

# Management Plan for the South Australian Commercial Spencer Gulf Prawn Fishery

October 2020



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Approved by the Minister for Primary Industries and Regional Development pursuant to section 44 of the Fisheries Management Act 2007

Hon David Basham MP

24 October 2020



### Management Plan for the South Australian Commercial Spencer Gulf Prawn Fishery

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# **1** Fishery to which this plan applies

This plan applies to the Spencer Gulf Prawn Fishery (SGPF), which is formally constituted by the *Fisheries Management (Prawn Fisheries) Regulations 2017*.

The regulations define the fishery as:

- a. the taking of prawns in Spencer Gulf; and
- b. the taking of aquatic resources specified in Schedule 1 Part 1 of the regulations in Spencer Gulf where the aquatic resources are taken at the same time in the same net incidentally to the taking of prawns.

The aquatic resources specified in Schedule 1 Part 1 of the regulations are Balmain Bug (*Ibacus* spp.) and Southern Calamari (*Sepioteuthis australis*).

Spencer Gulf is defined in the regulations.

# 2 Consistency with other management plans

The management plan has been developed so that it can be integrated with any Aboriginal traditional fishing management plans that are made in the future that apply to the waters of this management plan.

This management plan has been developed to be consistent with other fisheries management plans including the 'Management Plan for the South Australian Commercial Marine Scalefish Fishery' (PIRSA 2013a) (hereafter referred to as the MSF management plan). In particular, the provisions relating to allocation of access to the SGPF resource between each fishing sector are consistent with the Marine Scalefish Fishery in terms of Southern Calamari.

# **3 Term of the plan**

This management plan applies from 24 October 2020 for a period of ten years.

Sections 47 of the *Fisheries Management Act 2007* (hereafter referred to as the Act) prescribes the requirements for extending this management plan if required.

# **4 Description of the fishery**

There are three commercial prawn fisheries in waters adjacent to South Australia – the SGPF, the Gulf St Vincent Prawn Fishery and the West Coast Prawn Fishery (see Figure 1). The SGPF is the largest prawn fishery in South Australia in terms of production and number of licence holders. It is a single-species prawn fishery, based on the capture of the Western King Prawn (*Melicertus latisulcatus*).

Fishing is permitted in all waters greater than 10m in depth, north of the geodesic joining Cape Catastrophe on Eyre Peninsula and Cape Spencer on Yorke Peninsula, as defined in the *Fisheries Management (Prawn Fisheries) Regulations 2017*. Spencer Gulf is divided into 125 prawn fishing blocks, which are aggregated into regions reflective of the historic main trawl grounds of the fishery (Figure 1).



Figure 1: Map of fishing blocks in the three commercial prawn fisheries of South Australia.

There are 39 commercial fishery licences issued for the SGPF. The input controls under which the SGPF is managed are outlined in the *Fisheries (Prawn Fisheries) Management Regulations 2017.* As at October 2020, the regulations stated any boat used in the SGPF must be registered and endorsed upon the licence under which it is being used. Boats in

the fishery must not have an overall length exceeding 22m, nor a main engine continuous brake horsepower rating exceeding 336 kW.

Commercial fishing is undertaken using the demersal otter trawl technique, both single and double rigs are permitted, with a minimum mesh size of 4.5cm and a maximum headline length of 29.26m.

In addition to prawns, commercial licence holders are permitted to retain and sell two species that are harvested incidentally during prawn trawling – the Balmain Bug Lobster (*Ibacus* spp) and Southern Calamari (*Sepioteuthis australis*). These species are referred to as by-product.

On 25 July 2011, following a rigorous environmental assessment, the SGPF built upon its reputation as a global leader by becoming the first prawn fishery in Australia to gain certification by the Marine Stewardship Council (MSC). The SGPF was recertified for an additional 5-year period on 21 July 2016. The MSC certification program provides for ecolabelling of fishery products based on a scientifically robust standard for assessing whether wild-capture fisheries are ecologically sustainable and well managed. In gaining this certification, the SGPF has established itself as one that demonstrates best-practice ecologically sustainable fisheries management.

### 4.1 Historical overview

#### 4.1.1 Commercial fishing sector

The first record of King Prawns being trawled from Spencer Gulf was by the research vessel *FIS Endeavour* in 1909. In 1948, the first attempt to trawl for prawns on a commercial scale in Spencer Gulf was made by a New South Wales Danish-seine boat, but was unsuccessful. On a number of occasions between 1957 and 1964, the South Australian Department of Fisheries and Fauna Conservation carried out exploratory trawling using the *Weeruta* but also had no commercial success. In 1961, Port Lincoln fishers Gavin Scott and Roger and Clyde Haldane on the *Mameena* also tried but had only limited success.

It wasn't until 1967 that the industry showed its true potential through the work of Port Lincoln fisherman Roger Howlett, who is considered the pioneer of the South Australian prawn fishery. In July 1967 Howlett began an extensive resource survey of Spencer Gulf without any outside financial assistance. After two and a half months of conducting surveys during daylight and dark in the southern area, he finally caught the first commercial quantity of prawns in October 1967. Other fishers soon joined Howlett and a developing fishery was underway. Soon after, commercial quantities were also found in Venus Bay on the West Coast.

In March 1968, A.M. Olsen, the Director of Fisheries, closed all South Australian waters to trawling. Forty permits for prawn fishing in a number of different management zones were

then offered and 25 were taken up. These early steps were critical in preventing overexploitation of the resource and over-capitalisation within the fishery, while providing for rational development of the fishery and quantification of the resource. These principles are still the cornerstone to the successful management of this important fishery resource.

In 1968 the Spencer Gulf and West Coast Prawn Fishermen's Association (SGWCPFA) was formed and it was in these early days that the fishermen made gentleman's agreements to restrict fishing. Since this time the SGWCPFA, with its strong membership and dedicated committee, has played a major role in the successful management of the fishery.

The management system now in place for the SGPF has evolved over a number of years and has been largely influenced by the SGWCPFA following a downturn in catch in 1983-84 and 1984-85. At that time, it was believed that the harvesting of smaller-size classes of prawns in the immediately preceding years was responsible for the downturn in biomass and subsequent catches and so the SGWCPFA, in collaboration with the South Australian Research and Development Institute (SARDI) Aquatic Sciences, investigated strategies to change effort patterns in order to target areas with larger-sized prawns, as described in the Harvest Strategy for the fishery in Section 10.

In 1992 the first coordination of fishing strategies at sea during fishing operations (termed 'real-time management') was developed with the appointment of a Committee-at-Sea. Real-time management gives the fleet the ability to apply alternative fishing strategies based on the movement of prawns, their size, fishing effort and catch rates in an ongoing process based on information gathered from the fleet. The Committee-at-Sea, consisting of a Coordinator-at-Sea and skippers, monitor all fished areas and implement changes according to the SGWCPFA's policies, fishing strategies and the triggering of reference points.

The Harvest Strategy developed with the SGWCPFA initially included in the 1998, then 2007 Management Plan (Dixon and Sloan 2007) and refined in the 2014 management plan (PIRSA 2014a) for the fishery aimed to ensure biological sustainability and promote economic efficiency, and used a series of spatial and temporal closures to manage fishing effort. This involved legislating 'closure lines' (a series of GPS coordinates) and prescribed times and dates of trawling to target areas of high catch rates of appropriately sized prawns.

Table 1: Summary of management of the Spencer Gulf Prawn Fishery

Date	
1967	First commercial catch of prawns recorded.
1968	All South Australian waters closed to trawling except for specific managed zones for which permits are offered; all waters less than 10 m in depth are closed to trawling.
1968	25 out of 40 licences taken up.
1969	The <i>Preservation of Prawn Resources Regulations</i> 1969 is introduced and vessels must be licensed to fish for prawns.
1971	The two Spencer Gulf fishing zones are merged to form one.
1975	34 licences taken up in the Spencer Gulf Prawn Fishery, with 5 additional licences added to the SGPF.
1976	Fishers operating in Anxious Bay and Coffin Bay zones on the West Coast are offered the opportunity to switch to the Spencer Gulf zone.
1981	Industry closures of the waters north of Point Lowly and adjacent to Port Broughton to trawling.
1995	The <i>Fisheries (Management Committees) Regulations 1995</i> are introduced and provide a forum for the SGWCPFA to play a major role in the management of the fishery.
1998	First management plan for SGPF introduced.
2002	Industry closure of waters adjacent to Wardang Island to Corny Point.
2007	Second management plan for SGPF introduced.
2011	First prawn fishery in southern hemisphere to be awarded MSC certification.
2012	Coordinator-at-Sea authorised to maintain fishing activities at sea, through gazettal notice.
2014	Third management plan for SGPF introduced.
2016	Re-certified under the MSC principles.
2017	Coordinator-at-Sea and Executive Officer of the SGWCPFA granted Ministerial powers to set fishing runs.
2017	Industry implemented Corny Point closure.

# **5 Economic characteristics**

Data on economic indicators for the Spencer Gulf Prawn Fishery are monitored and reported annually. These reports can be found at https://www.bdo.com.au/en-au/econsearch/safisheriesreports

The GVP in the SGPF was \$30.3 million in 2010-11 and increased to \$41.5 million in 2018-19. A number of factors affect the GVP and costs in the fishery. Some of the increase is related to increased catches and a portion is attributed to increases in nominal prices.

Fluctuations in total output and gross state product (GSP) contributions are generally related to changes in price and fishery catch. The total employment contribution of the fishery has fluctuated over 15 years to 2016-17 but followed an increasing trend overall.

In 2018/19, the estimated total contribution to GSP (directly and indirectly) was estimated to be \$106 million and the total employment contribution was estimated to be 929 FTE jobs (BDO Econsearch 2020).

# 6 Ecosystem and habitat

The Spencer Gulf is a shallow embayment, with depths reaching a maximum of 60m in its southern regions. Due to its shallow nature and temperate location, water temperatures vary markedly throughout the year. A paucity of freshwater influx combined with high levels of evaporation during summer leads to increased levels of salinity, particularly in the shallow northern reaches. This unique 'hyper-saline' environment, along with the vast areas of tidal flat and mangrove habitat, creates ideal breeding conditions for Western King Prawns.

Dixon et al. (2007) presented analyses of habitat types associated with Spencer Gulf coastal habitats from data presented in Bryars (2003). These analyses concentrated on the habitat types crucial to prawn recruitment, particularly tidal flats and mangrove habitats that were associated with tidal flats.

The Spencer Gulf coastline is estimated at 992km in total length; 508km (51%) was tidal flat only and 245km (25%) was mangrove forest associated with tidal flat. Areas with the greatest juvenile prawn nursery habitat were the Far Northern Spencer Gulf (~201km tidal flat only and 67km mangrove forests and tidal flat), Germein Bay (~95km tidal flat only and 57km mangrove forests and tidal flat) and False Bay (~63km tidal flat only and 49km mangrove forests and tidal flat) (Figure 2). These areas of identified nursery habitat correspond well with sites in Spencer Gulf previously found to have the greatest abundances of juvenile prawns (Roberts et al. 2005).



Figure 2: Map of Spencer Gulf habitats.

# 6.1 Biology of key species

The following descriptions provide brief background information on the biological characteristics, commercial production statistics and recreational catch and effort levels for Western King Prawn (*Melicertus latisulcatus*), Balmain Bug (*Ibacus* spp.) and Southern Calamari (*Sepioteuthis australis*) – the latter two of which are important by-product species in the SGPF. More detailed information on biology and stock status is provided in stock assessment and stock status reports prepared by SARDI Aquatic Sciences. All completed reports are available on the Department of Primary Industries and Regions (PIRSA) Fisheries and Aquaculture and SARDI Aquatic Sciences websites at www.pir.sa.gov.au/fisheries and www.sardi.sa.gov.au.

#### 6.1.1 Western King Prawns

Western King Prawns are crustaceans with five pairs of swimming legs (pleopods) and five pairs of walking legs (pereiopods), the front three of which are clawed. Western King Prawns are nocturnal and burrow into the seabed during the day and emerge at night to feed.

