



**Australian Government**

---

**Department of the Environment and Heritage**

Assessment of the  
**South Australian Rock Lobster Fishery**

**October 2003**

© Commonwealth of Australia 2003

This work is copyright. Apart from any use as permitted under the Copyright Act 1968, no part may be reproduced by any process without prior written permission from the Commonwealth, available from the Department of the Environment and Heritage. Requests and inquiries concerning reproduction and rights should be addressed to:

Assistant Secretary  
Wildlife Trade and Sustainable Fisheries Branch  
Department of the Environment and Heritage  
GPO Box 787  
Canberra ACT 2601

ISBN: 0 642 54971 0

## **Disclaimer**

This document is an assessment carried out by the Department of the Environment and Heritage of a commercial fishery against the Commonwealth's 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 EPBC Act. The views expressed do not necessarily reflect those of the Minister for the Environment and Heritage or the Australian Government.

While reasonable efforts have been made to ensure that the contents of this report are factually correct, the Commonwealth does not accept responsibility for the accuracy or completeness of the contents, and shall not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the contents of this report. You should not rely solely on the information presented in the report when making a commercial or other decision.

**Assessment of the ecological sustainability of management arrangements for the South  
Australian Rock Lobster Fishery**

**TABLE OF CONTENTS**

|   |           |
|---|-----------|
| <b>EXECUTIVE SUMMARY .....</b>  | <b>4</b>  |
| Background .....  | 4         |
| Overall assessment .....  | 7         |
| Recommendations .....   | 8         |
| <b>PART I - MANAGEMENT ARRANGEMENTS .....</b>   | <b>10</b> |
| Conclusion.....   | 14        |
| <b>PART II – GUIDELINES FOR THE ECOLOGICALLY SUSTAINABLE<br/>MANAGEMENT OF FISHERIES.....</b> | <b>15</b> |
| <b>STOCK STATUS AND RECOVERY .....</b>  | <b>15</b> |
| <i>Maintain ecologically viable stocks .....</i>  | <i>15</i> |
| Information requirements .....  | 15        |
| Assessment .....  | 16        |
| Management response .....   | 19        |
| Conclusion.....   | 22        |
| <i>Promote recovery to ecologically viable stock levels.....</i>                              | <i>23</i> |
| <b>ECOSYSTEM IMPACTS.....</b>   | <b>25</b> |
| <i>Bycatch protection.....</i>  | <i>25</i> |
| Information requirements .....  | 25        |
| Assessment .....  | 25        |
| Management response .....   | 26        |
| Conclusion.....   | 27        |
| <i>Protected species and threatened ecological community protection .....</i>                 | <i>27</i> |
| Information requirements .....  | 27        |
| Assessment .....  | 28        |
| Management response .....   | 28        |
| Conclusion.....   | 30        |
| <i>Minimising ecological impacts of fishing operations.....</i>                               | <i>30</i> |
| Information requirements .....  | 30        |
| Assessment .....  | 31        |
| Management response .....   | 31        |
| Conclusion.....   | 32        |
| <b>REFERENCES.....</b>  | <b>33</b> |
| <b>LIST OF ACRONYMS.....</b>  | <b>33</b> |

## EXECUTIVE SUMMARY

### Background

South Australia's Department of Primary Industries SA (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 Rock Lobster Fishery* (the submission) was received by the Department of the Environment and Heritage (DEH) in December 2002. The submission was released for a thirty-day public comment period that expired on 30 May 2003. Three public comments were 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 Rock Lobster (SARL) Fishery against the Commonwealth *Guidelines for the Ecologically Sustainable Management of Fisheries*. The DEH assessment considers the submission and associated documents, public comments and PIRSA's response to the comments.

### Summary of the South Australian Rock Lobster Fishery

|                                    |  |
|------------------------------------|--|
| <b>Area</b>                        | Marine waters adjacent to South Australia. For management purposes the area is divided into 2 zones: a Southern Zone and Northern Zone.  |
| <b>Fishery status</b>              | Southern Zone: TAC increased in 2002-03 in recognition of successful stock building<br>Northern Zone: stock declining, most fishery performance indicators outside reference ranges.   |
| <b>Target Species</b>              | Southern rock lobster <i>Jasus edwardsii</i>   |
| <b>Byproduct Species</b>           | Predominantly octopus <i>Octopus maorum</i> , giant crab <i>Pseudocarcinus gigas</i> , leatherjacket and wrasse species.   |
| <b>Gear</b>                        | Beehive pot  |
| <b>Season</b>                      | Closed 1 May to 30 September (Southern Zone) and 1 June to 31 October (Northern Zone).   |
| <b>Commercial harvest</b>          | 2387 tonnes in 2001-02   |
| <b>Value of commercial harvest</b> | \$83 million in 2001-02  |
| <b>Recreational harvest</b>        | 118 tonnes as at 2001-02 season (4.7% of total SA commercial and recreational catch)   |
| <b>Commercial licences issued</b>  | 181 licences – Southern Zone<br>69 licences – Northern Zone  |
| <b>Management arrangements</b>     | All fishing: legal minimum lengths<br>Commercial fishery:<br>Input controlled through: limited entry, boat and gear restrictions, numbers of egg-carrying females and sub-adults, and spatial and temporal closures.<br>In Southern Zone, also output controlled through TAC of 1770 tonnes and ITQs.<br>Recreational fishery: input controls such as 2 pots per-person limit and spatial and temporal closures. |
| <b>Export</b>                      | About 95% of the annual catch is sold live to China,   |

|  |   |
|--|---|
|  | Taiwan, Hong Kong and other Asian markets.  |
| <b>Bycatch</b>                             | Various fish and invertebrate species, such as hermit crabs and starfish.   |
| <b>Interaction with Threatened Species</b> | Seal interactions infrequent and localised. Mainly involve pups drowning, trapped trying to take bait from pots. Other interactions with marine mammals rare. |

The fishery occurs over reefs in waters adjacent to South Australia (SA) from the shore to the outer reaches of the continental shelf and from the seaward boundary with Victoria to the boundary with Western Australia (WA) in the Great Australian Bight. Rock lobsters are more abundant on the more continuous and interconnected limestone reefs in the south – where strong upwellings boost productivity - than on the patchy discrete mainly granite reefs in the north. For management purposes the SARL Fishery is divided into the Southern Zone (from the Murray River mouth to the Victorian border) and Northern Zone. This arrangement reflects the different physical and ecological characteristics in the two zones and the impacts of these differences on rock lobsters and fisheries there.

The sole target species is southern rock lobster *Jasus edwardsii*. The species occurs as what is believed to be a single genetic stock on rocky substrates around Australia's south coast, from south west WA to southern New South Wales (NSW), and around New Zealand. A range of scalefish, crustacean, mollusc and shark species may be retained as byproduct. The main byproduct species include octopus *Octopus maorum*, giant crab *Pseudocarcinus gigas* and small quantities of scalefish such as leatherjacket and wrasse species. Catch controls are in place for some key byproduct species, including a daily landing limit for gummy sharks and a trip limit of 5 giant crabs. Otherwise there is no limit to the quantity of prescribed species listed on Schedule 1 of the *Scheme of Management (Rock Lobster Fisheries) Regulations 1991* that may be taken as byproduct by the fishery, although for most species quantities taken are relatively minor. Many commercial rock lobster fishers also have access to the SA Marine Scalefish Fishery and the Commonwealth Southern and Eastern Scalefish and Shark Fishery (SESSF).

The southern rock lobster is a decapod crustacean occurring in cool-temperate marine waters of Australia and New Zealand. Fertilised eggs are carried under the female rock lobster's tail for several months before hatching into transparent pelagic larvae that spend more than a year in offshore surface waters, circulating widely before returning to coastal waters. Settling to the bottom they seek shelter and take on the familiar coloration and habits of rock lobsters, feeding mainly on invertebrates.

The most productive Australian fisheries for the species occur off southern SA, western Victoria and around Tasmania, where rock lobsters occur in large numbers wherever suitable rock habitats occur. Small fisheries for the species occur off WA and NSW. SA's northern coastal waters are towards the western limit of the rock lobster's geographic range. Rock lobster populations there are characterised by faster growth and lower abundances resulting from the combination of lower and less frequent annual post-larval recruitment, warmer water and patchy habitat, compared to populations to the south.

While rock lobsters have been caught and marketed in SA since the early 1870s, it was the post World War 2 expansion of the USA market that led to the development of the fishery to its current level of importance to the State. Following rapid and uncontrolled growth in the early part of this post-war period, a succession of input controls were introduced, including

limited licences, restricted pot numbers and shortened fishing seasons. The introduction of quota based management (ie output controls) to the Southern Zone in 1993 has helped to stabilise the fishery and rebuild the stock. From November 2003 a similar approach will begin in the Northern Zone, where the stock abundance has declined despite a series of effort reduction measures introduced during the last decade.

In the 2001-02 fishing season, SA's commercial harvest of rock lobster was 2387 tonnes (live weight) with a landed value of \$83 million. Total landings comprised 1713 and 674 tonnes from the Southern and Northern zones, respectively. The fishery generates export earnings of \$110 million, has a business turnover of \$230 million and creates around 2200 jobs directly and contributes to many more in support industries.

