An Aquaculture Industry for Queensland

Briefing paper

1. Introduction

Tropical northern Australia is the epicentre for some of Australia's biggest aquaculture industries, including farmed prawns, barramundi, pearls and crayfish, which collectively account for ~$300 million of aquaculture product annually. The northern Queensland region – its unique partners and collaborators in marine science, education, industry and tourism organisations – make this location the obvious choice to be the epicentre of aquaculture in Australia. Furthermore, with our focus on clean, safe and high quality product, northern Queensland is strongly positioned to be a global leader in this industry.

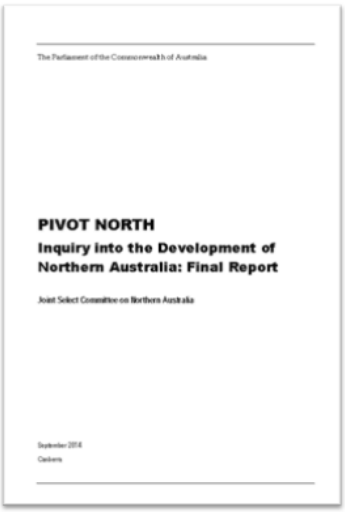
The development of sustainable aquaculture has the strong support of Industry partners (who have significantly invested in R&D and facilities at the JCU campus), the Federal Government (through research project and researcher funding) and locally the Great Barrier Reef Marine Park Authority, Port of Townsville, the Australian Institute of Marine Science and Reef HQ.

There is significant transformative capacity and economic potential for aquaculture industry in northern Queensland, leading to job creation and skilled workforce development, the ability to transfer knowledge and skills to the Asia Pacific region from northern Queensland, and potential flow on effects to tourism and edu-tourism. A focus on aquaculture holds in prospect the development of a new industrial focus - at scale - for the north.

2. Why Aquaculture and Marine Science is essential to Queensland's economic future

Food security and the associated demand for high quality seafood protein are amongst the great challenges of the 21st Century. Some simple facts bear this out.

- Aquaculture is the fastest growing primary food production sector globally, with 50% of seafood now consumed derived from farm production.
- Aquaculture production recently surpassed world beef production as a source of animal protein.
- Based on population projections and current growth in per capita fish consumption, aquaculture will be a 300,000 tonne+, $US2 trillion+ per year industry by 2050.
- Aquaculture (growing at current rate) will be the 2nd largest agri-food export in Australia by 2050 ($12.8 billion)
- Much of the future growth in demand will come from the developing economies of Asia, expected to support more than half of the world's middle class by 2020.
- Significant import replacement opportunity (30,000 tonne at $100million p/a)
- Growing concern over levels of contaminants in Asian cultured seafood products (antibiotics) and the demand for high quality Australian product
- Intensification of aquaculture production will require expertise associated with selective breeding, husbandry, sustainable diets, improved disease detection and management systems.



Fisheries and Aquaculture

2.76 The CSIRO advised that fisheries and aquaculture was worth $232 million to the Northern Australian economy during 2006–07, and had grown by around 14 per cent 'over the last five years'. Australia has a significant advantage compared to other aquaculture nations because its product is known to be of high quality.

2.80 Further, there had been 'significant advances in environmental management technology' in the marine aquaculture sector which would enable saltwater aquaculture to 'play a much more significant role in responding to the huge demand for high-quality seafood from Asian markets.'

2.84 In Queensland there is considerable potential to expand aquaculture from the present 700 hectares production area. The Australian Prawn Farmers Association, however, conveyed its frustration at being constrained in its plans to expand and thereby create an additional 200 jobs and increase revenues from $70 million to $412 million.

Extracts from Pivot North Report

Given its proximity to the Asian "dining boom", similarity in tropical species farmed, suitable space (significant expansion capacity for aquaculture in Cardwell, Ayr and Bowen), coupled with the world class expertise located at JCU, GBRPMA and AIMS needed to both manage the industry sustainably and transfer that expertise via higher education and commercialisation, we are ideally situated in northern Queensland to develop and export the tropical marine and aquaculture expertise required for sustainable development of these aquatic resources.

