

TAC Committee

Total Allowable Catch Committee Report and Determination for 2010/11

ABALONE FISHERY

30 May 2010

SUMMARY

It is clear that the NSW abalone fishery is experiencing a period of increased productivity (i.e. increased recruitment and/or growth rate), which is now passing through the fishery, as evidenced from the catch rates currently being experienced by fishers. While this is very encouraging, the stock remains at very low historical levels.

A key question is the strength and persistence of the 'pulse' of recruitment currently passing through the fishery, as this will determine both the extent of current stock rebuilding and the future scope of sustainable catches. A second question relates to the extent of recruitment overfishing (i.e. fishing at a level that reduces the breeding stock and the number of young abalone produced) in Region 2 and, potentially, other regions of the fishery. Knowledge of how the stock is responding to previous management measures intended to protect it is also required. Due to a discontinuity in research in the fishery, Total Allowable Catch and Review Committee (the Committee) has very limited information available to it to answer these questions and base its deliberations. There is also ongoing uncertainty about the interpretation of the information which is available.

Industry have expressed great frustration at what they perceive as intransigence by the Committee in relation to its precautionary approach towards using industry observations and submissions, particularly those on the recent substantial increases in CPUE, to underpin Total Allowable Catch (TAC) increases. The Committee remains committed to TAC decisions and minimum size recommendations that will assist in securing the future sustainability prospects, both biological and economic, of the NSW abalone fishery. It believes that until additional information is available such a precautionary approach is warranted.

Efforts by industry, with very limited resources, to implement a finer scale management (FSM) approach that will ultimately result in an alternative and improved system of assessment, management and TAC setting, are commendable. The TAC Committee has been, and continues to be, very supportive of this approach, which combined with the recent concerted effort to build bridges between industry, researchers and managers, augers well for the chances of a sustainable, longer-term recovery.

Management issues

As the Total Allowable Commercial Catch (TACC) has contracted, the number of active divers operating in the fishery, as distinct from shareholders, has also contracted with increased leasing occurring and divers taking multiple shareholders' quota. Restructuring in terms of the share transfers that occurred in the rock lobster fishery is not happening primarily, it is believed, due to the low price of shares and the unwillingness to take losses.

The management objectives, performance indicators and triggers contained in the Fisheries Management Strategy (FMS), are problematical, both in terms of their level of precaution and utility. The Department Industry & Investment (the Department) has acknowledged this problem and the Committee looks forward to their revision.

The efforts by industry and the Department to improve the spatial management of effort and catch within the fishery are commendable. Finer scale, regional approaches to managing abalone fisheries with regional catch caps developed with industry and varying minimum sizes is well accepted in other states. The excellent work by industry, as presented to the last TAC Forum, is illustrative of the value and prospects for the use of data logger technology to underpin TAC and other

management decisions. It is important that FSM is introduced in a structured manner, and within an up-front agreed framework, as a priority if recovery of the fishery as a whole is to be achieved. The chosen method of FSM will need to reflect current and likely future realities in the fishery, including its size and value, legislative and management complexity, industry relationships and cost. Successful adoption will be conditional on adequate resources, a responsive and supportive administration, and meaningful industry involvement. In the opinion of the Committee, Industry 'going it alone' is not a viable option, and the necessary protocols for data holding, sharing and analysis should be developed and agreed with the Department as a priority activity. FSM should not be seen as solely an industry responsibility, but as a widely acknowledged and necessary approach to managing abalone fisheries.

There is a misconception that the Committee is an advocate for a single size limit for the entire NSW abalone fishery. The Committee acknowledges that the longer term aim of the fishery should be to implement variable size limits to better manage the different growth rates in the fishery.

Past recommendations by the Committee for a single size limit increase have been based on the need for a simple, robust and precautionary approach to managing the fishery within the constraint of the information and resources currently available. Together with the precautionary approach to setting the TACC, a single size limit allows for stock rebuilding, to provide increased protection for the spawning stock and to build a 'buffer' against future declines in recruitment.

The Committee was pleased to see that, despite industry misgivings, the effect on the fishery of the increase in minimum length to 117mm continues to be positive. The decision by the Department not to raise the size limit to 119mm, as recommended in last year's TAC Committee Report to afford greater protection for the abalone stock, was very disappointing. A further increase in the size limit to 120mm is an appropriate action to ensure that in the future the fishery stays away from a 'knife edge' situation reliant on recently recruited abalone, which is both undesirable and irresponsible. This is a fundamental requirement for any sustainable fishery.

The reduction in the bag limit for recreational fishers and continuing compliance efforts appear to have resulted in effective management of the recreational catch to a point where it is estimated to be of the order of 10 tonnes. However, with the opening of Regions 1 and 2 there is likely to be a 'gold rush' effect and recreational fishing effort may need to be constrained through closely controlled spatial and temporal management arrangements. The Victorian example of a 60 day central region recreational open season (weekends and public holidays between October and June), which it is believed has been successful in reducing illegal catch, may provide a useful model, particularly in Region 1 south.

The Department is to be again congratulated on its efforts to deal with illegal fishing, and in particular, the increasing trend in serious, well-organised crime syndicates who are allegedly stealing large quantities of abalone. From expert opinion, it now appears that illegal catch could be as low as 20-30 tonnes, although this figure is almost impossible to verify. The Committee welcomed the decision to make abalone stealing an indictable offence. The Committee remains, however, concerned at the previous decision to reduce compliance efforts (and costs) by removing 1.5 officers from the State-wide Operations and Investigations Group (SOIG). This Group has made significant contributions to reducing the serious impact of illegal abalone fishing and reducing capability in this area at a time when it is known that illegal fishing remains of significant concern, and vital stock rebuilding is occurring, is questionable.

The Committee notes the potential for new management provisions for cultural fishing that may result in substantial increase in catch, both legal and illegal. It is recommended that estimates should be made of the potential catch arising from the new cultural fishing arrangements.

There has been a drastic reduction in the overall value of the fishery due to reductions in beach price and TACC. This reduction has substantially impacted on the capacity of the industry to pay the fees and charges associated with managing the fishery. In response, the Department has been very effective in reducing the management fees payable by Industry. For the period 2005/06-2007/08, costs stabilised at approximately 15% of the gross value of production (GVP) of the fishery. The management charged dropped to around 4% in 2008/09 and is anticipated to rise to around 7% (or \$40.74 per share) for 2009/10.

The reduction in management fees has resulted in fewer funds being available for undertaking management, compliance and research activities, with research suffering the most. This is at a time when there is the greatest need for funds for monitoring and research to inform management action that will halt declines in stock and ensure stock rebuilding is effective. The Committee continues to be of the view that expenditure on research needs to be maintained at a sufficient level to ensure that there is adequate information on the status of the resource. The consequences of the drastic reduction in funding for the management of the fishery and the flow-on effects to the task of setting a TACC are discussed extensively in this report.

Ineffective co-management approaches in the fishery have held back the rebuilding of the abalone fishery. The Committee is encouraged by the perceivable change in the level of communication between industry and managers and was reassured by the decision to hold an Abalone Management Advisory Committee (MAC) meeting immediately before the TAC Forum. At this meeting we understand that there was some progress towards addressing future issues rather than looking to the past, although there was only limited discussion of key fisheries assessment and management issues.

Despite an increasing willingness to communicate and cooperate on the key issues facing the fishery, an ongoing barrier to more effective cooperation is the unfortunate expectation by industry that the Minister's Office will engage and intervene in what would normally be considered to be minor operational issues. This avenue of redress appears to be viewed by industry as a better approach to addressing concerns than more appropriate channels of communication between industry, researchers and managers.

Economic issues

The economic analysis possible under this section is restricted by the data and analysis provided to the Committee. While the Committee understands the competing calls on funding, and the constraints imposed by the economic significance of the fishery, the lack of data and analysis on the structure, conduct and performance of the NSW abalone industry is a serious shortcoming in the monitoring of the fishery. The Committee has recommended that the Department and industry make greater efforts to provide the economic advice needed to equip the Committee to provide advice on the economic situation of the industry. Collection of this information would normally be expected to be driven by Government, possibly via a cost sharing arrangement with industry. Industry have also expressed for some time a desire to improve economic data, and at this year's TAC Forum there was a useful presentation from industry on how this information may be cost-effectively obtained and utilised.

The volume and value of the fishery has been steadily declining since 2000 reflecting depletion of the stock, falling TACCs and deteriorating market conditions. The current GVP of the fishery (3.1 million) is lower, in both real and nominal terms, than at any other time, and down about 86% from its peak in 2000/01. Further deterioration seems likely in 2009/10, with a predicted value of around \$1.9 million. Attention has been drawn to severe competition on export markets for small abalone from aquaculture producers and a general deterioration in price. Evidence that the 117mm size increase has had a negative impact on prices through the overall fishery has not been forthcoming.

Fisher net income has fallen dramatically and considerable financial stress is likely in the industry, particularly among those who entered the industry in 2000, or thereabouts, when share prices were at around \$30,000 per share. Despite these circumstances, industry has shown none of the structural change tendencies typical of a primary industry under economic and financial pressure. In fact, since 2005/06 the share market has effectively ceased to exist. Divers have displayed a greater tendency to restructure their operations, with diver numbers falling as fewer individuals catch the quota of increasing numbers of non-diving shareholders.

There are unconfirmed reports that restructuring is occurring off-market. It seems that shareholders, whose numbers have declined only slightly, are either committed to the industry or "locked-in" to prevent realising losses. Another key factor is that the fishery is changing in nature to one of a general investment, with indications that only a minority of shareholders (possibly as low as 20%) are owner/divers.

Those operators that gained windfall gains when limited entry and allocation occurred, are, at face value at least, still deriving positive returns from their assets. This, of course is little consolation to those who have experienced significant real or paper capital losses and particularly those who are indebted. It may be concluded that sections of the industry are almost certainly suffering serious financial stress and that its long term viability, as presently structured and operated, is under threat.

The Committee believes that financial intervention by Government to assist with moving the fishery to a sustainable basis is justified. Any intervention or assistance should be based on the proposition that the likelihood of the fishery recovering under market forces and the current management regime is minimal, as discussed elsewhere in this report. The Committee has suggested that there are likely to be more efficient/cheaper ways to manage the fishery without compromising sustainability objectives, and that these should be pursued, with consideration of public assistance to move to new arrangements.

Biological issues

In previous years, the Committee has relied on a range of information on which to base the TACC. These were: Fishery Independent Surveys (FIS), catch rate and weight composition from commercial fishing, integrated analysis of this information using a length-based population model, and model based predictions of the expected future trends in the status of the stocks under different levels of catch. In addition, there has been some limited information from surveys and structured fishing in Regions 1 and 2.

The information available to assess the status of stocks is in a transition to new methods based on Structured Fishing/FSM approaches that are hoped to be better and cheaper. The issue facing the Committee again this year is that previous methods have been stopped before the new methods have been fully established or shown to be adequate. This has resulted in the ongoing uncertainty about the interpretation of information from the fishery and consequently about the state of the stock. Particular concerns relating to uncertainty relate to:

- recruitment overfishing (i.e. reduced breeding stock reducing the number of young abalone produced) in Region 2 and potentially other regions, the need to resolve the extent of this, and how the stock is responding to previous management measures intended to protect it; and
- the strength and persistence of the most recent pulse of increased productivity (i.e. increased recruitment and/or growth rate), which is now passing through the fishery and that will determine both the extent of current stock rebuilding and the future scope of sustainable catches.

The data and analysis available this year does not allow precise interpretation or tracking of the status of the population and its response to previous management measures - as was also the case last year. The development of a program to record fine scale information from commercial fishing operations during the past year is very promising. However, it has yet to be fully established. It is also yet to be demonstrated that the information provided is an accurate and adequate basis for assessing and managing the fishery. The indicators of abundance of legal sized abalone that have been calculated from the fine scale catch per unit effort (CPUE) information so far remain vulnerable to hyper-stability (see below) and there remains an inability to measure changes in the abundance of the sub-legal sized abalone that provide the basis for sustaining the population and fishery production in the next few years.

There is now heavy reliance on CPUE as an indicator of stock abundance, which has well known problems owing to the dynamics of fisher behaviour under quota and the fact that CPUE is a 'trailing' indicator that reflects what has happened, rather than a 'leading' indicator that informs what will happen – it contains no information about the numbers of sub-legal sized abalone that provide the future commercial stock.

The main sources of information available this year are:

- the commercial catch rates and mean weight of abalone in the catch (including the results of Structured Fishing in Regions 1 and 2);
- an initial comparison between stock indicators based on commercial catch rates;
- Structured Fishing catch rates;
- Fishing Surveys and Fishery Independent Surveys (FIS) in Regions 1 and 2; and
- an update on the likely illegal and unreported catches.

In addition there were several sources of information from analysis conducted in previous years; specifically a preliminary analysis of the Fishing Surveys in Regions 1 and 2 and the last model-based stock assessment (analysed in 2008).

Data from Fishing Surveys and Structured Fishing in 2007-2009 in Regions 1 and 2 have been considered separately. While these data are not necessarily comparable to the catch rates from the earlier free commercial fishing, the catch rate in Region 1 has been fluctuating without major trend while the catch rate in Region 2 has increased in each of the last 4 years, similar to the pattern in the Regions further south, and has increased substantially in the most recent year to be much higher than at any time since 1987.

There are no additional data available for the area of Region 1 north of Port Stephens (subregions A-E) and the catch in this area in 2008/9 was very small. There has never been FIS coverage in this area and very little commercial fishing at any time since 1987. It is not known whether, and to what extent, the stocks there were affected by the disease *Perkinsus* that significantly reduced stocks in the

southern portion of Region 1. Accordingly we have provided a **recommendation that 3 tonnes be taken from subregions A-E in Region 1 North (subregions A-E)**, to allow data collection to determine the extent of *Perkinsus* impacts and to support an initial assessment of the stocks, and estimate a sustainable catch.

The 2007 survey in Region 1 south of Port Stephens was based on fishing at historically productive sites, with additional fishing around those areas at sites selected by divers. The preliminary analysis provided in 2008 concluded that about 2/3rds of the historically productive sites were not productive and 70-80% of the historically productive sites had catch rates lower than those recorded in 1994 or 1997. The northern part of region 1, between Sydney and Port Stephens, had very few abalone and showed a major loss of historically productive sites, while the remainder of Region 1 south of Sydney had considerably higher abundance and had lost fewer historically productive sites. For almost all sites more than 50% of the abalone were greater than 120mm in size and about 60% of the sites were reported to have 'many' sublegal abalone present. Overall these preliminary results are consistent with the FIS data in indicating that stock in Region 1 South of legal sized abalone has recovered to 1994 levels at more than half of the sites and while some pockets of large and dense abalone aggregations exist, many historically productive sites still do not support large abalone aggregations or significant numbers of small abalone despite many years of protection from fishing. The stock of legal sized abalone in the northern subregions remains very depleted.

Structured Fishing and fine scale data recording was progressively introduced into Regions 1 and 2 during 2008 and 2009 and a preliminary report and analysis by industry was presented to the Committee. The development and delivery of the fine scale data reporting associated with Structured Fishing is a very significant and positive development to support assessment and management of the fishery. However, it is acknowledged by all that the methods and approaches will need to further develop and evolve to meet the needs of fishery management.

As with the 2007 data, only very limited information on sub-legal abalone was collected and reported from the Structured Fishing operations and at this stage the fine scale data were not available to government scientists for quality assurance or for collaborative/independent analysis.

The main finding of the industry report were that depletion estimated from the FISs, Fishing Surveys and Structured Fishing in Region 1 South were consistent in indicating significant depletion from the 1994 benchmark for all the subregions between Port Stephens to Botany Bay (i.e. subregions F- H). This supports continued protection of these stocks and a **recommendation that zero catch be taken subregions F-H in Region 1**.

There was less consistency for the more southern subregions of Region 1 South (J, K and L), with combined estimates indicating that subregion J is somewhat below the 1994 benchmark and that subregions K and L are at about the 1994 benchmark for legal sized abalone. It is unclear whether the numbers of sub-legal sized abalone in Region 1 south are sufficient to sustain either the current population or substantial fishing. Any commercial fishing in the southern portion of Region 1 South needs to be responsibly conducted in this context, recognising that if the population is mostly a relic from the disease outbreak then it could rapidly collapse under fishing. In this situation responsible fishing requires an ability to be able to detect adverse outcomes and implement appropriate management measures in time to avoid serious harm to the stock. This mitigates for the **recommendation that 4 tonnes be taken from subregions J-I in Region 1** in a manner that allows monitoring and assessment of both the legal sized and sublegal sized abalone.

For Region 2 there are only Structured Fishing data available. They can be compared with commercial catch data, noting that the comparison is not necessarily valid, since the commercial data is simply agreed catch rate when targeting relatively large catches, compared with the scope for taking small catches by targeting high aggregations at less than sub-regional scale. Region 2 has provided historically high catch rates in each of the past 2 years but the serious concern of recruitment overfishing there remains (see also discussion below). The high catch rates demonstrate that there are areas within Region 2 that support high densities of abalone, although as for the southern portion of Region 1 that has never been in doubt. The critical questions concern the recent amount of juvenile recruitment and the recent size of the mature population – in both cases in relation to their historical values. The currently available data do not address the questions relating to juvenile recruitment and there are questions with the validity of the historical comparison of the mature population using catch rate.

With that rider, the depletion estimated from Structured Fishing catch rates in region 2 suggests that the legal sized abalone stock is near or somewhat above the 1994 benchmark. Early indications from preliminary examination of catches from Region 2 indicate that there is now proportionately more abalone in the 120-130mm size range than was the case in 1994.

From the data and analysis currently available the interpretation of recruitment overfishing in Region 2 cannot be dismissed, although the improved data from Structured Fishing appears to offer opportunities to further test that interpretation and monitor the stock in future. There is a balance from the potential benefits from this improved information and the risks from further catches, particularly as the improved information has not yet been fully analysed and evaluated. At the present time, and considering that the catch decisions are reconsidered annually, there is considered to be considerable value in further development and use of information from existing and further Structured Fishing in Region 2. Accordingly, we have provided a **recommendation that 5 tonnes be taken from subregions in Region 2** to allow collection of data to test the representativeness of the FIS and support an improved assessment of the stocks, especially in relation to the interpretation of recruitment overfishing.

There has been a substantial increase in catch rate and abalone stocks in Regions 3-6 during the past 4 years of decreasing TACs and an increased size limit. However, this increase is from a low base. The catch rate is still well below the 1994 benchmark in Regions 5 and 6, and is about at the 1994 benchmark in Region 4. Only in Region 3 has the catch rate increased above the 1994 benchmark. The recent reductions in TAC and increase in size limit were intended to allow substantial rebuilding of the population, and particularly the age structure of the mature population, from the current pulse of increased productivity so as to buffer the population and fishery from the effects of these fluctuations in productivity. This rebuilding appears to be happening, although its extent and adequacy is not clear. The pulse of increased productivity appears to have continued for a 4th year into 2009, which is a very positive event. However it is not known whether it will persist further and if it does not the stock rebuilding in at least Regions 4, 5 and 6 will not have been sufficient to prevent an overall and long-term decreasing trend superimposed on the fluctuations from the productivity pulses. Accordingly, we have provided a **recommendation that 25 tonnes be taken from Regions 3 and 4 and 45 tonnes from Regions 5 and 6.**

The very rapid response of both the catch rate and mean size of abalone to the increased size limit to 117mm indicates that the fishery in recent years was far from the optimum combination of size limit and fishing mortality. The size composition information available from region 1 shows that a large fraction of the abalone there

are larger than 120mm, and preliminary information from Region 2 indicate that there has been an increase in the relative abundance of 120-130mm abalone there. The decision has already been taken to introduce a 120mm size limit in the southern part of Region 6. Use of a 120mm legal size limit throughout the fishery at this stage would provide precautionary protection of the breeding stock and is likely to be closer to optimal for much of the fishery (i.e. those parts of the fishery where asymptotic size and growth rates are large). So long as the fishing mortality is sufficiently low, the increased targeting of abalone in areas of large asymptotic size and growth rates that could follow under a 120mm size limit would not cause excessive depletion. Further, population responses under the current TAC suggest that the fishing mortality is low enough to provide that protection. In future, with improved information and stock condition, the size limit could be reduced, i.e. a regime of variable size limits introduced, in areas where growth conditions and management cost-effectiveness warranted it.

Although becoming increasingly dated (2008 analysis of population status in 2007), the model-based stock assessment provides a reasonable basis for many of the general interpretations of the past and recent status of the stock. Several features of the population, such as the age/size structure and mature biomass, would not be expected to change quickly because of the relatively low rate of natural mortality and growth of abalone

The model also provides an estimate of the history of recruitment in the regions. Since 1990, periods of good recruitment are shorter and the low recruitment between these peaks is lower. Other observations are that:

- the two most recent periods of good recruitment were very weak in Region 2, although there was some increase;
- there is a decreasing trend of recruitment in Region 2 since about 1983, with peaks and troughs superimposed on that trend; and
- the average recruitment in Regions 3 and 4 and 5 and 6 since about 1990 is lower than in the earlier period, with an increasingly 'spiky' pattern of recruitment through time. Different regions show different mixtures of lower lows, more persistent lows and briefer highs.

