

# **TAC Committee**

## **Total Allowable Catch Committee**

### **Report and Determination for 2010/11**

#### **ROCK LOBSTER FISHERY**

**12 May 2010**

## SUMMARY

### ***Management issues***

The New South Wales rock lobster has experienced a steady recovery, with catch per Unit Effort (CPUE) approximately doubling between 2000/02 and 2007/08 and exceeding the 1998/99 benchmark by nearly 50%. The 2008/09 catch was worth \$6.7 million, a record high. The market price for shares has almost tripled in the past four years and demand is strong to both purchase and lease quota/shares. There was, however a decrease of around 6% CPUE in 2008/09. It is expected that catches from the deeper water in the remainder of this season will lift CPUE to around or slightly below the 2008/09 level.

The Committee notes that the recent rapid increase in 'raw' CPUE (the catch rate experienced by operators) is unlikely to be a direct reflection of an overall increase in the abundance of lobster. Catch rates appear to have also been affected by changes in fishing patterns (more fishing effort in deeper water) and gear (larger pots).

The ITQ system operating in the rock lobster fishery 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. Over the past ten years, the total number of shareholders in the fishery has contracted leaving 38% less shareholders in the Fishery since its commencement in 2000 (174 down to 106). Significantly, about 75% of the commercial lobster catch is now being taken by 30% of the shareholders in the fishery (32 fishing businesses).

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 40% of the total number of shares in the fishery (currently 3,890 shares). The Committee supports I&I NSW initiatives to consider and, where appropriate, remove input controls and address quota and share transfer processes 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 previously adopted the allowances used in the I&I NSW stock assessment of a 25.8t recreational catch (illegal and legal components) and 17% of the illegal unreported commercial catch. The latter total is considered too high, given the incentives for rock lobster fishers to operate within the law, and the revised estimate of around 10% provided by the Department's Statewide Operations and Investigations Group. The figure is, however, unlikely 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; accordingly this estimate has increased the estimate to 12% for the purposes of the stock assessment. 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 absence of a strategy to ensure recreational compliance. The Committee concurs with these concerns. The Committee noted comments made by commercial fishers that recreational fishers appear to be enjoying improved rock lobster catches in NSW and that tight restrictions on commercial harvest may not result in the intended gains to the rock lobster stock due to increasing recreational fishing harvest. The Committee is unable to refute or confirm this suggestion.

Legislative changes have occurred to recognize the spiritual, social and customary significance to Aboriginal persons of fisheries resources and to protect and

promote Aboriginal cultural fishing. These include the creation of an Aboriginal Ministerial Advisory Council and management changes aimed at improving access for the purpose of cultural fishing; these changes are in addition to the current arrangements for the harvesting of lobsters for cultural events. 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.

The Committee considers that given the relatively small size of sanctuary zones within marine parks in NSW, in depths preferred by adult rock lobsters (generally 10 to 150m), and the migratory nature of rock lobsters, it is unlikely that the presence of existing sanctuary zones has a significant influence for the stock assessment and TACC setting process. The current Commonwealth process for developing marine reserves in the east marine bioregion may increase the area of sanctuary zone in mid shelf and slope waters and this may influence future TAC setting deliberations.

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 not increased in 2009/10.

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, allow access to oversize stock in southern waters and give greater overall benefits to the lobster fishing industry.

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. I&I NSW (managers and researchers) and industry are to be congratulated on their high level of involvement and support for the TAC setting process and their collaborative approach to this fishery.

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

### ***Economic issues***

There continues to be improvements in the economic outlook for the lobster fishery as reflected in higher share prices. The real value of production has continued on the upward trend which began in 2004/05. Between 2007/08 and 2008/09 it increased by 16 per cent to \$6.7 million due mainly to higher beach prices. Lobster prices have maintained an upward trend since 2004/05 and appear to have been relatively resistant to the volatility affecting lobster export markets.

Given lower supply levels and an expected depreciation of the Australian dollar, prices for lobster on international markets are likely to increase. This is likely to make the export market for lobster an increasingly attractive prospect for NSW producers.

The operating environment of the NSW lobster fishery is complex. Income for many of the smaller operators is derived from multiple fisheries; while for the larger

operators there is an increasing trend towards specialisation. Changes in the operating environment of the fishery are also occurring as fishers take measures to improve their efficiency (increased deepwater fishing, larger vessels and larger traps).

Structural change in the industry continues to occur through reductions in the number of shareholders and an increase in the number of larger shareholdings. Shareholdings are concentrated in the medium-sized cohort, suggesting that this size of enterprise, perhaps through association with other endorsements, has efficiency and/or stability advantages.

There are active markets for both shares and quota and the Department has taken a number of steps to assist the market by improving information flow and lowering the costs of transfers. After a strong trend upwards since 2004/05, share prices have stabilised and are believed to be worth around \$2,000, up from around \$640 per share in 2004/05 and approaching the 1998/99 high of \$2400. This increase reflects the recovery of expectations concerning the economic and biological health of the industry. Although data is sparse, quota leasing prices declined in 2008/09 by around 14% (from \$17.90 to \$15.90), possibly reflecting the slight fall in catch rate. This ends a five-year run of increasing quota prices.

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.

Although the future economic outlook for the lobster fishery is positive, this assertion is based on the relatively unreliable interpretation of changes in share and quota prices. In order to make authoritative comment on whether improvements in the value of lobster fishing have resulted in improvements in the economic viability of the lobster industry, information on industry costs and operating structure is required. The Department is urged to make progress on developing, with industry, cost effective means of obtaining better economic data for the fishery, as occurs in other States, including South Australia and Victoria.

Additional economic data will also assist in making the necessary transition towards setting a TACC which optimises economic outcomes. This information would also enable calculation of return on capital return on management and community contribution charges.

The Committee's conservative determination for 2010/11 is based on strengthening the prospect of restoration of the spawning stock and maintenance of an appropriately sized available biomass. The current TAC strategy offers promise of continuing the trend of improving economic circumstances over the longer term. Collection of data on the costs of fishing, and the establishment of economic targets and management strategies to achieve them, will also be necessary to optimise the economic viability of the fishery into the future.

### ***Biological issues***

Data from the fishery show a strongly increasing trend in catch rate for 7 years, peaking in 2007/08. In 2008/09 the catch rate was somewhat reduced from that and it is likely that the complete 2009/10 catch rate will also be lower than the 2007/08 peak. The reduced catch rate in the last two years is widespread across depths and is stronger in the southern regions (i.e. south of 33 degrees latitude). This pattern is expected from the relatively weak puerulus settlement 3-5 years ago there and the predicted reduction of the exploitable biomass through the current and next few years.

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 quantity of legal sized lobsters is slightly decreasing, as predicted previously from modelling, and so the recruitment to the spawning stock will also be expected to be slower compared to recent years.

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. While other explanations are available, the interpretation currently being used 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 subsequent response of the stock to the reduced TAC 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 has slowly rebuilt 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.

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.

There is measurable and continued improvement in the spawning stock in recent years. However, the stock condition in 2009/10 is estimated to be almost the same as the previous year, although with a very slight reduction in both total biomass and spawning biomass.

Under any weighting scheme of the model 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 3 years – with a slight decrease in the exploitable biomass and spawning biomass in the last year. Model outputs indicate that the management measures of the past several years have had the desired effect of stopping further decline and begin

rebuilding of the stock, although the spawning stock is still significantly depleted and there is only very slow or no rebuilding occurring under the current catch levels.

Looking forward, estimates of the spawning biomass and exploitable biomass are slightly less optimistic than those of last year for the same catch levels, which in turn were slightly less optimistic than the year before, reflecting the higher catches following TAC 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. The spawning biomass is predicted to remain about the same or grow very slightly during the next 5 years under recent catch levels, but those same catch levels are predicted to result in a further reduction of the exploitable biomass.

The interpretation of low spawning biomass poses risk to the sustainability of the fishery in the near term. While there may be further periods of low recruitment in the north resulting in increased targeting on the spawning stock, the reduced maximum legal size, combined with a larger spawning stock should provide some protection and reduce that risk.

### ***The determination***

At this time it is considered necessary to reduce the total catch slightly to 175t. This catch is predicted to provide a very small chance of further rebuilding of the spawning stock, although the scope for rebuilding may be slightly better than this average prediction if the recent good puerulus settlement produces better than average recruitment into the fishery over the next 3-4 years. This approach carries some risk and progress should be monitored closely in coming years. In particular there is need to ensure continued recovery of the spawning stock to the limit reference point. The current catch level may result in reduced catch rates from the exploitable stock, as occurred last year. A reduction in the estimates of illegal and unreported removals results in a **TACC of 131 tonnes**, a slight increase of 3 tonnes from last year.

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

**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 2010 it consisted of:

- Mr Ian Cartwright – Chairman
- Dr Keith Sainsbury – fisheries science
- Dr Jessica Hartman – natural resources economics
- Mr Bill Talbot – fisheries management

The Committee was provided with Secretariat services by Ms Carly Goddard, 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 regards 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 I&I NSW and LOBMAC 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 entirely for I&I NSW.

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 again helpful if the I&I NSW 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:

- Industry and Investment NSW, Fisheries Research;
- Industry and Investment NSW, Commercial Fisheries Management;
- Industry and Investment NSW, 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 8 April 2010, representing industry interests.

As occurred in 2009 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 I&I NSW;
- advice on the economic status of the fishery as assessed by I&I NSW and by industry representatives;
- the stock assessment for rock lobster provided by I&I NSW;
- 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 20010/11 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 Industry and Investment (I&I NSW) 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 the 1800s. 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 these amount 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, leaving 38% less shareholders in the Fishery since its commencement in 2000 (174 down to 106).

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 I&I NSW has in place for the fishery. The proportion of shareholders that hold less than minimum shareholding (55) has reduced by 81% (94 to 18). This suggests a general trend of share reallocation from small (<55) to large (>100) 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, although there is anecdotal information that an increasing number of NSW lobsters are being exported live to the Chinese market. 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 (around \$60 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 TAC to be taken before the end of the current quota period was discussed. As in previous years there appear to be range of issues contributing to the lower-than-expected catch at this time of the year and 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 2010.

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. This matter was not raised at the 2010 Forum. 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 I&I NSW 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 from 200 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. There also seems to be general support for 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. This initiative has provided a greater level of protection for the adult spawning stock which is a priority management objective for the fishery, which in turn underpins decisions of the TAC Committee.

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 106. 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 75% of the commercial catch lobster catch is now being taken by 30% of the shareholders in the fishery (32 fishing businesses).

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 the minimum shareholding of 55 shares at the time of introduction of quota are eligible for an endorsement to fish. This exception (to the current 55 share minimum) was reviewed by LobMAC on the 30 September 2009, which unanimously supported its retention. It is noted that the proportion of shareholders that hold less than minimum shareholding has reduced by 81% (94 to 18). In the past the Committee, while noting that the number of licence holders in this category has reduced substantially over recent years, has been of the view that the exception to the 55 share minimum be removed, to encourage further restructuring. The Committee, noting the comments of LobMAC concerning retaining the ability to customise businesses to best suit their needs and minimise the impact on the viability and fishing practices of current participants, has withdrawn their recommendation to remove the exceptions to the 55 share minimum share holding.

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.

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 purpose of maximum share or 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 in the view of the Committee may be counter-productive by acting as a barrier to more efficient operations. In principle and 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. This restriction has been raised with the Department and industry at previous meetings 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 shares to 40% of the total number of shares in the fishery (currently 3,890 shares). As the fishery evolves this and becomes more profitable, this should lead to a reduced number of operators who are more efficient. These operators can be expected to be more compliant, resulting in reduced compliance costs.

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.

### **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 in 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 continues to be targeted and may now be reducing.

In common with other fisheries jurisdictions, I&I NSW 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 I&I NSW compliance officers in the supply of intelligence.

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.

