

Management Plan for the South Australian Spencer Gulf Prawn Fishery

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This document also contains information in relation to the *Fisheries Act 1982* and associated regulations. This information has been prepared as a summary of the fisheries management arrangements that are in place at the time of publication, and does not replace the legislation. Legislation may change from time to time. It is the responsibility of each individual to ensure that they are aware of the law that applies and to comply with it.

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FOREWORD

Management of the South Australian Spencer Gulf Prawn Fishery

The prawn resources of the South Australian Spencer Gulf Fishery are community owned resources. The role of the Government, as custodian of these resources on behalf of the broader community and future generations, is to ensure that they are used in an ecologically sustainable and economically efficient manner, while at the same time promoting optimum utilisation and maximising returns to regional and wider South Australian communities.

The South Australian Spencer Gulf Fishery is single-species fishery that operates out of the ports located on Spencer Gulf, mainly Port Lincoln and Wallaroo. The benthic ecosystem that supports the fishery is characterised by a shallow sandy/mud bottom across much of the Gulf (<50m). The species is heavily influenced by the spawning potential of prawn biomass in the Gulf and due to this needs careful management of stock through input controls. The fishery contributes to the socio-economic well being of regional coastal communities that are engaged in the fishing and processing of the prawn stocks.

Experience world-wide has demonstrated that where unrestricted access to fisheries resources is allowed, the incentive for individuals to conserve fish stocks is diminished. The resulting competition among and between user groups often leads to increased fishing effort and excess fleet capacity, which in time reduces biological, ecological and economic productivity.

In managing fisheries resources, the South Australian Government has the primary responsibility of balancing optimum utilisation with the need to ensure long term resource sustainability. The Government must also ensure that the basis for sharing fisheries resources among all user groups is clearly understood and accepted as equitable, and that the allocation of fisheries resources and their level of utilisation is consistent with the needs of present and future generations.

Where there are considered to be threats of serious or irreversible damage to fisheries resources, or the environment upon which they depend, a lack of full scientific certainty or insufficient information will not prevent the Government from making decisions. Where resource management decisions must be made in an environment of uncertainty, the Government, in partnership with the stakeholders, will take a precautionary approach to the management of South Australia's fisheries resources.

This Management Plan provides a framework to address key challenges facing the future management of the Spencer Gulf Fishery over the next five years.

Hon. Paul Holloway MLC

Acting Minister for Agriculture, Food and Fisheries
September 2007

ACKNOWLEDGEMENTS

The Prawn Fisheries Management Committee (FMC) coordinated a process to finalise this Management Plan. All members of the FMC are acknowledged for their contributions. The following organisations are also acknowledged for contributions: South Australian Research and Development Institute (SARDI) Aquatic Sciences; the South Australian Spencer Gulf and West Coast Prawn Fishermen's Association Inc; the South Australian Fishing Industry Council; and the South Australian Recreational Fishing Advisory Council. Thanks also to Les Gray (PIRSA) for assisting in the documentation of the management history of the fishery.

As of March 2007 FMCs were discontinued in South Australia in preparation for the introduction of the *Fisheries Management Act 2007* which establishes a Fisheries Council to advise the Minister. The Act is scheduled to commence 1 September 2007. In the absence of FMCs and in preparation for operations under the new Act, PIRSA Fisheries has consulted directly with the Spencer Gulf and West Coast Prawn Fishermen's Association which has positioned itself as the peak industry association for providing fisheries management advice. The Association provided comment and input in relation to the earlier drafts of the management plans.

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1 PURPOSE

This Management Plan sets objectives and strategies that aim to maintain ecologically viable stock levels in the Spencer Gulf Prawn Fishery, promoting economic efficiency, equitable distribution and participative management from all stakeholders.

This Plan sets out a formal harvest strategy for the fishery that includes a set of decision rules to guide harvest strategy development for each fishing period within a season. The Plan provides direction for the formulation of regulations under the *Fisheries Act 1982* (the Fisheries Act). It is intended to provide greater certainty in day-to-day and long-term management decision-making for all stakeholder groups and assist the commercial industry in a move towards a greater level of self-management.

Access to fisheries resources, managed by the Government on behalf of the broader community and future generations, comes with certain obligations for commercial licence holders, recreational participants and traditional fishers regarding the proper management and care of fisheries resources. Where appropriate, these obligations are set out in this Management Plan. Information in this document provides a reference for the broader community in relation to the management measures that have been introduced to ensure long-term sustainability of the fisheries resources utilised in the Spencer Gulf Prawn Fishery.

In accordance with the objectives of the Fisheries Act, a key goal of this Management Plan is to ensure that an appropriate balance exists between the need to ensure long term ecological sustainability of the prawn resources that support the Spencer Gulf Prawn Fishery, and the optimum utilisation and equitable distribution of those resources, for all stakeholder groups and future generations.

This Management Plan sets out key performance measures to allow for assessment of the degree to which management objectives are being achieved.

2 FISHERY OVERVIEW

2.1 Commercial Fishery

Three commercial prawn fisheries occur within South Australia: the Spencer Gulf Prawn Fishery, the Gulf of St Vincent Prawn Fishery and the West Coast Prawn Fishery (figure 1). This Management Plan applies to the Spencer Gulf Prawn Fishery, which is the largest in terms of total area, production, and number of licence holders. It is a single species prawn fishery, based on the capture of the Western King prawn, *Melicertus latisulcatus*.

In Spencer Gulf, fishing is permitted in all waters >10 metres in depth north of the geodesic joining Cape Catastrophe (Latitude 34° 35.4'S, Longitude 136° 36.0'E) on Eyre Peninsula and Cape Spencer (Latitude 34° 9.6'S, Longitude 135° 31.2'E) on Yorke Peninsula.

There are currently 39 commercial fishery licences issued for the Spencer Gulf fishery. Any boat used in the prawn fisheries must be registered and endorsed upon the licence under which it is being used. Boats in the Spencer Gulf prawn fisheries must not have an overall length exceeding 22 metres and the main engine must not exceed 365 continuous brake horsepower. Both single and double rigs are permitted to be used in the fishery, with a minimum mesh size of 4.5 centimetres and a maximum headline length of 29.26 metres (the headline length of any single prawn trawl net used in a double rig must not exceed 14.63 metres).

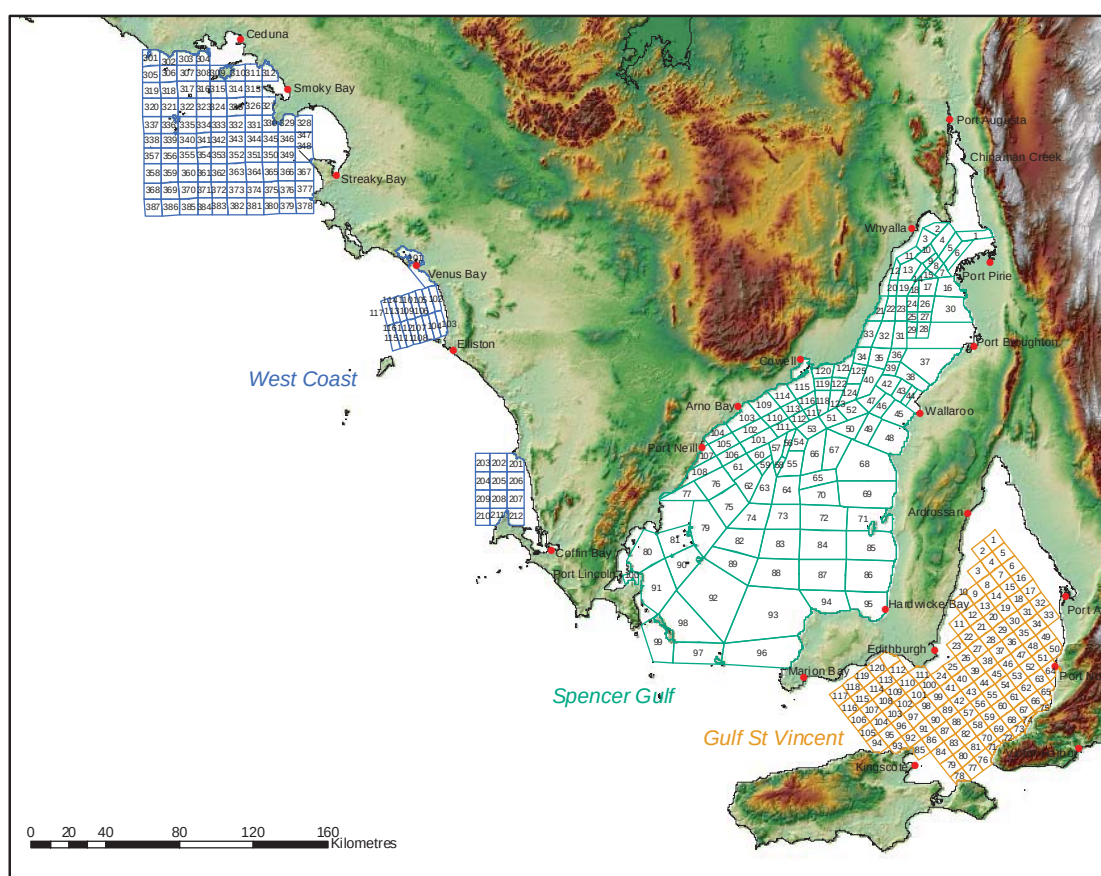


Figure 1. South Australia's three commercial prawn fisheries (figure courtesy of SARDI Aquatic Sciences).

Commercial fishing is undertaken using the demersal otter trawl technique. This essentially consists of towing a funnel-shaped net leading into a bag (most commonly referred to as a cod end) over the sea floor (figures 2 and 3). A separate large meshed bag, referred to as a crab bag, is held within the cod end and acts to retain blue crabs and megafauna such as sharks and rays, while prawns flow through to the cod end. The crab bag reduces crab mortality, incidental damage to prawns and allows the other species to be returned promptly to the sea. Otter boards are used to keep the trawl nets open horizontally whilst being towed.

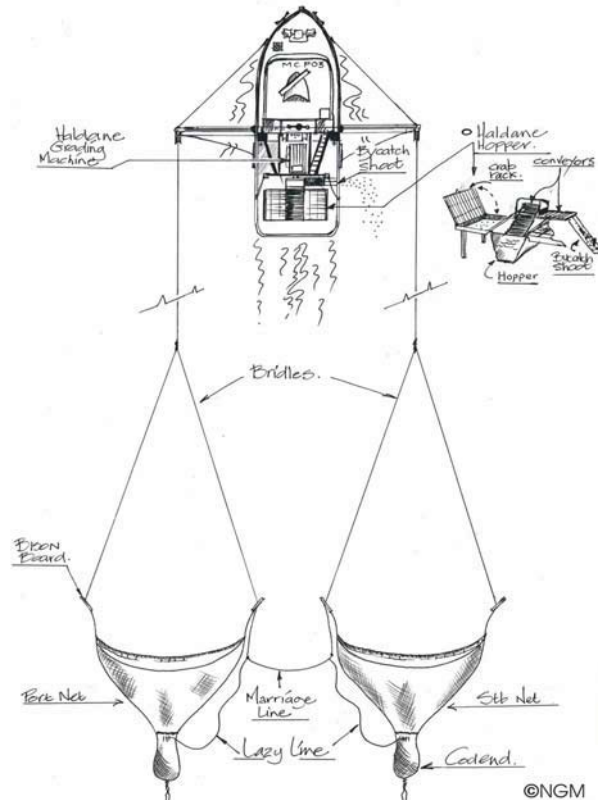


Figure 2. Double rig trawl gear and location of hopper sorting and prawn grading systems used in the Spencer Gulf Prawn Fishery (figure courtesy of SARDI Aquatic Sciences).

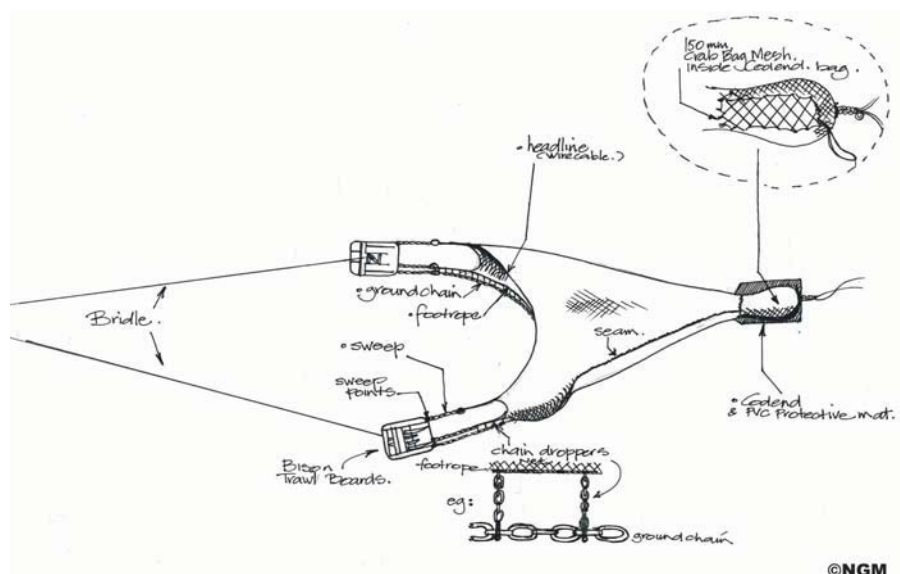


Figure 3. Trawl net configuration showing trawl boards, head rope, ground chain and cod end with crab bag.

