



Australian Government

Department of the Environment and Heritage

Assessment of the
South Australian Giant Crab Fishery

March 2004

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This document is an assessment carried out by the Department of Environment and Heritage of a commercial fishery against the Australian Government Guidelines for the Ecologically Sustainable Management of Fisheries. It forms part of the advice provided to the Minister for the Environment and Heritage on the fishery in relation to decisions under Parts 13 and 13A of the Environment Protection and Biodiversity Conservation Act 1999. The views expressed do not necessarily reflect those of the Minister for the Environment and Heritage or the Australian Government.

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**Assessment of the ecological sustainability of management arrangements for the South
Australian Giant Crab Fishery**

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EXECUTIVE SUMMARY

Background

The Department of Primary Industries and Resources, South Australia (PIRSA) has submitted a document for assessment under Parts 13 and 13A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The document - *Ecological Assessment of the South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery* (the Submission) was received by the Department of the Environment and Heritage¹ (DEH) in December 2003. The Submission was released for a thirty-day public comment period that expired on Wednesday 11 February 2004. One public comment was received and PIRSA provided a response to the issues raised. No changes were made to the Submission as a result of public comment.

The Submission reports on the South Australian Giant Crab (SAGC) Fishery against the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries* (the Guidelines). The DEH assessment considers the Submission and associated documents, public comments and PIRSA's response to the comments.

Table 1: Summary of the South Australian Giant Crab Fishery

Area	State and Commonwealth waters adjacent to South Australia. Fishery area is divided into 2 zones: Southern and Northern Zones
Fishery status	Key fishery performance indicators within reference ranges
Target Species	Giant (or king) crab <i>Pseudocarcinus gigas</i>
By-product Species	None permitted for 2 specialist giant crab fishers. Southern rock lobster, octopus, leatherjacket and wrasse permitted for rock lobster fishers with giant crab quota.
Gear	Beehive pot – maximum of 100 per licence - restrictions on dimensions and use apply.
Season	Closed: 1 May-30 September (Southern); 1 June-31 October (Northern).
Commercial harvest 2002-03	18.5 tonnes (i.e. below the 22.1 tonne total allowable commercial catch (TACC))
Value of commercial harvest 2001	\$447,000
Recreational harvest	No significant recreational take of target species
Commercial licences issued	2 dedicated giant crab licences; all 250 commercial rock lobster licensees may hold giant crab quota or have access to a giant crab by-catch trip limit
Management arrangements	Zonal management; TACC 8.7 tonnes (Northern) and 13.4 tonnes (Southern); 5 crab/trip limit for non-quota holders; limited entry, boat and gear restrictions, VMS, CDR documentation and spatial (no fishing in waters shallower than 60 fathoms) and temporal closures; legal minimum length, egg-bearing females protected.
Export	Most of the catch is sold overseas live to Asian markets.
Bycatch	Undersized and egg-bearing giant crabs and rock lobsters, fish and other invertebrate species, such as hermit crabs and starfish.
Interaction with Threatened Species	Potentially seals, whales, dolphins and turtles but little information directly implicating this fishery.

¹ The Department of the Environment and Heritage was formerly named Environment Australia

The area of the fishery includes waters on the continental shelf and the continental slope adjacent to South Australia (SA) to depths of over 400 m. While giant crabs are occasionally taken from State waters in depths as shallow as 18 m, the species is mainly targeted in Commonwealth waters in depths greater than 50 m. The highest numbers generally occur near the shelf break at depths of around 200 m. The two specialised operations fish at depths exceeding 65 fathoms (110 m) on predominantly soft substrates. Most of the giant crabs taken by dedicated rock lobster fishers are caught on rocky reefs in shallower waters.

The fishery targets giant crabs (*Pseudocarcinus gigas*). The major by-product species is southern rock lobster (*Jasus edwardsii*) which may only be retained and landed by rock lobster quota holders in accordance with rock lobster quota entitlements and fishing regulations. There are no limits on the quantities of octopus (the other main by-product species) or the main scalefish species taken as by-product by rock lobster/giant crab fishers. The two dedicated giant crab fishers are not permitted to retain any species other than giant crab.

The giant crab is endemic to the waters of southern Australia, extending from Perth in Western Australia to the central New South Wales coast and includes the waters surrounding Tasmania (Kailola *et al.*, 1993). Studies using allozyme and DNA techniques have indicated a genetically homogenous stock structure that shows variable depth distribution based on sex and size (Levings *et al.*, 2001). Factors such as the 3-4 month planktonic larval phase and adult movements of at least 400 km contribute to dispersion and mixing within the stock (Levings *et al.*, 2001). While they are found on a variety of substrates from depths as shallow as 18 m to over 400 m, they are most abundant in water depths of 150-350 m. Giant crabs are a slow growing, long-lived carnivorous species, which feed on a variety of other slow moving or sedentary species. Female giant crabs are highly fecund and reach sexual maturity at 125 mm carapace length. It takes about 7 and 4-5 years for females and males, respectively, to reach the legal minimum carapace length of 150 mm. Males grow to more than twice the size of females and may reach at least 13 kg.

In 2002-03, 18.5 tonnes of giant crab were harvested in the SAGC Fishery, at an estimated value of \$0.45 million. Most of the catch is exported in live, pickled, green (i.e. uncooked) or cooked form.

The SAGC Fishery is small and has only recently been managed in its own right, separate from the rock lobster fishery with which it is closely linked in terms of its history and current management arrangements. For decades, giant crabs were caught by rock lobster fishers mainly in the Southern Zone. Some were landed and sold to local or overseas markets. With the development of overseas markets and the growth of inter-state fisheries, SA's giant crab fishery grew through the 1990s, with the annual catch peaking at 33 tonnes in 1998-99, leading to the introduction TACCs for each zone. Jurisdiction for the fishery passed from Commonwealth management up to 1992, through joint State-Commonwealth management until 1997 when the responsibility for management passed to SA under an Offshore Constitutional Settlement agreement. Two SA fishers who had started fishing specifically for giant crabs during the mid-1990s were issued with SA licences to continue in the fishery from January 1997.

The fishery is managed under the *Fisheries Act 1982*, the *Scheme of Management (Miscellaneous Fisheries) Regulations 2000* and the *Fisheries (General) Regulations 2000*. These management arrangements are administered by the Agriculture, Food and Fisheries Division of PIRSA. While there is no management plan for the fishery, the Submission itself represents a comprehensive statement of the policy, legislative and administrative framework

under which the fishery is currently managed. The Submission indicates PIRSA's intention to commence the development of a formal management plan following the completion of the current DEH assessment process. Specific management arrangements for the fishery are described and discussed under Part Two of this report.

Giant crabs are only harvested by the commercial fishing sector. While recreational fishers may use pots they operate mainly in shallow inshore waters and, hence, rarely if ever catch giant crabs. There is no record of giant crabs being taken by the indigenous sector. Within South Australia, giant crab may also be captured during rock lobster fishing operations, by those fishers who hold giant crab quota, or as by-product (a 5crab/trip limit applies to non-quota holders). Giant crab is also harvested in managed commercial fisheries in Tasmania, Victoria and Western Australia and is taken in small quantities as by-product in the Great Australian Bight Trawl Fishery.

Because of the duration, depths of fishing, general ecological character of the fishing grounds and pot construction, including escape gaps, the bycatch by crab pots is small. For specialist giant crab fishers, the bycatch comprises non-retained (i.e. undersized, egg bearing or damaged) giant crabs and small numbers of a variety of species of scalefish, sharks and invertebrates such as hermit crabs. For rock lobster fishers who take giant crabs, the bycatch comprises non-retained giant crabs and rock lobsters and small numbers of many scalefish, small sharks, crabs and other invertebrates. None of these species is currently listed as protected under the EPBC Act. While the potential for entrapment and entanglement of seals, whales, dolphins and turtles in giant crab gear exists, the incidence is believed to be extremely rare. There is very little information directly implicating giant crab fishing in these interactions and the available information suggests that these interactions are at a very low level. While there is limited information about ecosystem impacts, in particular the role of giant crabs in the ecosystem, given the small quantities harvested in this fishery, DEH considers that the fishery also poses limited risk to the general ecosystem. Bycatch, protected species interactions and ecosystem impacts are discussed under Part Two, Principle Two of this report.

Overall assessment

The material submitted by PIRSA demonstrates that the management arrangements for the fishery meet most of the requirements of the Australian Government *Guidelines for the ecologically sustainable management of fisheries*.

DEH is satisfied that – in broad terms - the current management arrangements for the SAGC Fishery are appropriately precautionary and are commensurate with the development stage of this fishery. DEH recognises that the management arrangements for this small scale fishery are still in a developmental stage and considerable progress towards sound and precautionary management arrangements has been made. DEH particularly notes the introduction of an Individual Transferable Quota (ITQ) system and conservative total allowable catch limits to both zones of the fishery; the conservative minimum size limit; catch validation system and sound compliance and enforcement capabilities. The current strategic management planning, monitoring, assessment, response and review programs and processes in place, and the improved measures outlined in the Submission, show evidence of PIRSA's commitment to the ecological sustainability of the fishery.