The Department's Statewide Operations and Investigations Group has provided a revised estimate of around 10% illegal unreported commercial catch. This estimate is based on observed compliance trends and increased incentives for rock lobster fishers to operate within the law. These incentives include higher penalties, the risk of share forfeiture, and increasing shareholdings resulting in fishers having more to lose in the event of non-compliance. The Committee accepts this estimate, but has increased it to 12% for the purposes of stock assessment to take account of unrecorded mortalities from other fisheries, most notably trawling and fish trapping.

I&I NSW Compliance notes that overall compliance rates remain relatively stable, however there has been a downward trend over the last few seasons. This trend is felt to be in part due to increased compliance effort and not a matter of major concern at this stage. The Department has raised ongoing issues with the use of oversize "caller" rock lobsters, falsifying log books and receiving illegally taken lobsters. The Committee believes that while compliance in the rock lobster fishery is generally high, there remains a need for ongoing focus on quota related issues such as tagging and log book offences.

The committee notes the reduction in the time required to submit daily catch sheets from 7 days to 48 hours and is aware that negotiations are underway regarding pre-fishing, pre-landing and post-landing reporting.

**The Committee recommends that I&I NSW and the industry conclude discussions on pre-fishing, pre-landing and post-landing IVR reporting and implement processes that will manage compliance costs and assist in reducing over-quota fishing.**

### 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 daily bag and total 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. The Committee noted comments made by commercial fishers that recreational fishers appear to be enjoying improved rock lobster catches in NSW and that tight restrictions on commercial harvest may not result in the intended gains to the rock lobster stock due to increasing recreational fishing harvest. There is no quantitative evidence available which would support or refute either contention.

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.

I&I NSW 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.

I&I NSW 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.

I&I NSW 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 recommends the development of a research program to determine the extent of the recreational rock lobster catch in NSW as a priority.**

### 3.6 Indigenous Fishing for Rock Lobster

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

These new arrangements will include the creation of an Aboriginal Ministerial Advisory Council and management changes aimed at improving access for the purpose of cultural fishing. Existing permitting arrangements will stay in place for the harvesting of lobsters (and other fishes) for cultural events. The Department provides information on the number of lobsters (261 in 2009) that are permitted to be taken but the actual amount of lobsters taken is unclear as there is limited compliance with reporting requirements.

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. If new management provisions result in a substantial increase in real or potential catch from the Aboriginal community then this will have to be factored into TACC setting arrangements.

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

### **3.7 Marine Parks**

Commercial fishers raised the matter of marine parks and asked the Committee to consider the possible implications of the rock lobsters in sanctuary zones during the stock assessment and TACC setting process.

All five coastal NSW marine parks include sanctuary zones over reef area likely to provide habitat for rock lobsters. In four of these parks lobster shares were purchased in amounts estimated to be proportional to catch from grounds lost to the fishery (507 shares in total). In response the TACC and management charges were adjusted accordingly.

The existence of sanctuary zones raises two primary considerations for the rock lobster stock and fishery management. 1) the extent to which these areas reduce fishing mortality by an amount that allows juveniles to make an appreciable contribution to the adult spawning stock, and 2) the degree to which the spawning biomass protected from fishing mortality within sanctuary zones makes a significant contribution to recruitment.

Sanctuary zones make up less than 7% of state waters and cover a range of estuarine and marine habitats including those with mud, sand and rocky substrates. Well under half the area of sanctuary zone would include habitat suitable for rock lobsters and these areas would cover a range of depths from the intertidal to around 80 metres.

Evidence from a range of published studies indicates that there would be an increase in the number and size of lobsters in sanctuary zones; however these increases may decline over time due to the effects of intraspecific competition and foraging and migration into fished areas. It is expected that juvenile rock lobsters settling in sanctuary zones may benefit from protection for a period, but would then enter the fishery as they reach sexual maturity, forage more widely and move into deeper waters.

The Committee considers that given the relatively small size of sanctuary zones in NSW, the small percentage of these zones in depths preferred by adult rock lobsters (generally 10 to 150m), and the migratory nature of rock lobsters it is unlikely that the presence of existing sanctuary zones has a significant influence for the stock assessment and TACC setting process. The Committee notes that the current Commonwealth process for developing marine reserves in the east marine bioregion may increase the amount of sanctuary zone in mid shelf and slope waters and that this may influence future TAC setting deliberations.

### **3.8 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)	Reported catch (tonnes)	% of TACC caught	Management charge (inc. EIS charge)	Average price (\$/kg)	Est Value (\$m)
1998/99	125	110	88.0	\$38	\$34.76	3.8
1999/00	140	117	83.6	\$48	\$39.16	4.6
2000/01**	150	102	68.0	\$58	\$42.98	4.4
2001/02	150	102	68.0	\$58	\$46.33	4.7
2002/03	135	121.3	89.9	\$59.70	\$44.77	5.4
2003/04	135	107.9	79.9	\$61.70	\$38.83	4.2
2004/05	102	98.1	96.2	\$58.60	\$38.30	3.8
2005/06	102	100.5	98.5	\$63.09	\$41.30	4.1
2006/07	112	109.4	97.7	\$62.06	\$47.46	5.2
2007/08	124	121.6	98.1	\$57.91	\$48.10	5.6
2008/09	128	121.8	95.2	\$64.04	\$60.40	6.7
2009/2010	128	76.6	59.4	TBD	64.70	TBD

\*\*\* Commencement of full cost recovery

The increase in management charges for 2008/09 was 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. There is little change in management charge between the 2008/09 and 2009/10 fishing periods (Table 1).

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 (currently 9.4%). 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 I&I NSW 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. 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.

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. This review could be usefully done in conjunction with the setting of economic targets for the fishery, as previously discussed.

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.

### **3.9 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 at the Forum from LobMAC members including the Chairman, Mr Alan Dodds. Committee members consider that from time to time there are issues raised at the TAC forum that would be better addressed in direct negotiations between the Department and LobMAC. We note that with the increasing effectiveness of LobMAC, this issue is of reducing concern.

The Committee again requests that LobMAC considers the TAC determination and the associated rationale, and recommendations of the Committee and provides feedback to assist in its further deliberations.

**The Committee recommends that a LobMAC meeting be held following the TAC determination to allow discussion of the TACC and the associated rationale, and recommendations made by the Committee.**

Industry representatives have mentioned in the past that licence holders do not, as a matter of course, receive copies of the TAC Committee's determination and report. The Committee suggests that 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 generally continue to support a precautionary approach to the TACC reflects the fact that they understand and appreciate that the fishery is still in a re-building phase.

### **3.10 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. As a consequence, approval has been given for the continued export of lobsters that are taken from the fishery under an exemption from species listed under Part 13 of the EPBC Act for the period up to 30 March 2012.

### **3.11 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 I&I NSW 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.

### **3.12 Gear Conflict**

The Committee did not receive submissions from industry members concerned about the perceived loss of habitat, including large areas of soft corals, due to trawling operations. The Committee notes that LobMAC supports the development of 'gentlemen's agreements' at port level between trap and trawl operators. In the past, licensed fishers have been 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.

If the issue again becomes of concern to industry 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 have the potential to be an issue of serious concern.

Some Re-structuring of the NSW trawl fishery has taken place (Ocean Trawl Fishery endorsements have reduced from 638 in 2007 to the current 528) and is seen by the Department 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 may not be sufficient to protect areas of sensitive rock lobster habitat.

### **3.13 Conclusion**

A steady recovery of the New South Wales rock lobster fishery has occurred. 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%. CPUE did, however, decline slightly (around 7%) between 2007/08 and 2008/09. Part season CPUE trends infer that a further decline is unlikely in 2009/10, subject to the offshore fishery performing strongly as it has done in previous years. 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 and it appears that Chinese market opportunities may be available.

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

While the Committee is receptive the submissions of industry, recovery in the breeding stock remains a priority, and until it is clear that that this has been achieved, a conservative management approach is considered to be the best option. The Committee notes that the rapid increase in 'raw' CPUE experienced by operators is unlikely to be a direct reflection of an overall increase in the abundance of lobster. Catch rates appear to have also been affected by changes in fishing patterns (more fishing effort in deeper water) and gear (larger pots).

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. The engagement and work of LobMAC also merits mention.

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,

#### **4. ECONOMIC CONSIDERATIONS**

##### **4.1 Introduction**

In this section of the report, the economic status of the New South Wales Rock Lobster industry is described, consistent with the requirement that the Committee have regard to economic and social issues the making its determination. Economic considerations focus on gross returns to the industry rather than net returns due to the absence of information on fishing costs. Further, this analysis is undertaken for the rock lobster fishery only, rather than for the fishing business as a whole, and as such, does not consider returns from other types of fishing. A summary of quota and share market prices is presented as an indicator of both short and long run industry profitability. Analysis of other data affecting the economic performance of the fishery, such as export prices and catch per unit effort, is also presented.

The absence of timely and relevant data on fishing costs means that it is not possible to make a complete analysis of the economic performance of the New South Wales Rock Lobster industry. Focussing on gross returns only means that changes in costs, and the impact of this on profitability, is not taken into account in determining economic performance. Further, as returns from other types of fishing, especially in the far north of the fishery, contributes to overall economic performance of a fishing business, concentrating on returns from rock lobster fishing only provides an incomplete picture of the impact of changes in gross returns from lobster fishing on the economic performance of fishing businesses.

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

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

##### **4.2 Volume and value of production**

The volume of reported catch of rock lobster in 2008/09 was 121.8 tonnes, a slight increase from 2007/08 where 121.6 tonnes was caught (Figure 1). This catch accounts for around 95 per cent of the TACC. The reported ability of industry to catch virtually the full TACC over a number of consecutive years, reportedly with less effort, suggests that recovery of the stock continues, as is suggested elsewhere in this report.

The value of reported catch increased by 16 per cent between 2007/08 and 2008/09, from \$5.8 million to \$6.7 million (Figure 2). This increase is due to higher beach prices, which increased by 16 per cent between 2007/08 and 2008/09 from \$47.24 (in real terms) to \$54.67 (Figure 3). Prices have been relatively flat in real terms

since 2003/04 and have still to exceed those prevailing from 2000/01 to 2002/03. For the first eight months of 2009/10 average beach prices have been \$59.40, suggesting that the final price for the year will be similar to the previous year (the current 'high' average price is influenced by Christmas and the Chinese New Year and is expected to fall over the remainder of the financial year).

Prices are based on daily average prices of lobster landed at the Sydney Fish Market. These prices provide only a guide as to price movements for lobster in New South Wales as a significant quantity of lobster (around 40 per cent) is sold through other registered fish receivers and restricted registered fish receivers in Sydney and along the New South Wales coast. Price information for lobster sold through these outlets is not publicly available; however anecdotal evidence suggests that prices all along the coast follow the Sydney Fish Market Price (New South Wales I&I NSW, 2004).

