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Management Plan for the South Australian Commercial Blue Crab Fishery

JANUARY 2012

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MANAGEMENT PLAN FOR THE SOUTH AUSTRALIAN COMMERCIAL BLUE CRAB FISHERY

Approved by the Minister for Agriculture, Food and Fisheries pursuant to section 44 of the *Fisheries Management Act 2007*.

Hon Gail Gago MLC
1 January 2012

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1 FISHERY TO WHICH THIS PLAN APPLIES

This plan applies to the commercial Blue Crab Fishery, which is formally constituted by the *Fisheries Management (Blue Crab Fishery) Regulations 1998*.

The regulations define the fishery as:

The taking, in the waters of the blue crab fishing zones—

(a) of aquatic resources specified in Schedule 1 Part 1; and
(b) of aquatic resources specified in Schedule 1 Part 2 for the purpose of bait.

Schedule 1 of the regulations is also included as Schedule 1 to this management plan.

Blue crab fishing zone means—
(a) the Gulf St Vincent Blue Crab Fishing Zone; or
(b) the Spencer Gulf Blue Crab Fishing Zone.

2 CONSISTENCY WITH OTHER MANAGEMENT PLANS

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

3 TERM OF PLAN

This plan applies from 1 January 2012 for a period of five years.

Section 44 of the *Fisheries Management Act 2007* prescribes the requirements for replacing or extending this management plan upon expiry.

4 DESCRIPTION OF FISHERY

The commercial Blue Crab Fishery is based on the capture of a single species, *Portunus armatus*, although other crustacean species are permitted to be landed and sold as by-product. A number of other species are permitted to be taken for use as personal bait.

Access to the fishery is provided through a licence for the Blue Crab Fishery or the Marine Scalefish Fishery. Licences are endorsed with quota units for either the Gulf St Vincent zone or Spencer Gulf zone. Blue Crab Fishery licence holders use crab pots to trap their catch and bait nets are also permitted to be used. Marine Scalefish Fishery licence holders are restricted to using crab nets (i.e. hoop nets or drop nets).

Blue Swimmer Crabs can be stored live in tanks or packed with ice cooked or uncooked before being landed in port. Most of the South Australian commercial catch is sold to the Sydney and Melbourne markets.

4.1 Historical overview

Blue Swimmer Crabs were initially taken commercially as incidental catch in the marine scalefish and prawn fisheries. In the late 1970's, the South Australian Department of Fisheries began to investigate the potential for the development of a commercial Blue Swimmer Crab fishery.

This investigation led to the establishment of an experimental Blue Swimmer Crab pot fishery in 1983 through a call for expressions of interest from Marine Scalefish Fishery licence holders who had been impacted by net closures in upper Spencer Gulf. Following consideration of applications lodged, six permits were issued on an annual basis with no right of renewal.

Those licence holders receiving permits were restricted in their operations to one of the following areas.

- West coast – all waters west of longitude 135° east
- Spencer Gulf – all waters north of a line from Cape Elizabeth to Cape Driver, excluding aquatic reserves
- Gulf St Vincent – all waters north of a line from Stanvac chimney to Oyster Point (Stansbury)

During the 1985/86 season a total of 12 fishers were offered licences to take Blue Swimmer Crabs in these areas (4 west coast, 6 Spencer Gulf and 2 Gulf St Vincent) for a two-year period. Those fishers taking up the offer were required to place their marine scalefish licence in abeyance during the trial period.

The west coast fishery collapsed in 1986, due to an environmentally driven recruitment failure. As a result, the four fishers operating in this area subsequently surrendered their licences. By 1989 a number of operators had forfeited their experimental permits, with two fishers left operating in Gulf St Vincent and four in Spencer Gulf.

In 1996 the South Australian Government established a commercial Blue Swimmer Crab pot fishery, implementing management and research strategies to maintain a sustainable and financially viable fishery. Access arrangements to the fishery were determined using historical catches. A number of marine scalefish licence holders who had historically targeted Blue Swimmer Crabs in waters adjacent to the Yorke Peninsula using hoop and drop nets were provided access. The fishery was divided into two zones (Spencer Gulf and Gulf St Vincent).

Since the establishment of the fishery an Individual Transferable Quota (ITQ) management system has been in place. At the commencement of the fishery in 1996 total allowable commercial catches (TACCs) were set and divided equally amongst licence holders in each of the zones.

The TACC was initially set at 520 tonnes for the 1996/97 fishing season. Over the next four seasons the TACC gradually increased until it reached 626.8 t in 2000/01. The TACC has been set at 626.8 tonnes every year since 2000/01.

Since 1997/98, the total number of licences with blue crab quota has decreased from 40 to 12. In 2008/09 there were nine Blue Crab Fishery licences and three Marine Scalefish Fishery licences with blue crab quota entitlements.

4.2 Ecosystem and habitat

Spencer Gulf

Spencer Gulf is a unique marine environment in South Australia. It contains the most extensive seagrass meadows in South Australia. The mangrove *Avicennia marina* forms large stands around the coast. Both of these habitats provide vital nursery areas for a large number of fish and crustacean species in the gulf. Black Point, near Whyalla, provides an important breeding ground for the giant cuttlefish, *Sepia apama*.

The Spencer Gulf is considered vulnerable to environmental impacts because its water exchange with the ocean is constrained and the waters are naturally very low in nutrients by world standards. The existing marine communities have evolved to these unique circumstances, and are therefore particularly susceptible to changes in their environment (DEH, 2006).

Gulf St Vincent

Gulf St Vincent lies within the Gulf St Vincent Bioregion. Habitats typical of this region include:

- Saltmarshes, mangroves and tidal flats
- Dense seagrass meadows and sandy seafloor
- Sand and shell grit beaches, tidal creeks and river deltas

The habitats in the upper Gulf St Vincent area provide critical baselines to measure changes to the State's marine ecosystems that may arise over time from, for example, pollution or climate change.

The coastal wetlands of Gulf St Vincent provide nursery habitats for King George Whiting, Southern Garfish, Mullet, King Prawn and Blue Swimmer Crab. Exposed tidal flats provide important food and resting places for thousands of migratory shorebirds during summer. Species within the region are influenced by the distinctive clockwise circulation of currents within Gulf St Vincent (DEH, 2009).

The overall environmental impacts associated with Blue Swimmer Crab fishing are considered to be low. Management of the Blue Crab Fishery as part of the broader ecosystem is a goal of this plan. Ecosystem impacts are considered in more detail in section 7.

4.3 Biology of key species

The following description provides brief background information on the biological characteristics, commercial production statistics and recreational catch and effort levels for Blue Swimmer Crabs. More detailed information on stock status is provided in stock assessment and stock status reports prepared by the South Australian Research and Development Institute (SARDI), Aquatic Sciences. All completed reports are available on the PIRSA and SARDI Aquatic Sciences websites at www.pir.sa.gov.au/fisheries or www.sardi.sa.gov.au.

Blue Swimmer Crabs (*Portunus armatus*) are distributed throughout the coastal waters of the tropical regions of the western Indian Ocean and the Eastern Pacific (Kailola et al. 1993); they are adapted to a life in warmer waters. In the relatively colder, temperate parts of Australia, the life cycle has evolved to increase growth and reproduction during the warmer part of the year when water temperatures are elevated

to those similar to the tropical regions. Activity reduces during the colder winter months. Blue Swimmer Crabs are found throughout South Australian waters but the majority of the stock inhabits the warmer shallow waters of Gulf St Vincent and Spencer Gulf.

Blue Swimmer Crabs are generally distinguished by the fact that their last pair of legs is modified as swimming paddles. They are active swimmers but when inactive, they bury themselves in the sediment leaving only their eyes, antennae and gill chamber opening exposed. Males are blue and have larger claws than females, which are green-brown in colour (Dixon and Hooper, 2009).

The species occurs in a wide range of algal and seagrass habitats and on both sandy and muddy substrata, from the intertidal zone to at least 50 metres of depth (Williams, 1982; Edgar, 1990 in Dixon and Hooper, 2009). In coastal waters, smaller crabs are found in shallow waters, while adults are found in comparatively deeper waters. Juvenile crabs occur in mangrove creeks and mud flats for eight to twelve months by which time they attain a size of 80 to 100 mm carapace width. Within South Australia, there is a distinct seasonal pattern of adult crab movements into shallow inshore waters during the warmer months of September to April and to deeper offshore waters during the colder months of May to August (Smith, 1982 in Dixon and Hooper, 2009).

The Blue Swimmer Crab populations within Spencer Gulf, Gulf St Vincent and the West Coast regions of South Australia are believed to represent separate sub-populations with a limited gene flow. Inter-regional larval dispersal has also been found to be restricted and each sub-population must be dependent on its own larval supply (Bryars and Adams, 1999). Chaplin *et al.* (2001) also found that the assemblages of *P. armatus* in different embayments in South Australia often constitute genetically different meta-populations. The level of migration between these populations is probably limited and likely to be determined by local factors (Dixon and Hooper, 2009).

Male and female *P. armatus* generally reach sexual maturity at a size of 70 to 90 mm in carapace width, when they are approximately one year old. The spawning season lasts for three to four months over the Summer/Autumn period. The duration of the growing season varies among individuals because those settling in early summer have a longer growing season than those settling in mid-to-late summer. In South Australian waters, crabs close to the minimum legal-size (110 mm) are approximately 14 to 18 months old, sexually mature, and females have produced at least two batches of eggs within one season (Kumar *et al*., 2000, 2003 in Dixon and Hooper, 2009).

Available data suggests that the Blue Crab Fishery is currently being harvested at sustainable levels. The stock assessment is considered reliable. The total commercial catch of Blue Swimmer Crab reached a peak of 651.3 t in 1995–96, the year prior to the introduction of quota management in the fishery. The introduction of quota resulted in a 29% reduction in total catch, with 462.4 t being landed in 1996–97. Catches have generally increased each season. In 2007/08, 625 tonnes or 99.7% of the TACC for the fishery was harvested (Figure 1) (Dixon and Hooper, 2009). The total catch during 2008/09 was 603.8 tonnes (Dixon and Hooper, 2010)

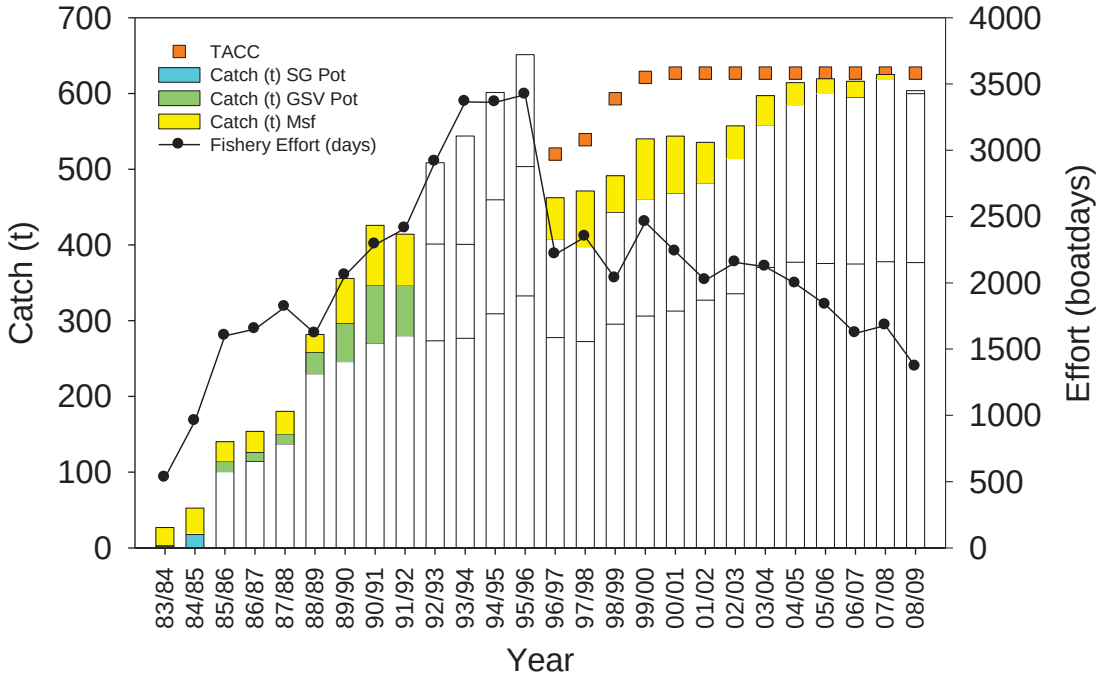

Figure 1. Commercial catch (t) from the Spencer Gulf (blue) and Gulf St Vincent (green) pot fishing components and the marine scalefish (yellow) component, TACC (squares, t) and fishing effort (line, boat days) for the Blue Crab Fishery from 1983/84 to 2008/09.

(Source: SARDI Aquatic Sciences – Dixon and Hooper, 2009)

Blue Swimmer Crabs are a significant target catch of South Australian recreational fishers over the warmer summer months. Crabs are taken from boats and jetties using drop or hoop nets as well as by shore-based activities, such as raking and dabbing with a hand net while wading in the shallows following the tidal movement.

McGlennon and Kinloch (1997) estimated a total catch of 161.2 t per year, of which 115.8 t was taken in Gulf St Vincent and 45.4 t in Spencer Gulf. The recreational catch was therefore estimated to be 32.9% in Gulf St Vincent, 10.8% in Spencer Gulf and 20% of the overall state-wide catch. The estimate does not include the recreational shore-based fishery, which is considered to be significant (Dixon and Hooper, 2009).

A National Recreational and Indigenous Fishing Survey (Henry and Lyle, 2003) was conducted between May 2000 and April 2001. The estimated annual catch taken by recreational fishers during this period for South Australia was 389.8 t. This indicated that the recreational harvest was 37.5% of the total catch during 2000/01. A further 31.7% of the total recreational catch was released after capture (Anon, 2003 in Dixon and Hooper, 2009). Reasons for release may include capture of undersize crabs, berried females and/or exceeding daily bag or boat limits.

A South Australian recreational fishing survey (Jones, 2009) was conducted between October 2007 and November 2008. This survey used the same methodology as the national survey, with an improved technique to analyse the results, except that only South Australian residents were included. The estimated annual catch taken by recreational (non-commercial) fishers during this period for South Australia was 283.7 t. This indicated that the recreational harvest was 29.8% of the total catch during 2007/08.

4.4 Economic characteristics

4.4.1 Catch and Gross Value of Production

The total catch of Blue Swimmer Crabs in South Australia increased from 434 tonnes in 1990/91 to 655 tonnes in 1995/96 before decreasing to 467 tonnes in 1999/00. This corresponds with implementation of new management arrangements (including the introduction of a TACC) in 1996/97[1]. The total Blue Swimmer Crab catch has trended upward in subsequent years reaching 658 tonnes in 2008/09 (Table 1). There has been a gradual decrease in the catch taken by Marine Scalefish Fishery licences and an increase in the catch taken by the Blue Crab Fishery licences. By 2009/10, catch in the pot sector had increased to almost 99 per cent of total catch and marine scale sector catch had fallen to just over 1 per cent of the total. This reflects the shift in access entitlements as quota has been transferred to the pot sector over time.

Table 1 and Figure 2 illustrate how the value of the whole fishery has increased markedly over the period 1997/98 to 2008/09. The total catch in 2008/09 (658 tonnes) was 52 % above that in 1990/91 (434 tonnes) while the value of the catch was 212 % higher, increasing from $1.6 million in 1990/91 to $5.1 million in 2008/09. The increase in GVP is a result of both an increase in catch and price. The nominal price of Blue Swimmer Crabs increased steadily between 1998/99 and 2001/02 before following a declining trend over the next three years. Average price of Blue Swimmer Crabs increased in 2005/06 and 2006/07 before falling slightly in 2007/08 and falling again in 2008/09 (Figure 2).

[1] The description of economic characteristics includes Blue Swimmer Crab fishing activity from the Blue Crab Fishery (pot sector) and the Marine Scalefish Fishery (net sector).

Table 1. SA Blue Swimmer Crab catch and value of catch, 1990/91 to 2008/09

Year	Pot Sector		Marine Scale Sector [a]		South Australia	
	(tonnes)	($'000)	(tonnes)	($'000)	(tonnes)	($'000)
1990/91	354	1,337	80	303	434	1,640
1991/92	357	1,156	68	221	425	1,377
1992/93	403	1,256	108	337	511	1,593
1993/94	401	1,332	143	476	544	1,808
1994/95	465	1,683	143	518	608	2,201
1995/96	506	1,929	149	566	655	2,495
1996/97	410	1,816	54	241	464	2,057
1997/98	396	1,837	73	336	469	2,173
1998/99	429	1,913	72	321	501	2,234
1999/00	416	1,916	51	233	467	2,149
2000/01	469	2,588	87	479	556	3,067
2001/02	481	2,975	79	486	560	3,461
2002/03	515	3,157	68	417	583	3,574
2003/04	559	3,385	53	253	611	3,638
2004/05	584	3,322	47	269	632	3,591
2005/06 [b]	600	4,966	48	270	649	5,236
2006/07 [b]	595	5,328	42	301	637	5,629
2007/08 [b]	618	5,564	50	314	668	5,878
2008/09 [b]	604	4,805	54	315	658	5,120

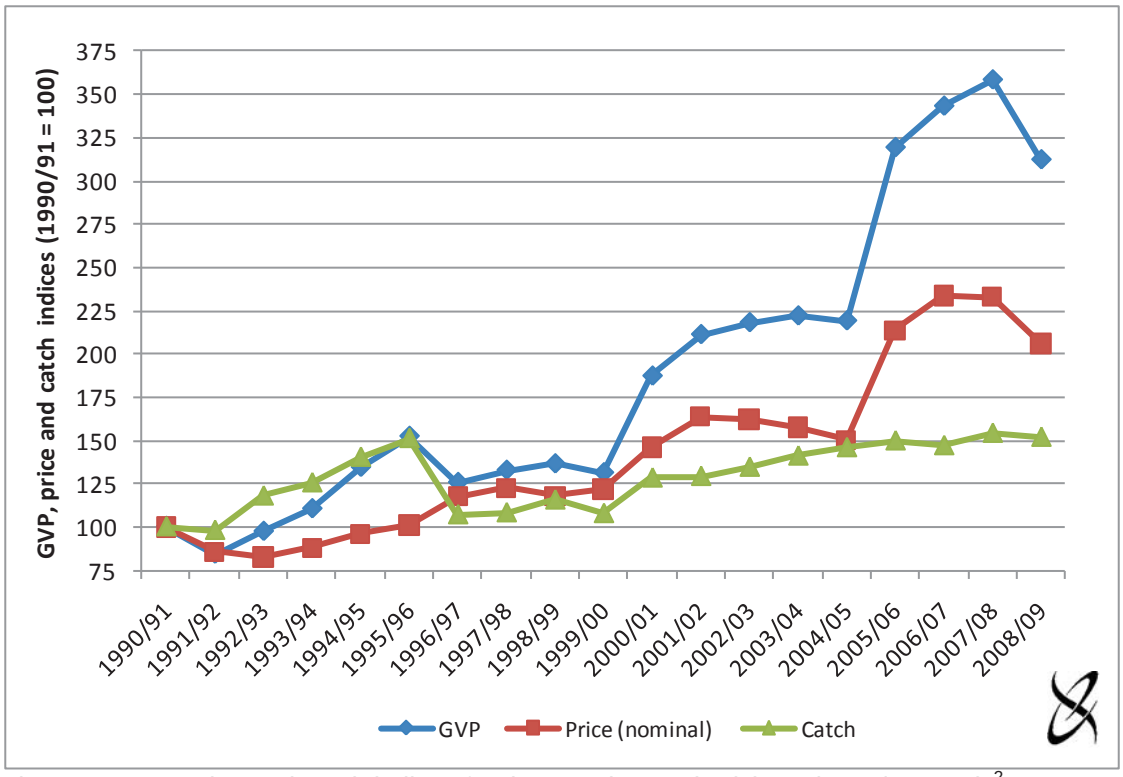

Figure 2. GVP, price and catch indices for the SA Blue Crab Fishery (1990/91=100) [2]

Figure 3 shows that the 106 % increase in nominal price over the period 1990/91 to 2008/09 has been equivalent to 28 % increase in the real price (that is the nominal price adjusted for inflation).

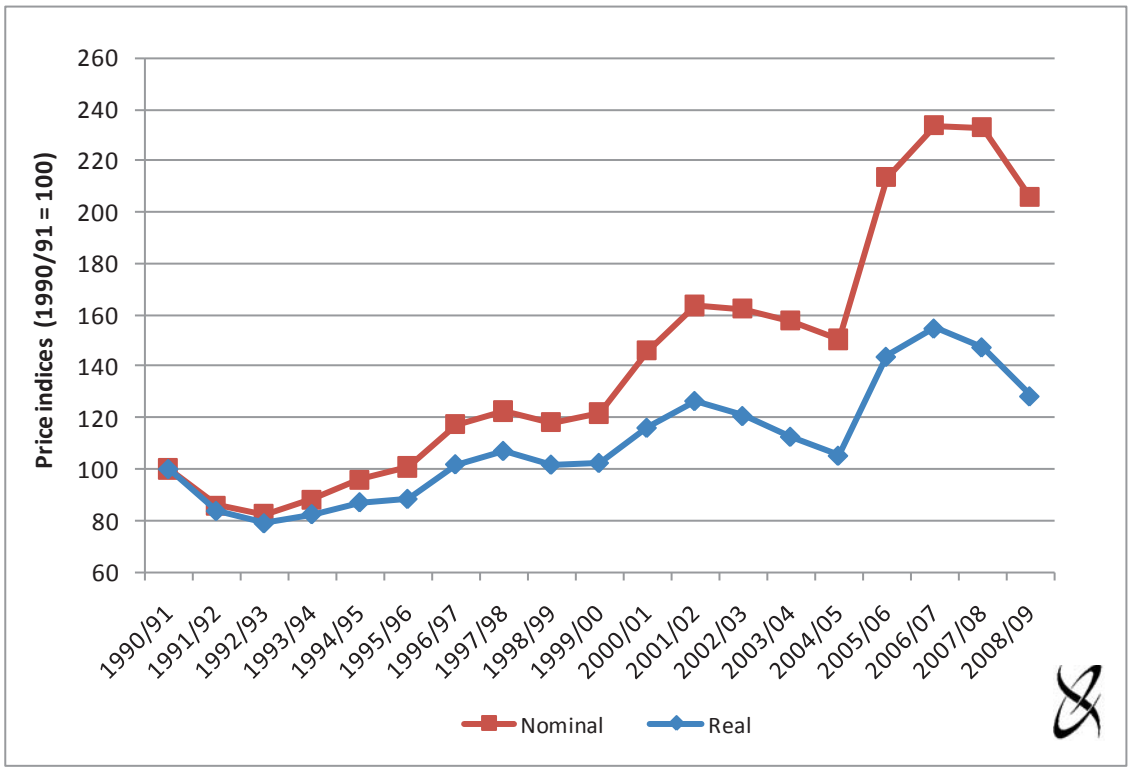

Figure 3. Price indices for the Blue Crab Fishery (1990/91=100)3

[2] SARDI estimate of GVP for 2005/06 to 2008/09 have been re-valued to reflect price differentials between fishery sectors.

Access to take Blue Swimmer Crabs in the area of the Blue Crab Fishery is provided via a Blue Crab Fishery or a Marine Scalefish Fishery licence with endorsed with quota entitlements. Marine Scalefish Fishery licences endorsed with crab nets are permitted to take Blue Swimmer Crabs on the west coast of South Australia, outside of the quota management system. Access rights underpin the economics of the fishery and are a driver of individual business performance.

The allocation of quota units is a key determinant of catch level in each of the sectors of the fishery. The allocation of units between sectors for the period 2000/01 to 2009/10 is illustrated in Table 2. The proportion of units held by the marine scale sector has fallen from approximately 13 % in 2000/01 to just 5 % in 2008/09. The proportion of quota held by marine scale licence holders decreased further in 2009/10 to just over 1 % of the total quota in the fishery. The proportion of quota units held by the pot sector has risen over the period, from approximately 87 % in 2000/01 to 95 % in 2008/09 and to almost 99 % in 2009/10.

