FINAL REPORT

FRDC Project No 2018-177

If you don't know where you are going, you'll end up someplace else - future proofing the Australian mud crab industry through improved strategic direction

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The traditional custodians of the lands and waters where this work was undertaken are acknowledged.

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ACRONYMS

Acronym	Details
AFMF	Australian Fisheries Management Forum
AMCI	Australian Mud Crab Industry
ASC	Aboriginal Sea Company
ASFB	Australian Society Fish Biology
C-AID	C-AID Consultants
CI	Co-investigator
DAF	Queensland Department of Department of Agriculture and Fisheries
DITT	NT Department of Industry, Tourism and Trade
DPI	NSW Department of Primary Industries
DPIRD	WA Department of Primary Industries and Regional Development
ECCFN	East Coast Crabfishers Industry Network
EISP	Experienced Independent Service Provider
FMC	Fisheries Management Committee
FRDC	Fisheries Research and Development Corporation
GoCCFA	Gulf of Carpentaria Commercial Fishermen Association
IPA	Industry Partnership Agreement
ITCAL	Interim Total Commercial Access Level
ITQ	Individual Transferable Quota
MBSIA	Moreton Bay Seafood Industry Association
MEY	Maximum Economic Yield
MSC	Melbourne Seafood Centre
NESP	National Environmental Science Program
NIRS	Near Infra-Red Spectrometry
NLC	Northern Land Council
NMP	National Marketing Plan
NSW	New South Wales
NT	Northern Territory
NTRAC	Northern Territory Research Advisory Committee
NTSC	Northern Territory Seafood Council
PD	Personal Development
PFA	Professional Fisheries Association
PI	Principal Investigator
PoC	Proof of Concept
Qld	Queensland
QSIA	Queensland Seafood Industry Association
QSMA	Qld Seafood Marketers Association
R&D	Research and Development
RAC	Research Advisory Committee
RPN	Research Providers Network
Sea Sense	Sea Sense Australia Pty Ltd
SFM	Sydney Fish Market
SIV	Seafood Industry Victoria
TAC	Total Allowable Catch
Vic	Victoria
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council

1. EXECUTIVE SUMMARY

Project No. 2018/177	If you don't know where you are going, you'll end up someplace else - Future proofing the Australian Mud Crab Industry through improved strategic direction

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2. BACKGROUND

Australian mud crab fisheries extend from northern Western Australia (WA) across the Northern Territory (NT) and Queensland (Qld) through to northern New South Wales (NSW) and are managed across the four jurisdictions. The product from each jurisdiction is sold into a larger common market valued at around $50M/annum[1], mainly within Australia, but also into a number of international markets.

This project's genesis came when mud crab Industry leaders from key jurisdictions caught up by phone, discussing the status of individual jurisdiction's fisheries. To them it became apparent that they were catching the same species, *Scylla serrata* and *S. olivacea, (*which are called mud crabs), and were all supplying the same markets, and therefore there were many common issues to resolve.

It was noted there was no formal cross-jurisdictional connectivity and it was felt that there could be improved outcomes achieved through a collaborative approach across jurisdictions. This was particularly so as, after a number of years of relative status quo in the Australian fisheries, recent years had seen significant structural and management changes that will lead/have led to operational changes in the fishery landscape.

A national workshop was considered the optimal mechanism to bring Industry, and importantly, Agencies, together, to develop a common purpose. Through an approach where participants learn from each other and build relationships, Industry leaders believed that a coordinated approach to building the Industry's future would lead to improved outcomes from an operational, economic, ecological, social and regulatory perspective. Each major Industry group

1 Based on average annual catch over last 10 years of approximately 1,450t at $35/kg at first sale point

and relevant Agency in Australia was contacted and provided unanimous support for this approach.

The concept was supported by the FRDC through Project 2018-177, '*If you don't know where you are going, you'll end up someplace else - Future proofing the Australian Mud Crab Industry through improved strategic direction*'.

Like many projects that were planned for this period (2020) the impacts and uncertainty caused by COVID restrictions led to significant delays, and the project value was questioned due to the time from its genesis to its potential completion. This view was tested with Industry and Agency participants who unanimously supported the holding of a face-to-face workshop to address the project's objectives. As such, the workshop was deferred from 2020 until it was eventually held in late 2022.

3. OBJECTIVES

1 Share experiences and understandings to identify issues and opportunities for collaborative approaches across the Industry and Agencies

2 Build Industry cohesion and capacity through development of a national Industry plan and communication network.

4. METHODOLOGY

The core approach in this project was to bring together the diverse range of stakeholders (i.e. licensee/quota holders, catchers, processors, managers and researchers) from the Australian mud crab fishery, and hold a facilitated two day workshop to identify and develop a national approach to a range of issues facing this fishery and to build joint Industry/Agency solutions and opportunities.

Potential participants were sought in 2019, with around 30 people expected to ensure coverage from each relevant jurisdiction, across the supply chain and from those actively involved in the Industry at a high level. Eventually 29 participants were identified and attended the 2022 workshop (see list at Attachment 1).

Initially, the workshop's aim was to distil broad Industry ideas into key objectives, priority issues and deliverables, that could be incorporated into a high-level plan to guide and focus national conversation on the wild caught mud crab Industry.

Due to delays in holding the workshop, due to COVID restrictions, it was determined there was value in undertaking an online preworkshop survey. All workshop participants were requested to complete a SurveyMonkey questionnaire. A summary report of findings (see Attachment 2) was developed and shared prior to the workshop, with key areas incorporated into the workshop structure as prompts for sessions.

The workshop program was developed to follow a stepwise approach with a clear view to developing outputs to address the project objectives. It was noted however that there needed to be inbuilt flexibility in the program to ensure inclusivity, whilst allowing ideas to flow and be captured.

Information was collected, via small and large groups, and plenary sessions, that identified challenges, opportunities, commonality and potential solutions. This information was distilled

into a structured format to provide participants with clear directions on suggested approaches, actions, extension, methods, materials, priority level, funding and resourcing options.

Post workshop, a plan, based on the workshop outputs, was drafted and distributed to all participants, seeking their input. Based on feedback, amendments were to be incorporated into the final workshop report (also referred to as the National Plan) (Attachment 3).

Finalisation of the workshop report laid out a pathway forward. Subsequent liaison with Industry and Agency participants and potential funders addressed how to progress the workshop outputs to achieve Industry benefits into the future. This was to be assisted by the development of a Working Group.

5. KEY FINDING

It was apparent that there is considerable opportunity to improve the future for the Australian mud crab industry on several fronts. Foremost among these is to develop a coordinated direction based on the National Plan, developed as the workshop summary (Attachment 3), to address the seven key investment areas identified. This will require communication within and between sectors.

A major recommendation was to form a Working Group which will have interim responsibility for progressing the National Plan, and to gauge the appetite to move to a more formalised arrangement for the Industry to coordinate its activities nationally.

What was also clear was that a process where diverse participants learn from each other and build relationships can support a coordinated approach to building the Industry's future from an operational, economic, social and regulatory perspective. It was noted that in the short term a standalone Industry approach would most likely fail, and that Agency involvement in the process was a critical component of generating agreed, sustainable and positive outcomes.

In addition, it is clear that many of the key areas that require investment are not solely the remit of the Australian mud crab industry. A process to ensure that sectoral and regional needs can be amalgamated and coordinated to undertake high level and nationally focussed Research and Development (R&D) could lead to positive outcomes for many fisheries around Australia, particularly if there were a two way feedback process to share information (positive and negative) of new R&D and practices (i.e. impacts of climate, better understanding of ecological, weather and climate processes, capacity and capability, communications etc).

6. IMPLICATIONS

The outputs and outcomes from the project, mainly via the National Plan, have the capacity over time to lead to a substantial increase in the economic value of the fishery, along with significant operational, social and ecological benefits. If the challenges and opportunities identified in the National Plan can be addressed that would guide the fishery's future actions, in a sense future proofing the Industry.

If the Working Group is formed and adequately resourced, a process of evaluating progress of the National Plan should be developed, and be used to guide adjustment to directions and activities.

Some variables will be easier to assess, such as the annual revenue to each of the commercial sector stakeholder groups and improvement estimates based on economic performance. However, some ecological and social variables may be more difficult to measure quantitatively

but through quantitate measures a level of progress against the key activities identified in the National Plan may be possible (i.e. -improved confidence in sustainability outcomes across all sectors, greater confidence in R&D and management, better engagement etc).

The fact that several investment areas identified in the National Plan are not unique to Australian mud crab fisheries means an important outcome will be to identify which of the areas have a shared value across fisheries, regions and jurisdictions and might be better addressed (or are being addressed) at a regional or national level. For example, evaluation of water quality in estuarine and coastal habitats might be a priority for mud crab, barramundi and prawn fisheries.

7. KEYWORDS

Scylla spp., mud crab, supply chain, research, strategic, communication.

8. INTRODUCTION

The Australian mud crab fisheries extend from northern WA across the NT and Qld through to northern NSW and so are managed across the four jurisdictions. The product from each jurisdiction is sold into a larger common market valued at around $50M/annum[2], mainly within Australia, but also into a number of international markets.

This project's genesis came when mud crab leaders from key jurisdictions caught up by phone, discussing the status of individual fisheries. It became apparent that they were catching the same species *Scylla serrata* and *S. olivacea, (*which are called mud crabs) and all supplying the same markets and therefore there were many common issues to resolve.

The Australian Mud Crab Industry (AMCI)[3] had little cross-jurisdictional connectivity, and although high-quality work was undertaken across jurisdictions, from an Industry perspective, R&D, monitoring and management approaches didn't appear coordinated enough, with Agencies appearing to generally operate in isolation. It was felt that there could be improved outcomes achieved through a collaborative approach across jurisdictions, and at several levels.

After a number of years of relative status quo in the Australian mud crab fisheries, recent years had seen significant structural and management changes that will lead/have led to operational changes in the fishery landscape. These are expanded on in the needs section but include:

- A rationalisation of the NSW fishery, as a prelude to the current quota system
- A formal review in Qld that led to development of a quota management system
- Development of the fishery in WA
- Likelihood of structural changes in the NT that will see much greater Aboriginal ownership and participation in the fishery, arising from 'Blue Mud Bay' negotiations.
- .A national shift to harvest strategies
- A desire at jurisdictional levels to model the fishery for management applications
- Development of new monitoring and data collection needs and techniques with associated R&D requirements
- A rationalisation and redefinition of the market arising from revised management arrangements, and subsequent operational and logistical adjustments
- Implementation of cost recovery programs
- Issues with decreasing community support for near shore fisheries.

This project was seen as critical for the Australian Industry's future as it navigates these changes and seeks to optimise outcomes. Other potential beneficiaries included supply chain partners, and Agencies.

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2 Based on average annual catch over last 10 years of approximately 1,450t at $35/kg at first sale point

3 We use the term 'Australian Mud Crab Industry, (AMCI) as a catch-all to describe the wider commercial Mud Crab sector, including licence and quota holders, fishers, and the post-harvest sector including marketers.

By seeking an approach where participants learn from each other, build relationships and reduce duplication, Industry leaders believe that a coordinated approach to building the Industry's future would lead to improved outcomes from an operational, economic, social and regulatory perspective. It was noted however that at this early stage a standalone Industry approach would fail, and that Agency involvement in the process was a critical component of generating sustainable and positive outcomes.

A national workshop was considered the optimal mechanism to bring Industry and Agencies together to develop a common purpose. Such an approach has not been undertaken previously for the Australian mud crab fisheries, although some issue-specific Industry workshops and Agency specific meetings have been held, a joint national meeting has not been attempted previously. The Industry didn't have logistical coordination or resources to carry it out, and sought FRDC funds and arranged significant Industry and Agency in-kind.

Each major Industry group in Australia was contacted, and they provided unanimous support for this approach. In addition, each Agency was contacted and they also provided unanimous support for the approach outlined in the application.

The project sought to discuss the fisheries from a national perspective and to lay foundations for a more coordinated and successful national fishery with clearer direction. Key outputs and outcomes sought were to:

- Bring together Industry members and Agency people from across Australia
- Increase knowledge, connectivity and direction
- Identify gaps and knowledge to inform end users so as to increase knowledge, connectivity and direction.
- Develop a formalised plan to target and focus attention in respect to R&D investment, operational considerations and potential direction for Industry marketing (with a focus on joint priorities and potential solutions and commitments to progress priority areas).
- Reduce duplication to allow outcomes to be built on, and to minimise waste
- Develop information for effective investment to improve sustainability, productivity, profitability, community support and Industry connectivity
- Attempt to develop a Working Group to share uptake after project completion.

The concept was supported by the FRDC through Project 2018-177, '*If you don't know where you are going, you'll end up someplace else - Future proofing the Australian Mud Crab Industry through improved strategic direction*'.

Like many projects that were planned for this period (2020) the impacts and uncertainty caused by COVID restrictions on travelling, and face-to-face meetings led to significant delays, and the project value was questioned due to the time from its genesis to its potential completion.

To address this, the PI undertook semi-regular contact with the potential participants to firstly, ascertain their desire to continue with the project with a face to face focus, secondly to update potential participants (many Agency people had moved on) and thirdly, to look to a future date and workshop structure. The unanimous response was a validation of the ongoing importance of the workshop and that a face-to-face approach was really the only viable option. As such, the workshop was deferred from 2020 until it was eventually held late in 2022.

Due to the delay in holding the workshop it was agreed that a participants' preworkshop survey would be used to reassess key areas for discussion.

9. PROJECT OBJECTIVES

1 Share experiences and understandings to identify issues and opportunities for collaborative approaches across the Industry and Agencies

2 Build Industry cohesion and capacity through development of a national Industry plan and communication network.

10. METHOD

The proposal was to run a two day independently facilitated workshop in Brisbane in 2020 (deferred due to COVID until 2022) with representatives from the mud crab industry across Australia (i.e. licence/quota holders, catchers, processors) along with Agency based managers and researchers, to develop a national approach to a range of issues facing this fishery and identify Industry solutions and opportunities.

An Experienced Independent Service Provider (EISP; Dr Buckworth) with high level facilitation and writing skills was engaged as a Co-Investigator to assist the Principle Investigator and project team to develop the program, preworkshop material, facilitate the workshop, and develop workshop output materials to distil the broad Industry ideas into key objectives, priority issues and deliverables, that could be incorporated into a high-level National Plan to guide and focus national conversation on the wild caught mud crab Industry.

In line with advice provided by FRDC, Sevaly Sen, an applied fisheries economist with extensive experience in the Industry, was added to the team.

Participants

In 2019 workshop planning commenced via electronic communication with key Industry and Agency stakeholders in WA, NT, Qld, NSW and Victoria (Vic) (a major market) to identify appropriate people to attend, and key areas to workshop.

Around 30 people were expected to attend, with participants sought to ensure coverage from each relevant jurisdiction, across the supply chain sector, and from those actively involved in the Industry at a high level. Interested FRDC Staff and relevant Subprogram/Coordination Program leaders were also welcome to attend (at FRDC cost for travel and accommodation). Although Industry participants were to be drawn from major Industry groups, they were attending based on their expertise, not as representatives.

Formal support was provided by WA, NT, Qld, NSW Industry and Agencies and Vic postharvest sector, either directly as CIs and/or via letters of support.

Support was also provided by the Northern Territory Seafood Council (NTSC), East Coast Crabfishers Industry Network (ECCFN, Gulf of Carpentaria Commercial Fishermen Association (GoCCFA), Fishermans Portal, Queensland Seafood Industry Association (QSIA), Moreton Bay Seafood Industry Association (MBSIA) and Professional Fisheries Association (PFA) as coinvestigators and Melbourne Seafood Centre (MSC), Sydney Fish Market (SFM), Seafood Industry Victoria (SIV), Western Australian Fishing Industry Council (WAFIC), and the Northern Land Council (NLC).

Importantly, in addition the NSW Department of Primary Industries (DPI), NT Department of Industry Tourism and Trade[4] (DITT), Qld Department of Agriculture and Fisheries (QDAF) and WA Department of Primary Industries and Regional Development (DPIRD) also provided formal support and offered participants to attend.

The final 29 participants were identified and their details are provided at Attachment 1.

The initial workshop program was designed to follow a staged, but flexible approach, as outlined below (a more detailed initial approach is provided at Attachment 4).

Preworkshop Survey

In line with discussions with FRDC, it was agreed to develop a more extensive and up to date formalised 'Issues Paper' prior to the workshop, to fine tune current and potential future issues and opportunities that the fishery faced. This was undertaken via a 26 question online survey powered by SurveyMonkey which was sent out to 27 participants (two participants felt they were not in a position to provide views). The survey sought input on the questions shown below at Table 1.

Depending on the question, participants were asked to rank a series of statements (either from strongly agree to strongly disagree, or from 0 to 7) or to provide free text responses.

A summary report of the preworkshop survey findings (see Attachment 2) was developed and shared prior to the workshop with key areas incorporated into the workshop structure or as prompts for sessions.

In addition, a summary was developed of current and previous FRDC funded mud crab projects along with the project objectives. This was provided to participants to allow them to better understand where R&D has been completed and is currently taking place in the fishery (see Attachment 5).

Workshop Structure

A draft and stepwise approach to the workshop was developed by the PI and EISP (as per the draft program provided at Attachment 4), with a clear view to developing outputs to address the project objectives. It was noted that there needed to be inbuilt flexibility in the program to ensure inclusivity, whilst allowing ideas to flow and be captured. The proposed approach is summarised below:

DAY 1

- Workshop outline and participant introductions
- Visioning and Valuing Exercises
- Industry and Agencies Breakout Groups - document key areas, challenges, opportunities and solutions
- Joint sessions to review key areas and identification of areas of commonality and any potential solutions
- Informal dinner to allow conversation on key areas in preparation for day 2.

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4 Until 2020 was called the Department of Primary Industry and Resources

DAY 2

- Series of joint sessions with Industry and Agency, small and big groups, plenary sessions to workshop key matters from day 1 in a structured manner (i.e. approaches, actions, extension, methods, materials, priority level, funding and resourcing options).

Post Workshop

The PI, with assistance from the EISP, was to draft a plan based on the workshop outputs. This draft would be distributed to all participants seeking their input (and other key people within their networks). Based on feedback, any amendments were to be incorporated into the final Workshop Summary document.

Liaison was to take place with Industry and Agency participants and potential funders, such as FRDC, to assess how to progress the workshop outputs to achieve Industry benefits into the future. This was to be assisted by the development of a Working Group.

11. RESULTS AND DISCUSSION

The following section provides an overview of the project's outputs and provides discussion on key areas from the preworkshop survey, workshop and post workshop activities.

11.1. Preworkshop Survey Findings

Participants responded very well to the survey, with 23 of the 27 participants responding for an 85% response rate. Not every responder answered every question, as some indicated that they did not have current knowledge, or expertise, in some specific areas. Therefore, the totals of responses do not always add to 100% or 23 responses, as summarised in Table 1 and expanded on in Appendix 5.

The survey clearly showed that although there was a broad range of people from across the Industry, in nearly all instances (bar two) the majority of questions led to responses that were aggregated towards a position of agreement, or had free text responses that closely aligned.

Rather than undertake a formal assessment of the survey findings at the Workshop, participants were asked to provide any thoughts prior to the meeting. The results were assessed by the PI and EISP, with findings integrated into the workshop program.

Table 1: Summary of preworkshop questions and findings[5]

Question	Format	Responses
Q1: What is your role in the Industry?	Tick boxes	11 roles were identified, with the bulk being: ▪ researchers (22%) ▪ fishers (20%) ▪ quota owners (15%) ▪ managers (10%)
Q2: How long have you been involved in the mud crab fishery?	Select a range	Mean 18.2 years. ▪ 7 Individuals had less than 10 years ▪ 15 had 10 or more, with 9 of those having 25+ years' experience ▪ Respondents had a total of nearly **400** years of expertise

[5] *Survey results where the mean of responses was less than 3.5 are highlighted in green in the Table 1*

Question	Format	Responses
		with the fishery
Q3: How do you see the health of the mud crab stocks in the fishery?	Select a range from 0 to 7.	Mean 5.4 ▪ 1 rated it 3 ▪ 9 rated it 4 or 5 ▪ 10 rated it 6 or 7.
Q4: How do you see the overall quality of the markets?	Select a range from 0 to 7.	Mean 4.6 ▪ 2 rated it 3 ▪ 7 rated it 4 ▪ 11 rated it 6 or 7.
Q5: What rating would you give for the overall management of your fishery?	Select a range from 0 to 7.	Mean 4.0 ▪ 2 rated it 1 ▪ 5 rated it 3 ▪ 14 rated it 4, 5 or 6
Q6: How well is research addressing what you see as important in the fishery?	Select a range from 0 to 7.	Mean 3.8 ▪ 1 rated it 0 ▪ 7 rated it 1, 2 or 3 ▪ 13 rated it 4, 5 or 6
Q7: Importance of communication within and between Industry and government?	Select a range from 0 to 7.	Mean 6.4 ▪ 1 rated it 1 ▪ 1 rated it 4 ▪ 19 rated it 6 or 7
Q8: What are the best things about the fishery?	Free text with results aggregated	Four Key areas ▪ Quality Seafood, Fishery Passion, Resource Status, Management
Q9: What are the biggest issues in the fishery?	Free text with results aggregated	Seven Key areas ▪ Compliance, Access and Allocation, Modelling and Uncertainty, Climate, Management Challenges, Marketing, Others
Q10: What exciting opportunities do you see for the fishery?	Free text with results aggregated	Five Key areas ▪ Improved and Innovative Management, Certification, Markets and Economics, Indigenous Development, Others
Q11: What things about the fishery keep you awake at night?	Free text with results aggregated	Six Key areas ▪ Access, Management Challenges, Quota Management, Compliance, Climate, Others
Q12: What do you think the impacts of climate change are on the fishery?	Select a range from 0 to 7.	Mean 4.1 ▪ 4 rated it 0 ▪ 7 rated it 2, 3 or 4 ▪ 12 rated it 5, 6 or 7
Q13: How important is social licence to operate in the fishery?	Select a range from 0 to 7.	Mean 5.5 ▪ 2 rated it 1 ▪ 5 rated it 3, 4 or 5 ▪ 15 respondents rated 6 or 7

Question	Format	Responses
Q14: How effective do you think the use of harvest strategies are to manage your fishery?	Select a range from 0 to 7.	Mean 4.7 ▪ 1 each rated it 0 or 1 ▪ 4 rated it 3 or 4 ▪ 14 rated 5, 6 or 7
Q15: Do you think the current harvest strategies cope well with variability in the fishery?	Select a range from 0 to 7.	Mean 3.2 ▪ 3 rated it 1 or 2 ▪ 3 rated it 3 ▪ 16 rated 4, 5, 6 or 7
Q16: Where would you target research and development if it were up to you?	Free text with results aggregated	Seven Key areas ▪ Markets and Economics, Environment and Climate, Assessments and Modelling, Species Ecology, Monitoring, Improved Management, People Development
Q17: If your fishery is cost recovered, is that working well for you?	Select a range from 0 to 7.	Mean 3.7 ▪ 5 rated it 1, 2 or 3 ▪ 7 rated it 4 ▪ 2 rated it 5 or 7
Q18: How do you see the working relationship between government (Agencies) and Industry?	Select a range from 0 to 7.	Mean 3.1 ▪ 8 rated it 1, 2 or 3 ▪ 14 rated 4, 5, 6 or 7
Q19: Is there a need to improve Industry economics?	Select a range from 0 to 7.	Mean 3.1 ▪ 3 rated it 0, 1 or 2 ▪ 6 rated it 4 ▪ 11 rated 5, 6 or 7
Q20: What is the status of the health and well-being of those people involved in the fishery (across all sectors)?	Select a range from 0 to 7.	Mean 3.7 ▪ 3 rated it, 1 or 2 ▪ 7 rated it 3 ▪ 11 rated 4, 5 or 6
Q21: Is there a need for better training, education, mentoring etc in the fishery?	Select a range from 0 to 7.	Mean 5.6 ▪ 7 rated it 4 or 5 ▪ 14 rated 6 or 7
Q22: What does succession planning look like to you?	Free text with results aggregated	Key areas ▪ Its Lacking, Better Industry Management, People Development Programs
Q23: Do you feel a coordinated voice working on behalf	Select a range from strongly agree to	▪ None disagreed ▪ ≈9% needed more details ▪ ≈11% neutral

Question	Format	Responses
of all Industry would be useful?	strongly disagree	▪ ≈80% agreed or strongly agreed
Q24: What 2-way communications methods are best for future development and ongoing engagement?	Rate each option on a range from 0 to 7	▪ Workshops – 5.75 ▪ Face to face - 5 ▪ Video/YouTube – 4 ▪ Email – 3.75 ▪ Phone - 3.5 ▪ Social media groups – 3 ▪ Written - 3
Q25: Would you support the development of a national marketing plan?	Select a range from strongly agree to strongly disagree	▪ None disagreed ▪ ≈9% needed more details ▪ ≈26% neutral ▪ ≈65% agreed or strongly agreed
Q26: Is there anything that you wish to add.	Free text with results aggregated	Three Key areas identified ▪ Compliance, Community, Industry Uniqueness

11.2. Workshop Findings

The Workshop was attended by 29 participants and included people from key areas of Industry, Agencies and with relevant expertise. Although it was acknowledged that not 'everyone' was in the room, there was a diverse group of participants from the various regions and with different expertise. Of the participants, eight were from NSW, six from the NT, twelve from Qld (including the PI and EISP), two from WA and one from Vic. The participants identified their key areas of expertise as follows, but it was noted that many wore a number of hats:

Owner/fisher/marketers	8
Researcher	9
Fishery Manager	3
Funder/project manager	2
Indigenous representatives	2
Post-harvest	2
Representatives	2
Economist	1

Although the facilitators had a planned approach to the workshop (as per the draft program provided at Attachment 4), flexibility was built into the program to allow ideas to flow and be captured in an inclusive way, but with a clear view to developing an output that was suitable to guide future directions for the Industry at a national level.

Due to the preworkshop planning, facilitators' expertise and participants' input, the two day program delivered what was hoped for, and exceeded expectations to some extent.

A program of small group work in conjunction with larger plenary sessions allowed all participants to be heard. Further, the use of Industry and Agency only groups, self-selected groups and selected groups ensured there was a sharing of ideas at multiple levels over the

two days, as well as through the opportunity of some 'safe spaces' where participants could speak their minds without fear of conflict or retributions.

For each session information was collected via butcher paper notes, post it notes, on screen data capture and via forums where ideas were captured by dedicated scribes. These processes led to a huge amount of data being collected (around 30 sheets of butcher's paper, 50+ post it notes and dozens of screen captured inputs).

From this raw data, finalised workshop materials were developed. A full copy of the Workshop Report is provided at Attachment 3 with key outputs highlighted below:

- A Vision for the AMCI
- Key Values for AMCI
- Key Challenges for the AMCI
- Key Opportunities for the AMCI
- Exploration of Opportunity for a National Body for the Mud Crab Industry
- Key Investment Areas.

11.2.1. A Vision for the AMCI

Through a facilitated process, participants were advised as to what a vision statement is and what it hopes to achieve. That is, a vision is written in present tense and should be the 'who, why, meaning and purpose' of the AMCI and should act as a clear guide for current and future courses of action. Participants provided thoughts and key words in respect to where they saw the Industry in the future (see Figure 1).

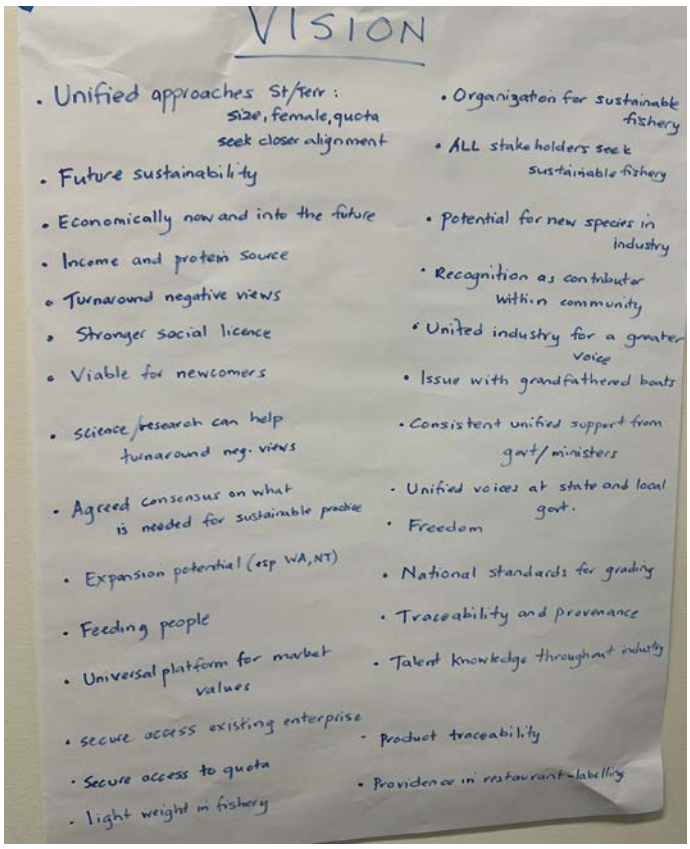


Figure 1: Ideas captured during visioning exercise.

That information was used to draft a vision statement that described what the AMCI would like to be, achieve, or accomplish in the future. After some group wordsmithing and negotiations, the participants agreed to accept the following as the guiding vision:

'The iconic Australian mud crab is a premium product, managed for sustainability and fished responsibly'.

11.2.2. Key Values for AMCI

Participants were advised that values are used to develop a sense of inclusion, or shared views, that can guide every decision they make and how they, and also the outside world, perceive the group/Industry. Values can be a combination of core values, that are sacrosanct and cannot be compromised, and aspirational values that need to be adapted into the future in a changing environment.

In this session, participants worked in small, randomly selected groups to identify key values. These ideas were shared across the broader group and were captured by a scribe onto butchers' paper (see Figure 2).

Figure 2: Ideas captured during values exercise.

The information was used to develop a series of dot point key values that were adopted by participants.

As part of finalising the Workshop Report the PI and EISP added context to the values. These were shared with participants post workshop. With some amendments, they were adopted as appropriate values as shown below, and expanded on at Attachment 3. Key values were:

- Our Iconic Species
- Our People
- Our Environment
- Our Innovative Approaches

- Our Consumers
- Our United, Respectful and Respected Industry
- Our Well-Managed Industry.

11.2.3. Key Challenges for the AMCI

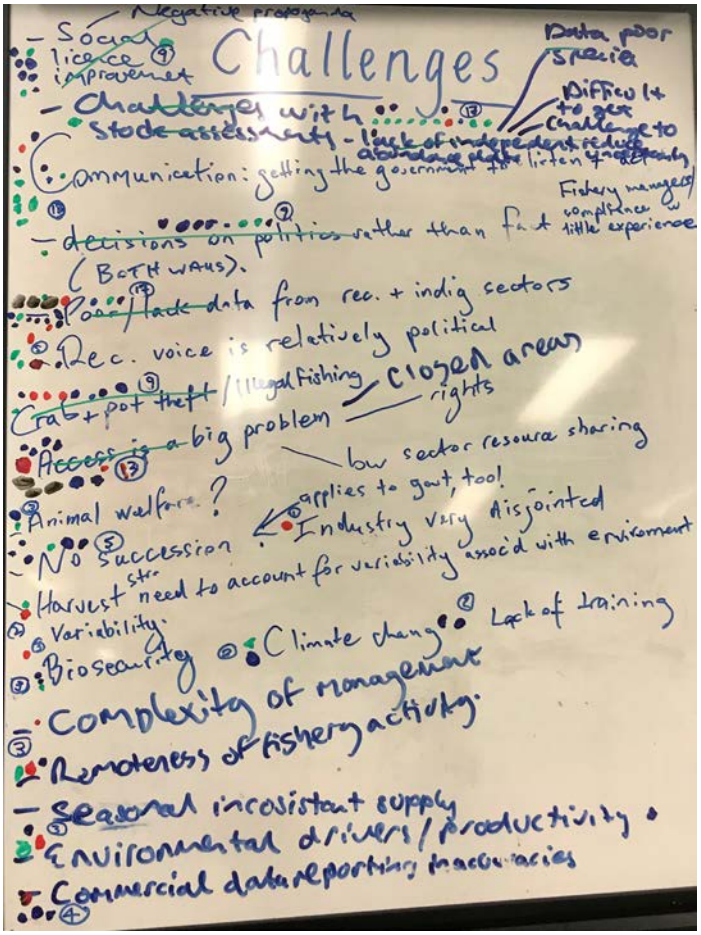
To identify major issues causing impact, participants were asked to consider internal and external challenges to their organisations, themselves and the fishery.

This session was undertaken via small, randomly selected groups initially to identify key challenges. These ideas were shared across the broader group and were captured by scribe(s) onto a white board. Participants were encouraged to aggregate challenges and/or contextualise them, or add to the challenges (see Figure 3).

