

*Sustainable Seas, National Science Challenge*

# **Transitioning to a Blue Economy: Scoping and Horizon Scanning**

Envirostrat Ltd

*December 2019*

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## EXECUTIVE SUMMARY

This report documents current trajectories in blue economy innovation and development, domestically and internationally. It discusses the drivers of blue economy development at national and sectoral scales and provides an overview of industry perspectives on opportunities and constraints. The research provides a platform for developing research questions for the Blue Economy theme in Phase II of the *Sustainable Seas* National Science Challenge.

This work reviewed a range of reviews of blue economy in the academic, grey and policy literatures, and a set of domestic policy documents and commentaries on trends in the development of a blue economy. It also sought input from >40 iwi and stakeholders from a range of perspectives, including both public and private sectors (including investment and finance), industry, Māori organisations, and NGOs.

The following general observations / themes were identified:

- Traditional sectors are changing rapidly – encouraging blue economy innovation in these sectors is an important pathway to transitions.
- Seaweed aquaculture is an emerging sector - a comprehensive, system-wide approach to development will support its growth and sustainability.
- Ecosystem based adaptation through ecological infrastructure / nature-based solutions is a significant opportunity.
- Iwi, and Māori generally, are interested in strategic economic planning (nationally and regionally) to generate economic multipliers (e.g. employment and wellbeing) for Māori communities.
- Improving critical infrastructure and greening existing technology to reduce environmental footprint is essential to grow a blue economy.
- Innovative financing models offer opportunities to support large-scale restoration and leverage synergies with land-based opportunities / needs (pollution mitigation) to generate a series of win-win arrangements between commercial and non-monetary economies.
- There is significant stakeholder demand for place-based research on multi-sectoral blue economy development, especially in the Hauraki Gulf.
- Climate change adaptation and innovation is widely recognised as a driver of existing and potential Blue Economy initiatives. Stakeholders expect that climate change considerations will be integrated with future research areas.
- There is much to learn (and adapt) from successful blue economy initiatives offshore.

### **On the horizon:**

- Innovative financing of the blue economy that leverages across new technologies in existing industries, investment in new sectors, impact investment, environmental management objectives and restoration, climate change initiatives, and philanthropy
- Bluetech innovation, incubators and alliances that focus investment initiatives on new blue economy sectors
- Financing restoration and high value, diversified Blue Economy development
- Multi-scalar, multi-trophic blue economy initiatives ranging from large-scale, open ocean aquaculture to local scale living-reef and community economy developments (e.g. Greenwave)
- A vibrant and growing Māori blue economy that will place new demands on governance and management settings

### **The following were identified as interest areas for Māori research opportunities:**

- Defining Kaitiakitanga & Rangatiratanga within a Māori fisheries context:



- What does it mean to be a Māori / Iwi owned fishing company operating in today's context of climate change, sustainability, and bycatch etc?
- What change is required to enable Māori fisheries companies to implement kaitiakitanga & rangatiratanga in their operations, and could this be certified?
- How to positively influence the fisheries sector beyond Māori owned fisheries?

#### **Future Research Opportunities and priorities in New Zealand**

- Supporting the development of offshore / open ocean farming, multi-trophic farming, and seaweed farming –into significant blue economy sectors
- Developing innovative finance models to support win-win restoration economies (including water quality, blue carbon, flood protection / climate resilience)
- Place-based research (ideally in the Hauraki Gulf) into EBM regulatory tools and arrangements that integrate blue economy win-wins (new forms of marine spatial planning, ecosystem services accounting, ecological / nature infrastructure).
- Implementing and socialising Maori cultural values in fisheries and aquaculture
- Growing a Māori blue economy: what will it take to grow a Māori blue economy in terms of resource management that allows for the implementation of kaitiakitanga and rangatiratanga that translates tikanga and values into principles, responsibilities and practices and socialises these into the wider blue economy
- Identify opportunities for a blue economy in seaweed and what it will take to realise them
- Identify opportunities to realise the potential of ecotourism to link natural assets, travel experience and food into novel clusters of blue economy.

# 1. Introduction

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## *Sustainable Seas* National Science Challenge

This work forms part of the *Sustainable Seas*' National Science Challenge; *Theme 2: Creating value from a blue economy*.

### **Overarching Theme Objective:**

*Enhanced utilisation of our marine resources within environmental and biological constraints.*

### **Mission:**

Transformation of Aotearoa New Zealand's ability to enhance our marine economy, and to improve decision-making and the health of our seas through ecosystem-based management

**The Blue Economy** is defined by Sustainable Seas as marine and coastal activities that:

*"generate economic value and contribute positively to social, cultural and ecological well-being"*

Fostering and growing the blue economy is crucial to meeting the Challenge objectives. This project will provide a baseline from which research directions for transitioning to a blue economy will be developed for the Blue Economy theme in Phase II of Sustainable Seas.

## Purpose of this Document

The project aims to present an account of the state of Blue Economy development in New Zealand as the Challenge enters Phase Two. This project set out to:

1. Map the New Zealand innovation landscape for blue economy.
2. Outline trajectories and influences of change domestically and internationally.
3. Document the views of iwi and stakeholders on sector-level and regional-level threats, opportunities and directions of change, and canvas related research requirements and needs.

The project identifies research opportunities for developing the Blue Economy theme in Phase II.

## Approach

We used three methodologies to generate our findings:

- (1) A review of the literature (both published and grey) on the state of relevant sectors and blue economy development more generally was used to identify political, economic, technological, legal, social, and environmental horizons of blue economy futures (PESTLE analysis).
- (2) Carrying out the PESTLE in the context of Theme 2 of Sustainable Seas is an adaptation to the traditional context for applying the tool. This PESTLE analysis was carried out primarily as a desktop exercise (review of relevant documents, reports and analysis) combined with inputs and perspectives gathered through stakeholder interviews and expert opinion. The stakeholder interviews (see next section) were not carried out with the purpose of informing the PESTLE analysis, however, where relevant, they were used to inform or validate factors highlighted in PESTLE.
- (3) Iwi and stakeholder input was sought through >40 semi-structured interviews from a range of perspectives, including both public and private sectors (including investment and finance), industry, Māori organisations, and NGOs. The interview guidance is included in Appendix One – Interview Guide.

We used this material to inform a series of discussions with stakeholders, so as to identify current sector activities and structures and innovation landscapes in New Zealand, elaborate on the initial findings and identify implications of current changes and anticipated futures for New Zealand marine sectors, and canvas iwi and stakeholder perspectives on directions of change and the potential for research and innovation.

Stakeholder interviews were conducted via a guided discussion based around several key themes rather than rigid questionnaire format. The stakeholder list (see Appendix Two – List of interviewees) was developed with input from the *Sustainable Seas* leadership and leveraged an extensive network of contacts held by the Project Team. We explicitly sought input from iwi and stakeholders from a range of perspectives, including public sector, research, investment and finance, philanthropy, industry, Māori organisations, and NGOs. A cross-sectoral approach to the interviews enabled the researchers to develop a holistic picture of the blue economy in its current state and document a range of perspectives on the blue economy landscape within the New Zealand context.

Semi-structured interviews with stakeholders were led by Dr Nigel Bradly, Cerasela Stancu, and Dr John Reid to ascertain views with regard to the development of the blue economy in New Zealand and abroad. A semi-structured interview in this context does not provide specific, standardised questions for each discussion; rather it allows the conversation to be adapted to the particular context. This approach is useful when canvassing views from a variety of backgrounds.

This helped to map emerging areas, key issues, the players, and the type and scale of innovation; evolving sectors, and the risks to development of the blue economy; and data gaps and mechanisms that enable measurement of the blue economy (following systems / well-being thinking). The draft analyses and insights were tested in a workshop setting with interested parties and experts in the field.

## 2. P.E.S.T.L.E.

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### Summary of Insights and Main Findings

Below is a synthesis of the main insights and findings from PESTLE analysis. For more detailed information, a separate PESTLE report has been prepared<sup>1</sup>.

#### Political Factors

New Zealand's marine economy has many active stakeholders from industry (including advocacy groups), Māori, resource users, the general public, and conservation groups. The Blue economy as an economic development concept is not on the political agenda as such, but the ocean economy and the opportunities and risks linked to it are increasingly discussed in the contexts of Treaty Partnership, climate change and environmental pollution in particular.

Recent governments have focused attention of export-led economic growth. The current Government has retained a growth agenda, but has set a sustainability agenda that prioritises mitigating and adapting to climate change. Marine economy development focuses on developing marine resources in a sustainable and innovative way. This is supported by MPI, DOC and MfE efforts to refine, develop and implement policy and regulation for fisheries and aquaculture; support the development of aquaculture; developing a nationwide network of MPAs along with a policy revamp (Marine Protected Area policy). Current policy initiatives include developing Māori rights and interests in fisheries and aquaculture, developing an Ecosystem Based Fisheries Management (EBFM) approach, implementing the recently completed aquaculture development strategy; implementing Sea Change and developing a nationwide network of MPAs (Marine Protected Area policy); and responding to 2019.

Maori fisheries rights were established under the Treaty of Waitangi (Fisheries Claims) Settlement Act 1998 and Iwi/Maori continue to seek protection over these rights. Māori question the centralisation and compartmentalisation of the current national political environment. Māori are politically engaged at multiple scales including pan-iwi, iwi, hapū, marae komiti, and whānau. Unique and dynamic structures have been developed to manage political tensions and interests across these scales to support economic development, the protection of property rights, governance, and management in the marine estate. Māori are especially concerned that new governance, conservation, and management regimes may abrogate their Treaty rights. New Zealand is actively engaged in international marine governance and is party to many international conventions.

#### Economic Factors

Existing industries are well established (e.g. fisheries, aquaculture, shipping) and are 'pivoting' toward incorporating elements of the Blue Economy, such as green innovation, circular economy (zero waste), climate change adaptation, and high value – low impact products and services. New industries are emerging that will also provide economic benefit, but we feel there are opportunities to leverage international experience that could be the subject of more focus at a domestic level. For example, nutraceuticals, onshore aquaculture, bio-fuelling or electrifying New Zealand's transport are all areas with high economic growth potential that are well advanced in other countries.

The marine economy is estimated by Statistics New Zealand to contribute \$3.8 billion per year to the national economy and includes shipping, fisheries and aquaculture, offshore minerals, services, marine tourism and recreation, and government spending. This is a conservative estimate, and research commissioned by Sustainable Seas from Market Economics puts this figure at \$7.4 billion. New Zealand has huge potential in aquaculture production. Industry has growth ambitions to become a major primary industry (\$3 billion annual sales by 2035). There is significant potential to expand aquaculture; although there are technological limitations and knowledge gaps about markets and environments associated with new species. Future growth

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<sup>1</sup> PESTLE analysis of New Zealand's Blue Economy (2019). EnviroStrat Ltd

will depend on continued access to marine areas allocated to marine farming production along with the move toward open ocean aquaculture, which is constrained in part by technology. Marine tourism is poorly measured and not identified as a sector for development by government or industry. Market Economics suggests that it currently makes the single biggest sectoral contribution to national economy. Eco-tourism offers significant opportunities for a blue economy. America's Cup 36 in 2021 is anticipated to provide significant economic benefits. Future success in wild fisheries relies on productivity gain through technology, market price adjustments to global scarcity and low environmental impact, value-added strategies, and the possibility of market-led shifts to new species.

There are significant changes globally in consumer preferences as result of converging concerns about climate change, environmental degradation, movement away from animal-based proteins and human health (nutrition). To perform well and capture value in these shifting and newly emerging markets New Zealand needs to enhance its understanding of how to respond in existing and emerging value chains.

The economic challenges associated with climate change and the Blue Economy are poorly understood - there is a real risk that some sectors will face significant economic headwinds if adaptation pathways are not found or the pace of adaptation is too slow. A drive to establish improved and consistent open ocean accounting is being led by the United Nations and promises to intersect with domestic calls for reliable measures of New Zealand's blue economy.

Māori are significant participants in New Zealand's marine economy with interests in wild fisheries, aquaculture, marine tourism, and non-market customary harvest. The Māori marine economy (MME) focused on wild fisheries. Māori have a 35% interest in the seafood industry by value, have doubled their economic interests since Settlement, and are seeking to develop economic initiatives that create community employment and open-up premium markets for products with Māori provenance values.

Ecosystem services approaches offer opportunities to create systems for value(s) exchange and to underpin innovative financing of restoration for water quality improvement or habitat restoration for biodiversity. Such benefits are social as well as environmental. These ecosystem services-based approaches require further knowledge and have yet to become common practice - representing a threat to efforts to establish or enhance our environmental credentials in international markets.

## Social Factors

There are significant changes globally in consumer preferences as result of converging concerns about climate change, environmental degradation, movement away from animal-based proteins and human health (nutrition). New markets are emerging as a result of this and New Zealand needs to enhance its understanding and knowledge how to respond and capture such markets.

