Te Moana-a-Toi / Bay of Plenty Iwi Aquaculture: Opportunities Assessment

Prepared by Envirostrat Ltd | 27 Aug 2020
Ngā Iwi i te Rohe o Te Waiariki, in partnership with the Ministry for Primary Industries, are exploring opportunities and pathways to the development of a **sustainable, resilient, and world-class** Māori aquaculture industry in the Bay of Plenty.

The project primarily focusses on offshore water space but is also considering land and geothermal-based aquaculture opportunities.

Key drivers for Iwi for this kaupapa are:

1. **Maori economic development**: growing people through job creation, training, career pathways, and research and leadership opportunities.

2. Empowering and exercising **kaitiakitanga** and maintaining and enhancing the **mauri** of Te Moana Nui-a-Toi.
Chris Karamea Insley (Te Arawa), Dickie Farrar (Whakatōhea) and Rikirangi Gage (Te-Whānau-ā-Apanui) are the lead Iwi representatives within the project and provide an oversight role, including regularly disseminating information with Bay of Plenty Iwi. The Aquaculture Team (Fisheries NZ) and Te Ohu Kaimoana are helping to facilitate and fund the project, which is being managed by a multi-disciplinary team at EnviroStrat, in collaboration with Aquaculture Direct Ltd.
Methodology

Not an exercise in “business as usual”, this project looked to the potential of viable innovation that aligns with Te Ao Māori, taking a systems approach that maintains ecosystem health, and contributes to community livelihoods and hauora.

The assessment draws on international and domestic expertise and insights.

A three-stage process has been prepared to determine potential key aquaculture pathways. This presentation summarises the output of **Stage One – Opportunities Assessment Report**.

High level findings from the Stage One report will be put forward for ratification by Bay of Plenty Iwi and the project management team, and then for **further refinement and prioritisation in Stage 2, and business case development in Stage 3**.
What Does Success Look Like?

**Sustainable**

- Social, cultural, environmental, and economic wellbeing are in balance.
- Aquaculture pathways for Iwi upscale and amplify impact across these four pou of wellbeing.
- A best practice sector within Te Ohanga Māori that benefits NZ.
- Exercising Mana Motuhake - ownership and autonomy.
- Provision of significant long-term employment for Māori communities and connection to the marine-based economy.
- Strengthening the traditional Iwi and community relationship with the ocean.
- Replicable, scalable, whānau and hapū-centric models with collective power.
What Does Success Look Like? Continued...

**Resilient**
- Intergenerational knowledge transfer of mātauranga Māori.
- Implementing data science and artificial intelligence to deliver adaptive management.
- Responsive to changing risks and opportunities (including climate change) and competing demands.
- Future-focussed, helping to drive alignment between policy/regulation to support industry growth.
- A long-term strategic roadmap supported by partnership with the Crown.

**World-Class**
- Excellence in technology, people, and systems.
- Astute commercial and scientific partnerships with a shared values base.
- Collaboration and knowledge sharing 'mana to mana' with indigenous businesses and initiatives around the world.
- Creating and adding value across the supply chain.
- A world leader in intellectual property, provenance, and brand identity.
Key Findings
International Trends

Production

- Innovation mainly occurring in Norway where a positive regulatory framework rewards innovation risk.
- More robust farming systems that can withstand more exposed environments using existing technologies.
- Movement to offshore farming systems.
- Semi-closed inshore farming systems that deliver a more controlled farming environment.
- RAS that deliver a completely controlled environment for the stock.
- ‘Smarter Farming’ - digitalised system of assessing, monitoring, and adaptive management to continuously optimise farming activities.
International Trends

Markets

• Growth in the production and consumption of aquaculture products in the EU dominated by salmon.

• Significant changes globally in consumer preferences as a result of converging concerns about climate change, environmental degradation, and human health (nutrition).

• The movement away from animal-based proteins in particular has the potential to impact markets for seafood products.

• Low growth in production means that Japan will continue to look overseas for high quality imported product.

• Rising seafood consumption in Australia has driven revenue growth in aquaculture over the past 5 years; however there has been a strong import presence in the domestic market that has inhibited industry growth.
What do international insights mean for BoP aquaculture?

- The world focusses on a select group of aquaculture species, and does them well. BoP Iwi should adopt a strong market-led approach to selecting and developing species for aquaculture.
- Hatchery production of key species is a fundamental aspect of successful modern aquaculture internationally – hatchery technology has been identified as a key investment area for the NZ industry going forward.
- The international movement of aquaculture into the offshore environment aligns strongly with the future opportunities afforded to BoP Iwi.
- The digitalisation of aquaculture offers many exciting opportunities to create new value, enable efficiencies, adaptive management, and cost savings – any new aquaculture in the Bay should look to build capability in this area.
- Other countries adopt a ‘clean, green’ marketing image – the same approach doesn’t differentiate NZ products – BoP Iwi have an opportunity to develop their own iconic brand(s) that focus on identity, story and traceability.
- Processing facilities are key to developing high-value products – for BoP aquaculture, investment in flexi-factories (with ‘bolt-on’) capability should be considered.
• The single greatest bottleneck restricting the growth of aquaculture in New Zealand is the shortage of smolt (juvenile fish) and spat (shellfish) to stock farms.