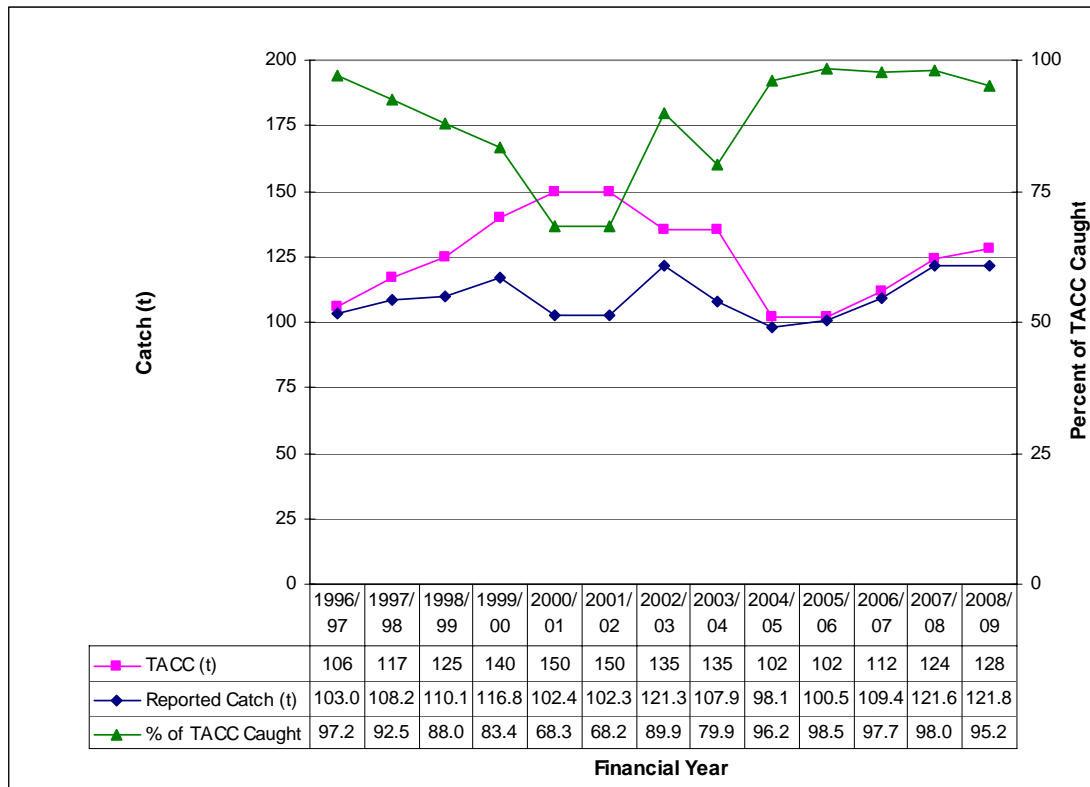


Figure 1: Catch, TACC and percent of TACC caught, 1996/97 to 2008/09

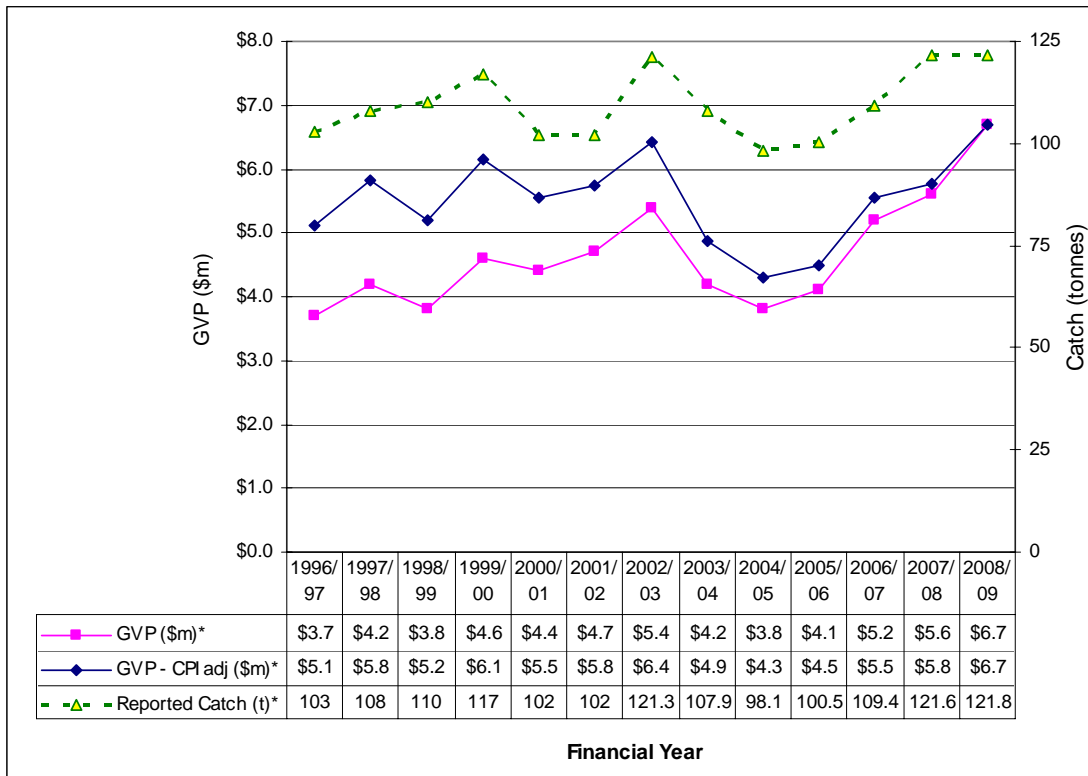


Figure 2: Value of production and reported catch, 1996/97 to 2008/09

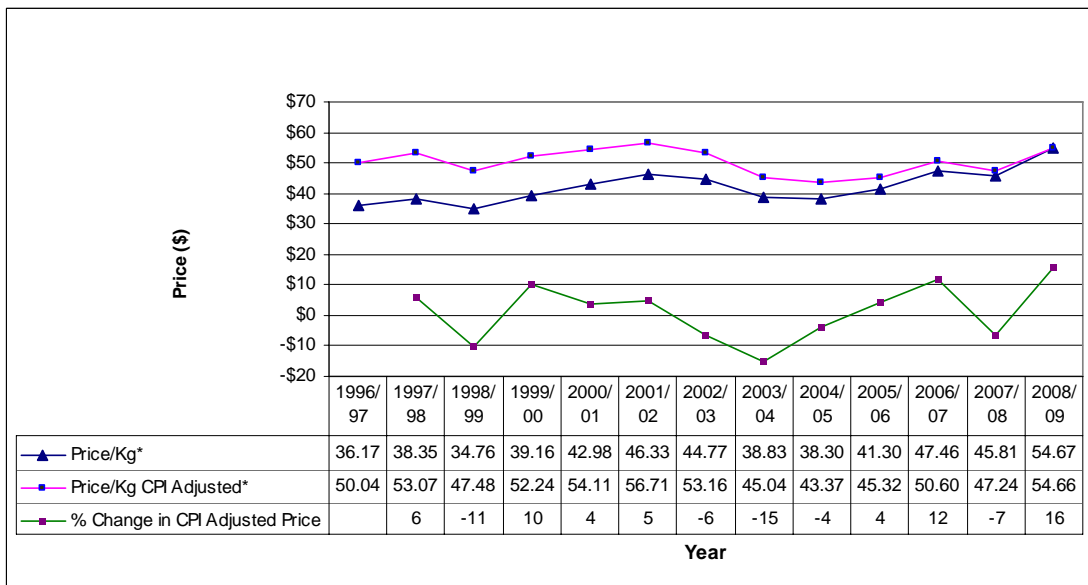


Figure 3: Beach prices in real and nominal terms, 1996/97 to 2008/09

### 4.3 Catch per unit effort

Catch per unit of effort has increased markedly over the period since 2001/02. Catch rates in 2007/08 and 2008/09 represent the greatest and third greatest rates of catch over the past 36 years. Catch per unit effort in 2008/09 was 7 per cent lower than in 2007/08. It is likely that catch per unit effort for 2009/10 will be similar to that achieved in 2008/09. Higher catch rates reflect a number of factors including greater stock abundance, a reduction in the number of trap lifts by deep water fishers at times when stock is less abundant and an increase in the size of vessels and the

size of traps used. In part, these changes indicate that lobster fishers are taking measures to improve their efficiency, and, hence, their return from lobster fishing.

#### **4.4 Rock lobster markets**

As indicated, New South Wales 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 rock lobster from New South Wales is exported. In 2004/05, 127 tonnes were exported from New South Wales. This is only a very small proportion of production, and an even smaller 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. Hong Kong and China have been the strongest growth markets for Australian fisheries products and for rock lobster and abalone in particular. The total value of Australian exports of fisheries products to these destinations has almost doubled over the past 10 years, with rock lobster accounting for well over half of the total value of fisheries product exported (ABARE, 2010).

Prices for rock lobster on overseas markets have been high because of strong demand, but these high prices have not flowed through to domestic producers because of the high value of the Australian dollar. However, the expected depreciation of the Australian dollar over the medium term, coupled with strong demand and continued high prices for rock lobster on international markets, is expected to result in an increase in prices received for rock lobster exports by Australian fishers. These higher prices are likely to be exacerbated by reduced supply from Western Australia over the medium term (the majority of Western Australian rock lobster production is exported) (ABARE, 2010)<sup>1</sup>.

Despite the fact that only a small percentage of New South Wales rock lobster production overall is currently exported, New South Wales lobster fishers who export a large proportion of production are likely to benefit from higher prices on international markets. Those fishers who currently don't export much or any of their production may also be able to take advantage of higher prices on international markets by exporting a greater proportion of their catch. An understanding of the size preference/price relationship on Chinese and Hong Kong markets would be useful in the context of understanding the opportunity for exported product from New South Wales to satisfy increased demand on these markets.

#### **4.5 Income from fishing**

Traditionally, nearly all lobster fishers have held endorsements in several different fisheries, though the extent to which they have gained income from each of them has varied. According to reports from the lobster industry, there is a trend towards specialisation in the lobster fishery, particularly among larger shareholders.

The most common endorsement to be held in conjunction with a lobster endorsement is an Ocean Trap and Line endorsement for the purpose of fish trapping

As already discussed, concentrating on returns from rock lobster fishing only provides an incomplete picture of the impact of changes in gross returns from lobster fishing on the economic performance of fishing businesses as a whole. The income of lobster fishers should be considered as that of businesses operating in several different fisheries. Depending on the reliance of the fishing business on lobster

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<sup>1</sup> Production of rock lobster in Western Australia in 2009/10 is expected to be almost half of what it has been over the 10 years to 2008/09 (5,750 tonnes down from an average of 11,000 tonnes). This lower production is a result of measures introduced by the Western Australian Government to reduce total catch in response to concerns about stock abundance (ABARE, 2010).



fishing, substantial changes in income from lobster fishing has the potential to affect overall business income.

#### **4.6 Fisher net income**

Without an understanding of the changes in fishing costs over the last few years, it is difficult to ascertain whether increases in gross revenue from lobster fishing have resulted in higher net incomes. The gains from increased prices and production for rock lobster may have been mitigated by rises in costs, particularly of fuel. Results from ABARE's most recent fishing survey indicate that fuel prices have increased even after taking into account the fuel rebate received by fishers (ABARE, 2010). Recent upward trends in share and quota lease prices, as discussed later, suggest impacts on fisher net income from increased prices and production have been favourable.

The costs of fishing include both fixed and variable costs, with variable costs such as fuel, bait and repairs being the most susceptible to change in response to short term fluctuations in prices and production. Fixed costs such as boat capital and other overheads associated with running a small business are unlikely to be as responsive to short term fluctuations in prices and production. However, when changes in prices and/or production are maintained over the longer term, and such changes are indicative of a longer term decline in the resource and/or demand for lobster, fixed costs may change. In addition, some operators may choose to leave the lobster fishery, or, if they hold endorsements in other fisheries, shift the balance of their effort into these other fisheries.

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

Surveys to collect economic data in the South Australian Rock Lobster fishery provide a good example of how surveys can be conducted and used to provide data on the costs and returns from fishing (EconSearch, 2008). These surveys have been conducted every three years. In the years in between surveys estimates are made of changes in: variable costs such as bait and fuel; effort; the volume and value of catch; and the structure of the fishery.

Without a repeat survey of the costs of fishing, authoritative comment on the profitability of the lobster fishery is restricted to interpretation of changes in share and quota prices. Given that net returns can inform: (i) the process through which the TACC is set in order to maximise profits from lobster fishing, and (ii) the process for setting the community contribution charge such that it does not extract less, or more, economic rent than is present in the fishery, a repeat of a survey of the costs of fishing is vital. This survey should commence as soon as possible and should be conducted every three years to ensure that fishers are able to maximise economic returns from fishing over time<sup>2</sup>.

