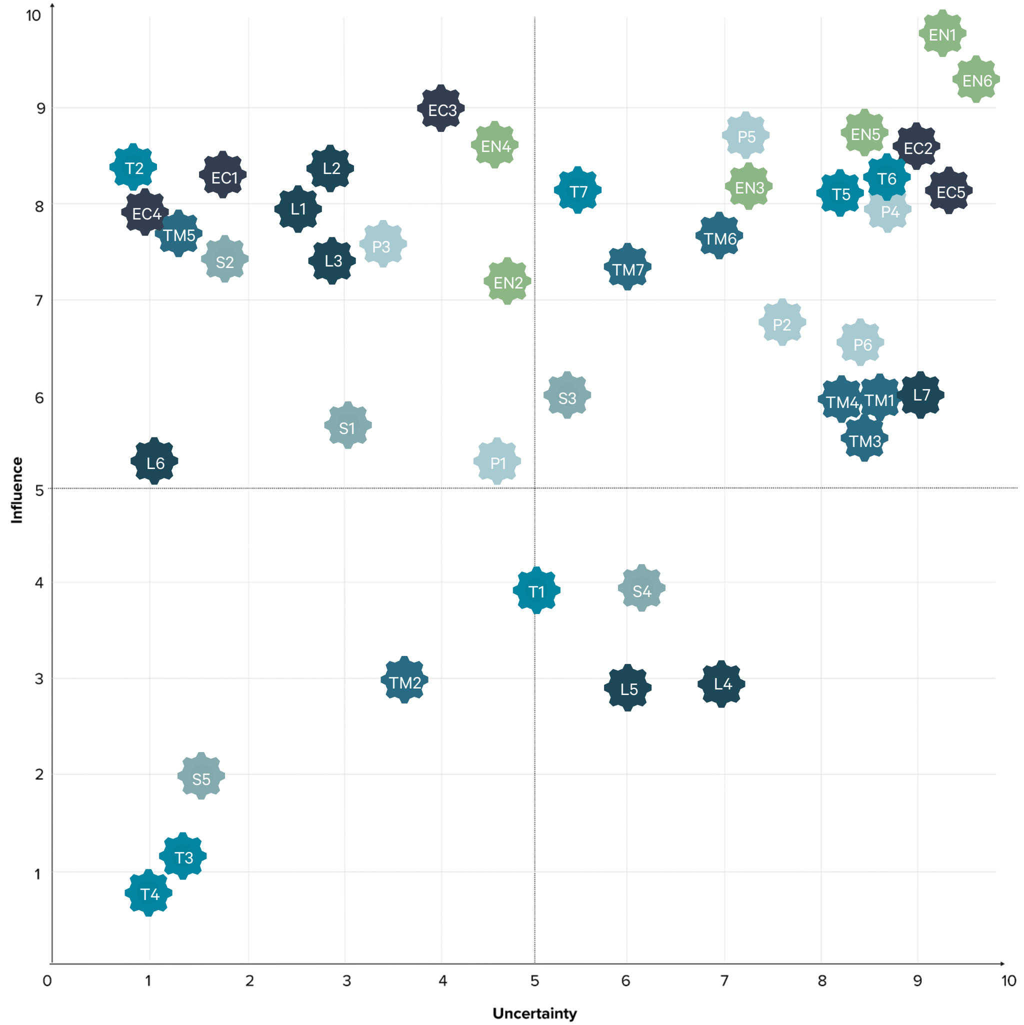
Social

S1	**Consumer demand for sustainable and low-emission seafood** Growing consumer preferences for environmentally friendly and sustainably sourced seafood.
S2	**Global population growth and demand for protein** Global demand for protein, influencing seafood consumption trends.
S3	**Public perception of the management system and fishing methods and aquaculture*** Public perception of Aotearoa New Zealand's quota management system as well as its fishing and aquaculture methods, including their perceived impacts on nature.
S4	**Educational initiatives and awareness of seafood benefits** Efforts to educate consumers about the health and environmental benefits of seafood.
S5	**Workforce and skill development in the seafood sector** Addressing the need for workforce training and attracting younger generations to the sector. Promoting employment, food sovereignty, and the empowerment of Māori communities through initiatives such as rangatahi training and upskilling.