Blue economy development offers significant opportunities for enhancing regional and local livelihoods and environments for local and regional populations. Opportunities for the empowerment of mana whenua and enablement of small communities to participate meaningfully in the Blue Economy are on the rise. Ahu Moana initiatives (mana whenua and community co-management of ocean space and resources) could provide a modern model for co-governance in the Blue Economy – if expansion and uptake at scale can be facilitated. Māori coastal communities are well-placed to support local governance and management of coastal marine areas, providing important local context. Blue economy opportunities exist to encourage capability development among young Māori, especially with respect to new technologies

Maturanga Māori has a significant role to play in the governance and management of the marine estate including:

- Establishing legal personalities for ecosystems and species;
- Mauri-centred monitoring and reporting frameworks; and
- Marae-centred protocols and Māori decentralized governing models that offer unique insights and opportunities in the development of Ecosystem Based Management (EBM) and other resource management processes.

Participatory processes such as the *Tai Timu Tai Pari Sea Change* marine spatial planning process offer opportunities to resolve distributional and values-based conflicts, expedite economic possibilities, and develop

and implement strategies that incorporate distributional concerns. Failures to address and resolve these conflicts represent a threat to innovative economic development.

## Technological Factors

Technology for the Blue Economy is evolving rapidly, disrupting existing value chains and creating new pathways to consumer and value creation. New Zealand does have investment into new technologies, but we feel many areas of technology are more appropriately adapted from international developments rather than risking 'reinventing the wheel'.

'Bluetech' is an established sector globally but is not recognised as such in New Zealand, although there are examples of successful technology development in the Blue Economy. New Zealand has the opportunity to align with global bluetech leaders who have formed collaborative 'virtual hubs' to best leverage the opportunities associated with technology.

Organisations across a wide range of sectors are already exploring new technologies, but they are faced with significant barriers to uptake such as lag time between development and uptake, lack of bluetech networks or transfer of IP. A focus on developing solutions that will appeal to offshore markets has the potential to stimulate an effective transition towards the Blue Economy in New Zealand.

Technological improvements in the MME have primarily occurred in fishing and supply chain operations, and to a much lesser extent tourism. Generally-speaking, uptake and development of blue technology in the MME has been initiated by smaller agile fishing companies. Improvements have occurred through the adoption of sustainability fishing technologies, tracing systems, provenance, indigenous-centred marketing, and environmental packaging. Several Māori enterprises are building bluetech initiatives into their investment and production portfolios. Innovations have occurred through the development of new harvesting technologies, new aquaculture species; seaweed production; and marine mammal locating techniques.

There are significant opportunities in the land-sea interface including: Māori landowners developing alternative biodegradable fibre options (e.g. nets and packaging); and growing and developing aquaculture feed and developing multi-trophic aquaculture to take pressure off wild fisheries.

## Legal Factors

New Zealand has a substantial but complex and fragmented governance and legal framework for coastal and oceans management. This represents a major challenge for transitioning to a more integrated Blue Economy. Examples include the challenges posed by the QMS to organising responses to changing fisheries distributions caused by changing sea temperatures; the regulation of the gathering and/or farming of seaweed; the siting of large-scale ocean aquaculture operations; the regulation of multi-trophic aquaculture that may see QMS species farmed alongside non-QMS aquaculture species; land-based aquaculture operations; and the regulation of mineral resources in the near shore.

Inconsistencies among regional council policies and between regional and national policies are identified by many as an impediment to blue economy investment and development. Recent legal challenges in the Bay of Plenty, for example, place a previously unintended expectation on regional councils to manage the environmental effects of commercial fishing on benthic habitats through regional coastal plans, whereas councils have historically assumed that this was managed through the Fisheries Act. The New Zealand Coastal Policy Statement 2010 has made managing cumulative effects at the resource consent stage challenging in the absence of a robust, wider strategic planning framework in policy statements and plans. New national standards and strategies (e.g. National Environmental Standard for Aquaculture, National Biodiversity Strategy, National Aquaculture Strategy) will provide councils greater certainty and guidance for future regional coastal plans and regional policy statements.

The regulatory context is complicated further by a raft of 'one off' specific purpose laws that impose specific approaches, exclusions or regulations in spatially defined areas. Examples include the Hauraki Gulf Marine Park Act, Subantarctic Islands Marine Reserves Act.

The marine legislative and regulatory framework in which Māori blue economy operates is complex and contested.

Māori rights and interests face threats from regulatory changes that may impact the full and final nature of the Fisheries Settlement and the financial value of the settlement. There are tensions between individual iwi and pan-Māori rights. For example, iwi quota is held within non-traditional corporate structures, settlement quota is often uneconomic to fish at an iwi level, yet cannot be sold and can only be traded amongst iwi, devaluing it.

The division between commercial and customary rights continues to undermine rights and interests (Māori cannot exchange or sell fish caught under these rights, while Māori 'commercial' fishers at times fish for customary occasions); creating customary management areas & acquiring customary rights is difficult, requiring social/financial capital; Maori commercial fishers often supply iwi with customary harvest, which is a complex, contentious process; customary areas create tensions with some recreational fishers.

Te Ohu Kaimoana (TOKM) has published a number of priorities for 2017-2020 that identify opportunities for the legal framework to be improved – these priorities have implications for customary rights, environmental management practices, and the rights structures of the QMS as well as its administration. The creation of Fisheries New Zealand (FNZ) as a standalone directorate within MPI in 2018 marks a significant change in the regulatory environment. Its establishment has been welcomed by TOKM.

### **Environmental Factors**

New Zealand marine ecosystems (habitats, species) are under threat from human activities on land and at sea. Our Marine Environment 2019 names four primary areas of concerns: native marine species, pollution from land-based activities, poor environmental practices at sea, and climate change. Climate change is anticipated to have a significant effect on New Zealand's economy and financial system, more generally, as well as affecting marine ecosystems and taonga species directly. The cumulative effects of climate change, loss of biodiversity, and pollution are anticipated to undermine marine ecosystem resilience and lead to further substantial reductions in ecosystem services e.g. nutrient sequestration.

Around New Zealand, sedimentation, high temperatures, ocean acidification, habitat modification and pollution already negatively impact the productivity of marine ecosystems and those economic activities that rely on this productivity. Fisheries and aquaculture are particularly dependent on climate-sensitive natural resources. As these sectors grapple with the potential impacts of reduced ecosystem productivity and sub-optimal growing conditions, greater focus (across public and private sectors) is expected and widely welcomed regarding:

- Adaptive management approaches;
- Building resilience;
- Integrating environmental monitoring and information in operations;
- Intersectoral collaboration (e.g. combined research efforts);
- Promoting climate change awareness; and
- Investment in natural buffers and underpinning ecosystem services.

Internationally, long-term interest in ecosystem services has produced measures that are being used to monetise the costs of pollution, create natural capital accounts, and encourage innovative financial models for ecosystem recovery and restoration. Measurements have rarely been made in New Zealand.

Mātauranga Māori offers a valuable body of environmental information and understandings but is not fully utilised. This is especially the case with respect to making the most of local knowledge of local environments, managing relations between land and sea and developing EBM. Most Māori fishing companies have kaitiakitanga at core of governance & operations and go above and beyond environmental regulatory requirements. This is an underutilised asset in marketing and innovation.

## 3. Blue Economy Horizons

### The International Blue Economy Experience

Globally, the contribution of marine economic activities is increasingly recognised (Colgan, C 2016), although despite efforts to measure them, the significance of natural capital and ecosystem services is less well integrated into economic development strategies. While economic activity based around coasts and oceans has increased rapidly<sup>2</sup>, its potential is threatened by the declining state of the ocean ecosystems and climate change.

Blue growth has emerged as a concept equivalent to green growth but applied specifically to the oceans. It emphasises the interconnectedness of economic, environmental and social outcomes and a holistic and participatory approach to coastal and marine development (see Appendix Four – International Blue Economy Case Study, for an example of a highly successful overseas blue economy development). Countries that have pursued strategies for Blue Economy development have developed tailored definitions and principles for blue growth in recognition of their specific contexts and the core dimensions of sustainable development: environmental, social, cultural and economic. Below are selected examples of developments and approaches internationally.

#### International Approaches to Blue Economy: policy integration as a pivot

Different national approaches are examined by Patil et al (2018)<sup>3</sup> and provide useful guidance for the development of the Blue Economy. An example at the national level is Australia. The country's policy related to the Blue Economy is reflected in the 2015 National Marine Science Plan, focused on growth of the ocean economy to AU\$100 billion by 2025 through addressing seven key challenges:

1. Maintaining marine sovereignty and security and safety;
2. Achieving energy security;
3. Ensuring food security;
4. Conserving biodiversity and ecosystem health;
5. Creating sustainable urban coastal development;
6. Understanding and adapting to climate variability and change; and
7. Developing equitable and balanced resource allocation (Voyer et al. 2017).

The plan articulates a strategy focused on research and development activities to address each challenge, without a central role for CMSP or a focus on developing innovation hubs and maritime clusters (Voyer et al. 2017). To transition the Blue Economy into mainstream economic development, address risks from ecosystem degradation and climate change, and capture opportunities for development, a wide range of programmes and initiatives are ongoing at sub-national, national, regional and international levels.

The Sustainable Development Goal 14 (see Appendix Three – Sustainable Development Goals) was adopted by the UN as part of the 2030 SDG agenda and includes specific targets that countries pursue in order to sustainably use the oceans. Multiple other SDG's are also relevant to the Blue Economy, depending on the specific context.

<sup>2</sup> OECD 2016. *An overview of the ocean economy: assessments and recommendations*.

<sup>3</sup> P.G. Patil, J. Virdin, C.S. Colgan, M.G. Hussain, P. Failler, and T. Vegh (2018). *Toward the Blue Economy: A Pathway for Sustainable Growth in Bangladesh*. Washington, DC: The World Bank Group.

## The Indian Blue Economy

Initiatives such as the *Blue Economy Vision 2025* produced by the Federation of Indian Chambers of Commerce and Industry are providing impetus and insights specific to the Indian context. This includes reviewing business opportunities and constraints in India and a suggested high-level methodology for the Blue Economy assessment. This document notes that “conscious efforts have to be made in terms of planning, investment, and sectoral allocation of factor endowments to ensure natural growth of the Blue Economy. For infusing dynamism in selected sectors, priority areas for different sectors of the Blue Economy should be identified, based on the potential and feasibility of the Blue Economy in India.”<sup>4</sup>

The *Blue Economy Vision 2025* notes that development of the Blue Economy in India depends on the evolution of the established sectors to embrace a low waste, low carbon future alongside emerging sectors and ocean-based industries and activities (see Table 1). Emerging sectors in India are characterised by the use of cutting-edge science and technology in their operations, and a low carbon / low impact approach:

*Table 1. Indian Blue Economy overview of established and emerging sectors.*

Established Sectors	Emerging Sectors
- fisheries	- renewable ocean energy including offshore wind, tidal and wave energy and biofuels
- shipping	- seabed mining for metals and minerals
- port and maritime logistics	- marine aquaculture
- marine coastal tourism and leisure	- marine biotechnology
- conventional minerals exploration and production	- ocean monitoring, control and surveillance and education and research
- marine construction activities	

The Task Force responsible for the *Blue Economy Vision 2025* noted that, “in the coming years, India Inc needs to give priority to the following five sectors: Fisheries and Aquaculture; Seaport and Shipping (including port development); Tourism (including island development for tourism); Renewable Ocean Energy; and Mining (offshore hydrocarbons and seabed minerals)”. Although this is not an official document of the Government of India, it does provide a useful comparative guide as to potential sectors for future evaluation in the New Zealand context.

## The European Blue Economy: measurement and programmatic investment

**The EU Blue Economy Report<sup>5</sup> analyses the scope and size of the Blue Economy in the European Union, solidifying a baseline to support policymakers and stakeholders in the quest for a sustainable development of oceans, sea and coastal resources.**

“According to the most recent figures, the established sectors of the EU Blue Economy directly employed over 4 million people, generated €658 billion of turnover and €180 billion of gross value added in 2017.”

“The evolution of the Blue Economy has been significantly influenced by general macroeconomic developments, in particular the global financial and economic crisis of 2008-2009. High growth rates can be observed in traditional sectors as well as the emerging ones.”

The Blue Economy Report is a key source of information for a wide variety of stakeholders: policy makers, blue economy experts, industry, as well as scientists and citizens. The report illustrates the size and impact of the Blue Economy in the European Union.

<sup>4</sup> <http://ficci.in/spdocument/20896/Blue-Economy-Vision-2025.pdf>

<sup>5</sup> <https://op.europa.eu/en/publication-detail/-/publication/676bbd4a-7dd9-11e9-9f05-01aa75ed71a1/language-en/>

A focus on measurement to understand the long-term potential in terms of jobs, growth is combined with assessment of investment opportunities – ultimately intended to support policy and decision making and direct marine and coastal ecosystem stewardship.

