TAC
Committee

Total Allowable Catch Committee Report and Determination for 2015

ABALONE FISHERY

14 November 2015

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EXECUTIVE SUMMARY AND RECOMMENDATIONS

The Total Allowable Catch and Review Committee (the Committee) in 2014 comprises four members: Mr Ian Cartwright (Chairman); Dr Keith Sainsbury (fisheries scientist); Dr Jessica Hartman (natural resources economist); and Ms Kelly Crosthwaite (fisheries manager). The Committee received a range of submissions from DPI and industry using a statutory process established under Section 26 of the *Fisheries Management Act 1994* and met on the 8th and 9th October 2014 in Merimbula. A TAC Forum was held on the 8th October in Merimbula, providing industry and government with an opportunity to present information to the Committee relevant to the assessment and management of the NSW abalone fishery. This report and Determination is based on the submissions, information provided at the Forum and other information received subsequently.

Biological considerations

There is no doubt that there has been substantial improvement in the state of the NSW abalone stock in recent years, starting in about 2006 but particularly since about 2009. The TACC reductions and increased MLL have succeeded in their objectives, resulting in additional accumulated stock above the MLL. While the current catch rates from the fishery and comparisons with recent years may suggest to some that that recovery has occurred, the current extent of stock rebuilding remains uncertain.

The trends in indicators for the last 2-3 years, a period of increasing TACC, are mixed. The key indicators are summarised below:

- ***Catch rates*** have continued to increase in most Regions (i.e. Region 1, most of Region 3, and Region 4), while in some Regions the catch rate is increasing more slowly or has plateaued (i.e. Region 5 and part of Region 6).
- The combined estimated ***catch density*** (Kg/Ha) for all Regions increased until 2012 and has since remained about constant. This is in contrast to the catch rate (Kg/h), which continued to increase after 2012, indicating that the catch rates in the past few years have been increased through operational changes in the fishery and that they give an overoptimistic impression of stock density.
- The ***mean weight*** of individual abalone continued to increase in most Regions (i.e. Region 1, Region 2, most of Region 3 and Region 4), but has plateaued in others (Region 5 and part of Region 6). The recent mean weights remain considerably higher than they were in the mid-2000s when the stock was severely overfished.
- The ***harvest fractions*** for Regions 4, 5 and 6 derived from direct estimates of abalone biomass based on GPS data logger information are estimated to be around 15%. This harvest fraction is likely to be more appropriate for a fully recovered resource than for a recovering one, where significant net productivity is required for stock rebuilding.

In summary, the indicators show that stock rebuilding is continuing overall but it is slower, spatially patchy (including in Regions 5 and 6 that provide the bulk of the recent catch and that earlier showed more consistent rebuilding), and less certain.

The areas showing plateaued catch rate and mean weight are of particular concern. In these areas, it appears that catches in the last 2-3 years have removed much of the net productivity at recent growth rates and recruitment levels, resulting in rebuilding being greatly slowed or stopped. This could be due to i) recently reduced growth and/or recruitment, ii) recent catches in these areas having increasing faster than recruitment as the spawning stock rebuilds or iii) stocks in these areas having completed rebuilding and now reaching a new steady state.

The third explanation above is considered unlikely. Under the first explanation, and if the past fluctuations in recruitment continue, it is expected that recruitment will pick up and rebuilding resume. However, it is important not to deplete the stock (e.g. through inappropriate TACC increases) during the current period of lower productivity. Under the second interpretation the catch from plateaued Areas should not be increased further, and there is a case for reduction until the spawning stock and recruitment are further increased.

Determining a unique explanation for the trends in the data is hampered because the main indicator of stock size, the catch rate, is not likely to be directly proportional to stock abundance, There is now evidence that aggregate catch rate has over-optimistically reflected abalone density since 2012. The mean 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. Further, 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 considering future TACCs, it is important to consider the extent of the recovery in relation to i) thresholds for recruitment overfishing and optimum stock productivity, and ii) the robustness of the recovery so far to fluctuations in stock productivity and to increased catch. In addition it is necessary to identify and rectify past management settings that allowed overfishing to occur previously.

The recovery so far does appear to be robust to fluctuations in stock productivity. However, the information and analysis available does not provide convincing examination or confident conclusions in relation to the remainder of these central questions, including robustness to increased catch. Now, as in recent years, the Committee has very limited information and analysis for its decisions, which is an issue given that the management situation is more complex, with the rebuilding proceeding differently in different Areas. 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 Committee considers that greater investment in information support is necessary to manage the stock effectively and achieve optimum benefits for both the industry and the community. Previously, the imperative was to stop further stock decline and begin recovery, which can be addressed (albeit inefficiently) with little information. Currently however, the management situation is balancing continued recovery, management reform to prevent a return to overfishing, and increasing catches. In pursuing this balance, there are limitations and risks due to the few 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 Committee has made a range of recommendations for improving the fisheries assessment process and the development of initial benchmarks and reference points related to productively thresholds.

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 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 or 'default' MLL to 120mm, with allowance for different MMLs for faster growing areas (e.g., south of Wonboyn) and areas of stunted (slower growing) abalone.

In the circumstances discussed above, the Committee has concluded that the TACC for 2015 should be 130t, with the increase coming mainly from Region 3 and there being no increase in the catch from Regions 5 and 6. Control of the spatial distribution of catch is now

becoming a very important aspect of management, and in increasing the TACC the Committee is making the strong assumption that this management control can be achieved through a combination of the Departmental management and industry cooperation. If this management control cannot be achieved it will limit options for the ongoing management of the fishery to recovery.

Economic considerations

Little has changed in terms of the short-run profitability of the fishery from the report of the Committee in November 2013. However, the long-term outlook for the fishery appears to have improved, as reflected by a significant increase in share values.

Catches of abalone have increased since 2009/10; however abalone prices have remained reasonably flat over the same time period. The gross revenue from abalone fishing was $3.76 million in 2013/14. This value is very low 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. Despite reasonable flat prices, lower costs of fishing are likely to have resulted in greater profitability, especially over the last three years.

Abalone prices have remained static for the last three years, at around $30-32 per kg. Pressure from the increased supply of cultured 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 to be 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. 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 over time. They are currently at $62.81 per share for 2014/15. The Committee is of the view that the 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 is insufficient to allow for appropriate levels of research to inform management decisions, and compliance. The Committee believes that there is a need to review the current level of cost recovery and to create a situation 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 Committee was pleased to have a detailed set of draft economic indicators available for the fishery for 2011/12 on which to base its assessment of economic performance. Based on the survey data, it can be concluded that the abalone industry was profitable in 2011/12 and that a positive rate of return is being generated in the fishery. As a result improved gross returns in 2012/13 and 2013/14, and reported lower catching costs, it is likely that the profitability of the abalone fishery will have improved even further in 2012/13 and 2013/14. 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.

The Committee has made a number of recommendations in this report that are aimed at providing improvements in the economic viability of the abalone fishery in the future. These include: that industry undertake a marketing study to investigate, among other things, tastes

and preferences for abalone on overseas markets, and size / price relationships for abalone on these markets; 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; and that the Department and Industry work together to update the base data obtained from the Econsearch survey on an annual basis 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.

Despite the positive outlook for the fishery, it should be noted that there is still considerable management charge debt ($400,000) 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.

The Committee notes that the current economic indicators and triggers for the fishery are lacking in specificity and relevance, and clear management responses. Economic indicators for the fishery relating to long-term profitability, which can then be translated into, or influence, the 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.

The Committee's continued conservative determination for the TACC 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.

Fisheries 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 and 125t for the 2013/14 fishing period (which was later truncated to a 6 month season to re-align the quota year to the calendar year). For the 2014 calendar year the TACC was maintained at 125t.

Economically, the value of the fishery has also improved and recently stabilised, 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, 31 shareholdings have reported fishing in 2014 (up from 29 the previous year). There are reportedly some new entrants to the fishery that have actively fished this year.

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. To date, this finer spatial scale management system has been 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. It is for these reasons that the Committee has made its determination on the basis of moving to a formalised catch-spreading mechanism.

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 has been based on these data. The assessment has therefore been very limited.

This year the process has been adjusted so that the logbook data has been prepared and presented by the industry service provider (Duncan Worthington) in addition to the logger data and analysis, and this has been provided to the Department earlier to allow for review and comment. The Committee appreciates these improved timeframes, which have provided the opportunity for more meaningful (but still very limited) input by the Departmental scientists and time for the Committee to consider the reports prior to our meetings.

This process was improved but by no means perfect and further improvements were discussed, particularly in terms of clarifying the format, method and timing of presenting the logger data and analysis. Having a harvest strategy in place against which to asses this information will be a critical next step to making the scientific assessment rigorous and useful.

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 placed significant weight on these industry views as a part of interpreting the data and increasing the TACC in June 2013. The growing time-series of logger data is also allowing for trends to be observed over longer timeframes and in many parts of the fishery reflects strong and increasing catch rates.

Balanced against these positives, the data has affirmed the concern raised in the last Committee report in relation to uncertainty about the rate of recovery and the possibility that it is being impacted by catches in some Areas. 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 previous season and this tapering has continued. Again, the lack of predictive indicators, a fishery-independent survey or a proper structured fishing

program is limiting the ability to fully understand and measure these effects and therefore requires extra levels of precaution in decision-making.

Overall, the process leading to setting this TACC has again reinforced the need for a harvest strategy that outlines the objectives the fishery is working to, how performance will be measured, how data will be collected and analysed to inform decision-making and how decisions will be made. More consistency and transparency is required of the data monitoring and stock assessment program. In turn, the level of investment in these programs needs to be revisited as the fishery has reached the point where under-investment is impacting TACC decisions.

Decision-making framework

The abalone fishery lacks a management plan, long-term objectives, meaningful indicators and reference points. This materially impacts TACC decisions as there are 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 again 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.

Strong Government commitment, engagement and the necessary resources will be required to progress this work and move to more formal management framework. In the past, 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. The Department has made some improvements this year and has assigned resources to developing the draft harvest strategy / management plan. The Committee strongly supports this work.

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 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.

It is noted that the Department's work on a proposed interim harvest strategy / management plan seeks to address these issues.

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 continues to counsel a cautious approach to mooted future increases to the recreational fishery limit. 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.

The level of compliance within the licensed commercial sector has dropped in 2013/14 to 51% from 71% in the previous reporting period. While this is mostly attributed to a crackdown on late catch returns, and therefore mostly minor offences, it is an important aspect of managing the fishery and requires improvement from licence holders. The Committee supports the Department's work in this area.

The levels of compliance in the recreational sector has increased to 69% from 56%.

The Department continues to undertake more efficient targeting using an intelligence-led approach and an added emphasis on specialised compliance teams that focus their efforts on deliberate non-compliance and recidivist offenders. Despite the generally positive trends in abalone compliance, it was again 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 continued 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. Nevertheless, some of the indicators of concern observed in some high-catch Areas last year are again evident in the data. Further analysis is necessary to resolve some of the key issues associated with the status of the resource. In the meantime, the Committee is this year determining a modest increase in the TACC of 5t to a total of 130t, on the express recommendation that catch is spread across the fishery so that the additional catch does not exacerbate the observed impacts in some Areas of the fishery.

Summary of Recommendations

1. A TACC setting timetable be developed and provided well before the scheduled date for the TACC Forum. The timetable should be promulgated to industry and cover dates for i) the 2015 TACC Forum and meeting(s) (including locations), ii) the delivery of associated supporting documentation; and iii) the delivery of the Committee Report and Determination.
2. That a response to the assumptions and recommendations contained in this report be provided as part of the 2015 Management Report.
3. Local catch targets and limits for areas be established and implemented so as to provide reasonable operational flexibility to the fishery and to protect local stock status (see also Recommendation 16 below).
4. The data-logger program to be continued at a high level of coverage in the fishery.
5. Fishery monitoring to be extended to provide length composition of the catch in addition to the mean weight.
6. Further development and testing of robust and interpretable indicators of stock and fishery status based on the finer scale data that will be consistently reported on through time.
7. Further development of criteria for assessing the status of each area over time and as part of the broader development of the management framework/harvest strategy, make more use of indicators from fine scale monitoring and benchmarks that reflect long-term optimal resource use and overfishing limits.
8. Provide more explanation about the workshop assessment of each sub-region or Area, and the basis for the conclusions reached.
9. Include a technical description of the data and the analysis with input to the fisheries assessment as a further development of the documentation provided this year.
10. Provide more information about the workshop assessment of each sub-region or Area, and the basis for the conclusions reached.
11. Increase the ‘default’ size limit for Regions 1-5 and Region 6 other than the area South of Wonboyn (Y31-Y32) to 120mm.
12. Industry to undertake a marketing study to investigate tastes and preferences for abalone on overseas markets and size / price relationships for abalone on these markets.
13. Industry to 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.
14. Department and Industry to work together to update the base data obtained from the EconSearch survey on an annual basis 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.
15. Further changes to the abalone recreational fishing bag limit to 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 integrates that information into a revised harvest strategy for the fishery. If this deferment cannot be agreed, then any increase in the recreational bag limit should be accompanied by additional monitoring of the recreational catch, and measures to control the catch from vulnerable areas (e.g. Region 2).

