

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



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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.

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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

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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/ annum¹, 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) technology², 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 recruitment³. 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 CUC⁴, 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 ITCAL⁵ 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 businesses⁶. 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 estimated⁹ 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 legislation¹¹ 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 $((y_2 - y_1) / y_1) * 100 = \text{percentage change (where } y_1 = \text{start value and } y_2 = \text{end value)}$

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>).

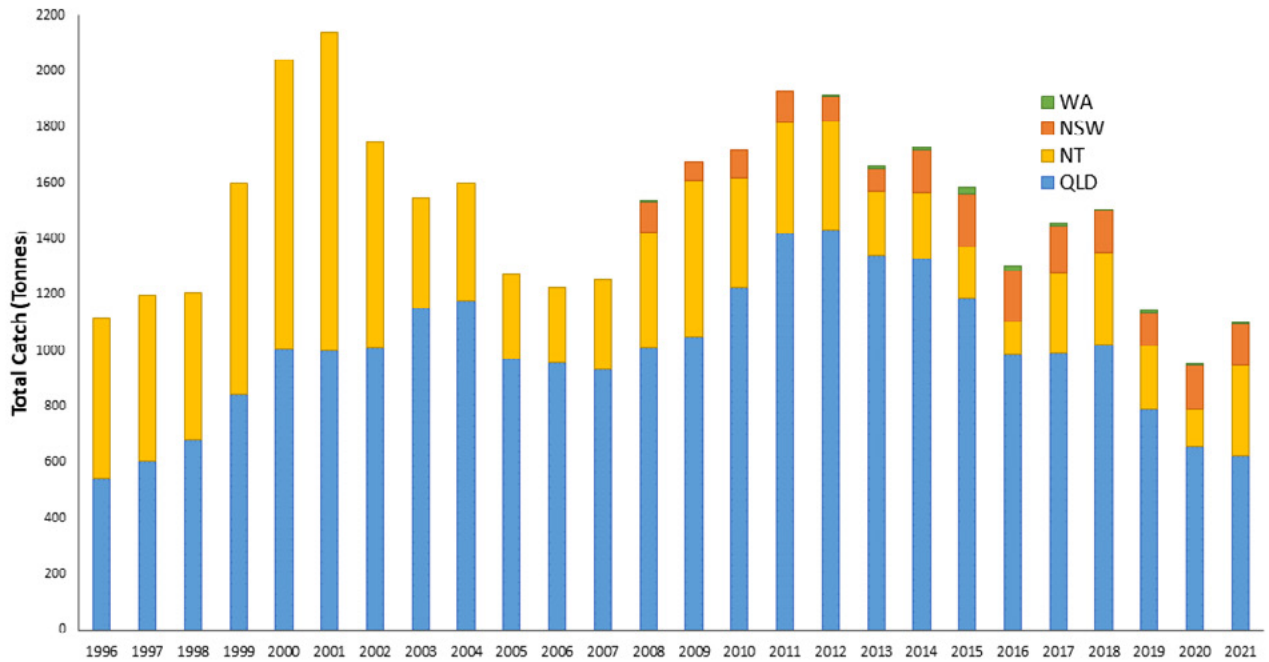


Figure 1: Australian Mud Crab (*Scylla spp.*) production (t) by state from 1996 to 2021 (2021 WA and NSW production are estimated based on 2017-2020 data).