Trawling is undertaken during the night between sunset and sunrise, and generally between the last quarter of the moon, through the phase of the new moon to the first quarter. Trawl shots are of short duration relative to other prawn fisheries and take 1 hour on average in Spencer Gulf.

Most vessels in Spencer Gulf are fitted with a “hopper”, into which the contents of the cod ends are spilt. The hopper is flooded with water to increase the survival of by-catch that is subsequently discarded. The contents of the hopper trickle onto a conveyer belt system where the retained catch is sorted from the by-catch. Discarded by-catch is returned directly to the water from the conveyer system. The prawn catch is then placed through a commercial grading machine that sorts the prawn catch into weight categories. The graded catch is then usually packed and frozen immediately, either cooked or green, into 5 kg or 10 kg cartons. On rare occasions the catch may be placed directly into a brine solution.

In addition to prawns, commercial licence holders are permitted to retain and sell two species harvested incidentally during prawn trawling: the slipper lobster (*Ibacus* spp) and southern calamary (*Sepioteuthis australis*). These species are referred to as by-product. At the end of each fishing trip, the catch is off-loaded at suitable ports adjacent to the fishing grounds and transported to fish processing factories. Major home ports for Spencer Gulf boats are Port Lincoln, Wallaroo, Port Adelaide, and Port Pirie.

The Spencer Gulf Prawn Fishery is an important element of South Australia’s commercial fishing industry. In 2004/05, 1,939 t of prawns were harvested from Spencer Gulf with an approximate total value of \$31.9 M (Knight *et. al.* 2006). This represented 89% of South Australia’s total production of prawns and >50% of Australia’s production of Western King prawn (Dixon *et al* 2006a).

2.2 Biological Characteristics of Key Species

The following section provides brief background information on the biological characteristics, for the target species (Western King prawn) and by-product species (slipper lobster and calamary) in the Spencer Gulf Prawn Fishery. More detailed information on these species is provided in stock assessment reports prepared by the SARDI Aquatic Sciences. These reports are available on the PIRSA Fisheries website at <http://www.pir.sa.gov.au/fisheries> and SARDI Aquatic Sciences website at <http://www.sardi.sa.gov.au>.

2.2.1 Western King prawn (*Melicertus latisulcatus*)

Prawns are crustaceans with five pairs of swimming legs (pleopods) as well as five pairs of walking legs (pereiopods) with the front three having claws. They are nocturnal and burrow into the seabed during the day and emerge at night to feed. Adult Western King prawns aggregate, mature, mate and spawn in deep water between October and April, with the main spawning period between November and February. Females may spawn on multiple occasions during one season. During the peak spawning period, females tend to be more prevalent in the catch, due likely to increased feeding activity associated with ovary development. At other times the catch is generally male biased. Larger female prawns are proportionally more fecund than smaller prawns. Further, the proportion of female prawns with fertilized eggs increases with size. Therefore, the combination of the short spawning season, increased catchability of females, disproportionate fecundity levels and varying fertilization success, means that the harvest of prawns, particularly larger size classes of females, during the peak spawning period has substantial implications on recruitment to the fishery and thus sustainable management.

Whilst adult *M. latisulcatus* 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, with faster development in warmer water (Hudinaga 1942). The distribution of prawn larvae is influenced by wind patterns and tidal currents, with the highest densities found in the north of Spencer Gulf (Carrick 1996).

Post-larvae settle in inshore nursery areas when 2–3 mm carapace length (CL) and can remain there for up to 10 months, depending on the time of settlement (Carrick 1996). The post-larvae produced from early spawning events settle in nursery areas during December or January where they grow rapidly and then emigrate to deeper water in May or June. Alternatively, post-larvae produced from spawning after January settle in nurseries from March and then grow slowly. They “over-winter” in nursery areas before recruiting to trawl grounds in February the following year (Carrick 2003). The effects of over-wintering on adult growth and survival are unknown.

In Spencer Gulf, spatial and temporal differences in juvenile prawn abundances are evident (Roberts *et al.* 2005). Even so, inter-annual patterns are generally consistent across sites. Abundances were greatest between February and May, with key nursery sites identified as False Bay, Shoalwater Pt, Plank Pt, Mt Young, 5th Creek and Port Pirie, all in the north of the gulf (Carrick 1996; Roberts *et al.* 2005).

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 completed, as prawns reduce the energy spent on reproduction. Female prawns grow faster and attain a larger maximum size than males.

2.2.2 Southern calamary (*Sepioteuthis australis*)

The southern calamary is common throughout southern Australian coastal waters. It ranges from Dampier in Western Australia to Moreton Bay in Queensland, including Tasmania, and it also occurs in northern New Zealand waters. *S. australis* usually inhabits coastal waters and bays in depths of <70 m (Winstanley *et al.* 1983).

In GSV, small (<30 mm dorsal mantle length (DML)) and large calamary (>150 mm DML) are predominately found in shallow, inshore waters, whereas small to medium individuals are usually found in deeper, offshore waters (Steer *et al.* 2006). Adult calamary were found to have a seasonal, systematic distribution and abundance in GSV, following an anti-clockwise direction that starts at Kangaroo Island in spring and ends up at Edithburgh during late winter (Steer, *et al.* 2006). These patterns were closely attributed to spawning behaviour and water clarity. Detailed studies on the general and reproductive biology of calamary in GSV are presented by Steer *et al.* (2006).

2.2.3 Slipper lobster (*Ibacus* spp.)

Ibacus peronii was the only species of slipper lobster captured in recent by-product studies in the Gulf St. Vincent Prawn Fishery (Dixon *et al.* 2006 b). *I. peronii* inhabits depths of 4–288 m (Brown & Holthuis, 1998). It is commonly referred to as the “Balmain Bug”. It is long-lived, with low fecundity compared to other lobsters in the Scyllarid family (Stewart & Kennelly, 1997, 2000). Whilst little is known of its biology in Spencer Gulf, it exhibits limited movement patterns in NSW (Stewart & Kennelly, 1998).

Whilst *I. peronii* is certainly the species captured frequently in Spencer Gulf, it is unclear whether other species of slipper lobster 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: 82–696 m, Brown and Holthuis, 1998).

2.3 Environmental Characteristics

2.3.1 The Spencer Gulf

The Spencer Gulf is a shallow embayment, with depths reaching a maximum of 60 metres 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, combined with the vast areas of tidal flat and mangrove habitat, creates ideal breeding conditions for the Western King prawn.

2.3.2 Coastal habitats

Dixon *et. al.* (2006) 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 was estimated as 992 km in total length (table 1). 508 km (51%) was tidal flat only and 245 km (25%) was mangrove forest associated with tidal flat. Areas with the greatest juvenile prawn nursery habitat were the Far Northern Spencer Gulf (~201 km of tidal flat only and 67 km of mangrove forests + tidal flat), Germein Bay (~95 km of tidal flat only and 57 km of mangrove forests + tidal flat) and False Bay (~63 km of tidal flat only and 49 km of mangrove forests + tidal flat) (figure 4). These areas of identified nursery habitat correspond well with sites in Spencer Gulf previously found to contain the greatest abundances of juvenile prawns (Roberts *et al.* 2005).

Table 1. The estimated proportion and distance of coastline of tidal flat only and mangrove forest associated with tidal flat for the Spencer Gulf coastline (see Dixon *et. al.* 2006a).

Fishery	Coastline (km)	Tidal flat only		Mangrove +Tidal Flat	
		%	KM	%	KM
Spencer Gulf	992	51	508	25	245

2.3.3 Adult habitats

The Western King prawn is distributed broadly throughout Spencer Gulf. It is a benthic species that prefers sand or mud sediments to seagrass or vegetated habitats (Tanner & Deakin 2001). Adults tend to inhabit waters greater than 10 metres depth and are harvested in depths of up to 60 metres 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). Although prawns are broadly distributed throughout the gulf, commercial effort tends to be concentrated in areas with large prawns at high density. Carrick (2003) estimated that <10% of the area of the gulf is trawled annually. In recent years around 50% of the commercial catch has been harvested from the Wallaroo region (Dixon *et. al.* 2006a; see Appendix 9.6).

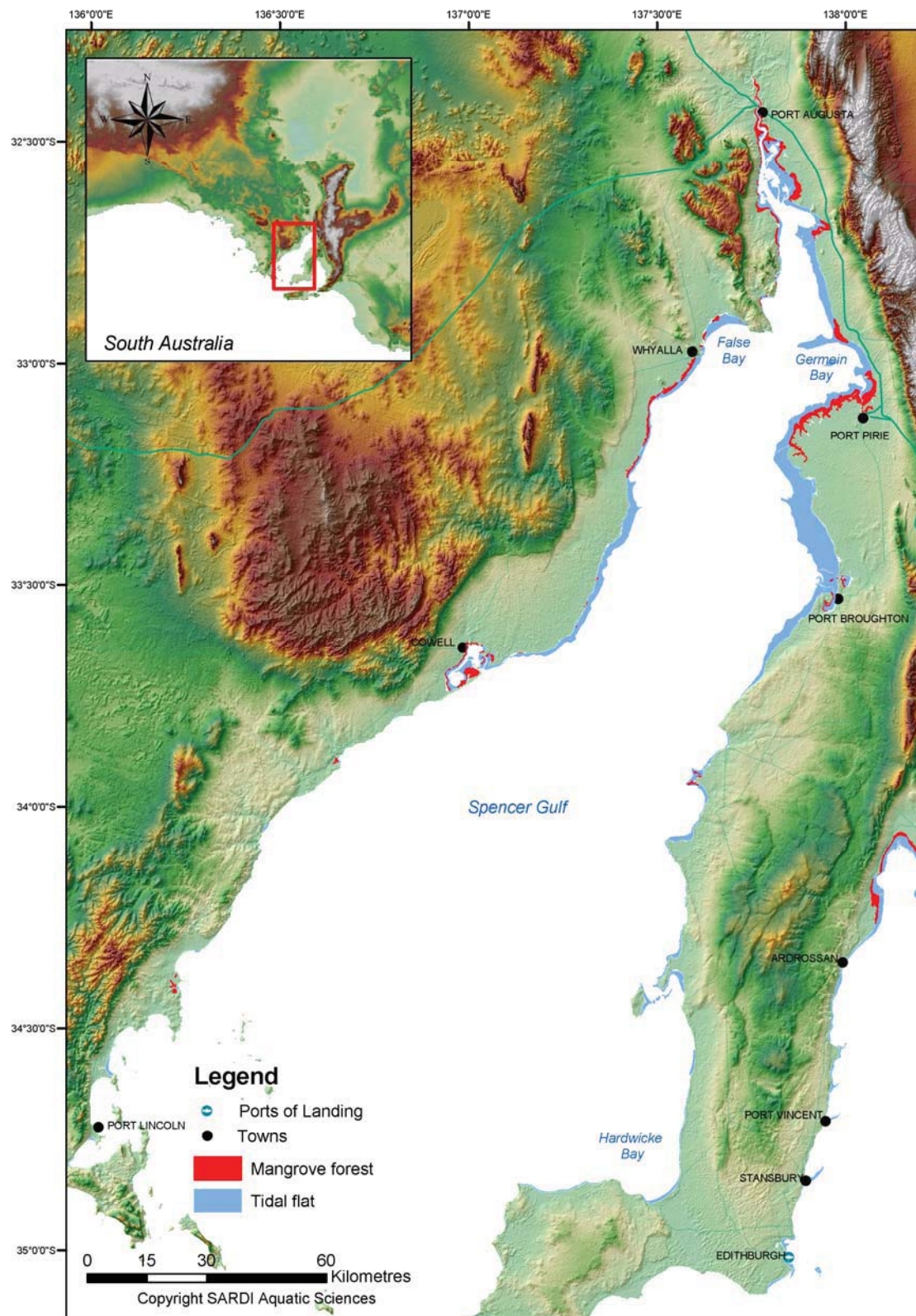


Figure 4. Areas of mangrove forest and tidal flats, important for prawn recruitment, around coastal Spencer Gulf (figure courtesy of SARDI Aquatic Sciences).

3 SCOPE OF THE MANAGEMENT PLAN

3.1 General

The *Fisheries Act 1982* (the Act) provides a broad statutory framework to ensure the ecologically sustainable management of South Australia's fisheries resources. In the administration of the Act, the Minister for Agriculture, Food and Fisheries, the Director of Fisheries and the Fisheries Management Committees must operate in accordance with the following objectives:

- a) *ensuring, through proper conservation, preservation and fisheries management measures, that the living resources of the waters to which this Act applies are not endangered or overexploited; and*
- b) *achieving the optimum utilisation and equitable distribution of those resources.*
- c) *insofar as this Act applies to the River Murray, seeking to further the objects of the River Murray Act 2003 and the Objectives for a Healthy River Murray under that Act.*
- d) *insofar as this Act applies to the Adelaide Dolphin Sanctuary, seeking to further the objects and objectives of the Adelaide Dolphin Sanctuary Act 2005.*

This Management Plan updates the first Management Plan developed for the fishery (MacDonald 1998). It covers all fishing activity undertaken within the Spencer Gulf Prawn Fishery, including commercial, recreational, traditional and any illegal fishing. This Management Plan does not form part of the *Fisheries (Scheme of Management – Prawn Fisheries) Regulations 2006* and is a policy document.