The Western King Prawn is distributed broadly throughout Spencer Gulf but prefers sand or mud sediments to seagrass or vegetated habitats (Tanner and Deakin 2001). Adults tend to inhabit waters greater than 10m depth and are harvested in depths of up to 60m in the southern reaches of the gulf. Tagging studies have shown that the general movement patterns for the species are from north to south (Carrick 2003).

Whilst adult Western King Prawn have an offshore life phase, the juvenile phase is spent in shallow nearshore environments generally associated with mangroves and/or tidal flats. Prawn larvae undergo metamorphosis through four main larval stages – nauplii, zoea, mysis and post-larvae. The length of the larval stage depends on water temperature, and development occurs more rapidly in warmer water (Hudinaga 1942). The distribution of prawn larvae is influenced by wind patterns and tidal currents, and the highest densities are found in the north of Spencer Gulf (Carrick 1996).

Growth of the Western King Prawn in Spencer Gulf is highly seasonal and increases with increasing temperature. The highest growth period is immediately after the spawning period is complete, from November to February. Female prawns grow faster and attain a larger maximum size than males.

#### 6.1.2 Southern Calamari

The Southern Calamari (*Sepioteuthis australis*) is common throughout southern Australian coastal waters, ranging from Dampier in Western Australia to Moreton Bay in Queensland and also occurring in Tasmania and northern New Zealand waters. Southern Calamari usually inhabits coastal waters and bays in depths of less than 70m (Winstanley et al. 1983).

It is likely that the Spencer Gulf calamari population share similar characteristics to the adjacent Gulf St Vincent population (Roberts and Steer 2010), where the calamari are spatially segregated into an offshore nursery ground and inshore spawning grounds (Steer et al. 2007). These patterns are closely attributed to spawning behaviour and water clarity.

#### 6.1.3 Balmain Bug

Also referred to as the slipper lobster, the Balmain Bug (*Ibacus peronii*) inhabits depths of 4–288m (Brown and Holthuis 1998). It is long-lived and has low fecundity compared to other lobsters in the Scyllaridae family (Stewart and Kennelly 1997, 2000). Whilst little is known of its biology in Spencer Gulf, it exhibits limited movement patterns in New South Wales waters (Stewart and Kennelly 1998).

Although the Balmain Bug is certainly the species of slipper lobster captured most frequently in Spencer Gulf, it is unclear whether other species are harvested. Only one other species of slipper lobster, *I. alticrenatus*, has been identified in South Australian waters; however, it is unlikely to be captured by Spencer Gulf prawn fishers as it inhabits water depths greater than those fished (depth range: 82–696m, Brown and Holthuis 1998).

#### 6.1.4 Biological status of Western King Prawns in Spencer Gulf as of 2018

The status of the fishery is comprehensively assessed and reported on biennially in a stock assessment report made publically available on the SARDI website (www.sardi.sa.gov.au). The most recent available report was published in June 2019 and relates to the 2017-18 fishing season (Noell et al. 2019). In addition, the SARDI provides stock status classification advice in an Advice Note, which is used to determine the fishing strategy for the season (see Section 10.4.1).

The primary measure for stock status in Spencer Gulf is the adult average catch rates (lb/min or kg/hr), which are obtained during fishery independent stock assessment surveys (SASs) conducted in November, March and April that are used as indices of relative biomass. As the fishery has maintained a long and stable history of surveys, commercial catches and recruitment, the performance indicators for relative biomass aim to maintain survey catch rates within historical ranges that are considered to be at or above maximum sustainable yield (Dixon et al. 2013).

For the 2017-18 fishing season, mean catch rates for adult prawns from surveys conducted in November 2017 and February and April 2018 were 2.27lb/min (62kg/h), 2.96lb/min (81kg/h) and 5.19lb/min (142kg/h) respectively (Noell & Hooper 2019). The mean catch rate for November 2017 survey was below the limit reference level of 2.46lb/min (67kg/h), whereas the catch rates for February and April 2018 were above the limit reference levels of 2.54lb/min (69kg/h) and 3.75lb/min (102kg/h) (Noell & Hooper 2019).

The commercial catch in 2017-18 of 2,197 tonnes was one of the highest recorded since 2009-10 (Figure 3). The weighted annual mean survey catch rate for adult prawns, used as an indicator of harvestable biomass, has been above the limit reference point of 1.75lb/min (48kg/h) since standardised surveys began in 2004-05. Therefore, the fishery has been classified as a sustainable stock (Noell et al. 2019).



Figure 3: Catch and effort in the Spencer Gulf Prawn Fishery 1968 to 2016-17.

Further evidence that the fishery has been fished within sustainable limits for much of its history include relatively stable annual harvests (generally between 1,600 and 2,200 tonnes since 1973-74), a reduction in effort (by more than 60% between 1978-79 and 2001-02) and increases in prawn size over time (between the late 1970s to the 1990s).

Stable measures of relative biomass by size (as determined by surveyed catch rates) indicate that the fishery has continued to be harvested within sustainable limits in recent years. Given the performance against these measures, the current level of fishing mortality is unlikely to cause the fishery to become recruitment overfished (Noell 2019).

### 6.2 Ecosystem impacts

The *Fisheries Management Act 2007* (the Act) requires that ecological impacts be identified and assessed in developing a management plan. A goal of this plan is the management of the SGPF as part of the broader ecosystem, using an ecosystem-based fisheries management (EBFM) approach.

The Act requires that ecological impacts be identified and assessed. The Act specifically requires that the following impacts are identified:

- 1. Potential impacts of the fishery on its associated ecosystem or ecosystems, including impacts on non-target species of fish or other aquatic resources.
- 2. Ecological factors that could have an impact on the performance of the fishery.
- 3. Assessment of the risks (if any) identified under points 1 and 2 to determine the most serious risks and set out strategies for addressing those risks.

To efficiently meet its ecological impact accountabilities under both State and Commonwealth legislation, PIRSA Fisheries and Aquaculture has adopted the 'National Ecologically Sustainable Development (ESD) Reporting Framework for Fisheries', developed by Fletcher et al. (2002). The steps of this analysis include:

- 1. Identifying the issues relevant to the fishery.
- 2. Prioritising these issues.

The primary methods chosen to complete these two elements were:

- 1. Conducting a qualitative risk assessment for:
  - non-species components that make up the SGPF
  - some ecosystem components of the fishery.
- 2. Conducting a semi-quantitative assessment for:
  - target species
  - by-product species
  - by-catch species and
  - defined habitat(s) in the fishery.

An ESD risk assessment for the SGPF was initially conducted to inform development of the 2014 management plan for the fishery. A review of this risk assessment was conducted in 2019 using data from the 2007 and 2013 by-catch surveys and any other

new information available at the time the assessment was conducted. The resulting 2019 addendum to the 2014 ESD report therefore, identifies the risks for species components of the risk assessment available at that time. It is recognised that the fishery and the Spencer Gulf environment are dynamic and risks will change over time. The risk assessment will be repeated to update the assessment of the fishery as required.

To inform the review of the 2014 risk assessment an ESD risk assessment workshop was conducted in Port Lincoln on 20 May 2019 for the SGPF. The results from the ESD risk assessment workshop are described in the 'Addendum to the 2014 ESD risk assessment of South Australia's Spencer Gulf Prawn Fishery' (PIRSA in draft).

Semi-quantitative assessment of the species components of the fishery identified from the 2007 and 2013 by-catch surveys was carried out at the ESD risk assessment workshop. The method used followed the productivity susceptibility analysis (PSA) methodology described in the ecological risk assessment for the effects of fishing (ERAEF) framework developed by Hobday et al. (2011).

The PSA approach measures potential for risk that allows all units within the ecosystem components to be effectively and comprehensively screened for risk. PSA for species components is often used to assess the risk of species whose distribution includes the area in which the fishery operates (regardless of whether there is ever an interaction recorded). The units of analysis for this PSA comprised species (by-catch, by-product and Threatened Endangered and Protected Species (TEPS)) the fishery has interacted with in the assessment period (i.e. last 5 years), that have been reported in fisheries logbooks, wildlife interaction logbooks and independent observer logbooks.

The PSA measures potential risk. While the relative fishery interactions are measured through the PSA, assessment of the actual impact of the fishery on a species is not made. It does not take into account the level of catch, the size of the population, or the likely exploitation rate. Thus, the risk rating provided from the PSA identifies species that may require further consideration with regard to mitigation options or additional information requirements.

A stakeholder panel at the workshop on 20 May 2019 considered the PSA outcomes for each of the 212 species identified from the 2007 and 2013 by-catch surveys and logbooks. The stakeholder panel identified species at potential high risk or requiring further consideration and considered management arrangements currently in place to mitigate risk. Additional arrangements, including the collation of additional information, were recommended where appropriate.

An assessment of the impact of prawn trawling on habitat was also undertaken. The Consequence Spatial Analysis (CSA) used by the MSC, based on the 'habitat PSA' component of the ERAEF was used by SARDI (Hobday et al. 2007, 2011; Williams et al. 2011). The CSA was structured around a set of attributes that describe fishing gear impacts (consequence) and the habitat (spatial) for each habitat being affected by the gear type(s).

The main outcomes from these risk assessment processes are described in the report, 'Addendum to the 2014 ESD risk assessment of South Australia's Spencer Gulf Prawn Fishery' (PIRSA 2019 in draft). The report describing the ESD risk assessment can be found on the PIRSA website at www.pir.sa.gov.au/fishing

# 7 Goals and objectives

Section 7 of the *Fisheries Management Act 2007* sets out the objects of the Act. Ecologically sustainable development is established as the overall object of the Act. A number of biological, social and economic factors are identified that must be balanced in pursuing ecologically sustainable development. Object 7(a), relating to the avoidance of over-exploitation, is specified as the primary consideration.

Objectives for the SGPF are set out below (see Table 2). They are organised under 4 broad goals. These goals and objectives capture all the factors identified in the Act.

#### Goal 1: Maintain ecologically sustainable prawn biomass

This goal relates to the sustainability of the target stock. The objectives of this management plan in relation to sustainability are that management arrangements are sufficient to maintain:

- Relative spawning stock biomass of prawn stocks at sustainable levels
- Future prawn biomass is maintained above sustainable levels
- Information collected is sufficient to manage fishing at sustainable levels.

These objectives aim to ensure that prawn resources in Spencer Gulf are harvested within sustainable limits as defined by performance indicators relevant to reference points described in the Harvest Strategy at Section 10.

The main strategies for ensuring the sustainability of the resource are:

- Limited entry
- Closed areas
- Gear restrictions
- Decision rules (described in the Harvest Strategy in Section 10.4).

Performance of the fishery against identified reference points, for the target species, are reported annually in a stock assessment report developed by SARDI Aquatic Sciences. These reports can be accessed from the SARDI website at www.sardi.sa.gov.au/fisheries.

#### Goal 2: Optimum utilisation and equitable distribution

This goal relates to optimising the economic and social benefits derived from the SGPF and focuses on providing economic efficiency for fishing operations.

The objective of this management plan in relation to optimum utilisation is:

• Having an economically efficient fleet without compromising sustainability objectives.

The strategies implemented to achieve this goal are focused on a Harvest Strategy (Section 10) that allows for flexible fishing operations within sustainable limits.

With regard to equitable distribution, as the fishery is exclusively a commercial fishery by virtue of the limiting management arrangements that hamper non-commercial fishing, the objectives in this plan relate to ensuring access to the resource is in line with requirements under the Act. The operational objective related to resource access is to:

• Provide access to the resource as per PIRSA's Allocation policy: Allocation of Access to Fisheries Resources between Fishing Sectors (PIRSA 2011) (Allocation Policy).

