



# Table of Contents

Forewords	1
Introduction	4
Purpose	5
Research Strategy Synopsis	6
Potential Benefits	7
Immediate Research Opportunities	8
Diversification	9
Efficiency	10
Expertise in Aquaculture Research	11
Infrastructure in Aquaculture Research	12
Sustainability	13
Security	14
Implementation	15
Funding	16
Acronyms	17
Acknowledgements	17



Aquaculture NZ Research Strategy  
ISBN: 978-0-473-15491-2  
2009

Published by:  
Aquaculture New Zealand  
Level 1, Wakatu House  
Montgomery Square  
Nelson, 7010  
New Zealand  
Ph: +64 3 548 8944  
[www.aquaculture.org.nz](http://www.aquaculture.org.nz)

Written by:  
Mike Mandeno, Research Manager, Aquaculture New Zealand

## Forewords



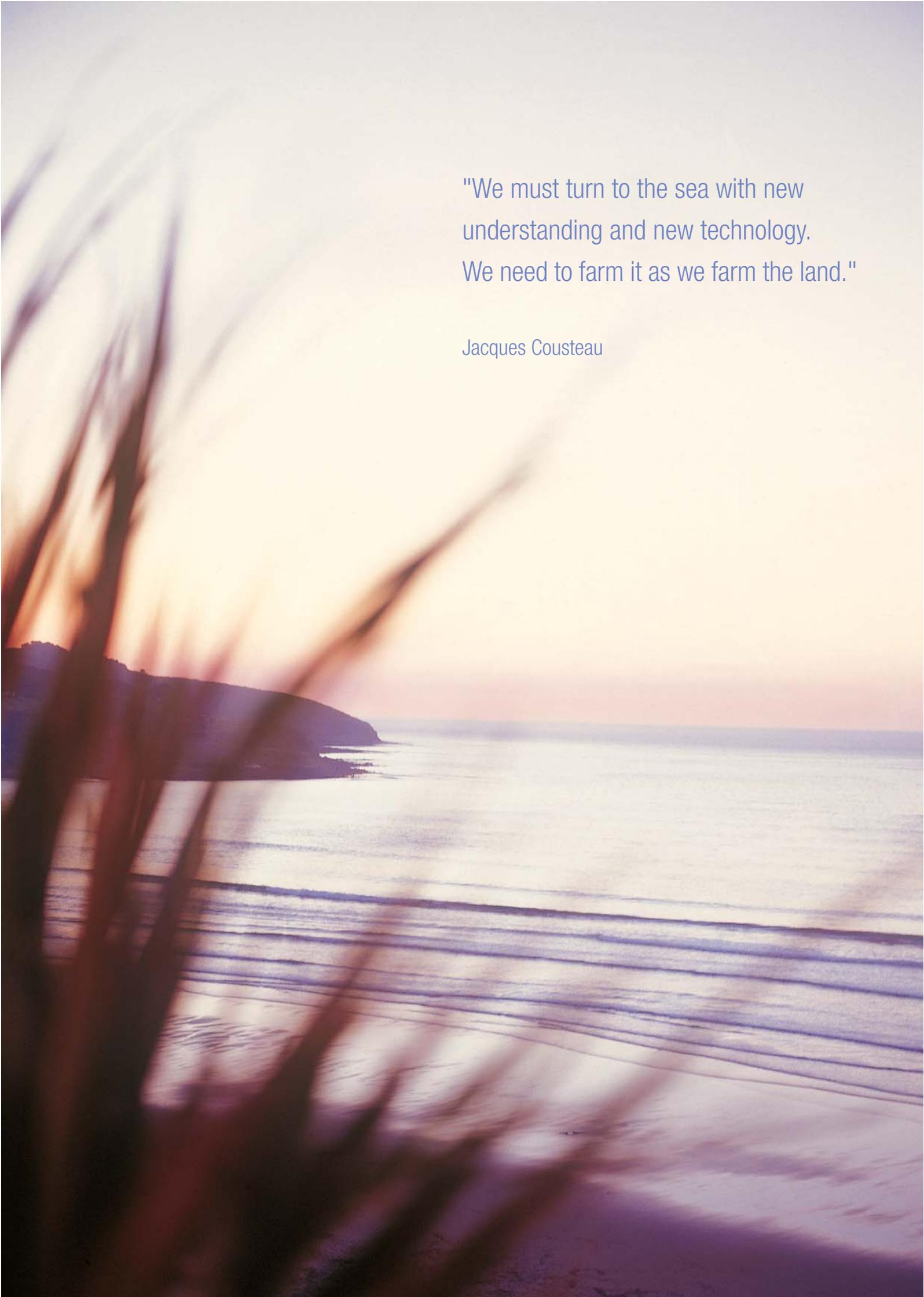
**Peter Vitasovich - Chairman of Aquaculture New Zealand**

New Zealand's aquaculture sector owes much of its current success to those early pioneers who through their persistence, resourcefulness and knack for invention established a successful, efficient and, above all, innovative sector. From water quality through to farming, harvesting and processing, it has been good old kiwi ingenuity as the key ingredient in every step of the way, and will be in the continuing growth of our sector in New Zealand.