While the fishery is relatively well managed, DEH has identified a number of risks and uncertainties that must be managed to ensure that their impacts are minimised:

- Inadequate information on critical elements of giant crab biology, including stock recruitment relationships and potential productivity of the resource;
- The absence of a robust assessment model and robust indicators of stock status;
- Reliance on unstandardised effort data;
- Risk of and inability to detect localised depletions; and
- Declining catch per unit effort trend in the Northern Zone.

Recommendations to address these issues have been developed to ensure that the risk of impact is minimized in the longer term. Through the implementation of the recommendations and the continuation of a responsible approach to the management of the fishery, management arrangements are likely to be sufficiently precautionary and capable of controlling, monitoring and enforcing the level of take from the fishery while ensuring the stocks are fished sustainably.

The management regime aims to ensure that fishing is conducted in a manner that does not lead to over-fishing and for fishing operations to be managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem. On balance, the fishery is being managed in an ecologically sustainable manner and has identified areas for future work to address existing problems and minimise environmental risks. The recent history of this developing fishery shows that PIRSA has reacted appropriately to threats to sustainability and DEH is confident that PIRSA will continue to provide this high quality management.

The operation of the fishery is consistent with the objects of Part 13A of the EPBC Act. DEH is satisfied that the fishery will not be detrimental to the survival or conservation status of the taxon to which it relates in the short term. Similarly, it is not likely to threaten any relevant ecosystem in the short term. DEH therefore recommends that the fishery be declared an approved Wildlife Trade Operation (WTO) with the actions specified in the recommendations to be undertaken by PIRSA to contain the environmental risks in the long term. DEH is satisfied that the fishery, as managed in accordance with the management regime is not likely to cause serious or irreversible ecological damage over the period of the export decision. Specifically, the WTO declaration would allow the export of product from the fishery for a period of three years. The WTO declaration will require annual reporting on the progress of implementing the recommendations of this report and other managerial commitments. The implementation of the recommendations will be monitored and reviewed as part of the next DEH review of the fishery in three years time.

As the official fishery area encompasses Commonwealth as well as State waters, consideration under Part 13 of the EPBC Act is required regarding the impact of the fishery on listed threatened species, listed migratory species, cetaceans and listed marine species.

A number of protected wildlife species occur in the fishery area, including marine turtles, seals, cetaceans and seabirds, however the fishery has minimal interaction with these species. DEH considers that the fishery is unlikely to have an unacceptable impact on protected species. DEH recommends that the management regime be accredited under Sections 208A, 222A, 245 and 265 of the EPBC Act. In making this judgement, DEH considers that the fishery to which the regime relates does not, or is not likely to, adversely affect the survival in nature of listed threatened species or population of that species, or the conservation status of a listed migratory species, cetacean species or listed marine species or a population of any of those species. DEH also considers that the management regime requires that all reasonable steps are taken to avoid the killing or injuring of protected species, and the level of interaction under current fishing operations is low. On this basis, DEH is satisfied that an action taken by an individual fisher,

acting in accordance with the management regime, would not be expected to have a significant impact on a listed threatened species or listed migratory species protected by the EPBC Act.

Recommendations

1. PIRSA to inform DEH of any significant future amendments to the management regime for the South Australian Giant Crab Fishery or managerial commitments made in the Submission.
2. PIRSA to establish a consultative mechanism to ensure that specialist giant crab fishers have the opportunity to provide input into management, stock assessment and research priority setting for the giant crab fishery. In addition, the current review of South Australia's Fisheries Act 1982 should provide for the inclusion of general community members on fisheries management committees. Greater efforts should also be made to increase conservation and general community involvement in stock assessments and research priority setting processes.
3. PIRSA to implement a system for the ongoing monitoring of giant crab catch size composition for giant crab quota holders, and incorporate results into annual stock assessments and future management arrangements.
4. PIRSA to review the research and stock assessment needs and priorities to support the sustainable management of the giant crab fishery. Analysis of research needs should take into account any gaps in the basic biological parameters required for stock assessment and include consideration of any habitat and ecosystem impacts associated with fishing. A strategic research plan / strategy to address identified priority areas will be developed and will include clear and achievable timeframes for implementation.
5. PIRSA to ensure that fishing effort data are standardised to more accurately reflect the degree of targeting of giant crabs by all fishers in the fishery and provide a more robust index of giant crab abundance. Existing assessments should be re-evaluated and all future assessments based on standardised effort data.
6. PIRSA to develop and implement, in conjunction with other relevant jurisdictions where possible, a robust stock assessment model to establish a quantitative basis for annual TAC setting and determination of stock status.
7. PIRSA to establish a regular dialogue with other Australian jurisdictions responsible for managing giant crab fisheries to ensure that research and management arrangements are complementary. All available information regarding removals of target and by-product species by other jurisdictions and sectors (including Commonwealth trawlers) is to be considered in stock assessments.
8. PIRSA to collaborate, where appropriate, with the Tasmanian Department of Primary Industries, Water and Environment and the Australian Fisheries Management Authority on any future research or data collection programs to assess the impact of harvest and incidental damage to giant crabs and their habitat by trawling activity in giant crab fishing grounds.
9. PIRSA to review the suite of indicators and measures used to assess the performance of the fishery, following the completion of a quantitative stock assessment.

10. PIRSA to develop and implement a mandatory system for the monitoring and assessment of bycatch and protected species interactions for all giant crab quota holders to ensure that changes in bycatch quantity and/or composition and protected species interactions can be detected and monitored over time.
11. PIRSA to conduct an ecological risk assessment focussed on interactions of the fishery with bycatch and protected species, ecological communities, deepwater habitats and the marine environment to confirm assumptions that the fishery poses minimal risk to these components. The risk assessment should also include assessment of the risk of ghost fishing by lost or discarded giant crab pots in the fishery. Using the outcomes of the risk assessment, PIRSA to also develop appropriate monitoring, performance measures and responses for the ongoing management of components identified as high risk.

PART I - MANAGEMENT ARRANGEMENTS

The South Australian Giant Crab (SAGC) Fishery is managed by the Department of Primary Industries and Resources, South Australia (PIRSA).

The management regime is described in the following publicly available documents:

- *Fisheries Act 1982*;
- *Scheme of Management (Miscellaneous Fisheries) Regulations 2000*;
- *Fisheries (General) Regulations 2000*;
- *Fisheries (Management Committees) Regulations 1995*;
- and relevant Gazetted notices and licence conditions.

There are a number of other documents, including research reports, scientific literature and discussion papers, which are integral to the management of the fishery. Several of these documents are published. A notable example is the “Management policy for the South Australian Giant Crab Fishery” which is accessible on the PIRSA website at www.pir.sa.gov.au in the form of a report titled “A report prepared for Environment Australia on the management of the South Australian giant crab (*Pseudocarcinus gigas*) fishery”. The Submission represents an updated detailed and publicly available summary of the policy, legislative, administrative and other elements of the management regime for the fishery.

The Submission indicates PIRSA’s intention to begin the development a formal management plan for the fishery at the completion of this DEH assessment process. Currently, SA’s management plans are policy documents that have no legislative basis despite the fact that they specify important elements of the management arrangements not found in statutory documents. For example, they generally include detailed management triggers, decision rules and performance measures and define the objectives, targets, monitoring requirements and management responses. The commitments of this sort outlined in the Submission have been fundamental to DEH’s assessment and consequent recommendations. While DEH believes that South Australia’s (SA’s) management plans will continue to be well documented, publicly available and transparent, DEH regards the development and formalisation of the management regime as a priority for the fishery.

DEH considers it important that management arrangements remain flexible to ensure timely and appropriate managerial decisions. Due to the importance of the management plan and documents referred to above to DEH’s assessment of the fishery, an amendment could change the outcomes of our assessment and decisions stemming from it.

Recommendation 1: *PIRSA to inform DEH of any significant future amendments to the management regime for the South Australian Giant Crab Fishery or managerial commitments made in the Submission.*

SA’s statutory fisheries management committees provide the main expression of co-management, ensuring the involvement of a range of expertise and community interests in the assessment, planning and consultation processes involved in the development and review of management for individual fisheries. These committees also provide the main forums for stakeholder and broader community input on management and policy issues – and the development of management plans - as a key feature of their role in advising and assisting the Director of Fisheries and the responsible Minister in the management of the fishery. In the case of the SAGC Fishery, significant management issues are currently referred to the Southern Zone

Rock Lobster Fisheries Management Committee and Northern Zone Rock Lobster Fisheries Management Committee or to an informal “giant crab fishery management working group”. DEH understands that, at its current stage of development and given SA’s cost recovery policy, this fishery may not be in a position to warrant a dedicated fisheries management committee. Under these circumstances, and given its historical and continuing links with the rock lobster fishery, the current arrangements appear to be adequate.

