



Northern Australia Aquaculture Industry Situational Analysis

Project A.1.1718119

Summary – Key Findings and DRAFT Recommendations

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Northern Australia Aquaculture Industry Situational Analysis
Summary of Key Findings and DRAFT Recommendations



Australian Government
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ACRONYMS AND ABBREVIATIONS

Acronym	Definition
ABFA	Australian Barramundi Farmers Association
APFA	Australian Prawn Farmers Association
CoOL	Country-of-Origin Labelling
CRCNA	Cooperative Research Centre for Developing Northern Australia
CSIRO	Commonwealth Scientific and Industrial Research Organisation
FRDC	Fisheries Research and Development Corporation
GVP	Gross Value Product
ILSC	Indigenous Land and Sea Corporation
IRG	Indigenous Reference Group, an advisory committee to the FRDC
JCU	James Cook University
OECD	Organisation for Economic Co-operation and Development
NA	Northern Australia
NAAI	Northern Australian aquaculture industry
NAC	National Aquaculture Council
NAIF	Northern Australia Infrastructure Facility
NATA	National Association of Testing Authorities
NT	Northern Territory
ONA	Office of Northern Australia
PPA	Pearl Producers Association
QLD	Queensland
ROI	Return on Investment
UTAS	University of Tasmania
WA	Western Australia
WSSV	White spot syndrome virus

1 PROJECT SCOPE

The overall objectives of the Cooperative Research Centre for Developing Northern Australia (CRCNA) Aquaculture Industry Situational Analysis Project (A.1.1718119) (as specified by the CRCNA) were to identify key challenges and opportunities facing the north Australian aquaculture sector, to explore potential solutions, and identify the most strategic research projects for further investment. The scope of the study included infrastructure, policy, investment, environmental, production, knowledge, training and human capital gaps.

2 KEY FINDINGS

The scale of the aquaculture opportunity is vast...

Northern Australia is massive: the opportunity for aquaculture is huge – but the development of the northern Australian aquaculture industry (NAAI) has, despite considerable confidence and rhetoric, largely failed to meet its potential or aspirations, particularly when compared and contrasted with the southern Australian industry (and international benchmarks).

The area defined as ‘northern Australia’ – the regions of Western Australia, the Northern Territory and Queensland above the Tropic of Capricorn comprises nearly 4.8 million km² of land (53% of Australia’s total land-mass) (NAIF, 2019).

Current annual Gross Value Product (GVP) (FY2016-17) from aquaculture in northern Australia was around \$223 million (adapted from ABARES, 2018) (c.f. the northern Australian beef industry which had a 2018 FY GVP of approximately \$5 B). It is constituted predominantly by the production of barramundi (33%), prawns (32%), and pearls (non-edible) 31%, with several other species (oysters, redclaw and other finfish) making up the remaining 3% of value.

In comparison, in FY2016-17 Australia’s entire aquaculture industry GVP was approx. \$1.35 B, of which southern aquaculture production (dominated by Tasmanian salmon, South Australian southern bluefin tuna and NSW, SA & Tasmanian oysters) constituted about \$1.12 B.

Vast areas of land suitable for land-based, marine pond aquaculture have been identified by CSIRO (Irvin et al 2018). CSIRO estimates that northern Australia has 9,500 ha and 225,000 ha of Class 1 land (i.e. suitable with negligible limitations) for marine farming in earthen and lined ponds, respectively. For freshwater farming, suitable areas were 3,000,000 ha for earthen and 13,000,000 ha for lined ponds. Further assessment is required on environmental and planning regulatory requirements for the land-based areas identified, including tenure and land access. For a sense of comparison in terms of the opportunity presented in northern Australia, the current Australian prawn farming industry utilises approximately 900 ha. (For comparison of national and global regions, see page 24.)

However, there has not been a similar comprehensive assessment of marine (coastal/offshore) sites potentially suitable for cage-based aquaculture.

A diverse and fragmented industry structure...

A review of the NAAI indicates that it is diverse, multi-sectoral, fragmented and dispersed. It has been slow-growing, particularly compared with southern Australia. Overall, its structure is predominated by small and medium-sized enterprises (SMEs) and family business producers, with large support sectors in Research Development and Extension (RD&E), and government service. The overall industry management, reflected in online survey responses, is comprised of mostly highly-educated middle-aged men, and Aboriginal and Torres Strait Islander people are poorly represented.

A survey sample indicated the industry is diverse (multi-sectoral) and fragmented and, compared to other industries, probably constitutes several separate and distinct sub-sectors: pearling, barramundi farming, prawn farming and ‘others’ (Table 1). The ‘others’ category comprised of several small emerging sectors or operations

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such as freshwater crayfish (redclaw and cherabin), other finfish (grouper and cobia), tropical oysters, and algae production all showing promise.

The 'industry' is geographically widely dispersed with limited operational concentration and is comprised of several species- and jurisdictional-based industry associations and representative bodies.

Growth of the NAAI over the last decade has been slow (particularly compared with southern Australian aquaculture) and has been derived primarily from new entrants and consolidations. Mergers/acquisitions have been uncommon, but their impacts on increased overall production volumes and GVP are demonstrably significant. There has been a contraction in the number of producers in most sectors, and considerable numbers of issued aquaculture licences are currently non-operational (87% in QLD). Industry consolidation is occurring and transition to large corporate operators has begun. This reflects a similar pathway to that of the Tasmanian salmon industry.

Table 1: The current structural profile of the northern Australia aquaculture industry, determined by 117 stakeholders responding to the online survey.

Sub-sector	Sub-sector/industry Profile	Player/Operator profile	Personnel profile
Producers	Diverse – constituted by separate and distinct species-based production sub-sectors: pearling, barramundi & prawn farming, and 'others'. 'Others' – comprised of a variety of smaller emerging industries such as freshwater crayfish (redclaw), tropical oysters, lobsters, other marine finfish (grouper and cobia), freshwater fish (jade perch, silver perch) and some algae production	Comprised of predominantly SME and family-business operators (< 40 employees) undertaking production of a range of species, and utilising a variety of culture systems	Predominantly male (>95%) with the majority mid- to late-age (>71% and less than 29% under age 40), mostly with a university degree (58%) or VET (19%) qualifications and more than 10 years' experience
Suppliers	Primarily specialist feed and equipment providers with some other agri-/technology generalists.	Comprised of a combination of small representative offices of large international suppliers (e.g. feeds and equipment) or SME businesses providing specialist services or products. Reported annual sales ranges of \$50,000 - \$1,200,000.	Predominantly male (70%) with the majority mid- to late-age (>70% and less than 30% under age 40), mostly (56%) without university degrees or VET qualifications, but had the majority (55%) with more than 10 years' aquaculture industry experience
Education/ Research & training providers	Large and diverse sector. Many institutions/ entities and people involved in the northern aquaculture industry	Several larger groups (e.g. JCU, CSIRO, and UTAS. Other government groups represented in 'Government agencies' (FRDC, State/NT, R&D agencies)	Predominantly male (66%) with the majority under 40 year of age (54%) and with 89% with university graduate or post-graduate qualifications, with more than 10 years' industry experience and involved in research and/or teaching
Government agencies	Large sector. Involved in policy, planning, regulation and economic development roles and R&D (included in Education/R&D providers above)	Comprised of WA, QLD and NT government agencies (and some Australian government agencies).	Predominantly male (69%) with the majority over 40 years of age (69%) and with 53% with university graduate or post-graduate qualifications and 38% with more than 10 years' industry experience
Aboriginal and Torres Strait Islander people	Poorly represented in industry overall.	Primarily represented in the Education/Research & training sector with some participants in Government agencies, and a few in the Producers sector. A few representatives in the Production Sector	Predominantly male (with limited data on gender, education and industry experience).