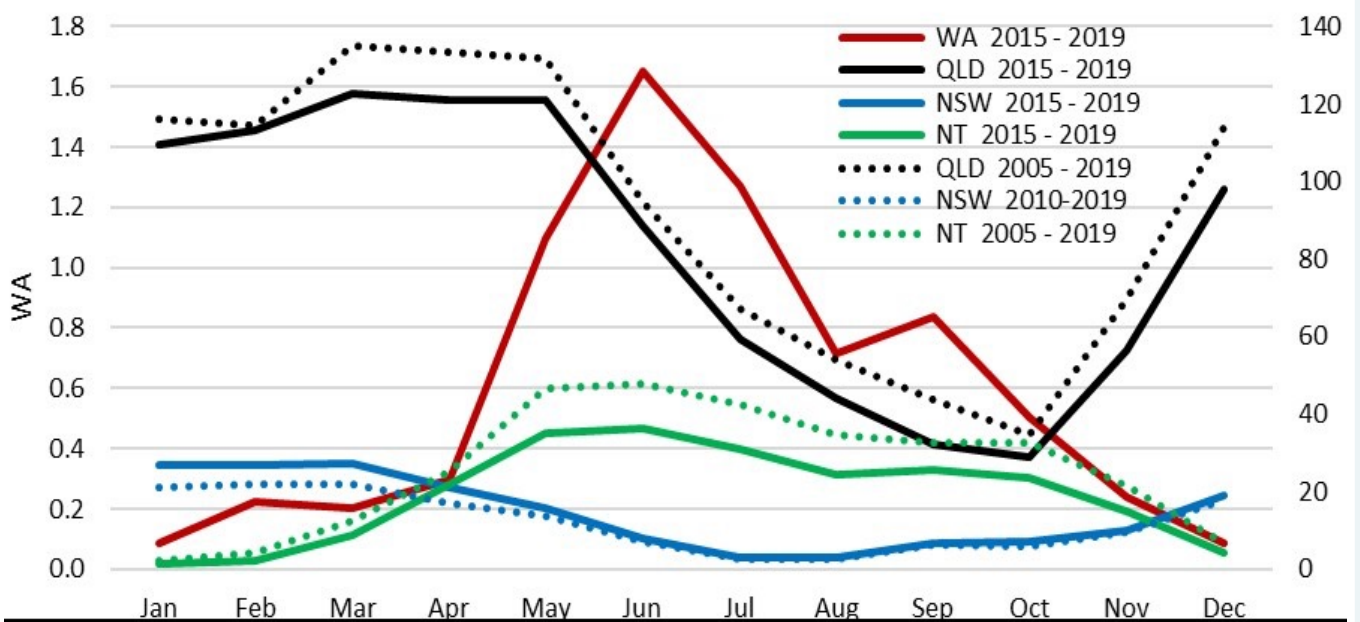


Figure 2: Average Monthly Commercial Harvest (Tonnes) - WA, NSW, NT, QLD (note WA on separate axis due to low volumes)

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).