Infrastructure which stimulates industry participation and engagement, and promotes the transfer of knowledge and research to the Pacific and Asian regions, is essential to realise and capitalise on these opportunities. The pathway of innovation from marine and aquaculture research into industry is already strong, through relationships with industry partners in algal production and bioremediation, prawns, barramundi and others.

For example, JCU will lead the $5 million Australian Research Council Industrial Transformation Research Hub for Advanced Prawn Breeding and Genomics, which brings together world-leading experts in aquaculture genetics, genomics, prawn husbandry and diseases, terrestrial animal breeders, the Australian Genome Research Facility, international collaborators, and the Australian prawn farming sector to develop and transfer the capacity for the farmed black tiger prawn industry to benefit from genomic-informed breeding programs.

3. Research and Innovation in support of a developing industry

Industry has stressed that the aquaculture industry needs innovation if it is to deliver its considerable (re)discovered potential. They have stated that JCU and Townsville is the perfect location to leverage tropical marine science, engineering and industry skills to address research priorities. Investment in facilities supporting industry R&D will provide a critical mass and catalyst for links to other regional Australian and international institutions and industry. Key issues, opportunities and competitive advantage for the aquaculture industry in Queensland are:

- Maintaining technological advantage
- Disease management and strong growth rates in high quality broodstock
- Bioremediation, environmental and ecological sustainability innovation
- Skilled workforce and industry exposed graduates
- Innovation vs Regulation (review by State of aquaculture regulation is welcomed as is support of GBRMPA)
- Achieving scale

All this is possible in northern Queensland building on collaborations between industry and JCU. James Cook University is recognised internationally as the world's leading institution for coral reef and tropical aquaculture research, home to the Australian Research Council's Centre of Excellence for Integrated Coral Reef Science and Industrial Transformation Research Hub for Advanced Prawn Breeding and Genomics, the Centre for Sustainable Tropical Fisheries and Aquaculture and Australia's top-rated tourism research. With the significant Commonwealth and State scientific assets in the region including CSIRO, AIMS, GBRMPA, and scientists located in the Department of Agriculture, Fisheries and Forestry, northern Queensland has a globally significant community of expertise.

Part of the reason why aquaculture has not developed into the significant industry it has the potential to be in Queensland goes to concerns about the impact on coastal ecosystems and the Great Barrier Reef. We note that over 90% of the economic activity along the Great Barrier Reef coast is directly associated with tourism, worth nearly $5.2 billion and over 64,000 jobs in 2012. Through science and technology innovation however, the State can support a world-leading ecologically sustainable aquaculture industry *as well as* expand on the support to the region's tourism industry (through research to preserve our natural assets as well as potential edu-tourism opportunities).

Part of the requirement in developing aquaculture is to have facilities that are accessible to tourists and the general public to foster an understanding of the aquaculture industry and marine science and the jobs and careers available; and demonstrating how industry partners and JCU are engaged in research and innovation that will drive the further development of the industry. The type of facility which will give full effect to Townsville as the global hub for tropical marine sciences, tourism and aquaculture commercialisation, drawing tourists, researchers and Industry from around the country and the world.

The collaborations with MBD Energy in particular around algal production and bioremediation are truly innovative for the aquaculture industry. Research projects being undertaken include bioremediation of nutrient rich aquaculture waste water with the objective to provide a zero net discharge. This will contribute to the environmental sustainability of aquaculture industry and facilitate expansion of land based aquaculture. The pilot scale project with Pacific Reef has been successful in reaching this zero net discharge, indeed the water being released from the creek system supporting Pacific Reef is cleaner than that coming in. The algae cultivation also generates profitable revenues from the sale of algae-based products (such as nutraceutical, cosmetics, aquaculture feed and agriculture feed), further diversifying job opportunities in the region.

Aquaculture is also the most efficient form of meat production. With increasing exploitation of finite natural resources like feed, water and space, aquaculture product will feature more prominently as a percentage of overall protein intake in the future because of its efficient use of resources compared to pork, lamb and beef production.