### Innovative Financing of the Blue Economy is Increasingly Common

Innovative approaches to financing new initiatives promise opportunities to extend blue economy development beyond traditional forms. These include:

- Impact investment.
- Philanthropic grant / discretionary funding.
- Public / private partnerships.
- Climate finance.
- Blended finance combining multiple funding sources.

Increasingly, blue economy projects seek diversification and ongoing self-funding, rather than sole reliance on government funds or grants. It is important to note that science and research play different roles in supporting innovative finance, particularly with regard to developing methodologies for benefits assessment, new practices and methods, and tools for adaptive management and outcome measurement. Any effort to utilise ecosystem services effectively in terms of EBM will require significant scientific and social-scientific research. This is critical if New Zealand is to explore new ways to finance things like ecosystem restoration.

### Bluetech Innovation, Incubators & Alliances

Globally, increasing numbers of incubator and technology hubs are being activated around the general concept of marine technology (known as bluetech). A global alliance (BlueTech Cluster Alliance) has been formed with seven members sharing resources, knowledge and innovation. Examples are discussed below.

#### *BlueTech Cluster Alliance*

The BlueTech Cluster Alliance (BTCA) formally launched in January 2017 with seven charter members including Forum Oceano (Portugal), Marine Institute (Ireland), Oceans Advance (Canada), PLOCAN (Spain), Pole Mer Mediterranee (France), The Maritime Alliance (US) and the UK Blue Growth Network (UK). The BTCA now includes ten clusters in total from eight countries.

#### *TMA Bluetech*

- The non-profit TMA BlueTech (previously known as The Maritime Alliance) is the cluster organiser for the San Diego maritime technology community. TMA BlueTech fosters maritime business and technology innovation and has a growing number of members nationally and internationally.
- Companies at the BlueTech Incubator (BTI) - San Diego's ocean & water tech incubator run by TMA BlueTech (formerly The Maritime Alliance) - are at the cutting edge of innovation in the growing Blue Economy. BTI fosters early stage, innovative, science-based ocean & water/wastewater tech companies, helping propel them to greater opportunity and financial viability. BTI bring together the 'Triple-Helix of Academia, Industry & Policy Makers' for purposes of "Fostering Innovation Through Collaboration" to create a supportive network for our companies to connect and thrive.



**SeaAhead** is based on the East Coast of the United States and incubates and develops bluetech such as:

- Hybrid ship propulsion; Ballast water treatment systems; Sustainable anti-fouling technology; New materials/methods to reduce ship hull friction; Whale strike avoidance; Ship emissions control; Logistics efficiency software; Maritime and supply-



chain cybertech for protecting life, property and the environment; Electrification of port infrastructure & operations; Ocean Internet-of-Things sensing and analytics, Aquaculture sensors, alternative feed & system design; Underwater autonomous vehicles; Wild fishery traceability - including acoustics, satellites & supply chain; New processes for locally-sourced fish stocks; Marine-derived pharmaceuticals.

## New Zealand Developments

### Blue Economy Snapshot

Statistics New Zealand estimate that in 2013, New Zealand’s marine economy contributed \$4.0 billion (1.9 percent of total GDP) to New Zealand’s economy and provided 102,400 jobs. In comparison, Australia’s marine economy is estimated to contribute \$74.2 billion to its national economy in 2013-14 (4.8 percent of total GDP) providing almost 400,000 jobs. Fast forward to 2017, and Statistics NZ estimates our marine economy to have dropped to \$3.8 billion (1.4 percent of total GDP) where shipping is now the major contributor to GDP, but fisheries and aquaculture continue to be the most significant providers of jobs (see Figure 1, figures from StatsNZ).

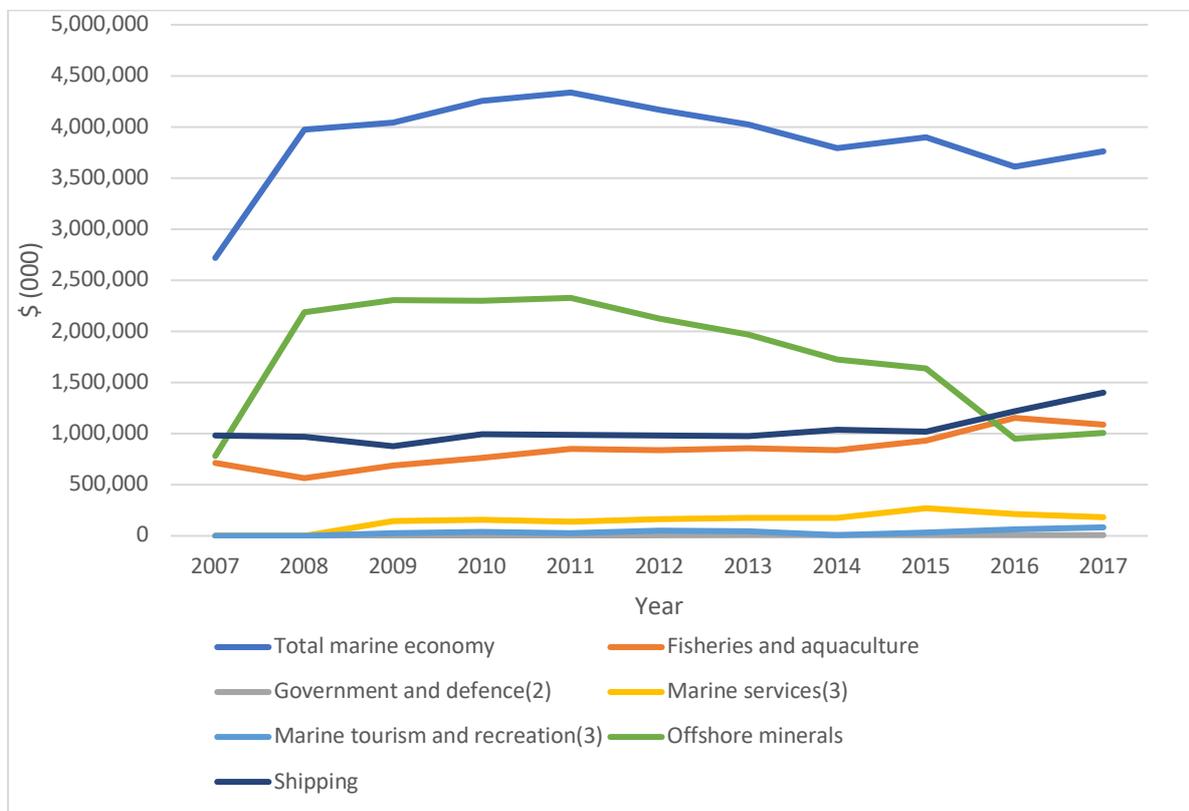


Figure 1. New Zealand's Marine Economy 2019, Stats NZ.

International shipping is critical due to New Zealand’s isolated location in the Pacific Ocean and the importance of primary industry exports and tourism to the economy. However, it brings considerable threats including biosecurity threats but also contributes to greenhouse gas emissions. The economic contribution of commercial fishing to New Zealand’s economy is estimated at \$544 million providing 4,305 jobs involving both capture fishing and seafood processing activities. Of the fishing sectors (deepwater, inshore, highly migratory species and shellfish), highly migratory species contributes the most (\$197 million average in the five years to 2015). In total, approximately 450,000 tonnes of wild fish are harvested each year through the QMS.<sup>6</sup> Fish

<sup>6</sup> The economic contribution of commercial fishing to the New Zealand economy, 2017. Report prepared for NZ Seafood Council by BERL.

exports are estimated at \$1.5 billion and are New Zealand’s fifth largest export by value, representing 3.2% of total exports (hoki and rock lobster being the major exports).

New Zealand has huge potential in aquaculture production. The sector has growth ambitions to become a major primary industry notable for its light environmental touch and its overwhelmingly positive social, cultural and economic contribution to regional New Zealand. New Zealand has the 10th longest coastline and fourth largest Exclusive Economic Zone of any country. Currently only a tiny fraction of this is farmed; the total area in New Zealand in aquaculture is similar to the area in onions or a single high-country sheep farm. Aquaculture is a global growth story, supplying growing seafood consumption in the place of flat wild capture. Globally, aquaculture has increased its share to about half of total seafood volume.

Regarding marine tourism, a report prepared by Market Economics in early 2019 suggests that the contribution of marine economy to GDP may be as high as 3%<sup>7</sup>, double the contribution identified by Stats NZ.

In the Market Economics measures, marine tourism contributes roughly 40% of the value of marine economic activities and 62% of jobs. Using broad estimates of the indirect and induced economic impacts from activity in the sector, the contribution of marine economy activities may be as high as 5% of the national economy. These numbers do not include the value of recreational uses of marine resources or any estimate of the cultural and amenity values these resources contribute contribution of marine resources. This work begins to highlight the importance of marine tourism that is hidden in most accounts of the marine economy; the marine tourism sector has enormous potential at the regional and small to medium sized enterprise (SME) level as well as national foreign exchange earnings.

### Case study: Marine Tourism and Americas Cup 36

Tourism is New Zealand’s largest export industry in terms of foreign exchange earnings. International visitor arrivals to New Zealand are forecast to reach 5.1 million visitors spending 14.8 billion in 2024 (from 3.7 million visitors in 2017). Strong short-term growth will be driven by a range of factors, including favourable economic situations, low travel costs, and destination marketing. This growth is forecast to moderate in the medium to long term.

Marine tourism is an industry experiencing rapid growth, both worldwide and in New Zealand. Increased interest in the marine environment and access to boating opportunities is responsible for putting many more people on the water. Marine tourism operations are diverse and encompass physical activities such as seal swimming, diving and snorkelling, sea kayaking, and recreational fishing, as well as more passive observation of wildlife and scenery such as whale watching. The cruise sector is also an important part of the tourism industry in New Zealand. This sector creates significant inflows of foreign expenditure and it is expected to grow. Moreover, America’s Cup 36 in 2021 is anticipated to follow a similar tourism influx and offer economic benefits as seen at previous events. Prior to this, Emirates Team New Zealand (ETNZ) and the other syndicates will be based in New Zealand developing their boats and training in race conditions.

In doing so they generate an economic benefit for the Auckland and New Zealand economy. This stretches from the retail, accommodation and hospitality sectors across the economy to manufacturing, transportation and the marine sector (marina’s, boat builders, marine servicing and supplies). During the regatta, tourism sector benefits as visitors are attracted to Auckland and other regions from around the world (as well as from around New Zealand). The net effect of these activities drives net additional economic activity, GDP, sustains

#### **Established industries (ranked by \$ value)**

1. Transportation (shipping and ports)
2. Fisheries and aquaculture
3. Offshore oil and gas
4. Marine manufacturing, R&D
5. Tourism (marine and coastal)
6. Shipbuilding and repair

#### **Key figures:**

- Total value: \$3.77 billion (direct value-add)
- Contribution to GDP: 1.4%
- Jobs: 33,000 (fisheries: 14,700; shipping: 15,800)
- Indirect value-add: \$6.97 billion

<sup>7</sup> *Measuring New Zealand’s Blue Economy*. 2019. Prepared for *Sustainable Seas* and the University of Auckland by Market Economics Ltd.

employment and lift household incomes. Furthermore, the event acts as a catalyst for several sectors within the economy and for Auckland itself. The long-term effects of infrastructure investment that is required to host the event will ensure that the Auckland Super Yacht Refit and Charter sector is able to grow significantly. A recent study reveals that for every \$1 invested, between \$1.25 and \$1.89 of benefit will accrue to the economy (MBIE, 2019). The Viaduct Basin, developed for the 2000 America’s Cup in Auckland, has become a hub of city dining and evening entertainment – a lasting legacy of the event.

## Sustainable Development Goals

New Zealand ratified the Sustainable Development Goals (SDG) in 2015, thereby signalling its ongoing commitment to sustainable development both in New Zealand through domestic action, and internationally through leadership in global policy issues and development assistance. To date, the New Zealand government has been relatively slow to take action towards the SDGs. However, with the recent change in government in 2017, and especially the Labour-Green Confidence and Supply Agreement, the current political climate is more conducive to the implementation of the SDGs. Notably, the Confidence and Supply Agreement positions the SDGs as a priority for action.

In 2019 New Zealand prepared its first National Voluntary Report<sup>8</sup> detailing how it is achieving the SDGs<sup>9</sup> and is working across different agencies to coordinate indicators and results measurement and reporting systems. In addition to governmental efforts, many New Zealand businesses have explicitly committed to SDGs – though not necessarily focused on SDG 14 (see below). The Sustainable Business Council (SBC) is a leading sustainability body in New Zealand’s business community and is the only Global Network Partner of the World Business Council for Sustainable Development in New Zealand. The SBC is a member organisation that aspires to mainstream sustainable business practices within the New Zealand business community by providing sustainability solutions and tools for businesses to become more sustainable and connecting members to work together on sustainable projects. SBC members are required to reduce greenhouse gas emissions and annually report on progress made towards addressing environmental, social and economic issues.

