FRDC
FISHERIES RESEARCH & DEVELOPMENT CORPORATION

Australian Prawn Farmers Association, (APFA): Management of R&D Portfolio

Industry Partnership Agreement

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Australian Prawn Farmers Association (APFA) Management of R&D portfolio

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In submitting this report, the researcher has agreed to FRDC publishing this material in its edited form.

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Abbreviations

APFA	Australian Prawn Farmers Association
DAF	Department of Agriculture and Fisheries (Queensland)
FRDC	Fisheries Research and Development Corporation
IPA	Industry Partnership Agreement
R&D	Research and Development
RD&E	Research, Development and Extension
NSILP	National Seafood Industry Leadership Program

Executive Summary

This report describes the outcomes from a five-year Industry Partnership Agreement (IPA) between Fisheries Research and Development Corporation (FRDC) and the Australian Prawn Farmers Association (APFA). The project was led by APFA Executive Officer, Kim Hooper with assistance from members of the APFA Management Committee and Chair of the APFA R&D Subcommittee Tony Charles. The primary objective of the IPA was to coordinate R&D related to Australian prawn farming funded through FRDC and other sources. To ensure involvement of members in the development, execution, and extension of research for members of the APFA.

This project worked within the framework of the APFA Strategic Management plan 2020, to conduct research in the following key priority areas:

- Animal Health and Performance
- Industry Biosecurity and Border Protection
- Human Capital and Emerging Technologies
- Broodstock-Sourcing, Quality and Supply
- Environmental Sustainability and Compliance

Throughout this project, APFA undertook 14 projects, 4 of which are now complete or near completion. Projects supported by the IPA were consistent with the priorities in the APFA Strategic Management Plan 2020-2025 and FRDC priorities (Appendix A & B). All the projects have delivered benefits to the industry.

Keywords

Prawn farming, *Penaeus monodon,* Black Tiger Prawn, F*enneropenaeus merguiensis*, Banana Prawn, aquaculture, R&D, Strategic Management Plan

Introduction

The Australian Prawn Farmers Association (APFA) was formed in 1993 to represent the interests and foster the development of the Australian prawn farming industry. The Association is the key contact for investors, new farmers and stakeholders wishing to do business with the Australian prawn farming sector. The Australian prawn farming industry now produces over 8700 tonnes (2020-2021) of product annually with a value estimated at over $160 million (2020-21) and currently provides over 300 full time equivalent jobs. The industry is currently undergoing rapid expansion leading to more exciting opportunities. The Australian prawn farming industry recognises the importance of investing in RD&E as a vehicle for a sustainable and profitable future.

In 2001 the Australian prawn farming industry became the first Australian seafood sector to implement a compulsory federal levy based on production, to fund research, development and extension. This helps raise over $500,000 annually for investment in prawn aquaculture RD&E. With realised and planned expansion of production area this is anticipated to increase significantly over the next few years. This new position was created to assist in the full realisation of benefits for the RD&E investment by industry including people development.

The Australian prawn farming industry is rapidly expanding and APFA identified the need for assistance to manage the APFA/FRDC IPA as efficiently and effectively as possible to ensure full realisation of benefits for the RD&E investment by industry and the Board of FRDC. The RD&E Coordinator's role is to support APFA's RD&E Sub-committee, who provide input and guidance on research projects through rigorous discussions and offer support and technical advice directly or in-directly to researchers. The RD&E coordinator is the first point of contact for anything related to research with the APFA. Proposals are submitted through a newly developed pre-proposal questionnaire and reviewed by the RD&E Sub-committee. The RD&E Coordinator links the prawn farming industry with researchers by being in regular contact with scientists wishing to work with the APFA. These interactions assist in developing collaborative research projects by connecting people and facilitate research activities. This project provided funding for a dedicated APFA RD&E Coordinator to undertake the following tasks:

- Where and when appropriate, fully expend APFA IPA funds annually to address highest priority R&D issues required by APFA members.
- Identifying additional sources of funding for research activities to maximise the leveraging of APFA IPA funds.
- Applying for additional grants and funding for research activities
- Increasing people development through workshops/presentations
- Coordinating successful research activities in a collaborative manner.
- Guiding and assisting the development of applications that align with APFA R&D strategic planning.
- Managing project milestones and inform the RD&E sub-committee
- Managing communication and extension of RD&E activities and outcomes to industry and to FRDC.
- Liaising with, and assisting, project stakeholders to ensure outcomes for the industry and FRDC.
- Ensuring the best use of resources and best practice.