16. Recreational abalone dive fishers be required to hold an endorsement to a recreational fishing licence for the purposes of enabling cost-effective surveys to estimate recreational catch and effort, or that the Department explores other methods of identifying diver fishers so that targeted surveys can be conducted.
17. The development and distribution to industry of a draft interim harvest strategy as soon as possible or the purpose of consultation, with a view to being able to apply the interim harvest strategy for 2016.
18. The creation of i) a “northern quota zone” with a specified portion of the TACC allocated to that zone, in proportion to holdings on “normal” quota and ii) “cap and close” arrangements to limit the amount of catch from specified priority Areas to specified limits.
19. Existing management arrangements be reviewed and a new management plan developed as a high priority
20. Full access to fine scale data generated by industry using data loggers be secured by the Department.
21. The development of cost recovery arrangements for the fishery to ensure that the provision of services is adequate to inform TACC decisions and management of the fishery.
22. The interim harvest strategy under development to include research priorities and ensure that adequate funding is made available to address those priorities.
23. The Committee to 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

TOTAL ALLOWABLE CATCH COMMITTEE

ABALONE FISHERY

REPORT AND DETERMINATION FOR 2015

1. INTRODUCTION

The Total Allowable Catch and Review Committee (the Committee) is established under Section 26 of the *Fisheries Management Act 1994*. In 2014, 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 is required to determine the total allowable catch for the commercial sector (TACC) of the abalone fishery and, in doing so, 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 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 of the TACC, as has occurred in the past in the case of abalone.

NSW fisheries 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 should not be 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 (the sum of the bag limits); and Aboriginal fishers; 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 the 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; the abalone fishery is an instance were the Committee is currently taking a precautionary approach. 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 Management;
- NSW Department of Department of Primary Industries Fisheries Compliance;
- the NSW Abalone Council; and
- industry members.

While a researcher from the Department was present at the TAC Forum and provided useful input into the process, the assessment data and analysis on the fishery was again presented by a clearly conflicted industry researcher. While some technical review by the Department of this work occurred, the Committee considers that continued reliance on industry analysis remains a deficiency in the current management/TACC setting process. Informally, the Committee was informed that the Department is intending to apply additional scientific input into the assessment in future years, which will be very helpful.

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 2014.

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;
- data and analysis presented by the NSW Abalone Council,

- comments on the data and analysis presented by the NSW Abalone Council provided by the Department;
- a range of technical and other industry comments regarding the status of the abalone stock and other matters regarding aspects of the management of the abalone industry;
- an industry member presentation including and underwater video footage and photos of key reefs;
- 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 of the annual TACC for abalone for the 2015 fishing season is provided at the end of the report.

The Committee notes the improvement in the timeliness of delivery of information. This was very helpful and allowed for due consideration of the issues.

*The Committee **recommends** that a timetable be developed and provided well before the scheduled date. The list should be promulgated to industry and cover dates for i) the 2015 TACC Open Forum and meeting(s) (including locations), ii) the delivery of associated supporting documentation; and iii) 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 again requests the Department to consider and comment in a timely manner on the assumptions and recommendations made in the various sections of the Committee Report.

*The Committee **recommends** that a response to the assumptions and recommendations provided in this report, be provided as part of the 2015 Management Report*

3. State of the Stocks

3.1 Introduction

The information flow for this assessment was a considerable improvement on previous years. The Department provided documentation (including reviews of the science which have not been provided in recent years) well ahead of the TACC meeting. The NSW Abalone Council provided both the documentation of its assessment of the abalone stocks (previously these were not documented other than through a PowerPoint presentation) and the updated fishery-based data well ahead of the meeting. The fishery-based data for month and Area were updated, mostly to the end of June 2014, through the NSW Abalone Council website (http://acnsw.ambrad.com.au/). This more complete documentation and its earlier availability to the TACC greatly improved the assessment process.

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 in NSW 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 i) variability in the number of young abalone recruiting to the population, ii) their growth rate or iii) their survival. Variability in any of these three 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 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,* which significantly reduced stocks in the southern portion of Region 1. Commercially targeted fishing was stopped in 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 from the trial fishing 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 were 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. For the most part, these allocations were not taken up. 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.

All of these success factors were strongly evident during the late 2000s and they were maintained through the 2011-2013 period, though with the catch rate and mean weight showing slower or no further increase in some Areas in 2012-2013.

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 full 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. the GPS-linked data loggers now widely used in the fishery), 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 overly concentrated fishing and serial depletion). Attempts to set and manage finer scale catch targets and have limits on a voluntary basis have 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 in 2010 and then to 123mm in 2012, 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 they are 127-138mm across different harvesting regions, and in South Australia 125-130mm across different harvesting regions. For several years the Committee has 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. There are several advantages of a higher 'default MLL' that can be selectively relaxed as appropriate, rather than low MLL everywhere. Such a strategy protects from over fishing abalone sub-populations that grow quickly. have a large size at first maturity and reach large maximum size. These fast growing abalone are highly productive if managed appropriately, but are vulnerable to overfishing if fished at too low a MLL. 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 is required and needs to be explicitly grounded in the biological productivity of the stock. The development of a harvest strategy and management plan for the fishery (see Section 5.3.3) should address this issue.

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, prior to the fine scale information, which is now in the early stages of development.

- Up to and including 2008, 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 2009, 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, 2013 and again in 2014 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 presented that related interpretations of the currently collected data from the data loggers to interpretations of historically collected data, or to reference levels relating either to 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 i) the previous methods based on Fishery Independent Surveys, coarse scale data from commercial fishing, and population modelling to ii) 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 has caused increased uncertainty about the state of the stock and the likely consequences of different catch levels. New indicators based on the fine scale data are being developed, and several appear promising, but as yet there is no objective basis for calibration or 'ground truthing' them – instead there is a slower and riskier process of 'trial and error' as new indicators are brought into consideration and used in assessment/management of the fishery. Also there is now heavy reliance on commercial catch rate (CPUE) 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 i.e. high catch rates can be obtained and maintained for a time by targeting concentrations of abalone in known patches of preferred habitat even as the overall population declines to low levels. Such hyper-stability of catch rates has been seen in the history of the NSW abalone fishery at the both the Regional and Sub-Regional 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 many of these problems, and a current FRDC funded project is intended to address this, but to date such 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. Key uncertainties relate to the robustness of the recent stock improvements, the limited ability to detect faltering recovery if that eventuates, and the lack of benchmarks for the currently used indicators that allow recognition of overfishing and optimal fishing. 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 in light of this information must be simple, robust and precautionary.

3.3 Information and analysis available for the current 2014 assessment

There are two primary sources of information available: (i) the logbook and related information from commercial fishing (i.e. the catch, catch rate and mean weight of individuals in the catch aggregated at the space scales of Regions, Zones and Areas), and (ii) the fine-scale GPS data-logger information.

3.3.1 Aggregate catches, catch rates and mean weight

The annual commercial catch, catch rate and the mean weight of abalone in the catch is shown for each Region in Figure 2.

The annual catch rates in all Regions have strongly increased since the mid-late 2000s, with catch rates in the most recent year either continuing to increase or remaining at about the recent high levels, and well above previously set targets that were thought at the time to represent optimal fishing levels. The catch rates in all Regions are now well above recorded historical levels. Although the increase in catch rate has slowed during the past year in some Regions, they have remained high through the period when past productivity patterns suggest that lower stock productivity might occur (i.e. about 2011-13). 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.

There has been very little fishing in Regions 1 & 2, so the representativeness of the commercial data there is likely to be poor. Nevertheless the catch rate in Region 1 continues to increase. The catch rate in Region 2 has plateaued for the past 3 years, and this effect is particularly apparent in Area 5, which has provided the bulk of recent catches from Region 2. The catch rates in Regions 3 &4 continue to increase steadily under the recent catches. The catch rates in Region 5 has plateaued in the past 2 years and in Region 6 the rate of increase has slowed somewhat during the most recent 2-4 years. All Areas in Region 5 (i.e. Areas 14-16; Area 15 is shown in Figure 3) and the northern Areas of Region 6 (i.e. Areas 17 and 18; Area 18 is shown in Figure 4) show a slowing or stabilization of recent catch rates. The southern Areas of Region 6 (i.e. Areas 19, 20 and 21) continue to show increasing catch rates.

Catch rates in all regions increased steadily through the introduction of the 117mm MML in 2008, and they have continued to increase steadily in Areas 19, 20 and 21 through the increases MLL to 120mm in 2010 and to 123mm 2012. The catch rate decreased for a few months after each increase in MLL, but then quickly recovered.

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 increases 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. 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 mean weight of individuals in the commercial catch has been measured from the weight of each bin of abalone landed divided by the number of abalone in the bins. The mean 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 have influenced the distribution of catches, but there is no report of systematic or widespread size selection in the fishery. The simplest interpretation of the mean weight data assumes that there is no significant or changing size selectivity by the fishery, and this is assumed here.

All Regions show a substantial increase in the mean weight of individual abalone since the reduced TACCs in the mid-late 2000s and the MLL increase to 117mm in 2008 (Figure 2). There has been little recent fishing in Region 1, so trends may not be representative, but nevertheless the mean weight has increased there during the past 3-4 years. There has been further steady increase in the mean individual weight during the past 3-4 years in Region 3, Region 4 and one Area (Area 21) in Region 6. In a pattern similar to that seen in the catch rates the mean weight has plateaued during the past 3-4 years in Area 5 of Region 2, all Areas in Region 5 (i.e. Areas 14-16; Area 15 is shown in Figure 3) and Areas 17 and 18 of Region 6 (Area 18 is shown in Figure 4). Areas 19 and 20 of Region 6 show no increase in mean weight over the past 2 years.

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. This importance is emphasised by the emergence of different stock responses in different Areas. Catch rates continue to increase in most Areas but have plateaued in Areas 5 and 14-18, indicating that the catches in these Areas specifically need to be limited. Catch targets and limits have been identified by Area. However, it is apparent from comparison of the targets, limits and actual catch in recent years that management of catches within the intended range is not entirely successful; some Areas have provided more catch than intended and others provided 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 and possibly even at the current TACC. The ability to set and achieve appropriate local catch caps is necessary to prevent a repeat of sequential depletion if 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 for Areas be established and implemented so as to provide reasonable operational flexibility to the fishery and to protect the local stock status.*

Overall, the mean weight data indicate that rebuilding of the population size composition has been occurring over the past 7-8 years. However the pattern of recently decreasing mean weight in some Areas, and the plateaued catch rate in most of the same Areas, indicates that i) the population abundance and size structure is stabilising in these Areas and ii) that the relatively small increase in recent catches during the past 3-4 years has caused a measurable reduction in the size composition. This would not be possible if these populations had recovered substantially in number, and suggests that the population recovery is not yet robust in all Areas. Further, it indicates that for these Areas the recent catches have taken the net productivity at the recent level of recruitment and growth – recognising that a period of lower productivity was expected during approximately 2011 to 2013 if past patterns were repeated. This interpretation applies to Areas 5 and 14-18. The

mean weight in catches from Areas 19 and 20 did not increase during 2013/14; if this persists in future years it will raise similar concerns for these Areas.

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

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 three years, 2011/12, 2012/13 and 2013/14.

Several indicators that were reported from the logger data in previous years were not reported for 2013/14 and so comparisons could not be made. This included:

- the size (area) and location of concentrated fishing effort to assess the patterns of spatial focus and rotational harvesting in the fishery;
- the catch rate and mean weight at fine scale (1Ha hexagon) catch rate data to help to interpret the Area aggregated catch rate and mean weight data, and particularly the possible causes of the decreased and plateaued mean weight in some Areas.

The abalone density (Kg/Ha) was calculated from logbook catch rates and logger estimates of area fished, and was reported in aggregate for all Regions (Fig 5). Effectively this density corrects the logbook catch rate (Kg/h) for any systematic changes in the area fished per unit time (e.g. speed of swimming). Fig 5 shows that the catch density (Kg/Ha) increased till about 2012 and has plateaued for the 3 years since then. The logbook catch rate continued to increase after 2012, indicating that this increase was substantially due to operational changes rather than abalone density. Further, the aggregate density shown in Fig 5 is dominated by the Regions that provided the bulk of the catch (i.e. Regions 5 and 6) and is consistent with the interpretation from the mean weight data that the stock recovery has plateaued in many of these Areas.

The GPS data logger information was used to estimate abalone density and the area fished, from which a total biomass of exploitable abalone was calculated (Table 1). This is a new methodology and, though promising, its reliability is not yet clear. Some confidence is provided by the similarity of density estimates provided by this methodology and by scientific survey estimates in Victoria and in Region 6 of NSW (Table 1). The biomass estimates suggest that the harvest fraction is about 15% in Regions 4, 5 and 6, and that it has exceeded 15% in all these areas in that past year. While the harvest fraction giving common fishery management reference points (e.g. maximum sustainable yield) has not been calculated for NSW, a value of 15% is relatively high for a stock that is being rebuilt after overfishing. The estimated harvest fraction in Region 3 is about 5%, indicating that additional harvest is available there. The estimated biomass in Regions 1 and 2 is significant, but the reliability of these estimates is unclear because they are based on relatively low catches whose spatial distribution was not reported. A future analysis in Regions 1 and 2 should relate the spatial coverage and densities from the data loggers with the earlier scientific monitoring locations and the experimental fishing sites in Region 1 (south) in 2007; this may provide an objective way to assess the recovery and harvest potential in Regions 1 and 2.

The length frequency of the catch from data loggers in abalone processors was analysed. The length frequencies in 2011 and 2012 were compared by Area. Broadly this analysis was consistent with the mean weight data; both show an overall increase.

This very preliminary analysis and data provided 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. Length-based indicators, with reference points based on 'per recruit' analysis, are relatively low cost and seem particularly suited to monitoring and management of this fishery.

