



Australian Government

Department of the Environment and Heritage

Assessment of the
Western Australian Abalone Fishery

October 2004

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

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Assessment of the ecological sustainability of management arrangements for the Western Australian Abalone Fishery

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EXECUTIVE SUMMARY

Background

The Department of Fisheries Western Australia (DFWA) 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 *Application to Environment Australia on the Abalone Managed Fishery Against the Guidelines for the Ecologically Sustainable Management of Fisheries for continued listing on Section 303DB of the Environment Protection and Biodiversity Conservation Act 1999* (the submission) was received by the Department of Environment and Heritage (DEH) in November 2002. The submission was released for a thirty-day public comment period that expired on 31 January 2002. Two public comments were received. While DFWA provided a response to the issues raised, no changes were made to the submission as a result of public comments.

The submission reports on the Western Australian abalone fishery against the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries*. The DEH assessment considers the submission, associated documents, public comments and DFWA response to the comments.

Table 1: Summary of the WA Abalone Fishery

Area	The fishery licence area spans over State and Commonwealth waters. Although the target species are harvested from reefs and rock shelves within Western Australian waters. Shark Bay is approximately the northern range limit for commercial abalone species.
Fishery status	The stocks of the target species are considered fully exploited.
Target Species	Greenlip abalone (<i>Haliotis laevis</i>), brownlip abalone (<i>Haliotis conicopora</i>) and Roe's abalone (<i>Haliotis roei</i>).
By-product Species	Due to the highly selective fishing methods, only the target species are taken in the fishery.
Gear	Diver hand collection using abalone iron.
Season	Commercial harvesting year round, from 1 April to 31 March. Recreational season limited in certain areas, including a very limited 9 hour yearly season applying around Perth metropolitan area.
Commercial harvest 2002/03	292 tonnes whole weight.
Value of commercial harvest 2002	\$14.4 million.
Recreational harvest	57 tonnes in 2002/03.
Commercial licences issued	42 licences – 27 endorsed to take Roe's abalone, 15 to take greenlip/brownlip abalone.
Management arrangements	Input controls of limited entry, 8 commercial areas, area and seasonal closures. Output controls of tonnes whole weight Total Allowable Commercial Catch (currently 336 tonnes) and Individual Transferable Quotas, minimum legal lengths for commercial abalone species.
Export	Majority of catch exported frozen or canned to Japan, China and other South East Asian countries with little

	being exported as live.
Bycatch	Negligible - Limpets/algae/benthic microorganisms.
Interaction with Threatened Species	No significant interactions.

The Western Australian (WA) abalone fishery includes all coastal waters from the WA/South Australian (SA) border to the WA/Northern Territory border. Under an Offshore Constitutional Agreement between WA and the Commonwealth Government, WA has management jurisdiction for abalone from the low water mark out to the 200 nautical miles limit of the Australian Exclusive Economic Zone.

The fishery targets three species of abalone – Roe’s abalone (*Haliotis roei*), brownlip abalone (*H. conicopora*) and greenlip abalone (*H. laevigata*). Greenlip abalone are contiguous throughout southern waters with a range from Corner Inlet (Victoria) and northern Tasmania to Cape Naturaliste in WA, occurring in rocky habitats in water ranging from 5 to 40 metre depths and temperatures from 12-22°C. Brownlip abalone is very similar to blacklip abalone and is considered by some taxonomists to be a subspecies of blacklip abalone. Brownlip abalone prefer calmer waters and inhabit rock crevices and sheltered reefs from the WA/SA border to Fremantle generally in waters up to 30 metres in depth and temperatures from 12-22°C. Roe’s abalone range from western Victoria to Shark Bay in WA, and inhabit the shallow, high wave action inter-tidal and sub-tidal areas to a depth of 3 metres and water temperatures from 14-26°C.

Brownlip, greenlip and Roe’s abalone are univalve gastropods. Brownlip and greenlip abalone can grow to maximum shell lengths of 220 and 240 millimetres respectively in WA, with common shell sizes between 140-160 and 140-170 millimetres, respectively. After 5 to 10 days spent as larvae, brownlip and greenlip abalone reach sexual maturity at about three to four years of age, and grow to harvestable size in 4 to 6 years. Roe’s abalone is faster growing but much smaller, with a maximum shell length of 120 millimetres and a size of 40 millimetres at sexual maturity. Greenlip and brownlip abalone can live up to 20 years, Roe’s abalone up to around 10 years. As abalone 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. These three species of abalone feed mainly on drift algae, and are preyed upon by crabs, rock lobster, octopi, fish, rays, starfish and predatory whelks.

Approximately 322 tonnes of abalone were commercially harvested in the WA abalone fishery in 2002, at an estimated value of \$14.4 million. The fishery began in 1964 mainly harvesting Roe’s abalone, and expanded after 1970 to include greenlip and brownlip abalone. Fishing was initially at low levels due to the isolated areas harvested but expanded rapidly in the late 1960s with an influx of interstate divers. To control this expansion licences were limited in 1971 to 36 across 3 management zones. An Individual Transferable Quota (ITQ) regime under a Total Allowable Commercial Catch (TACC) for each targeted abalone species was introduced in 1985-86 and quotas progressively reduced until 1990 with little variation since. The fishery was further divided into 8 management areas in 1999.

Catch records have been maintained for the fishery since its commencement in 1964, and show a relatively stable overall commercial yield of abalone over the last 25 years, with some variation in the proportion of catch of individual species each year. Recent stock assessments across all management areas indicate the stocks of all commercial abalone species in the WA abalone fishery are fully exploited. The majority of the abalone commercial harvest is exported to Japan, China and South East Asia, either frozen, canned, dried or boiled.

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 commercial fishing season extends year round apart from short term commercial fishing closures around the Perth metropolitan area during the limited recreational fishing period.

The main management responses in place for commercial harvesting include input and output controls of limited entry to the fishery (42 licences), species and Area-specific TACC limits and ITQ limits, and species and Area-specific legal minimum size limits, area and seasonal closures. The recreational catch is controlled through bag limits, possession limits and legal minimum size limits for all commercially targeted 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.