#### Goal 3: Minimise impacts on the ecosystems

This goal relates to the management of the fishery using an EBFM approach. Australian Government guidelines for the ecological sustainability of Australian fisheries acknowledge the need to minimise the impacts of fishing on the ecosystem. The objectives of this management plan, consistent with the guidelines, to achieve this goal are:

- Minimise fishery impacts on by-catch and by-product
- Minimise the interaction with TEPS
- Minimise impacts on benthic habitat.

#### Goal 4: Cost effective and participative management of the fishery

This goal relates to co-management of the fishery, planning of management activities, and the recovery of the costs of management of the fishery.

The overall objectives of this goal are:

- Ensure management arrangements reflect concerns and interests of the wider community
- Provide cost effective and efficient management of the fishery, in line with the Government's cost recovery policy
- Maximise compliance with management arrangements.

The key objectives of this goal are to ensure that the fishery has involvement in the decision making processes for developing and implementing management arrangements and to ensure that management arrangements are complied with.

The cost effectiveness of management arrangements also needs to be taken into account in the development process as the costs of management are recovered from fishers in accordance with the Government's cost recovery policy (PIRSA 2013c).

Objective	Strategies	ESD risk addressed	Performance indicator	Description	Reference point
Goal 1: Maintain ecologi	cally sustainable prawn biomass.				
1a. Management arrangements are sufficient to maintain relative spawning stock biomass of prawn stocks at sustainable levels for the future.	<ul> <li>1ai. Controls on fishing effort through, restriction on the number of licences (mesh size and head line length restrictions); adherence to limits on the amount of gear used in the fishery; restriction to areas and times in line with Harvest Strategy, horsepower, vessel size.</li> <li>1aii. Closed areas maintained, e.g. waters &lt;10m.</li> </ul>	Fishing impacts on target species.	Average weighted adult prawn catch rate from three SASs each season.	Adult prawn catch rates from SASs is used as an indicator of relative spawning biomass. Catch rates are weighted as described in the Harvest Strategy at Section 9.	Average weighted adult prawn catch rate ≥ 3.16lb/min (86kg/hr). <sup>1</sup>
	1aiii. Harvest Strategy guides fishing operations.		Mean egg production	Count in million eggs/hr trawled during November SAS.	>500 <sup>1</sup>
			Recruitment index	Index of future biomass, based on the catch rate of recruits from 34 set locations in March.	> 1.78lb/min recruits

Table 2: Management goals, objectives and strategies for management for the Spencer Gulf Prawn Fishery.

<sup>&</sup>lt;sup>1</sup> Reported annually in a SARDI advice note for the fishery and biennially through a stock assessment report (<u>www.sardi.sa.gov.au/fisheries</u>).

Objective	Strategies	ESD risk addressed	Performance indicator	Description	Reference point
1b. Information is collected sufficient to manage fishing operations to sustainable levels.	<ul> <li>1bi. Fishery-dependent information collected through commercial logbooks.</li> <li>1bii. Fishery-independent prawn surveys conducted.</li> <li>1biii. Fishery status assessment reported.</li> <li>1biv. Appropriate environmental data to</li> </ul>	Research knowledge	Commercial catch and effort.	Spatial and temporal catch and effort data provided by all commercial fishers for each day fished in commercial logbooks.	Mean commercial catch rate >80kg/trawled hour. Logbook records provided by all fishers for 100% of fishing nights.
	aid assessment collected. 1bv. Research plan maintained to guide strategic research.		Fishery independent surveys conducted.	Fishery assessment reports against biological performance indicators in the Harvest Strategy.	Fishery surveys conducted sufficient to inform annual fishery status assessments <sup>1</sup> .
			Strategic research plan.	A research and monitoring plan prioritises research and monitoring activities developed by SGWCPFA Research Subcommittee.	Research plan reviewed regularly.

Objective	Strat	egies	ESD risk addressed	Performance indicator	Description	Reference point			
Goal 2: Ensure optimal utilisation and equitable distribution.									
2a. An economically efficient fleet without compromising sustainability objectives.	2ai. 2aii.	Harvest strategy allows commercial operators to maximise operational flexibility within sustainable limits. Economic performance of fishery assessed.	Industry profit. Economic value to regional	Gross value of production (GVP).	Total catch valued at the landed beach price. Used to determine the whole fishery value.	GVP monitored regularly <sup>2</sup>			
			Asset value. Market access. Economics.	Return on investment (ROI).	Net profit after depreciation as a percentage of capital employed reported in economic indicators reports <sup>2</sup> .	ROI monitored regularly <sup>2</sup> .			
				Gross operating surplus (GOS).	GOS provides an index of capacity of operator to remain in the fishery in the short to medium term.	GOS monitored regularly <sup>2</sup> .			
				Economic indicators report.	Reporting against economic performance indicators.	Economic indicator report conducted regularly <sup>2</sup> .			
			Number of full time equivalent (FTE) positions directly and indirectly employed.	Employment directly and indirectly associated with the fishery.	Number of FTEs monitored when available <sup>2</sup> .				
2b. Provide access to the resource as per the Allocation Policy	2bi. 2bii.	Resource allocation between sectors provided in this management plan. Review of allocation provided in the management plan.	Allocation.	Allocation reviewed as per Allocation Policy (PIRSA 2011), if appropriate.		Allocation reviewed if appropriate.			

<sup>&</sup>lt;sup>2</sup> Reported regularly in the economic indicators report for the fishery (www.pir.sa.gov.au/fisheries).

Objective	Strat	egies	ESD risk addressed	Performance indicator	Description	Reference point				
Goal 3: Minimise impacts on the ecosystems.										
3a. Fishery impacts on by-catch and by- product species are minimised.	3ai.	Control fishing effort through, restriction on the number of licences (mesh size and head line length restrictions); limits on the amount of gear used in the fishery, restrictions on horse power.	Impacts on trophic structure. By-catch.	By-catch and by-product monitoring through surveys.	Monitor changes in by-catch and by- product species	ESD risk assessment report reviewed in life of the plan.				
	3aii.	Closed areas maintained e.g. waters <10m.		Ecological reporting and monitoring measures developed where	Monitoring and reporting methodologies	Research plan considers monitoring				
	3aiii. Risks specie asses	Risks to by-catch and by-product species monitored through ESD risk assessment.		appropriate.	allow for risks to by- catch species to be identified effectively and assist in developing effective mitigation measures.	strategies. Reference points				
	3aiv.	Closed areas through co- management arrangements promoted.				SGWCPFA Research Sub- Committee where appropriate				
	Sav.	technology to reduce impacts of fishing activity.		Technology for reducing impacts of fishing activity on	Technology that mitigates identified risk to by-catch species sustainability be	Technology for reducing impacts of				
	3avi.	Industry codes of practice for by- catch species where available.		by-catch species sustainability adopted where appropriate.		fishing activity on by-catch species sustainability				
		Long term by-catch reporting and monitoring.			adopted where available and appropriate.	adopted where appropriate.				
				ESD risk assessment report reviewed in life of the plan.		ESD risk assessment report reviewed in life of the plan.				
3b. Fishery impacts on TEPS are minimised	3bi. C <10m	Closed areas maintained e.g. waters	TEPS	Interaction rate for TEPS (number of interactions per fishing day reported in wildlife interaction logbooks).	All commercial fisheries are required to report in wildlife interaction	Interaction rates for TEPS from wildlife interaction				

Objective	Strategies	ESD risk addressed	Performance indicator	Description	Reference point
	3bii. Vulnerability of TEPS to fishing operations monitored.			logbooks for interactions with	logbooks and SASs monitored annually.
	3biii. Fishing interactions with TEPS recorded in wildlife interaction logbooks.		Closed areas maintained.	Area closures to	Area closures for reducing fishery impacts on syngnathids
	3biv. Management measures to avoid interactions with TEPS developed where appropriate.			reduce fishery impacts on syngnathids are	
	3bv. Industry codes of practice for TEPS adopted where appropriate.			developing harvest strategies where	strategies where appropriate.
	3bvi. Closed areas through co- management arrangements promoted.			appropriate.	
			Industry codes of practice followed where developed.	Where appropriate, codes of practices for avoiding or reducing the impacts of interactions with TEPS developed by industry.	Where developed, Industry codes of practice are communicated to fishing fleet and adopted.
3c. Fishery impacts on benthic habitat and associated species communities are minimised.	3ci. Controls on fishing effort through, restriction on the number of licences (mesh size and head line length restrictions); limits on the amount of gear used in the fishery; restriction to areas and times in line with fishing	Habitat disturbance. Impacts on trophic structure.	Annual fishery footprint relative to maximum annual fishing footprint maximum.	Annual fishing footprint refers to the area of Spencer Gulf fished in a year.	Changes in the footprint will continue to be monitored.
	strategy.		Closed areas maintained.		Closed areas maintained in
	<ul> <li>3cii. Closed areas maintained e.g. waters &lt;10m.</li> <li>3ciii. Technology to reduce impacts of fishing activity on habitats developed and promoted where appropriate</li> </ul>				fishing strategies.
	3civ. Impacts on habitat and associated species communities monitored.				

Objective	Stra	ategies	ESD risk addressed	Performance indicator	Description	Reference point				
Goal 4: Enable effective and participative management of the fishery.										
4a. Industry participation in management through co-operative arrangements.	4ai. 4aii. 4aiii.	Delegation provided to Officers of the SGWCPFA under regulation 10 of the Fisheries Management (Prawn Fisheries) Regulations 2017. Fishing Strategies developed and maintained through the SGWCPFA Management Committee and the Committee-at-sea. Advance along the co-management continuum, with the SGWCPFA increasing management	Management effectiveness. Co- management. Access. Governance – Industry. Delegation reviewed.	Membership on SGWCPFA's Management Committee and Research Subcommittee.	SGWCPFA Management Committee provide advice to PIRSA on fisheries related issues including fishing strategy development and at-sea decisions to maintain fishing strategies.	Membership of SGWCPFA committees is maintained and positions filled. Industry and PIRSA co- management responsibilities fulfilled as per co- management agreement.				
	4aiv.	responsibility and PIRSA to more of an auditing role. Evaluate options for the SGWCPFA to undertake scientific research and monitoring.		Strategies developed where appropriate to progress management, monitoring and research to a delegated model.	Framework outlining mechanisms and responsibilities associated with moving to a delegated model.					
				Fishing strategies are set in accordance with the Harvest Strategy.	Fishing strategies that set the guidelines for fishing operations are in line with the aims and management framework described in the Harvest Strategy.	Fishing strategies are set in accordance with the Harvest Strategy.				

Objective	Strategies	/e	ESD risk addressed	Performance indicator	Description	Reference point
4b. Management arrangements support cohesion and connectedness between fisheries industry and wider community.	<ul> <li>4bi. Stakeholder input to the management of the fishery, through established co-management processes.</li> <li>4bii. Communicate management arrangements to the wider community.</li> </ul>	agement ments support n and edness n fisheries and wider nity.	Management effectiveness. Fishing Industry relationship with community. Governance – Others (NGOs)	Ensure stakeholders are involved in development of management arrangements through maintenance of co- management arrangements. Management arrangements allow commercial operators to maximise operational flexibility. Non-fishing stakeholder positions maintained on SGWCPFA Research Subcommittee. Management information is available on PIRSA website.	The SGWCPFA's Management Committee and its Research Subcommittee provide advice to PIRSA on fisheries related issues under formal a co- management agreement. Fishing strategies as described in the Harvest Strategy are developed in collaboration with the SGWCPFA. Information related to management of the fishery is correct and relevant on PIRSA website.	Membership of industry and non- industry stakeholders on SGWCPFA committees is maintained. Co-management arrangements between SGWCPFA and government are maintained. Fishing strategies are developed through the SGWCPFA. PIRSA website information is updated as required.
4c. Maximise stewardship of fisheries resources.	<ul> <li>4ci. Undertake annual compliance risk assessment.</li> <li>4cii. Implement a cost-effective compliance and monitoring program to address identified risks.</li> <li>4ciii. Information on fisheries management is available in a timely and publicly accessible manner.</li> </ul>	mise ship of fisheries es.	Governance – Industry. Fishing Industry relationship with community. Fishing impacts on target species.	Number of prosecutions. Compliance risk assessment undertaken in cost-recovery process. Management information is available on PIRSA website.	Number of prosecutions related to the fishery. Compliance risk assessment undertaken in cost- recovery process. Information related to management of the fishery is correct and relevant on PIRSA website.	Number of prosecutions over three years does not increase significantly. Compliance risk assessment undertaken. PIRSA website information is updated as required.