Overall the pattern above is consistent with recruitment overfishing of the stock having begun in the early 1990s, and having become quite severe in Region 2.

This interpretation of recruitment overfishing (i.e. the rate of fishing above which the recruitment to the exploitable stock becomes significantly reduced) is also consistent with the relationship derived from the model between the abundance of the mature abalone stock and the average recruitment. This relationship implies a significant reduction in average recruitment for the depletion that has occurred in the abalone populations for some regions. The depletion in Region 2 is to 28% of the unfished level, implying that significant recruitment overfishing is occurring (i.e. a reduction in recruitment to perhaps half of the unfished value). Some appreciable, but less severe, recruitment overfishing would also be expected on this basis in Regions 3 and 4, and Regions 5 and 6.

The interpretation above suggests that the 1994 abundance benchmark is not an appropriate one to protect against recruitment overfishing. It has previously been noted that it is also not an appropriate benchmark to provide the maximum sustainable yield.

Given the overall state of the stock, and the desire for continued commercial fishing, it is imperative that there is a robust and reliable means to monitor, assess and predict the state of the stock. This should include leading indicators that are based

on the abundance of sub-legal abalone, which will bring considerable advantages to management and industry from improved planning horizons. The information and analysis available for this year's assessment by the Committee is not adequate to support reliable decision making and an optimal fishery on an ongoing basis. The Committee draws attention to the need to be able to relate any new indicators of stock status to the indicators used historically. Without that the fishery will be very vulnerable to the 'creeping baseline' syndrome that has frequently led to very sub-optimal ecological and economic outcomes in fishery management.

The TAC report provides some guidance as to new information and analyses required for Regions 1- 6.

The TAC and associated recommendations could be reviewed if new information and analyses become available.

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**TOTAL ALLOWABLE CATCH COMMITTEE
ABALONE FISHERY
REPORT AND DETERMINATION FOR 20010/11**

1. INTRODUCTION

The Total Allowable Catch Committee is established by Section 26 of the *Fisheries Management Act 1994*. In 20010, it consists of:

- Mr Ian Cartwright – Chairman
- Dr Keith Sainsbury – fisheries scientist
- Dr Jessica Hartman – natural resources economist
- Mr Bill Talbot – fisheries manager

The Committee was provided with limited Secretariat services.

The Committee is required to determine the total allowable catch for the commercial sector (TACC) of the abalone fishery and, in doing so, to give effect to the objectives of the *Fisheries Management Act 1994*, as amended by the *Fisheries Management Amendment Act 1997*. It is not subject to the control or direction of the Minister, but in reaching its decision, the Committee is required to have regard to:

- all relevant scientific, industry, community, social and economic factors;
- the need to ensure that the abalone resources are exploited in a manner that will conserve stocks in the long term;
- the impact of fishing on other species and the environment; and
- the precautionary principle as set out in Section 30(2)(c) of the Act.

The Committee is also consulted out of session concerning a range of management issues.

The Committee produces a stand-alone report each year as background to, and in support of, the TACC determination. The report includes a number of recommendations for the management of the fishery as they relate to the TACC, based on the experience and background of the Committee members. The Committee finds it helpful when DPI provides views on the recommendations and their associated logic, creating a dialogue on a range of issues directly related to the TAC in a whole-of-fisheries context. As stated above, however, the Committee can only make a determination on the TACC, and the degree to which its suggestions and recommendations are accepted is a matter for the NSW Department of Industry and Investment.

To meet its statutory obligations, the Committee must consider the full extent of abalone exploitation. Total removals from the stocks of abalone are made up of:

- the quota allocated to commercial fishers;
- the legal catch of recreational fishers (the sum of the bag limits); and
- other catches (by both commercial and non-commercial fishers) not sanctioned by the Regulations controlling the fishery and not recorded in the statistics.

The Act defines, in Section 30(2)(c), how the Committee should apply the precautionary principle, namely:

'if there are threats of serious irreversible damage to fish stocks, lack of scientific certainty should not be used as a reason for postponing measures to prevent that damage.'

The Committee views the word 'threat' in this context to mean an 'indication of probable harm to come'. Thus it believes that where evidence before it indicates probable future harm to the fishery or the stocks but there is some scientific uncertainty surrounding that evidence, it must not postpone action to prevent that harm occurring. Such uncertainty, and principally the strength of the current and possible future recruitment events into the fishery, continues to surround a number of key aspects of the abalone stock assessment and the Committee must, and does, take this into account when setting TACCs and recommending limits for regional catches.

The determination of the Committee is to be published in the Gazette by the Minister. In the light of the determination, the Minister is required to review the regulations and any other instruments under the Act. The determination is to be implemented in accordance with the Management Plan.

2. PROCEDURES

2.1 Public Consultation by TAC Committee

The Committee called for public submission on the appropriate total allowable catch under the requirements of Section 31 Division 4 of the *Fisheries Management Act 1994*. Abalone fishers, relevant industry bodies, environmental groups and the community generally were encouraged to make submissions on the total allowable commercial catch. The details of this consultative process are set out in Appendix 1.

The Committee interviewed and received reports from:

- NSW Department of Industry and Investment Fisheries Research;
- NSW Department of Industry and Investment Fisheries Management;
- NSW Department of Primary Industries Fisheries Compliance;
- representatives and members of the Abalone Management Advisory Committee; and
- industry members.

As in previous years, submissions to the Committee were provided in an open forum situation, which allows stakeholders an opportunity to hear views on the status and management of the abalone resource. There was also an option for the Committee to call on *in camera* submissions where appropriate. During the forum, the Committee and industry were able to ask questions of clarification, and a number of issues were discussed by all stakeholders present which assisted the Committee in its deliberations.

2.2 Matters considered

Before reaching its determination, the Committee considered:

- the documentation available on the fishery and the submissions it received;
- the management objectives set out in the draft management plan;
- the current state of the fishery;

- advice on the status of management of the fishery provided by the Department;
- advice on the economic status of the fishery as assessed by the Department and by industry representatives;
- an abbreviated stock assessment for abalone provided by the Department;
- a range of technical and other industry comments regarding the status of the abalone stock and other matters regarding aspects of the management of the abalone industry; and
- the compliance situation as assessed by the Department and by industry representatives.

This report covers the three key areas affecting the management of the fishery, including the TACC setting process. These are:

- management considerations;
- economic considerations; and
- the status of the stocks.

The Determination of the Committee for the annual TACC for abalone for the 2010/11 fishing season is provided at the end of the report.

The Committee notes that the Department was unable to deliver the stock assessment and associated supporting documentation in sufficient time to allow the MAC time to comment and meet the deadlines for submissions to the Committee.

*The Committee **recommends** that an action list and timetable be developed well before year end and adhered to. The list should be promulgated to industry and cover dates for the 2011 TACC Open Forum and meetings (including locations), the delivery of associated supporting documentation; and for delivery of the TAC Committee Report and Determination.*

2.3 Format of the Report

As in recent years, the TAC Committee, in addition to the Determination and suggested regional catch limits, has made a number of recommendations for the consideration of the Department. These recommendations are provided to clarify the position of the Committee on a number of issues, as they relate to the TACC. The Committee finds it very helpful where the Department comments on the assumptions and recommendations made in the various sections of the Committee Report and in particular, those associated with the stock assessment. Industry has also referenced the recommendations and findings of the TAC Committee, an approach which is also appreciated.

3 Management Considerations

3.1 Introduction

This section provides a brief historical background to the New South Wales abalone fishery and its management. Current issues and fisheries performance, recreational fishing, compliance and management arrangements are discussed. Recommendations are made concerning management actions that would assist with the recovery of the commercial fishery, in particular the adoption of an appropriate finer scale management regime. The impact of the severe reduction in resources that are provided by the NSW Department of Industry and Investment (the Department) (partly at the behest of abalone shareholders) has

led to a lack of the scientific information which has traditionally informed the process of setting a Total Allowable Commercial Catch (TACC) for this fishery. That this should happen at a time when the abalone resources in New South Wales were in a particularly precarious position was most unfortunate. Industry, with the support of the Department has, however, made considerable progress with an alternative fisheries assessment framework, using GPS/data loggers. There remain significant issues with:

- coverage, detail, quality assurance/control, data and analyses, and
- the ability to link previous fisheries independent surveys and stock assessment outputs to the new FSM approach.

These issues have left the TAC Committee in a most difficult position. Divers are seeing, and the TAC Committee acknowledges, that a significant recruitment has occurred, CPUE is increasing, and there has been some recovery in abalone stocks. There is, however, restricted ability to understand the extent of this recovery, and, importantly, very limited information to use to look forward in a predictive sense.

The Committee was surprised that the timely implementation of formalised FSM approaches and efforts to close the knowledge gap arising from the cessation of stock assessment processes to enable sound TAC setting processes were seen by industry and some DPI&I staff to be a Committee imposition, rather than a core responsibility of the management agency.

3.2 Fishery background

The New South Wales commercial abalone fishery was established in the early 1960s, and in 1973 annual production peaked at approximately 1250 tonnes. Since that time the status of the abalone stock and annual production has steadily declined to the extent that the Total Allowable Commercial Catch (TACC) is less than 10% of peak production. There is anecdotal information available which suggests that in the early days of the fishery it was quite productive, and, in the south of the State, probably comparable to the adjacent fishery in Victoria.

The fishery extends from Forster in the north to the border with Victoria in the south. Since 2002, the bulk of the commercial catch of abalone has been harvested from the area of the coast that is south of Jervis Bay.

Following the observation of declining catch rates at the end of the 1970s, in 1978 a Parliamentary Select Committee recommended that entry into the fishery should be restricted. From over 100 applications, the number of permits initially issued was 59. In 1979, an economic survey considered that around 29 divers could derive a 'reasonable income' from the fishery at a time when annual production from the fishery was in the order of 600 tonnes. By 1980, 55 divers still remained in the fishery. Under the 2-for-1 transfer arrangements and a buy-back scheme, the number of licences was reduced to 37 by 1992.

These 37 licence holders were then allocated 100 shares in the share management fishery and, notwithstanding court challenges, in February 2000 the final shares became the statutory fishing right under the share management fishery arrangement. Prior to the commencement of the share management plan, the 100 shares were the minimum shareholding to be eligible for an endorsement to take abalone (i.e. as a diver). This minimum was subsequently reduced to 70 on commencement of the plan to enable endorsed divers and crew to make an investment in the fishery. To monitor any potential blowout in diver numbers (potentially to 51) a cap of 42 was set as a trigger. The fishery now sits at that trigger level as it did last year. There are currently 45 shareholders with shareholdings varying between 10 and 150. Of these, 38 are currently eligible for an endorsement.

The Environmental Impact Statement (EIS) identifies diver numbers as a key risk to the long-term sustainability of the fishery. Improvements to the economic efficiency of the fishery should occur with any substantial reduction in actual diver numbers. There are now positive signs that in the past three years a trend has developed which shows a contraction in the number of active divers that are operating in the fishery. While *active* diver numbers have fallen, the number of endorsements in the fishery remains unchanged, representing considerable and undesirable latent effort.

With the exception of the Marine Park buy-out and one 'book' (rather than market) transaction, there have been no shares sold during the past four years. The lack of selling of shares would suggest that quota holders are now more inclined to lease out their quota in preference to selling shares at what is now a comparatively low price. Recent cuts in quota and ongoing uncertainty over the status and prospects for the abalone resource are exacerbating this situation. Further reasons for the lack of structural adjustment are discussed in the economics section of the report.

There continues to be no agreement on the means of reducing endorsements to fish for abalone. At previous industry forums, some sectors of the industry suggested that an additional 'dive entitlement' be issued as a statutory right to cap diver numbers at the current level and offer a flexible means of reducing endorsements to dive from the fishery. Such an approach was not mentioned at this years' Forum.

The approach of creating a separate diver entitlement has not been supported by the Department which continues to be of the view that the current legislative mechanism of adjusting diver numbers through changing minimum shareholding requirements is a better mechanism. In this respect, the freeing up of share trading (minimum one share, no maximum limit) and removing restrictions on the transfer of quota, will in the view of the Committee, assist this process. The Department is working on this issue.

During the 2008/09 fishing period, about half of the commercial catch has been taken by 9 divers, with the remaining number of authorised divers reporting very low catches.

This change in the trend coincides with an increase in the amount of the TACC that is leased across the fishery and indicates that some informal restructuring is occurring within industry.

The Committee was advised that a number of the divers who take small catches have employment in other sectors of the NSW commercial fishing and oyster industries fisheries, a strategy which is necessary to supplement their income.

There is now around \$900,000 outstanding in the payment of management fees by industry. It is understood that the regulations provide the Department with the opportunity to not approve the transfer of shares until these payments have been made. This debt has also led to an unwillingness of the Department to use the cost recovery process to fund industry-based research, as requested in a recent industry ballot regarding fisheries management services.

The price paid for shares in the fishery has contracted from a high of \$25,300 in 2002/03 to \$9,250 in 2005/06. There have been no shares transferred (other than the book transfer mentioned above) during the period 2008/09, so it is not possible to determine what the current value of shares might be. As part of the Marine Park buy-out, 200 shares were bought out at a value of \$14,800 each.

Comments were again made at the industry forum that would suggest that any shareholder who may contemplate selling quota in the current climate would have to accept a price that is substantially less than the last recorded market price for shares. The low price of shares is a major barrier to restructure, with current shareholders unwilling or unable to exit the fishery.

*The Committee **recommends** that further efforts are made by industry and the Department to consider how best to achieve the structural adjustment necessary to help restore viability to the fishery.*

3.3 Current issues and fisheries performance

The TAC Committee continues to be of the view that the wording of some of the objectives, and most of the performance indicators in the current plan are problematical. I&I NSW staff acknowledged that new objectives, performance indicators and triggers will need to be developed and the Committee looks forward to the finalisation of new measures that are more meaningful.

*The Committee **recommends** that the current performance indicators and triggers in the FMS/Management plan be reviewed*

3.3.1 Management of catch and effort

The New South Wales commercial and recreational abalone fisheries are based entirely on black-lipped abalone. The abalone fisheries in Tasmania and Victoria that are also based on black-lipped abalone have their own issues and problems, but the difference between the NSW fishery and the other two fisheries continues to be quite pronounced.

Significant differences include:

- (a) an hourly catch rate for commercial divers which in NSW is about one tenth of that found in Victoria, and
- (b) a decline in the annual catch in NSW from a peak of 1250 tonnes in 1972 to the current catch of 75 tonnes. In Victoria, catches peaked at approx 3500 tonnes in 1968 but have averaged approx 1400 tonnes since 1988.
- (c) the use in other states of finer scale, regional management of abalone fisheries with regional TACCs and varying minimum sizes, introduced with strong support from the industry.

The spread of effort in the NSW fishery has traditionally relied on the largely unmanaged movement of divers across the State. Commercial access to Regions 1 is now subject to permit control and there are caps on the total catch that can be taken from Regions 2-6, following the lapse in the Region 2 closures as recommended by the TAC Committee.

Divers move their fishing operations up and down the coast to seek out the more productive beds of abalone, and are also balancing travel time, costs of fishing and social factors. It is clear from industry submissions that there is a growing interest in, and support for, smaller zonal or area based catch management arrangements and size limits and industry has moved to self-regulate such limits in a number of areas. While these moves are welcomed and supported, there continues to be no clear agreement as to how this might be informed by research/data collection, or managed in a transparent manner.

Fine scale management (FSM) approaches are being developed in most Australian abalone fisheries. In Victoria, some assessment and management is at reef scale, based on cooperative industry/government approaches. In other fisheries, data is collected (and in some cases analysed) at relatively fine scales, but management is at a larger scale, reflecting operational and licensing/fishing entitlement constraints. Some ad-hoc progress has been made based on the recommendations of the TAC Committee, but FSM should be introduced in a structured manner as a priority if recovery of the fishery as a whole is to be achieved. It is noted that the SARG report considered that the introduction of FSM

approaches with the support of Government was essential to support the recovery of the fishery.

It is the belief of the Committee that the term ‘**finer**’ (rather than fine) scale management would be more a more appropriate term in the NSW context, and that moving directly to a Victorian model from the current management arrangements in NSW may not be realistic. The Victorian approach was developed over a number of years in conjunction with a far more cohesive industry and a high degree of confidence and cooperation between researchers, management and industry. That said, there appears to be an increasingly encouraging environment of cooperation and coordination, and provided the clear industry vision of how FSM will work in NSW is underpinned by an agreed, scientifically robust framework, an inclusive, workshop-type approach to catch planning will become increasingly realistic.

Accordingly, and as suggested in the SARG report, the Committee believes that NSW DPI should consider the range of options/models used in other states and select a way forward that reflects current and likely future realities in the fishery. Success in this area will be very much conditional on adequate resources, a responsive and supportive administration, and significantly increased, cohesive and meaningful industry involvement. In the opinion of the Committee, Industry ‘going it alone’ is not a viable option. It is also difficult to see how FSM will be successfully introduced in NSW without industry being prepared to rigidly support appropriate area based caps/TACCs, which would complement **variable minimum sizes** across the fishery as further information on the stock comes to hand. These conclusions have been drawn for some years now.

While noting these preconditions, the Committee strongly endorses the industry view that the fishery must continue to move towards FSM as rapidly as possible, by formalising and expanding the collection of comprehensive data at fine scales using data loggers. In this regard, the Committee recognises and strongly supports the initiatives taken by industry to date, noting the limited financial and other resources available for this work. Decisions as to scales of spatial management and other measures (including TACCs and size limits) can then flow from analysis of that data.

The Committee is pleased to see that the dysfunctional government/ industry/ researcher relationship that has plagued the NSW abalone industry is now starting to be addressed. Preliminary efforts to establish an alternative stock assessment and management process are now underway and there is an increasing optimism that a way forward will be found. The Department must now work with industry to build and agree up-front a FSM assessment and management framework to formalise current industry efforts with data loggers and analysis. This will be essential to managing expectations on all sides.

*The Committee **recommends** that efforts to develop and agree a framework for a finer spatial scale management approach should continue to be pursued as a matter of priority. The Special Abalone Recovery Group (SARG) Report provides a clear direction as to how this may be achieved. The Committee also **recommends** that the SARG Report should be released for general public consideration.*

An industry-based approach to managing regional or area based TACCs, similar to that used in other states but reflecting the realities of NSW, continues to be supported by the Committee. During the 2008/9 season industry made significant progress with catch reporting and caps, showing some potential for this approach.

It will be necessary for the Department to take an active role in ensuring that such practices are introduced in an effective and timely manner, with the relevant measures to ensure quality assurance and quality control. An effective finer scale management approach will need substantial and detailed discussion between industry, researchers and managers. Past

apparently irreconcilable difficulties with the MAC has significantly hampered progress and created doubt as to the ability of that forum, as currently constituted, to provide a platform for such discussions. The Committee, however, notes that the last MAC meeting (the first for over a year) was carried out in a more positive atmosphere, with increased emphasis on the future considerations rather than attempting to attribute blame for past decisions.

Objective 8 of the share management plan for the fishery stipulates that a review will take place if the number of endorsements in the abalone fishery exceeds 42. The potential number of endorsements for the fishery is 49. The Department has advised that there are currently 38 businesses that are eligible for an endorsement.

As discussed above, the Department and industry agree that the low TACCs that are now being set for the fishery have adverse economic and compliance ramifications for the current number of operators in the fishery (divers in the water), with the average catch per shareholder decreasing from 8 tonnes in 2001/02 to 2.4 tonnes in 2007/08. Under the current and likely projected TACC, it is reasonable to expect that the number of active divers will not increase and this trigger will not be activated.

3.3.2 Catch rates

CPUE is considered to be an index of abundance in fisheries. Since CPUE is fishery dependent, and in the case of abalone, liable to 'hyperstability' (meaning that high catch rates can be achieved from aggregations, even under circumstances of severe depletion of the overall stock) means that, as an index of abundance, CPUE should be used with some caution. The Committee does not agree with the statement in the DI&I Management Report that CPUE is "a conservative indicator of abalone abundance". However there does appear to be a case for cautious optimism in that the decline in catch rates has been addressed, and for regions 3-6 have increased for the 4th successive year. Given the 'knife-edge' recruitment nature of this fishery and the uncertainty of the most recent recruitment, this increase should not be seen as an indication that the fishery is in a position of assured sustainability going forward. As noted in the DPI&I report, CPUE is a backward rather than a forward looking tool and can mask fishery failure as was the case in 2001, when CPUE was high, with a TAC of the order of 300 tonnes; this was followed by reduced catches and CPUE, despite severe cuts in the TAC.