Te Ao Māori

TM1	**Commercial fishing, aquaculture deeds of settlement and Māori fisheries*** The significance of commercial fishing, fishing-related activities, aquaculture deeds of settlement, and Māori fisheries settlements.
TM2	**Non-commercial fishing under deed of settlement and Māori fisheries** The protection and management of customary non-commercial fishing rights and practices.
TM3	**Application and acknowledgement of tikanga, whakapapa & kawa in fisheries management*** Incorporation of traditional Māori concepts and principles (e.g rāhui (temporary closure)) into modern fisheries management.
TM4	**Integration of mātauranga Māori into aquaculture and fisheries*** Utilising traditional Māori knowledge for sustainable practices and environmental stewardship.
TM5	**Impact of climate change on iwi property rights and taonga species** How climate change affects the value of settlement quotas, property rights, and the abundance and location of culturally significant species.
TM6	**Degree to which Te Tiriti o Waitangi is honoured*** Ensuring that fisheries and aquaculture management respects and reflects the principles of Te Tiriti, including collaboration, protection of Māori rights, fair resource allocation, cultural integration, sustainable management, effective dispute resolution, and adaptable policies.
TM7	**Degree to which Māori can exercise kaitiakitanga*** Degree to which Māori can exercise guardianship/stewardship over the management of their marine resources.

* = Critical Uncertainty



Appendix B: Driver Descriptions & Matrix

Technology

T1	**Advances in biotechnology and lab-based protein production** Development and application of new biotechnologies such as scaling of lab-grown seafood and alternative proteins.
T2	**AI, machine learning, and remote sensing for fisheries and aquaculture** Using AI, machine learning, and remote sensing to assist with locating fish stocks, monitoring, biomass estimation, feeding efficiency, compliance, and reducing emissions.
T3	**Innovations in traceability technology** Enhanced food traceability systems to meet market access requirements and avoid food fraud.
T4	**Improvements in freezing and packaging technologies** Innovations to increase shelf life and reduce carbon footprint during transport.
T5	**Advancements in genomics – aquaculture only*** Selection and breeding to improve resilience and productivity of farmed species, driven by growing environmental stressors.
T6	**Development of alternative fuels and vessel designs*** Progress in creating and adopting low-emission fuels and redesigning vessels to accommodate alternative fuels.
T7	**Advancements to improve fishing methods and aquaculture systems*** Development of new nets that improve precision fishing and the use of AI machine learning.