Table 2. Allocation of quota units in the SA Blue Crab Fishery, 2000/01 to 2009/10

Year	Pot Sector (Units)	Marine Scale Sector (Units)	South Australia (Units)
2000/01	9,404	1,450	10,854
2001/02	8,810	2,044	10,854
2002/03	9,404	1,450	10,854
2003/04	9,517	1,337	10,854
2004/05	10,086	768	10,854
2005/06	10,136	718	10,854
2006/07	10,442	412	10,854
2007/08	10,360	494	10,854
2008/09	10,360	494	10,854
2009/10	10,717	137	10,854

The total fishery income (GVP) and total number of licence holders in the fishery for 1997/98 to 2008/09 is illustrated in Figure 4. The total number of licences in the fishery declined steadily over the 12 years 1997/98 to 2008/09. The total fishery income (GVP) increased over the period reflecting an increase in both catch and price in the fishery (Figure 4). A decline in the number of licence holders and an increase in gross fishery income imply that average income per licence holder increased between 1997/98 and 2008/09.

[3] Nominal price refers to the beach price in the current year's dollars. Real price is the nominal price adjusted for the purchasing power of money. The CPI (consumer price index) has been used to make this adjustment (ABS 2008). It enables meaningful comparisons of prices to be made between years.

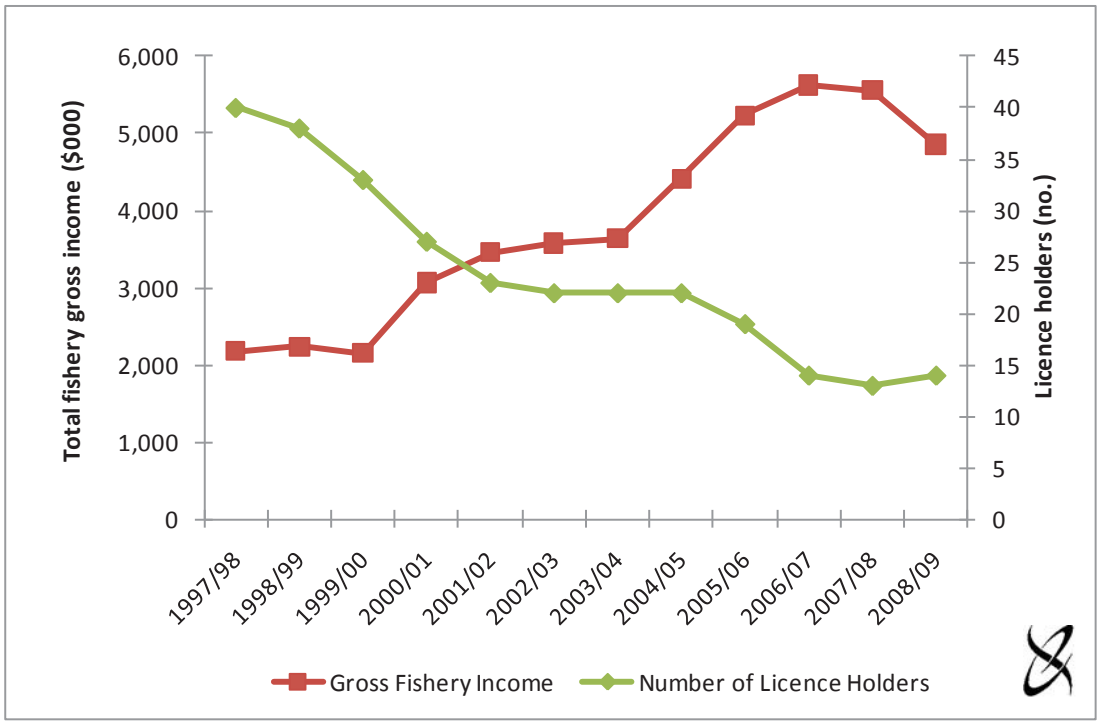

Figure 4. Fishery income and number of licence holders in the Blue Crab Fishery, 1997/98 to 2008/09 (in nominal terms)

4.4.2 Costs

PIRSA collects licence fees from commercial operators in accordance with the South Australian Government's cost recovery policy for the management of commercial fisheries. Licence fees currently include the costs of management, compliance and research.

The average management fee per pot licence holder and the licence fee as a proportion of GVP are illustrated in Figure 5. Licence fees as a percentage of GVP fluctuated between 1997/98 and 2008/09 but generally followed a declining trend. This change was a result of both a decrease in the total cost of management of the fishery and an increase in fishery GVP. The increase in the average fee per licence holder in 2009/10 of $5,027 is a result of the decrease in the number of pot licence holders, as the cost of management has not changed significantly. The management cost per pot licence holder peaked at $20,811 in 2006/07 and decreased slightly in 2007/08 and 2008/09 before increasing in 2009/10.

A breakdown of major cost items as a proportion of total cash costs is illustrated in Figure 6. In each year of the analysis labour costs accounted for the largest share of total cash costs. The labour costs are comprised of payments to licence owners and crew as well as an imputed wage to those licence owners and other family members who are not paid a wage directly by the business. Other significant cash costs were fuel and repairs and maintenance.

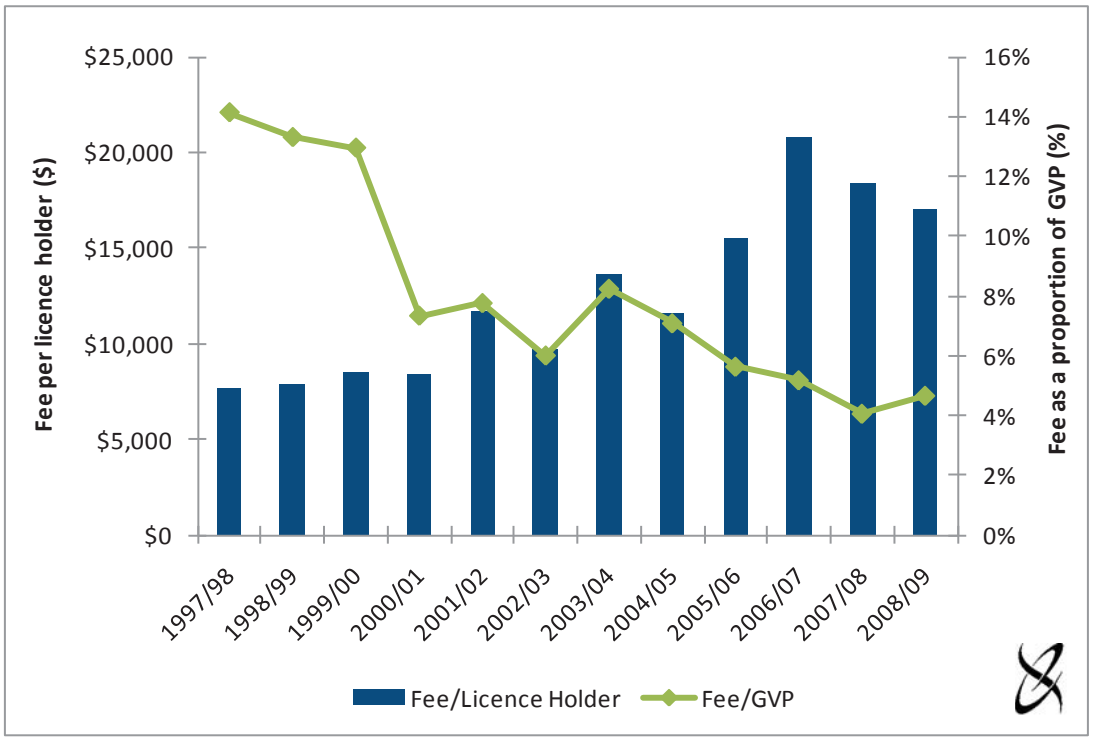

Figure 5. Management fee per licence holder and as a proportion of GVP, Blue Crab Fishery, 1997/98 to 2008/09

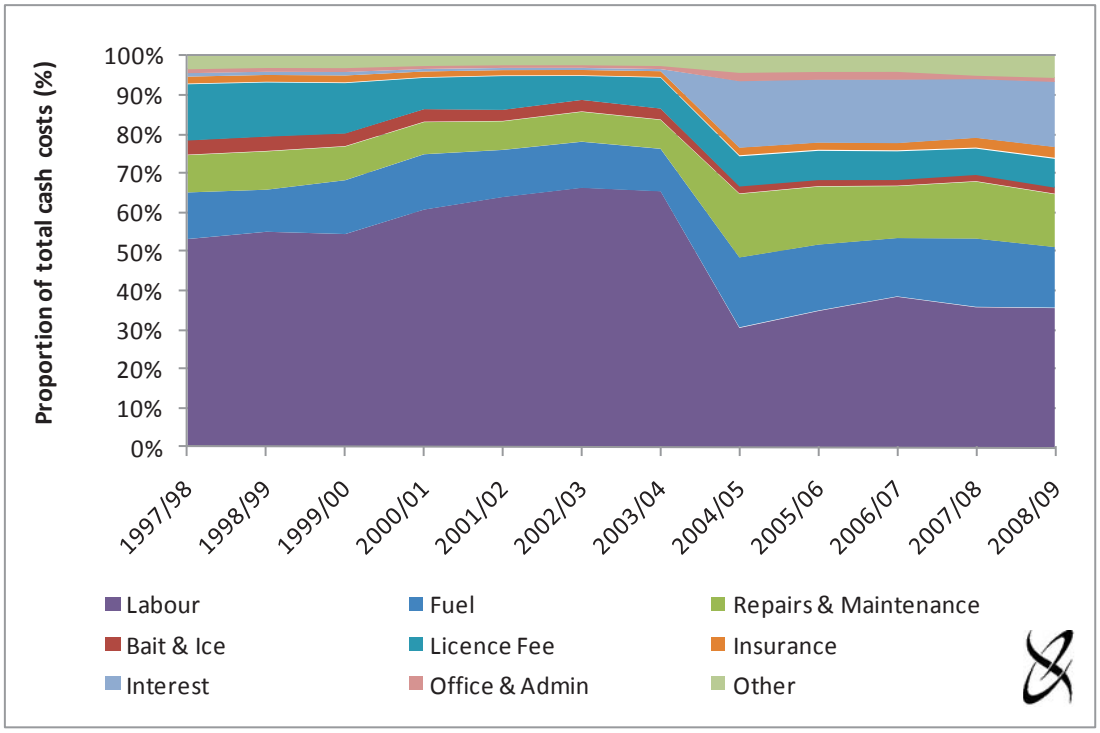

Figure 6. Cost shares in the Blue Crab Fishery, 1997/98 to 2008/09 (nominal terms)

4.4.3 *Cost Price Squeeze*

Price and cost indices for the Blue Crab Fishery for the years 1997/98 to 2008/09 are summarised in Figure 7. These indicators are derived from the average price and average cost per kilogram of catch. Overall, between 1997/98 and 2008/09, the average price of Blue Swimmer Crabs increased by 68 % in nominal terms. The average costs of catching Blue Swimmer Crabs generally followed an increasing trend. In 2008/09, average cash costs per kilogram were 52 % higher than in 1997/98.

Figure 7. Price and cost indices for the Blue Crab Fishery, 1997/98 to 2008/09 (1997/98 = 100)

4.4.4 *Profitability*

Selected measures of profitability for the Blue Crab Fishery are summarised in Figure 8 for the years 1997/98 to 2008/09. Changes in each of the profitability measures for the fishery were closely related to the total gross income earned. Overall profits increased between 1997/98 and 2008/09, although profits declined slightly in 2007/08 and 2008/09 as a result of a decrease in fishery income.

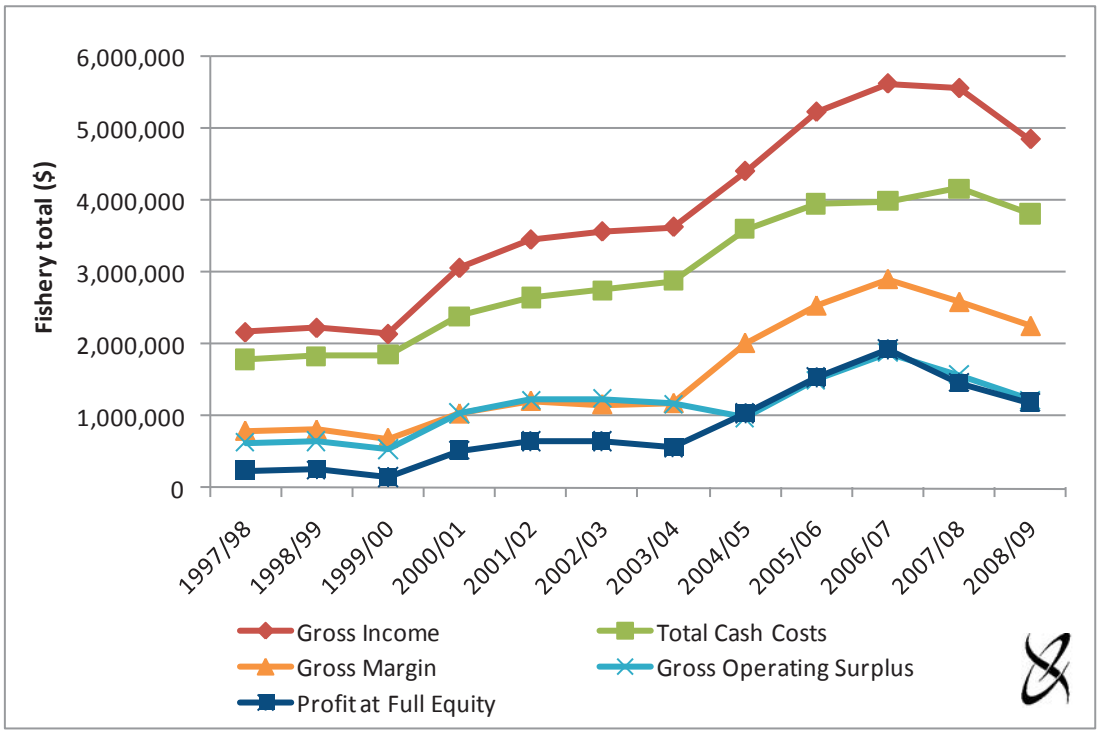

Figure 8. Income and profit in the Blue Crab Fishery, 1997/98 to 2008/09 a

4.4.5 Contribution to the South Australian Economy

Figure 9 illustrates the total economic impact of the fishery on the SA economy for the 12 years, 1997/98 to 2008/09. Total economic impact refers to the direct fishing industry impacts (fishing, processing, etc.) and the indirect impacts on other sectors of the economy. The change in total output and GSP impacts are closely related to changes in price and fishery GVP (Figure 9). There has been some decrease in the direct employment impact of the fishery between 1997/98 and 2008/09, as illustrated in Figure 10. This decrease is likely due to the decrease in the total number of licence holders in the Blue Crab Fishery over the period.

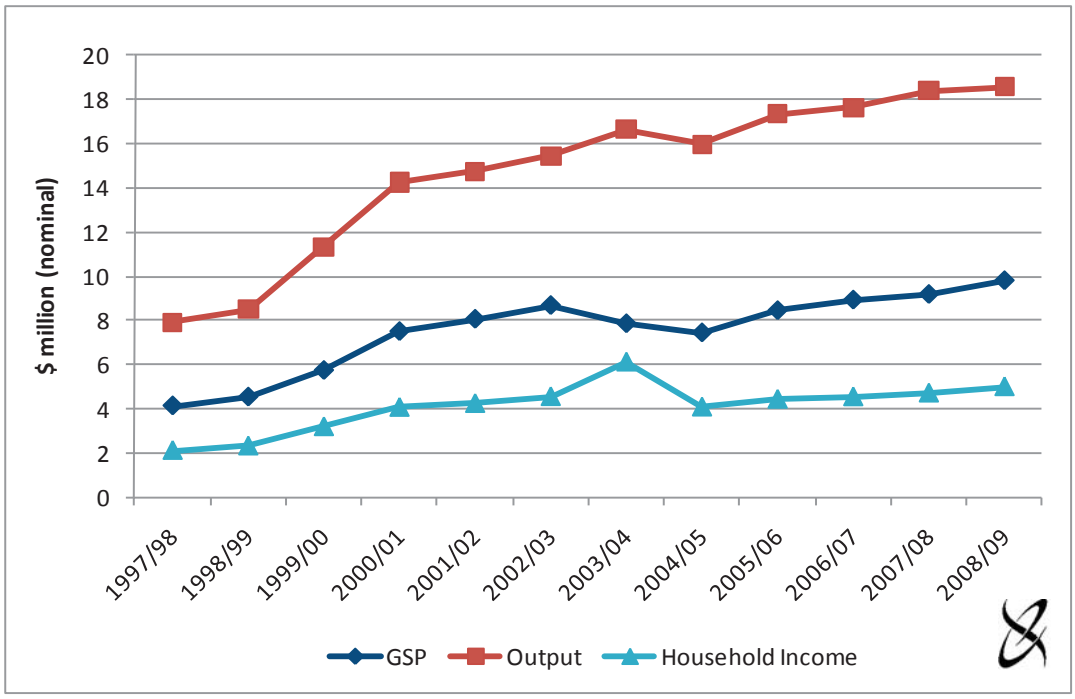

Figure 9. Total gross state product, output and household income impact of the Blue Crab Fishery on the SA economy, 1997/98 to 2008/09 (in nominal terms)[4]

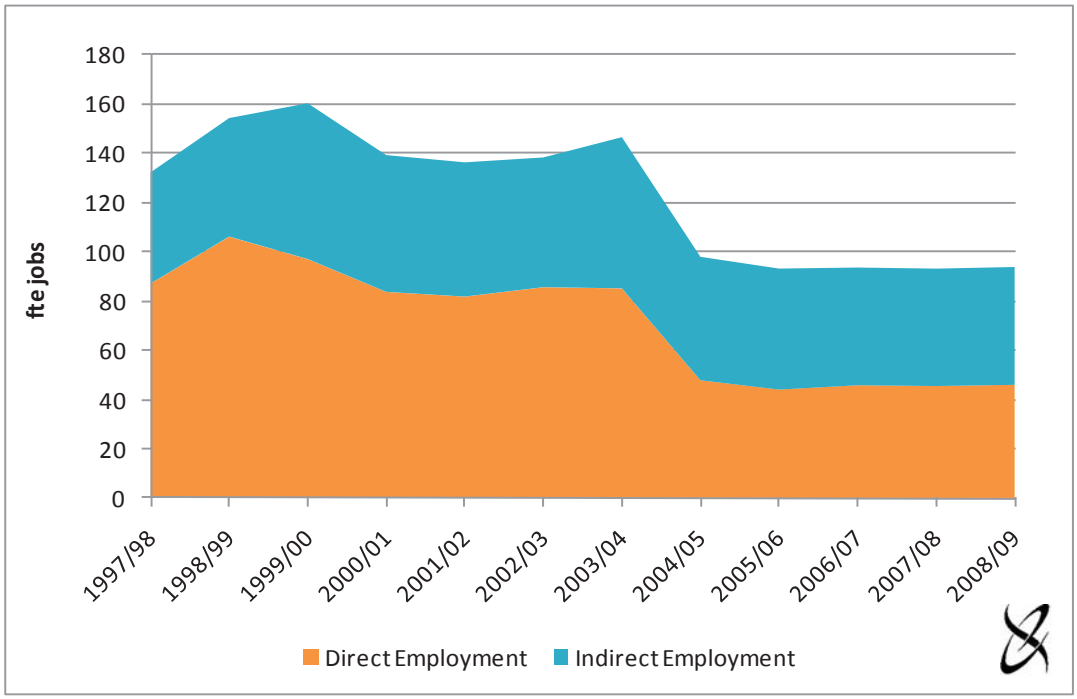

Figure 10. Total direct and indirect employment impact of the Blue Crab Fishery on the SA economy, 1997/98 to 2008/09[4]

[4] The economic impact of the Blue Crab fishery in 1997/98 and 1998/99 does not include the direct and flow-on effects of estimated capital expenditure by licensees; these effects have been included in subsequent years. Estimates of economic impact for the period 1997/98 to 2002/03 do not include the impact of local retail and food service trade; these effects have been included in subsequent years.

4.4.6 Economic Rent

Economic rent is defined as the difference between the price of a good produced using a natural resource and the unit costs of turning that natural resource into the good including the opportunity cost of capital. In this case the natural resource is the Blue Crab Fishery and the good produced is the landed crabs. Estimates of the economic rent generated in the Blue Crab Fishery are summarised in Figure 11 for the period 1997/98 to 2008/09. The economic rent generated in the Blue Crab Fishery increased from $121,000 in 1997/98 to $1.6 million in 2006/07 but declined to $1.2 million in 2007/08 and $939,000 in 2008/09.