The recreational harvest of commercial abalone species is quite substantial and also targets the three commercial abalone species. Current estimates of recreational catch are around 57 tonnes, mostly targeting Roe's abalone around the Perth metropolitan area and near Geraldton. In recognition of the extent of recreational catch, a structured management process is in place to monitor and control the extent of recreational harvest, including minimum size limits, closed seasons, bag and boat limits, recreational licences, periodic recreational catch and effort surveys. Recreational management arrangements have been designed to complement the commercial abalone fishing operations, where possible.

A very small amount of abalone is also collected for aquaculture broodstock, through the use of Ministerial Exemption Notices. Broodstock collection is limited to 300 Roe's, 300 greenlip and 100 brownlip abalone. The extent of illegal harvest in the WA abalone fishery is uncertain and as yet no illegal harvest estimate has been specifically identified in the stock assessment process.

Due to the specific harvesting techniques required, abalone is not taken as byproduct or bycatch in other fisheries operating in the area of the fishery.

The fishery is managed under the statutory *Abalone Management Plan 1992*, which obtains its authority from the *WA Fish Resources Management Act 1994* and regulations in the *WA Fish Resources Management Regulations 1995*. The management plan is supported by various Gazetted notices, Ministerial Policy Guidelines and licence conditions.

Overall assessment

The material submitted by DFWA indicates that the WA abalone fishery operates in accordance with the Australian Government *Guidelines for the ecologically sustainable management of fisheries*. DEH considers that the WA 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. Overall, the sophisticated management regime of detailed analysis of catch data, sound stock assessment process, comprehensive stock control measures and proposed enhancements to monitoring programs suggests that the fishery is being managed in an ecologically sustainable way.

In making its assessment, and subject to the implementation of the recommendations made to improve management of the fishery, DEH is satisfied that the information collection systems, 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 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. Management of this fishery has a history of reacting appropriately to threats to sustainability and DEH is confident that DFWA will continue to provide this high quality management.

The assessment finds that the 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 requirements of Part 13A of the EPBC Act, with that exemption to be reviewed in five years. DEH is satisfied that the fishery, as managed in accordance with the management plan is not likely to cause serious or irreversible ecological damage over this period. DFWA'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.

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

A number of protected species occur in the fishery area, including seals and sea lions, sharks and marine turtles, however 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 WA Abalone Fishery, in accordance with the *Abalone Management Plan 1992* under the *WA Fish Resources Management Act 1994* and *WA Fish Resources Management Regulations 1995*, 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 WA 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 WA 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 WA abalone fishery management regime, would not be expected to have a significant impact on a listed threatened species, listed migratory species, cetacean or listed marine species protected by the EPBC Act.

To further strengthen the effectiveness of the management arrangements for the WA 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 and other commitments made by DFWA 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.

DEH Recommendations for WA Abalone Fishery

Recommendation 1: *DFWA to ensure, where appropriate, that any relevant community, conservation and recreational interests in the fishery are considered through consultative mechanisms.*

Recommendation 2: *DFWA, in its annual State of the Fisheries Report, to report on the performance of the fishery against performance measures that relate to the ecological sustainability of the fishery.*

Recommendation 3: *DFWA, in consultation with other abalone fishery agencies, to further develop appropriate biological parameters and reference points for abalone harvesting within the WA abalone performance assessment system, and pursue with other agencies a national process for developing, adopting and reviewing these performance indicators, and for periodically reviewing abalone stock assessment processes.*

Recommendation 4: *The ESD report, including all performance measures, responses and information requirements, to be formally incorporated into the management regime and decision making process.*

Recommendation 5: *If there is a breach in a performance measure, this will be reported in the State of the Fisheries Report. If a breach materially affects the sustainability of the target species or negatively impacts on byproduct, bycatch, protected species or the habitat, the breach will be reported to the Minister for Fisheries within 3 months for subsequent management review and action with timeframes for implementation.*

Recommendation 6: *DFWA to advise DEH of any material change to the fishery's legislated management plan and/or arrangements that could affect the criteria on which EPBC decisions are based, within 3 months of that change being made.*

Recommendation 7: *DFWA, within 2 years, to develop and implement enhanced fishery independent monitoring programs across the fishery, representative of species distribution and catch across the various Areas of the fishery, to improve the understanding of the relevant stock structures and abundance. Data from the independent monitoring programs should also be used to inform the further development of reference points and performance indicators required under Recommendation 3.*

Recommendation 8: *DFWA within 2 years to further develop biological sampling programs, representative of species distribution and catch across all Areas of the fishery, to provide the necessary data to inform the range of biological performance measures developed in accordance with Recommendation 3 and enhance the stock assessment process.*

Recommendation 9: *DFWA to take account of all abalone removals, including best estimates of recreational and illegal harvesting, in the stock assessment process and the determination of the annual TACC.*

Recommendation 10: *DFWA to investigate and establish, over the next 3 years, appropriate decision rules or strategies, relevant to the scale of management required, to prevent serial depletion of brownlip and greenlip abalone stocks in the fishery.*

Recommendation 11: *DFWA to work with other jurisdictions to develop effective strategies and response measures to quantify and reduce the extent of illegal take of abalone in WA.*

Recommendation 12: *DFWA to provide a mechanism which allows fishers to record interactions with protected/listed species.*

PART I - MANAGEMENT ARRANGEMENTS

The Western Australian Abalone Managed Fishery is managed by the Department of Fisheries Western Australia.

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

- The *Fish Resources Management Act 1994* (FRMA);
- The *Fish Resources Management Regulations 1995* (FRMR);
- The *Abalone Management Plan 1992*;
- 2002 ESD Report of the WA Abalone Fishery (developed in accordance with the National ESD Reporting Framework); and
- Relevant Gazetted notices, Ministerial Policy Guidelines and licence conditions.

There are a number of other documents, including policy statements, research reports, scientific literature and discussion papers, which are integral to the management of the fishery.

Copies of the *Abalone Management Plan 1992* can be purchased from the State Law Publisher and is available through the Internet.