4. Current industry activities and imperatives

Current partnerships:

- *MBD Energy Ltd* – together with its JCU team are regarded as international leaders in the use of algal biomass for the bioremediation of waste water from aquaculture, agriculture, mining and energy generation, with the concomitant development of innovative bioproducts and energy. MBD's major Australian project is based at Pacific Reef Fisheries in north Queensland.
- *Mainstream Aquaculture* – is the most technically advanced producer of barramundi fingerlings in the world based on an advanced selective breeding program developed in partnership with JCU. Mainstream supplies high quality juvenile barramundi demonstrating rapid growth, low growth variance, high fillet yield and resistance to disease.
- *Seafarm Group* – aims to establish the world's largest black tiger prawn farm in northern Australia, and develop genetically superior seafood for international markets which will dramatically transform the aquaculture landscape and significantly contribute to Queensland's food security and export earnings.

- *Finfish Enterprises* – aspires to be the largest producer of high quality reef finfish to the aquaculture industry, both domestically and globally.
- *Pacific Reef Fisheries* – is one of Australia's largest and most innovative producers of black tiger prawns. Pacific Reef uses leading edge technology to deliver the highly intensive and sustainable production of prawns for national and export markets.

MBD Energy has built its business on the R&D outcomes achieved under the JCU/MBD partnership. The company has invested more than $40m of private equity and $30m of government grants/rebates over last 5 years to create a strong commercial business in:

- the provision of biological based remediation of industrial waste streams, and
- the high yield production of valuable algae-based by-products

Work to date provides an excellent base and will continue for many years, the partnership is currently being extended for a further 10 years to support the commercial rollout of projects.

For our region's seafood producers (particularly in Cardwell and Ayr) to achieve their aims they need to maintain a technological advantage to differentiate themselves in the high value overseas market, reduce operational costs through advances in all aspects of culture and production. Queensland has a competitive advantage in logistics infrastructure support with established road and rail networks, cold stores and access to ports and airports.

Aquaculture labour is highly skilled so JCU would be a source of multi-skilled, industry exposed graduates. By providing facilities with specialised research capability, accessible by all industry to address research priorities including disease management, improved genetics, nutrition, and environmental sustainability, the State Government can bring together leading-edge science with commercialisation to sustain established and emerging marine-based industries.

Benefits:

- Sustaining existing tourism (and potential edu-tourism)
- Leverages a global reputation for marine science and aquaculture in northern Queensland
- Economic potential (job creation and flow on impacts)
- Training and skills development meeting current and diversifying future job demand (skilled workforce)
- Provides visibility to innovation and research
- Industry and innovation catalyst

5. Workforce development needs for tropical aquaculture

Within Australia there is a developing gap in providing new entrants to the aquaculture industry with industry-relevant skillsets. Disease management, along with skilled workforce needs are two critical aspects that urgently need to be addressed if the tropical aquaculture industry is to grow to its full capacity in producing safe, sustainable sources of protein and increasing regional employment and economic development opportunities.

There is demand for specific training programs to enable various aquaculture industries to up-skill their staff, and to deliver hands-on skills to industry aspirates. JCU is in the process of modifying its aquaculture curricula to incorporate more hands-on, industry-embedded training as well as to deliver short training courses so that the developing aquaculture industry doesn't face a skills shortage in the near future.

Example:

Food and Agriculture Organization of the United Nations

Expression of Interest submitted through the FAO to deliver a short-course in barramundi broodstock management and hatchery culture of barramundi to the Saudi government. JCU has over 15 years of training industry participants in barramundi aquaculture techniques and conducting industry-relevant Research and Development. These short courses will train participants in broodstock management, spawning techniques, early larval husbandry, live food production and grading. These courses would be offered domestically and internationally from Townsville.

Industry input and co-contribution to deliver hands-on training in a commercial aquaculture setting is also being investigated to support industry growth (particularly in prawn aquaculture where appropriate training facilities aren't available). JCU, with the Australian Prawn Farmers Association, is discussing the development of a 2-3 week hands-on workshop to be delivered at one of the commercial hatcheries in Queensland by commercial hatchery operators and JCU.

