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**WEST COAST DEEP SEA
CRUSTACEAN RESOURCES
HARVEST STRATEGY
2015 – 2020**

Version 1.0

**WEST COAST DEEP SEA CRUSTACEAN
MANAGED FISHERY**

FISHERIES MANAGEMENT PAPER NO. 272

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West Coast Deep Sea Crustacean Managed Fishery

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1 INTRODUCTION

Harvest strategies for aquatic resources managed by the Western Australian Department of Fisheries (the Department) are formal documents prepared to support the decision-making processes required to ensure the management of these resources are consistent with the principles of Ecologically Sustainable Development (ESD). The objectives of ESD are reflected in the objects of the *Fish Resources Management Act 1994* (FRMA), Section 3 and the draft *Aquatic Resources Management Bill 2013* (ARMB), Clause 9, which will replace the FRMA once enacted.

The publication of these strategies is intended to make the decision-making considerations and processes for the management of specified aquatic resources publicly transparent and provide a basis for informed dialogue on management actions with resource users and other stakeholders.

These strategies provide guidance for decision-makers, but do not derogate from or limit the exercise of discretion required for independent decision-making under the FRMA by either the Minister for Fisheries, the Chief Executive Officer of the Department of Fisheries or other delegated decision-makers in order to meet the objects of the FRMA.

Harvest strategies make explicit the objectives, performance indicators, reference levels, and harvest control rules for each defined ecological asset taken into consideration by the Department when preparing advice for the Minister for Fisheries. They also indicate the scope of management actions required in relation to the status of each resource in order to meet the specific long- and short-term management objectives for the resource and the broader goals of the ESD strategy.

1.1 Review Process

It is recognised that fisheries change over time and that a review period should be built into each harvest strategy to ensure that it remains relevant. This harvest strategy will remain in place for a period of five (5) years, after which time it will be fully reviewed; however, given that this is the first harvest strategy for this resource, this document may be subject to further review and amended as appropriate within the five year period.

2 SCOPE

This harvest strategy has been developed for the west coast deep sea crustacean resources of Western Australia. It relates primarily to the crystal crab (*Chaceon albus*), giant crab (*Pseudocarcinus gigas*) and champagne crab (*Hypothalassia ascerba*) resources in offshore waters north of Augusta (34° 24' S latitude) through to the Northern Territory border and seaward of the 150 m isobath (Figure 1). The West Coast Deep Sea Crustacean Managed Fishery (WCDSCMF) is the only fishery that targets deep sea crustaceans in this region.



Figure 1. Location and boundaries of the West Coast Deep Sea Crustacean Managed Fishery and specified Port Areas

This strategy has been developed in line with the Department's over-arching *Harvest Strategy Policy for Aquatic Resources* (Department of Fisheries in press) and relevant national policies / strategies (ESD Steering Committee 1992) and guidelines (e.g. Sloan et al. 2014). In addition to considering fishing impacts on the target species (i.e. crystal crab), it also considers retained non-target species (giant and champagne crab), bycatch¹, endangered, threatened and protected (ETP) species, habitats and other ecological components to ensure the risks to these elements are managed effectively.

This strategy also sets out and summarises matters relevant to independent third-party certification assessment against the Marine Stewardship Council (MSC) sustainability standard and should be read in conjunction with the MSC full assessment documentation for these resources.

This document has been developed via a consultative process with industry members and has been approved by the Director General of the Department of Fisheries and the Minister for Fisheries.

2.1 Environmental Context

The boundaries of the WCDSCMF are from the 150 m isobath to the edge of the Australian Exclusive Economic Zone, but most fishing is concentrated on the continental slope between depths of 500 to 800 m (How and Nardi 2014). The continental slope is dominated by sand and mud substrates and is too deep for photosynthetic organisms such as seagrasses and algae due to light limitations (Australian State of the Environment Committee [ASEC] 2001). Sediments at depths greater than 300 m are mostly mud, with macrobenthic fauna decreasing with increasing depth (Levings et al. 2001). The dominant large animals that are likely to live in the sediment and mud are marine worms, crustaceans, echinoderms (e.g. sea urchins) and shellfish. The epifauna include hydroids, sea-pens, small bryozoans and sponges (ASEC 2001). The deep sea environment has relatively stable conditions and factors such as temperature changes and the strength of the Leeuwin Current are not thought to have a major influence on the aquatic resources.

2.2 Target Species – Crystal Crab

The primary target species of the WCDSCMF is crystal crab, a large (> 180 mm carapace width [CW]) Geryoniidae crab that is found from 300 to 1450 m depths in sand, mud or broken shell habitats. The species was originally thought to be the Pacific congener, *Chaceon*

¹ *Bycatch* is described as the part of the catch which is returned to the sea (usually referred to as non-retained or discarded) either because it has no commercial value or because legislative requirements preclude it being retained.

bicolor, until described as a new species (Davie et al. 2007). It is endemic to Western Australia and distributed from North West Cape to Esperance. Tagging studies indicate crystal crabs are slow-growing and long-lived with a likely maximum age of 25 to 30 years. Preliminary studies indicate that maturity in males is attained at 12 years and legal size at 14 years. There is little evidence of seasonality in the crystal crab reproductive cycle, and spawning occurs year-round (Smith et al. 2004; Melville-Smith et al. 2007).