The basic gear unit is the beehive-shaped pot with a single top entry, most commonly constructed of wire mesh on a welded steel frame. Baited pots are attached to buoyed pot lines and are set individually, using echosounders to place them over rocky bottom formations. After fishing overnight they are hauled at first light using mechanical line haulers. Legal retained catches are held in open wells or recirculating tanks while the bycatch, including undersized rock lobsters, is returned immediately to the water alive. Advances in echo sounders, navigation and position fixing technology and improvements in fishing boats have enabled the fishery to effectively exploit rock lobsters over their entire range to the point where the risk of over fishing brought about a series of management responses over the years. In the Southern Zone, these responses culminated in the shift to reliance on output controls in 1993. Similar patterns of growth, intensifying fishing pressure and management responses have occurred in the rock lobster fisheries in Victoria and Tasmania. Recreational fishers may use pots, hoop nets and bait sticks and take rock lobsters underwater by hand.

Current fishery management arrangements include seasonal closures which protect egg-bearing females and recently moulted rock lobsters and help to limit fishing effort. Limited licensing has been in place since 1968 and pot dimensions and numbers are controlled to further limit fishing effort. There are 181 licences and 11,709 pots in the Southern Zone and 69 licences and 3950 pots in the Northern Zone. For each zone the specified legal minimum length applies to rock lobsters of both sexes taken by all sectors and provides for most female rock lobsters to reproduce at least once before being retained.

Apart from undersized and egg bearing female rock lobsters, the bycatch comprises small numbers of many species of scalefish, small sharks, crabs and other invertebrates. None of these species is currently listed as protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Protected species interactions in this fishery are rare, but do include infrequent drowning of seals (which become trapped while removing bait from pots) and rare entanglement of seals, turtles, dolphins and whales in pot lines. Available information suggests these interactions are at a very low level. Protected species interactions are assessed further under Part II of this report.

The most recent survey of the recreational catch and effort in the fishery in 2001-02 estimated recreational harvest of around 118 tonnes, or 4.7% of the combined commercial and recreational harvest, although this did not fully take account of some methods of recreational harvesting such as drop and hoop netters without registered pots and charter fishers. The Submission states that there is no significant take by the indigenous fishing sector although

this is yet to be quantified Outcomes from the recent National Recreational and Indigenous Fishing Survey took account of indigenous fishing within the overall estimates of rock lobster catch.

While much of the area covered by the fishery is in Commonwealth waters the entire fishery is managed by SA under an Offshore Constitutional Settlement or OCS agreement between the Australian Government and the SA Government. The fisheries in SA's two management zones are managed under the comprehensive suites of arrangements described in the *Management Plan for the South Australian Southern Zone Rock Lobster Fishery* and the *Management Plan for the South Australian Northern Zone Rock Lobster Fishery*. These non-statutory plans are supported by the *Fisheries Act 1982*, the *Scheme of Management (Rock Lobster Fisheries) Regulations 1991* and the *Fisheries (General) Regulations 2000*. These management plans are the responsibility of the Southern Zone Rock Lobster Fisheries Management Committee and Northern Zone Rock Lobster Fisheries Management Committee, operating under the *Fisheries (Management Committees) Regulations 1995*.

### **Overall assessment**

The material submitted by PIRSA indicates that the fishery operates in accordance with the Commonwealth *Guidelines for the ecologically sustainable management of fisheries* (the Guidelines). DEH concurs that the South Australian Rock Lobster Fishery is a well managed fishery that is unlikely to have an unacceptable or unsustainable impact on the environment in the short to mid term. Recommendations have been developed to ensure that the risk of impact is minimised in the longer term. Overall, the sophisticated management regime of output controls, licence and gear limits, closed seasons, fishery dependant monitoring and review processes, performance measurement, stock assessment and predictive modelling suggests that the fishery is being managed in an ecologically sustainable way.

In making this assessment, DEH is satisfied that the information collection system, risk assessments, management arrangements and objectives are sufficient to ensure the fishery is conducted in a manner that, in the case of the Southern Zone, does not lead to overfishing and, in the case of the Northern Zone, will promote the recovery of recently overfished stocks. DEH recognises that further improvements to management may result from a number of PIRSA initiatives, in particular the revised harvest strategy for the Northern Zone that includes the introduction of quota management, quantitative risk assessment of byproduct species and revision of reference points and objectives under the new management plans to be developed shortly for both zones of the fishery. DEH notes that stock recovery measures proposed by PIRSA for the Northern Zone of the fishery should redress the recent decline in stock levels in this part of the fishery, and has recommended PIRSA implement a conservative harvest strategy and closely monitor the stock status to promote the early recovery of rock lobster biomass in this zone.

Considering the research programs and management arrangements either in place or proposed, and the targeted mode of fishing operations, DEH is satisfied that fishing operations are managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem. Management of this fishery has a history of reacting appropriately to threats to sustainability and DEH is confident that PIRSA will continue to provide this high quality management.

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 species occur in the fishery area. DEH is satisfied that the monitoring of interactions, assessment of the impacts, current and proposed management responses are sufficient to ensure that all persons engaged in fishing are required to take all reasonable steps to minimise impacts. DEH considers that the fishery is unlikely to have an unacceptable impact on protected species. DEH recommends that this fishery be accredited under Part 13 of the EPBC Act.

The assessment concludes that the fishery is managed in an ecologically sustainable way. DEH recommends that the export of Southern rock lobster *Jasus edwardsii* should be exempt from the export permit requirements of Part 13A of the EPBC Act, with that exemption to be reviewed in five years.

To further strengthen the effectiveness of the management arrangements for the SARL Fishery, and to contain the environmental risks in the medium to long term, a series of recommendations have been developed. The implementation of these recommendations and other commitments made by PIRSA in the submission will be monitored and reviewed as part of the next Commonwealth review of the fishery in five years time.

## **Recommendations**

**Recommendation 1:** *PIRSA to inform the Department of the Environment and Heritage of any significant changes to the management regime of the South Australian Rock Lobster Fishery.*

**Recommendation 2:** *The current review of SA's Fisheries Act 1982 should provide for the inclusion of general community members on the two fisheries management committees. Greater efforts should also be made to increase conservation and general community involvement in stock assessments and research priority setting processes.*

**Recommendation 3:** *PIRSA to pursue complementary management arrangements with other Australian jurisdictions responsible for managing southern rock lobster fisheries to ensure that all removals and other relevant impacts on the stock are properly accounted for in stock assessments.*

**Recommendation 4:** *PIRSA to continue to improve assessment of all components of non-commercial catch in the fishery to be factored into the annual stock assessment process and management of the fishery. This will include further periodic surveys or other data collection and analysis measures to enhance the assessments of recreational and indigenous catch in the fishery. .*

**Recommendation 5:** *PIRSA, within 18 months, to review the monitoring requirements for both zones of the fishery, including options for independent monitoring appropriate to the scale of fishing and status of stocks in the main fishing areas, to identify monitoring measures necessary to confirm the status of stocks and support stock recovery strategies. PIRSA to progressively implement priority actions identified in the review.*

**Recommendation 6:** *PIRSA and the SA industry to work with their Victorian counterparts to investigate and adopt appropriate measures to address quota avoidance, misreporting of catches and other illegal activities in waters near the SA-Victoria border. These measures should be built into SA's compliance strategies.*

**Recommendation 7:** *Performance measures and targets for the main byproduct species to be included in the revised management plans for both zones, and the catches of the main byproduct species should be reviewed as part of the annual stock assessment process.*

**Recommendation 8:** *PIRSA to develop within 18 months a conservative harvest strategy for the Northern Zone fishery, including a TAC to commence on 1 November 2003, that includes recovery targets and reference points, and monitoring arrangements, representative of the scale of fishing in the Zone, and stock recovery timeframes.*

**Recommendation 9:** *Priority should be given to early implementation of escape gaps in the Northern Zone, and should be mandatory in both zones by October 2004. Decisions on the dimensions of escape gaps in both zones to be based on the requirement to minimise fishery impacts on all bycatch species.*

**Recommendation 10:** *PIRSA within 18 months to introduce mandatory structured reporting of all interactions between the rock lobster fishery and endangered, threatened or protected species.*

**Recommendation 11:** *PIRSA and industry to continue to monitor the extent of interactions between rock lobster fishery and fur seals and sea lions, and develop appropriate mitigation measures, including establishment within 2 years of preliminary trigger and reference points, to minimise these interactions.*

**Recommendation 12:** *PIRSA within 12 months to conduct a qualitative risk assessment of the interactions between the rock lobster fishery and protected species off SA and use the outcomes of this assessment to implement further protected species mitigation measures as required.*

**Recommendation 13:** *PIRSA to develop measures to assess ecosystem impacts of the fishery. Consideration should be given to the appropriateness of reference areas that would allow comparison between fished and unfished areas.*

## PART I - MANAGEMENT ARRANGEMENTS

The SARL Fishery is managed by PIRSA.