Management of the fishery incorporates a range of consultative mechanisms and a commitment to effective consultation with a variety of stakeholders. The ongoing management of the fishery involves co-operative management arrangements through the Abalone Management Advisory Committee (AbMAC) and the Western Australian Abalone Industry Association (WAAIA). AbMAC consists of an independent chair, a DFWA representative, three commercial abalone licence holders or fishermen, one recreational abalone fisherman and one person from the general community. The AbMAC is appointed by the Minister to provide advice on issues that affect the fishery, to advise the Minister on matters relating to the management and protection of the fishery and assist with setting priorities for management, research, enforcement and development of the fishery. WAAIA is an independent industry association that liaises directly with DFWA on commercial fishery management matters.

The DFWA Ecologically Sustainable Development (ESD) Report was developed through a consultative process that included a wide range of stakeholders including the abalone industry, recreational sector, representatives of government and non-government conservation agencies, indigenous and research sectors. The DFWA ESD Report will be amended in light of the recommendations made in this assessment. It will then be made publicly available via publication or electronically. DEH notes that the WA Environmental Protection Authority (WAEPA) is preparing a framework for reporting on all WA fisheries. It is proposed that this framework would be linked to a regular audit cycle involving the WAEPA and the Office of the Auditor General.

DFWA has indicated that the ESD workshop will be repeated at the five-year review of the ESD report. DEH considers that a fishery management regime should be developed through a consultative process providing opportunity to all interested and affected parties. If the stakeholder workshop is not repeated at the five-year review, then DFWA will need to ensure that adequate consultation occurs through other fora. DEH notes that DFWA holds an annual public meeting in Perth to allow for abalone commercial operator and other stakeholder input into management arrangements and to provide information on management issues such as compliance, broader fishery policy management issues, and results from research and catch data analysis.

DEH notes that one of the indicators in the ESD Report is the level to which licensees consider that they are adequately and appropriately consulted. DEH considers that this could be broadened to also include other stakeholders to ensure ongoing representation of all interested parties. The ESD Report notes that recreational fishers' interests are specifically catered for through the Recreational Fishing Advisory Council that advises the WA Minister on matters relating to recreational fishing, including recreational abalone fishing.

Recommendation 1: *DFWA to ensure, where appropriate, that any relevant community, conservation and recreational interests in the fishery are considered through consultative mechanisms.*

The management measures for the fishery are specified in the *Abalone Management Plan 1992*. The Plan currently does not contain the objectives and performance criteria for the fishery. The management objectives for the fishery have been developed in consultation with AbMAC and are published in the WA Fisheries Overview #1, and address sustainability of abalone stocks, economic return from the abalone resource, cost-effective management and commercial flexibility.

The ESD Report specifies the objectives, performance indicators, performance measures and actions to address the main components of the fishery. DFWA is also responsible for reviewing the stock assessment of the abalone fishery and for preparing and publishing the annual WA State of the Fisheries Report that reports on the performance of major aspects of WA fisheries. The State of the Fisheries report is a public document which can be assessed and viewed on the DFWA website.

DEH commends DFWA for its annual public reporting on the state of WA fisheries and considers that such reporting should be comprehensive and include reporting against all criteria relating to ecological sustainability.

Recommendation 2: *DFWA, in its annual State of the Fisheries Report, to report on the performance of the fishery against performance measures that relate to the ecological sustainability of the fishery.*

DEH notes that the WA abalone fishery performance indicators and measures are primarily based on a fairly narrow range of fishery derived catch and effort data. DEH also 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 biologically based parameters and reference points for abalone harvesting. Given the biological characteristics of abalone aggregating to form self-recruiting metapopulations within scales that can be less than one square kilometre, the ability of jurisdictions to jointly manage abalone from the same recruiting stock is 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.

DEH considers that DFWA should take account of the range of biologically based performance measures being used in other abalone fisheries in Australia and include a broader range of biological parameters in the performance assessment of the WA abalone fishery.

Recommendation 3: *DFWA, in consultation with other abalone fishery agencies, to further develop appropriate biological parameters and reference points for abalone harvesting within the WA abalone performance assessment system, and pursue with other agencies a national process for developing, adopting and reviewing these performance indicators, and for periodically reviewing abalone stock assessment processes.*

Currently the ESD Report is not a formal component of the legislative arrangements for the fishery. The Report sets out a number of management commitments, including management triggers and performance measures that have been fundamental to DEH 's assessment and recommendations. An assessment of the effectiveness of these measures is included in Part Two of this report. Although DEH is satisfied that the lack of a legislative basis will not cause issues in the fishery in the short term, for certainty in the longer term, the Report needs to be formally incorporated into the management regime. DFWA noted in its submission that it proposes to formally publish the relevant objectives and performance measures for each fishery in a series of Ministerial Guidelines that would form an adjunct to the respective fishery management plan. DEH supports this approach and considers priority should be given to completing this process.

Recommendation 4: *The ESD report, including all performance measures, responses and information requirements, to be formally incorporated into the management regime and decision making process.*

The ESD Report contains some triggers for management action should performance measures not be met, however, DEH notes that timeframes for the implementation of these actions are not included.

Recommendation 5: *If there is a breach in a performance measure, this will be reported in the State of the Fisheries Report. If a breach materially affects the sustainability of the target species or negatively impacts on byproduct, bycatch, protected species or the habitat, the breach will be reported to the Minister for Fisheries within 3 months for subsequent management review and action with timeframes for implementation.*

Management of the commercial fishery is based on a mixture of input and output controls. Such controls include:

- Area-based TACCs and ITQs for each relevant commercial target species;
- Limited entry, with 42 licences current;
- A requirement for licence holders to have a minimum number of quota units for a particular commercial abalone species;
- Seasonal and area closures for certain areas of the fishery;
- Minimum legal size limits.

Additionally, there is a range of measures to manage the recreational harvest of abalone, which is a significant component of the overall harvest of abalone in some areas of the fishery. Recreational management measures include minimum legal size limits, bag and boat limits, seasonal closures, very restricted open seasons in high recreational harvest areas and recreational licence requirements.

