
**This is the Second of Three Volumes of the Environmental Impact
Statement on the NSW Abalone Fishery**

VOLUME 2

**Consideration of Alternative Management Regimes
The Draft Fishery Management Strategy
Assessment of the Potential Impacts of Implementing the Draft FMS
Justification of Preferred Management Options in the Draft FMS**

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Shareholders of the NSW Commercial Abalone Fishery**

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CHAPTER C CONSIDERATION OF ALTERNATIVE MANAGEMENT REGIMES

A key requirement of environmental impact assessment in New South Wales is that alternatives be considered in relation to any proposed activity subject to an EIS. The commercial Abalone Fishery is an established activity and its proposed future operation and management are described in the draft Fisheries Management Strategy (FMS), detailed in Chapter D. Alternatives considered here include: not having a commercial fishery; not changing the existing operations and management; and a variety of high level alternative strategies that have been considered in developing the draft FMS.

C1.0 INTRODUCTION

Management responses in the draft FMS have been developed to reduce the risks associated with the current operation of the fishery (as described in Chapter B). During the development of these management responses numerous alternatives were considered. These ranged from consideration of alternative broad-scale approaches in policy to alternatives for specific management responses. For example, risk related to the harvest of abalone commercially could be controlled through alternative broad-scale approaches in policy, such as managing the level of total catch by quota system (i.e. output control) or by addressing the level of effort by regulating the number of divers, areas accessible to divers, etc (i.e. input control). Further, within each of these broad-scale approaches, a range of specific alternatives exist, such as the strategies by which the appropriate catch or effort may be determined. Rather than attempt to detail all combinations of alternatives considered, this section considers some of the more practical management responses considered to address the risks (Chapter B) in the current operation of the fishery, taking into consideration:

- the no fishery alternative;
- no change to existing management arrangements;
- alternative harvesting methods and strategies;
- alternative performance indicators and monitoring programs;
- alternative arrangements for cost recovery or funding sources for management responses.

The draft FMS describes management responses that would directly address the risks, while other management responses will contribute to the ongoing development of strategies to address risks over time. For example, the risks of impact from the commercial fishery to bycatch species, associated habitats and ecosystems are considered to be low to moderate, and two management responses are proposed in the draft FMS in an attempt to further reduce this risk. The first management response proposes to continue to develop and implement a program for increasing knowledge (i.e. including monitoring) of the effects of removing legal-sized abalone on the environment. The second management response relates to the use of any knowledge developed to inform and modify fishing practices to

reduce any potential affects of the fishery on the environment. Finally, some of the alternatives considered in the development of the FMS may not be warranted now, but may become more appropriate in the future.

C2.0 ABALONE FISHERIES OUTSIDE NEW SOUTH WALES

Species of abalone are harvested in many temperate countries around the world, many of which are managing risks similar to that likely in NSW (Jenkins 2004). Importantly, the blacklip abalone is harvested commercially and recreationally in Victoria, Tasmania, South Australia and Western Australia, along with up to two other species (McShane 1999). A useful starting point for considering alternative strategies of management in NSW is to consider how abalone fisheries are managed elsewhere in southern Australia.

Management of blacklip abalone fisheries within Australia are generally similar, although some differences do exist (Table C1). All states have approved management plans, most of which include objectives, management responses or strategies. All except Western Australia have specific management responses or strategies for achieving objectives; Western Australia is in the process of designing specific strategies for its fishery for black lip abalone.

Apart from South Australia, where the greenlip abalone is an important harvested species, NSW has the smallest annual allowable commercial quota for black lip abalone. All states except Tasmania have linked catch quotas to diving entitlements, although proposals to separate are being developed in Victoria, South Australia and Western Australia. Tasmania has created two entitlements in the fishery; one for quota and another for diving. Although there are over 100 diving entitlements in Tasmania there are much fewer actual divers operating as not all holders of diving entitlements have current access to quota. NSW and Tasmania quota holders can sell part of their quota to other quota holders or new entrants on a permanent basis, although in NSW there is a minimum share/quota holding required for retaining a diving entitlement (Section B1.3.2.2).

In all states, owners of an abalone fishing entitlement (or in Tasmania, an entitlement to dive for abalone) may nominate a person to dive on their behalf. There is provision to trade quota in all fisheries. In all states, traded quota is only valid for the duration of a fishing period. Tasmania, Victoria and South Australia have regional TACCs, while NSW and Western Australia have a state wide TACC. Currently, NSW has voluntary catch targets (with some flexibility attached) for different regions. Regional TACCs used in other states are in the order of hundreds of tonnes whereas the regional catch targets used in NSW in the 2004/5 fishing period ranged from 5 to 105 tonnes.

All states apart from NSW use variable size limits as a management tool. Victoria, South Australia and Tasmania have size limits for different areas. Areas to which size limits are applied range from very small areas (i.e. < 100 m) to over hundreds of kilometres and depend on how similar the growth of abalone is within a defined area. Victoria, South Australia and Western Australia have provisions in their management plans for harvesting stunted populations at smaller sizes at designated times and areas. Moreover, NSW has trialled harvesting on a width limit (as opposed to the standard length limit). A width limit was proposed so that effort could be distributed evenly between abalone with different morphological characteristics. Importantly, these variable size limits and provisions for harvesting stunted stock recognise the large variability that may occur in growth rates on quite small geographical scales.

Outside NSW, there are no seasonal closures for commercial harvest of abalone (Table C1). However, as TACCs in other state abalone fisheries are generally caught within a timeframe of months (and weeks in some instances) there can be times in the year when stocks are not harvested. This is in contrast to the NSW fishery where the catch is spread over the whole fishing period. In NSW, a voluntary closure has in the past been initiated based on social and economic considerations. The closure has extended through January in recent years, although it was not implemented in 2004 and 2005 due to a recommendation by Industry (Section B1.1.3.4). Finally, recreational and Indigenous bag limits apply in all states, with a maximum bag limit of 10 applying in Victoria, Western Australia and NSW. In NSW, there is also provision for Indigenous groups to request from DPI a permit to collect abalone for special cultural events, the size of the harvest being determined on a case by case basis. Estimates of the non-commercial catch of blacklip abalone are used, in NSW, when determining the TACC.

Table C1. Broad comparison of management arrangements for blacklip abalone fisheries in Australia as at February 2005. Arrangements for NSW are as under the current management, not as proposed under the draft FMS.

Key Management Strategy	Victoria	Tasmania	South Australia	Western Australia	New South Wales
1. Approved management plan	2002	2000	2004	1992	2000
2. Documented objectives/specific management responses or strategies	yes	yes	yes	under development	yes
3. Performance monitoring, triggers & review	yes	yes	yes	under development	yes
4. Output management (TACC)	yes: 1,359 t	yes: 2,380 t	yes: 202.1 t	yes: meat weight equivalent to ~330 t whole weight	yes: 206 t
5. Quota/diving entitlement	linked	separated	linked	linked	linked
6. Provision for nominated divers	yes	yes	yes	yes	yes
7. Tradable quota units/shares	yes	yes	yes	yes	yes
8. Regional management	yes	yes	yes	yes	no (voluntary targets)
9. Area-based size-limits	yes: 100, 110, 120 mm & provision to access stunted stock	yes: 114, 127, 132, 136, 140 mm	yes: 125, 130 mm; & 110 mm in fish-downs	no: 140 mm , with provision for fish-downs of stunted stocks	no: 115 mm
10. Seasonal closures	no	no	no	no	no, voluntary:
11. Recreational/Indigenous bag-limit	yes 10	yes 5	yes 5	yes 10	yes 10 + provision for special cultural events

The comparison of management of blacklip abalone in NSW to other states is important for two reasons. First, it shows that NSW has a system of management that is highly developed and comparable to other states. Second, it suggests some possible alternative methods of management, for example in terms of the relationship between quotas and diving entitlements and the use of area-based size limits. However, it is important to note that the NSW fishery is significantly smaller than many other states, and any management arrangements need to be tuned to the local circumstances. Both of these alternatives have been considered as part of the draft FMS with some elements proposed for implementation, or to be the subject of research for incorporation into future management strategies.

C3.0 BROAD-SCALE ALTERNATIVES

C3.1 The No Fishery Alternative

The 'no fishery' option is reviewed here in terms of reducing the level of risk from the commercial fishery to various aspects of the environment. If the commercial fishery were to be closed, there would be significant economic and social implications for shareholders, divers, fishing communities, the local and state economy, and the general public in terms of supply of seafood, seafood trade (domestic and foreign trade), employment and economic benefits.

C3.1.1 Economics and Employment

In 2004/5, commercial abalone divers produced approximately 206 t of abalone, of which virtually all was exported. Under the no fishery alternative the community would lose its direct contribution to the local economy which currently ranges from \$8M to \$12.5M per year. The processing industry currently has a turnover of \$16M due to processing abalone from NSW and other states; most of this revenue coming from exports. Under category 1 share management the closure of the fishery would require compensation to be paid to shareholders and would currently be between \$40M and \$90M, depending on the agreed share value. This would be a cost to government, and hence the community.

Under share management commercial operators are allocated a right of access to the fishery by way of shares. For this privileged access to a community resource, shareholders pay a 'community contribution' (see Chapter B1.3.2.17 for details).

In December 2003, there were a total of 117 direct jobs employed in the catching sector of industry (Section B3.4). The abalone processing sector in NSW has an estimated total of 106 direct employees attributable to the processing of abalone sourced from NSW.

The employment multiplier from expenditure is approximately 1.5. There are approximately 111 people indirectly dependent on the Abalone Fishery and processing sector in NSW who provide inputs such as boats and diving equipment and supplies to the processing sector. The total of jobs in NSW directly and indirectly related to abalone is estimated to be 334. A study by the National Institute of Economic and Industry Research of the Abalone industry in Victoria also indicates that the flow on impact to the national

economy is an additional 12.5% of the regional estimates for Victoria (NIEIR 2004).

Assuming the NSW case is similar, there would be an additional 42 jobs created from the NSW abalone industry giving a total of 376 jobs nationally.

The 'no fishery' option would create further unemployment in rural areas. Abalone divers, their families and communities would have a reduction in social capital. Those who depend directly or indirectly on abalone divers would face financial difficulties and would likely depend on social security funds and services to an increased extent. This would be an additional cost to government.

C3.1.2 Management and Research

Management costs of \$930,000 per year are currently paid to government for a range of administrative, research and compliance functions. Under the 'no fishery' alternative research into abalone would be severely curtailed and likely cease without funding from the commercial fishery. Researchers would find it more difficult to secure funds and political support for their research if abalone resources were not commercially exploited. The research funded through the Abalone Fishery also has significant, but less tangible, benefits, including enhancement of knowledge about reef ecosystems, potential indicators of change to the coastal environment (e.g. caused by pollution, global warming, etc), and education of scientists which can lead to transfer of skills to other areas of ecology and fisheries biology.

Management fees also support compliance and enforcement officers. Without this support for services there would be less protection across the whole fishery and a considerable expense for government to replace.

C3.1.3 Recreational, Indigenous and Illegal Harvest

In the absence of commercial harvesting of abalone, it is to be expected that there would be an increase in the abundance of abalone of sizes ≥ 115 mm (i.e. the maximum legal size, MLS) in areas where illegal activity was not occurring. There would probably also be an increase in the abundance of smaller abalone in these areas, but this increase would not be large because the MLS currently provides for a large proportion of abalone to reproduce before they are harvested legally. The fishery allows the use of breathing apparatus, so abalone can be collected commercially throughout their depth range.

In this context, under a 'no fishery' alternative, it is probable that more abalone would become available to recreational and Indigenous divers in some areas, which would clearly benefit those users of the resource. There would also potentially be a refuge created in deeper water, because non-commercial divers cannot use breathing apparatus to aid in the collection of abalone (this is discussed further in Section C4.1). An increased harvest by recreational divers would be of little benefit to the community. For example, it is unlikely that the recreational harvest of abalone would enhance the economies of coastal centres. Specifically, minimal diving equipment is required, no bait is used and the opportunity to collect more abalone would hold little benefit for local tourism. This is in contrast with, for example, sport or game fishing, which can attract tourists who are likely to spend far more in pursuit of their recreational activities.

An increased harvest by Indigenous divers would benefit local Indigenous communities culturally, but it is not clear if an increased harvest would significantly enhance the number or value of cultural events. As with recreational harvesting, there would be limited benefits to non-Indigenous coastal communities of NSW. It should be noted that the draft FMS (Chapter D) has specific objectives to enhance the relationship between the commercial fishery and Indigenous harvesting of abalone.

Without commercial harvesting of abalone, however, it is likely that illegal harvesting would continue and probably increase in some areas. In order to take advantage of the current export markets, which constitute the main market for abalone collected in NSW, illegally collected abalone would need to be exported illegally. This would be difficult given that the export market is essentially a live trade. Alternatively, abalone caught illegally in NSW could either be sold as preserved or dried product at a lesser value, or consigned live through other markets (i.e. their origin of capture concealed and product sent from interstate). Either approach would represent a significant loss to the NSW economy. On balance, the 'no fishery' alternative would probably lead to an increase in illegal harvest and support organised crime, with limited resources available for compliance and virtually no resources available for monitoring the stock of abalone in terms of abundance and size.

C3.2 No Change to Existing Management Arrangements

The existing share management plan has provided a firm basis for managing the Abalone Fishery in NSW. It has proven to be relatively adaptive, as shown by changes to the catch quota, implementation of closures in response to *Perkinsus* and initiation of research.

Moreover, it has helped to inform management in relation to other reef-based fisheries, specifically sea urchins. These actions have also helped to guide the management of the non-commercial sector, with changes to bag and size limits, and to methods of collection. Hence, the existing share management plan has had a large and positive influence both within and outside the Abalone Fishery.

The requirement by Government that all fisheries in NSW undergo environmental impact assessment has provided a significant opportunity for the Abalone Fishery to re-assess and revise management arrangements. The review of existing operations (Chapter B) has closely examined these operations and identified a range of improvements that could be made to management arrangements and these are proposed within the draft FMS (Chapter D). In particular, the review has identified potential risks to the sustainability of the industry due to a range of internal and external factors, as described in Chapter B. Hence, there is an opportunity to modify or replace existing management arrangements with new arrangements that will ensure that the operation of the fishery responds adequately to current and predicted concerns. The share management plan will respond to new arrangements appropriately.

Given the requirements for impact assessment of the Abalone Fishery (as with other fisheries in NSW), the development of external factors affecting the fishery and the identification of a range of improvements that could be made to the management of the fishery, the alternative of continuing with existing arrangements as described in the share management plan is not considered desirable or feasible.

C3.3 Structure of the Draft FMS

The detailed structure of the draft FMS is presented in Chapter D, but it is important to consider from a broad perspective if there are desirable alternatives to this structure. The overall intention of the draft FMS is to be able to:

- manage risks that have been identified in the current operation of the Abalone Fishery (Chapter B) and in the way it is proposed that the fishery would operate (Section D2.0); and
- provide a framework to manage unforeseen risks that may arise during the life of the FMS.

Clearly, some risks are more likely to occur and have greater consequences than others. Thus, the draft FMS must also be able to identify priorities to address identified risks and present a schedule of how, when and at what cost those priorities can be addressed.

The broad approach of preparing a draft FMS is a requirement of all fisheries in NSW subject to an EIS. Thus, there is no feasible alternative to the development of a fishery management strategy and the EIS process. The structure of the draft FMS for the Abalone Fishery broadly follows FMSs already prepared for other fisheries in NSW and specified in guidelines prepared by the Department of Infrastructure, Planning and Natural Resources (DIPNR – Appendix A2). It comprises three tiers: Goals, Objectives and Management Responses. These are supported by requirements for performance reporting and monitoring (including definitions of performance indicators and trigger points) and by a plan of ongoing research and development of a fishery code of practice. Previous and current research on abalone in NSW is of a high standard, demonstrating willingness by the fishery to acquire the best information possible. The structure of the draft FMS has two important components. First, it encapsulates methods of operation, possible risks associated with these methods and appropriate responses if risks eventuate. Second, it provides for a wide range of alternatives that can be initiated where appropriate, with both Industry input (i.e. ABMAC) and independent scientific input (the TAC Committee). Thus, the draft FMS represents a dynamic and flexible approach to the operation and management of the Abalone Fishery.

The draft FMS (and its associated code of practice) is built upon the existing operation of the fishery and Industry is confident that it is workable and addresses risks identified at this time. It is also flexible enough that it can respond to a range of threats that may arise in the short to medium term. Thus, if a more structured approach is required in future, either in certain areas or overall format, it can be adapted when the FMS is next revised.

The remainder of this chapter considers alternatives to the way the fishery currently operates or is proposed to operate. These are described in terms of harvesting methods, performance indicators and monitoring, and cost recovery, including sources of funding.

C4.0 POTENTIAL ALTERNATIVES TO THE OPERATION OF THE FISHERY

Several feasible alternatives to aspects of the operation of the fishery are described as part of this chapter, which are listed as follows:

- appropriate regional distribution of catch; and
- controls to the number of divers.

Decisions will be made in relation to each of these when the final determination for the fishery is made following public exhibition and consideration of any submissions.

Some of these issues have been incorporated into management plans in other states (Section C2.0). The following sections consider alternatives to the way in which abalone are harvested and the fishery is structured. It also presents alternatives to the above issues.

C4.1 Alternative Methods for Collecting and Delivering Abalone

As detailed in Chapter B, 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; and
- diver knowledge and experience that enable harvesting to be safe and efficient.

Superficially, some alternatives exist for each of the above elements. For example, it may be possible to collect some abalone from shore or without the use of breathing apparatus (i.e. by snorkel diving). In fact, much of the recreational and Indigenous collection is done from

the shore and all is done without the use of breathing apparatus (note: Illegal collection uses both snorkel and breathing apparatus). However, when applied to the commercial fishery these alternatives would vastly reduce the efficiency of the fishery and potentially lead to safety risks for divers. It may also be argued that there should be a depth limit to collection of abalone, hence providing a refuge in deeper water. However, most of the stock is in shallow water and it would be extremely difficult, if not impossible to enforce such a requirement, given that depth contours are highly variable and deeper areas are very frequently adjacent to shallow areas (an exception would be offshore reefs). A far better approach in relation to refugia is the closure of specific areas (e.g. Jervis Bay Marine Park) where there is more certainty regarding boundaries and their effectiveness can be more easily monitored, although consideration needs to be made of the potential for illegal activity to erode the benefits of such closure (Palmer 2004).

The use of an abalone iron to remove individuals is extremely efficient and its design causes minimal damage to abalone and the surrounding reef. A pointed knife, screwdriver, etc. is often used recreationally, but these are less efficient and risk damaging individual animals. Removal of abalone by hand alone is extremely difficult, particularly if abalone are disturbed beforehand and can apply maximal suction on the substratum. Thus, in terms of efficiency, causing minimal damage to abalone and the reef environment, there are currently no feasible alternatives to the methods of capture that are used now and proposed for the ongoing operation of the fishery.

Holding tanks on some boats are necessary to ensure that abalone are alive and in good condition when transferred to the processors. It has been assessed (Chapter B) that there is a slight risk of transfer of reef biota and pathogens between reefs as water in the tanks is recirculated (see also Jenkins 2004). It is proposed in the draft FMS that this risk be further assessed. At this stage, it is considered that no practical alternative to the current operation of holding tanks is available or warranted.

The use of relatively small boats is necessary to enable working close to the shore. Larger boats would be less efficient and potentially more at risk in shallow reef areas. The transfer of catch to processors occurs at easily accessible landing points which can be visited by compliance officers. At this stage, there are no feasible alternatives to this component of the fishery, although the draft FMS identifies some aspects that can be adjusted to improve safety, efficiency and knowledge regarding regions where divers operate (Chapter D).

C4.2 Key Alternative Management Approaches

The following sub-sections identify alternative management approaches that are to be specifically considered. These relate directly to Goals, Objectives and Management Responses identified within the draft FMS (Section D3.3).

C4.2.1 Sustainability of the Catch of Abalone

This issue is dealt with in Goal 2 of the draft FMS (Section D3.3). The key components of sustainability are the Total Allowable Commercial Catch (TACC) and minimum legal size (MLS), which are the primary management responses used to control the risk of over-depletion of the state-wide biomass of abalone. The combination of TACC and MLS is an advanced form of management that is used by only two fisheries in NSW (abalone and lobster). If reliable information about the stock is available, this form of management can provide substantial control of the risk from the fishery to the target species. This is possible as the TAC Committee estimate the biomass of abalone that escapes harvest and contribute to ongoing reproduction of the population. The number of abalone that contributes to ongoing reproduction is also protected by the MLS which prevents the legal harvest of individuals until they have grown to a size well above that at which they are likely to mature. Current management of the fishery sets the TACC annually to maintain biomass within the performance indicators of the current share management plan, while the MLS has been constant since 1987.

There is a range of combinations available when setting the TACC and MLS to enable an appropriate number of abalone to escape harvest and contribute to ongoing production of stock. These include limiting effort or catch alone, or considering different combinations of TACC and MLS in order to get similar levels of risk to the target species. For example, a smaller MLS or a maximum legal size (as used in the NSW Lobster Fishery) may be appropriate with a reduced TACC. The combination could ensure a similar number of abalone escape harvest and contribute to ongoing reproduction of the population. While the number of abalone escaping harvest under different combinations of TACC and MLS could be similar, the size-structure would be different. Modified size-limits may also be able to reduce the risk to the target species (through increasing the abundance of abalone at a size likely to maximise successful reproduction), and economic efficiency (through supplying abalone or a preferred size to the market). A reduced MLS may also lower the availability of abalone to illegal operators and contribute to a reduction in the illegal catch.

Essentially, the use of the TACC and MLS represent an advanced and well developed approach to managing abalone in NSW. Currently, other alternatives are less likely to deliver the same safeguarding to the stock. There is much potential for reducing risk to the stock by adjusting the TACC and MLS (including the potential to implement a maximum legal size) and the management arrangements built in to the existing and proposed fishery provide for these alternatives to be implemented if and when necessary.

Despite the significant benefits that the TACC provides for the Abalone Fishery, there are some limitations of setting a TACC on a state-wide basis as it is not matched to the population biology of abalone. The population biology of abalone (Section 2.3.1) would suggest that a state-wide TACC can provide adequate protection for the population only if catches are distributed appropriately; if they are not, there is a risk of serial depletion of local populations which might in turn lead to over-depletion of the broader population. To completely account for small-scale variation in demography of abalone, TACCs or any spatial catch limits would have to be set for very small areas (i.e. within individual reefs).

In recent times, effort has become less uniformly distributed throughout the area of operation of the fishery than it has in the past. In general, fishing effort has shifted to the more southern regions of the fishery. This has been due to the effects of *Perkinsus* in the north (Section B1.5.1 and B2.3.3.2) as well as other factors such as: the progressive retirement/relocation of some endorsement holders previously based around Region 1; and higher travel costs for divers set against fixed contracts offered by shareholders. Regardless, this led to a catch for Regions 5 and 6 in the 18 month fishing period from January 2002 to June 2003 that exceeded the recommended regional catch target. That is, the target and actual catches for Regions 5 and 6 combined was 206t and 228.4t, respectively. It is important to note that the catch for all regions in this fishing period was 450 t under the total statewide TACC, which may suggest that the potential additional catch from regions 5 and 6 could have been higher (i.e. 250.8t assuming a regional pro rata addition.) In the 2003/4 fishing period the regional catch recommendation was exceeded for Region 2. The reported catch (41 t) was 20 % greater than the recommended catch of 34 t. Catches for other regions were less than the recommended targets.