Factors inhibiting growth...

The growth of aquaculture development and operations in northern Australia have been inhibited or thwarted by a range of complex, multi-factorial, often negative synergistic hurdles.

Inhibiting factors for aquaculture development and operations in northern Australia have been: geographic, demographic and commercial challenges; lack of coordinated, science-based, aquaculture policy and implementation; and lack of clear and navigable regulatory pathways. Contributors to the geographic, demographic and commercial challenges are: the remoteness, low population (a common issue for all

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industries that do not have the financial capacity to build their own economies of scale, e.g. gas or iron ore), lack of local infrastructure, labour, services and consequent high costs of accessing/importing key inputs for the industry.

In terms of regulation, there is a lack of clear, open and navigable paths to aquaculture investment, development and operations. This has now been clarified in WA (DoF, 2016), and there are issues remaining in NT and QLD. However, many of these regulatory issues have not been purely aquaculture-specific. There is a lack of coordinated policy development and implementation which could alleviate many of the above hurdles, which persists despite considerable policy discussion (parliamentary inquiries, strategic and regulatory reviews). In addition, there has been inadequate implementation following review and assessment of policy and regulation, and no assessment of the effectiveness of reviews.

Specific barriers/issues identified by industry in surveys (most identified in previous studies) were:

- Lack of availability of **development areas, sites** (dependent on the selection criteria imposed, e.g. some designated areas have poor suitability for aquaculture production).
- **High environmental and regulatory hurdles** persist, despite the Productivity Commission (PC) 2016 findings that there is little evidence suggesting that regulations have systematically impeded the viability or growth of aquaculture businesses (for example, by preventing investment, experimentation and hence advancement in the key drivers of nutrition, fish and marine health, and genetics) (PC, 2016). The PC view was driven by data from Australia's overall aquaculture output growth rate over the past decade — underpinned by growth in salmon. The PC cites this growth as 'similar to those of the dominant producer countries in Asia; the growth rate in value terms was second only to Norway among OECD countries; and that the development of the industry has been shaped more by technological, geographic and other non-regulatory influences'. This is not the case for the northern Australia industry, which has experienced a different regulatory influence.
- Aquaculture is a relatively new agricultural industry and where there is discharge of water to the environment, this occurs at one point. This is different from traditional cropping, horticulture and grazing sectors that have a diffuse discharge of nutrients and sediments. The nature of point-source discharge and the proximity to marine protected areas (e.g. Great Barrier Reef Marine Park) means that the aquaculture industry has strict regulatory and legislative obligations, including **high environmental criteria on aquaculture developments and operations in northern Australia**. In Queensland, the introduction of no additional nutrient or sediment load release limits for new development in GBR catchments is a barrier to growth. The aquaculture industry is committed to sustainable production systems, effective regulatory frameworks, waste management, sustainable resource management and ecologically sustainable development (ABFA, APFA and PPA plans and key initiatives). Innovative technologies have been adopted by land-based farms for nil discharge and/or bioremediation of nutrients before water is discharged. This requires a large investment from producers in terms of infrastructure, technology and allocations of farm area for bioremediation (more than 50% of farm area in some instances). There is an apparent disconnect between scientific evidence, policy and regulation in aquaculture, particularly compared to those for other agricultural industries (Scaling Up Report- JSCNA, 2016). Further research is required to understand environment carrying capacities, nutrient assimilation capacity in discharge receiving environments, and aquaculture-environment interactions, which can be used to inform science-based policy (not yet implemented from Scaling Up report recommendations).
- **Harsh weather conditions** and climatic uncertainty. While the weather is largely stable and predictable in northern Australia, cyclones have an impact and the intensity of the wet is variable.
- **Remoteness** from other key requirements, in large part a function of industry scale (although close to potential markets in Asia).
- **Lack of local or regional infrastructure** to support aquaculture operations (roads, power, water, services, social infrastructure).
- High and increasing costs for **insurance**.
- **High costs** of key inputs, including: local inputs (labour, water, power - noting renewable options are available); transported/imported inputs (feed, power, labour, parts and services); and supply chain inputs (transport services/options and connectivity).
- A **shortage of skilled staff**, reflecting an overall national shortage for aquaculture, in addition to unavailability of local/regional skilled staff, and shortfalls in skills training and output. Access to skilled, senior personnel is affecting key parts of the industry now, particularly with difficulties and

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pressures from the (short-)term and conditions of visas. This could be turned to an advantage, with implemented changes, discussed below.

- Lack of historical industry success in **accessing capital**, related/contributing to a lack of understanding of aquaculture by lenders and the perceptions regarding industry's (in)ability to manage risk (e.g. disease, currency, labour).
- **Inability to access key markets** due to the lack of and/or high cost of the supply chain to market, and significant competitive pressure from imports.
- **Market competition** is characterised by considerable ambiguity around the origin of products in Australian seafood purchasing (at worst some misleading practices and at best, importers receiving high margins for imported seafood presented alongside Australian products). Historical campaigns for stronger Country of Origin Labelling (CoOL) regulation have not been successful in implementing changes which protect Australian prawn, barramundi and pearl farmers from ambiguous and misleading competitive practices (in contrast to arguments in the PC, 2016 report).
- The effective **loss of the exclusive use the word 'barramundi'** (an Australian Indigenous word) as a Geographical Indicator registrable for goods using the certification trademark system (i.e. that could only be used for Australian grown product) is a challenge for the barramundi industry.
- **Lack of coordinated policy development**, where human capital and environmental factors must be recognised, with deliberate action needed to address planning and implementation. Aquaculture planning should be in cooperation with other infrastructure planning, regional and population planning (migration and immigration), investment attraction (local and international) accompanied by vetting, facilitation and support.
- **Biosecurity and health** (discussed below)

Factors for successful aquaculture growth...

Reviews of successful aquaculture industry development elsewhere indicate the presence of both: (1) natural advantage (e.g. climate, environmental conditions, well-suited species); and (2) strategic commercial competitive advantages (usually several).

