
**TAC
Committee**

**Total Allowable Catch Committee
Report and Determination for 2016**

ABALONE FISHERY

7 December 2016

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EXECUTIVE SUMMARY AND RECOMMENDATIONS

The Total Allowable Catch and Review Committee (the Committee) in 2015 comprises four members: Mr Ian Cartwright (Chairman); Dr Keith Sainsbury (fisheries scientist); Dr Jessica Hartmann (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 at the TASC forum held on the 9th and 10th November 2015 in Merimbula. The TAC Forum provided 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 has been substantial improvement in the state of the stock in recent years, starting in about 2006 but particularly since about 2009. The TAC reductions and increased LML have succeeded in providing additional accumulated stock above the LML since the mid-2000s when those management interventions began. The stock has shown considerable rebuilding, as evidenced by the substantial increases in catch rate and mean weight of abalone. This increase is also mirrored in the biomass estimates from the GPS logger observations; while these estimates are preliminary they indicate an about doubling of exploitable biomass since 2009.

While the overall trend toward recovery in the past 10 years is very clear it is also now clear that stock rebuilding has slowed considerably in the past 2-3 years as the catches have increased. The key catch rate and mean weight indicators are plateauing. The plateauing of these indicators was first recognised in a few Areas in 2013, it was more widespread in 2014 and it is now seen in almost all Areas of the fishery. The plateauing seen in the catch rate and mean weight observations is also seen in the biomass estimates from the fine scale logger observations for Areas 1-10 and 14-21 (i.e. SMUs 1, 3 and 4) and in the logger derived density (Kg/Ha for the fishery as a whole. This is also consistent with the relatively high harvest fractions (i.e.15%) estimated for SMUs 3 and 4 from the logger observations in recent years.

Some implications of this plateauing of the recovery in recent years are:

- The recent catches have been taking most of the surplus production, leaving relatively little to contribute to rebuilding.
- The rebuilding is not robust, in that it has been significantly slowed by relatively small (about 30t) TAC increase since 2011.
- The rebuilding is likely to be very incomplete because the fishery catch history suggests that surplus production from the fully recovered population would be considerably larger than current catches. This implication would be much better understood if a population model was used to characterise surplus production and quantitatively estimate the current status/recovery of the stock, as further elaborated in the body of the report.
- Under current TAC and LML settings the stock may stabilise close to its current status, or any continued rebuilding is likely to be slow.

A period of low abalone productivity was anticipated from earlier population modelling to occur in about 2011-2013, assuming past productivity patterns persisted. It is possible that

the timing or duration of this low productivity period has extended into the 2013-2015 period and contributed to the observed slowing of stock recovery. If this is the case then it is expected that the low productivity period will eventually be replaced with more normal productivity, and more rapid recovery under current management settings would resume. But until such a productivity increase is observed management must be on the basis of protecting the stock under the current productivity regime, and in particular not depleting the stock again during periods of lower productivity.

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 LML. The management situation is more complex, with the rebuilding proceeding differently in different Areas and slowing overall. This more complex situation requires greater information support than previously. Previously the imperative was to stop further stock decline and begin recovery, and that can be addressed (albeit inefficiently) with little information. Currently the challenge is balancing continued recovery, management reform to prevent a return to overfishing and localised depletion, and catch levels. In this there are limitations and risks from the few stock status indicators available, poor knowledge of the current status and surplus productivity in relation to full recovery, 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 analysis of the monitoring data and modelling of population dynamics. Without improvements to this investment the future is likely to be continued uncertainty and the need for considerable precaution. In regards to analysis and modelling the Committee notes that the management changes and stock rebuilding during the past about 10 years has resulted in potentially very informative trends in the key indicators, and the Committee recommends that formal population modelling should be conducted. This modelling should be strategically focused to provide guidance for management in the next few years on reference points related to productivity thresholds for the indicators currently available. An aspect of this modelling would necessarily be consideration of the LML.

While taking measures to continue stock rebuilding the Committee has also been concerned to identify and rectify the past management settings that allowed overfishing to occur previously. Without this rectification there is risk that overfishing and stock collapse could occur again. The Committee considers that two features of the management settings are important in this:

- ***Finer scale monitoring, assessment and management.*** The logger program has augmented the logbook program and considerably improved the ability to monitor and assess abalone at finer space scales. Finer scale management of catches is improving but it is still not adequate to deliver the spatial distribution of catches that is intended. There is a need to develop more formal methods to control the catch from Areas, and to more formally develop Area and SMU catch caps, targets and tolerances. The Committee recommends that the Department and industry further address these issues.
- ***Appropriate size limits.*** Because of the spatial variability of abalone life history parameters, maximising the yield while protecting the spawning stock implies different LML in different areas. If the LML is too small even moderate TAC levels can result in both growth and recruitment overfishing in areas, while if it is too large yield is foregone. The TACC Committee has consistently recognised the need for different LMLs in different areas. The Committee has argued for higher overall LMLs 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 LML protection for the fast growing portions of the stock this protection must be provided by a low overall TAC, 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 LML.

In the circumstances discussed above the Committee has concluded decided that the TAC for 2016 should remain at 130t, and the distribution of catches among Areas should also remain the same as recommended last year. Following consultation with the Department the Committee also provides an indicative LML for each Area.

Economic considerations

The long-term outlook for the abalone fishery appears to have improved, as reflected by a continued increase in share values. However, gross returns from abalone fishing have fallen since 2012/13 from \$4.05 million to \$3.57 million. This is mainly attributable to lower prices more than offsetting higher catches over this time period. Despite gross returns falling, lower costs of fishing are likely to have resulted in greater profitability.

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 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 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 LML have not been borne out. We again suggest that increased LMLs will further improve economic returns.

Management charges in the abalone fishery have reduced significantly over time. They are currently at \$68.37 per share. 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 economic indicators available for the fishery for 2011/12 on which to base its assessment of economic performance. These economic indicators were developed from a survey of 17 abalone fishing businesses/external shareholders. However, the ability of the Committee to rely on this data to make an informed judgement on the profitability of the abalone fishery is becoming difficult as the survey data is dated. 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. 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 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; that the Department apply a consistent approach to calculating CPI adjusted data with reference to a base year;

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 (\$328,000) 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 LML 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. For 2015 it was increased to 130t.

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 LML 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. In recent years, 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 assess 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 key indicators in all actively fished Areas are plateauing. The implications of this for the stock are summarised above and discussed in detail in the stock status section. The management implications are that recent increases in catch (30t in total in recent years) have impacted the rate of rebuild and that caution is required in TACC decision-making, particularly in the absence of reliable stock assessments.

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. 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 LMLs, a revised harvest strategy and an improved governance process.

Governance

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

While 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. At the very least, the existing conflict of roles created by the same person providing the fishery's science and being paid by industry needs to be more actively managed to meet minimum standards of good governance.

Other catch

On the basis of the information and advice available in relation to non-commercial catch (Aboriginal, recreational and illegal), the low estimates that have been assumed in recent years are continued to be considered sound estimates.

Summary

While the overall trend toward recovery in the past 10 years is very clear it is also now clear that stock rebuilding has slowed considerably in the past 2-3 years as the catches have increased. The key catch rate and mean weight indicators are plateauing. The plateauing of these indicators was first recognised in a few Areas in 2013, it was more widespread in 2014 and it is now seen in almost all Areas of the fishery.

The evolving logger data and its analysis are starting to provide tools for identifying trends that would otherwise be masked by standard catch and effort data. However, there is no agreement and guidance on the most useful indicators and how they could be consistently presented.

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. 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 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 LMLs, 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.

The Committee considers that in the context of the status of the fishery and the continuing deficient state of the fishery's management, it is appropriate to maintain the TACC at 130t.

Summary of Recommendations

1. Develop and provide a timetable for the TACC determination process well before the scheduled TACC Forum date. The list should be promulgated to industry and cover dates for i) the 2016 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. Department to provide specific responses to the assumptions and recommendations provided in this report, be provided as part of the 2016 Management Report.
3. The reporting areas be aligned, either with those used in the past and with those used by the Departmental reports, or conversely that all reports use the new spatial groupings and full historical data are re-tabulated and re-presented in these groupings. The service contract for preparation of the annual assessment report should specify the indicators as well as the space and time domains to be included as a minimum in the assessment report. The time domain should include reporting from 1982. The space domain should include both local (e.g. Areas or Zone/Subzone) and aggregated (e.g. Region or SMU) scales. The indicators reported for each of these space/time domains should include catch, logbook CPUE, mean weight of landed abalone, logger Kg/Ha and logger fished area from a standardized definition of this. There should also be a requirement to provide the Ha level hexagon reports of catch, effort, abalone weight and Kg/Ha; but this information may be available only electronically because of its size.
4. Local catch targets and limits for areas to be established and implemented so as to provide reasonable operational flexibility to the fishery and to protect the local stock status. The current practice of allowing +/- 30% from the target is a relatively large amount that could and should be customised to the stock circumstance of the relevant Area, and it should not be accepted that a particular Area is persistently over or under the target for multiple years. (see also Recommendation 18 below).
5. The continuation of the data-logger program at a high level of coverage in the fishery.
6. Fishery monitoring be extended to provide length composition of the catch in addition to the mean weight.
7. Further development and testing of robust and interpretable indicators of stock and fishery status based on the finer scale data continue to be developed and tested, including estimates of exploitable biomass.
8. Further development of benchmarks or reference points relating to stock condition and productivity be developed for these indicators.
9. Identify a set of indicators that will be consistently reported through time.
10. Give urgent consideration to an increase in the overall LML to increase benefits to both the stock and the fishery
11. 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.
12. 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.

13. Apply a consistent approach to calculating CPI adjusted data with reference to a base year
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. A harvest strategy for the fishery be finalised in time to guide the determination of the abalone TACC for the 2017 quota year.
18. A spatial management regime with appropriate governance arrangements is implemented as a high priority.
19. Existing management arrangements be reviewed and a new management plan developed .
20. The Department and the Abalone Council introduce improved governance arrangements in the provision of the scientific services that support decision-making in the fishery.
21. Full access to fine scale data generated by industry using data loggers be secured by the Department.
22. 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.
23. The harvest strategy under development to include research priorities and ensure that adequate funding is made available to address those priorities.
24. 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 2016**

1. INTRODUCTION

The Total Allowable Catch and Review Committee (the Committee) is established under Section 26 of the *Fisheries Management Act 1994*. In 2015, 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. This year considerable feedback was received from industry in relation to the apparent refusal of the Department to consider changes to LMLs, despite the available scientific evidence, TACC Committee advice, the support of the fishery manager and a substantial number of shareholders.

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.

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 where 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, the assessment data and analysis on the fishery were again presented by an industry researcher. While some technical review by the Department of this work apparently occurred, the Committee considers that continued reliance on industry analysis remains a deficiency in the current management/TACC setting process. Informally, the Committee was once again informed that the Department is intending to apply additional scientific input into the assessment in future years, which will be very helpful when it occurs.

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 allowed 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 2015.

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;
- 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;
- industry member presentations including underwater video footage and photos; and
- the compliance situation as assessed by the Department and by industry representatives.

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

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

The Determination of the Committee of the annual TACC for abalone for the 2016 fishing season is provided at the end of the report.

The Committee notes that the timeliness for the delivery of information slipped in some areas and while due consideration was given to the issues, it is important to receive all data and reports in sufficient time to allow for queries to be raised.

*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 2016 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 2016 Management Report*

3. State of the Stocks

3.1 Introduction

The information flow for assessment improved last year and has further improved for the current assessment. This marks a considerable improvement over previous years. The NSW Abalone Council report was provided two weeks before the meeting. It provided fishery-based data to September 2015, and these data for month and Area were available through the NSW Abalone Council website (<http://acnsw.ambrad.com.au/>). The report also contained their assessment of the abalone stocks, and the improved description of analysis was particularly useful.

There is an ongoing difficulty with inconsistency and complexity in the spatial scale of reporting. There are now a multiplicity of space scales being used (see Table 1). Regions, Zones and Sub-Zones were historically used. More recently, Areas were introduced through the industry workshop process, which did not exactly match the Region or Zone/sub-Zone boundaries. Additional Spatial Management Units (SMU) were introduced this year through

the industry workshop process. These changes in the spatial scale of reporting make it difficult to provide a consistent historical picture of trends and changes. For example this year no reports at the Regional level were provided to allow consistent comparison with the reports of previous years. Additionally the reports provided at Area and SMU level began in 1999 (rather than the more usual 1982) so that the full history of the fishery is not portrayed at those space scales. The Committee has been made aware that the Department remains committed to the Region, Zone and sub-zone reporting structure, rather than to the Area or SMU structure. It is appropriate and useful to have a small number of relatively large spatial units for overall assessment, reporting and coarse catch allocation. Regions or SMUs could meet that need. It is also useful to have finer scale spatial scale units for assessment and finer scale catch management. Zones or Areas could meet that need. As previously, the Committee reiterates its recommendation on consistent reporting.

*The Committee **recommends** that “the reporting areas be aligned, either with those used in the past and with those used by the Departmental reports, or conversely that all reports use the new spatial groupings and full historical data are re-tabulated and re-presented in these groupings. The service contract for preparation of the annual assessment report should specify the indicators as well as the space and time domains to be included as a minimum in the assessment report. The time domain should include reporting from 1982. The space domain should include both local (e.g. Areas or Zone/Subzone) and aggregated (e.g. Region or SMU) scales. The indicators reported for each of these space/time domains should include catch, logbook CPUE, mean weight of landed abalone, logger Kg/Ha and logger fished area from a standardized definition of this. There should also be a requirement to provide the Ha level hexagon reports of catch, effort, abalone weight and Kg/Ha; but this information may be available only electronically because of its size.*

There was no independent scientific assessment provided by NSW DPI, but the Committee was informed that this scientific input was provided through the DPI Management Report and the industry workshop process. It would be preferable for the DPI scientific assessment to be provided separate from the industry and management inputs to the Committee. See management section for a recommendation on this issue.

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 previous status of the stocks provides a key context for the current interpretations and recommendations. The NSW abalone stocks historically suffered from significant over-fishing and over-depletion. The actions of the Committee since the early 2000s have been a response to this situation, with the aim of recovering the stocks and preventing repetition of the previous over-exploitation. These actions have included reductions in the total catch (commercial and recreational), recommended increases of the minimum legal size and recommended greater control of the spatial catch distribution to counter sequential localised depletion.

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 Legal Minimum Length (LML) each year, with the population having substantially lost the buffering effect of multiple and well represented year-classes above the LML.

