Queensland mud crab fishery harvest strategy: 2021–2026

CONSULTATION DRAFT

Queensland Government

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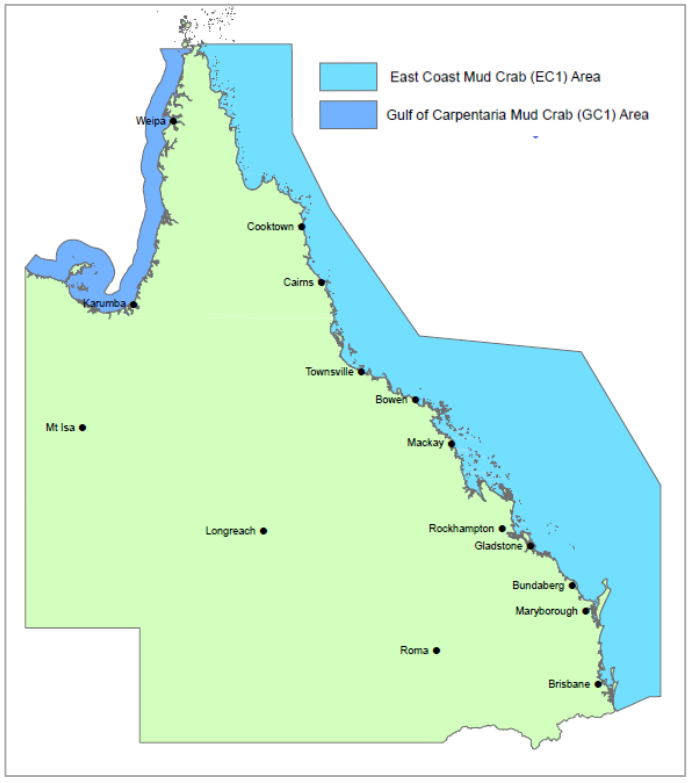
What the harvest strategy is trying to achieve

This harvest strategy has been developed to manage the harvest of Queensland's mud crab resource. The sustainability risk to mud crab stocks in Queensland is considered low, due to management controls in place such as single sex harvest and a minimum legal size limit. The Queensland Mud Crab fishery (QMCF) is currently under a period of transition from a fishery with high effort and no effective catch limits, to a quota managed fishery.

The aim of this harvest strategy is to manage the fishing mortality of mud crabs through the setting of a total allowable catch (TAC) at a level that allows the stock to achieve specified biomass targets. Through the transition to quota management, improved catch and effort data from all sectors will build confidence in a biomass based management approach in the future. The harvest strategy's decision rules are designed to set catch at levels appropriate for achieving the 60% biomass target for mud crabs as well as to maintain catch shares amongst commercial, recreational and traditional fishing sectors.

Fishery overview

The QMCF includes commercial, recreational, traditional and charter fishing that target mud crabs. Queensland's mud crab fisheries operate throughout the state's coastal waters, including the East Coast and Gulf of Carpentaria. The main apparatus used by all fishers to catch mud crabs are wire-mesh crab pots and trawl-mesh (nylon) collapsible traps. Because of the ease of access to this fishery there is a high level of use by all sectors.



It is characterised by both intense effort and high catches, with the harvest of mud crabs totalling more than other Australian mud crab fisheries combined (Northern Territory, Western Australian, and New South Wales). The commercial catch has declined in recent years with catches falling from around 1419 tonnes in 2011 to around 863 tonnes in 2017, while effort has remained high (37,000 fishing days per year). Importantly, from 2011 to 2017 the commercial catch-per-unit-effort (CPUE) has reduced from 33 kg/day to a low of 23 kg/day. Many commercial fishers state these catch rates are no longer economically viable.

The reported mud crab catch from the Gulf of Carpentaria has dropped between 2011 (184 tonnes) and 2017 (130 tonnes). The reduced catch of mud crab in the Gulf of Carpentaria has been linked to low recruitment from environmental factors, such as a lack of significant rainfall during recent wet seasons.