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

*Committee **recommends** that:*

- *the data-logger program be continued at a high level of coverage in the fishery;*
- *the monitoring be extended to provide length composition of the catch in addition to the mean weight;*
- *robust and interpretable indicators of stock and fishery status based on the finer scale data continue to be developed and tested including:*
    - *the spatial coverage and densities from the data loggers in Regions 1, 2 and 3 should be related to the earlier scientific monitoring locations and the experimental fishing sites in Region 1 (south) in 2007:*
    - *the logger-based biomass estimates should be calculated for each year back to 2007, when logger data collection began, to give an indicator or stock recovery and to measure the inter-annual variability of the estimates;*
- *benchmarks or reference points relating to stock condition and productivity be developed for these indicators; and*
- *a set of indicators are identified that will be consistently reported through time.*

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 intended increase of the recreational bag limit from 2 to 5 abalone for Regions 2-6 is expected to increase recreational targeting of abalone. The extent to which this will increase the overall recreational catch, and in particular increase catch from areas where recovery is highly uncertain (e.g. Regions 1 and 2) or plateaued (e.g. Region 5 and Area 5) is not known.

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, to be in the vicinity of 20-40t per year through to about 2013, and is now in the lower part of that range and trending down. 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 August 2014 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 recommended TACC was 136.6t, compared to the actual TACC last year of 125t, and virtually the same as the 136.8t the industry recommended last year. The industry suggested that the catch from 13 Areas stay at the same levels as they suggested last year, that the catch from 3 Areas be increased from the levels they suggested last year, and that the catch from 5 Areas be decreased from the levels they suggested last year. The Areas that have recently shown plateaued catch rate and mean weight (i.e. Areas 5 and 14-18) were recommended by industry to have catches that were higher or the same as those the industry recommended last year.

While 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, the Committee believes there are a number of ways to further improve this workshop input.

*The Committee **recommends** that:*

- *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/harvest strategy, 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, as a further development of the documentation provided this year. This will become even more important as the fine scale data is increasingly used to provide indicators and to aid interpretation of stock status. There was some additional description provided with the current assessment, but it is not sufficiently detailed or complete.*

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 their objectives, resulting in additional accumulated stock above the MLL.

The trends in indicators for the last 2-3 years, a period of increasing TACC, are mixed. Stock rebuilding is continuing overall but it is slower, spatially patchy (including in Regions 5 and 6 that provide the bulk of the recent catch and that earlier showed more consistent rebuilding), and less certain. Specifically:

- In the past 2-3 years catch rates continued to increase in most Regions (i.e. Region 1, most of Region 3, and Region 4), but in some Regions the catch rate is increasing more slowly or has plateaued (i.e. Region 5 and part of Region 6). The recent catch

rates remain considerably higher than they were in the mid-2000s when the stock was severely overfished.

- The estimated catch density (Kg/Ha) for all Regions combined increased until 2012 and has since remained about constant. This is in contrast to the catch rate (Kg/h), which continued to increase after 2012, indicating that the catch rates in the past few years have been increased through operational changes in the fishery and that they give an overoptimistic impression of stock density.
- In the past 2-3 years the mean weight of individual abalone in the catch continued to increase in most Regions (i.e. Region 1, Region 2, most of Region 3 and Region 4), but has plateaued in others (Region 5 and part of Region 6). The recent mean weights remain considerably higher than they were in the mid-2000s when the stock was severely overfished.
- Direct estimates of abalone biomass from the GPS data logger information suggest that the harvest fractions for Regions 4, 5 and 6 are about 15%. The harvest fraction giving maximum sustainable yield, maximum yield per recruit or maximum economic yield is not estimated for NSW abalone. But 15% is likely to be more appropriate for a fully recovered resource than for a recovering one where significant net productivity is required for stock rebuilding.
- For the Areas showing plateaued catch rate and mean weight it is interpreted that the catches in the last 2-3y have removed much of the net productivity at recent growth rates and recruitment levels, and so catches have greatly slowed or stopped stock rebuilding there. This could be due to:
    - recently reduced growth and/or recruitment (such the reduction in about 2011-13 that is expected if previous patterns of fluctuation have persisted);
    - to the recent catches in these Areas increasing faster than recruitment as the spawning stock rebuilds from its low point in about 2005; or
    - to the stocks in these Areas having completed rebuilding and now reaching a new steady state (this is considered unlikely).
- Under the first interpretation above, an increase in productivity would be expected in a few years as a part of the productivity fluctuation, which would lead to the resumption of rebuilding. However, it is important not to deplete the stock during the current period of lower productivity. Under the second interpretation the catch from plateaued Areas should not be increased further, and there is a case for reduction, until the spawning stock and recruitment are further increased.

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, and there is now evidence that the aggregate catch rate has over-optimistically reflected abalone density since 2012. The mean 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. Further, 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, including robustness to increased catch. Now, as in recent years, the Committee has 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, with the rebuilding proceeding differently in different Areas, and it requires greater information support than has been provided to date.

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 pursuing this balance, there are limitations and risks due to the few 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 monitoring, assessment and management. Without an increase in investment there is likely to be continued uncertainty and the need for considerable precaution (see also Sections 4.5 and5.3.5). In regards to stock assessment the Committee re-iterates its previous recommendations.

*The Committee **recommends that**:*

- *further development and testing of the indicators and benchmarks based on the fine scale data;*
- *extending the current monitoring to include the length composition of the catch;*
- *conducting '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;*
- *using 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, mean weight, harvest fraction), and initial options for benchmarks of indicators based on fine scale data;*
- *developing more formal methods to control the catch from Areas.*

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, has 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 that the TACC for 2015 should be 130t, with the increase coming mainly from Region 3 and there being no increase in the catch from Regions 5 and 6. Control of the spatial distribution of catch is now becoming a very important aspect of management, and in increasing the TACC the Committee is making the strong assumption that this management control can be achieved through a combination of the Department and industry cooperation. If this management control cannot be achieved it will limit options for the ongoing management of the fishery to recovery.

The recommended catch targets by Area are:

Comment	Recommended catch (t)	Area
Industry workshop target	1	1
Industry workshop target	1	2
Industry workshop target	2	3
Industry workshop target	1	4
Industry workshop target	5	5
Industry workshop target	1	6
Increase 1t from industry workshop target	2	7
Increase 1t from industry workshop target	5	8
Increase 1.3t from industry workshop target	8.5	9
Industry workshop target	10	10
Industry workshop target	9	11
Industry workshop target	8.5	12
Industry workshop target	5	13
Hold at last year's industry workshop target	10	14
Hold at last year's industry workshop target	8	15
Hold at last year's industry workshop target	10	16
Hold close to last year's actual catch	7	17
Hold close to last year's actual catch	4	18
Industry workshop target	7	19
Industry workshop target	9	20
Industry workshop target	16	21
	130	Total

Table 1. The abalone biomass estimated from GPS data logger information from commercial fishing operations. The catch for various harvest fractions is also shown, along with the range of catches taken in 2013 and 2014. A 2013 scientific survey in Areas 20 and 21 in Region 6 gave an estimated density of 597Kg/Ha, compared to 524Kg/Ha for the whole region estimated by from the data loggers).

						Estimated from GPS loggers	
2013 and 2014 Catch (t)			**Catch with Harvest fraction (t)**	**Biomass (t)**	**Area (Ha)**	**Density (kg/Ha)**	
	15%	**12.5%**	**10%**				
2-3	-	-	22	223	448	497	**Region 1**
6-3	-	-	20	199	573	348	**Region 2**
6-8	**27**	**23**	**18**	182	456	399	**Region 3**
39-35	**38**	**32**	**25**	253	690	367	**Region 4**
40-33	**39**	**33**	**26**	263	508	518	**Region 5**
32-43	**39**	**32**	**26**	258	493	524	**Region 6**
	143	**120**	**96**				**Total**

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.

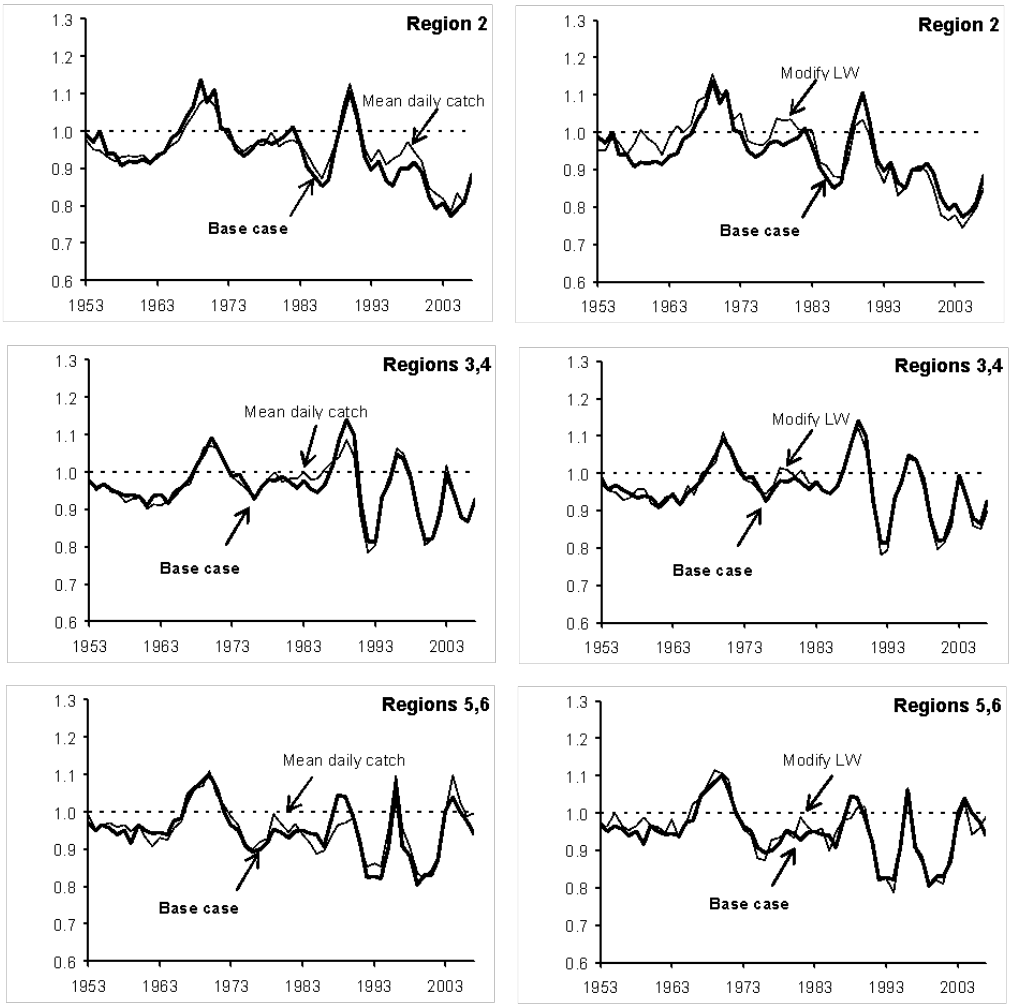
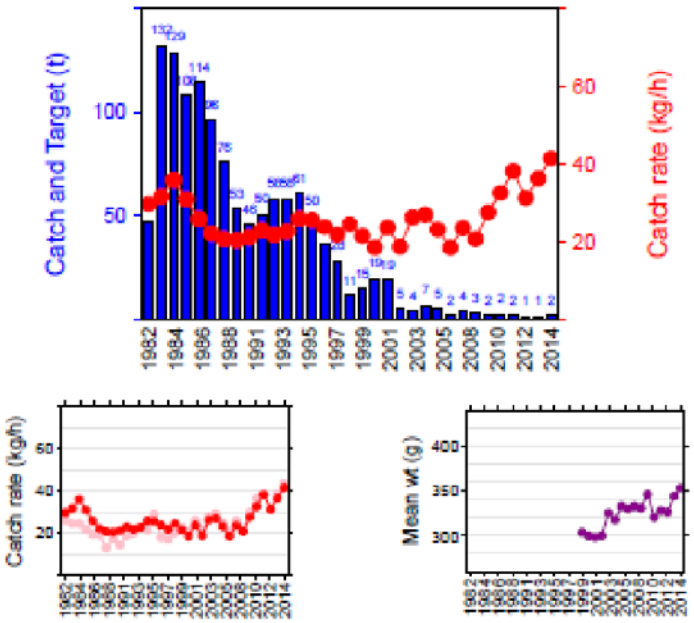
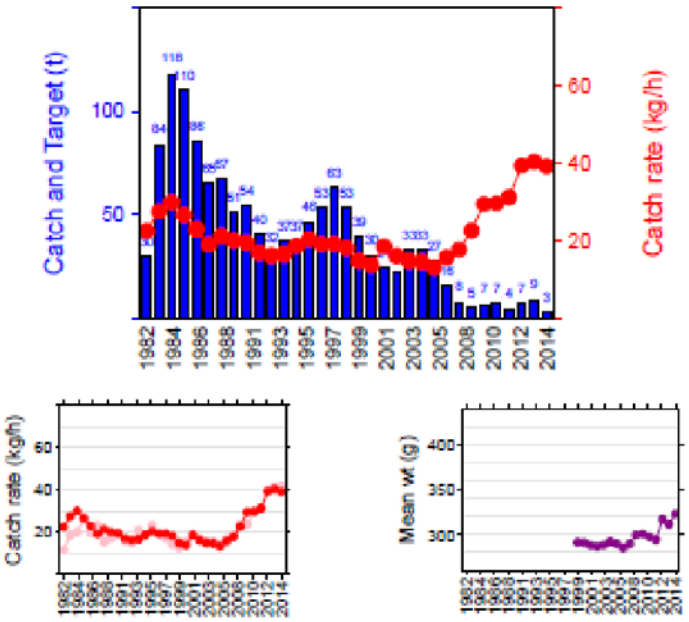


Figure 2 Annual catch (blue histograms), CPUE (red lines) and mean weight (purple lines) of abalone in the catch for each region of the fishery. The MLL was increased for all Regions from 115mm to 117mm in late 2008. The MLL was further increased for the southern part of Region 6 (Areas 19-21) from 117mm to 120mm in late 2010 and from 120mm to 123mm in late 2012.