The powers contained in Section 14 of the *Fisheries (Management Committees) Regulations 1995* (the FMC regulations) provide the legal basis for the preparation of this Management Plan. This Management Plan is an expression of the policy that applies in relation to the Spencer Gulf Prawn Fishery to inform the exercise of any discretionary decision-making powers in the legislation, as they apply to the fishery.

The regulations that govern the management of the Spencer Gulf Prawn Fishery are the *Fisheries (Scheme of Management – Prawn Fisheries) Regulations 2006* and the *Fisheries (General) Regulations 2000*. This Management Plan should be read in conjunction with these regulations. The South Australian Government has management jurisdiction for Western King prawns from the low water mark out to three nautical miles and within all State internal waters that includes the Spencer Gulf, the Investigator Straits and Gulf St. Vincent. South Australia also has jurisdiction for western king prawns from three nautical miles out to the edge of the Australian Fishing Zone (200 nautical miles) under an Offshore Constitutional Settlement (OCS) agreement between the South Australian and Commonwealth governments.

Management of the South Australian Spencer Gulf Prawn Fishery is subject to a number of international legal instruments including the United Nations Convention on the Law of the Sea. The existing management regime complies with these international conventions.

3.2 Operation of the Management Plan

This Management Plan will operate for a five-year period from 2007 to 2011 inclusive, subject to annual review and amendments that are considered necessary. This Management Plan will be used to guide annual processes for providing advice to the Minister and Director of Fisheries on management and research for the fishery.

The reporting framework established in this Management Plan will be used to prepare an annual report on the performance of the fishery against all performance indicators and reference points. A stock assessment report will provide the basis for this assessment of fishery performance. Stock assessment reports will address the key performance indicators and limit reference points outlined in this Management Plan.

3.3 Review of the Management Plan

This Management Plan has been designed specifically to ensure sustainable harvest of prawns in an economically efficient manner. It will be periodically reviewed and improved over time as major advances in knowledge are made. In 2011, PIRSA Fisheries will undertake a major review of this Management Plan, including the strategic research and monitoring plan, in association with key stakeholders.

New legislation to replace the *Fisheries Act 1982* has been passed by parliament and will be implemented in 2007. This legislation contains extensive provisions about management plans. This plan will be reviewed and developed as a plan under the *Fisheries Management Act 2007*. At that time, the new plan will replace this plan.

3.4 Policy Context

This Management Plan aims to achieve outcomes that are consistent with broader Government objectives for the management of the marine environment. Other important policy drivers that have been taken into account in the development of this Management Plan are:

- The National Strategy for Ecologically Sustainable Development;
- The Precautionary Principle, as set out in the Intergovernmental Agreement on the Environment;
- The Australian Government 'Guidelines for the Ecologically Sustainable Management of Fisheries', which relate to the requirements of the *Environment Protection and Biodiversity Conservation Act 1999*; and
- The National Policy on Fisheries By-catch.

3.4.1 National Strategy for Ecologically Sustainable Development

The principles of Ecologically Sustainable Development (ESD) have been incorporated into fisheries legislation and management frameworks throughout Australia. The Australian Government defined the concept of ESD in the National Strategy for ESD as 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased' (the National Strategy for Ecologically Sustainable Development, 1992, p.6).

The overriding goal of the National Strategy for ESD is 'development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends'. The following core objectives were developed as part

of the National Strategy for ESD (the National Strategy for Ecologically Sustainable Development, 1992, p.8):

- To enhance individual and community wellbeing and welfare by following a path of economic development that safeguards the welfare of future generations;
- To provide for equity within and between generations; and
- To protect biological diversity and maintain essential ecological processes and life-support systems.

The following guiding principles are outlined in the National Strategy for ESD (the National Strategy for Ecologically Sustainable Development, 1992, p.8):

- Decision making processes should effectively integrate both long and short term economic, environmental, social and equity considerations;
- Where there are threats of serious irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
- The global dimension of environmental impacts of actions and policies should be recognised and considered;
- The need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised;
- The need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised;
- Cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms; and
- Decisions and actions should enable broad community involvement on issues that affect them.

The broad national objectives and guiding principles outlined in the National Strategy for ESD have shaped the way in which natural resources are currently being managed throughout Australia. In 2000, the Australian Standing Committee on Fisheries and Aquaculture initiated a process to develop a national ESD reporting framework for all Australian fisheries (Fletcher *et al.*, 2002). The national ESD reporting framework provides for a consistent national approach to reporting on fishery performance against all elements of ESD.

The National ESD reporting framework highlights that implementing ESD in the day-to-day management of fisheries requires consideration of not only the impacts of fishing on target species, but also the impacts of fishing on non-target species and the wider ecosystem. Linked to this is a recognition that the economic health of a fishery also relies on maintaining essential ecological processes. In addition, Governments and key stakeholder groups must be able to satisfy the wider community that the management systems in place are adequate and that fisheries are providing sufficient socio-economic benefits to justify any negative impacts they may have (Fletcher *et al.*, 2002).

This Management Plan takes into account the approach suggested in the National ESD Reporting Framework and aims to provide regular assessment of fishery performance against all aspects of ESD.

3.4.2 The Precautionary Approach

The 'precautionary approach' is widely accepted as an integral tool in managing naturally renewable resources. Applying 'the precautionary approach' to fisheries management means recognising that changes in fisheries systems are only slowly reversible, difficult to control, not well understood and subject to changing environmental and human values (FAO 1996).

The FAO International Code of Conduct for Responsible Fisheries prescribes a precautionary approach to the management of all fisheries, in all aquatic ecosystems, and regardless of their jurisdictional nature, recognises that most problems affecting the management of fisheries results from a lack of precaution in management regimes when faced with high levels of uncertainty (FAO 1996).

Principle 15 of the Rio Declaration of the United Nations Conference on Environment and Development states that *"In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."* (FAO 1996, p.3). The implications of adopting a precautionary approach to fisheries management are summarised as follows (FAO 1996):

"The precautionary approach involves the application of prudent foresight. Taking account of the uncertainties in fisheries systems and the need to take action with incomplete knowledge, it requires inter-alia:

- *Consideration of the needs of future generations and avoidance of changes that are not potentially reversible;*
- *Prior identification of undesirable outcomes and of measures that will avoid them or correct them promptly;*
- *That any necessary corrective measures are initiated without delay, and that they should achieve their purpose promptly, on a time scale not exceeding two or three decades;*
- *That where the likely impact of resource use is uncertain, priority should be given to conserving the productive capacity of the resource;*
- *That harvesting and processing capacity should be commensurate with estimated sustainable levels of resource, and that increases in capacity should be further contained when resource productivity is highly uncertain;*
- *All fishing activities must have prior management authorisation and be subject to periodic review;*
- *An established legal and institutional framework for fishery management within which management plans implement the above points are instituted for each fishery; and*
- *Appropriate placement of the burden of proof by adhering to the requirements above."*

The Australian Commonwealth and State governments formed an agreement in 1994 to implement a precautionary approach to all facets of policy development and decision-making concerning the environment. This agreement is embodied in section 6 of the *National Environment Protection Council Act 1994* (the NECP Act), which sets out the Intergovernmental Agreement on the Environment. Clause 3.5.1 of the Australian Intergovernmental Agreement on the Environment defines the precautionary principle as:

“Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decision-making should be guided by:

- *careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and*
- *an assessment of the risk-weighted consequences of various options.*

This Management Plan seeks to promote a precautionary approach to the management of the Spencer Gulf Prawn Fishery, as stated in the harvest strategy. For the purposes of this Management Plan, the precautionary principle has the same meaning as in clause 3.5.1 of the Australian Intergovernmental Agreement on the Environment.

3.4.3 Australian Government Environment Legislation

The *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) establishes reporting requirements against the ‘guidelines for the sustainable management of fisheries’. All State and Commonwealth fisheries must undergo a comprehensive independent ecological assessment process, which is subject to public consultation, prior to fishery products being considered for export approval under Parts 13 and 13A of the EPBC Act.

The two key principles of the EPBC Act ‘guidelines for the ecologically sustainable management of fisheries’ are as follows:

- A fishery must be conducted in a manner that does not lead to overfishing, or for those stocks that are over-fished, the fishery must be conducted such that there is a high degree of probability the stock(s) will recover; and
- Fishing operations should be managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem.

In September 2003, PIRSA Fisheries provided a submission to the Australian Government Department for the Environment and Heritage (the DEH) to allow for an assessment of the management framework in place for the South Australian Prawn Fisheries, against the EPBC Act ‘guidelines for the ecologically sustainable management of fisheries’. Following this assessment, the Federal Minister for Environment and Heritage provided the South Australian Government with a five year exemption to the export controls of the EPBC Act, subject to a number of recommendations for improved management of prawn stocks over this period. The recommendations have been integrated into this Management Plan and in particular have been used to guide the formulation of objectives and strategies for management of the fishery. Appendix 9.2 summarises the recommendations and includes information about how each recommendation is addressed within the management plan.

3.4.4 National Policy on Fisheries By-catch

The Ministerial Council on Forestry, Fisheries and Aquaculture endorsed the National Policy on Fisheries By-catch in April 1999 to ensure a unified national response to the problem of by-catch across all Australian fisheries. The overall goal of the policy is to ensure that the direct and indirect fishery impacts on ecosystems are taken into account in the development and implementation of fisheries management regimes. An overarching objective of the policy is to ensure that by-catch species and populations are maintained at sustainable levels.

The National Policy on Fisheries By-catch defines fisheries by-catch at its broadest level, to include all material, living and non-living, other than targeted species which is caught while fishing. However, for practical purposes, the National Policy defines by-catch to include discards (that part of the catch returned to the water) and also that part of the catch that is not landed but is killed as a result of interactions with fishing gear. By-product is defined as non-targeted catch that is commercially valuable and therefore retained by fishers. For the purposes of this Management Plan, by-catch and by-product have the same meaning as the definitions set out in the National Policy on Fisheries By-catch.

4 MANAGEMENT OF THE FISHERY

4.1 Commercial Fishing

4.1.1 History

The existence of Western King prawns in South Australian waters has been known for many years, yet it was only in the late 1960s that the first commercial catches were made. Small prawns have always been found in shallow water areas of the gulfs and were recorded over many years as shrimps.

The first record of Western 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. He is considered the pioneer of the South Australian prawn fishery as he began an extensive resource survey of Spencer Gulf without any outside financial assistance in July 1967. 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 from the bend of The Gutter. 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 of those 25 were taken up. These early steps were critical in preventing over-exploitation 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. His vision prevented the gross over-capitalisation and over-exploitation that plagues many Australian and overseas fisheries today.

In the early days, it was the fishermen who by agreement restricted their fishing times. Furthermore, the Spencer Gulf prawn fishery has a detailed database from commercial fisher's logbooks that have provided detailed catch and effort statistics since the fishery's inception in 1968. Since 1981 the Spencer Gulf prawn fishery has halved its total effort whilst maintaining stable catches (see figure 5). The Spencer Gulf and West Coast Prawn Fishermen's Association with its strong membership and dedicated committee, has played a major role in the management of the fishery and making it so successful.

The management system now in place for the Spencer Gulf prawn fishery has evolved over a number of years and has been largely influenced by the Association following a downturn in catch in 1983/84 – 84/85. 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 Association, in collaboration with SARDI Aquatic Sciences, investigated strategies to change effort patterns in order to target areas with larger size prawns.

The current management strategy has evolved from a history of trawling surveys conducted by licence holders since February 1982. In essence, these surveys provide a snapshot of the prawn biomass in Spencer Gulf, enabling areas of appropriate sized prawns to be targeted. From these data, harvest strategies are developed that restrict effort through temporal and spatial closures.

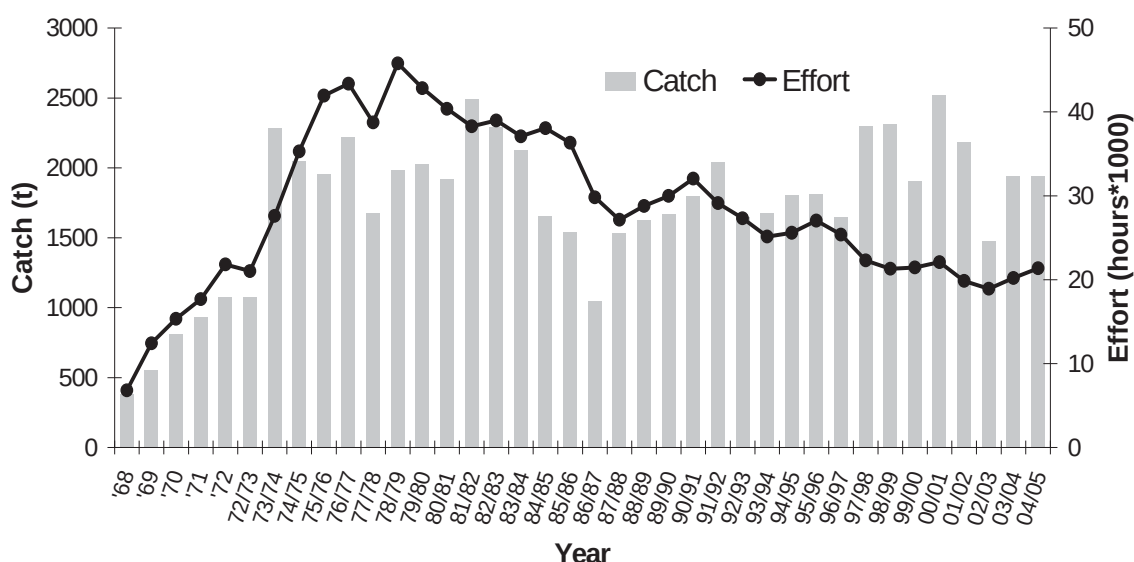


Figure 5. Total catch (t) and effort (hrs) for Spencer Gulf from 1968 to 2004/05. Data for 1968–1972 are reported as calendar year. Data for 1972/73 are from January to October 1973. From 1973/74 data are from November to October each year (a fishing season).