During the 1990s and to the mid-2000s the abalone fishery showed a pattern of increasingly fluctuating catch rates. The peaks coincide approximately with estimated peaks in recruitment of young abalone (Figure 1), although the estimation methods cannot distinguish well between variability in the number of young abalone recruiting to the population, their growth rate or their survival – variability in any of these factors could give similar consequences and they may vary together. This pattern of fluctuating catch rate is consistent across all of the well monitored Regions and is reflected in peaks of the fishery catch rate in about 1988, 1995 and 2001 (Figure 2), with troughs in about 1992, 1998 and 2005. After the catch rate peak in 2001 there was a rapid reduction in catch rate and 2005 gave the lowest catch rates yet seen in the fishery. A relatively weak peak in recruitment was predicted from population modelling for most Regions in about 2007/8. These peaks and troughs are interpreted as being due to relatively small fluctuations in biological productivity (a combination of the number of young abalone recruiting to the population and their growth rate), 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 LML each year. Consequently catch rates directly reflected these productivity fluctuations. This situation indicates a very high fishing mortality on abalone above the LML, a population that has lost most of its age structure and resilience, and a population with greatly reduced breeding potential because (in addition to high fishing mortality) the LML was relatively close to the size at reproductive maturity.

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, Zones A-E)

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

Region 1 South (south of Port Stephens, Zones 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. They showed an accumulation over time of increasingly large abalone, interpreted to be the survivors of the outbreak augmented by low recruitment. Fishery Independent Survey sites in Region 1 South were clustered in three areas - Port Stephens, Sydney and Kiama (Zones F, J and K) – so there has been concern about how representative these sites were of the whole region.

Trial fishing in Region 1 South during 2004 showed that it was possible to take large abalone at high catch rates 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 more structured program of trial fishing was conducted to test the change in status of the stock at pre-identified sites that were recognised as being historically productive. This program allowed comparison of the proportion of previously productive sites that remained productive, of the change in catch rate at those sites compared to catch rates in 1994, 1987 and 1982-85, and of the current catch rates at historically productive sites compared to sites chosen by divers as being productive in 2007. The general conclusions were:

- i) about 36% of historically productive sites were still as productive as they previously were;
- ii) 70-80% of historically productive sites have catch rates that are lower than those recorded there in 1994 or 1987;
- iii) the northern Zones, between Pt Stephens and Sydney (Regions F, G and H, which comprise the northern part of Area 2), had very low abalone abundance and a major loss of historically productive sites;
- iv) the southern Zones, between Sydney and Wreck Bay (Zones J, K and L, which comprise the southern part of Area 2 and the northern part of Area 3), 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 in the early 2000s Region 1 South supported some pockets of large and dense abalone aggregations, but that many historically productive sites still did 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 Zones (F, G and H) remained very depleted in 2007, while the stock of legal sized abalone in the more southern Zones (J, K and L) has recovered to 1994 levels at more than half of the sites fished.

The south Zones (i.e. Sydney to Wreck Bay) were re-opened to commercial fishing in 2010 while the northern Zones (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. Region 2 was re-opened to commercial fishing in 2010.

The substantial reductions in the TACC through the 2000s, and the recommendations for increased LML, 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; and
- that these increases persist through the expected next period of low productivity –in about 2011-2013 based on past patterns.

All of these success factors were clearly and strongly evident during the late 2000s and they were maintained through the 2011-2013 period. In some Areas the increase in catch rate and mean weight slowed or stopped during 2012-2013, but catches were also increased in that period and so the effects of increased catch and fluctuating productivity are confounded.

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 benefits from the resource. In addition to the appropriate catch level, the Committee considers that three other issues are very important to achieving this goal:

- 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 efforts to improve finer scale data gathering from the fishery (e.g. GPS-linked data loggers), interpretation of these data as sustainability indicators for stock assessment, and finer scale fishery management (e.g. local catch limits and other mechanisms to prevent overly concentrated fishing and serial depletion). The collection and use of logger-based information for finer scale stock assessment has progressed well. Attempts to set and manage finer scale catch targets and have limits have had variable success.
- ii) The Committee and some in industry have questioned the appropriateness of the LMLs used in the fishery. The fishery has a history of a relatively small LMLs compared to that used in other fisheries on the same species. In NSW the LML 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 LML was increased to 120mm in 2010 and then to 123mm in 2012. Some in industry have voluntarily and successfully fished to a 120mm size limit in more northern areas also. The LML for the same species in Victoria is 120mm in open coastal habitats east of Lakes Entrance (with voluntary industry size limits of 125mm and 130mm in some areas), in Tasmania is 127-138mm across

different harvesting regions, and in South Australia is 125-130mm across different harvesting regions. For several years the Committee recommended that a larger size limit be applied to the overall fishery, within which various arrangements can be applied (considering cost-effectiveness) 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 LML' which can be selectively relaxed as appropriate, rather than low LMLs everywhere; it protects from localised overfishing abalone sub-populations that grow quickly, have a large size at first maturity and reach large maximum size. Such fast growing abalone are highly productive if managed appropriately, but are vulnerable to overfishing if fished at too low a LML. A major element in the argument against increase in the overall LML 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 LML simply would have been impossible if the population was dominated by stunted stocks.

- iii) The Committee has for several years commented that the benchmarks and reference levels used in the Share Management Plan and the Fishery Management Strategy were set at levels that did not adequately protect the sustainability and productivity of the stock. Revision of these benchmarks and reference levels needs to be explicitly grounded in scientific assessment of the biological productivity of the stock.

3.2.2 The information available for recent assessments

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

- Up until and including 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, 2014 and again in 2015 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 increased as more, and more reliable, data loggers have been provided to divers. Descriptions of the data from the data loggers and some derived indicators 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 has been no analysis that related interpretations of the currently collected data from the data loggers to interpretations of historically collected data, or to reference levels relating either 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). In the past two years, logger-based estimates of the exploitable biomass and harvest fraction have been provided, and while this is a useful advance, they are of limited value without corresponding reference points for the biomass and harvest fraction corresponding to desired (and undesired) outcomes.

The information available to assess the status of stocks is in a transition from the previous methods based on Fishery Independent Surveys, coarse scale data from commercial fishing, and population modelling to future methods that are hoped to be better and cheaper based on fine scale data reporting and analysis. But the previous methods were stopped before the new methods were developed and shown to be adequate. This has resulted in a period of very limited information on the state of the stocks, increased uncertainty about the state of the stock and increased uncertainty about the consequences of different catch levels. New indicators based on the fine scale data are being developed, and several appear promising, but 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.

Further, there is now heavy reliance on commercial catch information for the indicators of stock abundance. Assessment and management of the recovery is now based mainly on trends in commercial catch rate and the average weight of abalone in the catch. This reliance on commercial catch data has well known problems:

- In a fishery managed by individually tradable quotas the management intent is for industry to innovate and change fishing practices so as to optimise economic returns in a dynamic cost and market environment. These innovations and changed fishing practices can be expected to directly affect the indicators used for assessment, including the catch rate and mean weight of abalone caught. There is anecdotal information suggesting that operational and market conditions are indeed having such effects but these effects are not quantified.
- Commercial catch rate, particularly for large aggregated areas and times, is notoriously 'hyper-stable' for abalone fisheries. That is, high catch rates can be obtained and maintained for a time by targeting concentrations of abalone in known patches of preferred habitat even if the overall population is low. Such hyper-stability of catch rates has been seen in the history of the NSW abalone fishery at both the Region and Sub-Region scales.
- Commercial catch rate and mean weight in the catch are 'trailing indicators' that reflects what has happened, rather than 'leading indicators' that inform what will happen – for example they 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 some of these problems, but to date solutions have not been demonstrated.

The current lack of population analysis also does not allow scientific examination of the LML 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 must be simple, robust and precautionary.

3.3 Information and analysis available for the current 2015 assessment

There are two primary sources of information available: (1) the logbook and related information from commercial fishing (i.e. the catch, catch rate and mean weight of individuals in the catch aggregated variously at the space scales of Regions, Zones, Sub-Zones, Areas and Spatial Management Units), and (2) 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 Spatial Management Unit (SMU) in Figure 2. Figure 3 shows these recent trends in catch rate and mean weight for each SMU and also their percentage change.

There is a very consistent pattern shown across all SMUs. The annual catch rates and mean weight increased rapidly from about 2008 through to about 2012/2013, after which time the rate of increase began to reduce and it is now substantially lower. The catches per year were increased by about 30t in the years 2010-2014.

This pattern is also seen at the Area spatial scale (eg Fig 4). Last year the Committee pointed out that the catch rate and mean weight was plateauing in several Areas, and in particular Area 5 in Region 2, Areas 14-16 in Region 5 and Areas 17 and 18 in Region 6. This plateauing is now seen in almost all Areas of the fishery i.e. in Areas 5, 7, 9 and 11-19 and 21; Area 20 is the only high-production Area not to show this pattern yet.

From these trends in CPUE and mean weight it is expected that under the current catch and LML settings the fishery will stabilise close to but somewhat higher than the current CPUE and mean weight. Relatively small increases in catch since about 2010 have substantially reduced the rate of population recovery, suggesting that the recovery to this point is not robust and it remains vulnerable. This is consistent with the Committee's comments last year that most of the net population productivity of the resource is being harvested, leaving relatively little to contribute to further in 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 several 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, 5 and 6 have plateaued in the past 2-4 years, with the pattern less pronounced in Region 4.

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

Such rapid recovery of the catch rate following increases in the LML 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 LML 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 LML; just that it is larger than the current

LML and that the current LML is not optimal. Hence the TAC recommendations concerning size limits.

The mean weight of individuals in the commercial catch has been measured from the weight of each bin of abalone landed by the number of abalone in the bins. The mean weight is a coarse and insensitive indicator, 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.

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. Catch targets and limits are 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 improving but is not entirely successful; some Areas have provided more catch than intended and others have provided less. At low TACs this inability to control fishing effort and catch at local space scales is not expected to have major stock consequences, but formal finer scale management arrangements are not yet in place as a means to prevent serial depletion at higher TACs and possibly even at the current TAC. The ability to set and achieve appropriate local catch caps is necessary to prevent a repeat of sequential depletion if the TACs 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. The current practice of allowing +/- 30% from the target is a relatively large amount that could and should be customised to the stock circumstance of the relevant Area, and it should not be accepted that a particular Area is persistently over or under the target for multiple years.*

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

All divers in the fishery have access to data-loggers though not all divers operate them on all fishing days and there are occasional equipment failures. The analysis provided for 2014/15 covered 50-60% of diver days. There has been good coverage now for four years; 2011/12, 2012/13, 2013/14 and 2014/15.

Several indicators that were reported from the logger data in previous years were not reported for 2014/15 and so comparisons could not be made. It is recognised that the interpretation of indicators from logger data is developmental, but it is difficult to test and use them when they are not consistently reported. Specifically indicators of interest and value are:

- The Kg/Ha measure of commercial catch rate from the logger data. Analysis was presented both last year and this year showing that this measure captures several aspects of fine scale diver operations and that it likely provides a better index of abalone abundance than the catch rate from log books. In particular the Kg/Ha indicator suggests that the log book catch rate has over-estimated the increase in abalone abundance in recent years. But while the Kg/Ha was provided for some selected Areas this year there was no systematic reporting by Area, Zone or Region. The aggregate Kg/Ha indicator for all Regions combined, as presented last year, is repeated in Fig 5.

- The area fished and the location of concentrated fishing effort was previously provided to assess the patterns of spatial focus and rotational harvesting in the fishery, but was not presented this year.
- The catch rate and mean weight at fine scale (1Ha hexagon) catch rate data was previously mapped and available, but was not available this year.

The absence of systematic reporting of the Kg/Ha indicator means that there is no additional and systematic check on the CPUE and mean weight data from the log books, despite selected analysis in both years suggesting bias in the log book catch rates as an index of abundance. The absence of the fine scale maps of concentrated fishing and catch rate is unfortunate because questions about the spatial extent of fishing, and in particular whether it limited to a few easily accessible parts of each Area, are important to interpreting the generality of the plateauing pattern seen in the aggregate CPUE and mean weight data.

The GPS data logger information was used to estimate abalone density and the area of productive reef, from which a total biomass of exploitable abalone was calculated (Table 2 and Figure 6). This is a new methodology and, though very promising, its reliability is not yet clear. Some confidence was provided from a preliminary analysis last year that showed similar estimates of abalone density by this methodology and by scientific survey estimates in Victoria and in Region 6 of NSW. The analysis this year is more comprehensive, including biomass estimates for each SMU and year from 2009/10 and incorporating a range of assumptions.

The estimates in Table 2 indicate an about doubling of the exploitable biomass in each of the SMUs since 2009/10. They indicate an approximate stabilisation of the biomass in SMUs 1, 3 and 4 (i.e. Regions 1-3, 5 and 6 respectively) in the past 3-4 years. They indicate that the biomass in SMU 2 (Region 4) continues a steady steadily increased.

The estimated Harvest Fractions have been reasonably stable from 2009/10 to the present in SMUs 2, 3 and 4. The Harvest Fraction in SMUs 3 and 4 are about 15% per year, and those for SMU 2 about 10%. The harvest fraction giving common fishery management reference points (e.g. maximum sustainable yield) has not been calculated for NSW but based on Victorian experience a value of 15% is relatively high for a stock that is being rebuilt after overfishing, and a value of 10% allows for greater rebuilding. SMU 1 shows a decreasing trend in Harvest Fraction, from less than 10% in 2009/10 to less than 5% in 2014/15.

The estimated biomass in SMU 1 (Regions 1-3) is large, 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 biomass estimates and the interpretations of CPUE and mean weight appear broadly consistent for SMUs 3 and 4, with both indicating a broad plateauing of the abalone population there under recent catches. The situation in SMU 2 is slightly less consistent, with the biomass estimates indicating further growth in the population but the CPUE and mean weight indicating a recent slow-down in recovery.

This preliminary analysis and data provided to the Committee illustrates the high potential value of the fine scale data and analysis. There are few years of data available for comparison and the methods for interpretation are not yet well developed and tested, but it is already allowing exploration of some of the key questions of stock recovery and sustainability. Developing indicators capable of robust interpretation and providing more complete analysis will allow more confident and certain tracking of the status of the stock and its recovery. The estimation of biomass from logger data is very promising, although

this approach needs further development and testing - and in particular testing against direct surveys of biomass.

The Committee strongly supports the use of finer scale information for assessment and management of the fishery. While recognising that some of these recommendations will take time the Committee recommends a number of improvements:

*The 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 estimates of exploitable biomass;*
- *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 less than 10t, and that the recreational catch had not increased in recent years. There are continuing plans and discussions about increasing the recreational bag limit from 2 to 5 abalone for Regions 2-6. The extent to which this will increase the overall recreational catch, and in particular increase catch from areas where recovery has been weak, is not known. It is recommended that any increase in the recreational bag limit be accompanied by additional monitoring of the recreational catch, and that measures to control the catch from vulnerable areas (e.g. Region 2) be considered.