Economic rent expressed as a percentage of GVP is a useful indicator for analysing a fishery over time and for comparing different fisheries. This indicator is illustrated in Figure 12 and shows a general increase between 1997/98 and 2008/09, although it has fallen in the past two years from the peak of 28 % in 2006/07

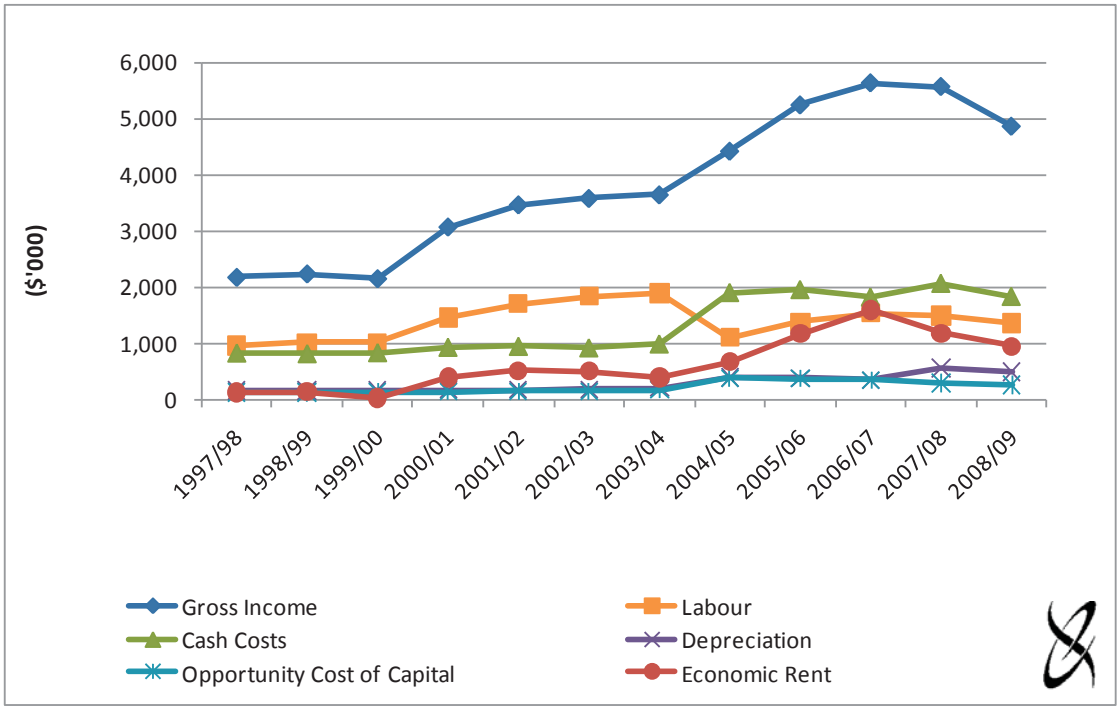

Figure 11. Economic rent in the Blue Crab Fishery, 1997/98 to 2008/09 ($'000) (nominal terms)

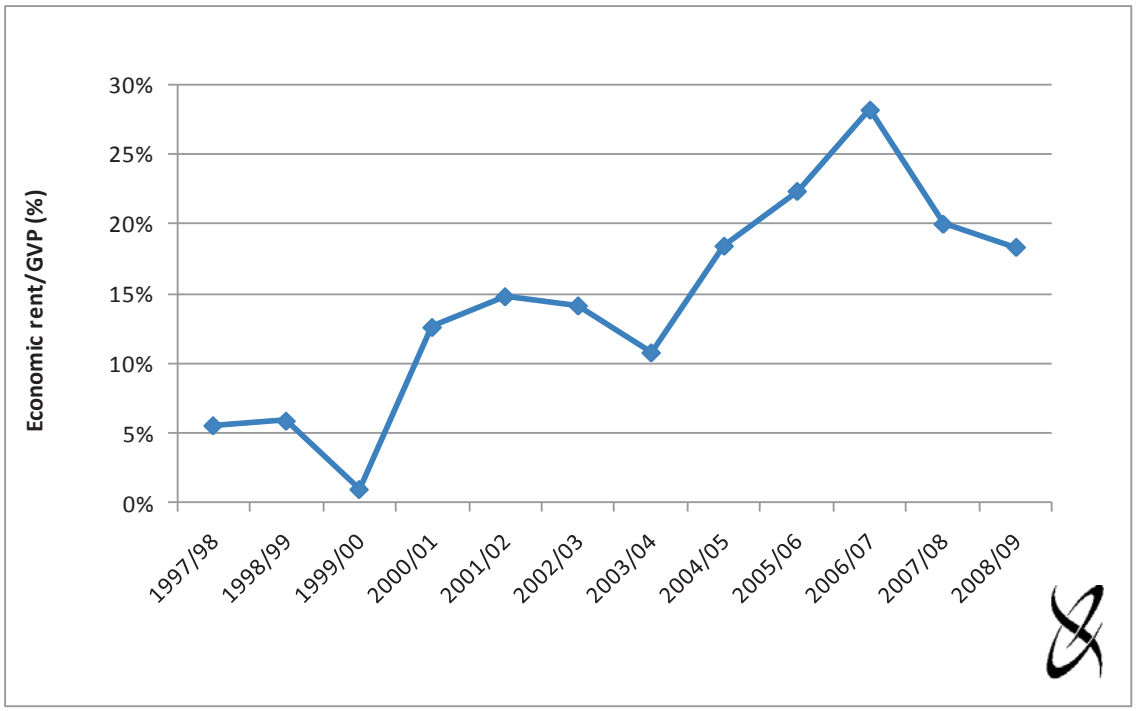

Figure 12. Economic rent as a proportion of GVP in the Blue Crab Fishery, 1997/98 to 2008/09

Economic rent represents a return to the value of a licence in the fishery. The aggregate value of licences in the Blue Crab Fishery and the return to capital value of the fishery is illustrated in Figure 13. The return to the capital value of the fishery increased between 1999/00 and 2001/02 as a result of an increase in economic rent generated by the fishery. The return to capital declined between 2001/02 and 2004/05 due to an increase in the capital value of the fishery and a decrease in economic rent. The return to capital value increased in the following years, despite a significant increase in licence value, as a result of an increase in economic rent. Economic rent, the aggregate value of licences and the return to capital in the fishery all declined slightly in 2007/08 and 2008/09 (Figure 13).

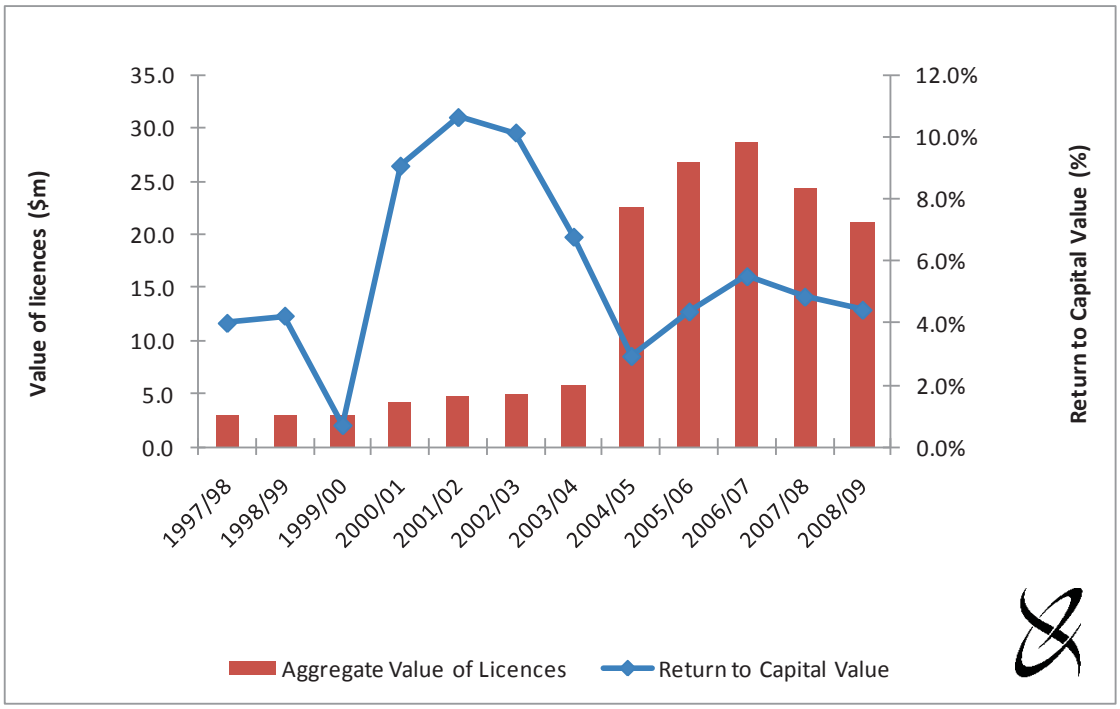

Figure 13. Aggregate value of licences and return to capital in the Blue Crab Fishery, 1997/98 to 2008/09[5]

Data on economic indicators for the Blue Crab Fishery have been sourced from Econsearch, 2010a and Econsearch, 2010b.

4.5 Social characteristics

The three regional areas associated with the fishery are Port Broughton (three licence holders), Port Wakefield (one licence holder) and Wallaroo (base for many Spencer Gulf operations).

The fishery generates direct and indirect employment, contributes to regional development, and supports many small businesses in direct fishing enterprises as well as various support industries, primarily in regional South Australia.

The provision of employment to those people involved in the fishery is considered to be very important to the fishing industry community. Table 3 shows that in 2008/09, the SA Blue Crab Fishery was responsible for the direct employment of around 28 full-time equivalents (fte) and downstream activities created employment of 18 fte jobs state-wide. Flow-on business activity was estimated to generate a further 48 fte jobs state-wide. These state-wide jobs were concentrated in the trade (14), manufacturing (8) and business services sectors (6) (EconSearch, 2010).

[5] The value of licences represents licence holders' estimates of the value of their fishing licence derived from survey responses. Estimates were based on different survey samples and techniques. Some of the difference between years is, therefore, attributable to sampling variability.

Table 3. Economic impact of the Blue Swimmer Crab fishing industry on the South Australian economy, 2008/09

Sector	Output		Employment [a]		Household Income		Contribution to GSP	
	($m)	%	(fte jobs)	%	($m)	%	($m)	%
Direct effects								
Fishing	5.1	27.5%	28	30.0%	1.5	29.7%	3.6	36.7%
Processing	0.6	3.3%	2	2.3%	0.1	2.7%	0.2	2.0%
Transport	0.8	4.2%	3	3.2%	0.2	3.7%	0.3	3.5%
Retail	0.0	0.0%	0	0.0%	0.0	0.0%	0.0	0.0%
Food services	1.5	8.3%	11	11.6%	0.4	8.0%	0.7	6.8%
Capital expenditure [b]	0.3	1.4%	2	1.9%	0.1	1.5%	0.1	1.1%
Total Direct [c]	*8.3*	*44.8%*	*46*	*47.1%*	*2.3*	*44.2%*	*4.9*	*49.0%*
Flow-on effects								
Trade	1.6	8.5%	14	14.5%	0.5	10.5%	0.8	7.7%
Manufacturing	2.3	12.5%	8	8.9%	0.5	10.4%	0.8	7.7%
Business Services	1.3	6.9%	6	6.1%	0.5	9.0%	0.6	6.2%
Transport	0.6	3.0%	2	2.3%	0.1	2.6%	0.2	2.4%
Other Sectors	4.2	22.5%	18	19.1%	1.1	21.8%	2.5	25.9%
Total Flow-on [c]	*9.9*	53.3%	*48*	51.0%	*2.7*	54.3%	*4.9*	49.9%
Total [c]	**18.6**	**98.1%**	**94**	**100.0%**	**5.0**	**100.0%**	**9.8**	**100.0%**
Total/Direct	2.2	-	2.0	-	2.2	-	2.0	-
Total/Tonne	$28,200	-	0.14	-	$7,500	-	$14,800	-

[a] Full-time equivalent jobs. Direct employment in the fishery was comprised of 16 full-time jobs and 30 part-time jobs, that is, 46 jobs in aggregate and 28 fte jobs.

[b] Capital expenditure includes expenditure on boats, fishing gear and equipment, sheds and buildings, motor vehicles and other equipment.

[c] Totals may not sum due to rounding.

Source: EconSearch 2010a

5 CO-MANAGEMENT ARRANGEMENTS

The *Fisheries Management Act 2007* establishes the Fisheries Council of South Australia. Section 16 of the Act sets out the functions of the Council, which include the preparation of management plans under the Act, advising the Minister on allocation issues and promoting the co-management of fisheries.

Essentially, co-management is an arrangement whereby responsibilities and obligations for sustainable fisheries management are negotiated, shared and delegated at appropriate levels between government, industry and other stakeholders. The Council is currently considering the development of a policy on co-management which will help inform discussion with the wider commercial fishing industry and other stakeholder groups as to how best to promote and implement co-management.

In the meantime, consultation arrangements have been established between PIRSA and the representative industry body for each major commercial fishery. These arrangements recognise the relevant body as the representative body for the industry on the basis that they meet the following criteria:

1. *Financially viable*. The body must be demonstrably financially viable to the extent that it can fulfil a fisheries management advisory role. This will be assessed in terms of financial support for the body and financial capacity to engage in the communication and extension necessary to provide input to fisheries management processes.

2. *Representative*. The body must be able to demonstrate that it represents the interests of members and the broader industry. This may be demonstrated through the structure of the body, its governance arrangements and its processes for canvassing industry feedback.

3. *Credible*. The body must have demonstrated an ability to provide credible industry advice on fisheries management issues and to engage with PIRSA in a constructive manner.

The arrangements for specific fisheries have been agreed between PIRSA and the relevant body and are encapsulated in a communication protocol signed by the Director of Fisheries and the body.

The South Australian Blue Crab Pot Fishers Association Inc. (SABCPFA) has been recognised as the representative industry body of the Blue Crab Fishery. A communication protocol has been signed and an annual schedule of meetings is agreed pursuant to that protocol. The Minister and the Fisheries Council have oversight of the management of the fishery under this management plan, but day to day management is conducted by PIRSA in association with the SABCPFA.

Once this management plan is implemented, further discussions will take place with the industry association to progress co-management, whereby the industry will consider taking greater responsibility of the management of the fishery.

6 ALLOCATION OF ACCESS BETWEEN SECTORS

6.1 Current allocated shares of the resource

The *Fisheries Management Act 2007* provides that a management plan must specify the share of the fishery to be allocated to each fishing sector under the plan (43(2)(h)).

The Act also provides that, in determining the share of aquatic resources to be allocated to a particular fishing sector under the first management plan for an existing fishery, the share of aquatic resources to which that fishing sector had access to at the time the Minister requested the Council to prepare the plan (based on the most recent information available to the Minister) must be taken into account (43(3)).

The Minister formally requested that the Fisheries Council prepare this management plan on 3 July 2008. Therefore, this plan must take into account the share of the Blue Swimmer Crab resource that the commercial fishing sector had access to at that time.

Allocations for the recreational and Aboriginal traditional fishing sectors must be determined at the same time.

The shares allocated to each sector in relation to the Blue Crab Fishery are:

Species	Commercial		Recreational	Aboriginal traditional
Blue Swimmer Crab	BCF	65.5%	29%	1%
	MSF	4.5%		

The Blue Crab Fishery also has access to other crustacean species, which are permitted to be landed and sold as by-product, and a number of other species that are permitted to be taken for use as personal bait (refer to Schedule 1). There have been no or negligible reported catches of these species by the fishery in recent years.

Marine Scalefish Fishery

Licence holders in the Marine Scalefish Fishery with the appropriate gear entitlements are permitted to take Blue Swimmer Crabs on the west coast of South Australia and there has been a low level of historical take by this component of the commercial sector. These fishing activities are not managed under this management plan but as part of the Marine Scalefish Fishery. A share has been allocated to the Marine Scalefish Fishery, as part of the commercial sector allocation.

Prawn Fisheries

The commercial prawn fisheries catch Blue Swimmer Crabs during trawling operations as bycatch only and are not permitted to retain them. Given that all Blue Swimmer Crabs are returned to the water by the prawn fisheries, they are not taken and there is no extractive use. A share of the resource has therefore not been allocated to the prawn fisheries.

The level of mortality caused to Blue Swimmer Crabs by these activities is not well understood. The historical status of the Blue Crab Fishery is believed to have been sustainable, despite the impacts of the prawn fisheries. The ESD risk assessment for

the Blue Crab Fishery identified that the incidental bycatch of Blue Swimmer Crabs by the prawn fisheries under these existing arrangements is unlikely to put the resource at risk of overexploitation, as long as these impacts do not increase.

The Spencer Gulf Prawn Fishery and Gulf St Vincent Prawn Fishery, which operate in the same area as the Blue Crab Fishery, are considered to be sustainable. Harvest strategies are in place to manage fishing effort using spatial and temporal closures to target areas of high catch rate of appropriately sized prawns, ensuring sustainability and promoting economic efficiency.

Aboriginal Traditional Sector

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 developed when an Indigenous Land Use Agreement (ILUA), agreed to resolve a native title claim, is in place in relation to a native title claim area. The State is currently engaged in ILUA negotiations with native title claimants and other stakeholder groups, including the fishing industry. The agreements arising from these negotiation processes will inform the way that access to fisheries resources by Aboriginal communities is defined and implemented. Aboriginal traditional fishing under the Act only relates to fishing agreed through the ILUA process. Aboriginal people are also recreational fishers outside of these arrangements.

In this management plan, a share of access has been has been allocated and set aside for the purpose of resolving these native title claims. There is little available information on the take of Blue Swimmer Crabs by the Aboriginal traditional fishing sector; however the small number of claims with fishery-related interests and negotiations to date has informed the share that has been put aside for this purpose. A nominal share of 1% has been made to the Aboriginal traditional sector in this management plan, which has been deducted from the total recreational share. This is because Aboriginal traditional fishing is non-commercial fishing.

It is anticipated that all fishery-related ILUAs will be negotiated within five years. Therefore, at the five year review for this management plan, any difference between the nominal share put aside and the actual share agreed through the ILUA can be calculated. Any difference would then be re-allocated to or from the recreational sector.

6.2 Information used to allocate shares

In determining the share to be allocated to a particular fishing sector under the first management plan for an existing fishery, the share to which that sector had access at the time the Minister requested the Council to prepare the plan (based on the most recent information available to the Minister) must be taken into account.

Quantifying current shares was an estimate based on the best available information on the current level of use of all sectors.

The Allocation Policy requires that information about current use by sectors must be:

- Real – that is, data must be available – it must have been collected and published.

- Recent – data on which the information is based should be the most recent available and in any case no more than five years old.

- Reliable – the data on which the information is based should have been obtained, and the information or report collated or prepared, in a way that is verifiable. The process for obtaining the data and preparing the information should be properly documented.

The information used to allocate shares of aquatic resources in this management plan is derived from the following sources:

- 2007/08 South Australian Recreational Fishing Survey (Jones, 2009)

- Blue Swimmer Crab (Portunus pelagicus) Fishery 2007/2008. Stock Assessment Report to PIRSA Fisheries (Dixon and Hooper, 2009).

6.3 Review of allocations

Allocations between sectors are to be reviewed periodically in accordance with the criteria set out in the Allocation Policy. For the Blue Crab Fishery the first comprehensive review of shares will be conducted five years after the commencement of this management plan.

In addition to a periodical review, the allocation framework for the Blue Swimmer Crab resource may be reviewed if:

1. More information becomes available that quantifies the mortality of Blue Swimmer Crabs caused by the prawn fisheries; or
2. Fishery information indicates that the amount of Blue Swimmer Crab bycatch by the prawn fisheries has significantly increased; or
3. Fishery information indicates that that the amount of fishing effort (number of trawl shots) in the prawn fisheries in Spencer Gulf or Gulf St Vincent has significantly increased.

Such a review would consider whether mortality caused by the prawn fisheries needed to be explicitly allocated a share of the resource as a 'bycatch' allocation only. This would not require a reallocation of the quantum of the shares allocated to each sector above but would be an additional allocation, to recognise that existing mortality of the resource by the prawn fisheries was able to be quantified.

6.4 Method for adjusting allocations of access in future

A need for adjustment of shares between different sectors may be triggered by:

1. A review of the allocations between sectors (refer to section 6.3 above);
2. A review of the management plan, which will reassess the appropriateness of shares and may trigger an adjustment (refer to section 14); or
3. Outcomes of a resource assessment, which trigger a fisheries management decision that is made primarily to ensure sustainability of the fishery but that may result in a shift of shares between sectors.

The declaration of a marine protected area that would result in reallocation of shares would be given effect through the *Marine Parks Act 2007* and policies applying under that Act. That Act provides that compensation will be paid to licensed fishers affected by the closure of an area or restrictions of activities within a marine park.

If any future adjustment of shares is to be from the commercial sector to the non-commercial sector, a voluntary scheme would always be pursued in the first instance. The Blue Crab Fishery has a small number of licences and few participants and this may mean that it is difficult to assess the value of quota units and fishery licences

and/or that a voluntary adjustment scheme may not be able to be implemented in the fishery. Therefore, second voluntary option/step is required, which would investigate an incentive-based scheme for share adjustment. Compulsory acquisition of commercial access to the fishery would be explored as a last resort.

The adjustment of shares from the commercial sector to a non-commercial sector can be summarised by the following options:

1. Purchase commercial access (i.e. quota units) to the resource on the open market;
2. Create incentives for the commercial sector to trade access to the resource;
3. Compulsory acquisition of commercial access to the fishery would be explored as a last resort. Any compulsory acquisition would include compensation to the commercial sector.

7 ECOSYSTEM IMPACTS

The *Fisheries Management Act 2007* requires that ecological impacts be identified and assessed as the first step in developing a management plan. A goal of this plan is the management of the Blue Swimmer Crab resource as a part of the broader ecosystem, using an ecosystem-based fisheries management (EBFM) approach. The Act specifically requires that the following impacts are identified:

- Current known impacts of the fishery on the ecosystem
- Potential impacts of the fishery on the ecosystem
- Ecological factors that could have an impact on the performance of the fishery

These risks must be assessed to determine the most serious risks and strategies for addressing those risks must be developed.

The ecological impacts associated with the fishery have been identified and assessed through the process of conducting an ecologically sustainable development (ESD) risk assessment for the fishery. The *National ESD Reporting Framework for Australian Fisheries* (Fletcher et al 2002) was used to conduct the risk assessment.

In accordance with the ESD objective in the Act, this approach is aimed at assisting PIRSA with identifying and prioritising all of the important ecological, social and economic factors effecting the management of the fishery. Risks and important issues in the fishery were identified in consultation with stakeholders and were prioritised using risk ratings from negligible to extreme. Risks identified as moderate, high or extreme have been summarised in Table 4 below. Specific management strategies to minimise these risks and associated performance indicators have been developed and are provided in Table 7. An overview of the ESD risk assessment for the Blue Crab Fishery is provided at Appendix 19.

The report ‘Ecologically Sustainable Development (ESD) Risk Assessment for the Blue Crab Fishery’ (PIRSA, 2010) provides detailed information about the Blue Crab Fishery and the outcomes of the ESD risk assessment.

Table 4. Summary of moderate to extreme risks identified in the Blue Crab Fishery ESD risk assessment.

Component	Risk	Description	Risk Rating	Objective	Strategy
Retained Species	Blue Swimmer Crab – Spencer Gulf population	Risk of fishery impacts on breeding population	Moderate	1a; 1b 4c	1a(i); 1a(ii); 1b(iii) 4c(i); 4c(ii); 4c(iii); 4c(iv); 4c(v); 4c(vi)
	Blue Swimmer Crab – Gulf St Vincent population	Risk of fishery impacts on breeding population	Moderate	1a; 1b 4c	1a(i); 1a(ii); 1b(iii) 4c(i); 4c(ii); 4c(iii); 4c(iv); 4c(v); 4c(vi)
General Ecosystem Impacts of Fishing	Addition / movement of biological material caused by translocation	Risk of fishery impacts on the ecosystem (*Caulerpa taxifolia*)	Moderate	3a	3a(i)
	Air quality - greenhouse gas / carbon emissions	Risk of fishery impacts on the broader environment	Moderate	3a	3a(ii)
	Water quality - oil discharge	Risk of fishery impacts on the broader environment	Moderate	3a	3a(iii)
Community	Profit	Importance of profit to the fishing industry	Moderate	2a; 2b; 2e	2a(i); 2b(i); 2e(i)
	Employment	Importance of employment to the fishing industry	Moderate	2b	2b(i)
	Occupational health, safety and welfare	Importance of good OHS&W practices to the fishing industry	Moderate	2b	2b(ii)
	Relationships with community	Importance of positive relationships with the community to the fishing industry	Moderate	2b	2b(iii); 2b(iv)
	Asset value	Importance of asset value to the fishing industry	Moderate	2b; 2e	2b(i); 2e(i)
Governance	Management effectiveness	Cost effective management that ensures resource is harvested within	Moderate	1a	1a(i); 1a(ii) 4a(i); 4a(ii); 4a(iii);

Component	Risk	Description	Risk Rating	Objective	Strategy
		sustainable harvest		4a; 4b; 4c	4a(iv); 4b(i); 4b(ii); 4b(iii); 4c(i); 4c(ii); 4c(iii); 4c(iv); 4c(v); 4c(vi)
	Research/information	Sufficient information to inform management decisions	Moderate	1b 2e	1b(i); 1b(ii); 1b(iii); 1b(iv); 1b(v) 2e(i)
	Allocation	Explicit allocation of resource for optimum utilisation & equitable distribution for benefit of community	Extreme	2c; 2d; 2f	2c(i); 2c(ii); 2d(i); 2f(i); 2f(ii); 2f(iii)
	Compensation (other agencies)	Compensation for loss of access to resource by other sectors	Extreme	2e; 2f 4a	2e(i); 2f(i); 2f(ii); 2f(iii) 4a(iv); 4a(v)
	Access security	Importance of certainty of access for commercial fishing industry	High	2f 4a	2f(i); 2f(ii); 2f(iii) 4a(iv); 4a(v)
External factors affecting performance of the fishery	Water quality	Impact of human induced changes to water quality on resource and performance of fishery (a key issue was the proposed desalination facility in northern Spencer Gulf)	Moderate	1c 4a	1c(i) 4a(v)
	Economic drivers	Impact of external factors on performance and profitability of the fishery	Moderate	2b; 2e 4a	2b(i); 2e(i) 4a(i); 4a(ii); 4a(v)
	Access	Impact of external factors (access issues) on performance of fishery	Moderate	2e; 2f 4a	2e(i); 2f(i); 2f(ii) 4a(v)

8 GOALS AND OBJECTIVES

8.1 Goals and objectives

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

Objectives for the Blue Crab Fishery are set out below. They are organised under four broad goals. These goals and objectives capture all of the factors identified in the Act that must be balanced to pursue ecologically sustainable development.

