



**PRIMARY INDUSTRIES  
AND RESOURCES SA**



---

---

## **SOUTH AUSTRALIAN FISHERIES MANAGEMENT SERIES**

### **Ecological Assessment of the South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery**

Assessment Report Prepared For the Commonwealth Department of the Environment and Heritage,  
against the Commonwealth '*Guidelines for the ecologically sustainable management of fisheries*'

For The Purposes Of Part 13 And 13(A) of the *Environment Protection and Biodiversity  
Conservation Act 1999*

24 December 2003

Prepared by the Agriculture, Food and Fisheries Division of Primary Industries & Resources, South  
Australia

---

25 Grenfell Street, Adelaide  
GPO Box 1625 ADELAIDE 5001

Ecological Assessment of the South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery

Assessment Report Prepared for the Commonwealth Department of the Environment and Heritage, against the '*Guidelines for the ecologically sustainable management of fisheries*'. For the purposes of Part 13 and 13(A) of the *Environment Protection and Biodiversity Conservation Act 1999*.

24 December 2003

Sean Sloan  
Fisheries Manager  
Primary Industries and Resources South Australia (Fisheries)  
GPO Box 1625  
ADELAIDE SA 5001  
[www.pir.sa.gov.au](http://www.pir.sa.gov.au)

ph (08) 8226 0219  
fax (08) 8226 2320

e-mail: [sloan.sean@saugov.sa.gov.au](mailto:sloan.sean@saugov.sa.gov.au)

---

## FOREWORD

---

The marine and freshwater fisheries resources of South Australia are community owned resources. The role of the Government, as custodian of these resources on behalf of the broader community and future generations, is to ensure that they are used in an ecologically sustainable and economically efficient manner, while at the same time maximising returns to the community.

Experience world-wide has demonstrated that where unrestricted use of marine and freshwater fisheries resources is allowed, there is little incentive for individuals harvesting the resource to conserve fish stocks. Left unmanaged, the increase in fishing effort that results from competition is reflected in lower individual catches in the recreational fishing sector, and over-capitalisation and reduced financial returns in the commercial fishing sector. Loss of these resources to the community can result in significant regional economic problems.

In managing fisheries resources, Governments have the primary responsibility of ensuring long term sustainability. Governments must also ensure that the basis for sharing fisheries resources among all users is clearly understood and accepted as equitable, and that the allocation of fisheries resources and their level of utilisation are consistent with the needs of present and future generations.

To assist decision-making by the Government in managing South Australia's fisheries resources, numerous fishery-specific stakeholder-based fishery management committees were established to provide expertise-based advice to the Minister for Agriculture, Food and Fisheries. These committees are comprised of Government managers, research scientists, commercial and recreational fishers, fish processors and members of the general community. They are convened by an independent chairperson. Appointment of members and the terms of reference of the committees are embodied in the *Fisheries (Management Committees) Regulations 1995*.

Where there are considered to be threats of serious or irreversible damage to fisheries resources and resource management decisions must be made in an environment of uncertainty the Government, in partnership with the fisheries management committee, will take a precautionary approach to the management of South Australia's fisheries resources.

---

# CONTENTS

---

<b>FOREWORD</b> .....	<b>3</b>
<b>CONTENTS</b> .....	<b>4</b>
<b>LIST OF FIGURES</b> .....	<b>4</b>
<b>1 INTRODUCTION</b> .....	<b>6</b>
1.1 PURPOSE.....	6
1.2 SCOPE OF THE CURRENT MANAGEMENT POLICY .....	6
1.3 DESCRIPTION OF THE FISHERY.....	7
1.4 CONSULTATION AND CO-MANAGEMENT .....	9
1.5 AVAILABILITY OF THE CURRENT MANAGEMENT POLICY AND REGULATIONS .....	10
1.6 CURRENT APPROVED WILDLIFE TRADE OPERATION .....	11
<b>2 ECOLOGICAL ASSESSMENT</b> .....	<b>12</b>
1.1 PRINCIPLE 1 .....	12
1.2.1 <i>Objective 1</i> .....	12
1.6.1 <i>Objective 2</i> .....	30
1.3 PRINCIPLE 2.....	31
1.3.1 <i>Objective 1</i> .....	31
1.3.2 <i>Objective 2</i> .....	33
1.3.3 <i>Objective 3</i> .....	37
<b>3 REFERENCES</b> .....	<b>40</b>
<b>ATTACHMENT A</b> .....	<b>42</b>
<b>ATTACHMENT B</b> .....	<b>43</b>

---

## LIST OF FIGURES

---

<b>FIGURE 1.</b> SOUTHERN AND NORTHERN MANAGEMENT ZONES FOR THE SOUTH AUSTRALIAN GIANT CRAB FISHERY. ....	<b>8</b>
---	----------

## LIST OF TABLES

<b>TABLE 1.</b> CATCH AND VALUE (LANDED BEACH PRICE) OF THE GIANT CRAB FISHERY. SOURCE: SARDI AQUATIC SCIENCES RESEARCH REPORT SERIES No. 58 (KNIGHT, TSOLOS AND DOONAN 2003).....	<b>7</b>
<b>TABLE 2:</b> CURRENT MANAGEMENT CONTROLS FOR THE SOUTH AUSTRALIAN GIANT CRAB FISHERY .....	<b>8</b>

---

TABLE 3. BIOLOGICAL PERFORMANCE INDICATORS AND ESTIMATION METHODS USED IN THE GIANT CRAB FISHERY. ....	15
TABLE 4. TOTAL CATCH (KG) OF GIANT CRAB TAKEN IN SOUTH AUSTRALIAN WATERS IN EACH ZONE SINCE THE 1997/98 FISHING SEASON AND TACCs ESTABLISHED FOR EACH ZONE SINCE 1999.....	21
TABLE 5: REFERENCE RANGE FOR KEY PERFORMANCE INDICATORS.....	24
TABLE 6. KEY ANNUAL PERFORMANCE INDICATOR ESTIMATES.....	25
<b>TABLE 7. HARVEST STRATEGY FOR THE GIANT CRAB FISHERY. ....</b>	<b>26</b>

---

# 1 INTRODUCTION

## 1.1 Purpose

This report has been prepared by the Agriculture, Food and Fisheries Division of the Department of Primary Industries and Resources, South Australia (PIRSA).

The purpose of this report is to provide the Commonwealth (Cwth) Department of the Environment and Heritage (DEH) with a detailed assessment of the management arrangements in place for the South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery, against the '*guidelines for the ecologically sustainable management of fisheries*', set out in the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act).

This document details the harvest strategy that has been developed for the fishery, contains relevant background information and describes current and potential future research and monitoring arrangements. It is intended that this report serve as an initial step in the process to have giant crabs taken from South Australian waters, placed on the list of exempt native species for export, under Part 13 and 13(A) of the EPBC Act, 1999.

## 1.2 Scope of the Current Management Policy

PIRSA Fisheries is the State Government agency responsible for the sustainable management of South Australia's marine, estuarine and freshwater resources. The *Fisheries Act 1982* (the Fisheries Act) provides the broad statutory framework to ensure the ecologically sustainable management and development of South Australia's marine, estuarine and freshwater fisheries resources. In the administration of the Fisheries Act, the Minister for Agriculture, Food and Fisheries, the Director of Fisheries and all established Fisheries Management Committees have the following two principal objectives:

- (a) *ensuring, through proper conservation, preservation and fisheries management measures, that the living resources of the waters to which this Act applies are not endangered or overexploited; and*
- (b) *achieving the optimum utilisation and equitable distribution of those resources.*

South Australia has management jurisdiction for *P. gigas* from the low water mark out to 200 nautical miles in the waters adjacent to South Australia, under an Offshore Constitutional Settlement (OCS) Agreement between the South Australian and Commonwealth Governments. The management policy outlined in this document covers all forms of commercial, recreational and potential illegal catch of the species in South Australian waters.

This document provides an updated statement of the management policy framework and harvest strategy employed to ensure the ecologically sustainable management and development of the South Australian giant crab fishery. The management policy in place for the fishery is also outlined in previous assessment documents provided to the Cwth DEH. No formal Management Plan exists for the South Australian giant crab fishery. It is the intention of PIRSA Fisheries to commence a process of developing a formal Management Plan for the fishery, following this ecological assessment process.

The regulations that govern the management of the South Australian giant crab fishery are established in the *Scheme of Management (Miscellaneous Fisheries) Regulations 2000* and the *Fisheries (General) Regulations 2000*. While the management policy outlined in this document provides direction to the development of these regulations, it does not have any statutory basis. However, this management policy should be read in conjunction with the regulations.

---

The management of the South Australian giant crab fishery is not subject to any specific international or regional management regimes or legal instruments, except for the United Nations Convention on the Law of the Sea, to which the existing management regime complies.

This management policy is considered to form part of a process of continual improvement, which reflects current understanding of the resource upon which the fishery is based. As such, this management policy is intended to be periodically updated as significant advances in knowledge occur, particularly with respect to stock assessment work planned during 2004.

PIRSA, in consultation with key stakeholder groups and the broader community are currently undertaking a comprehensive review of the Fisheries Act. This review, which is expected to be completed during 2004, is likely to result in changes to the broad sustainability framework for the management of South Australia's fisheries resources.

### 1.3 Description of the Fishery

Giant crabs (*P. gigas*) are endemic to Australian waters and are distributed from southern Western Australia to central New South Wales (Kailola *et al.* 1993) inhabiting waters between 18 and 500 metres in depth, in temperatures between 10 and 18°C. The highest population densities occur at the shelf break in a depth of approximately 200 metres. Historically, giant crabs have been taken as a by-product by rock lobster fishing operations in southern Australia for over 80 years. Targeted commercial fishing for giant crabs was initiated in Tasmanian waters in 1990 and began in South Australian waters in 1992.

Prior to 1992, access to giant crabs off the South Australian coastline was controlled by the Cwth Government through the Australian Fisheries Service. Joint Cwth-State management regimes were established in 1992. Since January 1997, giant crabs targeted off the South Australian coastline have been managed by the South Australian Government under an OCS Arrangement between the South Australian and Cwth Governments.

During the mid 1990s, two South Australian based fishers began dedicated target fishing for giant crabs in Commonwealth waters adjacent to South Australia under the provision of Commonwealth Fishing Permits. These two fishers were subsequently issued with South Australian miscellaneous fishing licences in January 1997, under the provisions of the Fisheries Act.

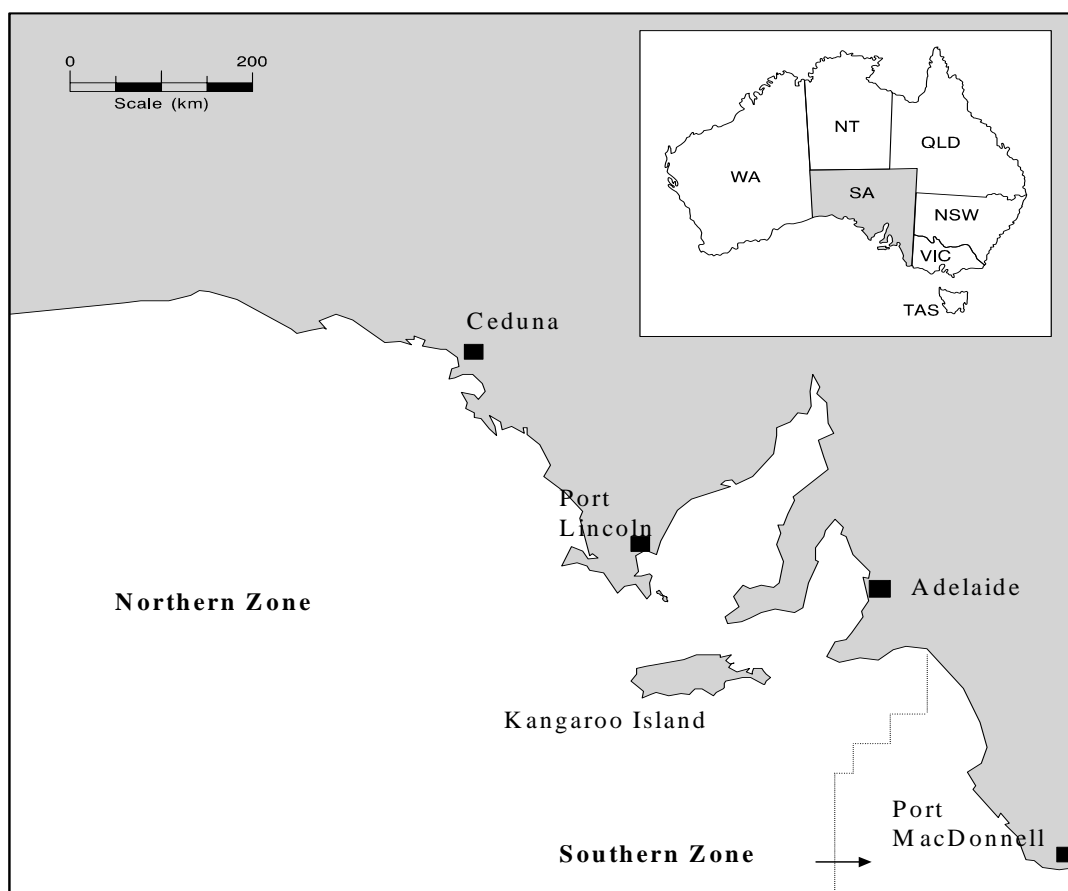
A total of 18.5 tonnes of giant crab were taken from South Australian waters in the 2000/01 season, with an estimated total landed value of \$447,000 AUD. Giant crabs are sold in four forms; live, fresh green, cooked, and pickled, the majority of which is sold on overseas markets. As with many State based fisheries, the total value of the industry to the South Australian community is considerably higher than the total landed value, due to the flow of economic and social benefits to other support industries, particularly in rural and regional communities.

**Table 1.** Catch and value (landed beach price) of the giant crab fishery. Source: SARDI Aquatic Sciences Research Report Series No. 58 (Knight, Tsolos and Doonan 2003).

Year	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02
Catch (t)	7	12	29	16	12	30	33	31	24	18.5
Value (\$,000)	73	100	385	260	203	757	1008	907	638	447

The South Australian giant crab fishery is a single-species, single-method fishery. The fishery has been separated into two discrete fishing zones for the purposes of management since 1997 - to be consistent with the boundaries of the southern and northern zone rock lobster fisheries (Fig. 1). This geographic separation recognises key differences in the physical and ecological character that exist between the eastern and western borders of South Australia. The climatic and oceanographic

influences on each zone are quite distinct because of the wide geographic separation between the south eastern and west coasts.



