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Saucer Scallop Resource of Shark Bay Harvest Strategy : 2020-2025 : Version 1.0

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Saucer Scallop Resource of Shark Bay Harvest Strategy 2020-2025

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LIST OF ACRONYMS

ARMA	*Aquatic Resources Management Act 2016*
CDR	Catch Disposal Record
DPIRD	Department of Primary Industries and Regional Development
EBFM	Ecosystem Based Fisheries Management
EPBC (Act)	*Environment Protection and Biodiversity Conservation Act 1999*
ESD	Ecologically Sustainable Development
ETP	Endangered, Threatened and Protected (species)
FRMA	*Fish Resources Management Act 1994*
FRMR	*Fish Resources Management Regulations 1995*
HCR	Harvest Control Rule
ITQ	Individual Transferable Quota
MSY	Maximum Sustainable Yield
OCP	Operational Compliance Plan
SBCMF	Shark Bay Crab Managed Fishery
SBPMF	Shark Bay Prawn Managed Fishery
SBSMF	Shark Bay Scallop Managed Fishery
TACC	Total Allowable Commercial Catch
VMS	Vessel Monitoring System
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council

1 INTRODUCTION

Harvest strategies for aquatic resources in Western Australia (WA) that are managed by the Department of Primary Industries and Regional Development (DPIRD, the Department) are formal documents that support decision-making processes and ensure these are consistent with the principles of Ecologically Sustainable Development (ESD; Fletcher 2002) and Ecosystem Based Fisheries Management (EBFM; Fletcher et al. 2012). The objectives of ESD are reflected in the objects of the *Fish Resources Management Act 1994* (FRMA), Section 3, and the *Aquatic Resources Management Act 2016* (ARMA), Section 9, which will replace the FRMA once enacted.

This harvest strategy has been developed in line with the Department's Harvest Strategy Policy for Aquatic Resources (Department of Fisheries 2015) and is consistent with relevant national harvest strategy policies and guidelines (e.g. Sloan et al. 2014; Department of Agriculture and Water Resources 2018a, b). It makes explicit the performance indicators, reference levels, and harvest control rules designed to achieve the specific long- and short-term management objectives for the resource, and the broader goals of ESD and EBFM.

The publication of this harvest strategy 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 (Department of Fisheries 2015). The strategy provides guidance for decision-makers, but do not derogate from or limit the exercise of discretion required for independent decision-making by the Minister for Fisheries, the Chief Executive Officer (CEO) of DPIRD, or other delegated decision-makers in order to meet the objects of the FRMA.

Consistent with the Department's Stakeholder Engagement Guideline (Department of Fisheries 2016), this harvest strategy has been subjected to formal stakeholder consultation with industry members and peak commercial and recreational fishing sector bodies, as well as public consultation processes. It has been approved by the Minister for Fisheries.

1.1 Review Process

The WA Harvest Strategy Policy recognises that fisheries change over time and that a review period should be built into each harvest strategy to ensure that it remains relevant (Department of Fisheries 2015). This 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 formal harvest strategy for this resource, this document may be subject to review and amended as appropriate within this five-year period.

2 SCOPE

This harvest strategy relates to the saucer scallop resource in Shark Bay, WA, and the fishing activities influencing this resource.

Saucer scallops in the waters of Shark Bay are primarily harvested commercially by the Shark Bay Scallop Managed Fishery (SBSMF; Figure 1) using low-opening otter trawls. The SBSMF is limited entry and consists of two classes of licence; A Class vessels licenced to take only scallops, and B Class vessels that also target prawns in the Shark Bay Prawn Managed Fishery (SBPMF). Recreational and customary fishing for scallops is permitted, however, catches are considered negligible.

In addition to considering fishing impacts on the target species (i.e. the western saucer scallop), this harvest strategy also covers impacts on any other retained species, bycatch[1], endangered, threatened and protected (ETP) species, habitats and other ecological components, to ensure any risks to these elements are managed effectively. Note that only the impacts of scallop trawling on these ecological components are considered in this harvest strategy, while the impacts of prawn trawling by B Class fishers (although they may retain scallops) are addressed separately in the harvest strategy for the Shark Bay prawn resource (Department of Fisheries 2014; DPIRD in prep. a).

2.1 Environmental Context

The Shark Bay prawn resource occurs within the Gascoyne Coast Bioregion of WA, which represents a transition between the tropical waters of the North West Shelf and the temperate waters of the lower west coast. This region has a semi-arid climate, characterised by hot, dry summers and mild winters. Water temperatures inside Shark Bay typically range from 23 °C to 26 °C between January and March and drop to 20-22 °C in winter.

Shark Bay is located 800 km north of Perth (at ~26º S) and covers an area of approximately 13,000 km^2. It is the largest marine embayment in Australia and supports the most extensive and diverse seagrass meadows in the world (Walker 1989). The hydrology of Shark Bay is influenced by the Leeuwin Current, which carries warm, low-salinity water southward down the WA coast. The embayment is mostly shallow, with an average depth of 9 m and increasing to 29 m deep in the north (Francesconi and Clayton 1996). Shark Bay is only infrequently impacted by cyclonic flooding and the mean annual rainfall is low, ranging from 200 mm in the west to 400 mm in the east.

The embayment is of great significance to recreational, commercial and conservation sectors, and was added to the World Heritage List in 1991 (Francesconi and Clayton 1996; Figure 2). Parts of Shark Bay are also managed as part of the Shark Bay Marine Park and Hamelin Pool Marine Nature Reserve (Figure 2).

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

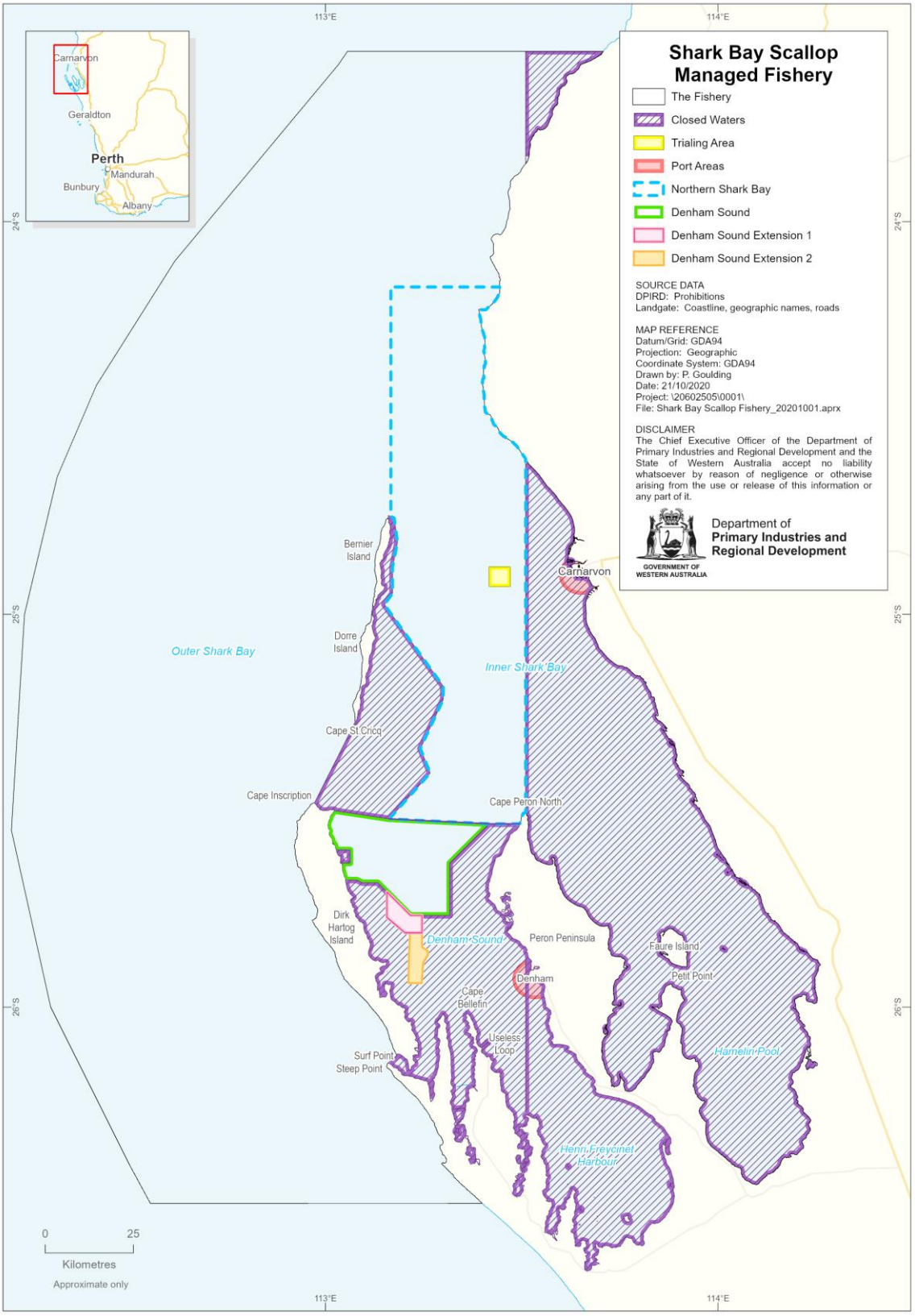

Figure 1. Boundaries and area closures for the Shark Bay Scallop Managed Fishery in Western Australia.

