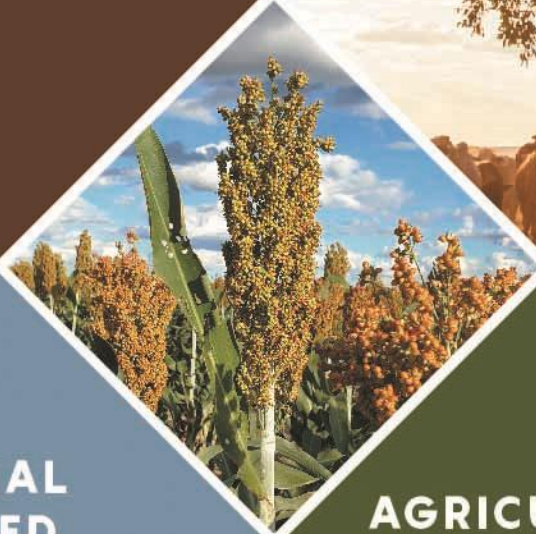


# NORTHERN HEALTH SERVICE DELIVERY



TRADITIONAL  
OWNER-LED  
DEVELOPMENT



AGRICULTURE  
& FOOD



## Future-proofing the NA aquaculture industry need for skilled staff to 2050

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**CRCNA**  
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The author(s) confirm(s) that this document has been reviewed and approved by the project’s steering committee and by its program leader. These reviewers evaluated its:

- originality
- methodology
- rigour
- compliance with ethical guidelines
- conclusions against results
- conformity with the principles of the Australian Code for the Responsible Conduct of Research (NHMRC 2018),

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## Acronyms

APFA	Australian Prawn Farmer's Association
CRT	Central Regional TAFE
DESE	Department of Education, Skills and Employment
RTO	Registered Training Organisation
TAFE	Technical and Further Education
VET	Vocational Educational and Training
WIL	Work integrated learning
NCVER	National Centre for Vocational Education Research



## Project Participants

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## Executive Summary

The aquaculture industry in Northern Australia (NA) is undergoing a period of unprecedented growth, precipitating an increasing demand for skilled staff. To facilitate this growth, the industry requires an increasing stream of suitably skilled and qualified entrants to the industry workforce. Prior to this project, the extent to which educational models aligned to industry requirements was unclear, in terms of graduate knowledge and skills, but also in terms of graduate numbers. We aimed to address this alignment, while also identifying barriers to cost-effective delivery of vocational training for the Northern Australian aquaculture industry and investigating new training models that may assist. We further aimed to identify career pathways and derive careers documentation to better align the interests of potential industry entrants to education and careers pathways, highlighting this industry to those with compatible interests.

In order to better understand and align educational outputs with industry needs, this project collected data from the industry by means of interviews, surveys and job advertisements. The resulting outputs have defined three different categories of employment: farmhand, technical and management. Data from the interview process populated these categories with skills and qualifications associated with each of these categories. Job advertisements were reasonably evenly distributed between farmhand, technical and management positions, with a slight bias (44%) toward technical positions.

We confirmed that the industry is expanding in response to strong demand for seafood and high profitability. With growth has come an increased engagement with technology, which is the major driver of skills changes that are envisioned into the future. Our study did not reveal significant qualitative gaps in educational outputs, but it highlighted the need for closer integration of education and on-farm practices, with strengthened internship and work-integrated-learning (WIL) programs highlighted as areas for development. The more significant gap was found in the quantity of staff currently being educated compared to requirements, with current rates of graduates unlikely to supply more than half of the new staff required by 2030.

In order to ensure sufficient staff for the NA aquaculture industry into the future, it is apparent that work is required to increase its attractiveness and awareness for new entrants as well as retaining staff that currently work within the industry. We consider on-farm vocational education to be a central pillar of existing workforce skill development and staff retention. As the industry grows, retention will be increasingly dependent on a structured approach to career development, including job satisfaction, skill development and remuneration.

Registered Training Organisations (RTOs) are able to maintain viability where they are located close to large aquaculture enterprises that are committed to upskilling. The dispersed nature of the industry makes training delivery challenging on-site and the cost of facilities makes centralised teaching particularly expensive. Nevertheless, RTOs may be able to contribute significantly to new career entrants to the industry through government funded preemployment programs.

This project has contributed digital training modules that are envisaged to support RTOs and Universities train the next generation of aquaculture staff and engage new entrants to the industry. These are not intended to supplant existing training models and the value of face-to-face training and assessment cannot be over-emphasised.





## 1. Introduction

The northern Australian aquaculture industry will need between 1400 and 2300 new skilled staff by 2030 to support projected industry growth (Cobcroft et al 2020). Aquaculture producers have identified challenges in the shortage of domestic skilled and experienced aquaculture staff, as well as on-farm biosecurity and health management capacity building. Producers highlighted the requirement to build skills to meet industry growth needs, including professional development for current staff, aligning training with industry needs and promoting career opportunities in the northern Australian aquaculture industry among regional communities. The proposed project aims to de-risk industry investment into growth by matching human capital expansion to industry growth predictions.

This project aims to define the industry's need for specific skills and education levels, map existing training and education providers, and propose improved models for education and training delivery. By evaluating industry workforce needs currently and into the future and analysing the gaps between industry need and educational output, we aim to highlight gaps in careers pathways to meet future industry requirements. These careers pathways will form the basis of promotional tools created to highlight education and skills development options that lead workforce entrants into the aquaculture industry. Cost-effective delivery models for training will be key to the outcomes of the project and a pilot project to up-skill existing industry employees in biosecurity will be used to develop and de-bottleneck new training delivery models.

The project consists of four main workstreams:

- Identify current and future skills needs and how well current graduates meet these needs
- Identify limitations in cost-effective delivery within the vocational education and training (VET) educational pathway to identify pathways to cost-effective training for the industry.
- Develop tech-enabled training pilots to test the use of technology in future training and student recruitment
- Document career pathways to better inform potential industry entrants about industry careers and educational pathways.



## 2. Current and future skills requirements and existing training programs for the Northern Australian aquaculture industry.

The Northern Australian aquaculture industry is in a period of unprecedented growth, coupled with an elevated engagement with technology. With these changes comes the need to employ more staff and to re-evaluate the skills they need now and into the future to enable educational institutions to train the staff of the future. The level of industry growth is expected to generate the need for between 1400 and 2300 new skilled staff between 2020 and 2030 (Cobcroft, J et al 2020). Assuming a consistent rate of growth, this relates to 140 to 230 additional positions per year.

The intended growth of the industry leads to the question of whether this number of suitably qualified and skilled staff are likely to enter the workforce in the near future. With formal education processes lasting years rather than months, future workforce planning is needed to ensure timely access to appropriately skilled graduates.

This project aims to understand the qualifications and skills associated with different levels of employment within the industry. This will be used to more clearly define current and perceived future skills requirements to aid searches for staff, and ultimately to inform syllabus development for educational programs that best align with industry requirements.

### 2.1. Methods

A structured interview and questionnaire were combined to derive both quantitative and qualitative data on skills requirements and roles in the Northern Australian aquaculture production industry (JCU Human Ethics H8494). Peripheral industries such as health, systems and feed industries were not included in this scope but are nonetheless identified as critical to the industry and additional careers pathways for graduates. Interviews were conducted via videoconference between 31<sup>st</sup> August and 30<sup>th</sup> September 2021 and covered 13 different businesses engaged in aquaculture in Northern Australia (Figure 1). Respondents came from various managerial roles within the businesses in order to get an appropriate overview of the business needs and staffing requirements. Interviews were recorded and transcribed into NVivo (Release 1.0, QSR International) which was used to annotate, tag and compile respondent data.