3.3.3 Minimum sizes

The minimum size for abalone in New South Wales was increased to 117 mms from the 1st of July 2008 following a recommendation to the Minister from the SARG. Minimum sizes are designed to ensure that abalone will have at least one spawning opportunity before they can be harvested. Other abalone fisheries utilise a combination of minimum sizes, often set on a regional basis and reinforced with voluntary arrangements and supported by industry training. These arrangements recognise that some abalone reach maturity at well below the average (for the fishery) minimum size, i.e. are considered slow growing (stunted), and others do not reach maturity at maximum size, i.e. are fast growing. **Having a range of minimum sizes, set on a cooperative basis and combined with relatively small area-based TACCs, better reflects the nature of abalone populations, provides improved yields and affords greater protection to reefs from serial depletions and the harvesting of immature abalone.** It should be noted however, that fisheries where this approach has been successful enjoy a greater abundance of abalone with a far greater number of year classes and a higher proportion of mature, breeding adults in the fishery than is currently the situation in NSW.

The Fishery Management Strategy (FMS) for the NSW abalone fishery proposes that any upward increase in the minimum size for abalone should only be done on an incremental

basis and at a time when catch rates are high. The TAC Committee partially shares this view and continues to recommend that measures increasing the average size of commercially harvested abalone in NSW should be a priority for management and industry.

The commercial fishery in NSW has been historically based predominately on abalone that are just above the minimum size. In this situation, and unless the TAC/caps are set appropriately, abalone can be repeatedly removed from reefs, measured and not retained because they are just undersize. This practice, which is commonly called 'chipping' and leads to some mortality of undersize abalone due to shell damage, should be avoided.

The decision by DPI not to raise the size limit to 119mm as recommended in last year's TAC Committee Report to afford greater protection for the abalone stock was very disappointing. An increase in size limit is an appropriate action in the current circumstances that will move the fishery to a more sustainable level and continues to be strongly supported by the TAC Committee. The Committee also **acknowledges that the longer term aim of the fishery should be to implement more variable size limits to better manage the different growth rates in the fishery.**

At the time of the proposed increase to 117mm, some members of Industry, and in particular the MAC, made strong representations that this action was not appropriate, based on:

- a potential shift of effort towards areas with larger abalone present thereby exacerbating the current problems with the spatial distribution of effort;
- the decision being incompatible with previous undertakings to move towards FSM with variable size limits;
- the potential to drive down the current TACC; and
- the impact on the niche Japanese market, which apparently relies on quantities of small (115-117mm abalone).

Other members of industry showed strong support for the size increase.

The level of protest generated at the 2008 industry forum, and subsequently, for what was a marginal size limit increase, was somewhat excessive given the benefits generated. If a single size limit (rather than variable limits) is the sole management tool, then there is a strong argument that subsequent incremental increases are necessary to place the fishery on a more biological and economically secure footing. By incrementally raising size limits, carefully monitoring catches, size distributions and shell characteristics, it should be possible to identify faster and slower growing areas and develop FSM-based **(variable)** size limits.

At the TACC setting forum last year, the Committee was advised that the change in the minimum size led to a decline in CPUE for the fishery of less than 1% and an increase in the weight of individual abalone of about 12%. In other words, the disruption to normal fishing expectations has been short-term and minimal but the benefits are considerable, particularly as they resulted directly in less abalone being taken to fill the TACC. The TAC Committee was informed this year that the Japanese market is under increased pressure from aquaculture product, reducing demand for small abalone. This development is at odds with the argument that widespread size limit increases effectively lock NSW out of a substantial marketing opportunity.

We repeat our view that, ideally, **size limit increases should be matched spatially to growth characteristics**. However, the nature of NSW abalone industry, lack of cooperative management approaches and cost/complexity of administering various size limits means that such an approach will be difficult to implement, until FSM approaches are developed, agreed and fully implemented. Given the status of the resource and other factors described

in further detail in section 5 of this report, the Committee recommends again an increase in LML to 120mm.

*The 2mm increase in size has had a number of benefits and minimal adverse impacts which were basically short-term. The TAC Committee believes that now is an appropriate time to implement a further increase and strongly **recommends** an increase in minimum size to 120mms.*

The Committee is pleased to note that the increase in the minimum size to 120mms for the area that is located south of the township of Womboyn has been agreed.

3.3.4 Research, spatial Management and the use of data loggers

Data loggers are now used extensively in other States where fine scale management has been adopted by the respective management agencies and industry. They offer a promising way forward for ensuring the cost-effective data collection and management in the NSW fishery.

The industry presentation to the Committee confirmed the general effectiveness and capacity of data loggers to collect essential information on catch size, structure and location as part of a structured approach to spatial management. The degree to which industry has been able to introduce data logging, with the recent support of the Department, Dr Craig Munday's work and a FRDC TRF project, is a credit to those involved. The Committee is very supportive of such approaches and, given the cost recovery and research framework in NSW, agree that it provides a very viable way forward subject to resolution of a number of issues.

Whilst some data is being collected by permit holders under the structured fishing activity, there does not yet appear to be any formal arrangement in place on appropriate methodology and protocols either under current permit arrangements or more widely as a framework for FSM. The Committee considers that this is an essential part of the process if structured fishing is to provide the information necessary to assess the status of the fishery and set a TACC.

As soon as possible, the Committee strongly recommends that data logging and provision of data should be a condition of access to the fishery, i.e. industry must fit a working logger to be endorsed to operate. This will give effect to the stated objective of the Department to move to FSM. For its part, Government will need to invest in the systems and infrastructure to store and analyse the data for the use and benefit of both industry and government.

The Committee notes the past difficulties in addressing the gap between industry expectations and that of DPI and the Committee in terms of the scientific methodology for undertaking structured fishing, and the QA/QC aspects of data collection, storage and analysis.

3.3.5 Regions 1 and 2

Region 1 South (Port Stephens to Wreck Bay, Jervis Bay) was closed to abalone fishing in November 2002. Region 1 North (Port Stephens to the border with Queensland) and Region 2 were closed to fishing in August 2007.

In past reports, the TAC Committee has been very explicit concerning the information it was seeking to inform the TACC setting process, and in particular Regions 1 and 2, taking the position that robust and structured industry-based surveys would provide verified data on which to base decisions on future commercial harvesting options. There have been a range of issues with surveys/structured fishing in Regions 1 and 2, although some progress has been made.

In 2008/9 I the DI&I developed a mechanism for access into regions 1 and 2 following the recommendations of the Committee for the taking of up to five tonnes of abalone from Region 1 (North), five tonnes from Region 1 (South), and five tonnes from Region 2. The intent of these arrangements was to provide information about changes in abalone stocks and to spread commercial catch appropriately. The degree to which these arrangements have provided the information necessary to inform TAC setting is discussed in detail in Section 5 of this report.

Under the choice afforded to industry and the decision of the Department to effectively withdraw from stock assessment work on abalone, there are now inadequate resources to do any reasonable analysis of the structured fishing program. Further, the plans by the industry to have in place their own monitoring and data analysis program have not sufficiently progressed such that the TAC Committee has sufficient available information from them on which to make TACC setting decisions that take full advantage of the considerable efforts by industry to engage in the stock assessment and management process.

The DI&I research section undertook a useful analysis of structured fishing programme, which was provided to the TAC Committee. The findings were restricted to the degree to which the work addressed the issues nominated by the TAC Committee, rather than providing independent scientific review of the degree to which the information provided was adequate to inform the management of the stocks in Regions 1 and 2. It does however provide suggestions as to how to improve the 'contract' between DI&I and industry, including the need to take account of funding limitations. It appears to the committee somewhat unusual that one branch of I&I has been commissioned to provide critical comment on an arrangement with industry to collect and provide data after implementation of the contract rather than before. If this work had been done initially, then the degree of industry frustration, much of which now seems aimed at the TAC Committee, would have been considerably reduced.

*The Committee **recommends** that the use of data loggers to record catch and location details should be a pre-requisite for the issue of all permits to fish in Regions 1 and 2 and, progressively, other areas of the fishery, and data provided directly to the DI&I. If industry is to undertake the primary data collection and analysis function, then adequate processes and protocols must be agreed, implemented and monitored.*

3.4 Recreational Fishing

There is now general acceptance that the decision to reduce the recreational bag limit from ten abalone per person per day to two abalone per person per day has had a profound effect on the recreational harvesting of abalone in NSW. Prior to the introduction of the reduced bag limit four years ago, the Committee set the provisional allowance for the recreational catch of abalone at 50 tonnes. Following the introduction of the reduced limit this allowance was decreased to 20 tonnes, and then for last year further reduced to the current estimated figure of 10 tonnes.

The Region 1 and 2 abalone fishing closure is also likely to have further reduced recreational catches as the area covered by the closure (Jervis Bay to Port Stephens) as the area incorporates the major population centres on the NSW coast. The reduction in catch would have been mitigated to some degree by the depleted state of abalone stocks in these regions.

Once Region 1 and 2 reopen there is likely to be a 'gold rush' effect and recreational fishing effort may need to be constrained through closely controlled spatial and temporal management arrangements. The Victorian example of a 60 day central region recreational open season (weekends and public holidays between October and June), which it is

believed has been successful in reducing illegal catch, may provide a useful model, particularly in Region 1 and noting the additional stress on the resource possible in Region 1 south.

The Committee is confident that the 10 tonnes it allows for as recreational catch in the TACC setting process is a reasonable estimate of what may now be taken by this sector of the fishery. It is intended that this figure will remain in place until there is better and more precise information available on the extent of the recreational catch.

*The Committee **recommends** the development of a research program to determine the extent of the recreational abalone catch in NS.*

*The Committee **recommends** that I&I NSW develop appropriate management arrangements to prevent a 'blow out' of recreational fishing effort and catch prior to reopening Region 1 and 2.*

3.5 Compliance Issues

In setting a TACC for the NSW abalone fishery, the Committee makes provision for the illegal catch taken by people who are not licensed as commercial fishers and who operate outside of the prescribed recreational fishery. The illegal catch was initially set at 40% of the legal catch (first introduced in 1987) when the illegal catch was estimated at 102 tonnes from Regions 2-6.

The 102 tonne figure has been maintained to this day and we now have arrived at a position whereby the estimated illegal catch for 2008/09 now exceeds the actual commercial catch.

General impressions from compliance officers and industry are that the illegal catch was below 100t but above 50t in 2008, and could be as low as 20-30t in 2009. The introduction of indictable offences for abalone theft, the targeting of poaching syndicates by compliance officers, and the development of improved methods to permit indigenous catch are all thought to have improved the situation. In the present circumstances of stock condition and stock assessment capability it was considered appropriate to have any reduction in illegal catch contribute to stock rebuilding

Objective 7 of the Management Plan is to minimise the number of offences committed by fishers in relation to abalone. General compliance rates as reported by DPI for the commercial sector for 2007/08 is recorded at 93%, which is a slight improvement on last year. For the recreational sector it is at 67%, which is deterioration in the situation as it was reported last year.

The plan provides for a review of the situation when the aggregate compliance rate for the fishery falls below 70% but the combined compliance rate of 79% is still comfortably above this figure.

Some further refinement of the recording of illegal activities by the recreational (or non-commercial) sector has been identified by the Department as a priority objective. All non-commercial fishing is lumped together as recreational fishing which leads to disparate groups, such as low-key recreational fishers, who may be involved in smaller scale lower impact activities be included in the same category as serial or professional abalone poachers who are having a significant impact on the resource. It is encouraging to see that this issue has been identified and will part of a move to improved reporting of illegal/non licensed commercial fishing.

In a fishery such as this which has clearly been under a high degree of stress for a number of years, and which has seen substantial cuts in both the commercial and recreational catch from the fishery, illegal catches must be kept to a minimum if the stock is to recover.

The Committee appreciates the difficulty in accurately defining the illegal catch of abalone from NSW waters. For stock assessment purposes, the Department continues to rely on the original figure for the illegal and recreational catches. As discussed above, it seems clear that the reduction in the recreational bag limit to two abalone per day has significantly impacted on the “small scale” poacher who relied on taking multiple recreational bag limits of 10 (the old daily bag limit) to make his illegal activities viable.

*The Committee **recommends** that the reporting of recreational fishing be progressively refined to reflect the difference in impact on the resource by low key recreational offenders and serial or large scale abalone poachers.*

The Department has identified that organised poaching syndicates that often have interstate connections are the groups that need to be targeted as a priority. It appears that until fairly recently NSW based serial poachers would often work in other states where better catch rates could be obtained. In recent years, a combination of improved compliance practices, interstate cooperation and severe penalties for illegal fishing have had a major impact on poaching in other states, particularly Victoria, and has significantly reduced illegal catches. However, this success has had the effect of forcing NSW based poachers to look to operating in their home state where the penalties that the courts are able to impose are substantially less. This problem is now most pronounced on the south coast where stocks of undersize abalone are targeted.

The Committee is confident that the Department has an effective abalone compliance capacity. The State-wide Operations and Investigations Group (SOIG) does the bulk of the compliance activity that is targeted at serial abalone poachers and is supported (albeit with reduced manpower resources for this year) by coastal fisheries officers and members of the police force. The Committee again noted that at this year’s Open Forum, those industry representatives that were in attendance were strong in their praise of the efforts that NSW fisheries officers are putting in to detect and catch illegal fishers.

The Committee was pleased to hear that amendments to the Fisheries Act providing for increased penalties for abalone poaching (indictable offences) have been approved by the NSW Parliament. The Committee has frequently stated its support for increased penalties or indictable offences for abalone poaching. Now that indictable offences are in place, NSW will be on a similar footing to Tasmania, Victoria and South Australia in having a key tool to address the scourge of abalone poaching.

Finally, the Committee was concerned at the option provided to industry by ballot to reduce compliance efforts (and costs) by removing 1.5 officers from the Special Operations Unit. This Unit, as discussed above, has made significant contributions to reducing the serious impact of illegal abalone fishing. It appears very questionable to reduce capability in this area at a time when it is known that illegal fishing remains of significant concern.

3.6 Other Fishing

Amendments have been made to the Fisheries Management Act to formally recognise the spiritual, social and customary significance to Aboriginal persons of fisheries resources and to protect and promote Aboriginal cultural fishing.

These new arrangements will include the creation of an Aboriginal Ministerial Advisory Council and management changes aimed at improving access for the purpose of cultural fishing. Existing permitting arrangements will stay in place for the harvesting of abalone

(and other fishes) for cultural events. The Department provides information on the number of abalone (2,360 in 2009) that are permitted to be taken but the actual amount of lobsters taken is unclear as there is limited compliance with reporting requirements.

The quantity of abalone that can be taken under these provisions is currently relatively small. If new management provisions result in a substantial increase in real or potential catch from the Aboriginal community then this will have to be factored into TACC setting arrangements.

*The Committee **recommends** the development of improved abalone catch estimates as part of the implementation program of new cultural fishing arrangements.*

3.7 Fishery Management Costs

Shareholders in the NSW abalone fishery are required to meet all management costs attributable to the commercial fishery in accordance with pricing principles recommended by the independent Pricing and Regulatory Tribunal (IPART).

At the time of writing this report, the situation regarding the collection of annual management charges for 2008/09 and the provision of funding for research and base-line monitoring of the NSW abalone is in a state of flux.

Industry has experienced declining beach prices for abalone (in 2002 - \$46 per kg, in 2008/09 - \$25.56 per kg) mainly caused by the steady increase in the value of the Australian dollar and progressive drops in TACC from 300 tonnes in 2002 (worth \$12.7 million) to 75 tonnes in 2008/09 (worth around \$1.9 million). These changes have substantially impacted on the capacity of the industry to pay the fees and charges associated with managing the fishery, including those associated with management, compliance and research services in a cost recovery environment. Since 2002, total management costs to industry have contracted by more nearly 50%. In 2002, the total industry contribution to management costs for the fishery was \$962,000 and for the 2007/08 period was \$581,000. For the period 2008/09, the value of abalone landed in NSW was just under \$3,500,000. For the period 2005/06-2007/08, costs have stabilised at approximately 15% of the GVP of the fishery. The management charged dropped to around 4% in 2009/09 and is anticipated to rise to around 7% (or \$40.74 per share) for 2009/10.

In 2008, faced with a situation whereby management costs were remaining relatively high in a time of declining returns to shareholders from the fishery, DPI acquiesced to an industry choice of ceasing the then research programme and commencing a structured fishing-based programme. While this did reduce management costs the TAC Committee were advised that the Department went to some lengths, both in the written information provided and in formal and informal discussions at meetings with industry, to make clear what the likely consequences might be flowing from a reduction in industry contributions to the cost of managing the NSW abalone fishery. The consequences of this drastic reduction in funding for the management of the fishery and the flow-on effects to the task of setting a TACC are discussed extensively in this report. As the fishery recovers the TAC Committee continues to be of the view that expenditure on research needs to be maintained at a sufficient level to ensure that there is an adequate level of information on the status of the resource.

Accumulated debt in the fishery caused by the non-payment of fees and charges has since 2003/04 and is now in the order of \$900,000 and their recovery at a meaningful level appears remote.

Almost ten years have elapsed since the Independent Price and Regulatory Tribunal (IPART) developed its pricing principles for NSW commercial fisheries, as cited in the FMS. There would be value in a new independent assessment of cost recovery principles in the

management of NSW fisheries, including abalone. It is understood that the SARG has made a similar recommendation.

The Committee notes that while the decision to drastically reduce funding for research and monitoring had over-whelming support from share-holders, this has left the fishery in a difficult position with respect to management decision making. The Committee believes that ensuring the appropriate collection and analysis of data in support of management arrangements is a core responsibility of Government. To do this, there is a need for Government to also ensure that appropriate mechanisms for the proper collection and analysis of that data are in place. Given the current circumstances of industry, some assistance, through the provision of resources to develop such mechanisms, would be appropriate. This is not to infer that Government should be responsible for meeting the ongoing costs of data collection and analysis; this should be dealt with through normal cost recovery processes.

*The Committee **recommends** that DPI&I ensure that the resources are available to develop and support the initial implementation of a viable alternative industry based assessment and management package, and that such a package be developed as a high priority.*

The Committee was heartened by preliminary indications that the Department will endeavour to apply additional resources towards the establishment and implementation of alternative, finer scale spatial assessment and management arrangements.

3.8 Community charge payments

The commercial abalone industry has been granted some relief from the payment of the community charge, which has been levied on the industry at 6% of the annual gross value of the fishery. Details of this are contained in the Report of the Working Group that assessed these charges.

Significant changes have been made to the basis of levy collection with no charge being levied if the beach price for abalone is below a \$43 threshold. For 2009/10 (2009/10) fishing period, abalone shareholders will not be required to make any payment of Community Contribution and, given the status of the fishery, this seems highly appropriate.

3.9 Co-management approaches

The failure of the Management Advisory Committee (MAC) to meet since April 2008 is not encouraging. This lack of a functional MAC, staff changes at DPI, and divisions within the industry has clearly hampered the effective management of the fishery. A number of the issues which would more properly be dealt with at the MAC are coming to the TAC Open Forum, which at times, is inappropriate. The TAC Committee notes that despite the best efforts of the Chair, the MAC has been mired in the controversies of the past, and has been unable to give attention to a path forward for the fishery, and in particular the best ways to move from current stock assessment and management arrangements to a different, more affordable (but effective) alternative based on FSM approach.

At the recent MAC meeting, and as mentioned above, it appears some progress was made towards addressing future issues rather than looking to the past, although there was limited discussion of key fisheries assessment and management issues.

An ongoing barrier to cooperation is the unfortunate expectation by industry that the Minister's Office will engage and intervene in what would normally be considered to be minor operational issues, and that this avenue of redress remains a viable alternative approach to more proper channels of communication between industry, researchers and managers.

*The Committee **recommends** that for the future the MAC be used as a forum to discuss and exchange information on key aspects of the abalone fishery such as the previous year's Determination and TAC Committee report, stock assessment, management and economics, prior to the TAC Committee deliberations. LobMAC provides a useful model for such an approach.*

The future role of the Abalone Resources Planning Group (ARPG) is unclear. The recommendations of this group appear to have overridden the advice of the TACC on the size limit increase and other recommendations, and it is now fulfilling many of the detailed fisheries management advisory roles normally provided by the MAC in providing advice to the Department on the abalone resource. Interestingly, the Department also took the advice of the ARPG on the introduction of a larger size limit south of Womboyn, an action which industry, with the support of the TACC, has been requesting for some years.

3.10 Conclusion

Industry representatives continue to be generally optimistic that the decline in commercial catches has been arrested. The move to an increase in minimum size has some support from industry, but a universal and strong rejection by MAC members. Whilst commercial catch rates have improved over the last year measuring the status of resource using the available data is problematic.

The decision of NSW abalone shareholders to overwhelmingly accept the invitation by DPI to substantially reduce their payment of charges for research without putting in place alternative and complementary activities continues to have a profound effect on the TACC setting process for the 2010/11 quota period. Whilst it was the stated intention of industry representatives at the TACC setting forum that they could in part at least fill this void, the unfortunate fact is that the research and monitoring information that had informed the Committee on a consistent basis over recent years is no longer available. At the time of writing there remains limited data (compared to what has been provided before) on which to base a coherent decision on the quantum of the TACC.