In previous years, the illegal and unreported catch was assumed to be 40% of the legal and reported catch in 1987 – that is 102t from Regions 2-6. The absolute quantity of illegal catch is very unclear. General impressions from compliance officers and industry are that the illegal catch probably was about 100t per year in the past, that it was likely to have been below 100t but above 50t in 2008, 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 2015 industry workshop

The Committee reviewed and considered the documents from the August 2015 industry workshop. There was widespread agreement among workshop participants that the workshop process was a reasonable one, though several participants again expressed disappointment that the LML issues were not adequately addressed.

The industry workshop reached consensus for a recommended TAC of 130-140t, compared to the TAC last year of 130t. The workshop recognised the general plateauing of catch rates and mean weight in the south and so further TAC increases there were not recommended.

Rather it was recommended that any increased catch should come from the north (i.e. north of about Area 10).

The management Area catches to match the targets appears to be improving but it still is not fully successful. Catches to August were already at or above those recommended by the TACC in Areas 17, 18 and 19. Additionally, at past trends the catch in Area 16 is projected to exceed the TACC recommendation. The workshop used its own previous catch recommendations by Area as targets for reporting, rather than using the TACC recommendations. Consequently the sum of the Area targets used by the workshop exceeds the determined TAC for the fishery, and some Areas (e.g. 17 and 18) were regarded by the workshop as being 'on target' when the catch to August had already exceeded the TACC figures. There is need to align the targets and reporting to the determined TAC and the spatial distribution of catch that the TAC was based on.

The workshop input to the committee was very helpful, and the ongoing efforts to review indicators and manage catches at a finer space scale is particularly important and promising.

3.4 Conclusions

There has been substantial improvement in the state of the stock in recent years, starting in about 2006 but particularly since about 2009. The TAC reductions and increased LML have succeeded in providing additional accumulated stock above the LML since the mid-2000s when those management interventions began. The stock has shown considerable rebuilding, as evidenced by the substantial increases in catch rate and mean weight of abalone. This increase is also mirrored in the biomass estimates from the GPS logger observations; while these estimates are preliminary they indicate an about doubling of exploitable biomass since 2009.

While the overall trend toward recovery in the past 10 years is very clear it is also now clear that stock rebuilding has slowed considerably in the past 2-3 years as the catches have increased. The key catch rate and mean weight indicators are plateauing. The plateauing of these indicators was first recognised in a few Areas in 2013, it was more widespread in 2014 and it is now seen in almost all Areas of the fishery. The plateauing seen in the catch rate and mean weight observations is also seen in the biomass estimates from the fine scale logger observations for Areas 1-10 and 14-21 (i.e. SMUs 1, 3 and 4) and in the logger derived density (Kg/Ha for the fishery as a whole. This is also consistent with the relatively high harvest fractions (i.e.15%) estimated for SMUs 3 and 4 from the logger observations in recent years.

Some implications of this plateauing of the recovery in recent years are:

- The recent catches have been taking most of the surplus production, leaving relatively little to contribute to rebuilding.
- The rebuilding is not robust, in that it has been significantly slowed by relatively small (about 30t) TAC increase since 2011.
- The rebuilding is likely to be very incomplete because the fishery catch history suggests that surplus production from the fully recovered population would be considerably larger than current catches. This implication would be much better understood if a population model was used to characterise surplus production and quantitatively estimate the current status/recovery of the stock, as further elaborated below.
- Under current TAC and LML settings the stock may stabilise close to its current status, or any continued rebuilding is likely to be slow.

A period of low abalone productivity was anticipated from earlier population modelling to occur in about 2011-2013, assuming past productivity patterns persisted. It is possible that the timing or duration of this low productivity period has extended into the 2013-2015 period

and contributed to the observed slowing of stock recovery. If this is the case then it is expected that the low productivity period will eventually be replaced with more normal productivity, and more rapid recovery under current management settings would resume. But until such a productivity increase is observed management must be on the basis of protecting the stock under the current productivity regime, and in particular not depleting the stock again during periods of lower productivity.

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 LML. The management situation is more complex now, with the rebuilding proceeding differently in different Areas and slowing overall. This more complex situation requires greater information support than previously. Previously, the imperative was to stop further stock decline and begin recovery, and that can be addressed (albeit inefficiently) with little information. Currently the challenge is balancing continued recovery, management reform to prevent a return to overfishing and localised depletion, and catch levels. In this there are limitations and risks from the few stock status indicators available, poor knowledge of the current status and surplus productivity in relation to full recovery, 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 analysis of the monitoring data and modelling of population dynamics. Without improvements to this investment the future is likely to be continued uncertainty and the need for considerable precaution. In regards to analysis and modelling the Committee notes that the management changes and stock rebuilding during the past about 10 years has resulted in potentially very informative trends in the key indicators, and the Committee recommends that formal population modelling should be conducted. The aim of this modelling is not tactical stock assessment and to directly derive a TAC recommendation. Rather it should be strategically focused to provide guidance for management in the next few years on 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, exploitable and mature biomass, harvest fraction). An aspect of this modelling would necessarily be consideration of the LML.

While taking measures to continue stock rebuilding the Committee has also been concerned to identify and rectify the past management settings that allowed overfishing to occur previously. Without this rectification there is risk that overfishing and stock collapse could occur again. The Committee considers that two features of the management settings are important in this:

- Finer scale monitoring, assessment and management. The logger program has augmented the logbook program and considerably improved the ability to monitor and assess abalone at finer space scales. Finer scale management of catches is improving but it is still not adequate to deliver the spatial distribution of catches that is intended. There is a need to develop more formal methods to control the catch from Areas, and to more formally develop Area and SMU catch caps, targets and tolerances. The Committee recommends that the Department and industry further address these issues.
- Appropriate size limits. Because of the spatial variability of abalone life history parameters, maximising the yield while protecting the spawning stock implies different LML in different areas. If the LML is too small even moderate TAC levels can result in both growth and recruitment overfishing in areas, while if it is too large yield is foregone. The TAC Committee has consistently recognised the need for different LMLs in different areas. The Committee has argued for higher overall LMLs 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 LML protection for the fast growing portions of the stock this

protection must be provided by a low overall TAC, 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 LML.

*The Committee **recommends** that urgent consideration be given to an increase in the overall LML to increase benefits to both the stock and the fishery*

In the circumstances discussed above (as well as the rest of the report) the Committee has concluded that the TAC for 2016 should remain at 130t, and the distribution of catches among Areas should also remain the same as recommended last year. Following consultation with the Department, the Committee also provides an indicative LML for each Area.

The recommended catch targets by area are shown in Table 1 below:

Table 1: Recommended catch targets by area

Area	Recommended catch (t)	LML
1	1	117mm
2	1	117mm
3	2	117mm
4	1	117mm
5	5	117mm
6	1	115mm
7	2	117mm (or Zone R 115mm, Zone S 177mm)
8	5	120mm
9	8.5	120mm
10	10	120mm
11	9	120mm
12	8.5	120mm
13	5	120mm
14	10	117mm
15	8	120mm
16	10	120mm
17	7	120mm
18	4	120mm
19	7	120mm
20	9	123mm
21	16	123mm
Total	130	

Table 2. Summary of some of the spatial categorisations used in the fishery.

Area	Area name	Zone or sub-Zone	Region	Spatial Management Unit (SMU)
1	Tweed	A-E	1 north	1
2	Pt Stephens	F-J	1 south	1
3	Kiama	K-M	1S (K-L) 2 (M)	1
4	Ulladulla	N	2	1
5	South Brush	P	2	1
6	Batemans	Q	2	1
7	Moruya	R-S	2 (R) 3 (S)	1
8	Narooma	T	3	1
9	Bermagui	U1-U3	3	1
10	Bunga	U4-V2	3 (U4) 4 (V1-2)	1 2
11	Moon Bay	V3-W1	4	2
12	Turingal	W2-X1	4	2
13	Long Beach	X2	4	2
14	Eden	Y11-Y21	5	3
15	Saltwater	Y22-Y23	5	3
16	Bittangabee	Y24	5	3
17	Green Cape	Y31	6	3
18	City Rock	Y32	6	3
19	Wonboyn	Z1-Z3	6	4
20	Saltlake	Z4	6	4
21	Howe	Z5	6	4

Table 3. The biomass of legal sized abalone estimated from GPS data logger information from commercial fishing operations each year since 2009/10. Two densities (Kg/Ha) and two area of productive habitat are calculated for each SMU from the logger information for different assumptions, resulting in a range of biomass estimates. For these calculations Sub-Zone Y3 is included in Region 5 rather than Region 6 where it was located historically.

	SMU 1	SMU 2	SMU 3	SMU 4
	Region 1-3	Region 4	Region 5+	Region 6-
	Area 1-10	Area 10-13	Area 14-18	Area 19-21
	Subzone A-U	Subzone V-X	Subzone Y1-Y3	Subzone Z
Year				
	Density (kg/Ha)			
2009-10	303-372	222-272	241-296	219-268
2010-11	326-401	348-427	284-349	387-475
2011-12	357-438	336-412	393-482	378-464
2012-13	431-529	369-452	405-497	270-331
2013-14	415-509	421-517	573-467	426-523
2014-15	414-508	476-584	390-478	429-527
	Area (Ha)			
All years	601-1024	679-754	656-729	356-396
	Biomass (t)			
2009-10	182-380	150-205	158-216	78-106
2010-11	196-410	236-322	187-254	138-188
2011-12	215-449	228-311	258-351	135-184
2012-13	259-541	250-341	265-362	96-131
2013-14	249-521	286-390	306-418	152-207
2014-15	249-520	323-441	256-348	153-208
	Catch and targets (t)			
2014 Workshop targets	25	31	49	32
2013-14 catch	13	38	51	26
2015 Workshop targets	21	33	50	32
2014-15 catch	10	31	50	31
2015 catch to end Aug for 88.7 t	9	21	35	23
2015 catch to end Aug extrapolated to 130 t	13	31	51	34

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.

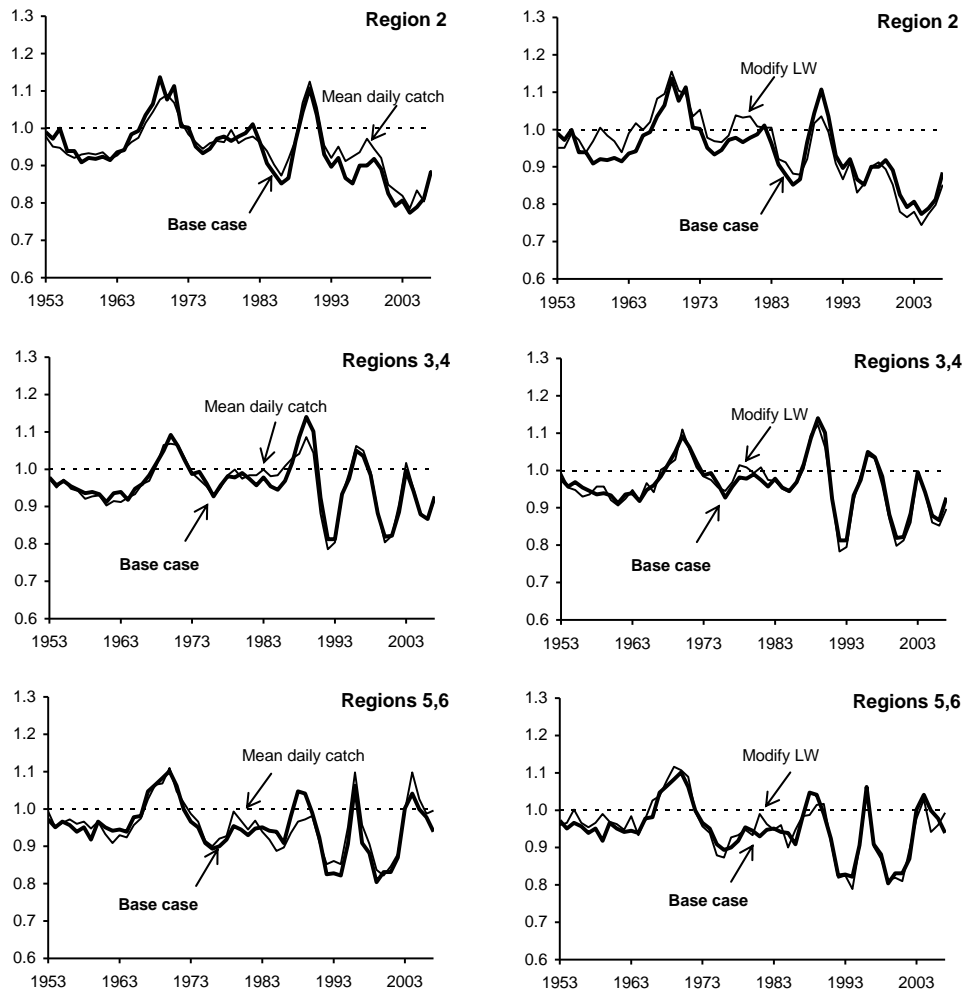
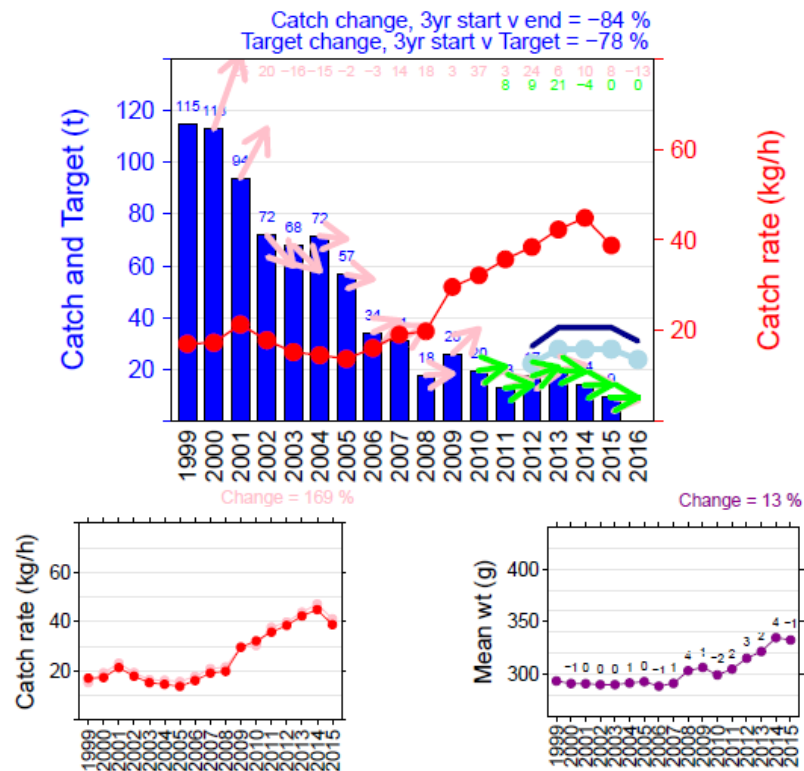
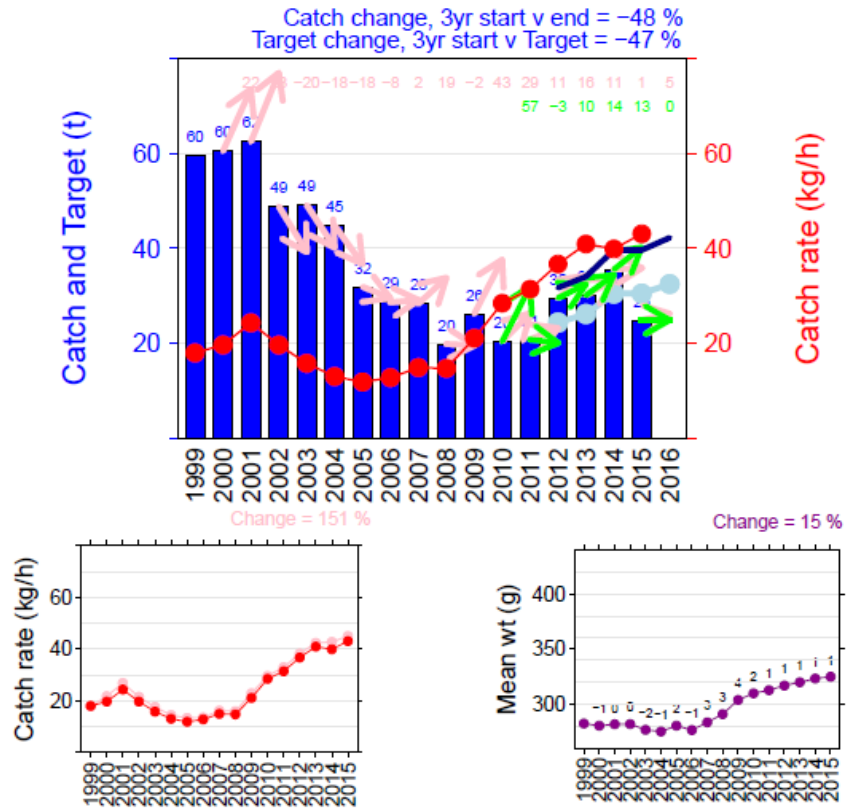


