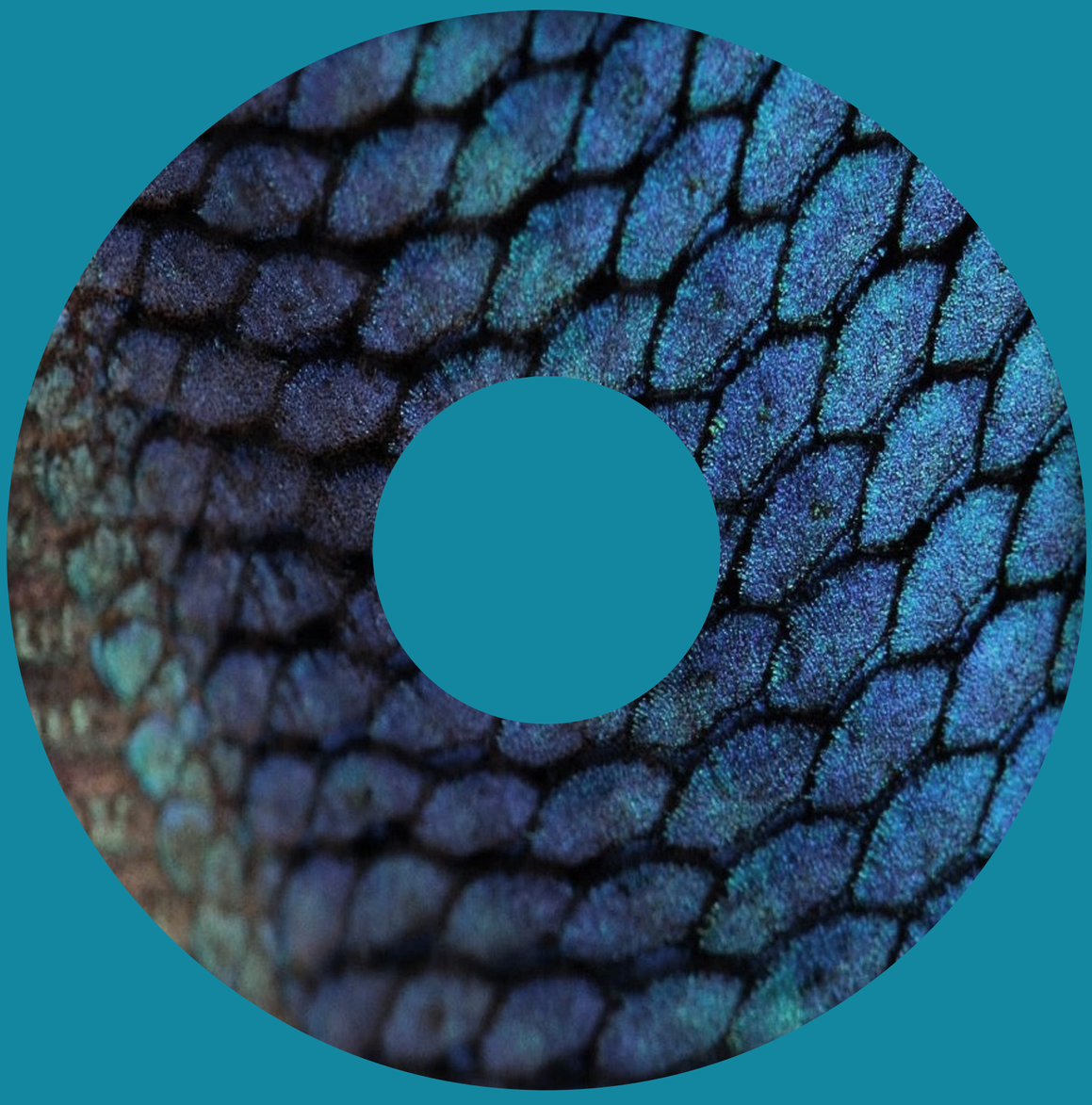

Seafood Sector Adaptation
Deepwater Toolkit

The Aotearoa Circle

Mā te Kaitiakitanga
ko te Tōnuitanga
Prosperity Through
Guardianship

Contents

Deepwater Adaptation Toolkit

Introduction
Over the past three years, a diverse group of fishers, scientists, regulators, and industry stakeholders - coordinated by The Aotearoa Circle - has come together to examine the future of New Zealand's seafood sector in the face of climate change. Our goal was twofold: to understand the challenges posed by climate change and to identify practical strategies for adaptation.

