



Australian Government

Department of the Environment and Heritage

Assessment of the
South Australian Abalone Fishery

June 2004

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This document is an assessment carried out by the Department of Environment and Heritage of a commercial fishery against the 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.

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

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EXECUTIVE SUMMARY

Background

The Department of Primary Industries and Resources South Australia (PIRSA) has submitted a document for assessment under parts 13 and 13A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The draft document *Ecological Assessment of the South Australian Abalone Fishery* (the submission) was received by the Department of Environment and Heritage (DEH) in June 2003 after a period of discussion between PIRSA and DEH, during which preliminary drafts were refined. The submission was available for public comment from 13 June–14 July 2003. Two formal public comment submissions were received during this period, although several additional informal comments on one of the public comment submissions were also provided to DEH after the closure of the public comment period. While PIRSA provided a response to DEH on the issues raised, no changes were made to the submission as a result of the public comments.

The submission reports on the South Australian (SA) Abalone Fishery against the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries*. The DEH assessment considers the submission, the draft Management Plan for the South Australian Abalone Fishery, the South Australian Research and Development Institute's (SARDI) 2003 Abalone Fishery Assessment Reports, public comments and PIRSA's response to the comments.

In relation to abalone aquaculture production, the submission and this report only address the harvesting of wild abalone stocks to serve as aquaculture broodstock.

Summary of the South Australian Abalone Fishery

Area	Target species harvested from reefs and rock shelves within South Australian and adjacent Commonwealth waters
Fishery status	Fully fished commercial fishery
Target Species	Blacklip abalone (<i>Haliotis rubra</i>) (464.3 tonnes) and greenlip abalone (<i>Haliotis laevigata</i>) (395.5 tonnes)
Byproduct Species	<i>H. roei</i> , <i>H. scalaris</i> , and <i>H. cyclobates</i> may be taken opportunistically but rarely reach the prescribed minimum legal length
Gear	Diver hand collection
Season	Year round
Commercial harvest 2001/2002	859.8 tonnes whole weight
Value of commercial harvest 2000/2001	\$58 million
Recreational harvest 2002	14.45 tonnes whole weight (1.7% of commercial catch)
Commercial licences issued	35 licences in operation since 1976
Management arrangements	Input controls of limited entry, 3 commercial zones Output controls of 859.8 tonnes whole weight TACC, quotas, minimum legal lengths for all abalone species (target and byproduct)
Export	96 per cent of South Australia's abalone are sent to Japan, China and South-East Asia
Bycatch	Limpets/algae/benthic microorganisms
Interaction with Threatened Species	No significant interactions

The SA abalone fishery extends south from the coastline into Commonwealth waters out to the outer edge of the Australian Exclusive Economic Zone. SA has management jurisdiction for abalone from the low water mark out to 200 nautical miles from the coast under an Offshore Constitutional Agreement between the SA and Commonwealth Governments.

The fishery targets two species of abalone, namely the blacklip abalone (*Haliotis rubra*) and the greenlip abalone (*H. laevigata*). Blacklip abalone are contiguous throughout southern Australian waters from Coffs Harbour in NSW to Rottnest Island in WA and inhabit rock crevices and sheltered reefs generally in shallow waters up to 10 metres in depth. Greenlip abalone are also contiguous throughout southern waters but with a more limited range from Corner Inlet (Victoria) to Cape Naturaliste in WA, occurring in rocky habitats in deeper water ranging from 10 to 30 metre depths. Other abalone species (*H. roei*, *H. scalaris* and *H. cyclobates*) may also be taken opportunistically although seldom reach legal collection size.

Blacklip and greenlip abalone are univalve gastropods which can grow to a shell length of over 200 millimetres and live up to 20 years. After 5 to 10 days spent as larvae, abalone reach sexual maturity at about three years of age, and grow to harvestable size in 4 to 10 years. As larval dispersal and adult movements are generally localised, intermixing of recruits tends to be limited, leading to patchily distributed but highly dense aggregations, or metapopulations, with distinct genetic differentiation. Abalone feed on algae, and are preyed upon by crabs, rock lobster, octopi, fish and rays.

The SA abalone fishery provides around 20% of the national wild abalone production and is the third most valuable fishery in the State, with an estimated value of \$58 million in the 2000-01 fishing season. The vast majority of the harvest is exported to Japan, China and South East Asia, either frozen, canned, dried or boiled. The developing SA abalone aquaculture industry generated a further \$2.7 million in 2000-01.

The SA abalone fishery began in 1964 and grew rapidly in size until 1971. Over 100 commercial licences had been issued by then. This number gradually decreased through a policy of non-transferability until 1976 when five new licences were issued, bringing the total to 35. In 1976, the fishery was divided into the three management Zones still in operation today.

Minimum legal lengths for all species of abalone were introduced in 1971 and reviewed in 1984. Fishing effort and catch increased significantly and in 1985, due to concerns that the abalone stocks may have been over-exploited, quotas were introduced to the Western Zone. Quotas were subsequently introduced to the Southern (1988) and the Central (1989) Zones.

Abalone divers operate from small boats using hookah gear (a long hose delivering air to the diver from a deck-mounted compressor), harvesting abalone with a metal blade known as an "abalone iron". Divers sometimes use protective, self-propelled cages to protect themselves from shark attacks while fishing. The fishing season extends year round.

The main management responses in place for commercial harvesting include input and output controls of limited entry to the fishery (35 licences), species and Zone-specific Total Allowable Commercial Catch (TACC) limits, species and Zone-specific Individual Transferable Quotas (ITQs), and species and Zone-specific legal minimum size limits. The recreational catch is controlled through bag limits, and legal minimum size limits for all abalone species.

Due to the hand collection of abalone, bycatch is limited to the commensal species that live on abalone shells, such as limpets, algae and other organisms. Interactions with protected species are reported infrequently and appear to be insignificant in terms of effects. These interactions are assessed under Principle Two of this report.

Data on the recreational harvest is limited. In 2002 it was estimated at 14.45 tonnes whole weight (1.7% of the commercial harvest). A small amount of abalone is also collected for aquaculture broodstock, through the use of Ministerial Exemption Notices. In 2002, the seven operators holding Ministerial Exemption Notices were allowed to harvest a combined total of 1400 greenlip and 500 blacklip abalone for broodstock purposes. This represents around 0.1% of the average annual commercial catch of blacklip and greenlip abalone. The extent of the level of illegal take in the SA abalone fishery is uncertain, but has been estimated as up to 10% of the TACC in some sectors of the fishery. Due to the specific harvesting techniques required abalone is not taken as byproduct or bycatch in other fisheries operating in the region.

The SA Abalone Fishery is managed through the *Fisheries Act 1982* and its regulations are established in the *Scheme of Management (Abalone Fisheries) Regulations 1991* and the *Fisheries (General) Regulations 2000*. The fishery's management framework is contained in the 1997 Management Plan for the South Australian Abalone Fishery. The Management Plan does not form part of the *Scheme of Management (Abalone Fisheries) Regulations 1991* and does not have any statutory basis. Responsibility for the preparation of management plans rests with the Abalone Fishery Management Committee (AFMC). The AFMC has developed a new Management Plan to replace the 1997 Plan. A draft of the new Plan was released for public comment towards the end of 2003, and is expected to be finalised in mid 2004.

A comprehensive review of the *Fisheries Act 1982* is currently being undertaken by PIRSA in consultation with key stakeholder groups. The submission states that the review, which is expected to be completed in 2004, is likely to result in changes to the principal objectives of the *Fisheries Act*, and in turn, the broad sustainability framework for the management of SA's abalone stocks.

Overall assessment

The material submitted by PIRSA indicates that the fishery operates in accordance with the Australian Government *Guidelines for the ecologically sustainable management of fisheries*. The DEH considers that the SA Abalone 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. In particular, recommendations have been developed to address shortcomings with certain aspects of management for some areas of the fishery such as understanding of local stock status, potentially overfished local areas and absence of specific recovery strategies. DEH considers that these areas must be given priority by PIRSA to ensure that the fishery does not increase the risk in the longer term of having an unacceptable or unsustainable impact on the environment.

Overall, the sophisticated management regime, including detailed analysis of catch data, well structured stock assessment process, comprehensive performance measures, review processes and proposed enhancements to independent monitoring programs suggests that the fishery is being managed in an ecologically sustainable way.