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

Compliance and enforcement tools utilised in the fishery are based on the ITQ regime, which involves a detailed document trail including quota docket, catch and effort records, catch and disposal records and abalone processor returns. Other major compliance field activities include sea and land patrols, inspections of landed commercial catches and recreational catches, processing facility inspections, licence and gear inspections, covert surveillance of targeted commercial operators and of various illegal activities. Compliance risk assessments have recently been introduced into the fishery to determine the most appropriate field operations compliance approach.

The ESD Report acknowledges the ongoing difficulties in identifying illegal activities and the need for dedicated close working relationships with enforcement agencies in WA and other States to address illegal activities.

Further assessment of the effectiveness of compliance measures and impacts of illegal harvesting of abalone is contained in Part Two of this report.

DEH is broadly satisfied that these compliance measures, together with the recommendations made in this report, contain the means of enforcing critical aspects of the management arrangements for the fishery.

The ESD Report for the abalone fishery provides another review forum for the fishery. The ESD Report includes, *inter alia*, status reports for those components that are not subject to annual assessment and are generally more detailed than the annual State of the Fisheries Report. The DFWA ESD report will be reviewed every five years. DEH is satisfied that a five-year review of the entire fishery is appropriate while critical aspects are reviewed annually through the stock assessment and when adverse signals appear in the fishery.

DEH considers it important that management arrangements remain flexible to ensure timely and appropriate managerial decisions. Because of the importance of the *Abalone Management Plan 1992*, relevant Ministerial Policy Guidelines and the DFWA ESD Report to DEH's assessment of the fishery, any amendments to these documents could change the outcomes of the assessment.

Recommendation 6: *DFWA to advise DEH of any material change to the fishery's legislated management plan and/or arrangements that could affect the criteria on which EPBC decisions are based, within 3 months of that change being made.*

The relatively benign method of fishing used in the fishery results in very little or no contact with other species. 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 DFWA 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 WA 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

DFWA notes in its submission that catch statistics have been collected for the commercial abalone fishery since 1964. Fishery dependent data are obtained through compulsory daily logbooks. Logbook data are recorded on a grid basis of 10 x 10 nm blocks. The logbooks contain information on daily catch weight, catch effort and areas of operation, and, for greenlip and brownlip abalone, number of individual abalone caught per day, to allow calculation of average meat weight as part of the stock assessment process. DFWA notes in its submission that a new industry catch reporting system based on finer scale data recording was introduced from the 2000 season onwards.

Monthly returns from logbook data are also provided by operators to DFWA. 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) and overall catch rates in all Areas of the fishery. Fishery dependent data is also used to determine mean weight of harvested greenlip and brownlip abalone stocks. Catch data is recorded in a centralised database administered by DFWA.

To assist with ongoing compliance and monitoring arrangements, divers and processors are required to provide daily catch and disposal returns (CDRs), that include relevant catch and effort data, for all abalone landed and consigned in WA. CDRs are checked for accuracy by the DFWA’s Serious Offences Unit. Processors are also required to provide returns to DFWA with details of all abalone received. DFWA notes that it is reviewing the implementation of a National Docketing System, similar to systems used in other States, to enhance the monitoring of abalone trade. DFWA is aiming to have the National Docketing System implemented for the fishery in 2005.

DFWA and industry obtain additional information on population structure and dynamics through commercial catch shell sampling and length frequency and growth data sampling across the various fishing areas. The extent and duration of this sampling data varies across the various fishing areas. The information obtained from industry is in the form of commercial shell samples, and by tag and recapture study sites.

DEH believes that data reliability is reasonable and that compliance and enforcement activities for the licensed commercial sector of the fishery have the capacity to ensure the ongoing reliability of data in the fishery.

Fishery independent data collection is limited. To date, fishery independent surveys have focussed on Roe’s abalone in the fishery area close to the Perth metropolitan area. This area is subject to additional pressures of recreational fishing and potentially illegal fishing for abalone. Six reef platform sites are surveyed annually, following the recreational fishing season, to determine the size distributions and densities of Roe’s abalone stocks in the area as a measure of recruitment strength and changes to the fished stock over time. The survey program also provides a sound means of assessing the effects of recreational fishing and determining available stock levels for the subsequent seasons.

The DFWA submission acknowledges that a greater focus is needed on fishery independent data collection to monitor abalone and analyse abalone stocks across the fishery. An Fisheries Research and Development Corporation (FRDC) application has recently been approved to study the feasibility of in-water video monitoring assessment of stock abundance and structure of greenlip and brownlip abalone. DFWA note that if these trials prove successful longer term stock monitoring programs using these techniques will be implemented.

DEH notes that DFWA collects data from a wide range of sources (logbooks, processor records, quota management docket, catch sampling and fisher advice) to counteract the current lack of fishery independent data. Nonetheless, DEH considers that the reliance on fishery dependent data to assess the stock dynamics for the majority of the fishery needs to be balanced by a broader scope of fishery independent data collection to better determine the impacts of all forms of fishing on available stocks and validate trends in stock availability currently determined by fishery dependent data collection systems.

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

DFWA has previously developed a research plan for the fishery in consultation with industry to prioritise future research needs. Currently, DFWA is developing a new research plan in consultation with industry. In addition to the abovementioned proposed video underwater stock monitoring program, other research priorities include development of protocols to fish stunted stocks of greenlip abalone, and investigate habitat effects on survey techniques and re-seeding success.

Recreational harvesting is a significant component of the WA abalone fishery. Recreational abalone fishers are required to obtain a licence from DFWA and the details are stored on a licensing database. Estimates of recreational fishing indicate that it accounts for around 20% of the combined commercial and recreational catch of Roe's greenlip and brownlip abalone. DFWA subsequently draws on the recreational licence database to conduct annual telephone surveys, as well as field surveys for the Perth recreational Roe's abalone fishery, to estimate the annual recreational effort (in diver days), catch number and catch weight of recreational abalone harvest, and derive estimates of catch rate, mean weight and trends in distribution of recreational harvesting effort. These data collection systems complement those in place for the commercial abalone sector and allow for direct comparison of commercial and recreational catch shares.

DEH considers that these arrangements provide a suitable means of monitoring the impacts of the recreational harvest appropriate to the scale of recreational fishing across 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.