2.3 Retained (Non-Target) Species

The two key retained non-target species of the WCDSCMF are champagne crab and giant crab, both which are large in size (140 and 270 mm CW, respectively). The champagne crab is endemic to Western Australia and occurs from Kalbarri to Eucla. The giant crab is endemic to southern Australia but is restricted to cooler waters. It is distributed from the Perth Canyon in Western Australia to the central coast of New South Wales. Champagne and giant crabs occur at depths of 90 to 310 m and 18 to 550 m, respectively.

2.4 Fishing Activities

2.4.1 Governance

Deep sea crustaceans off the west coast of Western Australia are targeted solely by the commercial WCDSCMF, which is managed by the Department under the following legislation:

- FRMA (will be replaced by ARMB once enacted);
- *Fish Resources Management Regulations 1995* (FRMR);
- FRMA Part 6 – *West Coast Deep Sea Crustacean Managed Fishery Management Plan 2012*; and
- FRMA Section 7 Exemptions.

Fishers must also comply with the requirements of:

- The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- *Western Australian Marine Act 1982*; and
- *Western Australian Wildlife Conservation Act 1950*.

2.4.2 Commercial Fishing

Interest in the harvest of deep sea crustaceans in Western Australia began in the late 1980s and early 1990s, and by the end of 1993, seven fishers were endorsed to fish the offshore waters of the west coast under an Exemption.

The fishery became an interim managed fishery in 2003, with effort initially allocated over the fishery using spatial zones. Recognising that the fishery was unlikely to support seven

separate fishing operations, a revised interim management plan came into effect in 2008 which introduced a quota system. On 1 January 2013, the 2008 interim management plan was revoked and replaced by the current management plan giving the fishery 'fully-managed' fishery status.

There are currently seven licence holders who have equitable spatial access throughout the fishery area. The only allowable method of fishing is with baited traps, set in lines of up to 200 individual traps per line.

The WCDSCMF is a fully-unitised, quota-managed fishery, with individual units of entitlement indicated on each managed fishery licence. The annual total allowable catch (TAC) for crystal crab is currently set at 140 tonnes, well below maximum catches of 200 tonnes that were caught prior to the introduction of quota in 2008. There is also a combined annual TAC for champagne and giant crabs of 14 tonnes. The champagne and giant crab TAC was initially set up to allow the retention of non-targeted crabs of up to 2 tonne per licence. Utilising transferability of quota units, the TAC for crystal crab is currently being fished by only three vessels, two of which fish within the Gascoyne Coast Bioregion out of Denham and Carnarvon and catch ~ 90 % of the annual TAC. The remaining quota is caught by a single vessel operating in the West Coast Bioregion out of Fremantle.

The TAC for crystal crab has been achieved (i.e. $\geq 90\%$ caught) each year since the introduction of the quota, with catch ranging from 136 to 140 tonnes annually. Catches of champagne crabs have fluctuated between 0 and 6.3 tonnes annually since 2008, with very low catches of giant crab catches (< 1 tonne annually). Effort in the fishery has declined steadily since 2000 as the fishery has transitioned from a developing to a managed fishery. In 2013 nominal effort was 68 807 trap lifts, relative to a historical maximum of $> 200\,000$ trap lifts in the late 1990s.

There are strict restrictions in the management plan as to what species are allowed to be retained or brought on board a fishing vessel, and all other captured species must be released within five minutes of being brought on board or before the next trap is pulled, whichever is first. To date, the only retained species reported in the fishery have been crystal, champagne and giant crabs. Other species caught in the traps and subsequently discarded by fishers include other deep sea crabs (e.g. king, spider and hermit crabs), sea lice (*Bathynomus* sp.), deep water sharks, echinoderms, and octopus. Catches of these species are very low.

The fishery has only had one interaction with an ETP species reported since 1990. This interaction involved a humpback whale (*Megaptera novaeangliae*), which was entangled in a trap line and released unharmed. The use of longlines has reduced the number of vertical lines deployed in the fishery, and the fishery is considered to be a low risk to ETP species along the west coast.

The fishery operates mainly in depths of 500 to 800 m. These deep water benthic habitats are dominated by mud / sand substrates that support a relatively sparse invertebrate community. Solitary coral and sponges are occasionally brought to the surface after being entangled in the

traps, although this is rare. When benthic biota is brought to the surface, it is returned immediately to the water. Most (> 90 %) of current fishing effort is focused in waters off Carnarvon and thus the majority of the WCDSCMF area is not fished.

A large proportion of deep sea crustaceans are exported to overseas markets. Fluctuations in the value of the Australian dollar and other macroeconomic factors can have a major influence on the fishery.

2.4.3 Recreational Fishing

There is currently no known recreational fishery targeting the west coast deep sea crustacean resources.

2.4.4 Customary Fishing

There are no data on the level of customary fishing for the west coast deep sea crustacean resources; however, as these species occurs in offshore waters deeper than 100 m, it is likely to be non-existent.

3 HARVEST STRATEGY

3.1 Harvesting and Management Approach

The harvest strategy for crystal, champagne and giant crabs is based on a *constant catch approach*, which involves harvesting a fixed tonnage from each stock each year. Under this approach, the level of catch remains constant and is not affected by normal levels of recruitment variation. This approach is considered suitable for deep sea crustaceans as they are long-lived, deep-water species with stable recruitment.