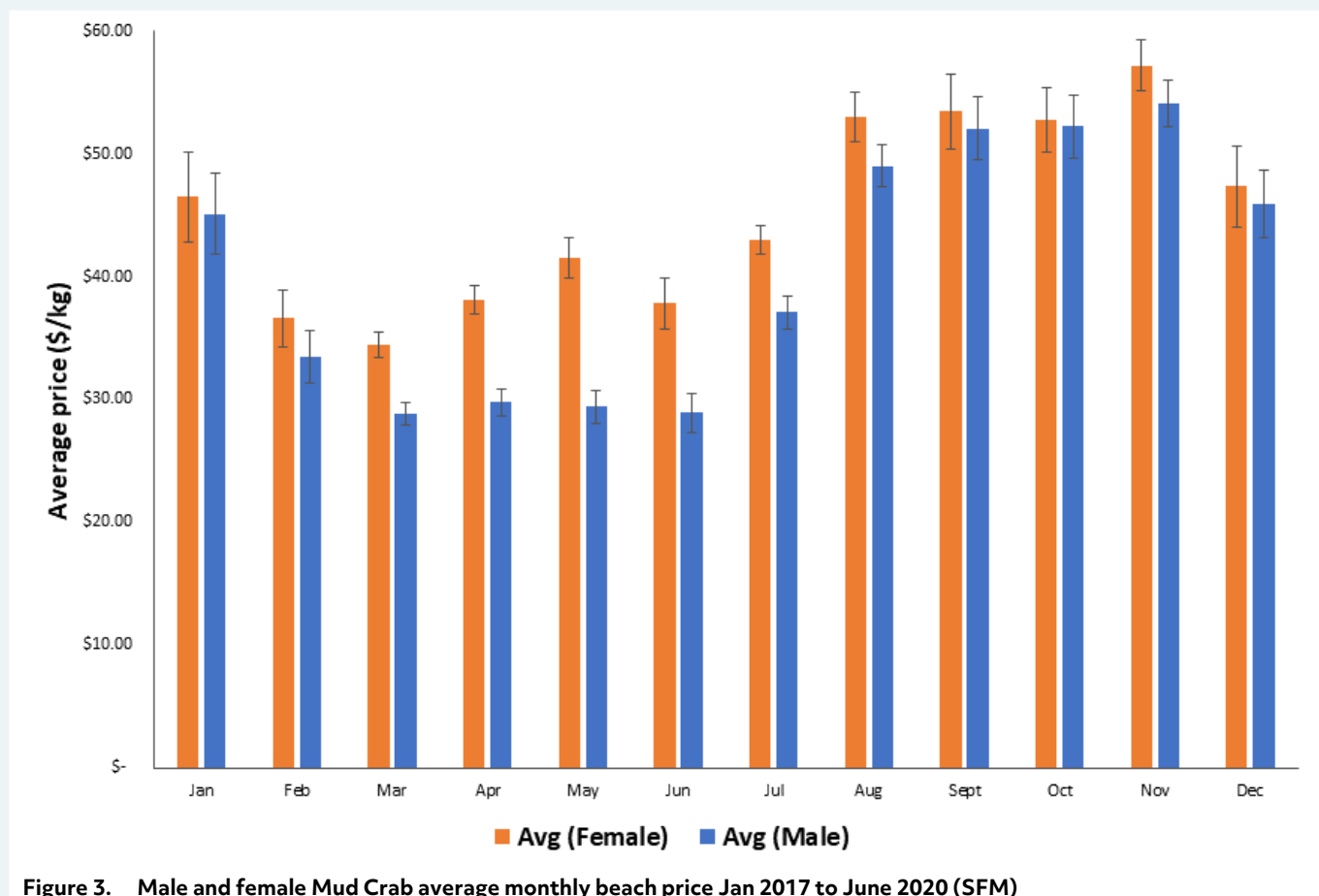


Figure 3. Male and female Mud Crab average monthly beach price Jan 2017 to June 2020 (SFM)

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 solid, 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).