There are potential risks of exceeding recommended regional targets over a period of years (i.e. serial depletion of stock in some regions, inefficiencies for divers in terms of increased search times and an increase in the 'turn-over' rate of under-size abalone). Under the

current system of management, it would be expected that the regional targets would be adjusted accordingly by the TACC Committee to compensate for these effects, but no assurance could be given that this action would rectify any problems as the 'targets' are only voluntary. It is the potential for catches above the regional targets to occur in a specific region(s) over a series of years that is relevant from a risk assessment point of view (Section B2.3.4).

The draft FMS seeks to ensure that commercial catches are distributed appropriately at a range of spatial scales (Section D3.3) and to mitigate the potential risks outlined above. The main contrasting alternatives to the management response presented in Section D3.3 (MR 2.2b) are described below, along with discussion of the advantages and disadvantages of each proposal. It should be noted that there are potentially other variations to the options presented that might provide a more appropriate management response for mitigating the risk to the stock of undesirable concentrations of fishing effort. These could, for example, involve a staged-approach that blended the options presented. For example, the less regulated approach (I) could be trialled with the option of switching to a more regulated approach (II) if agreed criteria were not adhered to.

Option I. Continuation of the application of voluntary regional targets as specified by the TAC Committee, with improved communication to and within Industry to adhere to the targets basis.

This proposal from Industry is based on what currently occurs in the fishery with further enhancement. To be effective it requires adherence to recommended regional targets and a flow of information from DPI to Industry, and within Industry, about the distribution of catch among fishing areas. Adherence to regional targets would be reinforced through the proposed Abalone Fishery Code of Practice. The arrangement could have provision for closure and review if industry exceeded the recommended catches by an amount that is considered significant.

This arrangement provides some flexibility in the level of catch for each region recommended by the TAC Committee (i.e. the 10 % buffer). This has a number of advantages. Flexibility in regional catch would allow divers to catch their quota in other regions if environmental conditions (within a fishing period) reduced the availability of abalone for commercial harvest in a particular region (e.g. from inundation by sand as occurred in Region 3 in 2003 (TAC Committee 2004a). Flexibility in regional catches also

accounts for the inherent imprecision in the process of determining an appropriate catch at such a small-scale. For example, if divers had been forced to take the recommended target for Region 3 when inundation of sand occurred, this would have had potential to cause overfishing in the region. Although area-based quota is used to manage abalone fisheries in other states, the areas (and size of the stock within each area) are generally much larger than in NSW and hence, are less vulnerable to imprecision in the stock assessment process. This alternative also has the advantage of relatively low additional administrative costs and is consistent with a contemporary approach for Industry to take greater responsibility for the management of commercial fisheries through an appropriate governance arrangement, provided an effective means for this to occur is developed and implemented.

The arrangement has the disadvantage of having no guarantee that the whole of Industry adheres to regional catch targets and is dependent on adherence to the proposed Abalone Fishery Code of Practice. Harvesting in excess of regional targets, particularly over a period of years, would increase the risk of over-fishing in some regions. Under this proposal there is also potential for the TAC Committee to lower the state-wide TACC as a precautionary approach against regional targets not being adhered to. This proposal also has the potential to concentrate fishing effort at the beginning of a fishing period, as divers may rush to harvest abalone from the regions where catch rates are greatest before the target catch is reached. If a region's target catch is exceeded before the end of a fishing period some divers may have to travel further a field than desired and incur unwanted expenses. This situation may occur to divers who, for a variety of reasons, were unavailable to work early in a designated fishing period. Such situations could cause social conflict among Industry.

Option II. TACC regional targets are used to allocate individual quota on a pro-rata regional basis, with provision for shareholders to trade quota between regions.

This is the alternative approach to the voluntary arrangement described above and is based on the allocation of portions of the state-wide TACC to different areas (regions). It is proposed that allocations of quota would be applied to the following groups of regions: 1 and 2; 3 and 4; 5 and 6. A trigger point would separate any grouping if catch within a single region exceeds its target by 10 %.

This approach has the advantage of controlling the upper limit of exploitation at a regional scale, and, with prior reporting, has a greater likelihood of all Industry participants adhering to regional targets. This may allow the TAC Committee to be more certain about their

assessment. Allocation of individual quota at a regional scale would reduce the potential for social conflict among Industry. Divers would be able to harvest their quota for a particular region at any time during a designated fishing period without fear of a regional target being exceeded before a fishing period had ended. Regional quota could also be traded, potentially allowing some divers, who are reluctant to travel, to harvest mostly in their nominated regions. Tradeable regional quota may minimise the costs of travelling and allow divers and shareholders the opportunity for more efficient planning within a fishing period. Finally, this approach has potential to reduce the risk of over-fishing a region by reducing the potential for Industry to harvest above regional targets for a period of years.

This arrangement has the disadvantage of having additional costs that would be required to make it effective. Additional compliance resources would be required to monitor prior reporting by Industry and, potentially, a vessel monitoring system (VMS) may be required to ensure catches have been taken from where reported. Further, there are administrative costs associated with increased level of quota-trading that would occur under this proposal. Another disadvantage of this proposal is that there is less flexibility to respond to changes in stock occurring in a region within a fishing period (e.g. inundation by sand, illegal catch, storms, weaker than expected recruitment), although there is no guarantee that the voluntary approach would ensure an appropriate adjustment in catch. If such changes occurred in a region without an adjustment in catch, there would be an increased risk of over-fishing that region if Industry was still to take the portion of TACC allocated to it. Finally, there is potential for this arrangement to cause operational inefficiencies if shareholders were unsuccessful in trading regional quota according to the needs of their businesses or their divers. That is, divers may have to work in unfamiliar areas and incur extra costs associated with travelling. Some shareholders may be reluctant to trade quota from regions where catch rates are good.

Multiple regional TACCs (be they voluntary targets or mandatory limits) are limited in their ability to control risk to the target species as they are only able to address depletion at a regional scale. Determination of TACC at a regional scale could require increased monitoring and assessment resources to ensure the same level of certainty that is applied to state-wide TACC determination. That is, precision and generality of fishery-independent surveys are reduced at a regional scale.

C4.2.2 Fisheries Management Services

Management of a fishery requires administrative and other services. It is reasonable that shareholders contribute some of the cost of management according to how much they benefit from the arrangements. When users pay the cost of management there is potential for management to be more efficient than where government is subsidising management services (Arnason 2001).

Part of the share management concept is that increased ownership leads to greater involvement of shareholders in fishery management and development due to the incentives for shareholders to build up the resource. It would be expected that the share and TACC system means that shareholders know what can be harvested and can devise the most efficient way to take their share of the allowed catch. Also, shareholders should be able to inspect the services provided by management and to examine the benefits than could accrue to the fishery from management cost expenditure. Initially, shareholders may wish to minimise management costs, but if the benefits from management visibly flow on to the shareholder, more investment in management could be expected to add value. A number of alternatives exist as to how services could be delivered for the Abalone Fishery that would influence their effectiveness and efficiency.

In general terms, complete government control of services provided to a fishery might lead to increased costs of management compared to arrangements where there is contestable supply (assuming that the relevant services can be supplied effectively by other providers at a lower cost). On the other hand, no government control of some services, such as enforcement has the potential to have negative effects on other stakeholders in the fishery as interests may not be protected adequately. This is an important consideration in decisions about the delivery of services applicable to a public resource.

More alternatives in service delivery arrangements become available when management services are specified via service delivery agreements between shareholders and service providers, including the government. Through service delivery agreements shareholders can have greater input into how the fishery is managed, paying for the desired standard of any service required. Agreements would undergo independent auditing to facilitate their effective delivery. Alternative supply of management services can be achieved through outsourcing. For example, the Victorian Abalone Fishery outsources a large part of its stock assessment program. The development of service delivery agreements for administration,

research and compliance in the Abalone Fishery proposed under the draft FMS provides the opportunity for some services to be outsourced.

The draft FMS recognises the high level of service being provided currently by government in terms of management, research and compliance, whilst seeking flexibility in provision of services for the future. Clearly there are several alternative models that are available to provide services to Industry and the flexibility sought through the draft FMS seeks to adopt these models as appropriate.

C4.2.3 Alternatives for Promoting Economic Viability

The abalone industry is driven by the demand of Asian markets where most abalone collected from NSW is exported. The economic viability of the fishery is most sensitive to price and catch fluctuations. Price changes tend to be due to external factors not under the control of the fishery, such as changes in the Asian economies, exchange rates and the impact of competing product. Operational costs for businesses are labour and expenses, such as boats, fuel and business support at prevailing costs. Over the past decade, the costs of management fees, and the community contribution have become part of maintaining economically viable businesses.

Where the TACC or price is falling, it is likely that shareholdings will have reduced economic viability. Shareholders should expect price fluctuations and be able to absorb these if they are short term, moderate and if prices recover. Declines in beach price combined with declines in TACC occurring over a longer period, as has been the case for the Abalone Fishery since 2000, have eroded economic viability.

Such fluctuations present a number of alternatives for a shareholder seeking to maintain economic viability. The central concept of the share and TACC system is that market downturns cause producers to adjust their share holdings through trading of shares in the market, thereby letting the market make the necessary adjustments. Evidence in the Abalone Fishery is that shareholders are reluctant to sell shares when the share market is down and that markets are thin, with few buyers being evident. Alternative strategies for shareholders under the market system are based around ways of reducing the costs of harvesting. This may involve hiring a diver to increase efficiency, or alternatively, dispensing with a nominated diver and returning to diving. Other alternatives are for shareholders to rationalise and share the services of a diver to reduce production costs.

There are a number of alternatives for making the necessary adjustments for maintaining or promoting economic viability in a share managed fishery. One option is that management avoids intervening in a market system as this may lead to distortions in the market process. Other options involve regulating capacities of the fishery or changing the limits of its capacity. It is not clear how much policy should intervene in adjusting the capacity in the fishery and whether it is primarily the role of the market in a TACC system. Capacity could be regulated by applying minimum shareholdings to increase aggregation of shares through minimum shareholding provisions. For example, a fisher currently with 70 shares could be required to increase to 98 shares in the next ten years under such a regime. This would increase the aggregation of the shares in the fishery and may increase enterprise viability. Reductions in the cost of production would come from shareholders arranging to employ fewer divers (and associated crew and equipment) to take the TACC.

There are other alternatives available to address capacity in the fishery that allow the flexibility required under different circumstances to adjust the number of divers and individual shareholdings in the fishery within appropriate bounds. For example it is proposed in the draft FMS that the limit of aggregation of shares held by individuals be removed and to lower the limit on the minimum number of shares that can be traded from ten shares to one share. This would allow shareholders more flexibility for adjustment needed to increase the viability of businesses.

The risk of potential increases to the number of divers in the fishery has been highlighted as a key issue in the fishery (Section B5.1.3). Increases in the number of divers may not only erode economic viability but could potentially lead to other problems associated with compliance, occupational health and safety, and increased disturbance to abalone.

Prior to implementation of the share management plan, 37 persons were endorsed to take an equal portion of the total allowable catch (333 tonnes at that stage) in the Abalone Fishery (Section B1.3.1). This was a reduction from over 59 divers at the commencement of the restricted fishery in 1985 and prior to the introduction of the quota regime. Diver numbers were reduced in the restricted fishery through an industry funded buyback and a two out for one in transfer policy. All divers in the restricted fishery were allocated 100 equal shares in the share management fishery and quota allocated proportionally. In developing the share management plan, ABMAC strongly supported a reduced minimum shareholding from 100 to 70 to be eligible to an endorsement, based on the view that this would provide

employees with greater opportunity to invest in the fishery and therefore greater husbandry of the resource. This effectively increased the potential number of divers in the fishery.

Although there are currently 42 endorsements, there is potential for this to rise to 52.

Under the current arrangements, it would be expected that the number of divers would fluctuate with changing economic conditions of the fishery, so that the number of divers decreased when operating margins were reduced and potentially increased when conditions improved. Despite the fishery experiencing contrasting economic circumstances since the inception of the share management plan this has not occurred to the degree expected. The general trend has been an increase in the number of divers despite a down-turn in economic viability.

More divers increase the risk of illegal activity occurring as compliance resources allocated to the commercial sector need to be spread further. In addition, more divers would potentially increase disturbance to abalone. Although the TACC would be spread among divers, so there is not necessarily an increase in effort, there would, however, potentially be more inexperienced divers with potential to increase the rate of damage (Section B2.3.4).

Controlling the number of divers agrees with National Competition Policy. NCP is an Australia-wide initiative intended to remove, as far as possible, all impediments to competition and efficiency arising from restrictions contained in legislation. The guiding principles for NCP reviews of legislation are that it should not restrict competition unless it can be demonstrated that:

- the benefits of the restriction to the community as a whole outweigh the costs; and
- the objectives of the legislation can only be achieved by restricting competition.

Legislation relating to the management of common property resources such as fisheries falls into a special category, since those resources have special characteristics and management requirements if they are to remain sustainable. This means that not all restrictions contained in fisheries legislation should be removed, but NCP demands that those that remain must be necessary, their outcomes must be unable to be achieved in any less restrictive way and they must be in the public interest. It is understood that the Centre for International Economics (CIE) reviewed the *FM Act* according to NCP criteria and concluded that the overall benefits of restrictions on fishing exceed their costs and that fisheries management objectives can only be achieved by restricting competition to some degree.

As the number of endorsements currently stands at 42 (i.e. at a level that requires review under the share management plan) this creates an opportunity for potentially new management arrangements to be discussed and implemented through the draft FMS. The draft FMS seeks to ensure that the number of divers is kept at appropriate levels, subject to determining the means to do this (Section D3.3). This will not only reduce the potential risk to the economic viability of the fishery but also mitigate other potential risks to the stock. The main contrasting alternatives to the management response presented in Section D3.3 (MR 4.1b) are described below, along with discussion of the advantages and disadvantages of each proposal. There are potentially other variations to the options presented that might provide a more appropriate management response for mitigating the risks associated with potential increases to the number of divers. For example, under option II where an increase to the minimum shareholding is proposed, there may be benefits in exploring the potential of allowing two shareholders to merge shares to reach the minimum shareholding.

Option I. Issue a new diving entitlement to the shareholders who currently hold 70 or more shares, with the entitlement not transferable except upon sale of the associated shares or fully transferable separate to shares.

This proposal is supported by ABMAC.

In a rights system, the shareholding and the right to dive can be coupled together as in NSW, but can also be uncoupled as in Tasmania, establishing a distinct share market and also a market trading rights to dive. A separate market for diver services is created, independent of shareholdings, based around the right to dive. In Tasmania the system was developed to reflect changes that had already occurred in that fishery, where increasing numbers of divers were leasing their licences from former divers, processors or other financiers (DPIWE 2004). Under the Tasmanian system a diver needs to be authorised by the holder of an abalone quota unit to take the abalone which the abalone quota unit represented. In NSW, the uncoupling of the shareholding right and the right to dive, would need to be evaluated and the legal implications of establishing diver rights fully investigated.

The advantages of such a system are that there might be another valuable, tradeable item in the fishery apart from shares. Separating the diving entitlement from shareholdings would potentially provide some shelter against the responsibilities that shareholders currently have for the occupational health and safety of divers. There is potential under such a system that

there would be less nominated divers as a diving entitlement may be a more accessible purchase to current divers than shares. This could lead to potentially greater compliance in the commercial sector as divers owning a diving entitlement would have more responsibility for their actions. A diver owning an entitlement would have more to lose than he would as a nominated diver. Potentially, with less nominated (inexperienced) divers in the fishery there would also be potentially less damage to under-size abalone (Section B2.3.4). Finally, this system has the advantage of immediately capping the number of divers at 42. There would also be potential for an industry-funded buyback of diver entitlements at a lower cost than shares, although it would be necessary to determine how the costs of such a scheme would be distributed within industry (particularly between those with an entitlement and those without one).

A disadvantage of such a system is the potential for the values of shares to be reduced because there would be two tradeable items in the fishery. This would be balanced to some extent by a potential increase in the value of diving entitlements for those eligible to obtain one. Investors currently with holdings less than the minimum shareholding for a diving endorsement, however, would be financially disadvantaged as they would not be compensated for a potential loss in value to their shares. In particular, any existing shareholders who entered the fishery with a view to progressively building their shareholding to 70 shares in order to obtain an endorsement would be disadvantaged. This could cause conflict among participants in the fishery. These circumstances need thorough legal evaluation. Another disadvantage would be the cost of the legislative changes required to instigate the system and the ongoing administrative costs which are currently not provided for in the *FM Act*.

Option II. Progressively limit the number of endorsements to dive to 37 by a) immediately raising the minimum shareholding (to dive) for new entrants into the fishery to 98, and, b) setting a 10 - year timetable to raise the minimum shareholding requirement to 98 for all existing shareholders (with provision to trade less than 10 shares).

This alternative involves regulation to obtain a desired upper limit of 37 to the number of divers. The arrangement would have financial impacts to some shareholders but the proposed 10 – year timetable would mean the impact was not immediate and allow

shareholders to plan as to how to proceed. The impact on current shareholdings would be as follows (NB: based on the cost of shares ranging from \$10K to \$20K per share):

- 15 shareholders with greater than 98 shares - potential capital gain if they sell;
- 11 shareholders would need up to 18 shares to keep endorsement (\$180K to 360K each);
- 16 shareholders would need 28 shares to keep endorsement (\$270K to 540K each);
and
- 7 shareholders have less than 70 shares and do not qualify for an endorsement, with an associated potential capital gain if they sell.

An advantage of such an arrangement is that the final outcome would limit the number of divers to 37 or less, thereby reducing the potential risks that too many divers have to economic viability, compliance and undersize abalone. The process is consistent with the share management framework and *FM* Act and so does not involve major changes to legislation. Shareholders would have an extended period to plan and save to purchase additional shares to reach the minimum shareholding, with flexible provision to trade in small amounts of shares.

A disadvantage of the arrangement is that there is substantial cost to the majority of shareholders (although not immediate) in retaining an endorsement. In addition, an increase to the minimum shareholding may increase the price of shares as shareholders who need to increase their shares to reach the minimum shareholding will have to compete with one another for potentially only a small amount of shares available. In addition, the arrangement would have no immediate benefits in reducing the current number of divers.

Option III. Continue current arrangements where there is a review of management if the number of divers exceeds 42.

See Sections B 1.3.2.7, B3.8 and B2.3.4 for analysis of the risks associated with the current arrangements. Market forces control the number of divers under current arrangements. Although the fishery could potentially have 52 divers under the current minimum shareholding, the numbers have not exceeded 42 since the gazettal of the share management plan in 2000. Currently, the numbers of divers is at 42 and, as such, a proactive review of management is appropriate.

The advantage of continuing this arrangement is that there are no immediate administrative costs of change. In addition, despite contrasting economic conditions in the fishery since the gazettal of the share management plan in 2000 there have been no great fluctuations in the numbers of divers. This suggests there is some stability in numbers and that they may not continue to rise.

The risk in allowing the market to adjust the number of divers is that improved economic viability may enable more divers to remain in the fishery than is desirable to maintain productivity of the fishery.

C4.2.4 Alternatives for Controlling Illegal Fishing

The illegal catch of abalone is estimated to be about 40% of the TACC in 1997, which clearly has a significant impact on the resource, particularly given that many of the illegally taken abalone would be below the MLS and below reproductive size. Industry is limited in the way it can prevent illegal harvest from outside the Industry, but it has contributed significantly to the cost of compliance in an effort to reduce the illegal take.

There are alternatives for changing the way resources are allocated to compliance, and who is to provide and pay for the service. Alternatives would affect the compliance rate in the fishery and the size of the illegal catch. Allocating fewer resources to compliance would likely reduce the compliance rate in the fishery and increase the illegal catch from unlicensed operators. Allocating more resources to compliance would likely reduce the illegal catch if the additional resources were used appropriately, but this would entail additional cost to Government or the Industry. Clearly, there is a need to maintain a proper balance between compliance, its costs and the benefits that flow from it; although this relies on a measurement of compliance efficacy, which is very difficult to obtain. The draft FMS proposes to evaluate the cost-effectiveness of adjusting the resources allocated to compliance. Additional resources would be most effective if targeted at what is thought to be the greatest source of illegal catch (i.e. theft by unlicensed operators) and possibly also at buyers of illegally harvested abalone. Management responses are also proposed to reduce the potential for registered abalone processors and wholesalers buying illegally harvested abalone (Chapter D).

There is also a need to ensure that compliance within Industry is maintained and, wherever possible, improved. A management response is proposed whereby commercial divers

report the planned location of their daily fishing activities. An alternative to this voluntary approach could involve the use of vessel monitoring systems (VMS). The costs of using such an expensive and complicated system may outweigh the compliance benefits. The more cost-effective approach proposed in the draft FMS is to allow compliance access to the existing reporting system between divers and processors used to co-ordinate the transport of abalone from the dive area to the processing facility. Reporting would be made at a zone level to allow some flexibility to divers in the area that they intend to work for the day. Notwithstanding this approach, whilst VMSs are not considered to be an appropriate alternative to voluntary reporting of positions at this stage, reporting mechanisms within the draft FMS allow for this to be assessed as part of ongoing management.

Finally, the draft FMS proposes a fishery code of practice for operation within the commercial fishery. There is potential within this code for a series of demerits or penalties ultimately leading to forfeit of diving rights or shares. Alternatives could be specified in terms of the severity of responses to operating outside the code. The draft FMS has sufficient flexibility that changes to the code and its responses can be made during the life of the FMS. Thus, it is not considered that alternatives to this approach are warranted.

C4.2.5 Alternative Stakeholder Involvement and Community Consultation

Communication within Industry (i.e. between shareholders, divers and processors) is important to ensure that management arrangements for the fishery are adequate and carried out appropriately. It is also important that Industry communicates with other stakeholders in the fishery to avoid the potential for any negative impacts from the commercial fishery occurring.

The alternatives for making communication effective are for the different sectors of Industry and the various stakeholder groups to consult between each other on an individual basis or to communicate together through Abalone Management Advisory Committee. ABMAC is a statutory body and represents the most efficient and effective means by which communication and consultation would occur. Recreational and Indigenous divers for abalone, and conservationists (i.e. the Nature Conservation Council of NSW) have representation on ABMAC. Proposals in the draft FMS provide for the commercial divers and Indigenous groups on the south coast of NSW to have better representation. Based on the success of these initiatives further measures may be introduced during the life of the FMS, but at this stage no other alternatives are warranted.

C4.3 Alternative Performance Indicators and Monitoring Programs

Performance indicators enable managers to measure the effectiveness of management arrangements in the fishery. They track the status of the fishery relative to the goals and objectives and in some cases relative to reference points that define acceptable limits for the quantity being measured. At the broadest possible level, it is important that the draft FMS defines a set of performance indicators, hence it is not considered an alternative that there be no such indicators. Within each of the goals defined in Chapter D there are either specific performance indicators proposed or a process is identified whereby indicators can be developed in a timely manner.