The initial increase in minimum size which followed a recommendation in the report prepared by the SARG has, despite initial criticism from some industry members been generally well received and is in the opinion of the TAC Committee continuing to benefit for the NSW abalone resource, as demonstrated by a considerable number of industry submissions.

The market situation for abalone is now at a low ebb, and given high catch rates, now would in the Committee's view, be a good time to increase the minimum size by a further 3 mms.

Industry support for the efforts made by the Department to improve the effectiveness of its compliance performance continues to be most encouraging. Hopefully the contraction in resources that DPI provides for compliance will not see any decline in compliance effectiveness at this important time for the fishery. The shift to indictable offences is a welcome and significant step forwards.

Improvements in the relationship between industry and the research and management arms of the Department are now becoming apparent and will be essential to an effective management process for the fishery. This is particularly relevant to current efforts to establish FSM.

If this occurs, and differences within and between key players at all levels can be dealt with effectively and transparently, then the prospects for developing more effective, affordable management arrangements are reasonable. This, coupled with the reversal of stock declines and a longer-term view of what are sustainable catches, will be fundamental for the future. If these are not achieved, then the recovery of the fishery will remain in severe doubt.

4. Economic considerations

4.1 Introduction

In this section of the report, the economic status of the NSW abalone industry is described, as consistent with the requirement that the Committee have regard to economic and social issues the making its determination. Economic considerations focus on gross returns to the industry rather than net returns due to the absence of information on fishing costs. A summary of quota and share market prices is presented as an indicator of both short and long run industry profitability. Analysis of other data affecting the economic performance of the fishery, such as export prices and catch per unit effort, is also presented.

The absence of timely and relevant data on fishing costs means that it is not possible to make a complete analysis of the economic performance of the NSW Abalone industry. Focussing on gross returns only means that changes in costs, and the impact of this on profitability, is not taken into account in determining economic performance.

Social considerations, such as the non-pecuniary lifestyle benefits fishers derive from the activity of fishing itself, influence the return from abalone fishing. Data on the lifestyle factors associated with fishing, the demographic profile of fishers and the profile of the regions within which fishers live and work were collected through a survey by Roy Morgan Research in 2001 (Roy Morgan, 2001a). However, more up to date information is required.

An understanding of the economic impacts of the fishery at the state and regional level would also be useful in terms of understanding the contribution of the abalone industry to the economy more broadly. Work in this area was undertaken by Roy Morgan Research in 2001 for NSW commercial fisheries, but it requires updating as economic conditions and the structure of the fishery have changed since then (Roy Morgan 2001b).

4.2 Volume and value of production

The volume of reported catch of abalone in 2008/09 was 103.3 tonnes, a fall of 5.6 per cent on the previous year catch of 109 tonnes (Figure 1). This catch accounts for around 98 per cent of the TACC. Since 2005/06, industry has been able to catch virtually the full TACC; and more recently with reportedly less effort. With reported catch in the current year to March 2010 at 47 tonnes, it is likely that actual catch will approach the TACC of 75 tonnes set for the current year.

The TACC has declined by 75 per cent since 2001/02 responding to a substantial depletion in the stock and efforts to rebuild the fishery.

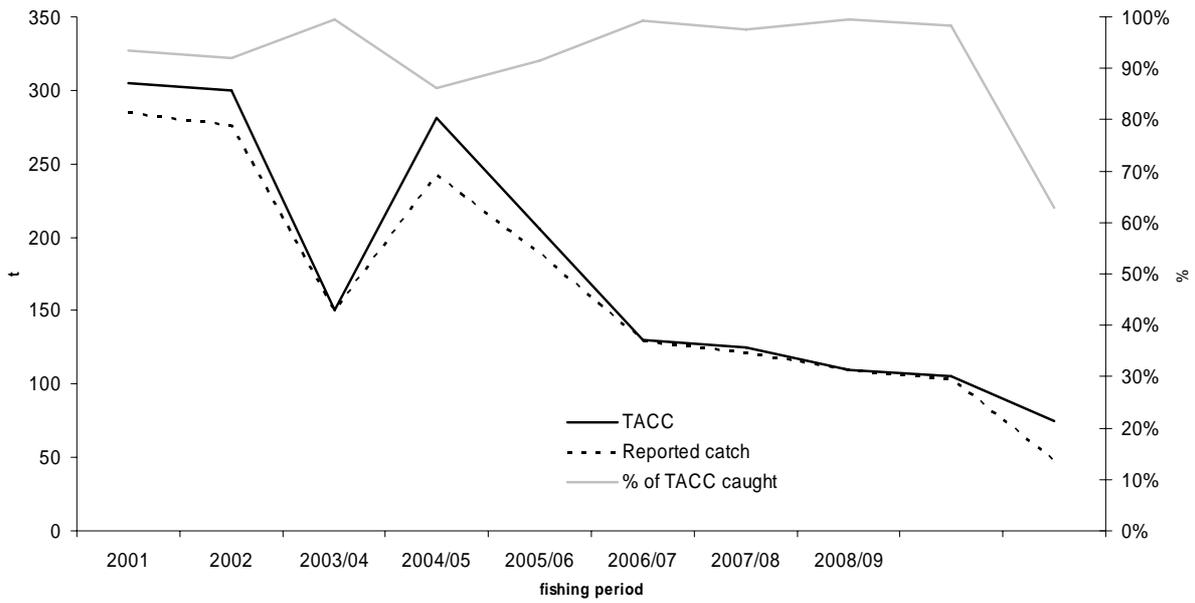


Figure 1*. TACC (t), total reported commercial catch (t) and proportion of TACC caught (%) for each fishing period from 2001 to 2008/09.

*This figure was provided by the Department; it is suggested it be modified prior to next year's report as the x-axis is incorrect. Partial data for the current year also needs to be removed as it is distorting interpretation of the figure.

The value of reported catch of abalone in 2008/09 was \$3.1 million, an 18 per cent fall when compared to the previous year (Figure 2). After reaching a peak of \$21.4 million dollars in real terms in 2000/01, the value of reported catch fell by 85.5 per cent to \$3.1 million in 2008/09. These falls are due both to lower levels of reported catch and lower prices. Production and reported prices for the first eight months of 2009/10 suggests that the value of reported catch for the current year will decline further, to about \$1.9 million.

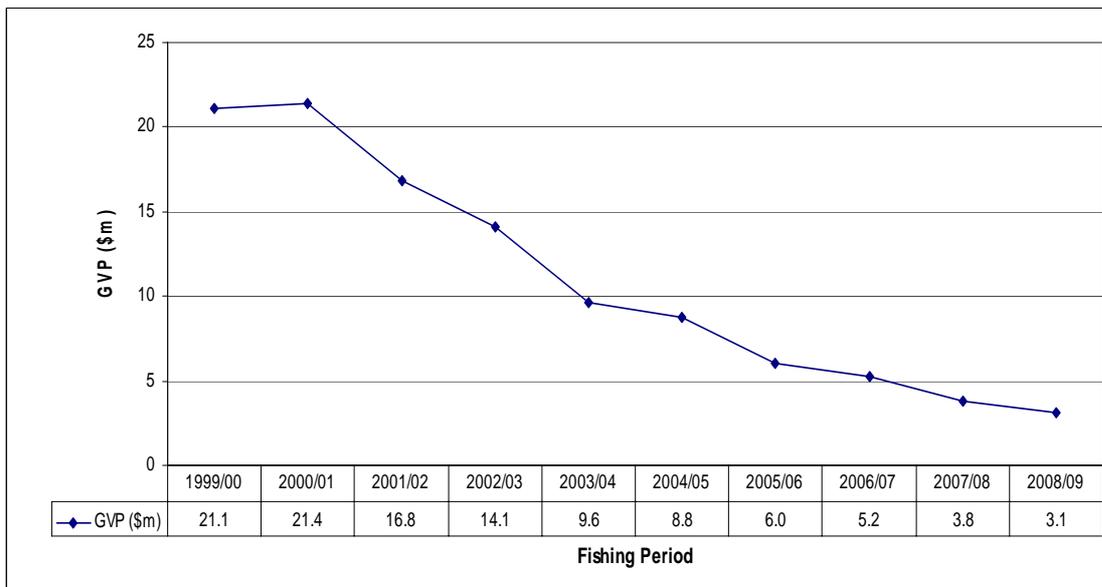


Figure 2: Gross value of production of abalone in NSW, 1999/2000 to 2008/09

NSW abalone production is a very small percentage of Australia’s overall production, at around 2 per cent as at 2007/08 (ABARE, 2009). With lower levels of reported catch since this time, this percentage is likely to have fallen even further. The bulk of Australian production of abalone comes from Tasmania, Victoria and South Australia.

4.3 Prices

Prices for abalone are estimated from data abalone processors provide to the Department. In 2008/09, the average real price was \$30/kg, a fall of 13 per cent when compared to 2007/08 (Figure 3).

The peak real price of around \$69/kg in 2000/01 was followed by a steady decline to 2003/04 (during the SARS outbreak which affected Chinese markets in particular) before climbing back to almost \$43/kg or more for three years in a row. Prices have since dropped to an average price of \$26/kg (as of March 2010). In real terms, abalone beach prices have not kept pace with inflation. The peak price of \$69/kg was unusually high for the years of record.

Periods of lower beach prices can be explained partially by the SARS episode and partially by the strength of the Australian dollar against the Japanese Yen and US dollar. An expected depreciation of the Australian dollar over the medium term should result in higher prices for abalone on international markets (ABARE, 2010).

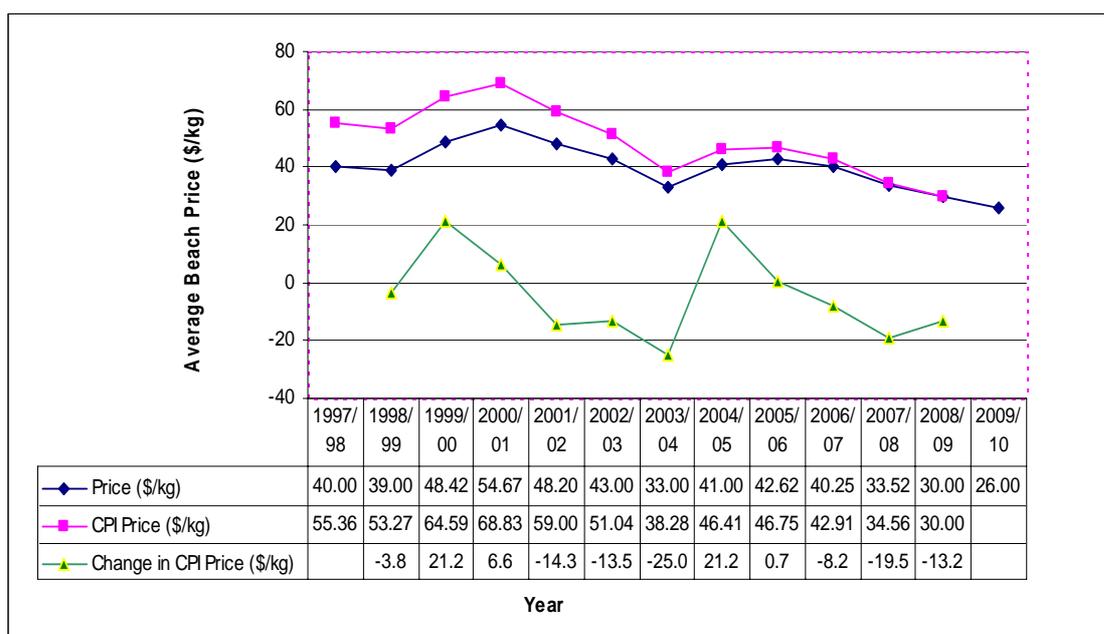


Figure 3: NSW abalone beach prices, 1997/98 to 2009/10

4.4 Catch per unit effort and average size

Catch per unit effort (CPUE) data gives a general indication of overall trends in availability of abalone to the fishery. CPUE in 2008/09 increased by 7 per cent from the previous fishing period to around 20kg/hour. The CPUE for 2009/10 to 10 March has risen significantly to 25.5kg/hr. These increases in CPUE are likely to be as a result of lower TACCs over the past five years and a higher size limit over the last two years. Higher size limits and significantly reduced numbers of fish being taken put the fishery in a much better position to improve and consolidate recruitment events going forward and, subject to the extent of the current and future periods of recruitment, are a positive sign of likely improved returns from fishing in the future.

There is no evidence that the increase in the lower size limit to 117mm has excluded significant areas of the fishery or resulted in effort shift. The average size of abalone in the fishery catch has risen significantly over the past fishing periods from 280g in 2005/06 to 303g in 2008/09, with a continued rise in the current fishing period to 305g. These figures compare to 1999/00 when the approximate average weight of caught fish was 285 g. The increase in average size in 2008/09 is in excess of that anticipated due to the size increase from 115mm to 117mm.

4.5 Abalone markets

Abalone product is sold through registered and registered restricted fish receivers to processors along the NSW coast. Increasingly there has been a tendency for shareholder/divers to become registered and registered restricted fish receivers and sell product directly to processors.

The NSW abalone industry is predominantly export oriented. As a result, prices received for NSW abalone are subject to economic conditions in the main export markets, competition from exports from other abalone exporters, and other factors, the two most significant being aquaculture production and exchange rate fluctuations.

The main export market for abalone is North-East Asia. Total exports of abalone from Australia have declined from 4,910 tonnes in 2003/04 to 3,580 tonnes in 2007/08. Prices received for abalone on export markets have also fallen over the same period driven by an appreciation of the Australian dollar against the Japanese yen and US dollar (ABARE, 2010).

Australian exports of abalone are divided into two categories: 'fresh, chilled or frozen' and 'canned' In 2007/08 the largest export market for fresh, chilled or frozen abalone is Hong Kong followed by Japan and China (exports to mainland China were higher than Japan in 2005/06). The largest export market for canned abalone is Hong Kong, followed by Japan and Singapore.

Wild caught abalone has been subject to increased competition from aquaculture product. Nearly 10 per cent (507 tonnes) of total abalone production in 2006/07 was sourced from aquaculture farms (ABARE, 2010:15). The Department reports that by 2014/15 approximately one-third of total Australian abalone production could be farmed product. As costs associated with producing farmed product fall, prices may fall, undercutting those for wild caught product in the future, particularly for smaller sizes of abalone.

Important long-term structural changes may be occurring as a result of the growth of the aquaculture industry and, perhaps, changes in tastes and preferences for abalone in China and Japan. Industry report that the preference in China is for smaller sized abalone than can currently be produced in NSW and that this market is currently being serviced by farmed product. Industry also report that the niche market that NSW abalone previously held in Japan is shrinking due to aquaculture competition and that the preference in the Chinese market is for larger sized abalone than can currently being produced in NSW. The Chinese market is now being serviced by Tasmanian wild caught product. One processor considers that there is potential to competitively market smaller abalone in China using the fact that it is wild caught rather than cultured as a marketing edge.

As aquaculture operations continue to expand in Tasmania, Victoria and South Australia, new overseas markets and marketing initiatives for wild caught abalone will need being explored. The Committee notes the McKinna Report on the development of a marketing strategy for Australian abalone may offer some suggestions in this regard.

4.6 Fisher net income

Declines in gross revenue of the magnitude that have been experienced in the abalone industry mean that considerable financial stress is likely in the industry, particularly among those who entered the industry in 2000, or thereabouts, when share prices were at around \$30,000 per share. Questions must be asked about the future viability of the industry if prices continue at present levels, stock levels (and hence the TACC) do not recover, and appropriate adjustments do not occur. Precise estimates of the circumstances of individual fishers are, unfortunately, not possible without detailed information on the structure, conduct and performance of the industry, particularly the structure of costs and levels of debt.

The costs of fishing include both fixed and variable costs, with variable costs such as fuel, bait and repairs being the most susceptible to change in response to short term fluctuations in prices and production. Fixed costs such as boat capital and other overheads associated with running a small business are unlikely to be as responsive to short term fluctuations in prices and production. However, when changes in prices and/or production are maintained over the longer term, and such changes are indicative of a longer-term decline in the resource and/or demand for abalone, structural change in the industry may result in lower fixed costs. There may also be a reduction in the number of shareholders and divers, though this has not occurred in the abalone industry to the extent that would have been expected, as is discussed later, and in Sections 4.7 and 4.8.

The last survey of fishing costs and returns was undertaken by Roy Morgan Research for the 1999/2000 fishing year. As the estimates of fishing costs from this survey are now out of date, they cannot be relied upon to estimate net returns from abalone fishing. Further, the survey is for a single year, and, as such, only provides a snapshot of the net return from abalone fishing. A more accurate representation of the net return from abalone fishing would consider the stream of net returns over time, and, hence, would require cost data over a number of years.

In the absence of up to date information on fishing costs, some observations about likely changes in variable costs can be made. As nominated divers are usually paid on a \$/kg basis, variable costs may have fallen as a result of a reduction in catches across the fishery. Offsetting this will be the impact of higher fuel costs, as reported in ABARE's most recent fishing survey (ABARE, 2010). Anecdotal evidence suggests that fishers' costs per unit of output have, in fact, increased over time.

Speculation such as the above aside, net returns, i.e. gross returns less costs, will probably have fallen to a greater extent than gross returns. Recent downward trends in share prices support this finding, as is discussed in Section 4.8. Given that the number of shareholders in the industry has not reduced in response to the reduction in net returns, net return per shareholder will have also fallen, and is likely to be so low as to seriously threaten the viability of the industry in the long run. Some shareholders, particularly the heavily indebted, must be in particularly difficult financial circumstances at present.

Some shareholders may be able to survive in the industry by covering their operating costs while disinvesting in their plant and equipment. Some may have been able to invest surplus income from the 'good times' elsewhere in the economy, while others may have been able to draw on capital gains from trading in shares. Still others, while holding shares, may be actively employed in or have investment elsewhere in the economy. Some of the non-diving shareholders may be retired and relying on their income from leasing of quota. Divers are also increasing efficiency by taking the quota of an increased number of shareholders. However, as the fishery recovers, and some shareholders choose to become active divers again rather than lease quota, these efficiency gains may be eroded.

BOX 1 A crude estimate of net returns from abalone fishing

The Committee understands that a reasonable approximation to the cost of catching abalone remains around \$14/kg, or \$275.80 per share. Although probably an understatement, if this is assumed to cover all costs, including return on non-share capital and depreciation, adding current management charges of \$35.57 per share gives total costs per share of \$311.37. Assuming a beach price of \$26/kg and 19.7kgs per share (at the current TACC at 75 tonnes) the gross return per share is \$512.20. Deducting costs from gross returns, net return in 2009/10 is likely to be in the order of \$200.83 per share. A fisher with 100 shares would then have a total net return of \$20,083.

At an interest rate of say, 8 per cent, a total net return of \$20,083 would justify a maximum share price in the region of \$1,600. This is of little consolation, however, to those who have experienced significant real or paper capital losses, are carrying high levels of debt, or rely on the return on their shares for the bulk of their income.

Those operators that gained windfall gains when limited entry and allocation occurred, are at face value at least, still deriving positive returns from their investment in the abalone fishery. However, given the risk associated with abalone fisheries, many would conclude that this is far from an adequate return to capital and that more attractive investments exist.

4.7 Shares

There are currently 45 shareholders in the fishery (Figure 4). Of these shareholders, 38 had more than 70 shares and so qualify for endorsement. The remaining 7 do not qualify for an endorsement and presumably lease-out quota.

The number of shareholders increased from 39 to 49 in the 'boom' years from 2000 to 2002. While that is consistent with the expansionary outlook one would expect in such years, the relatively small fall (less than 10 per cent) since then is not consistent with the changes one would expect over a period of significant decline. Further, the decline in the number of shareholders over this period is mainly due to the Batemans Bay and Port Stephens Marine Parks buyouts in 2007/08, rather than to voluntary restructuring. There appears to be a degree of integration of activity among shareholders, either through family connections or through companies with common directors.

The average number of shares per shareholder has fallen from 97 in 2000 to 77 in 2008/09 (Figure 4). This is the opposite of what has occurred in the lobster fishery, where the average number of shares per shareholder has increased. Shareholders owning 70 or more shares increased from 37 to 39 between 2000 and 2001, to 41 in 2003, and to 42 in 2004 (Figure 5). The number of shareholders with less than 70 shares was 1 in 2000, 3 in 2001 and 10 in 2002. The number has been stable at 7 since 2006/07.

