



Australian Government

Department of the Environment and Heritage

Assessment of the Victorian Abalone Fishery

**Wildlife Trade and Sustainable Fisheries Branch
Approvals and Wildlife Division, Department of the Environment and Heritage**

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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 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. 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 Victorian
Abalone Fishery**

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EXECUTIVE SUMMARY

Background

Fisheries Victoria, a division of the Department of Primary Industries, provided a report addressing the Commonwealth's *Guidelines for the ecologically sustainable management of fisheries* for assessment under Parts 13 and 13A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The draft submission *Assessment of the Victorian Abalone Fishery against Guidelines for the Ecologically Sustainable Management of Fisheries* was submitted for assessment in May 2001 and discussed with Environment Australia (EA) before its release for a thirty-day public comment period that expired on 20 August 2001. Two public comments were received and Fisheries Victoria provided a response to the issues raised.

The submission reports on the wild harvest of blacklip (*Haliotis rubra*) and greenlip (*H. laevigata*) abalone from the Victorian Abalone Fishery (VAF) against the Commonwealth's *Guidelines for the ecologically sustainable management of fisheries*. The EA assessment considers the submission and associated documents, including the public comments, Fisheries Victoria's response to the comments, Victorian Abalone Fishery Management Plan 2002 and the Victorian Abalone Fishery Assessment Group's assessment reports for the VAF.

Apart from the limited harvesting of abalone wild stocks to serve as aquaculture brood stock, Environment Australia's report does not address abalone aquaculture management arrangements in Victoria.

Table 1: Summary of Victorian abalone fishery

Area	Victorian State waters, extending into Commonwealth waters of the northern Bass Strait region.
Fishery status or development stage:	Fully fished commercial fishery
Stock assessment reliability:	Status of stock determined by catch trends and population models
Target Species	Primarily Blacklip abalone (<i>Haliotis rubra</i>) - greenlip abalone (<i>Haliotis laevigata</i>) taken as minor by-product
Gear	Diver hand collection
Bait species	Nil
Fleet	Diver support boats of 6 to 8 metres
Commercial harvest 2002/03:	Total Allowable Catch of 1,432 tonnes
Value of commercial harvest (including byproducts):	\$70 million at 2000/01 beach prices
Five year trend and average (commercial):	Stable catch of allocated TAC for last 5 years
Recreational harvest 2001	Estimated 11 tonnes
Commercial licences issued:	1,420 quota units distributed amongst 71 licence holders
Management arrangements Commercial:	Quotas, legal minimum lengths, limited entry, 3 commercial zones, night closures.
Recreational management arrangements	Possession and boat daily collection limits, licences, legal minimum lengths, night and seasonal closures (for greenlip abalone)
Export	Virtually all commercial catch exported, small domestic market
Bycatch	None
Interaction with Threatened Species	None reported

The VAF is the most valuable state-managed fishery in Victoria. It's landed catch value for wild abalone production is around \$70 million per annum based on 2000/01 beach prices. Around \$3.2 million is additionally derived from production of seed abalone from hatcheries in the developing

Victorian abalone aquaculture sector of this fishery. The VAF provides around 10% of the world wild abalone production.

The fishery is a dive fishery for hand collection of individual wild abalone growing on substrate such as sheltered reefs or rock crevices. Abalone are univalve gastropods which can grow to a shell length of 250 millimetres and live up to 20 years. Abalone spend 5 to 10 days as larvae then settle on reefs. Abalone reach sexual maturity at about three years of age, and grow to harvestable size in four to ten years. As larval and adult movements are generally restricted to ranges of 10 to 100 metres, abalone tend to form patchily distributed but highly dense aggregations, leading to concentrated harvesting in discrete areas. Abalone feed on algae, and are preyed upon by crabs, rock lobster, octopi, fish and rays.

The Commonwealth and State of Victoria are signatories to an Offshore Constitutional Settlement (OCS) agreement which gives the State of Victoria management responsibility for abalone below low water mark. The VAF extends into Commonwealth waters in the northern region of Bass Strait and is divided into 3 separate management zones. The meridian of latitude 39° 12' south which runs about six nautical miles south of Wilson's Promontory is the generally agreed border. As abalone is normally harvested inshore from depths up to 30 metres, fishing operations are primarily located in State waters.

There are two commercially harvested abalone species in the fishery – blacklip abalone (*Haliotis rubra*), comprising 99% of the current commercial catch, and greenlip abalone (*H. laevigata*). Fishing for abalone is permitted for the full year with the quota management season applying from the 1 April until the 31 March the following year. The commercial fishery commenced in 1962 and has been subject to limited entry licensing arrangements since 1968. Output controls in the form of Total Allowable Catch (TAC) were introduced in 1988 after peak yields of around 1900 tonnes were achieved in 1987/88. This level of take was considered unsustainable so the TAC for blacklip abalone was reduced by 25% in 1988 to 1440 tonnes and ITQs introduced along with a comprehensive quota monitoring system, the Abalone Quota Management System (AQMS). The TAC is subject to an annual stock assessment process by an Abalone Fishery Assessment Group (AbaloneFAG) that includes representatives from industry, fisheries management agencies, scientific organizations and peak conservation bodies. This is coordinated by the Marine and Freshwater Resources Institute (MAFRI) of DPI's Research Institute.

Greenlip abalone was severely overfished in the late 1960s and early 1970s when catches peaked around 260 tonnes. Since then reported annual catches have not exceeded 5 tonnes and a zero commercial TAC has recently been applied to greenlip abalone in Victoria and in accordance with the fishery management plan will remain until further certainty is obtained on the sustainability of existing stocks.

Due to the targeted harvesting techniques employed in the fishery there are no byproduct species, minimal levels of bycatch, negligible impacts on protected species and the broader marine environment and no interactions with threatened ecological communities.

The fishery is managed in accordance with the Victorian Abalone Fishery Management Plan 2002 which is administered by Fisheries Victoria under the Victorian *Fisheries Act 1995* and supporting Regulations. It is a multi-sector fishery including commercial harvest of wild abalone, recreational harvesting and aquaculture production both on and offshore. Available information indicates a limited indigenous take of wild abalone, with indigenous catch primarily managed under the recreational catch arrangements, although provision exists in Victorian fisheries legislation to accommodate specific indigenous cultural ceremonies.

The Management Plan for the fishery specifies a range of input and output controls for the commercial harvesting sector, including limiting entry to 71 holders of Abalone Fishery Access Licences (AFAL), individual transferable quotas (ITQs), zonal management and legal minimum lengths for target species. The recreational sector and wild broodstock collection for aquaculture are controlled through licenses and possession limits along with seasonal and nocturnal closures. The 'legitimate' recreational catch is estimated to be very small at around 1% of the commercial catch. The broodstock collection is strictly controlled and less than 1% of other commercial wild harvest. Abalone processors are an integral component of abalone harvesting arrangements with 19 processors operating in the fishery, with all required to hold Fish Receiver (Abalone) Licences under the *Fisheries Regulations 1998*. The commercial licensed sector is amongst the most tightly regulated (i.e.-sealed bins prior to landing) and closely monitored quota (i.e.- real time catch reporting and documentation) managed fisheries in Australia.

The valuable nature of abalone product has made it subject to suspected increasing levels of theft from a range of both organised and casual sources. The uncertainty with levels of theft is a major issue to be addressed further in the stock assessment and management processes and a key priority in the fishery in order to maintain ecologically sustainable abalone harvest levels. An Abalone Fishery Compliance Strategy, that includes a range of measures such as a quantitative Illegal, Unreported and Unregulated (IUU) reporting system, has recently been developed and is being implemented to monitor trends in illegal catches and take appropriate action to reduce illegal activity.

Associated with the recent establishment of Marine National Parks and Marine Sanctuaries along the Victorian coast, was a commitment from Government to inject an additional \$14.3 Million over 4 years and over \$3 Million per annum on-going into enhancing DPI's fisheries compliance capability. Included as one of the objectives of this initiative, was the achievement of substantial reductions in the level of abalone theft.

