

FRDC FINAL REPORT

**IMPACT OF MANAGEMENT CHANGE
TO AN ITQ SYSTEM IN THE
TASMANIAN ROCK LOBSTER
FISHERY**

Stewart Frusher, Linda Eaton and Matt Bradshaw

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1. Project Summary

99/140	Impact of management change to an ITQ system in the Tasmanian rock lobster fishery.
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OBJECTIVES:

- 1) To assess the response (fleet dynamics) of rock lobster fishers to changes in management, including any change in the rules, which fishers used to influence their fishing decisions prior to and after quota implementation.
- 2) To evaluate the impacts (catch and effort) of rock lobster fishers on other fisheries prior to and post quota implementation.
- 3) To determine socio-economic changes associated with implementation of quota management and establish performance indicators relevant to managing the fishery.

OUTCOMES ACHIEVED:

1. Future rock lobster fishery assessments in Tasmania will account for CPUE changes independent of changes in lobster abundances. This will enable valid comparisons of pre-and post- quota implementation data and provide managers and industry with greater certainty when recommending Total Allowable Commercial Catch (TACC) amounts.
2. Routine assessments of the lobster fishery are now able to account for changes in fisher behaviour that have occurred since 1995. This project has demonstrated that changes are occurring in the fleet dynamics of the fishery after implementation of quota and that the sub-model will need to be regularly up-dated. A fleet dynamics sub-model based on post-quota data will need at least 5 years of data and a review will be undertaken in 2004. The rock lobster model has been amended appropriately.
3. Despite there being no evidence of increased effort into other fisheries there is the possibility of gradual effort creep, and data extraction routines developed in this project will be used to monitor effort redirection in the future.

4. Industry and Government are currently in the process of developing a strategic plan and vision for the commercial rock lobster fishery. The results of this study have provided a stimulus for the inclusion of socio-economic performance indicators in the document so that industry will be better positioned to address ESD requirements under the EPBC Act (1999).

NON TECHNICAL SUMMARY:

In any fishery, a change in the management system is expected to result in a change in fishing activity. In the Tasmanian commercial rock lobster fishery an individual transferable quota management system (ITQMS) was introduced in 1998. This change in management system, which allocated fishers a set portion of the total allowable catch, was expected to encourage individual fishers to maximise profits by improving their return per unit of fish caught rather than by increasing effort to catch more lobsters. This change to a profit maximisation strategy had the potential to alter the meaning of catch and effort data, the linchpin of routine assessments of the resource.

Catch rates are used in most lobster fishery assessments as a proxy for lobster abundance – as abundance declines, so too does catch rate. Prior to implementation of the ITQMS, when catch rates reflected maximising the number of fish caught, this assumption was considered appropriate. However, post-ITQMS, fishers could target premium fish at periods of high prices and low catchability, which in turn could result in lower catch rates that were unrelated to abundance. Further alterations to catch rates that are unrelated to abundance could also have occurred with a change in the efficiency of existing fishers. A rapid reduction in the lobster fishing fleet from 315 to 240 vessels in the years after quota presented such an opportunity. Analysis of the catch efficiency of pre-and post-quota vessels found that there were small gains in the efficiency of the remaining vessels, although these were insufficient to account for the increases in biomass noted since implementation of quota. Changes in fisher's behaviour that was likely to impact on catch rates were also identified in interviews with fishers. These changes were primarily related to: 1) Fishing more in winter when prices were higher and catch rates were lower; 2) Fishing inshore to maximise the number of premium quality large red lobsters caught; and 3) Fishing less from homeports.

Analysis of fisher's catch returns confirmed an increase in effort during winter although it was noted that this trend was apparent prior to the introduction of quota. Since the introduction of quota the trend has been amplified. Catch and effort data suggested that fishers might have increased effort in shallower waters, although with the limited amount of data available this trend is inconclusive. Data from interviews may be more sensitive to this, with 25% of those interviewed stating that they had changed their fishing patterns. Analysis of the number of statistical reporting blocks fished by vessels did not support the 33% of fishers who considered that fishing was becoming more localised since quota. These results suggest that spatial catch and effort data obtained since the introduction of quota is continuous with pre-quota data. Comparisons may thus be made between pre- and post-quota datasets for the initial period after introduction of quota, although it should be remembered that change is often not instantaneous. Statements by fishers regarding likely changes in their own fishing patterns need to be constantly evaluated and do not necessarily relate to the whole fleet.

Evaluation of differing harvests (changes in quota) is a powerful tool used by the Tasmanian Crustacean Fisheries Advisory Committee (CFAC) to recommend future quotas to the Minister. The impact of an increase or decrease in quota on biomass and egg production is aggregated over eight regions of the fishery in Tasmania. These different regions are modelled independently as biological characteristics such as growth and size of maturity vary regionally around Tasmania. However, the fishing fleet is not constrained in where it fishes and is highly mobile in Tasmanian waters. Movement of the fleet between the eight stock assessment areas is considered in the assessment to take account of changes in catch rate in any one region. For instance, if catch rates increase in one region due to a recruitment pulse, it is likely that more of the fishing fleet will move to this region to take advantage of the improved catch rates. A fleet dynamics sub-model is therefore used to describe the expected movement of the fleet in future projections of different harvest levels (quotas).

The existing fleet dynamics sub-model is based on the fishing patterns of fishers from 1990 to 1995, which was when the primary rock lobster fishery assessment model was constructed. This sub-model was compared with both a sub-model that only used data since quota implementation (3 years of data) and with one that used all of the data. In addition to these, sub-models that incorporated parameters not used in the initial sub-model were also compared. Although changes since the introduction of quota management have been noted, the dataset was still too small to create a post-quota fleet dynamics sub-model. The best fit to the data was achieved by incorporating additional parameters (an area by month interaction term) and using the largest (10 year) dataset.

Fishers stated that the main impact of the introduction of quota in the rock lobster fishery was minor with a few boats shifting interstate. Several large fishers moved to Queensland to operate in the tuna fishery and others moved to lobster fisheries in Victoria and South Australia. The main Tasmanian fishery to receive “lobster effort” was the giant crab fishery, which has subsequently changed to an ITQ management system. Some lobster fishers have access to the scallop fishery and operate in this fishery when it is open although, as with giant crab, the fishery is managed on a weight based ITQMS. Fishers did not report redirecting effort into other Tasmanian fisheries, although an analysis of finfish catch and effort data suggests that there was a small expansion into Tasmanian line fishing. This expansion was primarily in the striped trumpeter fishery, which has seen a gradual increase in effort by rock lobster fishers since the mid-1990s. The recent decline in catch and catch rates in this fishery is considered to be associated with recent scalefish management changes. On the other hand, the decline in the number of vessels now operating in the rock lobster fishery has resulted in less effort being directed into most scalefish fisheries. Changes in the management plans of the giant crab, scallops, and some of the scalefish fisheries appears to have limited the capacity for rock lobster fishers to substantially shift effort into any of these fisheries.

A comprehensive socio-economic survey of the majority of participants in the lobster industry identified a number of positive and negative responses by fishers relating to the introduction of quota management. Positive responses related primarily to the improvement in lobster stocks, reduction in boat numbers and an end to the ‘race for fish’. It is worthwhile noting that reduction in boat numbers would have been required under any restructuring of the fishery to reduce effort, although the group of fishers affected may have been different under different management regimes or quota allocation mechanisms. Negative responses to quota management related primarily to the increase in the price of quota units (pots). Although prices are currently comparable to other lobster fisheries operating either under input or output controls in Australia, a substantial escalation in prices occurred after the introduction of quota management. Fishers needing to lease quota to make up catch equivalent to pre-quota catches and leasee’s have both found profit margins restrictive, while fishers attempting to buy into the fishery have found the costs prohibitive. Fishers are concerned that there is limited opportunity for persons associated with the fishery (e.g. deckhands, skippers currently leasing) to buy into the fishery and that the fishery is gradually moving into the hands of investors. Concerns were also aired regarding decreasing employment associated with decline in the number of boats. Decline in economic activity was also noted in several ports, disproportionate to the expected loss due solely to the reduction in boat numbers.

Zoning was the most frequently raised unsolicited issue, with the industry split evenly for and against this management tool.

A series of performance indicators was developed to monitor the main issues raised in this report. This report represents the baseline for these indicators, recognising however, that monitoring of any trends is of little value unless a direction for the industry is determined.

In summary, this study has shown that fishers, their behaviour, their capital investments and their regional distribution are all essential components of Tasmania's valuable rock lobster resource. As such, the sustainability of these socio-economic components of the fishery is considered to be as important as any biological components in the evaluation of the rock lobster fishery.

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2. Background

In March 1998, the rock lobster fishery changed its management to an individual transferable quota (ITQ) system. Under an ITQ system, fishers are expected to maximise the value as opposed to the quantity of fish caught. It is also expected that this will result in a change in the quality of fishing effort and in the dynamics of the fleet. Describing changes in effort due to changes in the management of the rock lobster fishery is made even more difficult since changes are confounded by the fact that size, colour and time of year affect prices and hence fishing intensity; the time of year is of paramount importance as prices can double within a season. Historically the fishery opened in November when catch rates were high but prices low and, in effect, the high catch rates offset the lower unit value of the catch. An initiative of the new management system has been to commence the quota year in March, at a time when the unit price for rock lobster is generally high and increasing.

Catch and effort data are a critical input into the rock lobster stock assessment model, which has been used to assess the risks associated with future harvest scenarios (Punt and Kennedy, 1997). Effort in the model has not been standardised to account for possible increases in effectiveness due to technological change. Studies in other fisheries (eg. Fernandez *et al.*, (1997) – Western Rock Lobster; Robins *et al.* (1996) - Northern Prawn Fishery) have indicated that advances in technology have had significant impacts on the effective effort and interpretation of CPUE data. In particular, stability or declines in catch rates may misrepresent true declines in the resource.

To quantify the ramifications of a shift to an ITQ system in the Tasmanian rock lobster fishery, it is important to understand any redirection of effort both within the rock lobster fishery (spatial and temporal) and into other fisheries. In terms of the latter issue, redirected effort could have significant impacts on the sustainability of other fisheries such as giant crab, finfish and scallops. Furthermore, changes in management of these other fisheries will impact on the operations of rock lobster fishers who may have directed effort into these fisheries in the past. The concern about effort shift is well founded, as an accumulation of quota units onto fewer vessels occurred within the first three months of ITQ implementation. Vessels, which no longer have quota, have other entitlements (primarily in finfish, giant crab and scallops) and thus the potential exists to significantly increase effort in these fisheries. Similarly, rock lobster vessels, which are now restricted in catch under the ITQ system, are expected to divert effort into other fisheries. Gauvin *et al.* (1994) stated that when ITQ programs are established in a piecemeal approach (compared to an integrated approach), the input control measures in place in other fisheries may be inadequate to protect these fisheries from the potential influx of effort from ITQ fisheries.

Recognition of the need for socio-economic in addition to biological assessment has also been highlighted for management of the Tasmanian rock lobster fishery. In evaluating the impact of ITQs on wreckfish in the USA, Gauvin *et al.* (1994) noticed substantial changes in the socio-economics of the fishery within the first eighteen months. Changes included reduced overcapitalisation, improved efficiency of the fishing fleet and consolidation of operators. Daryl Sykes, Industry spokesperson for

the New Zealand Fishing Industry Board, claimed that the lack of attention given to socio-economic issues when the New Zealand rock lobster fishery went to ITQs, had the most devastating of all impacts on New Zealand rock lobster fishers (Southern Rock Lobster Council of Australia, Hobart 1996).

An understanding of the changes occurring with the introduction of ITQs will be the basis for incorporation of socio-economic performance indicators in future management plans.

3. Need

To sustainably manage Tasmania's marine resources it is important to understand the impact that management change has on the biological and socio-economical aspects of Tasmania's fisheries. In order to account for changes in catch rates and biomass levels for future risk assessments of the fishery, changes in fishing practices need to be understood. This is particularly important in the rock lobster fishery where CPUE and biomass levels are key trigger points and performance indicators for the fishery in the rock lobster management plan.

The change to an ITQ management system in the rock lobster fishery will have immediate impacts on both the rock lobster resource and other marine resources, which have the potential, but not capacity, to soak up redirected effort. Within the first three months after quota management there was an accumulation of quota units on fewer vessels and an associated increase in effort in the giant crab and scallop fisheries. To manage these fisheries sustainably, it is necessary to understand the dynamics of effort shift between these fisheries and the consequences of management change in these fisheries on the rock lobster fishery.

In New Zealand, there was an unforeseen accumulation of quota units in fewer hands and a change from owner-operators to lease-operators, which has had substantial impacts on the socio-economic fabric of the New Zealand rock lobster fishery. One of the policy objectives of the Tasmanian rock lobster fishery is to provide socio-economic benefits to the community. Such benefits would include employment and economic return to coastal communities.

An understanding of the impact of change to an ITQ management system is necessary for development of socio-economic performance indicators in this fishery.

4. Objectives

- 1) To assess the response (fleet dynamics) of rock lobster fishers to changes in management, including any change in the rules, which fishers used to influence their fishing decisions prior to and after quota implementation.
- 2) To evaluate the impacts (catch and effort) of rock lobster fishers on other fisheries prior to and post quota implementation.
- 3) To determine socio-economic changes associated with implementation of quota management and establish performance indicators relevant to managing the fishery.

5. Impact of the Individual Transferable Quota Management System on the fleet dynamics of the rock lobster fishery

5.1 Quantitative analysis of logbook data

5.1.1 Composition of the Fleet

5.1.1.1 Number of Vessels and Entitlement Owners Operating

To facilitate direct comparison between years, we have taken a fishing season to begin in March each year and end in February of the following year, regardless of the actual management regime in practice at the time thus, 98/99 relates to March 1998 to February 1999).

Since quota was introduced in 1998, there has been a decrease in the total number of vessels actively involved in the rock lobster fishery (Figure 1 and Table 1). Over the first three years of quota management, the number of vessels operating in the fishery dropped by 25.5% from 325 in the 97/98 fishing season to 242 vessels in the 00/01 fishing season. Most of the vessels left the fishery in the first two years of quota management. From the preliminary figures for the 01/02 fishing season it appears that the fleet is now beginning to stabilise in size (Table 1).

In contrast, the number of entitlement holders in the fishery began to decrease in 1996, well before the introduction of quota management. During each season from 96/97 until 98/99 there was a 6 % drop in the number of entitlement holders in the fishery. The 99/00 fishing season saw a record decrease of 13 %. From the preliminary figures, for the 01/02 season it appears that the number of owners has stabilised (Table 1).

Table 1. Number of Owners and Vessels Fishing and Percentage Change. At the time of writing, not all records had been recorded for the 01/02 fishing season and so the figures for this year represent preliminary estimates only. The total figures are the difference between the first and last year.

Season	Numbers Fishing		Percentage Decrease	
	Owners	Vessels	Owners	Vessels
93/94	343	348		
94/95	334	345	2.62	0.86
95/96	341	340	-2.10	1.45
96/97	321	328	5.87	3.53
97/98	302	325	5.92	0.91
98/99	284	287	5.96	11.69
99/00	247	255	13.03	11.15
00/01	231	242	6.48	5.10
01/02	230	238	0.43	1.65
97/98 – 00/01			23.51	25.54
Total			32.94	31.61

It has been suggested by Industry members that the drop in license holders prior to quota management was a reaction to the proposed quota management arrangements. Speculating that quota was to have been equally divided among license holders, the larger fishers brought licenses from operators planning to leave the fishery and then, prior to the introduction of quotas, leased them to vessel owners with no license. Once quota was introduced and divided, they could then concentrate their holdings on one vessel and continue to fish the same quantity as they had prior to quota management (Bradshaw *et. al.*, 2000). The declining trends in number of vessels and number of owners fishing prior to the introduction of quota management supports this notion (Figure 1; Table 1). However, some caution must be taken when interpreting this information. The raw data used to produce these figures tends to overestimate the number of entitlement owners because owners who traded under different names are counted as different. Therefore, some of the changes apparent in the data may be related to those owners who reshuffled their licenses amongst their trading names.

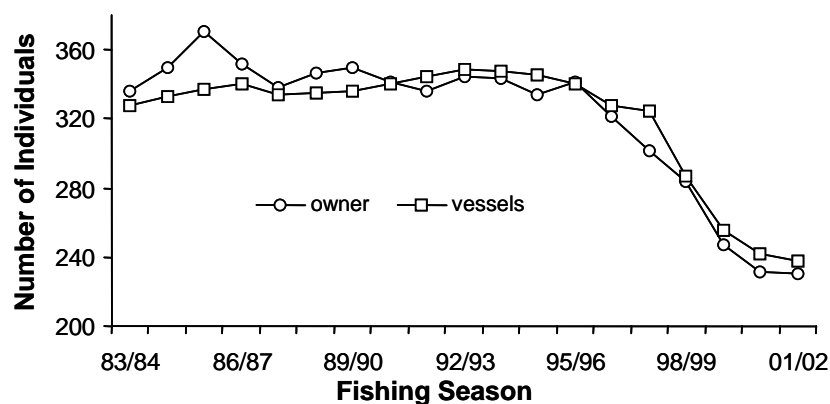


Figure 1. Numbers of Vessels and Entitlement Owners Fishing against fishing season. Note the origin does not begin at zero. The decline in numbers begins before quota management was introduced in 1998.

5.1.1.2 Number of owner operators

Traditionally, the Tasmanian rock lobster fishery consisted mainly of family operated businesses. Both management and industry members were concerned that with the introduction of quota management the fishery would move toward more lease-lessee holdings (as happened in New Zealand). The aim in this section is to estimate the number of family operations and determine if this has changed since the introduction of quota.

Catch and effort data is collected with the intention of recording the quota holder that is associated with the catch, rather than the skipper who operated the vessel. For this reason, there are few records available to provide insight into the number of family operations. Investigations were limited to between the 92/93 and 99/00 fishing seasons because reasonably accurate records of skipper were kept over that period. To give an estimation of the number of family operations, we attempted to match the surname of the entitlement owner with the surname of the skipper operating each vessel. If the surname differs for at least part of a fishing season, we have assumed that the business is not a purely family operation. As Tasmanian rock lobster fishers are predominantly male, this assumption should give a reasonable estimate of the number of family operations. This data is not an accurate representation of the nature of ownership as, once again, the problem of owners trading under different trading names arises.

Nevertheless, it is expected that the data provide an approximate estimate of the nature of ownership in the fishery.

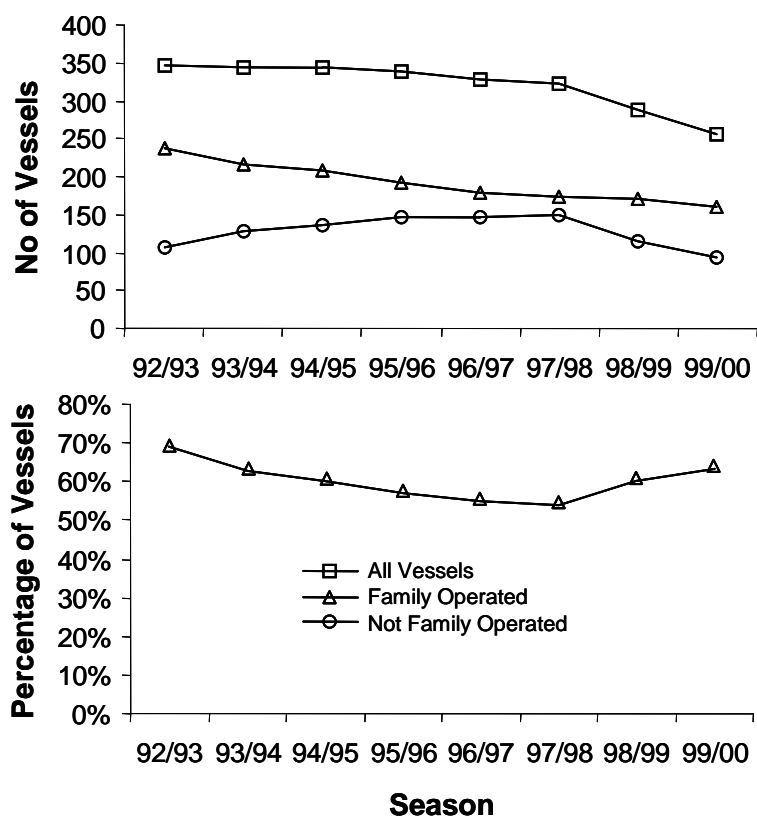


Figure 2. The number and percentage of family operations in the Tasmanian Rock Lobster Fishery between the 92/93 and 99/00 fishing seasons.

The number of vessels operated by a family member dropped steadily between 92/93 and 96/97 (Figure 2). The number of vessels that were not operated by a member of the family increased during these years but then decreased over the first two years of quota management; that is, during the 98/99 and 99/00 fishing seasons. This is also reflected in the percentage of family operations in the fishery, which decreased in the years prior to quota management but then increased in the first two years of quota management (Figure 2). These trends are also consistent with the suggestion (Section 5.1.1.1) that several operators brought licenses from those leaving the fishery in the years prior to quota and then consolidated their holdings onto one vessel.

5.1.1.3 Length of vessel

There was no significant change in the overall distribution of the length of vessels operating in the fishery during the 96/97 and the 00/01 fishing seasons (Figure 3). Thus, while numerous vessels left the fishery with the advent of quota management this did not affect the size structure of the fleet.

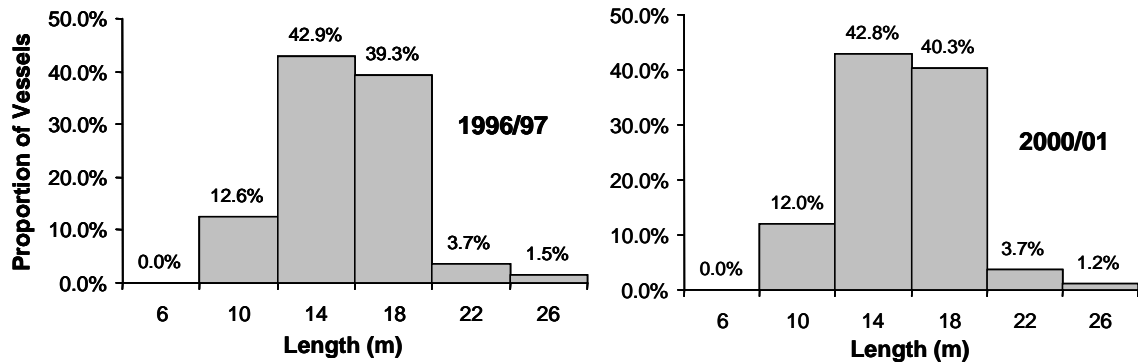


Figure 3. The length distribution of the fleet fishing in the 96/97 and 00/01 fishing seasons.

5.1.2 Fishers who left the fishery with the introduction of quota management

In Section 5.1.1 it was shown that the number of vessels operating in the fishery dropped with the introduction of quota management. The present section looks at this change in more detail to see if those who left the industry after quota was introduced (termed “leavers” throughout this section) tended to have common characteristics. To identify the leavers we checked each vessel fishing between March 1996 and February 1998 to see if they had stopped fishing any time before the 2001 season; that is, before February 2001. A consideration of the number of “leavers” who actively fished during each month from Mar 1996 until Feb 2001 gives an indication of exactly when they left the fishery (Figure 4). There was a steady decline in the amount of fishing by leavers with the largest decrease occurring at the beginning of the introduction of quota management in March 1998.

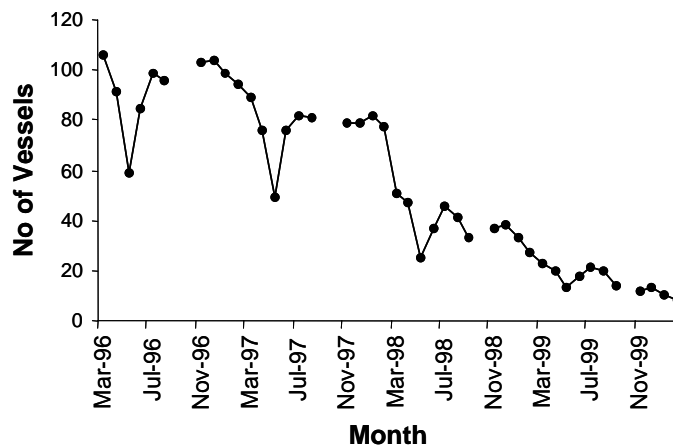


Figure 4. Number of “leavers” fishing. The periodic dips in the graph represent months of winter fishing when many vessels choose not to participate actively in the fishery.

The average number of pot lifts per month in 1996/97 and 1997/98 for vessels that left the fishery was generally less in each calendar month compared with those that remained in the fishery at Feb 2001 (Figure 5). This suggests that those that left the fishery tended to fish less than those who chose to remain in the fishery.

