

TAC Committee

Total Allowable Catch Committee

Report and Determination for 2009/10

ROCK LOBSTER FISHERY

7 May 2009

SUMMARY

Management issues

The steady recovery of New South Wales rock lobster continues. Catch per Unit Effort (CPUE) has doubled between 2000/02 and 2007/08 and exceeds the 1998/99 benchmark by nearly 50%. The market price for shares has almost tripled in the past four years and demand is strong to both purchase and lease quota/shares.

The ITQ system operating in the rock lobster fishery, in contrast with that of abalone, is working effectively, with the total commercial catch in the fishery now constrained by the annual Total Allowable Commercial Catch (TACC). The transfer and sale of shares and quota is leading to rationalisation within the industry under management arrangements that DPI has in place for the fishery. Over the past ten years, the total number of shareholders in the fishery has contracted from 188 to 112, with an increasing number of operators with larger shareholdings specialising in rock lobster fishing.

The number of input controls that are likely to be acting as a barrier to more effective operations continue to be reduced. The current maximum quota holding is scheduled to increase from 350 to 1400 shares and removal of the exception to the 55 share minimum quota holding (for an endorsement to fish) is under consideration. The Committee supports DPI initiatives to consider and, where appropriate, remove input controls which hamper the performance of the fishery.

As noted in previous years, the Committee is of the view that updated estimates of illegal, unreported and recreational catches are required. In the absence of other verifiable data, the TAC Committee has adopted the allowances used in the DPI stock assessment of a 25.8t recreational catch (illegal and legal components) and 17% of the unreported commercial catch. The latter total is considered too high, given the incentives for rock lobster fishers to operate within the law. The figure is, however, likely to be representative of 'other commercial' unreported catch including unrecorded mortalities from trawling and fish trapping, and the black market for lobsters from all sectors. The Committee suggests that efforts be taken to more accurately determine the components of the illegal catch. The commercial sector remains concerned about the lack of an accurate estimate of recreational catch and the lack of a strategy to ensure recreational compliance. The Committee concurs with these concerns.

As the commercial viability of the commercial sector has improved, there appears to be less concern over the level of charges that apply to the fishery. Management costs as reported by the Department have continued to contract by such means as reductions in on-costs and the apportionment of some management costs to the recreational sector. Management charges have however increased in 2008/9, apparently due to a change in the methodology for collecting research contributions for the Fisheries Research and Development Corporation. In the past, these were part of annual licence fees but they are now part of the management charge – in this sense they are not an additional charge.

As the stock recovers, long term targets designed to maximise the economic yield from the resource will be required as the fishery moves away from an emphasis on limit (biological) reference points towards an agreed target (economic) reference point for the rebuilding for the fishery.

Consideration should be given to approaches including a spatially structured TACC and different combinations of TACCs and size limits. Such measures could reduce catches in the north, but protect the spawning stock, enable higher TACCs than would otherwise be available, and give greater overall benefits to the lobster fishing industry.

As was the case last year, a number of submissions to the Committee concerned the perceived loss of habitat, including large areas of soft corals, due to expanding (into new areas) trawling operations. The Committee understands that there are currently

'gentlemen's agreements' between trap and trawl operators and that a habitat mapping exercise has occurred. Given experience elsewhere and the relatively low cost and availability of positioning technology, spatial management to avoid gear conflict and habitat damage should be explored.

Communication and consultation processes in the industry remain effective and the Committee continues to be impressed at the sophistication of the debate and the valuable exchanges with industry that occurred at the annual TAC Open Forum meeting. DPI (managers and researchers) and industry are to be congratulated on their collaborative approach to this fishery.

The Committee urges LobMAC to become more active in discussing with NSW DPI, the issues and recommendations raised in this report and where appropriate, find ways and means to address them.

Economic issues

There seems to be increasing optimism in the fishery, as reflected in industry reports, of increasing prices both for leasing quota and purchasing shares. The real value of production in 2007/08 was the second highest, in real terms, after the 2002/03 high. The improvement over recent years reflects both improved production and prices on the local market, the latter proving to be relatively resistant to the volatility affecting export lobster markets.

The operating environment of the fishery is complex. Income from many of the smaller operators is derived from multiple fisheries, there is an increasing trend towards specialisation and larger shareholdings, and changes are occurring through restructure and increased revenue. The Committee is unable to provide authoritative comment in the economic status of industry in the context of these changes due to a lack of data on industry costs and returns. As such, the Committee's analysis is restricted to the relatively unreliable interpretation of changes in share and quota prices. As the stock recovers, attention should be shifted to the lower but more profitable MEY. Setting a TACC targeted at MEY will require information on costs, and the structure (capital) and operations (operating costs) of the rock lobster industry. This information would enable calculation of return on capital, net income and returns on management. Such information is vital to the context in which the TACC is set. DPI is urged to make progress on developing, with industry, cost effective means of obtaining better economic data for the fishery.

Structural change in the industry continues to occur with shareholdings concentrating in the medium-sized cohort, suggesting that this size of enterprise, perhaps through association with other endorsements, has efficiency and/or stability advantages.

Share prices continue to rise. They are now believed to be worth over \$2,000, up from around \$640 per share in 2004/05 and approaching the high of \$2,364 in 1998/99. This increase reflects the recovery of expectations concerning the economic and biological health of the industry. Similarly, quota prices have displayed a significant upward trend in real terms up from \$9.77 per kilogram in 1999/00 to \$18.90 per kilogram to February 2009. Price information on quota/leasing values, and information on holdings of unused quota would be useful to inform both the economic status of the fishery and to assist in efficient quota trading.

The Committee's determination for 2009/10 is based on the strengthening the prospect of restoration of the spawning stock, and while unlikely to further increase revenue in the short term, offers promise of improved circumstances. In the longer-run, continued structural change, improved management and the return of spawning stock to acceptably robust levels, suggest the fishery is on track to become a biologically and economically sustainable industry.

Biological issues

Data from the fishery indicate that the aggregate catch rate continues the increasing trend of the past 7 years. While the preliminary 2008/09 catch rate is somewhat lower than that of the previous 2 years, it remains higher than catch rates since the 1970s. The main cause of the reduction this year is reduced catch rates in the 10-30m and (especially) the >30m depths in the mid-south and far-south regions (i.e. south of 33°). This reduction is ascribed to poor weather and current conditions in the relevant season for fishing these regions, when high catch rates are usually taken. The current interpretation of the fishery implies that lobsters will be available later in the year to the fishery operating in depths >30m on the mid north coast, and this is supported by very high catch rates in the preliminary 2008/09 data from this region. The decreased catch rates in the south of the fishery should be temporary, and catch rates in subsequent years should be closely monitored.

Overall, the catch rates for most areas are similar to those in the previous year or have changed in the way expected from the short-term fluctuations in puerulus settlement, such as the decrease in catch rate in the on the mid-north coast in waters less than 30m.

During the second half of the 1990s, this Committee steadily increased the TACC of lobsters based on increasing catch rates, optimistic predictions from the stock assessment model and the confidence of fishers following the 1992 restructuring.

After an initial rise in catch rates, possibly as a result of an increase in efficiency and targeting practices that followed the introduction of ITQs in 1994/95, catch rates fell by about 50% between 1999/00 and 2000/01. This reduction was most severe in the mid-depth and deep areas of the northern part of the fishery where the spawning stock is located. The low catch rates in the mid-depths on the mid-north coast persisted for 4 years. They then increased in 2004/05 to about half of their level prior to 1999/00, and have been maintained at about that level during the last 5 years.

The degree to which the reduction in the mid and far north areas was due to the influences of oceanic conditions as opposed to fishing pressure remains to be completely resolved. By 2002 however, there were strong indications that the stock may have been in a much weaker state in the early 1990s than the earlier models suggested, with the spawning biomass being particularly hard hit.

While other explanations are available, the interpretation currently being used to explain this reduction is that a shortage of juvenile lobsters in the northern zones in depths less than 10m, due to previous weak puerulus settlement, resulted in a transfer of fishing effort during 2000 and 2001 to deeper water. This led to excessive catches of larger lobsters from the spawning stock. This relatively small shift in effort resulted in a large change in fishery selectivity, and caused a significant reduction in the spawning stock - implying that, at the time, the absolute size of the spawning stock was quite low. As a result of this interpretation, management action was taken to protect and rebuild the spawning stock by reducing the overall TACC and the maximum legal size (from 200mm to 180mm from 2004/05).

The size composition of the catch on the mid-north and far-north coast, the area occupied by the mature lobsters, remains of particular interest. The size compositions from the northern regions for 2004/05 to 2007/08, and especially 2008/09, show good signs of recovery of pre-adult and adult lobsters less than 200mm, but this recovery is limited to the mid-north coast only. The far north coast remains of concern, and while some slow increase in catch rate has occurred, indications are that the lobsters there represent an ageing population that is not being adequately replenished by young animals.

Subsequent determinations (and recommendations) of this Committee, reinforced by management decisions over the past several years, have sought to provide for stock rebuilding and protection for what was estimated to be a severely depleted biomass. There is now measurable evidence that the spawning biomass has been rebuilding in recent years, and in the most recent year (2007/08 to 2008/09) is estimated to have stabilised, with a

slight increase. However, the spawning stock is still significantly depleted and there is only slow rebuilding occurring under the current catch levels. The median spawning stock remains below the limit reference point of depletion to 0.3 of the unfished level, with credible interpretations being that the median spawning biomass is between 0.20 or 0.26.

The estimated total stock biomass in 2008/09 is slightly lower than that in the previous year. The total biomass has stabilised or is slightly decreasing. The reduced total biomass is due to reduction in the exploitable biomass (104-180mm lobsters) because of the reduced puerulus settlement of several years ago and the decreased size range of harvestable lobsters following the decrease of the maximum size limit. The recently increased TAC is removed from a narrower range of sizes in the population, whereas the spawning biomass has significant protection from the 180mm maximum size limit.

The base case assessment, which is currently given the greatest credibility, implies rebuilding of the spawning stock will continue under the current catch levels and almost recover to 0.3 of the unfished level in the next 5 years. The alternative assessment implies that there will be no further rebuilding of the spawning biomass under current catch levels, while both assessments imply that the exploitable biomass will decrease over the next 5 years under current catch levels. There is some preliminary evidence that the natural mortality may be slightly higher than is assumed in assessment model, and if correct this provides a more optimistic interpretation than the base case assessment of both the current status of the stock and the rate of recovery.

None of the model fits matched the rapidly increasing catch rate in the last 3 years of complete data (i.e. 2005/06, 2006/07, 2007/08). The model interpretations are of a relatively stable stock abundance through those three years, rather than of a stock abundance that is rapidly increasing in proportion to the catch rate. Suggestions for additional analysis of fisheries data to resolve this issue has been recommended by the Committee.

The interpretation of low spawning biomass poses risk to the sustainability of the fishery in the near term. It is reasonable to assume that there may be further periods of low recruitment in the north, which could again result in a change of targeting away from immature lobsters and onto the spawning stock. The recently reduced maximum legal size, combined with a bigger spawning stock should provide some protection so that relatively minor operational changes in targeting do not put the spawning stock at risk.

The determination

By maintaining a total catch of 180t and a TACC at 128 tonnes for 2009/10, priority is given to rebuilding the spawning stock while recognising that the projections do not include all sources of uncertainty. This approach carries some risk, and progress will be monitored closely in coming years. In particular, there is need to ensure continued recovery of the spawning stock to the limit reference point, and under some interpretations of the available information this may not occur under present catch levels. Also the current catch level may result in significantly reduced catch rates from the exploitable stock.

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**TOTAL ALLOWABLE CATCH COMMITTEE
ROCK LOBSTER FISHERY
REPORT AND DETERMINATION FOR 2009/10**

1. INTRODUCTION

The Total Allowable Catch Review and Setting Committee (the TAC Committee) is established by Section 26 of the *Fisheries Management Act 1994*. In 2009 it consisted of:

- Mr Ian Cartwright – Chairman
- Dr Keith Sainsbury – fisheries science
- Prof Warren Musgrave – natural resources economics
- Mr Stephen McCormack – fisheries management

The Committee was provided with Secretariat services by Ms Jackie Gerard, Executive Officer.

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

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

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

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

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

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

The legal and illegal components of the recreational fishery are currently estimated as a single figure, and the unreported commercial catches are estimated as a percentage of the actual commercial catch.

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. The rationale and measures suggested by the Committee concerning the maintenance of an adequate spawning biomass in the north of the fishery is an example of the application of the precautionary principle. It is important that DPI and the MAC provide feedback on the suggested rationale and measures made by the Committee in relation to the application of the precautionary principle in its Report and Determination.

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

2. PROCEDURES

2.1 Public Consultation by TAC Committee

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

The Committee interviewed and received reports from:

- NSW Department of Primary Industries, Fisheries Research;
- NSW Department of Primary Industries, Commercial Fisheries Management;
- Department of Primary Industries, Fisheries Compliance;
- representatives and members of the Lobster Management Advisory Committee; and
- industry members.

Mr Daryl Sykes, a New Zealand consultant experienced in rock lobster fisheries, again attended the Open Forum on the 31 March 2009, representing industry interests.

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

As occurred in 2008, submissions to the Committee were provided in an open forum, with an option for the Committee to call on *in camera* submissions where appropriate. During the forum, the Committee and industry were able to ask questions of clarification. This year, no requests were received to provide submissions in camera.

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 DPI;
- advice on the economic status of the fishery as assessed by DPI and by industry representatives;
- the stock assessment for rock lobster provided by DPI;
- the spatial nature of the fishery, particularly in relation to the spawning biomass;
- comments and commentary provided at the TACC Open Forum;
- the issues raised by Mr Daryl Sykes on behalf of industry; and
- the compliance situation as assessed by the Department and by industry representatives.

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

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

The Determination of the Committee for the annual TACC for rock lobster for the 2009/10 season is provided at the end of the report.

3. MANAGEMENT CONSIDERATIONS

3.1 Introduction

This section of the TACC report provides background information on the New South Wales Rock Lobster Industry focusing on the commercial component of the fishery. The NSW Department of Primary Industries (DPI) has been the key information source for data on the fishery, through its submission to the TAC Committee. In the context of TACC setting, the status and effectiveness of the current management regime and areas where improvements could be made are considered. Some overall conclusions are drawn.

3.2 Background to the Management of the Commercial Fishery

Rock lobsters have been commercially harvested in New South Wales since at least 1983. The fishery is based almost exclusively on the Eastern rock lobster (*Jasus verreauxi*). Occasional landings of southern rock lobster and painted rock lobster occur, but this amounts to less than 1% of the catch.

Sustainable management of the commercial fishery for Eastern rock lobster is more challenging than is the case with other Australian lobster fisheries because of the fact that the larger, mature lobsters that make up the breeding stock of the fishery are found in the north of the state. In southern waters, smaller immature lobsters that have yet to breed are harvested.

Since 1994, the setting of an annual Total Allowable Commercial Catch (TACC) and the allocation of transferable, individual fishery catch quota (shares) to licence holders have

been the most important management measures for the fishery. These measures are augmented by input controls, including minimum and maximum size limits.

Lobster fishers in New South Wales traditionally operated in more than one commercial fishery. However it is now apparent that an increasing proportion of the total catch is being taken by a smaller group of operators who fish predominately for lobsters. Over the past ten years, the total number of shareholders in the fishery has contracted from 188 to 112, with a transfer of shares between small (>55) to large (>100) shareholdings.

The transfer and sale of shares and quota are an important and integral part of the management of an output-controlled fishery, and are encouraged by the management arrangements that DPI has in place for the fishery. Submissions to the TAC Committee from shareholders indicate that there are operators in the fishery who are keen to expand their level of investment by increasing their individual quota shareholdings. This is consistent with the management objectives for the fishery and is an encouraging sign for the future.

The NSW commercial fishery for rock lobster is very small by comparison to similar fisheries in other States. Total annual landings for all lobsters in Australia exceed 15,000 tonnes, with the NSW catch making up about 1% of the total. While other lobster fisheries are strongly dependent on export markets, the NSW fishery has an established market within the State and only small quantities are exported. Eastern rock lobsters are clearly sought after by consumers (particularly by the Chinese community) and attract and maintain relatively high prices and strong demand on local domestic markets. The strong current price (\$60.40 per kilo at the time of writing) and relative lack of volatility suffered by mainly export fisheries are strengths for the fishery into the future.

3.3 The Commercial Fishery

The total commercial catch in the fishery is effectively constrained by the annual TACC. Concerns that have been expressed in the past about the capacity of the commercial sector to take all of the allocated TACC now appear to be redundant, with annual landings above 96% (98.3% in 2008/09) of the TACC for the past four years. At the TACC setting forum held on the 31st of March 2009, the fact that there was still a large proportion of the TACC to be taken before the end of the current quota period was discussed. There appear to be a range of issues contributing to the lower-than-expected catch, including poor weather conditions and a slow start to the fishery particularly in the north of the State. There was no concern raised that the lower catch was indicative of a lower abundance of lobsters in the fishery. Industry representatives were confident that, as in recent years, nearly all of the TACC would be taken before the end of June 2009.