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<sup>2</sup> 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.

In order to ascertain the net return from fishing an estimate of economic profit, as distinct from accounting profit needs to be made. The estimate of accounting profit is the starting point. This involves collecting information on the fixed and variable costs associated with the lobster component of the fishing business. In order to estimate economic profit, a return for risk, entrepreneurial skill and opportunity cost must be deducted from accounting profits. An estimate of the value of unpaid labour used in the fishing business should also be made. This cost data must then be matched with corresponding data on catch per unit of effort for the lobster component of the fishing business, and the gross value of that catch, to complete the picture. To make an estimate of return on capital, a value should also be placed on licenses, fishing gear and equipment.

An example of the data that would need to be collected for a typical fishing business holding a lobster endorsement is provided in Appendix 2 of this report. An example of how this data can be used to estimate the TAC for the fishery can be found in a paper by Department of fisheries in Western Australia (Western Australian Department of Fisheries, 2009). How this data can be used to estimate economic rent in the fishery can be found in a report by ABARE on the Southern Bluefin Tuna Fishery (ABARE, 1989).

In order to ensure that data collected through a survey is representative of the lobster fishery, a random sample of a number of different fishing businesses holding lobster endorsements needs to be selected. How large this sample needs to be in order to be considered to be representative of the fishery still needs to be ascertained. In South Australia a sample representing 54 per cent of licence holders in the lobster fishery was chosen (EconSearch, 2008).

From discussions with staff at New South Wales Industry and Investment, it is unclear if such a survey should be an ongoing role of government, or if it should be funded by industry. This issue needs to be resolved as a matter of urgency. Other States and the Commonwealth generally use government funding for economic surveys of the fishing sector<sup>3</sup>. While the Committee has not received a formal response from the Department to its previous 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.

**The Committee recommends that a survey of the costs of fishing be undertaken to inform both: (i) the process through which the TACC is set in order to maximise profits from lobster fishing; and (ii) the process for setting the community contribution charge. This survey should commence as soon as possible and should be conducted every three years.**

**The Committee also recommends that the issue of funding for the cost survey, (government, industry or some combination), should be resolved as a matter of urgency.**

#### 4.7 Shares

There are currently 106 shareholders in the lobster fishery who are eligible for a lobster fishing endorsement. Of these, 78 have reported fishing in the current fishing period. The number of shareholders in the fishery has fallen over time from 174 shareholders at the commencement of the Share Management Plan in 2000.

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<sup>3</sup> See for example Econsearch (2008), Economic Indicators for the SA Southern Zone Rock Lobster Fishery 2006/07, Report prepared for Primary Industry and Resources South Australia.

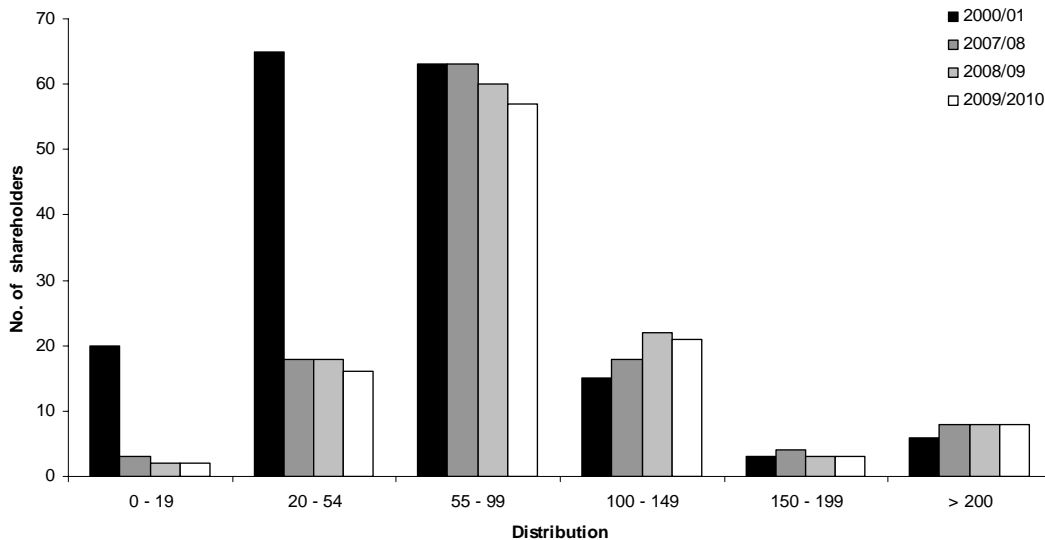
Between 2006/07 and 2008/09 the number of shareholders in the fishery, and the total number of shares, declined significantly from 142 shareholders and 10,051 shares to 106 shareholders and 9,727 shares. The reduction is mainly due to shares surrendered through the Batemans Bay and Port Stephens-Great Lakes Marine Parks buy out programs.

The number of shares per fisher ranges between 12 and 218 shares. The average number of shares per shareholder is 89. This has increased from 54 in 1996/97. There has been an increase in the number of shareholders who hold large shareholdings and a redistribution from small to large shareholders. Evidence of this can be seen in Figure 4 where there has been a reduction between 2000/01 and 2009/10 of 81 per cent in the proportion of shareholders who hold less than 55 shares.

Changes in the structure of the fishery have resulted in fewer fishers landing a higher proportion of the total reported catch. Fifty per cent of the 2008/09 reported catch was landed by 14 fishing businesses. The transferability of quota is helping to facilitate this change.

It should be noted that under current management arrangements for the lobster fishery, individual fishers are prevented from owning more than 350 shares in the fishery. This limits the further restructuring and economies of scale that can be achieved in the fishery. It is proposed to amend the maximum shareholding to 40 per cent of the total number of shares in the fishery as consistent with other New South Wales share managed fisheries. The Committee supports this amendment.

As would be expected, with a heavier reliance on the lobster component of the fishing business in the south of the fishery due to relatively higher stock abundance, the average number of shares held by fishers in the south is higher than in the north of the fishery.



**Figure 4: Distribution of shareholders by size of holding**

The Department has indicated, and the Committee agrees, that structural change in the industry is desirable in order to ensure the continued viability of lobster fishing operations, to promote stewardship and to allow for greater efficiency in both fishing effort and the 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

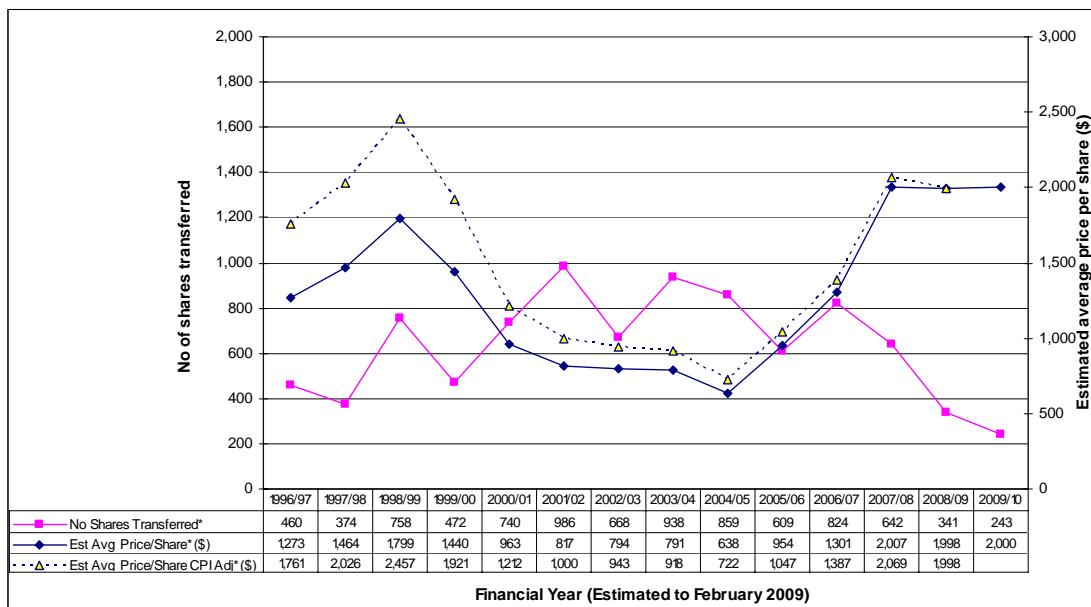
this regard, care must be taken that regulation of the share market does not impede desirable structural change.

#### 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. The ability to trade shares allows existing shareholders to structure their operations based on performance during the year and, to some extent, the availability of lobsters. The reason for the minimum size of package is unclear.

In 2008/09, 314 shares were transferred to existing shareholders or new entrants. As a consequence two fishing businesses ceased to hold shares in the lobster fishery and one new fishing business was created. The average share price was \$1,998 in 2008/09, a slight decrease from 2007/08 when the average share price was \$2,007 in real terms (Figure 5). 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. Reported prices paid per share in 2008/09 ranged from \$1,800 to \$2,330.

Share transfer prices provide an indication of the economic health of the lobster fishery and of expectations of industry participants on the future outlook of the fishery. In this sense, price rises since 2004/05 can be interpreted as reflecting improved economic conditions and rising expectations concerning the future economic and biological health of the industry. It should be noted, though, that overall, the real price of shares is still less than it was in 1998/99, which indicates that some shareholders would have to accept a loss in real income if they wanted to exit the industry at this time.



**Figure 5: 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 such as interest rate fluctuations and poor overseas markets. Further, ABARE (2000) note that share prices can also reflect factors that are not necessarily associated with a healthy fishery; for example, over-capacity and over-fishing. In this sense, 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 obtaining information on the costs of fishing, and fishers net returns, share prices remain the only robust, verifiable indicator of the economic health of the fishery.

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. 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 Share Management 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 lease 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. The Committee urges industry to maintain a watching brief on the extent to which this limit becomes binding, thereby restricting the ability of fishers to take advantage of favourable catching conditions/stock abundance by leasing in quota.

#### **4.10 Quota transfers and values**

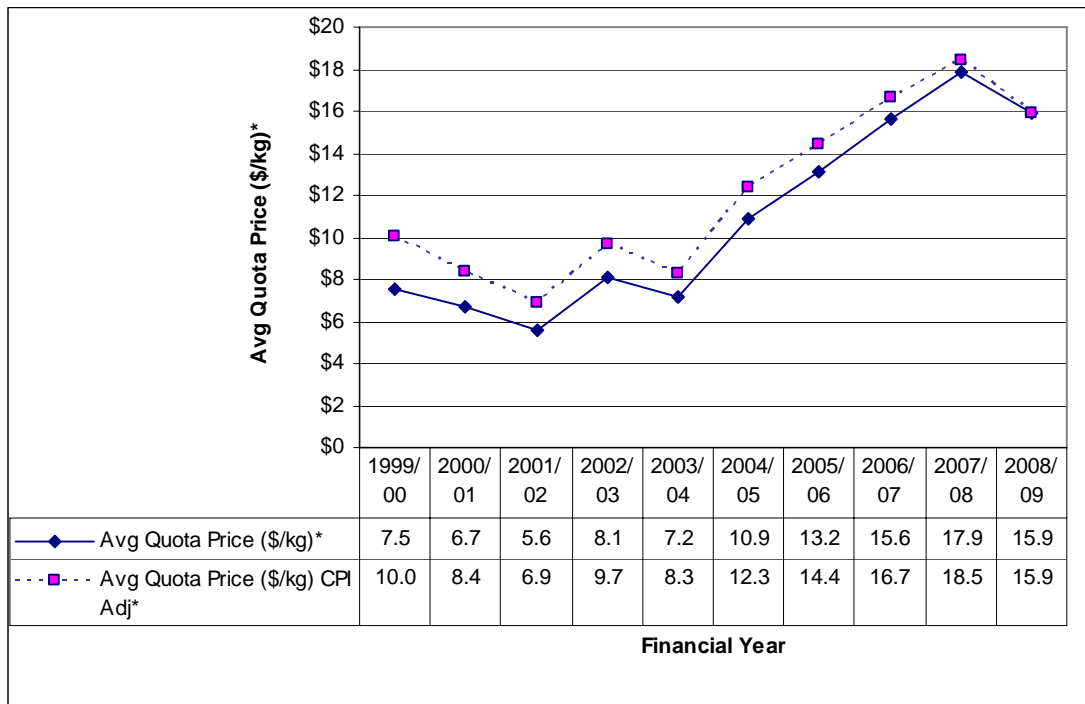
Quota trading in 2008/09 was similar to that in the previous year, with a total of 81 quota transactions that comprised a total of 42.2 tonne of quota (33 per cent of the TACC), which is above the long-term average for the fishery (Table 2). Quota trading volumes are currently at their highest level since implementation of the Share Management Plan in 2000. Further, the trend in the number of quota transferors exceeding the number of transferees continues, suggesting progressive reallocation of quota from smaller to larger operators, and most likely from less efficient to more efficient operators. Fishers indicate that the ability to lease quota helps improve efficiency by providing them with greater flexibility in handling fluctuations in catches. The restrictions on the amount of quota that can be transferred could, however, impede full attainment of these efficiency gains. Further, the high fee paid on quota transfers may be inhibiting trade in small parcels of quota. As noted above, the Committee urges industry to maintain a watching brief on the extent to which this limit becomes binding, thereby restricting the ability of fishers to take advantage of favourable catching conditions/stock abundance by leasing in quota. However, the Committee also notes that the on-line system, which is scheduled to start in 2012, will assist in reducing transactions costs associated with quota transfer and should, therefore, increase the efficiency of these transfers.

