Emerging and Developing Aquaculture Species Subprogram: Review of FRDC investment policies and strategies and development of a management framework for new and emerging aquaculture research

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2009/219: Emerging and Developing Aquaculture Species Subprogram: Review of FRDC investment policies and strategies and development of a management framework for new and emerging aquaculture research.

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OBJECTIVES:

1. To review FRDC's current policies and investment in new and emerging species (including an assessment of the existing five investment criteria)
2. To advise on a new policy for new and emerging species
3. To develop an investment strategy (including the role of FRDC (facilitator, leader, catalyst, co-investor, follower), partnership linkages)
4. To develop a process for implementing the strategy (including what would be the level of FRDC investment program coordination/support and KPIs (environmental, economic and social performance))

NON TECHNICAL SUMMARY:

OUTCOMES ACHIEVED

Outcomes from this review suggest that

- Timely, tactical investment in new aquaculture initiatives is essential to address unknowns, reduce elements of risk and attract the level of investment and scale required to ensure success of new aquaculture businesses.
- An "FRDC Aquaculture Incubator" could create the enabling environment required to generate research and development momentum and a structured approach to aquaculture development without constraining ideas and opportunities.
- Following initial investment and demonstration of potential, on-going FRDC investment in new aquaculture industries and initiatives must be based on specific criteria which include significant evidence that the aquaculture business has the capacity to generate the necessary capital, cash-flow and critical mass to become a viable.
- FRDC should not be focused on emerging and developing food species but "New Aquaculture Initiatives". This also improves alignment with other investment bodies such as the Rural Industries Research and Development Corporation.
- New aquaculture initiatives require a dedicated and significant FRDC investment.
- There are a wide variety of expectations from investments in new aquaculture industries that cannot be pre-empted by FRDC alone (in relation to selection of "winners")
- FRDC's existing investment strategy in aquaculture requires modification to reflect the current aquaculture operating environment in Australia.

- FRDC should adopt a multi-level investment strategy for new aquaculture initiatives. Suggested investment modes include:

Exploratory funding: This could include support for the development of business or marketing plans, overseas study tours, mentoring through established networks, modeling, development of an understanding of resource requirements and regulatory requirements, engagement with regional councils and development bodies etc. Funding could be staged (eg. available funds increase as each milestone is met).

Industry Ready: This investment would be aimed at promoting research collaborations and programs that had the best chance of assessing the potential to overcome technical bottlenecks and truly enhance the potential for the establishment of a new business or sector and reduce risk to a point that additional investment is attracted.

Strategic Partnerships: Investment could be with specific groups into specific areas of production. Strategic partnership investment by FRDC would require strong evidence of capacity to raise the capital necessary to ensure the new aquaculture initiative is viable.

- Research quantum in the order of $1.5 – 2.0 million per annum by FRDC can be justified based on the relative merit of the priority, traditional research expenditure and need.

- FRDC should adopt a multi-faceted approach to management of investment in new aquaculture initiatives consistent with the mode of investment.

- FRDC need specific parameters to monitor the success of their investment in new aquaculture initiatives.

- FRDC should work in partnership with other research investors, but should not attempt to consolidate the role of other investors under the FRDC management framework.

- While resource access is a significant issue for new aquaculture industries, it should not consume all of the FRDC resources in this portfolio, but some investment could be directed towards securing resource access for new aquaculture initiatives.

- FRDC should adopt a base position that investment in embryonic and pioneer aquaculture initiatives will generate know-how and public information rather than protectable IP.

Outcomes from the above were used to develop an FRDC policy document for new aquaculture initiatives.

KEYWORDS: Aquaculture, emerging species.

BACKGROUND

This project was a result of a Consultancy Brief provided by the FRDC.

The FRDC's previous policy regarding investment in aquaculture species was based on the larger sectors or sectors that could return the highest potential (such as high end species) that contributed or could contribute higher levels of funds back to the FRDC. This was a rational decision as this could provide the highest return on investment and therefore a greater proportional return to industry and subsequently to the FRDC through increases in GVP on which FRDC funding allocation from industry and government is based.

As a result in 2000, FRDC expressed the view that its aquaculture investment would focus on:

1. The five large developed aquaculture sectors of pearl, SBT, Atlantic Salmon, edible oysters and prawns (compromise 90% of aquaculture GVP).
2. The top 4 developing species – barramundi, abalone, marron and mussels.
3. One or two emerging species – rocklobster, temperate finfish (Yellowtail Kingfish, Striped Trumpeter).
4. Cross sector science based on a discipline approach around aquatic animal health, nutrition, grow-out platforms (eg inland saline) and environmental performance.

This policy differentiated between developing and emerging species. The former are characterised by being in the pioneer stage of development, such as exploring new technologies to grow a species that has already had hatchery production bottlenecks overcome. Emerging species are characterised/defined by being pre-pioneer where almost all knowledge of their aquaculture production is unknown and they are a high risk for investors. The analogy is that one is still in the garage being designed and built, and the other is out of the garage and being test driven.

Therefore, to meet FRDC's criteria for funding new species, a species has to show that it meets at least 3 of the following:

1. That the development is market driven. This requires evidence of existing market size, value, growth and existence of distribution pathways to supply it. Further, Australia must be in a position to exploit this market.
2. That the development is being driven by industry with significant existing investment.
3. Evidence that the cost of production will be less than the farm gate price. Normally this has meant high value market prices to offset the high cost of production in Australia.
4. That the species is endemic to Australia and builds on successful existing wild caught species with high value and large export markets.
5. That there exists the planning framework and access to resources to allow for the timely and orderly development.

FRDC has placed a significant amount of weight on the last criteria. In some Australian jurisdictions aquaculture development has been almost impossible for new species due to limited access to resources. A good example is marine cage culture for finfish in Queensland.

With the above in mind, review and development of the FRDC investment strategies regarding emerging and developing species is required together with development of a framework for management of research relating to emerging and developing aquaculture species.

NEED

Since 2000 FRDC has invested, through its public good, considerable resources in emerging and developing aquaculture species. There have been some slight changes in the direction taken, but overall very little has changed. For example, abalone and barramundi aquaculture are now seen as mature sectors that should not obtain the degree of public good investment they received in the past. These areas have traditionally been managed as individual sectors with little cross fertilisation.

In the recent funding round, six new applications in the emerging and developing species aquaculture category were submitted. As such, it was considered that the FRDC should revise its investment strategy in this area. This would involve FRDC ceasing its individual sector based approach using public good funds and initiating a Emerging and Developing Aquaculture Species Program.

In addition, the Rural Industries Research and Development Corporation (RIRDC) has been involved in the development of new rural industries and has recently published reports regarding critical success factors (Critical Success Factors in New Rural Industries, RIRDC Publication 09/002, March 2009) and turning good ideas into profitable ventures. The RIRDC has also been involved in the investment in fisheries related programs regarding the development of aquaculture species. The FRDC is keen to engage in this process and co-invest in fisheries related R&D.

OBJECTIVES

1. To review FRDC's current policies and investment in new and emerging species (including an assessment of the existing five investment criteria).

2. To advise on a new policy for new and emerging species.

3. To develop an investment strategy (including the role of FRDC (facilitator, leader, catalyst, co-investor, follower), partnership linkages).

4. To develop a process for implementing the strategy (including what would be the level of FRDC investment program coordination/support and KPIs (environmental, economic and social performance)).

GENERAL METHODS

1. Review of past FRDC research investments into emerging and developing aquaculture species relative to the current FRDC policy surrounding investment into aquaculture research.

Using previous FRDC research applications and final reports, a review of research relevant to emerging and developing species was undertaken and a qualitative assessment of the success of the research investments was provided. In particular, investments into rock lobsters, abalone, tuna, and barramundi was undertaken as a potential guide to future strategies for investment into emerging and developing species (based on the fact that these industries are now established at various levels, or are on the cusp of establishment).

2. Review of current applications to FRDC for investment into emerging and developing aquaculture species.

A review of six current FRDC applications (see "Related Projects") was undertaken to establish if there are any common investment criteria, research overlaps or synergies between the projects that could be used as a basis for a more cohesive and collaborative research approach.

Projects that were not funded by FRDC were also reviewed together with the reasons for rejection of the proposals and whether or not there was any subsequent development of the project without further FRDC investment.

3. Draw parallels between emerging and developing aquaculture industries and other new and emerging rural industries.

RIRDC have invested significantly into the development of new rural industries and have published a number of reports on critical success factors associated with the establishment of new industries.