These objectives have been developed through the process of undertaking an ESD risk assessment. The methodology for this assessment is described in Appendix 19.1.

8.1.1 Goal 1 – Ensure the Blue Swimmer Crab resource is harvested within ecologically sustainable limits

This goal relates to the sustainability of the target stock.

The primary objective for Goal 1 is to ensure that Blue Swimmer Crab stocks are harvested sustainably and that adequate data exists to determine this. The main management strategies for ensuring sustainability of the fishery are the major output controls - restrictions on the total commercial catch each year through the quota system, bag and boat limits for recreational fishers, a minimum legal size limit and restrictions on taking berried females.

As the commercial sector accesses approximately 70% of the fishery each year, the decision rules and reference points for determining the annual TACC in the harvest strategy are an important focus in terms of ensuring ecologically sustainable stock levels.

The objectives of this management plan in relation to sustainability are:

- Maintain the stock within sustainable limits in accordance with performance indicators
- Collect biological and environmental information to inform management decisions based on the performance indicators specified in this management plan

8.1.2 Goal 2 –Allocate access to Blue Swimmer Crab resources to achieve optimum utilisation and equitable distribution to the benefit of the community

This goal relates to the economic and social benefits derived from the fishery.

The objectives of this management plan in relation to these benefits are:

- Maintain the stock at or above a level that will support commercial catch rates within the historical range
- Maintain a flow of economic benefit from the fishery to the broader community

- Provide equitable public access and recreational fishing opportunities
- Recognise Aboriginal traditional fishing access
- Ensure there is economic information to make properly informed management decisions based on the performance indicators specified in this management plan
- Shares of access to Blue Swimmer Crabs are explicitly allocated between Aboriginal, commercial, charter and recreational sectors

Goal 2 aims to optimise the use of the fishery in an equitable way, within the sustainability constraints of the fishery. Optimising the use of the fishery is addressed in the objectives and strategies in terms of maximising stable economic returns from the commercial fishery and maintaining equitable access to the resource for the non-commercial sectors.

The TACC decision rules and reference levels in the harvest strategy aim to establish catch limits that maximise catch and returns from the commercial fishery.

8.1.3 Goal 3 – Minimise impacts on the ecosystem

This goal relates to the management of the fishery using an ecosystem-based fisheries management (EBFM) approach.

The objectives of this management plan in relation to EBFM are:

- Minimise fishery impacts on bycatch species and the ecosystem
- Avoid the incidental mortality of endangered, threatened and protected species

Australian Government guidelines for the ecological sustainability of Australian fisheries acknowledge 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.

8.1.4 Goal 4 – Cost effective and participative management of the fishery

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

The objectives of this management plan in relation to co-management, planning and cost recovery are:

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

The key objectives of this goal are to ensure that the fishery has involvement in the decision-making processes for developing and implementing management arrangements and to ensure that management arrangements are complied with. The cost effectiveness of management arrangements also needs to be taken into account in the development process as the costs of management are recovered from fishers in accordance with the Government's cost recovery policy.

9 HARVEST STRATEGY

9.1 Spatial scale of fishery management

The areas of waters in which holders of licences for the Blue Crab Fishery may take Blue Swimmer Crabs are provided in Figure 14 below and are as follows:

Gulf St Vincent - In the waters of Gulf St Vincent north of the geodesic from the location on Mean High Water Springs closest to 35°10′04.74″ South, 137°40′38.64″ East to the location on Mean High Water Springs closest to 35°36′48.51″ South, 138°05′44.01″ East.

Note that this is an extension of the Gulf St Vincent Zone, moving the southern boundary approximately 25 nautical miles south from Marino Rocks (taking the line from Cape Jervis to Troubridge Point). This is in response to:

- That fishers have reported an abundance of crabs along the southern boundary of the Gulf St Vincent (GSV) zone; and
- Historical interactions between commercial and recreational fishers along populated stretches of the metropolitan coastline. An increase in the size of the GSV zone southward may assist in drawing commercial effort away from these areas.

Spencer Gulf - In the waters of Spencer Gulf north of the geodesic from the location on Mean High Water Springs closest to 34°26'45.00" South, 136°06'57.58" East to the location on Mean High Water Springs closest to 34°26'45.00" South, 137°24'59.26" East, **with the exception of the following areas**;

- Upper Spencer Gulf – in the waters of Spencer Gulf north of the geodesic from the location on Mean High Water Springs closest to 32°43'45.67" South, 137°47'41.28" East to the location on Mean High Water Springs closest to 32°43'45.67" South, 137°54'11.78" East.

- Whyalla – in the waters of or near False Bay contained within and bounded by a line commencing at Mean High Water Springs closest to 33°04'26.61" South, 137°32'58.50" East, then beginning north-easterly following the line of Mean High Water Springs to the location closest to 32°59'41.12" South, 137°45'31.96" East (Stony Point), then south-westerly to 33°05'12.75" South, 137°34'10.86" East (north-eastern corner of Whyalla-Cowled's Landing Aquatic Reserve), then north-westerly following the boundary of the Whyalla-Cowled's Landing Aquatic Reserve to the point of commencement.

- Port Broughton and Fishermen's Bay - in the waters of or near Fisherman Bay contained within and bounded by a line commencing at Mean High Water Springs closest to 33°32'57.56" South, 137°56'27.59" East, then beginning south-easterly following the line of Mean High Water Springs to the location closest to 33°35'40.46" South, 137°55'20.82" East, then northerly to the location on Mean High Water Springs closest to 33°33'27.77" South, 137°55'24.65" East (Shag Island), then north-easterly to the point of commencement.

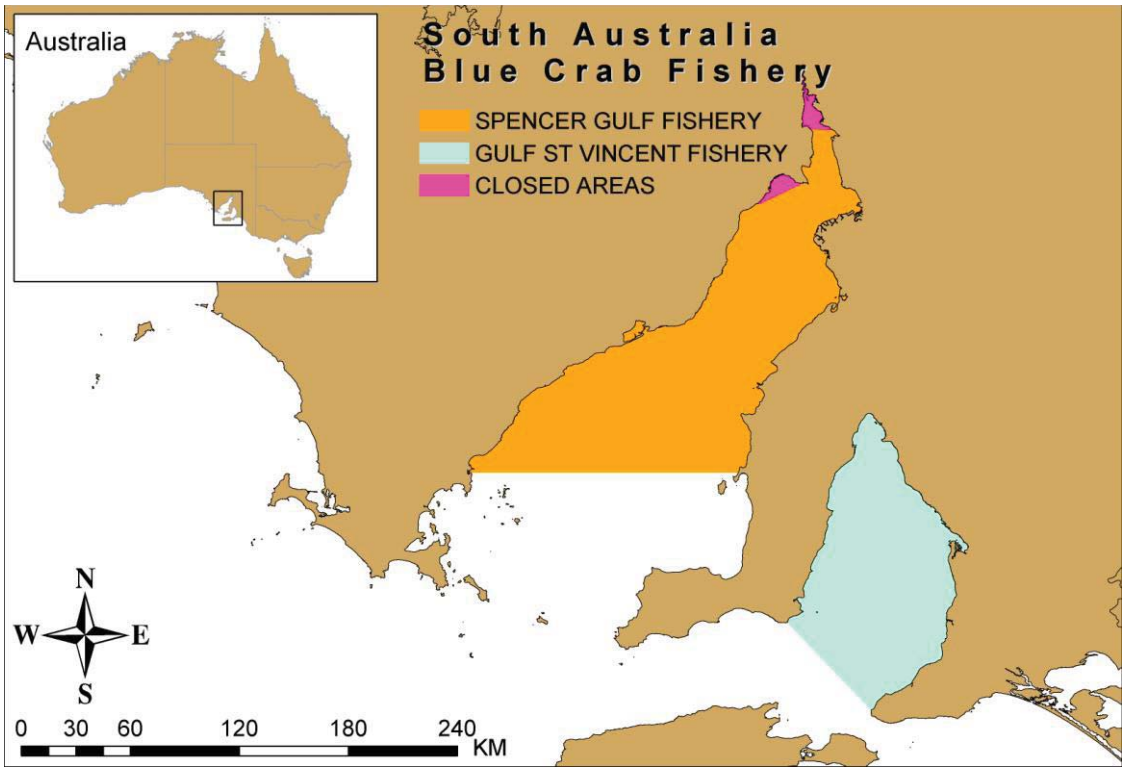

Figure 14. Area of the Blue Crab Fishery

Some aquatic reserves also have prohibitions and restrictions on fishing and what species can be taken. The locations and coordinates of the State's aquatic reserves are provided in the *Fisheries Management (Aquatic Reserves) Regulations 2007* or on the PIRSA website.

Data is collected and analysed for the Blue Crab Fishery for each of the Spencer Gulf and Gulf St Vincent regions, at a sub-population scale. This ensures that a clear picture of the biological performance of the fishery is provided and used in decision-making, appropriate to the distribution and stock structure of the population.

Regions within the fishery are determined taking into the account the spatial structure of the stock and the spatial structure of the fishing fleet and fishing effort. The regions for which biological performance indicators are assessed in the Blue Crab Fishery are set out in Figure 15. These regions will require modification after the implementation of this management plan.

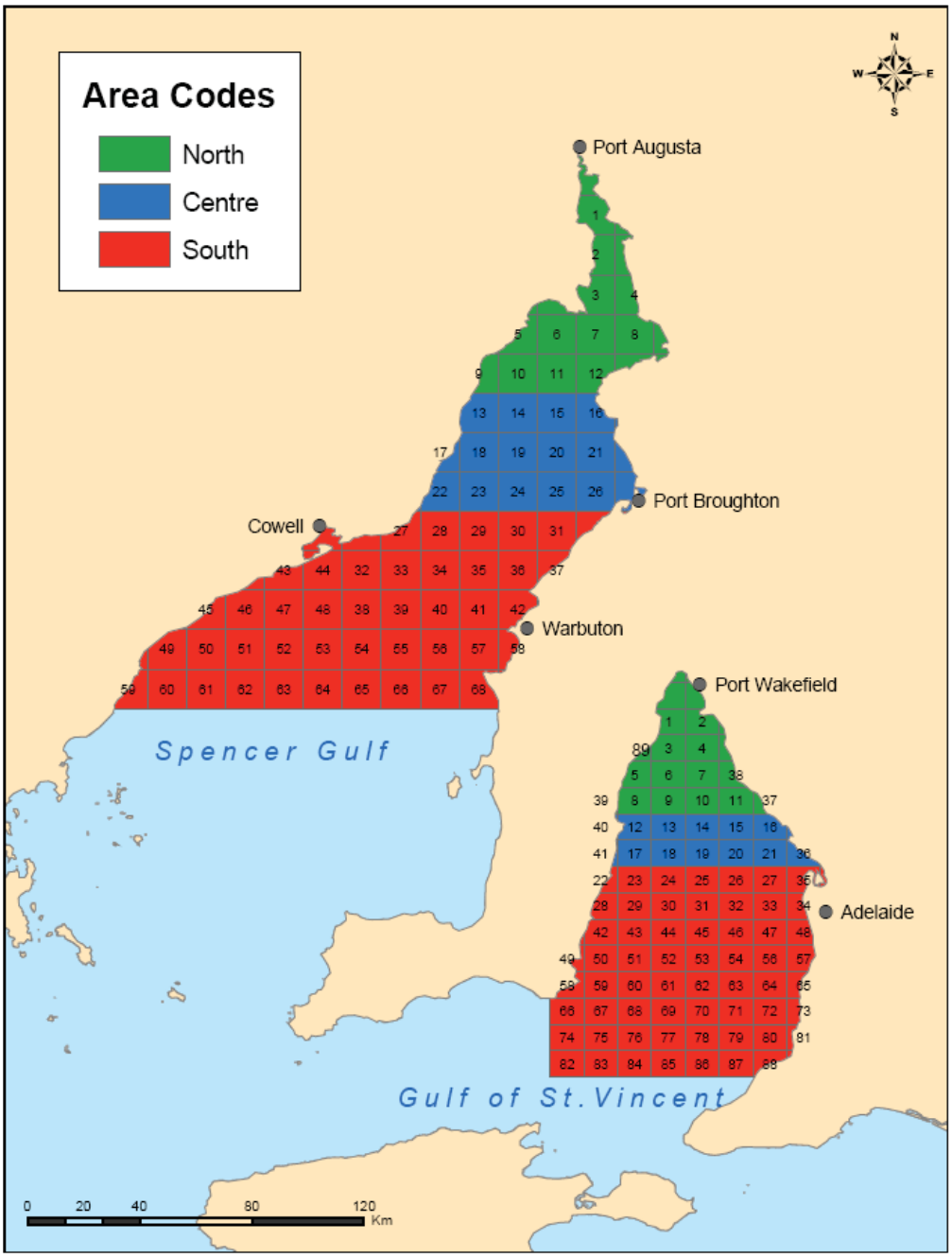

Figure 15. Regions for data collection and analysis in the Blue Crab Fishery

Source: SARDI Aquatic Sciences (Currie *et al.*, 2007)

This harvest strategy is designed to implement a precautionary approach to managing the fishery and to set the TACC at a level that promotes stock sustainability, as well as certainty and stability for the industry. The harvest strategy has been designed acknowledging that a key priority for the fishery during the term of the management plan is to build a robust knowledge base about the fishery and Blue Swimmer Crab stocks across both gulfs.

The TACC decision rules pursue objectives 1a, 2a and 2b by establishing limit reference points and decision rules to guide the annual TACC decision-making process. This harvest strategy has been developed to ensure that the TACC is set at a

level that allows the Blue Swimmer Crab resource to be harvested within ecologically sustainable limits and to protect it from overfishing.

The decision rules provide that reaching a lower limit reference point will trigger a review of the TACC by PIRSA and the relevant co-management body, with the possibility of a decrease from the baseline TACC of 626.8 tonnes. This is deemed to be an appropriate response for this management plan, given the current level of understanding about the species, fishery production and dynamics and the limitations of existing fishery data.

During the term of this management plan, a key strategy is to build scientific knowledge and improve the quality of both fishery-dependent and fishery-independent information. The purpose of building a suite of more robust fishery performance indicators is to be able to develop future harvest strategies for the fishery that incorporate more confidence in the decision-making process. Part of this intent is to have the ability to set limit reference points that are linked to explicit TACC decision rules in the next management plan, which will set the strategic direction for management of the fishery over the following five to ten years. Explicit decision rules in the future will provide greater certainty to the industry, fishery managers, other fishing sectors and the broader community on how the fishery will be sustainably managed under the quota management system. While this management plan aims for stability in the TACC, the next management plan may aim to better utilise peaks of inter-annual crab abundance and more closely follow trends in abundance with the annual TACC setting process.

The management plan also sets additional performance indicators to supplement the key performance measures used in the decision rules (see section 9.2.2. / Table 6). These performance measures provide supplementary information for fishery assessment. They will also provide information for periodic review to ensure that the performance indicators are adequate indicators for fishery assessment. These additional performance measures do not trigger a specific response. They require that a management issue be considered, without dictating what the response should be.

Section 9.5 also sets out additional performance indicators that measure performance against other objectives by initiating a response process if they are triggered (refer to Table 6).

9.2 Biological performance indicators

A goal of this management plan is to ensure that the Blue Swimmer Crab resource is harvested within ecologically sustainable limits. This goal will be achieved by ensuring that fishery performance is maintained above the limit reference points that have been developed for key performance indicators. Although this plan sets out a range of biological performance indicators, reference points have only been developed for three of these.

9.2.1 Primary biological performance indicators

Primary biological performance indicators are identified to provide measures of the status of the fishery and predictions about the future performance of the fishery. The primary biological performance indicators for a fishery establish measures relating to productivity of the fishery and predicted recruitment to the fishery. Analysis of these indicators is incorporated into the decision rules for the fishery, which are used set the annual TACC for the fishery.

For the Blue Crab Fishery the three key biological performance indicators are:

1. Relative abundance of pre-recruit crabs from FIS (crabs/potlift)
2. Relative abundance of legal-sized crabs from FIS (crabs/potlift)
3. Commercial CPUE (kg/potlift) of legal-sized crabs

Relative abundance of pre-recruit crabs (all crabs below the minimum legal size limit) and legal-sized crabs are measured using catch and effort data collected through the annual or bi-annual fishery-independent survey (FIS) for each gulf. SARDI Aquatic Sciences produces a report with the results of the FIS within a few weeks of its completion. This report will be used as an early measure of these performance indicators against the limit reference points provided in section 9.3. A detailed description of the FIS is provided in section 11.2.3.

Commercial CPUE of legal size crabs is measured using catch and effort data recorded and submitted in logbook returns, in accordance with the regulations. This information is summarised and published in annual fishery stock assessment reports. Further information about commercial logbook data is provided in section 11.2.2.

Commercial CPUE for pre-recruit crabs is considered to be an important biological performance indicator; however robust information to set limit reference points and measure fishery performance is not yet available in the fishery. The daily pot sampling program has been established to provide meaningful data to enable this to occur in the future (refer to section 11.2.2).

Performance of the fishery against these indicators will guide TACC setting in the fishery. This approach aims to achieve the following outcomes:

- Sustainability of the resource
- Greater certainty in the annual TACC setting process for all stakeholders;
- Stability within the commercial fishery
- Simple and robust assessment of fishery performance against management goals
- Responsive management to changes in biological productivity
- Improved structure in the annual TACC setting process
- Stronger stakeholder ownership over the annual TACC setting process

9.2.2 Secondary biological performance indicators

Secondary biological performance indicators for a fishery provide additional measures to assess the performance of the fishery; however they are not used routinely in decision-making for the fishery. These indicators are assessed less frequently and are used in reviews of the fishery, rather than in day-to-day decision-making. They are measured and reported on every year and used to provide additional information on performance of the fishery.

The secondary biological performance indicators for the Blue Crab Fishery are:

1. Total commercial catch vs. TACC
2. Mean size of legal-sized crabs in commercial catches and fishery-independent surveys
3. Mean size of pre-recruit crabs in commercial catches and fishery-independent surveys
4. Commercial CPU (kg/day) of legal sized crabs

A summary of all performance indicators for the fishery is provided in Table 6 on page 50.

9.3 Reference levels for primary biological performance indicators

Reference levels are established in this management plan for each primary biological performance indicator. They have been designed to provide clear guidance to the TACC setting process by defining how key performance indicator estimates should be interpreted and by linking them to a set of decision rules for review of the TACC. These levels provide a reference against which performance of the indicator can be assessed. An upper reference level establishes a benchmark for exceptionally positive fishery performance. A lower limit reference level establishes a benchmark for undesirable fishery performance that the fishery aims to avoid. Therefore, overall fishery performance will be measured by evaluating annual estimates of key performance indicators, relative to established limit biological reference points.

The provision for TACC increases above the baseline TACC of 626.8 tonnes (381.7 tonnes for the Spencer Gulf zone and 245.1 tonnes for the Gulf St Vincent zone) is not included in this management plan. Therefore, only the lower limit reference points will be used for the purpose of TACC setting, in the event that a TACC reduction is required.

For the primary biological indicators for the Blue Crab Fishery set out in 9.2.1 above, the reference levels are provided in Table 5 below.

Table 5. Limit reference points for the Blue Crab Fishery

Region	Relative abundance from FIS (crabs/potlift)				Commercial CPUE (kg/potlift)	
Limit reference point	Pre-recruit		Legal-sized		Legal-sized	
	Lower	Upper	Lower	Upper	Lower	Upper
Spencer Gulf	2	9	5	8	2	4
Gulf St Vincent	1.5	8.5	1.5	4	2	4

Limit reference points for fishery-independent and fishery-dependent catch rate have been defined taking into account:

- Historical information from annual fishery-independent surveys
- Historical commercial catch and effort data
- Historical stock assessments of the fishery
- Available scientific information about the species and fishery production

- Stakeholder expectations of biological and economic performance
- A long term goal to maintain a biomass that will support and sustain a TACC of 626.8 tonnes

The limit reference points were selected to represent fishery performance within a desirable range and pursue sustainability of the fishery in an ESD context, taking into account both biological and economic objectives. PIRSA considers that the Blue Crab Fishery has been operating in an ecologically sustainable manner since the quota management system was introduced in 1996.

Fishery-independent survey data have been collected from consistent sites since 2002 and are the most reliable source of information currently available for assessment of the fishery (Dixon and Hooper, 2009). Data from the seven-year period 2002-2009 were considered when setting the limit reference points for pre-recruit and legal size abundance. Relative abundance is represented by survey CPUE, calculated as the mean number of pre-recruit and legal-sized crabs caught per pot (small mesh pots only) for each fishery-independent survey[6]. Relative abundance data are presented for standardised pot lifts that were regularly surveyed from 2002 to 2008 (refer to Figure 16 and Figure 17 for Spencer Gulf; and Figure 19 and Figure 20 for Gulf St Vincent).

There are several sources of uncertainty in estimates of relative abundance from the FIS. These include, but are not exclusive to: the employment of different fishers and gear types between and within years; differences in the timing and duration of surveys; extrinsic factors such as weather and water temperature, and; differences in the spatial distribution of survey pots (Dixon and Hooper, 2009).

The limit reference points for relative abundance of legal-sized crabs are significantly different between the Spencer Gulf zone and Gulf St Vincent zone. They have been set at levels that reflect historical abundance, based on fishery-independent information, and represent differences in production between the two gulfs.

Data from the 11-year period 1997/98 to 2007/08 were considered when setting the limit reference points for commercial CPUE (refer to Figure 18 and Figure 21). Considerable uncertainty exists in some aspects of the fishery-dependent data (Dixon and Hooper, 2009). The small number of licences in the fishery and the motivation of commercial licence holders to maintain catch rates throughout the fishing season in order to maximise efficiency means that analysis of CPUE must be interpreted with caution.

Commercial catch rates have shown consistency and stability over the reference period for both zones of the fishery despite indications of fluctuating abundance from fishery-independent survey information. This suggests that the TACC of 626.8 tonnes has been sustainable over this period. It also suggests that this indicator is likely to be less sensitive to and reflective of changes in abundance than the fishery-independent performance indicators. The limit reference points for commercial catch rate have been set to represent a range outside which any significant fluctuation could genuinely be considered to indicate an increase or decrease in abundance.

[6] Note that fewer pot lifts were done during 2002 surveys than subsequent years and that the survey design changed in 2008 with the removal, shifting and addition of pot lift locations (Dixon and Hooper, 2009).