• **Open ocean aquaculture** is currently limited to two sites in New Zealand; both are in the early stages of development and currently focus on Greenshell.

• Only one source of Greenshell mussel hatchery spat (SpatNZ), not open market.

• One source of Pacific oyster hatchery spat, not open market. The capacity of this hatchery is being increased.

• Currently there is no RAS in production in New Zealand, limited hatchery technology, and very little shift in farming techniques since the industry began.

• There is limited use of artificial intelligence or other digital resources.

New Zealand’s aquaculture industry consists primarily of longline farming for Greenshell™ mussels (averaging 85,857 greenweight tonnes (GWT) per annum), intertidal farming for Pacific oysters (1,964 GWT per annum), and canal and cage farming for king salmon (14,339 GWT per annum).
Aquaculture in NZ

Markets

• The mussel market remains unchanged (predominantly half-shell), but strong growth in value added products (nutraceuticals, mussel oil, mussel powder). The factory production focus on frozen half-shell mussels means that seasonality is not such an issue.

• Although there has been extensive scientific interest in producing derived compounds from seaweeds, there has been little to no investment into growing seaweed in New Zealand in an aquaculture setting.

• Strategic planning around new consumer trends and changing market dynamics should be at the forefront of business planning for the aquaculture sector.

• Greater public awareness and social consciousness around issues such as climate change, corporate environmental footprint, sustainability, nutritional requirements, health, and ethical consumption will force companies to adapt their business models or risk becoming obsolete.
State of Bay of Plenty Aquaculture

- Ōpōtiki Harbour Development Project is critical infrastructure for the region and will **unlock offshore expansion**.
- Seed / spat supply is, and will continue to be, a **constraint to growth**. Hatchery infrastructure for various species is a key gap. While there are now hopeful signs that industry in each species are looking to collaborate and provide additional hatcheries, this is yet to translate into extra capability in the field.
- Processing facilities are **limited** and currently restricted to half-shell mussel production except for the construction of a facility in Ōpōtiki due to open early in 2021; other high-value processing opportunities should continue to be pursued.
- Marine services sector is **strong** in Tauranga and is expected to develop in Ōpōtiki as need grows; however, vessel construction and servicing capability is very low.
- Scientific monitoring and development of technology (e.g. artificial intelligence) is **low**. There is little scientific structure to industry development.
- Workforce development is **under resourced** and limited – this is a key constraint to growth.
- The University of Waikato and Toi Ohomai are offering **aquaculture programmes** with long-term intent to support learning and career pathways for communities across the Bay of Plenty region.
Species Feasibility Matrix

For the purposes of **preliminary screening of options** we developed a matrix to assess the potential for relevant species to be developed in the BoP.

This assessment only provides a **coarse overview/snapshot of the current potential** for the species listed (and their dominant products), and should not be used on its own to determine the feasibility of a species.

<table>
<thead>
<tr>
<th>Species</th>
<th>Demand Readiness</th>
<th>Expected Margin</th>
<th>Technology Readiness</th>
<th>Time Horizon</th>
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<tbody>
<tr>
<td><strong>Marine</strong></td>
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<td>Pacific Oyster / tio repe</td>
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<td>Yellowtail Kingfish / warehenga</td>
<td>High</td>
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<td>Greenshell Mussel / kūtai</td>
<td>High</td>
<td>Low</td>
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<td>Snapper / tāmure</td>
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<td>NZ Scallop / tupa</td>
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<td>Geoduck / Hohehohe</td>
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<td>High</td>
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<td>Wreckfish / hapuku</td>
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<td>Medium</td>
<td>Long</td>
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<tr>
<td>Brown Kelp / Ecklonia radiata</td>
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<td>Medium</td>
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<tr>
<td>Sea Lettuce / Ulva spp.</td>
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<tr>
<td>Microalgae spp.</td>
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<td>High</td>
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<tr>
<td>Trevally / araara</td>
<td>Medium</td>
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<td>Long</td>
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<tr>
<td><strong>Freshwater</strong></td>
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<tr>
<td>Whitebait / Inanga</td>
<td>High</td>
<td>High</td>
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<td>Medium</td>
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<tr>
<td>Freshwater crayfish / koura</td>
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<td>Medium</td>
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<tr>
<td>Freshwater Macroalgae</td>
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<tr>
<td><strong>Restricted Species</strong></td>
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<tr>
<td>Rainbow Trout / tarauta</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Short</td>
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<tr>
<td>King salmon / Hāmana</td>
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<td>High</td>
<td>High</td>
<td>Short</td>
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<tr>
<td>Wakame / Undaria pinnatifida</td>
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<td>Low</td>
<td>High</td>
<td>Short</td>
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<tr>
<td>Flat Oyster / Ōra para</td>
<td>Medium</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
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Species Feasibility Key Findings

Key preliminary findings from the feasibility matrix (*not final determinations*):

- **Salmon & trout** score highly but trout farming is currently prohibited, and King salmon faces biological and regulatory challenges.