The management arrangements are described in the following documents, all of which are, or will be, publicly available:

- *Management Plan for the South Australian Southern Zone Rock Lobster Fishery;*
- *Management Plan for the South Australian Northern Zone Rock Lobster Fishery;*
- *Fisheries Act 1982*
- *Scheme of Management (Rock Lobster Fisheries) Regulations 1991;*
- *Fisheries (General) Regulations 2000;*
- *Fisheries (Management Committees) Regulations 1995;*
- relevant Gazetted notices and licence conditions.

A number of other documents, including research reports, scientific literature and discussion papers, are integral to the management of the fishery. Notable among these are two fishery assessment reports:

- *Southern Zone Rock Lobster (Jasus edwardsii) Fishery*
- *Northern Zone Rock Lobster (Jasus edwardsii) Fishery.*

Management plans, management review papers and updated stock assessment reports for the fisheries in both zones are accessible on the PIRSA website at [www.pir.sa.gov.au](http://www.pir.sa.gov.au)

Currently the 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. In particular, they contain a number of detailed management triggers, decision rules and performance measures and define the objectives, targets, monitoring requirements and management responses of the fishery in each zone. The commitments specified in the management plans, as outlined in this report, have been fundamental to DEH's assessment and consequent recommendations. The formal incorporation of the management plans into the management regime as statutory instruments is highly desirable. However, as it seems clear that SA's management plans will continue to be well documented, publicly available and transparent, DEH is satisfied that this lack of a legislative base will not cause issues in the fishery. The implementation of statutory management plans is being considered as part of the current review of the *Fisheries Act 1982*.

While management arrangements must remain flexible to ensure timely and appropriate manage responses, changes to the management regime may have bearing on aspects of DEH's assessment. PIRSA should therefore inform DEH of any changes to the management plans or commitments made in the Submission.

**Recommendation 1:** *PIRSA to inform Environment Australia of any significant changes to the management regime of the South Australian Rock Lobster Fishery.*

The fisheries management plans outline the broad policy framework, harvest strategy and strategic research plan for the fisheries in each zone. Responsibility for developing the plans lies with the Southern Zone Rock Lobster Fisheries Management Committee and the Northern Zone Rock Lobster Fisheries Management Committee. Each 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 committee support officer. The 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. These committees also provide the main forums for stakeholder input on management and policy issues 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. 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.

However, 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. With the management of commercial fishing in both zones coming under output controls and a ceiling set for the recreational catch, SA will be in a good position to include explicit resource allocation policy statements in the revised management plans later this year. Development of these policies requires the broadest possible community input, starting with the fisheries management committees.

**Recommendation 2:** *The current review of SA's Fisheries Act 1982 should provide for the inclusion of general community members on the two fisheries management committees. Greater efforts should also be made to increase conservation and general community involvement in stock assessments and research priority setting processes.*

In addition to the management committees' roles in community involvement and consultation, PIRSA routinely consults the broader community on all significant management proposals, such as fisheries management plans. Each management plan operates for a period of five years. The plans for both rock lobster management zones have operated from 1997 to 2002 and are currently being reviewed by the respective fisheries management committees. They will be updated at the conclusion of the current DEH review process.

PIRSA is examining options for establishing a stakeholder forum for reviewing annual stock assessments and research priorities, thus broadening the involvement of interest groups in key processes underpinning the management of the SARL Fishery.

SA, Victoria and Tasmania are moving towards closer collaboration in the areas of research and assessment of the southern rock lobster stock and fishery. Through a range of tri-state fora, PIRSA maintains regular contact in relation to trends, innovations and performance of management arrangements for southern rock lobster fisheries. However, there is no apparent attempt to achieve complementary management arrangements designed to effectively protect minimum biomass and egg production levels, for Australian stock as a whole.

Inter-state management arrangements are not explicitly incorporated in detailed arrangements for the SARL Fishery. In its assessment of the Tasmanian Rock Lobster Fishery, DEH noted that, ideally, management arrangements for fisheries based on a single stock should be under a single jurisdiction. Failing that, each jurisdiction should take explicit account of the impacts of fishing and the management regimes elsewhere, based on the same stock. There is a risk that SA's fishery, stock assessments and management arrangements may be compromised by

failure to account for activities managed under other jurisdictions. Accordingly, DEH recommends that SA develop strong formal collaborative arrangements with Tasmania and Victoria (and preferably WA and NSW as well) to develop joint stock assessments and fully complementary management arrangements.

**Recommendation 3:** *PIRSA should pursue complementary management arrangements with other Australian jurisdictions responsible for managing southern rock lobster fisheries to ensure that all removals and other relevant impacts on the stock are properly accounted for in stock assessments.*

PIRSA's 2002 submission and the respective zone management plans are strategic documents describing management objectives and strategies and the current status and reference ranges for a suite of variables which, together, reflect the state of the stocks and the degree to which management objectives are being met in each zone. Management strategies are defined for biological, environmental, economic and social management objectives and performance measures are specified for most strategies. An assessment of the effectiveness of these measures is included in Part Two of this report. These performance measures are the outcome of an independent fishery assessment process described in the publicly available 1997 fishery reports for both zones and reviewed in annual stock assessments. The findings of these annual reviews are used to help determine the necessity, nature and extent of adjustments or more substantial changes to management arrangements. Current management arrangements describe harvest strategies and specify actions to be triggered should reference points fall outside specified ranges. Modelling tools are being developed to provide quantitative analyses of risks as well as potential benefits of management changes. Arrangements are also in place to monitor and, if necessary, respond to increases in the recreational catch beyond a trigger point.

A range of input controls applied to the fisheries in both zones for many decades has been only partly effective in controlling the level of harvest and then only through successive measures to tighten these controls. Such controls include:

- limited entry, with 181 and 69 licences in the Southern and Northern zones, respectively;
- gear and (in Northern Zone) vessel restrictions;
- seasonal closures for the whole fishery;
- single pot lifts per day for the Northern Zone

The introduction of output controls to the Southern Zone in 1993 has effectively controlled the harvest level. As continued reliance on input controls in the Northern Zone has resulted in a stock decline below the reference ranges for key indicators, output controls in the form of quota management are to be introduced from November 2003. The recreational catch is capped indirectly at 4.5% of the total statewide catch through the combination of input and output controls, monitoring of recreational pot registrations and the specification of a trigger limit (currently set at 21,000 registered pots) and management response should this be reached.

Compliance tools operating in the fishery include at sea, aerial and port inspections of commercial and recreational fishers and substantial penalties for non-compliance. A compliance strategy is in place for the whole fishery and the relevant compliance risks are addressed separately for each sector of the fishery. Separate commercial fishery compliance and monitoring programs operate in the two zones reflecting differences in the fisheries and

their respective controls under input and output measures. In the Southern Zone where quota evasion (ie unreported landings) is the greatest risk to the fishery, the compliance program focus is on landings. The Submission states that the combination of a recently introduced Dockside Monitoring Program and reconciliation of commercial catch and effort logbook data and catch and disposal records have improved both compliance and fishery monitoring capabilities. In the Northern Zone, the focus has for many years been on the characteristics and usage of fishing vessels and gear. The proposed introduction of quota management in the Northern Zone in November 2003 will include the requirement for vessels to install a Vessel Monitoring System (VMS) to enable closer monitoring of fishing operations and, in particular, catch landings. In addition, all Northern Zone commercial fishers will be required to make 2 hour prior landing reports, place all rock lobster in PIRSA approved sealed bins and record all landings on Catch and Disposal Record (CDR) forms.

PIRSA notes that high levels of industry support for current management arrangements contribute to observed high compliance levels in both zones. An operational plan for compliance in the fishery sets compliance levels and addresses surveillance requirements. The low numbers of offences detected suggests that compliance rates are high in most areas of the fishery. In the recreational fishery, the requirements for all pots to be clearly marked and all rock lobsters taken to be marked upon landing are intended to enable easy identification of recreational gear and rock lobster landings, thus preventing illegal sale. Education and information programs and the involvement of industry and recreational stakeholders in management are intended to further encourage ownership of, and compliance with, management arrangements. A risk assessment approach is facilitating the strategic and cost effective use of enforcement resources.

Annual stock assessments review the status of the fisheries and performance of the management arrangements for each zone against management objectives and reference ranges. These assessments also examine assessment methodologies and information requirements. The management plans provide for a set response process, that may include changes to TACs or size limits, when assessments detect that performance indicators are outside acceptable ranges, and time closures in the Northern Zone. In addition, a more formal decision process for making TAC adjustments will be developed during 2003. Separate to this, the fisheries management plans for each zone are reviewed annually and amended where necessary. Both plans are undergoing comprehensive reviews and will be updated at the conclusion of this assessment process. DEH is satisfied that a five year review of the fishery in each zone is suitable while critical aspects are reviewed annually. These are discussed more fully in Part Two of this report.

A number of monitoring and validation programs are in place to underpin assessment processes and management responses to identify and mitigate adverse ecological impacts of the fishery. Fishery dependent and independent (puerulus monitoring program) information relating to the target species is collected on a regular basis. Fishery dependent data are obtained through compulsory monthly commercial catch and effort logbooks. Mandatory daily entries include locality, effort and catch details for retained rock lobster (numbers and weights) and byproduct species. Voluntary entries include size and sex data from rock lobsters taken in sampled pots, fine scale location data and details of undersized, dead, spawning and returned legal rock lobsters. Fishing locality details are validated periodically and logbook records of rock lobster landings are validated against processor records and, in the Southern Zone, catch and disposal forms and a Dockside Monitoring Program. Fishery independent data on puerulus settlement are used to formulate predictions of future

recruitment. SARDI researchers also undertake independent bycatch and byproduct monitoring at sea and in port. These information collection systems are discussed under Part Two of this report.