In order to be effective, performance indicators need to have a trigger level, above or below which there is a requirement for a review of the relevant management. Trigger levels are often defined as a percentage change in a performance indicator and management responses may range from a review of data to changes in the way abalone are collected, quotas, etc. There is potential for an almost limitless number of performance indicators and trigger levels that could be considered in the operation of the Abalone Fishery. In the remainder of this section broad alternative indicators are identified for major aspects of the fishery.

C4.3.1 Performance Indicators for Collection and Delivery of Abalone

Chapter B identified a number of potential, albeit small, risks to the coastal environment associated with the collection and delivery of abalone. These included damage to the reef ecosystems and bycatch species. The performance of the fishery in relation to both these aspects can be determined by the use of rigorous experimental studies and delivery of the most unequivocal outcomes demands the best scientific approach. At this level there is no appropriate alternative.

There are, however, alternatives regarding the specific ecosystem indicators used and the timing and duration of studies. As a potential model, in the Victorian Abalone Fishery, divers monitor ecosystem indicators including cover of macroalgae, abundance of predators, cover of coralline algae, etc, and these would be considered for application in NSW. The draft FMS proposes a framework by which the best scientific approach is used and appropriate ecosystem indicators are selected. This continues the high standard of research previously sponsored by the Industry and lesser alternatives are considered inappropriate.

C4.3.2 Performance Indicators for Management

C4.3.2.1 Indicators for Sustainability of Stock

A detailed program of stock assessment has been the foundation of measuring performance in terms of abalone biomass (SMP 2000). The draft FMS proposes that this be continued, with some additional work to be initiated. The current program is based on detailed knowledge of specific sampling sites, many of which have been closely monitored for a considerable period of time. Alternatives that require for the methodology to be changed are considered highly unsuitable because they would lack continuity. At best, there would be a requirement for a transition stage to any different stock assessment approach, which would probably require preliminary investigations early in the life of the FMS. It should also be noted that the data obtained from the stock assessment program is used by the TAC Committee to set quotas. This committee is independent and would no doubt recommend if alternative measures of stock assessment were warranted (note that alternatives were considered by Sainsbury (2000) in a review of the NSW Abalone Fishery). One possible alternative would be to consider the potential of changing the frequency of the independent surveys used for stock assessment. They are currently done annually but there is potential for them to be done every two years. The independent surveys are an important tool in the TACC setting process and the risk to this process of decreasing the frequency of surveys needs to be considered under such an arrangement.

If the Abalone Fishery becomes managed more at a regional (or even zone) level (Section C4.2.1), it may be feasible to develop performance indicators of management that differ among regions to better reflect specific ecological conditions, trends in abalone populations, variable effects of illegal harvesting or *Perkinsus* outbreaks, etc. This approach makes sense in that it can allow fine-tuning of management responses to achieve the goals of the fishery. It may also be cost effective because resources allocated for measuring some aspects of performance may not need to be spread across the entire area of operation of the fishery. Such alternatives, however, must be developed consistently with the management proposed and will be best determined during the operation of the FMS. Therefore, it is considered more appropriate to have a management plan that is flexible enough to enable indicators to be developed on a regional basis than to prescribe specific approaches at this stage. Notwithstanding this, since 2001, ABMAC has initiated a program of catch reporting at the regional level, with the intention of extending this to the scale of sub-zones. Hence the

fishery already recognises the benefits of having some performance indicators applicable at a finer scale than across the entire fishery.

One potential shortcoming of this approach that needs to be guarded against is the risk that performance indicators will become so specialised at smaller scales that they lose their ability to be compared directly across regions. Hence, at the state level, Industry will need to ensure that key indicators are designed so that they can be evaluated across the whole fishery. In addition, if the data requirements don't fit the scale to which the performance indicator is to be applied there is a risk of indicators being triggered incorrectly.

Two management responses regarding managing regional catch are to be considered for inclusion in the FMS (Section C4.2.1), and the performance indicators would need to be tuned to suit the purpose (eg appropriate trigger points on catch levels).

C4.3.2.2 Indicators for Provision of Management Services, Including Research & Monitoring

Performance indicators for the provision of services would focus on value for money, the standard of the service and timeliness of supply and timeliness of responses to matters arising. Clearly, the quality of management services is essential to the successful management of the fishery. In the past, management services have been provided largely through government, with ancillary services (e.g. TAC Committee) supported through government. Apart from the IPART process, which focuses on economics, reviews have generally been on a needs basis. One example of this is peer review of the standard of science used for stock assessment for research publications (there is also an internal review process with DPI for manuscripts prepared for publication). Another example is the ICAC (Independent Commission Against Corruption) available through Government, but this form of review would be triggered only following concerns raised about the governance of the fishery. Finally, this EIS and the adaptive revision of the FMS represents, amongst many other things, an indicator of management services currently provided and proposed.

There is scope to continually improve the indicators of management services. The draft FMS proposes an independent review of management services, to be undertaken by a suitably qualified reviewer with a frequency to be determined. The alternatives to this approach would be to not have a formal review of management services, or to commission the review either by DPI or the Abalone Fishery (e.g. through ABMAC). The proposed approach is considered by far to be the most appropriate strategy because it can be seen to be

independent and to provide a co-ordinated view of the quality of the services provided to the fishery. Furthermore, as the fishery moves towards outsourcing certain management services, it will be even more important to ensure that these services are delivered at a high standard.

C4.3.3 Performance Indicators of the Economic Viability of the Fishery

The draft FMS proposes four key performance indicators of economic viability, which extend through the operation of the fishery. They include catch rates of abalone, beach prices, total commercial catch (as a raw value and expressed as a percentage of the TACC) and the cost of management (Section D4.2). Several alternative (or supplementary) economic indicators are also available that can be applied to individual businesses within the fishery, or to the fishery as a whole:

- **Share price and number of shares traded.** These have been used in the share management plan but have recently been shown to not represent the economic performance of the fishery adequately (Sections B1.4.1 and B3.5.2). Share price reflects the cost of having a stake in the fishery and of the capital tied up in the fishery (in addition to cost of boats and other operational costs). It is less responsive to current operational circumstances and can reflect a range of expectations and information. Although share values reflect capitalized prospective net returns, the time horizons for monitoring economic performance are much longer than for net returns from harvesting. Trades of shares are required as impartial measures of value in the market, but can be infrequent when prices fall.
- **Net returns to businesses.** To understand net returns to businesses it is essential to understand operating costs, revenue and profitability. It could be relatively expensive and difficult, however, to acquire reliable information about net returns. This alternative would require further development, costing and consultation before to fully assess its suitability. The approach taken in the draft FMS is to monitor information about the amount of revenue generated (i.e. as a consequence of beach price and catch). Beach price and catch can change from year to year and as such are likely to have a great bearing on the economic performance of the fishery and are indicative of net returns. It is important to note that there is no current formal and verifiable method of reporting.

- **Exchange rate.** The majority of the commercial catch is sold overseas, thus the exchange rate and the beach price can interact to affect the economic viability of the fishery. The beach price, however, takes into account exchange rates and hence is considered to be a more comprehensive indicator.
- **The size of the TACC.** The size of the TACC represents the amount of resource accessible to the commercial sector in any one year and hence is indicative of potential revenue. In some years, however, there is potential that the whole TACC may not be caught. As such, it is considered that the total commercial catch is a better indicator of revenue. Other potential indices, such as the total harvestable biomass, and the size of the illegal and recreational catch in relation to the TACC identify how much of the resource is available to the commercial sector. Currently, there is some uncertainty about the biomass and limited knowledge of the size of the illegal and recreational catch, hence these are not considered to be appropriate alternative indicators at this stage. Notwithstanding this, reliable statistics on the non-commercial catch should be included as they become available.

C4.3.4 Performance Indicators for Compliance within the Abalone Fishery

Performance indicators are proposed in the draft FMS to assess compliance within the fishery by commercial divers and operators. The Industry has very limited control over compliance outside the commercial sector (other than, for example, by reporting illegal divers that are seen by commercial divers; or processors who report non-commercial divers trying to sell illegally harvested abalone). Notwithstanding this, the commercial fishery contributes financially to compliance, hence as part of service delivery it expects that it be informed, using appropriate measures (e.g. number of compliance operations, successful prosecutions, etc) of the success of compliance outside the fishery. Such information is provided to ABMAC meetings on a routine basis. In addition, a supplementary indicator of the performance of compliance could be based on the cost of compliance compared to the financial benefits to Industry of maintaining a contribution to compliance. Although the information required for such an indicator (i.e. the reduction in illegal activity due to compliance) is difficult to estimate, the potential is to be explored in the life of the FMS. On this basis, it is not considered that other alternatives are appropriate for the draft FMS.

C4.3.5 Performance Indicators of Stakeholder Involvement and Community Consultation

The draft FMS proposes stakeholder involvement and community consultation through a fishery code of practice, ABMAC meetings (which have community representation) and port meetings to be held with divers and DPI officers. The Abalone EIS and draft FMS are available for public inspection and comment during the statutory period of exhibition. Information from research and monitoring is also made available through scientific publications and Industry members have made themselves available for media presentations. Whilst there are other avenues available for dissemination of information, these can be costly and the measures proposed within the draft FMS, along with those identified above are considered to be the most suitable approach.

C4.4 Alternative Arrangements for Cost Recovery or Funding Sources

C4.4.1 Alternative Arrangements for Cost Recovery

Cost recovery is currently administered through DPI which is empowered by the *Fisheries Management Act* to obtain levies and fees from commercial operators for management costs. Costs of management are derived from allocation and apportionment of indirect overhead costs between fisheries. Direct costs for services are stated as part of each managed fishery's budget process. In 1998, the Independent Pricing and Regulatory Tribunal (IPART) was asked to investigate the cost to DPI of managing the commercial fisheries in NSW, including how management charges should be shared between the commercial sector and the community (i.e. due to the recreational catch). The draft FMS proposes an independent review of the current application of the arrangements for cost recovery.

With development of cost recovery, one alternative is for those shareholders in the levy base to examine the option of collecting levies among shareholders through a group entity. The entity can then negotiate with government and other service providers for services that are contestable, in the hope of reducing cost or increasing services from the available budget. Such an initiative requires legal support for the agreed management entity to impose levies on Industry members and would be evaluated.

Another alternative for cost-recovery, as occurs in the Tasmanian Abalone Fishery, would be to link the fees paid by shareholders for the management of the fishery to the average beach price. This would reduce the potential risk to shareholders of an economic burden of fees at times when revenue was reduced (i.e. beach price and/or TACC is low) and extra money

would be available to provide extra resources to the fishery at times when revenue was increased. For example, extra compliance officers may be beneficial at times when the value of abalone is great as there may be an increase in illegal activity. Further, illegal activity may decline at times when the value of abalone is reduced and, therefore, resources allocated to compliance could be reduced. Although this form of cost recovery may be appropriate for large abalone fisheries because they generate considerable revenue, (e.g. the Tasmanian Abalone Fishery) it may not be suitable for a smaller fishery such as operates in NSW. For example, there is a risk that at times when beach price is down the revenue generated for management of the Abalone Fishery may be inadequate funding for some of the basic administrative, research and compliance services. This risk could be reduced, however, with the use of a sinking fund that provided for storage of money at times when revenue was high for use in years when revenue was down. Such alternatives will be evaluated during the life of the FMS.

C4.4.2 Sources for Research Programs

There are a number of sources of funding for implementing proposed research programs

- **DPI.** DPI fully-fund or contribute to many research programs associated with commercial fisheries. Under the policy of full cost recovery for category 1 share managed fisheries, however, the Abalone Fishery would receive limited financial support from DPI for future programs.
- **Fisheries Research and Development Corporation (FRDC).** The FRDC is a national body that funds fisheries research and development. The FRDC obtains money by levying commercial fishers all over Australia which is in turn matched by government funding. The money is used to fund research and development needs in commercial fisheries, including the Abalone Fishery. Funding from FRDC is very competitive.
- **Universities.** Universities have some potential for contributing to research needs in commercial fisheries. They also, however, depend on government funding bodies to support their research and must apply for funding on a competitive basis.
- **Industry.** The abalone industry continues to offer financial support for research and monitoring in the fishery. As a large proportion of the research budget is allocated to stock assessment it is difficult for Industry to finance other research programs.

It is not possible to rely completely on any one of the above sources to fund research and development programs for the fishery. As such, the approach taken in the draft FMS, as has been the approach used in the past, is to continue to explore ways of obtaining funding from a number of sources.

C5.0 CONCLUSIONS

This chapter has discussed a range of alternatives to the way in which the Abalone Fishery would operate under the draft FMS. It also discusses some of the consequences of not having a commercial fishery for abalone, of continuing the existing management arrangements and of having an instrument of management other than an FMS. It is essential to recognise that the FMS needs to be sufficiently flexible to accommodate changes within and outside the fishery as they emerge. This flexibility extends to a range of alternative management approaches which could be evaluated during the implementation of the FMS and incorporated as required. The current structure of review, including ABMAC and the TAC Committee, along with a proposal for independent reviews of management, should ensure that only the most suitable management responses are triggered as required.

CHAPTER D THE DRAFT FISHERY MANAGEMENT STRATEGY FOR THE ABALONE FISHERY

This chapter presents the draft Fisheries Management Strategy (FMS), which describes how the commercial Abalone Fishery would operate in New South Wales. Chapters B and C describe the current operation of the fishery and present broad alternatives for the fishery, ranging from having no commercial fishery to various components of how the fishery could operate. Whilst Chapter D is presented within the framework of the EIS, it is also a requirement that the draft FMS be available as a stand-alone document, hence it contains some background information, with extensive cross-referencing to other parts of the EIS.

D1.0 INTRODUCTION

D1.1 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 3rd most valuable in NSW. Both 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 Indigenous 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 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 abalone (SMP 2000) established under the Act. Annual quotas are set by the Total Allowable Catch Setting and Review Committee (TAC Committee) established under the 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 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 Indigenous fisheries does not form part of the 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, Indigenous 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 requires 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 is based on an analysis of a draft fishery management strategy (FMS), which describes the rules, regulations and programs that are in place or proposed to manage the fishery into the future.

According to guidelines issued by The Department of Infrastructure, Planning and Natural Resources (DIPNR) an FMS is a document: "... outlining the management goals, objectives, controls and other measures for achieving the objectives, performance indicators and monitoring programmes applying to a particular commercial designated fishing activity. The strategy must contain the 'management tools' applying to the commercial fishery, as well as data collection protocols and triggers for the review of the strategy" (DIPNR 2003).

The guidelines also note that the strategy should be an informative document detailing the future vision for the management of the particular designated fishing activity – including:

- short, mid and long term vision for the fishery;
- regulatory controls, management arrangements and other measures for achieving the vision including setting target effort or fishing capacity of each fishery and any restructuring programme;
- the framework for providing fisheries and other stakeholders with greater certainty about the rules and administrative arrangements applying to the fishery;
- an information resource for the endorsement holders as well as the broader community on a particular fishery (DIPNR 2003).

This 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 for the Abalone Fishery have been adapted in this management strategy 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 B). 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 the goals and objectives to be achieved through management of the fishery. 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 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 (Section D2.3), 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
- Indigenous 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.

D1.2 Relevant Legislation and Policy

D1.2.1 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.*

D1.2.2 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 programs¹:

- 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.

D1.2.3 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

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

fish, and the use of boats and 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 Abalone Share Management Plan containing the *Fisheries Management (Share Management Plan) Regulation 2000* commenced in 2000. The share management plan for the Abalone Fishery 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 management strategy. The share management plan will be revised following the development of the FMS for the Abalone Fishery and its environmental assessment.

D1.2.4 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 DIPNR has issued guidelines for the various fisheries, including guidelines for the Abalone Fishery, that outline 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 assesses 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.

D1.2.5 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. To give time in which those assessments may be made, the exemption will continue until 1 December 2005. Until then, current arrangements regarding the export of marine species will remain in effect, that is, the export of most marine fish and the bulk of marine invertebrates will continue to be exempt from export controls under the Act.

If a fishery is not assessed as exempt, it will more than likely be able to continue to supply product for export through an approved wildlife trade operation (Section 303FN) under the *EPBC Act*. These declarations will have conditions attached that will bring the management and operations of the fishery in line with the Commonwealth guidelines. Once declarations are made, exporters will need to apply for and obtain from Environment Australia a permit to export.

D1.2.6 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 the marine park. 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 the consultation over the selection of marine protected areas, as declaration of such areas can be beneficial to all sectors of the community, including the commercial fishing sector. However, such declarations can also 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).

D1.2.7 Indigenous Fisheries Strategy and Implementation Plan

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, which is detailed in the Appendices of the EIS, seeks to protect and enhance the traditional cultural fishing activities of Aboriginal communities, and ensure Aboriginal involvement in the stewardship of fisheries resources. There are some issues that

will be addressed immediately by the IFS and others that can be resolved only after lengthy negotiation involving Aboriginal communities, the broader community, fishing groups and government agencies. The IFS establishes a process which will ensure discussion and negotiation can continue with progressive resolution of problems and challenges (see NSW Indigenous Fisheries Strategy and Implementation Plan 2002).

To better understand the linkages between fishing activities and Indigenous issues, a substantial research study has been proposed through the IFS which seeks, among other things, to identify the species, areas and harvesting techniques of cultural importance to Aboriginal people in NSW.

D1.2.8 Consideration of Alternative Governance Arrangements

The NSW Government's *Vision for the NSW Seafood Industry* (December 2003) includes commitments 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 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 be responsive to the final outcomes of this initiative.

D2.0 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. A more detailed description, including reference to scientific studies, is provided in Chapter B of the EIS for the Abalone Fishery.

D2.1 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 Chapter B, 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 D1 summarises the known status and level of certainty for the following stock assessment and biological parameters for black lip 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 Catch (TACC) for the whole fishery and has advocated management of the stock at smaller spatial scales (TAC Committee 2004).

(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 (Chapters B and E).

Table D1: 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 $M \sim 0.3$ 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 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) before they are subject to legal harvesting.

D2.2 Operation of the Fishery

D2.2.1 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 D1), which is described in detail in Section B1 in the EIS. The scale of subzones in the fishery to which the commercial catch is reported to is shown in Appendix B2.

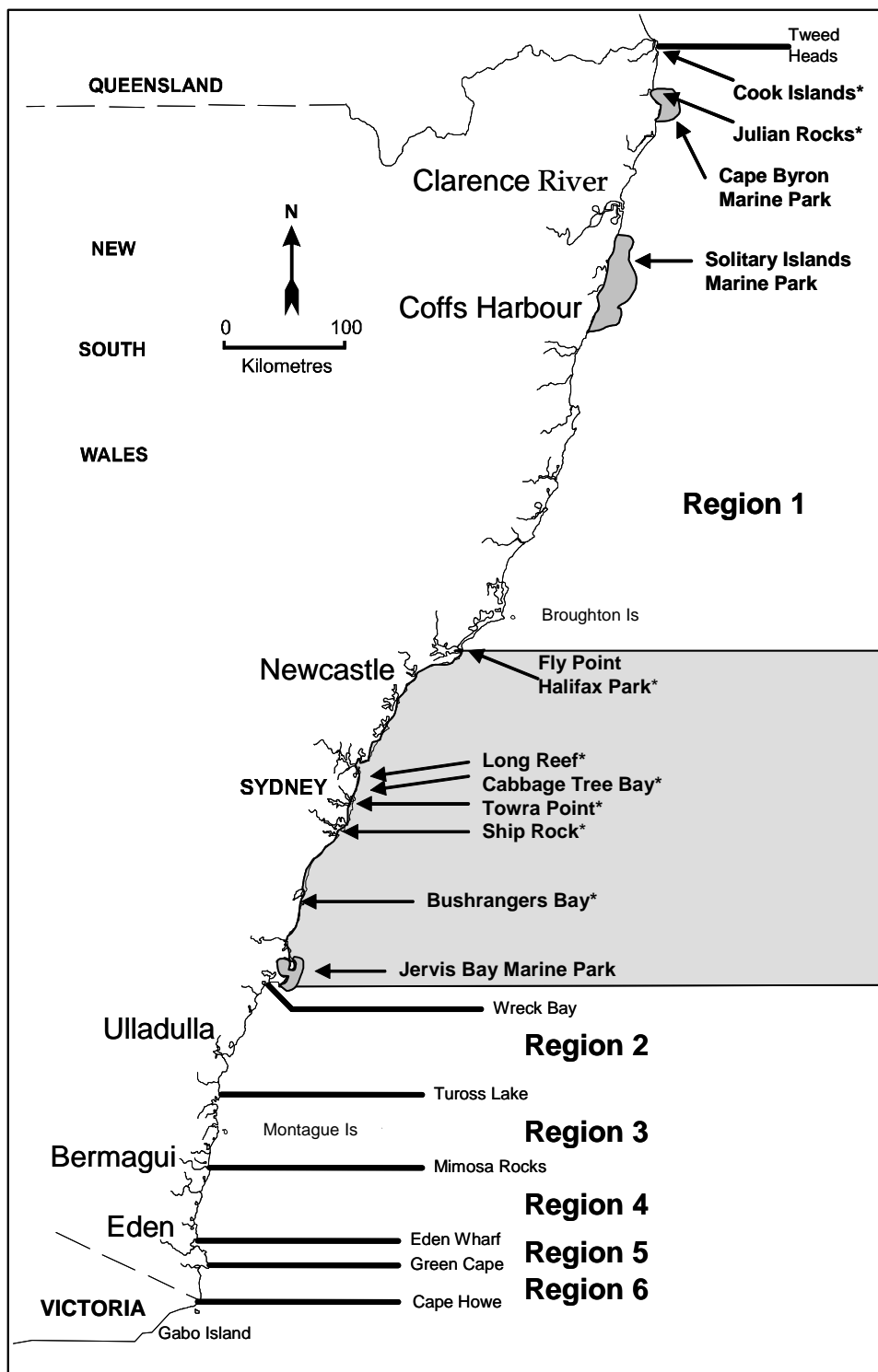


Figure D1. NSW coast, showing abalone assessment regions 1-6, marine parks (dark grey) and aquatic reserves (*) where abalone harvesting is not permitted and the current general closure to the taking of abalone (light grey). NB. Some commercial fishers are allowed to take abalone in the Region 1 closure under a Section 37 Research Permit (Refer to Appendix B1 of the EIS for an updated list of closures).

D2.2.2 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.*

As part of this management strategy some additions and amendments to regulations in the share management plan have been developed (Section D3). These will be implemented upon revision of the share management plan. Further details can be seen in the Part 4 of the *Fisheries Management (Abalone Share Management Plan) Regulation 2000* (Appendix B3 of the EIS).

D2.2.3 Enforcement and Compliance

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. DPI Field Services strategies include:

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

The Strategic Plan for Abalone Compliance 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

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, processors will be required to record the number of abalone handled (in addition to weight) and will be issued with temporary bans if caught in possession of abalone without the appropriate documentation. Some of these 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 management strategy in order to better understand whether objectives are being achieved.