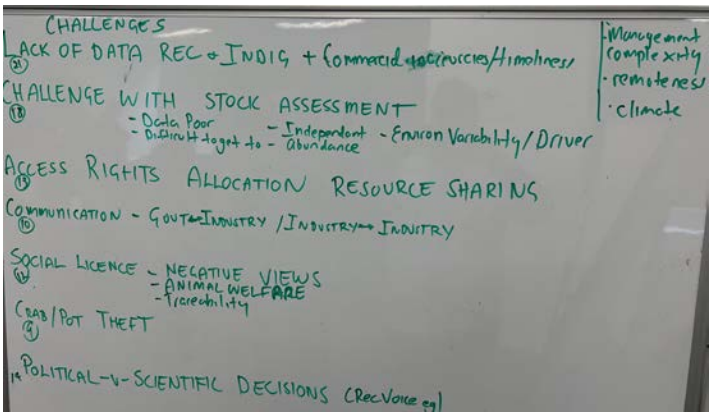
All participants were then allocated 5 votes (indicated by dots) that they could allocate to the key challenges from their perspective. From this process the major challenges were identified and prioritised as:

- Inadequacy of accurate, timely and relevant data from all stakeholders and sources to assess and manage stocks
- Stock assessments and models that currently cannot adequately capture or address the characteristics of the species and operations of the Industry
- Uncertainty regarding resource sharing and the security of access rights
- Trust and communication challenges between, and across Industry and stakeholders
- To build and then maintain social licence to operate by valuing commercial fishers, addressing negative views, improving animal welfare practices and traceability
- Logistical and communication constraints for fishers operating in remote regions in challenging conditions
- Ensuring management decision making processes are based on the best scientific knowledge
- External biosecurity risks to the stocks and the operation of the fishery
- Management regulations that are too complex and which may be unnecessary or redundant
- Not currently optimising economic return to Industry.

Three additional areas that were not initially identified during this process were added in the plenary session. These were: management complexity, remoteness and climate. These are shown below (see Figure 3, Refined List of Challenges and Priorities) and expanded on at Attachment 3.



Group Brain Dump of Challenges



Refined List of Challenges and Priorities

Figure 3: Ideas captured during challenges exercise.

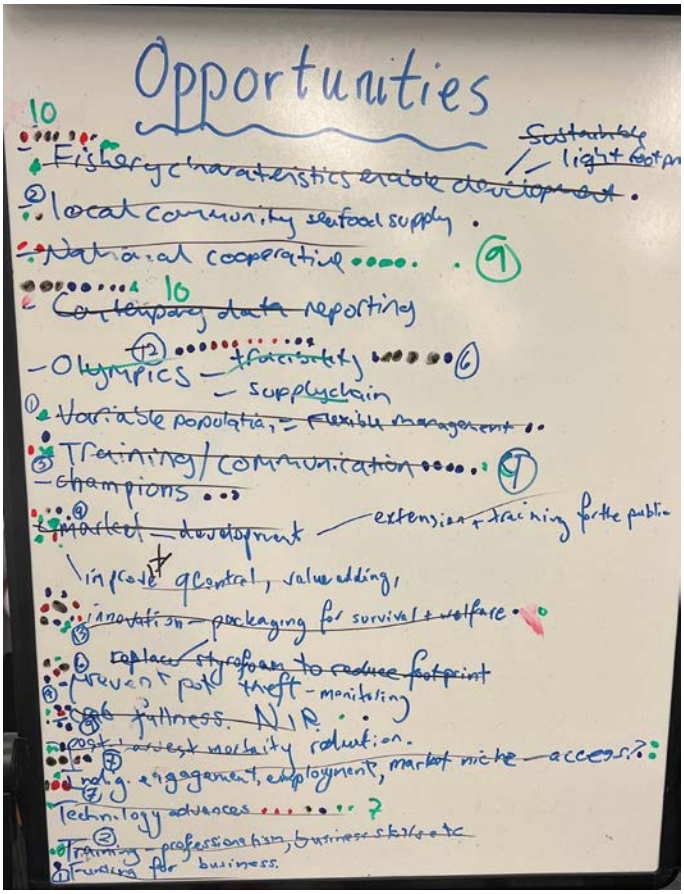
11.2.4. Key Opportunities for the AMCI

Participants were then asked to consider internal and external opportunities for their organisations, themselves and the fishery. The session used the same process as that used to identify challenges.

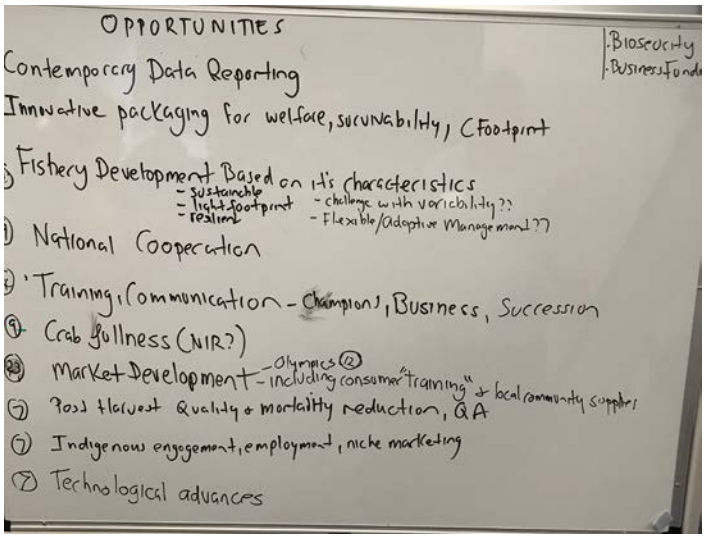
After an initial brain dump, participants were encouraged to aggregate identified opportunities and/or contextualise them, or add to the opportunities (see Figure 4). From this process the major opportunities identified were:

- Development of relevant contemporary and cost-effective data reporting methods and practices
- To build models that can better assess stock status and elucidate appropriate harvest regimes
- Continual improvement and adoption of best practice handling techniques and innovative packaging to improve animal welfare, product quality, survivability, public confidence and reduce carbon footprint
- Capitalise on the species and Industry characteristics (i.e. high valued and desirable product in the market, sustainably caught, light harvest footprint, small scale and flexible operations, species resilience, remoteness including social value in remote communities, annualised catch variability)
- Chance to build national cooperation and a peak organisation
- Develop skills to build a more resilient Industry and Agencies through training, succession planning and communication
- Diversification of domestic markets and building consumer support and demand
- Enhancing measures and practices to maintain and increase biosecurity to support and protect the ecological and economic sustainability of the fishery
- Supporting opportunities to build Indigenous participation and opportunities, across all sectors in the Industry
- Using technological advances to improve operations, product quality, compliance and fisher wellbeing
- Development opportunities in some jurisdictions (i.e. WA and remote NT)
- Build minimalist and flexible management approaches that reflect the limited risks associated with the fishery.

Two additional opportunities that were not identified during this process, but which were expressed in subsequent discussion, were added. These were biosecurity and business funding and these are shown below (see Figure 4, Refined List of Opportunities and Priorities) and expanded on at Attachment 3.



Group Brain Dump of Opportunities



Refined List of Opportunities and Priorities

Figure 4: Ideas captured during opportunities exercise.

11.2.5. Exploration of Opportunity for a National Body for the Mud Crab Industry

At the time of the workshop, Industry did not have a national organisation that specifically represented Australia's mud crab licence and quota holders, catchers and key supply chain partners.

The concept of developing a national body for the AMCI generated substantial support at the workshop as it was felt that there has not been a unified voice operating from a clear and coordinated, agreed national strategic direction. Issues were therefore currently only addressed on a jurisdictional and adhoc basis and it was felt that a national body could provide a vehicle to advance, or lead, a number of the key investment areas identified at the workshop.

Although the merit of a national body had a high level of support, a number of key questions remain unanswered and work is needed to provide information on those matters.

Below are outlined the merits, potential roles and potential funding mechanisms for such a national body (also see Section 4 of the Workshop Report for more detail).

Merit of a National Group:

- An unstated question was - are there any national groups already in existence that are, or should be doing this?
- Does the idea of a national group really have broader merit and/or broader Industry support?
- What is the 'value proposition' that is clear, attractive and well understood and would deliver value so that people want to join the organisation?
- What roles and responsibilities would the organisation undertake, and what would it not be involved in?
- What would the governance model look like?
- How would the body support itself?
- Can Industry develop, or provide, the capacity and capability to organise and run such a group?
- Why not do it?

Potential Roles

The overall aims of a national group should be to provide trusted whole of Industry guidance through information, consultation and representation by undertaking tasks such as:

- Promoting and supporting all aspects of the Australian Industry
- Providing a unified Industry voice to governments and others
- Enhancing communication within Industry, and between Industry and governments and others
- Building capacity and capability of Industry members
- Promoting cost effective and relevant R&D in the Australian Industry
- Seeking to improve the well-being of Industry members
- Maintaining and promoting the AMCI as an environmentally sustainable Industry
- Working cooperatively with other like-minded organisations and building healthy and respectful relationships with Industry groups, Government and other stakeholder groups for the benefit of the Australian Industry and broader community
- Developing and overseeing a National Marketing Plan.

Funding Options

Potential resource possibilities that need further investigation were:

- Government and/or Statutory Authority sources – seed funding, grants and/or fees for service
- Voluntary fees – e.g. based on a set price per licence and/or quota held
- Co-investor contributions – e.g. marketing groups, Industry groups, co-ops, packaging suppliers, airlines, freight companies etc
- Third-party levy contribution system based on sales (e.g. per kg sales through a market, traceability tags etc)
- Collaborative investment options
- Developing an IPA proposal for the FRDC
- Other sources – including sponsorship, project funding and fees for service.

Table 2 outlines options to progress a national group. It was clear during the workshop however, that the concept, although well supported, would need some level of external resourcing to clarify its role such as how it would operate and how it would be resourced in the longer term. Options still need to be explored and a committed Working Group would be required to oversee the process.

Table 2: Potential process to establish a national commercial coordinating group.

Focus	**What/How**	**Resourcing Human and Financial**
Proof of Concept Project	• Proof of Concept (PoC) to investigate: - Merits or otherwise of establishing a national body to represent harvest and post-harvest - Understanding roles, responsibilities, governance, resourcing etc	FRDC Industry
Build a Sound Governance Model	• Develop a constitution • Build effective and transparent management and leadership team • Establish and manage governance platform • Appoint staff and roles as per constitution (e.g. initially a part-time CEO plus Chair and Directors) • Build strong alliances with other organisations (SIA membership) • Consider having subgroups (e.g. Fisheries Managers, Fisheries Researchers).	Govt grants Industry inkind
Explore Resourcing Options	• Investigate State/Territory/Federal Grant Schemes for seed funding • Identify means to incentivise membership • Product traceability fund (e.g. tag fee) • Seek potential members' support (e.g. current Industry groups, Aboriginal Sea Company (ASC) etc	Govt grants Industry levy Fees for service
Develop a Business Plan	• Develop a costed national plan to achieve objectives and strategic priorities including: - R&D Strategy to formalise R&D needs, investigate IPA with FRDC, identify other resourcing options	Industry Govt grants FRDC – IPA

Focus	What/How	Resourcing Human and Financial
	- Communication Plan to engage with all members, government and other stakeholders to build greater trust and promote Industry benefits to community for mutually beneficial reasons (e.g. social licence, economics, employment) - Capacity Building program.	
Build a National Marketing Plan	• Promote mud crab purchases via targeted market development to diversify consumer base.	Industry and supporters, inc SFM
Build Industry Capacity	• Increase human capacity across core areas including capacity to lobby on key issues • Maintain a watching brief on strategic opportunities to establish alliances with other bodies • Undertake regular meetings • Communication.	Industry and supporters

11.2.6. Key Investment Areas

Based on information collected prior to, at the workshop, and via small and large group processes during the workshop, participants developed a vast amount of data and information to guide the development of key areas needing investment.

Through an open process, participants identified a range of issues and by linking 'like issues' with 'like issues' these were condensed into nine focal themes (Figure 5).

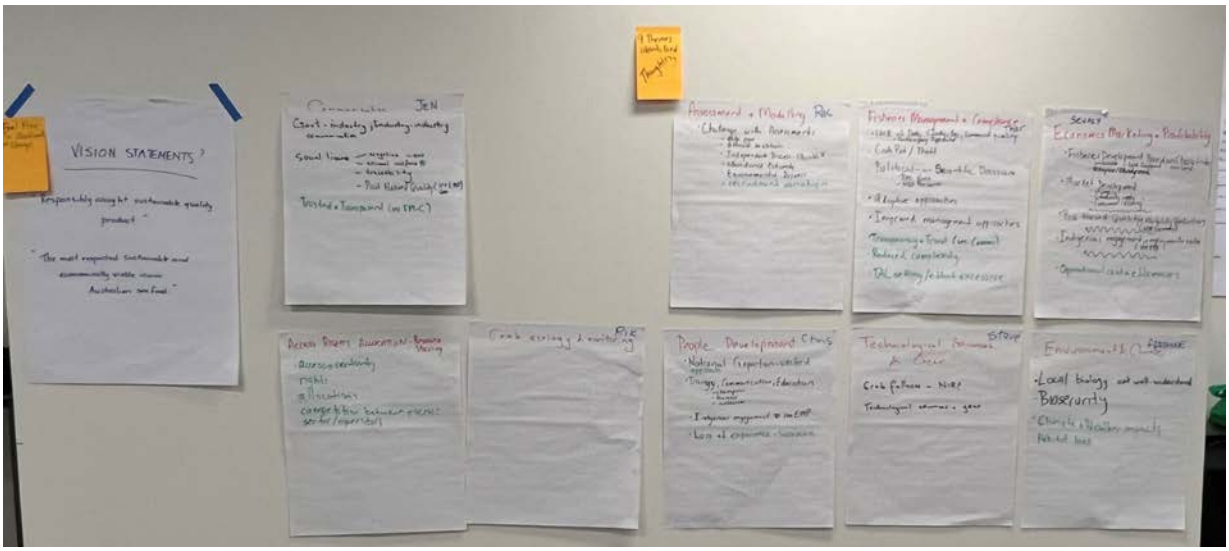


Figure 5: First cut of nine investment areas developed by participants.

Participants identified the following themes:

- Economics and profitability
- Environment and climate
- Assessment and modelling
- Crab ecology and monitoring

- Fisheries management and compliance
- People development
- Communication
- Access rights
- Technology advances and gear.

The next step was to put some 'meat on the bones' of the themes via small group work. Participants self-selected the theme that was of highest interest to them (noting a minimum of 3 people per group) to deep dive into the specific area. This was done with a first round of five themes and then a second round of four.

The aim was to develop a stand-alone one/two-page sheet for each of the themes. With the help of identified leads[6], participants methodically provided the following information:

- What is the specific focus or challenge?
- How high a priority is the issue?
- How could the issue be specifically addressed?
- Who should be the lead organisation or person and what level of funding may be needed (if possible to guestimate)?
- Which human resources would be required?
- What time frames were appropriate?
- Additional comments.

It was anticipated that during this process there would be cross over of needs and ideas from the nine areas and the final key investments may need to be revisited to address and refine that.

Feedback on each theme investment sheet was provided to the broader group and thoughts and comments were incorporated live into or onto working documents.

It should be noted that group feedback was provided using free notes, completing a butcher's paper table, via white board notes or via computer-generated tables. This approach was supported as it allowed each person, or group, to work in a format that suited them best (see Figure 6).

After this plenary session, participants felt they had identified the key needs, and means to address the needs.

6 *Jenny Buckworth, Sevaly Sen, Steve Eayrs, Adrianne Laird and Thor Saunders led and facilitated the small groups, scribed and reported back to the workshop.*

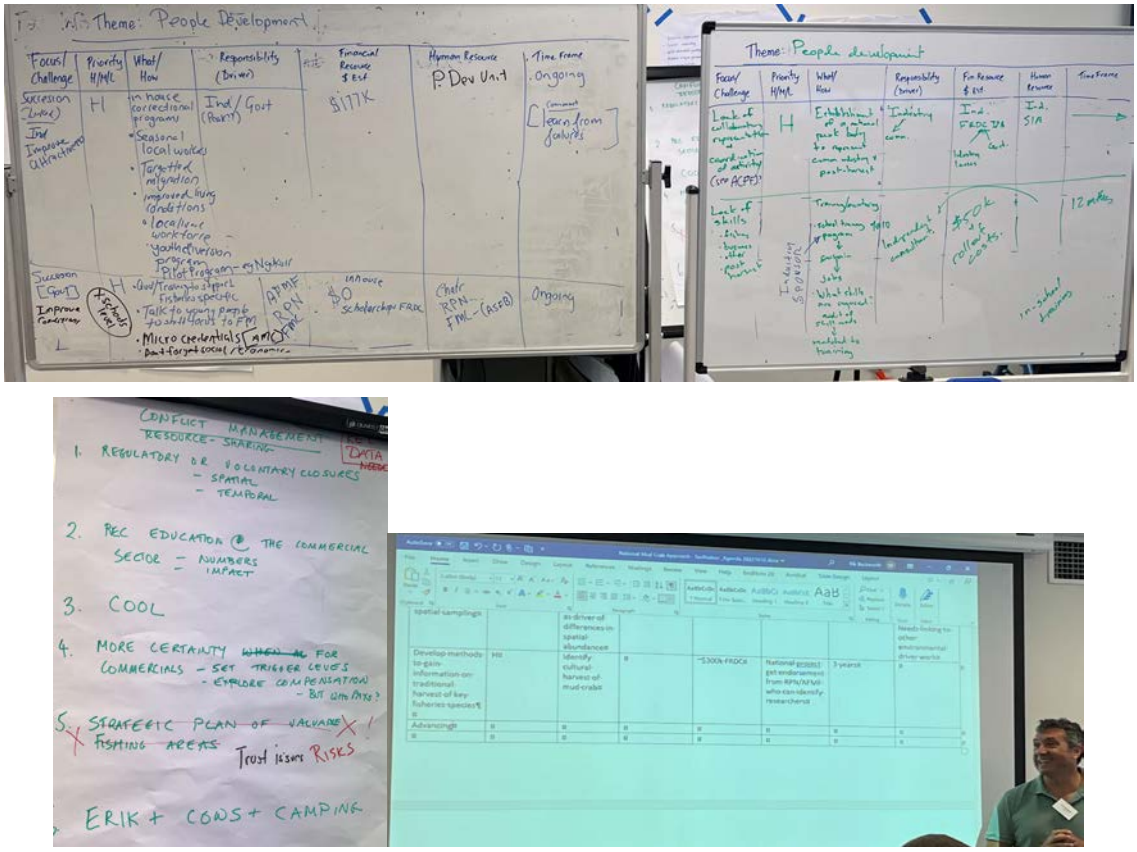


Figure 6: Examples of feedback developed for investment sheets (white board, butchers' paper and via laptop).

A large number of high priorities were identified across the investment themes, and it was clear that there would need to be a further prioritisation process to support the development of future research programs.

Participants felt it was not possible during the two day workshop to undertake that task, but that there would be benefit from using the group's expertise (as a sub group or a whole) to meet further to refine the priorities. This could include a cost-benefit analysis of potential projects to determine if they were value for money, were likely to be effective and have real world change, and to identify other projects or programs to maximise the utility of project investment.

It was agreed that the PI, EISP and workshop leads would assess each of the nine Investment sheets and from that develop a more thorough and consistently delivered series of Investment Sheets to provide back to participants for input and feedback after the workshop.

Post Workshop Report Development

Post workshop, the PI and EISP systematically assessed each theme and associated sheet to develop a consistent approach for each area (see example at Figure 7).

It was clear that there had been some cross over on themes where the needs, outputs and expected outcomes clearly aligned (i.e. 'Environment and Climate' Aligned with 'Crab Ecology and Monitoring' and 'Fisheries Management and Compliance' aligned with 'Access Rights'). These themes were therefore amalgamated and this brought the number of key investment areas down from nine to seven (see Table 3).

Focus	Priority	What/How	Lead	Budget Estimate and Fund Source	Human Resourcing	Timelines	Comment FRDC Outcome
1. Improving Assessments	**H**	Improve data inputs and model forms to provided better assessments and compliance protocols	• Agencies	Est MED Agencies	• Govt • Industry	Ongoing,	Could significantly improve confidence in stock status Better able to achieve MEY objective FRDC Outcomes 2, 4

Figure 7: Example of one line from a completed investment table

It wasn't realistic to develop precise budgets for each investment area at the workshop. However, based on participants' experiences it was possible to develop estimated magnitudes of financial requirements, ranking these from Low to Very High. It was clearly noted that these estimates may change once each of the investment areas is further developed and fully scoped.

To reflect the expected budgetary requirements, the following guide was developed for reporting purposes:

LOW Lower Cost Project - estimated project cost to be less than $150,000

MED Medium Cost Project - estimated project cost to be less than $500,000

HIGH High Cost Project - estimated project cost to be less than $800,000

V HIGH Very High Cost Project - estimated project cost to be equal to, or more than $800,000.

For each investment area background information was developed, as well as a clear statement as to the objectives identified to address the issue.

Further, each of the identified Focus Areas was aligned to the Outcomes and Focus Areas in the FRDC 2020-2025 R&D Plan (see Attachment 6 for an overview or go to https://rdplan.frdc.com.au/wp-content/uploads/2020/07/FRDC-RD-Plan-2020-025_low.pdf)

The seven Investment Areas are expanded on in sections 3.1 – 3.7 of the Workshop Report, provided at Attachment 3.

Table 3: Seven key investment areas for the Australian mud crab fishery.

INVESTMENT AREAS
Investment Area 1 – Assessment and Modelling
Investment Area 2 –Understanding Ecological, Climatic and Environmental Impacts
Investment Area 3 – Fisheries Management and Compliance
Investment Area 4 – Technical Advance and Improved Fishing Gear and Practices
Investment Area 5 – Economics, Marketing and Profitability
Investment Area 6 – Enhanced Communication
Investment Area 7 – People Development

12. PLANNED OUTCOMES

Table 4 shows how the outcomes achieved align with the project's planned outcomes.

Table 4: Summary of planned outcomes and actual outcomes.

Planned Outcomes	Outcome Achieved
1. Bringing together Industry members and Agency people from across Australia	Outcome Fully Achieved ▪ Workshop attended by 29 participants ▪ Included people from key sectors of Industry and Agencies with relevant expertise: o 8 Owner/fisher/marketers o 9 Fisheries researchers o 3 Fishery Managers o 2 Funder/project managers o 2 Indigenous representatives o 2 Post-harvest researchers o 2 Industry representatives o 1 Economist ▪ Participates from identified areas attended: o 8 NSW o 6 NT o 12 Qld o 2 WA o 1 Vic.
2. Identifying gaps and knowledge to inform end users so as to increase knowledge, connectivity and direction; and 3. Developing increasing knowledge, connectivity and direction.	Outcome Fully Achieved ▪ Preworkshop survey identified and ranked importance of issues affecting Industry and Agencies and shared with all participants to increase understanding of issues; the Workshop provided further nuance to these issues ▪ Participants were provided an update on all FRDC mud crab related projects (and some participants provided additional references/papers). Shared with all participants to inform of R&D works undertaken or currently underway. Assisted in identifying gaps in knowledge and needs ▪ Workshop program showcased two current projects with presentations and Q&A session: o FRDC Project 2018-089 'Developing a non-invasive method to assess mud crab meat fullness using portable Near Infrared spectroscopy (NIRS)' o FRDC Project 2021-056 'Initial field trial of an anti-theft estuarine pot prototype by applying Industry-Adoption-Centric research in collaboration with industry' ▪ Workshop program was based on users from mixed backgrounds identifying gaps and knowledge to build the 'Workshop Outputs' provided at Attachment 3
4. Formalised plan to target and focus attention in respect to R&D investment, operational considerations and potential direction for Industry marketing	Outcome Fully Achieved ▪ The Workshop Report (the National Plan) (Attachment 3) provides a clear targeted approach to address R&D investment needs, address operational considerations, provide potential direction for Industry marketing and

Planned Outcomes	Outcome Achieved
(with a focus on joint priorities and potential solutions and commitments to progress priority areas).	look to the development of an Industry coordinating group ▪ All priority areas and priority levels were developed through a joint and inclusive process ▪ Leads for Investment Priority Focus area were identified.
5. Reducing duplication to allow outcomes to be built on, and to minimise waste	Outcome Mostly Achieved ▪ The workshop process identified a large number of areas where work was needed, had been undertaken but not adopted or areas that were being partially addressed by current work but needed additional focus or resources ▪ The linking of 'like to like' or linking similar needs across broad areas, during the workshop and report preparation process, removed most levels of duplication in needs, identified leads for each area and also identified areas that would fit best under a more national whole of Industry/Agency approach.
6. Developing information for effective investment to improve sustainability, productivity, profitability, community support and Industry connectivity	Outcome Mostly Achieved ▪ The Workshop Report (Attachment 3) provides a clear targeted approach to address R&D investment needs, address operational considerations, provide potential direction for Industry marketing and look to the development of an Industry coordinating group ▪ The major challenge is to further distil the large number of focus areas and identify appropriate funding sources, including those external to the mud crab Industry, to incorporate into their programs, particularly at a national level, e.g.: o Industry and Agency capacity o broader climate, habitat and ecosystem work o data, modelling and assessments o stakeholder, Agency and public engagement and communication o Indigenous engagement and opportunities ▪ Additional easy to use material may be needed to address targeted needs. This is yet to be developed.
7. Attempt to develop a Working Group to share uptake after project's completion.	Outcome Partly Achieved ▪ An initial Working Group has been put together with representatives from WA, NT, Qld and NSW covering areas of harvest, ownership, marketing, post-harvest and research. Fisheries managers are not currently part of the Working Group ▪ Further discussion is necessary with FRDC and other sources to identify options to help support the Working Group on an interim basis to progress the investment outcomes

13. CONCLUSION

This project arose from the realisation there was a strong need to develop communication and coordination via a joint Vision, within the AMCI - in all sectors. A strong outcome of this project was that it brought individuals and sectors of the AMCI together specifically to address these issues.

A Vision and set of Key Values were distilled through an intensive preworkshop and workshop process. These describe what Industry and Agency, as a whole, really wants the future of that industry to look like.

The project elicited attitudes, and exposed apparent challenges and opportunities and a National Plan (Attachment 3) was developed to capture these important opportunities, barriers and pathways to be addressed.

There is clearly an overarching positive attitude to the fishery. The general perception was that the values of the fishery - economic, social, sustainability - could be substantially enhanced. The National Plan was developed to provide the directions for this enhancement.

Improvements can only be achieved, however, by overcoming the apparent poor communication within and between sectors (i.e. harvest, post-harvest and Agencies). The project findings underscored the need for continued connectivity so that the National Plan could be advanced through coordinated communication and action.

A key outcome of the project was to stimulate the formation of a Working Group, to manage implementation of the National Plan, and to explore means of developing and supporting a more formal structure. A primary role of this group is to maintain the connectivity, communication and enhancement of interpersonal networks developed in the workshops.

The Working Group will need support. Resourcing this group should be regarded as an investment by which the potential value of the fishery can be realised. Some options are explored in the Recommendation Section.

The approach undertaken in this project could be applied to many fisheries. There are many other multi-jurisdictional, multi-agency fisheries in Australia, many of which seem to have challenges and unrealised potential and are constrained by fragmented communication between and within sectors.

Similarly, many of the challenges and priority areas that were identified under this project were not specific to the Australian mud crab fishery; for example, monitoring of environmental drivers and of water quality and the impacts of water resource development. Such issues need to be flagged and taken forward as part of national processes.

14. IMPLICATIONS

A substantial increase in the economic value of the fishery, along with significant operational, social and ecological benefits, can be achieved as the outputs and outcomes from the project are progressed, mainly via the National Plan. If the challenges and opportunities identified in the National Plan can be addressed that would guide the fishery's future actions, in a sense future proofing the Industry through guided adaptive responses.

If the Working Group is put into place and adequately resourced, a process of evaluating the progress of the National Plan should be developed and be used to guide adjustment to directions and activities.

Some attributes will be easier to assess, such as the annual revenue to each of the commercial sector stakeholder groups and deriving estimates based on economic performance. However, some ecological and social variables may be more difficult to measure quantitatively, but through qualitative measures, a level of progress against the key activities identified in the National Plan may be possible (i.e. improved confidence in

sustainability outcomes across all sectors, greater confidence in R&D and management, better engagement etc).

The fact that several investment areas identified in the National Plan are not unique to the Australian mud crab fishery means an important outcome will be to identify which of the areas have a shared value across fisheries, regions and jurisdictions and might be better addressed (or are being addressed) at a regional or national level.

15. RECOMMENDATIONS AND FURTHER DEVELOPMENTS

It is critical that the Working Group maintain momentum and identify ways to ensure interim and then ongoing resourcing.

The priorities identified through this project need to be further streamlined to achieve a balance of both tactical actions and strategic directions. Those that are specific to Australian mud crab fisheries need to be taken forward to Agencies and to the FRDC Research Advisory Committees (RACs), and/or other funding pathways need to be identified.

Where there might be mutual benefit in research and development, the Working Group should seek ways to take broader issues forward to jurisdictional and national levels e.g. estuarine water quality evaluation might be important to several fisheries in each of the northern Australia jurisdictions and the topic taken forward to Agencies and the RACs as a research priority.

Recognising the public benefit, including economic and social benefit, that realising the value of the Australian mud crab fishery could provide, Agencies must make efforts to ensure communication within and between sectors.

This project should be revisited in the future (within a five year timeframe) and a specific objective of evaluating progress against the plan and thus the success or not of this approach.

Similar actions should be undertaken to develop coordinated, national approaches to Australian fisheries which are currently fragmented across regions and jurisdictions.

Specific recommendations are:

- Identify participants for the Working Group seeking as much as is possible geographical and sector representation. (It should be noted that this has already been achieved to an extent with industry-based owner/harvester/marketer members from NT, Qld and NSW and Agency staff from WA and Qld involved.)
- Identify interim funding options, including:
    - Determine suitability for establishment of an IPA for the National Mud Crab Industry. *(It should be noted that this has already been undertaken and the current Industry make up, specifically a lack of a functioning peak group, is not suitable for an IPA at this time – see Attachment 7 which outlines IPA requirements and responsibilities*)
    - Seek interim support from the FRDC to progress the key areas identified at the workshop (i.e. streamline the priorities, identify AMCI versus broader Industry priorities, coordinate pathways for workshop outcomes to be incorporated into national, regional or local R&D or other funding streams, extend outputs and outcomes).

- Longer term resourcing options are to be explored by the Working Group
- Consider undertaking a review of the effectiveness of the National Plan in 5 years' time.

16. EXTENSION AND ADOPTION

In line with the commitments in the project application, project scope, agenda and workshop draft outputs were extended widely to participants to allow them the opportunity to share them more widely through existing channels; Industry association and Agency linkages/meetings and through the co-investigators links and supporting industry partners. Based on the level of feedback received this did not extend far beyond the workshop participants and closest confidants.

The Industry associations directly cover 80+% of the industry and each have existing consultation pathways to their members, which will be a critical link between disseminating the project outputs to industry. In addition, the Agencies and SFM will be able to share this information through their various mechanisms (direct contacts, social media, newsletters etc).

The professionally produced Workshop Report is available in an electronic form (Attachment 3) and will be widely distributed amongst Industry and Agencies, along with a summary document (1 – 2 pages) that will seek to distil the key findings into a discrete document.

It is likely that Agencies will utilise the National Plan to guide R&D into the national fishery and more broadly. Now that a clearer picture is evident there should be greater collaboration on R&D and possibly in respect to regulatory approaches.

National adoption to a large extent, from an Industry perspective, will depend greatly on the success of the Working Group to deliver on the National Plan's Investment Areas and the progressing of a National Coordination Group.

Workshop participants showed little appetite for the development of a closed Facebook group to hold and distribute information and outputs as was proposed in the application, so that will not be progressed.

It is anticipated that articles in the various FRDC media will be published outlining outputs.

All RAC and relevant Coordination Programs will be directly contacted to ensure there is clear direction from Industry on where focus in the mud crab industry should be, and where collaborative opportunities exist.

17. PROJECT MATERIAL DEVELOPED

Preworkshop Survey Report (see Attachment 2)

Workshop Report – National Plan (see Attachment 3)

18. APPENDICES

APPENDIX I: Intellectual Property

No intellectual property was developed under this project and any knowledge gained through this project is available to the broader Australian fishing and seafood Industry.