An analysis of the capacity for assessing, monitoring, avoiding, remedying or mitigating any adverse impacts on the wider marine ecosystem in which rock lobsters live and the fishery operates is contained under Principle Two of this report.

DEH is satisfied that the current management arrangements comply with all relevant threat abatement plans, recovery plans, the National Policy on Fisheries Bycatch, and bycatch action strategies developed under that policy. However, there is no mechanism in the arrangements that requires compliance with any future plans or policies.

As the fishery area contains Commonwealth waters, operators are required to comply with the International Convention on Marine Pollution (MARPOL). The submission is silent on how fishers and PIRSA ensure that these requirements are addressed adequately. The current management arrangements comply with the United Nations Convention on the Law of the Sea (UNCLOS).

No specific study or risk assessment has been undertaken on the impacts of the fishery on air and water quality. However, the Submission proposes that the combination of the small number of vessels in the fishery and the wide expanse of the fishing area, combined with improved waste disposal methods being developed with industry, have resulted in the further reduction of already low impacts on water quality. Nevertheless, the zone management plans and industry codes of practice should make specific reference to actions and requirements in the fishery related to the prevention of marine pollution from vessels.

## **Conclusion**

DEH considers that the management arrangements for the SARL Fishery are appropriately precautionary and provide for the fishing operations to be managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem. The current strategic management planning, monitoring, assessment, response and review programs and processes in place in SA, and the improved measures outlined in the submission, offer clear evidence of PIRSA's performance and commitment to the ecological sustainability of the fishery.

The management regime is developed through a consultative process, the management arrangements are adaptable, are underpinned by adequate objectives and performance criteria, and are enforceable and reviewable.

DEH has made a several recommendations to improve the long term management of the fishery.

## **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 from all commercial operators in compulsory monthly logbooks providing information on daily catches of rock lobster and byproduct species, fishing location and depth, and pot lifts (effort). The logbook landings data are validated against processor records. In the Southern Zone, logbook landings data are also validated against catch and disposal records and dockside monitoring by independent agents at prescribed landing points. Logbooks also provide for voluntary reporting of numbers of undersized, spawning and dead rock lobsters caught.

PIRSA has operated a fishery dependant catch sampling program for over 10 years in both fishing zones to collect more detailed information on retained and non-retained catch, in particular sex and size frequency data. PIRSA has pursued the collection of this data on a voluntary basis to provide more reliable data returns, and has taken account of former FRDC sampling projects in developing the appropriate catch sampling strategies for the fishery. The current sampling process provides for data to be collected from around 3 pot lifts per fisher per day. PIRSA note in their submission that on average 40% of fishers participate in the catch sampling program, and the data has significantly improved the stock assessment for the fishery. Research staff have participated in commercial fishing trips to train fishers in data collection methods, encourage further participation in the data collection program and provide a quality control role on data collected. Since 2000, the sampling program has provided for better estimation of catch selectivity and discarding rates through the inclusion of data on legal size lobsters returned to the sea, to help determine if stock are being targeted on the basis of certain size, colour, hardness or physical condition.

In addition, data on vessels, equipment and fishing gear are collected to help account for technological advances and their impact on effective fishing effort. PIRSA’s confidence in the reliability and accuracy of fishery dependent inputs to assessment processes was strengthened by the results of an independent review of stock assessment and research for the Northern Zone fishery, conducted during 2002. This review arose from questions about the status of the stock in the Northern Zone and was conducted by prominent scientists from NZ’s National Institute of Water and Atmospheric Research (NIWA). Their findings confirmed the quality of SA’s biological and fishery data and collection programs.

In recent years SARDI has conducted periodic surveys of the recreational fishery to provide essential inputs to stock and fishery assessments and to monitor trends in recreational fishing. A 1998 survey estimated catch and effort by location for recreational pot fishing. The results of a 2001-02 survey of catch and effort by all forms of recreational fishing were published in 2003. PIRSA noted in their submission their intention to periodically commission further surveys to ensure that reliable estimates of recreational catch are factored into the stock assessment process. The 2001-02 survey indicated that the major proportion of recreational rock lobster catch is from rock lobster pots. PIRSA requires all rock lobster pots to be registered and details of registered pot fishers are monitored through a database.

Fishery independent data is mainly confined to larval collectors based at seven locations across the two zones (5 in the Southern Zone and two in the Northern Zone) to monitor puerulus and post-larval settlement as an indication of recruitment to the fishery. PIRSA acknowledged in their submission that additional puerulus collectors are necessary in higher recruitment areas of the Northern Zone. Puerulus settlement indices have proved to be valuable indicators of the strength of year classes entering the fishery 3-4 years on. Further analysis of independent monitoring requirements is provided in the Assessment section below.

Five-year strategic research plans are based on the need for reliable and cost effective performance management, with indicators linked to management objectives for the stocks and fisheries in each zone. The main focus is on the core research built around the needs of annual stock assessments, identified by an independent review of research priorities and resource needs. Additional discrete research projects are funded through external bodies such as the Fisheries Research and Development Corporation (FRDC).

## **Assessment**

Independent annual stock assessments update information on the fishery (eg catch, effort and size composition trends) and stocks (eg recruitment and abundance trends) and examine the performance of the fishery against the management objectives and performance indicators set for each zone. The main assessment tool is the qR model which provides estimates of annual changes in exploitation rates, egg production, biomass and recruitment. This model has been revised and improved and NIWA scientists have independently rated it as appropriate for assessing the status of the SARL Fishery. Assessment results are published annually in reports accessible on the PIRSA website ([www.pir.sa.gov.au](http://www.pir.sa.gov.au)). Performance indicators include estimates of catch, exploitation rate, stock structure, egg production, recruitment and biomass. Performance is measured against a set of values for the reference period 1992-1996. This period was chosen on the basis of the historical performance of the fishery which was considered to be relatively stable at that time in terms of measures such as catch, catch rate, gear and fishing technology.

As an outcome of its regular review of assessment processes and data needs, SARDI is developing an integrated risk assessment model. Scheduled for completion in December 2003, this model will integrate all available data to help managers predict likely stock responses to - and assess risks associated with - alternative harvest strategies.

The annual stock assessment process builds upon a monitoring and assessment program that has undergone increasing sophistication, power and robustness over several decades. In its

current and projected form, the program encompasses the latest in population dynamics approaches designed to provide timely assessments and risk-based predictive capabilities to meet the needs of management. DEH is satisfied that this allows PIRSA to ensure that assessments of the dynamics and status of the fishery are robust and capable of identifying reductions in biological diversity and reproductive capacity.

On the matter of independence of scientific advice and assessments, while SARDI receives most of its funding from the SA Government and is contracted to conduct fisheries research, monitoring and assessments by PIRSA, it is independent of PIRSA fisheries managers. The quality and standing of SARDI's work on rock lobsters has been confirmed by external peer review by, for example, NIWA scientists.

Because of its commercial value and long history of exploitation, the distribution and spatial structure of the southern rock lobster have been studied throughout its range off southern Australia and around New Zealand. As suggested by its extended offshore pelagic larval phase, a single genetic stock has been shown to occur throughout the species' range. Consequently, management of fisheries in SA and other jurisdictions focuses on local attributes so that spawning stocks and annual contributions to larval recruitment are maintained to ensure that the fisheries are sustainable. Growth rate data from extensive tagging studies and population size structure data all indicate that the fishery is not affecting the genetic diversity of the stock.

The SARL Fishery is managed according to the conservative hypothesis that the stock off SA is largely self recruiting. As previously noted, the weakness of this approach by the southern states is that there is no combined assessment or coordinated suite of assessments aimed at protecting minimum levels of biomass and egg production at a whole-of-stock level. DEH has recommended, in Part I of this report, a more complementary approach to stock assessment arrangements with other jurisdictions. The CSIRO is also currently undertaking an FRDC project on the larval transport and recruitment processes of southern rock lobster. The project's objectives include improved understanding of puerulus settlement patterns and recruitment rates and to build this information into future assessments of recruitment indices and stock status.

The separation of the SARL Fishery into two zones with differing management arrangements is largely based on environmentally determined differences in stock structure, productivity and other biological and ecological characteristics. The different size limits in the two zones typify these distinctions.

PIRSA noted in their submission that for both fishing zones estimates of all removals from each sector are factored into the stock assessment process and taken account in the determination of the TAC and/or effort controls. Comprehensive and detailed records of all commercial removals are recorded on mandatory monthly logbook forms provided by all fishers. Rock lobster catches are recorded both as numbers and weight landed. In the Southern Zone these records are validated against catch disposal records which are completed at landing points where a dockside monitoring program has also been established. Processor records are also used to validate fishers' data in both zones. Fishers' records of numbers of rock lobsters killed in pots by octopus are also used to estimate pot-induced mortality, and this is factored into stock assessment and TAC setting processes. While the stock assessment models can incorporate the impacts of unreported catches, compliance records indicate low levels of illegal take by both commercial and recreational fishers.