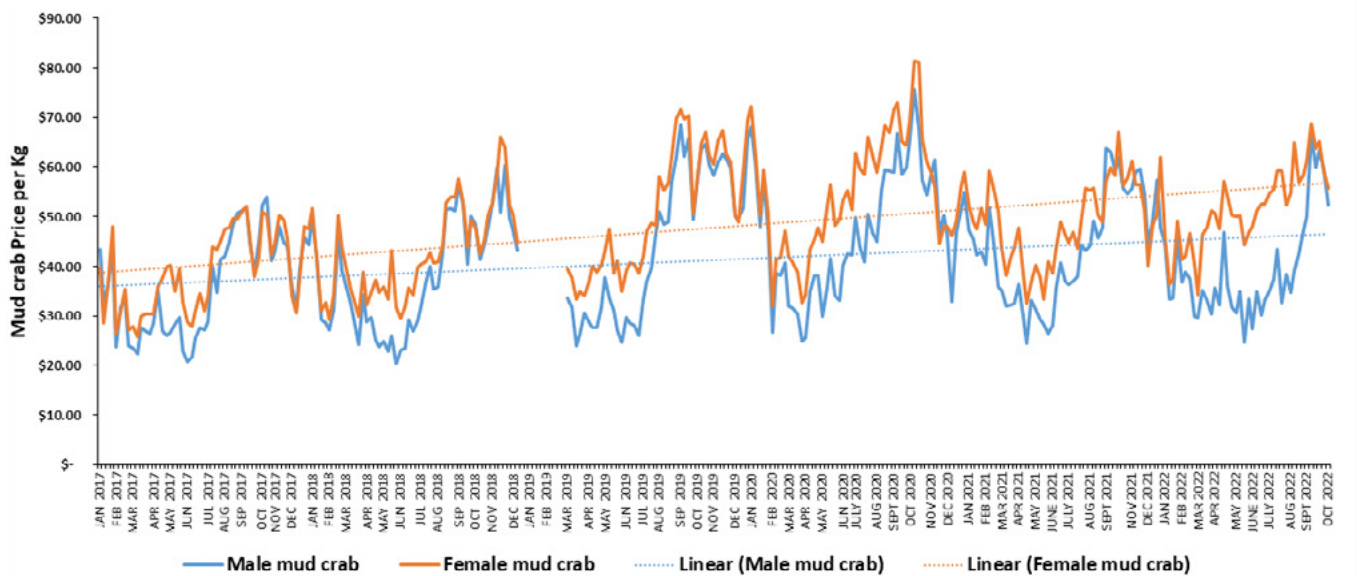


Figure 4. 'A Grade' male and female mud average price Fridays 2017 -2022 (source: SFM)

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	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 (WTO¹²) 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 Strategy¹³ is in place.
1. If it has 3rd party accreditation¹⁴ 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	<ul style="list-style-type: none"> Agencies 	Est MED Agencies	<ul style="list-style-type: none"> Govt Industry 	Ongoing	<p>Could significantly improve confidence in stock status</p> <p>Better able to achieve MEY objective</p> <p>FRDC Outcomes 2, 4</p>
2. Using management strategy evaluation to understand options and benefits, costs of in-season management	H	<p>Using real time data may provide potential to use in season measures to adaptively manage for in-season variation</p> <p>Clearly identify alternate data needs</p> <p>Liaise with Fisheries Management and Industry to develop management options, appropriateness, feasibility and costs</p>	<ul style="list-style-type: none"> Agencies 	Est LOW FRDC, Agencies co-contributor	<ul style="list-style-type: none"> Agencies 	3 years	<p>Chance for substantial improvement of economic performance as well as enhancing sustainability.</p> <p>(Link to Investment Area 3)</p> <p>FRDC Outcomes 1, 3, 4, 5</p>
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)	<ul style="list-style-type: none"> Industry collection Agencies analysis 	Est MED Possibly student projects	<ul style="list-style-type: none"> Agencies Industry PhD students Outsource 	3-5 years	<p>Options for spatial assessment and forecasting</p> <p>Linked to other environmental driver work</p> <p>FRDC Outcomes 1, 2, 4, 5</p>
4. Identify cultural harvest	H	<p>Develop appropriate methods to gain information on traditional harvest of key species</p> <p>Quantify cultural harvest</p> <p>Potential National project</p>	<ul style="list-style-type: none"> Indigenous people Agencies 	Est MED FRDC	<ul style="list-style-type: none"> Agencies and RPN/ AFMF identify researchers Indigenous people 	3 years	<p>May be part of a larger project to determine Indigenous catch/effort</p> <p>(Link to Investment Area 3)</p> <p>FRDC Outcomes 2, 3, 4, 5</p>