At previous meetings, industry representations to the TAC Committee continue to draw attention to concerns about the high transaction costs for quota leasing which inhibits the transfer of small amounts of quota at the end of the fishing season. The inability to fish right up to the full TACC due to small 'residual' holdings of quota being shared among all quota holders is not unusual in quota fisheries. There was strong support from industry representatives at the forum for the establishment of a quota register which would provide up to date and precise information on the availability of uncaught quota. While DPI was supportive of such a register, some concern was expressed on confidentiality issues.

Quota registers are commonly used in a number of fisheries. It would appear that a register, or a system that would achieve similar outcomes in terms of matching buyers and sellers in the quota market, would be of considerable benefit to the overall economic performance of the fishery as a whole. Fishers who need to seek additional catch, particularly towards the end of the quota period, would particularly benefit from such a scheme.

The Committee recommends that DPI assess the options for providing more timely information on the availability of quota for lease. LobMAC is ideally placed to provide advice to the Department on this issue.

The 2004 decision to reduce the maximum size for lobsters to 180 mm was reviewed by LobMAC at the suggestion of the Department in 2007. There continues to be strong support for retaining the current maximum size. This initiative has provided a greater level of protection for the adult spawning stock which is a priority management objective for the fishery. Maintaining a healthy stock of mature lobsters continues to be a priority management objective underpinning decisions of the TAC Committee.

There seems to be a degree of comfort with the current minimum size arrangements. This is most likely due to the fact that the benefits of an increase in LML to the stock are likely to be relatively much less than the economic costs that would be incurred by not being able to target the currently available smaller, more valuable lobsters.

The *Fisheries Management (Lobster Share Management Plan) Regulations of 2000* set out the arrangements that are in place for the day-to-day operation of the commercial fishery. The Fishery Management Strategy (FMS) for the NSW Lobster Fishery provides detailed information on management arrangements for the fishery. Objective 5.1 of the Plan is (in part) to promote the long-term economic viability of the fishery.

Since the introduction of the Share Management Plan in 2000, the number of shareholders in the fishery has contracted from 174 to 112. Advice from the Department shows that some 81 shareholders have actually reported fishing activity for lobsters so far during the current quota period. Significantly, about half the commercial catch lobster catch is now being taken by 12 licence holders.

The Department continues to support a reduction in the number of active operators as distinct from the number of shareholders in the fishery. Apart from the fact that this will lead to greater economic efficiency, it should also lead to significant reductions in management and compliance costs for the fishery. For these reasons, and to prevent the activation of latent effort as the fishery recovers, the Committee supports the minimum share holding requirements in place for this fishery.

Currently, shareholders who held less than 55 shares at the time of introduction of quota are eligible for an endorsement to fish. This exception (to the current 55 share minimum) is being reviewed. It is noted that around 80 shareholders held less than 55 shares in 2001/02, but this number is now down to 19, 12 of whom reported fishing in 2007/08.

The Committee notes that the number of licence holders in this category has reduced substantially over recent years but continues to be of the view that the exception to the 55 share minimum be removed.

The purpose of maximum share or and quota holdings is unclear but they were probably developed to prevent monopoly holdings across the fishery. Whatever the intention was, it now appears that they have become redundant and may well be counter-productive by acting as a barrier to more efficient operations. Subject to availability, operators in the fishery should be able to buy or lease the amount of quota that is relevant to their individual fishing circumstances and this may well exceed what is specified in the current maximum quota holdings.

Approximately one third of quota is leased on an annual basis and is invariably acquired by one of the specialised lobster fishers who are developing a viable basis for their operation. Annual lease prices for quota that range between \$15 and \$20 a kilo are clearly not a deterrent to this.

It seems to the Committee that the process of restructuring the fishery is proceeding at a steady rate but because of the number of leasing arrangements that are in place, a true picture of share and quota ownership in the fishery cannot be established. This makes the task of assessing the economic status of the fishery quite difficult.

Fishermen should have the option of obtaining additional quota by purchasing more shares rather than having to rely on leasing additional quota on an annual basis if this better suits their business operations.

The Committee has queried the reason why the maximum amount of quota that an operator in the fishery can hold should be restricted, and last year suggested that this restriction be reviewed. The Committee is pleased to note that with LobMAC support, the maximum shareholding limit is scheduled to be increased from 350 to 1400 shares. As the fishery evolves this should lead to a reduced number of operators who are more efficient should lead to reduced compliance costs.

3.4 Illegal Catch

A key objective of the Share Management Plan for the fishery is to minimise the number of offences that occur in the fishery. Commercial sector compliance rates for the 2007/08 period were determined by the Department to be at 89%, which is above the trigger point of 70%. Preliminary data from the 2008/09 period indicates that compliance rates will remain relatively high.

Compliance staff target their resources to four key areas - black marketing, intelligence-driven operations, development of a database and advisory activities. The success of these activities is of direct relevance to the TACC setting process. Falsifying log-book information, non-tagging of lobsters and the use of holding pens are all mechanisms that can be used by unscrupulous operators to defeat the quota system and increase their returns from the fishery to the detriment of other operators. The Committee notes that the issue of carry-over of lobster between quota periods remains a serious compliance issue that will be targeted in the future.

In common with other fisheries jurisdictions, DPI Compliance Operations are placing additional effort into targeting areas suspected of high levels of non-compliance, as identified by intelligence. The Committee is very supportive of this approach, and notes the high level of cooperation between industry and DPI compliance officers in the supply of intelligence. This appears to be in stark contrast with the abalone sector.

In the process of developing the TACC for the fishery, the Committee determines an amount for illegal unreported and unregulated catch. This estimate has, in recent determinations, been 17% of the TACC and is based on an estimate for the commercial sector in a report by Ruello and Associates that is now eight years old. Industry representatives are increasingly critical of the accuracy of this figure, which in real terms now equates to about 20 tonnes of lobster. DPI, however, considers that this figure is reliable if all sectors of the fishery are taken into account

Industry, with some support from the Department contends that this figure is too high, and maintains that the penalties that apply to them for transgressions against the rules of the fishery that include the forfeiture of shares are a strong incentive to rock lobster fishers to operate within the law. The Committee is also concerned at the apparent complacency with respect to the 17% figure incorporated in the stock assessment, and at face value cannot see evidence of systematic non-compliance by rock lobster fishers. The degree of 'other commercial' unreported catch is unknown. It is suggested that efforts be taken to more accurately determine the components of the illegal catch, noting that this figure includes unrecorded mortalities from other fisheries, most notably trawling and fish trapping.

At the present, legal (compliant) rock lobster fishers appear to be at risk of being penalised by a lack of compliance effort in other commercial fisheries. The Department has indicated that in 2010, observer surveys will be conducted in the trawl fishery which should provide some base information on lobsters caught by this fishing method.

DPI Compliance notes that it 'continues to receive information from reliable sources suggesting large quantities of rock lobster are being sold on the black market by all sectors

of the fishery'. The Committee believes that while compliance in the rock lobster fishery is improving, there remains more to do in terms of compliance, including tightening up the quota system.

The Committee notes that in response to concerns over the retention of non-reported catch at sea in pens and/or traps, catch reporting requirements are being amended to require a precise rather than estimated statement of lobsters held in this way. Further consideration of ways that can be employed to improve this situation involving the Department and LobMAC are encouraged.

The allowance of a seven-day period before daily catch sheets must be submitted has always seemed over-generous and it is encouraging to see that is being reduced to 48 hours. Daily reporting which could be done electronically combined with a system of prior reporting before landing could be deployed by DPI and this would significantly improve the confidence of all parties in the quota system.

The Committee continues to recommend that DPI and the industry look to refining landing and reporting requirements that could lead to a reduction in over-quota fishing and the concomitant benefit to the commercial sector in TAC setting process. LobMAC could take a lead role in this.

3.5 The Recreational Catch

There are about one million people in New South Wales who partake in some form of recreational fishing and they pay some \$12,000,000 by way of licence fees. Collecting rock lobsters is popular with recreational fishers who, if are not exempt need a recreational fishing licence to use a single pot (in waters less than ten metres) or take their catch by hand (i.e. diving) without any assistance from scuba or hookah equipment. A bag and possession limit of two applies, and recreational fishers are subject to the same minimum and maximum size restrictions as the commercial sector.

Estimating the number of people who target rock lobsters and what they catch is the subject of regular and ongoing discussion at the TACC setting forum. Anecdotal information suggests that the use of recreational pots is contracting in popularity, with recreational diving for lobsters becoming more popular. There is no quantitative evidence available which would support or refute either contention. The Committee noted comments made by commercial fishers and DPI compliance staff that recreational fishers appear to be enjoying improved rock lobster catches in NSW.

The TAC Committee makes an allowance for what it considers to be the total recreational catch of lobsters as well as the illegal catch (see separate discussion) in making its determination. Since 1994/95 the allowance that has been made for the recreational catch has been 25.8 tonnes

Goal 4 of the Fishery Management Strategy for the NSW Lobster Fishery is about sharing access to the resource by the various interest groups (predominately the commercial and recreational sectors). Obtaining information on the extent of the recreational catch is a challenge that faces all State agencies that manage rock lobster fisheries. The introduction of a specific licence or endorsement system as is used in some States, possibly supported by the prescribed tagging of recreationally caught lobsters, are options that are regularly canvassed at the TAC forums. The use of mechanisms like this are generally accepted as being essential if information on which the recreational catch allowance is based is to match the precision that is used in determining the commercial catch.

Compared to the commercial sector, recreational fishers are more limited to the area of the fishery that they can access to take lobsters. Recreational pots can only be set in depths less than 10 metres and divers can only operate in relatively shallow water because of the depth restriction on the use of captive air, whereas the commercial sector can target lobsters in almost their full range of depths. It seems to the Committee that it is unlikely that the

recreational catch will have expanded to such an extent that it is compromising the task of setting a responsible TAC for the commercial sector.

DPI appears to be having some success in developing a database of recreational licence-holders and those who fish for rock lobster, which should provide a future basis for better determining if not the actual recreational catch, then at least providing an indication of any significant upward change in recreational catch rates. If this is occurring then the case for a more sophisticated licensing becomes more compelling.

DPI compliance staff collect information on recreational divers which is recorded in the "Nautilus Compliance Reporting System". Increased input from compliance staff would enhance the quality of the data that is available and subsequently provide better information.

DPI also advises that it is reviewing a recent survey of recreational fishers to determine the use it can make of data obtained concerning the recreational rock lobster catch.

The Committee acknowledges the difficulty that DPI has in obtaining precise information on the extent of the recreational catch of lobsters. Improved reporting arrangements by compliance staff should provide valuable information on trends that may be occurring with the recreational catch. The Committee recommends that the development of this data series and analysis of information from the survey of recreational fishers should continue to be a priority.

3.6 Indigenous Fishing for Rock Lobster

The Department has developed an Indigenous Fisheries Strategy and Implementation Plan to recognise the traditional cultural activities of the Aboriginal community. The plan is supported by an Aboriginal Reference Group, which provides advice to the Minister.

Permits can be issued for the taking of lobsters and this generally occurs in the south of the State. The Department provides information on the number of lobsters (108 in 2008/09) that are permitted to be taken but the actual amount of lobsters taken is unclear.

Because the quantity of lobsters that can be taken under these provisions is relatively small, the Committee does not see that there is currently a need to make an allowance for this in the TACC setting process.

A discussion paper is being prepared on possible changes to Fisheries Act as it relates to indigenous fishing practices. Unless there was to be substantial increase in real or potential catch from the indigenous community then it is unlikely that this would have any impact on TACC setting arrangements.

3.7 Fishery Management Costs

Category 1 share management fisheries are subject to cost recovery of government services. Charges for management services provided by the Department are payable in proportion to the shareholding. Implementation of full cost recovery in the fishery was staged over three fishing periods from the 1998/1999 fishing period, as indicated in Table 1.

Table 1: Catch, structure and value of the Lobster share management, including management charges

Fishing period	TACC (tonne)	# share holders	Reported catch (tonnes)	% of TACC caught	Management charge	Average price (\$/kg)	Est Value (\$m)
1998/99	125	178	110	88.0	\$38	\$34.76	3.8
1999/00	140	174	117	83.6	\$48	\$39.16	4.6
2000/01	150	172	102	68.0	\$58 (full cost recovery)	\$42.98	4.4
2001/02	150	173	102	68.0	\$58	\$46.33	4.7
2002/03	135	166	121.3	89.9	\$59.70	\$44.77	5.4
2003/04	135	161	107.9	79.9	\$61.70	\$38.83	4.2
2004/05	102	152	98.1	96.2	\$58.60	\$38.30	3.8
2005/06	102	142	100.5	98.5	\$56.43	\$41.30	4.1
2006/07	112	131	109.4	97.7	\$55.20	\$47.46	5.2
2007/08	124	114	121.9	98.3	\$50.89	\$48.10	4.6
2008/09*	124	112	72.9	59	\$56.73	\$60.40	4.79

* as at March 2009. Sydney Fish Market (SFM) average price paid per kilo for lobster.

The increase in management charges for 2008/09 has been attributed to a change in the methodology that is adopted for collecting research contributions for the Fisheries Research and Development Corporation. In the past these were part of annual licence fees but they are now part of the management charge – in this sense they are not an additional charge.

While fishers appear to be, on average, earning rents from the fishery, the contribution of management charges to total costs continues to be significant even though it is contracting as a share of GVP from the fishery. The commercial sector did not express the degree of concern over level of charges that apply to the fishery as it has done in previous years. The Committee continues to support a transparent system of cost recovery where services received by industry against management and other charges are fully justified and delivered efficiently. In considering 'management', the totality of fees applying to the fishery should be considered. These fees are a combination of management fees, a community charge and the environmental assessment charge. The cost recovery model that is applied to this fishery does not include all DPI costs. For instance, the effort that fisheries officers attribute directly to patrols targeting the commercial lobster fishery are not levied against industry as part of the management charges.

Against this, management costs as reported by the Department have continued to contract by such means as reductions in on-costs and the apportionment of some management costs to the recreational sector. Management charges have been reduced by approximately 10% from last year. In real terms, management charges have dropped by a far greater percentage than the nominal time series suggests.) (Table 1, Figure 1) The Department's efforts in obtaining significant reductions in industry costs need to be acknowledged. Management charges peaked at 15.4% of the Gross Value of Production (GVP) from the fishery in 2004/05 and for the current financial year will be 8.4% of GVP.

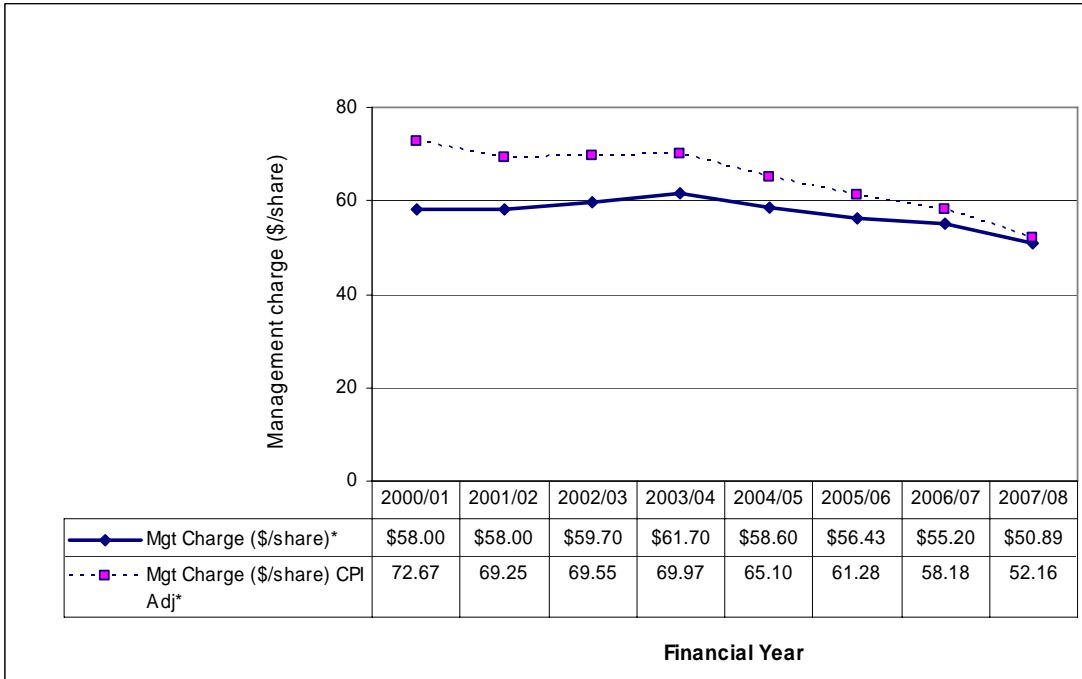


Figure 1: Management charges (CPI Adjustment to 31 December 2007)

While the concern of fishers over the size of management charges is understandable, the likely reason for this could be the relatively small size of the industry compared to those in other jurisdictions. A larger industry might enjoy lower costs per share due to economies of size. It is unlikely that similar economies of scale will occur in NSW even when full stock recovery has occurred.