Skills shortages are not unique to Australia. There is a global shortage of well-trained tropical aquaculture workers and there is undoubtedly an untapped market (particularly in China) for upskilling existing aquaculture staff in *best practice production* and *quality assurance* methodologies to overcome middleclass concerns about safe food production in Asia. From a knowledge economy perspective, there is significant demand for edu-tourism opportunities in aquaculture from Asian investment brokers keen to facilitate access for Asian university students to high quality Australian short course training in aquaculture. There is considerable appetite for a mixed model delivery approach where some basic in-country training could be provided by JCU-accredited staff followed by a short visit to Townsville to gain hands-on training (short course) and experience in Australia.

There is a worldwide shortage of veterinarians who have been suitably trained to diagnose and treat disease in tropical aquaculture animals. JCU has the largest critical mass of capacity in tropical disease management in the country and potentially in the world. Opportunities for international short courses exist for vets from the tropical region who want to develop skills in aquatic disease pathology, diagnosis and treatment. In addition, recognising that there is currently no local commercial diagnostic testing facility to service the current north Queensland industry and turnaround times to send samples to southern labs (ie non-Queensland) to get results are taking weeks, there is potential to work with government and industry to deliver a timely, fee-based disease testing service, to northern Australia aquaculture, based in Townsville.

6. What does turbocharging the aquaculture industry in northern Queensland require?

JCU's industry partners are ready to take aquaculture to the next level. The industry is subject to very stringent development and discharge conditions through GBRMPA and Qld EPA. The Queensland Competition Authority (QCA) review of Aquaculture regulation is seen as "a significant opportunity for a 'rebirth' of the industry - strengthened by regulatory reform"[1]. This reform will ideally ensure the industry's ongoing sustainability and success as a major economic contributor for Queensland. Initial feedback seems to be that the QCA appears keen to explore potential for large-scale aquaculture development in Queensland Gulf country (Gilbert & Flinders Rivers) and this has been viewed positively.

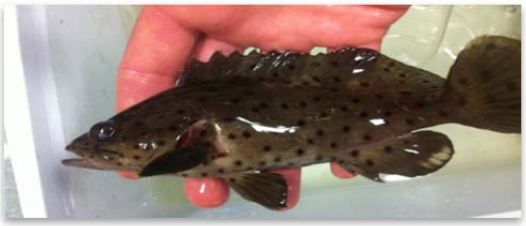
Australian aquaculture production systems must be able to deliver high-quality, consistent volumes of produce, operate with minimal environmental impact, and use sustainable input feed raw materials. The future of aquaculture systems lies in larger sea sites further from shore and larger, more-sophisticated land-based production. The aquaculture industry states that innovation is only achieved through partnerships with world leading research institutions in aquaculture and marine science, through infrastructure and technology, and through skills and training. The collaborative research and development entity growNORTH, a multidisciplinary team including JCU as a core partner, is seeking a 10 year federal funding commitment alongside a substantial private sector investment. growNORTH has as its key tenets socially and environmentally sustainable development, technological innovation for profitable value chains into Asia, recommendations around policy, structural and governance changes to facilitate development, and the delivery of high impact research that will lower investment barriers and enable significant capital to flow to development in the north.

MBD has an exclusive R&D relationship with JCU because of our recognised expertise in micro and macro algae. Industry needs access to world expert knowledge critical for aquaculture industry in the development of new opportunities, proof of concept and fine-tuning of projects. FinFish Enterprises commercial success relies on the specialised research capability within the University in disease management, genetics (breeding selection and improvement), nutrition (growth rates, waste management and water quality), environmental management (nutrient loads, waste water treatment, and restocking). At an Industry Round Table held at JCU on 5 September, Seafarm, Maintstream Barramundi, MBD and FinFish all reinforced the importance of expanded research facilities in Townsville for growing the industry, and are interested in public/private partnerships to support this.

The widely acknowledged and acclaimed expertise matched with world-class facilities and industry partners will assist in delivering ground-breaking outcomes in sustainable food production and marine resource management. Appropriate infrastructure would accelerate the capacity to deliver high impact research of economic, environmental, and social benefit to northern Queensland and the region, as well as building the human capital and expertise to:

- deliver increased research and development solutions and staffing requirements to the Australian and international tropical aquaculture sector, and
- enable the transfer of knowledge and technology into Queensland firms for global export.