Each of the rock lobster zone fisheries management committee is a statutory body comprising an independent chair, commercial fishers, recreational fishers, PIRSA Fisheries manager, South Australian Research and Development Institute (SARDI) scientist and a committee support officer. DEH notes that there is no direct representation of specialist giant crab fishers operating in the fishery. DEH considers that specific consultation with specialist giant crab fishers should be incorporated in PIRSA’s ongoing management of the giant crab fishery. If it is not possible for giant crab fishers to be included on the existing rock lobster committee then PIRSA should establish a separate consultative mechanism to ensure that specialist giant crab fishers are afforded adequate input to management and stock assessment. DEH notes that PIRSA has previously used a working group involving the two dedicated fishers and other giant crab quota holders, which may continue to be a useful mechanism.

The Submission indicates that fisher members of the management committees are generally drawn from local coastal communities and broader community input is provided through such means as requiring each committee to hold an annual public meeting and provision for observers at meetings. DEH considers that broad community interests and stakeholders should also be directly represented on each fisheries management committee. Involvement of conservation and broad community interests should also be actively encouraged in stock assessment and research priority setting processes. Noting the current review of the *Fisheries Act 1982* there should be scope to pursue this need in the near future.

Recommendation 2: *PIRSA to establish a consultative mechanism to ensure that specialist giant crab fishers have the opportunity to provide input into management, stock assessment and research priority setting for the giant crab fishery. In addition, the current review of South Australia’s Fisheries Act 1982 should provide for the inclusion of general community members on fisheries management committees. Greater efforts should also be made to increase conservation and general community involvement in stock assessments and research priority setting processes.*

The Submission demonstrates the strategic nature of SA’s management arrangements in its harvest strategy for the fishery, which sets out the management objectives, strategies and linked performance indicators for the fishery in all areas of concern under the Guidelines. The management objectives are consistent with SA’s Act, the EPBC Act and the Guidelines, with particular emphasis placed on the health and integrity of the giant crab stock and associated marine ecosystem. DEH considers that these goals and objectives are appropriate as the basis for managing the fishery. The management arrangements include performance indicators, limit reference points and management responses in relation to the fishery as a whole. An assessment of the effectiveness of these measures is included in Part Two of this report.

Zonal management is a critical component of the management regime. The fishery is divided into two zones: the developed fishery in the Southern Zone and the developing fishery in the Northern Zone. In addition to zonal management, the management regime is also based on a mixture of input and output controls. These controls, which are discussed in detail under Part One, Principle 1 of this report, include:

- Quota management system (QMS) using individual transferable quota (ITQ) and a TACC for each zone;
- Mandatory fitting of a vessel monitoring system (VMS) to all vessels;
- Real time pre-landing reporting;
- Catch disposal records (CDRs) at the time and point of landing;
- Minimum giant crab size limit (150 mm);
- Limited entry;
- Gear and spatial restrictions;
- Seasonal closures; and
- Prohibition on the harvest of berried females.

The critical aspects of these management arrangements are underpinned by compliance and quota monitoring. The major emphasis of the enforcement arrangements for this output controlled fishery is the monitoring of landings, involving in-port inspections, use of VMS technology, prior reporting of landings and CDRs completed immediately upon landing with copies accompanying catches to processors for final completion. CDRs form the primary basis for monitoring quota use and are cross-checked against fishers' monthly catch and effort returns and with processor records. Monitoring vessel positions using VMS (linked with prior landing reports) provides a capacity for compliance to monitor landings as well as another valuable means of achieving compliance with spatial and seasonal restrictions and catch and effort reporting. Compliance intelligence indicates a high level of industry support for and compliance with reporting requirements. PIRSA has adopted a risk assessment approach to achieving the most strategic and cost effective use of compliance and monitoring resources. DEH is satisfied that these compliance measures contain the means of enforcing critical aspects of the management arrangements.

The Submission indicates that the performance of the fishery and the effectiveness of the management arrangements are examined annually against a suite of biological performance indicators at informal assessments undertaken by PIRSA and the South Australian Research and Development Institute (SARDI). DEH has received copies of the reports of the first two assessments, held in 2000 and 2001. The Submission refers to PIRSA's intention to move to a more formal annual assessment process. DEH recognises the progress achieved in SA's management of this fishery since assuming responsibility in 1997 and urges PIRSA to ensure that community and conservation interests are given the opportunity to contribute to this assessment process in future (see **Recommendation 2**). The Submission states that performance indicators are to be reviewed when a quantitative stock assessment model has been developed. It also refers to a "regular internal review process of assessment methodologies and information requirements" as part of SARDI's annual stock assessment process. However, it makes no reference to the periodic review of management objectives, strategies and performance measures. DEH notes that with the development of a management plan, regular periodic reviews will be built in as a standard feature of the ongoing management of the fishery.

Fishery-dependent data relating to the target species is collected on a regular basis in the fishery. Limited fishery independent information is also collected. In addition, explicit management strategies outline monitoring, research and education actions which are intended to improve SA's capabilities in terms of avoiding, remedying or mitigating such impacts on the wider ecosystem. Discussion of the information collection system and future work, both proposed and required, can be found in Part Two of this report. A full analysis of the fishery's capacity for assessing, monitoring and avoiding, remedying or mitigating any adverse impacts on the wider marine ecosystem in which the target species lives and the fishery operates is also contained in Part Two of this report.

DEH is satisfied that the current management arrangements are consistent with all relevant threat abatement plans, recovery plans, the National Policy on Fisheries Bycatch, and bycatch action strategies developed under that policy. The *Fisheries Act 1982* contains mechanisms that allow for amendments to management practices so that they comply with any future plans of these types.

No regional or international management regimes, to which Australia is a party, are of direct relevance to the fishery. The prime international regime affecting the fishery is the United Nations Convention on the Law of the Sea (UNCLOS). The management regime essentially complies with this. Other international regimes are applicable to fisheries management but do not explicitly involve this fishery, for example the 1992 Convention on Biological Diversity and in particular the 1995 Jakarta Mandate requiring that, in relation to the sustainable use of marine and coastal biological diversity, the precautionary principle should apply in efforts to address threats to biodiversity. While these agreements are not specifically addressed in the Submission, the fishery's compliance with their requirements can be assessed by examination of Part Two of this report. The application of the International Convention for the Prevention of Pollution from Ships (MARPOL) to vessels operating in the fishery is explicitly discussed under Principle 2, Objective 3.

DEH considers it is incumbent on all authorities to develop a thorough understanding of the framework of national, regional and international agreements and their applicability to export-based fisheries for which they are responsible.

Conclusion

DEH is satisfied that the SAGC fishery management regime is documented, publicly available and transparent, and is developed through a consultative process. The management arrangements are adaptable and underpinned by appropriate objectives and performance criteria by which the effectiveness of the management arrangements can be measured, enforced and reviewed.

The management arrangements are capable of controlling the harvest through a combination of input and output controls appropriate, to the size of the fishery. Periodic review of the fishery is provided for, as are the means of enforcing critical aspects of the management arrangements. The management regime also takes into account arrangements in other jurisdictions, and adheres to arrangements established under Australian laws and international agreements.

DEH considers that there is scope to refine the management arrangements in some of these areas and has provided a number of recommendations for improvements in the longer term.

PART II – GUIDELINES FOR THE ECOLOGICALLY SUSTAINABLE MANAGEMENT OF FISHERIES

Stock Status and Recovery

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’*

Maintain ecologically viable stocks

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

Fishery dependent data are obtained through compulsory monthly catch and effort logbooks, which operators complete on a daily basis and submit to SARDI each month. This information has been collected from rock lobster fishers since 1994 and from specialist giant crab fishers since 1997. The detailed daily records include catch of giant crabs (sex, numbers and weight), by-product and bycatch (recorded by rock lobster fishers only), fishing effort (pot numbers), location and depth details. Commercial logbook data are periodically validated against CDR records and show a high level of agreement. Effort data is validated against VMS records. Enforcement sources also indicate high levels of industry support for and compliance with fishery reporting requirements.

Daily logbook reporting requirements for specialist giant crab fishers also include the numbers of undersized, spawning and legal sized giant crabs which are discarded. These records can provide important inputs to stock assessments and the estimation of fishing-induced mortality as well as information on trend in the population structure and distribution. However, similar information is not required of rock lobster fishers, whose impacts on the giant crab stock may be quite different because of the shallower and more rocky substrates on which they fish. While the Submission gives no indication of the respective catches, landings and discards by specialist fishers and rock lobster fishers who take giant crabs, DEH considers it important that the full impact of rock lobster fishers on giant crab stocks be monitored. DEH notes that limited information on giant crabs as by-product and bycatch of rock lobster fishing is being collected – at sea and in ports - as part of an independent monitoring study of the rock lobster fishery. However, the duration of this program is uncertain. DEH believes that in the absence of mandatory recording of giant crab discards by rock lobster fishers that this independent study provides important information relevant to the overall management of the giant crab resource in SA. DEH strongly encourages the continuation of the monitoring program so as to provide an indication of the level of giant crab discarding by rock lobster fishers.