Through this collaboration, we undertook three in-depth case studies, including one focused on the deepwater fishery. We explored critical questions about the future of the sector - considering factors such as changing stock dynamics, fuel costs, efficiency and the potential for alternative fuels, and evolving public expectations around fishing practices.

This effort led to the development of three adaptation strategies designed to strengthen the deepwater sector's preparedness for future changes and uncertainties:

1. **Innovative value adding:** Through collaboration, research and development, fuel innovation in processing and product creation from climate-resilient species.
2. **Diversification:** Utilise advanced stock assessments and climate data to guide market opportunities for new or resilient species, while optimising fishing practices to a more diverse range of species.
3. **Innovative fuel efficiency measures:** Implement measures to enhance fuel efficiency, progress alternative fuel development, enhance sustainability and reduce emissions.

These strategies have been developed into practical project plans, providing a clear starting point for adaptation that aligns with the specific needs and realities of the deepwater sector.

What is the purpose of this document?
This toolkit presents strategies and actions that can be undertaken to strengthen the resilience and sustainability of New Zealand's deepwater fishing industry. Designed as a resource for stakeholders across the sector - including industry groups, research institutions, government agencies, and environmental organisations - the toolkit outlines practical actions to secure the sector's long-term viability and competitiveness in the face of a changing climate.

How to use this document?
Each strategy includes a series of projects designed to help achieve its overarching objective, with stakeholder involvement indicated for each project. The ticks in the table indicate which key stakeholders are required to implement the strategies and actions outlined in this document. Where relevant, the notes section provides additional context on current work underway, commercial dependencies, and prerequisites. Users are encouraged to actively engage with the strategies, collaborate with relevant partners, and use the outlined actions to guide their implementation efforts.

What is the opportunity?
This toolkit presents a significant opportunity to position New Zealand as a leader in sustainable deepwater fishing. By enhancing the value of fish products, diversifying the species harvested and developing innovative fuel efficiency measures the industry can improve its global reputation, meet consumer demands for sustainability, and drive economic growth.

What impact do we hope to have?
We aim to achieve a sustainable and thriving deepwater fishing industry that supports the health and welfare of New Zealand's marine ecosystems, reduces environmental impacts, and secures a reliable and diverse supply of fish products. While uncertainties remain, our work has helped define a pathway toward a well-adapted and resilient fishery.

Stakeholder Explanations

Consumer Markets
End-users or buyers of New Zealand deepwater seafood products - both domestic and global consumers. Influence demand, sustainability standards, and traceability efforts. Increasingly engaged in expectations around ethical sourcing and environmental impact.

ENGOs (Environmental, non government organisations)
Non-governmental organisations working toward for environmentally friendly and sustainable practices. Provide input into biodiversity, bio-remediation, and marine spatial planning. Examples include WWF.

Funding Agencies
Public or private entities funding research, innovation, and sustainability initiatives in the deepwater sector. Support data collection, gear innovation, habitat assessments, and climate change adaptation. Examples include the Sustainable Food and Fibre Futures (SFFF) fund, MBIE, and the Strategic Science Investment Fund (SSIF).

Government and Councils
Central and local government bodies. Responsibilities include setting out strategic direction and regulatory frameworks as well as supporting development through advice and funding.

Industry Groups
Representative bodies that coordinate and advocate on behalf of the deepwater fishing industry. Facilitate best practice guidelines, market access, and regulatory engagement. Examples include the Deepwater Group, Seafood New Zealand.

Operators (Asset and Infrastructure)
Commercial fishing companies or quota holders that own and manage vessels, equipment, and infrastructure. Responsible for investment in adaptation measures such as gear upgrades, vessel efficiency improvements, and sustainable harvesting systems. Examples include Sealord, Sanford, Moana New Zealand.

Operators (Staff)
Skippers, deckhands, observers, and technical staff who operate vessels and fishing gear. Play a critical role in implementing adaptation practices on the water, such as by-catch mitigation, gear trials, and data collection. Often the first to observe environmental changes and operational challenges.

