ABALONE FISHERY
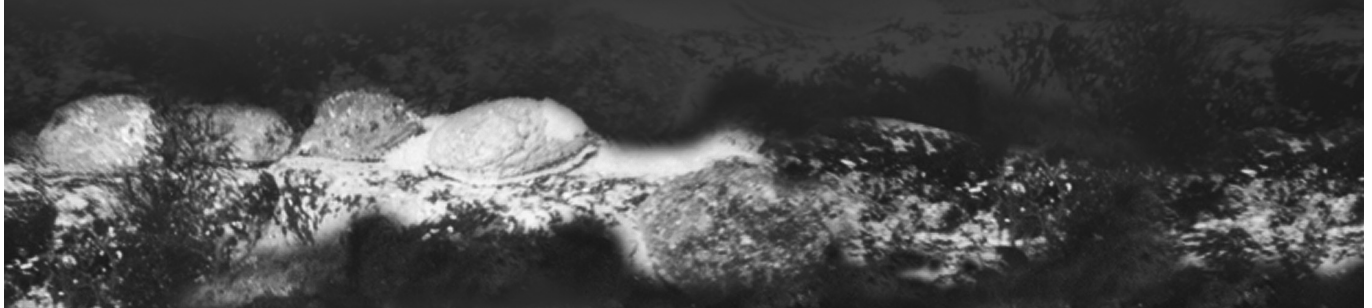
Fishery Management Strategy

APRIL 2007

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for the

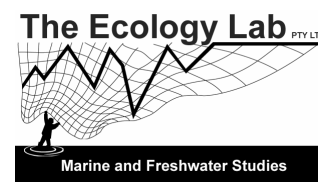# NSW Abalone Fishery

April 2007

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On behalf of:

NSW Department of Primary Industries and

Shareholders of the NSW Commercial Abalone Fishery

Fishery Management Strategy for the NSW Abalone Fishery

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The Fishery Management Strategy for the Abalone Fishery will be updated from time to time. Amendments will be made available on the NSW DPI website:

http://www.dpi.nsw.gov.au/fisheries

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by John Smythe and Department of Primary Industries.

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1. INTRODUCTION

1.1 Background

The harvesting of abalone from rocky reefs forms the basis of important commercial, Indigenous and recreational fisheries in temperate regions in many parts of the world. In Australia, abalone fisheries exist in New South Wales, Victoria, Tasmania, South Australia and the southern section of Western Australia. The abalone is a gastropod mollusc belonging to the Family Haliotidae. In NSW, blacklip abalone, *Haliotis rubra*, forms the basis of the fishery. This species also occurs in the other southern states of Australia.

Abalone occur in relatively shallow coastal waters and are typically collected by divers using either snorkel, surface-supplied air or scuba. They have been harvested commercially in NSW since at least the 1950's and the fishery is now the third most valuable in NSW. Both the NSW Department of Primary Industries (NSW DPI) and the commercial abalone divers have long recognised the need to manage the stocks of abalone in NSW waters in a sustainable way. Thus, in 1980 the fishery became the first restricted fishery in NSW, with entry based on past participation. Fifty-nine permits were initially issued, 57 of which were based on catch history and two of which were allocated to Aboriginal persons. The Abalone Fishery in NSW has a strong history of management, much of which has been initiated by the divers in close collaboration with the NSW Government. This has included restrictions on the numbers of divers, increasing of size limits, an industry funded buy-back scheme, area and time closures and implementation of a quota system. These conservation measures have been supported with industry funding for research and compliance. In 1995 the fishery was included in Schedule 1 of the *Fisheries Management Act 1994* (the FM Act) as a share management fishery. In 1996, the 37 divers in the previous restricted fishery were granted 100 equal shares on a provisional basis with quota allocated in proportion to shareholdings.

In February 2000, final shares were issued under the share management plan for the Abalone Fishery (SMP 2000) established under the FM Act. Annual quotas are set by the Total Allowable Catch Setting and Review Committee (TAC Committee) established under the FM Act.

In addition to controls on the commercial fishery, collection of abalone by recreational divers is subject to bag and size limits, and recently has been restricted to collection of two abalone without the use of surface supplied air or scuba. There are also several marine protected areas along the NSW coast where abalone cannot be harvested, either commercially or recreationally. Management of the recreational or Aboriginal fisheries does not form part of the fishery management strategy (FMS). There is nevertheless a need to recognise that the sustainability of the fishery is affected not only by commercial harvesting, but also by recreational, Aboriginal and illegal fishers.

In recent years it has been determined that there is a requirement, under Part 5 of the NSW *Environmental Planning and Assessment Act 1979* to undertake environmental impact assessments of fisheries in NSW. The legislation required the preparation of an Environmental Impact Statement (EIS) assessing the effects of each designated fishing activity, including the Abalone Fishery, on the environment. The assessment was based on an analysis of a draft FMS, which describes the rules, regulations and programs that are in place or proposed to manage the fishery into the future.

This approved FMS for the Abalone Fishery seeks to continue and where necessary adapt the developments initiated in past management arrangements, particularly the share management plan. The management objectives in the share management plan have been adapted in this FMS and developed as eight broad goals, with a set of underlying objectives and applicable management responses contributing to the overall vision of the fishery. Section 2 of the FMS provides a concise description of the fishery. A more detailed description is provided in the EIS. Section 2 also describes the risks identified in the EIS that affect the operation of the fishery and how they are being addressed by the FMS. Section 3 presents management goals and objectives for the fishery for addressing the risks. Section 4 describes measures to evaluate the performance of the management strategy, including monitoring programs, research and communication of results to stakeholders. The FMS builds on those that have been developed for other commercial fisheries in NSW that have been through the assessment and consultative process.

The role of the FMS is to outline the long term approach to management of the fishery. Accordingly, the strategy does not include full details for the implementation of some specific management changes but it must be flexible enough to respond to the risks that may arise. Ultimately, the strategy will be implemented through various supporting documents and operational plans, such as the share management plan and research and compliance strategic plans and the Abalone Fishery Code of Practice, which will establish the specific mechanisms for implementing and monitoring the changes foreshadowed by the FMS. Many of the detailed actions will require consultation with stakeholders to obtain the support that is often necessary to achieve effective implementation and compliance with the new rules.

The Abalone Fishery currently faces a number of major challenges that could affect the sustainability and viability of the fishery over the long term. These challenges include a variety of internal and external factors (as detailed in the EIS), which are being addressed in this FMS, such as:

- recent decline in stock, including major declines in some areas and natural fluctuations in stocks;
- the *Perkinsus* parasite affecting stocks in Region 1 and its potential movement further south;
- the persistence of illegal fishing and uncertainty about the scale of this activity;

- increasing coastal development and resulting impacts on the environment including water quality and the potential impacts of aquaculture;

- the concentration of fishing effort in Regions 5 and 6 and the risk of increasing fishing effort; and

- Aboriginal interests/claims over access to the resource.

Industry is committed to working with government agencies and other users of the abalone resource to rebuild and maintain a sustainable and viable fishery. For the commercial sector, the FMS proposes the actions that will be taken to achieve this outcome.

1.2 Relevant Legislation and Policy

1.2.1 The Fisheries Management Act

The *Fisheries Management Act 1994* (FM Act) seeks to achieve ecologically sustainable development for the fisheries of NSW through the achievement of its stated objectives, which are:

(1) *To conserve, develop and share the fishery resources of the State for the benefit of present and future generations.*

(2) *In particular the objects of the Act include:*

    (a) *to conserve fish stocks and key fish habitats;*

    (b) *to conserve threatened species, populations and ecological communities of fish and marine vegetation; and*

    (c) *to promote ecologically sustainable development, including the conservation of biological diversity;*

and, consistent with those objects:

    (d) *to promote viable commercial fishing and aquaculture industries;*

    (e) *to promote quality recreational fishing opportunities;,*

    (f) *to appropriately share fisheries resources between the users of those resources; and*

    (g) *to provide social and economic benefits for the wider community of New South Wales.*

In meeting these objectives, Division 4 of Part 2 of the FM Act establishes a Total Allowable Catch Setting and Review Committee (TAC Committee) to determine a specified total allowable catch for the Abalone Fishery, as required by the Abalone Share Management Plan. In determining the Total Allowable Commercial Catch (TACC), the TAC Committee is required to consider all relevant scientific, industry, community, social and economic factors impacting on the resource. In addition, Section 30 of the FM Act requires:

(2)   *The TAC Committee is also to have regard for:*

a) *the need to ensure the exploitation of fisheries resources is conducted in a manner that will conserve fish stocks in the long term;*

b) *the impact of fishing activities on all species of fish and aquatic environment; and*

c) *the precautionary principle, namely, that if there are threats or serious or irreversible damage to fish stocks, lack of scientific certainty should not be used as a reason for postponing measures to prevent that damage.*

1.2.2 Ecologically Sustainable Development

Ecologically Sustainable Development (ESD) was defined under the National Strategy for ESD as "development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends". It can be achieved through the implementation of the following principles and programs[1]:

- precautionary principle – if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;

- intra-generational equity – the benefits and costs of pursuing ESD strategies should be distributed as evenly as practicable within each generation;

- inter-generational equity – the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations;

- conservation of biological diversity and ecological integrity – conservation of biological diversity and ecological integrity should be a fundamental consideration; and

- improved valuation, pricing and incentive mechanisms – such as user pays and the use of incentive structures to promote efficiency in achieving environmental goals.

1.2.3 Share Management Plans

The FM Act requires that a share management plan be developed and implemented for all share management fisheries. The primary role of a share management plan is to provide the legislative framework for the fishery and the rights of shareholders in a share management fishery. The share management plan provides a range of fishery specific controls in the form of a regulation. Examples of these include the species that may be taken, the areas for taking fish, and the use of boats and

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[1] Adapted from section 6 (2) of the NSW *Protection of the Environment Administration Act 1991.*

fishing gear. If the *Fisheries Management (Share Management Plan) Regulation 2000* is inconsistent with any other regulation or fishing closure, the *Fisheries Management (Share Management Plan) Regulation 2000* prevails. The only occasions where the *Fisheries Management (Share Management Plan) Regulation 2000* does not prevail over another regulation, are where the regulation specifically expresses that it is to have effect despite the share management plan or where the share management plan specifies that other controls apply.

The share management plan for the Abalone Fishery containing the *Fisheries Management (Share Management Plan) Regulation 2000* commenced in 2000. The share management plan will continue to apply subject to any amendments made to give effect to modified or new fishing regulatory controls that are needed as a result of this FMS.

1.2.4 The NSW Environmental Planning and Assessment Act

Division 5 of Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) requires an environmental impact statement (EIS) to be prepared for each designated fishing activity described in Schedule 1A of the FM Act, for the purposes of an environmental assessment. The Department of Infrastructure, Planning and Natural Resources issued guidelines for the various fisheries, including guidelines for the Abalone Fishery, that outlined the matters required to be covered in the EIS.

Prior to the environmental impact statement being prepared, a FMS must be prepared under the FM Act. The environmental impact statement assessed the likely impact of implementing the FMS on the biophysical, economic and social environments.

Once a management strategy and environmental impact statement have been prepared and subject to a determination by the Minister for Primary Industries (under s.115O(4) of the EP&A Act), the requirement to undertake an environmental assessment for each individual fisher's licence approval or renewal does not apply. A determination for the Abalone Fishery was made by the Minister on 27 June 2006 (see Appendix 1).

1.2.5 The Commonwealth Environment Protection and Biodiversity Conservation Act

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) makes it an offence for a person to undertake an action that has the potential to significantly impact on a matter of 'national environmental significance' without first obtaining a permit from the Commonwealth Minister for Environment and Heritage. Matters of national environmental significance include: declared World Heritage areas; declared Ramsar wetlands; listed threatened species and ecological communities; listed migratory species; listed marine species; nuclear actions; and the environment of Commonwealth marine areas.

The EPBC Act was amended in January 2002 to incorporate the provisions of the *Wildlife Protection Act* (which was repealed at the same time). The new Part 13A of the EPBC Act removes the previous blanket exemption from export control for marine species. As a result, the export of all marine organisms will come under the controls of the EPBC Act and be subject to ecological sustainability assessments based on guidelines established by the Commonwealth.

After considering the environmental assessment, on 28 December 2005 the Commonwealth Minister for Environment and Heritage declared the NSW Abalone Fishery to be an approved Wildlife Trade Operation in accordance with section 303FN(2) and (10)(d) for the purposes of the EPBC Act. On 27 November 2006, approval to export was extended to 28 November 2008. Attached to the declaration were conditions for bringing the management and operations of the fishery in line with the Commonwealth guidelines.

1.2.6 The NSW Marine Parks Act

The NSW Government is using a systematic approach to identify sites for marine protected areas and to prioritise new areas for marine biodiversity conservation in NSW waters. There are three types of marine protected areas in NSW - large multiple-use marine parks, small aquatic reserves and the marine and estuarine components of national parks and nature reserves.

Marine parks aim to conserve biodiversity by protecting representative samples of the habitats in defined 'bioregions'. Zoning and operational plans are used to guide the protection of conservation values and manage activities that occur within marine parks. Four zones are used in marine parks - sanctuary zones, habitat protection zones, general use zones and special purpose zones.

Consultation occurs with the community prior to the declaration of marine parks. It is also important that the Abalone Management Advisory Committee participates in consultation over the selection of marine protected areas, as declaration of such areas could potentially impact on the operations of commercial abalone divers.

The *Marine Parks Act 1997* was introduced to provide for the declaration of marine parks in NSW. The objects of the Act are as follows:

  (a) *to conserve marine biological diversity and marine habitats by declaring and providing for the management of a comprehensive system of marine parks;*

  (b) *to maintain ecological processes in marine parks; and*

  (c) *where consistent with the preceding objects:*

     (i) *to provide for ecologically sustainable use of fish (including commercial and recreational fishing) and marine vegetation in marine parks; and*

(ii) *to provide opportunities for public appreciation, understanding and enjoyment of marine parks.*

This FMS has been prepared taking into account, and ensuring consistency with, the objects of the *Marine Parks Act 1997.*

Up to date information on the creation and zoning of marine parks in NSW waters is available on the Marine Parks Authority website (www.mpa.nsw.gov.au).

1.2.7 Aboriginal Fishing Initiatives

Fishing has been an integral part of the cultural and economic life of Aboriginal communities since they have been in this land. Fishing has been an important source of food, a basis for trade and an important part of cultural and ceremonial life. Traditionally, Aboriginal fishers had responsibility for providing not just for themselves but for family and community. These cultural expectations continue in Aboriginal communities today.

In December 2002, the NSW Indigenous Fisheries Strategy and Implementation Plan (IFS) was released. The IFS, detailed in the Appendices of the EIS, was funded until June 2004 and sought to protect and enhance the traditional cultural fishing activities of Aboriginal communities and ensure Aboriginal involvement in the stewardship of fisheries resources. Since the release of the IFS, the NSW Government created NSW DPI, which now incorporates the management of fisheries. Whilst some issues were addressed by the IFS, the resolution of other issues will likely require extensive negotiation with Aboriginal communities, the broader community, fishing groups and other government agencies. NSW DPI is continuing to examine and develop Aboriginal fisheries initiatives. A NSW DPI Aboriginal Reference Group has been formed and will be closely involved in reviewing initiatives prior to their implementation. The IFS established a process for discussion and negotiation (refer NSW Indigenous Fisheries Strategy and Implementation Plan 2002).

1.2.8 Consideration of Alternative Governance Arrangements

The NSW Government's *Vision for the NSW Seafood Industry* (December 2003) included a commitment to undertake a feasibility study to assess alternative fishery management models involving greater industry responsibility, with (a) an initial focus on the commercial abalone fishery; and (b) to publish a discussion paper on an alternative fishery management model for the whole catching sector.

A feasibility study was funded jointly by NSW DPI and the Abalone Development Company, overseen by an industry/government working group and prepared by Marsden Jacob (2004). The

study identified the potential to assign greater responsibilities to industry for delivery of key services and decisions on harvest strategies, within the context of government continuing to fulfil its responsibilities for the sustainable and equitable sharing of fisheries resources. The study also identified a range of matters that need to be addressed in order to progress the initiative. The FMS will remain responsive to any alternative governance arrangements that may apply with respect to the Abalone Fishery.

2. DESCRIPTION OF THE DESIGNATED FISHING ACTIVITY

This section provides an overview of the fishing activity sufficient to place the management responses into an appropriate context. For a more detailed description, including reference to scientific studies, refer to Chapter B of the EIS for the Abalone Fishery.

2.1 Collection of Abalone and Characteristics of the Stock

The abalone stock is based on collection of a single species, the blacklip abalone, *Haliotis rubra*. As detailed in the EIS, the operation of the Abalone Fishery involves a relatively small amount of equipment but requires considerable efficiency to ensure that the abalone collected for sale are kept alive and in good condition. The key elements of the fishery include the use of:

- a fast, seaworthy boat that can be transported to launching points by trailer;
- breathing apparatus to enable divers to remain submerged for long periods and hence most efficiently seek out and collect abalone;
- a hand-held 'abalone iron' to remove abalone from rock surfaces;
- holding tanks on boats to maintain abalone once collected;
- communications to enable divers and processors to meet at landing points and then to weigh and transfer the catch in preparation for sale.

Table 1 summarises the known status and level of certainty for the following stock assessment and biological parameters for blacklip abalone in NSW. The stock is currently considered to be 'fully fished'. In recent times the TAC Committee has recognised the vulnerability of the stock to sequential depletion under a single Total Allowable Commercial Catch (TACC) for the whole fishery and has advocated management of the stock at smaller spatial scales (TAC Committee 2004, 2005, 2006).

(i) Geographical and depth distribution and stock structure

Blacklip abalone are endemic to Australian waters and found on rocky reefs from the NSW/Queensland border to the southern fringes of the southern states of Australia. In NSW, abalone are most abundant on the far south coast while in areas further north they become progressively less abundant and more patchily distributed. Few abalone occur north of Coffs Harbour. Abalone are, or have been, found on coastal rocky reefs throughout NSW, most commonly from the inter-tidal to depths of up to 40 m, although they can be found as deep as 100 m. Most abalone live in cracks and fissures in rock within beds of macroalgae. Abalone are gregarious and the distribution of their preferred habitats is patchy, so individuals are aggregated at a range of spatial scales. Whilst there is little distinct genetic variation among populations, there is considerable spatial structure to abalone

populations so that abalone separated by relatively small distances (e.g. hundreds of m to km) can be reproductively isolated to some extent (Prince *et al*. 1988). The consequences of this spatial structure are considered in detail within the EIS.

Table 1. Overview of characteristics of the stock of abalone in NSW.

Characteristic	**Description**	**Level of Certainty**
Geographical distribution	State-wide, but abundance increases in the south	High
Depth distribution	Intertidal to ~100 m, but most common between 0 - 40 m	High
Stock Structure	The total stock is made up of many smaller populations	Moderate
Spawning season	Early spring to late autumn	High
Spawning areas	Throughout depth and geographical distribution	Moderate
Relationship between stock and recruitment	Strong relationship between recruitment and biomass of parent stock	Moderate
Movement, migration and larval dispersal	Limited movement of juveniles and adults; no migration; short distance of larval dispersal	Moderate
Minimum legal size	115 mm	High
Average age at minimum legal size	5 - 6 years	Moderate
Maximum age	~20 - 30 years	Low
Average age of abalone in commercial catch	5 - 8 years	Moderate
Average size at maturity	90 - 100 mm	Moderate
Average age at maturity	3 - 6 years	Moderate
Average number of years at maturity before reaching minimum legal size	2 - 5 years	Moderate
Average natural mortality, M	M = 0.2 - 0.4 for adults	Moderate
Average fishing mortality, F	F = 0.1 - 0.5 for adults	Low

(ii) Spawning season, spawning areas and stock-recruitment relationship

Blacklip abalone are dioecious and spawn throughout their distribution during a prolonged season from early spring to autumn, with peaks in early spring and late summer. Research programs indicate a high level of certainty for this information. There appears to be some synchronicity to spawning, suggesting the influence of local environmental conditions. Abalone spawn throughout their distribution. The short dispersal of larvae, and the fact that post-larvae, juveniles and adults all occur in the same habitat, suggest local recruitment is dependent on the proximity of adults (Prince *et al*. 1987), although other factors operating during the early life-history of abalone are thought to reduce any direct relationship between the adult stock and recruits. The stock recruitment relationship is

probably tighter than many fish species, which often migrate to and from spawning areas and nursery habitat.

(iii) Movement and migration

Although abalone are able to move over short distances (i.e. 10 - 100 m) within days, movement of post-settlement abalone is generally limited and there is no migration (Officer *et al*. 2001). Thus post-settlement abalone tend to spend all their lives within a small area of reef. Dispersal of larvae may also be limited and is thought to be confined to only a short distance from parents (Prince *et al*. 1987).

(iv) Age and growth

Growth of abalone is highly variable in terms of rates of growth and maximum size. Variability is thought to be related to environmental conditions, such as the availability of food and exposure (Day and Fleming 1992). The time it takes for abalone to reach legal size varies and can be as little as 5 years if conditions are good, but at some sites with poor conditions, growth may slow and individuals become stunted with few ever reaching the legal size. On average, abalone from 115 mm increase in size at about 5 mm per year (Worthington *et al*. 1995, Worthington and Andrew 1997). Limited information about the age of abalone is available from NSW as the age of abalone is not easily determined. Information from southern states, however, suggests abalone there may live for about 20 - 30 years (Day and Fleming 1992), but specific studies on longevity of abalone in NSW have not been done.

(v) Size and age at maturity

In the wild, abalone start to mature at about 80 mm, with 50% becoming mature by 90 - 100 mm, and all mature by 110 mm. In terms of age, this corresponds to most being mature in their 4th - 5th year.