The Sustainable Business Network (SBN) is a member-based social enterprise that helps businesses to succeed through sustainability. Their vision is to make New Zealand a model sustainable nation. To realise this vision SBN helps members succeed in four areas considered critical for New Zealand: Renewables- enabling the use of renewable energy; Community- building thriving communities; Mega efficiency- maximising the use of all resources; Restorative - enhancing New Zealand’s natural capital.

### **SDG 14: Conserve and Sustainably Use the Oceans, Seas and Marine Resources for Sustainable Development.**

SDG 14 is critical to several societal and economic goals (see Appendix Three – Sustainable Development Goals). New Zealand government agencies voluntarily report on SDG 14 as related to their specific areas of responsibility - per the table below. Most SDG’s are relevant to the Blue Economy; but SDG 14 is the focus here because it is explicitly about oceans and marine resources.

*Table 2. Public sector organisation (self-reported) alignment with SDGs.*

<b>Organisation</b>	<b>Responsibility</b>
<b>Department of Conservation</b>	Coastal acidification: Rate, impacts and management (NIWA research project) Estuary protected areas reporting Implementation of best practice seabird bycatch mitigation in commercial fisheries Marine protected area research, monitoring and reporting: Ecological integrity and sentinel site programmes Review of Hector’s and Maui dolphin Threat Management Plan (DOC and MPI) The South East Marine Protection Forum (DOC and MPI)

<sup>8</sup> <https://www.mfat.govt.nz/assets/Uploads/New-Zealand-Voluntary-National-Review-2019-Final.pdf>

<sup>9</sup> report is available at: <https://www.mfat.govt.nz/assets/Uploads/New-Zealand-Voluntary-National-Review-2019-Final.pdf>

**Ministry for Primary Industries** Climate change and ocean acidification: risks and opportunities for the seafood industry (NIWA Research)

National Plans of Action for Seabirds & Sharks

Fisheries Policy Reform: Future of Fisheries

Threat Management Plan for the New Zealand Sea Lion (MPI and DOC)

**Ministry of Business, Innovation and Employment** Marine Science & Research Investment

**Ministry for the Environment**

To improve the regulatory framework for decommissioning offshore oil and gas installations and pipelines

To reform national marine protection through the introduction and implementation of modern marine protected areas legislation

To undertake public consultation on a proposal to prohibit or control the manufacture and sale of personal care products containing microbeads in New Zealand and to consider the public submissions made as part of any future policy or regulatory changes.

## The Māori Marine Economy

The Māori Marine Economy (MME) spans small whānau-scale operations using relatively traditional fishing methods inshore through to large mechanised fleets trawling far out in New Zealand’s Exclusive Economic Zone (EEZ). It covers activities as diverse as a whanau exercising their customary harvest rights to gather a taonga species for a tangihanga through to a hapū run whale watching business that takes tens of thousands of visitors from around the world out to see the behemoths of the deep. The MME is *all* the marine-related economic – in the broadest sense of the word – activities of Māori, from customary harvest to marine tourism to commercial fisheries though the latter is dominant in this report as it is the highest value subsector.

The MME can be understood in four ways: institutionally, organisationally, economically and orientationally. **Institutionally**, the MME is the product of a range of critical pieces of legislation that created and continue to shape the MME as a specific and identifiable subsector of the wider marine economy. **Organisationally**, the MME can be viewed in terms of the entities that operate within this subsector as well as the governance and judicial entities that oversee and adjudicate the MME. **Economically**, the MME can be understood as the business strategies which determine the financial returns that come from exercising the commercial fishing rights in the MME. **Orientationally**, the MME is a space in which Māori are able to exercise and implement their core values.

The institutional, organisational, economic and orientational perspectives have an important relationship. The constitution of many of the various entities that operate in the subsector are largely a result of the legal framework that created and shapes the MME. The legislative framework determines the organisational response. Following on from this relationship, the economics of the MME are the manifestation of the guiding legislation and the resulting organisational forms the subsector has adopted as a result. The economic, organisational and institutional are also informed by the orientational, though Māori values are not the only or necessarily dominant influence on any of these. This relationship is mapped below:



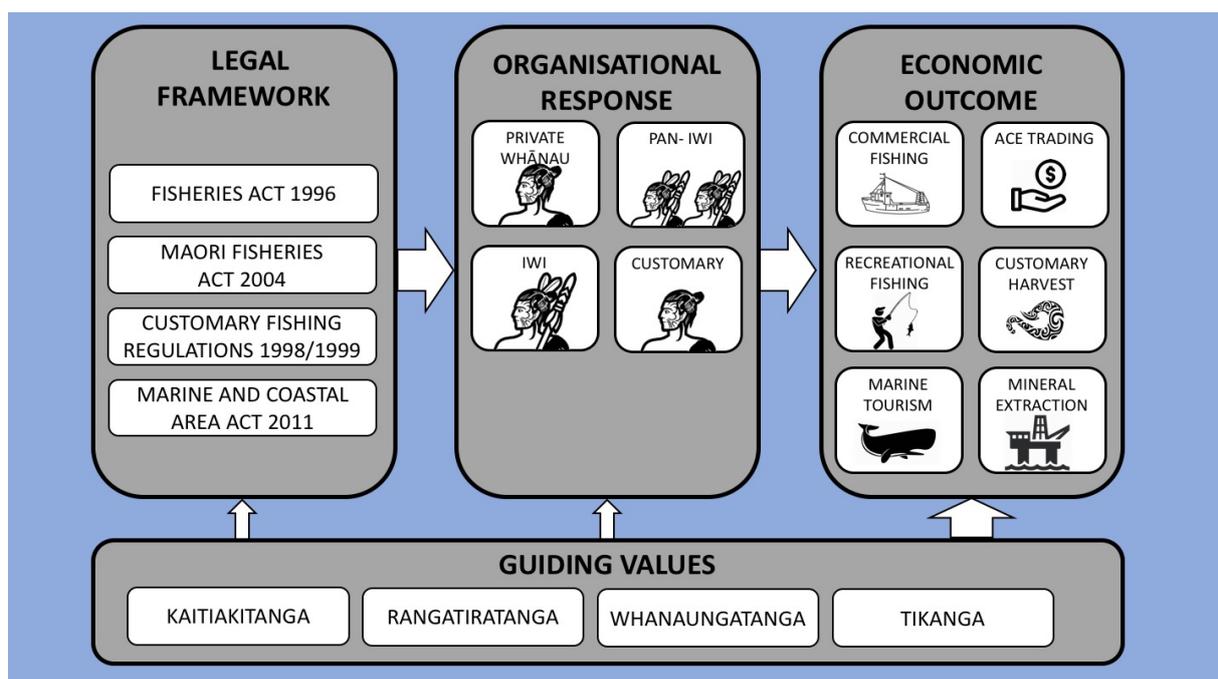


Figure 2. Interactions between guiding values, legal framework, and broader Maori Marine Economy.

### Evolving and Emerging Industries in the Blue Economy

Technological innovation is critical to the Blue Economy. ‘First movers’ and new entrants are continually challenging conventional practices through revolutionary solutions to both old and new problems; existing players are forced to innovate or risk losing a competitive edge. The increasing prevalence of disruptive technologies highlights significant opportunity for bluetech in the Blue Economy, particularly as we transition to a low emissions economy. The rapid pace of technological change can be intimidating; therefore, it is important that regulators and the private sector are able to understand and respond to these shifts in an adaptive way, and that we can learn from and adapt international technologies. Many organisations within New Zealand’s Blue Economy are already exploring new technologies that are leading to creation of new industry.

Technology developments for the Blue Economy are evolving rapidly – disrupting existing value chains and creating new pathways to consumer and value creation. New Zealand does have investment into new technology but many areas of technology are more appropriately adapted from international developments rather than risking ‘reinventing the wheel’. ‘Bluetech’ is an established sector globally but is not recognised as such in New Zealand, although there are examples of successful technology development in the Blue Economy. New Zealand should align with global bluetech leaders which have formed collaborative ‘virtual hubs’ to best leverage the opportunities associated with technology. Organisations across a wide range of sectors are already exploring new technologies, however, they are faced with significant barriers to uptake such as lag time between development and uptake, lack of bluetech networks or transfer of IP.

A focus on developing solutions that will appeal to offshore markets is necessary for effective transition towards the Blue Economy in New Zealand; for example, responding to the changing consumer preferences (e.g. away from animal protein).

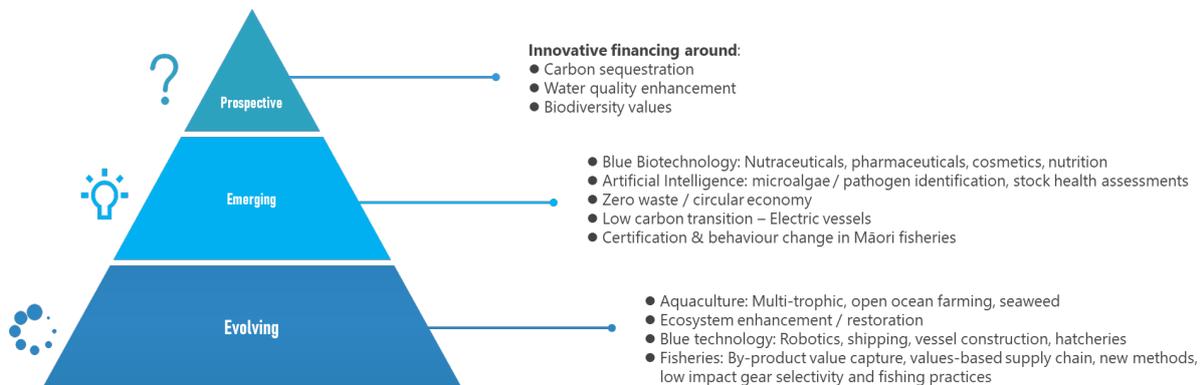


Figure 3. Current status and trajectories of New Zealand (and international) Blue Economy sectors; there are no available estimates of their potential.

The following areas are presently emerging industries / technologies in New Zealand:

**1. Offshore / Open Ocean Aquaculture**

(e.g., Mobile production systems that are resilient to the offshore environment and require minimal human operation).

**2. Integrated Multi-Trophic Aquaculture / New Species Aquaculture**

(e.g., new farming structures, novel compatible species, harvesting & culture techniques for multi-species systems, feed conversion rates, circular nutrient economies).

**3. Seaweed Farming**

(e.g., Development of new seaweed culture systems, hatcheries, and niche products unique to New Zealand).

**4. Bioprospecting**

(e.g., New nutraceutical / pharmaceutical products from indigenous species, genetic improvement).

**5. Artificial Intelligence**

(e.g., Rapid real time microalgae / pathogen identification, real time catch quality monitoring in fisheries, data driven decision making).

**6. Low-carbon Transport**

(e.g., Battery powered fast commuter ferries, biofuel for maritime transport).

**7. Commercial Fishing Gear**

(e.g., Passive fishing devices that reduce or eliminate bycatch, mitigate benthic impact, enhance catch quality, and reduce environmental footprint).

**8. Carbon Neutral / Zero Waste Industries**

(e.g., Mussel shell recycling, fishing by-products such as fish skin).

**9. Clean Energy Sources and Production**

(e.g., Tidal / wave energy production, Bio-fuels).

**10. Upstream and Downstream Infrastructure**

(e.g., Hatchery production systems, product processing plants, value chain enhancement).

## 4. Findings and Insights

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In parallel to undertaking the PESTLE analysis, we conducted >40 in-depth interviews with iwi and stakeholders to document and analyse their views and incorporate them into potential Phase II research development. Interviews were qualitatively analysed, with a focus on identifying themes and / or trends. No attempt was made to undertake quantitative analysis because the semi-structured nature of the interviews does not lend itself to quantitative analysis. The overarching question we were seeking to answer was:

*“How is New Zealand positioned in terms of trajectories of on-going innovation and change that may or may not be driving towards this vision of a blue economy and technological innovation in key sectors?”*

### Theme 1: Traditional sectors are changing

#### Commercial Fisheries:

There is a movement towards management of commercial fisheries for resilience instead of abundance; switching away from maximum sustainable yield (MSY) as a fisheries ‘target’, and closer to Ecosystem Based Fisheries Management (EBFM).

*“By managing for resilience, you actually drive innovation by forcing fishers to try to generate more value from their quota, rather than just capping the TACC. There is still a neo-liberal lens cast over innovation and catch management.”*

*“Currently MPI has enough info to adopt an ‘EBFM-lite’ approach. Nothing is stopping MPI from giving this a go now. Iwi is key to implementation. We could make a lot of decisions for the purpose of managing for resilience with limited scientific data, albeit with a conservative approach.”*

*“We want to get to a point where government has to make less decisions on fisheries. Currently stakeholders expect government to make decisions because there is a cost associated with making them. Who should have to pay for additional complexity? What cost recovery options are there?”*

Key stakeholders emphasise the value of better aligning other uses (recreational, tourism etc) with marine protection and commercial fisheries; understanding opportunities for Māori-owned fishing companies to adapt and differentiate, allowing them to develop a unique market position. Risks associated with global consumer changes toward plant-based proteins and increasing awareness of carbon footprint of exports from NZ are also important contextual factors that may impact our seafood production.