APPENDIX II: Staff/Key Consultants

Project Staff and key consultants

Gail Calogeras	C-AID Consultants	Administration
Dr Chris Calogeras	C-AID Consultants	Principal Investigator
Dr Rik Buckworth	Sea Sense Australia Pty Ltd	Co-Investigator
Dr Jenny Buckworth	Sea Sense Australia Pty Ltd	Facilitation Support
Sevaly Sen	Oceanomics Pty Ltd	Facilitation Support

19. ATTACHMENTS

ATTACHMENT 1: Workshop Attendees

NAME	REGION	ROLE
Adriane Laird	NSW	FRDC Research Portfolio Manager
Alan Fraser	WA	Crabber/Owner
Allen Haroutonian	NSW	Anti Pot Theft Developer
Ben Day	QLD	Crabber/Owner/Marketer
Bo Carne	NT	Indigenous Representative
Brenton Cardona	NT	Indigenous Representative
Chris Calogeras	QLD/NT	Industry Representative and PI
Damian Young	NSW	Fisheries Manager
Dan Hewitt	NSW	PhD student
Daniel Johnson	NSW	Research
Danielle Johnston	WA	Research
Donna Cawthorn	QLD	Post-harvest Research
Eliza Kimlin	NT	Fisheries Manager
Erik Poole	NSW	Post-harvest
Janet Harris	QLD	Licence owner
Jenny Buckworth	QLD	Facilitator and scribe
Julie Robins	QLD	Research
Keith Harris	QLD	Crabber/Owner
Matt Tybell	NT	Licence Owner/Industry Representative
Max Giaroli	QLD	Representative MBSIA
Paul Exley	QLD	Post-harvest Research
Peter Jackson	QLD	Crabber/OwnerMarketer
Rik Buckworth	NT	Independent expert and CI
Sam Miller	QLD	Fisheries Manager
Sevaly Sen	NSW	Economist
Steve Eayrs	QLD	FRDC Extension Officer
Thor Saunders	NT	Research
Tony Riesenwebber	QLD	Owner/Marketer
Troy Billin	NSW	Crabber/Owner/Marketer
Wes Gordon	VIC	Post harvest

ATTACHMENT 2: Preworkshop Survey Report

Summary of Reponses to the National Mud Crab Pre-workshop Survey 2022 (FRDC Project 2018-177)

Survey Results

As part of prepping for the upcoming workshop all participants were asked to complete a SurveyMonkey questionnaire to assist in developing the workshop design and program by providing an initial feel as to which areas are important for them.

27 invites to participate were sent out and we received a remarkable 23 responses so we feel that we have a achieved a good cross section of feedback from participants.

We thank you and appreciate the level of detail that participants have provided, and each and every point has been captured and is included in this survey report. We have attempted to aggregate like ideas with like to allow a higher level focus at some workshop sessions.

Following are those results. Please take the time to read through before the workshop.

Regards and see you on the 12th October 2022

Background to project

The project idea is quite simply to bring together, as equals, representatives from the national mud crab industry (researchers, managers, fishers, owners and marketers), together from across Australia to build a more coordinated approach to developing and managing this fishery nationally.

The bringing together of Industry members and Agency people from across Australia to discuss the fishery from a national perspective will be the first of its kind, and can hopefully

lay foundations for a more coordinated and successful fishery with clearer direction. The key objectives are to:

- Share experiences and understandings and to identify issues and opportunities for collaborative approaches across the industry and agencies
- Build industry cohesion and capacity through development of a national industry plan and communication network.

Key outcomes will be increased knowledge, connectivity and directions. It is felt that without a formalised plan it will be near on impossible for the Australian industry to clearly plan and manage where to target and focus its attention. The development of a national plan can provide critical direction for R&D investment, operational considerations and potential direction for industry marketing.

Importantly Industry experience shows well organised and managed programs lead to industry betterment, whilst ad hoc approaches are highly unlikely to give optimal outcomes.

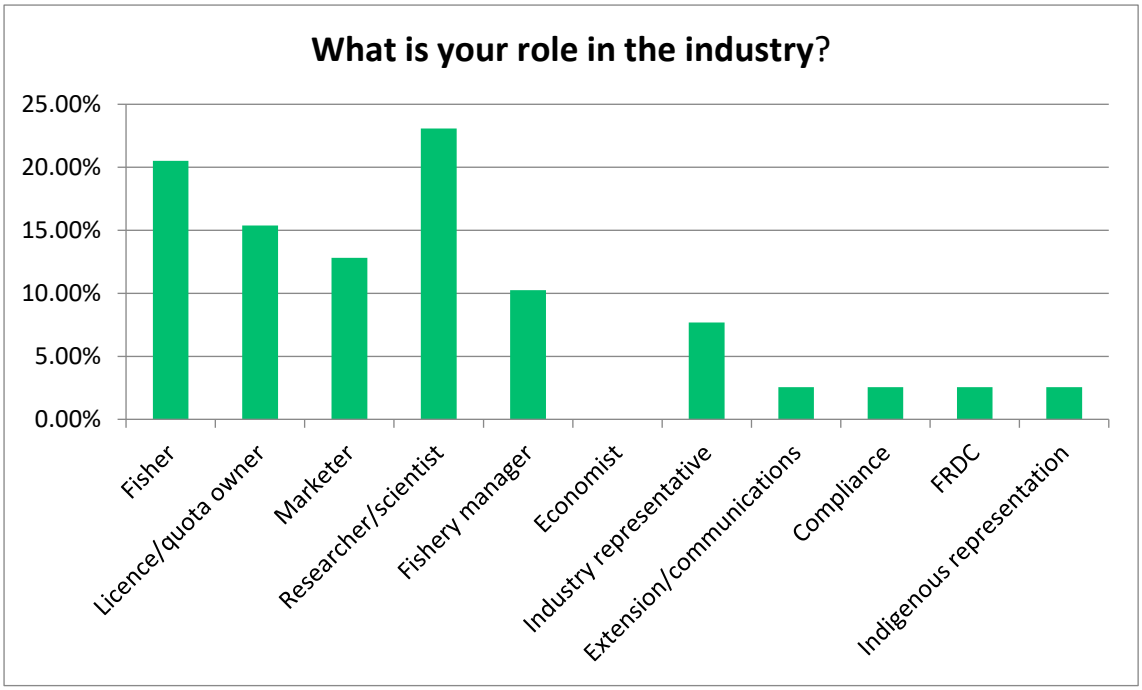
A range of Industry members, groups and agencies have been part of a number of R&D projects, but there has been no attempt to develop a coordinated approach to industry improvement, and a well-structured plan should allow this to happen whilst minimising waste.

Further, Industry ownership of the outputs, developed in conjunction with Agencies, will increase uptake and an adopted plan should provide clearer direction for investment and directed research leading to improved performance for Industry, policy makers, R&D providers, funders and consumers.

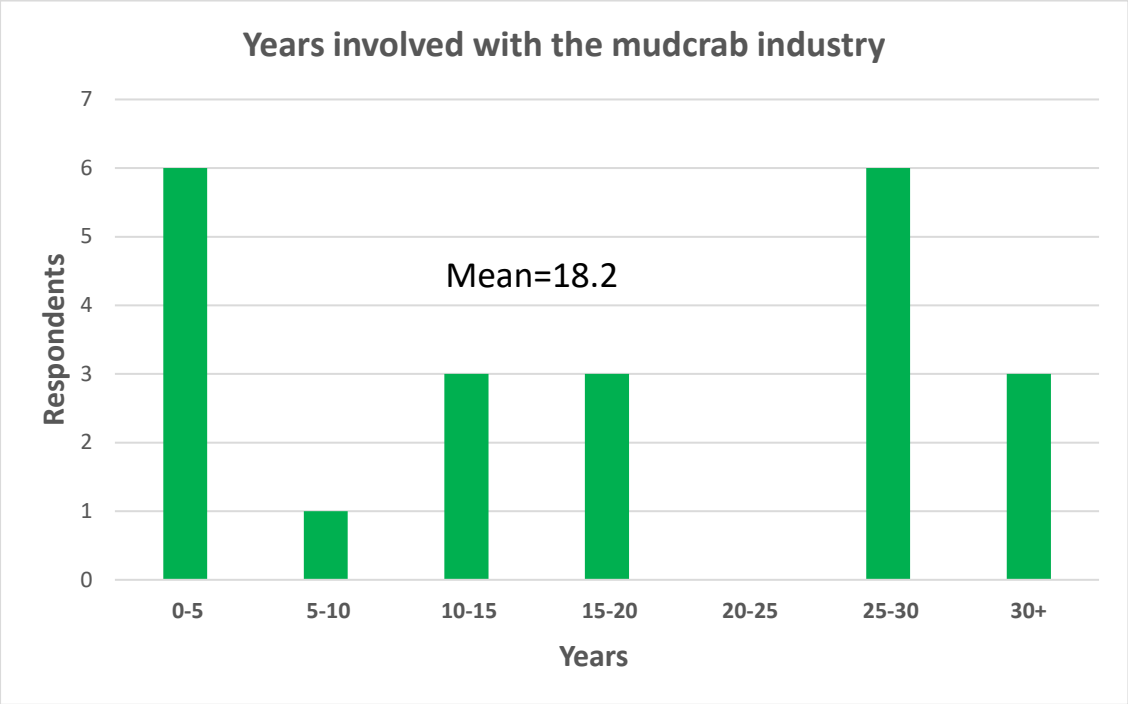
Post workshop there will be a draft plan developed based on the workshop outputs.

Dr Chris Calogeras and Dr Rik Buckworth

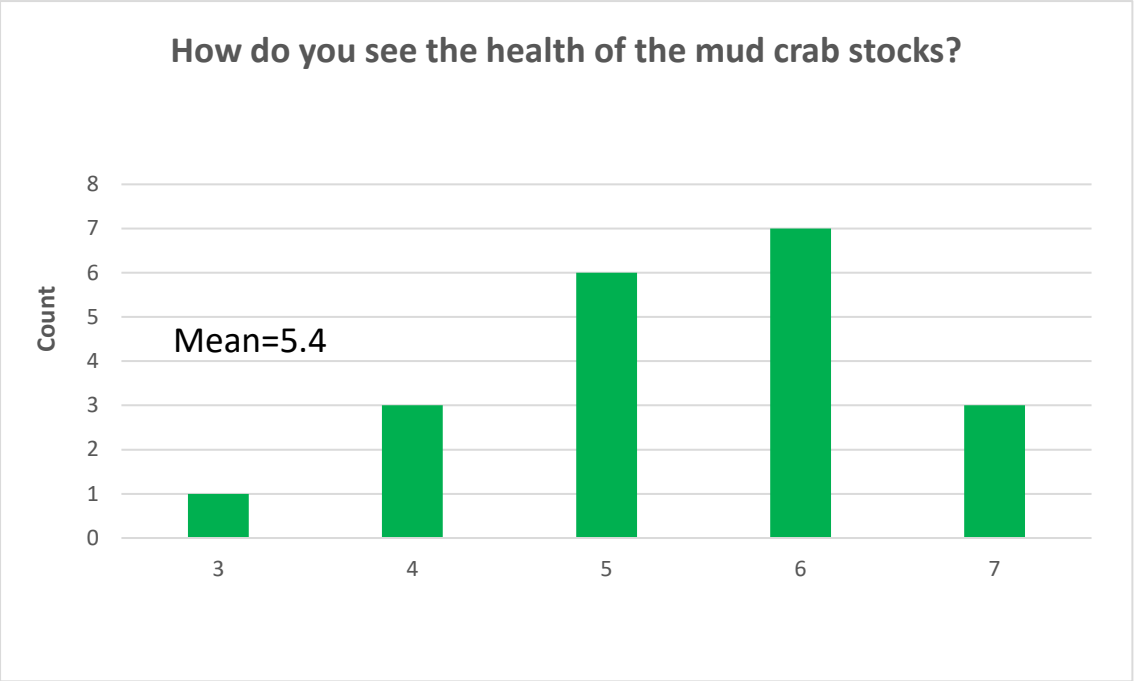
Q1: What is your role in the industry? (tick multiple boxes but please focus on your key areas)



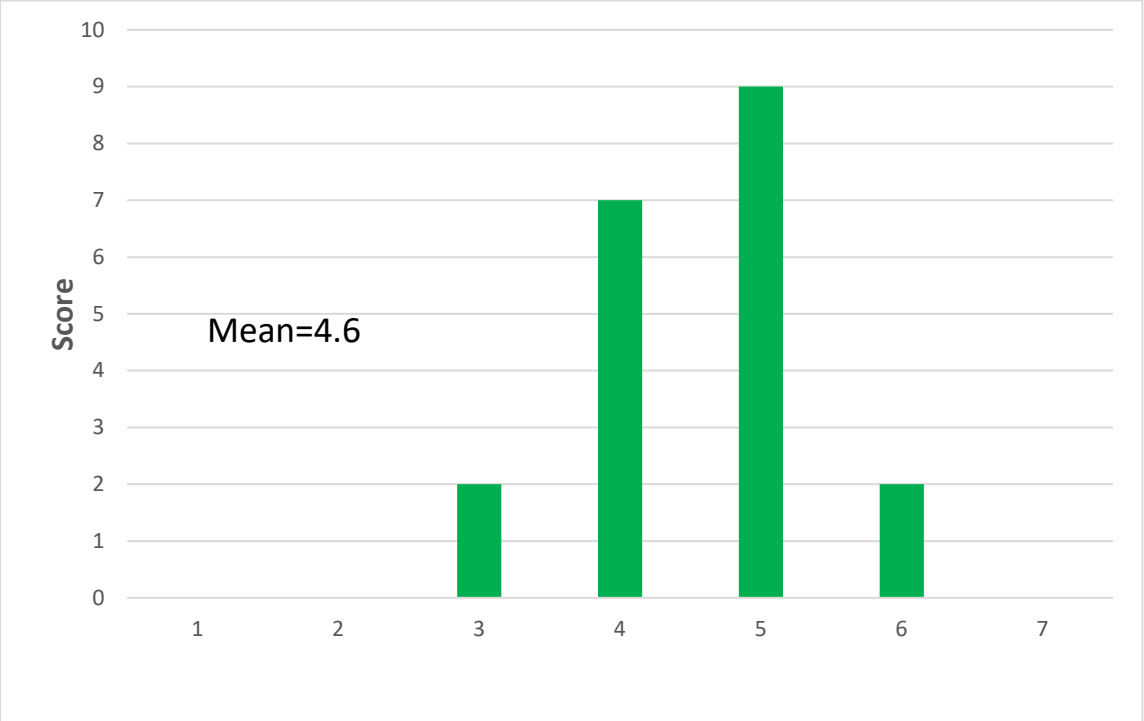
Q2: How long have you been involved in the mud crab fishery?



Q3: How do you see the health of the mud crab stocks in the fishery?

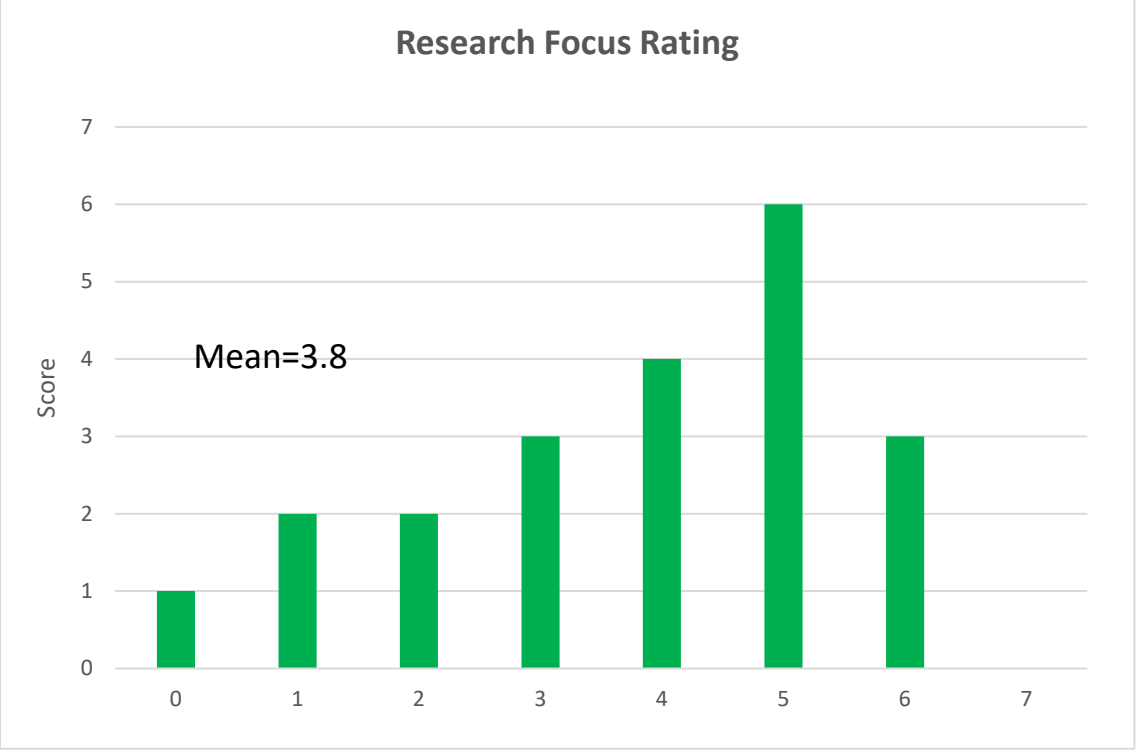


Q4: How do you see the overall quality of the markets?

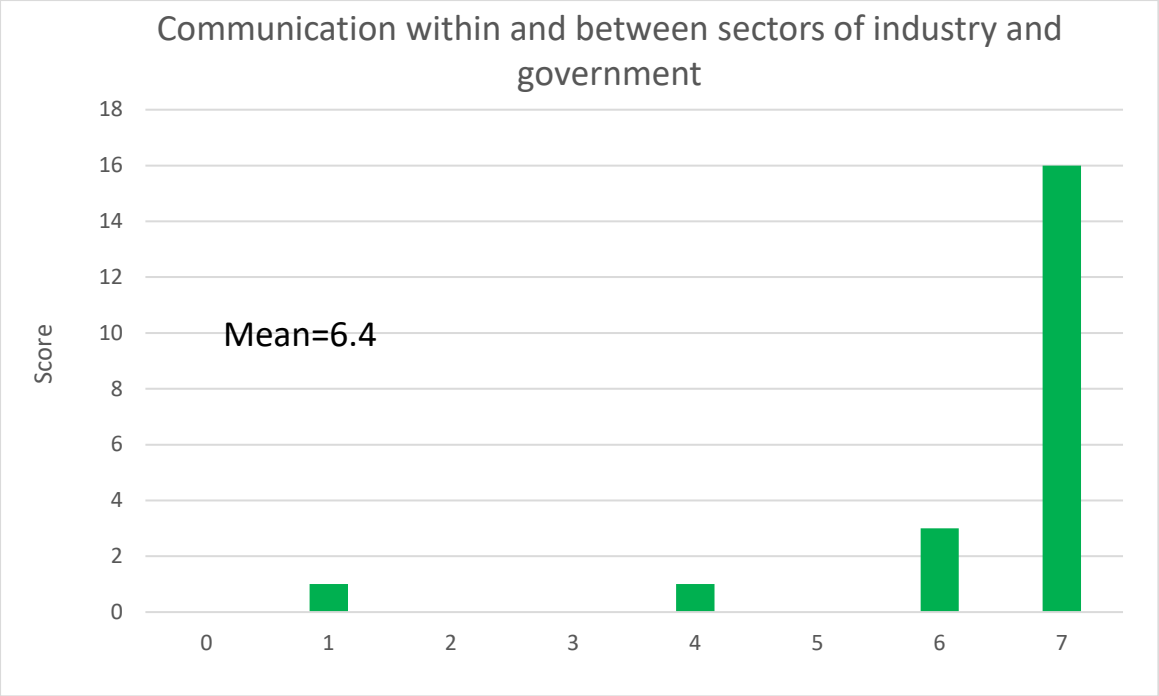


Q5: What rating would you give for the overall management of your fishery?

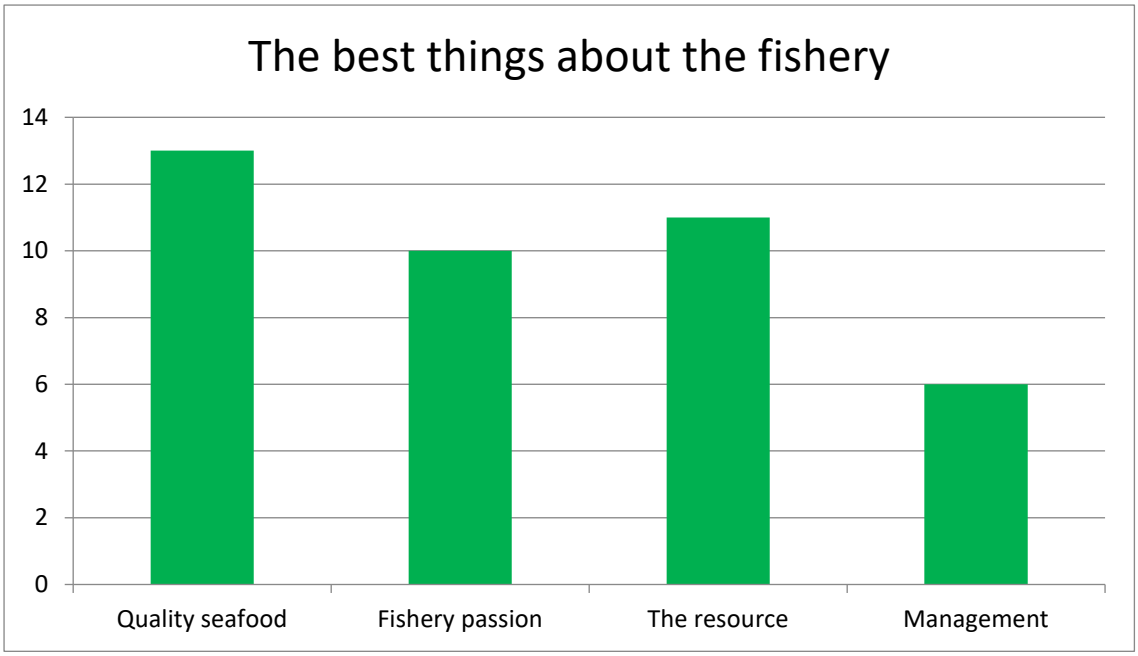
Q6: How well is research addressing what you see as important in the fishery?



Q7: How important is communication within and between sectors of industry and government?

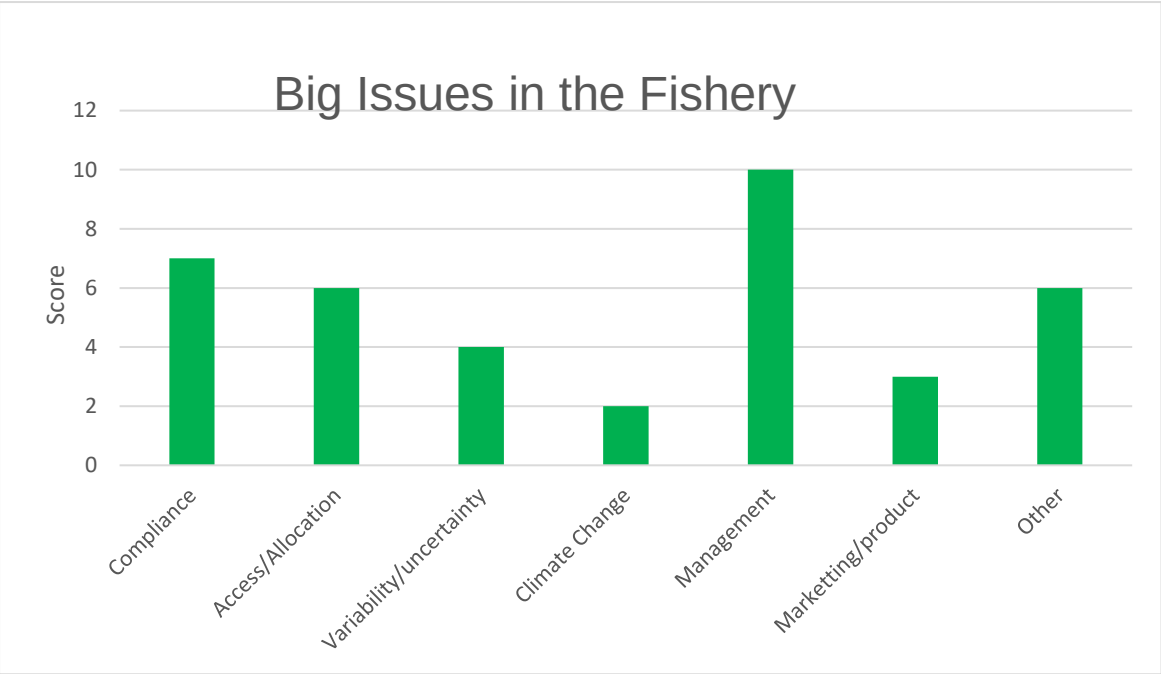


Q8: What are the best things about the fishery? (write down up to two things below)



Quality	Fishery Passion	The Resource	Management
Large Variety Of Markets, Local, Interstate, Private Buyers, Direct To Public	Every Day Is The Challenge And Changes Every Day	Low Impact	Management Largely In Place To Support Fishery Into The Future
High Value Product	Flexibility To Work 60, 90, 120 Pots Etc..	Resilience	Potential Economic Opportunities For Aboriginal People
Has Great Potential For Increased Value	Iconic Species, Loved By All Ethnic/Customer Groups	Resilient Stocks	Fully ITQ managed
CUC When It's Not Being Incorrectly Assessed By Compliance Officers	Passion	Sustainability	Harvest strategy backed up by stock assessment
Is Based On A High Value Product So Don't Need Large Tonnages	People	Very Resilient Species As Productivity Is Driven By The Environment	Very low fishing effort allocation
High Value Product Consistently Demanding High Prices.	Profitability	Sustainable	Minimal Fisheries Management or Enforcement s
Quality Product	Profitable (Or Should Be)	Low Impact	
High Value	The Crabbers	Pristine Environments	
Satisfaction Of Supplying A Quality Product	Your Own Boss And Work Flexibility	Capacity For Expansion	
Premium High Value Product	Passion And Enjoyment Of My Fishery	Long-Term Stability In Catch And Catch-Rate	
Contribute Fresh Produce To Australian Seafood		Abundance	
Increase In Sales.			
High Value Product			

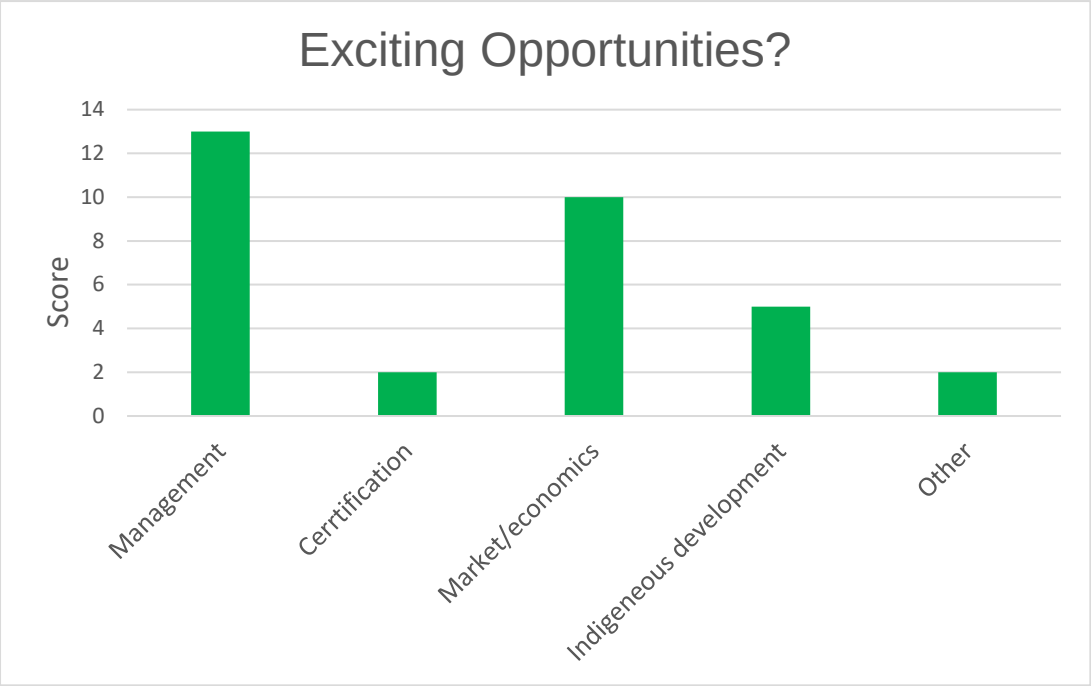
Q9: What are the biggest issues in the fishery? (write down up to two things below)



Compliance	Climate Change	Access Allocation	Variability Uncertainty	Management	Marketing Product	Others
Black Market	How Climate Change Will Impact Fishery	Access And Allocation Amongst Stakeholder Groups	Modelling Uncertainty	Industry Issues And Concerns Are Given No Credence And Disregard For The Fact That We Do Actually	Market Driven Pricing Of Product and Inconsistency - But Many Operators Do Not Want A Uniform Price, As Retained Product Not Uniform In Standard	Recruiting Young Fisher
Trap And Crab Theft	Climate Change Impacts	Access	Lack Of Region Specific Biological Info (Eg NSW	Improve Quota	Market	Language Barrier

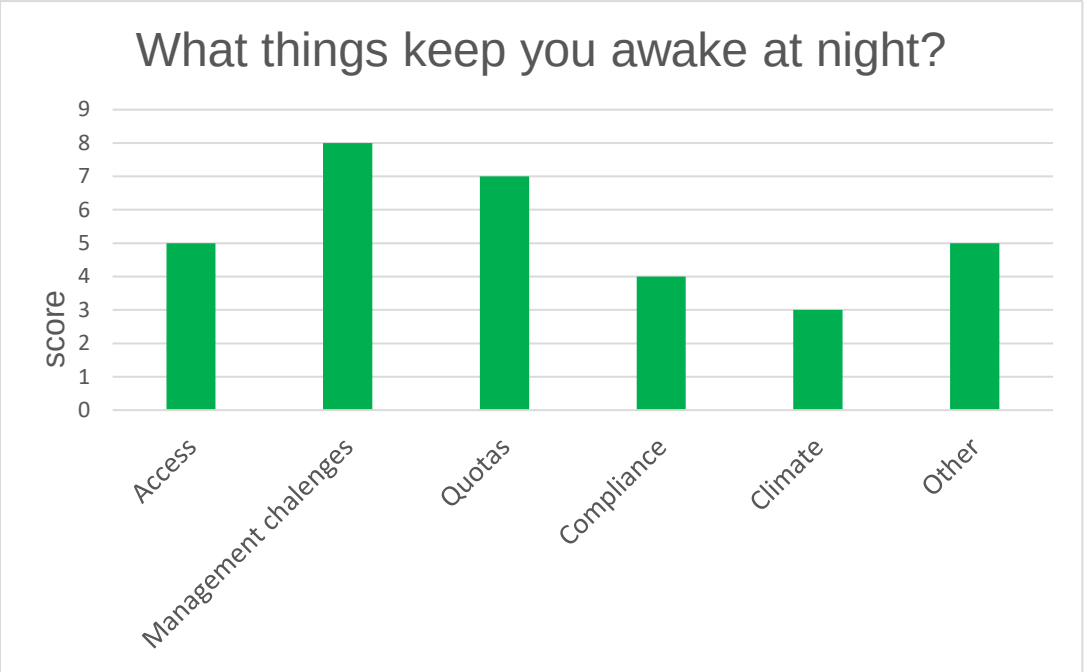
Compliance	Climate Change	Access Allocation	Variability Uncertainty	Management	Marketing Product	Others
Illegal Fishing And Sales		Uncertainty Around S19 Access Arrangements	Lack Of Recreational Data	Structural Adjustment Reforms	Fluctuations In Price	Logistically Difficult To Fish, Isolated/Remote
Theft		Access To Managed Species As Bait Provided By Commercial Barra Fisher	Difficulty In Forecasting Fishery Performance	Institutional Incapacity To Manage The Variability In The Fishery		Remoteness
Theft / Interference With Pots		Marine Parks And Stakeholder Conflict/Uncertainty		Heavy Fishing Pressure In Some Areas Leading To A Downwards Spiral In Effort ~ Catch		Lack Of Trust In Industry And Poor Data From Some Stakeholders.
Trap Theft/ Black Marketing				Potential To Over Fishing Localised Areas		No Limited Season For A Year
Taking Soft Crab				Know What We Are Talking About. Disregarded By Management		
				Too Much Effort (Qld)		
				Lack Of Regulatory Certainty		

Q10: What exciting opportunities do you see for the fishery?