**Figure 1.** Southern and northern management zones for the South Australian giant crab fishery.

Since taking over management responsibility of the South Australian giant crab resource, PIRSA Fisheries has worked towards implementing a management system based on individually transferable quota units to ensure the long term sustainability of the resource. The fishery now operates under this output control based management system with a total allowable commercial catch (TACC) of 13.4 and 8.7 tonnes for the northern and southern zones, respectively. The TACC for each zone is allocated between licence holders, with an allocation set aside for by-product taken by rock lobster fishers. A suite of input controls complements these arrangements. The following management controls currently apply to management of the fishery.

**Table 2:** Current management controls for the South Australian giant crab fishery.

Management Arrangement	Control
Limited entry	- 2 dedicated non-transferrable licences, with transferable quota units. - All rock lobster licence holders may hold transferable giant crab quota.
By-product limits for rock lobster licences	All rock lobster licence holders without giant crab quota holdings may take up to 5 crabs per trip as a by-product.
TACC	Northern zone (13.4 tonnes); southern zone (8.7 tonnes).
Seasonal closures	Southern zone (1 May – 30 September); northern

	zone (1 June to 31 October)
Quota holding limits per licence	No limits
Minimum legal length (both sexes)	150 mm CL (both zones)
Maximum pot numbers	100 pots per licence
Pot specifications	Maximum diameter 1 m; maximum height 1 m, maximum weight 40 kg; single top entrance; mesh size 50 mm diameter or escape gaps 55x150 mm.
Egg-bearing females	No retention at any time
Spatial closures	No dedicated giant crab fishing within a depth of 60 fathoms
Vessel Monitoring System (VMS)	Required by all dedicated giant crab fishers and northern zone rock lobster fishers
Single trip fishing	Rock lobster fishers with giant crab quota are only permitted to fish for either crabs or lobster on a single fishing trip
Catch and effort data	Daily logbook submitted monthly
Catch and Disposal Records (CDR)	Daily CDR records, upon landing.
Maximum vessel length	18 meters
Maximum engine capacity	1,200 break horsepower

The current compliance and monitoring program is focussed on monitoring landings to ensure adherence with individual quota limits. A risk assessment approach to compliance and monitoring has recently been adopted by the PIRSA Fisheries Compliance unit to assist in developing a more strategic approach to resource deployment and improve cost-effectiveness.

There is currently no bag or boat limit in place for the recreational sector, on the basis that *P. gigas* is rarely caught by recreational fishers due to the proximity of the fishing grounds. Recreational fishers are required to purchase a gear registration for a maximum of two rock lobster pots per person, which is the only recreational device with the capacity to catch giant crabs. All recreational rock lobster pot fishers are asked to fill out voluntary catch and effort logbooks, which are returned to PIRSA Fisheries.

The South Australian giant crab fishery is one of several State managed fisheries for *P. gigas*. In Western Australia a multi-species deep-sea crab fishery for *P. gigas*, snow crabs (*Chaceon bicolor*) and spiny crabs (*Hypothalassia armata*) operates under an input control system. In the south east, *P. gigas* also supports the Tasmanian and Victorian giant crab fisheries, which are both closely linked to State-managed rock lobster fisheries and operate under quota management systems. Coordination between jurisdictions occurs through various southern State and national fisheries management forums.

## 1.4 Consultation and co-management

Section 32 of the Fisheries Act establishes a set of powers to formalise a co-management process for fisheries management in South Australia. The *Fisheries (Management Committees) Regulations 1995* outline a set of co-management principles and establish a number of dedicated Fisheries Management Committees (FMCs) for key fisheries, including a separate FMC for each Rock Lobster Fishery. Any significant giant crab fishery management issues are considered by the relevant rock lobster FMC, or a less formal giant crab fishery management working group that meets on a periodic, as needs basis.

The FMCs provide the principle forum for stakeholder consideration of fisheries management and research issues relevant to the fishery. The regulations set out the advisory role and function of the FMCs, which are designed to assist the Minister for Agriculture, Food and Fisheries and the Director of Fisheries in the administration of the Fisheries Act, consistent with the objectives of the Fisheries Act and the designated management policy for the fishery. The Fisheries Act also provides a

---

capacity for the Minister or the Director of Fisheries to delegate decision-making functions to and FMC.

FMC membership consists of a Government fisheries manager, a Government scientist, commercial fishers, recreational fishers, a committee support officer and in some instances community members. An independent Chairperson is appointed by the Minister to facilitate each meeting. The current membership of each Lobster FMC does not include a general community member. However, recreational and commercial fishing members are generally people selected from the regional coastal communities relevant to each fishery, who also facilitate broader community input to the FMC process. The Minister appoints all non-Government members to the committee after calling for applications from relevant parties or established bodies and undergoing an independent and transparent selection process involving relevant stakeholder representation.

Each FMC is also required to hold an annual public meeting each year to allow for members of the broader community to discuss relevant issues with FMC members and provide an opportunity for the FMC to report on its activities. Observers are also welcome to attend FMC meetings, upon agreement from the independent FMC Chair. Note that the review of the Fisheries Act currently being undertaken is expected to result in some changes to FMC membership structure and operation. The operating costs of each FMC are fully recovered from licence holders in each commercial fishery. Each FMC meets approximately five to six times per year in line with an annual business plan.

The FMC regulations assign responsibility for the preparation of Management Plans to individual Fisheries Management Committees. Key stakeholder and community input to the development of management arrangements and strategic research and monitoring priorities is facilitated through the FMC process, during the development and periodic update of the Management Plans and key management policies.

Section 37 of the Fisheries Act requires the Minister, or his/her delegate, to consult with licence holders who may be adversely affected by a change to licence conditions, in particular, the removal of a species or gear entitlement. No formal requirements currently exist in the Fisheries Act to consult with the broader community concerning fisheries management decision-making. However, consultation does occur with the broader South Australian community through public comment processes, as a matter of course when significant policy changes or developments are being considered. For example, all formal Fisheries Management Plans (which include a strategic research plan) undergo an extensive public consultation process. Formal community consultation and accountability provisions are being considered as part of the Fisheries Act review process.

Each year, prior to the formal cost recovery process undertaken by PIRSA Fisheries, all licence holders are consulted on the range of management, research and compliance services considered necessary to administer each fishery.

All new fishing regulations or Fisheries Act amendments are subject to the disallowance provisions set out under the *Subordinate Legislation Act 1978*, and as such can be disallowed by either house of Parliament, if deemed appropriate.

## **1.5 Availability of the Current Management Policy and Regulations**

The current giant crab fishery management policy is outlined in this document and is also publicly available on the PIRSA Fisheries website at [www.pir.sa.gov.au/fishing](http://www.pir.sa.gov.au/fishing). The *Scheme of Management (Miscellaneous Fisheries) Regulations 2000* and the *Fisheries (General) Regulations 2000* are

---

available on the South Australian page of the Australian Legal Information Institute website at [www.austlii.edu.au](http://www.austlii.edu.au)

## 1.6 Current Approved Wildlife Trade Operation

Since 1999, the export of giant crab has been controlled under the wildlife protection provisions of the Cwth EPBC Act. Under Section 303FN (Approved Wildlife Trade Operation) of the EPBC Act, giant crabs are declared as controlled specimens, which requires PIRSA Fisheries to submit annual reports to the Cwth DEH on the management of the giant crab resource, including the results of research and monitoring activities. The existing declaration allows for giant crabs taken from South Australian waters to be exported until 31 March 2004.

The current declaration requires that:

1. Collection of giant crabs (*Pseudocarcinus gigas*) is to be carried out in accordance with the management program for giant crab in South Australia, submitted by the Department of Primary Industries and Resources South Australia;
2. The Department of Primary Industries and Resources will annually submit to the designated authority a report detailing the setting of each year's total allowable catch by 28 September, each year of this declaration;
3. The Department of Primary Industries and Resources South Australia will provide information demonstrating that satisfactory progress is being made on the development of a joint stock assessment research program with Tasmania by 25 January 2002;
4. The Department of Primary Industries and Resources South Australia will provide the designated authority with an annual report on the harvest of giant crabs which will include: total harvest by weight; catch per unit effort; results of any size sampling of the catch; and a summary of current and recently completed research programs and their impact on the setting of management arrangements such as trigger limits, size limits and total allowable catch by 28 September each year of this declaration.

It is intended that this report provide information to allow for the fishery management policy framework to be assessed. This report serves as the initial step in the process to have giant crabs taken from South Australian waters, placed on the list of exempt native species for export, under Part 13 and 13(A) of the EPBC Act, 1999.

---

## 2 ECOLOGICAL ASSESSMENT

### 1.1 PRINCIPLE 1

**A fishery must be conducted in a manner that does not lead to over-fishing, or for those stocks that are over-fished, the fishery must be conducted such that there is a high degree of probability the stock(s) will recover.**

#### 1.2.1 Objective 1

**The fishery shall be conducted at catch levels that maintain ecologically viable stock levels at an agreed point or range, with acceptable levels of probability.**

##### Information requirements:

**There is a reliable information collection system in place appropriate to the scale of the fishery. The level of data collection should be based upon an appropriate mix of fishery independent and dependent research and monitoring.**

Prior to 1997, during the period that the Commonwealth Australian Fisheries Service managed the giant crab resource, no catch and effort information was recorded (Levings *et al* 2001). In 1997, when the States took over management responsibility for giant crabs under OCS Agreements with the Commonwealth, all dedicated South Australian giant crab fishers (two) were required to provide daily catch and effort data on their fishing activities to the South Australian Research and Development Institute (SARDI), Aquatic Sciences.

##### *Fishery-Dependent Data – Commercial Logbook*

The existing South Australian data collection system is underpinned by a compulsory catch and effort logbook system. Daily fishing records are reported in the logbook and submitted at monthly intervals. Logbooks used by rock lobster fishers have included information on both catch by number and catch by weight of giant crabs from 1994 onward. This same information has been collected by the two dedicated giant crab fishers since 1997, which provides a history of the mean weights in the fishery and, via weights at age, the stock structure and an indication of recruitment over time. In 2000, a dedicated logbook for the giant crab fishery was introduced.

The two dedicated giant crab fishers are not permitted to retain any other species that are caught incidentally as part of their giant crab fishing operations. At present, these two fishers are not required to compulsorily record any other species taken incidentally as part of their giant crab fishing operations.

All rock lobster fishery licence holders are permitted to retain by-product of all the species listed on Schedule 1 of the *Scheme of Management (Rock Lobster Fisheries) Regulations 1991* (Attachment A) and are required to record information on by-product and by-catch in the daily logbook. All other rock lobster fishers (those without giant crab quota holdings) are permitted to retain five giant crabs per trip as a by-product and are required to record these catches in the prescribed daily fishing logbook, along with any other incidental catches of other species that are taken.

---

In the 2000/01 fishing season, a list of marine scalefish by-catch and by-product species was added to the logbook to simplify and improve data collected on non-target species taken in the course of lobster fishing. These data sections of the logbook are compulsory.

Catch and effort data are entered into a database upon receipt and late returns are promptly pursued to ensure high levels of data availability and quality. This database is a secure, modern, relational database, which is professionally managed and maintained. The specific details currently recorded by all rock lobster fishers in the daily logbook include:

- licence number, licence holder, date and main port of landing;
- Marine Fishing Area (MFA) where fishing took place;
- depth in which pots were set;
- number of pots set;
- weight of retained legal-sized lobsters - reported at the end of each trip or as a daily estimated weight;
- landed number of legal-sized lobsters;
- number of undersized lobsters caught;
- number of dead lobsters caught;
- number of spawning lobsters caught;
- weight of octopus caught;
- number of octopus caught;
- number of giant crab pots;
- depth of giant crab pots;
- landed weight of giant crabs;
- landed number of giant crabs; and
- the species, weight, number and form of any marine scalefish species taken as part of the rock lobster fishing operation.

The two dedicated giant crab fishers are not required to record information on any incidental catches of rock lobster, marine scalefish and octopus, as none of these species are currently permitted to be retained by these two fishers. The following additional information is required to be recorded by the two miscellaneous licence holders and all rock lobster licence holders that have giant crab quota entitlements:

- the position (latitude and longitude) that pots were first set;
- the position (latitude and longitude) that pot setting was completed;
- depth that pots were set;
- number of giant crab pots;
- total number of crabs retained;
- total number of undersized crabs returned to the water;
- total number of spawning crabs returned to the water;
- total number of legal sized crabs returned to the water;
- total number of rock lobster returned to the water;
- total number of female giant crabs retained;
- total weight of female giant crabs retained;
- total number of male giant crabs retained; and
- total weight of male giant crabs retained.

### *Catch and Disposal Records*

At the point of landing, licence holders that hold giant crab quota are required to complete a giant crab Catch and Disposal Record (CDR). The CDR provides information including total estimated weight, numbers, port and time of landing, name of the receiving processor and if the crabs were processed or live. The CDR then accompanies the giant crabs to the processor where, upon

---

immediate receipt of the giant crabs, the processor must accurately weigh the giant crabs and complete Part B of the CDR with the certified accurate weight. The CDR is then forwarded to a PIRSA Fisheries compliance office by the fish processor within 24 hours. CDR information is entered onto a database and catches are subtracted from individual quota holdings.

These data are periodically compared with the research catch and effort data collected via commercial logbooks and form an independent check on their accuracy. There is typically a difference of less than 0.3% difference between the two data sources (Prescott, JH 2001, pers. comm.).

#### *Accuracy of Logbook Information*

While recognising the natural limitations of fishery-dependent data, PIRSA Fisheries has high levels of confidence in the existing data set and consider the information collected by rock lobster fishers and dedicated giant crab fishers to be reliable and accurate. The nature of the management arrangements in place (quota system) may provide an incentive for fishers to misreport catches, which is an inherent characteristic of all quota systems. However, existing penalties create a strong deterrent for catch misreporting. Compliance intelligence suggests that increasing levels of industry support for the management arrangements has evolved over time, resulting in low levels of catch misreporting. These elements, together with the compliance and monitoring program in place, underpin the confidence that PIRSA Fisheries has in the data collection system currently in place for the fishery.

#### *Processor Data*

Processor purchase records are recorded on monthly logbooks submitted to SARDI. These records provide some opportunity for an additional check on giant crab landings, but may be confounded by periodic purchases from other *P. gigas* fisheries external to South Australia, eg. Western Australia, Victoria or Tasmania.