The recreational sector has been experiencing a similar magnitude of declines to the commercial sector. In 2013, more than 642 000 people fished recreationally in Queensland. Of the 11.56 million fish taken, around 1.7 million were mud crabs, with 80% of the catch released back into the water. Estimates of recreational crab harvest has halved from 661 tonnes to 339 tonnes between 2000 and 2013. Based on the most recent recreational harvest estimate for mud crabs in Queensland the vast majority of catch was attributed to the east coast (332 tonnes).

While catch and effort in the indigenous fishing sector is the least understood, it is assumed that this sector has comparatively low levels of effort in comparison to other sectors. Previous estimates suggest traditional harvest to be less than 20 tonnes per year.

Stocks covered by the harvest strategy

Two species of mud crabs are found in Australian waters: 'mud crab' (*Scylla serrata*) and the orange mud crab (*S. olivacea*). The former constitutes more than 99 per cent of the commercial catch of mud crabs in the Northern Territory and Queensland, and the entire commercial catch in New South Wales. Genetic evidence suggests that there are at least two biological stocks of mud crabs in Australian waters: one to the west and another to the south-east of the Torres Strait.

Table 1: Summarises the fish stocks covered by this harvest strategy

Feature	Details
Target species	Mud crab (*Scylla serrata*)
Other species	Orange mud crab (*S. olivacea*)
Biology	Mud crabs are a fast growing and highly fecund species. Growth rate appears to be accelerated in warmer northern and Gulf of Carpentaria waters. Growth is seasonal with moulting activity mainly from September to January Mud crabs are thought to spawn offshore. Egg numbers depending on the size of the female. Females generally hold between 2–10 million eggs for around 2 weeks. The age at first maturity is estimated to be between 12 and 18 months and longevity is between 3 and 4 years.

Management units for the harvest strategy

Defining the fishery to which a harvest strategy applies is a critical step in determining its scope. The management unit for this harvest strategy is as defined by the Fisheries (Commercial Fisheries) Regulation 2019:

- East Coast: tidal waters of waterways that flow to the sea east of longitude 142 °31'49'' east, to the New South Wales border and south of latitude 10 °48' south.

- Gulf of Carpentaria: tidal waters of waterways that flow to the sea west of longitude 142°31'49'' east to the Northern Territory border and south of latitude 10°41' south.

Summary of management information

A summary of the management arrangements for the QMCF are set out Table 2 below. Fishers should consult the relevant fisheries legislation for the latest and detailed fishery rules or visit www.fisheries.qld.gov.au.

Table 2: Summary of management arrangements for the QMCF

Feature	Details
Commercial access	Primary Commercial Fishing Licence with a "C1" fishery symbol
Relevant fisheries legislation	*Fisheries Act 1994* *Fisheries (General) and (Commercial Fisheries) Regulations 2019* *Fisheries Declaration 2019*
Other relevant legislation	*Great Barrier Reef Marine Park Act 1975 and Regulation 2019* *Marine Parks Act 2004* *Environment Protection and Biodiversity Conservation Act 1999* and *Regulation 2000*
Working Group	Crab Fishery Working Group Terms of Reference and meeting communiques are available online
Gear	The following apparatus are currently permitted for use within the Crab Fishery: Commercial: wire-mesh traps, trawl-mesh crab pots, and hoop/dilly. Pots can be arranged along a trotline (excluding some areas), escape vents for mud crab fishery (proposed). Commercial fishers are limited to a maximum 50 pots, traps, or dillies per C1 symbol. 100 pots can be used where a commercial fishing boat licence has two C1 symbols written. Recreational: wire-mesh traps, trawl-mesh crab pots, and hoop/dilly (with restrictions). Recreational fishers are limited to a maximum of 4 pots/dillies per person.
Main management methods	*Commercial* • The primary management method under the harvest strategy is Individual Transferable Quota (ITQ) and associated total allowable commercial catch (TACC) for east coast mud crab, and the Gulf of Carpentaria mud crab. • A minimum quota holding of 1.2 tonnes applies to the commercial mud crab fishery. *Recreational* • The primary management method under the harvest strategy is a total allowable recreational catch for east coast mud crab and the Gulf of Carpentaria mud crab. • The management of the recreational harvest of mud crab is also managed by recreational in possession limits • Combined boat limit of two times the in-possession limit *Other management methods include*:

Feature	Details
	• Limited access through Commercial Fishing Boat Licences • Vessel size (20m)
Fishing year	1 July – 30 June
Stock Status	Mud Crab east coast and Gulf of Carpentaria are listed as '**Sustainable**' by SAFS 2018 https://www.daf.qld.gov.au/business-priorities/fisheries/monitoring-compliance/data/sustainability-reporting/stock-status-assessment *Note the classification system used as part of the SAFS reporting is assessed against a 20% biomass sustainability criteria. Therefore, although a species may be classified as 'sustainable' in SAFS, this does not mean that the biomass is meeting the targets set out in the Sustainable Fisheries Strategy 2017-2027.
Accreditation under the Environment Protection and Biodiversity Conservation Act 1999	Part 13: Accredited (expires 2022) Part 13A: Accredited (expires 2022) https://www.environment.gov.au/marine/fisheries/qld/mud-crab

Fishery objectives

Fishery objectives set out the direction and aspirations to achieve in the long term. The objectives for this fishery are to:

- Maintain the mud crab resource at, or returned to, a target exploitable biomass level that aims to maximise economic yield (MEY) for the fishery.

While:

- Minimising and mitigating high ecological risks arising from fishing-related activities
- Maintain sectoral allocations for the mud crab fishery resource;
- Maximising profitability for the commercial sector
- Managing excess capacity to improve social and economic benefits
- Monitoring the social and economic benefits of the fishery to the community

Catch shares

This harvest strategy aims to maintain the existing catch shares between sectors. The resource allocation arrangements are set out in the Table 3 to ensure that catch shares among sectors can be maintained in response to changes in the TAC.

Catch share arrangements will be formalised by the end of the first harvest strategy, taking into account results from the 2019/20 state-wide recreational fishing survey, any other available information relating to recreational harvest, and validated commercial catch over corresponding years. Table 3 outlines *indicative* catch shares (rounded to nearest 5%) for all sectors for mud crab, based on available data up to 2018.

Aboriginal peoples and Torres Strait Islanders traditional fishing rights are protected under native title legislation and relate to harvest for domestic, communal and non-commercial purposes. Accordingly, traditional and customary fishing is not a defined allocation.

Aboriginal Peoples and Torres Strait Islanders also desire more economic opportunities through fishing, particularly in their own sea country. In line with the Indigenous Commercial Fishing Development Policy, up to 10 tonnes will be set aside to provide access through an Indigenous Fishing Permit, issued in accordance with section 54 of the *Fisheries (General) Regulation 2019,* to provide opportunities for communities to take part in fishing-related business.

Table 3: Resource allocation arrangements for the mud crab fishery

Management unit	Commercial fishing[1]	Recreational fishing[2]	Indigenous commercial fishing development
East coast mud crab	70%	30%	10 tonnes
Gulf of Carpentaria mud crab	90%	10%	6 tonnes

[1] Commercial catch share is informed by the 2013-17 catch average.
[2] Recreational catch share is informed by average harvest from 2010 and 2013 State-wide recreational fishing surveys, and reported charter harvest.