Further investment in the Townsville region will build on the critical mass in marine science infrastructure with complementary purpose built, world-class facilities providing flexible experimental space that allows scientists and industries the ability to control marine and aquatic systems to solve problems that face marine environments, fisheries and aquaculture, as well as an industry engagement shop-front and demonstration facility for commercialisation of marine system solutions.



Facilities need to provide space that brings together industry partners, scientists and researchers across a broad range of subjects extending from aquaculture, fisheries, coral reef ecology, conservation biology, and transformative marine products to facilitate innovation and collaboration. The facility should include offices and workstations for researchers, technicians and post graduate students, flexible experimental wet and dry laboratories, and a large industry and public interaction space. Specifically:

- state-of-the-art life support systems for aquaculture (1050 m2 including quarantine)
- flexible experimental, controlled-environment wet labs (20) and 8 dry labs (3000 m2)
- semi-enclosed aquasheds (4 @ 500 m2)

[1] Robert Bell, Seafarm Group, 5 Sept 2014

- industry engagement shopfront with facilities for industry extension and training demonstration site for “proof of concept” trials of innovative technology

The location of this facility at the Port provides the necessary access to seawater, allows for expansion and increased scale, and is a natural location that supports engagement with business and industry, aquaculture industry commercialisation spin offs and start-ups industries/companies. This has the potential to demonstrate best-practice industry collaboration/integration at the Port of Townsville making the business proposition for a lessor more attractive. Additionally, investment in a capital project of this scale will create an estimated 533 construction jobs over the life of the project (using a Queensland Government formula).

With appropriate facilities, Townsville will be the global expert hub for tropical aquaculture and aquatic disease research and training, further growing the knowledge economy.

7. Tourism potential

Locating aquaculture training, research, and industry partnerships in the Townsville City-Port marine precinct in collaboration with the Port Authority, and the existing eco-tourism facilities of Reef HQ and Museum of Tropical North Queensland, provides an educational and tourism precinct that maximises use of existing and future infrastructure to maintain and build the value of tourism and education in North Queensland’s economy. Together with the unique tourism attraction of Reef HQ, the world’s largest living coral reef aquarium, and its contribution to science education and research, and partnered with GBRMPA, these facilities provide increased accessibility, knowledge and discovery of the marine environment – its conservation, management and sustainable aquaculture production.

Supporting the Townsville City Council’s imperatives for a revitalised CBD, a facility of this type would also bring substantial academic activity to the city, with up to 20 world renowned researchers, over 80 PhD students, and visiting scholars on site. It will promote scientific exploration and engaging school students and the wider public on the issues around coral reef management and sustainable food production industries will enhance the edu-tourism opportunities and profile of Townsville and the broader region.

A series of interactive screens in the public and demonstration space will provide a virtual reef experience with live streaming of video and data from JCU’s Orpheus Island Research Station, ReefHQ’s aquarium, the Barramundi brood stock tanks within the facility for example, and other sensors and sources. Multi-touch technologies will enable the user to manipulate, intimately explore and interact with the reef world, specific behaviours and relationships. Users will have the opportunity to go beyond the virtual experience and interact with the marine world both in this facility (*look and learn*) and ReefHQ (*touch and feel*).

Reef HQ houses the world’s largest artificial coral reef and other aquaria, interactive pools and several educational exhibits. It provides the public explorations engagement and reef science education to interpret GBRMPA research and to promote reef conservation. Infrastructure of this type will complement and add value to the Reef HQ experience as well as provide additional research and content for the delivery of out of the classroom interactive and hands on learning experiences.

Our ability to draw tourists to the region and educate them on the natural ecology and biology of northern Queensland will have flow on effects to local business up and down the Coast as they seek to explore the reef and rainforest throughout the region (e.g. fishing charters, reef tours, eco-tourism operators), and potentially industry visits.

Attachment 1

Industry Partners Background Briefs

MBD Energy Limited
Macroalgae Bioremediation - Pacific Reef Fisheries

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MBD Energy has world class expertise in the identification and cultivation of algae - “micro” and “macro”. MBD Energy has developed a world-leading Algae R&D Facility with James Cook University and builds on more than 30 years of expertise in marine biology. MBD Energy is using this algae knowledge and expertise to build a strong commercial business in:

- the provision of biologically based remediation of industrial waste streams, and
- the sustainable production of algae-based products.