Figure 2 Annual catch (blue histograms), CPUE (red lines) and mean weight (purple lines) of abalone in the catch for each Spatial Management Unit (SMU) in the fishery. Previously these trends were reported by Region and starting in 1982. The different reporting areas and truncated time series provided this year makes historical comparisons difficult. SMU 1 is a combination of Regions 1-3; SMU 2 is Region 4; SMU 3 is Region 5 plus Sub-Region Y3 (Areas 17 and 18); and SMU 4 is Region 6 minus Sub-Region Y3 (Areas 17 and 18). The LML was increased for all Regions from 115mm to 117mm in late 2008. The LML 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.

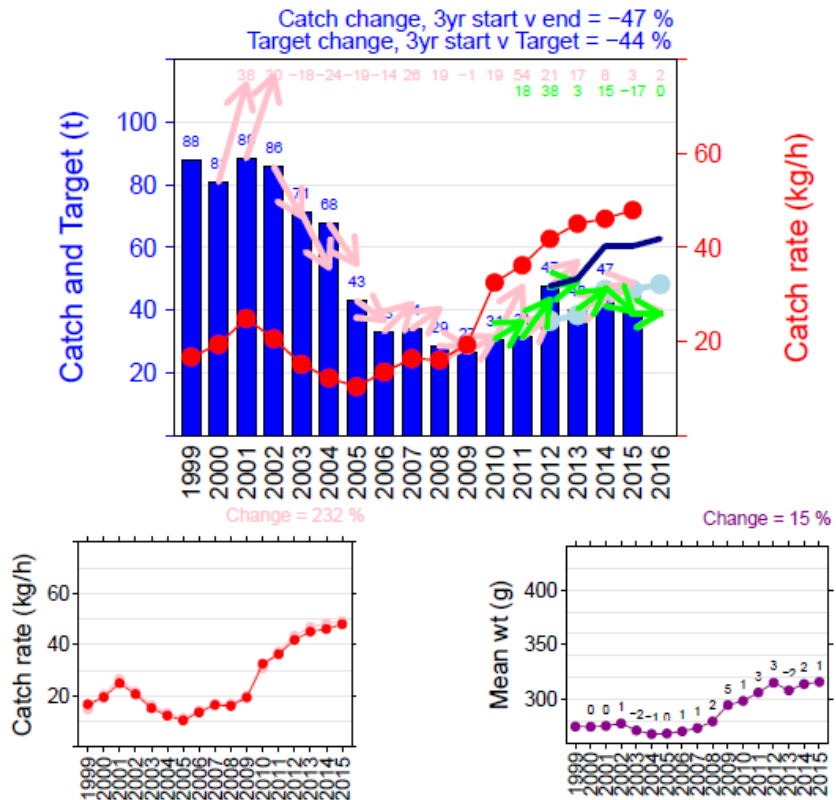
SMU 1, Tweed to Bunga, A-U3



SMU 2, Bunga to Eden, U4 to X2



SMU 3, Eden to Wonboyn, Y11-Y32



SMU 4, Wonboyn to Howe, Z1-Z5

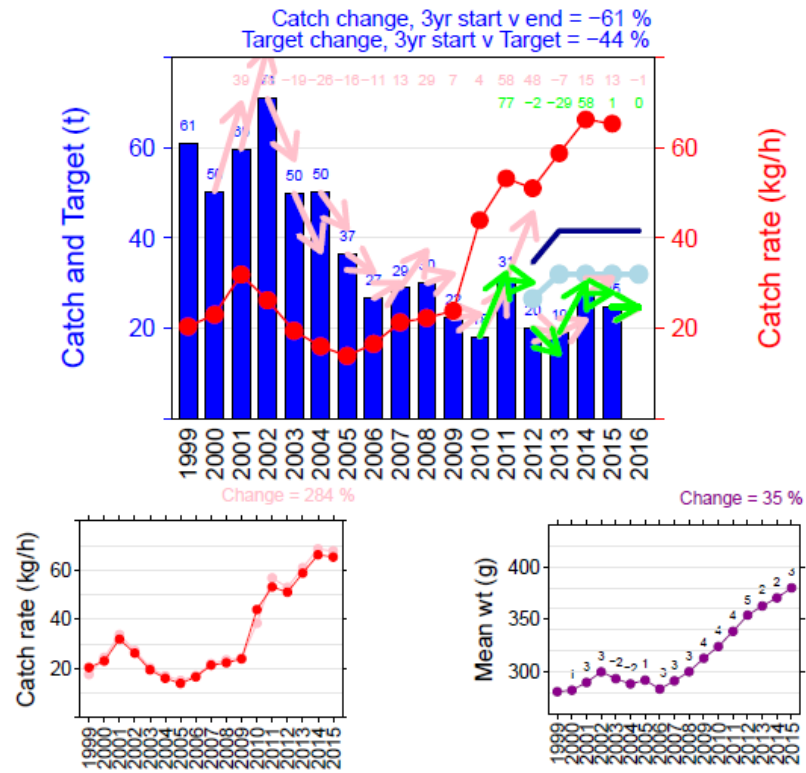
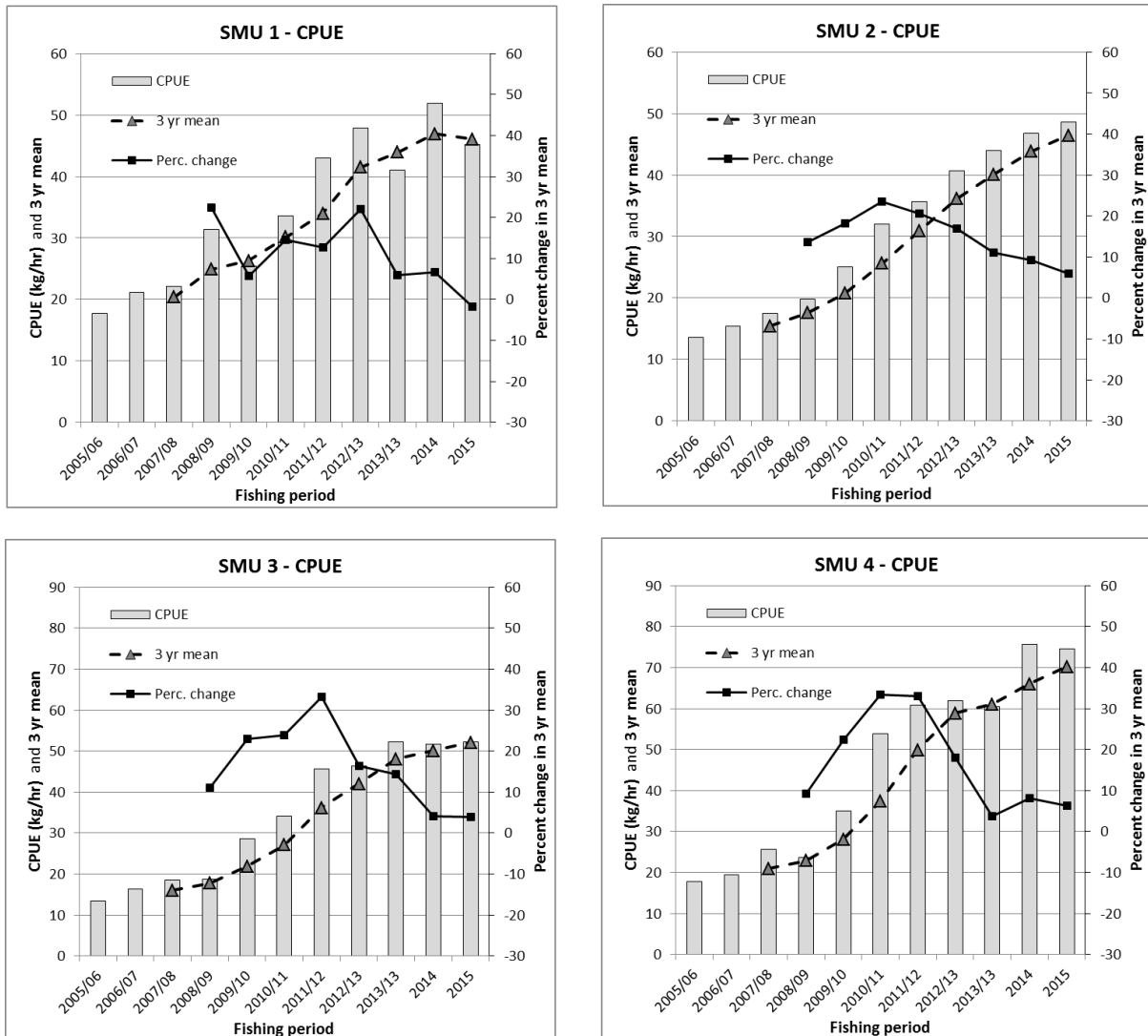


Figure 3. Recent trends and the rate of change for the commercial catch rate (CPUE) and mean weight of caught abalone by SMU. For all SMUs the CPUE and mean weight is plateauing, with the rate of increase reducing and now approaching zero (i.e no further increase). From these trends it is expected that under the current catch and LML settings the current catches are taking most of the surplus production and that the fishery will stabilise close to the current CPUE and mean weight.