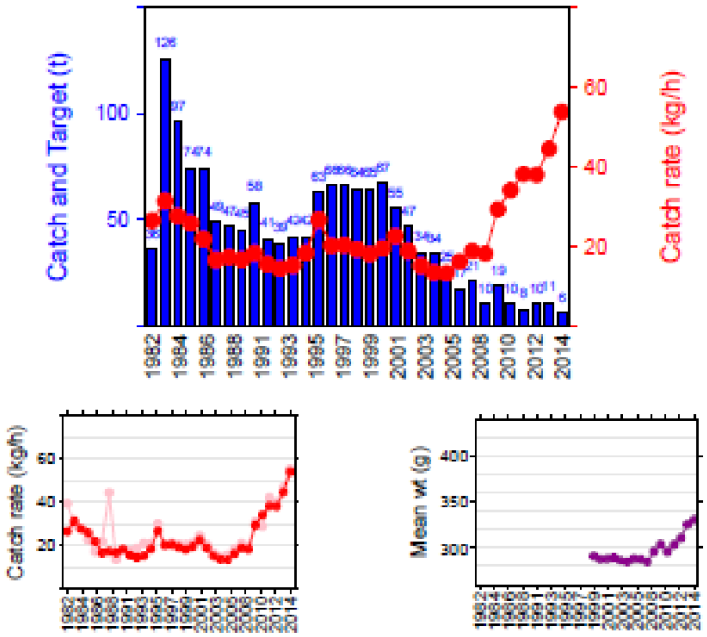
Region 1, Tweed, A-L



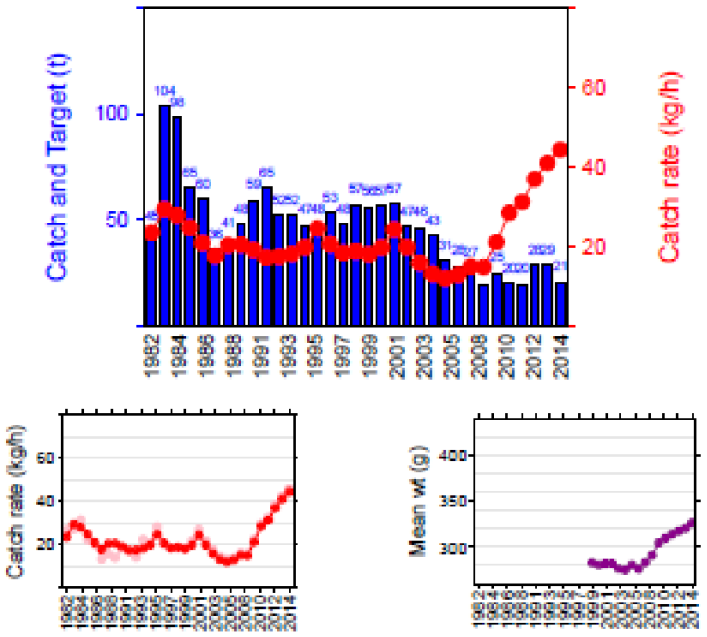
Region 2, Jervis Bay, M-R



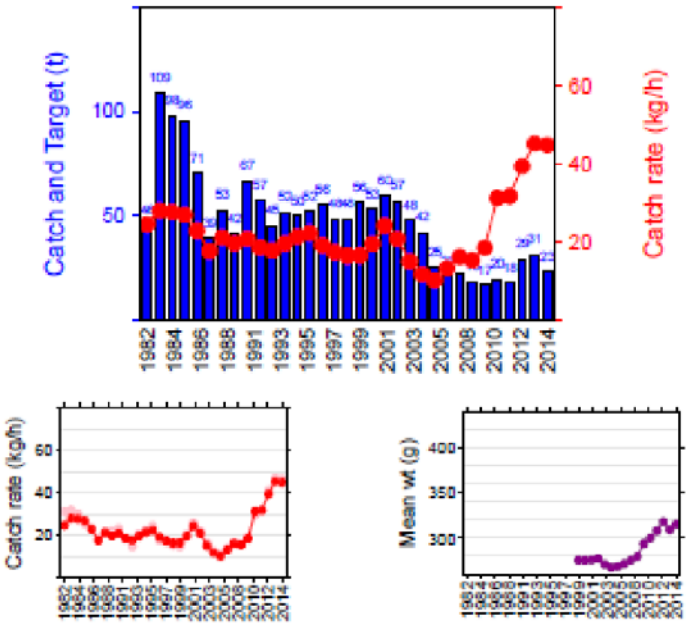
Region 3, Tuross, S-U



Region 4, Bunga, V-X



Region 5, Eden, Y1-Y2



Region 6, Green Cape, Y3-Z

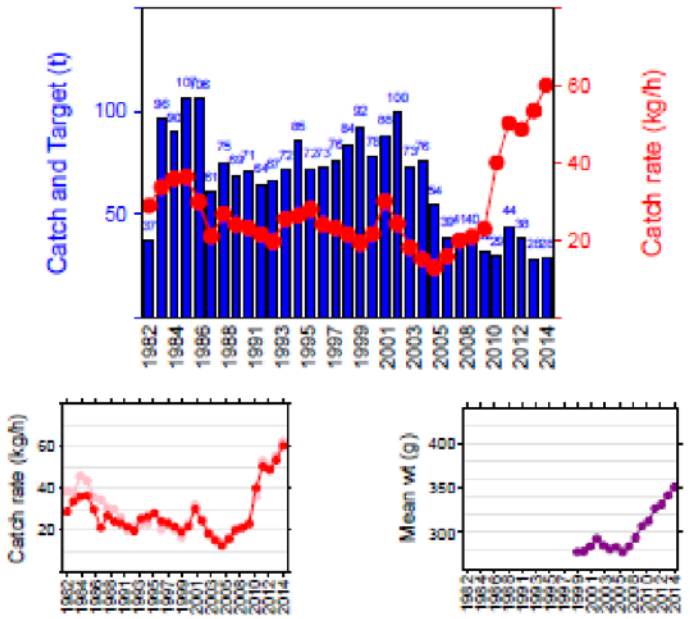


Figure 3. Example of an area showing moderate plateauing of recent catch rate and mean weight of individuals in the catch.

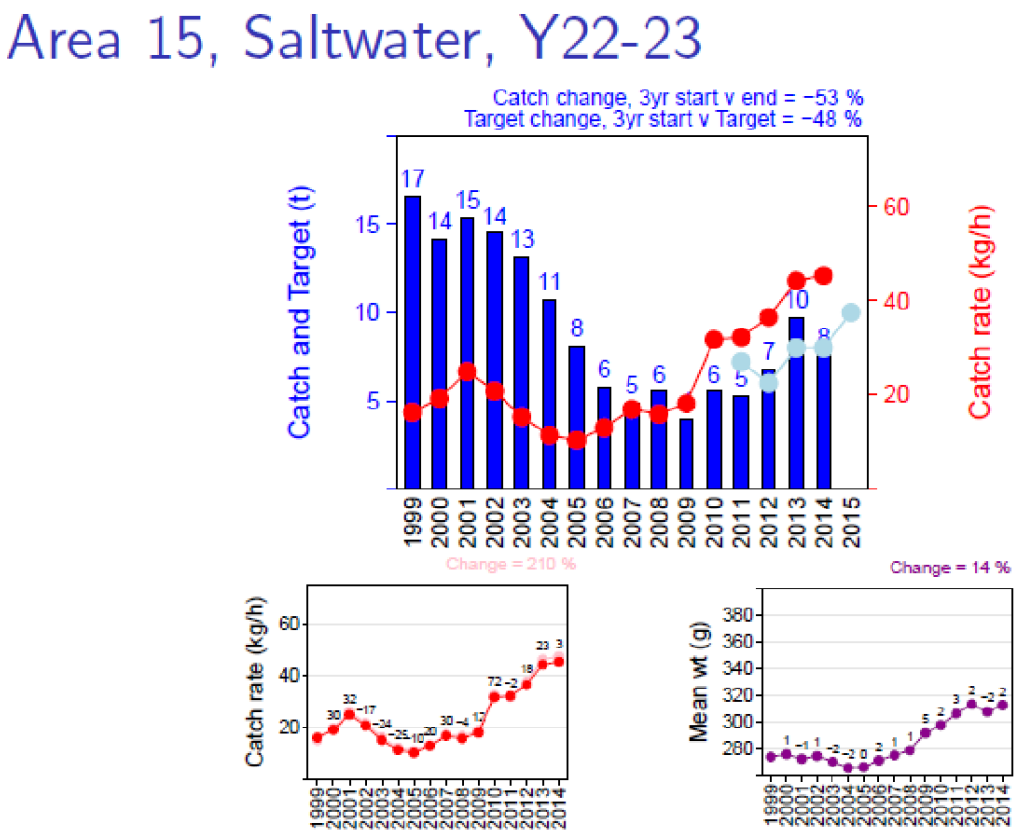


Figure 4. Example of an area showing pronounced plateauing of recent catch rate and mean weight of individuals in the catch.

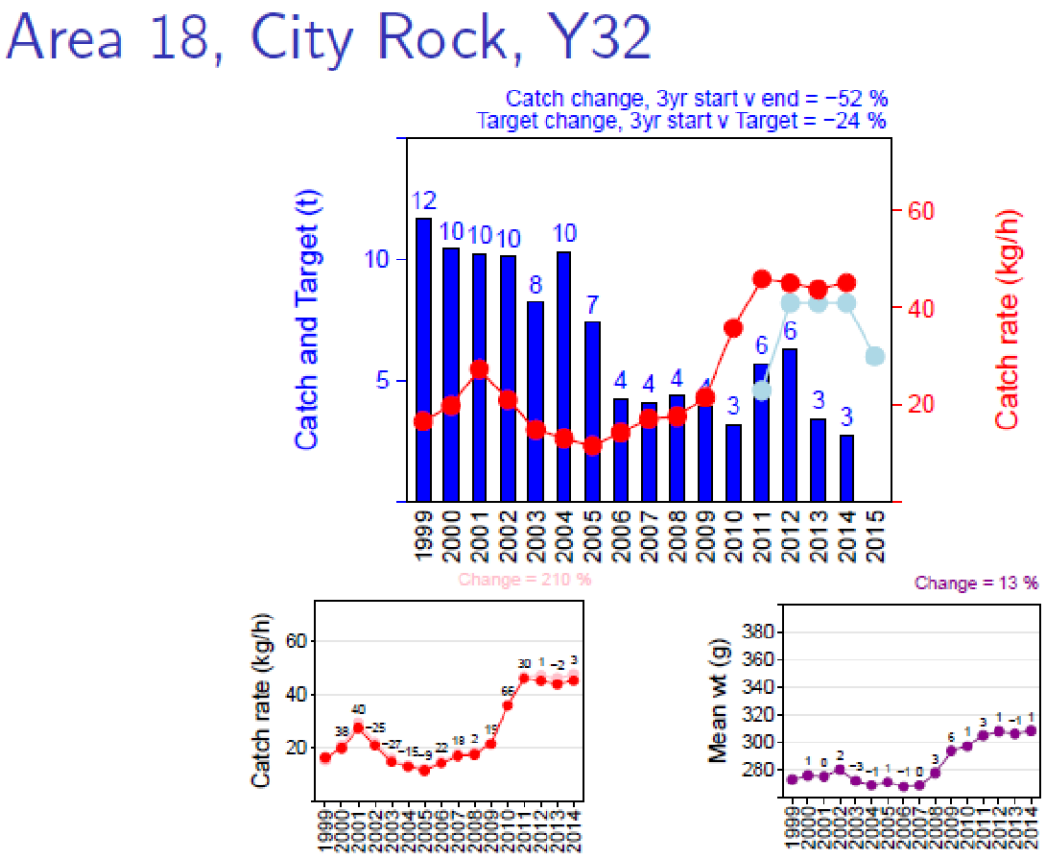
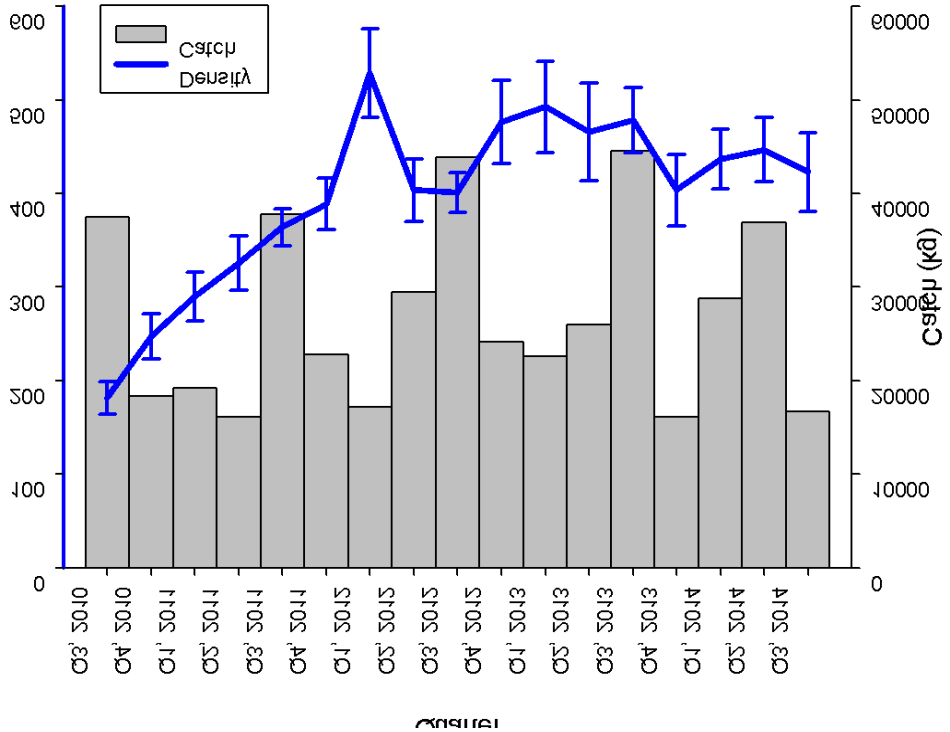


Figure 5. The average density of abalone calculated from data logger information aggregated for all Regions.