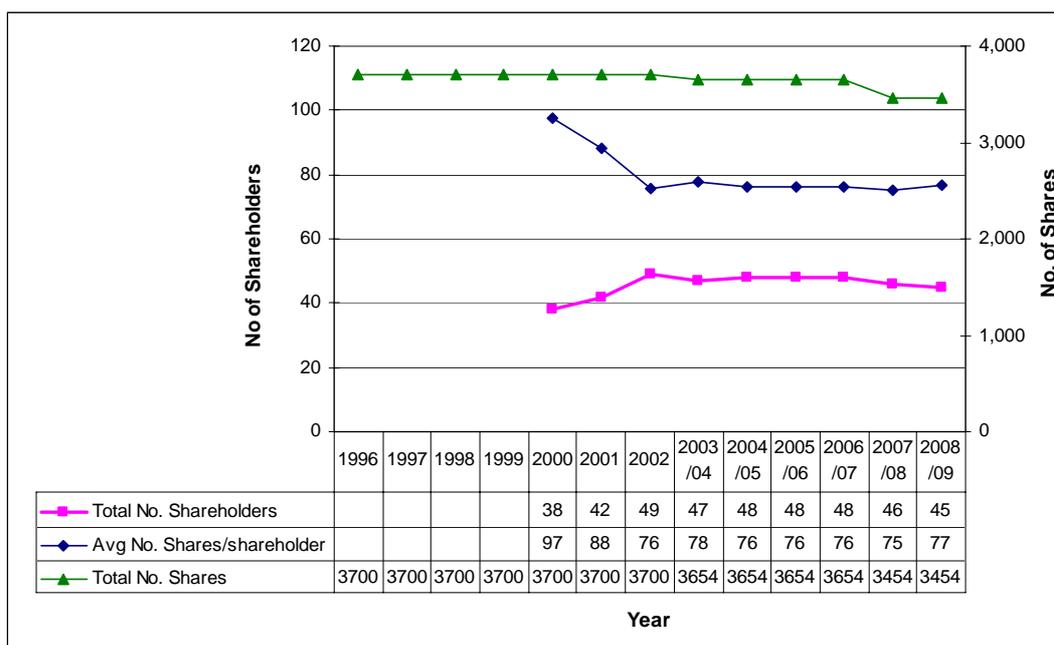


Figure 4: Number of shareholdings, 1996 to 2008/09

Diver numbers appear to have been more responsive to the economic circumstances of the industry than the number of shareholdings. Diver numbers peaked at 42 in 2005 and 2006 but have declined to 31 in 2008/09 (a fall of about 25 per cent) (Figure 6).

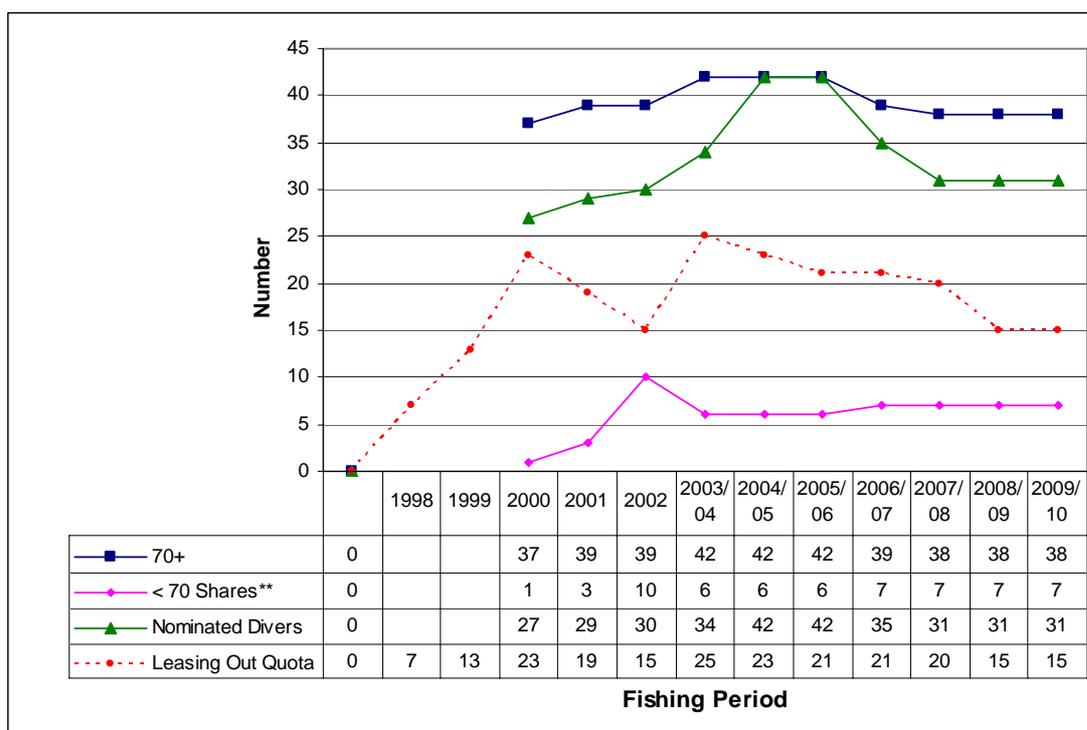


Figure 5: Distribution of shareholdings, diver numbers and quota leasing, 1998 to 2009/10

4.8 Share trading, transfers and values

Share trading activity is reported in Figure 6. No shares were traded in 2006/07, 2008/09, or the current year to-date. In 2007/08, 80 shares were traded at an average price of \$4,124 (CPI adjusted); a trade that the shareholder made public as a 'book' value transaction between two fisheries businesses.

The average price per share climbed from \$9,580 in 1996/97 to \$29,930, in real terms, in 2002/03, and then fell to \$10,231 in 2005/06. Since then, the share market could not be said to have existed, apart from the one sale mentioned above. The cessation in share trading is most likely due to the fact that many shareholders would have to accept a loss in real income if they wanted to exit the industry at this time.

Share transfer prices provide an indication of the economic health of the abalone fishery and of expectations of industry participants on the future outlook of the fishery. In this sense, falls in share prices since 2002/03 can be interpreted as reflecting a poor economic outlook for the fishery.

The volume of share trading increased after the Share Management Plan commenced at the start of the 1999/00 financial year. This trading was triggered by the change in minimum shareholding required for endorsement from 100 to 70 shares in February 2000.

In the five years following the change in minimum shareholdings the TACC declined by 15.6 per cent from 333 tonnes in 1999/00 to 281 tonnes in 2003/04. During this period some shareholders sold "excess" shareholdings – given the financial incentive to do so – noting that decisions to sell or buy were largely based on continuing confidence in the future outlook for the industry.

In accordance with the Fisheries Management (Abalone Share Management Plan) Regulation 2000, shares can be traded in packages of 10. The ability to trade shares allows existing shareholders to structure their operations based on performance during the year and, to some extent, the availability of lobsters. The reason for the minimum size of package is unclear, however it may be impeding potential improvements efficiency that may have otherwise arisen as a result of the transfer of smaller numbers of shares. The Committee notes the Department's intention to remove this impediment

Another trading rule is the cap of 210 on the maximum shareholdings in the abalone fishery. This cap could be considered unnecessarily restrictive as it falls well short of a monopoly situation. The Committee notes the Department's intention to remove this impediment and well as the removal of the requirement to transfer quota with shares other than when an entire shareholding is transferred.

The comparatively high unit price per share (i.e. the lumpiness of the price of shares) could also be an issue in impeding share trading.

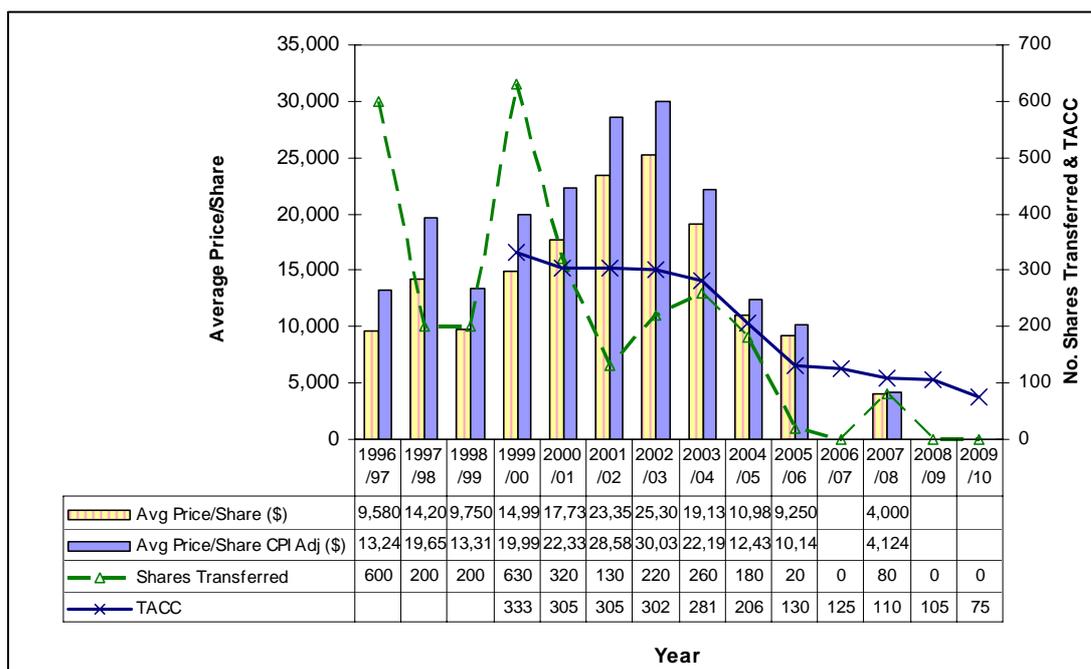


Figure 6: Share transactions in the abalone fishery, 1996/99 to 2008/09

4.9 Quota transfers and values

Quota became fully transferable in the late 1990s. The number of shareholders leasing out quota has ranged from 7 in calendar year 1998 to a peak of 26 in 2004. Since then there has been a decline to 15 in 2008. In 2008/09 47 quota transactions were completed, which comprised a total of approximately 32.8 tonnes of quota (31.2 per cent of the TACC) (Figure 7). To date in 2009/10 18 quota transactions have been completed comprised of approximately 20.5 tonnes of quota (27.3 per cent of the TACC).

The ability to trade-out quota is vital to those shareholders who do not dive, while the ability to buy-in quota would be important to the declining number of divers in the industry. More research into the operation of the quota market would be useful in assessing the resilience of the industry.

The Committee invites more detailed discussion of the quota market and its role in the restructuring of the industry.

Unfortunately, information on the price at which quota is transferred is not collected by the Department. A price of \$18/kg from one quota transfer was voluntarily reported in 2008/09.

Industry members, particularly Mr George Chung, have indicated that many transfers are not commercial, in that they are un-priced transfers between shareholders, on a quid pro quo basis. If this is the case, then a potentially thin market is made even thinner, and potentially less efficient in revealing the value of abalone.

A number of administrative rules regulate quota trade. For example, quota may be transferred only in lots of 100 kilograms or as otherwise approved by the Director. Also, a shareholder may not acquire by any such transfer more than twice the amount of the shareholder's initial quota for the fishing period. These rules may impede a shareholder's ability to take advantage of market signals, that is, to operate more efficiently in the market. First, they may prevent requests for the transfer of smaller lots of quota. Second, they prevent a shareholder from acquiring substantial amounts of relatively risk free quota. The

Committee notes the Department’s intention to review the current restriction on the amount of quota that can be leased by shareholders.

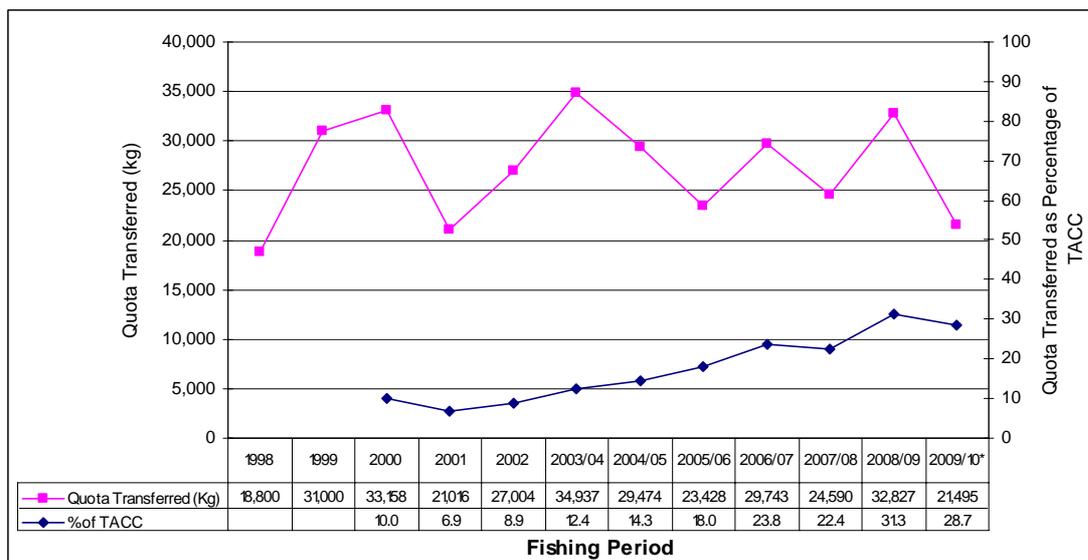


Figure 7: Quota transferred as a percentage of TACC

*The Committee repeats its **recommendation** that the Department and Industry work together to develop more detailed information on the structure and operation of the quota market.*

4.10 Impact of illegal unreported removals

Previous reports by the Committee have discussed the loss of economic value from the fishery due to high levels of illegal catch. It has been suggested, in those reports, that the returns on investment to either reduce the level of these catches, or to determine the real extent of illegal catch (which may or may not result in an increase in TACC) would be high.

4.11 Recreational and indigenous catch

As with illegal catch, there is the possibility of loss of economic value from the fishery due to high levels of recreational and indigenous catch. Current estimates of recreational and indigenous catch are unreliable. More reliable estimates of recreational and indigenous catch are needed.

4.12 Economic data

In past verbal presentations and discussions with the Committee, both the Department and the industry have shown appreciation of the need to improve the quality and quantity of the economic data they present. However, the economic data available to the Committee on which to base its recommendation is still lacking and the Committee is still unable to meet its statutory obligations regarding provision of economic advice to underpin setting of the TACC. In the absence of economic data, the Committee remains concerned about the possible consequences of its determination for the profitability of the industry and the financial well being of those in it.

As indicated earlier in this report, authoritative comment on the economic performance of the abalone fishery is restricted to interpretation of changes in share prices and some crude calculations of net returns. As also discussed earlier, better information on the costs of

fishing would allow for the net return from abalone fishing to be calculated more accurately. It would also place industry in a much more informed position regarding setting of the TACC in order to maximise profits, and setting of the community contribution charge such that it does not extract less, or more, economic rent¹ than is present in the fishery.

In order to collect better information on the costs of fishing, a survey, such as that undertaken by EconSearch for the South Australian rock lobster fishery, could be undertaken (EconSearch, 2008). Ideally, this survey would commence as soon as possible and would be conducted every three years, with annual updates, to ensure that fishers are able to maximise economic returns from fishing over time.

Industry, in a helpful presentation to the Committee suggested a similar way forward by using simple indicators including:

- GVP, TACC x beach price;
- agreed fixed costs; and
- indexed variable costs e.g. fuel, deckhand days etc

Industry suggests that the survey undertaken by Roy Morgan Research in 2001 could be used as a guide as to the types of fixed and variable cost data that need to be collected. The Committee notes that a similar set of cost variables are used in the Econsearch study.

Such information would be combined with a set of more meaningful economic performance indicators than those currently in the EIS.

The Committee **recommends** that the Department and industry work together to devise a cost-effective and collaborative means of collecting economic data on the performance of the abalone fishery, at least to a point where performance against agreed indicators and triggers is possible

4.13 Community Contribution Charge

The community contribution charge is calculated annually and considers CPI, abalone beach price and TACC. It is payable by each shareholder following each fishing period. The community contribution charge has been set at \$0 since 2005/06, following a decline in TACC and average estimated beach price.

The formula for calculating the community contribution charge was developed by a Government Working Group with representatives from the then NSW Department of Primary Industries and NSW Treasury. In developing its formula, the group used data on fishing costs collected for the 1999/2000 fishing year by Roy Morgan Research. As the estimates of fishing costs from this survey are now out of date, they can no longer be relied upon to estimate the appropriate level at which the community contribution charge should be set. Better information on the costs of fishing is required in order to ensure that the community contribution charge does not extract less, or more, economic rent than is present in the fishery.

4.14 Performance indicators for the fishery

The Committee notes that the economic indicators and triggers in the proposed Fishery Management Strategy for abalone are lacking in specificity and relevance, and clear

¹ Economic rent is profit in excess of normal returns on capital. Estimates of normal returns on capital in commercial fisheries vary, but can be as high as 10 per cent.

management responses. These indicators and triggers need to be revised as a matter of urgency to make them more relevant to measuring the economic status of the industry.

However, whatever the indicators and triggers for the assessment of the economic status of the industry are, the Committee believes the currently available data on the structure, conduct and performance of the industry will not be sufficient to make them operable.

*The Committee **recommends** that performance indicators and triggers are revised to make them more relevant to measuring the economic status of the industry.*

4.15 Structural Change

Given the current perilous economic circumstances in the abalone industry, structural adjustment is necessary if the industry is to remain viable. Looking at this in a slightly different way, the limited structural change that has occurred in the abalone industry does not seem consistent with an industry in perilous economic circumstances.

As stated above shareholders appear reluctant to exit the industry, or to undertake other structural adjustments which may reduce costs. The returns, however poor, appear to be adequate for the moment (at least for some shareholders) and indebted shareholders are not prepared to realise a loss on their initial capital investment by selling at current share prices. Further, many shareholders, as is discussed in Section 4.6, may be supplementing/subsidising their involvement in the fishery by using other sources of income. It is also possible that there are significant non-financial benefits (e.g., unpriced lifestyle values) that make up for low returns to capital and labour.

In 2005, the Keniry Report (2005:4) raised concerns about the number of divers and the value of shares in the abalone fishery:

The declining ecological state of abalone has had a seriously adverse impact on the financial state of the commercial fishery. There are too many endorsed divers, whose average annual revenue is now insufficient to meet their costs and provide even a modest living. In many cases, divers have been forced to adjust by taking employment in other fields to supplement their income from abalone. There are many shareholders in the industry whose shares are now worth a fraction of their initial cost and whose income falls well short of meeting their operational and financing costs.

A better understanding of the reasons behind the reluctance of industry to restructure in the face of such difficult economic circumstances would be useful, along with detailed information on the structure, conduct and performance of the industry, particularly the structure of shareholdings, costs and levels of debt. The Department has provided some time-series information on the distribution of shareholdings to the Committee for this determination, but as the data is in aggregate form it is difficult to fully assess whether structural change has occurred.

If, as appears to be the case, the abalone industry is now facing pressure to adjust, there is reason to believe on *a priori* grounds, and on the basis of the experience of the rock lobster industry, that present share management arrangements should facilitate adjustment rather than impede it. In Sections 4.8 and 4.9 of this report, management arrangements relating trading of shares and quota that may be impeding restructuring were discussed. However, it was also noted that the Department intends to remove many of these impediments.

The Committee believes that financial intervention by Government to assist with moving the fishery, including the abalone resource and its management, to a sustainable footing through assistance with the development of alternative assessment/management arrangements, is

justified. The basis for intervention should be the proposition that the likelihood without intervention of the fishery as a whole, recovering to sustainable levels under market forces and the current management regime is minimal, as discussed elsewhere in this report. The purpose of such intervention should be to facilitate the necessary steps to ensure restoration of sustainable levels of the stock.

The Committee believes this view is consistent with the views of SARG, application of the precautionary approach, and with the view of IPART. In the case of the last-mentioned, previous IPART rulings have supported the principle that the development of public policy is a matter of public good and should therefore be paid for by government.

4.16 Conclusion

While the available data makes an authoritative assessment of the economic status of the industry and the potential economic impact of this determination difficult, it is sufficient to conclude that sections of the industry are almost certainly suffering financial stress and that its long term viability, as presently structured and operated, is under threat. Measures such as the reduction or removal of management fees and charges, and the reduction of research effort, while perhaps welcome in the short run, are at least only palliative and at worst, destructive. Continued support of this nature will, in fact, impede structural change, which is necessary if the abalone industry is to cover all appropriate costs, including the provision of appropriate government services and the payment of a community contribution when and if economic rents are being earned. The Committee has suggested that there are likely to be more efficient/cheaper ways to manage the fishery without compromising sustainability objectives, and we note that these are now being pursued.

The Committee reiterates its strong position that it would be appropriate, and indeed a good use of public funds, to use Government funds to intervene in the abalone fishery and support the development of alternative, more cost-effective management arrangements.

The Committee notes that NSW abalone product is up against strong competition from wild caught product in the significantly larger producing states of Tasmania, Victoria and South Australia, and aquaculture product. As aquaculture operations continue to expand new overseas markets and marketing initiatives for wild caught NSW abalone will need being explored. The Committee cannot, however, support any initiatives that place market considerations over the long-term sustainability of the resource.