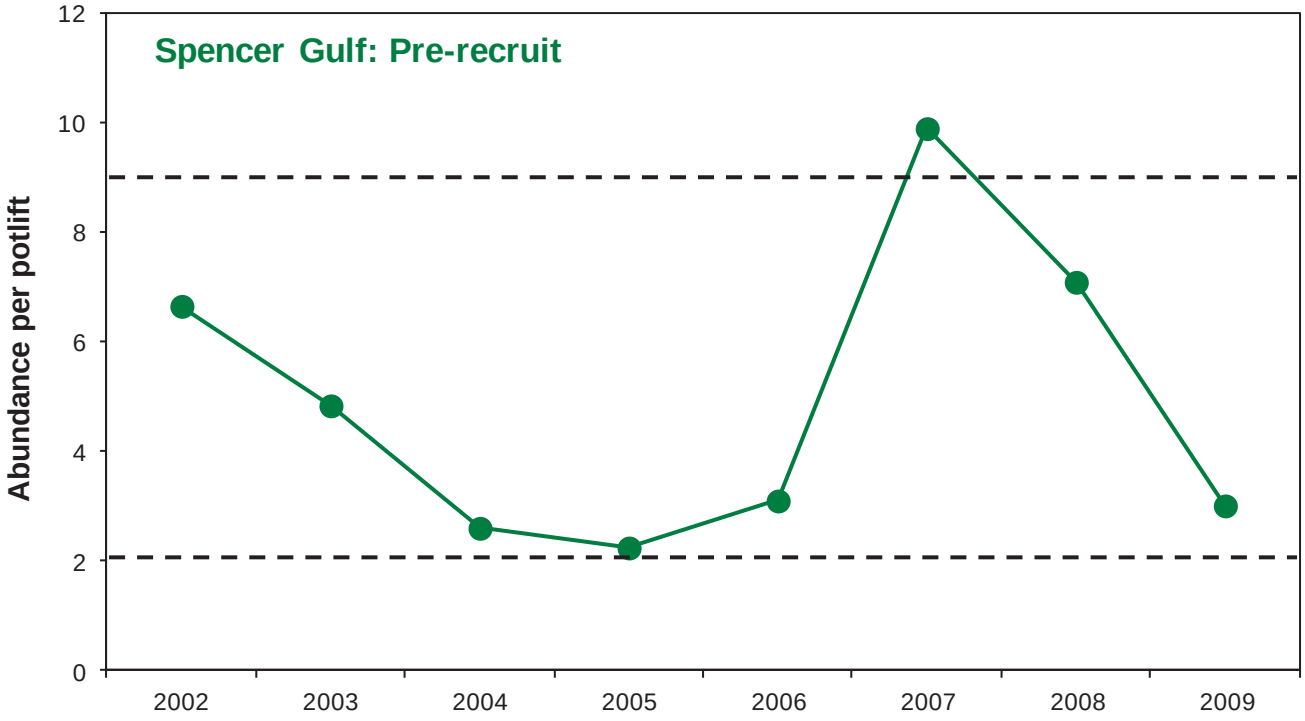

Figure 16. Relative abundance of pre-recruit crabs. Mean (SE) CPUE (crabs/pot lift) of pre-recruit crabs for standardised potlifts from fishery-independent surveys conducted in Spencer Gulf between 2002 and 2009

(Source: SARDI Aquatic Sciences)

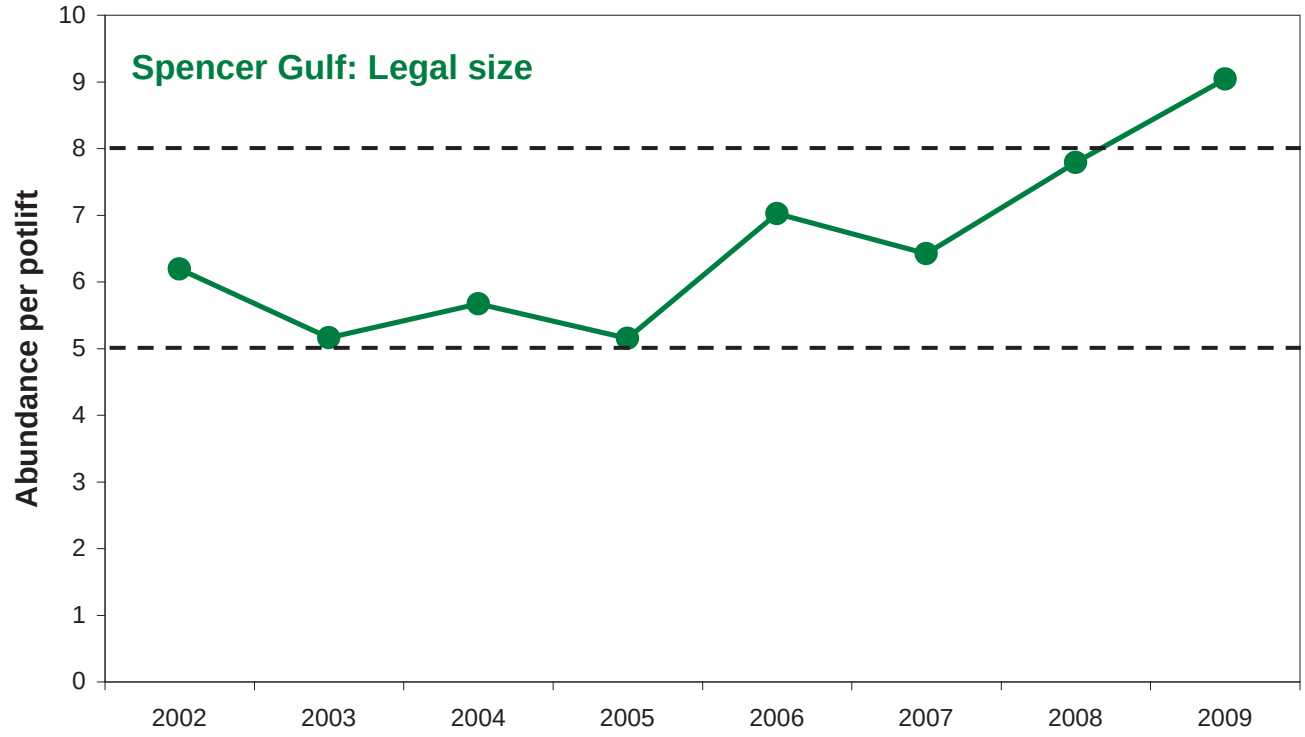

Figure 17. Relative abundance of legal-sized crabs. Mean (SE) CPUE (crabs/pot lift) of legal-size crabs for standardised pot lifts from fishery-independent surveys conducted in Spencer Gulf between 2002 and 2009

(Source: SARDI Aquatic Sciences)

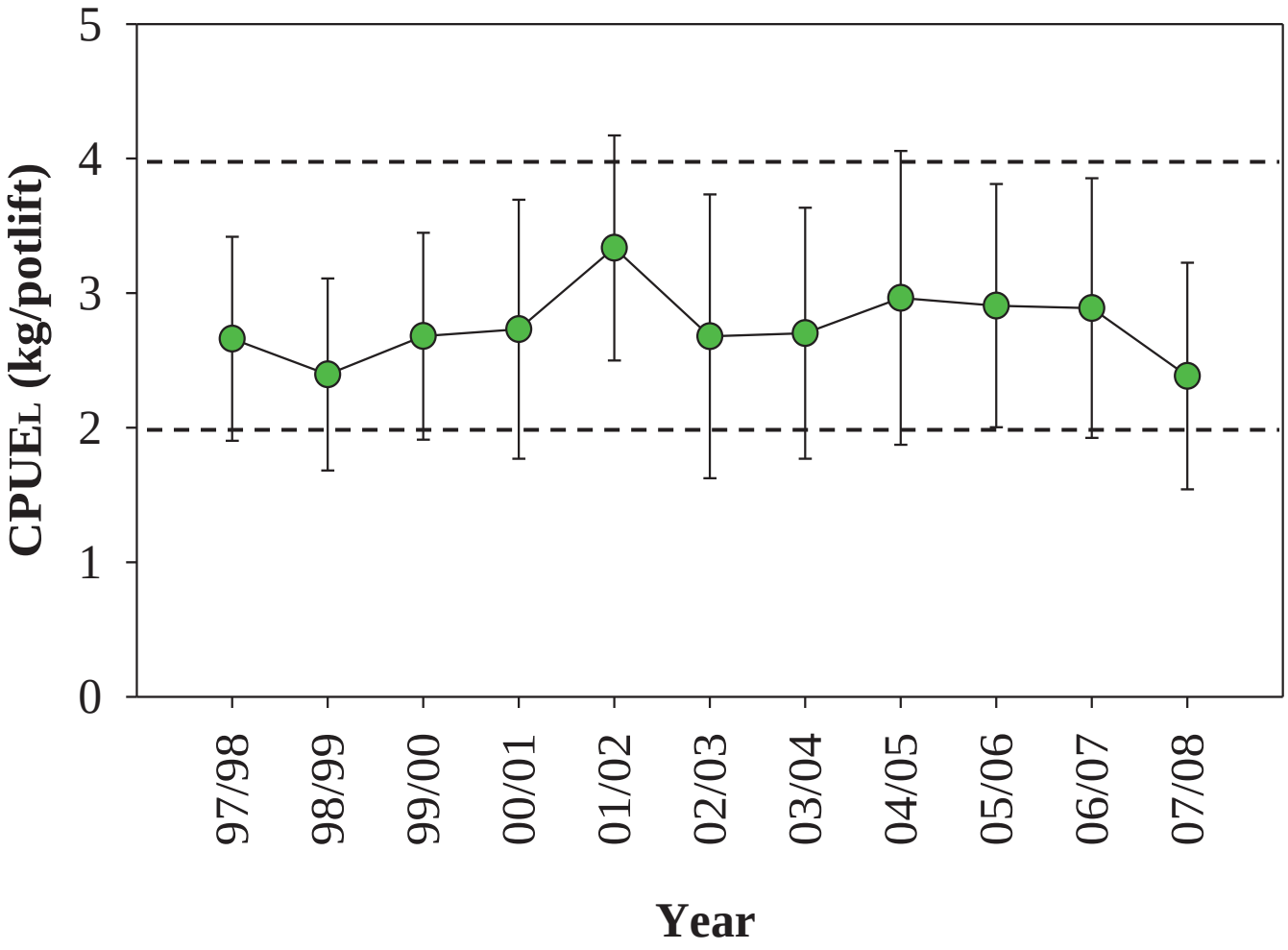

Figure 18. Commercial CPUE. Mean (SD) CPUEL (kg/pot lift) in the commercial Spencer Gulf pot fishing sector from 1997/98 to 2007/08

(Dixon and Hooper, 2009)

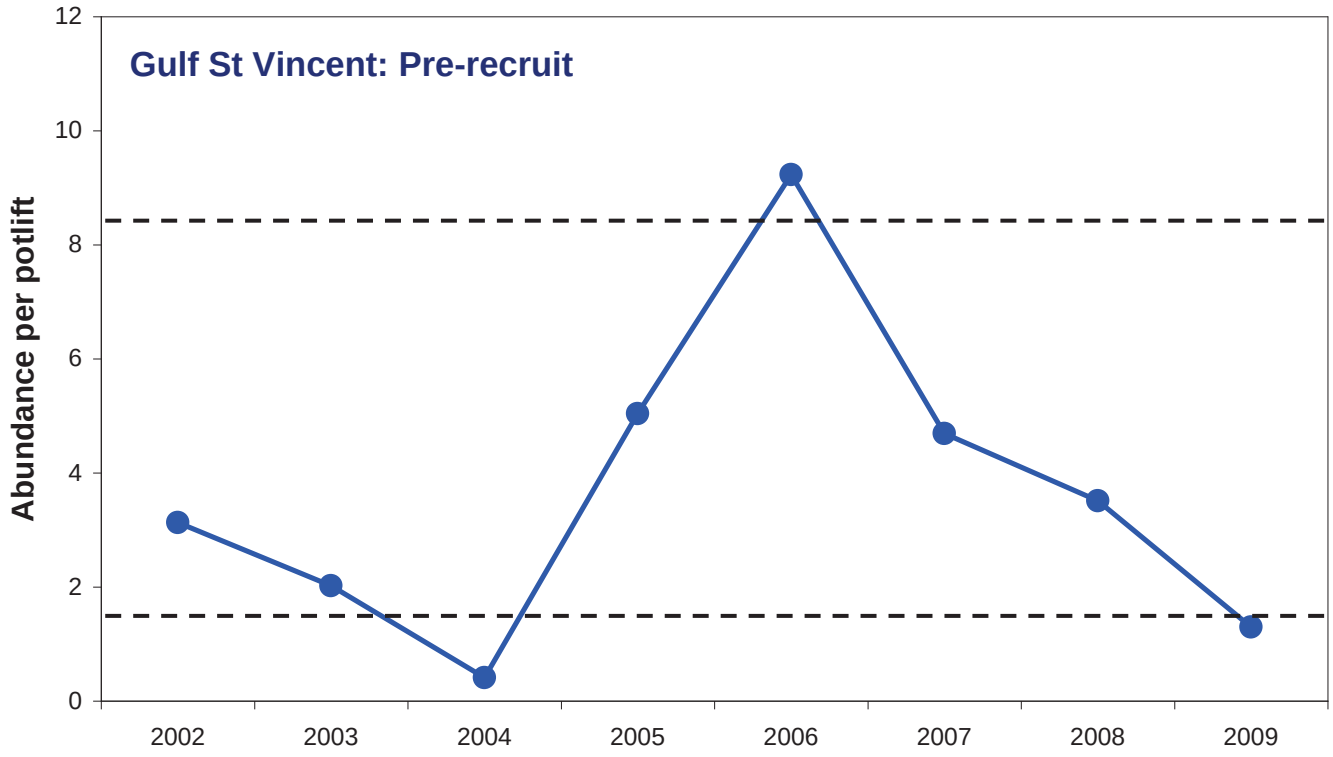

Figure 19. Relative abundance of pre-recruit crabs. Mean (SE) CPUE (crabs/pot lift) of pre-recruit crabs for standardised potlifts, from fishery-independent surveys conducted in GSV between 2002 and 2009

(Source: SARDI Aquatic Sciences)

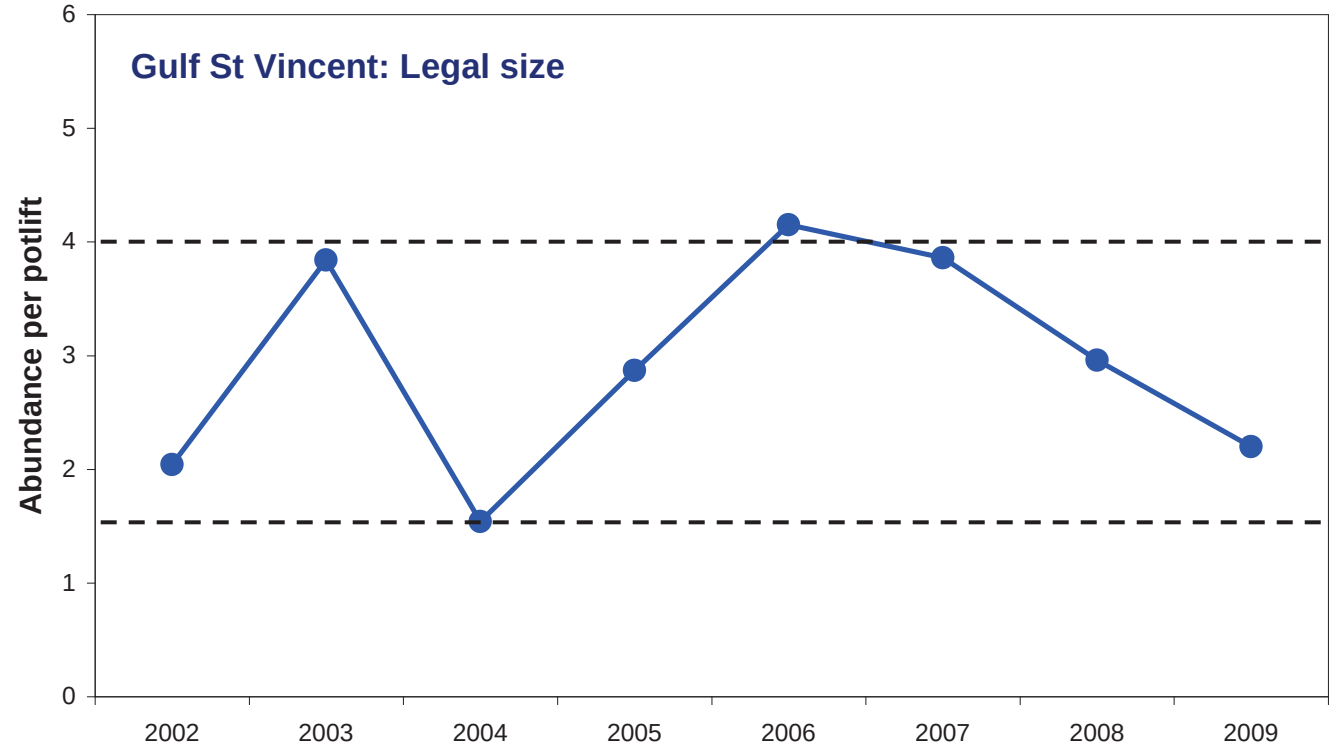

Figure 20. Relative abundance of legal-sized crabs. Mean (SE) CPUE (crabs/pot lift) of legal-size crabs for standardised pot lifts, from fishery-independent surveys conducted in GSV between 2002 and 2008

(Source: SARDI Aquatic Sciences)

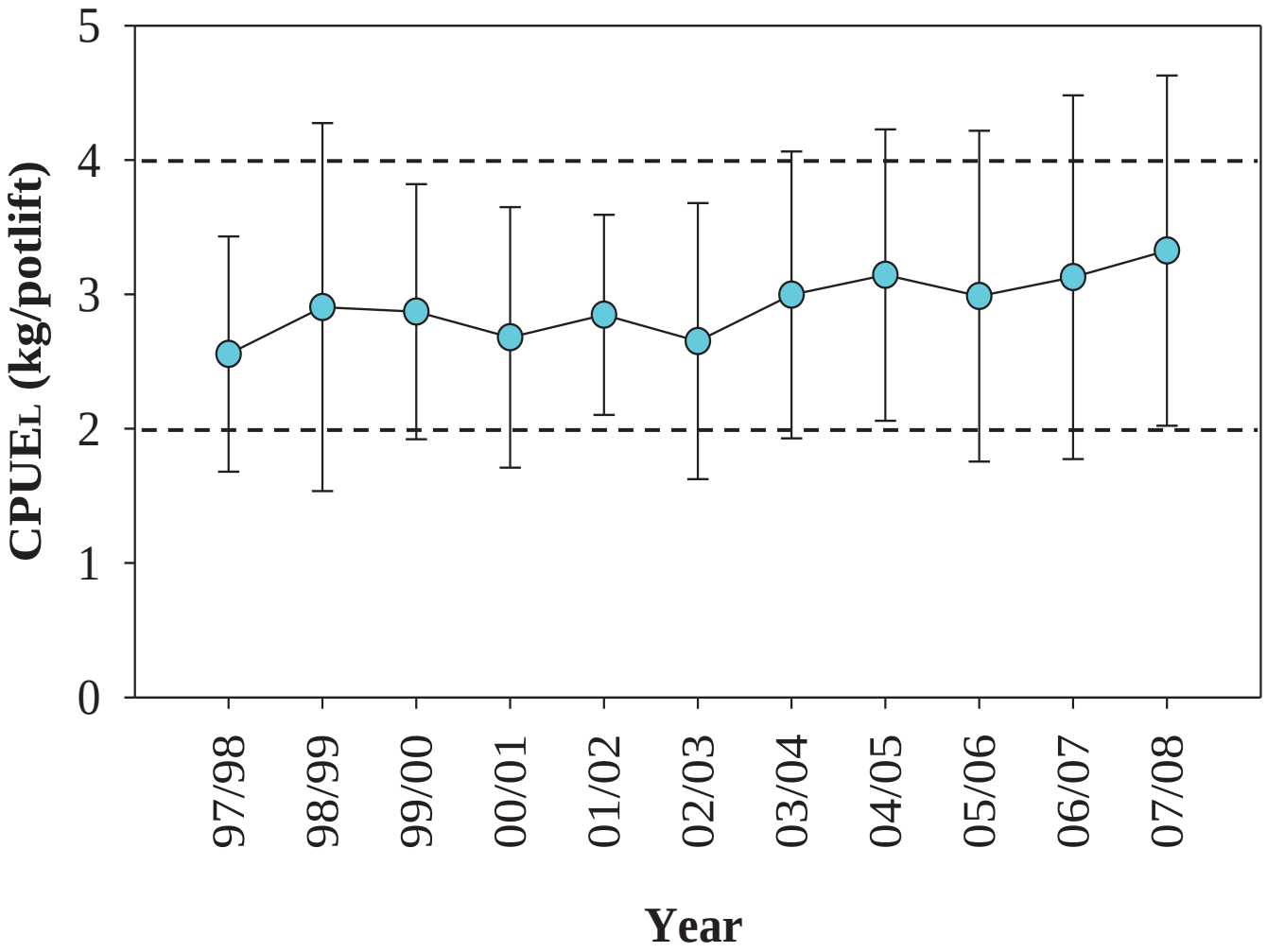

Figure 21. Commercial CPUE. Mean (SD) annual CPUEL (kg/pot lift) in the commercial GSV pot fishing sector from 1997/98 to 2007/08

(Dixon and Hooper, 2009)

9.4 Decision Rules for TACC Setting

The decision rules for a fishery establish rules for using the measurement of biological performance indicators against defined reference levels. They apply to annual TACC setting, to ensure greater certainty and security for all stakeholders in the decision-making process. As discussed in section 9.3 only the lower limit reference point is to be used to apply decision rules for a TACC decrease in this management plan. The upper limit reference point decision rules have been included as an appendix for comparison and future discussion (see Appendix 4). The baseline TACC for the Blue Crab Fishery is 626.8 tonnes (381.7 tonnes in the Spencer Gulf zone and 245.1 tonnes in the Gulf St Vincent zone).

Spencer Gulf

Review the TACC (with the possibility of a decrease) for the Spencer Gulf zone for the next season when one of the following conditions is met in that zone any given year:

1. Relative abundance of pre-recruit crabs drops below the limit reference point (two crabs per pot lift); or

2. Relative abundance of legal-sized crabs drops below the limit reference point (five crabs per pot lift); or

3. Commercial CPUE for legal size crabs drops below the limit reference point (two kg per pot lift).

Gulf St Vincent

Review the TACC (with the possibility of a decrease) for the Gulf St Vincent zone for the next season when one of the following conditions is met in that zone any given year:

1. Relative abundance of pre-recruit crabs drops below the limit reference point (1.5 crabs per pot lift); or

2. Relative abundance of legal-sized crabs drops below the limit reference point (1.5 crabs per pot lift); or

3. Commercial CPUE for legal size crabs drops below the limit reference point (two kg per pot lift).

These decision rules will be applied in making a recommendation to the Minister in relation to the TACC. The Minister has responsibility for determining the value of a quota unit on an annual basis and setting the TACC under the *Fisheries Management (Blue Crab Fishery) Regulations 1998*.

9.5 TACC decision-making process

The decision rules guide decision-making about the TACC under the regulations. The following actions will be taken by PIRSA and the relevant co-management body once the decision rules trigger a TACC review:

1. Notify the Minister that a limit reference point has been reached and a review of the TACC will be conducted.
2. If the lower limit reference point for pre-recruit abundance has triggered, consider whether a secondary recruitment survey needs to be conducted (as provided below).
3. Undertake a detailed review, including an examination of the causes and implications.
4. Provide a report to the Minister at least one month prior to the next quota period on the effects of reaching the limit reference point(s); recommendations in relation to the TACC for the next quota period and any additional management strategies.
5. The Minister will consider recommendations, endorse supported strategies and implement them as appropriate.

In the event that 'relative abundance of pre-recruit crabs' from the FIS triggers the lower limit reference point in either zone, PIRSA and the SABCPFA will consider whether a secondary recruitment survey needs to be undertaken in the first instance. The purpose of this secondary survey would be to investigate and confirm the results of the FIS. This acknowledges the possibility that the timing of the FIS, which is essentially a snapshot in time across the range of the fishery, may not have not correlated with the pulse of recruits that usually enter the fishery during June/July. It is intended to be a smaller scale, targeted survey to focus on relative abundance of pre-recruit crabs and to be as cost effective as possible to minimise costs to the industry.

The secondary recruitment survey would be conducted under the following conditions:

1. It would be undertaken in the relevant zone as soon as practicable following the results of the formal fishery-independent survey (FIS), which is conducted in June/July. This is likely to be four or six weeks after the FIS.
2. A subset of the total fishing blocks used in the FIS that have been historically important for pre-recruits would be included in this survey.
3. Commercial vessel(s) would be used to conduct this survey and an independent observer would be on board at all times.

The TACC review triggered by the decision rules will be conducted by PIRSA and the relevant co-management body. Relevant, available and up-to-date information about the fishery will be used to inform the review and the provision of TACC advice to the Minister. This may include:

- Secondary recruitment survey data
- Updated fishery catch and effort information
- Daily pot sampling data
- Fishery data at a finer spatial and/or temporal scale
- Any changes to fisher habits/ability
- Any major environmental changes

The process for setting the annual TACC is set out in Figure 24.