In line with this harvesting approach, the WCDSCMF is managed using both input and output controls. Overall effort in the fishery is constrained by a cap on the number of licences / vessels (limited entry) and limits on fishing gear. Spatial closures inshore of the 150 m isobath and in all waters between Point Maud and Tantabiddi (Figure 1) further limit the effective fishing effort. Fishery removals are managed via quota limits on the amount of crystal, champagne and giant crabs that can be retained annually by each licence holder. Class A units confer an entitlement to take an amount (kilograms) of crystal crab, while Class B units confer an entitlement to take an amount (kilograms) of champagne and giant crab.

Fishers are not permitted to retain any berried¹ female crabs or crabs smaller than the minimum legal size limits prescribed in the FRMR. Species restrictions are also in place, which limit the retention of other species such as western rock lobster, scampi and white-tailed bugs.

3.2 Long-Term Objectives

In addition to ensuring the biological sustainability of all captured aquatic resources, this harvest strategy includes broader ecological objectives for each ecosystem component, as well as a social and economic objective for the fishery as a whole. It is important to note that the social and economic objective is applied within the context of ESD.

3.2.1 Ecological Sustainability:

- 1) To maintain spawning stock biomass of the target species (i.e. crystal crabs) at a level where the main factor affecting recruitment is the environment;
- 2) To maintain spawning stock biomass of each retained (non-target) species at a level where the main factor affecting recruitment is the environment;
- 3) To ensure fishing impacts do not result in serious or irreversible harm² to bycatch species populations;
- 4) To ensure fishing impacts do not result in serious or irreversible harm to ETP species populations;
- 5) To ensure the effects of fishing do not result in serious or irreversible harm to habitat structure and function; and
- 6) To ensure the effects of fishing do not result in serious or irreversible harm to ecological processes.

3.2.2 Social and Economic Objective

- 1) To provide flexible opportunities to ensure fishers can maintain or enhance their livelihood, within the constraints of ecological sustainability.

¹ With eggs attached beneath its body.

² Serious or irreversible harm relates to a change caused by the fishery that fundamentally alters the capacity of the component to maintain its function or to recover from the impact.

3.3 Operational Objectives

Long-term management objectives are typically operationalised as short-term (e.g. annual), fishery-specific objectives through one or more performance indicators that can be measured and assessed against pre-defined reference levels so as to ascertain actual performance. Thus, within the context of the long-term objectives provided above, each fishery (commercial and recreational) has operational objectives to maintain each resource / component above the threshold level (and, where relevant, close to the target level), or rebuild the resource if it has fallen below the threshold or the limit levels (see below).

3.4 Performance Indicators, Reference Levels and Control Rules

Suitable indicators have been selected to describe performance of the fishery in relation to each management objective, with a set of reference levels established to separate acceptable from unacceptable performance. Where relevant, these levels include:

- A target level (where you want the indicator to be);
- A threshold level (where you review your position); and
- A limit level (where you do not want the indicator to be).

The associated control rules define what management actions should occur in relation to the value of each indicator compared to the reference levels. The extent of management actions taken (e.g. to reduce catches) will be determined by the extent to which a performance indicator has breached a threshold or limit reference point. Summaries of the management objectives, performance indicators, reference levels and control rules for each component of the fishery are provided in Table 2 and Figure 2. The ability, and timeframe, to implement management changes depends on the legal instrument under which the management measure occurs. Further information on the management measures in place for this fishery is provided in Section 4.

3.4.1 Identifying Performance Indicators and Reference Levels

3.4.1.1 Reference Periods

Different reference periods have been used for setting the reference levels for the assessment of the deep sea crustacean resources and associated ecological assets (Table 1). Note the reference period for most performance measures includes the period leading up to the introduction of the TAC (2003 to 2007) and fishing activities since the introduction of the TAC in 2008. The reference period for the catch of retained non-target crustaceans (giant and champagne crab) is the five years following the introduction of the TAC in 2008.

Table 1. Reference periods used for setting reference levels

Performance Indicator	Reference Period
Standardised catch rate of legally-retainable crystal crabs	2003 – 2012
Standardised catch rate of berried female crystal crabs	2003 – 2012
Standardised catch rate of sublegal crystal crabs	2003 – 2012
Catch of other crustacean species	2008 – 2012
Extent of area fished	2003 – 2012
Fishing effort	2003 – 2012

3.4.1.2 Crystal Crabs

Four performance indicators are used to evaluate the status of the west coast crystal crab resource.

The primary performance indicators for crystal crabs are the annual commercial catch and the mean annual standardised catch rate of legally-retainable crabs. Catch rate for this fishery is estimated as the mean annual catch per traplift (i.e. kg / traplift) across the fishery.

The annual commercial catch is used to assess whether the fishery has been able to achieve the TAC for this species. The TAC is considered to have been achieved if $\geq 90\%$ is caught in any given year. Thus, the target reference levels relate to achieving the TAC, while not achieving the TAC has been set as the threshold level (Table 2). Note, where $< 90\%$ of the TAC is caught, consideration will be given to operational or economic factors which may have affected catch.

The target reference levels associated with the mean annual standardised commercial catch rate of legally-retainable crystal crabs have been identified based on the reference period (see Table 1) and are 1.34 to 2.54 kg / traplift. The upper value of the target range is 1.1 times the mean standardised catch rate during the reference period. The lower value of the target range is the lowest 95 % confidence interval for the standardised catch rate during the reference period; this value has been identified as the threshold level. The limit reference point is defined as the value 20 % below the threshold reference point (i.e. 0.8 times the threshold; Table 2) and is 1.07 kg / traplift.