The Aquaculture New Zealand Research Strategy underscores the ongoing importance of R&D to New Zealand's aquaculture sector. Research and development forms an integral part of our overarching strategy to grow the aquaculture sector in New Zealand beyond \$1 billion in annual revenue by 2025.

Investing in the right R&D will be essential. Investment that is informed by international market demands and facilitated by a supportive legislative regime offers the potential to drive substantial growth within the sector. In doing so, it will be critical to balance our growth with ongoing sustainability, quality and desirability of our products. Partnerships between sector participants and both public and private research providers will be the key to success.

An inclusive and sector-wide approach to R&D will allow aquaculture to grow into New Zealand's next major primary sector. This will have benefits not only for current and future sector participants; but Maori/iwi, communities and New Zealand as a whole. Through the building of capability and internationally recognised expertise, New Zealand's aquaculture sector will be able to play a sustainable and rewarding role in the continuing growth aquaculture is experiencing world-wide.



"We must turn to the sea with new understanding and new technology. We need to farm it as we farm the land."

Jacques Cousteau



**Mike Burrell - Chief Executive  
Officer of Aquaculture New  
Zealand**

Welcome to the aquaculture research strategy.

Research and development is fundamental in today's commercial world regardless of what you are producing or providing. The aquaculture sector is one of the world's youngest commercial forms of food production. This historical situation does not lessen the importance of research and development in its ability to meet the escalating global demand for protein, particularly marine based protein.

The growth of the international aquaculture sector is outstripping other forms of food production - the New Zealand sector must continue to grow to take advantage of the increased demand in order to reap the benefits such demand can bring.

New Zealand has a rich history of primary sector producers using research and development to drive their growth, efficiency and efficacy. We are a small relatively isolated nation with limited natural resources and scale, however, our traditional food producers have consistently 'punched above their weight' in their respective international markets.

How have they done this? Through the long-term planning and consistent delivery of focused research and development. The aquaculture sector can do little wrong in applying this same philosophy.

Research and development is imperative to sustainable and profitable growth of the seafood sector. We must continually strive to find new ways of doing the things we do already and reap the benefits from harnessing the things we don't. It must become implanted in the DNA of the collective sector - understood, supported and seen as a common good to the benefit of all within the sector.

The production of this research strategy is not the goal - it is only the beginning and through its application the current international recognition enjoyed by the sector will be enhanced.

# Introduction



The New Zealand Aquaculture Strategy (NZAS) sets a goal for the revenue of the New Zealand Aquaculture Sector to grow to \$1 billion by 2025, and identifies a clear need for R&D to contribute to this growth. Increases in volume and value of aquaculture production are required to attain the \$1 billion target.

The New Zealand Government has endorsed the NZAS in its response *Our Blue Horizons*, which identified R&D as one of five pillars through which government can support and enable the growth of the aquaculture sector.

Aquaculture in New Zealand has significant opportunities to take advantage of increasing global demand. The FAO predicts a substantial shortfall between global seafood production and demand.

In particular, New Zealand is well placed to supply premium aquaculture products to discerning markets. New Zealand has abundant clean waters, enviable food safety systems and sustainable production systems that enable the aquaculture sector to produce products that are eligible for premium markets.

New Zealand also has considerable experience of R&D driving step-changes in the growth of primary sector industries. Investment in R&D programmes and infrastructure for New Zealand's terrestrial primary industries has enabled them to develop the biological expertise and technical systems required to grow into multi-billion dollar export earners. Selective breeding, and a science based, systematic approach to farming are key elements of that success. New Zealand has also benefited substantially from development of tertiary agricultural products-support technologies that arise from research and development within a sector.

A similar opportunity is available to New Zealand in relation to aquaculture. The same disciplines which have driven growth in the terrestrial primary sector can do the same for aquaculture. Investment in the right amount, and the right kinds of aquaculture R&D will support a step change in volume and value growth.

In 2008 the aquaculture sector in New Zealand has an annual revenue of approximately \$350 million, including approximately \$265 million in export earnings. The three main species are Greenshell™ Mussels, Pacific Oysters and King Salmon. Greenshell™ Mussels are New Zealand's

single largest seafood export.