DPI has moved to implement the enhanced fisheries compliance budget initiative by engaging a number of additional Fisheries Officers and Investigators, along with specialist equipment and infrastructure, to enhance both regional and state-wide enforcement operations along the coast of Victoria.

The availability of these additional resources has been taken into account in developing the Strategy and specifically in the development of performance indicators and targets against which the effectiveness of the Strategy will be assessed.

Overall assessment

The material submitted by Fisheries Victoria indicates that the fishery operates generally in accordance with the Commonwealth *Guidelines for the ecologically sustainable management of fisheries*. EA concurs that the VAF 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 minimized in the longer term. Overall, the management regime, including detailed analysis of catch data, well structured stock assessment process, independent monitoring, performance measures, management actions and review processes suggests that the fishery is being managed in an ecologically sustainable manner.

In making this assessment, EA is satisfied that the information collection system, risk assessments, management arrangements and overall objectives are sufficient to ensure the fishery is conducted in a manner to prevent stocks being overfished and to maintain an ecologically sustainable yield from

the fishery. EA recognizes that further improvements to management may result from a number of Fisheries Victoria initiatives, in particular improved precision in the AQMS to be delivered through the new Beach Weighing Catch Registration System (BWCRS) and the efforts to quantify and reduce illegal catch through a range of measures under the Abalone Compliance Strategy. EA notes that these measures provide an immediate redress to the declining biomass levels detected in the stock assessment process, and has recommended that these aspects of the fishery's operations be closely monitored to ensure that they do result in an identified recovery in blacklip abalone biomass levels.

Considering the research and monitoring programs and management arrangements in place and the particular selective and benign nature of the fishery operations, EA is satisfied that fishing operations are managed to minimize their impact on the structure, productivity, function and biological diversity of the ecosystem. Management of the fishery has a history of reacting appropriately to threats to sustainability and EA is confident that Fisheries Victoria will continue to provide high quality management.

As the principal fishery area occurs in Commonwealth waters, consideration under Part 13 of the EPBC Act is required regarding the impact of the fishery on listed threatened species and threatened communities, listed migratory species, cetaceans and listed marine species. While a number of protected species occur in the fishery area, there is little indication from available information of any significant interactions with protected species. EA is therefore satisfied that the operations of the fishery ensure that it is unlikely to have an unacceptable impact on protected species. EA is also satisfied that in the event that interactions are detected Fisheries Victoria will ensure that all persons engaged in fishing are required to take all reasonable steps to minimize impacts. EA recommends that this fishery be accredited under Part 13 of the EPBC Act.

The assessment concludes that the VAF is managed in an ecologically sustainable way. EA recommends that the export of *Haliotis rubra* and *H. laevigata* should be exempt from the export permit requirements of Part 13A of the EPBC Act, with that exemption to be reviewed in five years.

To further strengthen the effectiveness of the management arrangements for the VAF, and to contain the environmental risks in the medium to long term, EA has developed a series of recommendations and made a number of suggestions. The implementation of these and other commitments made by Fisheries Victoria in the submission will be monitored and reviewed as part of the next Commonwealth review of the fishery in five years time.

Recommendations

Recommendation 1: *Fisheries Victoria should inform Environment Australia of any future changes to the management regime of the Victorian Abalone Fishery.*

Recommendation 2: *Abalone Fishery Committee to report on the performance of the fishery against fishery objectives, performance indicators and reference points as part of the annual Fishery Assessment Report process.*

Recommendation 3: *Fisheries Victoria 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, along with periodic review of respective abalone stock assessment processes.*

Recommendation 4: *Abalone Fishery Committee to give priority to defining target biomass to produce the ecologically sustainable yield from the fishery within 3 years and review this estimate within the context of the annual stock assessment process.*

Recommendation 5: *Fisheries Victoria to ensure reliable growth data across the various regions of the fishery is obtained as a high priority to ensure the effectiveness of existing management controls and continued sustainability of abalone stocks.*

Recommendation 6: *Fisheries Victoria to investigate and establish, over the next 3 years, appropriate decision rules, relevant to the regional-scale or sub-zonal management, to prevent the potential serial depletion of abalone stocks.*

Recommendation 7: *Fisheries Victoria to review within 3 years the effectiveness of beach weighing measures currently being implemented, including any implications for the stock assessment process.*

Recommendation 8: *Fisheries Victoria to take actions to improve the reliability of illegal catch estimates and establish and implement measures to achieve the reduction targets set out in the Victorian Abalone Fishery Compliance Strategy.*

Recommendation 9: *Fisheries Victoria, within 12 months, to assess the extent of take and level of recreational abalone fishing, with an emphasis on greenlip abalone impacts, and implement additional management measures where necessary.*

Recommendation 10: *Fisheries Victoria to ensure a full risk assessment on the ecological implications, including disease and genetic impacts, of artificial stock enhancement of abalone in Victorian reefs is completed before any reseeded program is undertaken.*

Recommendation 11: *The Abalone Fishery Committee to give priority to the development of decision rules based on an identified list of indicator species to provide the basis for monitoring and responding to ecosystem changes.*

PART I - MANAGEMENT ARRANGEMENTS

The Victorian abalone fishery is managed by Fisheries Victoria, a Division of the Department of Primary Industries (DPI). Its management procedures fit within the structure of the Victorian Abalone Fishery Management Plan 2002 administered under the *Fisheries Act 1995*. In acknowledging the value the species provides to the Victorian community, the Department of Primary Industries (DPI) has included abalone in the *Fisheries Act 1995* under the definition of a 'priority species' (the only other priority species is rock lobster). Extensive rules and regulations govern the harvest, possession and sale of priority species to ensure the ongoing sustainability of the resource.

The management regime for the Victorian abalone fishery is well documented, publicly available and transparent. The documents relating to the management regime comprise the Victorian Abalone Fishery Management Plan 2002, *Fisheries Act 1995* and *Fisheries Regulations 1998*. The documents are available from DPI and online at DPI's website. Prior to entering the fishery, commercial fishers are provided with a copy of these documents and briefed on the management arrangements.

It is mandatory under the Victorian *Fisheries Act 1995* to consult with peak bodies on key fisheries management issues. The Abalone Fishery Management Plan was developed through a reference group, involving a wide range of community stakeholders reporting to a ministerially appointed steering committee with an independent chair. The Plan was made available on DPI's website for public comment before finalisation. The Fisheries Co-Management Council (FCC), an expertise based Ministerial advisory body established under the Act, oversaw the process.

The Victorian abalone assessment submission was widely available to the public on the EA web site, with copies available from DPI's offices and targeted mail outs to key stakeholders. Input on the assessment report was sought from other abalone stakeholders including industry, scientific and peak conservation group representatives.

The ongoing management of the fishery under the Management Plan emphasises co-management arrangements. A key management body is the Abalone Fishery Committee (AFC) of the FCC that advises the Minister on the Total Allowable Catch (TAC) and legal minimum length (LML) measures, along with advice on research, compliance and other issues relevant to the status of the fishery. The AFC includes an independent chair, the Departmental fishery manager, industry experts from each of the fishery zones, an expert on abalone processing and marketing, an abalone fishery scientist, recreational and conservation experts.

The AFC seeks information from a variety of sources, and one of the key groups is the Abalone Fishery Assessment Group (AbaloneFAG). This body provides scientific and technical input to the stock assessment, prepares the annual Abalone Fishery Assessment Reports and advises on future research priorities. The Abalone FAG includes scientists with expertise in abalone biology and fish stock assessment, fisheries managers from Fisheries Victoria, AFC representatives, abalone fishery licence holders and processors, and representatives from the peak conservation (Victorian National Parks Association) and recreational fishing bodies and representatives from the DPI coastal regions. The annual Abalone Fishery Assessment Reports are published by MAFRI and distributed to all stakeholders.