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.

The Committee was pleased that it 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.

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, 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.

Little has changed in terms of the short-run profitability of the fishery from the report of the Committee in November 2013. However, the long-term outlook for the fishery appears to have improved, and is reflected by a significant increase in share values.

4.2 Volume and value of production

The volume of reported catch of abalone in 2012/13 was 119.9 tonnes, an increase of 9 per cent from 2011/12 (Figure 6). Reported catch for the six months July 2013 – December 2013 was 62.5 tonnes. Data to August 2014 has the reported catch at 84.7 tonnes (68% of the TACC). Although numerous environmental, operational and administrative factors influence the fishery's ability to catch the TACC, the proportion of TACC caught has remained above 97% since 2005/06.

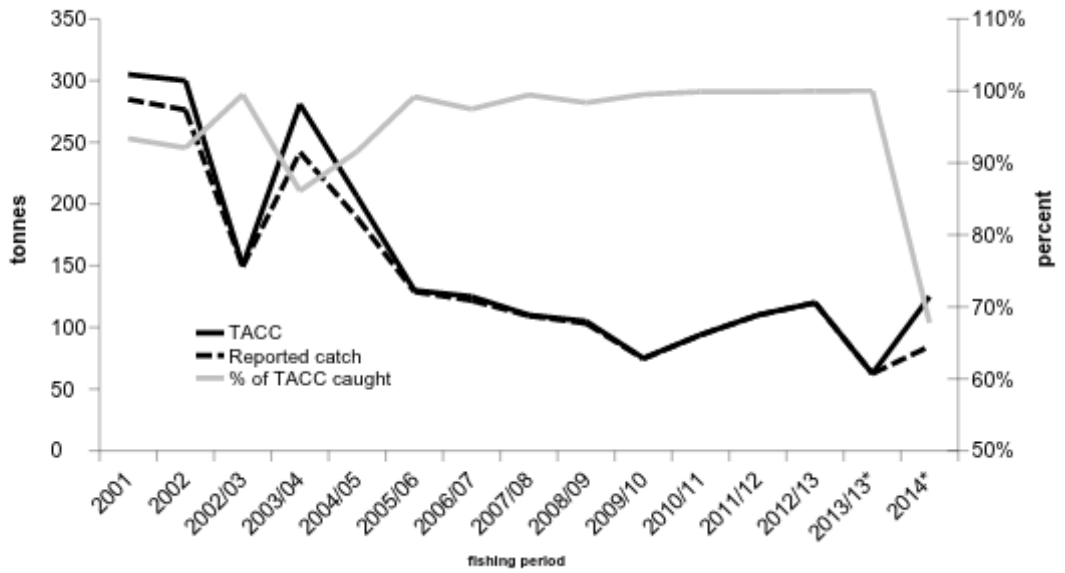
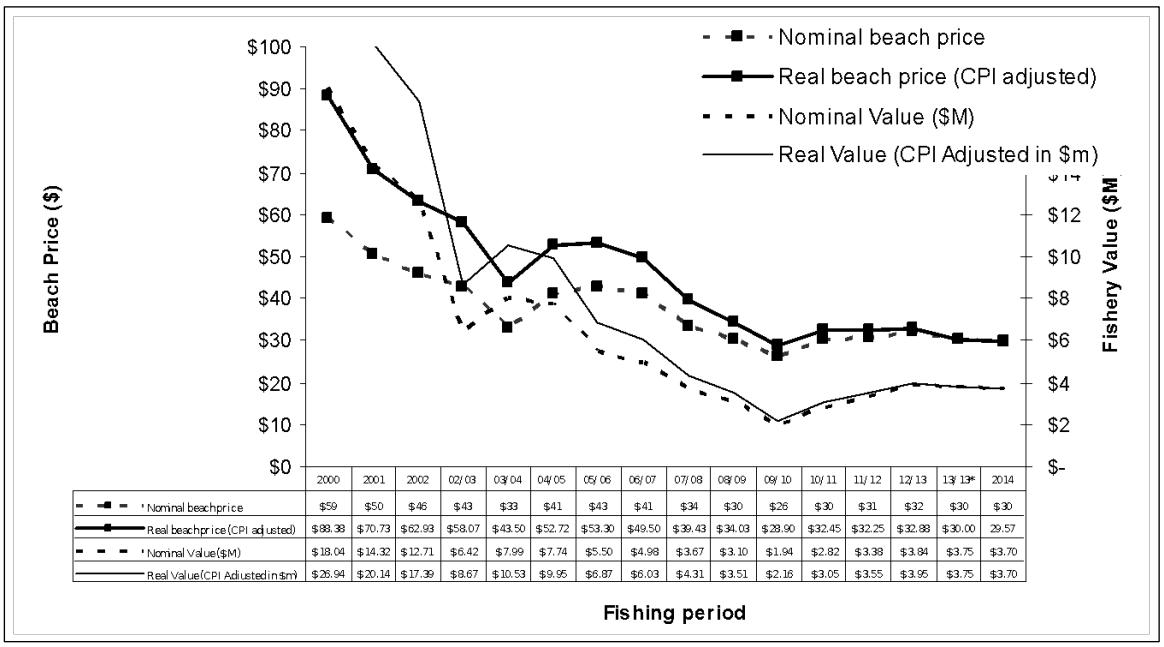


Figure 6. TACC (t), total reported commercial catch (t) and proportion of TACC caught (%) for each fishing period from 2001 to August 2014 (*note 6 month fishing period 2013; and incomplete year 2014).

The real value of reported catch of abalone in 2012/13 was $3.84 million, an increase of 11 per cent when compared to 2011/12 (Figure 7). Given the change in the fishing period between 2012-13 and 2014, it is difficult to accurately estimate changes in the gross value of production. However, converting to a twelve month equivalent for the period June 2013 – December 2013 indicates that the gross value of the fishery fell by 2 per cent to $3.75 million.

Since bottoming out at $2.10 million in real terms in 2009/10, the gross value of production has almost doubled over the past three years. Current 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	13/13*	2014
Nominal beach price	$59	$50	$46	$43	$33	$41	$43	$41	$34	$30	$26	$30	$31	$32	$30	$30
Real beach price (CPI adjusted)	$88.38	$70.73	$62.93	$58.07	$43.50	$52.72	$53.30	$49.50	$39.43	$34.03	$28.90	$32.45	$32.25	$32.88	$30.00	29.57
Nominal Value ($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	$3.75	$3.70
Real Value (CPI Adjusted in $m)	$26.94	$20.14	$17.39	$8.67	$10.53	$9.95	$6.87	$6.03	$4.31	$3.51	$2.16	$3.05	$3.55	$3.95	$3.75	$3.70

Figure 7. Estimated nominal and real value of the fishery ($m) and average nominal and real beach price ($) for each fishing period from 2000 to August 2014. 2013 catch figures have doubled to represent 12-month equivalent gross value of production. *Note: an industry report gives beach prices in the early 2000's which are lower than this table*

4.3 Abalone markets and prices

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

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.), of which the main export product is live abalone. Information from a shareholder in NSW indicates that this is still the case.

Prices for abalone are estimated from data abalone processors provide to the Department. In 2012/13, the average real price of abalone was $33.00/kg, which was a slight increase when compared to 2011/12 (Figure 7). Beach prices fell in 2013/14 due mainly to a weakening Japanese Yen.

Since 2000, prices for abalone 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 strength of the Australian dollar against the Japanese Yen and US dollar. 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.

Around 11 per cent of total abalone production in 2011/12 in Australia was sourced from aquaculture farms (ABARES 2013). This is up from 9 per cent in the previous year. The Australian cultured abalone sector has more than doubled over the past five years to 604 tonnes in 2011/12 (ABARES 2013).

Global production of cultured abalone has also grown, from around 1,200 tonnes in 2002 to 65,000 tonnes in 2010. Of this, China produced 56,000 tonnes and Korea 6,200 tonnes (FAO data). Production has continued to expand since 2010.

As costs associated with producing cultured abalone fall both in Australia and, more significantly in the key producing nations (China and Korea), prices for aquacultured abalone may fall, undercutting those for wild caught product in the future, particularly for smaller sizes of abalone.

ABARES (2014) have forecast that the Australian dollar will depreciate against both the US dollar and Japanese Yen over both the short and medium term. However the extent to which this will result in higher prices for NSW abalone will depend on the extent to which cultured abalone is substituted for wild caught product in the future. Anecdotal information from a Victorian processor indicates that there is a global surplus of good quality abalone (including cultured product) and that this is likely to result in lower prices for Australian abalone.

NSW abalone is sold through registered fish receivers 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 availability of quota).

The relatively small 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 Committee notes that the intention by SOS to open a processing plant in the northern part of the fishery should help encourage fishing in that section of the fishery.

Since the last TACC determination several shareholders / divers have begun to sell product through 'AFCOL' in Mallacoota. This shift has been driven by a shareholder / diver moving to Mallacoota, and shareholders / divers who also dive in the Victorian eastern zone finding it more convenient to sell product through the Mallacoota processing plant. With no daily catch limits applying to abalone landed at Mallacoota there may be increasing interest from shareholders / divers in landing catch through this port. The Department should keep a watching brief on movement in fishing effort towards this section of the fishery.

Evidence from a Victorian processor indicates that the size preference for abalone sold through AFCOL in Mallacoota may differ from processors in NSW. As AFCOL cans abalone, as opposed to live sale, they are happy with a range of sizes. However, the

strongest demand, and highest prices, is for smaller sized abalone (250g in the shell), which the NSW industry can supply.

In comparison, evidence from a NSW shareholder indicates that the main processor in NSW, Pacific Shoji, prefers larger abalone to supply live to Japan. The strongest demand, and highest prices, is for 130mm plus abalone. The other supplier of live abalone, SOS, currently will only take abalone at or above 140mm, which NSW cannot supply.

Evidence provided to the Committee at previous industry meetings indicated that tastes and preferences in overseas markets were changing away from product that can easily be supplied by NSW abalone fishers. In particular, it was stated that the niche market that NSW abalone previously held in Japan was shrinking due to competition from cultured product; and that a separate Japanese market was emerging for larger size abalone due to a recent change in tastes and preferences. It was also suggested to the Committee that reducing the size limit down to facilitate a 120g – 150g meat weight would allow NSW abalone to compete directly with cultured product. It was thought that there would be a market for live wild caught product in this size range and that consumers would pay the price premium that would be required for NSW wild caught product over cultured product. A counter view and one held by Tasmania, is that it is difficult to compete in the small abalone market which is dominated by aquaculture production and better returns are to be achieved from larger abalone.

Given the indicators above: potential strong demand for live abalone at current legal sizes in NSW that can be canned; potential strong demand for product at larger sizes than NSW can currently supply; and potential strong demand for live abalone at sizes below the current minimum legal length, it is more important than ever to undertake a marketing study to investigate, among other things, tastes and preferences for abalone on overseas markets, and size / price relationships for abalone on these markets. The longer this takes, the more difficult it may become 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. Once the abalone industry decides the size of fish they wish to be targeting, an appropriate TACC and size limit(s) can be determined under the planned harvest strategy to meet this economic goal.

The Committee notes that FRDC and the seafood industry (including the abalone sector) have previously invested in marketing initiatives. The Committee also notes that the Australian Abalone Council also co-invested in this work. The Committee recommends that industry invest further in this initiative, possibly by linking in with the broader Australian abalone sector through the Seafood CRC/industry-led work on the development of a marketing strategy for Australian abalone in China. The Committee is of the view that this is how research funds could (and should) be invested.

*The Committee **recommends** that Industry undertake a marketing study to investigate tastes and preferences for abalone on overseas markets and size / price relationships for abalone on these markets.*

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 40.89 kg/hr in 2012/13, most likely as a result of lower TACCs and higher size limits. The CPUE for the 8 months between January 2014 and August 2014 increased again to 47.40 kg/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 331g in 2014 to end August.

