TAC
Committee

Total Allowable Catch Committee Report and Determination for 2013/14

ABALONE FISHERY

30 June 2013

SUMMARY

Abalone stocks in NSW have historically suffered from significant over-fishing and showed significant evidence of over-depletion in increasing fluctuations in catch rates, in the 1990s and early 2000s. A catch rate peak in 2001 was followed by a rapid reduction in catch rate, with the lowest catch rates yet seen in the fishery in 2005. This situation indicated a very high fishing mortality on abalone above the MLL, a population that had lost most of its age structure and resilience, and (because the MLL was relatively close to the size at reproduction) greatly reduced breeding potential.

The substantial reductions in the total allowable commercial catch (TACC) through the 2000s, and the recommendations for increased MLLs, were intended to limit further depletion of the stock and to begin stock recovery. As a result of these actions there is no doubt that there has been substantial improvement in the state of the stock in recent years, but there remains uncertainty as to the extent and robustness of that recovery.

The information available to the Committee to assess the status of the stock has changed and diminished considerably in recent years. Since 2008, 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, the Committee has had very limited verified information and analysis on which to base its decision, and there is a high level of uncertainty about the true status of the stocks and their responses to recent changes in the TACC and MLL.

In the recent past, it was imperative to take very cautionary decisions to stop further stock decline and begin recovery. Management decisions going forward require greater information support to effectively balance continued recovery, management reform and increasing catches, while preventing a return to overfishing. The fishery is now being significantly limited by under-investment in the monitoring, assessment and management, and without change to this investment the future is likely to be continued uncertainty, the need for considerable precaution and continued frustration for industry, scientists, managers and the Committee.

Collection of fine scale data on fishing effort and catch, through the use of GPS-linked data loggers, started in 2008. Coverage of the fishery has increased since then as more, and more reliable, data loggers have been provided to divers. While descriptions of the data from the data loggers have been presented to the Committee these data were not analysed or interpreted with respect to historically collected data, current stock status or expected future trends. Such analysis is necessary to provide perspective and context for the interpretation of current stock status. That said, the very preliminary analysis and data made available to the Committee both before and after the meeting illustrates the high potential value of the fine scale data and analysis. A longer time series, indicators capable of robust interpretation and more complete analysis will allow more confident and certain tracking of the status of the stock and its recovery. A number of recommendations are made in this regard.

While stock rebuilding is continuing overall, it is slow, spatially patchy (including in Regions that provide the bulk of the catch and that earlier showed more consistent rebuilding), and uncertain. The trends in indicators for the last 1-2 years, a period of increasing TACC, are mixed. The catch rates aggregated by Region continue to increase in some Regions (Regions 2, 4 and 5) and have plateaued or decreased in others (Regions 3 and 6). Similar variations exist in many sub regions. The average

weight of individual abalone caught continues to increase in some Regions, but has plateaued in others.

Industry finer scale information is provided for Areas, rather than the previously used Regions and sub-Regions, with Areas variously being the same as or an aggregation of sub-Regions. Based on this information, some Areas have shown very little recent further increase in average weight, and there has been a distinct decrease in average weight under recent increased catches in other Areas. These Areas are of particular concern and at face value indicate that recent relatively small catches increases have significantly eroded the rebuilt population size composition in these Areas, which would not be possible if the stock rebuild was strong. The area fished greatly increased to achieve a relatively small (13 tonne) increase in catch between 2011 and 2012. This is again of concern because of the implications that previous high catch rates were from relatively small areas of high abalone concentration, and that these concentrations are not widespread.

Because of the spatial variability of abalone life history parameters, maximising the yield while protecting the spawning stock implies the use of different MLLs in different areas. If the MLL is too small, even moderate TACC levels can result in both growth and recruitment overfishing in areas. If it is too large yield is foregone. The rapid recovery of the catch rate following increases in the MLL implies that in aggregate, across whatever local variation there is in growth rates at fine spatial scale, the stocks are on the steep and non-optimal part of the yield per recruit curve. From the available data and analysis it is not possible to determine the optimum MLL; just that it is larger than the current MLL and that the current MLL is not optimal. Accordingly we have again suggested a modest increase in the ‘default’ size limit to 120mm for Regions 1-5 and Region 6 other than the area South of Wonboyn (Y31-Y32). We also suggest that specific arrangements be developed to provide harvesting access to areas that contain predominantly slow-growing abalone, at reduced size limits.

The arrangements to set and implement Area-based catch targets and limits, intended to spread the catch spatially and avoid localised depletion, are an important aspect of management to avoid localised and sequential depletion, particularly as TACCs are increased. From the intended targets, limits and actual catch provided by Area for the past two years it is apparent that industry arrangements to spread catch were not entirely successful. The Committee has recommended that local catch targets and limits be established and implemented at the spatial scale of either sub-Regions or Areas so as to provide reasonable operational flexibility to the fishery and to protect the local stock status.

The levels of illegal, unreported and recreational catch were again reviewed The Committee considered that the recent recreational catch was likely to be in the vicinity of 5-15 tones, using 10 tonnes as an estimate. For the illegal and unreported catch an estimate of 20-40t per year was considered reasonable, having reduced as a result of the introduction of indictable offences the targeting of poaching syndicates by compliance officers, and improved methods to permit indigenous catch.

The Committee reviewed and considered the documents from the 2013 NSW Abalone Council Industry Workshop, and, in particular, the criteria for assessment of each Area and the industry suggestions about the appropriate catch from each Area. This was useful input to the Committee and the Committee has made a number of recommendations to improve the process further.

There is no doubt that stock rebuilding since about 2006 has resulted in additional accumulated stock above the MLL. A recovered stock will have considerable stock abundance across a wide range of abalone sizes above the MLL so as to buffer the stock against variations in annual productivity, to maintain an adequate spawning stock (and most mature abalone will be emerged and highly visible), and to provide

high fishery catch rates. The current stock condition is clearly better than that of a few years ago, and by those standards it may appear to some that that recovery has occurred. But the current extent of stock rebuilding remains uncertain, with the main indicator of stock size being catch rate. This is not likely to be directly proportional to stock abundance especially, as recently, when a low TACC can be effectively targeted in high catch rate areas. The average weight of individuals in the catch is also an indicator that is difficult to interpret uniquely because it can be influenced by changes in diver selectivity. In principle, analysis of the fine scale data could address some of these uncertainties, especially if augmented with structured fishing to an appropriate design, but as yet these analyses have not been done. All available indicators are 'trailing indicators', potentially indicating past stock conditions but not future conditions; there is no indicator related to recruitment or sub-MLL sized abalone.

In arriving at the TACC for 2013/14 the Committee is very aware of countervailing interpretations of the fishery assessment that are possible. There are reasonable interpretations of the available data that range from a conclusion that a 125t TACC would not seriously impeding further stock recovery through to a conclusion that the recent 110-120t TACC has resulted in early signs of the recovery faltering in some parts of the fishery. The limited range of indicators available as discussed above, and the difficulty in interpreting them, have compound this uncertainty. Without more definitive information on the status of the stock it is expected that a period of time will now be required to fully recognise and understand the consequences of the TACC increases in the past few years (31 tonnes since 2011/12 including the 2013/14 determination). There are indications of stock stress in some indicators following the increases to 2011/12, the full consequences of the increase to 2012/13 are not yet analysed or available, and there remains slow progress on identifying and implementing an appropriate MLL and reliable local catch caps.

Economic considerations

In comparison to previous years, this year the Committee had a detailed set of draft economic indicators for the fishery for 2011/12 on which to base its assessment of economic performance. These indicators were provided through a survey undertaken by EconSearch of 17 abalone fishing businesses / external shareholders. This data will enable the Committee to make a more informed judgement on the economic status of the fishery and the impact of its TACC determination on the likely future profitability of abalone fishing businesses / external shareholders. The Committee recommends that the Department and Industry work together to update the data annually and run a similar survey periodically (every three to four years), which will allow for the collection of new information that would assist with managing the fishery.

Catch in 2011/12 increased by 17% over the previous year to 109.8 tonnes and a further increase to 120 tonnes is likely for the current year. Gross revenues from abalone fishing have improved over the past three years from $1.99 million in 2009/10 to an expected $3.84 million in 2011/12. These values are very low, however, when compared to levels in 2000, when the gross value of the fishery was $24.9 million in real terms due to both higher catches and prices.

Abalone prices have remained static for the last three years, at around $31-32 per kg. Pressure from the increased supply of aquacultured abalone and from other Australian abalone-harvesting states is likely to be maintained and continue to constrain price for the wild product. As aquaculture operations continue to expand, new overseas markets and marketing initiatives for wild caught NSW abalone will need being explored. With these continuing pressures on price, it will also be important to maintain focus on minimising the costs of fishing.

CPUE has increased dramatically in the fishery, most likely as a result of lower TACCs but has fallen slightly in 2011/12 compared with the previous year. This increase, combined with higher size limits and a significantly reduced and larger number of fish being taken, continue to put the fishery in a much better position to improve productivity and consolidate recruitment events going forward. There was no evidence presented to the Committee that the increases in size limits have excluded significant areas of the fishery and the concerns about the negative impact on economic returns as a result of a higher MLL have not been borne out. We again suggest that increased MLLs will further improve economic returns.

Management charges in the abalone fishery have reduced significantly to around $77 per share for 2012/13. This rate of recovery for management fees and charges is so low as to be unrepresentative of the current real costs of managing the fishery and insufficient to allow for appropriate levels of research and compliance. The Committee believes that there is a need to review the current level of cost recovery and to create a position where the industry is required, and in some cases encouraged to, invest in appropriate management services to allow it to be sustainable and to improve its economic situation into the future.

The results from the EconSearch survey of the economic performance of 17 abalone fishing businesses / external shareholders demonstrates that the abalone industry was profitable in 2011/12 and that a positive rate of return is being generated in the fishery. 12 abalone fishing businesses were earning a rate of return of 4.1 per cent and external shareholders were earning a rate of return of 5.3 per cent. This result contrasts with the situation a number of years ago, when the Committee reported that, on the basis of the information available to it, it was unlikely that the abalone fishery was profitable.

As a result of expected higher catches and stable prices in 2011/12, and reported lower catching costs, it is likely that the profitability of the abalone fishery will have improved even further in 2012/13. Depending on future movements in beach prices and catching costs, if the health and robustness of abalone stocks continue to improve, it is likely that the profitability of the abalone fishery will continue to improve into the future.

Despite the positive outlook for the fishery, it should be noted that there is still considerable management charge debt ($700,000) to be repaid, and that some fishers also have considerable debt repayments associated with borrowing against the purchase of shares when share prices in the fishery were a lot higher. Repayment of this debt will erode future profits, especially for fishers with high levels of management charge / capital debt.

The return to share trading in the fishery is evidence of the improvement in economic returns from abalone fishing and improved optimism in the future fishery. However, as price information on all of these share transfers is not available, it is difficult for the Committee to make a full assessment of the degree to which optimism has returned in the fishery. The Committee urges industry to make such information available wherever possible.

Quota leasing remains active as a result of the low TAC and consolidation in the number of divers in the water. Unfortunately, information on the price at which quota is transferred is not collected by the Department and the Committee has again suggested that that Industry make available information on the price of share and quota transfers in the abalone fishery, and that the Department and Industry work together to develop more detailed information on the structure and operation of the quota market.

The Committee notes that the current economic indicators and triggers for the fishery are lacking in specificity and relevance, and clear management responses. Objectives for the fishery relating to long-term profitability, which can then be translated into operational objectives, performance indicators and target reference levels in the harvest strategy for the fishery, are required. The economic data collected through the EconSearch survey should assist in this process.

While some restructuring has occurred with fewer divers taking a greater proportion of the catch, further rationalisation is required for the abalone fishery for it to improve its economic viability. Shareholders have appeared reluctant to exit the abalone industry, or to undertake other structural adjustments that may reduce costs.

The Committee's continued conservative determination of 125 tonnes for the TACC in 2012/13 is based on a commitment to rebuild a robust and profitable fishery and to avoid a return to past practice and the associated economic losses. The size limit changes recommended by the Committee, in combination with the determined TACC levels should continue to improve the long-term economic outlook for the fishery.

Management considerations.

Context
The abalone fishery is in the early stages of rebuilding, biologically and economically.

The TACC fell to an historical low of 75t in 2009/10 after previous highs of 300t. A series of MLL increases were also implemented. After this time, limited recovery has occurred and a series of TACC increases have been implemented on the basis of improved biological performance. The TACC was set at 120 tonnes for the 2012/13 fishing period.

Economically, the value of the fishery has also improved recently, but this is from historical lows. The lows have been driven partly by low TACCs but also a high Australian dollar and competition from aquaculture product. These are factors that will continue to affect the fishery. Returning the fishery to profitability and increasing its competitiveness in a challenging abalone market will require a unified and co-ordinated response and a secure resource base in reliable catches and catch rates.

Structurally, the number of fishers has contracted greatly over time since the introduction of limited licensing, through the introduction of the share management system in 2000 and subsequent operation of that system under decreasing TACCs. There are currently 47 shareholders, with shareholdings ranging between 10 and 160. Of these, 38 shareholdings are currently eligible for an endorsement. In the current fishing period, 29 shareholdings have reported fishing.

Management arrangements
The core management arrangements in the commercial abalone fishery are catch limits managed by ITQs and MLL regulations. On their own these can be blunt instruments for managing an abalone fishery. Increasingly, and in common with other abalone jurisdictions, NSW is implementing a system of finer scale management using voluntary catch caps informed by the use of electronic data loggers. Currently, this finer spatial scale management system is being developed and implemented informally and the industry is to be commended for the progress that has been made, with little government assistance. However, the system requires further work to improve its consistency, rigour and transparency and, ultimately, its effectiveness at spreading catch. This is particularly important as the fishery rebuilds and TACCs increase over time to ensure that past patterns of localised overfishing and serial depletion are not repeated.

There remains considerable controversy surrounding size limits in the fishery. The Committee believes that its role under the Act should be reviewed, and consideration given to the provision afforded to the Minister to request the Committee to make a determination on size limits and spatial distribution of catch in the same way as the TACC. This would, in our opinion, remove much of the controversy surrounding the size limit issue. The Committee suggests that some thought be given to utilising this provision in the future.

Data monitoring and stock assessment

Currently, formal catch and effort information is collected through regulated logbooks. The resource assessment provided by the Department is based on these data. The assessment is therefore very limited.

In addition to the logbook information, the industry provided the Committee with a report and presentation, which again confirmed the general effectiveness and capacity of data loggers. This information was used to support industry workshop discussions and TACC recommendations on catch settings for the 21 Areas that have been informally adopted.

While limited, it can be concluded from the finer scale data that the stock is recovering in response to management changes implemented in recent years. These positive trends are strongly reinforced by industry observations and the Committee places significant weight on these industry views as a part of interpreting the data. Furthermore, the industry workshop conducted this year, and the presentations to the Committee, indicate that there is near unanimity in the industry position this year, in contrast to previous years where opinions have been divided. Divers / shareholders known for their conservative approach to catch levels support the industry position for a TACC increase.

Balanced against these positives, there are several concerns. First, in relation to stock status, while the data indicate generally positive trends, there are also indicators that warrant further investigation. In particular, while catch rates and mean size have generally increased, the finer scale information shows that in some Areas those indicators 'tapered off' during the season. Some of these Areas have been recommended for increases through the industry workshop process. Further, the analysis of total area fished at a fine spatial scale presented to the Committee suggests that the 'footprint' of the fishery this season compared to the previous year is significantly bigger. Further analysis would be required to rule out the possibility that these observed changes are due to localised depletions at the reef level and/or fishing to market effects (i.e. targeting smaller abalone preferred by the market).

The second area of concern is that the fishery has no predictive indicators and measures only trailing indicators. Given the volume and value of the fishery, a return to a Fishery Independent Survey (FIS) of a size and cost of the former programme in the foreseeable future is probably not realistic. However, the Committee has commented in the past that the introduction of a selective FIS, with the express purpose of examining pre-recruits, should be considered.

Decision-making framework

The abalone fishery lacks a meaningful management plan, long term objectives, meaningful indicators and reference points. This materially impacts TACC decisions as there is no stated objective about how to maximise the benefit from the fishery in the medium to long term (for example, desired rates of rebuild). In turn this means that there is no basis on which to make decisions about the appropriate level of investment in either the fishery's management or fishing businesses. The Committee recommends that existing management arrangements be reviewed and a new management plan developed as a priority. The Plan should include defined

objectives for the fishery and in particular the operational objectives contained in a harvest strategy would guide these decisions and inform the balance of the various risks.

The options for different data monitoring and stock assessment programs need to be fully costed and the costs taken into account in designing the harvest strategy. This will inform the trade-offs to be made when formulating objectives, choosing performance indicators and setting reference levels. It will identify the key indicators that should be used in decision-making, and standardise and document how the data will be treated and what analyses would be done.

To date, industry has been largely left to go it alone in the development of fine scale monitoring and assessment arrangements, industry workshops and a revised harvest strategy. Due to the inappropriately low level of cost recovery and the financial pressures facing the NSW Government, the level of stock assessment advice provided by Department scientists is almost non-existent. As the fishery recovers the Committee continues to be of the view that expenditure on fisheries management, including 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.

Strong Government commitment, engagement and the necessary resources will be required to progress this work and move to more formal management framework. The Committee has made a range of management recommendations in this regard, including those on recommended MLLs, a revised harvest strategy and an improved governance process.

Governance

The formal consultation structures in NSW have been in a state of flux since 2009. The lack of a functional MAC or some similar consultative/advisory process and ongoing, and at times acrimonious, relationships between and within industry and with the Department have clearly hampered the effective management of the abalone fishery. While the past tendency of some shareholders to bypass the Department and involve the Minister's office in operational issues has reduced somewhat, the Committee is aware that political pressure to influence operational decisions, particularly on size limits, is continuing. This is not helpful and not in the best interests of the fishery.

While there are contractual arrangements in place between the Department and the industry to undertake data collection and analysis, more clarity about the respective roles of the Department and the research providers is necessary. This situation again reinforces the need for a decision-making framework with an associated data monitoring and stock assessment program outlined in detail, including the relevant scientific protocols. This would provide the basis for a more robust and helpful contractual arrangement and minimise the very real risk of conflicts of interest.

Other catch

In response to stock declines the recreational bag limit was reduced in July 2005 from ten to two abalone per person per day, in open areas of the fishery. This has had a profound effect on the recreational harvesting of abalone in NSW, leading to a reduced estimated catch of 10 tonnes. Recent changes now permit recreational fishing for abalone in areas adjacent to large population centres and are likely to have increased the level of recreational harvest. The Committee is advised that there also is a proposal, supported by the former Abalone MAC and the Advisory Council on Recreational Fishing, to increase in the bag limit to five. The Committee considers that this change may result in a significant increase in recreational harvest and risks, in particular, local depletion in areas adjacent to large population centres. We believe it would be prudent to delay any decision to increase the recreational bag limit until the current recreational harvest is known, the extent of the recovery of the

resource is better understood and a management plan and harvest strategy for the fishery is in place.

There are high levels of compliance within the licensed commercial sector and most offences are minor. The levels of compliance in the recreational sector have dropped from 75% to 50% (year to date), probably due to the more efficient targeting and an added emphasis on specialised compliance teams that focus their efforts on deliberate non-compliance and recidivist offenders. Despite the positive trends in abalone compliance, it was reported that illegal abalone activity remains high in NSW. This activity is fuelled by strong black market demand and is undertaken by highly organised illegal syndicates. It is important in this context that resourcing is maintained so that industry will have increased confidence that TACC's will be protected against abalone theft and that TACCs that constrain catch are genuine protections for the stock.

Summary

The abalone fishery is showing signs of rebuilding, attributable to management decisions in recent years (TACC reductions, increases in MLLs, some spreading of catch). Catch and catch rate for all Regions are above historical thresholds. Similarly, at the Area (sub-regional) level – which is a more meaningful scale for analysing abalone stocks – there are also positive signs. Catches, catch rates and mean size have increased or remained constant in key Areas. The industry is encouraged by these signs and recommended a TACC increase. These positive signs are offset by the changes in mean size and area fished, which provide some indications that the recovery may not be as widespread or as significant as industry believes. Further analysis is necessary to resolve some of the key issues associated with the status of the resource.

From a fisheries management perspective, an increase in the TACC for abalone of 5 tonnes resulting in a **TACC of 125 tonnes for the 2013/14 quota year** is considered consistent with the current principles as laid out in the Objects of the Fisheries Management Act and the prescribed role of the Committee. The positive trends observed in the data, and reinforced by industry advice, justify an increase in the TACC, notwithstanding the improvements that have been identified that would greatly improve the certainty of the stock assessment.

The Committee is increasingly concerned that the risks to the fishery are not being measured and analysed and as TACCs continue to increase, the risk to the stocks increase. Any further TACC increases beyond this year without other action on the identified deficiencies in the current management framework, including monitoring and assessment, are likely to be high risk.

Recommendations

1. An action list and timetable be developed and provided well before year-end and adhered to. The list should be promulgated to industry and cover dates for the 2014 TACC Open Forum and meetings (including locations), the delivery of associated supporting documentation; and for delivery of the Committee Report and Determination.
2. Local catch targets and limits be established and implemented at the spatial scale of either sub-Regions or Areas so as to provide reasonable operational flexibility to the fishery and to protect the local stock status.
3. In relation to the data logging programme that:
   - the data-logger program be continued at a high level of coverage in the fishery;
   - through the data-logger program or other means the monitoring be extended to provide length composition of the catch in addition to the average weight;
   - robust and interpretable indicators of stock and fishery status based on the finer scale data continue to be developed and tested; and
   - benchmarks or reference points relating to stock condition and productivity be developed for these indicators.
4. To improve the industry fisheries assessment workshop process that:
   - the reporting areas used are aligned with those used in the past and with those used by the Departmental reports, or conversely that all reports use the new Area groupings and historical data are re-tabulated and re-presented in these groupings;
   - more explanation be provided about the workshop assessment of each sub-region or Area, and the basis for the conclusions reached;
   - the criteria for assessing the status of each area be further developed over time and as part of the broader development of the management framework with management, to make more use of indicators from fine scale monitoring and to use benchmarks that reflect long-term optimal resource use and overfishing limits; and
   - input to the Committee is accompanied by a technical description of the data and the analysis conducted, rather than just having the results provided as a PowerPoint presentation and through a web-accessible set of graphs - this is necessary for technical review and understanding of the material presented and will become even more important as the fine scale data is increasingly used to provide indicators and to aid interpretation of stock status.
5. The ‘default’ size limit for Regions 1-5 and Region 6 other than the area South of Wonboyn (Y31-Y32) be increased to 120mm.
6. Performance indicators and triggers for the abalone fishery, as suggested under the management section of this report, be developed to measure the economic status of the industry.
7. Further changes to the abalone recreational fishing bag limit be deferred until there is enhanced monitoring of recreational abalone fishing which provides sufficient knowledge of the extent and distribution of the recreational catch,

and that information is integrated into a revised harvest strategy for the fishery.