D2.2.4 Fees, Charges, Cost Recovery and Community Contribution Payments

Under the NSW Government's policy on cost recovery, abalone shareholders are required to pay their attributed 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 DPI as requested by the ABMAC.

The subsidy provided by the DPI with respect to the benefits of managing the abalone fishery to recreational fishing has been increased from 4% to 14%, in light of recent changes in the estimated proportions of commercial and recreational catch. The FMS contains a number of new services that will have budgetary implications.

The community contribution charge calculation method was changed in 2005. It is calculated as a percentage of gross revenue per share however the percentage will vary on a sliding scale in accordance with a CPI adjusted average annual beach price (AABP).

For example:

- 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 Total Allowable Catch (TAC) on industry profitability, threshold points relating to the sliding scale will be adjusted as follows:

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

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

- If TAC 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 TAC change, rounded to the nearest whole dollar;
- If the TAC increases, the threshold levels will be reduced by the same amount as thresholds are increased when the TAC decreases, with some exceptions as follows;
- If a TAC 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 TAC 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 preparation fees for the FMS and EIS for the Abalone Fishery, quota transfer, share transfer/mortgage fees, Voluntary

Association (now the Abalone Development Company, ADC) fees and application fees for crew registration.

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

D2.2.5 Fishing Closures

The *Fisheries Management Act 1994* 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 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, Bushrangers Bay, and some areas of Jervis Bay Marine Park).

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 DPI website (www.fisheries.nsw.gov.au).

D2.2.6 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 code of practice (abalone fishing) (Appendix B4 of the EIS) would implement a bycatch removal 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 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”.

D2.2.7 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 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.

D2.2.7.1 Management Advisory Committee

Management Advisory Committees (MACs) have been established for each commercial fishery in NSW under Section 230 of the *FM Act 1994*. 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 and non-Industry members appointed by the Minister to represent other interest groups such as Indigenous, recreational fishers, conservation groups and 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.

D2.2.7.2 Ministerial Advisory Councils

Two ministerial advisory councils are currently established under the *Fisheries Management Act 1994*. 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 Conservation (ACoRF).

The Commercial Abalone Fishery and other share management and restricted fisheries have industry members on the SIAC.

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.

D2.2.7.3 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 1994*.

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 1994* 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.

D2.3 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 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, identified in the EIS (Section B: *Review of Existing Operations*). These are described below and have been considered as part of the 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.

The internal factors outlined above are largely under the control of either the industry or the FMA. External risks (Section B of the EIS) 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 Indigenous groups;
- other human-induced impacts on the stock (e.g. aquaculture and sewage disposal); and
- diseases affecting abalone.

D3.0 GOALS, OBJECTIVES AND MANAGEMENT RESPONSES

D3.1 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.

Each management action should:

- Describe the current situation for the issue to be addressed by the management response;
- Outline the management response itself;
- Identify the time frame for implementing the management response; and
- Outline the desired outcome(s) from the management response, in terms of the way perceived risks to the Abalone Fishery identified in the EIS (Section B) and outlined in the previous section, are addressed.

In addition, the principles of Ecologically Sustainable Development (Section D1.2.2) have been incorporated into the management responses/actions for sustainable management of the Abalone Fishery.

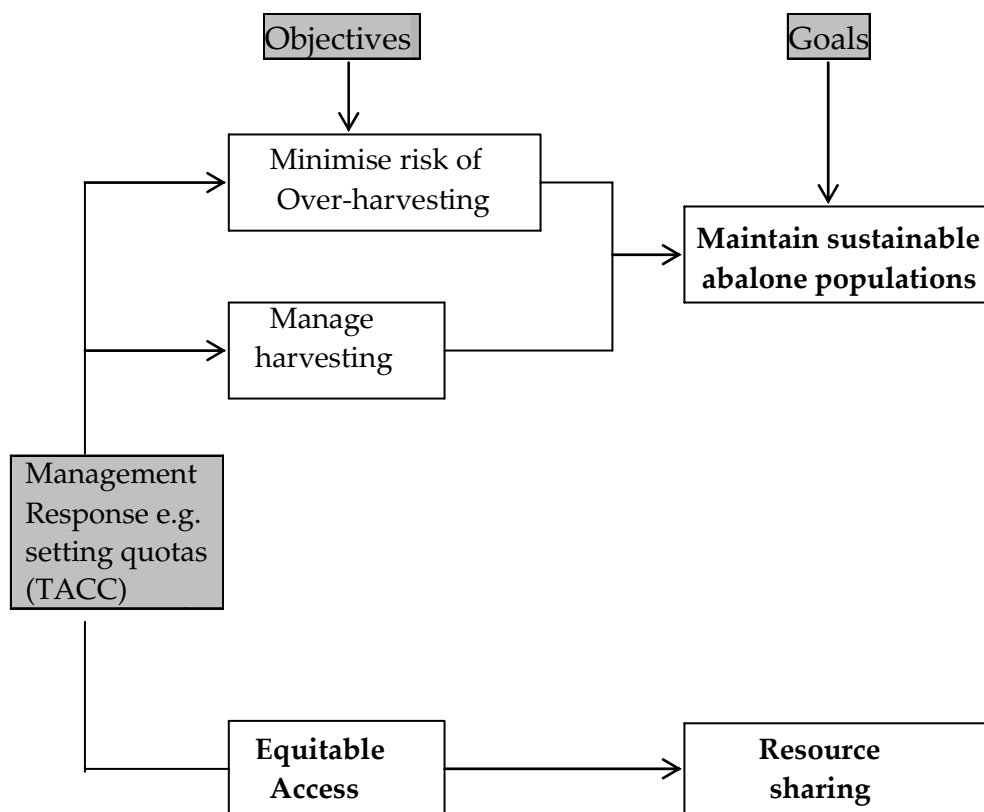
Figure D2 presents a simple management framework that can be used to relate the overall requirements under the *Fisheries Management Act 1994* through to specific actions that could be used to ensure the requirements are achieved.

Figure D2. Goals, Objectives and Responses in the Fisheries Management Strategy.



In practice, many of the management responses can achieve multiple objectives and even several goals. Figure D3 shows one example of how a single management response can affect several goals and objectives.

Figure D3. 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 Chapter B of the EIS. The overall management regime for the Abalone Fishery includes the management responses, the principles and guidelines contained within the share management plan, as well as the general requirements of the *FM Act* and associated Regulations (Appendix B3 of the EIS). This outlines the time periods within which each management response is

scheduled to be implemented, and which component of Industry or management has 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.

D3.2 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.

D3.3 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.

- (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 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.

- (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 species caught incidentally to abalone (e.g. sponges, gastropods) to the reef and recording sightings and interactions with threatened and protected species or introduced pests.

As indicated above, the code of practice (abalone fishing) also addresses other issues in the fishery as outlined below, and supports the implementation of other management responses in the FMS (particularly responses 2.2c, 2.3a & e, 5.1a & b, 5.2a & b, 7.1b and 8.1b & d):

- harvesting abalone in a manner that would cause minimal impact to the stock and the marine environment;
- returning any fauna caught incidentally to abalone (e.g. chitons) 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, and how their operations can be modified so as to minimise any impacts of items or relics of Aboriginal or European cultural heritage;
- reporting evidence of illegal harvesting to the appropriate authorities; and
- any other behaviours and practices relevant to the fishery.

(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 Fisheries Management Act 1994, 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 management strategy.

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

Objective 2.1 To maintain the spawning and exploitable biomass of abalone at or above the level observed in 1994

- (a) Continue to implement a state-wide TACC for abalone, determined by the TAC Committee, and develop a more complete harvest strategy for the fishery.

Background

The state-wide Total Allowable Commercial Catch (TACC) of abalone is set each year by the TAC Committee. 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. The TAC Committee is formed under the FM Act and must take account of the objectives of the Act when determining the TACC (see Section 2.2.7.4). Over recent years the state-wide TACC has been reduced to, among other things, compensate for the decline in the populations and reduced catches in Region 1 related to Perkinsus. The TAC Committee has also recommended an appropriate distribution of catch among regions to avoid concentration of fishing effort in the far south of the coast.

A state-wide TACC can provide adequate protection for abalone populations only if catches are distributed appropriately. A management response that aims to distribute commercial catches appropriately will be included in the FMS after a formal assessment of the alternative management options (see management response 2.2b and Section C of the EIS).

The objective of this management response is to maintain the state-wide biomass of mature and exploitable abalone at or above the level observed in 1994. A trigger point has been included within the FMS to detect when the mature biomass and exploitable biomass of abalone is reduced, or is likely to be reduced within the next five years, to below 85% of the biomass observed in 1994. This follows the arrangements in the share management plan. A review of the stock assessment research for abalone in 2000 determined the 1994 level to be a convenient relative reference point for the fishery, but also considered that its appropriateness should be re-examined periodically (Sainsbury 2000). Appropriateness of alternative reference points for the biomass of the stock could be scheduled within the Research Strategic Plan (see management response 6.1a).

The biomass reference points provide guidance to the TAC Committee for making changes in the TACC in response to changes in the abundance of abalone, although other factors need to be taken into account. For example, if the biomass of the state-wide population declines, the question of the desired rate of recovery arises; a matter that may influence the level of the TACC determined for the next fishing period(s). A relevant consideration for the TAC Committee in such a case would be the economic climate in the fishery at the time. A more complete harvest strategy that addresses issues such as the desired rate of change in the TAC under different circumstances would be advantageous as it would provide guidance as to how the TACC is applied under different circumstances. Such guidance would make the TACC setting process more transparent to Industry and allow shareholders to plan operations more effectively over the medium- and long-term.

This management response attempts to achieve the objective of maintaining the state-wide population at or above the level observed in 1994. However, because of spatial variation in changes in biomass, it may be appropriate to assess performance of stock sustainability at a smaller spatial scale. For example, the TAC Committee has suggested combining regional assessments of abalone populations in an attempt to achieve the state-wide objective. Additional objectives and management responses described below also acknowledge, and attempt to address, the substantial depletion of some areas within the state (see Objective 2.2). For example, some populations affected by Perkinsus within

Region 1 were already depleted in 1994. Further, illegal catches often contribute to overfishing of localised areas. Rebuilding of such depleted populations is a priority for the fishery.

- (b) 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.

- (c) 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 docketts. Daily docketts 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 2.1e). Other information is also collected from the fishery when appropriate. For example, information about the size of abalone being caught is collected when needed.

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

Background

Commercial abalone divers began funding the development of fishery-independent surveys in 1994. These surveys involve sampling the abundance and size-structure of abalone populations in areas throughout most of NSW and have now been completed for 10 consecutive years. This information forms the basis of estimates of change in the mature and exploitable biomass of abalone, and is fundamental to the annual assessment of the population (see management response 2.1e) and determination by the TAC Committee. It may be appropriate to reduce the frequency or intensity of these surveys in the future. The frequency and intensity of the surveys will be responsive to concerns about the population and particularly advice from the TAC Committee. Future development of the surveys will be considered in the harvest strategy to be developed for the fishery.

- (e) Continue an annual stock assessment 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, and abundance and size-structure from independent surveys. 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.

Objective 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.

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 (see management response 2.1b). This is based on the average size at maturity of abalone in NSW which is about 90-100mm. 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. To prevent complications related to compliance to the state-wide MLS, such changes to the MLS could be enforced for short time periods (i.e. fishdowns in stunted or flood-prone areas) and/or within specific areas (e.g. south of Wonboyn). Any proposal to modify the MLS will need to carefully consider both biological, compliance and cross-sector issues prior to implementation. For example, while sustainable yield of fast growing populations may be increased by increasing the MLS 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 consider the current state of the stock, the likely influence of changes in the MLS on commercial catch rate and any associated changes to administration and compliance. 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. Alternative MLSs, such as those described above, have been successfully implemented and provide benefits to sustainable yields in all other abalone fisheries in southern Australia.

- (b) [Note: A management response to manage the spatial distribution of fishing effort is to be inserted into the final FMS in accordance with the determination in response to the associated EIS for this designated fishing activity. An analysis of the relevant risks associated with the current operation of the fishery and a range of alternative management responses to address those risks is presented in Chapter B and C of this EIS, respectively.]

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. The use of smaller-scale management may be appropriate given uncertainties about stock and sub-stock structure.

There has been a significant shift in fishing effort to the far south of the State in recent years. This may be caused by a variety of factors, including the closure of Region 1, the use of more nominated divers who prefer to work on reefs that provide a more reliable yield in the south of the state and the cost associated with divers operating away from their place of residence. This concentration of effort in the south of the state could result in over-depletion of abalone populations in the area. To address this, there is a need to implement a program to enable a more appropriate distribution of effort across the available fishing area.

[Note: See Chapter C for a detailed examination of the issue and possible response options. Further details of the approved management response to be inserted in accordance with the determination.]

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

Background

Large areas of the coast have been closed to abalone harvesting in the past for different purposes and durations, for example, to minimise the spread of *Perkinsus* and aid the recovery of abalone stocks affected by *Perkinsus*, for marketing reasons, and to assist in the protection of the spawning stock (see Figure D1 and Appendix B1 of the EIS for current closures).

The framework will specify objective criteria for opening and closing fishing areas which are based on biological information and have regard to relevant industry needs, including the processing sector. Closure actions need to have clear objectives and include performance indicators for re-opening (or maintaining or strengthening) the closure. All stakeholders need to be clear about what monitoring requirements are for the support of the closure as well as the arrangements for funding these and other costs associated with the closure. The development of criteria will involve collaboration among researchers, managers, commercial abalone divers, shareholders and other stakeholders.

The program will also include guidelines for Industry to apply spatial and/or temporal fishing closures on a voluntary basis (e.g. through the code of practice), and a facility for Industry to request DPI to make the closures mandatory in the event that some divers do not comply. Since 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).

- (d) Implement 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 DPI for the past six 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. However, no reseeding will be authorised until a detailed proposal is developed and approved with regard to the FM Act. 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.

- (e) Implement experiments on the effects of translocating abalone within 1 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 DPI for the past ten 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 5 km). No short-distance movement of abalone will be authorised until a detailed proposal is developed and approved with regard to the FM Act. 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.

- (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 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 with regard to the FM Act. The proposal will address a range of issues including the sites and techniques 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 assessed under the EP&A Act would be required for proposals to manipulate sea urchin abundance that had the potential to affect a larger area of reef or to be conducted on an ongoing commercial basis.

- (g) Develop a mechanism for industry to determine the use of a seasonal closure on an annual basis.

Background

A seasonal closure has been used in the past to provide a rest for divers and a time for processors to do annual maintenance. Additionally, this was believed to provide a respite for the stock from disturbance. This would also have the effect of compressing the fishing year into a shorter period, increasing the fishing intensity in the rest of the year. The absence of abalone divers during that period may have allowed increased illegal activity to take place unnoticed.

The intent of this management response is for shareholders to develop a process to collectively decide whether or not to implement a closure each year. DPI will be asked to implement the closure to which will be binding on all shareholders.

Objective 2.3 To address impacts from factors external to the commercial Abalone Fishery.

The draft 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 (Chapters B & E) evaluates external threats in more detail, but the draft 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.

- (a) Develop a program to manage marine pests and diseases affecting abalone, with initial priority to address *Perkinsus*, 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, is being 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. 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 code of practice (abalone fishing) (Appendix B4 of the EIS) 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.

- (b) Continue to support initiatives to refine estimates of the total catch of abalone, including commercial, recreational, Indigenous 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 Indigenous 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 3.1b). 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 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.

- (c) ABMAC will provide advice on the development and ongoing management of Marine Protected Areas, including proposed zoning arrangements.

Background

A comprehensive system of representative marine protected areas (i.e. marine parks and aquatic reserves) is being established in NSW to protect and enhance marine and estuarine biodiversity. Large marine bioregions have been identified by the Interim Marine and Coastal Regionalisation for Australia (IMCRA) report.

ABMAC will provide advice on the proposed zoning arrangements for new marine protected areas in ocean waters, including any implications for the abalone fishery and the need for compensation for loss of productive abalone areas.

- (d) 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. Regular updates to ABMAC of planned aquaculture initiatives that potentially affect the Abalone Fishery would allow Industry to provide advice, plan for, and seek to mitigate the effects of such initiatives. The Abalone Development Company (ADC) also proactively participates in reviewing proposed aquaculture ventures – for example, as a partner in the Memorandum of Understanding to develop a hatchery (for abalone reseedling and oysters) as part of a Marine Centre in Eden; other partners include oyster farmers and the Local Aboriginal Land Council. As a key partner, the ADC receives regular updates on progress.

- (e) Continue to communicate with Government and other stakeholders about external factors that have the potential to affect abalone populations, with the aim of minimising such effects.

Background

Communication with groups whose activities potentially affect the Abalone Fishery will be mostly done through ABMAC. Many sectors have representatives on ABMAC – i.e. DPI, the Nature Conservation Council, and recreational and Indigenous sectors. However, ABMAC will also continue to communicate with other government agencies that are not represented on ABMAC (e.g. Marine Parks Authority, DIPNR, NSW Police), and with other agencies which manage abalone fisheries in other states.

Areas of particular concern to abalone fishers include catchment runoff, sewage outfalls discharging into coastal waters and any other activities that modify water quality or may increase the chance of marine pest and disease incursions. Industry is particularly concerned about a possible link between water quality and the Perkinsus parasite.

Additionally, Industry, through the ADC, will continue to liaise with other state and national industry bodies. As a member of NSW SIC, the peak NSW industry body, the ADC, will continue liaising with other sectors such as the aquaculture and marketing sectors and any others that may impact on the abalone fishery. This includes Oceanwatch, the environmental arm of the fishing industry. Industry will also continue its working relationship with Seafood Training NSW (previously known as the NSW Fishing Industry Training Council) with regards to training and OH&S issues to be included in the code of practice (abalone fishing).

- (f) Develop a strategic plan for the management of the current closure within Region 1 and all areas of the fishery affected by *Perkinsus*.

Background

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 of the area when populations 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. The presence of commercial divers in an area can assist compliance through detection and reporting of illegal fishing, as well as providing other information on environmental factors and the resource status. There is currently no strategic plan for the management of areas where abalone are affected by Perkinsus, and the intent of this management response is to develop such a plan. The plan would primarily detail how stock assessment information would be obtained through a structured, scientific sampling program and analyses. 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 plan would be developed in consultation with ABMAC and ACoRF.

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.

- (a) 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 current cost recovery policy applicable to the abalone share management fishery was implemented when the fishery became a fully established category 1 share management fishery. The policy is based on recommendations made by IPART.

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 share management fishery and DPI will provide available information as per the service agreement. The outcomes, once approved by government, will be implemented.

- (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”. The delivery of management services requires ongoing monitoring and refinement through service delivery agreements or outsourced contracts, including the development of fishery management standards. The agreements will reflect the mutual obligations of the service provider and service receiver to facilitate the cost effective delivery of services.

Service delivery agreements regarding administration would include, for example, agreements on 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. Service delivery agreements regarding research would include, for example, agreements on the 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. Service agreement relating to the administration of the MAC to include performance criteria (including times) for all services.

- (c) On request by the Abalone Management Advisory Committee (ABMAC), undertake independent performance reviews of the services delivered by 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 in the abalone share management fishery and DPI will provide available information as per the service agreement.

- (d) Develop and implement a nominated divers 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 will be developed; the Nominated Divers Card System. Under this system, business owners whose shareholding exceeds the minimum shareholding specified in the share management plan may apply for a Nominated Divers Card. The business owner can then register a pool of nominated divers associated with their business. A registered diver will be deemed to be endorsed with respect to that business when they are in possession of the card. All registered divers and those in possession of the card must abide by the rules and regulations that would normally apply to the business owner if endorsed. The standard criminal checks will need to be undertaken before nominated divers are first registered and then at six-monthly intervals while they are registered. The Department will cancel a registration if the nominated diver is convicted of an abalone offence or a serious fisheries offence at any stage during the term of the registration. 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.

- (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.

- (f) Communicate the Department'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 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 and to provide clear guidance to industry about implementation, particularly for new entrants. Policies to be reviewed include those relating to outstanding fees, fishery management budgeting and compliance policies related to the measurement of abalone retained by commercial divers.

Goal 4. To promote the economic viability of the fishery

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

- (a) Refine the performance indicators for monitoring trends in the commercial viability of typical abalone fishing businesses so as to be based on net returns.

Background

This management strategy includes a range of indirect performance measures that seek to monitor economic viability of abalone fishing businesses and the Abalone Fishery, using gross returns among other things. Net return, however, rather than gross return, is a better indicator of economic performance as it accounts for changes in shareholders' and divers' costs over time. An understanding of the average net return across abalone businesses requires data on market prices, management charges, and the cost of physical inputs such as fishing gear, fuel and bait. A process will be developed in consultation with ABMAC to determine 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. Once this process is developed, the performance indicators can be modified accordingly.

- (b) [Note: A management response to manage the number of divers is to be inserted into the final FMS in accordance with the determination in response to the associated EIS for this designated fishing activity. An analysis of the relevant risks associated with the current operation of the fishery and a range of alternative management responses to address those risks is presented in Chapter B and C of the EIS, respectively.]

Background

The number of endorsements in the Abalone Fishery has increased from 37 at the commencement of the current share management plan in early 1999/2000 to 42 in April 2004. This increase has occurred as some shareholders have 'traded down' their share packages, as a result of the current minimum shareholding specified in the share management plan being set at 70 shares. This has enabled a greater number of shareholders to obtain the minimum number of shares required to hold a diving endorsement in the fishery. The number of endorsements (and associated divers) could increase to 52 under the current minimum shareholding. (Note: the trigger point in the current share management plan (SMP 2000) is breached when the number of endorsements exceeds 42).

An increasing number 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 in the fishery. An increase in the 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. This management response would assist in reducing the repetitive handling of abalone and the resultant negative impacts on the growth and mortality of those individuals.

[Note: further details of the approved management response to be inserted in accordance with the determination.]

- (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. The intent of this management response is to develop a range of strategies to enable the fishery to adapt to the effects of such environmental and economic fluctuations. The range of options to be considered include strategies for reducing fluctuations in the TAC, investigating further recovery of the stock (see also harvest strategy in MR 2.1) and other options to reduce the size of fluctuations in the stock, such as reseeded and other enhancement initiatives. Financial strategies, like the Farm Deposit Scheme and/or a sinking fund will also be considered.

- (d) Revise the minimum level for trading abalone shares to one share.

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 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.

Objective 4.2 To increase the appropriate level of ownership capacity in the fishery.

- (a) 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 TAC variations. This may require industry shareholders to aggregate shareholdings to some higher level than the current level of 6%. This 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.

Objective 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.

Background

The Indigenous Fisheries Strategy and Implementation Plan (IFS) was released in December 2002. The IFS 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 Indigenous involvement in the fisheries of NSW. The key point of contact for the commercial Abalone Fishery with the Indigenous sector is via ABMAC, which has a position for Indigenous 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 Indigenous access to fishery resources (including abalone). Permits may be issued to Indigenous people/communities to take more than the recreational bag limit of abalone, on occasion, for traditional cultural purposes. Thus, Indigenous people can apply to the Department for a "special permit" allowing exemption from particular regulations for special events. Two special permits were issued for community cultural events in each of 2002 and 2003 for access to abalone by Indigenous people on the NSW south coast.