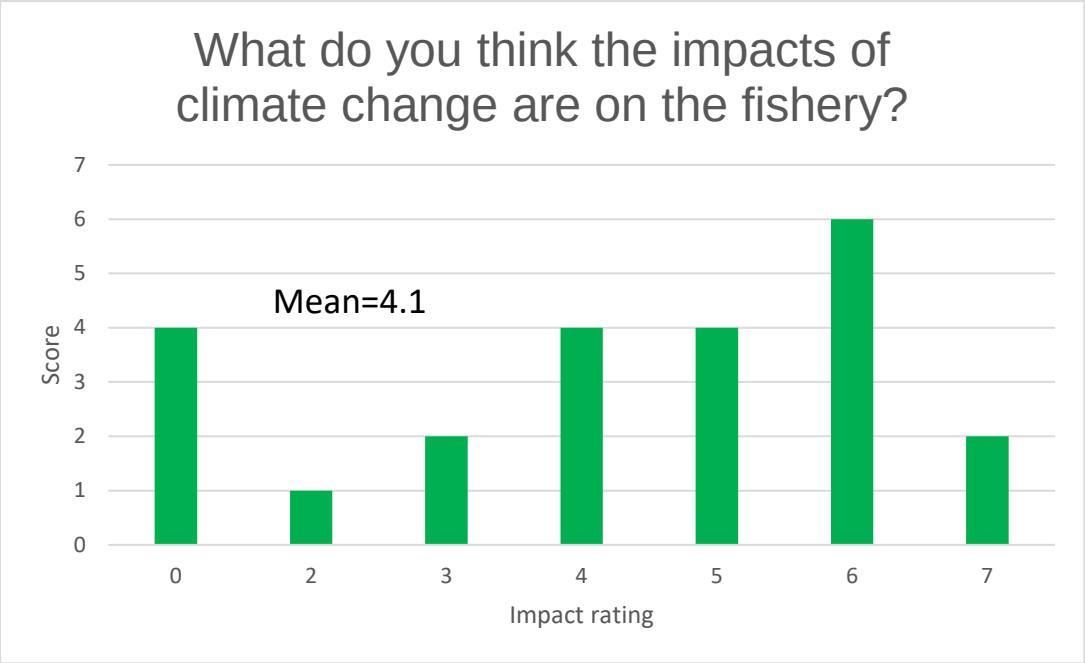
Management	Certifications	Market Economics	Indigenous Development	Other
Effort Reduction From Quota	MSC	Consolidation Leading To Increased Profitability	Aboriginal People Getting Into The Commercial Mud Crabbing Industry	Building Social Licence
Tagging Program To Reduce Illegal Sales	3rd Party Certification	Improved Marketing	Establishment Of The Aboriginal Sea Company	Stocking
The Need For Better Management And A Management That Listens To Fishers What's Needed		The Need To Market Our Product Better For A Better Price We Need Government Assistance To Do This Fisherman Can't Do It Alone	Development Of Indigenous Fishing Through Future 600 Trap Allocation	
Less Volume Should Lead To Better Grading & Prices		Co-Operative Marketing	Commercial Fishers Aligning With Indigenous Seafood Company Aspirations	
Electronic Reporting		Enhanced Value All Along The Catching And Selling Chain	Aboriginal People Being Included Within The Fisheries Management	
Better Addressing Bycatch Concerns		More Value-Adding To Product		
Inter-Jurisdictional Management/Assessment		Growth Of Profitability		
Fully Sustainable Fishery		Development Of Commercial/Economic Environment		
Taking Advantage Of Good Wet Seasons With Higher Catches		Growth Of Marketing		
Industry Growth To Allow Sustainable Supply To Public		Opportunity To Market Through Online Platforms		
Improved Connectivity		Market Growth Ie Price		
Opportunity To Develop Data Collection Programs To Support Rigorous Assessments				

Q11: What things about the fishery keeps you awake at night? (write down up to two things below)

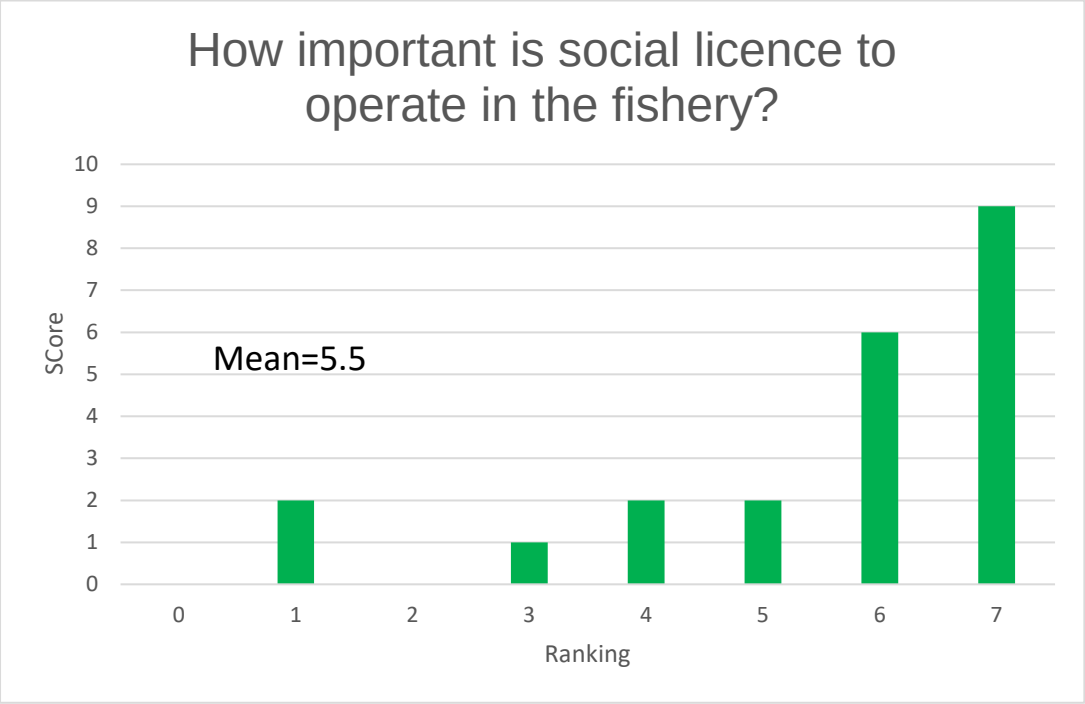


Compliance	Access	Management	Quotas	Climate	Other
Crab And Trap Theft	Access And Allocation Amongst Sectors	Investment Required To Fill Critical Knowledge Gaps	NSW DPI Not Managing Fishery Properly , Re Closures	Weather	Mental Wellbeing
Illegal Fishing	Access	Ill Informed Management	Security Of Tenure Ie Quota Allocation	Potential Impacts From Climate Change	Access To Skilled Workforce
Ghost Pots	Access To Fishing (Crabbing) Ground	Uncertainty And Changing Management Regulations	Quota Value And Trading	Climatic Impacts	Remoteness
Theft	Marine Parks And Exclusion Zones	Professionalism Of The Commercial Sector	Setting A Responsive TACC		Dickhead Operators (Lessees)
	The Uncertainty Of Our Future As Queensland Fisherman	How To Overcome Difficult Conditions (Remote, Market Development Etc) To Develop The Fishery To Its Full Potential	The Government Issued Quota But They Have Their Finger On The Dial They Can Reduce The Value Of Our Quota For The Strike Of A Pen		Prices Dropping Due To The Economy
		Potential Changes In The Regulatory Environment	Developing A Defensible TAC Approach For Catch Quota Fisheries		
		Lack Of Consistent Fishing And Investment Into The Fishery	Large Quota Holdings Of Investors		
		Commercial And Recreational Conflicts			

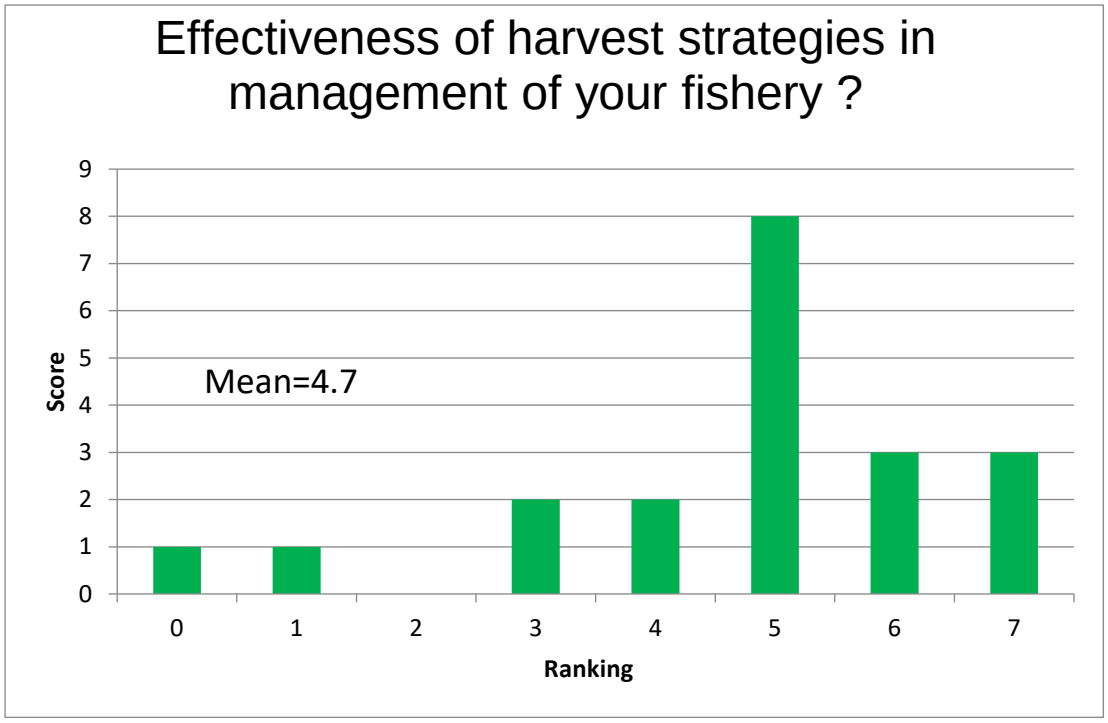
Q12: What do you think the impacts of climate change are on the fishery?



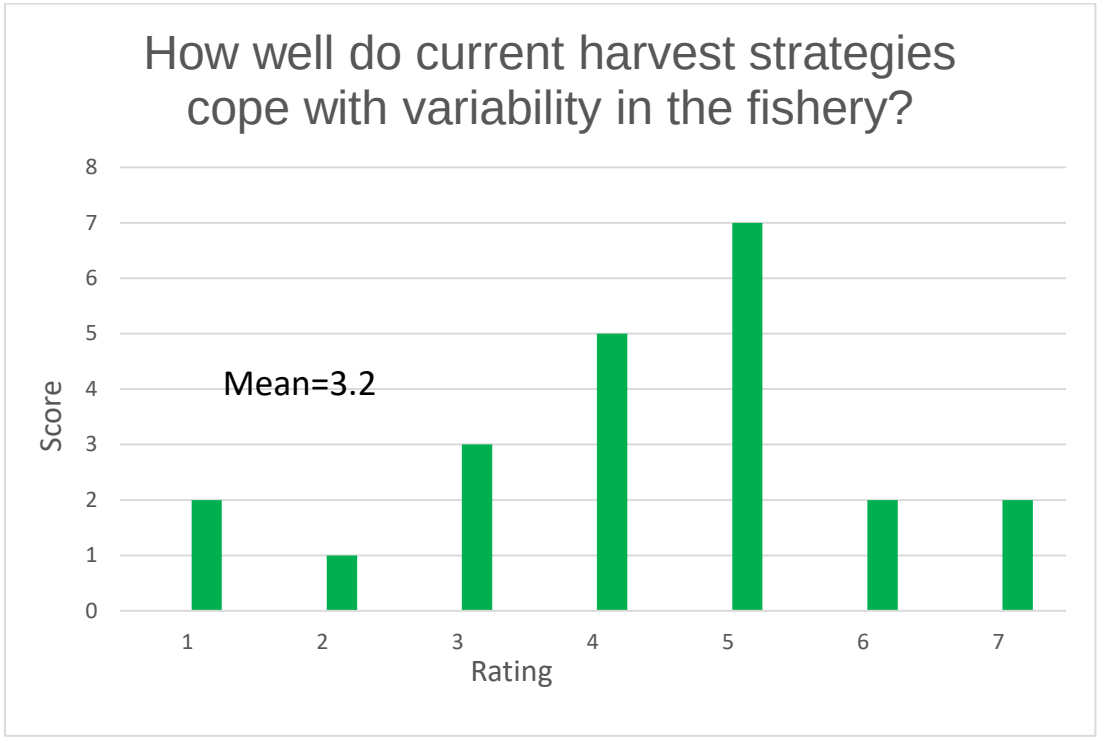
Q13: How important is social license to operate in the fishery?



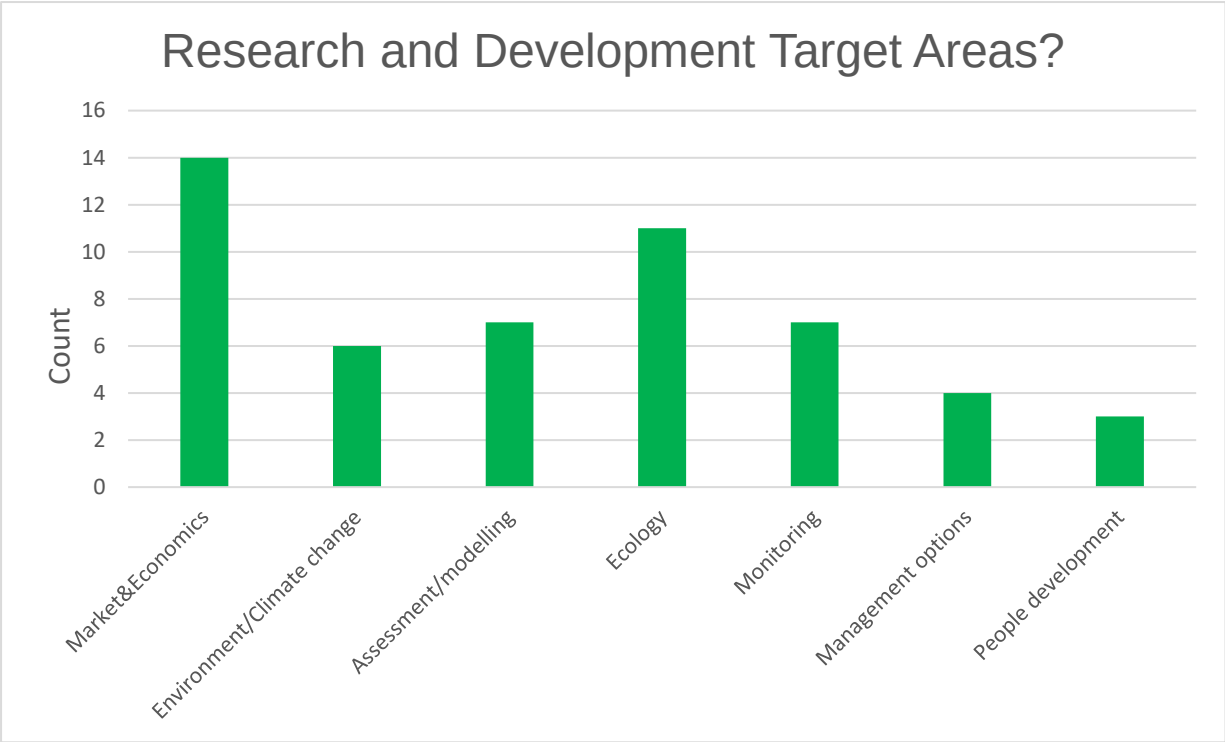
Q14: How effective do you think the use of harvest strategies are to manage your fishery?



Q15: Do you think the current harvest strategies cope well with variability in the fishery



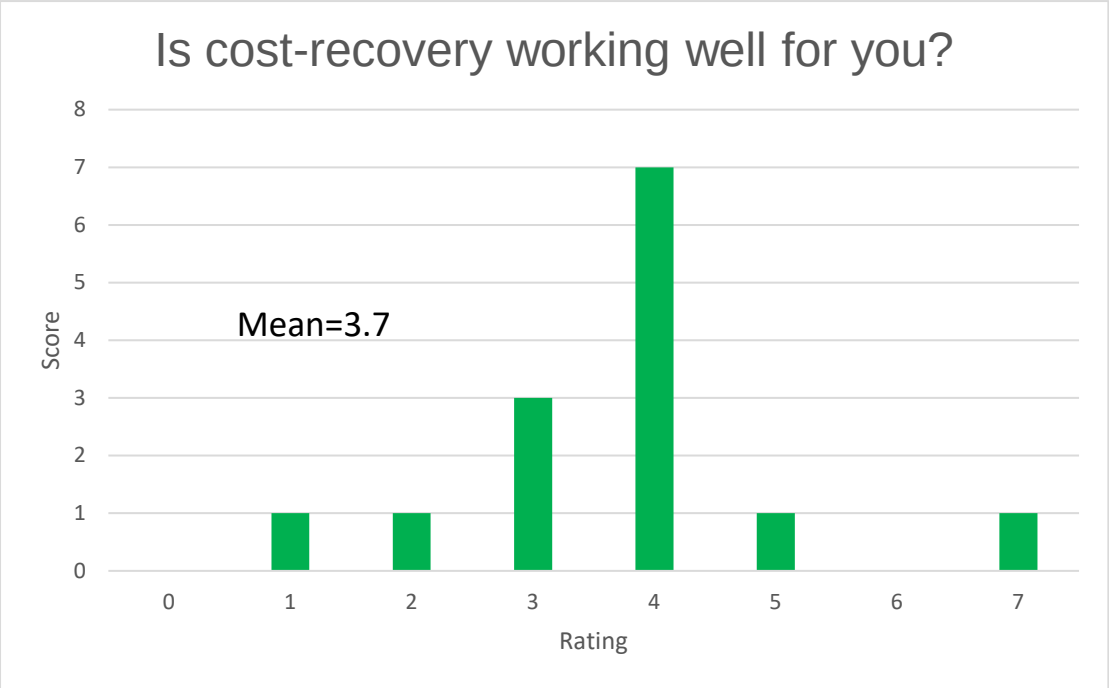
Q16: Where would you target research and development if it was up to you?



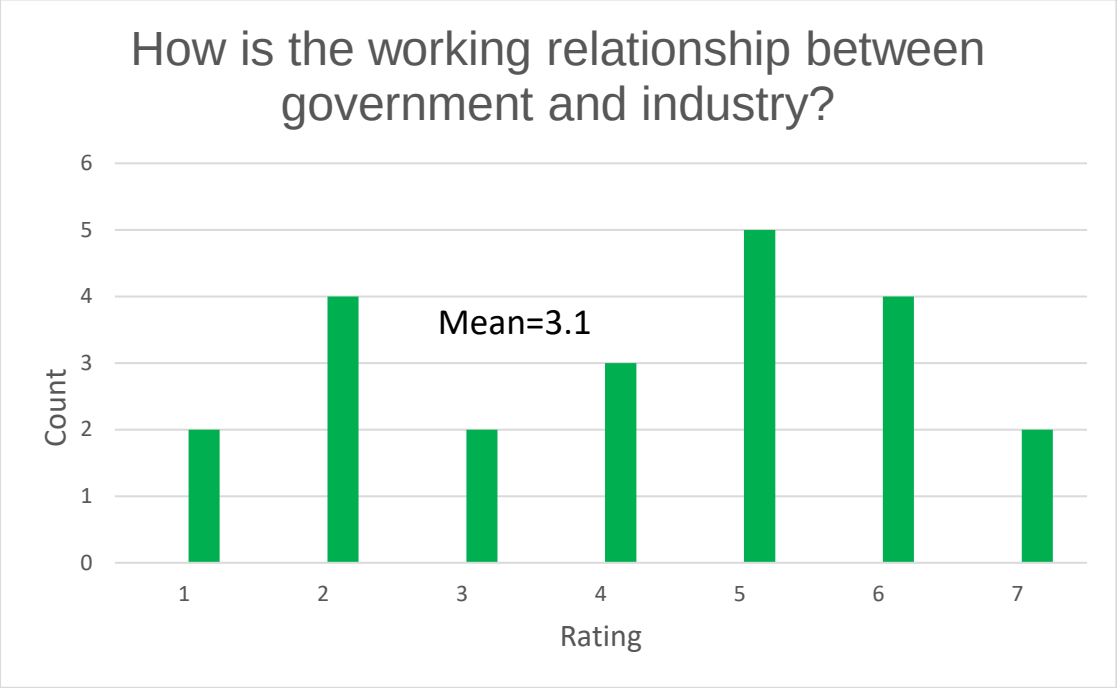
Market Economics	Environment Climate	Assessment Modelling	Ecology	Monitoring	Management Options	People Development
Development Of New Improved Markets	Vulnerability To Climate Change	Extensive Modelling Of Fishery, Environment And Management Scenarios	Better Understanding Of Fishery Recruitment	How Can Fishermen Provide Quality Monitoring Information	Application Of Same Standards Regulated For The Commercial Fishery To The Recreational Fishery	Development Of Skilled Workforce In Remote Communities
Increasing Market Value Of Product	Linkage Between Seasons	Confirming Stock Abundance And Spatial Distribution	Better Understanding Of Stock Structure And Influences	Electronic Reporting	Would It Be Wise To Harvest Female Crabs In Qld	Indigenous Fishing - Opportunities To Expand
Better Packaging And Handling Methods	Climate Change Adaptation	Stock Assessment	A Complete Review Of The Biology (Any Changes From Historical Estimates).	Improved Recreational Catch Monitoring & Management	Understanding The Potential For Stocking	Increased Social Licence & Local Community Support For Commercial Crabbers

Market Economics	Environment Climate	Assessment Modelling	Ecology	Monitoring	Management Options	People Development
Development Of Supply Chains And Markets, Overcoming Logistics	Impacts Of Climate Change	Localised Stock Assessments	Spawning And Recruitment	Estimation Of Recreational Catch (Higher Precision, Accuracy Than Current Program	Developing A More Professional Commercial Fishery	
Extension To The Current NIR Fullness Project 2018-089 To Include All States	Incorporating Environmental Drivers Into Harvest Strategies	Stock Assessment	Life Cycles	Enhanced Knowledge Base (Real Not Just Perceived) Of On-Water Crabbers		
Revisit Workshops On Handling Training	Climate Change Effects	For Qld To Take Larger Female	Understanding The Range And Interactions Of Our 2 Species	Determining The Effort And Catch Of Other Stakeholders Leading To Mandatory Catch Reporting = More Robust Harvest Strategy.		
Research Into The Effect The Different Fisheries In Each State Have On The Other Fisheries In Each		Impact Of Increasing Amateur Effort On Stock	Region Specific Basic Biology (Eg. Growth, Size/Age At Maturity)	Electronic Reporting Apps To Support Fisher-Collected Data Programs (I.E., Icalliper App Used In WA Crystal Crab Fishery). Allow Collection Of Additional Data (I.E., Grades Kept, Undersized Crab Caught Ect) To Support Stock Assessments At Low Cost To Industry.		
Tagging Program			Spanning When And Where	More Field Sampling And Biomass Estimates		
Escape Vents / Bycatch Reduction			Mortality Mitigation In Hot, High Tidal Areas			
Understand Market Opportunities for Aboriginal Owned Operated Business			Life Span			
Tool To Determine The Meat Content Of A Male Mud Crab						
Optimise Marketing						
State						
More Work On Handling Practices To Minimise Crab Deaths In Holding And Transport To Market						
Quality Control						

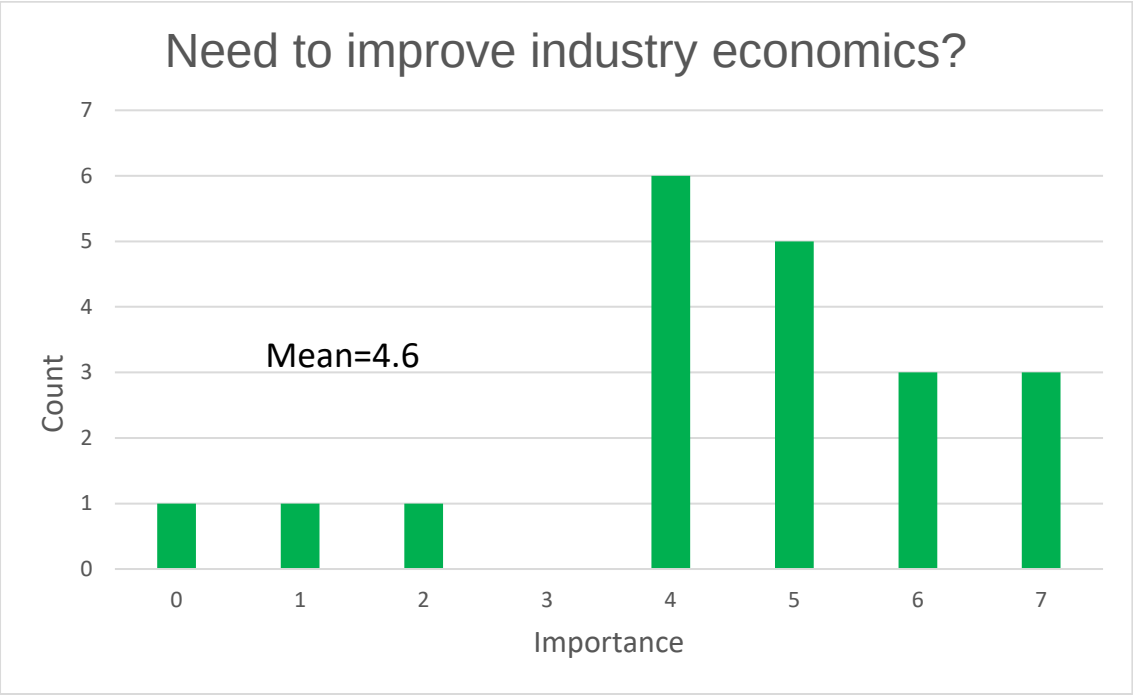
Q17: If your fishery is cost recovered, is that working well for you?



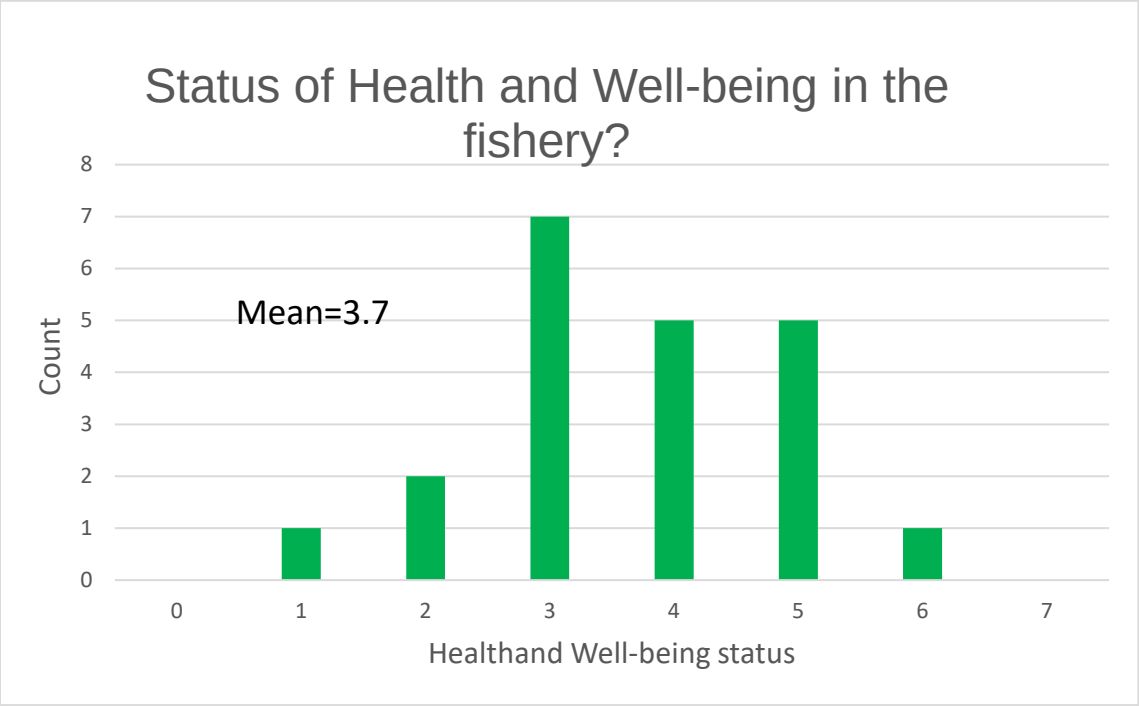
Q18: How do you see the working relationship between government and industry?



Q19: Is there a need to improve industry economics? (Examples are marketing plans, supply chain, fishing methods, new products, branding, certification)

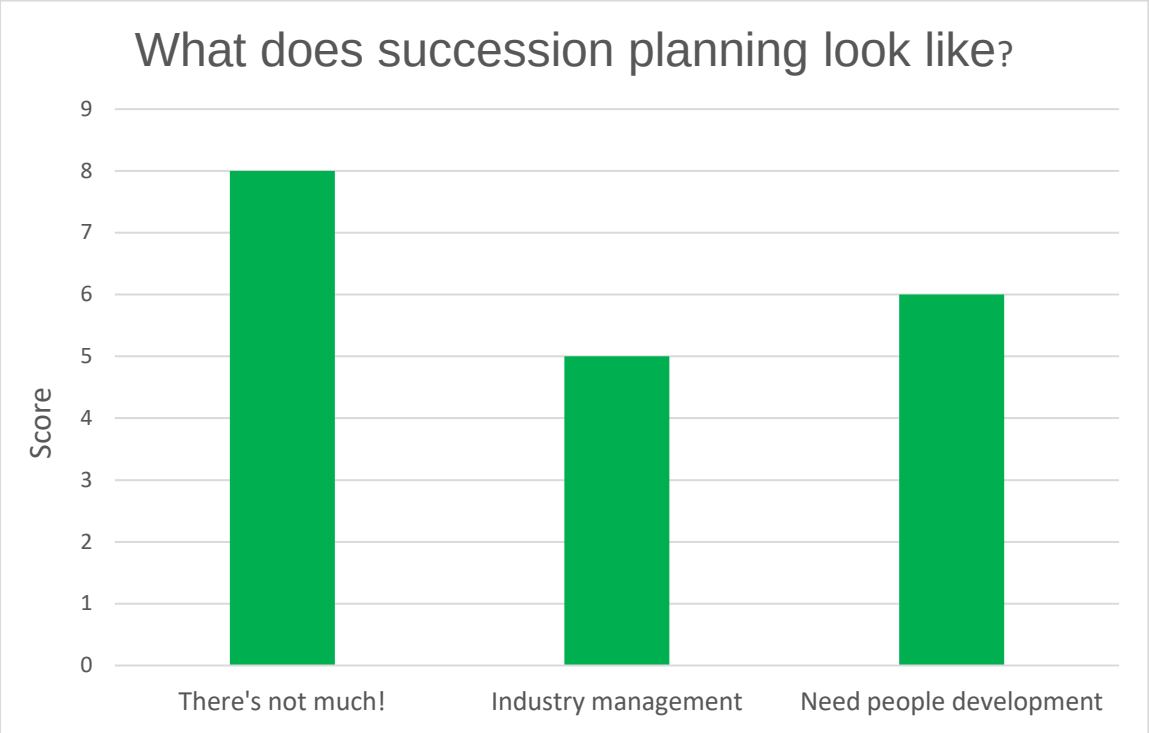


Q20: What is the status of the health and well-being of those people involved in the fishery (across all sectors)?



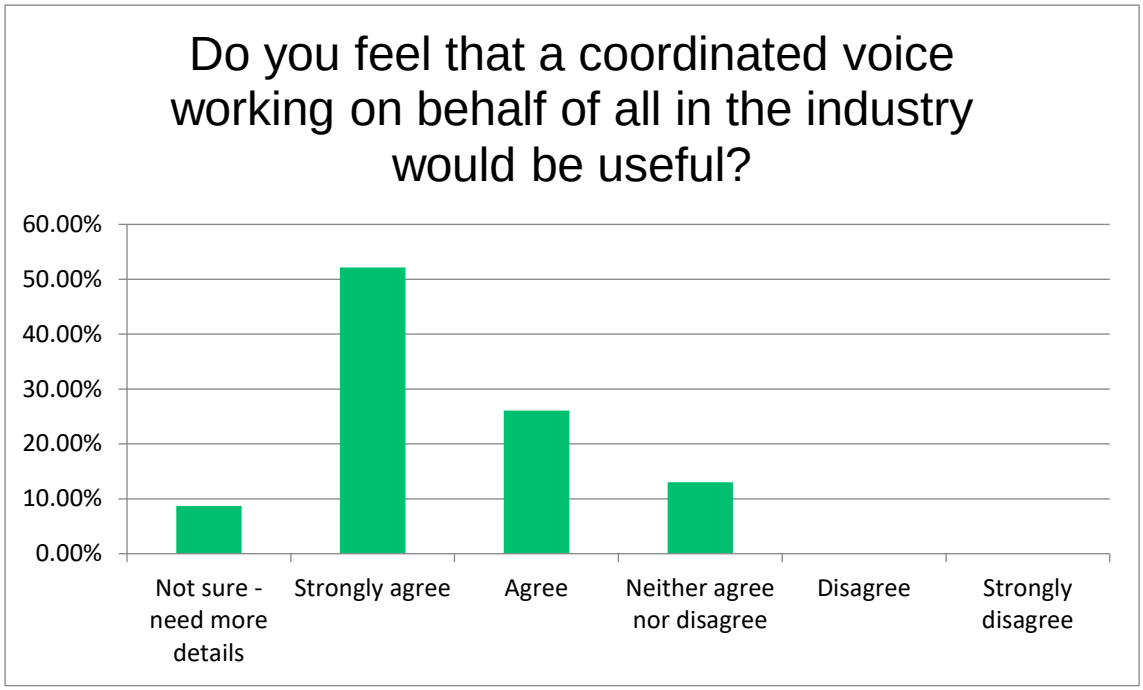
Q21: Is there a need for better training, education, mentoring etc in the fishery?