On reviewing these documents, there appears to be confounding between the role of investors in research and development and the development of supply chains associated with a new industry. These reports were largely based on surveys across a range of stakeholders and consistently state that the primary driver for the establishment of a new industry should be markets and market research. They also cite capital investment and industry champions as critical to success. While these may be important from a whole of chain perspective, it is interesting that the reports do not rate demand, elasticity of demand, and versatility of the product (although competition from other sources is mentioned as important) or time between initial investment and point of first cash flow as critical. All of these issues should be addressed in terms of establishing new criteria for emerging and developing aquaculture species from a research and development perspective. There will also be a need to define investment criteria depending on the stage of development of the new aquaculture sector - embryonic, sub-commercial, commercial or established to a level that will attract professional investment.

4. Identify potential overlaps and synergies between new investment and management frameworks for emerging and developing aquaculture species and existing investment and management frameworks.

There are a number of existing FRDC investments and management frameworks that may overlap or contribute to future investments in emerging and developing aquaculture species including the Aquaculture Innovation Hub, the Aquatic Animal Health and Aquaculture Nutrition Subprograms, respectively, and a range of species-based aquaculture subprograms. These programs will be reviewed and recommendations made in relation to synergies and overlaps with any new proposed investment or management framework.

5. Interview key stakeholders in emerging and developing aquaculture.

A range of face-to-face and telephone meetings were planned with key stakeholders in emerging and developing aquaculture to define (at least):

1. Past experience with investment in emerging and developing aquaculture;
2. Key drivers to future investment;
3. Potential base resources for use in emerging and developing aquaculture species research;
4. Views on critical success factors relating to investment and emerging and developing aquaculture species research;
5. Existing investments and research management practices associated with emerging and developing aquaculture species research.
6. Experiences with FRDC Subprograms and their potential for research management associated with new and emerging species;
7. Responses to potential initiatives for future management and investment policies for FRDC in relation to emerging and developing aquaculture species.

Face-to-Face Meetings were planned with:

- Northern Territory Aquaculture Program (Darwin) - Ann Fleming (Confirmed - October 15-16, 2009)
- SARDI Aquatic Sciences Aquaculture Program (Adelaide) - Mehdi Doroudi, Mark Gluis, Xiaoxu Li (Tentative - October 5, 2009)
- Southern Rocklobster Ltd (Adelaide) - Roger Edwards (Tentative - October 5, 2009).
- Seafood CRC (Adelaide) - Len Stephens (Tentative - October 5, 2009)
- TAFI Aquaculture Program (Hobart) - Colin Buxton, Stephen Batteglene (Tentative - October 6, 2009)
- Skretting (Hobart) - Rhys Hauler, Matt Bransden (Tentative - October 6, 2009)
- Tasmanian Salmon Growers Association (Hobart) - Pheroze Jungalwalla (Tentative - October 6, 2009)
- CSIRO Marine Research (Brisbane) - Nigel Preston (Tentative - September 29, 2009)
- Department of Primary Industries and Fisheries, Queensland (Brisbane) - Paul Hickey, Rick Fletcher, Beth Woods (Tentative - September 29, 2009)
- Ridley Aquafeeds (Narangba) - Richard Smullen (Tentative - September 29, 2009)
- RIRDC (Canberra) - TBA (Tentative - October 7, 2009)
- FRDC (Canberra) - Patrick Hone, Crispian Ashby, Kylie Giles (Tentative - October 7, 2009)
- National Aquaculture Council (Canberra) - Justin Fromm, Craig Foster (Hobart) (Tentative - October 7, 2009).
- AIMS and DPIFQ (Townsville) - Matt Kenway, Clive Jones (Tentative - October 9, 2009)
- Department of Fisheries WA (Perth) - Sagiv Kolkovski (Tentative - October 12-13, 2009)
- Western Rock Lobster Council (Perth) - Dexter Davies (Tentative - October 12-13, 2009)
- Lobster Harvest (Perth) - Peter Rogers (Tentative - October 12-13, 2009)

Phone meetings were planned with other stakeholders (including Geoff Allan (location makes a face to face visit difficult in the timeframe), Samara Miller, Ray Tynan, Andy Baker, David Maidman, Wayne O'Conner, Cleanseas Tuna (if unavailable in person while in Adelaide) Sam Gordon and Paul Graham) and those identified during the course of the Consultancy.

6. Host a workshop for stakeholders in emerging and developing aquaculture species research.

A dinner and workshop was planned for October 22-23, 2009 at the Novotel Hotel, Creek Street, Brisbane. The objectives of the workshop were to:

1. Present core findings from the consultation process relating to investment and management of research involving emerging and developing aquaculture species.
2. Discuss and debate the proposed strategies.
3. Identify opportunities for initial investment based on the proposed investment criteria.

4. Develop an action plan for implementation of key recommendations arising from the consultation process and workshop.

7. Develop and define an investment strategy for frdc and other stakeholders into emerging and developing aquaculture species research.

Based on the outcomes from the consultation process and workshop, a series of concise recommendations were developed for FRDC and other stakeholders in relation to investment strategies and policies for emerging and developing aquaculture species.

8. Develop and define a research management framework for emerging and developing aquaculture species.

Based on the outcomes from the consultation process and workshop, a series of concise recommendations were developed for FRDC and other stakeholders in relation to potential research management frameworks for emerging and developing aquaculture species.

RESULTS/DISCUSSION

PROJECT SCOPE

The scope of this project was to:

1. Review FRDC's current policies and investment in emerging and developing species (including an assessment of the existing five investment criteria);
2. Advise on a new policy for emerging and developing species;
3. Develop an investment strategy (including the role of FRDC (facilitator, leader, catalyst, co-investor, follower, partnership linkages);
4. Develop a process for implementing the strategy (including what would be the level of FRDC investment program coordination/support and KPIs (environmental, economic and social performance)).

In addressing the above project scope, it was expected that the following issues would also be addressed:

- The classifying of pre-pioneer and pioneer, what are the criteria;
- Capacity to build an industry (eg. access to land or water infrastructure, financing);
- Should FRDC again select species of interest and focus resources?
- Is there a need to prove that a market advantage is available especially for non-endemic species (include ornamentals as non-endemic);
- Develop the program and criteria and then determine the priorities;
- Whatever the outcome, ensure that there is a competitive advantage for Australia;
- Should R&D back into existing platforms for lesser species but at a reduced cost?
- Assessment of marine farming techniques (eg. platforms like inland saline aquaculture);
- How do we manage diversification within aquaculture systems?
- Development of species and systems for remote regions;
- Sustenance vs selling (food security argument);
- Innovative and novel techniques, systems and species to grow production and value (but not necessarily together);
- Is there potential to collaborate with co-funding partners (eg. RIRDC/SCRC)?

CONSULTATION

The following individuals were consulted as part of this project:

Name	Affiliation
Dr Patrick Hone	Fisheries Research and Development Corporation
Mr Crispian Ashby	Fisheries Research and Development Corporation
Dr Peter McInnes	Rural Industries Research and Development Corporation
Dr Nigel Preston	CSIRO Marine Research
Dr Nick Elliott	CSIRO Marine Research
Mr David Ham	DEEDI, Department of Primary Industries, Queensland
Dr Greg Robbins	DEEDI, Department of Primary Industries, Queensland
Dr Warwick Nash	DEEDI, Department of Primary Industries, Queensland
Dr Colin Buxton	Tasmanian Aquaculture and Fisheries Institute
Dr Stephen Batteglene	Tasmanian Aquaculture and Fisheries Institute
Dr Craig Foster	National Aquaculture Council/Cleanseas Tuna Pty Ltd
Dr Rhys Hauler	Skretting Aquafeeds Pty Ltd
Mr Pheroze Jungalwalla	Tasmanian Salmon Growers Association
Mr Steven Clarke	South Australian Research and Development Institute
Dr Richard Musgrove	South Australian Research and Development Institute
Dr Xiaoxu Li	South Australian Research and Development Institute
Dr Peter Lauer	PIRSA Aquaculture
Dr Len Stephens	Australian Seafood CRC
Dr Graham Mair	Australian Seafood CRC
Mr Tom Robinson	Coorong Cockles Pty Ltd
Dr Mike Hall	Australian Institute of Marine Science
Mr Matt Kenway	Australian Institute of Marine Science
Dr Clive Jones	DEEDI, Department of Primary Industries, Queensland
Mr John and Ms Lillian Lever	Koorana Crocodile Farm
Mr David Ellis	Tuna Boat Owners Association of SA
Mr Dexter Davies	WAFIC
Mr Dan Machin	Aquaculture Council of WA
Dr Sagiv Kolkovski	WA Fisheries
Mr Craig Cammilleri	Occoculture Pty Ltd
Dr Ann Fleming	Darwin Aquaculture Centre
Mr Bob Richards	Humpty Doo Barramundi
Mr Dan Richards	Humpty Doo Barramundi
Dr Geoff Allan	NSW Fisheries/ACIAR
Mr Chris Barlow	Australian Centre for International Agriculture Research
Dr Richard Smullen	Ridley Aquafeeds Pty Ltd
Mr James Fogarty	Shearwater Consulting Pty Ltd/QFIRAC
Mr Justin Fromm	National Aquaculture Council
Mr Angus Cameron	Watermark Seafoods Pty Ltd
Dr Clive Keenan	Coral Coast Mariculture Pty Ltd
Dr Peter Rogers	Lobster Harvest Pty Ltd
Mr Terry Burnage	Lobster Harvest Pty Ltd
Mr Matt Seccombe	Wild River Farmed Seafoods
Mr Adam Body	ARDA-Tek
Dr Colin Shelley	DEEDI, Department of Primary Industries, Queensland
Dr Mehdi Doroudi	PIRSA Aquaculture
Dr Steven Nell	WA Fisheries
Mr Brian Jeffries	Tuna Boat Owners Association of SA