A variety of businesses and individuals participate in the sector, from large vertically integrated seafood companies to independent farmers. Maori/iwi are significant participants in the sector.

Exported product forms are dominated by simple whole foods. Biological understanding of key species is variable, as is the degree of domestication, and subsequent use of selective breeding. Current government investment in R&D directly and indirectly benefitting aquaculture via FRST totals approximately \$10.5 million p.a. AQNZ best estimates (unpublished data) suggest sector R&D expenditure is between \$5 -6 million per annum.

Aquaculture is inherently expensive because it involves working with organisms outside of their natural environments. R&D progress is steady but constrained by available funding, and consequently by R&D capacity which comprises broad capability but limited depth, and lack of some infrastructure (e.g. marine R&D farms).

Aquaculture New Zealand is currently in the first year of implementing a 3-year market development strategy. This includes market research to characterise consumer product preferences, the market potential of new species, and opportunities for aquaculture products that are compatible with the New Zealand environment. This intelligence can be utilised to introduce market pull into R&D prioritisation.

A strong set of R&D priorities and a strategically coordinated approach to implementing R&D programmes is needed. Increased and secure investment in aquaculture R&D is required to drive the R&D volume, capability and infrastructure required to deliver a step change in growth.

Benefits awaiting increased and stable investment in aquaculture R&D include:

- Sustainable growth (volume and value) contributing to the \$1 billion goal
- Diversification
- Increased export returns
- Regional socio-economic development
- Maori/iwi socio-economic development
- Development of new income streams from novel aquaculture technologies, (contributing additional revenue over and above the \$1 billion goal).

---

## Purpose

The broad purpose of this research strategy is to provide an overarching strategic framework for aquaculture R&D in New Zealand. In that regard it is a component of the NZAS and intended to provide guidance on the emphasis of aquaculture R&D efforts.

It is intended to signal to public funders of R&D activities and R&D capability, where investment can most usefully be applied. Organisations such as the Ministry of Research, Science and Technology, Foundation for Research Science and Technology, Tertiary Education Commission and the Primary Growth Partnership can use this research strategy to frame their investment programs.

The strategic framework provided by this research strategy is also intended to assist aquaculture companies and research providers to design and implement R&D programs and projects that deliver sustainable growth.



# Research Strategy Synopsis

## Vision

Aquaculture R&D that adds value and volume to the sector, and improves the return on investment, is market driven and is delivered by strategic alignment between sector, researchers and government.

## Goal

Sustainable value and volume growth that contributes to the aquaculture sector exceeding its goal of \$1 billion sales by 2025.

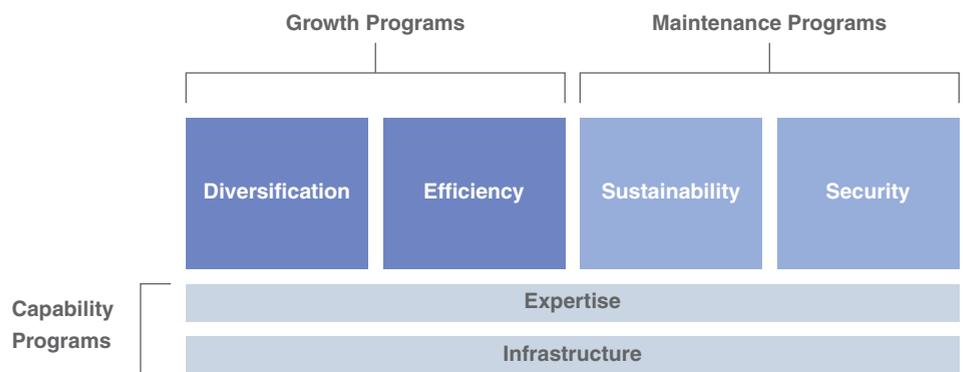
## Objectives

- Provide strategic long term direction for aquaculture sector R&D
- Identify a set of R&D priorities to:
- Develop novel aquaculture products, systems and technologies,
- Increase the value of aquaculture products, and
- Maintain and enhance the productive capacity of the aquaculture sector
- Ensure R&D is implemented in a coordinated manner
- Ensure availability of sufficient resources including funding, people and infrastructure

## General Approach

This research strategy focuses on three types of programmes: -

- Growth Programs: R&D to deliver substantive economic growth
- Maintenance Programs: R&D to protect the sector's productive base.
- Capability Programs: Ensuring the necessary R&D capability is in place to support R&D in both growth and support programmes



Aquaculture R&D needs to be firmly focused on sustainable growth.

Diversification and efficiency are the primary growth drivers. Sustainability and security play smaller but important roles in facilitating growth by ensuring the security and sustainable management of the sector now and in the future. Both growth and maintenance programmes require the necessary R&D capability to be available. However there is sufficient existing capability to undertake maintenance programmes. Capability to support growth programmes should be the priority focus for new investment.