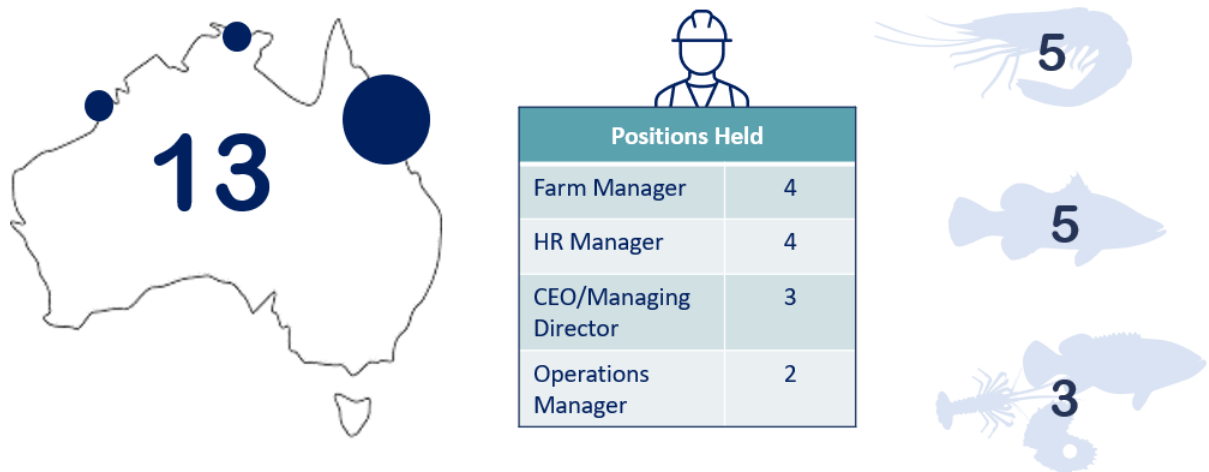


Figure 1. Interview participant location, position and species farmed

As all interview participants advertised online and most (11 of 13) advertised on Seek.com, additional data on skills and education requirements for the Northern Australian aquaculture industry was derived by monitoring all relevant postings on this platform during a three-month period from October 2021 to January 2022.

Educational output numbers come from James Cook University’s internal databases and the National Centre for Vocational Education Research (NCVER). James Cook University has the only Northern Australian degree program with an aquaculture major, while vocational Certificate courses are available through Charles Darwin University and LMC Training. While aquaculture training occurs in other domestic and international institutes, the national and global migration of graduates is beyond the scope of the current study, and we therefore assume zero net movement in and out of Northern Australia.

## 2.2. Results and Discussion

### 2.2.1. Sourcing Staff

All farms that were interviewed report local sourcing of staff, however 92% of interviewees also sourced staff interstate and 23% sourced staff internationally. Farmhand positions are predominantly filled locally which can be difficult due to the lack of labor, and physical demands of farmhand positions. Technical and management positions are difficult to fill due to more specific position requirements and are more likely to come from a broader geographical area. The SARS-CoV-2 (COVID-19) pandemic has limited travel and is linked to difficulties in filling technical and management positions, declining enrolments in the tertiary sector and increased competition between aquaculture business, and with other industries, for trained and qualified staff. There is a hopeful outlook that industry growth will raise its profile and attract more people into entering aquaculture careers, linked to an appreciation that presenting attractive career pathways will be an important step.

---

*“I think it (recruiting technical and management positions) will become easier for the bigger organizations that have technology and offer an attractive career path”.*

---

Every interview participant reported utilizing online recruitment tools, while word of mouth and existing networks were also commonly used. Of the online advertising, 11 of the 13 interviewees reported using Seek.com and so further data on skills and education requirements were gathered by monitoring and collating Seek.com advertisements for aquaculture jobs in Northern Australia for a three-month period between October 2021 and January 2022.

### 2.2.2. Industry Changes

Consistent with industry growth, 85% of businesses interviewed had expansion plans, with 69% either currently expanding or planning to do so within the next 5 years.

Expansion is fueled by a strong demand for Australian farmed seafood, combined with investment in technological advancements that facilitate efficiency (Figure 2). This is anticipated to facilitate a shift in job functions, reducing the number of manual labor roles and requiring a higher degree of technical aptitude.

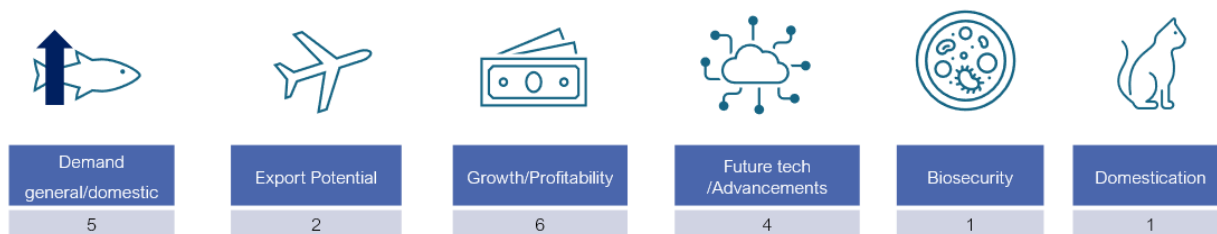


Figure 2. Drivers of business expansion or change in the Northern Australian aquaculture industry.



*“...automation and the technical aspect and automation of everything really. New equipment, new ideas, it’s all about efficiencies and cutting more costs and growing more fish. Anything and everything in the industry is becoming more automated, more engineering, more mechanical aids and that sort of thing.” Farm Manager*

### 2.2.3. Job functions and minimum requirements

A variety of job titles are used within different farms, and they are summarized into Farmhand, Technical and Management according to Table 1. Employees at the Farmhand level either require no formal education or require commercial tickets to fulfil their job function. In some cases, the employer reports providing training for commercial tickets, so these may not be a barrier to entry. The skills and work duties identified at the Farmhand level include knowledge of water quality and biology, for which upskilling is provided on-farm. This reflects the general consensus that staff learn specifics of jobs through experience and further training rather than necessarily from pre-existing education.

Table 1 Job titles summarised from interview responses

<b>Farmhands</b>	<b>Technical</b>	<b>Management</b>
Farm Technicians Assistant Technicians Packers and Sorters Aeration Technicians Processing Hands General Farmhands 2IC Farmhands Farm Attendants Feeders Aquaculture Attendants (Level 1-2)	Senior Technicians Technicians (Level 1-4) Technical Specialists Data Analysts Farm Technician Nursery Technician Environmental Officer Aquaculture Attendant (Level 3-4) Water Quality and Health Assistant Water Quality Manager Feed and Health Manager Hatchery Technician	Farm Manager Site Manager Operation Manager Technical Manager Senior Manager General Manager Section Heads / Managers Processing Manager Hatchery Manager Nursery Manager Grow-out Manager Maintenance Manager Head of Business Sales and Marketing Manager Research and Development Manager Supervisors Team Leaders

Technical and management positions predominantly require tertiary degrees (69% and 61% of interviewees, respectively) with a combination of Vocational Education and Training (VET) qualifications, trades and commercial tickets also valued (Table 2.). The tasks and responsibilities identified for technical roles are clearly those that apply technical knowledge to the farming environment. Employers report having provided training leading to Certificate III in Aquaculture and commercial tickets. While most respondents indicate that tertiary degree qualifications are required for technical positions, the provision of Certificate III training appears to be an avenue of upskilling staff from Farmhand to Technical levels of the business for motivated staff. Three of the 13 interviewees reported providing Certificate III training to their staff, however another two suggested that they would provide this upskilling if it was accessible in their area. The lack of accessibility of on-farm training and upskilling was highlighted as an impediment to the industry and this issue will be addressed in detail in Section 3 of this report.