When consulting with the above stakeholders at either face-to-face meetings or via teleconference, the following key questions were raised in an attempt to distill the information necessary to address the project scope:

1. Past experience with investment in emerging and developing aquaculture;
2. Key drivers to future investment;
3. Potential base resources for use in emerging and developing aquaculture species research;
4. Views on critical success factors relating to investment and emerging and developing aquaculture species research;
5. Existing investments and research management practices associated with emerging and developing aquaculture species research.
6. Experiences with FRDC Subprograms and their potential for research management associated with new and emerging species;
7. Responses to potential initiatives for future management and investment policies for FRDC in relation to emerging and developing aquaculture species.

Following the individual consultations, a workshop was convened in Brisbane on October 22-23, 2009 to further fine-tune the feedback received during the consultation process. The workshop was attended by a selected group of invitees representative of the consultation group, including:

Name	Affiliation
Dr Patrick Hone	Fisheries Research and Development Corporation
Ms Kylie Giles	Fisheries Research and Development Corporation
Dr Peter McInnes	Rural Industries Research and Development Corporation
Dr Warwick Nash	DEEDI, Department of Primary Industries, Queensland
Dr Colin Buxton	Tasmanian Aquaculture and Fisheries Institute
Dr Stephen Batteglene	Tasmanian Aquaculture and Fisheries Institute
Mr Pheroze Jungalwalla	Tasmanian Salmon Growers Association
Mr Steven Clarke	South Australian Research and Development Institute
Mr Tom Robionson	Coorong Cockles Pty Ltd
Dr Mike Hall	Australian Institute of Marine Science
Mr Matt Kenway	Australian Institute of Marine Science
Dr Sagiv Kolkovski	WA Fisheries
Mr Ross Cammilleri	Occoculture Pty Ltd
Dr Ann Fleming	Darwin Aquaculture Centre
Mr James Fogarty	Shearwater Consulting Pty Ltd/QFIRAC
Dr Clive Keenan	Coral Coast Mariculture Pty Ltd

The objectives of the workshop were to:

1. Present core findings from the consultation process relating to investment and management of research involving emerging and developing aquaculture.
2. Discuss and debate the proposed strategies.
3. Identify opportunities for initial investment based on the proposed investment criteria.
4. Develop an action plan for implementation of key recommendations arising from the consultation process and workshop.

The workshop did not consider every detailed aspect of the consultation process, but focussed on the development of the core arguments for and against on-going FRDC investment in new aquaculture industries.

CONSULTATION OUTCOMES

An overarching summary of the outcomes from the consultation process is encompassed in the following statements:

- **Timely**, **tactical** investment in **new aquaculture initiatives** are essential to address unknowns, **reduce** elements of **risk** and **attract** the level of **investment** and **scale** required to ensure success of new aquaculture businesses.

- An "FRDC Aquaculture **Incubator**" could create the **enabling environment** required to generate research and development **momentum** and a structured approach to aquaculture development without constraining ideas and opportunities.

Outcome: *"New Aquaculture Initiatives" should be the focus rather than "emerging and developing food species".*

An important consideration when looking at investment into emerging and developing species is the definition of what actually constitutes this sector.

A strong message was that FRDC should not be focused on emerging and developing species but "New Aquaculture Initiatives" (and the remainder of this report will utilize this terminology). This also improves alignment with other investment bodies such as the Rural Industries Research and Development Corporation.
To date, when considering emerging and developing aquaculture species, we have tended to focus primarily on food species. Justification of FRDC investment in new aquaculture initiatives is strengthened if we consider the sector in the following context:

NUTRIENTS/FEED	NON-EDIBLE	NOVEL COMPOUNDS	FOOD
• Culture of micro and macro-algae or autotrophic bacteria as food sources for omega-3 rich oils. • Culture of micro and macro-algae or autotrophic bacteria as protein and energy sources for aquaculture and livestock species. • Culture of micro and macro-algae for carbon biofixation.	• Ornamentals, aquarium fish, live rocks • Tourism • Jewelry, unique • Aquaculture technical expertise	• Health – cancer prevention and cure • Pharmaceuticals • Industrial chemicals • Nutriceuticals • Pigments • Energy from biofuels produced from cultured algae or autotrophic bacteria	• High-value, niche products for local and overseas fresh food markets • Commodity protein • Value-added food products • Artemia production • Stock for re-seeding wild capture fisheries

While FRDC could assist through its expertise networks with the development of aquaculture systems for biofuel production, investment in this area would be hard to justify given the extensive commercial investment in the sector. All others areas would be worthwhile focus points from an FRDC perspective.

It should also be recognized, that aquaculture expertise and research and development is an aquaculture industry in its own right.

Some consideration was given to the definition of "new" in the context of future FRDC investment. Rather than link new to "capacity to pay" or "high risk", it was suggested that "new" should be linked

to novel initiatives in any aquaculture sector, and the potential for the development of new businesses rather than "industries". From an FRDC investment perspective, "new" could also mean:

- Non-MOU related research (eg. if there was potential to develop an novel aquaculture initiative around tanning salmon skin, that did not fit within the core objectives of the FRDC-TSGA MOU, it will be eligible for funding under this portfolio);
- Development of a new relationship with FRDC and potential financial contributions to the FRDC pool.

Outcome: *New aquaculture initiatives require a dedicated and significant FRDC investment.*

Investment in preliminary assessments of aquaculture potential and pioneering research in new aquaculture initiatives is a clear area of **market failure**. A range of failed public floats in new aquaculture ventures has also sullied the reputation of aquaculture of late, and their needs to be a revised approach to investment that renews confidence.

The vast bulk of responses supported **FRDC as the core, first-stage investor** in new aquaculture initiatives based on:

- It is difficult to attract investment in this area given the level of risk and uncertainty;
- Often, some form of potential needs to be demonstrates before other investment can be attracted, or before resource access will be considered;
- There are limited other options available to innovators for investment in this type of research;
- FRDC have access to the skills, expertise and networks to promote success in this area;
- FRDC investment strategies should be directed towards industry development and it is important to formalize this investment as a priority given the range of other broad issues the FRDC needs to consider.

The following was also suggested:

- Aquaculture is a cornerstone of FRDC investment and an appropriate level of resources need to be directed towards this initiative despite competing objectives;
- FRDC investment needs to be sufficient to ensure an adequate critical mass in this field – insufficient allocations will result in wasted time and investment;
- While it could be argued that existing aquaculture industries are still gaining traction, it could also be argued that there is no new horizon for aquaculture in Australia;
- There is considerable uncertainty surrounding access to common-use resources for the conduct of aquaculture production in various States, and most States have adopted a highly risk averse approach to aquaculture. Hence, even if a research investment successfully provides the foundation for a new aquaculture sector, there is no guarantee that approvals will be granted for the business to proceed and this could be used as a justification not to fund new aquaculture initiatives. If FRDC adopt a position that resource access must be guaranteed before proceeding with an aquaculture investment, then the entire sector will stagnate.
- We should stop thinking about businesses involved with a specific species as an "industry" – Aquaculture as a whole is the "industry" and FRDC is investing with businesses.

In terms of establishing a balanced investment portfolio, FRDC should not be limiting their investment in new aquaculture initiatives based on a perceived level of risk. A significant proportion of the current FRDC investment is very low risk and new aquaculture initiatives also represent one of the few opportunities for FRDC to invest in "blue sky" research. Investment in new aquaculture initiatives should accept a high level of risk, should accept that there will be some failures, ensure that the investment approach does not waste investment but truly explores new opportunities, and allow the investment process to generate the momentum that may allow those initiatives with the greatest potential to gain traction.

Aquaculture is an intensive form of livestock production. Despite the many unknowns associated with aquaculture, we tend to expect industry or business development at a rate consistent with other intensive industries, such as pigs and poultry, and often apply many of these other intensive industry principles when developing a new aquaculture enterprise. Aquaculture in Australia is often a victim of running before it can crawl and we need to re-instill of culture that facilitates basic foundations for the development of more sound and sustainable aquaculture businesses.

