

**SHARK BAY PRAWN MANAGED FISHERY
HARVEST STRATEGY
2014 – 2019
Version 1.0**

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Shark Bay Prawn Managed Fishery harvest strategy 2014 – 2019

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1.0 BACKGROUND

This fishery-specific harvest strategy has been developed in line with the Department of Fisheries' (Department) over-arching *Harvest Strategy Policy for Aquatic Resources* (Department of Fisheries in prep.) and in consultation with licensees. The broad scope of the *Harvest Strategy Policy for Aquatic Resources* is consistent with the National Harvest Strategy Guidelines but as well as considering all retained target species it also incorporates retained non-target species, bycatch¹ and other ecological components to ensure the risks to these elements are managed effectively.

The Shark Bay Prawn Managed Fishery (SBPMF) harvest strategy outlines the long- and short-term fishery-specific management objectives; a description of the performance indicators used to measure performance against these objectives; reference levels for each performance indicator; and associated harvest control rules, which articulate pre-defined, specific management actions designed to maintain each resource at target levels and achieve the management objectives for the fishery. The monitoring and assessment procedures for the collection and analysis of data to underpin the harvest strategy and determine stock status and fishery performance are described.

This document also includes a description of the management measures that have been adopted for the fishery and how the specific operations of the fishery may be adjusted in response to performance against each of the target, threshold and limit reference levels. Consultation and decision making processes, together with compliance measures are also included to ensure stakeholders are provided with a fully transparent description of the key processes that are used to manage the fishery.

2.0 FISHERY DESCRIPTION

The SBPMF is located in Shark Bay, Western Australia. The fishery commenced in 1962 with four boats and increased to 35 boats by 1975. The fleet currently consists of 18 Licensed Fishing Boats using quad-rig demersal otter trawl gear.

The entire fishery covers approximately 41 514 km². The Inner Shark Bay area where fishing occurs is 15 957 km² although the permitted trawl area within Inner Shark Bay is 6 063 km² (i.e. once permanent closures are accounted for). Fishing generally only occurs in 40 – 50% of this permitted trawl area each season, which represents 14 – 18% of the Inner Shark Bay area. The fishing grounds are adjacent to the Shark Bay Marine Park which was gazetted in 1990 and within the Shark Bay World Heritage area which was inscribed in 1991 (refer to Figure 1).

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.

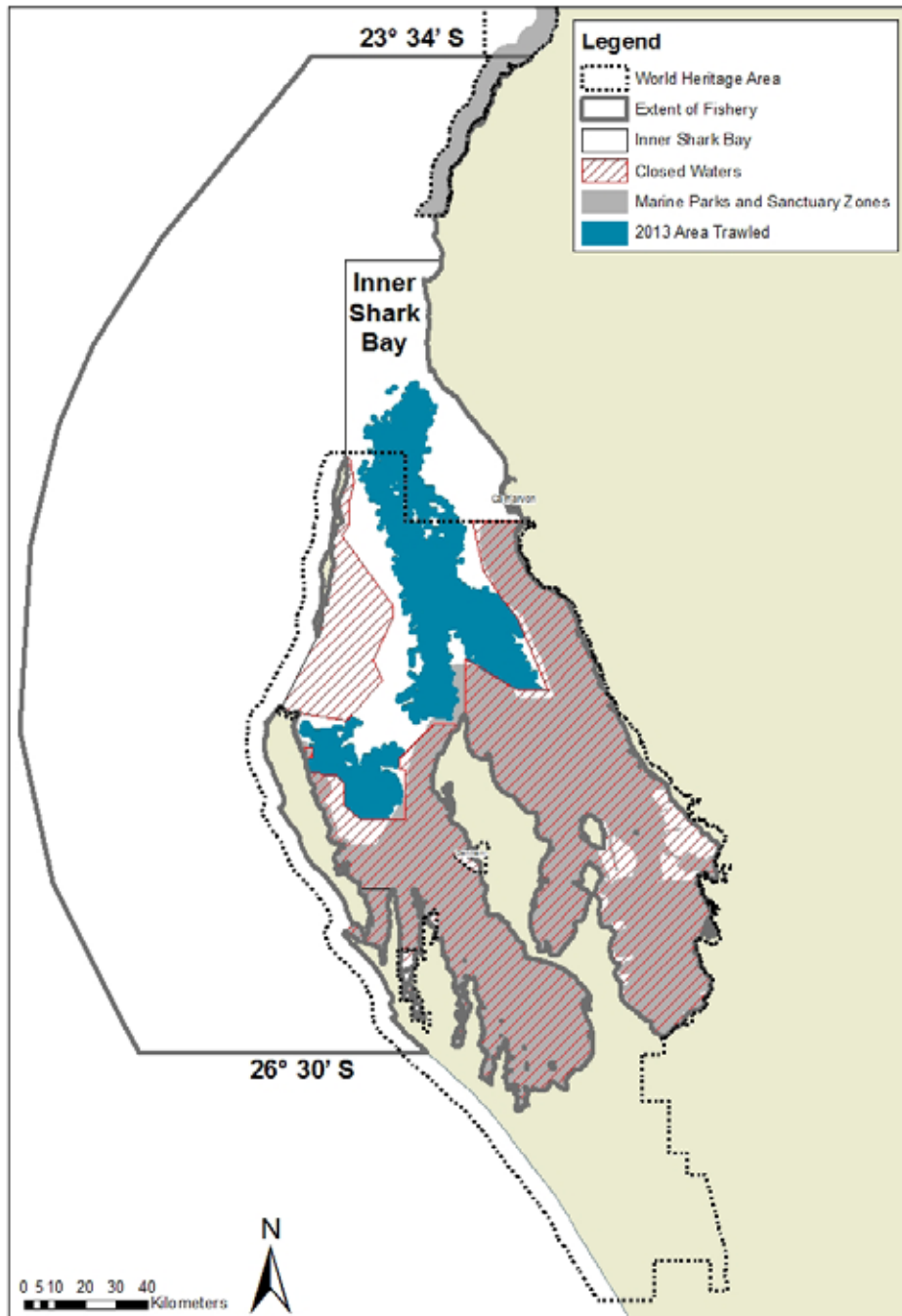


Figure 1. Extent of the entire SBPMF area, the Inner Shark Bay area, the area trawled in 2013, and the Shark Bay Marine Park and World Heritage Area boundaries.

The target species of the SBPMF are brown tiger and western king prawns (*Penaeus esculentus* and *P. latisulcatus*, respectively). These species are short-lived, fast-growing and have variable recruitment, which is primarily environmentally driven. The SBPMF currently has an estimated annual value of more than \$20 million with a target catch range of 1,350 to 2,150 tonnes per annum.

The fishery also retains a variety of smaller prawn species, including endeavour (*Metapenaeus* spp.) and coral prawns (various species but primarily *Metapenaeopsis crassissima*), and other species, such as blue swimmer crabs (*Portunus armatus*), squid, cuttlefish (*Sepia* spp.), bugs (*Thenus* spp.), mixed finfish and octopus. Prawn licensees also hold B Class scallop licences

and retain scallops under a scallop Managed Fishery Licence (as part of the Shark Bay Scallop Managed Fishery) when the scallop season is open.

Bycatch levels for the SBPMF are variable, and bycatch is dominated by mixed finfish and invertebrates (Kangas & Thomson 2004). The fishery also has the potential to interact with several groups of endangered, threatened and protected (ETP) species including marine mammals, marine reptiles, protected fish and elasmobranchs. Bycatch reduction devices (BRDs) consisting of grids and square mesh panels have been mandatory since 2002/03 and, when captured, all bycatch and ETP species are returned to the water as quickly as possible (for more details refer to the *SBPMF Bycatch Action Plan 2014 – 2019*).