Note the primary performance indicators are also used to evaluate performance against the social and economic objective for the fishery (see Section 3.4.1.4 below).

Two secondary performance indicators are also used to assess fishery performance in meeting long-term management objectives for crystal crabs. These indicators are the mean annual standardised catch rates of (1) berried female and (2) sublegal sized crystal crabs. These indicators provide information on spawning stock biomass and recruitment levels of crystal crabs, respectively. Threshold levels of 1.74 and 2.57 crabs / traplift, respectively, have been identified as the minimum value of standardised catch rates of berried female and sublegal crystal crab (i.e. the lower boundary of the target range) during the reference period with 95 % certainty. No limit reference levels have been set for these indicators (Table 2).

3.4.1.3 Other Ecological Assets

Other ecological assets incorporated in this harvest strategy include other retained species, bycatch, ETP species, habitats and ecosystem processes.

Where reliable quantitative information is available (e.g. retained species, ETP species and habitat impacts), reference levels have been set based on data from the reference periods defined for each performance indicator (see Table 1).

Champagne and giant crabs are the only two retained (non-target) species caught by the fishery to date. The combined TAC for these two species was set at 14 tonnes at the time the fishery moved to ITQ, however this may need to be reviewed based on what the actual catches have been since moving to a TAC. The threshold catch levels of 6.3 tonnes and 0.8 tonnes, for champagne and giant crabs, respectively, have been identified based on the highest annual catch during the reference period (see Table 1). These levels reflect the recent low catches of both species, well-below the permitted combined TAC, due to a lack of targeting. The limit reference levels have been set at two-times the threshold level (i.e. twice the highest catch reported during the reference period), with the target range set to include any catches below the threshold level (Table 2).

The number of ETP species interactions reported annually in the fishery is used as an indicator of the impacts on ETP species populations. Threshold levels for interactions with ETP species have been set at three individuals per year of any species, noting that only a single interaction with an ETP species has so far been recorded by the fishery (Table 2).

Performance indicators for habitat impacts are the extent of the area fished annually (number of 10 x 10 nm blocks) and annual fishing effort, measured in number of traplifts. Target levels of ≤ 125 blocks and $\leq 169\,043$ traplifts / year have been identified based on the highest levels recorded during the reference period (see Table 1). The limit reference levels have been set as 10 % above the target levels, with threshold ranges set to include fishing area or effort above the target but below the limit levels (Table 2).

Where reliable quantitative information is lacking, reference levels for performance indicators have been set to differentiate acceptable fishery impacts (target levels) from unacceptable fishery impacts (limit levels) according to the risk levels defined in Fletcher (2014). Risk assessment outcomes are also used in a weight-of-evidence approach to support each of the assets considered within this harvest strategy.

3.4.1.4 Social and Economic Objective

In line with the Harvest Strategy Policy and the principles of ESD, this harvest strategy also includes a social and economic objective and a performance indicator for the fishery. This objective relates to the provision of flexible fishing opportunities to ensure commercial fishers can maintain / enhance their livelihood. It is important to note that management actions relating to this objective are applied within the constraints of ecological sustainability.

The performance indicator for this objective looks at whether fisheries management arrangements impose constraints, for reasons other than ecological sustainability, on access to livelihood opportunities. The main way this is achieved is by providing fishers the opportunity to increase the TAC by up to 10 % annually, subject to targets for ecological objectives being met or exceeded (Table 2).

It is important to note that fisheries managers cannot always address the causes of constraints on access to fishing activities, as these may be due to environmental or other factors, or may compromise ecological sustainability.

Table 2. Summary of the harvest strategy for the West Coast Deep Sea Crustacean Managed Fishery. Note the reference levels essentially prescribe the operational objective which is to maintain each resource above the threshold level. ** Where < 90 % of the TAC is caught, consideration will be given to operational or economic factors which may have affected catch.

Component	Management Objectives	Resource/Asset	Performance Indicators	Reference Levels	Control Rules
Ecological					
Target species	To maintain spawning stock biomass of the target species at a level where the main factor affecting recruitment is the environment.	Crystal crabs	<p>Primary</p> <ol style="list-style-type: none"> 1. Annual commercial catch of crystal crab. 2. Standardised commercial catch rate of legally-retainable crystal crab. <p>Secondary</p> <ol style="list-style-type: none"> 3. Standardised commercial catch rate of sublegal crystal crab. 4. Standardised commercial catch rate of berried female crystal crab. 	<p>Target: TAC is achieved ($\geq 90\%$ caught);</p> <p>Catch rate of legally-retainable crabs is ≥ 1.34 and < 2.54 kg / traplift; and</p> <p>Catch rates of sublegal crabs <u>and</u> berried females are ≥ 2.57 and 1.74 crabs / traplift, respectively</p> <p>Threshold: TAC is not achieved ($< 90\%$ caught);</p> <p>Catch rate of legally-retainable crabs is ≥ 1.07 and < 1.34 kg / traplift ; or</p> <p>Catch rate of sublegal crabs <u>or</u> berried females is < 2.57 and 1.74 crabs / traplift, respectively</p> <p>Limit: Standardised commercial catch rate of legally-retainable crabs is < 1.07 kg / traplift</p>	<p>No management action required.</p> <p>If $\geq 90\%$ of the TAC is caught <u>and</u> the catch rate of legally-retainable crabs is within or above the target range, <u>but</u> catch rates of either sublegal or berried female crabs <u>are not</u>, a review is triggered to assess causes of variation and appropriate management response initiated.</p> <p>If $< 90\%$ of the TAC is caught <u>** or</u> the catch rate of legally-retainable crabs is below the threshold (but above the limit) <u>and</u> catch rates of both sublegal and berried female crabs are <u>above</u> the threshold, the TAC will be reduced by up to 20%.</p> <p>If $< 90\%$ of the TAC is caught <u>** or</u> the catch rate of legally-retainable crabs is below the threshold (but above the limit) <u>and</u> catch rates of either sublegal or berried female crabs is <u>below</u> the threshold, the TAC will be reduced by $20 - 50\%$.</p> <p>The TAC will be reduced by $50 - 100\%$.</p>