Closures

In 1968 all South Australian waters less than 10 metres deep were closed to trawling. Since 1981, there have been additional area closures (north of Point Lowly, north of Port Broughton, Arno Bay, Cowell, Port Pirie and Port Victoria) and seasonal closures. These closures were in order to protect areas deemed important to the ongoing health of prawn stocks and the gulf ecosystem in general. Seasonal closures aim not only to limit effort to sustainable levels, but also to maximise the economic return of the catch by managing both market demands and biological traits of prawns in Spencer Gulf e.g. reproductive cycles, growth and catchability. Table 2 presents a chronology of major management changes for the Spencer Gulf Prawn Fishery.

Table 2. A chronology of management changes in the Spencer Gulf Prawn Fishery.

	Management change
1948	First attempt to trawl prawns on a commercial scale in Spencer Gulf are unsuccessful
1967	After extensive privately funded surveys, the first commercial quantities of prawns are harvested from Spencer Gulf
1968	All SA waters closed to trawling except for specific managed zones for which permits are offered and all waters less than ten metres are closed to trawling
1969	The <i>Preservation of Prawn Resources Regulations 1969</i> is introduced and vessels licensed to fish for prawns. Twenty-five licences are issued initially but numbers have increased with caution during following years as prawn stocks are assessed.
1971	The two Spencer Gulf fishing zones are merged to form one
1976	All those prawn 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	The waters north of Point Lowly and adjacent to Port Broughton are permanently closed to trawling
1995	The <i>Fisheries (Management Committees) Regulations 1995</i> are introduced and provide a forum for the Spencer Gulf and West Coast Prawn Fishermen's Association to play a major role in the management of the fishery

4.1.2 Current Management arrangements

The current management arrangements in place for the Spencer Gulf Prawn Fishery reflect historical arrangements as well as some major changes that were introduced in the 1990s following a management review. The commercial fishery is managed using a mix of input controls aimed at matching harvesting capacity with resource availability and promoting stock recovery (table 3).

The boundaries of the Spencer Gulf Prawn Fishery as described in the *Fisheries (Scheme of Management – Prawn Fisheries) Regulations 2006* are: all those waters of Spencer Gulf that are north of the geodesic joining Cape Catastrophe (Latitude 34° 35.4'S, Longitude 136° 36.0'E) on Eyre Peninsula and Cape Spencer (Latitude 34° 9.6'S, Longitude 135° 31.2'E) on Yorke Peninsula. No fishing is permitted in waters that are shallower than 10m in the Spencer Gulf and trawling is banned during daylight hours. Commercial access to the fishery is limited to 39 commercial licences. Licences are fully transferable and corporate ownership of licences is permitted. All licence holders are permitted to use single or double rigged gear with a maximum headline length of 29.26 m. A minimum mesh size of 4.5 cm applies. Vessel size must not exceed 22 m in length and vessel power must not exceed 272 kW brake horse power.

Commercial licence holders are permitted to retain, for the purpose of trade or business, the by-product species slipper lobster (*Ibacus* spp) and southern calamary (*Sepioteuthis australis*).

Table 3. Management controls in the Spencer Gulf Prawn Fishery.

	Current restriction
Permitted species	<i>Melicertus latisulcatus</i> , <i>Ibacus</i> spp., <i>Sepioteuthis australis</i>
Limited entry	39 licences
Licence transferability	Permitted
Corporate ownership	Permitted
Spatial and temporal closures	Adjusted based on survey results
Closed areas	No trawling in waters shallower than 10m
Method of capture	Demersal otter trawl
Trawl rig	Single or double rig
Trawling times	Not during daylight hours
Maximum headline length	29.26 m
Minimum mesh size	4.5 cm
Maximum vessel length	22 m
Maximum vessel power	272 kW
Catch and effort data	Daily and monthly logbook submitted monthly
Landing locations	Landings permitted anywhere in the State
Landing times	Landings permitted at any time during the season

4.2 Recreational Fishing

Recreational fishers are permitted to take Western King prawns using permitted recreational devices (which includes hand nets) in depths >10 m, throughout the year. Details related to the gear specifications are set out in the *Fisheries (General) Regulations 2000*. These regulations prevent significant recreational catches of Western King prawns in South Australia.

4.3 Fish Processing and Markets

Western King prawns caught in South Australia are both exported and sold on domestic markets. During 2004/05, key export nations were Japan (60% of export value), Spain (21%) and Greece (19%), whilst Sydney and Melbourne markets dominated domestic sales (Anon 2006).

Fish processors that receive Western King prawns in South Australia are subject to compliance with the *Fisheries (Fish Processors) Regulations 2006*. They are required to maintain written records for each consignment or batch of prawns received, in accordance with regulation 8. All records must be maintained at the related premises for a period of at least 12 months after the product is received.

4.4 Aboriginal Traditional Fishing

All of the management measures in place for the recreational sector currently apply to Aboriginal communities when undertaking traditional fishing practices. This is because the Act does not currently recognise traditional or customary fishing as a separate type of fishing.

Access to South Australia's fisheries resources by Aboriginal communities under the *Fisheries Management Act 2007* will be provided through Aboriginal traditional fishing management plans. These plans may be made where an Indigenous Land Use Agreement (ILUA) is in place in relation to a native title claim area. The State is currently engaged

in ILUA negotiations with native title claimants and the commercial fishing industry. The agreement negotiation process will inform the way that access to fisheries resources by Aboriginal communities is defined and implemented.

4.5 Consultation and co-management

The *Fisheries (Management Committees) Regulations 1995* outline a set of co-management principles and establish a number of Fisheries Management Committees (FMCs) for key fisheries or groups of fisheries, including the Prawn Fishery Management Committee (PFMC). Under these regulations, the PFMC developed this management plan. New co-management arrangements will be established under the *Fisheries Management Act 2007*, with a greater emphasis on industry self-governance.

5 FRAMEWORK FOR DECISION-MAKING

The framework for decision-making for the Spencer Gulf Prawn Fishery is set out in the following section of the Management Plan. There are three subsections within this framework. Firstly, the Goals, Objectives and Strategies provide overarching principles for management of the fishery. The second sub-section describes the harvest strategy, which is the operational aspect of the Plan that defines the decision rules that limit fishing to sustainable levels. The final sub-section regards performance assessment. Here, limit reference points are defined for various performance indicators of the fishery, each of which relate specifically to the Goals, Objectives and Strategies defined below.

5.1 Goals, Objectives, and Strategies

The *Fisheries Act 1982* provides an overarching framework to ensure long-term sustainability of South Australia's fisheries resources. This Management Plan provides a set of management goals and objectives for the Spencer Gulf Prawn Fishery that are complementary to the objectives outlined in the Fisheries Act. These goals and objectives also take into account policy drivers set out in section 3.4 such as the 'principles of ecologically sustainable development', the 'precautionary principle', the 'guidelines for the ecologically sustainable management of fisheries' set out in the *EPBC Act 1999* and the National Policy on Fisheries By-catch.

Whilst the primary aim for the Spencer Gulf Prawn Fishery for the life of this Management Plan is to maintain ecologically sustainable stock levels, the Plan also aims to identify an appropriate balance between long term sustainability and the optimum utilisation and equitable distribution of resources between all stakeholder groups and future generations.

There are four key management goals for the Spencer Gulf Prawn Fishery:

1. Maintain ecologically sustainable stock levels
2. Ensure optimum utilisation and equitable distribution
3. Minimise impacts on the ecosystem
4. Enable effective management with greater industry involvement

A series of objectives have been established to ensure that management goals are operationalised. Linked to these objectives are a series of management strategies designed to ensure that stated management objectives are effectively pursued over the next five years. The objectives and strategies that relate to each management goal are presented in table 4. The following paragraphs describe some of the key objectives and strategies for each goal.

5.1.1 Goal 1: Maintain ecologically sustainable stock levels

The primary objective for Goal 1 is to ensure that prawn stocks are harvested in a sustainable manner, and that adequate data exists to determine this. The main management strategies for ensuring sustainability of the fishery are restrictions on the number of licences and gear used, and the development of spatially and temporally explicit harvest strategies. These measures aim to limit effort in the fishery, the latter operating at the finer temporal scale of harvest period (usually no more than 16 days). Certainty in the sustainability of the resource is obtained from the frequency of stock assessment surveys (3 times per year). Such frequency is necessary because of the high levels of mortality that can be imposed on prawn stocks in a short period of time.

Details on licence and gear regulations are presented in section 4.1.2. Harvest strategies and the decision rules that govern their development are presented in section 5.2.

Stock assessments and research and monitoring plans need to be updated annually. These strategies aim to ensure that fishery performance is maintained within reference levels and that scientific research is relevant and prioritised.

5.1.2 Goal 2: Ensure optimum utilisation and equitable distribution

Within the context of ecological sustainability, Goal 2 aims to ensure optimum utilisation and equitable distribution of the resource. This is addressed through the objectives of maximising the economic return from the resource, ensuring economically efficient harvesting of the resource by the fleet, and by enabling equitable access to this public resource.

Whilst harvest strategies primarily aim to limit effort to sustainable levels, they also aim to maximise the economic return of the catch by targeting prawns of an appropriate size, at appropriate times of the year. To achieve this, the harvest strategy decision rules developed in this Management Plan have considered market demand and prices, biological knowledge of prawn growth rates and egg production, and historic data from the fishery. Other strategies to achieve these objectives include economic evaluation of the commercial fishery in the form of an annual report (see Anon 2006) and a review of the current access arrangements and allocation issues.

5.1.3 Goal 3: Minimise impacts on the ecosystem

The target of ecological sustainability for Australian fisheries acknowledges the need to minimise the impacts of fishing on the ecosystem. Three key objectives were identified to achieve this goal: ensure sustainability of by-catch and by-product species; minimise interactions with threatened, endangered and protected species (TEPs); and minimise impacts on benthic habitats and associated communities.

A strategy that is common to each of these objectives is the maintenance of effort restrictions through licence limitation, gear restrictions and the continued temporal and spatial closures developed through harvest strategy. Also, the development and implementation of environmentally friendly fishing gear and fishing practices will be encouraged to minimise impacts on the ecosystem.

Considerable historic research has been conducted in Spencer Gulf on the by-catch and by-product species captured by Spencer Gulf Prawn fishers. To augment this research another by-catch survey is planned for 2007, from which a semi-quantitative risk assessment will be conducted. The risk assessment will aim to determine the risk that prawn fishing poses to by-catch, by-product, and threatened, endangered and protected species encountered during the survey. Mitigation strategies will be subsequently developed for species deemed at high risk. The risk assessment process will be repeated every 5 years to determine if the risks to these species have changed.

Another strategy to be employed during the life of this Plan is to facilitate improved information on interactions with threatened, endangered and protected species. The first phase of this strategy has begun with the development of a draft commercial logbook designed specifically by PIRSA Fisheries to be used across all of South Australia's commercial fisheries.

Whilst there has been substantial historic research on by-catch and by-product species captured in Spencer Gulf, it is acknowledged that there is a limited understanding of the

effects of prawn trawling on benthic habitats and the communities they support. Strategies to address this issue relate to minimising the effort imposed on habitat by maintaining existing spatial and temporal closures, as well as the development of research strategies to address the impacts on habitats and communities.

5.1.4 Goal 4: Enable effective management with greater industry involvement

Goal four relates to the effective and participative management of the fishery. The key objective of this goal is to increase the level of responsibility for management processes delegated to industry over the life of the Plan. Given the demonstrably sustainable harvesting strategies in place and the high level of governance and financial security of the Spencer Gulf and West Coast Prawn Fishermans Association, PIRSA Fisheries considers that the Spencer Gulf Prawn Fishery is in a strong position to move toward greater industry self-management.

The strategies used to achieve this revolve around defining the tasks required for effective management of the fishery, identifying those tasks that industry can manage and developing processes to ensure that management arrangements are transparent and can be fully audited by Government. Other objectives of this goal aim to ensure that management arrangements reflect the concerns of the wider community, are complied with and are fully and equitably funded by stakeholders.

Table 4. Management goals, objectives and strategies for the management of the Spencer Gulf Prawn Fishery during 2007–2011.