There is a relationship between the percentage of TACC caught and the percentage of quota transferred, albeit an imperfect one. It appears that 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 per cent, the percentage of quota transferred was only 11 per cent. Conversely, since 2004/05 when the percentage of TACC caught has been close to 100 per cent, the proportion has been around 30 per cent.

**Table 2: Total quota transferred, number of quota transferors and transferees, amount of TACC transferred and average price paid for quota**

Fishing period	Total quota transferred (tonnes)	Quota transferors	Quota transferees	TACC transferred (per cent)	Average Price (\$/kg)
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	42.2	48	36	33%	\$15.9
2009/2010	23.3	32	28	18.2%	\$15.2

About 26 per cent of quota transferees provide data on the price of quota transfers. The available information, while possibly not representative, indicates that quota prices in 2008/09 were 14 per cent below those in 2007/08 (Figure 6). This brings to an end the steady upward trend in quota transfer prices observed since 2003/04.



**Figure 6: Average quota price per kilogram**

Quota prices may provide an indication of the short-term economic health of the lobster fishery. 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 and beach price) 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.

Unfortunately, information on the price at which quota is transferred is not reported for all transfers. Given the advantage of having access to it, this information should be reported and made generally available. The Department and LobMAC have investigated the feasibility of requiring fishers to provide price information and it was found that this is not possible. As such, information on quota trading will continue to be provided on a voluntary basis. The Committee notes that the move towards an on-line system for transferring quota will facilitate better reporting of quota transfer prices; however, in the short term it is recommended that fishers continue to be encouraged to provide price information.

**The Committee recommends that the Department and LobMAC encourage fishers to make further efforts to report price information for quota transfers.**

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.

#### **4.11 Impact of illegal and unreported removals**

Previous reports by the Committee have discussed the loss of economic value from the fishery due to high levels of illegal catch. It has been suggested, in those reports, that the 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. The Committee believes that this matter should be re-examined, possibly through the establishment of a joint industry/I&I NSW working group.

**The Committee recommends that the estimate of illegal and unreported removals from the rock lobster fishery be refined and that a joint industry/I&I NSW working group be established.**

#### **4.12 Recreational catch**

As with illegal catch, there is the possibility of loss of economic value from the fishery due to high levels of recreational catch. Current estimates of recreational catch are unreliable; hence it is not known how much of the TAC should be apportioned to recreational fishers. It was suggested by the Department that as a starting point in collecting better data on the level of recreational take, the conditions on the recreational fishing licence could be amended to require that people identify whether they are taking lobster (see Recommendation in section 3.5).

#### **4.13 Economic data**

As indicated earlier in this report, authoritative comment on the economic performance of the lobster fishery is restricted to interpretation of changes in share and quota prices. However, as discussed earlier, a survey of costs of fishing would allow for the net return from fishing to be calculated and would place industry in a much more informed position regarding setting of the TACC in order to maximise profits, and setting of the community contribution charge.

The level of the TACC at which profits (net returns) from lobster fishing are maximised for the fishery as a whole is known as the maximum economic yield (MEY). At MEY the TACC is lower than it would be if it was set with reference to stock abundance only, i.e. at maximum sustainable yield (MSY). The TACC is currently set with reference to MSY. At MSY profits from fishing will be substantially dissipated.

Data on net returns from lobster fishing may be incorporated into the current biological model used to estimate the status of the stock using MSY and net returns estimated for different rates of stock recovery.

At MSY, with much returned economic rent<sup>4</sup> a community contribution charge levied in order to return economic rent from the fishery may result in many fishers leaving the industry.

With a TACC set with reference to MEY and economic rent in the fishery, a political decision can be made on whether to collect all or part of this rent, or to leave it with fishers. As part of the economic rent in the fishery is attributable to the skill of the fisher, there is a strong argument for not appropriating all of the economic rent in the fishery<sup>5</sup>. Costs of collection are also a consideration.

Economic rent may be returned to society through a resource rent charge (in New South Wales commercial fisheries this is known as the community contribution charge). An estimate of economic rent in the fishery should be made to avoid too much rent, or too little rent, being appropriated from the fishery through a community contribution charge. If the community contribution charge is set too high many fishers will leave the industry.

The current community contribution charge of \$115 per shareholder is set to change in February 2012. The community contribution charge will then be based on estimates of net returns and economic rent in the fishery from a study by Hassall and Associates in 1999. Undoubtedly, net returns in the fishery have changed since this study was undertaken. As a result, it is imperative that more up to date information on net returns from fishing is collected prior to commencement of the new community contribution charge in 2012.

As mentioned in last year's report, discussions were held between the TAC Committee and Department economists in April 2008 in response to requests from the Committee for improved economic data on the economic situation and structure of the New South Wales commercial lobster fishery. The Departmental representatives undertook to see what could be done to meet the needs of the Committee with respect to economic data. 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.

As discussed in section 4.6 above, a survey of the costs of lobster fishing should commence as soon as possible and should be conducted every three years (with annual updates) on an ongoing basis to ensure that fishers are able to maximise economic returns from fishing over time

#### **4.14 Conclusion**

While the lack of information on the net return from lobster fishing means that only tentative conclusions about the economic status of the industry are possible, the

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

5 Rents attributable to the skill of fishers are termed 'intra-marginal' rents. Intra-marginal rents should be left with fishers. Intra-marginal rents can be as high as 36 per cent of total economic rent in the fishery (ABARE, 1990)



evidence available to the Committee suggests that the lobster industry in New South Wales is economically viable. This improvement in viability has been reflected in higher share prices. Higher share prices also indicate that the future outlook for the fishery remains positive. The increase in viability reflects a number of factors including an increase in stock abundance and catch per unit effort, the latter believed to have been influenced partly by an improvement in the efficiency and practices of lobster fishers.

There has been significant restructuring in the lobster fishery with fewer fishers landing a higher proportion of the catch. This structural change is desirable in order to allow for the most efficient fishers to land the majority of the catch, and to ensure the continued viability of lobster fishing businesses. However, the current management arrangements for the lobster fishery, which prevent shareholders from owning more than 350 shares in the fishery, limits the extent to which further restructuring can occur. The Committee notes, and supports, the amendment of the maximum shareholding to allow shareholders to hold up to 40 per cent of the total number of shares in the fishery.

The Committee notes that there are limits on the maximum amount of quota that can be transferred by lobster fishers and urges the lobster industry to maintain a watching brief on the extent to which this limit becomes binding thereby impeding the ability of quota to be transferred from less to more efficient fishers.

The Committee has made a number of recommendations in this report which are aimed at providing improvements in the economic viability of the lobster fishery in the future. These include: that lobster fishers make further efforts to report price information for quota transfers; that data is collected on the costs of fishing; and, connected to this, that a decision is taken on whether the collection of this data is funded by industry, government or some combination of the two.

The Committee's conservative determination for 2010/11 is based on strengthening the prospect of restoration of the spawning stock and maintenance of an appropriately sized available biomass. The current TAC strategy offers promise of improving economic circumstances over the longer term. Collection of data on the costs of fishing, and the establishment of economic targets and management strategies to achieve them, will also be necessary to optimise the economic viability of the fishery into the future.

## **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 I&I NSW using a length-based model is reviewed. Finally, a number of conclusions concerning spawning stock rebuilding are drawn and a TACC for 2010/11 is recommended.

### **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.

Previously commercial catch rates have not been 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. This year catch rates are reported both in the 'raw' form and with a simple standardisation to account for the gross effects of recent shifts in fishing effort from shallow (less than 30m) to deeper pot sets. The deeper sets use larger pots and longer soak-times, and have greater catch per pot-lift, than shallow sets.

The total catches are shown in Figure 7. The total catch, effort and catch rates since 1969/70 are shown in Figure 8. The detailed catch, effort and catch rate by area and depth since 1997/8 are shown in Figure 9. These figures provide data from the most recent complete catching year (2008/09) and a preliminary estimate of the catch rate in the current incomplete catching year (2009/10). Although data from 2009/10 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 9) and so the annual catch and aggregate catch rate for 2009/10 is expected to be higher than the incomplete figures indicate.

These data show a strongly increasing trend for the 7 years, peaking in 2007/08 (Fig 8). In 2008/09 the catch rate was somewhat reduced from that and it is likely that the complete 2009/10 catch rate will also be lower than the 2007/08 peak. The reduced catch rate in the last two years is widespread across depths and is stronger in the southern regions (i.e. south of 33 degrees latitude). This pattern is expected from the relatively weak puerulus settlement 3-5 years ago there and the predicted reduction of the exploitable biomass through the current and next few years.

This overall trend and interpretation of the catch rates is consistent across the standardised and the raw catch rate data. However the standardised catch rates are increasingly lower than the unstandardised catch rates, having removed some of the effects of the increased use of deep-set traps in recent years. In population assessment and modelling the catch rates are used as an index of population abundance, and the standardised catch rates indicate a lower recent rate of recovery of the population to a lower abundance than do the raw catch rates.

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 quantity of legal sized lobsters is slightly decreasing, as predicted previously from modelling, and so the recruitment to the spawning stock will also be expected to slower compared to recent years.

The size composition of the catch from logbooks and augmented by observer data on the mid-north and far-north coast, the area occupied by the mature lobsters, are shown in Figure 10. This information was not updated in 2009/10 because monitoring has changed to an alternate-yearly frequency. A substantial decrease in

the catch rate of all sized lobsters occurred across both the far-north and mid-north coasts between 200/01 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 a 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 (1998-1999) levels.

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

1. The aggregate catch rate in Fig 8 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 1994/5. 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. But the experience with other ITQ fisheries is that, as intended, fisheries can rapidly increase in efficiency and change targeting practices 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 1999/00 and 2000/01 (Figure 8). 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 9). 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 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 10). 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 180mm. 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 1999/00 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 10 metres, 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 TAC 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 TAC 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 has slowly rebuilt 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 the TACC has operated with implicit target and limit reference points for several years. These are:

**Target reference point.** A depletion to 0.5 of 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. But as the stock is recovered an appropriate target reference point should be considered and selected. The target reference point should include social and economic as well as biological considerations.