Processors and Retailers
Companies that process, distribute, and sell aquaculture products domestically or internationally. Critical for value chain and market alignment, including packaging, freight, and customer demand.

Research Institutes
Institutions conducting scientific research on deepwater ecosystems, fisheries stock assessments, gear technology, and climate-related impacts. Examples include NIWA (National Institute of Water and Atmospheric Research), Cawthron Institute, Plant and Food Research.

Rights Owners
Entities or individuals holding quota under the Quota Management System (QMS) or associated fishing permits. May include Iwi, companies, or individuals with rights to access deepwater fish stocks such as hoki, orange roughy, or ling.

Technical Service Providers
Companies delivering marine engineering, electronic monitoring, vessel technology, and gear design for deepwater fisheries. Support compliance, innovation, and operational efficiency. Examples include marine electronics suppliers, net and trawl gear manufacturers, and fisheries data services providers.

We acknowledge that Iwi have not been identified as a distinct stakeholder group within this document. This is a deliberate choice that reflects the integral and embedded role Iwi play across all parts of the inshore fishing sector - including ownership, rights, and kaitiakitanga (guardianship) responsibilities. Rather than treating Iwi as a separate stakeholder, their influence and contributions are recognised as foundational to the sector's structure and operations.

To accompany the toolkit, dedicated Guidance Documents have been created to support seafood sector organisations in incorporating Tiriti-based approaches into their practice. This Guidance acknowledges the central importance of mātauranga Māori and te ao Māori in shaping the development, sustainability, and future of the sector. It offers practical advice for aligning organisational practice with te Tiriti o Waitangi, thereby supporting the effective implementation of the Seafood Sector Adaptation Strategy and its associated toolkits in a way that honours Māori perspectives and leadership.

1 | Innovative Value Adding

What is the problem we are trying to solve?
The issue is the underutilisation and low market value of certain fish species in deep-sea fishing. Many species are not fully utilised or are deemed low value, leading to economic inefficiencies and missed opportunities.

Why are we trying to solve it?
Addressing this problem is crucial to enhance economic growth by increasing profitability and sustainability. Maximising resource efficiency reduces waste and ensures better use of marine resources. Market diversification decreases reliance on a few high-value species and spreads economic risk. As ocean conditions change, adapting value-adding processes can help capitalise on new opportunities

What actions are required to solve it?
To effectively address the under utilisation of certain fish species, we need a comprehensive strategy that fosters innovation and collaboration. Creating products that use the entire fish can satisfy evolving market demands, while “100% Fish” initiatives enhance value and reduce waste. Supporting ongoing research and development will fuel innovation in processing and product creation. Collaboration among companies to share resources and expertise is crucial. Monitoring and identifying climate-resilient species will inform harvesting, sales and marketing strategies. Securing diverse funding and exploring new market opportunities will further advance diversified, sustainable products.

Strategy 1.1: Innovative Value Adding

Beyond Cyber Marine (Plant & Food Research) and other future-of-food pilot projects

Following completion of Plant & Food Research Cyber Marine project, and other related projects, consider how fleet operations can accommodate new ways to process seafood. Viability is linked to capital and IP management.

Outcome: Delivering higher value from all species through innovation, overlaying changes in catch (species and quantities) due to climate impacts.

Timeline	Actions	Rights Owner	Industry Groups	Research Institutes	Govt & Councils	ENGOs	Consumer Markets	Funding Agencies	Notes
Now	Continue to develop novel products to suit changing markets	✓							**Commercial dependencies:** • Cost of any IP developed by research institutes may be a barrier, as could capital investment to unlock the scale-up. **Work already underway:** • Plant and Food Research CyberMarine Project and individual business programs to increase value **Decision Points:** • Cyber Marine progress, reports and outcomes.
	Start work toward transformational "future food" development. (e.g. PFR Cyber Marine)			✓					
	Explore and advocate for "100% Fish" initiatives that maximise utilisation					✓			
	Raise market awareness and value of "low value species"						✓		
	Ongoing government support for research, development, and market expansion				✓			✓	
	Innovations in processing and product development aligned with future food concepts	✓		✓					
	Enable intercompany collaboration		✓						
Next	Develop products that use "whole of fish" approach	✓		✓					Market Intel
	Develop industry approach to increasing value of products and developing products		✓						
	Scope and evaluate global initiatives for use in/application to Aotearoa New Zealand		✓	✓					
	Support education and outreach to socialise and acculturate potential novel and diversified products.		✓	✓		✓	✓		
	Identification of relevant markets to target		✓				✓		
	Identify government, public, or private organisations to explore funding opportunities and availability							✓	