Table 2 Qualifications summarised from interview responses

Qualification	Farmhands	Technical	Management
<i>Not defined/Not applicable</i>	0	1	1
<i>No formal education required</i>	11	-	-
<i>Commercial Tickets</i>	4	1	1
<i>Cert III Aquaculture</i>	-	2	1
<i>Trade</i>	-	2	2
<i>Industry Qualification</i>	-	1	1
<i>Tertiary</i>	-	9	8

Management role functions focus more on leadership and personnel management, for which a strong understanding of technical and industry issues are important (Table 3).

Soft skills have been identified as important for all three job categories and are often missing. There was an emphasis on effective communication, a positive attitude and willingness to do hard work are all important across these job functions, with a bias toward strategic and leadership skills required with progression through the technical and management categories.

Formal education and on-farm upskilling are largely considered to be complimentary, with the background knowledge and critical thought processes obtained in formal education supporting the farm-specific skills developed with upskilling.

Table 3 Role-specific skill requirements summarised from interview responses

Farmhands	Technical	Management
Cleaning equipment	Hatchery operations	Soft skills
Water quality	Larval rearing maturation	Leadership/People Management
Fish sampling	Water quality	Project Management
Fish Feeding	Environmental compliance and management	Teamwork
Equipment maintenance	Use of environmental management tools e.g., oxy and PH probes	Mentorship communication
technical work onsite	Pond performance	Technical experience required for the role
Manual labor (getting into ponds, loading up trucks, unloading to processing plant)	Monitoring fish health	Understanding of industry
Ability to observe and understand	Data entry	Technical & industry experience
Soft skills (work ethic, communication, attendance)		
biology knowledge		
understanding water quality		



#### 2.2.4. Job advertisement data collection

A total of seventy-one job advertisements were collected during the 3-month online data collection of job advertisements. While all of these were for companies engaged with aquaculture, some (44%) were not specific to aquaculture fields (Figure 3). There may be some unknown bias in the results specific to the arbitrarily chosen study period; however, in the absence of known biases these data are considered representative of the contemporary industry needs. These data are representative of the major aquaculture industries in Northern Australia, with barramundi, prawns and pearls making up the majority of advertisements. In line with interview responses, technical roles were the largest contributor to the aquaculture-specific roles (43%) with the remainder split relatively evenly between management and farmhand roles.

On a state and territory breakdown, it can be seen that 44% (33) are for Queensland located jobs, with 35% in the NT and the remainder in northern WA (Figure 4). The Queensland and WA-located positions were dominated by technical and management positions, while the NT advertisements targeted farmhand to technical positions with a minor proportion of management roles. The positions advertised are predominantly full-time and there may be a bias toward advertising for full-time staff but using word-of-mouth or other means for part-time and casual positions. It is also likely that these are more at the farm-hand level.

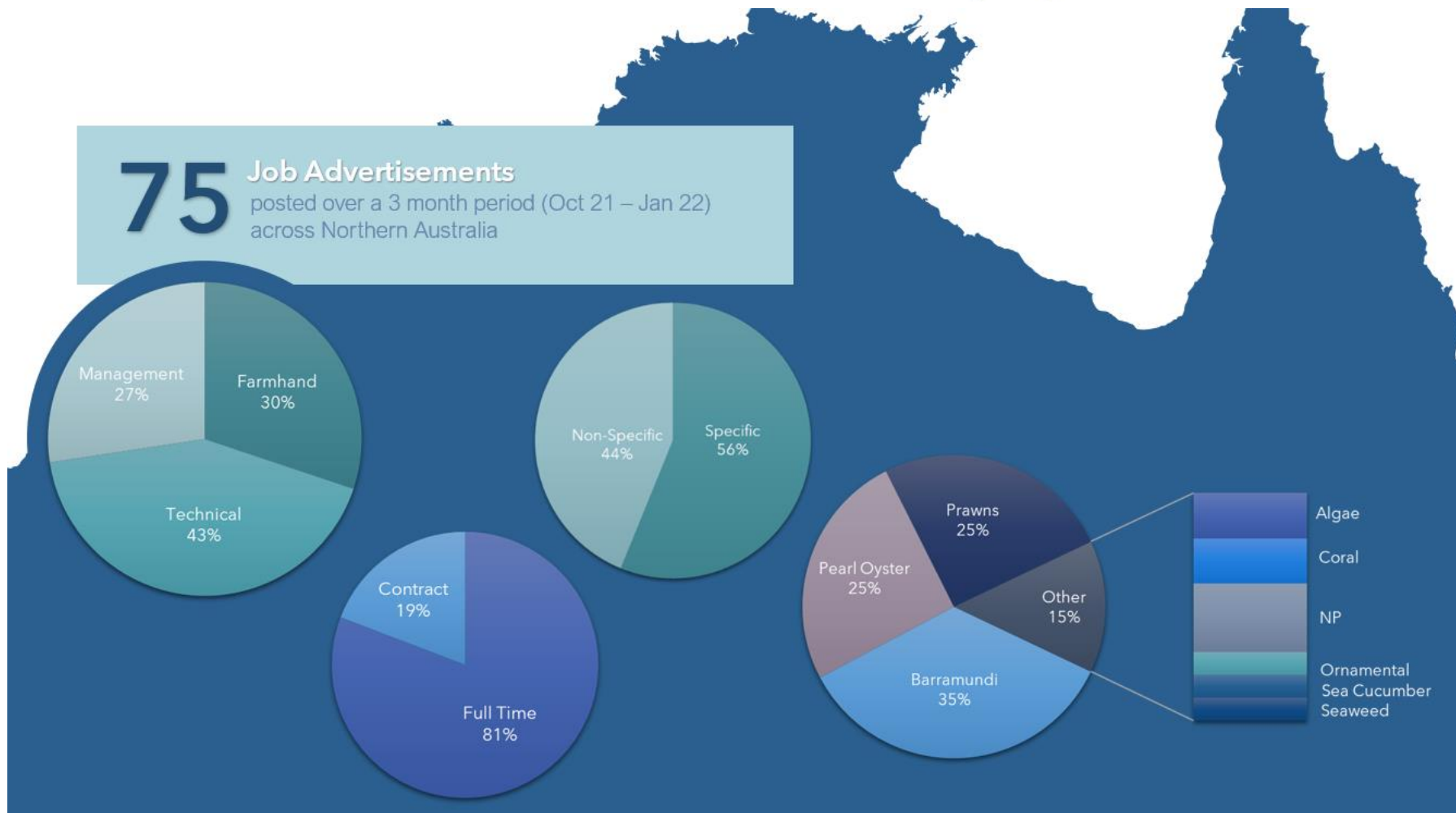
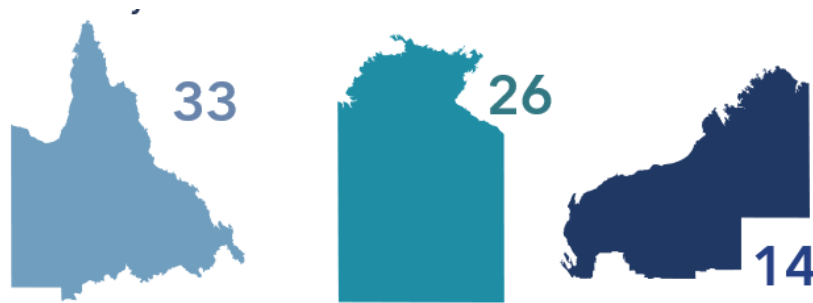
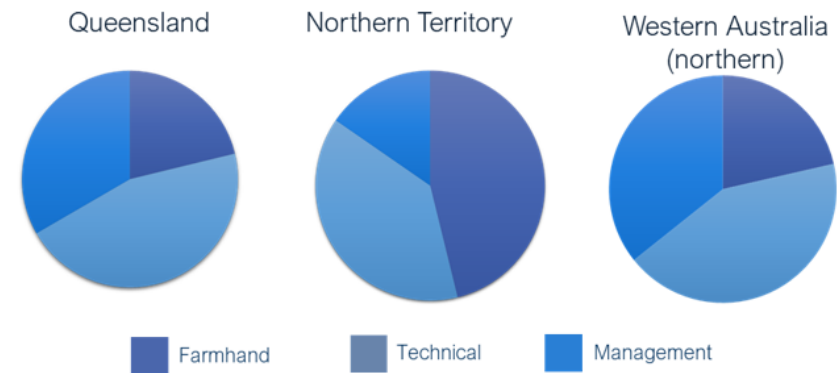