Vessels that left the fishery took a higher proportion of their catch from Areas 1 and 2, on the South East of Tasmania, which includes the major port of Hobart, in the two years prior to quota (Figure 6).

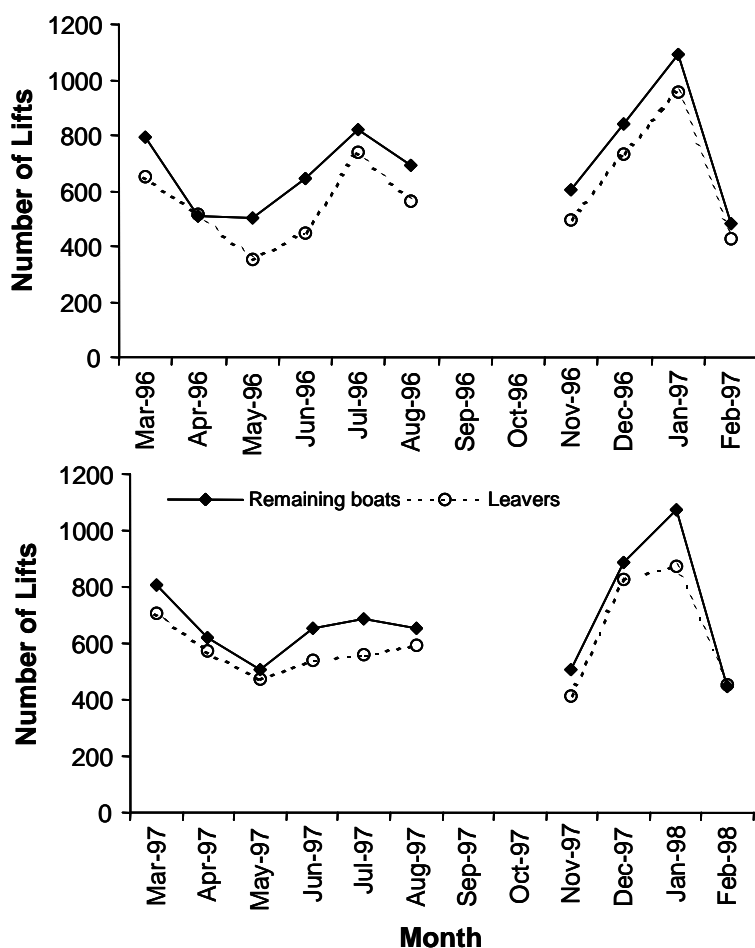


Figure 5. Average potlifts per month from March 1996 to February 1998 for the vessels that left the fishery after quota management was introduced compared to those that remained in the fishery.

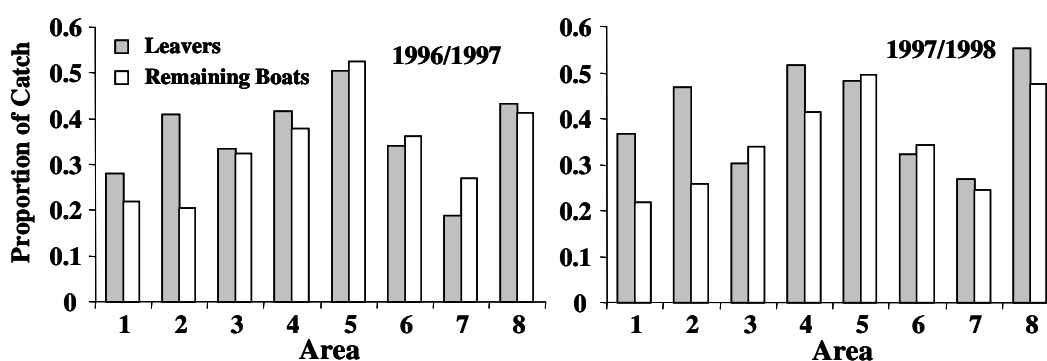


Figure 6. Average proportion of yearly effort in each Area amongst all boats and those that left the fishery in either 98/99 or 99/00

It has been suggested that those vessels leaving the fishery were possibly the less efficient operators. This should be apparent when we compare their catch per unit effort (CPUE) with that of the other vessels in the fleet. We define CPUE to be the weight caught in kilograms per pot lift. As CPUE data tends to be log normally distributed, the natural logarithm of CPUE ($\ln\text{CPUE}$) was used in the comparisons; the average of the $\ln\text{CPUE}$ for each vessel and each month were compared. The vessels were divided into two groups: The leavers (those who fished in the two years prior to quota, between March 1996 and February 1998, but left the fishery sometime after this

time) and those who remained fishing during the 2000/2001 fishing season (remaining boats). The leavers did tend to have a lower catch rate than those who remain in the fishery (Figure 7). This has an important implication for the management of the fishery as the remaining vessels should have higher average CPUE in the following years, which will lead to an increase in CPUE that is not connected to an increase in stock abundance. This demonstrates the effect a change in composition of the fleet has on CPUE and highlights the need to standardize catch rates to ensure confidence when using it as a measure of abundance.

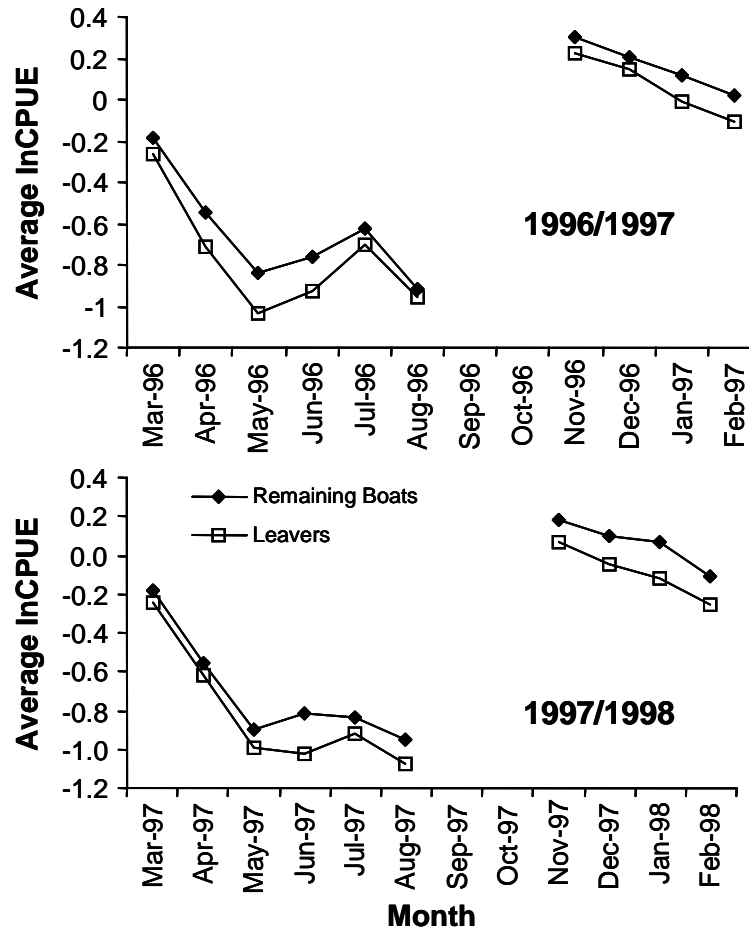


Figure 7. The average lnCPUE (kg/potlift) for “leavers” from the 96/97 and 97/98 fishing years compared with boats that were still fishing during the 2000/2001 fishing season.

5.1.3 Temporal Allocation of Catch

It was expected that the introduction of quota management would encourage fishers to maximize profits rather than catch and so would have effects on the temporal (seasonal) allocation of effort and catch throughout the year. Before these analyses, it is important to understand the historic and economic factors that have influenced fishers’ seasonal fishing behaviour.

Historically, fishing effort and catch were concentrated during the summer months when catch rates are relatively high. During the 1990s, the development of a live fish market in Asia saw the price of rock lobster during winter months fetch up to twice that of the summer months. Over the past ten years, the maximum and the minimum of the

average recorded monthly price through each year exhibited a minimum difference of approximately \$20 and often more (Figure 8). Between 90/91 and 93/94, the maximum price rose steadily, peaking during 93/94. Since then, the maximum price has stabilised and actually fallen slightly over the past few years. In contrast, the minimum price has remained roughly stable over the past 10 years. This is also apparent in the range between the maximum and minimum prices, which closely reflects the trends seen in the maximum price (Figure 8).

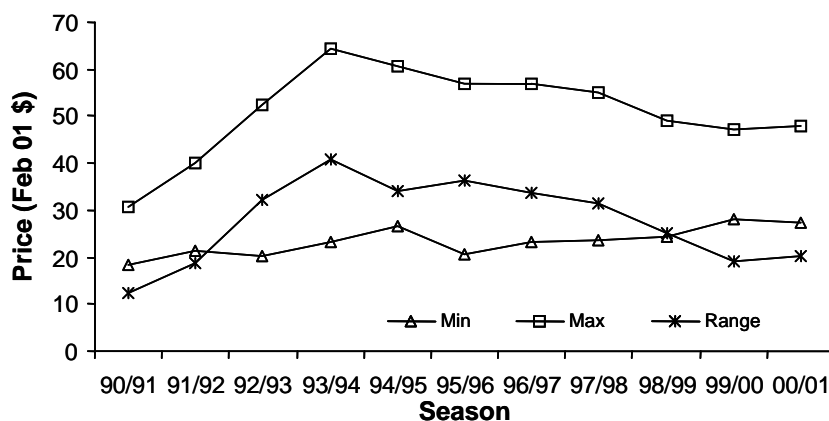


Figure 8. The maximum and minimum average monthly market price for rock lobster and the range between the two. Prices are indexed for inflation and given in terms of February 2001 dollars.

Prior to the introduction of quota, fishers maximised their returns by maximising their catch. Competition for lobsters caused fishers to fish hard and fast, early in the season, in order to catch their perceived share of the catch (Frusher, 1997). As the season used to start in November each year, this meant that fishers fished hard during the summer months when the price was low leaving less stock available when the higher prices in winter developed. Although the increase in price encouraged fishers to increase their winter fishing, it was not at the expense of their summer fishing patterns. This ‘race to fish’ at the start of the season reflected fishers’ concerns that if they didn’t catch the fish, others would (see socio-economic section).

With the introduction of quota management the fishing season was changed from one that ran from November until September each year to one that runs from March until February. With this change, management hoped to encourage fishers to fish in a more economically driven manner as fishers are now under pressure to maintain their financial return on their now limited catch. A fisher must decide between fishing harder in the summer months when catch rates are at their highest or fishing during the winter months with the aim of fetching higher per kilo prices but at lower catch rates and therefore higher per kilo costs. Fishers must also ensure their entire quota has been caught prior to the end of the season in February each year. Saving quota for the final months of the season gambles on favourable catch rates, good prices, and good weather during this time. Moreover, trading quota is not profitable at this time as the market value of quota drops considerably because supply exceeds the demand as fishers try to obtain some return on quota they cannot feasibly catch before the season end.

To facilitate this investigation we have divided the months of the year into two groups. The “winter months” from April until September, and the “summer months”, which incorporate all other months when the season was open for fishing. To investigate the relative level of participation in the fishery over summer and winter we first determined

the number of vessels that actively participated in the fishery during the year. That is, the vessels that submitted a catch return. Of these vessels, the proportion that fished during at least one of the winter months and those that fished during at least one of the summer months were then determined (Figure 9A). The proportion of the vessels fishing during each month of the year was also calculated (Figure 9B, C and D). From these figures, it is apparent that the proportion of vessels fishing in winter has increased, following roughly the same trend for the last decade. There does not appear to be a noticeable change in this trend since the introduction of quota. In contrast, in Figure 9D we see that the proportion of vessels fishing in each summer month fell slightly, prior to the introduction of quota in 1998, and since then has decreased significantly. This suggests that some vessels are now moving towards taking more of their catch during the higher pricing period of winter. The months that have seen the most marked changes are November and February.

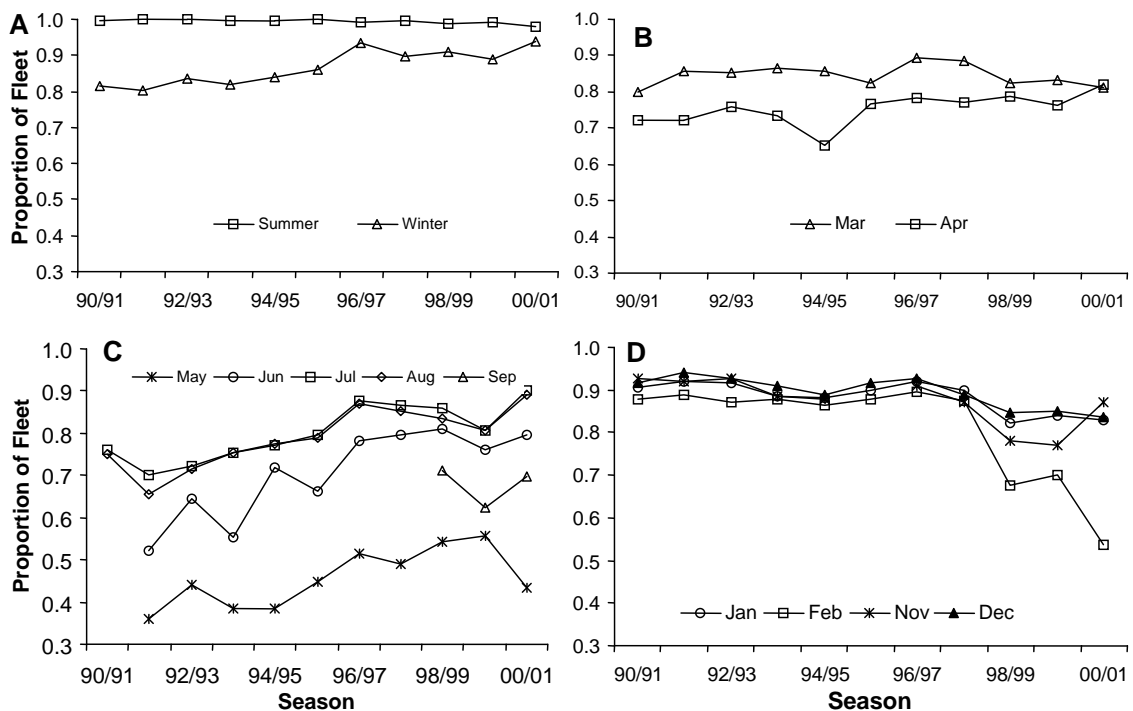


Figure 9. Proportion of vessels that fished in (A) at least one of the summer months from November to March compared with the winter months of April to September, (B) the months of March and April. (C) each of the winter months from May to September, and (D) each of the summer months from November to February.

To isolate temporal changes in the allocation of effort and subsequent catch, the proportion of each vessel's yearly catch taken during the winter months was calculated. Relative frequency distributions of the proportion caught in winter for each year since 90/91 were determined, with large differences between the 90/91 and 00/01 seasons being obvious (Figure 10). As there are 10 years data to compare, plotting the distributions for each year using a bar chart representation would be difficult to interpret. Instead, to visualise how the distributions have altered with time, a time series representation of these distributions is presented (Figure 11a). The relative number of vessels taking 20% to 40% of their catch during winter has increased markedly since the 90/91 fishing season, while those taking 20% or less during winter has decreased (Figure 10 and Figure 11). In the last three years, there has also been an increase in vessels taking between 40% and 60% of their catch during winter months. This demonstrates that not only has there been an increase in winter fishing over the

past 10 years, but this effect has been more apparent since the introduction of quota management in 1998.

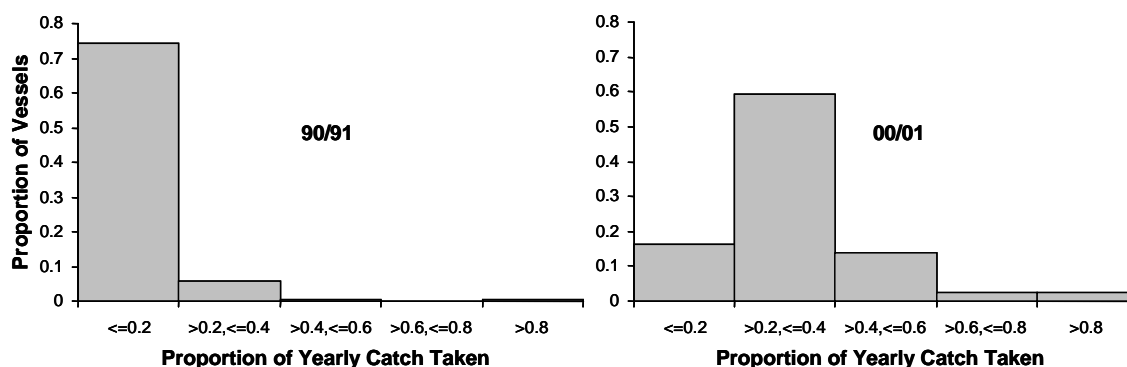


Figure 10. The relative frequency distribution of the proportion of catch taken in winter for the fishing seasons 90/91 and 00/01.

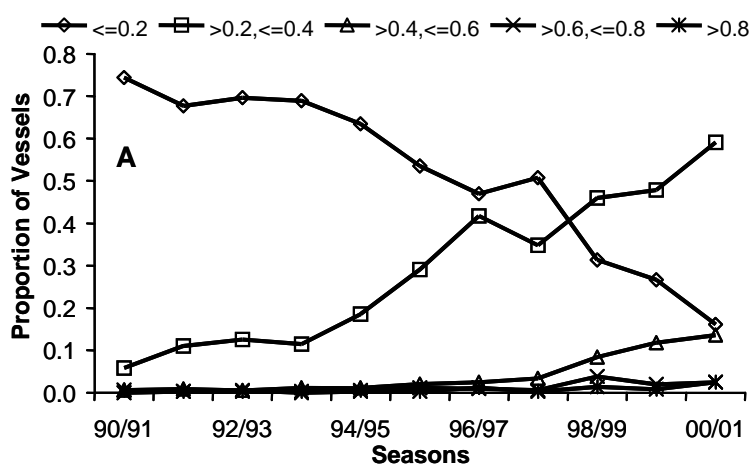


Figure 11. The relative distributions of the proportions of a vessel's yearly catch taken during the winter months of April through to September.

The averages of the distributions were also found (Figure 12). The average proportion of catch taken in winter has increased continuously between 90/91 and 00/01. The relationship between the proportion of catch taken during winter and fishing season can be described by an exponential curve (Figure 12) implying that the rate of change to winter fishing is increasing each fishing season. Thus, the increased winter catches since the introduction of quota are simply an extension of the pattern occurring prior to implementation of the ITQ management system. This is not unrealistic, as the improvement in winter prices would enable lower catch rates in winter to yield improved profits.

It is also possible to treat the data as distinct before and after datasets. The pre-quota data show a linear increase in the proportion of winter catch from 90/91 to 97/98. If this trend is extrapolated to the post-quota winter catches, all post-quota catches are above the trend line. This would suggest that the introduction of quota had an immediate effect on the proportion of the catch taken during winter. With only three post-quota data points, it is difficult to determine the relationship since the introduction of quota. It is possible that the trend could reflect the pre-quota trend although at a higher elevation. To determine if the post-quota winter catches are a continuation of a trend since the early nineties (exponential trend) or whether they have a separate new

relationship (e.g. a new linear trend) at least two more years of data will be required. Despite the uncertainty of the actual impact of the ITQMS, there are two issues that are apparent. There has been an increase in winter fishing that started before quota was introduced and, since the introduction of quota, there has been an increase in the rate of increase towards winter fishing.

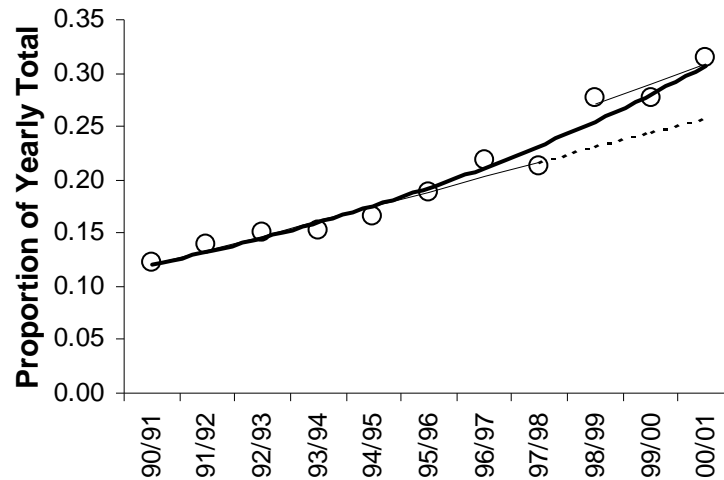


Figure 12. The average of the proportion of a vessel's yearly catch taken during the winter months of April through to September. Alternative descriptions of this information are possible. Illustrated are two linear relationships (thin solid line - sharing a common intercept, 0.1063 and separate gradients, 0.0138 and 0.0183 respectively) representing pre- and post quota trends, and an exponential curve (bold solid line - Proportion = $0.1098 \exp(0.0935 \text{ Season})$, where season was an index from 1 to 11, $r^2 = 0.9738$). The pre-quota linear trend ($r^2=0.9468$) has been extrapolated (broken thin line) to highlight the increased post-quota winter catches.

As a large number of vessels left the fishery after quota was introduced, it is natural to ask whether the exit of these vessels was solely responsible for the change in the trends of winter fishing, or whether the vessels that remained in the fishery are changing toward winter fishing. In fact, those vessels that left the fishery, on average, fished a greater proportion of their catch in winter (Figure 13). It is clear that the vessels that left did not greatly affect the trends seen in the average values, and any effect would have been to reduce the average proportion of winter fishing. Therefore, the vessels that remained in the fishery after quota did increase their winter fishing patterns.

To see how economic factors are related to the move towards winter fishing we compare the market price for Rock Lobster with a vessel's catch rate and the return on their catch.

Each vessel's monthly catch per unit effort (CPUE) was calculated by dividing the total weight caught in kilograms by the total number of pot lifts used to catch this weight. A vessel's expected return for its catch was estimated by multiplying the weight caught by the average market value for the month in which the catch was caught. All prices were indexed to Feb 2001 dollars to make comparisons between years meaningful. The return per unit effort (RPUE) was computed by dividing the number of pot lifts applied to obtain this return.

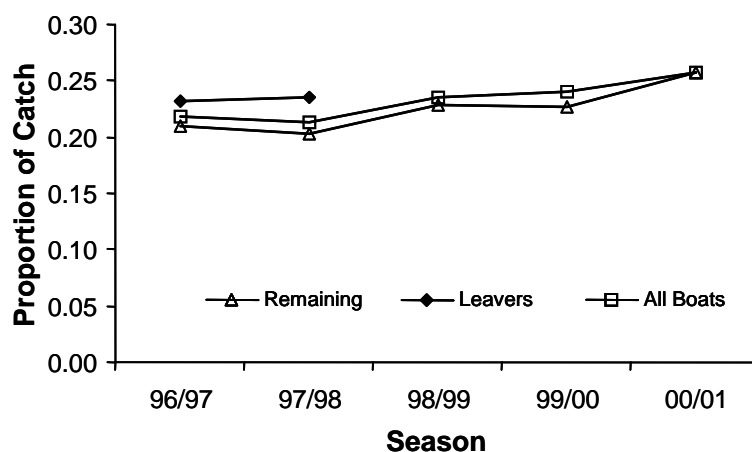


Figure 13. The average proportion of catch taken in the winter month by vessels that left the fishery after quota management was introduced compared with those who remained

As is standard practice, natural logarithms of the CPUE and RPUE were taken. We let LnCPUE and LnRPUE denote the logarithms of these values. To deal with zero values a small number was added to each monthly CPUE and RPUE prior to applying the logarithmic operator. The resulting distributions of LnCPUE and of LnRPUE for all vessels for each month and for each year were found to be approximately normal distributed. The average monthly LnCPUE and LnRPUE for each month were calculated and plotted for the 93/94 year (Figure 14). This year was chosen for investigation as it represents a year in which the price differential for the summer and winter market value of rock lobster was at its peak. The low LnCPUE seen in winter months is offset by the price so that the LnRPUE over winter is closer to the summer average.

The yearly averages of the LnCPUE and LnRPUE for each vessel over all months were found and the averages over all vessels are plotted (Figure 15). Comparing the average LnCPUE and LnRPUE over a year for the entire fleet captures the effect that the seasonal change of price along with the move to winter fishing has had on the economics of the fishery. Although catch rates were falling during the early 1990's, the large differential between summer and winter price for lobster made winter fishing profitable and on average fishers maintained an increasing LnRPUE (Figure 15).

It is clear that vessels were increasing their winter fishing throughout the 1990s and this increase appears to have been amplified since the introduction of quota. Moreover, it demonstrates that fishers alter their temporal allocation of effort for reasons other than catch rate alone and highlights a need to develop economically based models to describe fisher behaviour.