Outcomes: *There are a wide variety of expectations from investments in new aquaculture industries that cannot be pre-empted by FRDC alone (in relation to selection of "winners")*

FRDC investment in any form of aquaculture can only be justified if we can define a valid role for aquaculture in Australia. At present, even our largest aquaculture sectors are only small contributors to the national economy and it could be argued that the potential for some is limited through stiff competition from neighbouring Asian countries.

In response, this review addressed the question of "why any investor would invest in aquaculture in Australia" and "does aquaculture have something to offer the Australian economy".

The reasons for investment in aquaculture, and the return being sought differed across two main categories – government or "public good" investment and private investment.
Private investors seek the following from aquaculture:

1. Profitability or wealth;
2. A sustainable business with capacity for growth;
3. An opportunity for diversification and security.

The last point is relevant to both the existing aquaculture sector and wild capture fisheries. Existing aquaculture enterprises that are subject to fluctuations in market prices and other challenges are often seeking to diversify the species they farm, or the value-adding opportunities for their existing products to make better use of their existing, often significant, investment in infrastructure hence spreading their overhead costs. Wild capture fisheries seek, or could seek, to utilize aquaculture to increase the supply of their existing wild capture product to meet increased market demand (eg. octopus and cockles are two current examples) or decrease in wild-capture supply. Wild capture fisheries could also utilize aquaculture to protect against incidences of recruitment failure (eg. the WA rock lobster industry). Finally, diversification and security can also apply to the utilization of Australian technologies and research and development expertise to develop off-shore aquaculture production systems that ultimately supply product to Australia.

Australian state and federal government investors, including FRDC have slightly different expectations from investment in aquaculture, including:

1. Job creation (it should also be recognized that aquaculture could represent an employment avenue for individuals previously employed in declining fisheries and that aquaculture represents long term employment opportunities);
2. Regional development;
3. Increase in the state or federal GVP;
4. Food security;
5. Protection of global wild fish resources;
6. Greenhouse gas mitigation.

During this review, special attention was paid to ensure the last three points were not simply rhetoric, and surprisingly, there is great potential for Australian aquaculture to make significant contributions in these areas.

In relation to food security, it was clear that investment in Australian aquaculture as a means of producing commodity protein (the most common objective in relation to food security) was not a priority, however, it was clearly enunciated that food security can be viewed in a number of ways, including:

a) Australian seafood consumption is more a reflection of affluence rather than seafood forming a base food staple in our diets. To this end, it could be argued that aquaculture production of high value, low volume products is in response to "wants" rather than "needs". Conversely, the health benefits from consumption of omega-3 oils via seafood are well documented. Omega-3 oils via seafood are a resource worth protecting and this target represents a form of food security that can be addressed through local aquaculture.
b) Ensuring food safety through delivery of seafood free from microbial and chemical contaminants is a form of food security that can be addressed through local aquaculture.
c) Importation of seafood can represent a biosecurity risk that threatens food security, and could be addressed through local aquaculture production.
d) Australia currently has a heavy reliance on imported seafood – a resource that is not guaranteed in the future, especially from poorly managed wild capture fisheries, hence representing a threat to Australian food security.

Protection of global wild fishery resources is an important consideration given the level of importation of seafood into Australia. As a nation, it is absolutely irresponsible to conserve our own wild capture resources and local environment while potentially exploiting the same resources from other countries. Cost is often the justification for favouring imports over local products, but often this cost does not include the potential global collateral damage that is occurring through supply of this product as an export/import commodity.

Greenhouse gas mitigation is very topical at present, but local aquaculture production has significant potential to contribute to this initiative through:

a) Reduction in the proportion of imported seafood and the contributions of transporting and storing seafood on net greenhouse gas emissions;
b) Protection against recruitment failure in wild capture fisheries and the reduction in unsuccessful trawl or fishing effort;
c) Use of micro-and macro-algae, or autotrophic bacteria, as a nutrient source to conserve traditional nutrients sources and as a carbon sink.

As a result of these diverse priorities, the nature of Australian aquaculture and new aquaculture initiatives will also be diverse and/or subject to change. Australian aquaculture in the future will be:

- Focussed on high value, comparatively low volume (recognizing the need for economies of scale), niche products, but could expand to more extensive forms of aquaculture depending on shifting focus to food security and greenhouse gas mitigation and competition for fresh water resources that may start limiting traditional protein production systems;
- Comprised of a limited number of enterprises by aquaculture type;
- Variable by region depending on the prevailing attributes of the production and regulation environment;
- Collectively making a significant contribution to the Australian economy, while potentially representing a range of diverse, smaller businesses farming a wide variety of aquaculture species.

To this end, FRDC investment in aquaculture may also require more diversification and a wider variety of criteria against which investment decisions are made.

Outcome: *FRDC's existing investment strategy in aquaculture requires modification to reflect the current aquaculture operating environment in Australia.*

It could be argued that the existing FRDC investment strategy has been successful based on:

- We have well-established aquaculture sectors in the form of prawns, Southern Bluefin Tuna, edible oysters, pearls and salmon, although, none of these are without their challenges in the current environment. It could be argued that FRDC investment to date has helped underpin the viability of these businesses.
- Strategic FRDC investment in rock lobster research has resulted in some highly successful research outcomes which now have potential to underpin the development of a new aquaculture sector in Australia. The initiative has attracted additional investment from Australia and overseas and a range of exciting research programs are underway in Australia aimed at developing commercially viable propagation methods.
- Past FRDC investment into the culture of abalone and *Artemia* have been central to the success of these industries.

Alternately, it has been suggested through the review process that FRDC investment strategies could be significantly enhanced:

- If we examine the status of Australian aquaculture, it could be argued that it has lost momentum and has failed to deliver against expectations. In 1999, it was projected that Australian aquaculture would be generating in excess of $2.5 billion in revenue, when in reality we have fallen far short of that (Figure 1). Could a different investment strategy have influenced this outcome or at least have created on-going opportunities or confidence in the sector? Other countries, including developed countries have successfully met their 10 year projection targets. The counter argument to this is that the initial targets were greatly exaggerated and unrealistic.
- There are many examples of significant research investments into new and existing aquaculture species that have failed to yield dividends (for a wide variety of reasons) or fully exploit the industry potential.

FRDC have many priorities to consider as an organization. However, it is essential to note that food security will increase in relevance as will food production that does not rely on fresh water in coming years. Global aquaculture already supplies more than 50% of total seafood consumed.

Moving forward, it has been suggested that the FRDC aquaculture investment strategy needs to be modified to reflect the following:

1. The initiative is market driven and involves at least one commercial partner. Potential must also exist for Australia to exploit this market, or generate a local return from the market;
2. Resource access for aquaculture production is unlikely to be impeded through environmental or other impacts of the initiative, or the research investment could significantly assist in the granting of resource access.
3. The new aquaculture initiative has potential to significantly enhance an existing aquaculture enterprise or wild-capture fishery, or promote the generation of a new business or regional development.
4. Investment from FRDC will generate outcomes that have capacity to attract additional or on-going investment in the initiative;
5. Following preliminary scoping and evaluation, opportunity exists for early cash flow, capital requirements are manageable or attainable and the projected return on investment is comparable with other investment opportunities.

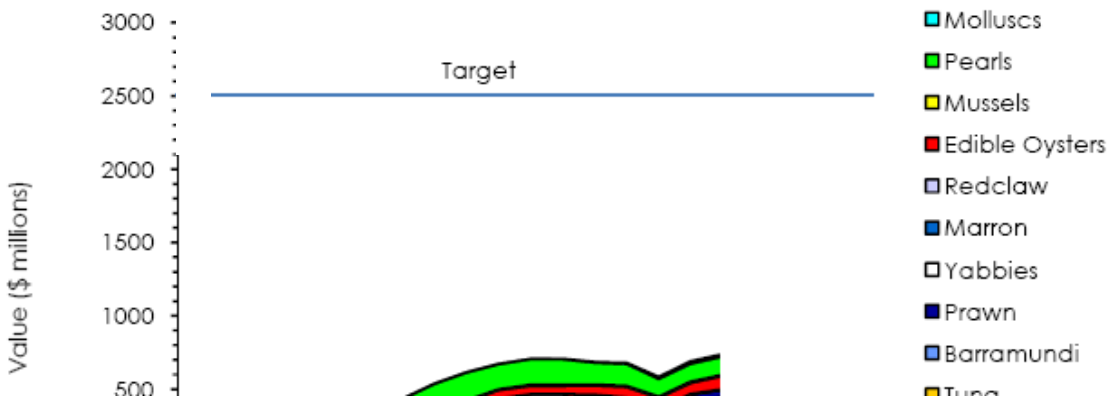

Figure 1. *Australian aquaculture revenue relative to 1999 projections.*

Outcome: *FRDC should adopt a multi-level investment strategy for new aquaculture initiatives.*

Current FRDC processes in relation to investment in emerging and developing aquaculture was subject to some criticism.