- Ensuring effective and rapid dissemination, extension, and update of the outcomes of RD&E.
- Assisting the APFA RD&E committee to perform their duties through coordination of research applications to APFA and monitoring progress to ensure outcomes.
- Coordinating RD&E committee meetings.
- Developing an annual industry report for FRDC and industry on RD&E activities and projects.

Objectives

This project addressed the following six main objectives:

1. Coordinate development of RD&E projects in line with APFA/FRDC IPA.
2. Manage communications with APFA members.
3. Promote confidence by APFA farm members and researchers in APFA's RD&E investment for betterment of the industry.
4. Coordinate projects in line with the APFA RD&E Strategic Plan and FRDC priorities.
5. Promote RD&E investment confidence through an annual industry workshop and presentation at the APFA conference.
6. Promote people development.

Methods

The APFA Executive Officer (EO, Kim Hooper) appointed 2 RD&E Coordinator's throughout this project, Dr Camilla Thompson (2020-2021) and Dr Sarah Berry (2022). The RD&E Coordinators led the project in close consultation with Kim Hooper and Tony Charles (Chair, APFA R&D Subcommittee). The RD&E Coordinators worked with the APFA R&D Subcommittee and Management Committee to develop RD&E projects that addressed the APFA Strategic Management Plan 2020-2022 and priorities identified throughout the duration of the project. Project applications were subsequently submitted through FishNet for FRDC consideration in line with the APFA/FRDC IPA. The project included organising and chairing quarterly R&D Subcommittee meetings that included FRDC representation from Mr Wayne Hutchinson.

Coordinate development of RD&E projects in line with APFA/FRDC IPA.

The APFA had a call for applications early March 2021 and March 2022, the first of which was sent out to all universities in Australia, APFA's members and research contacts, as well as through LinkedIn. The latter was advertised privately due to the sensitivity of the topics. The purpose of these grant rounds was to offer financial support to research and development projects that that address priorities identified by APFA to help the Australian prawn farming industry to become more resilient, prosperous, sustainable, cohesive and respected. The APFA called for projects that achieved one of the outcomes listed below:

March 2021:

- Total Nitrogen Removal in prawn farm effluent water
- An aerial/amphibious/terrestrial drone for un-manned use in Australian prawn farms

12 applications were received, 8 that addressed nitrogen removal and 4 that were addressing the call for un-manned drones. From these applications, one project was approved for funding (2021-030 Aerial Drones), and an Electrocoagulation project is currently under development.

March 2022 (private call):

- Novel solutions for stimulating ovarian maturation in *Penaeus monodon*
- Animal welfare best practice

4 applications were received, one addressing ovarian maturation, two addressing animal welfare and one proposal addressing both themes in a combined project. Three of these projects were supported for funding by APFA and will commence in late 2022 and early 2023 (FRDC projects 2022-069, 2022-074 and 2022-079)

Manage communications with APFA members.

The APFA R&D Coordinator plays an integral role in communicating R&D updates and strategy to APFA through the APFA Connected Community Newsletter (once a week email), email, phone and in person at site visits and conference attendance. Communication is clear and well-managed through the position to instil confidence in members that their R&D investment is being spent in line with the APFA 2020-2025 Strategic Management Plan and with the intent of a growing and supporting industry.

During this project the following communications activities were conducted:

- Webinars
    - 22/2/21 WorkSafe QLD Webinar
    - Digital skills webinar in collaboration with CQU (project code)
    - "Shrimply the best – advancing prawn breeding and farming in Australia" on APFA's research priorities for the Australian Association of Animal Sciences Webinar Series with Professor Dean Jerry 26 Nov 2020.
- Workshops
    - 3 Digital Skills Hub Workshops in collaboration with CQU (project code) held on the Gold Coast, Mackay, and Townsville in 2022.
- Surveys
    - In May 2021 CSIRO developed a survey, fully funded by CSIRO to understand the use, gaps and needs of probiotic applications in commercial prawn farms. Results from the survey will assist in developing research projects in this area. The survey will be done anonymously through an online platform, such as survey monkey. The RD&E Sub-committee has reviewed the survey and approved the project and this was distributed to members.
- Regular communication of RD&E activities through platform

Promote confidence by APFA farm members and researchers in APFA's RD&E investment for betterment of the industry.