The SBPMF is subject to an input control management system. Overall effort in the fishery is constrained by a cap on the number of licences / vessels (limited entry), limits on fishing gear (headrope capacity), restrictions on the number of available fishing days each year (seasonal closure) and restricted trawl hours (mainly night-time trawling). Monthly moon closures around each full moon and significant permanent and temporary closed areas throughout the fishery also reduce the effective fishing effort. The total number of days fished per year is generally around 175 days (i.e. less than half the year). Fishing activity is monitored using the Vessel Monitoring System (VMS).

The SBPMF has been assessed and accredited under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (Parts 13 & 13A) since 2003 and will be re-assessed in 2018. The fishery is also currently pursuing third party certification against the Marine Stewardship Council's (MSC) standards to demonstrate the high standards maintained with respect to sustainability.

3.0 GOVERNING LEGISLATION

The fishery is managed by the Department under the following legislation:

- *Fish Resources Management Act 1994* (FRMA)
- *Fish Resources Management Regulations 1995* (FRMR)
- *Shark Bay Prawn Managed Fishery Management Plan 1993* (SBPMF Management Plan)
- Managed Fishery Licence conditions
- Section 43 Order - *Prohibition on Commercial Fishing (Shark Bay Marine Park) Order 2004*
- FRMA Section 7(2) Instruments of Exemption
- *Environment Protection and Biodiversity Conservation Act 1999* (Export Exemption)

4.0 HARVEST STRATEGY

4.1 Fishery Management Objectives

In addition to ensuring the biological sustainability of all captured aquatic resources, the SBPMF harvest strategy includes broader ecological and economic objectives. It is important to note that the ecological objectives must be met irrespective of the economic objectives for the fishery.

4.1.1 Long-Term Objectives

The long-term management objectives of the SBPMF are:

Ecological:

- i. To maintain spawning stock biomass of each target species at a level where the main factor affecting recruitment is the environment;
- ii. To maintain spawning stock biomass of each retained non-target species at a level where the main factor affecting recruitment is the environment;
- iii. To ensure fishery impacts do not result in serious or irreversible harm to bycatch species populations;
- iv. To ensure fishery impacts do not result in serious or irreversible harm to endangered, threatened and protected (ETP) species populations;
- v. To ensure the effects of fishing do not result in serious or irreversible harm to habitat structure and function ; and
- vi. To ensure the effects of fishing do not result in serious or irreversible harm to ecological processes.

Economic:

- i. To provide industry the opportunity to optimise the economic returns generated by the SBPMF within a sustainable fishery framework.

4.1.2 Short-Term Objectives

The short-term operational objectives are to maintain each resource above the threshold level (and, where relevant, close to a target) or rebuild the resource if it has fallen below the threshold (undesirable) or the limit (unacceptable) levels (see Table 1).

4.2 Harvesting and Management Approach

The SBPMF is managed based on a constant escapement harvesting approach.

The management activities related to this approach have been developed over time based on a comprehensive understanding of the biology of western king and brown tiger prawns in Shark Bay, with the annual cycle of operation depending on the strength and timing of prawn recruitment.

The fishing season is generally open from March through November each year, with specific opening and closing dates set according to the lunar phase. During the initial fishing period, there is a large area closure inside the Carnarvon Peron Line (CPL) to avoid the harvest of small-size prawns and to provide protection of brown tiger prawns prior to their spawning period. The remainder of the season consists of a series of rolling openings and closures of defined fishing areas (Figure 2) within the fishery. Some of the areas within the CPL are closed at (approximately) the same times each year to protect brown tiger and western king prawn breeding stocks. Fishery-independent spawning stock surveys are conducted in June, August and September, collecting data that are used to inform the potential (re-)opening of fishery areas, as well as to assess annual fishery performance. An overview of the general annual operations in the SBPMF is provided at Appendix 1, and a detailed description of the 2014 season arrangements is provided at Appendix 2.

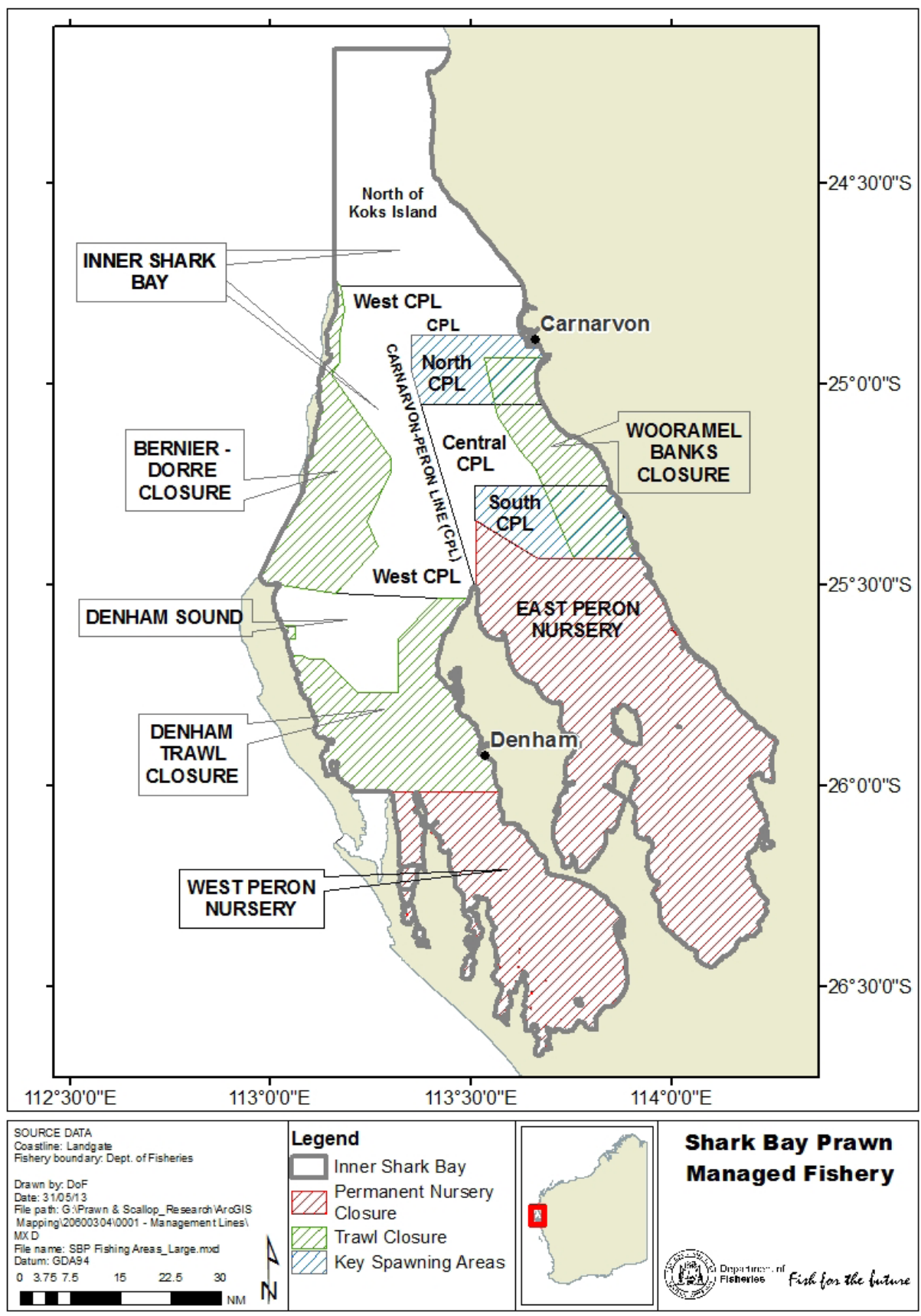


Figure 2. Fishing areas within the Shark Bay Prawn Managed Fishery.