The key drivers of the project with Pacific Reef Fisheries are:

- Establishment of a low cost bioremediation system that enables water to be discharged at the same or lower levels of nitrogen and phosphorous as the water that is drawn into the facility from the Great Barrier Reef, and;
- The opportunity for the MBD Energy Limited to replicate the system over and over again to provide sustainable algae-based water remediation services and to sell algal-based products in Australian and overseas markets through its specialist food and feed division – MBD Nutrition.

The key benefits of bioremediation program for MBD’s land based remediation services are:

- Improvement in coastal water health due to zero-nett discharge of nitrogen and phosphorous (reduction of eutrophication).
- Reduction in source water needs & pumping requirements due to improved internal water quality.
- Reduction of discharge water to the environment to satisfy regulatory requirements
- Improvement of source water quality - healthy water will improve fish/prawn productivity.
- Improved water quality has a positive impact on product quality (taste) with improved health & production rates.
- Revenue improvements with increased product quality.

Pacific Reef Fisheries

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Pacific Reef Fisheries’ (PRF) is a large, fully integrated operation consisting of a site at Ayr (farm, administration, office and processing plant) and Guthalungra (hatchery and future farm expansion). The farm operation in Ayr comprises the grow-out facility of 68 earthen ponds and is located just south of Alva beach. PRF has been operating since 1998 and is immediately adjacent to the Great Barrier Reef (GBR) where they draw their water to grow premium quality black tiger prawns. The farm is a wholly family owned and funded state-of-the-art operation capable of growing up to 900 tonnes per annum when fully operational.

PRF employs a wide range of people from mechanics to accountants as well as farm and hatchery technicians, many of whom have marine science training through James Cook University. During the growing season staff members swell from a base of around 20 staff to anything up to 80 staff once processing gets underway. It is fortunate that the prawn growing season coincides with the end of the sugar crushing season at the local mills and the availability of local staff is generally quite good.

PRF is a committed participant in research and development to ensure the very best methods and technology is harnessed to grow their premium quality Australian black tiger prawns. The Guthalungra hatchery with industry partners and CSIRO, as part of the Seafood CRC, has domesticated the black tiger prawn. It is hoped that in the very near future that there will no longer be a need to source wild breeding stock at the beginning of each season and instead pick the fastest growing animals from each season to breed from, a technique used more widely in other livestock industries.

PRF is currently seeking approval for a further 259 hectares of prawn ponds adjacent to the Elliot River near Guthalungra, approximately 40km north of Bowen, North Queensland. This will make it the largest single prawn farm in Australia. Total future production of black tiger prawns exceeds 2,500 tonnes. This future development is being supported through a partnership with MBD Energy where waste water from the production of prawns is remediated through the intensive production of seaweed. In this process the seaweed removes nitrogen and phosphorous from the water improving the quality to meet compliance guidelines for both enhanced production at the Ayr Facility and the development of Guthalungra under strict guidelines for aquaculture in the Great Barrier Reef World Heritage Area. At the same time this seaweed is a valuable food resource for the Asian food bowl where quality seafood products are highly prized. PRF and MBD Energy are delivering world-class innovation to support the sustainable operation and expansion of Australia's aquaculture industries.

Mainstream Barramundi

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Mainstream was founded in 2001 with a vision to build a "business for the future" by becoming the world's leading provider of recirculating aquaculture food fish products. Through over a decade of successful research and development, Mainstream Aquaculture has developed proprietary technology that is unique in enabling continuous (year round) high quality production of the popular table fish, Barramundi. Mainstream Aquaculture operates the largest recirculating aquaculture business in mainland Australia and is a top 10 domestic producer of Barramundi. Mainstream distributes its food fish into premium retailers and restaurants around Australia and exports juvenile Barramundi to 14 countries across 4 continents.

Mainstream's facilities are supported by an advanced selective breeding program conducted in the world's largest Barramundi hatchery in Melbourne, Australia, along with a research centre in Townsville, Australia. This program underpins Mainstream's production process through the supply of high quality juvenile Barramundi that demonstrate rapid growth, low growth variance, high fillet yield and disease resistance.