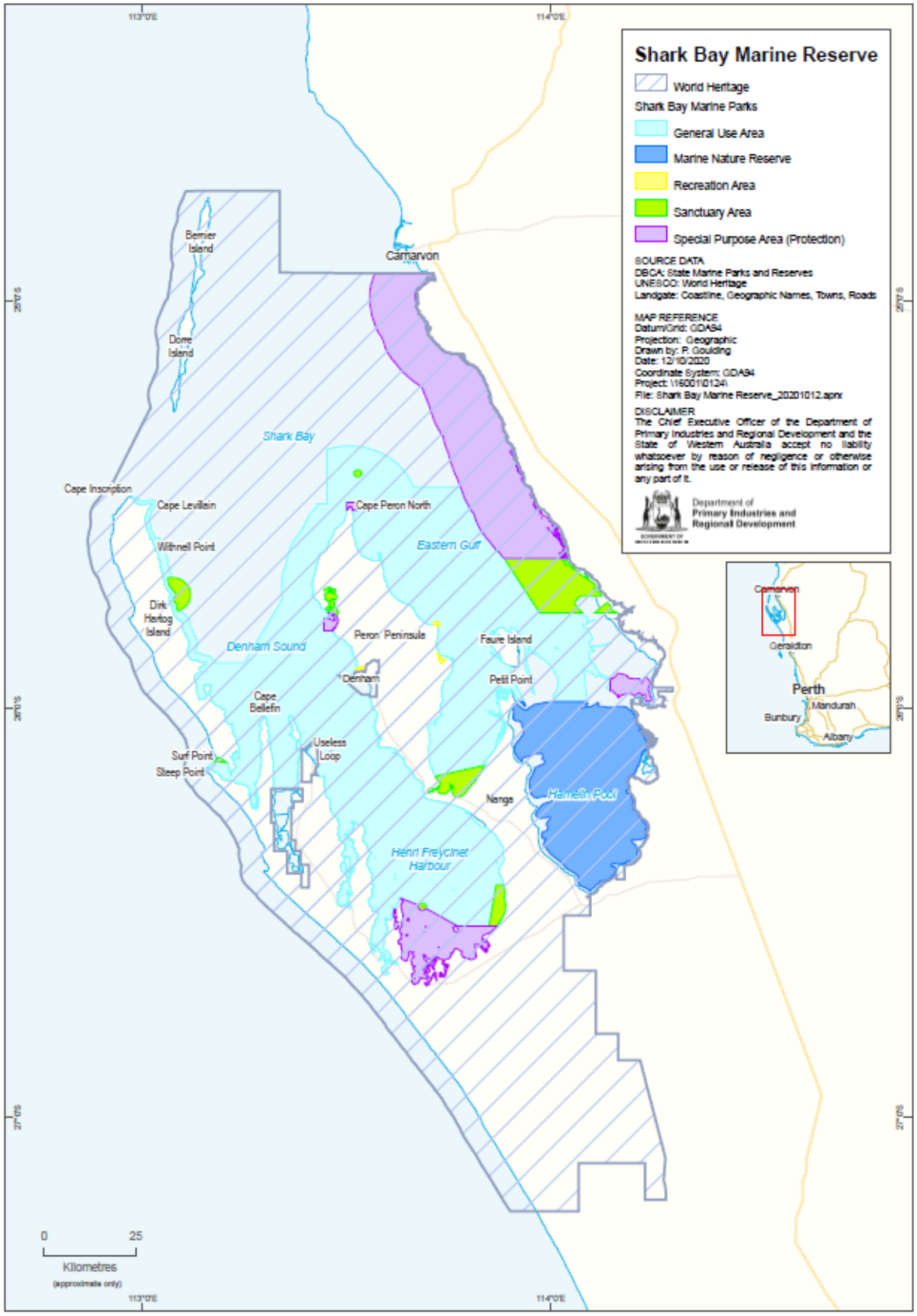

Figure 2. Shark Bay Marine Park and World Heritage Area.

2.2 Target Species

The western saucer scallop (*Ylistrum balloti*) is a bivalve mollusc that belongs to the family Pectinidae. It occurs on the east and west coast of Australia and in New Caledonia. The western population is distributed from Broome in the north to Israelite Bay in the south of WA, not overlapping with the eastern Australian population. Despite its extensive distribution, the species tends to be restricted to areas of bare sand in the more sheltered environments found in the lee of islands and reef systems. The greatest numbers in WA are found in Shark Bay and around the Abrolhos Islands (Joll 1989).

Saucer scallops in Shark Bay typically live no more than two years and attain a maximum size of around 115 mm (Heald 1978). There are two discrete stocks in Shark Bay; one in Denham Sound and the other in northern Shark Bay (Figure 1). The two stocks are considered as one broader scallop resource, however, each stock is assessed and managed separately.

Scallops are broadcast spawners, releasing their eggs and sperm into the surrounding waters for fertilisation to occur. While spawning in northern Shark Bay occurs predominantly from May through to September (Joll and Caputi 1995), there appears to be two distinct spawning peaks in Denham Sound; during winter in July and August, and during the peak of summer in February and March. Research suggests that reproduction and survival of larvae are greatly influenced by environment conditions, particularly water temperature.

2.3 Fishing Activities

2.3.1 Governance

The saucer scallop resource in Shark Bay can be targeted by commercial, recreational and customary fishing sectors. Although not an exhaustive list, these fishing sectors are managed by the Department under the following legislation:

- *Fish Resources Management Act 1994* (FRMA, will be replaced by the ARMA once enacted);
- *Fish Resources Management Regulations 1995* (FRMR);
- FRMA Part 6 — *Shark Bay Scallop Managed Fishery Management Plan 1994* (SBSMF Management Plan);
- FRMA Section 43 Order — *Prohibition on Commercial Fishing (Shark Bay Marine Park) Order 2004*; and
- FRMA Section 7 Instruments of Exemptions.

Fishers must also comply with the requirements of the:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);

- *Marine Safety (Domestic Commercial Vessel) National Law Act 2012*;
- Western Australian *Marine Act 1982*;
- Western Australian *Biodiversity Conservation Act 2016*;
- Western Australian *Conservation and Land Management Act 1984*; and
- Any other legislation governing the use of the marine environment in which fishing activities occur.

2.3.2 Commercial Fishing

Commercial catches of saucer scallops were first recorded in the Shark Bay prawn trawl fishery in 1966, with the first substantial catch taken in 1969 when a number of trawlers specifically fished for scallops in this region (Kangas et al. 2011). Scallop catches fluctuate widely in response to variable recruitment but have typically ranged between 200 and 500 tonnes (meat weight) annually. Very high annual catches above 2000 tonnes were observed in the early 1990s, following a period of favourable environmental conditions that led to exceptional recruitment.

The current SBSMF is limited entry and comprises 11 Class A licences (scallops only) and 18 Class B licences (prawns and scallops). The fishery is currently managed primarily through output controls in the form of a Total Allowable Commercial Catch (TACC) set annually for each of the two scallops stocks (northern Shark Bay and Denham Sound) and allocated to licence holders as Individual Transferable Quota (ITQ). Management also includes a mix of input controls including gear restrictions, and spatial and temporal closures (see Section 3.3 for more detail).

The SBSMF was closed to fishing for three years from 2012 to 2014 in response to low scallop abundance caused by adverse environmental conditions (marine heatwave). Since the fishery reopened to limited fishing in 2015, catches gradually increased to around 300 tonnes. Scallop fishing in northern Shark Bay ceased in 2019 after surveys indicated that the stock in this area had once again fallen below acceptable levels. The northern Shark Bay stock is now considered to be in a recovery phase (Section 3.4.2.1), while Denham Sound is considered fully recovered.

2.3.3 Recreational Fishing

There is no known recreational fishery for scallops in Shark Bay, with no scallop catches by boat-based recreational fishers reported to date (e.g. Ryan et al. 2019).

2.3.4 Customary Fishing

Although there is no quantitative information available on the customary catch of scallops in Shark Bay, these are likely to be negligible.

2.4 Catch-Share Allocations

The saucer scallop resource in Shark Bay has historically been fished by the commercial sector, without an explicit catch share allocation with recreational and customary fishing sectors.

In 2011, the (then) Minister for Fisheries adopted a formal commercial catch share arrangement to share the annual scallop catch between A Class (scallop only) and B Class (prawn and scallop) boats of 70% and 30%, respectively. This is now reflected formally in the allocation of the TACC each year as ITQs per (A and B Class) Managed Fishery Licence.