**Limit reference point.** The 2007 Fishery Management Strategy (SMP) identifies stock depletion to 0.25 of the unfished biomass as a level of depletion that is of concern in relation to biological productivity and that would trigger a review of management. The TACC treats this as a limit reference point, below which urgent corrective action is required. In the past the TACC has used a depletion to 0.3 of the unfished level as the limit reference point. These two different limit reference points are consistent and equivalent when applied with different requirements for the probability that the reference point is achieved. In the past the limit reference point used by the TACC was 0.3 depletion combined with a 50% probability that the actual population was above the 0.3 depletion level (i.e. that the median of the estimated depletion is 0.3 or larger). The standard error of estimated depletion in recent assessments is about 0.05, and so a median estimate of 0.3 depletion implies (approximately) and that there is a 95% probability that the true population is above 0.2 depletion and that there is an 84% probability that the true population is above 0.25 depletion. The limit reference point used by the TACC is a depletion of 0.25 of the unfished level with a 84% probability that the true population is above this level of depletion. This is approximately equivalent to the median estimate of the depletion being above 0.3, and in some analysis it is simpler to report using the median in relation to a 0.3 depletion rather than an 84% probability level in relation to a 0.25 depletion.

The reasons for use of 0.25 depletion (with 84% probability) or equivalently 0.3 depletion (with 50% probability) as the limit reference point in this fishery are:

- It is above the point where recruitment over-fishing and 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 in the range of about 0.1-0.2 of the unfished level. The 'base case' population model 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 in this fishery is to avoid depletion below 0.2. An estimated 0.25 depletion with 84% probability, or equivalently an estimated 0.3 depletion with 50% probability, are each associated with an about 95% probability that the true stock is above a depletion of 0.2. And so either of these forms of the limit reference point is expected to give a high chance of avoiding recruitment over-fishing.
- 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. 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. This gives a need to consider the absolute estimates of the spawning biomass, as well as the relative depletion, 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 TAC, then that extra spawning stock catch is less than 10% of the spawning biomass that would be present if the population was at a depletion of 0.3. And so 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 was at a depletion of 0.1 the same catch could be up to 25% of the spawning biomass present, resulting in a rapid reduction on spawning biomass. Maintaining the stock at or above a median depletion of 0.3, rather than a lower median value such as 0.2 or 0.25, greatly increases the probability that the absolute spawning biomass is sufficiently large to buffer such operational changes in the fishery.

- The recent experience of significant reduction in recruitment to lobster populations in other Australian fisheries jurisdictions, despite the spawning stocks of these populations being above levels at which reduction in recruitment was expected, illustrates that there are unknown ecological processes and risks in managing lobster populations. In particular it is speculated that climate change may be causing patterns and levels of productivity that are different from those seen in the lobster fisheries historically and that form the basis of current expectations about the risk of reduced recruitment. These additional risks mitigate for a higher spawning biomass and general population size that historically used so as to increase the 'safety margin' against increased variability or reduced levels of population productivity and recruitment.
- 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.

Performance against the limit 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.

### **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 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. And the higher puerulus catches in the northern regions between 2000 to 2004 is 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 2007/8 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 1999/00 and 2000/01. Puerulus settlement on the far-north coast was very low for 3 years (04/05, 05/06 and 06/07), 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 2-3y this situation should improve. On the mid-north coast there were 2y of low settlement (04/05 and 05/06) 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 2004/5 to

2006/7 and substantially increased during 2007/8 and 2008/9, 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. In the current stock situation, and considering the range of information sources being used to monitor and predict the population, it is considered reasonable to move the spawning stock surveys from a yearly to 2-yearly frequency.

**5.2.4 Illegal, unreported and recreational catches**

As in previous years the assessments and population projections assume a 25.8t recreational catch. The 25.8t recreational catch is based on estimates provided by previous studies and surveys. This estimate requires updating.

Previously an unreported catch that is 17% of the total commercial catch was assumed to allow for all unreported catch (e.g. unreported retained catch from the lobster fishery, trawl fisheries and fish trap fishery; mortality due to ghost fishing by lost fishing gear; predation or other mortality of commercially caught lobsters during fishing operations). This year consistent input from the Compliance Operations Branch and the fishing operators concluded that this figure was probably too high. While there were no quantitative estimates available the combined expert judgement was that the unreported retained catch was probably about 10%. An additional allowance of 2% for incidental mortality was considered to be reasonable, giving a total unreported catch of 12% of the reported catch. That is:

$$0.12 = \frac{\text{unreported catch}}{\text{total catch}}$$

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

and so

$$0.14 = \frac{\text{unreported catch}}{\text{reported catch}}$$

The 25.8t recreational catch is based on estimates provided by previous studies and surveys. This estimate requires updating.

This approach to categorising the various reported and unreported catches can be summarised as:

<b>Fishing activity</b>	<b>Reported</b>	<b>Unreported</b>
Commercial rock lobster share holders	Reported catch of RL shareholders	x
Commercial other fishers	zero	y
<b>Subtotal:</b> commercial catch	Reported catch of RL shareholders	x + y = 12% of Reported catch of RL shareholders
Recreational	zero	25.8t
Indigenous	Reported catch of indigenous fishers	zero
<b>Total</b>	Reported catch of RL shareholders + Reported catch of indigenous fishers	25.8t + 12% of Reported catch of RL shareholders

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



TAC=commercial reported catch + commercial unreported catch + recreational catch

TAC= TACC + 0.14 TACC + recreational catch

and so

TACC= (TAC – recreational catch)/1.14

or TACC= (TAC- recreational catch)\*0.88

### 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 were 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 inclusion of model fits to a standardised catch rate, in addition to the raw catch rates used in previous years. The 'base case' in this year's assessment used the raw catch rate data, as in previous years and the standardised catch rate was compared as a sensitivity treatment.

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. None of the model fits matched the rapidly increasing catch rate in the last 3 – 4 years of complete data (i.e. 2005/6 to 2008/9), although the standardised catch rate data are more consistent with the model than the raw catch rate data. The model interpretations are of a relatively stable stock abundance through those 4 years, rather than of a stock abundance that is rapidly increasing in proportion to the raw catch rate.

### 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:

	Median	5% limit	95% limit
<b>Unexploited. total biomass (K)</b> <u>weighting</u>			
<b>Base case</b>			
<b>99.75 on length: 0.25 on catch rate</b>	6,116	5,841	7,351
99.9 on length:0.1 on catch rate	6,096	5,837	7,273
Standardised catch rate	6,124	5,841	7,385
<b>2009-10 total biomass</b> <u>Weighting</u>			
<b>Base case</b>			
<b>99.75 on length: 0.25 on catch rate</b>	2,075	1,551	3,260
99.9 on length: 0.1 on catch rate	1,702	1,325	2,838
Standardised catch rate	2,140	1,555	3,349
<b>2008-9 total biomass/K</b> <u>Weighting</u>			
<b>Base case</b>			
<b>99.75 on length: 0.25 on catch rate</b>	0.34	0.26	0.44
99.9 on length: 0.1 on catch rate	0.28	0.22	0.39
Standardised catch rate	0.35	0.26	0.45
<b>Unexploited spawning biomass</b> <u>weighting</u>			
<b>Base case</b>			
<b>99.75 on length: 0.25 on catch rate</b>	2,229	2,129	2,679
99.9 on length: 0.1 on catch rate	2,222	2,127	2,651
Standardised catch rate	2,232	2,129	2,691
<b>2009-10 spawning biomass</b> <u>weighting</u>			
<b>Base case</b>			
<b>99.75 on length: 0.25 on catch rate</b>	584	407	965
99.9 on length: 0.1 on catch rate	447	337	804
Standardised catch rate	608	408	1010
<b>2008-9 spawning biomass/unexp. spawning biomass</b> <u>weighting</u>			

<b>Base case</b>	0.26	0.19	0.36
<b>99.75 on length: 0.25 on catch rate</b>	0.20	0.16	0.31
99.9 on length: 0.1 on catch rate	0.27	0.19	0.37
Natural mortality internally estimated with 99.75:0.25 weighting			

There is measurable and continued improvement in the spawning stock in recent years, and in the most recent two years (2007/8 to 2009/10) the stock is estimated to have been approximately stable. The stock condition in 2009/10 is estimated to be almost exactly the same as the previous year, although with a very slight reduction in both total biomass and spawning biomass. The estimated stock condition based on the raw and standardised catch rates are very similar, with the standardised catch rate giving very slightly more optimistic estimates of all key parameters. 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 very slow or no 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 and the existing spawning biomass has significant protection from the 180mm maximum size limit.

Under any weighting scheme the level of depletion of the total stock that is below 0.5 of the unfished level. Both the base case and standardised catch rate assessments indicate that the median depletion for total biomass is about 0.34 and that there is about 95% chance that the depletion is above 0.25. Only for the more conservative weighting is there a greater than 50% probability that the total population is depleted below 0.3 and a significant probability that it is depleted below 0.25.

Under any interpretation of catch rate and 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 that the spawning biomass is above 0.3 of the unfished level and there is an about 50% chance that the spawning biomass is below 0.25 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 (447t), and so it is vulnerable to being depleted by increased targeting by the fishery.

Under any weighting scheme the interpretation is of increase in stock condition during the last about 10 years, but a levelling off of this increase in the last 3 years – with a slight decrease in the exploitable biomass and spawning biomass in the last year.

The two weightings, the base case and the alternative, both give credible interpretations of the available information. And 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.

The standardised catch rate interpretation gives a better fit to the available data and this would be an appropriate base case for future assessments.

### **5.3.3 Predictions of future stock levels**

Predictions were made of the change in the biomass that would occur after 5y 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 20013/14 divided by spawning biomass in 2007/08) after 5y of various constant future catches are:

<b>Predicted proportionate change in spawning biomass after 5y of various constant future catches</b>		
<b>Total Catch (t)</b>	<b>Weighting on catch rate and length data in assessment model</b>	<b>Increase in spawning biomass (<math>SB_{2014-15}/SB_{2008-09}</math>); Median and the 95% confidence interval</b>
<b>150</b>	<b>Base case</b>	<b>1.11 [1.02 to 1.18]</b>
	<b>99.75:0.25 weighting</b>	1.13 [0.96 to 1.24]
	99.9:0.1 weighting Standardised catch rate	1.10 [1.03 to 1.17]
<b>175</b>	<b>Base case</b>	<b>1.03 [0.91 to 1.12]</b>
	<b>99.75:0.25 weighting</b>	1.03 [0.83 to 1.17]
	99.9:0.1 weighting Standardised catch rate	1.03 [0.92 to 1.10]
<b>200</b>	<b>Base case</b>	<b>0.95 [0.81 to 1.08]</b>
	<b>99.75:0.25 weighting</b>	0.93 [0.70 to 1.12]
	99.9:0.1 weighting Standardised catch rate	0.95 [0.82 to 1.07]

<b>Predicted proportionate change in exploitable biomass (104-180mm length lobster) after 5y of various constant future catches</b>		
<b>Total Catch (t)</b>	<b>Weighting on catch rate and length data in assessment model</b>	<b>Increase in exploitable biomass (<math>B_{2014-15}/B_{2008-09}</math>); Median and the 95% confidence interval</b>
<b>150</b>	<b>Base case</b>	<b>1.03 [0.97 to 1.09]</b>
	<b>99.75:0.25 weighting</b>	1.05 [0.99 to 1.13]
	99.9:0.1 weighting Standardised catch rate	1.02 [0.97 to 1.09]
<b>175</b>	<b>Base case</b>	<b>0.87 [0.77 to 0.97]</b>
	<b>99.75:0.25 weighting</b>	0.88 [0.72 to 1.01]
	99.9:0.1 weighting Standardised catch rate	0.87[0.77 to 0.97]
<b>200</b>	<b>Base case</b>	<b>0.72 [0.54 to 0.88]</b>
	<b>99.75:0.25 weighting</b>	0.70 [0.38 to 0.91]
	99.9:0.1 weighting Standardised catch rate	0.73 [0.79 to 0.88]

These projections for the spawning biomass and exploitable biomass are slightly less optimistic than those of last year for the same catch levels, which in turn were slightly less optimistic than the year before, reflecting the higher base catches now applied

following TAC 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. The spawning biomass is predicted to remain about the same or grow very slightly during the next 5 years under recent catch levels, but those same catch levels are predicted to result in a further reduction of the exploitable biomass. After 5 years of a constant 150t catch per year the median rebuilding of the spawning biomass is to about 1.10-1.13 times the present level, with a range of outcomes that could be as low as 0.96 or as high as 1.18. For a catch of 175t the median rebuilding of the spawning biomass is to 11.03 of the current level after 5 years, while the range of outcomes could be as low as 0.0.83 or as high as 1.17.