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

- Annual performance monitoring of the fishery by the AFC;
- Annual Fishery Assessment Report by the AbaloneFAG;

- Annual review by AbaloneFAG of research requirements; and
- Review and reconciliation checks on data in the Abalone Quality Management System.

The Management Plan is in force for a period of 5 years, and then subject to review involving public consultation. If required the Minister may also amend the Plan before its review through a formal public consultation process with stakeholders.

EA considers that the management framework is sound and comprehensive with adequate opportunity for external contribution to management and stock assessment processes. While EA considers it important that management arrangements remain flexible to ensure timely and appropriate managerial decisions, future changes to the management regime could have bearing on the outcomes of EA's assessment of the fishery. EA will therefore require advice from Fisheries Victoria on significant changes to the management regime and management processes.

Recommendation 1: *Fisheries Victoria should inform Environment Australia of any future changes to the management regime of the Victorian Abalone Fishery.*

Fisheries Victoria states that the objectives for the Abalone fishery are in accordance with the Victorian Fisheries Act 1995, the Victorian Abalone Fishery Compliance Strategy, the Standing Committee on Fisheries and Aquaculture's ESD framework and Environment Australia's Guidelines for the Ecologically Sustainable Management of Fisheries.

The Abalone Fishery Management Plan provides a suite of performance indicators and reference points associated with ecological, economic, social and governance objectives for the fishery. The objectives address the productive capacity of abalone stocks, wider ecosystem impacts of abalone fishing and prevention of illegal abalone fishing. The Management Plan includes details of action to be taken by the AFC once a trigger reference point is reached, including further monitoring over the following year, immediate investigation of stock assessment, and adjustment of TAC or LML or other appropriate actions to restore biomass above trigger levels within 5 years.

EA notes that the reports on the annual Fishery Assessment Reports, while comprehensive, do not make reference to whether the relevant ecological management objectives and performance measures in the Management Plan have been achieved or how the fishery is performing against the relevant reference points. EA considers this should be reported in the context of the stock assessment process to provide an indication of the effectiveness of current and proposed stock management measures.

Recommendation 2: *Abalone Fishery Committee to report on the performance of the fishery against fishery objectives, performance indicators and reference points as part of the annual Fishery Assessment Report process.*

Fisheries Victoria acknowledges that there are some limitations in available data that influence the reference points used, in particular the limited data on sustainable egg production at various spatial aggregations to accurately determine mature biomass across the fishery. Fisheries Victoria also notes that more work is required on modelling biomass estimates for abalone across all regions to obtain a more accurate estimate of biomass and associated biologically-based reference points once this information is obtained.

EA 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, there are limited practical requirements for jurisdictions to jointly manage abalone from the same recruiting stock. Nonetheless, EA considers that all states commercially harvesting abalone would benefit from improved stock assessments and development of more standardised reference points with a sound biological basis.

Recommendation 3: *Fisheries Victoria 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, along with periodic review of respective abalone stock assessment processes.*

The commercial fishery has a balanced mixture of input and output controls including limited entry, zonal TAC's and ITQ's and minimum legal size limits, landing of abalone in sealed bins, documentation and real time catch reporting. Daily bag and possession limits, size limits and post landing requirements also exist for recreational divers. In recognition of the currently depleted greenlip abalone stocks, greenlip and blacklip abalone are managed under separate stock arrangements, with separate TAC's and additional measures for greenlip abalone, such as seasonal closures.

The stock assessment processes underpinning control measures, such as TACs, are detailed in the annual Fishery Assessment Reports. Various measures are proposed in the Management Plan and the Victorian submission to improve the outputs from the stock assessment and performance monitoring processes.

Further discussion on harvest controls is provided in Part II of this report.

Well established monitoring and compliance systems are in place for the legal commercial catch of abalone to ensure compliance with quota allocations. Reporting requirements include daily catch and effort logbook data that is validated through a catch docketing system under the Abalone Quality Management System (AQMS). The AQMS, administered by Fisheries Victoria provides a comprehensive audit trail from point of landing to point of export or domestic sale, with strict reporting and transporting conditions for divers, traders and processors alike. This system is supported by electronic database systems to reconcile catch data and inventories of stock held by processors.

A range of surveys are used to monitor and estimate the extent of recreational abalone catch.

A Statewide Quality Inspection Program (SQIP) is in place to assist with a range of compliance measures including intercepting illegal catches. SQIP that fisheries officers, with police assistance, in a range of compliance measures, including routine surveillance, intelligence gathering, inspections of both licenced and unlicenced operators and targeted covert operations. Processors and storers of abalone are licensed and licence holders are subject to random inspection and review. SQIP also addresses recreational compliance through patrols, random licence checking and educational programs by specialist recreational fisheries officers. The Management Plan notes the intention to enhance the performance monitoring and review of the AQMS by establishing a monitoring and reporting system that will highlight the level and outcomes of compliance inspections.

Both the Management Plan and the Victorian submission acknowledge the deficiency in information on both illegal and recreational catches, and identify the high level of abalone theft as the major threat to the fishery and the most significant challenge to managing the fishery. The annual illegal catch is estimated to range from 10-40% of the legal catch. Estimates of illegal and

recreational fishing catches are included in the stock assessment models and factored into biomass and catch level targets. An Abalone Fishery Compliance Strategy targeting the harvesting, processing and marketing sectors of the fishery has been developed to guide enforcement and deter illegal activities. Further initiatives will be pursued to improve the estimation of recreational catch and factor this into ongoing commercial and recreational management measures.

Further discussion on compliance and enforcement measures is provided under Part II in this report.

As harvesting techniques for the target species are confined to diver hand collection, the actual harvesting operations provide minimal impact on the wider marine ecosystem. The Management Plan contains performance indicators on ecosystem health and monitoring of ecosystem entities, and commitments to annual fishery independent surveys on aspects such as abundance of predator species, habitat, food and shelter organisms, with a reporting process through the AbaloneFAG and AFC. The FCC Research Committee's 5 year research plan includes among its abalone research priorities ecosystem level projects such as development of environmental sustainability indicators, interactions between abalone and other benthic predators and competitors, and impact of marine protected areas on abalone sustainability and yields.

Further discussion on the impacts of the fishery on the wider marine ecosystem is provided in Part II of this report.

The relatively benign method of fishing employed in the fishery results in very little or no contact with other species. Fisheries Victoria note there are no threatened species affected by the fishery and as a result no threat abatement plans, recovery plans or bycatch action plans are required. Similarly, international or regional management regimes to which Australia is a party have little bearing on the activities in the fishery. As the fishery includes Commonwealth waters, divers and operators are required to comply with the International Convention on Marine Pollution (MARPOL). Given the nature and scale of the fishery, EA is satisfied that the fishery poses insignificant risk to air and water quality and that management arrangements will ensure that MARPOL obligations are met.

Conclusion

EA is satisfied that the management regime in the Victorian Abalone Fishery is appropriately precautionary and provides for the fishery to be conducted in a manner that will maintain ecologically viable stock levels and for fishing operations to be managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem.

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

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 collection of catch and effort data for both blacklip and greenlip abalone taken from the fishery. Daily commercial landings are reported at a relatively fine scale, referring to the area and specific reef complex, small bay or headland from where abalone were taken. Fishery dependant catch weight and effort data are collected through daily log books returns and transferred via a docketing system to the Abalone Quota Management System (AQMS) that also incorporates market returns from processors. This provides not only a secure audit trail and acquittal process from point of landing to point of sale but also an automated system for tracking attainment of individual quotas and readily available statistics for resource assessment.

Further work is being undertaken on use of GPS recording and digital scanning technology to enhance finer scale spatial reporting and improve efficiency of age/length recording of catch, with limited industry trials underway.