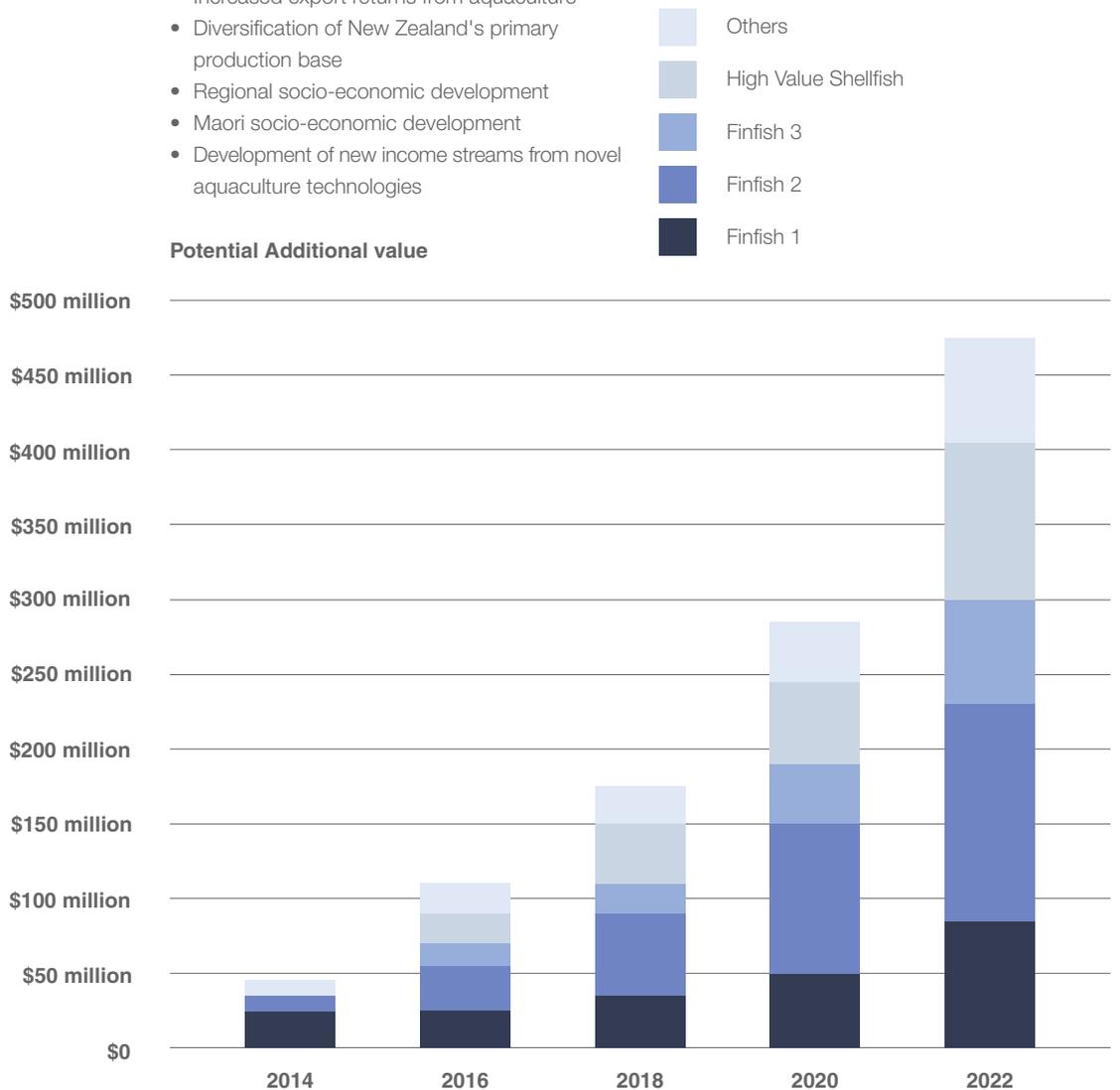
# Potential Benefits

Investment in aquaculture research and development offers the chance to grow a young and environmentally sustainable sector into a mature exporter. Aquaculture New Zealand estimates suggest additional export revenues of approximately \$500 million are achievable in a 10-15 year timeframe from investment in aquaculture R&D opportunities that are apparent now.

This first wave of growth in the aquaculture sector would result in a number of benefits to New Zealand and New Zealanders including: -

- A stronger, more commercially sound aquaculture sector
- Increased export returns from aquaculture
- Diversification of New Zealand's primary production base
- Regional socio-economic development
- Maori socio-economic development
- Development of new income streams from novel aquaculture technologies

Early growth would support downstream development of more ambitious R&D objectives, as well as facilitating outward foreign investment by New Zealand companies, and the potential to license New Zealand developed aquaculture technologies on world markets.