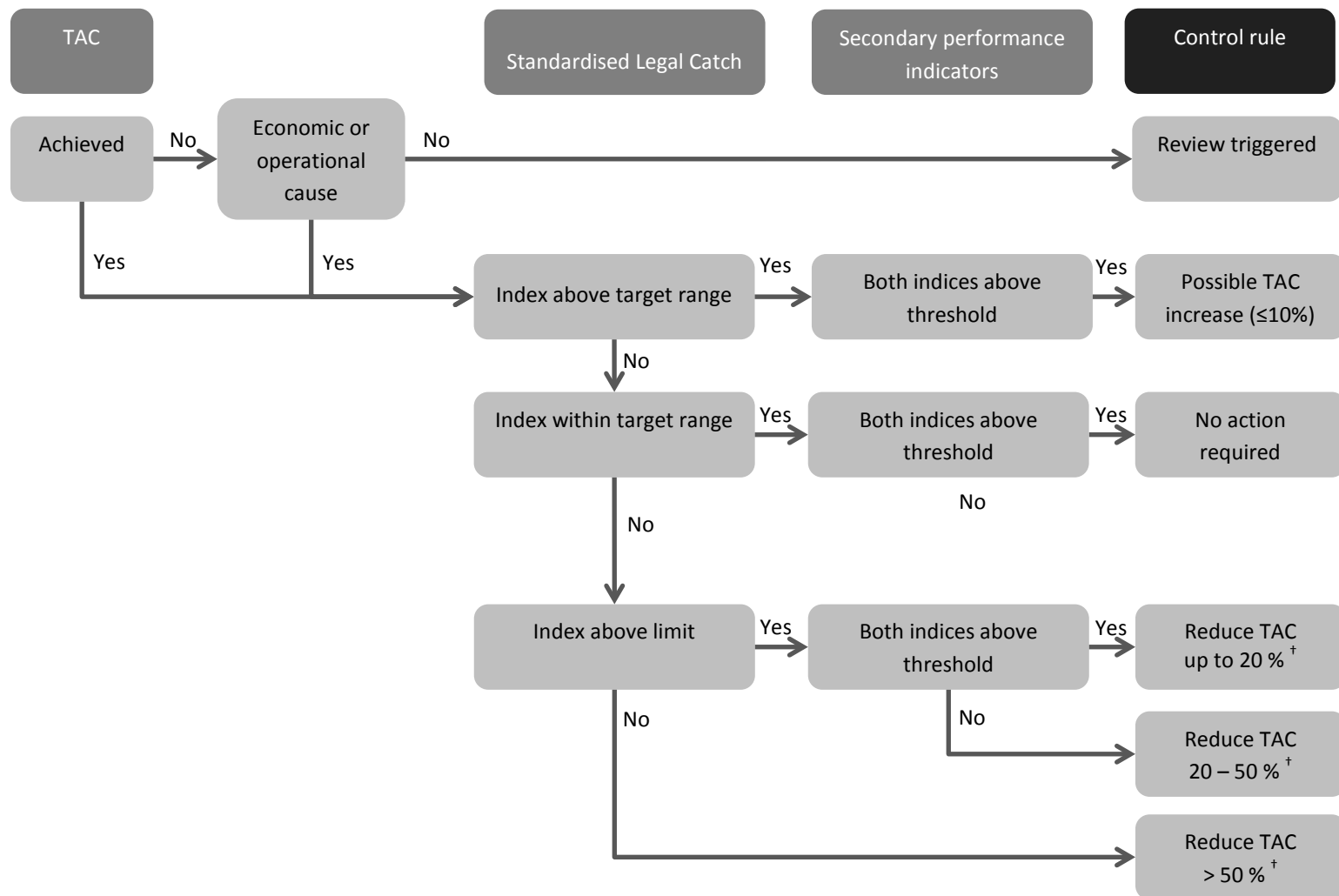
Retained (non-target) species	To maintain spawning stock biomass of each retained species at a level where the main factor affecting recruitment is the environment.	All other retained crustacean species	1. Annual commercial catch of each species.	<p>Target: The catch of champagne crab is ≤ 6.3 tonnes; and The catch of giant crab is ≤ 0.8 tonnes.</p> <p>Threshold: The catch of champagne crab is > 6.3 and ≤ 12.6 tonnes; or The catch of giant crab is > 0.8 and ≤ 1.6 tonnes.</p> <p>Limit: The catch of champagne crabs is > 12.6 tonnes; or The catch of giant crabs is > 1.6 tonnes.</p>	<p>No management action required.</p> <p>A review is triggered to investigate the reasons for the variation. Appropriate management action will be taken to return indicator(s) to the target level(s).</p> <p>Appropriate management action will be taken to return indicator(s) to the target level(s).</p>
Bycatch (non-ETP) species	To ensure fishing impacts do not result in serious or irreversible harm to bycatch species populations.	All (non-ETP) bycatch species	<p>1. Periodic risk assessments:</p> <ul style="list-style-type: none"> • Current management arrangements; and • Catch rates of each species from observer monitoring. 	<p>Target: Fishing impacts are considered to generate an acceptable level of risk to all bycatch species' populations, i.e. moderate risk or lower.</p> <p>Threshold: Fishing impacts are considered to generate an undesirable level of risk to any bycatch species' populations, i.e. high risk.</p> <p>Limit: Fishing impacts are considered to generate an unacceptable level of risk to any bycatch species' populations, i.e. severe risk.</p>	<p>No management action required.</p> <p>A review is triggered to investigate the reasons for the increased risk. Appropriate management action will be taken to reduce the risk to an acceptable level.</p> <p>Appropriate management action will be taken to reduce the risk to an acceptable level.</p>
Endangered, threatened and protected (ETP) species	To ensure fishing impacts do not result in serious or irreversible harm to endangered, threatened and protected (ETP)	All ETP species	<p>1. Number of interactions with ETP species annually</p> <p>2. Periodic risk assessments:</p> <ul style="list-style-type: none"> • Current management arrangements; and 	<p>Target: ≤ 3 interactions with any particular ETP species in a year; and</p> <p>Fishing impacts are considered to generate an acceptable level of risk to all ETP species' populations, i.e. moderate risk or lower.</p>	No management action required.