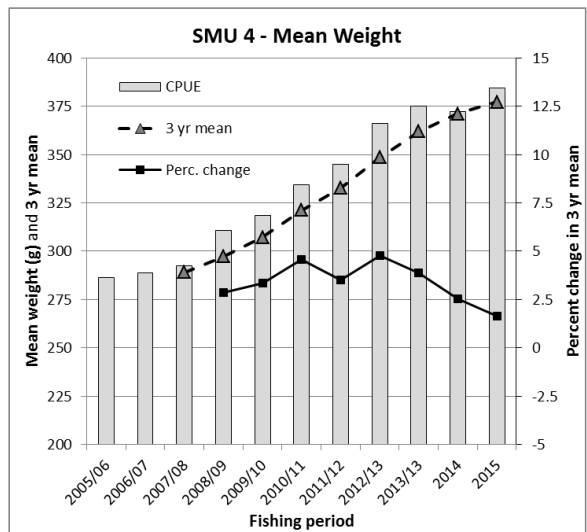
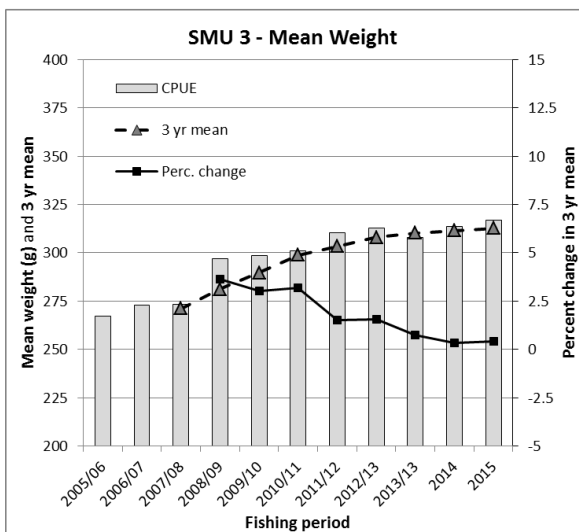
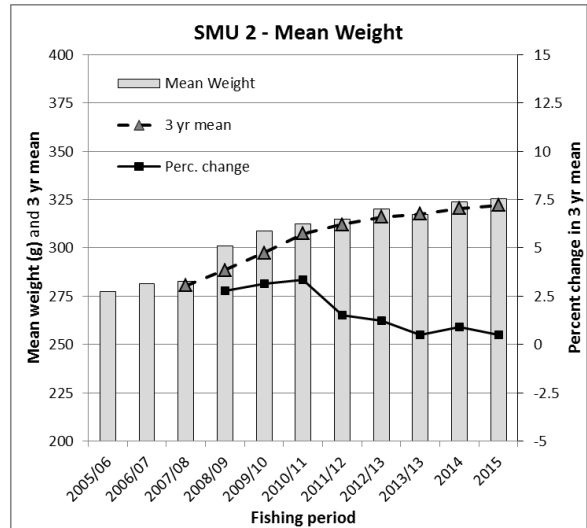
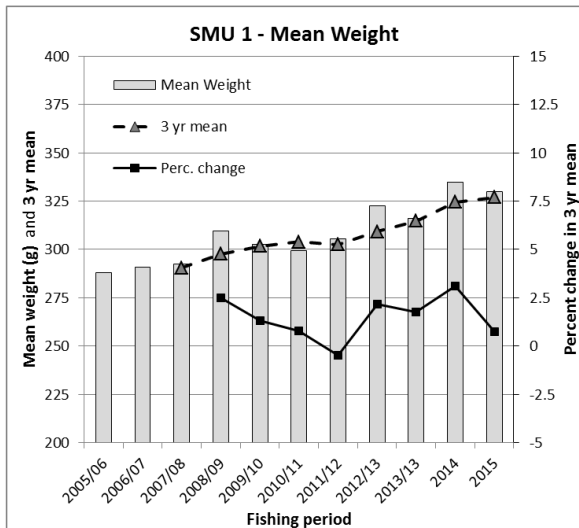
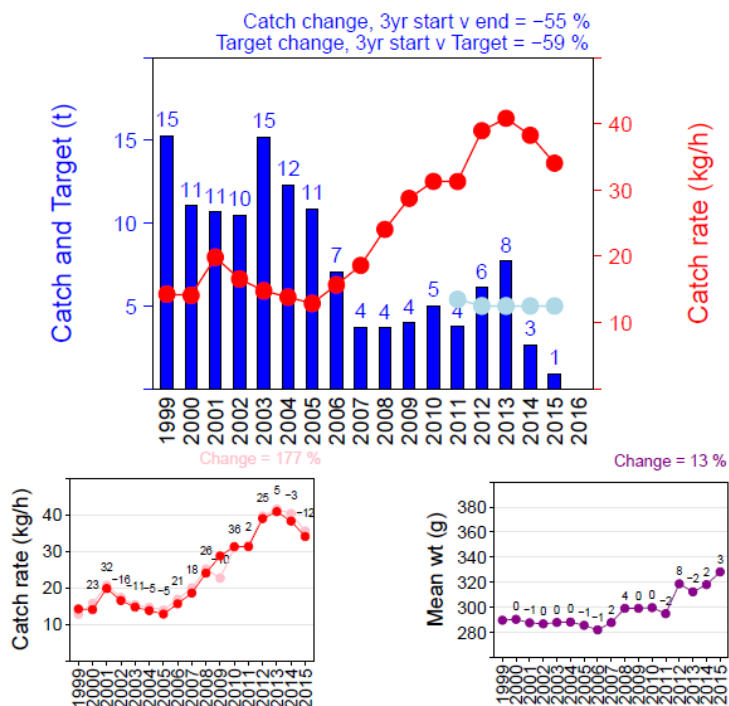
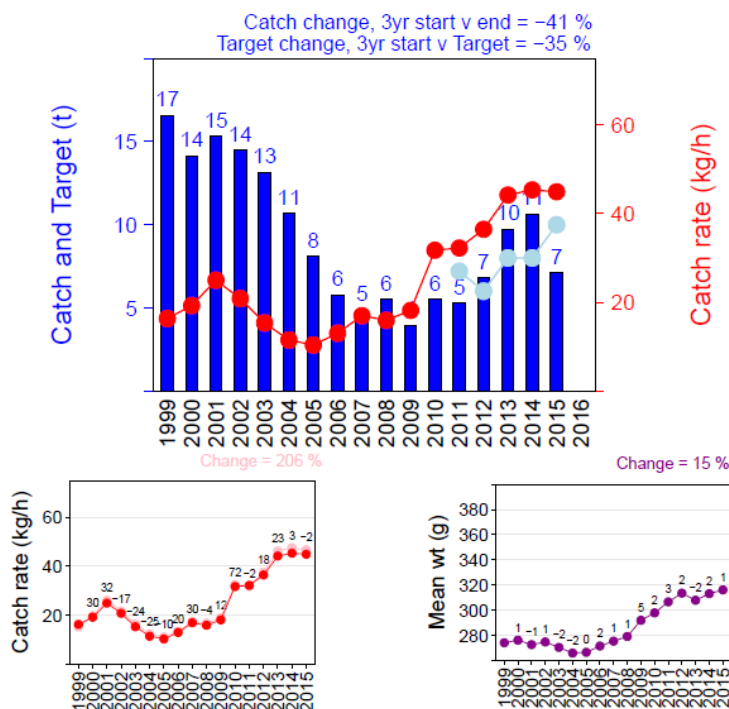


Figure 4. Example of Areas showing plateauing of recent catch rate and mean weight of individuals in the catch. Area 5 is in Region 2, Area 15 is in Region 5 and Areas 19 and 21 are in Region 6.

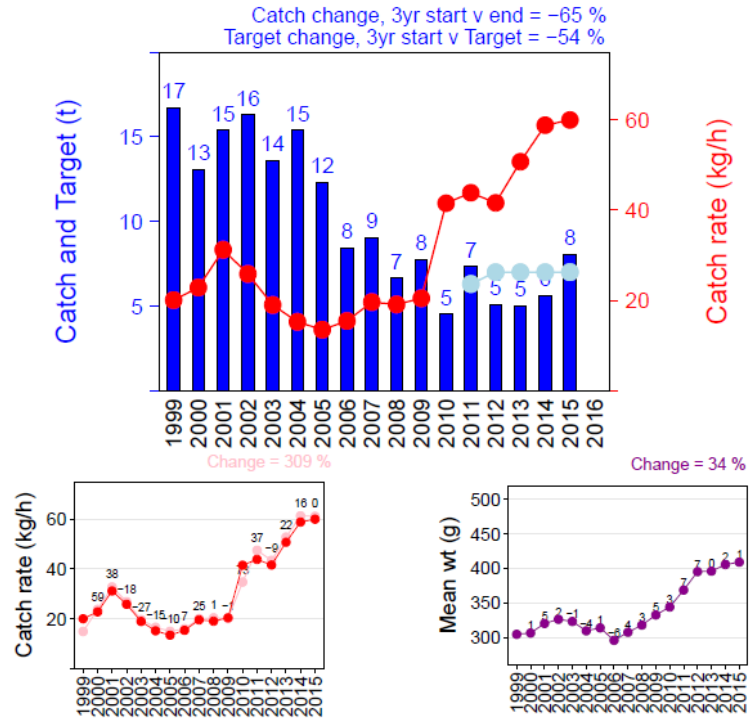
Area 5, South Brush, P



Area 15, Saltwater, Y22-23



Area 19, Wonboyn, Z1-3



Area 21, Howe, Z5

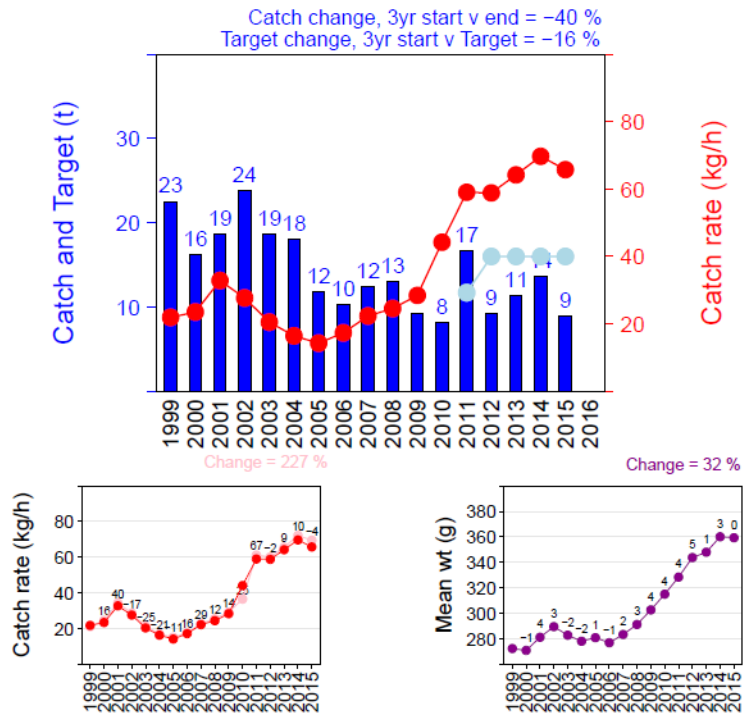


Figure 5. The average density of abalone calculated from data logger information aggregated for all Regions. Note that this has not been updated for the 2014/15 year.

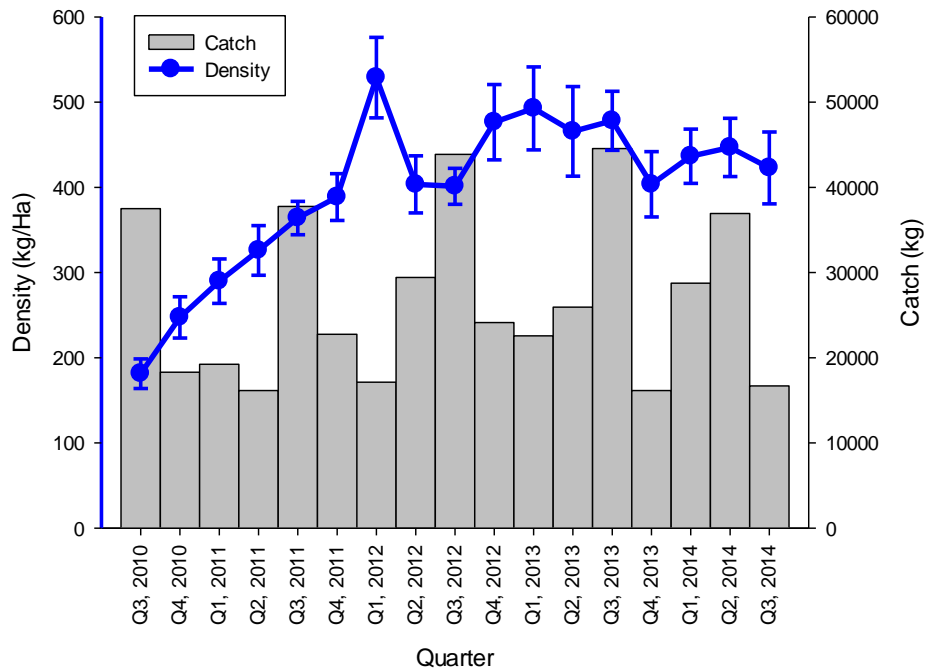
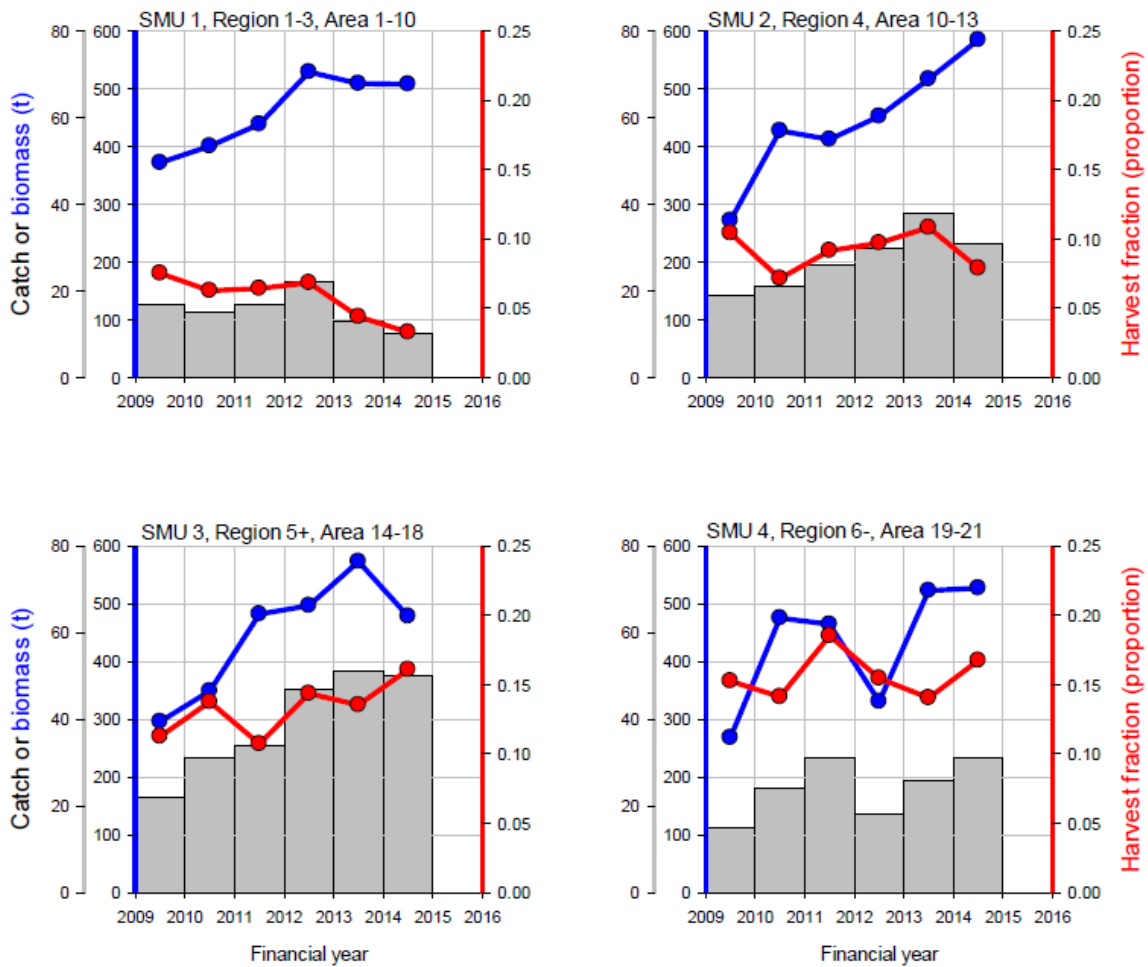


Figure 6. The catch (grey bars), standardised biomass density that is proportional to exploitable biomass under the assumption of a constant habitat area (blue lines), and the implied Harvest Fraction resulting from the catches in recent years.



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.

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, the financial performance of abalone fishers as a result of a survey of 17 abalone fishing businesses/external shareholders for the 2011/12 fishing year undertaken by EconSearch and funded by the Australian Seafood CRC is provided. However, the ability of the Committee to rely on this data to make an informed judgement on the profitability of the abalone fishery is becoming difficult as the survey data is dated.

4.2 Volume and value of production

The volume of reported catch of abalone in 2014 was 124.6 tonnes. Reported catch for the six months July 2013 – December 2013 was 62.5 tonnes. Data to August 2015 has the reported catch at 88.7 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 7).