There remain significant costs in running this fishery, particularly in the areas of research and compliance. It is important that both areas are properly resourced, given that the fishery remains in the recovery stage. Unless the IPART cost recovery principles covering the fishery are reviewed, as has been recommended by the Committee in the past, it is difficult to see how further substantial reductions in government costs can be achieved.

As the stock recovers, the fishery will be faced with options concerning the frequency (and cost) of stock assessment and level of monitoring. It would be appropriate to review costs and look at ways of developing an overall management package (including science, compliance and fishery reference points) that has costs appropriate to the scale of the fishery.

Decisions on targets and the TACC will need to be made on the basis of balancing i) a lower risk, more conservative TACC (with associated loss in gross revenue), and ii) lower assessment costs vs. maintaining a higher TACC (higher gross revenue) with higher assessment costs. The net benefit will depend on the level of costs necessary to provide an acceptable level of risk.

3.8 Industry Consultation

Section 2.1 and Appendix 1 of this report detail the industry consultation processes that are in place for the fishery and lists the details of submissions that were made by the commercial sector to the Committee.

The Committee continues to be confident that the open forum process that has now been in place for several years is working effectively and has the ongoing support of commercial fishers. The Committee finds the level of discussions at the open forum to be very positive and constructive. As raised elsewhere in this report, the Committee welcomes direct feedback from industry and LobMAC on its recommendations and report.

None of the attendees at the forum opted to hold discussions with the Committee in camera. This facility, along with the ability to keep submissions confidential, will continue to be offered, but wherever possible, industry is urged to make their views known to all stakeholders. Other than commercial-in-confidence catch and other data which would not be appropriate for the forum, resolution of the more general concerns involved would have benefited from wider discussion.

The Committee was encouraged by the strong representation from LobMAC members including the Chairman, Mr .Alan Dodds, at the meeting. Committee members have felt for some time that there are issues raised at the TAC forum that would be better addressed in direct negotiations between the Department and LobMAC. Having an additional LobMAC meeting following the TAC determination would allow discussion of the TACC and the associated rationale, and recommendations of the Committee.

The Committee recommends that an additional LobMAC meeting be held following the TAC determination would allow discussion of the TAC and the associated rationale, and recommendations made by the Committee.

Industry representatives mentioned that licence holders do not, as a matter of course, receive copies of the TAC Committee's determination and report and asked if the Department could at least send these documents to LobMAC members. Such an action would be necessary in support of the above recommendation.

The fact that LobMAC members and the industry supported retention of the status-quo in determining the TACC reflects the fact that they understand and appreciate that the fishery is still in a re-building phase. Whilst long-term prospects for the fishery are encouraging the fact that fishers support the setting of a conservative TACC in these difficult economic times merits special comment.

3.9 EPBC Act Assessment of the NSW Rock Lobster Fishery

The NSW lobster fishery has now been assessed under the *Environment Protection and Biodiversity Act 1999* (EPBC) Act. This basically means that the Commonwealth Government is satisfied that the fishery is being managed in an ecologically sustainable way and as a consequence approval has been given for the continued export of lobsters that are taken from the fishery for the next five years.

3.10 Fishery Management Strategy (FMS)

The Minister for Primary Industries approved the FMS for the fishery in February 2007. The plan lists visions and goals for the fishery and focuses on ensuring that fishing activities including recreational fishing are conducted in an environmentally sustainable way.

The Committee agrees with the Management Report that... 'long term targets for the fishery designed to maximise the economic yield from the resource are required', particularly as the fishery moves away from an emphasis on limit (biological) reference points towards an agreed target (economic) reference point for the rebuilding for the fishery.

The Committee recommends that DPI and industry work to develop a harvest strategy, including target reference points relating to maximising economic yield, to provide guidance on TACC decisions in relation to stock rebuilding.

The Department has indicated in its response to the Committee's report of last year that it is examining the type of economic data that it considers needs to be collected from the fishery and has had some discussions on this with LobMAC. The lack of economic data on the fishery was raised at the industry forum, and it is clear that improvements to the long-term management arrangements for the fishery are being inhibited by the lack of economic input.

The Committee continues to be of the view that management arrangements for this fishery could be enhanced by greater recognition of the spatial structure of the fishery.

3.11 Gear Conflict

The Committee again received submissions from industry members concerned about the perceived loss of habitat, including large areas of soft corals, due to expanding (into new areas) trawling operations. The Committee understands that there are currently 'gentlemen's agreements' between trap and trawl operators and that a habitat mapping exercise is being conducted by the Department. Licensed fishers are concerned about the potentially damaging impact that other fishing methods such as trawling can have on fragile soft coral beds that are key lobster habitat. It is unclear if these "conflicts" involve Commonwealth licensed trawl operators as well State licensed vessels.

There appear to be at least two ways to address this issue, both require mapping of habitat. One is to build on the current voluntary arrangements/agreements currently being used; the other is to seek spatial management measures to prevent habitat loss, possibly limited to areas that are currently not trawled. The advent of new technology, including GPS and modified gear, is allowing trawlers to operate in areas previously avoided due to concerns over gear damage. The expansion of trawled areas is a problem in many other jurisdictions and is considered by the Committee to be an issue of serious concern.

In response to a recommendation by the Committee last year, the Department has stated, somewhat emphatically, that it looks to local agreements between operators as the best means of resolving gear conflict and habitat damage in the fishery. Re-structuring of the NSW trawl fishery that is currently taking place is also seen as a means of at least partially addressing this problem, presumably as a result of a reduction in overall effort in the trawl fishery. While this might well occur, an effort reduction alone is not sufficient to protect areas of sensitive rock lobster habitat.

The Committee recommends that the Department and Industry continue to work together, through LobMAC to investigate the issue of spatial management measures to address the impact of trawling on previously untrawled areas of rock lobster habitat.

3.12 Conclusion

The steady recovery of the New South Wales rock lobster fishery continues. Catch per Unit Effort (CPUE) has more than doubled between 2000/02 and 2008/09 and now exceeds the 1998-99 benchmark by nearly 50%. The market price for shares has almost tripled in the past four years and demand is strong to both purchase and lease quota/shares.

The strong local market and consumer confidence in NSW caught lobsters is strength that can be built on.

Whilst there is a lack of up to date, precise information on the state of illegal activities in the fishery, these do not appear to pose a threat to the fishery.

Recovery in the breeding stock remains a priority, and until it is clear that that has been achieved, a conservative management approach is considered to be the best option. With the support of the commercial sector, the Committee feels that maintaining the TACC at the level as it was for last year is in the best long-term interest of the fishery.

Reduced Departmental costs and the ongoing commitment to research and monitoring for the fishery are tangible indications of the Department's commitment to returning this fishery to its former status. The Committee continues to be impressed by the high level of co-operation between the Department and the commercial sector for both the research and compliance programs.

Recreational lobster fishing continues to be popular and the Committee looks forward to receiving better quality information on the status of this activity over the coming years.

To conclude, the TAC Committee would again like to emphasise that a change in the management approach to the fishery should be seriously considered. Such an approach should recognise:

- the need to consider targets for the fishery that incorporate economic, rather than solely biological considerations;
- the unique north/south characteristics of the fishery; and
- the ongoing vulnerability of the spawning biomass,

Re-structuring of the fishery is progressing at a steady pace but there are a number of rules affecting the transfer and leasing of quota that appear to now be redundant, and which are inhibiting operators from structuring their fishing businesses the way that they want to and which suit the objectives for future of the fishery.

4. ECONOMIC CONSIDERATIONS

4.1 Introduction

In making its determination, the Committee is required to pay attention to economic and social issues. That is the purpose of this section of the Report. The volume and value of production is described, the market situation reviewed, fisher incomes discussed and the quota and share markets assessed. Next, the overall economic status of the industry is summarised, to the extent allowed by the available information and the possible impact of the determination considered. Finally, note is taken of the emerging interest in investigating the efficiency of industry performance and the determination of maximum economic yield.

Attention is drawn to the fact that, due to resource limitations, the economic advice provided to the Committee by the Department was less than that provided in previous years. As a result, advice on the national lobster industry and export markets is missing from this report. While the Committee understands that the bulk of NSW Eastern Rock Lobster is sold on the domestic market, exports are not unimportant to some fishers. Further, as has been noted in previous reports, Western Australian lobster, to which the export market is of great importance, while regarded as inferior to the local product, can be a competitor in the local market when the export market is depressed.

4.2 Volume and value of production

As Figure 2 shows, the volume of reported production of lobster in NSW in 2007/08 was 121.6 tonnes, the highest in the last 12 years and the third year of a rising trend initiated in 2005/06. The reported ability of industry to catch virtually the full TACC over those years, reportedly with less effort, suggests that recovery of the stock continues, as is suggested elsewhere in this report.

Figure 2 also shows that, up until 2002/03, the value of the catch, when adjusted for inflation, was trending upwards. It fell during the next two years, reaching \$3.8 million in 2004/05. The reason for this fall was related to both lower catches and depressed conditions in the export market. The situation has improved over the last three years, and the real value of reported production in 2007/08 is the second highest, in real terms, after the 2002/03 high. The improvement over the last three years reflects higher production rather than higher prices.

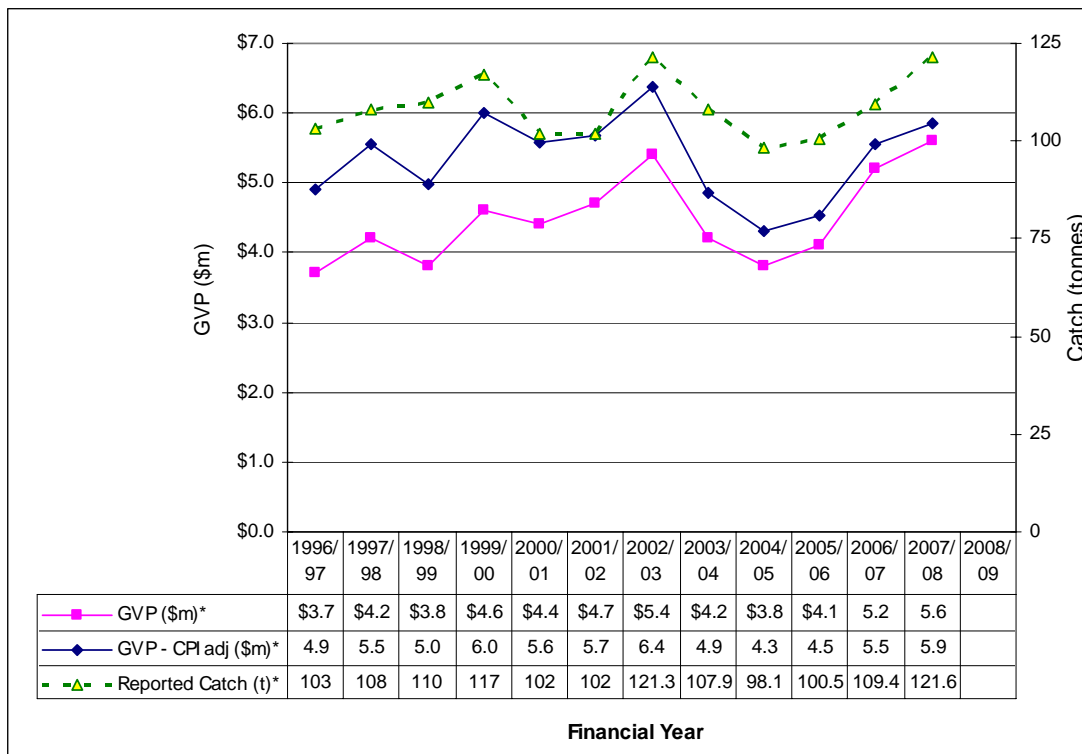


Figure 2: Value of production and reported catch, 1996/97 to 2007/08

4.3 Prices

The average price of lobster, both actual and adjusted for inflation, fell between 2001/02 and 2004/05 (Figure 3). In 2001/02, the average price was \$46.33 per kilogram. This price dropped to \$38.83 per kilogram in 2003/04 and to \$38.30 in 2004/05 (Figure 3). It then rebounded, and the 2006/07 price exceeded that of 2001/02 only to fall to \$45.81 in 2007/08. In real terms, however, prices have been relatively flat since 2003/04 and have still to exceed those prevailing from 2000/01 to 2002/03. The 2007/08 price shows a slight drop from the 2006/07 level in both nominal and real terms but has risen spectacularly in early 2008/09. Informal reports indicate, however, that prices have since fallen from that high.

Note should be taken that Sydney Fish Market prices provide only a guide as to price movements for lobster in NSW. A significant quantity of lobster (around 60 percent) is sold through other registered fish receivers and restricted registered fish receivers in Sydney and along the NSW coast. Price information for lobster sold through these outlets is not publicly available

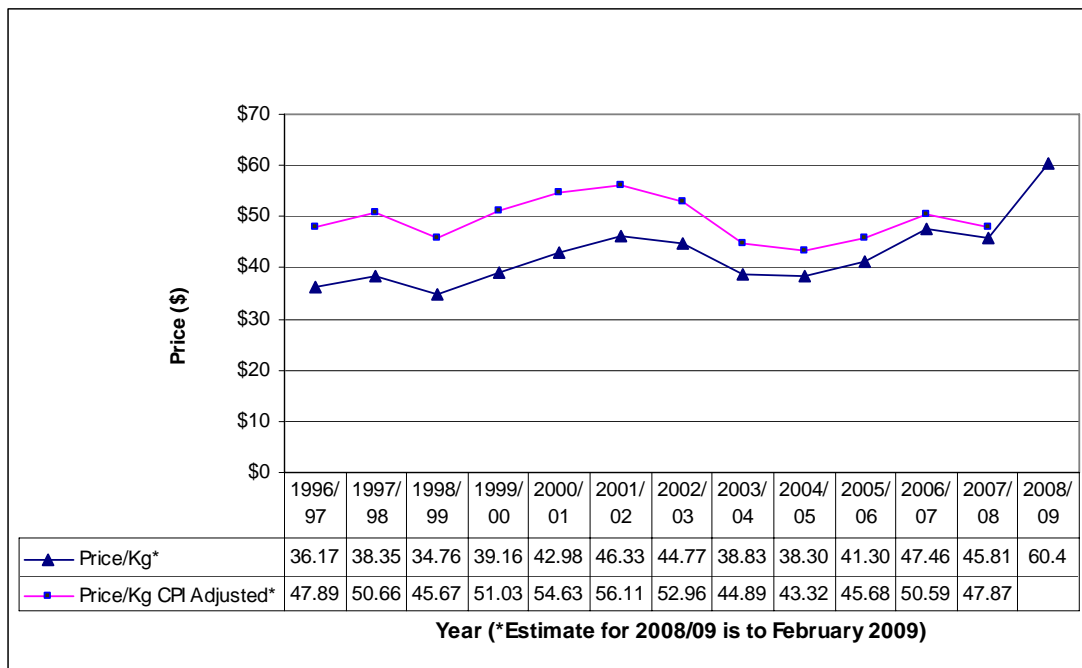


Figure 3: Beach prices in real and nominal terms

4.4 Rock lobster markets

As indicated, NSW is a minor contributor to the total output of lobster in Australia, with the bulk of production coming from Western Australia and South Australia. Only a small proportion of lobster from NSW is exported. In 2004/05, 127 tonnes were exported from NSW. This was a miniscule proportion of total Australian exports of 12,619 tonnes in that year. The largest markets for Australian exports of rock lobster are Hong Kong and China, closely followed by Japan. Despite its small contribution to exports, NSW lobster cannot be regarded as being isolated from its competitors in other States. When export markets are weak, or there is excess supply in Western Australia and South Australia, a higher volume of product from these markets may be sent to receivers at the Sydney Market. Such a situation arose in 1999/2000 when Western Australian rock lobster production reached 14,600 tonnes. A similar situation occurred in 2003/04.

4.5 Fisher net income

Traditionally, nearly all lobster fishers have held endorsements in several different fisheries, though the extent to which they gained income from each of them has varied. The income of such fishers should, therefore, be considered as that of businesses operating in several different fisheries. In such a situation, variation in income from lobsters could well be masked by variation in the income from the other fisheries. That being said, any substantial change in income from lobster fishing has the potential to affect overall business income, especially where fishers are heavily reliant on the fishery. According to reports from the industry, there is a trend towards specialisation in the lobster fishery, particularly among larger shareholders. Such fishers might be exposed to more income variability.

Whether improved industry revenue has resulted in higher net incomes over the last three years is not clear. The gains from increased prices and production may have been mitigated by rises in costs, particularly of fuel. Recent trends in share and quota lease prices, however, suggest impacts on fisher income have been favourable.

Fixed costs such as boat capital and other overheads associated with running a small business are unlikely to be as responsive to changes in catch and prices as variable costs. When changes in catches and/or prices are maintained over the longer term, however, and

such changes are indicative of a longer term decline in the resource and/or demand for lobster, some operators may choose to leave the fishery, or, at least, if multi-endorsed, shift the balance of their effort between fisheries. This behaviour may be expected to contribute to a lowering of the share price but also contribute to the structural change, which has been a feature of the industry in the recent past, and thereby enhance the economic prospects of those remaining in the industry. If, however, changes in prices or optimism about the health of the fishery were felt to indicate an improvement in the long-term prospects of the industry, new operators may enter the industry, or existing operators increase the balance of their effort, thereby contributing to an increase in the share price. This reflects the current situation in the fishery.