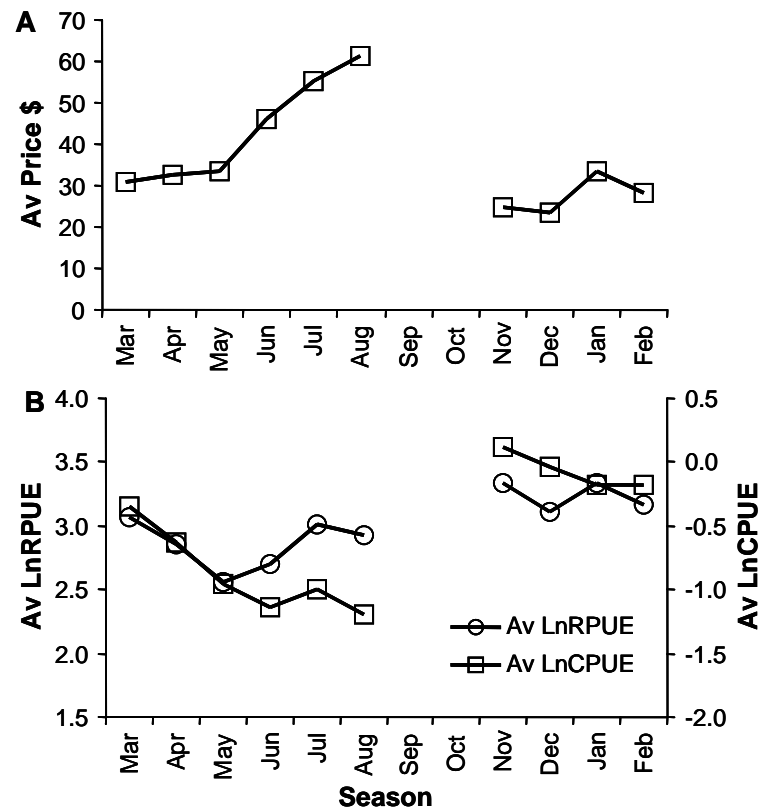


Figure 14. (a) The average monthly market value of rock lobster during the 93/94 fishing season. Values are given in terms of Feb 2001 dollars. (b) The average of the logs of each vessel monthly catch per unit effort (LnCPUE) and log return per unit effort (LnRPUE) for the 93/94 fishing season.

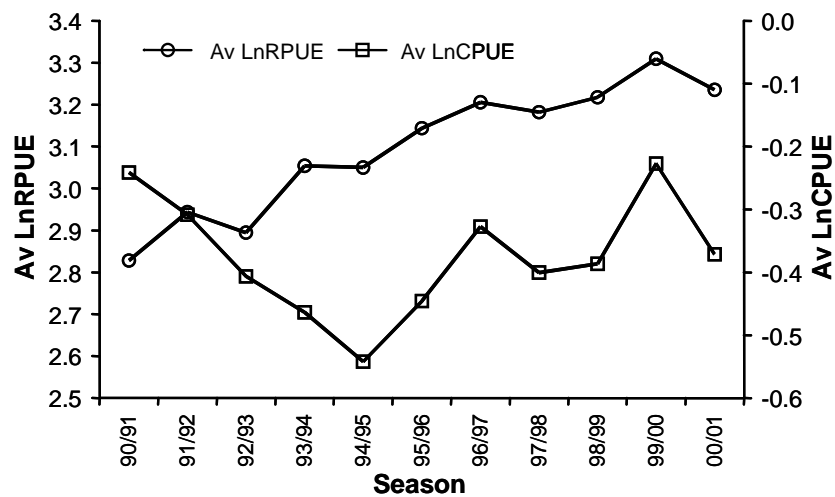


Figure 15. Averages of yearly average of a vessel's logged monthly catch per unit effort (LnCPUE) and return per unit effort (LnRPUE).

5.1.4 Spatial Allocation of Catch

Interviews with fishers highlighted the belief that many fishers are now fishing more locally or possibly in shallower inshore sites. The feeling is that as there is no need to race to the catch, the need to travel large distances to target higher density fishing areas is reduced and fishers choose to fish in more convenient locations. In this section, we investigate the spatial changes apparent in the catch and effort data.

There are two spatial grid patterns commonly used in the rock lobster fishery to divide catch (Figure 16). Currently fishers are required to report their catch location in reference to a half-degree grid pattern. Each cell in this grid is referred to as a *block*. For stock assessment purposes catch is also divided amongst 8 regions. These larger regions are known as *areas*.

If fishers have started to “localise” their efforts, we would expect that the number of regions fished over the year has started to decrease. There are a number of advantages to exploring this question on both recognized spatial scales. The larger areas give us a general sense of how far a fisher moves during the year, whereas the small blocks provide a more refined analysis. At the area level, we can follow a fisher’s catch back to 1983 whereas fishers have only recorded their catches using the half-degree block grid since 1993. There is concern that fishers falsify their spatial records to ensure the privacy of their catching history. Although this may be apparent when associating catch to block it is unlikely that this would affect an analysis at area level.

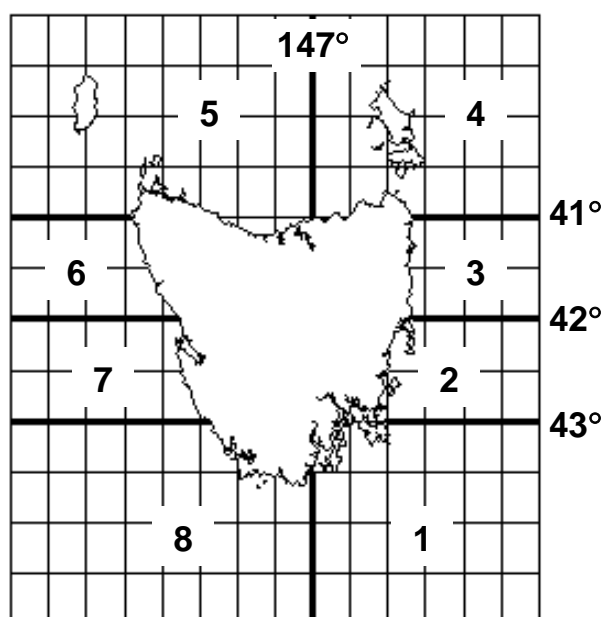


Figure 16. Tasmanian rock lobster fishery assessment areas and half-degree statistical reporting blocks. Fishers have been required to report their catches in relation to the half-degree block scale since 1993. The larger regions defined by the darker lines are the boundaries of the eight areas used to divide the catches for stock assessment purposes.

For each vessel and for each year since the 83/84 season, the number of different assessment areas in which their catch was taken was calculated. There is an eighteen-year history, so the frequency distributions of the number of assessment areas fished during the year are only plotted at nine-year intervals (Figure 17). A time series

representation of these distributions for the full eighteen years illustrates the trends involved (Figure 18).

The frequency distributions from all years are skewed towards fewer numbers of areas fished (Figure 17). In the 83/84 season, fewer areas were fished over the year but by the 91/92 season, fishers were tending to fish in more assessment areas. This is clearly seen when the proportion of vessels fishing in only 1-2 areas decreases during the 1980s while the proportion that fished in 3-4 areas increased (Figure 18). During the 1990s, there was some further variation to the distributions but no clear trends are apparent.

The average increased approximately linearly during the eighties until around 87/88 and then exhibited a slightly negative linear decline (Figure 18b). To isolate the two separate trends, a piecewise linear curve was fitted which had the form:

$$y = \begin{cases} m_1x + c & \text{where } x \leq 0 \\ m_2x + c & \text{where } x \geq 0 \end{cases}$$

where x is the number of seasons from the 87/88 season (i.e.: $x=0$ when the season is 87/88 and $x=3$ when the season is 90/91), y is the average number of areas and m_1 , m_2 , and c , are parameters to be estimated. Note that the equations share the data in 87/88 and that the c parameter is the estimated average number of assessment areas in that season. The least squares linear regression on positive values of x gave $m_2 = -0.0186$ and $c = 2.841$. Holding c constant at this value, the second line was fitted with a least squared residual solution of $m_1 = 0.149$. The fitted line suggests that the average number of areas fished was increasing at a rate of 0.149 areas per year until the 87/88 season and then began to decrease at a rate of 0.0186 areas per year.

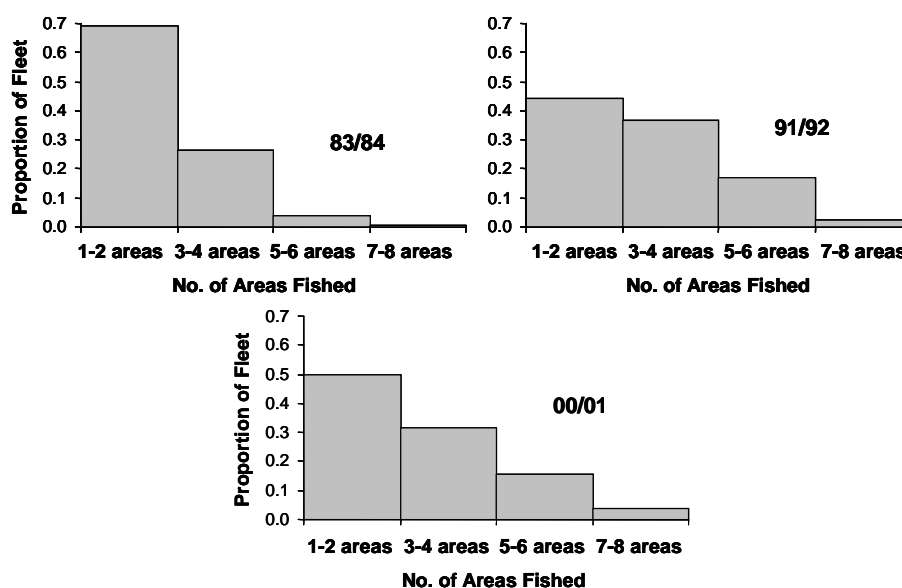


Figure 17. Relative frequency distribution for the number of areas fished by a vessel for the 83/84, 91/92, and 00/01 fishing seasons.

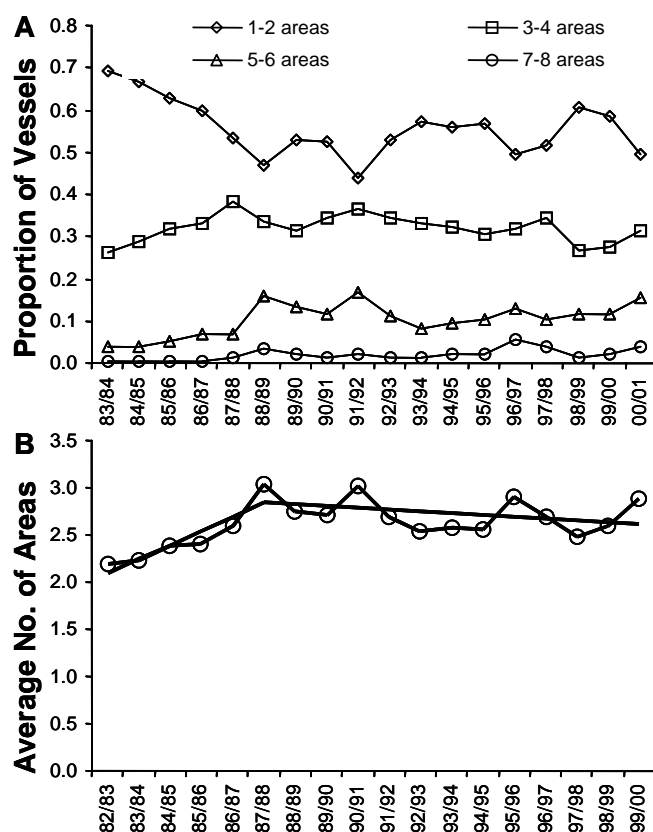


Figure 18. (a) Time series of the relative frequency distributions of the number of areas fished by a vessel during a season and (b) the average number of these distributions. The gradient (increase per year) from 82/83 to 87/88 was 0.149, while from 87/88 to 99/00 it was -0.0186 .

The increasing trend in the eighties could possibly be linked to the introduction of GPS systems, falling catch rates, which were characteristic of the fishery at this time, and the discovery and exploitation of additional fishing grounds. The curves are also marked by a number of periodic peaks which possibly correspond to unusual events in the fishery such as exceptional catch rates in a particular area attracting fishers who normally would not fish there, unusually low catch rates causing fishers to seek alternative grounds, or unusual weather patterns forcing fishers to adjust their fishing patterns. In the last three years, which correspond to the first three years of quota management, there was a decrease in those fishing in one or two areas in the 98/99 and 99/00 seasons, but this possibly offsets an increase that occurred over previous seasons. In the 00/01 season, we again see fishers tending to fish in more areas. Therefore, these plots supply no evidence to suggest that the variation is connected to the onset of quota management.

It could be argued that counting the number of areas fished does not take into account the amount of effort fished in each area. An area is counted regardless of whether there is one or several thousand pot lifts applied to that region. The same analysis was also performed by counting only those areas where a vessel had taken more than 5%, and more than 10%, of its yearly catch. The distributions were found to be similar to those above and so provided no extra information; this was not pursued further.

To investigate the question on a smaller spatial scale we computed the number of statistical reporting blocks a vessel fishes in throughout a season. The data available provides an eight-season history. The relative frequency distribution of the number of block fished during the 92/93 and 00/01 fishing seasons indicate that for both seasons the distributions are skewed towards a low number of blocks (Figure 19). There does appear to be a small move toward fishing in more blocks over the past eight years.

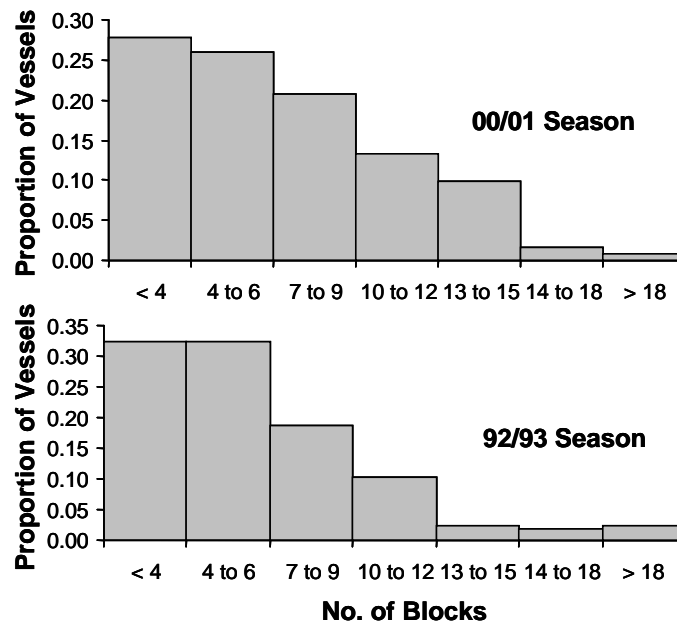


Figure 19. Relative frequency distribution for the number of half degree statistical reporting blocks fished by a vessel for the 92/93 and 00/01 fishing seasons.

This is better demonstrated where a time series representation of these distributions is given for all eight years of data and the average of these distributions are plotted (Figure 20). During the past few years, there has been a decrease in the proportion of vessels that fish in three blocks or less per year and an increase in those fishing in four or more blocks. This is apparent in the plot of the average values, which is seen to have increased over the past two years. Thus, these figures provide contrary evidence to the claim that fishers are tending to fish more locally since the introduction of quota. It may best be interpreted to imply that fishers are spreading their effort across more blocks but within fewer areas.

Again there is some danger that the number of blocks fished during a year could be exaggerated as blocks are counted regardless of the amount of catch caught in that block. Only counting blocks where at least 5% of a vessel's catch was taken did little to change the trends present.

Another indication of the change in the spatial allocation of effort, which has the advantage of incorporating the size of the yearly catch taken from a block, is the proportion of a vessel's catch that is taken from their primary fishing block. For each vessel we identified the block in which most of their yearly catch was taken and computed the proportion of their yearly catch that was taken from this block. The relative frequency distributions for the 93/94 and 00/01 seasons were once again considered (Figure 21), as was a time series representation of these distributions over the past eight years (Figure 22a). The averages of these distributions were also

calculated (Figure 22b).

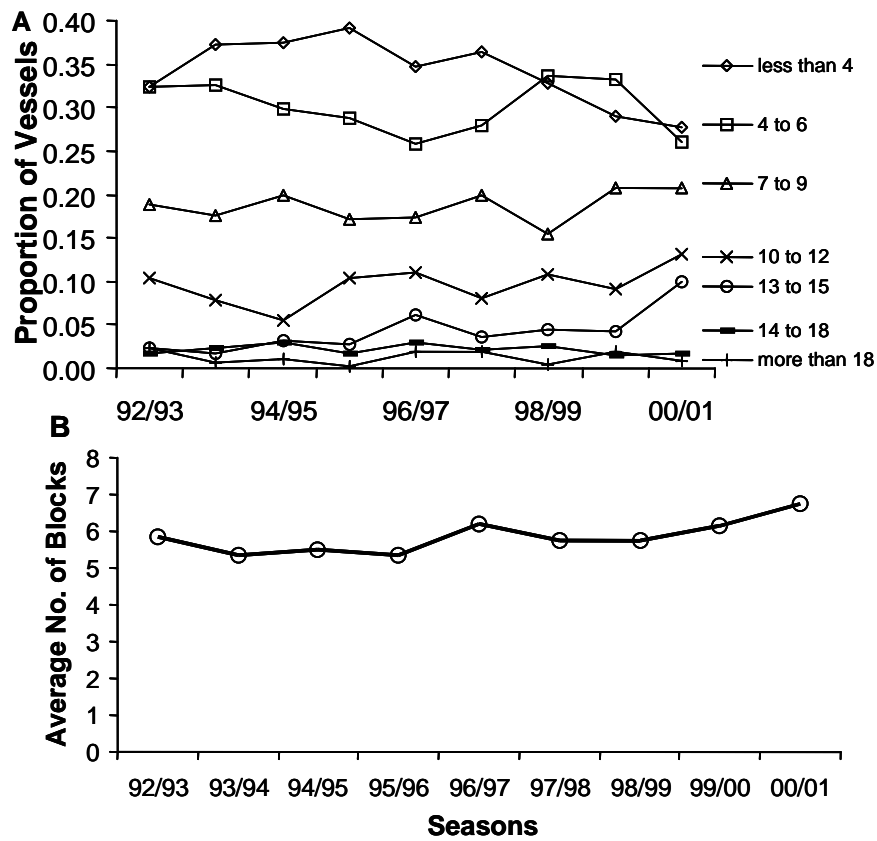


Figure 20. (a) Time series of the relative frequency distributions of the number of statistical reporting blocks fished by a vessel during a season and (b) the average of these distributions.

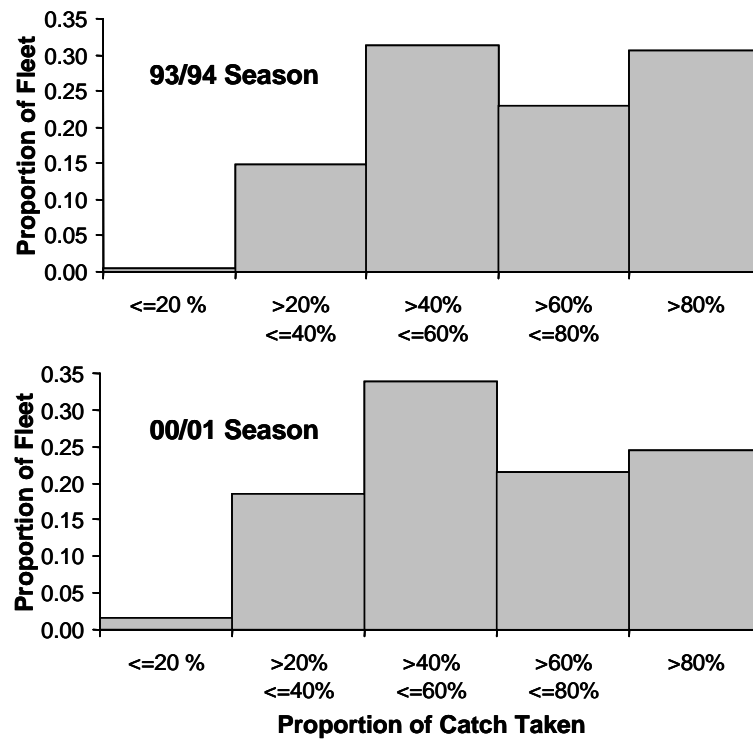


Figure 21. Frequency distribution for the proportion of catch taken in the primary catching statistical reporting block during the 93/94 and 00/01 seasons.

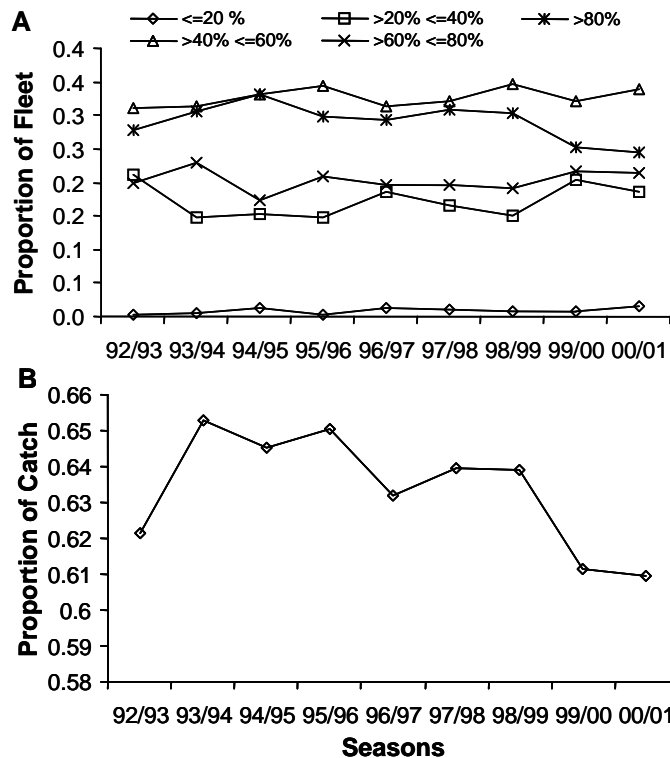


Figure 22. (a) Time series of the relative frequency distributions of the proportion of catch caught in primary fishing block and (b) the average of these distributions.

One would expect that if fishers were localising their efforts through time, a larger proportion of their catch would come from their primary fishing block, while if they

were extending their fishing grounds, the proportion of their total catch taken in the primary block would become lower. The distributions of the proportion caught in a vessel's primary catching block for each year since 92/93 are strongly skewed with vessels tending to fish the majority of their catch in their primary block. It appears that the 92/93 fishing season portrays unusual behavior. If we exclude this season it seems that the proportion caught in a vessel's primary catching block has on average been decreasing since 93/94. In the 99/00 and 00/01 seasons it appears that vessels who once tended to fish 80% or more of their catch in one block are now spreading their effort to other blocks. This does not appear to support the claim that fishers are tending to localise their efforts.

As a large number of vessels left the fishery after quota was introduced it is important to determine whether these vessels may have been fishing "more locally" or "less locally" which would affect the interpretations of the graphs given above. It becomes apparent that the vessels that left the fishery after quota was introduced tended to fish in fewer blocks, suggesting they were more local fishers (Figure 23). Moreover, they caught a larger proportion of their catch in their primary fishing block. Although this has some affect on the data given for all boats regardless of whether they left the fishery or not, the conclusions given above are still valid. That is, there is no evidence from this data to suggest fishers are becoming more local in their fishing patterns at the scale of the statistical reporting blocks.

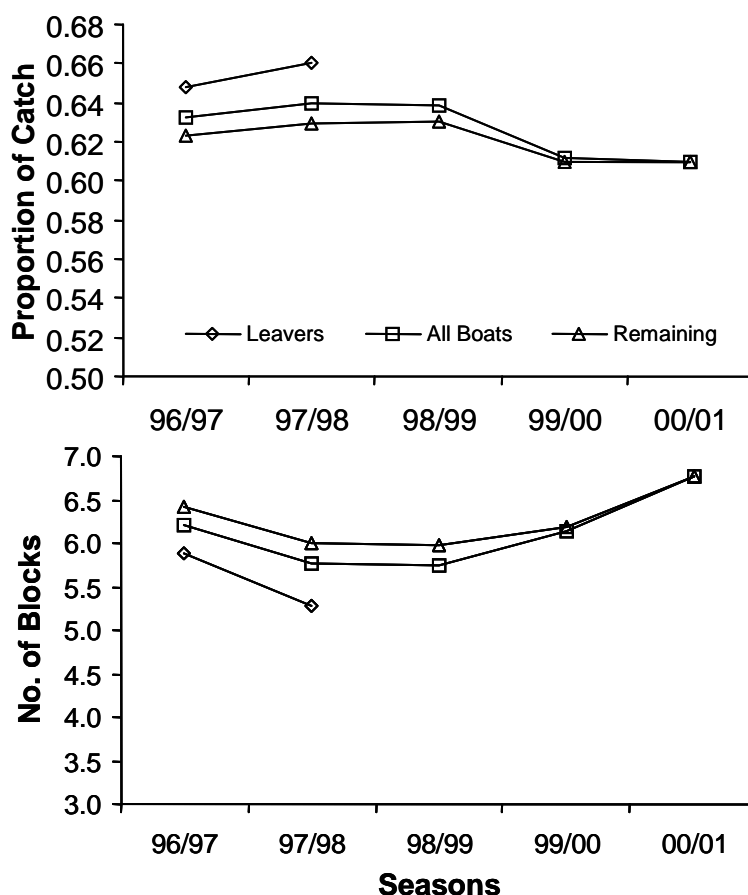


Figure 23. The average number of blocks fished and the average proportion caught in the primary block for vessels that remained in the fishery and those who left.