The catch by recreational fishers' pots was estimated at 67 tonnes in 1999 (McGlennon 1999). The results of the detailed survey of recreational catch that PIRSA commissioned SARDI to undertake in 2001-02 (Venema *et al* 2003) indicated that around 118 tonnes, or 4.7% of the total catch from both zones of the fishery, is taken annually by registered recreational potters, using either lobster pots or drop-nets, and by recreational divers. The 2001-02 survey noted that this was an underestimate of the recreational catch as it did not adequately include harvest by drop or hoop nets by recreational fishers without registered pots, fishing using other gear types and charter boat operators. The National Recreational and Indigenous Fishing Survey reported an annual recreational harvest of rock lobster from South Australian waters of approximately 95.5 tonnes (Henry and Lyle 2003). As previously mentioned PIRSA has indicated their intention to periodically commission further surveys to improve the reliability of recreational catch estimates in the stock assessment process. These surveys, or other assessment mechanisms used to assess the recreational catch component, need to provide for the inclusion of all recreational harvesting methods to ensure accurate estimation of the recreational catch component in the stock assessment process.

PIRSA's submission notes no information is available on indigenous catch of rock lobster in South Australian waters, and while it also notes that all non-commercial activity is managed under recreational arrangements, there is no indication of the extent of indigenous take or how this could be estimated. The recently completed National Recreational and Indigenous Fishing Survey included indigenous catch in the survey findings, but as a combined estimate with recreational catch that did not differentiate the actual indigenous catch component. The national survey outcomes will nonetheless provide PIRSA with further data to use in the assessment and management of all non-commercial components of the fishery. Provisions for indigenous access and practices in all of SA's fisheries are currently being examined as part of the review of the SA Fisheries Act.

DEH is encouraged by the approach taken by PIRSA to date to quantify and monitor the recreational catch component in the fishery and acknowledges the relative robustness of the stock assessment process. Nonetheless, DEH is concerned about the uncertainties associated with the extent of the non-commercial take identified in recent surveys. DEH considers that further work should be undertaken to more accurately determine the extent of recreational and indigenous catch across the fishery and assessing the need for additional management responses in the event that revised estimates are above the existing levels used in stock assessments.

**Recommendation 4:** *PIRSA to continue to improve the assessment of all components of non-commercial catch in the fishery to be factored into the annual stock assessment process and management of the fishery. This will include further periodic surveys or other data collection and analysis measures to enhance the assessments of recreational and indigenous catch in the fishery.*

Current and proposed stock assessment models do not provide estimates of virgin biomass,  $B_0$ , or explicit estimates of potential productivity, such as maximum sustainable yield. The models are being further developed to improve recruitment strength forecasting capabilities.

Models for the Southern Zone indicate strong annual recruitment and estimated increases in legal size relative biomass and egg production of 50% and 35% respectively in recent years,

resulting in the zone performing well above the productivity reference ranges set in the management plan. In comparison, recent stock assessments in the Northern Zone indicate declining recruitment and egg production levels and the fishery performing below the productivity reference ranges set in the management plan

Public comments noted the primary reliance on interpretation of catch rate data for estimates of relative abundance of stock and suggested that further fishery independent data should be used to gain a more accurate estimate of unfished biomass, indication of changes in size structure of stocks and to validate stock assessment models.

In response to these public comments, PIRSA has acknowledged the benefits of independent catch and population monitoring to obtain more representative estimates of population size structure and rates of discarding and high grading. While noting the cost implications in implementing a comprehensive independent program across the large areas of the fishery, particularly in the Northern Zone, PIRSA has indicated that it will investigate the costs and benefits of independent catch and population monitoring in the fishery for stock assessment purposes.

DEH acknowledges the robustness of the current assessment process and welcomes PIRSA's commitment to review the independent monitoring needs of the two fishery zones. As part of this review, consideration should be given to developing, where possible, compatible monitoring arrangements with neighbouring jurisdictions that also manage common stock of southern rock lobster.

In the Southern Zone, the current indications of strong recruitment suggest that the need for comprehensive independent monitoring in this zone is not urgent.

In the Northern Zone, PIRSA has taken direct action to address the declines in recruitment and relative abundance by introducing a TAC, and intends to investigate extending the number of independent puerulus monitoring sites from 2 to 4. In this zone, independent validation of overall biomass levels, proportion of breeding stocks and size distribution, in support of the quota management system, would increase certainty about the effectiveness of the stock recovery strategy.

**Recommendation 5:** *PIRSA, within 18 months, to review the monitoring requirements for both zones of the fishery, including options for independent monitoring appropriate to the scale of fishing and status of stocks in the main fishing areas, to identify monitoring measures necessary to confirm the status of stocks and support stock recovery strategies. PIRSA to progressively implement priority actions identified in the review.*

### **Management response**

Harvest strategies are in place for both zones of the fishery, supported by a range of performance indicators and management controls on the level of commercial and non-commercial removals.

The management plans for the respective zones set out biological, economic, environmental and social management objectives, strategies and performance indicators. Associated with the biological objectives are limit reference ranges (outlined in the Assessment section above) specified for a range of performance indicators for both zones that include estimates of

exploitation rates, egg production, recruitment, catch rates and mean sizes. Under the management plans, the harvest strategies link the annual stock assessments to decision processes which include adjustments to harvest levels and other management arrangements for each zone. Current arrangements specify notification, investigation, consultation and reporting actions which the respective zone management committees must take as a response when one or more reference point is reached or exceeded.

The harvest strategies in both zones are supported by a comprehensive range of input and output controls to maintain ecologically viable stock levels. The current Southern Zone harvest strategy has focused on re-building the stock by maintaining a constant annual commercial catch through the TAC since 1995-96.

The TAC is supported by a wide range of other controls, including limited entry licences, minimum legal size lengths, seasonal closures, ban on retaining egg bearing females, pot specifications and number limits.

Since the introduction of the TAC in the Southern Zone, the combination of these input and output controls, supported by risk based compliance and monitoring programs, have proved to be effective in controlling the annual take. As noted in the previous Assessment section of this report, the harvest strategy has allowed the zone to exceed reference targets in terms of estimated relative biomass. In response to these strong indicators in abundance and recruitment, PIRSA increased the TAC by 50 tonnes for the 2002-03 season. PIRSA's submission notes that the harvest strategy will be revised and a more formal TAC adjustment decision framework put in place under the proposed new Management Plan.

The current Northern Zone harvest strategy, in the absence of TACs, has focused on maintaining the exploitation or harvest rate within a defined range, primarily through effort controls. The upper limit of the proportion of all annual deaths and removals attributable to all forms of fishing is set at 28%. In addition to controls applied in the Southern Zone such as size limits, limited entry licences and pot specifications, additional in-season closures, vessel power and dimension and pot hauling limits have applied to control effort in the fishery. This approach was intended to compensate for increased effectiveness of fishing effort (due to improved technology) and for fluctuations in stock size (due to recruitment variations) over time.

In terms of sustainability of the SARL Fishery, the continued poor performance of the Northern Zone fishery is the main concern. DEH is encouraged by the way that PIRSA and industry worked together in increasing the legal minimum length for rock lobsters and introducing successive effort reduction measures over the last 10 years. Since 1992, pot numbers have been reduced by 10% and permissible fishing days have been reduced on six occasions.

As indicated in the Assessment section of this report, these measures have failed to halt declines detected by recent stock assessments of stock abundance in this zone. PIRSA will consequently introduce a new management system based on ITQ and a conservative TAC for the zone for the start of the 2003-04 season. This will include a revised harvest strategy to take account of stock recovery needs. PIRSA has estimated that the average catch over the past 20 years for the zone is around 890 tonnes and has advised that a TAC of 625 tonnes, or 70% of the mean annual catch over the last 20 years, has been set for a minimum of 3 years,

subject to annual fishery performance review. As with the Southern Zone, a formal decision-making framework will be established for the TAC setting and adjusting process.

Non-commercial catch controls primarily focus on monitoring and capping the level of recreational catch by pots. A range of recreational control measures exist for both zones, including legal size limits, seasonal and spatial closures, bag and boat possession limits, gear restrictions and pot specifications. A trigger point of 21,000 registered recreational pots has been set as a proxy for the cap on the state-wide recreational catch which is not to exceed 4.5% of the total catch of the commercial and recreational sectors. If triggered, the arrangement requires PIRSA to introduce management responses to offset any additional recreational catch. The trigger limit of 21,000 pots is currently under review.

The effectiveness of the performance measures and management strategies in place for the recreational fishery rely heavily on PIRSA's ability to monitor the magnitude of the total catch. As discussed earlier in this report DEH has recommended further attention be given to more accurately accounting for all elements of non-commercial rock lobster catch in the fishery.

While a sound process exists for fishery dependent data to be accurately recorded and validated, and there are indications of high compliance with commercial fishery reporting requirements, DEH is aware of past problems with misreporting and other illegal activities occurring on a regular basis near the SA-Victoria seaward border. In particular, the potential for dual SA-Victorian rock lobster access licence and quota holders to misreport area-of-capture details has been subject to combined efforts of governments and industries in the two States.