Managing the performance of the fishery

Key indicators measure how healthy the fishery is performing. The indicators relate to the objectives, and use reference points to establish acceptable performance (Table 4). The indicators measure the relative amount of fish biomass of key stock(s) against target and other reference points. The default biomass-reference-points identified in this harvest strategy are:

- A target reference point (B*targ*) of 60% of the exploitable biomass (for key target species) being the relative biomass level the harvest strategy aims to achieve. This is also considered a proxy measure of B*mey* for the purposes of this harvest strategy;
- A limit reference point (B*lim*) of 20% of the exploitable biomass being the level that the harvest strategy aims to avoid. If the stock is assessed to be below B*lim* the risk to the stock is unacceptably high and the stock is defined as “depleted”.

For key stocks, performance indicators and sustainable harvests for all sectors will be estimated from a stock assessment. The aim is to measure the capability for the stock to attain the target biomass level (B*targ* 60%), and at which point the harvest strategy will be considered as meeting its objectives.

The decision rules for setting a sustainable harvest in the mud crab harvest strategy are based on a ‘hockey stick’ approach. This is where the TAC is set based on a linear relationship between B*lim*, where the level of fishing mortality (F) is equal to zero, and B*targ* where the exploitation rate and TAC is set at the level to achieve MEY (Figure 1). The decision rule takes into account the current biomass level of the stock for determining the TAC to achieve the B*targ*. The recommended TAC is calculated by applying the rate of fishing mortality to achieve B*targ* to the current exploitable biomass level. As a result, the recommended TAC represents the total catch from all sectors (including discards) that can be harvested in the following years, to move the current biomass level towards the target level.

If the exploitable biomass falls below the limit reference point (B*lim* 20%), there will be no more targeted fishing of the stock until a rebuilding strategy is developed to increase the exploitable biomass above the limit within three generations (where a generation is defined as the average age of full maturity for the fish species). The rebuilding timeframe of three generations takes into account the productivity and life span of the fish species.

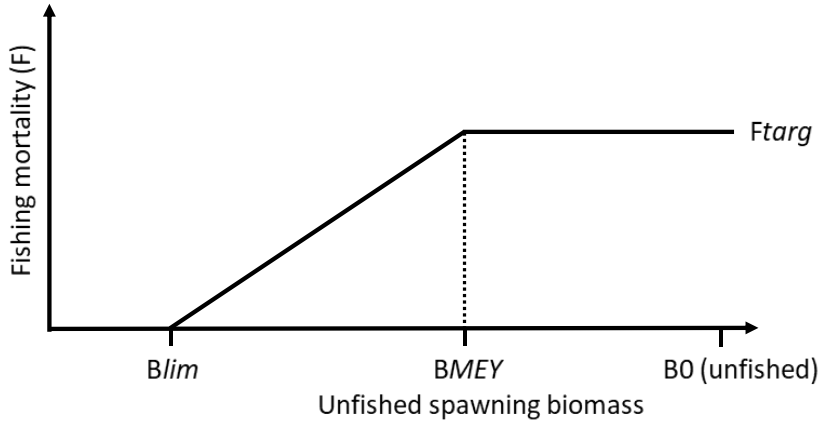


Figure 1: showing the "hockey stick" rule, B*lim* is limit reference point, B*mey* is the biomass at MEY, B0 is the unfished biomass at 100%, F is fishing mortality and F*targ* is the level of fishing mortality for B*mey*.

The decision rules in this harvest strategy are designed to maintain the TACC at a level that allow the fishery to meet a biomass exploitable target of 60% (as a proxy for Maximum Economic Yield). The initial TAC for all sectors and the TACC for Year 1 for the east coast and Gulf of Carpentaria mud crab fisheries will be informed by *Northrop et al* (2019)[1], and is proposed as outlined in the Table 4.

The decision rules will aim to also achieve rationalisation of the commercial fleet in order to further promote economic viability of the fishery. This rationalisation will be undertaken through a break out rule that is aimed at maintaining the TACC at levels that effectively manage total commercial harvest (i.e. keeping the TACC within 30% of commercial harvest).