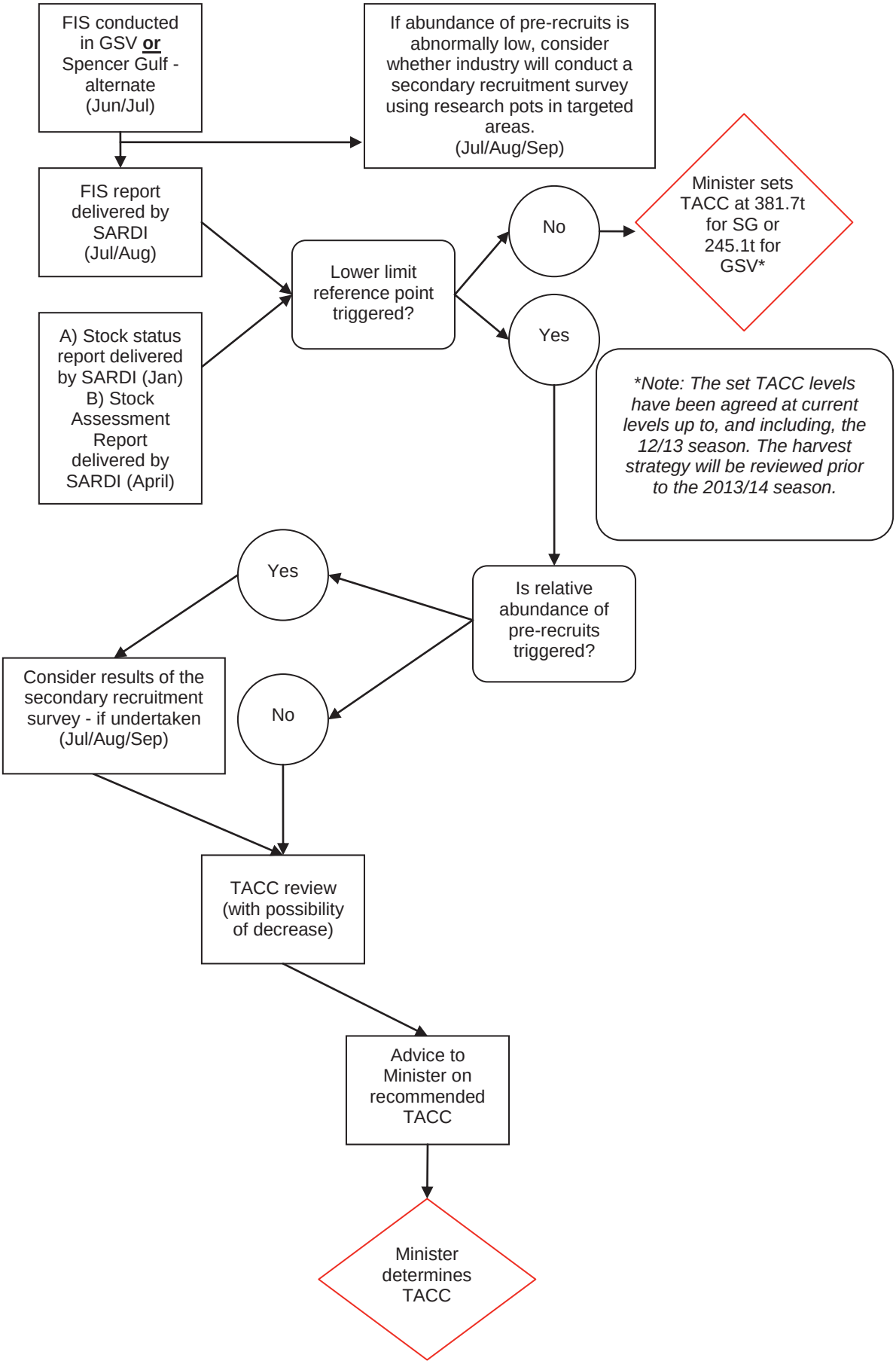

Figure 22. Annual TACC setting process for the Blue Crab Fishery

9.6 Reference Points for Fishery Independent Surveys (FIS)

PIRSA and the SABCPFA agreed that this harvest strategy would not provide for an increase in the TACC above 626.8 tonnes. Instead, the option to conduct a bi-annual FIS has been incorporated into this management plan. In the event that the 10-year average of pre-recruit abundance is exceeded for either gulf, PIRSA and the SABCPFA will consider omitting the FIS in that gulf the following year (Figure 22 and Figure 23). Average pre-recruit abundance for Spencer Gulf is 5.33 crabs/potlift and for Gulf St Vincent is 4.45 crabs/potlift. At a minimum the FIS is required to be undertaken bi-annually in each gulf. The decision to remove a survey will also take into account the following:

- Updated fishery catch and effort information
- Daily pot sampling data
- Fishery data at a finer spatial and/or temporal scale
- Any changes to fisher habits/ability
- Any major environmental changes

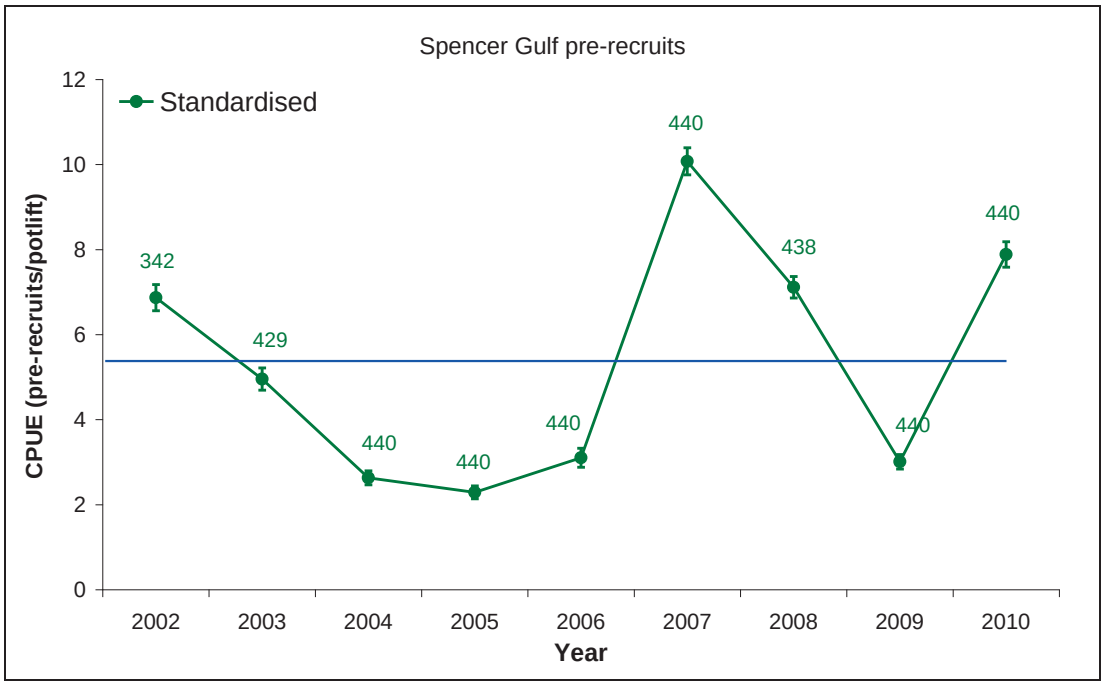

Figure 23. Relative abundance of pre-recruit crabs in Spencer Gulf. Blue line is the standardised average = 5.33 crabs/pot lift

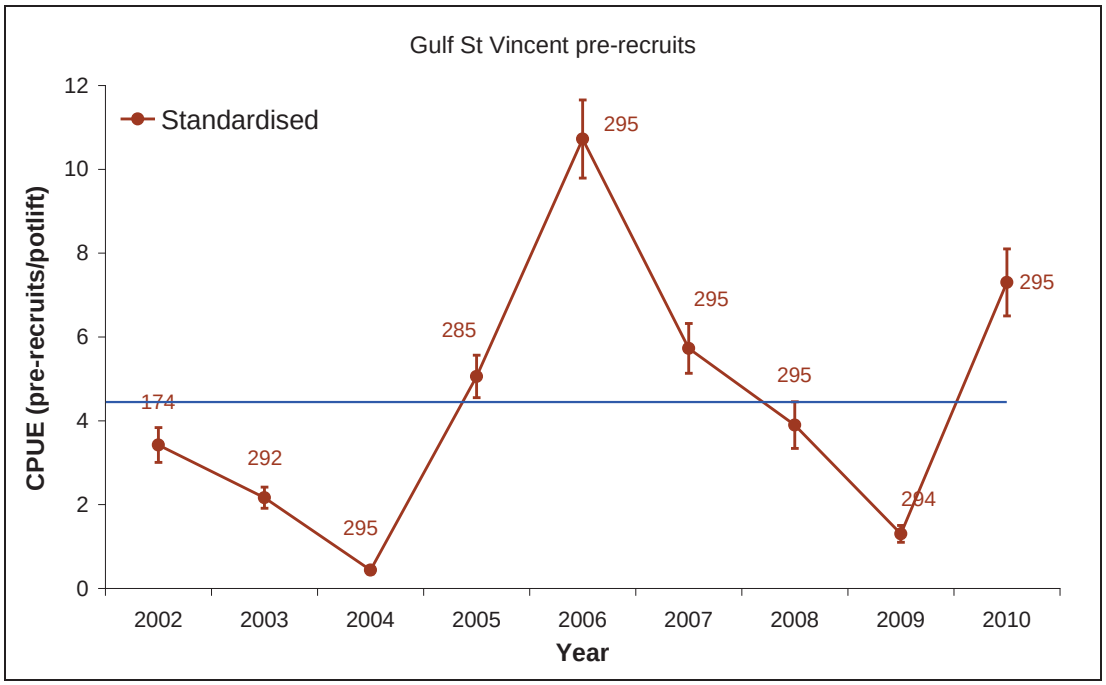

Figure 24. Relative abundance of pre-recruit crabs in Gulf St. Vincent. Blue line is the standardised average = 4.45 crabs/pot lift

Table 6. Summary of management goals, objectives, strategies, performance indicators and reference points for the Blue Crab Fishery

Goal	Objective	Strategies	Addressing Risk	Performance Indicator	Description	Limit Reference Point
Goal 1 Ensure the Blue Swimmer Crab resource is harvested within ecologically sustainable limits	1a Maintain the stock within sustainable limits in accordance with performance indicators.	1a(i) Set the TACC annually, in accordance with the harvest strategy. 1a(ii) Ensure other input and output controls support sustainable use of the resource.	Blue Swimmer Crab – Spencer Gulf population Blue Swimmer Crab – Gulf St Vincent population Management effectiveness	Relative abundance of pre-recruit crabs from FIS (crabs/potlift)	Fishery-independent estimate of abundance for pre-recruit (undersize) crabs provides the best indicator of biomass for future seasons, across the area of the fishery.	SG: 2 crabs per pot lift GSV: 1.5 crabs per pot lift
				Relative abundance of legal-sized crabs from FIS (crabs/potlift)	Fishery-independent estimate of abundance for legal size crabs across the area of the fishery during the year it was measured.	SG: 5 crabs per pot lift f GSV: 1.5 crabs per pot lift f
				Commercial CPUE (kg/potlift) of legal-sized crabs using fishery-dependent commercial logbook data.	Trends in fishery-dependent data recorded throughout the fishing season may provide indicator of abundance from year to year.	SG: 2 kg per pot lift GSV 2kg per pot lift
				Total commercial catch vs. TACC	Total commercial catch is restricted by the annual TACC, under the quota management system. A significant shortfall in the total commercial catch may indicate low abundance.	95% of the TACC is taken.
				Mean size of legal size crabs in commercial catches and fishery-independent surveys	Used in conjunction with abundance information, mean size of legal size crabs can provide insight into the level of fishing mortality on the stock.	Monitored annually and reported in stock assessment
				Mean size of pre-recruit crabs in commercial catches and fishery-independent surveys	Used in conjunction with abundance information, mean size of pre-recruit crabs can aid assessment of recruitment strength.	Monitored annually and reported in stock assessment
				Commercial CPU (kg/day) of legal-sized crabs using fishery-dependent commercial logbook data.	Trends in fishery-dependent data recorded throughout the fishing season may provide indicator of abundance from year to year.	Monitored annually and reported in stock assessment
	1b Collect biological and environmental information to inform management decisions based on the performance indicators specified in this	1b(i) Collect fishery-dependent information through commercial logbooks and a pot sampling program. 1b(ii) Conduct regular fishery-independent surveys to collect data on the spatial abundance and sizes of Blue Swimmer Crabs in SG and GSV during	Research/information Blue Swimmer Crab – Spencer Gulf population Blue Swimmer Crab – Gulf St Vincent	Licence holder participation in daily pot sampling program Fishery-independent surveys undertaken at least bi-annually for	Good quality temporal data on the abundance of pre-recruit crabs (as an indicator of recruitment biomass) is vital to building a robust suite of fishery data.	100% participation in voluntary pot sampling program on 95% of fishing days

Goal	Objective		Strategies		Addressing Risk	Performance Indicator	Description	Limit Reference Point
		management plan.		winter.	population	each quota zone (considering reference points for FIS) Annual fishery stock assessment reports published		
			1b(iii)	Assess the status of the stock through stock assessment.				
			1b(iv)	Review and update the strategic research and monitoring plan tri-annually.				
			1b(v)	Communicate research and information on the commercial fishery to the broader community.				
	1c	Minimise non-fishery impacts on the Blue Swimmer Crab resource.	1c(i)	Influence other management processes that impact on the ecologically sustainable development of the fishery.	Water quality			
Goal 2 Allocate access to Blue Swimmer Crab resources to achieve optimum utilisation and equitable distribution to the benefit of the community	2a	Maintain the stock at or above a level that will support commercial catch rates within the historical range.	2a(i)	Set the TACC annually, in accordance with the harvest strategy.	Profit	Standardised catch rate (CPUE) of legal-sized crabs using fishery-dependent commercial logbook data.	Commercial fishers need to maintain catch rates in order to maximise economic efficiency.	SG: > 2 kg per pot lift GSV: > 2 kg per pot lift
	2b	Maintain a flow of economic benefit from the fishery to the broader community.	2b(i)	Develop and implement management arrangements that allow commercial operators to maximise operational flexibility, economic efficiency, value and returns.	Profit Employment Asset value Economic drivers	Economic indicators are monitored and reported annually Gross Value of Production (GVP) Cost price squeeze Profitability Total economic impact Total Gross State Product Level of full-time equivalent employment provided by the fishery Economic rent	GVP is the total catch valued at the landed beach price. Used to determine whole fishery value. Price and cost indices indicators are derived from the nominal average price and average cost per kilogram of catch. Total economic impact refers to the direct fishing industry impacts (fishing, processing, etc.) and the indirect impacts on other sectors of the economy. Economic rent is the difference between the price of a good produced using a natural resource and the unit costs of turning that natural resource into the good including the opportunity cost of capital.	

Goal	Objective	Strategies	Addressing Risk	Performance Indicator	Description	Limit Reference Point
				Gross operating surplus	Gross operating surplus gives an indication of the capacity of the operator to remain in the fishery in the short to medium term.	
				Profit at full equity	Profit at full equity is a measure of the profitability of licence holders in the fishery.	
				Licence value		
				Value of quota units		
		2b(ii) Industry to maintain adherence to existing occupational health, safety and welfare requirements and procedures.	Occupational health, safety and welfare			
		2b(iii) Develop and maintain positive relationships with the regional communities in the area of the fishery.	Relationships with community			
		2b(iv) Communicate positive sustainability and economic outcomes of the fishery to the broader community.				
	2c Equitable public access and recreational fishing opportunities.	2c(i) Maintain commercial catch limits within the allocation framework.	Allocation			
		2c(ii) Undertake recreational survey to estimate catch and effort every five years.				
	2d Recognise Aboriginal traditional fishing access.	2d(i) Integrate any traditional fishing access prescribed in Aboriginal traditional fishing management plans with the management of the commercial, charter and recreational sectors.	Allocation			
	2e Sufficient economic information to ensure management decisions are properly informed based on the performance indicators specified in this management plan.	2e(i) Undertake economic surveys of the commercial fishery to assess economic performance against a set of economic indicators.	Profit Asset value Research/information Compensation (other agencies) Economic drivers Access	Delivery of annual economic indicator reports assessing annual economic performance of the fishery		

Goal	Objective		Strategies		Addressing Risk	Performance Indicator	Description	Limit Reference Point
	2f	Shares of access to Blue Swimmer Crabs explicitly allocated between Aboriginal, commercial, charter and recreational sectors.	2f(i)	Develop mechanisms for adjusting shares in the future that utilise market tools, in accordance with the *Fisheries Management Act 2007*.	Allocation Compensation (other agencies) Access security Access			
			2f(ii)	Integrate any traditional fishing access prescribed in Aboriginal traditional fishing management plans with the management of the commercial and recreational fishing sectors.				
Goal 3 Minimise impacts on the ecosystem	3a	Minimise fishery impacts on bycatch species and the ecosystem.	3a(i)	SABCPFA to develop industry code of conduct for fishing operations to reduce the risk of translocation of exotic aquatic plants and animals.	Addition/movement of biological material caused by translocation	Code of conduct developed to address risks posed by translocation of *Caulerpa taxifolia*	*Caulerpa taxifolia* is a marine alga that has been associated with biological invasions with negative environmental and economic effects.	
			3a(ii)	SABCPFA to develop industry strategy to increase efficiency of the fleet in order to reduce greenhouse gas / carbon emissions and document industry progress.	Air quality - greenhouse gas / carbon emissions	Industry strategy developed for increasing efficiency of fleet Industry progress documented	The industry recognises it will need to be able to demonstrate its impact on the environment in the future as industries everywhere become more accountable for their energy use.	
			3a(iii)	Maintain compliance with existing regulations and procedures to minimise risk of oil discharge in the fishery.	Water quality - oil discharge	Number of reported breaches of regulations	The *Pollution of Waters by Oil and Noxious Substances Act 1987* relates to the protection of the sea and certain waters from pollution by oil and other noxious substances.	
			3a(iv)	Maintain a limit on the quota unit to pot ratio used in the commercial fishery.				
			3a(v)	Maintain minimum mesh size for pots to minimise bycatch of undersized crabs and other non-target species.				
			3a(vi)	Continue using commercial logbook returns to collect information on bycatch.				
			3a(vii)	Manage the take of key by-product species to ensure that catches remain at very precautionary levels.				
	3b	Avoid the incidental mortality of endangered, threatened and protected species.	3b(i)	Continue and improve commercial data recording systems to capture fishing interactions with endangered, threatened and protected		Wildlife interaction logbooks completed and submitted	All commercial fishery licence holders are required to complete and submit wildlife interaction logbooks to report any interactions with threatened, endangered or protected species	

Goal	Objective	Strategies	Addressing Risk	Performance Indicator	Description	Limit Reference Point
		species.				
		3b(ii) Develop management measures to avoid interactions with endangered, threatened and protected species should any new issues arise in the fishery.				
Goal 4 Cost effective and participative management of the fishery	4a Cost-effective and efficient management of the fishery, in line with government's cost recovery policy.	4a(i) Develop and implement management arrangements that are effective at achieving management objectives and optimising costs.	Management effectiveness Economic drivers	Fee per licence holder Licence fees as a proportion of GVP Proportion of total cash costs	Licence fees include the costs of management, compliance and research. A breakdown of major cost items as a proportion of total cash costs.	
		4a(ii) Determine the annual real costs of management, research and required costs of compliance for the fishery.				
		4a(iii) Recover licence fees from commercial licence holders, sufficient to cover the attributed costs of fisheries management, research and compliance of the commercial fishery in accordance with the Government's cost recovery policy.				
		4a(iv) Develop options for greater co-management by the commercial sector.	Compensation (other agencies)			
		4a(v) Influence other management processes that impact on the ecologically sustainable development of the fishery and access security.	Access security Water quality Access			
	4b Management arrangements reflect concerns and interests of the wider community.	4b(i) Promote stakeholder input to the management of the fishery, through co-management processes and communication strategies.	Management effectiveness			
		4b(ii) Ensure that social and cultural issues are given appropriate consideration when new management strategies are being developed.				
		4b(iii) Communicate management arrangements to the wider community.				
	4c Compliance with management arrangements.	4c(i) Undertake annual compliance risk assessment as part of the master operational planning process.	Blue Swimmer Crab – Spencer Gulf population	Compliance risk assessment undertaken annually		

Goal	Objective	Strategies	Addressing Risk	Performance Indicator	Description	Limit Reference Point
		4c(ii) Develop a model for determining a quantifiable level of monitoring in the fishery to achieve optimum compliance in a cost-effective way. For example, determine a percentage of landings that should be monitored per year. 4c(iii) Review existing quota monitoring arrangements. 4c(iv) Develop and implement management arrangements that are clear and uncomplicated so as to promote voluntary compliance and assist with successful enforcement. 4c(v) Where possible, develop and implement licensing, compliance and monitoring arrangements that are consistent with other fisheries to reduce administrative costs. 4c(vi) Investigate methods to quantify illegal recreational catch. 4c(vi) Encourage the community to report fisheries offences to FISHWATCH.	Blue Swimmer Crab – Gulf St Vincent population Management effectiveness			

10 EXPLORATORY AND DEVELOPMENTAL FISHING

10.1 Permits for research fishing

Some research activities are undertaken as part of a commercial enterprise, where the fish caught as part of the research fishing are sold for the purposes of funding the research. Regulations under the *Fisheries Management Act 2007* have provisions to issue permits for research activities with a commercial element. Other non-commercial research activities are authorised by exemption.

Broodstock and seedstock collection is the taking of aquatic resources or part of resources for the purposes of commercial aquaculture. Only low levels of this type of activity are permitted. Large scale collection must be done under a fishery licence by arrangement between a fishery licence holder and aquaculture licence holder on a commercial basis. If the species is part of an existing commercial fishery, broodstock and seedstock collection activities will be considered through a permit system under the Act.

10.2 Exploratory and developmental fishing

Applications for exploratory and developmental fishing for species that are not part of the Blue Crab Fishery are dealt with under the Exploratory and Developmental Fishing Policy and regulations under the *Fisheries Management Act 2007*. These applications are addressed on a case by case basis.

11 STOCK ASSESSMENT AND RESEARCH

11.1 Research services

PIRSA contracts research services for each fishery. SARDI Aquatic Sciences is currently the primary research provider for core research for the Blue Crab Fishery.

11.2 Data collection and analysis

11.2.1 Previous Related Research

The first report on the South Australian Blue Crab Fishery was published in 1987 by the South Australian Department of Fisheries (Grove-Jones, 1987). The fishery was later reviewed in 1994 by Baker and Kumar (1994). SARDI completed the first stock assessment report for the fishery in 1998, and has since provided annual reports (Kumar, *et al.,* 1998; Kumar, *et al.,* 1999a; Kumar *et al.,* 1999b; Boxshall, *et al.,* 2000; Boxshall, *et al.,* 2001; Hooper and Svane, 2003; Svane and Hooper, 2004; Currie and Hooper, 2006; Currie *et al.*, 2007, Dixon *et al.*, 2008, Dixon and Hooper, 2009). The Proceedings of the First National Workshop on Blue Swimmer Crab were published in 1997 (Kumar *et al.,* 1997).

Initiated by the Fisheries Research and Development Corporation (FRDC), the Centre for Research on Ecological Impacts of Coastal Cities at the University of Sydney completed an independent review into the research needs of the fishery in February 2001. This report, which was done in consultation with stakeholders, includes comments on the sampling issues for Ecological Sustainable Development (ESD) outcomes, and provides a research review, short-term monitoring advice, and recommendations for a five-year research program (Scandol and Kennelly, 2001).