- (b) To raise the awareness of commercial abalone divers about the traditional value of abalone to Aboriginal people and the way that this traditional value is reflected in contemporary Indigenous communities.

Background

Work is continuing on a review of archaeological and other literature that refers to past and contemporary use of abalone by the Indigenous community. This material includes archaeological survey and excavation reports on coastal middens, ethnographic /historic references and contemporary studies of Indigenous community fishing practices. This material will be supplied to abalone divers and shareholders as a requirement of the code of practice (abalone fishing) (management response 1.1b).

Objective 5.2 To minimise any negative impacts of the Abalone Fishery on Indigenous 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.

- (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. As new information becomes available it will be passed on to Industry through the code of practice (abalone fishing) (see management response 1.2a).

The scattered debris and structures of shipwrecks have often created artificial cover for marine flora and fauna. 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 activities associated with harvesting abalone are likely to have little or no impact on cultural heritage values other than those associated with maritime heritage and particularly shipwrecks (see Sections B4.7 and E3.4 of the EIS for further discussion). 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) 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.

- (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 TAC setting process.

Historically, Industry, in collaboration with 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 2.3f).

- (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 MR 2.1c 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 (MR 2.1d) and the use of logbooks (as developed in previous research) by selected commercial divers. Reduction of disturbance to undersized abalone is also referred to in the fishery's draft code of practice.

Objective 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.

Background

The inaugural Abalone Conference held in Adelaide in 2001 brought Industry, researchers, compliance officers and managers together. State abalone researchers and Industry representatives have agreed to meet annually to provide advice on setting research priorities. Officers from NSW have also met with officers from other states to assist in developing state-wide and national compliance strategies. The 2nd National Abalone Convention (Melbourne 2003) also brought Industry, managers and researchers together. Given the limited size of the NSW industry and of the industry nationally, sharing of strategies and development information is essential.

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

Objective 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 strategic plan and update where appropriate.

Background

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 also to respond to other relevant government initiatives (such as the Report on Illegal Fishing for Commercial Gain or Profit in NSW). The Statewide Operational Plan for the Abalone Fishery and each District Compliance Plan are developed to be consistent with the Statewide Compliance Plan (Industry currently contributes funding for four 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 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 could meet periodically to discuss compliance strategies to deal with illegal harvesting of abalone.

- (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, and hence more effective targeting of illegal activities by non-commercial fishers. 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.

A cost-effective system for this reporting could require the provision of this information by divers to processors, and it being made available to Compliance Officers, as required. Such reporting is also identified in the fishery's draft Code of Practice. 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 be flexible and 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 DPI of the necessary information in a timely and confidential way to improve compliance outcomes). For example, future options (if necessary) 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 implementation.

Objective 7.2 To ensure that commercial abalone shareholders, divers, crew and receivers comply with the rules for the fishery.

- (a) Continue compliance and enforcement measures applicable to operators in the commercial fishery.

Background

The share management plan (SMP 2000) 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 Fisheries Management Act 1994 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 Fisheries Management Act 1994 establishes requirements for fish receivers, which will continue to be applied with respect to abalone.

- (b) Extend the fit and proper persons requirements applicable to abalone crew to abalone divers, shareholders and receivers.

Background

As described in the share management plan, the Director may refuse to register a person as an Abalone Fishery crew member if the person has been convicted of any of the following offences, within the period of 5 years before the application for registration is made. The offences include: an offence under the Fisheries Management Act 1994 or the regulations under the Act or an offence relating to commercial fishing operations under a law of the Commonwealth, another State, a Territory or New Zealand; an offence relating to theft of fish, fishing gear or a boat; an offence relating to an assault on a fisheries official. While there are similar provisions for Abalone Fishery endorsement holders (including nominated fishers), they need to be reviewed and extended to shareholders and 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.

- (c) 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

Receivers are currently required to record the weight of abalone, but not numbers of animals. However, the Regulation has been amended recently to provide for recording both weight and numbers, and arrangements for implementation are being made. 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. One of the four receivers in NSW has already introduced counts of abalone. This change would also improve consistency with the labelling requirements under the National Docketing System for abalone but would not apply to product from other states where count requirements have not yet been implemented.

- (d) 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.

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

Background

The minimum qualifications will aim to ensure that commercial fishers, particularly new fishers, have an appropriate understanding of the relevant fishery, the rules that apply, the need for provision of accurate data, appropriate catch handling practices, occupational health and safety requirements and other practices relevant to the sustainable and efficient management of the fishery. 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 7.3 To continue to minimise the illegal catch of abalone.

- (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).

Industry, in collaboration with 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.

- (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.

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

Background

The illegal abalone trade is demand-driven and the National Docketing System seeks to make any abalone sold in Australia traceable, as the system applies across State and Territory borders. This enables illegal abalone to be identified in the market place by enforcement agents.

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.

- (a) Continue the development of the MAC and industry networking process to improve the effectiveness of consultation, including the appointment of an independent chairperson and examination of improved communication methods.

Background

The nature and role of the Management Advisory Committee is outlined in the share management plan. Industry companies and networks can be used to increase communication with shareholders. For example, the ADC is in contact with industry members on a regular basis. In addition, there are 4 processors through which all shareholders conduct business and this avenue for communication should be useful. Many shareholders and fishers in the abalone fishery have email access. Its may be a more efficient communication method and should be investigated.

- (b) Improve the communication with nominated divers to ensure information from divers is transmitted to management and vice versa.

Background

There are currently nine shareholders working as divers and 30 nominated divers. The increasing number of nominated divers and the aging of the original owner/divers mean fewer shareholders are directly observing the fishery underwater, being replaced by nominated divers. It is important that the information from nominated divers is incorporated into the management system. Nominated divers also need to be able to receive information from managers.

A committee of active divers is currently being set up to enable divers to put their ideas forward and than implement these in the form of actions positive to the resource. Ongoing meetings of all divers are currently being scheduled to enable compliance workers and shareholders to develop an information package for all divers and deckhands on issues ranging from how to report illegal activity to identification of introduced species.

Industry holds regular updates/courses, for both divers and deckhands including First Aid, General Purpose Deckhand and Coxswain courses. Courses are also conducted through Seafood Training NSW (previously known as the NSW Fishing Industry Training Council).

The code of practice (abalone fishing) is being developed to help achieve this response (management response 1.1b).

- (c) Consult with abalone processors and marketing agencies while developing management policies.

Background

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. Consultation between ABMAC and abalone processors and marketing agencies will increase the effectiveness of the development of management policies.

- (d) 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 Indigenous people in fisheries management in NSW. 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 fishery code of practice is being developed to help achieve this response (management response 1.2a).

- (e) 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 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.

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

- (a) Communicate information about the habitat (including alienation of reefs), stocks and risks to the fishery from invasive species and disease outbreaks to the community.

Background

The reasons for recent closures of areas for collecting abalone need to be explained to the public and recreational fishers. Information should be provided on the Perkinsus pathogen and its affect on abalone stocks as well as risks from other invasive species and from illegal fishing. Communication could be in the form of media releases, posters to be displayed at tackle shops and licensing agents and an article on the DPI website. Ways in which the community can modify its behaviour to decrease the environmental risks and help prevent further disease outbreaks should be identified and communicated.

- (b) Develop a communication plan regarding human-induced environmental impacts that are likely to adversely effect or alienate abalone populations, habitat or reef.

Background

A variety of external factors can effect abalone populations, habitats and reef, and potentially the interests of Shareholders. These might include developments such as sewage outfalls or reclamation of reefs. The intent of this management response is to improve communication among Shareholders, proponents of developments, local councils, DPI and other Government agencies about the types of developments that may affect abalone. Initially, this will involve the preparation of an information

package to advise council and agency planners about potential impacts that can adversely affect abalone. Opportunities to involve other fisheries or entities such as Catchment Management Authorities will also be explored.

D4.0 PERFORMANCE REPORTING AND MONITORING

D4.1 Performance Monitoring

Many of the management responses listed in Section 3 of the 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.

D4.1.1 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 D2. The performance indicators defined in the share management plan and monitored since its introduction in 2000 have, where appropriate, been incorporated into Table D2.

D4.1.2 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 D2 identifies the information sources and data requirements and availability used as part of the performance monitoring and review process for the fishery.

D4.1.3 Robustness

The robustness ratings applied to each performance indicator in 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.

D4.1.4 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 D2 establishes the performance indicators and trigger points that will be used to measure whether each of the management goals described in Section D3 of this management strategy are being attained. As the performance indicators defined in the share management plan have been incorporated into Table D2, so have the triggers associated with them.

D4.2 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 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 the performance indicators that appear in the management strategy. 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 management strategy 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 management strategy, in consultation with the 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 D2. Performance indicators and trigger points for Goals 1-8 of the Management Strategy.

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 1.1). This program will identify appropriate performance indicators to assess the impact of the fishery. 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 the fishery code of practice	The fishery code of practice is currently being developed and implemented. Information about breaches of the code will be compiled.	Breaches of sections of the code of practice that refer to minimising the impact of the fishery on biological diversity in the coastal environment.	Medium	The fishery code of practice describes harvesting practices to minimise or avoid impacts of the fishery on biological diversity in the coastal environment.

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 changes in the mature and exploitable biomass of abalone. This information includes 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 to collect this information when appropriate.	The state-wide 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 TAC is unchanged.	High	Incorporation of all available information into a formal modelling framework can provide the most reliable and objective assessment of change in biomass. 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 [A performance indicator for monitoring regional catch is to be inserted after the Minister determines the appropriate management response]				
2.3 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	Medium	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 3.1(b) provides for independent performance reviews of the services delivered by 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 DPI records.	Raw catch rate of commercial divers falls below 19.12 kg/hr.	Medium	<p>Raw catch rate of commercial divers is an indicator of the operating costs of fishing operations, thereby affecting net return to divers.</p> <p>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).</p>
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	<p>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.</p> <p>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).</p>

4.3 Total commercial catch of abalone	Commercial catch of abalone for each fishing period. Data available from 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 the 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 DPI and Abalone Development Corporation (ADC) records	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.

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 code of practice (abalone fishing)	The code of practice (abalone fishing) is currently being developed and implemented. Information about breaches of the code will be compiled.	Consistent or serious breaches of code with respect to interaction with other harvest sectors and items of cultural heritage.	Medium	The code of practice (abalone fishing) describes harvesting practices and protocols that seek to minimise any potentially negative impacts of the fishery to other harvest sectors (incl. recreational and Indigenous fishers) and items of cultural heritage.
5.2 Proportion of abalone taken by the commercial sector relative to the recreational and Indigenous 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 Indigenous fishing surveys.	Relative catch between sectors shifts by 25% or more between year 1 and year 5 values following the commencement of the FMS and then every five year period thereafter.	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 fishery				
Performance indicator	Data requirements and availability	Trigger point	Robustness	Justification/comments
6.1 The 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 annually	Data about frequency and outcomes of reviews required and available through records kept by DPI	In any year, the Research Strategic Plan is not reviewed and updated, including consultation with ABMAC.	Moderate	A strategic plan for research focuses activities and helps to ensure efficiency and cost-effectiveness of the programs undertaken. Annual presentation of the plan to ABMAC, in terms of the outcomes achieved, and consultation regarding further development of the plan will ensure the plan accommodates the needs of the Abalone Fishery.

Goal 7: To achieve appropriate compliance, monitoring and enforcement 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 major 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 detections of minor offences exceeds 20% of inspections; detection of major offences exceeds 10% of inspections.	High	This is an enforcement-based measure of compliance in the existing share management plan.
7.2 The percentage of total inspections of processors and wholesalers which result in the detection of minor and major 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 detections of minor offences exceeds 20% of inspections; detection of major offences exceeds 10% of inspections.	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 Strategic Plan for the Abalone Fishery reviewed and updated annually	Data about frequency and outcomes of reviews required and available through records kept by DPI	In any year, the Compliance Strategic Plan is not reviewed and updated, including consultation with ABMAC.	Moderate	A strategic plan for Compliance focuses activities and helps to ensure efficiency and cost-effectiveness of the programs undertaken. Annual presentation of the plan to ABMAC, in terms of the outcomes achieved, and consultation regarding further development of the plan will ensure the plan accommodates the needs of the Abalone Fishery.

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 code of practice (abalone fishing)	The code of practice (abalone fishing) is currently being developed and implemented. Information about communication with stakeholders will be compiled.	Consistent or serious breaches of sections of the code of practice (abalone fishing) relating to communication with stakeholders.	Low	The code of practice (abalone fishing) will be an effective means by which a sound consultative process occurs between sectors of Industry and other stakeholders regarding issues of importance.
8.2 Number of ABMAC meetings held each year	The number of ABMAC meetings held is available through records kept by 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 fisheries officer.	Records of port meetings held are kept by 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 DPI on issues impacting on the Abalone Fishery (including operation, social and economic issues).

D4.3 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 indicator for the fishery is breached.

D4.3.1 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 responsible for Fisheries in NSW 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.

D4.3.2 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.

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 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.

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 management strategy 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.

D4.4 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 the Abalone MAC 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.

D5.0 RESEARCH AND DEVELOPMENT PLAN

D5.1 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 DPI and Industry in 1993 through an FRDC grant. Other areas of research and development (e.g. abalone-sea urchin interactions, the potential for reseeded) 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 assessment 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.

D5.2 Current Priorities

Current priorities for research and development (Table D3) are linked to the goals and objectives of the FMS and share management plan and are consistent with previous approaches. The various sub-programs for research can be grouped into four broad categories: stock assessment; habitat and ecosystem; rebuilding biomass; and socio-economic.

Table D3. Proposed Strategic Plan for Abalone Research. Funding secure (black shading); funding not yet committed (grey shading).

Research Project	Priority	2005/06	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/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/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/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 provides a key component of the resource assessment.

Research Project	Priority	2005/06	Timeframe for Project	Actual/Possible Source of Funding	Objectives and Comments
Resource assessment	High		Annually, with potential for changes to periodicity	Industry/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/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 (and allocating appropriate Compliance resources).
Develop / implement methods for improving monitoring and assessment of abalone stock in Region 1	Medium		Not determined	Industry/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	2005/06	Timeframe for Project	Actual/Possible Source of Funding	Objectives and Comments
Develop/implement methods for estimating the recreational and Indigenous catches of abalone	Medium		Not determined	Industry/DPI/Other	Develop and implement a strategy and methodology for estimating annual catches of abalone by recreational and Indigenous fishers 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 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/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/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.

Research Project	Priority	2005/06	Timeframe for Project	Actual/Possible Source of Funding	Objectives and Comments
Habitat and Ecosystem					
Investigating and managing the <i>Perkinsus</i> -related mortality of blacklip abalone in NSW	High		Potential extension of the FRDC project	FRDC/DPI/ Industry	<p>1. Document the historical evidence about the spread of <i>Perkinsus</i>-related mortality of abalone in NSW;</p> <p>2. Describe the pathogenesis and make initial investigations of the epidemiology of the mortality of abalone; and</p> <p>3. Contribute to the development of strategies to manage populations of abalone that have, or might be, affected by <i>Perkinus</i> and evaluate the need for further research.</p> <p>A key component of this project is a survey of <i>Perkinsus</i> infection in abalone along the NSW coastline (providing evidence of any change in distribution since the survey done in 2002. This is a 1-year FRDC funded project that finishes in January 2006.</p>
Development of a program to monitor the impacts of harvesting abalone on the coastal environment	Low		Not determined	Industry/DPI/ Other Institutions	Increase knowledge of the effects of harvesting abalone on the associated ecosystems.

Research Project	Priority	2005/06	Timeframe for Project	Actual/Possible Source of Funding	Objectives and Comments
Rebuilding Biomass					
Development and delivery of technology for enhancement of black-lip abalone fisheries in NSW using hatchery-produced seed stock	High			FRDC/ DPI/ Sydney University/ University of New England	<p>1. To evaluate alternative methods of reducing high post-release mortality rates commonly sustained by hatchery produced abalone seed;</p> <p>2. To optimise production of triploid black-lip and scarlet-rayed abalone; and</p> <p>3. To assess the utility of sterile but potentially fast growing triploid black-lip and scarlet rayed abalone for enhanced fisheries production.</p> <p>FRDC-funded project beginning in 2005 and scheduled to finish in 2008.</p>
Design / Implement experiments to assess reseeded, translocation of abalone and harvest of sea urchins to rebuild populations of abalone	Medium		Not determined	Industry/DPI Other	To investigate the potential of reseeded 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/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	2005/06	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	<p>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.</p> <p>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.</p> <p>FRDC-funded project beginning in 2001 and scheduled to finish in 2005.</p>
Socio-Economic					
Economic and social surveys of abalone shareholders	High		Not determined	Industry/DPI	<p>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.</p>

D6.0 CONCLUSIONS

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 code of practice (abalone fishing), 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.

CHAPTER E ASSESSMENT OF THE POTENTIAL IMPACTS OF IMPLEMENTING THE DRAFT FMS

This section of the EIS assesses the Draft FMS, as described in Chapter D, to determine whether it will effectively reduce or mitigate the moderate to high risks associated with the current operation of the Abalone Fishery identified in Chapter B and ensure that the fishery continues to operate in a sustainable manner. This chapter is an appraisal of the goals, objectives and management responses in the draft FMS, and the means by which their performance is to be monitored. Although appraisals are made of the effectiveness of measures proposed, only by monitoring the implementation of these measures will it be possible to fully determine whether they are sufficient to reduce risks associated with the Abalone Fishery.

The role of the FMS is to outline the long term strategies for managing the fishery. Accordingly, the strategy does not include full details for the implementation of specific management changes, but does describe the management objectives that are desired. Ultimately, the FMS will be implemented through various supporting documents and operational plans, such as the share management plan, research plan and compliance strategic plans, 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 affected stakeholders so as to obtain the support that will be necessary to achieve effective implementation and compliance with the new rules.

E1.0 BIOPHYSICAL ISSUES

E1.1 Outline of the process to assess the potential of the FMS to reduce risk

The aim of this section of the EIS is to describe any changes to the biophysical context of the Abalone Fishery potentially arising from the implementation of the draft FMS (as described in Chapter D). This is done by evaluating potential changes to risk from the fishery to biophysical components identified in Chapter B, with the overall objective of ensuring that the fishery operates in an ecologically sustainable manner.

As discussed in Chapter B2.1.1, this EIS and its components, particularly the draft FMS and this assessment of the draft FMS, were written against a specific legislative framework.

Although this framework is broadly consistent with the guidelines for ESD reporting for Australian fisheries (Fletcher *et al.* 2002) there are some differences. In particular, the 'How to' Guide (Fletcher *et al.* 2002) sets performance measures and indicators for each management response, whereas the draft FMS uses multiple management responses to achieve goals and objectives, and sets multiple performance indicators to achieve the goal.

The approach used here was to highlight the efficacy of individual management responses in reducing or mitigating risk to components or sub-components of the biophysical environment, while also assessing their contributions to reducing the major risks identified for the existing fishery and their ability to achieve broader goals and objectives.

Those parts of the biophysical environment with sub-components at greater than low risk from the fishery, their associated issues and common information gaps are summarised in Table E1.1. Some of the information gaps are related to one or more issues. It is important to note that many components and issues overlap, as expected, given the complexity of the marine environment, and that the table is a simplified representation that does not attempt to create linkages between any components.

Table E1.1 Summary of components of the biophysical environment at greatest risk from the existing activity and issues and information gaps that the FMS needs to address.

Components at moderate or greater risk	Issues	Information gaps (not specific to any particular component)
Target species - Mature stock high risk at local scales moderate risk at general scales - Distribution of stock moderate risk at all scales - Size structure moderate risk at local scales - Non-retained moderate risk at local scales	Target species (general) Potential for concentrations of fishing effort to cause over-fishing Recovery programs for once productive areas Illegal fishing Discarding rates and mortalities Other human-induced impacts	Lack of information about: size of illegal catch; effectiveness of compliance programs, effectiveness of closures, effectiveness of alternative size limits; effectiveness of recovery programs and their ecological impacts (i.e. from reseeded, translocation and habitat rehabilitation); bycatch; discarding rates, influence of external factors such as water quality, pollution etc.
Bycatch - Obligate species moderate risk at local scales	Bycatch Lack of information and understanding	

In assessing the effectiveness of the various management responses within the draft FMS, the focus is on the ability of each to achieve a reduction in risk to a specific component or sub-component of the environment. Because of the multi-faceted nature of the management responses, a response may not reduce risk for one component to which it is directly related, but could do so for another component.

The key determinants in the potential risk reduction for each management response are the quality of information that is used in the construction of a management response, and

whether a management control or regulatory head of power has been identified or is unspecified. It should be noted that a management response that focuses on the collection of information does not, on its own, reduce risk. It does, however, provide essential data that can be used to refine the level of risk which best fits a component and may, where necessary, provide the foundation for more appropriate and effective management measures.

There are four broad information types used in the development of a management response – unspecified information, regulation reviews or non-independently validated information, descriptive information and experimental information (mensurative and/or manipulative). These different information types can vary considerably in their reliability (accuracy and variability) and hence when used to develop management responses should be expected to lead to variable outcomes on actual risk reduction following the implementation of the management responses.

As a general guide, not specifying the type or source of information means that it cannot be assessed and can only be reported as offering no risk reduction. Information that has been collected or independently validated by trained observers or scientific staff as part of a descriptive monitoring program or experimental study have moderate and major potential for risk reduction, respectively. Such information is generally of high quality because robust, scientifically-based sampling protocols minimise, but don't remove, the possibility of collecting biased data. It is also noteworthy that it is important that this type of information is grounded by those with knowledge of the issues to avoid being irrelevant. The quality of self-reported information is likely to depend on whether the information provider has a stake in the industry. For example, the information provided by those with an investment or long-term interest (e.g. through family businesses) in the industry is likely to be in the best interest of the resource. Those with little stake in the industry may provide information that is biased in order to make a gain in the short-term.

Monitoring can be either the routine collection of information about a fishery, such as weights of landings, lengths and sex of species caught. The information is used to update resource assessments but does not specifically change management procedures (Sainsbury *et al.* 2000). Monitoring can also form part of adaptive management (Walters 1986, Sainsbury *et al.* 2000), which sets up management controls to test specific hypotheses about the effectiveness of alternate management strategies or action. Whatever form of monitoring is used it is important that there is a review of the information at predetermined frequencies so

that the effectiveness of management responses can be evaluated and any necessary adjustments or changes to the activity or the FMS can be done.

A control mechanism is simply a tool of management that is the means by which a management response will be achieved. Management controls are either output focused or input focused (Walters and Pearse 1996). Output controls place limitations on how much can be taken out of a resource, such as quotas. Input controls place limitations on the effort to catch fish, such as restrictions on number of days fished, gear specifications, size-limits and closures. Usually a fishery management strategy will use a combination of management controls because of the complexities of the ecological, economic and social structure of a fishery.

It is not the aim of this section to appraise every management response in the draft FMS, as it would become un-necessarily lengthy, responses can affect multiple objectives, and would shift the focus away from the components at risk from the existing activity. Rather, this section will appraise the management responses that are directly related to components of the target species, bycatch, threatened and other species, assemblages and habitat perceived to be at risk in Chapter B2.