4.3 Performance Indicators, Reference Points and Control Rules

Suitable indicators (e.g. catch rate, catch levels, percent of area trawled) 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 don't want the indicator to be).

The associated control rules define what management actions should occur in relation to the performance indicator being at the limit, threshold or target levels. A summary of the management objectives, performance indicators, reference levels and control rules for each component of the fishery are provided in Table 1.

For retained non-target species, the acceptable catch ranges have been set to reflect the historical catches of these species as follows:

- Minor prawn species (i.e. coral prawns): annual acceptable catch levels based on historical catches during the period 1989 – 1998 (represents a period of stable fishing patterns, management and environmental conditions);
- Blue swimmer crabs: as per the Shark Bay blue swimmer crab resource annual TACC; and
- All other retained non-target species: annual acceptable retention levels based on historical landings during the period 1990 – 2010 (as these species are not targeted to set acceptable levels, time period was set to encompass fluctuations in catches for these species). Note that retention levels for finfish species have only been identified for the current most-commonly retained species groups, i.e. whiting, flathead, mullet and flounder, and these acceptable retention levels are still being developed. Industry has indicated that retention of non-target retained catch may increase in coming seasons as part of its commitment to minimising bycatch discards.

The habitat performance indicators relate to the extent of the area trawled within Inner Shark Bay. The Inner Shark Bay area includes a number of sensitive habitats, which are managed as part of the Shark Bay Marine Park and Shark Bay World Heritage Area. The majority of trawling has historically occurred in this area, providing reliable estimates of the extent of fishing activities from which to base a target reference level.

Noting the ongoing closure of the commercial scallop trawl fishery and that scallops are a target species under the Shark Bay Scallop Managed Fishery when it is open, scallops are treated in Table 1 as a bycatch species in the SBPMF. A Shark Bay Scallop Recovery Plan is being developed to ensure that the recovery of the scallop stock is not hampered by fishing activity by the SBPMF fleet.

Table 1.

Summary of the Shark Bay Prawn Managed Fishery Harvest Strategy. Note that the ecological objectives are separated into (i) stocks of target species, (ii) stocks of retained non-target species, (iii) bycatch (non-ETP species), (iv) endangered, threatened or protected (ETP) species, (v) habitat and (vi) ecosystem. Note the reference levels essentially prescribe the operational objective which is to maintain each resource above the threshold level. * indicates decisions made prior to season opening and provided to fishers as part of annual season arrangements. Note that the actual starting date can be either March or April. If the latter, then opening/closing in subsequent months may be rescheduled, subject to survey results, commercial catch rates and species biology.

Component	Management Objectives	Species	Performance Indicators	Reference Levels	Control Rules
In-season Operations					
Target Species	Ecological: To maintain spawning stock biomass of each target species at a level where the main factor affecting recruitment is the environment.	Brown tiger & western king prawns	Feb/March lunar phase	After late Feb or March full moon phase. Depending on inter-annual variability in moon phases, fishing may start in 1 st week of March.	Fishing season opens and fishing permitted in area outside CPL and north of Denham Sound.
			Season Opening*		
			Commencement of fishing in all areas east of the CPL	Catch rates of western king and brown tiger prawns from recruitment surveys in areas east of the CPL Target: Mean catch rate of each species is ≥ 25 kg/hr. Threshold: Mean catch rate of either species is < 25 kg/hr and > 15 kg/hr. Limit: Mean catch rate of either species is 15 kg/hr.	If the target level is met, area opens to fishing. Review options for modifying the spatial or temporal extent of fishing operations within the area. If the catch rate of either species is below the limit, the area remains closed to fishing and a review is triggered to investigate the reasons for the low catch rate.
			North CPL (formerly TPSA) Closure*	June lunar phase	Start of June moon closure. North CPL key spawning area (formerly TPSA) closed to fishing; may be re-opened following September spawning stock survey (see North CPL Re-opening rules below).
			South CPL (formerly ENA) Closure*	August lunar phase	Start of August moon closure. South CPL key spawning area (formerly ENA) closed to fishing.

Component	Management Objectives	Species	Performance Indicators	Reference Levels	Control Rules
			Final fishing period		North CPL (TPSA) re-opens to fishing on the third quarter moon phase of the final fishing period each year.
			August lunar phase	July /August.	Denham Sound area (excluding Denham Trawl Closure) opens to fishing.
			Catch rates of western king and brown tiger prawns and snapper (number of snapper per trawl hour) in fishery-independent stock surveys	Combined catch rates of both prawn species is ≥ 50 kg/hr AND pink snapper numbers at acceptable levels (< 200 snapper per trawl hour).	Partial opening of the Denham Trawl Closure by Notice for a fishing period of 10 days.
			Number of total available fishing nights since the season opening date	Season has been open for a maximum of 175 fishing nights depending on other performance indicators.	Fishing season closes.

Component	Management Objectives	Species	Performance Indicators	Reference Levels	Control Rules
Annual Operations					
Target Species	Ecological: To maintain spawning stock biomass of each target species at a level where the main factor affecting recruitment is the environment.	Brown tiger & western king prawns	Catch rate of brown tiger and western king prawns from spawning stock surveys	Target: Mean catch rate of each species is ≥ 25 kg/hr. Threshold: Mean catch rate of <u>either</u> species is ≤ 25 and > 10 kg/hr. Limit: Mean catch rate of <u>either</u> species is 10 kg/hr.	If the target level is met, no change to season management arrangements required for the following season. A review of season arrangements and monitoring system is triggered to investigate the reasons for the variation, which may trigger changes to the arrangements for the following season if sustainability is considered to be at risk. If the catch rate of either species is at or below the limit, a comprehensive review of the fleet's spatial fishing pattern and catch rates are undertaken to investigate the reasons for the low catch rate in the monitored spawning areas. This will either trigger management actions to limit fishing on that species for the following season if sustainability is considered to be at risk or a change to the monitoring system if it is considered to be inaccurate.
Retained non-target species	Ecological: To maintain spawning stock biomass of each retained species at a level where the main factor affecting recruitment is the environment.	Minor prawn species (i.e. coral prawns)	Annual commercial retention of coral prawns	Target: The annual commercial retention of coral prawns is < 280 t. Threshold: The annual commercial retention of coral prawns is above the target level for two consecutive years. Limit: The annual commercial retention of coral prawns is above than the target level for three consecutive years with no non-stock related reason identified for this variation as part of the threshold review.	No changes to management arrangements required unless this level is exceeded. A review is triggered to investigate the reasons for the variation, which may trigger changes to management arrangements for the following season if sustainability is considered to be at risk. Management strategies to further protect the breeding stock will be investigated and further management may be initiated.