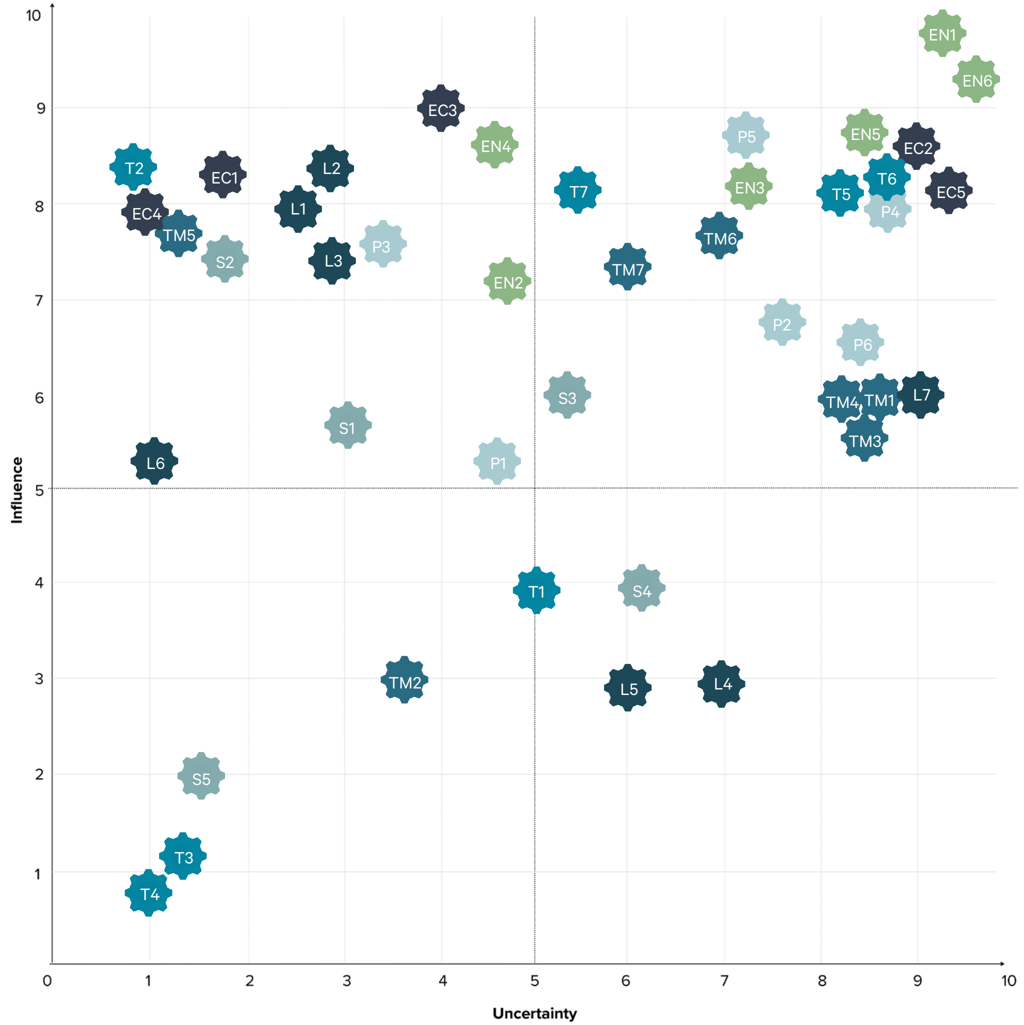
Legal

L1	**Climate and nature compliance requirements** Legal obligations and compliance requirements related to climate and nature conservation.
L2	**Director responsibilities and liabilities** Evolving legal responsibilities and liabilities for directors concerning environmental and climate impacts.
L3	**Fisheries and aquaculture management and quota systems** Changes in regulations and quota systems to address sustainability and shifting seafood species distributions (e.g. water use).
L4	**Climate and nature disclosure requirements** Introduction and impact of new mandatory financial disclosures, e.g. TNFD, TCFD, the EU Corporate Sustainability Reporting Directive, (domestic or international).
L5	**Labour laws** Legislation addressing modern slavery and its impact on supply chains and labour practices, including immigration and access to highly skilled migrants.
L6	**Litigation and greenwashing** Legal action taken against organisations due to actual or perceived inconsistencies with climate and nature obligations.
L7	**Land and water ownership*** Changes to the extent of public or private ownership rights to land and water, including legal changes to Māori property rights and potential aquaculture taxes.

Economic

EC1	**Global demand for seafood** Trends and changes in global market demand for seafood products.
EC2	**Access to capital, financing and insurance*** Availability of capital, financing and insurance structures for sustainable initiatives and innovation.
EC3	**Compliance and consenting cost** Costs associated with meeting regulatory and market access requirements. Includes on-water operational compliance costs.
EC4	**Infrastructure investments** Investments in infrastructure that support economic resilience and growth of the sector.
EC5	**Global connectivity and value chain disruptions*** Disruptions to value chains, for example, due to pandemics or climate change.

* = Critical Uncertainty



Appendix C: Scenario limitations

Limitations

Climate science may be moving slower than climate change, and the projections in this report therefore have the potential to significantly underestimate the extent and/or timing of its impacts. As such, users should apply the precautionary principle when making material decisions in the face of this deep and dynamic uncertainty.

These integrated scenarios have inherent limitations surrounding:

- **Uncertainty:** Scenarios are based on assumptions about the future, and the future is intrinsically uncertain. The speed at which climate and nature-related impacts are evolving is unprecedented and little reliance can be placed on historical experience to assess their magnitude, timing, or how different climate and nature-related forces might interact. This gives rise to a higher level of uncertainty.
- **Simplification:** Even the most complex scenarios are highly simplified representations of profoundly complex systems. They cannot capture all the nuances and interdependencies of the real world, and they may overlook important forces.
- **Bias:** Scenarios are influenced by the assumptions and biases of the people that develop them. Different participants may create different scenarios based on their own perspectives and assumptions.
- **Over-reliance:** Scenarios are useful tools for exploring different futures, but they should not be over-relied upon. They are just one of many tools that can help inform decision-making, and they should be used in conjunction with other methods and sources of information.