Strategy 1.2: Innovative Value Adding

Identify 'Climate Winning' Species

With climate change and shifting oceanic conditions, it is highly likely that some species will thrive while others may decline or become harder to catch. Through forecasting, monitoring, and scientific support, identifying these species will inform both fisheries regulations and fishing practices.

Outcome: Delivering higher value from all species through innovation.

Timeline	Actions	Rights Owner	Industry Groups	Research Institutes	Notes
Now	Identify 'climate winning' (and losing) species	✓	✓	✓	**Prerequisite:** • Cross-Cutting Initiative: Climate Change and Vulnerability Forecasting is needed to help identify which species are likely to thrive or decline under future climate conditions.
	Innovate for harvest, products, and marketing of "winner" species	✓	✓		
	Investigate third party certification (e.g. Marine Stewardship Council)		✓		
	Identify likely climate winner (and loser) species and locations	✓	✓	✓	

2 | Diversifying

What is the problem we are trying to solve?
We are tackling the limited adaptability and resilience of the current fisheries management system to changing oceanic conditions and climate change. The industry's economic reliance on a few high value species makes it vulnerable to environmental shifts affecting their availability and sustainability.

Why are we trying to solve it?
Adapting to climate change is crucial as it alters oceanic conditions, affecting fisheries species environments, food, and populations. By maximising the value and diversity of the species we harvest, the industry can enhance economic stability and reduce dependency on a few high-value species, thereby spreading economic risk. This approach also promotes sustainable fisheries management, ensuring responsible stock management. Introducing new species to existing or new markets opens up opportunities for growth and innovation, catering to diverse consumer preferences.

What actions are required to solve it?
Enhancing the adaptability and resilience of fisheries management requires a strategic shift toward greater species diversity and sustainable practices. This includes optimising fishing methods to target a broader range of species, reducing reliance on a few high-value stocks and spreading economic risk. Advanced technology and climate data will support accurate stock assessments and inform forward-looking management decisions. Identifying climate-related risks and exploring market opportunities for new or more resilient species will further strengthen the sector's ability to adapt, ensuring long-term sustainability, economic stability, and the capacity to meet evolving consumer demand.

Strategy 2.1: Diversify

Agile fisheries management and harvest

Fisheries management is organised for rapid response to proactive science. Industry has confidence to keep fleet optimised for species and volume.

Outcome: Fisheries management and associated regulation is agile enough to accommodate climatic change. Industry have confidence to invest

Timeline	Actions	Rights Owner	Industry Groups	Research Institutes	Govt and Councils	ENGOs	Technical Service Providers	Funding Agencies	Notes
Now	Optimise and adapt catch plans and fishing methods to support a more diversified catch	✓							Work already underway: • Business as usual for industry. **Decision Points:** • Government recognition that FM plans are not fit for purpose.
	Advocate for responsive and timely stock assessment and Total Allowable Commercial Catch (TACC) settings		✓						
	Identify potential species and locations at risk of climate-associated threats			✓					
	Develop new methods of stock assessment and monitoring using latest technology			✓			✓		
	Government funding of 'blue sky', pilot-scale research				✓			✓	
Next	Use climate data and species research to assess productivity and risk under climate change scenarios, helping to identify both opportunities and challenges.			✓					Prerequisites: • Cross-Cutting Initiative: Climate Change and Vulnerability Forecasting is needed to help identify which species are likely to thrive or decline under future climate conditions. • Cross-Cutting Initiative: Agile Regulatory Framework will be essential to support timely and adaptive management responses
	Change stock assessment guidelines to prioritise timely and appropriate Total Allowable Commercial Catch (TACC)				✓				
Later	Proactively review stock assessments and quota allocations for emerging species	✓	✓	✓	✓				

Strategy 2.2: Diversify

Preferentially harvest best species

Measure and communicate the credentials of the lowest carbon and most resilient species, highlighting to consumers the benefits of choosing climate-positive protein.