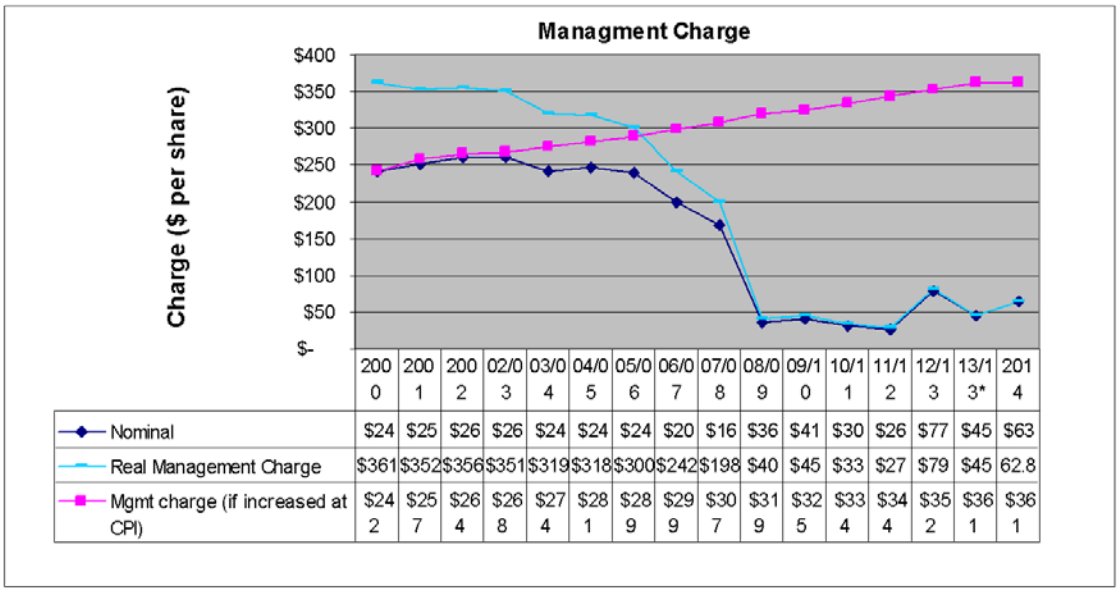
There was no evidence presented to the Committee that the increase in the lower size limit from 115mm to 117mm and from 117mm to 123mm south of Wonboyn has excluded significant areas of the fishery. Further, the increase in average weight of abalone has been in excess of that anticipated due to the increase 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 'default' MLL to 120mm in all regions of the fishery, with the exception of the area South of Wonboyn. As repeatedly stated by the Committee, there will be areas of the fishery identified that could (and should) be fished at a lower MLL than 120mm and arrangements to do this should be developed (e.g. by fish downs or area specific size limits). The Committee believes such a strategy will further improve economic returns for the fishery .

4.5 Management charges

Management charges in the abalone fishery reduced significantly from a high of $346 per share in real terms in 2002 to $27 per share in the 2011/12 fishing period (Figure 8). For the 2012/13 fishing period management fees were increased to $79 per share, which represented around 7 per cent of the gross value of production of the fishery. This is a similar proportion to the lobster fishery. In 2013/14 management fees were reduced again to $45.5 per share in real terms, which represented around 4 per cent of the gross value of production of the fishery. In 2014/15 management charges have increased again to $62.81 per share.

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.

The Committee notes that the low fee recovery in 2013/14 was made possible by unspent research funds, totalling $50,000, being returned to fishers. This underspend resulted in only $100,000 being spent on research in the abalone fishery out of the total $150,000 allocated in 2012/13. This is disappointing given that expenditure on research into the abalone fishery is essential to ensuring that there is an adequate level of information on the status of the resource. It is also surprising given that in last year's report the Committee advised that the 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 May 2013 open forum 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.



	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	13/13*	2014
Nominal	$24	$25	$26	$26	$24	$24	$24	$20	$16	$36	$41	$30	$26	$77	$45	$63
Real Management Charge	$361	$352	$356	$351	$319	$318	$300	$242	$198	$40	$45	$33	$27	$79	$45	62.8
Mgmt charge (if increased at CPI)	$242	$257	$264	$268	$274	$281	$289	$299	$307	$319	$325	$334	$344	$352	$361	$361

Figure 8: Nominal and real management charge ($) per share from 2000 to end August 2014

The Committee notes that the current level of management charge debt in the fishery is approximately $400,000 (falling from $900,000 over the last three years). Of the 48 shareholders, 12 currently have management fee debt, as compared to 19 in the previous year. As at the end of August 2014, average debt is $35,312 for debtors. This average debt is similar to that observed at the same time 2013. However at the end of August 2014, only three fishers had debts above $50,000, as opposed to four at the same time last year. 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, has resulted in the rate of debt repayment increasing.

4.6 Economic performance

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

Seventeen surveys were undertaken by EconSearch, on behalf of the Australian Seafood CRC, to collect information on both fixed and variable costs for 12 abalone fishing businesses with an average shareholding of 170 shares[12]. The information collected was

[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) were also included in the survey as they 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

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).

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 that catch their quota[3]. They also spent 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).

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

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

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).

In interpreting the results of the survey it is important to note that for some shareholders in the abalone fishery interest repayments on debt are a significant cost item. These shareholders are not near full equity and actual returns may be much lower than reported through the survey. Further to this, for highly geared shareholders, namely those who bought into the fishery when share prices were at their highest, profit at full equity may even be negative.

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, which 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 more information be collected 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	
2.9%	4.1%	7.3%	**Fishing business (100 shares)**
3.5%	5.3%	10.3%	**External shareholder (100 shares)**

Economic performance of small versus large fishing businesses

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

Whilst profit at full equity 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 fishing businesses / external shareholders would suggest that the abalone industry was profitable in 2011/12 and that a positive 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 improved gross returns in 2012/13 and 2013/14, and reported lower catching costs, it is likely that the profitability of the abalone fishery will have improved even further in 2012/13 and 2013/14. 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 management charge debt ($400,000) 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 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.

4.7 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 the return a fisher's investment in abalone fishing could have earned if invested in the next best alternative use (e.g. investment in another enterprise). 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].

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.

4.8 Shares

There are currently 48 shareholders in the fishery (increased from 47 in 2012/13). Of these shareholders, 38 had more than 70 shares and so qualify for an endorsement. The remaining 9 do not qualify for an endorsement and presumably lease out their 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 and 2012/13. This is the opposite of what has occurred in the lobster fishery, where the average number of shares per shareholder has increased as the fishery has rationalised. 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, there may be some redistribution of shareholdings from smaller to 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; and 10 in 2012/13. It has remained stable since this time. The distribution of shareholdings at each different level as of end August 2014 is illustrated in Figure 9.

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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 skillful 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.

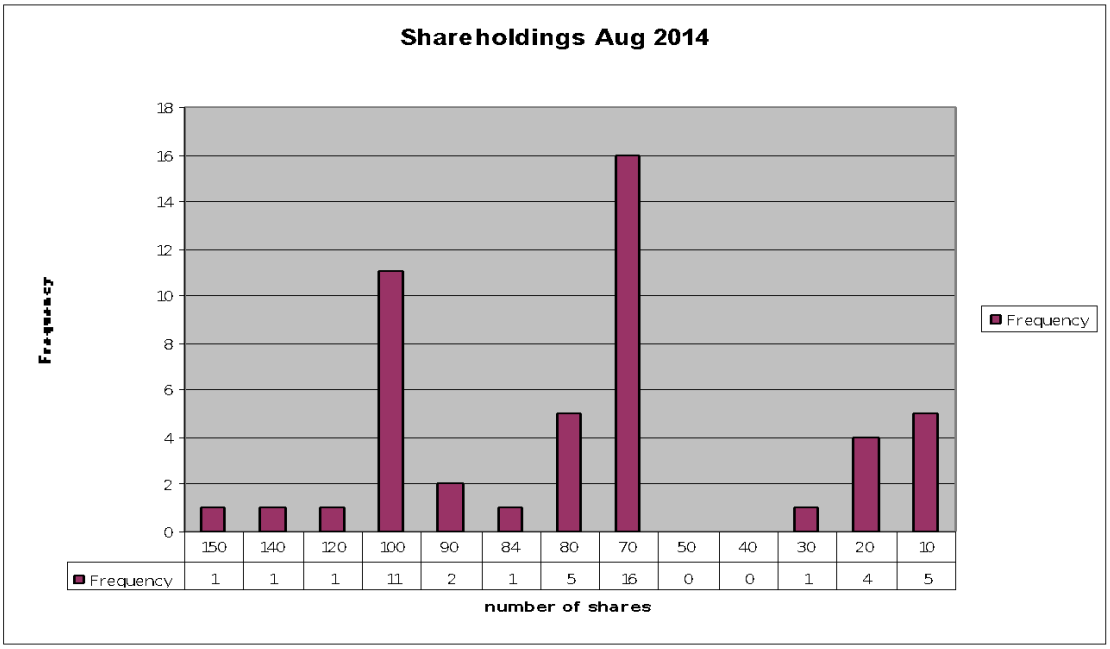

Figure 9: Number of shareholders at each level of shareholding as of end August 2014.

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 was 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 precise share prices in these transactions are commercial in confidence the average share price for the 6 transactions is estimated at $4,340 per share. There were two transactions totalling 30 shares in 2012/13 and a further 2 transactions totalling 140 shares to end August 2013. The average price for these transactions was in excess of $6,000 per share.

Since August 2013 there has been a considerable increase in share transactions and prices paid. There were 15 separate transactions involving the transfer of 744 shares, which equates to a 21 per cent turn over in the total number of shares in the fishery. One of these transactions was a transmittance of 70 shares i.e. a book transfer. Taking this transaction out of the price information gives an overall trade share value of $5.5 million, a price range of $6000 to $9350 per share, and an average price of $8,190 per share. This is an increase of 36.5 per cent in share prices when compared to those observed at the same time in the previous year.

The following comments are the fisheries manager's generalised opinion based on anecdotal information on share transactions that have taken place since August 2013. There were two purchases involving a modest and major consolidation by existing shareholders, a re-entry by a previous shareholder, at least 3 purchases by experienced divers/shareholders from Victorian zones, several others were experienced commercial (but not abalone) divers who intend to dive and several were non diving investors attracted by the prospects of a recovery in the fishery. Sellers included small and large shareholders with reasons for sale including: taking advantage of the price for profit or loss management/debt reduction; retirement; and concerns regarding long-term markets.

The return to share trading in the fishery is evidence of the improvement in economic returns from abalone fishing and optimism based on the likely improvement in the fishery in the future. 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 share transaction 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 to further improve the economic viability of the fishery.

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.

4.9 Nominated divers

Diver numbers appear to have been more responsive to the economic circumstances of the industry than shareholders consolidating shareholders. Diver numbers have trended downwards since 2008/09, from 35 to 26 in 2012/13; however they increased to 30 in 2013/14 due to the entry of new shareholders into the fishery (Figure 10). The most recent five fishing periods show a continuing trend for fewer numbers of divers to take a greater percentage of the catch (Figure 11).

The average number of days fished per diver fell from 69 days in 2004/05 to 21 days in 2009/10 and 20 days in 2010/11. It increased to 23.3 days in 2011/12; 28.4 days in 2012/13; and 24.3 days in 2013/14 (Figure 10). This is due in part to increased TACC's; but is mainly a result of the limits processors are placing on daily catches. The number of days required to catch a given quota would be considerably less without daily catch limits. The average catch per day has increased from 57kg/day in 2004/05 to 118kg/day in 2009/10; 154kg/day in 2010/11; 173kg/day in 2011/12, then decreasing to 162.5kg/day in 2012/13. It increased again to 178kg/day in 2013/14. Again daily catches could be far higher without processor-imposed limits.

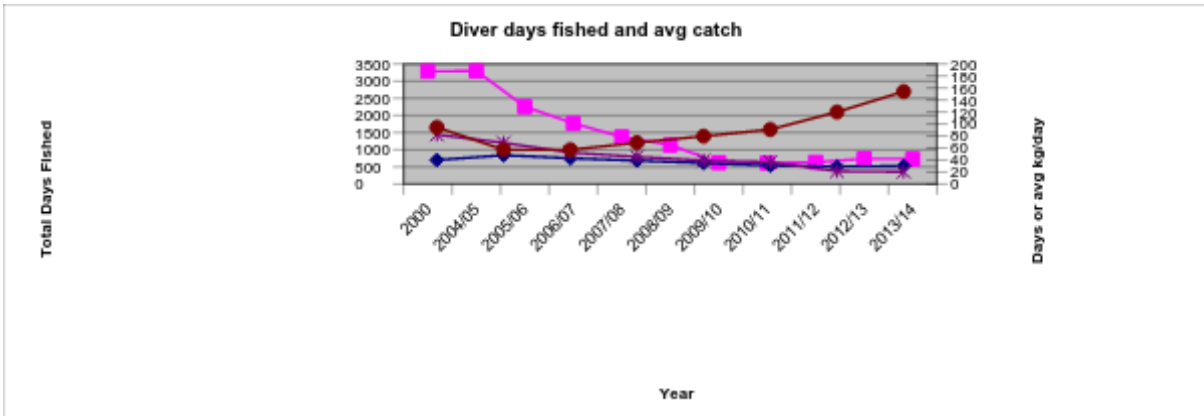

Figure 10: Total days fished, average days per diver and average catch per day from 2004/05 to 2013/14

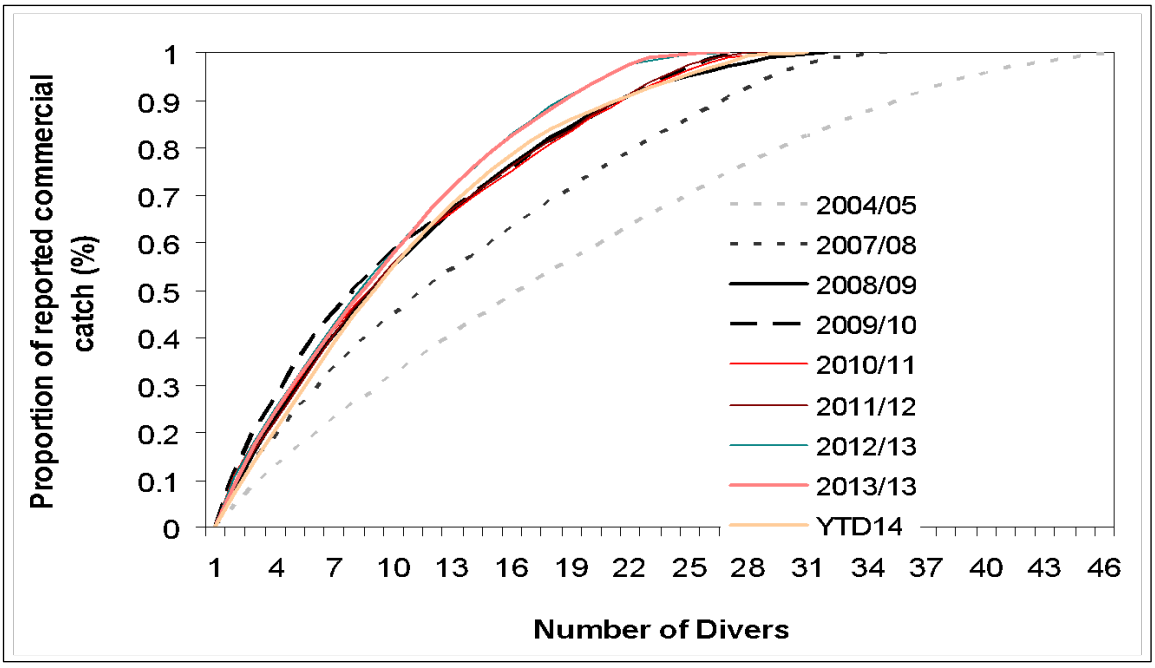

Figure 11: Percentage catches accumulation by divers from 2004/05 to August 2014 (*note: 6 month fishing period 2013; and incomplete year 2014).*

4.10 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 2012/13, 21 shareholders leased out quota, and a total of 27 quota transfers were processed; in the last six months of 2013, 21 shareholders leased out quota, and a total of 25 quota transfers were processed; and in 2014 to end August 24 shareholders leased out quota, and a total of 30 quota transfers were processed. This is down from 2011/12 when 25 shareholders leased out quota, and a total of 43 quota transfers were processed, indicating that the quota market has become less active (Table 2).