	species populations.		<ul style="list-style-type: none"> Fishing methods (e.g. number of lines in the water). 	<p>Threshold: > 3 interactions with any particular ETP species in a year; or Fishing impacts are considered to generate an undesirable level of risk to any ETP species' populations, i.e. high risk.</p> <p>Limit: Fishing impacts are considered to generate an unacceptable level of risk to any ETP species' populations, i.e. severe risk.</p>	<p>A review is triggered to investigate the reasons for the variation. Appropriate management action will be taken to return indicator(s) to the target level(s).</p> <p>Appropriate management action will be taken to reduce the risk to an acceptable level.</p>
Habitats	To ensure the effects of fishing do not result in serious or irreversible harm to habitat structure and function.	Benthic habitats	<ol style="list-style-type: none"> Extent of area fished annually. Annual fishing effort (number of trap lifts). 	<p>Target: The area fished is ≤ 125 blocks; and Fishing effort is $\leq 169\,000$ trap lifts.</p> <p>Threshold: The area fished is > 125 blocks and ≤ 138 blocks; or Fishing effort is $> 169\,000$ trap lifts and $\leq 186\,000$ trap lifts.</p> <p>Limit: The area fished is > 138 blocks; or Fishing effort is $> 186\,000$ trap lifts.</p>	<p>No management action required.</p> <p>A review is triggered to investigate the reasons for the variation. Appropriate management action will be taken to return indicator(s) to the target level(s).</p> <p>Appropriate management action will be taken to return indicator(s) to the target level(s).</p>
Ecosystem	To ensure the effects of fishing do not result in serious or irreversible harm to ecological processes.	Deep sea ecosystem	<ol style="list-style-type: none"> Periodic risk assessments: <ul style="list-style-type: none"> Current management arrangements; Annual catch of all retained and bycatch species; Bait usage; Number of interactions 	<p>Target: Fishing impacts are considered to generate an acceptable level of risk to ecological processes within the ecosystem, i.e. moderate risk or lower; and Fishing impacts on each ecological resource / asset impacts are considered to generate an acceptable level of risk, i.e. moderate risk or lower.</p>	No management action required.

			<p>with ETP species annually;</p> <ul style="list-style-type: none"> • Extent of area fished annually (blocks); and • Annual fishing effort (trap lifts). 	<p>Threshold: Fishing impacts are considered to generate an undesirable level of risk to any ecological processes within the estuary, i.e. high risk.</p> <p>Limit: Fishing impacts are considered to generate an unacceptable level of risk to any ecological processes within the ecosystem, i.e. severe risk; or</p> <p>Fishing impacts are considered to generate an unacceptable level of risk, i.e. severe risk, to the majority of ecological resources / assets within the ecosystem.</p>	<p>A review is triggered to investigate the reasons for the increased risk. Appropriate management action will be taken to reduce the risk to an acceptable level.</p> <p>Appropriate management action will be taken to reduce the risk to an acceptable level.</p>
Social and Economic					
WCDSCMF	To provide flexible opportunities to ensure fishers can maintain or enhance their livelihood, within the constraints of ecological sustainability.	All retained species	<p>1. Constraints on access to livelihood opportunities imposed by fisheries management</p> <ul style="list-style-type: none"> • Annual commercial catch of crystal crab; and • Standardised commercial catch rate of legally-retainable, sublegal and berried female crystal crabs. 	<p>Target: Provide the option to increase the TAC subject to the following ecological conditions being met:</p> <ul style="list-style-type: none"> • Current TAC achieved ($\geq 90\%$ caught); • Catch rate of legally-retainable crabs is ≥ 2.54 kg / traplift; and • Catch rates of sublegal <u>and</u> berried female crabs are ≥ 2.57 and 1.74 crabs / traplift <p>Threshold: Fisheries management actions are constraining access to livelihood opportunities for reasons other than ecological sustainability.</p>	<p>If fisheries management actions are not constraining livelihood opportunities, no management action is required. The main way this is achieved is by providing fishers the option to increase the TAC. If $\geq 90\%$ of the TAC is caught <u>and</u> standardised commercial catch rate of legally-retainable crabs is <u>above</u> the target range <u>and</u> standardised commercial catch rates of sublegal and berried female crabs is \geq Threshold, proposals from industry to increase quota in any one season by a maximum of 10 % will be considered.</p> <p>Review reasons for any constraints identified.</p>