8. A revised harvest strategy be developed, as an integral part of the new management plan.
9. In addition to the harvest strategy, the other components of the spatial management system be formalised including the implementation of recommended MLLs and a governance process for the input of industry and DPI in formulating TACC advice.
10. Existing management arrangements be reviewed and a new management plan be developed as a priority.
11. Department legislate/undertake contractual arrangements to secure full access to fine scale data generated by industry using data loggers.
12. Cost recovery arrangements for the fishery be reviewed to ensure that the provision of services is adequate to inform TACC decisions and management of the fishery.
13. The TACC be required by the Minister to make a determination on size limits and spatial distribution of catch. Such a Determination would be an integral part of the TACC setting process, and would be done in full consultation with industry and the Department.

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TOTAL ALLOWABLE CATCH COMMITTEE

ABALONE FISHERY

REPORT AND DETERMINATION FOR 20012/13

1. INTRODUCTION

The Total Allowable Catch and Review Committee (the Committee) is established by Section 26 of the *Fisheries Management Act 1994*. In 2012, it consisted of:

- Mr Ian Cartwright – Chairman
- Dr Keith Sainsbury – fisheries scientist
- Dr Jessica Hartman – natural resources economist
- Ms Kelly Crosthwaite – fisheries manager

The Committee welcomed Ms Crosthwaite who has recently joined the Committee.

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)* as set out in Section 3:

(1) The objects of this Act are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations.

(2) In particular, the objects of this Act include:

(a) to conserve fish stocks and key fish habitats, and

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

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

and, consistently with those objects:

(d) to promote viable commercial fishing and aquaculture industries, and

(e) to promote quality recreational fishing opportunities, and

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

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

(h) to recognise the spiritual, social and customary significance to Aboriginal persons of fisheries resources and to protect, and promote the continuation of, Aboriginal cultural fishing.

While is not subject to the control or direction of the Minister in formulating the TACC, the Committee may be required by the Minister to undertake a re-determination, as has occurred in the past.

The legislation is structured so that fishery management plans set out fishery objectives, which are a fishery-specific application of the broad objects of the Act. In the absence of a meaningful management plan (as discussed later in this report), the Committee is guided primarily by the requirements in section 30 of the Act:

1) In determining total allowable catches under this Division, the Committee is to give effect to the objects of this Act and is to have regard to all relevant scientific, industry, community, social and economic factors.
2) The Committee is also to have regard to:
    a) the need to ensure that the exploitation of fisheries resources is conducted in a manner that will conserve fish stocks in the long term, and
    b) the impact of fishing activities on all species of fish and the aquatic environment, and
    c) the precautionary principle, namely, that if there are threats of serious or irreversible damage to fish stocks, lack of full scientific certainty should not be used as a reason for postponing measures to prevent that damage.

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

The TACC under the Act is clearly defined. However, the Committee has concluded in the past that setting a single TACC number is not a necessary and sufficient action to achieve the role and function of the Committee under the Act. The Committee reiterates the position that the determination is inextricably linked to selectivity (size limit and spatial aspects) considerations and that its recommendations in this regard are not discretionary.

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 the NSW Department of Primary Industries (DPI) and industry provide views on the TACC report, creating a dialogue on a range of issues directly related to the TACC in a whole-of-fisheries context. As stated above, however, the Committee makes a determination on the TACC under the Act, and the degree to which its suggestions and recommendations, including those on size limits and the spatial distribution of catch, are accepted is currently a matter for DPI. This issue has again created difficulties for the Committee and suggestions have been made in this report to rectify the matter.

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 and indigenous 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. Similarly, the Committee should not take pre-emptive decisions on issues such as increasing the TACC when there is insufficient verifiable information on which to base such decisions. Uncertainty, principally in 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. The Committee must, and does, take this into account when setting TACCs and making other recommendations.

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 Committee

The Committee called for public submission on the appropriate TACC 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 TACC. The details of this consultative process are set out in Appendix 1.

The Committee interviewed and received reports and presentations from:

- NSW Department of Primary Industries Fisheries Research;
- NSW Department of Primary Industries Fisheries Management;
- NSW Department of Department of Primary Industries Fisheries Compliance;
- representatives and members of the NSW Abalone Council; and
- industry members.

A summary of submissions and the issues raised is provided in Appendix 2.

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 accept *in camera* submissions, where requested. No such requests were received in 2013. During the forum, the Committee and industry were able to ask questions of clarification, and the stakeholders present discussed a number of issues relating to the status of the resource and the fishery. These comments greatly assisted the Committee in its deliberations. The tone of discussions and quality of debate on key issues related to the TACC-setting process were very positive.

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;
- data and analysis presented by the NSW Abalone Council,
- 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;
- an industry member presentation on size frequency data collected for over 7000 abalone, and underwater video footage and photos of key reefs;
- the results of the economic survey, which were not available at the time of the Committee meetings but were provided subsequently and are discussed in the economic issues section of this report; 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:

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

The Determination of the Committee for the annual TACC for abalone for the 2013/14 fishing season is provided at the end of the report.

The Committee is sensitive to the work pressures that the Department is working under, and in particular, the priority afforded to implementing the major reform and restructure programme arising from the Independent Review of NSW fisheries. However, the administration of the Committee is now at a point where it is very difficult to function efficiently and unreasonable expectations are being placed on members. The Department was again unable to supply supporting documentation in time to for sufficient consideration. Providing electronic copies of reports consisting of close to 100 pages one or two days before an Open Forum with industry is insufficient. Also, the dates for the meetings were set unusually late and aligning the diaries of busy professional people is very difficult. The time given to complete the report was also inadequate.

*The Committee **requires** an action list and timetable be developed and provided well before year-end and adhered to. The list should be promulgated to industry and cover dates for the 2014 TACC Open Forum and meetings (including locations), the delivery of associated supporting documentation; and for delivery of the Committee Report and Determination.*

2.3 Format of the Report

As in recent years, the Committee, in addition to the Determination, 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. This has again not occurred this year.

3. State of the Stocks

3.1 Introduction

In making its determination the Committee considers the current and likely future status of the stock. There are two main features that provide a background and context for this year's consideration – previous conclusions about the status of the stocks and changes in the information available for assessment.

3.2 Background and context

3.2.1 Previous conclusions about the status of the stocks

The abalone stocks have historically suffered from significant over-fishing and over-depletion. Recent reductions of the total catch (commercial and recreational) and recommended increases of the minimum legal size have been a response to that situation. The stock showed significant evidence of over-depletion in the 1990s and early 2000s including:

- serial depletion starting in the north of NSW in Region 1 (exacerbated by mortality from a severe outbreak of *Perkinsus* in at least the southern part of this region in the late 1990s) and progressing south;
- recruitment overfishing (i.e. breeding stocks reduced to the extent that this results in a reduced number of young produced) in Region 2 which started in the early to mid-1990s;
- Regions 3 and 4 showed patterns consistent with the onset of recruitment overfishing from the mid-1990s to at least the early 2000s;
- all of the well monitored Regions (i.e. 2-6) showed an increasingly 'spiky' pattern in catch rates and estimated recruitment, including progressively lower lows between the spikes with briefer and (in most Regions) progressively lower highs; and
- the fishery became highly dependent on the abalone that grow over the Minimum Legal Length (MLL) each year, with the population having substantially lost the buffering effect of multiple and well represented year-classes above the MLL.

During the 1990s and to the mid-2000s the abalone fishery showed a pattern of increasingly fluctuating catch rates. The peaks coincide approximately with estimated peaks in recruitment of young abalone (Figure 1), although the estimation methods cannot distinguish well between variability in the number of young abalone recruiting to the population, their growth rate or their survival – variability in any of these factors could give similar consequences and they may vary together. This pattern of fluctuating catch rate is consistent across all of the well monitored Regions and is reflected in peaks of the fishery catch rate in about 1988, 1995 and 2001 (Figure 2), with troughs in about 1992, 1998 and 2005. After the catch rate peak in 2001 there was a rapid reduction in catch rate and 2005 gave the lowest catch rates yet seen in the fishery. A relatively weak peak in recruitment was predicted from population modelling for most Regions in about 2007/8. These peaks and troughs are interpreted as being due to relatively small fluctuations in biological productivity (a combination of the number of young abalone recruiting to the population and their growth rate across the MLL), combined with the loss of most of the larger abalone from

the population so that the fishery was highly dependent on the number of abalone growing over the MLL each year. Consequently, catch rates directly reflected these productivity fluctuations. This situation indicates a very high fishing mortality on abalone above the MLL, a population that has lost most of its age structure and resilience, and (because the MLL was relatively close to the size at reproduction) a population with greatly reduced breeding potential.

Within this overall context there have been additional specific issues and analyses relating to the status of stocks in the northern part of NSW (i.e. Regions 1 and 2).

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

There has always been very little information available to assess the status of stocks in Region 1 north of Port Stephens. There was no Fishery Independent Survey coverage in this area and there has been very little commercial fishing at any time since 1987 (i.e. even when there were no regulated restrictions on fishing there). It is not known whether, or to what extent, the stocks there were affected by the disease *Perkinsus* that significantly reduced stocks in the southern portion of Region 1. Commercially targeted fishing was stopped Region 1 North in 2002 but special catch allocations were made to allow structured collection of data to determine the extent of *Perkinsus* impacts, to support an initial assessment of the stocks and to estimate a sustainable catch. Region 1 North was re-opened to targeted commercial fishing in 2010.

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 in the southern portion of Region 1 but they all showed the death of 50-75% of abalone of all sizes. Some areas were 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 in Region 1 South were clustered in three areas - Port Stephens, Sydney and Kiama (subregions F, J and K) – so there has was concern about how representative these sites were of the whole region.

Trial fishing in 2004 showed that it was possible to take high catch rates of large abalone from targeted sites, as was expected from the Fishery Independent Survey data, but did not help to assess the status of the stock or the extent of any recovery.

In 2007 a program of trial fishing on pre-identified sites that were historically productive was conducted to test the change in status of the stock. This program allowed comparison of the proportion of previously productive sites that remained 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 chosen by divers as being productive in 2007. The general conclusions were:

i) about 36% of historically productive sites were still as productive as they previously 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 sub-Regions, between Pt Stephens and Sydney (sub-Regions F, G and H), had very low abalone abundance and a major loss of historically productive sites;

iv) the southern sub-Regions, between Sydney and Wreck Bay (sub-Regions J, K and L), had considerably higher abalone abundance and had lost fewer historically productive sites than the northern sub-Regions, and slightly more than half of all sites fished in these southern sub-Regions had catch rates greater than was recorded there in 1994;

v) 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);

vi) the diver selected sites provided slightly higher catch rates than the pre-identified historically productive sites but data from diver selected sites did not materially change the overall results or conclusions.

Overall these conclusions 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 dense abalone aggregations or significant numbers of small abalone, despite many years of protection from fishing. The stock of legal sized abalone in the northern sub-Regions (F, G and H) remained very depleted in 2007, while the stock of legal sized abalone in the more southern sub-Regions (J, K and L) has recovered to 1994 levels at more than half of the sites fished.

The south sub-Regions (i.e. Sydney to Wreck Bay) were re-opened to commercial fishing in 2010 while the northern sub-Regions (i.e. Pt Stephens to Sydney) were reopened in 2012.

Region 2

Region 2 was closed to commercial fishing in 2006 because of evidence of recruitment overfishing there (see Fig. 1). The average recruitment in Region 2 started decreasing in about 1995, including a decrease in the strength of recruitment in the 'pulse years'. 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 considerably weaker than was seen in Region 2 in the 1988/89 pulse. Following the closure of Region 2 in 2002, special catch allocations have been made each year to allow collection of data that would support an improved assessment of the stocks there, especially in relation to the interpretation of recruitment overfishing. Region 2 was re-opened to commercial fishing in 2010

The substantial reductions in the TACC through the 2000s, and the recommendations for increased MLL, were intended to limit further depletion of the stock and to begin stock recovery. The catch reductions between 2005/6 and 2009/10 coincided with the period when, based on previous patterns, a pulse of relatively good recruitment was expected to enter the population and help stock rebuilding. Expected 'success indicators' for improved stock condition were:

- substantial increase in the abundance of abalone;
- substantial increase in the commercial catch rate;
- substantial increase in the average size and size range of abalone; and, most importantly,

- that these increases persist through the next period of low productivity – expected in about 2011-2013 if past patterns are repeated.

A key issue in managing the population to recovery, and preventing repeated overfishing when it is recovered, is understanding and addressing what was wrong with the previous management settings. Recognising and correcting these factors is necessary to avoid a repetition of the failures of the past and to achieve the potential from the resource. In addition to the appropriate catch level the Committee considers that three other issues are very important in this:

i) The use of finer scale monitoring, assessment and management to better reflect the fine scale variability of abalone biology (especially growth and reproduction). There are ongoing discussions and efforts to improve finer scale data gathering from the fishery (e.g. GPS-linked data loggers), interpretation of these data as sustainability indicators and for stock assessment, and finer scale fishery management (e.g. local catch limits and other mechanisms to prevent excessive overly concentrated fishing and serial depletion). While these developments were promising and welcomed they have been slow to deliver outcomes. In particular there was little interpretation of the finer scale data in terms of stock or fishery status, and attempts to set and manage finer scale catch targets and limits had variable success.

ii) The Committee and some in industry have questioned the appropriateness of the MLL. The fishery has a history of a relatively small MLL compared to that used in other fisheries on the same species. In NSW the MLL was 100mm in the 1970s, was increased to 108mm for most of the 1980s, was further increased to 115mm for the 1990s and most of the 2000s, and was then increased fishery-wide to 117mm from 2008. In the most southern areas of Region 6 the MLL was increased to 120mm from 2010, while some in industry have voluntarily and successfully fished to a 120mm size limit in more northern areas also. The MLL for the same species in Victoria is 120mm in open coastal habitats east of Lakes Entrance (with voluntary industry size limits of 125mm and 130mm in some areas), in Tasmania is 127-138mm across different harvesting regions, and in South Australia is 125-130mm across different harvesting regions. For several years the Committee recommended that a larger size limit be applied to the overall fishery, within which various arrangements can be applied as is cost-effective to access any areas where abalone growth is stunted. This would give both biological and economic benefits. The advantage of a higher 'default MLL' which can be selectively relaxed as appropriate, rather than low MLL everywhere, is that it protects abalone grow quickly, have a large size at first maturity and reach large maximum size from localised overfishing and sequential depletion. Such fast growing abalone are highly productive if managed appropriately. A major element in the argument against increase in the overall MML has been the view that NSW has many areas of stunted abalone growth - a view supported by some early research results. However by 2010 it was clear from the response of the fishery to the changes in the size limit that the population is not dominated by stunted stocks and that the earlier research results were not representative of the overall stock or the current situation. The observed rapid increase in the individual weight of abalone caught and the very rapid recovery of catch rate following the recent increases in MLL simply would have been impossible if the population was dominated by stunted stocks.

iii) The Committee has for several years commented that the benchmarks and reference levels used in the Share Management Plan and the Fishery Management Strategy

were set at levels that did not adequately protect the sustainability and productivity of the stock. Revision of these benchmarks and reference levels needs to be explicitly grounded in the biological productivity of the stock.

3.2.2 The information available for recent assessments

The information available to the Committee to assess the status of the stock has changed and diminished considerably in recent years.

- Up until and including the fishery assessment was based on (i) 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), (ii) catch rate and weight composition from commercial fishing, (iii) integrated analysis of this information by fitting a length-based population model to estimate population size and recruitment, and (iv) 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, 2010, 2011, 2012 and again in 2013 there was no formal scientific stock assessment or prediction of future stock condition.
- Collection of fine scale data on fishing effort and catch, through the use of GPS-linked data loggers, started in 2008. Coverage of the fishery has increased since then as more, and more reliable, data loggers have been provided to divers. Descriptions of the data from the data loggers have been presented to the Committee each year. However, these data were not analysed or interpreted with respect to current stock status or expected future trends. In particular there was no analysis that related interpretations of the currently collected data from the data loggers to interpretations of historically collected data, or to reference levels relating either overfishing or optimum fishing. Such analysis is necessary to provide perspective and context for the interpretation of current stock status. Issues of special significance in this are comparisons of the fine scale information with the historical fishery independent surveys, with trends from previous data on commercial catch rates, and estimation of key fishery properties (e.g. thresholds for recruitment overfishing and maximum stock productivity).

The information available to assess the status of stocks is in a transition from the previous methods based on Fishery Independent Surveys, coarse scale data from commercial fishing, and population modelling to future methods that are hoped to be better and cheaper based on fine scale data reporting. But the previous methods have been stopped before the new methods have been fully developed and shown to be adequate. This causes increased uncertainty about the state of the stock and the likely consequences of different catch levels. Also there is now heavy reliance on commercial catch rate as an indicator of stock abundance.

This reliance on commercial catch rate has well known problems, particularly in a 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, particularly for large aggregated areas and times, is notoriously 'hyper-stable' for abalone fisheries. That is, high catch rates can be obtained and maintained for a time by targeting concentrations of abalone in known patches of preferred habitat even if the overall population is low. Such hyper-stability of catch rates has been seen in the history of the NSW abalone fishery at both the Region and Sub-Region scales. Furthermore, commercial catch rate 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. In principle analysis of the fine scale data now being collected could provide solutions to most of these problems, and a current FRDC funded project is intended to address this, but to date solutions have not been demonstrated.

The current lack of population analysis also does not allow scientific examination of the MLL that both optimises catch and provides adequate protection of the breeding stock of abalone. Consequently this is being explored empirically – by trying a small change and monitoring the results. This is inefficient (because it does not make use of well-known scientific prediction methods), slow (because monitoring and measuring the consequences of each change before the next change can confidently be made takes time) and risky (to the stock and to fishery yields for different reasons).

These are serious weakness in the current management situation where key questions relate to the robustness of the recent stock improvements and the ability to detect any lack of robustness if that eventuates. With the limited information and analysis that is currently available 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.

3.3 Information and analysis available in June 2013

3.3.1 Aggregate catches, catch rates and average weight

The annual commercial catch rate for each Region is shown in Fig 2. The annual catch rates in all Regions have strongly increased since 2005, with catch rates in the most recent year either continuing to increase (Regions 2, 4 and 5) or remaining about the same at recent high levels (Regions 3 and 6). The catch and effort in Region 1 is too low to draw reasonable about trends, but the recorded catch rate remains high by historical standards. The catch rates in all Regions are now above historical levels and thresholds. Although the increase has slowed during the past year in some Regions, catch rates have remained through the period (about 2011-13) when past productivity patterns predict that lower stock productivity is expected. This implies that, as intended, the low TACCs of recent years have allowed stock rebuilding and resulted in catches that are not overwhelmingly dominated by recent recruits to the fishery. Continuation of this pattern, along with corroborating changes in other indicators, will build confidence in the strength of stock rebuilding.

The monthly catch rate for each Region is shown in Fig 3. Two features are notable.

i. The monthly catch rates during the past 12 months show a similar, though not identical, trend to that seen in the annual catch rates. Monthly catch rates have continuing to increase in Regions 2, 3 and 5, while they have remained about the same in Regions 4 and 6. There was a lot of seasonal volatility in the monthly catch rates for Regions 3 and 4 during the past year, and this likely explains the difference between the monthly and annual trends in these Regions.

ii. The monthly catch rate in Regions 2-6 decreased for a few months after the 117mm MLL was introduced in 2008, then increased strongly and continued a general pattern of increase through to 2012 and 2013. Fishers who voluntarily harvested to a 119mm size limit reported no difficulty in catching their quota allocation with high catch rates. Within Region 6 additional increases in MLL to 120mm in 2010 and 123mm in 2012 were applied. The catch rate decreased for a few months after each increase in MLL, but then recovered quickly. The catch rates in Region 6 at the time

of the MLL increase to 123mm were reportedly also influenced by operational decisions by industry to reduce catches there.

Such rapid recovery of the catch rate following increases in the MLL implies that in aggregate, across whatever local variation there is in growth rates at fine spatial scale, the stocks are on the steep and non-optimal part of the yield per recruit curve. Historically a yield per recruit analysis was published for each of slow, medium and fast abalone growth. The observed response of the abalone stocks to the recent increase in MLL would be impossible if the aggregate growth was described by the slow or medium growth rates. It would only be possible if growth on average was described by the fast growth curve and the stocks were on the steep portion of the yield per recruit curve. The rapid increase in mean weight seen in all regions (but especially Regions 4-6) is also consistent with this interpretation. From the available data and analysis it is not possible to determine the optimum MLL; just that it is larger than the current MLL and that the current MLL is not optimal.

The arrangements to set and implement sub-Regional catch targets and limits, intended to spread the catch spatially and avoid localised depletion, are an important aspect of management to avoid future repetition of localised and sequential depletion. The catch by sub-Region was reported up to December 2011, but this has not been updated. The industry data summaries from 1999 and the fine scale data reporting since 2011 are by defined Areas, which are generally more aggregated than sub-Regions and not all boundaries are the same between Regions/ sub-Regions and Areas. Because of the changes in spatial scale and lack of historical summaries it is difficult to track the medium-term success in setting and achieving local catch targets and limits. However from the intended targets, limits and actual catch provided by Area for the past 2 years it is apparent that the arrangements were not entirely successful, with some Areas providing more catch than intended and others providing less. At low TACCs this inability to control fishing effort and catch at local space scales is not expected to have major stock consequences, but finer scale management arrangements are not yet convincing as a means to prevent serial depletion at higher TACCs. The ability to set and achieve appropriate local catch caps is necessary to prevent a repeat of sequential depletion if the TACCs are increased as the stock recovers. Confidence in the ability to control catches at this finer scale is a key consideration in management of this recovering stock.

*The Committee **recommends** that local catch targets and limits be established and implemented at the spatial scale of either sub-Regions or Areas so as to provide reasonable operational flexibility to the fishery and to protect the local stock status.*

The average weight of individuals in the commercial catch has been measured from the weight of each bin of abalone landed by the number of abalone in the bins. The average weight is a coarse and insensitive indictor, and interpretation is influenced by any changes in the size selectivity of the fishery. Industry and management reported that processor requirements and logistic limitations influenced the distribution of catches, particularly in the southern parts of Region 6 during the past year. But while there was sometimes an increasing commercial interest in large abalone there was no report of systematic or widespread size selection in the fishery, including during the last year. The simplest interpretation of the average weight data assumes that there is no significant or changing size selectivity by the fishery, and this is assumed here. Interpretations would be greatly improved by complimentary sampling of the length composition from the commercial catch, by surveys to measure population size composition, and by structured fishing to help correct for any fishery selectivity by area or abalone size.