It was accepted that the FRDC processes are robust, but it was felt they could be cumbersome, can constrain innovation and could be very protracted with no guarantee of a successful outcome. To those not familiar with FRDC processes, as would be the case with many involved in new aquaculture initiatives, the processes can be daunting.

Accepting that FRDC investment is important to support new aquaculture initiatives, and that this priority is worthy of public good investment relative to other FRDC public good priorities, the following key criteria have been suggested as a basis for future investment:

1. Timeliness – there need to rapid investment mechanisms to assist in distilling new ideas and assessing the potential for new aquaculture initiatives. This may necessitate a decision making process that operates at a lower level to the FRDC Board.
2. Funding mechanisms need to vary depending on the stage of development of the new aquaculture initiative.
3. If FRDC see investment in new aquaculture industries as a public good priority, then there should be a transparent and indicative allocation of funds towards this initiative for sufficient time to adequately assess the value and success of the investment.

In terms of varying funding mechanisms relative to the stage of new aquaculture industry development, the following has been suggested:

INDUSTRY STAGE	CHARACTERISTICS	MODE OF INVESTMENT
Embryonic/Pioneer	Limited knowledge about business potential, production methods, resource requirements, limited existing expertise	**Exploratory** funding covering a wide variety of applications (potentially matched in-kind)
Developing	Good knowledge of markets, potentially an established wild-	**Industry Ready**, collaborative, widely disseminated research

	capture fishery, primary focus on technical bottlenecks	(potentially matched in-kind, cash contributions)
Pre- or early commercial	Technical bottlenecks reasonably well understood, attracted commercial investment and interest, focus on scale-up and commercial efficiency	**Strategic partnership** investment that may further develop an aquaculture initiative to attract further capital investment with potential financial return to FRDC (matched cash)

A schematic representation of the various funding stages is presented in Figure 2.

Exploratory funding

This could include support for the development of business or marketing plans, overseas study tours, mentoring through established networks, modeling, development of an understanding of resource requirements and regulatory requirements, engagement with regional councils and development bodies etc. Funding could be staged (eg. available funds increase as each milestone is met).

The objective of this funding would be to stimulate momentum, improve timeliness, foster innovation, ensure we are not reinventing processes, and develop a process of natural elimination of unlikely winners while giving consideration to a wide variety of opportunities. A proportion of this funding could also be used to develop "groups" within more established aquaculture sectors that currently lack the critical mass necessary to develop a strategic research portfolio or grow the industry further.

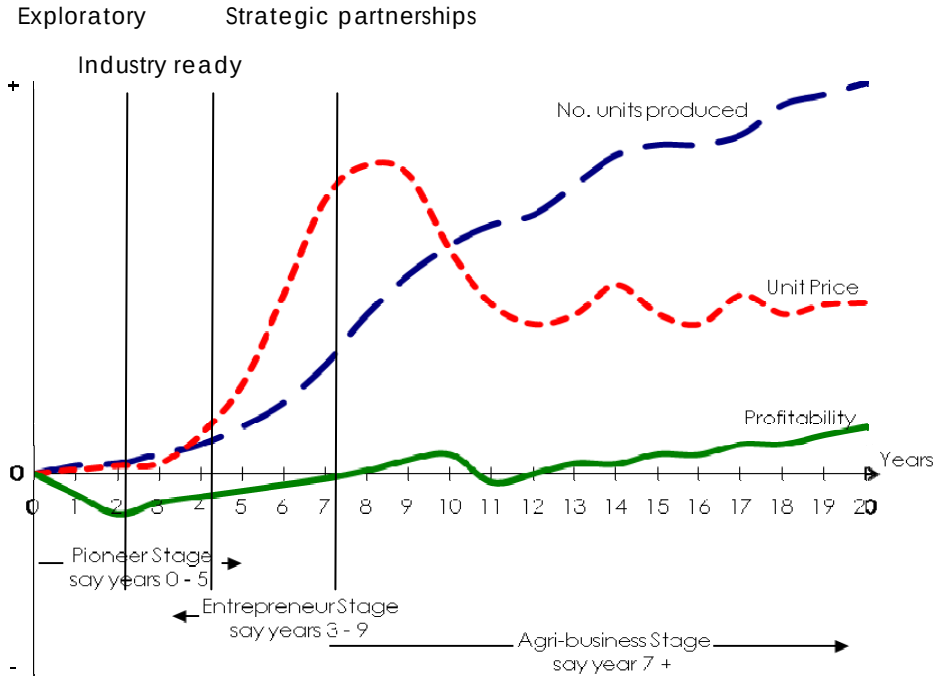

Figure 2. *Schematic representation of aquaculture industry development and funding stages.*

Industry Ready

This investment would be aimed at promoting research collaborations and programs that had the best chance of assessing the potential to overcome technical bottlenecks and truly enhance the potential for the establishment of a new business or sector and reduce risk to a point that additional investment is attracted.

Strategic Partnerships

Investment could be with specific groups into specific areas of production with or without potential for the development of protectable intellectual property and financial or other return to FRDC.

Strategic partnership investment by FRDC would require strong evidence of capacity to raise the capital necessary to ensure the new aquaculture initiative is viable.

Outcome: *Research quantum in the order of $1.5 – 2.0 million per annum by FRDC can be justified based on the relative merit of the priority, traditional research expenditure and need.*

If the FRDC Board recognise the need for investment in new aquaculture initiatives, then it must also recognize the need for an identifiable quantum of investment that is clearly communicated to the wider fisheries and aquaculture community. If the recognized need is not matched with an adequate research quantum, then there is a very real risk that any investment will be squandered and will fail to yield useful and quantifiable outcomes.

Research quantum in the order of $1.5-2.0 million per annum is recommended on the following basis:

1. This quantum is reflective of the need, and the relative priority of industry development within the FRDC portfolio. It is also one of the few FRDC investments that provides real potential for growth in the seafood sector.
2. FRDC arguably already invest at this level in new aquaculture initiatives, but the investment is fragmented, protracted and not identifiable as a core funding initiative. There are significant opportunities to improve the return on this investment.

3. This level of investment would offer sufficient quantum to make some progress within this portfolio.

In addition to the level of quantum, there also needs to be some commitment to the investment over a period of time. For example, the FRDC Board should consider allocating a proportion of indicative funding (ie pre-allocated or quarantined) to exploratory and industry ready initiatives, while recognizing a potential allocation to strategic initiatives for a period of at least 5 years with annual reviews of progress. Potential indicative and competitive allocations are summarized as follows:

Type	Quantum	Project Limit	Access*
Exploratory	$500,000/annum	<$75,000/project	Indicative
Industry Ready	$1,000,000/annum	<$200,000/annum	Indicative
Strategic	Up to $500,000/annum	Unlimited	Competitive

*Indicative or competitive is in relation to other FRDC priorities – all projects will have to have merit and will be considered against the merit of other projects.

In addition to the allocation of quantum, there should also be clear guidelines on how, when and who makes decisions relating to the allocation of funds. The following is suggested:

Type	Decision	Frequency	FRAB input	Industry Level	Investment Mode
Exploratory	Operational	Quarterly	No	Enterprise	Public
Industry Ready	Operational (with advice to the Board)	Bi-annually (ie 6 monthly)	Provided for information	Sectoral	Leveraged (Public + private)
Strategic	Board	Annually (within existing FRDC timelines)	Yes	Enterprise	Leveraged (Public + private)

It should also be recognized that if FRDC adopt these recommendations that potential exists to consolidate investment in some existing Subprograms into this portfolio. For example, the Aquaculture Nutrition Subprogram is primarily focused on the less developed aquaculture sectors, given the more developed sectors have core aquaculture nutrition programs within their portfolio. There is also no indicative allocation of funds to the Aquaculture Nutrition Subprogram which makes it difficult to attract interest or generate momentum. Secondly, the Rock Lobster Propagation Subprogram's relevance has changed since many of the research providers have developed commercial partnerships, and this type of initiative would fall well within the auspices of the new aquaculture initiative portfolio.