These predictions of the relative change in the spawning stock under different catch levels are remarkable insensitive to the weighting scheme used, but the predicted absolute stock abundance and level of depletion are quite different for the based 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 0.26, 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 maintain the population almost exactly as it is currently – that is below the limit reference point (i.e. 50% probability of depletion to 0.3 of the unfished level or 84% probability of depletion to the 0.25 level).

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 stability 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 0.87 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 remain at about the current level, the median depletion of the spawning biomass is predicted to be remain in the range 0.20 to 0.28, and the stock available for harvest is predicted to decrease to about 87% of the current levels.

#### **5.4 Conclusion**

Management decisions in the past several years have been aimed at stock rebuilding, and there is now measurable evidence that significant rebuilding of the spawning biomass has been achieved since about 2000, but that the spawning biomass is still somewhat below the limit reference point and that rebuilding is very slow under recent catch levels.

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. The consistency was improved by the simple standardisation of catch rate data applied this year, and it is likely that additional improvements would be achieved from further development of the standardisation.

At this time it is considered necessary to reduce the total catch slightly to 175t. This is close to a status quo catch that will approximately maintain the current level of the spawning biomass. This catch is predicted to provide a very small chance of further

rebuilding of the spawning stock, although the scope for rebuilding may be slightly better than this average prediction if the recent good puerulus settlement produces better than average recruitment into the fishery over the next 3-4 years. This approach carries some risk and progress should 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 reduced catch rates from the exploitable stock.

After adjustment for unreported and recreational catches, as above, this gives a Total Allowable Commercial Catch of  $(175-25.8)*0.88=131.2t$  (rounded to 131t).

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:

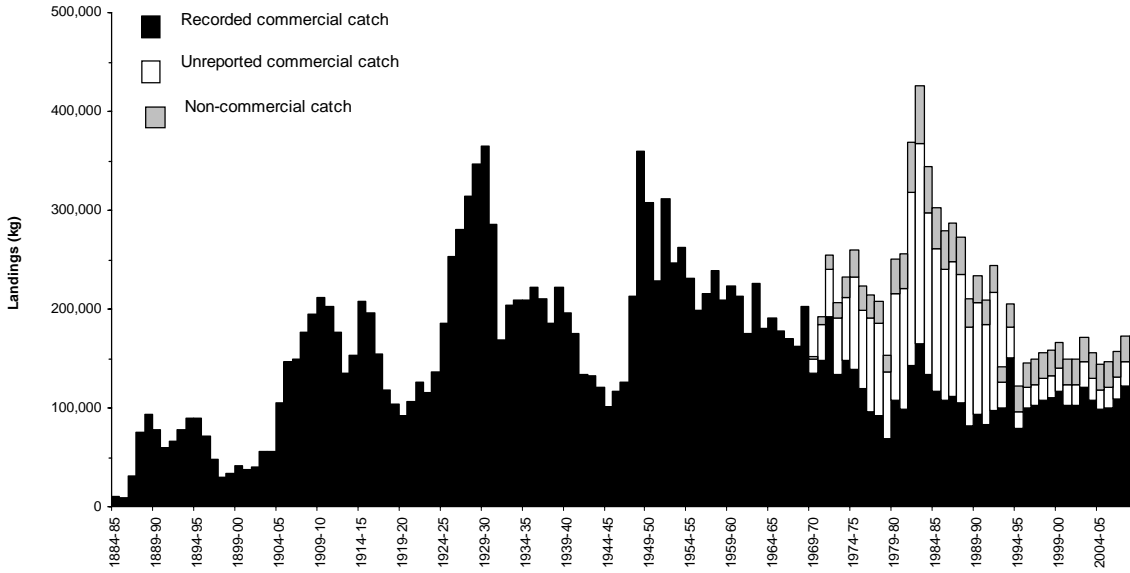
1. Updating the size frequency information used to drive the population model. Currently the information used is from 1999-2002. The most direct update would be achieved by repeating the observer coverage of the 1999-2002 period, and the Committee was informed that measures are in place that should allow updated data to be used in next year's assessment. But it could also be effective to make greater use of the size information from commercial logbooks and/or the fishery independent trap surveys.
2. 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.
3. 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.

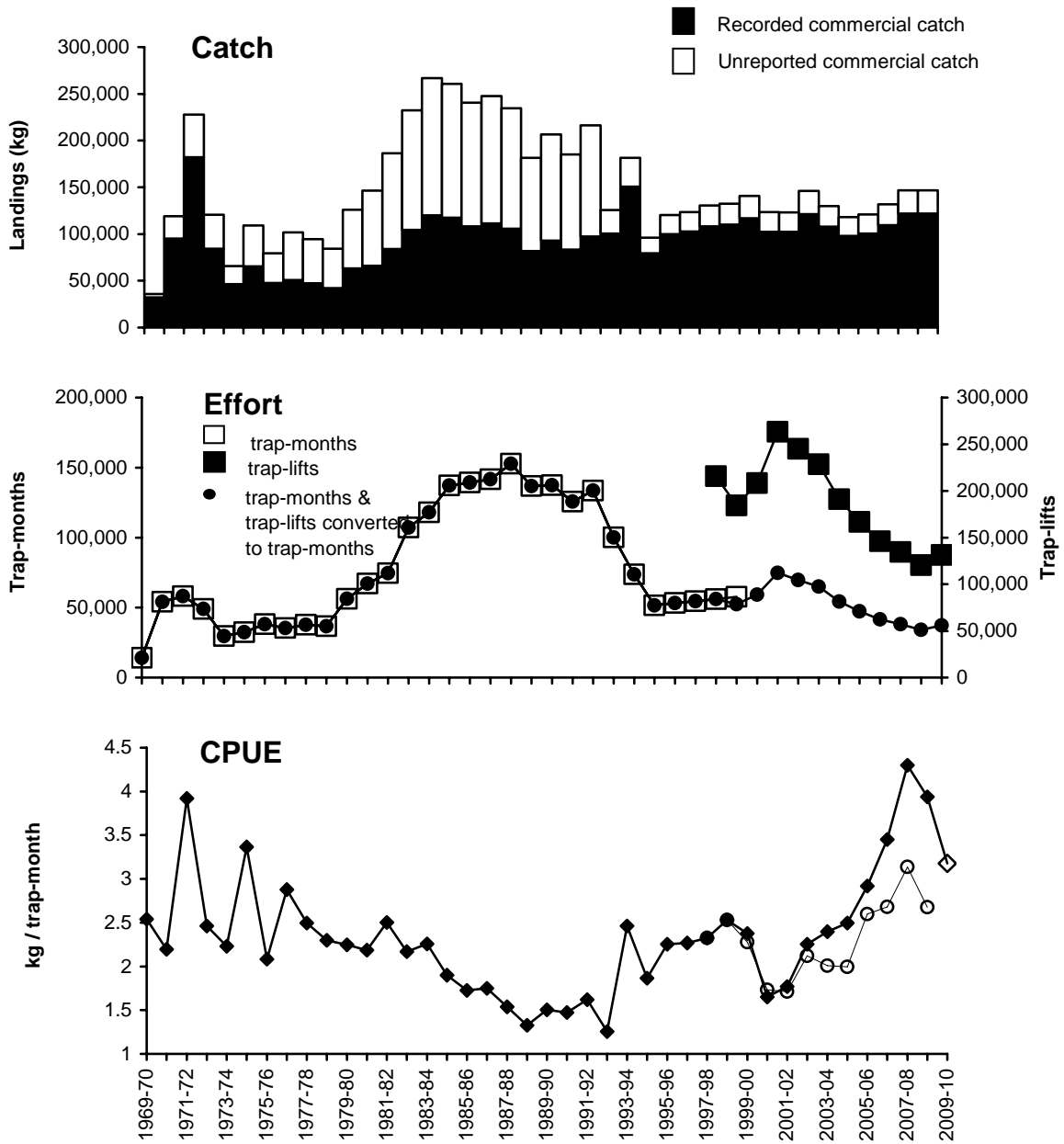
4. Further examine options for standardisation of CPUE. The fishery uses a wide range of trap sizes and fishing strategies (e.g. soak times, moon phase, bait type), parts of the fishery are intentionally expanding and changing some practices, and external factors such as weather force other changes for a time. Furthermore, in a healthy quota managed fishery such as this one it is expected and intended that industry innovate and alter fishing strategies to 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 further standardising the CPUE. The relatively simple standardisation significantly improved the consistency between different data collected from the fishery, and hence the confidence in the assessment. Further development of the catch rate standardisation is likely to give further such improvements.
5. 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.



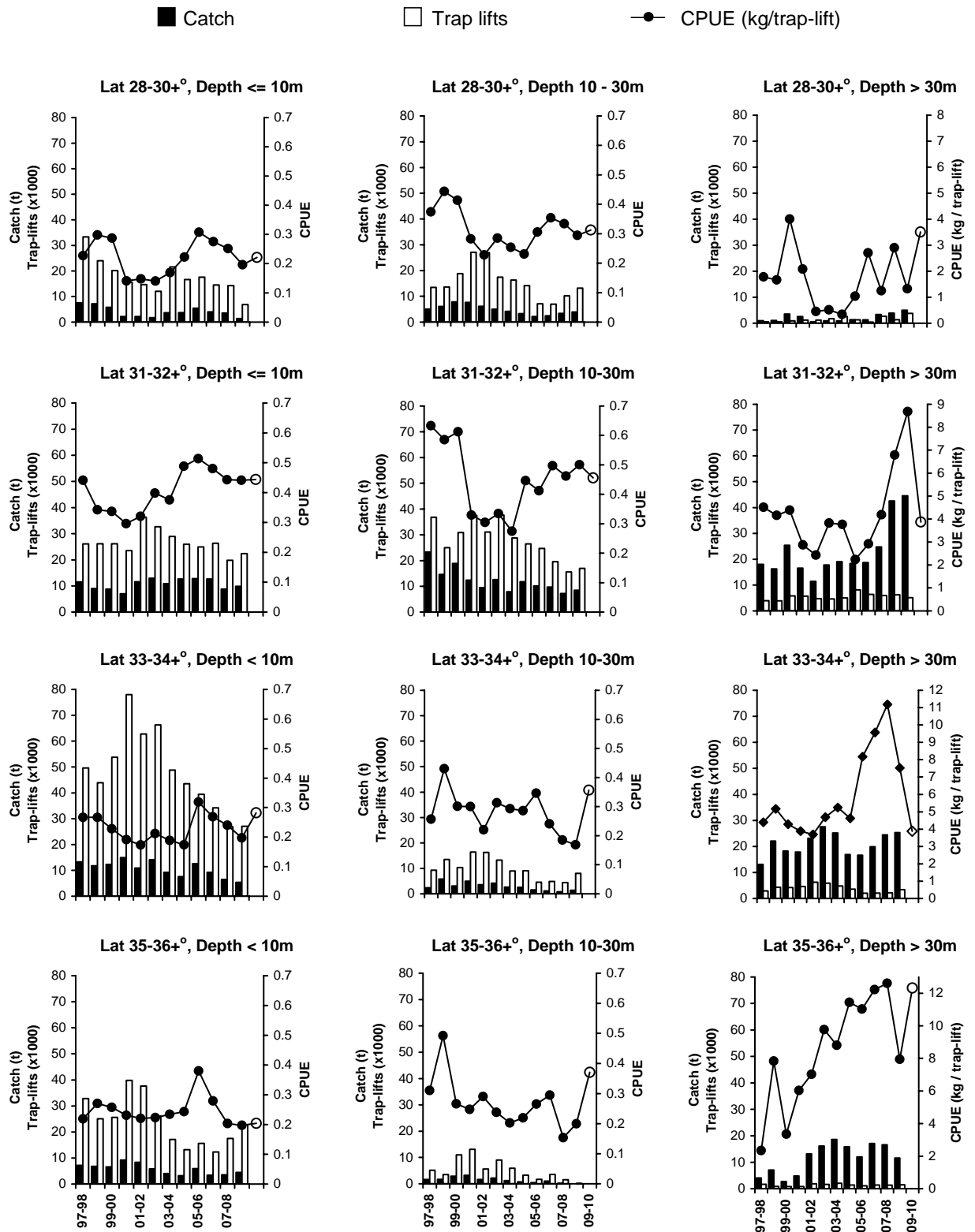
Figure 7: The landed catch since the start of the fishery