Past verifiable estimates of returns in the industry are now very dated. As a result, authoritative comment on industry net returns is restricted to the relatively unreliable interpretation of changes in share and quota prices. For this reason, a review of the economic circumstances of the industry remains urgent. From discussions with DPI staff, it appears unclear if such an activity should be an ongoing role of government, or if it should be funded by industry. Other States and the Commonwealth generally use government funding for economic surveys of the fishing sector¹. While the Committee has not received a formal response from the Department to its recommendations on this issue, informal communication indicates that the Department is not in the position to expand its support of the Committee in its endeavours to meet its statutory obligation regarding the economic circumstances of the industry. Indeed, this year the quality and quantity of this support has declined significantly.

4.6 The quota and share markets

Shares

The total number of shares in the fishery has reduced from 10,051 in 2006/07 to 9,727 in 2007/08 due to shares surrendered through the Batemans Bay and Port Stephens-Great Lakes Marine Parks buy out programs. A total of 94 shares, which were forfeited because of convictions recorded between 2002 and 2006, were put to public tender in 2008. The average tender price per share was \$2541.70. A further 14 forfeited shares arising from a recent conviction will also be put up for public tender in the future.

Shareholdings

At the commencement of the Share Management Plan, there were 174 shareholders with holdings ranging from 12 to 218 shares. Since 1996/97 the total number of shares has declined from 10,234 to 9,727, due primarily to government buy-outs resulting from the establishment of marine parks. There are currently 112 shareholders, a fall of about 36 percent since 1996/97. The average number of shares per shareholder increased from 54 in 1996/97 to 83 in 2007/08, an increase of 54 percent. The proportion of shareholders who hold less than 55 shares has decreased by 80% (94 to 19). This suggests a general trend of share redistribution from small (<55) to large (>100) shareholdings (Figure 4). Changes in the structure of the fishery have resulted in fewer fishers landing a higher proportion of the total reported catch (Figure 7). Fifty percent of the 2007/08 reported catch was landed by 14 fishing businesses and preliminary data suggests that 50% of the 2008/09 reported catch will be landed by 12 businesses. The restructuring, which introduction of transferable quotas was intended to facilitate, is happening in the lobster industry. This history of change and adaptation is in contrast with the abalone industry.

¹ See for example Econsearch (2007), Economic Indicators for the SA Southern Zone Rock Lobster Fishery 2005/06, Report prepared for Primary Industry and Resources South Australia.

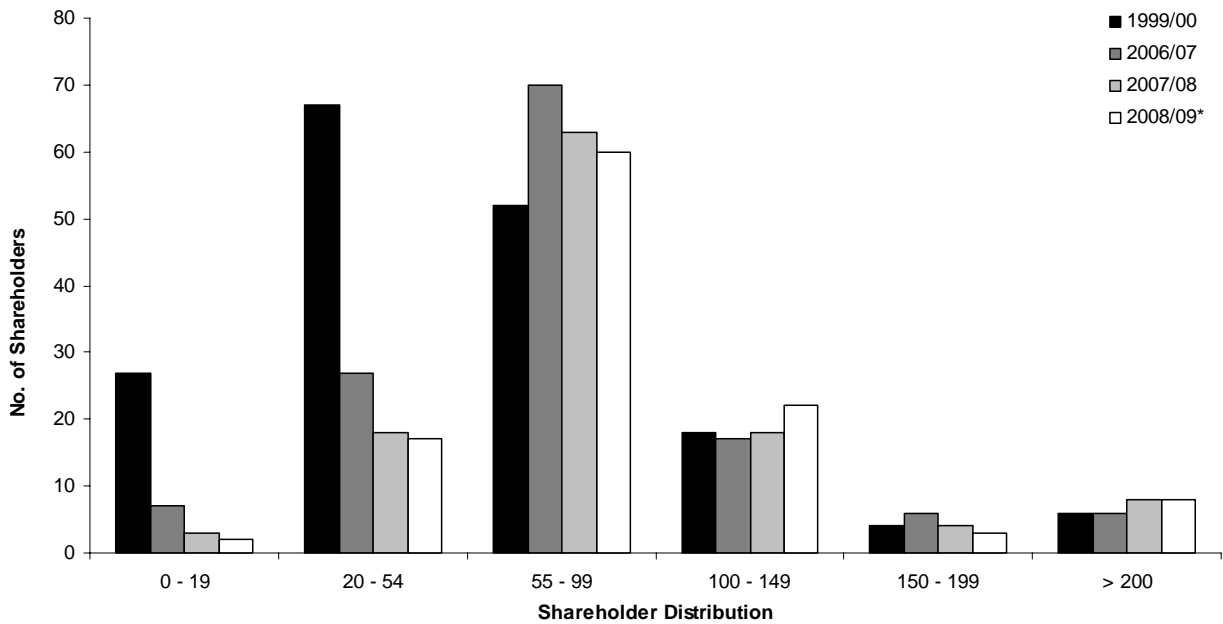
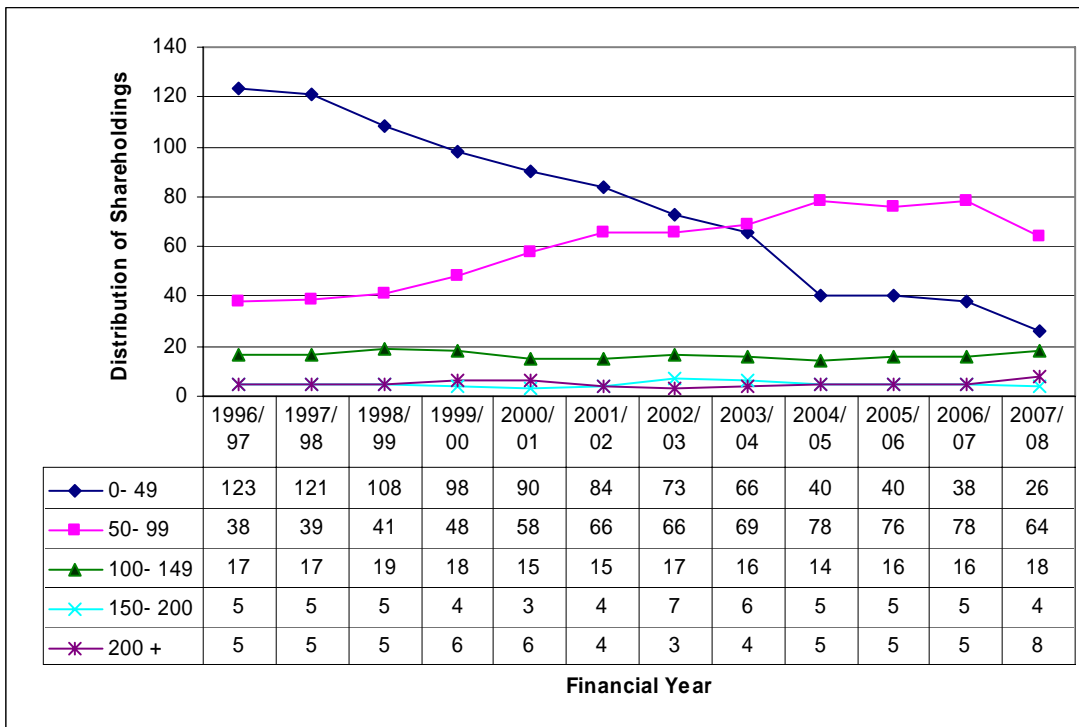


Figure 4: Distribution of shareholders by size of holding

4.7 Share holding distribution and structural change

Figure 5 provides an illustration of the pattern of structural change in the fishery over the fishing periods 1998/99 to 2006/07. It shows that the number of shareholders in the small shareholding class (i.e. 0 – 49 shares) has been decreasing, whilst the number of shareholders in the medium shareholding class (i.e. 50 – 99 shares) has increased. The number of large shareholders (i.e. 100 – 200+) has remained relatively small but doubled between 2003/04 and 2007/08 from four to eight. These data could, however, give a misleading impression of the distribution of size of businesses in the industry. This is because some businesses may involve several shareholders, with the result that the number of small and medium sized enterprises may be overstated and the number of larger ones understated. Despite this, the tendency for shareholdings to concentrate in the medium-sized cohort suggests that this size of enterprise, perhaps through association with other endorsements, has efficiency and/or stability advantages. Certainly, the data is not inconsistent with the observation that there is a tendency for the proportion of large specialised enterprises to increase.

The Department has indicated, and the Committee agrees, that it believes structural change in the industry is desirable in order to ensure the continued viability of lobster fishing operations, to promote greater stewardship and to allow for greater efficiency in administration of the fishery. The ultimate aim of restructuring is to improve the long-term sustainability of the fishery. The Committee remains of the opinion that market forces, particularly through the market for shares, rather than regulatory intervention, offer the best way to achieve the benefits of restructuring. In this regard, care must be taken that regulation of the share market does not impede desirable structural change.



Figure

5: Distribution of shareholdings

4.8 Share trading, transfers and values

In accordance with the *Fisheries Management (Lobster Share Management Plan) Regulation 2000*, shares can be traded in packages of 10. This facility is intended to allow existing shareholders to structure their operations based on performance during the year and, to some extent, the availability of lobsters. The reason for the minimum size of package is unclear, but possibly it could impede achievement of the intention of the facility.

In 2007/08, 534 shares were transferred to existing shareholders or new entrants. Eighteen shareholders ceased activity while seven new ones were created. The average share price was \$1,691 for the year (Figure 6). For the first eight months of the 2008/09 fishing period, there were 534 share transfers at an average price of \$2,077. Given the structure of the industry (e.g. family and other links between shareholders), the extent to which average share prices reflect 'true' market values is not clear.

Adjusting for inflation shows that the highest price paid for shares between 1996/97 and 2006/07 was an average of \$2,364 in 1998/99. The lowest real price was an average of \$722 in 2004/05. The 2007/08 real price of \$1,733, though representing a significant increase over the 2004/05 low, is still less than those of the late nineties.

Share transfer prices provide an indication of the economic health of the lobster fishery and of expectations of industry participants. In this sense, the sustained rise in prices since 2005/06 can be interpreted as reflecting improved economic conditions and rising expectations concerning the future economic and biological health of the industry.

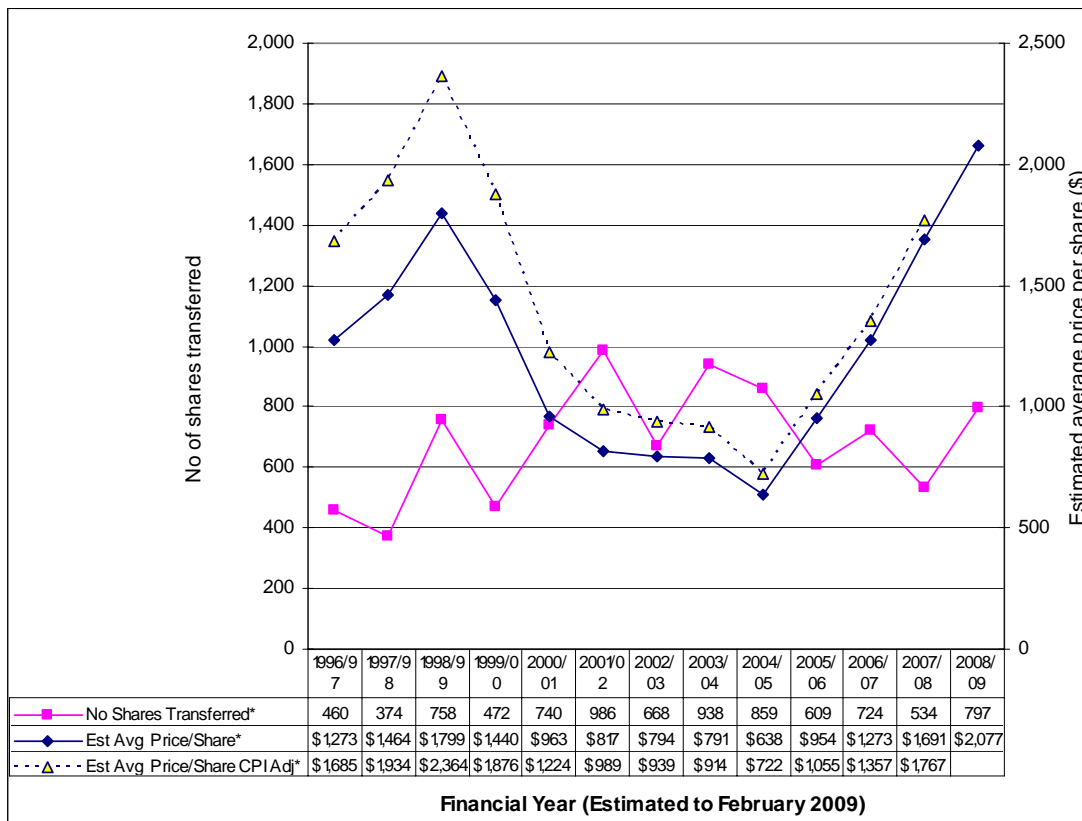


Figure 6: Share transactions in the lobster fishery (CPI Adjustment to December 2008)

The role of expectations concerning the future economic well-being of the industry indicate that, as was suggested in the Committee’s 2008 report, there might be a tendency for the share price to ‘overshoot’ and to be influenced by external factors. In fact, for a variety of reasons, share prices are not necessarily perfect indicators of industry profitability. That being said, in the absence of other data, such as would be provided by the economic review of the industry so frequently urged by the Committee, share prices remain the only robust, verifiable indicator of industry profitability and viability available. In sum, positive share prices can reasonably be taken as indicating that incomes exceed, and are expected to continue to exceed, what is needed to retain resources in the industry, and that it is viable. Increasing share prices suggest an improved outlook for the industry, at least in the minds of those involved in the share market.

4.9 Quota

Quota is allocated to shareholders in proportion to their shareholding. Shareholders can transfer a minimum of 10% of their quota allocation, or 50 kg, (whichever is the greater) of their entire allocation at any one time. Quota can only be transferred within the current fishing period and cannot be transferred between fishing periods. Under the Plan, shareholders may not acquire, by any such transfer, more than twice the amount of the shareholder’s initial quota for the fishing period. According to the Department, this clause was included in the Plan to encourage shareholders to buy shares, in order to promote restructuring of the industry, rather than allowing small shareholders to buy large quantities of quota without a longer-term commitment to the fishery. The benefits of this policy must be set against the cost of the loss of flexibility it imposes on the industry.

At its September 2004 meeting, the Lobster Management Advisory Committee (LobMAC) discussed restricting the amount of quota a shareholder can acquire (by quota transfer) to one times the amount of his/her initial allocation during a single fishing period, instead of two

times, which is the current arrangement. This, too, was designed to encourage shareholders to purchase more shares rather than relying on quota transfer, thus facilitating restructuring. Given the Minister's in principle agreement to an increase in the minimum shareholding, the Department believes this has circumvented the need to put in place other means to achieve restructuring. At its March 2005 meeting, LobMAC determined that the existing leasing arrangement should continue until further discussion is held on the implementation of the increase in minimum shareholding.

4.10 Quota Transfers and Leasing Values

Despite the regulatory restriction on trade, quota prices may provide an indication of the short-term economic health of the lobster fishery. Unfortunately, information on the price at which quota is transferred is not collected for all trades. Given the advantage of having access to it, this information should be collected and made generally available. Industry members indicated to the Committee their agreement with the idea that data collected by the Department concerning quota leasing should be put on the public record to the extent that privacy concerns permit. The Department and LobMAC plan to investigate the feasibility of collecting data to improve the quality of information and the Committee recommends that this matter be discussed at that time.

The Committee recommends that the Department make efforts to gather price information for quota/leasing values and that this information is placed on the public record to the extent that privacy concerns permit.

About 26 percent of transfers provide price data on a voluntary basis. The available information, while possibly not representative, nevertheless indicates a significant upward trend in real terms from \$9.77 per kilogram in 1999/00 to \$18.90 per kilogram to February 2009 (Figure 7). There has been a steady upward trend since 2003/04.

The price per kilogram of transferred quota appears, not surprisingly, to be strongly related to the levels of reported catch (and perhaps more significantly, catch rate) for a given fishing period, much more so than are share prices. When catches and catch rates are high, the price of quota tends to increase as the demand for quota rises, but share prices it seems, react even more strongly to high catches, perhaps reflecting expectations about prospects for the industry.