*“We should explore scenarios including different Marine Protected Area (MPA) opportunities (e.g. recreational only fishing zones), the types of interactions with commercial fisheries; leveraging international perspectives on fisheries management will be key.”*

### Aquaculture:

A new national strategy, along with increased consideration being given to new uses for existing species, new species development, new locations (offshore) and the technological hurdles to overcome this shift, and multi-trophic aquaculture / circular nutrient economy / zero waste approach to food production (away from standard monoculture).

*“Open Ocean Aquaculture is going to be a big focus for MPI; it is a key focus of the new, New Zealand Aquaculture Strategy.”*

*“Aquaculture is currently in a ‘sweet spot’; the sector is in a great position where they can work with government to plan out the future development of the industry to enable sustainable, high value production that could be a keystone component of the New Zealand economy.”*

*“Lots of opportunity for Integrated Multi-Trophic Aquaculture (IMTA) from the perspective of value-added, carbon sequestration, and habitat restoration. Could farm sea cucumbers underneath on the seabed, but there is nothing to stop anybody from coming and extracting those.”*

## Theme 2: Climate change adaptation and innovation is critical

New Zealand’s blue economy, including activities such as aquaculture, fisheries, and marine tourism, are significant contributors to New Zealand’s regional and national economy and are all dependent on climate-sensitive natural resources. These sectors are exposed to the direct impacts of a changing climate (e.g. changes to pH, ocean temperature, stratification, salinity and currents) as well as indirect impacts that compound and cascade through the economy (e.g. increased biosecurity threats and disruption to supply chains).

Although generally perceived as threats, climate change and environmental impact management also represent a distinct opportunity for Blue economy solutions and development. As New Zealand businesses look to buffer their operations from the potentially negative impacts resulting from changing environmental conditions, new technologies are being developed that add green values to products as well as protecting environments. Industries centred around transitioning to low-carbon futures, enhancing ecosystem resilience, and improving adaptability are being developed. Economic impacts are also likely to arise from coastal hard and soft engineering as national and local government authorities begin to plan retreat from sea-level rise, new transport links along our coastal roads and so on.

*“All [of our] fish are caught using hook and bait long lining, meaning we can target high-value species and leave other fish undisturbed. This has low impact on the seabed and produces better quality fish because they are less stressed in the catching process. We’ve also invested in a bio diesel fuelled fleet to reduce our carbon footprint.”*

## Theme 3: Ecosystem based management and adaptation through ecological infrastructure / nature-based solutions

New Zealand marine ecosystems are under increasing pressure from a range of direct and indirect factors such as climate change, sedimentation, over harvesting (e.g. fisheries) and habitat destruction<sup>10</sup>. Impacts linked to climate change, loss of biodiversity, and terrestrial and marine activity have interacting effects on the coastal and marine environment. The cumulative effects resulting from these pressures are anticipated to undermine marine ecosystem resilience, reducing the ability of natural systems to tolerate stress and leading to substantial reductions in productivity and the provision of fundamental ecosystem services (e.g. nutrient removal and carbon sequestration)<sup>11</sup>.

<sup>10</sup> <https://www.mfe.govt.nz/publications/marine/our-marine-environment-2019-summary>

<sup>11</sup> <http://documents.worldbank.org/curated/en/519821547481031999/The-World-Bank-Groups-Action-Plan-on-Climate-Change-Adaptation-and-Resilience-Managing-Risks-for-a-More-Resilient-Future.pdf>

One opportunity is restorative aquaculture. This idea is centred on the concept of utilising an organisms natural extractive capabilities to remove / sequester nutrients or contaminants from the water column, thus enhancing coastal water quality, sequestering carbon and enhancing climate resilience, along with improved biodiversity. Some seaweed and shellfish species have been proven to act as effective pollutant mitigators and ecosystem engineers when deployed in degraded nearshore ecosystems<sup>12</sup>; providing an innovative approach to restoring water quality alongside traditional management approaches. This approach is already being explored in areas like the Hauraki Gulf which suffer from heavy metal toxicity and high nutrient concentration (e.g. nitrogen and phosphorous); however, this model could be replicated in other areas around the New Zealand coastline.

The development of economic opportunities for the purpose of preserving ecosystems or enhancing the resilience of natural habitats through establishing wetlands, coastal buffers, kelp afforestation, wild shellfish restoration and improving cross-boundary management of the land-sea interface is a strategic opportunity for New Zealand.

*“We are looking at a way to preserve the mauri of the port area by protecting the important natural crayfish nursery. First and foremost, we need to inhibit the forestry material coming into the harbour, which disrupts the natural settlement process.”*

*“Managing for resilience is key. Most importantly, how could we create a model that can be transferred to other species/locations?”*

*“The main challenges include: climate change, the introduction of circular economy thinking, reducing reliance on carbon, responses to different knowledge systems (not just Māori), and bringing matauranga Māori into innovation and implementation.”*

#### **Theme 4: Iwi/Māori interest in strategic economic development (nationally and regionally)**

There are significant gains to be had from coordinated strategic economic development and planning for the blue economy. Internationally there are multiple governments, organizations and industries developing and applying innovative technologies and approaches to building blue economies. Māori emphasise the importance of bringing strategic and coordinated approaches to Māori businesses and governing bodies.<sup>13</sup> Such approaches place a premium on training and capability building, including supporting new generations of economic actors to build experience and capabilities in international settings and adopt innovation from overseas to complement mātauranga Māori. Shared tikanga, mātauranga, values and world view form a strong basis for wider collaboration across the MME. TOKM has noted that there is a general lack of Māori expertise in the fisheries sector and associated QMS.

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<sup>12</sup> <https://billionoysterproject.org/>

*“Because we’re a business that was built by acquisition, we used to be quite siloed. Hīkoi ki te Ora was the first programme to go across all our sites. And so each month we focus on a different kaupapa. Sometimes it’s just educational, sometimes we’re just drawing off the resources that the government or other agencies put out, so Breast Cancer Awareness or Diabetes. The aim of it was to be a holistic programme, so looking at physical wellness in terms of trying to get people moving, looking at what diets are, looking at nutrition and so we’ve had sugar-free demonstrations. We had people come in and do easy, simple recipes to try and get rid of this permanent noodle culture that we had. Also about just practical tools as well, so we’ve got a high Pacific demographic who are sending money back to the islands. So, we ran some training around the best way to do that so that they’re losing the least amount of money in that transaction”.*

*“Iwi will be integral to Blue Economy development. Through their Treaty Settlement agreements they are receiving significant economic assets within the marine economy (20% waterspace allocation + other resources), and will continue to be major players in fisheries and aquaculture. Iwi are also key to the social license to operate/develop marine resources.”*

### Theme 5: ‘Greening’ existing technology and improving (critical) infrastructure

Opportunity for technological development in the New Zealand Blue Economy is significant. Leveraging and building off momentum in existing sectors – especially in ‘greening’ technology – will be key to developing future prospects and competing on the international scene. Technology for the Blue Economy is evolving rapidly – disrupting existing value chains and creating new pathways to consumer and value creation. Many New Zealand companies have a positive outlook towards green growth, but interviewees in this research stress that greater consistency of effort is required to more fully realise the benefits of the opportunities it offers.

New Zealand does have investment into new technologies, but many are more appropriately adapted from international developments rather than risking ‘reinventing the wheel’. Although there may be opportunities to create new technologies that are distinctly relevant to the New Zealand context (e.g. endemic species development), researchers and technology developers should contemplate how information and IP can be exported to other markets globally.

*“The game changer – economically - is to charge vessels off the power grid completely, rather than adopting a hybrid hydrogen model. Electric ferries will end up saving people lots of money, however the hydrogen cost benefit is just not there at this stage”.*

*“We estimate GHG reduction of 35,000t by converting the entire Auckland ferry fleet to electric.”*

*“(Aquaculture) space is now not necessarily the primary constraint; new farming areas in Coromandel are consented but not developed yet, but other aspects such as port infrastructure and spat availability are constraining growth.”*

Public sector initiatives such as the Provincial Growth Fund<sup>14</sup> are playing an important role in growing the Blue Economy, with many opportunities lying outside of the main cities. PGF initiatives are funding a number of critical infrastructure upgrades (e.g. wharf developments in the Coromandel and Tasman). Core to these initiatives is the expectation that future infrastructure planning incorporates consideration of changing coastal conditions, this may include a combination of hard engineering solutions (e.g. raising structures above sea level rise projections) and / or soft approaches (e.g. shoreline management). Many interviewees were quick to point out that while there is a big focus on growing the private sector, significant consideration needs to be given to ensuring that public infrastructure (e.g. wharves, transport networks) are able to keep up with progress.

### Theme 6: Innovative financing for restoration, economic growth and pollution reduction win-wins

Innovative Financing refers to non-traditional approaches or non-conventional financial instruments that tap into a variety of funding sources including public, private and philanthropic, that enhance capital flow into

<sup>14</sup> <https://www.growregions.govt.nz/about-us/the-provincial-growth-fund/>

results or impact-related outcomes<sup>15</sup>. Innovative finance is increasingly being used overseas to link value to important ecosystem services (e.g. carbon sequestration, nutrient cycling, primary production, water quality regulation) that underpin proper ecosystem function, and subsequently, marine industries that rely on natural capital (e.g. fisheries). This approach depends on ability to put a monetary value(s) on ecosystem processes and represents a good opportunity for New Zealand to foster greater investment from a range of players in the restoration and preservation of these ecosystem services, allowing continued sustainable development of our Blue Economy.

In addition to the areas above, making the case for blue economy from a national income perspective and applying ecosystem services frameworks to measure and model the connection between the economy and ecosystem values is critically important and an opportunity for science and research.

*“It would be good to tie in (Sustainable Seas) project ideas with the sector entrepreneurs in order to meet the innovation fund requirements, creating co-funding opportunities from non-traditional sources.”*

*Internationally we are seeing a shift towards “outcomes-based contracts”, investments that yield a social/cultural/environmental co-benefit (e.g. green retrofitting of housing); these investments are typically receiving quite a wide variety of funding types.”*

### Theme 7: Place-based research

Interviewees consistently called for demonstration projects and testing of solutions through case studies in specific locations or contexts. The Hauraki Gulf was specifically highlighted by interviewees due to its prominence in the national marine economy, the challenge of regulating multi-use environments, and the potential for positive political and stakeholder alignment arising from *Tai Timu Tai Pari Sea Change*.

The Hauraki Gulf is seen as a valuable location to conduct research because:

- A marine spatial plan that incorporated broad stakeholder participation already exists.
- Investment from a variety of different sectors continues to occur here.
- There are many opportunities for coastal management improvements.
- The marine environment is under a range of different pressures that threaten industry.
- There are very high natural values (species, places, ecosystems) in the Gulf.
- A significant proportion of the national population lives around the edges of the Gulf, and there is a high level of public interest.
- The Regional Councils (Auckland and Waikato) and commercial sector (e.g. Ports of Auckland, Fonterra) are actively looking for coastal and marine projects to invest in, that provide environmental benefits.

<sup>15</sup> <http://siteresources.worldbank.org/CFPEXT/Resources/IF-for-Development-Solutions.pdf>

*“I’m keen to see relevant pilots as the best way to demonstrate viability of the blue economy in New Zealand and the value of research insights. In particular, research into technology (biotech/ other), and aquaculture in an applied manner within the Hauraki Gulf”*

*“Focusing the blue economy as a coastal development / regional growth opportunity; in my opinion, top tier target regions include the Hauraki Gulf (important that any work builds on existing Sea Change MSP), Marlborough Sounds, Tasman, and Southland. Second tier target regions include the Hawkes Bay, Gisborne, and Canterbury.”*

*“Marlborough and the Hauraki Gulf might provide interesting case studies with different geographic context.”*

*“Look at the broader economic value of Hauraki Gulf. Consider the non-market and intrinsic values, and how payment for ecosystem services could be implemented in the Hauraki Gulf.”*

## Theme 8: Seaweed sector development

There are a number of seaweed related industries in which kelp is gathered or framed to produce food, fertiliser, blue bio-tech and other products. Seaweeds are also being increasingly recognised for their value in providing important ecosystem services such as carbon sequestration and nutrient capture<sup>16</sup>, which could assist with combatting climate change<sup>17</sup>. Coastal ecosystems are estimated to sequester up to 20 times as much carbon per acre than terrestrial forests<sup>18</sup>; the rapid growth of some species of seaweed means that culturing seaweed on marine structures or restoring kelp forests could be a more time-effective solution to reducing carbon dioxide concentrations in the atmosphere than planting trees. It is important to note that currently there is no blue carbon finance globally. Until this is established it will be very difficult to justify the financing of seaweed afforestation for the purposes of carbon sequestration.