# Immediate Research Opportunities

A number of aquaculture R&D opportunities are available to New Zealand. These are areas where new or additional investment in R&D and commercialisation would be expected to result in rapid GDP returns.

## Farming Systems

- Development of exposed site marine farming techniques and equipment
- Development of novel culture techniques for shellfish and other high value invertebrates
- Development of efficient saltwater finfish hatcheries

## Species Diversification

- Selective breeding
- Diversification of finfish aquaculture
- Aquaculture of high value shellfish and other high value invertebrates
- Polyculture systems

## Harvesting, Processing and Presentation

- Improved yield/quality, harvesting and handling techniques
- Improved processing technologies
- Improved packaging and preservation
- Novel product forms





# Diversification

Diversification throughout the value chain offers considerable growth opportunities: Farming new species, producing new products, and using new systems to farm current species in different locations. Consequently, diversification can be expected to drive national and regional growth.

### Key Elements

- **New farming, harvesting and processing systems are developed**
- **New species - finfish, shellfish and others are brought into commercial production**
- **New high value products are developed from current and future aquaculture species and production systems**
- **Novel aquaculture technologies are developed**

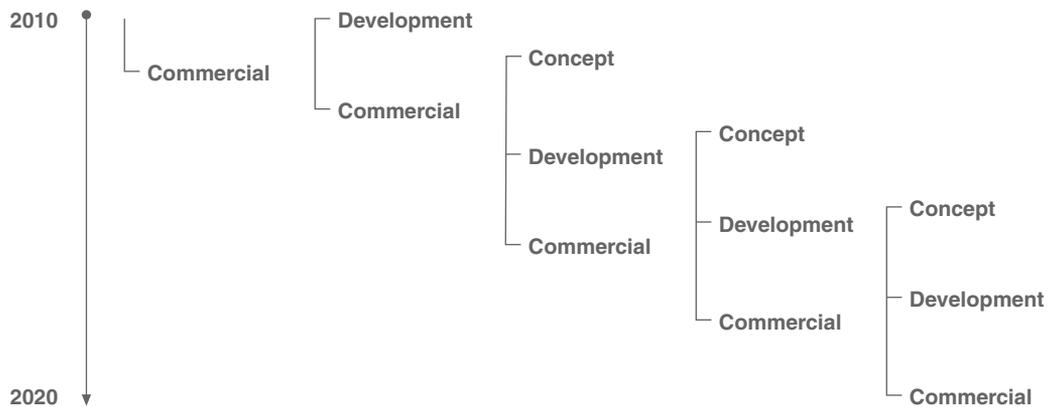
### Key to Research Effort

Lesser Greater

Outcomes	2009-14	2015-19	2020-25
Adaption of existing systems and techniques to suit New Zealand conditions	●	●	●
Invention of new aquaculture systems, species and products	●	●	●
Continuous improvement of aquaculture systems	●	●	●

### Key Themes:

**New species, new systems (farming harvesting and processing), novel high value products, novel aquaculture technologies**



Example Species Diversification Pipeline



# Efficiency

Efficiency has been the hallmark of New Zealand's successful development of its primary industries. Aquaculture should be no different. The efficiency of existing and emerging value chains is a vital component of R&D led growth.

### Key Elements

- **Optimal production capacity and profitability is attained for existing and future production systems within a framework of sustainable management**
- **Automation of processing systems**