Addressing one or even several of the identified hurdles facing the NAAI will not be enough to change the current industry paradigm. Whilst northern Australia has many natural advantages, commercial capacity needs to be developed and built, which in turn provides a competitive advantage for a successful industry. Therefore, future development of an internationally competitive and thriving NAAI that meets the government/ industry aspirations for northern Australia will need strategic thinking and strategic investment in enabling infrastructure. In addition, strategic development planning (for aquaculture, economic infrastructure and social infrastructure) and implementation are required.

Biosecurity – a priority and major risk...

The current (and potentially expanded) industry in northern Australia is at risk from disease outbreaks caused by pathogens from endemic (existing and new) sources as well as exotic pathogens that are imported. Maintaining biosecurity is the key competitive advantage for most aquaculture species in NAAI. The clean, green and disease-free status are key points of differentiation to the same species products from an overseas (e.g. Asian) market source.

Current policy and technical capacity are barely adequate for the existing industry and are without significant capacity development, which is a substantial risk for the industry. There needs to be a clear understanding in language/policy regarding the difference and particular issues for management of operational disease/health management versus incursion of a new, exotic, potentially catastrophic disease outbreak.

The recent incursion of whitespot syndrome virus (WSSV) likely via uncooked prawns imported as a food product highlights the issues and risks. There are similar risks for barramundi (and other native fish) from imported seafood products that may carry exotic pathogens currently not found in Australia. Biosecurity screening provisions are not adequate to screen or prevent the entry of most of these pathogens.

The development of selectively bred, domesticated lines for the prawn, barramundi and other NAAI industries has been recognised as fundamental for sectors with aspirations to industrialise. The reliance on wild-caught broodstock for most sectors constitutes arguably the greatest biosecurity threat to those industries. Past

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attempts to develop 'industry cooperative' breeding programs have largely failed, and new approaches are needed to overcome historical issues and to implement workable programs for industry. Domestication and breeding are also important beyond 'health' and are significant factors in the broader economic efficiency of the industry and its major production sectors. There is potential to streamline provisions to amend the live import list to trial/access new pathogen-free species/strains to support broodstock access and breeding programs.

Substantial effort and cross-jurisdictional expenditure will be required to support regional operational health/disease management for an expanded northern aquaculture industry in addition to national/regional border surveillance/quarantine to protect the industry. Regionally based programs and facilities are needed for rapid response diagnostics. Northern Australia programs and facilities, with available capacity and capability, are needed for increased pathogen understanding, documented risks, and investigating transmission pathways. Practical and effective national border surveillance and detection needs to be implemented for an expanded NAA industry (with an option to consider field functions shared between the conventional border and quarantine control and Regional Land and Sea Ranger groups).

Industry must drive investment in incident readiness. An industry-wide response should offer/drive cross-jurisdiction harmonisation so far as the legislation and policy shall allow. Farms should have in place an enterprise-level biosecurity response plan, conduct regular drills and invest in farm staff as the first responders. Government and industry partnerships are key to maintaining a professional and effective response, and formalisation of this partnership is currently in consideration through the Aquatic Deed.

A major driver of the success of the Tasmanian salmon aquaculture industry was the biosecurity protocols it was able to implement. These included domestication and breeding programs (initially State-operated) but also, import restrictions imposed on fresh salmon products, which significantly afforded the emerging industry a substantial commercial advantage, by effectively protecting it from both exotic disease incursion and competition by (lower cost) imported salmon products. The prawn and barramundi farming industries have not had the benefits of similar domestic industry protective policies. The lack of traction with politicians on biosecurity (and other key industry issues) possibly points to ineffectual lobbying and influence, particularly in Canberra.

Other key findings...

Northern Australia has significant aquaculture opportunities and strengths in its species.

Northern Australian aquaculture is naturally suited to growing pearls, prawns and barramundi and as key species it is recommended that the industry continue to focus on these.

Nonetheless, there is considerable potential to expand the opportunities for tropical oysters, freshwater crayfish, grouper, sea cucumber, algae and tropical lobsters as new/emerging key culture species. There is also a species 'portfolio gap' in Australian aquaculture – a high volume production, low-cost (low-trophic level), (possibly) freshwater, white fish fillet product to service lower value domestic markets (and potentially exports). It is recommended that these opportunities should be reviewed and if feasible, pursued.

Government-developed 'aquaculture zones' have been successful in creating significant new aquaculture development in northern Australia (and elsewhere).

In Western Australia, the Kimberley Aquaculture Development Zone (KADZ) and, south of the northern Australia boundary, the Mid West Aquaculture Zone (MWADZ) are established. The Queensland government also announced Aquaculture Development Areas (ADAs) in 2019. Zones also exist in South Australia and Tasmania. However, better site assessment protocols and ground-truthing pre zoning would improve zone uptake and benefits. Infrastructure development in 'hubs', to support utilisation of defined aquaculture zones, is a recommendation of the project to further stimulate industry uptake.

Other potential commercial competitive advantages in northern Australia, which could be exploited, were identified and discussed by industry members.

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Potential competitive advantages include:

- **Renewable energy.** Electricity is a major input cost of aquaculture (particularly land-based pond operations). Renewable generation offers the potential for northern Australian aquaculture to lower cost and achieve greater self-sufficiency/reliability than grid-connected supply. It offers a lower carbon footprint, which in turn delivers a considerable marketing/provenance selling point for products. There is potential for aquaculture operations to be developed around a renewable generation 'hub' or transmission line, or micro-grid/distributed generation model.
- **Collective purchasing of electricity.** There are some opportunities (especially in Queensland) for closely located aquaculture farmers to 'aggregate' their individual demand and collectively purchase electricity at significantly lower tariffs.
- **Development of key airport/seaport hub infrastructure** could provide competitive exports. Despite the presence of many regional and major city airports across northern Australia, very few have international freight export capabilities.
- **A transport subsidy scheme** (road/air) for key 'hubs' may be viable and provide cost competitiveness for Australian aquaculture produced seafood. A transport subsidy scheme exists for Tasmania.
- **Changes in biosecurity risk assessment and stricter provisions** to restrict importations of certain raw/uncooked/untreated seafood products could substantially lower the risk of disease transfer to the Australian environment and farming operations and provide a business advantage at multiple levels.
- **Opportunity to establish improved access to skilled staff.** An advantage could be achieved with potential changes to the system such as: changes to the 189 visas allowing for longer terms and more specialised (aquaculture) skill categories; more opportunities for specialised business migration; and opportunities for semi- and unskilled worker regional migration programs (specifically to support aquaculture). In addition, aquaculture management training and education provision could be enhanced. Training, pathway and mentoring schemes should be established for Aboriginal and Torres Strait Islander people to underpin engagement with aquaculture.
- **Country of Origin Labelling (CoOL),** whether legislated or broadly implemented on a voluntary basis, would allow informed choice for Australian consumers and could bring a competitive market advantage.
- **Australian, northern Australian and Indigenous branding** was suggested as an important component of addressing market development and access, that would provide unique advantages for NAAI.