*“There is a cross-agency (government) conversation happening in October to discuss the co-ordination of a new algae sector. We don’t want to flood the market with low value, low quality seaweeds as we risk characterising the industry from the start.”*

*“More research is needed on native species such as Karengo. We should explore the high value opportunities with our unique species rather than trying to produce internationally produced seaweeds with low value.”*

*“The start of an industry is the key time to properly frame up value proposition and the future vision for the sector. Undaria may be a useful start to help people to build confidence, but probably shouldn’t be an end point; there is a strong need to facilitate the discovery of new species/products that are characteristically ‘New Zealand’.”*

New Zealand is home to approximately 800 species of seaweed, many of which are endemic, and our nutrient rich temperate waters have been identified as ideal growing conditions to support a thriving seaweed farming industry<sup>19</sup>. *GreenWave 3D Multi-Species Ocean Farming* which focuses on the co-culture of extractive species like seaweed and shellfish represents an exciting potential prospect for transformative change in the way we produce seafood / generate value from marine ecosystem services<sup>20</sup>. Exploring restorative approaches to food production in the marine environment may provide a way for New Zealand to develop new industries that are built upon the premise of reversing climate change.

<sup>16</sup> Multi-Trophic, I. (2014). Seaweeds: Top Mariculture Crop, Ecosystem Service Provider.

<sup>17</sup> <https://www.nationalgeographic.com/environment/2019/08/forests-of-seaweed-can-help-climate-change-without-fire/>

<sup>18</sup> <http://sitn.hms.harvard.edu/flash/2019/how-kelp-naturally-combats-global-climate-change/>

<sup>19</sup> [https://www.seafoodnewzealand.org.nz/publications/seafood-nz-magazine/article/?tx\\_ttnews%5Btt\\_news%5D=267&cHash=048b7e07ae025854333d36408d118d39](https://www.seafoodnewzealand.org.nz/publications/seafood-nz-magazine/article/?tx_ttnews%5Btt_news%5D=267&cHash=048b7e07ae025854333d36408d118d39)

<sup>20</sup> <https://www.greenwave.org/>

## Theme 9: Changing consumer preferences: risk and opportunity

Strategic planning around new consumer trends and changing market dynamics should be at the forefront of business planning for marine sectors. Shifting consumer preferences driven by social consciousness around issues such as climate change, corporate environmental footprint, sustainability, nutritional requirements, health and ethical consumption (e.g. transition away from animal-based products) will force companies to adapt their business models or risk becoming obsolete<sup>21</sup>. Significant forethought around the needs and demands of the future consumer (both domestic and international) is critical to position New Zealand within shifting global markets. This may involve greening investment priorities, green innovations in production, processing and distribution, diversifying product ranges, and on-going attention to the promotion of New Zealand's green credentials. Exploring solutions at the interface of coastal – marine, i.e. sustainable land management to benefit marine environments and *vice-versa* offers opportunities for consumer reach-out and engagement. Pilots Blue Economy approaches promise a platform for successful seafood, bluetech and other marine economy futures, however, it is critical that we communicate the story behind products to potential customers using a range of media.

*“New Zealand has adopted a ‘China model’ where we produce, manufacture, process, and then sell to China. Too much focus on a “if we build it, someone will buy it”, this needs to change if we are to realise our potential on the export market; currently we are not truly connected to the consumers.”*

*“Seafood companies need to seriously consider how they will adapt to growing trends that promote transition away from animal protein. The emergence of veganism / vegetarianism are significant threats to the status quo of seafood businesses”.*

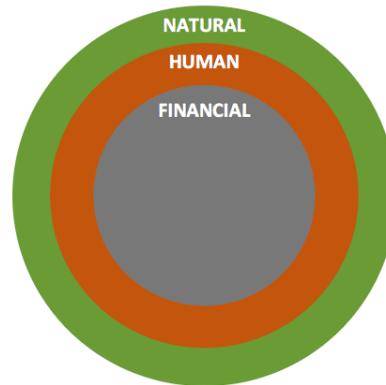
## A Māori Perspective on the Blue Economy

The blue economy is a useful start conceptually for Māori, but Māori emphasise that it must consider not just financial and natural capital but also social, human and cultural capital. These three need to be nested rather than the human and natural in service to financial capital. From an indigenous perspective, these ‘capitals’ are seen as nested, interacting spheres with natural capital encompassing all, human capital the next layer down as a subset of natural capital, and financial in the middle, as an abstraction of both natural and human capital. While mainstream economic approaches tend to treat these capitals as separate, distinct and equivalent, Māori see the natural (with humanity as part of this) as far more important.

Even the use of the term ‘economy’ is problematic from an indigenous perspective. In the contemporary Western world, the concept of ‘economy’ has seen exchange increasingly separated from the society and wider context within which it occurs. Hēnare outlines how for Māori an economy needs to be embedded in and constrained by both the natural and social: *“economics exists in the ecology, and not the other way around... [and] the economy is embedded in society and the values of that society inform the economy”*. He refers to this as the ‘Economy of Mana’, outlining how it is driven by *“four wellbeings—spiritual, environmental, kinship, and economic”*.<sup>22</sup>

<sup>21</sup> <https://www.sanford.co.nz/assets/announcements/Sanford-Annual-Report-2018-web.pdf>

**Māori view of capitals:**



*Figure 4. Visualisation of Māori view of capitals.*

These wellbeings align with the three forms of capital, with economic wellbeing premised on financial capital, environmental wellbeing on natural capital and spiritual and kinship wellbeing on social capital. For it to be indigenous, then, the concept of the ‘blue economy’ needs to re-embed exchange and the flows of financial capital back into the wider human and natural contexts in which it occurs, and it must also account for flows of human and natural capital.

**The Role of Mātauranga Māori**

Māori emphasise the value of complementing, extending and indigenising ecosystem-based management (EBM) approaches through mātauranga Māori.

In the terrestrial domain, Māori have established legal personalities for non-human entities such as rivers and national parks. The same approach may be applied to the marine estate where ecosystems and species could have legal personalities formed and kaitiaki trusts, across and between rohe (tribal areas), established to govern the ongoing maintenance of their mauri/health and welfare.

Mauri indicator approaches have emerged out of Māori ontology and epistemology and provide effective science-grounded models for determining the health and abundance of ecosystems, and their constituent human and non-human communities. Mauri indicators offer a transdisciplinary approach that allow different disciplines to talk to one another when measuring and determining socioecological wellbeing.

Marae-centred protocols and Māori decentralised governing models offer unique insights and opportunities in the development EBM and other resource management processes. Mātauranga Māori is also offering unique technical insights into applied methods and techniques to understanding a range of key issues including: ecosystem processes and harvesting technologies. A summary of issues and factors to consider includes:

**Indigenous Innovation**

- Continual development and updating of governing and operational structures to meet local regulatory demands and international market requirements
- Whakapapa networks for success – informal and formal (JVs etc.)
- Application of matauranga Māori in terms of traditional knowledge
  - Species management
  - Harvest technology
  - Ecosystem governance processes – hui, marae-based protocols, kotahitanga

### Hauora / Health

- Environment-human health nexus – maintaining identity, sense of place in marine landscapes as tipuna
- Development of health products from environment e.g. nutraceuticals
- Alternative economic systems for distribution (e.g. customary food) for providing access to kaimoana

### Matauranga

- Indigenous branding and provenance initiatives built around Māori understanding and concepts of kaitiakitanga.

### Capability

Shared tikanga, mātauranga, values and world view form a strong basis for wider collaboration across the Māori Blue Economy. Training in the utilisation and adaptation of existing approaches is recommended. In interviews Te Ohu Kaimoana has noted that there is a general lack of Māori expertise in the fisheries sector and associated QMS.

The pace of change within the MME is not rapid, and the approach to economic development has been mostly conservative. There are fears that adaptation and innovation will only be driven in response to a crisis, or a 'tipping point' as opposed to risk anticipation (e.g. climate change). This slow rate of innovation has also been hampered by the relative ease of the status quo, particularly market access to China.

## Challenges and Risks

There are a broad range of challenges associated with climate change and the Blue Economy, many of which are not well understood. Challenges are linked to:

- Consumer and government expectations, and value chain developments (e.g. performance disclosure, traceability).
- Economic understanding, including upfront costs of transition to the blue economy vs additional ecosystem services & their benefits.
- Poor understanding of the low carbon transition and speed of climate change impacts (costs vs benefits). Specifically linked to climate adaptation, there is a real risk that some sectors will face significant economic headwinds if adaptation pathways are poorly understood and the pace of adaptation is too slow.
- Limited access to finance / investment for scaling up solutions.
- Limited access to suitable knowledge (e.g. ecosystem-based management, natural capital frameworks and valuation).
- Limited holistic thinking (siloes).
- New Zealand has limited connections to international Bluetech and innovation; mentality of 'do it yourself', and not readily adopting tested technologies and ideas from overseas slows development here.

New Zealand's blue economy is also characterised by a complex assortment of risks that need to be carefully managed if the potential of the blue economy is to be fulfilled. As overfishing, climate change, and pollution are threatening marine ecosystems and the services they provide, population growth, coastal urbanisation and rising incomes are steadily increasing demand for its resources (e.g. energy, food, tourism & recreation etc). Each sector harbours its own specific environmental and business risks. The reasons for increase of revenue in shipping while fisheries are decreasing are not sufficiently understood – specifically how environmental degradation and climate change will impact on fisheries.

There are also cumulative risks to the environment from the increasing competition for space and the lack of spatial coordination of ocean activities. Growing congestion creates crowded seas, suggesting a future of higher accident rates, risks of more oil and chemical spills and mounting tensions among the maritime sectors

using the sea space. This is compounded by threats due to climate change and human pressures such as unsustainable tourism, coastal development and overfishing.

Information on investments – including ‘green’ investments for economic transition – is not readily available. Whereas marine economy is quantified in monetary terms, there is no model that connects the economic accounts to ecosystem health & ecosystem services trends and conditions. The research opportunities and recommendations in the next section are intended as frameworks for addressing these challenges and knowledge gaps.



## 5. Emerging Research Opportunities & Questions

In making the recommendations below, the aim is to provide some new ideas for research that address both the short and longer-term shifts required in marine economies to meet the environmental expectations of New Zealanders with a commensurate development of a blue economy – while also providing some answers to the more immediate knowledge needs of stakeholders. Interviews demonstrated there are many potential beneficiaries of research outcomes that do not feel fully engaged by the Challenge. This includes the investment and finance sector, marine transport, aquaculture and tourism; some of the recommendations recognise their needs and influence.

The last area of recommendations is about the opportunities for the Challenge to focus more on the uptake of research and the synergies to other National Science Challenges – recognising that the challenges in marine economies are extremely complex and requires a search for solutions developed from a systems-thinking perspective. The capability currently available to the Challenge was not considered when making these recommendations. It is assumed that if new capability is needed, the Challenge can secure it. Many of the recommendations are interconnected.

### Recommended Strategic Research Areas in Response to Emerging Developments & Opportunities

#### Key Themes Identified Through this Research

A high-level summary of the key areas of interest / sectors for innovation and research is captured in Table 3 below.

Specific research opportunities, including rationale and implementation, are provided below for consideration by the Challenge.

*Table 3. Key areas of interest for future research and innovation in the Blue Economy.*

<b>Areas of interest / sectors</b>	<b>Application</b>
<b>Open ocean aquaculture, multi-trophic farming, and seaweed farming – potential to grow into a new primary sector</b>	<p>Potential pilot projects to develop &amp; test frameworks for benefits assessment and investment models; strong interest in GreenWave model as community based / social enterprise solutions</p> <p>Locations/partners:</p> <ul style="list-style-type: none"> <li>Hauraki Gulf (MPI, Waikato Regional Council (WRC), Auckland Council, industry) – linkage to <i>Sea Change</i></li> </ul>
<b>Restorative aquaculture (N, P, sediment, heavy metal)</b>	<p>Opportunity for interface of urban &amp; coastal land-use pressure – marine conservation</p> <p>Locations / partners:</p> <ul style="list-style-type: none"> <li>Hauraki Gulf (WRC, Auckland Council)</li> <li>Te Waihora, Waituna (Ngāi Tahu, regional and district councils, industry)</li> </ul>

**Innovative Finance for restoration: leveraging carbon finance for blue carbon, N/P/sediment reduction, flood protection / climate resilience (linked to MPAs and ecological / nature infrastructure)**

Develop methodology for assessing and quantifying benefits and establish criteria for ethical investments and environmental offset; this requires strong biophysical science input and is a key step towards developing investment propositions. Also, strong linkages to MPA valuation

Applications: kelp and bivalve restoration, wetland enhancement, mahinga kai provision

Locations / partners:

- Far North; Hauraki Gulf – Miranda coast; Te Waihora; Waituna (DOC, MfE, regional councils, iwi)

**Maritime transport**

Low carbon, low impact transition, electric or biofuel vessels – recognising that maritime transport is growing in New Zealand

**(Eco)Tourism**

Low impact marine / coastal eco-tourism: unrecognised potential linking natural assets, travel experience and food

**Māori fisheries**

The changes required to enable Māori fisheries companies to implement kaitiakitanga & rangatiratanga in their operations.