Looking at the distribution of vessels' catches amongst blocks and areas, there appears to be no evidence to suggest that fishers efforts have localised there efforts. One proposed explanation for this phenonema is that while fishers are decreasing the number of areas in which they fish, they are increasing the number of statistical blocks in which they are fishing. This may be because they are fishing at a greater number of shallower inshore sites. Depth data is available from 1993 onwards and so we explored this question further.

To investigate the allocation of effort amongst depths, each vessel's catch was separated into two categories. That caught in what is considered by industry to be shallow depths (10 fathoms/18 metres or less), and that caught in deep water (greater than 10 fathoms). The proportion of their yearly catch caught in shallow water was determined along with the relative frequency distributions of these proportions. The distributions for the 93/94 and 00/01 fishing seasons are plotted in Figure 24 and a time series representation of these distributions for the past 7 years is given in Figure 25a. The average of the distributions are also given (Figure 25b).

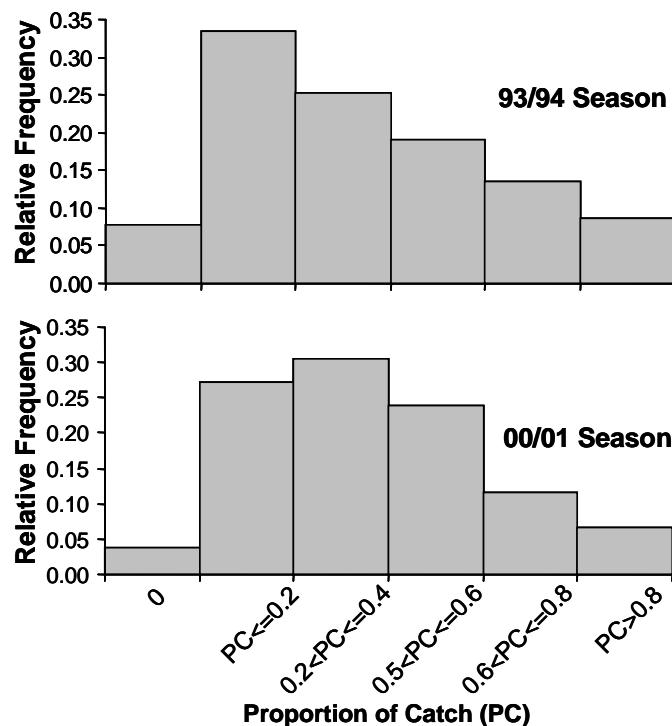


Figure 24. Relative frequency of the proportion of catch caught in shallow water sites.

The relative frequency distribution of the proportion of a vessels yearly catch taken from shallow depths is strongly skewed, with more vessels tending to fish the majority of their catch in depths of greater than 10 fathoms. It appears that in the last three years, since quota was introduced, the spread of these distributions has changed. A lower proportion of the fleet take under 20% of their catch from shallow sites and a higher proportion of the fleet take between 20% and 60% of their catch from shallow sites. On the other end of the scale, there has also been a decrease in the proportion of the fleet taking over 80% of their catch from shallow sites. Although the spread of the distributions has changed, the effect on the average is less apparent. There appears to

be a small increase in the average depth fished over the past three years but this increase does not fall outside the scope of variability suggested by earlier years' data.

As we saw there was limited evidence to suggest that vessels may be redistributing their efforts amongst depths. To determine if this had an overall effect on the allocation of the total commercial catch amongst depths, the portion of the total catch taken from shallower water was determined for each year since 93/94 (Figure 26). An inspection of this graph suggests that there has been an increase in proportion of the catch taken in shallow water. However, given the variability of the data a 5-year history is not enough to draw firm conclusions. This is apparent from the low R^2 value of 0.0825 for the trend line fitted to data for the years between 93/94 and 97/98, the years prior to quota management. Under the linear model, the 80% prediction interval for the 98/99 average value, calculated from a t-distribution with 3 degrees of freedom, is (0.186,0.415). The observed value of 0.320 falls easily within these bounds. Therefore, there is no evidence to support a claim that since the introduction of quota there has been an increase in the portion of commercial catch taken from shallower sites, which falls beyond that expected. This portion appears to have been relatively stable since the 98/99 season (Figure 26).

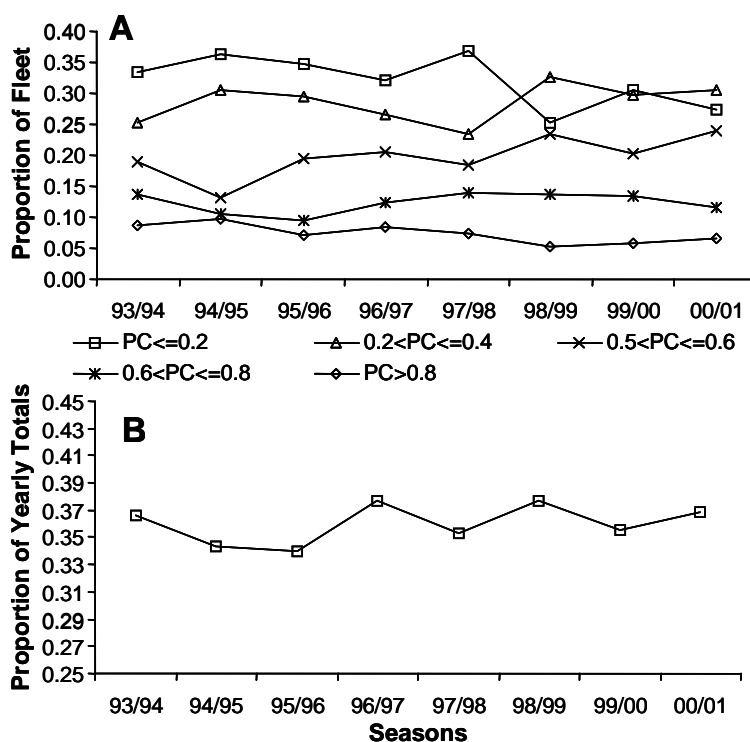


Figure 25. (a) Time series of the relative frequency distributions of the proportion of catch caught in shallow water and (b) the average of these distributions.

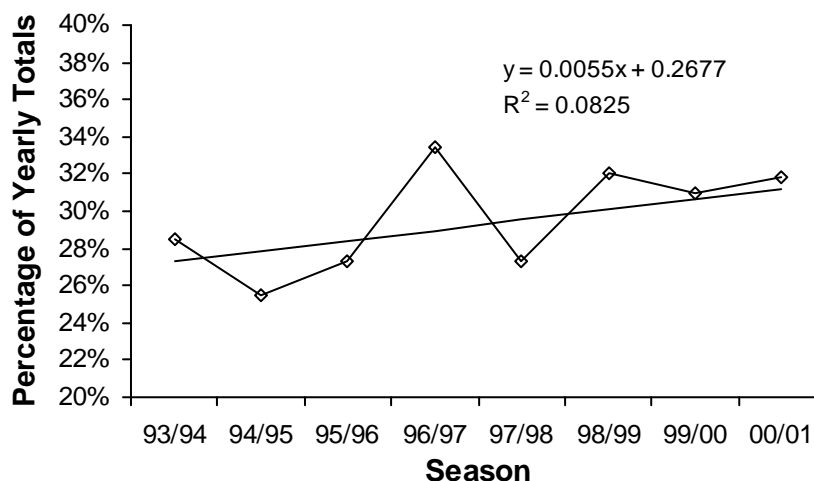


Figure 26. Percentage of total years catch caught in shallow water with linear trend fitted to data from 93/94 until 97/98.

A summary of the depths fished by the “leavers” exhibits high levels of variation (Figure 27). Due to the high variability exhibited in the proportion taken by depth, (Figures 24 and 25) we have traced leaver vessels as far back as 1993. They are compared to the vessels that were continuing to fish in the 2000/2001 season. In the 97/98 season it is clear that the leavers were fishing more of their catch in shallower water however prior to this time their depth allocations closely follows the vessels who continue to fish. This does little to alter the conclusions given above as the trend of averages for the remaining vessels still shows great variability. Thus, while the data does not contradict the possibility that, since quota, vessels have the tendency to fish in shallower depths, neither does it provide conclusive evidence to support the claim.

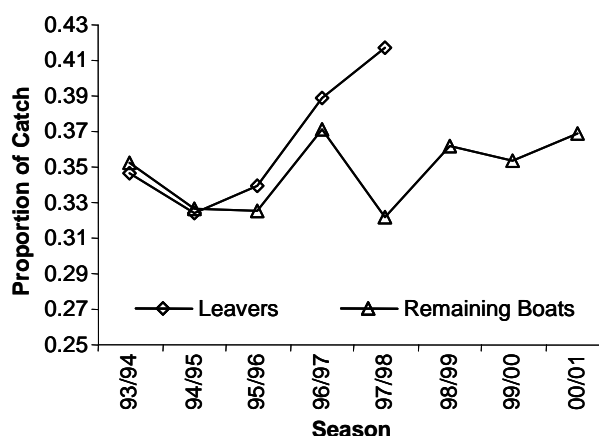


Figure 27. Average proportion of catch taken in shallow water by the boats remain in the fleet compared with all boats in the fishery.

5.1.5 Conclusions on analyses of fleet dynamics

As we have seen in this section, it is difficult to attribute changes that occurred in the years following the introduction of the quota management system to the change in

management. Nevertheless, a number of trends in fishing patterns have emerged.

- The number of vessels and entitlement owners participating in the fishery saw a large decline in the first two years of quota management. This decline has continued but at a much lower rate.
- The proportion of vessels operated by owner-operators saw a decrease prior to the introduction of quota management but increased after quota was introduced. It is suspected that these changes reflect a shuffling of licences amongst entitlement holders, rather than a significant change in the nature of the fishery.
- The length composition of vessels participating in the industry has seen no significant change.
- There has been a continuation of a trend of increasing fishing effort in winter and less in summer. This trend has been apparent for 10 years. However, since the introduction of quota this move to increased winter fishing appears to have increased.
- Vessels do not appear to be localising their effort in terms of the number of statistical blocks in which they choose to fish in throughout the year. There may be some localization of effort within the eight assessment regions around Tasmania.
- There is a possibility that vessels may be fishing in shallower sites but the data provides little evidence to support this claim.

5.2 Interview derived fleet dynamics data

5.2.1 Introduction

This report summarizes fishers perceptions of the changes in their fishing behaviour since the introduction of quota. In comparison to the previous section, which described changes in the fleet dynamics based on quantitative changes derived from fishers logbook returns, the text and statistics in this report are derived from interviews with fishers. The two perspectives on fleet dynamics resulting from the project make triangulation (Denzin and Lincoln, 1994) of fleet dynamics possible. In other words, each provides a different way of approaching fleet dynamics, is complementary with the other, and can be used in combination. The data set used in each has its strengths and weaknesses. Quantitative analysis of logbook data has a greater coverage of the fleet over a longer period of time, but may possibly be subject to greater uncertainty due to the questionable reporting practices of many fishers. For example, in 41 or 16.5 per cent of interviews, participants questioned the reliability of fishers' catch returns. Before the introduction of quota management, fishers state that both catch and area were falsified by some fishers. Although falsification of logbook data is considered by most fishers to be reduced after implementation of quota, some fishers still falsify area and effort, and, to a lesser degree, catch. In addition to providing a different perspective on fleet dynamics, interview derived fleet dynamics data can be used to

verify trends found from analyses of logbook data.

The coverage from interview derived data is not as complete as logbook data as not all fishers were available to be interviewed and most of the comments relate to current events and thus there is limited historical data. However, it may be more reliable due to the use of a different reporting frame. The catch returns are completed by fishers for the Department of Primary Industries, Water and Environment (DPIWE). Many fishers consider completion of catch returns to be onerous and are also suspicious of the motives and data security of DPIWE. Some fishers, therefore, are careless or perfunctory, and some are deliberately misleading, when completing parts of their catch returns. Many interview participants considered that catch returns were more reliable since the introduction of quota management – due to catch being more easily policed, a reduction in uncertainty regarding management change and an ebbing of competition between fishers – but that falsification continued to occur. While it was less likely that catch and time of year would be falsified under quota management, area and depth fished, and number of potlifts could still easily be falsified.

Data used to compile this report, on the other hand, were derived from interviews with fishers. Many participants preferred to talk rather than write about their fishing. That fishers were sharing information with social researchers from the University of Tasmania added impartiality and an ethical procedure to the reporting frame. It can not be claimed that data used in this report are free of falsification as it can be more satisfying to obfuscate in person than in print, but at least some factors contributing to falsification are minimised through the approach taken.

Finally, discrepancies may exist between data provided by catch returns and data derived from interviews. The question then is not which reporting frame is correct but why any discrepancy exists in the first instance. Each reporting frame has its strengths and weaknesses, and both contribute insight to changes in fleet dynamics since the introduction of quota management. Understanding is improved by having two perspectives on change. That ‘real’ change may lie somewhere between the two reporting frames is a matter for further research.

5.2.2 The data subset used

Variables relating to fleet dynamics are discussed in this report, namely:

- type of fisher;
- length of trip;
- number of people aboard;
- any change in depth fished;
- any change in time fished, both over the year and between summer and winter;
- any geographic contraction of fishing;
- area(s) fished prior to quota management;
- area(s) of operation when interviewed; and
- any emphasis on catching ‘quality’ rock lobster.

An example of the questionnaire is presented in Appendix 4.

Cases not relating to these variables have been culled from the data matrix used in this report. Cases removed are those with no direct relation to fishing commercially for rock lobster in Tasmania. Thus, 34 cases were removed, including brokers, investors and processors. This culling exercise leaves 213 cases; i.e. 213 interviews specifically with present and past Tasmanian commercial rock lobster fishers. The general types included are as follows: owner-operators; lessees; retired fishers; fishers who have left the fishery; boat drivers; and deck hands.

Entries regarding variables relating to cases have in some instances been standardised. Information in interviews is imparted verbally and is usually qualitative. Many words have been lost in fitting entries into shorthand categories in the data matrix. A sometimes difficult balance between preserving difference and identifying similarity is achieved differently for each variable. The full data matrix is a quarry from which subsets of data can be taken and analysed for particular purposes. The full data matrix has been constructed to contain as much difference as possible. The intention is that standardisation be kept to a minimum until a specific use is identified, as fine-grained difference may be important. In the case of fleet dynamics, however, much of the micro detail obscures the more macro patterns of interest to fishery biologists. Data used to produce the statistics presented have therefore been standardised to operate at an appropriate scale. Finally, statistics presented here in no way exhaust the possibilities of the data matrix. One output from the social research part of this project is therefore the data matrix itself. This is provided to fishery managers for possible further analysis according to more particular interests and expertise.

From this point, discussion largely proceeds one variable per section, starting with the types of fishers included in the data subset used in this report.

5.2.3 Types included

Of a total of 247 interviews conducted, 213 interviews (86.2 per cent) included individuals who were when interviewed, or had previously been, directly involved in fishing commercially for rock lobster in Tasmania. These 213 interviews involved many different types of participant. Further, more than one person was often included in an interview, in the role of a fisher's partner for example. Questions concerning fleet dynamics in an interview usually related to one boat, but in eight cases, more than one boat either was or had been involved in the fishing operation. The bulk of the 213 interviews, 135 or 63.3 per cent, involved owner-operators of some kind in the March 2000 to February 2001 Tasmanian commercial rock lobster fishing season. Given that only two owner-operators interviewed shared a boat, this figure represents at least 134 boats. A further 20 boats, or 9.3 %; can be added to this figure in the form of lessees. Overlap between the categories owner-operator and lessee is not relevant to the purpose in this report. Of primary importance is that 154 of the 213 interviews used to generate the statistics presented in this report represent at least one boat operating in the fishery. As noted, given that an interview could concern more than one boat, the figure represents more than 154 boats. A further five boats can be added in the form of boat drivers interviewed. An exact total of boats represented by the interviews active in the fishery at time of interview cannot be ascertained, but a figure of approximately 166, or 68.3 per cent of the fleet, is probable. The 51 of the 213 interviews not representing a

boat active in the fishery at time of interview is made up of those who had left or retired from the fishery since the introduction of quota management (22 or 10.3 per cent), deck hands (10 or 4.6 per cent), and ex-Tasmanian commercial rock lobster fishers who were fishing something and/or somewhere else, or had shifted out of fishing altogether (18 or 8.4 per cent). One investor has been included in the 213 interview data subset due to partnership with an ex-Tasmanian commercial rock lobster fisher leasing out both units and a boat. Data regarding fleet dynamics from this interview pertain to the ex-fisher.

Linda Eaton has calculated that 243 boats fished commercially for rock lobster at least once in the Tasmanian 2000/2001 season. The sample of approximately 166 reported here from 160 interviews represents over two-thirds of these boats. Given that only a sample of boats fishing is discussed, it is important to determine whether it is distributed geographically in a manner that corresponds approximately with the 'population' of 243 boats. This determination is discussed next.

5.2.4 Location of participants when interviewed

The main database used to contact participants was a mailing list of entitlement holders (Chapters 7). It was assumed that entitlement holders represented fishers and that location of participant when interviewed indicated area fished. From interview data, both surrogates proved adequate in the majority of cases. A geographic distribution of entitlement holders immediately prior to this study is given in Gardner (1999). The geographic distribution of the 213 interviews used in this report approximately matches that in Gardner (1999). There are only two major disparities, for Flinders Island and Smithton. These are explicable based on a declining number of entitlement holders but an increase in lessees on Flinders Island, and boundary differences between Gardner (1999) and this report in the case of Smithton. Boundary differences are introduced in the data matrix used in this report for reason of confidentiality. Some basic characteristics of the 213 cases are discussed next.

5.2.5 Length of trip and number of people aboard

Out of 213 interviews, 14 (6.6 per cent) generated no data on length of trip (Table 2).

Table 2. Length of trip

	Frequency	Per cent
Not stated	14	6.6
Overnight	121	56.8
Day (owner-operator), overnight (boat driver)	1	0.5
Both day and overnight	55	25.8
Day	22	10.3
Totals	213	100.0

In the majority of interviews, 121 or 56.8 per cent of participants fished commercially for rock lobster exclusively overnight; i.e. all fishing trips were greater than one day in duration. In over one-quarter of interviews, participants both overnight and 'day' fished; i.e. fishing trip length varied in a range between one day and multiple weeks. Many participants considered there to be a difference in fishing between single day and

overnight fishing. Single day fishing usually involved domiciling onshore, leaving port before dawn to pull pots on sunrise, re-setting pots and returning home, often before midday. Thus, only one night shot, usually inshore, was undertaken in a 24-hour period. This pattern may be varied in summer, particularly around the 'new shellers' period (catch rates are highest during this period) in November, by adding a day shot, often deeper offshore. Day fishing usually involved shooting pots within, at the most, a few hours steaming time from a fisher's 'home' port. In 22 interviews, or 10.3 per cent, participants day fished exclusively. Day fishing was considered by many participants to be a more enjoyable, low-key style of fishing that made possible the pursuit of a second occupation such as farming. Cross-tabulating length of trip with type of fisher revealed that only one lessee day fished exclusively compared with 18 owner-operators.

Overnight fishing, on the other hand, involved provisioning the boat for trips longer than one day. The geographic range of fishing was therefore greater, both along the coast and offshore. Moreover, number of shots in a 24-hour period was rarely limited to one, with an inshore night shot and an offshore day shot being common. Multiple night shots were also practiced by some fishers. In those 55 interviews in which participants undertook both day and overnight fishing trips, longer trips were often made in summer, particularly around the new shellers period, while effort contracted to day fishing in winter.

Cross-tabulating length of trip with fishing pattern at time of interview showed that exclusive day fishing was concentrated off the north-west (principally fishing out of Currie on King Island and off the north-west corner of the Tasmanian mainland from Bluff Hill Point down to Temma), the south-east, east (mainly Triabunna and Bicheno) and the north-east coasts. Fishers overnighing exclusively concentrated their fishing off the west, southwest, northwest and northeast coasts. Effort by exclusive overnight fishers off the northeast coast of Tasmania may reflect particularly good recent fishing seasons in the northeast due to large mid-1990s puerulus settlement. A number of fishers stated that they had 'followed the fish' to the north-east, with a few also preparing for the putatively possible future zoning of the fishery by catch history. Nearly all of those interviewed who fished in the northeast emphasised that any improvement in stocks was cyclic and not related to the introduction of quota management. Indeed, some areas in the northeast were said to be being fished more heavily than prior to quota management.

Cross-tabulating length of trip with area(s) fished prior to quota management – where a difference was identified compared with fishing pattern at time of interview (giving 60 cases) – revealed that in only five per cent of interviews was effort being shifted by exclusive day fishers. As noted, interviews involving exclusive day fishers account for 10.3 per cent of the 213 case subset. In 65 per cent of cases, on the other hand, effort was being shifted by exclusive overnight fishers, who account for 56.8 per cent of the data subset.

Similar patterns are evident when comparing fishing pattern at time of interview with fishers single handing a boat, commonly associated with day fishing. Single-handing is concentrated off the east, northeast, northwest and southeast coasts of Tasmania. Boats with two or more people aboard, on the other hand, also fish the west coast. Cross-tabulating number of people aboard with difference in area(s) fished prior to quota management (giving 53 cases) reveals that in 75.4 per cent of interviews effort was

being shifted by boats with more than one hand, whereas these boats account for 60 per cent of the 213 case subset. Finally, cross-tabulating number of people aboard with type of fisher reveals that 30 per cent of lessees were single-handing, while accounting for 13 per cent of single-handing cases.

5.2.6 Change in depth fished

In nearly three-quarters of the 213 interview subset, participants stated that they had not changed, or experienced a change, in the depths at which they fished for rock lobster since the introduction of quota management (Table 3).

Table 3. Change in depth fished

	Frequency	Per cent
No change	158	74.2
Yes, shallower inshore	53	24.9
Yes, deeper offshore	2	0.9
Totals	213	100.0

It is noted regarding all lines of questioning in interviews concerned with change since, compared with fishing practices before the introduction of quota management, that the 'no change' category includes close to ten cases in which participants were not involved in the fishery prior to quota management in the capacity in which they were interviewed.

In approximately one-quarter of interviews, participants reported a change in depths fished since the introduction of quota management. This change was almost solely of one kind, fishing more inshore, shallower, for 'quality' red rock lobster. In nearly one-quarter of interviews, participants mentioned, unsolicited, that fishing for quality rock lobster was more important in their operation since the introduction of quota management. Fishers defined 'quality' as rock lobster that were red in colour, hard shelled, robust, amenable to live transport, not missing any appendages, and, for some processors, weighed around 1.5 kilograms. A number of processors were prepared to pay over the going market rate for such rock lobster. Rock lobster with the above qualities are mostly found in shallower, inshore waters. In 89 or 41.7 per cent of the 213 interview subset, participants stated that they fished exclusively for red, as opposed to brindled or white coloured, rock lobster.

Cross-tabulating change in depth fished with an unsolicited emphasis on quality rock lobster shows that of 52 interviews in which participants mentioned the importance of fishing for quality rock lobster, fishing effort had been shifted inshore in 44.2 per cent of cases. Focus on catching quality rock lobster is approximately proportionally distributed across different types of fisher. In only one per cent of interviews did participants report fishing deeper than prior to quota management.

Cross-tabulating change in depth fished with number of people aboard reveals that boats multiple handing accounted for 67.9 per cent of operations shifting effort inshore; as noted, these boats made up 60 per cent of the 213 interview subset. Finally, change in depth fished is approximately proportionally distributed across the type of fisher, length of trip and fishing pattern at time of interview variables.

5.2.7 Change in time of year fished

There are two components to information generated by the line of questioning concerned with change in time of year fished: any change in total time fished per commercial rock lobster year since the introduction of quota management; and any change in time of year fished between summer and winter. In nearly 40 per cent of interviews participants stated that they had not changed, or experienced a change, in time of year fished; i.e. they neither fished more nor less over the year, nor altered their allocation of fishing time between summer and winter (Table 4).