		Strategies
1. Maintain ecologically sustainable prawn biomass	1a. Spencer Gulf prawn stocks harvested at ecologically sustainable levels	▪ Maintain a restriction on the number of licences and the total amount of gear in the fishery. ▪ Develop spatially and temporally explicit harvest strategies for each fishing period in line with established target and limit reference levels and decision rules. ▪ If the stock is determined to be operating below the established limits, the fishery will be managed to promote recovery to ecologically viable stock levels, within agreed timeframes.
	1b. Sufficient biological and environmental information exists to inform management decisions.	▪ Collect fishery-dependent information through commercial logbooks. ▪ Maintain the fishery-independent prawn survey program. ▪ Assess the status of the stock through quantitative stock assessment. ▪ Collect appropriate environmental data to aid assessment. ▪ Review and update the strategic research and monitoring plan.
2. Ensure optimal utilisation and equitable distribution	2a. A fishery exploited for maximum economic value	▪ Within a framework of sustainable exploitation, develop harvest strategies that match target size with market requirements ▪ When targets are reached, allow for higher exploitation levels to capture economic benefits from the fishery (subject to the constraints outlined under goal 1).
	2b. An economically efficient fleet.	▪ Develop management arrangements that allow commercial operators to maximise operational flexibility and economic efficiency. ▪ Undertake economic surveys of the commercial fishery to assess economic performance against a set of economic indicators.
	2c. Equitable public access	▪ Review appropriateness of access arrangements between sectors once within the life of the Management Plan ▪ Develop a mechanism for altering access arrangements should a change be required
3. Minimise impacts on the ecosystem	3a. Minimise fishery impacts on by-catch and by-product species	▪ Maintain a limit on the amount of gear used in the fishery. ▪ Maintain permanent closed areas. ▪ Undertake a risk assessment to determine the vulnerability of by-catch and by-product species to overfishing from prawn trawling. ▪ Develop mitigation strategies for by-catch and by-product species deemed at high risk of overfishing from prawn trawling. ▪ Promote the development of environmentally friendly fishing practices.

		Strategies
	<i>3b. Avoid the incidental mortality of endangered, threatened and protected species</i>	▪ Undertake a risk assessment to determine the vulnerability of endangered, threatened and protected species to fishing operations. ▪ Improve data recording systems to capture fishing interactions with endangered, threatened and protected species. ▪ Develop management measures to avoid interactions with endangered, threatened and protected species.
	<i>3c. Minimise fishery impacts on benthic habitat and associated species communities</i>	▪ Maintain a limit on the amount of gear used in the fishery. ▪ Maintain permanent closed areas. ▪ Promote the development of environmentally friendly fishing gear and fishing practices. ▪ Develop strategies for assessment of impacts on habitat and associated species communities
<i>4. Enable effective and participative management of the fishery</i>	<i>4a. Industry delegated greater responsibility in management</i>	▪ Industry manage the spot survey process and develop harvest strategies (with reference to PIRSA Fisheries and SARDI). ▪ Industry manage all at-sea operations of the fleet. ▪ Develop an improved industry decision-making structure to satisfy governance requirements. ▪ Develop explicit allocation of prawn resources between sectors. ▪ Develop a process for the industry association to review the necessary ecological assessment report to the CDEH for export accreditation.
	<i>4b. Management arrangements reflect concerns and interests of the wider community.</i>	▪ Promote stakeholder input to the management of the fishery, through established co-management processes. ▪ Ensure that social and cultural issues are given appropriate consideration when new management strategies are being developed. ▪ Communicate management arrangements to the wider community.
	<i>4c. Management arrangements are complied with.</i>	▪ Undertake annual compliance risk assessment. ▪ Implement a cost-effective compliance and monitoring program to address identified risks. ▪ Promote high levels of stakeholder stewardship through established management processes and Fishwatch activities.
	<i>4d. Costs of management of the fishery funded by relevant stakeholders</i>	▪ Ensure stakeholders are involved in development of management arrangements for achieving management objectives ▪ Determine the annual real costs of management, research and compliance for the fishery. ▪ Recover an economic return from commercial licence holders, sufficient to cover the attributed costs of fisheries management, research and compliance in line with established cost recovery principles.

5.2 Harvest Strategy

Harvest strategies for the Spencer Gulf Prawn Fishery are the mechanism for managing fishing effort using spatial and temporal closures. Specifically, this involves the legislation of appropriate closure lines (a series of GPS co-ordinates) and times and dates of trawling. The primary aim of the harvest strategy is for the fleet to target areas of high catch rate of appropriately sized prawns, ensuring biological sustainability (goal 1) and promoting economic efficiency (goal 2).

The harvest strategy functions at two scales: harvest strategy development and harvest strategy management. Harvest strategies are developed prior to the commencement of commercial fishing during each harvest period (usually November, December, March, April, May and June). The development phase involves the determination of suitable areas of the gulf to open to fishing based on data obtained from either fishery-independent, stock assessment surveys or industry-driven, spot surveys.

Once established, the harvest strategy is managed on a daily or even hourly basis during the fishing run by the “committee at sea”, a group of skippers that include SGWCPFA representatives and the “co-ordinator at sea”. Management of the harvest strategy is informed by data obtained during commercial fishing and involves reducing the area opened to fishing to avoid areas with small prawns or unsuitable catch rates.

This Management Plan is the first to provide formal guidelines for the development and management of harvest strategies by industry, based on data obtained from surveys and commercial fishing.

5.2.1 Harvest strategy development

Prior to a fishing run, committee members from the SGWCPFA in consultation with PIRSA Fisheries, discuss broad harvest strategy goals. At these meetings, details such as survey dates, the starting date of fishing, and the expected duration of the fishing run are determined.

Prior to the establishment of harvest strategy closures lines, a survey must be conducted. The survey will take one of two forms: a fishery-independent, stock assessment survey or an industry-driven, spot survey. Stock assessment surveys are comprehensive surveys across all regions of Spencer Gulf that primarily aim to determine the status of the resource. Their secondary function is to provide data from which the committee at sea and PIRSA Fisheries develop the harvest strategy. This initial strategy defines closure boundaries (as a series of GPS co-ordinates) and times and dates that they are effective for.

Spot surveys are smaller, industry-driven surveys that target particular areas of the gulf that the committee at sea consider as potential areas for inclusion in a new harvest strategy. Spot surveys are usually conducted during months when stock assessment surveys are not. On these occasions the original harvest strategy that was developed from stock assessment survey data is adjusted to include new areas identified as suitable for fishing from spot survey data.

Data used to inform harvest strategy development

Three stock assessment surveys are conducted annually at 209 fixed shots throughout Spencer Gulf (see Appendices 9.5 and 9.6). Prawn data collected for each survey shot include: total catch weight, catch weight per commercial prawn grade, mean prawn size

(count per 7 kg), sex-specific length frequency, and reproductive index (November and February only). Stock assessment surveys aim to provide an index of current and future biomass, and prawn size and catch rate data from survey shots throughout the gulf. Rapid assessment of these variables can be obtained immediately after the survey is completed, to inform harvest strategy development.

The index of current biomass is calculated as the total mean catch rate of prawns obtained from the survey. This value is the most reliable index of relative biomass available in the time constraints for harvest strategy development. The index of future biomass for the fishery is calculated as the total mean weight of the commercial prawn grade “20+”. This value is used to inform harvest strategy development because it can be rapidly calculated from survey data and it includes all commercial grades of prawns that are smaller than the size categories generally targeted by fishers. A rapid assessment of mean prawn size is obtained for each survey shot from a “bucket count” determined as the total number of prawns obtained from a 7 kg random prawn sample.

Spot surveys are conducted during the fishing months when fishery-independent surveys are not. Prawn data collected for each spot survey shot include: catch weight total; catch weight per commercial prawn grade; and mean prawn size (count per 7 kg).

Spot survey data aim to augment the harvest strategies developed from stock assessment surveys by targeting areas that are likely to have changed since the previous stock assessment survey such that they may be included in harvest strategy development. Estimates of catch rate and mean prawn size (from a bucket count) will be assessed on a shot by shot basis.

Harvest strategy development decision rules

These guidelines aim to provide decision rules for harvest strategy development that ensures biological sustainability in a transparent and easily audited process, whilst providing industry the flexibility to develop appropriate spatial and temporal closures for each harvest period.

Harvest strategy development rules are determined in a two-step process. Firstly, the **nature** of the harvest strategy to be employed is determined from the index of future and current biomass. In turn, the nature of the strategy and the period of harvest determine the **output control rule** for the following period. The harvest strategy is then developed by industry using the output control rule and fishery independent or spot survey data (dependent upon the harvest period).

The **nature** of the harvest strategy may be conservative, standard or maximum, and is dependent upon the relative indices of future and current biomass obtained from fishery-independent surveys (mean 20+ prawn grade catch rate and total mean catch rate, respectively). Standard strategies aim to capture the normal harvest strategy protocols that industry has employed in most years. Conservative strategies aim to reduce the amount of prawns harvested when indices of biomass are poor. Maximum strategies aim to take advantage of a high relative biomass by enabling more prawns to be harvested.

It is acknowledged that external factors can substantially affect fishery-independent survey results. Thus, the process for determining the nature of harvest strategies does not force the development of conservative harvest strategies if the lower threshold value is not reached for any given single survey. However, if survey results are unfavourable for two consecutive surveys (i.e. total mean or recruit catch rate <lower value), then conservative harvest strategies **must** apply and the management response outlined in section 5.3.1 will be evoked.

The following table and decision tree (table 5 and figure 6) enable the determination of the nature of the harvest strategy from stock assessment survey catch rate data. The nature of the harvest strategy is determined immediately after a stock assessment is conducted and it applies until the next stock assessment is completed.

Table 5. Measures for harvest strategy development. Values presented in kg/hr and (lb/min).

			Upper
Fishery-independent survey mean 20+ grade catch rate. Values in kg/hr and (lb/min)	November	10 (0.4)	
	February	50 (1.8)	
	April	40 (1.5)	
Fishery-independent survey total mean catch rate. Values in kg/hr and (lb/min)	November	95 (3.5)	135 (4.9)
	February	120 (4.4)	160 (5.9)
	April	160 (5.9)	220 (8.1)

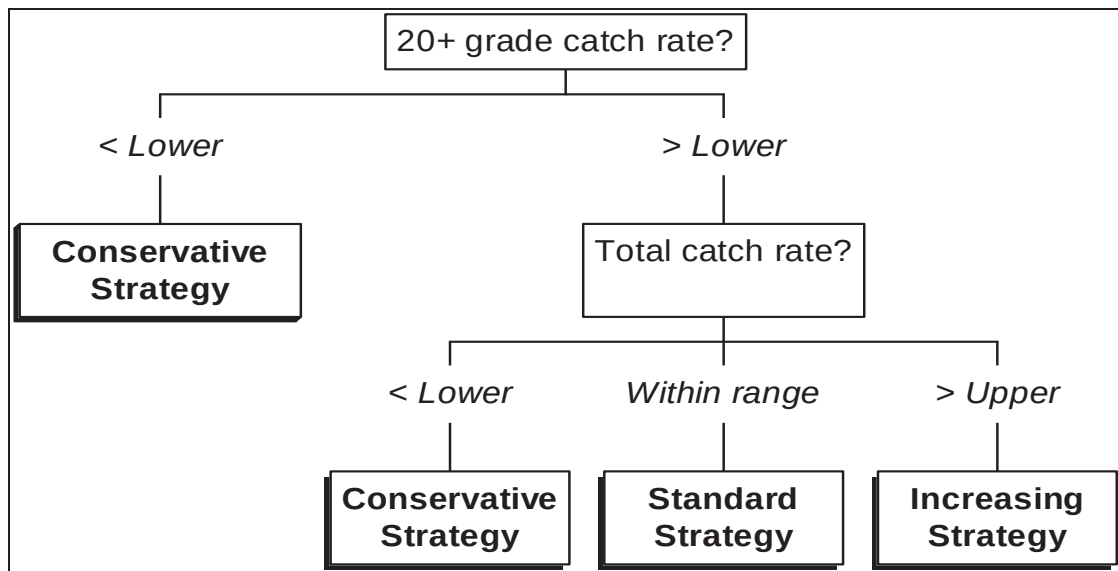


Figure 6. Decision tree to determine the nature of harvest strategy from fishery-independent survey results.

Output control rules aim to restrict the catch and effort for the harvest period to sustainable levels. To achieve this, the rules vary according to the nature and timing of the harvest strategy (table 6).

November and December coincide with the early spawning period for Western King prawns in Spencer Gulf. Studies show that relative egg production increases with increasing prawn size (Dixon *et. al.* 2006a), thus smaller prawns are targeted during this period to protect egg production and take advantage of the higher relative price of smaller prawns prior to Christmas. To minimise the possibility of recruitment overfishing, total catch is used as an output control for these periods. If the nature of the harvest strategy is conservative, total catch should not exceed 350 t for this period. Up to 450 t and up to 600 t may be harvested if the nature of the strategy is standard or maximum, respectively. The total catch for the period is estimated by the committee at-sea during the fishing run.

For the March and April runs, conservative, standard and maximum strategies will be developed using <200, <220 and <240 prawns/7 kg as a target size, respectively. During May and June the respective mean sizes for each strategy would decrease to <220, <240,

and <260 prawns/7 kg. Once determined, the output control rules are applied to survey data to develop the harvest strategy.

Table 6. Output control rules for the Spencer Gulf Prawn Fishery.

							May & June		
									Max
Mean size (no./7kg)	<250			<200	<220	<240	<220	<240	<260
Total catch (t)	<350	<450	<600	N/A			N/A		

Con=conservative, Std=standard, Max=maximum.

5.2.2 Harvest strategy management

Once fishing has commenced, the harvest strategy is managed by the co-ordinator and committee at sea. Harvest strategy closure lines may be adjusted on a daily or hourly basis, if prawns of an unacceptable size or catch rate are harvested. These changes reduce the area available to fishing by removing access to the area of small prawns or low catch rate. Further, trawling times and the duration of the harvest strategy can be adjusted when necessary.

Whilst the primary objective of harvest strategy management is economic efficiency, it is also very important for sustainability. Firstly, harvest strategy management must ensure that the output control rules established during the development of the harvest strategy are met. Secondly, effective management will reduce the risk of recruitment overfishing by reducing the capture of large amounts of small prawns.