Objective	Stra	tegies	ESD risk addressed	Performance indicator	Description	Reference point
4d. Costs of management of the fishery funded by relevant stakeholders.	4di.	Annual real costs of management, research and compliance for the fishery determined through -recovery process.	Management effectiveness.	Cost-recovery process undertaken.		Cost-recovery process undertaken as appropriate.
	4dii.	Costs of management research, co- management and compliance is collected from commercial licence holders.				

# 8 Co-management arrangements

Co-management is an arrangement whereby responsibilities and obligations for sustainable fisheries management are negotiated, shared and delegated at appropriate levels between government, the commercial fishing industry, recreational fishers, Aboriginal traditional fishers and other key stakeholders such as conservation groups (Neville 2008). Co-management is recognised as a collection of positions – starting from centralised government regulation with no industry input at one end to more autonomous management by industry groups and key stakeholders at the other, where government plays more of an audit role. Co-management is designed to achieve efficient regulatory practice (among many other things) and is by no means a way of industry or other key stakeholders avoiding regulatory scrutiny and influence.

PIRSA has adopted a Policy for the Co-Management of Fisheries in South Australia (PIRSA 2013b) to inform discussion with the wider commercial fishing industry and other stakeholder groups as to how best to promote and implement co-management. The policy proposes that implementation of a preferred co-management model should be through a phased approach through which industry and key stakeholders build their capacity over time and which allows for a government audit process to measure performance and success.

The SGWCPFA is recognised as the representative industry body for the commercial SGPF. The Minister has oversight of the management of the fishery under this management plan, but day-to-day management is conducted by PIRSA Fisheries and Aquaculture in collaboration with the SGWCPFA.

The Minister for Primary Industries and Regional Development, delegated his powers under section 10 of the *Fisheries Management Act 2007* to set fishing runs (period and timing of fishing over the dark of the moon) and surveys for a three year period, from 18 October 2019, to the Executive Officer and Coordinator-at-Sea positions within the SGWCPFA. Under this delegation the Executive Officer or Coordinator-at-Sea set the fishing run and survey arrangements in a written notice under regulation 10 of the *Fisheries Management (Prawn Fisheries) Regulations 2017.* The notice is formalized through publication in the South Australian Government Gazette. The fishing run notice is required to include the criteria under which fishing will cease in an area or across the fishery, as per the requirements of the Harvest Strategy in Section 10. The delegation provided by the Minister is consistent with the phased approach for a co-management model described in the Policy for the Co-Management of Fisheries in South Australia.

# **9 Allocation of access between sectors**

### 9.1 Current allocated shares of the resource

The Act provides that a management plan must specify the share of the fishery to be allocated to each fishing sector.

The Act also provides that, in determining the share of aquatic resources to be allocated to a particular fishing sector under the first management plan for an existing fishery, the share of aquatic resources to which that fishing sector had access at the time the Minister requested the plan be developed (based on the most recent information available to the Minister) must be taken into account.

The Minister formally requested preparation of the first management plan for the Spencer Gulf Prawn Fishery under the Act on 17 June 2010. Therefore, the 2014 Management Plan had to take into account the share of the Spencer Gulf Western King Prawn resource that the commercial fishing sector had access to at that time (Table 3). Allocations for the recreational and Aboriginal traditional fishing sectors were also determined as described in Table 4. There have been no changes to the share allocations since that time.

Species	SGPF	Other commercial	Recreational	Aboriginal traditional
Western King Prawns	100.0%	0.0%	0.0%	0.0%
Balmain Bug	100.0%	0.0%	0.0%	0.0%

Table 3: Shares of Spencer Gulf Prawn Fishery (SGPF) resources allocated to each fishing sector.

In the 2014 management plan, a share of the access has been allocated in relation to Southern Calamari and set aside for the purpose of resolving Native Title claims. A nominal share of 1% has been made to the Aboriginal traditional sector. There have been no changes to the share allocations since that time.

Table 4: Shares of Southern Calamari allocated to each fishing sector at the State-wide level. Marine Scalefish Fishery (MSF), Northern Zone Rock Lobster Fishery (NZRLF), Gulf St Vincent Prawn Fishery (GSVPF), West Coast Prawn Fishery (WCP).

Species	Commercia	d	Recreational	Aboriginal traditional	
	MSF	56%	37.4		
	NZRL	0.45%		1%	
Southern Calamari	GSVP	0.45%			
	SGPF	4.6%			
	WCP	0.1%			
Total	61.6%		37.4%	1%	

### 9.2 Recreational fishing sector

Recreational fishing for Western King Prawns and Balmain Bugs has historically been negligible, as fishers are permitted only to use hand-held nets in waters greater than 10m in depth (the same depth limitation that applies to commercial fishers). Southern Calamari is an important recreational fishing species; more detail on the recreational fishing of this species is provided in the MSF management plan (PIRSA 2013a) and the Recreational Fishery management plan (PIRSA 2017).

### **9.3 Aboriginal traditional sector**

Access to South Australia's fisheries resources by Aboriginal communities under the *Fisheries Management Act 2007* may be provided through Aboriginal traditional fishing management plans. These plans may be developed when an Indigenous Land Use Agreement (ILUA), agreed to resolve a native title claim, is in place in relation to a native title claim area. The State is currently engaged in ILUA negotiations with native title claimants and other stakeholder groups, including the fishing industry.

The agreements arising from these negotiation processes may inform the way that access to fisheries resources by Aboriginal communities is defined and implemented. Currently, Aboriginal traditional fishing under the Act only relates to fishing agreed through the ILUA process. Aboriginal people are also recreational fishers outside of these arrangements.

Research has not produced any publically available records of Aboriginal traditional fishing for Western King Prawns or Balmain Bugs in the Spencer Gulf region, additionally the more recent recreational surveys undertaken in 2007/08 and 2012/13 did not include methodology specific for identifying Aboriginal fishers. Anecdotal knowledge indicates that Aboriginal traditional fishing for prawns and Balmain Bugs was conducted historically in this region (S. Schnierer 2014 pers. comm.) however the extent is not known. If information on Aboriginal traditional harvest of this species becomes available, this position can be reviewed.

Aboriginal fishers have access to prawn resources in Spencer Gulf for traditional, domestic, non-commercial use subject to meeting the requirements of the Native Title Act 1994. The Barngarla, Narungga and Nukunu Nations have links to Spencer Gulf and at the time of writing this management plan had Native Title claims registered.

### 9.4 Review of Allocations

Allocations between sectors may to be reviewed periodically in accordance with the criteria set out in the Allocation Policy (PIRSA 2011) and section 43(2)(i) and (j) of the *Fisheries Management Act 2007* describes a framework for adjusting shares if required.

A survey of recreational fishing in South Australia was conducted in 2013/14 by Giri and Hall (2015). This survey reported no prawns or bugs in the survey data collected. On the

basis of this information the allocation shares in this Management Plan for these species remain unchanged from those described in the 2014 Management Plan.

Giri and Hall (2015) reported that recreational catch of Southern Calamari in 2013/14 was within the recreational allocation for that species and therefore the allocation shares in this Management Plan remain unchanged from those described in the 2014 Management Plan.

# **10Harvest Strategy**

### **10.1 Overview**

This Harvest Strategy is designed to be consistent with the 2014 *National Guidelines to Develop Fishery Harvest Strategies* (Sloan et al. 2014), and the *South Australian Fisheries Harvest Strategy Policy* (PIRSA 2015) developed by PIRSA Fisheries and Aquaculture in 2015.

The Harvest Strategy aims to:

- Define operational objectives that are both biological and economic
- Define biological performance indicators that align to national status classifications
- Provide decision rules that link SASs, which provide an index of abundance, to exploitation
- Provide decision rules that link real-time monitoring of size and catch rates to exploitation.

Monitoring of the fishery is achieved through three fishery independent SASs as well as industry at-sea monitoring of fishing catch and effort through co-management arrangements with the SGWCPFA.

The Harvest Strategy defines separate operational objectives, performance indicators and reference points based on SAS undertaken by SARDI Aquatic Sciences in November, March and April and at-sea commercial monitoring in real time. When the new moon falls late in the month preceding or early in the designated SAS month, the SAS may be undertaken or commence in the month following the SAS month.

### **10.2 Operational Objectives**

The specific operational objective is to maintain average catch rates of adult-sized prawns based on all three fishery independent SASs in a fishing season above 3.16lb/min (86kg/hr). Further general operational objectives relating to the target species, Western King Prawn, can be found in Section 7.

### **10.3 Biological performance indicators**

A goal of this management plan is to ensure that the relative spawning stock biomass and future prawn biomass is maintained at sustainable levels. This goal will be achieved by ensuring the fisheries performance is measured through the SAS and is maintained above the limit and trigger reference points that have been developed as key performance indicators (See Table 5 and

Table 6).

The catch rate of adult prawns is used as a key performance indicator of relative spawning stock biomass in the absence of a formal biomass estimate.

The catch rates from each of the three annual SASs are weighted as follows:

November	March	April
0.20	0.35	0.45

The weighted average catch per unit effort (lb/min or kg/hour) of recruits from all three SASs in the previous fishing season is used as a secondary performance indicator. This performance indicator is a measure of recent relative juvenile biomass. The values for recruit (juvenile) catch rates from each of the three annual SASs are weighted the same at the catch rate of adult prawns.

#### 10.3.1 Reference points for primary biological performance indicator

The trigger reference point (TRP) is set at an adult catch rate level at which the fishery is considered 'Sustainable' (the stock is considered at a level sufficient to ensure that, on average, future recruitment to the fishery will be adequate). The TRP represents the boundary between a stock being classified as Sustainable or Depleting.

The limit reference point (LRP) establishes a benchmark for undesirable fishery performance. In this case, the LRP for determining if a stock is 'Depleted' or not was considered to correspond to recruitment overfishing where the spawning stock biomass has been reduced so that average recruitment levels are significantly reduced. The reference points for average adult catch rate from SASs are set out in Table 5.

Reference point	Adult catch rate
Target	4.43lb/min (120.8kg/hr)
Trigger (TRP)	3.16lb/min (86.2kg/hr)
Limit (LRP)	2.21lb/min (60.3kg/hr)

Table 5: Reference points for primary biological performance indicator.

The reference points of SAS adult catch rate have been selected in consideration of the performance of the commercial fishery over time. Further information regarding setting reference points for the primary biological performance indicators can be found in Appendix 19.1.

#### 10.3.2 Reference points for secondary performance indicator

Reference points for average recruit catch rates for the three SASs from the previous fishing season are based on the range of historical records of this indicator using SAS values from 2004-05 to 2011-12. The reference points are considered to represent low, medium and high levels of juvenile biomass (see Table 6).

Table 6: Reference points for recent recruit prawn abundance from weighted annual average recruit catch rates from the previous season's SAS.

Reference point	Recruit catch rate
High Medium	≥ 2.18 lb/min (≥ 59.5 kg/hr) ≥ 1.09 < 2.18 lb/min (≥ 29.7 < 59.5kg/hr)
Low	< 1.09 lb/min (< 29.7 kg/hr )

### **10.4 Decision rules**

The decision making rules start by determining the annual stock status classification for the fishery. The stock is classified as either 'Sustainable', "Depleting', 'Recovering' or 'Depleted' consistent with the national Status of Australian Fish Stocks (SAFS) framework (Stewardson et al. 2018) at the time this harvest strategy was developed. The level of performance indicators are reported annually in a SARDI Advice Note to PIRSA for informing decision rules under this harvest strategy. The stock classification is directly linked to the reference points as shown in tables 5 and 6 for the fishery and the stock classification framework is in Figure 4. The performance indicators used to determine the stock classification are also used to determine stock status under the under the SAFS framework.