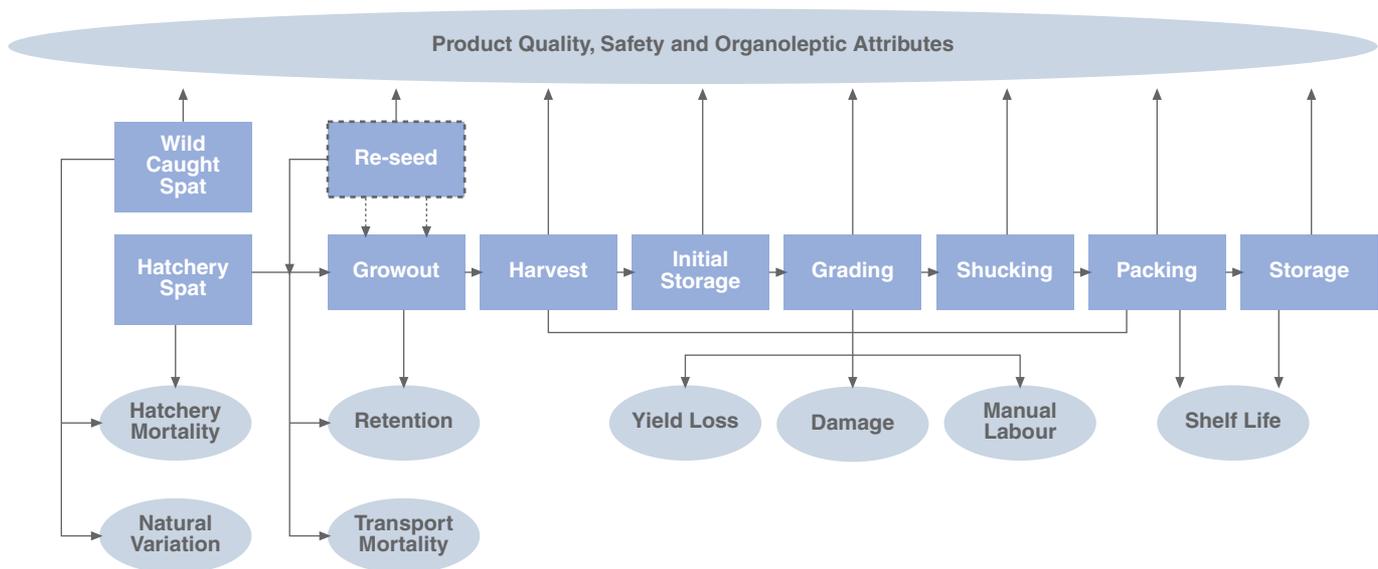
### Key to Research Effort

Lesser Greater

Outcomes	2009-14	2015-19	2020-25
Analysis of existing species value chains to identify key inefficiencies and constraints	●	●	●
R&D to resolve identified constraints and inefficiencies for existing species	●	●	●
Analysis of value chains for emerging species to identify key constraints and inefficiencies	●	●	●
R&D to resolve identified constraints and inefficiencies for emerging species	●	●	●
Ongoing reappraisal of value chains for all species	●	●	●

### Key Themes:

Genomics, yield, quality, automation



Hypothetical Value Chain Analysis for a Farmed Bivalve Shellfish



# Expertise in Aquaculture Research

People are crucial to success in aquaculture R&D.

Undertaking R&D and utilising R&D outcomes to drive growth requires researchers, technical expertise, and a suitably skilled workforce. Development of these areas will be a key requirement for R&D to drive sector growth, and can be expected to increase interaction between researchers and farmers.

## R&D Capacity

Ensure New Zealand has sufficient skilled researchers to attain identified R&D outcomes

- Undertaking a GAP analysis to identify capacity limitations in areas of expertise required to support attainment of R&D priorities
- Programmes supporting post graduate students to choose aquaculture as their research specialty
- Interactions that utilise overseas expertise to improve the knowledge of New Zealand researchers in high priority areas

**Target: From 2009**

## Technical Capability

Ensure the availability of sufficient technically skilled people to support implementation of R&D outcomes by: -

- Assess specialist technical expertise required to implement R&D outcomes
- Identify current capability and likely future deficiencies
- Where required, implement programmes to address deficiencies

## Sector Capability

Support the scientific understanding of sector people via improved access to research publications by maintaining a database of aquaculture related research.

Ensure a sufficient level of skill and knowledge within the sector to allow implementation of R&D outcomes by working with the Seafood ITO, training providers and tertiary educators to ensure provision of adequate training resources.

**Target: From 2010**

**Targeted Research**  
- Skilled Researchers

**Research Transfer**  
- Technical Experts

**Research Uptake**  
- Skilled Workforce

### The Role of Expertise in Transfer of Information along the Research Value Chain





# Infrastructure in Aquaculture Research

Infrastructure is a particularly critical requirement for aquaculture R&D. Appropriate facilities have played a pivotal role in New Zealand's successful development of terrestrial primary industries. Analogous facilities are crucial in aquaculture R&D.

There are a small number of land based aquaculture R&D facilities in New Zealand, but dedicated marine farm R&D space is extremely limited and most R&D is undertaken on commercial farms. Commercialisation of marine finfish farming will require additional saltwater hatchery facilities, to support pilot scale farming trials of multiple species.

## Land Based

- Undertake stock take of current and planned aquaculture R&D infrastructure
- Identify gaps and promote additional development of world class land based aquaculture R&D facilities and pilot scale saltwater hatcheries

**Target: From 2009**

## R&D Farm Space

- In co-operation with central and local government, establish marine based R&D farms in a range of strategic locations around New Zealand

**Target: From 2011**





# Sustainability

Sustainability is a core value of the New Zealand aquaculture sector. This requires comprehensive knowledge of the effects of aquaculture activities, and how to manage them. R&D to develop new aquaculture systems should integrate development of sustainable management techniques.