Component	Management Objectives	Species	Performance Indicators	Reference Levels	Control Rules
	Blue swimmer crabs ²	Blue swimmer crabs ²	Annual commercial retention of blue swimmer crabs	<p>Target: The annual commercial retention is 90 – 100% of the SBPMF's share of the annual blue swimmer crab TACC.</p> <p>Threshold: The annual commercial retention is 75% or greater than 120% of the SBPMF's share of the annual blue swimmer crab TACC.</p> <p>Limit: The annual commercial retention is 50% of the SBPMF's share of the annual blue swimmer crab TACC with no non-stock related reason identified.</p>	<p>No management action required unless threshold level is met.</p> <p>A review is triggered to assess why TACC has not been achieved.</p> <p>Management strategies to further protect the breeding stock will be investigated and may be initiated.</p>
	All other retained non-target species	All other retained non-target species	Annual commercial retention of each species	<p>Target: The annual commercial retention of each species is:</p> <p>Bugs: ≤ 15 t</p> <p>Cuttlefish: ≤ 30 t</p> <p>Octopus: ≤ 5 t</p> <p>Squid: ≤ 80 t</p> <p>Endeavour prawns: ≤ 30 t</p> <p>All other prawn species: ≤ 5 t</p> <p>³ Whiting: ≤ 15 t</p> <p>³ Flathead: ≤ 15 t</p> <p>³ Mulloway: ≤ 15 t</p> <p>³ Flounder: ≤ 15 t.</p> <p>Threshold: The annual commercial retention of any species is > 25% above the target level for three consecutive years.</p> <p>Limit: The annual commercial retention of any species is > 50% above the target level for two consecutive years.</p>	<p>No management action required unless threshold level is met.</p> <p>A review is triggered to investigate the reasons for the variation, which may trigger additional assessment of the risks to sustainability.</p> <p>An assessment of the risks to the relevant species will be undertaken, which may trigger additional management actions for the following season if sustainability is considered to be at risk.</p>

² Development and setting of annual TACC undertaken as part of the Shark Bay Blue Swimmer Crab Fishery.

³ Target catch for these species currently under development, with proposed level based on most recent catches.

Component	Management Objectives	Species	Performance Indicators	Reference Levels	Control Rules
Habitat	<p>Ecological: To ensure the effects of fishing do not result in serious or irreversible harm to habitat structure and function.</p>	All habitats within Shark Bay	<ol style="list-style-type: none"> 1. Extent of area trawled annually 2. Periodic Risk Assessments 3. Annual management arrangements in place 	<p>Target: The total area trawled is < 20% of Inner Shark Bay (both permitted and closed areas).</p> <p>Threshold: There is an increase in the level of risk to sensitive habitat types from fishery activities.</p> <p>Limit: Extent of trawling exceeds 20% of Inner Shark Bay (both permitted and closed areas); or Fishery impacts on sensitive habitat types are now at an unacceptable risk level (i.e. high risk or above).</p>	<p>No management action required unless threshold level is met.</p> <p>A review is triggered to investigate the reasons for the variation and any appropriate management actions.</p> <p>Appropriate management strategies to reduce the area trawled or the risk level will be investigated and may be initiated.</p>
Ecosystem	<p>Ecological: To ensure the effects of fishing do not result in serious or irreversible harm to ecosystem processes.</p>	All species and habitats within Shark Bay	<ol style="list-style-type: none"> 1. Periodic Risk Assessments 2. Annual management arrangements in place 3. Extent of area trawled annually 4. Annual catch of all retained species (To be updated as more data becomes available following activities outlined in the SBPMF Bycatch Action Plan) 	<p>Target: Fishery impacts on components (target species, bycatch species, ETP species and habitats) are all maintained at acceptable levels.</p> <p>Threshold: More than one component is not at an acceptable state due to fishing impacts.</p> <p>Limit: Most of the components are at unacceptable levels due to fishing, and the ecosystem now has an unacceptable risk level (i.e. high risk or above).</p>	<p>If target level is met, no management action required.</p> <p>A review of the risk levels is completed</p> <p>Appropriate management strategies to reduce the risk will be investigated and may be initiated.</p>
Target and non-target retained species	<p>Economic: To provide industry the opportunity to optimise the economic returns generated by the SBPMF within a sustainable fishery framework.</p>	All retained species	Industry submissions to the Department	<p>Target: No impediments to industry optimising efficiency identified or raised.</p> <p>Threshold: Impediments to industry optimising efficiency identified or raised.</p>	<p>No management action required.</p> <p>Consider proposals from industry to improve their economic efficiency that do not adversely affect meeting the ecological objectives.</p>

4.4 Monitoring and Assessment Procedures

4.4.1 Monitoring

The multi-species nature of this fishery requires the levels of harvest for both western king and brown tiger prawn stocks and a range of other species to be carefully monitored to achieve the overall maximum sustainable catch.

4.4.1.1 Fishery-independent monitoring

Fishery-independent trawl surveys are undertaken in Shark Bay each year to monitor the recruitment and spawning stock levels of brown tiger and western king prawns. Monitoring is carried out by independent personnel, currently Departmental staff, using commercial fishing boats (and to a lesser extent R.V. Naturaliste) with the intention to use the same boat(s) throughout a season for all surveys. These operate under a Service Level Agreement between the Department and the Shark Bay Prawn Trawler Operators' Association (SBPTOA).

The timing of surveys and the sites sampled have been determined based on the understanding of the biology and movement patterns of the brown tiger and western king prawns in Shark Bay, historical fishing patterns, early research surveys and the natural topography of the embayment. However, over the last two or three years tiger prawn spawning stock has been detected in areas within and outside the North CPL spawning area (TPSA). It appears that this may be due to changes in environmental conditions and the survey regime will therefore be reviewed.

At each survey site, the estimated catch of each prawn species is recorded, and a representative sample of brown tiger and/or western king prawns is collected from each trawl to provide information on size composition and sex ratios. During spawning stock surveys (see below), data are also collected on the reproductive stage of female prawns in the survey catch.

Recruitment surveys

The recruitment surveys monitor the annual recruitment of brown tiger and western king prawns to the fishery area. Two fishery-independent recruitment surveys are undertaken in Shark Bay each year, generally in March and April. Each survey includes a number of sites across the main fishing grounds within the CPL. At each survey site, catch rates and size structure information (grades and length frequencies) are collected for both brown tiger and western king prawns. The mean catch rate data for each of the two target species from the surveys are used as indices of recruitment strength and provide an indication of likely catch ranges for the season.

The data collected during these surveys are also used to inform the timing of the rolling openings of the defined areas within the CPL (e.g. North CPL (TPSA) and South CPL (ENA) spawning areas) for the fishing season.

Following the two recruitment surveys in March and April, if targets are not reached for east of the CPL, an additional independent survey may be undertaken to determine if a portion of the closed area (east of CPL) can be re-opened based on prawn size to allow industry to maximise economic returns.

Spawning stock surveys

The spawning stock surveys monitor the annual spawning stock biomass of brown tiger prawn and western king prawns in the fishery area. Fishery-independent spawning stock surveys are undertaken each year during the key spawning period (June – September) to provide more robust measures of spawning stock levels for brown tiger and western king prawns during this time.

These surveys are conducted in both the North CPL (TPSA) (June, August and September) and the South CPL (ENA) (August and September) as these are the key spawning areas for brown tiger prawns.

Information from the June survey is used to provide a measure of abundance of prawns in the North CPL (TPSA) at the start of the spawning season. The mean catch rates of brown tiger and western king prawns from the North CPL (TPSA) and South CPL (ENA) surveys in August and September are used as spawning stock indices to assess the performance of the fishery and may provide an early indicator of how to manage the stocks in the forthcoming season.