DEH understands that strategies to address these concerns - beyond the current at-sea border patrols - are being examined jointly by SA and Victorian authorities, including a Bill recently introduced in the South Australian Parliament to facilitate Victorian compliance officers having complementary enforcement powers within South Australia. Further use of VMS in the Southern Zone is being investigated to monitor and address cross-state illegal catch of rock lobsters. Additionally, the introduction of quota management in the Northern Zone will include mandatory use of VMS to assist with enforcement of compliance with the respective Northern and Southern Zone management arrangements.

DEH encourages further development of measures to strengthen cross jurisdictional compliance with respective management systems and minimise potential for illegal fishing activities.

**Recommendation 6:** *PIRSA and the SA industry to work with their Victorian counterparts to investigate and adopt appropriate measures to address quota avoidance, misreporting of catches and other illegal activities in waters near the SA-Victoria border. These measures to be built into SA's compliance strategies.*

Byproduct in the SARL Fishery is characterised by small quantities of several fish and invertebrate species which may be retained for sale, use as bait or personal consumption. Species which may be retained for business purposes are listed on Schedule 1 of the *Scheme of Management (Rock Lobster Fisheries) Regulations 1991*. With the exception of gummy sharks *Mustelus antarcticus*, fishing for all these species in waters off SA is managed by PIRSA. The main byproduct species landed for sale is octopus *Octopus maorum*. Detailed

landings data for all byproduct species are included on the mandatory commercial fisheries logbooks. Daily entries include weight landed for each species and, in addition, numbers landed for octopus and giant crabs *Pseudocarcinus gigas*. PIRSA noted in their submission that studies monitoring the catch per unit effort (CPUE) of octopus catch in South Australian fisheries indicated no change in relative abundance of octopus since 1983 and that the catch of octopus as byproduct in the rock lobster fishery had no measurable effect on octopus populations (Brock et al 2003).

From the start of the 2001-02 season, SARDI researchers have conducted fishery independent monitoring of byproduct (and bycatch) in the SARL Fishery to validate fishers' records. The results of this current 2-year study of byproduct and bycatch will be analysed and reported at the end of the 2002-03 season. The study will include a risk analysis and quantitative assessment of the impact on byproduct species relative to that of other fisheries.

Except for octopus, the SARL Fishery is not the major source of fishing mortality for the byproduct species it takes. The main scalefish byproduct species are leatherjackets and wrasses which are used mainly for bait. Preliminary studies by SARDI suggest that the take of scalefish species is negligible compared to the take of these species by targeted scalefish fisheries and that the SARL Fishery presents no significant risk to scalefish stocks and communities. Species which form significant target species of other fisheries (eg SA's Marine Scalefish Fishery and the Southern Shark Fishery) are subject to assessments and management arrangements for those fisheries and take into account the impacts of other fisheries including the SARL Fishery. Because of their design and usage, rock lobster pots are very selective and the proposed introduction of two escape gaps to every pot in the fishery should reduce catches and mortality of byproduct and bycatch species.

DEH is encouraged by the pro-active approach taken to quantify the impacts on byproduct species through the current independent byproduct survey and quantitative risk assessment. DEH notes that ongoing commitment to byproduct assessment is unclear under the existing management regime. PIRSA's approach to management of byproduct would be enhanced by the development of byproduct performance measures and targets. While DEH recognises that the cost effectiveness of ongoing bycatch and byproduct monitoring programs need careful consideration given the fishery's large area and relatively minor take of non-target species, the catch of some species, in particular octopus, is sufficient to warrant ongoing monitoring and consideration in the stock assessment process. The review of the management plans provides the opportunity for these arrangements to be formalised in both zones of the fishery.

**Recommendation 7:** *Performance measures and targets for the main byproduct species to be included in the revised management plans for both zones, and the catches of the main byproduct species should be reviewed as part of the annual stock assessment process.*

## **Conclusion**

DEH is satisfied that the information collection system, stock assessment and management arrangements are generally 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 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 Southern Zone fishery that is performing within or at higher levels than specified in its respective performance measures. Monitoring and assessment programs, trigger points and management responses in this zone are in place to ensure that the risk of overfishing rock lobster remains negligible.

The Northern Zone of the fishery has performed poorly in recent years and is currently below the limit reference levels for key performance indicators such as relative biomass, egg production, exploitation rate and catch rates, with the relative biomass estimated at its lowest level in the recent history of the fishery.

DEH is encouraged by the clear commitment shown by PIRSA, industry and other stakeholders to the recovery of the stock in the Northern Zone, with combined effort reductions of 15% in 2001 and 2002 fishing seasons to reduce catch levels. The continued reliance over the last decade on increasingly stringent input controls has failed to achieve the biological management objectives. Hence PIRSA has taken the additional step of working with industry on a revised harvest strategy aimed at stock recovery and featuring the introduction of a TAC and ITQs in November 2003. The revised strategy will include revised objectives, performance measurement, stock recovery targets, decision rules and information needs, and annual evaluation of the performance of the revised harvest strategy.

In its submission, PIRSA is emphatic about its commitment to a balanced strategy that attaches priority to the needs of the stock and the ecosystem. In order to ensure the sustainability of a productive fishery in this zone, it is critical that a sufficiently conservative TAC is set. While stock recovery targets and timeframes are yet to be finalised, a TAC of 625 tonnes has been set for a minimum of 3 years. This represents a harvest of 70% of the average annual harvest over the last 20 years (890 tonnes). Compliance with the new quota management arrangements in the Northern Zone will also be strengthened by the requirement for compulsory use of VMS, prior landing reports, the use of authorised sealed bins for transportation of lobster from the point of landing and a requirement to fill out Catch and Disposal Record (CDR) documentation.

DEH acknowledges that PIRSA is committed to a comprehensive response to the recovery of the Northern Zone stocks. DEH notes that while PIRSA's submission outlines the setting of a TAC for the start of the 2003-04 season, it lacks specific details of when any complementary measures in the revised harvest strategy will be implemented. Priority should be given to developing a comprehensive harvest strategy to accompany the introduction of quota management in the zone.

**Recommendation 8:** *PIRSA to develop within 18 months a conservative harvest strategy for the Northern Zone fishery, including a TAC to commence on 1 November 2003, that includes recovery targets and reference points, and monitoring arrangements, representative of the scale of fishing in the Zone, and stock recovery timeframes.*

As previously mentioned, the stock recovery strategy for the Northern Zone would be enhanced by comprehensive monitoring measures to confirm the effectiveness of the quota management system in rebuilding biomass levels and enhancing recruitment in the zone. The review of monitoring requirements for the fishery will therefore need to closely examine the mix of fishery dependant and independent monitoring required, particularly the options for targeted independent monitoring at representative sites in the Northern Zone to validate stock structure and abundance at various stages of the stock recovery process.

## **Conclusion**

DEH is satisfied that stocks in the Southern Zone are being suitably managed to be maintained above existing reference points and that should stocks fall below these levels, appropriate management measures are in place to promote recovery to ecologically viable stock levels within nominated timeframes. DEH is also satisfied that PIRSA is committed to an effective recovery strategy to return stocks in the Northern Zone above designated reference points, and has recommended the early implementation of a conservative harvest strategy with comprehensive monitoring measures, to enhance the management of the stock recovery process.

## **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**

Available information indicates there are relatively few bycatch species caught in the fishery. The bycatch includes non-retained rock lobsters, reef fish such as some species of wrasse and harlequin fish, and some eels, hermit crabs and starfish. Currently monitoring of bycatch in this fishery, through commercial logbooks, is limited. The SARDI 2-year fishery independent monitoring study of byproduct and bycatch in the SARL Fishery, due for completion at the end of the 2003 season, should provide baseline indications of bycatch levels and impacts in both zones of the fishery and identify requirements for further monitoring. Preliminary results of this study indicate that bycatch is low and most non-target catch is used as byproduct which must be recorded in logbooks, along with details of discarded rock lobsters which make up a significant part of the bycatch. Separate to this, the infrequent interactions with wildlife are reported in commercial fishing logbooks on an *ad hoc* basis.

### **Assessment**

PIRSA has undertaken a qualitative risk assessment to identify any priority bycatch issues that require a management response. Because of the selective nature of pots, the relatively small bycatch and the high likelihood of survival of most released bycatch, there has been no formal risk assessment. The one issue identified as requiring further attention is the interaction between seals and rock lobster pots and pot lines.

A formal risk assessment to determine the vulnerability of all non-target species to rock lobster fishing will be undertaken at the completion of the current 2-year bycatch and byproduct study. The need for and form of a formal non-target species management strategy will be assessed by PIRSA at the completion of the current study. This will include consideration of performance measures, stock assessments, decision rules and management responses commensurate with the risks posed by rock lobster fishing.

As previously noted DEH is encouraged by the approach taken by PIRSA with the bycatch and byproduct survey. The absence of bycatch quantification and formal risk assessment until now is a potential weakness in the management arrangements for the fishery. DEH understands that PIRSA will consider the development of a bycatch management strategy, commensurate with the identified threats, as part of the outcomes of the survey. DEH supports this approach and encourages the early development of bycatch performance measures and associated bycatch management strategies, including ongoing monitoring of bycatch impacts across the fishery appropriate to the level of risk, as part of the revised management arrangements for both zones of the fishery.