These sector-level scenarios are designed to help inform the creation of entity-level scenarios that organisations can use to identify their own climate and nature-related risks and opportunities. As well as the necessary limitations around project scope, timing, and the availability of participants across the sector, additional considerations and limitations for readers and users of these scenarios include:

- **Downscaling:** These sector scenarios are based upon information from existing global and Aotearoa New Zealand-specific climate-related scenarios and models, that have been explored in a qualitative way at a national level. These sector scenarios have not been 'built from the ground up' using entity or asset level data or insights. The global and Aotearoa New Zealand-specific climate and nature-related scenarios were chosen because as a set, they broadly cover the spectrum of physical and transitional climate impacts we may experience locally. The actual pathway that emerges will likely be much more complex than the sector scenarios are able to convey.
- **Source information:** Climate science and modelling is continuously evolving, and there is ongoing work to downscale global data to an Aotearoa New Zealand context. As such, it is recognised that there are data currency limitations in these scenarios. In order to support the accessibility and utility of these scenarios to a broad range of users, a reliance has been placed on utilising publicly-available datasets that are coherent with the scenario architectures, even where more up-to-date, but potentially less coherent, or privately-sourced, data is known to be available or imminent.
- **Sector representation:** These scenarios reflect the cumulative efforts of a diverse group of participants brought together for this work. However, the timeframes and requirements of the project meant that not all parts of the sector were able to be involved in the scenarios' development, which has influenced the depth of narratives for some aspects relative to others. It is however, broadly recognised that the tailoring of sector-level scenarios to the entity level requires the addition of more granular, entity-relevant information which can supplement any such imbalances.
- **Granularity of analysis:** Given the complexity of Aotearoa New Zealand's seafood system, as well as the scope of this project, this report is focused on providing a high level overview of potential key trends across the sector, rather than a detailed analysis of specific aspects, such as deep sea vs inshore fisheries, or location-specific physical risk impacts (which will vary considerably across Aotearoa New Zealand).
- **Detailed impact and outcome analysis:** Sector scenarios explore how high level, exogenous driving forces could plausibly shape the sector under distinct climate futures. This report is not intended to identify specific risks, opportunities and/or outcomes for organisations, communities or individuals. The next step for entities using these scenarios for either XRB-aligned analysis, or as a strategic tool, is to tailor the scenarios to their particular needs, and then explore detailed, relevant risks, opportunities and/or outcomes.

The data set out within these sector scenarios, and the associated assumptions, should be used as an input to developing credible, hypothetical scenarios and not as projections or forecasts. There are limitations to this data, including:

- **SSP-RCP Pairings:** The IPCC's SSP-RCP pairs are key architecture for these scenarios. It is noted that while widely recognised, these pairings have limitations including uncertainty, simplified assumptions, inflexibility, and a lack of integration with other political, economic, social, and technological factors.
- **Higher-level, public scenarios:** Integrating assumptions from a number of publicly available scenario sets allows for greater granularity and breadth of decision-relevant insights. However, they can be challenging to align into one coherent scenario architecture as they were developed using different methodologies, assumptions and models. The architecture used in this report was therefore pieced together as best as possible to create a set of assumptions that would underpin each scenario.
- **Te Ao Māori Pathways (TAMPS):** As high-level scenario frameworks for the climate (e.g. NGFS) and nature (e.g. TNFD) pillars of these integrated scenarios already existed, the Te Ao Māori Pathways (TAMPS) were developed (for the purpose of these scenarios) to cover the remaining element. These were guided by the assumptions of the SSP narratives and reviewed by participants. Their purpose was to establish a baseline level of Te Ao Māori recognition that could vary across scenarios. Overviews of these (relevant to their associated scenarios) are provided in *Appendix A*.

These scenarios integrate nature considerations and could be used to inform nature-related financial disclosures in line with the Taskforce for Nature-related Financial Disclosures (TNFD) framework. However, at the time of developing these Seafood Sector Scenarios, no official guidance existed on what sector-level scenarios for nature should entail. The approach and methodology implemented to develop these integrated scenarios follow best practice standards for sector-level climate scenarios.

KPMG

The Aotearoa Circle

Mā te Kaitiakitanga ko te Tōnuitanga
Prosperity Through Guardianship