#### *Fishery-Independent Data*

No fishery-independent data is currently collected from the South Australian giant crab fishery, due mainly to the small scale of the fishery. Some fishery-independent data is being collected by the Tasmanian Department of Primary Industries, Water and Environment as part of a Fisheries Research and Development Corporation (FRDC) research project aimed at developing quantitative stock assessment techniques. It may be possible for these techniques to be adapted for the South Australian fishery, when this work is completed.

#### *Non-target Species Catch Monitoring*

No non-target species monitoring is undertaken in the dedicated giant crab fishery (two fishers). However, an independent monitoring program for non-target species catches was introduced in both rock lobster fishing zones in the 2001/02 fishing season to monitor and record information on by-product, by-catch and non-target species (including protected species) interactions associated with rock lobster fishing. This program involves SARDI researchers undertaking low level at-sea monitoring (approx. 0.07% of total days fished in the southern zone and 0.08% in the northern zone) to record non-target species interactions and catch composition.

Catch sampling of by-catch and by-product associated with rock lobster fishing is also undertaken in-port (approx 1% of total trips in the southern zone and 0.3% in the northern zone) as part of this program to improve cost-effectiveness and ensure an adequate sample size is achieved. This data is used to validate rock lobster fishery logbook data collected by commercial fishers and will be quantitatively analysed and reported during 2004. At this stage, the by-catch monitoring program is intended to be continued for at least one more season to ensure adequate data are collected and

analysed. Following this, the costs and benefits of the program will be evaluated to determine the future need and/or frequency for periodic ongoing by-catch monitoring.

However, note that the location of the main giant crab fishing grounds are generally quite different (deeper and over softer muddy substrate) to standard rock lobster fishing grounds (reef substrate). On this basis, the by-catch and by-product associated with dedicated giant crab fishing operations is generally smaller in quantity and less diverse to that of standard rock lobster fishing operations.

### *Recreational Fishery Data*

The recreational catch of *P. gigas* is considered to be very minimal due to the depth and proximity of the fishing grounds. The National Recreational and Indigenous Fishing Survey (Henry and Lyle 2003) did not report any catches of *P. gigas* across any of the southern States.

### **Assessment**

**There is a robust assessment of the dynamics and status of the species/fishery and periodic review of the process and the data collected. Assessment should include a process to identify any reduction in biological diversity and/or reproductive capacity. Review should take place at regular intervals but at least every three years.**

### *Provisional Data Analysis*

PIRSA Fisheries and SARDI Aquatic Sciences currently undertake annual informal assessments of the South Australian giant crab fishery. The overall performance of the fishery is assessed against a suite of indicators identified in the management policy. The first report on this annual process was presented to the Cwth DEH in November 2000 (Ward and Loiterton 2000) and updated in 2001 and 2002 (Sloan 2002). The following suite of performance indicators are used to assess the biological performance of the fishery against the stated management objectives:

**Table 3.** Biological performance indicators and estimation methods used in the giant crab fishery.

<b>Performance Indicator</b>	<b>Description</b>	<b>Measurement</b>
Catch Rate	Reflects the catch (kg) per pot lift taken in the fishery, and is linked to the relative abundance of giant crabs*	Nominal average catch rate (as recorded in logbooks). Standardised catch rate to be estimated using stock assessment model being developed by Tasmania.
Mean Weight	Used to indicate changes in the stock structure (size and age), which can be used to determine the average age and size of giant crabs in the population. Higher mean weight values usually reflect a lack of newly recruited lobster in the population. Lower mean weight or size usually reflects a greater frequency of smaller lobster in the fishery, due to increased recruitment*	Nominal average mean weight recorded in logbooks.
Annual Commercial Catch vs TACC	Provides an indicator of the relative abundance of giant crabs and the capacity for the fleet to catch the established TACC (ie. the appropriateness of the TACC).	Recorded total catch by weight and numbers in logbooks.
Total Pot lifts	Provides an indication of the amount effort required between years to catch the established TACC.	Recorded in commercial logbooks.
Sex ratio	Provides an indication of the impact of fishing on	Recorded in commercial

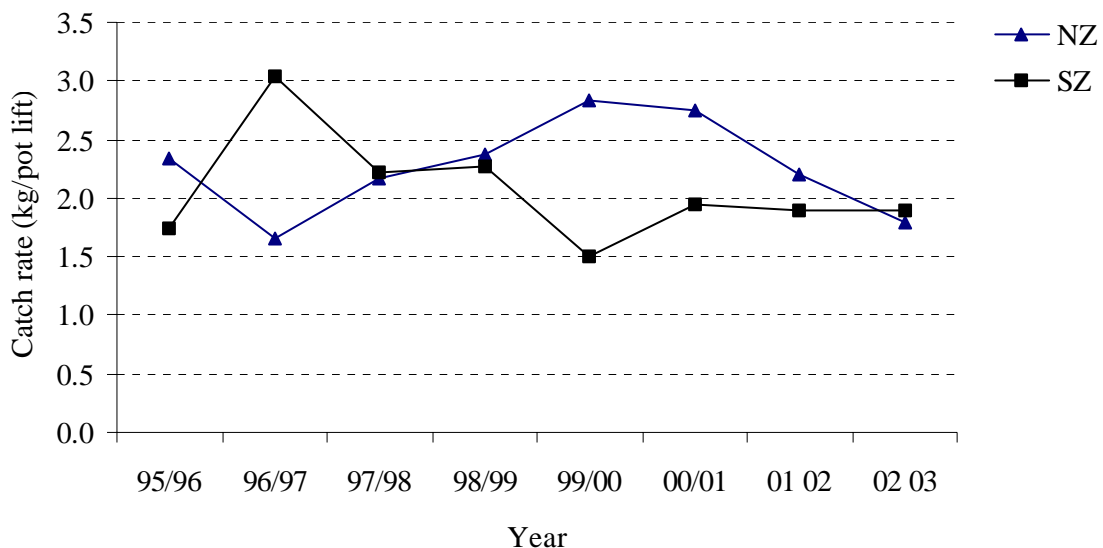
	the natural population structure and can be used as an indicator of the reproductive capacity of the population.	logbooks.
Pre-recruit abundance index	Provides an index of inter-annual changes in recruitment (undersize abundance) using the number of undersized giant crabs recorded in the commercial catch each year.	Recorded in commercial logbooks.
Spawning female abundance index	Provides an indication of inter-annual changes in the abundance of spawning females in the population. Can be used as an indicator of changes in the reproductive capacity of the population.	Recorded in commercial logbooks.

\* This indicator needs to be interpreted carefully because of the external market-based influences on targeting practices.

The key performance indicators used to assess the performance of the fishery are nominal catch per unit effort, total catch relative to each TAC, mean weight and pre-recruit index. The analyses used to estimate values for these performance indicators are not considered to be robust, due largely to insufficient data and the need for more quantitative assessment tools. All of the performance indicators currently used are considered to require further refinement.

A reference period between 1999/00 and 2002/03 has been selected to assist in the annual assessment of the performance of the fishery. This period has been chosen because it represents a period of relative stability, following the introduction of a quota system incorporating a competitive TACC for each zone. A review of the management arrangements and, in particular, the TACCs will be undertaken if any of the performance indicator estimates fall more than 15% outside of the range established for this period.

The following charts show trends in some key performance indicator over time. All of the performance indicators will be reviewed and updated following the development of a quantitative stock assessment model for the fishery.



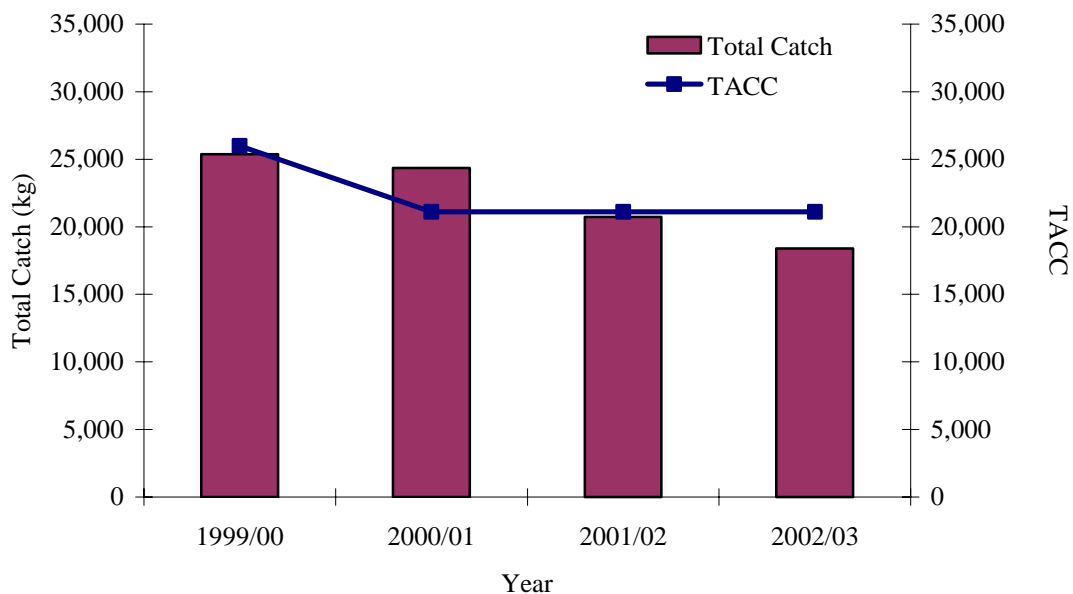
**Figure 2.** Inter-annual changes in catch per unit effort for the giant crab fishery.

Effort data (numbers of pot lifts) were not collected prior to 1997 while the species was under Commonwealth management, and catch per unit effort (CPUE) data are only available from 1995/96 onwards. Nominal (unstandardised) annual mean CPUE has ranged from approximately 1.6 to 3 kg per pot lift between the 1995/96 and 2001/02 fishing seasons.

Nominal CPUE estimates indicate that a possible decline in the abundance of giant crabs may have occurred in the southern zone from 1996 onward. Catch limits have been reduced in response and the southern zone is currently considered to be fished at close to optimal levels. In contrast, nominal CPUE estimates for the northern zone, which is still considered to be under-exploited, increased through the mid to late 1990s and started to stabilise in recent years. Monthly nominal CPUE estimates range from approximately 1.3 to 3.8 kg per pot lift. Nominal CPUE is generally high during summer-autumn and low during winter when spawning and moulting occurs.

Catch per unit effort records require standardisation to improve the robustness of estimates. Effort standardisation is intended to be undertaken by PIRSA Fisheries and SARDI Aquatic Sciences during 2004. CPUE estimates will continue to be closely monitored.

The following chart shows the relationship between the total catch across both zones and the TACC, since quota management arrangements were introduced in 1999.

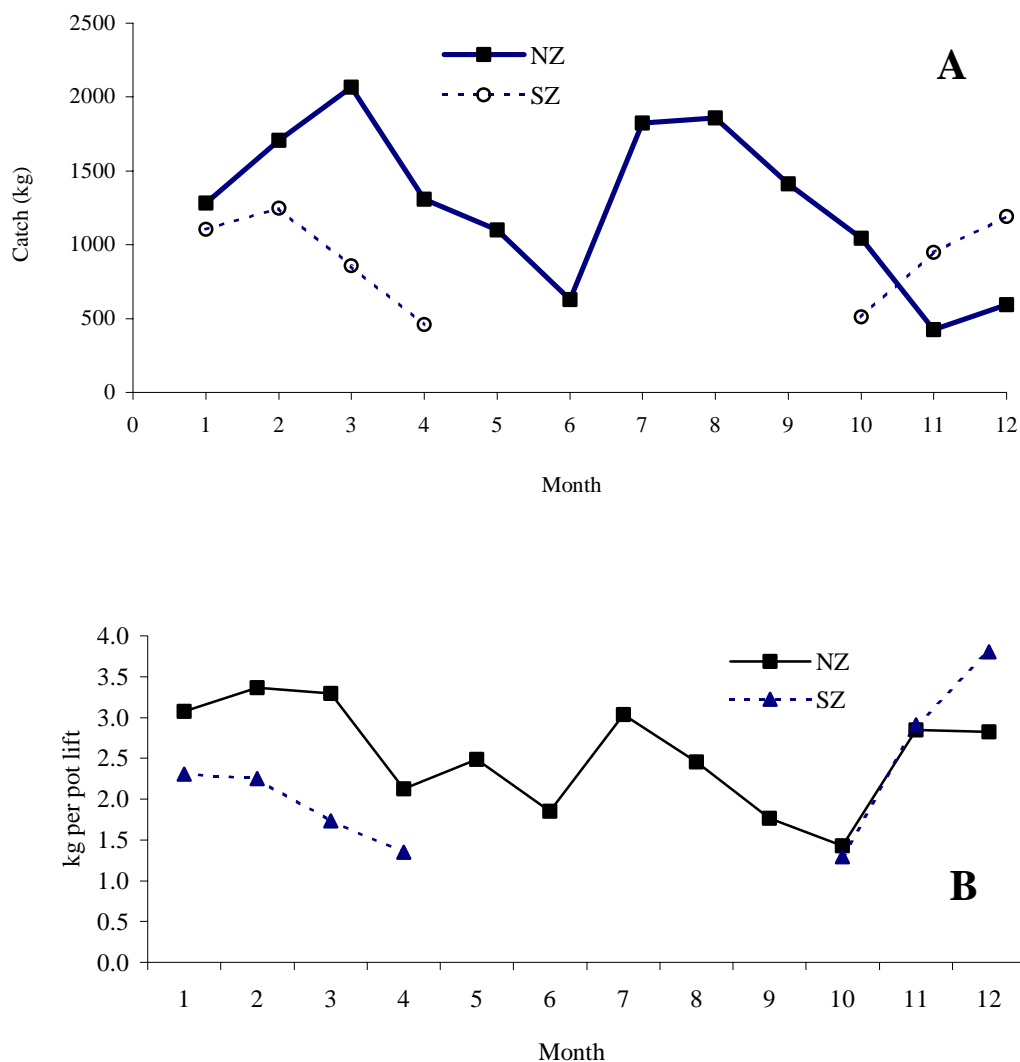


**Figure 3.** Relationship between the total catch and the TACC, across both zones of the giant crab fishery.

Information available suggests that the total annual catch of giant crabs in South Australian waters has ranged from approximately 7,500 kg in 1992-93 to 33,422 kg in 1998/99 (Fig. 3). The drop in catch between the 1998/99 and 1999/00 seasons was due to the introduction of quota management arrangements at the beginning of the 1999/00 fishing season. The drop in catch between the 1999/00 and 2001/02 fishing seasons is due to a reduction in the southern zone TACC from 12,600 to 8,700 kg. In the 2001/02 fishing season, both the southern zone and northern zone TACCs were taken.