Q22: What does succession planning look like to you? (type your thoughts below)

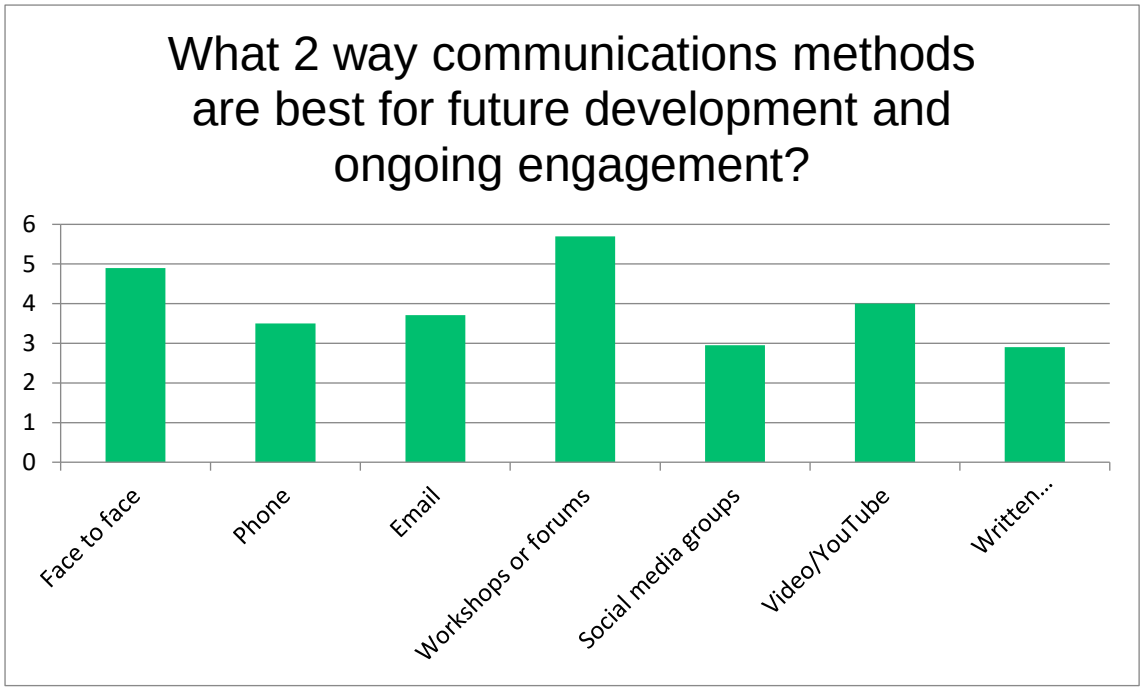


There's Not Much	Industry Management	People Development Programs
I Doubt Any Of My Immediate Family Will Take Up Commercial Fishing. That Being The Case, I Will Sell Up When I Am Over Being Involved With The Commercial Mud Crab Fishery	Important Especially To Identify Criterial Stages Of Potential Risks Within The Fishery. Planning For Future Generation	Develop Capacity Across All Sectors To Communicate With Each Other -Develop A Community. Build Business Skills And Knowledge Of Fishery Management Approaches.
Not A Lot Of Succession Planning Coming On	Getting More Professional Fishers To Buy Out Current Licence Holders (Not All But Most)	Increase Aboriginal Participation Across Remote Areas. More Promotion And Training In Schools
Not Sure What Is Meant By This Question? Do You Mean From One Fisher To The Next Generation? 2 Of The Commercial Fishers Have Not Fished The Stock But Have Leased Traps To Others As Business Propositions. Only 1 Long Term Fisher Family Operating. Traps Not Yet Allocated To Indigenous Fishers	Fewer Part-Time Participants; Greater Proportion Of Serious, Skilled Fishers Who Fish Efficiently With Less Bycatch And Invest In Value-Adding And Stewardship.	Developing Actions To Make The Fishery And Industry As Best As It Can Be
Not Good, Not Too Many Young People Want To Work Hard	A Broader Base For All Sectors From Catching To Compliance	Need To Encourage Young Blood And Train Them.
Most Current Operators Are Middle Aged Or Older, With Few Younger Participants. Some Operators Have Expanded To Include There Children, Eventually Passing The Business Over To Them.	Important To Ensure Skilled Catchers Remain In The Industry	Providing The Next Generation With Opportunities To Learn About Their Fishery But Also Beyond That To Enable Them To Develop A More Informed Picture Of Fisheries Management Around The Country. Provide Them With Opportunities To Build Networks Within And Outside Their Fishery Eg Participating In Committees That Are Directly And Indirectly Related To The Fishery, Mental Health And Sea Safety Programs, NSILP Etc
Not Much Planning. Quota Has Led To Concentration Of Ownership & Some Corporatisation		Industry Leaders Recommending And Driving Improvements In The Fishery.
Poor In NSW Wakes At The Current Time		
When I Finish No One To Take Over		

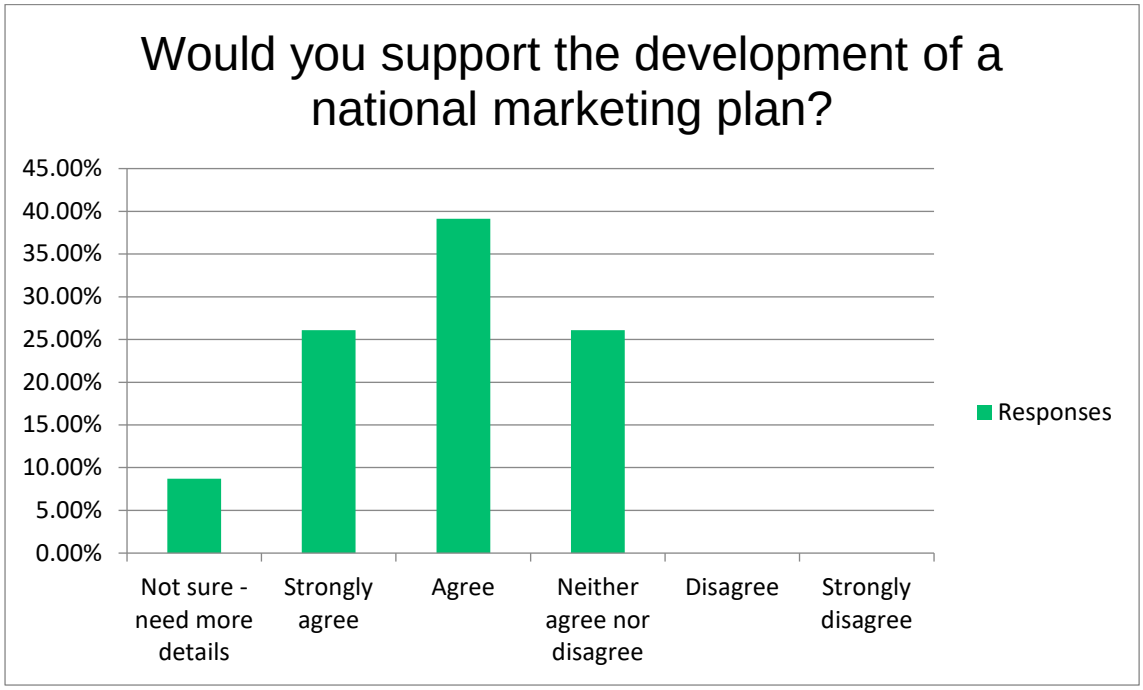
Q23: Do you feel that a coordinated voice working on behalf of all in the industry would be useful?



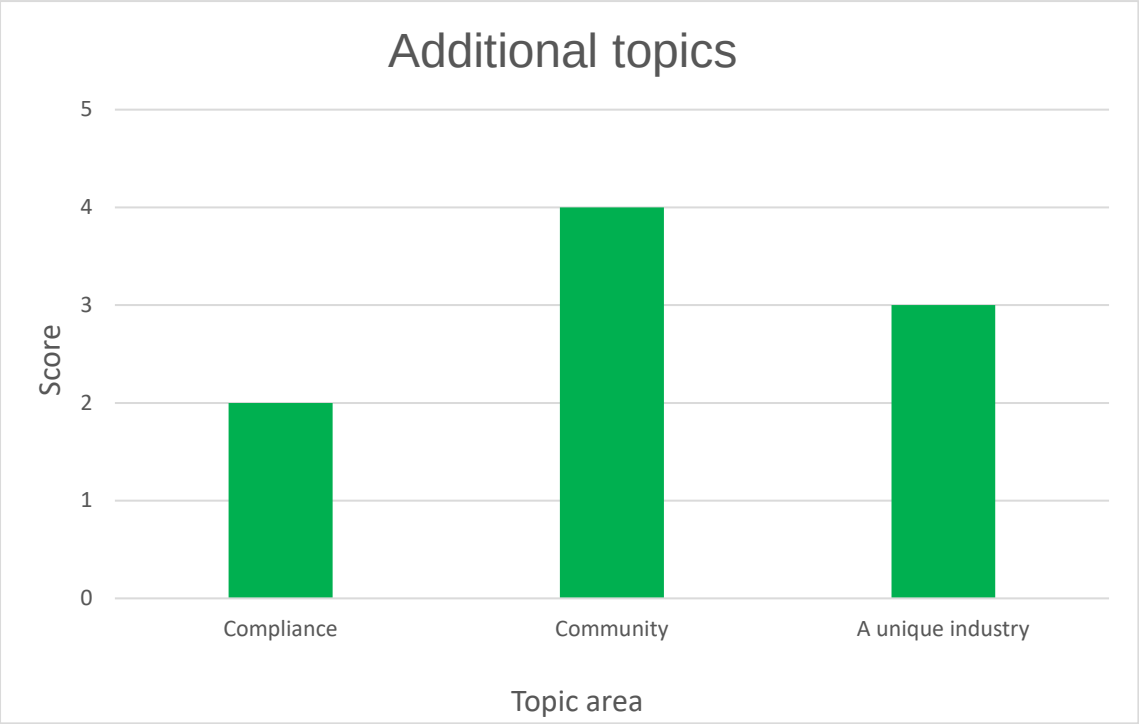
Q24: What 2-way communications methods are best for future development and ongoing engagement?



Q25: Would you support the development of a national marketing plan?



Q26: Is there anything that you wish to add (please write your thoughts below)



Compliance	Community	Unique Industry
Differences In Legislation Between Jurisdictions Are A Compliance Issue	I Would Like To See A Number Of National Approaches. Eg R&D, Marketing, Communication	The Mud crab Fishery Is A Stand Alone One. As So Many Fishers In So Many Different Areas No Corporate Or Corporates Can Actually Take Control Of The Industry. It Is And Always Will a\Be A Personal One On One Relationship With Catcher And Seller
Tagging Of Crabs (As Per Lobster In Many Jurisdictions) Has The Capacity To Address Issues Such As "Black Marketing/ Quota Avoidance" And May Provide Opportunities To Support More Advances Assessments (I.E., Using Average Weight Of Individual As A Proxy For Length)	Diversity Of Operations (Intensity, Seasonality, Profitability) Is Both A Strength And Weakness Of The Industry. How Can The Workshop Develop Outputs That Accommodate All Of Those Who Stay In The Industry Without Bias Towards Some Sectors (E.G., Catch Access Owners, Processors, Big Operators, Multi-Species Fishers)	Underdeveloped Nature Of WA Mud Crab Fishery - Only 3 Commercial Operators None Of Who Have Fished Consistently (2 Are Businessmen Leasing Their Pots To Others) Hasn't Helped The Development Of This Fishery. Previous Allocation Of Traps To Indigenous Groups Failed With Lack Of Fishing. So Small Industry Catch Resulted In Minimal Investment And Low Priority Of Mud Crab By Government. Things Slowly Changing With Recent Transfer To Managed Fishery Status And Interest In Indigenous Trap Allocation
	I Like The Idea Of Building A 'Community' For The Fishery In Which There Is Communication Across Sectors And Effort To Understand The Roles All Play. There Would Be Great Potential In Working Together For Mutual Benefit	For Christ Sake Give Us Credit For Being In An Industry For A Very Long Time, Crabbing Sustainably And Having A Consistently Economically Viable Business
	Interstate Cooperation On Research And Management Is Vital To Reduce Duplication And More Effectively Understand The Biology And Habitats Of The Mud Crab/S	

ATTACHMENT 3: Workshop Summary (the National Plan)

Mud Crab Industry Australia -A Plan to Future Proof the Industry

'If you don't know where you are going, you'll end up someplace else - Future proofing the Australian Mud Crab Industry through improved strategic direction'.

2023 - 2028

Workshop Outputs
FRDC Project 2018/177

Final Workshop Report
27 November 2022.

Scylla serrata

Scylla was a sea-monster that haunted the rocks of a narrow strait. Ships that sailed too close would lose lives to a ravenous, darting head. Serrata relates saw-toothed edge with toothlike projections

FRDC FISHERIES RESEARCH & DEVELOPMENT CORPORATION

C-AID CONSULTANTS

Sea Sense

Warning for Aboriginal and Torres Strait Islanders

Please be aware that this report may contain the names or images of deceased people. C-AID Consultants and Sea Sense Australia Pty Ltd strive to treat Indigenous culture and beliefs with respect. We acknowledge that to some communities it can be distressing and offensive to show images of people who are deceased.

Acknowledgements

Project leaders would like to acknowledge the input and support from the following:

- Fisheries Research and Development Corporation (FRDC) and the Australian Government
- All participants and their associated Industry associations, Agencies and businesses
- Thanks to those that helped and took lead roles, particularly;
  Dr Jenny Buckworth, Dr Sevaly Sen, Dr Steve Eayrs, Adrianne Laird and Dr Thor Saunders
- A special thanks to those participants who self-funded their attendance.

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Acronyms

Acronym	Details
AFMF	Australian Fisheries Management Forum
ASC	Aboriginal Sea Company
ASFB	Australian Society Fish Biology
DAF	Queensland Department of Department of Agriculture and Fisheries
DITT	NT Department of Industry, Tourism and Trade
DPIRD	WA Department of Primary Industries and Regional Development
DPI	NSW Department of Primary Industries
FMC	Fisheries Management Committee
FRDC	Fisheries Research and Development Corporation
IPA	Industry Partnership Agreement
ITCAL	Interim Total Commercial Access Level
ITQ	Individual Transferable Quota
AMCI	Mud Crab Industry Australia
MEY	Maximum Economic Yield
NESP	National Environmental Science Program
NIRS	Near Infra-Red Spectrometry
NMP	National Marketing Plan
NTRAC	Northern Territory Research Advisory Committee
PD	Personal Development
PoC	Proof of Concept
QSMA	Qld Seafood Marketers Association
R&D	Research and Development
RAC	Research Advisory Committee
RPN	Research Providers Network
SFM	Sydney Fish Market
TAC	Total Allowable Catch

CONTENTS

1. OVERVIEW OF WORKSHOP

1.1. Background

Australian Mud Crab fisheries are managed across four jurisdictions (WA, NT, Qld, NSW) with Industry having little cross-jurisdictional connectivity, and agencies appearing to generally operate in isolation, even though they are dealing with the same species (*Scylla serrata and Scylla olivacea*) and supply the same markets.

This project's genesis came when Mud Crab Industry leaders from key jurisdictions caught up by phone, discussing the status of individual fisheries. It was apparent that as a product going into the same markets, there were many common issues to resolve and opportunities for improvement. Although high-quality work is undertaken across jurisdictions; from an Industry perspective; R&D, monitoring and management approaches didn't appear coordinated enough, with no national voice or marketing plan.

It became clear that, although the national fishery is valued at around $50M/ annum[1], across the national market, connectivity is poor and improved operational, economic, social and regulatory outcomes could be achieved through a collaborative approach across jurisdictions.

It was agreed, this approach should be explored via a strategic workshop that included licence and quota holders, fishers, supply chain partners and Agencies to increase knowledge and foster sustainable economic, environmental and social benefits. It was also agreed to focus only on the commercial sector at this stage, in an attempt to build the capacity and connectivity of that group in the first instance before looking to consider incorporation of other sectors.

The concept was supported by the FRDC Project 2018-177, 'If you don't know where you are going, you'll end up someplace else - Future proofing the Australian Mud Crab Industry through improved strategic direction'

We have used the term 'Australian Mud Crab Industry, (AMCI) as a catch-all to describe the wider commercial Mud Crab sector, including licence and quota holders, fishers, and the post-harvest sector including marketers.

1.2. Stakeholder Workshop

The initial project proposal was to develop a national approach to a range of issues facing the fishery and so identify industry solutions and opportunities. This was to be achieved by holding a two day independently facilitated workshop in Brisbane in 2020, with representatives from the AMCI, as well as Agency managers and researchers.

However, COVID restrictions led to significant delays in holding the workshop with changes over time in potential participants and possibly key areas of concern. The workshop was finally held in Brisbane on 13-14 October 2022 and was attended by 30 participants

Prior to holding the workshop, an online survey was undertaken to refine key areas for consideration at the workshop (Survey results will be available in the Final FRDC Project Report).

By exploring and capturing the knowledge and viewpoints of the AMCI and Agency staff through the online survey and facilitated workshop, participants established an understanding of key Fishery issues.

1 *Based on average annual catch over last 10 years of approximately 1,450t at $35/kg at first sale point*

Participants developed the concepts and focal areas that follow, including a Vision, Values, Challenges, Opportunities and Key Investment Areas (i.e. priority areas to focus future activities).

1.3. Vision for the AMCI

The iconic Australian Mud Crab is a premium product, managed for sustainability and fished responsibly.

1.4. Values for AMCI

- *Our Iconic Species* - To acknowledge the high value placed on our sustainably sourced, wild caught Australian Mud Crab
- *Our People* - To respect the lifestyle and knowledge of the people harvesting and supplying Australian Mud Crab to the Australian community
- *Our Environment* – To commit to the environment that supports our fishery and people, through practices that minimise ecological impacts
- *Our Innovative Approaches* - To develop innovative methods, technologies and best practice along the entire supply chain to support our vision
- *Our Consumers* - To provide consumers with access to our Mud Crab so that every Australian has an opportunity to enjoy our product
- *Our United, Respectful and Respected Industry* - Our Industry operates with a mutually respectful and positive profile when interacting with each other, government, communities and consumers
- *Our Well-Managed Industry* - Our Industry operates within a lean but effective regulatory framework which supports quality, best practice operations, sustainability, environmental performance and economic performance.

1.5. Key Challenges for AMCI

- Inadequacy of accurate, timely and relevant data from all stakeholders and sources to assess and manage stocks (i.e. recreational, Indigenous, commercial, environmental)
- Stock assessments and models that currently can't adequately capture or address the characteristics of the species and operations of the Industry (e.g. limited data, climate and environmental variability and drivers, no current method to gain independent harvest rate or abundance measures in-season)
- Uncertainty regarding resource sharing and the security of access rights
- Trust and communication challenges between, and across Industry and stakeholders (Government to Government, Government to Industry, Industry to Industry, Industry to Community, Government to Community)
- To build and then maintain social licence to operate by valuing commercial fishers, addressing negative views, improving animal welfare practices and traceability
- Logistical and communication constraints for fishers operating in remote regions in challenging conditions
- Ensuring management decision making processes are based on the best scientific knowledge
- External biosecurity risks to the stocks and the operation of the fishery
- Management regulations that are too complex and which may be unnecessary or redundant
- Not currently optimising economic return to Industry.

1.6. Key Opportunities for AMCI

- Development of relevant contemporary and cost-effective data reporting methods and practices
- To seek to build models that can better assess stock status and appropriate harvest regimes
- Continual improvement and adoption of best practice handling techniques and innovative packaging to improve animal welfare, product quality, survivability, public confidence and reduce carbon footprint
- Capitalise on the species and Industry characteristics (i.e. high valued and desirable product in the market, sustainably caught, light harvest footprint, small scale and flexible operations, species resilience, remoteness, annualised catch variability)
- Chance to build national cooperation and a peak organisation
- Develop skills to build a more resilient Industry and Agencies through training, succession planning and communication
- Diversification of domestic markets and building consumer support and demand (e.g. consumer training, local community focused supplies and targeting the Olympics)
- Enhancing measures and practices to maintain and increase biosecurity to support and protect the ecological and economic sustainability of the fishery
- Supporting opportunities to build Indigenous participation and opportunities, across all sectors in the Industry
- Using technological advances to improve operations, product quality, compliance and fisher wellbeing (e.g. crab fullness project (FRDC 2018-089) using Near Infra-Red Spectroscopy (NIRS) technology[2], pot theft and pot loss prevention, traceability and selectivity)
- Development opportunities in some jurisdictions (i.e. WA and remote NT)
- Build minimalist and flexible management approaches that reflect the limited risks associated with the fishery.

1.7. Explore the Opportunity for a National Body for the Mud Crab Industry

At the time of the workshop, Industry did not have a national organisation that represented Australia's Mud Crab licence and quota holders, catchers and key supply chain partners.

The concept of developing a national body for the Mud Crab industry had substantial support at the workshop. It was felt that to date there has not been a coordinated voice operating from a clear and agreed national strategic direction and issues were only being addressed on a jurisdictional and adhoc basis. It was felt that a National Body could provide a vehicle to progress, or lead, a number of the key investment areas identified at the workshop.

The term 'Australian Mud Crab Industry, (AMCI) has been used as a catch-all to describe the whole commercial Mud Crab sector. The name could also be used for a potential, future organisation developed by the Industry as a formal vehicle to coordinate response to the various opportunities and challenges identified in this project. The concept of a national body and its potential roles are discussed further at Section 4 of this report.

2 *See Appendix 1 for Overview of FRDC Project 2018-089 'Developing a non-invasive method to assess mud crab meat fullness using portable Near Infrared spectroscopy (NIRS)'*

1.8. Key Investment Areas

Workshop participants identified seven critical investment areas (see Section 3) which are outlined on the following pages. It is anticipated that there will be some level of cross investment to address the range of priorities and these links are identified.

Noting the large number of High priorities across the seven investment areas, there will need to be a prioritisation process to support the development of future research programs. This could include a cost-benefit analysis of potential projects to determine if they are value for money and likely to be effective and have real world change.

INVESTMENT AREAS

Investment Area 1 – Assessment and Modelling

Investment Area 2 – Understanding Ecological, Climatic and Environmental Impacts

Investment Area 3 – Fisheries Management and Compliance

Investment Area 4 – Technical Advance and Improved Fishing Gear and Practices

Investment Area 5 – Economics, Marketing and Profitability

Investment Area 6 – Enhanced Communication

Investment Area 7 – People Development

Prior to expanding on the Seven Investment Areas a brief overview of the fishery is provided at Section 2.0. This is to provide readers with some background on the species, the fisheries operations, markets and fishery sustainability.

2. FISHERY OVERVIEW

2.1. Species

Globally Mud Crabs have a wide range, extending from South Africa around the Indian Ocean, up through SE Asia to Japan, and across the Pacific Ocean to Hawaii, Fiji and Samoa. This includes Australia.

Mud Crabs are widely distributed through northern Australia, extending from south of Broome in Western Australia (they have been reported below Fremantle) to Tathra in southern New South Wales. Mud Crab are found in estuaries, tidal flats and mangrove areas.

There are four species of Mud Crab of which two are found in Australian waters: *Scylla serrata* (Giant Mud Crab, sometimes referred to as the Green Mud Crab) and *S. olivacea* (Orange Mud Crab, sometimes referred to as the Brown or Red Mud Crab). The former constitutes more than 99 per cent of the commercial catch of Mud Crabs in the NT, Qld and the entire commercial catch in NSW. *S. olivacea* is a very minor component of the NT and WA catch, occurring only rarely in the Gulf of Carpentaria but increasing as a proportion of the catch across the Top End of the NT and into WA.

Genetic evidence suggests that there are at least two biological stocks of *S. serrata* in Australian waters. One identified stock is to the west of Torres Strait, while the other is to the south-east. These stocks are commonly referred to as the northern Australian and the east-coast biological stocks respectively. The Mud Crab fisheries in the Gulf of Carpentaria (GoC) are also managed by the NT and Qld as separate stocks.

Female Mud Crabs are reported in northern Australia to migrate up to 95km offshore during October to December to release their eggs, averaging around 4.5 million per individual. The planktonic larval stage can last for several weeks, which might facilitate gene flow between areas, depending on local oceanography. The extent of connectivity between areas is not known.

Mud Crabs are fast growing and short lived, with longevity believed to be up to four years. A Green Mud Crab matures at about 110mm (carapace width) and a Brown at about 90mm. Green Mud Crabs can grow to a size of 150mm carapace width within one year, depending on environment.

Levels of recruitment to these fisheries fluctuate considerably, most likely due to environmental influences, such as rainfall, run off levels and water temperature, which impact spawning success and larval survival through to recruitment[3]. Annual Mud Crab harvests will vary between and within years, dependent on recruitment, seasonal catchability and levels of fishing effort.

There are significant differences in the relative performance in the six fisheries operating across the two currently identified biological stocks. This suggest that despite the apparent larval connectivity, there are different exploitation rates on components of the adult stock in different areas.

3 *Examples of these influences can be found at Halliday and Robins 2007, Hay et al. 2005, Meynecke et al. 2010, Robins et al. 2020 and note current FRDC Projects 2019-062, 2017-006 and 2015-012*

2.2. Background to the Australian Fisheries

Each fishery in Australia operated in a different regulatory and operational environment. Following is a brief outline of each of the jurisdictional fisheries. For those that wish additional information, greater detail on each jurisdiction's fisheries status, operations and management arrangements can be found at the relevant Governments websites and/or via the Status of Australian Fish Stocks 2020 (SAFS 20203) report.

Northern Territory (NT)

NT crab fishers operate from dinghies between 5.0 - 7.2m, powered by petrol outboard motors ranging from a single 40hp to twin 250hp, depending on their fishing range.

Although there are 49 licences, each with two 30 pot units, there are only about 30 -35 crabbers. Crabbers use between 60 to 120 pots per operation, which they check and bait at least daily. Most operations are single fisher based and occasionally a crew member may be taken on to assist if crab numbers are very high, or as part of a succession process.

Retained crabs are tied and stored on board the vessel in hessian lined lug boxes. The NT requires crabbers to sort their crab as soon as possible and release unwanted or illegal crab, including CUC[4], back to the water and tie any retained crab before they land.

Some crabbers operate as day trippers back to a base camp and others live on their dinghies or mother craft for 5 - 6 days at a time, crabbing up to 200km from a base camp. Remote crabbers may stay away from Darwin for six or more months depending on access, weather conditions and crab numbers.

On return to base camp, crabs are stored short term and transported back to Darwin weekly for consolidation. This ranges from a two-hour drive for the closest crabbers, a 1,000km trip from the GoC, or a one or two-day barge trip from Arnhem Land.

Crabbers aim to catch a minimum of one basket of crabs per day (around 30kg) for a 60 pot operation to maintain their fishing ventures.

Queensland (Qld)

Qld crabbers generally fish from dinghies between 4.0 – 6.0m powered by petrol outboard motors ranging from 60 - 70hp. Most operations are single fisher based and occasionally a crew member may be taken on to assist.

There are around 380 crab entitlements allowed to use 50 pots each, but for a range of market, operational and stock reasons, there is a large amount of potential latent effort.

Quota was introduced in September 2021 for Qld GOC and East Coast entitlements, with a minimum quota requirement of 1.2t required to be able to harvest Mud Crab. This has led to a need to access additional quota from other quota holders for some who wish to continue to crab and did not receive the minimum holding quota holding necessary.

4 *CUC = Commercially Unsuitable Crab which are those crabs deemed to be soft in the shell (intermoult) to retain. Shell hardness/Softness is a proxy for meat content.*

Crabbers use between 50 to 100 pots per operation, which they check and bait at least daily. Retained crabs are generally tied and stored on board the vessel in crates or lug boxes.

Most crabbers operate as day trippers back to a base camp, or home, where crabs are stored short term, and then transported to markets.

Professional crabbers aim to catch at least 3t of crab per year per 50 pot operation.

New South Wales (NSW)

NSW is a quota-based fishery with a ITCAL[5] set at 206.3t for the transition to TAC management. This was implemented in 2017/18 and the declared TAC of 206.3t will remain the same for each financial year up to 30 June 2024. Total catch reported to date has not exceeded 70% of the allocated TAC.

NSW crabbers generally fish from dinghies between 5.0 – 6.0m powered by petrol outboard motors ranging from 30 - 80hp. Most operations are single fisher based and occasionally a crew member may be taken on to assist.

There are around 280 fishing business (FB) that hold Mud Crab quota. Approximately 75% of quota is held by 50 fishing businesses[6]. Between 40 – 60% reported utilising quota over the last three years. We note the 2020 – 21 season was impacted by COVID19 and saw a reduction in participation. NSW fishers may undertake multiple fishing methods under their various entitlements.

Fishers who wish to take Mud Crabs must have a minimum holding of 125 shares which equates to 10 pots. For each additional 10 shares, they can utilise an additional one pot, e.g.; 125 shares = 10 pots, 135 shares = 11 pots, 300 shares = 27 pots etc. The fishery has seen a significant restructure arising from the move to quota.

Most fishers have 10 pots, there are a few that have about 20, a 'handful' with approximately 50 pots, and a 'couple' with around 70 pots. There are also investors in the fishery who have people working their entitlements using 20 – 50 pots each.

Most crabbers operate as day trippers back to a base camp, or home, where crabs are either stored short term, or transported to markets or co-ops. Some use holding tanks.

Western Australia (WA)

WA is a limited access fishery with three 200 pot commercial licences and a 600 pot allocation for Aboriginal use. The three 200 pot licences can be split (sold) into six x 100 pot licences. Pot allocation to Aboriginal communities has yet to be confirmed and is waiting for research to provide biological, spatial and relative abundance data.

WA crabbing is at such a low level it is not possible to determine what best suits the fishery and fishers over time. Currently most of the commercial licence holders and those that lease their pots to operators, use a mothership with smaller tenders servicing the pots

Catch has remained below 20t with a high latent effort due to limited and sporadic fishing.

5 *Interim Total Commercial Access Level (ITCAL) set in 2017*

6 *https://www.dpi.nsw.gov.au/fishing/commercial/shareholding-information-for-share-management-fisheries*

2.3. Regulatory Frameworks

All states and the Territory operate under some form of limited entry access with associated gear and catch controls. Table 1 provides a high level summary.

Table 1: High Level Summary of Australian Commercial Mud Crab Management Arrangements

Method	Western Australia	Northern Territory	Queensland	New South Wales
TACC in place	No	No	770t East, 108t GoC	ITCAL (2017-24) 206.3t
Limited Entry	Yes	Yes	Yes	Yes
Licence Numbers/ Access Holders	3 x 200 pot commercial licences Plus 600 pots for aboriginal (not yet allocated)	49 with approx. 35 crabbers	Approx. 380	280 fishing businesses, Approx. 75% of quota held by 50 fishing businesses
Effort Limits – pot no's	Yes - 200 per commercial. 600 total for Aboriginal	Yes - effort units, min 2 x 30 pot units	Yes - 50 pots per licence	Yes - Linked to fishing shares. Minimum 125 shares
Gear Restrictions	Yes	Yes	Yes	Yes
Male-only Harvest	No	No	Yes	No
Protection berried females	Yes	Yes	Yes	Yes
Protection for soft-shelled crabs	No	Yes	No	No
Minimum size limits	Carapace width Green 150mm Brown 120mm	Carapace width Males 140mm Females 150mm	Carapace width Males 150mm	Carapace length 85mm
Management zones	No	Yes Western and GoC[7]	Yes Eastern and GoC	TAC is statewide with no restrictions. Endorsement/trap numbers controlled at the 7 estuary general regions. Endorsements/traps cannot be transferred between regions
Spatial closures	Yes	Yes	Yes	Yes
Seasonal closures	No	No	No	No
Data systems	Monthly catch effort log books (no elogs)[8]	Monthly catch effort log books (elogs proposed)	Daily catch effort log books (elogs proposed)	Daily catch and effort reporting Real-time quota reconciliation
VMS	Yes	Yes	Yes	No

7 *GoC = Western Gulf of Carpentaria Mud Crab Fishery (WGCMCF) and Western = Arafura West Mud Crab Fishery (AWMCF)*

8 *When an exemption based fishery, fishers were required to submit research logbooks with finer scale daily info and transect spatial data etc. But since fishery converted to managed status the submissions are no longer compulsory*

2.4. Volumes and Values

The volumes of reported harvest of Mud Crab across Australia are available from various sources. As can be seen from Figure 1 annual volumes change significantly, as do the proportion contributed by each jurisdiction. Since the mid 2000's, however, Qld have been by far the dominant national contributor to the overall reported landings.

Figure 2 shows that the monthly catches by jurisdiction and tend to follow a regular pattern as to peaks and troughs of catch volumes.

There is no consistent government source to determine the actual GVP of the national Mud Crab fishery. Instead, values are determined by each jurisdiction using estimates or proxies. Estimates of the value of the Australian Mud Crab Industry are therefore not readily available. However, based on an average annualised price per kilogram of $35/kg, the total value would be in the vicinity of $38M to $50M/year at the point of first sale. If estimates are based on actual price paid it could be expected the overall value would be higher as prices per kg vary greatly over the year and can be much higher than $35/kg (see Figure 3).

There is no domestic Mud Crab aquaculture sector but it is the dominant sector internationally.

2.5. Markets

Mud Crabs are an international commodity and traded across most continents (but mainly Asia) with 2018 global production estimated[9] at around 310,000t from farmed and wild caught, compared to about 32,000t in 2002 (increase of approx. 900%[10]).

The major growth in production has been through the increase in farmed crab from 2002 to 2018, increasing from 14,442t to 263,284t (increase of approx. 1,700%) and wild capture from around 18,000t to 48,205t (increase of approx. 170%) in the same period. China and Vietnam lead the growth in farmed crabs, and Indonesia in wild caught.