Figure 3. Data summary of the job advertisements in the Northern Australian Aquaculture industry from Seek.com over a 3-month period in October 2021-January 2022



Role	Queensland	Northern Territory	Western Australia
Specific	55%	54%	57%
Not-specific	45%	46%	43%
<b>Position</b>			
Single	76%	54%	29%
Multiple	17%	46%	71%
<b>Employment</b>			
Full-time	88%	73%	79%
Contract/Casual	12%	27%	21%



\*Note that for management category, corporate positions accounted for 24% in QLD, 8% in NT and 14% in WA.

Figure 4. State and territory split of aquaculture jobs advertisements in the Northern Australian Aquaculture industry from Seek.com over a 3-month period in October 2021-January 2022





Through the interview process, personality and soft skills were highlighted repeatedly as requirements for career success in aquaculture. From the job advertisement data, we were able to summarise the top-5 desired personality traits and soft skills that employers desire (Figure 5). These revolved around reliably being able to complete tasks without a lot of top-down management and being able to work in a team environment.



Figure 5. The top 5 personality traits and soft skills from aquaculture jobs advertisements in the Northern Australian Aquaculture industry from Seek.com over a 3-month period in October 2021-January 2022

### 2.2.5. Integrated learning and internships

A common theme that came from the interview process is that some graduates enter the workforce with unrealistic expectations, expecting to do science from a desk rather than farming operations. The skills that were consistently seen as missing in new employees were business-specific operations and the application of knowledge to farm operations. There was a very positive response to the application of Work Integrated Learning (WIL) and internships programs. Awareness and proficiency in business-specific skills comes from integrating education with industry placement, delivering first-hand practical experience to students as they are completing their education, enabling graduates a better understanding of the industry. In return, work placements provide employers access to a new stream of potential employees and the opportunity to mould them toward their business needs and operations. These programs can be time consuming for employers and they risk little return on their training investment if the placement is not suitable. Despite this risk, there is a general willingness to undertake work integrated learning (WIL) and internships. Several universities offer WIL-based courses and content as part of their undergraduate STEM degrees, which may represent a pathway to improve recruitment of students to the industry.



### 2.2.6. Number of staff and graduates

If the NA aquaculture industry is to support 140 to 230 new positions per year, it will require a combination of willing farm-hands, suitably qualified technical and management personnel and upskilling capacity to provide career pathways towards the job functions that are required. Data from James Cook University indicate that 20-32 students graduate annually with aquaculture qualifications at the Graduate Certificate, Graduate Diploma, Bachelor and Master levels (Table 4). These numbers curtail in 2021 due to the impacts of COVID-19. While tertiary-qualified individuals migrate into Northern Australia, there is likewise migration from Northern Australia to other states and international locations and therefore we assume a net-zero flux. It is likely a large over-estimation of the number of graduates that are likely to enter the aquaculture production industry, as these graduates have alternative career pathways available in research, education, policy, and aquaculture support industries such as health and feeds. It is also possible that larger and more developed aquaculture industries are more attractive for graduates due to a greater degree of structured career progression and broader breadth of job roles.

Table 4 James Cook University aquaculture graduates per year.

Year	JCU aquaculture graduates
2017	32
2018	21
2019	30
2020	20
2021	11
<b>Total</b>	<b>114</b>

The number of graduates from vocational training appear to be higher, although enrolments and completions are reported Australia-wide rather than regionally (Table 5). A certain proportion of Certificate II graduates are likely to move on to Certificate III and Certificate IV, however experience from the project team (Ruscoe and Oliver) suggests that few Certificate II graduates go on to Certificate III or join the aquaculture industry. An average of 114 Certificate III graduates are therefore available across Australia to join the aquaculture industry. If the NA aquaculture industry could secure all graduates from the local university and all Australia-wide VET training, it would secure 137 of the graduates that it requires per year, with a potential deficit of 93 staff per annum. While it is unachievable to attract all VET graduates to seek employment in the NA aquaculture industry, this shines a light on the deficit of staff likely to be faced by the industry as a barrier to its expansion goals. In the more likely scenario that half of the Certificate III graduates are available to the NA industry, 80 staff are available for recruitment at the current rate of education output.

Table 5 National NCVET (VOCOSTS TVA program) completions in aquaculture certificate and diploma qualifications

Year	Certificate II in Aquaculture	Certificate III in Aquaculture	Certificate IV in Aquaculture	Diploma of Aquaculture
2016	165	122	6	1
2017	175	120	0	31
2018	132	72	0	2
2019	87	141	1	12
<b>Total</b>	<b>559</b>	<b>455</b>	<b>7</b>	<b>46</b>

Data from LMC Training show that VET in Schools Certificate II programs are contributing significantly to education for the Northern Australian aquaculture industry, and short courses, both accredited and non-accredited, now make up a significant component of enrolments (Table 6). It appears that



integration of VET training with high schools is a positive move towards increased exposure of career opportunities within the industry at the secondary education level, at least raising awareness of the industry if not contributing directly with graduate entrants to the workforce.

Table 6 LMC Training enrolments 2020

Course	QLD	NSW	WA	NT
Cert II Aquaculture	2		2	
Cert II Aquaculture High Schools	24			
Cert II Aquaculture Traineeships	2			
Cert III Aquaculture	4		1	
Cert III Aquaculture High Schools				
Cert III Aquaculture Traineeships	2			
Diploma of Aquaculture	4		1	
Accredited Short Course	32			1
Non-accredited Short Course	67	12		

### 2.2.7. Conclusion and future directions

The Northern Australian aquaculture industry largely relies on the skills and abilities developed in tertiary qualifications (higher education and VET) to support the needs of technical and management positions. While farm hands typically require no specific qualifications, the VET framework is seen as a means of upskilling from entry-level knowledge and is critical for the level of upskilling that is in evidence from our interview process. While it is important to note that VET can provide entry-level training, this was not prominent in interview responses.

While 'soft skills' are a focus of both VET and university sectors, this is also a focus area for development within the industry. Respondents reported a desire to have closer integration with training of staff, particularly from the university sector, to better integrate the knowledge gained in this sector with the on-farm physical and inter-personal requirements. The gaps identified in this process relate more to the attitude of staff and their understanding of the farming focus of the aquaculture industry, than on particular skills gaps. Integration through internships and Work-Integrated Learning programs was identified as a key component of addressing this gap.

The current numbers of graduates from VET and university sectors clearly fall short of predicted industry requirements, with the future deficit dependent on the level of industry growth and future student numbers. There was an optimism within the interview respondents that industry growth would facilitate increased interest in career pathways. Increased focus on educating secondary students and an increased public profile of the industry are likely avenues for increasing future student numbers.