Officers from the Marine and Freshwater Research Institute (MAFRI) of the DPI periodically sample the commercial catch at processing factories and aboard dive vessels to record size structure and reproductive condition of the catch. MAFRI officers also conduct on-board observations from abalone support boats to record instantaneous catch rates and diver behaviour, including harvesting techniques and dive depth profiles. Divers are also interviewed about their general observations of the conditions of the fishery and general state of the ecosystem at each site dived. Their views are incorporated into the annual Fishery Assessment Report.

A comprehensive fishery independent survey program for blacklip abalone supplements fishery dependent data and assesses the reliability of industry-derived information in relation to catch rates and changes in abundance. MAFRI has conducted annual underwater independent surveys for over 10 years for blacklip abalone at 150 fixed survey locations across the commercial abalone fishing grounds. The surveys measure relative abundance, spatial distribution and shell length of abalone. Outcomes from these surveys are an integral component of the stock assessment process. An ongoing tagging program studies growth, natural mortality and movement of blacklip abalone, and also integral components of the stock assessment process. Fisheries Victoria claims the initial results show limited impact by intensive abalone fishing on the growth potential of sample abalone populations. The research program includes priorities for enhancing the collection of size composition and abundance data and revision of historical data to further improve spatial management in the fishery.

Prior to the introduction of the new Management Plan in 2002, greenlip abalone were managed as a common stock with blacklip abalone under the same TAC limit and hence were subject to a similar fishery dependant data collection regime. Historical catch records for greenlip abalone indicate that the species has never exceeded 5% of the total Victorian abalone catch, and is now estimated to be

less than 1%. Long term catch histories and targeted surveys of greenlip abalone stocks in 1998 have confirmed that greenlip abalone stocks are severely depleted. The new Management Plan has subsequently imposed a zero TAC on the commercial catch of greenlip abalone. While this will limit the availability of ongoing fishery dependant data, the historical commercial catch records and growth and reproductive studies, along with the recent independent surveys, have provided sound historical data on which to base further management decisions on rebuilding the depleted greenlip stocks. In the absence of fishery dependant data, the new Management Plan commits Fisheries Victoria to bi-annual resource surveys for each aggregate of greenlip abalone reefs to monitor population densities, length frequencies and productive seabed areas, as an ongoing assessment of the recovery of greenlip abalone populations. The evaluation of the sustainable yield from greenlip abalone stocks is also a current research program priority.

EA notes that the collection of recreational data has been less systematic to date and reliant on opportunistic measures, such as fisheries creel and telephone surveys. This approach is potentially problematic, given the severely depleted state of greenlip abalone stocks and the capacity for continued recreational take, even if at very restricted levels. The Management Plan acknowledges that while the current estimate of annual recreational catch of blacklip and greenlip abalone combined is believed to be very small in comparison to commercial catches (current estimate 11 tonnes from the National Recreational and Indigenous Fishing Survey), ongoing recreational catch and effort need to be determined. The Management Plan notes that MAFRI will conduct a systematic sampling and estimation process for recreational licence holders, along with a continuation of specific creel surveys at selected landing sites. The Victorian submission also notes that the National Recreational and Indigenous Fishing Survey currently underway will contribute to improved estimates of recreational catch.

The availability of information to determine the extent of illegal catch in the fishery is more problematic. A recent FRDC project 'Assessment of Illegal Catches of Australian Abalone' was commissioned to develop desk-based survey methods to more accurately estimate illegal abalone catches from abalone fisheries across Australia. The project examined available fisheries intelligence and compliance-monitoring data holdings. In the absence of more comprehensive data holdings and research on undetected and unreported abalone theft, the project was unable to provide reliable estimates of the quantities and source of illegally harvested abalone in Victoria. The project outcomes, including recommendations on how to improve illegal catch reporting systems and detection procedures and research strategies to enhance estimation of illegal catches, are being addressed under Fisheries Victoria's Abalone Fishery Compliance Strategy. Further discussion on illegal abalone catches is contained in subsequent sections of this report.

Assessment

A sound stock assessment process is in place for blacklip abalone based on fishery dependant and independent data and underpinned by the best available scientific information on stock structure. The assessment and review of the Victorian abalone fishery is undertaken by the AbaloneFAG through annual stock assessment workshops and publication of an annual fishery assessment report. The stock assessment includes a comprehensive analysis of the history and known stock structure, previous stock assessments, stakeholder perceptions of the current condition of the fishery, research requirements, current stock assessment process and results, and recommended management strategies in response to stock assessment outcomes.

The FAG uses as the basis for its blacklip abalone assessments, a length-based stock depletion model that has been in operation for 3 years and is subject to ongoing review and modification as further data become available. The stock assessment model relies on a range of fishery dependent data, including size and composition of catch, effort, area fished (down to reef-code level), plus independent relative abundance and length frequency data from over 150 fixed transect sites

surveyed annually. This information is supplemented by ongoing tagging studies to provide an indication of growth rates. Length-frequency catch composition data is also supplemented by data collected from processors that is combined with catch and effort data to obtain length-frequencies for different reefcodes. The assessment model also factors in a range of uncertain values, including illegal and recreational catch, in determining appropriate ongoing catch levels. Risk assessments are included in the stock assessment process to take account of existing uncertainties with and potential alternatives to blacklip abalone management strategies.

A separate stock assessment process is conducted for greenlip abalone. The Victorian submission and the Management Plan note that greenlip abalone was depleted significantly by overfishing two decades ago and that intensive stratified abundance estimates surveys in 1998 had determined that stocks had not recovered and could not support targeted commercial fishing. Latest abundance estimates suggest a precautionary catch of only 1 to 20 tonnes, and that catches within these limits were already being attained through recreational catches and commercial byproduct (harvesting for aquaculture broodstock). On the basis of this assessment the Management Plan provides for a zero commercial catch of greenlip abalone for the life of the Plan, subject to further scientific research on the recovery of the stock, which will include bi-annual resource surveys of densities, individual length-frequencies and productive seabed areas.

The distribution and spatial structure of stocks has been factored into the blacklip abalone stock assessment process. Considerable research on abalone habitat distribution, movement, population genetics, food sources and larval dispersal has helped to determine that the fishery comprises a number of metapopulations with high local heterogeneity. Several studies on genetic structure of abalone stocks have also confirmed the localised recruitment characteristics of Victorian blacklip abalone stocks.

A range of assessment measures are in place to incorporate localised changes in recruitment and reproductive capacity into the stock assessment process, including:

- independent survey data from the 150 transect sites to estimate relative abundance and spatial distributions at reef scale level;
- use of a long term CPUE data reported at reef level as a reference point to detect and respond to effort and catch variations at local levels;
- ongoing tagging studies to provide greater clarity about the distribution and movement of the stock at localised scales;
- commencement of a high resolution GIS mapping program of abalone reefs.

The AbaloneFAG has acknowledged that further information on localised recruitment is required and has built into the stock assessment process a commitment to obtaining more refined spatial datasets and developing an increased awareness of the spatial influences on recruitment, growth and reproductive capacity.

The stock modelling process is also broken down to the scale of key bioregions to take account of varying environmental characteristics that can affect the growth and relative productivity of local stocks, with a further breakdown to reef scale information proposed. The stock assessment and TAC setting process take account of all fishing mortalities including commercial, recreational, illegal and aquaculture wild stock harvesting activities.

A comprehensive process is in place to take account of all legal commercial removals from the fishery. Licensed commercial removals of abalone are well defined and appear highly reliable. The Abalone Quota Management System (AQMS) provides a comprehensive and verifiable system on the amount of abalone stock removed by licensed commercial abalone fishers to be factored into the

stock assessment process. Licensed removals are verified by diver docket returns, observers, fisheries inspectors and processor returns. Discards are recorded in diver logbooks but are known to be minimal given the very selective process of hand-harvesting the target species. Commercial catch sampling has also indicated a negligible rate of undersized abalone harvesting.