Table 4: Proposed catch limits for the mud crab fishery

Fishery	**TACC Year 1**	**Indicative recreational harvest range***	**Overall fishery TAC**
East Coast Mud Crab EC1	770 t	331 t (252 t – 410 t)	1101 t
Gulf of Carpentaria Mud Crab GC1	108 t	15 t (11 t – 19 t)	123 t

*the indicative recreational harvest range in based on the 2013 recreational harvest estimate plus or minus 2 x 12% reported standard error[2]

To meet the objectives of the fishery, the harvest strategy will also act to constrain all sectors within their allocated catch share. Should a new estimate of recreational harvest or catch from charter fishing logbooks indicate that a sector has increased their catch share outside of their allocated proportion for any TAC species, then adjustment will be made to constrain harvest within this share. Adjustments to the recreational fishing limits may be undertaken if large changes are made to the TAC for a species.

Table 5: Performance indicators and reference points for the mud crab fishery

Performance indicator	**Type of reference point**	**Reference level**
mud crab biomass	Target (Btarg)	60% exploitable biomass
mud crab biomass	Limit Reference Point (Blim)	20% exploitable biomass
Estimated recreational harvest	Target	2013 Recreational survey +- 12% error

Recreational limit change	Maximum change buffer	2 crabs

Management of target species

Decision rules for the commercial harvest of East coast mud crab (EC1) and Gulf of Carpentaria mud crab (GC1)

The decision rules below have been designed to provide clear guidance to the TACC setting process for the mud crab commercial fishery by defining how advice should be developed and implemented from stock assessments. The decision rules also include break out rules that are in place to ensure that the TACC approximates the validated commercial harvest level (see Appendix A).

1.1 If the biomass is at or above Btarg, set the TACC at a level that maintains biomass at Btarg.

1.2 If biomass is below Btarg and above Blim, the TACC should be set at a level where fishing mortality is reduced to the rate that allows the biomass to increase effectively back to Btarg.

1.3 If biomass is below Blim, there will be no further targeted fishing for that species, and a rebuilding strategy will be developed to increase the stock biomass to above Blim within three generations.

1.4 If any new information becomes available indicating that the assessment and TACC-setting arrangements are not consistent with the sustainable management of the fishery, decision rules must be reviewed and, if appropriate, the reference points or timeframes should be adjusted.

Notwithstanding that:

1.5 The rate of fishing mortality should not exceed that required to achieve Btarg (i.e. F60) ; and

1.6 The TAC should not exceed the level of fishing mortality required to maintain a stock at MSY.

Breakout rule

1.7 If the annual commercial harvest is 30% or more below the TACC, then TACC will be reduced to 10% above the most recent annual commercial harvest.

Decision rules for the recreational and charter sector harvest of mud crab

To ensure that no one fishing sector is increasing their catch share at the expense of another sector the harvest strategy has been designed to include decision rules for maintaining catch shares between sectors. Should a new estimate of recreational harvest (including catch from charter fishing logbooks) indicate that the recreational sector have increased their catch share outside of their allocated proportion for any TAC species then adjustments will be made to constrain them within this share. Adjustments to the recreational fishing limits may also be undertaken if large changes are made to the TAC for a species.

2.1 If a recreational harvest estimate is no more than 12% above the allocated recreational catch proportion then no management action is required.

2.2 If an estimate of recreational harvest exceeds the catch share by greater than 12% the recreational in possession limit will be decreased, and **notwithstanding that**

2.3 The new recreational limit must not be increased or decreased by more than two crabs in any given year, and if the TACC is equal to zero the fishery will be closed for all sectors.

Minimising ecological risks from fishing

A foundation of sustainable fisheries management is managing the impact of fishing activities on non-target species and the broader marine ecosystem. Ecological Risk Assessments (ERA) identify and measure the ecological risks of fishing activity and identify issues that must be further managed under harvest strategies. The below decision rules are in place to minimise and mitigate high ecological risks arising from fishing related activities.

3.1 If an Ecological Risk Assessment (ERA) identifies fishing impacts that are considered to generate an undesirable level of risk to any secondary or bycatch species' populations, (i.e. high risk) a review is triggered to investigate the reason for the increased risk. Appropriate management action should be taken to reduce the risk to an acceptable level.