The full TACC was not taken in the 2002/03 fishing season, by a marginal amount. This may have been due to a range of market externalities (eg. advent of the severe acute respiratory syndrome virus) that significantly reduced the landed value of many seafood exports (eg. giant crabs, lobster, prawns etc) during this season. In some cases fishers in a number of State fisheries chose to stop fishing towards the end of the fishing season because the cost of fishing was greater than the landed value attainable.

Data on monthly catches are only available from 1994/95 onwards and are incomplete, but provide some insights into seasonal variations in catches. No fishing (except for research purposes) has been conducted in the southern zone between May and September, or in the northern zone between June and October, due to seasonal closures. Figure 4a and 4b outlines the seasonality in total catch and catch rates.



**Figure 4.** Monthly total catch (A) and CPUE (B) of giant crabs in the South Australian northern and southern fishing zones.

### *Quantitative Stock Assessment*

The most pressing research need for the Giant Crab Fishery in South Australia remains the development of a quantitative population assessment model that will provide a quantitative basis for establishing annual TACCs. Despite the pressing need for this model, it is appropriate for PIRSA Fisheries to follow the advice of Kennelly (2000) and wait until the University of Tasmania has completed the development of a quantitative population model (FRDC project 2001/042) and established techniques for obtaining additional data from commercial fishers, before commissioning or encouraging the establishment of such a research project in South Australia. PIRSA Fisheries has instituted conservative TACCs for each fishing zone in South Australia, pending the development of a quantitative assessment model.

The main aim of the FRDC project is to develop a spatially explicit, size structured population model capable of quantifying the level of risk associated with various alternative harvest strategies and TACC settings. The model is being designed to provide a capacity to produce biomass estimates for the Tasmanian, South Australian and Victorian fisheries (Levitt 2002).

---

The University of Tasmania has made sound progress in both the development of the population assessment model and the on-board catch sampling program. PIRSA Fisheries and SARDI Aquatic Sciences will continue to liaise with the principal researcher coordinating the project. It is intended that this population model be adapted for use in assessing the status of the South Australian fishery during 2004. It is recognised that as the giant crab population in southern Australia is considered to consist of a single genetic stock, future research should be conducted collaboratively, wherever possible.

Until the population model is developed, it will be necessary to continue to apply a precautionary approach to the annual TACC setting process. It will also be necessary to continue monitoring nominal CPUE in the fishery, along with other fishery performance indicators. Improved information may be particularly useful in the southern zone where there is some evidence that CPUE has declined over recent years. However, monitoring nominal CPUE may provide fewer insights in the northern zone, where controlled expansion continues under a slightly higher TACC, and high nominal CPUE in previously unfished areas may mask possible declines in nominal CPUE in areas that have been fished more heavily.

The analysis of catch, effort and nominal CPUE data provided in this document is considered provisional. Once the Tasmanian stock assessment model has been adapted for the South Australian fishery PIRSA Fisheries will establish a process to commission annual or bi-annual stock assessment reports. Such an assessment process will include more detailed spatial analyses of catch, effort and CPUE information and will involve consolidating all South Australian data available, including those data currently held by Deakin University.

An initial preliminary assessment process is intended to be undertaken by PIRSA Fisheries during 2004, following the implementation of ITQ arrangements. PIRSA Fisheries has initiated cost recovery negotiations with commercial giant crab fishers and has provisioned funding for a preliminary stock assessment report to be prepared by SARDI Aquatic Sciences during 2004. This initial preliminary report is intended to focus initially on effort standardisation to improve the robustness of information supporting the TACC setting process, as well as instituting a basic on-board catch sampling program.

The aim of this preliminary study will be to analyse catch and effort data with a view to monitoring stock status and identifying any unsustainable trends as early as possible. Although undertaking a large research project on giant crabs in South Australia is not considered cost-effective at this stage, it may be suitable to monitor mating rates (through the abundance of sperm pouches in females) for evidence of changes in the frequency of mating, especially in large females, as recommended by McGarvey *et al* (1999).

#### *Reductions in Biological Diversity*

There is no evidence to suggest that reductions in biological diversity of *P. gigas* have occurred as a result of fishing in South Australia. However, no targeted research has been directed at investigating this issue as it is generally accepted that genetic patterns in *P. gigas* are not spatially structured, due to the early life history characteristics of the species and relatively long larval phase, which results in significant stock mixing throughout southern Australia (Levings *et al* 1999). Potential changes to biological diversity could be investigated in the future if the appropriate assessment tools are developed. No research has been undertaken to determine if trawl fishing operations undertaken by Commonwealth Great Australian Bight trawl vessels has reduced the biological diversity in the area of the South Australian giant crab fishery.

#### *Periodic Review Process*

The annual stock assessment processes coordinated by SARDI Aquatic Sciences include a regular internal review process of assessment methodologies and information requirements. When a quantitative assessment of the giant crab fishery is available this standard review process will be

---

applied. The current FRDC project being undertaken by Tasmania to develop a stock assessment model will undergo a standard peer review process.

**The distribution and spatial structure of the stock(s) has been established and factored into management responses.**

Giant crabs are endemic to southern Australia. They are found between southern Western Australia and central New South Wales (Kailola *et al.* 1993) inhabiting waters between 18 and 500 m in depth and in temperatures between 10 and 18°C. The highest population densities occur at the shelf break, where the continental shelf and slope meet (~200 m in depth). Size distribution is stratified by depth (Levings *et al.* 2001). Circumstantial evidence suggests that females move onto soft muddy substrate when they moult (Levings *et al.* 2001). Males are captured across a broader depth range than females. Most of the crabs taken as by-catch of the lobster fisheries (within depths shallower than 120 metres) are males (Levings *et al.* 2001).

The structure of the population is well understood, following genetic studies undertaken by Levings *et al.* (2001), in which allozyme and DNA techniques suggested that genetic homogeneity across populations throughout southern Australia is likely. During a tagging study journeys of up to 400km were recorded (Levings *et al.* 2001). A strong capacity for larval dispersal (3-4 month planktonic larval phase) and evidence of significant movements support the hypothesis that genetic homogeneity exists. There is a long inter-moult phase (2-3 years for males, 5-15 years for females), and exoskeletons are subject to extensive fouling. Moulting occurs during winter, and moult frequency decreases with age (Levings *et al.* 1999).

Giant crabs feed on a range of slow-moving benthic organisms, including gastropods, asteroids and decapods, especially other crabs (including other *P. gigas*). Smaller crabs, especially females, feed mainly on gastropods whereas larger crabs, especially males, consume more asteroids and decapods (Levings *et al.* 1999). Giant crabs reach a maximum size of at least 13 kg. Their morphology is typical of a xanthid, having a heavy exoskeleton and large crushing claws. Males grow to more than double the size of females, which is thought to be largely attributed to the advantages which relate to the development of an enlarged right cheliped, following sexual maturity (Kailola *et al.* 1993).

At present there is no formal coordination between the various State jurisdictions in relation the management of the giant crab resource. However, informal discussion of relevant issues takes place at a number of forums such as the southern fisheries managers forum and the Australian fisheries managers forum.

**There are reliable estimates of all removals, including commercial (landings and discards), recreational and indigenous, from the fished stock. These estimates have been factored into stock assessments and target species catch levels.**

*South Australian Commercial Catch*

Accurate data on all removals from each sector within South Australia are recorded in commercial fishing logbooks and factored into the annual provisional assessment for both fishing zones and are taken into account when setting annual TACCs in each fishing zone. Formal access to the Fishery is limited to the following three specific groups:

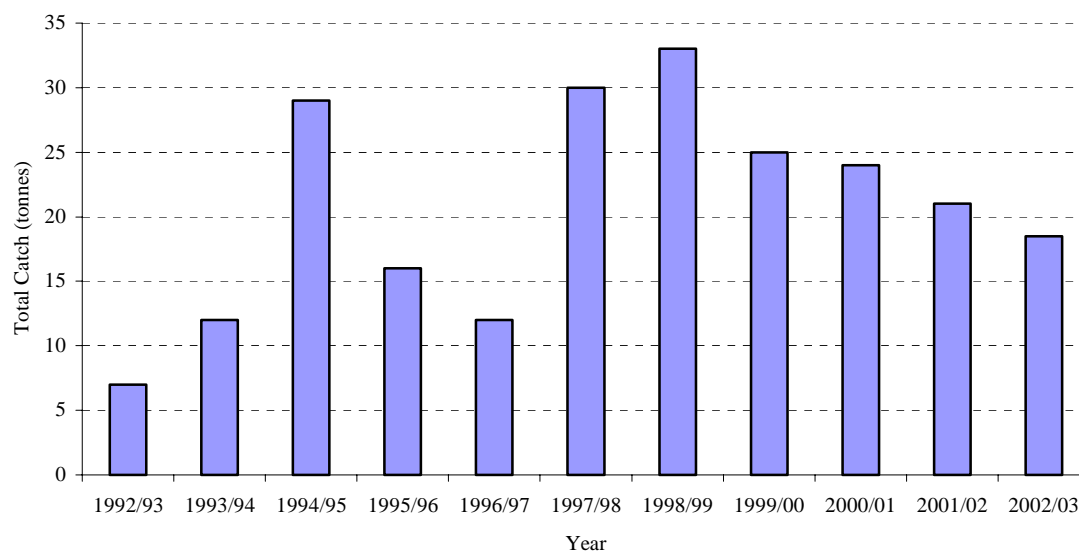
- 2 miscellaneous licence holders;
- 7 northern zone rock lobster fishery licence holders with giant crab quota entitlements; and
- 13 southern zone rock lobster fishery licence holders with giant crab quota entitlements.

All other rock lobster fishery licence holders in both zones are limited to a 5 crab trip limit. The following table outlines information that has been collected through commercial fishing logbooks since 1997 when the South Australian Government has had management jurisdiction for giant crabs taken in waters adjacent to South Australia. Prior to this period, only limited data are available.

**Table 4.** Total catch (kg) of giant crab taken in South Australian waters in each zone since the 1997/98 fishing season and TACCs established for each zone since 1999.

Year	Catch form	Northern Zone	Southern Zone	Total Catch (kg)
1997/98	Target	11,516	15,004	26,520
	By-catch	2,161	1,709	3,870
	Total	13,677	16,713	<b>30,390</b>
	TAC	N/A	N/A	N/A
1998/99	Target	14,499	14,987	29,486
	By-catch	1,798	2,138	3,936
	Total	16,297	17,125	<b>33,422</b>
	TAC	N/A	N/A	N/A
1999/00	Target	12,854	10,648	23,502
	By-catch	1,069	805	1,874
	Total	13,923	11,453	<b>25,376</b>
	TAC	13,400	12,600	26,000
2000/01	Target	14,039	7,659	21,698
	By-catch	1,891	756	2,647
	Total	15,930	8,415	<b>24,345</b>
	TAC	13,400	8,700	21,100
2001/02	Target	9,456	6,914	16,370
	By-catch	2,759	1,605	4,364
	Total	12,215	8,519	<b>20,734</b>
	TAC	13,400	8,700	21,100
2002/03	Target	8,894	7,159	16,053
	By-catch	1,659	764	2423
	Total	12,215	8,519	<b>18,476</b>
	TAC	13,400	8,700	21,100

The following chart outlines the total catch of giant crabs taken from waters adjacent to South Australia during the ten year period from 1992 to 2002.



**Figure 5.** Annual total catches (tonnes) of giant crab in South Australia between 1992/93 and 2002/03.

#### *Commercial Catch in Other Jurisdictions*

The commercial catch limits currently in place for the Tasmanian and Victorian Fisheries are 103.5 and 25 tonnes, respectively. In 2001/02, the Tasmanian fishery landed 96.2 tonnes of giant crabs (Levitt 2002) and the Victorian fishery landed 20 tonnes in 2000/01 (Victorian Department of Primary Industries 2003).

#### *Recreational and Traditional Catch*

The recreational catch is considered to be negligible, if not non-existent due to the depth range in which fishing occurs and the proximity of the fishing grounds. No traditional catch of giant crabs is known to have occurred in South Australian waters.

#### *Great Australian Bight Trawl Fishery*

Historically, there has been a small by-catch of giant crabs taken by vessels operating in the Commonwealth Great Australian Bight trawl fishery. A recent assessment of by-catch in this fishery showed that with the current spatial distribution of fishing effort, by-catch of giant crabs was minimal – an average of 2.5kg per trawl shot (Knuckey and Brown 2002). At present, effort is distributed over a small area of the available shelf/upper slope fishing grounds, mainly targeting bight redfish and deepwater flathead. Further expansion of the shelf/upper slope fishing grounds could result in greater incidental catches of giant crabs and this should be monitored closely to ensure that by-catch levels and any impacts on benthic communities remains sustainable. The most recent expansion in this fishery appears to be more focussed on small pelagic species with mid-water trawl gear.

By-catch has been monitored closely in recent years through the Great Australian Bight trawl fishery integrated scientific monitoring program, which involves at-sea and in-port monitoring of species catch composition. This ongoing independent monitoring program is considered critical to ensure the early identification of any changes to existing giant crab by-catch levels. Should a measurable increase in by-catch of giant crabs occur in this fishery, PIRSA Fisheries would liaise with the Australian Fisheries Management Authority and the Great Australian Bight Trawl Fishery Management Advisory Committee to resolve a suitable management response.

#### *Illegal Catch*

---

The extent of any potential illegal catches has not been accurately quantified. The nature of the management arrangements in place (quota system) may provide an incentive for some fishers to misreport catches, which is an inherent characteristic of all quota systems. Both dedicated giant crab fishers and all northern zone rock lobster fishers must have an operational vessel monitoring system (VMS) unit fitted to their vessel. All giant crab quota entitlement holders (and fish processors) must complete CDR documentation within a set timeframe. As previously stated, existing penalties create a strong deterrent for catch misreporting and compliance intelligence suggests that increasing levels of industry support for the management arrangements has evolved over time, resulting in low levels of catch misreporting.

**There is a sound estimate of the potential productivity of the fished stock/s and the proportion that could be harvested.**

The potential productivity of the population is not well understood. However, the available information on commercial catches across all jurisdictions suggests that the population may have been fished at close to optimum levels in some areas, particularly in the southern zone. The population modelling work being undertaken by the University of Tasmania will assist in gaining a better understanding of giant crab population parameters across all jurisdictions. In particular, this modelling work is aimed at providing realistic biomass estimates across all jurisdictions. On the basis of the current uncertainty associated with the potential productivity of the fished stock, PIRSA Fisheries has introduced conservative management arrangements that include conservative size limits and precautionary TACCs in both zones.