Table 4. Change in time of year fished

	Frequency	Per cent
No change	85	39.9
Less	78	36.6
Less, winter down	1	0.5
Less, winter up	33	15.5
More	4	1.9
More, winter up	12	5.6
Totals	213	100.0

In the approximately 60 per cent of interviews in which participants stated that change in time of year fished had occurred, two main trends were identified: less time fishing per year; and more time fishing in winter. If all categories in Table 3 involving less fishing per year are summed, participants stated that they were fishing less since the introduction of quota management in just over 50 per cent of interviews, while the figure for fishing more in winter was 21.1 per cent. Participants stated that they were doing more fishing since quota management was introduced in 7.5 per cent of interviews.

Cross-tabulating time of year fished with trip length reveals that when 'less' categories are summed, operations exclusively fishing over one or more nights account for 66.3 per cent of those fishing less since the introduction of quota management. As noted, 56.8 per cent of fishers exclusively undertake trips of two days or longer. Cross-tabulating time fished with change in depth fished shows that fishers shifting effort inshore accounted for 33.6 per cent of operations fishing less since quota management, and 40 per cent of operations shifting fishing into winter, recalling that fishers shifting effort inshore make up 24.9 per cent of the 213 interview subset. Finally, cross-tabulating time fished with fishing pattern when interviewed reveals less fishing occurring off the northwest, west and southwest coasts. A lower incidence of reduced fishing is observed for the northeast and east coasts. Effort shift into winter is approximately proportionally distributed off all coasts.

5.2.8 Distance travelled

In 62 per cent of cases in the 213 interview subset, participants stated that they had not changed, or experienced change, in distance travelled from 'home' port to fish (Table 5).

Table 5. Distance travelled

	Frequency	Per cent
No change	132	62.0
Less local	4	1.9
More local	71	33.3
More travel	1	0.5
North-east	1	0.5
Not Maatsuyker	1	0.5
Leaver	2	0.9
Less travel	1	0.5
Totals	213	100.0

One-third of interviews were with participants whose fishing involved less travelling since the introduction of quota management. For these participants, trip length may not have altered in terms of days fished or number of shots, but less distance was being travelled from ‘home’ port to fish. Many fishers referred to this change as fishing ‘locally more’. In 2.3 per cent of interviews, participants stated that they were fishing locally less or travelling more since the introduction of quota management. Quota units were being leased in by the four participants who stated that they were fishing locally less.

Cross-tabulations revealed slightly higher proportional distributions of day fishers and single handing fishers in the ‘localisation’ category. In both the categories of fishing less per year and fishing more in winter, in approximately 44 per cent of interviews participants were also fishing locally more, recalling that those fishing more locally make up one-third of the 213 interview subset. Moreover, in 40.8 per cent of interviews in which localisation was reported, participants had also shifted their fishing inshore; as noted, cases in which participants had shifted their fishing inshore make up approximately one-quarter of the interview subset. Finally, cross-tabulating localisation with fishing pattern when interviewed reveals the east, northeast and northwest coasts to be the main areas into which fishing was being contracted.

5.2.9 Change in geographic operating pattern

One line of questioning in interviews concerned operations’ geographic fishing patterns in the fishing years leading up to quota management compared with geographic operating patterns after quota management’s introduction. In 151 or 70.8 per cent of cases in the 213 interview subset, participants reported no change in geographic operating pattern. Geographic pre-quota management data in the matrix only include information on fishing. Geographic quota management data in the matrix, however, include the area in which participants operated whether they were fishing or otherwise. Thus, by cross-tabulating where participants were fishing prior to quota management with where they were operating when interviewed, it is possible to ascertain both from where effort has shifted in the fishery to where, as well as into what other activities. Though only 62 cases are tracked in this way, raising the issue of low absolute numbers regarding some of the variables involved, this exercise is nonetheless informative.

The largest shift, 14 of the 62 cases or 22.5 per cent, is into retirement, principally from fishing off the northeast, northwest and southeast coasts of Tasmania. The next largest shift, nine cases or 14.5 per cent, is exclusively to the north-west coast by fishers who

were fishing all coasts, or both the west and north-west coasts prior to quota management. This figure is primarily made up of fishers based on King Island localising their fishing under quota management by no longer fishing the new shellers period off the west coast of Tasmania. In six cases, or 9.6 per cent, fishing was shifted exclusively to the east coast. In nearly all these cases, fishing had occurred off all coasts prior to the introduction of quota management. While, for these operations, fishing did at times take place off the east coast out of their 'home' ports prior to quota management, the bulk of their fishing was done elsewhere. The same can largely be said for effort shift exclusively to the northeast, evident in four cases (6.4 per cent).

5.2.10 Summary and conclusion

To summarise:

- in 83 per cent of interviews, participants undertook some overnight fishing, while in 36.6 per cent of interviews participants undertook some day fishing (recalling that both these categories can be apparent in an operation);
- in 60 per cent of interviews, the operations concerned were not at any time run single handedly;
- in nearly 25 per cent of interviews, participants had shifted fishing effort into shallower, inshore waters;
- in more than half of the interviews, participants were fishing less than prior to quota management;
- in 21.1 per cent of interviews, participants were fishing more in winter;
- in one-third of the interviews, participants had localised their fishing, i.e. were not travelling as far from their 'home' port to fish as prior to quota management; and
- in 29.1 per cent of interviews, participants had changed the geographic pattern of their operation since the introduction of quota management, primarily shifting into retirement or contracting their fishing to the north-west, east or north-east coasts.

Cross-tabulation makes it possible to relate a number of these variables. It is then evident:

- that exclusive day fishers are concentrated off the north-west, south-east, east and north-east coasts of Tasmania;
- that fishers overnighing exclusively concentrated their fishing off the west, south-west, north-west and north-east coasts;
- that effort was being areally shifted by exclusive overnight fishers in greater proportion than exclusive day fishers;
- that effort was being areally shifted by boats with more than one hand in greater proportion than those with a single hand;
- that inshore effort shift was proportionally higher for boats multiple handing;
- that less fishing was proportionally higher for operations exclusively fishing over one or more nights;

- that fishers shifting effort inshore accounted for 40 per cent of operations shifting fishing into winter;
- that less fishing was principally occurring off the north-west, west and south-west coasts;
- that in both categories of fishing less per season and fishing more in winter, in approximately 44 per cent of interviews participants were also fishing more locally;
- that in 40.8 per cent of interviews in which localisation was reported, participants had also shifted their fishing inshore; and
- that the east, north-east and north-west coasts were the main areas into which fishing had been contracted.

In conclusion, it is worth reiterating that no change was reported in 74.2 per cent of the 213 interview subset for depth fished, in 39.9 per cent of cases for time of year fished, 62 per cent of cases regarding distance travelled, and in 70.8 per cent of cases regarding geographic fishing pattern. One type of fisher in particular, single handing owner-operators had, bar retirement, remained largely stable in its fishing dynamics since the introduction of quota management. Considerable change, however, was evident among many multiple handing operators. In short, many multiple handing operators are fishing less and have shifted their fishing effort inshore, into winter and closer to their 'home' ports. Those few multiple handing operators moving in the opposite direction to this pattern, i.e. fishing more and shifting offshore, are leasing in often large amounts of quota units. In short, the tendency in interviews was away from 'volume' towards 'quality' fishing. For many, maximising price for effort meant concentrating on catching inshore, winter 'money fish'. A focus on cost reduction also meant that many participants, including lessees, were single handing as well as fishing closer to their 'home' port. The result appears to be less fishing off particularly the west coast in deeper water and more fishing in many areas of the inshore day fishery, particularly off the east coast. In some 'hot spots', fishers reported few boats having left the area under quota management, a trend towards localisation of fishing, an up to 25 per cent upgrade in pots carried by many boats, and an increase in recreational fishing contributing to more pots at times being evident in the water than prior to quota management. The issue of possibly varying soak times before and after quota management aside, many of those interviewed considered that a number of areas in need of less fishing were being fished more, while some of the most abundant stocks were underfished under quota management. It may be worthwhile exploring possible mechanisms to provide incentives to fishers to shift their effort from possibly overfished to possibly underfished areas. However, it is noted that fleet dynamics could change markedly should recent good fishing years off the east coast not continue. Trends involving localisation, single handing and day fishing, for example, could all be affected if some boats were forced to travel further to catch rock lobster.

5.3 Fleet dynamic model options for future assessments

5.3.1 The Original Fleet Dynamics Model

The original fleet dynamics model was produced during the initial development of the current rock lobster Stock Assessment Model (Punt and Kennedy, 1997). The rock lobster assessment model is spatially explicit in that it treats the Tasmanian rock lobster fishery as being made up of eight geographical zones (Figure 16). Each is effectively assessed for present status independently of each other. However, for the risk assessments, where projections into the future are made under various alternative quota levels, it is necessary to treat the complete fishery as a single entity in terms of where the fleet chooses to impose the available effort. While it is true that all boats are free to fish wherever they wish, certain patterns of behaviour are discernible and, to date, these patterns have been used as the basis for predicting the distribution of effort across the eight zones into the future. This is a statistical model of the fleet dynamics and without this, risk assessment would not be possible with a spatially explicit stock assessment model. Information on the strategy and analyses used to develop the fleet dynamics model used in the Tasmanian rock lobster assessment model is distributed among a number of different works but, unfortunately, is not particularly informative. In brief, from the published material we know that a generalized linear model (GLM) was fitted to, at least, the factors: area, month, and catch rates (with catch rates being predicted by the model for each zone as a combination of biomass and catchability). We are also told that the predicted levels of effort around the eight zones are rescaled to generate the required TACC (Kennedy, 1998). In addition, we are informed that the GLM used data from 1990 to 1995 (Frusher, 1997). Apart from other comments stating that the fleet dynamics model needs to be updated or modified to account for changes to fishing patterns brought about by the shift to an ITQ management system, no further insights are offered into the structure of the fleet dynamics model.

From the rock lobster model Fortran code, we determined the structure of the statistical model and the parameters used to describe the fleet dynamics. Before attempting to modify the statistical model used, it was considered a useful check to reconstruct the fitting process to understand why this model was chosen in preference to other possible models.

The original fleet dynamics model was produced by fitting a generalised linear model to commercial catch and effort data from 1990 until 1995, predicting the harvest rate within a year according to month, area and predicted catch rate within that month and area. There are two fleet dynamics model options available in the assessment model source code:

1. $\text{Ln}(H) = a + m + m * cpue$ and
2. $\text{Ln}(H) = a + m + a * cpue + m * cpue.$

In these models the independent variables a and m are categorical and represent *area* and *month*, respectively. Thus, m can take on a value from 1 to 12, although as September and October were closed to fishing from 1990 until 1995, values of 9 and 10 did not occur. The values for a range from 1 to 8 representing each of the eight statistical areas used for assessment purposes (Figure 16). The variables H and $cpue$,

the *harvest rate* and *catch per unit effort* respectively, are continuous variables which depend on a and m . The harvest rate H was computed by $H = C/B$ where C is the catch in kilograms, B the exploitable biomass in tonnes for a given month m and area a (derived from the optimal stock assessment fit).

The first model, $\text{Ln}(H) = a + m + m * cpue$, is the one that has been used in the stock assessments (Frusher, 1997; Frusher, 1997b; Frusher, 1999). Although the source code allows for the use of the second model as an alternative, it has never been used.

We have reconstructed the process of fitting a generalised linear model to the 1990 through to 1995 data. We have compared all models containing the variables a , m , and $cpue$; interactions between a and m with $cpue$ were included. We did not consider interaction terms between a and m , as it appears that this was not considered during the original fitting process. In Section 5.3.2, models allowing a and m interaction terms are explored.

The parameters were re-estimated using commercial catch rate data for the years 1990 through to 1995 (estimated in the model as biomass times monthly catchability). The values of $cpue$ were determined by dividing the total catch caught during a month in a given area by the total amount of effort. The values of B were taken from the model estimates in the 2000 assessment and therefore rely on the model's performance. As these values are unlikely to equal those used in the original fitting process, whose values have not been recorded, it was expected that the parameter estimates will not exactly match the original ones. However, this procedure should provide insight into the model selection process.

To understand the reasons behind the choice of the fleet dynamic model used in the original assessment model, we compared the adjusted Akaike's Information Criteria, AICC of the array of possible models (Table 6A). The model with the larger value for AICC represents the model that better fits the data (Burnham and Anderson, 1998). As can be seen, the optimal model choice when no a and m interactions are allowed was $\text{Ln}(H) = a + m + a*cpue + m*cpue$, however, the difference between the AICC of this model and the model $\text{Ln}(H) = a + m + m*cpue$, which is currently in use, is not significant. It is possible that the biomass estimates used in the fitting process have varied significantly influencing the precise model choice.

As we can see from these model comparisons, $cpue$ is best included in the model with its month and area interactions, suggesting that the effect of $cpue$ on effort varies amongst months and areas.

Table 6 : Adjusted AIC (AICC) for model fits to data from 1990-1995. $\text{AICC} = \text{AIC} + 2p(p+1)/(n-p-1)$, where AIC is calculated using SAS mixed procedure, p is the number of model parameters and n is the

number of observations. A larger value represents a better model fit. Largest AICC values and associated models are shown bolded. The named models are used in later sections where different sets of years of data are compared.

No $a*m$ interaction (A)			$a*m$ interaction allowed (B)			$a*m*cpue$ interaction allowed (C)		
Model (LnH=)	pars	aicc	Model (LnH=)	pars	aicc	Model (LnH=)	pars	aicc
a	8	-613.1						
cpue	2	-545.0						
$m*cpue$	11	-527.8						
m	10	-507.6						
a + cpue	9	-484.2						
$a*cpue$	9	-482.1						
m+cpue	11	-479.2						
a + $a*cpue$	16	-469.7						
a + m	17	-459.9	$a*m$	80	-295.0			
$a*cpue + m*cpue$	18	-456.6				$a*m*cpue$	81	-296.1
a + $m*cpue$	18	-455.2						
a + $m*cpue + a*cpue$	25	-440.5				a + $a*m*cpue$	88	-288.6
m + $m*cpue$	20	-432.0						
m + a+cpue	18	-412.2						
m + $a*cpue$	18	-411.0						
m + a + $a*cpue$	25	-393.4	$a*m + a*cpue$	88	-258.4			
m + $m*cpue + a*cpue$	27	-359.2				M4: m+ $a*m*cpue$	90	-244.4
old2: a + m	27	-346.1	M3: $a*m + m*cpue$	90	-243.7			
+ $m*cpue$								
old1: a + m	34	-323.7	M1: $a*m + m*cpue + a*cpue$	97	-248.8	M2: a + m + $a*m*cpue$	97	-234.2
+ $m*cpue + a*cpue$								
						$a*m + a*m*cpue$	160	-230.6

5.3.2 Alternative Model Choices

The inclusion of an $a*m$ interaction into the statistical model can treble the number of parameters. It is for this reason that we have used the AICC as a comparison tool rather than the standard Akaike's Information Criteria (AIC) (Burnham and Anderson, 1998). When the term $a*m$ is introduced into the model then the $a + m$ term becomes redundant. Replacing $a + m$ by $a*m$ in the models significantly improves their fit to the 90-95 data set (Table 6B). For instance, the simple model $\text{Ln}(H) = a + m$, which has an AICC of -459.9 is less favourable than the model $\text{Ln}(H) = a * m$, with an AICC of -295. Similarly, the model $\text{Ln}(H) = a*m + a*cpue + m*cpue$, has an AICC of -248.8, which improves the AICC of $\text{Ln}(H) = a + m + a*cpue + m*cpue$, the original optimal model, by 74.9. Interestingly the $a*cpue$ term no longer contributes to the optimal model when $a*m$ interactions are considered (Table 6B). Therefore, an $a*m$ interaction is a worthwhile refinement of the original fleet dynamic model when judged by its fit to the 90-95 data set.

It is also possible to add an $a*m*cpue$ interaction term to the model. The AICCs for such models are comparable to those found when including only an $a*m$ interaction term (Table 6C). However, the final model, $\text{Ln}(H) = a*m + a*m*cpue$, which allows both types of interactions, has the largest number of parameters even though the AICC is comparable to other models. This large increase in parameters for the relatively

small increase in AICC makes this model undesirable.

With the exclusion of this last model, the best fit to the 90-95 data is given by the models $\text{Ln}(H) = a + m + a*m*cpue$, $\text{Ln}(H) = a*m + m*cpue$, $\text{Ln}(H) = m + a*m*cpue$, and $\text{Ln}(H) = a*m + a*cpue + m*cpue$, in order of decreasing AICC. As the range of the AICC values between these models is only 14.6 it is expected that all models are comparable in terms of model fit based on this data set (Table 6). It is clear that incorporating interactions terms into the fleet dynamics model would lead one to select one of these models in preference to the original fleet dynamic model that is currently in use.

5.3.3 Model fits to current data

The models considered above, which were fitted to data from 1990 until 1995, are likely to be outdated for today's fishery. To see how well they predict more current data and determine which model is optimal, we have estimated the value of $\text{Ln}(H)$ for the 00/01 fishing season using each of the statistical models, Old1: $\text{Ln}(H) = a + m + a*cpue + m*cpue$, Old2: $\text{Ln}(H) = a + m + m*cpue$, M1: $\text{Ln}(H) = a*m + a*cpue + m*cpue$, M2: $\text{Ln}(H) = a + m + a*m*cpue$, M3: $\text{Ln}(H) = a*m + m*cpue$, and M4: $\text{Ln}(H) = m + a*m*cpue$ (Table 6), and compared the results to the value of harvest rate predicted from the assessment model. The square root of the sum of the residuals squared is shown for each model, this provides an index of relative fit (Figure 28). The model with the best fit to the 00/01 data, in terms of these residuals, is M1: $\text{Ln}(H) = a*m + a*cpue + m*cpue$.

After applying the models to the 00/01 data, when the sum of the squared residuals for each model is plotted for each area and month, we see that the models vary greatly in their ability to estimate the data (Figure 29). It is not surprising that the catch during February is poorly estimated by the models, for, as seen in Section 5.1.3 (*cf* Figure 9), it is the catch during February that has seen the most significant change in the last few years. Despite the exceptional month of February, in general, the residuals between different models are similar.

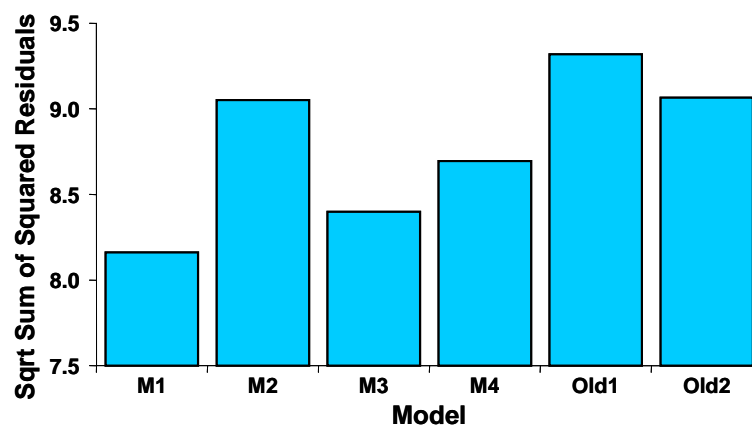


Figure 28. Square root of the sum of the squared residuals as an index of relative model fit to the 00/01 data; the smaller the value, the better the fit. Note the Y-axis does not begin at zero.

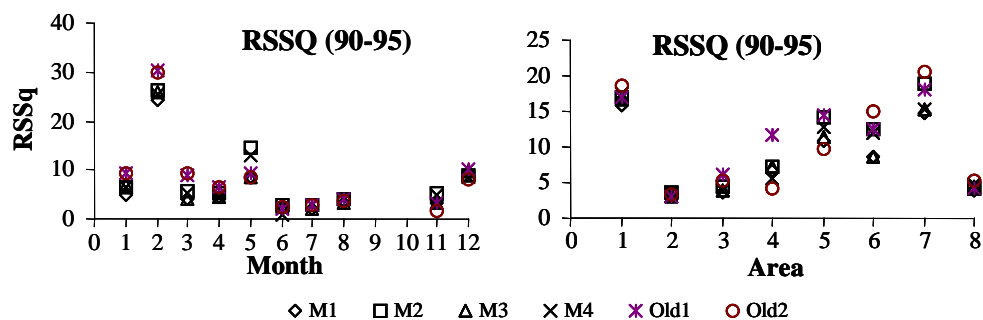


Figure 29. Residual Sum of Squares for each area and month and model applied to 00/01 data when fitted to 90-95 data. Different models are optimal (have the smallest sum of squared residuals) in different months and different areas.

5.3.4 Fits to updated data sets

The model fitting has so far been based on the 90-95 data set. It seems highly likely, considering the quality of fit to recent information (Figure 29) that by using more recent data from the fishery the predictive ability of the fleet dynamics model would be improved for use with current stock assessments. To address this problem we have attempted to answer a number of questions:

- A) What data set is most relevant to current stock assessments?
- B) Does a change in data set greatly affect the model parameters and the model projections?
- C) Does a change in data set affect the choice of optimal model?

The choice of data set is extremely important in fitting a generalised linear model of the form discussed herein as there is no time series component to the model and so each year's data is equally relevant in terms of model fits.

It is suspected that the fleet's fishing patterns may have changed since the introduction of quota management in 1998. However, data collected since the introduction of quota (Mar 1998 until Feb 2000) provides us with just two data points for each month-area combination. Although the 00/01 catch and effort data is available, the biomass estimates for this year can only be obtained after the rock lobster assessment model is run. There is a risk that this limited history of fishing pattern may not be indicative of future patterns. For instance, these two years may have demonstrated an exceptional recruitment in one area or unusual weather patterns. However, if it were the case that fishers' behaviour has altered drastically in these two years and that these changes are indicative of future fishing patterns, then data prior to this period would provide little information for future projections and the latest data would still be the most appropriate data set for the model.

At the other extreme, adding all data collected since the original model was created to the data set would result in data covering the years from 1990 until Feb 2000. To give a balanced representation of the month factor we only include data from March 1990 until Feb 2000 in this data set, which we will refer to as the "90-00 data set". This data set includes 8 years worth of data prior to and two years of data since, the introduction of quotas. The problem with this data set is that as each year's fishing pattern is

considered equally relevant more weight is given to the years prior to the introduction of quota. This biases the model toward pre-quota fishing patterns.

It has been suggested that prior to the introduction of quotas, fishers were already adopting different fishing practices in response to the knowledge that quota management was coming. These changes were considered to be taking effect from at least 1995. The effect this may have on the fleet dynamics model is dependent upon the nature and the magnitude of these changes. If the changes were spatial or temporal in nature then they would directly impact on the model. Whether the impact pertains to future predictions depends on whether fishers were moving towards the fishing practices now shown, or whether they were acting in an extreme manner that has not continued to the present time.

To obtain some indication of the relevance of different combinations of years of data we have fitted models to each of the following data sets: the 90-95 data set, the 90-00 data set, the 95-00 data set, and the 98-00 data set. It is hoped that by comparing the model fits on each of these four data sets we will gain a clearer insight into how choice of data set affects the model choice to be used in future projections when conducting risk assessments.

5.3.5 Optimal Models

The AICC compromises between the quality of fit against the number of parameters, but the quality of fit is at least partly determined by the number of data points being fitted. If one had the same number of parameters as data points a perfect fit would be possible but the statistical model would not summarize the information in any way. Of the four data sets being considered, 98-00 contains the least number of records and so a potential bias may arise in its favour as the sum of squared residuals will be smaller simply through there being fewer observations. Should this data set be chosen as the most appropriate data set then it may be necessary to use techniques to reduce the number of parameters in the model. One way of doing this may be by grouping the months together into 4 seasons.

Looking at all four sets of data, the models that consistently give the best fits based on the AICC are M1: $\text{Ln}(H) = a*m + a*cpue + m*cpue$, M2: $\text{Ln}(H) = a + m + a*m*cpue$, M3: $\text{Ln}(H) = a*m + m*cpue$, and M4: $\text{Ln}(H) = m + a*m*cpue$, the same four models that were found to be optimal when only the 90-95 data set was used Table 7; the model involving complete interactions was, once again excluded as being over-parameterized). The ordering of the optimal models altered depending upon which data set was used (Table 8). The results from the 98-00 data set differed most from each of the other data sets.

Table 7. Adjusted AICC values for the various models fitted to the different data sets. Pars refers to the number of parameters in the statistical model. Undefined refers to the fact that the Excluded model could not be fitted to the 98-00 data set because it was over-parameterized for the available data. The models are sorted in order of optimal model with the 90-00 data set.