3 HARVEST STRATEGY

This harvest strategy is structured to describe, hierarchically:

1) the high-level, long-term objectives of management (Section 3.1);
2) the short-term, operational objectives (Section 3.2); and
3) how these translate into the management approach used for this fishery (Section 3.3).

This is followed by a more detailed description of:

4) the processes for assessing ecological sustainability (Section 3.4);
5) the processes for assessing fishery performance (Section 3.5); and
6) the specific monitoring and assessment procedures used to ascertain if objectives are being met (Section 3.6).

3.1 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.

3.1.1 Ecological Sustainability

1) To maintain spawning stock biomass of saucer scallops at a level where the main factor affecting recruitment is the environment;
2) To maintain spawning stock biomass of each retained 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 harm[2] to bycatch species populations;

4) To ensure fishing impacts do not result in serious or irreversible harm to endangered, threatened and protected (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.

3.1.2 Economic and Social Benefits

1) To provide flexible opportunities to ensure fishers can maintain or enhance their livelihood through optimising the value of their catch, within the constraints of ecological sustainability, by:
    a. considering the ability of fishers to retain scallops at times when it is most economically favourable (based on the size and quality of scallops, as well as other retained species), and
    b. minimising the interaction between A and B class fleets while allowing equitable access to catch.

3.2 Operational Objectives

Long-term management objectives are typically operationalised as short-term (e.g. annual or periodic) objectives through one or more performance indicators that can be measured and assessed against pre-defined reference levels to ascertain actual performance. Within the context of the long-term ecological objectives provided above, operational objectives aim to maintain each resource 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.

3.3 Harvesting and Management Approaches

The harvest strategy for the Shark Bay saucer scallop resource is based on a constant escapement approach, which aims to maintain sufficient abundance of scallops prior to the key winter spawning period.

In line with this approach, scallop fishing in Shark Bay has traditionally been managed primarily based on fishery-independent survey information from November, which was used to predict catches for the upcoming fishing season and set an appropriate opening date to control effort (Kangas et al. 2011). Following the introduction of a TACC in 2015, a larger proportion of scallop catches have been taken during the summer months (November to

[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.

February) and two additional surveys are now undertaken in February and June to provide additional information on scallop abundance throughout the year.

To make the best use of available survey information, the scallop quota year starts on 1 May and extends for 12 months (Figure 3). No retention of scallops is permitted during the winter spawning closure, the exact timing of which is dependent on moon phases and is specified each year in the season arrangements (e.g. 16 May to 21 August in 2019). To ensure sufficient protection of pre-spawning scallops, the temporal and spatial extent of fishing during the months leading up to the spawning closure is reduced as scallop abundance decreases and the risk to the stock increases (Figure 3). Note that B Class fishers are only permitted to fish for scallops outside the prawn fishing season when using A class (scallop mesh) gear.

The management arrangements for each fishing season, including the annual TACCs, are determined during March and April (see Appendix 1) based on a risk-based weight-of evidence assessment of the two scallop stocks (Denham Sound and northern Shark Bay) that incorporates all available information; including fishery-independent survey data, fishery-dependent catch rates from the summer fishing period, and environmental data. The TACC for each stock is set primarily using fishery-independent data from the November and February surveys, which provide indices of scallop abundance before and after the key summer fishing period (Section 3.4.1.1), covering the period where juvenile recruitment is observed.

Within-season reviews of the management arrangements and/or monitoring of fishery-dependent data may be triggered if new data from the June and/or November surveys, or fishery-dependent information, indicates that a substantial and unexpected change in scallop abundance has occurred. For example, information from the November survey is used to determine whether trawl access can be permitted in the areas in the Denham Sound extension (Figure 1), subject to a number of conditions (see Table 1). The within-season review process is undertaken in consultation with industry, as outlined in Appendix 2. Where necessary, this review may also consider management measures to mitigate the impact of scallop fishing on other species, including prawns and snapper.

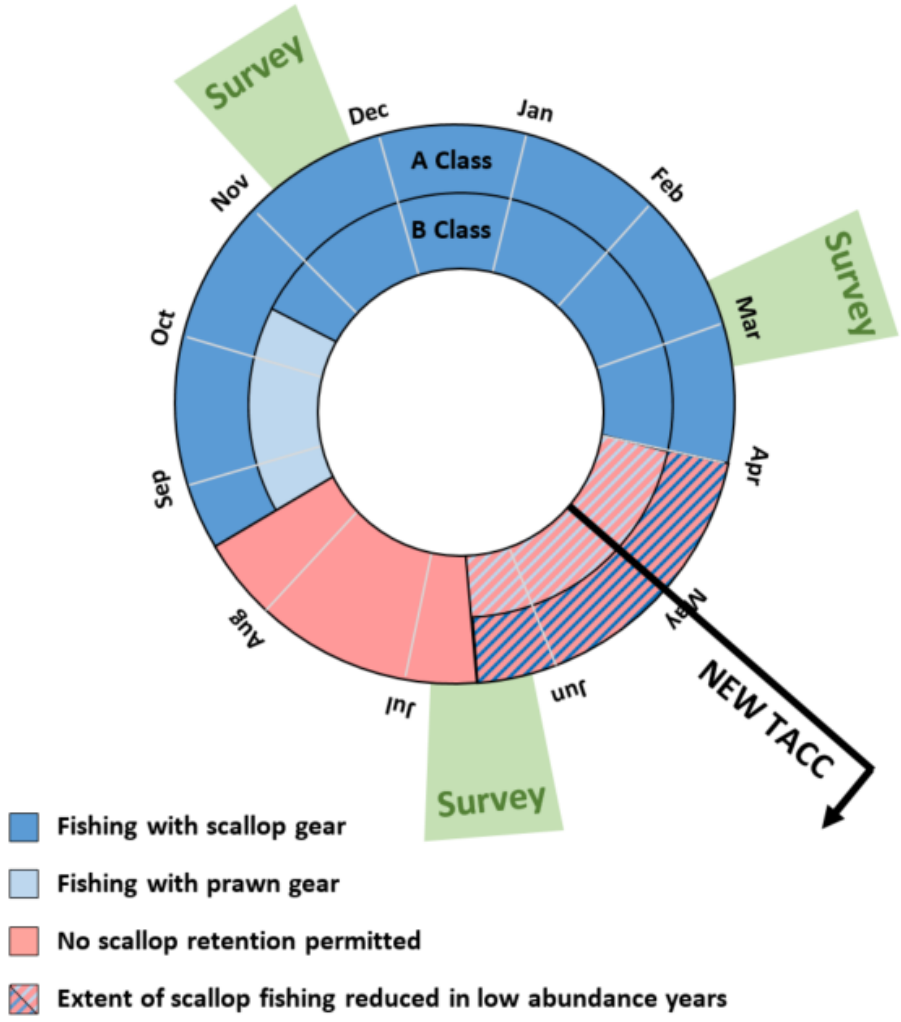

Figure 3. Schematic of the fishing season for scallops in Shark Bay for A Class (outer circle) and B Class (inner circle) fishers. Note that this figure is indicative only and the specific dates of the spawning closure and the extent of the prawn season can differ between years.

3.4 Ecological Sustainability

A formal, resource-level review process is undertaken by the Department to assess the status of relevant target stocks and performance in relation to each other ecological management objective. Suitable indicators have been selected to describe the status of the Shark Bay scallop resource, and other ecological assets, against defined reference levels established to separate acceptable from unacceptable performance (Section 3.4.1). Where relevant, these levels include:

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

Harvest Control Rules (HCRs) define the management actions that should occur in relation to the value of each indicator compared to the reference levels (Section 3.4.2). The HCRs aim to maintain each resource at their target level, and return the resource to this level when a threshold or limit level has been breached.

3.4.1 Performance Indicators & Reference Levels

3.4.1.1 Saucer scallops

The status of the Shark Bay scallop resource is assessed using a risk-based weight-of-evidence approach that incorporates all available information, primarily based on fishery-independent data to monitor relative stock levels at certain times during the fishing season.

The primary performance indicator for the two scallop stocks (northern Shark Bay and Denham Sound) is derived from the November survey (Table 1), which provides a long-term index of scallop abundance based on both recruits (0+, i.e. <1-year old scallops) and adults (1+) in each area. These data have informed the current reference points for each stock (see Section 3.6.2.1), including a limit level below which recruitment may be impaired and the TACC for the next season will be set to zero (unless there are signs of improvement in stock levels). Given the highly dynamic and variable nature of the saucer scallop resource, the target reference level is considered as any index values above a threshold level, below which a conservative TACC will be set and further management measures implemented to protect pre-spawning scallops.

Although based on a shorter time series of data, the February survey index provides a secondary measure of scallop abundance in each area, after the key summer fishing period, which is used to inform the TACC setting process during March and early April. Where the November and February abundance indices suggest that stock levels are acceptable, the historical relationships between these survey indices and the catch landed in the next fishing season, are broadly used to recommend the annual TACC for each stock, as part of the overarching weight-of-evidence assessment framework.