Denham Sound surveys

Surveys are also undertaken in Denham Sound in June/July (or July/August). These surveys are used to assess the timing of movement of prawns into the area and obtain prawn size and catch rate data on western king prawns prior to fleet fishing in the Denham Sound area. The data collected during these surveys is also used to determine the potential partial opening of the Denham Trawl Closure.

4.4.1.2 Fishery-dependent monitoring

Logbooks

Fishers are required to report all retained (target and non-target) species catches, effort, any ETP species interactions and fishing location (detailed shot-by-shot longitude and latitude) in daily logbooks, which have been in place since the fishery began in the 1960s and became compulsory in the fishery in 2008. These logbooks are used to provide information on the daily catch (kg) of each target species and effort (hours trawled) expended in specific fishing areas.

The information provided in logbooks is validated using processor unloads, which have been provided to the Department on a monthly basis since the fishery began.

Reporting of the fishing locations enables the Department to map the spatial extent of the trawled area. The logbooks are checked by the Department's research staff on a monthly basis and any possibly erroneous entries or gaps are checked directly with skippers or the fishing company.

Compliance Monitoring

The Department and industry uses VMS to monitor all activities, including both voluntary and statutory closures, in the fishery.

4.4.2 Assessing Ecological Impacts of the Fishery

4.4.2.1 Target species stock assessment

The stock status of brown tiger and western king prawns in Shark Bay is assessed primarily on the basis of inter-annual and within-season trends in spawning stock abundance, recruitment levels and catch.

Spawning stock abundance is determined based on fishery-independent catch rates of brown tiger and western king prawns during spawning stock surveys. The catch rate is assessed against the in-season reference levels to determine in-season operations, and against annual reference levels in order to determine the success of the season's arrangements in maintaining an adequate spawning stock biomass.

While spawning stock abundance provides a general prediction about the level of recruitment

in the following season, the actual recruitment may be affected by environmental (or other) impacts on mortality. In order to ensure adequate in-season operations, annual recruitment of brown tiger and western king prawns is assessed using the catch rate and prawn size information collected during fishery-independent recruitment surveys during the start of the fishing season.

Data collected as part of these annual recruitment surveys are also used to forecast the catch for the season. The actual catch of each species at the end of each season is then compared to this predicted catch and historical catch ranges (for the period 1989 – 1998), when recruitment was not impaired. Although spawning stock abundance is the primary indicator for fishery impacts on stock biomass, fluctuations in the annual catch may provide insight on any environmental factors affecting recruitment that may need to be considered in future season arrangements.

4.4.2.2 Ecosystem Component Assessment

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 led the development of the Ecological Risk Assessment (ERA) processes for the SBPMF. The ERA process has helped to prioritise research, data collection, monitoring needs and management actions for fisheries and ensures that they are managed both sustainably and efficiently.

A formal ERA was undertaken for the SBPMF in 2001, with additional internal workshop reviews of the 2001 ERA in 2008 and 2010. Further details regarding the strategies used to manage and monitor ecological impacts can be found in the *SBPMF Bycatch Action Plan 2014 – 2019*.

The reference levels identified for ecosystem components, i.e. retained non-target species, bycatch, ETP species, habitat and ecosystem process, reflect risk outcomes identified as part of the ERA process. Where quantitative information and monitoring occurs, i.e. catches of retained non-target species and extent of fishing activities, additional performance indicators and reference levels have been identified.

The catches of all retained non-target species and all ETP species interactions are reported by fishers in daily logbooks and are assessed annually by the Department.

The spatial extent of fishing activities is monitored via logbooks (and VMS), with the extent and intensity of fishing activities throughout Shark Bay assessed on an annual basis.

5.0 MANAGEMENT MEASURES AND OPERATIONS

There are a number of management measures in place in the fishery, which can be amended as needed to ensure the fishery is achieving its objectives (Table 2).

Table 2 Current management measures and instrument of implementation for the SBPMF

Measure	Description	Instrument
Limited Entry	A limited number of Managed Fishery Licenses (18) are permitted to operate in the SBPMF.	SBPMF Management Plan
Effort Restrictions	The fishery currently operates under a maximum headrope capacity restriction of 724 metres (396 fathoms).	SBPMF Management Plan FRMA (Section 7 Exemptions)
Gear Controls	Include controls on mesh size (≤ 60 mm) of nets, boat length, size of the ground chain (≤ 10 mm diameter) and the dimensions of the otter boards, including metal shoes.	SBPMF Management Plan FRMA (Section 7 Exemptions)
Bycatch Reduction Devices (BRDs)	The fleet is required to have BRDs in the forms of grids and fish exclusion devices (FEDs), such as square mesh panels, in all standard nets.	MFL Condition
Annual Closed Season & Cap on Fishing Days	The fishery is closed to fishing between November and March each year, with the aim of a maximum of 175 total fishing days each year.	SBPMF Management Plan (clause 10 determination)
Spatial Closures	Parts of Shark Bay are permanently closed to trawling activities to preserve seagrass and other sensitive habitats that are essential nursery areas for prawns and other species. There are also two Port Area Closures in place within three nautical miles of Carnarvon and Denham. The waters of Hamelin Bay are also permanently closed to trawling as part of the Shark Bay Marine Park. A combination of statutory and voluntary rolling spatial closures of a number of areas are used throughout the season to contain and direct overall fleet effort, control effort on brown tiger prawns and provide industry the opportunity to maximise economic returns.	SBPMF Management Plan Section 43 order (Shark Bay Marine Park) SBPMF Management Plan (clause 10 determination); Co-operative Agreement
Temporal Closures	Fishing is only permitted at night, as prawns are nocturnal. Fishing closures also occur around each full moon.	SBPMF Management Plan (clause 10 determination) Co-operative Agreement
Reporting	Fishers are required to report all retained (target and non-target) species catches, effort, ETP species interactions and fishing location in statutory daily logbooks. Fishing activities are also monitored via the satellite Vessel Monitoring System (VMS) and the master must submit a nomination of intention to enter the fishery via VMS.	FRMR SBPMF Management Plan

5.1 Consultation and Decision-Making Process

In addition to the Western Australian Fishing Industry Council (WAFIC), the peak body for commercial fisheries, licence holders of the SBPMF are also collectively represented by the SBPTOA.

The Department works closely with the SBPTOA and licensees to develop annual season arrangements (see 2014 example in Appendix 2) that achieve the operational objectives contained in the harvest strategy. In addition, a cooperative real-time (in-season) management framework exists between the Department's Research Division and the SBPTOA to implement opening and closing of areas that maximise economic return from the Shark Bay prawn resource within the sustainable management framework.

While the Department will consult directly with individual licence holders, particularly for notification regarding statutory decisions, consultation generally occurs via the SBPTOA. This is particularly the case when seeking consensus on day-to-day and strategic management issues.

Annual Management Meetings (AMMs) are generally held post-season and are used as the main forum to consult with stakeholders and licence holders on the management of the fishery. During these meetings, Departmental (research, management and compliance) staff, licence holders and WAFIC discuss current and future management issues that may have arisen during the fishing season.

Prior to the start of each season briefings are held with skippers to describe the details of the arrangements for the forthcoming season. The Department also holds meetings on an "as needs" basis with industry.

5.1.1 Annual Consultation and Decision-Making (Season Arrangements)

Annual seasonal arrangement decisions are based primarily on maintaining sustainable stocks, while providing the opportunity for industry to maximise economic returns from the prawn resource.

The Department consults with industry to discuss the previous season, develop and finalise the forthcoming season's fishing arrangements including season opening and closing dates, moon closure periods, recruitment and spawning survey dates. Once agreement is reached with the SBPTOA the proposed season arrangements are then provided to the Director General for consideration and approval.