### 3. Impediments to Delivery of Vocational Training to the Aquaculture Sector in Northern Australia

#### 3.1. Background

The Vocational Educational Training (VET) sector is a cornerstone of the Northern Australian Aquaculture workforce development. VET has been designed to enable workers the opportunity to gain high-quality, nationally recognised qualifications for employment. Training has a strong focus on practical skills and well as obtaining the knowledge required to undertake work.

The Northern Australia Aquaculture Industry Situational Analysis (Cobcroft et al, 2020) found that expansion and growth of the aquaculture industry in Northern Australia was likely to be hindered by lack of access to labour. It further found that the major shortfalls were in the technical/VET skills and senior management roles (p79). A review of the detailed recommendations (pp91-93) highlight the importance of VET to the development and maintenance of a skilled workforce to support Northern Australian aquaculture.

The current *Seafood Industry SFI Training Package*, a publicly available resource detailing occupational skills standards and knowledge requirements, was released in 2019 and has been updated as recently as 2022 (version 2.1). It includes information on the training outcomes for specific aquaculture occupations, including:

- Aquaculture Production Hand Assistant
- Aquaculture Production Hand
- Aquaculture Maintenance Worker
- Aquaculture Leading Hand
- Aquaculture Supervisor
- Aquaculture Business Support Worker
- Aquaculture Operations Manager

These training packages have been developed in consultation with Industry representatives to meet their requirements, however, the uptake of training has been limited, particularly at Certificate IV and Diploma level. Entry level or trade level courses (Certificate II and Certificate III) have had higher levels of uptake but most of the learners have been those already employed in the industry. VET training in the aquaculture sector has therefore played a more significant role in upskilling and retention of staff rather than attracting new employees to Industry.

This training is most successfully achieved when delivered by Registered Training Organisations (RTOs), through tailored training relationships with companies in their local area and to existing employees. The typical model of internal training delivery in a TAFE style system does not always apply but remains an important component of Industry development.

Developing a capable aquaculture workforce will be supported by a strong vocational training sector. The success of RTOs will depend on adaptive and creative approaches to training delivery in very close consultation with Industry and focused government funding arrangements.

This analysis looks at the various challenges facing RTOs in delivering training to the aquaculture sector. It also explores where RTOs have found successful models for training delivery and viability in their local areas.

The views expressed in this documented have been drawn from the experience of the authors working in the aquaculture vocational sector in the Northern Territory and Queensland. These are Charles Darwin University with an established aquaculture VET programme and Central Queensland University in the developmental stages of initiating a VET programme in aquaculture; and a privately operated RTO business, LMC Training Pty Ltd. It also draws on the consultation and research data from an organisation tasked with the development of Training Packages, Skills Impact Ltd. Feedback from experienced trainers across the country has also been incorporated. Much of this information was gathered during discussions in March and April 2022 regarding the issues and solutions they see in their local areas.



### 3.2. Current status of Vocational Training Providers

There are relatively few providers of vocational training for aquaculture in Northern Australia, as shown in Table 7. These RTOs work in relative isolation from each other, focusing on the industry in their respective local areas.

The number of RTOs displayed below is also an over-representation. While current RTOs may have a qualification on scope (i.e. are formally approved to deliver the qualification), that does not mean they are necessarily delivering the qualification, perhaps only doing so when there is sufficient demand in a given year. This is particularly the case for the Diploma of Aquaculture (SFI50119).

Table 7 Number of RTO providers listed as current on the National Training Register	Certificate II (SFI20119)	Certificate III (SFI30119)	Certificate IV (SFI40119)	Diploma (SFI50119)
Northern Australia	5	4	0	2
Southern Australia	8	6	1	3
Total	13	10	1	5
N. Australia Coverage	Qld, NT, WA	Qld, NT, WA		Qld, WA

Table 8 The current listed RTO providers with capacity to deliver in Northern Australia:

Provider	Location
LMC Training Pty Ltd	Southern Queensland
Kirwan State High School	North Queensland
Charles Darwin University	Northern Territory
North Regional TAFE	North Western Australia
Central Regional TAFE	Central Western Australia

### 3.3. Thin markets in a big North.

Registered Training Organisations are attempting to deliver vocational training in aquaculture to a thin market in a widely dispersed geographic area. For the purpose of this document, we take ‘the North’ as those areas engaged in subtropical and tropical aquaculture, from approximately the Southern Qld border to Geraldton in WA.

Even at the optimistic level of projections, it is estimated that total employment in aquaculture in Northern Australia will be less than 3,000 by 2030 (Cobcroft et al, 2020). While this is a significant number for an industry in Northern Australia, it is relatively small when compared on a national level to other industries supported by VET in Australia. Aquaculture is also widely dispersed geographically, making it difficult economically to utilise delivery models based on on-site training (whether workplace or institution, and more difficult when delivering with the mix of both workplace and institution).

Over the last few decades, the broad national context of Vocational Education and Training (VET) has undergone a transition from the traditional trade apprenticeship model, where learning was part of workplace practice, to an institutional model featuring training facilities and offering courses in classrooms and simulated work environments. Candidates enrol, complete the course, and then ideally move into work (or higher-level training). This model is suited to high-volume programs, especially when delivered in central locations in urban Australia. However, the number of new entrants into aquaculture training has not been sufficient to support the viability of this approach, especially with the cost burden of maintaining aquaculture training facilities. RTOs have therefore investigated diversification as a means to expand revenue streams.

The main alternative revenue stream to the emerging classroom focus in the VET industry is on-farm staff upskilling. This approach provides opportunities for entry-level staff to obtain qualifications in aquaculture while providing employers with appropriate skills within their workforce. With increased competency comes increased work satisfaction and therefore we propose that on-farm vocational training provides the means for increased staff effectiveness and retention. It is unsurprising that the most important factor in RTO viability is having an industry above a threshold in size within the local area that is willing to engage in staff development through training. These relationships are more likely to succeed with businesses



employing a dedicated HR manager who has time to commit to coordinating training with the RTO. HR managers can identify the opportunities for skills training that improves the business (from farm operations to economic management) and can commit time to coordinating with RTOs and facilitating staff movements. This is often beyond the capacity of farm managers in organisations without HR support, even if they desire to initiate training.

### 3.4. Cost of maintaining facilities

Maintaining and staffing a comprehensive training facility is expensive. Establishing such a facility requires significant upfront capital investment, similar to that faced by aquaculture businesses. The return on investment is unlikely to cover costs if the facility's only income is from vocational training, and if a business facility is established, there are increased staffing and support costs due to the need to permanently staff the facility beyond training periods. The cost and time required to maintain aquatic training facilities has been described by one RTO as an "albatross around one's neck" (James Garde, SMT Tasmania, Pers. Comm.), however, advantages conferred through having training facilities should not be undervalued.

Workplace skill development and assessment are highly regarded in training and form central pillars in VET training delivery and assessment, with Units of Competency designed to align with workplace tasks completed in a workplace environment (State of Tasmania, Dept. Education, 2021). However, it is generally not feasible to complete all training through workplace assessment. The Certificate III in aquaculture is an example where a course covers a diversity of skill sets that may include biosecurity, aquatic health, water quality, environmental sustainability, feeding stock, harvesting stock, maintaining aquatic systems, and food safety, as well as core skills in areas such as working in industry. Larger aquaculture enterprises engaging in training arrangements have workplaces that are structured with dedicated crews e.g., feeding or harvesting team, water quality team, fish health team and so on.

Therefore, it is generally not feasible to effectively train and assess candidates across all required skill sets, at the workplace alone, as they may not have the opportunity for sufficient workplace exposure in all areas.