3.4.1.2 Other ecological components

Other ecological assets incorporated in this harvest strategy include other retained species, bycatch, ETP species, habitats and ecosystem processes that may be affected by scallop trawling (Table 1).

Where reliable quantitative information is available, reference levels used to monitor performance against management objectives relating to these ecological assets have been set based on data available from ongoing monitoring. The impact of scallop trawling on habitats is monitored by estimating the annual spatial trawl footprint of the fishery and ensuring it does not extend across more than 20% of Inner Shark Bay (see Figure 1). Although the fishery generally operates over sandy areas to target scallops, and avoids areas that can damage fishing gear (e.g. reefs), there is potential for the fishery to interact with other benthic

habitats which may be vulnerable to trawl fishing, such as sponges, seagrasses and soft corals. A move on rule will be triggered when the component of vulnerable habitat bycatch in the fishery exceeds a specified amount (see Table 1).

For all ecological components, reference levels have also been set to differentiate acceptable fishery impacts from unacceptable fishery impacts according to the risk levels defined in Fletcher (2015). An ecological risk assessment for the Shark Bay invertebrate fisheries (including scallop trawling) was undertaken in September 2019 to inform these components of the harvest strategy, with these risk scored to be reviewed after no more than five years (see Section 3.6.2.4).

The risk of scallop fishing on western king and brown tiger prawns in Shark Bay is assessed annually as part of the risk-based weight-of-evidence assessment of these stocks (Table 1), which informs the Shark Bay prawn harvest strategy (DPIRD in prep. a) and considers if additional management measures (such as spatio-temporal restrictions) are necessary.

3.4.2 Application of Harvest Control Rules

For each ecological performance indicator and reference level, an accompanying HCR directs the management needed to meet the sustainability objectives (Table 1). These HCRs are designed to maintain the resource above the threshold level (i.e. within the target range), or rebuild it where it has fallen below the threshold (undesirable) or the limit (unacceptable) levels.

Where an indicator suggests that the fishery impact on a resource is no longer acceptable, the HCR typically initiates a review of all available information to determine an appropriate management response. The extent of management action taken is determined by the extent to which a performance indicator has breached a reference point, increasing in line with an increasing risk to the resource. This review process also includes consideration of future research and monitoring to ensure the indicator returns to the target level, as well as the compliance response needed to ensure management changes are adequately enforced.

Although a wide range of management measures may be used to achieve the management responses broadly outlined by the HCRs (Table 1), examples for the Shark Bay scallop resource include

1. setting a more conservative TACC for the next fishing season,
2. limiting the proportion of the TACC that can be taken prior to the key scallop spawning closure, and
3. restricting the spatial and/or temporal extent of fishing effort on pre-spawning/small scallops by implementing closures.

The ability to, and timeframe for, implementing these changes depends on the legal instrument under which the management measure occurs (see Section 4.1 for more information).

3.4.2.1 Recovering Depleted Stocks

A resource that has fallen below the acceptable level and for which suitable management adjustments have been implemented to reduce catch and/or effort (as outlined in the HCRs) is considered to be in a recovery phase (Department of Fisheries 2015). For target stocks that fall below the limit reference level, a recovery strategy will be implemented to ensure that the resource can rebuild at an acceptable rate. Where the environmental conditions have led, or contributed significantly, to the resource being at an unacceptable level, the strategy needs to consider how this may affect the speed and extent of recovery.

Due to the naturally variable recruitment and stock levels of scallops, a key component of the recovery strategy for scallops (see Appendix 3) is setting the TACC for the affected area to zero until stock levels have returned to above the threshold level. As scallops can be caught and discarded by prawn fishers during this recovery phase, the strategy also considers additional management measures to minimise potential impacts of discarding on scallops, including spatial closures to trawling.

When the stock has returned to above the threshold level, a precautionary TACC of <100 t will remain in place until the index has been maintained above this level for two consecutive years. Before the stock is considered to have rebuilt, a review of the harvest strategy will be undertaken to ensure the original HCRs remain appropriate to maintain the stock above the threshold levels in the future.

Table 1. Harvest strategy performance indicators, reference levels and control rules for the Shark Bay saucer scallop resource, and associated ecological assets that may be impacted by fishing activities targeting scallops within Shark Bay. Note that only the impacts of fishing with scallop trawl gear (i.e. large mesh nets) on ecological assets other than the target species are currently assessed within this harvest strategy.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
Target species	To maintain spawning stock biomass of saucer scallops in Shark Bay at a level where the main factor affecting recruitment is the environment	Northern Shark Bay saucer scallops	**Primary** November abundance index for northern Shark Bay stock **Secondary** February abundance index for northern Shark Bay stock (under development)	**Target:** November index >130 scallops per nm	If the November index is above the Threshold, set the TACC for the next season based on the February survey and a weight-of-evidence assessment of all available information. Where necessary, subject to the proximity of the index to Threshold level, consider additional management measures to reduce the extent of fishing in the months prior to spawning (April – June).
				Threshold: November index ≤130 scallops per nm	If the November index breaches the Threshold, set the TACC for the next season to a precautionary level (<100 t) based on the February survey and a weight-of-evidence assessment of all available information. Consider additional monitoring and/or management measures to reduce the extent of fishing in the months prior to spawning (April – June).
				Limit: November index ≤90 scallops per nm	If the November index is equal to or below the Limit, set the TACC for the next season to zero (unless February survey demonstrates a marked improvement in scallop abundance). Additional management measures and/or monitoring will be implemented as soon as possible to protect scallops over the summer fishing period, until February survey provides additional information.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
Target species	To maintain spawning stock biomass of saucer scallops in Shark Bay at a level where the main factor affecting recruitment is the environment	Denham Sound saucer scallops	**Primary** November abundance index for Denham Sound stock **Secondary** February abundance index for Denham Sound stock	**Target:** November index >160 scallops per nm	If the November index is above the Threshold, set the TACC for the next season based on the February survey and a weight-of-evidence assessment of all available information. Where necessary, subject to the proximity of the index to Threshold level, consider additional management measures to reduce the extent of fishing in the months prior to spawning (April – June).
				Threshold: November index ≤160 scallops per nm	If the November index breaches the Threshold, set the TACC for the next season to a precautionary level (<100 t) based on the February survey and a weight-of-evidence assessment of all available information. Consider additional monitoring and/or management measures to reduce the extent of fishing in the months prior to spawning (April – June).
				Limit: November index ≤100 scallops per nm	If the November index is equal to or below the Limit, set the TACC for the next season to zero (unless February survey demonstrates a marked improvement in scallop abundance). Additional management measures and/or monitoring will be implemented as soon as possible to protect scallops over the summer fishing period, until February survey provides additional information.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
			November survey catch rates of scallops and snapper in Areas 1 or 2 of the Denham Sound extension	**Target:** ≥ 400 scallops per nm, and <100 snapper per trawl hour	If both targets are met, trawling in that area by A class vessels is permitted for one fishing period of up to a total of 10 nights duration in December, January or February.
Other retained species	To maintain spawning stock biomass of each retained species at a level where the main factor affecting recruitment is the environment	Blue swimmer crabs	Refer to the Shark Bay Blue Swimmer Crab Resource Harvest Strategy		
		All other retained non-target species (mainly bugs)	Periodic risk assessments incorporating: • current management arrangements, • annual fishing effort and catch • species information, and • other available research	**Target:** Fishing impacts are expected to generate an acceptable level of risk to all retained species' populations, i.e. moderate risk or lower.	Continue management aimed at achieving ecological, economic and social objectives.
				Thresholds: A potentially material change to risk levels is identified; or Fishing impacts are considered to generate an undesirable level of risk to any retained species' populations, i.e. high risk.	Review the reasons for this variation within 3 months and implement an appropriate management response to reduce risk to an acceptable level as soon as practicable.
				Limit: Fishing impacts are considered to generate an unacceptable level of risk to any retained species' populations, i.e. severe risk.	Initiate an immediate management response to reduce the risk to an acceptable level as soon as practicable.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
Bycatch (non-ETP) species	To ensure fishing impacts do not result in serious or irreversible harm to bycatch species populations	Western king prawns and brown tiger prawns	The risk of scallop fishing and potential discarding on western king and brown tiger prawns is assessed annually as part of the overall weight-of-evidence assessment of stock status that informs the Shark Bay Prawn Resource Harvest Strategy.		
		All other bycatch species	Periodic risk assessments incorporating: • current management arrangements, • use of BRDs, • fishing effort and catch (including discards), • review of alternative measures to minimise unwanted catch, • species information, and • other available research	**Target:** Fishing impacts are expected to generate an acceptable risk level to all bycatch species' populations, i.e. moderate risk or lower.	Continue management aimed at achieving ecological, economic and social objectives.
				Thresholds: A potentially material change to risk levels is identified; or Fishing impacts are considered to generate an undesirable level of risk to any bycatch species' populations, i.e. high risk.	Review the reasons for this variation within 3 months and implement an appropriate management response to reduce risk to an acceptable level as soon as practicable.
				Limit: Fishing impacts are considered to generate an unacceptable level of risk to any bycatch species' populations, i.e. severe risk.	Initiate an immediate management response to reduce the risk to an acceptable level as soon as practicable.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
ETP species	To ensure fishing impacts do not result in serious or irreversible harm to ETP species' populations	All ETP species	Periodic risk assessments incorporating: • current management arrangements, • use of BRDs, • annual fishing effort and catch, • number of reported ETP species interactions, • species information, and • other available research	**Target:** Fishing impacts are expected to generate an acceptable risk level to all ETP species' populations, i.e. moderate risk or lower.	Continue management aimed at achieving ecological, economic and social objectives.
				Thresholds: A potentially material change to risk levels is identified; or Fishing impacts are considered to generate an undesirable level of risk to any ETP species' populations, i.e. high risk.	Review the reasons for this variation within 3 months and implement an appropriate management response to reduce risk to an acceptable level as soon as practicable.
				Limit: Fishing impacts are considered to generate an unacceptable level of risk to any ETP species' populations, i.e. severe risk.	Initiate an immediate management response to reduce the risk to an acceptable level as soon as practicable.
Habitats	To ensure the effects of fishing do not result in serious or irreversible harm to habitat structure and function	All habitats	1. Extent of Inner Shark Bay trawled annually (with scallop trawl gear), and 2. Periodic risk assessments incorporating: • current	**Targets:** Extent of scallop trawling remains ≤20% of Inner Shark Bay; and Fishing impacts are expected to generate an acceptable risk level to all benthic habitats, i.e. moderate risk or lower.	Continue management aimed at achieving ecological, economic and social objectives.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
			management arrangements, • annual fishing effort, • extent of area trawled annually, and • other available research	**Thresholds:** Extent of scallop trawling is >20% of Inner Shark Bay; A potentially material change to risk levels is identified; or Fishing impacts are considered to generate an undesirable level of risk to any benthic habitats, i.e. high risk.	Review the reasons for this variation within 3 months and implement an appropriate management response to reduce risk to an acceptable level as soon as practicable.
				Limit: Fishing impacts are considered to generate an unacceptable level of risk to any benthic habitats, i.e. severe risk.	Initiate an immediate management response to reduce the risk to an acceptable level as soon as practicable.
		Vulnerable habitats[3]	Amount of fishery bycatch comprised of vulnerable habitats	**Threshold:** >1 basket[4] of vulnerable habitat per nautical mile trawled in a shot	Move on rule triggered. Cease fishing and report coordinates for the area trawled during shot to the Department such that a notice can be distributed to all active vessels to avoid area. Return to historically fished scallop grounds until additional habitat assessments have been conducted.