A detailed Literature Review of northern Australian aquaculture was undertaken for the project covering the historical R&D (including species biology and culture, systems, and product/market development), Indigenous aquaculture, biosecurity, as well as a compilation of government reviews, policy development and implementation strategies, plans and initiatives.

R&D support is a major strategic advantage for the Australian aquaculture industry and its future advancement. In 2018-19, our survey revealed researchers were engaged in up to 74 active research projects across northern Australia (noting some may be reported by more than one respondent). The projects were predominantly focussed on the key marine or estuarine species of pearl oysters, prawns, rock oysters and barramundi. Most were funded by government (56%) and industry (26%), with durations of 2 – 5 years, and had values of \$1 – 5 M (36%), with several projects valued at \$6 -10 M or above \$10 M.

RD&E funding of northern Australian aquaculture has probably had lower benefit/cost outcomes than southern aquaculture.

Capacity issues were identified in relation to increasing the number and scope of research projects to meet the current and expanding industry needs. Ongoing RD&E for the northern Australian industry needs to be relevant, focussed, cooperative and largely 'applied and readily applicable' to industry. There were opportunities identified for additional research positions for in-demand research areas (e.g. aquatic animal health), and start-up and RD&E 'incubators/accelerators'.

Aquaculture business opportunities for Aboriginal and Torres Strait Islander peoples are at research and pilot production scale with support from government agencies, consultants and private investors.

It is imperative that we learn from past experience with Indigenous aquaculture and avoid issues of attempting technically challenging, or new unproven species, without cultural alignment of these ventures, and projects

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must be well-resourced with local capacity building. Aboriginal and Torres Strait Islander people shared their vision for unique, Indigenous branded aquaculture products and business that provide for employment and positive economic outcomes for our first nations people.

Expansion and growth of the industry is likely to be hindered by shortages of labour volume and key skill capabilities.

There is already a current undersupply of skilled personnel (particularly in the technical/VET skills and senior management areas. Data collected from this project indicates a need for skilled personnel to fill **at least 1,400 additional jobs** in aquaculture in northern Australia by 2030.

Skills shortage issues are currently (and will potentially continue to be) exacerbated by small regional populations and the inability to locally source skills. Difficulties in attracting and retaining new skilled staff to live and work in northern Australia (due to actual/perceived inadequacy of social infrastructure and liveability), and/or hiring skilled staff from overseas (due to issues with visa conditions and term of employment).

Stakeholders suggested that a re-evaluation of the attitude to foreign nationals being farm labour may be needed. In some cases, there might be a choice available to recruit from overseas or from locally sourced labour. However, in most locations in northern Australia, there are high rates of unemployment, and the reality remains that many people are either unable to understand what the aquaculture labour market may offer or unwilling to do that type of work.

Existing systems are in place to assess the national skills needs in aquaculture, e.g. through the Aquaculture and Wild Catch Industry Reference Committee, and jurisdiction industry reviews. A recent review of the aquaculture vocational qualifications resulted in revised qualifications and skills standards, approved in June 2019 (Skills Impact, 2019). Development and delivery of sector-specific content, aligned to the revised training package, is ongoing.

A Scenario Planning exercise was undertaken for this project to predict what the industry for northern Australia may look like in 2030 and to stimulate industry discussion on the pathways and barriers to achieving the industry and government's aspirations.

Four possible future Scenarios for the northern Australian aquaculture industry were developed. The two 'worst-case/low-aspiration scenarios (the 'Dry' and 'Shower') were regarded as having lower probability/plausibility than the two better/best-case scenarios ('Storm' & 'Monsoon'). This is primarily because current indications are that the industry, within the timeframe of the last year (2018-19), has commenced changes and development that should align with the trajectory for the Storm scenario and potentially into the Monsoon scenario.

The 'Storm' scenario – describes a future where the northern Australian industry has successfully achieved expansion and increased production volumes, eliminating the restrictive issues across the region and industry (and within sectors). However, the industry has not improved all drivers, and this has caused some investment reluctance for upscaling in parts of northern Australia. The result of this growth is a northern Australian aquaculture industry with a 2030 GVP around \$534 M.

'Monsoon' – is the best-case scenario and describes a future where the northern Australian aquaculture industry has reached its 2030 vision(s). This is a ripple effect of a choice the industry made to collaborate to solve the key issues enabling the overall industry and key sectors to significantly expand and become very successful. This, combined with good RD&E and production outcomes, strong marketing efforts and an increase in global demand, has resulted in approximately 5 times the production volume from the northern Australian aquaculture industry. This represents a 2030 GVP in the range of \$1.33 B via the production of 56,600 tonnes of fish, prawns and other seafood products as well as substantial volumes of premium pearls.

2.1 INDUSTRY VISION 2030 - DRAFT

A draft northern Australia aquaculture industry Vision 2030 was developed to support its Monsoon aspirations, based on the implementation of the Key Recommendations.

"In 2030, northern Australian aquaculture will be a nationally significant (\$1b a year GVP), cohesive, sustainable, respected industry, providing premium products to Australian and international markets, that contributes to the prosperity and diversification of regional and Indigenous communities across the north."

2.2 STRATEGIC RECOMMENDATIONS (7) - DRAFT

Table 2 provides a summary of seven proposed strategic recommendations originating from the situational analysis review of related literature and extensive industry feedback provided through the online survey, focus groups, workshops, Scenario Analysis, and videoconference engagement. These were refined following the project videoconference and other feedback in November-December 2019. The project is seeking feedback on these recommendations in January 2020, prior to the end-of-project workshop in February 2020, and stakeholder contributions will be included in the final version of recommendations in the final report (submission to CRCNA in February 2020).

2.2.1 Recommendation 1. Bolster Biosecurity

Industry stakeholders prioritised bolstered biosecurity as the primary project recommendation. This recommendation covers at-the-border, regional and enterprise-level biosecurity needs to prevent pathogen incursion, to manage disease outbreaks, and control loss of production efficiency. The recommendation includes:

- Review of policy and meeting the requirements for improved risk assessments and R&D programs to better understand biosecurity risk and management at the border.
- Increased pathogen understanding, documented risks, transmission pathways, and practical surveillance implemented for the aquaculture industry in northern Australia.
- Establish the most effective structures to develop high health lines for key production species.

At a national level, AQUAPLAN 2014-2019 (DAWR, 2014) has progressed activities to support aquatic biosecurity, and the intent of the recommendation is to highlight areas of importance to the NAAI that are incomplete or not yet meeting the industry needs in NA. Resolution of the Aquatic Deed would bring more certainty to pathways forward for government and industry. Animal Health Australia, the proposed custodian of the Deed, is currently developing a value proposition canvas for presentation to aquaculture sectors.

High health lines are included here as a key component of biosecure production systems, acknowledging that the value of these lines also contributes to the capacity for selective breeding programs, and resultant improvement in production performance. Given past challenges to establishing domesticated high health lines, a proposed option is a new 'cooperative' model led by government(s)/CSIRO and with the involvement of industry (via key industry players and possibly whole of industry arrangements) (e.g. Stephens, 2019).