The average weight of individual abalone caught by month and Region is shown in Fig 4. All substantially fished Regions (i.e. 2-6) show a substantial increase in the average weight of individual abalone since the MLL was increased to 117mm in 2008. There has been further steady increase in the average individual weight during the past 2 years in Regions 2, 3, 4 and possibly 6 (Region 6 shows high variability in the most recent about 6 months). The average individual weight has remained approximately constant during the past 2 years in regions 1 and 5.

The average weight of individual abalone was reported by month and Area for the past 2 years through the Abalone Council website (http://acnsw.ambrad.com.au/) and some of this was summarised in a presentation to the Committee. In most cases the finer scale Areas show trends in average weight that are similar to those at the Regional level. In the past 2 years all Areas within Regions 3 and most Areas in Region 4 show continued increase in average weight; all of the Areas in Region 5 show little change in average weight; two of the five Areas in Region 6 show little change in average weight while the other three show increasing average weight; and most Areas in Region 2 have an approximately constant average weight and one has an increasing average weight.

Mostly the trends in average weight for each Area within the past 2y show a relatively steady increase or little change. However this finer scale information also reveals a different pattern that is similar in each of 5 Areas; Area 5 (i.e. sub-Region P in Region 2; see Fig 5), Area 13 (i.e. sub-Region X2 in Region 4 on the border with Region 5; see Fig 6) and Areas 14 and 15 (i.e. sub-Regions Y11-Y23; see Fig 7 for sub-Regions Y11-Y21). For these Areas the average weight at first increased and then, following a period of increased catches in mid-late 2012 (the exact timing of this is different among Areas) the average weight decreased. This later decrease in average weight is substantial in these Areas, in each case reducing the average weight back to values similar to those of 2y ago. The Area 16 (i.e. sub-Region Y24 in Region 5) shows a much more limited change in recent average weight, with only a small decrease seen. This pattern of recently decreasing average weight in these Areas is significant for two reasons:

- It suggests that for several Areas, including some that provide a significant fraction of the fishery catch, a relatively small increase in the catch has caused a measurable reduction in the size composition of the population in that area. This would not be possible if these populations had recovered substantially in number. These Areas comprise about half of the Areas recommended for further catch increase by the 2013 industry workshop (see below).
- It suggests that the fishing mortality in these areas is high enough to move the average abalone size back closer to the MLL, and towards greater fishery dependency of the catch on abalone that have recently grown over the MLL, which is one of the undesirable characteristics of the fishery in that past.

Overall the average weight data indicate that rebuilding of the population size composition is continuing strongly in many locations, particularly in Region 3 and most of Regions 4 and 6. The population size composition has been stable in Region 2 and the remaining parts of Region 6. It should be noted that the population may still increase in abundance with a stable size composition. However there are some sub-Regions where the population size composition has reduced under the slightly larger catches taken during 2012/13, indicating that population rebuilding in these sub-Regions had been relatively weak and is easily reversed by slightly higher catches. These weakly recovering sub-Regions are mostly in Region 5 and the southern part of Region 4, but one is in Region 2.

Anecdotal observations from industry are unanimous in reporting that there are numerous undersized abalone in the population, and while all report significant improvement in the

stock during the last few years, there are different views about the robustness and stage of the recovery so far.

3.3.2. Fine scale data and interpretations

Fine scale catch and effort information from the GPS data-logger system was presented to the Committee during its meeting. Further fine scale catch rate data was provided on request to the Committee after the meeting; that additional information and analysis was particularly useful and the rapid and effective response to the request was appreciated.

The coverage of data-loggers in the fishery is greater than 50% of operations in most Areas and it is greater than 75% in the Areas providing most of the catch. There has been good coverage now for two years, 2011 and 2012, so that detailed comparisons can be made between these years of the fishing effort distribution, catch rates, re-visitation rates and mean abalone weight from fine scale locations. Note that these are calendar years, and so they straddle TACC years, with the relevant TACCs being 94t in 2010/11, 110t in 2011/12 and 120t in 2012/13. In future such analysis should be provided in years that match the TACC years.

The area of concentrated fishing effort for most of the fishery (Regions 4, 5 and 6) was estimated in each of these two years. Significant results from this were:

- Overwhelmingly the areas of fishery concentration in 2011 were within the areas of fishery concentration in 2012. This indicates that there is not a pattern of extreme localised serial depletion occurring between these fishing years (e.g. it is not a case of areas fished in one year being abandoned the following year).
- The area of concentrated fishing expanded greatly between 2011 and 2012, from about 93ha to about 325ha (i.e. a 250% increase). Between these years the averaged TACC increased from 102t to 115t (i.e. a 13% increase). The extra about 13t of catch required a very large extra area to be fished. There are several possible reasons for this and additional analysis would be necessary for confident interpretation. But one interpretation is that the population is highly aggregated with small areas of high abalone density that are targeted when the TACC was low, and much larger areas of much lower average abalone density (e.g. with more dispersed or smaller aggregations), with this large more patchy area being increasingly searched to provide the additional 13t of catch. This could indicate that the stock recovery is very patchy, that catch rates at a low TACC are a poor indicator of overall stock abundance, and that relatively small changes in TACC can have big effects on the exploitation pattern.

Providing a definitive interpretation of the area fished as an indicator of stock and fishery status requires further analysis, but this interpretation is not inconsistent with the information available.

The fine scale (1Ha hexagon) catch rate data were examined to help to interpret the Area aggregated catch rate and average weight data, and particularly the possible causes of the decreased average weight in Areas 5, 10, 11, 13, 14 15 and (to a lesser extent) 16. At this fine scale there has been a pattern between 2011 and 2012 of (i) greatly increased area fished (ii) not achieving high catch rates in 2012 in most cells with high catch rates in 2011 (iii) adding some new high catch rate cells in 2012 that were not fished in 2011, and (iv) adding many new low catch rate cells in 2012 that were not fished in 2011. The fine scale catch rate data shows a substantially different pattern to the fine scale effort data, with the many or most areas of high catch rate in 2012 being different to those in 2011. The best way to integrate and analyse these data into meaningful and definitive trends of stock or fishery status is not yet developed. It is expected that local cells will be depleted and whether that is sustainable depends on the recovery rate and the fishery return time. So just

having areas of high catch rate in one year not giving high catch rate the next year is not necessarily a problem. But the pattern of spatial effort transfer and catch rate seen between these two years does not exclude the possibility of localised depletion – it would take more years of observation to determine whether the local scale patch fishing was sustainable or not. It also does not exclude the interpretation that some of these areas that were lightly fished during the years with low TACC, leading to an increase in average weight, which was then quickly removed by somewhat increased catches during 2012 indicating that the rebuilding had not been substantial in these Areas.

This very preliminary analysis and data made available to the Committee illustrates the very high potential value of the fine scale data and analysis. There are few years for comparison and the methods for interpretation are not yet developed, but it is already allowing exploration of some of the key questions of stock recovery and sustainability, even though at this stage definitive interpretations cannot be made. Developing indicators capable of robust interpretation and providing more complete analysis, including documentation of the technical methodology applied, will allow more confident and certain tracking of the status of the stock and its recovery.

While recognising that some the following recommendations will take time to develop and implement, the Committee strongly supports the use of finer scale information for assessment and management of the fishery.

*The Committee **recommends** that:*

- *the data-logger program be continued at a high level of coverage in the fishery;*
- *through the data-logger program or other means the monitoring be extended to provide length composition of the catch in addition to the average weight;*
- *robust and interpretable indicators of stock and fishery status based on the finer scale data continue to be developed and tested; and*
- *benchmarks or reference points relating to stock condition and productivity be developed for these indicators.*

3.3.3. 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.

In July 2005 the permitted recreational bag limit was reduced from ten abalone per day to two, and since then there has been both extra focus on compliance and increased penalties for illegal recreational fishing. Reports from recreational fishers, industry, management and compliance all agree that this strongly discouraged recreational divers from targeting abalone and substantially reduced the recreational catch. The Committee considered that the recent recreational catch was likely to be in the vicinity of 5-15t, that 10t was a reasonable estimate, and that the recreational catch had not increased during the last year. The Committee was informed that during 2013 the Department intended to increase the recreational bag limit to 5. The extent to which this will increase the overall recreational catch, and in particular increase catch from areas where the stock is still depleted and vulnerable (e.g. Regions 1 and 2), is not known. It is recommended that any increase in the recreational bag limit be accompanied by additional monitoring of the recreational catch and that measures to control the catch from vulnerable areas be considered.

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 in the vicinity of 20-40t per year since then. 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. The recent relaxation of indigenous permits has not caused a significant increase in indigenous catch.

3.3.4. The 2013 industry workshop

The Committee reviewed and considered the documents from the 2013 industry workshop, and in particular the criteria for assessment of each subregion and the industry suggestions about the appropriate catch from each Area. This was useful input to the Committee. There was widespread agreement among workshop participants that the workshop process was a reasonable one, though several participants expressed disappointment that the MLL issues were not addressed.

The industry suggested that the catch from 15 Areas stay at the same levels as they suggested last year, and that the catch from 6 Areas be increased from the levels they suggested last year. T hree of the 6 Areas for suggested catch increase are Areas for which the average catch has decreased following the catch increases over the past 1-2y, as discussed above.

The workshop input to the committee was very helpful, and the developing approaches to review indicators and manage catches at a finer space scale are particularly promising. Committee believes there are a number of ways to further improve this workshop input.

*The Committee **recommends** that:*

- *the reporting areas used are aligned with those used in the past and with those used by the Departmental reports, or conversely that all reports use the new Area groupings and historical data are re-tabulated and re-presented in these groupings.*
- *more explanation be provided about the workshop assessment of each sub-region or Area, and the basis for the conclusions reached.*
- *the criteria for assessing the status of each area be further developed, over time and as part of the broader development of the management framework with management, to make more use of indicators from fine scale monitoring and to use benchmarks that reflect long-term optimal resource use and overfishing limits.*
- *input to the Committee is accompanied by a technical description of the data and the analysis conducted, rather than just having the results provided as a Powerpoint presentation and through a web-accessible set of graphs. This is necessary for technical review and understanding of the material presented. This will become even more important as the fine scale data is increasingly used to provide indicators and to aid interpretation of stock status.*

3.3.5 Prince Report, October 2012

The committee was provided with a report describing a visit by Dr Prince to re-dive areas that he had dived in the 1980s and 1990s, to provide his observations about the state of the stocks, and to suggest an approach to fishery assessment and use of reference points.

His conclusion on the state of the stocks was that it is now much improved but is still far from recovered. Specifically he commented that there was now a more healthy size range of

abalone beyond the MLL, that breeding aggregations were forming and that there were good numbers of juvenile abalone. He also commented on the improved marine environment more generally, with increased kelp cover and reduced urchin barrens in some areas due to the introduction of the urchin fishery. His suggestions with regard to stock assessment and reference points were to make use of 'Per Recruit Analysis'. This is a well-known methodology and some recent developments make it more easily applied in data-poor situations such as the NSW abalone fishery. Use of this form of analysis has also been recommended by the Committee over several years.

3.4 Conclusions

There is no doubt that there has been substantial improvement in the state of the stock in recent years, starting in about 2006 but particularly since about 2009. The TACC reductions and increased MLL have succeeded in this regard and the population has accumulated stock 'on the bottom'. There are spatial differences in stock recovery –slow recovery in Regions 1 and 2 (though there is very limited fishing and hence data available for these Regions); faster recovery in regions 3, 4 and 5; fastest in Region 6.

The trends in indicators for the last 1-2y, a period of increasing TACC, are mixed. The stock rebuilding is continuing overall but it is slower, spatially patchy (including in Regions that provide the bulk of the catch and that earlier showed more consistent rebuilding), and less certain. Specifically in the past 1-2y:

- The catch rates aggregated by Region continuing to increase in some Regions (Regions 2, 4 and 5) and have plateaued or decreased in others (Regions 3 and 6).
- The catch rates at sub-Regional (Area) scale continued to increase in many sub-Regions, but there are also many with plateaued catch rate and some with decreasing catch rate.
- The average weight of individual abalone caught continues to increase in some Regions (Regions 3 and 4), but has plateaued in others (Regions 2, 5 and 6). For many sub-Regions (Areas) there has been very little recent further increase in average weight, and for 5 Areas there has been a distinct decrease in average weight under recent increased catches. These Areas showing decreased average weight are of particular concern and at face value indicate that recent relatively small catches increases have significantly eroded the rebuilt population size composition in these sub-Regions, which would not be possible if the stock rebuild was strong (i.e. involved significant increase in the number of larger abalone).
- The area fished greatly increased to achieve a relatively small increase in catch. There was a three-fold increase in the area fished for an extra about 13t of catch taken between 2011 and 2012. This is of concern because of the implications that previous high catch rates were from relatively small areas of high abalone concentration and that these concentrations are not widespread. Interpretation of sustainability will depend greatly on fine scale analysis to show that the local areas continue recovery or are at least maintained between harvesting visitations, and that this applies to both the 'hotspots' targeted at low TACC and the larger area fished at higher TACC. Such detailed analysis is not currently available but is necessary for confident interpretation of stock status.

There is no doubt that stock rebuilding since about 2006 has resulted in additional accumulated stock above the MLL. A recovered stock will have considerable stock abundance across a wide range of abalone sizes, above the MLL so as to both provide buffer the stock against variations in annual productivity, maintain an adequate spawning stock (and most mature abalone will be emerged and highly visible), and to provide high

fishery catch rates. The current stock condition is clearly better than that of a few years ago, and by those standards it may appear to some that that recovery has occurred. But the current extent of stock rebuilding remains uncertain. In addition to the points above unique interpretation is hampered because the main indicator of stock size is the catch rate. This is not likely to be directly proportional to stock abundance especially, as recently, when a low TACC can be effectively targeted in high catch rate areas. The average weight of individuals in the catch is also an indicator that is difficult to interpret uniquely because it can be influenced by changes in diver selectivity. In principle analysis of the fine scale data could address some of these uncertainties, especially if augmented with structured fishing to an appropriate design, but as yet these analyses have not been done. And all available indicators are 'trailing indicators', potentially indicating past stock conditions but not future conditions; there is no indicator related to recruitment or sub-MLL sized abalone.

The central questions are (i) the extent of the recovery in relation to thresholds for recruitment overfishing and optimum stock productivity, (ii) the robustness of the recovery so far to fluctuations in stock productivity and to increased catch, and (iii) identification and rectification of the past management settings that allowed overfishing to occur previously.

The recovery so far does appear to be robust to fluctuations in stock productivity. But the information and analysis available does not provide convincing examination or confident conclusions in relation to the remainder of these central questions. As in recent years the Committee has had very limited information and analysis for its decisions. Consequently there is a high level of uncertainty about the true status of the stocks and their responses to recent changes in the TACC and MLL. The management situation is more complex now, and it requires greater information support, that previously. Previously the imperative was to stop further stock decline and begin recovery, and that can be addressed (albeit inefficiently) with little information. Currently the management situation is balancing continued recovery, management reform to prevent a return to overfishing, and increasing catches. In this there are limitations and risks from the limited stock status indicators available, the spatially patchy nature of the recovery (and hence the need for spatial controls on catch which are not yet reliably established), and the time needed to learn from previous management changes before making major new changes. The fishery is now being significantly limited by under-investment in the monitoring, assessment and management, and without change to this investment the future is likely to be continued uncertainty, the need for considerable precaution and continued frustration for industry, scientists, managers and the TACC. In regards to stock assessment the Committee re-iterates its previous suggestions to:

- further develop and test the indicators and benchmarks based on the fine scale data;
- extend the current monitoring to include the length composition of the catch;
- conduct 'per recruit' analyses (for yield, legal biomass, spawning biomass, mean length and mean weight) and use the existing population model to examine scenarios of the expected changes in these stock indicators given the recent changes in TACC and MLL
- use these analyses to develop initial benchmarks and reference points related to productivity thresholds (e.g. recruitment overfishing, optimum yield, maximum yield) for the indicators currently available (i.e. catch rate and average weight), and initial options for benchmarks of indicators based on fine scale data;
- develop more formal methods to determine the catch at finer space scales (i.e. Areas or sub-zones.

Because of the spatial variability of abalone life history parameters, maximising the yield while protecting the spawning stock implies different MLL in different areas. If the MLL is too

small even moderate TACC levels can result in both growth and recruitment overfishing in areas, while if it is too large yield is foregone. The Committee has consistently recognised the need for different MLLs in different areas. The Committee has argued for higher overall MLLs that are adequate to optimise the fishery in the areas of fast growth that provide most of the catch, augmented by specific arrangements to provide harvesting access to slower growing areas. In the absence of adequate MLL protection for the fast growing portions of the stock this protection must be provided by a low overall TACC, but alone this is an inefficient tool and does not allow the fishery to reach its biological and economic potential.

The Committee again finds that all the available evidence indicates that there would be further benefit to the stock and fishery from an increase in the overall MLL. The Committee was pleased to see that the size limit south of Wonboyn has been increased to 123mm but was disappointed that the size limit increase to 120mm elsewhere, which was previously recommended by the Committee and endorsed by the Department, have not been implemented. The Committee notes that submissions it received from many licence holders are in favour of this increase. Those that oppose it have consistently and vocally opposed almost all MLL increases, including the increase from 115mm to 117mm that demonstrably improved the stock and fishery.

*The Committee strongly **recommends** that the 'default' size limit for Regions 1-5 and Region 6 other than the area South of Wonboyn (Y31-Y32) be increased to 120mm.*

In the circumstances discussed above the Committee has concluded decided that the TACC for 2013/14 should be increased to 125t.

In making this judgement the Committee is very aware of countervailing interpretations that are possible, and that the information and analysis available is weak for detecting any problems in time for management correction. There are reasonable interpretations of the available data that range from a conclusion that a 125t TACC would not seriously impeding further stock recovery through to a conclusion that the recent 110-120t TACC has resulted in early signs of the recovery faltering in some parts of the fishery. This uncertainty is contributed to by the limited range of indicators available, the difficulty in precise or unique interpretation of these indicators, that none of the available indicators are 'leading indicators', and the absence of appropriately identified target and limit reference points for any indicators. In this situation the Committee encourages close monitoring of the stock, analysis of the fine scale data to determine patterns of local scale depletion and recovery, the collection and analysis of length data, and the application of 'per recruit' analysis to determine appropriate reference points for the length/weight composition and MLL. Without more definitive information on the status of the stock it is expected that a period of time will now be required to fully recognise and understand the consequences of the TACC increases in the past few years. Including the currently recommended increase for 2013/2014 there will have been a 31t increase in the TACC since 2010/11, there are some indications of stock stress in some indicators following the increases to 2011/12, the full consequences of the increase to 2012/13 are not yet analysed or available, and there remains slow progress on identifying and implementing an appropriate MLL and reliable local catch caps. The committee also recommends that further management attention be directed to determining local catch caps and ensuring that these are not exceeded. There is a risk the TACC is being increased faster that the currently limited monitoring, assessment and management arrangements allow for safely. Further TACC increases would require improved understanding and confidence.

Figure 1 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.

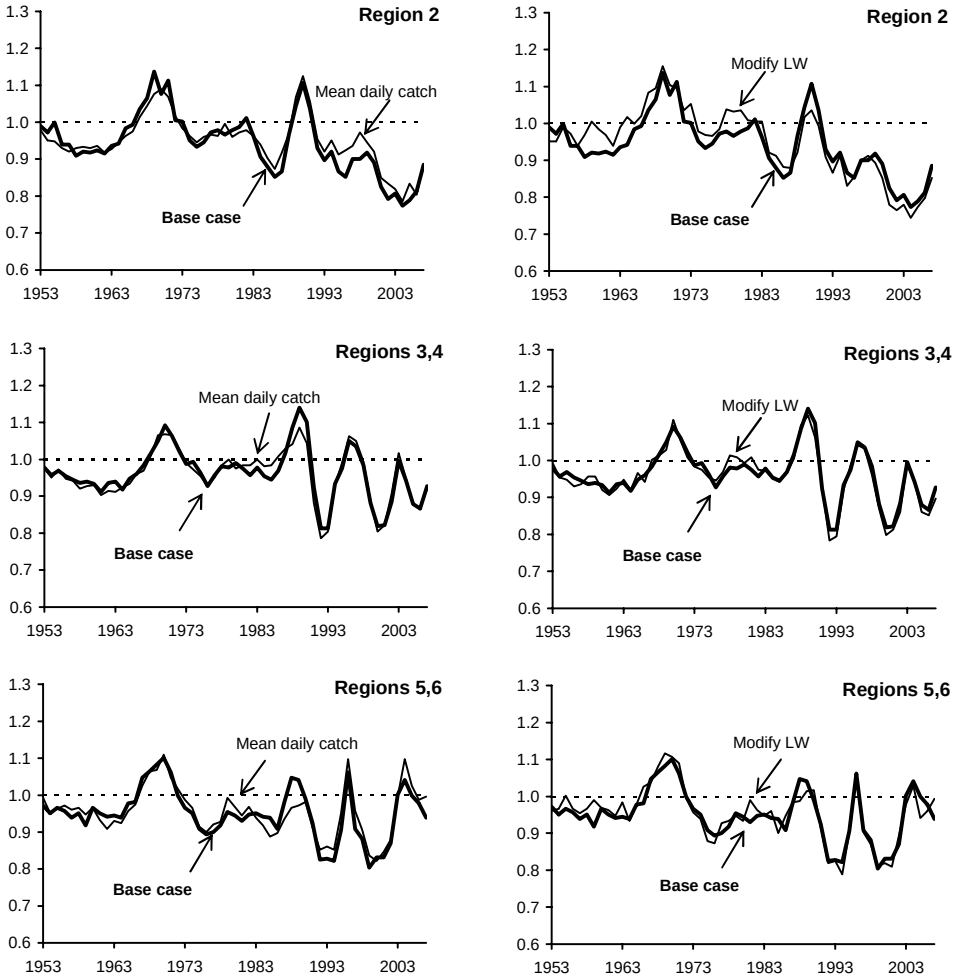


Figure 2 Annual catch (histograms) and CPUE relative to 1994 (lines) for each region of the fishery since 1987. Dashed lines represent the value of mean CPUE in 1994, and dotted lines are +/- 15%. The white histogram bars and open circles for recent years in regions 1 and 2 indicate the years in which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

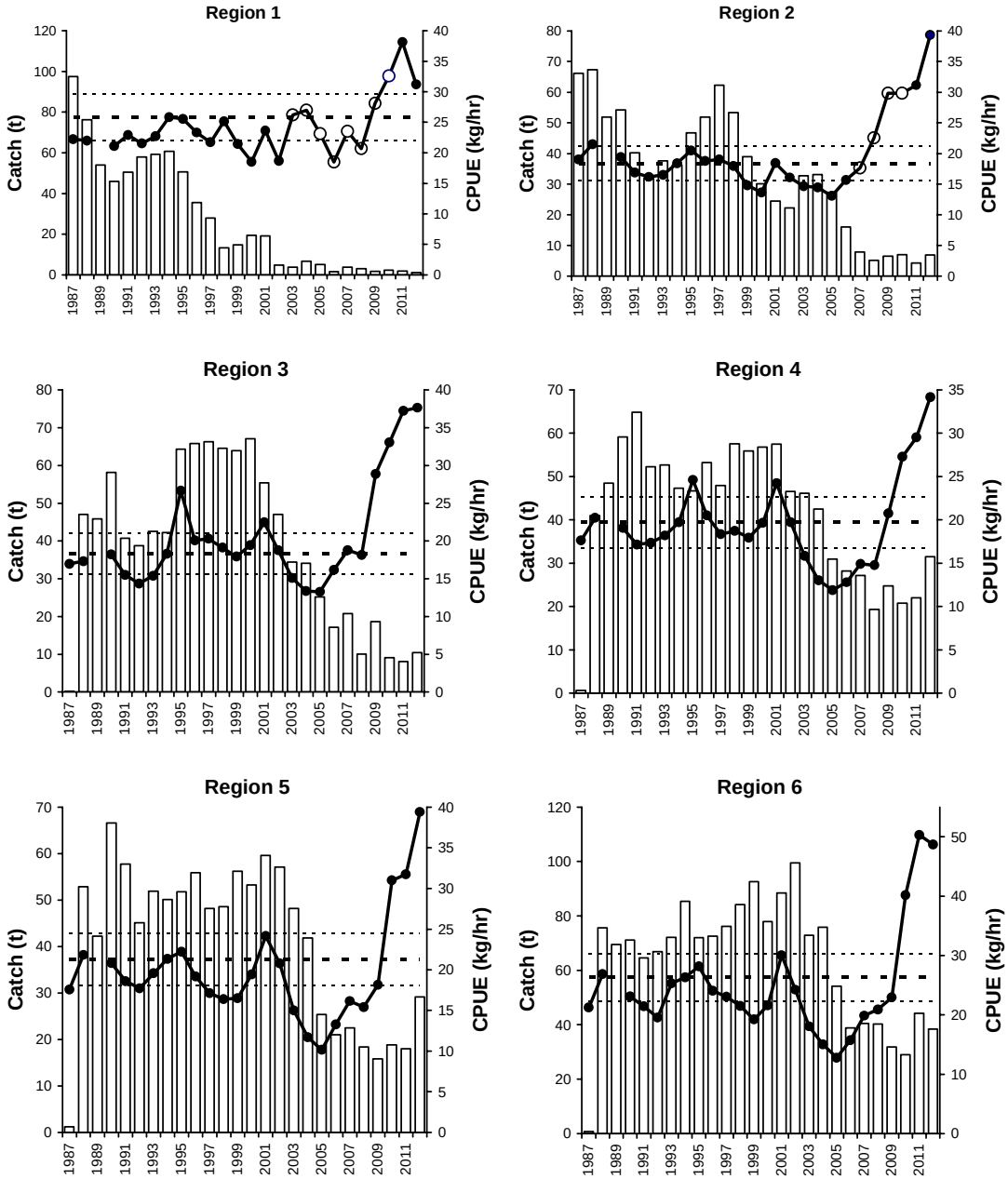


Figure 3 Mean monthly CPUE (kg/hr) for each region of the fishery since 1998. Vertical dashed line indicates the increase in MLL from 115 to 117 mm in July 2008.