Outcome: *FRDC should adopt a multi-faceted approach to management of investment in new aquaculture initiatives consistent with the mode of investment.*

A traditional Subprogram approach may not be required to manage this investment portfolio given the research areas may be diverse, some of the suggested modes of investment could be managed using existing FRDC processes, some existing subprograms could manage aspects of the portfolio if they involve new initiatives within existing sectors, the National Aquaculture Council may be able to contribute to the decision making process and it is hard to establish representative Subprogram

Committees when there is no existing industry and you are using largely public good funds in association with a limited number of commercial entities. Despite this, there does need to be a dedicated management framework in place. The following is suggested:

Exploratory Investment

Identify an individual within or external to FRDC (New Aquaculture Initiatives Coordinator) to administer the allocated indicative funds aimed at generating renewed momentum and initiatives in the aquaculture sector. Guidelines for the allocation of exploratory funds will be ratified by the FRDC Board and the identified individual will make quarterly recommendations to the FRDC Board re funding allocations. If external to FRDC, this individual and the indicative funds could be contracted as a single project with a series of sub-contracts. Given the indicative funds are only in the order of $500,000 per annum, this individual would only need to allocate part of their time to the task, but would need to be an identified "champion" for the cause. This project could also be nominated as part of the FRDC "Base Resource Framework" under the PIMC initiatives.

Industry Ready Investment

Utilising the New Aquaculture Initiatives Coordinator to facilitate processes, industry ready investments could be assessed and subsequently managed using the following mechanisms:

1. Assemble a "Technical Review Team" to consider new aquaculture initiatives against agreed investment criteria;
2. Utilise the National Aquaculture Council to provide advice on the likelihood of success and potential overlaps with existing aquaculture initiatives;
3. Utilise existing species-based or MOU-based FRDC Subprograms for consideration of opportunities relevant to existing sectors;
4. Compile the above inputs and make recommendations to the FRDC Board on a six-monthly basis re use of allocated indicative funds.
5. Utilise existing FRDC processes to manage individual projects accepted by the FRDC Board.

Strategic Partnerships

Investment in strategic partnerships by FRDC will be based on a high level of outcomes from either exploratory or industry-ready investment and there will be a good existing relationship between FRDC and the industry partner. There will be strong evidence that capacity exists to raise the capital necessary to ensure the new aquaculture initiative is viable. As a consequence, strategic partnerships can be managed using existing FRDC processes and project management frameworks based on referrals from either the New Aquaculture Initiatives Coordinator and/or the National Aquaculture Council. Project submissions and approvals would be based on existing FRDC timelines and procedures.

Outcome: *FRDC need specific parameters to monitor the success of their investment in new aquaculture initiatives.*

There were strong views that the core measure of success of any FRDC investment is the basis for the establishment of a new, sustainable and profitable aquaculture business (not necessarily an industry) in Australia.

This success could be quantified through:

- Establishment of new aquaculture businesses;
- A measurable contribution to fisheries GVP
- Increase in contributions to FRDC through levies or provision of matching research funds.

It was also felt that investment by FRDC in new aquaculture initiatives was one of the few mechanisms for promotion of real growth in the fisheries sector.

A number of case studies can be used to highlight the potential benefits and success from previous investment in new aquaculture initiatives:

1. *Artemia*: FRDC invested in the development of closed Artemia production systems in Western Australia in collaboration with Cognis. Despite the size of Cognis as a business, they would never have invested the culture of Artemia in conjunction with their *Dunaliella* production systems (equivalent to growing locusts in the middle of a field of wheat) without the FRDC investment. In a very short time frame (< 3 years), this investment has demonstrated the potential for Artemia production in conjunction with an existing aquaculture system (and in the process have removed the threat of Artemia blooms in the *Dunaliella* ponds), has attracted significant additional investment from the commercial partner, is in the process of expanding to 200 x 35 tonne tanks, and will generate tens of millions of dollars in revenue.
2. *Rock lobster*: FRDC took a very public lead in the development of rock lobster aquaculture in Australia. Despite tremendous opposition from the wild capture sector, the initiative was pursued through a research subprogram. Despite significant technical bottlenecks, the research progress was rapid and very successful. Within a short period of time, Australia has become a world leader in rock lobster aquaculture technologies and the initial FRDC investment has resulted in significant commercial investment in on-going research. The likely outcome of this FRDC and other investment will be the closure of the rock lobster lifecycle and the development of a rock lobster aquaculture sector in Australia and overseas.
3. *Abalone*: Without FRDC investment, there would be no Australian abalone industry. Clearly a niche sector, Australian abalone aquaculture did not have access to wild kelp as a nutrient source and success with manufactured diets was limited. Australian research developed and demonstrated that abalone production could be pursued with exclusive use of manufactured diets with performance far exceeding that based on kelp.

Outcome: *FRDC should work in partnership with other research investors, but should not attempt to consolidate the role of other investors under the FRDC management framework.*

It was recognized through the review process that agencies such as RIRDC and ACIAR could be significant co-investors and contributors to new aquaculture initiatives.

RIRDC currently generate an investment in aquaculture projects of about $500,000 per annum ($250,000 direct cash contribution and $250,000 in cash and in-kind through funded projects) with this likely to continue at least until 2011.

ACIAR have potential to significantly increase locally relevant research relevant to new aquaculture industries in Australian that are also relevant to their overseas investment strategies.

It is felt that FRDC could best play a role as motivator, leader and facilitator and through the generation of renewed investment momentum there is no need for formalized agreements between these and other groups, and by default, the critical mass will develop and a coordinated research approach will ensue. It was also felt that relinquishment of management responsibilities to FRDC by these other organizations may result in a reduction in their concurrent investment over time, which would not be a desirable outcome.

It was felt that these organizations have as much to offer FRDC in the area of new aquaculture initiatives as FRDC have to offer them, and that promotion and fostering of these synergies will be an important part of the process. RIRDC, for example, have extensive experience in investment in new and emerging industries with a view to promoting diversification of the rural sector by supporting and maintaining small or niche industries, and supporting or encouraging growth and development of

emerging industries. A recent review of this RIRDC portfolio by LEK demonstrated significant return on investment from this strategy and strongly supported on-going investment in this portfolio.

It was interesting to note that some significant research providers in Australia no longer view FRDC as a useful co-investor in research, either due to a lack of investment quantum, or due to the number of requirements attached to the FRDC investment (eg. reporting, embargos etc) relative to the level of investment. FRDC need to regain some confidence from these providers, who have a lot to offer, and have an identifiable commitment to new aquaculture initiatives.

Outcome: *While resource access is a significant issue for new aquaculture industries, it should not consume all of the FRDC resources in this portfolio, but some investment could be directed towards securing resource access for new aquaculture initiatives.*

Peripheral to investment in new aquaculture initiatives was the suggestion that the resource access issue was so significant that FRDC may be better investing in standardizing the process for access to aquaculture sites across Australia.

There was limited support for this approach. Access to aquaculture resources is going to need high level political lobbying for a protracted period of time and there is going to need to be a significant shift in the priority for aquaculture over other potential resources uses.

It was strongly felt that FRDC investment in new aquaculture initiatives could also include research that contributes to the procurement of resource access for the new aquaculture enterprise. For example, FRDC could invest in the development of environmental carrying capacity models that could be used to facilitate approvals utilizing information that has been derived from other FRDC research investments.

Outcome: *FRDC should adopt a base position that investment in embryonic and pioneer aquaculture initiatives will generate know-how and public information rather than protectable IP.*

Another peripheral issue that arose during this review related to intellectual property and the justification for potential investment of public good funds with commercial enterprises.

In the past, FRDC attempts to capture protectable intellectual property has created angst, has not yielded any additional financial return to FRDC, and has significantly stalled some research initiatives (eg. rock lobster).

Protectable intellectual property should be easily identifiable in the advance of the project commencing. In this portfolio, protectable IP is likely to only relate to strategic investments.

In terms of public good investment in new aquaculture initiatives, it was suggested that FRDC:

1. Recognise the bulk of IP generated will be in the form of know how;
2. Consider a moratorium on dissemination for a set period of time as the best form of protection;
3. Ensure that the processes are very clear and transparent to all.

It is also suggested that if projects yield protectable IP, that the FRDC encourage the research partner to utilize funding opportunities provided via “Commercialisation Australia”, a new Federal Government initiative announced in late 2009. Commercialisation Australia is a merit-based, competitive assistance program that offers:

- Skills and knowledge support to help build the skills, knowledge and connections required to commercialise new ideas. This includes:

1. Up to $50,000 to pay for specialist advise and services;
2. Up to $200,000 over two years to assist with the recruitment of experienced executives.

- Proof of Concept grants of $50,000 to $250,000 to test the commercial viability of a new product, process or service.

- Early Stage Commercialisation repayable grants of $250,000 to $2 million to develop a new product, process or service to the stage where it can be taken to market.

BENEFITS

FRDC investment in “new aquaculture initiatives” would be of benefit based on:

1. It meets a significant need and area of market failure;
2. Australian aquaculture is in urgent need of renewed momentum and new horizons;
3. It provides balance to the FRDC research and development portfolio;
4. It is very relevant to federal government research priorities;
5. It could potentially make better use of existing FRDC and other investments that lack coordination or critical mass in this area.

FURTHER DEVELOPMENT

Outcomes from this process resulted in the development of a New Aquaculture Initiatives Policy for FRDC (Appendix I).