## Management response

The quantities of bycatch in this fishery are inherently small, as is the number of species involved. There is nothing to indicate that the level of bycatch is unsustainable. Currently each pot must either be constructed of wire mesh of at least 50 mm mesh size or be fitted with two escape gaps measuring 55 x 150 mms to minimise the retention of undersized rock lobsters and other non-target species. If adopted, a proposal to require every pot used in the fishery to be fitted with two escape gaps (measuring 57 x 280 mms in the Northern Zone and 55 x 280 mms in the Southern Zone) will further reduce the catch of non-target species, in particular the numbers of undersized rock lobsters that commonly make up the majority of the bycatch.

The submission refers to the Northern Zone industry support for the proposal and describes how many fishers have fitted escape gaps even when not required to do so, recognising the benefits they provide because of the reduced retention of undersized rock lobsters and other bycatch. PIRSA Fisheries has advised that escape gaps will be required in pots used in the Northern Zone from 1 November 2003. Of concern to DEH is the continued apparent reluctance of industry in the Southern Zone to endorse the requirement for all pots there to be fitted with escape gaps. Industry's concern appears to be based on their consideration of the biological and economic losses that some members believe may result from increased octopus predation on rock lobsters.

Reduced retention and related injury and mortality of all bycatch, including undersized rock lobsters, is clearly a significant factor in relation to minimum mesh and escape gap sizes used in the fishery. DEH considers that, in both zones of the fishery, PIRSA and industry need to urgently take account of the recommendations from SARDI's research on this issue and agree as soon as possible on the introduction of escape gaps to every pot used.

Given the significant management changes being introduced in the Northern Zone in November 2003, DEH considers it is appropriate to implement the new mesh size and escape gap measures at the same time. This will provide an immediate means of reducing undersize lobster catches (and associated mortalities) and support early recovery of stocks. DEH acknowledges that while these gear changes are also important for the Southern Zone, a longer period of consultation may be more appropriate before implementing gear modifications, given the healthier status of target stocks, relatively minor levels of bycatch and the large number of licence holders to be consulted in this zone.

**Recommendation 9:** *Priority should be given to early implementation of escape gaps in the Northern Zone, and should be mandatory in both zones by October 2004. Decisions on the dimensions of escape gaps in both zones to be based on the requirement to minimise fishery impacts on all bycatch species.*

PIRSA indicates in their submission that the constant TAC strategy used in recent years in the Southern Zone of the fishery has resulted in stock build up and increased catch rates. This in turn has reduced the fishing effort and exposure of bycatch species to the fishery due to the catch being taken in fewer days with fewer pot lifts. The introduction of a TAC for the Northern Zone fishery in the 2003-04 season is intended to have a similar effect.

Given the current reliance on the TAC as the main stock control measure, and the implications that the TAC level can have on bycatch impacts, DEH encourages PIRSA and the fisheries management committees to continue to take account of the impacts on bycatch species in the TAC setting and adjustment processes.

Because of the relatively small quantities, diversity and high variability of bycatch across the range of the fishery, no indicator group of species is monitored on a regular basis. The need for ongoing monitoring will be determined at the completion of the current study of bycatch in this fishery.

## **Conclusion**

DEH is satisfied that the fishery is conducted in a manner that does not threaten bycatch species and that appropriate risk assessment measures are being undertaken to further address the level of risk posed to bycatch species. DEH has recommended enhancements to certain areas in the assessment process and in fishing operations to further minimise the impact on bycatch species by activities in the fishery.

## **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**

A range of protected seal, cetacean, shark, seabird and turtle species occur in the area of the fishery. PIRSA notes in their submission that there is potential for interactions of pots and float lines with marine mammals, turtles and sea birds. Fishers may report such interactions in their commercial fishing logbooks but are not required to do so. Interactions are also currently monitored opportunistically through the fishery independent bycatch monitoring program (which will end later in 2003). Over the years other *ad hoc* reports have been provided by research cruises and on-board observers on commercial vessels, including SARDI's current bycatch monitoring program. In the past, industry has worked with SA National Parks and Wildlife (NPW) staff on the occurrence of interactions between rock lobster fishing and seals and on the effectiveness of seal exclusion devices.

Public comments on PIRSA's submission raised concerns that the limited documenting of protected species interactions prevents an accurate quantification of impacts of the fishery's operations on protected species of whales, seals and turtles.

PIRSA is currently considering amending commercial fishing logbooks – or introducing a special new logbook - to provide for recording of interactions with endangered, threatened or protected species by all of SA's commercial fisheries.

Given the potential for protected species interactions, DEH considers that priority should be given to establishing data collection systems that provide a more reliable means of monitoring and managing the impact of the fishery on protected species. DEH and PIRSA will also need to give further consideration to providing appropriate supporting information to ensure that all industry members have the capacity to make accurate reports of protected species interactions.

**Recommendation 10:** *PIRSA within 18 months to introduce mandatory structured reporting of all interactions between the rock lobster fishery and endangered, threatened or protected species.*

There are no threatened ecological communities identified in the area of the SARL Fishery.

### **Assessment**

There has not been any formal assessment of the impact of the fishery on endangered, threatened or protected species. A range of past research studies and other information sources on fishery interactions with various protected species suggests that, apart from seals, interactions in the SARL fishery have been fairly low, and the impact is likely to be small or negligible. Incidents involving whales, dolphins and turtles have been recorded in the area of the fishery but the comparatively low numbers of these species in these areas compared with seals, provides for a far lower likelihood of entanglement in lobster pot ropes. As recommended above, more systematic reporting of interactions by the commercial fishery should facilitate improved assessments for all protected species in the future.

Of all the interactions between rock lobster fishing and marine wildlife, those with seals (including sea lions and fur seals) are the most common, although even these are normally infrequent occurrences. There are several major seal colonies along the SA coast and seals are common in many areas where rock lobster fishers operate. Seals are attracted by baited pots and predate on juvenile rock lobsters returned to the water by fishers. The rare harmful impacts on seals resulting from interactions with this fishery include cuts and lesions from pot ropes and death by drowning in pots or entanglement in pot ropes. The most common incidents involve seals – usually juveniles – removing or attempting to remove bait from pots.

There have been anecdotal reports of seals suffering cuts, lesions or drowning as the result of entanglement in bait packaging, some of which may have come from rock lobster fishing boats. While not formally quantified, previous joint work by the industry and NPW indicates that the mortality of seals resulting from interactions with this fishery is low. Nonetheless, many fishers have adopted the use of seal exclusion devices based on previous collaboration with NPW. In addition, the industry in both zones has supported an on-board study to quantify interactions with seals, with a view to developing appropriate mitigation measures.

### **Management response**

Given the most significant protected species interactions in the fishery are with seals, PIRSA is giving priority to quantifying and mitigating seal interactions in the fishery. As most seal populations are increasing and seals will always be attracted to baited pots, the greatest threats posed by the fishery in terms of protected species are the associated seal injuries and mortality. As the most serious incidents usually involve seal pups, it may be that these threats are greatest around seal colonies. If this is the case, it may be possible to develop targeted mitigation strategies to great effect. Much of the initiative for minimising injuries and drowning of seals in pots has been led by industry itself. Developed in collaboration with NPW, seal exclusion devices have been adopted by many fishers who have the added incentive of reducing losses of rock lobsters, bait, pots and working time that result from seals

raiding pots. Many fishers have also altered the manner in which they secure bait to make it inaccessible to seals.

PIRSA, in collaboration with SARDI and a number of key marine mammal researchers, has developed a major 3 year research project to develop principles and guidelines for assessing and addressing the interaction of fur seals and sea lions with southern rock lobster fisheries. The project will involve on-board observer monitoring of seal and sea lion interactions with fishing operations, quantification of the extent of interactions, assessments of the risks to populations by these interactions and developing and assessing measures to mitigate interactions with these species. The project is also likely to provide an opportunity to monitor and assess interactions with other marine wildlife. The project proponents have sought substantial funding from FRDC and if supported expect the project to commence in July 2004.

DEH acknowledges the efforts to date by PIRSA, NPW, industry and researchers to address seal interactions in the area of the fishery and agrees that the above project would be very beneficial in supporting management agencies meet their obligations, under the EPBC Act, to avoid death or injury to protected species. DEH considers that, given the growing populations of fur seals in southern waters, there is an ongoing potential for continuing seal interactions in the fishery. Additionally, the uncertain conservation status of sea lion populations in the region places an increasing priority on ensuring measures are in place to minimise future interactions with these species. In the event that funding is not provided for the above project PIRSA should continue to give priority to more accurately quantifying fur seal and sea lion interactions in the fishery and developing appropriate mitigation measures. The establishment of preliminary reference points for fur seal and sea lion deaths or injuries would appear an appropriate first step in minimising seal interactions and providing guidance on the need for further mitigation measures. The risk assessment process recommended below for interactions between marine wildlife and the SARL fishery should help inform the development of initial reference points for seal interactions.