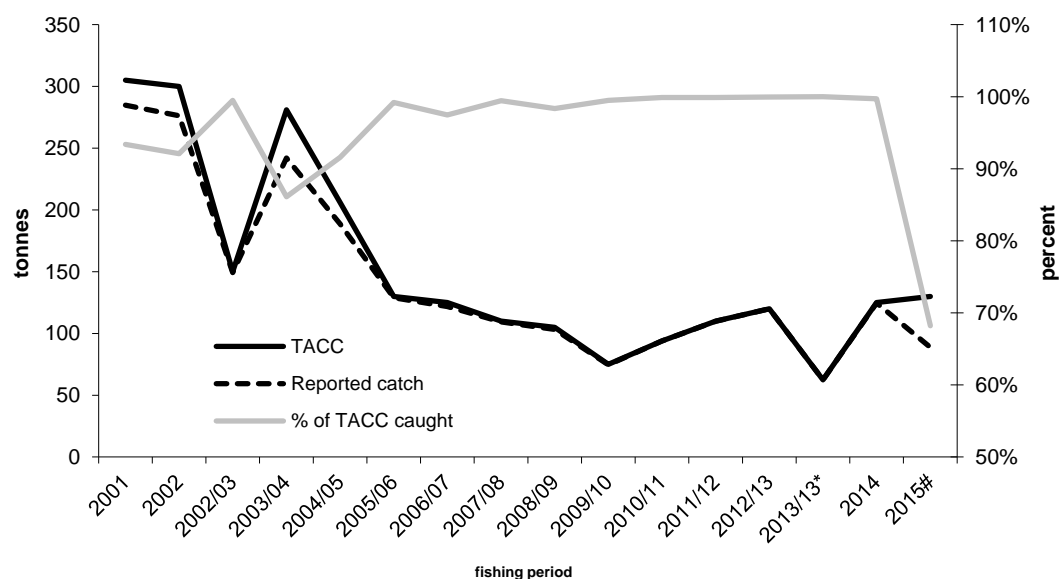


Figure 7. TACC (t), total reported commercial catch (t) and proportion of TACC caught (%) for each fishing period from 2001 to end August 2015 (note *6 month fishing period 2013; # incomplete year 2015).

The real value of reported catch of abalone has fallen since 2012/13 from \$4.05 million to \$3.57 million over the first eight months of 2015 (Figure 8).

Current values are 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. 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.

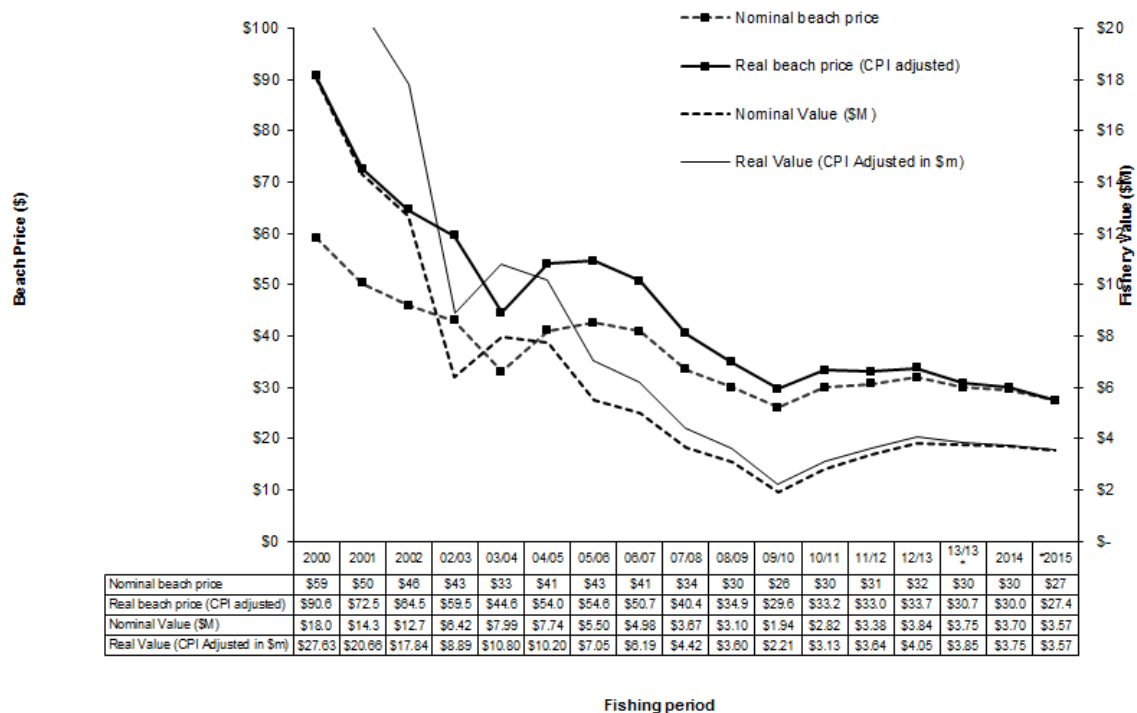


Figure 8. Estimated nominal and real value of the fishery (\$m) and average nominal and real beach price (\$) for each fishing period from 2000 to end August 2015. 2013 catch figures have doubled to represent 12-month equivalent gross value of production. Note: an industry report gives beach prices in the early 2000's which are lower than those reported in this figure

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 cultured product.

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. Prices for abalone have gradually declined since 2012/13 from \$33.7/kg to \$27.4/kg in real terms over the first eight months of 2015 (Figure 8). Beach prices have fallen despite a depreciating Australian dollar.

Since 2000, prices for abalone have trended downwards from a level of around \$86/kg 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.

In China, prices for abalone continue to fall due to a curb on official funds for fine dining and a significant increase in domestic supply of abalone. However, the Free Trade agreement between China and Australia will see import tariffs for abalone (which currently sit at 14 per cent) progressively reduced to zero over the next three to four years. Likewise, the reduction in import tariff to zero from the 15th January 2015 under the Japan Australia

Economic Partnership Agreement (JAEPA) could stimulate demand for Australian seafood on the Japanese market.

The Australian cultured abalone sector has more than tripled over the past seven years to 910 tonnes in 2013/14 (Shane McLinden (July 2014)). This represents 19 per cent of total Australian abalone production in 2013/14.

Global production of cultured abalone has also grown, from around 1,200 tonnes in 2002 to 103,468 tonnes in 2013/14. Of this, China produced 90,694 tonnes and South Korea 5,300 tonnes (Abalone Council of Australia, 2014). Cultured product produced in South Korea is mainly sold to the Japanese market, as the species, *Halitosis discus hanai*, is preferred by Japanese consumers. Japan is also a small producer of cultured abalone, producing 200 tonnes in 2013/14. Production of cultured abalone is expected to continue to expand in both South Korea and Japan: South Korea is predicted to produce 10,000 tonnes of cultured abalone in 2014/15 and triple production within the next ten years (Abalone Council of Australia, 2015).

With Japan the most important market for NSW wild caught abalone, expansion of cultured production in South Korea, and Japan, is a concern.

Costs associated with producing cultured abalone are continuing to fall both in Australia, and, more significantly, in China and Korea. This is resulting in lower prices for cultured abalone, undercutting those for wild caught product, particularly for smaller sizes of abalone.

The value of the Australian dollar influences the price and demand for Australian exports overseas, including abalone. For example, if all other things are equal, a fall in the value of the Australian dollar against currencies in abalone export markets would have the effect of decreasing the price of Australian (including NSW) abalone on these markets, increasing demand and the prices received by Australian (including NSW) producers.

Econsearch investigated the relationship between exchange rates and prices received for NSW Abalone in a report prepared for the Australian Seafood CRC. It was found that when the Australian dollar appreciates, as it did between 2010/11 and 2011/12, there is, generally, a corresponding decline in the average price of NSW Abalone (Econsearch 2013).

Despite the above logic, a depreciating Australian dollar relative to the US dollar and Japanese Yen in 2014 and 2015 has not resulted in higher prices received by NSW abalone producers. This could be a result of competition from cultured abalone; or higher prices received by processors not being passed on to producers.

ABARES have forecast that the Australian dollar will depreciate against both the US dollar and Japanese Yen over both the short and medium term however it remains to be seen if this will result in higher prices for abalone. 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; and a processing plant in Mallacoota in Victoria. The capacity of the two NSW 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.

Shareholders / divers continue to sell an increasing share of abalone through 'AFCOL' in Mallacoota. With no daily catch limits applying to abalone landed at Mallacoota, and

willingness from this processor to travel as far north as Tathra to collect product, there is likely to continue to be increasing interest from shareholders / divers in landing catch through this port. The Department should continue to 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 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 study to investigate tastes and preferences for abalone on overseas markets, and size / price relationships for abalone on these markets. 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 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. Also relevant to the NSW abalone industry is recent efforts by the Australian Wild Abalone brand to investigate opportunities to market wild caught Australian abalone on the Japanese market.

*The Committee repeats its **recommendation** that Industry undertake a 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 last six

months of 2013 was 43.93 kg/hr; it was 47.04 kg/hr in 2014; and for the first eight months of 2015 it increased again to 48.71 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 324g in 2012/13. It fell slightly to 320g in the last 3 months of 2013; and then rose again in 2014 and the first eight months of 2015 to 335g.

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 Womboyn has excluded significant areas of the fishery. Further, the increase in average weight of abalone has been in excess of that anticipated due to the increase in the size limit. As such, the concerns about the negative impact on economic returns as a result of a higher LML have not been borne out. It is still the opinion of the Committee that an increase in LML in many areas of the fishery is appropriate. Suggestions as to the appropriate LML by area are provided in the earlier section of this report on state of the stocks.

4.5 Management charges

Management charges in the abalone fishery reduced significantly from a high of \$365 per share in real terms in 2002 to \$28 per share in the 2011/12 fishing period (Figure 9). For the 2012/13 fishing period management fees were increased to \$81.36 per share in real terms, which represented around 7 per cent of the gross value of production of the fishery. This is a similar proportion to the lobster fishery. Over the remainder of 2013 management fees were reduced again. In 2014 management charges were \$63.76 per share in real terms; in 2015 they have been set at \$68.37 per share (which is around six per cent of the gross value of production).

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.

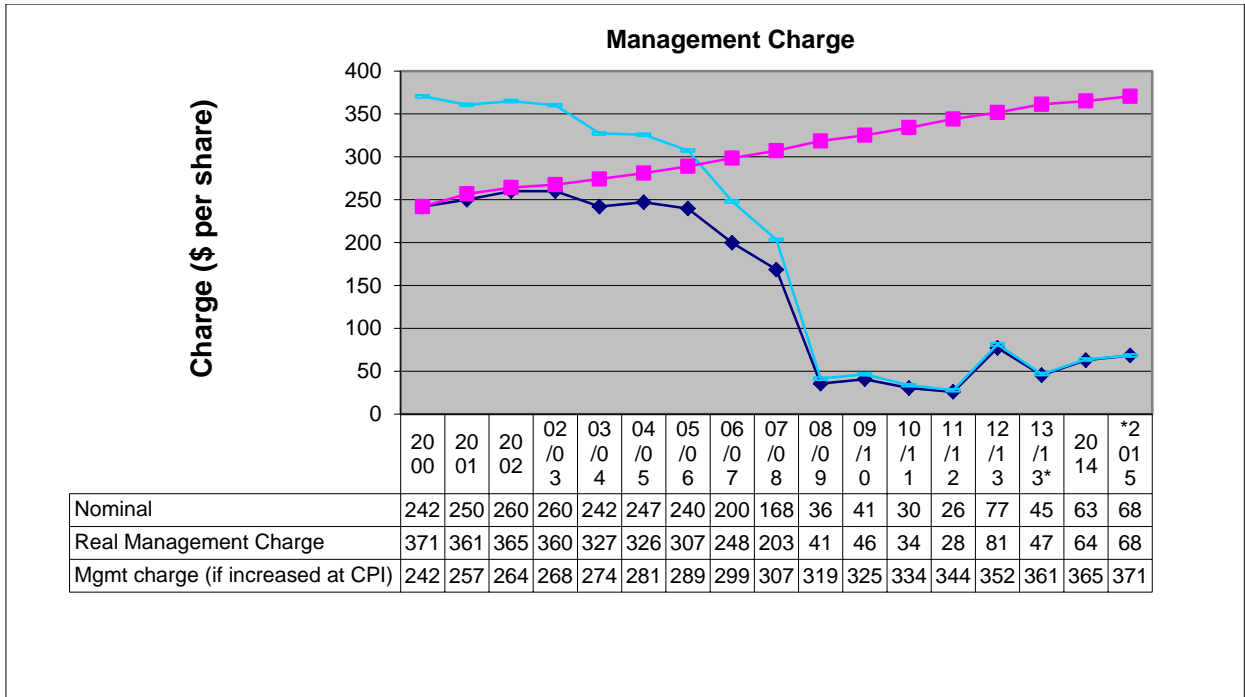


Figure 9: Nominal and real management charge (\$) per share from 2000 to end August 2015

The Committee notes that the current level of management charge debt in the fishery is approximately \$328,000 (falling from \$900,000 over the last four years). Of the 48 shareholders, 10 currently have management fee debt, as compared to 12 in the previous year. As at the end of October 2015, average debt is \$32,813 for debtors. This average debt is \$3,000 lower than that observed at the same time in 2014. However at the end of August 2015, only two fishers had debts above \$50,000, as opposed to three at the same time last year, with these two debtors responsible for 46% of the total debt. 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 three per cent to seven per cent of the gross value of production, meaning debtors pay between three per cent and seven 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, has resulted in the rate of debt repayment increasing.

4.6 Economic performance

As mentioned earlier in this report a survey of 17 abalone fishing businesses/external shareholders for the 2011/12 fishing year was undertaken by EconSearch and funded by the Australian Seafood CRC. However, the ability of the Committee to rely on this data to make an informed judgement on the profitability of the abalone fishery is becoming difficult as the survey data is now dated.

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 shares¹². 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

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 quota³. 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

adjusted to lower quota limits, the number of divers (endorsement holders) and active fishing operations have reduced, while the number of shareholders has remained relatively constant. There are almost twice as many shareholders as divers in the fishery, so many fishing businesses lease in additional quota. Many external shareholders have historical connections with the fishery and attempt to remain active in management of the fishery and industry. Some shareholders are retaining boat capital as an option to start diving again should it become viable financially

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

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

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

Boat capital

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

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

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

Economic performance of the abalone fishery

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

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

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. Table 4 below, adapted from the EconSearch report, illustrates the sensitivity of the rate of return to changes in licence values.