The stock classification system framework in this harvest strategy is:

- Sustainable: Biomass (or proxy) is at a level sufficient to ensure that, on average, future levels of recruitment are adequate (recruitment is not impaired) and for which fishing mortality (or proxy) is adequately controlled to avoid the stock becoming recruitment impaired (overfishing is not occurring). Appropriate management is in place
- Depleting: Biomass (or proxy) is not yet depleted and recruitment is not yet impaired, but fishing mortality (or proxy) is too high (overfishing is occurring) and moving the stock in the direction of becoming recruitment impaired. Management is needed to reduce fishing mortality and ensure that the biomass does not become depleted.
- Recovering: Biomass (or proxy) is depleted and recruitment is impaired, but management measures are in place to promote stock recovery, and recovery is occurring.
- Depleted: Biomass (or proxy) has been reduced through catch and/or non-fishing effects, such that recruitment is impaired. Management is needed to recover this stock; if adequate management measures are already in place, more time may be required for them to take effect.

The application of management arrangements for each stock classification are broadly described in Figure 4. For a fishery classified as Sustainable, the fishing strategies are:

- Set a total allowable catch for pre-Christmas fishing
- Set and maintain areas of fishing based on target prawn size
- Maintain minimum fleet catch rates post-Christmas.

For a fishery classified as Depleting/Recovering, fishing strategies are:

- Set a maximum number of nights allowed for fishing for the whole season
- Set a portion of the maximum number of fishing nights that can be fished pre-Christmas (November and December)
- Set and maintain areas of fishing based on prawn size.

For a fishery classified as being Depleted, no commercial fishing will be allowed until the stock assessment surveys trigger a change in management as described in the meta rules.



Figure 4: Framework of decision making for stock classifications.

#### 10.4.1 Fishing Strategies

When the fishery is classified as Sustainable or Depleting/Recovering a fishing strategy (the rules that guide fishing operations during a fishing run) setting the fishing run (the period of fishing activity between quarters of the lunar cycle that include a new moon) is required. The fishing strategy is set prior to the commencement of each fishing run, usually in the months of November, December, March, April, May and June. For months when the new moon falls late in the month preceding or early in the following month, fishing may commence in that month through to the new moon in the following month.

Fishing strategies involve two phases – a 'development phase' that sets the initial fishing arrangements, and a 'management phase' where at-sea monitoring maintains fishing operations during a fishing run.

The development phase involves the SGWCPFA Management Committee determining the fishing strategy based on the stock classification provided by SARDI. When the fishery is classified as Sustainable or Depleting/Recovering the committee must determine the following:

- the fishing area based on prawn size from SAS or spot surveys
- the average nightly catch or catch limit to close an area or the entire fishery
- the number of fishing nights before an area or the entire fishery is closed.

When determining the spatial component of the fishing strategy the management committee will consider the size criteria and practicality of opening fishing grounds from the SAS and/or industry spot surveys in line with the decision rules for a Sustainable or Depleting/Recovering Fishery (see Sections 10.4.2 and 10.4.3).

Once the SGWCPFA Management Committee has provided advice on these arrangements the Executive Officer or the Coordinator-at-Sea positions within the SGWCPFA will sign a notice under regulation 10 of the *Fisheries Management (Prawn Fisheries) Regulations 2017* enacting the fishing strategy for the fishing run.

Once fishing has commenced for a fishing run, the fishing strategy enters the management phase and is maintained by the Committee-at-Sea, which is chaired by the Coordinator-at-Sea. The Committee-at-Sea monitor and manage fishing by the fleet against the fishing strategy criteria set in the notice under regulation 10 of the *Fisheries Management (Prawn Fisheries) Regulations 2017* in line with the Harvest Strategy.

The data used by the Committee-at-Sea to monitor and manage the fishing strategy for the fishing run against the criteria set out in the notice includes data provided by vessels in the fleet, from either the skipper or their representative. The data provided and assessed is a 'daily catch weight' estimate and 'mean prawn size' (number of prawns per 7kg, bucket count). The assessment of the combined data from vessels is used to inform whether fishing should continue or cease and the area to be fished if fishing continues for a subsequent night. The assessments made by the Committee-at Sea, to change the fishing area or cease fishing, are based on the best catch information available from a representative sample of vessels in the fleet.

#### 10.4.2 Sustainable Fishery

When the fishery is classified as sustainable different management strategies are used for the pre-Christmas (November and December) and post-Christmas (March to June) fishing periods. Both fishing periods are constrained by criteria set for prawn size, while pre-Christmas fishing is also constrained by a maximum fleet catch (see Table 7) and post-Christmas fishing is restricted by requiring the fleet to maintain a minimum average nightly catch per vessel (see Table 8).

#### 10.4.2.1 Pre-Christmas management strategy

Fishing strategies in this period aims to protect spawning adult prawns by limiting the quantity harvested. This strategy allows for fishing during this period of high market demand and strong prices, while protecting adequate spawning biomass to maintain sustainability in the fishery.

The decision rules for pre-Christmas fishing set a total allowable catch for the entire fleet for the November and December fishing runs. The total allowable catch is determined based on the catch rate of adult prawns from the November SAS (Table 7).

Table 7: Pre-Christmas total allowable catch limits in relation to November SAS adult catch rates. Unless specified, these<br/>triggers represent the lower limit at which the corresponding level of harvest is determined.Adult catch rate (kg/hr)Adult catch rateTotal allowable pre-Christmas

Adult catch rate (kg/hr)	Adult catch rate (lb/min)	Total allowable pre-Christmas catch
<28.4	<1.04	0
28.4	1.04	120 t
37.5	1.38	200 t
46.9	1.72	300 t
52.6	1.93	350 t
58.2	2.13	375 t
64.8	2.37	400 t
73.2	2.68	425 t
81.6	2.99	450 t
90.1	3.30	475 t
98.5	3.61	500 t

Development of pre-Christmas fishing strategies requires the SGWCPFA Management Committee to set a total allowable pre-Christmas catch constraining catch to levels defined in Table 8 and identify fishing areas that meet a target prawn size of **260 prawns/7 kg bucket** or less, using the November SAS or industry spot survey information.

Management of pre-Christmas fishing strategies for a Sustainable Fishery will monitor the total allowable catch and average prawn size data from bucket counts. 'Total allowable catch' refers to the total catch for the fishing period for the entire fishing fleet.

The pre-Christmas catch will be determined by the Committee-at-sea based on the best data available. The fishery will be closed in the morning of the night during which the estimated total allowable pre-Christmas catch is harvested.

#### 10.4.2.2 Post-Christmas management strategy

The fishing strategy in each fishing run in the post-Christmas period is constrained by setting different criteria for prawn sizes (monitored through the number of prawns per 7kg, a 'bucket count') and minimum average fleet catch rates (kg/vessel/night). The SGWCPFA Management Committee determine the criteria for target prawn sizes and catch rates prior to the commencement of each fishing run. The committee may set more conservative strategies than are prescribed in Table 8. However, the average fleet catch must be equal

to and, not less than the catch rates and not greater than the bucket counts described in Table 8.

The fishing areas that meet the catch rate and bucket count criteria are determined by each of the three SAS, with the most recent SAS used to determine the area to be fished in the fishing run.

Two areas in Spencer Gulf have been identified by industry as having differing characteristics and relative contributions to fishery sustainability. Consequently these two areas have different target bucket counts and minimum fleet catches required to maintain fishing (described in Table 8). These areas are referred to as the Mid/North Gulf and the Southern Gulf, and are defined as:

- Mid/North Gulf north of the Southern Gulf area.
- Southern Gulf south of the following coordinates:

\$33° 51.00'E136° 40.00'\$34° 02.00'E136° 51.00'\$34° 17.00'E136° 43.00'\$34° 17.00'E136° 51.00'\$34° 14.00'E136° 55.00'\$34° 14.00'E136° 57.00'\$34° 11.00'E137° 01.00'\$34° 11.00'E137° 30.00'

Each fishing run in the post-Christmas fishing period is required to be set within the bucket count and fleet average catch criteria specified in Table 8. When the bucket count exceeds the criteria described in Table 8, fishing in the area open to fishing is stopped and fishing is transferred to another area where the criteria can be met. When the catch rates fall below the criteria described in Table 8, fishing in the area is stopped and fishing is transferred to areas that meet the criteria in Table 8.

At the time of writing this management plan the Coordinator-at-sea and Executive Officer positions within the SGWCPFA had the delegated Ministerial powers to set the fishing runs (i.e. the opening and closing of areas to fishing based on the bucket count and catch rate criteria in Table 8) and support the spot surveys and SAS.

The delegated legislative powers under section 10 of the *Fisheries Management Act 2007* were first provided by the Minister for Primary Industries and Regional Development for a one year period in December 2018. The Minister subsequently delegated legislative powers under section 10 of the *Fisheries Management Act 2007* for a three year period commencing on 18 October 2019.

When both areas are open to fishing, the estimated average catch for the fleet will be calculated from the best information available against the Mid/North catch rate and bucket count criteria (described in Table 8). If the Mid/North Gulf area is closed to fishing, the estimated average catch for the fleet will be calculated from the best data available against the Southern Gulf catch rate and bucket count criteria.

Table 8: Target levels for management of sustainable fishing strategies.

	Strategy		
		March/ April (pre survey)	April (post survey) / May/ June
Mid/North Gulf	Bucket counts (no. prawns/7 kg)	≤240	≤260
	Fleet average catch kg/vessel/night	≥500	≥500
OR	Bucket counts (no. prawns/7 kg)	≤220	≤240
	Fleet average catch kg/vessel/night	≥400	≥400
	Bucket counts	≤260	≤260
Southern	(no. prawns/7 kg)		
Gulf	Fleet average catch	≥350	≥350
	kg/vessel/night		
		Over two consecutive nights in Southern Gulf area only	Over two consecutive nights in Southern Gulf area only

#### 10.4.3 Depleting/Recovering Fishery

A Depleting/Recovering fishing strategy is implemented when prawn stocks are classified as below the trigger limit. Depleting/Recovering fishing strategies limit fishing, giving stocks time to recover to sustainable levels. This strategy sets a total allowable number of nights fishing in a fishing season and for fishing pre-Christmas.

#### 10.4.3.1 Setting number of fishing nights

The number of nights fishing allowed for a fishing season for a Depleting/Recovering Fishery is determined by the secondary biological performance indicator of abundance of juvenile prawns (recruits), determined from weighted average recruit catch rate from the previous fishing season's three SASs (as described in Section 10.3). Within the season's total allowable fishing nights, a maximum number of nights that may be fished in November and December (pre-Christmas) will also be set (as described in Table 9) in recognition of the need to provide protection to adult spawning prawns during this period.

Reference point	Recruit catch rate	Max allowable season fishing nights for fleet	Maximum allowable pre- Christmas fishing nights for fleet
High	≥ 2.18lb/min (≥ 59.5 kg/hr )	37	11
Medium	≥ 1.09 < 2.18ĺb/min (≥ 29.7 < 59.5kg/hr )	31	9
Low	< 1.09lb/min (< 29.7kg/hr )	25	7

Table 9: Reference points for recent recruit prawn abundance from weighted annual average recruit catch rates from the previous season's SAS.

Under this harvest strategy for the purpose of the application of

Table 9, any fishing activity undertaken by the fleet as a whole carried out over one night exceeding six hours will be considered a night's fishing effort and will be deducted from the season's and pre-Christmas (if applicable) allocated total number of fishing nights. Fishing for any part of a night less than six hours will be considered to be half a night's fishing and will be deducted from the season's and pre-Christmas (if applicable) allocated total number of fishing nights.