In this case aquaculture training facilities remain critical in delivering all outcomes. Facilities allow for gap training in areas where it is impractical to deliver to the required level of competency at the work site. For example, Charles Darwin University VET Aquaculture uses a model where workplace assessment form a key component of training and trainees are rotated through different areas of the work site to address as many criteria as possible. The trainees are also required to attend block training at the CDU training facility to cover specialised content in areas such as fish health, biosecurity, and water quality, which they would not otherwise be able to attain to a sufficient level of competency.

Facilities also allow for training to be delivered to those not currently employed in the Industry. The Certificate II is delivered at Charles Darwin University and is carried out entirely within the aquaculture facility to trainees that do not currently work in Industry and would therefore not have the opportunity to meet training outcomes.

As such, training facilities are an important, if not critical, component to effectively delivering VET aquaculture training. Training facilities exist in WA at Central Regional and North Regional TAFE and in the NT at Charles Darwin University and these RTOs must bear the cost of building and maintaining the facilities.

Registered training organisations (RTOs) in aquaculture have the constant challenge of marginal returns in relation to significant operational costs and have been required to modify operations from a traditional training approach to delivery. As an example, Central Regional TAFE (CRT) utilises its aquaculture facilities for the delivery of units from other training packages such as sampling and water quality units in the Conservation and Environmental Management, Laboratory Technologies and Environmental Monitoring & Technology TPs. It also uses its aquaculture facilities for the delivery of Tourism qualifications and runs regular tours for the general public. This diversification in the use of the facilities has allowed for a higher utilisation rate, and therefore improved the viability of the Aquaculture facilities. CRT also sells fish that are produced at the facility as part of its training programs and utilises the funding from these sales to provide additional technical support (Suresh Job, Central Regional TAFE WA, Pers. Comms.).



Charles Darwin University VET Aquaculture has similarly had to rework its operations following a University restructure, resulting in reduced technical support from 2 FTE to less than 0.5 FTE. This was required to improve its financial viability but directly affects capacity to deliver higher maintenance programmes such as VET in Schools. VET in Schools requires a higher level of resourcing such as several tank systems, which must then be maintained over most of the year to provide sufficient training resources for a class of adolescents, who must be kept engaged. This was discontinued in favour of discrete modular programmes for adults where animals are moved in or out only as required or are kept in “low maintenance” systems such as aquaponics.

One way forward may be for RTOs to work in partnership with schools to reduce demands on resources. An example is TAFE SA working closely with Port Lincoln High School. The school offers a flexible learning subject in Aquaculture and TAFE SA partners to offer core unit delivery and VET assessment in discrete training blocks. The RTO can deliver accredited training using facilities maintained within the school. There is also a reduced time required to train the class, (noting that more learning time is required overall with younger people), as this is part shared with a qualified teacher delivering the aquaculture course as part of the school’s curriculum, when trainers are not present. The RTO carries out core delivery and assessment in scheduled training blocks with the school providing supportive delivery to build skills and knowledge in their normal aquaculture classes (Brent Smith, TAFE SA, Pers. Comms.).

There are also unrealised advantages that dual sector Universities could bring to the problem of maintaining a facility. There are clear opportunities for both Higher Education and VET sectors to work within the one facility and take advantage of multiple income streams to support operational costs. The initial capital funding is only one aspect. The primary issue is ongoing levels of maintenance required with aquatic systems, particular saltwater systems which degrade rapidly, and the need to fund ongoing qualified technical staff.

To survive, each facility will need to find its own path to viability unless it is heavily subsidised by other funding arrangements. Each of these paths add significant complexity to operations and the impost of additional management on the RTO and its training staff.

Without access to facilities for on-site training there is less latitude to offer courses for the Certificate II entry level aquaculture worker, particularly at the VET in Schools level. With limited resources available generally, RTOs gravitate to supporting non-aquaculture higher volume offerings that help maintain viability. Small, important workforces, such as aquaculture, will struggle to compete with other industries providing an easier pathway to viability.

From the point of view of the RTO, costs of training are critical to the viability of running programmes, especially given the substantial non-completion rates (often due to learners becoming employed during training).

Table 9 Completion rates for Aquaculture VET Qualifications (2018 – 2020)

Qualification	2018		2019		2020	
	Enrol	Comp	Enrol	Comp	Enrol	Comp
SFI20119- Certificate II in Aquaculture	304	128	274	117	377	176
SFI30119- Certificate III in Aquaculture	439	71	447	143	352	154
SFI40119- Certificate IV in Aquaculture	0	0	1	0	0	0
SFI50119- Diploma of Aquaculture	12	2	40	12	25	18

Source NCVET (2021)

### 3.5. Upskilling demand for Aquaculture Training



Given the difficulty in attracting sufficient trainees to onsite training through the typical VET approach, combined with the prohibitive cost of maintaining training facilities, RTOs need to be adaptive and find workable solutions to service the Industry and survive.

Aquaculture is not a formally licensed trade. There are generally no regulatory or licencing incentives to undertake formal training, outside of individual skill requirements with a broader application, such as the Coxswain or Forklift Licences. When seeking entry-level employees, employers do not demand that people have existing aquaculture training, particularly with the very tight low skilled employee market Australia is currently experiencing. From this there would appear to be little incentive to undertake VET training in aquaculture by individuals seeking entry-level work in the Industry.

However, once employed in Industry there are several incentives for businesses to support additional training of their employees.

Businesses operate under complex legislative frameworks and as aquaculture businesses expand the challenge to keep up increases. In particular, there is an incentive to have employees trained in work health and safety and areas of high-risk operation including 'micro-credentials' such as forklift, elevated work and confined spaces, so the businesses can comply with legislation. In sea-based farming operations there is often a requirement for coxswain licensing. These competencies are not specific to aquaculture, however, several of these are included in the Aquaculture Training Packages and can be included as part of an Aquaculture Certification.

Clients undertaking a Certificate III in Aquaculture will likely be eligible for financial incentives through the Australian Apprenticeships programme making it further attractive for employers to enrol their employees.

A strong common thread in discussions with RTOs is the requirement for a close relationship to be forged with the businesses before there is an uptake in training. Simply advertising a course and expecting enrolments is not a pathway to success. RTOs need to be very cognisant of this and understand they must develop a contextualised product that client companies will buy into, to see value in terms of training outcomes that directly complement their businesses. Trainers need to have expertise that is regarded by the Industry and be front and centre in developing relationships.

A key barrier is the allocation of time needed to complete accredited training qualifications. People who are already employed in the industry can see the value of continued training as a means to up-skill and progress to higher levels within the industry, with their employers typically supportive of additional training that meets specific operational needs. The time needed to complete training can conflict with the time needed to complete farm operations, and it is the farm operation that typically takes priority.

The Certificate III qualification, often linked to an Australian Apprenticeship or Traineeship, lends itself particularly well to workplace assessment and this can substantially alleviate the impost of time away from the job site, and is arguably a better training model than off-site training in a teaching facility for several of the aquaculture competencies. There are a number of examples where this training model has been successfully applied around the country. Notably Seafood and Maritime Training in Tasmania, with the Salmonid and Oyster Industry, TAFE SA with the local oyster, tuna and abalone growers, Maritime and Safety Training in NSW with local oyster growers and Charles Darwin University with the local barramundi industry.

### 3.6. Increasing workforce through retention

Aquaculture farming in Northern Australia generally takes place in regionally isolated environments and is physically demanding, with most work taking place outdoors in a hot and humid conditions. The ability to work under these conditions, in an independent, positive and reliable way has been a consistent theme of the interview process and analysis of advertised positions within this project. On-farm experience has been identified as critical for workforce success, building on the framework of formal training. Our analysis of advertised positions indicates that 30% of staff recruitments are at the Farmhand level, with no formal qualifications required and our interviews have revealed that on-farm training is critical to development of staff entering these positions. By engendering a feeling of job-satisfaction and progression, on-farm upskilling is seen as a pivotal step in staff retention. Retention of staff by definition, reduces the need for new recruitment and finding better ways to retain staff requires consideration.