Outcome: Market shifts to match climate resilient harvest.

Timeline	Actions	Rights Owner	Industry Groups	Research Institutes	ENGOs	Consumer Markets	Funding Agencies	Notes
Now	Investigate market opportunities for producing and promoting new products from climate resilient species	✓						Work already underway: • Business as usual for industry. There is a good understanding of the supply side changes.
	Enable trade and marketing of (previously) low-value species through (e.g., MPI Economic Intelligence, MFAT, NZTE)				✓			
Next	Industry collaboration for market development of diversified species harvest	✓	✓			✓		Dependencies: • Cross-sector collaboration on the Climate Change and Vulnerability Forecasting Cross-Cutting Initiative will be essential for the successful realisation of this strategy. • Strategy 1: Reduction of catch effort and lower cost per kilo of carbon

Strategy 2.3: Diversifying

Project Description: Part-time fishing

Find revenue for vessels outside periods of high intensity fishing.

Outcome: New opportunities

Timeline	Actions	Rights Owner
Now	Find revenue for vessels outside periods of high intensity fishing.	✓

3 | Innovative Fuel Efficiency Measures

What is the problem we are trying to solve?
The main challenge is the increasing fuel costs and the associated carbon emissions in deep-sea fishing. Over 90% of scope[1] one emissions in the industry stem from vessel fuel consumption during activities like steaming, fishing, and port operations. A lack of shared knowledge and best practices exacerbates inefficiencies, increasing environmental impact.

Why are we trying to solve it?
Reducing carbon emissions is vital to combat climate change and ultimately protect marine ecosystems. Optimising fuel use can significantly cut operational costs, enhancing economic sustainability. With stricter global emissions regulations, the industry must adapt to avoid penalties. A commitment to sustainability can also boost the industry's reputation among environmentally conscious consumers and stakeholders.

What actions are required to solve it?
To tackle fuel inefficiencies in deep-sea fishing, a comprehensive strategy involving multiple stakeholders is essential:

1. Implementing real-time fuel monitoring on vessels will yield valuable data, while sharing best practices and results of data analysis can uncover optimal strategies.
2. Exploring new fuel-efficient technologies and aligning fisher remuneration with carbon reduction goals.
3. Benchmarking New Zealand vessel fuel consumption against international standards will support the development of standardised guidelines, promoting more efficient operations across the industry.

[1] Scope one refers to the greenhouse gas emissions emitted as a result of running vessels (or land-based operations) directly owned or controlled by the fishing company (i.e. vessel fuel).

Strategy 3.1: Innovative Fuel Efficiency

Project Name: Optimising fuel consumption

Across the industry, over 90% of Scope One emissions come from vessel fuel. Limited information is available or shared regarding optimal fuel use across activities such as steaming, fishing, and time spent in port. While no viable fuel alternative currently exists, there are clear financial and carbon reduction benefits in developing and sharing best practices - if proven effective.

Outcome: Reduce carbon emissions and fuel costs per unit of catch through improved efficiency.

Timeline	Actions	Rights Owner	Industry Groups	Research Institutes	Govt and Councils	ENGOs	Technical Service Providers	Funding Agencies	Operator (Asset or Infrastructure)	Operator (Staff)	Notes
Now	Institute fuel monitoring technology across different vessels	✓									Work already underway: • Many companies and vessels have adopted this technology. • Off-the-shelf products that provide real time fuel efficiency data are available Dependencies • The amount of data is high and analysis is difficult with multiple variants. Decision Points: • Funding resource to undertake analysis
	Explore, share, and advocate for innovative fuel efficiency technologies		✓								
	Possible third party to crunch fuel usage data (port, steam, trawl) to assist in best practice			✓		✓					
	Identify government, or other public or private funding to undertake fuel efficiency work						✓				
	Review fisher remuneration structure to ensure alignment with fuel efficiency goals							✓	✓	✓	
Next	Share any learnings of any work on fuel efficiency	✓									Work already underway: • Seafood New Zealand Deepwater Council are scoping an initial report on fuel efficiency best practice. Decision points: • Relevance of data to be applied across fleet and vessel types
	Benchmark fuel efficiency and carbon footprint with international deepwater fisheries		✓								
	Research fuel efficiency/carbon footprint to guide best practice			✓							
	Encourage and promote research efforts within the industry, focussed on improving operational efficiency and developing fuel consumption guidelines					✓					
	Assist with the development of best practice			✓			✓				
	Implement best practice and conduct regular reporting								✓	✓	
	Develop best practice fuel consumption guidelines		✓								
	Utilise best practice fuel guidelines	✓							✓	✓	