DFWA acknowledges in its submission the difficulties in identifying all types of illegal activities and that the impact of illegal operators is of great concern. The submission notes that the DFWA's Serious Offences Unit is responsible for most of the detection and prosecution of individuals and organisations involved in the illegal take and sale of abalone, and that the extent of illegal catch is estimated from compliance data. The compliance data is generated from intelligence data based on information from the public, commercial industry and information from investigative processes undertaken by the State Fisheries and Marine Officers around the state. However neither the submission nor the WA State of the Fisheries Report provide an estimate of the extent of illegal

catch currently in the fishery. Further discussion on illegal abalone catches is contained in subsequent sections of this report.

Overall, given the range of fishery dependent data gathered by DFWA and the mechanisms for regularly reviewing the data requirements, DEH is satisfied that there is a reliable information collection system in place appropriate to the scale of the fishery. Continuation of existing data collections and research programs, combined with extension and refinement of fishery independent data collection programs, will be important for the future management of the fishery.

Assessment

A sound annual stock assessment process is in place for brownlip, greenlip and Roe's abalone, based on fishery dependent and available independent data.

These annual assessments are conducted by the research division of DFWA and published by DFWA in the WA State of the Fisheries Report. DFWA considers the stocks of brownlip, greenlip and Roe's abalone to be fully exploited. The assessment takes account of the performance of the fishery and status of target stocks in each management area. The fishery was divided into 3 management Zones until 1999, when it was further subdivided into 8 discrete management Areas to improve monitoring and assessment of specific abalone stocks. The assessments published in the WA State of the Fisheries Report include an analysis of the available data, a summary of the effects of management arrangements in place, a research summary, and ecosystem effects of the fishery.

The stock assessment process predominantly uses catch information for the fishery (catch, effort, size composition) along with available biological data on the target species, and, in the case of Roe's abalone, annual independent survey data. The stock assessment model draws primarily on standardised CPUE data, catch and relative effort data, and average meat weight, to estimate relative abundance trends for stocks and to determine if declines have occurred and if management triggers are reached. The current stock assessment model used is a GLM (Generalised Linear Model) which statistically accounts for environmental and technology effects on stock indicator trends, such as CPUE and meat weights. In 2004, it is proposed to fit the National Abalone Population Dynamics model (an FRDC project just completed) to WA abalone fishery data, and this model will develop biomass estimates.

All of the DFWA abalone stock assessments are subject to internal peer review within the Department of Fisheries, and external peer review when published as reports or scientific manuscripts.

The primary management tool for the fishery is a TACC which is determined following the annual performance assessment of the fishery. Since the introduction of quota management, DFWA 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. DFWA notes in the submission that it has a long time series of catch and effort data over a 30 year period to assist with determining stock trends, and that in regions of higher activity analysis of this data is undertaken at a sub-Area or intra-Area basis to detect trends in fishing behaviour and catch distribution and changes to relative abundance of stocks. DFWA notes in the submission that, for brownlip and greenlip abalone, the catch rates for these stocks have remained high and there are no adverse indicators for the level of juvenile abalone recruitment, and therefore breeding stock is at sufficient levels to maintain recruitment and support current catch rates.

DEH notes that this approach places a heavy reliance on catch and effort data to determine the productivity of abalone stock in the fishery and provide the basis for evaluating the sustainability of

the fishery against the various performance indicators. DEH also notes the concerns raised in the past for other abalone fisheries, that use of CPUE and other fishery derived catch data does not fully detect changes in fisher behaviour and local fluctuations in abalone populations, factors that can have a significant influence on the longer term available abundance and sustainable yield of abalone stocks.

Public comments received by DEH noted the primary reliance on interpretation of catch rate data for estimates of relative abundance of stock, particularly for brownlip and greenlip abalone, 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.

DFWA acknowledged in its response to DEH on the public comments that a mix of fishery dependent and independent monitoring programs is preferable to successfully manage fisheries. DFWA has taken steps to establish independent monitoring programs within the abalone fishery management regime. As mentioned above, DFWA intends to test the suitability of in-water video monitoring as a means of enhancing independent monitoring programs across the fishery. DFWA has also established in recent years an independent monitoring program for Roe's abalone at six monitoring sites in the highly fished areas near Perth to confirm recruitment strength and changes in local Roe's abalone abundance over time.

DFWA has indicated that if the above in-water video trials are successful, around 42 greenlip abalone and 50 Roe's abalone independent monitoring sites may be established using a combination of video and more traditional diving surveys. DFWA has also advised that new monitoring sites will be established to measure abalone population trends regardless of the monitoring techniques to be deployed.

DEH is encouraged by this approach to further define changes in stock status and recognises the difficulty faced by DFWA in further developing a cost effective and indicative fishery independent monitoring program across all areas of the fishery, due to the extensive fishery area and the localised nature of abalone aggregations and harvesting.

Nonetheless, DEH considers that improved understanding of the structure and abundance changes of stocks across the fishery, in particular for brownlip and greenlip abalone, 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.

DEH encourages DFWA to give priority to establishing further independent monitoring programs across the fishery, appropriate to the scale and the distribution of abalone stocks and fishing effort, and to use this data to inform the development of more biologically based reference points and performance indicators recommended in Part I of this report.

Recommendation 7: *DFWA, within 2 years, to develop and implement enhanced fishery independent monitoring programs across the fishery, representative of species distribution and catch across the various Areas of the fishery, to improve the understanding of the relevant stock structures and abundance. Data from the independent monitoring programs should also be used to inform the further development of reference points and performance indicators required under Recommendation 3.*

The distribution and spatial structure of abalone stocks has been factored into the stock assessment process. The management of the fishery has progressively moved towards an increasing level of finer spatial resolution. As previously noted, fishery dependent data is collected on a 10x10 nautical mile block data system that is generally consistent with the metapopulation structure of stocks in most areas of the fishery, with data now being obtained at a finer scale of resolution where required.

The 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 recommended above, further fishery independent surveys would supplement and validate this data, particularly for greenlip and brownlip abalone populations.