PIRSA proposes to commence an industry-based on-board catch sampling program following a preliminary stock assessment to be conducted by SARDI during 2004/05. DEH encourages the commencement of this program as an important source of essential information to complement catch and effort data as inputs to stock assessments, TACC setting and fishery performance measurement.

Apart from the use of pots in what are quite specialised fishing operations there is no effective way of sampling the giant crab stock. Because of the small size of the fishery and the deep, extensive and remote nature of the waters where giant crabs occur, all information on the stock

off SA has been obtained from giant crab pot-fishing undertaken from commercial fishing vessels. The Submission recognises the lack of independent monitoring in the fishery but states that collecting fishery-independent information is not cost-effective given the small scale of the fishery and high cost of independent monitoring. DEH agrees that at this time, fishery independent monitoring may not be feasible but encourages PIRSA to incorporate any independent data made available by other giant crab fisheries where appropriate and to continue to ensure high compliance with fishery dependent monitoring systems.

SARDI researchers are in periodic contact with Tasmanian and Victorian counterparts who have undertaken a joint program involving the collection of data at sea on commercial giant crab fishing vessels. This project has gathered data (in particular, critical size composition data) for use in the development of a new and reliable risk-based stock assessment model, a cost-effective long term monitoring program and for the standardisation of fishing effort. Acknowledging the difficulties associated with mounting a dedicated fishery independent monitoring program for the SA fishery, DEH encourages PIRSA to continue working closely with inter-state counterparts towards the application of the results to the SAGC Fishery. This issue is discussed further in a later section under this objective.

The size composition of the catch has not been monitored by PIRSA in this fishery. Although the two dedicated giant crab fishers have recorded individual giant crab size and weight for a number of years, in response to requests from buyers and processors. This information has been provided to PIRSA for analysis. As an important input to the stock assessment model being developed in Tasmania – and as a useful indicator in monitoring fishery impacts – DEH sees this as a significant deficiency in the monitoring arrangements for the SAGC Fishery. PIRSA advise that this information has now been made available to PIRSA for future incorporation into annual stock assessments.

Part of the Fisheries Research and Development Corporation (FRDC) project (2001/042) on giant crabs aimed to establish an on-board catch sampling program. DEH notes that Tasmania has completed this part of the project successfully and that PIRSA intend to implement a similar program for the SAGC to provide valuable information for future annual stock assessments. DEH understands the practical difficulties associated with independent monitoring at sea and agrees that sampling needs may be addressed by instituting voluntary catch sampling by giant crab fishers, as currently operates in the rock lobster fishery. DEH encourages consideration of the outcomes of the Tasmanian program and the timely development of a similar program in the SAGC Fishery.

Recommendation 3: PIRSA to implement a system for the ongoing monitoring of giant crab catch size composition for giant crab quota holders, and incorporate results into annual stock assessments and future management arrangements.

The Submission identifies the development of a 5-year strategic research and monitoring plan as a key action required in support of the objective of ensuring that fishing is conducted on a sustainable basis. It indicates that the highest priority research need for this fishery is a quantitative stock assessment model. It also indicates the need for research to determine the optimum escape gap size to minimise ecological and biodiversity impacts of giant crab trapping. DEH notes that information on critical elements of giant crab biology is inadequate and may impede further development of the fishery, especially in relation to the development of a robust stock assessment model. Recognising that (a) stock assessment has already been identified as the priority need for the fishery; (b) that significant work in Tasmania is underway (jointly with south Australia) to develop a robust stock assessment model; and (c) significant information

gaps may still exist, particularly in relation to basic giant crab biology, habitat and ecosystem impacts, DEH considers there is a need for a clear set of research priorities and a research strategy/plan for the fishery.

Recommendation 4: *PIRSA to review the research and stock assessment needs and priorities to support the sustainable management of the giant crab fishery. Analysis of research needs should take into account any gaps in the basic biological parameters required for stock assessment and include consideration of any habitat and ecosystem impacts associated with fishing. A strategic research plan / strategy to address identified priority areas will be developed and will include clear and achievable timeframes for implementation*

Taking into account the recent emergence of this fishery as a State managed fishery, DEH is satisfied that the current information system is reliable and has been appropriate to the nature and scale of the fishery. DEH acknowledges the practical difficulties associated with collecting fishery independent information on a fishery of this nature and size. Accordingly, DEH notes PIRSA's commitment to continue collaborating closely with inter-state counterparts towards the development of stock assessment and monitoring programs suited to giant crab fisheries. DEH is confident that the monitoring arrangements that will flow from that collaboration will represent a major advance in terms of establishing an appropriate mix of fishery independent and dependent research and monitoring. The development and implementation of PIRSA's proposed strategic research plan in 2004 will be vital additional steps towards an information system that is reliable and appropriate to the scale of the fishery.

Assessment

Giant crab stock assessments are conducted informally on an annual basis by SARDI and PIRSA and the results are used to set an annual TACC. In view of its recent development as a substantive State-managed entity, annual informal stock assessments for the SAGC Fishery rely heavily on the limited time series of commercial fishery data. The Submission acknowledges the limited robustness of the assessments, pending the implementation of more quantitative models and improved data sets. Nevertheless, DEH recognises these early efforts to use the available data to assess the fishery's performance in terms of impacts on the stock, population biology (including reproductive capacity) and attainment of the TACC.

Annual performance is measured against a set of values for the reference period 1999-00 to 2002-03. This period was chosen on the basis of the historical performance of the fishery which was considered to be relatively stable in terms of measures such as catch, catch rate, gear and fishing technology following the introduction of the TACC in 1999. In the absence of a solid time series of fishery data and desirable benchmarks (e.g. estimates of unfished stock biomass and egg production), DEH accepts this approach, which is also being used effectively in the management of SA's rock lobster fishery. DEH notes PIRSA's acknowledgement of the limitations associated with the current performance indicators, which means they should be applied very conservatively as an interim basis for performance measurement. Further discussion of performance measures is contained in the 'Management response' section below.

Annual stock assessments rely heavily on fishery dependent catch and effort data in the absence of a quantitative stock assessment model. DEH acknowledges that reliance on catch and catch per unit effort (CPUE) has been necessary to date and considers this an appropriate approach in the absence of more robust tools. However, DEH has some concerns about the continued reliance on unstandardised fishing effort data in the estimation and application of catch rates as the key assessment and performance measure. Commercial fishery data are being reported by a combination of up to:

- two specialist offshore fishers;
- 20 rock lobster fishers with giant crab quota when they target giant crabs;
- 20 rock lobster fishers with giant crab quota when they take giant crabs as a by-product of rock lobster fishing; and
- 230 rock lobster fishers without giant crab quota who take giant crabs as a by-product of rock lobster fishing.

These combinations of targeting practices potentially impact on the reliability of effort and CPUE data. PIRSA has indicated that targeting practices are taken into account in the current informal assessment process but explicitly recognise the need for effort standardisation under a more robust stock assessment. However, the DEH is concerned that the simple analysis of CPUE data currently undertaken could result in severe distortions in catch rates as indicators of abundance. PIRSA's current use of total pot lifts as a biological performance indicator and the use of fishing effort in estimating other performance indicators may expose assessments of SA's giant crab fishery and management regime to comparable distortions. Standardisation of effort in similar situations is commonplace in formal fisheries stock assessments and is an approach that DEH considers should be adopted in the proposed formal stock assessment for the SAGC Fishery.

Recommendation 5: *PIRSA to ensure that fishing effort data are standardised to more accurately reflect the degree of targeting of giant crabs by all fishers in the fishery and provide a more robust index of giant crab abundance. Existing assessments should be re-evaluated and all future assessments based on standardised effort data.*

In the pre-1997 period while the fishery was developing under Commonwealth jurisdiction, detailed effort data were not collected. Since then, catch rates have been used as a key indicator of stock abundance. The Submission states that, based on indications of a decline in abundance (indicated by the decline in annual catch rates) in the Southern Zone, the fishery there is regarded as being "fished at close to optimal levels". In response to this decline, PIRSA lowered the TACC for this zone to 8.7 tonnes after 1999-00 and catch rates have since stabilised. While the TACC for the Northern Zone has been unchanged at 13.4 tonnes, PIRSA is aware that the fishery there may involve a mixture of catches from regularly fished areas and unfished areas. DEH is concerned that localised depletion may have occurred in some regularly fished areas but accepts that at present, in the absence of a reliable stock assessment, this is difficult to determine. Similarly, the Southern Zone previously experienced declines in catch rates and localised depletion may have occurred in the past in this zone. The risk of localised depletion and the inability to detect it makes interpretation and reliance on catch rates and catch data problematic. DEH understands that without the robust stock assessment model and standardised fishing effort it will be difficult to identify areas of localised depletion. Noting these constraints, DEH considers this issue one that will need to be resolved in the future but accepts that it will not be done until further work on stock assessment and effort standardisation has been completed.