CONCLUSION

There was very active engagement in this consultation process, and while there was a range of views, the common belief that this is an important area of investment and that FRDC has a core obligation to this portfolio. The workshop was particularly useful in galvanizing some of the concepts and added significantly to the outcomes presented in this report.

Following the workshop, there was genuine optimism that engagement by the FRDC Board in this initiative would re-instill some momentum in Australian aquaculture and Australian aquaculture research that will not only generate a range of beneficial outcomes, but will fill a gap and area of market failure that has been evident for some time.

APPENDIX I - New Aquaculture Initiatives Policy

New Aquaculture Initiatives Policy

Australian Government
Fisheries Research and Development Corporation

Executive authorisation:	**Director's**
Effective date:	

TABLE OF CONTENTS

1. PURPOSE

To provide strategic and operational guidance for the FRDC on the mode of funding and strategic management frameworks for investment into new aquaculture initiatives.

2. DEFINITIONS

Term	Definition
New Aquaculture Initiatives	Innovations in aquaculture that lead to the establishment of new aquaculture businesses or industries, augment existing wild capture fisheries, or extend the scope of established aquaculture enterprises.
New	In the context of "New Aquaculture Initiatives", the term "new" is applied to novel initiatives in any aquaculture sector, not just emerging industries, and the potential for the development of new "businesses" in addition to "industries". From an FRDC investment perspective, "new" could also mean: • Non-MOU related research (eg. if there was potential to develop an novel aquaculture initiative around tanning salmon skin, that did not fit within the core objectives of the FRDC-TSGA MOU, it will be eligible for investment under "new aquaculture initiatives"); • Development of a new relationship with FRDC and potential financial contributions to the FRDC pool.
New Aquaculture Initiatives Coordinator	Individual or group within or external to FRDC appointed to coordinate the indicative allocation of FRDC funds for exploratory and industry ready investment in new aquaculture initiatives and to provide leadership in this research sector.
Commercialisation Australia	A merit-based, competitive Federal Government assistance program that offers: • Skills and knowledge support to help build the skills, knowledge and connections required to commercialise new ideas. This includes up to $50,000 to pay for specialist advise and services and up to $200,000 over two years to assist with the recruitment of experienced executives. • Proof of Concept grants of $50,000 to $250,000 to test the commercial viability of a new product, process or service. • Early Stage Commercialisation repayable grants of $250,000 to $2 million to develop a new product, process or service to the stage where it can be taken to market.

3. RISK ASSESSMENT

Likelihood: Almost certain; Likely; Possible; Unlikely; Rare
Consequence: Catastrophic; Major; Moderate; Minor; Insignificant

Risk	**Source of risk**	**Likelihood**	**Consequence**	**Existing controls**
Lack of activity and momentum generated within the New Aquaculture Initiatives portfolio	Failure to identify a suitable New Aquaculture Initiatives Coordinator (within or external to FRDC)	Possible	Major	Ensure adequate resources are allocated to the portfolio and ensure investments can be made in a timely and efficient manner
Perceived waste of FRDC funds	Lack of outcomes from portfolio or failure to convert good opportunities into commercial reality	Possible	Moderate	Development of strong networks; high level of rigour when allocating exploratory funds.
Lack of scale and capital to warrant any significant aquaculture development in Australia	Large number of commercial aquaculture failures in Australia and strong competition from overseas	Possible	Major	Re-establishing research and development momentum and strengthening the process of defining new aquaculture initiatives with commercial potential.
Insufficient interest or idea generation to utilize allocated investment funds	Poor promotion of the portfolio and poor engagement with the sector.	Unlikely	Moderate	Strong leadership from the New Aquaculture Initiatives Coordinator.
Insufficient FRDC investment	Many competing priorities	Possible	Catastrophic	Well balanced R&D portfolio.

4. RELEVANT DOCUMENTATION

Relevant documentation	**Link**
New Aquaculture Initiatives Workshop Report	
PLEASE INCLUDE ANY PROCEDURES ETC THAT RELATE TO THE POLICY	

5. BACKGROUND

The FRDC's previous policy regarding investment in aquaculture species was based on the larger sectors or sectors that could return the highest potential (such as high end species) that contributed or could contribute higher levels of funds back to the FRDC. This was thought to be a rational decision as this could provide the highest return on investment and therefore a greater proportional return to industry and subsequently to the FRDC through increases in GVP on which FRDC funding allocation from industry and government is based.

As a result in 2000, FRDC expressed the view that its aquaculture investment would focus on:

1. The five large developed aquaculture sectors of pearl, SBT, Atlantic Salmon, edible oysters and prawns (compromise 90% of aquaculture GVP)
2. The top 4 developing species – barramundi, abalone, marron and mussels
3. One or two emerging species – rocklobster, temperate finfish (Yellowtail Kingfish, Striped Trumpeter)
4. Cross sector science based on a discipline approach around aquatic animal health, nutrition, grow-out platforms (eg inland saline) and environmental performance

This policy differentiated between developing and emerging species. The former are characterised by being in the pioneer stage of development, such as exploring new technologies to grow a species that has already had hatchery production bottlenecks overcome. Emerging species are characterised/defined by being pre-pioneer where almost all knowledge of their aquaculture production is unknown and they are a high risk for investors. The analogy is that one is still in the garage being designed and built, and the other is out of the garage and being test driven.

Therefore, to meet FRDC's criteria for funding new species, a species has to show that it meets at least 3 of the following:

1. That the development is market driven. This requires evidence of existing market size, value, growth and existence of distribution pathways to supply it. Further, Australia must be in a position to exploit this market.
2. That the development is being driven by industry with significant existing investment.
3. Evidence that the cost of production will be less than the farm gate price. Normally this has meant high value market prices to offset the high cost of production in Australia.

4. That the species is endemic to Australia and builds on successful existing wild caught species with high value and large export markets.
5. That there exists the planning framework and access to resources to allow for the timely and orderly development.

FRDC has placed a significant amount of weight on the last criteria. In some Australian jurisdictions aquaculture development has been almost impossible for new species due to limited access to resources. A good example is marine cage culture for finfish in Queensland.

With the above in mind, review and development of the FRDC investment strategies regarding emerging and developing species is required together with development of a framework for management of research relating to emerging and developing aquaculture species.

Since 2000 FRDC has invested, through its public good, considerable resources in emerging and developing aquaculture species. There have been some slight changes in the direction taken, but overall very little has changed. For example, abalone and barramundi aquaculture are now seen as mature sectors that should not obtain the degree of public good investment they received in the past. These areas have traditionally been managed as individual sectors with little cross fertilisation.

In 2009 a review of FRDC investment into new and emerging species identified the following:

FRDC investment in “new aquaculture initiatives” in a coordinated manner is justified on the basis that:

1. It meets a significant need and area of market failure;
2. Australian aquaculture is in urgent need of renewed momentum and new horizons.
3. It provides balance to the FRDC research and development portfolio;
4. It is very relevant to federal government research priorities;
5. It could potentially make better use of existing FRDC and other investments that lack coordination or critical mass in this area.

Outcomes from this review also suggested that:

- Timely, tactical investment in new aquaculture initiatives is essential to address unknowns, reduce elements of risk and attract the level of investment and scale required to ensure success of new aquaculture businesses.

- An “FRDC Aquaculture Incubator” could create the enabling environment required to generate research and development momentum and a structured approach to aquaculture development without constraining ideas and opportunities.

- Following initial investment and demonstration of potential, on-going FRDC investment in new aquaculture industries and initiatives must be based on specific criteria which include significant evidence that the aquaculture business has the capacity to generate the necessary capital, cash-flow and critical mass to become a viable.

- FRDC should not be focused on emerging and developing food species but “New Aquaculture Initiatives”. This also improves alignment with other investment bodies such as the Rural Industries Research and Development Corporation.

- New aquaculture initiatives require a dedicated and significant FRDC investment.

- There are a wide variety of expectations from investments in new aquaculture industries that cannot be pre-empted by FRDC alone (in relation to selection of “winners”)

- FRDC’s existing investment strategy in aquaculture requires modification to reflect the current aquaculture operating environment in Australia.

- FRDC should adopt a multi-level investment strategy for new aquaculture initiatives. Suggested investment modes include:

    - **Exploratory funding:** This could include support for the development of business or marketing plans, overseas study tours, mentoring through established networks, modelling, development of an understanding of resource requirements and regulatory requirements, engagement with regional councils and development bodies etc. Funding could be staged (eg. available funds increase as each milestone is met).
    - **Industry Ready:** This investment would be aimed at promoting research collaborations and programs that had the best chance of assessing the potential to overcome technical bottlenecks and truly enhance the potential for the establishment of a new business or sector and reduce risk to a point that additional investment is attracted.
    - **Strategic Partnerships:** Investment could be with specific groups into specific areas of production. Strategic partnership investment by FRDC would require strong evidence of capacity to raise the capital necessary to ensure the new aquaculture initiative is viable.