Generally, the 'consequences' of potentially adverse effects to components of the biophysical environment will generally remain unchanged under the draft FMS, but there is potential for some management responses to reduce the 'likelihood' of particular adverse effects (consequences) occurring and hence some overall risks. Changes to likelihood and consequence can change overall risk. It is important to note, however, that the assessment of potential changes to risk is based on the explicit understanding that the actions specified in the draft FMS will be implemented. Risk reduction requires commitment from DPI and Industry to fulfil the intent of management responses and implement all of the proposed changes within the specified timeframes. If circumstances prevent implementation of some actions then reductions to risk may not occur. For example, further development of the fishery code of practice is an item of concern, as it is an important control for a number of issues that mitigate potential risks of the commercial fishery on components of the environment other than the target species. In its current state, the code is lacking sufficient detail to be effective. The intent in the FMS to develop an effective code is therefore extremely important and a failure to do so may present a threat to the sustainability of the Abalone Fishery.

E1.2 The Target Species

E1.2.1 Changes to Risks Caused by the Operation of the Fishery

A long history of research and an adaptive system of management has been the basis for the development of sustainable commercial harvesting operations for the Abalone Fishery.

Despite this, some low to moderate risks to key sub-components of the target species were identified as not being adequately addressed in existing arrangements for the fishery (Section B2.3.4). A moderate risk from current operations to the distribution, abundance of mature abalone was identified at general spatial scales and size-structure and non-retained abalone at local scales. The risk to abundance of mature and non-retained abalone at local scales was high. Basing management responses toward addressing the issues associated with these risks and information gaps (Table E1.1) would reduce the risk to the target species.

The performance indicators and trigger points are assessed in Section E1.6, so the following assessment will focus on the individual management responses, and whilst acknowledging the importance of the data collection responses, must assess them in terms of whether or not they can clearly demonstrate that risk will be reduced. The extent to which the issues and information gaps (Table E1.1) are addressed by the draft FMS is summarised in Table E1.2.

Table E1.2 Proposed management responses in the draft FMS that aim to directly reduce risk to the target species. Shaded management responses are those used already in the fishery.

Management response (& key feature)	Issue addressed	Information gap addressed
1.1b – Code of Practice	Discarding	
2.1a – Implement TACC and develop harvest strategy ²	Concentrated effort, sustainable harvest, stock building	
2.1b – State-wide MLS	Protection of spawning stock	
2.1c – Monitor landings and effort	Concentrated effort	

² Part of the actions of MR2.1a (i.e. 'continue to implement a TACC for the fishery') occur in the existing fishery.
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2.1d – Monitor population	Concentrated effort	
2.1e – Stock assessment	Concentrated effort sustainable harvest	
2.2a – Alternative size limits	Concentrated effort	Effectiveness of alternative size-limits
2.2b – Manage spatial distribution of effort	Concentrated effort	
2.2c – Strategy for closures	Concentrated effort, recovery programs, stock building	Effectiveness of closures
2.2d - Reseeding	Stock building	Effectiveness of stock building
2.2e - Translocating	Stock building	Effectiveness of stock building
2.2f – Habitat rehabilitation	Stock building	Effectiveness of stock building
2.2g – Seasonal closure	Recovery programs, stock building	Effectiveness of closures
2.3a – Manage <i>Perkinsus</i>	Stock building	Effectiveness of stock building
2.3b – Refine estimates of catch from other sectors	Illegal fishing	Imprecise estimates of illegal, recreational and Indigenous catches
2.3d – Advise on aquaculture	Other human-induced impacts to stock	
2.3e – Advise on external impacts	Other human-induced impacts to stock	
2.3f – Strategic plan for Region 1	Recovery programs, sustainable harvest	
4.1b – Manage diver numbers	Concentrated effort, discarding rates, increasing numbers of divers	
4.1c – Strategies for adapting to economic and environmental fluctuations	Concentrated effort, recovery programs	
6.1a – Research program	Stock building	All
6.1b – Estimate discard rate	Discarding	Discarding rates
7.1a – Implement and review Compliance strategic plan	Illegal fishing	
7.1b – Prior reporting	Illegal fishing	
7.2a – Monitor compliance in commercial sector	Illegal fishing	

7.2b – Fit and proper requirements	Illegal fishing	
7.2c – Processor requirement	Illegal fishing	
7.2d – Provision to ban processors	Illegal fishing	
7.3a – Industry communication program	Illegal fishing	Information about illegal catch
7.3b – Cost benefit assessment of enforcement strategies	Illegal fishing	Information about illegal catch
7.3c – Continue with National Docketing System	Illegal fishing	Information about illegal catch
8.1a – Improve communication between MAC and Industry and stakeholders	Illegal fishing	
8.1b – Improve communication between management and nominated divers	Discarding	Information about illegal catch,
8.1e – Encourage Indigenous participation in commercial fishery	Illegal fishing	
8.2a – Communicate with community about potential risks to the stock	Other human-induced impacts to stock	
8.2c – Communication plan regarding anthropogenic impacts	Other human-induced impacts to stock	

The draft FMS retains a number of existing measures from the share management plan for controlling the impact of the commercial fishery on the target species (Table E2.1). Among these, the use of the state-wide TACC (MR 2.1a), and associated monitoring of the fishery and the population (MR 2.1e and 6.1a), and the state-wide minimum legal size (MLS) of 115 mm (MR 2.1b) are probably the most important. These are bound in regulation and monitored closely for any breaches. As was described in Section B2.3.2 the current MLS protects the majority of the general population of abalone (~95%) from commercial fishing and generally about two-thirds of the mature biomass. An on-going stock assessment program (Section B1.6.1) is the basis for determining a TACC for each fishing period that the TAC Committee considers to be sustainable (Section B1.8.3).

Many new management responses in the draft FMS will combine with existing arrangements to potentially reduce the overall risk of undesirable consequences occurring to sub-components of the target species requiring more protection. In particular cases where overall risk is assessed to be reduced, this is because proposed changes to existing operations are considered to reduce the likelihood of particular adverse events occurring, although the consequences of particular events would generally remain unchanged (Table E1.1).

The suite of management responses proposed in the draft FMS builds on the current arrangements for the commercial fishery to provide for a more effective means of protecting and rebuilding the stock, where appropriate, yet allowing harvesting to be done with more flexibility and efficiency. Specific new arrangements considered to have the greatest effect are described below, while others are discussed generically.

MR 2.1 (a) proposes to continue to implement a TACC but also to develop a set of guidelines with regard to how the TACC is applied under different circumstances (i.e. a more complete harvest strategy). This management response is linked to MR 4.1 (c) which proposes adaptive management for overcoming periods where economic or environmental conditions are adverse to the industry. A more complete harvest strategy is a key reduction to risk to the target species as the intent is to develop a set of guidelines based on sustainability that also allow the fishery to be managed to achieve specific goals, and for Industry to plan operations more effectively over the medium- and longer-term. Guidelines for the harvest strategy should combine the use of the TACC with other measures proposed to make harvesting more efficient and for rebuilding biomass. This should include criteria about where and when these measures should be used. For example, the size of the TACC can influence the rate at which the stock recovers from a period of decline and should be adjusted according to what is desirable at the time. Although trigger points in the share management plan help guide the TAC Committee with their determination, there are no guidelines as to how the TACC is to be applied with regard to, for example, rebuilding over the longer term. The development of such guidelines and strategies will improve the effectiveness of the TACC as a management tool and should reduce the general likelihood of overfishing of mature stock at a general scale (Table E1.3).

The harvest strategy will also involve suitable arrangements as to how the TACC is distributed across the area of operation for the fishery. A state-wide TACC is most effective

if catches are distributed appropriately. Concentrations of fishing effort that have occurred at times in recent years in the far south of the state have the potential to increase the risk to the target species at all scales. A management response proposed for distributing commercial catches of abalone appropriately (i.e. MR 2.2b) would be an important part of the overall harvest strategy. The management response has great potential to reduce risk from commercial harvesting but specific options and details are yet to be determined (see Section C4.2.1). The appropriate arrangement would have its greatest impact by reducing the likelihood of risk to the abundance of mature stock and undesirable rates of discarding at the scale of regions. The harvest strategy, as discussed, and the proposal to manage potentially undesirable concentrations of effort are also linked to management responses proposing strategies for harvesting in Region 1 (MR 2.3f) and dealing with *Perkinsus* (MR 2.3a). These strategies would allow abalone to be harvested in Region 1 without adding to the overall risk already occurring to populations from *Perkinsus*.

The harvest strategy as described above would be effective at reducing the likelihood of risk caused by the commercial fishery to the existing distribution, abundance of mature abalone and size-structure at generally large-scales (Table E1.3) by increasing protection and assisting in rebuilding biomass, where appropriate. This would potentially lead to an overall reduction in risk from the commercial fishery to these sub-components (Table E1.3). The ability, however, of the measures described above for reducing risks to the target species at more local scales is limited.

Proposed measures in the draft FMS for reducing the risk posed by the commercial fishery to the target species at local scales are important because this is where the greatest potential for impact from harvesting was identified. At this scale, the overall risk of undesirable consequences from impacts to the abundance of mature stock was considered to be high under existing operations, and moderate to size-structure and non-retained abalone (Section B2.3.4). The recommendations in the 'How to' guide (Fletcher *et al.* 2002) suggest areas of high risk are where management needs to become more effective, although suitable management is also required where moderate risks occur.

Management responses directed at changing the operation of the commercial fishery at local scales will offer greater protection to populations of abalone at this scale as well as making harvesting more efficient. Growth over-fishing (i.e. when too many small abalone are taken, and therefore too few grow to a size that provides the largest yield from the fishery) and

recruitment over-fishing (i.e. removing biomass to a level that results in significantly less recruitment to a fished population) have the greatest potential to occur at places where the state-wide MLS is inappropriate (Section B2.3.2). The potential of these types of over-fishing to occur is largely due to a statewide MLS that cannot take into account local variation in growth of abalone between areas (Section B2.3.1). The abalone fisheries in NSW and WA are the only states in Australia that do not have variable size limits (although WA has provision for controlled fish-downs) for different areas (Sections B1.2.2 and C2.0). Although the state-wide MLS provides appropriate protection to abalone in many areas where growth rates are average, it may be inappropriate in others. For example, it may be inappropriate in areas where growth is rapid, and to large sizes, such as the general area between Wonboyn and the Victorian border, and in areas where growth is slow or populations are prone to mortality from floods and the majority of individuals in the population have difficulty in growing to the MLS. A new management response has been proposed to investigate potential alternatives to the state-wide MLS between Wonboyn and the Victorian border and at smaller scales across the distribution of the fishery (MR 2.2a). As part of MR 2.2a, an increase to the MLS between Wonboyn and the Victorian border will be investigated. Growth rates for the region indicate a general increase in the MLS of abalone in Region 6 would potentially increase the biomass, reproductive output and productivity in the region. As some populations of abalone in the region, however, would no longer be accessible to the commercial fishery because of local differences in rates of growth, an increase in the MLS for the region might need to be combined with controlled fish-downs, so that local populations within the region could be harvested at a smaller size-limit where appropriate, as is done in other states (Section C2.0). Flexibility in the MLS in the form of controlled fish-downs of stunted populations or those in flood-prone areas in other regions of the coast will also be possible as a consequence of the new management response directed at abalone populations at local scales. This will allow all of the general population to be harvested and potentially distribute fishing effort more appropriately than can occur under existing operations.

Changes to MLS, where appropriate, will substantially reduce the likelihood of growth over-fishing and recruitment over-fishing occurring at local scales, thereby reducing the overall risk to mature stock and size-structure (Table E1.3). This would also contribute to reducing the likelihood of impacts to the distribution, abundance and size-structure of abalone at all spatial scales (Table E1.3). It is acknowledged that a balance will be required between the

yield benefits from a more refined MLS at a local scale and the complexity and cost of managing such a system.

Programs for more effective use of closures (MRs 2.2c and g) to commercial harvesting have potential to reduce adverse impacts from harvesting at local scales. These would assist in providing more effective protection to the target species where required. Although there is little documentation of any benefits of closures used in the past, their effective use should contribute to a reduction in the likelihood of overfishing the mature stock, particularly at local and regional scales. The guidelines for closures should be prescriptive as to how and why they are applied, including regard to ecology, the needs of the Industry and effective policing. The FMS acknowledges the intent of Industry participants to work together, and with DPI, to pursue voluntary closure mechanisms where appropriate and to develop objectives and performance indicators for any closure.

Apart from the flexibility of harvesting at different size limits at local scales, and a more effective use of closures, a number of other management responses (Table E1.2) would contribute to reducing the likelihood of the commercial fishery having adverse effects on the target species at local scales, and therefore, the overall risk to mature stock and non-retained abalone (Table E1.3). Better management of the effects of the commercial fishery at local scales will not only reduce the risk to the target species at this scale but pass on benefits to the general population of abalone and potentially lead to increases in the TACC at some point. Included in the focus at smaller scales is a management response to control the number of divers (MR 4.1b), and another to develop the fishery code of practice which will assist in ensuring that abalone divers minimise damage to abalone smaller than the MLS (MR 1.1b). In addition, there is intent to investigate rates of discarding in MR 6.1b. As this is mostly about collecting new information, this management response alone would not reduce the overall risk of discarding. Discarding would, however, likely be minimised in the draft FMS through further control of fishing effort and diver numbers and development of the code of practice. This would reduce the likelihood for risk from discarding to non-retained abalone at local scales from possible to unlikely, but the overall moderate risk would remain the same at local scales (Table E1.3). Further, the implementation of experiments to reseed and translocate abalone in up to 1% of suitable reef habitat in NSW (MRs 2.2d and 2.2e) and to investigate the potential of restoring populations of abalone by harvesting sea urchins (MR 2.2f) offer considerable potential for reducing the risks from the commercial fishery or from external factors (e.g. theft of abalone), particularly at local scales.

These techniques, which are also being developed in other states, have the potential to rapidly reverse any depletion to local populations that may otherwise take decades to recover naturally, if at all. They are also a potential supplementary management measure to any broader stock rebuilding strategies. Experimental research investigating the potential for restoring populations of abalone by harvesting sea urchins, reseeded and translocating abalone has been done in the past on a small-scale but these were not considered 'activities' of the fishery and hence were not assessed in the review of existing operations (Chapter B). The proposals in the draft FMS, however, would potentially be ongoing and hence need to be assessed in this part of the EIS as they are proposed to be integrated into the activities of the fishery.

Despite the obvious benefits of reseeded, translocation and harvesting sea urchins, in terms of their potential to restore natural populations of abalone and mitigate risks from external factors, there is also potential for some less obvious adverse effects if activities are not managed appropriately (see also Section E1.5 for potential effects on other aspects of the ecosystem). This is particularly so for reseeded and translocation. For example, under both techniques there is potential for an impact on the genetic diversity of existing populations of abalone. This is exacerbated by the potential for populations to be genetically dissimilar over small distances. The movement of abalone from one area to another may spread disease (e.g. *Perkinsus*) and pests into areas where they are not naturally present and hence where there may be no natural resistance. This would also occur in a reseeded program if hatchery stock became infected.

The scale of proposed experiments (i.e. it is proposed to be restricted to < 1% of available reef) and assessment of proposals on a case by case basis (i.e. no proposal will be authorised unless it is approved with regard to the *FM Act*) indicate these management responses would be tightly controlled. Regardless, to avoid risks to the environment, further development of controls and policy (in line with what is done in other states where enhancement may occur: Vic and WA) and an EIS would be needed before commercial scale reseeded is be done in NSW.

There are some management responses proposed with the intent of improving communication and reducing illegal fishing within the commercial sector. Improved communication would increase efficiencies and reduce the potential for adverse impacts to the fishery from internal or external sources (MRs 8.1a and b). Although illegal fishing is

thought to be mostly an external problem (Section B1.2.5) there are measures proposed that would minimise illegal activity within the commercial sector (MRs 7.1a and b, 7.2a and b). Considering the limited size of the problem of illegal fishing occurring within the commercial sector, these management responses would have little effect on risk to the target species.

Table E1.3. Summary of the potential impacts of implementing the draft FMS on key sub-components of the target species. Definition of the terms as per Fletcher *et al.* (2002). Bold terms indicate where 'consequences', 'likelihoods' or 'overall risks' have changed.

Issue	Spatial scale	Consequence of activity	Likelihood of activity	Overall risk
Distribution of stock	All	Moderate	Rare	Low
Abundance of mature stock	Local	Severe	Unlikely	Moderate
	General	Severe	Rare	Low
Population structure				
Size-structure	Local	Severe	Unlikely	Moderate
	General	Severe	Unlikely	Low
Sex-structure	All	Minor	Remote	Low
Non-retained	Local	Severe	Unlikely	Moderate
	General	Severe	Rare	Low

E1.2.2 Changes to Risks from External Factors

External impacts have a much greater potential to affect the stock of abalone relative to any impacts from the commercial fishery, particularly when considered from a perspective of cumulative impact (Section B2.3.3). Consequently, a number of measures are proposed in the draft FMS for responding to current and potential external impacts to the target species (Table E1.2). Where it is considered that the impact to the stock from an external factor cannot be totally prevented (i.e. illegal fishing or *Perkinsus*), management responses in the draft FMS aim to mitigate and possibly compensate for the impacts of these factors.

Illegal fishing and *Perkinsus* are considered to cause a great impact on the target species as they are known to be the cause of large reductions to populations of abalone at local and regional scales. The strategies in the share management plan for addressing illegal fishing

have been retained in this management strategy. For example, MR 7.1b 'Continue to implement and review, in consultation with ABMAC and key stakeholders, the compliance strategic plan and update where appropriate'. To be effective, however, the compliance strategic plan must have the flexibility to respond where appropriate to new information about illegal fishing and evolve to allocate the appropriate level of resources to where they are most needed. Hence, management response MR 7.3b would: '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', to ensure an appropriate level of compliance is achieved and that the most effective allocation of resources between compliance in the commercial sector and the prevention of illegal fishing by unlicensed operators occurs. This management response was advocated by the TAC Committee (see Section B1.7) and also indirectly through the review of illegal fishing in NSW (Palmer 2004 and Section B1.2.5.2). Another new management response in the draft FMS that aims to reduce illegal fishing from unlicensed operators is MR 7.3: 'To design and implement an industry communication program to assist in preventing illegal catch'. This management response involves a partnership between government and the commercial sector. There are also management responses that would reduce the potential for illegal activities in the processing sector (MRs 7.2c and d).

Other management responses in the draft FMS that address illegal fishing, and *Perkinsus*, involve acquiring information that can be used to develop strategies for reducing the potential impacts of these factors. For example, a management response for supporting initiatives for refining estimates of illegal catch will help with development of the compliance strategy and allocation of resources towards illegal fishing (MR 2.3b). Management responses that advocate the development a strategy for managing *Perkinsus* (MR 2.3a) and harvesting in Region 1 (MR 2.3f) will mitigate the potential effects of further spread of the disease while potentially allowing sustainable harvesting to occur within the affected areas.

In addition to minimising the potential for further reductions to populations of abalone in the future as a consequence of *Perkinsus* or illegal fishing, other management responses proposed in the draft FMS focus on restoring populations of abalone that have been depleted. Whole populations of abalone can be depleted from reefs at a local scale and in some cases at a larger scale as a consequence of *Perkinsus* or illegal fishing (see Section B2.3.3). As abalone larvae mostly disperse over short distances, natural recovery of depleted

populations is slow and may take many years (Section B2.3.1). The management responses in the draft FMS for continuing investigations into reseeded (MR 2.2d) or moving abalone short distances (MR 2.2e) are a means of assisting recovery (see previous section).

Several other potential external impacts were identified in the review of existing operation (Section B2.3.3). These were legitimate competition for the resource (i.e. by recreational divers, including Indigenous participants), proposals in the future to create marine reserves, aquaculture industries and any development that affects the coastal environment. In many cases proposals that may affect the commercial fishery are assessed by determining authorities on a case by case basis. Shareholders in the Abalone Fishery have no direct control of proposals that may have a negative effect on the fishery. The means by which shareholders can try to minimise potential impacts, as proposed in the draft FMS, is for shareholders to provide advice and input where appropriate into policy on these matters. This advice to consent authorities will be in advance of approval and general in nature but ABMAC can also comment on specific developments. Management responses in the draft FMS propose that shareholders, through ABMAC, provide advice to the relevant authorities who control the location and zoning of proposed marine reserves (i.e. marine parks, marine protected areas etc), aquaculture enterprises and other developments with the potential to affect populations of abalone (i.e. MRs 2.3c, d and e) and the development of a formal communication plan (MR 8.2c). The advice can be used where the development of policy is required or in regard to specific proposals for such developments in the future.

Competition for the resource from other stakeholders was identified as an important external impact to the commercial fishery, but uncertainty exists as to the size and trend of the recreational catch. The draft FMS proposes to support initiatives to refine estimates of the recreational and Indigenous catch of abalone (MR 2.3b). This will have the benefit of informing policy on future allocation of the resource, and the associated costs of management, between the commercial and recreational sector (Section B1.3.2.3). It will also remove some of the uncertainty associated with setting appropriate TACCs for the commercial fishery (Section B1.8.3).

E1.3 Bycatch Species

The Abalone Fishery is based on direct and selective hand collection of the target species, but unavoidable collection of some algae and invertebrates known to live on the shell, foot or mantle cavity occurs, although this is restricted to bycatch occurring on only retained

abalone (Section B2.4). There is potential that some species have an obligate requirement to live on the shells of abalone. Although many of these would occur on the large proportion (~95%) of the stock smaller than the MLS (not available for commercial harvest), there is a possibility that larger abalone support different or more diverse types of 'bycatch' compared to smaller abalone. This risk to bycatch was considered to be low to moderate under current operations. Management responses are based on addressing the issues associated with risks to bycatch and information gaps (Table E1.1).

Table E1.4 Proposed management responses in the draft FMS that aim to reduce risk to bycatch.

Management response (& key feature)	Issue addressed	Information gap addressed
1.1a – Increase knowledge of bycatch	Lack of understanding	Lack of information
1.1b – Code of Practice	“ “	“ “
3.1f – Communicate fishery operational plans and policies to Industry	“ “	“ “
6.1a – Research program	“ “	“ “
8.1b – Improve communication between management and nominated divers	“ “	“ “

Future research proposed in the draft FMS will evaluate the overall risk of the commercial fishery on bycatch in more detail by providing the necessary information to understand bycatch and a monitoring program to help minimise effects from commercial harvesting (Table E1.4). This will reduce the likelihood of risk to any identified obligate species, thereby reducing the overall risk to these species from the commercial fishery to low when implemented. The relevant management responses in the draft FMS (MR 1.1a and 1.1b) propose a twofold approach. First, to address biodiversity and ecological integrity issues by proposing to expand and develop an existing program for monitoring the effects of harvesting abalone on bycatch species and associated habitat and ecosystems as well as increasing knowledge about potential interactions where information is limited. Second, the current code of conduct for abalone divers will be extended to a formal fishery code of

practice. The code will address how divers and deck-hands deal with bycatch, to reduce the likelihood of potential impacts on species that are found to have obligate requirements for abalone as a habitat. It is proposed that the code of practice be adaptive to incorporate new knowledge and techniques as information emerges.