Statutory aspects of the season arrangements are then outlined in a (statutory) determination in accordance with clause 10 of the SBPMF Management Plan.

5.1.2 In-Season Consultation and Decision-Making

Further to the permanent closures in the SBPMF, spatial closures are in place at the commencement of the season and are opened and closed throughout the season to control, manage and direct fishing effort. Decisions around in-season spatial areas opening and closing are primarily based on maintaining breeding stocks of brown tiger and western king prawns (i.e. ecological objective), while providing the opportunity for industry to harvest optimum size/value prawns (i.e. economic objective).

The decision-making process is carried out in a similar way each year and is linked to the in-season harvest strategy reference levels and control rules. The closure of these areas may be enforced either statutorily (to meet ecological objectives) or voluntarily (to meet economic objectives).

5.1.2.1 Statutory (In-Season) Closures

When it is identified that an area needs to be closed for a period of time during the fishing season, legislative instruments are used. This involves a decision-making process whereby the Department's Director General specifies the period by which an area may open or close to fishing via a statutory determination (made pursuant to clause 10 of the SBPMF Management Plan). These decisions involve significant internal consultation to ensure all relevant components of the Department (i.e. compliance, VMS, management and research) are aware of and can enforce the changes where required. The Director General is also required to consult with licensees prior to making any decisions on implementing any proposed change.

5.1.2.2 Voluntary Closures

Once ecological objectives have been met, a cooperative framework is applied for decisions predominantly aimed at meeting economic objectives. In this case, areas may be opened and closed voluntarily through agreement with industry. The Department and industry collaborate to make decisions regarding the timing and extent of voluntary area openings and closures, with outcomes communicated to all relevant staff (i.e. management, compliance, VMS and research). All in-season voluntary area closures and openings may be communicated to skippers through VMS messaging.

5.1.3 Statutory Management Changes

Statutory management changes are facilitated through amendments to legislative instruments, such as the fishery management plan, section 43 orders, exemptions and gazetted determinations by the Department's Director General (see Table 2 above).

Amendments to the SBPMF Management Plan cannot be undertaken without addressing statutory consultation requirements. The SBPMF Management Plan identifies those persons that the Minister must consult with prior to making an amendment. The statutory consultation function is presently conducted by WAFIC on behalf of the Department under a Service Level Agreement.

Determinations made by the Director General under clause 10 of the SBPMF Management Plan (generally used to open and close the fishery and various spatial areas) cannot be given effect without prior consultation with licence holders.

There are no statutory provisions as to the consultation requirements relating to amendments to management arrangements for instruments of exemption or section 43 orders. In the absence of any statute specifying consultative procedures, the Department has regard for common law principles to afford natural justice to licence holders. As such, the Department will formally consult with licence holders when making changes to management arrangements via instrument of Exemption or Orders.

5.2 Compliance Measures

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

5.2.1 Operational Compliance Plan

The SBPMF has a fishery-specific Operational Compliance Plan (OCP), which is informed and underpinned by a compliance risk assessment conducted for the fishery. The SBPMF OCP has

the following objectives:

- to provide clear direction and guidance to officers regarding compliance activities that are required to support effective management of the fishery;
- to provide a mechanism that aids the identification of future and current priorities; and
- to review compliance strategies and their effective implementation.

The OCP is generally reviewed every 1 – 2 years.

5.2.2 Compliance Strategies

Compliance strategies and activities that are used in the fishery include:

- pre-season briefing to Masters of Licensed Fishing Boats;
- pre-season inspections of fishing boats;
- inspection in port – at Carnarvon and Fremantle; and
- at-sea inspection of fishing boats – in the waters of Shark Bay.

Inspections may involve:

- inspection of all nets, BRD's, otter boards, VMS and other gear;
- inspection of all authorizations; and
- inspection of freezers and fish on board the boat.

5.2.3 Vessel Monitoring System

Boats operating within the SBPMF require a VMS and need to be fitted with a device known as an automatic location communicator (ALC). The ALC is used to track the location of a boat by transmitting information such as the geographical position, course and speed of the boat to VMS compliance officers at the Department.

The use of VMS in the SBPMF allows the Department to carry out real-time monitoring of the SBPMF fleet's adherence to spatial closures, provides intelligence for investigations and provides information and analysis to research and management branches on vessel activities and patterns.

6.0 HARVEST STRATEGY REVIEW

It is recognised that the fishery does change over time and that a review period should be built into the harvest strategy to ensure that it remains relevant. The harvest strategy will remain in place for a period of five years, after which time it will be fully reviewed. However, given that this is the first harvest strategy for the fishery, this document may be subject to further review and amendment as appropriate.

7.0 HARVEST STRATEGY APPROVAL

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

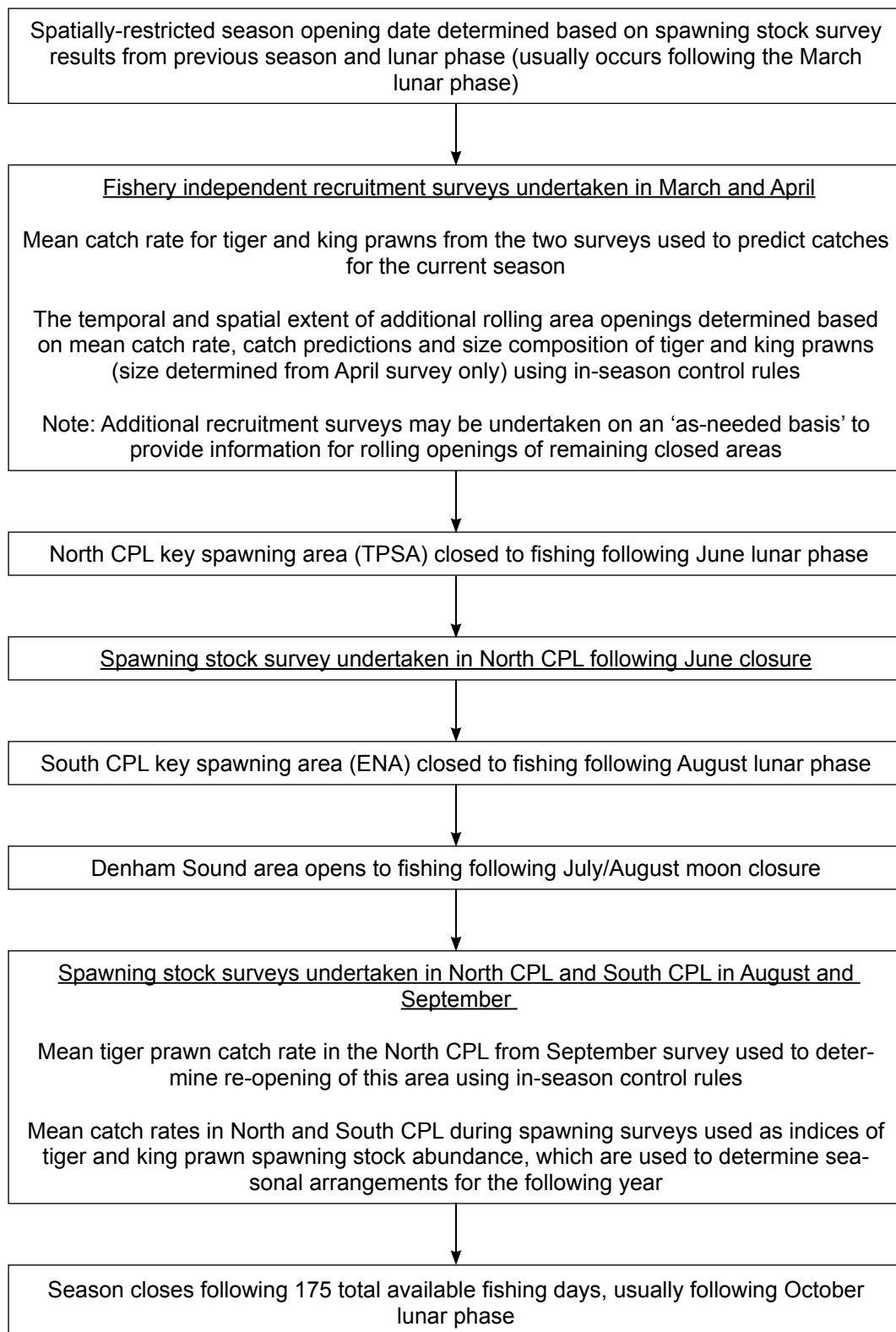
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APPENDIX 1: OVERVIEW OF GENERAL ANNUAL OPERATIONS IN THE SBPMF