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 to 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 that 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 August 2014

Processed quota transfers	Number of shareholders transferring out quota	% TACC	Amount of quota transfer in (kg)	CY or FY
N/A	7	5	18,800	**1998**
N/A	13	9	31,000	**1999**
N/A	23	11	33,158	**2000**
Minimum 19 (exact no. not available)	19	7	21,016	**2001**
N/A	23	15	46,376	**2002/03***
30	25	12	34,937	**2003/04**
Minimum 28 (exact no. not available)	23	14.3	29,474	**2004/05**
34	21	18	23,428	**2005/06**
43	21	23.8	29,743	**2006/07**
37	20	22.35	24,589.9	**2007/08**
47		31.2	32,826	**2008/09**
24	21	32.7	24,511.7	**2009/10**
39	22	31.8	29,910.8	**2010/11**
43	25	29	31,993.1	**2011/12**
27	21	30.6	36,702.8	**2012/13**
25	21	27.9	17,471.9	**2013/13** **
30	24	30.8	38,577.9	**2014*** **

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

** 6 month fishing period

*** to end August - 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.

4.11 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 has been estimated to be as high as 40 per cent of legal take, which in 2013/14 represented around 52 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 17.2 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 2013/14 gives an estimated value of $1,031,184 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 increase the rate of recovery of the stock, is essential. Such investment should reduce the level of illegal catch, which could be returned to the commercial sector or could be left in the water to speed up the rate of recovery.

In 2013/14, 3,182 abalone were seized, which is up from the previous season when 2,174 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 $11,837 of lost value to the fishery.

The Committee is reassured that the number of seizures and serious abalone offences has been trending down over the past few years.

4.12 Recreational and Aboriginal 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 Aboriginal catch. Current estimates of recreational and Aboriginal 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 Aboriginal catch.

The Committee notes that there is a proposal to increase the recreational abalone bag limit from 2 to 5. The Committee understands that this increase is supported by both the members of the former Abalone Management Advisory Committee and the Advisory Council on Recreational Fishing. The Department advises that it intends to consider this increase in future reviews of recreational catch. 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 the harvest strategy and management plan for the fishery is in place.

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

4.13 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.

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 could be inflated using the labour price index and fuel costs inflated using the cost index for petrol. Average income would be adjusted based on fishery GVP[6].

The Committee notes that that EconSearch intends to use the data collected through the surveys conducted in various abalone fisheries 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 EconSearch 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.

*The Committee **recommends** that the Department and Industry work together to update the base data obtained from the EconSearch survey on an annual basis 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.*

4.14 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 suggest that in 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 each 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, which 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.

4.15 Performance indicators for the fishery

The Committee notes that the economic indicators and triggers in the 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 is being developed in the draft interim harvest strategy for the Abalone fishery. The Committee also notes that these indicators will be refined and expanded upon as the full harvest strategy is developed, and in any management plan for the fishery. Economic performance indicators for the fishery should relate to long-term profitability.

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.

4.16 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.

4.17 Conclusion

The short-term profitability and long-term outlook for the NSW Abalone Fishery continues to improve. A recent increase in share trading and values attest to this; share values increased by 36.5 per cent over the 12 months to end August 2014.

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 that 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 in the draft interim harvest strategy 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. In particular, the Committee recommends that industry undertakes a marketing study to investigate, among other things, tastes and preferences for abalone on overseas markets, and size / price relationships for abalone on these markets.

The Committee's continued conservative determination for the TACC is based on a commitment to rebuild a robust and profitable fishery. The size limit changes 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 2015 TACC decision is outlined, as well as the reasons for the decision and some further recommendations.

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, as for last year, verified information and analysis are not available to quantify the extent of the stock recovery with sufficient confidence. The Committee noted in its last report that without the information to assess the risks to the stock of future catch levels further TACC increases are likely to be considered too high-risk. It noted that until new information becomes available to address the existing uncertainties, a cautious approach is required.

It is in this context of generally positive signs with some concerns about specified Areas of the fishery, that the 2015 TACC is determined at 130t but predicated on formalised catch spreading mechanisms being put in place to spread the additional catch away from those potentially vulnerable Areas.

The Department has reported on its progress in developing an interim harvest strategy. The Committee strongly supports this work, and notes the importance of effective industry engagement in the process.

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.

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 and price pressures 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, which provides increasing and relatively stable catches at high 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 in that few recreational fishers targeted abalone. In addition, it effectively prevented the use of frequent repeat illegal catches taken under the guise of bona fide recreational fishing. 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. Targeted surveys to estimate recreational abalone catch and effort would be required to provide robust estimates, particularly when and if bag limits are increased (see below). Identifying an adequate sample size in small recreational dive fisheries is notoriously difficult and therefore expensive unless divers are identified through some type of registration such as a licence endorsement, as is the case in Tasmania. If not, experience in other jurisdictions would suggest that the costs of surveying divers would be prohibitively expensive. Consideration should therefore be given to licensing recreational dive fishing for the purposes of enabling cost-effective surveys of recreational catch and effort, or some other method of identifying divers (for example, through a tick-box on the existing recreational licence application form). It is understood that a licence endorsement for abalone diving, even if provided at cost, is not likely to be acceptable in NSW,

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 consider this increase in future reviews of recreational catch limits.

The Committee considers that this change may result in a significant increase in recreational harvest and in particular could 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. It also raises the possibility that recreational catch could, in some Areas, impact on commercial catches. There is currently no resource sharing arrangement to manage these impacts.

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 to manage any increases in total catch and changes in relative share between the commercial and recreational sectors.

*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. If this cannot be agreed, then any increase in the recreational bag limit should be accompanied by additional monitoring of the recreational catch, and that measures to control the catch from vulnerable areas (e.g. Region 2) be considered*

*The Committee **recommends** that recreational abalone dive fishers be required to hold an endorsement to a recreational fishing licence for the purposes of enabling cost-effective surveys to estimate recreational catch and effort, or that the Department explores other methods of identifying diver fishers so that targeted surveys can be conducted.*

5.2.3 Aboriginal 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 in 2012/13. To date in 2013/14 two permits have been issued approving a total of 800 abalone. The actual amount of abalone taken under permits is unclear. Based on the advice from the Department's compliance staff that it is significantly less than the amounts formally permitted it is the Committee view that this catch is highly unlikely to have a detectable impact on the resource.

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, without spatial management considerations these can be blunt instruments for managing an abalone fishery. Increasingly, and in common with other abalone jurisdictions, NSW is implementing finer scale management of the

commercial abalone fishery with voluntary catch caps for Areas and two MLLs (117mm for most of the fishery; 123mm from Wonboyn south).

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 to ensure that past patterns of localised overfishing and serial depletion are not repeated as the fishery rebuilds and TACCs increase over time. It is difficult to progress this work without strong and ongoing Government commitment, and the resources to move to a more formal management framework.

As noted in the two previous reports, a formal framework would ideally include:

- applying the recommended MLLs – implemented in a way that the MLL can be selectively relaxed in the future where it is demonstrated that the stocks are 'stunted' (slow growing) and it is cost-effective to apply differential rules to that area (see 3.2.1);
- 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 (i.e. applying the harvest strategy).

The Department reported on its progress in developing a draft interim harvest strategy and its intention to engage with fishermen in the near future. This is a significant step forward and the Committee strongly supports this work, noting that progress since last year has been limited. As stated previously, in our view this process must be undertaken in close consultation with industry but be driven, implemented and monitored by the Government in its role as regulator of the abalone fishery as a community resource.

As previously stated, the Committee suggests that an effective harvest strategy should be based on the following guiding principles:

- The objectives and content 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.
- Performance indicators should be measurable and appropriate, given the shift to fine scale management, new monitoring and assessment arrangements and catch planning workshops.
- The respective roles 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 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 Committee notes that the current levels of cost recovery in the fishery are insufficient to provide for adequate management of the resource and that the costs of implementing the harvest strategy need to be explicit. 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.

The Committee supports the development of an interim harvest strategy and ***recommends*** that a draft be distributed for industry consultation as soon as possible with a view to being able to apply the interim harvest strategy for 2016.

Further discussion on spreading catch spatially

The proposed comprehensive management regime has been described in various reports and correspondence in recent years, including the two previous Committee reports. This year, as an interim step towards the full management arrangements described, the Department has indicated a willingness to implement, in conjunction with the TACC determination a "northern quota" and "cap and close" arrangements at the Area level. This will enable the additional TACC to be allocated, with measures in place to prevent the catch being taken from Areas of uncertainty and potential stress (Areas 14-18 as discussed in the stock status section of this report). The proposal discussed at the meeting and subsequently with the Department is that the TACC will be allocated as normal and be able to be taken across the entire fishery but a specified portion of it will be allocated to the defined northern zone and will only be able to be taken from that zone. In other words, this special zone will overlap with the existing quota zone and both types of quota would be able to be taken from the special zone. Catch will therefore be spread to the more lightly fished northern part of the fishery. There will need to be discussion with industry and researchers on where to place any boundary delineating the northern zone. The initial thoughts of the Committee are that the line be placed north of the boundary between Regions 3 and 4.

Preliminary discussions between the Department and industry on this proposal have reportedly been positive. Nevertheless, these proposed arrangements are subject to a range of considerations including:

- the ability of the DPI Fisheries computer system to accommodate the new zone and the costs associated with any necessary changes/adaptions;
- consultation with industry on any additional costs; and
- approval by the relevant statutory decision-makers (Minister or delegate depending on the method of implementation).

The Committee ***recommends*** *that i) a "northern quota zone" is created and a specified portion of the TACC is allocated to that zone, in proportion to holdings on "normal" quota and ii) that "cap and close" arrangements are put in place to limit the amount of catch from specified priority Areas to specified limits.*

While the issues above are being worked through, and if a way forward on a northern zone cannot be found by the next quota year, the Committee considers that the use of 'cap and close' management will be particularly important to ensure an appropriate spread of catch.

5.3.2 Data collection and stock assessment

Formal catch and effort information is collected through regulated logbooks and managed in a Departmental database (the quota management system). The data logger program is implemented by the Abalone Council of NSW as a service provider to the Department. The Council engage their own scientific adviser (Duncan Worthington) to provide the technical expertise to fulfil their contractual responsibilities. The data logger information is uploaded into the Abtrack database, which is managed by the Council. Arrangements are also in

place between the Department and the Council to confidentially share logbook information so that it can be integrated with the logger data.

Due to the low levels of funding for abalone research (both cost recovery and Departmental budgets) the resource assessment that is traditionally provided by the Department is based only on the raw catch and effort data collected through logbooks. The assessment has therefore been 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 light of this, the Department has this year improved the process by reviewing the industry report ahead of the Committee meetings rather than doing its own limited review of catch and effort data in isolation from the majority of the information. This is a small but significant improvement, which assisted the Committee. Nevertheless, deficiencies in the availability of data and analysis still exist. These are outlined in the stock status section of the report above and it is to be hoped that these and other related issues will be addressed through the harvest strategy.

The Council conducted an industry workshop in August 2014 to develop industry recommendations for local Area catch targets and the TACC. The Council (represented by Dr Worthington) provided a lengthy presentation to the Committee, with information for selected Areas from the data loggers in addition to the logbook data. In summary the industry position is that the TACC should be increased to 136.6 (i.e. the same level recommended in 2013). In putting this position, emphasis was placed on continuing high catch rates.

In addition to the presentation, further information was requested of the Abalone Council by the Committee subsequent to the meeting. Some of this information was able to be provided, subject to the constraints of time and the contractual arrangements with the service provider. The balance of information was not available for this year, and the section on biological considerations provides guidance as to the additional analysis that the TACC would like to see done before the next round of TACC setting.