The AQMS is operated by Fisheries Victoria and designed to track abalone catches from the point of landing to the processing factory to ensure that illegally caught abalone do not enter the system and that all catches are correctly recorded against the allocated quota. A second component is to track the inventory of processors by registering abalone both entering and leaving the premises. The system also allows for receipts of abalone from divers and from abalone traders. The current AQMS system relies on the paper based abalone docket, which is completed by divers at the place of landing and is placed in the sealed bins along with the abalone.

The *Fisheries Regulations 1998* requires that abalone be transported unshucked, from place of landing to processors, in sealed bins with bin tags attached. A completed abalone docket¹, showing the serial number of the bin tags, the total tare weight (including weight of bins, lids and dividers), diver identity, and signature, must also be attached. Arrival at the processors must occur within 24 hours of first landing. No later than 25 hours after landing, the processor must determine the gross weight, records these and other details on the abalone docket, and report these to the notification service administered by Fisheries Victoria via the Internet.

The information is downloaded to the AQMS, which verifies the details, and provides a confirmation to the processor. Confirmation by the Secretary is required before the processor may break the bin tags and proceed with processing. The weight is added to the processor's inventory.

Reported abalone catch weights are used to monitor progress towards attaining the TAC in each quota season and prior to 1 April 2003 the processor reported landings by each diver within 25 hours of landing. Abalone are susceptible to weight loss due to seepage of body fluids. The loss of weight in abalone during storage results from the release of water and body fluid caused by exposure to air. The degree of weight loss is a function of time, as well as the temperature and humidity to which the catch is exposed once landed. These factors introduce imprecision into the catch recording system. This has a flow on impact throughout the AQMS, and in particular monitoring of the TAC.

On 1 April 2003 (start of new quota licensing year) the AQMS was enhanced by the introduction of a beach weighing catch registration system (BWCRS) requiring catches to be weighed at the point of landing within 1 hour throughout the State. Catch weight information is now being reported by the diver by contacting the abalone telephone notification service. This weight is then automatically decremented from the relevant quota entitlement. This replaced the practice where catch weights were reported by processors via the Internet for TAC monitoring purposes. This is a more biologically sensible form of real time TAC monitoring and is considered an improvement as in most quota managed fisheries it is desirable to monitor progress in attaining the TAC as close to the first point of landing as is practically possible. To ensure effective abalone quota auditing from the point of landing through to the final point of export or domestic sale licensed processors continue to report the weight of abalone received at the processor premises.

A structured collection program is also in place for abalone wild stock collected to serve as broodstock for the aquaculture industry. Collection is by way of permit and subject to annual trip,

¹ The abalone docket also captures resource management information such as reef code data, estimated diver catch hours and estimated weight of abalone, which assist in fishery assessment and monitoring.

dive and maximum collection limits. Details must be recorded and reconciled through a broodstock collection program. The stock assessment process takes account of broodstock removals and also advises of reefs at risk from over exploitation to be avoided when collecting broodstock.

The Management Plan provides for a standardised determination of annual recreational catch and effort. Fisheries Victoria estimate current recreational catch removals to be around 11 tonnes per annum based on the Victorian component of the National Recreational and Indigenous Fishing Survey. There are no quantitative data on indigenous take although anecdotal evidence suggests the take of abalone is very small compared to the recreational take. The majority of indigenous take is anticipated to be included in the recreational catch estimate as most indigenous collectors are required to have a recreational licence and be covered by general recreational collection provisions. An indigenous cultural fishing permit system has recently been introduced to further monitor abalone take for cultural purposes.

The ongoing recreational catch estimates will depend on periodic creel surveys at landing sites by regional fisheries officers and sampling surveys of the Recreational Fishing Licence database, plus further outcomes from the National Indigenous and Recreational Fishing Survey.

As previously noted, the current level of illegal abalone harvest is yet to be quantified and potentially provides significant uncertainties with the stock assessment outcomes. Fisheries Victoria has used the best available information from fishery dependant and independent data sources to estimate the proportion of illegal catch compared with legal catch in each management zone, with regional breakdowns in known higher poaching areas. The variable illegal catch rates are factored into the stock assessment process and vary from 10% to 40% of the total catch across the stock assessment regions. Quantifying the extent of illegal abalone removals from the fishery is both a compliance and research priority under the new Management Plan. Further discussion on illegal catch measures are provided in the following 'Management response' section.

Despite the lack of reliable quantitative data for illegal catches, and to a lesser extent recreational catches, EA notes that the annual fishery independent abundance surveys do provide a means of corroborating the impacts of all removals from the fishery, including illegal take, through the trends in abundance that are identified through these surveys.

The Management Plan outlines the current strategy underpinning the stock assessment process for blacklip abalone of establishing a maximum constant yield (maximum catch) that maintains mature biomass at the year 2000 levels over a 15 year period. Recent stock assessments have estimated the long term potential yield to maintain this level of biomass as 1738 tonnes. The use of year 2000 relative biomass levels as a sustainable benchmark is based on recent outcomes from the current stock assessment model that uses a combination of long term catch history, fishery independent length frequency data, trends in relative abundance of black lip stocks derived from the independent survey program and shell growth rates from tagging programs. Fisheries Victoria has indicated that these parameters provide for a relatively high degree of confidence in maintaining ecologically sustainable levels of blacklip abalone stock until further data are obtained to reliably predict maximum sustainable yield (MSY) and the mature biomass that can support MSY.

While previous stock assessments have estimated median biomass for Victorian abalone stocks to be in the order of 23-41% of pre-fishing levels, it is not clear from available information whether this is a sufficiently conservative level for abalone populations. Given the developing status of the stock assessment model, the need for more data inputs and uncertainty with total catch components such as illegal and recreational take, EA considers there is still a fair degree of uncertainty on the ongoing ecological sustainability of maintaining relative biomass at the year 2000 levels. The Management Plan also indicates from estimates of biomass depletion since commencement of the

fishery that biomass has been steadily reducing over the last two decades and that the year 2000 biomass level equates more to the limit level of sustainable blacklip abalone stock. A more precautionary approach for ongoing management would be to define a biologically based target biomass from which to confidently derive ecologically sustainable yields over a similar 15 year period as set for the maximum constant yield approach.

Recommendation 4: *Abalone Fishery Committee to give priority to defining target biomass to produce the ecologically sustainable yield from the fishery within 3 years and review this estimate within the context of the annual stock assessment process.*

The AbaloneFAG stock assessment reports also note the difficulty in accurately determining the overall productivity of abalone populations due to their highly variable recruitment and growth rates. The stock assessment reports note that growth rate data are a key determinant in the current assessment of the relative biomass of blacklip abalone, and in the establishment of suitable legal size limits to ensure protection of a sustainable proportion of spawning stock. The stock assessment process therefore gives a higher priority to length based data to determine size at maturity and ensure suitable legal size limits are established to safeguard ongoing recruitment rates. Recent stock assessment processes have revealed that in some zones of the fishery the growth rates to maturity were faster than previously expected and that size limits were too low to optimise spawning potential. This indicates an urgent need for further data collection to determine the extent this applies across the fishery, along with more tagging studies to provide more representative growth data to evaluate the appropriateness of legal size limits.

Recommendation 5: *Fisheries Victoria to ensure reliable growth data across the various regions of the fishery is obtained as a high priority to ensure the effectiveness of existing management controls and continued sustainability of abalone stocks.*

Management response

The management regime for the fishery includes a suite of output and input controls to regulate abalone harvests from the fishery, such as:

- Limited entry of licence holders;
- TAC's that can be applied at sub-zone level;
- Legal minimum size limits that can also be applied at sub-zone levels;
- Seasonal closures;
- Possession and size limits for recreational catch; and
- Separate reporting requirements, collection limits and codes of practice for collection of wild abalone for aquaculture broodstock.