#### 10.4.3.2 Pre-Christmas management strategy

Development of a fishing strategy for fishing pre-Christmas for a Depleting/Recovering Fishery requires the SGWCPFA Management Committee to:

- Set a number of fishing nights that does not exceed the number of remaining unfished nights from the pre-Christmas allocation as described in Table 9
- Identify areas to open to fishing that meet or are less than the target prawn size of 240 prawns/7 kg bucket using survey information from the November SAS or industry spot surveys.

Management of pre-Christmas fishing strategies for a Depleting/Recovering Fishery will monitor the total number of fishing nights fished and average prawn size data from bucket counts.

#### 10.4.3.3 Post-Christmas management strategy

Development of a fishing strategy for fishing post-Christmas for a Depleting/Recovering Fishery requires the SGWCPFA Management Committee to:

- Set a number of fishing nights that do not exceed the number of remaining unfished nights from the season's allocation as described in
- Table 9
- Identify areas to open to fishing that meet or are less than the target prawn size of 240 prawns/7 kg bucket using survey information from the most recent SAS or industry spot surveys.

Management of pre-Christmas fishing strategies for a Depleting/Recovering Fishery will involve monitoring the total number of fishing nights fished and average prawn size data from bucket counts.

The fishery will be closed when the total number of fishing nights permitted, as detailed in Table 9, is reached.

#### 10.4.4 Depleted Fishery

A Depleted fishery is considered where biomass (or proxy) has been reduced through catch and/or non-fishing effects, such that recruitment is impaired and for which management is needed to recover this stock; or if adequate management measures are already in place, more time may be required for them to take effect. No fishing will be

allowed for the SGPF where the primary performance indicator is below the limit reference point (LRP).

#### 10.4.5 Meta-rules

- 1. For a fishery classified as Sustainable, the SGWCPFA may request additional SASs (to be cost recovered from the industry) to allow for reconsideration of the level of fishing strategy required for the fishery. The highest SAS result will be used in applying the Harvest Strategy.
- 2. It is acknowledged that SAS catch rates and recruit catch rates can increase dramatically within a season. In order to respond to real time changes in SAS results the fishery may move within a season from the fishing strategy applied under a Depleting/Recovering fishery to the fishing strategy in Table 10 when two consecutive SAS deliver results equal to or above the adult catch rates and recruit catch rates described in Table 11.
- 3. Should the decision be made to move the fishery from a Depleting/Recovering fishing strategy to the strategy in Table 10 a limit on the number of fishing nights applied under a Depleting/Recovering fishing strategy will no longer be applied. Should the fishery transition from Depleting/Recovering to the fishing strategy described in Table 10 this strategy will apply for the remainder of the season.
- 4. It is acknowledged that SAS catch rates and recruit catch rates can increase dramatically within a season. In order to respond to real time changes in SAS results the fishery may move within a season from the fishing strategy applied under a Depleted fishery to the fishing strategy applied under a fishing strategy in Table 10 when three consecutive SAS deliver results equal to or above the adult catch rates and recruit catch rates described in Table 11.
- 5. Should the decision be made to move the fishery from a Depleted fishing strategy to the strategy in Table 10 the closure of the fishery to all fishing activity, as applied under a Depleted fishing strategy, will no longer be applied. Should the fishery transition from a Depleted fishing strategy to the fishing strategy in Table 10 this strategy will apply for the remainder of the season.
- 6. If the fishery is classified as a Depleted fishery at the start of the season on 1 November, the fishery may move to the fishing strategy described in Table 9 when the November SAS results are equal to or above the adult catch rate and recruit catch rate for the November SAS described in Table 11. The application of Table 9 (limit on fishing nights) will be based on the weighted annual average recruit catch rates from the previous seasons SAS (i.e. November, February and April). Should the fishery transition from a Depleted fishery to a fishing strategy described in Table 9 this strategy will apply for the remainder of the season, unless meta-rule 4 is triggered.

Table 10: Fishing strategy applied should meta-rule 2 or 4 be enacted.

		March/ April (pre survey)	April (post survey) / May/ June
Mid/North	Bucket counts	≤240	≤260
Gulf	(no. prawns/7 kg)		
Southern	Bucket counts	≤260	≤260
Gulf	(no. prawns/7 kg)		
	·	Over two consecutive	Over two consecutive nights in
		nights in Southern Gulf	Southern Gulf area only
		area only	

Table 11: Adult catch rate and recruit catch rate reference points to enact meta-rule 2 and 4 fishing strategy.

	Adult catch rate	Recruit catch rate
SAS	aLRP	rLRP
November	2.50lb/min (68.2kg/hr)	0.78lb/min (21.3kg/hr)
March	3.32lb/min (90.5kg/hr)	1.49lb/min (40.6kg/hr)
April	4.55lb/min (124.1kg/hr)	1.41lb/min (38.5kg/hr)

7. It is acknowledged that external factors can substantially affect results from the November SAS and impact on the total pre-Christmas catch cap. For a fishery classified as Sustainable, during a pre-Christmas fishing strategy with a catch cap set at between 120t and 425t (Table 7), if the fleet average catch rate is ≥ 600kg/vessel/night when the catch cap is reached, the fleet may fish for an additional two nights providing fleet catch rate remains above 500kg/vessel/night. The fleet may harvest above the total allowable pre-Christmas catch in this scenario but the total catch will not exceed 500t.

# **10.5 Review of the Harvest Strategy**

The harvest strategy may be reviewed to incorporate such measures into the management framework of the fishery required to address any significant issues not anticipated when this plan and harvest strategy were developed.

### **10.6 Changes in the Harvest Strategy**

The Harvest Strategy in this management plan includes some differences to the previous Harvest Strategy included in the 2014 management plan. The main changes are:

#### **10.6.1 Fishing Strategy Classification**

The conservative, standard and increasing fishing strategies when the fishery is classified as Sustainable have been removed and now a single fishing strategy is applied. The single fishing strategy has applied the reference points for the performance indictors average catch rate of adult prawns (lb/min or kg/hour) and bucket count (no. prawns/7kg) that were applied under the previous standard fishing strategy.

#### 10.6.2 Stock Assessment Survey design

A new survey design moving the February survey to March and reducing the number of shots in the April and November surveys. The change in survey design has changed the reference points for adult catch rates when the fishery is classified as sustainable to the following (Table 12). A description of the new survey design is provided in the Appendix 19.1.

Harvest Strategy	Limit	Trigger	Target
	1.75 (lb/min) 47.7	2.50 (lb/min)	3.50 (lb/min)
previous	(kg/hr)	68.2 (kg/hr)	95.5 (kg/hr)
	2.21 (lb/min) 60.3	3.16 (lb/min)	4.43 (lb/min)
new	(kg/hr)	86.2 (kg/hr)	120.8 kg/hr)

Table 12: Comparisons of reference points between harvest strategies applied in management plans.

The purpose of the new survey design is to restrict surveying to one night in April, when catches and catch rates have historically been high, and to reduce the financial cost and time associated with surveying.

#### 10.6.3 Total allowable pre-Christmas catch

The maximum total allowable pre-Christmas catch when the fishery is classified as sustainable has been reduced from 550t to 500t. This modification has been made as the SGWCPFA have identified when the pre-Christmas catches exceed 500t total catches for the season and subsequent seasons are reduced. To prevent catch reductions in subsequent years and stabilise catches over time the maximum allowable pre-Christmas catch has been reduced to 500t.

#### 10.6.4 Pre-Christmas average fleet catch rate

The Meta-rule previously provided for two additional pre-Christmas fishing nights when the catch cap was set between 120t and 425t, and the catch rate is above  $\geq$  700kg/vessel/night when the catch cap is reached. This Meta-rule has now been changed, with the catch rate reduced to  $\geq$  600kg/vessel/night when the catch cap is reached.

In the case of each of the four amendments to the Harvest Strategy since the last Management Plan the Management Committee and Research Sub-Committee of the SGWCPFA supported the amendments to the Harvest Strategy.

#### 10.6.5 Meta-rule moving the fishery within season from Depleting/ Recovering

In order to provide the capacity to move to a less conservative fishing strategy when two consecutive SAS illustrate catch rates and recruit catch rates have increased substantially a new meta-rule has been incorporated in this management plan (see section 10.4.5). The modified meta-rule permits a fishing strategy consistent with the fishing strategy applied when the fishery is classified as Sustainable.

#### 10.6.6 Meta-rule moving the fishery within season from Depleted

In order to provide the capacity to move from a fishery classified as Depleted to a fishery classified as Depleting/ Recovering or Sustainable during a season meta-rules have been incorporated into this management plan (see section 10.4.5). The meta-rules only permit the movement between stock status classifications when the reference points for adult catch rate and recruit catch rate that correspond to the stock status classifications have been reached (see Tables 5 and 6). The modified meta-rules permit fishing strategies consistent with the fishing strategies applied when the fishery is classified as either Depleting/ Recovering and Sustainable.

# **11 Other commercial fishing**

# 11.1 Research fishing

Research fishing is fundamental to the management of the SGPF, and the results of research surveys are used to guide fishing operations under the agreed Harvest Strategy. As the surveys are conducted through collective agreement with the SGWCPFA, fishing surveys are undertaken pursuant to an exemption granted to the SGWCPFA. Therefore, additional research fishing permits are not necessary to facilitate this fishing.

### **11.2 Exploratory and developmental fishing**

Applications for exploratory and developmental fishing for species that are not part of this fishery will be dealt with through Exploratory and Developmental Fishing Policy and the *Fisheries Management (Miscellaneous Research Fishery) Regulations 2013* under the *Fisheries Management Act 2007.* 

Exploratory and developmental fishing for species that are part of this fishery in the area of the fishery are dealt with either by issuing a permit or an exemption under the *Fisheries Management Act 2007*, depending on the activity being undertaken. Applications will be considered on a case-by-case basis and guided by the objectives and principles in this management plan.

# **12 Stock assessment and research**

### **12.1 Research services**

PIRSA Fisheries and Aquaculture contracts research services for each fishery. SARDI Aquatic Sciences at the time of drafting this plan was the designated research provider for core research for the SGPF. Costs of the annual research program for the fishery are recovered through licence fees.

External funding sources, such as the Fisheries Research and Development Corporation (FRDC) through an annual levy base collected through licence fees.

### **12.2 Data collection and analysis**

To achieve the research and monitoring needs for the fishery, a variety of data types are collected and analysed.

Fishery independent data:

- Fishing surveys
  - By-catch surveys
  - Economic surveys.
- Fishery dependent data
  - Spot surveys
  - Commercial catch and effort logbook data
  - Wildlife interaction logbook data
  - At-sea catch data.

# **12.3 Fishery independent research**

#### 12.3.1 Fishery independent stock assessment surveys

Fishery independent SASs are conducted before, mid and toward the end of each normal fishing season and inform the fishing strategy undertaken by the fishing fleet and assess the fishery against Performance Indicators described in this management plan. Additionally, data from the November SAS provides information on egg production, and data from the March SAS provides information on recruitment (Noell et al. 2019).

SASs are conducted using industry vessels with a mix of independent and a small number of industry observers. The surveys involve trawl shots conducted at semi-fixed sites for a specified length of time. The distance trawled depends on trawl speed and tide, which is measured with a GPS. The number and locations of shots conducted during each survey has been optimised, taking into account historic data sets, information priorities and

logistic reasons. The November SAS generally includes 173 shots for November, 187 shots for March and 92 shots for April. Additional shots can be incorporated in the survey, which do not contribute to calculating the results.

The data collected during SASs include total catch, trawl time, trawl distance, trawl direction and bucket counts. A length frequency sample is also taken from the catch to provide sex-specific length, sex ratio and mean prawn weight data. Further details regarding the methods used in undertaking SASs are described in Noell et al. (2019).

#### 12.3.2 By-catch surveys

By-catch surveys have historically been conducted approximately every five years to underpin a risk assessment of the SGPF. The aims of the survey are to describe the species composition and spatial distribution patterns of prawn trawl catch. The most recent completed by-catch survey was conducted in 2013 (Burnell et al. 2015) to reassess the spatial distribution of by-catch compared to an earlier survey conducted in 2007 (Currie et al. 2009). These two surveys provided the basis for the assessment of individual species completed as part of a risk assessment for the SGPF.