*Southern Zone*

In 1999, the TACC established for the southern zone was 12,600 kg. In 2000, the TACC in this zone was reduced to 8,700 kg, which represents 60% of the average catch taken in the zone during the period between 1997/98 and 1999/2000. This precautionary TACC was established in response to indications that nominal catch per unit effort in the zone had declined during the years following the period in which the fishery was managed under Commonwealth jurisdiction. PIRSA Fisheries also consulted with other management jurisdictions and experienced South Australian commercial giant crab fishers when considering the TACC adjustment.

On the basis of current assessment, the southern zone is considered to be fished at close to optimal levels. This classification will be reviewed following more refined quantitative assessment of the fishery by SARDI Aquatic Sciences during 2004 and through planned collaborative work with Tasmania. The southern zone TACC has been maintained at 8,700kg for the 2001/02, 2002/03 and 2003/04 fishing seasons. This approach is consistent with the current precautionary management strategy, aimed at stabilising the catches and catch rates in each zone, during the period in which ITQ management arrangements have been implemented.

*Northern Zone*

In 1999, the northern zone TACC was set at 13,400kg. This TACC has been maintained in order to continue the controlled development of the fishery in the northern zone. This TACC represents 90% of the average catch taken during the period between 1997/98 and 1999/2000.

On the basis of current assessment and consultation with managers and commercial fishers from other jurisdictions, the northern zone is currently considered to be under-exploited. This classification will be reviewed following more refined quantitative assessment of the fishery by SARDI Aquatic Sciences during 2002/03, and through collaborative work with Tasmania.

While there has been pressure from commercial fishers to increase catch limits in the northern zone, PIRSA Fisheries has maintained the TACC at 13,400kg for the 2002/03 and 2003/04 fishing seasons to allow for some controlled development and exploration. This approach, while promoting limited

---

development, is consistent with the current precautionary management strategy aimed at stabilising the catches in each zone during the period in which ITQs have been implemented.

### *Egg Production*

The estimated maximum size for males and females is 13.6 and 6.0 kg, respectively. Approximately 50% of females mature at 125 mm carapace length. Determining the functional maturity of males has proven to be problematic, as breeding opportunities are subject to heavy competition among physiologically mature (enlargened cheliped) males of different size groups. Modelling work undertaken by McGarvey *et al* (1999) suggested that under the current size limit, female egg production in the South Australian fishery is being maintained at 50% of virgin egg production levels. This exceeds conventional crustacean egg production reference points of 10-30%. The same modelling work suggested that only limited protection may be being provided for males under the existing size limit because of issues associated with male functional maturity.

Females only bear eggs in non-moulting years. Reduction in moult frequency with age means that large females reproduce more often than smaller ones. Clutch size ranges from approximately 0.5 to 2.0 million eggs per year, and is less correlated with female size than in most crustaceans. Mating occurs in June-July. Females carry eggs for approximately four months. As hatching approaches (October to November) females are thought to migrate to the shelf break. As with many crustaceans, patterns of larval settlement are poorly understood.

### **Management responses:**

**There are reference points (target and/or limit) that trigger management actions including a biological bottom line and/or a catch or effort upper limit beyond which the stock should not be taken.**

The following reference period and performance indicators (Table 5) have been developed and improved over the past three years. A reference period between 1999/00 and 2002/03 has been established across both zones (not zone specific) to assist in assessing the annual performance of the fishery. This period has been chosen because it represents a period of relative stability, following the introduction of a quota system incorporating a competitive TACC for each zone.

**Table 5:** Reference range for key performance indicators.

Performance Indicator	Reference Range
Total average catch Rate (kg.pot lift <sup>-1</sup> )	1.5 - 3
Annual Commercial Catch vs TACC	Total catch is within 15% of the TACC
Mean Weight (kg)	2.96 – 3.65
Pre-recruit abundance index (undersize crabs/pot lift)	1.6 – 1.7

A review of the management arrangements and, in particular, the TACCs may be undertaken if any of the performance indicator estimates fall more than 15% ± outside of the range established for this period. To this end, an implicit goal of the existing Management Policy is to maintain fishery performance within the 1999/00 to 2002/03 range. All of these performance indicators and reference values will be reviewed and updated, following the move to a more formal stock assessment process.

The following management action will be undertaken if any of the performance indicator estimates fall more than 15% outside of the reference range:

1. Notify the Minister for Agriculture, Food and Fisheries and participants in the fishery as appropriate.
2. Undertake an examination of the causes and implications of ‘triggering’ a reference value.

3. Consult with key stakeholders on the need for alternative management strategies or actions, which may include changes to the:
  - TACCs in subsequent years;
  - legal size limits;
  - fishing season;
  - fishing area permitted;
  - amount of fishing gear that can be used;
  - the design of fishing gear; and
  - the number of participants.
5. Provide a report to the Minister and relevant stakeholders, following initial notification of fishery performance outside of the reference range.

Given the inherent uncertainty in assessment processes and the range of external factors that can influence assessment outcomes, PIRSA Fisheries considers this non-prescriptive approach to management review and response to be appropriate at this stage. A more structured approach may be considered when assessment tools become available that provide a capacity to quantify the level of risk and uncertainty associated with the adoption of various alternative management strategies. The following table provides details on the estimates of performance indicators over the reference period.

**Table 6.** Key annual performance indicator estimates.

Performance Indicator	1999		2000		2001		2002	
	SZ	NZ	SZ	NZ	SZ	NZ	SZ	NZ
Total average catch rate	1.5	2.8	2.0	2.8	1.9	2.2	1.9	1.8
Annual catch vs TACC	2% under		15% over		2% under		12% under	
Mean weight (kg)	3.65		3.15		2.96		2.96	
Pre-recruit abundance index	*		1.62		1.70		1.60	

\* The dedicated giant crab fishery logbook was introduced in 2000.

Similar to other deep sea crab fisheries managed by other jurisdictions, the inherently small number of participants presents some challenges in using fishery-dependant data to generate estimates of performance indicators. Small changes in fisher behaviour can result in significant changes to the data collected and the inferences drawn from performance indicator estimates. For this reason, any analysis undertaken using the fishery-dependant data set requires careful interpretation.

### **There are management strategies in place capable of controlling the level of take.**

#### *Commercial Take*

There is a range of management strategies in place to ensure that PIRSA Fisheries controls the total level of take. The primary tools in place are total allowable commercial catch (TACC) limits in place for each zone. These TACCs have been set at conservative levels in recognition of the current level of uncertainty over key stock parameters. The full range of management controls in place have been outlined earlier in this document in Table 2 on page 9 and 10. The overall harvest strategy, which includes management objectives, strategies and performance indicators is outlined in Table 7 below.

**Table 7.** Harvest Strategy for the giant crab fishery.

Management Objectives	Management Strategies	Performance Indicators
To ensure that fishing is conducted at a level that maintains ecologically viable stock levels and protects fish stocks from overfishing.	<ul style="list-style-type: none"> <li>▪ Limit the number of licences in the fishery.</li> <li>▪ Restrict the total catch to a pre-defined precautionary limit in each zone (13.4 tonnes in the northern zone and 8.7 tonnes in the southern zone).</li> <li>▪ Prohibit fishing during spawning periods (closed seasons). <ul style="list-style-type: none"> <li>- southern zone (1 May – 30 September)</li> <li>- northern zone (1 June – 31 October)</li> </ul> </li> <li>▪ Restrict the catch of all crabs to above the minimum legal size limit of 150mm.</li> <li>▪ Prohibit the retention of egg-bearing females.</li> <li>▪ Restrict the quantity of gear used to target giant crabs to a maximum of 100 pots per licence.</li> <li>▪ Prohibit fishing for giant crabs by dedicated fishers to waters deeper than 60 fathoms.</li> <li>▪ Monitor vessel position and landings using VMS.</li> <li>▪ Restrict all commercial rock lobster fishers to a 5 crab by-catch trip limit.</li> <li>▪ Restrict the size at first capture by ensuring all giant crab pots comply with design specifications.</li> <li>▪ Restrict vessel size and capacity.</li> <li>▪ Stabilise the catch in each zone by maintaining the TACs in each zone during the period in which ITQs are being implemented.</li> <li>▪ Establish a 5-year strategic research and monitoring plan for the fishery.</li> <li>▪ Establish and maintain a commercial logbook system.</li> <li>▪ Maintain a cost-effective compliance and quota monitoring program to limit the opportunity for illegal activity.</li> <li>▪ Undertake an annual compliance risk assessment for the fishery.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Average annual catch rate</li> <li>▪ Annual mean weight</li> <li>▪ Annual commercial catch vs TACC</li> <li>▪ Total Pot lifts</li> <li>▪ Sex ratio</li> <li>▪ Pre-recruit abundance index</li> <li>▪ Spawning female abundance index</li> </ul>
To minimise any disruption to the structure, productivity, function and biological diversity of the marine ecosystem, within which the fishery operates.	<ul style="list-style-type: none"> <li>▪ Monitor and quantify non-target species interactions.</li> <li>▪ Monitor potential interactions with threatened or endangered species in the fishery.</li> <li>▪ Undertake research to identify optimal escape gap dimensions for giant crab pots.</li> <li>▪ Promote environmentally sensitive fishing practices and actions that reduce fishery impacts.</li> <li>▪ Improve data recording systems where possible.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Availability of data to undertake assessment of non-target species interactions and fishery impacts.</li> <li>▪ Trend in the relationship between target and non-target species catch levels.</li> </ul>
To provide efficient and cost effective management of the fishery.	<ul style="list-style-type: none"> <li>▪ Identify and recover attributable costs of management, research and compliance from direct beneficiaries each year.</li> <li>▪ Maintain cost-effective management frameworks.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Trend in the attributed costs of management, relative to fishery gross value of production.</li> <li>▪ Trend in annual base licence and quota unit fees.</li> </ul>
To maximise the economic returns and social benefits associated with the exploitation of the giant crab resource.	<ul style="list-style-type: none"> <li>▪ Develop a system for the routine collection of economic information.</li> <li>▪ Maximise operational flexibility.</li> <li>▪ Introduce a management system based on Individually Transferable Quota's (ITQs).</li> <li>▪ Maintain the regional development nature of the fishery.</li> <li>▪ Have regard to the range of social values attached to the fishery.</li> <li>▪ Maintain high levels of support for the management arrangements through consultation and public</li> </ul>	<ul style="list-style-type: none"> <li>▪ Trend in gross value of production.</li> <li>▪ Annual licence and quota unit market value.</li> <li>▪ Annual return on investment.</li> </ul>

	<p>accountability.</p> <ul style="list-style-type: none"> <li>▪ Encourage high levels of responsibility for management to stakeholder groups through consultative management processes.</li> </ul>	
To ensure equitable distribution of the giant crab resource.	<ul style="list-style-type: none"> <li>▪ Maintain an equitable system for allocating access shares between sectors and individuals.</li> <li>▪ Maintain equitable levels of public access and recreational opportunities.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Scope of resource access.</li> </ul>

### *Recreational and Traditional Take*

As previously stated, the recreational catch is considered to be negligible, if not non-existent due to the depth range in which fishing occurs and the proximity of the fishing grounds. No traditional catch of giant crabs is known to have occurred in South Australian waters.

### *Compliance and Enforcement*

PIRSA FISHWATCH monitors compliance with established TACCs and other management measures. The strategic aim of PIRSA Fiswatch is “to achieve optimal levels of compliance by all fishers”. Optimal compliance is considered to be cost-effectively controlling the level of non-compliance at an acceptable level, whilst not compromising the integrity and sustainability of the fisheries resource. To achieve this strategic aim, Fishwatch has two main goals:-

#### Goal 1 – Improved voluntary compliance

Voluntary compliance means encouraging fishers to voluntarily adopt and support fisheries laws for moral and ethical reasons.

#### Goal 2 – Effective deterrence

Effective deterrence means ensuring the penalties resulting from illegal activity outweigh any benefits gained from that activity.

A range of specific compliance and monitoring measures are in place for the giant crab fishery, that include the use of a vessel monitoring system, a catch and disposal record system, prior landing reports. Fishwatch has a statewide capacity through a regional distribution of fisheries offices throughout South Australia.

### **Fishing is conducted in a manner that does not threaten stocks of by-product species.**

The two dedicated giant crab fishers operating in South Australia are only permitted to retain giant crabs, in accordance with quota entitlements issued under the *Fisheries Act 1982*, which means that no by-product is retained by these two fishers. Other rock lobster fishers that have giant crab quota entitlements are permitted to retain by-product taken pursuant to their rock lobster fishery licences, in accordance with schedule 1 of the *Scheme of Management (Rock Lobster Fisheries) Regulations 1991*, which is set out in Table 8 below.

**Table 8.** Non-target species permitted to be retained for trade or business in the South Australian Rock Lobster Fisheries.