- Research quantum in the order of $1.5 – 2.0 million per annum by FRDC can be justified based on the relative merit of the priority, traditional research expenditure and need.

- FRDC should adopt a multi-faceted approach to management of investment in new aquaculture initiatives consistent with the mode of investment.

- FRDC need specific parameters to monitor the success of their investment in new aquaculture initiatives.

- FRDC should work in partnership with other research investors, but should not attempt to consolidate the role of other investors under the FRDC management framework.

- While resource access is a significant issue for new aquaculture industries, it should not consume all of the FRDC resources in this portfolio, but some

investment could be directed towards securing resource access for new aquaculture initiatives.

- FRDC should adopt a base position that investment in embryonic and pioneer aquaculture initiatives will generate know-how and public information rather than protectable IP.

6. POLICY

6.1 Approach to New Aquaculture Initiative Investment

FRDC will be the core, first-stage investor in new aquaculture initiatives to:

- Foster new ideas in a timely and tactical manner;
- Reduce elements of risk associated with establishing new aquaculture ventures or undertaking new aquaculture initiatives;
- Assist in attracting the level of capital investment and scale required to ensure success of new aquaculture businesses;
- Contribute to successful resource access for new aquaculture initiatives;
- Contribute to the objectives associated with industry development in the FRDC strategic plan.

6.2 Scope of Investment in New Aquaculture Initiatives

Scope of investment in new aquaculture initiatives will be based upon broad categories of aquaculture production, including:

AQUACULTURE-DERIVED NUTRIENTS	AQUACULTURE PRODUCTS AND SERVICES	AQUACULTURE NOVEL COMPOUNDS	AQUACULTURE FOOD PRODUCTION
• Culture of micro and macro-algae or autotrophic bacteria as food sources for omega-3 rich oils. • Culture of micro and macro-algae or autotrophic bacteria as protein and energy sources for aquaculture and livestock species. • Culture of micro and macro-algae for carbon biofixation.	• Ornamentals, aquarium fish, live rocks • Tourism • Jewelry, unique • Aquaculture technical expertise	• Health – cancer prevention and cure • Pharmaceuticals • Industrial chemicals • Nutriceuticals • Pigments • Energy from biofuels produced from cultured algae or autotrophic bacteria	• High-value, niche products for local and overseas fresh food markets • Commodity protein • Value-added food products • Artemia production • Stock for re-seeding wild capture fisheries

6.3 Criteria for Investment

FRDC investment in new aquaculture initiatives will be based on:

6. The activity being market driven and involving at least one commercial partner. Potential must also exist for Australia to exploit this market, or generate a local return from the market;
7. Evidence that resource access for aquaculture production is unlikely to be impeded through environmental or other impacts of the initiative, or the research investment could significantly assist in the granting of resource access.
8. The investment can significantly enhance an existing aquaculture enterprise or wild-capture fishery, or promote the generation of a new business or regional development.
9. Investment from FRDC will generate outputs that have capacity to attract additional or on-going investment in the initiative;
10. Following preliminary scoping and evaluation, there is evidence that the activity can be adequately resourced (capital, personnel, expertise) to deliver a successful commercial outcome.

6.4 Mode of Investment in New Aquaculture Initiatives

FRDC will invest in new aquaculture initiatives in three ways:

6.4.1 Exploratory funding

This would support the development of business or marketing plans, overseas study tours, mentoring through established networks, modeling, development of an understanding of resource requirements and regulatory requirements, and consultation with relevant regulatory bodies.

The intent is to stimulate momentum, improve timeliness, foster innovation, reduce duplication, and develop a process of natural elimination of unlikely winners while giving consideration to a wide variety of opportunities. A proportion of this funding could also be used to develop “groups” within more established aquaculture sectors that currently lack the critical mass necessary to develop a strategic research portfolio or grow the industry further. Investment would be incremental based on successful completion of each phase or activity and demonstrated potential warranting further investigation.

6.4.2 Industry Ready

This is aimed at promoting research collaborations and programs that have the best chance of overcoming identified technical bottlenecks and enhancing the potential for the establishment of a new business or sector and reduce risk to a point that additional investment is attracted.

6.4.3 Strategic Partnerships

Investment negotiated with specific groups into specific areas of production with or without potential for the development of protectable intellectual property and financial or other return to FRDC. This investment requires strong evidence of capacity to

raise the capital necessary to ensure the new aquaculture initiative is commercially viable.

6.5 Investment Quantum

FRDC will make an indicative investment allocation to the portfolio (rather than individual projects) on a 3-5 year basis consistent with the proportional investment directed towards Program 2 in the FRDC Research, Development and Extension plan.

Investment quantum will be sufficient to ensure research and development progress is possible within the portfolio and of sufficient duration to allow assessment of potential of new aquaculture initiatives. In 2010, using historical investments, relative need, and potential return on investment as a guide, an indicative investment in the order of $1.5-2.0 million per annum is appropriate.

Investment allocations by mode will be based on the following:

Type	Quantum	Project Limit	Access*
Exploratory	$500,000/annum	<$75,000/project	Indicative
Industry Ready	$1,000,000/annum	<$200,000/annum	Indicative
Strategic	Up to $500,000/annum	Up to $500,000	Competitive

*Indicative or competitive is in relation to other FRDC priorities – all projects will have to have merit and will be considered against the merit of other projects.

In addition to the allocation of quantum, allocation of funds and project approvals will be based on the following:

Type	Decision	Frequency	FRAB input	Industry Level	Investment Mode
Exploratory	Operational	Quarterly	No	Enterprise	Public
Industry Ready	Operational (with advice to the Board)	Bi-annually (ie 6 monthly)	Provided for information	Sectoral	Leveraged (Public + private)
Strategic	Board	Annually (within existing FRDC timelines)	Yes	Enterprise	Leveraged (Public + private)

Exploratory and Industry Ready indicative investment quantum will be defined by FRDC Board within the existing FRDC funding rounds and process. Once approved, the Exploratory and Industry Ready investments in specific projects will be made on a quarterly and six-monthly basis, respectively (as sub-contracts to a single FRDC project or administered in a similar way to the existing Tactical research Fund). Strategic investments will be made via existing FRDC funding rounds and processes.

6.6 Investment Management

6.6.1 Exploratory Investment Management

FRDC will identify an individual within or external to FRDC (New Aquaculture Initiatives Coordinator) to administer the allocated indicative funds aimed at generating renewed momentum and initiatives in the aquaculture sector. Guidelines for the allocation of exploratory funds will be ratified by the FRDC Board and the identified individual will make quarterly recommendations to the FRDC Board re funding allocations. If external to FRDC, this individual and the indicative funds will be contracted as a single project with a series of sub-contracts. Given the indicative funds are only in the order of $500,000 per annum, this individual would only need to allocate part of their time to the task, but would need to be an identified “champion” for the cause. This project will be nominated as part of the FRDC “Base Resource Framework” under the PIMC initiatives.

6.6.2 Industry Ready Investment Management

Utilising the New Aquaculture Initiatives Coordinator to facilitate processes, industry ready investments will be assessed and subsequently managed using the following mechanisms:

6. Assemble a “Technical Review Team” to consider new aquaculture initiatives against agreed investment criteria;
7. Utilise the National Aquaculture Council to provide advice on the likelihood of success and potential overlaps with existing aquaculture initiatives;
8. Utilise existing species-based or MOU-based FRDC Subprograms for consideration of opportunities relevant to existing sectors;
9. Identify potential alternative investment sources that may be better suited to the initiative including Commercialisation Australia, the Australian Centre for International Agricultural Research and the Rural Industries Research and Development Corporation.
10. Compile the above inputs and make recommendations to the FRDC Board on a six-monthly basis re use of allocated indicative funds.
11. Utilise existing FRDC processes to manage individual projects accepted by the FRDC Board.

6.6.3 Strategic Partnership Management

Investment in strategic partnerships by FRDC will be based on a high level of outcomes from either exploratory or industry-ready investment and there will be a good existing relationship between FRDC and the industry partner. There will be strong evidence that capacity exists to raise the capital necessary to ensure the new aquaculture initiative is viable. As a consequence, strategic partnerships can be managed using existing FRDC processes and project management frameworks based on referrals from either the New Aquaculture Initiatives Coordinator and/or the National Aquaculture Council. Project submissions and approvals would be based on existing FRDC timelines and procedures.

6.7 Key Performance Indicators

Successful outcomes from this research portfolio will be measured by:

- Establishment of new aquaculture businesses;
- A measurable contribution to fisheries GVP
- Increase in contributions to FRDC through levies or provision of matching research funds.

APPENDIX II - Staff

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