#### 12.3.3 Bio-economic modeling

A bio-economic modeling tool has been developed for the SGPF that allows testing of alternate management strategies, including fleet reduction, quota management and other management frameworks suggested by stakeholders. The model has integrated economic dynamics with biological information to allow for explicit implications on the economic efficiency of various management options with biological outcomes taken into account.

#### 12.3.4 Economic indicators

The economic indicators project presents a set of economic performance indicators for fishers, a consistent time series of economic information to aid management of the fishery in the future as well as information about some social aspects of the fishery. Economic information regarding the fishery is collected from licence holders through regular surveys with information on catch, effort, price and the consumer price index. The first surveys were conducted in 1997-98 and the most recent surveys were conducted in 2018-19. The most recent economics report provides information for 2016-17 (Econsearch 2018).

### 12.4 Fishery dependent monitoring

License holders are required to complete daily and monthly logbooks detailing their fishing activities and harvest. The information is entered into a database maintained by SARDI Aquatic Sciences.

The SGWCPFA conduct spot surveys in fishing months when there are no SASs conducted. These SGWCPFA driven surveys target particular areas that industry considers as potential areas for fishing. Data collated from these surveys includes estimates of catch rate and mean prawn size (bucket counts). Spot survey data aims to augment the fishing strategies developed from fishery independent surveys (SASs) by

targeting areas that are likely to have changed since the previous survey such that they may be included in fishing strategy development.

PIRSA Fisheries and Aquaculture implemented a generic data recording logbook in 2007 for wildlife interactions (including TEPS for all South Australian commercial fisheries). The wildlife interaction logbook was implemented to ensure consistent reporting practices for interactions with TEPS. SARDI Aquatic Sciences collate and archive the data from the wildlife logbooks and summarise these in an annual report.

# 12.5 Reporting

SARDI Aquatic Sciences has conducted stock assessments on the SGPF since 1998. The stock assessments aim to synthesise information available for the fishery, assess the status of the resource, and comment on the performance of the fishery with respect to the current biological Performance Indicators. Stock assessment reports document the available information on the biology and management of Western King Prawns, present analyses of commercial logbook and fishery independent survey data, and provide assessment against the Performance Indicators in the management plan including:

- Index of future and current catch rate (SAS catch rates of recruits and adults)
- Total commercial catch
- Mean commercial catch rate
- Recruitment index
- Mean egg production.

### 12.6 Strategic research plan

In addition to the core stock assessment work that informs periodic decision-making in the fishery, additional research projects are undertaken to meet longer-term fishery objectives or to underpin the development of strategies under this plan.

The SGWCPFA Research Subcommittee have developed and updated a research plan to undertake research and development projects for the SGPF. The Research Subcommittee review and update the research plan regularly, taking into account the changing nature of the fishery, social expectations, economic performance, and the changing gulf environment.

# **13 Compliance**

PIRSA Fisheries and Aquaculture runs a compliance program that has dual objectives:

- To maximise voluntary compliance with fisheries rules.<sup>3</sup>
- To create effective deterrence to breaching fisheries rules.

These objectives are consistent with the Australian National Fisheries Compliance Policy<sup>4</sup>

Voluntary compliance is maximised through ensuring that fishers are aware of and understand the rules that apply to their fishing activities, that they understand the purpose of the rules, and that they operate in a culture of compliance.

Effective deterrence is created through the presence of fisheries officers and compliance operations, as well as through the detection and prosecution of illegal activity<sup>5</sup>.

# 14 Review of plan

A review of this management plan may be conducted at any time and a full review will be conducted as soon as practicable after the fifth anniversary of its operation which will involve a review of the plan for the purpose of determining whether the plan should be amended, replaced or reinstated without amendment. Section 49 of the Act outlines the process of reviewing a management plan.

<sup>&</sup>lt;sup>3</sup> Rules include regulations, licence conditions, closure notices or any other enforceable instrument under the *Fisheries Management Act* 2007.

<sup>&</sup>lt;sup>4</sup> The <u>Australian Fisheries National Compliance Strategy 2010-2015</u> was developed by the National Fisheries Compliance Committee outlines the objectives that Australian fisheries agencies will pursue to achieve an optimal level of compliance and create effective deterrence to illegal fishing activity.

<sup>&</sup>lt;sup>5</sup> Prosecution may include the issuing of a formal caution or an expiation notice, in addition to prosecution through the courts.

# 15 Resources required to implement the plan

In fulfilment of the objects of the *Fisheries Management Act 2007*, South Australian commercial fisheries currently operate in accordance with the Government's cost recovery policy. Costs of policy development, management, research and compliance programs are recovered through licence fees to reflect that South Australia's aquatic resources are owned by the State and managed by PIRSA on behalf of the South Australian community. Any costs associated with Government services that arise as a direct result of commercial access and benefit from resources, are recovered from commercial licence holders. Therefore, the costs of policy development, research and compliance programs are recovered from industry through licence fees. The commercial fishing industry, through its representative bodies, has a high level of involvement in structuring the relevant policy, compliance and research programs, in partnership with PIRSA Fisheries and Aquaculture and its service providers. This is an important facet of co-management in South Australia.

# **16 References**

BDO Econsearch 2020, *Economic and social indicators for the Spencer Gulf Prawn Fishery 2018/19: a report to PIRSA Fisheries and Aquaculture*, BDO Econsearch, Adelaide.

Brown DE and Holthuis LB 1998, 'The Australian species of the genus *Ibacus* (Crustacea: Decapoda: Scyllaridae), with the description of a new species and addition of new records', *Zoologische Mededelingen Leiden*, 72 (10), pp. 113-141.

Bryars, S 2003, *An Inventory of Important Coastal Fisheries Habitats in South Australia, Fish Habitats Program*, Primary Industries and Resources South Australia, Adelaide.

Burnell OW, Barrett SL, Hooper GE, Beckmann CL, Sorokin SJ & Noell CJ (2015). Spatial and temporal reassessment of by-catch in the Spencer Gulf prawn fishery. Report to PIRSA Fisheries and Aquaculture. Adelaide: South Australian Research and Development Institute (Aquatic Sciences). SARDI Publication No. F2015/000414-1, SARDI Research Report Series No. 854.

Carrick, NA 1996, Key factors which affect prawn recruitment and implications to harvesting prawn stocks: final report, Fisheries Research and Development Corporation, *FRDC* 91/3. Fisheries Research and Development Corporation, Canberra.

Carrick, NA 2003, *Spencer Gulf Prawn (*Melicertus latisulcatus) *Fishery: fishery assessment report to PIRSA*, SARDI RD03/0079-2, South Australian Research and Development Institute (Aquatic Sciences), Adelaide.

Currie, DR, Dixon, CD, Roberts, SD, Hooper, GE, Sorokin, SJ & Ward, TM 2009,. Fisheryindependent by-catch survey to inform risk assessment of the Spencer Gulf Prawn Trawl Fishery. Report to PIRSA Fisheries. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2009/000369-1. SARDI Research Report Series No. 390.

DAFF 2007, *Commonwealth fisheries Harvest Strategy: policy and guidelines*, Australian Government Department of Agriculture, Fisheries and Forestry, Canberra.

Dixon, CD and Sloan, S 2007, *Management plan for the South Australian Spencer Gulf Prawn Fishery: Fisheries Management Series paper no. 54*, Primary Industries and Regions South Australia (Fisheries and Aquaculture), Adelaide.

Dixon, CD, Roberts, SD and Hooper, GE 2007, *Spencer Gulf Prawn* (Melicertus latisulcatus) *Fishery: fishery assessment report to PIRSA Fisheries and Aquaculture*, SARDI publication no. RD03/0079-4, SARDI Research Report Series no. 161, South Australian Research and Development Institute (Aquatic Sciences), Adelaide.

Dixon, CD, Hooper, GE and Burch, P 2012, *Spencer Gulf Prawn Penaeus* (Melicertus latisulcatus) *Fishery 2010/11: fishery assessment report to PIRSA Fisheries and* 

*Aquaculture*, SARDI publication no. F2007/000770-5, SARDI Research Report Series no. 603, South Australian Research and Development Institute (Aquatic Sciences), Adelaide.

Dixon, CD, Noell, CJ and Hooper, GE 2013, *Spencer Gulf Prawn Penaeus* (Melicertus latisulcatus) *Fishery 2011/12: fishery assessment report to PIRSA Fisheries and Aquaculture*, SARDI publication no. F2007/000770-6, SARDI Research Report Series no. 683, South Australian Research and Development Institute (Aquatic Sciences), Adelaide.

Fletcher, WJ, Chesson, J, Fisher, M, Sainsbury, KJ, Hundloe, T, Smith, ADM and Whitworth, B 2002, *National ESD reporting framework for Australian fisheries: the 'how to' guide for wild capture fisheries*, FRDC Project 2000/145, Fisheries Research and Development Corporation, Canberra.

Fletcher, WJ, Sainsbury, KJ, Fisher, M and Hundloe, T 2005, 'A flexible and practical framework for reporting on ecologically sustainable development for wild capture fisheries', *Fisheries Research*, 71, pp. 175-183.

Flood, M, Stobutzki, I, Andrews, J, Begg, G, Fletcher, W, Gardner, C, Kemp, J, Moore, A, O'Brien, A, Quinn, R, Roach, J, Rowling, K, Sainsbury, K, Saunders, T, Ward, T and Winning, M (eds) 2012, *Status of Key Australian fish stocks reports 2012*, Fisheries Research and Development Corporation, Canberra.

Jones, K 2009, *South Australian Recreational Fishing Survey*, South Australian Fisheries Management Series paper no. 54, Primary Industries and Regions South Australia (Fisheries and Aquaculture), Adelaide.

Knight, MA and Tsolos, A 2012, *South Australian Wild Fisheries Information and Statistics Report 2010/11*, SARDI publication no. F2008/000804-4, SARDI Research Report Series no. 612, South Australian Research and Development Institute (Aquatic Sciences), Adelaide.

Hobday, AJ, Smith, ADM, Webb, H, Daley, R, Wayte, S, Bulman, C, Dowdney, J, Williams, A, Sporcic, M, Dambacher, J, Fuller, M, Walker, T 2007, *Ecological risk assessment for the effects of fishing methodology*: Report R04/1072 for the Australian Fisheries Management Authority, Canberra.

Hobday AJ, Smith ADM, Stobutzki IC, Bulman C, Daley R, Dambacher JM, Deng RA, Dowdney J, Fuller M, Furlani D, Griffiths SP, Johnson D, Kenyon R, Knuckey IA, Ling SD, Pitcher R, Sainsbury KJ, Sporcic M, Smith T, Turnbull C, Walker TI, Wayte SE, Webb H, Williams A, Wise BS & Zhou S (2011). Ecological risk assessment for the effects of fishing. *Fisheries Research* **108**, 372–384.

Hollamby, KL, Sloan, S, McShane, PE and Brook, J 2010, *Competition to collaboration: exploring co-management models for the Spencer Gulf Prawn Fishery*, FRDC project no. 2007/025, Fisheries Research and Development Corporation and the Spencer Gulf and West Coast Prawn Fishermen's Association, South Australia.

Hudinaga, M 1942, 'Reproduction, development and rearing of *Penaeus japonicus* Bate.', *Japanese Journal of Zoology*, 10, pp. 305-393.

MacDonald, N 1998, *Management plan for the Spencer Gulf and West Coast Prawn Fisheries*, South Australian Fisheries Management Series, No. 34.

MSC (2018). MSC Guidance to the Fisheries Certification Process. Version 2.1, 31 August 2018. London: Marine Stewardship Council.

Neville, P 2008, Co-management: managing Australia's fisheries through partnership and delegation: report of the Fisheries Research and Development Corporation's National Working Group on the Fisheries Co-management Initiative, Project No. 2006/068. Fisheries Research and Development Corporation, Canberra.