(vi) Natural mortality and fishing mortality

Information from NSW and other states suggests natural mortality varies greatly. Variation is related to the size of abalone but natural mortality also varies among places. Natural mortality is thought to be greater than 1.0 for small individuals but declines as individuals grow, so that M ~0.3 for adults (Shepherd and Breen 1992, Worthington and Andrew 1997). Stock assessment models are generally very sensitive to variation in estimates of natural mortality. Model-based estimates of fishing mortality F, are very sensitive to estimates of natural mortality M, so probably vary from F = 0.1 - 0.5 (i.e. high M related to high F). Confidence associated with estimates of natural and fishing mortality is considered to be moderate and sensitivity to variation in these is considered in the EIS.

The minimum legal size (MLS) is set above the maximum size attained for becoming mature. Moreover, the MLS ensures that virtually all abalone have had the opportunity to spawn at least twice (and up to five times) <u>before</u> they are subject to legal harvesting.

2.2 Operation of the Fishery

2.2.1 Operational Areas, Protected and Closed Areas

The area of operation of the fishery as defined in the FMS is unmodified from that which occurs under the current operation (**Figure 1**), which is described in detail in Section B1 of the EIS. The scale of subzones in the fishery to which the commercial catch is reported to is shown in Appendix 3.

2.2.2 Controls Under the Abalone Share Management Plan

The share management plan regulates many aspects of the operation of the fishery. Examples include the following:

- *Dealings in shares* - outlines the shareholding rights, registration and trading arrangements in the fishery;
- *Endorsements and nominated fishers* - outlines arrangements for nominating fishers and cancellation of endorsements;
- *Total allowable catch and quota allocation*; and
- *Provisions relating to crew, boats, records and other matters*.

Further details can be seen in the Part 4 of the share management plan.

As part of this FMS, some additions and amendments to regulations in the share management plan have been developed (Section 3). These will be implemented upon revision of the share management plan.
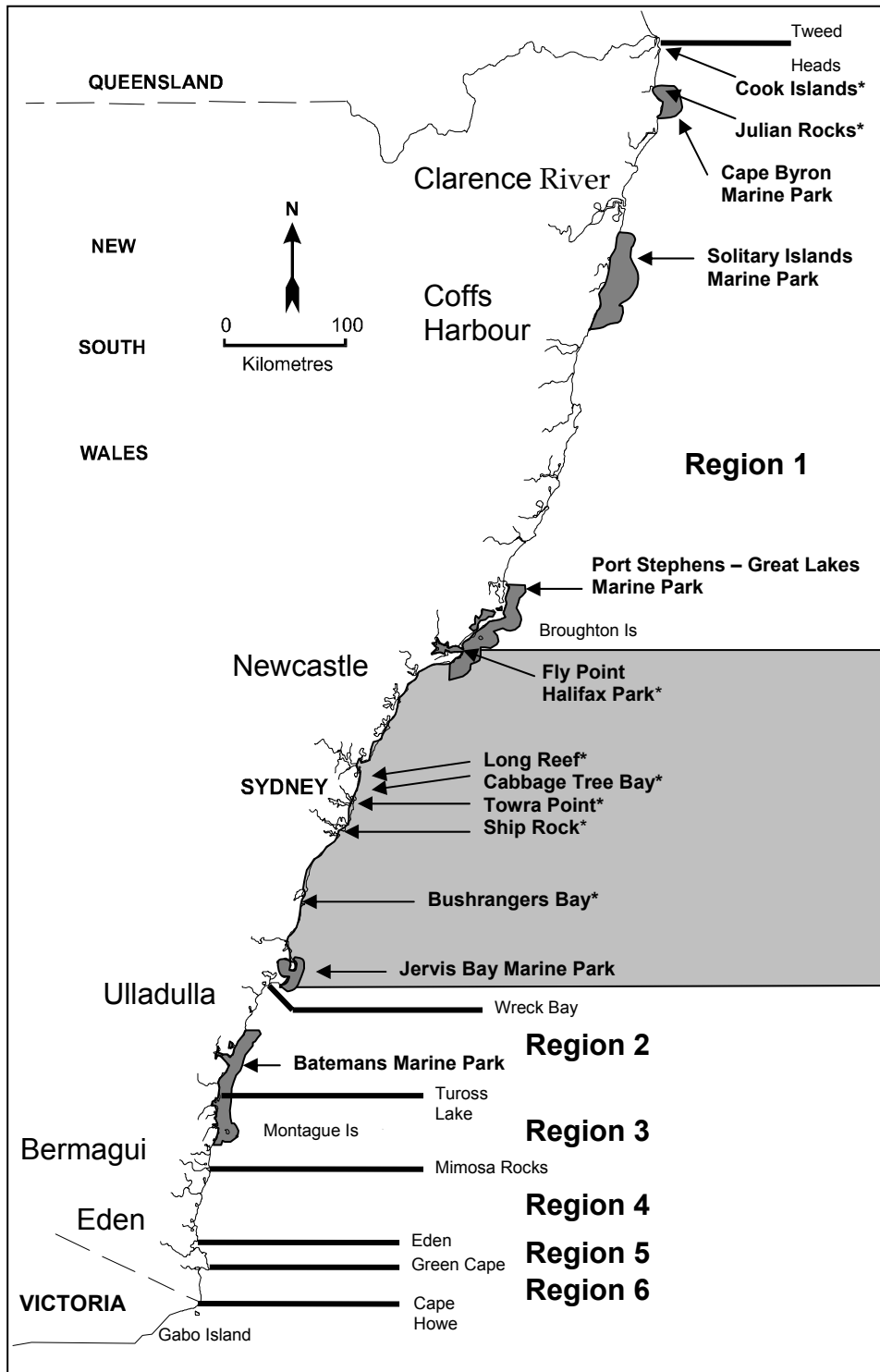
Figure 1. NSW coast, showing abalone assessment regions 1-6, marine parks (dark grey) and aquatic reserves (*) where commercial harvesting of abalone is not permitted and the current general closure to the taking of abalone in the southern part of Region 1 (light grey). NB. Occasionally, some commercial divers are allowed to take abalone in the Region 1 closure under a section 37 research permit.

2.2.3 Enforcement and Compliance

NSW DPI Field Services aims to provide protection and ensure long term sustainability of the abalone resource by utilising advisory and enforcement programs consistent with the management arrangements for the fishery. NSW DPI Field Services strategies include:

- Maximising voluntary compliance;
- Providing effective deterrence; and
- Effective support services.

The Abalone Compliance Strategic Plan is also in place and has the specific objectives to:

a) Maintain or increase the biomass of mature and legal sized abalone (i.e. abalone that are not a prohibited size, as specified in Clause 7 of the *Fisheries Management (General) Regulation 1995*). This involves attendance of Fisheries Officers at MAC meetings, liaison with stakeholders to discuss concerns and trends and ensure information is given to the TAC Committee; and

b) Minimise the number of offences committed by divers and abalone processors. This is ensured by: maintaining dedicated officers in the Fisheries Investigation Unit identified through program budgeting tasked with abalone compliance duties; overt patrol of coastal waters targeting recreational and commercial and illegal diving activities; intelligence gathering and analysis; implementation of the National Docketing System; and extended abalone compliance patrols targeting organised abalone thieving operations leading to prosecution of persons involved in the theft and illegal trade in abalone. These processes are coupled with continued public awareness programs through information packages and advisory functions.

The compliance plan is re-evaluated annually as part of performance monitoring of the share management plan.

A number of new initiatives for improving compliance are proposed as part of the FMS. For example, it is intended that processors will be temporarily banned if caught in possession of abalone without the appropriate documentation. Some of the initiatives are to be implemented within a specific time, others on revision of the share management plan. Performance indicators for compliance have also been refined as part of this FMS in order to better understand whether objectives are being achieved.

2.2.4 Fees, Charges, Cost Recovery and Community Contribution Payments

Under the NSW Government's policy on cost recovery, abalone shareholders are required to pay the attributable costs of managing the fishery and to make a community contribution for exploiting the resource. Management charges including research and compliance are calculated based on the broad pricing principles recommended by the *Independent Pricing and Regulatory Tribunal* (IPART 1998).

The fishery is managed to ensure that the management charge does not increase significantly (greater than Consumer Price Index), excluding any increase for the provision of additional services by NSW DPI as requested by the Abalone Fishery advisory body.

The FMS contains a number of new services that will have budgetary implications.

The community contribution charge is calculated as a percentage of gross revenue per share. The percentage varies on a sliding scale in accordance with a CPI adjusted average annual beach price (AABP), wherein:

- if the AABP is below $43/kg the percentage rate will be 0% (i.e. no charge will be payable);
- for an AABP between $43 and $52/kg the rate will increase by 0.5% per dollar to 5% of the revenue at $52;
- for beach prices from $52 to $62 the rate will increase by 1% per dollar to 15% of revenue at $62; and
- above $62/kg the rate will remain at 15%.

To take into account the impact of any significant changes in the TACC on industry profitability, threshold points relating to the sliding scale will be adjusted as follows:

- If the TACC decreases by less than 10%, the thresholds remain unchanged;
- If the TACC decreases by 10% or more, all thresholds for calculating the charge in the year affected increase by $1 for each 10% decrease in TACC;

Note that a TAC decrease will be rounded to the nearest 10% to calculate the increase in the threshold:

- If TACC reductions in any one year increase the thresholds by $2 or more, the thresholds for each subsequent year will increase by half the amount of the immediately preceding years adjustment for that TACC change, rounded to the nearest whole dollar;
- If the TACC increases, the threshold levels will be reduced by the same amount as thresholds are increased when the TACC decreases, with some exceptions as follows;
- If a TACC adjustment wholly or partly reverses an adjustment which applied in the previous year, the thresholds for the latest year will be set at the level that would have applied if the net TACC change had all occurred in that year; and
- If more than one adjustment in the same direction applies in any one year, the final adjustment for that year will be the total of all the adjustments that apply.

Shareholders also pay a number of other specific fees such as preparation fees for the FMS and EIS for the Abalone Fishery, quota transfer, share transfer/mortgage fees and application fees for crew.

This FMS does not in itself set the management fee or limit, or otherwise govern the way fees are charged.

2.2.5 Fishing Closures

The FM Act provides for the use of fishing closures in the Abalone Fishery to, among other things, manage the amount of fishing effort in a sensitive area/region, manage conflicts between stakeholders over the use of the resource and to ensure it is equitably shared, and to prevent the spread of marine pests or diseases (e.g. *Perkinsus*). While most closures are implemented under section 8 of the FM Act, other regulations such as marine parks and aquatic reserves can have the same effect of regulating how abalone fishing is undertaken in specific areas (e.g. Bouddi National Park and Bushrangers Bay).

Fishing closures can be established on a seasonal, time, area, operator or gear-specific basis.

Fishing closures are required to be published in the NSW Government Gazette, however, if the Minister for Primary Industries considers that a fishing closure is required urgently, the Minister may introduce the closure and advise the public through media outlets and by displaying prominent signs in areas adjacent to the waters affected. In the case of an urgent closure, the Minister is to publish the closure in the Government Gazette as soon as practicable.

Details on up-to-date fishing closures that may apply to the Abalone Fishery can be found on the NSW DPI website (www.dpi.nsw.gov.au).

2.2.6 Bycatch and Threatened Species

Abalone are individually gathered by hand, hence it is a target-specific fishery, with virtually no incidental catches (bycatch) of other species. The shells of abalone, however, can be colonised by commensal organisms which include invertebrates such as chitons and limpets, sponges, boring annelids and algae. These organisms are harvested together with the abalone on which they reside, and may therefore be considered as a limited bycatch, and although they have no commercial value they may be of value to the ecological system. As part of the proposed research on potential ecosystem effects of the fishery, there would be an assessment of the bycatch associated with abalone. Subject to the results of this research, the Abalone Fishery Code of Practice (to be developed within 12 months of the implementation of this FMS) would implement a bycatch management strategy.

There are several threatened species that occur within habitats near where abalone are harvested. One example is the eastern population of the grey nurse shark, *Carcharias taurus*, for which a recovery plan has been prepared by NSW DPI. The risk of the commercial fishery for abalone interfering with threatened species is minor and no specific measures are warranted at this point in time to manage potential interactions. However, the FMS includes a response to facilitate reports of sightings of endangered or vulnerable species and introduced pests, such as the Japanese Sea Star, by divers

(management response 1.1b). Industry has met with researchers to enable abalone divers to identify such pests and alert the relevant authority. The Abalone Council Australia Ltd, a formal body set up to promote and help safeguard the abalone industry of Australia, supports such initiatives and terms this diver-awareness as 'sentinels of the deep'.

2.2.7 Provision for Consultation & Participation by Stakeholders in Management

There is a range of consultative bodies established in NSW to assist and advise the Minister and NSW DPI on fisheries issues. There are committees established to provide advice on specific issues as well as bodies to advise on matters which cut across different fisheries or sectors. In particular, there are three committees that have a very significant input into the operation of the Abalone Fishery and these would continue under future management of the fishery. These committees are detailed below.

2.2.7.1 Management Advisory Committee

Management Advisory Committees (MACs) have been established for each commercial fishery in NSW under Section 230 of the FM Act. They provide advice to the Minister for Primary Industries regarding the management of each fishery. Initially, consultation between government and industry was achieved through the United Abalone Divers Association, which remained a cohesive group until 1990. In 1989, the first Abalone Management Advisory Committee (ABMAC) was established. MACs provide a forum for discussion, negotiation and conflict resolution in each fishery. The desired outcome of the MAC process includes production of a management plan that clearly defines the rules and actions required to ensure ecologically sustainable development of fisheries resources in NSW.

MACs comprise an independent chairperson, elected industry members, and non-industry members appointed by the Minister to represent other interest groups such as Aboriginal, recreational fishers, conservation groups and NSW DPI. Other industry and departmental observers may also attend MAC meetings. Departmental staff attend to provide expertise on fisheries management, research, conservation and compliance considerations. The MACs are the Department's main point of contact with each fishery, providing a forum where issues relating to a fishery can be discussed, problems identified and solutions developed. The functions of a fishery MAC are:

- to advise the Minister on the preparation of any management plan or regulations for the fishery;
- to monitor whether the objectives of the management plan or regulations are being achieved;
- to assist in a fishery review in connection with any new management plan or regulations;
- to advise on any other matter relating to the fishery.

2.2.7.2 Ministerial Advisory Councils

Two ministerial advisory councils are currently established under the FM Act. The councils provide advice on matters referred to them by the Minister for Primary Industries, or on any other matters the councils consider relevant. They report directly to the Minister.

The Ministerial advisory councils currently established are:

- Seafood Industry Advisory Council (SIAC); and
- Advisory Council on Recreational Fishing (ACoRF).

The Abalone Fishery and other share management fisheries have industry members on the SIAC. The Council also includes representatives from NSW DPI, conservation interests and Aboriginal interests.

The name and composition of the Ministerial advisory councils are determined by regulations under the FM Act and may be altered from time to time.

2.2.7.3 Total Allowable Catch Setting and Review Committee

The process for assessing the status of and pressure on abalone stocks will ultimately include the TAC Committee which is empowered to make "determinations" under Division 4 of Part 2 of the FM Act.

This committee will, as required by the share management plan, make determinations about the total level of fishing effort to apply in the harvesting of abalone in connection with this fishery. The TAC Committee consists of at least four members appointed by the minister, including:

(a) the Chairperson of the TAC Committee, being a person who is neither engaged in the administration of the FM Act nor in the commercial fishery;

(b) a natural resource economist not employed by the Government;

(c) a fishery scientist not employed by the Government; and

(d) an independent specialist with appropriate fisheries management qualifications.

The composition and role of the TAC Committee are set by the FM Act and its regulations, and these arrangements may change from time to time.

Changes were made in early 2005 to make TAC Committee processes more independent, transparent and accessible. These included engaging an independent person with fisheries management expertise to be included in the committee. The TAC Committee will also provide opportunities to give oral presentations to the committee and ability for the committee to meet in regional locations.

2.3 Factors Affecting the Operation of the Fishery

A history of careful management of the Abalone Fishery coupled with a well developed research program since 1994 has helped the industry and NSW DPI identify and address many of the internal challenges that have arisen in the past three decades. Key to the successful management of internal issues has been the establishment of the 115 mm minimum legal size (MLS), which allows the majority of abalone in the state-wide population at least two years of spawning before being harvested. Quota management has also been important to the successful management of internal issues to the fishery. Quotas protect an appropriate component of the stock of abalone above the MLS from being taken by commercial fishers. Despite the benefits to the fishery of an appropriate size limit and quota, the NSW Abalone Fishery is facing a variety of internal risks, as identified in the EIS for the fishery. These are described below and have been considered throughout the development of this FMS.

The main internal risks include:

- potential for inappropriate concentrations of fishing;
- reduced economic viability;
- potential increase in the number of divers (and associated capital investment) relative to the available resource base;
- insufficient involvement of industry in management arrangements;
- other ecological impacts from harvesting abalone; and
- potential increases to the rates of discarding abalone.

These internal factors are largely under the control of either the industry or the FM Act. External risks (as identified in the EIS for the fishery) are often beyond the control of the industry but nevertheless have been fully investigated as part of the EIS and require consideration in the FMS. In some cases, external risks could have a greater impact on the fishery than internal risks. For example, *Perkinsus* has been responsible for large-scale reduction of the stock in assessment Region 1.

Broadly, the main external risks include:

- illegal collection of abalone;
- competing interests in the resource from recreational and Aboriginal groups;
- other human-induced impacts on the stock (e.g. aquaculture and sewage disposal); and
- diseases affecting abalone.

3. GOALS, OBJECTIVES AND MANAGEMENT RESPONSES

3.1 Management Framework

The management objectives in the share management plan for the Abalone Fishery have been adapted in the FMS and developed as eight broad goals. Each goal has its own set of objectives and applicable management responses for achieving particular objectives. This section of the FMS presents the goals and objectives through which the FMS would operate.

In addition, the principles of Ecologically Sustainable Development (Section 1.2.2) have been incorporated into the management responses/actions for sustainable management of the Abalone Fishery.

Figure 2 presents a simple management framework that can be used to relate the overall requirements under the FM Act through to specific actions that could be used to ensure the requirements are achieved.

Figure 2. Goals, objectives and responses in the fisheries management strategy.

Fisheries Management Act 1994
These are the legal parameters for managing NSW Fisheries resources and developing fisheries management strategies

Goals of the fishery management strategy
These are major objectives that show how the strategy will comply with its legislative requirements; performance against them must be measured, assessed and responded to

Objectives of the fishery management strategy
The objectives relate to the actions used to achieve the fishery goals

Management Response
These are the specific actions that will be used to achieve the fishery objectives

In practice, many of the management responses can achieve multiple objectives and even several goals. **Figure 3** shows one example of how a single management response can affect several goals and objectives.

Figure 3. Example of how a single management response can affect multiple goals and objectives.
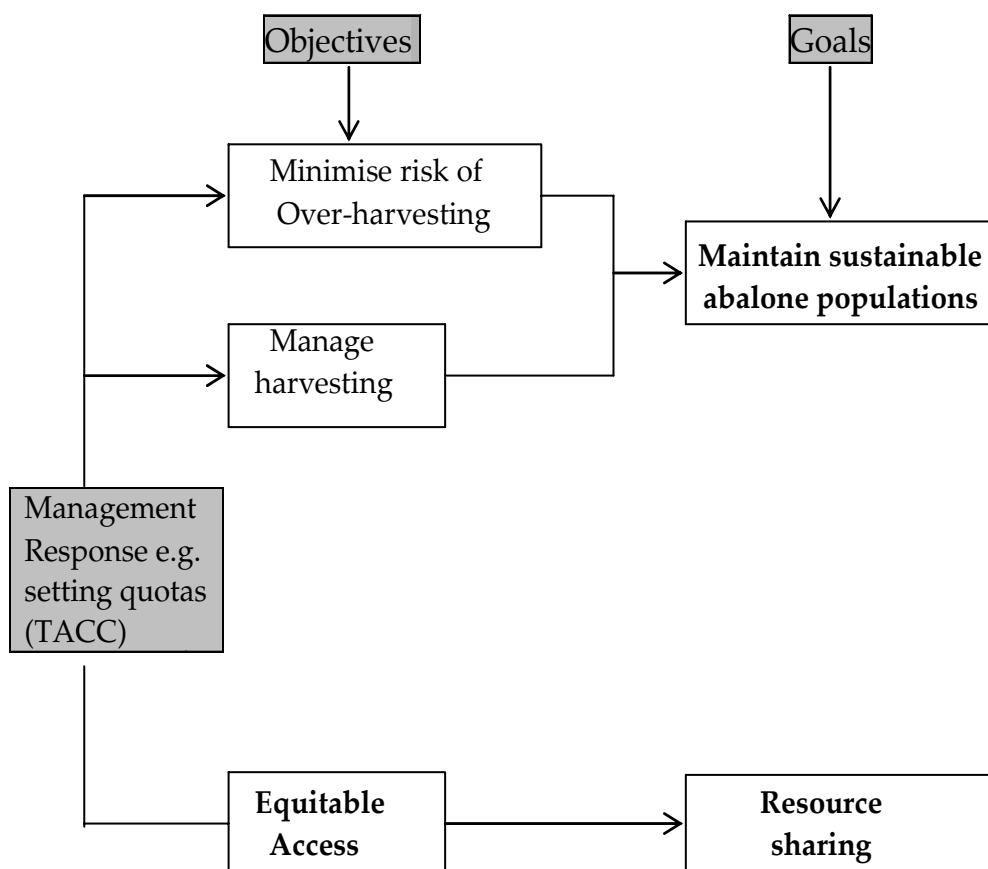
This management structure has been dealt with below by listing each management response once only, under the objective that the response contributes most towards achieving. The management responses listed below relate to specific actions that contribute directly to meeting the goals and associated objectives defined for the Abalone Fishery. Some of these responses have been identified to address specific risks identified in the EIS.

The overall management regime for the Abalone Fishery includes the FMS management responses, the principles, guidelines and legal requirements contained within the share management plan, as well as the general requirements of the FM Act and associated Regulations. The time periods within which

each FMS management response is scheduled to be implemented are included at Appendix 4, as are the entities who have the lead responsibility for carrying out the actions.