DFWA indicates in its submission that there is considerable knowledge about the distribution range, preferred habitats, size at maturity and life history for the three target abalone species in the fishery. The submission also notes that significant genetic analysis studies have been conducted for Roe's abalone in WA to determine the scale of the population structures and the recruitment range for the species, and the outcomes have been factored into the management and research arrangements applied in the relevant areas of the fishery.

DEH notes that in addition to further independent monitoring surveys, there will be an ongoing need for biological data from other sources to support the recommended development of more biologically-based performance assessment measures. This would include data on growth rates, mortality and fecundity to determine life history trends, and further commercial catch sampling data representative of the scale of the fishery in all areas to support the assessment of size distribution and fishing mortality of stocks, particularly for greenlip and brownlip abalone. Sound biological data is also needed to validate changes in stock structure, distribution and abundance that is currently primarily estimated from existing catch and effort data, and hence provide greater certainty in the stock assessment process and setting of TACCs at ecologically sustainable levels.

DEH notes that some of this biological data may be made available by the recommended enhancements to the fishery independent survey programs. DFWA notes in its submission that, as part of its continuing process to improve the estimates of breeding stock, field information such as length frequencies and growth data, along with commercial sampling data such as shell measures, is collected for analysis. However it is not clear from the submission nor the relevant management regime documents whether a structured process is in place for obtaining a range of appropriate biological data.

DEH considers that DFWA needs to take into consideration the ongoing biological data requirements needed to enhance performance assessment measures across all areas of the fishery and enhance the research or commercial catch sampling programs accordingly.

Recommendation 8: *DFWA within 2 years to further develop biological sampling programs, representative of species distribution and catch across all Areas of the fishery, to provide the necessary data to inform the range of biological performance measures developed in accordance with Recommendation 3 and enhance the stock assessment process.*

Existing removals from the wild abalone populations include direct commercial wild harvest by the fishery, collection of broodstock for aquaculture purposes, recreational and indigenous harvest, and illegal harvest by unlicensed organisations or individuals. The highly selective nature of fishing operations means that the level of discarding, at less than 1% of landed catch, is an insignificant issue for the fishery.

As noted earlier in this report a comprehensive process is in place to take account of all legal commercial removals from the fishery. The fishery operates under an ITQ system with an annual TACC. Operators are required to record all abalone harvested, which are then decremented against the TACC. Estimates of the commercial catch factored into the stock assessment process are therefore highly reliable. Mandatory fishery logbook catch and effort must be completed on a daily basis, with monthly returns provided to DFWA for the stock assessment process. Logbook data is validated against mandatory CDR forms and processor returns to validate individual catch quota. Monitoring of the quota system includes sea and land patrols, inspections of landed commercial catches, and inspections of processing facility inspections, licences and gear. Penalties apply for breaching regulations and licence conditions.

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. DFWA continues to support the concept of beach weighing, but acknowledges that there are important logistical concerns that would need to be overcome before this could be introduced. These logistical issues relate primarily to the ability to consistently weigh abalone to a suitable degree of accuracy in locations where it is difficult to establish a flat, stable area where scales can be set up, or in isolated locations where scales must be transported over large distances on rough tracks.

However, it should be noted that although the received weight at the processor rather than the beach weight is decremented against quota, there is a legal requirement under the management plan for product to be weighed at the point of landing. This provides a valuable and constant reference point for compliance purposes. Also, the fact that the received weight at the processor, and not the beach weight, is used to determine quota usage is taken in account in the TAC setting process.

DFWA has advised that the harvest of abalone for use as aquaculture broodstock is accounted for within the quota management system. The broodstock collection process is currently undertaken through direct purchase of abalone from licensed commercial divers or through wild collection under the provisions of a Ministerial exemption notices granted under Part 7 of the *Fish Resources Management Act 1994*. Broodstock abalone purchased from commercial divers is counted as part of the total commercial quota and is subject to separate CDR and consignment provisions. Ministerial exemptions to collect broodstock are subject to a strict set of conditions to control the distribution and level of abalone collection, with limits of 300 Roe's, 300 greenlip and 100 brownlip abalone collected per exemption notice each year. DFWA notes that since 1998 only 688 greenlip, 61 brownlip and 90 Roe's abalone have been collected under Ministerial exemption notices, which is an insignificant amount of abalone removed compared to the overall commercial harvest.

As detailed earlier in this report, there is a sound and fairly comprehensive process in place to estimate and monitor the extent of recreational harvest of abalone across the fishery. As previously mentioned in this report, the recreational harvest of abalone accounts for around 20% of abalone removals from the fishery and is therefore a key component in the analysis of stock status and catch trends in the stock assessment process.

While DEH considers the current data collection and assessment processes for recreational harvesting are appropriate for the scale of the fishery, it notes that there is currently no restriction on the number of recreational licences issued for the abalone fishery, and that information in the WA State of the Fisheries Report identifies a dramatic rise in the last 10 years of recreational licences

permitting the collection of abalone (from less than 8,000 to over 20,000). DEH therefore considers that the size and impact of the recreational component will need to be closely monitored and further measures possibly taken to ensure that the impacts of recreational catch on available stocks continue to be accurately accounted for in the stock assessment process.

As previously noted there are currently no management arrangements to separately account for indigenous fishing. As indigenous people are required to abide by recreational catch arrangements, details of indigenous catch are incorporated in recreational catch estimates.

Similarly the DFWA submission and WA State of the Fisheries report do not provide an estimate of the extent of illegal abalone removals from the fishery, and illegal catches do not appear to be factored as a quantified amount in the stock assessment process. 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. While DEH acknowledges that the level of illegal abalone harvesting is difficult to quantify, the lack of data on illegal catch would prevent reliable assessment of total catch and provide further uncertainty in the stock assessment of the fishery. DEH considers that priority should be given to obtaining more reliable estimates of illegal abalone harvesting in WA and including this as an ongoing stock assessment component and performance measure for the fishery.