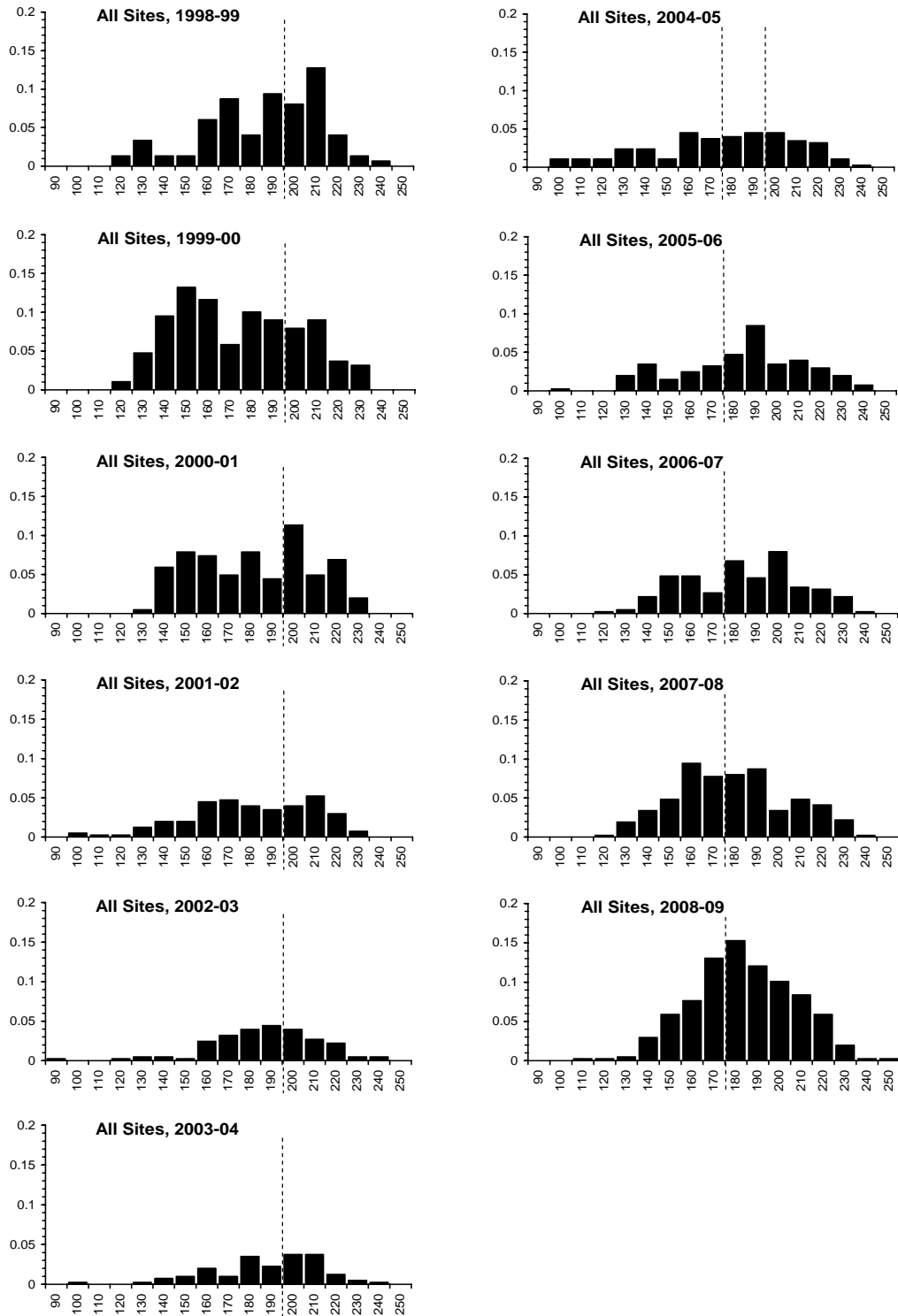
**Figure 8: Commercial catch, effort and catch rate since 1969/70 when reliable effort is available**



**Figure 9: 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 10: Size composition of lobsters in the commercial catch of the combined mid- and far-northern areas, from data provided by logbooks and augmented by observers. The dashed line is the maximum legal size. These data have not been updated this year.**



## References

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## 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.



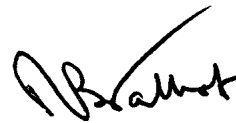
Ian Cartwright  
Chair



Keith Sainsbury  
fisheries scientist



Jessica Hartman  
fisheries management



Bill Talbot  
natural resource economist

### Appendix 1: Details of public consultation

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

Date	Fisheries Management Act	Consultation Stages
10.2.10	Section 31(1)	TAC Committee called for public submissions on the appropriate level of the annual TACC for Lobster for 2009/10.
10.2.10	Section 284 (1b)	The advertisement was placed in the Sydney Morning Herald, the Daily Telegraph and made available at NSW I&I NSW fisheries offices.
8.2.10	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"> <li>• All Lobster Shareholders</li> <li>• All Members of the Lobster Management Advisory Committee</li> <li>• NSW Regional Industry Convenor</li> <li>• NSW Fishermen's Co-operatives</li> <li>• I&amp;I NSW Fisheries Offices</li> <li>• Nature Conservation Council of NSW</li> </ul>
18.3.10	Section 284 (1b)	The TAC Committee allowed a period of 30 days for public consultation.
21.4.10	Section 31 (2)	<p>The TAC Committee gave regard to eight submissions. The respondents included the following:</p> <ul style="list-style-type: none"> <li>• I&amp;I NSW - Commercial Fishery Management, Science and Research, and Compliance branches</li> <li>• Lobster Fishery Shareholders</li> <li>• Members of the Lobster Management Advisory Committee (LobMAC)</li> </ul>
21.4.10		<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"> <li>• Dr Geoff Liggins – Manager, Scientific Services, I&amp;I NSW</li> <li>• Matt Cartwright – Investigator, Special Operations – Lobster, I&amp;I NSW</li> <li>• Nathan McNamara - Fisheries Manager, I&amp;I NSW</li> <li>• Darryl Sullings – Manager Commercial Fisheries, I&amp;I NSW</li> <li>• Alan Dodds - LobMAC</li> <li>• Ron Firkin - LobMAC</li> <li>• Lee Monin - LobMAC</li> <li>• Noel Gogerly - LobMAC</li> <li>• Scott Westley - LobMAC</li> <li>• Daniel Stewart – LobMAC</li> <li>• Mark Cranstone</li> <li>• Daryl Sykes – Industry representative</li> </ul>

## Appendix 2: Financial Performance in the SA Southern Zone Rock Lobster Fishery

Table 3.4 Financial performance in the SA Southern Zone Rock Lobster fishery, 2002/03 to 2006/07 (average per boat)<sup>a</sup>

	2002/03		2003/04		2004/05		2005/06		2006/07	
	All Boats	Share of TCC	All Boats	Share of TCC	All Boats	Share of TCC	All Boats	Share of TCC	All Boats	Share of TCC
<b>Gross Income</b>	<b>\$354,481</b>		<b>\$273,860</b>		<b>\$314,212</b>		<b>\$379,715</b>		<b>\$452,604</b>	
<b>Costs</b>										
Fuel	\$13,016	6%	\$15,730	8%	\$18,161	10%	\$21,559	10%	\$23,925	10%
R&M	\$10,912	5%	\$13,362	7%	\$16,624	9%	\$19,228	9%	\$21,417	9%
Bait	\$5,804	3%	\$7,158	4%	\$8,906	5%	\$9,794	5%	\$10,261	4%
Provisions	\$253	0%	\$310	0%	\$299	0%	\$346	0%	\$385	0%
Labour	\$125,150	59%	\$96,686	50%	\$86,990	47%	\$105,124	50%	\$125,303	52%
Licence fee	\$12,884	6%	\$15,061	8%	\$15,762	8%	\$15,832	7%	\$18,685	8%
Insurance	\$4,352	2%	\$4,483	2%	\$6,176	3%	\$6,412	3%	\$6,522	3%
Interest	\$15,993	8%	\$16,408	8%	\$21,683	12%	\$21,951	10%	\$23,557	10%
Admin and Other	\$23,182	11%	\$23,881	12%	\$11,005	6%	\$11,425	5%	\$11,621	5%
<b>Total Cash Costs</b>	<b>\$211,546</b>	<b>100%</b>	<b>\$193,079</b>	<b>100%</b>	<b>\$185,606</b>	<b>100%</b>	<b>\$211,670</b>	<b>100%</b>	<b>\$241,677</b>	<b>100%</b>
<b>Cash Operating Surplus</b>	<b>\$142,936</b>		<b>\$80,781</b>		<b>\$128,606</b>		<b>\$168,045</b>		<b>\$210,927</b>	
<b>Depreciation</b>	<b>\$44,520</b>		<b>\$44,286</b>		<b>\$47,960</b>		<b>\$45,030</b>		<b>\$45,855</b>	
<b>Earnings Before Tax</b>	<b>\$98,415</b>		<b>\$36,494</b>		<b>\$80,646</b>		<b>\$123,015</b>		<b>\$165,072</b>	
<b>Earnings Before Interest &amp; Tax</b>	<b>\$114,408</b>		<b>\$52,902</b>		<b>\$102,330</b>		<b>\$144,966</b>		<b>\$188,629</b>	
<b>Capital</b>										
Fishing Gear & Equipment	\$321,797		\$320,105		\$351,807		\$330,318		\$336,370	
Licence Value	\$3,640,406		\$2,812,450		\$2,682,397		\$2,873,997		\$3,079,283	
<b>Total Capital</b>	<b>\$3,962,204</b>		<b>\$3,132,555</b>		<b>\$3,034,204</b>		<b>\$3,204,315</b>		<b>\$3,415,653</b>	
<b>Rate of Return to Fishing Gear &amp; Equip</b>	<b>35.6%</b>		<b>16.5%</b>		<b>29.1%</b>		<b>43.9%</b>		<b>56.1%</b>	
<b>Rate of Return to Total Capital</b>	<b>2.9%</b>		<b>1.7%</b>		<b>3.4%</b>		<b>4.5%</b>		<b>5.5%</b>	

<sup>a</sup> Financial performance estimates for 2000/01 to 2003/04 are based on the October 2001 survey of licence holders. Financial performance estimates for 2004/05 to 2006/07 are based on the April-May 2006 survey of licence holders. Estimates for 1997/98 to 2001/02 are provided in Appendix 4 of this report.

Source: EconSearch analysis.