Limit: Fisheries management actions are constraining access to livelihood opportunities for reasons other than ecological sustainability, for more than two consecutive years.

Where possible, implement management action to address ongoing constraints to livelihood opportunities.



[†] The extent of TAC reduction will be determined by the extent to which the indicator has breached the threshold or limit reference point

Figure 2 Harvest control rule decision tree designed to achieve the ecological objective of maintaining crystal crab spawning stock biomass

3.5 Monitoring and Assessment Procedures

3.5.1 Information and Monitoring

3.5.1.1 Fishery-Dependent Information

3.5.1.1.1 Commercial Catch and Effort Reporting

The catch and effort data required to determine the standardised catch rates for legally-retainable, sublegal and berried female crystal crabs are obtained from monthly catch and effort (CAES) returns, catch disposal records (CDRs) and volunteer logbooks.

There is a statutory obligation for fishers to provide monthly CAES returns to the Department's research division. These forms provide information on the location ($1^{\circ} \times 1^{\circ}$ blocks) of catch for each retained species (to a resolution of 0.1 kg) and associated effort (number of trap lifts). Fishers are also required to report all ETP species interactions on these forms.

With the move to a quota-managed fishery in 2008, a CDR form was introduced that provides a more accurate record of catch for compliance purposes. CDRs include information on the weights of all retained species. Fishers are required to submit a copy of each CDR to the Department's Regional Services Division at the end of each fishing trip. Catches are verified against what is provided by the processors in their written returns to the Department. The 'official' catch is that which is recorded by the processors, not the fishers on landing.

Volunteer daily logbooks are currently being completed for 90 % of the landed catch. These logbooks provide information to the Department on effort, location, depth, soak-time and catches on a line-by-line basis. Catch data is provided for retained and discarded (including sublegal and berried female) crabs. This information is used for stock assessment purposes in catch rate standardisation models.

3.5.1.1.2 Commercial (Observer) Monitoring

On-board monitoring and tagging have been conducted by the Department at least four times each year since 2000. During these trips, every second trap pulled is sampled, and research staff make detailed records of the target species catch (both retained and discarded) and all bycatch, as well as environmental conditions and information on fishing activity. This information is used to validate data collected as part of the volunteer logbook program.

3.5.2 Assessing Fishery Impacts

3.5.2.1 Crystal Crabs

The crystal crab resource is assessed annually using standardised catch rate models that provide indices of abundance of legally-retainable, berried female and sublegal crabs.

3.5.2.1.1 Standardised Commercial Catch Rates

Catch rates are standardised to account for a range of potential influencing variables. The current catch rate standardisation considers six variables: year, month, fishing depth, fishing (soak) time, fishing vessel and latitude. CDRs provide accurate information on catch for the analysis. Effort and other explanatory variables are determined from information recorded in volunteer daily logbooks.

3.5.2.1.2 Commercial Catch

In addition to standardised catch rates, the stock status of crystal crabs is assessed annually through monitoring crystal crab catch relative to the TAC.

3.5.2.2 Risk Assessments

The Department uses a risk-based Ecosystem Based Fisheries Management (EBFM) framework to assess the impacts of fishing on all parts of the marine environment, including the sustainability risks of target species, retained non-target species, bycatch, ETP species, habitats and the ecosystem. This framework has led the development of the periodic risk assessment process for the WCDSCMF, which is used to prioritise research, data collection, monitoring needs and management actions for this fishery and to ensure that fishing activities are managed both sustainably and efficiently.

An initial internal risk assessment took place for this fishery in 2002. As part of this process, the issues that needed to be addressed of the WCDSCMF were determined through an external workshop held for the West Coast Rock Lobster Managed Fishery and an internal workshop held for the South Coast Crustacean Fisheries due to the similarities between the three fisheries, i.e. fishing methods, species caught, habitats they operate over and location (Department of Fisheries 2003). The WCDSCMF was considered to be a moderate risk to crystal crab stocks, and a low or negligible risk to all other assets.

In 2014 an internal risk assessment was conducted on target, other retained, bycatch and ETP species for the WCDSCMF using the Productivity Susceptibility Analysis (PSA) methodology. Fifteen retained, bycatch and ETP species or species groups were assessed and the risk posed by the fishery was found to be low for all species.