Date Range		90-95	90-00	95-00	98-00	
Number of Observations		457	777	392	160	
Model	pars	aicc	aicc	aicc	aicc	
Excl:	a*m + a*m*cpue	160	-230.6	-406.5	-256.2	undefined
M1:	a*m + a*cpue + m*cpue	97	-248.8	-454.4	-233.1	-316.2
M2:	a + m + a*m*cpue	97	-234.2	-458.7	-217.6	-297.3
M3:	a*m + m*cpue	90	-243.7	-459.8	-243.9	-258.8
M4:	m + a*m*cpue	90	-244.4	-475.4	-226.1	-240.4
	a*m + a*cpue	88	-258.4	-516.2	-236.6	-239.5
	a*m	80	-295.0	-527.4	-256.1	-207.4
	a + a*m*cpue	88	-288.6	-574.0	-225.0	-223.9
	a*m*cpue	81	-296.1	-587.5	-240.5	-192.5
Old1:	a + m + m*cpue + a*cpue	34	-323.7	-592.4	-242.7	-76.0

Table 8. The ordering of the identified models in Tables 6 and 7, relative to which data set was used in the fitting process and the resulting Adjusted AIC values (as in Table 7). Only the ordering of recognized models is listed; for the 98-00 data, except for Old1, the remaining named models were ranked last in the order shown. The Excluded model was undefined for the 98-00 data.

Data Set	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6
90-95	Excl	M2	M3	M4	M1	
90-00	Excl	M1	M2	M3	M4	
95-00	M2	M4	M1	Old1	M3	Excl
98-00	Old1	----	M4	M3	M2	M1

5.3.6 Optimal Data Set

Comparing the AICC between models based on different data sets is meaningless. To determine which data set is most appropriate for the 00/01 data we have computed the Residual Sum of Squares for each model and each data set, when compared to the data collected in the 00/01 fishing season (Table 9; Figure 30). From this we see that the 95-00 and 98-00 data sets give rise to models that best approximate the 00/01 data. As the data sets based on later years appear more optimal than earlier data sets, we expect that the fishes must be changing their catches preferences over time.

Table 9. Square Root of Residual Sum of Squares for each of the identified models when they are applied to the 00/01 fishing season data. The smallest residuals indicate that the statistical fleet dynamics model most closely matches the 00/01 data when fitted using the indicated data sets.

MODEL	90-95	90-00	95-00	98-00
M1	8.1613	6.5544	5.7289	4.397711
M2	9.0514	6.9656	5.9130	4.837668
M3	8.3970	6.6076	5.7614	4.139873
M4	8.6950	6.8254	5.8591	4.259792
Old1	9.3174	7.2030	6.4283	4.916349
Old2	9.0645	7.0964	6.2359	7.280383

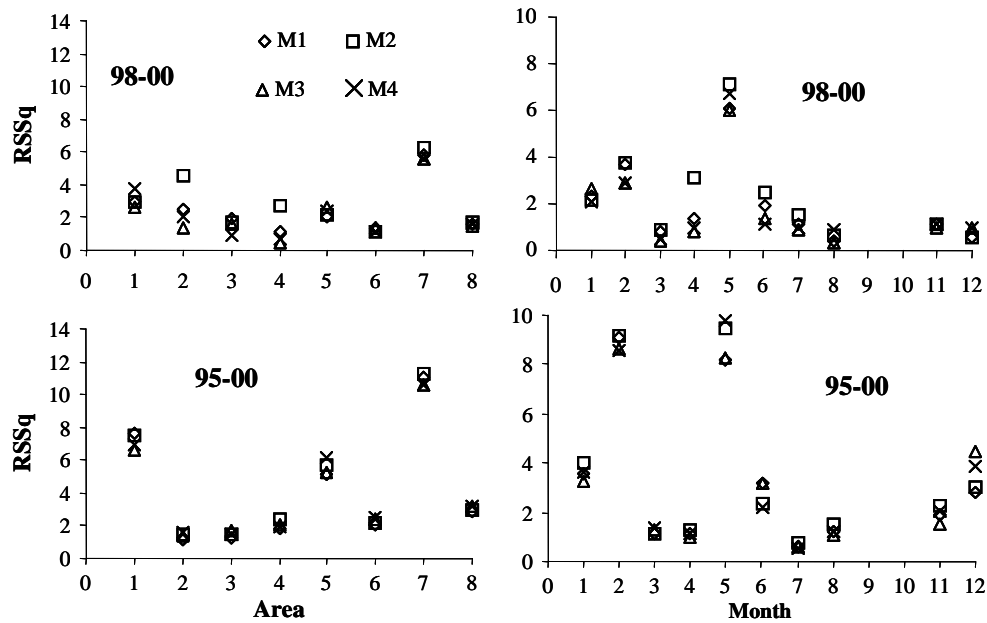


Figure 30. Deviations from the expectations of the 00/01 data when using models fitted to the 95-00 and 98-00 data sets. The eight assessment areas are shown in the two left-hand panels and the months are in the two right-hand panels. There are particular problems with areas 1, 5, and 7 and months February and May; with the 95-00 data having more problems than the 98-00 data.

It is clear that the fleet dynamics models based on the 98-00 data give a better approximation to the expectations of the assessment model in the 00/01 fishing season than the other data sets (Table 9; and see Figure 30). However, we are cautious to commit to this 98-00 data set as it is only based on two years of data. As more data is collected, the post-quota data set will grow and will most likely become the better choice for the assessment model. It is recommended that the models be refitted each year as more data becomes available, with the expectation that the optimal model will settle down as a pattern of fishing behaviour adapted to the quota management system evolves and is adopted. The 98-00 data set should not be used in assessments.

The models fitted the 95-00 data set give a poorer fit to the data from February 2001 when compared to the models fitted to the 98-00 data set (Figure 30). This is not surprising as February was the month that saw the most drastic changes in fishing patterns since the introduction of quota management (Section 5.1.3; *cf* Figure 9). Both data sets give poor estimates for the month of May 2000. We saw that the number of boats participating in the fishery in May of the 00/01 season was considerably less than previous years (Section 5.1.3; *cf* Figure 9), so as this month seems to represent an exception in terms of fishing patterns it is also not too surprising that both models give poor fits for May.

The models fitted to both the 95-00 and the 98-00 data sets gave poor fits for Area 7 (Figure 30). The 95-00 models also give a poorer estimate of Area 1 and Area 5 fishing patterns. Overall, the appearance is that for the most recent data the use of the 98-00 data set is optimal. However, this data set has relatively few observations in it, which means it is more prone to the effects of the years covered being exceptional and not representative of future fishing patterns. The recommendation that this data set not be used stands.

Depending on which data set is used, different models are considered more optimal.

Under the 95-00 data set M1: $\ln(H) = a*m + a*cpue + m*cpue$, gives the best fit to 00/01 data whereas if the 98-00 models are compared M3: $\ln(H) = a*m + m*cpue$, gives the better fit (Table 9). The only difference between these models is that Model 1 is lacking the $a*cpue$ term seen in Model 3. This suggests that the effect that different area's catch rates have on fishers' fishing patterns is less relevant in the later years data set. In Section 5.1.4 (see Figure 18), it was suggested that fishers are fishing more locally now that quota has been introduced. It is believed that as fishers are less competitive in catching their now limited catch, then, rather than seeking out high catch rate areas, they choose to fish in locations that are more convenient for other reasons. The absence of the $a*cpue$ term when the 98-00 data set is used could be a consequence of this change. Alternatively, it may simply be that there are too few data observations for any area * cpue interaction to be detectable. Either way, it strengthens the recommendation that the fleet dynamics model be recalibrated each year that new data becomes available.

5.3.6.1 Comparison with models based on Older Data Sets

It is useful to compare the model fits to these 2 later data sets, 98-00 and 95-00, with those obtained from data sets containing earlier years, 90-95 and 90-00. In Figure 31, we have plotted the sum of squares of residuals for each area and month for models based on the 90-95 and 90-00 data sets. Care must be taken when comparing these graphs with those of Figure 29 as different scales were used to display the data.

It becomes apparent that the fits to Areas 1, 5, 6 and 7, were poorer when the older data was used; especially with the 90-95 data set. This suggests that these areas especially have seen a change in fishing pattern since the early nineties.

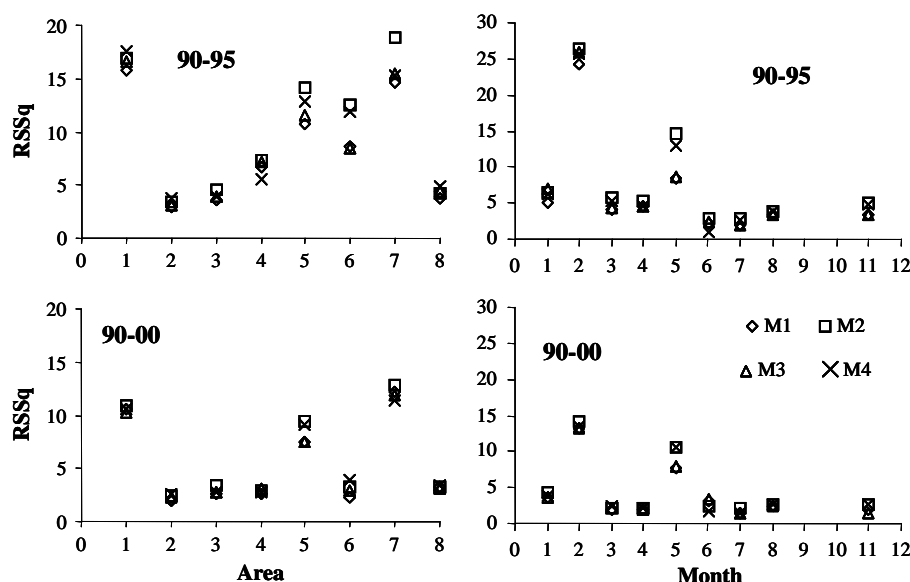


Figure 31. Deviations from the expectations of the 00/01 data using models based on the 90-95 and 90-00 data sets. Note that the y-axes in this graph are at a larger scale than in Figure 29.

When the fits for each month are compared, we see that the 90-95 data set shows a significant difference in fits for each month of the year. The most apparent change has occurred in the month of February. Again we see that in May all models give a poor fit to the data but as already mentioned it is expected May 2000 was an exceptional period in terms of fishing patterns.

In conclusion, the 98-00 data set has too few observations for all models to be adequately fitted to it and should be avoided until more data can be added to this post-quota data set. The 90-95 data set provides only a very poor fit to more recent data and for that reason should also be avoided. The two data sets 95-00 and 90-00, on the other hand both provide acceptable fits to more recent data and it is recommended that both be used until more data is available. This is suggested, instead of just recommending the 95-00 data set as being the best fitting, in case the 00/01 fishing season was unusual as appears to be the case in some ways (cf. Figure 9).

5.3.7 Time Delay Term

To determine whether adding a time delay component would be a useful addition to the model we added a first order time delay term, $\text{Ln}H_{t-1}$, to each of the models discussed above and refitted the data. The new models are

$$\begin{aligned} \text{Old1}_t: \text{Ln}(H) &= a + m + m^*cpue + \text{Ln} H_{t-1}, \\ \text{Old2}_t: \text{Ln}(H) &= a + m + a^*cpue + m^*cpue + \text{Ln} H_{t-1}, \\ \text{M1}_t: \text{Ln}(H) &= a^*m + a^*cpue + m^*cpue + \text{Ln} H_{t-1}, \\ \text{M2}_t: \text{Ln}(H) &= a + m + a^*m^*cpue + \text{Ln} H_{t-1}, \\ \text{M3}_t: \text{Ln}(H) &= a^*m + m^*cpue + \text{Ln} H_{t-1}, \text{ and} \\ \text{M4}_t: \text{Ln}(H) &= m + a^*m^*cpue + \text{Ln} H_{t-1}. \end{aligned}$$

The AICC of each of these models fitted to data from the years 90-00, 95-00 and 98-00 are given in Table 10. Comparing them with the AICC of the models without a time series component we see that the addition of the time delay term gives an improvement in each case, especially in the models fitted to 98-00 data. The 98-00 data set, however, only has 160 data points in it and so only has about 2 data points per parameter for some of the more complex models. This density of data per parameter is too low and re-affirms that this data set should not be used.

Table 10. A comparison of the adjusted AIC values for the standard models with a time delay term added. Note the very great improvement in the values for the 98-00 data set.

Date Range		90-00	95-00	98-00
Number of Obs		705	392	160
Model	pars	aicc	aicc	aicc
Old1t: $\text{Ln}(H) = a + m + m^*cpue + \text{Ln} H_{t-1}$	28	-410.2	-175.4	-44.1
Old2t: $\text{Ln}(H) = a + m + a^*cpue + m^*cpue + \text{Ln} H_{t-1}$	35	-386.8	-157.3	-22.3
M1t: $\text{Ln}(H) = a^*m + a^*cpue + m^*cpue + \text{Ln} H_{t-1}$	91	-336.6	-114.3	223.4
M2t: $\text{Ln}(H) = a + m + a^*m^*cpue + \text{Ln} H_{t-1}$	98	-301.1	-87.5	241.9
M3t: $\text{Ln}(H) = a^*m + m^*cpue + \text{Ln} H_{t-1}$	98	-320.1	-77.2	307.2
M4t: $\text{Ln}(H) = m + a^*m^*cpue + \text{Ln} H_{t-1}$	91	-313.2	-57.2	326.3

To compare how well these models fit the data for the 00/01 fishing season we used the models to estimate $\text{Ln}(H)$ for this season. The improvement through the inclusion of the time delay term is most significant when the 90-00 data set is used to determine the model (Table 11). It appears that the time series component must capture some of the trend that is apparent in fishers behaviour.

Table 11. Square root of Residual Sum of Squares of Model with Time Delay. $\text{AICC} = \text{AIC} + 2p(p+1)/(n-p-1)$, where AIC is calculated using SAS mixed procedure, p is the number of model parameters and n is the number of observations. A larger value represents a better model fit.

MODEL	90-00	95-00	98-00
M1	5.813973	5.116606	4.493385
M2	5.822357	5.176729	4.992364
M3	5.925226	5.16311	4.184971
M4	5.710669	5.014809	4.193603
Old1	5.534245	4.985628	4.102667
Old2	5.313308	10.93282	4.136303

The quality of fit to the various months and assessment areas was variable and was similar between data sets (Figure 32). With both the 90-00 and 95-00 data sets, both models had trouble capturing the fleet dynamics in February and May, while at the same time areas 1, 5, and especially 7 were poorly determined. If it were not for the low number of observations the 98-00 data set would be preferred, but, once again, the option to use both the 95-00 and 90-00 data sets until more post-quota data is available is to be preferred.

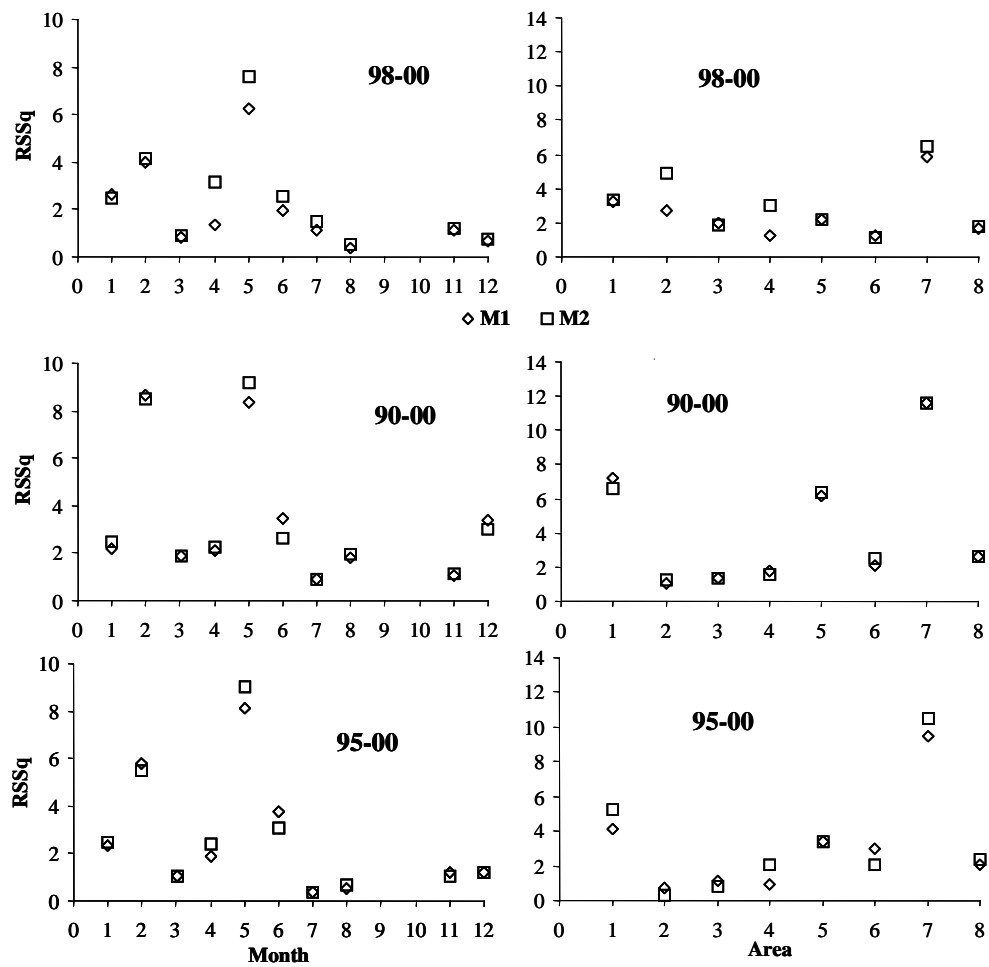


Figure 32. The square root of the sum of squared residuals for models M1 and M2 with the additional time delay term, when fitted to the 90-00, 95-00 and 98-00 data sets.

6. Impact of the Introduction of Quota in the Tasmanian Rock Lobster Fishery onto Other Tasmanian Fisheries

A concern regarding the introduction of quota management to the rock lobster fishery was that there could be a significant shift of fishing effort directed towards other fishery resources. We therefore explored whether rock lobster management change led to changes in the fishing patterns of rock lobster vessels that were also involved in other fisheries. Two categories of effort redistribution were explored by attempting to answer the following questions:

1. Have substantial numbers of fishing vessels left the rock lobster fishery and, if so has fishing effort been re-directed elsewhere?
2. Has restricting the rock lobster catch increased the available time for rock lobster fishers to increase effort in other fisheries?

Initially, there were concerns that effort would be re-directed into the scallop and giant crab fisheries. However, the scallop fishery has been closed since 1999 and will have new management restrictions when it reopens. In addition, the giant crab fishery has also since changed to a quota management system. Because of these management changes, these fisheries are no longer of concern regarding re-directed effort. Similarly, shark and blue eye trevalla are managed by quota under Commonwealth jurisdiction. However, as the management of these fisheries restricts the number of other fisheries into which effort from the rock lobster fishermen could be re-directed, there is the potential for an even greater impact on any remaining fisheries. These alternative fisheries are primarily Tasmanian scalefish fisheries and provide the focus for the analyses in this chapter.

6.1 Fishing Effort

Of the 372 vessels that fished in the rock lobster fishery between March 1996 and Feb 2001, 21.8% were also involved in other fisheries. Of the 242 rock lobster vessels that fished for rock lobster in the 00/01 season, 19.4% of these also fished in other fisheries. In contrast, of the 130 vessels that left the fishery sometime between March 1996 and February 2000, 26.2% were involved in other Tasmanian fisheries (Table 12). Whether this greater activity and experience in these other fisheries encouraged some of the fishers to leave the rock lobster fishery is unknown.

Table 12. Vessels who fished for rock lobster between March 1996 and February 2001. Throughout this section we refer to all vessels that fished for Rock Lobster between Mar 1996 and Feb 2000 as *RL all*. Of those vessels, we refer to the vessels that continued to fish during the 00/01 season as *RL remaining* and those who left before this season as *RL leavers*. Percentages are taken of the total for each row.

	Fished in other fisheries	Fished for rock lobster only	Total
RL remaining	47 (19.4%)	195 (80.6%)	242 (65.1%)
RL leavers	34 (26.2%)	96 (73.8%)	130 (34.9%)
RL all	81 (21.8%)	291 (78.2%)	372 (100%)

The majority of fishers who left the rock lobster fishery did so when quotas were introduced (Figure 33). Proportionally, this affected both the entire fleet and those that fished in scale fish fishery equally (Figure 33).

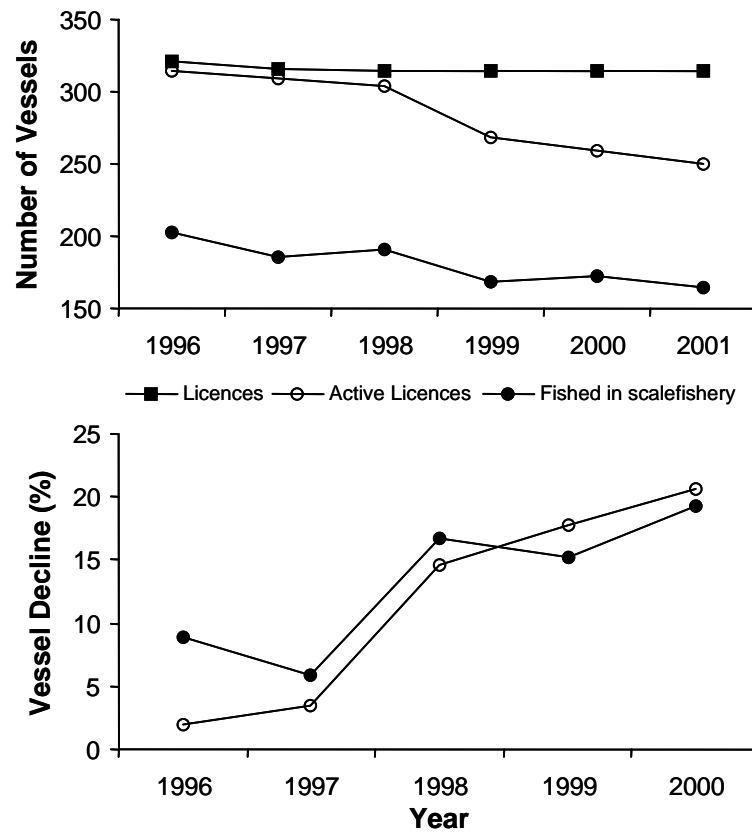


Figure 33. a) Number of vessels that actively fished in the rock lobster fishery (open circle) and those vessels that also fished in the scalefish fishery (solid circles) from 1996 to 2001. The percentage decline in these vessels is demonstrated in b).

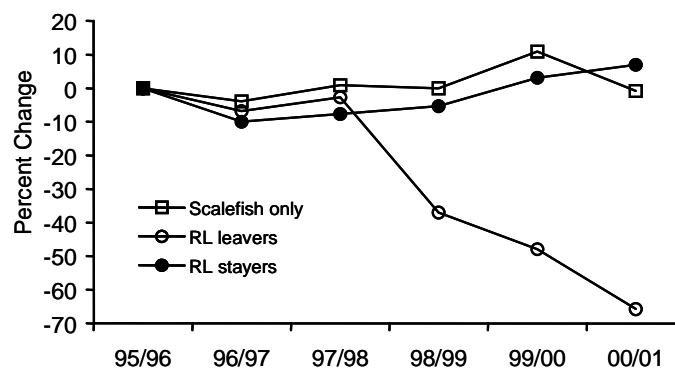


Figure 34. The percent change in the number of vessels operating in the scalefish fishery from 1995/96 to 2000/01 relative to 1995/96.

Of the rock lobster vessels that fished for scale-fish, those that left the rock lobster fishery did so primarily as a result of the introduction of quota and over 60% of leavers no longer participate in the scalefish fishery (Figure 34). In contrast, both the vessels operating solely in the scalefish fishery and rock lobster vessels that were operating in

the scalefish fishery in 2001, have shown only minor changes since the introduction of quota (Figure 34). With available information it cannot be determined whether the small decline in vessels operating solely in the scalefish fishery in 2001 is related to the slight increase in rock lobster vessels that have now become active in the scalefish fishery.

Between 1996 and 2001, 73 rock lobster fishing vessels left the fishery and only 34% of these continued to participate in other fishing activities in 2000/2001. The majority of these leavers have stopped fishing in the gillnet fishery (Table 13). Although there has been a 10% reduction in the number of boat days that rock lobster leavers have spent in the line fishery, those that remain have substantially increased the days they fish and now spend more days line fishing than comparable scalefishers. Only relatively minor changes have occurred in the number of fishing days using lines for both the rock lobster stayers and the scalefishers (Table 13). Thus, the main impact of re-directed effort from fishers that have left the rock lobster fishery is into the Tasmanian scalefish line fishery.

There has been a small decrease in the number of total boat days spent gill netting by remaining rock lobster fishers. However, this decrease (9%) is substantially smaller than the decrease in total number of boat days spent gill netting by scalefishers (29%) over the same time (Table 13), indicating that whatever is affecting the behaviour of the scalefishers is not having an equal impact on the rock lobsters fishers who use gill nets. This is expected as lobster fishers primarily gillnet to acquire bait for their pots rather than targeting fish for commercial sale.