## Seaweed: A New Sector for New Zealand

**What are the opportunities for seaweed – what could this industry look like in New Zealand? What benefits could it generate?**

Numerous new initiatives and businesses are targeting seaweed as a novel primary resource for the Blue Economy. However, there is no over-arching vision for a regenerative seaweed sector to guide regulatory frameworks, ecological sensitivities, climate change, relationship to protected areas, fairness/social justice and systems implications of un-coordinated economic development. The challenge is to create space for niche, high-value blue economy enterprises, whilst also encouraging any larger operations to develop high-value, blue economy approaches from the outset so as to avoid creating yet another primary sector commodity trap.

Seaweed can, in principle, sequester carbon faster than terrestrial trees and plants and some species make excellent fertilisers and feed that decrease methane production. It also provides marine habitat and various ecosystem services. There is an opportunity to deliberately engage stakeholders to aim for high-value, ecologically regenerative practices for the benefit of all New Zealanders. Seaweed is a new sector in New Zealand and its development is behind many other countries.

### Research opportunity:

*Model the seaweed opportunity across many lenses (i.e. the whole system) in a dynamic, multi-stakeholder context to understand opportunities and risks including:*

- Social opportunities
- Regulatory changes needed
- Market demand
- Pollution
- Upstream/downstream infrastructure and technology needs
- Environmental benefits and risks, including changing species distribution from climate change
- Māori aspirations

## Māori (Commercial) Fisheries Research Opportunities

### Overview:

In general, Māori fisheries businesses first need to implement organisational improvements before they can focus on operational improvements / innovations – this is necessary to overcome quota fragmentation issues and a lack of internal capacity. We found a few cases of real innovation, either at the largest or smallest scale of actors. Māori commercial fishers interviewed identified issues with Total Allowable Commercial Catch (TACC) mean that the only way of increasing profit is by adding value, rather than taking more fish. At this point, most businesses focus on more reliable improvement over higher risk innovation. Rangatiratanga is necessary for kaitiakitanga.

### Implementation:

Marae-centred protocols and Māori decentralised governing models offer unique insights and opportunities in the development of Ecosystem Based Management and other resource management processes. Getting as many iwi actively fishing their own quota through smaller whanau and hapu owned operations focused on targeted fishing methods - longline etc - with supply chain support provided at the iwi level will enable culturally-resonant fisheries management. Many smaller operators have closer relationships with particular fisheries / locations. These could also be tied to the wider creation of mataitai / taiapure that are strategically located close to provided breeding grounds.

### Research opportunity:

*Define Kaitiakitanga & Rangatiratanga in relation to Māori Aquaculture and Commercial Fisheries*

- What does it mean to be a Māori / Iwi owned fishing company operating in today's context of climate change, sustainability, and bycatch etc?
- What are the implications of this in terms of responsibilities and decisions?
- What are the constants in terms of tikanga and values that can be distilled into principles for application today?
- What change is required to enable Māori fisheries companies to implement kaitiakitanga & rangatiratanga in their operations?
- Could this be certified?
- How to positively influence the fisheries sector beyond Māori owned fisheries?

## Innovative Financing for Restoration & Ecosystem Services

**How can ecosystem restoration (marine and coastal) and ecosystem services be enhanced and accelerated through leveraging Blue Economy opportunities to increase access to finance and investment?**

### Rationale:

- Mechanisms for valuation of natural and social capital are giving rise to new ways to finance transition to blue economy, as has been seen in the Seychelles Blue Bond issued by The Nature Conservancy to restructure national debt in return for large scale protection of ocean areas.
- In New Zealand, there are learnings from government and user financed programmes for ecosystem services across the domains of water (e.g. nutrient limits and water allocation) that could be expanded to marine biodiversity, blue carbon, hazards protection (flooding, erosion).

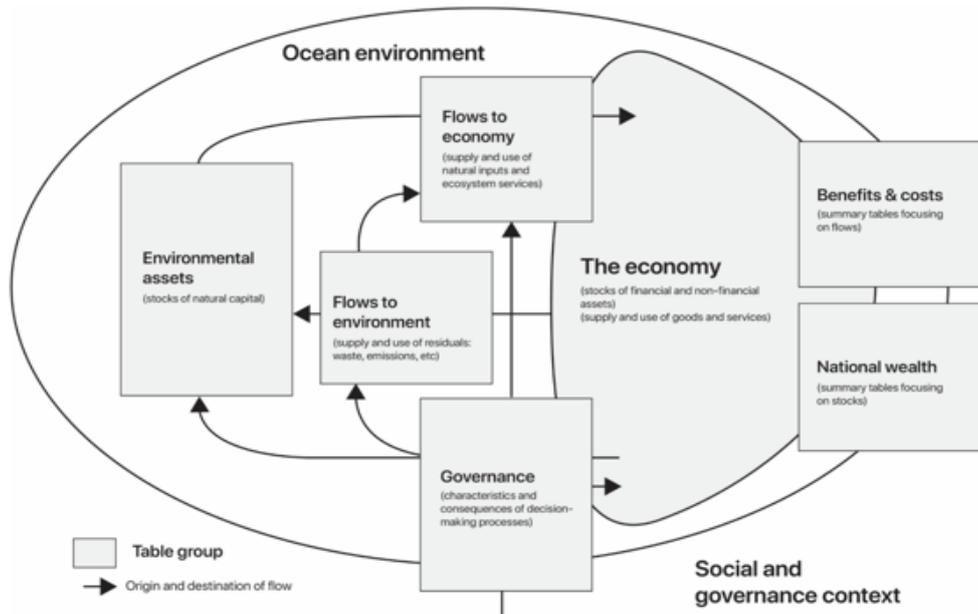


Figure 5. UNSD (2019): Framework for ocean accounts

- Low carbon transitions and payments for carbon sequestration, water quality or biodiversity are increasingly used to access finance and investments for restoration of coastal and marine ecosystems.
- Blue carbon is a focus globally since carbon is a fundable product; there are no examples in New Zealand yet but blue carbon funds have been set up elsewhere.

### Knowledge gaps & applications:

- Recognising restoration economies as an investment opportunity; consider sector (e.g. aquaculture) & small and medium enterprises (SMEs), (incubators) when considering access to finance solutions.
- Blue carbon: leveraging the synergy between carbon sequestration (e.g. seaweeds, seagrass) and restoration of ecosystems (e.g. wetlands, kelp) with tangible co-benefits (community resilience, biodiversity, mahinga kai etc.) – opportunity to test this (Hauraki Gulf, Waituna, other).
- Ecosystem services measures and models: innovative finance for restoration projects and carbon markets relies heavily on measures of natural capital and ecosystem services. Government and user financed programmes across the domains of water that could be expanded to marine biodiversity, blue carbon, hazards protection (flooding, erosion)
- New Zealand methodologies are needed in order to underpin new financial mechanisms like blue carbon funds and increase access to finance. This includes developing knowledge and insights regarding potential market players (buyers and sellers), what motivates them, what metrics are used and what type of institutions and governance are appropriate to support the fair exchange of value(s) from ecosystems.

### Research opportunities:

- Develop metrics for business and investment that consider costs and benefits to the natural ecosystem
- Test and develop ocean accounts at different scales and assess contribution to blue economy growth
- Develop markets to monetise restoration for carbon, water, sediment, flood protection
- Integrate EBM with ecological functioning and mauri indicators to develop value propositions for restoration

### Natural capital and ecosystem services measurement of the Blue Economy

### Rationale:

International methodologies are emerging combining ecosystem services and economic concepts to measure and govern blue economy more effectively.<sup>23</sup> New Zealand could adapt international approaches like that of the European Union<sup>24</sup> to develop understandings of the scope and size of our blue economy. Critically, this will provide baseline knowledge to support policymakers and stakeholders in the quest for sustainable development of marine and coastal resources.

Ocean accounting can be strengthened through both national and regional analyses, identifying the underlying factors driving the blue economic growth at various scales.

### Knowledge gap / research opportunity:

- Modelling and testing ecosystem services connections and impacts.
- Integrating and aggregating Māori concepts & indicators for measuring well-being.
- Exploring new approaches to benefits and resource sharing.
- Understand the value of different sectors and plan for future changes – e.g. from climate change. Prioritise higher productivity sectors with low environmental impacts and greater social outcomes for future Blue Economy development.

### Research Opportunities:

- *Develop metrics and a set of ocean accounts that measure the blue economy and account for natural and well-being outcomes at different scales (local, regional, national)*



Figure 6. Building on Natural Capital and Ecosystem Services

### Place Based Research: Hauraki Gulf as a Case Study for the Blue Economy

The Hauraki Gulf is a priority location for the Blue Economy and was repeatedly identified by interviewees as a place to focus future research. This is in part due to the existence of the *Hauraki Gulf Marine Park Act 2010*, which promotes an EBM approach, the only marine spatial plan in NZ (*Tai Timu Tai Pari Sea Change*), as well as

<sup>23</sup> <https://sustainabledevelopment.un.org/sdg14>

<sup>24</sup> <https://op.europa.eu/en/publication-detail/-/publication/676bbd4a-7dd9-11e9-9f05-01aa75ed71a1/language-en/>

significant regulator, Māori, stakeholder and commercial alignment of interest in the Blue Economy. An opportunity exists to align the Challenge research for the Blue Economy suggested above, with other applied research and development initiatives, including the restoration economy, aquaculture, and fisheries, marine protected areas, tourism and recreational uses, marine transport, and very high ecological values. Politically, there is alignment in the Hauraki Gulf through the Ministerial Advisory Committee for Tai Timu Tai Pari Sea Change, with the overall Challenge objectives and the Blue Economy opportunities discussed in this report. The *Market Economics* report for Phase One showed how vital the different uses of the Hauraki Gulf are to the Blue Economy, yet we fail to measure many of these (and understand their relative importance), or to undertake significant research and analysis into the opportunities in the Gulf.

### Research Opportunity:

*Develop scenarios for the future Blue Economy in the Hauraki Gulf*

- Considering the Total Economic Value (TEV) of the Hauraki Gulf.
- Managing fisheries for resilience (i.e. above MSY).
- Recreational fisheries policy considerations - links with recreational fishing & tourism & commercial fisheries.
- Explore scenarios including: different MPA types, interaction with commercial fisheries, recreational and conservation values, leverage international experience with MPA's.
- Eco-tourism & opportunities for growth.
- Develop place-based understandings/cases to underpin/test/implement other projects: seaweed strategy, spatial allocation for restoration projects, innovative financing for restoration projects

## Blue Economy as Connector

Because the challenges in the marine economy are complex, transformation at scale in New Zealand requires systems thinking and deep understanding of the tangible and intangible links between all capitals (natural, human, social and manufactured capital), and where dependencies or risks might arise. This necessitates consideration of the interactions (both positive and negative) across different economic, social, environmental and cultural landscapes that are captured by the National Science Challenges. Multiple stakeholders have highlighted the need and opportunity to develop strong crossovers with other core *National Science Challenges* in Phase II and with other Themes in the *Sustainable Seas Challenge*.

### Within Sustainable Seas

The blue economy theme of *the Sustainable Seas Science Challenge* can play an important integrating role within the Challenge.



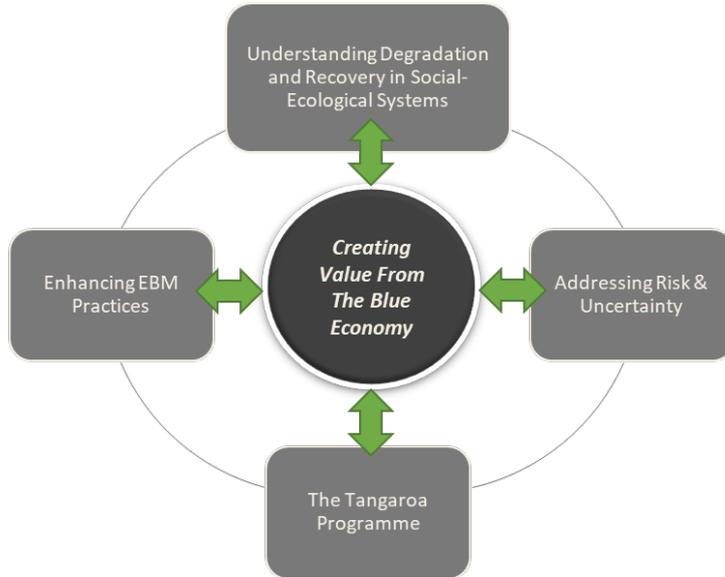


Figure 7. Blue Economy as connector within Sustainable Seas Theme.