2.2.2 Recommendation 2. Facilitate infrastructure development for key Aquaculture Development Hubs

The establishment of aquaculture development areas and zones by governments has provided an important stimulus to industry development. However, to capture the opportunity that these areas provide, key infrastructure and support services in key locations are critical for industry growth in northern Australia. Hubs are proposed to support the full development (realisation) of established aquaculture development areas (where these suit species' production requirements) not as a mechanism to allocate new areas at this stage. Hubs should be developed to gain maximum leverage of infrastructure investment, for aquaculture and other industry sectors, with finance and funding schemes such as NAIF, contributing to: electricity supply; air, road and sea transport; feed mills or local feed storage. Hubs would align supply chain logistics, industrial inputs, land-based support for offshore operations, labour, community and social needs, training and research facilities. Hub development also aligns with the social goals of community development in remote and regional locations (Infrastructure Australia, 2019).

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Table 2: Potential candidate locations for infrastructure and service provision at Aquaculture Development Hubs in northern Australia.

Region	Key City/towns	Aquaculture Industry	Electricity	Airport	Other transport/services
Gascoyne	Carnarvon, Shark Bay and Exmouth	Rock Oysters Prawns (Exmouth Seafarms breeding centre) Pearl Oysters		Carnarvon Learmonth	Cool chain vegetables in Gascoyne Horticulture zone from Carnarvon to Perth
Pilbara	Karratha	Rock Oysters	Solar Hub	Karratha	Heavy shipping ex Dampier and Port Hedland Marina facilities in Dampier
West Kimberley	Broome, Derby	Paspaley, Cygnet Bay, Willie Creek – Pearls Marine Produce Australia – Barramundi Aarli Mayi – Barramundi Tropical Oysters – Maxima Opportunity Emama Nguda – Cherabin Broome Tropical Aquaculture Park – DPIRD Yawuru Aquaculture North West Regional TAFE Broome – Training, R&D New hatchery development New marine growout sites – (more accessible via One Arm Point road (and jetty)) Land-based growout sites	Solar Hub	Curtin air base (international potential) Broome domestic	Cold chain storage (servicing aquaculture, beef, horticulture) – Curtin airport Dampier Peninsula– Road (completion) and One Arm Point – potential for jetty development Industry equipment fabrication, repairs & maintenance North West Regional TAFE Broome – local education and training DPIRD BTAP offers significantly underutilised infrastructure Universities – dedicated local R&D Integration with tourism industry
East Kimberley	Kununurra	Project Sea Dragon Prawns FW fish culture (Lake Argyle) – 10000T aquaculture industry development plan was done for Lake Argyle in 1999-2000. Could be refreshed for other species – (e.g. Silver Cobbler) to meet the portfolio gap.	Pacific Hydro – Lake Argyle Dam Ord scheme	East Kimberley Regional Airport Kununurra	Supply chain for horticulture product to Darwin and eastern states. Wyndham Port
Northern Territory	Darwin (Legune/Kununurra)	Humpty Doo – barramundi DAC – Indigenous groups – TROs Seafarms (Project Sea Dragon) – prawns Other (historical) – prawns/barramundi Large areas for new potential marine and coastal onshore development Darwin Aquaculture Centre (DAC) – hatcheries, R&D	Solar hub (integration with new proposed solar gen-distribute projects) – aggregated demand New gas-fired opportunities	Darwin – (internat. expansion) - integrated road logistics and cold storage facilities	Cold chain storage (servicing aquaculture, beef, horticulture) – Darwin airport Road Transport hub? Logistics/transport subsidy Industry equipment fabrication, repairs & maintenance CDU/TAFE – local education and training CDU – dedicated local R&D Integration with tourism industry Feed inputs growing
Mid-north QLD tropics	Townsville (TSV) – Rockhampton (ROK) Cities of Townsville, Burdekin, Whitsunday, Mackay/ Rockhampton	Tassal – prawns Ornatas – lobsters Spring Creek - barramundi PB/PRF – prawns, cobia GFB – barramundi Australian Prawn Farms (APF) Australian Crayfish Hatcheries – redclaw JCU/CQU/TAFE – training & R&D New QLD ADAs (large areas for new development) Mackay Airport Other airports	Solar hub (integration with new proposed solar gen-distribute projects) – aggregated demand New gas-fired opportunities	Townsville – some current internat. ROK – some current internat. Whitsunday – capacity for international	ROK – currently undertaking feasibility for integrated airport cold-store facilities Industry equipment fabrication, repairs & maintenance JCU/CQU/TAFE – local education and training JCU/CQU – dedicated local R&D Integration with tourism industry Feed inputs growing
Far north QLD/Gilbert River/Cape		Seafarms Valverde – redclaw (Atherton) IFED development (stalled) – redclaw CSIRO-identified high-potential site for FW culture systems Gulf and Western Cape York coast – potential for high-quality sites Indigenous interest Rio Tinto (Weipa)	Solar hub Renewable biomass fired opportunities	Cairns export hub Mt Isa Weipa	Needs key road links developed to larger regional service towns (Cairns, Mt Isa) Industry equipment fabrication, repairs & maintenance JCU/CQU/TAFE – local education and training JCU/CQU – dedicated local R&D Integration with tourism industry Feed inputs growing

Hubs may provide infrastructure for remote production (in designated zones or ADAs) or be clusters of production operations in a development area. Whilst licencing requirements are established to protect the surrounding environment, where multiple farms are located together there is an opportunity to share bioremediation infrastructure. Environment monitoring should be implemented to avoid any potential cumulative impact of intensive or large-scale development.

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2.2.3 Recommendation 3. Market Development and Access

In a phase of industry expansion, the stakeholders have prioritised market development and access in order to understand the potential impact of higher production volumes and to inform market strategy. Activities suggested include improved access to seafood trade data, and understanding of domestic and international markets. Exploration of international market opportunities may be enhanced by trade delegations to potential international markets. Additional R&D is required for sector and enterprise branding, provenance, online sales, and the application of blockchain. To strengthen the demand for northern Australian aquaculture products, there is a need for further lobbying for CoOL in seafood in conjunction with enhanced consumer awareness campaigns.

2.2.4 Recommendation 4. Build skills to meet industry growth needs

In association with the projected growth of industry to 2030, an additional 1,430 – 2,340 new jobs will be established in NA. The range in labour estimates accounts for efficiencies of scale and/or the adoption of technology that may reduce staff per tonne of production (lower value) and business-as-usual labour requirements per tonne. The recommendation suggests improvements in the existing aquaculture education and training system, increased industry input to and monitoring of education/training delivered, mechanisms to attract more people to the sector, pathways for engagement of Aboriginal and Torres Strait Islander people, and the need to enhance the skilled migrant worker visa conditions and programs.