It is important to recognise that the FMS is for the commercial Abalone Fishery and can manage only those factors that are under the control of management; for example, catch taken by commercial divers as opposed to catch taken by recreational divers. The strategy can monitor variables outside the direct control of managers, such as changes in the business and ocean environment, but is unable to directly address many of these as they are outside human control. Therefore the goals, objectives and management strategy discussed below concentrate on variables that are under the control of the commercial fishery and its management.

3.2 Vision for the Commercial Abalone Fishery

The vision for the fishery is:

A healthy, productive, well managed abalone stock, being fished sustainably and profitably by fishers with minimal impact on the natural and social environment.

3.3 Goals, Objectives and Management Responses

Goal 1. Manage commercial harvesting of abalone to promote the conservation of biological diversity in the coastal environment

Objective 1.1 Increase knowledge and minimise any adverse impacts of harvesting abalone on bycatch, associated habitats and ecosystems

1.1(a) Continue to develop and implement a program to increase knowledge of the effects of abalone harvesting on bycatch species and associated habitat and ecosystems

Background

Unlike most other fisheries, harvesting abalone is highly selective with minimal bycatch. The fishery does not interact closely with any endangered, threatened or protected species or threatened ecological communities. Furthermore, there is little damage to the physical environment and non-target species, associated with harvesting abalone from reefs, as is often the case with trawling and other fisheries. While there is good knowledge of the interaction between abalone and the purple sea urchin, Centrostephanus rodgersii *(Andrew* et al. *1998), knowledge of the ecological interactions between abalone and other species could be improved.*

*Two types of surveys developed by shareholders and NSW DPI will form the basis of the proposed program. First, surveys of the extent of different habitat types associated with abalone populations have already been completed in areas open and closed to abalone harvesting. Second, surveys of populations of turban shells (*Turbo *spp.) and sea urchins (i.e. of distribution, abundance, size-structure etc.) associated with abalone habitat have also been completed in areas open and closed to abalone harvesting. These surveys need to be developed and expanded to improve their ability to monitor changes in the environment associated with harvesting abalone. As well as expansion of the surveys to more areas closed to abalone harvesting, the surveys will be developed to consider other species, and particularly the potential use of indicator species. The frequency of the surveys will be considered and will be responsive to identified environmental risks.*

In addition to the surveys, a range of other factors will be investigated in the design of the monitoring program, including collaboration with other research institutions, and the development of a reporting system for divers to report observations about bycatch, habitats, ecosystems or threatened and protected species. Historically, divers have been the first to recognise changes in the environment, such as increases in mussel and sea urchin populations, and declines in abalone populations associated with the parasite, Perkinsus*. The development of a reporting system for divers may provide very valuable information about changes in the environment, particularly considering the large time spent underwater by divers.*

The programs undertaken under this response will enable the selection of an appropriate performance indicator(s) that can be used in the future to monitor the impacts of the fishery on marine biodiversity.

1.1(b) Develop and implement a NSW Abalone Fishery Code of Practice to minimise the impact of harvesting abalone on bycatch species, associated habitats and ecosystems

Background:

In the past, divers and processors have developed harvesting and handling practices to maintain the quality of abalone for market and to minimise any impact of harvesting on associated species. These practices have been developed in conjunction with the establishment of live markets over the past decade. Live exporters demand unmarked, undamaged, vibrant abalone. This quality control starts

with the diver carefully removing the abalone without damaging the meat or shell (and if it is undersized then it can be safely resettled). The deckhand must carefully clean algae, invertebrates and debris off shell and pack in special crates, which prevent abalone physically damaging each other (i.e. by abrasion). These crates are held in 'live tanks' on board until removal for validation. These practices already form the basis for an informal code of practice for abalone divers but the code will be extended to a formal NSW Abalone Fishery Code of Practice that contains information for encouraging best-practice management techniques in all areas of the fishery, with links to the Australian Seafood Industry Council (ASIC) Code of Conduct for the Australian Seafood Industry, training and accreditation schemes. The code will be adaptive to address evolving knowledge or new issues as they arise. Specific objectives of the code that relate to this management response include techniques to harvest abalone to minimise the impact on associated species, including returning animals caught incidentally to abalone (e.g. some molluscs) to the reef and recording sightings and interactions with threatened and protected species or introduced pests.

The Abalone Fishery Code of Practice would also address other issues in the fishery such as those outlined below, and supports the implementation of other FMS management responses:

- *harvesting abalone in a manner that would cause minimal impact to the stock and the marine environment, including a practical approach to returning fauna caught incidentally to abalone to the reef;*
- *returning undersized stock to original habitat they were collected from;*
- *using best practice handling techniques so as to provide a high quality product to the market;*
- *recording sightings and interactions with marine threatened and protected species and introduced pests;*
- *educating fishery participants in the importance of the abalone resource to the maintenance of Aboriginal cultural heritage, including how their operations can be modified so as to minimise any impacts of items or relics of Aboriginal or European cultural heritage and communication with Aboriginal stakeholders;*
- *reporting evidence of illegal harvesting to the appropriate authorities;*
- *providing guidelines to help control the spread of* Perkinsus*; and*
- *any other behaviours and practices relevant to the fishery.*

Performance measures to monitor the effectiveness of the Abalone Fishery Code of Practice would be developed following finalisation of the code.

> 1.1(c) Implement, in consultation with the ABMAC, the provisions of any relevant threatened species recovery plan, threat abatement plan, or other similar management arrangements designed to protect critical habitat areas

Background:

Once a species, population or ecological community has been listed as threatened, a recovery plan must be developed. These plans are designed to return the species, population or ecological community to a point where its survival in nature is assured. The recovery plans referred to in this response could include those being developed under the FM Act, the Threatened Species Conservation Act 1995 *or other State or Commonwealth legislation.*

Additionally, threatened species legislation requires the development of a threat abatement plan for any listed key threatening processes. A threat abatement plan outlines actions to eliminate or manage the key threatening process, and identifies the authorities responsible for carrying out those actions.

This response recognises that the statutory provisions of a threatened species recovery plan or threat abatement plan, or any arrangement necessary to protect a critical habitat area, must be implemented and given precedence over the provisions of this FMS.

Goal 2. Maintain or rebuild the biomass of abalone to ensure stock sustainability

Objective 2.1 To maintain or increase the spawning and exploitable biomass of abalone

2.1(a) Continue to implement a state-wide TACC for abalone, determined by the TAC Committee

The state-wide Total Allowable Commercial Catch (TACC) of abalone is set each year by an independent committee formed under the FM Act - the TAC Committee. In setting the TACC, the Committee must take into account the objectives of the FM Act and is required to have regard to all relevant scientific, industry, community, social and economic factors. The TACC establishes the maximum weight of abalone to be harvested by commercial fishers within each fishing period, and is implemented using a tradeable quota management system. Shareholders are allocated quota from the TACC in proportion to each individual shareholding. Over recent years the state-wide TACC has been reduced in response to, among other things, the decline in populations and reduced catches in Region 1 related to Perkinsus *and to rebuild the biomass of abalone where appropriate (see management response 2.1b).*

A state-wide TACC can provide adequate protection for abalone populations only if catches are distributed appropriately. The TAC Committee endeavours to do this within its terms of reference by recommending an appropriate distribution of the TACC among regions of the fishery. Management response 2.2b details the arrangements for managing the spatial distribution of catch.

2.1(b) Refine the existing harvest strategy for the fishery and implement a definitive recovery strategy for the abalone resource

Background

The harvest strategy for the NSW Abalone Fishery has historically been based around a state-wide TACC and minimum legal size. The contemporary approach adopted in abalone fisheries in other jurisdictions has been to move towards management at smaller spatial scales, including greater flexibility in the size at which abalone are harvested. Such an approach might be appropriate for NSW to adopt, if shown to be cost effective within the context of the relatively small scale of the fishery. Accordingly, the suite of management responses in this FMS places a greater focus on the potential for managing the harvest of abalone at smaller spatial scales. Management responses 2.2a-f outline how harvesting might be done using alternative sizes, how populations could potentially be enhanced rapidly at local scales, and include the development of a framework for the application of fishing closures. Some of these smaller-scale rebuilding strategies are to be developed shortly after the approval of the FMS (see Appendix 4). Other proposals that would assist with rebuilding stocks at local scales are being developed by industry and these would focus on management outcomes at scales smaller than the existing regions.

The current recovery strategy for abalone in NSW is based on an annual review (and adjustment where appropriate) to the TACC. In setting the TACC in recent years, the TAC Committee has used a principle of delivering a population (in terms of the mature stock) at or above the 1994 benchmark[2] in 5 years, with at least a 90% probability. A review of NSW abalone stock assessment research completed in 2000 found the 1994 benchmark to be a convenient relative reference point, but noted

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[2] The 1994 benchmark level was identified in the share management plan as a biomass level in an area of the fishery in which a TACC applies against which changes could be reliably made, and identifies the biomass level of 85% of the 1994 biomass level as a trigger for corrective management action. A further trigger identified in the share management plan occurs if there is more than a 50% chance of the biomass falling below the minimum benchmark if the TACC remains unchanged.

that its appropriateness should be re-examined periodically (Sainsbury, 2000). It is timely to review that reference point as part of the implementation of a more definitive recovery strategy for the NSW abalone resource. The strategy needs to specify clear recovery targets (ie. target biomass levels and timeframes, and hence the desired rate of recovery) and contingency actions if the targets are not met. Clearer recovery targets should assist the TAC Committee in setting an appropriate TACC for each fishing period, further improve the transparency of that process, and allow shareholders to plan operations more effectively over the medium to long term. This FMS includes the range of management tools needed to achieve any recovery targets that are set.

2.1(c) Continue to apply the state-wide minimum legal size of 115 mm

Background

Minimum legal size (MLS) limits can be used to protect the reproductive capacity of a population by delaying the harvest of individuals until they have matured and spawned. Commercial divers encouraged the introduction of an MLS of 100 mm in length for abalone in 1973, and encouraged a series of increases to 115 mm by 1987. This MLS is considered necessary to ensure an appropriate level of reproduction in a population with average rates of demography, and is likely to provide at least two years of spawning for individuals with average growth rates before becoming exposed to harvesting. Abalone less than 115 mm in size are now abundant in many populations throughout NSW. Despite this, it may still be appropriate to investigate the potential of alternative size limits and management response 2.2a provides for an examination of alternative size limits on a variety of spatial and temporal scales. For example, different minimum size limits for different areas could be examined, and maximum size limits could also be investigated.

2.1(d) Continue the collection of fishery-dependent information to contribute to the abalone stock assessment

Background

Information about the catch and effort of commercial divers is collected by daily and monthly dockets. Daily dockets provide information on the catch (i.e. weight and number) and effort (i.e. diving hours) within each sub-zone of the fishery. They also provide information about nominated fishers, crew, boat ramps and validation. This information can be summarised and is essential for management of the fishery, particularly for stock assessment (see management response 2.1f).

Options to involve industry in the collection of other information will continue to be pursued.

2.1(e) Continue the collection of fishery-independent information to contribute to the abalone stock assessment

Background

Fishery-independent surveys are surveys of the stock done completely independent of the fishing process. Commercial abalone divers began funding the development of fishery-independent surveys in 1994. The surveys involve sampling the abundance and size-structure of abalone populations in areas throughout most of the fished areas of NSW. This information forms the basis of estimates of change in the mature and exploitable biomass of abalone within each stock assessment region, and is fundamental to the annual assessment of the population (see management response 2.1f) and determination by the TAC Committee. In the future, it may be appropriate to modify the frequency or intensity of the surveys in response to concerns about the population and particularly advice from the TAC Committee.

2.1(f) Continue stock assessments of the abalone resource

Background

An assessment of the abalone stock is currently prepared each year. The assessment presents all available observations about the abalone populations, and particularly relies on estimates of catch and catch rate from the commercial fishery (management response 2.1d), and abundance and size-structure from independent surveys (management response 2.1e). A formal assessment of the current state of the population is made using a length-structured model of the state-wide population fitted to observed data on the stock within a rigorous statistical framework. The model is used to simulate the likely effects (i.e. risk to the population) of future catches under a number of scenarios involving different TACCs. The assessment of the current status of the stock, along with the likely effects of future TACCs is presented to the TAC Committee each year and forms the basis of their annual determinations and regional targets for catch (see management responses 2.1a and 2.1b).

As per the fishery-independent surveys (management response 2.1e), it may be appropriate in the future to modify the frequency or intensity of the assessment in response to concerns about the population and particularly advice from the TAC Committee.

Objective 2.2 To improve the efficiency of harvesting and investigate the potential of techniques to rebuild populations of abalone

2.2(a) Develop a plan to investigate the feasibility of implementing different size limits on a variety of spatial and temporal scales, with provision to implement longer term actions

Background

Minimum size limits are generally applied to balance harvesting with the capacity of the population to replenish itself. If a size limit is set too high then only a small proportion of a stock will be available for harvesting. If set to low, then immature abalone could be exposed to harvesting thereby increasing the risk of recruitment overfishing. The current state-wide MLS of abalone is 115mm (management response 2.1c). This is based on the average size at maturity of abalone in NSW which is about 90-100 mm. Under average growth rates, individuals are thought to reproduce at least once before reaching the MLS. However, because of spatial variation in growth, and potentially in size at maturity, it may be appropriate to utilise different size limits within different areas and times. For example, in areas with very fast growing abalone (e.g. south of Wonboyn), sustainable yield is likely to be improved by increasing the MLS and allowing individuals a greater chance to reproduce. In areas with stunted abalone populations, where few individuals grow above the MLS, sustainable yield is likely to be improved by decreasing the MLS. Such changes to the MLS could be be done over short time periods (i.e. fishdowns in stunted or flood-prone areas) or on a longer term basis within specific areas (e.g. south of Wonboyn). Alternative MLSs, such as described above, have been successfully implemented and provide benefits to sustainable yields in all other abalone fisheries in southern Australia.

Any proposal to harvest at alternative sizes will need to carefully consider biological, compliance, cross-sector and cost effectiveness factors, as well as the use of voluntary versus mandatory mechanisms. For example, while sustainable yield of fast-growing populations may be increased by increasing the MLS of abalone harvested south of Wonboyn, this may also reduce access to stunted populations within the area, unless short-term fishdowns on these populations are also provided for. Further, implementation of alternative MLSs should also consider the current state of the stock and the likely influence of changes in the MLS on commercial catch rate. For example, if the MLS were to be increased in an area, this may be done in a series of increments when catch rates were high.

Although it is expected that any plan for harvesting at alternative size limits would evolve over time as conditions in the fishery change and more knowledge of the stock within particular areas becomes available, an initial plan is proposed to be completed within 12 months of the approval of the FMS.

2.2(b) Manage the spatial distribution of catch through:

(i) the TAC Committee continuing to set a state-wide TACC with recommended catch limits for specific regions;

(ii) encouraging industry to develop its own spatial management controls (eg. catch limits closures and size limits at a sub-regional scale) including the duration of such measures;

(iii) the automatic implementation of binding regional catch limits (starting with the 2008/09 fishing period) if the improved voluntary arrangements result in breaches to the TAC Committee's recommended regional limits during the 2006/07 and 2007/08 seasons (or any subsequent season); and

(iv) development of new performance measures to monitor the effectiveness of any smaller scale spatial management approach

Background

It is generally acknowledged that stocks of abalone have important structure at small spatial scales. The broad management regions for the Abalone Fishery in NSW probably have different overall levels of productivity with little inter-connection. Hence, there is potential for local depletion of abalone populations if fishing effort becomes concentrated in particular areas, and through serial depletion this can lead to more general over fishing. Given that there is uncertainty about stock and sub-stock structure, and there has been a significant shift in fishing effort to the far south of the State in recent years, a program of small-scale management might be appropriate.

It should not be assumed that a fixed management approach will be able to operate at the scales necessary to best address the risk associated with undesirable concentrations of fishing effort. The contemporary approach to managing abalone fisheries is for government to provide broad-scale regulated protection for the stock, together with shareholders and divers in the fishery implementing, justifying and demonstrating appropriate management of the spatial distribution of catch at smaller spatial scales. This management will require industry to justify and demonstrate outcomes from finer-scale spatial management to government, the TAC Committee and all other stakeholders.

With respect to point (ii) of the response, flexibility in sub-regional catch limits will allow for imprecision in determining the appropriate catch for smaller areas and allow divers to catch their quota in other areas if environmental conditions reduce the availability of abalone for commercial harvest in a particular area. Industry will take the lead role on proposals to implement catch limits for sub-regional areas, taking account of advice from the TAC Committee and NSW DPI.

NSW DPI will continue to provide timely information to industry about catches and catch rates at regional scales, taking account of relevant privacy provisions. That is, the aggregated catch for each region will be released to industry by the 15th day of each month and industry will need to act when regional catch limits look likely to be exceeded. Any closures proposed by industry will need to be consistent with the closing/re-opening policy to be developed under management response 2.2c.

2.2(c) Develop and implement a framework for closing and re-opening areas to commercial abalone harvesting

Background

The intent of this management response is to develop a framework (agreed to by industry and NSW DPI) that will specify criteria for closing and re-opening fishing areas. Initial priority will be given

to the current closure within Region 1 and the use of a seasonal closure as previously applied to the whole fishery.

Criteria will be based on biological information and have regard to relevant industry needs, including the processing sector. Closure actions will need clear objectives and include performance indicators for re-opening (or maintaining or strengthening) a closure. The development of criteria will involve collaboration among researchers, managers, commercial abalone divers, shareholders and other stakeholders. All stakeholders need to be informed about the purpose, scope and duration of a closure and any compliance, monitoring and funding requirements.

The framework will also include guidelines for industry to apply spatial and/or temporal fishing closures on a voluntary basis (e.g. through the Abalone Fishery Code of Practice), and a facility for industry to request NSW DPI to make the closures mandatory in the event that some divers to not comply. Since NSW DPI retains legal responsibility for such a closure, these arrangements will need to provide for a means of dealing with divergent industry views on recommended closures (e.g. share- or shareholder based plebiscite).

Initial emphasis will be to develop specific objectives for the closure in Region 1. Reductions in the abundance of abalone related to infection by Perkinsus *were first confirmed in 1992 near Sydney. The area from Jervis Bay to Port Stephens was closed in November 2002. Although catch from the area was low immediately prior to closure, there is a history of the commercial fishery using the area when populations of abalone in the south of the state are more limited and/or as a seasonal preference for divers. The decline of abalone stocks due to* Perkinsus *and the subsequent closure of the region have led to an increased concentration of divers in the southern regions. There is currently no strategic plan for the management of areas where abalone are affected by* Perkinsus, *and the success of the closure has not been assessed. For example, the presence of commercial divers in an area can assist compliance officers through detection and reporting of illegal fishing, as well as providing other information on environmental factors and the resource status. The plan for Region 1 would primarily detail how stock assessment information would be obtained through a structured, scientific sampling program and analysis. Industry representatives have indicated a strong interest in participating in the program and opportunities to do so will be pursued (e.g. using commercial divers to be involved with the survey). The assessment would be used to develop objectives as to when the area should be re-opened or when partial commercial fishing can occur.*

> 2.2(d) Provide for the implementation of reseeding experiments in up to 1% of reef in water depths less than 20 m in NSW waters

Background

Research into the potential of releasing hatchery-reared larval and juvenile abalone to reseed areas of reef has been undertaken by commercial abalone divers and NSW DPI in recent years. All releases to date have been small, and designed to investigate the development and potential of the technique. While rates of recapture of released abalone have been variable, it is clear the technique offers considerable technical potential. In particular, reseeding offers the potential to redress the over-depletion of localised areas of reef, or mitigate the effects of future impacts, that may occur for a variety of reasons (e.g. illegal catch).

This program will enable the carrying out of relatively small-scale experiments to further investigate the potential and effects of reseeding. No reseeding, however, will be authorised until a detailed proposal is developed and approved under the FM Act. This process will require, for each proposal, the preparation of a comprehensive risk assessment, consultation with key stakeholder groups and a permit issued under the FM Act. The requirements for the risk assessment will be agreed between NSW DPI and ABMAC.

The proposal will address a range of issues including collection of brood stock, hatchery and grow-out site and maintenance, genetic and health issues, harvesting size, monitoring, rights of access

including the distribution of costs and benefits among stakeholders, and commercial viability. A separate EIS prepared under the EP&A Act would be required for proposals to reseed over a larger area or to re-seed on an ongoing commercial basis.

2.2(e) Provide for the implementation of experiments on the effects of moving abalone within 2 km distances, in up to 1% of reef in water depths less than 20 m in NSW waters

Background

Research into the potential of moving mature abalone short distances (i.e. <1 km) to help rehabilitate abalone populations has been undertaken by commercial abalone divers and NSW DPI in recent years. This technique is also used in several other abalone fisheries around the world. All movements in NSW to date have been small, and designed to investigate the development and potential of the technique. For example, abalone have been moved short distances from areas where stunted populations occur, (i.e. where few grow to the MLS) to areas where they have been heavily depleted and grow faster. The abalone that are moved begin to grow more rapidly and contribute to reproduction and potentially recruitment at the new site. Rates of growth and recapture of moved abalone have been high and the technique offers considerable potential. In particular, moving abalone short distances offers the potential to redress the excessive depletion of localised areas of reef, or mitigate the effects of future impacts, that may occur for a variety of reasons (e.g. illegal catch).

This program will enable the carrying out of relatively small scale experiments to further investigate the potential and effects of moving abalone short distances (commonly less than 1 km and never more than 2 km). No short-distance movement of abalone will be authorised until a detailed proposal is developed and approved under the FM Act. This process will require, for each proposal, the preparation of a comprehensive risk assessment, consultation with key stakeholder groups and a permit issued under the FM Act. The requirements for the risk assessment will be agreed between NSW DPI and ABMAC.

The proposal will address a range of issues including the sites and techniques and sizes of abalone to be used, compliance issues, the type and scale of monitoring that will be undertaken, commercial viability and the distribution of costs and benefits, and the implications for other lawful resource users. A separate EIS prepared under the EP&A Act would be required for proposals to move abalone short distances that had the potential to affect a larger area of reef, other lawful resource users or to move abalone over larger distances.