In particular, the aim of barramundi research undertaken at JCU is to gather baseline genetic data to aid advanced breeding programs for the species. Here the JCU/Mainstream partnership is estimating the genetic basis of commercially important traits, developing molecular genetic technologies to identify genetically superior broodfish for selection and understanding the genetic basis of sex change to better control sexual maturation.

Finfish Enterprise

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Finfish Enterprise Pty Ltd (Finfish) is a privately owned Australian company. Finfish aspires to become a leading producer and supplier of tropical marine finfish for the Australian and global markets. The Company has exclusive ownership of world class breeding technologies and is uniquely positioned to take advantage of the continued rising demand for food and shortage of natural fish production.

In October 2013, Finfish entered into a long term lease arrangement with the Queensland Government to operate the Northern Fisheries Centre (NFC) located in Cairns, Queensland. The NFC is a world class tropical marine finfish hatchery that breeds four species of fish from the Grouper family; Giant, Gold Spot, Tiger, and Coral Trout. Finfish is in the process of expanding the NFC to convert it from a pure research & development facility to one that is capable of commercial production. The production facility is unique in Australia and the south-east Asian region with Grouper broodstock maintained under full environmental control in recirculation tank systems. This level of control enables year-round spawning utilising existing technical expertise and innovation to maintain the consistent production of robust fingerlings.

Grouper larvae are difficult to raise and require highly specialised diets. The NFC is the only facility in Australia with mass culture technology for production of copepods and the technology to apply these to significantly increase larval survival. Finfish has extensive links with universities and research providers and is well equipped to address research priorities and to further enhance Intellectual Property. Accordingly, research and development continues on all four Grouper species.

Seafarms Group Limited

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Commencing in 2005, as Western Australian Resources Limited (WARL), the company's early history was in minerals exploration and identification of under-allocated and new water resources. In early 2011, WARL embarked on a new business direction to investigate opportunities for new water projects, agribusiness, food development projects and aquaculture. In 2012, having completed a concept study for the development of large-scale aquaculture systems in Australia, WARL's directors determined that several particular opportunities should be further analysed. Project Sea Dragon, a business opportunity to establish one of the world's largest prawn farms (10,000 ha) in northern Australia and that will produce 100,000 t of product annually, was subsequently initiated. As the first stage of Project Seadragon the company purchased Australia's largest prawn farm in Cardwell, Queensland, that of Seafarms.

With the recent acquisition of the Seafarms prawn farms and the Crystal Bay Prawns™ brand in Queensland, Seafarms is now also one of the largest aquaculture asset operators in Australia. Seafarms will continue to build upon this foundation and – with Australia poised on the doorstep of the world's largest aquatic protein demand growth – will continue to seek other opportunities in this re-emerging industry.

Seafarms Group is the major industry partner in the Federal Government's Australian Research Council's (ARC) Industrial Transformation Research Program titled *Unleashing the tiger - advanced breeding to transform prawn aquaculture*. This grant awarded to JCU as the lead institution is to the value of $5 million over five years. It will fund research and development that will lead to the most advanced selective breeding program for this important aquaculture species globally. As well as JCU and Seafarms Group, it also involves participants from the University of Sydney, CSIRO, Australian Genome Research Facility (AGRF), and Vlaams Instituut voor Biotechnologie (Ghent), Belguim. The project will develop and implement advanced genetic animal breeding technologies to produce prawns that grow faster, are tolerant to disease and that are more attractive to buyers.

It is the first time world-leading experts in aquaculture genetics, genomics, prawn husbandry and diseases, and terrestrial animal breeders, along with Australia's biggest genome sequence provider, the AGRF, have come together to identify prawns with elite characteristics using information within the prawn genome that will revolutionise the farmed black prawn sector. *Unleashing the tiger*, in association with plans to develop the world's largest prawn farm in northern Australia, will dramatically transform the aquaculture landscape and significantly contribute to Australia's food security and export earnings, and bring the Australian black tiger prawn aquaculture industry to the same knowledge base of many terrestrial livestock species, by defining the genetic architecture of the black tiger prawn genome and linking the genome to commercially important growth, disease and physiological traits.