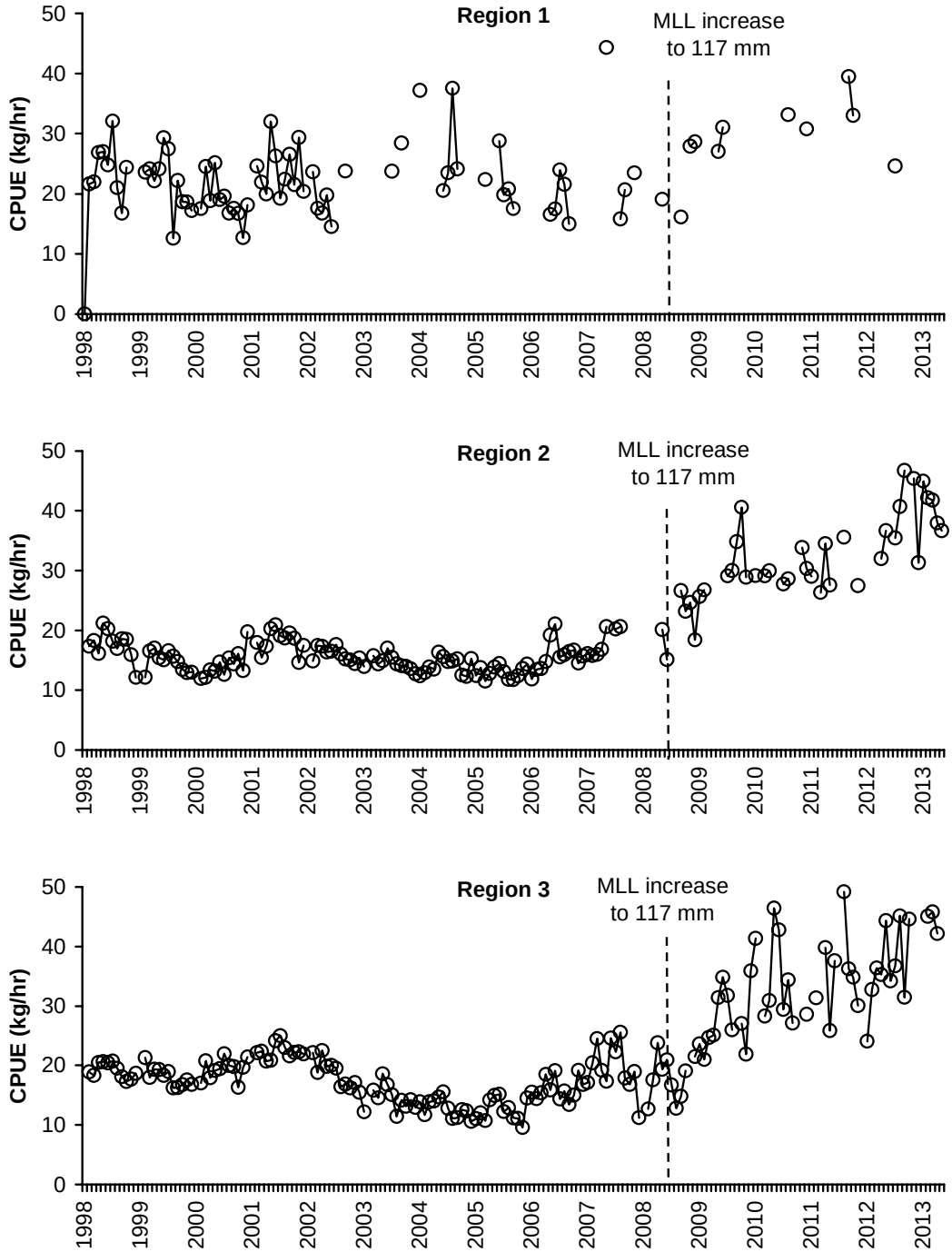


Figure 3 continued. Mean monthly CPUE (kg/hr) for each region of the fishery since 1998. Vertical dashed line indicates the increase in MLL from 115 to 117 mm in July 2008 and an increase in MLL from 117 mm to 120 mm in Regions Z1-Z5 (region 6) in May 2010.

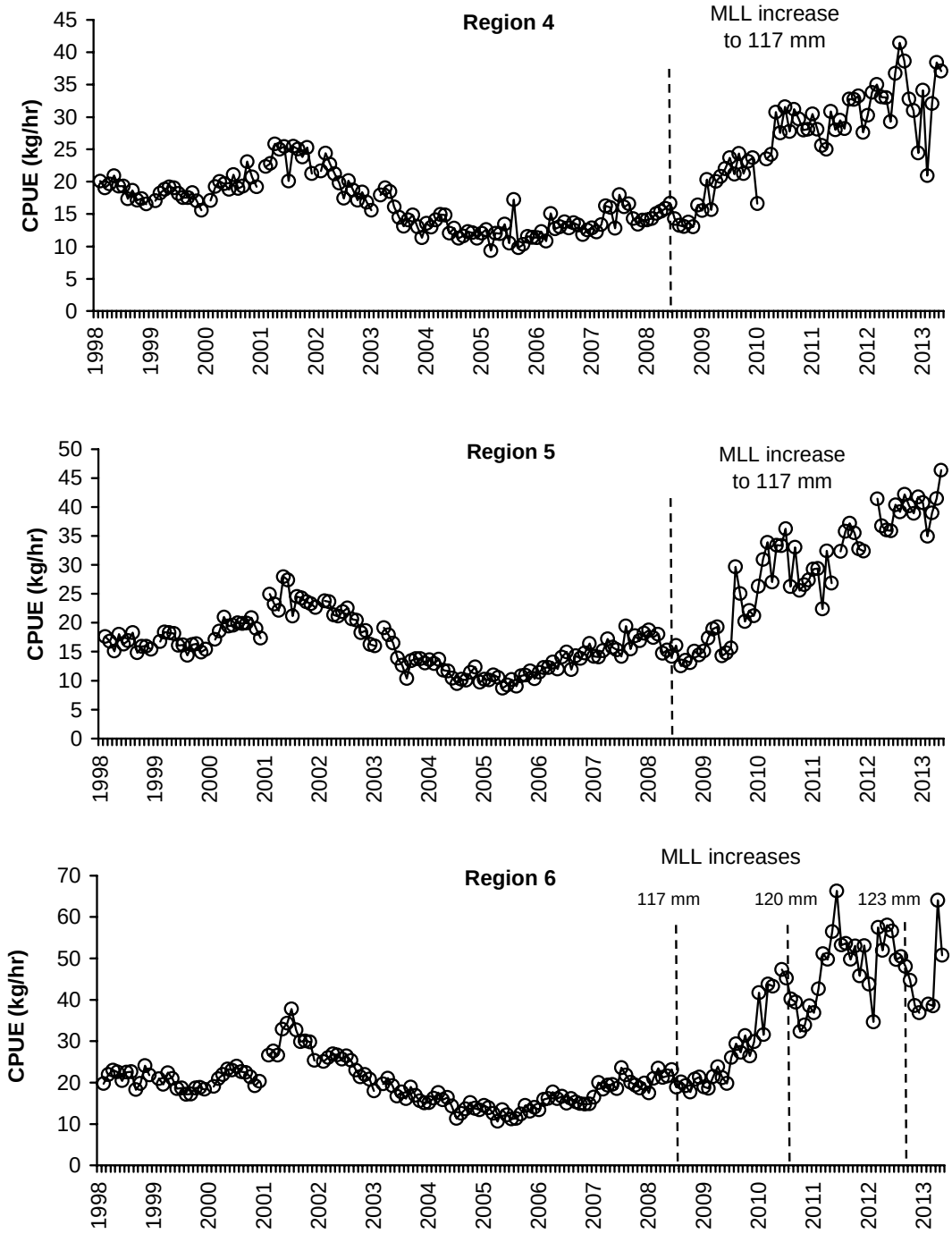


Figure 4. Monthly mean weight of individuals caught for regions 1-6 since 1999. Vertical dashed line indicates the increases in MLL.

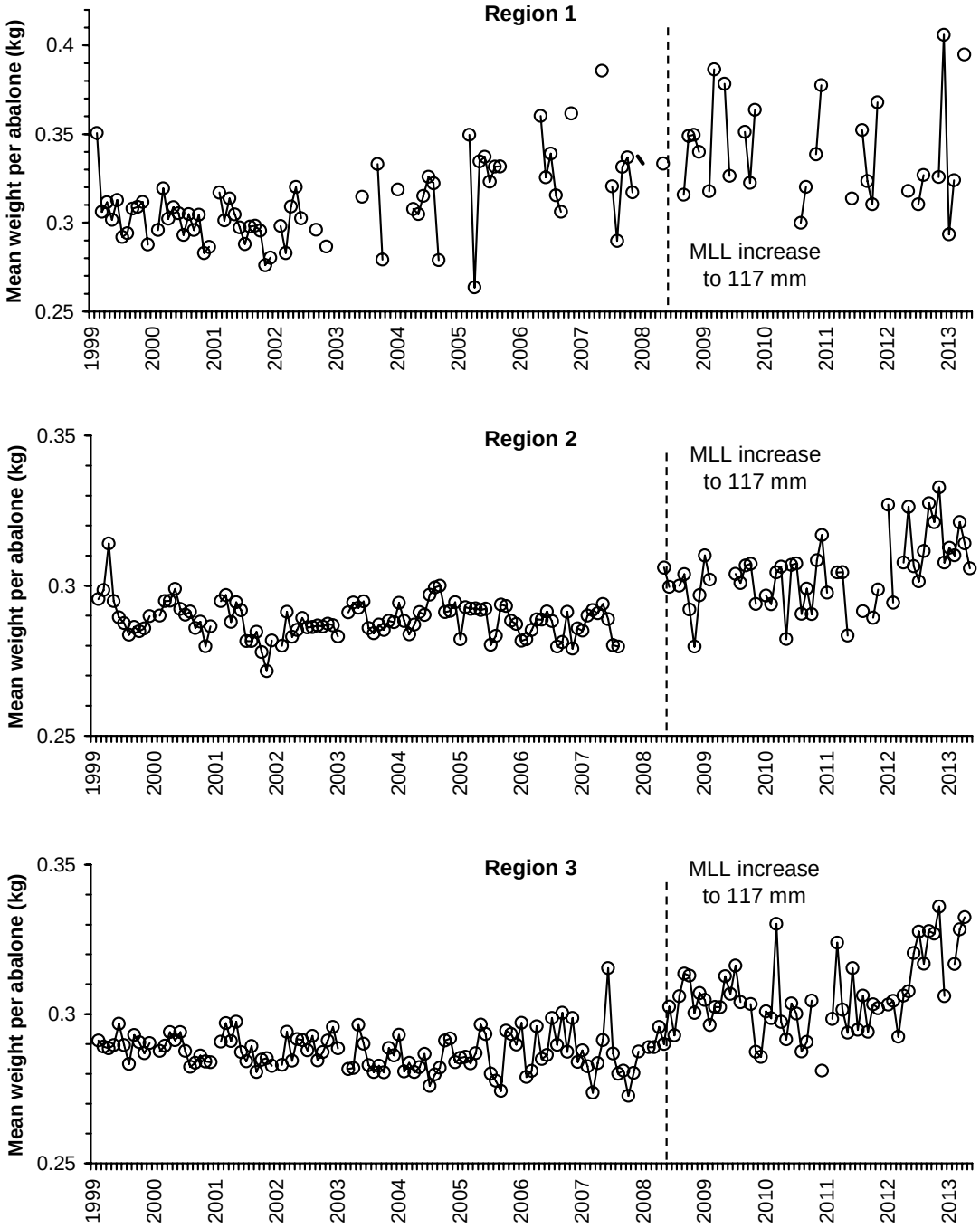


Figure 4 continued.

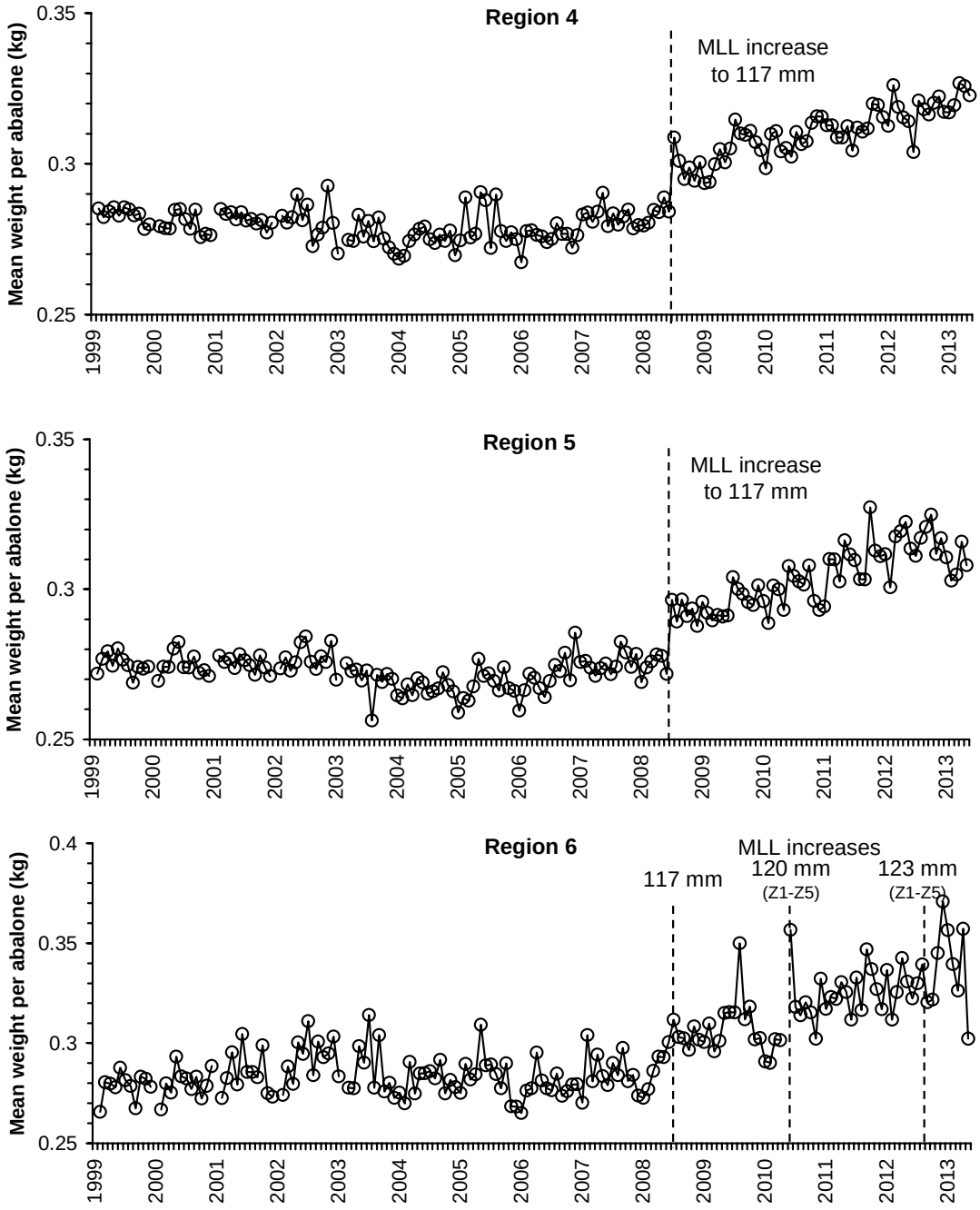


Figure 5. The monthly catch and catch rate (upper panel) and catch and the mean weight of individual abalone in the catch (lower panel) for Area 5, which comprises sub-Region P in Region 2. The green dots and line on the lower panel show the mean weight of individual abalone in the catch. On both panels the blue bars show the monthly catch and the blue line is the 6m moving average catch.

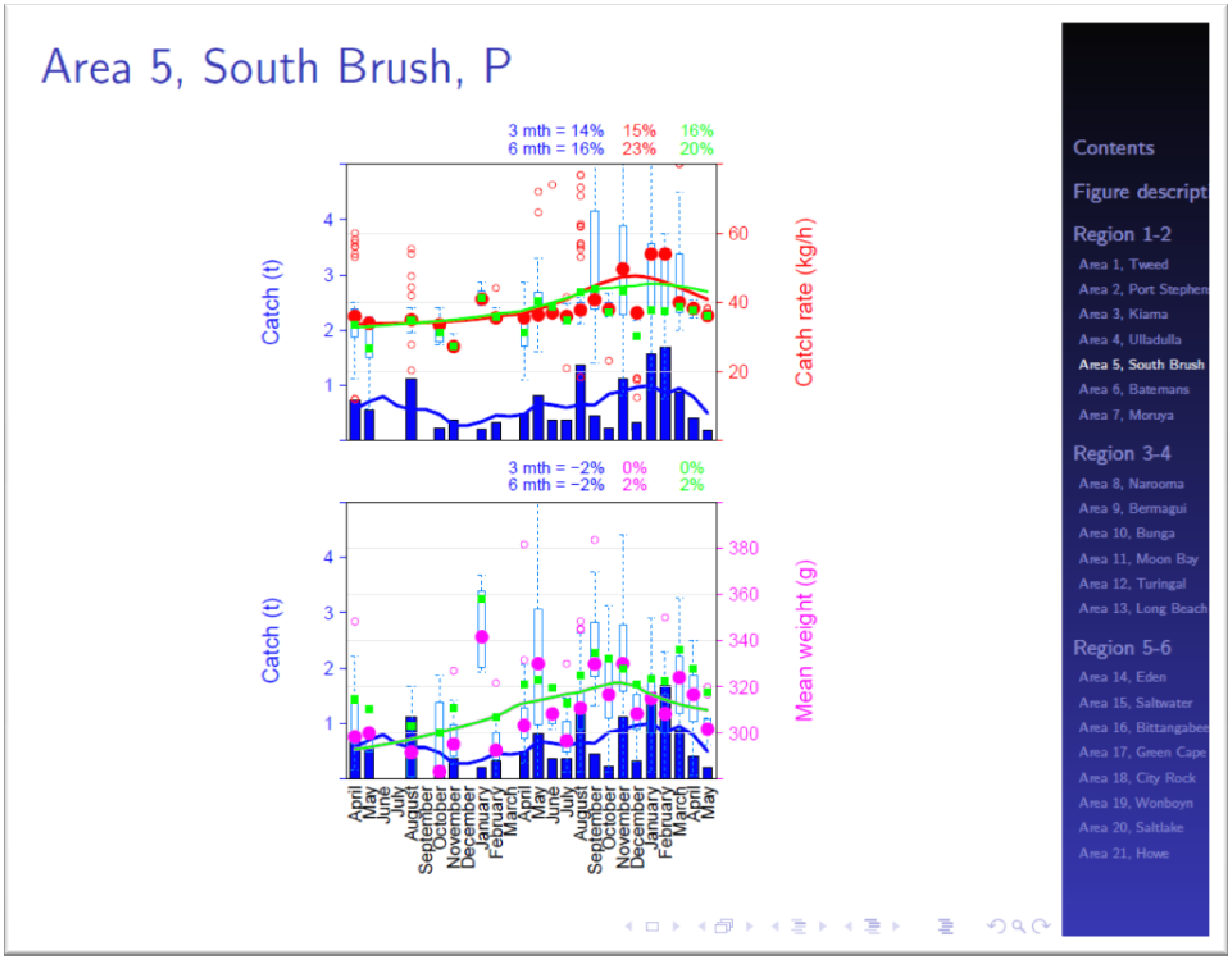


Figure 6. The monthly catch and catch rate (upper panel) and catch and the mean weight of individual abalone in the catch (lower panel) for Area 13, which comprises sub-Region X2 in Region4. The green dots and line on the lower panel show the mean weight of individual abalone in the catch. On both panels the blue bars show the monthly catch and the blue line is the 6m moving average catch.