The RD&E Coordinator has regular meetings with APFA's research network, to uphold communication and staying informed of new research being undertaken which could benefit the prawn farming industry. These include, but are not limited to, JCU, UQ, Griffith, CQU, SCU, Genics, CSIRO, local councils, and state and federal governments.

Promote RD&E investment confidence through an annual industry workshop and presentation at the APFA conference.

The ability to present industry workshops and presentations and the APFA conferences was impacted by COVID-19. Alternative arrangements were made with a virtual conference held in 2021. The R&D Coordinator produced an annual report for the AGM and in 2022 made a presentation summarising these efforts to members at the AGM. These documents were made available to members via the APFA Connected community.

Promote people development.

Skills and training are a priority for APFA and is reflected in the APFA Strategic Management Plan. To promote people development in 2019-2022, APFA has submitted the project "2022-061: Developing leadership and networking capability in Australian prawn farming" to fund 1 member per year to attend the National Seafood Industry Leadership Program (NSILP).

Results, Discussion and Conclusions

Summary of outcomes from FRDC/APFA IPA projects

For the duration of this project, the following projects were undertaken by APFA using IPA funds. Below is a short summary of the progress and outcomes of each project.

2021-033: Aerial drones for un-manned use in Australian prawn farms

Project Status: Ongoing. Due for completion January 2023

Summary:

The aquaculture industry has been moving towards more automated processes to increase the standard of operations; reduce operational expenditure (labour resources, etc.); realise gains in stock performance and to improve decision-making processes. This concept of "smart farming" has been realised in agriculture for some years, and technologies that are proven effective in enhancing businesses can now be adapted to the aquaculture industry.

This team aims to provide the Australian Prawn Industry a demonstrator model of a potential automated UAV/software product with 3 specific use cases. The aim of this first phase is to prove 1) that the use-cases for the drones can be performed successfully; 2) that the drones can be used in their predicted manner; 3) estimate the cost of consumables and life span associated with a basic package; 4) work within the legal framework of drone operations and consider this in package development; and 5) commercial feasibility of drone integration into farming operations.

This project is well aligned with the FRDC's strategic R&D priorities and aims to improve best practices and production systems (FRDC 2030 vision: Outcome 2) using strategy I (Drive digitisation and analytics), strategy III (Promote innovation and entrepreneurship), and strategy IV (build capability and capacity) of the FRDC Strategic R&D plan (Appendix B).

2021-026: Water disinfection for influent water biosecurity on prawn grow-out farms.

Project Status: Ongoing. Due for completion June 2023.

Summary:

Prawn farms have few options for high level influent water biosecurity. Rotating drum filters have proven to be effective in excluding a majority of high-risk crustaceans, however, at certain times, an even higher level of protection is considered appropriate. Chemical treatment to remove residual vectors and/or destroy the pathogen is currently the only practical approach. Currently there is no locally compiled guideline on how Australian farms can achieve effective application of trichlorfon and there is little detail around what can and what can't be achieved through such treatment. The industry needs a set of guidelines that expand upon the basic APVMA use conditions and define the environmental factors that need to be considered for safe and effective use.

2021-019: Future proofing the northern Australia aquaculture industry need for skilled staff to 2050.

Project Status: Finalising. Due for completion July 2022.

Summary:

This project aims to evaluate the current workforce needs now and, in the future, analysing the gaps between industry needs and educational output and highlight gaps in career pathways to meet future industry requirements. A pilot project to upskill existing employees in biosecurity will be used to develop new training models.

2021-018: SafeFish 2021-2025

Project Status: Ongoing.