The industry report and presentation again confirmed the general effectiveness and capacity of data loggers to collect information on fishing that is essential as part of a structured approach to spatial management. The information being collected provides an opportunity to analyse catch and effort trends at fine spatial and temporal scales through the analysis of dive events, which can be can be aggregated up to reef, sub-zone or Area level as required, and analysed for within-season and across year trends. This information can be integrated within logbook data and length-frequency data (from the Measuring Board (MB) loggers used by two divers and at processing facilities) to provide spatially structured catch, effort and size information.

There has been some structured fishing in 2014 whereby participating divers tag their first bin of each day and each abalone in that bin is measured using an MB logger at the processors. This information can be cross-referenced with dive logger and logbook data to provide the location of this catch. Diver comments are collected in relation to each of these bins. However, more structure should be built into this program, particular to enable comparisons of the same sites across time. The length-frequency measuring undertaken by some divers should also be integrated into the structured fishing program to ensure the most effective and efficient data set is built up. The data collection program will be a fundamental part of the interim harvest strategy – the structured fishing program should be designed as part of the strategy.

The Council's presentation to the Committee and subsequent provision of data on request reinforced that 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).

This should be done through the development and implementation of the interim harvest strategy.

Irrespective of these suggested improvements, there continues to be some positive signs in the available data. 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 can be 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 gives due consideration to these industry views as a part of interpreting the data as they are based on diver experience and observations. 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 still exist, as they did in the two previous Committee reports. 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. The data collection and analysis necessary to rule this out are not available. Rather, these potential signs continue to appear in the data and reinforce the Committee's caution in putting any more pressure on those Areas in which the rate of recovery is possibly slowing.

Some preliminary estimates of harvest fraction were also presented for the first time. As discussed in the stock status section, whilst these are crude estimates, they do represent potentially high harvest fractions that, at a minimum, warrant further scientific work (noting that the data available are limited).

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 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.

5.3.3 Management plan

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, inappropriate targets and indicators, and is in urgent need of review.

The fishery has no long-term objectives, meaningful indicators or reference points, which materially impacts TACC decisions (e.g. 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 harvest strategy/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. In addition to the problems these shortfalls cause for the Committee, the lack of a transparent management framework creates uncertainty and frustration among industry, who perceive that the Committee is being needlessly precautionary.

As noted above, the Department's recent work to prepare a draft interim harvest strategy is a significant step forward in meeting the deficiencies in the current management arrangements. The Department has advised that it is preparing an interim strategy, which it intends will be reviewed in approximately 3 years, with a view to then refining it and establishing an ongoing harvest strategy. Ideally, the ongoing harvest strategy will sit within a revised management plan for the fishery, which the Committee continues to recommend. The revised management plan should, among other things, formalise the co-management arrangements in place for the abalone fishery and establish appropriate governance mechanisms.

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

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 (Abalone Council of NSW) to undertake data collection and analysis. The Committee understands that there is an ongoing lack of clarity about the respective roles of the Department and the research providers, although this has improved recently. 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. In the short term consideration should be given to how industry input will be provided in implementing the interim harvest strategy.

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 scientific advice provided. Standard governance arrangements such as the use of independent chairs, Departmental oversight of industry driven research, 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 logger information for assessment, management and governance purposes. In the past there have been assertions 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 audit the quality or even understand the basis of the industry recommendations on catch levels and Area management. The arrangements need to be sustainable beyond a particular service provider.

The Committee **recommends** that the Department secures 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 have represented 3.6% of GVP in 2011/12, increasing to 6.94% in 2012/13 and decreasing to 4% in 2013/14. For 2013/14 the management fee was $45.47 per share and this year has increased to $62.81 but this is estimated to represent 4% of GVP. 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 in 2008 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. It is recommended that the interim harvest strategy includes research priorities and that adequate funding is available to address those priorities.

Further, in addition to research and monitoring, the Committee notes that the current levels of cost recovery in the fishery in general are insufficient and that the costs of implementing the harvest strategy need to be explicit.

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.

The Committee **recommends** that the interim harvest strategy that is being developed include research priorities and that adequate funding is made available to address those priorities.

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 and therefore lower rates of compliance. Therefore, crude 'compliance rate' information is difficult to draw conclusions from without also being supported by qualitative explanations. The Committee has previously recommended that the Department investigate presenting the available statistics in terms of both compliance rate and detection rate, and present the data with the relative amount of compliance effort applied each year, to allow more meaningful comparison across years. While there are difficulties with this, the explanatory notes in the report help to explain the raw data.

In this reporting period, the compliance rate for licensed abalone divers dropped from 71% to 51%. This is largely explained by a crackdown on late catch returns and is comprised mostly of relatively minor offences. However, catch returns are a fundamental component of the efficient management of the fishery and returns need to be on time and of a high standard. The Committee supports the Department's work in this respect. Some serious offences were also detected in this sector through compliance operations and these were discussed with the Committee and industry.

The levels of compliance in the recreational sector have risen from 56% in 2012/13 to 69% in 2013/14. Notably, non-compliance in this category is attributed to targeted illegal activity that is unlicensed (i.e. as opposed to minor offences by 'genuine' recreational fishers). The compliance report notes that the Department continues to develop 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 – which is a more effective strategy but appears as low compliance rates due to the way the statistics are presented. The Department reported on numerous operations targeting abalone theft during 2013/14.

As in previous reports, 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.

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

The amount of compliance effort put into the abalone fishery in 2012/13 increased since 2011/12 - for unlicensed activity approximately 4790 hours (up from 4670) and for licensed commercial approximately 1654 hours (up from 1478). Fisheries compliance effort into the recreational and targeted illegal abalone sector for the 2013/14 season was approximately 3189 hours. Fisheries compliance effort into the commercial sector was approximately 452 hours. 37 quality inspections were conducted on licensed abalone fishers.

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 Department estimates that the current illegal and recreational catch would be at the low end

of this scale. The introduction of indictable offences for abalone theft, the targeting of poaching syndicates by compliance officers, and the development of improved methods to permit Aboriginal catch are all thought to have improved the situation. The Compliance unit also report that the heavier penalties applied to high-end abalone offences is starting to have a deterrent effect.

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 described above, 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 so that industry can 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 2015

Similar information was presented to the Committee this year as it was last year. However, there were significant improvements in the presentation and timing of the report and some (albeit crude) estimations of harvest fraction. This, in addition to the growing time series of logger data, is contributing to an emerging picture of how the stock is performing. At this stage, the additional information and analysis confirms the existing uncertainties in our knowledge of the resource, its potential and the impact of catch on the rate of recovery. Nevertheless, the reporting of logger data at fine spatial scales is enabling the distinction between Areas that are showing signs of slowing in recovery in contrast to those that appear to be able to handle maintained or increased catch levels (see stock status section of this report).

As noted last year, it is of concern that the industry recommended TACC, which is the sum of proposed Area catches, again recommends increases in some of the potentially slowing Areas. This is not a criticism of industry but reinforcement of the need for a harvest strategy and agreed approach to analysing catch and effort information.

Having noted this, the Committee agrees that a modest increase in TACC to 130t is appropriate. The Committee has gone through its own process of identifying Area limits – the recommended limits and rationale are set out in the stock status section of this report.

It is important to note that if neither the requisite "northern zone quota" nor the "cap and close" arrangements are in place for 2015, the impact of the 130t TACC on the fishery could be to further slow the rate of recovery for the fishery and in particular in some Areas. Future TACC determinations will take this into account.

Even if a "northern zone quota" is not implemented, it is hoped that "cap and close" arrangements, which we are advised are administratively simpler to implement, will suffice to limit the impact of the identified Areas.

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. Ex industry MAC members have resisted most attempts to increase in minimum size through vocal and continuous protest, commencing when the size limit was increased from 115 to 117mm. This increase, and subsequent increases in size limits, have been beneficial to the fishery and strongly supported my many in industry.

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 has taken the position in the past that it would be derelict in its duty not to condition TACC determinations with advice on size limits and spatial distribution of catch as an integral part of the TACC determination.

In response to the previous Committee report, the Department has advised that at present it considers that the biological benefits to increases to 120mm MML across the fishery north of Wonboyn are outweighed by the costs "in terms of industry conflict and potential loss of market opportunity". In relation to spatial distribution of catch, the Department reports that it will progress this issue through the development of the interim harvest strategy.

The Committee appreciates the clarity provided on this issue and looks forward to the development of the interim harvest strategy. However, in relation to size limits, the Committee maintains that the setting of biologically-appropriate size limits is integral to the functioning of a fine scale management system, especially as the fishery rebuilds and TACCs increase. Size limits will be an important management lever to avoid growth and recruitment overfishing as experienced in the past. The Committee therefore maintains that size limit decisions need to be integrated with TACC decisions in some way. Given that the Committee is established under the Act as a statutory body for the express purpose of making what can be controversial decisions at arm's length from government, we consider that the Committee is well-placed to make size limit decisions. Our recommendation from previous reports is therefore repeated:

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.

However, irrespective of the Department's position on whether the Committee should be required to make size limit decisions, the priority is that the issue of size limits is considered and that those decisions are linked to TACC decisions in some way. The development and implementation of the interim harvest strategy provides an opportunity to do this.

*The Committee **recommends** that the Committee 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 continues to show 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 and catch rates 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 continue to be observed after initially being identified last year, particularly the reduction of those indicators in other Areas.

The positives 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. Some significant improvements have been made this year. 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. The Committee is encouraged by the Department's report of progress in developing an interim harvest strategy and urges the Department to develop the strategy quickly for consultation.

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 increases.

The Committee does however feel confident that the growing time series of logger data is providing a reliable indication of the Areas of the fishery that are continuing to rebuild strongly, in contrast to those where signs of slowing may be appearing. Overall, the Committee has judged that a modest increase of 5t is appropriate, providing that the catch is spread away from the high-catch Areas showing potential slowing, to those Areas clearly capable of having sustained or increased catch taken out of them.

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 January 2015 to 31 December 2015 should be **130 tonnes.**

In making this determination, the Committee has recommended a spatial distribution of catch, by Area. The Committee is recommending this TACC under the assumption that the Department, in consultation with industry, will manage the fishery to achieve an appropriate spatial catch distribution. The use of 'cap and close' arrangements will be necessary to ensure such a distribution. The introduction of a Northern Zone in the fishery, if implemented, will provide a requirement to take a proportion of the catch from the more northern areas of the fishery thereby spreading catch and effort to the more lightly fished section of the fishery.

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*.

Consultation Stages	Fisheries Management Act	Date
Committee called for public submissions on the appropriate level of the annual TACC for Abalone for 2015 fishing period.	Section 31(1)	10 September 2014
The advertisement was placed in the Sydney Morning Herald, the Daily Telegraph and made available at NSW DPI Head Office and Fisheries Offices.	Section 284 (1b)	11 September 2014
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	Section 284 (1b)	10 September 2014
The Committee allowed a period of at least 30 days for public consultation.	Section 284 (1b)	12 October 2014
The Committee gave regard to the following submissions. The respondent included the following: ■ NSW DPI – Commercial Fisheries Management, Research, and Compliance. ■ Abalone Shareholders	Section 31 (2)	
The submissions were collated and analysed, and the Committee heard formal presentations regarding views and opinions at the meeting held on 8 October. The following made presentations, or provided information to the Committee: Note one submission was considered despite being received by the Committee on 13 October 2014. ■ Cameron Westaway – Senior Fisheries Manager, DPI ■ Anthony Chen – Senior Investigator, Special Operations, DPI ■ Duncan Worthington – Abalone Council of NSW ■ John Smythe Abalone Shareholder/diver ■ Bob Lewis – Abalone shareholder/diver		8 October 2014

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

Submission provided by*[8]	Issue(s)/Recommendations
Abalone Council of NSW[9]	Submission comprised: ● Annual Area logbook summary by Year since 1999 with catch data to end June 2014 ● Monthly Area logbook summary for 26 months with catch data to end August 2014 ● Commercial catch until end August 2014 in the 2014 Fishing Period against catch targets. ● Summary of outcomes from open abalone fishery Workshop held August 19 2014 ● Annual Zone logbook summary from July 1982 with catch data to end August 2014 ● A Submission to the Committee setting process for abalone in 2015, including logger data analysis The submission notes that: the TACC and catch remain well below historical levels, but is concentrated in areas south from Bunga (Areas 10-21).; changes in catch among areas have still seen record catch rates maintained, and gradually increase, together with gradual increases in the size of abalone above the size limit; logger performance indicators suggest stocks are mostly fully fished and stable at current catch levels south of Bunga; estimates of exploitable biomass, and comparison of logger-based estimates with historic model-based estimates, suggests biomass increased significantly for several years, but is now more stable, despite ongoing gradual increases in catch rate and weight of abalone; less clear how much more recovery of stocks is possible at current levels of catch in southern areas, but there remains the opportunity to increase catch in some areas, and particularly north of Bunga to the Queensland border. Reports that the Catch Planning Workshop recommended an increase in the TACC from 125 t to 136.6 t (i.e. the same level recommended in 2013), with increased catch targets in Areas 10 and 14-15, to levels consistent with current catch, and decreases in Areas 1-4 and 18, again more consistent with current catch. Suggests that the increased TACC recommended for 2015 would see more catch being taken, than has been in recent years, and highlights the opportunity for a separate northern quota to ensure catch is taken in the north, which appears to be a priority for the fishery. Notes that a formal Harvest Strategy for the fishery should also be progressed, including a commitment to analysis, measuring and reporting programs in the fishery, and that no contract for this has work has been in place since June 2014. Suggests further commitment should also be made to the GPS logger program i.e. beyond the current contract, which ends in June 2015.
Confidential Submission *	.

[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 confidential submissions have been removed from this version

[9] Additional data and analysis was provided by Duncan Worthington as requested by the Committee, noting that this activity was hampered by the lack of a current contract.

Confidential Submission*	.