As the Australian market generally demands live product, there are no overseas competitors in that space in the domestic market due to federal biosecurity legislation[11] which prohibits live Mud Crab imports into Australia. Australian markets are therefore sheltered from this international volume as the domestic live market is only accessible to Australian fisheries. Conversely the international market is highly competitive, with multiple supply options and with a lower price point in general.

9 *Source FAO*

10 *((y2 - y1) / y1)*100 = percentage change (where y1=start value and y2=end value)*

11 *Biosecurity Regulation 2016 https://www.agriculture.gov.au/biosecurity/risk-analysis/guidelines. To be imported they must be on the Department of Environments Live Import List which has to meet Biosecurity Regulations. (https://www.environment.gov.au/biodiversity/wildlife-trade/live-import-list).*

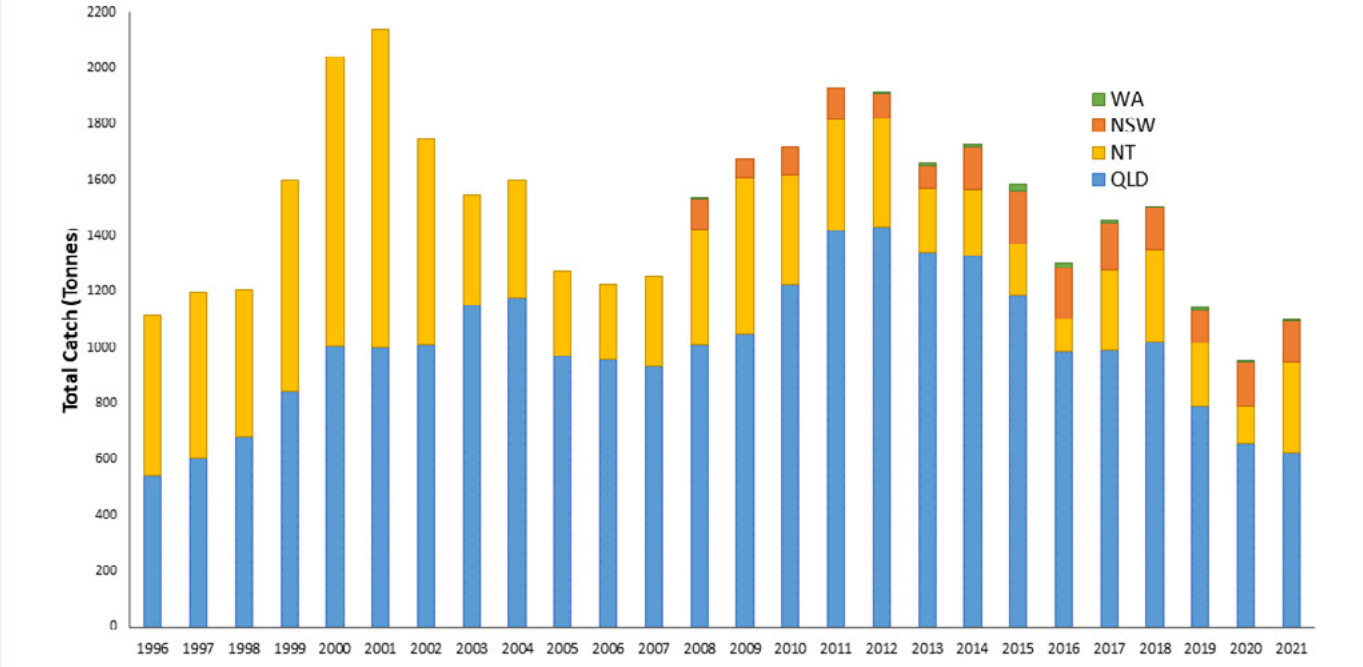


Figure 1: **Australian Mud Crab *(Scylla spp.)* production (t) by state from 1996 to 2021 (2021 WA and NSW production are estimated based on 2017-2020 data).**

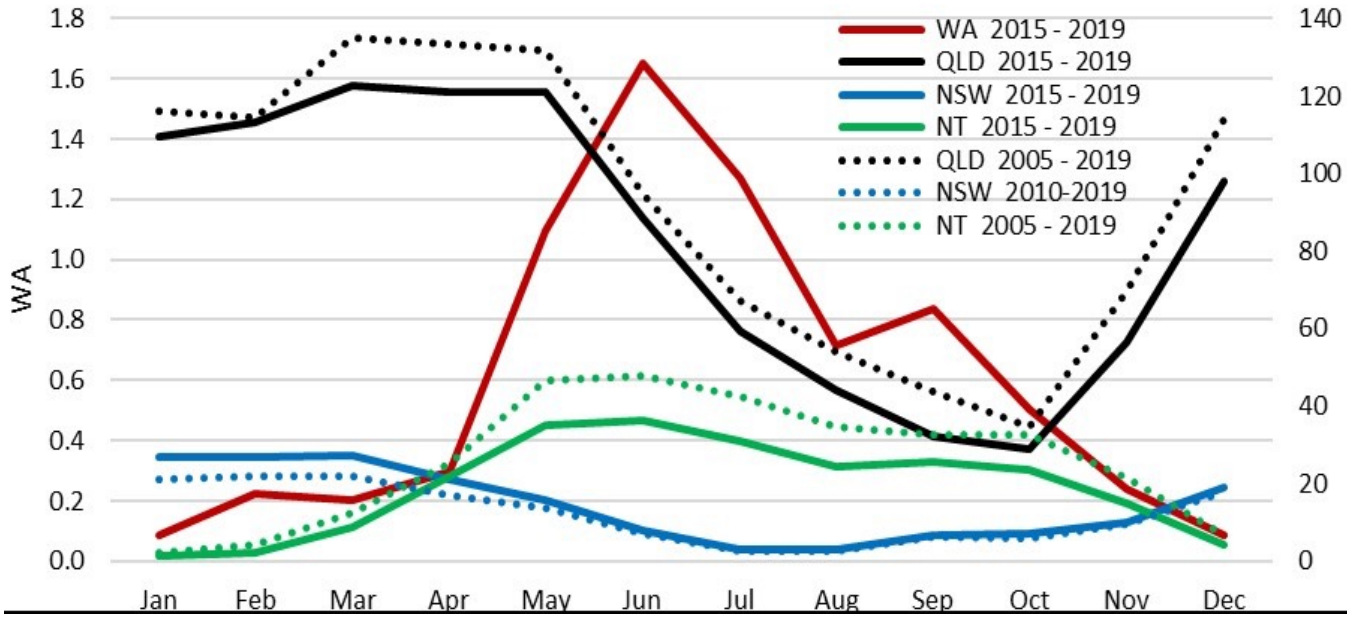


Figure 2: **Average Monthly Commercial Harvest (Tonnes) - WA, NSW, NT, QLD (note WA on separate axis due to low volumes)**

Domestic

Over the last couple of decades annual reported national commercial production has ranged between 1,100t to 2,000t, with Qld producing around 70%, NT 20%, NSW 10% and WA less than 0.4% (see Figure 1).

Mud Crab is sold mainly in the NSW, Melbourne and Qld markets, targeting Asian based cuisine and demographics, and also for the whole steamed/boiled crab market, often for non-Asian consumers. Historically the majority of product is destined for the food service restaurant sector, rather than for home consumption, although COVID may have slightly shifted this focus.

Within Australia there is competition in the various markets from producers in NT, Qld, and NSW, based

on availability, quality, price and sex of the Mud Crabs. Qld is the major supplier (but only of male crabs) whilst all other jurisdictions allow the sale of female crabs.

Demand for Mud Crab is strong within Australia, but as the market relies on a live product it is relatively easy to oversupply, and this can lead to decreased prices when all jurisdictions are supplying the market together (see Figure 2 and Figure 3).

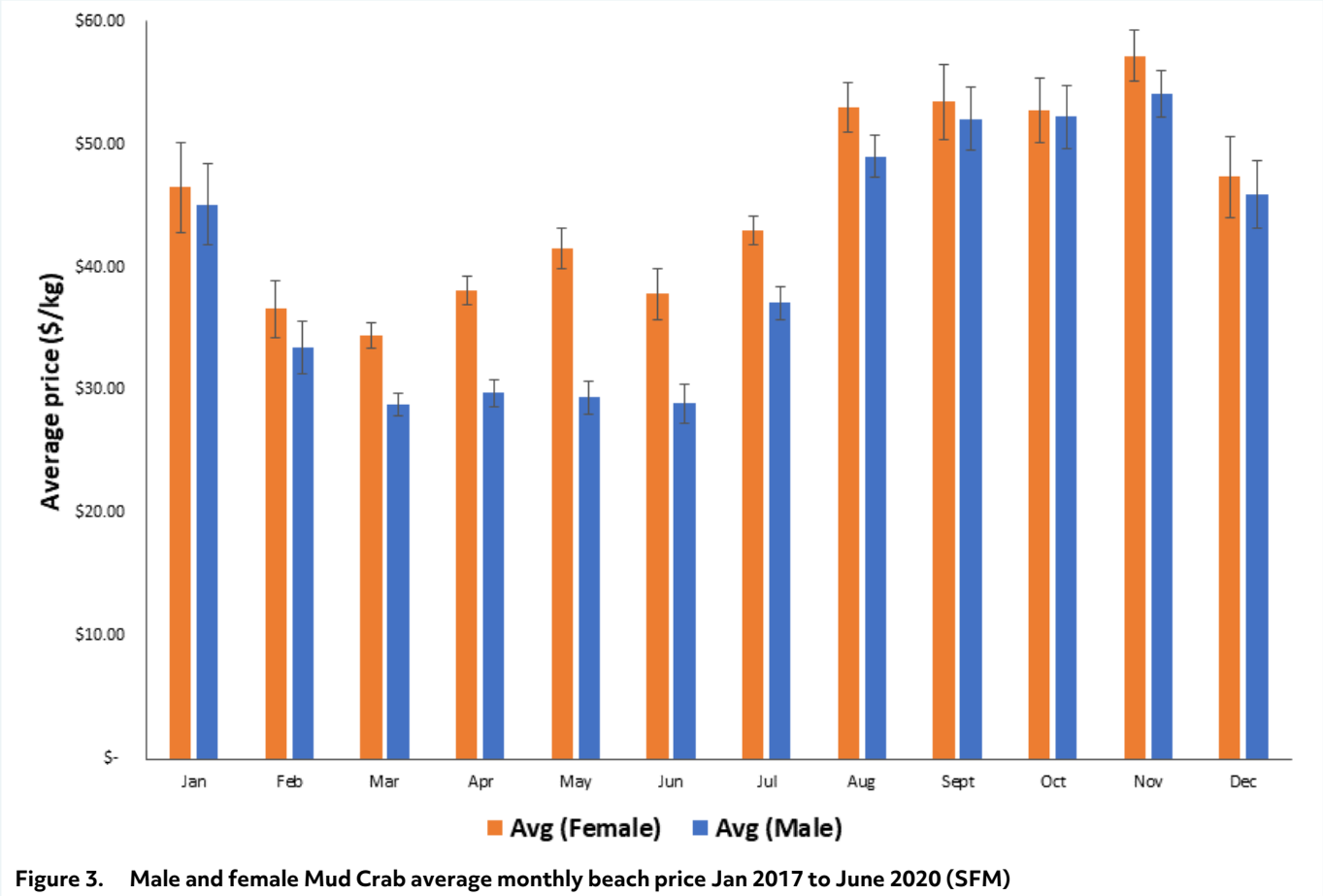


Figure 3. Male and female Mud Crab average monthly beach price Jan 2017 to June 2020 (SFM)

Although SFM prices are not a true representation of price across the broader market, as the majority is sold outside the SFM, it is a swolid, transparent and reputable indicator to the market as a price guide (See Figure 4).

The SFM is the major purveyor of Mud Crab in Australia, handling over an estimated 30% of domestic production. Mud Crab was the 10th highest volume product through that market in 2019/20 (295t) and 15th in 2020/21 (279t). Over the last two SFM reporting periods Mud Crab was the most valuable (2019/20) and 2nd most valuable in 2020/21 (approximately $10M annually).

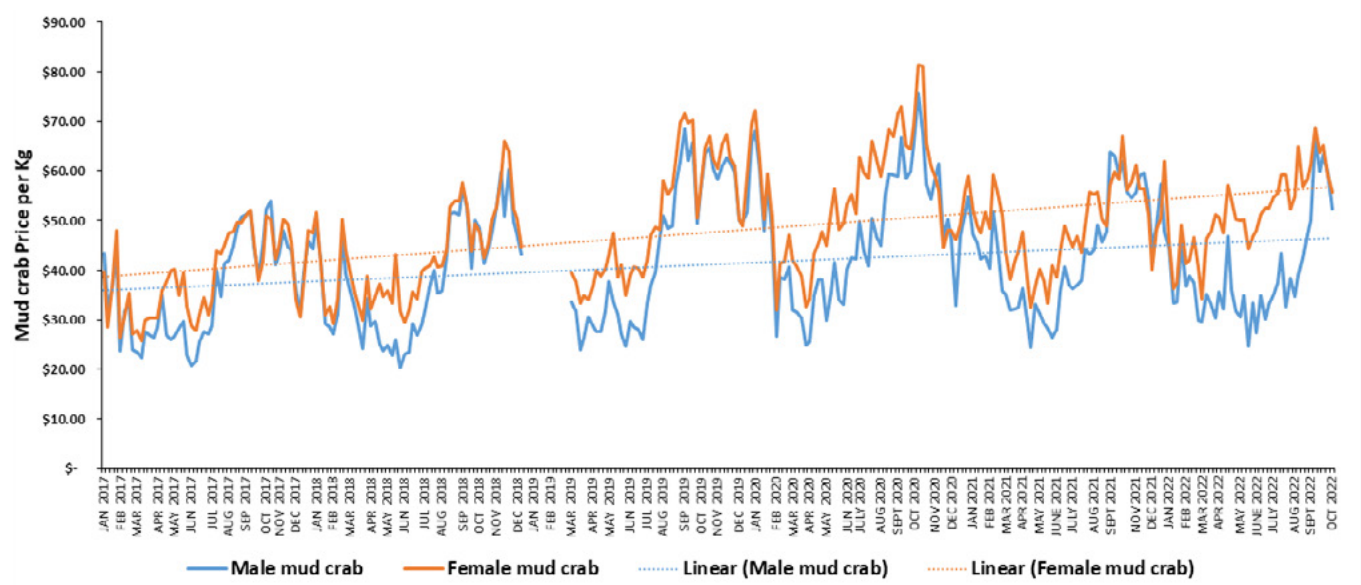


Figure 4. 'A Grade' male and female mud average price Fridays 2017 -2022 (source: SFM)

An estimate for the distribution of national production across the main consumer markets is provided at Table 2.

Table 2: Estimates of share of market destinations by each jurisdiction

Market Destination	Source %			
	Qld	NT	NSW	WA
NSW	50%	45%	85%	0%
Vic	30%	40%	10%	0%
Qld	15%	3%	3%	0%
WA	0%	4%	0%	100%
SA	0%	3%	0%	0%
NT	0%	1%	0%	0%
Overseas	5%	4%	1%	0%
Online	<1%	0%	1%	0%
Total	100%	100%	100%	100%

Exports

Exports of Mud Crab are not specified in the ABARES data. However, the Mud Crab contribution to exports is estimated to be negligible given that the Australian Mud Crab market is dominated (>95%) by locally produced live crabs sold at attractive food service market prices.

The level of exports is not high, as the demand and price within Australia is generally healthy, whilst the international market is highly competitive, with multiple supply options and with a lower price point in general.

Exporting can, however, be an attractive short term competitive mechanism when the A$ exchange rate is favourable and the Australian market is oversupplied. This occurred in the early 2000s. Historically exporting has been to a range of countries including Singapore, Malaysia, Hong Kong, Macau, Taiwan, China and the USA.

Imports

Relevant trade databases (ABARES and FAOStat) do not specify the Australian Mud Crab species, but some indicative assessment can be made of imported competitor product.

Imports are comprised of many species and product formats, so it is not possible to determine the percentage of imports of Mud Crab product A small amount of frozen large Mud Crab may be imported, mainly for lower cost dining markets. However, large volumes of frozen soft shell Mud Crab are imported and utilised in a range of dining venues.

The total annual volume of all imported crab product is around 1,700t (Table 3), a volume similar to the total domestic Mud Crab production.

Table 3. Imported Crab Products (FAOStat 2021 and ABARES)

Imported Crab Products	2014		2018	
Value $US'000	Value $US'000	Volume tonnes	Value $US'000	Volume tonnes
Crab meat, prepared and preserved	5,814	480	5,945	456
Crabs, frozen	19,555	412	15,347	1,311
Crabs, dried, salted, in brine, smoked, nei	0	1	124	11
Crabs, not frozen	187	16	0	0
Total FAOStat $US	**25,556**	**1,908**	**21,416**	**1,778**
Comparative ABARES $A	**28,337**	**2,097**	**26,151**	**1,622**

2.6. Sustainability and Environmental Status and Reporting

Each of the six stocks identified by SAFS 2020 in Australia can be assessed a number of ways to determine its sustainability and environmental credentials. Four key indicators are:

1. If it has a Wildlife Trade Operation (WTO[12]) approval. If you want to export Australian native wildlife for commercial purposes, it must come from an approved WTO. This indicates that it is harvested within an approved management arrangement by the Department of Climate Change, Energy, the Environment and Water (DCCEEW).
1. The fisheries sustainability status as provided in the SAFS 2020 report. This report brings together available biological, catch and effort information to report on the status of Australia's key wild catch fish stocks (see current status at Table 4).
1. Whether a formal Harvest Strategy[13] is in place.
1. If it has 3rd party accreditation[14] such as MSC, Friends of the Sea etc.

The related summary for reach jurisdiction follows.

NT

- Under SAFS 2020, both the AWMCF and WGCMCF regions are considered SUSTAINABLE.
- The Fishery has been assessed by DCCEEW and has a WTO in place until 21/08/2026.
- A formal Harvest Strategy is in place.
- There is no 3rd party certification.

Qld

- Under SAFS 2020, both the GoC and East Coast regions are considered SUSTAINABLE.
- The Fishery previously held a WTO until 27 May 2022, subject to conditions. As conditions were not met, this has now been revoked.
- A formal Harvest Strategy is in place.
- There is no 3rd party certification.

NSW

- Under SAFS 2020, the Estuary General Fishery (which takes Mud Crab) is considered UNDEFINED as there is uncertainty around the use of excess gear, there is no biomass estimate, or fishing mortality rates determined.
- The Fishery has been assessed by DCCEEW and has a WTO in place until 31 March 2028.
- There is no Harvest Strategy in place.
- There is no 3rd party certification.

12 *https://www.environment.gov.au/marine/fisheries*

13 *A Harvest Strategy is a framework that specifies pre-determined management actions in a. fishery for defined species (at the stock or management unit level) necessary to achieve the agreed. ecological, economic and/or social management objectives.*

14 *Third party accreditation (or certification) is the formal, independent recognition that a prescribed standard of performance has been achieved.*

WA

- Under SAFS 2020, the Kimberley Crab Managed Fishery is considered SUSTAINABLE.
- The Fishery does not have a WTO.
- No Harvest Strategy is in place, but a draft strategy and control rules have been developed. Set limits/threshold and performance indicators are based on commercial catch rate
- There is no 3rd party certification, but a MSC Pre-Assessment was undertaken in 2014.

Table 4: Mud Crab stock status - 2020 Status of Australian Fish Stocks, FRDC.

Jurisdiction	Fishery	2016	2018	2020	Indicators
NSW	Estuary General Fishery	Undefined	Undefined	Sustainable	Catch, catch rate, biomass, fishing mortality
NT	Arafura-West Mud Crab Fishery	Sustainable	Sustainable	Sustainable	Catch, effort, catch rate
NT	Western Gulf of Carpentaria Mud Crab Fishery	Transitional-Depleting	Sustainable	Sustainable	Catch, effort, catch rate, biomass, fishing mortality
QLD	East Coast Mud Crab Fishery	Sustainable	Sustainable	Sustainable	Catch, effort, catch rate, fishing mortality
QLD	Gulf of Carpentaria Mud Crab Fishery	Sustainable	Sustainable	Sustainable	Catch, effort, catch rate, biomass, fishing mortality
WA	Kimberley Crab Managed Fishery	Sustainable	Sustainable	Sustainable	Catch, effort, catch rate

3. WORKSHOP OUTPUTS AND OUTCOMES – KEY INVESTMENT AREAS

The outputs in this section were developed by workshop participants via small and large groups processes. From the large amount of data and information collected prior to and during the workshop, participants identified a number of key issues. These were developed into seven focal investment areas.

For each of the seven investment areas, participants methodically developed the following:

- Key objectives to address the issues
- What is the specific focus or challenge
- How high a priority is the issue
- How could the issue be addressed?
- Who should be the lead organisation or person
- Which human resources would be required
- Estimated timeframe to undertake the work

Although it wasn't possible to develop precise budgets for each investment area, based on participants' experience, estimated financial requirements were developed as a guide. To reflect the expected budgetary requirements, a budget guide range for each Focus Area was developed based on the following values:

LOW	Lower Cost Project	estimated project cost to be less than $150,000
MED	Medium Cost Project	estimated project cost to be less than $500,000
HIGH	High Cost Project	estimated project cost to be less than $800,000
V HIGH	Very High Cost Project	estimated project cost to be equal to, or more than $800,000.

It is acknowledged that these estimates may change once each of the investment areas is further developed and more fully scoped.

Each of the identified Focus Areas has been aligned to the Outcomes and Focus Areas in the FRDC R&D Plan (see Appendix 2 for an overview or go to https://rdplan.frdc.com.au/wp-content/uploads/2020/07/FRDC-RD-Plan-2020-2025_low.pdf)

The Seven Investments areas are expanded on in sections 3.1 to 3.7.

3.1. INVESTMENT AREA 1 – Assessment and Modelling

Currently assessment and modelling in the various Mud Crab fisheries around Australia is challenging. This is because Mud Crabs are hard to observe, and it is difficult therefore to develop independent abundance monitoring. Additionally, environmental drivers and associated recruitment variations are highly variable between locations and years, and are not well understood. As the fishery each year largely comprises recently recruited crabs to the fishery, this means annual abundance varies widely and is poorly predictable.

Although long-term catch and effort data has been provided by Industry for many years, that data has not been adequate to fully refine models and associated assessments. There is no doubt that richer and more timely data collection from Industry may help in the assessment process, but the main drivers most likely affecting abundance are not described by Industry driven data and must be sourced from elsewhere (e.g. weather, flows, etc).

An assessment of potential independent assessment processes could yield more effective means to improve modelling and assessment rather than seeking ever more refined Industry catch/effort data that comes with increased burden for industry. The lack of data from other extractive user groups (Indigenous, recreational, charter) also needs to be addressed, particularly in low commercial fishing areas.

The outcomes from this Area would be used to inform Fisheries Management.

Objectives identified to address the issue:

1. Evaluate status of Mud Crab stocks in terms of relevant Harvest Strategy Policies
2. Investigate the utility of in-season management (e.g. by applying trigger points) using real time data
3. Investigate the spatial dynamics of larval supply, in the context of environmental variations, as a driver of spatial and inter-annual stock variation.

Focus	Priority	What/How	Lead	Budget Estimate and Fund Source	Human Resourcing	Timelines	Comment FRDC Outcome
1. Improving Assessments	H	Improve data inputs and model forms to provided better assessments and compliance protocols	• Agencies	Est MED Agencies	• Govt • Industry	Ongoing	Could significantly improve confidence in stock status Better able to achieve MEY objective FRDC Outcomes 2, 4
2. Using management strategy evaluation to understand options and benefits, costs of in-season management	H	Using real time data may provide potential to use in season measures to adaptively manage for in-season variation Clearly identify alternate data needs Liaise with Fisheries Management and Industry to develop management options, appropriateness, feasibility and costs	• Agencies	Est LOW FRDC, Agencies co-contributor	• Agencies	3 years	Chance for substantial improvement of economic performance as well as enhancing sustainability. (Link to Investment Area 3) FRDC Outcomes 1, 3, 4, 5
3. Assess options for fishery independent baseline data collection	M	Consider larval spatial dynamics information model development to investigate larval supply as a driver of differences in spatial abundance (e.g. particle modelling and spatial sampling)	• Industry collection • Agencies analysis	Est MED Possibly student projects	• Agencies • Industry • PhD students • Outsource	3-5 years	Options for spatial assessment and forecasting Linked to other environmental driver work FRDC Outcomes 1, 2, 4, 5
4. Identify cultural harvest	H	Develop appropriate methods to gain information on traditional harvest of key species Quantify cultural harvest Potential National project	• Indigenous people • Agencies	Est MED FRDC	• Agencies and RPN/ AFMF identify researchers • Indigenous people	3 years	May be part of a larger project to determine Indigenous catch/effort (Link to Investment Area 3) FRDC Outcomes 2, 3, 4, 5

3.2. INVESTMENT AREA 2 – Understanding Ecological, Climatic and Environmental Impacts

The biology and life history of Mud Crabs and how it varies at local scales is not well understood. As such, it is difficult to understand the long-term impacts of climate and weather events on the recruitment and abundance of Mud Crabs, especially at the local level. In addition, significant change and development has taken place in coastal areas with ongoing pressure for further domestic, commercial and agricultural uses being proposed.

The unknown impacts of environmental drivers and species habitat dependence, and the interplay of these means that developing sound, reliable, timely and robust assessments is very difficult.

Assessments could be improved by enhancing inputs of biological knowledge and ecological information and having better understanding of trends in changed environmental capacity to support Mud Crabs. An improved understanding of these variables could assist stock assessors, modelers and Industry to better utilise the resource in a sustainable manner, whilst enhancing ecological, social and economic wellbeing and performance.

Understanding the impacts of changes to habitat, climate and productive capacity along with spatial, temporal and seasonal variability may allow future work to develop predictive capacity of modelling.

Objectives identified to address the issue:

1. Critically review and update biological information used in assessment of Mud Crabs, including at local scale
2. Understand influences of climate, water chemistry and environmental variation on long-term recruitment, abundance, reproduction, growth, survival and recruitment, as well as behaviour
3. Build knowledge of critical habitats for Mud Crabs and the impacts of habitat loss and degradation
4. Build a detailed life-cycle analysis to inform recruitment monitoring and prediction, incorporating spatial and inter-annual variation.

Focus	Priority	What/How	Lead	Budget Estimate and Fund Source	Human Resourcing	Timelines	Comment FRDC Outcome
1. Improve poorly understood biology of Mud Crabs, particularly at local scales	H	A considerable body of research has been undertaken over time but much of the data may be dated and modern analytic techniques are available Critically review existing information.	• Agencies • Industry	Est LOW FRDC Agencies co-contributor	• Lead agency • Industry data • PhD students	1-3 years	Improve confidence in assessments May be a part of a larger project FRDC Outcomes 1
	H	Better understand localised biology Understand spatial segregations, genetic differences Assess validity of parameters used in assessments and spatial applicability	• Agencies • Industry	Est HIGH Agencies co-contributor	• Lead agency • Industry data • PhD students	2-3 years	
2. Improve poorly understood biology of Mud Crabs, particularly at local scales	H	Climate change effects. habitat change from development, pollutants etc will impact water chemistry This may influence crab populations -build knowledge via a portfolio of case studies	• Agencies	Est MED Alternative funding via environmental funding sources	• Govt • Industry • PhD Students • NGO • Peak bodies • Independent or outsource	1-5y	Investigate appetite for projects May be a part of a larger project FRDC Outcomes 1, 2, 5
3. Understand species habitat needs	M	Map existing habitat and identify a timescale of change Evaluate extent and influence of habitat changes on Mud Crab production in each region, including impacts of loss Understand how habitat influences biology, life cycle and the influence on stock assessment Undertake a series of 'pilot projects' or case studies to 'test the waters'	• Agencies	Est V HIGH Alternative funding via environmental sources; e.g.; NESP and FRDC	• Lead agency • NGO • PhD students • Industry • Independent or outsource	1-5 y	May be a larger than 'Mud Crab' project particularly in developed/ developing areas Link to broader climate and environment projects FRDC Outcomes 1, 4
4. Understand climate influences on recruitment variability	M	Assess impacts of weather and/or climate influences on recruitment variability Better understand environmental drivers and long-term impacts of climate change Understand variation in yearly recruitment and impacts on catch rate variations	• Agencies	Est V HIGH NESP/FRDC	• Lead agency • PhD students	3-4 years	Link to broader climate and environment projects FRDC Outcomes 1, 2, 5
	H	Assess direction from past and current FRDC projects, i.e.: FRDC 2022-010, 2017-047, 2017-006, 2015-012, 2008-012, 2000-142.	• Agencies • Industry	To Be Determined (TBD)	• TBD	Post other projects	Completed projects and those underway will provide basis for future research requirements Liaise with Fisheries Management and Industry on appropriateness, feasibility and costs (Link to Investment Area 3) FRDC Outcomes 1, 2, 5

3.3. INVESTMENT AREA 3 – Fisheries Management and Compliance

Sound fisheries management and associated compliance provides the scaffold supporting all aspects of a fishery. The aim, from an Industry perspective, is to have an adaptive management system that applies the minimum interference into operations, provides security of access rights and underpins stock assessment, quality control, best practice, stock sustainability and good environmental performance expected from a professional fishing Industry.

This is built around relevant, reliable and timely data, accountability and independent and trusted science-driven decision-making processes that work closely with stakeholders to achieve ecological, social and economic outcomes.

A key aspect of fisheries management is understanding who is using the resource and with what rights and conditions are attached to that use. Uncertainty about resource allocation and sharing is a major area of conflict, both within Industry and across other stakeholder groups. Government policies seek to deliver resource shares that achieve the 'optimal' balance of ecological, economic and social outcomes. This however does not always align with stakeholders' views, or addresses changes in resource use between sectors. All users seek certainty of access, rights and allocation and to minimise competition and conflicts. but at times there is insufficient information to make those decisions as there is insufficient data, particularly for recreational and Indigenous sectors.

Objectives identified to address the issue:

1. Develop evidence-based sustainable catch and effort limits and associated management frameworks for each sector
2. Build 'light touch' management approaches that are fair and adaptable
3. Provide certainty of access, rights and allocation
4. Develop mechanisms to enable changes in resource shares which are fair and equitable.

Focus	Priority	What/How	Lead	Budget Estimate and Fund Source	Human Resourcing	Timelines	Comment FRDC Outcome
1. Improve accuracy, timeliness of relevant data from all stakeholders	H	The lack of data from non-commercial extractive user groups (Indigenous, recreational, charter) needs to be addressed, particularly in areas with nil or low commercial fishing activity	• Agencies	TBD based on need and scale	• Agencies	2-5 years	Insufficient information to make those decisions based on data, particularly for the recreational and Indigenous sectors. Possible national project FRDC Outcomes 1, 2, 3, 4, 5
	H	Identify cultural Mud Crab harvest	• Indigenous • Agencies	Est MED FRDC	• Indigenous • RPN/AFMF Lead	3 years	May be part of a larger project to determine Indigenous catch/effort (Link to Investment Area 1) FRDC Outcomes 2, 3, 4, 5
2. Understand the Impacts of variable catch rates on stock assessment and management	H	Assess effectiveness of existing management models where recruitment and abundance are seasonally variable and environmentally driven and/or are temporally and spatially differentiated Investigate low cost adaptive and responsive approaches Develop justifiable catch limits (e.g. TAC setting) Develop innovative, cost effective and best practice management methods - Reduce complexity and increase transparency using science-based approaches	• Agencies	Est MED FRDC	• Agencies		Reduce complexity and increase transparency using science-based approaches (Link to Investment Area 3) FRDC Outcomes 1, 2, 3, 4, 5
3. Improve security of access, resource sharing	M	Trial regulatory or voluntary spatial and/or temporal methods to manage resource shares Identify options to provide more certainty for commercials (e.g. set levels at which reallocations could occur, explore compensation options and who would pay)	• Agencies	Est MED Jurisdictional funding Stakeholders support.	• Agencies • Stakeholders	1-5 years	Broader national project FRDC Outcomes 3, 4
4.Increase stakeholder understanding about Fisheries Management	H	Undertake stakeholder training on management frameworks. Use of 'management 101' material developed by IRG to inform stakeholders	• Agencies • Industry	Est MED Jurisdictional funding Industry support to run programs	• NT fisheries lead • Other jurisdictions support	2 years	May be linked to a larger project FRDC Outcomes 1, 3, 5

Focus	Priority	What/How	Lead	Budget Estimate and Fund Source	Human Resourcing	Timelines	Comment FRDC Outcome
5. Identify and minimise pot theft.	H	Adopt and integrate knowledge from 'CrabNabber' project technology to identify and minimise rates of theft	• Industry driven.	Est LOW Jurisdictional funding Industry support or purchases	• NSW fishers (with Qld and NT) • Nationally Compliance & Managers	2 years	Look to continue advancement of 'CrabNabber' project (Link to Investment Area 4 for development) FRDC Outcomes 1, 2, 3
6. Improve community understanding of the commercial Industry	H	Develop educational material to better inform non-commercial users of the impacts each sector has on the Mud Crab resource	• Industry	Est LOW Grants Industry funding	• Industry	TBD	(Link to Investment Area 6) FRDC Outcomes 1, 2, 5
7. Identify options for product differentiation	M	Investigate the feasibility of Australia Mud Crab brand or other ways to differentiate from other competing products, including imports	• Industry	Est MED Grants Industry funding	• Industry	TBD	FRDC Outcomes 1, 3

3.4. INVESTMENT AREA 4 – Technical Advance and Improved Fishing Gear and Practices

Worldwide, technological advances are moving at a rapid pace but in many instances the Australian Mud Crab Industry have been slow adopters, often due to the small operations and minimal impact fisheries in which they operate.