Summary:

SafeFish was developed by Seafood CRC to bring businesses and sectors together to work on issues that affect them. SafeFish run incidence response section, provide technical advice, and help interpret results. They look at the seafood industry holistically. During the project, they plan to continue scanning international standards, SPC notices and what they mean for the prawn farming industry. They will develop a risk register for each sector, which will be reviewed yearly. SafeFish will be helping the seafood industry be prepared and anticipate when a market issue will occur rather than react. They have an open email line for sectors and businesses to use. The APFA is joining the ACPF in this project and therefore the risk register developed through this project will be conjoint with wild caught prawns. The project is projected to start in the 2020/2021 financial year.

2020-115: Demonstrating the impact of prawn viruses on prawn aquaculture production

Project Status: Ongoing. Due for completion August 2024.

Summary:

This project aims to robustly investigate the effect of purified strains of IHHNV, Whenzhou Shrimp Virus-2 and GAV on prawn health under controlled laboratory conditions. At the moment, numerous endemic viral pathogens are monitored on-farm. The real effect of these viruses on shrimp health and farm productivity have not been assessed with certainty. In particular, sub-clinical impacts of individual pathogens have not been quantified, nor how multiple viral infections synergistically, or antagonistically affect health and growth.

This project links to a previous CRCNA project that focussed on quantifying the types and prevalence of various pathogens in productions systems in prawn hatcheries and farm. Drawing connections between pathogen load and type and their impacts on disease events is difficult on farm as there are an enormous combination of variables. Therefore, a controlled lab-based approach has been suggested for the next project, looking into how salinity, temperature or a combination of both impact growth and survival compared to control.

Expected outcomes include:

1. Reducing risk of the Northern Australian investment landscape by improving the understanding of disease outbreaks in prawn farming by identifying the viral strains and environmental risk factors that increase the impact of viral infections.
2. Delivering a coordinated approach to sector development through the creation of viral standard and increased accuracy in detection and management.
3. Delivering research and extension solutions with impact including a pathogen testing panel that can underpin future prawn selection programs to identify genetically virus resistant/tolerant lines.
4. Deliver strategic research capacity and develop the workforce skills of northern Australians by training industry members and stakeholders in prawn health and disease.

2020-111: Accelerating the adoption of digital technology on Queensland prawn farms

Project Status: Finalising payments.

Summary:

APFA has together with CQU applied for funding from the Queensland Department of Agriculture and Fisheries to upskill the current workforce in digital skills and to attract new workers to the industry. The APFA was successful in this application. This project aims to assist the prawn farming industry to adopt digital technologies to increase profitability, productivity and environmental sustainability. This will be achieved by 1) building a Prawn Skills Digital Training Hub, which will provide education and training material free of charge to the industry; 2) developing training materials to support the prawn farming industry and 3) featuring face-to-face and/or online delivery of the training material.

2020-098: Consumer and market data to inform Love Australian Prawns 2021-22

Project Status: Complete

Summary:

The Love Australian Prawns campaign is a long-standing collaborative marketing campaign (10 years) involving the APFA and the Australian Council of Prawn Fisheries (ACPF) to promote Australian prawns. This collaboration runs a national marketing and promotional strategy focussing on:

- Increasing value and volume for Australian prawns
- Increasing desire for and desirability of Australian prawns
- Giving Australian prawns a special place in the eating habits of Australians

2020-074: Understanding white spot syndrome virus (WSSV) transmission in Moreton Bay - epidemiological modelling of surveillance data

Project Status: Complete

Summary:

This project aims to undertake simulation modelling to 1) identify what vectors/sentinels are involved in the spread of WSSV and design surveillance for these; 2) investigate at what rate WSSV is spreading by defining the current zone; 3) understand how seasonal factors could impact the spread and 4) advice whether the boundary of the current zone is likely to be changed. Information gathered from this project will assist farmers initiate appropriate management practices on an individual and regional basis and to improve their biosecurity plans. Looking forward into what is likely to happen in the future will assist the industry in taking precautionary measures in controlling and managing prawn farms where WSSV is a real risk.

Discussion and Conclusions

There were six primary objectives of this project:

1. Coordinate development of RD&E projects in line with APFA/FRDC IPA.
2. Manage communications with APFA members.
3. Promote confidence by APFA farm members and researchers in APFA's RD&E investment for betterment of the industry.
4. Coordinate projects in line with the APFA RD&E Strategic Plan.
5. Promote RD&E investment confidence through an annual industry workshop and presentation at the APFA conference.
6. Promote people development.