In making this assessment, and subject to the implementation of the recommendations made to improve management of the fishery, DEH is satisfied that the information collection system, management arrangements and objectives and performance measures are sufficient to ensure that the fishery is conducted in a manner that does not lead to overfishing and that stocks are not currently overfished. Considering the research programs and management arrangements in place and the particular selective and benign characteristics of the fishery operations, DEH is satisfied that fishing operations are managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem.

The assessment finds that the SA Abalone Fishery is managed in an ecologically sustainable way and its operation is consistent with the objects of Part 13A of the EPBC Act. DEH recommends that the export of species taken in the fishery should be exempt from the export permit requirements of Part 13A of the EPBC Act, with that exemption to be reviewed in five years. DEH considers that the fishery, as managed in accordance with the management plan, is not likely to cause serious or irreversible ecological damage over this period. PIRSA's agreement to DEH's recommendations for actions to enhance the longer term ecologically sustainable management of the fishery has been an important consideration in reaching this conclusion. DEH will be closely monitoring the implementation of the recommendations.

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 and ecological communities, listed migratory species, cetaceans and listed marine species.

A number of protected species occur in the fishery area, including seals and sea lions, sharks and marine turtles, however, apart from Great White Sharks, the fishery has no recorded interactions with these species groups. The actual and potential impact on Part 13 species under the management arrangements is considered very low and adequate protection is provided. There are no listed threatened ecological communities in the fishery area.

DEH recommends that the management regime for the South Australian Abalone Fishery, in force under the South Australian *Fisheries Act 1982* and the *Scheme of Management (Abalone Fisheries) Regulations 1991*, be declared an accredited management regime under Sections 208A, 222A, 245 and 265 of the EPBC Act. In making this judgement, DEH considers that the South Australian Abalone Fishery does not, or is not likely to, adversely affect the survival in nature of listed threatened species or population of that species, or the conservation status of a listed migratory species, cetacean species or listed marine species or a population of any of those species. DEH also considers that the South Australian Abalone Fishery management regime requires that all reasonable steps are taken to avoid the killing or injuring of protected species, and the level of interaction under current fishing operations is very low. On this basis, DEH considers that an action taken by an individual fisher, acting in accordance with the South Australian Abalone Fishery management regime, would not be expected to have a significant impact on a listed threatened species or listed migratory species protected by the EPBC Act.

To further strengthen the effectiveness of the management arrangements for the SA Abalone Fishery, and to contain the environmental risks in the medium to long term, DEH has developed a series of recommendations. The implementation of these recommendations and other commitments made by PIRSA in the submission will be progressively monitored by DEH over the next 5 years, and re-assessed at the next DEH review of the fishery in five years time.

Recommendations

Recommendation 1: *PIRSA Fisheries to consult with other fishery agencies on the development and implementation of appropriate biological parameters and reference points for abalone harvesting, and pursue with these agencies a national process for developing, adopting and reviewing these indicators, and for periodically reviewing abalone stock assessment processes.*

Recommendation 2: *PIRSA to inform DEH of any future amendments to the Management Plan for the South Australian Abalone Fishery or managerial commitments made in the submission.*

Recommendation 3: *PIRSA to ensure that the new stock assessment model be developed by the end of 2005 and be used as part of the stock assessment process from 2006.*

Recommendation 4: *PIRSA, within 12 months, to more accurately quantify the extent of recreational, indigenous and illegal catch, and to take account of all removals, including aquaculture broodstock, in the stock assessment process and the determination of the annual TACC.*

Recommendation 5: *PIRSA, within 2 years, to develop and implement enhanced fishery independent research and monitoring programs for greenlip and blacklip abalone in the Central and Western Zones, representative of species distribution and catch across these zones of the fishery, to improve the understanding of the stock status in these zones and support the development of more refined stock assessments and models.*

Recommendation 6: *PIRSA within 2 years to further develop biological sampling programs, representative of species distribution and catch across all zones of the fishery, to provide the necessary data to inform the range of biological performance measures in the Management Plan for the South Australian Abalone Fishery and support the development of more refined assessment models.*

Recommendation 7: *PIRSA to investigate and establish, over the next 3 years, appropriate decision rules or strategies, relevant to the regional or area scale management as required, to prevent serial depletion of blacklip and greenlip abalone stocks in all zones of the fishery.*

Recommendation 8: *PIRSA to continue to work with other jurisdictions to develop effective strategies and response measures to quantify and reduce the extent of illegal take of abalone in SA.*

Recommendation 9: *PIRSA to develop within 18 months recovery strategies that can be applied to areas assessed as below key reference points or levels for stock abundance and recruitment. The recovery strategies should include preliminary recovery targets and monitoring arrangements, appropriate to the scale of fishing in the area, and associated timeframes.*

Recommendation 10: *PIRSA, within 12 months, to develop options for the recording and reporting of protected species interactions in the fishery.*

Recommendation 11: *PIRSA to give priority to developing environmental indicators that can be reported against in future Stock Assessment Reports.*

PART I - MANAGEMENT ARRANGEMENTS

The SA Abalone Fishery is managed by PIRSA. Its management procedures fit within the structure of the Management Plan for the South Australian Abalone Fishery administered under the *Fisheries Act 1982*.

The management regime for the SA abalone fishery is well documented, publicly available and transparent. The SA Abalone Fishery is managed through the *Fisheries Act 1982* and its regulations are established in the *Scheme of Management (Abalone Fisheries) Regulations 1991* and the *Fisheries (General) Regulations 2000*, and the *Fisheries (Management Committees) Regulations 1995*. The documents are available from PIRSA and online at PIRSA's website (www.pir.sa.gov.au/fishing).

Five year management plans are developed for the SA Abalone Fishery to provide a statement of the policy, objectives and strategies to be employed in the management of the fishery. A new management plan for the fishery is currently under development to replace the existing 1997 Management Plan and is expected to be finalised in mid 2004. The new draft Management Plan contains a range of new management measures such as a comprehensive suite of objectives, strategies and performance measures for the fishery that are being incorporated into the stock assessment process and will be key components in the longer term sustainable management of the fishery. The provisions of the new draft Management Plan were therefore considered along with existing measures in the assessment of the fishery. The finalised Management Plan, after approval by the relevant SA Minister, will be sent out to relevant stakeholder groups and made available online at PIRSA's website.

Although SA legislation does not prescribe a consultation process for the development or review of fishery management plans, the Management Plan for the South Australian Abalone Fishery is being developed through a consultative process, including a period of public consultation, providing opportunity for input to all interested and affected parties. The Management Plan is not a statutory document and does not form part of the *Scheme of Management (Abalone Fisheries) Regulations 1991*. Responsibility for the preparation of management plans rests with the Abalone Fishery Management Committee (AFMC).

The role and membership of the AFMC emphasises the co-management arrangements in operation for the fishery. The AFMC is made up of Ministerially-appointed representatives from the commercial industry (4), the South Australian Fishing Industry Council (SAFIC) (1), South Australian Recreational Fishing Advisory Council (SARFAC) (1), research scientist (1), fishery manager (1) and an independent chair (1). The composition of the AFMC ensures that a range of expertise and community interests are involved in the management process. The role of the AFMC includes preparation of the Management Plan for the South Australian Abalone Fishery, recommending the annual TACCs based on advice provided through the annual stock assessments for the fishery, advising on responses to breaches in reference points in the Management Plan and developing a 5 year strategic research plan for the fishery.

Annual stock assessment reports for the SA Abalone Fishery have been produced by SARDI since 1997. 2002 was the first year that separate stock assessment reports were developed for each Zone of the fishery. The Stock Assessment reports draw on all available information sources.

The new draft Management Plan for the South Australian Abalone Fishery provides a suite of performance indicators and reference points associated with biological, environmental, economic and social objectives for the fishery. The overall objectives of the new Plan address the productive capacity of abalone stocks, the wider ecosystem impacts of abalone fishing, and the assessment of illegal abalone fishing. The annual stock assessment report assesses performance of the fishery against the respective performance indicators and reference points stipulated in the Management Plan.