DEH is satisfied that the current assessment approach has been adequate to enable the status of the fishery and stock to be followed during the development phase of the fishery and to develop and implement appropriate management controls. Noting (a) the absence of fishery independent data in the fishery, (b) uncertainties in the stock assessment process, (c) a reliance on unstandardised effort and CPUE data, and (d) that current indicators of stock abundance and recruitment are not robust; a stock assessment model is needed that takes into account inherent uncertainties and provides a reliable estimate of stock status. DEH is aware that work is underway with Tasmania on stock recruitment and abundance indices and believes that where

possible this work should be included in future stock assessment work in the SAGC Fishery. An assessment model should also be informed by any available independent information collected by this and/or other giant crab fisheries in other jurisdictions (e.g. future, existing or previous research, surveys etc) where possible and not simply rely on fishery dependent catch and effort information.

Recommendation 6: *PIRSA to develop and implement, in conjunction with other relevant jurisdictions where possible, a robust stock assessment model to establish a quantitative basis for annual TAC setting and determination of stock status.*

The potential productivity of the giant crab stock off SA and elsewhere off southern Australia is not well understood. In the interim period while a quantitative model is being developed, PIRSA's approach has been to implement a conservative minimum size limit and TACCs and to respond to the signs of a possible decline in abundance in the Southern Zone by reducing the TACC for that zone. Initially, the TACCs were set at 90% of the mean annual catch between 1997-98 and 1999-00. A similar approach was taken in the initial setting of the Tasmanian TACC at 85% of the mean catch in 1997 and 1998. SA's approach has been built upon the collection of commercial fishery data and the focus on catch rates as an index of abundance until SARDI undertakes more robust and refined quantitative assessments later in 2004, in collaboration with Tasmanian researchers. Notwithstanding its reservations about reliance on unstandardised effort data, DEH concurs that all the signs indicate that this interim strategy has been sufficiently precautionary to maintain the productivity of the giant crab stock off SA at a satisfactory level. Work to develop a quantitative stock assessment model (see **Recommendation 6**) should enable a sound estimate of the potential productivity to be determined in the longer term.

Giant crabs are endemic to southern Australia, occurring on the continental shelf and slope from southern Western Australia to central New South Wales (Kailola *et al*, 1993). Electrophoretic studies of giant crabs from different localities across southern Australia have indicated genetic homogeneity across the species' range (Levings *et al.*, 2001). While dedicated research and assessments of the giant crab in this region have only occurred during the last decade, the time series of fishery and anecdotal information has provided a good working knowledge of the distribution and spatial structure of the species off SA. This information has helped in the development of separate management regimes in the Southern and Northern zones. It has also enabled a degree of separation of targeted giant crab fishing - with dedicated fleets of crab pots on soft bottom substrates on the shelf break at depths beyond 110 m - from rock lobster and giant crab fishing on rock substrates in shallower waters on the continental shelf.

Potential removals from the giant crab population include direct harvest (and discarding) by this fishery, direct harvest and mortality from damage caused by trawling operations in the Great Australian Bight Trawl Fishery (GABTF) and South East Trawl Fishery (SETF) and harvest of the species by other giant crab fisheries. Due to the offshore, deepwater nature of the fishery, recreational and indigenous take of giant crabs is not significant.

Ideally, management arrangements affecting a single stock should be under a single jurisdiction, or at least complementary across jurisdictions. DEH believes it would be beneficial, for both giant crab stocks and PIRSA governance, for PIRSA to be involved in cross-jurisdictional actions to address shared stock concerns. Furthermore, removals of the species in other jurisdictions should be factored into stock assessments in the SAGC fishery.

The Submission refers to PIRSA's commitment to cooperative research and management for stocks shared with other jurisdictions. In keeping with this there is some discussion by management, research and industry in the southern states in relation to matters of mutual interest. As part of this there has been a trend towards closer collaboration and information sharing between Victoria, South Australia and Tasmania in the areas of research and assessment of the rock lobster and giant crab stocks and fisheries in each jurisdiction.

While some collaboration exists, most notably in research, DEH notes that there is no apparent attempt to achieve complementary management arrangements designed to effectively protect minimum biomass and egg production levels at the level of the whole Australian stock. Similarly, the Submission highlights the lack of a formal unified approach between the southern states in the assessment and management of the giant crab stock across its range. In addition the uncertain influence of trawling activities in giant crab fishing grounds on the giant crab stock, directly through harvesting and indirectly through habitat impacts, is not factored into assessments. As a result there remains a risk that inappropriately managed fishing in one jurisdiction could impact on that part of the stock and fishery in another. The need for cross-jurisdictional work in management is well recognised and some collaborative efforts are in place, however DEH believes that collaboration should be conducted on a regular basis and include all relevant users and managers of the resource.

Recommendation 7: *PIRSA to establish a regular dialogue with other Australian jurisdictions responsible for managing giant crab fisheries to ensure that research and management arrangements are complementary. All available information regarding removals of targeted and by-product giant crabs by other jurisdictions and sectors (including Commonwealth trawlers) are to be considered in stock assessments.*

From its validation of landings data and from compliance intelligence, PIRSA is confident that all giant crab removals by the commercial fishery are being fully and accurately reported through the combination of commercial fishing logbooks and CDRs. These landings data are key inputs in the annual fishery performance measurement and TACC setting processes. The need for standardisation of effort data to improve reliability of data used in assessments was discussed above (see **Recommendation 5**). Giant crab harvested by other jurisdictions is not factored into stock assessments, however DEH has recommended that this be conducted in the future (see **Recommendation 7**).

Similarly, removals of giant crabs by the GABTF are not considered to have a significant impact on the management of the SAGC Fishery. DEH strongly encourages PIRSA, in collaboration with the Australian Fisheries Management Authority (AFMA), to ensure that the quantities of giant crabs taken by GABTF trawlers is identified and considered in stock assessments and management (see **Recommendation 7**).

DEH notes PIRSA's comments in the Submission regarding the impact of activities by GABTF trawlers in the fishery area. DEH also notes that current data collected through the GABTF Integrated Scientific Monitoring Program (ISMP) shows that on average 7.3% of total annual trawl shots contain giant crab by-catch. A fishery-wide average of 3 kg of giant crab by-catch is taken per trawl shot, in those trawl shots that contain giant crabs. ISMP data indicates that about 17% of the total giant crab taken (by weight) is retained, which represents about 0.7% of the northern zone TACC. ISMP data also indicates that the remaining proportion of giant crab by-catch is discarded (about 83%, by weight) and that crabs are generally captured alive and not damaged when discarded.

The Submission indicates that while expansion of trawling activities may be cause for concern and would require ongoing monitoring, current by-catch levels are not a great concern. There is some risk that ongoing and increasing activities in the GABTF may adversely affect the giant crab fishery by damaging giant crab habitat. DEH believes that this issue must be resolved to minimise the risk of serious damage to giant crab habitat and subsequent impacts on recruitment levels. Noting that the Tasmanian Department of Primary Industries, Water and Environment (DPIWE) and AFMA are attempting to resolve the issue in relation to the Tasmanian Giant Crab Fishery, and that recommendations for future work have been made in relation to that fishery and the Victorian Giant Crab Fishery, impacts on the SAGCF should also be considered.

DEH acknowledges that the extent of trawling activity undertaken in the GABTF is not directly comparable to the extent of trawling activity undertaken in waters off Tasmania by South East Trawl Fishery vessels, given the small number of vessels operating in the GABTF, the spatial distribution of species targeted by GABTF trawlers and the spatial management measures in place which restrict trawling to waters deeper than 200 m throughout most of the fishery. However, DEH considers further work is required to determine the extent of impact by trawling activities on giant crabs in general and work is needed to identify ways to manage the issue in the future to ensure impacts on the marine environment are minimised. PIRSA should collaborate with other affected jurisdictions in future work, where appropriate.

Recommendation 8: *PIRSA to collaborate, where appropriate, with the Tasmanian Department of Primary Industries, Water and Environment and the Australian Fisheries Management Authority on any future research or data collection programs to assess the impact of harvest and incidental damage to giant crabs and their habitat by trawling activity in giant crab fishing grounds.*

Management response

The current SAGC Fishery management regime aims to maintain ecologically viable stock levels through a range of output and input controls. These measures were outlined in Table 1 and Part One of this report. The DEH accepts that both fishing zones are considered to have conservative and effective management controls in place and is confident that PIRSA will continue to adopt sound and precautionary management practices in the fishery.