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

Recommendation 9: *DFWA to take account of all abalone removals, including best estimates of recreational and illegal harvesting, in the stock assessment process and the determination of the annual TACC.*

Management response

As noted earlier in this report, the ESD Report contains a series of objectives and performance measures relating to the harvest of greenlip, brownlip and Roe’s abalone. They include limit reference points and ranges relating to changes in catch rates and annual diver effort. For greenlip and brownlip abalone, an additional reference point of changes in average annual meat weight is used as an indicator of changes in abalone abundance. For Roe’s abalone, performance measures are being developed that will draw on the independent survey program in the Perth Area to give a better indication of stock levels and structure for local Roe’s abalone populations, while a system of monitoring changes in average meat weight is being developed in conjunction abalone processors. As stated earlier in this report, DEH has recommended the collection of further independent survey and biological sampling data for the commercial catch to better inform the stock assessment process across the fishery and support the development of more biologically based performance measures in the management regime.

The catch rate and effort reference points are monitored against 5 year data ranges (1994-98), while meat weight is monitored against a 6 year average (1995-2000). These periods were used as benchmarks by DFWA due to their stable and acceptable catch levels, although longer time series of catch and effort data are available to support performance assessment. Monitoring of reference points is generally undertaken at an Area scale, although average catch rates, total catch and average meat weights are also measured for certain sections within the main greenlip and brownlip abalone fishing Area to detect more localised stock trends and fishing impacts. For Roe’s abalone, a finer spatial scale of assessment is undertaken through measurement of changes in catch and effort

within the 10x10 nautical mile fishing blocks, within reference limits to measure and respond to significant spatial changes in harvesting.

DEH notes that in the event that a trigger point is breached, a review of the fishery status and management options is required. The submission outlines a number of potential generic management responses, including changes in quota allocation, additional area or temporal closures and changes in legal size limits. DEH has recommended, earlier in this report, the development of timeframes to be applied when reviewing breaches in performance measures and implementing appropriate management responses.

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

The key commercial fishing control measures are:

- limited entry through restricted number of fishing licences (27 endorsed to take Roe's abalone, and 15 endorsed to take greenlip and brownlip abalone);
- individual and area quotas generated from an annual TACC);
- minimum legal size limits, adjusted for species and particular Areas, to ensure sufficient levels of spawning stocks and recruitment to the fishery;
- area and seasonal closures, in particular closures to avoid cumulative impacts with areas of high recreational abalone harvesting.

TACCs and quota limits are set annually by the Executive Director of the DFWA in consultation with AbMAC and on advice from the Research Division of the DFWA. The TACCs and ITQs have been in place since the mid 1980s to restrict the level of abalone catch.

The comprehensive monitoring system for the recreational abalone harvesting sector is supported by a range of management controls that include:

- daily bag limits of 20 Roe's abalone and 5 greenlip and brownlip abalone (as of 1 Oct 2003);
- daily boat limits of twice the daily bag limits;
- minimum legal size limits for harvested abalone;
- restricted access to highly fished areas eg. Perth recreational Roe's abalone fishery only open for a total of 9 hours each year.

DFWA advised in their submission that data is currently collected at a relatively fine spatial scale across the fishery to detect trends in localised depletion of abalone stocks. However, this data is largely drawn from commercial catch and effort sources, and DEH has noted earlier in this report that there is a risk, given the aggregating nature of abalone stocks, that localised overfishing can occur without being reflected in the fishery dependent data sets.

Indications of serial depletion of both greenlip and brownlip abalone stocks and the absence of finer scale spatial management measures at the metapopulation-levels were identified by public comments on the DFWA submission as requiring urgent attention to conserve greenlip and brownlip abalone stocks and ensure the longer term sustainability of these species in this fishery.

DFWA in its submission has identified concerns with actual and potential localised depletions in certain areas of the fishery, such as evidence of localised stock depletions for greenlip and brownlip abalone since the commencement of commercial fishing in the Area with the highest greenlip and brownlip TACC (Area 3), and localised depletion of Roe's abalone in Area 8 due to a concentration of fishing effort.

DEH acknowledges that DFWA and commercial operators has taken steps in some areas of the fishery to implement finer spatial scale management measures. These include:

- voluntary reduction in TACCs to address potential overfishing and redirect effort in some Areas in certain seasons;
- monitoring of locations of catch and effort within 10x10 nautical mile grid blocks for Roe's abalone to assess finer scale changes in stock distribution and abundance;
- increases in size limits to deter localised overfishing in some Areas;
- monitoring of catch and average meat weight trends in several sectors within the highest greenlip and brownlip catch Areas of the fishery;
- fine scale transect surveys of catch, effort, density and size frequency of Roe's abalone to monitor changes in stock structure and abundance in key reef areas close to the Perth metropolitan area;
- intention to develop precautionary decision rules to respond to changes in average meat weight for greenlip and brownlip abalone.

DEH is encouraged by the more structured process that appears to be in place for Roe's abalone to systematically detect and respond to the more significant threats of localised overfishing and serial depletion. DEH considers that a more systematic process should be established for greenlip and brownlip abalone to address potential problem areas with stock abundance and recruitment and reduce the risk of localised serial depletions.

DEH notes that the parameters and process to be used to prevent serial depletions are not currently defined in the WA abalone fishery management regime. A more structured approach should be developed, in conjunction with the AbMAC and operators, to establish decision rules or corrective strategies to implement controls for greenlip and brownlip abalone that allow for more effective and rapid responses to the potential overexploitation and declines of stocks at finer scales of management.

Recommendation 10: *DFWA to investigate and establish, over the next 3 years, appropriate decision rules or strategies, relevant to the scale of management required, to prevent serial depletion of brownlip and greenlip abalone stocks in the fishery.*

This report has previously noted that a sound process exists to ensure compliance within the legal commercial abalone fishery operations. In addition to the measures previously stated, DFWA is attempting to implement a National Docketing System similar to that used in other States to enhance the monitoring of abalone trade and deploy similar levels of scrutiny of abalone movements. DFWA stated in its submission that it spends around \$750,000 each year on enforcement and compliance monitoring in the abalone fishery on a range of initiatives including land patrols, aerial surveillance, processing factory inspections and covert surveillance.