2.2.5 Recommendation 5. Build the Northern Australia aquaculture industry as a means for Indigenous economic development and independence

Indigenous Australians are responsible for managing 45% of the land and sea country in northern Australia. There are multiple avenues for Indigenous communities to engage with aquaculture. An important step is understanding if a community is interested and the communication of what an aquaculture business is, how it works, and how they might want to be involved. This involves engaging communities and developing sensible and realistic business concepts that deal with biology, business and culture constraints. Previous projects have established that a long-term commitment and positive organisational relationships are required to develop successful Indigenous agri-business opportunities. Business and community governance must be in place and suited to an aquaculture enterprise to achieve success. The recommendation provides potential pathways and options for Aboriginal and Torres Strait Islander engagement, including: investors in projects; owners and managers; venture partners; supply-chain partners; and a local workforce.

2.2.6 Recommendation 6. Match and target RD&E to key industry needs and outcomes

RD&E for the NAAI should be aligned with the National Aquaculture Strategy 2017 (DAWR, 2017), the National Fishing and Aquaculture Research, Development and Extension Strategy 2016 (FRDC, 2016), the FRDC RD&E Plan 2015-20 (FRDC, 2015) (the FRDC 2020-25 Plan when complete), and existing industry association and State/Territory plans. For northern Australia, the recommendation focusses on increased collaboration across sectors and jurisdictions, improved extension (translation) of research, and evaluation of RD&E to ensure benefit (e.g. improved production efficiency on-farm).

2.2.7 Recommendation 7. Stronger and adaptive governance of the northern Australian aquaculture industry

In order to achieve the industry Vision 2030, and capture the opportunities in northern Australia, enhanced and adaptive governance is required. The intent of the recommendation to streamline processes for new aquaculture development, leverage opportunities across jurisdictions and sectors, and provide a stronger voice to policy-makers in southern Australia. The proposed recommendation is that the Minister for Northern Australia establishes a body charged with the development of aquaculture in northern Australia. The role of such a body would be to:

- ensure co-ordination between Commonwealth agencies and between jurisdictions
- identify priorities for Government investment, taking into account efficiencies and opportunities arising from scale, co-location, coordination and existing facilities and infrastructure
- identify actions that would increase participation by and create business and economic opportunities for Aboriginal and Torres Strait Islander people in the northern Australian aquaculture industries

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- liaise with industry to understand industry priorities and encourage private sector investment
- over-see the implementation of the CRCNA aquaculture industry situational analysis project recommendations.

Stakeholder engagement suggests the established industry associations for key species in NA (ABFA, APFA and PPA) and the National Aquaculture Council (NAC) will continue to provide input on issues important in the north, for example: skills needs; aquaculture policy and regulation; biosecurity; CoOL; prioritised RD&E; aquaculture reputation; and community engagement. FRDC maintains a leading role in developing RD&E priorities across Australia, working through Industry Partnership Agreements, jurisdiction Research Advisory Committees and a Northern Hub for research leads.

There was discussion among stakeholders in 2016, regarding the idea to develop the Australian Tropical Aquaculture Alliance (ATAA). The concept was that this group would be a 'coalition of the willing' of stakeholders from aquaculture sectors (industry, government, research and education providers) in relation to all issues that included development, training, and skills across northern Australia. This structure may be useful to revisit as a potential group to drive/develop components of recommendations.

2.2.8 Estimated cost of implementation

The proposed recommendations and potential pathways (action steps) remain to be endorsed by industry stakeholders. Based on preliminary estimates of stakeholders (December 2019 videoconference), the required government investment in the recommendations would be at least \$90 million, and much higher if partner leveraged funds and private investor capital were included.

Agreement on final recommendation pathways is needed before economic estimates can be made.

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Table 3: Summary of DRAFT strategic recommendations of the Northern Australia Aquaculture Industry Situational Analysis

Key priority actions for sector development	Potential action owner (not yet identified) and potential key partners	Potential pathways to implementation and timeline	Intended industry impacts
<p>1. <u>Bolster Biosecurity</u></p> <p>The proposed recommendation is to bolster aquaculture biosecurity through:</p> <ul style="list-style-type: none"> review of policy and meeting the requirements for improved risk assessments and R&D programs to better understand biosecurity risk and management at the border increased pathogen understanding, documented risks, transmission pathways, and practical surveillance implemented for the aquaculture industry in northern Australia establishment of the most effective structures to develop high health lines for key production species. 	<p>Commonwealth Department of Agriculture</p> <p>State and territory responsible departments and agencies</p> <p>Industry</p> <p>Animal Health Australia</p> <p>FRDC, Aquatic Animal Health Subprogram</p> <p>Australian Animal Health Laboratory, CSIRO, Victoria</p> <p>Universities</p> <p>Diagnostic laboratories</p> <p>Veterinary service providers</p>	<p><u>Policy</u></p> <ul style="list-style-type: none"> Resolution of Aquatic Deed Implement existing sector biosecurity plans and complete plans for other NA sectors Improve the working relationship between producers and agencies Support sector-specific biosecurity plan writing for NA enterprises Complete emergency response drills R&D to better understand biosecurity risk and threats from imports Commence R&D on transmission pathways Review policy and risk assessment with clear government – industry communication Implement accountability measures Review biosecurity architecture aligned with NA industry growth <p><u>Pathogen understanding & surveillance</u></p> <ul style="list-style-type: none"> Prioritise tests not currently available in NA for timely diagnostics – on-farm and NATA-accredited labs New co-funded positions to establish diagnostics in NA Develop ‘farm guides’ for early identification and implement monitoring Integration of land and sea Rangers in surveillance and monitoring <p><u>High health lines for key species</u></p> <ul style="list-style-type: none"> Determine best (cooperative) model for high health, domesticated lines of key species (e.g. prawns, barramundi, pearls, oysters) Establish high health lines Potential to streamline provisions to amend the live import list to trial/access pathogen-free strains 	<ul style="list-style-type: none"> Protection of ~\$223 million industry from a species sector or regional sector collapse, underpinning expansion to \$1.3 billion GVP by 2030, and protecting between 1,950 and 2,860 jobs Improved understanding of biosecurity risks Research to support appropriate science-based policy responses to manage the risk conservatively Increased productivity per ha of an estimated 10%, of all aquaculture sectors in northern Australia with a value of at least \$100 million p.a. by 2030 Reduced cost of production High health lines as a foundation to selective breeding programs Reduced risk of disease outbreak, with results available in time to give farm managers time to respond to identified pathogens Knowledge of the impact of chronic health challenges caused by endemic pathogens on-farm, linking pathogen prevalence with pond or tank productivity, leading to informed decision making by managers
<p>2. <u>Facilitate infrastructure development for key Aquaculture Development Hubs</u></p>	<p>Office of Northern Australia</p> <p>Infrastructure Australia</p>	<ul style="list-style-type: none"> Obtain funding for master-planning, aligned with developing NA initiatives and existing development 	<ul style="list-style-type: none"> Meet industry infrastructure requirements by co-development of