[3] Structurally complex and/or ecological vulnerable habitats (e.g. seagrass, sponges, soft corals)

[4] Basket dimensions: 600 L x 420 W x 320 H (mm)

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
Ecosystem	To ensure the effects of fishing do not result in serious or irreversible harm to ecological processes	Community structure and function	Periodic risk assessments incorporating: • current management arrangements, • use of BRDs, • catch levels, • number of reported ETP species interactions, • extent of area trawled annually, and • other available research	**Target:** Fishing impacts are expected to generate an acceptable risk level to the ecosystem, i.e. moderate risk or lower.	Continue management aimed at achieving ecological, economic and social objectives.
				Thresholds: A potentially material change to risk levels is identified; or Fishing impacts are considered to generate an undesirable level of risk to the ecosystem, i.e. high risk.	Review the reasons for this variation within 3 months and implement an appropriate management response to reduce risk to an acceptable level as soon as practicable.
				Limit: Fishing impacts are considered to generate an unacceptable level of risk to the ecosystem, i.e. severe risk.	Initiate an immediate management response to reduce the risk to an acceptable level as soon as practicable.

3.5 Fishery Performance

Defining annual tolerance levels for fisheries provides a formal but efficient basis to evaluate the effectiveness of current management arrangements in delivering the levels of catch and/or effort specified by the HCRs and, where relevant, any sectoral allocation decisions (Fletcher et al. 2016). In line with the principles of ESD, this fishery-level review process can also consider the performance against any objectives relating to the economic and social amenity benefits of fishing. Where possible, and in due consideration of ecological sustainability, fisheries management arrangements can be adjusted or reformed to help meet these economic and/or social objectives.

Tolerance ranges have not yet been developed for the SBSMF scallop trawling in the SBSMF due to the naturally fluctuating catch and fishing effort between years, as a result of the variable recruitment of scallops. The performance of this fishery is rather monitored throughout each fishing season, based on the fishery-dependent and independent data used to measure stock status.

The economic and social objective for the scallop fishery does not currently have explicit performance measures within the harvest strategy. Rather it is through formal consultation processes that regulatory impediments to maintaining or enhancing economic return, and maximising social benefits of fishing, are discussed. This broadly considers the ability of fishers to retain scallops at times when it is most economically favourable (based on the size and quality of scallops, as well as other retained species) and minimising the interaction between fleets while allowing equitable access to catch. Once suitable and measurable indicators for monitoring performance against the economic and social objectives have been identified, these will be included in future revisions of this harvest strategy.

3.6 Monitoring and Assessment Procedures

3.6.1 Information and Monitoring

3.6.1.1 Commercial Fishing Information

It has been a statutory requirement for fishers in the SBSMF to provide daily logbook records of catch (in weight and numbers) and effort (trawl start time and duration) since 1983. The spatial resolution of the logbook data was initially recorded by fishers for 10×10 nautical mile blocks or fishing grounds. However, since 1998, the reporting of latitude and longitude coordinates for the start of each trawl in logbooks has been mandatory. Following the move of the SBSMF in 2015 to a quota management system, fishers are now also required to fill in a Catch and Disposal Record (CDR) when landing catch.

Although some operators in the SBSMF now land scallops whole, the majority of catches have typically been shucked at sea and skippers record an estimate of the meat weight (on average approximately 20% of the whole weight) together with the number of baskets of whole scallops caught. Departmental staff check, enter and validate the logbook data against processor unload records on a monthly basis and any possibly erroneous entries or gaps are

checked with skippers and possibly adjusted. Spatial data validation is undertaken by plotting maps of logbook effort and random checks of data against location records from the Vessel Monitoring System (VMS).

Although there have been no major gear changes in the SBSMF for a number of years (i.e. number of nets or headrope length), fishing efficiency has likely increased through advances in GPS and contour mapping technology, use of bigger boats and provision of annual survey information to allow skippers to focus on higher abundance areas with less exploration. While fishery-independent survey data are considered a more reliable indicator of stock abundance, fishery-dependent data is important for monitoring within-season operations.

3.6.1.2 Recreational Fishing Information

Surveys of all boat-based recreational fishing in WA have been undertaken periodically since 2011/12 to provide bioregional estimates of recreational boat-based catches (e.g. Ryan et al. 2019).

3.6.1.3 Fishery-Independent Information

Fishery-independent scallop surveys in Shark Bay (both Denham Sound and northern Shark Bay) have been undertaken annually in November since 1983. Additional February and June surveys were first introduced to northern Shark Bay in 2012 and were expanded to include Denham Sound since 2015.

The surveys are undertaken by Departmental staff using standardised twin-rigged trawl gear with 100 mm mesh cod-ends and the duration of each trawl is 20 minutes. As the speed of trawling influences the efficiency of the trawl gear, the catch is adjusted to the equivalent catch at a trawl speed of 3.4 knots. At each survey site, the catch rates and length frequency data provide information on the abundance and size of scallops, which are considered as part of the overall weight-of-evidence assessments of the stocks at the time of TACC setting, and throughout the fishing season as new data become available.

3.6.2 Assessment Procedures

3.6.2.1 Saucer Scallops

The status of the two scallop stocks (Denham Sound and northern Shark Bay) is assessed using a weight-of-evidence approach that considers all available (fishery-independent and fishery-dependent) information at multiple times each fishing season. For each stock, the total abundance index (recruits and residuals/adults) derived from the November survey is currently used as the primary performance indicator to evaluate stock status relative to specified reference levels. The subsequent February survey is used as a secondary measure to evaluate the status at the end of the summer fishing period (including new recruits from late spawning) and set an appropriate annual TACC.

The current reference levels for each stock have been derived from empirical stock-recruitment-environment relationships based on the November indices of recruits and

residuals/adults since 1983. The limit levels have been set to the values of the November abundance index below which historical data for each stock indicates an unacceptable risk of recruitment impairment if fishing was to occur the next fishing season. The threshold level, below which the TACC is set to a very conservative level to ensure exploitation is reduced, is approximately 1.5 times the limit level. Although the naturally fluctuating stock levels and recruitment make it very difficult to determine the Maximum Sustainable Yield (MSY) for saucer scallop stocks, the target has been set as the range of values greater than the threshold level.

For the northern Shark Bay stock, the historical time series of the November index has not provided an accurate prediction of catches in recent years, considered to be due to the changing environmental conditions. The November survey index has continued to provide an accurate prediction of catches for Denham Sound. Together with February survey information, these data are used to inform TACC setting process for each stock when abundance is sufficient to allow fishing to occur.