## Key Elements

- **Ecological foot prints of current and future production systems are understood, quantified, managed and verifiable.**

## Key to Research Effort

Lesser Greater

Outcomes	2009-14	2015-19	2020-25
Significant environmental effects of existing aquaculture systems characterised			
Significant environmental effects of emerging aquaculture systems characterised			
Provision of support information for sector eco-certification programmes			

## Key Themes:

**Eco-efficiency , quantitative environmental footprints, environmental management.**





# Security

Effective risk management is an important aspect of farming and food production. Ensuring the security of future and emerging aquaculture value chains will underpin the sector, providing a strong platform for growth.

### Key Elements

- **Strong risk management systems and tools protect current and future production systems from existing and emerging threats**

### Key to Research Effort

Lesser  Greater

Outcomes	2009-14	2015-19	2020-25
Improved risk management for existing aquaculture value chains			
Improved risk management for emerging aquaculture value chains			
Ongoing surveillance and review			

### Key Themes:

**Water quality, food safety, technical barriers to market access, stock health, biosecurity.**

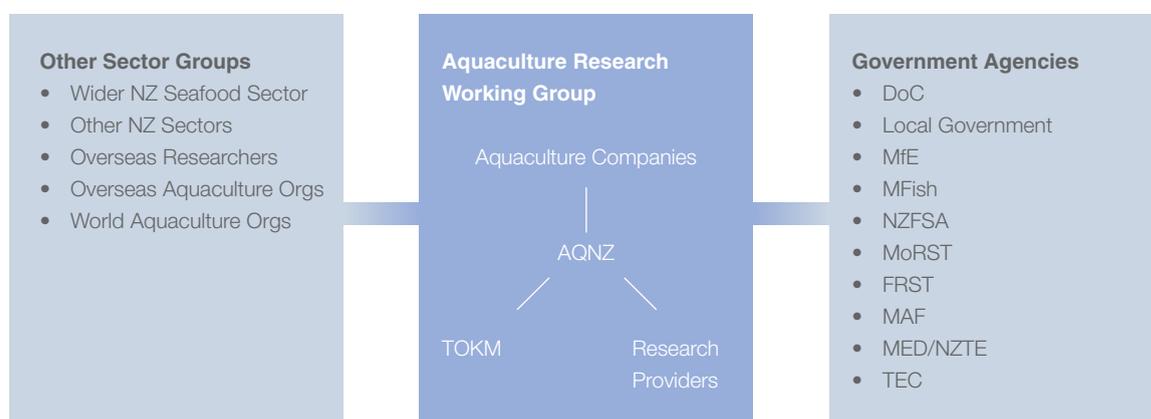


# Implementation

A range of groups have an interest in priorities for aquaculture R&D: -

- Sector firms as investors in and end users of R&D and producers and marketers of aquaculture products
- Aquaculture New Zealand as the owner of this research strategy and sector advocate
- Maori/iwi as sector participants and Kaitiaki
- Research providers including CRIs, Universities and private research providers/institutes
- Local government as a regulatory end users of some aquaculture research
- Central government as an investor in R&D activities and capability via various agencies
- Central government as a regulatory end user of some aquaculture research via various agencies

All these groups have a role to play in the implementation of this research strategy



## Aquaculture Research Working Group (ARWG)

AQNZ will support establishment and operation of a working group for aquaculture R&D in New Zealand.

The working group will be facilitated by AQNZ, and include sector participants, Maori/iwi representation and research providers. Importantly the working group will have linkages to other stakeholders in aquaculture R&D and other sector organisations with related R&D interests.

The brief of the ARWG will be to: -

- Communicate with relevant government agencies
- Communicate with other sector groups in New Zealand and internationally.
- Develop R&D priorities for the aquaculture sector that deliver on the key outcomes identified in this document
- Communicate on the implementation of R&D programmes

Prioritisation will be informed by: -

- Market information including that gained from Aquaculture New Zealand's market development
- Sector needs
- Potential benefits and timeframes for investment
- Availability of resources
- A balanced portfolio of basic-targeted, developmental and applied R&D

## Maori/iwi Interests in Aquaculture Research

In addition to a common interest in commercial aquaculture R&D, Maori/iwi may have wider non-commercial aquaculture R&D interests. While non-commercial R&D is outside the scope of this research strategy, there are potential synergies and benefits to both Maori/iwi stakeholders and the wider aquaculture sector from exploring the full spectrum of R&D interests with Maori/iwi. Maori/iwi have a

long association with the coastal environment and a deep understanding of the marine ecosystem. The traditional concept of 'Kaitiakitanga' as a system of environmental management also provides synergies with the aquaculture sector's drive for sustainability. Opportunities for synergies with wider sector R&D programmes include: -