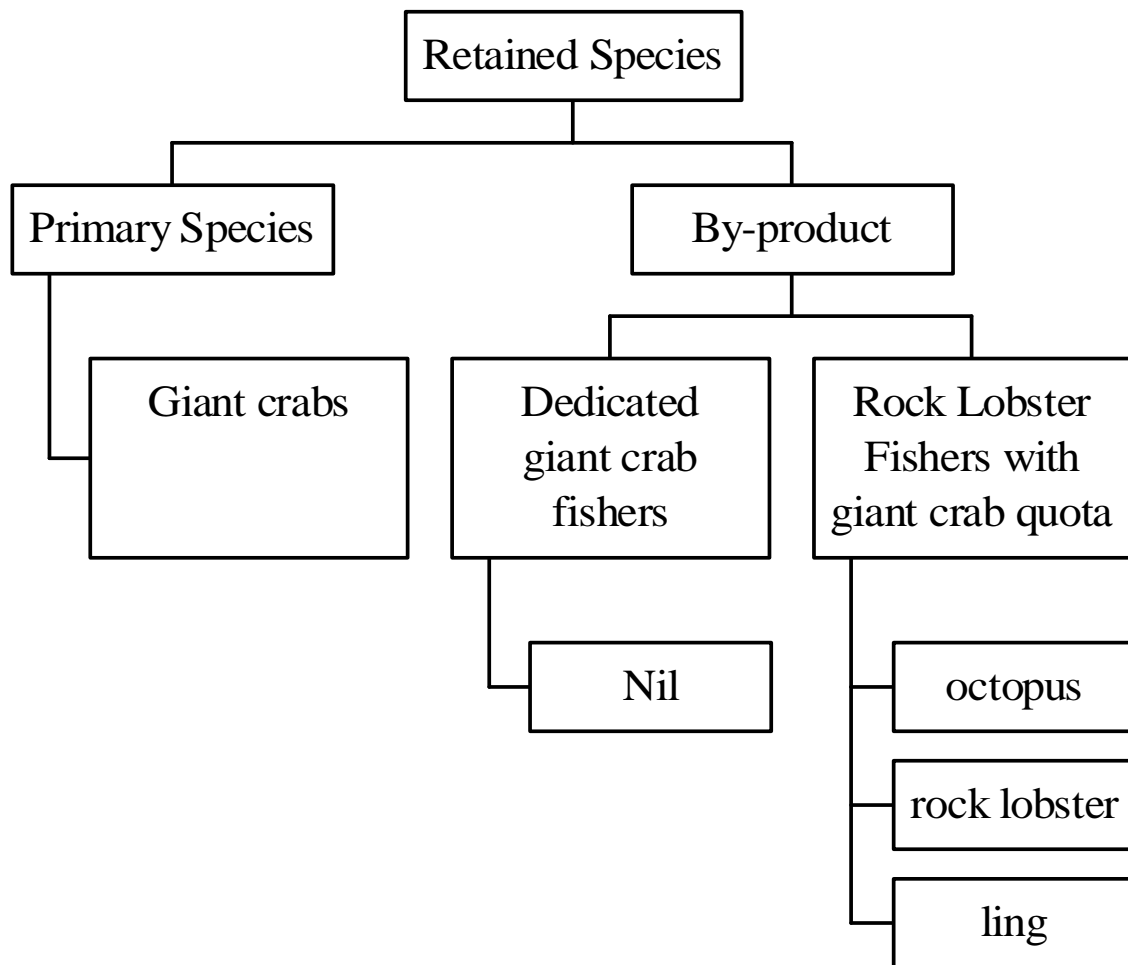
<b>Species Common Name</b>	<b>Species Scientific Name</b>
<u>Marine Scalefish</u>	
Anchovy	<i>Engraulis australis</i>

Barracouta	<i>Thyrsites atun</i>
Bluethroated wrasse	<i>Notolabrus tetricus</i>
Bream	<i>Acanthopagrus butcheri</i>
Cod	Family Moridae
Dory	Family Zeidae
Flathead	Family Platycephalidae
Flounder	Family Pleuronectidae; Family Bothidae
Garfish	<i>Hyporhamphus melanochir</i>
Horse mackerel	<i>Trachurus declivis</i>
Leather jacket	Family Aluteridae
Ling	<i>Genypterus blacodes</i>
Mackerel	<i>Scomber australasicus</i>
Morwong	Family Cheilodactylidae
Mullet	Family Mugilidae
Mulloway	<i>Argyrosomus hololepidotus</i>
Nannygai, Red snapper, Swallowtail	Family Berycidae
Pilchard	<i>Sardinops neopilchardus</i>
Red mullet	<i>Upeneichthys porosus</i>
Salmon	<i>Arripis truttaceus</i>
Snapper	<i>Chrysophrys auratus</i>
Snook	<i>Sphyraena novaehollandiae</i>
Sole	<i>Aserragodes haackeanus</i>
Sweep	<i>Scorpius aequipinnis</i>
Tommy ruff	<i>Arripis georgianus</i>
Trevalla	<i>Hyperoglyphe antarctica</i>
Trevally	<i>Usacaranx georgianus</i>
Whiting	Family Sillaginidae
<u>Crustaceans</u>	
Crab, giant	<i>Pseudocarcinus gigas</i>
Crab, velvet	<i>Nectocarcinus tuberculatus</i>
<u>Molluscs</u>	
Cockle	Suborder Teledonta
Cuttlefish	<i>Sepia</i> spp.
Mussels	<i>Mytilus</i> spp.
Octopus	<i>Octopus</i> spp.
Oyster	Family Ostreidae
Scallop	Family Pectinidae
Squid, calamary	<i>Sepioteuthis australis</i>
Squid, arrow	<i>Nototodarus gouldi</i>
Beachworm; Bloodworm; Tubeworm	Class Polychaeta
<u>Sharks</u>	
All shark, skate and ray species (other than white pointer sharks)	Class Elasmobranchii ( <i>Carcharodon carcharias</i> )

The different depth range (120 to 400m) and habitat in which giant crab fishing occurs results in less frequent and diverse by-product species capture than that associated with rock lobster fishing operations. The main by-product species that are taken in giant crab fishing operations are octopus (*Octopus maorum*), rock lobster (*Jasus edwardsii*) and pink ling (*Genypterus blacodes*). No specific by-product study of giant crab fishing operations has been undertaken in South Australia. The degree to which these species are taken as by-product or by-catch by rock lobster fishers varies across individual licence holders in each fishing zone. When retained, these species are either used as: (1) bait for rock lobster fishing operations; (2) by-product for commercial purposes; or (3) by-product for personal consumption.

An independent by-product/by-catch monitoring program commenced in both rock lobster fishing zones at the start of the 2001/02 fishing season. This program involves SARDI researchers undertaking low level at-sea monitoring to record non-target species interactions and total catch

composition. Catch sampling of by-catch and by-product is also undertaken in-port as part of this program to improve cost-effectiveness. This data is used to validate data collected by commercial fishers through logbooks and will be quantitatively analysed and reported during 2004.



**Figure 6.** Retained species in the giant crab fishery.

The main by-product species taken by rock lobster fishers is octopus (*O. maorum*), which is a common attribute of other fisheries for rock lobster in Australia and New Zealand. A recent study of the species taken in the South Australian fisheries by Brock, Prescott and Ward (2002) demonstrated that, since 1983 between 38,000 and 119,000 octopus have been taken per year in lobster pots across both zones, the majority being taken in the more productive Southern Zone. The study suggested that over the last 5 years approximately 240,000 lobster were killed each year as a result of pot-induced octopus predation, which represents an estimated 4% of the total annual lobster catch.

The study found that the relative abundance of octopus, as measured by CPUE data, does not appear to have declined in any statistical fishing blocks since 1983 and demonstrated that, over the last 26 years there have been large inter-annual fluctuations in catch rates across both zones. Brock, Prescott and Ward (2002) suggested that current levels of octopus mortality, as a result of the by-product taken by rock lobster fishers, has had no measurable affect on the population of octopus within the geographic extent of the fishery. The study concluded that there is no evidence to suggest that existing octopus by-product levels are unsustainable.

The main marine scalefish by-product species taken in rock lobster pots for bait purposes are leatherjackets and wrasse. Preliminary results of the by-product/by-catch study suggests that the take

---

of scalefish species in the rock lobster fishery, relative to that of other targeted scalefish fishing (both commercial and recreational), is low in most cases and does not present any significant risks to by-product species populations. The risk analysis intended to be completed as part of the by-catch monitoring program will provide a quantitative assessment of the impacts on non-target species populations associated with rock lobster fishing, relative to that of other target fisheries for marine scalefish.

**The management response, considering uncertainties in the assessment and precautionary management actions, has a high chance of achieving the objective.**

Despite the uncertainty in current assessments, the management strategies in place, particularly the direct controls in place on the total catch (TACCs) across both fishing zones, have stabilised catch rates and ensured that management is proceeding in a precautionary manner. The move from a competitive TACC system to one based on individually transferable quota (ITQ) arrangements is progressively gaining greater acceptance from remaining fishery participants, which will provide positive outcomes for management of the resource over time. When quantitative assessment techniques are refined through the work being undertaken by Tasmania and adopted in the South Australian fishery, other alternative and complementary management measures may be evaluated.

### **1.6.1 Objective 2:**

**Where the fished stock(s) are below a defined reference point, the fishery will be managed to promote recovery to ecologically viable stock levels within nominated timeframes.**

#### **Management responses**

**A precautionary recovery strategy is in place specifying management actions, or staged management responses, which are linked to reference points. The recovery strategy should apply until the stock recovers, and should aim for recovery within a specific time period appropriate to the biology of the stock.**

The fishery is considered to be in a sustainable position, following the introduction of precautionary TACCs and other management measures across both fishing zones. No formal stock recovery strategy has been put in place, although, as stated previously the southern zone TACC was reduced in recognition that the stock may have been fished at close to optimum levels prior to South Australia taking over management control of the species.

The process that will be followed, if fishery performance is determined to be unsatisfactory has been outlined previously on page 25. This process involves notifying the South Australian Minister for Agriculture, Food and Fisheries and other key stakeholders, followed by a review of the possible reasons for the fishery performing outside of the established reference range and consideration of what management measures may be necessary to return fishery performance to an acceptable level.

**If the stock is estimated as being at or below the biological and/or effort bottom line, management responses such as a zero targeted catch, temporary fishery closure or a ‘whole of fishery’ effort or quota reduction are implemented.**

As stated above, despite the uncertainty in current assessments, the fishery is considered to be performing well against established management objectives and performance measures. The management responses that will be implemented if fishery performance is assessed as unacceptable are outlined above and on page 25. This criteria is not considered to be applicable to the giant crab fishery at this stage.

### 1.3 PRINCIPLE 2

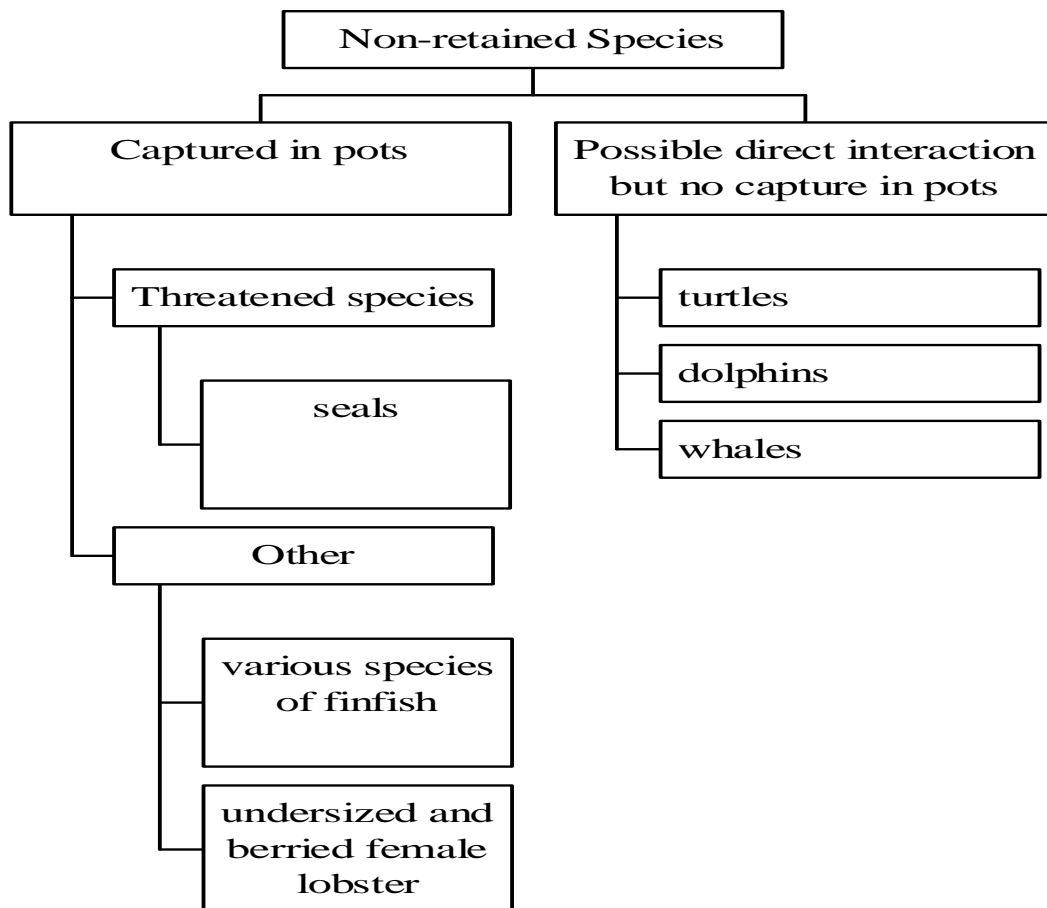
**Fishing operations should be managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem.**

#### 1.3.1 Objective 1

The fishery is conducted in a manner that does not threaten by-catch species.

Reliable information, appropriate to the scale of the fishery, is collected on the composition and abundance of by-catch.

The following table outlines the known interactions between giant crab fishing operations and non-target species.



**Figure 7.** Non-retained species in the giant crab fishery.

Information on by-catch is currently collected through the existing logbook program. The by-catch monitoring program in place for the rock lobster fishery is collecting information on the by-catch composition in relation to rock lobster fishing operations. The following preliminary by-catch composition table has been developed as part of this study.

**Table 15.** Non-target species catch composition in the Northern and Southern Zone Rock Lobster Fisheries, as recorded by the existing by-catch monitoring program.

<b>Species Common Name</b>	<b>Species scientific name</b>
<u>Marine Scalefish</u>	
Horseshoe Leatherjacket	<i>Meuschenia hippocrepis</i>
Chinaman Leatherjacket	<i>Nelusetta ayraudi</i>
Bluethroat Wrasse	<i>Notolabrus tetricus</i>
Sixspine Leatherjacket	<i>Meuschenia freycineti</i>
Velvet Leatherjacket	<i>Meuschenia scaber</i>
Barber Perch	<i>Caesioperca rasor</i>
Snapper	<i>Pagrus auratus</i>
Yellowstriped Leatherjacket	<i>Meuschenia flavolineata</i>
Brown Striped LeatherJacket	<i>Meuschenia australis</i>
Orangespotted Wrasse	<i>Notolabrus parilus</i>
Bluelined Leatherjacket	<i>Meuschenia galii</i>
Largetooth Beardie	<i>Lotella rhacina</i>
Moonlighter	<i>Tilodon sexfasciatum</i>
Ocean Perch	<i>Helicolenus percoides</i>
Red Snapper	<i>Centroberyx gerradi</i>
Bearded Rock Cod	<i>Pseudophycis barbata</i>
Conger Eel	<i>Conger verreauxi</i>
Jackass Fish	<i>Nemadactylus macropterus</i>
Maori Wrasse	<i>Ophthalmolepis lineolata</i>
Harlequin Fish	<i>Othos dentex</i>
Silver Spot	<i>Threpterus maculosus</i>
Knife Jaw	<i>Oplegnathus woodwardi</i>
Rosy Wrasse	<i>Pseudolabrus psittaculus</i>
Banded Seaperch	<i>Hypoplectrodes nigroruber</i>
Red Cod	<i>Pseudophycis bachus</i>
Spinytail Leatherjacket	<i>Acanthaluteres brownii</i>
Red Mullet	<i>Upeneichthys vlamingii</i>
<u>Sharks</u>	
Port Jackson Shark	<i>Heterodontus portusjacksoni</i>
Banded Wobbygong	<i>Orectolobus ornatus</i>
Gummy Shark	<i>Mustelus antarcticus</i>
<u>Crustaceans</u>	
Juvenile rock lobster	<i>Jasus edwardsii</i>
Crab, giant	<i>Pseudocarcinus gigas</i>
Crab, hermit	
Crab, velvet	<i>Nectocarcinus tuberculatus</i>
<u>Molluscs</u>	
Cuttlefish	<i>Sepia spp.</i>
Octopus	<i>Octopus maorum</i>
<u>Echinoderms</u>	
Starfish	
Sea urchins	

### **There is a risk analysis of the by-catch with respect to its vulnerability to fishing**

No formal risk analysis has been undertaken to determine the vulnerability of by-catch species to giant crab fishing operations. A risk analysis of the vulnerability of by-catch species in the rock lobster fisheries is planned to be undertaken by SARDI Aquatic Sciences during 2004 as part of the existing by-catch monitoring program. Based on the current understanding of by-catch interactions in the giant crab fishery, the risk level is considered to be low.