3.6.2.2 Other Retained Species

Other species retained by A and B Class fishers in the SBSMF (when fishing with large mesh scallop gear) include blue swimmer crabs (*Portunus armatus*) and other small invertebrates such as bugs (*Thenus* spp.).

The catch of blue swimmer crabs (by the trap and trawl sectors) in Shark Bay is managed through quota in the Shark Bay Crab Managed Fishery (SBCMF) and is assessed as part of a separate harvest strategy for that resource (DPIRD in prep. b). Likewise, the retained catch of prawns by B Class fishers (when fishing with smaller mesh) is considered in the Shark Bay Prawn Resource Harvest Strategy (Department of Fisheries 2014; DPIRD in prep. a).

Due to the low and highly variable reporting of bug catches retained over the history of the fishery (<1 t annually), the impact of scallop fishing on this resource is currently assessed based on risk (see Section 3.6.2.4).

3.6.2.3 Habitats

The spatial extent of fishing in the SBSMF is calculated annually using fishery-dependent logbook data and the Department's VMS. The spatial location of fishing is plotted using the VMS data which is trimmed to the start and end times of fishing, as recorded in the fishery-dependent logbook data. This fine-scale spatial effort data can be used to overlay fishing effort to any available habitat information within the fishery to describe the level of direct interaction.

3.6.2.4 Ecological Risk Assessments

The Department uses a risk-based EBFM framework to assess the impacts of fishing on all parts of the marine environment, including the sustainability risks of target species, other retained species, bycatch, ETP species, habitats and ecological processes (Fletcher 2015). This framework has led the development of a periodic risk assessment process, which is used

to prioritise research, data collection, monitoring needs and management actions for fisheries and to ensure that fishing activities are managed both sustainably and efficiently.

An ecological risk assessment for the overall Shark Bay invertebrate resource was most recently undertaken in September 2019. The risk assessment considered the impacts of the key fishing sectors targeting the resource (scallop trawl, prawn trawl and crab trap) on the ecosystem, assessed both individually and cumulatively. The risks of scallop fishing to each of the ecological components (other than the target species) were assessed as Negligible or Low risk. The cumulative risks of the fishing sectors on these ecosystem component were all determined to be acceptable.

Risk assessments for the Shark Bay invertebrate resource will continue to be undertaken periodically (at least every five years) to reassess any current or new issues that may arise in the fisheries. A new risk assessment can also be triggered if there are significant changes identified in fishery operations or management activities or controls that are likely to result in a change to previously assessed risk levels.

4 MANAGEMENT MEASURES AND IMPLEMENTATION

4.1 Management Measures

There are a number of management measures in place for the fisheries that target the Shark Bay scallop resource (Table 2). These measures can be amended as needed to ensure management objectives are achieved, however, they do not preclude the consideration of other options.

Table 2. Management measures and instrument of implementation for the fisheries that target the Shark Bay scallop resource

Measure	Description	Instrument
Limited Entry	A limited number of Managed Fishery Licences are permitted to operate in the SBSMF: - 11 Class A (scallop only) - 18 Class B (scallop and prawn).	SBSMF Management Plan
Quota System	The SBSMF is managed via output controls in the form of a TACC, which is divided into individually transferable quota entitlement of scallop meat weight per Managed Fishery Licence, based on a proportional 70:30 split between Class A and Class B licences.	FRMA (Section 7 Exemption)
Temporal Closures	No retention of scallops is permitted during the key spawning period.	SBSMF season arrangements
	Class B (scallop and prawn) licence holders are only permitted to operate at night during the prawn season.	SBPMF Management Plan
	Fishing closures also occur around each full moon for Class B operators.	Voluntary agreement
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.	SBSMF Management Plan; SBPMF Management Plan
	The waters of Hamelin Bay are permanently closed to trawling as part of the Shark Bay Marine Park.	Section 43 Order (Shark Bay Marine Park)
	Areas are also periodically closed to protect aggregations of juvenile and spawning scallops and prawns.	SBPMF Management Plan; FRMA (Section 7 Exemption); and voluntary agreement
Gear Restrictions	Includes controls on size of ground chain, mesh size and shape, headrope length and the dimensions of otter boards.	SBSMF Management Plan
Bycatch Reduction Devices (BRDs)	The fleet is required to have BRDs in the form of grids and fish exclusion devices such as square mesh panels in all standard nets.	Condition of licence; and SBPMF Management Plan
Reporting	Fishers are required to report all retained species catches, effort, ETP species interactions and fishing location in statutory daily logbooks. As a quota-managed fishery, they must also complete Catch Disposal Records (CDRs) of landed scallops for each fishing trip.	FRMR
	Fishing activities are also monitored via the Vessel Monitoring System (VMS) and the master must submit a nomination of intention to enter the fishery via VMS.	SBSMF Management Plan; and FRMA (Section 7 Exemption)

4.2 Implementing Changes to the Management Arrangements

Decision-making processes can be triggered following the identification of new or potential issues as part of an ecological risk assessment (generally reviewed every three to five 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 for the Shark Bay scallop resource:

- Annual decision-making processes that may result in measures to meet the operational objectives (driven by the harvest strategy); 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).

If there is an urgent issue, stakeholder meetings may be called as-needed to determine appropriate management action.

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 consultation with all affected parties and the approval of the Minister for Fisheries and/or the CEO (or appropriate delegates). In making decisions relevant to fisheries, the Minister for Fisheries may choose to receive advice from any source, but has indicated that:

1) DPIRD is the primary source of management advice; and
2) The peak bodies of the Western Australian Fishing Industry Council (WAFIC) and Recfishwest are the primary source of advice and representation from the commercial and recreational harvesting sectors, respectively.

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 DPIRD, WAFIC has been funded to undertake statutory consultation functions related to fisheries management and the facilitation of management meetings for licensed fisheries such as the SBSMF.

Annual Management Meetings (AMMs) between DPIRD, WAFIC and licence holders in the SBSMF (Class A and B) are generally held in February and are an important forum to consult 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 arrangements are discussed. Follow-up meetings may be held as required.

A Shark Bay Scallop Working Group, comprising representatives from both Class A and B licence holders and from the Department's Science and Aquatic Resource Management Divisions, was established in December 2015. The Working Group generates recommendations for wider industry members and the CEO (or delegate) in relation to

seasonal and longer-term management arrangements, annual TACC setting, review and stock assessment discussions.

TACC Setting & Review

The TACC for each fishing season (1 May to end of April) is determined for each of the two key areas of the fishery, northern Shark Bay and Denham Sound, based on a weight-of-evidence assessment of all available information but primarily focused on indices of scallop abundance from the November and February fishery-independent surveys. The process of consultation ahead of determining the annual TACC is described in Appendix 1.

Additional survey and other information is reviewed by the Department as it becomes available during the fishing season. If these data indicate a substantial and unexpected change in stock levels and/or recruitment, the management arrangements (and TACCs) may be revised in consultation with licence holders during the fishing season (see Appendix 2).

4.2.1.2 Consultation with Other Groups

Consultation on scallop management with Recfishwest, customary fishers and non-fisher stakeholders, including Government agencies, conservation sector Non-Government Organisations (NGOs) and other affected/interested parties is undertaken in accordance with the Departmental Stakeholder Engagement Guideline (Department of Fisheries 2016). DPIRD's approach to stakeholder engagement is based on a framework designed to assist with selecting the appropriate level of engagement for different stakeholder groups and includes collaborating with and involving key stakeholders, seeking input from interested parties through a public consultation process and keeping all parties fully informed through the provision of balanced, objective and accurate information. Key fishery-specific documents such as harvest strategies, recovery plans and bycatch action plans are subjected to both formal key stakeholder consultation and public consultation processes.

As parts of the scallop fishery operates within the Shark Bay World Heritage Area and the Shark Bay Marine Park, key stakeholders identified in accordance with the Stakeholder Engagement Guideline include the Shark Bay World Heritage Advisory Committee and Department of Biodiversity, Conservation and Attractions.

4.3 Compliance and Enforcement

As the key regulatory agency, DPIRD's compliance role is to achieve economic, social, equity and sustainability objectives by addressing:

- our ability and capacity to influence compliance with the rules; and
- the effectiveness, capacity and credibility of the compliance program.

The Western Australian Fisheries Compliance Strategy (the Strategy; DPIRD 2018) was published in 2018. The purpose of the Strategy is to provide an understanding of the principles underlying the DPIRD's compliance role and how its compliance services are delivered to the WA community. The Strategy aligns with, and complements, DPIRD's

Compliance Framework and Risk Assessment Policy which informs the risk-based model, compliance planning and the governance structure applied to fisheries compliance services.

The Department's compliance model is based on the Australian Fisheries National Compliance Strategy 2016-2020 (the National Strategy). DPIRD's compliance program is aligned to support the three key compliance strategies recommended by the National Strategy:

- maximising voluntary compliance;
- effective deterrence; and
- organisational capability and capacity.