2.2(f) Continue to investigate the potential for, and effects of, restoring abalone populations through sea urchin harvesting in up to 1% of reef in water depths less than 20 m in NSW waters

Background

*Research into the potential of restoring abalone populations by reducing the density of sea urchins (*Centrostephanus rodgersii*) has been undertaken by commercial abalone divers and NSW DPI for the past ten years. Abalone are most abundant in habitats dominated by macroalgae. Sea urchins are able to maintain areas of reef free from macroalgae by grazing. Areas dominated by sea urchins with few macroalgae or abalone are also termed 'barrens' or 'white rock' habitat. There is some evidence that the area of barrens habitat has expanded over the last 10-20 years, reducing the area of habitat preferred by abalone. It is unclear to what extent, if any, past removal of abalone or other species (e.g. rock lobster) has influenced sea urchin populations. Previous experiments investigating habitat rehabilitation in NSW have been small, and designed to investigate the development and potential of experimental methodology. Reduction of the density of sea urchins could lead to the re-establishment of macroalgae and an appropriate habitat for abalone. Such habitat rehabilitation offers the potential to increase abalone populations by the expansion of the area of reef dominated by sea urchins and hence increasing the amount of habitat available for abalone.*

This program will enable the carrying out of relatively small scale experiments to further investigate the potential and effects of habitat rehabilitation. This will be done in conjunction with entitlement holders in the Sea Urchin and Turban Shell Fishery, so that the benefits of reducing sea urchin density can be investigated by both fisheries. No habitat rehabilitation will be authorised until a detailed proposal is developed and approved under the FM Act. This process will require, for each proposal, the preparation of a comprehensive risk assessment, consultation with key stakeholder groups and a permit issued under the FM Act. The requirements for the risk assessment will be agreed between NSW DPI and ABMAC.

The proposal will address a range of issues including the sites and techniques to be used, compliance issues, the type and scale of monitoring the will be undertaken, commercial viability and the distribution of costs and benefits, and the implications for other lawful resource users. A separate environmental assessment under the EP&A Act would be required for proposals to manipulate sea urchin abundance which did not fall within the scope of the Sea Urchin and Turban Shell Restricted Fishery and had the potential to affect a larger area of reef or to be conducted on an ongoing commercial basis.

<u>Objective 2.3</u> To address impacts from factors external to the commercial Abalone Fishery

The FMS proposes initiatives for management of the commercial Abalone Fishery, but it is beyond its scope to control many external activities (e.g. illegal harvesting), developments (e.g. aquaculture of abalone) and policies (e.g. proposals for marine parks) which may affect the fishery. However, some of the management responses proposed below can help to minimise the effects of external activities. The EIS evaluates external threats in more detail, but the FMS identifies that, without an understanding of external sources of potential change, it is often difficult to assess the effectiveness of management initiatives designed to maintain a viable and sustainable fishery.

> 2.3(a) Develop strategies and practices to minimise the affects of *Perkinsus* and other marine pests and diseases with potential to affect abalone, and implement (in consultation with ABMAC) any measures required in accordance with marine pest or disease management plans

Background

Outbreaks of Perkinsus *are held to be largely responsible for the recent decline of abalone stocks between Port Stephens and Jervis Bay. The current strategy has been to close areas affected by* Perkinsus *to allow stocks to recover from the parasite without the added pressure of harvesting. Area closures have been implemented in Region 1 since 1995, with a complete closure (including recreational harvest) between Port Stephens and Jervis Bay. Some harvesting, however, has been allowed on a trial basis to assess stock recovery, under a section 37 permit. Evidence suggests that in the Sydney area at least, recovery has been slow, but this may be confounded by illegal harvesting, which would keep populations of abalone small.*

There is a need to develop a response strategy to manage pest and disease incursions, with an initial focus on Perkinsus*. The strategy would firstly aim to identify the cause/s of the pest or disease (initially for* Perkinsus*) and enable the implementation of appropriate and effective management responses. This could include a strategy for closing and opening fishing grounds in and around infected areas (management response 2.2c). The strategy would initially include a policy on how abalone are harvested and handled in areas affected by* Perkinsus *to avoid the potential of spreading the disease. The Abalone Fishery Code of Practice may inform and will be responsive to this strategy. A research project, which began in 2004 and is being funded by FRDC, will focus on the development of strategies, in line with outcomes of the 2003 expert workshop on* Perkinsus*, to manage parts of the stock of abalone that have, or might be affected by the parasite.*

The strategy to manage Perkinsus *prepared under this response would also be able to be used (along with any other general plans for managing marine pests and diseases developed under the Marine*

Pest and Diseases Management Program) in the event that some other marine pest or disease began to affect the abalone stock or the fishery. For example, there is concern that colonies of mussels on some reefs on the far south coast of NSW are establishing at an unnatural rate, causing abalone to be displaced. If this problem continues, a plan to respond to mussels needs to be considered.

    2.3(b) Continue to support initiatives to refine estimates of the total catch of abalone, including commercial, recreational, Aboriginal and illegal catches, for use in stock assessment models and reports to the TAC Committee

Background

Whilst setting the TACC for the Abalone Fishery, the TAC Committee currently takes into account estimates of total catches including illegal, recreation and Aboriginal catches. The accuracy of estimates of non-commercial catch impacts directly on the robustness of stock assessment information and Independent Pricing and Regulatory Tribunal's (IPART) recommended management charge applied to the commercial fishery (see also management response 3.1a). Illegal catch includes catches that are not reported by licensed commercial divers or catches sold by unlicensed divers. Estimates of the illegal catch are made by the TAC Committee based on information provided by NSW DPI Compliance and past sporadic surveys, and have been confined by the Committee to estimates of the total weight of illegal catch, rather than the effect of taking smaller sized abalone or trends in illegal catch (i.e. is it increasing or decreasing?). ABMAC has supported research proposals in the past for refining estimates of illegal catch, but dedicated projects are yet to be undertaken. A 12 month survey of recreational fishing in NSW was conducted in 2000-2001 as part of the National Recreational and Indigenous Fishing Survey but was not specifically designed to produce precise estimates of the recreational catch of abalone.

    2.3(c) ABMAC will provide advice on proposed aquaculture developments in NSW that have the potential to affect wild populations of abalone

Background

The establishment of marine aquaculture enterprises in NSW has potential to affect the Abalone Fishery if abalone are cultured as part of these operations for direct sale to market or used to reseed coastal populations. Abalone aquaculture has the potential to spread disease and alter the genetic structure of wild abalone if cultured abalone are inadvertently released. In addition, sale of cultured abalone competes in the market with the wild fishery, thereby potentially affecting social and economic aspects of the industry. NSW DPI will inform ABMAC of any well-developed aquaculture proposals referred to it by the NSW Department of Planning that potentially affect the Abalone Fishery. This would include proposals to culture abalone and take abalone from the wild for broodstock.

Goal 3. Facilitate effective management arrangements and provision of an efficient fisheries management service

  Objective 3.1. **To facilitate the delivery of effective and efficient management services**

    3.1(a) On request by the Abalone Management Advisory Committee, undertake an independent review of the application of established cost recovery principles to the Abalone Share Management Fishery and implement the approved outcomes

Background

The NSW Government policy on cost recovery for share management fisheries requires users to pay for the attributable costs of management (see section 2.2.4). The current cost recovery policy applicable to the Abalone Fishery was implemented when the fishery became a fully established

category 1 share management fishery. The policy is based on recommendations made by the Independent Pricing and Regulatory Tribunal (IPART).

Upon the request of ABMAC, a thorough and open review will be undertaken by an independent person with qualifications and experience relevant to the application of cost recovery principles in the management of fisheries or other natural resources. The cost of the independent reviewer will be fully funded by shareholders in the Abalone Fishery and NSW DPI will provide available information as per the service agreement. The outcomes, once approved by government, will be implemented.

      3.1(b) Continue to refine the delivery of specific management services and standards through service delivery agreements or outsourcing regarding research, administration and compliance

Background

The current share management plan seeks to "Ensure management arrangements for the fishery do not have a significant impact on the costs of taking abalone for sale, and promote cost efficient management, and ensure the fishery remains economically viable" and to "Promote best practice by continually reviewing and refining current performance where necessary". Service delivery agreements for research, administration and compliance activities, including fishery management standards, will be developed. The agreements will describe the mutual obligations of the service provider (whether NSW DPI or otherwise) and service receiver to facilitate the cost effective delivery of services.

Agreements regarding administration would include, for example, the mutual obligations of the service provider and receiver regarding budgeting and on the timing of matters affecting the daily operation of the fishery such as quota transfers, processing of matters relating to endorsement holders and crew, catch validation, reconciliation, etc. Agreements regarding research would include, for example, the mutual obligations of the service provider and receiver for resource monitoring and assessment and other research as required. Service delivery agreements regarding compliance would include, for example, agreements on the mutual obligations of the service provider and receiver for monitoring and record keeping, reporting, auditing, sanctions, etc. All agreements will require ongoing monitoring and will include performance criteria (including times) for all services.

      3.1(c) On request by the Abalone Management Advisory Committee, undertake independent performance reviews of the services delivered by NSW DPI under service agreements or other service providers under contract

Background

Abalone shareholders wish to ensure that they are receiving high quality and efficient performance for the services that they fund under service agreements with the Department or contracts with other service providers. Under this management response, ABMAC can request that a review be undertaken for a current service agreement or contract with respect to a specified financial year. The reviews will be undertaken by an independent person with qualifications and experience relevant to assessing the performance of public agencies against service agreements or private sector contracts in the management of fisheries or other natural resources. The cost of the independent reviewer will be fully funded by shareholders and NSW DPI will provide available information as per the service agreement.

      3.1(d) Develop and implement a nominated diver's card system to facilitate the efficient use of nominated divers

Background

To increase the flexibility for shareholders to employ nominated divers at short notice, a new system is being implemented; the Nominated Diver's Card System. New arrangements commenced on 5

February 2007 which provide for the issue of fishing business cards to business owners whose shareholding equals or exceeds the minimum shareholding specified in the share management plan may apply for a card. The business owner can register a pool of eligible divers associated with their business. Although no limit applies initially, a limit may be placed on the number of divers within the pool. A eligible diver will be deemed to be endorsed with respect to that business when they are duly nominated by the business owner and in possession of the card. A simple and cost-effective method of reporting fishing activity (management response 7.1b) will be required to confirm which shareholder a diver is working for on each day to provide an audit trail with respect to activity and catch. Also, the standard criminal checks will need to be undertaken before eligible divers are first licensed, and the Abalone Fishery endorsement may be suspended or cancelled if the shareholder or nominated diver is convicted of an abalone offence or a serious fisheries offence at any stage. It will be an offence under the share management plan if a nominated diver collects abalone after being convicted of a relevant offence in the intervening period and fails to inform the Department.

> 3.1(e) Adopt technological improvements in the catch reporting system that are cost effective and result in the earlier receipt of catch and effort data

Background

The information gained through monitoring catch and effort in the Abalone Fishery is essential to the stock assessment process and for managing the fishery on a sustainable basis. Currently catch data are entered daily and reconciled monthly. Divers are currently advised within five days of discrepancies or omissions of log sheets. Advances in technology are envisaged to be implemented shortly, which will permit electronic data entry for the first time. Divers will be able to submit catch returns by email. Fax or paper copies will be scanned. This will speed-up data entry, improve the efficiency of the catch reporting system and potentially reduce costs. Future technological advances that might provide substantial benefits to the Abalone Fishery will also be considered.

> 3.1(f) Communicate NSW DPI's operational plans and policies for the management of the fishery to all fishery participants

Background

A range of operational plans and policies are used by NSW DPI to manage the Abalone Fishery. The intent of this management response is to work with ABMAC to clarify all current operational plans and policies to ensure transparency and understanding about management of the fishery. The industry (shareholders, divers, deckhands and processors), particularly new entrants, requires clear guidance as to how plans and policies are implemented. Policies to be reviewed include, for example, those relating to outstanding fees, fishery management budgeting and compliance policies related to the measurement of abalone retained by commercial divers. When clarification is needed, efforts will be made to document the issue and inform industry.

Goal 4. To promote the economic viability of the fishery

Objective 4.1 To promote the long term economic viability of commercial abalone fishing

> 4.1(a) Seek to improve the economic performance of the fishery by:
>> (i) preparing a productivity and business case analysis; and
>> (ii) developing an economic monitoring plan for the fishery

Background

There may be opportunities to increase the economic productivity from the resource for NSW commercial abalone fishers, through the further use of share management provisions or the adoption

of alternative public and private governance arrangements. The latter was foreshadowed in a previous study co-funded by government and industry and a discussion paper issued under the oversight of the Seafood Industry Advisory Council. NSW DPI will undertake a productivity and business case analysis to inform decisions about the most viable option for improving the economic productivity of the fishery.

Additionally, the recent decline in the economic performance of the fishery has emphasised the need for improved economic monitoring. Industry will prepare an economic monitoring plan (within guidelines agreed to by ABMAC and NSW DPI) and provide the financial information for the required monitoring. The plan will seek to refine the economic performance indicators in the FMS and define how best to collect data on the costs of harvesting, taking into account confidentiality/ privacy concerns and the cost-effectiveness of the data collection methods. The plan will also include consideration of the outcomes of NSW DPI's productivity and business case analysis and any relevant issues arising from the Report on the Review of the NSW Abalone Fishery (Keniry, 2005).

4.1(b) Manage the number of divers by implementing appropriate minimum shareholding limits, allowing greater competition among divers and providing more flexibility for shareholders to adjust their individual shareholdings

Background

The trend in recent years has been for the number of divers in the fishery to increase as more shareholders trade down their shares to the minimum shareholding (i.e. currently 70 shares). Increased numbers of abalone endorsements is considered undesirable due to potential reductions in the viability of abalone businesses and the overall productivity of the fishery, given that financial returns would be dissipated among a greater number of participants (shareholders and divers) in the fishery. This becomes apparent during times when the TACC is relatively small as has occurred in recent years. An increased number of divers is likely to cause operational inefficiencies for businesses, particularly through longer search times for legal sized abalone as the same areas are worked by more divers more often. Repetitive handling of abalone could also result in negative impacts on the growth and mortality of those individuals.

Arrangements for the management of diver numbers must address the issue of excessive numbers and must be responsive to changing conditions in the fishery (i.e. fluctuations in TACC). The new arrangements will require shareholders to continue to possess a minimum shareholding but will allow greater competition among divers and the flexibility for shareholders to better adjust individual shareholdings (see management responses 4.1d and 4.1e). The intent is to create the conditions whereby market forces will adjust the number of divers to the appropriate level for a given TACC. Under the arrangements divers will be able to work for more than one shareholder, facilitated through the Nominated Divers Card System (management response 3.1d).

4.1(c) Develop formal strategies to plan for and adapt to the effects of environmental and economic fluctuations on the fishery

Background

The Abalone Fishery has a long history of large and sometimes rapid changes in revenue, costs and returns to Shareholders. These fluctuations have had a variety of causes including natural fluctuations in the stock, environmental changes such as large storms, changes in management and the costs of fishing, and external factors such as currency fluctuations and market conditions that have influenced beach prices. Industry manages these fluctuations to some extent already by rationalising crew and boats when needed and by spreading the catch over the fishing period according to recommendations from the processors. The intent is to develop a range of more formal strategies to enable the fishery to adapt to the effects of environmental and economic fluctuations. Some of these would involve seeking to reduce fluctuations in the TACC (e.g. through reseeding and

other enhancement initiatives). Further, financial strategies, like the Farm Deposit Scheme and/or a sinking fund will also be considered. It is intended for industry to take the lead in developing such strategies.

> 4.1(d) Revise the minimum level for trading abalone shares so that shareholders with 10 or more shares can trade any number of shares, including single shares, but their overall holding must remain at 10 or more shares

Background

There is currently a limit on the minimum number of shares that may be traded in one transaction (10 shares). The intention of this management response is to allow trading of small numbers of shares, including single shares, amongst existing shareholders in order to improve the capacity of shareholders to plan and adjust their business activities as needed. The requirement to hold a minimum of 10 shares would remain.

> 4.1(e) Remove the shareholding aggregation limit

Background

Currently a maximum limit of 210 shares (6%) applies to share ownership in the share management plan. This rule was implemented in response to initial concerns regarding concentration of ownership of shares developing. The fishery is one of several Australian abalone fisheries supplying a global market on which it is a price taker. In future, industry requires the capacity to have autonomous economic adjustment in response to TACC variations and may require shareholders to aggregate shareholdings to a higher level than 6%. This action is desirable for increasing efficiency and long term economic viability of abalone businesses.

Goal 5. To appropriately share the resource and harvest abalone in a manner that minimises negative social and economic impacts

> ### <u>Objective 5.1</u> Mitigate negative impacts of the Abalone Fishery on Aboriginal cultural heritage

> 5.1(a) Manage the Abalone Fishery in a manner consistent with the Indigenous Fisheries Strategy and Implementation Plan and participate in any review of that Strategy

Background

In addition to ensuring consistency between management of the Abalone Fishery and the IFS, this response seeks to raise the awareness of industry about the traditional value of abalone to Aboriginal people and the way that this traditional value is reflected in contemporary Aboriginal communities.

The IFS was released in December 2002 and funded until June 2004. The Strategy recognises the importance of traditional cultural fishing activities of Aboriginal communities and encourages their involvement in the stewardship of fishery resources. The IFS is based on achieving key results including the sustainability of the resource, respect for Aboriginal fishing heritage, involvement of Aboriginal people in fisheries management, access to social and economic development and employment opportunities in the fishing industry. The IFS establishes a process of discussion and negotiation which can continue with progressive resolution of problems and challenges in relation to Aboriginal involvement in the fisheries of NSW. The key point of contact for the commercial Abalone Fishery with the Aboriginal sector is via ABMAC, which has a position for Aboriginal representation.

The IFS identifies several strategies to assist in this regard, including employment of Aboriginal staff to assist with law enforcement, research and the negotiation of culturally appropriate and fair

regulations affecting Aboriginal access to fishery resources (including abalone). Aboriginal people can apply to NSW DPI for a permit to take more than the recreational bag limit of abalone and other species on occasion, for special events incorporating traditional cultural activities.

Regarding sharing the resource, the abalone industry will participate in the development of appropriate arrangements regarding access to abalone by Aboriginal fishers (see management response 8.1c) and assist in identifying current sharing arrangements for the resource (including catch levels).

Objective 5.2 **To minimise any negative impacts of the Abalone Fishery on Aboriginal and European cultural items in the vicinity of abalone harvesting areas**

5.2(a) Ensure that abalone divers and shareholders are aware of and take into account any information about areas or items of cultural significance that may be affected by their activities

5.2(b) Respond, where relevant, to new information about areas or items of cultural significance in order to minimise the risk from abalone harvesting activities

Background to (a) and (b)

The Abalone Fishery needs to respond appropriately to information about items or locations of Aboriginal or other cultural significance (e.g. any newly uncovered shipwrecks). The Department of Environment and Conservation is responsible for management of cultural heritage within National Parks estate and for the protection of Aboriginal objects on all lands. Having regard for cultural heritage sites, particularly where their declaration may affect commercial operations, is essential when promoting equitable access to all resource user groups. Work is continuing on a review of archaeological and other literature that refers to past and contemporary use of abalone by the Aboriginal community. This material includes archaeological survey and excavation reports on coastal middens, ethnographic/historic references and contemporary studies of Aboriginal community fishing practices. As new information becomes available it will be supplied to abalone divers and shareholders or described in the Abalone Fishery Code of Practice (see management response 1.1b).

The scattered debris and structures of shipwrecks have often created artificial cover for marine flora and flora. All wrecks within the distribution of abalone are close to shore and considerably old and storms have often dispersed metal and other pieces of wreckage. For example, the Lyee-Moon *shipwreck off Green Cape is the most historically-significant site, most of which is in water deeper than 30 m and therefore not generally within the range of abalone divers.*

The Abalone Fishery is likely to have little or no impact on cultural heritage values other than those associated with maritime heritage and particularly shipwrecks (see the EIS for further details). The NSW Heritage Office is responsible for the management of cultural heritage in NSW (outside of NPWS estate) including the management of shipwrecks and other aquatic heritage items. There are some 250 known shipwrecks along the NSW south coast (south from Wollongong), listed in the Australian National Shipwreck database. Work is continuing on the documentation of these wrecks to assess the risk of interaction between them and Abalone fishery activities. Historic shipwrecks can be the subject of protection at both State and Commonwealth level, although not concurrently. At State level, shipwrecks falling within the definition of 'historic shipwreck' are protected by Pt.3(c) of the Heritage Act 1977.

Goal 6. Facilitate appropriate research and monitoring of the Abalone Fishery

Objective 6.1 **To collect information on the Abalone Fishery and the environment on which it operates in a timely manner**

6.1(a) Continue to implement an integrated monitoring and research program involving both fishery independent research and joint industry/government initiatives, and update as necessary

Background

The Abalone Fishery is well suited to fishery-independent surveys of the stock because of its accessibility to researchers via underwater study. Medium to long term fishery independent surveys funded by the fishery participants have resulted in the existence of a comprehensive database of annual surveys, which can be used to measure abalone abundance. This database allows an assessment of appropriate timeframes for future surveys and consideration can be given to conducting surveys at greater than annual intervals, however, the integrity of the stock assessment data directly influences the TACC setting process.

Historically, industry, in collaboration with NSW DPI, has been involved in research into restoring populations through the harvesting of sea urchins, moving abalone broodstock, experiments on size limits of abalone and matters related to Perkinsus. *Industry is currently collaborating with researchers to provide information, additional to the independent surveys, of the status of stocks in Region 1. Similar collaborative assessments could be used to assess other areas presently not covered by independent surveys such as northern parts of Region 1 (see also management response 2.2c).*

Many of the management responses in the FMS propose the continuation of existing research and development programs or the implementation of new projects. The strategic plan for abalone research (see section 5) details what is required and the relative priority of projects. The plan has a major focus on stock assessment but also details research proposed in the areas of habitat and ecosystem, rebuilding biomass and socio-economic aspects of the fishery. The research strategic plan will be reviewed annually to take account of any new or emerging issues, the changing needs of the fishery and funding and resource availability.