For management purposes the SAGC Fishery is divided into a Southern Zone (from the Murray River mouth to the Victorian border) and Northern Zone. This arrangement is derived from zoning of the SA Rock Lobster Fishery from which the SAGC Fishery has evolved over several decades and with which it retains much in common. It turns, this zoning arrangement reflects the different physical and ecological characteristics in the two zones and the impacts of these differences on rock lobster and giant crab fisheries there.

The fishery is managed under precautionary output controls featuring a TACC for each management zone. As an interim measure, until a reliable risk-based stock assessment model and stock biomass reference points become available, the TACCs were initially set at 90% of the mean annual catch between 1997-98 and 1999-00. In 2000, the Southern Zone TACC was reduced to 60 % of the mean catch for that period in response to a decline in mean catch rates for the zone since 1997; annual catch rates have since stabilised. Under the TACC set for the Northern Zone, catch rates have declined but have been generally higher than in the preceding period 1995-96 to 1998-99. The northern zone encompasses a much broader area of coastline (over 200,000km, including the waters adjacent to Kangaroo Island) than the southern zone (about 22,000km) and has not been fished as extensively as the southern zone. On this basis, the

northern zone TACC has been set to promote limited development and exploratory fishing activity throughout the zone.

The two specialist giant crab fishers catch crabs in pots which may only be set in depths greater than 60 fathoms. While standard rock lobster pots are usually used, some operators are using purpose-built crab traps for targeted giant crab fishing (Sloan, 2002). All pots and traps must comply with regulations specifying maximum dimensions and weight, single entrance and escape gaps. Rock lobster fishers usually haul and reset their pots daily while crab pots may be set for longer periods. Cattle hocks and a variety of fish are used for bait.

Limit reference points are set for the fishery as a whole for the key performance indicators mean catch rate, catch-vs-TACC, mean weight and pre-recruit abundance. In the absence of a more objective reference point, these limits have been based arbitrarily on the range of values estimated for the fishery during the established reference period 1999-00 to 2002-3 (the period immediately following the introduction of the TACC). The annual average catch rates for each zone have converged at around 1.8 kg/potlift in 2002-03 compared to the reference range 1.5 – 3.0 kg/potlift. What is different between the two SA zones is that, while the Southern Zone catch rate has stabilised after a decline, the Northern Zone catch rate shows a recent unbroken 4-year decline, which is a cause for concern. However, DEH notes PIRSA's view that the declining northern zone catch rate may be an artefact of many factors, including seasonal changes in the fishing patterns of the two dedicated giant crab fishers and changes linked to exploratory activity targeted at traditionally unfished areas. This exploratory activity results in a high variation in mean annual catch rate. PIRSA has indicated that effort standardisation will help to identify any concerns over stock status in the northern zone.

DEH has some concerns regarding the performance indicators and performance measures used in the fishery. Specifically, DEH is concerned about the appropriateness of performance measures used to trigger review of management arrangements. While DEH recognizes that the current reference ranges are based on historical data from an established reference period, in the absence of a long data series and a more formal stock assessment process, the use of +/- 15 % of the range as a review trigger appears to inject significant room for variation outside historical values. While it is accepted that some management flexibility is required, the Submission does not demonstrate how a variation of 15 % outside the historical range is considered precautionary and appropriate. Furthermore, the performance indicator of mean weight has raised concerns given that the lower range value is close to the weight of crabs around the minimum legal size and there is some risk that the fishery could develop into a recruit only fishery without tripping the performance indicator (this issue was also raised during public consultation). The Submission recognizes that the current performance indicators require refinement and that the analysis used to estimate values for these performance indicators is not considered to be robust. DEH believes a review of existing performance indicators, their reference ranges and trigger points is necessary, especially as the results of the Tasmanian stock assessment project become available to better inform management of this fishery.

Recommendation 9: *PIRSA to review the suite of indicators and measures used to assess the performance of the fishery, following the completion of a quantitative stock assessment.*

Management strategy review, which may result in a reduction of the TACC, will be triggered if the annual commercial catch is more than 15% above or below the TACC or any of the average catch rate, mean weight or pre-recruit abundance measures fall more than 15% above or below their respective reference ranges. The management response involves notification of the responsible Minister, examination of the causes, consultation with key stakeholders on the need

for action and a recommendation to the minister. PIRSA states that these reference points and this non-prescriptive response process are appropriate to ensure viable stock levels with acceptable levels of probability at this stage of the fishery's development. However, if in 2003-04 the mean annual catch rate for the Northern Zone shows a continuation of the existing 4-year downward trend - but does not reach the trigger point - DEH strongly encourages PIRSA to consider implementing the management response unless there are clear mitigating factors. Tasmania has set regional catch rates (Catch Per Unit Effort or CPUE) as one of the performance indicators for its giant crab fishery. In 2000-01, the reference point was set at the "Previous 2 years CPUE" and the trigger point was defined as "CPUE for any region declines by a total of 20% in 2 years". If such a performance measure were used for the SA Northern Zone fishery, the trigger would have been activated in 2003.

DEH is confident that the combination of input and output controls, reference points and consequent management actions specified in the Submission are appropriate to ensure viable stock levels with acceptable levels of probability in the short term. However, the development of reliable stock indicators in addition to catch rates, underpinned by robust ongoing monitoring and assessments, is a matter requiring urgent action and recommendations have been made to address these deficiencies.

The level of by-product catch in this fishery is very low because of the nature of crab pots and the depths and manner in which they are used. SA's rock lobster fishers generally take giant crabs in the deeper reefs at depths over 50 m where they are caught with rock lobsters. Their take of giant crabs is often the by-product of targeted fishing for rock lobsters. When they do target giant crabs, their by-product – apart from rock lobsters – comprises small quantities of a wide range of fish and invertebrate species, which may, depending on the levels of access to the marine scalefish fishery, be retained for sale, bait or personal consumption only. The main by-product species are octopus *Octopus maorum*, rock lobster and pink ling *Genypterus blacodes*. These are also by-product species in SA's rock lobster fishery. Dedicated giant crab fishers targeting giant crabs at depths over 110 m may not retain by-product.

While there has been no specific study of by-product in the giant crab fishery, rock lobster fishers must record detailed landings data for all by-product species in their mandatory commercial fisheries logbooks. Assessment of octopus catch rate data from SA's rock lobster fishery have shown no change in relative abundance of octopus since 1983, with the catch of octopus as by-product in the rock lobster fishery having no measurable effect on octopus populations (Brock *et al.*, 2003). A separate DEH assessment process for SA's rock lobster fishery has shown that, in the Southern Zone under output controls the rock lobster stock has increased significantly and is in a healthy and productive state. In the Northern Zone, under input controls the stock has declined below reference ranges specified in the management plan. PIRSA has introduced a quota management system with a conservative TACC in the northern zone rock lobster fishery aimed at rebuilding the stock. Given that dedicated giant crab fishers are not permitted to take by-product, the small quantities of by-product taken in giant crab fishing grounds by rock lobster fishers and the strong management arrangements in place for the rock lobster fishery, DEH considers that the SAGC poses minimal threat to by-product species.

Conclusion

DEH is satisfied that the management regime in the SAGC Fishery is appropriately precautionary and provides for the fishery to be conducted in a manner that does not lead to over-fishing. DEH is satisfied that the information collection system and stock assessment and

management arrangements generally are sufficient to ensure that the fishery is conducted at catch levels that maintain ecologically viable stock levels with acceptable levels of probability.

DEH considers that there is scope to further refine some of the existing information collection, assessment and management responses and has provided a number of recommendations for improvements in the longer term.

Promote recovery to ecologically viable stock levels

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’*

This objective is not applicable to the fishery at present. In the short term, fishery monitoring, performance measures and management responses are in place and are adequate to ensure that the risk of overfishing of the giant crab stock off SA remains negligible. Improved research, assessment and management arrangements are proposed and should further strengthen confidence in the maintenance of the stock at an ecologically viable level. The positive and rapid apparent response of annual catch rates in the Southern Zone to a reduction in the TACC suggests that - should the need arise – a similar measure would prove effective in the Northern Zone.

DEH is satisfied that the giant crab stock is not below a defined reference point but should that occur in the future, the fishery is conducted such that there is a high degree of probability the stock would recover to ecologically viable stock levels within nominated timeframes.

Ecosystem impacts

Principle 2: *‘Fishing operations should be managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem’*

Bycatch protection

Objective 1: *‘The fishery is conducted in a manner that does not threaten bycatch species’*

Information requirements

Bycatch reporting in the SAGC Fishery is limited and has not been considered a priority in the fishery to date due to the small quantities of bycatch taken. Non-retained giant crabs are likely to be the main component of the bycatch, with the overall numbers and variety of other bycatch being extremely small because of the small number of boats, the nature of the gear (including escape gaps) and its use, and the depth and substrate of fishing grounds.