SHARK BAY ANNUAL OPERATIONS



APPENDIX 2: EXAMPLE OF SEASON ARRANGEMENTS²

SHARK BAY PRAWN MANAGED FISHERY - 2014 SEASON ARRANGEMENTS

DEPARTMENT OF FISHERIES ACTIVITIES 24/2/2014

The *Fish Resources Management Act 1994* (FRMA) provides the overarching legislative framework to implement the management arrangements for this fishery. The objects of the Act are: (a) to develop and manage fisheries and aquaculture in a sustainable way; and (b) to share and conserve the State's fish and other aquatic resources and their habitats for the benefit of present and future generations.

P1 Biological Objectives

To maintain the breeding stock at a level where the main factor affecting recruitment is the environment and catch under normal environmental conditions is within historic ranges. This is achieved for the two major species as follows:

Brown tiger prawns:

- Ensuring that brown tiger prawn catch rates derived from a combination of fishery-dependent and independent surveys remain above a level based upon the stock-recruitment relationship

Western king prawns:

- Ensuring that western king prawn catches remain within levels recorded during a historical period (1989-1998) when recruitment is known not to have been affected by fishing effort. The current focus of industry is to target larger size prawns which has resulted in a shift in effort which has reduced the expected range of total landings (under normal environmental conditions) for king prawns to 950 -1450 t compared to historical catch ranges. This interim range will be reviewed after 2015.

Management Principles

A harvest strategy applies in the fishery, which addresses the management objectives below:

- Protect prawn (particularly brown tiger) spawning stocks during the key spawning period and locations;
- Allow industry the opportunity to optimise size, quantity and quality of prawns;
- Ensure that bycatch of, in particular, large animals, including turtles is minimised; and
- That the effects of fishing do not result in irreversible changes to habitat and ecological changes

² Note that the 2014 season arrangements were developed prior to the publication of this harvest strategy, thus some aspects may be slightly different (e.g. management objectives).

Key Harvest Strategy Guidelines for Prawns

1. Harvest strategy based on a constant escapement policy to avoid recruitment overfishing and maintain sustainability (adequate spawning stock).
2. The harvest strategy is also based on an input control management framework, which includes permanent and temporary closed areas and a maximum headrope capacity.
3. The fleet is highly efficient and spatial and temporal controls are required to control effort (including moon closures) to achieve sustainability objectives.
4. Tiger prawns are very vulnerable to overfishing, therefore the harvest strategy needs to provide adequate protection of the breeding stock. The key spawning period for tiger prawns is August to October with spawning generally commencing July. Generally most of the tiger prawns are removed from the fishery in a four-month period therefore highly targeted fishing on tiger prawns at the commencement of the prawn season could reduce the tiger prawn spawning stock abundance to unacceptable levels before the spawning period if all areas of the fishery (particularly east of the Carnarvon Peron Line (CPL) were opened initially.
5. Moon closures are aimed at reducing overall effort for sustainability purposes and best suited to times when prawn quality (soft and small size) is poor (lower value) and when king prawn catchability is low as they are light sensitive. Tiger prawns are more catchable during this period and if fishing occurs at this time effort is targeted on tiger prawns. Fishing during the latter part of the season provides a prawn size, which is larger and better quality.
6. Recruitment surveys provide a catch prediction, which determines the level of fishing that should take place. Appropriate initial area openings and provides key indices used in stock assessment.
7. The commencement of the prawn season should not be until late March based on the lunar phase around the third moon phase to avoid the harvest of small size prawns to avoid growth and recruitment overfishing.
8. Phased or rolling opening of spatial closure (Carnarvon/Peron Line (CPL)) areas based on recruitment surveys used to contain effort, control effort on tiger prawns and provide industry the opportunity to harvest larger size prawns in the area.
9. A closed fishing period from November to March each year contains and reduces overall effort and helps to protect small king prawns.
10. Spawning surveys are used to verify the success of harvest strategies.
11. The fleet is multi license/multi species and this is a relevant consideration when determining annual fishing arrangements.

Harvest Control Rules

Consistent with the “constant escapement” strategy for this fishery, decision (control) rules are in place to determine the following in each season:

- *Prawn Season Opening:*

The legislated prawn season start date is set on the historical understanding of prawn biology and migration onto the trawl grounds and on lunar phase. The objective of the start date is to protect small (pre spawning) prawns and ensure flow-through to the breeding stock for sustainability purposes (particularly for protection of pre-spawning tiger prawns).

- *Moon Closures*

Monthly moon closures are implemented to contain effort during the season and reduce targeting on tiger prawns during low catchability period for king prawns (quality of prawns may also be poor during this time) and should be a minimum of seven nights each month. The first two moon closures will be 5 days, subject to the fleet fishing outside the CPL, followed by 7-day moon closures for the remainder of the season. Industry may voluntarily choose to extend the moon closure periods.

- *Carnarvon Peron Line (CPL)*

1. Closed from the start of the season. There are three key areas within the waters east of the CPL: TPSA³, Central area and the ENA⁴ (Figure 2).
2. Generally, two areas within the CPL (TPSA and Central area) can open after the April survey. The amount of area opened in these two areas is determined from the results of the April survey and is dependent on the size of prawns. This control rule contains effort for sustainability purposes and provides industry the opportunity to harvest larger size prawns in these areas. When to open east of the CPL can also be influenced by the catch rates and size of prawns in the area being fished that is west of the CPL.
3. Subsequent openings of areas that remain closed are determined by industry (generally open areas when the prawns (mainly king prawns) are a size that results in at least 70% of prawns being a suitable grade).

- *Tiger Prawn Spawning Area (TPSA) closure and possible re-opening*

The TPSA closure since 2001 has been based on a catch rate level (target of 25 kg / hr) through real-time monitoring of the fishers' daily catch rates. For 2014 (and in the future) the TPSA will be closed on the June moon closure period to ensure adequate spawning stock is retained. The set date provides certainty for the closure for fishers and adequate protection for the tiger prawn spawning stock at the commencement of the spawning period. The prawn abundance in this area is not stable over the spawning period (July to October) and generally the catch rates decline to a lower level by the end of the season. As this area is a key spawning area in the early stages of the spawning period it is important to close the area in a timely manner.

Re-opening: If the tiger prawn-catch rate in the TPSA during the September survey is \geq 20 kg/hr (well above the limit of 15 kg/hr) then the TPSA may be re-opened to fishing for the last fishing period.