Any new research proposals will be considered by NSW DPI and referred to ABMAC for comment (as appropriate) and will be reviewed against the priorities established in the research strategic plan prior to their endorsement.

6.1(b) Develop and implement a method of estimating the rate of disturbance of undersize abalone

Background

The intention of this management requirement is to provide an estimate of the rate at which commercial divers remove, disturb and return undersize abalone. Such disturbance may effect their growth, mortality and spawning. An estimate of the disturbance to undersized abalone, and monitoring of this through time would include performance indicators for this factor and could be developed from a range of fishery-dependent and independent data sources. Fishery-dependent information about the frequency of abalone being landed that are close to the MLS (see management responses 2.1d and 7.2c which provide for reporting of a count and weight of abalone within every bin of abalone landed in the fishery) could provide a cost-effective measure of the likely disturbance to undersize abalone. Such information could be further validated by the combination of fishery-independent information about the availability of abalone of different sizes (management response 2.1e) and the use of logbooks (as developed in previous research) by selected commercial divers. Reduction of disturbance to undersized abalone will also be referred to in the Abalone Fishery Code of Practice.

Objective 6.2 To keep informed of research and management initiatives in other jurisdictions

6.2(a) Maintain good communication links with abalone researchers, managers, compliance officers and industry bodies nationally and internationally

Background

The Australian abalone industry in general recognises the need for sharing information and collaborating on projects. Many issues of concern to NSW are applicable to abalone fisheries in other states, and vice versa. The issue of disease, for example, is a concern for many of the mainland fisheries as it has potential to spread between stocks. On such issues, sharing of research and management strategies is essential.

There are a number of initiatives which assist with the sharing of information and collaboration. The inaugural Abalone Conference held in Adelaide in 2001 brought industry, researchers, compliance officers and managers together. Since the inaugural meeting, similar conferences have been held regularly and researchers, managers, compliance officers and representatives from industry in NSW should continue to attend. In addition to the national conferences, State abalone researchers and industry representatives meet annually to discuss research priorities and agree on collaborative projects. As at early 2007, the NSW industry and researchers were involved with various other state abalone agencies and universities in developing indicators that commercial abalone divers can use to assess the status of populations of abalone at the scale of individual reefs (see section 5.2). NSW compliance officers have also met with colleagues from other states to assist in developing state-wide and national compliance strategies.

Goal 7. Achieve a high level of compliance within the Abalone Fishery

Objective 7.1 Promote a high level of compliance in the fishery

7.1(a) Continue to implement and review, in consultation with ABMAC and key stakeholders, compliance plans and update where appropriate

Background

NSW DPI maintains a Statewide Compliance Plan covering all fisheries. The plan provides an overarching framework that identifies priorities and objectives for compliance throughout the State. This plan is subject to review every three years and needs to respond to other relevant government initiatives. The Statewide Operational Plan for the Abalone Fishery and each District Compliance Plan are developed to be consistent with the Statewide Compliance Plan (As at early 2007, industry contributed funding for two officers to address abalone theft concerns and to liaise with general duty officers at a local level).

Consistent with the compliance plans, successful prosecutions are published and serve as a compliance mechanism to deter divers from committing offences against the FM Act and its regulations. The vast majority of prosecutions involve non-commercial fishers. Compliance rates in the commercial fishery in recent years have been high (generally above 80%) and the breaches recorded have been minor only.

The Statewide Compliance Plan, Statewide Operational Plan for the Abalone Fishery and the Service Delivery Agreement (see management response 3.1b) to be developed for the Abalone Fishery will be reviewed and updated in light of the findings of the Report on Illegal Fishing for Commercial Gain or Profit in NSW.

Communication is essential to address illegal harvesting. A working group between ABMAC and Departmental staff should meet periodically to discuss compliance strategies to deal with illegal harvesting of abalone.

7.1(b) Develop a cost-effective system for divers to report the planned location of their fishing activity

Background

The reporting of the planned location of fishing could provide some benefits for compliance of commercial fishing operations, particularly in relation to closures or areas where harvesting would potentially be done at an alternative size-limit (see management responses 2.2a and 2.2c). Prior reporting would assist in more effective targeting by compliance officers of illegal activities by non-commercial fishers.

A cost-effective system for this reporting could utilise the information provided by divers to processors, by having it available to compliance officers as required. Such reporting could be a component of the Abalone Fishery Code of Practice. Most commercial divers already report the planned location and timing of their boat movements (i.e. boat ramp) and fishing activity (i.e. probable sub-zone) to processors each day. This information is needed to facilitate cost-efficient collection of catches by processors. More regulated requirements for the provision of this information to compliance officers would need to address some difficult logistical issues. For example, planned dive locations and times need to have some flexibility as they have to be responsive to local weather and swell conditions.

The effectiveness of the proposed system will be reviewed within two years of its implementation, particularly with regard to the adequacy of the reporting system through processors (e.g. the provision to NSW DPI of the necessary information in a timely and confidential way to improve compliance outcomes). If prior reporting through processors is found to be inadequate, future options could include reporting directly to NSW DPI (rather than to a processor), the introduction of penalty points for breaches or a requirement to operate a Vessel Monitoring System. Any changes would be determined in consultation with ABMAC prior to being implemented.

7.1(c) Continue compliance and enforcement measures applicable to operators in the commercial fishery

Background

The share management plan has as an objective to minimise the number of offences committed by commercial shareholders, divers and crew. Existing compliance and enforcement measures are in place to minimise offences. The share forfeiture offences and the share forfeiture scheme for the Abalone Fishery are defined in the share management plan. Section 75 of the FM Act provides for shares to be forfeited if a shareholder is convicted of an offence against the Act.

An endorsement suspension and share forfeiture scheme linked to penalty points will be introduced in all other NSW share management fisheries and the current share forfeiture scheme in the Abalone Fishery will be reviewed, in consultation with ABMAC, to ensure a consistent and/or complimentary approach across all schemes. An important principle applied in these approaches is that the scale of the penalty is proportional to the importance of the offence.

The FM Act establishes requirements for fish receivers, which will continue to be applied with respect to abalone.

7.1(d) Extend the fit and proper persons requirements applicable to abalone crew to abalone divers, shareholders and receivers

Background

The Fisheries Management (General) Regulation 2002 *provides that the Director-General, NSW DPI may refuse to issue an abalone crew licence if the applicant has been convicted or found guilty of an offence: (i) under the FM Act or the regulations under the Act, (ii) relating to commercial fishing operations under a law of the Commonwealth, another State, a Territory or New Zealand, (iii) relating to theft of fish, fishing gear or a boat, or (iv) relating to an assault on a fisheries official. While there are similar provisions for Abalone Fishery endorsement holders (including nominated fishers), this response seeks to review and extend those provisions to shareholders and abalone receivers. The intent of this management response is for similar fit and proper requirements to be extended to all involved in the Abalone Fishery, with the review and consultation to consider the need for any specific variation in requirements among crew, divers, shareholders and receivers. Any review of the fit and proper person provisions should take into account the broader licensing arrangements in place or proposed for other NSW commercial fisheries.*

7.1(e) Require receivers of abalone harvested from the fishery to record the number of abalone handled (in addition to weight) on the prescribed record keeping form(s)

Background

The Regulation was amended to provide for recording both weight and numbers of abalone. Abalone lose some of their recorded beach weight (after removal from the water), which provides an opportunity for the illegal addition of more animals in the processing sector. Recording the number of abalone handled improves consistency with the labelling requirements under the National Docketing System (management response 7.2c) for abalone but would not apply to product from other States where count requirements have not yet been implemented.

7.1(f) Develop and implement a mechanism to apply temporary bans on receivers, wholesalers and retailers (including individuals and business entities) if they are caught in possession of abalone without the appropriate documentation

Background

Estimates from the Australian Quarantine and Inspection Service (AQIS) suggest that national abalone exports from Australia are greater than the combined Total Allowable Commercial Catches of all Australian abalone fisheries. This suggests that a significant amount of abalone are being processed that have been caught and sold illegally. In attempting to reduce the problem of illegal fishing of abalone, it is important that the post-harvest sector deal only in abalone taken legitimately and that they retain the appropriate documentation to enable tracking of the product back to an abalone endorsement holder (whether in NSW or other jurisdictions). This management response seeks to impose tougher sanctions on post-harvest operators who trade in illegally caught abalone (i.e. significant quantities of abalone that cannot be accounted for). These businesses undermine the fishery management arrangements that apply to the legitimate commercial harvesting of abalone. The details of the arrangements for bans are to be determined in consultation with industry, including details regarding the severity of offences and the duration of bans.

7.1(g) Participate in the development and implementation of a training and accreditation scheme for commercial fishers (i.e. divers and crew)

Background

Shareholders are proposing an Industry Development Plan for training and accrediting abalone fishers, particularly new fishers, so that they have a clear understanding of the fishery. Topics may include education regarding the rules that apply, the need for provision of accurate data, appropriate

catch handling practices, relevant occupational health and safety requirements, coxswain, diving and deckhand courses and other practices relevant to the sustainable and efficient operation and management of the fishery. The Abalone Fishery Code of Practice will be developed to assist with this process (management response 1.1b). Increasing the professionalism of operators can provide long term benefits to the industry. The experience of long term fishers would be recognised in any accreditation scheme.

Objective 7.2 To continue to minimise the illegal catch of abalone

7.2(a) Design and implement an industry communication program to assist in preventing illegal catch

Background

Illegal catch has been identified as a major threat to abalone fisheries nationally (MacArthur Agribusiness 1998). ABMAC, in collaboration with NSW DPI, will design a notebook that fishers can use to record information on suspected illegal fishing activity. Over time, the information collected may assist in detecting patterns in illegal activity that can be used by compliance officers to focus future compliance efforts. The notebook could contain accurate maps with place codes for reporting suspect activity and a phone number for divers to call (e.g. a 'hot line') to pass on information if immediate compliance action is deemed necessary.

The proposed system will be reviewed within two years of commencement to examine whether it has improved the detection and apprehension of illegal activity. If the system is found to be ineffective, options for improving or removing it should be considered.

7.2(b) Examine the costs and benefits of increasing effective enforcement to reduce illegal catch and assist in maintaining the fishery biomass, relative to other stock rebuilding measures

Background

The extent of the illegal catch and the consequent value lost to the legitimate commercial fishers is a serious economic issue for industry. An analysis of the cost effectiveness of adjusting compliance efforts (including any feasible options for detection, surveillance and enforcement) compared to other strategies to rebuild the abalone stock (e.g. research on disease control, reseeding, translocation, etc) warrant thorough assessment in consultation with ABMAC. The findings from the Report on Illegal Fishing for Commercial Gain or Profit in NSW should be considered in any adjustment of efforts.

7.2(c) Continue implementation of the National Docketing System for abalone product in consultation with ABMAC and abalone processors

Background

The illegal trade in abalone is a major risk to the sustainability of the fishery. In the past, attention has focused on those who catch the fish but the the National Docketing System (NDS) extends to the marketing chain including processors, transporters, retailers and restaurants. It involves a two-tiered system of documentation reflecting the level of risk associated with different seafood products (abalone, being a species of high risk, is in tier two) that requires businesses to hold appropriate documentation for seafood in their possession. This creates an audit trail of purchase and sale of abalone that enables enforcement agents to identify illegal abalone in the market place. The NDS seeks to make any abalone sold in Australia traceable, as documentation must accompany product at all times whilst it is in transit within Australia. New entrants to the processing sector should be provided with details of what is required as part of the NDS.

Goal 8. Ensure adequate stakeholder involvement and community consultation

Objective 8.1 **To ensure the Abalone Management Advisory Committee communicates effectively with shareholders, other industry sectors and other stakeholders**

8.1(a) Continue the development of the Abalone Management Advisory Committee and industry networking process, including the appointment of an independent chairperson, to improve the effectiveness of consultation and communication within industry and with other stakeholders

Background

Communication and consultation within industry, between NSW DPI and industry and with other stakeholders is important to the successful management of the Abalone Fishery. It is intended that communication and consultation will take on a range of forms, including inviting shareholders, fish receiver and marketing agency representatives to participate as observers in the Abalone Management Advisory Committee (ABMAC) process (see section 2.2.7.1). Industry networks (i.e. shareholders, divers, processors and marketers) can also play a useful role in communicating information to, and disseminating information from ABMAC.

With an increasing number of nominated divers in the fishery, it is important that observations of the stock and habitat by nominated divers are incorporated into the management system. Nominated divers also need to receive regular information from managers as they are at the forefront of harvesting. Management response 3.1f should assist with this process.

Further, the post harvesting sector (processing and marketing) plays an important role in maintaining or enhancing the economic viability of the fishery. As the Abalone Fishery depends on overseas markets, the marketing sector's role in observing any changes in overseas markets is important. This sector is also important in identifying illegal activities in the fishery. Communication between ABMAC and abalone processors and marketing agencies can ultimately increase the effectiveness of management programs.

In addition to the regular updates/courses industry holds for participants in the fishery to canvass issues and disseminate information, the potential for communicating information through email should be investigated.

The Abalone Fishery Code of Practice is being developed to help achieve this response (see management response 1.1b).

8.1(b) Promote consultation with the Aboriginal community in a culturally appropriate manner

Background

The Indigenous Fisheries Strategy (IFS) provides an overall framework for the participation of Aboriginal people in fisheries management in NSW (see section 1.2.7). Aboriginal practices for information sharing, discussion and decision making are often inconsistent with modern day European methods of consultation. The effectiveness of consultation with Aboriginal communities can be improved by placing more emphasis on face-to-face briefings and discussion of issues, longer time frames for documents requiring written comments and feedback to Aboriginal people on the outcomes of the consultation process. Such communication techniques, as well as ensuring the content of material is culturally appropriate, should be carried out whenever possible. Encouraging an Aboriginal person to accept a position as a member on ABMAC would be a positive first step in this regard. The Abalone Fishery Code of Practice is being developed to help achieve this response (see management response 1.1b).

8.1(c) Encourage Aboriginal involvement in the commercial fishery

Background

Aboriginal fishers have a tradition of access to the abalone resource for cultural and barter purposes. The intent of this management response is for shareholders in the fishery and NSW DPI to encourage Aboriginal fishers and communities to access the abalone resource for their communities through involvement in the commercial sector of the Abalone Fishery. In particular, this could be achieved through employment in the fishery as divers or crew to develop commercial fishing skills, expertise and experience or through direct investment in the industry. Industry will also participate in the development of appropriate arrangements regarding access to abalone by Aboriginal fishers.

8.1(d) ABMAC will become involved with other harvest sectors through potential co-management arrangements in the future

While it is beyond the scope of the commercial fishery FMS to manage other harvest sectors, the intent of this proposal is to consult with stakeholders through the MAC to develop a shared vision for the future of the abalone harvest, similar to what is done in Victoria and WA. Presently, the poor understanding of the harvest of these sectors has social and economic consequences to the commercial sector. New arrangements should be informed by the outcome of the business case analysis specified in management response 4.1a and any other relevant reports (e.g. Keniry 2005).

Objective 8.2 **To promote community awareness about the importance of habitat and other environmental factors that affect abalone**

8.2(a) Continue to provide advice to government, other stakeholders and the public about the risks and impacts of disease and the potential for human-induced activities to affect populations of abalone and their habitat

Background

The intent of this management response is to stimulate further communication among industry, proponents of developments, local councils, NSW DPI, Catchment Management Authorities, other government agencies and the general public about the types of developments that may affect abalone as well as the risks and impacts of spreading disease. To help safeguard against, or minimise, the potential effects from the variety of development types that can affect abalone populations and the commercial fishery (e.g. construction of sewage outfalls, reclamation of reefs for coastal infrastructure, etc), it is important for industry to become involved in the planning and consultation stages of major proposals that may affect the nearshore marine environment.

Forms of communication may include advice by ABMAC, an information package developed and distributed by industry (e.g. outlining reasons for closed areas, issues surrounding Perkinsus, *etc), media releases, poster displays at tackle shops and recreational fishing licence agents, and articles on the NSW DPI website.*

4. PERFORMANCE REPORTING AND MONITORING

4.1 Performance Monitoring

Many of the management responses listed in Section 3 of this FMS contribute to achieving multiple goals. Therefore, rather than examining the performance of each individual response or objective, it is more efficient and appropriate to measure the performance of the management strategy against the eight goals (i.e. the major objectives). A periodic report will, however, be prepared (as outlined later in this section) detailing the progress made in implementing each of the management responses.

4.1.1 Performance Indicators

The performance indicators provide the most appropriate indication of whether the management goals are being attained. Monitoring programs are to be used to gather information to measure performance indicators. These performance indicators and associated monitoring programs are detailed in **Table 2**. The performance indicators defined in the share management plan and monitored since its introduction in 2000 have, where appropriate, been incorporated into **Table 2**.

4.1.2 Data Requirements and Availability

The data requirements and availability for each performance indicator relate to the collection of information used to measure the performance indicators. Much of the information will come from existing monitoring programs for the Abalone Fishery, but some information will only be provided as new information becomes available. **Table 2** identifies the information sources and data requirements and availability used as part of the performance monitoring and review process for the fishery.

4.1.3 Robustness

The robustness ratings applied to each performance indicator have been selected according to the following definitions:

- Highly robust ('High'): The indicator is a direct measure of the goal, or if indirect, is known to closely reflect changes in the issue of interest;

- Moderately robust ('Medium'): The indicator is suspected to be a reasonably accurate measure against the goal, or the known error is in the conservative direction; and

- Minimally robust ('Low'): The degree to which the indicator measures against the objective is largely unknown, or known to be low. Often this will involve surrogate indicators.

4.1.4 Trigger Points

The trigger points specify the point when a performance indicator has reached a level that suggests a potential problem with the fishery and a review of management arrangements is required. The review will determine the suspected reasons for the breach of the trigger point and whether any action is required.

Table 2 establishes the performance indicators and trigger points that will be used to measure whether each of the management goals described in section 3 of this FMS are being attained. As the performance indicators defined in the share management plan have been incorporated into **Table 2**, so have the triggers associated with them.

4.1.5 Priorities

As some goals and objectives for the fishery are more important than others, it is prudent for monitoring priorities to be set. The highest priority are those performance indicators that directly monitor the effects of harvesting on the stock (ie. Goal 2), as the EIS indicated that some components of the target species were at moderate to high risk.. Performance indicators that do not directly monitor the status of the stock, but rather monitor actions that could affect the stock (eg. Goal 7) would be a medium priority. As harvesting generally has a low risk to other species, habitat and the ecosystem, the monitoring of performance indicators that measure the effect of harvesting on these components (eg. Goal 1) would be a lower priority. Given that the EIS indicates that current circumstances threaten the economic viability of the fishery, performance indicators that monitor economic viability (ie. Goal 4) would be a moderate to high priority.

4.2 Predetermined Review of Performance Indicators and Trigger Points

It is likely that changes to the activities authorised under the FMS would evolve over time in response to issues that arise or with a better understanding of the Abalone Fishery and its related ecology. It is also likely that performance indicators will be refined over the course of the next few years and it may then be an inefficient use of resources to continue monitoring some performance indicators that appear in the FMS. If new information becomes available as a result of research programs, more appropriate performance indicators and trigger points can be developed and amendments to the FMS may be considered for approval by the Minister for Primary Industries accordingly. A potential risk, however, of this approach, is that data collected in relation to a management response may not be comparable through time. Therefore, it is important to assess the benefits of continuity of data compared to changing approaches and relying on new types of data.

A comprehensive review of the appropriateness of all performance indicators and trigger points will be carried out not more than three years from the commencement of the FMS, in consultation with ABMAC.

As new or improved guidelines for fishery reporting become available, such as those being considered in the *'National ESD Reporting Framework for Australian Fisheries – the how to guide for wild capture fisheries report'* (Fletcher *et al.* 2002), they will be taken into account to promote continuous improvement in the management of the fishery.

Table 2. Performance indicators and trigger points for Goals 1 to 8 of the FMS.

Goal 1: Manage commercial harvesting of abalone to promote the conservation of biological diversity in the coastal environment			
Performance indicator	**Data requirements and availability**	**Trigger point**	**Robustness**	**Justification/comments**
1.1 [To be determined following refinement of the program to increase knowledge of the effects of abalone harvesting on bycatch species and associated habitat and ecosystems]	A program to increase knowledge of the effects of abalone harvesting on bycatch species and associated habitat and ecosystems is proposed to be further developed (see management response 1.1a). This program is necessary to identify appropriate performance indicators to assess the impact of the fishery on biodiversity. Determination of the effects of the fishery will require monitoring in areas open and closed to abalone harvesting.	[To be determined]	-	Performance indicators for assessing the effects of the fishery on biological diversity in the coastal environment are not defined. A program, already underway, to increase knowledge of the effects of abalone harvesting on bycatch species and associated habitat and ecosystems, is proposed to be refined (see management response 1.1a).
1.2 Adherence with relevant parts of the Abalone Fishery Code of Practice	The Abalone Fishery Code of Practice is currently being developed and is proposed to be completed within 12 months of approval of the FMS. Information about breaches of the code will be compiled by industry and presented to NSW DPI.	The Director-General, NSW DPI determines that an unacceptable level of breaches of the Abalone Fishery Code of Practice have occurred with respect to minimising the impact of the fishery on biological diversity in the coastal environment.	Low	The Abalone Fishery Code of Practice will describe harvesting practices that minimise or avoid impacts of the fishery on biological diversity in the coastal environment. The 'level of breaches' will include consideration of the number and nature (ie. seriousness) of the breaches.