Risk assessments will be undertaken periodically (every 3 – 5 years) to reassess any current or new issues that may arise in the fishery; however, a risk assessment can also be triggered if there are significant changes identified in fishery operations or management activities or controls that may change current risk levels.

3.5.2.3 Social and Economic Objective

The annual commercial catch and standardised catch rates of crystal crabs in the WCDSCMF are used to assess performance against the social and economic objective.

4 MANAGEMENT MEASURES AND IMPLEMENTATION

4.1 Management Measures

There are a number of management measures in place in the fishery (Table 3), which can be amended as needed to ensure each fishery is achieving the resource objectives. These do not preclude the consideration of other options.

Table 3. Management measures and instrument of implementation for the West Coast Deep Sea Crustacean Managed Fishery

Measure	Description	Instrument
Limited Entry	A limited number (7) of Managed Fishery Licences are permitted to operate in the WCDSCMF.	WCDSCMF Management Plan
Fishery Capacity	The maximum quantity of crystal, champagne and giant crabs that can be removed from the fishery annually is limited by their TAC.	WCDSCMF Management Plan
Allocation of Units	Class A units entitle fishers to retain an amount (kg) of crystal crabs; Class B units entitle fishers to retain an amount (kg) of champagne and / or giant crabs.	WCDSCMF Management Plan
Spatial Closures	Fishers are not permitted to fish landward of the 150 m isobath.	WCDSCMF Management Plan
Gear Controls	Fishers are only permitted to use fish traps with an internal volume less than 0.257 ³ and two escape gaps	WCDSCMF Management Plan
Condition and Size Limits	The legal minimum size limits in place for crystal, champagne and giant crabs is greater than the size at maturity for both males and females. Female crabs that are actively breeding ('berried') are required to be returned to the sea.	FRMR
Species Restrictions	Fishers are not permitted to retain rock lobster or finfish throughout the entire fishery area or scampi or white tailed bug east of 126° 58' E	WCDSCMF Management Plan
Reporting	All fishers are required to provide CAES returns to the Department's research branch.	FRMR
	All fishers are required to provide CDR forms to the Department within 48 hours of landing catch.	WCDSCMF Management Plan
Specification of Port Areas and Approved Fish Processors	All catches must be unloaded at approved port areas.	WCDSCMF Management Plan
	All catches must be sold or transferred to an approved fish processor.	WCDSCMF Management Plan / WCDSCMF Notice of Approved Processors

4.2 Implementing Changes to the Management Arrangements

Decision-making processes can also be triggered following the identification of new or potential issues as part of an ecological risk assessment (generally reviewed every 3 – 5 years), results of research, management or compliance projects or investigations, monitoring or assessment outcomes (including those assessed as part of the Harvest Strategy) and / or expert workshops and peer review of aspects of research and management.

There are two main processes for making decisions about the implementation of management measures and strategies in the WCDSCMF:

- Annual decision-making processes that may result in measures to meet the operational fishery objectives (driven by the control rules); and
- Longer-term decision-making processes that result in new measures and / or strategies to achieve the long-term fishery objectives (i.e. changes to the management system).

However, if there is an urgent issue, stakeholder meetings may be called to discuss the issue and determine appropriate management action, as needed.

4.2.1 Consultation

Management changes are generally given effect through amendments to legislation, such as the commercial fishery management plan, regulations and orders. These changes generally require the approval of the Minister for Fisheries. In making decisions relevant to fisheries, the Minister for Fisheries may choose to receive advice from any source, but has indicated that:

- 1) The Department is the primary source of management advice; and
- 2) Peak Bodies (Western Australian Fishing Industry Council [WAFIC] and Recfishwest) are the primary source of industry advice and representation.

The peak bodies are funded by Government under Service Level Agreements (SLA) to undertake their representation / advisory and consultation roles.

4.2.1.1 Commercial Sector Consultation

Under its SLA with the Department, WAFIC has been funded to undertake statutory consultation functions related to fisheries management plans and the facilitation of annual management meetings for licensed fisheries.

The FRMA requires the Minister to consult with affected parties when changes to a Part 6 management plan are being considered. In the case of the WCDSCMF, this includes all licence holders. Annual Management Meetings (AMMs) between the Department, WAFIC and licence holders are used as the main forum to consult with stakeholders and licence holders on the management of the fishery. During these meetings, current and future management issues that may have arisen during the previous fishing season, and any

proposed changes to the management plan, are discussed. Follow-up meetings may be held as required.

4.2.1.2 Consultation with Other Groups

Consultation with the public, other Government agencies, marine users, Native Title parties and NGOs is undertaken by the Department on an as needs basis.

4.3 Compliance and Enforcement

The primary objective of the Department regarding compliance is to encourage voluntary compliance through education, awareness and consultation activities.

4.3.1 Operational Compliance Plan

Management arrangements are enforced under the combined Operational Compliance Plan (OCP) for minor commercial fisheries in the Midwest region of Western Australia. The OCP is informed and underpinned by compliance risk assessments conducted for each fishery. Annual planning meetings are held for OCPs, with regular specific planning of day-to-day targeted and non-targeted patrols linked to the OCP based on resources and competing priorities.

The primary monitoring activity in the WCDSCMF relates to the reporting and validation of crystal, champagne and giant crab catches for quota-monitoring purposes. Other activities undertaken by Fisheries Officers in relation to the WCDSCMF include opportunistic in-port inspections, which may include catch, licence and gear checks.

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