---

**Measures are in place to avoid capture and mortality of by-catch species unless it is determined that the level of catch is sustainable (except in relation to endangered, threatened or protected species). Steps must be taken to develop suitable technology if none is available.**

Escape gaps are used voluntarily by both dedicated giant crab fishers in South Australia, but are not compulsory at this stage. Escape gaps are required to be fitted to all rock lobster pots in the northern zone and are being considered for use in the southern zone (refer to ecological assessment of the South Australian rock lobster *Jasus edwardsii* fishery, Sloan 2003). The use of escape gaps is considered to minimise the interactions between giant crab and rock lobster fishing operations and non-target species.

**An indicator group of by-catch species is monitored.**

No indicator group of non-target species is monitored in the giant crab or rock lobster fisheries at this stage. The by-catch monitoring program currently being undertaken by SARDI Aquatic Sciences will continue to collect information on by-catch and other non-target species interactions in the rock lobster fishery. The risk to by-catch species taken in both rock lobster fishing zones is currently considered to be minimal because of the low level of take and interaction, relative to that of other targeted fishing operations, which are managed under separate arrangements. The current management of by-catch and by-product species will be re-evaluated following completion of the risk analysis, to be undertaken during 2004. Following this analysis, the need for ongoing monitoring will be determined.

**There are decision rules that trigger additional management measures when there are significant perturbations in the indicator species numbers.**

No formal decision rules have been put in place at this stage. Consideration will be given to appropriate decision rules and triggers for by-catch species, following the completion of the by-catch risk analysis. A general performance indicator has been established to monitor the trend in the amount of by-catch, relative to targeted catch.

**The management response, considering the uncertainty in the assessment and precautionary management actions, has a high chance of achieving the objective.**

This criterion is not considered to be applicable at this stage. However, the Fisheries Act provides a capacity for PIRSA Fisheries to rapidly introduce management responses to concerns over by-catch species, if necessary.

### **1.3.2 Objective 2**

**The fishery is conducted in a manner that avoids mortality of, or injuries to, endangered, threatened or protected species and avoids or minimises impacts on threatened ecological communities.**

**Reliable information is collected on the interaction with endangered, threatened or protected species and threatened ecological communities.**

Potential exists for a number of protected marine species to interact with rock lobster and/or giant crab pot float lines on rare occasions. These species include whales, dolphins, seals and turtles. The degree to which fishers may encounter each of these species varies temporally and spatially, although this has not been formally quantified. Information on these interactions has been collected on an *ad-hoc* basis through commercial logbooks and research cruises over many years and also through the current rock lobster fishery by-catch monitoring

---

program. It is currently not compulsory for fishers to record interactions with endangered, threatened or protected species in the prescribed fishery logbooks.

On rare occasions, seals in the family Otariidae are known to interact with float lines and become captured in rock lobster and giant crab pots. Seals that may interact with rock lobster pots in South Australian waters include the Australian sea lion (*Neophoca cinerea*), the New Zealand fur seal (*Arctocephalus forsteri*) and the Australian fur seal (*A. pusillus doriferus*). However, the feeding behaviour of Australia fur seals and the more remote offshore proximity of the giant crab fishing grounds is likely to exclude them from these interactions. In a general sense, this is also likely to be true for many other seal species.

Information on these interactions is collected in an *ad-hoc* way through commercial logbooks (currently not compulsory), through research cruises, by National Parks and Wildlife and via the current independent by-catch catch monitoring program. Although the level of seal interaction in each fishing zone appears to be low (generally lower in the Southern Zone than it is in the Northern Zone) it has not been independently and formally quantified. On this basis, the rock lobster industry in both South Australian fishing zones has supported the establishment of an on-board monitoring program to formally assess and quantify the level of interaction between rock lobster fishing and seals, in order to develop appropriate mitigation measures. Options and partnerships to progress the development of this project will be investigated during the course of 2003. Consideration could be given to extending this program to include the two dedicated giant crab fishers.

At present, it is not compulsory to record interactions with endangered, protected or threatened species in the South Australian rock lobster or giant crab fisheries. Consideration is currently being given to amending the existing logbooks or generating a new dedicated logbook to provide scope for fishers to record interactions with endangered, threatened and protected species, across all South Australian fisheries.

**There is an assessment of the impact of the fishery on endangered, threatened or protected species.**

There has been no formal risk assessment of the vulnerability of endangered, threatened or protected species to giant crab or rock lobster fishing. However, the giant crab fishery impact on populations of these species is considered to be low or negligible. The proposed on-board seal monitoring program in the rock lobster fisheries will provide additional information to facilitate impact assessments being undertaken.

Seals

The South Australian giant crab and rock lobster fisheries operate in waters that are adjacent to a number of seal breeding sites and specified critical habitats (Shaugnessy 1999). However, note that the giant crab fishing grounds are much further from these sites than standard rock lobster fishing grounds, in waters deeper than 60 fathoms, which significantly limits the likelihood of interactions with these species.

There are a number of major breeding colonies of Australian sea-lions and New Zealand fur seals throughout South Australia. Three locations in South Australia were estimated to account for 42% of the total Australian sea-lion population and most (77%) of the New Zealand fur-seal population in Australia exists in central South Australian waters.

While seal interactions appear to be rare in the rock lobster fisheries, the most frequently reported interactions relate to seals attempting to remove bait and lobster from pots, seal predation on juvenile rock lobster returned to the water and seal interactions with float lines. These interactions have not been reported in the giant crab fisheries. The impacts associated with these rare interactions include cuts and infections from float lines, death by drowning

---

through capture in pots and death by drowning through entanglement in float lines. The mortality rate of seals associated with pot interactions has not been formally quantified, but is likely to be low, based on information collected during collaborative work previously undertaken between SA rock lobster fishers and National Parks and Wildlife staff.

Some anecdotal reports of seal interactions with marine debris have been documented in South Australian waters. Some of this debris, namely plastic bait packaging straps, may have originated from commercial rock lobster fishing vessels. The impacts associated with these interactions include cuts and lesions and death by drowning due to entanglement (Shaughnessy 1999).

The current impact of giant crab and rock lobster fishing on seal populations is considered to be low. However, the frequency of seal interactions and the level of impact are considered to require further monitoring and investigation, as outlined above. It is intended that the monitoring program proposed to be undertaken, form the basis of a formal risk analysis of the impacts on seal populations associated with rock lobster pot fishing and also be used to develop appropriate mitigation measures. Note that many rock lobster fishers already use seal exclusion devices in pots, as a result of previous collaborative work undertaken with National Parks and Wildlife. These devices have not been used in giant crab pots because of the low level of interaction.

### Turtles

Turtle interactions with float lines in the South Australian giant crab and rock lobster fisheries are rare, due primarily to the low abundance of turtles distributed throughout South Australian waters. Carrick (1999) prepared a report entitled “The Spencer Gulf Penaeid Shrimp Fishery: A Case for an Exemption to the US Shrimp Embargo” in response to concerns over turtle interactions with the South Australian Spencer Gulf Prawn Fishery. This report documented that three turtle species have been recorded in South Australian waters. These include the loggerhead turtle (*Caretta caretta*), the leatherback turtle (*Dermochelys coriacea*) and the green turtle (*Chelonia mydas*).

No turtle rookeries occur in South Australia. The nearest rookery is approximately 1,800 nautical miles from the southern Spencer Gulf. Information indicates that no breeding populations or rookeries occur south of 25° 50' S and that both air temperature (for egg incubation) and sea water temperature impose natural limitations on rookery distribution in Australia (Carrick 1999). Turtles are known at times to be distributed further south in the east Australian current and the Leeuwin current during summer months.

Due to the factors outlined above, the impact of giant crab and rock lobster fishing on turtles populations is considered to be negligible. No formal risk assessment has been undertaken for turtles in the rock lobster fisheries, nor is it considered necessary. However, ongoing monitoring of turtle interactions with rock lobster fishing operations will continue to occur through the current by-catch monitoring program and potentially as part of the proposed seal monitoring program.

### Dolphins and Whales

The Head of the Bight is a significant breeding and calving area for the endangered southern right whale. The northern zone giant crab and rock lobster fisheries encompass the waters of the Great Australian Bight, with fishing activity occurring during the period between November and May of each year. No fishing is permitted in the sanctuary zone of the Great Australian Bight Marine Park, established primarily for southern right whales and Australian sea-lions.

---

Anecdotal information exists to suggest that interactions between whales, dolphins and giant crab/rock lobster pot float lines may occur on rare and infrequent occasions. On the basis that these events are extremely rare, no formal impact assessment has been undertaken, nor is it considered necessary. Due to the minimal interaction, the impact of rock lobster fishing on whale and dolphin populations in South Australian waters is considered to be negligible. However, ongoing monitoring of whale and dolphin interactions will continue to occur through the current rock lobster fishery by-catch monitoring program and potentially as part of the proposed seal monitoring program.

**There is an assessment of the impact of the fishery on threatened ecological communities.**

There are no threatened ecological communities currently listed in South Australian waters and there have been no specific assessments of the giant crab or rock lobster fishery impacts on ecological communities in South Australia. A study has been undertaken to assess the direct effects of rock lobster pots on rock lobster habitat, namely temperate shallow rocky reefs in South Australia (Casement and Svane 1999), which indicated that only a low level of impact occurs. The current plan of the State Government to implement a representative system of Marine Protected Areas may result in changes to the current classifications.

**There are measures in place to avoid capture and/or mortality of endangered, threatened or protected species.**

A number of measures have been introduced to minimise rare interactions with endangered, threatened and protected species in the South Australian Rock Lobster Fisheries. However, no specific measures have been developed for the giant crab fishery. Management measures that minimise the capture and mortality of endangered, threatened or protected species in giant crab pots include the following:

- The small number of fishery participants
  - 2 dedicated giant crab fishers
  - 7 northern zone rock lobster fishers
  - 13 southern zone rock lobster fishers
  - all remaining rock lobster fishers have a 5 crab trip limit
- All giant crab fishing is restricted to waters deeper than 60 fathoms
- Use of VMS technology
- All giant crab fishers are limited to a maximum of 100 pots.

A number of methods have been trialed to minimise the number of seal interactions with rock lobster pots. These include: (1) seal exclusion devices which consist of a vertical spike situated at the base of the pot neck, designed to stop seals and large fish from entering pots; and (2) attaching the bait storage container to the side of the entrance neck of the pot to prevent seals from being able to manoeuvre their heads far enough around the inside of the pot to steal the bait.

National Parks and Wildlife seal specialists endorsed the seal exclusion devices developed by South Australian rock lobster fishers during field trials. Although not regulated in South Australia, these measures are used widely by the rock lobster industry. Importantly, there are significant economic incentives for rock lobster fishers to avoid seal interactions, due to the reduced lobster catch rates associated with bait loss and seal predation.

In response to community concerns associated with marine debris, the commercial rock lobster industry, in partnership with the local and State Government's, has developed a plan to introduce a series of waste reception facilities along the South Australian coast in key fishing ports. The facilities are aimed at reducing, and eventually eliminating, marine debris associated with rock lobster fishing. These waste disposal facilities are a component of the 'clean green' project being developed by the South Australian Rock Lobster Advisory

---

Council, to have the fishery formally accredited against a comprehensive set of best practice guidelines. The aim of the project is to improve the environmental management of the rock lobster fishery in each zone, covering the fishing practices carried out at sea to the delivery of the product to the market.

Giant crab and rock lobster pot soak time is currently not regulated in South Australia. However, it is standard practice for commercial rock lobster fishers to set and haul pots once per day. This period may be longer for giant crab fishing operations. The need to maintain bait effectiveness mean that this principle is generally applied by most fishers across the fleet in both fishing zones.

**There are measures in place to avoid impact on threatened ecological communities.**

There are no threatened ecological communities in South Australian waters. The use of VMS technology assists PIRSA Fisheries to monitor fishing patterns in relation to any restricted areas, including the depth restrictions (60 fathom isobath).