Harvest strategy management is informed from data that is collected during commercial fishing and reported to the “committee at-sea”. The data reported to the committee at sea may include: daily catch weight estimates, catch weight per grade, and mean prawn size (count per 7 kg).

Prawn size data are provided at appropriate spatial scales to enable refinement of the harvest strategy closure lines. The threshold values for management of commercial prawn size data are the same as those for the output control rule.

Data on the indicative total catch per vessel are used for two purposes. Firstly, during November and December the estimates of all vessels’ catches are summed to give an indicative cumulative catch for the fleet. This figure is used to ensure adherence with the output control rule for catch during this period. Secondly, if the minimum average catch per vessel per night falls below threshold levels, an area (or all areas) may be closed to fishing.

The data and values used for harvest strategy management are termed **at-sea decision rules** and are presented in table 7. Other rules governing at sea decision-making are described in the Spencer Gulf Prawn Fishery Industry Code of Practice.

Table 7. At sea decision rules for the Spencer Gulf Prawn Fishery.

							May & June		
									Max
Total catch (t)	<350	<450	<600	N/A			N/A		
Mean size (no./7 kg)	<250			<200	<220	<240	<220	<240	<260
Minimum average catch (kg) per boat per night	350 kg			400 kg			400 kg		

Con=conservative, Std=standard, Max=maximum.

5.3 Performance Indicators

The extent to which the Management Plan is achieving the range of stated goals and objectives is assessed using a combination of indicators designed to measure performance of the fishery. These performance indicators may be biological or non-biological. Each performance indicator is measured against a limit reference point that may be quantitative or non-quantitative. Limit reference levels represent the minimum acceptable level of fishery performance. If performance falls below limit reference levels, measures to improve performance must be developed, following the management responses outlined in section 5.3.1.

Each performance indicator is related to a specific goal and objective. The following table defines the suite of performance indicators, their related objectives and reference points. Importantly, the values provided are the initial values set for the first year of the life of this Management Plan. These limit reference points may be changed on an annual basis if additional scientific information is available that suggests change is appropriate. The reasoning behind these changes should be documented.

These performance indicators are reported on by PIRSA Fisheries. They are assessed from a number of sources that include both the stock assessment and economic reports. Biological reference points are calculated from either fishery independent survey data or commercial logbook data. Recruitment indices are measured as the square root of the number of juvenile prawns (males <33 and females <35 mm CL) captured per nautical mile trawled following Carrick (2003).

Table 8. Performance indicators for assessment of the Spencer Gulf Prawn Fishery.

		LIMIT REFERENCE POINT
1b	Fishery independent surveys	3 surveys completed
1b	Stock assessment report	Completed
2b	Economic report	Completed
1a	Indices of future and current biomass (see table 5)	Neither index is below lower threshold levels (table 5) in 2 consecutive surveys
1a	Recruitment index (see table 14)	>35
1a & 2a	Total commercial catch (t)	>1800
1a & 2a	Mean commercial CPUE (kg/hr)	>80
2a	% vessel nights with mean size >280prawns/7 kg	<2%
2b	Gross Value of Production (GVP)	<0% change
2b	Management Costs	>10% incr.
2b	Return on investment	<0% change
4a	Committee comply with harvest strategy decision rules	Committee develops all harvest strategies based on results of surveys and in accord with decision rules
4c	Fleet complies with harvest strategies	Fleet operates within prescribed open areas and times described in every harvest strategy

The performance indicators in table 9 measure the success of strategies to address the impacts of fishing on the ecosystem. These indicators are assessed on a 5-year cycle to coincide with the life of this Management Plan.

Table 9. Performance indicators measured for 5-year assessment of ecosystem impacts for the Spencer Gulf Prawn Fishery.

			Limit Reference Point
3a & 3b	Undertake a by-catch risk assessment.	Within 5 years	Completed
3a	Develop mitigation strategies for high-risk species.	Prior to the conduct of the next risk assessment	Completed
3a	Measure the success of each mitigation strategy.	Within 1 year of development of the mitigation strategy	Successfully reduced the risk
3a	Measure the effectiveness of mitigation strategies by assessing differences in consecutive risk assessments.	5 years after the previous risk assessment	Reduced number of species deemed at high risk
3b	Develop measures to record interactions with endangered, threatened and protected species.	Within 5 years	Completed
3b	Develop measures to reduce interactions with endangered, threatened and protected species.	Within 5 years	Successfully reduced the risk
3c	Maintain permanent closed areas	Annual	Completed
3c	Develop strategies to assess impacts on benthic habitats and associated communities	Within 5 years	Completed

5.3.1 Management response

If limit reference points for performance indicators are not achieved in table 8 or 9, the following actions will be taken:

1. Notify the Minister for Agriculture, Food and Fisheries and participants in the fishery as appropriate.
2. Undertake a detailed review including an assessment of the additional performance measures outlined in 5.3.2 where appropriate. Provide a synopsis of the causes and implications of failure to achieve the minimum desired performance.
3. Where appropriate, consult with key stakeholder groups regarding the need for alternative management strategies and the collection of additional data.
4. Provide a report to the Minister, within three months of the initial notification, on the effects of breaching the performance indicator, including any recommendations on management strategies.
5. Minister or Director of Fisheries to consider recommendations, endorse supported strategies and implement as appropriate.

5.3.2 Additional performance measures

Assessment against the following table of additional performance measures will provide information to supplement assessment of the performance of the fishery. These measures are not required for robust annual assessment of the fishery. However, if limit reference points are not achieved and the management response outlined in 5.3.1 is evoked, assessment of these additional performance measures may assist with informing the potential causes of inadequate performance.

The performance measures aligned with Objective 1a are calculated from stock assessment survey data. Recruitment indices are measured as the square root of the number of juvenile prawns (males <33 and females <35 mm CL) captured per nautical mile trawled following Carrick (2003). Egg production is calculated following Dixon *et al.* (2006a).

The performance measures aligned with Objective 2a are calculated from commercial logbook data.

Assessment of performance measures aligned with Objective 4a and 4b may assist with understanding the causes of breaches of governance regarding the development and compliance with harvest strategy guidelines.

Table 10. Additional performance measures for the Spencer Gulf Prawn Fishery.

		LIMIT POINT	REFERENCE
1a	November recruitment index 209 shots	>12	
1a	February recruitment index 209 shots	>19	
1a	April recruitment index 209 shots	>15	
1a	Egg production (million eggs/ hr trawled)	>500	
2a	% of 20+ in the catch – Nov & Dec	<12%	
2a	% of 20+ in the catch – March to June	<7%	
2a	% of 16–20 in the catch – Nov & Dec	25–35%	
2a	% of 16–20 in the catch – March to June	<30%	
4a	Level of corporate governance and related reporting	All Committee members aware of Corporate Governance requirements	
4b	Stakeholder involvement in decision-making process	All stakeholders engaged in the management process	
4b	Availability of information	Information on management freely and widely available	

6 STOCK ASSESSMENT AND RESEARCH

SARDI Aquatic Sciences has conducted stock assessments on the Spencer Gulf Prawn Fishery since 1998. These early reports were combined with assessments of the West Coast Fishery and provided basic information on the fishery, predominately on catch and effort data. In 2003 the first “living” document was prepared, with substantially more information for assessment of the fishery provided, including a description of the life history and management of the fishery, detailed spatial and temporal analyses of fishery-dependent and fishery-independent data, assessment of the fishery against the performance indicators defined in the Management Plan, and a review of the biology of Western King prawns.

6.1 Strategic Research and Monitoring Plan

The strategic research and monitoring plan below describes the research and monitoring requirements for the Spencer Gulf Prawn Fishery to achieve the Goals and Objectives of this Management Plan. It is not intended to be a definitive list of all research needs for the fishery over the life of this Plan. In this context, the research needs are defined by the Goals for which they are required.

Maintain ecologically sustainable stock levels

- Fishery-independent stock assessment surveys to be conducted at the times and locations specified in Appendices 9.5 and 9.6.
- Spot surveys to be conducted prior to the development of harvest strategies that intend to open different areas than were fished during the previous run.
- Conduct stock assessments that independently assess stock status and assess the fishery against the biological performance indicators defined in this Management Plan.
- Conduct research, as required, to facilitate management responses outlined in 5.3.1.

Ensure optimum utilization and equitable distribution

- Improve the understanding of the effect of exploitation on spawning stocks, egg production and future recruitment.
- Conduct economic assessments that assess the fishery against the economic performance indicators defined in this Management Plan.

Minimise impacts on the ecosystem

- Conduct a fishery-independent by-catch risk assessment to assess the risk that prawn fishing poses to by-catch species captured in the Spencer Gulf Prawn Fishery. The risk assessment should be semi-quantitative in nature, and underpinned by data on the distribution and abundance of by-catch species obtained during a fishery-independent by-catch survey conducted in February 2007.
- Develop mitigation strategies for by-catch species deemed at “high” risk. Strategies should demonstrably reduce the risk of overfishing and be complied with by industry. Examples of mitigation strategies may include the development/implementation of by-catch reduction devices, or the introduction of spatial or temporal closures in harvest strategy.
- Develop strategies for assessment of impacts on habitat and associated species communities.

Enable effective and participative management of the fishery

- Conduct research to 1) identify and document the processes currently involved in the management of the Spencer Gulf Prawn Fishery, 2) determine the management processes that need to be altered, included as new or removed, 3) determine the processes for which responsibility of management may be delegated to industry, and 4) develop strategies and timelines for industry to move toward greater self-management.

7 COMPLIANCE AND MONITORING

PIRSA Fisheries uses a risk management approach to the development of compliance strategies across all fisheries in South Australia. This approach is designed to improve the cost-effectiveness of compliance and monitoring activity in all sectors by prioritising key activities, based on a formal semi-quantitative assessment of the risks in all fisheries.

Risk levels are rated using semi-quantitative estimations of:

- The *likelihood* of identified risks occurring; and
- The *consequences* if the identified risks occur; and
- The degree to which existing management *controls* and *compliance programs* limit the likelihood of risks occurring.

The risk profile prepared for the Spencer Gulf Prawn Fishery for the 2007/08 fishing season is provided in Appendix 9.3. The risk priorities contained in the appendix will be the focus of compliance activity in the Spencer Gulf Prawn Fishery during 2006/07. Other risks will be addressed outside of the planned programme for 2006/07, as circumstances require.

The focus of compliance activity may change during the course of the year on the basis of information received. Activity and outcome information is collected in relation to compliance activities to address priority risks. The risk profile for the fishery is audited and updated each year to take account of any changes to arrangements or emerging issues. The commercial industry has input to the annual review of the risk assessment.

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9 APPENDICES

9.1 Schedule 1 – Permitted Species

The following fish are prescribed for the Spencer Gulf Prawn Fishery:

Crustaceans

Lobster, slipper (*Ibacus* spp.)

Molluscs

Squid, calamary (*Sepioteuthis australis*)

9.2 Commonwealth DEH recommendations

One of three core objectives of the National Strategy for Ecologically Sustainable Development (ESD) is to 'protect biological diversity and maintain essential ecological processes and life support systems'. The National Strategy for ESD was a key policy driver in the development of the Australian Government 'guidelines for the ecologically sustainable management of fisheries' set out in the *Environment Protection and Biodiversity Conservation Act 1999*. These guidelines mandate the need to ensure that fisheries management frameworks aim to minimise the impacts of fishing on the structure, productivity, function and biological diversity of ecosystems.

This Management Plan aims to address broad ecosystem impacts related to fishing operations. Broader ecosystem impacts have only recently been taken into account in fisheries management systems and stock assessment (Fletcher, *et al.*, 2000). As a result, there is generally a higher level of uncertainty associated with the potential consequences of these impacts.

The Australian Government Department of Environment and Heritage (DEH) undertook an ecological assessment of the South Australian Prawn Fisheries in September 2003, using the 'guidelines for the ecologically sustainable management of fisheries' outlined in the *Environment Protection and Biodiversity Conservation Act 1999*. As part of this assessment process, the DEH provided recommendations (table 11) to PIRSA Fisheries to further strengthen the effectiveness of the management arrangements for the fishery and minimise environmental risks in the medium to longer term.

The DEH considered that the management arrangements, especially in terms of bycatch, are more advanced in the SGPF than the GSVPF and the WCPF, consequently, a number of recommendations require specific actions on GSVPF and WCPF with the intention of moving these fisheries closer to the level of management of the SGPF. The DEH has proposed that PIRSA Fisheries should action all recommendations before the next review in 2009 unless a specific timeframe is presented in a recommendation.

During 2005, SARDI Aquatic Sciences completed a report (Dixon *et al.* 2005) that reviewed independent by-catch information collected for a number of years in the Spencer Gulf Prawn Fishery. An outcome of the report was that monitoring long-term trends in key indicator by-catch and by-product species by establishing statistically meaningful performance measures was likely to be an unattainable goal for any of South Australia's three prawn fisheries. As a result, PIRSA Fisheries has developed a new strategy to address critical issues for the assessment of the by-catch and by-product species for all three prawn fisheries.

The Spencer Gulf Prawn fishery has funded another by-catch survey to be conducted in February 2007. This survey will underpin a semi-quantitative risk assessment for the fishery that will identify levels of risk for individual species. Appropriate management responses and mitigation strategies will be developed for high risk species. This new approach will replace the approach of monitoring long-term trends in abundance for the Spencer Gulf Prawn Fishery. This new strategy replaces recommendations that refer to long-term monitoring of by-catch indicator species.

Table 11. Commonwealth DEH recommendations for South Australia's prawn fisheries.