There has not been the degree of structural change in the abalone fishery that one would expect in light of the perilous economic circumstances. In this report, a number of suggestions are provided as to why this may be the case. Better information on the structure, conduct and performance of the industry, would improve the prospects of understanding the reasons behind the reluctance of industry to restructure in the face of such difficult economic circumstances.

The Committee is reassured that restructuring seems to be occurring amongst divers in the fishery, with fewer divers taking a greater proportion of the catch. Quota is trading, potentially towards low cost more efficient operators, and the number of divers in the water is falling. The Committee believes that this pattern of change is likely to be sustained. It also believes that both the fishery and the remaining industry participants will benefit from it.

The Committee has made a number of recommendations in this report that are aimed at improving the economic information available on which to base management decisions. The Committee also recommends that the performance indicators and triggers against which the economic status of the industry is measured should be revised.

The Committee notes that while the volume of illegal catch appears to be falling, this is still significant and undermines the economic value from the fishery.

The Committee's continued conservative determination for the TAC in 2010/11 is based on the need to provide strong prospects for biological recovery of the fishery over the long term. By leaving stock in the water, this TAC strategy also offers improved prospects for economic recovery of the fishery, again over the longer term. As reflected elsewhere in this report, there is an important trade off to be made between short-term economic gain from increased TACs and the longer-term biological and economic recovery of the fishery. As with the lobster fishery, it is also expected that as stock increases and the fishery is seen as more robust against short term fluctuations, asset (share) values will increase.

5. State of the Stocks

5.1 Introduction

In making its determination the Committee considers the current and predicted status of the stock. The information available to the Committee to make this assessment has changed and diminished considerably in recent years.

- Up until and including the Committee's 2008 determination the fishery assessment was based on
 - o Fishery Independent Surveys of the relative abundance of different size categories of abalone (including abalone smaller than the minimum legal size in the fishery so as to provide a 'leading indicator' of recruitment to the fishery),
(catch rate and weight composition from commercial fishing;
 - o integrated analysis of this information by fitting a length-based population model to estimate population size and recruitment; and
 - o prediction of the expected future trends in the status of the stocks under different possible levels of fishery catch.
- Since 2008, through various decisions of the industry and Department, the Fishery Independent Survey has not been conducted, there has been no update of the population model to assess stock status and there has been no scientific prediction of future trends of the stock. Consequently in 2009 and again in 2010 there was no formal scientific stock assessment or prediction of future stock condition. The primary reason for this was to reduce costs, although there were also some concerns about the representativeness of the Fishery Independent Survey sites and hence the indices of relative abundance based on them.
- In recent years there has been some information available from trials of various designs of Fishing Surveys (i.e. commercial fishing to a scientific design that enables specific statistical comparisons or tests) and Structured Fishing (i.e. commercial fishing to catch limits by relatively broad area and with enhanced spatial reporting of catch, effort and length composition through the use of electronic data loggers). These trials were focused on Regions 1 and 2 which have been closed to 'free' (i.e. unrestricted choice of where and when to fish for the allocated catch quota) commercial fishing because of concerns about stock condition and/or inadequate information on which to justify a safe commercial catch. These trials are intended to
 - o investigate methods of monitoring the stock that are more cost effective than Fishery Independent Surveys;
 - o inform stock assessment and management decision-making for those regions; and

- verify/calibrate indicators that are based on Fishing Surveys or Structured Fishing against those based on the previously used commercial catch rate and Fishery Independent Surveys.
- Fishing Surveys were suggested in 2003, the first significant trial was completed in 2007, and some preliminary analysis was provided to the Committee in 2008. Finalised analysis has not yet been provided. Structured Fishing formally started in late 2008 and coverage of the fishery has increased since that time as more, and more reliable, data loggers have been made available for use by divers. Descriptions of the data from Structured Fishing in 2008/09 and the first part of 2009/10 were presented to the Committee this year, including some preliminary analysis and initial attempts to calibrate the indicators of stock status from 'free' commercial fishing, Survey Fishing, Structured Fishing and Fishery Independent Surveys. This preliminary work, while being a very promising start that should be pursued, does not yet provide fully understood, verifiable and interpretable calibrations or stock condition indicators.

But the previous methods have been stopped before the new methods have been fully established or shown to be adequate, leaving the current period in which there is increased uncertainty about interpretation of information from the fishery and consequently about the state of the stock.

There is now heavy reliance on commercial catch rate as an indicator of stock abundance, which has well known problems, particularly in this fishery managed by individually tradable quotas where the management intent is for industry to increase catch rate through innovation and changed fishing practices. Commercial catch rate is also notoriously 'hyper-stable' for abalone fisheries, in that high catch rates can be maintained by targeting concentrations of abalone in known patches of preferred habitat even if the overall population decreases. Such hyper-stability of catch rates has been seen in the history of the NSW abalone fishery at both the regional and subregional scales. Further, commercial catch rate is a 'trailing' indicator that reflects what has happened, rather than a 'leading' indicator that informs about what will happen – it contains no information about the numbers of sublegal sized abalone that provide the future commercial stock.

The reduced information to monitor and assess the population is particularly problematic at this time because of several interacting issues and in particular:

- concerns about recruitment overfishing (i.e. reduced breeding stock reducing the number of young abalone produced) in Region 2 and potentially other Regions, and the need to resolve the extent of this and how the stock is responding to previous management measures intended to protect it; and
- the strength and persistence of the most recent pulse of increased productivity (i.e. increased recruitment and/or growth rate), which is now passing through the fishery and that will determine both the extent of current stock rebuilding and the future scope of sustainable catches.

The history of the fishery for the past about 20 years has been one of pulses of productivity with decreasing peaks and increasing troughs as the reducing population lost the ability to buffer the pulses. Rebuilding this buffer in the population is necessary both for population productivity and greater stability in the fishery. Region 2 was closed to commercial fishing because of the evidence that recruitment overfishing was occurring there, and the Committee later expressed concern about the possibility of recruitment overfishing in the more southern regions. Specifically, the concern was that the population model predicted the pulse of relatively strong recruitment currently passing through the fishable population would be weaker than previous pulses, which, if correct, could both indicate the onset of recruitment overfishing in these regions and cause further decline in the mature biomass –

further exacerbating the problem of recruitment overfishing. **A key question is whether the pulse of recruitment currently passing through the fishable population is as strong as previous pulses (i.e. fluctuating recruitment without trend) or whether it is weaker (i.e. recruitment overfishing with recruitment decreasing on average through these pulses).**

With the recent limited information and analysis it is not appropriate or possible for management measures to be based on detection and tracking of the detailed nuances of population change in response to natural variability or the effects of previous management interventions – rather management measures must be simple, robust and precautionary. Reflecting this situation the Committee last year substantially reduced the Total Allowable Catch and recommended an increase in the size limit by 2mm to 119mm (building on the 2mm increase to 117mm in 2008). Together these measures were considered to allow for stock rebuilding and to provide increased protection for the spawning stock. The increase in size limit to 119mm was not introduced into the fishery, although some industry operators voluntarily fished to a 119/120mm size limit and there has been agreement to increase the size limit for the six southern-most subregions (i.e. south of Wonboyn) to 120mm from 1 May 2010.

Regions 1 and 2 have been closed to free commercial fishing in recent years, with special catch allocations having been provided each year to encourage the collection of data that could help resolve the specific fishery assessment and management issues there. These fishery assessment and management issues are;

Region 1 North (north of Port Stephens, subregions A-E)

There is very little information available to assess the status of stocks in Region 1 north of Port Stephens. There has never been Fishery Independent Survey coverage in this area and there has been very little commercial fishing at any time since 1987. It is not known whether, and to what extent, the stocks there were affected by the disease *Perkinsus* that significantly reduced stocks in the southern portion of Region 1. The special catch allocations in Region 1 North have been, and are again this year, to allow data collection to determine the extent of *Perkinsus* impacts and to support an initial assessment of the stocks, and estimate a sustainable catch.

Region 1 South (south of Port Stephens, subregions F-L)

This area suffered a severe outbreak of *Perkinsus* in the late 1990s. There were relatively few Fishery Independent Survey sites the southern portion of Region 1 but they all showed the death of 50-75% of abalone of all sizes. Part of this area was closed to commercial fishing in 1996 and the whole of Region 1 South was closed in 2002. The Fishery Independent Surveys subsequent to total closure showed continued low abundance and no recovery of the small or medium sized abalone, and an accumulation over time of increasingly large abalone interpreted to be the survivors of the outbreak augmented by low recruitment. The Fishery Independent Survey sites were clustered in three areas - Port Stephens, Sydney and Kiama (subregions F, J and K) – so there has been concern about how representative these sites were of the whole region. Some trial fishing in 2004 showed that it was possible to take high catch rates of large abalone from targeted sites, as expected from the Fishery Independent Survey data and abalone fisheries generally. However, this trial fishing did not address:

- the spatial extent of any recovery;
- the abundance of sublegal abalone to support the population and fishing; or

- whether the stock mostly comprised aging survivors of the disease outbreak.

The special catch allocations in Region 1 South have been, and are again this year, to allow collection of data that would test the representativeness of the Fishery Independent Surveys and support an improved assessment of the stocks to determine whether a commercial harvest should be allowed, and if so its size and any appropriate conditions.

Region 2

Region 2 was closed to commercial fishing in 2006 because of evidence of recruitment overfishing there. The 1995/96 and 2001/02 pulses of increased productivity and recruitment were estimated to be very much weaker in Region 2 than in the more southern regions in those years, and were weaker than that seen in Region 2 in 1988/89. This interpretation is of a decrease in average recruitment to Region 2 since about 1995, including a decrease in the strength of recruitment in the 'pulse years'. This interpretation was broadly consistent with both commercial catch rates data and Fishery Independent Survey data, although there were differences between them. The Survey interpretations were more optimistic than the commercial catch rate interpretations until about 2005 and since then the commercial catch rates were more optimistic, caused by the rapid decrease then increase of the commercial catch rates in the period between the last two pulses of increased productivity. The special catch allocations in Region 2 this year are to allow collection of data that would test the representativeness of the Fishery Independent Surveys and support an improved assessment of the stocks especially in relation to the interpretation of recruitment overfishing.

5.2 Information used to assess the state of the abalone stock

The main information available this year are:

- the commercial catch rates and mean weight of abalone in the catch (including the results of Structured Fishing in Regions 1 and 2);
- an initial comparison between stock indicators based on commercial catch rates;
- Structured Fishing catch rates;
- Fishing Surveys and Fishery Independent Surveys in Regions 1 and 2; and
- an update on the likely illegal and unreported catches.

In addition there were several sources of information from analysis conducted in previous years; specifically a preliminary analysis of the Fishing Surveys in Regions 1 and 2 (conducted in 2007 and analysed in 2008) and the last model-based stock assessment (analysed in 2008).

Commercial fishing operations in Regions 3-6 have been conducted as 'free' commercial fishing throughout the history of the fishery. Commercial fishing operations in Regions 1 and 2 in recent years have been constrained by the requirements of Fishing Surveys and/or Structured Fishing. Information from these two types of fishing is considered separately.

5.2.1 Data from 'free' commercial fishing

This relates to Regions 3-6. The annual commercial catch and catch rates by region, from 1987 to 2009, are shown in Figure 8.

The commercial catch rate in the most recent year increased in all Regions (including in Regions 1 and 2 under Fishing Surveys and/or Structured Fishing), and substantially so in

some Regions. The increase in the most recent year is part of a widespread improvement of catch rates during the past 4 years. This pattern is consistent with earlier interpretations and predictions that a pulse of increased productivity (i.e. increased recruitment and/or growth) is currently passing through the population. The general reports from industry are of increasing numbers of legal and just sub-legal (especially in the previous 115mm to 117mm size range) abalone and of legal sized abalone being 'left on the bottom' with the current Total Allowable Catch. This is very encouraging both in that the increased size limit is not restricting catches and that the reduced catch limit is allowing some rebuilding of stocks from the current pulse of increased productivity.

While a general pattern of increased catch rate has occurred in all Regions in the past 4 years the details differ by Region. In Region 3 the catch rate has increased substantially in the most recent year to be the highest seen since 1987. In Region 4 the catch rate also increased substantially in the most recent year, but this increase was to about the 1994 benchmark for catch rate. In both Regions 5 and 6 the catch rate increase in the most recent year was similar to the increase seen in each of the past four years, and this increase was to about 15% below the 1994 benchmark. These commercial catch rates, if assumed to directly and consistently reflect abalone density, imply that the current pulse of productivity under current management settings has been sufficient to:

- return Region 3 to slightly above the levels of the historic peaks of the productivity pulses;
- improve Region 4 to about the average historic density, but not to return it to the historic peaks of the productivity pulses there;
- improve Regions 5 and 6 but only to the extent of returning it densities that are at the lower benchmark and that are still well below the historic peaks of the productivity pulses there.

It remains to be seen whether the 2009 catch rates are the new peak or whether further increase occurs in 2010. During the onset of previous pulses in productivity the duration of increasing catch rates has usually ranged from 3-4 years, so the present 4 year period of increasing catch rate is at the upper end of previous experience. If 2009 does transpire to be the peak then the recovery in Regions 4, 5 and 6 will not have been strong enough to prevent a continuing trend of decline superimposed on the fluctuations (i.e. a trend of lower peaks and deeper troughs in the fluctuations). But it is also possible that, as intended, sufficient stock has been rebuilt in the past few years from this pulse to prevent or at least reduce any decrease in catch rate following the pulse. This will become apparent in the next few years.

The recent history of the monthly catch rate is shown in Figure 9 and the mean weight of individuals caught is shown in Figure 10, with the time of the increased size limit to 117mm superimposed on both. The catch rates for Regions 3-6 all decreased initially after the increase in size limit, as expected. But this decrease was recovered within 6 months for Regions 3-5 and within 12 months for Region 6, as abalone grew through to the larger size limit, and subsequently all Regions had catch rates substantially greater than at the time of the size limit increase. The average weight of abalone caught has increased by about 40% in Region 3 and 60% in Regions 4-6 compared to before the increased size limit. As intended, this increase in mean weight substantially reduces the number of abalone killed to achieve the same Total Allowable Catch. Overall the detailed catch rate and mean weight data support the interpretations that the increased size limit in combination with the low Total Allowable Catch is providing increased protection for the stock. Furthermore the negative effects on commercial catch rates were relatively brief and the positive effects were both substantial and quickly obtained. The rapidity of recovery in catch rates and the scale of the increase in mean weight imply that (for recent growth conditions at least) the population has

been suffering growth overfishing (i.e. greater long term yields would be achievable with a larger size limit and lower fishing mortality than has been applied on average in the past say 10-15 years).

5.2.2 Data from Fishing Surveys and Structured Fishing

This relates to Regions 1 and 2, and includes consideration of both the Fishing Surveys in Region 1 South during 2007 and the Structured Fishing in Regions 1 (North and South) and 2 during 2008 and (particularly) 2009. Some Fishing Surveys were also conducted in Region 1 South between 2003 and 2006 but these are not considered in detail here. The annual catch and effort from all these commercial fishing activities in Regions 1 and 2 are shown in Figure 8. The recent catch rates from Fishing Surveys and Structured Fishing are not necessarily comparable to the catch rates from the earlier free commercial fishing, particularly because the small catches can be taken from targeting patches of high abalone density. Nonetheless the observations are that the catch rate in Region 1 has been fluctuating without major trend while the catch rate in Region 2 has increased in each of the last 4 years, similar to the pattern in the Regions further south, and has increased substantially in the most recent year to be much higher than at any time since 1987.

The 2007 Fishing Surveys in Region 1 South were based on re-fishing at historically productive fishing sites, with further exploratory fishing then conducted in the general region at sites selected by divers. This allowed comparison of the proportion of previously productive site that remain productive, of the change in catch rate at those sites compared to catch rates in 1994, 1987 and 1982-85, and of the current catch rates at historically productive sites compared to sites currently chosen by divers. The Fishing Surveys were commercial fishing and so only legal sized abalone were taken, but qualitative estimates of undersized abalone were made by divers.

A preliminary analysis of these data was provided in 2008 and the general conclusions were:

- i) only about 36% of historically productive sites were still as productive as they were;
- ii) 70-80% of historically productive sites have catch rates that are lower than those recorded there in 1994 or 1987;
- iii) the northern subregions, between Pt Stephens and Sydney (subregions F, G and H), had very low abalone abundance and a major loss of historically productive sites;
- iv) the southern subregions, between Sydney and Wreck Bay (subregions J, K and L), had considerably higher abalone abundance and had lost fewer historically productive sites than the northern subregions, and slightly more than half of all sites fished in these southern subregions had catch rates greater than was recorded there in 1994;
- v) it was not possible to quantify or calibrate the abundance categories used to record sub-legal sized abalone, but overall about 60% of sites were considered to have 'many' sublegal abalone and most of the sites with 'many' sublegal abalone also had medium to high catch rates of legal abalone (consistent with the limited dispersal of abalone larvae and the reliance of local recruitment on local mature abalone);
- vi) for almost all sites the median length of abalone taken was greater than 120mm (i.e. more than 50% of abalone were larger than 120mm length);
- vii) the diver selected sites provided slightly higher catch rates than the historically productive sites but data from these additional sites did not materially change the overall results or conclusions.

Overall these preliminary results are consistent with the Fishery Independent Survey data in indicating that Region 1 South supports some pockets of large and dense abalone aggregations, but that many historically productive sites still do not support large abalone aggregations or significant numbers of small abalone despite many years of protection from fishing. The stock of legal sized abalone in the northern subregions (F, G and H) remains very depleted, while the stock of legal sized abalone in the more southern subregions (J, K and L) has recovered to 1994 levels at more than half of the sites fished. The numbers of sub-legal abalone present to support further recovery of the population or sustainable fishery catches remains unclear, and resolution requires further data and/or analysis to calibrate the abundance categories used to record sub-legal sized abalone.

Structured Fishing and fine scale data recording was progressively introduced into fishing of regions 1 and 2 during 2008 and 2009, and was reported to be covering most fishing operations by late 2009. The spatial distribution of fishing effort was controlled through target and limit (cap) catches set for each subregion, with operators being free to choose the time and location of dives within each subregion. For all subregions the actual catches taken were less than the limit that had been set. The target catches were not met in some subregions and were exceeded in others. Structured Fishing provided some catches from all of the subregions of Region 1 North and Region 2, although the amount of catch from Region 1 North was very small. Almost all of the subregions of Region 1 South had some catch. The development and delivery of the fine scale data reporting associated with Structured Fishing is a very significant and positive development to support assessment and management of the fishery. However it is acknowledged by all that the methods and approaches will further develop and evolve to meet the needs of fishery management.

A preliminary analysis of the fine scale data collected through Structured Fishing in Regions 1 and 2 was provided by industry, including a first attempt at calibrating the information from Fishery Independent Surveys, Fishing Surveys and Structured fishing. At this stage the fine scale data were not available to government scientists for quality assurance or for collaborative/independent analysis. It was appreciated by all that these preliminary analyses were conducted quickly so as to provide early and timely input to the stock assessment process. The analysis of data from structured fishing is based on commercial catches of abalone and focused on the legal sized part of the stock. Divers have the option to record qualitative estimates of sub-legal abalone abundance, but that option was apparently not often exercised and in any event would suffer from similar problems of interpretation as the qualitative estimates provided as part of the 2007 Fishing Surveys. The main points from these analyses are:

- i) There was insufficient data to allow meaningful interpretations for Region 1 North.
- ii) Structured Fishing and Fishing Survey catch rates were very similar to one another and low in the northern part of Region 1 South (i.e. Port Stephens to Botany Bay or subregions F- H).
- iii) Structured Fishing and Fishing Survey catch rates were less consistent with one another but on average considerably higher in the southern part of Region 1 South (i.e. Botany Bay south to Wreck Bay and or subregions J-L). The Fishing Surveys gave higher catch rates than Structured Fishing in subregions J and K, while the opposite was the case in subregion L.
- iv) Depletion estimated from the Fishery Independent Surveys, Fishing Surveys and Structured Fishing in Region 1 South were consistent in indicating significant depletion from the 1994 benchmark for all the subregions between Port Stephens to Botany Bay (i.e. subregions F- H). There was less consistency for the more southern subregions of Region 1 South (J, K and L) – on average these subregions combined

were at or above the 1994 benchmark but the Fishing Surveys indicated that subregion L was below the benchmark while the Structured Fishing indicated that subregion J was below the benchmark. Combining estimates indicated that subregion J is somewhat below the 1994 benchmark and that subregions K and L are at about the 1994 benchmark for legal sized abalone.