There are separate performance indicators for both blacklip and greenlip abalone in each Zone of the fishery. These address the objectives of controlling, measuring and regulating all catches and extractions from the resource, maintaining sufficient egg and sperm production to provide for adequate levels of recruitment, and monitoring and controlling disease. Specific performance indicators include determining the spatial distribution of the catch, CPUE, mean size of fished abalone, abundance of legal-sized abalone, and the percentage of egg production from fished areas relative to that area in a pristine state. Each performance indicator is linked to a statistical trigger point and a broad management response.

Further details on the application of these measures are included in Part II of this report.

The Management Plan details the responses of PIRSA to trigger points being exceeded. These include an examination of the causes and effects of a trigger point being breached, and consultation with the abalone industry and the AFMC on the need for alternative management strategies, such as spatial closures.

DEH notes that abalone fishery management agencies across the various State jurisdictions have been involved in some cooperative research projects and management consultation to address the need for more appropriate biological parameters and reference points for abalone harvesting. Given the biological characteristics of abalone aggregating to form self-recruiting metapopulations within scales of less than one square kilometre, practical requirements for jurisdictions to jointly manage abalone from the same recruiting stock are limited. However, DEH considers that further cooperative research and management consultation is needed to enhance stock assessment outcomes and develop more standardised reference points with a sound biological basis.

Recommendation 1: *PIRSA Fisheries to consult with other fishery agencies on the development and implementation of appropriate biological parameters and reference points for abalone harvesting, and pursue with these agencies a national process for developing, adopting and reviewing these indicators, and for periodically reviewing abalone stock assessment processes.*

The fishery has a balanced mixture of input and output controls for the commercial and recreational harvest, including:

- limited entry to 35 licences;
- TACCs and ITQs at a zonal level;
- Zone- and species-specific minimum legal size limits;
- daily individual bag and boat limits for retained abalone.

Abalone is also collected for aquaculture broodstock under closely regulated arrangements as detailed in Part II of this report.

Compliance and enforcement tools utilised in the fishery are based on the ITQ regime. This involves a detailed document trail including daily catch records validated through a catch disposal record system, along with periodic stock takes and audits of abalone processing businesses, requirement to report before fishing, point of landing, transit and unloading at processors spot checks, unloading reports, fish catch reports, dispatch reports, gathering of field intelligence on illegal activities and joint compliance and information gathering exercises with both SA and interstate enforcement agencies. Compliance measures for the recreational catch are based around education and community awareness programs. Random compliance checks are also carried out by PIRSA Fishwatch Officers.

DEH is satisfied that these compliance measures contain the means of enforcing critical aspects of the management arrangements for the fishery. Further assessment of the effectiveness of compliance measures is contained in Part II of this report.

The management regime for the fishery is subject to several review processes, including:

- Annual review of the Management Plan by the AFMC, the Director of Fisheries and the Minister for Agriculture, Food and Fisheries.
- A review every three years of PIRSA's fishery assessment tools.
- Annual internal review of SARDI's stock assessment methods and reports.

DEH is satisfied that a five year review of the entire fishery policy framework through revision of the Management Plan is suitable while critical aspects are reviewed annually through the stock assessment process.

A comprehensive review of the *Fisheries Act 1982* is currently being undertaken by PIRSA in consultation with key stakeholder groups. The review, which is expected to be completed in 2004, is likely to result in changes to the principal objectives of the Fisheries Act. At present the *Fisheries Act 1982* makes no statement regarding Aboriginal harvest of abalone. A formal consultative process has been established by the Government to progress the aspirations of Aboriginal people.

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

Recommendation 2: *PIRSA to inform DEH of any future amendments to the Management Plan for the South Australian Abalone Fishery or managerial commitments made in the submission.*

The new draft Management Plan for the South Australian Abalone Fishery contains performance indicators on ecosystem health. The AFMC's 5-year strategic research plan includes among its priorities the assessment of the ecological impact of abalone fishing and the impact of marine protected areas on abalone productivity and ecosystem protection. An analysis of the fishery's capacity for assessing, monitoring and avoiding, remedying or mitigating any adverse impacts on the wider marine ecosystem in which the target species lives and the fishery operates is contained under Principle Two of this report.

Fishery-dependent data relating to the target species is collected on a regular basis in the fishery. Some fishery independent information is also collected. Discussion of the information collection system can be found in Part II of this report. An analysis of the fishery's capacity for assessing,

monitoring and avoiding, remedying or mitigating any adverse impacts on the wider marine ecosystem in which the target species lives and the fishery operates is contained under Principle II of this report.

The relatively benign method of fishing used in the fishery results in very little or no contact with other species. PIRSA notes that threatened species are not affected by the fishery and as a result, no threat abatement plans, recovery plans or bycatch action plans are required. 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. DEH expects that PIRSA will also ensure compliance with any future plans or policies.

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

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

Conclusion

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

The management arrangements are capable of controlling the harvest through a combination of input and output controls, appropriate to the size of the fishery. Periodic review of the fishery is provided for, as are the means of enforcing critical aspects of the management arrangements.

The management regime takes into account arrangements in other jurisdictions, and adheres to arrangements established under Australian laws and international agreements.

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

PART II – GUIDELINES FOR THE ECOLOGICALLY SUSTAINABLE MANAGEMENT OF FISHERIES

Stock Status and Recovery

Principle 1: *‘A fishery must be conducted in a manner that does not lead to over-fishing, or for those stocks that are over-fished, the fishery must be conducted such that there is a high degree of probability the stock(s) will recover’*

Maintain ecologically viable stocks

Objective 1: *‘The fishery shall be conducted at catch levels that maintain ecologically viable stock levels at an agreed point or range, with acceptable levels of probability’*

Information requirements

The current management framework provides a sound basis for the collection of catch and effort data for both blacklip and greenlip abalone. Fishery dependent data has been collected since 1968. Daily commercial landings are reported at the relatively fine scale of Fishing Areas, of which there are 40 across the State. These areas are further defined into sub-areas or map codes. Fishing areas and map codes vary considerably in size, from reef level to much larger expanses. Reporting requirements include a daily Catch Disposal Record (CDR) form that must be completed immediately upon landing and forwarded to PIRSA Fishwatch to ensure compliance with quota allocations.

A fishery logbook must also be completed for each day’s fishing and lodged with SARDI at the end of each month. Information recorded in the logbooks by divers is used in the annual stock assessment reports to assess the levels of catch, effort and catch per unit effort (CPUE) in all three zones of the fishery. Fishery dependent data is also used to determine catch rates and mean size of abalone stocks. Logbooks were recently revised to include the number of abalone harvested and refine the spatial data by inclusion of GPS position data. This data is to be provided on a voluntary basis. The further use of GPS systems to enhance finer scale spatial reporting is being investigated as part of the AFMC’s 5 year strategic research plan.

Data logbooks have recently been modified to include the ability to record data from designated “fishdown” areas. Located in the Southern Zone, fishdown areas are populated by blacklip abalone that do not reach the full legal minimum length, and are therefore subject to smaller minimum legal lengths and separate TACCs and ITQs. DEH notes that the modification of logbooks to include fishdown areas in the Southern Zone has enhanced finer scale spatial reporting abilities.

SARDI conducts commercial catch shell sampling across the various fishing zones to collect more detailed information for stock assessment, in particular the size frequency distribution of the catch. The extent and time duration of this sampling data varies for both greenlip and blacklip abalone catches across the fishing zones and various fishing areas. PIRSA acknowledge in their submission that further strategies need to be employed, particularly in the Central and Western Zones, to ensure that the catch is appropriately sampled both spatially and temporally.

Fishery independent research and surveys for the fishery have primarily been undertaken by SARDI along with some intermittent research by universities. To date fishery independent surveys have focussed on the changes in greenlip abalone abundance and population structure in the main fishing areas of the Central and Western Zone, along with fisheries biology of both greenlip and blacklip abalone in various areas across the fishery. Tagging studies to estimate growth, movement and natural mortality are ongoing at six sites in both the Southern and Western Zones. Fishery independent surveys on greenlip abalone in the Central Zone have been in operation on a regular basis since 1968, and in areas of the Western Zone since the early 1980s, and provide abundance and size information that forms an integral part of the stock assessment process. The new draft Management Plan for the South Australian Abalone Fishery notes that over 50% of the greenlip abalone TACC is harvested from areas that are subject to the independent monitoring program.