It is felt that there are, however, many advances that would improve Industry operations, profitability and well-being along with improved consumer and Government confidences and support.

Objectives identified to address the issue:

1. Improve grading consistency and transparency
2. Improve reporting and traceability and extension of fishery knowledge
3. Minimise gear theft and loss.

Focus	Priority	What/How	Lead	Budget Estimate and Fund Source	Human Resourcing	Timelines	Comment FRDC Outcome
1. Improve grading consistency and consumer trust	H	Roll out existing knowledge and technology across the nation to improve grading consistency, confidence and profitability	• DAF	Est HIGH FRDC	• DAF-- Brett Wedding • 2ndary Qld, NT, WA RACs	3 + years	Longer term, seek funding from retail sector; e.g.: QSMA, SFM, Melb Fish Mkt and other individual businesses (i.e. catchers, marketers) (Link to Investment Area 5) FRDC Outcomes 1, 3
	H	Test efficacy of NIRS across select locations in QLD, NT and WA - similar to NSW study	• DAF				
2. Improve catch reporting and traceability across jurisdictions	M	Identify if consistent reporting across jurisdictions is feasible or desirable Streamline and improve relevant catch reporting and traceability across jurisdictions, including electronic options Explore and/or develop new and cost-effective traceability 'systems', including Industry driven post-harvest tag systems	• DAF, DPI, DITT, DoF • Industry	Est MED FRDC data project	• Govt • AFMF	5 years	Streamline and simplify reporting Improve consumer confidence and experience Link with NIRS concept (Link to Investment Area 3 and 5) FRDC Outcomes 1, 2, 4, 5
3. Utilise technology to reduce crab pot theft and interference	H	Advance existing trap theft 'CrabNabber' project to use technology to identify and minimise rates of theft Review current options and support development of new technology. Engagement with compliance	• CrabNabber project • Industry	Est MED Existing project Industry uptake FRDC research Jurisdictional funding	• 'CrabNabber' project NSW fishers (Qld and NT) • Industry • Nationally Compliance & Managers	ongoing	Look to continue advancement of 'CrabNabber' project Reduce ghost fishing Embrace GPS technology Look to adoption via 'CrabNabber' project (Link to Investment Area 3 for adoption) FRDC Outcomes 2, 3, 4

3.6. INVESTMENT AREA 5 – Economics, Marketing and Profitability

Improving Industry profitability covers a potentially wide range of investment areas. In the first instance focus is on a number of potentially controllable areas. These relate to: further development in areas with low fishing activity (e.g. WA and remote areas of the NT) which may align with increased Indigenous involvement; and, optimising post-harvest activities to maximise survivability, improve quality, developing a more focused approach to marketing and to identify potential operational cost efficiencies.

The concept of a National Marketing Plan (NMP) could have merit.

Objectives identified to address the issue:

- 1. Improve post-harvest quality and reduce mortality
- 2. Promote Mud Crab consumption
- 3. Improve Indigenous involvement
- 4. Improve efficiencies in bait use in the NT.

Focus	Priority	What/How	Lead	Budget Estimate and Fund Source	Human Resourcing	Timelines	Comment FRDC Outcome
1. Improve harvest quality and post-harvest mortality	H	Refine and extend existing Handling/ Guidelines (Industry and supply chain) Link with NIRS concept Develop onboard induction material (see NT CODE as example) Clear labelling on boxes to reduce post-harvest losses during transport Advocate for simple live product training module in induction/ onboarding for cargo handlers (e.g. don't put boxes in the sun)	• DAF • Industry	Est LOW FRDC Inhouse	• DAF identify gaps, update materials • Industry revise/ adopt NT CODE • Packaging companies • FRDC Extension officers	1-2 years	Large amounts of post-harvest materials have been developed but extension may not have been optimal – and may need revision Packaging companies (VISY, AMCOR, Oceanic etc) can easily add printing to boxes for no cost (Link with Investment Area 4, NIRS concept) FRDC Extension and culture change work FRDC Outcomes 1, 2, 3, 5
2. Improve public awareness of Mud Crab product	H	Promote Mud Crab purchases in Australia via targeted market development Investigate promotions during times of abundance or lower prices Develop and extend cooking and dining consumer materials Build non-Asian background consumer base Engage Tourism campaigns	• SFM • Industry	Est LOW Inhouse Grants or seed funding to build a NMP	• SFM • Industry • SFM Identify optimal times • Industry build program through NMP	1 year	Once SFM has identified optimal time(s) they can utilise some of their social and marketing resources to trial concept Industry will need to build and cost a plan if trials successful FRDC Outcome 2, 3, 5
3. Increase Indigenous involvement	H	Engage/develop formal training programs and build partnerships with existing mentoring program and business (catching, handling, marketing and business) Build fishing portfolio and businesses Assess outcomes of FRDC Indigenous brand project (FRDC 2020-121)	• ASC • Govt • Industry	Inhouse ILSC TBD	• CEO ASC • Govt through programs • Industry members		ASC can take a lead with support of Industry and Govt FRDC Outcomes 1, 2, 3, 4, 5
4. Develop improved access to bait	M	Regulation change to allow use of specified managed species as bait in the NT (e.g. Barra frames)	• NT Industry	Inhouse	• DITT and NT Industry		NT only issue - Need to liaise with other NT stakeholders FRDC Outcome 1, 2, 3

3.7. INVESTMENT AREA 6 – Enhanced Communication

Communication was seen as a high priority Area which could and should be improved. This related to intra Industry, Industry and Government and with the broader community. It was also noted that at times poor communication between Government to Government was also an issue. It is felt that there needs to be increased opportunities to have full, frank and honest conversations within and across stakeholder groups to build relationships, trust, transparency and opportunities. The impact of misinformation on relationships was highlighted as a major obstacle to optimising relationship and Industry outcomes.

Having a source of timely and trusted science driven information that is delivered in a way that addresses the various target audience needs was seen as a critical step moving forward to improved communication. A national trusted sharing platform may assist.

There's an associated need to build capacity and capability through targeted Personal Development (PD) as expanded on in Investment Area 3.7.

Objectives identified to address the issue:

1. Build trusted information sources and connections
2. Develop timely, clear, consistent, responsive messaging
3. Identify best communication options for target audience (e.g. including forums, socials, regional approaches, champions).

Focus	Priority	What/How	Lead	Budget Estimate and Fund Source	Human Resourcing	Timelines	Comment FRDC Outcome
1. Improve Industry to Industry communication (Ind:Ind)	H	Research audit on communication work completed (what did or didn't work) Build regional communication, then intrastate, interstate and nationally Build and showcase champions to highlight successes Develop a national approach Engage impartial, trusted, independent expert Undertake PD to build skills sets	• Industry	Est LOW FRDC audit project	• Industry driven • Identify people to enter PD programs (Industry Govt)	Immediately	Immediate connections should be made post workshop to build cross jurisdictional relationships Misinformation is an issue - needs to be rectified with no loss of face FRDC Outcome 2, 3, 5
.2 Improve Industry to Govt communication	H	Post Ind:Ind Informal start at officer level Build trust and a common language Develop clarity and consistency across regions and agencies to build national approaches	• Govt to instigate initial processes	Inhouse	• Govt • Industry	Informal ASAP Post Ind:Ind	An informal approach should start immediately building on workshop relationships Investigate trusted national source(s) FRDC Outcome 1, 2, 3, 4, 5
3. Improve Govt to Govt communication	H	Internal government processes	• Officer, Executives	Inhouse	• Govt	ASAP	FRDC Outcome 2, 3, 4, 5
4. Improve Industry and Govt, Community communication	M/H	Marketing and social licence Requires clear message, clarity of purpose and pitch well to address audience Skilled content developers could turn around misinformation and overcome mistrust using social media and advertising	• TBD	Est LOW Audit existing opportunities	• TBD	2 years	Not 'white coat' researcher approach May be best served at whole of seafood Industry level FRDC Outcome 1, 2 ,3, 4, 5

3.8. INVESTMENT AREA 7 – People Development

Issues around capacity, capability and succession are a common Industry theme. An ageing Mud Crab catching sector (estimated average age of 55+) puts the medium-term future of the whole Industry in jeopardy. This, along with acknowledged lack of expertise and experience in research and management in the fishery, adds another layer of risk to the fishery's future.

Key areas identified were to better understand why this isn't a fishery of choice for the catching sector and why up and coming researchers and managers do not gravitate towards working in these areas.

This lack of succession and pathways are often raised, and some key focal areas were identified, particularly around understanding the reticence of identifying fishing based career pathways, improving attractiveness, developing a national and cooperative approach to the challenge, and building Indigenous involvement.

Objectives identified to address the issue:

1. Explore the concept of developing a national body for the commercial sector
2. Understand what the disincentives to involvement in the Industry are, and identify ways forward
3. Build Indigenous involvement.

Focus	Priority	What/How	Lead	Budget Estimate and Fund Source	Human Resourcing	Timelines	Comment FRDC Outcome
1. Build collaborative representation and coordination	H	Proof of Concept (PoC) to investigate establishing a national body to represent harvest and post-harvest (see ACPF, SRL model) Understanding roles, responsibilities, governance, resourcing etc (see supplementary and further information on a National Group at Section 4)	• Industry	Est MED FRDC for PoC Govt grants Industry funds	• Industry • FRDC • SIA support	1 year – PoC	Staged approach Undertake PoC to understand uptake, roles and resourcing options Understand how the FRDC IPA process works and assess viability of an FRDC – IPA FRDC Outcome 1, 2, 3, 4, 5
2. Understand skill shortages across Industry from catcher to compliance	H	Audit of skills need Assess upskilling options including: – Training/mentoring – School training program linked to jobs – On job inductions sponsor – Formal programs (fishing, business, post-harvest, leadership etc)	• Industry and Govt	Est LOW FRDC rollout costs	• Independent consultancy • Industry and Govt sponsorship or grant for programs	1 year ongoing	Undertake audit as first step Leads to involvement in a range of programs (Link to Investment Area 3) FRDC Outcome 1, 2, 5
3. Build Industry Capacity and Succession	H	Understand why there is a problem. Develop a succession plan including: – Inhouse correction programs – Seasonal local workers transfers – Targeted immigration – Improved living/working conditions – Localised/regional workforce – Youth diversion programs (e.g. pilot program at Ngukkur, NT)	• Industry and Govt	Est MED FRDC	• FRDC People Dev • Consultant • SIA	Ongoing	Important to Learn from failure This is most likely part of larger Industry need Look to Indigenous opportunities through out Lined to Challenge 2 FRDC Outcome 1, 2, 3, 4, 5
4; Build Government Capacity and Succession	H	Understand why there is a problem. Develop a succession plan including: – Improved conditions – Training to support Fisheries specific roles – Encourage new entrants to shift focus from broader science to fisheries science, FM, social, economics – Engage at school level (NRM programs) – Micro credentials opportunities (AMC)	• AFMF • RPN • FMC			Ongoing	This is most likely part of larger Government needs FRDC Outcome 1, 2, 3, 4, 5

4. A RESOURCED NATIONAL INDUSTRY BODY TO DELIVER OUTCOMES

Background

To date, Industry has not had a coordinated voice and as such has been addressing issues on an as needs basis, reactively, rather than operating from a clear and agreed national strategic direction. The 'Australian Mud Crab Industry' association is a yet to be developed organisation, that would seek to represent the vast majority by numbers and production of Australia's Mud Crab licence and quota owners, catchers and key supply chain partners.

Investigating the merit of a national body had a high level of support at the national workshop but a number of key questions remain unanswered. Work is needed to provide information on matters such as:

- Does the idea of a national group have broader merit and/or broader Industry support?
- What is the 'value proposition' that is clear, attractive and well understood and would deliver value so that people want to join the organisation?
- What roles and responsibilities would the organisation undertake, and what would it not be involved in
- What would the governance model look like?
- How would the body support itself?
- Can Industry develop, or provide, the capacity and capability to organise and run such a group?
- Why not do it?

Potential Roles

The potential aims of a national group should be to provide trusted whole of Industry guidance through information, consultation and representation by undertaking tasks such as:

- Promoting and supporting all aspects of the Australian Industry
- Providing a unified Industry voice to governments and others
- Enhancing communication within Industry, and between Industry and governments and others
- Building capacity and capability of Industry members
- Promoting cost effective and relevant R&D in the Australian Industry
- Seeking to improve the well-being of Industry members
- Maintaining and promoting the Australian Mud Crab Industry as an environmentally sustainable Industry
- Working cooperatively with other like-minded organisations and building healthy and respectful relationships with Industry groups, Government and other stakeholder groups for the benefit of the Australian Industry and broader community.
- Developing and overseeing a National Marketing Plan.

Funding Options

Potential resources possibilities need further investigation. Some options identified at the workshop were:

- Government and/or Statutory Authority sources – seed funding, grants and/or fees for service
- Voluntary fees – e.g. based on a set price per licence and/or quota held
- Co-investor contributions – e.g. marketing groups, Industry groups, co-ops, packaging suppliers, airlines, freight companies etc
- Third-party levy contribution system based on sales (e.g. per kg sales through a market, tags etc)
- Collaborative investment options

- Other sources –including sponsorship, project funding and fees for service
- Developing an IPA proposal for the FRDC.
- The following table outlines a potential process for the establishment of a national coordinating group for the commercial sector.

Focus	What/How	Resourcing Human and Financial
Proof of Concept Project	• Proof of Concept (PoC) to investigate: – Merits or otherwise of establishing a national body to represent harvest and post-harvest – Understanding roles, responsibilities, governance, resourcing etc	FRDC Industry
Build a Sound Governance Model	• Develop constitution • Build effective and transparent management and leadership team • Establish and manage governance platform • Appoint staff and roles as per constitution (e.g. initially PT CEO, Chair, Directors) • Builzd strong alliances with other organisation (SIA membership, consider subgroups such as Fisheries Managers Group, Fisheries Researcher Groups etc).	Govt grants Industry inkind
Explore Resourcing Options	• Investigate State/Territory/Federal Grant Schemes for seed funding • Identify means to incentivise membership • Product traceability fund (e.g. tag fee) • Seek potential members' support (e.g. current Industry groups, ASC) etc	Govt grants Industry levy Fees for service
Develop a Business Plan	• Develop a costed national plan to achieve objectives and strategic priorities including: – R&D Strategy to formalise R&D needs, investigate IPA with FRDC, identify other resourcing option – Communication Plan to engage with all members, government and other stakeholders to build greater trust and promote Industry benefits to community for mutually beneficial reasons (e.g. social licence, economics, employment) – Capacity Building program.	Industry Govt grants FRDC – IPA
Build a National Marketing Plan	• Promote Mud Crab purchases via targeted market development to diversify consumer base	Industry and supporters, inc SFM
Build Industry Capacity	• Increase human capacity across core areas including capacity to lobby on key issues • Maintain a watching brief on strategic opportunities to establish alliances with other bodies • Undertake regular meetings • Communication	Industry and supporters

5. APPENDICES

5.1. Appendix 1: Overview of FRDC Project 2018-089 'Developing a non-invasive method to assess mud crab meat fullness using portable Near Infrared spectroscopy (NIRS)'

Industry Update October 2022

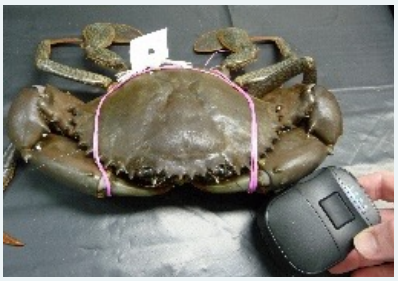
Project: Developing a non-invasive method to assess mud crab meat fullness using portable Near Infrared spectroscopy (NIRS) (FRDC 2018-089).

Project work to date:

A range of commercially available, portable/miniature, off the shelf near infrared (NIR) instruments were identified, sourced and investigated for the potential application of measuring meat fullness in live male and female mud crabs based on percentage meat yield.

Instruments that were selected for further development in stage 2 of the project are below and calibration models are being developed for these instruments:

MicroNIR

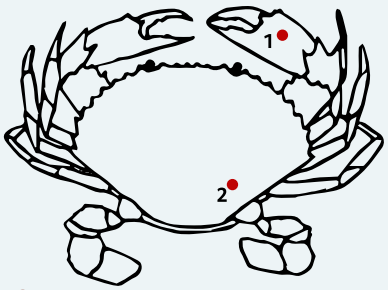


Innospectra NIR-SG-1

Felix-750

In relation to further equipment enhancement, engineers from James Cook University (JCU) secured internal JCU funds in 2021 to assist with housing modifications for the base platform of the Innospectra NIR-SG-1 instrument to address robustness and application in a marine environment.

Taking into account a single operator use of the NIR instruments and difficulties for practical infield application with handling live mud crabs, two locations were selected for NIR spectra collection sites and further calibration model development. The two sites include: 1) the dominant claw, and 2) the rear of the carapace (near the swimming leg) on the dominant claw side.



Data collection and calibration model development is expected to be completed by April 2023.

Mud crab NIR spectra collection locations selected for calibration model development.

For further information contact:
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Department of Agriculture and Fisheries
Email: brett.wedding@daf.qld.gov.au
Tel: +61 7 4241 8204

5.2. Appendix 2: Outcomes and Focus Areas in the FRDC R&D Plan

Outcome 1: Growth for enduring prosperity	Outcome 2: Best practices and production systems	Outcome 3: A culture that is inclusive and forward thinking	Outcome 4: Build capability and capacity	Outcome 5: Community trust, respect and value
Increased growth and profitability	Minimise impacts on NTS and ecosystems	Finding and addressing change obstacles	Integrated and effective resource management	Perception of strong government oversight with fair decision-making processes
Coordinated growth strategy (sustainable, efficient & effective - incl. circular economy, community benefits and Indigenous knowledge)	Increase worker wellbeing, safety and equity	Greater inclusiveness, creativity and solution seeking	Development and adoption of management measures suited for resilience to change: – Flexible harvest strategies (HS) – Flexible spatial arrangements and decision-making tools, – Management approaches that aim for fairness, – Participant management across fisheries	Sustainable practices with evidence based demonstration and good outward communication
Better solutions to understand and respond to biosecurity issues, climate change and increased globalisation	Better decision making and reporting tools, methods and communication	Openness to new ideas and approaches, more inclusive thinking		Sectors are building good relationships with community
Maximise understanding of and benefit from aquatic systems	Manage negative impacts climate change	Improve success sharing		F&A work together to resolve issues
	Capitalise positive impacts	Strengthen intersectoral collaboration		Shared vision, and positive for Australian community
	Improve animal welfare outcomes			

ATTACHMENT 4: Workshop Program PowerPoint

If you don’t know where you are going, you’ll end up someplace else - Future proofing the Australian Mud Crab Industry through improved strategic direction

FRDC Project 2018-177.

Dr Chris Calogeras

Dr Rik Buckworth

Project Workshop 12-13 October 2022

C-AID CONSULTANTS

FRDC
FISHERIES RESEARCH AND DEVELOPMENT CORPORATION

Sea Sense

Thankyou!

- We pay our respects to the customary owners and their elders past, present and emerging.
- Thanks to all the people, agencies and organisations that have supported getting this workshop together –it has taken a while!
- Fisheries Research and Development Corporation –FRDC - for funding and support –and their patience!

Introduction -why we are all here

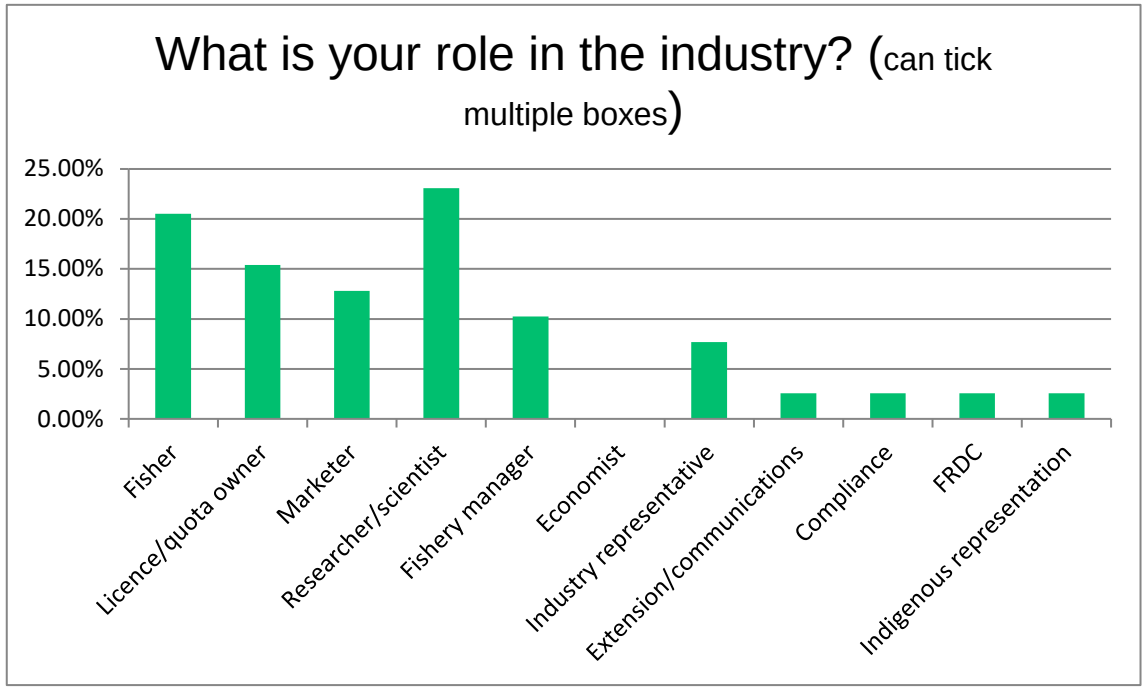
To bring people together to lay the foundation for …

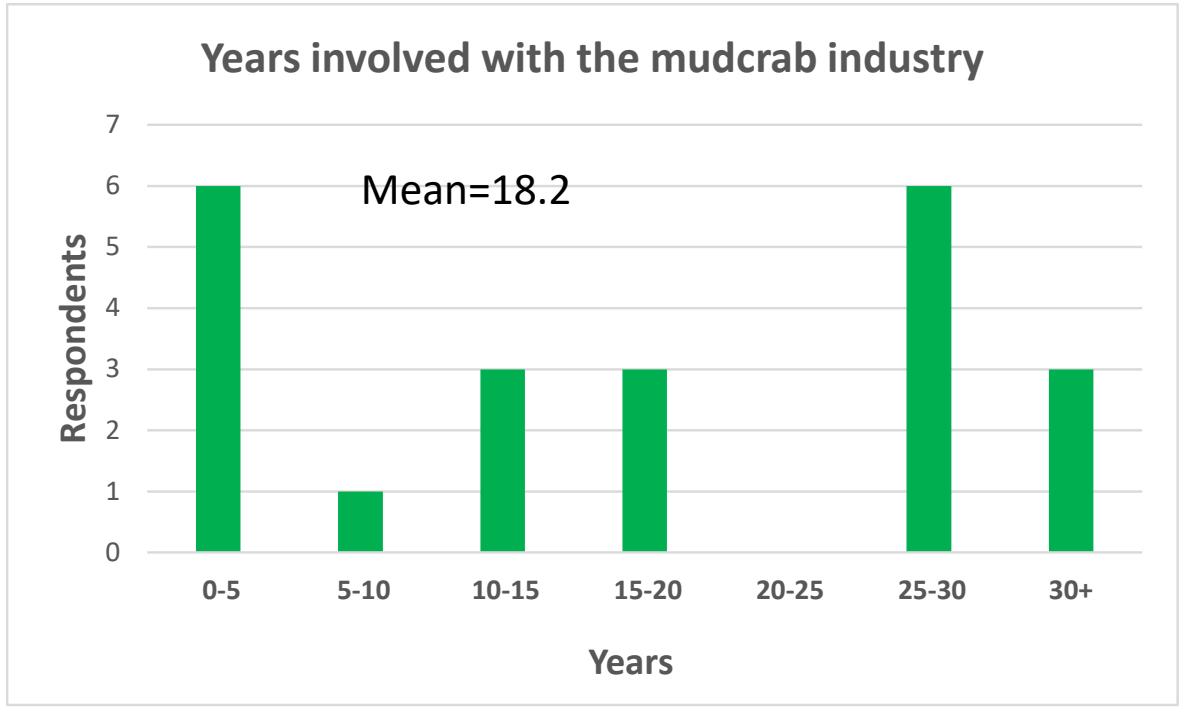
- A more coordinated and successful fishery and industry with clearer direction
- Outputs - An investment sheet developed for each and every priority area, building
- A National Strategic Plan to provide critical direction for RD&E investment, operational considerations and potential direction for industry marketing and economic development.
- Without that plan – we are going nowhere!!

What we Want from You

- Project background
- Let’s agree to a process, a mechanism, of transition and improvement
- We will work together to elicit the things that need to be worked on
- We will occasionally work as one big group, and often in smaller groups
- We want all voices to be heard and we ask everyone to respect to each other!
- Let’s have an interesting and productive couple of days!!

Who are we: Roles and experience with the industry…

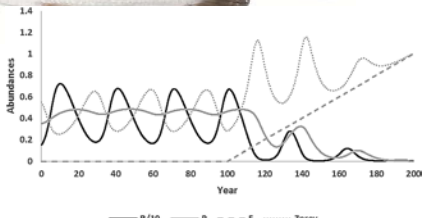




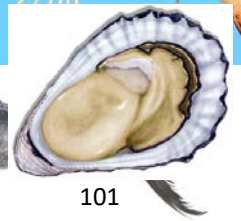
(collect sticky notes)

But we are more than ‘roles’ of course - Who we all are??!!

- <1 min each around the room – name, role AND something curious about you!



$$$



87.243

What is this number??

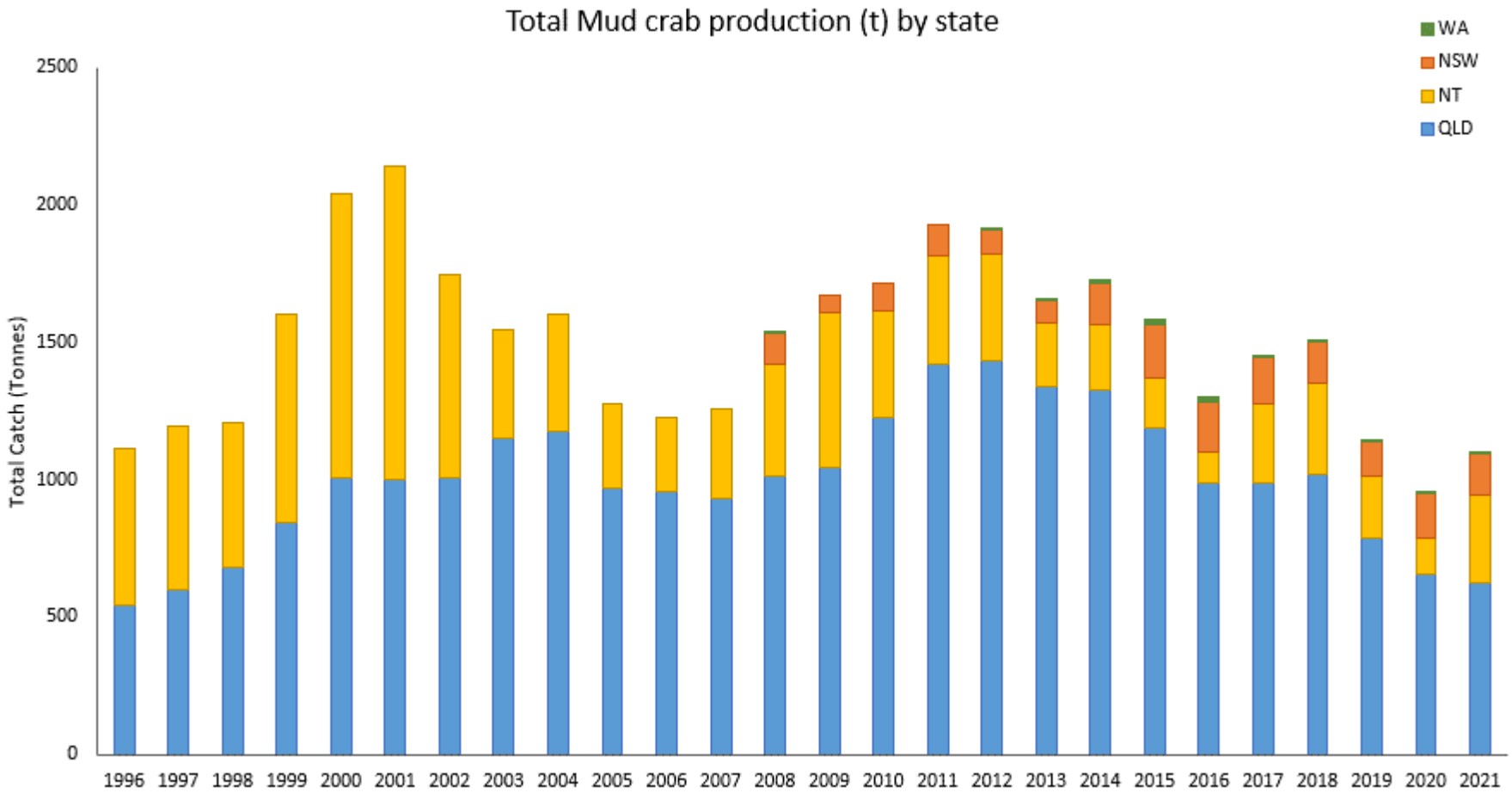
$87.243 mill

ONE measure of value

- The approximate retail value of commercial crabs caught in 2020
- If they all made it to restaurants that might be ~ $232 mill!!!!!

- PLUS!! Recreational, charter and Indigenous catch was > 30% commercial

Catches –commercial fishery 1996-2021



There is a lot more to ‘value’ than some guesstimate of retail sale value!

- Food!
- Jobs!
- Income!
- Social!

Values are immense!!