Table 4: 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 were 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.

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 (\$328,000) 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 capital⁴. 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 fishing⁵.

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 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. With an increase from 47 to 48 shareholders in 2013/14, the average is now 72 shares per shareholder. 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 10.

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.

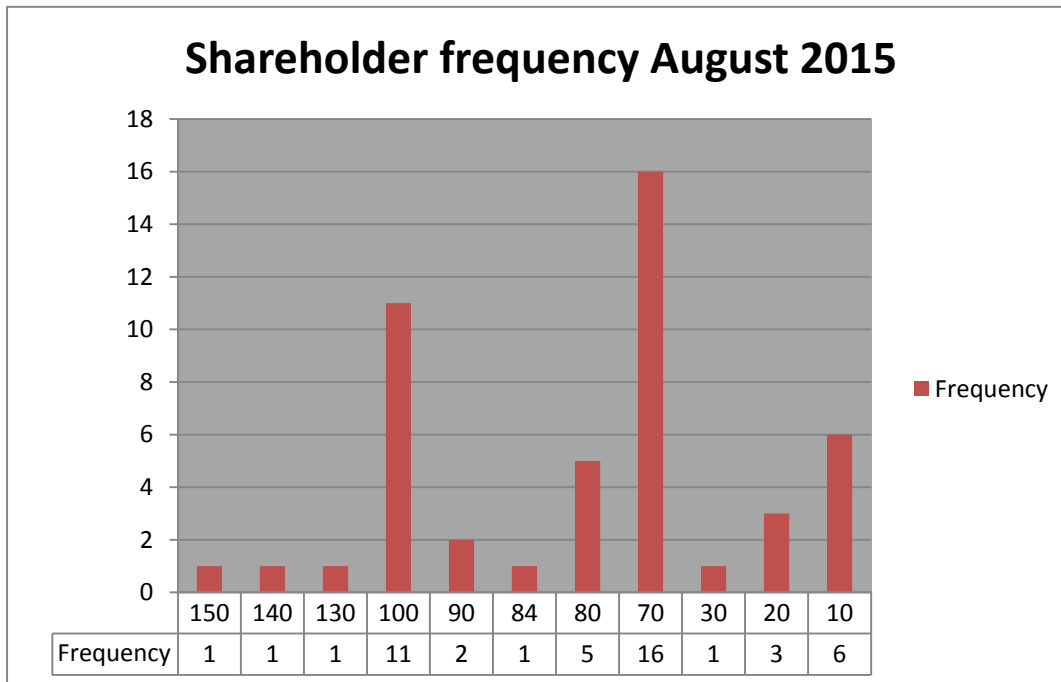


Figure 10: Number of shareholders at each level of shareholding as of end August 2015.

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, and in 2011/12 a total of 200 shares were transferred in six transactions. While precise share prices in these transactions are commercial in confidence the average share price for the six transactions is estimated at \$4,340 per share. There were two transactions totalling 30 shares in 2012/13 and a further two transactions totalling 140 shares to end August 2013. The average price for these transactions was in excess of \$6,000 per share.

From August 2013 to August 2014 there was 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.

During the 2014/15 financial year four share transactions took place comprising a total of 100 shares. One of these transactions was a whole fishing business package of 70 shares. In total \$891,500 worth of shares were traded at an average price of \$8,915 per share, which is an increase when compared to the previous year.

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. Diver numbers have trended downwards since 2008/09, from 35 to 26 in 2012/13; however they increased to 31 in 2014 due to the entry of new shareholders into the fishery. They are back at 30 again in 2015 (Figure 11). The most recent five fishing periods show a continuing trend for fewer numbers of divers to take a greater percentage of the catch (Figure 12).

The average number of days fished per diver fell from 69 in 2004/05 to 20 in 2010/11 and then increased over the following 2 years to 28.7 in 2013. The average number of days fished per diver fell to 20.1 in 2014 and 20.8 in 2015 period (estimate for the full year). This is due in part to increased TACs, but mainly to daily processor-imposed catch limits; 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 over time from 57kg/day in 2004/05 to 187.7 kg/day in 2014 and 208.7kg/day for 2015 to end August; again this would be far higher without daily processor-imposed catch limits.

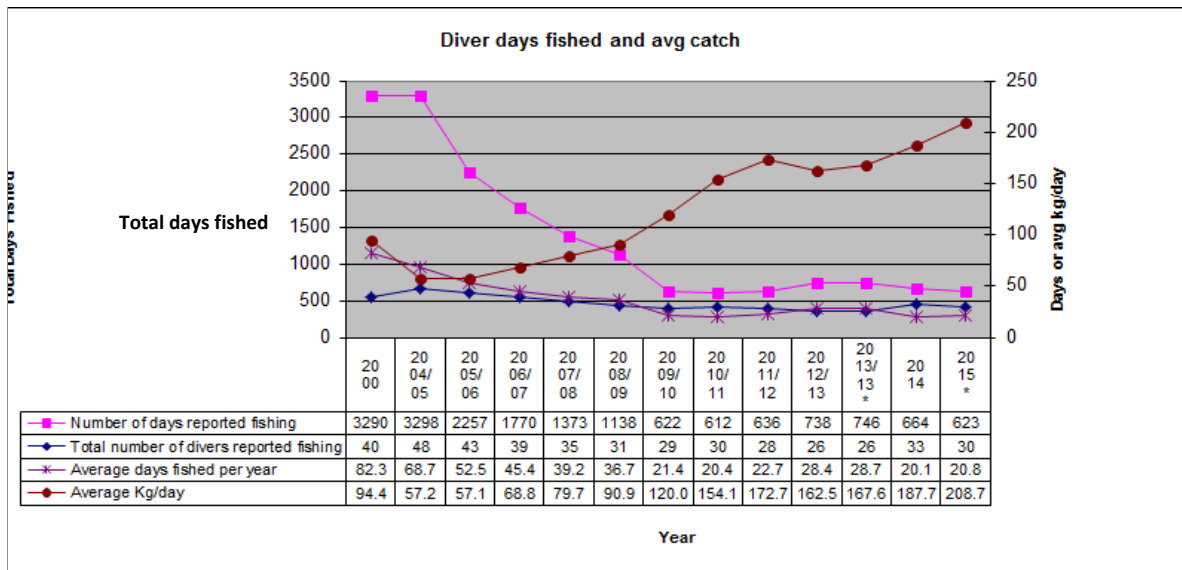


Figure 11: Total days fished, average days per diver and average catch per day from 2004/05 to 2015. * Note 2013/13 and 2015 data are full year estimates.

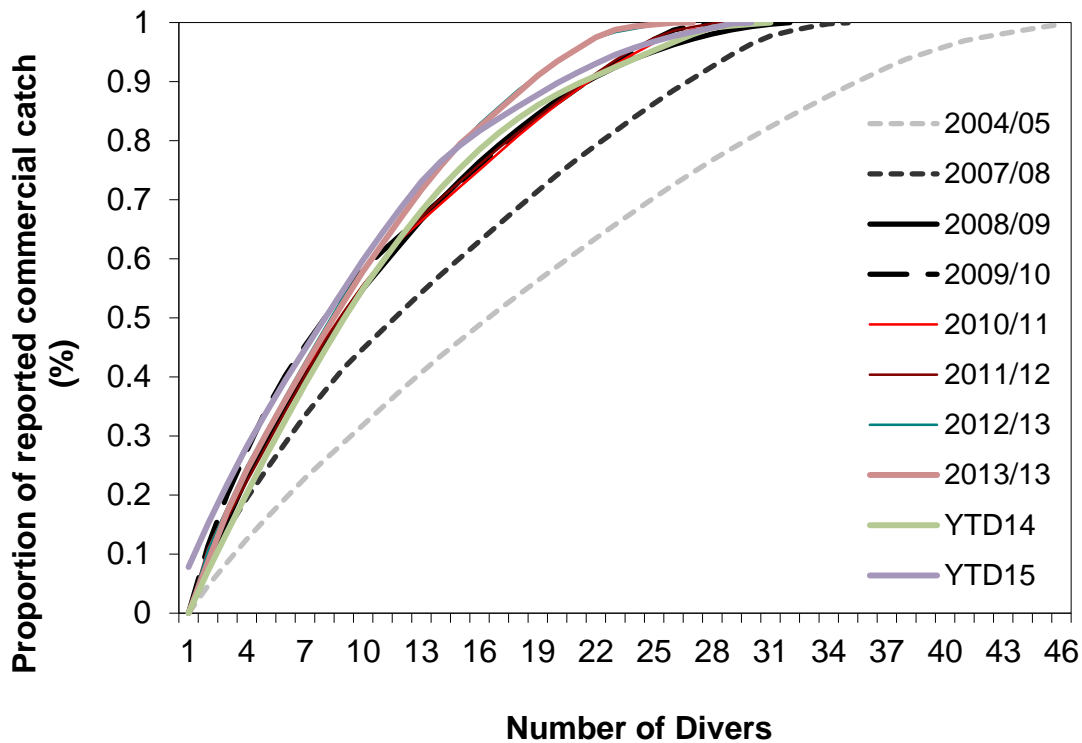


Figure 12: Percentage catches accumulation by divers from 2004/05 to end August 2015. Please note this graph still contains data to August 2014 for the 2014 fishing period.

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 2014, 27 shareholders leased out quota, and a total of 36 quota transfers were processed; and in 2015 to end August, 20

shareholders have leased out quota, and a total of 27 quota transfers have been processed (Table 5).

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 5: 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 the end of August 2015.

CY or FY	Amount of quota transfer in (kg)	% TACC	Number of shareholders transferring out quota	Processed quota transfers
1998	18,800	5	7	N/A
1999	31,000	9	13	N/A
2000	33,158	11	23	N/A
2001	21,016	7	19	Minimum 19 (exact no. not available)
2002/03*	46,376	15	23	N/A
2003/04	34,937	12	25	30
2004/05	29,474	14.3	23	Minimum 28 (exact no. not available)
2005/06	23,428	18	21	34
2006/07	29,743	23.8	21	43
2007/08	24,589.9	22.35	20	37
2008/09	32,826	31.2		47
2009/10	24,511.7	32.7	21	24
2010/11	29,910.8	31.8	22	39
2011/12	31,993.1	29	25	43
2012/13	36,702.8	30.6	21	27
2013/13**	17,471.9	27.9	21	25
2014	42,263.1	33.8	27	36
2015***	35,030.6	26.9	20	27

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

** 6 month fishing period

*** to 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 2014 represented around 50 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 16.5 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 2014 gives an estimated value of \$990,000 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 2014/15, 2,319 abalone were seized, which is down from the previous season when 3,182 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 \$8,905 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 two to five. 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 notes that the Department calculates CPI adjusted values using RBA "all groups" CPI data up to June 2015. Fiscal year adjustments are taken from the December quarter of the appropriate year up to 2014 when June quarter figures are used. CPI adjusted data is identified as "real price" figures on graphs. This approach is sound however, what is missing is the application of a base year. "A series of real values over time, such as for real GDP, measures quantities over time expressed in prices of one year, called the *base year* (or more generally the *base period*)."

The Committee recommends that the Department apply a consistent approach to calculating CPI adjusted data with reference to a base year.

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 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 GVP⁶.

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/optimize 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.

⁶ For more details refer to EconSearch 2012

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 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.

At some point in the future, the community contribution charge may change and be based on net returns and economic rent in the abalone fishery (this was due to happen in 2012). Given the recent improvements in economic returns in the abalone fishery, this may not be too far off. In the absence of more up to date information, it is likely that the community contribution charge will be based on information from the survey conducted by EconSearch, which indicates that economic rent is present in the abalone fishery. As net returns in the fishery will change over time, it is imperative that information is collected to update the figures in the EconSearch survey.

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 Spatial management

As recommended by the Committee in the section of this report on state of the stocks, it is important that the abalone fishery is effectively managed through the use of spatial management units with caps. There will also be a need for additional management of catch/effort at appropriate area levels to ensure rebuilding efforts are not undermined.

There are areas of the fishery where concerns exist over potential serial depletion and conversely, there are productive areas of the fishery that are currently have the potential for modest increases in catch. Use of spatial management will help to ensure the long term viability and revenue from the fishery as a whole.

One of the key factors influencing the catch that is taken from areas that are currently relatively underfished is the ability of fishers to access processor transport. Where such transport is not available, the cost involved in lengthy travel times delivering abalone to a processor may make it less profitable to fish in these areas. Conversely, the location of processing plants makes it more cost effective to fish near to those plants. These factors, along with the costs of travel to more distant fishing areas and costs of management and enforcement should be taken into account in determining the economic implications of various models of spatial management for the fishery.

4.18 Conclusion

The long-term outlook for the NSW Abalone Fishery continues to improve. Recent increases in share trading and values attest to this.

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 at this time. 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/optimize 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 LML 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 LMLs in the fishery will further improve economic returns.

NSW abalone product is up against strong competition from aquaculture product from both within Australia and from the rapidly expanding aquaculture industries in China and Korea, and to a lesser extent wild caught product from the significantly larger producing states of Tasmania, Victoria and South Australia. 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 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.

Much of the discussion in this section of the report is, this year, focussed on governance issues. It is clear to the Committee that there are important decisions to be made that will affect the future potential of the fishery and that some governance issues need to be resolved to ensure that the best, informed decisions are made (including decisions other than the TACC that are fundamental to the performance of the fishery). These issues have been identified over the previous three years and are reiterated and emphasised in this report.

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 NSW Abalone Fishery is currently classified as 'overfished-recovering' in the Status of Key Australian Fish Stocks Report 2012.

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, the bag limit of two means that abalone is effectively a by-product of rock lobster diving and so effort remains relatively low and stable. The 10 tonne estimate is therefore probably still reasonable.

Recreational Trust funded fisher surveys are providing some data regarding the recreational harvest of abalone. However, as predicted last year, the initial results from the survey (report yet to be finalised) affirms that recreational take of abalone is low (likely less than 10 tonnes) but that estimates are statistically unreliable.

As noted in last year's report, 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).

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 advised last year that it intends to consider this increase in future reviews of recreational catch limits. This has not yet occurred. It is noted that the Department does not intend to review other restrictions on recreational effort and that the restrictions on fishing only on weekends and adjacent public holidays in the area from Port Stephens and Wreck Bay Beach, and spatial closures around heavily populated urban areas, won't be lifted, if and when the bag limit is reviewed.

The Committee considers that the proposed change in bag limit 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 again this year 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.

Over recent years, permits have been issued for:

- 3,890 abalone in 2009/10
- 1,700 in 2010/11
- 2,115 in 2011/12
- 880 in 2012/13
- 1050 in 2013/14; and
- 1450 in 2014/15.