Goal 2: Maintain or rebuild the biomass of abalone to ensure stock sustainability

Performance indicator	Data requirements and availability	Trigger point	Robustness	Justification/comments
2.1 Biomass of mature and exploitable abalone	All available information is combined within a formal modelling framework to provide information about the status of the mature and exploitable biomass of abalone. Surveys of abundance completed independent of the fishery, standardised catch rates of commercial divers and the size of abalone being caught. Management responses are proposed for ongoing collection of this information as it is needed.	The biomass of mature or legal sized abalone: (a) falls below the 1994 benchmark by more than 15%, or (b) there is > 50% chance of (a) occurring in the next 5 years if the TACC is unchanged.	High	Incorporation of all available information into a formal modelling framework provides the most reliable and objective assessment of change in biomass and the sustainability of different harvest levels. Because of spatial variation in changes in biomass, it may be appropriate in future to assess performance relative to this objective at a smaller spatial scale (e.g. regional).
2.2. Information flow between NSW DPI & industry	Reports on the monitoring of information flow will be provided by industry and by NSW DPI as required.	(a) Industry provides ≥90% of catch & effort data to NSW DPI within timeframes required by the share management plan. (b) NSW DPI provides ≥90% of available summary data to industry by the 15th day of each month.	Low Low	The share management plan currently requires divers to supply catch and effort data to NSW DPI within 24 hours. Adherence to voluntary regional targets requires effective flow of information from industry to NSW DPI and vice-versa.
2.3. Catch at regional and smaller spatial scales	Monthly reports of catches in relation to regional targets will be produced by NSW DPI. Industry will provide reports to ABMAC and NSW DPI where a voluntary target is exceeded in other smaller scale areas.	Catches exceed the levels recommended by the TAC Committee or other finer scale limits set by industry.	Medium	The TAC Committee currently recommends regional catch limits and management response 2.2b describes the option for industry to set catch limits at finer geographical scales. This indicator seeks to monitor and detect if either of these limits are being exceeded.

		Low
2.4 Response of the fishery to marine pest and disease incursions	Reports on the monitoring of pests and diseases are needed and will be provided to ABMAC by the Marine Pest Management Program.	Guidelines specified in any marine pest and disease management program are not adhered to in the Abalone Fishery.

Marine pest and disease management programs are responsible for monitoring marine pests and diseases and developing contingency plans in the event of new incursions. This performance measure provides that management of the fishery will be responsive to existing or new marine pest and disease incursions that may threaten the biodiversity in the marine environment.

Goal 3: Facilitate effective management arrangements and provision of an efficient fisheries management service

Performance indicator	Data requirements and availability	Trigger point	Robustness	Justification/comments
3.1 Performance of service delivery agreements as established by independent performance reviews	Management response 3.1b provides for independent performance reviews of the services delivered by NSW DPI under service agreements or other service providers under contract, upon the request of ABMAC. Such reviews will provide the information necessary for this performance measure.	An independent performance review finds the performance of service delivery agreements unsatisfactory and recommends changes to the FMS.	High	Service delivery agreements between shareholders and service providers will be the basis for efficient and effective management of the Abalone Fishery.

Goal 4: To promote the economic viability of the fishery

Performance indicator	Data requirements and availability	Trigger point	Robustness	Justification/comments
4.1 Raw catch rate of commercial divers	Raw catch rate for specific periods is monitored as part of the ongoing stock assessment program. Data available from NSW DPI records.	Raw catch rate of commercial divers falls below 19.12 kg/hr.	Medium	Raw catch rate of commercial divers is an indicator of the operating costs of fishing operations, thereby affecting net return to divers. Catch rate and biomass from 1994 have been used as appropriate benchmarks in the share management plan. Raw catch rate in 1994 was 22.50 kg/hr. The trigger represents a reduction to 85% of this level (i.e. 19.12 kg/hr).

Indicator	Measurement	Trigger	Priority	Justification
4.2 Beach price of abalone	The average beach price for abalone in each fishing period paid to fishers by processors. Data available from processor records.	Beach price falls below $35.70 per kg (CPI adjusted each year).	Medium	Beach price is a direct and immediate indicator of the market price of abalone. Whilst well run businesses plan for fluctuations in market price, it is recognised that primary industries are subject to a number of unpredictable market factors such as competition, changing consumer preferences, strength of the Australian dollar and other world issues (eg. SARS). Sustained or sudden reductions in beach price can present significant cash flow issues for businesses, and potentially affect their ability to pay for the costs of fishing. An independent report by Dominion Consulting indicated that during consultations about the Community Contribution in 1999 at the then prevailing TACC, shareholders required a beach price of $36 per kg to have the capacity to pay. With CPI increases, this represents $42 per kg in 2003-04. The trigger represents a reduction to 85% of this level (i.e. $35.70).
4.3 Total commercial catch of abalone	Commercial catch of abalone for each fishing period. Data available from NSW DPI records.	Total commercial catch falls below 85% of the TACC in the fishing period.	Medium	The commercial catch level, along with beach price and costs of fishing, affects the economic viability of the fishery.
4.4 Management fees	The fee per share payable to undertake the services required to manage the fishery. Data available from NSW DPI.	Management fees increase by more than CPI between any two consecutive years.	Medium	Changes in management fees and other input costs are important factors affecting net returns to shareholders.
4.5 Number of divers harvesting abalone	The number of divers harvesting abalone is available from data held by NSW DPI.	The number of divers harvesting abalone falls outside a range determined by the Director-General, NSW DPI following consultation with shareholders.	Medium	Determination of an appropriate range is important because if there are not enough divers, there is risk that the quota will not be caught. Further, too many divers could make the fishery less economically viable for the divers and have risks associated with potentially more turnover of undersized abalone.

Goal 5: To appropriately share the resource and harvest abalone in a manner that minimises negative social and economic impacts

Performance indicator	Data requirements and availability	Trigger point	Robustness	Justification/comments
5.1 Adherence with the Abalone Fishery Code of Practice	The Abalone Fishery Code of Practice is currently being developed and is proposed to be completed within 12 months of the approval of the FMS. Information about breaches of the code will be compiled by industry and presented to NSW DPI.	The Director-General, NSW DPI determines that an unacceptable level of breaches of the Abalone Fishery Code of Practice have occurred with respect to interaction with other harvest sectors and items of cultural heritage.	Medium	The Abalone Fishery Code of Practice describes harvesting practices and protocols that seek to minimise any potentially negative impacts of the fishery to other harvest sectors (incl. recreational and Aboriginal fishers) and items of cultural heritage. The 'level of breaches' will include consideration of the number and nature (ie. seriousness) of the breaches.
5.2 Change in the distribution of landings between the *commercial sector* and *non-commercial* (combining recreational and Aboriginal) sectors	Requires commercial landings data and information (or estimates) of catches by other stakeholder sectors. Data will be obtained through mandatory catch reporting provided by abalone fishers and through any recreational and Aboriginal fishing surveys.	Maximum absolute difference in the distribution of landings between the commercial and non-commercial sectors is greater than 25 percentage points when compared every five years.	High	Further work would be needed to define specific targets for appropriate sharing of the resource and what might be considered a negative social impact. In the interim, however, a trigger point can be specified that will detect a relative large shift in catch over time between stakeholder sectors.

Goal 6: To implement appropriate research and monitoring of the Abalone Fishery

Performance indicator	Data requirements and availability	Trigger point	Robustness	Justification/comments
6.1 Sufficient scientific data available for assessment of abalone stocks	Data for setting the TACC are collected by current research programs. Appropriate data are available to meet the requirements of the TAC Committee	TAC Committee determines insufficient scientific data is available for the purpose of setting the total allowable catch for abalone within acceptable levels of confidence.	High	The TACC setting process is critical to the operation of the commercial fishery and depends on collection of scientific data through the research and monitoring program.
6.2 Research Strategic Plan for the Abalone Fishery reviewed and updated prior to expiry	Data about frequency and outcomes of reviews required and available through records kept by NSW DPI	The Research Strategic Plan expires without being reviewed and updated.	Low	A strategic plan for research focuses activities and helps to ensure efficiency and cost-effectiveness of the programs undertaken. Development and monitoring of the plan, in consultation with to ABMAC, should help to ensure the plan accommodates the needs of the Abalone Fishery.

Goal 7: To achieve a high level of compliance within the Abalone Fishery

Performance indicator	Data requirements and availability	Trigger point	Robustness	Justification/comments
7.1 The percentage of total inspections of commercial divers which result in the detection of minor and serious offences	Rate of compliance is estimated from information about the annual number of inspections, with the rate of compliance determined by the number of inspections with observed non-compliance as a proportion of those with observed compliance. Information about the scale of the offence can also be considered.	Percentage of inspections resulting in the detection of offences exceeds either of the following: (i) 20% for minor offences; (ii) 10% for serious offences.	High	This is an enforcement-based measure of compliance in the existing share management plan.

Performance indicator	Data requirements and availability	Trigger point	Robustness	Justification/comments
7.2 The percentage of total inspections of processors and wholesalers which result in the detection of minor and serious offences	Rate of compliance is estimated from information about the annual number of inspections, with the rate of compliance determined by the number of inspections with observed non-compliance as a proportion of those with observed compliance. Information about the scale of the offence can also be considered.	Percentage of inspections resulting in the detection of offences exceeds either of the following: (i) 20% for minor offences; (ii) 10% for serious offences.	High	Appropriate monitoring of the post-harvesting sector is required to reduce the occurrence of the amount of abalone that has been illegally caught and sold.
7.3 Compliance Plans relevant to the Abalone Fishery reviewed and updated prior to expiry	Data about frequency and outcomes of reviews required and available through records kept by NSW DPI.	Compliance plans relevant to the Abalone Fishery expire without being reviewed and updated.	Moderate	Compliance plans focus enforcement and educational activities and help to ensure efficiency and cost-effectiveness of the compliance programs undertaken. Annual presentation of relevant compliance plans to ABMAC, particularly with respect to the outcomes achieved, and consultation regarding further development of of plans will help to ensure the needs of the Abalone Fishery are accommodated.

Goal 8: Ensure adequate stakeholder involvement and community consultation

Performance indicator	Data requirements and availability	Trigger point	Robustness	Justification/comments
8.1 Adherence with the Abalone Fishery Code of Practice	The Abalone Fishery Code of Practice is currently being developed and is proposed to be completed within 12 months of implementation of the FMS. Information about breaches of the code will be compiled by industry and presented at ABMAC meetings.	The Director-General, NSW DPI determines that an unacceptable level of breaches of the Abalone Fishery Code of Practice have occurred relating to communication with stakeholders.	Low	The Abalone Fishery Code of Practice will be an effective means by which a sound consultative process occurs between sectors of industry and other stakeholders regarding issues of importance. The 'level of breaches' will include consideration of the number and nature (ie. seriousness) of the breaches.

8.2 Number of ABMAC meetings held each year	The number of ABMAC meetings held is available through records kept by NSW DPI.	Number of ABMAC meetings is less than 2 in any financial year, unless otherwise agreed by the ABMAC.	Low	Holding two ABMAC meetings per year is currently a requirement of the *FM (General) Regulation* which ensures that regular stakeholder consultation is taking place and can lead to improved management outcomes.
8.3 Occurrence of port meetings conducted with divers and NSW DPI officers	Records of port meetings held are kept by NSW DPI.	No port meetings held in any financial year, unless otherwise agreed by the ABMAC.	Low	Port meetings provide for communication between abalone fishers and NSW DPI on issues impacting on the Abalone Fishery (including operation, social and economic issues).

4.3 Reporting on the Performance of the Fisheries Management Strategy

There are two types of performance monitoring reports to be prepared under the FMS. One reports generally on the performance of the fishery with respect to the strategy. The other is a review report, which is to be prepared if a performance measure for the fishery is breached.

4.3.1 Performance Report

A performance assessment examining each performance indicator will be undertaken annually. A report on the performance indicators will be submitted to the Minister for Primary Industries within two years of the commencement of the FMS, and biennially thereafter. The report is the formal mechanism for reporting on performance indicators and trigger points, and will be made publicly available. It will also include a review of progress made in implementing each of the management responses. The performance report may be submitted to the Minister for Primary Industries in conjunction with performance reports for other relevant fishery management strategies.

The vast majority of management responses in the management strategy are linked to specified implementation timeframes. Some of these management actions are subject to specific trigger points that ensure reviews and appropriate remedial actions if the target timeframes are not met.

If the performance report identifies that any specified target timeframe has not been met, a review will be undertaken and any necessary remedial measures recommended to the Minister for Primary Industries.

The fishery will continue to be regarded as being managed within the terms of the FMS while any remedial measures associated with breaches in timeframes or triggering of performance indicators are being considered through the review process and/or by the Minister for Primary Industries.

4.3.2 Review Report in Response to Trigger Points

If the trigger point for a performance indicator is breached, a review is to be undertaken of the likely causes for the breach. Any such review is to include consultation with ABMAC.

NSW DPI will continue to collect and analyse information relevant to the performance of the fishery, such as compliance rates, economic data, catch data and other statistics as the information becomes available and prior to the preparation of reports relating to performance monitoring in the management strategy. This does not, however, prevent a review from being conducted at any other time should it become apparent that a performance indicator has breached a trigger point.

Once the relevant information is obtained an initial analysis against the trigger points will be undertaken by NSW DPI. Where the data or information indicates that a trigger point has been breached, details will be provided to the relevant fishery MACs and the relevant Ministerial Advisory Councils. Consultation will then occur with the ABMAC and other relevant advisory bodies either through a meeting or out of session. During this consultation, advice will be sought on the suspected reasons for any breaches. During this consultation ABMAC will also be able to provide advice on the preparation of any review reports that are required.

A review report outlining the remedial actions recommended in response to trigger point breaches, is to be provided to the Minister for Primary Industries within 6 months of the trigger point being breached. Reviews arising from landings data exceeding trigger points should consider, but not be limited to, the following factors:

- changes in the relative catch levels among harvest sectors (including those beyond NSW jurisdiction);
- new biological or stock information (from any source) available since the most recent review of the species;
- changes in the activities or effectiveness of fishing businesses targeting the species;
- changes in principal markets or prices for the species; and
- environmental factors.

Review reporting should include whether the suspected reasons for the trigger point being breached are the result of a fishery effect or an influence external to the fishery, or both. If a review concludes that the reasons for the trigger point being breached are due to the operation of the fishery, or if the fishery objectives would be compromised if the fishery continued to operate unchanged, management action must be taken with the objective of returning the performance indicator to an acceptable range within a specified time period. The nature of any remedial action proposed may vary depending on the circumstances that have been identified as responsible for the trigger point being breached and the priority of the performance indicator being monitored.

If a review considers that the management objectives or performance monitoring provisions are inappropriate and need to be modified, the strategy itself may be amended by the Minister for Primary Industries. If the reasons are considered to be due to the impacts on the resource from factors external to the fishery, these factors should be identified in the review and, if possible, referred to any relevant managing agency for action.

There may be circumstances where no change to management arrangements or the management strategy is deemed necessary following the review. For example, a review could be triggered because the landed catch declines. However, there would be little cause for concern over the performance of

the FMS if the decline in abalone catch was clearly caused by a drop in market prices as price fluctuations can result in divers adjusting their activities. All review reports will be publicly available.

4.4 Contingency Plans for Unpredictable Events

In addition to the circumstances outlined above, the Minister for Primary Industries may order a review and/or make a modification to the management strategy in circumstances declared by the Minister for Primary Industries as requiring contingency action, or upon the recommendation of the ABMAC. In the case of the former, the Minister for Primary Industries must consult ABMAC on the proposed modification or review.

These circumstances may include (but are not limited to) food safety events, environmental events, disease outbreaks, unpredictable changes in overseas markets, results of research programs or unpredictable changes in fishing activity over time. The Minister for Primary Industries may also amend this FMS if matters identified during the finalisation of any other FMS indicate that a modification is necessary.

5. RESEARCH AND DEVELOPMENT PLAN

5.1 Previous Reviews and Priorities

The Abalone Fishery has previously been subject to programs of research and development. Programs have become more extensive over time and many are ongoing. The basis for the current stock assessment program was initiated by NSW DPI and industry in 1993 through an FRDC grant. Other areas of research and development (e.g. abalone-sea urchin interactions, the potential for reseeding) have also occurred in the past, some of which are ongoing.

An external review of the stock assessment research and monitoring program in the fishery has also been undertaken (Sainsbury 2000). The Review entailed detailed interviews with stakeholders, including members of the TAC Committee and ABMAC, the fishery manager, researchers, abalone divers and processors, to identify their views on research and the stock assessment and reporting process. As the review was done some time ago, many of the recommendations have been implemented. Consultation at the time indicated that there was very strong support for the current modelling and stock assessment, which were considered adequate for the needs of the current operation of the fishery.

Research priorities at the time were assigned by the review. Those with the highest priority and still to be done were:

- Reconstruction of historical catch data;
- Review and incorporation of all historical catch data into the assessment;
- Independent verification of model estimates of population parameters by Region;
- Estimation of illegal catch level and fate;
- Strategic Direction: impacts of coastal pollution and development;
- Strategic Direction: stock and habitat enhancement;
- Strategic Direction: finding solutions to the illegal catch; and
- Strategic Direction: identify and evaluate options for fishery rebuilding.

In addition, there are broad objectives for research in the share management plan. These are to collect the information that is needed to complete an annual assessment of abalone stocks in NSW; and to investigate techniques for increasing the productivity of the abalone stocks in NSW.

5.2 Current and Future Priorities

Table 3 outlines the current (2006/07) research priorities for the Abalone Fishery. Future priorities for research and development should be linked to the goals and objectives of the FMS and share management plan. The various sub-programs for research can be grouped into four broad categories: stock assessment; habitat and ecosystem; rebuilding biomass; and socio-economic.

Table 3. Strategic plan for abalone research for 2006/07. [Funding secure (black shading); funding not yet committed (grey shading)]

Research Project	Priority	2006/07	Timeframe for Project	Actual/Possible Source of Funding	Objectives and Comments
Stock Assessment					
Fishery-independent surveys of the relative abundance of abalone	High		Annually, with potential for changes to periodicity	Industry/NSW DPI	**Monitor abundance of abalone on reefs.** Fishery-independent surveys currently done annually at fixed sites along NSW coast. Analysis of data from this survey provides time-series of indices of annual abundance of 3 size-classes of abalone. These time-series provide: (i) an important component of the resource assessment and (ii) the basis for calibration of the model of the abalone population & fishery. Options for maximising the cost-benefit of this survey (e.g. frequency of survey, number of fixed sites sampled each survey) should be periodically reviewed.
Analysis of fishery-dependent catch and effort data (from the commercial fishery)	High		Annually	Industry/NSW DPI	**Monitor catch, effort and CPUE (and their spatial and temporal variation) for the commercial fishery.** These fishery-dependent data are sourced from the daily logbooks completed by commercial abalone fishers. Analysis of these data provides time-series of catch and indices of abundance of legal-sized abalone. These time series provide: (i) an important component of the resource assessment and (ii) the basis for calibration of the model of the abalone population and fishery.
Modelling for resource assessment and analysis of harvest strategies	High		Annually, with potential for changes to periodicity	Industry/NSW DPI	**Provide model-based estimates of: (i) stock depletion (relative to 1994 and virgin biomass) and (ii) prospective changes of biomass in response to alternative TACCs.** A length-structured model of the population of abalone and the fishery is used within a Bayesian framework to provide retrospective and prospective estimates of biomass. This model is currently updated annually and is a key component of the resource assessment.

Research Project	Priority	2006/07	Timeframe for Project	Actual/Possible Source of Funding	Objectives and Comments
Resource assessment	High		Annually, with potential for changes to periodicity	Industry/NSW DPI	**Provide an annual assessment of the status of the abalone resource and analysis of the consequences of alternative TACCs.** This resource assessment (currently completed annually) is the primary source of information used by the TAC Committee in making its determination. The assessment is principally based on data from the fishery-independent survey, fishery-dependent catch & effort and retrospective and prospective components of the model of the stock & fishery.
Develop methods for estimating the illegal catch of abalone	High		Not determined	Industry/NSW DPI	**Develop a methodology and provide estimates of the annual illegal catch of abalone in NSW.** Accurate assessment of the status of the abalone stock is dependent on knowledge of the commercial, recreational and illegal components of the total catch. The nature of illegal fishing makes it very difficult to obtain a precise estimate of illegal catch. Illegal fishing, however, is a major risk to the resource and more precise information about its magnitude and variation through time is needed to: (i) improve the accuracy of the stock assessment model and resource assessment and (ii) to provide the basis for evaluating the effectiveness of compliance services (and allocating appropriate compliance resources).
Develop / implement methods for improving monitoring and assessment of abalone stock in Region1	Medium		Not determined	Industry/NSW DPI	**Design and implement methods for monitoring abalone abundance in Region 1; Develop the model of the abalone population and fishery to provide retrospective and prospective model-based estimates of biomass in Region 1.** Region 1 (Jervis Bay to far-north coast of NSW) is a large region, with its southern section (Jervis Bay to Port Stephens) currently closed to fishing due to *Perkinsus*-related mortality. This region is inadequately covered by the fishery-independent survey and fishery-dependent catch and effort data is limited to the small amount of commercial fishing that occurs north of Port Stephens.

Research Project	Priority	2006/07	Timeframe for Project	Actual/Possible Source of Funding	Objectives and Comments
Develop/implement methods for estimating the recreational and Aboriginal catches of abalone	Medium		Not determined	Industry/NSW DPI/Other	**Develop and implement a strategy and methodology for estimating annual catches of abalone by recreational and Aboriginal fishers in NSW.** Accurate assessment of the status of the abalone stock is dependent on knowledge of the commercial, recreational and Aboriginal components of the total catch. The most precise survey-based estimate was made in 1997. A long-term strategy for repeating this survey periodically, or an alternative survey design, needs to be developed.
Develop / implement a method for estimating the rate of discarding of undersize abalone	Medium		Not determined	Industry/NSW DPI/Other	**Design and implement a method for estimating and monitoring the rate of discarding of undersized abalone.** Removal and then subsequent discarding of sub-legal-size abalone may impact subsequent spawning, growth or survival. Such impacts could be significant at times when legal-size abalone are relatively scarce and a large proportion of abalone removed by divers are subsequently discarded. The simplest methodology may involve fishers providing estimates of numbers of abalone removed and subsequently discarded on the existing daily logbook.
Validation of growth parameters used in the stock assessment model	Low		Not determined	Industry/NSW DPI/Other	**Validate assumptions about growth of abalone used in the stock assessment model.** A tagging program, done in cooperation with industry, could provide estimates of growth parameters at spatial and temporal scales of interest. In addition to validating parameters of growth used in the assessment model, understanding differences in growth with latitude (or at more complex spatial scales) would facilitate analysis of the benefits of alternative minimum sizes and the spatial scale at which different minimum sizes should be applied.