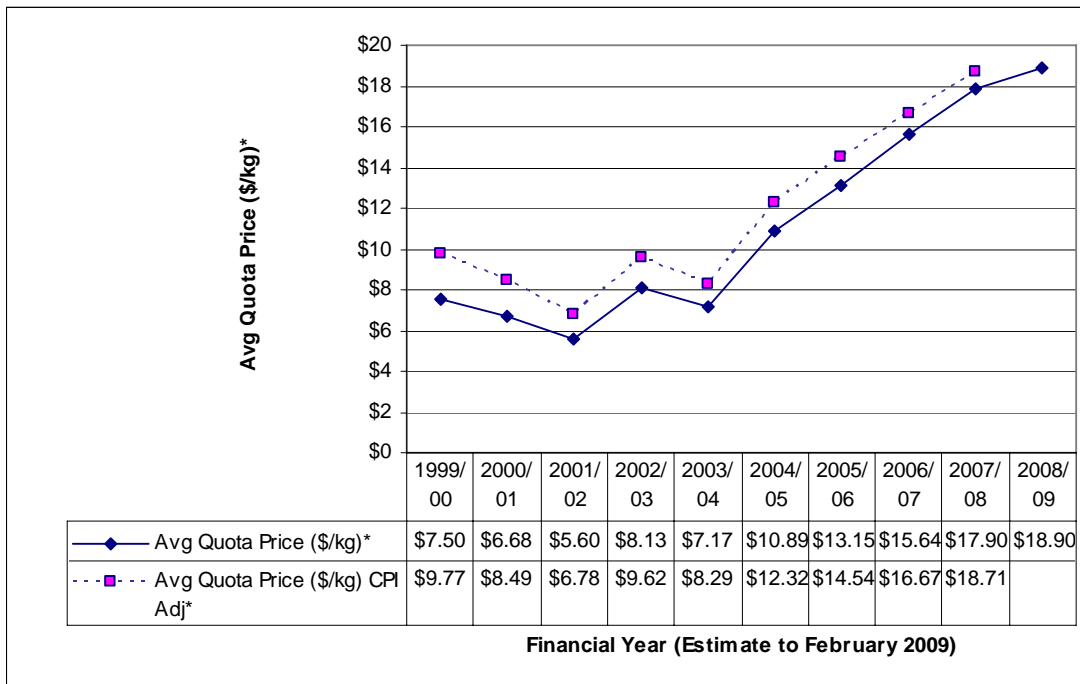


Figure 7: Nominal and real quota price per kilogram (CPI Adjusted to February 2009)

In the absence of robust data on the prices at which quotas are traded, the quantity of quota transferred in a year arguably provides some indication of the economic health of the fishery. There were 88 quota transactions, comprising 42.34 tonnes and 34 percent of the TACC, in 2007/08. This was the highest proportion of TACC transferred since the implementation of the Management Plan. Further, the number of quota transferors has exceeded the number of quota transferees annually since 2000/01, suggesting the progressive redistribution of quota from small to large shareholdings.

Table 2: Total quota transferred (t), number of quota transferors and transferees, amount of TACC transferred (%) and the average price paid for quota (\$/kg) in each fishing period from 1996/97 to 2008/09.

Fishing period	Total quota transferred (t)	Quota transferors	Quota transferees	TACC transferred (%)	Average Price (/kg)
1996/97	29.5	43	78	28%	
1997/98	28.9	47	65	25%	
1998/99	26.1	51	49	21%	
1999/00	30.0	31	33	21%	
2000/01	17.0	31	29	11%	
2001/02	30.6	40	24	20%	
2002/03	44.0	77	60	28%	
2003/04	29.3	56	41	22%	\$7.17
2004/05	34.5	68	47	33.8%	\$10.89
2005/06	30.1	64	45	29.5%	\$13.15
2006/07	35.6	59	23	31.8%	\$15.64
2007/08	42.3	60	32	34.2%	\$17.9
2008/09	26.9	29	27	21%	\$18.9

What should be made of trends in quota leasing and reported prices is not clear. There can be little doubt, however, that the market is active and quota is probably being transferred from lower value to higher value users. Fisher comments indicate that the ability to lease quota helps improve efficiency by providing them with greater flexibility in handling fluctuations in catches. The restrictions on trade, described above, could however, impede full attainment of these efficiency gains. Certainly, the high fee paid on transfers would inhibit trade in small parcels of quota.

There is a relationship between the percentage of TACC caught and the percentage of quota transferred, albeit an imperfect one. It appears that the license holders are more willing to lease (invest) in additional quota where there is a strong expectation that the additional quota will be caught under a constraining TAC. For example, in 2000/01 when the percentage of TACC caught was around 68 percent, the percentage of quota transferred was only 11 percent. Conversely, since 2004/05 when the percentage of TACC caught has been close to 100 percent, the proportion has been around 30 percent.

4.11 Management and other charges

See Section 3.7 Fishery Management Costs.

4.12 Impact of illegal unreported removals

Previous reports have discussed the loss of economic value from the fishery due to the high levels of illegal catches. It has been suggested, in those reports, that the return on investment to either reduce the level of these catches, or to determine the real extent of illegal catch (which may or may not result in an increase in TACC) would be high. As the fishery recovers and economic circumstances improve, the Committee believes that this matter should be re-examined, possibly through the establishment of a joint industry/DPI working group. The presentation by the compliance group of the results of targeted operations, and comments that further results (fines, reduced illegal take) would eventuate from additional investment in compliance adds weight to this proposition.

4.13 Economic surveys

Discussions were held between the TAC Committee and Department economists in April 2008, in response to repeated requests from the Committee for improved economic data on the economic situation and structure of the rock lobster fishing industry. The Departmental representatives undertook to see what could be done to meet the needs of the Committee with respect to economic data. As indicated earlier, the current situation has seen a reduction in the quality of the industry analysis provided to the Committee by the Department. As yet there has been no formal communication from the Department in response to the Committee's recommendation on this matter.

It appears that the current reluctance to undertake or contribute to economic surveys (or assessments) of the industry is based on the concerns over precedent (as it relates with other fisheries and industries) and funding. While the Committee is aware that gathering data from industry can be a costly and labour intensive exercise, it believes that there are cost-effective avenues available for obtaining the necessary data.

Information on gross revenue is relatively available, but there is little information on costs, and the structure (capital) and operations (operating costs) of the rock lobster industry. If this information was available, the calculation on return on capital, net income and returns on management would be possible and, indeed, important to the context in which the TACC is set². There is a need to commence this work as soon as possible to enable changes in

² Given the apparent attitude of the Department towards such work, the initiative and funds to have such work undertaken would seem to have to come from the LobMAC. Advice on the alternative methodologies, which could be employed in such a

economic circumstances in the fishery to be tracked as a time series³. Changes likely to arise include those from management measures, productivity changes and market developments.

There are at least two major areas where economic data will be vital. These are:

- I. To inform the process that will see the introduction of maximum economic yield (MEY) targets, which will guide stock rebuilding to levels that optimise economic outcomes. This will occur as the fishery moves away from biologically-driven limit reference points and towards economic-based target reference points; and
- II. To inform the process of levying community contribution.

The Committee recommends that, as an important integral part of the information required by the TAC Committee, a time series of economic data, including prices, revenue, in real and nominal terms be established, and provided to the TAC Committee on an annual basis. (NB some data on prices/revenue are currently provided)

Industry members have shown increasing interest in MEY and its determination. To date the Committee has been focused on setting TACCs intended to improve the status of the stock and ultimately, stabilisation of the industry with a TACC set to achieve maximum sustainable yield (MSY). As the stock recovers, attention should be shifted to the lower but more profitable MEY. Recent improvements in the state of the stock suggest that initial steps in this direction would now be appropriate. The first step could be a scoping study to assess the costs and likely benefits of the bio-economic modelling involved. The responsibility of the TAC Committee for such an exercise would appear to be to ensure the availability of robust and accurate estimates of the state of the stock and the determination of a TACC, which would represent an upper bound to the MEY.

4.14 Conclusion

While the lack of adequate data means that only tentative conclusions about the economic status of the industry are possible, the evidence available to the Committee suggests that it is viable. This is despite continued low levels of the TACC, and higher costs per unit effort. The capital losses experienced due to low share prices in the early 2000s have however, been recouped to an extent, with preliminary estimates of share prices approaching 1999/00 levels in 2008/09. Whether the return to better times means an improvement in the conditions of those sections of the industry which may have suffered hardship in the early 2000s, such as the cohort with small shareholdings, and highly geared operators who were experiencing difficulty servicing their debts, is, in the absence of more detailed financial information, a matter for conjecture.

The Committee's determination for 2009/10 is based on the strengthening prospect of restoration of the spawning stock, and while unlikely to further increase revenue in the short term, offers promise of improved circumstances. In the longer-run, continued structural change, improved management and the return of spawning stock to acceptably robust levels, suggest the fishery is on track to become a biologically and economically sustainable industry. If this is to be achieved, and as the stock rebuilds, it will be necessary to give consideration to the long-term objectives of the fishery in terms of developing target reference points and strategies that take account of both biological and economic efficiency. In this respect, the Committee noted and welcomed discussion of the concept of maximum economic yield at its open meeting on 31 March and strongly encourages contemplation of

study, could reasonably be expected to come from the Department in the first instance. Similar studies have been undertaken for other fisheries in other Australian jurisdictions, as is indicated earlier in this report. In this respect see the reference cited in footnote 1 above.

³ The current FMS notes that a process will be developed to collect data on costs, and that data on net returns is ...'useful for setting the TACC to ensure that the lobster resource is being harvested at the point where the greatest net return to society is achieved'. The FMS also makes mention of the need to collect information to detect patterns in the quantity and price of share transfers and the quantity and price of quota traded.

steps to be taken, and by whom, to pursue its determination. In providing this endorsement, the Committee again draws attention to the fundamental need for underpinning economic data and modelling.

5. STATE OF THE STOCKS

5.1 Introduction

In making its determination of a TACC for rock lobster, the Committee is required to consider the current and predicted status of the stock. This section considers the major features of a range of data from fishery operations and fishery independent surveys and monitoring, and estimates of illegal unreported and recreational catches. The analysis undertaken by DPI using a length-based model is reviewed. Finally, a number of conclusions concerning spawning stock rebuilding are drawn and a recommendation for a TACC for 2009/10 is made.

5.2 Data

5.2.1 Data from fishery operations

As in previous years, two different time-series of data are available from the fishery.

The first series of data covers the period 1884 - 1958. The data from the fishery in this period is limited to catch and fishing effort and the data sources are poorly understood, fragmentary, variable and often coarse. These data provide a valuable historical perspective for the fishery and assessment, but they are open to many interpretations. Old reports and records have been examined previously in attempts to clarify these interpretations. From these examinations, it was concluded that the catches were probably reasonably accurate but that fishing effort was unreliable.

The second series of data covers the period 1969 to the present. The data for this period are better understood, are more detailed and cover a wider range of issues than just catch and fishing effort. In particular, voluntary logbooks since 1994 record the size of lobsters and the breeding condition of females, and a standardised observer program since 1998 has independently measured the size composition of lobsters caught.

Commercial catch rates are not formally standardised for changes in details such as the gear, area, depth or time of fishing operations; reported catch rates are calculated as the total catch divided by the total effort in the area/time of interest.

The total catches are shown in Figure 8. The total catch, effort and catch rates since 1969/70 are shown in Figure 9. The detailed catch, effort and catch rate by area and depth since 1997/98 are shown in Figure 10. These figures provide data from the most recent complete catching year (2007/08) and a preliminary estimate of the catch rate in the current incomplete catching year (2008/09). Although data from 2008/09 is incomplete, it comprises a reasonable fraction of the available TACC. The remaining fishing period includes the season when high catch rates are traditionally obtained from depths greater than 30m on the mid-north coast (see Fig 10) and so the annual catch and aggregate catch rate for 2008/09 are expected to be higher than the incomplete figures indicate. But it is not clear whether the TACC will be fully taken in 2008/09.

The data in Figure 5.2 indicate that the aggregate 2007/08 catch rate continued the strongly increasing trend of the past 7 years, and that while the preliminary 2008/09 catch rate is somewhat lower than that of the previous 2 years, it remains higher than catch rates since the 1970s. The main cause of the reduced catch rate in preliminary 2008/09 data is reduced catch rates in the 10-30m and (especially) the >30m depths in the mid-south and far-south

regions (i.e. south of 33°). This reduction is ascribed to poor weather and current conditions in the relevant season for fishing these regions.

The catch rates for most areas are similar to those in the previous year or have changed in the way expected from the short-term fluctuations in puerulus settlement (Fig 10).

The increase in catch rate seen since about 2004/05 on the mid-north coast in waters less than 30m has been approximately maintained in 2007/08 and 2008/09, with the recent (2008/09) decrease expected on the basis of earlier relatively weak puerulus settlement. The higher catch rates seen since about 2005/06 on the far-north and mid-north coast in waters less than 30m depth has also been maintained in 2007/08. The preliminary 2008/09 catch rates in those regions are slightly lower than the previous few years, but are still high, especially in the mid-north coast.

- A decrease in the catch rate in depths less than 10m on the southern coast is shown for 2007/08 and a further decrease is indicated by the preliminary data for 2008/09 (Fig 10), but overall catch rates remain reasonable in historical terms and are consistent with patterns of earlier puerulus settlement. The catch rates in depths greater than 10m on the southern coast was maintained at a moderate level in 2007/08 but decreased considerably in the preliminary data from 2008/09. Operators in that region reported disruptive weather and current patterns during the period in which high catches are usually taken, with a resulting decrease in availability and/or vulnerability of the lobsters. This interpretation implies that the lobsters will be available later in the year to the fishery operating in depths >30m on the mid north coast, and this is supported by very high catch rates in the preliminary 2008/09 data from this region.

Overall the catch and catch rate data support interpretations that the stock is broadly stable with inshore catches fluctuating in response to patterns of puerulus settlement and deeper catch rates showing continued recruitment of immature lobsters into the spawning stock. The decreased catch rates in the southern areas deeper than 10m are being interpreted as environmental variability in the catchability of lobsters, but this should be temporary and catch rates in subsequent years should be closely monitored.

The size composition of the catch on the mid-north and far-north coast, from logbooks and augmented by observer data, are shown in Figure 11. This is the area occupied by the mature lobsters. A substantial decrease in the catch rate of all sized lobsters occurred across both the far-north and mid-north coasts between 2000/01 and 2003/04, and this was followed by reductions in the Total Allowable catch and a decrease in the maximum legal size from 200mm to 180mm. On the far-north coast catch rates of most size classes in the past 5 years remain low, although they are slowly increasing from this low base and the 2008/09 catch rates were about half of the pre-2001 levels. However in the mid-north coast there has been a significant recovery of the catch rates and size composition in the past 3 years, and especially the last 2 years. This includes significant accumulation of lobsters larger than the maximum size limit in the population. The catch rates of mature female lobsters from standardised, fishery independent trap surveys in the mid and far-north coasts indicate that the number of mature females in the population has steadily increased from a low point in about 2001/02, and in 2008/09 this catch rate was back to earlier (1998/99) levels.

There are several particularly significant features and interpretations from these data:

1. The aggregate catch rate in Fig 9 shows a general decline with increasing effort between about 1977 and 1993, followed by a sharp reduction in effort and increase in catch rate just before and during the introduction of Individual Transferable Quotas in 1994/95. To some extent the increase in catch rate may be due to reduction in gear competition, and this has been incorporated previously in the assessment models. However, the

experience with other ITQ fisheries is that, as intended, fisheries can rapidly increase in efficiency and change targeting after ITQs are introduced. The available information is consistent with this having happened in about 1994/5 in this fishery, and analysis to reflect these operational changes in the fishery have been included in the fishery stock assessments since 2004.

2. An about 50% reduction in aggregate catch rate from the fishery occurred between 1999/2000 and 2000/01 (Figure 9). This was due almost entirely to reduction in the mid-depth and deep areas of the northern part of the fishery, the location of the spawning stock (i.e. 10-30m depth from 28-32°S and greater than 10m depth from 28-30°S; see Figure 10). The low catch rates in the mid-depths on the mid-north coast persisted for 4 years. They then increased in 2004/05 to about half of their level prior to 1999/00, and have been maintained at about that level during the last 4 years. The catch rates in the mid-depths on the far-north coast remained low for 5 years following the reduction in 1999/00, but have increased somewhat in the last 2-3 years. Catch rates in the more southern areas which take immature lobsters, were broadly maintained, with significantly increasing catch rates from depths greater than 30m. Aggregate catch rates from the fishery have steadily increased from 2002/03, mainly due to increases in the southern part of the fishery and from the shallow depths of the northern fishery where predominantly immature lobsters are taken. A reduction in the inshore catch rates in the incomplete 2008/09 data is interpreted at this time as being due to operational constraints rather than reduced lobster abundance, but this will need to be examined further as more complete data become available.
3. The size composition of lobsters in the northern part of the fishery shows a sharp reduction of catch rates across all size classes, starting in about 2000 and continuing to 2004. (see Figure 11) This coincides with the timing of the reduced catch rates. It shows large reductions in the abundance of lobsters in the 120-160mm size range (i.e. immature), in the 160mm+ size range (i.e. mature) and in the 200mm+ size range (i.e. mature and larger than the maximum legal size).
4. The size compositions from the northern regions for 2006/07, 2007/08 and especially 2008/09 show very good evidence of recovery of pre-adult and adult lobsters. There is very good evidence of accumulation of mature lobsters above the maximum legal size limit of 200mm. However this increase is mainly on the mid-north coast. On the far-north coast there has been a slow increase in abundance but the absolute catch rates are still low compared to historical levels.