**The management response, considering uncertainties in the assessment and precautionary management actions, has a high chance of achieving the objective.**

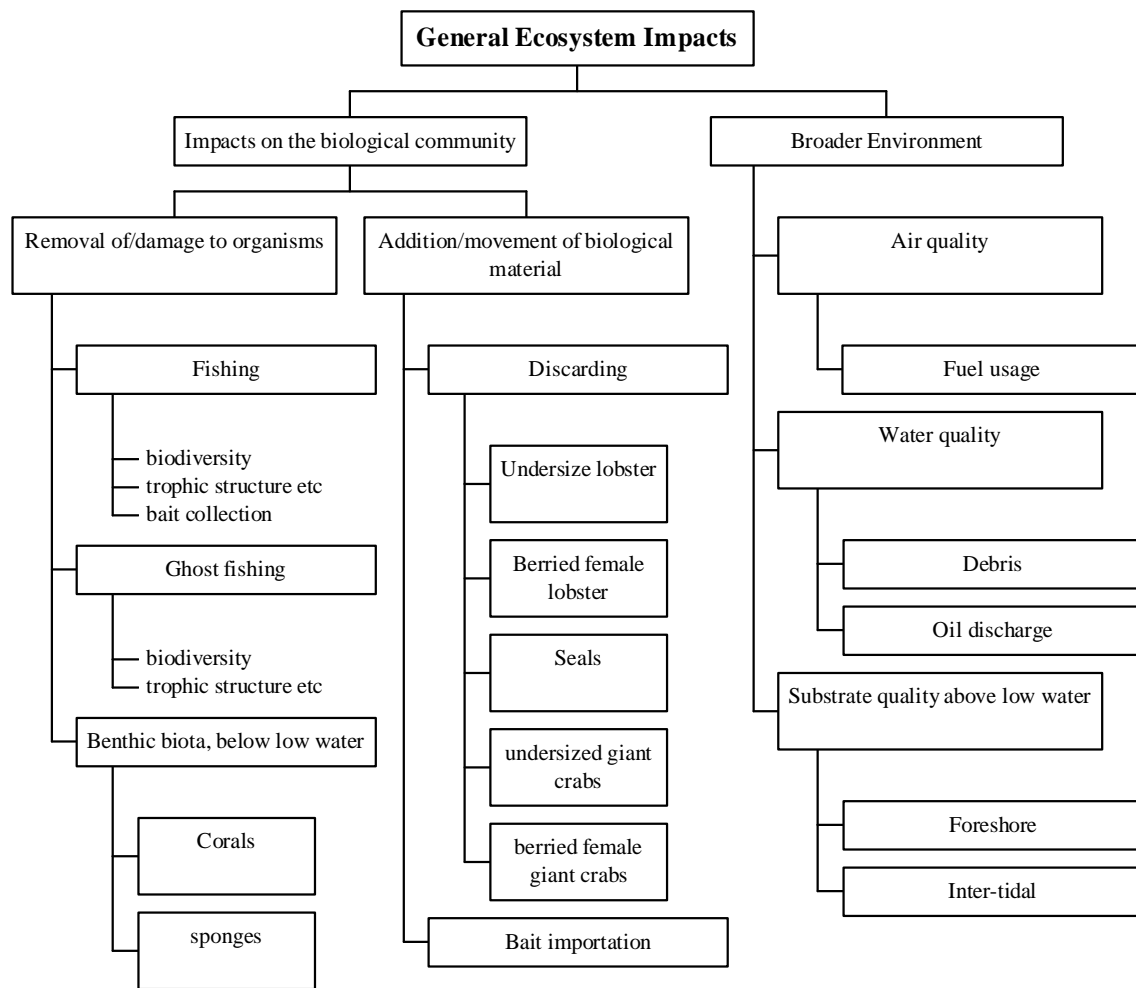
The fishery has an inherent low level of interaction with endangered, threatened or protected species and does not have an impact on any threatened ecological communities. On this basis and on the strength of the range of measures that have been introduced to address issues such as seal interactions with rock lobster pots used mainly in inshore waters, it is considered that the performance of the fishery against established management objectives is acceptable and that the fishery is being conducted in a manner that avoids mortality or injuries to endangered, threatened or protected species. The Fisheries Act provides scope to respond swiftly to any issues that may require the protection of a species or aquatic habitat

### **1.3.3 Objective 3**

**The fishery is conducted in a manner that minimises the impact of fishing operations on the ecosystem generally.**

**Information appropriate for the analysis in 2.3.2 is collated and/or collected covering the fisheries impact on the ecosystem and environment generally.**

No specific information on the broader ecosystem impacts of giant crab or rock lobster fishing is currently regularly collected. Additional research and information collection in this area may also flow from the South Australian Government's plan to introduce a representative system of MPAs. The following component tree outlines some of the potential impacts that may be associated with giant crab fishing operations.



**Figure 8.** The general ecosystem effects that may be associated with giant crab and rock lobster fishing.

**Information appropriate for the analysis in the assessment is collated and/or collected covering the fisheries impact on the ecosystem and environment generally.**

**Information is collected and a risk analysis, appropriate to the scale of the fishery and its potential impacts, is conducted into the susceptibility of each of the following ecosystem components to the fishery.**

**1. Impacts on ecological communities**

- **Benthic communities**
- **Ecologically related, associated or dependent species**
- **Water column communities**

**2. Impacts on food chains**

- **Structure**
- **Productivity/flows**

**3. Impacts on the physical environment**

- 
- **Physical habitat**
  - **Water quality**

Pots used to take giant crabs and rock lobster are generally considered to cause minimal environmental disturbance and limited damage to the benthos (Casement and Svane, 1999). Casement and Svane (1999) indicated that several factors minimise impacts on the environment:

- ❑ Pots are relatively small and only affect correspondingly small areas of habitat;
- ❑ By-catch is low and legislation specifically prohibits the taking of some by-catch species;
- ❑ Incidental capture of pinnepeds is not an issue of concern, as pots must be set in depths of greater than 120m;
- ❑ Rates of pot loss are low;
- ❑ The effectiveness of pots is limited to the period when the bait is present;
- ❑ Ecological implications of unused or discarded bait are limited as only small quantities of bait are used in each pot.
- ❑ The substrate in which giant crab fishing occurs is predominantly soft, muddy bottom that generally can not be significantly impacted by giant crab pots.

#### *Impacts on Ecological Communities*

No information is currently available. However, benthic survey work being undertaken by collaborative research between the CSIRO, the Tasmanian Aquaculture and Fisheries Institute (TAFI) and University of Tasmania may provide some insights to these impacts. The research will include a series of five benthic surveys in waters of between 150-350 metres aimed at assessing the seabed habitat of giant crabs around Tasmania. The project will include a study of the distribution of giant crabs in relation to habitat features, evaluating ecosystem links with the seabed habitats and assessing the abundance, sex, condition and size of the giant crabs.

#### *Impacts on Food Chains*

No direct information is available on the food chain impact of giant crab fishing, however, the Tasmanian research will advance understanding of these impacts. The maintenance of sustainable giant crab biomass levels across both fishing zones in South Australia is considered to minimise the risk of disturbance to wider food chain interactions.

#### *Impacts on the Physical Environment*

As previously discussed, a study by Casement and Svane (1999) assessed the direct impacts on the physical environment, namely shallow sub tidal reef biota, caused by the deployment and retrieval of rock lobster pots (light beehive design, heavy beehive design and square pot). The results of this study showed that rock lobster pot fishing in South Australia had minimal physical impacts on shallow temperate rocky reefs. No assessment has been undertaken in relation to the impacts of giant crab fishing on the physical habitat specifically.

#### *Water Quality*

---

The impacts of giant crab and rock lobster fishing on water quality are considered to be low due to the small number of vessels operating across South Australian waters, relative to the geographic expanse of the fishing grounds and the range of industry measures being developed to improve waste disposal and address potential localised impacts. The development of the previously discussed ‘clean green’ rock lobster industry initiative is aimed at reducing the environmental impacts associated with rock lobster fishing by improving the environmental performance of both fishing zones through improved industry practices.

The clean green initiative aims to establish a comprehensive set of standards for the rock lobster industry to address target and non-target species sustainability, ecological interactions, environmental impacts, food safety and product quality, which will be regularly audited by an independent accreditation body established by the joint Australian/New Zealand standards organisation, JAS-ANZ. The establishment of a series of waste reception facilities for oil, plastics and cardboard commenced in December 2002.

**Management actions are in place to ensure significant damage to ecosystems does not arise from the impacts described in 2.3.1.**

No specific management actions are in place. However, the management arrangements in place for are aimed at controlling the total catch of giant crabs to ensure ecologically sustainable giant crab population levels are maintained. These management arrangements, along with a range of other complementary management measures including gear specification restrictions, are considered to ensure the long-term sustainability of giant crab populations and minimise the overall impact on the ecosystem. A 40kg restriction on the maximum weight of pots was introduced to minimise the impact of pots on reef structures in the rock lobster fishery.

**There are decision rules that trigger further management responses when monitoring detects impacts on selected ecosystem indicators beyond a predetermined level, or where action is indicated by application of the precautionary approach.**

Not at present, however, these could be developed as better understandings are gained through research such as that being undertaken by Tasmania.

**The management response, considering uncertainties in the assessment and precautionary management actions, has a high chance of achieving the objective.**

While a formal ecological risk assessment has not been undertaken for the South Australian giant crab or rock lobster fisheries, the impacts on the ecosystem associated with fishing are considered to be acceptable and inherently low, as previously discussed. This is evidenced by the maintenance of long-term sustainable catches being produced by the ecosystem over a long time period. On this basis, the fishery is considered to be conducted in a manner that inherently minimises the impact of fishing operations on the ecosystem generally.

## **3 References**

---

Casement, D. and Svane, I. (1999). Direct Effects of Rock Lobster Pots on Temperate Shallow Rocky Reefs in South Australia: A Report to the South Australian Rock Lobster Industry. SARDI Aquatic Sciences.

Gardiner, C. (1997). Effect of size and reproductive output of giant crabs *Pseudocarcinus gigas* (Lamarck): Oziidae *Mar. Freshw. Res.* 48: 581-587.

Gardener, C. and Maguire, G.B. (1998). Effect of photoperiod and light intensity on survival, development and cannibalism of larvae of the Australian giant crab, *Pseudocarcinus gigas* (Lamarck) *Aquaculture* 158: 203 – 214.

Gardener, C. and Northam, M. (1998). Use of prophalactic treatment for larval rearing of giant crabs, *Pseudocarcinus gigas* (Lamarck) *Aquaculture* 158: 203 – 214.

Gardener, C. and Quintana, R. (1998). Larval development of the Australian giant crab *Pseudocarcinus gigas* (Lamarck 1818) (decapoda: Oziidae) reared in the laboratory. *Journal of Plankton Research* 20(6): 1169-1188.

Gardener, C., Rush, M. and Bevilacqua, T. (1998). Non-lethal imaging techniques for crab spermathecae. *Journal of Crustacean Biology* 18(1): 64-69.

Gardner, C. and Mackinnon, C. 2002. Tasmanian Giant Crab Fishery Stock Assessment. Published by the Marine Research Laboratories - Tasmanian Aquaculture and Fisheries Institute, University of Tasmania 2002

Ford, W. (1998) Summary report on the giant crab Research Workshop. Unpublished report.

Kailola, P.J., Williams, M.J., Stewart, P.C., Reichelt, R.E., McNee, A. and Grieve, C. (1993) Australian Fisheries Resources. Commonwealth of Australia. 422p.

Kennelly, S.J. (2000). Review of research on the giant crab fishery. Final unpublished report to PIRSA Fisheries. 14 p.

Levings A, Mitchel B.D., McGarvey R, Mathews J, Laurenson L, Austin C, Heeron T, Murphy N, Miller A, Rowsell M, and Jones P. Fisheries Biology of the Giant Crab, *Pseudocarcinus gigas*. Final Report to the Fisheries research and Development Corporation, Australia, for Projects 93/220 & 97/132. Deakin University.

Levings, A, Mitchell B.D., Heeren, T., Austin, C., Matheson, J. (1999). Size distribution, reproductive stage, movement and depth; a preliminary model of the fisheries biology of the giant crab. Preliminary report to FRDC.

McGarvey, R., Matthews, J.M. and Levings, A. (1999) Yield-, Value- and Yield-Per-Recruit of giant crab, *Pseudocarcinus gigas*. Final Report to FRDC. 73p.

# Attachment A

---

*Summary of project FRDC2001/042. Development of the tools for long term management of the giant crab resource: data collection methodology, stock assessment and harvest strategy evaluation.*

## Milestones

- 01-September-2001      Exchange of project agreements between states.  
30-November-2002      Completion of fisher and processor interviews. Completed correction of historical database and standardisation of CPUE.  
**31-March-2003          Completed initiation of fisher sampling in other states using methods developed in Tasmania. Completion of construction of stock assessment model frame.**  
30-July-2003          Completion of sensitivity analyses of model and model refinement.  
01-September-2003      Draft final report submitted.  
01-December-2003      Final report submitted.

## Progress summary

PIRSA is requested by EA to utilise outputs from this project for future assessments of the South Australian giant crab resource. This mainly relates to incorporating logbook and size structure data into the stock assessment model to assist with monitoring trends in giant crab biomass. Development of the stock assessment model is the final phase of the project and is scheduled for release with the final report, December 2003.

Work to date has been on preparing input data to the model. This includes:

- a) testing of data collection techniques for obtaining size-structure data;
- b) accumulating commercial log book data from state agencies in SA, Vic and Tas.
- c) obtaining consistency in data types between states and through time (eg definition of targeting crabs vs bycatch; spatial recording of effort), plus database corrections (eg errors in weight estimations due to unloadings).
- d) collecting interview data and interpreting in relation to tracking historical trends in CPUE

Major issues have been data errors in Tasmanian series and effort records in South Australian data pre 2000. Standardised and corrected CPUE estimates are due at the end of November 2002. The ability of State Agencies to incorporate model outputs into stock assessments will be possible after the distribution of the assessment model, scheduled for December 2003.

# Attachment B

## South Australian Giant Crab Fishery Logbook

### GIANT CRAB LOG

Main Port of Landing.....

Month .....

Year .....

Licence No. ....

Licence Holder.....

Depth Units Used: Fathoms  Metres

**GC 23601**

Day	At Sea Record									Crab Landing Details			
	Start lat/long	Finish or Most Distant lat/long	Depth	Crab Pots	Crab Number (retained)	Undersize Crabs	Spawning Crabs	Legal Crabs (Returned)	Lobster No. (Retained)	Female Kg	Female Number	Male Kg	Male Number
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31	JANUARY	MARCH	MAY	JULY	SEPTEMBER	OCTOBER	DECEMBER	ONLY					

I declare these figures to be true and accurate.

TOTALS

Signature.....

# South Australian Rock Lobster Fishery Logbook

## ROCK LOBSTER LOG

Depth Units Used: Rathom  Metres

RL 23602

Licence No.		Licence Holder		Main Part of Landing										Month	Year											
Day	Area	Depth	Tide	Lobster				Other Lobster Catch (including)				Scud Crab		Bycatch		Octopus		Other Marine Fish								
				kg	Number	Shedder	Dead	Spawning	Carapace (including)	kg	Number	kg	Number	Species Code	Form	kg	Number	Species Code	Form	kg	Number	Species Code	Form	kg	Number	
1																										
2																										
3																										
4																										
5																										
6																										
7																										
8																										
9																										
10																										
11																										
12																										
13																										
14																										
15																										
16																										
17																										
18																										
19																										
20																										
21																										
22																										
23																										
24																										
25																										
26																										
27																										
28																										
29																										
30																										
31																										
<b>TOTALS</b>																										

I declare these figures to be true and accurate.

This is my entire Marine Scale Catch Yes  No

Signature \_\_\_\_\_