High level values and visions…

What we want here:

- What **Values** and **Visions** are important …
- Do we consider what we already have (and what is missing) from the survey outputs
- Please break into designated groups of four
- Groups to discuss high level Values and Visions
- Discuss ~ 5min
- Feedback ~2 min

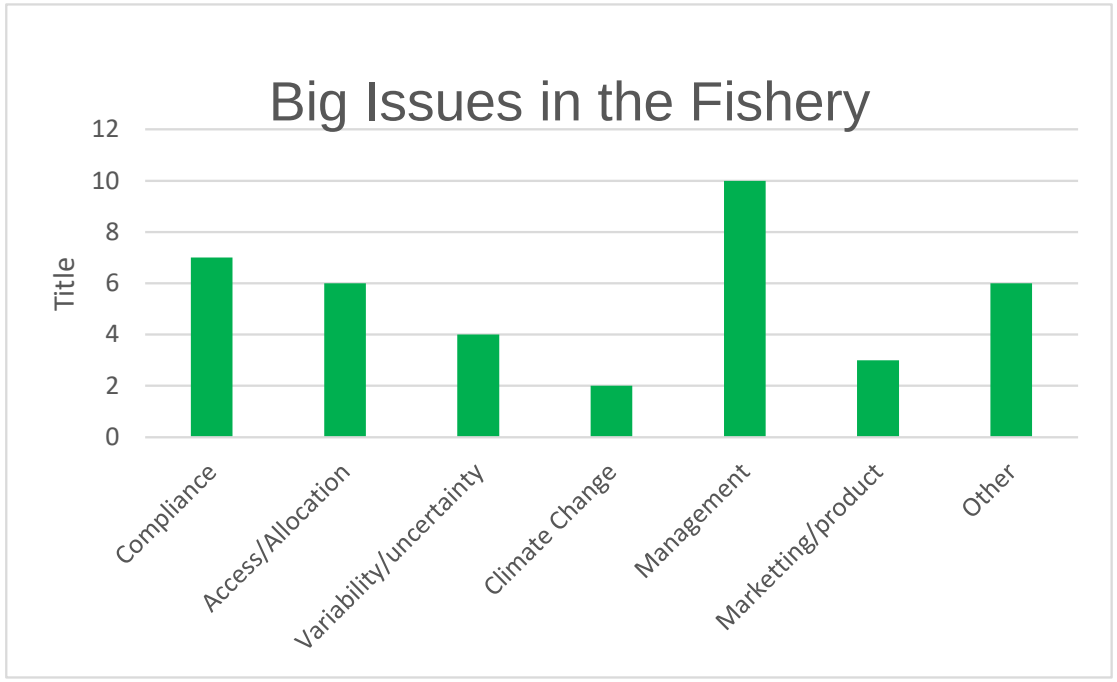
  (team collate on butcher's paper during the tea break)
- NOTE THIS IS NOT A **WORDSMITHING** EXERCISE – JUST key ideas to guide

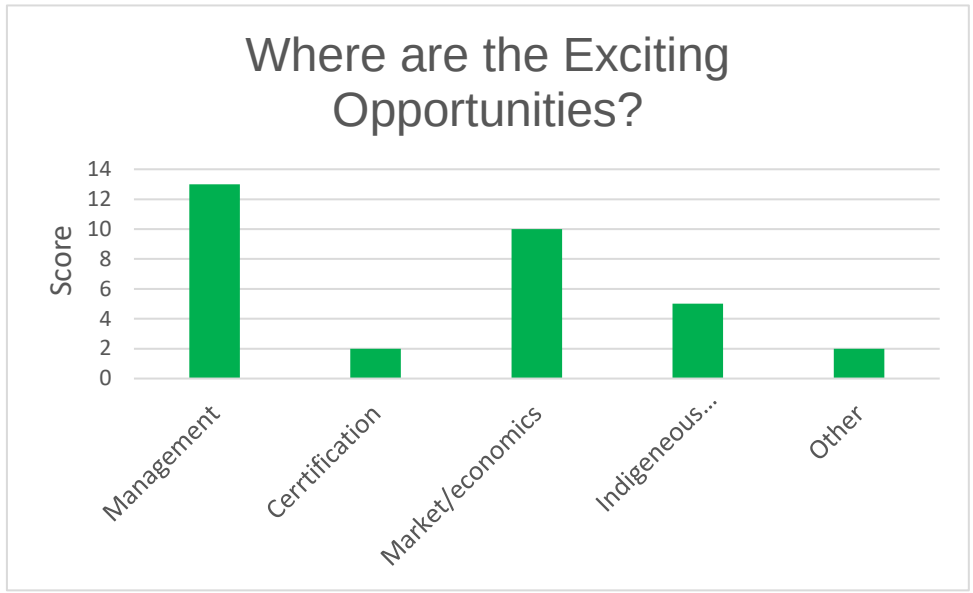
….Tea break …

The Big Picture: High level Values and Visions…

- What are the key Values and Visions
- Kept on the Butcher’s paper on the wall for the duration of the workshop with Feedback from Sticky notes

The Big Issues, the Opportunities:





Industry/ agency sessions – from high level Values and visions to Issues and Opportunities

- From surveys: what **Big Challenges** identified ?~ 10 min
- From surveys: what **Big Opportunities** identified ?~ 10 min
- Answers on sticky notes
- Collate within the industry/ agency groups, break into operational/ management/strategic issues

Plenary session
Issues and Opportunities…understanding and addressing problems

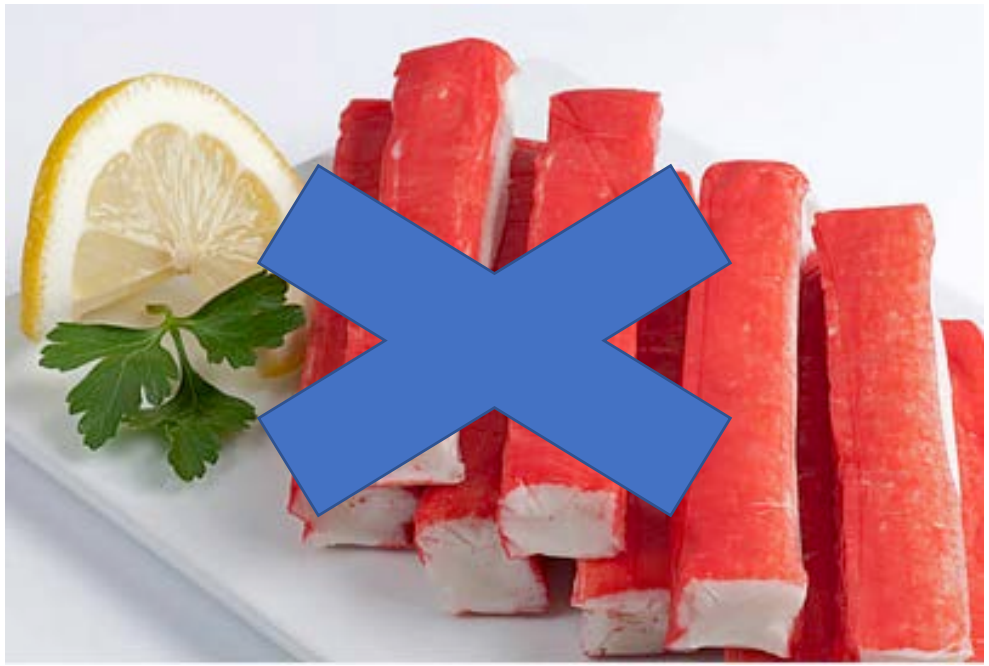
- What has come out of the mix
- How do the groups differ and how to resolve the group differences
- Define the good outcomes
- Prioritise- dots on the paper, Chris is the secret squirrel
- Top 6, next 6, the rest are ‘emerging’
- Actions to get there?
- Timelines (urgent, medium, long term – 5+y?)
- Who is responsible?
- GET AGREEMENT TO THE PROCESS AND OUTCOMES
- Record outputs in investment tables

… opportunities …

… lunch break …
Team collating and preparing

Announcement: lunchtime development!

Unforeseen Risk



AU $9.00 /kg

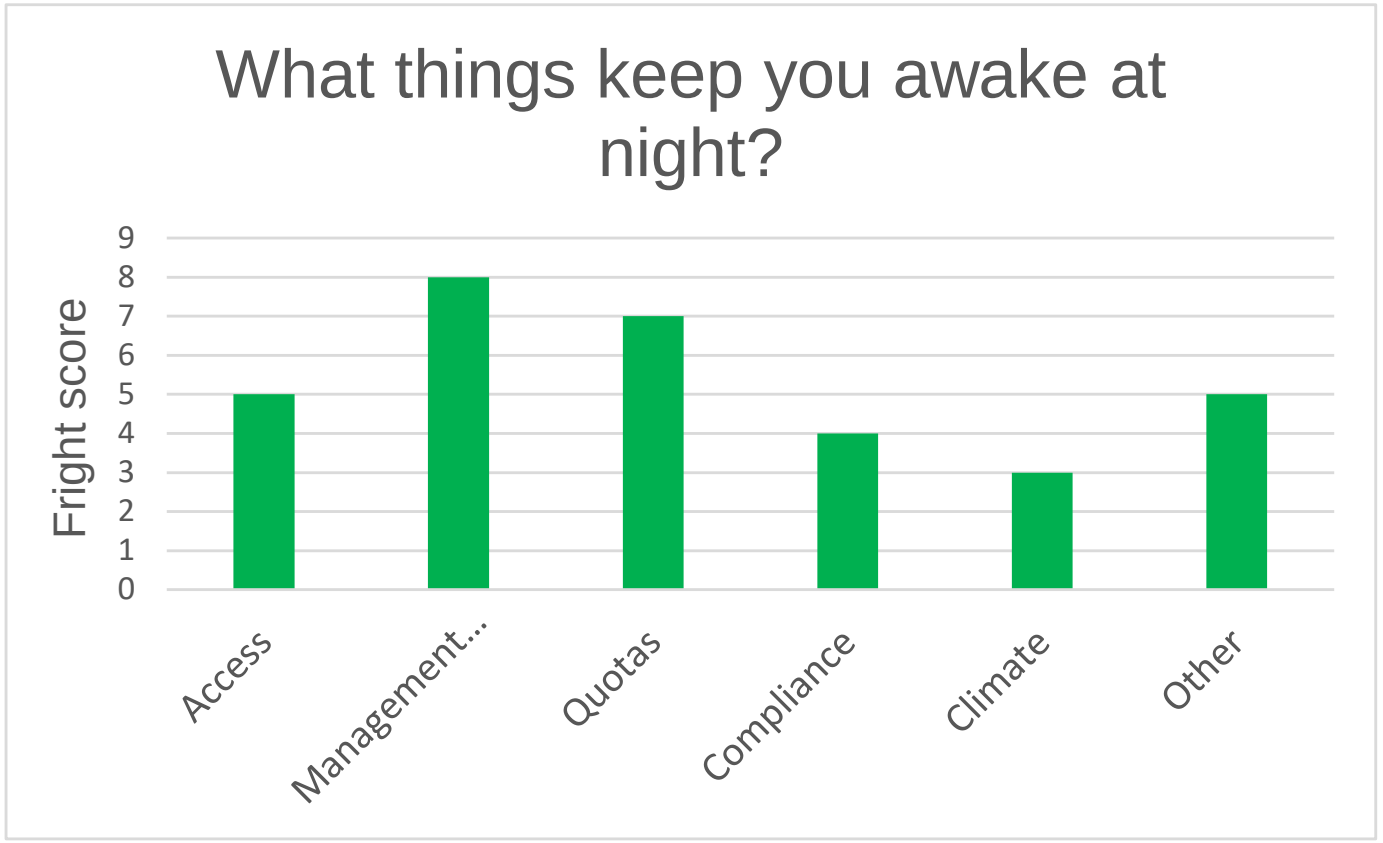
Vegan surimi - AU $ 7.99 / kg

Vegan ‘mud crab’ - tasty, inexpensive and makes you sing like Ed Sheeran!

How do you identify, define and address a risk like this? Or any risk?

What do you think are the **Key Risks**?

Key Risks?



- Break out sessions in small groups as before
- Each group to consider and Rank 6 of the main risks from the survey
- If you think they are important, include risks **Not** identified in the survey.
- Each group to provide 3 risks, recorded on butcher's paper. If a risk is already recorded, add another

Plenary sessions- the **Key Risks** …

- Summarise key areas identified
- Priority areas - Group differences and commonalities
- AGREE Top 6 to be addressed by a voting process
  - Discuss to explain,
  - Do we have consensus –dissent is important and should be captured
- Next 6 to be addressed
- Agree to the list
- Actions ?
  - What we can directly influence
  - Why is it a priority
  - How was it decided as a priority

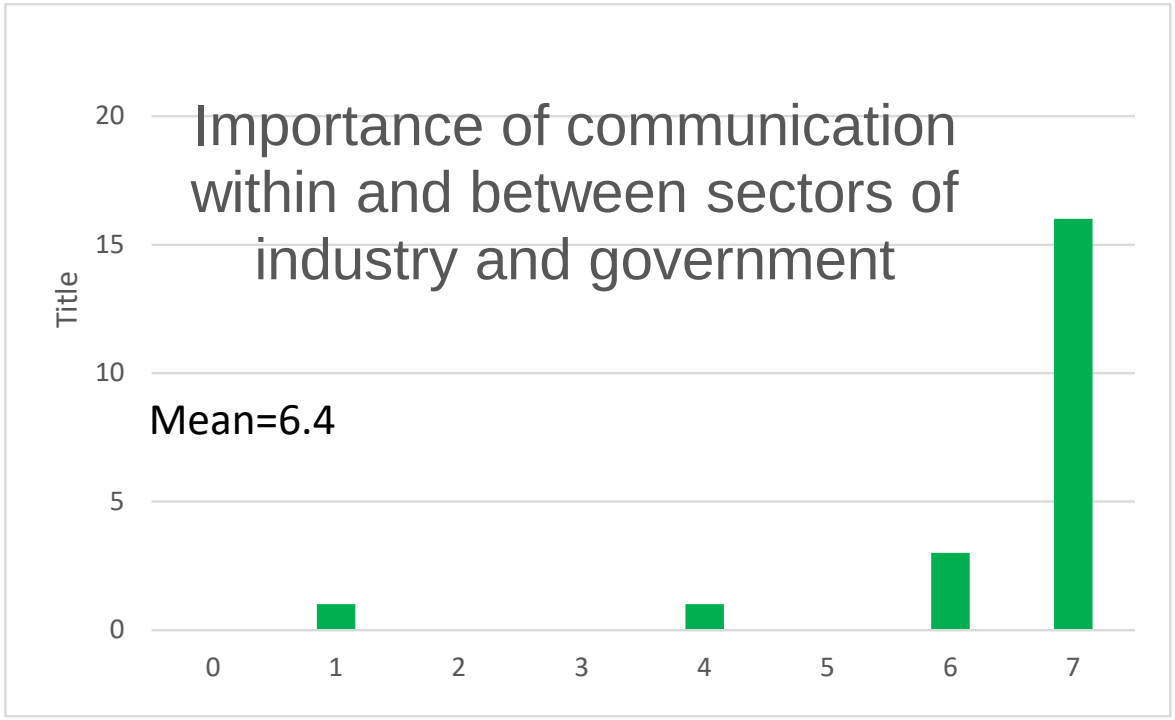
Examples Investment sheets:

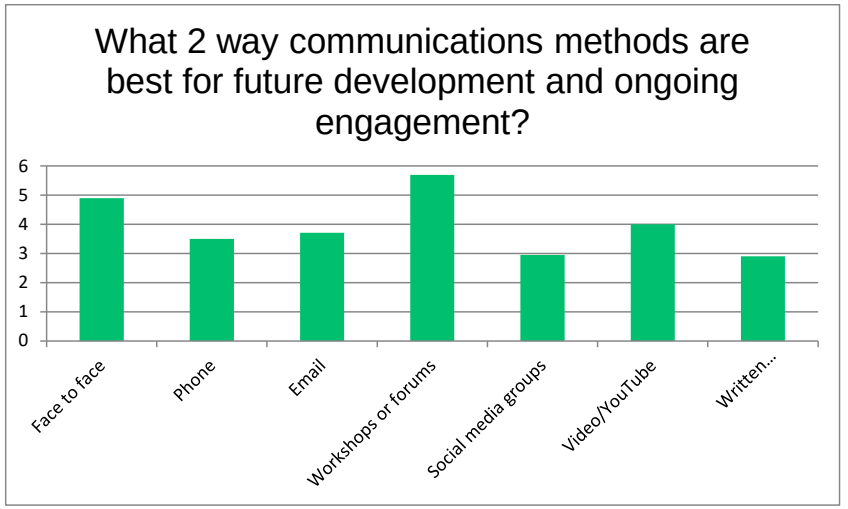
through a time limited session complete a sheet for each area

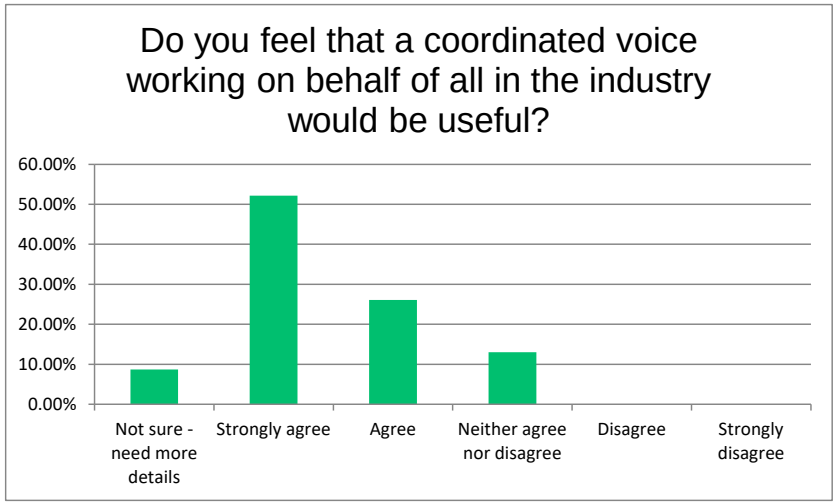
Priority Area 1 (Let's Call It Investment Areas, Time or Money)
One/two para description
Key areas

Objective	Rationale for action	Responsibility	Financial Resourcing Option	Human Resourcing	Timeframe	Comment
1						
2						
3						

Communication …







Making voices heard! Communication Q & A

Questions

- What are the main barriers to effective communication in this industry
- Why do the barriers exists. Why don’t you do something about it?
- Who should be responsible
- Can you suggest a mechanism or some actions to fix it

- Forum discussion
- We believe communication is a two way process – and a process involving continual engagement
- Individual written responses

Summary day 1…

- Values
- Challenges
- Opportunities
- Risks
- Communication

Take discussion to dinner

Day 2…

- Brief re-cap to ensure everyone understands outputs and outcomes from yesterday
- Outline day 2

Identify themes

Open forum approach to discuss headings from Day 1

- Economics and marketing/ profitability
- Environment and climate
- Assessment and modelling
- Crab ecology and monitoring
- Fisheries management
- People development
- Communication

Question

- Where do Biosecurity, animal welfare, gear and operational issues, data (anything else important?) fit in

Development of Theme objectives

- Groups - participants self choose under topic
- Do 4 topics then 3
- Team leaders, Sevaly, Rik, Jenny, Thor, Adrianne, Steve
- Each group to develop objectives (say 3) and rationales and example projects/ concepts for themes –onto butcher's paper

morning tea …

- Feed back and comments, discussion, polishing
    - Leaders from each group

Lunch …

National actions

Did we land on any national approaches

- National Marketing Plan
- National Group Industry and/or Agency
- National Capacity Building
- National Strategic Approach?

Recap on objectives

- Did we capture everything?

- OPEN FORUM
- Who is going to do all of this??
- Who will have carriage?
- How can this be supported
- How will it be funded?

Wrap up and summary

Life is about Choices

Choose to make what you want to happen, happen!!

ATTACHMENT 5: FRDC funded mud crab projects and objectives (1986 - 2022) and papers provided to participants – pre workshop

FRDC Project #	Project title	Applicant	Date start	Date end
2022-010	Assessment of the interactive effects of climate change, floods and discard stress on the commercially important Mud Crab (Scylla serrata) and Blue Swimmer Crab (Portunus armatus) - postgraduate	Southern Cross University (SCU) National Marine Science Centre	1/06/2022	1/04/2026
1. Provide the opportunity for a post-graduate research student to work with Industry and managers, gain exposure to stakeholder's perspectives on the issue and undertake high-quality research that results in the production of scientific outputs. 2. To correlate physiological indicators in giant mud and blue swimmer crabs with water quality parameters in different catchments during run-off events 3. To assess the synergistic effects of low salinity, pesticides simulated discarding on biochemical stress biomarkers in giant mud and blue swimmer crabs 4. To assess the effects of agricultural run-off and reduced salinity during flooding on the condition, texture and appearance of flesh from harvested giant mud and blue swimmer crabs.				
2021-119	Improving bycatch reduction strategies and escape vents in Queensland Mud Crab fisheries	Department of Agriculture and Fisheries EcoScience Precinct	1/05/2022	30/07/2023
1. Benchmark bycatch reduction devices and strategies currently in use in the Queensland crab fishery. 2. Trial alternate configurations and advise on potential changes to escape vent regulations achieve better commercial and ecological outcomes. 3. Collate information on marine turtle interactions with crab pots (including ghost pots) and consider pot configuration(s) that could contribute to a risk mitigation strategy for marine turtles in the Qld crab fishery. 4. Develop options for adoption of bycatch reduction devices and strategies in the recreational sector of the Qld crab fishery.				
2019-062	Knowledge to improve the assessment and management of Giant Mud Crabs (Scylla serrata) in Queensland	Department of Agriculture and Fisheries EcoScience Precinct	1/07/2020	30/06/2024
1. Assess the utility of next generation genetic analysis to inform spatial stock structure of the Giant Mud Crab (Scylla serrata), using South East Queensland and northern New South Wales as a case study. 2. Develop and assess the feasibility of 'survey' pots suitable for long-term implementation as a means of monitoring Giant Mud Crabs. 3. Gather key quantitative biological information on Giant Mud Crabs relevant to assessment and management, including the use of tagging studies and a pilot evaluation of means to understand the spawning migration of female Giant Mud Crabs.				
2019-160	Holding methods for mud crabs	Department of Agriculture and Fisheries EcoScience Precinct	19/03/2020	31/07/2020
Commercial in confidence				
2018-177	'If you don't know where you are going, you'll end up someplace else' - Future proofing the Australian Mud Crab Industry through improved strategic direction	C-AID Consultants	29/02/2020	29/01/2021
1. Share experiences and understandings to identify issues and opportunities for collaborative approaches across the Industry and Agencies 2. Build Industry cohesion and capacity through development of a national Industry plan and communication network.				

FRDC Project #	Project title	Applicant	Date start	Date end
2018-216	Mud Crab RAS training - NSW RAC people development	Professional Fishermen's Association Inc (PFAI)	17/06/2019	31/08/2019
To investigate the application of vertical mud crab farming to the NSW commercial fishing Industry				
2018-089	Developing a non-invasive method to assess mud crab meat fullness using portable Near Infrared spectroscopy (NIRS).	Department of Agriculture and Fisheries EcoScience Precinct	1/04/2019	28/02/2022
Commercial in confidence				
2017-047	Understanding environmental and fisheries factors causing fluctuations in mud crab and blue swimmer crab fisheries in northern Australia to inform harvest strategies	Department of Agriculture and Fisheries EcoScience Precinct	10/07/2017	31/12/2018
1. Evaluate the role of a broad range of environmental drivers on catch variation in Northern Territory and Queensland crab fisheries of the Gulf of Carpentaria. 2. Explore the relative importance of fishing pressure compared to environmentally driven variability using a population model of the GoC mud crab fishery. 3. Provide advice to support the development of harvest strategies appropriate for crab fisheries in northern Australia.				
2017-006	Informing adaptive management of portunid fisheries in New South Wales	NSW Department of Primary Industries	16/05/2018	15/06/2022
1. Describe temporal and spatial patterns in settlement and juvenile habitat use, to determine if spawning, nursery habitat availability, or connectivity creates localised recruitment bottlenecks in NSW estuaries 2. Define and model links between environmental (physicochemical and oceanographic) variables and these patterns, and potential effects on catch rates 3. Use this information to develop an independent measure of recruitment, which links the effects of environmental variability on recruitment to future catch quotas 4. Interpret patterns in recruitment limitation to target a large-scale release of BSC, and analyse post-release abundance patterns to better understand recruitment bottlenecks and improve modelled relationships				
2015-012	Influence of freshwater flows on growth and abundance of Barramundi and Mud Crab in the Northern Territory	Charles Darwin University (CDU)	1/07/2015	30/06/2017
1. Undertake ageing and biochronological measurement of barramundi otoliths and mud crab ossicles, and collate NT catch and environmental data (e.g. river discharge). 2. Develop rigorous, regionally specific empirical models to quantify the relationships between fisheries productivity and various metrics of freshwater inflow using advanced statistical techniques. 3. Provide research findings to Industry and government for a scientifically defensible and robust basis for decisions on the future use of water in northern Australia in relation to fisheries resources.				
2014-011	Direct age determination with validation for commercially important Australian lobster and crab species (western, eastern, southern and ornate rock lobsters, and crystal, Tasmanian giant and mud crabs)	Southern Cross University (SCU) Lismore Campus	1/07/2014	23/07/2016
1. to validate growth mark periodicity for western and eastern rock lobsters and crystal crab by vital staining and long-term grow-out 2. to determine absolute age and longevity for western, southern, eastern and ornate rock lobsters, Tasmanian giant, crystal and mud crabs -- validated with laser ablation				

FRDC Project #	Project title	Applicant	Date start	Date end
induction-coupled plasma mass spectroscopy (LA-ICPMS) 3. to assess the relationship between estimated age and size and the appropriateness of existing growth models for western and eastern rock lobster 4. to establish a network of Australian government and academic fisheries researchers who can consistently apply direct ageing methods to decapod crustaceans				
2014-218	Building precision into the Australian Industry Live Mud Crab Grading Scheme (AILMCGS) through addressing grading and regional anomalies	Department of Agriculture and Fisheries EcoScience Precinct	12/06/2014	25/05/2016
1. attain a defined and precise assessment method of shell hardness using the current Australian Industry Live Mud Crab Grading Scheme (AILMCGS) across whole o Industry 2. identify objective technologies and/or develop methodologies to support grading assessment within the AILMCGS 3. substantiate seasonal and/or regional grading anomalies within the AILMCGS and explore strategies to address them 4. increase profitability across Industry through equity of grading practices and reduced product down grades and wastage				
2011-225	Tactical Research Fund: using Industry expertise to build a national standard for grading of live mud crabs	C-AID Consultants	22/09/2011	1/11/2012
2010-066	Tactical Research Fund: working towards sustainability accreditation for the Queensland Mud Crab Fishery (QMCF)	Queensland Seafood Industry Association (QSIA)	1/05/2011	30/11/2011
2010-225	Tactical Research Fund: Options for the future management of Queensland's mud crab and blue swimmer crab fisheries	Department of Agriculture and Fisheries EcoScience Precinct	1/11/2010	28/02/2011
2010-042	Improving gear selectivity in Australian Mud Crab fisheries	Department of Industry Tourism and Trade	1/06/2010	31/08/2011
2010-302	Equipping the mud crab Industry with innovative skills through extension of best practice handling	Department of Agriculture and Fisheries EcoScience Precinct	3/05/2010	18/01/2012
2009-049	Tactical Research Fund: stakeholder evaluation of the benefits of fitting escape vents to Mud Crab pots	Department of Industry Tourism and Trade	1/03/2010	30/06/2011
2009-031	Taking female mud crabs (Scylla serrata): assessment of risks and benefits	Department of Agriculture and Fisheries EcoScience Precinct	1/08/2009	31/07/2010
2008-012	Evaluating the environmental drivers of mud crab (Scylla serrata) catches in Australia	Griffith University Nathan Campus	1/09/2008	30/03/2010
2008-007	Evaluating a management strategy to increase the profitability of the Queensland Mud Crab fishery Stage 1: process development.	Department of Agriculture and Fisheries EcoScience Precinct	31/07/2008	1/07/2010
2007-026	2007 Mud Crab Workshop: Revision of the National Strategy for Mud Crab Research	Department of Industry Tourism and Trade	30/06/2007	16/07/2008

FRDC Project #	Project title	Applicant	Date start	Date end
2000-210.01	Development of commercial production systems for mud crab (Scylla serrata) aquaculture in Australia: hatchery & nursery	Department of Industry Tourism and Trade	29/06/2007	1/07/2007
2007-237	Review of the Gwalwa Dariniki Enterprise (GDE) Mud Crab Pond Farming Project at Kulaluk, Darwin and of the Bawinanga Aboriginal Corporation (BAC) Mangrove Pen Mud Crab Farming project at Numungoorda, Maningrida, Northern Territory, Australia	MP and HM Heasman and Associates	7/03/2007	1/05/2007
2004-034	Implications of single-sex harvesting for Queensland mud crab fisheries	Department of Agriculture and Fisheries EcoScience Precinct	30/12/2004	1/07/2007
2003-240	Maximising revenue within the NT mud crab fishery by enhancing post-harvest survival of mud crabs	Department of Agriculture and Fisheries EcoScience Precinct	30/06/2003	11/12/2008
2000-142	Methods for monitoring abundance and habitat for northern Australian mud crab Scylla serrata	Department of Industry Tourism and Trade	30/12/2000	9/09/2005
2000-210	Development of commercial production systems for mud crab (Scylla serrata) aquaculture in Australia: hatchery & nursery	Department of Industry Tourism and Trade	13/09/2000	31/10/2008
1986-009	Development of intensive pond farming techniques for the mud crab, Scylla serrata (Forskal), in northern Australia	Sea Hatcheries Ltd	28/06/2000	1/07/2000

Additional Papers Reports

Hewitt, D.E., Niella, Y., Johnson, D.D. *et al.* Crabs Go With the Flow: Declining Conductivity and Cooler Temperatures Trigger Spawning Migrations for Female Giant Mud Crabs (*Scylla serrata*) in Subtropical Estuaries. *Estuaries and Coasts* **45**, 2166–2180 (2022). https://doi.org/10.1007/s12237-022-01061-1 (https://link.springer.com/article/10.1007/s12237-022-01061-1#citeas)

Daniel E. Hewitt, Hayden T. Schilling, Roshan Hanamseth, Jason D. Everett, Junde Li, Moninya Roughan, Daniel D. Johnson, Iain M. Suthers, Matthew D. Taylor (2022) Mesoscale oceanographic features drive divergent patterns in connectivity for co-occurring estuarine portunid crabs. (https://onlinelibrary.wiley.com/doi/10.1111/fog.12608)

Barnes, TC, Broadhurst, MK and Johnson DD. 2022. Disparity among recommended and adopted escape-gap designs and their utility for improving selection in an Australian portunid trap fishery. Fisheries Research, DOI: https://doi.org/10.1016/j.fishres.2021.106219

Barnes, TC, Broadhurst, MK and Johnson DD. 2022. Fleet-wide acceptance of escape gaps and their utility for reducing bycatch in south-eastern Australian Portunus armatus traps. Fisheries Management and Ecology, DOI: https://doi.org/10.1111/fme.12586

ATTACHMENT 6: Outcomes and focus areas in the FRDC R&D plan 2020-2025.

<table>
<tr><th>Outcome 1: Growth for enduring prosperity</th><th>Outcome 2: Best practices and production systems</th><th>Outcome 3: A culture that is inclusive and forward thinking</th><th>Outcome 4: Build capability and capacity</th><th>Outcome 5: Community trust, respect and value</th></tr>
<tr><td>Increased growth and profitability</td><td>Minimise impacts on NTS and ecosystems</td><td>Finding and addressing change obstacles</td><td rowspan="4">Integrated and effective resource management

Development and adoption of management measures suited for resilience to change:
- Flexible harvest strategies (HS)
- Flexible spatial arrangements and decision-making tools,
- Management approaches that aim for fairness,
- Participant management across fisheries</td><td>Perception of strong government oversight with fair decision-making processes</td></tr>
<tr><td>Coordinated growth strategy (sustainable, efficient & effective – incl. circular economy, community benefits and Indigenous knowledge)</td><td>Increase worker wellbeing, safety and equity</td><td>Greater inclusiveness, creativity and solution seeking</td><td>Sustainable practices with evidence-based demonstration and good outward communication</td></tr>
<tr><td>Better solutions to understand and respond to biosecurity issues, climate change and increased globalisation</td><td>Improve animal welfare outcomes</td><td>Improve success sharing</td><td>Sectors are building good relationships with community</td></tr>
<tr><td rowspan="2">Maximise understanding of and benefit from aquatic systems</td><td rowspan="2">Manage negative impacts climate change
Capitalise positive impacts
Better decision making and reporting tools, methods and communication</td><td>Openness to new ideas and approaches, more inclusive thinking</td><td>F&A work together to resolve issues</td></tr>
<tr><td>Strengthen intersectoral collaboration</td><td>Shared vision, and positive for Australian community</td></tr>
</table>

ATTACHMENT 7: Industry Partnership Arrangements s (IPA) Details

Background

The FRDC enters into IPAs with fisheries/sectors that display an ability to prioritise, plan and manage RD&E. IPA's provide a fishery/sector the ability to lead the planning and management of research relevant to its priorities, giving it greater certainty over obtaining funding for RD&E.

The FRDC enters into partnership agreements with fisheries/sectors to:

1. ensure that the sector's priorities are well articulated
2. ensure there is a robust RD&E planning process for the sector that is focussed on tangible deliverables
3. ensure proposals are developed to address the sector's RD&E priorities
4. maximise the effectiveness and efficiency of funded projects
5. maximise the adoption of the RD&E undertaken
6. provide to the sector greater surety with regard to the FRDC's investment in RD&E of relevance to the sector
7. guarantee an income stream from the sector to the FRDC
8. obtain recognition for the FRDC as the lead agency for the management of funds sourced from the Australian Government.

IPAs are established to formalise an agreement between a fishery/ sector and FRDC on how FRDC and the fishery/sector will collectively invest in RD&E. An IPA does not have a RD&E provider as a party to it; as this may constrain competition for resourcing the planned project investments.

Requirements

The following preconditions are required before the FRDC will enter in to an IPA with a fishery/sector:

1. The existing partnership with the fishery/sector is very strong, and well-grounded in past RD&E successes.
2. The fishery/sector has a substantial AGVP (or have the prospect of having one), is coordinated in its approach, maintains RD&E plans, and is able to facilitate the extension of the results of RD&E.
3. The fishery/sector is stable, mature, and can provide evidence of a desire by its members to have a greater engagement in the delivery of a range of RD&E issues.
4. The fishery/sector displays a strategic approach to RD&E investment supported by planning process and documentation.
5. The fishery/sector has a legally constituted organisation and a set of rules (constitution) clearly detailing the powers of the President/CEO; and is able to demonstrate good governance of the organisation.
6. The relationship is supported by a transparent and accountable decision-making process, understood and supported by all parties.
7. The fishery/sector demonstrates the capacity, skills, ability, resources and knowledge to deliver the agreed RD&E functions.
8. There is an effective, stable and trusted relationship between the fishery/sector and the relevant government(s).
9. The fishery/sector is committed to contributing at least 0.25% of AGVP to the FRDC, through the appropriate state or territory agency.

IPA responsibilities

The key responsibilities are:

1. the fishery/sector works to contribute the maximum matchable contribution for that sector
2. the FRDC leverages industry contributions as follows:
    a. industry contributions are matched up to 0.25% AGVP; less an 12% FRDC service charge on total funds
    b. the FRDC will allow overs/unders against the IPA budget in any one year

3. the fishery/sector aims to commit as much of the annual budget as possible
4. the fishery/sector recognises the FRDC as the primary manager for its RD&E investment
5. the fishery/sector communicates openly with the FRDC on its R&D priorities. The process of deciding on these must take in to account the needs of managers/regulators.

The IPA document also outlines additional requirements and objectives that are to be met.