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.	<ul style="list-style-type: none"> Agencies Industry 	Est LOW FRDC Agencies co-contributor	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Agencies Industry 	Est HIGH Agencies co-contributor	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Agencies 	Est MED Alternative funding via environmental funding sources	<ul style="list-style-type: none"> 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'	<ul style="list-style-type: none"> Agencies 	Est V HIGH Alternative funding via environmental sources; e.g.; NESP and FRDC	<ul style="list-style-type: none"> Lead agency NGO PhD students Industry Independent or outsource 	1-5y	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	<ul style="list-style-type: none"> Agencies 	Est V HIGH NESP/FRDC	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> Agencies Industry 	To Be Determined (TBD)	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Industry driven. 	Est LOW Jurisdictional funding Industry support or purchases	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Industry 	Est LOW Grants Industry funding	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Industry 	Est MED Grants Industry funding	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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)
	H	Test efficacy of NIRS across select locations in QLD, NT and WA - similar to NSW study	• DAF				FRDC Outcomes 1, 3
2. Improve catch reporting and traceability across jurisdictions	M	<p>Identify if consistent reporting across jurisdictions is feasible or desirable</p> <p>Streamline and improve relevant catch reporting and traceability across jurisdictions, including electronic options</p> <p>Explore and/or develop new and cost-effective traceability 'systems', including Industry driven post-harvest tag systems</p>	<ul style="list-style-type: none"> DAF, DPI, DITT, DoF Industry 	Est MED FRDC data project	<ul style="list-style-type: none"> Govt AFMF 	5 years	<p>Streamline and simplify reporting</p> <p>Improve consumer confidence and experience</p> <p>Link with NIRS concept (Link to Investment Area 3 and 5)</p> <p>FRDC Outcomes 1, 2, 4, 5</p>
3. Utilise technology to reduce crab pot theft and interference	H	<p>Advance existing trap theft 'CrabNabber' project to use technology to identify and minimise rates of theft</p> <p>Review current options and support development of new technology.</p> <p>Engagement with compliance</p>	<ul style="list-style-type: none"> CrabNabber project Industry 	<p>Est MED</p> <p>Existing project</p> <p>Industry uptake</p> <p>FRDC research</p> <p>Jurisdictional funding</p>	<ul style="list-style-type: none"> 'CrabNabber' project NSW fishers (Qld and NT) Industry Nationally Compliance & Managers 	ongoing	<p>Look to continue advancement of 'CrabNabber' project</p> <p>Reduce ghost fishing</p> <p>Embrace GPS technology</p> <p>Look to adoption via 'CrabNabber' project (Link to Investment Area 3 for adoption)</p> <p>FRDC Outcomes 2, 3, 4</p>

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)	<ul style="list-style-type: none"> DAF Industry 	Est LOW FRDC Inhouse	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> SFM Industry 	Est LOW Inhouse Grants or seed funding to build a NMP	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> ASC Govt Industry 	Inhouse ILSC TBD	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> NT Industry 	Inhouse	<ul style="list-style-type: none"> 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	<p>Research audit on communication work completed (what did or didn't work)</p> <p>Build regional communication, then intrastate, interstate and nationally</p> <p>Build and showcase champions to highlight successes</p> <p>Develop a national approach</p> <p>Engage impartial, trusted, independent expert</p> <p>Undertake PD to build skills sets</p>	<ul style="list-style-type: none"> Industry 	Est LOW FRDC audit project	<ul style="list-style-type: none"> Industry driven Identify people to enter PD programs (Industry Govt) 	Immediately	<p>Immediate connections should be made post workshop to build cross jurisdictional relationships</p> <p>Misinformation is an issue - needs to be rectified with no loss of face</p> <p>FRDC Outcome 2, 3, 5</p>
2. Improve Industry to Govt communication	H	<p>Post Ind:Ind</p> <p>Informal start at officer level</p> <p>Build trust and a common language</p> <p>Develop clarity and consistency across regions and agencies to build national approaches</p>	<ul style="list-style-type: none"> Govt to instigate initial processes 	Inhouse	<ul style="list-style-type: none"> Govt Industry 	<p>Informal ASAP</p> <p>Post Ind:Ind</p>	<p>An informal approach should start immediately building on workshop relationships Investigate trusted national source(s)</p> <p>FRDC Outcome 1, 2, 3, 4, 5</p>
3. Improve Govt to Govt communication	H	Internal government processes	<ul style="list-style-type: none"> Officer, Executives 	Inhouse	<ul style="list-style-type: none"> Govt 	ASAP	FRDC Outcome 2, 3, 4, 5
4. Improve Industry and Govt, Community communication	M/H	<p>Marketing and social licence</p> <p>Requires clear message, clarity of purpose and pitch well to address audience</p> <p>Skilled content developers could turn around misinformation and overcome mistrust using social media and advertising</p>	<ul style="list-style-type: none"> TBD 	Est LOW Audit existing opportunities	<ul style="list-style-type: none"> TBD 	2 years	<p>Not 'white coat' researcher approach</p> <p>May be best served at whole of seafood Industry level</p> <p>FRDC Outcome 1, 2, 3, 4, 5</p>