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*We know that if you can engage people and keep them interested that career progression opportunity, then they are always going to be more likely to stay at your organisation, so that is your return-on-investment processes.” – Interview respondent*

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Farmers recognise that training staff increases their effectiveness and staff retention, however, it is difficult to analyse the payback required for investment into staff training. This is particularly challenging for smaller operations with limited to no dedicated human resources capability. This introduces somewhat of a ‘chicken and egg’ scenario where farms need workers to stay with the organisation long enough to make the employer’s investment into workplace training worthwhile, but the investment in training itself is likely to increase longevity of service. Vocational training has an opportunity to assist employers develop workers beyond the role of a ‘rotating door resource’ and incentivise learners sufficiently to hold onto people for 12 months and beyond. It is unlikely that many entry level workers will become long-term aquaculture workers unless they are given an opportunity to learn and advance their career.

The focus of workforce development strategies should therefore be as much about retaining current workers as on finding new workers. Vocational training has a key opportunity here, working closely with organisations to help their employees grow in capability and develop a good workplace culture.

### 3.7. Pre-employment Programmes

Pre-employment programmes can be an effective tool to engage potential new employees. Their success will depend on how they are implemented.

The NT Government recently funded a pre-employment programme with candidates undertaking a three-week programme including training at Charles Darwin University and site visits with Industry. The training included aquaculture units around aquatic health and biosecurity, work health and safety and food handling safety. It also included forklift licencing. Of the 9 participants, 4 were immediately employed into the Industry which is a high uptake. This indicates what may be possible, even though the sample size is small in this case.

The organisers of the program reported that their challenge was finding suitable candidates even after extensive promotion and the offering of a fully paid pre-employment course with excellent opportunity for an immediate work start. Improved timing and marketing may improve this situation. For example, promoting the course closer to the end of the academic year when high school leavers are looking to what to do next after school.

LMC Training was also recently funded at the Federal level by the Department of Education, Skills and Employment (DESE) to undertake pre-employment training. The programme faced a barrier from the outset because eligibility required candidates to be long-term unemployed. They were not the people wanting to take up employment in the aquaculture sector. As mentioned previously, aquaculture requires ‘low skilled’ workers, but they still must have a strong employability aptitude. This programme would likely work if the eligibility criteria were expanded.

To be successful, pre-employment programmes will require an ongoing funding commitment from State or Federal governments and be structured for success, particularly being open to workers with the employability aptitude the Industry requires. If targeted correctly, it will likely have a very good cost for return as demonstrated through the NT example.

### 3.8. Working Smarter

The option for digital delivery of some of the course content (particularly knowledge criteria) has the opportunity to reduce the compliance and paperwork load that currently limits the capacity of RTOs to deliver.



Digital hand-held devices (smart phones) are owned almost universally in Australia, so access to digital learning resourcing and paced assessment material is achievable with current technology. Once developed, these resources could solve issues surrounding time off-farm to undertake training and also help streamline the trainer's workload.

This has probably not occurred sooner because aquaculture trainers tend to operate independently or in small teams and do not have the resources of time, software and/or capability to independently develop these new materials.

The Australian Prawn Farmer's Association (APFA) is currently developing the 'Digital Skills Project' with Central Queensland University. This is a set of digital skills training resources to be offered to farm employees and mirrors some of the competency training that exists in VET.

Development of resources such as these, that could assist the VET sector requires funding and third-party support in their development. A core of generic resources should be available for the Northern Australian VET sector so there is less duplication of effort. This would work to make the VET system more viable and would also assist in developing a VET community to align expectations and standards amongst groups.

Other options include the more cutting-edge access to virtual/augmented reality walkthrough and training packages that can either simulate hands-on practical experience for remote users or allow remote assessors real-time access to vision and sound from workplaces. James Cook University is piloting a module of this type of training in biosecurity as part of this CRCNA project.

It is recognised that training resources would still need to be contextualised for each farming operation. There are also many skills in aquaculture where there is currently no substitute for hands-on and on-site 'learning through practice', with many RTOs already well-placed for on-farm training to ensure skills competency.

There may be possibilities to formally develop more clustered models of training, with multiple competencies delivered simultaneously where there are content overlaps. This approach may be particularly useful for on-site training, where training outcomes can be achieved over fewer days and thus be less disruptive to the workplace. It is hoped that the current work on qualifications reform may lead to greater recognition that current Units of Competency are not training modules (as they do not define how training should be delivered), but occupational skills standards (as they define the required learner outcomes). Delivering training in a linear fashion, based on Units of Competency adds time to delivery and duplicates content.

Correspondingly, funding models would need to be adjusted because, currently, a simplistic approach is used to fund training based on whole units of competency, as outlined in the training package, rather than a more flexible approach based on the required training necessary for an individual to meet the skills standards. Making such adjustments would arguably help make training easier to deliver and, therefore, more accessible.

Future funding into digital skill training and assessment should be coordinated in close cooperation with the VET sector to take advantage of the existing Industry networks and analysis into of skills requirements, to develop resources in line with the Nationally accredited VET training system and to minimise duplication.

### 3.9. Conclusions and recommendations

The key challenges facing vocational training in aquaculture are;

- The Industry is currently too small and too dispersed across the North to support the viability of RTOs in all areas where aquaculture is being conducted.
- This is exacerbated by the cost of training delivery, particularly in light of the expense required in maintaining facilities.
- RTOs relying solely on a TAFE style approach to training delivery will struggle to be viable as Aquaculture is not a licensed trade and employers do not demand training for entry-level roles, where the predominant worker shortage exists.



- RTOs and their trainers expend considerable energy in work duplication to meet compliance requirements. They do not benefit from any existing work to help standardise training and assessment material across the sector or to move to digital training resources.

Key observations and solutions include;

- The key determinant of RTO viability and hence training being afforded in particular regions around the Country (including the North) is having an existing Industry of sufficient size that has a training demand
- Training in Aquaculture is primarily centred around upskilling existing workers and providing micro-credentials (linked into aquaculture training) that assist employers to comply with legislative requirements.
- RTOs need to work in close partnership with their local Industries to provide contextualised training products so that the industry see clear benefit and will buy into the training.
- This is often facilitated through HR managers in larger businesses who have time to commit to helping coordinate the training.
- The importance of VET in workforce development is as much about upskilling and retention of existing staff as it is in training new workers.
- Training of existing staff needs to be continued to be supported through initiatives such as the Australian Apprenticeships programmes which provide additional incentives for employers to engage their staff in training.
- Finding new employees for the Industry can be supported through well designed and funded pre-employment programmes.
- Workplace assessment is an integral part of training delivery for many RTOs, however the advantages of training conferred through on-site training in dedicated facilities should also be emphasised.
- Maintaining facilities is a cost burden that can only be accomplished through being subsidised or diversifying the business model but it must be recognised that this places additional strain on training staff.
- Coordinated development and digital delivery of course training and assessment material could substantially assist in reducing compliance workloads for trainers, allow expanded delivery of training across regions and ultimately assist in RTO viability.
- It also needs to be fundamentally acknowledged that competency training in aquaculture needs to remain a predominantly hands-on enterprise carried out by Industry competent training staff.



## 4. Development of technology-enabled training pilot material

Initial survey of the industry associations (APFA, ABFA and Pearl Producers Association) indicated that biosecurity was a focus throughout each of these aquaculture industries and therefore topical for development of pilot training materials. Extended reality platforms further enable new ways to interact with environments and biological material in a non-destructive and remotely accessible way, while also presenting an accessible platform to enable young people to engage with the industry.