- v) There is no Fishing Survey data for comparison with the Structured Fishing data for Region 2 but, as for Region 1, a measure of depletion can be made from comparing the catch rates from the recent Structured Fishing with those historically from free commercial fishing in the same subregions. This is not a necessarily valid comparison, it does not use the advantages of the detailed spatial data from Structured Fishing (it is a simple aggregated catch rate which could have been calculated without the fine scale data) and it does not avoid the issues of hyper-stability due to targeting abalone concentrations at space scales less than the subregion. While recognising these constraints on interpretation the depletion estimated from Structured Fishing catch rates in region 2 suggests that the legal sized abalone stock is near or somewhat above the 1994 benchmark.
- vi) The length information provided by the Structured Fishing program has not yet been examined in any detail. However early indications from the catches in Region 2 are that there are now proportionately more abalone in the 120-130mm size range than was the case in 1994.
- vii) The fine scale data available from the Structured Fishing Program appear capable of supporting a direct examination of the representativeness at various space scales of the Fishery Independent Survey sites, although this analysis has not yet been done. The fine scale data from the Structured Fishing program does not at this stage provide an interpretable index of the abundance of sub-legal sized abalone.

Analyses of the data from the Fishing Surveys and Structured Fishing are preliminary, and the interpretations are somewhat uncertain and tentative. However there is no doubt that the fine scale data collection, and the comparisons that these data make possible, can contribute greatly to assessment and management of the fishery. From the data and analysis available it is reasonably clear that the abalone stocks in the northern part of Region 1 South (i.e. subregions F-H) remain seriously depleted. In the southern part of Region 1 South (i.e. subregions J, K and L) there are many sites that support high densities of large abalone, with overall catch rates similar to or higher than those in the benchmark year of 1994. But many historically productive areas in the southern part of Region 1 South have not yet recovered and it is unclear whether the numbers of sublegal sized abalone are sufficient to sustain either the current population or substantial fishing. There is no substantial new information available about the status of the stock in Region 1 North,

5.2.3 Results from the last model-based stock assessment (2008 analysis of the population status in 2007)

While this assessment is now 3 years old it provides the most recent integration of all historical data and reconstruction of the historical population and productivity for comparison with the recent status - it provides the basis for many of the general interpretations of the past and recent status of the stock. Several features of the population, such as the age/size structure and mature biomass, would not be expected to change quickly because of the relatively low rate of natural mortality and growth of abalone.

The assessment model integrates commercial catch and catch rates, the average weight of abalone caught and the relative abundance from Fishery Independent Surveys. Non-

representativeness of any of these measures would bias the model interpretation. Conflicting patterns between the commercial catch rates and Fishery Independent Survey data in Region 2 has been raised repeatedly as an issue – for the first 5 years of the last 10 years the survey abundance measures were more optimistic than the commercial catch rates then the pattern reversed. From the currently available data and analysis there is no compelling argument to either dismiss or down-weight the Fishery Independent Survey data, or the resulting conclusions of the assessment model.

The 2007 estimates of the level of depletion of the mature biomass (MB) compared to the unfished population (MB_0), the 1994 population (MB_{1994}) and the population giving Maximum Sustainable Yield (MB_{MSY}) were:

Region	MB_{2007}/MB_0	MB_{2007}/MB_{1994}	MB_{2007}/MB_{MSY}
2	28% (20-36)	75% (66-84)	49% (35-63)
3 and 4	51% (38-68)	96% (85-107)	91% (67-121)
5 and 6	41% (28-56)	94% (84-106)	72% (50-98)

The model also provides an estimate of the history of recruitment in the regions. These estimates are shown in Figure 11. Key interpretations are:

- The good years for recruitment correlate well among all regions.
- After about 1990, several changes are apparent:
 - The periods of good recruitment are shorter and the low recruitment between these peaks is lower. The increased fluctuation in recruitment estimates matches that in the commercial catch rate data 2-4 years later.
 - The two most recent periods of good recruitment were very weakly in Region 2, although there was some increase.
 - There is a decreasing trend of recruitment in Region 2 since about 1983, with peaks and troughs superimposed on that trend.
 - The average recruitment in Regions 3 and 4 and 5 and 6 since about 1990 is lower than in the earlier period, with an increasingly 'spiky' pattern of recruitment through time. Different regions show different mixtures of lower lows, more persistent lows and briefer highs.
 - Overall, this is a pattern that is consistent with recruitment overfishing of the stock having begun in the early 1990s, and having become quite severe in Region 2.

This interpretation of recruitment overfishing is also consistent with the estimates of 'steepness' in the relationship between the abundance of the mature stock and the average recruitment that is produced. 'Steepness' is the proportionate reduction in average recruitment that results from a reduction in the mature biomass to 20% of the unfished level, and 'steepness' can range from 1, (i.e. no reduction in recruitment) to 0.2 (i.e. an approximately linear reduction in recruitment). The estimates of 'steepness' from the model are 0.4-0.5, which implies a significant reduction in average recruitment for the depletion that has occurred in the abalone populations for some regions. The depletion in Region 2 is to 28% of the unfished level, which for a range of steepness values 0.4-0.5 implies that significant recruitment overfishing is occurring (i.e. a reduction in recruitment to perhaps half

of the unfished value). Some appreciable but less severe recruitment overfishing would also be expected on this basis in Regions 3 and 4 and Regions 5 and 6.

This interpretation suggests that the 1994 abundance benchmark is not an appropriate one to protect against recruitment overfishing. It has previously been noted that it is not an appropriate benchmark to provide the maximum sustainable yield.

5.2.4. Biological assumptions

There are no new biological data used in consideration of the state of the stocks this year. The biological data and assumptions used in the 2008 stock assessment model and forward predictions are as described in previous reports.

5.2.5 Illegal, unreported and recreational fishing catches

The level of illegal, unreported and recreational catch, and trends during the history of the fishery, remain very uncertain.

Since July 2005 the permitted recreational bag limit has been reduced from ten abalone per day to two, and there has been both extra focus on compliance and increased penalties for illegal recreational fishing. Reports from industry, management and compliance all agree that this has substantially reduced the recreational catch. The Committee consider that the recreational catch now and in the next few years is likely to be in the vicinity of 5-15t.

In previous years, the illegal and unreported catch was assumed to be 40% of the legal and reported catch in 1987 – that is 102t from Regions 2-6. The absolute quantity of illegal catch is very unclear. General impressions from compliance officers and industry are that the illegal catch probably was about 100t per year in the past, that it was likely to have been below 100t but above 50t in 2008, and to be perhaps as low as 20-30t in 2009. The introduction of indictable offences for abalone theft, the targeting of poaching syndicates by compliance officers, and the development of improved methods to permit indigenous catch are all thought to have improved the situation. In the present circumstances of stock condition and stock assessment capability it was considered appropriate to have any reduction in illegal catch contribute to stock rebuilding.

5.3 Conclusions

The data and analysis available this year does not allow precise interpretation or tracking of the status of the population and its response to previous management measures - as was also the case last year. The development of a program to record fine scale information from commercial fishing operations during the past about year is very promising. But it has yet to be fully established or show that the information provided is an accurate and adequate basis for assessing and managing the fishery. The indicators of abundance of legal sized abalone that have been calculated from the fine scale information so far remain vulnerable to hyper-stability caused by the fishery targeting high density sites at scales smaller than regions and subregions. There remains an inability to measure changes in the abundance of the sub-legal sized abalone that provide the basis for sustaining the population and fishery production in the next few years.

There has been a substantial increase in catch rate and abalone stocks in Regions 3-6 during the past 4 years of decreased Total Allowable Catch and increased size limit. However this increase is from a low base. The catch rate is still well below the 1994 benchmark in Regions 5 and 6, and is about at the 1994 benchmark in Region 4. Only in Region 3 has the catch rate increased above the 1994 benchmark. The recent reductions in Total Allowable Catch and increase in size limit were intended to allow substantial rebuilding of the population, and particularly the age structure of the mature population, from the

current pulse of increased productivity so as to buffer the population and fishery from the effects of these fluctuations in productivity. This rebuilding appears to be happening, although its extent and adequacy is not clear. The pulse of increased productivity appears to have continued for a 4th year into 2009, which is a very positive event. But it is not known whether it will persist further and if it does not the stock rebuilding in at least Regions 4, 5 and 6 will not have been sufficient to prevent an overall and long-term decreasing trend superimposed on the fluctuations from the productivity pulses.

There is no substantial new information available from Region 1 North.

All of the information available indicates that abalone stocks in the northern portion of Region 1 South (i.e. Pt Stephens to Botany Bay or subregions F-H) remain depleted and well below the 1994 benchmark. This supports continued protection of these stocks. The situation in the southern portion of Region 1 South (i.e. subregions J, K and L) is more ambiguous. All the available information supports the existence of substantial areas with high density of large abalone, and that catches could be taken there for some time at least with very high catch rates. But it is also clear that there are many previously productive areas that have not recovered. And crucially it is not known whether the abundance of sub-legal sized abalone is sufficient to sustain the current population and significant fishery catches in the longer-term. Any commercial fishing in the southern portion of Region 1 South would need to be responsibly conducted in this context, recognising that if the population is mostly a relic from the disease outbreak then it could rapidly collapse under fishing. In this situation responsible fishing requires an ability to be able to detect adverse outcomes and implement appropriate management measures in time to avoid serious harm to the stock. This mitigates for a small catch taken in a manner that allows monitoring and assessment of both the legal sized and sublegal sized abalone.

Region 2 has provided historically high catch rates in each of the past 2 years but the serious concern of recruitment overfishing there remains. The high catch rates demonstrate that there are areas within Region 2 that support high densities of abalone, although as for the southern portion of Region 1 that has never been in doubt. The critical questions concern the recent amount of juvenile recruitment and the recent size of the mature population – in both cases in relation to their historical values. The currently available data do not address the questions relating to juvenile recruitment. And the only historical comparison of the mature population comes from comparison of the catch rate from past free commercial fishing to a large catch with the catch rate from recent Structured Fishing to a small catch. Because of the considerable scope for targeting the recent small catches onto dense abalone aggregations these catch rates are not necessarily comparable. The data from Structured Fishing appear to be sufficient to allow comparison of catch rates at specific locations through time, through analyses like those made in the preliminary analysis of the 2007 Fishing Survey data, but the relevant analysis has not yet been done. Similarly, the data from the Structured Fishing appear to be sufficient to examine the representativeness of the Fishery Independent Surveys (for legal sized abalone at least), and to estimate a calibration for the Fishery Independent Survey data in recent years if the surveys are found to be not representative. This could allow for improved historical comparison of the mature population but the relevant analysis has not yet been done. From the data and analysis currently available the interpretation of recruitment overfishing in Region 2 cannot be dismissed, although the improved data from Structured Fishing appears to offer opportunities to further test that interpretation and monitor the stock in future. There is a balance from the potential benefits from this improved information and the risks from further catches, particularly as the improved information has not yet been fully analysed and evaluated. At the present time, and considering that the catch decisions are reconsidered annually, there is considered to be considerable value in further development and use of information from Structured Fishing in Region 2.

The very rapid response of both the catch rate and mean size of abalone to the increased size limit to 117mm indicate that the fishery in recent years was far from the optimum combination of size limit and fishing mortality. The size composition information available from region 1 show that a large fraction of the abalone there are larger than 120mm, and preliminary information from Region 2 indicate that there has been an increase in the relative abundance of 120-130mm abalone there. The decision has already been taken to introduce a 120mm size limit in the southern part of Region 6. Use of a 120mm legal size limit throughout the fishery at this stage would provide precautionary protection of the breeding stock and is likely to be closer to optimal for much of the fishery (i.e. those parts of the fishery where asymptotic size and growth rates are large). So long as the fishing mortality (Total Allowable Catch) is sufficiently low the increased targeting of abalone in areas of large asymptotic size and growth rates that could follow under a 120mm size limit would not cause excessive depletion. And population responses under the current Total Allowable Catch suggest that the fishing mortality is low enough to provide that protection. In future, with improved information and stock condition, the size limit could be reduced, i.e. a regime of variable size limits introduced, in areas where growth conditions and management cost-effectiveness warranted it.

On balance the Committee decided that the commercial catch taken from each area should not exceed:

Region 1 North (subregions A-H)	3t available for Fishing Surveys or Structured Fishing to a design acceptable to the Department
Region 1 South (subregions F-H)	0t
Region 1 South (subregions J, K & L)	4t available for Fishing Surveys or Structured Fishing to a design acceptable to the Department
Region 2	5t available for Fishing Surveys or Structured Fishing to a design acceptable to the Department
Regions 3 and 4	25t
Regions 5 and 6	45t
Total TACC 82t, with all catches to a minimum legal length of 120mm	

These decisions could be reviewed if new information and analyses become available.

Given the overall state of the stock, and the desire for continued commercial fishing, it is imperative that there is a robust and reliable means to monitor, assess and predict the state of the stock. This should include leading indicators that are based on the abundance of sub-legal abalone, which will bring considerable advantages to management and industry from improved planning horizons. The information and analysis available for this year's assessment by the Committee is not adequate to support reliable decision making and an optimal fishery on an ongoing basis. The Committee has previously recommended against dismantling the established methods of monitoring and assessment before any new method is fully developed and calibrated against the previous methods. The Committee repeats that recommendation and the need to be able to relate any new indicators of stock status to the indicators used historically. Without that the fishery will be very vulnerable to the 'creeping baseline' syndrome that have frequently led to very sub-optimal ecological and economic outcomes in fishery management.

Specifically, the Committee **recommends** that the new information and analyses needed includes:

General

- Identify the information required and the design of future Fishing Surveys or Structured Fishing to support ongoing management of the fishery. This should include arrangements for data access and sharing between the industry and department, and quality assurance/quality control procedures. The limitations identified in the preliminary analysis of Structured Fishing data should be addressed, including the need for measures of the abundance of sub-legal sized abalone.

Region 1 North

- Analyse the structured fishing data to assess the status of the stocks, the areas and size of commercial stocks, the relative abundance of sub-legal abalone, and the appropriate size limit for commercial fishing.

Region 1 South

- Complete the preliminary analysis of the Structured Fishing and Fishing Survey data. This should address the extent of stock depletion (including prior to the *Perkinsus* infection), the relative abundance of sub-legal abalone, and calibration between any new monitoring methods and the Fishery Independent Surveys.

Region 2

- Complete the preliminary analyse of the Structured Fishing data. This should address the extent of stock depletion, the relative abundance of sub-legal abalone, and calibration between any new monitoring method, the Fishery Independent Surveys and historical commercial CPUE.
- Repeat the Fishery Independent Survey in this Region so as to provide updated and contemporaneous survey data for calibration with the fine scale data from Structured Fishing.

Regions 2-6

- Update the stock assessment model and stock predictions using the new minimum legal lengths and the additional data on commercial catch rates and the size composition of the abalone in the catch. If the analyses for regions 1 South and 2 provide a re-calibration of the Fishery Independent Survey abundances then they should be applied to regions 3-6.
- Provide 'per recruit' tables, on a regional or subregional basis if that is necessary to reflect course spatial differences in population parameters. These should provide yield per recruit, egg production per recruit and mean individual weight in the catch per recruit.

Figure 8. Annual catch (histograms) and CPUE relative to 1994 (lines) for each region of the fishery since 1987. Dashed lines represent the value of mean CPUE in 1994, and dotted lines are +/- 15%. The white histogram bars and open circles for recent years in regions 1 and 2 indicate the years in which substantial components of these regions were closed to routine commercial fishing and the data came from Fishing Surveys or Structured Fishing and so are not necessarily directly comparable.

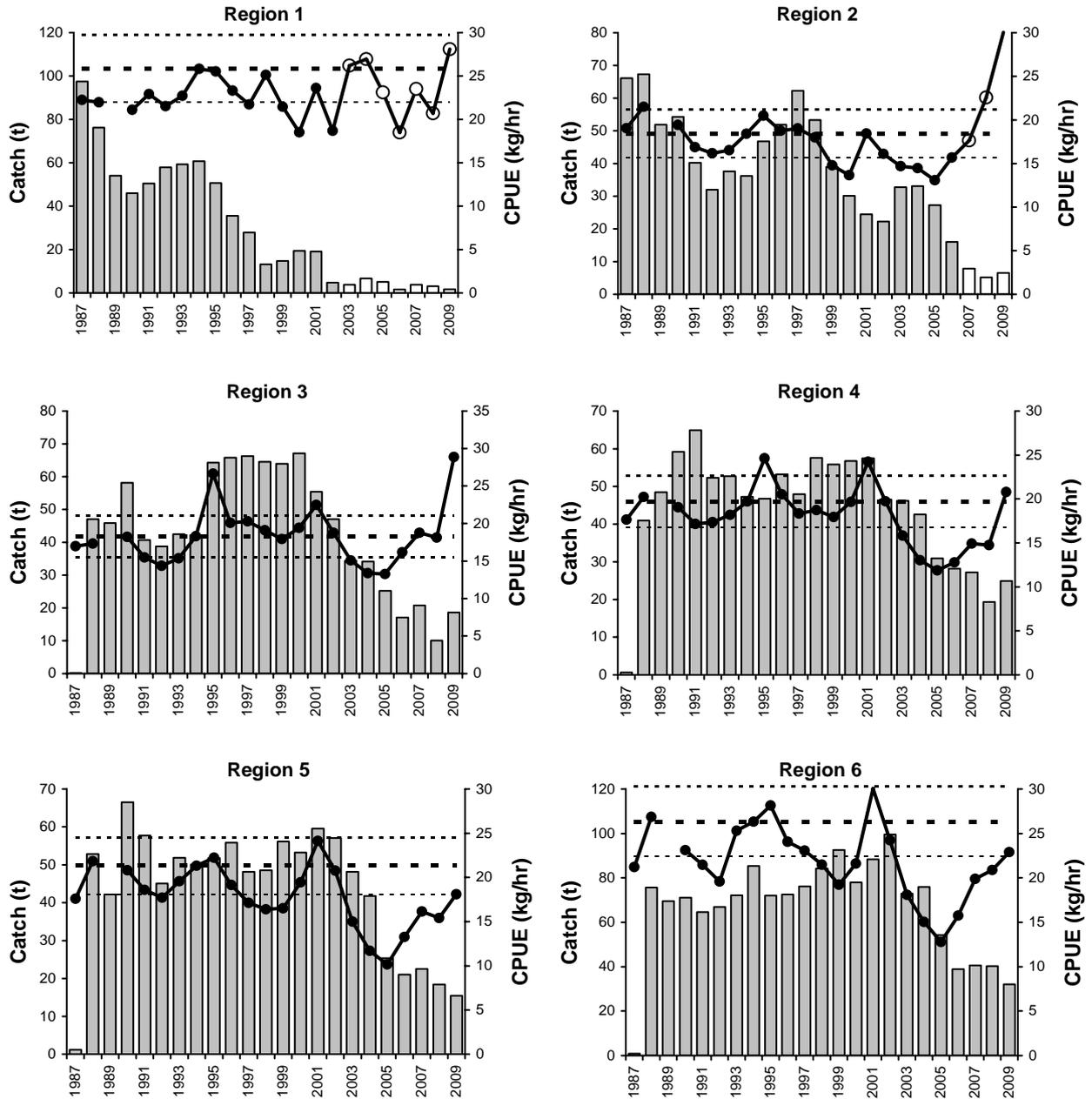


Figure 9: Mean monthly CPUE (kg/hr) for each region of the fishery since 1998. Vertical dashed line indicates the increase in MLL from 115 to 117 mm in July 2008. Bold horizontal lines indicate mean CPUE (kg/hr) during the 8 x 6-month periods between January 2006 and December 2009.