A whole-of-fishery Level 1 ERA for the crab fishery was completed in 2019 and identified two ecological components/sub-components at higher risk; Target & Byproduct species and Marine turtles (available at: http://era.daf.qld.gov.au/id/eprint/6965/). These components have been progressed to a species-specific Level 2 ERA, which is due for completion in 2020.

Fisheries Queensland's Ecological Risk Assessment Guideline, scoping study and Level 1 ERA is published online at https://www.daf.qld.gov.au/business-priorities/fisheries/sustainable/sustainable-fisheries-strategy/ecological-risk-assessment-guidelines.

Future risk assessments will be undertaken periodically to reassess any current or new issues that may arise in the fishery. Risk assessments can be undertaken more frequently if there are significant changes identified in fishery operations, management activities or controls that are likely to result in a change to previously assessed risk levels.

Social and economic performance

The Sustainable Fisheries Strategy outlines the target to set sustainable catch limits based on achieving maximum economic benefits of the resource, taken initially to correspond to around 60% of exploitable biomass. This is to support the most economically efficient use of the resource, improve the fishing experience for all sectors and promote a resilient system that can bounce back from other adverse environmental conditions (e.g. floods). The harvest strategy rules have been set up to maintain the stock to this target biomass level.

The following objectives are to support the social and economic performance of this fishery. The management options outlined are intended to provide some guidance on the options that could reasonably be considered if fishery trends are of concern.

Table 6: Social and economic indicators for the mud crab fishery

Objective	Performance indicators	Management options
Maximise profitability for the commercial sector	Potential indicators to monitor include: • Capacity utilization • CPUE (average per day) • Costs, earnings and net financial and economic profit • Quota sale and lease price • Profit decomposition (using profit or lease price) to determine impacts of prices, costs and stock/catch rates on changes in profits	Consider regulatory and non-regulatory options. Adjust management as needed. Options include minimum quota holding, latent effort review.
Monitor the broader social and economic benefits of the fishery to the community	Potential indicators to monitor include: • Fisher satisfaction (with their fishing experience – commercial and recreational) • Percent of quota/licences that are owned (rather than leased) • Gini coefficient of quota owner (measure of concentration) • Percent of total costs/inputs purchased from local businesses/residents • Income generated (crew plus profit – gross value added) • Proportion of catch sold locally • Fish prices • Number of platforms/number of active licenses/total capacity • Community satisfaction (with their fisheries and the way in which they are managed)	Consider regulatory and non-regulatory options. Adjust management as needed

Monitoring and assessment

Fishery-dependent information

The catch and effort data required to determine the standardised commercial catch rate for harvested mud crabs is obtained through commercial logbook returns. The mud crab fishery logbook is at https://www.business.qld.gov.au/industries/farms-fishing-forestry/fisheries/monitoring-reporting/requirements/logbooks

As the mud crab fishery moves to quota-management, real-time reporting and catch disposal records are also required to provide an accurate record of the catch for compliance. All boats in the mud crab fishery are required to have vessel tracking installed and operational on all primary and tender vessels to verify fishing effort reported in commercial fishing logbooks.

Harvest, effort and trends in the recreational sector will be monitored through the State-wide Recreational Fishing Survey and boat ramp surveys.

Fishery independent information

FRDC funded research is scheduled to commence in 2020. It will provide information on (i) spatial stock structure of mud crabs, (ii) key biological information (pre-recruit abundance for TAC adjustment, male to female ratios for spawning-stock recruitment relationship, growth, morality and movement achieved in the short-term by tagging work and in the long-term by fishery-dependent 'survey-pot' monitoring program).

Information and research priorities

Key information and research priorities have been identified in Table 7 to help meet the objectives of this harvest strategy. These will be updated as required.