The PIRSA submission acknowledges that a greater focus is needed on fishery independent monitoring of blacklip abalone stocks to confirm blacklip stock trends across the fishery. While an independent monitoring program for blacklip abalone has commenced in the last year at 6 sites in the Southern Zone, fishery independent monitoring programs are yet to be established in the Central and Western Zones that account for around 75% of the total blacklip TACC for the fishery. The draft Management Plan lists as a research priority the collection of adequate information for the general assessment of blacklip abalone.

Further analysis of independent monitoring requirements is provided in the Assessment Section below.

DEH notes that to date the collection of recreational data has relied on measures such as non-targeted telephone surveys and the National Recreational and Indigenous Fishery Survey (NRIFS). Annual recreational catch has been variously estimated as around 17,800 abalone or 8.9 tonnes by the latest NRIFS (around 1% of total commercial catch) and as 14.45 tonnes whole weight (1.7% of total commercial catch) through other periodic surveys. Past surveys have indicated that while most recreational catch by weight is in the Western Zone, around 50% of recreational effort occurs in the Central Zone. PIRSA noted in their submission an intention to implement recreational surveys every 3 years, and that estimation of recreational catch and effort would be enhanced by the introduction of recreational abalone fishery licences. DEH encourages PIRSA to further investigate the introduction of a licensing system as a means of improving the estimation of recreational catch in the fishery.

Currently there are no separate management arrangements for indigenous fishing. As indigenous people are required to abide by recreational catch arrangements, details of indigenous catch are incorporated in recreational catch estimates. Indigenous fishing aspirations and activities are being addressed in the review of the SA *Fisheries Act 1982* due to be completed in 2004.

PIRSA acknowledges, in the draft Management Plan, the difficulties in accurately estimating the extent of illegal abalone harvesting, and that past estimates, such as those from the FRDC project 'Assessment of Illegal Catches of Australian Abalone', may not be a reliable representation of the extent of illegal harvesting in South Australia. PIRSA Fishwatch uses a range of methods to estimate illegal abalone harvesting, including amount of abalone seized, information reported to field officers, anecdotal information gathered by fisheries compliance officers and other state and interstate government agencies. Quantifying the effects of abalone poaching on the level of catch and sustainability is one of the compliance priorities within the draft 5 year SA Abalone Fishery Strategic Research Plan. Further discussion on illegal abalone catches is contained in subsequent sections of this report.

Assessment

A sound stock assessment process is in place for both blacklip and greenlip abalone, based on fishery dependent and available independent data.

SARDI conducts an independent annual stock assessment for each zone of the fishery and has produced annual stock assessment reports since 1998. The reports have been Zone and species-specific since 2002. The stock assessment reports include a comprehensive analysis of the available data, a brief history of the fishery, recommendations for future research, and the current stock assessment process and results.

The stock assessment process draws on basic catch information for the fishery (catch, effort, size composition) and available biological and independent survey data to provide an analysis of stock recruitment and abundance. SARDI uses a generalised linear model that draws primarily on standardised CPUE data to estimate relative abundance trends for stocks. A preliminary egg production model drawing on available biological data is used to estimate egg production levels. The draft Management Plan has established a suite of new management objectives, biological performance indicators and reference ranges for each zone of the fishery. The performance indicators associated with the biological objectives include estimates of relative abundance, egg production, recruitment, catch rates and mean sizes. The stock assessment process now requires reporting against each of these indicators and is expected to provide significant enhancements in measuring the status of abalone stocks in each zone. The most recent stock assessment reports provided an analysis of performance against these indicators down to an area scale to provide a more localised indication of stock abundance and harvesting trends.

SARDI's annual stock assessments are subject to an independent peer review. PIRSA noted in its submission that it intends to implement a review process every three years that will assess current fishery tools and include an independent peer review.

Since the introduction of quota management PIRSA has sought to maintain a constant harvest strategy across the fishery. Determining the effectiveness of this strategy and its impacts on abalone stocks has primarily relied on commercial catch and effort data. SARDI has acknowledged in its stock assessment reports that the accuracy of catch and effort data in all zones is unknown, and may be adversely influenced by changes in diver behaviour or local fluctuations in abalone populations. SARDI also noted the need for further independent survey data and biological sampling to adequately inform the assessment against several of the performance indicators across the fishery.

PIRSA intends to pursue the development of a new integrated stock assessment model that will incorporate both fishery dependent and independent data to provide better information on the current status of stocks and have the capacity to predict changes in stock biomass under different harvest strategies. PIRSA also notes in its submission that fishing effort data is being reviewed to standardise variables in activities, such as diver behaviour and experience, dive depth and use of new technologies. The development of a fishery model and improved assessment techniques has been given high priority in the draft 5 year research plan for the fishery. The development of this new stock assessment model has been funded for the 2003-04 financial year, and PIRSA expects that the new model will be used in the 2005 stock assessment process. DEH encourages the early implementation of the new model.

Recommendation 3: *PIRSA to ensure that the new stock assessment model be developed by the end of 2005 and be used as part of the stock assessment process for 2006.*

The distribution and spatial structure of abalone stocks has been factored into the stock assessment process. The management of the fishery has progressively moved to an increasing level of finer spatial resolution. As previously noted, fishery dependent data is collected from 40 fishing areas across the fishery and from a further 360 map codes within these areas. Investigations into the use of GPS units to obtain even higher resolution in the fishery are underway.

PIRSA notes in its submission that considerable research has been conducted over the last 30 years in the fishery with the aim of establishing a comprehensive understanding of the fishery biology of the major species in all three zones. Studies have been undertaken on population genetics, larval dispersal and growth rates at a range of sites. SARDI is conducting tagging studies in the Southern and Western Zones to estimate growth rates, natural mortality and movement of abalone, to assess spatial variability at localised scales. The draft 5 year strategic research plan for the fishery includes in its priorities the further refinement of fine scale assessment parameters for the fishery including metapopulation boundaries, stock recruitment relationships, growth, mortality and age, along with the further investigation of the genetic structure of populations and genetic and environmental influences on growth differences.

A long term CPUE dataset for the fishery is available to assist with measuring localised changes in recruitment and abundance in the stock assessment process. As noted previously in this report, fishery independent surveys to supplement and validate this data have been conducted in defined locations in all 3 zones of the fishery, primarily focussing on greenlip abalone populations in key fishing areas. PIRSA in its submission and SARDI in the stock assessment reports both acknowledge the need to expand the spatial extent of the existing fishery independent monitoring program for both greenlip and blacklip abalone to, among other things, provide more accurate and localised estimates of the population abundance and distribution of abalone stocks, particularly in the more lightly fished areas of the Western Zone.

A comprehensive process is in place to take account of all legal commercial removals from the fishery. Estimates of the commercial catch in the SA Abalone Fishery factored into the stock assessment process are therefore highly reliable. A mandatory fishery logbook detailing catch and effort must also be completed on a daily basis, with monthly returns provided to SARDI for the stock assessment process. Recent amendments to the reporting system now require both number and weight of abalone landed to be voluntarily recorded in logbooks. Reporting requirements also include completing a daily Catch and Disposal Record (CDR) form administered by the PIRSA Fishwatch Quota Management Group to validate individual catch quota. Monitoring of the quota system consists of pre- and post-harvest checks, including prior reporting of any planned fishing activity, point of landing checks, at sea inspections and processor inspections. Penalties apply for breaching regulations.

The issue of wet and dry weight of abalone was identified in the Victorian Abalone Fishery as a contributing factor to the level of uncertainty in the stock assessment process. Abalone are susceptible to weight loss due to seepage of body fluids from the time of landing until their catch weight is verified at the processors, which may introduce imprecision into the catch recording system. Victoria has subsequently introduced a beach weighing catch registration system to address this issue.

In South Australia, harvested abalone must be weighed at the processor's premises within 48 hours from the time of landing. Remote fishing locations sometimes prevent immediate delivery of the abalone to the processing plant. While this allows potentially significant weight loss, PIRSA has noted that landed abalone are usually kept in refrigeration or on ice to restrict fluid seepage, and that the time between landing and weighing is usually kept to a minimum in the name of improved product quality. PIRSA also notes that as there have been minimal changes in harvesting arrangements over the years any variation in abalone wet and dry weights would more or less be factored in at a constant rate in the stock assessment process and the allocation of the TACC. The recent introduction of reporting number of abalone as well as weight provides a further means of reconciling the catch against the TACC and quota allocations. Nonetheless, DEH encourages PIRSA to closely monitor the effects of the beach weighing systems and give further consideration to the most appropriate mechanism to ensure the accuracy of the quota decrementing process.