**Recommendation 11:** *PIRSA and industry to continue to monitor the extent of the interactions between rock lobster fishery and fur seals and sea lions, and develop appropriate mitigation measures, including establishment within 2 years of preliminary trigger and reference points, to minimise these interactions.*

Given the limited number of recorded interactions with other protected species, the existing management regime has limited measures to address these interactions. Adult and juvenile southern right whales and other whale and dolphin species are protected by the prohibition of all fishing in the Great Australian Bight sanctuary zone and interactions between these species and the rock lobster fishery off the rest of the SA coast are rare.

The South Australian Rock Lobster Advisory Council's "clean green" project has addressed concerns with marine debris impacts on marine wildlife through the commercial rock lobster industry working with the SA and local governments on initiatives such as the development of waste reception facilities along the South Australian coast in key fishing ports. This is part of industry efforts towards formal accreditation of the industry against comprehensive best practice guidelines. Public comments on PIRSA's submission noted the possibility that extended soak times of pots may be increasing the risk of marine wildlife entanglements with pot lines. PIRSA is examining the possibility that the soak times for pots may have to be

regulated in the Southern Zone fishery to curb the increasing practice of leaving pots in the water for longer periods, thereby increasing the threats to wildlife.

Apart from risks of gear entanglements, public comments on PIRSA's submission also raised concerns with other impacts of fishing operations, such as habituation to the fishery from bait and bycatch discards and killing of marine mammals for use as bait in lobster pots. DEH acknowledges it will be some time before revised fishery dependent and independent programs are able to provide sufficient information for quantitative risk assessment on the impacts on all protected species. While monitoring of protected species interactions is currently being addressed through the bycatch and byproduct monitoring program, it is unclear what ongoing monitoring arrangements will exist for protected species, apart from seals, once that project concludes this year. However, useful assessments have been undertaken for fisheries in other jurisdictions where information was largely ad hoc or anecdotal.

DEH considers it appropriate that PIRSA leads an immediate risk assessment addressing the interactions between the SARL Fishery and marine wildlife and drawing on all sources with useful information to contribute. Such an assessment should assist in targeting the design of the any additional monitoring programs and supporting management controls that may be required as a result of the outcomes of this assessment.

**Recommendation 12:** *PIRSA within 12 months to conduct a qualitative risk assessment of the interactions between the rock lobster fishery and protected species off SA and use the outcomes of this assessment to implement further protected species mitigation measures as required.*

## **Conclusion**

All indications are that the overall occurrence of interactions between the fishery and endangered, threatened or endangered species is low. DEH is satisfied that the fishery is generally conducted in a manner that aims to minimise and avoid death or injuries to protected species. DEH considers there is scope to further enhance existing data collection, assessment and management responses to minimise the risk of unacceptable impact even further and has provided several recommendations for improvements in the medium to 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**

There is a great deal of information on the biology and ecology of the southern rock lobster in SA waters. Ongoing commercial fisheries monitoring and fishery independent studies (such as SARDI's current bycatch and byproduct study) provide information on the occurrence and some biological characteristics of a wide range of vertebrates and invertebrates caught in rock lobster pots. However, there is no specific ongoing collection of environmental data or information on the broader ecosystem impacts of rock lobster fishing off SA.

An FRDC proposal has been developed to study ecosystem impacts of rock lobster (and abalone) fishing on SA's rocky reef communities. This aims to assist the understanding of the ecological impacts of fishing, both for fisheries management and Marine Protected Area (MPA) planning purposes. The study would enable the assessment of management performance in relation to ecosystem impacts under the revised fisheries management plans.

### **Assessment**

While current and proposed information sources may enable a formal risk analysis of the fishery and its environmental impacts, to date no such assessment has been undertaken in respect of any ecosystem component of the fishery. PIRSA's submission points out that by managing the fishery at a high and sustainable level of productivity, the risks of impacts on marine communities and food chains should be minimised. It cites specific studies which indicate that many years of rock lobster fishing have had no measurable impact on octopus stocks and that the setting and hauling of pots has had little physical impact on shallow rocky reefs.

The submission proposes that the water quality impacts of the SARL Fishery are likely to be low because of the small number of vessels and the broad geographic area of the fishery. It suggests that the recent establishment of waste collection facilities in SA ports and other aspects of the "clean green" industry initiative should lead to improved industry practices and, hence, environmental performance.

The limited number of operators and vessels in the fishery, fishing methods and gear that has limited physical interaction with benthos, relatively low levels of bycatch and management arrangements that aim to control the level of catch and rebuild biomass of the target species in both zones suggest that the fishery is unlikely to have a significant impact on the marine environment generally.

### **Management response**

An important consequence of managing the fishery for target and byproduct species on a productive and sustainable basis is that ecological impacts are minimised. Other measures such as limits on pot sizes help to minimise physical impacts on bottom substrates and communities. DEH also acknowledges that responsible attitudes in relation to pollution and litter are being encouraged by industry.

The submission states that ecosystem based research will be given higher priority as part of the current review of the management plans for both zones. The proposed FRDC funded study of fishing impacts on reef communities is intended to help managers through the development of a performance assessment system to address wider ecosystem issues. If it proceeds the study will help PIRSA, industry and other stakeholders to understand the ecological interactions and risks associated with rock lobster fishing. It is not clear how the focus and priority for this study have been developed and whether it will extend beyond consideration of impacts on reef communities. DEH considers there would be benefits in extending this approach to include some comparative monitoring of representative fished and unfished areas to give a better indications of the broader ecosystem impacts of the fishery

Regardless of whether this study proceeds, DEH believes that a risk assessment approach would help PIRSA to identify the activities that have the greatest potential to harm the environment. It would also help to identify the nature and priority of management responses needed in areas including monitoring, research and education.

While SA's fisheries legislation provides for rapid and precautionary responses to threats to marine ecosystem, the environmental objectives are the only ones in the current fisheries management plans that do not have performance indicators or specific monitoring requirements. DEH acknowledges that limited information currently exists to reliably inform these objectives and considers that further attention should be given to approaches suggested above, or similar ecosystem-wide assessment measures, to assist with the eventual development of appropriate performance indicators and ecosystem monitoring strategies. Results of SARDI's current study of bycatch and byproduct may also assist in the short term in identifying the broader ecosystem impacts of the fishery and the most appropriate monitoring measures.

**Recommendation 13:** *PIRSA to develop measures to assess ecosystem impacts of the fishery. Consideration should be given to the appropriateness of reference areas that would allow comparison between fished and unfished areas.*

## **Conclusion**

DEH is satisfied that the fishery is conducted in a manner that minimises the impact of fishing operations on the ecosystem generally in the short to mid-term. Further actions to define and monitor ecosystem impacts have been recommended to ensure impacts on the general environment are minimised in the longer term.

## REFERENCES

- Breen, P., and McKoy, J., 2002. Review of current and past stock assessments for the South Australian Northern Zone Rock Lobster Fishery. NZ National Institute of Water and Atmospheric Research.
- Brock, D., Saunders, T., and Ward, T.M. 2003. Development and assessment of methods to reduce predation of 'pot caught' southern rock lobster (*Jasus edwardsii*) and maori octopus (*Octopus maorum*). FRDC Project 1998/150. South Australian Research and Development Institute, Fisheries Research and Development Corporation and University of Adelaide.
- Environment Australia, 2001. Assessment of the Tasmanian Rock Lobster Fishery against the Guidelines for the ecologically sustainable management of fisheries for the purposes of Part 13 and Part 13A of the *Environment Protection and Biodiversity Conservation Act 1999*.
- Venema, S., Boxall, V., and Ward, T.M. 2003. Survey of recreational rock lobster fishing in South Australia during 2001/02. South Australian Research and Development Institute.
- Ward, T.M., McGarvey, R., and Brock, D.J. 2002. Southern Zone Rock Lobster (*Jasus edwardsii*) Fishery. Fisheries Assessment Series 2002/04a.
- Ward, T.M., McGarvey, R., Xiao, Y., and Brock, D.J. 2002. Northern Zone Rock Lobster (*Jasus edwardsii*) Fishery. Fisheries Assessment Series 2002/04b.
- Zacharin, W. (editor) 1997. Management plan for the Northern Zone Rock Lobster Fishery. SA Fisheries Management Series, Paper No. 28.

## LIST OF ACRONYMS

|          |  |
|----------|--|
| DEH      | Department of the Environment and Heritage                           |
| EPBC Act | <i>Environment Protection and Biodiversity Conservation Act 1999</i> |
| ESD      | Ecologically Sustainable Development                                 |
| FRDC     | Fisheries Research and Development Corporation                       |
| ITQ      | Individual Transferable Quota  |
| MAC      | Management Advisory Committee  |
| MARPOL   | International Convention on Marine Pollution                         |
| NIWA     | National Institute of Water and Atmospheric Research (NZ)            |
| NPW      | National Parks and Wildlife  |
| OCS      | Offshore Constitutional Settlement                                   |
| PIRSA    | Department of Primary Industries and Resources, South Australia      |
| SA       | South Australia  |
| SARDI    | South Australian Research and Development Institute                  |
| SARL     | South Australian Rock Lobster  |
| SESSF    | Southern and Eastern Scalefish and Shark Fishery                     |
| TAC      | Total Allowable Catch  |
| UNCLOS   | United Nations Convention on the Law of the Sea                      |

USA  
WA

United States of America  
Western Australia