Table 7: Information and research priorities for the mud crab fishery

Project Description	Explanation of Need	Priority	Funding
Spatial stock structure of mud crabs	Currently information on the stock structure of mud crab use older genetic methods (mitochondrial DNA). The assessment and management of mud crabs would benefit from the use of additional work to investigate stock structure at a finer spatial scale (i.e. using new genetic methods, parasites or tagging).	High	FRDC and DAF
Establish a pre-recruit abundance for TAC adjustment	Developing a pre-recruit index through a pot sampling program may allow a harvest strategy to be developed that can account for environmentally driven inter-annual fluctuations in mud crab availability.	High	DAF
Improve key biological information	Male: female ratios for spawning-stock recruitment relationship, growth, mortality and movement achieved in the short-term by tagging work and in the long-term by fishery-dependent 'survey-pot' monitoring program.	High	DAF

Schedule of performance assessment and review

The fishery's performance will be reviewed against this harvest strategy annually. This review will include convening the Crab Working Group in February/March to provide operational advice on the fishery's performance and any matters that may need addressing. The primary performance measure for review will be exploitable biomass that will be undertaken intermittently, with a review of catch and effort data in intervening years. Table 8 summaries the key review and decision points for the QMCF.

Table 8: Schedule of Performance Assessment and Review

	Year 1- 2021/22	**Year 2 -2022/23**	**Year 3- 2023/24**	**Year 4- 2024/25**	**Year 5- 2025/26**
Monitoring and assessment Activity	Catch and effort monitoring	Modelled Assessment	Catch and effort monitoring	Catch and effort monitoring	Modelled Assessment
Management activity	Review of TAC and in-possession limits, declaration made if required	Review of TAC and in-possession limits, declaration made if required	Review of catch and effort data and bring forward TAC decision if needed	Review of catch and effort data and bring forward TAC decision if needed	Review of TAC and in-possession limits, declaration made if required

The above schedule outlines the expected timeframes that assessment information will be available to inform management action. There may be instances where an assessment may need to be available prior to, or delayed beyond the scheduled date. Any change to the schedule should be considered by the working group and decided on by the chief executive based on the below conditions:

- If during the period between scheduled stock assessments the chief executive is concerned that a performance indicator (e.g. stock status, length frequency distributions, standardised commercial catch rates, total harvest, age distributions etc.) suggests that the stock is not performing in a way that will achieve the target biomass level, the chief executive may decide that a stock assessment will be undertaken before the scheduled timeframe.
- If the chief executive is satisfied that; (1) indicators for the stock suggests that it is achieving, or rebuilding to, target biomass levels, and that there is a low ecological risk to the stock under the current management arrangement (i.e. TAC levels); (2) or if resourcing requirements prohibit the ability for an assessment to be delivered in the scheduled timeframe, the chief executive may decide that a scheduled stock assessment will be delayed.

Schedule of review

This harvest strategy will remain in place for a period of five years, after which time it will need to be fully reviewed in accordance with the *Fisheries Act 1994*.

While harvest strategies provide certainty and transparency in terms of management decisions in response to fishery information, there needs to be flexibility to allow new information or changing circumstances to also be considered. Consequently, the harvest strategy may be subject to further review and amendment as appropriate within the five year period if the following circumstances arise:

- There is new information that substantially changes the status of a fishery, leading to improved estimates of indicators relative to reference points; or
- Drivers external to management of the fishery increase the risk to fish stock/s; or
- A new recreational harvest estimate becomes available that suggests the defined sectorial catch shares may have been set incorrectly or may be unrepresentative; or
- It is clear the harvest strategy is not working effectively and the intent of the Queensland Harvest Strategy Policy is not being met.

Further explanation and information on the processes for amending harvest strategies can be found in the Queensland Harvest Strategy Policy published at https://www.daf.qld.gov.au/business-priorities/fisheries/sustainable-fisheries-strategy/harvest-strategy.

Appendix A: Flow diagram of decision rules for mud crabs