The only bycatch component which specialist giant crab fishers are required to record are those giant crabs returned to the water alive because they are carrying eggs, out of season, damaged or undersized. Otherwise, daily commercial catch records make no provision for recording their bycatch and there is no independent monitoring of bycatch from their operations. Rock lobster fishers who take giant crabs are required to record by-product but not bycatch. There is however a bycatch monitoring program in place for the rock lobster fishery, which covers dual giant crab/rock lobster fishers.

The current information gathering arrangements do not enable the by-catch impact of the SAGC Fishery to be monitored or assessed. Similarly, monitoring of protected species interaction with the fishery is not conducted (this is discussed in detail under Objective 2). While DEH accepts the probability that – at present - the fishery may not pose an unacceptable threat to non-retained species, there is continued reliance on indirect and incomplete data and a need for the ability to monitor and detect changes in bycatch on an ongoing basis. PIRSA’s giant crab management regime, outlined in the Submission, states that to “Monitor and quantify non-target species interactions” is a key strategy in support of the goal to minimise disruption of the marine ecosystem. The “availability of data to undertake assessment of non-target species interactions and fishery impacts” is shown as a performance indicator. Noting these statements, DEH considers the ability to monitor and detect changes in bycatch quantity and composition important for the future management of the fishery and its ability to demonstrate that fishing activities pose minimal threat to bycatch species.

Recommendation 10: *PIRSA to develop and implement a mandatory system for the monitoring and assessment of bycatch and protected species interactions for all giant crab quota holders to ensure that changes in bycatch quantity and/or composition and protected species interactions can be detected and monitored over time.*

No independent bycatch monitoring has been conducted in the SAGC Fishery. An independent bycatch (and by-product) monitoring program for the rock lobster fishery began in 2001, involving in-port and low level at-sea monitoring. The Submission provides a preliminary list of scalefish, sharks, crustaceans, molluscs and echinoderms recorded from the catches of non-target species. The rock lobster fishery monitoring program does not enable the bycatch from the giant crab fishing component of rock lobster fishers’ operations to be identified, nor does it quantify the bycatch. Logbook information and preliminary results from an independent 2-year study by SARDI indicate that the bycatch is low and relatively few species are caught. The bycatch includes non-retained rock lobsters, reef fish (e.g. wrasse species), eels, hermit crabs and starfish (PIRSA 2002). DEH understands that independent monitoring in such a small fishery as the SAGC Fishery may not be feasible and expects that through implementation of **Recommendation 10** valuable and reliable fishery dependent data will be used to monitor bycatch in the fishery on an ongoing basis.

With the exception of investigating optimum escape gap dimensions for giant crab pots, research relating to bycatch in the fishery is not undertaken due to the low quantities and risk to species. Research to identify ways of maximising the effectiveness of escape gaps is welcomed and DEH encourages PIRSA to include minimising catches of non-target species as well as undersized giant crabs as an objective of this research.

Assessment

There has been no risk assessment of the vulnerability of bycatch species to giant crab fishing, nor is there any estimate of the current level of bycatch. During 2004, SARDI is to conduct a risk analysis for bycatch in the rock lobster fishery based on information from the bycatch monitoring program for that fishery. The Submission proposes that the risk posed by giant crab fishing to bycatch species is low “Based on the current understanding”.

DEH considers that – within an acceptable level of probability – the SAGC Fishery is being conducted in a way that minimises the impact on the ecosystem generally. However, from what is presented in the Submission and from what is known about the giant crab stock and fisheries in other states, DEH believes that there is sufficient information to conduct a qualitative risk assessment of the impact of the SAGC Fishery on the ecosystem. Such an assessment is

essential if PIRSA's management objective to minimise disruption to the marine ecosystem is to be properly and fully supported by appropriate monitoring, performance measurement and management responses. DEH acknowledges that it will be appropriate for this assessment to be undertaken following the preparation of a formal stock assessment for the fishery.

Recommendation 11: *PIRSA to conduct an ecological risk assessment focussed on interactions of the fishery with bycatch and protected species, ecological communities, deepwater habitats and the marine environment to confirm assumptions that the fishery poses minimal risk to these components. The risk assessment should also include assessment of the risk of ghost fishing by lost or discarded giant crab pots in the fishery. Using the outcomes of the risk assessment, PIRSA to also develop appropriate monitoring, performance measures and responses for the ongoing management of components identified as high risk.*

Management response

The capture and mortality of non-target species in the specialised offshore component of the fishery is constrained by the tight controls on vessel numbers, pot numbers and dimensions and by spatial and season restrictions. Escape gaps are mandatory in pots used in that offshore fishery and in the rock lobster Northern Zone fishery. They are widely but voluntarily used in the Southern Zone where their use may also become mandatory as recommended by DEH in its recent assessment of the SA Rock Lobster Fishery. Along with the minimum mesh size specified for all pots, escape gaps contribute to the low retention of non-target species as well as discarded giant crabs. In examining the impact of Tasmania's rock lobster fishery on bycatch and by-product species, Frusher and Gibson (1999) found that escape gaps reduce bycatch by at least 80%.

The Submission sets out PIRSA's intention to monitor the "Trend in the relationship between target and non-target species catch levels" as a performance indicator against the goal of minimising disruption to the ecosystem. When implemented, DEH believes that the monitoring program designed to enable this performance measurement should provide PIRSA with the basis for determining the sustainability of bycatch in the fishery and implementing appropriate responses if needed. However, there is no specific proposal or timeline set for this program.

While no indicator bycatch species or group is monitored in the SAGC Fishery, SARDI is monitoring bycatch and by-product in the rock lobster fishery. Continuing monitoring needs will be assessed on completion of a risk assessment to be undertaken for bycatch and by-product species in the rock lobster fishery in 2004 and the risk assessment required for this fishery (see **Recommendation 11**). On present indications, compared to other fisheries, the risk posed by giant crab fishing is considered low because of the relatively low incidence of bycatch species in pots and the likelihood that the incidence is considerably less at the depths where giant crabs are targeted.

The harvest strategy for the SAGC Fishery sets out management actions and performance indicators intended to minimise disruption to the ecosystem. To date, there are no decision rules or triggers in place to respond to perturbations to bycatch species. The need for such measures will be considered following the risk assessment.

Conclusion

DEH is satisfied that there is a high likelihood the fishery is conducted in a manner that does not threaten bycatch species. Should this situation change, or a risk assessment process indicate

otherwise, DEH expects that PIRSA would undertake appropriate actions to ensure that this fishery does not threaten bycatch species.

DEH considers that there is scope to further refine some of the existing information collection, assessment, performance measurement and management responses and has recommended improvements in the longer term.

Protected species and threatened ecological community protection

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'*

Information requirements

Recording of protected species interaction is not required for the two dedicated giant crab fishers. Information on interactions with protected wildlife is reported on a voluntary and *ad hoc* basis by rock lobster fishers (including those with giant crab quota) in their commercial fishery logbooks. Research cruises, National Parks and Wildlife observations and the current SARDI rock lobster bycatch and by-product monitoring program have provided *ad hoc* fishery independent information.

DEH notes the potential for interaction, and while it recognises that interactions may be rare, ongoing recording/reporting of interactions in the fishery is needed to (a) confirm assumptions that interactions are minimal and (b) to meet legislative requirements of protected species reporting under the EPBC Act. DEH recommends the introduction of mandatory reporting of protected species interactions with all giant crab fishing operations. The data should be validated against fishery independent observations wherever possible to maximise the reliability of information used for monitoring interactions and assessing the impact of the fishery on those species. Ideally, fishers should also be provided with training or information material to facilitate accurate species recognition and to raise awareness of the importance of reliable reporting. **Recommendation 10** requires that monitoring and assessment of protected species interactions be conducted on an ongoing basis to ensure that interactions can be recorded and trends and changes in interactions can be detected.

There are no threatened or endangered species or ecological communities identified in the Submission as occurring in area of the SAGC Fishery.

Assessment

Protected wildlife species occurring in the area of the SAGC Fishery include seals/sea lions (mainly Australian fur seals *Arctocephalus pusillus doriferus*), whales, dolphins and leatherback turtles *Dermochelys coriacea*, all of which have the potential for interactions with giant crab and rock lobster pots and buoy lines. Interactions may take the form of entanglement in buoy lines (possibly resulting in injury or death) or – in the case of seals - capture in pots (resulting in drowning). While infrequent, the capture of mainly young seals drowned while attempting to remove bait from rock lobster pots does occur and appears to be the main form of wildlife interaction reported in the rock lobster fishery and of concern to DEH. The greater depth fished by targeted giant crab fishers and general offshore proximity of the fishing grounds, further limits the risk posed to seals through capture in pots. Seals and seabirds often feed on bait and

bycatch discarded by rock lobster fishers. Entanglement of wildlife with plastic and other debris, resulting in injury or death, has also been reported but is usually difficult to attribute to a particular fishery.