Table 13. Comparison of rock lobster fishers who remained in the fishery after quota (stayers - S) and those who left (leavers L) and non-lobster scale fishers. The indicator refers to days spent fishing in Tasmanian scale fish fisheries.

Gear	Leaver or Stayer	97/98	00/01	% Change
		(pre-quota)	(3 yrs after quota)	
Total Boat Days				
Gill Net	L	908	157	- 83%
	S	1037	945	- 9%
	Scale fisher	3225	2280	- 29%
Line	L	600	542	- 10%
	S	660	696	+ 5%
	Scale fisher	2129	2063	- 3%
Average Days per Boat				
Gill Net	L	19.32	15.70	- 19
	S	16.46	12.12	- 26
	Scale fisher	27.10	21.71	- 20
Line	L	14.29	33.88	+ 137
	S	7.59	8.00	+ 5
	Scale fisher	23.40	24.86	+ 6.2

6.2 Species Targeted

Over 70 species of scalefish and cephalopods are recorded in logbooks as being caught by fishers with rock lobster licences. Only 16 of these species have been harvested in excess of 10 tonnes during any fishing year (Table 14).

Table 14. Total catch (tonnes) of scalefish caught by Rock lobster fishermen (leavers and stayers combined). Year is March to February.

Species/group	95/96	96/97	97/98	98/99	99/00	00/01	Total
Shark	297.1	85.1	130.8	159.5	263.4	232.0	1167.9
Trevalla, blue-eye	146.5	239.5	202.4	119.9	126.4	139.9	974.6
Trumpeter, striped	33.2	45.6	61.1	75.4	88.4	46.5	350.2
Warehou, blue	19.4	40.5	58.7	107.8	82.2	18.2	326.7
Wrasse	31.1	28.9	27.9	31.5	29.4	30.5	179.3
Trumpeter, bastard	21.8	31.0	31.1	19.0	19.4	15.9	138.1
Squid, arrow	2.9	0.6	1.3	28.2	86.0	18.9	137.9
Australian Salmon	14.8	16.2	38.4	13.9	14.2	18.8	116.3
Barracouta	7.3	10.9	25.5	17.6	10.8	11.9	84.0
Ling	13.9	7.9	6.8	7.0	8.7	33.0	77.4
Morwong, jackass	18.0	12.1	12.4	13.3	9.5	9.2	74.4
Leatherjacket	9.5	8.7	7.3	8.7	9.4	13.8	57.4
Mackeral, jack	7.7	6.3	4.8	22.0	4.2	4.5	49.5
Morwong, banded	17.0	9.0	6.3	4.7	1.6	6.9	45.4
Flathead	5.5	10.7	6.6	4.4	5.2	4.6	37.2
Garfish	2.3	1.8	8.7	1.2	6.9	11.0	31.8

Rock lobster fishers target two groups of fish, the first are species that are targeted to sell commercially such as shark, trevalla, striped trumpeter, and squid, and the second are species that are targeted for bait. The former are usually associated with specific gears (shark nets, jigs and drop-lines) and the latter are associated with graball (gill) nets. As the shark and blue eye trevalla are commonwealth species managed by quota they will not be discussed here. While fishers may have sold their lobster entitlement when quota was introduced and used this to purchase quota in another fishery, this has no impact on sustainability in a quota-managed fishery.

6.2.1 Striped Trumpeter

Rock lobster fishers have steadily increased their catch, effort and catch rates of striped trumpeter since 1995/96 (Figure 35). The impact of quota has not altered the trends in this fishery. In August 2000, a 250kg trip limit was introduced in the management of this species. Lyle and Hodgson (2002) consider that the decline in catches, catch rates and effort in 2000/01 is partly due to this management change but also suggest that reduced availability and abundance cannot be discounted for the drop in effort. Only a few of the vessels that left the rock lobster fishery at the commencement of quota have remained fishing for striped trumpeter. The effort by this group has been reduced by two-thirds. In contrast, the effort by both scale fishers and those remaining in the rock lobster fishery has remained relatively stable. In summary, the striped trumpeter fishery remains associated primarily with the rock lobster fishery, which has been

steadily increasing its share of the catch independently of management change in the lobster fishery. The largest impact on this fishery has been the recent introductions of trip limits (Lyle and Hodgson, 2002).

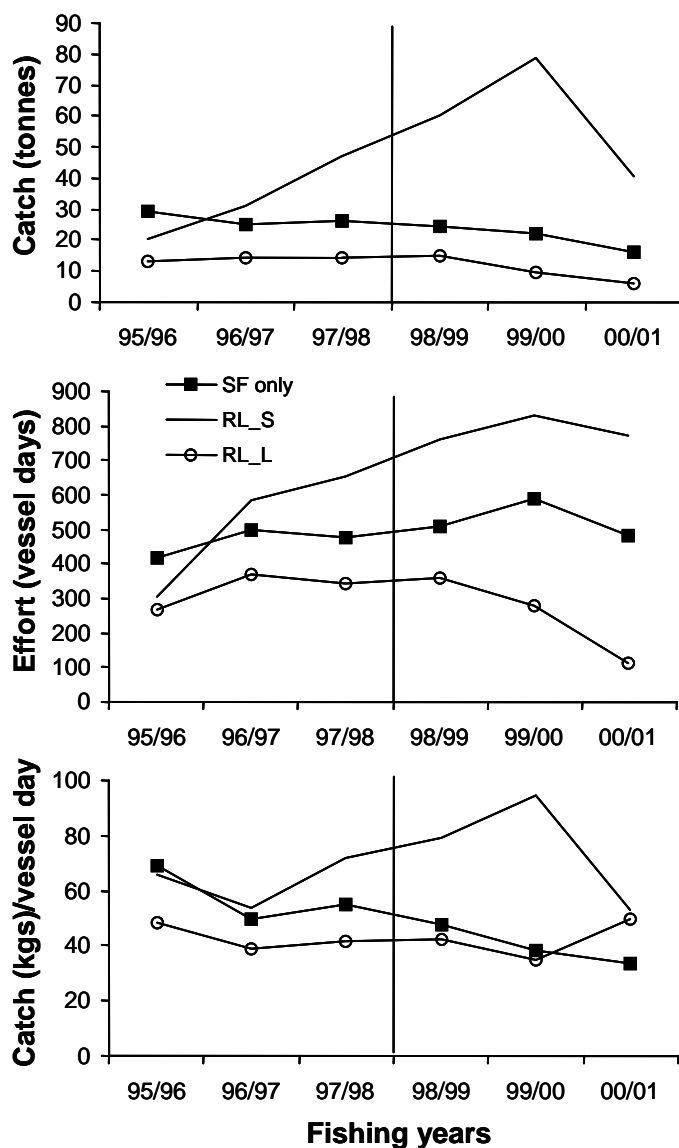


Figure 35. Catch (tonnes), effort (vessel days) and catch rate (kgs per day) of striped trumpeter caught by scalefish fishers (SF only, squares), rock lobster fishers who are currently lobster fishing (RL_S, fine line) and rock lobster fishers who have left the rock lobster fishery (RL_L, open circles).

6.2.2 Blue Warehouse

The majority of the blue warehouse catch is taken by scalefish fishers. Although the majority of rock lobster leavers have not remained active in this fishery, there were a few who appear to have been able to target blue warehouse during their normal fishing activities resulting in improved catch rates. In general, the catch rates of the rock lobster stayers and the scale fishers have remained relatively stable with the catch rate for all participants declining in the last fishing season due to a serious decline in the available stock. The introduction of quotas to the rock lobster fishery has had no observed impact on the blue warehouse fishery (Figure 36).

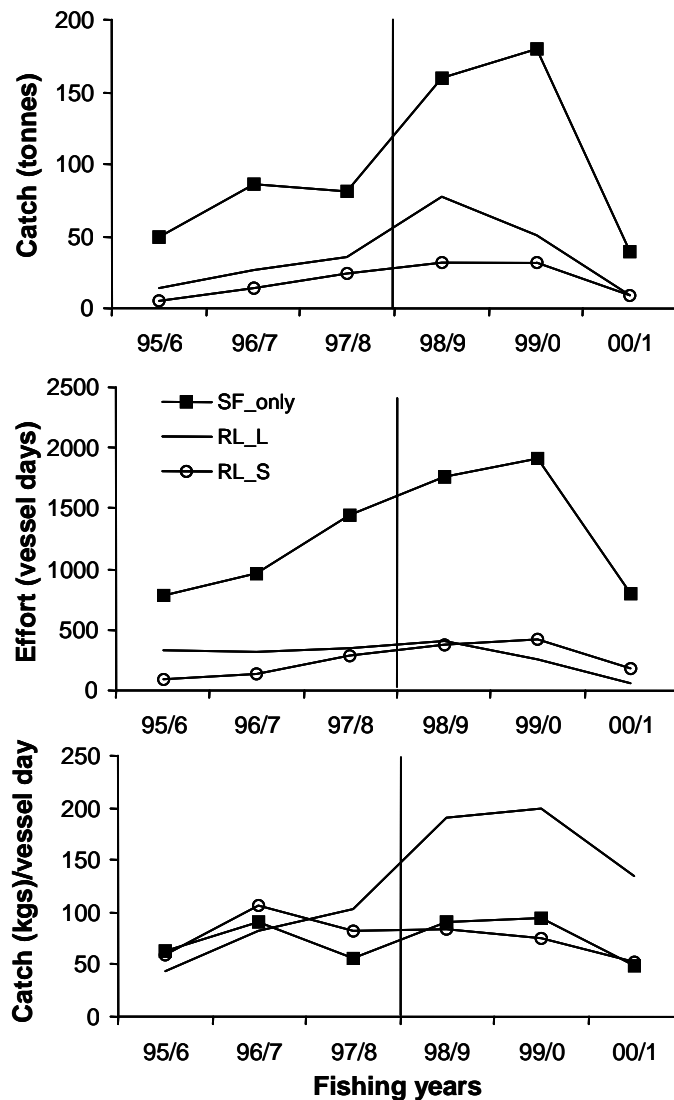


Figure 36. Catch (tonnes), effort (vessel days) and catch rate of blue warehou caught by scalefish fishers (SF only), rock lobster fishers who are currently lobster fishing (RL_S) and rock lobster fishers who have left the rock lobster fishery (RL_L).

6.2.3 Wrasse

Although the Wrasse catch by scalefish fishers has shown substantial variation over the last six fishing seasons the rock lobster fisher's share of that catch has shown a small increase from 18 tonnes in the 95/96 fishing season to 25.5 tonnes in 00/01.

Wrasse are targeted by the scalefish fishery as a 'live' fish trap or handline fishery. These two methods account for the majority of the wrasse catch. In contrast, rock lobster fishers use nets to catch wrasse as bait. The small increase in the amount of wrasse caught by lobster fishers since the introduction of quota may reflect the increased awareness of improving the unit return on each kilogram of lobster caught. Catching bait would offset costs associated with buying bait. Rock lobster bait has increased in costs and the combination of the increased costs and the need to increase economic efficiency may be causing the increased activity. Equally, there is concern by the rock lobster fishers that they will not be able to retain wrasse for bait and it has been suggested by industry that the improvement in the wrasse catch is simply an improvement in fishers reporting wrasse on their logbooks. Demonstrating past use of

the resource is considered beneficial in maintaining access in the future. As was seen for blue warehou, there has been an increase in the catch rate by the few vessels that have left the rock lobster fishery but continued to fish for wrasse. The impact on the wrasse resource by the introduction of quota appears favourable with fewer vessels and a subsequent smaller overall catch (Figure 37).

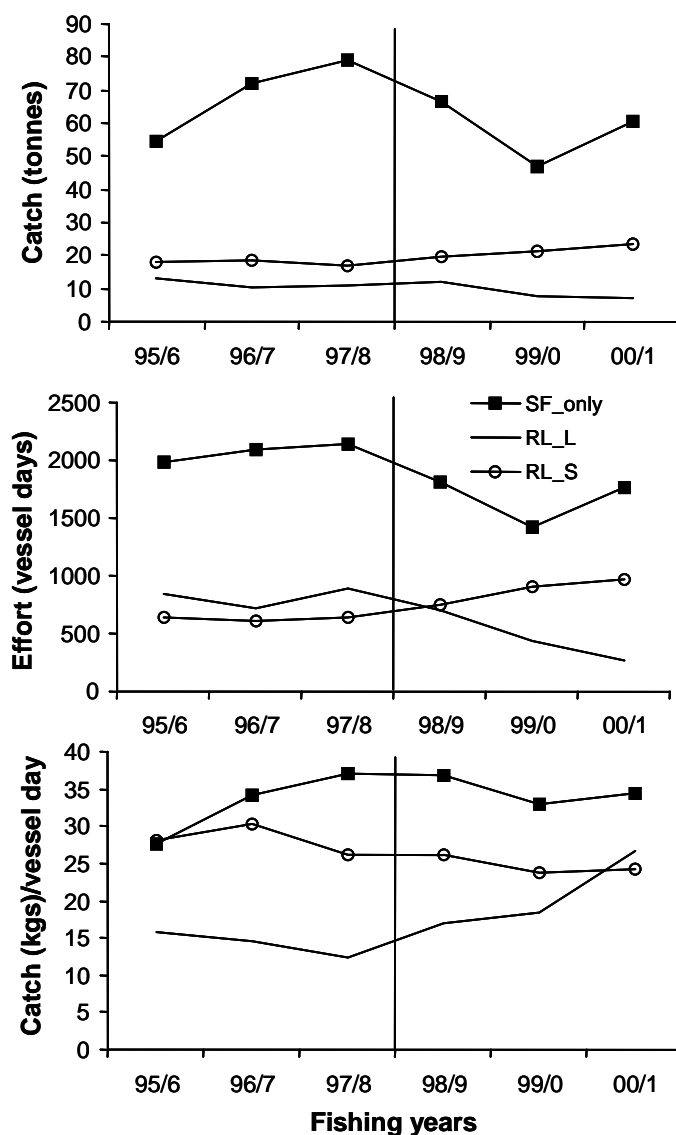


Figure 37. Catch (tonnes), effort (vessel days) and catch rate of wrasse caught by scalefish fishers (SF only), rock lobster fishers who are currently lobster fishing (RL_S) and rock lobster fishers who have left the rock lobster fishery (RL_L).

6.2.4 Bastard Trumpeter

Bastard trumpeter exhibited declining trends in the scale fish fishery with the exception of a rapid rise in the 1998/99 catch (Lyle and Hodgson, 2002). Interestingly, rock lobster fishers didn't see an increase in their catch or catch rate during this period suggesting that the scalefish fishers were targeting a different habitat than the standard habitat where lobster fishers fish. This is not surprising as bastard trumpeter are caught in gill nets and rock lobster fishers are primarily setting their nets for bait, a mixture of species, rather than specifically for bastard trumpeter. This interpretation is supported by the drop off in catch to virtually nothing by fishers who have left the rock lobster

fishery. As with wrasse the decline in vessels fishing for rock lobster has resulted in less effort being directed to the bastard trumpeter fishery (Figure 38).

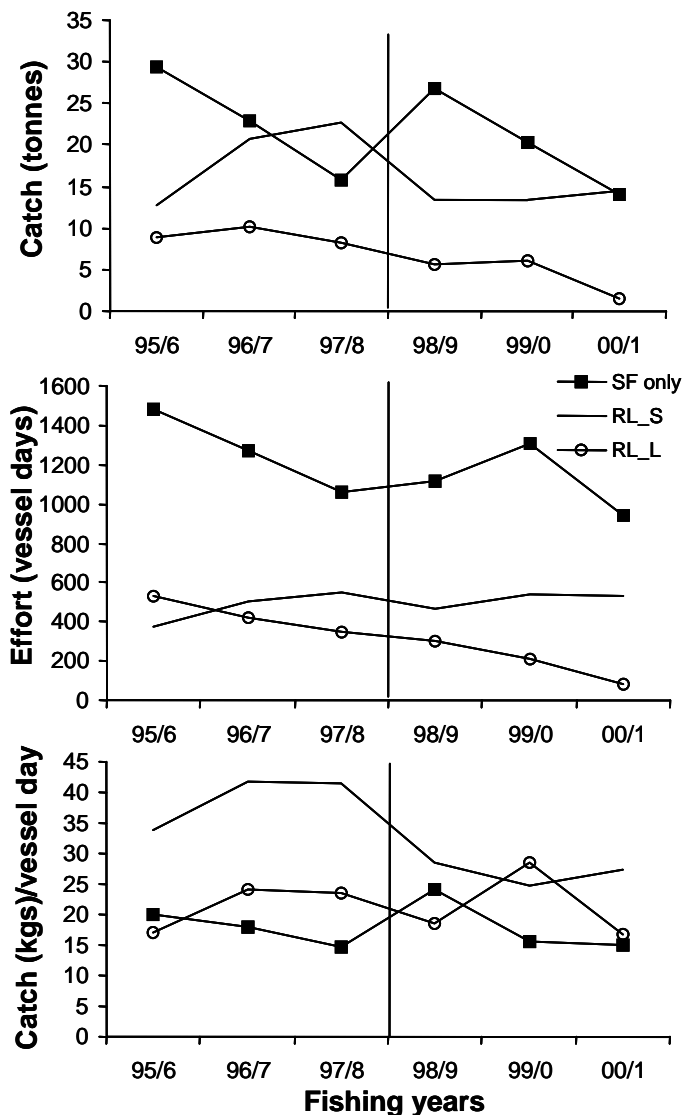


Figure 38. Catch (tonnes), effort (vessel days) and catch rate of bastard trumpeter caught by scalefish fishers (SF only), rock lobster fishers who are currently lobster fishing (RL_S) and rock lobster fishers who have left the rock lobster fishery (RL_L).

6.2.5 Arrow Squid

The arrow squid fishery has only recently developed in Tasmania with catches commencing to rise in 1998/99 to a peak of 460 tonnes in 1999/00 before dropping to 63 tonnes in the following year (Figure 39). Squid fishing involves specialised deck conversion with lights and jigging equipment. As such, few lobster fishers bothered to alter their deck layouts whereas several fishers who had left the rock lobster fishery and were looking for other fisheries to use their vessel were prepared to make these deck changes. These fishers have followed the same trend in catch as the scalefish fishers and account for between 20 and 30% of the arrow squid catch.

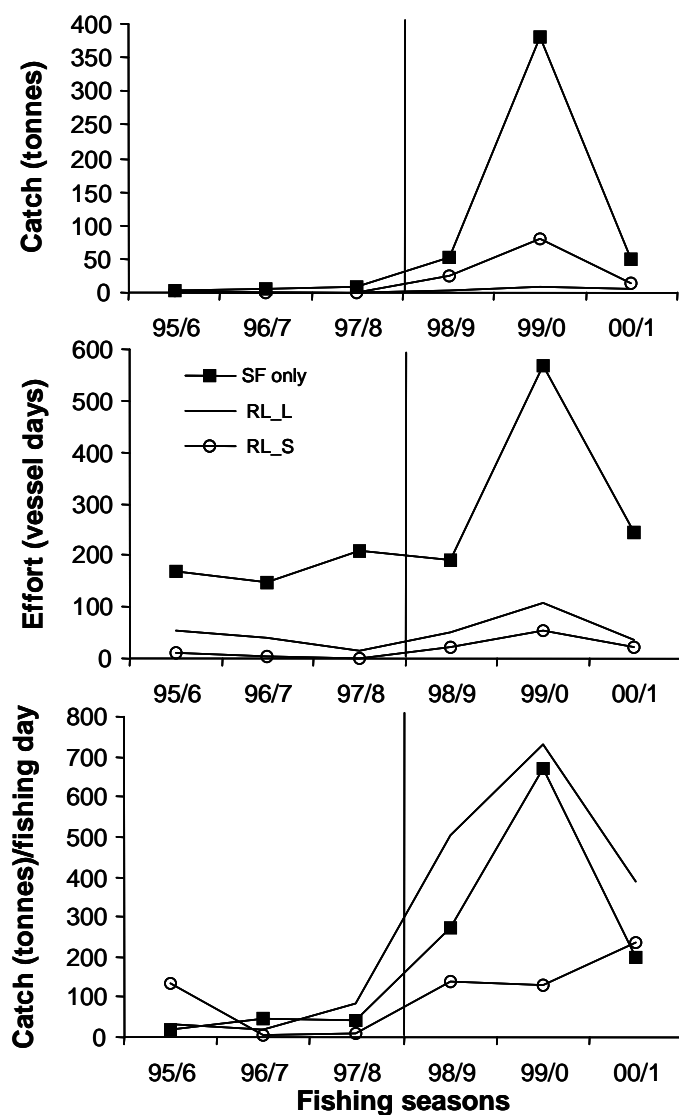


Figure 39. Catch (tonnes), effort (vessel days) and catch rate of arrow squid caught by scalefish fishers (SF only), rock lobster fishers who are currently lobster fishing (RL_S) and rock lobster fishers who have left the rock lobster fishery (RL_L).

6.2.6 Other species

Barracouta is a low value species caught primarily by scale fishers using troll line gear. Despite a five-fold increase in the catch in 1997/98, the scalefish catch has steadily declined since this time. In comparison, the catch by rock lobster fishers who remain in the fishery has remained relatively stable and thus their proportion of the barracouta catch has steadily increased. While market prices and other fishing opportunities will affect the scalefish fishers, barracouta is primarily caught by rock lobster fishers for baiting rock lobster pots.

Barracouta is primarily caught by trolling and rock lobster fishers troll between port and the fishing ground or between the fishing ground and the evening's anchorage (Figure 40). A small amount of catch is taken by lures cast from the vessel as the barracouta are attracted to the lights of the vessel at night. Targeting barracouta by trolling using the lobster vessel would not be considered a cost-effective method, as the operational costs of the lobster vessel would be too high. Both the catch of

leatherjackets and marblefish by remaining rock lobster fishers has increased since the introduction of quota (Figure 41 and 42). In comparison, the catch by scalefish fishers has slowly declined. As for barracouta, leatherjackets and marble fish are primarily used as rock lobster bait. Both species are caught in gillnets and fish traps. Marblefish and leatherjackets are caught by graball and gill nets. The increase in the catch of these species is most likely associated with either more rock lobster fishers activating their nets or using their nets more frequently. With the change to an ITQ management system fishers are focusing on improving profits by improving the unit return per lobster caught. At the same time, there has been an increase in the price of rock lobster bait and the supplementation of bait with graball and gill net catches is expected to reduce operational (marginal) costs.

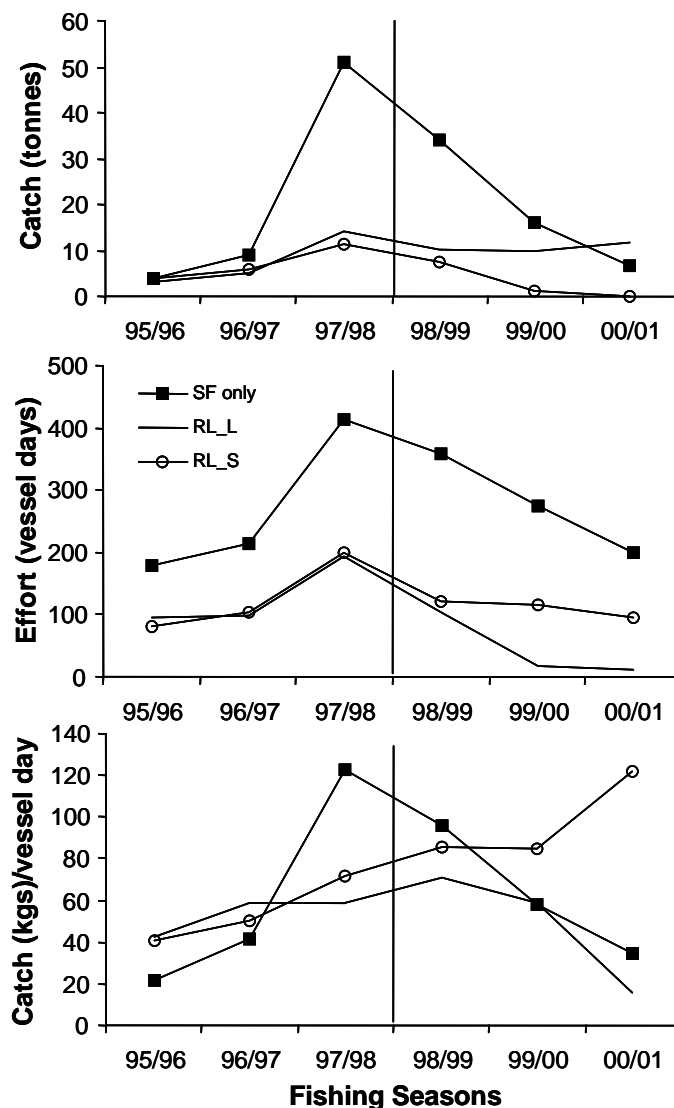


Figure 40. Catch (tonnes), effort (vessel days) and catch rate of barracouta caught by scalefish fishers (SF only), rock lobster fishers who are currently lobster fishing (RL_S) and rock lobster fishers who have left the rock lobster fishery (RL_L).