DEH has noted earlier in this report the serious concerns with the extent of illegal harvest of abalone from abalone fisheries in Australia, and has recommended that priority be given to more accurately quantifying the extent of the illegal take of abalone in WA and factoring this formally into the stock assessment and TACC setting processes. The ESD Report for the fishery includes the estimated level of illegal landings as one of the compliance indicators for the fishery, and the

ongoing collection of data on illegal activities is one of the key data collection requirements. DFWA's submission notes that the Department's Serious Offences Unit and Regional Services Division are actively engaged in gathering intelligence on suspected and known illegal activity and also prosecuting those involved with the illegal harvest and sale of abalone. DFWA also note there is a close working relationship with fisheries enforcement areas in other States and with the WA Police Department.

While DFWA notes that it has recently conducted compliance risk assessments for the fishery and negotiated a comprehensive compliance activity schedule, it is not clear what specific measures or strategies are in place under the management regime to more accurately quantify the extent of illegal harvesting and reduce the level of illegal take.

DEH acknowledges that illegal harvesting is a key issue for DFWA'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. DFWA should consider similar approaches in WA, 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 11: *DFWA to work with other jurisdictions to develop effective strategies and response measures to quantify and reduce the extent of illegal take of abalone in WA.*

While several other species of abalone occur in WA waters, DFWA has advised that neither these nor any other species are taken as byproduct in the fishery.

Conclusion

DEH considers that the management regime in the WA abalone fishery is appropriately precautionary and provides for the fishery to be conducted in a manner that does not lead to fishery-wide over-fishing.

DEH considers that, with DFWA'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'*

DFWA consider that stocks harvested within this fishery are currently above defined reference points. Trigger points and management responses are in place to avoid the risk of overfishing the abalone stocks in the fishery. DEH has made a range of recommendation earlier in this report to reduce the risk of overfishing and assist with the recovery of stocks, including:

- further collection of crucial biological data to inform and enhance the range and accuracy of performance measures and stock assessment process for the fishery;
- enhanced fishery independent monitoring programs to improve understanding of stock structure and abundance;
- linking of timeframes to management responses implemented following breaches of reference points; and
- development of decision rules and strategies to prevent serial depletion of brownlip and greenlip abalone stocks.

As noted earlier in this report, DFWA has in place a generic response process for when reference points are triggered. Actions such as reductions in TACCs and increases in legal size limits have been applied in the past in response to concerns over the status of abalone stocks in certain areas of the fishery.

DEH considers that the management measures in place, such as the performance measures, management responses, scope to further improve data collection and the range of reference points in the fishery, together with other DEH recommendations; should prevent stocks from falling below the defined reference points. Therefore this objective is not applicable to this fishery, at this time.

However DEH suggests continued close monitoring of stocks in the more highly fished Areas to ensure the implementation of timely management responses as needed. Should the stocks become overfished, DEH believes that DFWA has the tools it needs and the willingness, as demonstrated by past actions, to recover stocks.

Conclusion

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

Ecosystem impacts

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

Bycatch protection

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

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. However, should this situation change, DEH suggests that appropriate actions be undertaken to ensure bycatch species are not threatened from the fishery.

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 DFWA 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 and threatened species. Due to the fishery's operation in Commonwealth waters, operators are subject to Government cetacean guidelines. Key elements of these guidelines most relevant to the operation of the fishery are:

- When operating a vessel within 300 m of a whale, move at a constant close speed, no faster than the slowest whale or at idle, 'no wake' speed;
- Avoid sudden or repeated changes in vessel speed or direction;
- Do not approach whales closer than 100 metres;
- Do not attempt to approach mothers and calves.

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 DFWA so that the level of interactions occurring can be more accurately quantified.

Recommendation 12: *DFWA to provide a mechanism which allows fishers to record interactions with protected/listed species.*

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, 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 formal risk assessment conducted on the fishery, and outlined in the ESD Report, identified only low to negligible risks of impacts on the broader ecosystem for all aspects of abalone harvesting in the fishery. The WA 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. following the diver and not anchoring). 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 level of discarding of shells and abalone gut 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 or the marine environment generally.

DFWA'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 or have a direct effect on the structure of algal communities. 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. 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.

DEH notes that while the broader environmental impacts of abalone fishing may appear to be low, it is concerned at the lack of information collection and research covering the fisheries impact on the ecosystem and environment generally. However, this lack of information is common across a range of Australian and international fisheries and until appropriate research techniques and programs are developed and implemented this will continue to be the case. DEH strongly supports research in this area.

DEH notes that other jurisdictions have included ecosystem and environmental performance indicators within their abalone management regimes. DFWA has noted that it does not intend to review the general environmental impacts of its abalone fishery until its next major review, which may be several years away.

DEH considers that while immediate impacts may be low, a fully effective ecosystem based management approach requires DFWA to institute a more structured process within its abalone management regime to monitor any effects of harvesting on the broader ecosystem. DEH notes that research proposals relating to other southern water fisheries have recently been submitted to FRDC on the ecological impacts of abalone and rock lobster fishing in the temperate reef environments. DEH is encouraged by this approach and supports the funding of these type of projects by FRDC as a means of enhancing the awareness of the indirect effects of fishing on temperate reef ecosystems. DFWA may be able to draw on the findings in their ongoing management arrangements of any such studies that may eventuate.

Regardless of the outcome of these funding applications, DFWA should pursue the development of preliminary measures to monitor environmental impacts of abalone fishing with a view to eventually reviewing the extent of these environmental impacts as part of the stock assessment process.

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

AbMAC	Abalone Management Advisory Committee
CDR	Catch and Disposal Record
CPUE	Catch Per Unit Effort
DEH	Department of the Environment and Heritage
DFWA	Department of Fisheries Western Australia
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ESD	Ecologically Sustainable Development
FRDC	Fishery Research and Development Corporation
FRMA	Fish Resources Management Act, 1994
FRMR	Fish Resources Management Regulations, 1995
GLM	Generalised Linear Model
ITQ	Individually Transferable Quota
MARPOL	International Convention on Marine Pollution
NDS	National Docketing System
TACC	Total Allowable Commercial Catch
The Plan	Abalone Management Plan 1992
UNCLOS	United Nations Convention on the Law of the Sea
WA	Western Australia
WAAIA	Western Australian Abalone Industry Association
WAEPA	Western Australian Environmental Protection Authority