These measures are underpinned by a range of biological reference points, including:

- Target reference point of mature biomass at year 2000 levels;
- Trigger reference point of mature biomass at 90% of year 2000 levels;
- Trigger reference point of annual catches for one or more reefs at either upper or lower limits over 1988-2000 reference period;
- Trigger reference point of ecosystem health at 90% of average value of previous 3 years.

The stock assessment process establishes an ongoing maximum constant yield that maintains existing mature biomass levels. EA has recommended in the previous section the need to establish a more precautionary target biomass reference level to underpin future harvesting and management arrangements.

The Management Plan provides for the Minister to be advised by the Abalone Fishery Committee (AFC) once a trigger reference point is reached and for a range of management responses should the reference point be triggered, such as adjustments to TAC's or legal minimum size limits. Size limits are set to ensure at least a two year spawning period before harvesting to ensure sufficient egg production to sustain stocks. The Management Plan has provisions to adjust TAC's and size limits at sub zone levels to accommodate the differences in growth rates, natural mortality and sizes at maturity between reefs. The stock assessment process provides for review of local size limits to determine the risks of localised or serial depletion of sub-stocks or local aggregations. Both the Management Plan and stock assessment process provide for continuing monitoring, sampling and research programs to improve reliability of these reference points.

Given the characteristics of abalone in forming densely aggregated local populations and the capacity for fishing to focus on these local areas of high productivity, fine scale management control of catch and effort is crucial to the continuing effective overall management of the fishery. Fisheries Victoria, MAFRI and industry recognise that sub-zonal management is an important issue for the fishery and are implementing a number of sub-zonal initiatives. EA notes that Fisheries Victoria, MAFRI and industry are currently exploring options for sub-zonal or finer scale management. Experienced western zone abalone divers expressed at the last AbFAG meeting in October 2002 their belief that the standard government regulated LML of 120 mm is too low for a number of reefs in the western zone fishery. To address the former concern, western zone divers have developed an approved industry code of practice (CoP) based on industry funded scientific advice, which provides for finer scale 'sub-zonal' management. At the reef code level a number of different areas are being fished at higher minimum size limits (122mm-140mm) on a voluntary non-legislative basis to guard against recruitment overfishing.

A similar CoP initiative has also been implemented in the Eastern Zone aimed to protect recruitment by allowing abalone to reproduce at least once before entering the fishery. The 'Airport Area' in the Eastern Zone is also a longstanding example of sub-zonal management which has its own TACC (4.75 tonnes) per licence and lower LML of 11cm for nominated fishing days. This is in recognition that abalone beds in this area are slower growing and sexually mature at a lower LML.

The Central Zone has also trialed a form of sub-zonal management through a voluntary Memorandum of Understanding (MOU) with Fisheries Victoria for Port Phillip Bay (PPB) following concern over continuing high levels of catch from this area. The MOU did not involve sub-zonal LMSL's, instead focusing on a smaller sub-TACC for PPB within the larger Central Zone TACC. Catch levels were monitored by Fisheries Victoria over the last season on the understanding that if catch levels reached the sub-zonal TACC of 125 tonnes then PPB would be closed by fishery notice for the commercial sector. This did not eventuate and catches from PPB were very low, largely because of the shift in market demand for larger sized abalone last year.

Central Zone industry representatives, through the Victorian Abalone Divers Association (VADA) have also recently submitted a proposal to Fisheries Victoria for sub-zonal TACC and size limit management based on past catch history and diver knowledge. Discussions between the industry and Department on these issues are ongoing.

EA concurs with the provisions in the Management Plan to establish TAC's and legal size limits at the sub-zonal level to address localised serial depletion, but notes that the parameters and process to be used to establish these controls are not well defined at this stage. Priority should be given to establishing decision rules on the implementation of localised controls to allow for effective and rapid responses at more regional levels.

Recommendation 6: *Fisheries Victoria to investigate and establish, over the next 3 years, appropriate decision rules, relevant to the regional or sub-zonal -scale management, to prevent the potential serial depletion of abalone stocks.*

EA notes Fisheries Victoria introduced a beach weighing catch registration system (BWCRS) on 1 April 2003 requiring catches to be weighed at the point of landing within 1 hour throughout the State. Catch weight information is now being reported by the diver by contacting an abalone telephone notification service. This weight is automatically decremented from the relevant quota entitlement and replaces the practice where catch weights were reported by processors via the Internet for TAC monitoring purposes. EA agrees that this is a more biologically sensible form of TAC monitoring. To ensure effective abalone quota auditing from the point of landing through to the final point of export or domestic sale licensed processors continue to report the weight of abalone received at the processor premises.

The TAC is now based on a 'wet weight' allocation of quota in place of the previous 'drained weight' TAC. Recent published research² has examined the post harvest weight loss of blacklip abalone under a variety of simulated conditions typically occurring during commercial fishing operations. The results indicate that commercially harvested abalone contained in sealed bins and tags may weigh between 10–20% less after 25 hours of landing compared to the same number of abalone weighed within 1 hour of landing. The research notes that this has allowed for harvesting additional quantities of abalone that may exceed desired fishing mortalities for long-term population sustainability. Introduction of the proposed BWCRS, with beach weights deducted from quotas, may therefore equate to a reduced harvest in the order of 350,000 to 700,000 abalone and resolve the problem of these previously unaccounted additional fishing mortalities. EA considers this initiative will provide an important short term correction to the trend in declining blacklip abalone stocks detected in recent stock assessments and identified in the Management Plan.

In order to offset this unintended loss to the commercial sector, licence holders in each of the three zones received a one-off quota adjustment of 5% upon the commencement of the BWCRS at the start of the 2003 quota season on 1 April 2003. This 5% increase is considered conservative and will not exceed desired fishing mortalities for long-term sustainable management of the abalone biomass. By decrementing diver catch weights directly from the AFAL holder's quota entitlement commercial fishing mortality (i.e-the overall number of abalone taken by the licensed commercial sector) is likely to decrease under the proposed BWCRS. This is because the 5% one-off quota increase is considered conservative when compared to the likely reduction in abalone catch weights, which may be between 10-20% if drained over a 25 hour period.

Additional published research on this issue is limited and EA agrees that it is prudent to adopt a precautionary approach during the transition to a 'wet weight' TACC. The BWCRS requires the reporting of (wet) catch weights by the diver within 1 hour of landing and a drained weight by the processor within 25 hours of landing. EA believes that in time it will be possible to further examine the level of post-harvest weight loss in the fishery, especially the need to confirm that the 5% adjustment is conservative and has not had a negative impact on the fishery. In the meantime EA considers that Fisheries Victoria should closely monitor abundance trends from the independent monitoring program and other stock abundance indicators used in the annual stock assessment process and further adjust catch control measures, such as TAC levels, as appropriate.

² Gorfine, H. (2001) Post-harvest weight loss has important implications for abalone quota management. *Journal Of Shellfish Research*, Vol. 20., No. 2., 795-802.

Recommendation 7: *Fisheries Victoria to review within 3 years the effectiveness of beach weighing measures currently being implemented, including any implications for the stock assessment process.*

The most significant issue causing uncertainty with ensuring longer term ecological 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 TAC to greater than the national TAC.

Fisheries Victoria has acknowledged this is a significant management issue and has taken considerable steps to further reduce (and quantify) the level illegal abalone take from the fishery. Associated with the recent establishment of Marine National Parks and Marine Sanctuaries along the Victorian coast, was a commitment from Government to inject an additional \$14.3 Million over 4 years and over \$3 Million per annum on-going into enhancing DPI's fisheries compliance capability. Included as one of the objectives of this initiative, was the achievement of substantial reductions in the level of abalone theft.

A Victorian Abalone Fishery Compliance Strategy has been developed that will address many of the recommendations made in the above FRDC project. The goal of the Strategy is to protect abalone stocks from illegal exploitation through the achievement of optimum compliance levels with a view to enhancing ongoing sustainability of the resource. Moreover, the principal outcome is to progressively reduce by 50% (within 3 years) and then maintain the level of IUU fishing below 15% of the Total Allowable Catch (TAC) across the State.