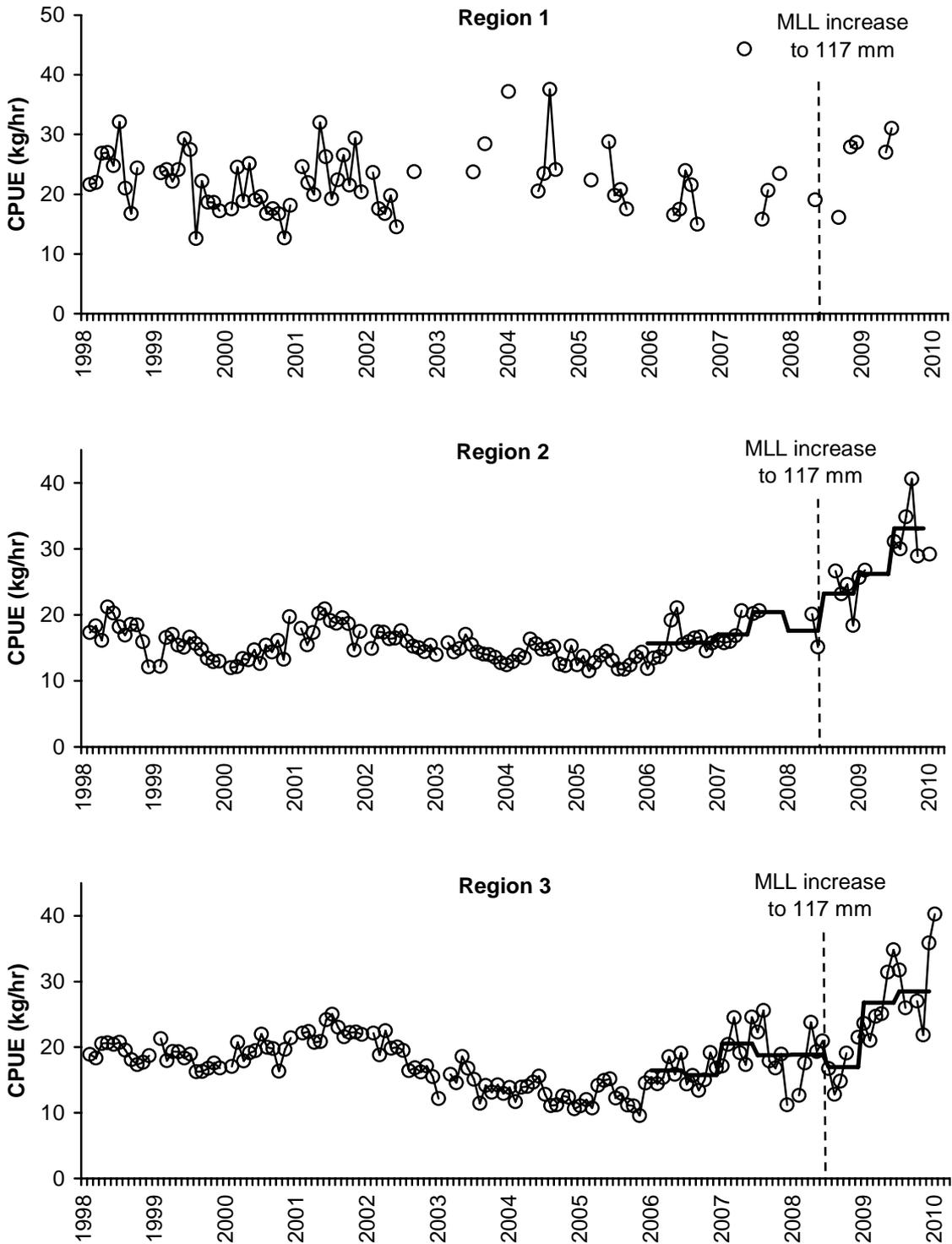


Figure 9: continued

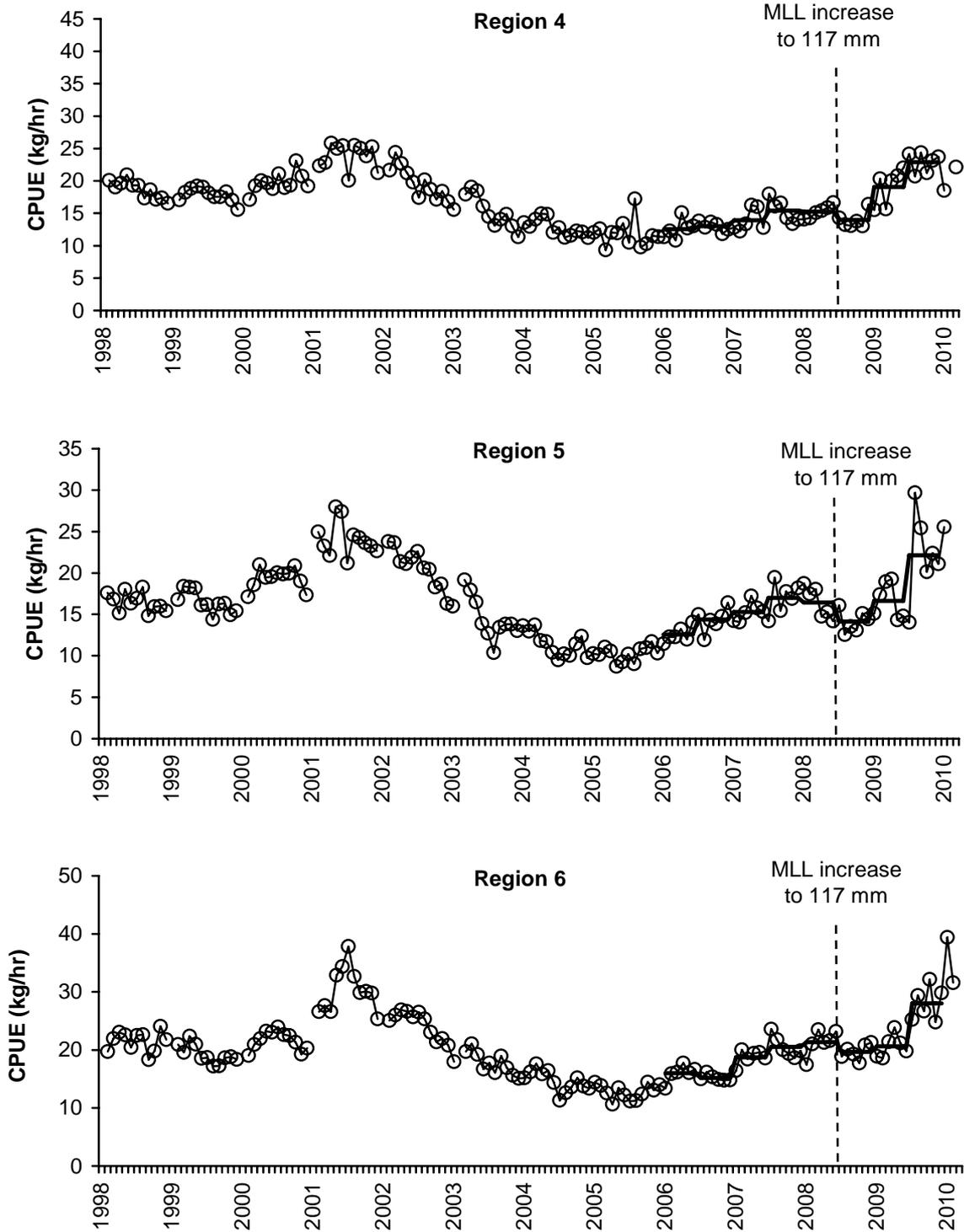


Figure 10: Monthly mean weight of individuals caught for regions 1-6 since 1999. Vertical dashed line indicates the increase in MLL from 115 to 117 mm in July 2008. Bold horizontal lines indicate mean weight during the 8 x 6-month periods between January 2006 and December 2009.

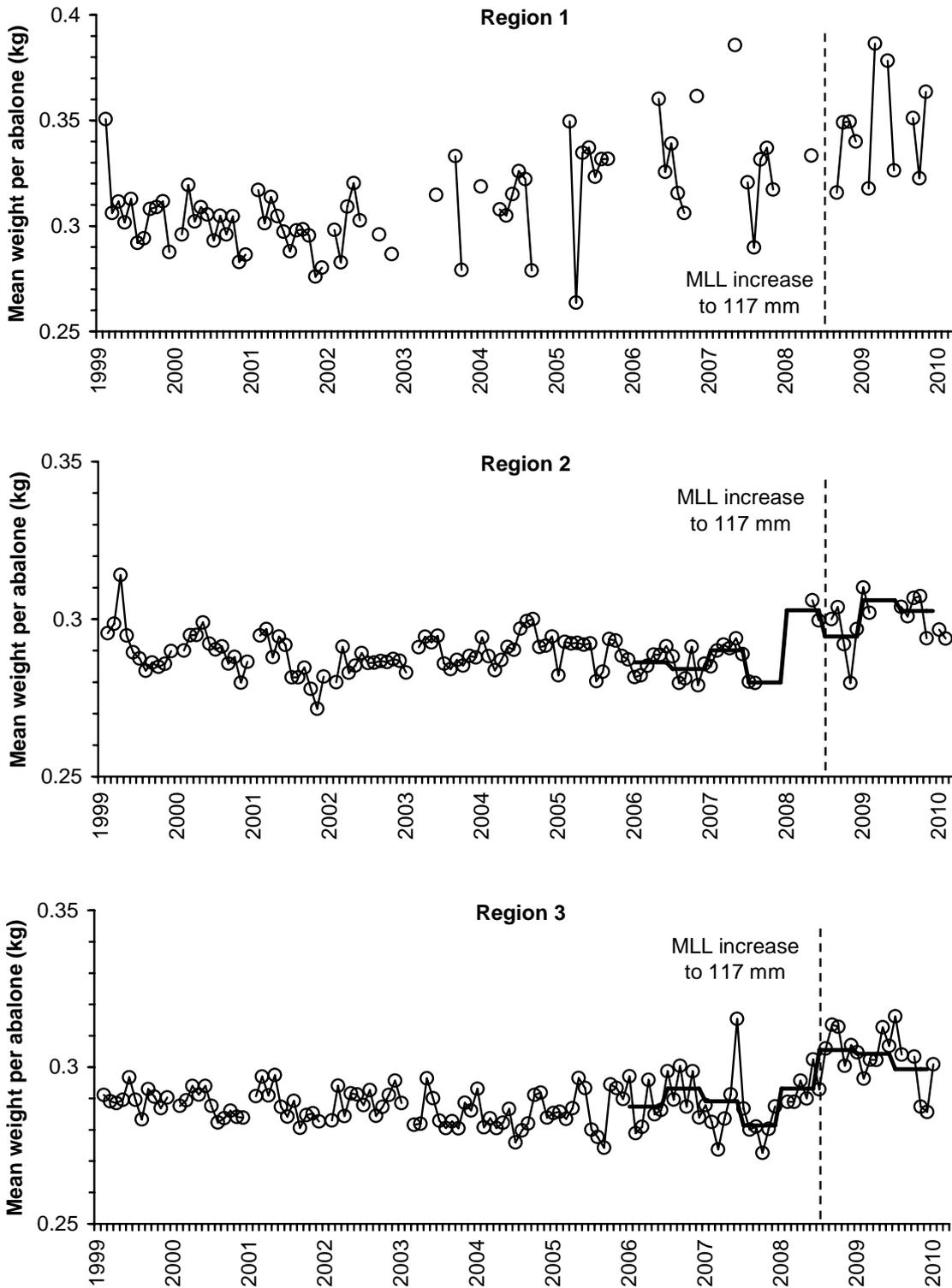


Figure 10 continued

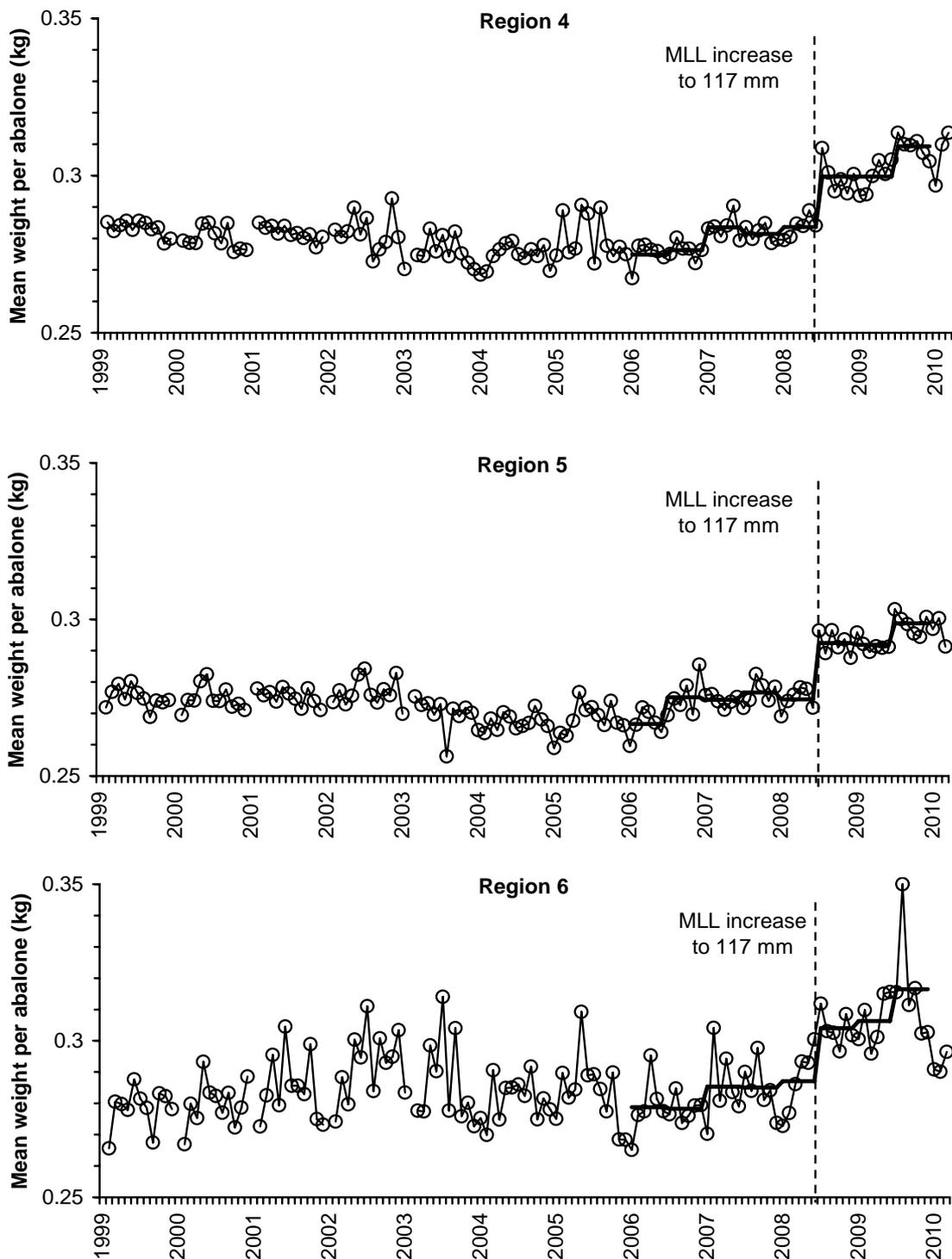
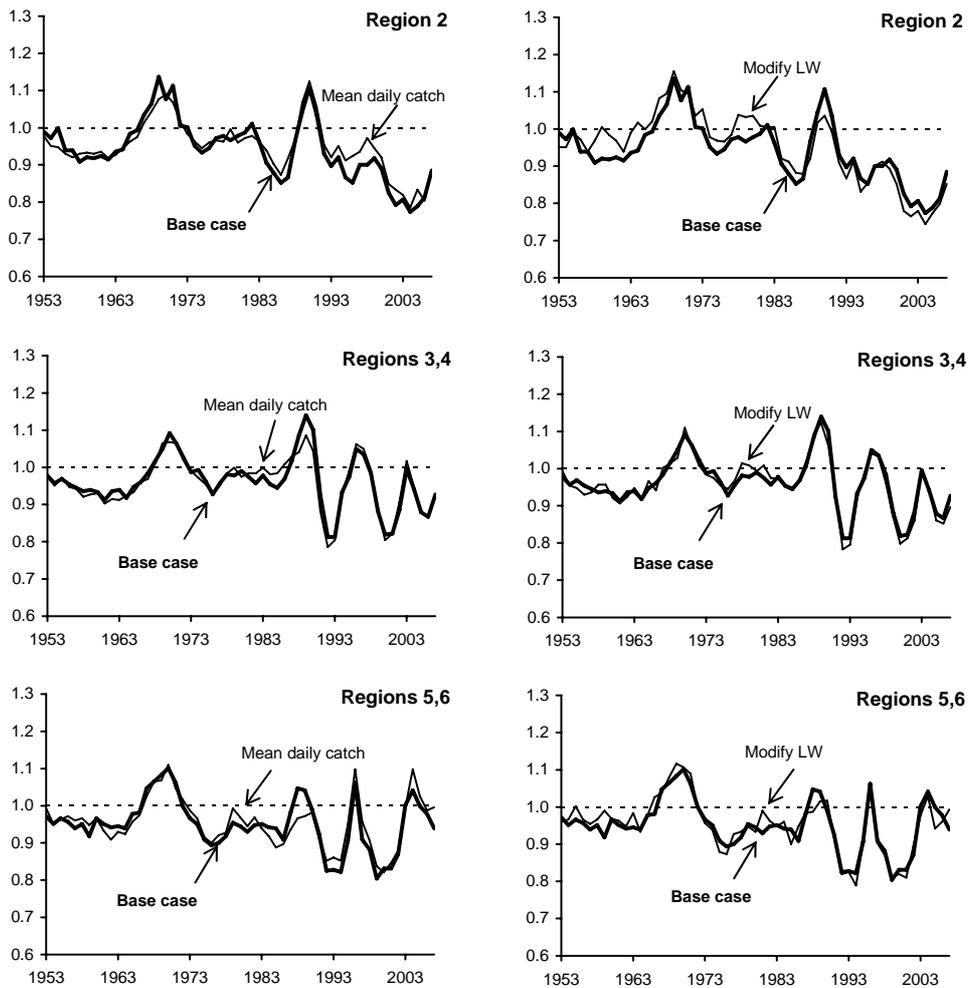


Figure 11: The pattern of recruitment estimated from the fitted population model in 2008 (the last year of its application) for the base case interpretation and various alternatives to test sensitivity of the analysis. The recruitment pattern is not sensitive to these alternatives. In Region 2, there has been a decreasing trend in recruitment since about 1990. The average recruitment in Regions 3, 4 and 5 and 6 since about 1990 is lower than in the earlier period, with an increasingly 'spiky' pattern or recruitment through time showing with different Regions showing different mixtures of lower lows, more persistent lows and briefer highs.



The Determination

The Total Allowable Catch Setting and Review Committee, pursuant to Division 4 of Part 2 of the Fisheries Management Act 1994, determines that the total allowable commercial catch of abalone that may be taken in the Abalone Fishery during the period 1 July 2010 to 30 June 2011 should be **82 tonnes**. In making this determination, the Committee strongly recommends that the following distribution of catches be adhered to at an increased minimum size limit:

Region 1 North (subregions A-H)	3t available for Fishing Surveys or Structured Fishing to a design acceptable to the Department
Region 1 South (subregions F-H)	0t
Region 1 South (subregions J, K & L)	4t available for Fishing Surveys or Structured Fishing to a design acceptable to the Department
Region 2	5t available for Fishing Surveys or Structured Fishing to a design acceptable to the Department
Regions 3 and 4	25t
Regions 5 and 6	45t
The Committee recommends that all catches are taken at a minimum legal length of 120mm	

These decisions could be reviewed if new information and analyses become available.



Ian Cartwright
Chairperson



Keith Sainsbury
fisheries scientist



Jessica Hartman
fisheries management



Bill Talbot
natural resource economist

Appendix 1. Details of public consultation

The TAC Committee undertook a comprehensive program of public consultation with stakeholders and the community. The details of this process are summarised in the table below, which chronologically records the stages of consultation undertaken by the TAC Committee and gives effect to the procedural requirements with reference to relevant sections from the *Fisheries Management Act 1994*.

Date	Fisheries Management Act	Consultation Stages
10.2.10	Section 31(1)	TAC Committee called for public submissions on the appropriate level of the annual TACC for Abalone.
10.2.10	Section 284 (1b)	The advertisement was placed in the Sydney Morning Herald, the Daily Telegraph and made available at NSW DPI Head Office and Fisheries Offices.
4.2.09	Section 284 (1b)	<p>Individual calls for submissions were also sent to particular interest groups who the Committee considered would be interested in providing a collective standpoint, either due to their direct involvement in the abalone industry or due to their interest in conservation issues. These groups included the following:</p> <ul style="list-style-type: none"> ■ All NSW Abalone Shareholders ■ All Members of the Abalone Management Advisory Committee ■ NSW Regional Industry Convenor ■ NSW Fishermen's Co-operatives ■ Nature Council NSW Conservation ■ I & I NSW Fisheries Offices
1.4.10	Section 284 (1b)	The TAC Committee allowed a period of 55 days for public consultation.
9.4.10	Section 31 (2)	<p>The submissions were collated and analysed, and the TAC Committee heard formal presentations regarding views and opinions at the meeting held on 22.4.10. The following made presentations, or provided information to the Committee:</p> <ul style="list-style-type: none"> ■ NSW DPI – Commercial Fisheries Management, Research, Compliance and Industry Analysis ■ Abalone Shareholders ■ Members Abalone Management Advisory Committee
4.5.10		<p>The submissions were collated and analysed, and the TAC Committee heard formal presentations regarding views and opinions at the meeting held on 22.4.10. The following made presentations, or provided information to the Committee:</p> <ul style="list-style-type: none"> ■ Peter Turnell – I & I NSW ■ Dr Geoff Liggins – Manager Scientific Services ■ Nick Schroder – Investigator, Statewide Operations and Investigations Group ■ Cameron Westaway – Senior Fisheries Manager ■ Robert Gale – Principal Policy Economist, I & I NSW ■ Carly Goddard – Fisheries Management Officer, I & I NSW ■ Nick Schroder – Investigator, Abalone, I & I NSW ■ Duncan Worthington – Abalone Council of NSW ■ Jim Miller – AbMAC ■ Dennis Loubikis – AbMAC ■ Steve Hunter – AbMAC ■ George Chung – AbMAC ■ Tony Fry – AbMAC ■ John Smythe – Shareholder ■ Peter Plunkett – AbMAC (Recreational Representative) ■ Warren Martin – Abalone Chairman