Habitat and Ecosystem

Research Project	Priority	2006/07	Timeframe for Project	Actual/Possible Source of Funding	Objectives and Comments
Investigating and managing the *Perkinsus*-related mortality of blacklip abalone in NSW	High			FRDC/NSW DPI/Industry	**1. Document the historical evidence about the spread of *Perkinsus*-related mortality of abalone in NSW;** **2. Describe the pathogenesis and make initial investigations of the epidemiology of the mortality of abalone; and** **3. Contribute to the development of strategies to manage populations of abalone that have, or might be, affected by *Perkinsus* and evaluate the need for further research.** A key component of this project is a survey of *Perkinsus* infection in abalone along the NSW coastline (providing evidence of any change in distribution since the survey done in 2002. This is a FRDC funded project due for completion at the end of 2006.
Development of a program to monitor the impacts of harvesting abalone on the coastal environment	Low		Not determined	Industry/NSW DPI/Other Institutions	**Increase knowledge of the effects of harvesting abalone on the associated ecosystems.**

Research Project	Priority	2006/07	Timeframe for Project	Actual/Possible Source of Funding	Objectives and Comments
Rebuilding Biomass					
Development and delivery of technology for enhancement of blacklip abalone fisheries in NSW using hatchery-produced seed stock	High	■		FRDC/NSW DPI/Sydney University/ University of New England	**1. To evaluate alternative methods of reducing high post-release mortality rates commonly sustained by hatchery produced abalone seed;** **2. To optimise production of triploid black-lip and scarlet-rayed abalone; and** **3. To assess the utility of sterile but potentially fast growing triploid black-lip and scarlet rayed abalone for enhanced fisheries production.** FRDC-funded project beginning in 2005 and scheduled to finish in 2008.
Design / Implement experiments to assess reseeding, translocation of abalone and harvest of sea urchins to rebuild populations of abalone	Medium		Not determined	Industry/NSW DPI/Other	**To investigate the potential of reseeding and translocating abalone and harvesting sea urchins as a means of rebuilding populations of abalone.** These techniques have potential to assist in rebuilding populations of abalone that have been depleted by illegal fishing or expansion of sea urchin 'barren grounds'. These techniques would be experimental and restricted to <1% of reef in NSW waters.
Assessing the effects of alternative size limits	Medium		Not determined	Industry/NSW DPI	**To assess (and implement where appropriate) alternative size limits that would contribute to rebuilding of populations or improve the efficiency of harvesting.** Involves various approaches. For example, modelling may be combined with tagging to assess the feasibility of alternative size limits for particular areas. Experiments would be done at a variety of scales.

Research Project	Priority	2006/07	Timeframe for Project	Actual/Possible Source of Funding	Objectives and Comments
Abalone Industry Development: local assessment and management by industry, integrated into State zonal assessment	Medium			FRDC/Various state fishery organisations/ Melbourne University/ State abalone industry associations/ Fisheries Consultants	**Objectives involve developing indicators that abalone divers can use to assess stock status at the scale of individual reefs and using these to integrate industry driven local scale assessment and management processes with formal and legislated management arrangements at the zonal scale.** Effective, cost-efficient management of abalone fisheries at scales smaller than regions would reduce the risk of over-fishing at small scales and increase the efficiency of harvesting. FRDC-funded project beginning in 2005 and scheduled to finish in 2007.
Socio-Economic					
Economic and social surveys of abalone shareholders	High		Not determined	Industry/NSW DPI	**Determine the components underlying the viability of abalone shareholders.** Further surveys of shareholders are required to provide updated information. Further development of appropriate surveying would produce information required to develop more robust performance indicators (based on net returns) of economic viability.

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APPENDIX 1. COPY OF MINISTER'S DETERMINATION MADE UNDER THE EP&A ACT

**DETERMINATION WITH RESPECT TO
A DESIGNATED FISHING ACTIVITY UNDER SECTION 115O OF THE
ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979**

I, IAN MACDONALD, MLC, the Minister for Primary Industries, pursuant to section 115O of the *Environmental Planning and Assessment Act 1979* ("the Act"), determine to permit the designated fishing activity described in Schedule 1 to be carried out subject to such modifications as will eliminate or reduce the detrimental effect of the activity on the environment set out in Schedule 2.

I have examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the designated fishing activity.

I have considered *inter alia*:

1. the Environmental Impact Statement ("EIS") for the Abalone Fishery published by The Ecology Lab Pty Ltd on behalf of NSW Department of Primary Industries in September 2005 and the representations duly received with respect to the designated fishing activity to which the EIS relates;

2. the advice of the NSW Department of Planning;

3. the recommendations of the Director-General, NSW Department of Primary Industries, dated June 2006;

4. the matters required to be considered under section 115N of the Act relating to threatened species conservation; and

5. the matters referred to in section 19(2) and section 20(3) of the *Marine Parks Act 1997*.

IAN MACDONALD, MLC
Minister for Primary Industries
Dated this 27th day of June 2006

**SCHEDULE 1
Designated fishing activity**

Fishing activities for commercial purposes in the Abalone Fishery as described in Schedule 1 of the *Fisheries Management Act 1994*.

**SCHEDULE 2
Modifications**

The draft fishery management strategy exhibited in September 2005 as part of the Environmental Impact Statement for the designated fishing activity is revised so as to incorporate:

a) the amendments expressly stated in the preferred strategy report for the activity dated June 2006; and

b) the recommendations of the Director-General, NSW Department of Primary Industries dated June 2006.

APPENDIX 2. GLOSSARY

Abalone	The target species, *Haliotis rubra.*
Abalone Fishery	The commercial fishery for abalone in NSW.
ABMAC	Abalone Management Advisory Committee.
ACoRF	Advisory Council on Recreational Fishing.
Abalone Development Company	An industry company originally formed to help progress alternative governance in the Abalone Fishery.
AQIS	Australian Quarantine Inspection Service.
Aquatic Reserves	Small areas declared under the *Fisheries Management Act 1994* where commercial and recreational fishing is restricted or not permitted.
Assemblage	A group of organisms living close together.
Beach price	Price payed to shareholders by processors for abalone at the point of first sale.
Biomass	The total weight of abalone.
Bycatch	Organisms caught incidentally to abalone.
Category 1 share managed fishery	Access rights in the commercial fishery are based on shareholdings in the fishery, which are transferable. Full cost recovery and community contribution payable. Includes Abalone Fishery and Lobster Fishery.
Closures	Areas of coastline closed to commercial and recreational harvesting of abalone.
Commercial catch rate	Weight of abalone caught by commercial divers relative to the amount of time spent harvesting (effort).
Commercial fishery	Operations carried out by endorsement holders in the Abalone Fishery.
Community contribution	NSW Government policy whereby shareholders in Category 1 share managed fisheries, such as the Abalone Fishery, make a periodic cash contribution to consolidated revenue in respect of privileged access.
Compliance	Fisheries field services whose core role is to provide advisory and enforcement services.
Contestable supply	Where opportunity exists for obtaining a service from a source of suppliers.
Cost recovery	NSW Government policy for recovering the costs of managing commercial fisheries. Full cost recovery policy is applied to Category 1 share managed fisheries such as the Abalone Fishery.
CPI	Consumer Price Index.
(The) Department	Department of Primary Industries.
Deck hand	Person nominated by a shareholder to work on an abalone boat and assist the diver.
Dioecious	Sexes are separate, i.e. individuals can only be male or female, not both.
DIPNR	Department of Infrastructure, Planning and natural Resources.
Discards	Abalone that have been removed from the reef by a diver and then determined to be under the minimum legal size and replaced.
Diver	Endorsement holder in the Abalone Fishery.
NSW DPI	Department of Primary Industries
Draft FMS	The Draft Fishery Management Strategy for the Abalone Fishery.
Ecology	Interrelationships between organisms and their environment and each other.
Economic return	Economic benefits generated by the Abalone Fishery
Ecosystem	Biological community of interacting organisms and their environment.
EIS	Environmental Impact Statement
Endorsement	Licence to harvest abalone commercially.

Environment	Includes biological, ecological, physical, economic and social conditions.
EP&A Act	*Environmental Planning and Assessment Act 1979.*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999.*
ESD	Ecologically Sustainable Development
Existing operations	Operations of the commercial fishery under the existing share management plan.
Fish receiver	Refers to a business that handles abalone after it has been landed by commercial divers.
Fisher	Person who harvests abalone.
Fisheries Investigations Unit (FIU)	A separate unit within the Department that integrates intelligence with abalone and lobster compliance functions.
Fishery-independent surveys	Surveys of abundance of abalone carried out each year at a number of fixed sites.
Fishing ground	Areas where abalone are harvested.
Fishing mortality	Removal of a portion of the stock of abalone due to commercial fishing.
Fishing period	The period to which a designated TACC applies. In June 2003, the fishing period was changed from the calendar year to the financial year.
'Foot' of abalone	The muscular part of abalone that attaches to the reef.
FM Act	*Fisheries Management Act 1994.*
FMS	Fishery Management Strategy.
Fully-fished	NSW DPI term used to define the status of exploitation of the stock of abalone as one in which 'current catches are sustainable and close to optimum levels' and where 'significant increases in fishing effort above current levels may lead to over-fishing'.
GDP	Gross domestic product
Gross return / revenue	Financial return to shareholders from the sale of abalone quota before costs have been deducted.
Growth over-fishing	This occurs when too may small abalone are taken, and therefore too few grow to a size that provides the largest yield from the fishery.
Harvesting	The process of removal of abalone from their environment.
Hookah	Apparatus used by divers to breath air underwater. Involves a compressor or large tank containing compressed air aboard the boat which pumps air down to the diver through a hose.
IFS	Indigenous Fishing Strategy and Implementation Plan.
Illegal fishing	Harvesting of abalone that is done by commercial, recreational and Aboriginal fishers that breaches regulations.
Indigenous	People with aboriginal heritage.
Indigenous fishery	The Aboriginal sector of the community that harvest abalone. Aboriginal fishers must harvest according to general recreational fishing rules for abalone, although special permits that allow groups to exceed the bag-limit may be granted in particular circumstances.
Indigenous Fishing Strategy and Implementation Plan	A strategy for promoting the recognition of Aboriginal culture and involvement of aboriginal people in fisheries in NSW.
Industry	Refers to stakeholders in the commercial sector of the fishery.
IPART	Independent Pricing and Regulatory Tribunal.
Larvae	Small, planktonic recently hatched abalone that live in the water column before settling on the reef.
Legal sized abalone	Abalone of a size above the minimum legal size.

Management charges	Fees paid by shareholders for the management of the Abalone Fishery. This does not include community contribution.
Marine Parks	Large areas declared under the *Marine Parks Act 1997* where commercial and recreational fishing is restricted or not permitted.
Marine Pests and Diseases Management Plan	Any approved plan for controlling the spread of marine pests and diseases.
Marine Protected Areas	Areas where commercial and recreational fishing is restricted or not permitted. Includes Marine Parks and Aquatic Reserves.
Mature Biomass	The total weight of abalone that are above the size at which individuals mature.
Minimum shareholding	The minimum number of shares required by a shareholder to be issued with an endorsement to take abalone (currently the minimum is 70 shares).
MLS	'Minimum legal size'- The minimum size (115 mm) at which abalone can be harvested by commercial, recreational and Aboriginal fishers.
Model(ing)	Refers to outputs from the computer model(ing) used in the stock assessment of abalone.
National Docketing System (NDS)	A docket system, applying to all abalone sold in Australia, that assists in reducing marketing of illegally caught abalone.
Natural mortality	Removal of a portion of the stock due to natural rates of death of abalone.
Net return	Financial return to shareholders from the sale of abalone quota after costs have been deducted.
Nominated diver	Endorsement holder nominated by a shareholder to take abalone on his behalf.
NSW	New South Wales.
Over-fishing	Harvesting abalone at a rate that is thought to be unsustainable.
Performance indicator	A parameter that measures whether an objectives for the Abalone Fishery is being attained.
Perkinsus	A single-celled protistan parasite of abalone that is thought to be responsible for large-scale mortality of abalone in parts of NSW.
Poacher	An individual who does not hold an endorsement in the fishery but harvests abalone for commercial gain.
Population	The total number of individuals in an area. In most cases it refers to the 'general' population of abalone but in some cases where it refers to smaller populations the distinction is made evident.
Post-harvest	Refers to processes that occur in operations involved with abalone after it has been landed by commercial divers.
Precautionary principle	Taking a precautionary approach to preventing environmental degradation when there is a lack of full scientific certainty.
Processor	Refers to a business that handles abalone after it has been landed by commercial divers.
Protected species	Any species of fish listed under Sections 19 or 20 of the FM Act.
Quota	Weight of abalone allocated to shares in the Abalone Fishery for a fishing period.
Ranching	Maintaining reseeded or wild abalone on a particular area of reef to which there are privileged access rights.
Recreational fishery	A sector of the community with legitimate access to the resource. Recreational fishers must hold a general saltwater recreational fishing licence and not exceed a bag-limit of 2 abalone per individual.
Recruitment	Refers to the total number of individuals for a year that are added to the stock of abalone.

Recruitment over-fishing	This occurs when harvesting greatly reduces the number of mature (breeding) abalone in a population, causing a decline in the reproductive output and leading to a very significant reduction in the number of young abalone recruiting to the harvesting portion of that population.
Reef	Refers to rocky reef habitat on which abalone are known to live.
Region	Stock assessment regions for the Abalone Fishery. There are 6 regions in NSW between the Queensland and Victorian borders.
Regulation	The regulations in the Abalone Share Management Plan (2000).
Reseeding	Releasing hatchery-reared abalone into the wild.
Section 37 Research Permit	A permit issued under the FM Act to research scientists and commercial fishers assisting in undertaking research programs.
Serial depletion	When harvesting systematically removes all of the stock from one area to another.
Share management plan	The share management plan for the Abalone Fishery.
Shareholders	Shareholders in the Abalone Fishery.
Shares	Shares in the Abalone Fishery (total = 3,654).
SIAC	Seafood Industry Advisory Council
Size at maturity	The size of abalone at which the majority of individuals mature.
Spatial	Refers to area and geographical relationships.
Spawning	Refers to abalone that release eggs or sperm.
Stock	The biomass of mature abalone.
Stock assessment	A process of estimating the biomass of abalone and fishing mortality rates in a computer model that combines sources of data derived from surveys of abundance and catch and effort information from the commercial fishery.
Strategic plan	A strategy for Administration, Research or Compliance in the Abalone Fishery as detailed in the share management plan.
Subzone	An area of coast within a zone to which commercial divers in the fishery must report their catch. There are a total of 72 reporting subzones in the Abalone Fishery.
SUTS	Sea Urchin and Turban Shell Fishery.
TAC	Total Allowable Catch (includes commercial and recreational catch).
TACC	Total Allowable Commercial Catch.
TAC Committee	Total Allowable Catch Setting and Review Committee.
Target species	The species targeted by the commercial fishery (i.e. the black-lip abalone, *Haliotis rubra*).
Threatened species	Any species listed under Schedules 4 or 5 of the FM Act, Schedules 1 or 2 of the TSC Act or subdivisions C or D of the EP & A Ac*t*.
Trigger point	A level reached by a performance indicator that suggests a review is required.
Translocation	Movement from one area to another.
TSC Act	*Threatened Species Conservation Act 1995.*
VMS	Vessel monitoring system.
Zone	An area of coast within a stock assessment region. There are a total of 28 reporting zones in the Abalone Fishery.

APPENDIX 3. NSW COMMERCIAL ABALONE FISHERY REPORTING SUBZONES

Catch Subzones for the NSW Abalone Fishery				
Sub-zone	**Northern Boundary**		**Southern Boundary**	
A Tweed Heads to Ballina	153° 33' 07.2612"	28° 09' 52.3404"	153° 35' 25.0512"	28° 52' 38.3232"
B1 Ballina to Sandon	153° 35' 25.0512"	28° 52' 38.3232"	153° 19' 57.9648"	29° 40' 25.8456"
B2 Sandon to Red Rock	153° 19' 57.9648"	29° 40' 25.8456"	153° 14' 03.4764"	29° 58' 52.014"
B3 Red Rock to Coffs Harbour	153° 14' 03.4764"	29° 58' 52.014"	153° 09' 11.6064"	30° 18' 31.8888"
C1 Coffs Harbour to SW Rocks	153° 09' 11.6064"	30° 18' 31.8888"	153° 01' 43.7268"	30° 52' 24.6072"
C2 SW Rocks to Pt Macquarie	153° 01' 43.7268"	30° 52' 24.6072"	152° 55' 02.7192"	31° 25' 36.0984"
D1 Pt Macquarie to Harrington	152° 55' 02.7192"	31° 25' 36.0984"	152° 41' 27.8952"	31° 52' 39.8424"
D2 Harrington to Tuncurry	152° 41' 27.8952"	31° 52' 39.8424"	152° 30' 43.9632"	32° 10' 25.1724"
E2 Foster to Seal Rocks	152° 30' 43.9632"	32° 10' 25.1724"	152° 32' 09.9384"	32° 26' 02.3964"
E3 Seal Rocks to Hawks Nest Beach	152° 32' 09.9384"	32° 26' 02.3964"	152° 11' 14.118"	32° 40' 07.0356"
E4 Yacaaba Head and Islands	152° 11' 14.118"	32° 40' 07.0356"	152° 11' 09.4272"	32° 42' 40.032"
E1 Broughton Island	152° 17' 43.5840"	32° 35' 25.0044"	152° 17' 43.5840"	32° 38' 38.7872"
F1 Port Stephens to Anna Bay	152° 11' 09.4272"	32° 42' 40.032"	152° 07' 00.3864"	32° 46' 28.8192"
F2 Anna Bay to Newcastle	152° 07' 00.3864"	32° 46' 28.8192"	151° 47' 57.5844"	32° 55' 03.9936"
F3 Newcastle to Burwood Beach	151° 47' 57.5844"	32° 55' 03.9936"	151° 45' 43.9128"	32° 56' 42.108"
F4 Burwood Beach to Swansea	151° 45' 43.9128"	32° 56' 42.108"	151° 39' 57.6648"	33° 05' 13.1604"
G1 Swansea to Norah Head	151° 39' 57.6648"	33° 05' 13.1604"	151° 34' 36.1236"	33° 16' 44.8428"
G2 Norah Head to The Entrance	151° 34' 36.1236"	33° 16' 44.8428"	151° 30' 15.4908"	33° 20' 35.0484"
G3 The Entrance to Terrigal	151° 30' 15.4908"	33° 20' 35.0484"	151° 27' 00.8532"	33° 26' 46.644"
G4 Terrigal to Broken Bay	151° 27' 00.8532"	33° 26' 46.644"	151° 19' 43.8888"	33° 34' 40.7532"
H1 Broken Bay to Sydney Harbour	151° 19' 43.8888"	33° 34' 40.7532"	151° 16' 51.2508"	33° 49' 58.152"
H2 Sydney Harbour to Bondi Beach	151° 16' 51.2508"	33° 49' 58.152"	151° 16' 37.146"	33° 53' 30.9696"
H3 Bondi Beach to Botany Bay	151° 16' 37.146"	33° 53' 30.9696"	151° 13' 19.992"	34° 00' 05.364"
J1 Botany Bay to Port Hacking	151° 13' 19.992"	34° 00' 05.364"	151° 10' 08.8788"	34° 04' 29.5032"
J2 Port Hacking to Marley Beach	151° 10' 08.8788"	34° 04' 29.5032"	151° 08' 28.788"	34° 06' 57.8916"
J3 Marley Beach to Garie Beach	151° 08' 28.788"	34° 06' 57.8916"	151° 04' 06.816"	34° 10' 14.2464"
J4 Garie Beach to Stanwell Park	151° 04' 06.816"	34° 10' 14.2464"	151° 59' 27.5388"	34° 13' 48.6264"
J5 Stanwell Park to Wollongong Hbr	151° 59' 27.5388"	34° 13' 48.6264"	151° 54' 24.5016"	34° 25' 08.958"
K1 Wollongong Hbr to Shellharbour	151° 54' 24.5016"	34° 25' 08.958"	150° 52' 35.7672"	34° 34' 44.2416"
K2 Shellharbour to Bombo Beach	150° 52' 35.7672"	34° 34' 44.2416"	150° 51' 23.0616"	34° 39' 26.8092"
K3 Bombo Beach to Werri Beach	150° 51' 23.0616"	34° 39' 26.8092"	150° 50' 06.702"	34° 44' 04.182"
K4 Werri Beach to Shoalhaven Heads	150° 50' 06.702"	34° 44' 04.182"	150° 46' 10.686"	34° 53' 51.6264"

(Note: All GPS points in this Appendix taken in WGS 84)