- Contribution of Kaitiakitanga to sustainability and assessment of environmental effects
- Contribution of Mātauranga Māori (traditional Māori knowledge) to aquaculture R&D, especially R&D that is focussed on the natural environment and/or on native aquatic organisms
- Non-commercial R&D projects, which have alignment with wider sector R&D objectives

Any projects utilising Mātauranga Māori (traditional Māori knowledge) need to ensure appropriate processes are established to ensure the prior informed consent of the owners of the knowledge. This may include maintaining the integrity of the knowledge and the ownership of any R&D outcomes is understood and accepted by all parties involved in it.

## The Role of Government

Government agencies as end users of aquaculture research will provide input into the development of R&D priorities via ongoing dialogue and participation in processes implemented by the working group. AQNZ will work with government agencies to facilitate that participation.

Government agencies that invest in R&D activities and R&D capability will be interested in the R&D priorities developed by the working group. AQNZ will work with government agencies to develop a mechanism for communicating developed priorities.

## Interaction with Other Sector Groups

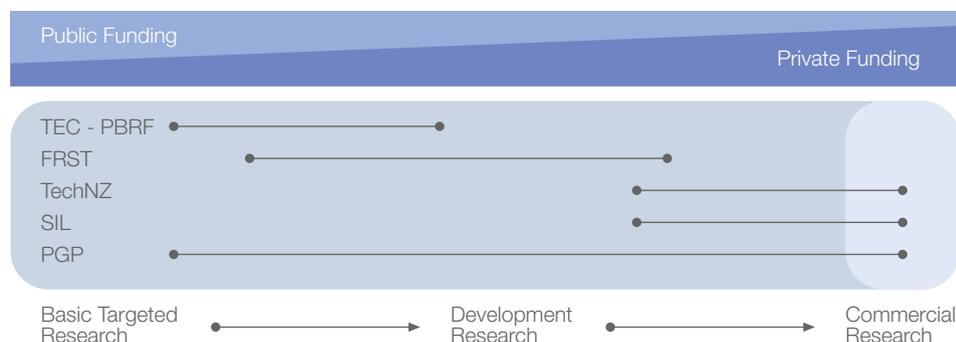
There is an important role for beneficial interaction with other sector groups. A range of initiatives from communication through to cross-sectoral R&D collaboration should be evaluated. This would include interaction with the wider New Zealand seafood sector, as well as other New Zealand primary sectors and potentially overseas aquaculture organisations. Opportunities would be identified and evaluated by the ARWG on a case by case basis.

## Funding

Funding for aquaculture R&D activities can be secured from a variety of sources including a variety of government agencies and private sources of funding. The particular mix of funding sources suitable for projects within a R&D programme will vary on a case by case basis depending on the type of R&D undertaken and the benefits accruing from it.

A basic model is presented below which shows the typical approach to funding where public funding for R&D activities is proportionately higher for R&D of an exploratory, targeted nature whereas private funding is higher for R&D of a more commercial, near to market nature.

Also displayed are the major funding agencies and where they typically concentrate their investments within the R&D spectrum.



## Acknowledgements

Aquaculture New Zealand wishes to extend its gratitude to the organisations and individuals who provided input into the development of this Research Strategy. Development of it has benefited from the involvement of a range of aquaculture companies, research providers, government agencies and Maori/iwi representatives.

Particular attention is drawn to the contributions made by Te Ohu Kaimoana, Plant and Food Research, The Cawthron Institute and the National Institute of Water and Atmosphere.

### Photographs:

Page Supplied By

- 4 Cawthron Institute
- 11 Plant and Food Research
- 13 Cawthron Institute

## Acronyms

AQNZ	Aquaculture New Zealand
ARWG	Aquaculture Research Working Group
CRI	Crown Research Institute
DoC	Department of Conservation
FAO	The Food and Agricultural Organisation of the United Nations
FRST	Foundation for Research Science and Technology
GDP	Gross domestic product
ITO	Industry Training Organisation
MAF	Ministry of Agriculture and Fisheries
MED	Ministry of Economic Development
MfE	Ministry for the Environment
MFish	Ministry of Fisheries
MoRST	Ministry of Research Science and Technology
NZAS	New Zealand Aquaculture Strategy
NZFSA	New Zealand Food Safety Authority
NZTE	New Zealand Trade and Enterprise
PBRF	Performance Based Research Fund
PGP	Primary Growth Partnership
R&D	Research and Development
SIL	Seafood Innovations Limited
TEC	Tertiary Education Commission
TechNZ	Technology New Zealand
TOKM	Te Ohu Kaimoana