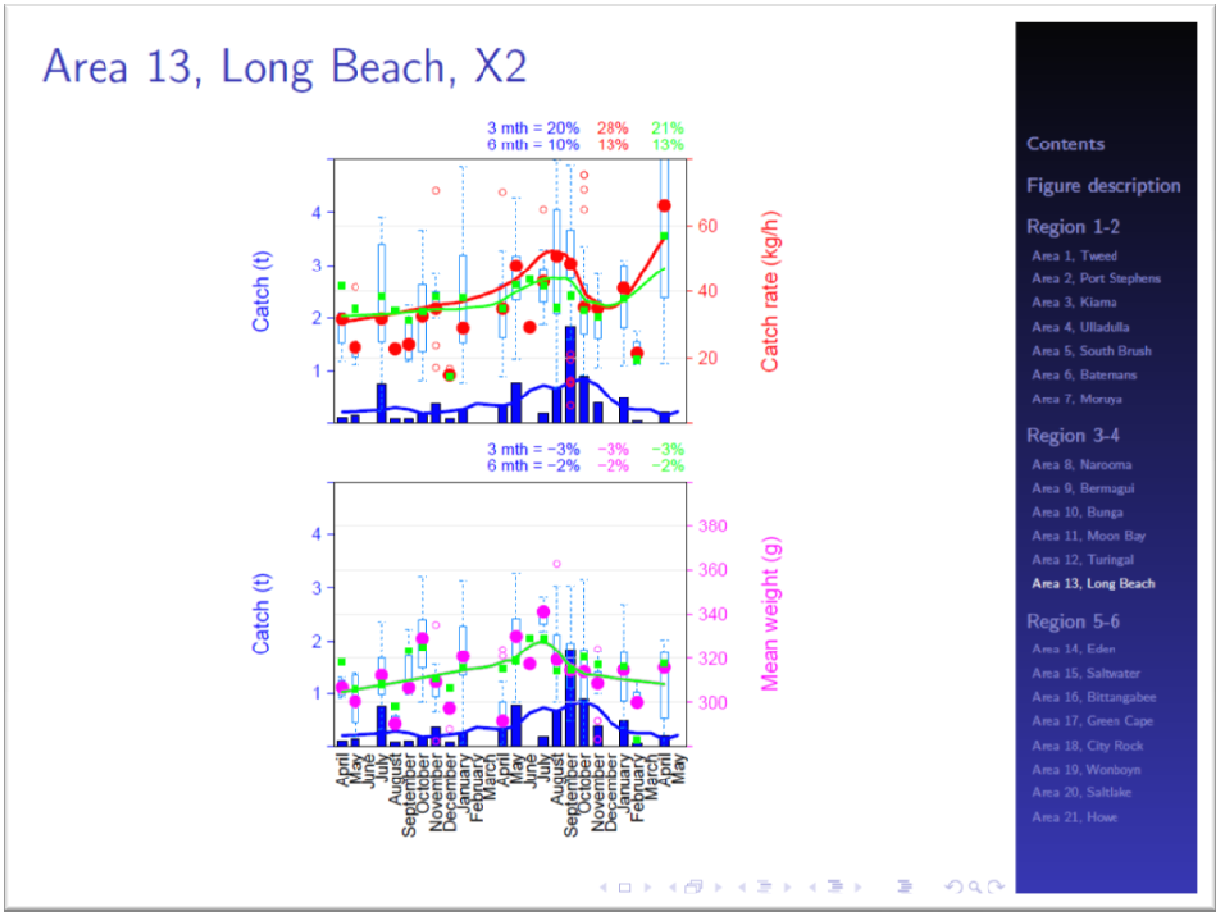
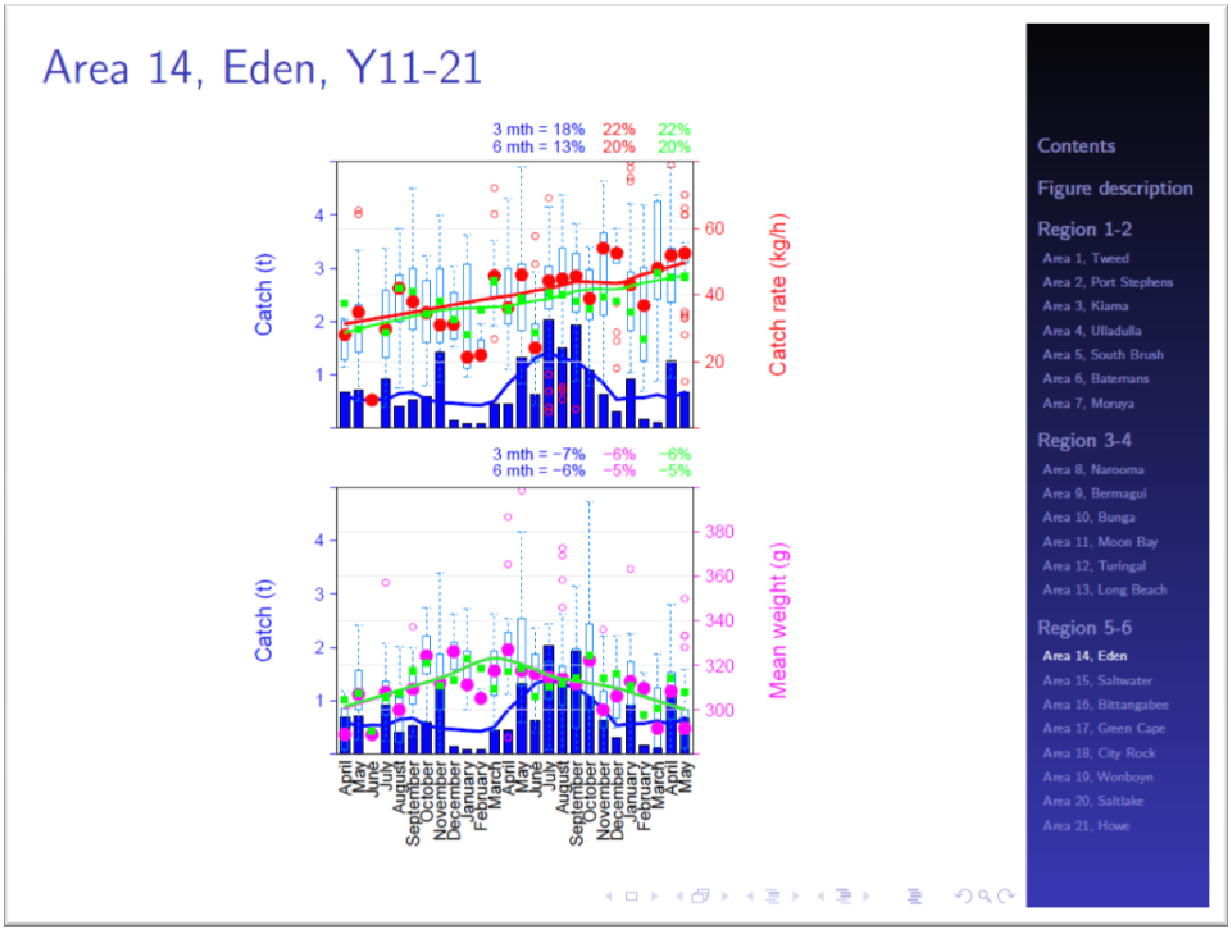
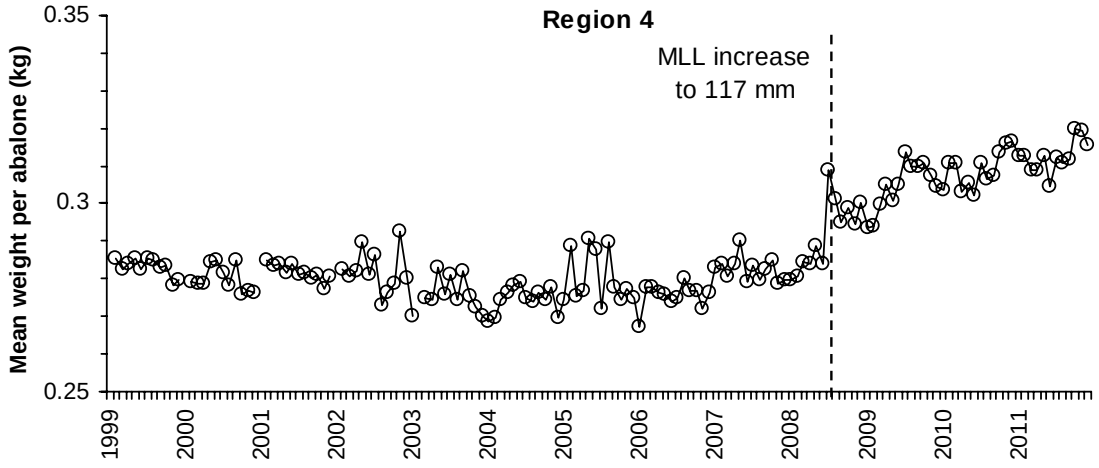
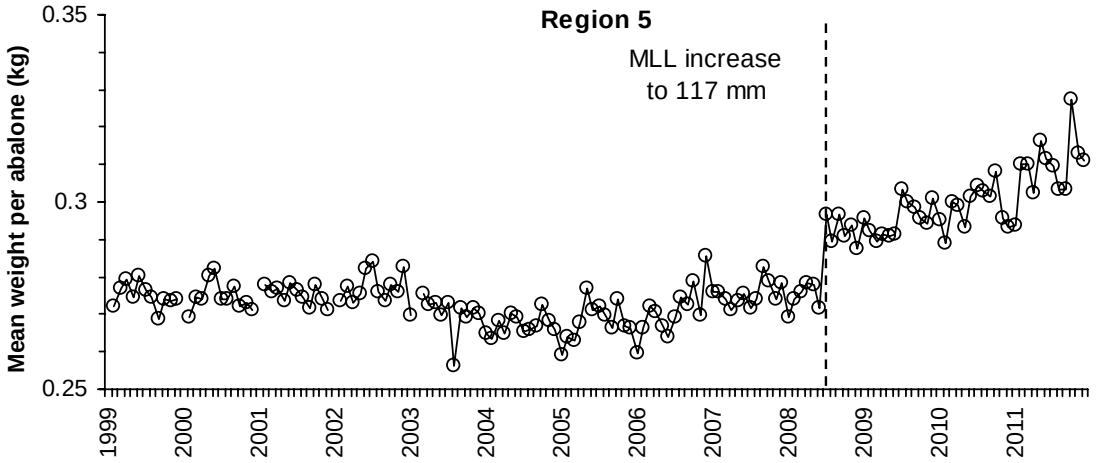
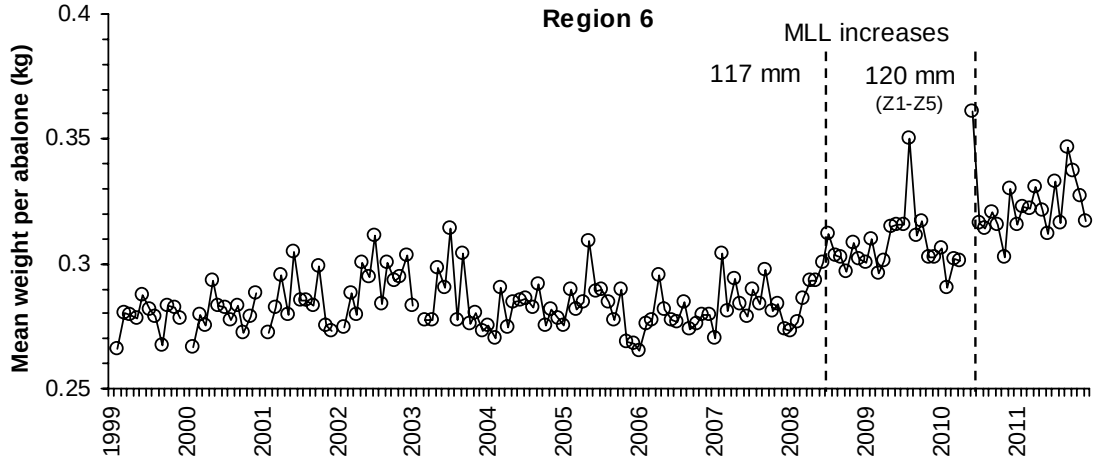


Figure 7. The monthly catch and catch rate (upper panel) and catch and the mean weight of individual abalone in the catch (lower panel) for Area 14, which comprises sub-Regions Y11-Y21 in Region5. The green dots and line on the lower panel show the mean weight of individual abalone in the catch. On both panels the blue bars show the monthly catch and the blue line is the 6m moving average catch.




Region 4
MLL increase
to 117 mm
Mean weight per abalone (kg)
0.35
0.3
0.25
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011


Region 5
MLL increase
to 117 mm
Mean weight per abalone (kg)
0.35
0.3
0.25
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011


Region 6
MLL increases
117 mm
120 mm
(Z1-Z5)
Mean weight per abalone (kg)
0.4
0.35
0.3
0.25
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011

4. ECONOMIC CONSIDERATIONS

4.1 Introduction

In this section of the report, the economic status of the NSW abalone industry is described, consistent with the requirement that the Committee have regard to economic and social issues in making its determination. In comparison to previous years, this year the Committee had a detailed set of economic indicators for the fishery on which to base its assessment of economic performance. These indicators were provided through a survey of 17 abalone fishing businesses / external shareholders, undertaken by EconSearch and funded by the Australian Seafood CRC. The economic indicators are for a single year, 2011/12. It should be noted that at the time of writing this report, the survey results produced by EconSearch were still in draft form.

As with previous years, analysis of the data affecting the economic performance of the abalone fishery, including gross revenue, export prices and catch per unit effort, is undertaken. In addition, this year it has been possible to report the financial performance of abalone fishers as a result of a survey of 17 abalone fishing businesses/external shareholders providing cost data for 2011/12.

Collection of data on the profitability of the abalone fishery in 2011/12 also makes it possible for the Committee to make a more informed judgement on the economic status of the fishery and the impact of its TACC determination on the likely future profitability of abalone fishing businesses / external shareholders.

4.2 Volume and value of production

The volume of reported catch of abalone in 2011/12 was 109.8 tonnes, an increase of 17 per cent from 2010/11 (Figure 8). This catch accounted for around 99 per cent of the TACC. Since 2005/06, industry has been able to catch virtually the full TACC; and more recently with less effort. With reported catch in the current year to end March at 91.8 tonnes, it is likely that actual catch will approach the TACC of 120 tonnes set for the current year.

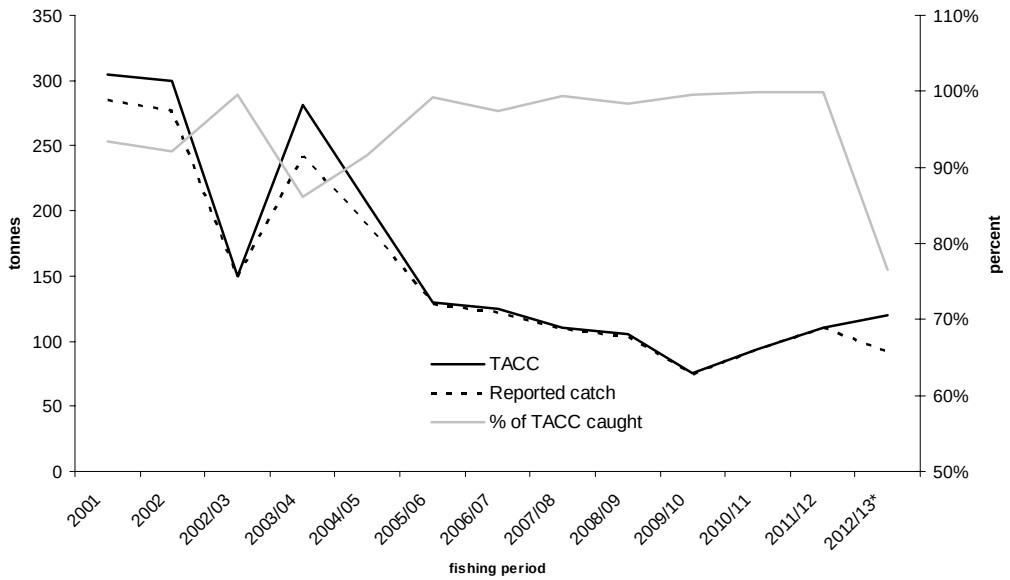
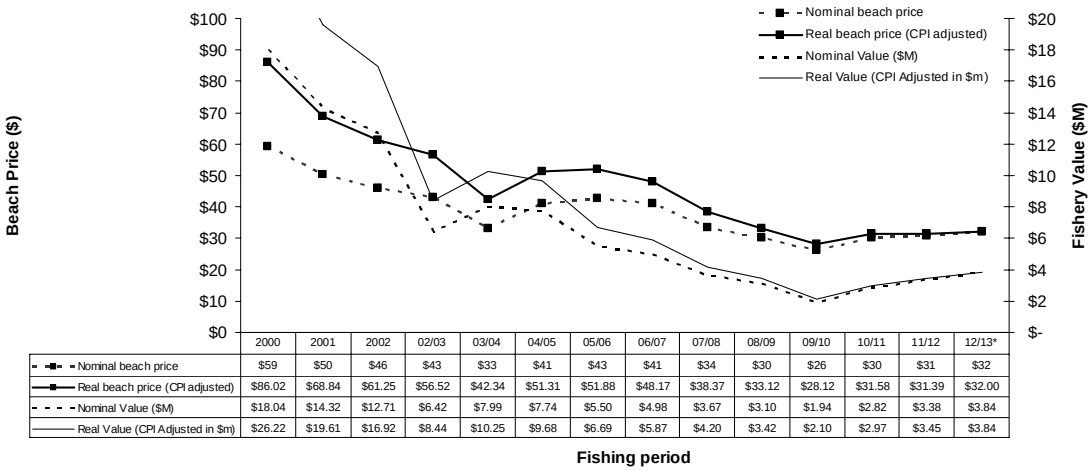


Figure 8. TACC (t), total reported commercial catch (t) and proportion of TACC caught (%) for each fishing period from 2001 to end March 2013.

The real value of reported catch of abalone in 2011/12 was $3.45 million, an increase of 42 per cent when compared to the 2.82 million in the previous year (Figure 9). Since bottoming out at $2.10 million in real terms in 2009/10, the gross value of production has more than doubled over the past three years. Production and reported prices for the first ten months of 2011/12 suggests that the value of reported catch for the current year will be higher again, at around $3.84 million. These values are very low, however, when compared to levels in 2000, when the gross value of the fishery was $24.9 million in real terms due to both higher catches and prices. However, it is noted that that the high levels of catch at this time were not biologically sustainable (NSW DPI 2006), and that the price of Abalone was unusually high.



	2000	2001	2002	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13*
Nominal beach price	$59	$50	$46	$43	$33	$41	$43	$41	$34	$30	$26	$30	$31	$32
Real beach price (CPI adjusted)	$86.02	$68.84	$61.25	$56.52	$42.34	$51.31	$51.88	$48.17	$38.37	$33.12	$28.12	$31.58	$31.39	$32.00
Nominal Value ($M)	$18.04	$14.32	$12.71	$6.42	$7.99	$7.74	$5.50	$4.98	$3.67	$3.10	$1.94	$2.82	$3.38	$3.84
Real Value (CPI Adjusted in $m)	$26.22	$19.61	$16.92	$8.44	$10.25	$9.68	$6.69	$5.87	$4.20	$3.42	$2.10	$2.97	$3.45	$3.84

Figure 9. Estimated nominal and real value of the fishery ($ m) and average nominal and real beach price ($) for each fishing period from 2000 to end March 2013.

NSW abalone production is a very small percentage of Australia's overall production, at around 2 per cent in 2010/11 (ABARES, 2012). 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 2011/12, the average real price of abalone was $31.39/kg, which was a slight decrease when compared to 2010/11 when it was $31.58/kg. Prices in 2012/13 are expected to increase slightly, to around $32/kg (Figure 9). Since 2000, prices have trended downwards from a level of around $86kg in real terms. This steady decline in prices can be attributed to the rapid expansion of cultured abalone production and the continued strength of the Australian dollar against the Japanese Yen and US dollar. Global aquaculture production of abalone grew from around 1,200 tonnes in 2002 to 65,000 tonnes in 2010 of which China produced 56,000 tonnes and Korea 6,200 tonnes (FAO data). Production has continued to expand since this time. In real terms, abalone beach prices have not kept pace with inflation and the growth in the quality and quantity of cultured abalone will continue to place downward pressure on prices.

ABARES (2013) have forecast that the Australian dollar will remain relatively strong over both the short and medium term. This is likely to result in prices for abalone on overseas markets remaining relatively flat, all else constant. Aquaculture production of abalone is likely to expand, which will also place pressure on prices, particularly for smaller sized abalone in less-discriminating markets.

The Committee has received various advice on market preference for abalone size and hence price. At a time when processors in most states were paying premium prices for larger abalone due to market pressure from smaller, cultured abalone, processors in NSW were apparently focusing on the Japanese live market for small, wild-caught abalone. In the past this has resulted in considerable opposition to increases in minimum size. The Committee were advised this year that the market for smaller sized fish in Japan has declined, and that the market preference is for larger abalone. See also Section 4.5 below.

4.4 Catch per unit effort and average size

For abalone, while there are risks in relying on overall catch per unit effort (CPUE) as an indicator of stock abundance, it does provide a measure of availability of abalone to the fishery. CPUE increased dramatically from 19.6kg/hr in 2008/09 to 39.8 kg/hr in 2011/12, most likely as a result of lower TACCs and higher size limits. The CPUE for 2012/13 to end March has fallen slightly to 39.5kg/hr.

Higher size limits, and significantly reduced numbers of fish being taken when compared to earlier in the decade, continue to put the fishery in a much better position to improve productivity and consolidate recruitment events going forward. Subject to the extent of current and future periods of recruitment, this is a positive sign of likely improved returns from fishing in the future.

The average size of abalone in the fishery catch has risen continuously since 2005/06 from 280g to 323g in 2012/13 to end March.

There was no evidence presented to the Committee that the increase in the lower size limit from 115mm to 117mm and from 117mm to 120mm south of Womboyn has excluded significant areas of the fishery. Further, the increase in average weight of abalone has been in excess of that anticipated due to the increase in the size limit. As such, the concerns about the negative impact on economic returns as a result of a higher MLL have not been borne out. It is still the opinion of the Committee that an increase in the MLL to 120mm in all regions of the fishery, with the exception of the southern part of Region 6, where it is currently set at 123mm, will further improve economic returns. Recent advice on size preference from the market adds further weight to the argument for an increase in MLL.