Appendix 3 continued: NSW Abalone Commercial Fishery Subzones

Sub-zones	Northern Boundary		Southern Boundary	
L1 Shoalhaven Heads to Currarong	*150° 46' 10.686"*	*34° 53' 51.6264"*	*150° 49' 20.4636"*	*35° 00' 49.5396"*
L2 Currarong to Pt Perpendicular	*150° 49' 20.4636"*	*34° 58' 58.6668"*	*150° 48' 16.236"*	*35° 05' 39.9084"*
L3 Inside Jervis Bay	*150° 48' 16.236"*	*35° 05' 39.9084"*	*150° 46' 06.0456"*	*35° 06' 43.992"*
L4 Nth tip Bowen Island to Wreck Bay	*150° 46' 06.0456"*	*35° 06' 43.992"*	*150° 37' 30.6192"*	*35° 10' 06.0816"*
M1 Wreck Bay to Bendalong	*150° 37' 30.6192"*	*35° 10' 06.0816"*	*150° 32' 43.4652"*	*35° 14' 54.8016"*
M2 Bendalong to Ulladulla	*150° 32' 43.4652"*	*35° 14' 54.8016"*	*150° 28' 43.5864"*	*35° 21' 20.6568"*
N1 Ulladulla to Termeil Point	*150° 28' 43.5864"*	*35° 21' 20.6568"*	*150° 23' 44.3148"*	*35° 27' 37.6272"*
N2 Termeil Point to Brush (excl. Island)	*150° 23' 44.3148"*	*35° 27' 37.6272"*	*150° 24' 27.1728"*	*35° 31' 45.7356"*
N3 Brush Island	*150° 24' 37.2060"*	*35° 31' 18.6672"*	*150° 24' 37.2060"*	*35° 32' 19.4604"*
P1 Brush (excl. Island) to Pretty Beach	*150° 24' 27.1728"*	*35° 31' 45.7356"*	*150° 21' 55.9548"*	*35° 34' 12.9864"*
P2 Pretty Beach to Sth Durras	*150° 21' 55.9548"*	*35° 34' 12.9864"*	*150° 17' 46.986"*	*35° 39' 09.4428"*
P3 Sth Durras to North Head	*150° 17' 46.986"*	*35° 39' 09.4428"*	*150° 16' 34.7772"*	*35° 43' 23.1924"*
P4 North Head to Batemans Bay	*150° 16' 34.7772"*	*35° 43' 23.1924"*	*150° 10' 54.1416"*	*35° 42' 26.5284"*
Q1 Batemans Bay to Lilli Pilli Beach	*150° 10' 53.9760"*	*35° 42' 34.6428"*	*150° 13' 32.07"*	*35° 46' 14.4624"*
Q2 Tollgate Islands	*150° 15' 00.0000"*	*35° 44' 00.0000"*	*150° 15' 00.0000"*	*35° 46' 00.0000"*
Q3 Lilli Pilli Beach to Malua Bay	*150° 13' 32.07"*	*35° 46' 14.4624"*	*150° 13' 51.1356"*	*35° 47' 34.5696"*
Q4 Malua Bay to Burrewarra Point	*150° 13' 51.1356"*	*35° 47' 34.5696"*	*150° 14' 07.7244"*	*35° 50' 06.0324"*
Q5 Burrewarra Point to Moruya River	*150° 14' 07.7244"*	*35° 50' 06.0324"*	*150° 09' 06.9732"*	*35° 54' 23.238"*
R1 Moruya River to Black Rock	*150° 09' 06.9732"*	*35° 54' 23.238"*	*150° 09' 10.3464"*	*35° 59' 01.2876"*
R2 Black Rock to Tuross Lake	*150° 09' 10.3464"*	*35° 59' 01.2876"*	*150° 08' 03.642"*	*36° 04' 01.7472"*
S2 Tuross Lake to Dalmeny	*150° 08' 03.642"*	*36° 04' 01.7472"*	*150° 07' 37.8804"*	*36° 09' 43.956"*
S3 Dalmeny to Narooma	*150° 07' 37.8804"*	*36° 09' 43.956"*	*150° 08' 01.3956"*	*36° 12' 39.096"*
S1 Montague Island	*150° 12' 58.7304"*	*36° 14' 13.7328"*	*150° 12' 58.7304"*	*36° 16' 00.9048"*
T1 Narooma to Corunna Lake	*150° 08' 01.3956"*	*36° 12' 39.096"*	*150° 07' 54.2136"*	*36° 17' 23.7228"*
T2 Corunna Lake to Bermagui	*150° 07' 54.2136"*	*36° 17' 23.7228"*	*150° 04' 26.4072"*	*36° 25' 17.8788"*
U1 Bermagui to Cuttagee Inlet	*150° 04' 26.4072"*	*36° 25' 17.8788"*	*150° 03' 18.2196"*	*36° 29' 16.6056"*
U2 Cuttagee to Thibbul Inlet (Murrah)	*150° 03' 18.2196"*	*36° 29' 16.6056"*	*150° 03' 27.1296"*	*36° 31' 32.7576"*
U3 Thibbul to Bunga Head (Goalen and Pressure)	*150° 03' 27.1296"*	*36° 31' 32.7576"*	*150° 03' 20.3508"*	*36° 33' 17.4264"*
U4 Bunga Head to Mimosa Rocks (Bunga)	*150° 03' 20.3508"*	*36° 33' 17.4264"*	*150° 03' 16.7112"*	*36° 35' 04.8624"*
V1 Mimosa Rocks to Bithry Inlet	*150° 03' 16.7112"*	*36° 35' 04.8624"*	*150° 01' 12.2052"*	*36° 37' 46.8768"*
V2 Bithry Inlet to Barounda Inlet	*150° 01' 12.2052"*	*36° 37' 46.8768"*	*149° 59' 41.7444"*	*36° 41' 09.3264"*
V3 Barounda Inlet to Tathra	*149° 59' 41.7444"*	*36° 41' 09.3264"*	*149° 59' 28.0212"*	*36° 43' 29.1864"*
W1 Tathra to Wallagoot Lake	*149° 59' 28.0212"*	*36° 43' 29.1864"*	*149° 57' 26.3844"*	*36° 47' 23.4816"*
W2 Wallagoot Lake to Short Point Beach	*149° 57' 26.3844"*	*36° 47' 23.4816"*	*149° 55' 57.3996"*	*36° 52' 04.720"*
W3 Short Point Beach to Merimbula	*149° 55' 57.3996"*	*36° 52' 04.720"*	*149° 54' 29.1924"*	*36° 54' 27.4104"*
X1 Merimbula to Long Beach	*149° 54' 29.1924"*	*36° 54' 27.4104"*	*149° 55' 39.864"*	*36° 59' 00.2796"*
X2 Long Beach to Eden Wharf	*149° 55' 39.864"*	*36° 59' 00.2796"*	*149° 54' 27.5904"*	*37° 04' 26.7456"*

Appendix 3 continued: NSW Abalone Commercial Fishery Subzones

Sub-zones	Northern Boundary		Southern Boundary	
Y11 Eden Wharf to Red Point	*149° 54′ 27.5904″*	*37° 04′ 26.7456″*	*149° 57′ 13.8672″*	*37° 06′ 02.7792″*
Y12 Red Point to Leatherjacket Beach	*149° 57′ 13.8672″*	*37° 06′ 02.7792″*	*149° 58′ 06.9312″*	*37° 07′ 31.0368″*
Y13 Leatherjacket Beach to Mowarry Point	*149° 58′ 06.9312″*	*37° 07′ 31.0368″*	*150° 00′ 16.5996″*	*37° 08′ 29.1552″*
Y21 Mowarry Point to Saltwater Beach	*150° 00′ 16.5996″*	*37° 08′ 29.1552″*	*150° 00′ 11.484″*	*37° 10′ 10.8336″*
Y22 Saltwater Beach to Long Point	*150° 00′ 11.484″*	*37° 10′ 10.8336″*	*150° 01′ 14.97″*	*37° 11′ 09.1824*
Y23 Long Point to Bittangabee Bay	*150° 01′ 14.97″*	*37° 11′ 09.1824*	*150° 01′ 05.6892″*	*37° 12′ 54.0364″*
Y24 Bittangabee Bay to Green Cape	*150° 01′ 05.6892″*	*37° 12′ 54.0364″*	*150° 03′ 07.2072″*	*37° 15′ 45.0324′*
Y31 Green Cape to City Rock	*150° 03′ 07.2072″*	*37° 15′ 45.0324′*	*150° 00′ 46.4400″*	*37° 15′ 19.7964′*
Y32 City Rock to Wonboyn	*150° 00′ 46.4400″*	*37° 15′ 19.7964′*	*149° 58′ 01.2900″*	*37° 15′ 02.8692″*
Z1 Wonboyn to Jane Spiers Beach	*149° 58′ 01.2900″*	*37° 15′ 02.8692″*	*149° 57′ 23.1372″*	*37° 21′ 13.2300″*
Z2 Jane Spiers Beach to Black Head Anchorage	*149° 57′ 23.1372″*	*37° 21′ 13.2300″*	*149° 58′ 21.5148″*	*37° 26′ 26.358″*
Z3 Black Head Anchorage to Nadgee Lake	*149° 58′ 21.5148″*	*37° 26′ 26.358″*	*149° 58′ 21.1764″*	*37° 27′ 54.9648″*
Z4 Nadgee Lake to Howe Beach	*149° 58′ 21.1764″*	*37° 27′ 54.9648″*	*149° 58′ 26.8788″*	*37° 29′ 51.1224″*
Z5 Howe Beach to Cape Howe	*149° 58′ 26.8788″*	*37° 29′ 51.1224″*	*149° 58′ 34.5468″*	*37° 30′ 19.152″*

APPENDIX 4. IMPLEMENTATION TABLES FOR MANAGEMENT RESPONSES FOR THE ABALONE FISHERY

The following implementation tables outline the target time periods within which each management response is to be implemented. The table also provides information for who has the responsibility for carrying out the action(s). A general description of the terms used in the table with respect to target timeframes is as follows.

Term	Description
Immediate	Upon the time of approval of the strategy
Short term	Within 12 months of the approval of the strategy
Medium term	Within 3 years of the approval of the strategy
Long term	In excess of 3 years of the approval of the strategy
As required	Whenever the circumstances warrant action
Ongoing	Continuing into the future

Where an specific implementation date (e.g. a particular month) has been included for a management response instead of the terms above, the date represents a specific target time within which the management response is to be implemented.

Goal 1: Manage commercial harvesting of abalone to promote the conservation of biological diversity in the coastal environment

OBJECTIVES	MANAGEMENT RESPONSES	CONTRIBUTE TO GOALS	TIMEFRAME	RESPONSIBILITY
1.1 Increase knowledge and minimise any adverse impacts of harvesting abalone on bycatch species, associated habitats and ecosystems.	a) Continue to develop and implement a program to increase knowledge of the effects of abalone harvesting on bycatch species and associated habitat and ecosystems.	1, 2, 5, 6	Medium term and then ongoing	Shareholders; NSW DPI; other institutions
	b) Develop and implement a NSW Abalone Fishery Code of Practice to minimise the impact of harvesting abalone on bycatch species, associated habitats and ecosystems.	1, 2, 5, 6	Short term	Shareholders
	c) Implement, in consultation with the ABMAC, the provisions of any relevant threatened species recovery plan, threat abatement plan, or other similar management arrangements designed to protect critical habitat areas.	1, 6	As required	NSW DPI; Shareholders

Goal 2: Maintain or rebuild the biomass of abalone to ensure stock sustainability

OBJECTIVES	MANAGEMENT RESPONSES	CONTRIBUTE TO GOALS	TIMEFRAME	RESPONSIBILITY
2.1 To maintain or increase the spawning and exploitable biomass of abalone.	a) Continue to implement a state-wide TACC for abalone, determined by the TAC Committee.	1, 2, 4, 5, 8	Ongoing	Shareholders; NSW DPI
	b) Refine the existing harvest strategy for the fishery and implement a definitive recovery strategy for the abalone resource.	1, 2, 4, 5, 8	Short term and then ongoing	Shareholders; NSW DPI
	c) Continue to apply the state-wide minimum legal size of 115 mm.	1, 2, 4, 5	Ongoing	Shareholders; NSW DPI
	d) Continue the collection of fishery-dependent information to contribute to the abalone stock assessment.	1, 2, 4, 5	Ongoing	NSW DPI
	e) Continue the collection of fishery-independent information to contribute to the abalone stock assessment.	1, 2, 4, 5	Ongoing	NSW DPI
	f) Continue stock assessments of the abalone resource.	1, 2, 4, 5	Ongoing	NSW DPI
2.2. To improve the efficiency of harvesting and investigate the potential of techniques to rebuild populations of abalone.	a) Develop a plan to investigate the feasibility of implementing different size limits on a variety of spatial and temporal scales, with provision to implement longer term actions.	1, 2, 4, 5	Short term	Shareholders; NSW DPI
	b) Manage the spatial distribution of catch thorugh: (i) [setting a state-wide TACC with recommended catch limits for specific regions] (ii) [encouraging industry to develop its own spatial management controls] (iii) [implementing binding regional catch limits if the improved voluntary arrangements result in breaches to the TAC Committee's recommended regional limits], and (iv) [development of new performance measures].	1, 2, 3, 4, 5, 6, 7, 8	(i) ongoing; (ii) medium term; (iii) ongoing; (iv) medium term	Shareholders; NSW DPI

		CONTRIBUTE TO GOALS	TIMEFRAME	RESPONSIBILITY
	c) Develop and implement a framework for closing and re-opening areas to commercial abalone harvesting.	1, 2, 4, 6	Short term and then ongoing	Shareholders; NSW DPI
	d) Provide for the implementation of reseeding experiments in up to 1% of reef in water depths of less than 20 m in NSW waters.	1, 2, 4, 6	As required	Shareholders; NSW DPI
	e) Provide for the implementation of experiments on the effects of moving abalone within 2 km distances, in up to 1% of reef in water depths of less than 20 m in NSW waters.	1, 2, 4, 6	As required	Shareholders; NSW DPI
	f) Continue to investigate the potential and effects of restoring abalone populations through sea urchin harvesting in up to 1% of reef in water depths of less than 20 m in NSW waters.	1, 2, 4, 6	As required	Shareholders; NSW DPI
2.3. To address impacts from factors external to the commercial Abalone Fishery.	a) Develop strategies and practices to minimise the affects of *Perkinsus* and other marine pests and diseases with potential to affect abalone, and implement in consultation with ABMAC any measures required in accordance with marine pest or disease management plans.	1, 2, 4, 6, 8	Short term and ongoing	Shareholders; NSW DPI
	b) Continue to support initiatives to refine estimates of the total catch of abalone, including commercial, recreational, Aboriginal and illegal catches, for use in stock assessment models and reports to the TAC Committee.	1, 2, 4, 5, 6, 8	Ongoing	Shareholders; NSW DPI
	c) ABMAC will provide advice on proposed aquaculture developments in NSW that have the potential to affect wild populations of abalone.	1, 2, 4, 6, 8	As required	Shareholders

Goal 3: Facilitate effective management arrangements and provision of an efficient fisheries management service

OBJECTIVES	MANAGEMENT RESPONSES	CONTRIBUTE TO GOALS	TIMEFRAME	RESPONSIBILITY
3.1 To facilitate the delivery of effective and efficient management services.	a) On request by the Abalone Management Advisory Committee, undertake an independent review of the application of established cost recovery principles to the Abalone Share Management Fishery and implement the approved outcomes.	3, 4	As required	Shareholders; NSW DPI
	b) Continue to refine the delivery of specific management services and standards through service delivery agreements or outsourcing regarding research, administration and compliance.	1, 2, 3, 4, 6, 7, 8	Short term and then ongoing	NSW DPI; Shareholders
	c) On request by the Abalone Management Advisory Committee, undertake independent performance reviews of the services delivered by NSW DPI under service agreements or other service providers under contract.	3, 4	As required	NSW DPI; Shareholders
	d) Develop and implement a nominated diver's card system to facilitate the efficient use of nominated divers.	3, 4	Medium term	NSW DPI;
	e) Adopt technological improvements in the catch reporting system that are cost effective and result in the earlier receipt of catch and effort data.	3, 4	Ongoing	NSW DPI; Shareholders
	f) Communicate NSW DPI's operational plans and policies for the management of the fishery to all fishery participants.	3, 7, 8	Short term and then ongoing	NSW DPI

Goal 4: To promote the economic viability of the fishery

OBJECTIVES	MANAGEMENT RESPONSES	CONTRIBUTE TO GOALS	TIMEFRAME	RESPONSIBILITY
4.1 To promote the long term economic viability of commercial abalone fishing.	a) Seek to improve the economic performance of the fishery by: (i) preparing a productivity and business case analysis, and (ii) developing an economic monitoring plan for the fishery	4, 5	Medium term	(i) NSW DPI (ii) Shareholders
	b) Manage the number of divers by implementing appropriate minimum shareholding limits, allowing greater competition among divers and providing more flexibility for shareholders to adjust their individual shareholdings.	1, 2, 4, 5,	As required	NSW DPI; Shareholders
	c) Develop formal strategies to plan for and adapt to the effects of environmental and economic fluctuations on the fishery.	2, 4, 5	Medium term	Shareholders; NSW DPI
	d) Revise the minimum level for trading abalone shares, so that shareholders with 10 or more shares can trade any number of shares, including single shares, but their overall holding must remain at 10 or more shares.	4, 5	Short term	NSW DPI
	e) Remove the shareholding aggregation limit.	4, 5	Short term	NSW DPI

Goal 5: To appropriately share the resource and harvest abalone in a manner that minimises negative social and economic impacts

OBJECTIVES	MANAGEMENT RESPONSES	CONTRIBUTE TO GOALS	TIMEFRAME	RESPONSIBILITY
5.1 Mitigate negative impacts of the Abalone Fishery on Aboriginal cultural heritage.	a) Manage the Abalone Fishery in a manner consistent with the Indigenous Fisheries Strategy and Implementation Plan and participate in any review of that Strategy.	5, 8	Ongoing	Shareholders
5.2 To minimise any negative impacts of the Abalone Fishery on Aboriginal and European cultural items in the vicinity of abalone harvesting areas.	a) Ensure that abalone divers and shareholders are aware of and take into account any information about areas or items of cultural significance that may be affected by their activities.	1, 5, 8	Ongoing	Shareholders
	b) Respond, where relevant, to new information about areas or items of cultural significance in order to minimise the risk from abalone harvesting activities	1, 5, 8	As required	Shareholders

Goal 6: Facilitate appropriate research and monitoring of the Abalone Fishery

OBJECTIVES	MANAGEMENT RESPONSES	CONTRIBUTE TO GOALS	TIMEFRAME	RESPONSIBILITY
6.1 To collect information on the Abalone Fishery and the environment on which it operates in a timely manner.	a) Continue to implement an integrated monitoring and research program involving both fishery independent research and joint industry/government initiatives, and update as necessary.	1, 2, 3, 4, 6, 8	Ongoing	NSW DPI ; Shareholders
	b) Develop and implement a method of estimating the rate of disturbance of undersize abalone.	2, 4, 6	Medium term	NSW DPI; Shareholders
6.2 To keep informed of research and management initiatives in other jurisdictions.	a) Maintain good communication links with abalone researchers, managers, compliance officers and industry bodies nationally and internationally.	1, 6	Ongoing	NSW DPI

Goal 7: Achieve a high level of compliance within the Abalone Fishery

OBJECTIVES	MANAGEMENT RESPONSES	CONTRIBUTE TO GOALS	TIMEFRAME	RESPONSIBILITY
7.1 Promote a high level of compliance in the fishery.	a) Continue to implement and review, in consultation with ABMAC and key stakeholders, the compliance plans and update where appropriate.	1, 2, 4, 5, 7	Ongoing	NSW DPI; Shareholders
	b) Develop a cost-effective system for divers to report the planned location of their fishing activity.	2, 4, 5, 7	Short term	Shareholders; NSW DPI
	c) Continue compliance and enforcement measures applicable to operators in the commercial fishery.	1, 2, 4, 5, 7	Ongoing	NSW DPI
	d) Extend the fit and proper persons requirements applicable to abalone crew to abalone divers, shareholders and receivers.	1, 2, 4, 5, 7, 8	Short term	NSW DPI; Shareholders
	e) Require receivers of abalone harvested from the fishery to record the number of abalone handled (in addition to weight) on the prescribed record keeping form(s).	1, 2, 4, 5, 7, 8	Ongoing	NSW DPI
	f) Develop and implement a mechanism to apply temporary bans on receivers, wholesalers and retailers (including individuals and business entities) if they are caught in possession of abalone without the appropriate documentation.	1, 2, 4, 5, 7	Medium term	NSW DPI
	g) Participate in the development and implementation a of training and accreditation scheme for commercial fishers (i.e. divers and crew).	1, 2, 4, 5, 7, 8	Medium term	Shareholders

7.2 To continue to minimise the illegal catch of abalone.	a) Design and implement an industry communication program to assist in preventing illegal catch.	2, 5, 7	Medium term and then ongoing	Shareholders
	b) Examine the costs and benefits of increasing effective enforcement to reduce illegal catch and assist in maintaining the fishery biomass relative to other stock rebuilding measures.	2, 4, 7	Medium term and then ongoing	Shareholders NSW DPI
	c) Continue implementation of the National Docketing System for abalone product in consultation with ABMAC and abalone processors.	2, 3, 4, 7	Ongoing	NSW DPI

Goal 8: Ensure adequate stakeholder involvement and community consultation

OBJECTIVES	MANAGEMENT RESPONSES	CONTRIBUTE TO GOALS	TIMEFRAME	RESPONSIBILITY
8.1 To ensure the Abalone Management Advisory Committee communicates effectively with shareholders, other industry sectors and other stakeholders.	a) Continue the development of the Abalone Management Advisory Committee and industry networking process, including the appointment of an independent chairperson, to improve the effectiveness of consultation and communication within industry and with other stakeholders.	3, 4, 5, 8	Ongoing	Shareholders
	b) Promote consultation with the Aboriginal community in a culturally appropriate manner.	5, 8	Ongoing	Shareholders
	c) Encourage Aboriginal involvement in the commercial fishery.	5, 8	Ongoing	NSW DPI; Shareholders
	d) ABMAC will become involved with other harvest sectors through potential co-management arrangements in the future.	1, 2, 3, 4, 5, 7, 8	Ongoing	Shareholders; NSW DPI
8.2 To promote community awareness about the importance of habitat and other environmental factors that affect abalone.	a) Continue to provide advice to government, other stakeholders and the public about the risks and impacts of disease and the potential for human-induced activities to affect populations of abalone or their habitat.	1, 2, 8	Ongoing	Shareholders