		Target Date
1	PIRSA to advise DEH of any material change to the management arrangements for the Spencer Gulf Prawn Fishery, Gulf St Vincent Prawn Fishery and the West Coast Prawn Fishery that could affect the criteria on which EPBC decisions are based, within 3 months of that change being made.	Ongoing
2	The current review of South Australia's <i>Fisheries Act 1982</i> should provide for the inclusion of general community and conservation interests on fisheries management committees. PIRSA to ensure that recreational, general community and conservation interests are provided the opportunity to engage regularly with the Prawn Fisheries Management Committee. Greater efforts should also be made to increase conservation and general community involvement in any additional stock assessments and research priority setting processes.	June 2007
3	By December 2005, PIRSA to develop and implement a compliance strategy for the South Australian Prawn Fisheries that is reviewable and publicly available, to address compliance and enforcement risks identified in the compliance risk assessment of the prawn fisheries.	December 2005
4	By the end of 2005, PIRSA to ensure that information on the size composition of prawn catch is collected and monitored on an ongoing basis in the Gulf St Vincent Prawn Fishery and the West Coast Prawn Fishery.	December 2005
5	By December 2005, PIRSA to review the performance indicators and performance measures used in the assessment of Western King prawns stock status in the Gulf St Vincent Prawn Fishery and the West Coast Prawn Fishery to ensure that they are appropriately precautionary and sufficient to detect significant changes in stock status.	December 2005
6	PIRSA to ensure that the recreational harvest of Western King prawns is monitored and factored into the management of the Spencer Gulf Prawn Fishery and the Gulf St Vincent Prawn Fishery.	Ongoing
7	PIRSA to develop and implement harvest strategies for all by-product species taken in the Spencer Gulf Prawn Fishery, Gulf St Vincent Prawn Fishery and the West Coast Prawn Fishery within 2 years. Harvest strategies should clearly articulate performance indicators and performance measures and any specific management arrangements to be applied to by-product species permitted in the fisheries.	December 2006
8	By December 2006, PIRSA to develop a system for the ongoing collection and monitoring of information on bycatch and by-product species taken in the Gulf St Vincent Prawn Fishery and the West Coast prawn Fishery sufficient to enable identification of long-term trends in bycatch and by-product. In the event that catch levels of any bycatch or by-product species change, PIRSA will investigate suitable management responses.	Replaced by Risk Assessment approach
9	PIRSA to conduct a bycatch risk assessment in the Gulf St Vincent Prawn Fishery and the West Coast Prawn Fishery and develop suitable management responses for any species identified as high risk.	June 2010

10	PIRSA to continue to pursue reduction in the amount of bycatch taken in the Spencer Gulf Prawn Fishery, Gulf St Vincent Prawn Fishery and West Coast Prawn Fishery through the adoption and refinement of bycatch mitigation technology and to investigate methods for increasing the survivability of bycatch species. Any suitable methods identified will be implemented in a timely manner.	Ongoing
11	By December 2008, PIRSA to specify bycatch indicator species for the Gulf St Vincent Prawn Fishery and the West Coast Prawn Fishery to be used to monitor the impact of the fisheries of bycatch species and/or species groups.	Replaced by Risk Assessment approach
12	By December 2005, PIRSA to introduce mandatory structured reporting of all interactions between the Spencer Gulf Prawn Fishery, Gulf St Vincent Prawn Fishery and the West Coast Prawn Fishery and endangered, threatened or protected species. To complement such a reporting system, PIRSA to also ensure that an education program for fishers is developed and implemented to promote the importance of protected species protection and accurate incident reporting.	December 2005

9.3 Compliance Risk Assessment.

Note that the following risk profile was developed for the 2007/08 fishing season. The risk priorities contained within the table below will be the focus of compliance activity for the Spencer Gulf Prawn Fishery during 2006/07. Other risks will be addressed outside of the planned programme as circumstances require. Focus risks may change during the course of the year on the basis of information received by PIRSA Fisheries. Activity and outcome information will be collected in relation to the risks and activities outlined below, and reported on a quarterly basis. The risk profile will be reviewed and updated on an annual basis.

Table 12. Compliance risk assessment for the 2007/08 financial year for the Spencer Gulf Prawn Fishery (continued next page).

Fishery sector	What can happen (risks)	Priority	Possible actions (mitigating strategies)	Notes on changes from 2006/07 risk profile
Commercial	Take non-permitted species	High	• Undertake random at sea boarding's • Conduct landing inspections • Conduct intel driven operations • Follow-up and investigate possible illegal activity • Conduct covert surveillance	•
	Fish in closed areas	High	• Conduct at sea line patrols • Attend pre-fishing briefings • Follow-up and investigate possible illegal activity	•
	Fish during closed periods (includes: Fish during daylight closure)	Moderate	• Conduct at sea patrols • Implementation of prior to landing reporting • Attend pre-fishing briefings • Follow-up and investigate possible illegal activity	• Trials of prior to landing reports conducted support implementation on an ongoing basis

	Use of illegal gear	Low	• Investigate ability to tag nets • Random vessel inspections land/at sea checking number of nets carried • Random vessel inspections measuring mesh size of nets used • Random vessel inspections measuring headline length of nets used • Investigate measuring and tagging of nets	•
Fishery sector	What can happen (risks)	Priority	Possible actions (mitigating strategies)	Notes on changes from 2006/07 risk profile
Processor	Deal in non-permitted species	Moderate	• Investigate and recommend legislative change • Conduct random processor checks • Raise processor awareness of permitted species list • Follow-up and investigate possible illegal activity	• Review of processor regulations to be included in new Act implementation

9.4 Links to Other Policy, Legislation and Codes of Practice

- The Management Plan for the South Australian Marine Scalefish Fishery
- The Commonwealth Southern and Eastern Scalefish and Shark Fishery Management Plan
- The National Strategy for Ecologically Sustainable Development
- The Australian Intergovernmental Agreement on the Environment
- The National Policy on Fisheries By-catch
- The Australian Government *Environment Protection and Biodiversity Conservation Act 1999*
- *Native Title Act 1993* (Australian Government)
- *Native Title (South Australia)(Act) 1994*
- Code of Conduct for Recreational Anglers in SA
- The National ESD Reporting Framework (Fletcher, *et al.*, 2002)

9.5 Stock assessment survey dates 2007–2011

The following table 13 of survey dates is based on new moon phases obtained from the website <http://www.maa.mhn.de/StarDate/moonphases.html> accessed on January 9, 2007.

Table 13. Proposed stock assessment survey dates for the period 2007–2011.

			Expected survey dates
2007	February	Sun, February 18	17/02/07–18/02/07
2007	April	Tue, April 17	17/04/07
2007	November	Sat, November 10	09/11/07–10/11/07
2008	February	Thu, February 7	07/02/08–08/02/08
2008	April	Sun, April 6	06/04/08
2008	November	Wed, October 29	29/10/08–30/10/08
2009	February	Wed, February 25	25/02/09–26/02/09
2009	April	Sat, April 25	25/04/09
2009	November	Tue, November 17	17/11/09–18/11/09
2010	February	Sun, February 14	14/02/10–15/02/10
2010	April	Wed, April 14	14/04/10
2010	November	Sat, November 6	6/11/10–7/11/10
2011	February	Tue, February 3	03/02/10–04/02/10
2011	April	Mon, April 4	04/04/10
2011	November	Wed, October 26	26/10/11–27/10/11

9.6 Stock assessment survey regions and shots 2007–2011

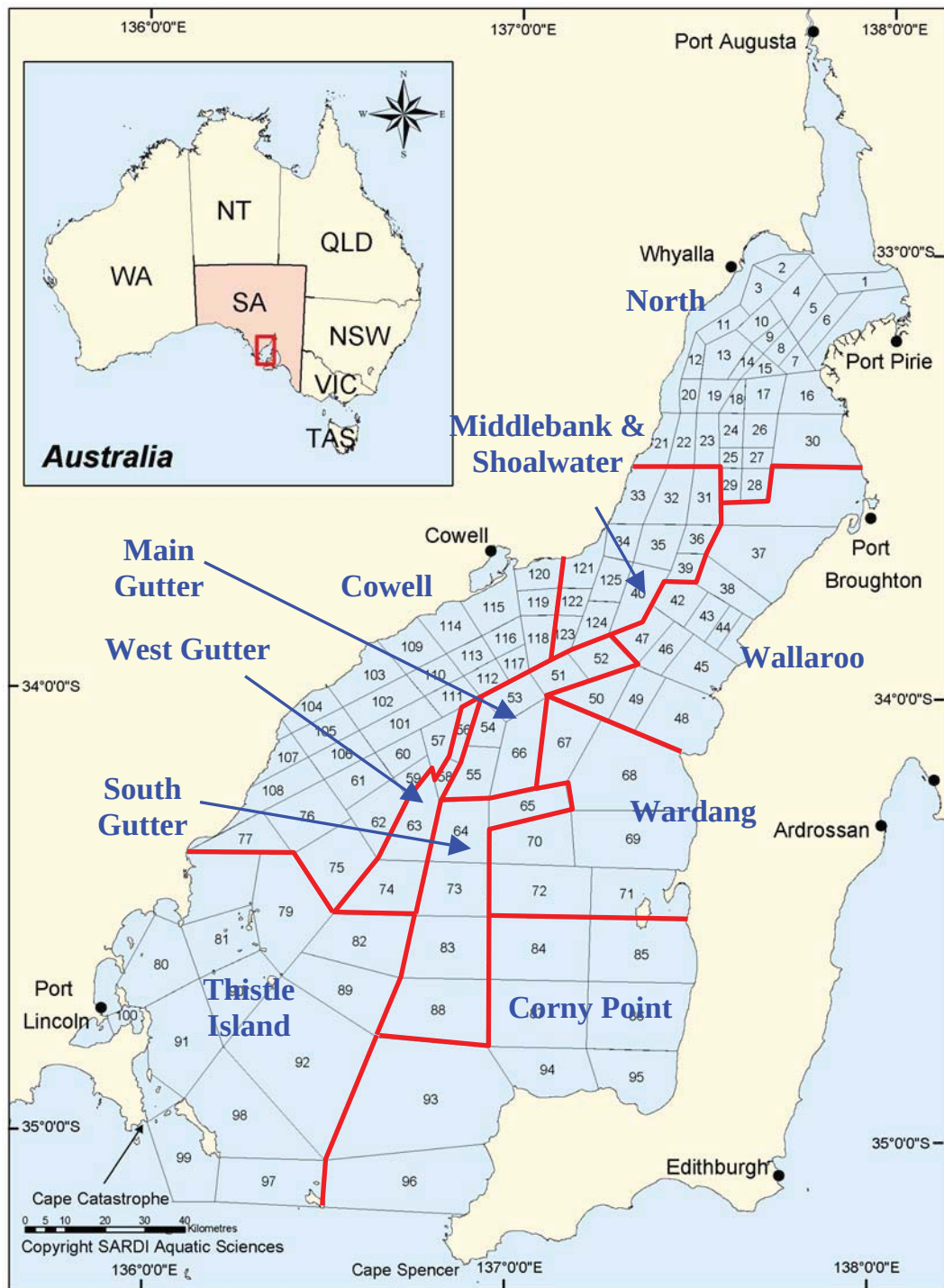


Figure 6. Fishing blocks and regions of the Spencer Gulf Prawn Fishery (figure courtesy of SARDI Aquatic Sciences).

Table 14. Regions and shots (209 total) surveyed during fishery-independent surveys.

* Indicates historic recruitment shots (34 in total).