4.5 Abalone markets

Abalone is sold through registered and registered restricted fish receivers to two processing plants along the NSW coast. The capacity of these processing plants to take abalone was identified as a key constraint by many divers interviewed through the EconSearch survey. In addition, preferences expressed by processing plants affected decisions on days to fish, where to fish and the size of fish to target (as opposed to weather or quota).

The size of the NSW industry and irregularity in demand from overseas were identified as key reasons for the processors' caps on abalone intake. The location of processors also dictates where divers fish, as processors are not willing to travel distances, especially to pick up from a single diver.

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 markets for Australian abalone are China, Hong Kong and Japan. The main market for NSW abalone in 2011/12 was Japan (Duncan Worthington pers. comm.). Total exports of abalone from Australia declined from 4,910 tonnes in 2003/04 to 3,320

tonnes in 2008/09. Exports increased in 2009/10 to reach 3,639 tonnes. They fell slightly again in 2010/11 to 3424 tonnes. Prices received for abalone on export markets fell between 2000/01 and 2009/10 as a result of an appreciation of the Australian dollar against the US dollar and Japanese yen (ABARES 2012). They increased slightly between 2009/10 and 2010/11 (ABARES 2012). The Australian dollar is expected to remain strong against the US dollar and Japanese yen over both the short and medium term which will result in prices for abalone on overseas markets remaining relatively flat, all else constant (ABARES, 2013).

In developing economic indicators for the NSW Abalone Fishery, EconSearch also undertook analysis of the correlation between exchange rate fluctuations and the beach price of abalone. This analysis indicated a high correlation between the $A/$US, $A/$HK and $A/Japanese Yen exchange rate and the price for NSW Abalone for the period 2001 to 2011/12. Thus, when the Australian dollar appreciates, as it did between 2010/11 and 2011/12, there is, generally, a corresponding decline in the average price of NSW Abalone.

Wild caught abalone has been subject to increased competition from aquaculture product. Around 9 per cent of total abalone production in 2010/11 in Australia was sourced from aquaculture farms (ABARES 2012). The Australian abalone aquaculture sector has more than doubled over the past five years to 491 tonnes in 2010/11 (ABARES 2012). 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 both in Australia and, more significantly in the key producers (China and Korea), 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 niche market that NSW abalone previously held in Japan is shrinking due to aquaculture competition. Industry also report that a separate Japanese market is emerging for larger size abalone due to a recent change in tastes and preferences. Industry suggests that NSW product is not competitive in either of these markets.

As tastes and preferences in overseas markets appear to be changing away from product that can easily be supplied by NSW abalone fishers, i.e. towards larger sized fish, it may become more difficult for NSW product to find a market. Further, supplying a product that does not currently meet what is being demanded by overseas markets is likely to negatively impact on prices received, especially at higher TACC's.

It is important now that new overseas markets and marketing initiatives for wild caught abalone are explored. The Committee notes the Seafood CRC-led work on the development of a marketing strategy for Australian abalone will offer some suggestions in this regard. It is also important that the abalone industry consider the size of fish they wish to be targeting and the appropriate harvest strategy that will meet this economic goal, while ensuring sustainability.

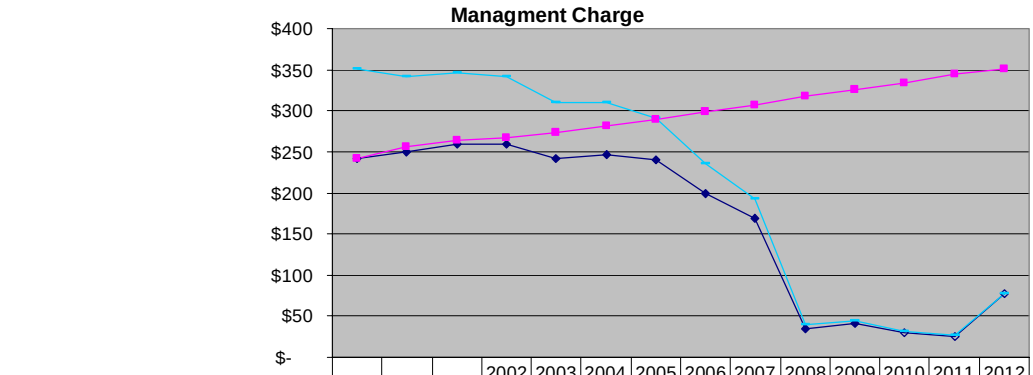
Restrictions placed on the volume of fish, size of fish and location of fishing by processors, combined with an unwillingness of processors to travel/relocate operations, appears to be strongly skewing the distribution of catch. This may also be constraining the ability of divers to target preferred (larger) size classes.

4.6 Management charges

Management charges in the abalone fishery have reduced significantly from a high of $346 per share in real terms in 2002 to $27 per share for the 2011/12 fishing period (Figure 10). Based on production and average beach prices to end March 2013, management fees in

2012/13 have increased to around $77 per share, which represents 7 per cent of the gross value of production of the fishery. This is a similar proportion to the lobster fishery.

The reduction in management fees in the abalone fishery has been driven by political pressure by industry and was made possible through: cutbacks in management activities previously undertaken by NSW DPI; agreement by NSW DPI to subsidise management activities previously recovered from fishers; and, improvements in the efficiency of service delivery by NSW DPI.



	2000	2001	2002	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13*
Nominal	$242	$250	$260	$260	$242	$247	$240	$200	$168	$36	$41	$30	$26	$77
Real Management Charge	$352	$342	$346	$342	$310	$309	$292	$235	$193	$39	$44	$32	$27	$77
Mgmt charge (if increased at CPI)	$242	$257	$264	$268	$274	$281	$289	$299	$307	$319	$325	$334	$344	$352

Figure 10: Nominal and real management charge ($) per share from 2000 to end March 2013

The Committee notes that not all of the funds generated from the current management charge of $77 per share have been used to manage the fishery, and that some of this will be returned to fishers. This is surprising given that in last year's report the Committee advised that the current management charge of $25 per share was inadequate to supply appropriate management services, in particular assessment and monitoring. Further, the Committee was advised at their 2013 open meeting with industry, that the Abalone Council of NSW had not received any extra funds to assist it to further implement its approach to fine scale management. As noted by the Committee in its previous determination, without adequate assessment and monitoring the economic return to the fishery may be negatively impacted.

The Committee notes that the current level of management charge debt in the fishery is approximately $700,000 (down from $800,000 in 2011/12). Of the 47 shareholders, 21 have management fee debt. Average debt is $31,000 for debtors, or $14,000 across all shareholders. NSW DPI has a process in place for the repayment of this debt whereby debtors pay the difference between their management fee and 10 per cent of the gross value of production divided by shareholdings. Management fees range from 3 per cent to 7 per cent of the gross value of production, meaning debtors pay between 7 per cent and 3 per cent of the gross value of production / shares each year.

Shareholdings must be cleared of debt before share transfers can be approved. An increase in share transfers, including several with debt, combined with the increase in the gross value of production, means that the rate of debt repayment should increase. In 2011/12 six fishers had debts above $50,000; this has reduced to three fishers in 2012/13.

4.7 Economic performance

As mentioned earlier in this report, collection of data on costs of fishing for 17 abalone fishing businesses / external shareholders for 2011/12 makes it possible for the Committee to report on the economic performance of the abalone fishery in this year's report.

The survey, undertaken by EconSearch on behalf of the Australian Seafood CRC, collected information on both fixed and variable costs for 12 abalone fishing businesses with an average shareholding of 170 shares, and 5 external shareholders[12]. The information collected is used to calculate economic performance indicators. Past experience of the TACC Committee has been that costs provided by similar surveys are unverified and tend to be overestimated. This comment also applies to the valuation of shares.

Gross income

In 2011/12, gross income (total catch multiplied by the average beach price received) for a fishing business with 100 shares was $100,632. For an external shareholder with 100 shares, it was $61,755.

Costs

In 2011/12 average total costs for a fishing business with 100 shares was $84,148. Of this, 78 per cent were variable costs (see Box 1 for a definition of variable costs), and 22 per cent were fixed costs (see box 1 for a definition of fixed costs). The most significant cost for fishing businesses was 'leasing quota', which accounted for around 39 per cent of average total costs in 2011/12. The majority of businesses involved in the survey fished quota in addition to their own quota (in some cases the businesses do not own any quota, and fish entirely for other shareholders). The majority of fishing businesses which do this are paid a per kilo dive fee, or they purchase the right to fish quota outright for a lump sum. The next most significant cost was labour (including both formal payments to crew as well as imputed unpaid labour). For further detail on costs reported by fishing businesses that participated in the survey refer to Attachment A.

In 2011/12 average total costs for an external shareholder with 100 shares was $49,926. Of this, 45 per cent were variable costs and 55 per cent were fixed costs. The most significant cost for external shareholders was labour (including both the catch fee paid to divers and imputed unpaid labour). Imputed unpaid labour represented a higher proportion of total costs for external shareholders (14.4 per cent) as compared to fishing businesses (7.8 per cent). This is because some shareholders spent time maintaining their own fishing gear despite not being directly involved in the fishing businesses which catch their quota[3]. They also spent

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[1] It should be noted that the survey results are skewed towards larger fishing businesses. The fishing businesses surveyed fished more quota than the average entitlement holder, an average of 170.2 shares per fishing business, compared to an average of 123.4 shares per diver across the whole fishery.

[2] External shareholders (i.e. those who are not currently directly involved in the operation of a fishing business) are an important component of the NSW fishery. As the fishery has adjusted to lower quota limits, the number of divers (endorsement holders) and active fishing operations have reduced, while the number of shareholders has remained relatively constant. There are almost twice as many shareholders as divers in the fishery, so many fishing businesses lease in additional quota. Many external shareholders have historical connections with the fishery and attempt to remain active in management of the fishery and industry. Some shareholders are retaining boat capital as an option to start diving again should it become viable financially

[3] This equipment is not currently being used in the fishery, but is being maintained for the option value of returning to abalone diving.

unpaid time on management and administration. Responses to the survey indicate that this, combined with time spent travelling for fishery and industry related meetings, reflects the desire of many shareholders to be heavily involved in fishery and industry management.

Interest is the next most significant cost for shareholders on average (23 per cent).

For further detail on costs reported by external shareholders that participated in the survey refer to Attachment A.

BOX 1: Costs of fishing

Variable costs may include:

- fuel, oil and grease for the boat (net of diesel fuel rebate)
- ice
- provisions
- labour (including crew payments and imputed unpaid labour)
- fishing equipment, purchase and repairs
- repairs & maintenance: ongoing (slipping, painting, motor)

Fixed costs may include:

- insurance
- licence and industry fees
- office & business administration (communication, stationery, accountancy fees)
- interest on loan repayments and overdraft
- leasing
- imputed unpaid labour

Note: imputed unpaid labour is a component of labour that does not draw a direct wage or salary from the business. This will generally include owner/operator labour and often also includes some unpaid family labour. The value of this labour needs to be accounted for which involves imputing a labour cost based on the amount of time and equivalent wage rate.

Boat capital

Total boat capital includes capital items that are required by the licence holder to earn the boat income. It includes boat hull, engine, electronics and other permanent fixtures and tender boats. Other capital items such as motor vehicles, sheds, cold-rooms, and jetty/moorings can be included to the extent that they are used by a fishing business. The fishing licence/permit value is also included in total boat capital.

For a fishing business with 100 shares, average total boat capital in 2011/12 was estimated to be almost $367,640. This included the licence holders' estimate of the value of their licence ($320,423) and estimated investment in fishing gear and equipment ($47,217).

For an external shareholder with 100 shares, average total boat capital was $401,137. This included the licence holders' estimate of the value of their licence ($391,950) and estimated investment in fishing gear and equipment ($9,187).

Economic performance of the abalone fishery

The best measures of the economic performance of the abalone fishery are profit at full equity and the rate of return on total boat capital (profit at full equity / total boat capital). A further useful measure of the value of the fishery can be derived from the lease/trade price of quota, where available. As noted below this price information for the NSW abalone fishery is extremely limited.

For a fishing business with 100 shares, profit at full equity is $15,128 and the rate of return on total boat capital is 4.1 per cent. For an external shareholder with 100 shares, profit at full equity is $21,175 and the rate of return on total boat capital is 5.3 per cent. For fishing businesses and external shareholders combined, profit at full equity is $29,227 and the rate of return on total boat capital is 4.1 per cent (similar to that of fishing businesses alone).

The results from the survey suggest that it is more profitable to be an external shareholder than a fishing business, mainly due to the lower total boat cash costs for an external shareholder versus a fishing business. The extent to which the costs for external shareholders, that are being passed on to divers, are affecting diver profit margins, is unclear. For this reason, and others, including that it would be useful to better understand the economic performance of divers, which is a large section of the abalone industry, it is suggested that information be reported on the economic performance of divers in future economic surveys.

EconSearch reported a large degree of variability in licence holders' estimates of licence value. This variability stemmed from variation in the estimates of the value of the licence unit, and also from variability in the number of licence units or shares owned by each business. As the value of licences represents a significant proportion of the capital for fishing businesses and external shareholders, the rate of return will be significantly affected by changes in licence values. The table below, adapted from the EconSearch report, illustrates the sensitivity of the rate of return to changes in licence values.

Table 1: Sensitivity of rate of return to changes in licence value 2011/12

	-50% licence value	Average from survey	+50% licence value
Fishing business (100 shares)	7.3%	4.1%	2.9%
External shareholder (100 shares)	10.3%	5.3%	3.5%

Economic performance of small versus large fishing businesses

EconSearch reported results separately for large and small fishing businesses to explore the possibility of structural differences between smaller operations and larger operations.

Whilst profit at full equity is is higher for large fishing businesses ($28,909) than for small fishing businesses ($22,528), the rate of return on total boat capital for large fishing businesses was smaller (3.6%) than for small fishing businesses (5.0%) due to the lower capital investment made by the smaller businesses.

Concluding remarks

The results from the EconSearch survey of the economic performance of 17 abalone fishing businesses / external shareholders demonstrates that the abalone industry was profitable in 2011/12 and that a postive rate of return is being generated in the fishery. This result contrasts with the situation a number of years ago, when the Committee reported that, on the basis of the information available to it, it was unlikely that the abalone fishery was profitable. Looking at the data collected by EconSearch for 2011/12, when gross returns

where higher than in previous years, and based on anecdotal evidence that the costs of fishing in 2011/12 were lower than in the previous year, it is likely that the concerns of the Committee were valid.

As a result of expected higher catches and stable prices in 2012/13, and reported lower catching costs, it is likely that the profitability of the abalone fishery will have improved even further in 2012/13. Depending on future movements in beach prices and catching costs, if the health and robustness of abalone stocks continue to improve, it is likely that the profitability of the abalone fishery will continue to improve into the future.

Despite the positive outlook for the fishery, it should be noted that there is still considerable management charge debt ($700,000) to be repaid, and that some fishers also have considerable debt repayments associated with borrowing against the purchase of shares when share prices in the fishery were a lot higher. Repayment of this debt will erode future profits, especially for fishers with high levels of management charge / capital debt.

Another issue is that the current rate of recovery of management fees and charges is so low as to be unrepresentative of either the current real costs of managing the fishery and insufficient to allow for appropriate levels of research and compliance. The Committee believes that there is a need to review the current level of cost recovery and to create a position where the industry is required, and in some cases encouraged to, invest in appropriate management services to allow it to be sustainable and to improve its economic situation into the future.

4.8 Economic rent

Economic rent is profit in excess of normal returns on capital[4]. Estimates of normal returns on capital in commercial fisheries vary, but can be as high as 10 per cent.

The results from the EconSearch survey provide an estimate of economic rent in the abalone fishery. In order to estimate economic rent, depreciation and the opportunity cost of capital are added to total boat capital costs. The opportunity cost of capital is equivalent to what the fisher's investment in abalone fishing could have earned in the next best alternative use. In the EconSearch survey a 10 per cent opportunity cost of capital is used, which is the 5 per cent long term (10 year) real rate of return on government treasury bonds with a risk premium of 5 per cent added, to reflect the high-risk nature of investment in abalone fishing[5].

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[4] Economic rent is comprised of three types of rent: entrepreneurial rent, quasi-rent and resource rent. As in any business some operators are more skilful than others and will therefore earn more profit. Rents attributable to the skill of fishers are described as *entrepreneurial rents*. Entrepreneurial rents should be left with fishers. Entrepreneurial rents can be as high as 36 per cent of total economic rent in the fishery (ABARE, 1990). In the short-term fishers may earn large surpluses over costs, which may provide prima facie evidence of substantial resource rents. However, there are some circumstances where such surpluses can occur but they are not true rents. These are referred to as *quasi-rents*. One example is where a fishery is developing or recovering and there may be under-investment in the fishery. Another example is where there is a short-term but unsustainable increase in price due to, for example, exchange rate fluctuations. However, some profits will be obtained because the natural resource being used (i.e. the fishery) has a value. These profits are described as *resource rents* and are also a component of economic rent.

[5] Abalone fishing is considered high risk as a result of weak property rights; exposure to exchange rate fluctuations; general price volatility; potential problems of resource sustainability and political risk in export countries.

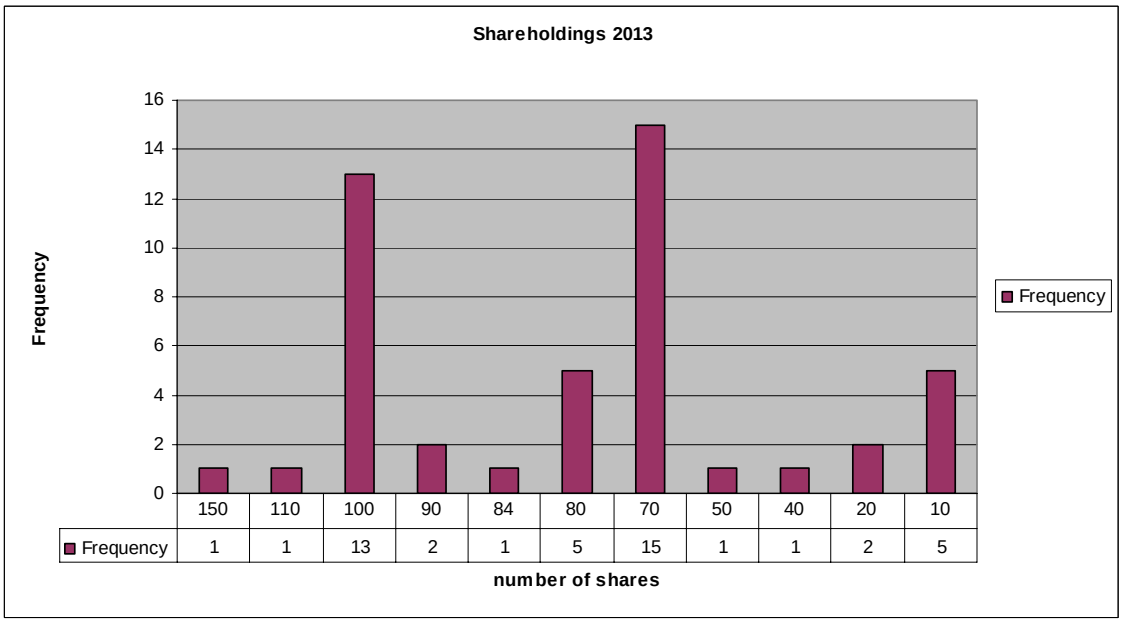
EconSearch estimated the economic rent generated in the NSW Abalone fishery in 2011/12 to be $827,000. Expressed as a rate of return on licenses, this rent represents a return of 3.8 per cent.

4.9 Shares

There are currently 47 shareholders in the fishery (increased from 44 in 2010/11). Of these shareholders, 38 had more than 70 shares and so qualify for endorsement. The remaining 9 do not qualify for an endorsement and presumably lease-out quota.

The average number of shares per shareholder has fallen from 97 in 2000 to 78.5 in 2010/11 to 73 in 2011/12. It has remained at that level in 2012/13. This is the opposite of what has occurred in the lobster fishery, where the average number of shares per shareholder has increased. The reluctance of shareholders to increase the size of their shareholdings may be as a result of a preference to lease in quota, rather than making a permanent, larger, investment in the fishery. However, as the profitability of the fishery improves, as it is likely to do over the next few years, there may be some redistribution of shareholdings away from smaller, towards larger, shareholders.

Shareholders owning 70 or more shares increased from 37 to 39 between 2000 and 2001, to 41 in 2003, and to 42 in 2004. The number decreased to 39 in 2006/07 and then to 38 in 2007/08. It has remained stable since this time. The number of shareholders with less than 70 shares was 1 in 2000, 3 in 2001 and 10 in 2002. The number was at 7 between 2006/07 and 2009/10, and increased to 9 in 2010/11. It has remained stable since this time. The distribution of shareholdings at each different level in 2012/13 is illustrated in Figure 11.



	150	110	100	90	84	80	70	50	40	20	10
Frequency	1	1	13	2	1	5	15	1	1	2	5

Figure 11: Number of shareholders at each level of shareholding in the 2012/13 fishing period.

No shares were traded in 2006/07, 2008/09, or 2009/10. 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.

There has been a return to share trading in the fishery in 2010/11 and 2011/12. In 2010/11 a total 80 shares were transferred in two transactions. A total of 200 shares were transferred in 6 transactions in 2011/12. While share prices in these transactions are commercial in confidence the average share price for the 6 transactions was $4,340 per share. There has

been one transaction of 10 shares in 2012/13 to date. As well as these transactions, there has been a general increase in interest in the purchase and sale of shares.

The return to share trading in the fishery is evidence of the improvement in economic returns from abalone fishing and likely improvement in optimism in the future fishery. However, as price information on all of these share transfers is not available, it is difficult for the Committee to make a full assessment of the degree to which optimism has returned in the fishery. The Committee urges industry to make such information available wherever possible.

The return to share trading in the fishery mirrors, to some extent, the previous situation in the NSW rock lobster fishery, whereby, following a series of conservative TACC determinations and a significant size limit change, stocks rebuilt, TACCs and profitability increased and the market for shares became very active. However, a lot more restructuring, in the form of share trading, and associated reductions in the number of shareholders, needs to take place in the abalone fishery for it to improve its economic viability.