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<p>The proposed recommendation is to facilitate infrastructure development for key Aquaculture Development Hubs in northern Australia.</p>	<p>Northern Australia Infrastructure Facility</p> <p>Commonwealth Department of Agriculture</p> <p>State and territory responsible departments and agencies</p> <p>Regional development agencies</p> <p>Local government</p> <p>Industry</p> <p>Investors</p> <p>Consultants</p>	<ul style="list-style-type: none"> ▪ Include Traditional Owners in Hub planning ▪ Clearly identify and prioritise infrastructure, supply chain, and service gaps and synergies for each region to inform Hub location ▪ Decide on the optimum number of Hubs ▪ Gauge political appetite to agree on at least one Hub site per high growth region, target three (3) agreed in 2020 ▪ Develop costed feasibility and investment models to attract funding and investors ▪ Identify Hubs, user groups, and allocate development responsibility ▪ Establish the Hub infrastructure, that may include State/Territory owned assets ▪ Monitor the uptake of greenfield aquaculture areas associated with Hub investment ▪ For at least one greenfield site – undertake technical studies, site and biological assessments, establish zone specific policies ▪ Promote Hubs and monitor uptake and business/production efficiency ▪ Environment monitoring and review of Hubs associated with production ▪ Establish value-add processing facilities ▪ Engage with RD&E to address any identified impediments ▪ Engage incubators for new aquaculture businesses ▪ Benchmark hub outcomes and review next phase of development 	<p>sites/hubs for maximum benefit and investment leverage</p> <ul style="list-style-type: none"> ▪ Improved supply chain logistics (electricity, air/road/sea freight, feeds) ▪ Establish increased capacity in the cold and perishable supply chains in northern Australia to allow the increased volume of production (from ~11,000 tonnes 2016-17 to over 56,000 tonnes in 2030) to reach domestic markets and to open up new export markets. ▪ Leverage or build an area/zone providing community benefits (labour, social, remote, Indigenous) ▪ Alignment with education, training and RD&E providers and facilities ▪ Aquaculture industry engaged in prosperous and diverse regional and Indigenous communities
<p>3. <u>Market Development and Access</u></p> <p>The proposed recommendation is to support the northern Australia aquaculture industry in market development and access (domestic and international).</p>	<p>Industry</p> <p>Consultants</p> <p>Universities</p> <p>Austrade</p> <p>Industry associations</p>	<ul style="list-style-type: none"> ▪ Define data and analysis needs for seafood trade and market data for key production species ▪ Understand consumer trends and future needs ▪ Economic analysis of the potential impact of higher product volumes, to inform sector market strategy ▪ Undertake trade delegations to potential international markets ▪ Develop sector branding 	<ul style="list-style-type: none"> ▪ Secure consumer demand for NA aquaculture products ▪ Established and expanded domestic market to match the increased product supply ▪ Established international export market(s) for at least one species ▪ Profitable and growing aquaculture sector, achieving expansion to \$1.3 billion GVP by 2030 ▪ Value-added products developed

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		<ul style="list-style-type: none"> ▪ R&D to establish tools to determine provenance ▪ Promote CoOL in seafood – add the northern Australian voice to the national campaign ▪ R&D on online seafood sales strategies ▪ Investigate the application of blockchain in NA seafood sales ▪ Enhanced consumer awareness campaigns ▪ Product development and value-add opportunities 	<ul style="list-style-type: none"> ▪ Sector and Indigenous aquaculture brands established
<p>4. <u>Build skills to meet industry growth needs</u></p> <p>The proposed recommendation is to build skills to meet industry growth needs in the northern Australia aquaculture industry.</p> <p>Meet the gap in skilled personnel to fill at least 1,400 new jobs in aquaculture in northern Australia by 2030.</p> <p>Retain skilled staff in northern Australia.</p>	<p>Commonwealth government departments and agencies</p> <p>State and territory government departments and agencies</p> <p>Australian Industry and Skills Committee</p> <p>Aquaculture and Wild Catch Industry Reference Committee</p> <p>Skills Impact (Skills Service Organisation)</p> <p>Universities</p> <p>TAFEs (VET)</p> <p>CSIRO</p> <p>Regional Jobs Committees (QLD)</p> <p>Regional Development Authorities</p> <p>Indigenous Reference Group for Developing Northern Australia</p> <p>Government – Indigenous agencies</p> <p>Industry associations and individual producer and supplier companies</p> <p>Regional Councils</p> <p>Regional schools</p>	<ul style="list-style-type: none"> ▪ Engage with Skills Australia and responsible government agencies on the critical immediate issues and emerging staff need for the aquaculture industry in NA ▪ Discussion leading to improvement of the skilled worker visa conditions and programs to better facilitate skilled migrant employment to fill the current gap in skilled personnel, especially in the short-term (2020-2024) ▪ Coordinate, boost and resource available training ▪ Align training with business needs and monitor progress ▪ Address inter-jurisdictional barriers, e.g. some State/NT subsidies for VET training are only available for residents of a State working in that State ▪ Include professional development training for current staff to foster career progression ▪ Develop industry-tailored training (e.g. VET-industry collaborative training centres and/or on-farm) ▪ Increase the number of qualified VET trainers (RTOs) ▪ Enhance innovation and entrepreneurship skills in aquaculture curricula ▪ Increase technology skills training, with a view to more automation ▪ Improve the image of sustainable aquaculture, through ‘career opportunity’ campaigns to attract new 	<ul style="list-style-type: none"> ▪ At least 1,400 additional skilled personnel available for the northern Australia aquaculture industry to enable achievement of projected production of \$1.3 billion GVP by 2030 ▪ Skilled staff who value the aquaculture industry and community in northern Australia ▪ Revised curricula endorsed by industry

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		<p>people to the sector – include celebrity endorsement</p> <ul style="list-style-type: none"> ▪ Industry funded prizes/traineeships/scholarships for schools, VET and university ▪ Increase training engagement (enrolments) and promote aquaculture career pathways, from secondary education, for Australians committed to living and working in northern Australia ▪ Establish demonstration farms for training (could be aligned with Hubs) ▪ Establish appropriate models of training and mentoring for Indigenous Australians ▪ Establish international exchanges for NA aquaculture trainees/students/staff professional development 	
<p>5. <u>Build the northern Australia aquaculture industry as a means for Indigenous economic development and independence</u></p> <p>The proposed recommendation is to build the northern Australia aquaculture industry as a means for Indigenous economic development and independence.</p>	<p>Indigenous Reference Group for Developing Northern Australia</p> <p>FRDC’s Indigenous Reference Group</p> <p>Torres Strait Regional Authority</p> <p>North Australia Indigenous Land and Sea Management Alliance</p> <p>Indigenous Land and Sea Corporation</p> <p>Aboriginal and Torres Strait Islander Corporations and Land Councils</p> <p>Industry</p>	<ul style="list-style-type: none"> ▪ Invest in existing programs of research and pilot-scale aquaculture ventures to maintain long-term development, relationship, mentoring and support ▪ Address tenure, and establish/partner with appropriate business governance models and economic frameworks ▪ Facilitate connection between aspiring Indigenous groups and existing business ▪ Build the capacity and availability of mentors in government agencies and service providers ▪ Incentivise industry involvement in indigenous development/mutually beneficial partnerships that are long-term ▪ Undertake feasibility studies and invest in economically viable opportunities ▪ Education and awareness opportunities ▪ Indigenous equity mobilisation and deployment ▪ Prototype projects, ventures and corporations ▪ Share aquaculture business stories and learn from past experiences 	<ul style="list-style-type: none"> ▪ Successful deadly businesses established, supported to grow and enabled to employ more people ▪ Aboriginal and Torres Strait Islander engaged in and positive about aquaculture in northern Australia