The Abalone Fishery Compliance Strategy will involve Fisheries Victoria's Special Investigations Group (SIG), Victorian Police, Fisheries officers, Regional Investigators and scientific researchers working together on a range of strategies including development of IUU catch reporting systems, baseline assessments of illegal catch, targeted investigation and intelligence gathering operations, enhancements to existing compliance and audit systems for the commercial abalone sector and industry and community education programs.

In particular the enhanced fisheries compliance budget initiative provides funding for:

- the engagement of 21 additional Fisheries Officers along the Victorian coast;
- the establishment of a station for Fisheries Officers at Apollo Bay;
- the appointment of 3 regionally based Investigators to assist in the targeting and planning of major fisheries enforcement operations;
- a significant injection of operating funds into the Regional Fishery Program budgets to ensure that these new fisheries officers are fully effective;
- the strengthening of the Department's Special Investigations Group (SIG) through the appointment of 2 additional Investigators and an Intelligence Officer
- the provision of substantial operating funds for the conduct of both regionally based state-wide planned enforcement operations; and
- the provision of specialist technical and other equipment.

EA notes that the significant increase in enforcement resources is a positive initiative and should result in decreased levels of illegal fishing in future. The challenge will be to develop systems that can measure this expected improvement.

EA considers that a sound strategic approach is being taken within the available resources to address the problem of abalone poaching. Given the significance of illegal harvesting to the overall sustainable management of the fishery, substantial progress with the strategies outlined with the Strategy should remain a high priority throughout the life of the current Management Plan.

Recommendation 8: *Fisheries Victoria to take actions to improve the reliability of illegal catch estimates and establish and implement measures to achieve the reduction targets set out in the Victorian Abalone Fishery Compliance Strategy.*

The estimated recreational catch of abalone of around 11 tonnes per year, including 600 kilograms of greenlip abalone, appears to be very insignificant compared with the legal TAC and estimates of illegal catch. A suite of recreational catch control measures in place and recreational compliance measures including gear restrictions, legal minimum size limits, bag limits, nocturnal closures and recreational licence requirements are in place. However, particularly in view of the precarious state of the greenlip abalone stocks, the estimation of actual recreational catch levels provides a further level of uncertainty in the stock assessment process that should be further addressed.

EA notes that Fisheries Victoria is currently reviewing the recreational management arrangements in response to concern of serial depletion of several inshore reefs, especially coastal areas within one-day's drive from Melbourne. EA agrees with Fisheries Victoria position that management responses may be needed in the near future to prevent further overfishing of inshore reefs.

Recommendation 9: *Fisheries Victoria, within 12 months, to assess the extent of take and level of recreational abalone fishing, with an emphasis on greenlip abalone impacts, and implement additional management measures where necessary.*

Due to the selective nature of harvesting in this fishery, there are essentially no byproduct species currently harvested commercially in the fishery under the new Management Plan. Prior to the implementation of the new Management Plan in 2002, Fisheries Victoria notes that greenlip abalone was essentially harvested and managed as byproduct, with catch rates comprising less than 1% of the total catch over the last decade. The Management Plan specifies arrangements for maintaining the commercial greenlip TAC as zero until further research and monitoring has identified an adequate recovery in the currently depleted stocks. Greenlip abalone harvesting is now only allowed under permit by recreational fishers and for aquaculture broodstock.

Conclusion

EA is satisfied that the information collection system and stock assessment and management arrangements are sufficient to ensure that the fishery is conducted at catch levels that maintain ecologically viable stocks with acceptable levels of probability.

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

Promote recovery to ecologically viable stock levels

Objective 2: “Where the fished stock(s) are below a defined reference point, the fishery will be managed to promote recovery to ecologically viable stock levels within nominated timeframes”

The Management Plan stipulates both target and trigger reference points for mature biomass relative to pre-fishing levels and a requirement for management intervention, up to the Ministerial level once the lower trigger points have been reached and for restoration of biomass above the trigger limits within 5 years. EA has recommended, earlier in this report, the establishment of a more precautionary biomass target which will also require review of existing reference points.

Management responses can include adjustments to TACs and/or legal minimum size limits and other actions required to achieve stock recovery. The annual stock assessment process reviews the performance of the fishery against these indicators and recommends appropriate management responses, based on the current trends in catch and relative biomass.

Fisheries Victoria has recently responded to stock assessment outcomes showing blacklip abalone stocks in some management zones below reference points, by reducing the overall catch through cuts in TAC allocations and introduction of the beach weighing system. Fisheries Victoria is confident that these measures, along with actions under the Abalone Fishery Compliance Strategy to reduce illegal catches, will ensure biomass is restored in the immediate future and maintained well above reference points.

The Management Plan also stipulates a range of monitoring, assessment and catch control measures to assist with greenlip abalone stock recovery, including legal size limits, zero greenlip TAC until research justifies a commercial catch, bi-annual resource surveys on population densities, individual length frequencies and productive seabed areas, strict aquaculture broodstock collection limits and a range of recreational catch restrictions including seasonal closures, individual and boat collection limits and prohibitions on night diving for abalone.

No specific target levels have been set to resume commercial greenlip abalone harvesting. AbaloneFAG estimate that up to a five fold increase in greenlip abalone abundance would be required to re-open the greenlip fishery in Victoria, which is highly unlikely in the short term given the slow rate of recovery of stocks over the last two decades. Apart from the abovementioned range of monitoring and catch control measures, the Management Plan provides for a set process to be undertaken by the AFC before commercial harvesting recommences.

EA considers that an adequate precautionary management framework to minimise existing catch and support recovery of stocks is in place for greenlip abalone.

The Management Plan and the Victorian submission both support a reseedling program for greenlip abalone wild stocks to enhance stock recovery. The Management Plan notes that resource enhancement programs, such as reseedling, will involve assessment of site criteria, genetic integrity and population health, followed by a program of monitoring growth and survival. Concerns were raised in public comments on the Fisheries Victoria submission about the genetic implications of translocation experiments.

EA also has concerns with the use of reseedling programs to compensate for past unsustainable fishing practices, particularly in the case of greenlip abalone where the recovery and sustainable catch rates have yet to be determined, and unsustainable practices such as illegal harvesting are still impacting on the natural abalone populations. There is also the risk to the genetic diversity and integrity of wild stock populations. EA therefore considers that priority should be given to other measures that enhance the natural regeneration of abalone stocks before resorting to reseedling

programs. Additionally, the outcomes of the risk assessment process should demonstrate that the risks of artificial stock enhancement measures are at acceptable levels before being implemented.

Recommendation 10: *Fisheries Victoria to ensure a full risk assessment on the ecological implications, including disease and genetic impacts, of artificial stock enhancement of abalone in Victorian reefs is completed before any reseeded program is undertaken.*

Conclusion

EA is satisfied that stocks are being suitably managed to be maintained above existing reference points and that should stocks fall below these levels, appropriate management measures are in place to promote recovery to ecologically viable stock levels within nominated timeframes.

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”*

No significant bycatch is 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. Disturbance to the substrate by diver or support boat activities is minimal. 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.

EA is satisfied that the fishery is conducted in a manner that does not threaten 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 from fishing activities. However, should this situation change, EA suggests that appropriate actions be undertaken to ensure bycatch species are not threatened from the fishery.

Protected species and threatened ecological community protection

Objective 2: *“The fishery is conducted in a manner that avoids mortality of, or injuries to, endangered, threatened or protected species and avoids or minimises impacts on threatened ecological communities”*

As a dive fishery with a direct and selective hand collection of target species, disturbance to substrate and risk of interactions with listed species is minimal. There is no indication from diver reports, the independent monitoring program and from the on-board observation program of catch and diver behaviour do not indicate any significant interactions of vessels and divers with protected, endangered and threatened species. There are no threatened ecological communities within the areas of the fishery.