A more recent FRDC report (Svane and Cheshire, 2005), reviewed the biology of Blue Swimmer Crabs and the key biological determinants for the fishery. This report also provides information on the geographical patterns of post-settlement in juvenile crabs.

11.2.2 Fishery-Dependent Data

Commercial logbooks

Catch and effort information forms the basis for decision-making in relation to the biology of the fishery. Daily catch and effort returns are completed and submitted monthly by registered masters in accordance with the regulations.

SARDI Aquatic Sciences maintains a comprehensive catch and effort database for the fishery using data collected from the compulsory fishing logbook system. To simplify reporting, each gulf is divided into a series of administrative fishery blocks. Data provided include: fishing block, depth, effort, catch weight and catch abundance. The logbook system is also used to collect biological data, including the number of undersized crabs, berried females and the sex-ratio of the catch. These data were first obtained in the 1996/97 fishing season. Historical data from the fishery were recorded into the GARFIS catch and effort database of the South Australian Fisheries Department from 1983/84 (Dixon and Hooper, 2009).

All licence holders in South Australian commercial fisheries are required to record all

interactions with threatened, endangered and protected species using a 'wildlife interaction' logbook.

Daily pot sampling data

The aim of pot sampling is to collect fishery-dependent data on abundance and size composition throughout the fishing season to compliment Fishery-Independent Survey (FIS) data on recruitment strength and sex-ratio.

Pot sampling data has been collected since May 2006 in Spencer Gulf and since July 2006 in Gulf St Vincent. Sampling was voluntarily undertaken from one small mesh pot and one commercial pot each fishing day. Since May 2008, data has been collected from small mesh pots only in each gulf. Data collected includes: date, licence number, fishing block, GPS co-ordinates of pot locations, depth, water temperature, and the sex and size of individual crabs (Dixon and Hooper, 2009).

The industry has committed to completing pot sampling data on every day of fishing in order to improve the quality of this data over the next five years. It is hoped that the results of this sampling will inform the fishery's research strategy, the review of this plan and provide useful fishery-dependent information on pre-recruit abundance for inclusion as another key performance indicator in the harvest strategy of the next management plan.

11.2.3 Fishery-Independent Survey Data

Fishery-independent surveys (FIS) for the Blue Crab Fishery have been conducted on an annual basis during June/July since 2002. The primary aim of the survey was to collect data on the spatial abundance and size composition of Blue Swimmer Crabs in Spencer Gulf and Gulf St Vincent during winter, when juvenile crabs generally recruit to the fishery.

The timing of surveys in Spencer Gulf was variable, particularly between 2002 and 2005. Whilst most surveys were conducted in June and early July, surveys were held in late July to early August in 2003 and were extended throughout the month of July in 2005. In Gulf St Vincent, surveys were conducted in July from 2002 to 2004, and June thereafter.

The surveyed area covers waters with depths ranging from 3 m to 22 m northwards of a line from Wallaroo to Cowell in Spencer Gulf and northwards of line from Glenelg to Port Vincent in the Gulf St Vincent. Sampling sites were determined based on fisher experience and historical catch and effort data. From these recommendations, four sites were selected in each fishing block to be surveyed.

Prior to the 2008 survey, the location of survey sites was modified by SARDI, PIRSA and Industry to provide a more accurate representation of the Blue Swimmer Crab biomass in each gulf. These changes included: removal of all sites from some fishing blocks; addition of new sites within previously unsurveyed fishing blocks, and; movement of sites within fishing blocks (Dixon and Hooper, 2009).

At each site, both commercial crab pots and small mesh pots were set and hauled on a daily basis. Commercial pots have a diameter of 1.2-1.4 m, a height of 50 cm, and are covered with a 90 mm mesh. Small mesh pots, designed specifically for surveys, have a diameter of 1.4 m, a height of 50 cm, and a smaller mesh covering of 55 mm. At each survey site, five sets of gear were deployed along a line, each comprising one commercial and one small mesh pot. Each pot was separated by 40 m of rope and

each set of gear spaced 150 m apart. Pots were baited with fresh Australian salmon or striped trumpeter, and were hauled from dawn each day.

A global positioning system (GPS) was used to locate the gear, and depth was recorded for each site. Blue Swimmer Crabs were measured using Vernier callipers (carapace width, mm), and details of sex (male or female) and condition (dead, soft, berried) were recorded. Data on by-catch species was collected during the survey, however they are not presented in this report. An assessment of by catch data from 2002 to 2006 was presented in Currie *et al.* (2007) (Dixon and Hooper, 2009).

11.3 Reporting

Two types of reports are prepared and delivered periodically for the Blue Crab Fishery:

1. Fishery-independent survey (FIS) report. This is a survey report that summarises survey results for each gulf each season published in August each year. It includes early indications of fishery-independent measures of pre-recruit abundance and legal size abundance, which are required to make decisions in accordance with the harvest strategy in this management plan (refer to section 9).

2. Stock assessment report. This is a major report that is published annually and documents, analyses and interprets the available data and assesses the South Australian Blue Crab Fishery against the performance indicators identified in this management plan. It formally provides the information required to make decisions in accordance with the TACC decision rules provided in the harvest strategy of this management plan (refer to section 9). This report is delivered to an industry forum each year.

11.4 Strategic research plan

During the first five years of this management plan, the commercial Blue Crab Fishery aims to build on its knowledge of the South Australian Blue Swimmer Crab resource and understanding about the impacts of the fishery on the resource.

The key strategic research priorities for the Blue Crab Fishery are:

- More robust data on the abundance of pre-recruit and legal sized crabs, through an improved fishery-independent survey
- More robust data on the abundance and distribution of pre-recruit crabs, which will be collected through the daily pot sampling program
- Movement of Blue Swimmer Crabs within Gulf St Vincent and Spencer Gulf
- Finer spatial scale management
- Understanding of environmental drivers
- Relationship between recreational fishing behaviour and abundance variability of Blue Swimmer Crabs

The research program for the fishery will be comprehensively reviewed after this management plan has been in place for five years.

12 COMPLIANCE AND MONITORING

12.1 Objectives

PIRSA runs a compliance program that has dual objectives:

- To maximise voluntary compliance with fisheries rules[7]
- To create effective deterrence to breaching fisheries rules

These objectives are consistent with the National Fisheries Compliance Policy.

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

Effective deterrence is created through the presence of Fisheries Officers and awareness of compliance operations, as well as through detection and prosecution of illegal activity. [8]

12.2 Cost recovery

The costs of the compliance program are funded in two ways. The costs attributed to the commercial sector are currently recovered from licence holders through licence fees. This is done in accordance with the Government's cost recovery policy for fisheries. PIRSA and industry associations are involved in annual negotiations in relation to the proposed compliance program.

The compliance program directly related to the Blue Crab Fishery is currently funded by the Blue Crab Fishery through licence fees. The costs attributed to non-commercial sectors are funded by the South Australian Government from consolidated revenue.

12.3 Planning

PIRSA compliance programs are developed on an annual basis to:

- support the fisheries management objectives for each fishery
- identify emerging compliance risks in each fishery
- respond to key risks within each three year period
- have an appropriate mix of tools designed to maximise voluntary compliance and create effective deterrence
- establish benchmarks against which to measure responses to risks

[7] Rules include regulations, licence conditions, closure notices or any other enforceable instrument under the *Fisheries Management Act 2007*.
[8] Prosecution may include the issuing of a formal caution or an expiation notice, in addition to prosecution through the courts.

12.4 Risk assessment

A risk assessment is reviewed on an annual basis for each fishery. This assessment identifies and prioritises the compliance risks that exist in the fishery. Risks are ranked according to the likelihood and consequence of the risk occurring.

This risk assessment is used to inform annual compliance planning processes.

The risk assessment for the Blue Crab Fishery is scheduled to be conducted in November each year, prior to the commencement of the cost recovery cycle in February of the following year. The risk assessment process will involve industry representatives.

12.5 Responses and benchmarks

Compliance activities are planned to respond to the risks identified in each fishery, with an emphasis on the most serious risks. Responses must include measures aimed at both maximising voluntary compliance and creating effective deterrence.

Benchmarks are established by which to measure compliance activities. These benchmarks are used to guide the allocation of resources in compliance planning.

12.6 Compliance plans

Compliance plans are developed each year for the Blue Crab Fishery and are implemented for the full financial year.

12.7 Compliance reporting

Every year a report is to be prepared assessing the compliance status of the Blue Crab Fishery. This report will:

- Describe the compliance program for the previous year including an overview of activities and relevant statistics
- Describe how the program has been implemented to achieve both voluntary compliance and create effective deterrence
- Describe the risks that have been addressed as a priority over that period
- Comment on any changes to the risk profile of the fishery during that period
- Analyse the compliance status of the fishery (including information about intelligence reports received)
- Make suggestions for future compliance planning

In addition to the yearly report, quarterly reports will be provided to the industry to capture any emerging compliance trends for the Blue Crab Fishery.

13 REGULATORY ARRANGEMENTS

Regulatory arrangements for the Blue Crab Fishery are contained within the *Fisheries Management (Blue Crab Fishery) Regulations 1998*, *Fisheries Management (Marine Scalefish Fisheries) Regulations 2006* and the *Fisheries Management (General) Regulations 2007.* Any amendments to the above regulations could change the regulatory arrangements listed in this section. Appropriate consultation will be undertaken should that occur.

In relation to licences, the Minister reserves the right to amend licence conditions and entitlements for the Blue Crab Fishery if required to meet sustainability objectives of the *Fisheries Management Act 2007* and/or in this plan through the term of the plan.

In addition, the Fisheries Council of South Australia is currently undertaking a review of the rules and regulations under the Act (the Rules Review) in order to standardise and simplify the number of rules imposed across all fisheries. The Minister reserves the right to amend licence conditions and entitlements as a result of the outcomes of the Rules Review, including the gear review component.

13.1 Licensing

13.1.1 Issue of licences

Access to the commercial Blue Crab Fishery is provided through a licence for the Blue Crab Fishery or the Marine Scalefish Fishery. Licences are endorsed with quota units for either the Gulf St Vincent zone or Spencer Gulf zone. Licences are issued for a period of five years under this management plan.

In 2008/09 there were nine Blue Crab Fishery licences - four licences with quota entitlements for the Gulf St Vincent zone and five licences with quota entitlements for the Spencer Gulf zone. However, these numbers may change in the future if other Marine Scalefish Fishery licences are forfeited for Blue Crab Fishery (pot) licences. In 2008/09 the pot sector held 99% of the quota units in the fishery. In 2008/09 there were two Marine Scalefish Fishery licences with quota entitlements for the Gulf St Vincent zone and one with quota entitlements for the Spencer Gulf zone.

13.1.2 Transferability

Blue Crab Fishery licences and quota entitlements are fully transferable. Quota units may also be transferred between Blue Crab Fishery and the Marine Scalefish Fishery licences.

13.1.3 Registered masters

A maximum of five masters may be registered on a Blue Crab Fishery licence at any one time.

13.1.4 Registered boats

The number of boats that may be registered on a Blue Crab Fishery licence at any one time is not restricted; however only one boat may fish pursuant to a Blue Crab Fishery licence at any one time.

13.1.5 Registered devices

Blue Crab Fishery licence holders use crab pots to trap their catch. Crab pots used by the commercial fishery must have a maximum diameter of 2 m, and height of up to 65 cm, and minimum mesh size of 75 mm.

The total number of pots each Blue Crab Fishery licence holder may use is directly related to the number of quota units endorse on the licence. This pot to quota unit ratio varies between areas. One pot may be used for every 12.5 quota units in Spencer Gulf and one pot may be used for every 11.5 quota units in Gulf St Vincent. These ratios will continue to be reviewed as consideration is given to allowing fishers to maximise efficiency in the fishery.

Blue Crab Fishery licence holders (pot fishers) generally fish in waters deeper than those fished by marine scalefish net fishers and recreational fishers. The ability to access deeper water provides for an extended season as they can access the stocks in waters where they continue to be caught during the cooler months. Pot fishers have developed their operations to make effective use of relatively high catches in order to produce higher returns from the resource. Vessels operating commercial pot licences generally have a skipper and one or two deckhands aboard, with most operators lifting pots on a daily basis.

Bait nets are also permitted to be used by licence holders. These nets may be up to 150 m in length and have a mesh size of between 30 mm and 150 mm.

Marine Scalefish Fishery licence holders may also hold blue crab quota but can only fish using crab nets (i.e. drop nets or hoop nets), which are hauled every 20–30 minutes. Marine scalefish fishers may also take Blue Swimmer Crabs from specified waters on the west coast; however this region is not subject to the quota management system. Seasonal variations in the abundance of Blue Swimmer Crabs present in this area have historically been dependent on water temperature and salinity. A combined maximum of 10 drop and hoop nets can be used at any one time.

13.2 Management arrangements

The Blue Crab Fishery has been managed under a system of individual transferable quota since 1996. The fishery is managed in two separate zones (Spencer Gulf zone and Gulf St Vincent) with separate quota units for each zone. The total allowable commercial catch (TACC) is set each year, based on the TACC decisions rules in this management plan.

When the Blue Crab Fishery was established in 1996, minimum quota unit holdings were established for Marine Scalefish Fishery licences in order to encourage the efficient use of the resource. These minimum holdings remain at 19 units for original participants who were granted access to the fishery in 1996 and 80 units for all other licence holders.

In 2002, management arrangements were introduced to allow Marine Scalefish Fishery licence holders with blue crab quota to enter the pot fishery. This required forfeiture of the Marine Scalefish Fishery licence in exchange for a Blue Crab Fishery licence. The purpose of implementing this arrangement was to provide the opportunity for those licence holders to expand their Blue Swimmer Crab fishing operations into the Blue Crab Fishery with the higher catching efficiency of crab pots.

The quota management system is monitored through catch disposal records (CDR). CDR forms are formally used to decrement quota, and are submitted by fishers at the time of weighing and consigning the catch.

A commercial closed season and gear restrictions apply. There are a number of commercial area closures in Spencer Gulf. Berried females are protected and minimum size limits are also in place for both the recreational and commercial fisheries. These management measures are summarised in Table 7.

Table 7. Summary of current management controls for the commercial Blue Crab Fishery

Management Tool	Management Arrangement
Minimum legal size limit	11 cm carapace length measured from side to side at the base of the largest spines.
Berried females	Fully protected
Catch limit	Individual transferable quota system 626.8 tonne TACC
Seasonal closures	SG: 21 Dec to 19 Feb GSV: 1 Nov to 15 Jan
Closed areas	SG: Upper Spencer Gulf, Whyalla and Port Broughton / Fishermen's Bay
Gear restrictions	SG: 1 pot per 12.5 quota units GSV: 1 pot per 11.5 quota units Crab pot dimensions: max. height of 650 mm, max. diameter of 2 m; min. mesh size of 75 mm or an escape panel that has min. mesh size of 75 mm and is at least 700 mm by 300 mm. Crab net dimensions: max. diameter of 150 cm; max. net extension 30% of hoop diameter; min. mesh size at base of 3 cm. Bait net: max. length 150 m; mesh size between 30 mm and 150 mm.

13.3 Fish processing

The Act and the *Fisheries Management (Fish Processor) Regulations 2007* set out the requirements for registration as a fish processor.

14 REVIEW OF PLAN

A review of this management plan may be conducted at any time and a full review of the Blue Crab Fishery will be conducted in the 12 months prior to the expiry of this plan. The harvest strategy of this management plan will be reviewed after three years of its operation.

Under the *Fisheries Management Act 2007* management plans are subject to periodic review by the Fisheries Council. Section 49 of the Act outlines the process of reviewing a management plan:

49—Review of management plans

(1) The Council may review a management plan at any time.

(2) The Council must, as soon as practicable after the fifth anniversary of the commencement of a management plan, conduct a comprehensive review of the plan for the purpose of determining whether the plan should be amended, replaced or reinstated without amendment.

(3) The Council must submit a report on the outcome of a review under this section to the Minister within 12 months after the commencement of the review.

(4) The Minister must, within 12 sitting days after receiving a report under this section, cause copies of the report to be laid before both Houses of Parliament.

(5) If a report under this section recommends that a management plan should be reinstated without amendment on its expiry, the plan may be so reinstated without following the procedures set out in section 44.

(6) If a plan is to be reinstated under this section, the Minister must—

(a) adopt the plan; and

(b) cause notice of that fact to be published in the Gazette; and

(c) in the Gazette notice adopting the plan, fix a date on which the plan will take effect.

15 RESOURCES REQUIRED TO IMPLEMENT THE PLAN

15.1 Cost recovery - Overview

South Australian commercial fisheries operate in accordance with the Government's cost recovery policy, which provides that the costs attributed to the management of the commercial fishery are recovered from industry. Therefore, the costs of policy development, research and compliance programs are 100% cost recovered through legislated licence fees. The commercial fishing industry, through its representative bodies, has a high level of involvement in structuring the relevant policy, compliance and research programs in partnership with PIRSA and its service providers. This is an important facet of co-management in South Australia.

The annual schedule for cost recovery in relation to commercial fisheries includes the following key dates:

Date	Activity	Parties
Sept/Oct	Review long term objectives for fishery and update if necessary. Identify priority outcomes for upcoming financial year.	PIRSA and industry association
October	Develop policy, research and compliance work programs in readiness for discussions (fisheries managers with industry) in November	PIRSA
November	Consult relevant industry associations in relation to proposed programs and reach agreement on these programs. Industry associations to consult with wider industry.	PIRSA and industry association
February	Formal meetings with industry associations to finalise work programs and summarise costs.	PIRSA and industry association
March	Submit proposed licence fees to Minister. Prepare Cabinet submission to amend regulations to prescribe new fees.	PIRSA and government agencies
June	Invoices sent for licence fees.	PIRSA

Further details about the process for developing compliance and research programs are set out in sections 11 and 12 of this management plan.

15.2 Cost recovery – Blue Crab Fishery

PIRSA collects licence fees from Blue Crab Fishery licence holders in accordance with the South Australian Government's cost recovery policy for the management of commercial fisheries. These fees are collected through a base licence fee and an additional fee per unit of quota endorsed on the licence, provided in the *Fisheries Management (Fees) Regulations 2007*.

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17 ACRONYMS

AFMA	Australian Fisheries Management Authority
CPUE	Catch per unit effort
DEH	Department of Environment and Heritage (South Australia)
DENR	Department of Environment and Natural Resources (DENR) (SA)
ESD	Ecologically sustainable development
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FIS	*Fishery-independent survey*
FRDC	Fisheries Research and Development Corporation
ILUA	Indigenous Land Use Agreement
MPA	Marine Protected Area
NRIFS	National Recreational and Indigenous Fishing Survey
PIRSA	Department of Primary Industries and Regions, South Australia
SABCPFA	South Australian Blue Crab Pot Fishers Association Inc.
SARDI	South Australian Research and Development Institute
TEPS	Threatened, endangered and protected species

18 GLOSSARY OF COMMON FISHERIES MANAGEMENT TERMS

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

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

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 fishing sectors.

Aquatic plant An aquatic plant of any species, including the reproductive products and parts of an aquatic plant.

Aquatic reserve An area of water, or land and water, established as an aquatic reserve by proclamation under the *Fisheries Management Act 2007*.

Aquatic resource Fish or aquatic plants.

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

Beach price Price received by commercial fishers at the "port level" for their catch, and is generally expressed in terms of $/kg. Processing costs are not included in the beach price, as processing operations are assumed to occur further along the value chain. The use of beach prices also removes the effect of transfer pricing by the firm if it is vertically integrated into the value chain.

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.

Biological reference point An indicator of the status of an exploited stock and a standard for comparison between years. Two types are often used when sufficient biological data are available: those based on fishing mortality and those based on the sustainability of recruitment. In data poor fisheries, other BPIs related to estimates of relative biomass may be used (i.e. total catch and catch per unit effort). Reference

points can be either desirable targets (target reference points) or minimum biologically acceptable limits (limit reference points).

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

Boat Business Profit Defined as *Gross Operating Surplus* less *Depreciation* less *Owner-operator and Unpaid Family Labour*. Boat Business Profit represents a more complete picture of the actual financial status of an individual firm, compared with GOS, which represents the cash in-cash out situation only.

Boat Capital Capital items that are required by the licence holder to earn the boat income. It includes boat hull, engine, electronics and other permanent fixtures and tender boats. Other capital items such as motor vehicles, sheds, cold-rooms, and jetty/moorings can be included to the extent that they are used in the fishing business. The fishing licence/permit value is included in total boat capital.

Boat Cash Income Defined as *Gross Operating Surplus* less *imputed wages for owner-operator and unpaid family labour*.

Boat Gross Margin *Total Boat Income* less *Total Boat Variable Costs*. This is a basic measure of profit which assumes that capital has no alternative use and that as fishing activity (days fished) varies there is no change in capital or fixed costs.

Boat limit The maximum number of a species that can be legally taken by recreational fishers 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 purpose of trade or business.

Commercial quantity A commercial quantity limit under the *Fisheries Management Act 2007* 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.

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.

Cost of management services Commercial fishery management services will generally include biological monitoring and reporting; policy, regulation and legislation development; compliance and enforcement services; licensing services; and research. Where a commercial fishery operates under full cost recovery, licence fees will be set to cover the cost of managing the fishery or at least the commercial sector's share of the resource. In fisheries where there is full cost recovery, it can be assumed that the cost of providing these management services to the commercial sector will be equal to the gross receipts from licence fees in the fishery. With information on licence fee receipts, GVP, catch and the number of commercial fishers in the fishery, the following indicators can be readily calculated:

- aggregate licence fee receipts for the fishery ($)
- licence fee/GVP (%)
- licence fee/catch ($/kg)
- licence fee/licence holder ($/licence holder)

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 is 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.

Depreciation Depreciation refers to the annual reduction in the value of boat capital due to general wear and tear or the reduction in value of an item over time.

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 Measures of fishing effort (such as hooks per day of fishing) that have been standardised so that the measure is proportional to the fishing mortality rate that the gear(s) impose on the stock of fish. Management measures to limit effective effort imply that the fishing mortality rate is to be limited.

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

Fish An aquatic animal other than an aquatic bird, an aquatic mammal, a reptile or an amphibian.

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.

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.

Gross Operating Surplus (GOS) is defined as *Total Boat Income* less *Total Boat Cash Costs* and is expressed in current dollar terms. GOS may be used interchangeably with the term Gross Boat Profit. A GOS value of zero represents a breakeven position for the business, where *Total Boat Cash Costs* equals *Total Boat Income*. If GOS is a negative value the firm is operating at a cash loss and if positive the firm is making a cash profit. GOS does not include a value for owner/operator wages, unpaid family work, or depreciation.

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

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

Log book An official record (statutory declaration) of catch and effort data made by commercial 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 Management Act 2007* 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.

Owner-operator and Unpaid Family Labour In many fishing businesses there is a component of labour that does not draw a direct wage or salary from the business. This will generally include owner/operator labour and often also include some unpaid family labour. The value of this labour needs to be accounted for which involves imputing a labour cost based on the amount of time and equivalent wages rate. In the above calculations this labour cost can be included simply as another cost so that Gross Operating Surplus takes account of this cost. Alternatively, it can be deducted from GOS to give a separate indicator called Boat Cash Income. Owner-operator and unpaid family labour is separated into variable labour (fishing and repairs and maintenance) and overhead labour (management and administration).

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.

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.

Profit at Full Equity Calculated as *Boat Business Profit* plus *rent, interest and lease* payments. Profit at Full Equity represents the profitability of an individual licence holder, assuming the licence holder has full equity in the operation, i.e. there is no outstanding associated with the investment in boat capital. Profit at Full Equity is a useful absolute measure of the economic performance of fishing firms.

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.

Rate of Return to Capital Calculated as *Profit at Full Equity* divided by *Boat Capital* multiplied by *100*. This measure is expressed in percentage terms and is calculated for an individual licence holder. It refers to the economic return to the total investment in capital items, and is a useful relative measure of the performance of individual firms. Rate of return to capital is useful to compare the performance of various licence holders, and to compare the performance of other types of operators, and with other industries.