- **Kingfish** scores the highest of the native finfish. Other native finfish species have longer time horizons and will need significant trialling to better demonstrate viability and appropriate biosecurity measures.

- **Existing farmed shellfish** species such as Greenshell mussel and Pacific oyster score well and are a likely inclusion in future BoP aquaculture developments, with the latter needing more secure triploid spat supply is assured and commercial trials to demonstrate adequate profitability.

- Other shellfish species have significant technology requirements before they become commercially viable.

- Crayfish have low immediate aquaculture potential despite expected high value.

- **Seaweeds** score variably, but represent a promising opportunity if demand and technology readiness factors can be resolved.

- Undaria scores highly but farming of this seaweed species is currently restricted to selected locations in New Zealand (and not yet enabled in the Bay of Plenty).
Geothermal Resources

- Assess availability of geothermal resources in terms of opportunities for:
  - geothermally powered RAS setup for trout and other species (including wastewater treatment);
  - geothermal drying facilities for seaweed product harvested from farms;
  - geothermally supported algal ponds for bioremediation of natural water bodies.

- Landscape analysis of geothermal resources to be undertaken in Stage 3

The Bay of Plenty area presents opportunity to utilise geothermal resources within an aquaculture context.
Climate Change. A challenge but also an opportunity…

- Develop traceable, low carbon products with a strong environmental sustainability aspect.
- Explore ‘zero waste economies’ (e.g. circular nutrient economies); co-culture of complementary species.
- Develop hatchery-bred species with lineages that demonstrate resilience to high temperatures and pH shifts.
- Explore the more physically/chemically-stable offshore environment for fish farming.

Te Taiao & Kaitiakitanga

Te Ao Māori is circular by nature. Iwi aquaculture in the Bay of Plenty offers great circular economy opportunities, guided by Te Ao Māori. This includes regenerative aquaculture opportunities such as seaweed farming for mitigation of climate change impacts, efficient use and re-use of products, materials and waste.
Technology & Innovation

• Invest early on in a network of offshore environmental sensors to collect farm-level data. Begin building ongoing long-term data sets that can generate supplementary revenue streams for marine farming entities.

• Explore long distance drone technology for monitoring purposes at offshore farms.

• Collaborate with research entities to incorporate machine learning capability into environmental sensory infrastructure – use to rapidly identify pathogens (e.g. toxic algae) and enable predictive and adaptive management.

• Explore novel offshore aquaculture practices for the New Zealand industry.

• Explore high value, circular economy product opportunities through post-harvest processing – must be market-driven.

• Explore a macro cascade biorefinery (‘flexi-factory’) approach to processing.

• Develop a circular economy approach to waste minimisation and revenue creation.
Growth Through Collaboration

- **Iwi partnerships** with academic and research institutes offer powerful opportunity to grow Māori careers in aquaculture, and drive success.
- Collaboration with **other industries** such as horticulture provides potential to maximise sustainability and commercial opportunities.
- **Collaborative models** and platforms could transform Iwi aquaculture potential addressing key constraints including access to finance and spat supply, and enabling initiatives at-scale.
- In some cases, a **collective approach** to whānau-centric operations, with shared research, processing, and distribution platforms, could unlock opportunities that might otherwise be unviable.
- Workforce development in the Bay of Plenty is **under resourced** and limited – this is both a constraint to growth and a driver for this kaupapa, with aquaculture presenting significant career opportunities for whānau.
- The University of Waikato and Toi Ohomai have expressed long-term intent to support **learning and career pathways** for communities across the Bay of Plenty Region.
## Potential Aquaculture Pathways

### Shellfish
- Scale up **Greenshell mussels**, develop hatchery and high-value processing capability
- Test **Pacific oyster** in offshore environment
- Pilot scallops and geoduck with research partners – including potential multi species bivalve hatchery

### Seaweed
- **Build capability** in seaweed sector – hatchery production, on-water farms, processing capability
- **Regenerative ocean farming** opportunities for environmental and social benefit; blue-green impacts.
- Explore **co-culture** opportunities with shellfish and/or finfish

### Finfish
- Primary focus on **kingfish** for commercial scale production
- Develop **trevally, snapper, hāpuku** as novel species
- Trial species in seacages in partnership with CRLs (2 year time horizon)
- Develop breeding programme to achieve growth improvements and resilience (10 year time horizon)
- Develop land-based **RAS** hatcheries and nurseries.