- *Extended Nursery Area (ENA)*

The first part of the area openings within the CPL does not include the ENA because removal of tiger prawns early in the season in this area can impact on sustainability and king prawns are generally a small size and a high proportion 'soft' (newly moulted) in this area.

The ENA opens after the June moon closure and remains open for two fishing periods but Industry may choose to only open in July for one fishing period (depending on catch rates and prawn size outside the ENA). The ENA is closed to coincide with the start of the August moon closure to protect small king prawns that start to move onto

3 North CPL

4 South CPL

fishing grounds after over-wintering in the nursery areas from around August and to protect spawning tiger prawns.

- *Denham Sound*

Denham Sound remains closed until August to protect small (mainly king) prawns. After the August survey, the STL may open for one fishing period (up to 10 days) based on a combined king and tiger prawn catch rate of 50 kg/hr and if the number of juvenile pink snapper caught remain at historical levels.

- *End of Season*

The end of season date is specified to contain overall effort and the date is set by the lunar phase and is linked to when the season starts. For 2014 the end of season date is proposed as 31 October subject to industry discussion and advice to the Department relating to possible effort shift from the fishing period in July to add on to the end of the season.

2014 Shark Bay Prawn Managed Fishery Season Arrangements

Date	Activity	Comment	What is Closed/Open
21 and 22 March	Industry survey (research staff on board).	<ul style="list-style-type: none"> Survey of grounds outside of the CPL for consideration of industry closures to avoid small prawns. 	<ul style="list-style-type: none"> All closed before 24 March.
23–24 March	Pre-season independent recruitment survey.	For purposes of generating catch prediction for the season, continuing spawning stock recruitment relationship. To be combined with April survey regarding opening east of Carnarvon-Peron Line (CPL).	<ul style="list-style-type: none"> All closed before 24 March. Industry closures in place (nor west Peron and northern tiger closure eastern part). Map and coordinates provided.
24 March	Season commences.	<ul style="list-style-type: none"> Commencement date of 24 March will protect small (pre spawning) prawns and ensure flow through to breeding stock. Carnarvon-Peron line (CPL) closed. Denham Sound (DS) closed. Standard fishing hours 1700 to 0800 hrs. North Koks (north of 24° 45.30') fishing hours 1700 to 1000 hrs. 	<ul style="list-style-type: none"> West of CPL in northern Shark Bay open to fishing.
14–18 April	5 day moon closure.		<ul style="list-style-type: none"> All closed.
19 April	Fishing re-commences.	<ul style="list-style-type: none"> Re-commence fishing 1700 hrs 19 April Awaiting final discussions on precise area(s) to open based on survey results. 	<ul style="list-style-type: none"> West of CPL in northern Shark Bay open.
21–22 April	Carnarvon-Peron Line survey (recruitment survey).	<ul style="list-style-type: none"> To determine prawn abundance and size. Survey results are analysed within 2 days of survey completion. Application of decision rules to survey results to determine the extent of area of Carnarvon-Peron Line to open and for what period. Extended Nursery Area (ENA) will remain closed. 	<ul style="list-style-type: none"> West of CPL in northern Shark Bay open.
April (after survey)	Determine extent of areas east of CPL to be opened.	<ul style="list-style-type: none"> ENA remains closed. The exact timing and extent of area opening is subject to survey results and is determined by Industry and Research consultation. 	<ul style="list-style-type: none"> West of CPL in northern Shark Bay open. Part of east of CPL (possibly including TPSA) based on survey results, but not ENA.
14–18 May	5 day moon closure.		<ul style="list-style-type: none"> All closed.

Date	Activity	Comment	What is Closed/Open
19 May	Fishing re-commences.	<ul style="list-style-type: none"> Re-commence fishing 1700hrs 19 May. 	<ul style="list-style-type: none"> West of CPL in northern Shark Bay open. Some or all of the closed parts east of CPL opened based on survey (industry) results, but not ENA.
10–16 June	7 day moon closure. Closure of TPSA.	<ul style="list-style-type: none"> TPSA (if opened) will close on June moon (10 June) to protect tiger prawn spawning stock. 	<ul style="list-style-type: none"> All closed.
17 June	Opening of remainder of Carnarvon-Peron line including ENA.	<ul style="list-style-type: none"> Re-commence fishing 17 June 1700 hrs. Opening of these areas can occur straight after June moon closure. The area that remained closed and the ENA opening may require survey before fishing. 	<ul style="list-style-type: none"> West of CPL in northern Shark Bay open. East of CPL and may include ENA. The TPSA is closed.
20 June	Survey of TPSA.	<ul style="list-style-type: none"> To check prawn spawning biomass in TPSA (may be undertaken on RV Naturaliste) and determine if further sustainability decisions are required. 	
9–15 July	7 day moon closure.		<ul style="list-style-type: none"> All closed.
16 July	Fishing re-commences.	<ul style="list-style-type: none"> Re commence fishing 1700 hrs 16 July. 	<ul style="list-style-type: none"> West of CPL in northern Shark Bay open. East of CPL now open including ENA (if it was not opened in June) but not TPSA.
8–14 August	7 day moon closure. ENA closed for remainder of season.	<ul style="list-style-type: none"> ENA closure to protect small prawns and tiger prawn breeding stock. 	<ul style="list-style-type: none"> All closed.
15 August	Fishing re-commences.	<ul style="list-style-type: none"> Re-commence fishing 1700hrs 15 August. Fishing Denham Sound based on survey results. 	<ul style="list-style-type: none"> West of CPL in northern Shark Bay open. East of CPL but not ENA or TPSA.
15, 16, 17 and 18 August	Survey.	<ul style="list-style-type: none"> TPSA, ENA, and Denham Sound. Survey results provide index (trigger) for fishing below Snapper Trawl Line (STL). Survey to be undertaken by commercial boat. CEO determination on opening of STL. 	<ul style="list-style-type: none"> West of CPL in northern Shark Bay open. DS (possibly STL opening).
5–11 September	7 day moon closure.		<ul style="list-style-type: none"> All closed.

Date	Activity	Comment	What is Closed/Open
12 September	Fishing re-commences.	<ul style="list-style-type: none"> • Re-commence fishing 1700hrs 12 September. 	<ul style="list-style-type: none"> • West of CPL in northern Shark Bay open. • DS (possibly STL if not fished previously). • East of CPL but not ENA or TPSA.
15 September	ENA survey.	<ul style="list-style-type: none"> • No re-opening of ENA. • Survey for purposes of obtaining tiger prawn spawning biomass only. 	
16 September	TPSA survey.	<ul style="list-style-type: none"> • To obtain tiger prawn spawning biomass by catch rate and determine whether TPSA can re-open. 	
September	TPSA re-opening decision.	<ul style="list-style-type: none"> • Based on catch rate assessment. Decision rule tiger prawn catch rate to be ≥ 20 kg/hr as the limit is 15 kg/hr and if fishing is to occur it should be during the last fishing period. 	<ul style="list-style-type: none"> • As above plus potentially re-open TPSA.
6–12 October	7 day moon closure.		<ul style="list-style-type: none"> • All closed.
13 October	Fishery re-commences.	<ul style="list-style-type: none"> • Re-commence fishing 1700hrs 13 October. 	<ul style="list-style-type: none"> • West of CPL in northern Shark Bay open. • DS (possibly STL if not fished previously). • Potentially re-open TPSA. • East of CPL but not ENA.
31 October	Season Closes.	<ul style="list-style-type: none"> • 0800 hours. 	<ul style="list-style-type: none"> • All closed.