These objectives have largely been achieved with the modification of some outcomes due to extenuating circumstances. Throughout the duration of this project, 5 IPA funded projects have been developed by APFA and researchers to support the APFA Strategic Management Plan and R&D Priorities. These projects addressed key topics including nutrient discharge, animal welfare, broodstock quality and technological development on farms. These projects and existing projects were supported and coordinated by the R&D Coordinators Dr Camilla Thompson (2020-2021) and Dr Sarah Berry (2022-Present). The R&D Coordinators managed communications with APFA members to ensure confidence in project development and delivery and ensure return on investment.

Hosting in-person workshops and conferences during this project was challenged by the COVID-19 pandemic. As a result, APFA did not host an in-person conference in 2020 or 2021 and an online conference was hosted instead. These online conferences were well-received by members and researchers with great participation and enthusiasm.

Implications

Overall growth of the industry partly attributed to valuable R&D development, management and extension. Significant projects under development in 2022 to address continue to enhance best practice including key aspects of animal welfare that has potential for significant industry impact including:

2022-069: Novel solutions for inducing ovarian maturation in P. monodon.

PI: Tomer Ventura & Abigail Elizur (University of the Sunshine Coast).

Status: Under review at FRDC

This project seeks to find alternative means to secure reproductive development and spawning in P. monodon broodstock. This project will apply a suite of cutting-edge technologies to identify the endogenous molecular factors that change following eye stalk ablation. Molecular technology will be explored (e.g. gene silencing, controlled hormonal delivery) to efficiently stimulate reproductive maturation, without eye stalk ablation.

Objectives:

- Generate a comprehensive understanding of the endogenous molecular changes associated with eye stalk ablation at the gene, protein, and metabolite level.
- Conduct experiments to advance reproductive development and spawning in P. monodon without eye stalk ablation.

Outcomes:

- Progress towards an alternative to eyestalk ablation as reproduction in crustaceans including identification of key target candidates (genes etc) for manipulation.

2022-079: Defining behaviour metrics for farmed prawns and developing methods to enhance spawning and welfare of *Penaeus monodon* broodstock

PI: Nick Wade (CSIRO)

Status: Preparing submission to FRDC

This project seeks to define new welfare standards for prawn farming from two perspectives. First by providing guidelines for industry about the ASC Standards and advice on how to implement them across the production cycle. Secondly, by investigating general indicators of stress or condition (biomarkers, welfare/wellbeing indices, nutritional condition prediction) in prawns. These new objective tools or methods will be used to define the impact of standard husbandry practices and establish sequential improvements to those practices based on practical research. Of significant focus will be the practice of broodstock ablation and methods to improve reproductive performance. This will investigate both potential nutritional (enhanced broodstock diets and condition), physical (non-

ablation alternatives or ablation welfare improvements) and injectable (hormone pathway modulators) interventions and their potential for integration within standard industry practices.

Objectives:

- Develop a best practice welfare manual for Australian prawn farming. The project will adopt a combination of initial reviews and reports of welfare knowledge and the current welfare status against the ASC Standard. A final output Best Practice Animal Welfare Manual incorporating input from an industry will be produced.
- Assess novel solutions for stimulating ovarian maturation. Alternatives for stimulating ovarian maturation will be investigated across 3 broad topics: pain relief, injectables and nutrition; combining broad knowledge of the team across animal husbandry, nutritional, behavioural, and molecular expertise

Outcomes:

- Welfare: Defined world-leading and achievable standards in animal welfare across production
- Ablation alternatives: Enhanced animal welfare through induction of ovarian stimulation without ablation or reducing reproductive performance outcomes
- Reproductive performance: Enhanced female broodstock maturation, spawn performance and spawn quality

2022-074: Animal Welfare Best Practice

PI: Belinda Yaxley (Nautilus Collaboration)

Status: Under review at FRDC

This project seeks to develop an animal welfare best practice guidelines for the Australian prawn farming industry that will outline best practice with respect to welfare from hatchery to processing. APFA can use the guidelines developed from the project to inform customers of their well standing welfare position as evidenced by meeting global welfare guidelines for prawn aquaculture.

Objectives:

- Outline interrelations with BAP and ASC practices on farm.
- Develop a Draft Guideline based on on-farm practice that is meeting the welfare requirements of ASC/BAP and some recommended guidelines where gaps have been identified.