							Shot
North	4*	North	81	Wallaroo	21	Cowell	Z1/2
North	5*	North	82	Wallaroo	22	Cowell	Z1/3
North	6*	North	90	Wallaroo	23	Cowell	Z1/4
North	7*	North	91	Wallaroo	24	Cowell	Z1/5
North	8*	North	92	Wallaroo	26	Cowell	Z2/1
North	10	North	93	Wallaroo	27	Cowell	Z2/10
North	11	North	94	Wallaroo	28	Cowell	Z2/11
North	12	North	96	Wallaroo	29	Cowell	Z2/13
North	13A	North	X1	Wallaroo	30	Cowell	Z2/14
North	13B	North	X2	Wallaroo	31	Cowell	Z3/1
North	13C	North	X3	Wallaroo	32	Cowell	Z3/10
North	14	M'bank/Shoalwater	1*	Wallaroo	33	Cowell	Z3/11
North	15	M'bank/Shoalwater	2*	Wallaroo	EWL1	Cowell	Z3/12
North	16W	M'bank/Shoalwater	3*	Wallaroo	EWL2	Cowell	Z3/2
North	17	M'bank/Shoalwater	60*	Wallaroo	EWL3	Cowell	Z3/8
North	18	M'bank/Shoalwater	61*	Wallaroo	N22	Cowell	Z3/9
North	18B	M'bank/Shoalwater	62*	Wallaroo	N23	West Gutter	11B
North	20B	M'bank/Shoalwater	63	Wallaroo	ST3	West Gutter	WG1
North	21B	M'bank/Shoalwater	64	Wallaroo	ST4	West Gutter	WG2
North	21C	M'bank/Shoalwater	65	Wallaroo	Y7	West Gutter	WG3
North	22B	M'bank/Shoalwater	66	Gutter	1B	West Gutter	WG4
North	23*	M'bank/Shoalwater	67	Gutter	1C	West Gutter	WG5
North	25*	M'bank/Shoalwater	68	Gutter	2B	West Gutter	WG6
North	26*	M'bank/Shoalwater	75	Gutter	2C	West Gutter	WG7
North	27*	M'bank/Shoalwater	76	Gutter	3A	West Gutter	WG8
North	28*	M'bank/Shoalwater	77	Gutter	3B	South Gutter	12B
North	29*	M'bank/Shoalwater	78	Gutter	4B	South Gutter	12C
North	30*	M'bank/Shoalwater	79	Gutter	4C	South Gutter	SG5
North	31*	M'bank/Shoalwater	N21	Gutter	5B	South Gutter	SG6
North	32*	M'bank/Shoalwater	SHW1	Gutter	5C	South Gutter	SG9
North	33*	M'bank/Shoalwater	SHW2	Gutter	6B	South Gutter	SGX1
North	35*	M'bank/Shoalwater	SHW3	Gutter	6C	South Gutter	SGX2
North	36*	M'bank/Shoalwater	SHW7	Gutter	7A	South Gutter	SGX3
North	39*	Wallaroo	1	Gutter	7B	Wardang	WD2
North	40*	Wallaroo	2	Gutter	8A	Wardang	WD3
North	41*	Wallaroo	3	Gutter	8B	Wardang	WD7
North	42*	Wallaroo	4	Gutter	8C	Wardang	WD8
North	44*	Wallaroo	5	Gutter	9A	Wardang	WD9
North	45*	Wallaroo	6	Gutter	9B	Corny Point	CP1
North	48*	Wallaroo	7	Gutter	9C	Corny Point	CP2
North	54*	Wallaroo	8	Gutter	10A	Corny Point	CP3
North	55*	Wallaroo	9	Gutter	10B	Corny Point	CP4
North	57*	Wallaroo	10	Cowell	C1	Corny Point	CP5
North	58	Wallaroo	11	Cowell	C11	Corny Point	CP6
North	58C	Wallaroo	12	Cowell	C12	Corny Point	CP7
North	69	Wallaroo	13	Cowell	C13	Corny Point	CP8
North	71	Wallaroo	14	Cowell	C14	Corny Point	CP9
North	72	Wallaroo	15	Cowell	C2	Corny Point	CP10
North	72C	Wallaroo	16	Cowell	C6	Corny Point	CP11
North	72D	Wallaroo	17	Cowell	C7	Corny Point	CP12
North	73*	Wallaroo	18	Cowell	C8		
North	74	Wallaroo	19	Cowell	C9		
North	80	Wallaroo	20	Cowell	Z1/1		

9.7 Glossary

These terms are intended to be used for the purposes of this management plan only and are not intended to be inconsistent with fisheries legislation.

Adaptive management Management involving active responses to new information or the deliberate manipulation of fishing intensity or other aspects in order to learn something of their effects. Within a stock, several sub-stocks can be regarded as experimental units in which alternative strategies are applied.

Age structure A breakdown of the different age groups within an individual population, or population sample.

Allocation Distribution of the opportunity to access fisheries resources, within and between stakeholder groups.

Aquatic reserve An area of water, or land and water, established as an aquatic reserve by proclamation under the *Fisheries Act 1982*.

Artisinal fishery A small-scale, low-cost and labour intensive fishery in which the catch is consumed locally.

Bag limit The maximum number of a species that can be legally taken by a person per day or per fishing trip, as specified.

Benthic Describes animals that live on, in or near the substrate.

Biodiversity The variability among living organisms from all sources (including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part) and includes: (a) diversity within species and between species; and (b) diversity of ecosystems.

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

Boat limit The maximum number of a species that can be legally taken by persons on a boat per day or per fishing trip, as specified.

By-catch At a broad level, fisheries by-catch includes all material, living and non-living, other than targeted species which is caught while fishing. It includes discards (that part of the catch returned to the water) and also that 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.

Catch The total amount (weight or number) of a species captured from within a specified area over a given period of time. The catch includes any animals that are released or returned to the water.

Catch per unit effort (CPUE) The weight or number of a species caught by a specified amount of effort. Typically, effort units are defined using a combination of the following factors: gear type; gear size; the amount of gear; the amount of time the gear is used ; and the number of people operating the gear. CPUE is often used as an index of relative abundance in fisheries stock assessment. In modern assessments, CPUE is standardised

to account for the diverse range of factors that can affect CPUE.

Closures Prohibition of fishing during particular times or seasons (temporal closures) or in particular areas (spatial closures), or a combination of both.

Cohort A group of fish spawned during a specified period, usually within a year. A cohort is also referred to as an age class.

Co-management Arrangements between governments and stakeholder groups to allow joint responsibility for managing fisheries resources on a cooperative basis. Co-management arrangements can range from a consultative model, where stakeholders have an advisory role to government, to an informative model where co-managers have decision-making powers.

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

Common property resource A resource that is determined to be owned by the community, or by the State on behalf of the community, and to which no individuals or user groups have exclusive access rights.

Critical habitats Habitats that are crucial in at least part of the life cycle of a species, which typically includes nurseries such as estuaries, mangroves, seagrass beds, reefs and defined spawning areas.

Data poor fishery A fishery where limited data are available to inform management. For example, fisheries for species where baseline biological data such as size at maturity, fishing mortality and growth rates are unknown.

Ecologically sustainable development Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.

Economic efficiency The maximisation of the value of the net benefits derived from fishery resources.

Ecosystem A dynamic complex of plant, animal, fungal, and micro-organism communities and the associated non-living environment interacting as an ecological unit.

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, 'hook-sets', 'trawl-hours', 'searching hours'.

Effective fishing effort

Fecundity Number of eggs an animal produces each reproductive cycle; the potential reproductive capacity of an organism or population.

Fishery A term used to describe the collective enterprise of taking fish. A fishery is usually defined by a combination of the species caught (one or several), the gear and/or fishing methods used, and the area of operation.

Fishery dependent data Information collected about a fishery or fish stock by the participants of a fishery, eg. 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, eg. scientific surveys, observer reports.

Fisheries Management Committee (FMC) A statutory advisory body established by the Minister to provide a forum for consideration of management issues relevant to a specific fishery, by stakeholders in that fishery. FMCs are designed to allow for stakeholder input to fisheries management.

Fishing capacity The amount of fishing effort that a fishing boat, or a fleet of fishing boats, could exert if utilised to its/their full potential.

Fishing mortality The rate of deaths of fish due to fishing.

Fully exploited This describes a fish stock for which current catches and fishing pressure are close to optimum (the definition of which may vary between fisheries; for example, catches are close to maximum sustainable yield). Categorising a species as 'fully fished' suggests that increasing fishing pressure or catches above optimum (allowing for annual variability) may lead to overfishing.

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.

Growth overfishing A level of fishing pressure beyond that required to maximise the yield (or value) per recruit; a level of fishing where young recruits entering the fishery are caught before they reach an optimum marketable size.

Habitat The place or type of site in which an organism naturally occurs.

Harvest The total number or weight of fish caught and kept from an area over a period of time.

Indicator species A species whose presence or absence is indicative of a particular habitat, community or set of environmental conditions.

Individually transferable quota A management tool by which portions of the total allowable catch are allocated among licence holders (individual fishers or companies) as units of quota. Quota entitlements can be made to be temporarily or permanently transferable between these licence holders.

Input controls Limitations on the 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.

Latent effort The potential for effective effort within a fishery to increase over time (i.e. inactive fishing licences that may be used in the future).

Length Frequency An arrangement of recorded lengths of a species of fish, which indicates the number of times each length or length interval occurs in a population or sample.

Limited entry Fishing effort is controlled by restricting the number of operators. It usually requires controlling the number of licences in a fishery. It can also include restrictions on the number and size of vessels, the transfer of fishing rights, and the replacement of vessels

Logbook An official record of catch and effort data made by fishers.

Marine protected area An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity and of natural and associated cultural resources, and managed through legal or other effective means.

Marine park An area of water, or land and water, considered to be of national significance because of the aquatic flora or fauna of those waters or the aquatic habitat, and established as a marine park by proclamation under the *Fisheries Act 1982* and/or the *National Parks and Wildlife Act 1972*.

Minimum mesh size The smallest size of mesh permitted in nets and traps; imposed on the basis that smaller individuals will escape unharmed.

Mortality Rate of deaths (usually in terms of proportion of the stock dying annually) from various causes. Comprises (i) Natural Mortality - deaths in a fish stock caused by predation, pollution, senility, etc., but not fishing and (ii) Fishing Mortality - deaths in a fish stock caused by fishing.

Nominal fishing effort ‘Nominal’ means quantities as they are reported, before any analyses or transformations. Nominal effort refers to measures of fishing effort or vessel carrying capacity that have not been standardised.

Non-target species Any part of the catch, except the target species, and 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.

Offshore Constitutional Settlement (OCS) An agreement between the State(s) and the Commonwealth whereby the State or the Commonwealth (or in some cases a Joint Authority) is given jurisdiction for a particular fishery occurring in both coastal waters and the Australian Fishing Zone. When no OCS agreement has been reached, the fishery remains under the jurisdiction of the State out to 3 nm, and the Commonwealth from 3 to 200 nm.

Output controls Limitations on the weight of the catch (quota), or the allowable size, sex or reproductive condition of individuals in the catch.

Over-exploited or overfished A fish stock in which the amount of fishing is excessive or for which the catch depletes the biomass too much; or a stock that still reflects the effects of previous excessive fishing.

Parameter A ‘constant’ or numerical description of some property of a population.

Parental stock The weight of the adult population of a species.

Population A group of individuals of the same species, forming a breeding unit and sharing a habitat.

Possession limit A possession limit under the *Fisheries Act 1982* is a prescribed number of fish for a species that represents what is considered a commercial quantity of that species. If a person has the prescribed amount of fish in their possession, then the onus of proof is reversed in any prosecution relating to taking those fish illegally.

Precautionary principle This concept asserts that where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decision-making should be guided by: (i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and (ii) an assessment of the risk-weighted consequences of various options.

Quota A limit on the weight or number of fish that may be caught of a particular stock or from specified waters.

Quota entitlement The proportion of a quota that is allocated to a particular licence, which limits the total amount of a species that is permitted to be taken pursuant to that licence.

Recreational fishing Fishing for a purpose other than trade or business, where the catch is released or used for personal consumption or taken for sport.

Recruitment The addition of new individuals to a stock.

Recruitment overfishing Occurs when excessive fishing effort or catch reduces recruitment to the extent that the stock biomass falls below the pre-defined limit reference point.

Relative abundance An index of fish population abundance used to compare fish populations from year to year. This does not measure the actual numbers of fish, but shows changes in the population over time.

Retained species The species within the catch that are not discarded.

Sample A proportion or a segment of a fish stock which is removed for study, and is assumed to be representative of the whole. The greater the effort, in terms of both numbers and magnitude of the samples, the greater the confidence that the information obtained is a true reflection of the status of a stock (level of abundance in terms of numbers or weight, age composition, etc.).

Seasonal closure The closure of a fishing ground for a defined period of time, usually used to protect a stock during a spawning season.

Selectivity The ability of a type of gear to target and catch a certain size or species of fish.

Socio-economic Relating to both social and economic considerations.

Spatial Of or relating to space.

Species A group of organisms capable of interbreeding freely with each other but not with members of other species.

Size limits A minimum or maximum size limit determines the legal size at which a given species can be retained.

Size of maturity Length or weight of the fish when it attains reproductive maturity.

Slot size limit Refers to a situation where both a minimum and maximum size limit has been determined for a given species.

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

Stock A group of individuals of a species occupying a well defined spatial range independent of other groups of the same species, which can be regarded as an entity for management or assessment purposes.

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

Target species The most highly sought component of the catch taken by fishers.

Target effort Effort that is directed at a particular species.

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

Temporal Of or relating to time.

Threatened A species or community that is vulnerable, endangered or presumed extinct.

Total allowable catch (TAC) For a fishery, a catch limit set as an output control on fishing. The total amount of a species that may be taken during a specified time period.

Total allowable commercial catch (TACC) For a fishery, a catch limit set as an output control specifically on commercial fishing. The total amount of species that may be taken by commercial fishing during a specified time period.

Trigger points Events or measures that, if they occur or if they reach specified levels, are used to determine when a response should be made. Not usually used as a criterion for overfishing, but to indicate the need for review of management.

Uncertain A fish stock that may be underfished, fully fished or overfished, but for which there is inadequate or inappropriate information to make a reliable assessment of its status.

Under-exploited or underfished A fish stock that has potential to sustain catches higher than those currently taken.

Vulnerable species Under endangered species protection legislation, a species that within 25 years will become endangered unless mitigating action is taken.

Yield Total weight of fish harvested from a fishery.

9.8 List of Acronyms

AFMA	Australian Fisheries Management Authority
CPUE	Catch Per Unit Effort
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific Industry Research Organisation
DEH	Department of Environment and Heritage
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EEZ	Exclusive Economic Zone
ESD	Ecologically Sustainable Development
FMC	Fisheries Management Committee
FRDC	Fisheries Research and Development Corporation
ITQ	Individually Transferable Quota
MPA	Marine Protected Area
MSC	Marine Stewardship Council
MEY	Maximum Economic Yield
MSY	Maximum Sustainable Yield
NRIFS	National Recreational and Indigenous Fishing Survey
PIRSA	Department of Primary Industries and Resources, South Australia
SAFIC	South Australian Fishing Industry Council
SARDI	South Australian Research and Development Institute
SARFAC	South Australian Recreational Fishing Advisory Council
TAC	Total Allowable Catch
TACC	Total Allowable Commercial Catch

9.9 Contacts

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