The harvest of abalone for use as aquaculture broodstock is currently managed through the provision of exemptions granted under section 59 of the Act. The seven current exemption holders are limited to a combined yearly take of 1400 greenlip and 500 blacklip abalone. While this is a fairly insignificant amount of abalone removed compared to the overall commercial harvest, the PIRSA submission states that policies are currently under development that will see broodstock collection taken into account in the annual TACC setting process.

Estimates of recreational and indigenous catch of abalone in South Australia have been based on periodic non-targeted surveys. The draft Management Plan includes performance indicators for recreational catch that require annual reporting against the extent of recreational catch at zone level. Limited quantitative data is obtained to reliably inform these indicators, and the Management Plan also notes that there are no datasets to estimate the value of the recreational fishery for abalone in South Australia.

As noted in the previous section of this report, recreational and indigenous catch data have been collected through the NRIFS and other non-targeted means. The most recent estimate of an annual recreational catch of 14.45 tonnes or 1.7% of the total commercial abalone catch was derived from a non-targeted survey in 2002 aimed at estimating the recreational catch of rock lobster. PIRSA notes in their submission that certain assumptions have been made in these estimates, including the ratio of greenlip and blacklip recreational catch being the same as for commercial catch. DEH strongly encourages PIRSA to undertake the submission's stated aim of conducting specifically targeted surveys every three years to gain a better understanding of the recreational catch and effort.

The level of illegal abalone harvesting is difficult to quantify. Evidence from the amount of abalone seized and used in prosecutions, information received from field officers, and anecdotal information gathered by Fisheries Compliance Officers suggests that the problem may be significant enough to impact on the sustainability of abalone stocks in some localised areas. The 2003 stock assessment reports estimates the level of illegal harvest as around 8%, 2.6% and 10% of the TACC's for Central, Western and Southern Zones respectively. SARDI notes in the stock assessment reports that the lack of data on illegal catch prevents reliable assessment of total catch and impedes assessment of the fishery. PIRSA has also conducted structured information gathering exercises, such as Operation INDEX, targeting operations both within and outside the legal abalone harvesting industry, to address the harvest of illegal abalone within South Australia.

Further information on the illegal take of abalone can be found in the “Management response” section of this report.

DEH notes that recreational and indigenous catch, illegal harvesting and aquaculture broodstock collection of abalone are not currently factored into the stock assessment process or specifically included in the determination of the TACCs. PIRSA notes in its submission that it intends to consider removals by way of illegal harvest and broodstock collection in the determination of the TACCs as more accurate information on the levels of illegal take becomes available or policies are developed. Given the uncertainty surrounding the extent of recreational and illegal abalone harvest and the potentially significant impact these additional removals may be having on stocks already under pressure in key commercial harvest areas, DEH considers that priority be given to developing more reliable estimates of recreational, indigenous and illegal take of abalone across the fishery. Priority should also be given to addressing the take of recreational, indigenous, illegal and broodstock collection abalone in the annual stock assessment process and factoring these removals into the TACC setting process.

Recommendation 4: *PIRSA, within 12 months, to more accurately quantify the extent of recreational, indigenous and illegal catch, and to take account of all removals, including aquaculture broodstock, in the stock assessment process and the determination of the annual TACC.*

PIRSA acknowledge in their submission that in the absence of a length based quantitative stock assessment model it is difficult to accurately estimate the productivity of abalone stock in the fishery. Current estimates of the productivity of abalone stocks therefore rely primarily on fishery dependent CPUE data. PIRSA has noted the need to develop a quantitative assessment model that provides, among other things, reliable estimates of fishable biomass.

The most recent stock assessment reports indicate that, from the available relative abundance and stock structure data, the major catches from the respective zones of the fishery are relatively stable at the current exploitation rates. The stock assessment reports also indicated that an acceptable size range of abalone were being caught to avoid “knife-edge” fishing (excess exploitation of stock as they reach minimum legal length for harvesting). Nonetheless the stock assessment reports highlighted a number of key signals that present potentially significant problems for the stock productivity and sustainable harvest levels in the medium to longer term. These include:

- Unknown status of blacklip abalone stocks in the Central and Western Zones, primarily due to the absence of fishery independent surveys to confirm trends in relative abundance and size structure of stocks;
- Limited information on the status of greenlip stocks for most areas of the Central Zones outside the prime fishing area of Tiparra Reef, and in the lightly fished areas of the Western Zone;
- The apparent dependence on a few fishing areas in the Central and Western Zone to provide the great majority of the greenlip abalone catch;
- Long term declines in the sub legal sized greenlip abalone in the Central Zone, raising significant doubts on recruitment;
- Potentially localised depletions of greenlip abalone in the Western Zone;
- An apparent decline in blacklip abalone stocks in the Central Zone;
- Few biological data available for blacklip abalone in the Central and Western Zones;
- Limited data on size composition of the commercial catch in all zones of the fishery to confirm stock structure;

- The highly uncertain status of both greenlip and blacklip stocks in Region B of the Western Zone (the only region of the fishery with a combined TACC for both species), with no data available on the size composition of the commercial catch, the fisheries biology or from fishery independent surveys on either species in the Region.

All these factors emphasise the need for more comprehensive monitoring and analysis of stocks in the Central and Western Zones. The latest stock assessment reports highlighted the need for regular fishery independent survey data in these zones to determine changes in abundance and population structure and to allow assessment of the performance of the fishery against several of the performance indicators that is currently not possible. PIRSA has also advised the AFMC during the 2004 TACC setting process of the urgent need to address the lack of information to assess the status of both greenlip and blacklip stocks in the Western Zone and the abundance and biology of blacklip stocks in the Central Zone.

Public comments received by the DEH noted the primary reliance on interpretation of catch rate data for estimates of relative abundance of stock and expressed concern that the use of fishery-dependent data and CPUE may be giving a false impression of stock stability and masking the effects of serial depletion.

PIRSA has recently taken steps to address uncertainty in abalone stocks for certain areas of the fishery. New independent survey sites for “fish-down” areas in Southern Zone were commenced in 2003 to validate changes in abundance and size distribution of undersize blacklip abalone stocks. A SARDI survey of the distribution and abundance of greenlip abalone off Cowell will commence in 2004 in the Central Zone, while an FRDC project is being undertaken by SARDI to enhance survey methods of greenlip abalone to improve estimates of absolute density of greenlip stocks.

The AFMC Research Sub-committee recently recommended to the AFMC that additional independent surveys should be undertaken in the Western and Central Zones to address the uncertainty in stock status and abundance of both blacklip and greenlip abalone in these areas of the fishery. The research sub-committee highlighted the need for additional research to determine the status of greenlip abalone stocks in unfished areas of the Western Zone, and fishery independent surveys in the major fishing areas for blacklip abalone in both Western and Central Zones.

DEH is encouraged by this approach to further define stock status and recognises the difficulty faced by PIRSA in further developing a cost effective and indicative fishery independent monitoring program across all zones of the fishery, due to the fishery’s large area and the localised nature of abalone aggregations and harvesting. Nonetheless, PIRSA and SARDI have both acknowledged the need to address the uncertainty in stock status in the Central and Western Zones and improve the effectiveness of the stock assessment process through the development of an integrated stock assessment model. Further fishery independent data for both blacklip and greenlip abalone in both these zones would appear to be an immediate priority to gain a more accurate estimate of changes in stock abundance and unfished biomass, an indication of changes in size structure of stocks and to inform the developing integrated stock assessment model.

DEH considers PIRSA, in conjunction with the AFMC, should give immediate attention to pursuing and implementing an expanded fishery independent research and monitoring program across the Central and Western Zones for both blacklip and greenlip abalone, appropriate to the

scale and the distribution of abalone stocks and fishing effort. The program of additional surveys noted above that was recently recommended by the AFMC Research Sub-committee appears to provide a sound basis for the immediate fishery independent data collection needs of the fishery. Such a program would ensure that the new stock assessment model currently being developed will be based on accurate and representative data, with which more reliable estimates of the productivity of abalone stocks will be generated.