Outcomes:

The guideline will act as an independent voice piece on welfare best practice for the Australian prawn farming industry. The document will detail how the industry meets ASC/BAP welfare requirements which will in turn showcase the Australian prawn industry as leading the way in welfare best practice in a cohesive manner, something not seen elsewhere in the world. Such an approach will alleviate concerns of customers, animal welfare lobby groups, the consumer and wider community.

2022-019: Removal of microalgae and total nitrogen in effluent water from prawn farms using electrocoagulation (EC) water treatment technology.

PI: Christine Huynh (Nautilus Collaboration)

Status: Approved for funding by FRDC, undergoing contracting.

To meet increasing regulation, the reduction of total nitrogenous output remains a significant challenge in the pond culture of prawns. The majority of total nitrogen (TN) output from the Australian prawn industry is organic nitrogen, of which microalgae assimilate a large proportion. In response to recent regulation requiring the industry to remove or reduce microalgae and TN from large quantities of release water, the team proposes a project that would investigate the use of electro-coagulation (EC) technology to remove microalgae and TN from settlement pond discharge. This technology works by applying an electrical current through the water, destabilizing/neutralizing the repulsive forces that keep particles suspended, causing these particles to form larger particles that settle for easier separation from water. The proposed project will utilise proprietary EC technology developed by Natural Aquatic Solutions has the capacity to treat around 20.5 m3/hr of water.

Objectives:

- Assess technical feasibility of electrocoagulation unit for wastewater remediation.
- Assess the economic feasibility of electrocoagulation for wastewater treatment.
- Determine any bottlenecks for application for prawn effluent treatment.

Outcomes:

- Determination of suitability of technology and if there are any modifications that are required for the EC to be applied to prawn effluent and monitoring requirements.
- Assessment of scalability and commercialisation including:
- Costs of upscaling technology to treat commercial quantities of outflow water.
- Potential options to remove flocculant from discharge water (e.g. drum filters, carbon filters etc.).
- Estimation CAPEX costs.
- Estimation of OPEX costs.
- Overall recommendation and cost benefit analysis of technology.

Recommendations

This project has supported the Executive Officer and R&D Subcommittee of APFA to ensure that APFA R&D investments are appropriately invested and managed. The position this project funds is essential to the continued success of the industry, and it is recommended that there be continued investment in funding a APFA R&D management project.

Extension and Adoption

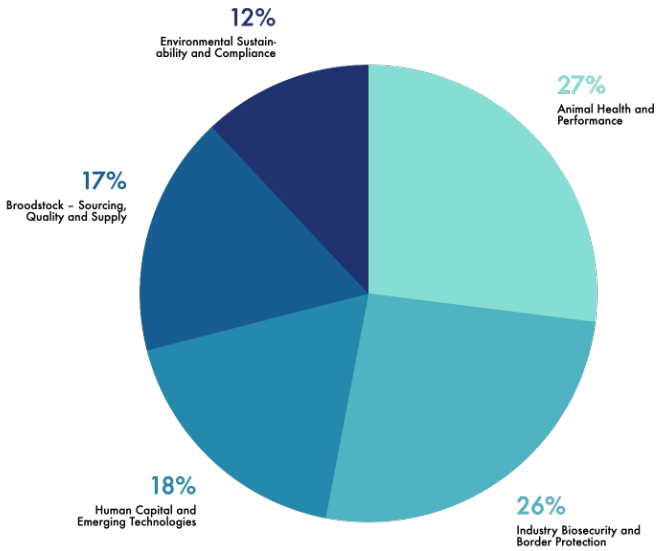
This project was successful and integral to the positive performance of the APFA R&D portfolio. As such, a follow-on Strategic Management Project (2021-125) has been developed and approved by APFA and FRDC. This project will continue to support the R&D activities of APFA 2022-2025.

Project Materials Developed

This project indirectly produces materials through supporting outcomes of other APFA projects including presentations, final reports and facilitating workshops.

Appendices

Appendix A – Suggested allocation of IPA funds to RD&E Priorities (AFPA Strategic Plan 2020-2025)



Appendix B – FRDC R&D Plan 2020-2025