**Between Other National Science Challenges**

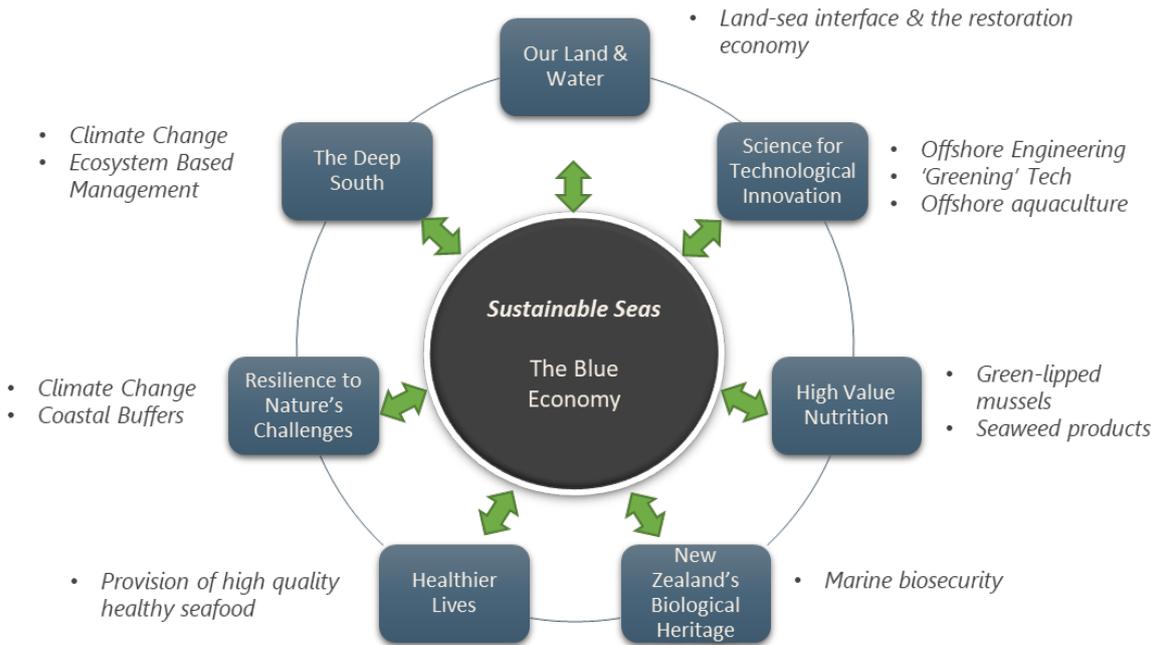


Figure 8. Blue Economy as connector between other National Science Challenges.

# Appendix One – Interview Guide

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## Topics for Discussion – Blue Economy Stakeholder Interviews

### The overarching question we are seeking to answer is:

*How is New Zealand positioned in terms of trajectories of on-going innovation and change that may or may not be driving towards this vision of a blue economy and technological innovation in key sectors?*

We are interested in understanding how well you think the Blue Economy in New Zealand is performing, and whether you believe the private and public sectors are positioning themselves to facilitate the transition to a thriving Blue Economy. Your input will be used to inform a series of research questions to be addressed in Phase 2 of the Sustainable Seas National Science Challenge.

### Topics for Interview Discussion

The approach we are taking is semi-structured and each interview will consider those topics that are of most relevance to you.

### Perspectives on Blue Economy and perceptions of Challenge contributions

- General understanding of the Blue Economy; how do you perceive New Zealand’s utilisation of the marine environment?
- New Zealand’s Blue Economy trajectory, is the growth happening under an umbrella strategy from your perspective?
- Sustainable Seas strategy compared to the other science challenges.
- Points of difference with Sustainable Seas that you and/or others value.
- How would Sustainable Seas best serve your interests?

### Innovation landscape

- Who is leading innovation?
- Pace of R&D and pathway to innovation.
- Emerging areas and established but evolving sectors: what sectors are pro-actively innovating, and what are the key areas receiving interest?
- Is government support enabling innovation in the Blue Economy?
- Your understanding of successful innovation models or approaches that facilitate R&D
- Strategic importance of innovation in New Zealand and how we compare internationally
- Social versus technical innovation – your organisation’s understanding

### Marine / coastal interface: challenge or untapped opportunity?

- The Blue Economy in relation to land-based economies
- Your understanding of a circular economy
- The importance of a holistic approach to resource management
- Climate resilience and coastal adaptation – are we doing this effectively?
- What opportunities exist, and are there any significant hurdles to overcome?

### Regulatory environment:

- Treaty of Waitangi versus local policy in the context of your organisation
- Political / institutional inertia or forward thinking?
- Legal frameworks
- Climate adaptation strategy and how it applies to your organisation



- Strategic framework to decision-making and policy creation relating to the blue economy

**Risks and hurdles to Blue Economy development**

- Suggestions for responding to emerging challenges (e.g. funding uncertainty, increasing marketplace competition)
- Strategic importance of science to your organisation's needs.
- Policy development and innovation – your understanding of political will.
- Access to markets and competitive landscape within and outside New Zealand
- New Zealand's science landscape – public versus private

**The Future**

- What you think government should do in addition to what it does (new offerings, collaboration, etc)
- Private sector opportunities, key growth areas
- New Zealand's Blue Economy strategy – where to from here?
- Your organisation's outlook and alignment with a broader strategy
- How to measure progress; your opinion on a wellbeing approach

**Māori Blue Economy?**

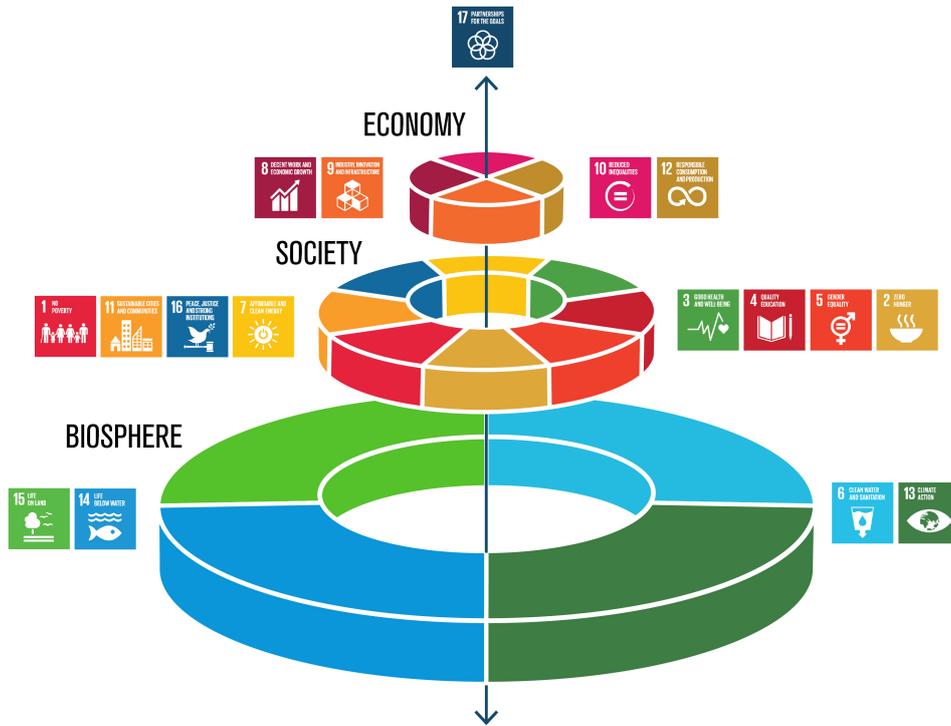
- Your understanding of the Māori economy within the wider New Zealand context
- Strategic outlook for mana whenua and iwi to develop the Blue Economy
- Incorporation of Māori knowledge in the Blue Economy

## Appendix Two – List of interviewees

Person	Organisation	Person	Organisation
Gary Hooper	<i>Aquaculture NZ</i>	Jonathan Large	<i>Cedenco, Marine Farming Assn</i>
Roger Belton	<i>Southern Clams</i>	Rebecca Mills	<i>Sustainable Seas Board</i>
Andrew Jeffs	<i>University of Auckland</i>	James Palmer	<i>Sustainable Seas Board</i>
Scott Gillanders	<i>MacLab</i>	Mark Solomon	<i>Sustainable Seas Board</i>
Andy Elliot	<i>Wakatu Inc</i>	Olivier Ausseil	<i>Tahi Spirulina</i>
Graeme Coates	<i>Aquaculture Direct Ltd</i>	Luda Graves	<i>NZTE</i>
Maru Samuels	<i>Iwi Collective Partnership</i>	Brendan Barnes	<i>Quayside Holdings</i>
Shaun Ogilvie	<i>Independent Consultant (Māori Fisheries)</i>	Mat Bartholomew	<i>MPI – Aquaculture</i>
Volker Kuntzsch	<i>Sanford, Sea Change MAC, Sustainable Seas Board</i>	Eugene Rees	<i>MPI - Fisheries NZ</i>
Chris Cornelison	<i>Cawthron Institute (also SS CLT and SFTI challenge lead)</i>	Paul Creswell	<i>MPI Aquaculture</i>
Luda Graves	<i>NZTE - Aquaculture</i>	Hamish Wilson	<i>MPI Aquaculture</i>
Sean Stratton	<i>Te Rarawa</i>	Ben Bunting	<i>MPI - Sea Change</i>
Toni Grant	<i>Maara Moana, Rata Foundation</i>	Rebecca Barclay	<i>Auckland Council</i>
Ian Ruru	<i>Sustainable Seas kahui</i>	Tracey May	<i>Waikato Regional Council</i>
Karl Warr	<i>Allstar Fishing</i>	Megan Reilly-Caton	<i>Oceans 2050 (Blue Carbon / Seaweed)</i>
Michael Eaglen	<i>EV Maritime</i>	Emily Stengall	<i>GreenWave</i>
Simon Thrush	<i>University of Auckland</i>	Charles Colgan	<i>Middlebury College</i>
David Woods	<i>NZ Green Investment Finance</i>	Kaitlyn Tregenza	<i>Twynam Investments</i>
Marjan Van Den Belt	<i>ReGenSea</i>	Ngarangi Walker	<i>Sustainable Seas / Tangaroa</i>
		Livia Esterhazy	<i>WWF</i>



# Appendix Three – Sustainable Development Goals



Graphics by Jerker Lohrants/Akate

Source: Stockholm Environment Institute.

## Appendix Four – International Blue Economy Case Study

### Case Study: Veta La Palma – A Blue Economy Model for New Zealand?

*Goal: to ensure that local people derive a sustainable economic benefit, while fostering a wide range of environmental values.*

Covering an area of some 11,000 hectares, the Veta la Palma estate is one of the largest privately-owned properties located in the municipality of Puebla del Río (Seville) on the Atlantic Coast of Spain. Up until the 1970's the estate was subject to extensive livestock farming, with the Argentinian owners transforming much of the natural wetland habitat into grazing fields. In 1982, the Argentinian owners sold the land to the Hisparroz, S.A. group (a Spanish food production company). Following several years of planning, the company was authorised by the General Directorate for Fisheries of the Andalusian Regional Government to introduce fish farming to the area.



Initially using 600 hectares of the estate, the fish farming project was gradually extended over the last two decades to reach ~3,200 hectares. These zones are flooded with high quality coastal waters which provide a habitat to the significant population of fish and crustaceans which are reared on the farm (1,200 tonnes produced annually). A further ~3,200 acres is dedicated to dry crops and some livestock, and 400 hectares to the cultivation of rice. The remaining ~4,800 hectares are maintained to preserve the original biotope of the wetlands.

The rich habitat of the wetland generates a significant secondary production of crustaceans and other aquatic invertebrates which make up the trophic basis which supports both the reared species and large amount of birds which are present in the area at any time of the year. The total bird population of Veta la Palma can reach 600,000, including some 250 different species, of which approximately 50 suffer some degree of threat. As such, the artificial wetland habitat re-created on the estate plays an essential part in the conservation of many migratory and resident bird species, and also supports a thriving tourism economy based on birdwatching.

The Veta la Palma aquaculture facility is a key asset for the socio-economic development of the area. The farm, which began operating with only 4 employees, currently generates some 100 direct jobs and many others which are indirectly related. As such, thanks to the economic benefits it generates and the territorial implications of its management, the farm has become an essential element in the entrepreneurial fabric of the community.

Today, Veta la Palma is a fine example of integrated intervention and blue economy development, whereby the creation of wetland habitat for fish farming and the interaction of this process with other activities on the estate, have enhanced the environmental quality of the area, whilst generating new economic and conservation values based on principles of sustainability.