Recreational fishing Fishing other than commercial fishing or Aboriginal traditional fishing, 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.

Total Boat Cash Costs (TBCC) Defined as *Total Boat Variable Costs* plus *Total Boat Fixed Costs.*

Total Boat Fixed Costs Costs that remain fixed regardless of the level of catch or the amount of time spent fishing. As such these costs, measured in current dollar terms, are likely to remain relatively constant from one year to the next. Examples of fixed cost include:
• insurance
• licence and industry fees
• office and business administration (communication, stationery, accountancy fees)
• interest on loan repayments and overdraft
• leasing

Total Boat Income (TBI) Term refers to the cash receipts received by an individual firm and is expressed in dollar terms. Total boat income is calculated as catch (kg) multiplied by 'beach price' ($/kg). Total boat income is the contribution of an individual licence holder to the GVP of a fishing sector or fishery.

Total Boat Variable Costs Costs which are dependent upon the level of catch or, more commonly, the amount of time spent fishing. As catch or fishing time increases, variable costs also increase. Variable costs are measured in current dollar terms and include the following individual cost items:
• fuel, oil and grease for the boat (net of diesel fuel rebate)
• bait
• ice
• provisions
• crew payments
• fishing equipment, purchase and repairs (nets, pots, lines, etc)
• repairs and maintenance: ongoing (slipping, painting, overhaul motor)

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.

Yield per recruit Analysis of how growth and natural mortality interact to determine the best size of animals for harvest.

19 APPENDICES

19.1 Appendix 1 - Methodology for ESD risk assessment

The current series of PIRSA ESD performance reports have been prepared to ensure that South Australian fisheries management is both effective and efficient in the context of achieving ESD outcomes. In addition to meeting the statutory requirements of the *Fisheries Management Act 2007*, and national environmental legislation, this approach will also provide the fishing industry, key stakeholders and the broader community with an ongoing opportunity to contribute to and influence fisheries management outcomes.

The reports will also provide the basis for the development of statutory management plans required under the *Fisheries Management Act 2007*. On behalf of the Fisheries Council of South Australia, PIRSA Fisheries has used the comprehensive issue identification and subsequent risk assessment and priority setting process to collaboratively develop more effective management arrangements under the new Act. Where necessary this may include development of fishery specific harvest strategies, and related research and monitoring programs for each of the fisheries assessed.

The issue identification, risk assessment, and reporting process described in detail below, as well as the final report format, is closely based on the National ESD Framework *How To Guide* (see www.fisheries-esd.com), as well as the Department of Fisheries, Western Australia ESD performance reports pioneered by Dr Rick Fletcher and other WA Fisheries staff.

Scope

The ESD report describes 'the contribution of the South Australian commercial Blue Crab Fishery to ESD' in the context of South Australian Fisheries legislation and policy. The report is based on preliminary scoping and issue identification work by PIRSA Fisheries staff in conjunction with Blue Crab Fishery industry representatives. This initial scoping was then refined and validated through a broader stakeholder workshop on 14 May 2009 facilitated by Dr Fletcher.

The scope of the assessment was contained to issues relevant to the commercial Blue Crab Fishery (pot sector). Crab net fishing for Blue Swimmer Crabs by Marine Scalefish Fishery licence holders will be assessed as part of the Marine Scalefish Fishery ESD assessment. The recreational catch of Blue Swimmer Crabs will be assessed separately through an ESD assessment of South Australian recreational fishing.

The assessment process examined an extensive range of issues, risks and opportunities identified by stakeholders during a number of workshops. The identification of issues was informed by the generic ESD component tree approach with each fishery component tree refined specifically for this fishery.

Each major component tree reflects the primary components of ESD, and the ESD report assesses the performance of the fishery for each of the relevant ecological, economic, social and governance issues facing the fishery (Table 1 overpage). The process also identifies where additional (or reduced) management or research attention is needed, and identifies strategies and performance criteria to achieve management objectives to the required standard.

Table 1. Primary ESD Components

Retained Species Non-Retained Species General Ecosystem Impacts	*Ecological Wellbeing*
Community Aboriginal Community	*Human Wellbeing*
Governance External Factors Affecting Performance of the Fishery	*Ability to Achieve*

Overview

The steps followed to complete the ESD Risk Assessment Report for the Blue Crab Fishery are detailed below:

1. A set of "Generic ESD Component Trees" were modified through an iterative process with stakeholders into a set of trees specific to the fishery. This process identified the issues relevant to ESD performance of the fishery under the categories described in Table 1 above.

2. A risk assessment of the identified issues (or components) was completed based on the *likelihood* and *consequence* of identified events that may undermine or alternatively contribute to ESD objectives. This was an iterative process involving managers, scientists, industry and key stakeholders.

3. Risks were then prioritised according to their severity. For higher level risks - where an increase in management or research attention was considered necessary - a detailed analysis of the issue, associated risks, and preferred risk management strategies was completed. For low risk issues, the reasons for assigning low risk and/or priority were recorded.

4. For higher level risks a full ESD performance report was prepared (Section 4 of the Blue Crab Fishery ESD risk assessment report). This was completed in the context of specific management objectives and includes operational objectives, indicators and performance measures.

5. A background report providing context and necessary supporting information about the fishery was also prepared to guide the identification of issues, risks and management strategies. This report includes the history of the fishery and its management, the areas of operation and their biological and physical characteristics, target species and by-product and bycatch species, and other relevant information.

The process is illustrated in Figure1 overpage.

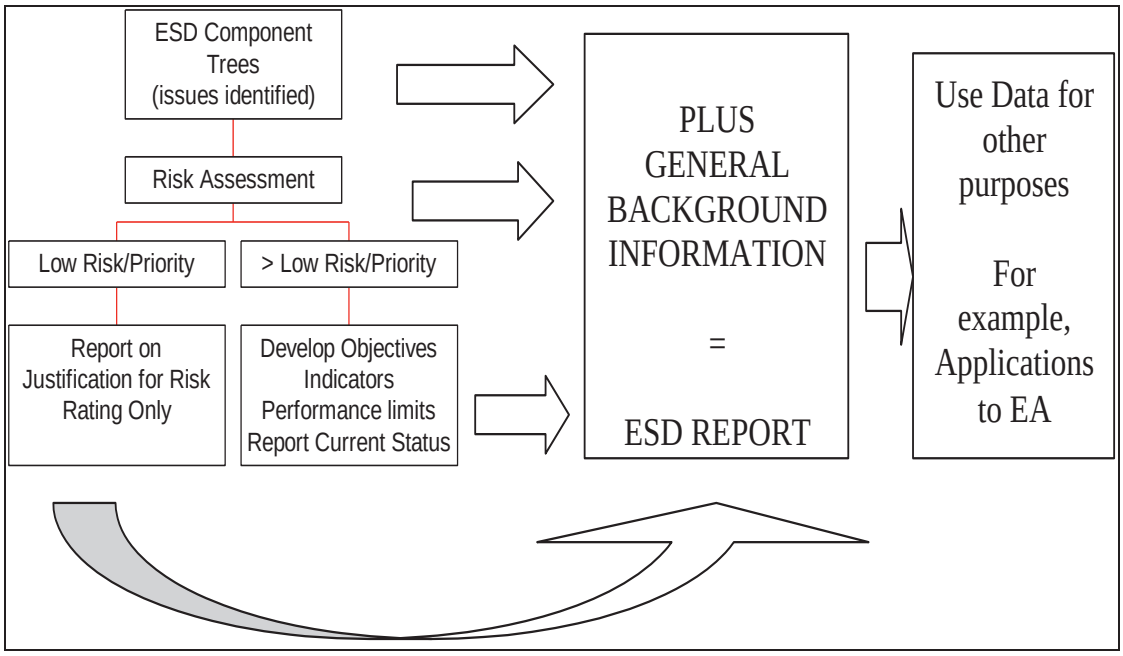

Figure 1. Summary of the ESD reporting framework processes
(Source: ESD Reporting *How To Guide*).

Issue Identification (component trees)

The Blue Crab Fishery ESD reporting component trees provided in the report are a refined version of the generic trees suggested in the National ESD Reporting Framework. The generic trees and the issues that they encompass were the result of extensive consideration and refinement during the initial development of the National Fisheries ESD approach. The trees were designed to be very comprehensive to ensure that all of the conceivable issues facing a fishery would be considered during the workshop process. The fishery specific component trees developed after expert and stakeholder consideration provide a more realistic and practical illustration of the issues facing a particular fishery.

The generic component trees have been used as the starting point to ensure thorough, consistent, and rigorous identification and evaluation of ESD issues across all of the South Australian Fisheries being assessed. When developing each of the major fishery specific component trees, each primary component is broken down into more specific sub-components for which operational objectives can then be developed.

For example, the component tree identifying *external factors affecting ESD performance of the fishery* that was refined during the stakeholder workshop for the Blue Crab Fishery is reproduced in Figure 2 overpage.

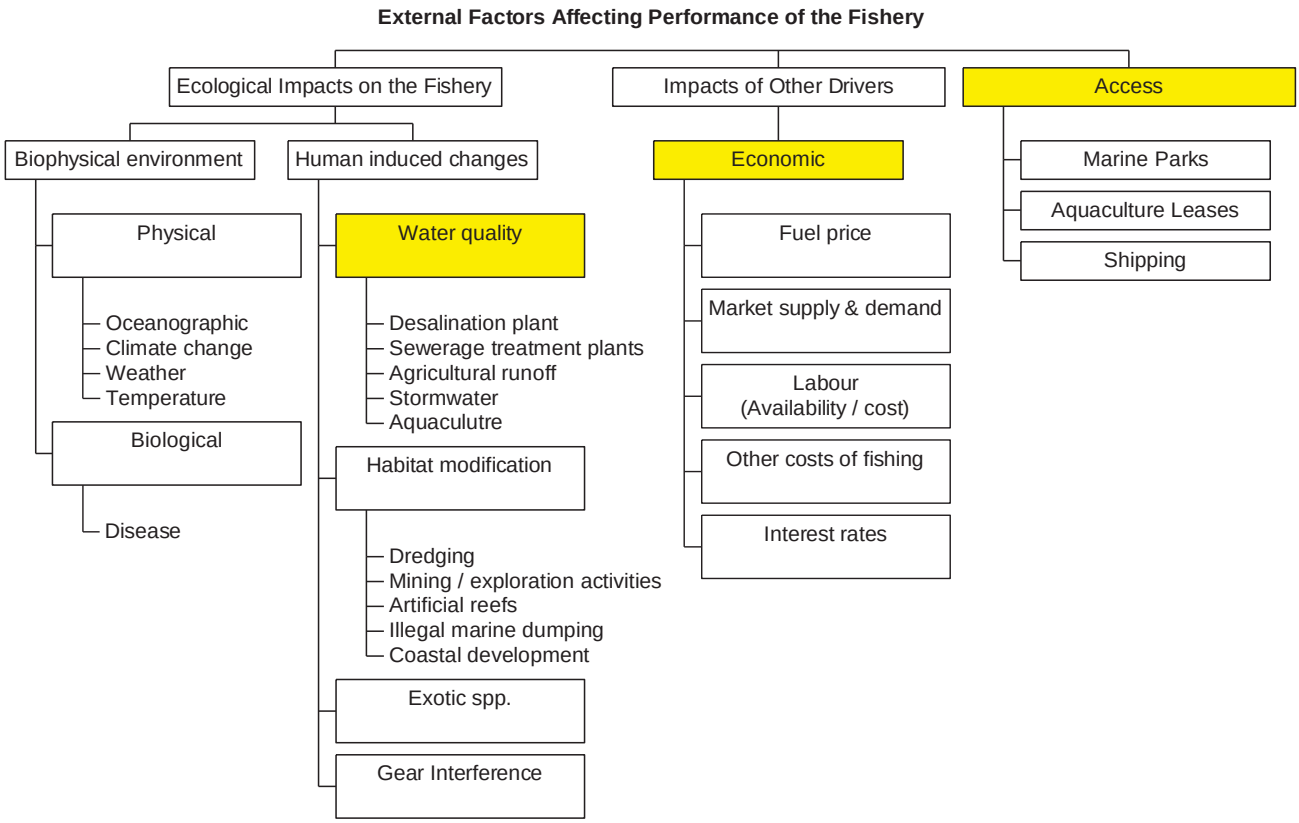

Figure 2. Blue Crab Fishery Component Tree Structure

Risk Assessment and Prioritisation of Issues

Once the fishery specific component trees were developed and reviewed by stakeholders, the focus moved to the assessment and prioritisation of risks and opportunities facing the fishery. These have been considered in the context of the specific management objectives for each fishery being assessed. The higher level management objectives and desired ESD outcomes are those described in the *Fisheries Management Act 2007*. Risks and opportunities are also evaluated against more detailed fishery specific objectives - such as those articulated in the management plan.

The risk assessment of issues identified for the Blue Crab Fishery has been done on the basis of existing management which is currently managing risks to the fishery. Hence the risk assessment conducted during stakeholder workshops considered the residual risk after the existing risk treatments were taken into account. For example, PIRSA's current compliance program for the Blue Crab Fishery is itself based on a separate compliance risk assessment process. This process identifies compliance risks in the context of the fishery's management objectives, and then develops and applies strategies to mitigate those risks. The ESD assessment and reporting process works across the full suite of fishery ESD objectives in a similar way.

Risk assessment applied under the national ESD framework has been designed to be consistent with the Australian Standard AS/NZS 4360:1999 for Risk Management. Subject matter experts and key fishery stakeholders consider the range of potential consequences of an issue, activity, or event (identified during the component tree development process) and how likely those consequences are to occur. The estimated consequence of an event is multiplied by the likelihood of that event occurring to produce an estimated level of risk.

ESD workshop participants worked methodically through each component tree from the top down and conducted a qualitative risk assessment of each issue. An estimate of the consequence level for each issue was made and scored from 0-5, with 0 being negligible and 5 being catastrophic/irreversible (see Appendix 1 for details of the risk consequence tables). The consequence estimate was based upon the combined judgement of workshop participants who had considerable expertise in the issues being assessed.

The level of consequence was estimated at the appropriate scale and context for the issue in question. For the target species (Blue Swimmer Crabs) the consequence assessment was based at the population not the individual level. Killing one crab is catastrophic for the individual but not for the population. Similarly, when assessing possible ecosystem impacts this was done at the level of the whole ecosystem or at least in terms of the entire extent of the habitat, not at the level of an individual patch or individuals of non-target species[1].

The likelihood of that consequence occurring was assigned to one of six levels from remote (1) to likely (6). This was based on a judgement about the probability of the events - or chain of events - occurring that could result in a particular adverse consequence. This judgement about conditional probability was again based on the collective experience and knowledge of workshop participants. See Appendix 1 for details of the likelihood table.

From the consequence and likelihood scores, the overall risk value (Risk = Consequence x Likelihood), was calculated. On the basis of this risk value each issue was assigned a Risk Ranking within one of five categories (see Table 2).

Table 2. Risk ranking definitions

RISK	Rank	Likely Management Response	Reporting
Negligible	0	Nil	Short Justification Only
Low	1	None Specific	Full Justification needed
Moderate	2	Specific Management Needed	Full Performance Report
High	3	Possible increases to management activities needed	Full Performance Report
Extreme	4	Likely additional management activities needed	Full Performance Report

[1] These descriptions, and detailed guidance about developing consequence and likelihood scores for fishery issues are provided in the *ESD How To Guide* at www.fisheries-esd.com.

Where a more detailed and/or quantitative risk assessment and management process was in place for the fishery - such as a robust quantitative stock assessment for a target species - the resultant risk score could be expected to be moderate to low. The risk score in this example reflects the fact that the risk is effectively being managed through existing arrangements.

The national ESD reporting framework suggests that only those issues scored at moderate, high and extreme risk, which require additional management attention, need to have full ESD performance reports completed. This is the approach that has been used in the PIRSA ESD reports. The rationale for scoring other issues as low or negligible risk has also been documented and form part of these reports. This encourages transparency and should help stakeholders to understand the basis for risk scores and the justification for no further management, or for additional management action if necessary. The process is summarised earlier in this section.

Performance Reports for Higher Risk Issues

As noted above, a comprehensive ESD performance report has only been prepared for higher risk/priority issues that require additional management attention (Section 4 of this Blue Crab Fishery ESD Risk Assessment Report). The content of these reports is based on the standard subject headings recommended in the ESD Framework's *How To Guide*.

The full performance report for the Blue Crab Fishery was developed by PIRSA Fisheries and Aquaculture, informed by the initial consultation with industry and then broader stakeholders at PIRSA's Adelaide ESD workshop on 14 May 2009. A preliminary draft ESD report was sent to industry members and other stakeholders for review. The review period was brief due to the short timeframe available to finalise the reports before consideration by the Fisheries Council of South Australia in June 2009.

19.2 Appendix 2 - Overview of the ESD Risk Assessment for the Blue Crab Fishery

Table 1. Overview of the ESD Risk Assessment for the Blue Crab Fishery

Issue	Risk / Priority	Objective Developed	Indicator Measured	Performance Measure	Current Performance	Robustness	Actions
Retained Species							
Blue Swimmer Crab – Spencer Gulf population	M	Yes	Total catch; Legal size abundance; Pre-recruit abundance; Sex ratio.	To be determined	Acceptable	Medium	To be determined
Blue Swimmer Crab – Gulf St Vincent population	M	Yes	Total catch; Legal size abundance; Pre-recruit abundance; Sex ratio.	To be determined	Acceptable	Medium	To be determined
Permitted species list	L	N/A – low risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years
Bait	N	N/A – negligible risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years
Non-Retained Species							
Capture	N	Yes but negligible risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years
Direct interaction but no capture	N	Yes but negligible risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years
General Ecosystem Impacts of Fishing							
Commercial Blue Swimmer Crab fishing	N	N/A – negligible risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years
Bait collection	N	N/A – negligible risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years
Lost gear	N	N/A – negligible risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years

Issue	Risk / Priority	Objective Developed	Indicator Measured	Performance Measure	Current Performance	Robustness	Actions
Discarding	N	N/A – negligible risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years
Translocation	M	Yes	To be determined	To be determined	Acceptable	Medium	To be determined
Greenhouse gas / carbon emissions	M	Yes	To be determined	To be determined	Acceptable	Medium	To be determined
Oil discharge	M	Yes	To be determined	To be determined	Acceptable	Medium	To be determined
Rubbish / debris	L	Yes but low risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years
Damage to seagrass	L	Yes but low risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years
Damage to soft substratum	N	Yes but negligible risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years
Damage to benthic invertebrates	N	Yes but negligible risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years
Damage by bait collection	N	Yes but negligible risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years
Community							
Profit	M	Yes	Gross operating surplus; Boat cash income; Profit at full equity	To be determined	Acceptable	Medium	To be determined
Employment	M	Yes	FTE employed by the fishery	To be determined	Acceptable	Medium	To be determined
Occupational health, safety and welfare	M	Yes	To be determined	To be determined	Acceptable	Medium	To be determined
Relationships with community	M	Yes	To be determined	To be determined	Acceptable	-	To be determined

Issue	Risk / Priority	Objective Developed	Indicator Measured	Performance Measure	Current Performance	Robustness	Actions
Asset value	M	Yes	Investment in fishing gear and licence; Licence value; Value of quota units	To be determined	Acceptable	Medium	To be determined
Lifestyle	N	Yes but negligible risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years
Regional economic value	L	Yes but low risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years
Regional social value	N	Yes but negligible risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years
Regional infrastructure	N	Yes but negligible risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years
Economic value	N	Yes but negligible risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years
Social value	L	Yes but low risk	N/A	N/A	N/A	N/A	Review at next major assessment in 5 years
Aboriginal community							
*To be completed							
Governance							
Management effectiveness	M	Yes	Delivery of fishery management plan; To be determined	To be determined	Acceptable	Medium	Develop new management plan under the *Fisheries Management Act 2007*
Research/information	M	Yes	To be determined	To be determined	Acceptable	Medium	To be determined

Issue	Risk / Priority	Objective Developed	Indicator Measured	Performance Measure	Current Performance	Robustness	Actions
Allocation	E	Yes	Delivery of fishery management plan; To be determined	To be determined	Acceptable	Medium	Develop new management plan under the *Fisheries Management Act 2007*
Compensation (other agencies)	E	Yes	To be determined	To be determined	Acceptable	Medium	To be determined
Industry access security	H	Yes	To be determined	To be determined	Acceptable	Medium	To be determined
External factors affecting performance of the fishery							
Water quality	M	Yes	To be determined	To be determined	Acceptable	Low	To be determined
Economic drivers	M	Yes	To be determined	To be determined	Acceptable	Medium	To be determined
Access	M	Yes	To be determined	To be determined	Acceptable	-	To be determined

19.3 Appendix 3 –Upper reference limit decision rules – for comparison

Spencer Gulf

Review the TACC (with the possibility of an increase) for the Spencer Gulf zone for the next season when the following conditions are met in that zone in any given year:

1. Relative abundance of pre-recruit crabs is above the target reference point (9 crabs per pot lift); and either

2. Relative abundance of legal-sized crabs is above the target reference point (8 crabs per pot lift); or

3. Commercial CPUE for legal size crabs is above the target reference point (4 kg per pot lift).

Gulf St Vincent

Review the TACC (with the possibility of an increase) for the Gulf St Vincent zone for the next season when the following conditions are met in that zone in any given year:

1. Relative abundance of pre-recruit crabs is above the target reference point (8.5 crabs per pot lift); and either

2. Relative abundance of legal-sized crabs is above the target reference point (4 crabs per pot lift); or

3. Commercial CPUE for legal size crabs is above the target reference point (4 kg per pot lift).

These decision rules will not be applied for the period of this management plan, but a discussion of their effectiveness during the first three year period of the plan will be valuable during the review of the harvest strategy.

SCHEDULE 1

Aquatic resources prescribed for Blue Crab Fishery by the *Fisheries Management (Blue Crab Fishery) Regulations 1998*

Part 1—Aquatic resources prescribed for purposes of regulation 5(2)(a)

Crustaceans
Blue Swimmer Crab (*Portunus pelagicus*)
Rock Crab (*Nectocarcinus integrifons*)
Spider Crab (Family *Majidae*)
Velvet Crab (*Nectocarcinus tuberculosus*)

Part 2—Aquatic resources prescribed for purposes of regulation 5(2)(b)

Molluscs
Octopus (*Octopus* spp)
Gould's Squid (*Nototodarus gouldii*)

Scalefish
Australian Anchovy (*Engraulis australis*)
Barracouta (*Thyrsites atun*)
Black Bream (*Acanthopagrus butcheri*)
Cod (marine species) (Family *Moridae*)
Flathead (Family *Platycephalidae*)
Flounder (Family *Bothidae* or *Pleuronectidae*)
Bluespotted Goatfish (*Upeneichthys vlamingii*)
Eastern Striped Grunter (*Pelates sexlineatus*)
Australian Herring (*Arripis georgianus*)
Yellowtail Kingfish (*Seriola lalandi*)
Leatherjacket (Family *Monacanthidae*)
Blue Mackerel (*Scomber australasicus*)
Common Jack Mackerel (*Trachurus declivis*)
Morwong (Family *Cheilodactylidae*)
Mullet of all species (Family *Mugilidae*)
Mulloway (*Argyrosomus hololepidotus*)
West Australian Salmon (*Arripis truttaceus*)
Australian Sardine (*Sardinops sagax*)
Snook (*Sphyraena novaehollandiae*)
Southern Sole (*Aseraggodes haackeanus*)
Sea Sweep (*Scorpis aequipinnis*)
Trevally (*Caranginae* spp)
Bluethroat Wrasse (*Notolabrus tetricus*)

Sharks
Rays of all species (Class *Elasmobranchii*)
Shark of all species (Class *Elasmobranchii*) other than White Shark (*Carcharodon carcharias*)
Skate of all species (Class *Elasmobranchii*)