Noell, C. J. and Hooper, G. E. (2019). Spencer Gulf

Prawn *Penaeus (Melicertus) latisulcatus* Fishery. Fishery Assessment Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. In press

PIRSA 2011, *Allocation policy: allocation of access to fisheries resources between fishing sectors*, Primary Industries and Regions (Fisheries and Aquaculture), Adelaide.

PIRSA 2013a, *Management plan for the South Australian Commercial Marine Scalefish Fishery*, South Australian Fisheries Management Series, Primary Industries and Regions (Fisheries and Aquaculture), Adelaide.

PIRSA 2013b, *Policy for the co-management of fisheries in South Australia*, Primary Industries and Regions (Fisheries and Aquaculture), Adelaide.

PIRSA 2013c, *PIRSA cost-recovery policy*, Primary Industries and Regions (Fisheries and Aquaculture), Adelaide.

PIRSA 2014a. Management Plan for the South Australian Commercial Spencer Gulf Prawn Fishery. Paper number 67. The South Australian Fisheries Management Series. Primary Industries and Regions (Fisheries and Aquaculture), Adelaide.

PIRSA 2014b, *ESD risk assessment report for South Australia's Spencer Gulf Prawn Fishery*, Primary Industries and Regions (Fisheries and Aquaculture), Adelaide.

PIRSA 2017. Management Plan for Recreational Fishing in South Australia The South Australian Fisheries Management Series. Paper number 73: Primary Industries and Regions (Fisheries and Aquaculture), Adelaide.

Roberts, SD, Dixon, CD and Ward, TM 2005, *Assessment of juvenile prawn (*Melicertus latisulcatus) *surveys in Spencer Gulf, South Australia: report to Primary Industries and Regions (Fisheries and Aquaculture)*, SARDI Aquatic Sciences RD04/0211-2, SARDI Research Report Series no. 95, South Australian Research and Development Institute (Aquatic Sciences), Adelaide.

Roberts, SD and Steer, MA 2010, *By-product assessment in the Spencer Gulf Prawn Fishery with an emphasis on developing management options for Balmain Bug*, SARDI publication no. F2010/000165-1, SARDI Research Report Series no. 439, South Australian Research and Development Institute (Aquatic Sciences), Adelaide.

Roberts, SD, Deveney, M and Sierp, M 2010, *Biosecurity and disease status of prawn nurseries in South Australia*, SARDI publication no. F2010/000593-1, SARDI Research Report Series no. 449, South Australian Research and Development Institute (Aquatic Sciences), Adelaide.

Rodgers, GG, Roberts SD and Dixon, CD in press, 'The effects of temperature on larval size in the Western King Prawn, *Penaeus (Melicertus) latisulcatus* Kishinouye, from Spencer Gulf, South Australia: implications for fishery management', *Marine and Freshwater Research*, CSIRO Publishing online, <a href="http://dx.doi.org/10.1071/MF13020">http://dx.doi.org/10.1071/MF13020</a>>.

Sainsbury, K 2008, *Best practice reference points for Australian fisheries: report to the Australian Fisheries Management Authority*, R2001/0999, Canberra.

Sloan, SR, Smith, ADM, Gardner, C, Crosthwaite, K, Triantafillos, L, Jeffries, B and Kimber, N 2014, *National guidelines to develop fishery harvest strategies*. Fisheries Research and Development Corporation Report, Project 2010/061, Primary Industries and Regions, South Australia, Adelaide.

Steer, MA, Lloyd, MT and Jackson, WB 2006, *Southern calamary* (Sepioteuthis australis) *fishery: report to PIRSA*, SARDI Aquatic Sciences RD05/0006-2, SARDI Research Report Series no. 149.

Steer, MA, Lloyd, MT and Jackson, WB 2007, *Southern calamari* (Sepioteuthis australis) *Fishery: fishery assessment report to PIRSA*, SARDI publication no. F2007/000528-2, SARDI Research Report Series no. 229, South Australian Research and Development Institute (Aquatic Sciences), Adelaide.

Stewardson, C., Andrews J., Ashby C., Haddon M., Hartmann K., Hone P., Horvat P., Klemke, J. Mayfield S., Roelofs A., Sainsbury K., Saunders T., Stewart J., Nicol S. and Wise B. (eds) 2018. Status of Australian fish stocks reports 2018, Fisheries Research and Development Corporation, Canberra.

Stewart J and Kennelly SJ 1997, 'Fecundity and eff-size of the Balmain Bug *Ibacus peronii* (Leach, 1815) (Decapoda, Scyllaridae) off the east coast of Australia', *Crustaceana*, 70 (2), pp. 191-197.

Stewart, J and Kennelly, SJ 1998, 'Contrasting movements of two exploited Scyllarid lobsters of the genus *Ibacus* off the east coast of Australia', *Fisheries Research*, 36, pp. 127-132.

Stewart, J and Kennelly, SJ 2000, Growth of the Scyllarid lobsters *Ibacus peronii* and *I. chacei*, *Marine Biology*, 136, pp. 921-930.

Tanner, JE and Deakin, S 2001, 'Active habitat selection for sand by juvenile western king prawns, *Melicertus latisulcatus* (Kishinouye)', *Journal of Experimental Marine Biology and Ecology*, 261, pp. 199-209.

Williams A, Dowdney J, Smith A, Hobday A, Fuller M (2011). Evaluating impacts of fishing on benthic habitats: a risk assessment framework applied to Australian fisheries. *Fisheries Research* **112**, 154–167.

Winstanley RH, Potter, MA and Caton, AE 1983, 'Australian cephalopod resources', *Memoirs of the National Museum Victoria*, 44, pp. 243-253.

# 17 Acronyms

Acronyms are spelled out in the first instance and then the acronym is used thereafter. The exception is Chapter 9: Harvest Strategy, in which all acronyms are spelled out in the first instance as they appear in that chapter, then the acronym is used thereafter.

ESD ecologically sustainable development

**EBFM** ecosystem-based fisheries management

FTE full time equivalent

ILUA Indigenous land-use agreements

MSC Marine Stewardship Council

**PI** performance indicator

**PIRSA** Department of Primary Industries and Regions

**PSA** productivity susceptibility analysis

SARDI South Australian Research and Development Institute

**SAS** stock assessment survey

**SGPF** Spencer Gulf Prawn Fishery

SGWCPFA Spencer Gulf and West Coast Prawn Fishermen's Association

TEPS threatened, endangered and protected species

# 18 Glossary of common fisheries management terms

These terms are intended to be used for the purposes of this management plan only.

**Aboriginal traditional fishing** Fishing engaged in by an Aboriginal person for the purposes of satisfying personal, domestic or non-commercial communal needs, including ceremonial, spiritual and educational needs, and using fish and other natural marine and freshwater products according to relevant Aboriginal custom.

**Allocation** Distribution of the opportunity to access fisheries resources, within and between fishing sectors.

**Biomass** The total weight or volume of individuals in a fish stock.

**Bucket count** Measure of prawn size derived from the number of prawns in a 7 kg sample monitored during SASs, industry spot surveys and at-sea monitoring of fishing strategies.

**By-catch** At a broad level, fisheries by-catch includes all material, living and non-living, other than targeted species caught while fishing. It usually refers to discards (that part of the catch returned to the water), by-product, and the part of the catch that is not landed but is killed as a result of interaction with fishing gear.

By-product Non-targeted catch that is commercially valuable and retained by fishers.

Commercial fishing Fishing undertaken for the purpose of trade or business.

**Effort** Amount of fishing taking place, usually described in terms of gear type and frequency or period during which the gear is in use; for example, hours of trawling.

**Fishery dependent data** Information collected about a fishery or fish stock by the participants of a fishery; for example, catch and effort information from fishery log sheets.

**Fishery independent data** Information collected about a fishery or fish stock by researchers, independent of the fishery; for example, scientific surveys and observer reports.

**Fishing area** Fishing areas are defined by the grounds identified on page 24 of the July 2015 SARDI Stock Assessment Report.

**Fishing run** A period of fishing activity between quarters of the lunar cycle that include a new moon.

**Gear restriction** A type of input control used as a management tool to restrict the amount and/or type of fishing gear that can be used by fishers in a particular fishery.

**Gross value of production (GVP)** Value of the total annual catch for individual fisheries, fishing sectors or the fishing industry as a whole, measured in dollar terms calculated as the quantity of catch for the year multiplied by the average monthly landed beach prices.

**Input controls** Limitations on the type or amount of fishing effort; restrictions on the number, type and size of fishing vessels or fishing gear or on the fishing areas or fishing times in a fishery.

**Limited entry** Where fishing effort is controlled by restricting the number of operators, usually by limiting the number of licences in a fishery.

**Management committee** The management committee is a committee of the SGWCPFA that has seven representatives elected according to the Spencer Gulf and West Coast Prawn Fishermen's Association's constitution and a SARDI and PIRSA member.

Mesh size The size of mesh permitted in nets and traps.

**Non-target species** Any part of the catch except the target species, including by-catch and by-product.

**Non-retained species** Species that are taken as part of the catch but are subsequently discarded, usually because they have low market value or because regulations preclude them being retained.

**Recruitment overfishing** Excessive fishing effort or catch which reduces recruitment to the extent that the stock biomass falls below the pre-defined limit reference point.

**Recruits** A prawn size category defined as ≥20 prawns/pound. While this size category will include some sexually mature prawns (adults), it generally comprises prawns that have recently recruited to the fishery.

**Reference point** A reference against which the performance of the indicator can be assessed.

**Spot survey** Independent spot surveys are undertaken by industry, to assess fishing grounds against the bucket count criteria set out in Table 8, when SAS are not scheduled.

**Stakeholder** An individual or a group with an interest in the conservation, management and use of a resource.

**Stock assessment** A detailed analysis of stock status (abundance, distribution, age structure, etc.) to support the management of the species/fishery.

**Traditional fishing** Fishing for the purposes of satisfying personal, domestic or noncommercial communal needs, including ceremonial, spiritual and educational needs and utilising fish and other natural marine and freshwater products according to relevant Indigenous custom.

# **19 Appendices**

# 19.1 Revision of the SAS and the application of new reference points for performance indicators

The revision of the SAS in this Management Plan to move the February survey to March and reduce the number of shots in the April and November surveys required adjustment the limit, trigger and target reference points in the Harvest Strategy (See Table 5 and 6).

An assessment by SARDI developed reference points based on the new survey design. Calculation of the new reference points for the revised survey followed a two-step process: (1) the proportional change in weighted annual means, relative to the previous survey design, was applied to the limit and target reference points; then (2) using the bioeconomic model (Noell et al. 2014) the March reference points were interpolated from the survey and fishing catch rate trajectories between February and April (Figure 5).



Figure 5: Adjusted catch rate and reference points of adult prawns for determining stock classification for the fishery relative to current survey and reference points in the Management Plan (green = sustainable, yellow = depleting/recovering, red = depleted). The dashed lines represent the adjustment of reference points for the new Harvest Strategy.



Figure 6: Adjusted reference points of recruits for determining.

Similarly, the reference points for catch rate of recruits under the new survey design (Table 6) were adjusted in proportion to the change in catch rate from the previous survey design (Figure 11).

It is considered that these reference points are appropriate for monitoring the status of the stock and consider various biological and fishery characteristics that indicate the stock is relatively robust to fishing.

The species is short-lived and highly fecund, indicating a propensity for resilience to fishing pressure; this is consistent with the commercial catch patterns seen historically (see Figure 3). In addition, management arrangements pre- Christmas specifically aim to protect spawning adults, thus protecting stocks against recruitment overfishing. These arrangements have seen a 25% increase in mean recruitment compared to the historic average (Dixon et al. 2013).

Total effort has decreased by ~60% since 1978-79 (see Figure 3), indicating that current fishing effort is well below maximum sustainable yield and management arrangements and industry practice in place maintain effort at these low levels.



Department of Primary Industries and Regions