While there are several seal breeding sites and colonies along the SA coast, seal interactions with the rock lobster fishery are rare and none has been reported from the giant crab fishery. Interactions with rock lobster pots are less frequent in the offshore areas beyond 110 m depth where the giant crab fishery is concentrated. There are occasional anecdotal reports of seals entangled in plastic strapping and other debris but these are rare instances and have not been attributed to the giant crab fishery.

The close links between the rock lobster fishery and the SAGC Fishery, and the known (albeit infrequent) interaction between seals and rock lobster pots, suggest that any work undertaken in the rock lobster fishery could provide useful information for the SAGC Fishery. DEH understands that rock lobster fishers support the implementation of an on-board monitoring program. The Submission indicates that details are being developed and consideration given to including the two offshore giant crab fishers in the monitoring program, an approach strongly endorsed by DEH.

Although three turtle species have been recorded from SA waters, there are no breeding populations and sea temperatures are not favourable there. Accordingly, the Submission indicates that risks posed by rock lobster and giant crab fishing are considered to be negligible. Interactions with whales and dolphins are so rare that the fishery impacts with these species are also considered to be negligible.

Available information suggests that the fishery poses minimal threat to protected species. However DEH believes PIRSA should adopt a risk assessment approach to confirm assumptions that risks to protected species are minimal. A recommendation addressing this concern has previously been made (see **Recommendation 11**).

Management response

The Submission describes the nature and infrequent occurrence of interactions between the rock lobster/giant crab fishery and protected wildlife species and the extreme unlikelihood of interactions by the specialised giant crab fishery. It outlines the industry-led initiatives to minimise occurrences and impacts of the most frequent events – entry to pots by seals – and to eliminate the discarding of debris at sea. It also outlines PIRSA’s intention to monitor giant crab fishery interactions with threatened or endangered species as part of the harvest management strategy. DEH endorses that proposal and urges PIRSA to implement, and to include the two offshore giant crab fishing operations, in the planned on-board monitoring of rock lobster fishery interactions with seals, turtles and other protected species.

The Submission also refers to PIRSA’s consideration of amendments to existing mandatory fishery reporting arrangements or the introduction of new logbooks specifically for reporting all interactions with endangered, threatened or protected species – for all fisheries. DEH’s view is that improved universal reporting is an essential precursor to providing confidence that the fishery is minimising impacts on, and avoiding interactions with, protected species (see **Recommendation 10**).

Conclusion

DEH notes that there are minimal interactions with protected species in this fishery and is satisfied that 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. Should this situation change, or the risk assessment process indicate otherwise, DEH suggests that appropriate actions be undertaken to ensure the fishery avoids mortality, injury to these species and avoids or minimises impacts on threatened ecological communities.

Recommendations have been developed to ensure that the risk of unacceptable impact on protected species is minimised in the longer term.

Minimising ecological impacts of fishing operations

Objective 3: *‘The fishery is conducted, in a manner that minimises the impact of fishing operations on the ecosystem generally’*

Information requirements

During the last decade knowledge of the biology and ecology of giant crabs off southern Australia has increased significantly. During the same period, information on the SAGC Fishery has been collected in increasing detail regarding the ecological position and role of giant crabs. Beyond this, the wider environmental impacts of giant crab fishing have not been monitored or studied specifically.

The Submission proposes that the information gathering and research leading into the SA Government’s planned establishment of a representative system of Marine Protected Areas may shed further light on these impacts. Monitoring of the rock lobster fishery and SARDI’s bycatch and by-product study is providing information on the occurrence and some biological characteristics of the wide range of species caught in pots across the range of the fishery.

DEH is concerned at the lack of information collection and research covering the fisheries impact on the ecosystem and environment generally. However, DEH understands that this lack of information is the case across a range of Australian and International fisheries and until appropriate research techniques and programs are developed and implemented this will continue to be the case. DEH strongly supports research in this area. **Recommendation 4** should enable ecosystem impact related research to be identified and included in the research strategy.

Assessment

The Submission outlines the potential areas of risk to ecosystem components, distinguishing between “impacts on the biological community” and on the “broader environment”. It considers the current knowledge and draws inferences to gain some understanding of the susceptibility of ecosystem components to the fishery. It also refers to current and proposed work that should help to expand knowledge of the environmental impacts of the fishery.

No formal assessment has been conducted to confirm assumptions that ecological impacts are minimal. DEH recognises that, in cases where it is impractical to obtain comprehensive information on which to base a decision, a risk assessment implemented in a precautionary way can provide a suitable decision making system and guide for future actions including

management and information collection. The SAGC Fishery is such a case and, accordingly, such a course of action has been recommended (see **Recommendation 11**).

The setting and retrieval of pots on shallow rocky reefs off SA has been shown to have “minimal physical impacts” (Casement and Svane, 1999). There is no direct information on the fishery’s impacts on communities and food chains. However, the Submission proposes that management of the fishery on a sustainable and productive basis such that giant crab biomass is maintained at a healthy level should minimise threats arising from such impacts. A current study of giant crab habitats around Tasmania may provide information which enables these impacts to be assessed with greater understanding. Because of the low intensity of giant crab fishing activity in relation to the expanse of fishing grounds, the impact on water quality is considered to be low. Current initiatives to eliminate discharges of wastes and debris at sea will further reduce this impact.

The potential impact of trawling on the deepwater ecosystems of giant crabs has proved to be a significant issue in Tasmania and is currently under investigation. The likelihood that South East Fishery trawlers have a greater impact on deepwater benthic ecosystems than giant crab trapping was raised as an issue in relation to the assessments of the Tasmanian and Victorian Giant Crab Fisheries. The Submission makes brief reference to the fact that the impacts of trawling in the Great Australian Bight on biodiversity have not been studied. It also refers to the independent scientific monitoring of bycatch and by-product of that fishery over recent years. The potential impacts of trawling on by-product, bycatch, benthic communities and the general deepwater ecosystem are clearly matters that should be of shared and significant concern to these south-eastern states responsible for managing giant crab fisheries. For this reason DEH strongly recommends that PIRSA work closely with the other jurisdictions responsible for managing giant crab and deepwater trawl fisheries and studying their environmental impacts (see **Recommendation 8**).

Management response

No specific management actions are in place to prevent significant damage to ecosystems arising from the fishery. The management emphasis is on controlling the catch to maintain the giant crab stock at a viable and productive level. Fishing gear and activities are managed in a way that adds to the sustainability of fishing and help to minimise impacts on the ecosystem. DEH recognises that managing the fishery on a sustainable basis in relation to target, by-product and bycatch species has the important consequence of helping to minimise ecological impacts.

Management measures which restrict the number of boats and their access to this wide-ranging offshore fishery and the way that pots are used contribute to the assessed low impacts of this fishery. The low incidence of bait and bycatch discarding, the position of crabs in the food chain and the current measures in place to maintain healthy crab stocks (e.g. TACCs and minimum sizes) are important factors which mitigate against impacts on higher or lower trophic levels.

There are no decision rules to trigger management responses to identified impacts on ecosystem indicators outside prescribed limits or to other situations where the need for a precautionary approach is indicated. The Submission suggests that studies, such as that currently being conducted around Tasmania, may enable the development of such measures.

The Submission concludes that the fishery’s impacts on the ecosystem are “acceptable and inherently low”. In the absence of formal risk assessment or specific direct evidence, it cites the sustainability of giant crab catches over a long term as evidence of the ecologically benign nature of the fishery. DEH sees the risk assessment required under **Recommendation 11** as an

important step in identifying risks and management responses appropriate to the scale of the fishery.

Conclusion

DEH is satisfied that the fishery is conducted in a manner that minimises the impact of fishing operations on the ecosystem generally. DEH notes that should circumstances alter significantly in the fishery appropriate assessments and additional actions will be developed by PIRSA.

Recommendations have been developed to ensure that the risk of significant impact by the fishery on the marine environment generally is minimised in the longer term.

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LIST OF ACRONYMS

AFMA	Australian Fisheries Management Authority
CDR	Catch Disposal Record
CPUE	Catch Per Unit Effort
DEH	Department of Environment and Heritage
DPIWE	Department of Primary Industries, Water and Environment
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
FRDC	Fisheries Research and Development Corporation
GABTF	Great Australian Bight Trawl Fishery
ISMP	Independent Scientific Monitoring Project
ITQ	individual Transferable Quota
MARPOL	International Convention on Marine Pollution
PIRSA	Department of Primary Industries and Resources, SA
QMS	Quota Management System
SA	South Australia
SARDI	South Australian Research and Development Institute
SAGC	South Australian Giant Crab (Fishery)
SETF	South East Trawl Fishery
TACC	Total Allowable Commercial Catch
UNCLOS	United Nations Convention on the Law of the Sea
VMS	Vessel Monitoring System
WTO	Wildlife Trade Operation