In addition, measures in the draft FMS for reducing the potential for small and large-scale depletions of the target species (Section E1.2) indirectly address the impact of harvesting on bycatch. Depletions of populations of abalone by the commercial fishery at various spatial scales could potentially deplete species of bycatch at those scales. The draft FMS addresses the potential for such depletions through sound management of fishing effort, potential changes to the MLS of abalone at regional and more local scales, etc. (Section E1.2.1).

Table E1.4. Summary of the risk from the operation of the fishery on bycatch. Definition of the terms as per Fletcher *et al.* (2002). Bold terms indicate where ‘consequences’, ‘likelihoods’ or ‘overall risks’ have changed.

Issue	Spatial scale	Consequence of activity	Likelihood of activity	Overall risk
Generalist species	All	Minor	Rare	Low
Obligate species	Local	Moderate	Rare	Low
	General	Moderate	Rare	Low

E1.4 Threatened and Protected Species

E1.4.1 Implications of the Draft FMS for Threatened and Protected Species

The risk of the Abalone Fishery having a significant impact upon threatened and protected species is very small and no specific measures are required. However, the draft FMS proposes means by which the abalone divers can have a positive impact on threatened and protected species by enhancing their protection.

The draft FMS aims to minimise the potential for impacts of the Abalone Fishery on threatened and protected species, and enhance their protection by proposing a management response to comply with relevant threatened species recovery plans and by developing the fishery code of practice. The code will reduce the potential for abalone fishing to impact on threatened or protected species by:

- providing divers with the means for accessing information about known locations of populations of threatened or protected species within abalone fishing grounds and providing abalone divers with new information about threatened or protected species (including newly discovered populations and any recovery plans as the information becomes available);
- providing divers with protocols endorsed by ABMAC for harvesting abalone in the vicinity of areas where threatened or protected species are known to occur;
- requiring divers to report any new sightings of significance of threatened or protected species, or other major threats to threatened or protected species such as introduced marine pests, to DPI; and
- requiring divers to ensure that boats are cleared of algae and potential pests before launching to avoid becoming a potential vector for dispersing marine pests that would affect threatened and protected species in NSW waters.

In addition, the management response in the draft FMS for 'developing a program for closing and reopening areas to harvesting' will be used in conjunction with the code of practice in relation to threatened species issues. For example, voluntary fishing closures could be used as a mechanism for avoiding areas with threatened and protected species issues.

E1.4.2 Effectiveness of Measures to Protect Threatened and Protected Species

It is clear from the results of the eight-part tests (Section B2.5.5, Appendix B6) that there is little risk to threatened or protected species from current operations of the Abalone Fishery. As the fundamental nature of harvesting or area of operation of the fishery would not change under the draft FMS no specific measures to further protect threatened or protected species from the fishery are necessary. In fact, proposed management responses in the draft FMS are likely to enhance the protection of threatened or protected species (see previous section). The fishery code of practice will reinforce the need for divers to exercise due care around threatened and protected species and provide divers with the means to receive and contribute to new information relevant to threatened and protected species and where abalone are harvested as it becomes available.

E1.5 Other Species, Assemblages and Habitat

Despite limited knowledge of the effects of abalone fishing to components of the biophysical environment other than the target species it was considered that the overall risk to other species, assemblages and habitat was generally low under the existing fishery (Section B2.6).

Regardless, some management responses are proposed in the draft FMS to expand and develop an existing program for monitoring the effects of harvesting abalone on ecosystems as well as increasing knowledge about potential interactions where information is limited (Table E1.5). The monitoring program (MR 1a) is proposed to consider the use of the most appropriate indicator species, the frequency of sampling and possible expansion of monitoring into more areas closed to commercial fishing to provide data on 'reference conditions'. The fishery code of practice will contain details of 'best practice' for harvesting to ensure divers can minimise potential impacts on the ecosystem. It is proposed that the code of practice be adaptive to incorporate new knowledge and techniques as information emerges. Management responses for improving communication between managers and divers (MRs 3.1f and 8.1b) would assist with incorporating and applying knowledge where it is required. These management responses would probably have little impact to the overall risk from harvesting to other species, assemblages and habitat.

In addition, depletions of mature stock of abalone by the commercial fishery at various spatial scales would affect other species, assemblages and habitat. The draft FMS addresses the potential for such depletions (and risk to other species, assemblages and habitat) through management of fishing effort, potential changes to the MLS of abalone at regional and more local scales, etc. (Section E1.2.1).

Management responses with the greatest potential for changing overall risk to other species, assemblages and habitat are those proposed for restoring populations of abalone by reseedling and translocating abalone or by harvesting sea urchins (MRS 2.2d-f). As discussed in Section E1.2.1, these techniques offer considerable potential for rebuilding populations of abalone at local scales and reducing the risks from the commercial fishery and particularly from external factors (e.g. theft of abalone) in causing localised depletions. As specific details for these techniques are yet to be developed it is not possible to assess the risks associated with each management response precisely. As such, the general assessment of the risk of each management response to other species, assemblages and habitat given below is consistent with the level of detail in the proposals.

Table E1.5 Proposed management responses in the FMS that aim to directly reduce risk to other species, assemblages and habitat.

Management response (& key feature)	Issue addressed	Information gap addressed
1.1a – Increase knowledge of bycatch, other species and ecosystems	Lack of understanding	Lack of information
1.1b – Code of Practice	“ ”	“ ”
2.2d - Reseeding	Recovery programs	Ecological impacts of reseeded
2.2e - Translocating	Recovery programs	Ecological impacts of translocation
2.2f – Sea urchin harvesting	Recovery programs	Ecological impacts of habitat rehabilitation
3.1f – Communicate fishery operational plans and policies to Industry	“ ”	“ ”
6.1a – Research program	“ ”	“ ”
8.1b – Improve communication between management and nominated divers	“ ”	“ ”

The nature of these management responses is such that potential effects to other species, assemblages and habitat would be restricted to local scales in most cases. All three of these management responses for restoring depleted populations of abalone (i.e. reseeded, translocation and harvesting sea urchins) are proposed to be experimental and confined to < 1% of reef in water depths of < 20 m.

Reseeded, translocation and the harvesting of sea urchins have potential to affect the existing wild stock, in terms of competition and effects to genetic diversity (as discussed in Section E1.2.1), but may also affect other trophic levels. It would be precautionary to assume that as a consequence of restoration, something would change in some level of the ecosystem, whether it is the food source of abalone, predators, competitors, or some other interaction. The harvesting of sea urchins, if not managed appropriately, could indirectly cause rapid changes to assemblages of algae (Sections B2.6.3 and B2.6.4). It is proposed that this form of restoration is done in conjunction with divers in the Sea Urchin and Turban

Shell Fishery so that some of the sea urchins harvested from areas are not wasted. Further, no proposals are to be authorised until approved with regard to the *FM Act* (this would potentially include a monitoring program). A review of environmental factors, prepared according to DIPNR guidelines, must be used to determine whether a separate EIS would be required before such an activity can be authorised under the *FM Act*.

The reseeded of reefs with hatchery reared juvenile molluscs and translocation of abalone between reefs to restore populations raises some issues in relation to adverse impacts on the ecology of the reef ecosystem. Some of these, as related to the target species, are discussed in Section E1.2.1. Others are, for example, that the movement of abalone from one area to another may spread disease and pests that affect other species of molluscs. Also, there would be potential effects to competitors of abalone if abalone were seeded or translocated into areas where they were not naturally present or at densities greater than natural levels. As the intent, however, is to use these techniques to rebuild it is unlikely that such situations would arise. Rebuilding populations of abalone would potentially restore the ecosystem to a state closer to how it was prior to any depletions of abalone. The proposed management for translocation and reseeded is: that no proposals are to be authorised until approved with regard to the *FM Act* (this would potentially include a monitoring program). A review of environmental factors, prepared according to DIPNR guidelines, must be used to determine whether a separate EIS would be required before such an activity can be authorised under the *FM Act*.

The overall risk to food, predators and competitors of abalone and habitat was determined to be low under the existing fishery (Section B2.6.1-4). This was because abalone generally were not considered to have a great impact on the ecosystem in which they live. With appropriate controls, the consequences of experiments to restore populations of abalone that involved reseeded, translocation and harvesting sea urchins would remain minor (i.e. 'abalone do not play a keystone role and there would only be minor changes in relative abundance of other species'; Table A5 of Appendix B5) with no changes to likelihood. As such, there would be no change to overall risk. The likelihood of translocation would increase under such proposal to occasional, but this would not change the overall risk from low.

Table E1.6. Summary of the risk from the operation of the fishery on several aspects of other species, assemblages and habitat. Definition of the terms in the table as per Fletcher *et al.* (2002). NB. Bold terms indicate where ‘consequences’, ‘likelihoods’ or ‘overall risks’ have changed.

Issue	Spatial scale	Consequence of activity	Likelihood of activity	Overall risk
Food of abalone	All	Minor	Rare	Low
Predators of abalone	All	Minor	Unlikely	Low
Competitors	All	Minor	Possible	Low
Translocation	All	Minor	Occasional	Low
Habitat - Direct effects	Local	Minor	Occasional	Low
- Indirect effects	Local	Minor	Occasional	Low
	General	Minor	Possible	Low

E1.6 Assessment of Performance Reporting, Monitoring and Research Regime

The performance reporting and monitoring regime described in Section D4.0 of the draft FMS is considered to be appropriate in terms of the information requirements and the suitability of performance indicators and trigger points necessary for monitoring the impact of the fishery on the target species. These measures are all appropriate to the scale of the fishery. The research and development plan for the fishery described in Section D5.0 of the draft FMS lists stock assessment projects as a high priority. Further, the research plan is also responsive to the new management measures proposed in the draft FMS to reduce risk to the target species from the operation of the fishery and from external factors. For example, the research plan proposes projects for rebuilding biomass at local and regional scales and to address the effects of *Perkinsus*.

The full performance reporting and monitoring regime for monitoring the impact of the fishery on other biophysical components of the ecosystem (i.e. threatened, other and bycatch species, assemblages of species and habitat) is not yet determined. Performance indicators and trigger points will be developed as information becomes available under a program to increase knowledge about the effects of the fishery on other biophysical components of the ecosystem. The research plan is responsive to this need and lists the project as a low priority relative to other needs of the fishery (Section D5.1). Research on this issue is proposed to be

done in collaboration with other Institutions. Performance indicators and trigger points for monitoring the impact of the fishery on other biophysical components of the ecosystem involve how commercial divers adhere to the relevant sections of the fishery code of practice. Although the code of practice is potentially an important tool for managing the impact of the fishery on the ecosystem by detailing 'best practice' operations for harvesting, the ability to collect information about breaches of the code is limited.

E1.7 Conclusions

It is expected that the draft FMS will not result in any increase to the risk of impact from the commercial fishery on biophysical components of the environment. Indeed, it is expected that the risk of impact to many components would be reduced under the draft FMS. In particular, moderate to high risks to components of the target species under existing operations would be reduced under the more complete harvest strategy proposed, and commitment to developing the fishery code of practice would contribute to a better understanding and management of the ecosystem in which abalone live. Again, although appraisals are made of the effectiveness of measures proposed, only by monitoring the implementation of these measures will it be possible to fully determine whether they are sufficient to reduce risks associated with the Abalone Fishery.

E2.0 ECONOMIC ISSUES

E2.1 Introduction

It is the NSW Government's intention to promote a viable commercial abalone fishing industry, consistent with ecological sustainability and to ensure cost-effective and efficient management and compliance. A number of measures are proposed in the draft FMS for achieving these goals and for reducing the risk to economic viability. This section outlines the potential change to the economic viability of the fishery as a result of implementing the draft FMS, and draws upon a report on economic issues associated with the NSW Abalone Fishery prepared by Dominion Consulting Pty Ltd (reproduced in Appendix CR1). The assessment is predicated on the secure property right established through the statutory share management arrangements for the fishery, and the continuation of the independent TACC setting and quota allocation system. That is, these arrangements provide the foundation for the long term viability of the fishery.

E2.2 Profitability and Productivity in the Fishery

The main drivers of profitability in the fishery come from changes to revenue as a consequence of changes to beach price or TACC. The draft FMS cannot control beach price but it does propose a number of measures that aim to reduce the risk of decline to the TACC and for rebuilding stocks. For example, there are management responses that aim to reduce illegal catch, manage the effects of *Perkinsus*, explore the potential of reseeded abalone (using experimental trials) and alternative size limits.

As noted in Chapter B3, the viability of the fishery is predominantly influenced by the abundance of harvestable abalone, as reflected in the level of the TACC, and the market 'beach price' for abalone. The scale of the fishery, especially when the TACC and/or the beach price is relatively low, makes the generally fixed costs of business operations and management disproportionately large, particularly relative to the NSW Abalone Fishery's competitors. Shareholders would be expected to be able to meet these costs by adjusting their business operations provided that revenue did not drop significantly. However, this may not be the case, at least in the short term, due to the current declining trend in TACC and recent low beach prices. Consequently, Industry adjustment may be inevitable, regardless of the management regime put in place.

The draft FMS signals the intent to develop and implement a structured and orderly approach for structural adjustment in the fishery, with respect to capping and potentially reducing the number of divers (and associated labour and capital costs). However, the effectiveness of this response cannot be assessed as the detailed arrangements to achieve this intent are yet to be determined. (See Chapter C for a description of the broad options under consideration.)

The draft FMS also includes other responses that should support the viability of the fishery, particularly with respect to providing greater flexibility for shareholders to adjust to the variable TACC and beach prices. These responses include reducing the minimum number of shares that can be traded from 10 to one share, and removing the 6 percent cap on maximum shareholdings. The response to examine ways to improve Industry's preparedness for significant variations in the TACC or beach price may also lead to the development of more flexible tools, such as potential changes in the setting of the TACC to dampen the impact of the variability of abalone stocks or the concept of a sinking fund that could be drawn on during periods of low TACC/prices.

Additionally, the cost-effectiveness of fisheries management services and management service delivery mechanisms is to be critically evaluated under the draft FMS. The draft FMS seeks to increase the effectiveness of expenditure in improving long term viability.

The recent change to the method for calculating the community contribution should reduce the risks to fishery economic viability, through the better linkage the performance of the fishery and the level of the contribution.

E2.3 Assessment of Performance Reporting, Monitoring and Research Regime

The performance reporting and regime for monitoring the economic viability of the fishery described in Section D4 of the draft FMS is considered to be adequate in terms of the information requirements and the suitability of performance indicators and trigger points.

The current monitoring regime has proven inadequate because market monitoring of share and quota transfers has proven difficult due to infrequent transactions, thereby failing to provide sufficient data to trigger this performance indicator. Lease prices can possibly be used to supplement share price analysis, but the lease price data is not currently collected in the fishery.

It is preferable to have a range of economic indicators based on revenue rather than share-value measures. For example, if beach prices are significantly down, it would be expected that revenue, and potentially the net return to shareholders, would reduce. Subsequently, there may be negative impacts in the market for shares.

Although net returns to shareholders and divers would be the preferred measure of economic viability in the fishery, these require a range of data, of which some is difficult to collect for reasons of privacy. Examples include information about the payments by shareholders to nominated divers and the costs to divers of harvesting.

The new measures proposed in the draft FMS for monitoring the economic viability of the fishery are based on revenue, but also indicate net return. These are catch rate, beach price, TACC and management charges. These performance measures should reflect the economic viability of the fishery more directly than indicators related to shares and are likely to highlight problems immediately so that remedial action can be instigated in appropriate time-frames.

Monitoring cost effectiveness and efficiency of management services requires the development of the existing management regime to include additional performance monitoring. The basis of efficiency and cost effectiveness of management would be the definition of services to be delivered and the standard required by industry, the client bearing the cost. These details will be presented in service delivery agreements between DPI and the abalone industry. Part of these agreements will be performance appraisal. In fishery management, the performance can be benchmarked against alternative management regimes in other comparable fisheries.

E2.4 Conclusion

The draft FMS addresses key problems, but is unable to address fundamentals affecting the economic viability of the fishery such as the trends in market prices for abalone and external factors affecting the stock. The fishery is significantly affected by variations in the abundance of harvestable abalone, as reflected in the TACC, and beach prices for abalone, particularly when low TACCs and prices coincide or prevail for prolonged episodes. For these reasons, sound management of the stock is important, particularly a policy of rebuilding harvestable biomass, which should lead to an eventual increase in the TACC.

However, the small size of the fishery limits the funds available for initiatives to enhance and protect the fishery. The draft FMS shows intent to explore new initiatives in management and for rebuilding the stock, and to establish an approach for structural adjustment. The draft FMS also specifies actions to provide greater flexibility for the fishery and its shareholders to adjust to the variable nature of the TACC and abalone prices, namely changes in the number of shares that can be traded or held, and potential changes in the way that the TACC is set or new financial strategies (e.g. a sinking fund). Such proposals are essential to the economic health of the fishery, whilst noting that in some cases the proposals are subject to further development. The long term profitability and productivity of the fishery requires action in the face of *Perkinsus*, illegal fishing and other external threats.

In summary, fluctuations in market prices for abalone will continue to pose a threat to operator profitability but are beyond the control of Industry. Shareholders and divers are expected to adjust their fishing operations and explore alternatives for marketing their products in order to remain viable. In addition, more effective measures for monitoring the economic viability of the fishery will give a better understanding of the status of the fishery. Overall, the current situation for the fishery is expected to improve, as management responses proposed in the draft FMS should have positive impacts on the overall economic viability of the fishery.

E3.0 SOCIAL ISSUES

E3.1 Introduction

Social issues arising from implementing a new management plan fall into several categories. Firstly, there are socio-economic impacts arising directly from how the draft FMS impacts the resource and consequently the social system in the community. Secondly, the draft FMS brings changes, with social issues to be addressed by Industry and other groups such as Indigenous communities. The socio-economic impacts are most readily quantified. Other measures of the capacity and willingness of Industry or other groups to respond or incorporate change are more difficult to estimate and require substantial consultation and communication.

The assessment is constrained by the available information, the resources available to the study and the lack of adequate background information in this emerging area. This section outlines the potential change to social issues associated with the fishery as a result of implementing the draft FMS, as assessed in reports by Dominion Consulting Pty Ltd (Appendix CR1) and Umwelt Pty Ltd (Appendix CR2).

E3.2 Changes to Risks to Shareholders, Divers, Deckhands and Local Communities

E3.2.1 Employment

Under the share management system the Abalone Fishery directly supports shareholders, divers and deckhands. Arrangements under the draft FMS are unlikely to create additional jobs in the catching sector as the total number of divers is proposed to be limited to 42 or possibly reduced. The abalone processing sector may gain some additional jobs as it is expected to continue to develop new value added products. The level of employment would be expected to vary to some degree over time in response to changes in the TACC and/or beach prices.

Share management has given greater security for the families of share owners and, to some degree, divers and deckhands. On the death of a shareholder or for any other reason a shareholder can no longer operate, his/her family can employ a nominated diver and still

receive an income from the business. If they chose to sell their shares and exit the fishery they can do so.

The time operated by each diver depends on a range of factors such as skill and experience and the area being fished. Although the quota system has given more flexibility to when divers collect abalone, closing and re-opening fishing areas and potential regionalisation of catch, may require divers to adjust their fishing operations. The impact of any changes will be dependent on the approach determined (see Chapter C for a description of the options under consideration).

E3.2.2 Equity Issues

In the design of the share management system there were concerns about the potential for concentration of ownership. To date these have not been realised. The draft FMS proposes to remove the current shareholding aggregation limit of 6% (MR 4.2a). Larger shareholdings would increase the capacity of shareholders to adjust their businesses in response to quota and market variations and thus maintain economic viability of their businesses.

Many of the young divers may be able to run their diving as a viable business and can invest in shares themselves through time, but they may not become endorsement holders unless they buy an existing shareholding of 70 or more shares with an attached endorsement. The economic survey indicates divers will not be able to gain entry to ownership from providing diving services in the current climate. Not having this incentive of ownership even in the future, risks having a fishery where divers are short term in perspective and may be open to malpractices as a way to get ahead. Mechanisms to enable diver numbers to reduce through adjustment out of the fishery are improved in the Draft FMS, although the details are to be determined.

Sharing resources between the commercial and other sectors (e.g. recreational and Indigenous) is likely to be an issue which needs to be addressed (See also Section E3.3). However, this is beyond the scope of this EIS.

E3.2.3 Compliance, Monitoring and Enforcement

The black market for illegally harvested abalone is lucrative and may involve suppliers, handlers, buyers and distributors. The draft FMS proposes management responses that should have a positive impact on controlling illegal activities in the fishery.

In addition, greater involvement of shareholders and divers in developing and implementing fishery policies should create a stronger incentive for divers to be more responsible and accountable for their behaviour in conducting fishing operations and hence increase compliance in the fishery.

E3.3 Changes to Risks to Indigenous Peoples

E3.3.1 Traditional Fishing and Access

There is minimal potential for commercial diving activities described in the draft FMS to impact on Aboriginal archaeological sites. In general, the physical evidence of past Aboriginal occupation along the NSW coast is severely threatened by land uses and activities other than abalone fishing. For example, many large midden sites along the coast (principally on estuarine shorelines) were exploited for lime in the nineteenth century, and sometimes also for road base. Many sites have also been destroyed by agricultural land uses, and urban and tourist development, as well as ongoing and/or accelerated coastal erosion.

There is no evidence of impacts of abalone diving on gazetted Aboriginal Places or traditional Aboriginal community fishing sites (cultural fishing). The measures to enhance Aboriginal participation in ABMAC and improve communication between the commercial sector and the Aboriginal community on the south coast will help to improve awareness of any interactions with places of cultural value, so that appropriate management strategies can be developed where necessary. Although the risk of abalone diving to Aboriginal sites and places is very small, the draft FMS offers potential to further reduce any impacts.

Apart from measures to protect abalone stocks, the fishery code of practice, which accompanies the draft FMS, identifies two actions directly relating to Aboriginal sites and places.

1. Be aware of known locations of items and sites of significance to Indigenous people and become aware of newly discovered locations as this information becomes available.
2. Harvest around the location of items and sites of significance to Indigenous people in an appropriate manner that respects the value of the items and sites to Indigenous people.

E3.3.2 Community Well Being

The Indigenous Fisheries Working Group (IFWG) estimates that 80% of Aboriginal people on the NSW south coast are unemployed. This situation clearly poses serious stresses on all aspects of community wellbeing. Although the community social issues cannot be attributed to a significant extent to fishery regulation, and specifically to the management of the Abalone Fishery, there are currently clear contributing factors such as definition and enforcement measures for bag limits and lack of current employment in the commercial abalone sector.

The draft Abalone FMS offers some measures that can contribute to the resolution of these very large community concerns. Enhanced Aboriginal participation in ABMAC and encouragement into the commercial fishery, particularly if supported by DPI, to foster information transfer to local Aboriginal communities should help overcome significant social and economic conflicts. Improved communication, improved cultural awareness and improved resource information should also help to create the conditions where other skill development and business/employment relationships can gradually be developed. Similarly, fostering understanding by Indigenous communities of the commercial harvest sector should lead to a long-term increase in the skills and experience in the community relating to the management and harvest of the abalone resource.