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	<p>Proof of Concept (PoC) to investigate establishing a national body to represent harvest and post-harvest (see ACPF, SRL model)</p> <p>Understanding roles, responsibilities, governance, resourcing etc (see supplementary and further information on a National Group at Section 4)</p>	<ul style="list-style-type: none"> Industry 	<p>Est MED</p> <p>FRDC for PoC</p> <p>Govt grants</p> <p>Industry funds</p>	<ul style="list-style-type: none"> Industry FRDC SIA support 	1 year – PoC	<p>Staged approach</p> <p>Undertake PoC to understand uptake, roles and resourcing options</p> <p>Understand how the FRDC IPA process works and assess viability of an FRDC – IPA</p> <p>FRDC Outcome 1, 2, 3, 4, 5</p>
2. Understand skill shortages across Industry from catcher to compliance	H	<p>Audit of skills need</p> <p>Assess upskilling options including:</p> <ul style="list-style-type: none"> – Training/mentoring – School training program linked to jobs – On job inductions sponsor – Formal programs (fishing, business, post-harvest, leadership etc) 	<ul style="list-style-type: none"> Industry and Govt 	<p>Est LOW</p> <p>FRDC rollout costs</p>	<ul style="list-style-type: none"> Independent consultancy Industry and Govt sponsorship or grant for programs 	1 year ongoing	<p>Undertake audit as first step</p> <p>Leads to involvement in a range of programs</p> <p>(Link to Investment Area 3)</p> <p>FRDC Outcome 1, 2, 5</p>
3. Build Industry Capacity and Succession	H	<p>Understand why there is a problem. Develop a succession plan including:</p> <ul style="list-style-type: none"> – 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) 	<ul style="list-style-type: none"> Industry and Govt 	<p>Est MED</p> <p>FRDC</p>	<ul style="list-style-type: none"> FRDC People Dev Consultant SIA 	Ongoing	<p>Important to Learn from failure</p> <p>This is most likely part of larger Industry need</p> <p>Look to Indigenous opportunities through out</p> <p>Lined to Challenge 2</p> <p>FRDC Outcome 1, 2, 3, 4, 5</p>
4; Build Government Capacity and Succession	H	<p>Understand why there is a problem. Develop a succession plan including:</p> <ul style="list-style-type: none"> – 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) 	<ul style="list-style-type: none"> AFMF RPN FMC 			Ongoing	<p>This is most likely part of larger Government needs</p> <p>FRDC Outcome 1, 2, 3, 4, 5</p>



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	<ul style="list-style-type: none"> • Proof of Concept (PoC) to investigate: <ul style="list-style-type: none"> – 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	<ul style="list-style-type: none"> • 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) • Build 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Develop a costed national plan to achieve objectives and strategic priorities including: <ul style="list-style-type: none"> – 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	<ul style="list-style-type: none"> • Promote Mud Crab purchases via targeted market development to diversify consumer base 	Industry and supporters, inc SFM
Build Industry Capacity	<ul style="list-style-type: none"> • 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

A large, leafy mangrove tree dominates the background, its branches spreading across the upper half of the frame. In the foreground, a circular, wire-mesh crab trap sits on a muddy bank. The trap has a flat, woven top and a cylindrical body. The ground is a mix of dark mud and dense mangrove roots. The sky is blue with some light clouds.

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:



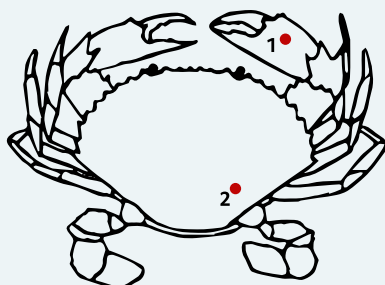
MicroNIR



Innospectra NIR-SG-1

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.



Felix-750

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:
 Dr Brett Wedding, Principal Scientist,
 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: <ul style="list-style-type: none"> – Flexible harvest strategies (HS) 	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	<ul style="list-style-type: none"> – Flexible spatial arrangements and decision-making tools, – Management approaches that aim for fairness, – Participant management across fisheries 	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			