Three different platforms were investigated through this project for technology-enabled training, with two goals in mind;

- to supplement face-to-face instruction in training staff in the face of the ‘tyranny of distance’ faced by Northern Australian training providers, and
- to showcase the industry and entice potential entrants to want to further explore what it has to offer.

### 4.1. Materials and Methods

An animated video training module was developed to incorporate:

- Biosecurity fundamentals
- Protection & Zones
- Risk Assessments
- Case studies on two known biosecurity risks in both barramundi and prawn aquaculture operations.
- A practical component uses the case studies to work through the risk assessment information presented earlier to inform which management phase is applicable for that specific risk.

In addition to digital training, a further platform of information cards and posters have been developed. Titled ‘AquaBioID’ cards, these were envisioned to highlight biosecurity risks and mitigation throughout the workplace. Placed in strategic locations, it is envisioned that these documents will form the catalyst for critical conversations around biosecurity in the workforce. The feedback horizon for these cards extends beyond the scope of this project and so will not be reported here.

An Aquaculture Species Viewer was developed with Handbuilt Creative and deployed as both a mixed-reality mobile App and a Virtual Reality application viewable on Oculus Quest 2 devices. This species viewer brings an immersive environment to learning about the biology and anatomy of barramundi and prawns.

A walkthrough of a recirculating aquaculture system was developed using 3D Vista software. This is playable in iOS and Android devices through the 3D Vista App as well as being available offline on PCs.

Each of these platforms has been made available to the project team and has been deployed at the ABFA conference and to selected stakeholder group participants. We collected anecdotal feedback on the utility of these platforms in addition to collection of survey data.

### 4.2. Results

All outputs were well received, and the platforms were generally seen as being appropriate for delivery of training. Unfortunately, the uptake on the survey responses was very low (only 3 returned, one of which was partially complete) and the feedback for these platforms is largely anecdotal.

The application of the animated video was seen as particularly versatile due to its accessibility without the need for specific devices, apps or internet, which can be a particular benefit in remote areas that lack effective mobile or Wi-Fi access. The potential to supplement on-farm induction material was also identified. An improvement was identified in providing voice-over guidance, particularly since it is difficult to time animations specifically to individual reading speed and ability.

The aquaculture species viewer was seen as an immersive and educational experience, particularly suited to bring younger people in contact with the aquaculture industry using technology with which they can identify. As such, its utility may be better suited towards engaging later secondary schools students in the aquaculture industry. This has been trialed with success, becoming the centrepiece for student communication in careers



expositions and open days. There were some technical difficulties with remote deployment of this technology, and it is noteworthy that Android devices are manufactured by a range of providers with different specifications that can make app deployment challenging. This was experienced in the current project, which was seen as a negative aspect of the technology. It is also notable that while the viewer contained a significant amount of educational material, participants tended to experience the look and experience rather than spending the time to fully explore the content. A future development of this technology may be to form questions or quizzes about the material to form stronger engagement.

The 3D walkthrough was useful to show people unfamiliar with aquaculture facilities what they can look like, in addition to providing an interactive environment for learning. The 'gamification' element of finding hidden elements was remarked upon for its engagement. Remote delivery of this platform also experienced issues, and not all devices appear to be able to use the materials.

### 4.3. Conclusions and recommendations

The use of technology for training and development comes with positives of engagement and remote deployment but also challenges of connectivity and compatibility that make some of the more immersive technologies challenging in certain circumstances. Many technologies come with the requirement for internet connection, which is not universally available. This makes locally stored video material more robustly useful in many farm environments.

Conversely, where experienced personnel are available to trouble-shoot, immersive technologies like mixed and virtual realities can offer a wider variety of interface and learning environments. They are further interesting for the next generation of tech-savvy individuals that will make up the future of the industry and form an effective tool for engaging with young people about this industry. This will be important for generating awareness and interest in aquaculture and its potential for career options into the future.



## 5. Career pathways documentation

It is apparent that the Northern Australian aquaculture industry presents an exciting career opportunity for people with relevant interests, with expanding need for qualified staff and a need to engage with school leavers as a source of new staff. We have explored technology-enabled training platforms in Section 4 of this report as a means of engaging students, however, the lack of apparent community awareness about careers in the aquaculture industry gives rise for the need to document careers pathways for students and parents. We have endeavored to capture the interests that will lead students toward a career in aquaculture and present the potential career pathways that they could take, and the education pathways that lead to the industry. The following materials have been developed through this project and are available as supplementary files:

- Career Pathways Handout
- Education Pathways Handout
- 7 Great Reasons to Study Aquaculture Handout

Each of these documents has been printed and will be disseminated to schools engaging with aquaculture and students attending careers events.



## 6. Conclusions

The Northern Australian Aquaculture industry is in a rapid state of expansion, with an accelerating need for staff at both technical and hands-on and management levels. There is a clear need for both higher education and VET training to supply these skills and the pathway of students through these programs needs to be planned well in advance in order to supply the industry with the required skills. The foundations for education and training at university and VET levels are available in NA, with suitable training available for each of the required skills and knowledge background for roles in the industry. The emerging trend for the future workforce is increasing engagement with technology, which is increasingly integrated into the aquaculture industry, and should be addressed in training platforms. The growth of the industry highlights the workforce issues of attraction enrolments, retention of labour and cost-effective delivery of education and training.

In addition to skills and training, it has been highlighted through this project that attitude and interpersonal skills are universally important in this industry, particularly the ability to reliably work unsupervised, toward outcomes in challenging environmental conditions. Internships and Work Integrated Learning has been identified as a means to test the suitability of new staff under farm conditions, while also providing valuable context to student learnings while undergoing education programs. The remote nature of many farms has made them less attractive for students who are typically challenged by financial and mobility issues. Increasing attractiveness of such on-farm placements with transport and accommodation assistance will likely increase the uptake of such initiatives.

The aquaculture industry has a relatively unstructured workforce, with a lack of specific award wages or progression that may lead to uncertainty within the workforce. We have drawn the available information into generally recognized categories of aquaculture worker and have visualized a career progression in the Career Pathways in order to highlight interesting careers for prospective students, but also to aid solidifying emerging careers progression trends in the industry. It has been previously highlighted that remuneration is key to staff progression (Anderson and McShane 2015) and a structured approach to pay rates, career progression and upskilling are envisioned as a three-pronged approach to attract and retain the workforce of the future.

The workforce of the future is dependent on public knowledge of the industry and what it has to offer. We have developed information and dissemination packages that we envisage will aid in engaging students in their secondary education phase and facilitating their understanding of aquaculture as an industry and potential career.



## Strategic recommendations

Key priority actions for sector development	Action owner and key partners	Pathways to implementation and timeline	Intended industry impacts
Public awareness of the industry and its career opportunities remains a barrier for staffing the industry's growth ambitions.	Education providers and industry associations	Documents developed in this project can be freely used to engage and upskill. Ongoing.	Increased awareness and a pathway to increased workforce.
Retention of staff may be as large an issue as recruiting new staff to the industry.	Industry businesses, industry associations	Upskilling on-farm, remuneration and career progression structure.	Increased staff satisfaction and retention.
On-farm training is important for career success	Universities, RTOs, aquaculture businesses	Funded upskilling Internships/Work Integrated Learning	Increased student understanding of farm practices and
Provide help with internship/WIL accommodation/transport	Industry	Direct funding packages	Educational context. Matching employees with farms for employment/staffing outcomes.
Funded pre-employment programmes	State and Federal Government	Funded programs by NA governments and promotion through the National Careers Institute/Jobs & Skills Australia	Increased uptake of entry-level workers, increased viability of RTOs





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