If effectively implemented, the draft Abalone FMS offers a reduced risk to Aboriginal community well being than is currently the case. However, some of the issues contributing to poor community well being are outside the scope of any individual FMS and require broader policy consideration by governments and communities.

E3.3.3 Indigenous Fisheries Strategy

The Implementation Plan that accompanies the Indigenous Fisheries Strategy (IFS) identifies actions for 2003 and 2004, and the progress towards priority actions is monitored by the IFWG. The contribution of the IFWG extends well beyond the Indigenous Fisheries Strategy itself and includes advice on the development, consultation process and implementation of fishery management strategies in all sectors. The IFWG plays a pivotal role in supporting Indigenous community participation in fishery management.

Relevant actions from the IFS Implementation Plan that will help to promote ecologically sustainable and culturally appropriate practices in the Abalone Fishery as noted below, together with an indication of the extent to which the draft FMS adopts this approach.

Table E3.1. IFS input to draft Abalone FMS

IFS Action	Comment
Develop and facilitate a model for community input to fishery management planning (and marine park management) and progressive involvement in fishery management strategies (to be completed in 2004).	Current IFWG suggestions for a regionally based “expert panel” approach to community consultation have not yet been adopted. However, the draft FMS does recognize the need for changes to the level of support for Aboriginal community representatives on ABMAC.
Review current Indigenous cultural access to fisheries, review options with IFWG and prepare advice after reviewing input from communities.	IFWG contributes substantially to Indigenous input to this assessment. Improved Indigenous participation in ABMAC could contribute to greater support from Industry for a more culturally sensitive allocation of bag limits (and simpler permit systems), and application of enforcement measures. It may, over time, also open the way for new employment partnerships. Other aspects of Indigenous access to traditional resources are outside the area of influence of the draft FMS.
Cultural awareness training for all existing DPI staff, all management advisory committees and new DPI staff (as part of Induction).	Draft FMS supports awareness raising activities and recognises that these need to be ongoing.
Project manager to identify strategies to maintain levels of Indigenous involvement in commercial fishing. This is a very high priority for the IFWG.	The poor level of Aboriginal community participation in the commercial Abalone Fishery has been noted, as has the history of licence allocation. The draft FMS does not directly address Aboriginal employment in the commercial sector, but may create circumstances where this becomes feasible.
Review aquaculture and commercial fishing opportunities, consult with IFWG and prepare advice to communities on the skills required to sustain these businesses.	Draft FMS acknowledges need for skill enhancement for Aboriginal community to increase participation in fishery management as well as commercial fishing. Improved communication about resource constraints is also critical.

E3.4 Changes to Risks to Heritage

With low risk to historic heritage from current operations, the appropriate responses in the draft FMS relate to procedures for monitoring shipwrecks (for instance locations, frequency and consequence) and reporting any incidents that do occur.

The operation of the Abalone Fishery presents an opportunity to reduce the risk to historic heritage by contributing to improved spatial data about the locations of shipwrecks. This is proposed through the fishery code of practice. Abalone divers may from time to time encounter shipwreck remains on the sea floor. When divers encounter shipwreck remains they could report location (GPS co-ordinates, water depth) and any other information they detect about the structure to the NSW Heritage Office and DPI. This information would be added to the data base, so that all divers can be alerted about potential obstacles on the sea floor (with heritage and safety implications), and the Heritage Office will have more accurate information about the location of shipwrecks.

To assist awareness of abalone divers of the potential for historic shipwrecks to be encountered in their routine activities, shareholders and divers will be provided (through the code of practice (abalone fishing)) with basic information about their responsibilities under the *Heritage Act (1977)*, including the provisions relating to damage to structures, exclusion zones and collection of any historic artefacts that may be observed.

E3.5 Changes to Health Risks to Divers and Consumers

E3.5.1 Divers

Diver safety will be given particular consideration within the draft FMS (Chapter D) through the fishery code of practice. The code has potential to incorporate recommendations regarding minimum safety standards, including safe diving and boating practices that could reduce the danger to divers and deckhands.

E3.5.2 Consumers

Although the health risk to consumers is minimal, the fishery code of practice will have specific provisions relating to handling practices to ensure the product is treated appropriately. Protocols for maintaining hygiene and cleanliness, keeping good records and keeping products cool will be applied to the handling of abalone in the catching and processing sector.

E3.6 Assessment of Performance Reporting, Monitoring and Research Regime

The performance reporting and regime for monitoring social issues in the fishery described in Section D4 of the draft FMS is considered to be adequate in terms of the information requirements and the suitability of performance indicators and trigger points.

The key social issues that require monitoring are:

- Appropriately sharing abalone resources (Goal 5);
- Indigenous issues; and
- Heritage issues.

The abalone resource should be shared by resource users in a way that minimizes negative social and economic impacts in the fishery (Goal 5). Although the abalone resource is currently exploited by commercial, recreational and Indigenous divers, there is little information about how the catch is shared between sectors. This will change with the development of the Indigenous Fishing Strategy and Implementation Plan and the research proposal in the draft FMS for improving estimates of recreational and illegal catch.

Performance reporting of the minimisation of conflict between sectors requires feedback from different sectors represented on ABMAC. The performance of Industry in recognising culturally significant areas requires communication with the Indigenous groups. The draft FMS proposes to improve communication between the commercial sector and other sectors.

The fishery code of practice is one of the major monitoring initiatives in the draft FMS. It is adaptive to the needs of the fishery. For example, including new information on heritage and culturally significant areas as it becomes available. Performance reporting is based primarily of self assessment by the Industry but also by DPI as the regulatory authority under which the fishery is occurring.

E3.7 Conclusion

The *Review of Existing Operations* (Chapter B) identified some social risks from current operations, including: illegal fishing and marketing activities; reduced employment opportunities; limited alternative employment opportunities; and other risks related to health and safety risks, conflicts, non-compliance, equity and the well-being of Indigenous communities. Most of these risks will be reduced under the draft FMS. For example, illegal fishing and marketing activities are likely to reduce as the draft FMS proposes to increase

monitoring of illegal activities and increase penalties. An internal industry communication program to report illegal catch is proposed as well as new requirements for processors.

The fishery code of practice will be a major tool in reducing social risks as it will cover areas such as health and safety of divers and culturally and historically sensitive objects and places.

The risk of increasing conflicts is likely to reduce as the FMS proposes to manage the fishery in a manner consistent with the Indigenous Fisheries Strategy. The draft FMS proposes to increase awareness among commercial abalone divers about traditional cultural values, and ensure specific consultation occurs with Indigenous stakeholders and interested groups in the fishery. Some conflicts, however, with other resource users such as recreational and Indigenous divers may still need to be addressed at a broader policy level than this FMS.

CHAPTER F JUSTIFICATION OF PREFERRED OPTIONS IN THE DRAFT FMS

Earlier chapters have described the operation of the Abalone Fishery in NSW in relation to mode of operation and management, and risks associated with the fishery as it currently operates and is proposed to operate under the draft FMS.

This chapter provides an overview of how the fishery is proposed to operate and presents a justification of the preferred strategy.

F1.0 THE NEED FOR THE ABALONE FISHERY

This section examines the need for undertaking the fishing activity proposed in the draft Fishery Management Strategy (FMS) and the consequences of not undertaking the activity. The Abalone Fishery exists because it satisfies a number of significant community needs, each of which is discussed below.

Should the Abalone Fishery not continue, some of the resources used by the fishery would become available to other users, or would contribute to ecological processes in reef environments. However, abalone can not be legally taken by other commercial fisheries in NSW and it is unlikely that increased catches by other resource harvesters would offset the loss of product if the Abalone Fishery ceased to operate.

F1.1 Economic Considerations

The value of the Abalone Fishery at point of first sale is in the order of \$10 million per year, which varies annually according to the TACC and the beach price. The processing sector has a turnover of between \$10 - 20 million per year. As the fishery and most of the processing sector is located on the south coast of NSW, this provides a significant input to the economy of the region and has multiplier effects. All businesses contribute to the local economy through the purchase of inputs needed for harvesting and processing. In addition, shareholders pay a community contribution for privileged access to a community resource.

The economic survey conducted during the preparation of this EIS, and other studies undertaken on the expenditure of commercial operators in NSW (see McVerry, 1996), have shown that around 27% of expenditure from fishing businesses moves outside the region of operation. Therefore approximately 73% of the first sale value of the catch stays within the communities where fishing takes place. This translates to approximately \$5.5 million of fishing revenue generated from the Abalone Fishery that was potentially spent locally in 2003.

F1.2 Employment Considerations

As at February 2005 there were 48 fishing businesses in NSW with shareholdings in the Abalone Fishery, comprising approximately 34 divers and 37 deckhands. This is a total of 119 people employed directly on a full time or part time/casual basis in the harvesting

sector of the Abalone Fishery. It has been estimated that the processing sector employs 106 people, giving a total of 225 people directly dependent on the fishery.

Although more investors are becoming shareholders in the Abalone Fishery, the abalone harvesting community tends to focus around key ports on the south coast such as Ulladulla, Batemans Bay and Eden, where unemployment rates are generally higher than in the larger cities. The presence of abalone divers and processors in a port also encourages the development of significant infrastructure for the supply of fuel, vessel maintenance and transport of product. The people employed in such businesses are at least partly dependent on the fishery. Studies of employment flow-on effects indicate that for each job created in the Abalone Fishery, approximately 1.5 jobs are created in the broader community, so the Abalone Fishery contributes indirectly to the employment of more than 111 people on either a full time or part time/casual basis in NSW.

F1.3 Supply of Seafood

Over the last ten years, the Abalone Fishery has provided, on average, about 300 tonnes of abalone annually for general consumption, although in recent years the TACC has declined to 206 tonnes for 2004-05 fishing period. Most of the abalone are exported to Asian markets and less than 10% is consumed locally. The supply of abalone to local markets by commercial divers satisfies demand from Australian consumers who do not wish to, or are unable to, venture out and catch abalone themselves. The NSW Abalone Fishery supplies mostly live abalone with only a small proportion of the catch canned, frozen on shell, par-boiled on shell, chilled or sold as frozen meat, depending on demand at the time for a particular product.

F2.0 JUSTIFICATION OF MEASURES IN THE DRAFT FMS IN TERMS OF THE PRINCIPLES OF ECOLOGICALLY SUSTAINABLE DEVELOPMENT

Ecologically Sustainable Development (ESD) was defined under the National Strategy for ESD as “*development that improves the total quality of life, now and in the future, in a way that maintains the ecological processes on which life depends*”. It can be achieved through the following principles and programs described in Section 6(2) of the NSW *Protection of the Environmental Administration Act 1991*:

- Precautionary principle;
- Intra-generational equity;
- Inter-generational equity;
- Conservation of biological diversity and ecological integrity; and
- Improved valuation, pricing and incentive mechanisms.

The Abalone Fishery collects a single species using a single method and is managed by a combination of input and output controls, including restricted entry, a total allowable commercial catch (TACC) and a minimum legal size limit.

The draft FMS (Chapter D) proposes objectives and management responses for the fishery under eight broad goals, having regard to the risks identified in the existing management regime (i.e. Part II of Chapter B). The preferred suite of rules (including management objectives and responses) contained within the draft FMS provides for appropriate allocation of the resource and incorporates the controls necessary to achieve ecological sustainability.

The draft FMS provides a broad framework for managing the Abalone Fishery that describes programs to be implemented under each of the eight broad goals; some of which are immediate actions, others are longer term programs with a development or investigation stage and a need to undertake further stakeholder consultation built in. For these longer term programs, it is often inappropriate for the draft FMS to develop fine details at this stage, because further information would be acquired through time and conditions may change. In order to ensure that the fishery operates in an ecologically sustainable manner

into the future and the risks are meaningfully reduced, it will be important to ensure that the strategies and plans that are subsequently developed under the FMS are implemented to fulfil the goals and objectives for the fishery and that Industry and regulators are flexible enough to adapt the FMS to changes. With this qualification, it can be stated that the draft FMS addresses the principles of ESD as discussed below.

F2.1 Precautionary Principle

The precautionary principle is defined in the May (1992) Intergovernmental Agreement on the Environment as:

“where 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” (Deville and Harding, 1997)

The introduction of the precautionary principle has, as described by Deville and Harding (1997), shifted the ‘onus of proof’ regarding impacts away from regulatory bodies and more towards those whose actions may cause damage. Those undertaking the activity are required to justify conclusions that the activity will not have serious or irreversible impacts on the environment, which exceed the long-term benefits of the action (Deville and Harding, 1997).

As recognised in the assessment guidelines under which the EIS was prepared (Appendix A2), scientific research into the size and characteristics of shellfish and finfish stocks is inherently complex and costly. Shellfish and finfish populations and the aquatic environment inhabited by them are extremely dynamic. This means that the level of scientific uncertainty associated with shellfish and finfish stocks and aquatic communities is generally high, especially for species that are of low commercial or recreational value. This situation is by no means unique to NSW or indeed Australian fisheries. It is important to note, however, the considerable resources that are currently being contributed by abalone shareholders and the NSW government to the existing stock assessment process for the abalone resource in NSW (including extensive monitoring and modelling of the resource).

Many of the management rules that have been applied to the Abalone Fishery, such as using minimum size limits and setting a TACC, have been adopted on a precautionary basis to provide an ‘insurance policy’ against over exploitation. For example, under the *Fisheries Management Act 1994* the TAC committee is required to take a precautionary approach in

setting the total allowable catch. The measures proposed in the draft FMS embrace this approach by continuing the existing controls on fishing and by proposing new initiatives to deal with the uncertainty surrounding the impact of abalone harvesting on incidental species and habitat. For example, developing a code of practice is a positive precautionary step that will minimise the impacts (known and presumed) of abalone harvesting on the environment. Additionally, the research programs proposed to investigate the impacts of removing abalone above the minimum legal size on associated species and ecosystems proactively address the information deficiencies in those areas.

The performance monitoring system established by the draft FMS also provides a necessary safeguard in case there are changes in either the operation of the fishery or stock levels, which could compromise the long term sustainability of the fishery.

F2.2 Intragenerational Equity

Intragenerational equity requires that the costs and benefits of pursuing ESD strategies are distributed as evenly as practicable within each generation (i.e. within the Abalone Fishery but also among the fishery and other parts of the community).

Intragenerational equity in the context of the Abalone Fishery is not as complex as many of the other commercial fisheries in NSW. It is a single species fishery and abalone cannot be taken legally by other commercial fisheries in NSW. As no other species are to be taken for commercial sale by the fishery there is no conflict with other commercial fisheries. Abalone are taken by other user groups, however, such as recreational and Indigenous divers. The Department of Primary Industries has an Indigenous Fishing Strategy and a permit can be issued that allows Indigenous people to exceed the recreational bag-limit if abalone are to be collected for special cultural events. There are fisheries for the same species of abalone in the other southern states. Apart from the issue of allocation of the resource, there is little overlap between the activities of the users (i.e. commercial fishing, recreational fishing, boating, swimming etc.).

Citizen participation in developing and implementing government policies can (1) improve relationships between stakeholders, which can increase their ability to work together toward management objectives; (2) increase the capacity of citizens or agencies to participate constructively in management by providing them with skills, experience, or knowledge; or (3) change beliefs, attitudes, or behaviour to help management processes occur more

smoothly. The Commonwealth and NSW State legislations require public consultation in the preparation of fishery environmental assessments. The EIS (including the FMS) process included public consultation and the FMS document promotes "... adequate stakeholder involvement and community consultation".

If the eight broad goals of the draft FMS are realised, the current generation would have the same or improved opportunities to benefit from the valuable abalone resource. Some management measures proposed within the draft FMS to achieve these goals, and hence intragenerational equity, include:

- Proposals to update and refine estimates of the size of the total catch of abalone (including recreational, Indigenous and illegal catches) so that the distribution of the resource is known, and performance measures are to be put in place to monitor and manage the distribution of catches over time.
- Continuing to ensure that the Abalone Management Advisory Committee (ABMAC) communicates effectively with all stakeholders in the fishery. ABMAC has a central role of communicating the needs of all the stakeholders in the abalone resource and can provide the means of facilitating arrangements that may increase opportunities and education as required to particular stakeholder groups. The draft FMS proposes that Indigenous representation on ABMAC is made more effective so the needs of this group are communicated more effectively.

The measures in the draft FMS distribute, as far as practicable, a fair and equitable sharing of the fisheries resource amongst the commercial sector, within broader resource sharing arrangements. Limiting the total catch in the fishery is important to both avoiding overexploitation and appropriately sharing the resource among commercial divers and other legitimate users. The TAC Committee sets a TACC annually, following consideration of the most recent estimated weights of recreational (including Indigenous) and illegal abalone catches. Individual transferable quotas are allocated to shareholders in the commercial fishery in proportion to the number of shares held. The operation of the fishery provides fresh local seafood to satisfy an ever increasing consumer demand for seafood, particularly a high value species, such as abalone. Fishing closures, such as those in marine parks and aquatic reserves, share the resource between users and the community by specifying areas where harvesting may or may not occur.

The cross-jurisdictional liaison, and the development of a code of practice proposed in the draft FMS all promote equity of access to the physical environment used by abalone divers and others in the community. Additionally, being a category 1 share managed fishery, abalone shareholders are required to make a periodic contribution to the community for their right to access a community owned resource.

F2.3 Intergenerational Equity

Intergenerational equity requires that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

In the context of the Abalone Fishery, intergenerational equity consists of ensuring the fishery operates in a manner that minimises the impact to habitat, bycatch and threatened species, populations and ecological communities, as well as maintaining abalone stocks at sustainable levels for future generations.

The eight broad goals proposed in the draft FMS, would provide future generations with at least the same and hopefully improved opportunities to benefit from the valuable natural resources which the current generation enjoys. Some management measures proposed within the draft FMS to achieve these goals, and hence intergenerational equity, include:

- Development of a fishery code of practice to address issues such as best practice techniques, handling of bycatch, reporting of interactions with threatened or protected marine species, regard for heritage items etc.
- Continued setting of a total allowable commercial catch (TACC) for abalone annually by an independent Total Allowable Catch Setting and Review Committee to protect an appropriate amount of biomass and use of a state-wide minimum legal size to protect an appropriate amount of mature stock.
- Changing the limits of capacity of the fishery including an increase to the limit of aggregation of shares to individual shareholders and the means for controlling the number of divers to promote economic viability.
- Continued development and review of the compliance strategic plan including new measures for deterring illegal activity in the post-harvest sector.
- Development of a research plan that responds to the current and future needs of the fishery.

- Development of a performance monitoring and review program, the results of which will be publicly available.

Abalone shareholders are free to sell their licences and quota to any eligible fishing business, or individual which enables transfers to be made between generations. In addition, there will be substantial benefits to future generations from the recent and continued declaration of a comprehensive, adequate and representative system of marine protected areas (such as marine parks, aquatic reserves and intertidal protected areas) that include a full range of marine biodiversity at ecosystem, habitat and species levels.

F2.4 Conservation of Biodiversity and Ecological Integrity

This principle incorporates the notion that conservation of biological diversity and ecological integrity should be a fundamental consideration in resource decision making. The draft FMS strongly adopts this principle. The impact of the Abalone Fishery upon biophysical aspects of the marine environment has been assessed in the EIS by an initial analysis of the risks associated with the existing management regime. The risks associated with the Abalone Fishery are partitioned into two components related primarily to (1) the retained species and (2) the ecological impacts of the harvest methods used in the fishery on bycatch and associated species, threatened and protected species and habitat. These risks have been fully reviewed and discussed in Chapters B and E.

In addition, one of the eight major goals in the draft FMS is to 'manage commercial harvesting of abalone to promote the conservation of biological diversity in the coastal environment'. Within this goal there are two management responses addressing the objective to 'increase knowledge and minimise any adverse impacts of harvesting legal-sized abalone on bycatch, associated habitats and ecosystems'. The management responses directly address biodiversity and ecological integrity issues by proposing to expand and develop an existing program for monitoring the effects of harvesting abalone on bycatch species and associated habitat and ecosystems as well as increasing knowledge about potential interactions where information is limited. In addition, the draft FMS proposes that a code of practice be developed to incorporate 'best practice' harvesting techniques for minimising the impact of harvesting abalone on non-retained individuals, bycatch species and associated habitat and ecosystems and procedures for minimising the spread of diseases of abalone such as *Perkinsus*. The code of practice would be adaptive to incorporate new knowledge and techniques as information emerges. The code would also include

information about the whereabouts of threatened species within abalone fishing grounds and provision for divers to report on new sightings as they occur.

In conclusion, the draft FMS contains a comprehensive and appropriate package of measures for ensuring that the impacts of the commercial Abalone Fishery on biodiversity are properly managed.

F2.5 Improved Valuation, Pricing and Incentive Mechanisms

This principle relates to the use of schemes including user pays and incentive structures to promote efficiency in achieving environmental goals. The Abalone Fishery is a category 1 share management fishery subject to full cost recovery. In addition, shareholders in the fishery pay a periodic community contribution for their right of access to the fishery, in addition to licensing and management fees. The share management plan for the fishery came into effect in 2000 providing shareholders with a statutory basis for the future of their fishery as well as objectives, performance indicators and trigger points (to be reviewed and updated following finalisation of the FMS) with the aim of ensuring that the fishery remains ecologically sustainable and economically viable. This management framework has provided for the issue of long term shares that are renewed automatically, with statutory compensation payable if shares are cancelled. It has also provided for a market based trading scheme of shares. The share management scheme for the Abalone Fishery has provided greater incentives for stewardship and long term sustainability of the resource because the value of shares when traded are generally linked to investors' views about the health of the fishery and the anticipated returns on investment.

Industry members and DPI have been concerned over the economic viability of the Abalone Fishery in recent years (reflected by a decrease in net return to shareholders) and there are a number of management measures in the draft FMS which aim to promote long term economic viability of abalone fishing. These include:

- Removal of the limit on the aggregation of shares by individual shareholders to allow fishing businesses to raise their shareholdings to a greater level if necessary to remain economically viable.
- Limiting the number of divers in the fishery to reduce the potential for economic inefficiencies, although the means to achieve this are yet to be determined.
- Introducing more cost-effective technological changes to the catch return system.

- Refinement of service delivery through 'service delivery agreements' between providers and recipients.
- A review of established cost recovery arrangements in view of updated information and the current needs of the fishery.
- Development of a code of practice (abalone fishing) for promoting 'best practice' harvest and post-harvest techniques to ensure best returns per kilogram.
- Performance measures of fishing businesses, based on net returns, to monitor trends in commercial viability.
- Arrangements (to be developed) for more efficient use of divers.
- Development of strategies to better enable industry to plan for and adjust to significant variations in the TACC and/or changes in beach prices for abalone.

F3.0 CONCLUSION

The NSW Abalone Fishery harvests a valuable marine resource that makes a significant contribution to the economy and social structure of the State. The fishery is currently based on a rigorous management regime. The ongoing operation and management of the fishery, as proposed in the draft FMS, is clearly justified in terms of protecting the natural environment, maintaining and hopefully enhancing the stock and protecting the interests of participants in the fishery and the community at large.

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