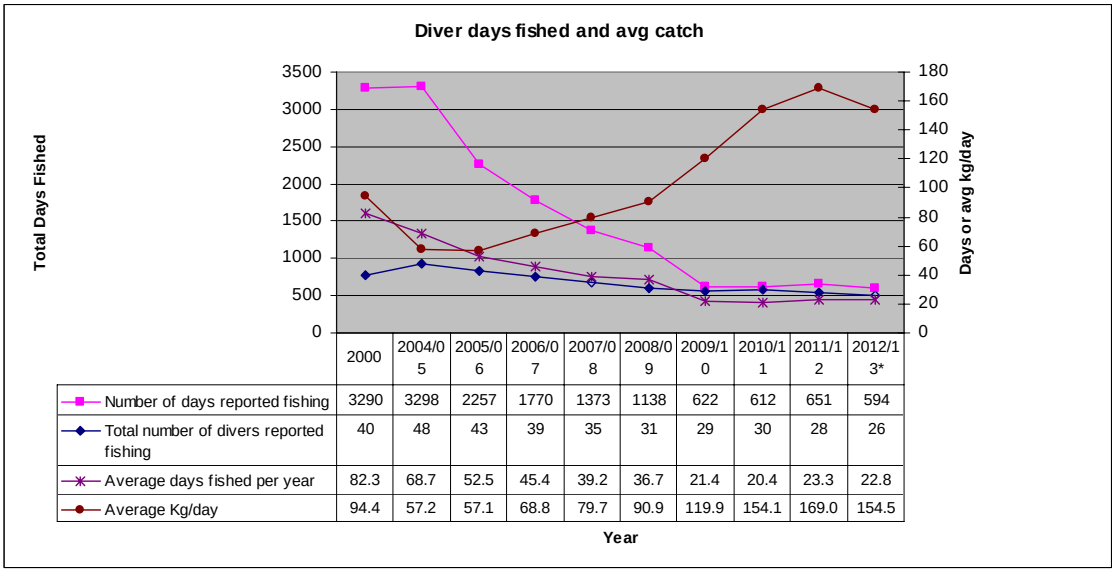
In accordance with the Fisheries Management (Abalone Share Management Plan) Regulation 2000, shares can be traded in packages of 10. The ability to trade shares allows existing shareholders to structure their operations based on performance during the year and, to some extent, the availability of abalone.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

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 amend the maximum shareholding to 40 per cent of the total number of shares initially issued in the fishery.

4.10. Nominated divers

Diver numbers appear to have been more responsive to the economic circumstances of the industry than the number of shareholders. Diver numbers have trended downwards since 2008/09, from 35 to 28 to date in 2011/12 (Figure 12). The most recent four fishing periods show a continuing trend for fewer numbers of divers to take a great percentage of the catch (Figure 13).

The average number of days fished per diver has fallen from 69 in 2004/05 to 21 in 2009/10, 20 in 2010/11 and 16.6 in 2011/12 (Figure 12). The average catch per day has increased from 57kg/day in 2004/05 to 118kg/day in 2009/10, 154kg/day in 2010/11 169kg/day for 2011/12, but has decreased to 154.5kg/day for 2012/13 to date. This is possibly due to the limits processors are placing on daily catches due to infrastructure restrictions.



	2000	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13*
Number of days reported fishing	3290	3298	2257	1770	1373	1138	622	612	651	594
Total number of divers reported fishing	40	48	43	39	35	31	29	30	28	26
Average days fished per year	82.3	68.7	52.5	45.4	39.2	36.7	21.4	20.4	23.3	22.8
Average Kg/day	94.4	57.2	57.1	68.8	79.7	90.9	119.9	154.1	169.0	154.5

Figure 12: Total days fished, average days per diver and average catch per day from 2004/05 to end March 2012/13

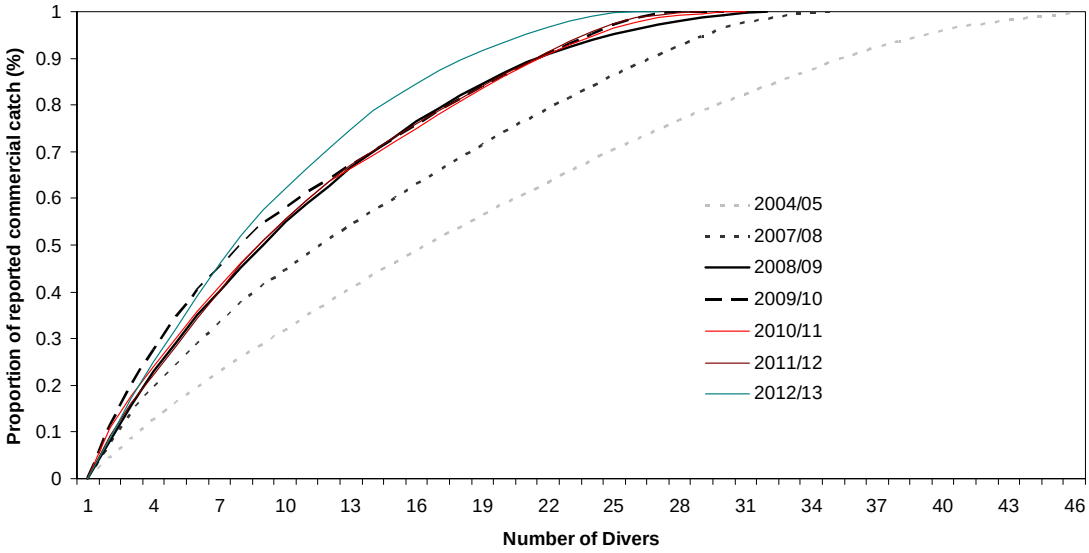


Figure 13: Percentage catches accumulation by divers from 2004/05 to end March 2012/13.

4.11 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 25 in 2003/04. Between 2003/04 and 2007/08 the number of shareholders leasing out quota declined to 20. Numbers have gradually increased since this time. In 2011/12, 25 shareholders leased out quota, and a total of 43 quota transfers were processed, indicating that the quota market is again becoming very active (Table 2). Industry has reported that the quota market is again very active this year.

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.

The Committee notes that information was collected through the EconSearch report on the amounts spent on quota trade in 2011/12, but not how much quota was traded. It would be possible for the Department to make this calculation based on information they hold on the amount of quota traded by the survey respondents. The Committee is unable to make this calculation due privacy provisions associated with the survey data. It would be helpful to the Committee if the Department undertook this calculation. It would also be useful if a question was added to the EconSearch survey which asked about the amount of quota traded to allow for this calculation to be made. This would also facilitate a public record of the average price of quota traded by survey respondents. That said, public reporting by shareholders of information on the price of share and quota transfers would be the best outcome.

*The Committee **recommends** that Industry make available information on the price of share and quota transfers in the abalone fishery, and that the Department and Industry work together to develop more detailed information on the structure and operation of the quota market.*

Table 2: Total quota transferred (t), amount of TACC transferred (%), number of quota transferors and the total number of processed transfers in each fishing period from 1998 to end March 2013

CY or FY	Amount of quota transfer in (kg) and % of TACC	Number of shareholders leasing out quota	Processed quota transfers
1998	18,800 kg (5% of TACC)	7	N/A
1999	31,000 kg (9% of TACC)	13	N/A
2000	33,158 kg (11% of TACC)	23	N/A
2001	21,016 kg (7% of TACC)	19	Minimum 19 (exact no. not available)
2002/03*	46,376 kg (15% of TACC)	23	N/A
2003/04	34,937 kg (12% of TACC)	25	30
2004/05	29,474 kg (14.3% of TACC)	23	Minimum 28 (exact no. not available)
2005/06	23,428 kg (18% of TACC)	21 2 applications refused	34
2006/07	29743 kg (23.8% of TACC)	21	43
2007/08	24589.9 kg (22.35% of TACC)	20	37
2008/09	32826kg (31.2% of TACC		47
2009/10	24,511.7kg (32.7% of TACC)	21	24
2010/11	29,910.8 kg (31.8% of TACC)	22	39
2011/12	31,993.1 kg (29% of TACC)	25	43
2012/13**	36,386.9kg (30.3% of TACC)	21	26

* 18 month fishing period as fishing periods changed from calendar year to financial year

** to end March - Incomplete fishing period

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 Department has generally been allowing transactions smaller than 100 kilograms. Further, in the Department's view, restrictions on the amount of quota that can be transferred does not impede efficiency, as fishers can either transfer quota to another business (often they have more than one fishing business), or simply nominate to fish on another fishing business' licence.

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

4.12 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. Illegal take is estimated to be as high as 40 per cent of legal take, which in 2011/12 represents around 44 tonnes. As most of the abalone that is caught illegally is shucked this should be converted to a meat weight, which the Department estimates is 33 per cent of whole weight. This gives a figure of 14.52 tonnes meat weight for the illegal catch. Departmental compliance officers estimate that this product is sold for around $60/kg. Applying this price to the illegal take in 2011/12 gives an estimated value of $871,200 that has been lost to the fishery.

As has been discussed in previous reports by this Committee, continued/increased investment in compliance activities, by both government and industry, to reduce the level of illegal catch, which could be returned to the commercial sector or could be left in the water to increase the rate of recovery of the stock, is essential.

In 2011/12, 3,178 abalone were seized, which is significantly down from the previous season when 9,247 abalone were seized. Departmental compliance officers estimate that this product has an average meat weight of 64g per fish and, as noted above, it is sold for around $60/kg. Using these figures, this represents around $12,204 of lost value to the fishery.

The Committee is reassured that the number of seizures in 2012/13 was much lower than in 2011/12 and that in the 2012/13 abalone fishing season to end February there has been a significant decrease in serious abalone offences. Seizures to end February 2013 were 1206.

4.13 Recreational and indigenous catch

As with illegal catch, there is the possibility of shifting of economic value from the commercial fishery due to high levels of recreational and indigenous catch. Current estimates of recreational and indigenous catch are unreliable. Estimates of recreational catch were previously 10 tonnes, but this is now thought to be too high. Recreational Trust funded fisher surveys currently being conducted by the Department should improve the information on recreational catch, however the Department acknowledges the need to obtain more robust time-series estimates of both recreational and indigenous catch.

The Committee notes that there is a proposal to increase the recreational abalone bag limit from 2 to 5. The Committee considers that it would be prudent to delay any decision to

increase the recreational bag limit until the project to determine the current recreational harvest is complete, the extent of the recovery of the resource is better known and a management plan and harvest strategy for the fishery is in place.

The Committee notes the advice of the Department's compliance unit that indigenous catch under the increased bag limit and cultural permits appears to have stabilised and in reality is significantly less than permitted.

4.14 Economic data

The Committee is pleased that information has been collected on the economic performance of the NSW Abalone Fishery in 2011/12 having recommended this occur for more than a decade. The Committee is reassured that it has a better understanding of the consequences of its determination on the profitability of industry, and has been able to base its TACC recommendation for 2013/14 on sound economic data.

The Committee would like to see the survey that was conducted by EconSearch for 2011/12 run periodically (every three to four years) and funded by cost recovery in order to capture structural changes in the fishery. In the interim, and as suggested by EconSearch in their draft report, economic indicators, cost and income data can be updated by the department based on ABS and fishery data. Labour costs are inflated using the labour price index and fuel costs are inflated using the cost index for petrol. Average income is adjusted based on fishery GVP[6].

The Committee notes that that EconSearch intends to use the data collected through the survey in 2011/12 to run bioeconomic models for Southern Abalone Fisheries. The Committee would be interested in the outcome of this work. This work would also be useful for the Department, as it would provide a better understanding of the impact of management decisions on the profitability of industry.

The Department and industry should utilise the data collected through the survey, and consider the types of data it would like collected through future surveys, to undertake economic analysis (including economic yield per recruit). The data collected through the survey can also be used to inform the setting of size limits; increase/optimise returns from the fishery; and inform the risk/catch/cost balance concerning appropriate research and monitoring strategies.

4.15 Community Contribution

The Community Contribution charge in the NSW Abalone Fishery was based on a decision by the NSW Government to return economic rent being earned by abalone fishers to society. The Community Contribution for a fishing period is calculated annually and considers CPI, abalone beach price and TACC. It is payable by each shareholder following each fishing period. The Community Contribution has been calculated at $0 since 2005/06 following a decline in TACC and average estimated beach price.

The results of the survey run by EconSearch suggests that is 2011/12 there was economic rent being generated in the NSW Abalone Fishery. However, economic rent should be net of the full costs of management; the NSW Abalone Fishery is not currently meeting those costs. Hence, true economic rent is likely to be lower than is estimated through the survey. Further to this, and as noted above, some of this rent is also not true 'resource rent' that is a result of the natural resource being used (i.e. the fishery). The other types of rent: entrepreneurial rent, that is attributable to the skill of the fisher; and quasi-rent, that are

[6] For more details refer to EconSearch 2012

surpluses that can occur for reasons such as exchange rate fluctuations, should not be removed from the fishery. Estimating how much of the different types of rent are present, and, therefore, how much should be extracted from the fishery each year, is a difficult task.

It is a political decision as to whether or not rent, if present, is collected from a fishery, or is left with fishers, and how much of the rent to collect. Rent should only be collected if it is cost-effective to do so. The fact that many state and Commonwealth fisheries agencies, who have attempted to collect resource rents, have later abandoned those proposals and programmes, may be evidence that it is not cost effective to collect resource rents in commercial fisheries.

The Committee believes it is appropriate to reconsider the Community Contribution Charge for the NSW abalone fishery as it is currently structured. In doing so, the following should be taken into account:

- the appropriateness of the current basis for calculation of the Community Contribution Charge;
- the costs/benefits of determining and collecting payments; and
- that rent is only collected from the fishery once the full costs of appropriate management are met – this is not currently the case and is a long-term goal at best.

Such a strategy is in accordance with the approach taken by most state and Commonwealth fisheries, with the exception of Tasmania.

4.16 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 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. The Committee notes that a more meaningful set of performance indicators may be developed as a result of the review of the management plan for the Abalone fishery. In particular, objectives need to be developed for the fishery relating to long term profitability, which can then be translated into operational objectives, performance indicators and target reference levels in the harvest strategy for the fishery.

The economic data collected through the EconSearch survey should assist in developing a more meaningful set of economic performance indicators than those currently in the EIS.

*The Committee **recommends** that performance indicators and triggers for the abalone fishery, as suggested under the management section of this report, are developed to measure the economic status of the industry.*

4.17 Structural Change

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.

Restructuring seems to be occurring amongst divers in the abalone fishery, with fewer divers taking a greater proportion of the catch.

A lot more restructuring, in the form of share trading, and associated reductions in the number of shareholders, needs to take place in the abalone fishery for it to improve its economic viability.

As noted in previous reports of this Committee, shareholders have appeared reluctant to exit the abalone industry, or to undertake other structural adjustments that may reduce costs.

4.18 Conclusion

The economic performance of the NSW Abalone Fishery continues to improve. Results from a survey undertaken by EconSearch on behalf of the Australian Seafood CRC suggest that in 2011/12 abalone fishing businesses were earning a rate of return of 4.1 per cent and external shareholders were earning a rate of return of 5.3 per cent. However, any improvements in profitability must be viewed in light of the debt currently owed by abalone fishers to NSW DPI for outstanding management fees.

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.

The Committee is pleased that information has been collected on the economic performance of the abalone fishery. The Committee urges the Department and Industry to work together to update this data and to also undertake periodic surveys (every three to four years) to gather a completely new data set which captures any structural changes in the fishery and allows for the collection of any new information that would assist with managing the fishery.

The Committee also urges the Department and Industry to use the data collected through the economic surveys to undertake economic analysis (including economic yield per recruit) and to inform the setting of size limits; increase/optimise returns from the fishery; and inform the risk/catch/cost balance concerning appropriate research and monitoring strategies.

The Committee notes that the economic indicators and triggers in the proposed Fishery Management Strategy for abalone are lacking in specificity and relevance. These indicators and triggers should be revised to make them more relevant to measuring the economic status of the industry.

The Committee notes that the increase in the MLL to 117mm does not appear to have excluded significant areas of the fishery and that the increase in the average weight of abalone has been in excess of that anticipated due to the increase in the size limit. It is the opinion of the Committee that further increases in MLLs in the fishery will further improve economic returns.

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 from both within Australia and from the rapidly expanding aquaculture industries in China, Korea and other overseas abalone producers. As aquaculture operations continue to expand new overseas markets and marketing initiatives for wild caught NSW abalone will need being explored.

The Committee's continued conservative determination of 125 tonnnes for the TACC in 2012/13 is based on a commitment to rebuild a robust and profitable fishery. The size limit changes and regional distribution of catches recommended by the Committee, in combination with the determined TACC levels, aim to: provide a larger and better protected spawning stock; have sufficient biomass to buffer the stock and fishery catch rates against periodic decreases in productivity; and increase the biological and economic yield per recruit.

5. MANAGEMENT CONSIDERATIONS

5.1 Introduction

This section provides a description of the components of the NSW abalone fishery, including a brief historical background. Current management arrangements are outlined to provide some context to the TACC decision. The information available to underpin the 2013/14 TACC decision is outlined, as well as the reasons for the decision and some further recommendations.

In summary, the abalone fishery is continuing to show positive signs that suggest a recovery in stocks as a result of decisions to cut the TACC and increase MLLs in recent years. These positive signs in the data (particularly catch rates and mean size) are reinforced by diver feedback. However, the information and analysis is not available to confidently quantify the extent of the stock recovery. Further, the fishery still does not have an effective management framework, including a harvest strategy with an agreed monitoring and assessment process. In this context, the Committee is willing to give the industry position some weight and consider a TACC increase. However, it is very clear that without the information to assess the risks to the stock of future catch levels further TACC increases in subsequent years are likely to be considered too high risk.

5.2 Description of fishery

5.2.1 Commercial fishing

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.

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.

The abalone fishery has seen significant change particularly in the last ten years The fishery has moved from free fishing through the 1970s, to many years at 300 tonne total allowable catch (TACC), size limit introductions, TACC reductions from 300 to 200 then around 100 for last four years, 75 tonnes in 2009/10 and 94 tonnes in 2010/11. The TACC was initially set at 94 tonnes in 2011/12 and subsequently increased to 110 tonnes after a review in March 2012. The TACC was set at 120 tonnes for the 2012/13 fishing period. The MML of 117mm was introduced in July 2008 and further increases to 120mm and then 123mm south of Wonboyn were introduced in May 2010 and September 2013 respectively. Figure 1 sets out the major changes in management arrangements over time.

Since the introduction of limited licensing in the late 1970's, through the introduction of the share management system in 2000 and subsequent operation of that system under decreasing TACCs, the number of shareholders and divers in the fishery has decreased. There are currently 47 (increased from 44 in 2010/11) shareholders with shareholdings ranging between 10 and 160. Of these, 38 shareholdings are currently eligible for an endorsement. In the current fishing period, 29 shareholdings have reported fishing.

The value of the fishery has improved recently, but this is from historical lows. The industry continues to face variable and challenging circumstances, especially its vulnerability to exchange rates and increasing competition from aquaculture product in its primary markets. This will require a unified and co-ordinated response to deal with these challenges. A

secure resource base in reliable catches and catch rates will be needed to underpin the response.

5.2.2 Recreational Fishing

Recreational fishers are permitted to harvest abalone by hand. A possession limit of two abalone and the minimum size limit of 117mm apply. The bag limit was reduced from ten abalone per person per day to two abalone per person per day in July 2005. This has had a profound effect on the recreational harvesting of abalone in NSW. Prior to the introduction of the reduced bag limit, 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 further reduced to the current estimated figure of 10 tonnes.

In the past the Committee has been confident that the estimate of 10 tonnes was a reasonable estimate of what may now be taken by this sector. In August 2010 changes in management opened up part of Region 1 South between Botany Bay and Wreck Bay to recreational fishing on weekends and adjacent public holidays. The area between Port Stephens and Botany Bay was opened to recreational fishing under the same arrangements in March 2012. These changes now permit recreational fishing for abalone in areas adjacent to large population centres and are likely to have increased the level of recreational harvest. Advice from NSW Fisheries Compliance is that improving catch rates appear to have contributed to increasing interest in abalone as a recreational species. However, these are anecdotal assessments only and the Department acknowledges the need to obtain robust time-series estimates of recreational catch and effort. Recreational Trust funded fisher surveys are providing some data regarding the recreational harvest of abalone which will provide an improved estimate. However, given the small sample size of recreational abalone fishers within the overall population this is unlikely to improve the confidence of the estimate for the purposes of the stock assessment.

The Department advises that both the former Abalone MAC and the Advisory Council on Recreational Fishing have supported an increase in the bag limit to five. The Department advises that it intends to support this increase as part of legislative changes flowing from the current the review of recreational bag & and size limits. This is expected to occur in late 2013. A proposal to increase the recreational abalone bag limit from 2 to 5 will be put out for public consultation in the upcoming review of recreational bag and size limits.

The Committee considers that this change may result in a significant increase in recreational harvest and risks, and in particular, cause local depletion in areas adjacent to large population centres. This proposed change highlights the need to improve the accuracy of estimates of the recreational harvest, to assess the stock taking into account estimates of all fishing mortality and for a decision-making framework against which to assess the risks of increased catches.

In the opinion of the TACC, it would be prudent to delay any decision to increase the recreational bag limit until the current recreational harvest is known, the extent of the recovery of the resource is better understood and a management plan and harvest strategy for the fishery is in place.

*The Committee **recommends** that further changes to the abalone recreational fishing bag limit be deferred until there is enhanced monitoring of recreational abalone fishing which provides sufficient knowledge of the extent and distribution of the recreational catch, and that information is integrated into a revised harvest strategy for the fishery.*

The Committee also confirms its recommendation that a default state-wide recreational fishing size limit of 120mm be introduced as a precautionary measure to limit the impact of recent changes to recreational fishing access arrangements.

5.2.3 Indigenous Fishing

Amendments were made to the *Fisheries Management Act* in 2010 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 include the creation of an Aboriginal Ministerial Advisory Council (AFAC) and management changes aimed at improving access for the purpose of cultural fishing. The amendments include special provisions to allow aboriginal people an extension to certain fishing rules including bag and possession limits to accommodate small communal and cultural gatherings. These provisions will be implemented once regulations are developed in consultation with the AFAC.

As a short-term measure the Department introduced an interim compliance policy that allows an Aboriginal person to take double the prescribed recreational bag limit with an additional allowance for abalone increased to 10 per person. The interim policy also allows the shucking of abalone within 100 metres of the high water mark if the abalone are to be consumed in this area. The Department reports that the implementation of the policy has been positive in terms of dealing with the issues, improving relationships and compliance.

If Aboriginal people have a need to access the fisheries resource for larger cultural events applications for Aboriginal cultural fishing permits can be made. A written request to the Department outlining species and numbers proposed to be taken is required before aboriginal fishing permits can be issued. Permits for 3,890 abalone were issued in 2009/10, 1,700 in 2010/11, 2,115 in 2011/12 and 880 to date in 2012/13. However, the actual amount of abalone taken is unclear – the Department's compliance staff estimate that it is significantly less than the amounts formally permitted.