Strategy 3.2: Innovative Fuel Efficiency

Reduction of catch effort and lower cost per kilo of carbon

The second pillar of reducing emissions is minimising fuel consumption while catching the Total Allowable Commercial Catch (TACC). By leveraging data, AI, and modeling, the project aims to identify the Right Time and Right Place for fishing. This initiative would naturally extend to stock assessment (location) guidelines, as well as the management of fishing effort and stock biomass.

Outcome: Increase effectiveness by reducing carbon emissions and fuel costs per unit of catch.

Timeline	Actions	Rights Owner	Industry Groups	Research Institutes	Govt and Councils	ENGOs	Technical Service Providers	Operator (Staff)
Now	Reassess fishing effort to reduce low-volume, high-effort fisheries.	✓						
	Align on approach to manage fisheries at higher abundance		✓					
	Analyse big data and use AI to optimise catch per unit of fuel.			✓				
	Change stock assessment guidelines to prioritise timely and appropriate TACC (total allowable commercial catch) setting				✓			
	Communicate to various NGO agencies about the project to use industry management objectives to reduce carbon emissions	✓	✓					
	Funding required to unlock Fleet Decarbonisation Cross-Cutting Initiative						✓	
	Buy in to maximum economic yield approach							✓
Next	Catch per unit of fuel informed by analysis of real data	✓						✓
	Support next phase of big-data fisher decision support tool		✓					
	Model and advise on catch rates			✓			✓	
	Manage fisheries at higher abundance so catch per unit fuel increases	✓			✓			
	Grant the industry the flexibility to manage fishing effort and stock biomass for optimised commercial and low-fuel outcomes				✓	✓		

Strategy 3.3: Innovative Fuel Efficiency

Alternative Fuels

A long-term project to investigate, assess, and trial alternative fuel options as they become available. This includes pan-sector involvement (across all marine industries) to ensure the fishing industry evolves its capability and capacity.

Outcome: Fossil Fuel Replacement

Timeline	Actions	Rights Owner	Industry Groups	Research Institutes	Govt and Councils	ENGOs	Technical Service Providers	Operator (Asset or Infrastructure)	Notes
Now	Fishing companies actively involved in marine fuel dialogue	✓							Decision Points: • Validated fuel additives for marine fuels. • Engine and fuel providers allow new fuel, additives without impacting warranties
	Maintain a watching brief on advances in fuel technology. Advocate for fishing applications as required		✓						
	Validation of potential fuel additives that could reduce carbon emissions from fossil fuels			✓					
	Fuel additive companies research			✓			✓		
	Significant potential infrastructure considerations across all levels of government							✓	
Next	Trial fuel replacement options as they become available	✓						✓	This initiative is also included in the Inshore Toolkit and aligns with the Fleet Decarbonisation Cross-Cutting Initiative. As such, it should be implemented collaboratively across the seafood sector. Decision Points: • International Maritime Organisation and International Convention for the Prevention of Pollution from Ships endorse new fuel
	Work with marine industry and government on supply chain considerations		✓		✓				
	Develop New Zealand sourced biofuels			✓					
	Encourage and promote support for new biofuel investment					✓			
	Assess alternative fuel options vs fossil fuels						✓		

Conclusion

New Zealand's deepwater fisheries sector is navigating a future shaped by climate change, shifting global markets, and increasing expectations for environmental stewardship. This toolkit provides a clear, practical framework for building a resilient, innovative, and low-emissions deepwater fisheries industry.

Through collaboration among diverse stakeholders, we can collectively implement strategies that enhance ecosystem health, support sustainable harvest practices, and future-proof the sector against climate-related risks.

The adaptation strategies outlined here are not fixed plans, but flexible starting points - designed to evolve with new science, technologies, and partnerships. With a shared commitment to action, New Zealand can continue to lead in sustainable deepwater fisheries and realise the potential of a thriving blue economy.

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