DEH considers that improved understanding of the status of stocks in the Central and Western Zones is crucial to maintaining ecologically viable stock levels in the longer term, and that a comprehensive independent monitoring program is required to provide greater certainty in the application of catch levels and other management measures used to ensure the ecological sustainability of fishing operations.

Recommendation 5: *PIRSA, within 2 years, to develop and implement enhanced fishery independent research and monitoring programs for greenlip and blacklip abalone in the Central and Western Zones, representative of species distribution and catch across these zones of the fishery, to improve the understanding of the stock status in these zones and support the development of more refined stock assessments and models.*

In addition to further independent monitoring surveys, the stock assessment reports have emphasised the need for additional biological data, particularly growth, mortality and fecundity, to determine life history trends, and further commercial catch sampling data representative of the scale of the fishery in all zones to support the assessment of size distribution and fishing mortality of stocks of both greenlip and blacklip abalone. These data are needed to provide greater accuracy to current model estimates of egg production to provide the basis for improved reporting against the range of biological performance indicators in place across the fishery and to support the effectiveness of the proposed integrated stock assessment model.

The recent recommendations from the AFMC Research Sub-committee mentioned above also included additional biological data collection on blacklip abalone in the Central and Western Zones, along with shell sampling in the remote Region B of the Western Zone to determine size structure of the locally harvested populations. DEH notes that while some of this data may be made available by the recommended enhancements to the fishery independent survey programs, PIRSA needs to take into consideration the ongoing biological data requirements needed to meet the performance assessment measures established under the draft Management Plan across all areas of the fishery and enhance the research or commercial catch sampling programs accordingly.

Recommendation 6: *PIRSA within 2 years to further develop biological sampling programs, representative of species distribution and catch across all zones of the fishery, to provide the necessary data to inform the range of biological performance measures in the Management Plan for the South Australian Abalone Fishery and support the development of more refined assessment models.*

Management response

The draft Management Plan for the South Australian Abalone Fishery sets out biological, economic, environmental and social management objectives, strategies and performance indicators for the fishery. As noted earlier in this report, the draft Management Plan includes a comprehensive suite of biological objectives, performance indicators and reference points that apply for both blacklip and greenlip abalone within each zone of the fishery and are reported

against in annual stock assessments. The performance indicators are applied at a spatial scale that reflects the current distribution of catch and effort across the fishery.

The spatial scale at which the performance indicators are applied is commensurate with the relative importance of the Zone. The spatial scale of performance measurement is more refined for the Western Zone (down to fishing areas from which >5% of the TACC for both species was harvested in the previous fishing season) given its prominence as the most heavily fished zone (23 licence holders) and highest level of catch (61% of the overall greenlip and blacklip harvest from SA)

DEH notes that the revised performance indicators, their application at spatial scales commensurate with the distribution of catch and effort, and the statistical basis of the trigger points has improved the spatial resolution of the stock assessment process and represents an improvement from the previous management measures. As stated in the previous section of this report, DEH has recommended the collection of further independent survey and biological sampling data for the commercial catch to better inform the assessments against the respective performance indicators in the draft Management Plan.

The draft Management Plan provides for the Minister to be advised in writing by PIRSA and for a range of management responses to be enacted, if a trigger point relevant to the various performance measures in the Plan is breached. Responses may include an adjustment to the TACC and minimum legal size limits, spatial and temporal restrictions, or increased fishery independent research for the area in which the reference point has been triggered. Further discussion on management responses can be found under Objective 2.

As previously noted, the fishery has deployed a harvest strategy in all zones that has focused on maintaining a constant annual commercial catch through minimal changes to the TACC since the early 1990s. The harvest strategies in all zones are supported by a range of input and output controls applicable to the commercial harvest of both blacklip and greenlip stocks to maintain viable target stock levels.

TACCs and quota limits are set annually by the Director of Fisheries who acts on advice from the AFMC and SARDI's stock assessment reports. The TACCs and ITQs have been in place for the major fishing areas in all zones of the fishery since the late 1980s to restrict the level of catch for both greenlip and blacklip abalone. Separate TACC and quota management arrangements were established for the more remote Region B of the Western Zone and the harvesting of stunted blacklip abalone stocks in areas of the Southern Zone from 1991 and 1994/95 respectively. PIRSA notes in its submission that the quota allocations were set at conservative levels compared to higher historical harvest levels attained prior to quota management, and as a result catches and catch rates have not declined for most areas of the fishery over the last 15 years.

A separate TACC is set for blacklip and greenlip abalone in all zones of the fishery except for Region B in the Western zone, where a combined greenlip/blacklip TACC is set. The Director of Fisheries introduced the combined subzonal TACC as an incentive for fishers to spread their effort into Region B, allowing them to opportunistically harvest both species when operating. This is seen as a way to mitigate the disadvantage of fishing in a remote region far from landing points. While the amount of abalone harvested from Region B in the Western Zone is small (around 5% of total harvest for both species across the fishery), it remains a priority for PIRSA

to obtain further data on the biology and abundance of these species to ensure that the fishing effort associated with the combined TACC is not unduly impacting on the longer term sustainability of local stocks of either species in this region.

The TACCs are supported by other controls, primarily limited entry licences and minimum legal size lengths.

Data is currently collected at a relatively fine spatial scale in the SA Abalone Fishery although there is room for further refinement of the spatial scale of management. Abalone aggregate in largely self-recruiting metapopulations, and as previously mentioned, there is a risk that localised overfishing can occur without being reflected in the fishery dependent data sets.

Indications of serial depletion of both greenlip and blacklip abalone stocks in previously productive areas and the absence of finer scale spatial management measures at the metapopulation-level in the SA Abalone Fishery were identified by public comments on the PIRSA submission as requiring urgent attention to conserve abalone stocks and ensure the longer term sustainability of the SA Abalone Fishing industry.

Given the characteristics of abalone forming densely aggregated populations and being susceptible to localised depletions, DEH concurs with the need to manage the fishery at finer spatial scales. The latest stock assessment reports identify breaches in triggers concerning changes in the spatial distribution of catch and egg production limits in key catch areas of the Central and Western Zones for both blacklip and greenlip abalone that may be further evidence of localised stock depletion and reduced recruitment.

DEH acknowledges that PIRSA has taken steps recently in some areas of the fishery to address the maldistribution of fishing effort and implement finer spatial scale management measures. These include:

- Development of an FRDC application that examines the range of issues relevant to finer spatial management in the Southern Zone;
- Voluntary agreement by licence operators to harvest 10% of the Central Zone greenlip TACC away from the highly exploited Tiparra Reef;
- Implementation of a voluntary size limit increase for greenlip in Central Zone to increase the level of egg production and reverse the trends of long term declining greenlip recruitment in this zone;
- Consideration of a strategy to separately manage greenlip abalone harvested from the prime catch area of Tiparra Reef;
- Acknowledgement by PIRSA that if localised depletions are evident in future Western Zone greenlip abalone stock assessments then corrective management action may be required in 2005;
- Surveys of the distribution and abundance of greenlip abalone stocks off Cowell in the Central Zone.

DEH considers that similar approaches should be taken across the fishery for both blacklip and greenlip abalone stocks where assessments have indicated potential problem areas with stock abundance and recruitment. To reduce the risk of localised serial depletions DEH considers PIRSA should investigate the further application of measures such as sub-zonal TACCs and minimum size limits, and other measures such as temporary closures at the metapopulation level across all Zones of the fishery.

DEH notes that the parameters and process to be used to implement these actions are not currently defined in the SA abalone fishery management regime. A more structured approach should be developed in conjunction with SARDI, the AFMC and operators to establish decision rules or corrective strategies to implement controls that allow for more effective and rapid responses to the overexploitation and declines of stocks at finer scales of management.

Recommendation 7: *PIRSA to investigate and establish, over the next 3 years, appropriate decision rules or strategies, relevant to the regional or area scale management as required, to prevent serial depletion of blacklip and greenlip abalone stocks in all zones of the fishery.*

A sound process exists for legal commercial fishery dependent data to be accurately recorded and validated. Compliance with quotas and other regulations is monitored by PIRSA Fishwatch. The draft Management Plan outlines a structured compliance and deterrence strategy to achieve legal compliance by all fishers. This includes working with and providing support for all stakeholders, using a risk management model.