5.3 Current management arrangements

5.3.1 Quota management system, size limits and finer spatial scale management

The core management arrangements in the commercial abalone fishery are the system of individual transferable quota and the Minimum Legal Length (MLL) regulations that apply differentially to regions across the State. The history of these management tools is outlined above and in previous reports. However, on their own these can be blunt instruments for managing an abalone fishery. Increasingly, and in common with other abalone jurisdictions, NSW is implementing a fine scale, regional management of abalone fisheries with largely voluntary catch caps for regions and varying minimum sizes, introduced with the support from the industry and informed by the use of electronic data loggers.

Currently, this finer spatial scale management system is being developed and implemented informally (see section 5.3.4 below). The industry is to be commended for the progress that has been made in this environment. However, the system requires further work to improve its consistency, rigour and transparency and, ultimately, its effectiveness at spreading catch. This is particularly important as the fishery rebuilds and TACCs increase over time to ensure that past patterns of localised overfishing and serial depletion are not repeated. It is difficult to progress this work without strong Government commitment, and the resources to move to a more formal management framework.

A formal framework would include:

- Applying the recommended MLLs – implemented in a way that the MLL can be selectively relaxed in the future if it is demonstrated that the stocks are 'stunted' in specified areas and it is cost-effective to apply differential rules to that area (see 3.2.1); and
- A revised harvest strategy designed to monitor and assess information at the finer spatial scale, and formulate catch caps for each area; and
- A governance process for the input of industry and government into developing TACC recommendations and the spatial distribution of catch (ie. applying the harvest strategy).

To date, industry has been largely left to go it alone in the development of fine scale monitoring and assessment arrangements, industry workshops and a revised harvest strategy. Due to the inappropriately low level of cost recovery and the financial pressures facing the NSW Government, the level of stock assessment advice provided by Department scientists is almost non-existent. Frequently the Committee is asked for its advice by industry on what the Committee would like to see in terms of a revised stock assessment/harvest strategy process. This is not the role of a review committee. As we have stated in the past, the Committee is ready and willing to provide advice to the Department and industry on a new management framework, including monitoring and stock assessment. In our view this process must be undertaken in close consultation with industry, but be driven and implemented by the Government in its role as regulator of a community resource.

An essential element of the new management plan will be an effective harvest strategy. As before, the Committee suggests that it should be based on the following guiding principles:

- The objectives of the HS to be consistent with the Act, including resource sharing etc.
- As the HS will dictate how a community resource will be harvested, it should be driven strongly by the Department as a joint exercise between managers, researchers and industry – as discussed above, the current HS appears to have been developed in isolation by industry.
- Performance indicators should be measurable and appropriate, given the shift to fine scale management, new monitoring and assessment arrangements and catch planning workshops.
- The role of industry/ACNSW, industry workshops, the Committee and Departmental managers and researchers must be clearly defined, within the requirements of the Act.
- Objective scientific testing of the performance of proposed HS decision rules/strategies against objectives of the Act under various conditions of recruitment/ catastrophic changes in mortality /catching efficiency should be undertaken, prior to its final adoption.
- Adequate quality control/assurance/ audit to be included.
- Consideration to be given to long-term human and financial resourcing requirements to implement and monitor the HS, based on current Government cost recovery principles.
- Use of 'weight of evidence' considerations to avoid overreliance on particular indicators, especially catch rates and individual views.

The harvest strategy should be underpinned by a risk assessment and have the following components:

- Operational objectives
- Indicators of performance
- Target and limit reference levels that relate to key indicators of stock productivity
- Decision rules – responses to triggering reference levels
- Data monitoring and stock assessment program (including agreed methodology and protocols for the collection and treatment of data).

*The Committee **recommends** that a revised harvest strategy be developed, as an integral part of the new management plan.*

*The Committee **recommends** that, in addition to the harvest strategy, the other components of the spatial management system be formalised including the implementation of recommended MLLs and a governance process for the input of industry and DPI in formulating TACC advice.*

The options for different data monitoring and stock assessment programs need to be fully costed and the costs taken into account in designing the harvest strategy. This will inform the trade-offs to be made when formulating objectives, choosing performance indicators and setting reference levels.

5.3.2 Data collection and stock assessment

Currently, formal catch and effort information is collected through regulated logbooks. The resource assessment provided by the Department is based on these data. The assessment is therefore very limited and subject to strongly expressed caveats about the conclusions that can be drawn from these data particularly in terms of using the crude catch rate information as an indicator of abundance.

In addition to the logbook information, the industry provided the Committee with a large amount of information from the data loggers, which was presented for the 21 regions that have been informally adopted. Likewise, the industry workshop also based their discussions on these 21 Areas and made their TACC recommendations based on the accumulation of catch caps for each of the Areas.

The industry report and presentation again 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 information being collected provides an opportunity to analyse catch and effort trends at the reef level through the fishing season, and to integrate that information with other indicators such as size, weight and area fished. Work is needed to identify the key indicators that should be used in decision-making, to standardise and document how the data will be treated and what analyses would best inform the management of the fishery (see stock status section for further discussion). A number of FRDC projects are under way around Australia in the area of fine spatial scale performance indicators and the Committee notes that NSW, via the involvement of Duncan Worthington, is fully engaged in these projects. When completed, these projects should provide useful outcomes and approaches that will be applicable to NSW.

Irrespective of these suggested improvements, there are some positive signs in the data available. The catch and effort logbook data indicates increases in catches and catch rates at the regional level. The catch rates in all Regions are now above historical levels and thresholds. However, in an abalone fishery catch rate is an unreliable indicator at a large spatial and temporal scale as serial depletions can be masked. The fine-scale data

collected by the industry are therefore more informative. They too show positive signs – catch rates and mean size in several key Areas have increased or stayed constant in the last two years. It can be concluded from these data that the stock is recovering in response to management changes implemented in recent years (see stock status discussion, particularly section 3.2.1).

These positive trends are reinforced by the industry. The committee puts significant weight on these industry views as a part of interpreting the data as they are based on diver experience and observations. Furthermore, the industry workshop conducted this year, and the presentations to the Committee, indicate that there is near unanimity in the industry position this year, in contrast to previous years where opinions have been divided. Divers / shareholders known for their conservative approach to catch levels support the industry position for a TACC increase.

Balanced against these positives, there are several concerns that exist. First, in relation to stock status, while the data indicate generally positive trends, there are also indicators that warrant further investigation. In particular, while catch rates and mean size have generally increased, the finer scale information shows that in some Areas those indicators 'tapered off' during the season. This may indicate that a relatively small increase in the catch has caused a measurable reduction in the size composition of the population in that Area, and therefore that stocks have not rebuilt sufficiently to be resilient to additional catch. Despite this, these Areas have been recommended for increases through the industry workshop process. Further, the analysis of area fished at a fine spatial scale presented to the Committee suggests that the 'footprint' of the fishery this season compared to the previous year is significantly bigger (see section 3.2.2). Further analysis would be required to rule out the possibility that these observed changes are due to localised depletions at the reef level. It has been suggested that there has been some impact from a market preference for smaller fish at different times of the year. Again, further analysis is required to distinguish these market effects from fishing impacts.

The second area of concern is that the fishery has no predictive indicators and measures only trailing indicators. Therefore, it is unclear whether there has been successful recruitment in year classes that are currently below the size limit. A fishery-independent survey (FIS) was used previously to provide this information and would also provide useful information for analysing catch rate information and therefore providing greater confidence about stock status. Given the volume and value of the fishery, a return to a FIS of a size and cost of the former programme in the foreseeable future is probably not realistic. However, the Committee has commented in the past that the introduction of a selective FIS, with the express purpose of examining pre-recruits, should be considered.

A stock assessment of the abalone fishery would be more robust if the outputs of a stock assessment model were available to add to 'weight of evidence' approach. While a model is not necessarily an essential component of a research programme, without these types of assessment tools TACC decisions going forward will necessarily be more conservative. Again, these decisions can be made by weighing up the trade-offs between catch and cost and risk when a formal decision-making framework is developed for the fishery.

5.3.3 Management plan

It is universally agreed that the current management plan is obsolete due to the status of the stock, changes in monitoring and assessment, informal implementation of fine scale approaches and knowledge of the resource, and is in urgent need of review.

This leaves the fishery with no long term objectives, meaningful indicators or reference points, which materially impact TACC decisions (eg. what rate of rebuilding is desired, what trade-offs should be made between total yield, catch rates or range of size classes

available). Defined objectives for the fishery and in particular the operational objectives contained in a harvest strategy would guide these decisions and inform the balance of the various risks.

The lack of a meaningful management plan leaves the fishery in a very uncertain management environment. There is no structure to maximise the benefit from the fishery in the medium to long term, and no basis on which to make decisions about the appropriate level of investment in either the fishery's management or fishing businesses.

*The Committee **recommends** that existing management arrangements be reviewed and a new management plan be developed as a priority.*

The proposed review should, among other things, formalise the co-management arrangements in place for the abalone fishery and establish appropriate governance mechanisms.

5.3.4 Co-management

The formal consultation structures in NSW have been in a state of flux since 2009. The lack of a functional MAC or some similar consultative/advisory process and ongoing, and at times acrimonious, relationships between and within industry and with the Department have clearly hampered the effective management of the abalone fishery.

An ongoing barrier to cooperation in the past has been 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. With the acceptance of the recent review of NSW Fisheries Management and a commitment to reduce the degree to which political pressure will able to influence decisions, the Committee is hopeful that a more constructive approach to management will be achieved.

Nevertheless, there has continued to be extensive informal consultation both with former MAC members and directly with all shareholders as well as with other industry and non-industry stakeholders. Further, contractual arrangements are in place between the Department and the industry to undertake data collection and analysis. The Committee understands that there have been some delays and difficulties in renewing this contract during the year, resulting in a 'gap' in the data and ongoing lack of clarity about the respective roles of the Department and the research providers. This was apparent in presentations made and discussions with the Committee. This situation again reinforces the need for a decision-making framework with an associated data monitoring and stock assessment program outlined in detail, including the relevant scientific protocols. This would provide the basis for a more robust and helpful contractual arrangement and minimise the very real risk of conflicts of interest.

More broadly, the co-management arrangements for the fishery need to be better articulated and formalised, ideally in the revised management plan for the fishery. The industry appears to be moving to a greater level of consensus now that the stock is showing positive signs, however the processes are still relatively unstructured. They need to be more transparent and have more checks and balances so that decision-makers can rely on the advice. Standard governance arrangements such as the use of independent chairs, communication protocols, peer review processes etc should be considered in setting up these arrangements.

It is important that the Department has full access to the fine scale information, for assessment, management and governance purposes. In the past there have been

recommendations from industry that finer scale data is the 'property' of industry and this issue needs clarification. Without access to the fine scale data the Department will simply not be in a position to quality assure or even understand the basis of the management recommendations coming from industry on catch levels and area management. Arguably that was the case this year, when it was only after the extra detail was provided to the Committee so that the reasonableness of the recommendations could be objectively examined. If this is not addressed the Department will quite quickly find itself unable to fulfil even an oversight role.

*The Committee **recommends** that the Department legislate/undertake contractual arrangements to secure full access to fine scale data generated by industry using data loggers.*

5.3.5 Fees

The abalone fishery is subject to the Government's policy on cost recovery whereby shareholders must meet all identified management costs attributable to the commercial fishery, less any savings passed on to shareholders. Management charges are payable by each shareholder in proportion to shareholdings. Cost recovery policy for commercial fishing is currently under review.

Similar to other share management fisheries, shareholders may be required to make an annual Community Contribution for the right of access to the fisheries resource. The community contribution for the abalone fishery has been set at $0 since 2005/06.

Over the last ten years, the abalone fishery has declined in value due mainly to the increasing value of the Australian dollar, declining catches and catch rates. These trends have been detailed in previous Committee reports, as have the large reductions in fees that have been made in response to the industry's capacity to pay and the negotiated debt recovery process to mitigate the impact of large accumulated unpaid fees. Fees currently represents 3.6% of GVP in 2011/12 and have increased to 6.94% in 2012/13. While in line with national and international standards that include much larger fisheries, it is not unusual for small fisheries like the NSW abalone fishery to attract considerably larger proportional levies due to diseconomies of scale, especially during times of low economic returns from the fishery.

The Committee notes that while the decision to drastically reduce funding for research and monitoring had, not unsurprisingly, over-whelming support from share-holders, this has left the fishery in a difficult position with respect to management decision making. The consequences of this reduction and the flow-on effects to the task of setting a TACC have been discussed extensively in previous reports of the committee. As the fishery recovers the Committee continues to be of the view that expenditure on fisheries management, including 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.

The Committee continues to strongly support the decision of the Department to apply additional resources towards the establishment and implementation of alternative, finer scale spatial assessment and management arrangements.

*The Committee **recommends** that the cost recovery arrangements for the fishery be reviewed to ensure that the provision of services is adequate to inform TACC decisions and management of the fishery.*

5.3.6 Compliance

Reporting on compliance rates and/or detection rates is notoriously difficult as improvements in the targeting of compliance effort can lead to more offences being detected, which can appear as higher levels of non-compliance when reported statistically. In fact, the use of an intelligence-led approach should lead to a higher rate of detections. Therefore, crude 'compliance rate' information is difficult to draw conclusions from without also being supported by qualitative explanations.

The report provided to the Committee indicates that, as for previous years, there are high levels of compliance within the licensed commercial sector and that most offences are minor.

The levels of compliance in the recreational sector have dropped from 75% to 50% (year to date). However, it is noted that interest in 'genuine' recreational abalone fishing activity remains low. The bag limit of 2 per person has seen the majority of recreational abalone activity being conducted as by-catch to other targeted fishing activity. For example, snorkel divers may take their bag limit of abalone during the inshore lobster season, as by-catch to lobsters they are targeting. Therefore, the drop in this compliance rate is actually related to targeted illegal activity that is unlicensed (ie. as opposed to minor offences by 'genuine' recreational fishers). The compliance report attributes this drop to more efficient targeting and an added emphasis on specialised compliance teams that focus their efforts on deliberate non-compliance and recidivist offenders. This strategic approach entails a reduction of inspections on low risk divers with an added focus on inspections of higher risk divers. The Compliance unit also report that the heavier penalties applied to high-end abalone offences is starting to have a deterrent effect in NSW.

Indigenous fishing levels have increased under the new arrangements although remain at relatively low levels. No major compliance issues have been identified.

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 in the vicinity of 20-40t per year since then. 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.

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 previously, 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.

Despite the positive trends in abalone compliance, it was reported that illegal abalone activity remains high in NSW. This activity is fuelled by strong black market demand and is undertaken by highly organised illegal syndicates. Despite considerable success with apprehensions and prosecutions, these activities continue to cause concern. In particular, syndicates are employing more refined and complex methods, making the task of detection, apprehension and prosecution more difficult. It is important in this context that resourcing is maintained. The industry can therefore have increased confidence that TACC's will be

protected against abalone theft and that TACCs that constrain catch are genuine protections for the stock.

5.4 Total Allowable Commercial Catch (TACC) for 2013/14

From a fisheries management perspective, an increase in the TACC for abalone of 5t for the 2013/14 quota year is considered consistent with the current principles as laid out in Objects of the Fisheries Management Act and the prescribed role of the Committee. Previous decisions (particularly reductions in TACC and increases in MLL) and the evolving spatial management system appear to have had a real impact and the stock appears to be rebuilding, at least in the short term. The positive trends observed in the data, and reinforced by industry advice, justify an increase in the TACC, notwithstanding the improvements that have been identified that would greatly improve the certainty of the stock assessment.

The increase in TACC is subject to recommendations about increased MLLs and distribution of catch, as set out in 5.3.1 above and in the 'stock status' section of this report.

The Committee notes that it considers that a future increase in the TACC in 2014/15 is unlikely without the identified deficiencies in the current management framework being addressed. The level of uncertainty relating to the long term impact of further increases will be high.

5.5 Role of the Committee - size limits and spatial distribution of catch

There remains considerable controversy surrounding size limits in the abalone fishery. It is very apparent that some members of industry support the Committee including advice on size limits and spatial catch recommendations in their determinations while others are strongly of the view that the Committee, under its legislative responsibilities, should have no part in influencing the choice of MLLs or the spatial distribution of catch.

The role of the Committee in setting a TACC under the Act is clearly defined under Section 28(2) of the Fisheries Management Act, 1994, which states that The 'TACC Committee is required to determine a specified total allowable catch for a share management fishery if the management plan for the fishery so requires'.

Further instructions as to the general considerations for the Committee to take into account in determining a TACC is provided in Section 30 of the Act:

1) In determining total allowable catches under this Division, the Committee is to give effect to the objects of this Act and is to have regard to all relevant scientific, industry, community, social and economic factors.
2) The Committee is also to have regard to:
    - the need to ensure that the exploitation of fisheries resources is conducted in a manner that will conserve fish stocks in the long term, and
    - the impact of fishing activities on all species of fish and the aquatic environment, and
    - the precautionary principle, namely, that if there are threats of serious or irreversible damage to fish stocks, lack of full scientific certainty should not be used as a reason for postponing measures to prevent that damage.

In light of the above, the Committee considers that it would be derelict in its duty not to condition TACC determinations with advice on size limits and spatial distribution of catch and

hence the advice provided as an integral part of the TACC determination. It has again taken such an approach for the 2012/13 Determination

To address this controversy, the Committee recommends that consideration be given to the provisions of the Act under Section 28(4) under which:

> 'The Committee may also determine, in accordance with this Division, any other matter relating to fishing effort in a share management fishery if (and only if) required to do so by the Minister. This Division applies to the determination of any such matter in the same way as it applies to the determination of a total allowable catch'.

Under this provision it appears that the Minister may request the Committee to make a determination on size limits and spatial distribution of catch in the same way as the TACC, which would, in our opinion, remove much of the controversy surrounding the size limit issue. The Committee suggests that some thought be given to utilising this provision in the future, possibly commencing for the determination due in early 2013 rather than this year, and the benefits such a requirement may provide.

*The Committee **recommends** that the TACC be required by the Minister to make a determination on size limits and spatial distribution of catch. Such a Determination would be an integral part of the TACC setting process, and would be done in full consultation with industry and the Department.*

5.6 Conclusion

The abalone fishery is showing signs of rebuilding, attributable to management decisions in recent years (TACC reductions, increases in MLLs, some spreading of catch). Catch and catch rate for all Regions are above historical thresholds. Similarly, at the Area (sub-regional) level – which is a more meaningful scale for analysing abalone stocks – there are also positive signs. Catches, catch rates and mean size have increased or remained constant in key Areas. The industry is encouraged by these signs and recommended a TACC increase.

However, there are also trends in the data that warrant further investigation, particularly the reduction of those indicators in other Areas, including Areas earmarked at the industry workshop for increased catches in the coming year. The fine scale data also indicates that that the total area fished has increased markedly between 2011/12 and 2012/13. Further analysis is required to understand what has caused this expansion of effort that is out of proportion with the corresponding increase in TACC.

The positive and negatives above reflect on the state of the fishery's management. Steps have been taken to develop the finer scale management system and the data logger program that underpins it, such that more information is available to the industry, Department and the Committee about the stock. However, further work is required before the information is collected, presented and used to a standard that can reliably inform TACC decisions. The industry has done well to develop the system to the extent that it has but it is difficult to progress it further without an improved management framework and greater investment in research and management.

The Committee has recommended since 2009/10 that the management plan for the fishery requires review. A revised management plan, including a harvest strategy, is critical to ensuring that the management settings in the fishery are adjusted over time so that that the current rebuild is measured and protected and that, in the long term, profitability is optimised. It will also provide clarity about the respective roles of the Department and stakeholders.

Compliance efforts against organised illegal activity appear to be paying dividends in deterring theft of abalone. However, this is balanced against the growing sophistication of organised criminal networks, which underlines the need to maintain compliance resources to protect the stock and the economic, cultural and social interests of legitimate fishers.

The value of the fishery has improved, but from historical lows, and the looming market forces facing the industry are serious. It will be important in facing these challenges that stock levels are secure.

In the context of the state of the fishery and the fishery's management, the Committee reinforces its previous recommendations in relation to increasing MLLs, formalising the spatial management system, revising the management plan and developing a harvest strategy for the fishery. It is difficult to set a fishery-wide TACC in isolation of, or in the absence of, these factors. Importantly, as TACCs continue to increase, the risk to the stocks increase. The Committee is increasingly concerned that the risks to the fishery are not being measured and analysed. Any further TACC increases beyond this year without other action on the above recommendations are likely to be too high risk.

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 (TACC) of abalone that may be taken in the Abalone Fishery during the period 1 July 2013 to 30 June 2014 should be **125 tonnes.** In making previous determinations, the Committee has recommended a spatial distribution of catch, by region. This year, the Committee is recommending a TACC and assuming that the Department, in consultation with industry, will use outcomes of the industry workshop, observations provided in this report and the ongoing supply of data logging information to set and manage an appropriate spatial catch distribution.

Ian Cartwright
Chairperson

Keith Sainsbury
fisheries scientist

Jessica Hartman
natural resource economist

Kelly Crosthwaite
fisheries management

Appendix 1. Details of public consultation

The 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 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
1 May 2013	Section 31(1)	Committee called for public submissions on the appropriate level of the annual TACC for Abalone for 2013/14.
1 May 2013	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.
1 May 2013	Section 284 (1b)	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: ■ All NSW Abalone Shareholders ■ NSW DPI Fisheries Offices
29 May 2013	Section 284 (1b)	The Committee allowed a period of at least 30 days for public consultation.
	Section 31 (2)	The Committee gave regard to the following submissions. The respondent included the following: ■ NSW DPI – Commercial Fisheries Management, Research, and Compliance. ■ Abalone Shareholders
29 May 2013		The submissions were collated and analysed, and the Committee heard formal presentations regarding views and opinions at the meeting held on 29 5 13. The following made presentations, or provided information to the Committee: ■ Cameron Westaway – Senior Fisheries Manager, DPI ■ Anthony Chen – Senior Investigator, Special Operations, DPI ■ Geoff Liggins – Manager Scientific Services, DPI ■ Doug Ferrel – Manager Resource Planning, DPI ■ Duncan Worthington – Abalone Council of NSW ■ John Symthe Abalone Shareholder/diver

Appendix 2. Summary of submissions and the issues[7]

Submission provided by*[8]	Issue(s)/Recommendations
George Chung, Tony Fry, Steve Hunter, Dennis Luobikis, Jim Miller	Concern over size limit increase and impact on the fishery. Uncertainty in funding and DPI support for the GPS and measuring logger programs. Noted status of stock was continuing to improve and that catch now being spread better across reefs. TAC recommendation of 136.8t. based on workshop outcomes. Change of season to calendar year and six month TAC of 68.4t recommended.

[7] Some submissions were lengthy and detailed. The table above seeks to summarise main points for information. The Committee did not use the table to inform their deliberations, but referred to full submissions.

[8] This report is provided to the Minister as background to the Determination. The Committee is aware that after submission, this report is also circulated to industry and other stakeholders. Some names and submissions were made in confidence and have been removed from this version.