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		<ul style="list-style-type: none"> ▪ Mentoring among Indigenous business to encourage new Aboriginal and Torres Strait Islander groups to engage ▪ Supply decision support tools for Aboriginal Corporation boards and an “Aquaculture Business development toolbox” ▪ Integration with Aquaculture Development Hubs (e.g. training, establishment of microbusinesses, employment) ▪ Support community champions and drivers ▪ Scholarships for Indigenous students ▪ Align ventures with cultural needs and community definition of success ▪ Investigate the feasibility of microfinancing to support small business establishment ▪ Support projects with continued engagement and emphasis on handover of operations to Indigenous partners/owners while still supporting as appropriate in the transition phase ▪ Support Indigenous branding, certification and provenance 	
<p>6. <u>Match and target RD&E to key industry needs and outcomes</u></p> <p>The proposed recommendation is that RD&E is focussed on industry outcomes, and is aligned with the National Aquaculture Strategy 2017, the FRDC RD&E Plan 2015-20, the FRDC RD&E Plan 2020-25 Plan (when complete), and jurisdiction and industry association plans.</p>	<p>CRCNA</p> <p>FRDC</p> <p>Commonwealth Department of Agriculture</p> <p>State and territory responsible departments and agencies</p> <p>Industry</p> <p>CRCNA’s Aquaculture Advisory Group (government and industry represented)</p> <p>CSIRO</p> <p>Universities</p> <p>Consultants</p>	<ul style="list-style-type: none"> ▪ Clearly define the budget available for NAAI RD&E from CRCNA and FRDC ▪ Call for applied RD&E for the NAAI in alignment with the National Aquaculture Strategy 2017, the FRDC RD&E Plan 2015-20 (the 2020-25 Plan when complete), and existing jurisdiction and industry association plans ▪ Encourage industry collaboration and knowledge sharing ▪ Capture opportunities in cross-sector and cross-jurisdiction RD&E ▪ Strengthen government extension capabilities and build extension into all projects ▪ Enhance R&D provider-industry collaboration to improve ROI ▪ Collaborate with other agriculture industries (e.g. common technology) ▪ Establish RD&E grant accessibility at different scales – laboratory, on-farm, start-ups, pilot, commercial upscaling 	<ul style="list-style-type: none"> ▪ Research aligned to industry needs and delivering value for investment ▪ Limiting bottlenecks to new investment and expansion, to support a 5-fold increase in production by 2030, providing an additional value of \$1.1 billion GVP, 1,400 jobs, and associated economic indirect benefits for regional Australia ▪ Rapid adoption of innovative technologies across a broad geographical area, estimated at 10% improved productivity of all aquaculture sectors in northern Australia with a value of at least \$100 million p.a. by 2030 ▪ Enhanced reputation of northern Australia through industry-relevant research excellence that attracts researchers to move and work there

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		<ul style="list-style-type: none"> ▪ Establish research infrastructure suitable for modern, tropical and remote aquaculture needs ▪ Engage the Startup community ▪ Incentivise and increase fluidity between researchers and industry ▪ Ongoing review of ROI on research investment ▪ RD&E themes include: <ul style="list-style-type: none"> • Species/biological/systems • Health/biosecurity/disease • Breeding and genetics • Environment – aquaculture interactions (including water quality, nutrient bioremediation, wildlife) • Technology (including remote monitoring and management with supporting telecommunications infrastructure; automation) • Post-harvest and value-adding • Markets, provenance and supply-chains • Commercial 	
<p>7. <u>Stronger and adaptive governance of the northern Australian aquaculture industry</u></p> <p>The proposed recommendation is that the Minister for Northern Australia establishes a body charged with the development of aquaculture in northern Australia.</p> <p>The proposed role of the body would be to:</p> <ul style="list-style-type: none"> • ensure co-ordination between Commonwealth agencies and between jurisdictions • identify priorities for Government investment, taking into account efficiencies and opportunities arising from scale, co-location, coordination and existing facilities and infrastructure • identify actions that would increase participation by and create business and economic opportunities for Aboriginal and Torres Strait Islander people in the northern Australian aquaculture industries • liaise with industry to understand industry priorities and encourage private sector investment • over-see the implementation of the CRCNA aquaculture industry situational analysis project recommendations. 	<p>Minister for Northern Australia</p> <p>Office of Northern Australia (ONA)</p> <p>Commonwealth government departments and agencies</p> <p>State and territory government departments and agencies</p>	<ul style="list-style-type: none"> ▪ Establish the government body, hosted by ONA ▪ Scheduled meetings to deliver the role ▪ Regular reports to Minister and CRCNA ▪ Facilitate independent evaluation of progress 	<ul style="list-style-type: none"> ▪ Oversight of expansion of aquaculture in northern Australia to \$1.3 billion GVP by 2030, providing 1,400 jobs, and associated economic and social benefits to regions and communities in NA ▪ Stronger governance of the NAAI and coordination of infrastructure development in NA

Regions for comparisons with northern Australia...

Northern Australia is equivalent to the areas of France, Spain, the UK, Portugal, Germany, Italy, Greece, Poland, Norway, Sweden, Denmark and Ukraine combined. The defined northern Australia coastline is about 12,400 km in length, and aquaculture GVP was \$220 million in FY17. By contrast, Norway has a coastline of about 25,000 km and the Norwegian aquaculture industry (salmon grown primarily in coastal cages) export value was NOK 62.7 B (AUD\$10.65 B) in 2017. Vietnam, with a coastline of about 3,300 km and over 1 million ha of coastal ponds, had nearly US\$10 B (AUD\$14.8 B) GVP of aquaculture production in 2017 (primarily prawns, *Pangasius* and tilapia).

There are differences in the locations, e.g. countries (such as Vietnam) have different labour costs, and environmental and social standards or different physical characteristics (such as Norway). Southern Australia has more population and infrastructure. However, these comparisons serve to highlight the challenges identified for northern Australia and, importantly, point to the relatively untapped potential for aquaculture industry development in northern Australia once challenges are overcome.

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