The draft Management Plan includes details of the risk management model, including assessments of the extent of potential risks and possible mitigation actions to apply for both commercial and non commercial removals of abalone. The draft Plan also includes compliance protocols for each zone of the fishery that stipulate the relevant compliance steps in the catch disposal recording system that must be observed by operators.

PIRSA Fishwatch also uses the following tools to monitor the abalone fishery:

- Random checks at point of landing and at processing premises
- Requirement to report before fishing
- Licence conditions regarding the completion of CDR forms and the transportation of abalone.

An onboard electronic counting and measuring device is currently being tested to increase the accuracy of fishery dependent data. Stock-take and audits of abalone processors are conducted to ensure compliance with the quota management system.

A significant issue causing uncertainty with ensuring longer-term ecologically sustainable abalone yields from the fishery is the level of illegal abalone catch. The recent FRDC project ‘Assessment of Illegal catches of Australian Abalone’ noted that, in the absence of targeted research and quantifiable data derived from sound scientific methods, estimates of Australian abalone theft varied widely from around 10% of the commercial TACC to greater than the national TACC.

Uncertainty remains as to the exact quantity of illegal harvest in SA, but the evidence suggests that the problem may be significant enough to impact on the sustainability of abalone stocks in localised areas. As previously stated in this report, estimates from the stock assessment reports of illegal abalone harvest in the SA Abalone Fishery zones vary from 2.6% to 10% of the TACCs set for the respective management zones. This amounts to around 43 tonnes of abalone illegally removed across the fishery each year, or around 5% of the annual average legal commercial catch. While PIRSA considers that illegal catch is likely to have been at current levels for a significant period of time, and therefore a constant factor in the assessment of

abalone resource, PIRSA Fishwatch has also indicated that the detection of illegal harvesting has increased in recent years.

DEH has previously recommended in this report that priority be given to more accurately quantifying the extent of the illegal take of abalone in SA and factoring this formally into the stock assessment and TACC setting processes. Information reports from PIRSA Fishwatch on the fishery are now required to include estimated quantities of illegally caught abalone where relevant.

The structured risk assessment process includes a range of measures to address the poaching of abalone. This includes a 24-hour PIRSA Fishwatch hotline through which members of the public can report suspected illegal harvesting, the sharing of information with intelligence units from other States, the participation in compliance and enforcement forums such as the National Fisheries Compliance Committee (NFCC) and the Australian Fisheries Law Enforcement Conference (AFLEC), and liaising with other government agencies.

Fisheries Officers attached to PIRSA Fishwatch enforce fishery legislation, while liaison and joint operational activity is continuing with specialist SA Police Divisions to counter increasing organised criminal groups involved with the illegal take and trade of abalone. Joint State fisheries operations involve close inter-jurisdictional liaison and have already resulted in the seizures of significant quantities of illegally obtained abalone. An abalone interdiction model has been established at the Adelaide International Airport in liaison with the Australian Customs Service to help prevent the illegal trade in abalone.

The draft Management Plan includes a performance indicator and reference point to assess the extent of illegal catch and the draft 5 year strategic research plan for the fishery gives priority to quantifying the effects of poaching on abalone stocks.

DEH acknowledges that illegal harvesting is a key issue for PIRSA's compliance and enforcement arrangements. DEH notes that the illegal harvest of abalone is a significant national issue with the potential for significant adverse impacts on the overall sustainability of abalone fisheries across Australia. DEH also notes that considerable work is being done in other jurisdictions to address the problem of abalone poaching, including the establishment of separate strategies and targets for the quantification and reduction of illegal abalone harvesting. PIRSA should consider a similar approach in SA, in cooperation with other jurisdictions, to ensure that a continuing priority is given to the accurate reporting of illegal harvesting and the development of appropriate management responses to reduce poaching.

Recommendation 8: *PIRSA to continue to work with other jurisdictions to develop effective strategies and response measures to quantify and reduce the extent of illegal take of abalone in SA.*

Recreational catch is managed using a range of measures including daily individual and boat bag limits, and legal minimum lengths, with separate possession and legal minimum length limits applying for greenlip and blacklip abalone. Current estimates in the stock assessment reports of recreational take vary from 1 to 2% of the TACC in each zone. PIRSA's submission acknowledges that the current understanding on the level of recreational take is limited, and that to improve the level of understanding, specifically targeted surveys will be carried out every three years. As discussed earlier in this report, DEH has recommended further attention be given to more accurately accounting for all elements of non-commercial abalone catch, including recreational and indigenous catch, in the fishery stock assessment and TACC setting processes.

DEH notes that recreational licensing systems to monitor and regulate the extent of non-commercial catches have been implemented in other abalone fisheries and has also noted earlier in this report the need for PIRSA to further investigate the implementation of a recreational abalone fishing licensing system.

The highly targeted nature of abalone fishing means that very few other species apart from blacklip and greenlip abalone are collected as part of the commercial harvesting operations. The existing management regime technically allows for 3 further species of abalone, *H. roei*, *H. scalaris*, and *H. cyclobates*, to be taken in the fishery. Collection of these species is subject to a legal minimum size limit of 130 mm. However, *H. roei*, *H. scalaris*, and *H. cyclobates* rarely reach the required size limit to be harvested and are therefore not normally taken by commercial or recreational fishers.

A collaborative project in the Western Zone has been developed by SARDI, PIRSA and the Abalone Industry Association of South Australia (AIASA) to investigate the extent of stocks of *H. roei*, including:

- Its fisheries biology;
- The effect of fishing on stock recovery; and
- The distribution and abundance of the resource.

This project will provide biological and stock status data on this species to draw on in the event of it being further targeted for commercial operations in the future.

Harvesting of *H. roei* stocks under this research program is controlled under Ministerial exemption notices with specific controls on the size limits, fishing areas and extent of fishing. Following the conclusion of the 3 year research program the results will be assessed and future management arrangements for the species recommended.

One of the public comments on PIRSA's submission raised concerns with the potential impact that any take would have on the stocks of *H. roei*, *H. scalaris*, and *H. cyclobates* in the absence of biological data and stock assessment. DEH is satisfied that suitable developmental arrangements are in place for *H. roei* in the event of further exploitation being undertaken for this species. While the existing size limits arrangements appear to protect *H. scalaris*, or *H. cyclobates* from commercial exploitation, DEH considers that further consideration be given to making arrangements in the current management regime more explicit in preventing the take of these two species until developmental research arrangements similar to *H. roei* have been undertaken.

Conclusion

DEH considers that the management regime in the SA Abalone Fishery is appropriately precautionary and provides for the fishery to be conducted in a manner that does not lead to widespread over-fishing.

DEH considers that, with PIRSA's agreement to implement key recommendations to improve the extent of data collection, further quantify removals from the fishery and address potential localised stock depletions, the information collection system and stock assessment and

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

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'*

As previously noted the draft Management Plan for the South Australian Abalone Fishery contains an extensive set of performance indicators, reference and trigger points with associated management responses. The draft Management Plan notes that in the event of reference points being triggered, a series of standard actions must be undertaken, including notification of the relevant SA Minister as appropriate, examination of the causes and implications of the reference point being triggered, consultation with the abalone industry on the need for appropriate response actions or strategies, review of the effects of the reference point being triggered and reporting to the Minister within 3 months of the initial notification. PIRSA noted in their submission that the range of management responses could include adjustments to the TACC, spatial or temporal closures and changes in legal size limits or further data collection in the area in which the trigger had been activated.

There are currently no recovery strategies with timeframes linked to management responses. PIRSA's submission acknowledges that the development of recovery timeframes is a priority for achieving management objectives, and that they will be incorporated into the Management Plan as more information on the biology of the stocks is gained. DEH has recommended earlier in this report that priority be given to obtaining further biological and population survey data for both greenlip and blacklip abalone to better inform assessment of the stocks, which in turn should provide a better indication of appropriate management responses to the trends in stock recruitment and abundance.