As described previously, the cause of this abrupt decline in catch rate and change in size composition that started in about 1999/2000 is unclear. The decline affected all mature animals - even those above the maximum legal size limit. It also coincided with a period of very low abundance of smaller lobsters in the north, a shift to catching more large animals to meet the quota, and a period of warm sea-water temperatures that reduced the availability of lobsters (either by causing migration out of the fishing area or reducing the likelihood of lobsters entering traps). The declines could be explained by significant change in the availability of lobsters (e.g. changed oceanographic conditions that resulted in the lobsters moving to areas where the fishery and surveys did not operate), by a significant change in the catchability of lobsters (e.g. changed behaviour that reduces the chance of lobsters entering or remaining in a trap), by widespread and unusually high natural mortality on the spawning stock, or by excessive fishing on the spawning stock. The first two explanations become more difficult to sustain as the phenomenon persists across multiple years, especially in the far-north, and a period of unusually high natural mortality has similar short term management implications as excessive fishing (i.e. the need for spawning stock rebuilding).

The interpretation currently being applied is that in the northern zones, a period of low abundance of predominantly juvenile lobsters in depths less than 10m due to previous weak

puerulus settlement, resulted in a transfer of fishing effort during 2000 and 2001 to deeper water where the larger lobsters occur. This in turn greatly altered the selectivity pattern of the northern fishery, and resulted in excessive catches from the spawning stock. Important implications of this interpretation are that a relatively small shift in the operation of the fishery in the northern areas gave a large change in fishery selectivity, and that a relatively small increase in catch from the spawning stock caused a significant reduction in the spawning stock - implying that at the time the absolute size of the spawning stock was quite low. These interpretations resulted in a reduction in the maximum legal size from 2004/05 (from 200mm to 180mm) and reduction of the overall TACC so as to protect and rebuild the spawning stock. These interpretations also result in increased credibility for stock assessments that imply a low absolute size of the spawning biomass in about 2000, and the need to ensure that the spawning biomass reference points provide sufficient absolute biomass to be robust to changes in targeting and selectivity in the northern part of the fishery.

The subsequent response of the stock to the reduced TACC and maximum size limit is consistent with the interpretation of excessive fishing on the spawning stock having been responsible for the abrupt reduction of mature lobsters in 2000 and 2001. The mature stock is slowly rebuilding under these management interventions, with rebuilding first occurring in the pre-mature lobsters in the deep-water parts of the fishery in the south, then feeding into the mature and premature lobsters in the deep water parts of the mid-north coast.

5.2.2 Fishery reference points

While target and limit reference points have not been formally agreed for the fishery, other than the 0.25 depletion level 'trigger point' for the spawning stock described in the FMS, the TACC has operated with implicit target and limit reference points for several years. These are:

Target reference point. A depletion of 0.5 to the unfished biomass has been used for reporting. Performance against this reference point has been reported for both total biomass and spawning biomass. Because the stock has been well below 0.5 of the unfished biomass since the Share Management arrangements were introduced this reference point has not been highly relevant operationally. However, as the stock is recovered an appropriate target reference point should be considered and selected. The target reference point should include socio-economic as well as biological considerations.

Limit reference point. Depletion to 0.3 of the unfished level has been used by the TAC Committee as the limit reference point, below which urgent corrective action is taken. Performance against this reference point has been reported for both total biomass and spawning biomass, with most importance and priority being given to the spawning biomass. In recent years, the estimates of spawning biomass have included a substantial probability that the spawning biomass is below this level, and so this limit has been relevant to the setting of the TACC. The level of 0.3 is used because:

- It is thought to be above the point where abrupt recruitment failure might be expected. Recruitment to the fishery, while fluctuating, does not appear to have been systematically reduced during periods of low spawning stock abundance, and for brief periods the spawning biomass was as low as about 0.1-0.2 of the unfished level. The 'base case' assessment assumes that significant and rapid recruitment decline would occur, on average, at depletion to 0.10 of the unfished level. So overall, the use of a reference point here is to avoid depletion below 0.2. Generally the precision of estimation of depletion in the lobster spawning stock is about +/- 0.09. That is, if the spawning stock is estimated to be depleted to 0.25 of its initial abundance, the 95% confidence interval about that estimate means that the true depletion could be as low as 0.16 or as high as 0.34. Similarly, if the median

estimate of depletion is 0.3 then there is 95% confidence that the true population is above 0.21 and below 0.39.

- This species of lobster has some unusual features in its life history, including a very spatially concentrated spawning stock, a complex migration process by immature animals through the fishery back to the spawning grounds, and some indications of spatial structure, i.e. the northern and southern regions show different patterns of puerulus settlement and different relationships between puerulus settlement and subsequent juvenile numbers, and recently there appears to have been a divergence in the dynamics of the spawning stock recovery in the mid-north and far-north regions. Uncertainty about the effects of these features on stock and recruitment dynamics at low abundance mitigates for a conservative limit reference point with respect to the spawning stock.
- A specific issue arising from the highly spatially concentrated nature of the spawning stock is its vulnerability to reduction as a result of changes in the targeting and operation of the fishery in the vicinity of the spawning stock. And this is one interpretation of what happened in about 2000. There is a need to ensure that there is sufficient absolute abundance of the spawning stock to absorb catches from such operational changes in the fishery, without significant depletion, before additional protective management can be applied as required. This gives a need to consider the absolute estimates of the spawning biomass and the proportional depletion of the reference point in the context of the size of the catches that could be taken. For example if the unfished spawning biomass was 2,208t (as implied by one interpretation of the stock assessment) and operational changes in the fishery could result in 50t being taken from the spawning stock rather than the immature stock as assumed when setting the TACC, then that extra spawning stock catch is less than 10% of the biomass that would be present if the population was above a limit reference depletion of 0.3. Such a change in selectivity could not cause rapid reduction of the spawning stock, and the change in selectivity could be recognised and appropriately managed over time. Whereas if the limit reference depletion was 0.1, the same catch could be up to 25% of the spawning biomass present at the time of the change in selectivity, resulting in a rapid reduction on spawning biomass. Maintaining the stock above a limit reference point for depletion of 0.3, rather than a lower value, ensures that the absolute spawning biomass is sufficiently large to reasonably buffer such changes in selectivity.
- The above points relate to the target species, but Objective 2 of the Lobster Share Management Plan considers the impacts of the fishery on the broader ecosystem. Scientific knowledge of these impacts in NSW is limited. However experience elsewhere has indicated that lobsters are important species in predator-prey relationships and can have significant effects on habitat and ecosystem structure. In some cases, the predation of large lobsters on urchins indirectly affects reef habitats (e.g. seaweed cover vs. urchin barrens) and associated species. Such considerations and the present state of knowledge mitigate for a larger rather than smaller limit reference point for biomass, especially in relation to large animals in the population.

The most recent Fishery Management Strategy identifies depletion of the spawning stock to below 0.25 of the pre-exploitation level as a trigger for review. Here, this is interpreted as meaning that a review is triggered if the estimated median depletion is less than 0.25. In considerations for setting the TACC, both this requirement and achieving a high probability of avoiding depletions below 0.2 are considered. Taking estimation error into account, a high chance of avoiding depletions below 0.2 is likely to be achieved by a limit reference point at an estimated median depletion of 0.3. The target and limit reference points should be reviewed periodically, but here median depletion levels of 0.5 as a proxy target, and 0.3

as a limit that gives a low chance of the true spawning stock biomass being below 0.2, will be used.

5.2.3 Fishery independent surveys and monitoring

The present stock assessment is strongly reliant on fishery dependent information such as commercial catch rate. This is essential and valuable information. The information covers a wide range of areas and times, and this coverage is chosen by fishers who have a great deal of experience about the behaviour of lobsters and strong incentives to fish where the lobsters are. However the ability of fishers to selectively target high-density aggregations of lobsters, and the economic incentives and constraints that influence where and when fishing is conducted, also results in the fishery dependent information being potentially biased. As a result, reliable fishery assessments also incorporate fishery independent information.

In this fishery, independent measures of spawning stock are particularly important because a maximum legal size is enforced that is intended to reduce fishing on a significant part of the spawning stock. This management measure correctly aims to protect the older mature animals from fishing because they contribute strongly to egg production. But it also has the consequence that commercial catches are unlikely to fully reflect the spawning stock, and hence the need for fishery independent surveys.

Recognising this need, two fishery independent monitoring programs have been established, one focused on measuring the spawning stock and the other on measuring settlement of post-larval lobster that will be available to the fishery about 2-3 years later. Both of these monitoring programs are relatively recent, with spawning stock surveys using standardised pot sets in the northern areas starting in 1998/99 and post-larval surveys starting in 1995/96. However both are already providing critical information that is being used to interpret trends in juvenile and spawning stock abundance in the northern part of the fishery.

The results from monitoring the settlement of puerulus show that 10 –100 times more lobsters settle in the southern part of NSW, i.e. about Sydney and south, than in the northern part. In the northern areas, there is an encouraging relationship between puerulus settlement and the availability of young lobsters to the fishery 2-3 years later. The puerulus settlement data do not indicate a change in recruitment to the southern part of the fishery, which encouragingly suggests that the supply of recruits to the south has not been diminished by the reduced spawning stock since about 2000.

In the northern areas, the low catch rates of small lobsters from about 2000 to 2003 is interpreted as being primarily due to weak settlement there in the late 1990s. The higher puerulus catches in the northern regions between 2000 to 2004 are interpreted as delivering the good numbers of young lobsters in the northern fishery in the last three years. However in the years 2004/05 to 2007/08, the puerulus settlement was weak again in the mid-north, and especially the far-north coasts, giving rise to the predictions of low inshore catch rates and repeating the conditions that apparently caused increased targeting of the deeper waters and the spawning stock in 1999/2000 and 2000/01. Puerulus settlement on the far-north coast was very low for 3 years (2004/05, 2005/06 and 2006/07), the 2007/08 recruitment was of moderate strength, but the 2008/09 settlement was strong. This suggests that there will be a further period of low abundance of juvenile lobsters in the inshore fishery, but that in 2-3 years this situation should improve. On the mid-north coast, there were 2 years of low settlement (2004/05 and 2005/06) but strong to moderate settlements in 2006/07, 2007/08 and 2008/09. So that while a reduction of juvenile lobsters is expected in the next year, it should not persist. On the southern coasts, there was a weak settlement in 2005/06 followed by very strong settlements in 2006/07, 2007/08 and 2008/09. This is expected to give reduced numbers of juvenile lobsters in the southern regions in the next year, but then a strong return to high numbers.

The results from the spawning stock surveys in the northern regions, using standard pot sets, confirm the interpretations made using the commercial and observer data. That is (i)

the spawning stock reduced substantially starting in about 2000, (ii) that the spawning stock on the mid-north coast slowly increased during 2004/05 to 2006/07 and substantially increased during 2007/08 and 2008/09, and (iii) that the spawning stock on the far-north coast is recovering but at a slower rate than that on the mid-north coast.

5.2.4 Illegal, unreported and recreational catches

The assessments and population projections assumed a 25.8t recreational catch and an unreported catch that is 17% of the total commercial catch. That is:

$$0.17 = \text{unreported catch} / \text{total catch}$$

$$= \text{unreported catch} / (\text{reported catch} + \text{unreported catch})$$

and so

$$0.2 = \text{unreported catch} / \text{reported catch}$$

The 25.8t recreational catch and the 17% unreported commercial catch are based on estimates provided by previous studies and surveys. These estimates require updating.

The 17% unreported commercial catch is intended to include allowance for the catch of commercial fishers not in the lobster fishery (e.g. fish trawlers and fish trappers) as well as unreported catch of lobster fishers. This approach to the various categories of reported and unreported catches can be summarised as shown in Table 3.

Table 3: Categories of reported and unreported catches

Fishing activity	Reported	Unreported
Commercial rock lobster share holders	Reported catch of RL shareholders	x
Commercial other fishers	zero	y
Subtotal: commercial catch	Reported catch of RL shareholders	x + y = 17% of Reported catch of RL shareholders
Recreational	zero	25.8t
Indigenous	Reported catch of indigenous fishers	zero
Total	Reported catch of RL shareholders + Reported catch of indigenous fishers	25.8t + 17% of Reported catch of RL shareholders

The Total Allowable Commercial Catch (TACC) is calculated from the desired Total Allowable Catch (TAC) from:

$$\text{TAC} = \text{commercial reported catch} + \text{commercial unreported catch} + \text{recreational catch}$$

$$\text{TAC} = \text{TACC} + 0.2 \text{ TACC} + \text{recreational catch}$$

and so

$$\text{TACC} = (\text{TAC} - \text{recreational catch}) / 1.2$$

$$\text{or TACC} = (\text{TAC} - \text{recreational catch}) * 0.83$$

5.3 Analysis

5.3.1 Stock assessment

The status of the lobster population was assessed using a length-based model. This model explicitly represents the length and associated age structure in the population, as well as the

sexual difference in some key parameters such as growth and hence availability to the fishery. It allows calculation of the size of the mature stock, it can represent the effects of strong or weak year-classes as they pass through the population, and it can incorporate changes in size selectivity in the fishery

This model was fitted to the catch data throughout the history of the fishery to the catch rate data since 1969 when detailed logbooks were introduced, and to the size composition of 160-200mm lobsters in the years 1999/2000, 2000/01 and 2001/02. The limited size range was used because this size range is expected to be less subject to changing fishery practices and the limited period was used because the size composition of the catch in those years was collected by observers. The model also incorporates a great deal of other information that is available. For example it includes detailed biological information (e.g. growth rate, maturity schedule, percentage berried females, natural mortality rate, relationship between mature stock and recruitment) and fishery information (e.g. selectivity of the fishing gear, discarding of lobsters near the legal size limits, and the mortality of discarded lobsters). Sensitivity tests were conducted in relation to the statistical weight given to the catch rate and length composition data, the level of natural mortality, and the steepness (at low spawning stock) of the relationship between the spawning stock and recruitment. As in last year's analysis, a historical pattern of vulnerability was used to reflect the effects that new gear types and expansion into new areas had on the accessibility of different sized lobsters to the fishery. A new feature of this year's assessment is the direct estimation of the natural mortality rate, rather than treating natural mortality as a known input. The estimations and predictions of this 'free estimation of natural mortality' assessment are included here to indicate sensitivity, but further technical evidence and analysis would be required to determine whether this should be adopted as the 'base case' for TACC recommendations.

As in previous years, the effect of different statistical weighting of the size composition data and catch rate data was examined. The base case interpretation this year again uses 0.25% weighting on catch rate and 99.75% weighting on the size distributions. In addition, the more conservative weighting – 0.1% on catch rate and 99.9% on size composition – was included because this interpretation includes the implication of small spawning biomass in 2000.

The model fit to the catch rate and length frequency data is reasonable, but there is tension in trying to fit both simultaneously. The fit was slightly better with direct estimation of natural mortality, as would usually be expected by from the inclusion of an extra 'free parameter' in a model. The estimated natural mortality was 0.19, compared to the assumed base-case value of 0.15, which implies slightly higher productivity than the base-case. The model interpretations with free estimation of natural mortality are included in the interpretation tables below.

None of the model fits matched the rapidly increasing catch rate in the last 3 years of complete data (i.e. 2005/06, 2006/07, 2007/08). This appears to be due to the use of catch rate that is an aggregate of the catch and effort from very dissimilar gears – the small inshore pots with relatively small catches and set times and the large offshore traps with relatively large catches and set times – and the use of catch per set as the unit of catch rate. This results in systematic increase or decrease in the catch rate, from an overall average trend, depending on the ratio of catch taken by large and small traps in the fishery. The model fit attempts to track the average. In 2005/6, 2006/07 and 2007/08 there has been an increasing proportion of the lobster catch taken in large traps, and a consequent systematic increase in the aggregate catch rate above that predicted by the model. Such multi-year systematic departures have been seen historical model fits. For fluctuating proportion of the catch among the trap types these fluctuations could be considered to be 'averaged out' by the model. But the departure in the recent years appears to be larger and this should be addressed in future assessments. The issue could be addressed by one or more of standardising the catch rate for gear type and operational details, developing a more spatially explicit assessment model and appropriate spatial catch rate measures for model

fitting, or developing appropriate catch rate measures for different size ranges that could act as a surrogate for a spatial model. Resolution of this would be aided by inclusion of more recent size composition data in the analysis; this was recommended previously and updated size compositions are expected to be available for next year's analysis.

5.3.2 Present stock levels

The key population and depletion estimates, for the two different statistical weighting of the catch rate and size composition data and for the model allowing estimation of natural mortality, are shown in Table 4.

There is measurable and continued improvement in the spawning stock in recent years, and in the most recent year (2007/08 to 2008/09) the stock is estimated to have stabilised and is slightly increasing. The estimated change in the spawning biomass is small but positive (about 8t). The estimated depletion of the spawning stock remains essentially the same as last year at 0.26 of the unfished level under the base case weighting and 0.20 under the alternative weighting. This indicates that the management measures of the past several years have had the desired effect of stopping further decline and beginning to rebuild the stock, although the spawning stock is still significantly depleted and there is only slow rebuilding occurring under the current catch levels. Nonetheless it is very encouraging to have a measurable turn-around in spawning stock condition in recent years.