4.3.1 Operational Compliance Plans

Management arrangements for the Shark Bay scallop resource are enforced under an Operational Compliance Plan (OCP) that is informed and underpinned by a compliance risk assessment. The 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;
- to encourage voluntary compliance through education, awareness and consultation activities; and
- to review compliance strategies and their effective implementation.

The OCP is reviewed every 1-2 years.

4.3.1.1. Compliance Strategies

Compliance strategies and activities that are used to protect the Shark Bay scallop resource include:

- land and sea patrols;
- catch validation against managed fishery licences;
- inspections of scallop wholesale and retail outlets;
- inspections at scallop processing facilities;
- inspections of vessels in port and pre-season briefings;
- at sea inspection of fishing boats; and
- closed area/season monitoring via VMS.

Inspections may involve:

- inspection of all compartments on board the vessels;
- inspection of all authorisations;

- inspection of logbooks; and
- inspection of catch on board the boat.

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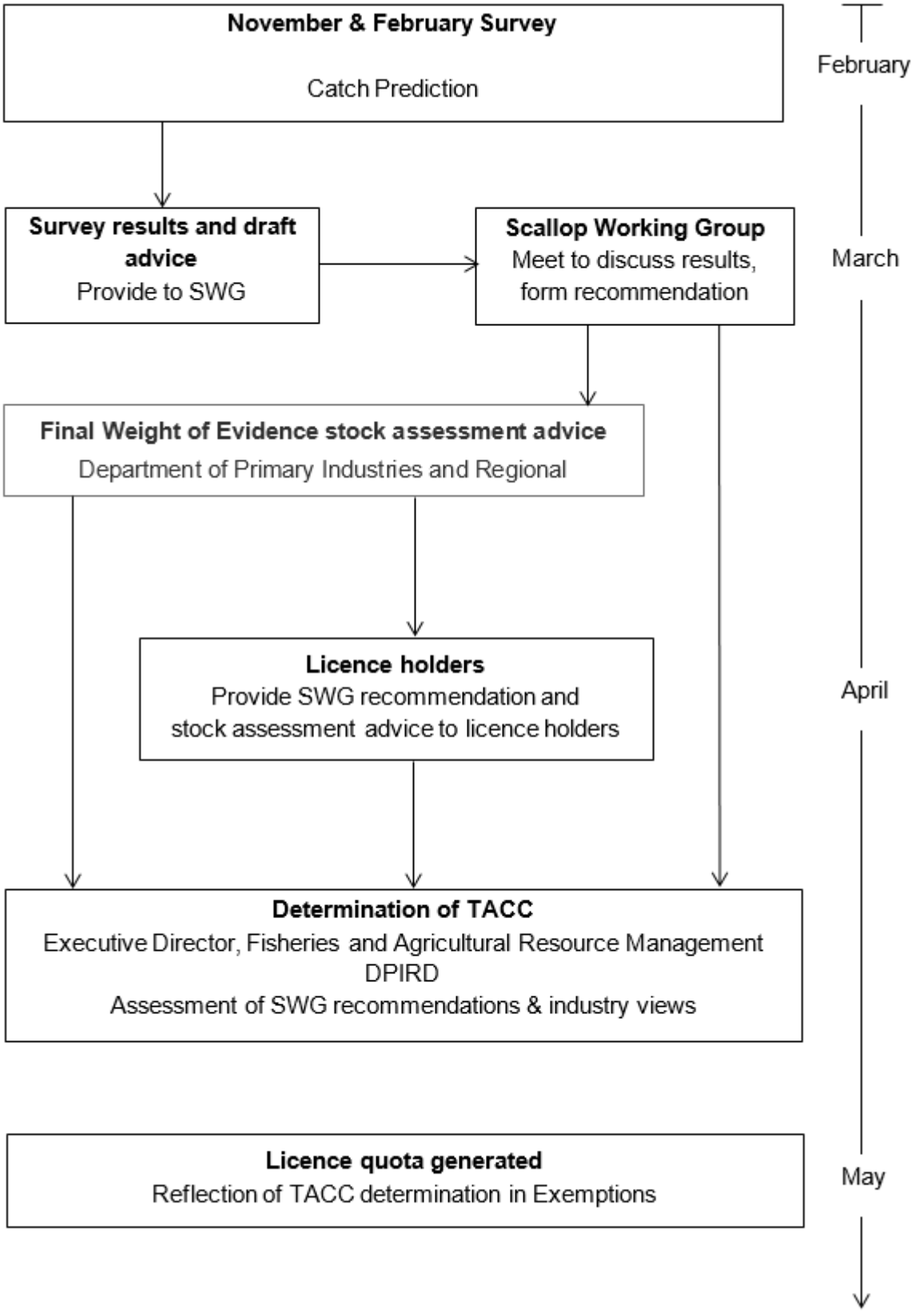
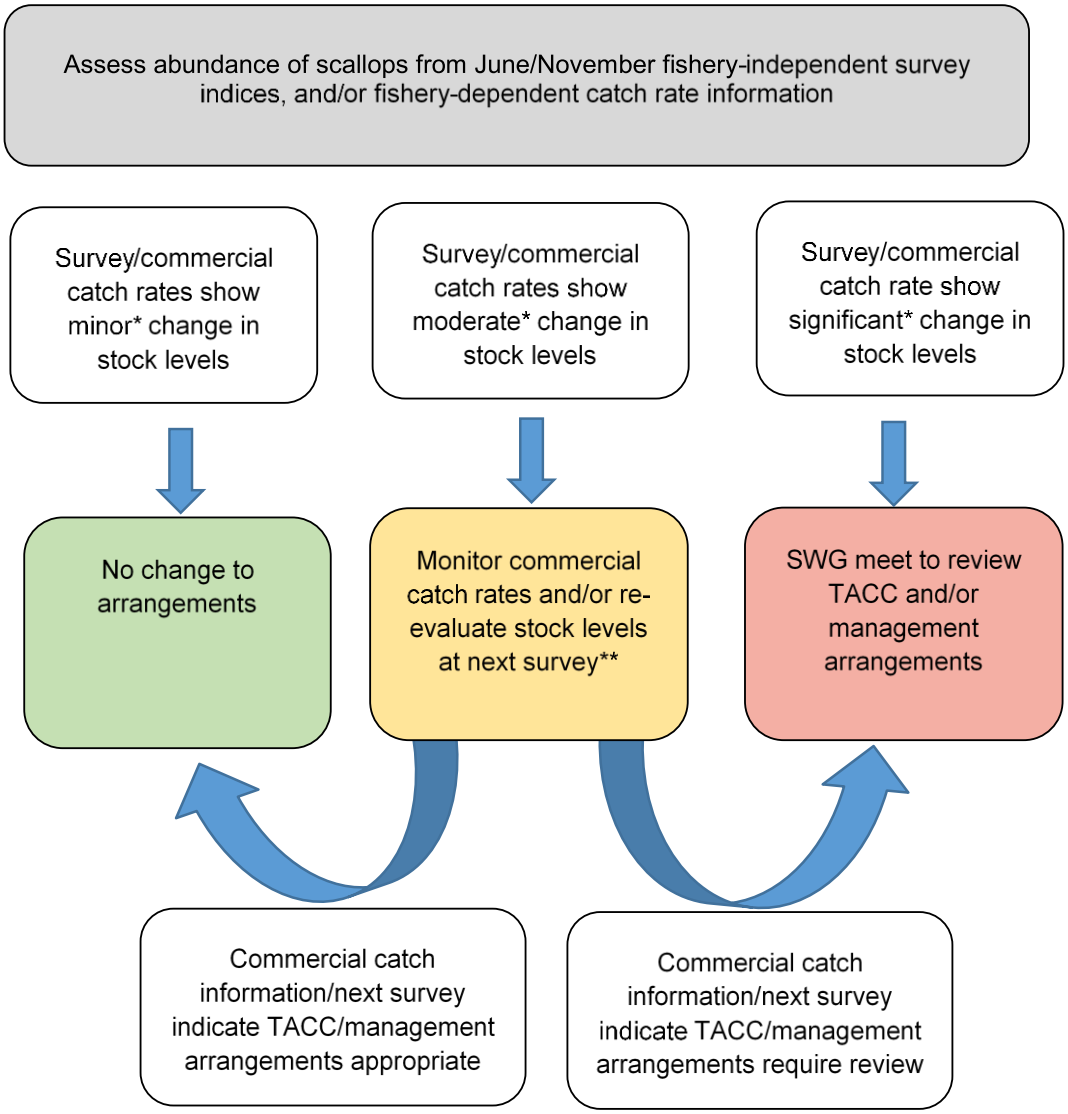
6 APPENDIX 1

Outline of annual TACC setting process for scallops in Shark Bay



7 APPENDIX 2

Outline of TACC review process for scallops in Shark Bay



*Determining minor/moderate/significant to be based on a change between two indices relative to catch taken and whether it is the June or November survey Further analysis required

**There may be minimal fishing or the area may be closed to harvest between surveys

8 APPENDIX 3

Shark Bay Saucer Scallop

Recovery Strategy

Introduction

Scallop abundance fluctuates naturally from year to year due to variations in recruitment success. In the key scallop fisheries in WA, there have been several periods of low scallop recruitment. On a number of occasions, scallops have been found to recover naturally within four years when environmental conditions were favourable and spawning stock levels were adequate.