As previously noted in this report, data from the 2003 stock assessment reports indicate possible continuing declines in the sub legal sized greenlip abalone in the Central Zone and populations of blacklip abalone in key areas in the Western and Central Zones. While these assessments triggered key reference points for catch and recruitment in the Central and Southern Zones, DEH is concerned that no specific management actions to respond to the possible declines in the relevant abalone populations were developed or implemented by PIRSA. Public comments on the PIRSA submission also expressed concern that despite evidence of declining catches and recruitment in several areas over a number of years no specific measures such as reductions in TACCs have been implemented.

DEH notes that the management regime has been responsive to threats to abalone stocks in the past. During times of particularly heavy *Perkinsus* infection (a protozoan parasite that kills abalone and spreads easily) in 1996, Region A in the Western Zone was closed to blacklip abalone fishing until research indicated that the level of infection had decreased to less threatening levels. Other measures developed to reduce the spread of infection and reduce its impact on the fishery include:

- No at-sea shucking allowed of blacklip abalone harvested from areas of particularly heavy infection.
- The rejection of *Perkinsus* infected abalone at the discretion of the processor.
- Rejected abalone not counted as part of the quota.

The AFMC has adopted a more detailed process, in the course of setting the TACC for the Southern Zone for 2003/04, for determining appropriate management measures following activation of relevant trigger points in the Zone.

The management regime has also responded to concerns over the status of abalone stocks in the past by introducing and subsequently modifying minimum legal size limits for both blacklip and greenlip abalone, although DEH notes that these have not changed for several years and may need to be further adjusted to address areas of potentially localised depletion.

DEH considers that sufficient indicators have been activated in recent stock assessment reports for PIRSA to now be giving priority to more definitive recovery actions in areas where stocks are showing signs of decline and potential overfishing. A more definitive response process that includes appropriate management actions within set timeframes should be developed and implemented when key stock abundance and recruitment triggers are activated.

The overall process should be flexible enough to apply across the various management zones and management areas but include specific measures to monitor and support the recovery of stocks in particular problem areas. DEH appreciates that definitive recovery strategies will need to be progressively developed, taking into account the available data on stock status and changing management and environmental conditions across the fishery. As a precautionary measure DEH considers that preliminary recovery targets and management measures should be established in the short term while further monitoring and assessment is undertaken to inform and support the stock recovery process.

Recommendation 9: *PIRSA to develop within 18 months recovery strategies that can be applied to areas assessed as below key reference points or levels for stock abundance and recruitment. The recovery strategies should include preliminary recovery targets and monitoring arrangements, appropriate to the scale of fishing in the area, and associated timeframes.*

Conclusion

DEH considers that, overall, stocks are not currently overfished, but there is some uncertainty on the status of stocks in particular areas.

The recent assessments that indicate concerns with stock status in certain areas are being addressed through enhanced performance assessment measures and a recovery framework stipulated in the fishery's management plan. DEH has made recommendations to enhance stock recovery strategies and is satisfied that there is a high probability that the stocks would recover under the proposed 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'*

There is no significant bycatch reported in the fishery, other than the unavoidable removal of encrusting and boring organisms such as algae. These “piggyback” species appear to be of negligible risk from the fishery. The fishery is based on direct and selective hand collection of target species, with no retained catch other than commercial abalone species reported. There is minimal disturbance to the substrate by diver or support boat activities. Management responses for bycatch species are therefore not required, nor is it necessary for the management of the fishery to monitor an indicator group of bycatch species.

The current management framework and involvement of the industry, community and government sectors in the development of management advice should provide an effective avenue to identify any potential adverse impacts on bycatch from fishing activities.

Conclusion

DEH considers that there is a high likelihood the fishery is conducted in a manner that does not threaten bycatch species. Should this situation change, or a risk assessment process indicate otherwise, DEH expects that PIRSA would undertake appropriate actions to ensure that bycatch species are not threatened by this 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'*

As a dive fishery with a direct and selective hand collection of target species, there is minimal disturbance to substrate and risk of interactions with listed species is minimal. There is no indication from diver reports, or monitoring programs of any significant interactions of vessels and divers with protected, endangered or threatened species (except Great White sharks as mentioned below). Due to the fishery's operation in Commonwealth waters, operators are subject to Government cetacean guidelines that include a range of measures to avoid disturbing cetaceans. There is no indication that abalone fishing operations in this fishery are in breach of these requirements.

There are no threatened ecological communities within the areas of the fishery. It is highly unlikely that the fishery has any significant adverse impacts on endangered, threatened or protected species or threatened ecological communities. The management framework, in particular the monitoring and reporting systems, provides for identifying any developing impacts and addressing them in a timely manner.

There may be times when there are interactions by divers with Great White Sharks. Further information about these interactions will be important for future management actions. DEH recommends that options be investigated for including the recording of protected species interactions in diver logbook and establishing arrangements to report these interactions to PIRSA so that the level of interactions occurring can be more accurately quantified.

Recommendation 10: *PIRSA, within 12 months, develop options for the recording and reporting of protected species interactions in the fishery.*

Conclusion

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

A recommendation has been developed to ensure that the risk of unacceptable impact on protected species is minimised in the longer term.

Minimising ecological impacts of fishing operations

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

The South Australian Abalone Fishery is a selective fishery, using hand-collection of the abalone. The possibility of direct disturbance to the substrate through the anchoring of dive tenders is low. This risk is reduced even further because the common practice is for divers to operate with a 'live boat' (i.e. not anchoring and following the diver). Vessels are removed from the water each day, meaning that there is little chance of transposition of hull organisms or a build-up and disposal of bilge discharge.

There is a very low potential of issues through the discard of shells when product is shucked at sea. This is considered to have a very low likelihood of causing mortality of, or injuries to, endangered, threatened or protected species. Likewise, the minimal increase in nutrient loadings as a result of such discards is likely to have no impact on any threatened ecological community.

PIRSA's submission notes that abalone tend to feed more on drift algae rather than grazing attached plants. It is therefore unlikely that abalone compete directly with other grazing herbivores. There is the potential for the removal of a dominant benthic herbivore such as abalone precipitating outbreaks of other dominant grazers such as sea urchins, but a linkage of abalone removal to urchin barrens is still to be proven. The submission notes that while a range of species such as rays, starfish, octopus and lobster and reef fish such as wrasse feed on abalone, none of these predators depend solely on abalone for food.

PIRSA acknowledges that more research needs to be carried out to determine the environmental effects of abalone fishing. The draft Management Plan for the fishery contains ecosystem and environmental performance indicators linked to strategies that include researching the interactions between abalone and other species. However, these performance indicators are not currently reported against. PIRSA's submission notes that funding proposals are in place to

develop programs to ensure that those performance indicators are reported against in the future. DEH notes that SARDI has recently submitted a proposal to the FRDC to fund a major project on the ecological impacts of abalone and rock lobster fishing in the temperate reef environments of the fishery. DEH is encouraged by this approach and supports the funding of this project by the FRDC as a means of enhancing the awareness of the indirect effects of fishing on temperate reef ecosystems. The findings of such a study may have application across similar southern Australian fisheries.

Regardless of the outcome of these funding applications, PIRSA should pursue the development of measures to monitor environmental impacts of abalone fishing and review the extent of environmental impacts as part of the stock assessment process.

Recommendation 11: *PIRSA to give priority to further developing environmental indicators that can be reported against in future Stock Assessment Reports.*

Conclusion

DEH considers that the fishery is conducted in a manner that minimises the impact of fishing operations on the ecosystem generally. A recommendation has been developed to ensure that the risk of significant impact by the fishery on the marine environment generally is minimised in the longer term.

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LIST OF ACRONYMS

AIASA	Abalone Industry Association of South Australia
AFLEC	Australian Fisheries Law Enforcement Conference
AFMC	Abalone Fishery Management Committee
CDR	Catch and Disposal Record
CPUE	Catch Per Unit Effort
DEH	Environment Australia
EPBC	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
FRDC	Fishery Research and Development Corporation
ITQ	Individually Transferable Quota
MARPOL	International Convention on Marine Pollution
NDS	National Docketing System
NFCC	National Fisheries Compliance Committee
NRIFS	National Recreational and Indigenous Fishery Survey
PIRSA	Department of Primary Industries and Resources South Australia
SA	South Australia
SAFIC	South Australian Fishing Industry Council
SARDI	South Australian Research and Development Institute
SARFAC	South Australian Recreational Fishing Advisory Council
TACC	Total Allowable Commercial Catch