The estimated total stock biomass in 2008/9 is slightly lower than that in the previous year. The total biomass has stabilised or is slightly decreasing, whereas the spawning biomass has stabilised and is slightly increasing. The reduced total biomass is due to reduction in the exploitable biomass (104-180mm lobsters) because of the reduced puerulus settlement of several years ago and the decreased size range of harvestable lobsters following the decrease of the maximum size limit. The recently increased TACC is removed from a narrower range of sizes in the population whereas the spawning biomass has significant protection from the 180mm maximum size limit.

Under any weighting scheme, the level of depletion of the total stock is below 0.5 of the unfished level. The base case assessment indicates that the median depletion for total biomass is above the limit reference point of 0.3, while the more conservative weighting indicates that median depletion is slightly below that limit. For both weightings there is a very high probability that the total biomass is greater than 0.25 of the unfished level – a slightly higher probability for the base case than the alternative weighting, but above about 95% probability in both cases.

Under any weighting scheme, the level of depletion of the spawning stock is well below 0.5 of the unfished level, and there is a small chance the spawning biomass is above the limit reference point of 0.3 of the unfished level. The probability that the spawning biomass is below 0.2 is about 5-10% for the base case weighting and about 50% for the alternative weighting. The more pessimistic alternative weighting scheme also implies that the absolute size of the spawning biomass is small, and so it is vulnerable to being depleted by increased targeting by the fishery.

Table 4: Key population and depletion estimates for the two different statistical weighting of the catch rate and size composition data and for the model, allowing estimation of natural mortality

	Median	5% limit	95% limit
Unexploited total biomass (K)			
<u>Weighting</u>			
99.75 on length: 0.25 on catch rate (Base Case)	6,124	5,841	7,375
99.9 on length:0.1 on catch rate	6,096	5,838	7,277
Natural mortality internally estimated with 99.75:0.25 weighting	5,287	4,938	5,635
2008/09 total biomass			
<u>Weighting</u>			
99.75 on length: 0.25 on catch rate (Base Case)	2,117	1,555	3,223
99.9 on length: 0.1 on catch rate	1,708	1,36	2,794
Natural mortality internally estimated with 99.75:0.25 weighting	2,185	1,735	3,169
2008/09 total biomass (K)			
<u>Weighting</u>			
99.75 on length: 0.25 on catch rate (Base Case)	0.35	0.27	0.44
99.9 on length: 0.1 on catch rate	0.28	0.23	0.39
Natural mortality internally estimated with 99.75:0.25 weighting	0.42	0.32	0.62
Unexploited spawning biomass			
<u>Weighting</u>			
99.75 on length: 0.25 on catch rate (Base Case)	2,232	2,129	2,688
99.9 on length: 0.1 on catch rate	2,222	2,127	2,652
Natural mortality internally estimated with 99.75:0.25 weighting	1,686	1,306	1,953
2008/09 spawning biomass			
<u>Weighting</u>			
99.75 on length: 0.25 on catch rate (Base Case)	587	399	943
99.9 on length: 0.1 on catch rate	437	339	776
Natural mortality internally estimated with 99.75:0.25 weighting	500	397	690
2008/09 spawning biomass/unexploited spawning biomass			
<u>Weighting</u>			
99.75 on length: 0.25 on catch rate (Base Case)	0.26	0.19	0.35
99.9 on length: 0.1 on catch rate	0.20	0.16	0.27
Natural mortality internally estimated with 99.75:0.25 weighting	0.30	0.21	0.50

Under any weighting scheme, the interpretation is of an increase in stock condition during the last about 10 years, but a levelling off of this increase in the last 2 years with a slight decrease in the exploitable biomass and a slight increase in the spawning biomass.

The two weightings, the base case and the alternative, both give credible interpretations of the available information, while the more pessimistic low spawning biomass alternative is consistent with the observations from the fishery in the early 2000s. The puerulus sampling indicates no systematic reduction in recruitment since monitoring began in the mid 1990s, but the risk and need for rebuilding of the spawning stock remains clear.

5.3.3 Predictions of future stock levels

Predictions were made of the change in the biomass that would occur after 5 years of catch at various levels. In the present stock situation there is a need to rebuild the spawning stock to have a low probability of the true spawning biomass being below 0.2 of the unfished abundance.

Predictions were made based on the stock assessments from the two weighting schemes described above, and also for the assessment in which natural mortality was estimated internally. The predicted changes in spawning biomass and exploitable biomass (i.e. biomass in 2013/14 divided by spawning biomass in 2007/08) after 5 years of various constant future catches are shown in Table 5 and 6.

Table 5: Predicted proportionate change in spawning biomass after 5 years of various constant future catches

Total Catch (t)	Weighting on catch rate and length data in assessment model	Increase in spawning biomass ($SB_{2014-15}/SB_{2008-09}$); Median and the 95% confidence interval
150	Base case	
	99.75:0.25 weighting	1.15 [1.09 to 1.21]
	99.9:0.1 weighting	1.18 [1.05 to 1.29]
	Natural mortality internally estimated and 99.75:0.25 weighting	1.21 [1.08 to 1.27]
175	Base case	
	99.75:0.25 weighting	1.07 [0.97 to 1.15]
	99.9:0.1 weighting	1.08 [0.91 to 1.21]
	Natural mortality internally estimated and 99.75:0.25 weighting	1.13 [1.05 to 1.18]
200	Base case	
	99.75:0.25 weighting	0.99 [0.87 to 1.11]
	99.9:0.1 weighting	0.98 [0.79 to 1.16]
	Natural mortality internally estimated and 99.75:0.25 weighting	1.05 [0.99 to 1.10]

Table 6: Predicted proportionate change in exploitable biomass (104-180mm length lobster) after 5 years of various constant future catches

Total Catch (t)	Weighting on catch rate and length data in assessment model	Increase in exploitable biomass ($B_{2014-15}/B_{2008-09}$); Median and the 95% confidence interval
150	Base case	
	99.75:0.25 weighting	1.00 [0.96 to 1.06]
	99.9:0.1 weighting	1.02 [0.96 to 1.11]
	Natural mortality internally estimated and 99.75:0.25 weighting	1.05 [0.99 to 1.12]
175	Base case	
	99.75:0.25 weighting	0.86 [0.77 to 0.95]
	99.9:0.1 weighting	0.84 [0.70 to 0.98]
	Natural mortality internally estimated and 99.75:0.25 weighting	0.95 [0.88 to 1.00]
200	Base case	
	99.75:0.25 weighting	0.74 [0.53 to 0.87]
	99.9:0.1 weighting	0.66 [0.41 to 0.88]
	Natural mortality internally estimated and 99.75:0.25 weighting	0.85 [0.73 to 0.92]

These projections for the spawning biomass and exploitable biomass are less optimistic than those of last year for the same catch levels, reflecting the higher base catches now applied following TACC increases in each of the last 3 years, the reduced recruitment now in the population as a result of lower settlement of puerulus about 3-5 years ago, and the effects of the changed size limit. Continued recovery and rebuilding of the spawning biomass is still predicted for the next 5 years under a range of catch levels, but those same catch levels are predicted to result in a reduction of the exploitable biomass. Significantly, the current catch is predicted to give a low rate of recovery for the spawning biomass and result in significant reduction in the exploitable biomass.

After 5 years of a constant 150t catch per year, the median rebuilding of the spawning biomass is to about 1.15-1.18 times the present level, with a range of outcomes that could be as low as 1.05 or as high as 1.29. For a catch of 175t, the median rebuilding of the spawning biomass is to 1.07- 1.08 of the current level after 5 years while the range of outcomes could be as low as 0.91 or as high as 1.21.

These predictions of the relative change in the spawning stock under different catch levels are remarkably insensitive to the weighting scheme used, but the predicted absolute stock abundance and level of depletion are quite different for the base case and alternative weighting.

- For the base case, the median depletion of the spawning stock after 5 years of 175t catch per year is predicted to be 0.28, with the 95% confidence interval giving outcomes as low as 0.18 and as high as 0.40. So with the base case interpretation,

catches of 175t per year for the next 5 years would achieve rebuilding close to the limit reference point of 0.3 and deliver the intended very low probability that the stock is below 0.2 of the unfished level. The median is also predicted to recover to above the trigger reference point in the Fishery Management Strategy (i.e. 0.25 depletion).

- For the alternative weighting, the median depletion of the spawning stock after 5 years of 175t catch per year is predicted to be 0.21, with the 95% confidence interval giving outcomes as low as 0.14 and as high as 0.34. At the end of the 5 year period, there remains a probability of nearly 50% that the spawning stock will be below 0.2 of the unfished level. So with the alternative interpretation, catches of 175t per year for the next 5 years would not achieve significant rebuilding and the population is predicted to remain very similar to its current status. The population would not rebuild to the limit reference point of 0.3 and there would remain a significant probability that the stock is below 0.2 of the unfished level. The median is also below the trigger reference point in the Fishery Management Strategy (i.e. 0.25 depletion).

The exploitable biomass is predicted to remain very similar to the present level for the next 5 years under catches of 150t per year, and to decrease under catches of 175t per year, despite the increase in the spawning stock. This is because of the recently restricted size range available for harvesting, the transient effects of increased catches and the patterns of recruitment passing through the fishery. For catches of 175t per year, the exploitable biomass is predicted to reduce to about 0.85 of its current level, and this prediction is insensitive to the weighting used. In the absence of innovation and increased capture efficiency, this would be expected to reduce the catch rate of commercially retainable lobsters proportionately; a significant reduction. This prediction was also highlighted in last year's report.

So overall with catches of 175t per year in the next 5 years, the spawning biomass is predicted to increase by 7-8% by the end of that period, the median depletion of the spawning biomass is predicted to be 0.21 or 0.28 depending on the weighting, and the stock available for harvest is predicted to decrease to about 85% of the current levels. The balance of credibility across the base case and alternative weighting interpretations are clearly critical in interpreting the likely future status of the stock under various catch levels. Both interpretations are consistent with the available information, and while the base case is considered to be the most credible the alternative cannot be dismissed and remains credible. For an annual catch of 175t per year, the spawning stock is predicted to recover almost to the limit reference point in 5 years under the base case interpretation, but under the alternative interpretation it is predicted that there will be little further recovery. The interpretation based on an estimated (higher) natural mortality is more optimistic than the base case; for annual catches of 175t and under all weighting schemes it implies recovery of the spawning biomass to the limit reference point (0.3) within 5 years and a stable exploitable biomass.

5.4 Conclusions

Management decisions in the past several years have been aimed at stock rebuilding, and there is now measurable evidence that rebuilding of the spawning biomass has been occurring in the past few years. In the last year, 2007/08 to 2008/09, the spawning biomass has increased slightly and the total stock has stayed about the same size. The median spawning stock remains below the limit reference point of depletion to 0.3 of the unfished level, with credible interpretations being the median spawning biomass is 0.26 or 0.19 of the unfished level. The base case assessment, which is currently given the greatest credibility, implies rebuilding of the spawning stock will continue under the current catch levels and almost recover to 0.3 of the unfished level in the next 5 years. The alternative assessment implies that there will be no further rebuilding of the spawning biomass under current catch levels. Both assessments imply that the exploitable biomass will decrease over the next 5 years under current catch levels. There is some preliminary evidence that the natural

mortality may be slightly higher than is assumed in assessment model, and if correct this provides a more optimistic interpretation than the base case assessment of both the current status of the stock and the rate of recovery.

The fishery data, scientific survey data and stock assessment provide reasonably consistent evidence and support for these interpretations. A significant discrepancy, however, is that the stock assessment model does not match the increases in commercial catch rate seen in the most recent 3 years. This is the case for all of the assessment model fits, including all sensitivity tests and the internal estimation of natural mortality. There are many possible reasons for this, including increasingly efficient fishing operations or a constraining effect of using only old size composition information (i.e. 1999-2002) in the stock assessment model. The explanation needs to be further examined but the assessment model results are treated as credible.

At this time, it is considered reasonable to maintain the total catch of 180t, but this approach carries some risk and progress will be monitored closely in coming years. In particular there is need to ensure continued recovery of the spawning stock to the limit reference point, and under some interpretations of the available information this may not occur under present catch levels. Also the current catch level may result in significantly reduced catch rates from the exploitable stock.

After adjustment for unreported and recreational catches, as above, this gives a Total Allowable Commercial Catch of 127.9t (rounded up to 128t).

Improvements in observations, modelling and management

The lobster fishery is in a very critical point in its recovery and there are several improvements in the observations, modelling and management that would be expected to significantly improve confidence in the short and medium term outcome. These are:

1. Updating the size frequency information used to drive the population model. Currently the information used is from 1999-2002. The most direct update would be achieved by repeating the observer coverage of the 1999-2002 period, and the Committee was informed that measures are in place that should allow updated data to be used in next year's assessment. It could also be effective to make greater use of the size information from commercial logbooks and/or the fishery independent trap surveys.
2. Previous analysis showed that for the south coast, the commercial logbook data for sub-legal-length lobsters provided a good predictor of the abundance of legal-length lobsters 1 year later. The catch rate of sub-legal-length lobsters should be developed into an index of abundance to improve model predictions of the abundance of lobsters in the southern part of the fishery.
3. A targeted tagging program should be considered. Important issues that could be examined through such a program include:
 - Direct estimation of the size of the spawning stock so as to help resolve which of the assessment weightings is most credible.
 - How far north the lobsters now travel. In particular this relates to where the spawning stock is currently located and whether there is any indication that the north and far-north zones are now operating as separate stocks or sub-stocks.
 - The fishing mortality imposed on the migrating lobsters. If this could be reliably estimated it would significantly resolve the question of which statistical weighting scheme to accept in the stock assessment (i.e. 99.75:0.25 or 99.9:0.1).

- The calibration of movement in a spatially resolved assessment model. A spatially resolved assessment model could be expected to provide better interpretations of the catch and catch rate information as the cohorts migrate through the fishery and join the spawning stock, provide improved understanding of the dynamics and mortality on the spawning stock, and allow exploration of management options based on spatial management.
 - Specific tagging experiments (e.g. In the Marine Protected Areas or sequentially on the same cohort) could improve estimates of natural mortality.
4. As the stock recovers, there should be focused development of the longer-term target for the stock and fishery, and the management and stock assessment arrangements that will be used to maintain the fishery in its desired state. The profitability of the fishery and cost-effectiveness of fishery assessment and management should be factors in these considerations. There appear to be options based on spatial management that could provide high protection for the spawning stock, allow high catches of immature lobsters, and reduce the requirements for management. For example, if the spawning stock was fully protected by spatial management measures, then management of the fishery could be treated more like the harvesting used in farming – high harvesting rates on the immature animals leaving just enough to replenish the spawning stock.
 5. A number of Marine Protected Areas (MPAs) have been introduced into the region of the fishery. The MPAs in the north may have benefits in protecting the spawning stock and they should be considered alongside the fishery management measures (including spatial management measures). The stock assessment is not presently spatially structured and it should be altered so as to be able to include the effects of MPAs and other spatial management.
 6. Examine options for standardisation of CPUE. The fishery uses a wide range of trap sizes and fishing strategies (e.g. soak times, moon phase, bait type), parts of the fishery are intentionally expanding and changing some practices, and external factors such as weather force other changes for a time. It was notable that several operators reported having changed their fishing strategies in 2007/08, including variation in soak time, and the apparently anomalous catch rate in the southern inshore region was reported as being due to unsuitable weather forcing a change in fishing strategy. Furthermore, in a healthy quota managed fishery such as this one, it is intended that fishing innovations and altered fishing strategies would increase fishing effectiveness and profitability, and that the fishing strategies might change quickly to match profitable situations. Assessment of this fishery relies extremely heavily on using CPUE as an index of abundance, and reliability of the assessment would be improved by standardising the CPUE.
 7. Examine options to distinguish between the base case and alternative weighting interpretations in the stock assessment (i.e. between the 99.75:0.25 and 99.9:0.1 weightings). Unresolved differences between these two interpretations of the available data are responsible for most of the uncertainty in the present assessments, and options to resolve the interpretations should be explored. Two obvious contenders for providing such resolution are the collection and use of more recent size composition data and a direct estimate of the fishing mortality, and both of these are identified in points above. But consideration should be given to what other approaches would be useful. One such possibility is an independent measure of spawning stock biomass. The base case and alternative interpretations differ considerably in their estimates of the absolute size of the spawning stock biomass, and a tagging study in the area occupied by the spawning stock may be able to resolve the correct interpretation. These and other options should be examined.

Figure 8. The landed catch since the start of the fishery.