The fishery is highly unlikely to have 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. The on-board observation program provides for recording any interactions with protected, endangered and threatened species and Fisheries Victoria is investigating options for inclusion of protected species interactions in diver logbook reporting arrangements.

EA notes that interactions with protected species in this fishery are minimal and is satisfied that the fishery is conducted in a manner that avoids mortality of, or injuries to, endangered, threatened or protected species and avoids or minimises impacts on threatened ecological communities. Should this situation change, EA suggests 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.

Minimising ecological impacts of fishing operations

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

Information requirements

Information is not collected specifically on the ecosystem impacts of the fishery. The fishery-wide independent transect surveys of abalone provide the opportunity to monitor changes in abalone abundance at reef scale and bioregional levels, and to consider any relationship between changes in abalone populations and the surrounding marine environment. These surveys include a quantitative estimate of abundance of other prevalent organisms that can impact on the abalone lifecycle, such as macroalgae, kelp canopies, crustose coralline algae, urchins, seastars and turban snails.

The catch reporting system and stock assessment process include direct observations by divers on factors such as changes in species composition in the abalone fishery. The stock assessment report includes specific comments on the state of the fishery ecosystem, such as changes in the prevalence of sea stars in some regions and possible link to localised abalone depletion. The on-board observer program for commercial catch activities also obtains divers’ observations of ecosystem conditions at each dive site.

Extensive surveys were conducted on species diversity and abundance across a range of rocky reefs in the context of establishing the recent suite of Marine Protected Areas (MPAs) along the Victorian coast. This has provided a useful baseline of species composition and habitat structure for a number of areas that overlap abalone habitats. Additional data should be available from future monitoring programs of the established MPA sites.

Assessment

No formal risk assessment has been conducted. Given the characteristics of the fishery, existing harvesting activities are likely in the short term to have minimal or transitory impacts on ecosystem components other than the target species. The Victorian submission acknowledges that the relationship between abalone and other ecosystem components is not well understood and likely to be complex, and that further research is needed on the effects of reducing abalone populations on nutrient flows and other organisms within their ecosystem. The research priorities listed in the Management Plan include further research on interactions between abalone and other benthic species and assessing the impacts of MPAs on abalone resources.

Past research has identified the role of abalone in the food chain as a dominant benthic herbivore. The Victorian submission notes that as abalone tend to feed more on drift algae rather than grazing attached plants it is unlikely to compete directly with other grazing herbivores. While the linkage of abalone removal to urchin barrens has been suggested by past research, the Victorian submission notes that urchin barrens are relatively uncommon in the Victorian abalone fishery and related more to urchin species that are not widespread in Victorian waters. The submission notes that while a range of species such as sharks, morwongs, rays, sea stars, crabs and reef fish, such as wrasse, feed on abalone at various stages of its lifecycle, there is no known top order predator depending solely on abalone for food.

One of MAFRI's ecologists has recently reviewed the literature relevant to ecosystem impacts and abalone removals and concluded that there are no obvious deleterious effects at current catch levels³. Importantly, the review report cautions that this does not mean such impacts do not occur and suggests that ongoing monitoring of key habitat modifiers such as urchins be undertaken. The review also recommends that because abalone populations are well suited to manipulative experiments, that further research be pursued by FV to investigate the effects of fishing on interactions among species.

Another important issue is burial of reefs by shifting sediment because this increases natural mortality of a range of organisms, reduces the available habitat for abalone and forces abalone into denser aggregations increasing their catchability. MAFRI intends to monitor sediment movement at its regular monitoring sites. The method of diver hand collection of abalone limits actual physical damage to the substrate. Vessels used to support diver collections of abalone usually range from 6 to 8 metres and while there is potential of localised anchor damage to substrate and benthic organisms this should not have wider ecosystem implications. While there are localised risks of oil and fuel spillage from diver support boats, there are also licence conditions regulating water quality and waste disposal.

Management response

The Management Plan notes the need to improve knowledge of ecological interactions between abalone and other species. The Management Plan includes objectives, performance indicators and trigger reference points to monitor impacts on ecosystem health resulting from fishing practices. The trigger point in the Plan requires management action when ecosystem health indices vary by more than 10% over a 3-year period. The management action required is similar to when biomass trigger limits are reached for commercial abalone harvesting, and involves review of the situation by the Abalone Fishery Committee and possible action such as reduction in the abalone TAC.

The basis for measuring changes in ecosystem health indices is not evident from the Victorian submission or Management Plan, although the Management Plan suggests that these could be drawn from predators of abalone or organisms providing food and habitat for abalone. The Victorian submission implies that monitoring changes in abundance of key species during the abalone independent survey program could be used as a source to assess ecosystem health changes.

While the Victorian submission notes that the natural dynamic nature of ecosystems makes it difficult to define a decision rule for ecosystem changes, EA considers that the ecosystem indices need further clarification to function as an accountable management measure and precipitate effective management responses.

³ Jenkins, G. (2003) A review of strategies for the assessment of ecological impacts of abalone fishing. (unpublished, MAFRI)

Recommendation 11: *The Abalone Fishery Committee to give priority to the development of decision rules based on an identified list of indicator species to provide the basis for monitoring and responding to ecosystem changes.*

Conclusion

EA is satisfied that the fishery is conducted in a manner that minimises the impact of fishing operations on the ecosystem generally. Given the nature of the fishery and low impacts on other species, the commitment to ecosystem performance measurement in the Management Plan and capacity to obtain further information, management responses are appropriate at this stage, subject to the recommended further work in defining and monitoring the ecosystem performance measures.

LIST OF ACRONYMS

AQMS	Abalone Quota Management System
AbaloneFAG	Abalone Fishery Assessment Group
AFAL	Abalone Fishery Access Licences
AFC	Abalone Fishery Committee
BWCRS	Beach Weighing Catch Registration System
CoP	Code of Practice
CPUE	catch per unit effort
DPI	Department of Primary Industries
EA	Environment Australia
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ESD	Ecologically Sustainable Development
FCC	Fisheries Co-management Council
FRDC	Fisheries Research and Development Corporation
FV	Fisheries Victoria
ITQ	Individual Transferable Quota
IUU	illegal, unreported and unregulated fishing
LML	legal minimum length
MAFRI	Marine and Freshwater Institute
MOU	Memorandum of Understanding
OCS	Offshore Constitutional Settlement
SIG	Special Investigations Group
SQIP	Statewide Quality Inspection Program
TAC	Total Allowable Catch
TACC	Total Allowable Commercial Catch
VADA	Victorian Abalone Divers Association
VAF	Victorian Abalone Fishery

REFERENCES

D'Silva, D. and Curtis, D. 2003. Regulatory Impact Statement – Fisheries (Commercial Abalone) Regulations 2003. Department of Primary Industries. Melbourne, Victoria.

Fisheries Victoria 2002. Victorian Abalone Fishery Management Plan. Department of Primary Industries. Melbourne, Victoria.

Gorfine, H., Tailby, R., Grant, F., Bruce, I. and Donaldson, M. 2002. Assessment of illegal catches of abalone: Development of desk-based survey methods. Final Report to Fisheries Research and Development Corporation (Project 2000/112). Canberra, ACT.

Gorfine, H., Taylor, B. and Smith, D. (eds.) 2002. Fishery Assessment Report Number 43: Abalone – 2001. Fisheries Victoria. Melbourne, Victoria.

Gorfine, H. 2001. Post-harvest weight loss has important implications for abalone quota management. *Journal Of Shellfish Research*, Vol. 20., No. 2., 795-802.

Jenkins, G. 2003. A review of strategies for the assessment of ecological impacts of abalone fishing. (unpublished). Marine and Freshwater Research Institute. Queenscliff, Victoria.