In 2012, the scallop fishery in Shark Bay was formally closed in response to low stock levels (below the Limit reference level) that followed a marine heatwave event that severely influenced scallop survival and recruitment. By 2015, there had been sufficient recovery of the stock in Denham Sound to allow a limited catch of 100 t to be taken after the key spawning period. The northern Shark Bay stock showed a slower recovery, and was first opened up to limited fishing in late 2016.

After a few years of good scallop recruitment, the November survey in 2018 indicated a decline in scallop abundance in northern Shark Bay, once again falling below the specified Limit level. The scallop stock in northern Shark Bay continued to be classified as inadequate after the 2019 November survey indicated that the stock remained below the limit level. A management response was implemented to cease fishing in that area for the 2019/20 fishing season and close two key areas to prawn trawling, and remains in place for the 2020/21 season.

This recovery strategy outlines the management actions to be implemented to help rebuild either scallop stock in Shark Bay, if either falls below the Limit reference level. It also includes the monitoring and assessment processes to evaluate how rebuilding is occurring. The recovery strategy is an ancillary document to be read in conjunction with the Shark Bay Scallop Resource Harvest Strategy and will remain in place until the stock is considered rebuilt. Due to the short generation time of scallops (~1 year), the timeframe for this recovery strategy has been set to 5 years, but this is dependent on environmental conditions.

Recovery Plan

The current harvest strategy takes a very precautionary approach to recovery by providing for an immediate closure of the scallop fishery on the affected stock (Denham Sound or northern Shark Bay). If the index of abundance from the November survey (and Feb?) is below the limit reference level, the relevant area will be closed to scallop fishing. Although the prawn fishery may continue to operate in that area, no retention of scallops will be permitted.

While current management measures in place for the prawn fishery (e.g. spatio-temporal closures) reduce the potential impacts of the prawn fleet on scallop stocks, some discarding of incidentally captured scallops during their normal operations still occurs. This may result in some discard mortality (Chandrapavan et al. 2012; Kangas et al. 2012) or other sub-lethal impacts.

They key management objective of this recovery strategy is to:

- Protect the residual biomass of saucer scallops to allow stock to recover to above the Threshold level within 5 years, to ensure the ecological objective is met.

To achieve this objective, three key steps have been identified:

Step 1: Initiate recovery of the stock and rebuild to above the Limit level.

Step 2. Rebuild scallop stock to above the Threshold level.

Step 3: Ensure recovery by maintaining scallop abundance above the Threshold level for two years.

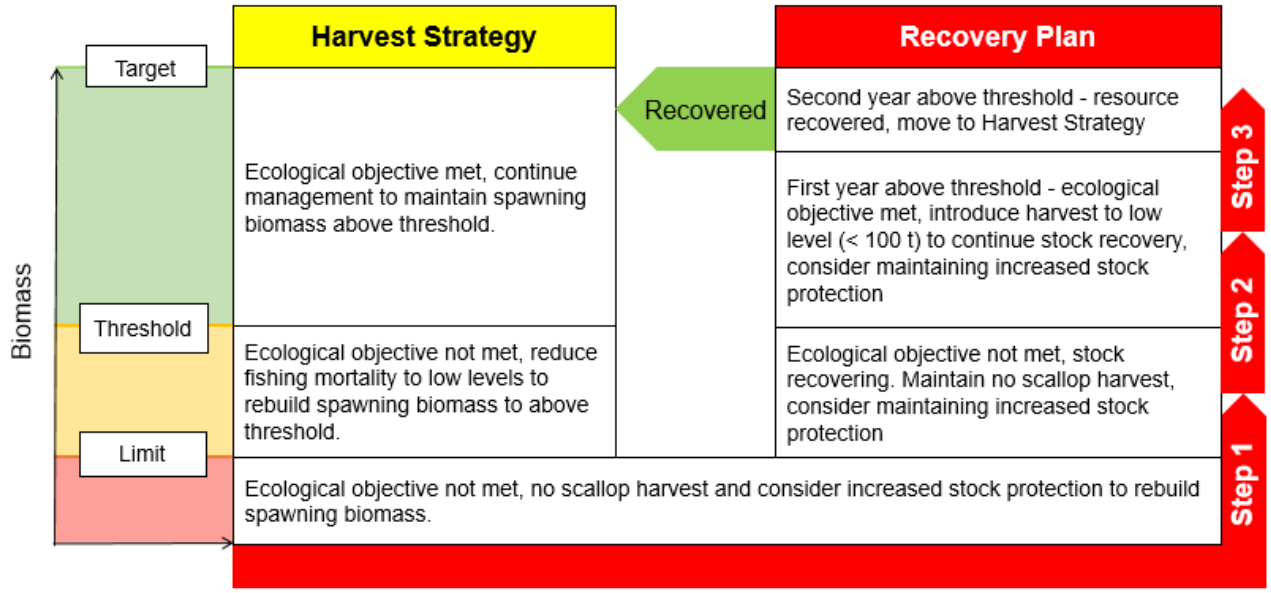


Figure 1. Schematic of scallop resource of Shark Bay harvest control rules when under the Harvest Strategy or Recovery Plan.

Two key strategies have been developed to support this recovery plan:

1) Set the scallop TACC to zero, prohibiting retention of scallops by A and B class fishers, and

2) Consider the implementation of closures in appropriate areas to maximise the protection of stock and to minimise discarding of scallops by prawn fishers.

Strategy 1 – No scallop harvest

Under Step 1, to initiate the recovery of the scallop stock, the harvest strategy requires that management action be taken to prohibit retention of scallops by the commercial fishery (A class and B class), to enable a return to above the threshold within 5 years.

The strategy towards achieving this involves closing the commercial scallop fishery of the affected stock and setting the TACC for this area to zero. Whilst the prawn trawl fishery continues to operate, no retention of scallops is permitted and any scallops brought up in prawn trawl nets must be returned to the water. The zero TACC will remain in place until the index of stock abundance has increased to above the Threshold level and remained at or above this level for two consecutive years.

Further management measures will also be considered to assist with stock recovery. If the results of the fishery-independent surveys show that stock levels have not increased to above the Limit level within one year of the zero TACC being introduced, these additional management measures (trawl closures) will be considered as the second component of this recovery strategy.

Strategy 2 – Increased stock protection

Two additional management measures to assist recovery of affected scallop stock when prohibiting retention of scallops does not appear sufficient. These measures focus on reducing the discarding of scallops by B class (prawn) fishers by:

1) Implementing a spatial trawl closure to areas with a high abundance of small scallops and/or areas historically important for scallop settlement.
2) Implementing temporal trawl closures over the key months (summer) when discarding is likely to have a greater impact on scallops.

These measures may be introduced under either of the above Steps. For example, under Step 1 when stock levels have not increased to above the Limit level within one year of the zero TACC being introduced, and under Step 2 or 3 if unable to reach or stay above the threshold for a sustained period of time.

If either of these measures have been implemented and the results of the November fishery-independent survey show that stock levels have not increased to above the Limit level within one year of the trawl closures being introduced, the closure (spatial extent, location and/or period) will be reviewed.

Monitoring & Assessment

The Department undertakes three fishery-independent surveys of scallop abundance each year, in February/March, June and November. Although all important to inform the recovery of the scallop stock, the November index is annually compared to reference levels to measure performance of the recovery strategy. The additional surveys in February and June will also be considered as part of a broader weight-of-evidence assessment of stock status.

Where spatial trawl closures are implemented to assist rebuilding (Strategy 2), scallop abundance inside and outside any closed areas will be monitored specifically to provide some information regarding scallop survival in ‘undisturbed’ and ‘potentially disturbed’ areas. It is critical to recognise that, due to natural variability and a potential for ongoing environmental

effects, a high degree of certainty regarding the effect of trawling closures on scallop abundance may be difficult to achieve.

Research Initiatives

An essential component of this recovery strategy is to improve the understanding of the natural and anthropogenic factors influencing scallop recovery including:

1) how environmental factors are changing and how they are influencing the biology and ecology of scallops leading to impacts on distribution, recruitment, growth and survival;

2) if ongoing (non-targeted) fishing operations are affecting egg production either directly via incidental mortality or indirectly via sub-lethal impacts. Sub-lethal impacts may be caused by either stress induced by non-lethal capture and release, disturbance to scallops from trawling that did not result in capture, and/or habitat disturbance at a scale that impacts egg production or recruitment; and

3) Investigating the costs and benefits of utilising closures to aid management and recovery of scallops in Shark Bay for the development of a methodology and process for their consideration into the future management of scallops in Shark Bay.

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