It should be noted that permits are issued for a basket of species, not just abalone, and so it is unlikely that the full number taken will be all abalone. Furthermore, advice from the Department's compliance staff is that actual take is significantly less than the amounts formally permitted. Therefore, although the actual amount of abalone taken under permits is

unclear, 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 (LML) 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. This is for several reasons, one of which is the phenomenon in abalone fisheries of 'hyper-stability', where catch rates can continue to appear healthy and stable due to changes in diver's catching behaviour that improve their effectiveness and efficiency, and therefore 'artificially' maintain catch rates and mask a decline in stocks.

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 LMLs (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 three previous reports, a formal framework would ideally include:

- applying the recommended LMLs – implemented in a way that the LML 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).

Last year, 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 was noted last year as a significant step forward and the Committee strongly supported this work, noting that progress since the year before had been limited. It was intended to have an interim harvest strategy to apply in the determination of the 2016 abalone quota. This has not come to fruition and the Committee is again in the position of making a decision without some fundamental management objectives being defined and a supporting decision-making framework in place. In addition, recommended size limit increases have not been considered and so mitigate against the effectiveness of the TACC as a restriction on catch.

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.

As in last year's report, 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 **strongly recommends** that a harvest strategy for the fishery be finalised in time to guide the determination of the abalone TACC for the 2017 quota year.*

Further discussion on spreading catch spatially

The proposed comprehensive management regime has been described in various reports and correspondence in recent years, including the three previous Committee reports. Last year, as an interim step towards the full management arrangements described, the Department had indicated a willingness to implement, in conjunction with the TACC determination a "northern quota" and "cap and close" arrangements at the Area level. This was considered as a way of enabling 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 at the time). The Committee report last year emphasised that the 'cap and close' arrangements are the most important component of this regime, particularly if the Northern Zone quota was not implemented. It recommended specific catch caps, in tonnes, for each Area.

The Northern Zone quota was not implemented, due to a variety of regulatory hurdles and other priorities for the Department. Unfortunately, cap and close arrangements were also not applied.

A mechanism for spatially managing the catch is critical to the management of an abalone fishery and vital to making the TACC meaningful. Without local area caps that are monitored and activated, increasing catches can continue to be taken on the 'best' reefs – those that are productive and close to port. This has in the past led to the serial depletion and over-fishing that led to the steep decline in this fishery that it is now still recovering from. Last year the Committee cautiously increased the TACC on the basis that there would be a mechanism put in place to ensure that this was not effectively an increase of 5 tonnes of catch to be applied to the already heavily fished reefs. As noted in the stock status section, it is apparent from comparison of the targets, limits and actual catch in recent years that

management of catches within the intended range is improving but is not entirely successful; some Areas have provided more catch than intended and others have provided less.

The Committee therefore urges the Department and industry to implement an effective spatial management regime.

Fundamental to implementing a regime is determining the spatial scale at which caps will be set. Last year, there was agreement that this would be at the “Area” level – 21 spatial units defined in the science reports. This agreement was recorded in the Committee report and reflected in the recommended caps that the Committee set out in last year’s report. These “Areas” are amalgamations of the previous “sub-zones” and considered to be at the appropriate scale for setting caps. The Department considers it important to continue to monitor at the sub-zone level, but this is not precluded by setting caps at the Area level.

There have been further discussions about the relative merits of a Northern Zone quota or some other regional caps to apply in tandem with Area caps. This would enable some flexibility to be applied to Area caps (for example a % tolerance for over-catch) but to ‘hardwire’ in strict caps at the regional level to ensure that the objective of the spatial management regime (spreading catch across the fishery) is able to be achieved. Various options were discussed. The Committee suggests that four ‘spatial management units’ would be appropriate to be defined in the spatial management regime (each SMU being an amalgamation of several Areas).

In terms of governance, another fundamental feature of the spatial management regime will be a transparent method for reviewing the status of an Area as it approaches its cap. This needs to be a simple but thought-through method for a balance of expertise (fisheries management, science and industry) to make decisions about whether to close an Area or to allow the catch to exceed the ‘soft cap’ by the pre-determined allowable percentage. This pre-supposes that each Area has a cap and a defined % of allowable over-catch appropriate for that Area. As catch approaches the cap, the expert panel should meet to provide advice to the Department on how to treat that Area when the cap is reached. Other jurisdictions have these arrangements in place.

The Committee notes that the industry informally use a “±30%” rule. This is too flexible and in general not appropriate, in particular for some Areas. This is also noted in the stock status of the report.

*The Committee **recommends** that a spatial management regime with appropriate governance arrangements is implemented **as a high priority**.*

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.

The Department reviews 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.

Despite these processes, 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 2015 to develop industry recommendations for catch targets and the TACC. This year the workshop did not discuss local Area targets and the presentation to the Committee therefore relied on the proposed 2014 industry targets (which are higher than the Committee's recommended Area targets). The Council (represented by Dr Worthington) then provided a lengthy presentation to the Committee at its public hearing, 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 130 to 140 tonnes. In putting this position, emphasis was placed on continuing high catch rates although with differing views about the robustness of the rebuilding.

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 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 and 2015 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 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. It is clear that there is an abundance of information available from the loggers and that the key to effectively using the information will be to pick one or two indicators that provide an insight into signs that effort is increasing as a means of maintaining catch rates. Kilograms per hectare appears to be the most reliable and useful indicator to be gleaned from the logger data. It is also noted in the stock status section that logger information that was presented last year (area fished and the location of concentrated fishing effort; and catch rate and mean weight at 1Ha hexagon scale) and which was promising in terms of analysis was not presented this year. Consistency in the presentation of relevant indicators is currently a deficiency affecting the quality of analysis and, again, should be clarified through a harvest strategy.

The stock status section of the report describes the plateauing of key indicators across almost all active Areas of the fishery. Therefore, while the fishery is in a strong position relative to recent history, it is evident that the rebuilding is slowing and possibly stabilising at or near current levels. Importantly, the biological analysis on the available information suggests that this is an impact of increasing fishing effort and that the fishery could reach much higher levels of productivity with active and informed management.

These signals are reinforced by the industry input received. 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 remain confident that the stock is rebuilding. However, the weight

of advice from industry submissions and discussions is to exercise caution in TACC-setting and to offer support to maintain the TACC. This is notably more cautious than last year.

Some preliminary estimates of harvest fraction were also presented for the first time last year. 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. The stock assessment section of this report analyses the impact that management decisions could have on the long term productivity of the fishery. Lack of guidance to the decisions that can be made mean that there is no intentional choice between growing the fishery to its potential, or alternatively to stabilise it at some lower stock levels.

As noted last year, the Department's work to prepare a draft interim harvest strategy was seen as a significant step forward in meeting the deficiencies in the current management arrangements. While this has not progressed, 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.*

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. Previous Committee reports have document the nature of the relationships over time.

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 representative body (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 in recent years. 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 against which delivery can be monitored and measured.

There remains a conflict of interest in the arrangements for the fishery with the contracted science service provider also being the paid industry advocate for the Abalone Council of NSW. This has the same individual being paid by the Department to deliver independent data and analysis and also being paid by the Abalone Council to advocate in its interest. This undermines the perceived independence of the science, and also gives weight to the advice of the Abalone Council in preference to other industry members who are not aligned to the Abalone Council. At the very least, this conflict should be managed by ensuring that the annual presentation of the data and its analysis is not combined with any advice on “industry views” or advocacy on their behalf (which is the experience at the moment). Furthermore, the annual industry workshop which is held to develop the industry position leading up to the TACC determination process must be independently chaired, rather than organised and run by the science provider. These would seem to be basic governance arrangements to bring some level of transparency, independence and balance to the process.

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 and the Abalone Council introduce improved governance arrangements in the provision of the scientific services that support decision-making in the fishery.*

*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 (at which time the fishery changed from a quota period aligned to the financial to being aligned the calendar year.) For 2014 the management fee was \$62.81 per share, which was 5.87% of GVP. For 2015 the fee has increased marginally to \$68.37 and is estimated to be 6.62% 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 harvest strategy 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.

The compliance rates for each sector in recent years are set out in the Table 6 below.

Table 6: Compliance rates by sector

Compliance activity type	2012/13 compliance rate	2013/14 compliance rate	2014/15 compliance rate
Unlicensed (Recreational and targeted illegal)	56%	69%	73%
Licensed commercial	71%	51%	64%

The improved commercial compliance rate reflects that no serious offences were reported during the 2014/15 period. All offences reported were minor and received cautions. The most common offences were late returns and ‘over-quota balance’ at the end of the season. (This was acknowledged as a minor offence related to end of season quota reconciliation and not quota fraud.)

The most common offences in the unlicensed sector were recreational offences - ‘take of undersize fish’ and ‘exceeding bag limit’ by small quantities. 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.

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. Compliance efforts have been expanded as shown in Table 7.

Table 7. The amount of compliance effort put into the abalone fishery in recent years has been:

Compliance activity type	2011/12 effort	2012/13 effort	2013/14 effort	2014/15 effort
Unlicensed (Recreational and targeted illegal)	4670 hours	4790 hours	3189 hours	2390 hours
Licensed commercial	1478 hours	1654 hours	452 hours (37 QA inspections on licensed fishers)	402 hours (33 QA inspections on licensed fishers)

The reducing effort in the licensed commercial sector reflects the risk-based, intelligence led approach and the fact that less major abalone operations have required intensive compliance effort in recent years. It is a positive reflection on industry compliance rates.

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 having 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 their 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.

The Committee again commends the Compliance Unit for their professional and transparent reporting.

5.4 Total Allowable Commercial Catch (TACC) for 2016

Last year the Committee made a moderate increase to the TACC to 130 tonnes with explicit explanation of the importance of a spatial management regime to be implemented at the same time as the increase, to ensure that the additional catch was taken from the Areas of the fishery that are lightly utilised. The Committee noted that “if 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.”

Based on the stock status, the lack of a harvest strategy and decision-making framework and the associated lack of a spatial management regime, as well as economic considerations, the Committee determines the TACC for 2016 to remain at 130t.

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

Until last year it was noted that there was considerable controversy surrounding size limits in the abalone fishery. However, this year, there is a detectable shift in attitude towards size limit changes. This is evidence in the submissions made to the Committee, as well as discussion at the public hearing. A combination of new licence holders to the fishery, and acceptance from more existing licence holders that the previous size limit increases have benefited the fishery, appear to have influenced a more positive attitude towards higher size limits being applied in the fishery.

This year, the Department has advised that it intends to review the existing data in relation to size limits and seek further advice on the benefit of increasing the size limits. The Committee sees any progress as a positive but considers that the evidence is already clear

as to the best approach to size limits in the fishery. This is discussed in the stock assessment section of this report.

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 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.

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

While the overall trend toward recovery in the past 10 years is very clear it is also now clear that stock rebuilding has slowed considerably in the past 2-3 years as the catches have increased. The key catch rate and mean weight indicators are plateauing. The plateauing of these indicators was first recognised in a few Areas in 2013, it was more widespread in 2014 and it is now seen in almost all Areas of the fishery.

The evolving logger data and its analysis are starting to provide tools for identifying trends that would otherwise be masked by standard catch and effort data. However, there is no agreement and guidance on the most useful indicators and how they could be consistently presented.

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. 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 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 LMLs, 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.

The Committee considers that in the context of the status of the fishery and the continuing deficient state of the fishery's management, it is appropriate to maintain the TACC at 130t.

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 2016 to 31 December 2016 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 areas. There remains, however the need for effective spatial management for full extent of the fishery.



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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		
3 October 2015	Section 31(1)	Committee called for public submissions on the appropriate level of the annual TACC for Abalone for 2015 fishing period.
3 October 2015	Section 284 (1b)	The advertisement was placed in the Sydney Morning Herald and the Daily Telegraph.
5 October 2015	Section 284 (1b)	Individual calls for submissions were also sent to particular interest groups who the Committee considered would be interested in providing a collective standpoint, either due to their direct involvement in the abalone industry or due to their interest in conservation issues. These groups included the following: <ul style="list-style-type: none"> ■ All NSW Abalone Shareholders ■ Nominated Divers ■ Abalone Processors
31 October 2015	Section 284 (1b)	The Committee allowed a period of at least 28 days for public consultation.
	Section 31 (2)	The Committee gave regard to the following submissions. The respondents included the following: <ul style="list-style-type: none"> ■ NSW DPI – Commercial Fisheries Management, Research, and Compliance. ■ Abalone Shareholders
10 November 2015		The submissions were collated and analysed, and the Committee heard formal presentations regarding views and opinions at the meeting held on 10 November. The following made presentations, or provided information to the Committee: <ul style="list-style-type: none"> • The Abalone Council of NSW (D. Worthington) • Compliance and management staff of NSW DPI • John Smythe • Michael Norris

Appendix 2. Summary of submissions and the issues⁷

Submission provided by ^{*8}	Issue(s)/Recommendations
Abalone Council of NSW ⁹	<p>An industry report, which now incorporates the stock assessment, a report from the Catch Planning Workshop and industry preference for future management measures. The report included:</p> <ul style="list-style-type: none"> ● Comparison of recent and historic lengths landed greater than current size limit. ● Comparison of recent and historic lengths landed greater than size limit at measuring. ● Length frequency in 2014-15 for 12 Areas selected with large samples. ● Monthly and annual catch figures to Aug 2015.. ● Catch table to Aug 2015. ● Workshop summary from Jul 2015. ● Annual catch figures by Zone to Aug 2015. ● Draft Reference points for the NSW Abalone Fishery. ● Annual catch figures by SMU with catch control ● An interpretative summary assessment of stocks. ● A submission to the Committee setting process for abalone in 2015, including logger data analysis <p>The submission notes that a novel, informative and cost-efficient framework has evolved to provide advice about catch setting in the fishery. While the TAC has been progressively reduced, catch remains concentrated in areas south of Bermagui (Areas 10-21), because of the ease of catching and processing. Notes increasingly positive indicators from the fishery, including catch rates and size of abalone. Acknowledges some areas where catch has been concentrated, causing catches to stabilise or decline in 2014-15. Notes that the industry Catch Planning Workshop recommended a TAC for 2016 of 130-140 t, Draws attention to the workshop recommendations for: a separate quota for northern areas of them fishery, to ensure catch spread; the need to ensure that no further catch should come from areas south of Eden (i.e. Region 5 and 6). Appropriate for Industry to manage catch distribution at the fine scale of Sub-zones and Areas, while regulatory approaches could be considered at broader spatial scales, such as a northern quota. If catch can be distributed better across all productive areas, the TAC recommended by the workshop of 130-140 t in 2016 should be sustainable, while maintaining stable or increasing fishery performance indicators</p>
3 X Confidential submissions	

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