### Land-based
- Explore pathways to enable **trout** farming as key opportunity (land-based, with geothermal integration potential, and at sea). (Currently prohibited by legislation).
- Explore **īnanga and freshwater kōura**
- Explore hāpuku production via RAS.
- Geothermal processing opportunities e.g. algae drying

*Underpinned by Iwi IP and brand strategy, training and workforce development, Iwi-industry-academic collaboration and whānau-centric & collective models*
Ngā mihi nui ki a koutou.
Te Moana-a-Toi / Bay of Plenty Iwi Aquaculture: Next Steps

Prepared by Envirostrat Ltd
Three stage process

Stage 1
Opportunities Assessment

Stage 2
Options Refinement

Stage 3
Business Case
Stage Two: Options Refinement

Outcomes of Stage Two

• Agree priority pathways that align Iwi aspirations with broader landscape.
• Early initiation of expert advice to be carried forward into Stage 3 business case development.

Engagement

• Deepen engagement with wider Iwi.
• Key technical contributors from Stage 1.
• Insights re IP, Iwi structuring, value chain.

Four Pou Analysis

Apply four pou (well-beings) & Iwi criteria to holistically evaluate proposals

- Pou tahi: Te Pāpori (Social)
- Pou rua: Te Taiao (Environmental)
- Pou toru: Te Ahurea (Cultural)
- Pou whā: Te Īhanga (Economic)
Stage Three: Business Case

- **Stage 3 outcome** = investment ready proposition(s)
- Investment appetite e.g. **long-term vs immediate** from investor perspective - both Iwi and private/public.
- Balance of **certainty vs innovation/risk**.
- Detailed economic analysis; financial modelling, environmental, social and cultural impact assessments.
- Application to the Sustainable Food & Fibre Futures Fund to support business case development.
Project timeline

### STAGE 1
Opportunities Assessment – overview and long-list

- Draft Report (30 June)
- Final Draft Report (30 July)

### STAGE 2
Options Refinement – Four Pou analysis and shortlist

- Draft Report (End Sept)
- Final Report (End Oct)

### STAGE 3
Business Case – investment-ready propositions

- SFF Application submitted
- Funding Decision
- Business Case begins
- BC completed approx. Mid 2021

### BOP Surveys
Environmental Assessment

- Surveys commenced
- Preliminary Results
- Final Report (End Feb)
Ngā mihi nui ki a koutou.
Creating GreenWave NZ: Opportunities to catalyse a sustainable seaweed sector

August 2020
Why GreenWave?

- GreenWave in the United States (GreenWave US) is a global pioneer of regenerative ocean farming involving the co-culture of seaweed and different shellfish species.

- We have partnered with GreenWave to adapt its model of **regenerative ocean farming for a New Zealand context**, including establishment of commercial seaweed farming at scale.

- GreenWave embodies a philosophy of regeneration and embeds principles and structures that ensures the farmers are profitable and not being squeezed throughout the supply chain.
How GreenWave has adapted to work with Tribes in Alaska

Alaskan tribes have adapted GreenWave to suit their needs:

1. Established as a collective in Alaska
2. Food Source
3. Regenerative Economies
4. Ecological Resilience -> Buffering & Biodiversity

Impact investment success story; blended finance has enabled indigenous farmers to keep equity and focus on repaying loan. $15m from Native Corporations is matched by equal amounts from philanthropy (grants) and impact investors (soft loans to keep equity in farms with the tribes)

Fundamentals:

- Declaration of principles: Restoration, Respect, Knowledge Sharing, Alignment.
- Kelp farmer rights at core: respect and honour for the farmer and what is produced, ensuring tribal communities have the opportunity to expand their local economies

Indigenous led innovation / adaptations:

- Portable processing and cold storage unit – enables quality retention.
- Starting internet auction marketing hub.
- Collectives offset overhead costs and own vessels.
- Portable nurseries (40 foot van) to get product to remote tribes
GreenWave NZ Possible Operating Model

**Upstream**
- **GreenWave**
  - Own / operate hatchery(s) and supplies juvenile seaweed to farmers
  - Perform R&D
  - Provide training
  - Compliance
  - Market support
  - Data collection and analysis, and systems for independent farmers.

**On Water**
- **Independent Farmers**
  - ‘Reef’ one
  - ‘Reef’ two
  - ‘Reef’ three

**Downstream**
- **Offtake Agreements / Environmental Markets**
  - Commercial offtake agreements with [XX]
  - Blue Carbon & Nutrient Markets
  - R&D for commercialisation of high value end uses

GreenWave support services across supply chain