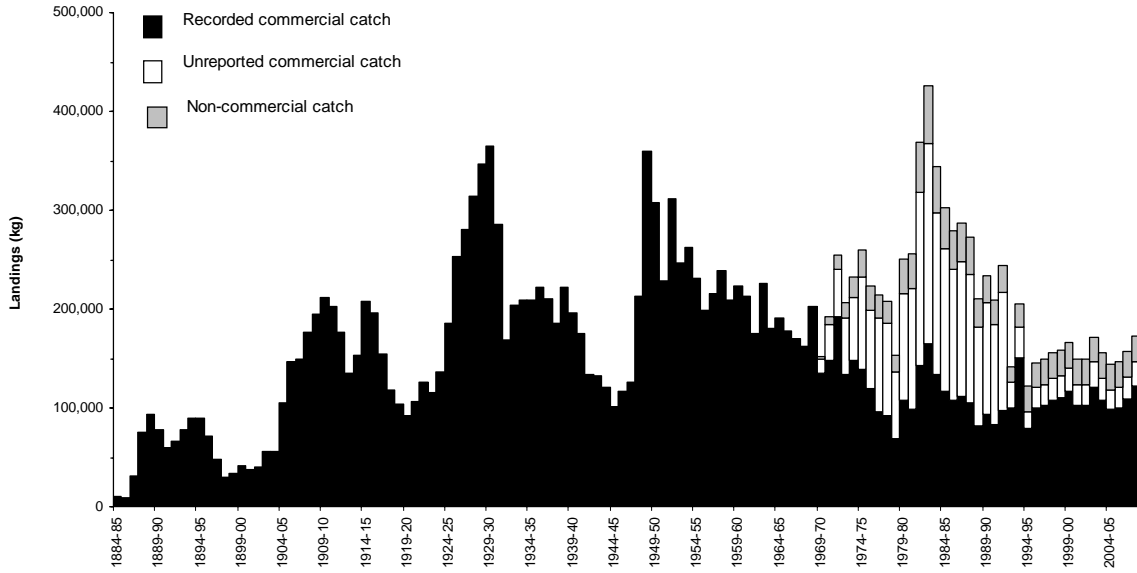


Figure 9. Commercial catch, effort and catch rate since 1969/70 when reliable estimates of effort are available.

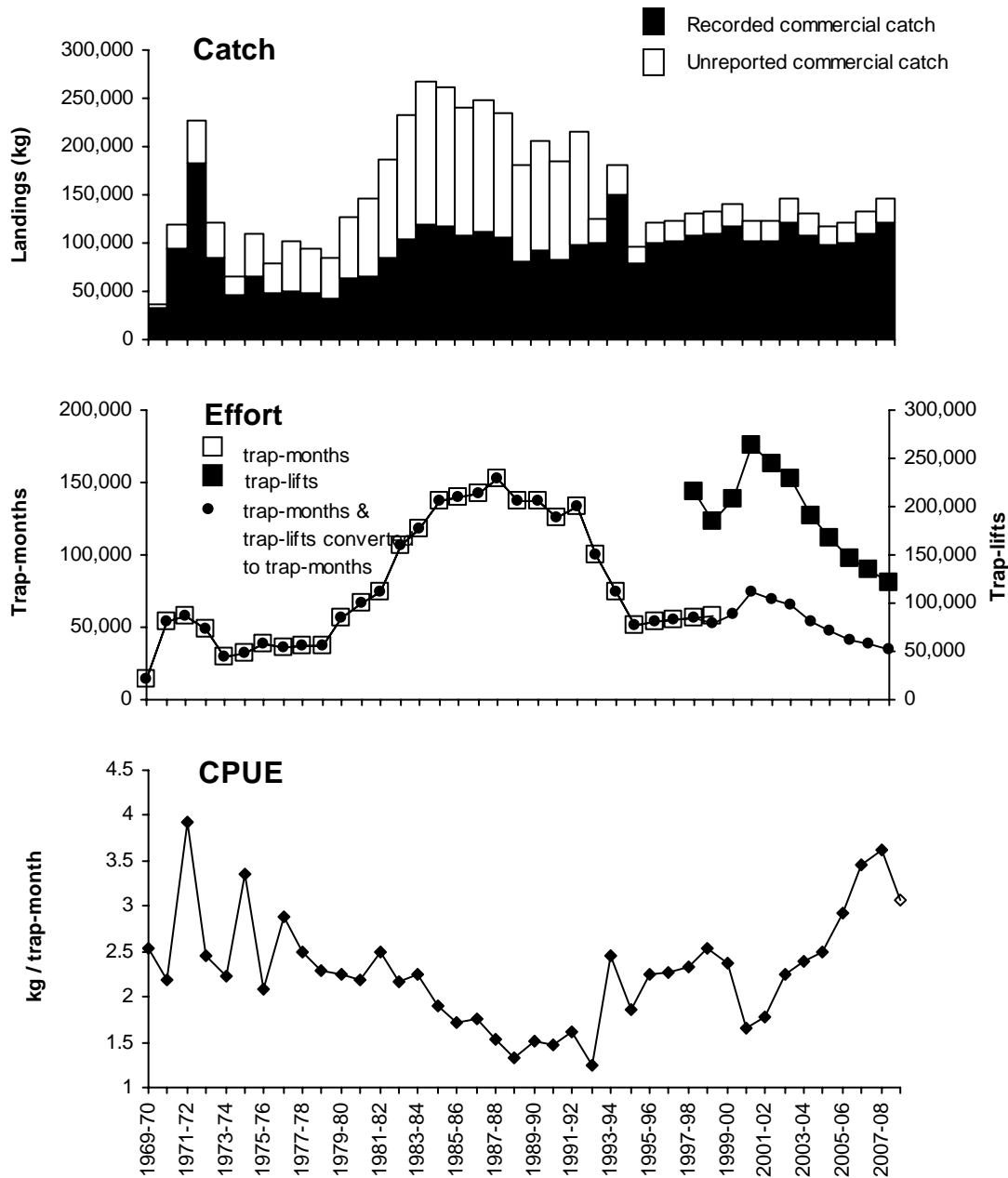


Figure 10. Commercial catch, effort and catch rate by area and depth since 1997/8 when detailed reporting became mandatory. The spawning stock is considered to be mostly found in the far north coast (28-30+) and mid-north coast (31-32) at depths greater than 10m and especially depths 10-30m.

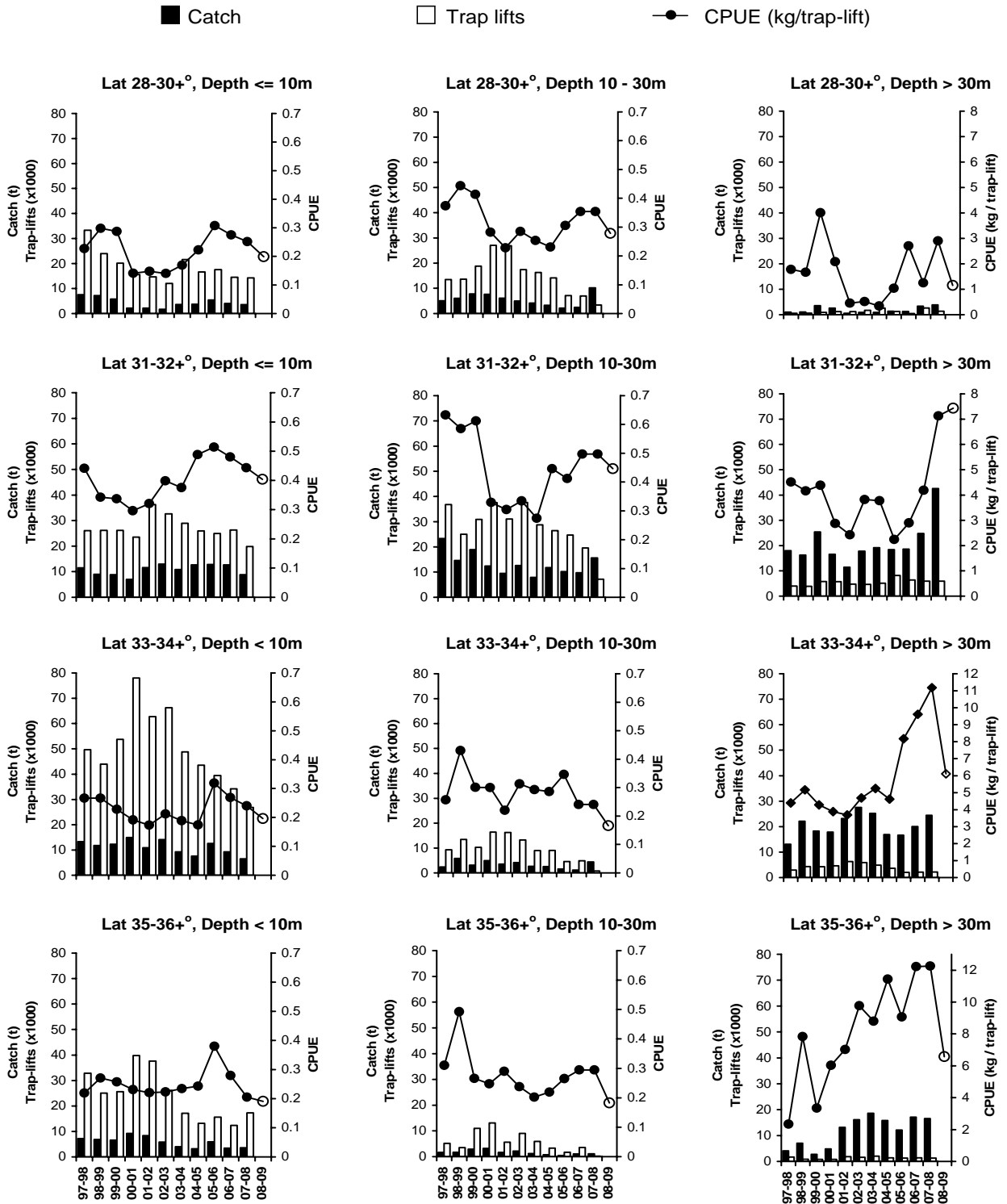
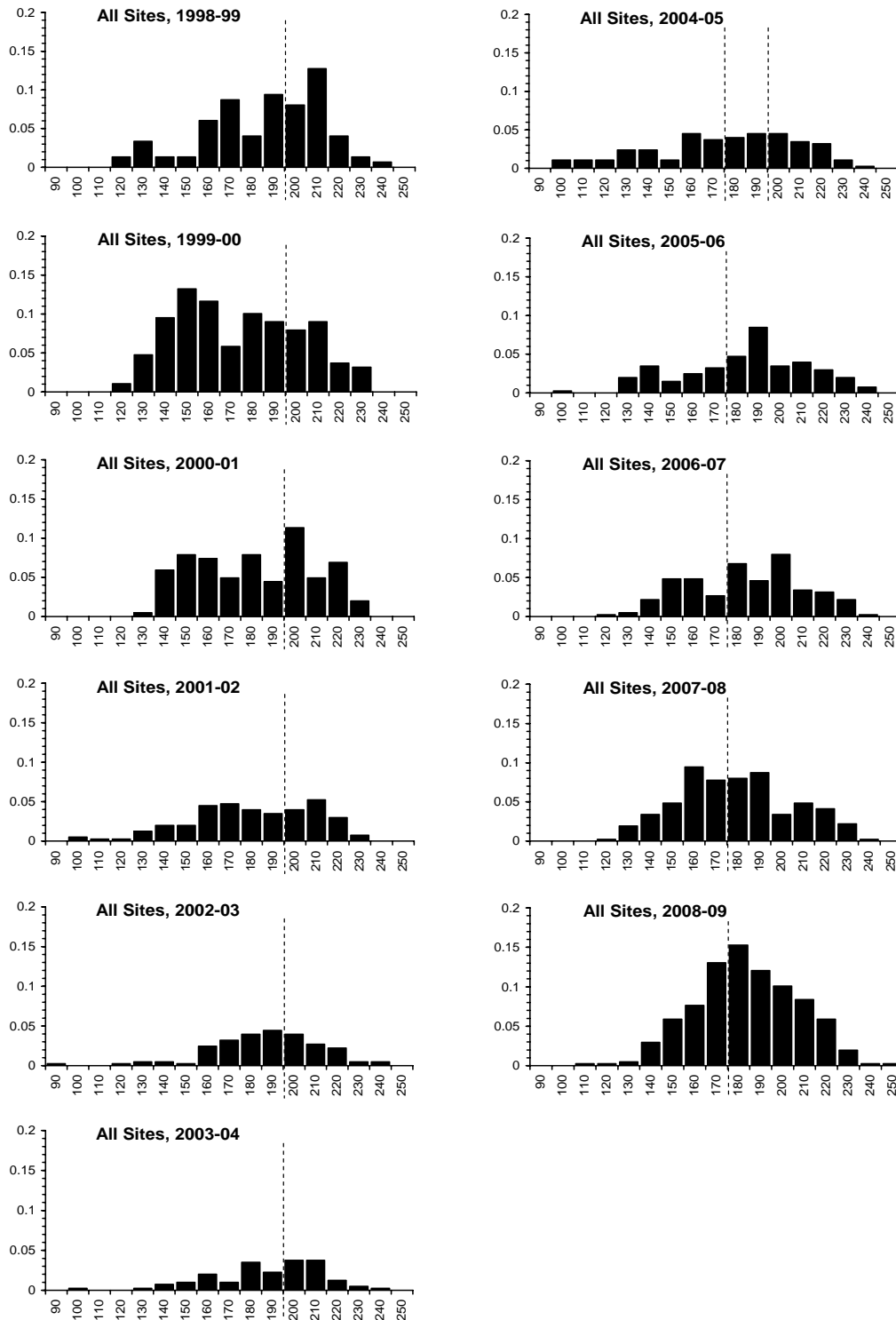


Figure 11. Size composition of lobsters in the commercial catch of the combined mid- and far-northern areas, including lobsters returned to the sea, from data provided by logbooks and augmented by observers. The dashed line is the maximum legal size.



THE DETERMINATION

The Total Allowable Catch Setting and Review Committee, pursuant to Division 4 of Part 2 of the Fisheries Management Act 1994, determines that the Total Allowable Commercial Catch of rock lobster that may be taken in the Rock Lobster Fishery during the period 1 July 2009 to 30 June 2010, should be **128 tonnes**.

In making this recommendation, the Committee recognises that while indicators from the fishery continue to be encouraging, the spawning stock remains severely depleted, and further rebuilding is required.



Ian Cartwright
Chair



Keith Sainsbury
fisheries scientist



Steve McCormack
fisheries management



Warren Musgrave
natural resource economist

Appendix 1: Details of public consultation

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

Date	Fisheries Management Act	Consultation Stages
4.2.09	Section 31(1)	TAC Committee called for public submissions on the appropriate level of the annual TACC for Lobster for 2009/10.
4.2.09	Section 284 (1b)	The advertisement was placed in the Sydney Morning Herald, the Daily Telegraph and made available at NSW DPI fisheries offices.
4.2.09	Section 284 (1b)	<p>Individual calls for submissions were also sent to particular interest groups who the Committee considered would be interested in providing a collective standpoint, either due to their direct involvement in the rock lobster industry or due to their interest in conservation issues. These groups included the following:</p> <ul style="list-style-type: none"> • All Lobster Shareholders • All Members of the Lobster Management Advisory Committee • NSW Regional Industry Convenor • NSW Fishermen's Co-operatives • DPI Fisheries Offices • Nature Conservation Council of NSW
9.3.09	Section 284 (1b)	The TAC Committee allowed a period of 30 days for public consultation.
30.3.09	Section 31 (2)	<p>The TAC Committee gave regard to eight submissions. The respondents included the following:</p> <ul style="list-style-type: none"> • NSW DPI - Commercial Fishery Management, Science and Research, and Compliance branches • Lobster Fishery Shareholders • Members of the Lobster Management Advisory Committee (LobMAC)
31.3.09		<p>The submissions were collated and analysed, and the TAC Committee heard formal presentations regarding views and opinions at the meeting held on 31.3.09. The following made presentations, or provided information to the Committee:</p> <ul style="list-style-type: none"> • Dr Geoff Liggins – Manager, Scientific Services, NSW DPI • Tony Chen – Senior Fisheries Investigator, Statewide Operations & Investigations Group, NSW DPI • Robert Peever – Investigator, Special Operations – Lobster, NSW DPI • Nathan McNamara - Fisheries Manager, NSW DPI • Darryl Sullings – Manager Commercial Fisheries, NSW DPI • Amy Priestly – Fisheries Management Officer, NSW DPI • Ron Firkin - LobMAC • Lee Monin - LobMAC • Noel Gogerly - LobMAC • Scott Westley - LobMAC • Daniel Stewart - LobMAC • Mark Cranstone – lobster shareholder • Peter Offner – lobster shareholder • Steve Drake – lobster shareholder • Robert Bryant – lobster shareholder • Bob Monin – lobster shareholder • Daryl Sykes – Industry representative • Don Moore - Marine broker

Appendix 2* Summary of submissions and the issues

Submission provided by	Issue(s)
New Castle Marine Brokerage (Don Moore)	Suggests reduced TACs have been successful in placing the fishery in an economically strong position. Believes the TASC should be very flexible and tuned to the likely catches of the next season to realise the 'TAC expectations'. Reports reduced catches and raises the possibility that the 128 tonne TAC might not be fully caught. Reasons for lower catch rates attributed to unusual weather conditions and possibility that catch rates are higher than estimates. Suggests more effort should be made to estimate recreational catch, possibly through a system of marking, such as tagging. Suggests an increase in the number of pueruli collectors to more effectively gather information to inform the TAC setting process.
NSW Department of Primary Industries	Research, compliance, industry analysis and management updates.

* 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. Submissions from fishers who explicitly requested that their responses either not be placed on public display or remain confidential and have been deleted.