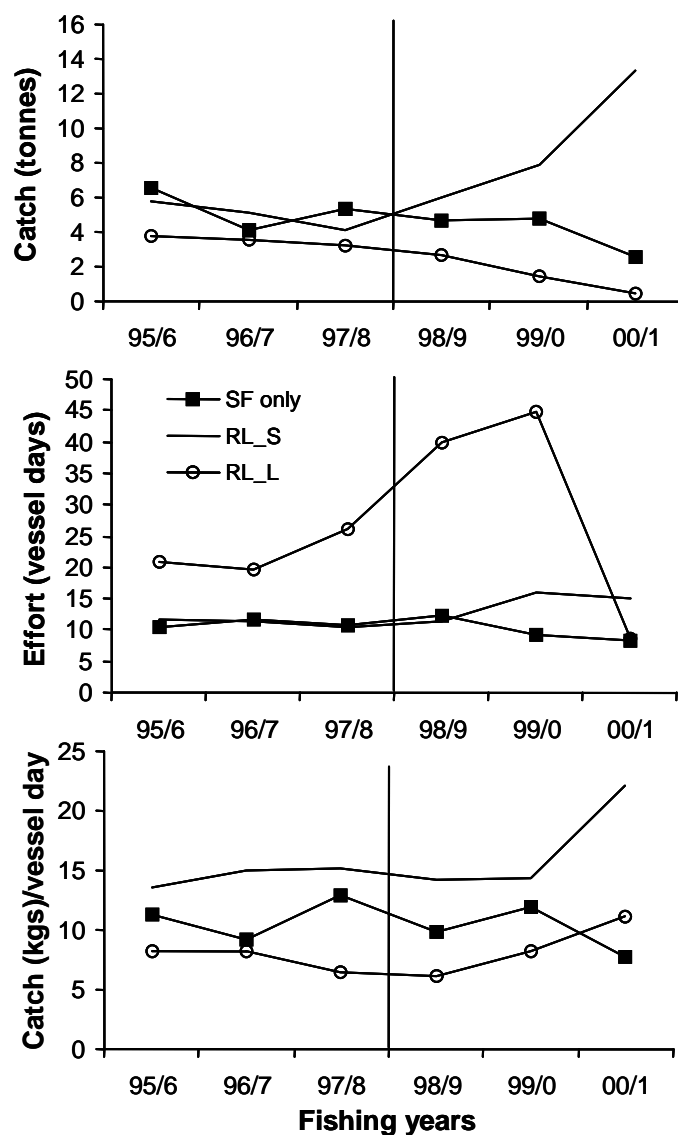


Figure 41. Catch (tonnes), effort (vessel days) and catch rate of leatherjackets caught by scalefish fishers (SF only), rock lobster fishers who are currently lobster fishing (RL_S) and rock lobster fishers who have left the rock lobster fishery (RL_L).

6.3 Discussion

During the interviews that made up part of the socio-economic study, rock lobster fishers reported that they had not redirected their effort into other Tasmanian fisheries. This is supported by the catch data recorded in the general fish (scalefish) logbooks. However, with the introduction of the ITQ management system into the rock lobster fishery there has been a substantial reduction in the number of vessels operating and thus the potential arose for vessels that no longer operate in the rock lobster fishery to redirect their fishing capacity into other fisheries. Fishers did state that several of the larger vessels that left the fishery went interstate to operate in other rock lobster fisheries or other fisheries (e.g. the east coast tuna fishery). Several fishers have moved into other Tasmanian fisheries (e.g. squid, striped trumpeter), the major impact of such re-direction was an expansion into Tasmanian line-fishing methods. This increased effort may be having a negative impact on some of the species targeted through these methods (e.g. striped trumpeter), however, it is difficult to separate the effects of the increase from the standard efforts of traditional scalefishers. On the other hand, the

decline in the number of vessels now operating in the rock lobster fishery has resulted in less effort being directed onto most scalefish fisheries (because of the absolute reduction in gillnet effort brought about by the reduced need for bait). Changes in the management plans of the giant crab, scallops, and some of the scalefish fisheries appears to have limited the capacity for rock lobster fishers to substantially shift effort into any of these fisheries.

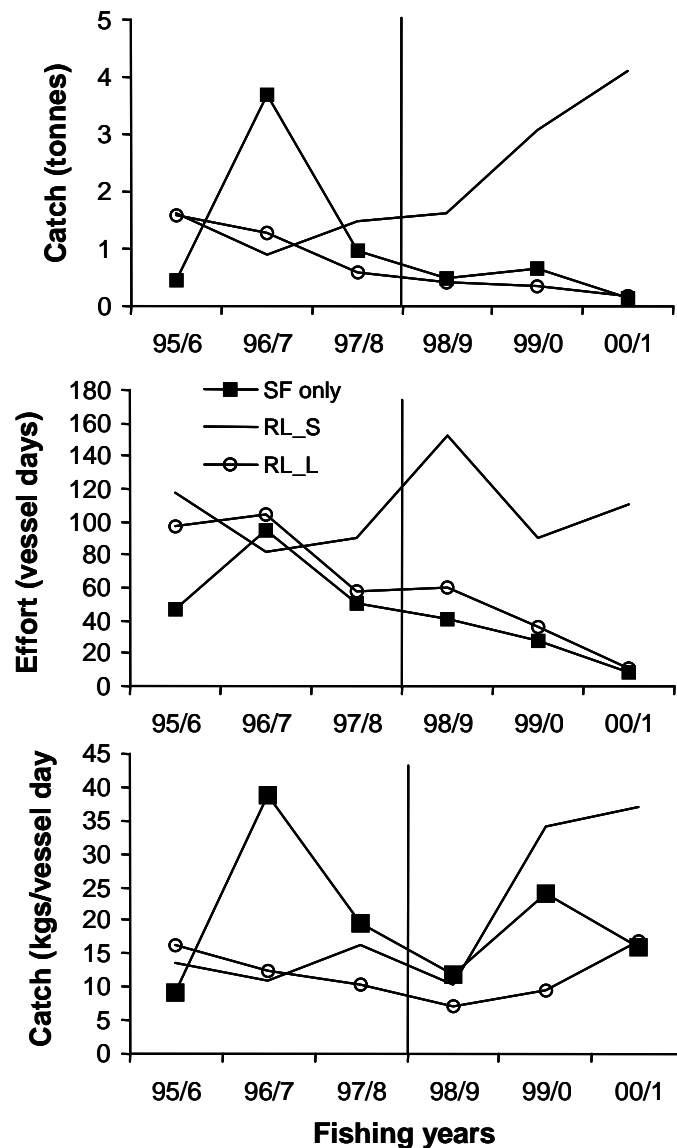


Figure 42. Catch (tonnes), effort (vessel days) and catch rate of marblefish caught by scalefish fishers (SF only), rock lobster fishers who are currently lobster fishing (RL_S) and rock lobster fishers who have left the rock lobster fishery (RL_L).

From a sustainability perspective there appears to be little concern that redirected effort from the implementation of an ITQ management system will result in a detrimental effect. There is a possibility that the striped trumpeter fishery has been negatively affected but there has only been one year of poor performance in the fishery for this species. Increased effort into fisheries that are of limited value and primarily harvested for bait may also be of concern. Because these species have limited commercial value, they are rarely studied and there is currently limited information regarding their abundance, spatial dynamics or basic biology. Furthermore, there is concern that the recording of species destined for bait is under-reported. Although the increase in the

bait catch may be an improvement in the recording of bait in logbooks, the increase in the price of bait is also considered to have increased fishers efforts into minimising this cost. Fishers state that there is a slow but gradual move to fishing in inshore waters where the quality of lobsters is higher. It is the coastal reefs, which are, targeted with fish traps and nets and thus this change in the dynamics of the lobster fishing fleet would allow for more time to be directed to 'bait' fishing. While the remaining rock lobster fishers have increased their fishing effort for bait, the reduction in fisher numbers will also have had a positive effect by reducing the absolute amount of bait taken.

It is recommended that further consultation with rock lobster fishers be undertaken to ensure that bait species are being recorded by all fishers. It is also recommended that the fishing for bait is monitored and efforts are made to determine its impact on the temperate reef ecosystem. A recently funded FRDC project evaluating ways of assessing fish species with limited data may help address the latter issue.

7. Socio-economic changes associated with change to an individual transferable quota management system in the Tasmanian rock lobster fishery.

7.1 Introduction

[T]o analyze a proposed policy is to attempt to understand who the gainers and losers are, how they regard their new situation *in their own terms*, and what this means for the full array of beneficial and harmful effects (Bromley, 1991).

This social impact assessment is by way of satisfying one of three social research components of a Fisheries Research and Development Corporation (FRDC) funded project into the introduction of quota management in the Tasmanian commercial rock lobster fishery. The full title of this project is *Impact of management change to an individual transferable quota system in the Tasmanian rock lobster fishery*. The two other reports that make up the social research component of this project are *Interview derived fleet dynamics comparing before with after the introduction of quota management in the Tasmanian commercial rock lobster fishery* and *Use of GPS and plotters in the Tasmanian commercial rock lobster fishery*.

Introduction to this social impact assessment is as follows. In 1997, a team was commissioned to compile a socio-economic profile of the Tasmanian commercial rock lobster fishery (Williamson *et al.*, 1998). It was commissioned by the then Tasmanian Department of Primary Industry and Fisheries to assist both government and industry to decide on a proposal to introduce a quota management system in the fishery. The present report draws on experience gained as part of Williamson *et al.* (1998). Based on this experience, a decision was made to build an understanding of the industry from its smallest possible unit, that of the individual participant. Rather than selecting a number of ports as case studies, it was decided to give all participants in the industry an opportunity to participate in the research.

Moreover, exploration of local multipliers in Williamson *et al.* (1998) found the pursuit of these to be problematic in the case of the Tasmanian commercial rock lobster industry. No areally discrete dedicated rock lobster ports and associated general communities and infrastructure exist in Tasmania in which the socio-economic impact of the introduction of quota management can be isolated and measured. Work was done with the ABS as part of Williamson *et al.* (1998) in an attempt to separate data for rock lobster fishers from the 1996 census. Some data were available, but in an insufficient number of cases to be useful. With the experience of Williamson *et al.* (1998) in mind, therefore, it was decided to focus on the impacts of quota management at the scale of the individual industry participant rather than to attempt to paint a general place-based picture in which the number of individuals involved in the industry was insufficient to be readily appreciated.

Having said this, once individual building blocks are available in the form of industry participants, these can be aggregated and treated at larger scales. One way of doing so is typologically, but another is spatially in terms of the geographic distribution of the

Tasmanian commercial rock lobster industry. It is a matter therefore of ascertaining an appropriate scale at which to assess social impacts. Clearly, individual participants are a good place to begin any social impact assessment and are the units used to 'build' this report. Locally, however, the community-wide scale may be too large and/or diverse to perceive the industry. Thus, the geographies of individuals, local fleets, ports and families are discussed, but the places associated with these, while important, are not a key unit of analysis. Note, too, that 'community' does not just apply to places but can relate to a group within or across places, such as in the case of a community of participants in the commercial rock lobster industry.

Research for this assessment took from March 2000 to February 2001 and involved an attempted interview 'census' or universal sample of the industry. Approximately 250 formal semi-structured interviews were undertaken with participants from all sectors of the industry. Approximately half of these interviews were audio taped, resulting in approximately 150 tapes or 200 hours of recorded interviews. The resources allocated to the project, however, did not make possible transcription of these tapes. Instead, detailed notes taken during interviews were used for analysis. The tapes have been catalogued and made available to the Tasmanian Aquaculture and Fisheries Institute (TAFI) for possible analysis at a later date. They represent an important archive of many industry participants' experiences and views regarding the introduction of quota management in the Tasmanian commercial rock lobster industry.

For purpose of conducting a valid and useful piece of social science, it could be argued that research has over-sampled the Tasmanian commercial rock lobster fishery. A 'census' was attempted, however, as it was recognised that the research was not simply a piece of science but was also meant to be a policy-relevant and management-useful exercise. For reports resulting from the research to have credibility in the view of industry as many industry participants as possible needed to be involved in the research. Fishery managers had found it difficult to implement results in the industry from reports in which only a small sample of the industry was involved. For their part, industry participants found it easy to ignore or discredit a report in which only a few of their number was involved.

'What study?', 'first I've heard of it', 'they didn't talk to me or any of the fishermen I know', 'that's just the view of a few in the industry', 'they only asked those who'd tell them what they wanted to hear'

and so on are the sorts of credibility-damning questions and comments that small samples of the industry risk. The scientific rigour of a sample may not be the issue; rather it is a question of a sample's industry-political utility. It is difficult for research to be policy-relevant or efficacious in an industry context without industry credibility based on widespread industry awareness of and preferably involvement in that research. (On sampling having possibly competing scientific [minimum sample] and population-political [maximum sample] aspects see Ram [1995].)

It was therefore considered important that every known participant in the industry be given the opportunity to participate in the research. From the outset, it was realised that research would fall short of a 'census' of the industry. The hope was that, by attempting to include all participants, a major sample would be achieved. Also, those not participating in the research would be made aware of the study and would have

actively to decide not to participate in it.

All known addresses of industry participants were posted letters of introduction inviting participation in the research, all known telephone numbers were used to contact participants verbally, and all ports in Tasmania were visited to contact and interview industry participants. In these ways, the study became known in the industry. On hearing of it, a number of participants approached researchers to be involved. The facts that the study was based at the University of Tasmania and that research aimed to include as many participants as possible contributed to a perception in the industry that the study was independent and fair. This perception was in part achieved by over-sampling. Over-sampling produced a non-random sample, discussed in Chapter 7.2, but this was considered acceptable given the credibility achieved.

A total of 247 interviews is a large empiric. It was considered that both quantitative and qualitative data were useful regarding policy and management of the fishery. A data matrix was constructed that standardised and summarised information from the interviews; transcription of the interviews was beyond the resources and scope of the project. Completing the data matrix alone required one researcher full-time for three months. Much of the report is drawn from the data matrix. Even regarding the data matrix, however, a substantial amount of information cannot be presented in this report. Like tapes of interviews, therefore, the data matrix has been made available to TAFI for possible further analysis at a later date. Note that it was beyond the resources and scope of this study to transcribe audio tapes of interviews. However, detailed qualitative typological analysis of industry participants is possible in future, as these tapes have been archived. Ideally, data detailing the range of experiences within each industry participant type could be presented. Much of this information is woven through the report, but given more time, scope and/or resources each type could be presented individually.

Another possibility that was beyond the scope of this study was that it would have been useful to undertake a boat-by-boat analysis for each port, comparing before with after the introduction of quota management. While for purpose of exemplifying the decline of 'away' ports under quota management such an analysis was conducted for Strahan, as well as in a limited way for a number of other ports, comprehensive treatment of the fishery in this way could have revealed the micro experience of every port. Given the size of this report, however, even with these omissions, meeting this possibility would most likely have resulted in an unwieldy document in terms of length.

Thus, in this report a strong empiric, built participant-by-participant underpins aggregate descriptive statistics and more general assessment. Note that this report is a social impact *assessment*, compared with the profile compiled by Williamson *et al.* (1998). The aim is that this report not be so much an academic as an industry-readable and policy-relevant document. Thus, little dense exemplification, academic referencing or quotation is undertaken. Instead, simple descriptive statistics drawn from a major empiric and accompanied by informed discussion and assessment is presented. As noted, the sheer volume of information generated by the research meant that such summation was essential if reporting was to be manageable. Moreover, general assessment across aggregate cases, rather than of case studies of specific individuals, was preferred for reason of confidentiality.

The aim in this report, then, is to stick close to the unique data set; DPIWE databases

are dealt with as part of separate work in the overall project. Having said this, there is a role in social impact assessment in conceptually framing or translating important industry terminology and relationships. There is a place in this role for social theory. For example, the Tasmanian commercial rock lobster industry can be considered according to its different capital components, namely organic, human, real, fictitious and social capital. This approach is drawn from a particular stream of political economy and, in addition to these terms, it poses relations between participant types in the industry. Thus, for example, lessees can be considered, not just as losers regarding the introduction of quota management, but as becoming 'labour', rather than becoming owners, in terms of their relations with so-called investors.

As well as some use of social theory to define terms and conceptualise relations, an element of postulation is presented in this report. For example, on the basis of the 247 interviews and in conjunction with DPIWE data, it is ventured that fishing out of 'away' ports for extended stints has declined considerably under quota management. To venture such a proposition, measures such as boats-through-ports and concepts such as 'away' ports, compared with 'home' ports, have been developed. These are removed from the language of many of the participants in the industry, as are the social theoretical terms noted above, but they make it possible, for example, to perceive at different scales comments made by many participants to the effect that their 'home' port experienced less visiting boat activity under quota management.

One of the objectives of the project is to *establish performance indicators relevant to managing the fishery*. Socio-economic indicators are 'fuzzy' measures; i.e. their specification is an often contentious industry-political process. Throughout this report, socio-economic characteristics of the fishery that could be monitored in future are discussed. The measure 'boats-through-ports' is one example. In the conclusion of this report, a number of such 'indicators' are identified that, given appropriate attention to data collection and manipulation procedures, could be used to monitor facets of the socio-economic structure of the fishery. Such indicators, however, are at best partial; each gives only summary insight to a complex, highly interrelated system. Consequently, production and monitoring of indicators need at intervals to be supplemented by social research to provide detailed background to these measures.

This report, then, is part of a hermeneutic circle (Gadamer, 1976), i.e. it is part of a movement from participants' understandings, through 'data', to assessment. *En route*, the hope is that as much of participants' understandings be retained as possible. These understandings, however, are filtered through processes of aggregation and conceptualisation that aim to understand at different scales social impacts due to the introduction of quota management. A participant's understandings can be included with those of other participants to gain an insight into experiences more general than that of a single individual. Considering one piece of information in light of another is an important part of much science. Such comparison is not just internal to data generated by social research as part of this project. On the contrary, in some respects findings in the report *Interview derived fleet dynamics comparing before with after the introduction of quota management in the Tasmanian commercial rock lobster fishery* differ from those obtained from analysis of logbook derived data. Changes many operators noted in their fishing under quota management – that they were fishing locally, inshore and in winter more – is not strongly supported by analysis of catch return data. This difference then raises the question of *why* the difference between the

two data sets?'. Are catch returns reliable regarding area and depth fished? Are fishers' perceptions reliable? An answer may exist somewhere between these two questions, the point is to compare the two assessments and work towards resolving what differences exist. In this way, a better understanding of changes in fleet dynamics under quota management may be achieved. It is worth noting that the two data sets can operate on different scales as well as in different time frames, interviews being more 'live' than catch return data for a period.

Finally, as noted, one aim in this report is to remain as close to interview derived data as possible. Academic debates and references, therefore, are largely eschewed in favour of data presentation. Readers wishing to avail themselves of various literatures concerning this report are encouraged to contact the authors.

The structure of this report is, in Chapter 7.3.3, to discuss the positive impacts noted by participants regarding the introduction of quota management. In Chapter 7.3.4, the negative impacts of the introduction of quota management are set out. Participants' opinions of a number of past, present and possible future policies are given in Chapter 7.3.6. In Chapter 7.3.7, effects of the introduction of quota management on ports are detailed, while conclusions are brought together regarding performance indicators in Chapter 7.3.8. Next, in Chapter 7.2 research methods and techniques used to generate data presented in this report are discussed.

7.2 Research Methods and Techniques

Networks can rarely be cut up into simple and easily quantifiable descriptive frameworks. 'Putting things into numbers', which is the extreme case of 'putting things into words' is only one possible form of description. Whether or not this is possible clearly depends on the state of the network. It makes no sense to try to quantify or to reduce behaviour to variables and functions under all circumstances. On the other hand, it is silly to reject all quantification. The choice of method obeys no epistemological imperative, since it is entirely dictated by the state of the network. If the network standardises itself then one is bound to count and calculate. If it is divergent and reversible, then excessive simplification (and quantification) will betray the state of the network, and it is better just to tell a story! Each actor is relatively unpredictable, because any translation is constantly being undone. Here, then, the only fruitful – indeed intelligible – method is that of literary description. Such description multiplies points of view to form a polyphonic narrative (Callon, 1991).

Research methods and techniques used in producing this report are outlined in this chapter. By methods and techniques is meant how the information was generated as well as how it was handled (Philip, 1998). To introduce the approach taken, the above quotation from actor-network theorist Michel Callon is discussed almost sentence-by-sentence. Apart from this quotation, this chapter is not encumbered with academic references regarding the conduct and combination of quantitative and qualitative research methods and techniques. Readers interested in academic literatures underlying this chapter are encouraged to contact the authors.

Networks can rarely be cut up into simple and easily quantifiable descriptive frameworks.

It is not news to many people in the Tasmanian commercial rock lobster industry that the industry is complex. Most industries are. The act of catching rock lobster for commerce is surrounded by technologies, markets, regulations, science, social relations and so on in such a way as to promote as much difference as similarity. From the outside, the industry presents a picture of seemingly unfathomable complexity, while from the inside differences between individuals make it hard to see any clear patterns. In other words, it can be difficult to see the wood for the trees. What was clear from the outset of this work, therefore, was that there was no shortcut to understanding the industry.

Faced with a complicated network of different individuals, research began with the difficulty of even accurately counting participants in the industry. Standard practice in social research is to define a research population and then to decide how to sample it. Defining the industry, however, depends on it being possible to categorise and quantify its various participants. Ignoring, for the moment, difficulties in fitting complex individuals into one-dimensional categories, rarely do networks have neat boundaries. For example, how far are live rock lobster to be followed on their journey to Asian markets before those handling them are not considered part of the industry? Asian markets influence the 'beach' price in Tasmania, i.e. the price paid by 'processors' to fishers for rock lobster, usually quoted in AU\$ per kilogram. The beach price is a central part of the industry's economy. Are wholesalers in Melbourne, Sydney or Hong Kong, then, to be counted as part of the industry? Put another way, what does the 'Tasmanian' in the Tasmanian commercial rock lobster industry mean? Clearly, some participants fish in Tasmanian waters but live in Victoria, or hold an entitlement and quota units in the fishery but reside in Queensland. A further example is the question of how to consider unregistered beneficial interests in quota units in the fishery. These interests are clearly a part of an industry market, but it is difficult even to identify them. A final difficulty, alluded to above, is that people are rarely part of only one network, and individuals' associations with other industries can have an important bearing on their participation in the Tasmanian commercial rock lobster industry.

The main point is that the Tasmanian commercial rock lobster industry overflows its Tasmanian management jurisdiction. Consequently, the approach taken, with the resources available, was to be as inclusive as possible. Anyone with a past, present and in some cases future part or full time labour and/or financial relationship with the industry was included. Research was resource-limited physically to Tasmania. Contact was made with industry participants on mainland Australia through postage and by telephone. Contact outside Australia was not undertaken due to both limited resources and language skills.

Research began with the intention of talking with everyone in the industry. The aim was to conduct an industry 'census' of a sort. Though a 'census' proved impossible due to the difficulty of defining the industry, noted above, the principle of talking in person with every participant who wished to be included in the research remained at the core of the work throughout. This principle then raised the question of how to establish awareness of the research in the industry, and then to make contact with industry participants; in other words, how to begin gathering the numbers that would make up a sample of the industry.

'Putting things into numbers', which is the extreme case of 'putting things into words' is only one possible form of description.

Before discussing numbers as the outcomes of statistical techniques below, in this section the numbers that are part of any method are set out. The issues of who to include and where to begin research were the start of a movement from numbers, to words and, in some cases, back to numbers. The core figure around which research was built was number of entitlement holders. These were chosen because a complete and up-to-date mailing list of entitlement holders was maintained by the Tasmanian Government Department of Primary Industries, Water and Environment (DPIWE). DPIWE also maintained a mailing list of those licensed to handle rock lobster, and this list was used to contact and interview the 'processing' sector in the industry. Thus, two numbers or lists representing two broad types of participant in the industry were the starting points for research. Only these two lists were used due to difficulties with DPIWE databases for research purposes, a use for which they were not designed. These difficulties ruled out using a list of skippers or 'licence supervisors' in the bulk of the research reported here.

Thus, the two reliable and up-to-date databases used in the research in this report were mailing lists rather than records derived from DPIWE fleet and industry data. First, the shorter of the two lists is discussed. Those with a licence to handle rock lobster that actually did so in 1999/2000 numbered 54. This number included some restaurants, fish punts and general seafood wholesalers, as well as entities dedicated to handling of rock lobster full-time. Preliminary telephone contact established that 22 of these 54 entities, principally full-time processors, may in some way have been affected by the introduction of quota management. This group of 22 was then targeted for formal interview. Some of these 22 licensed handlers were also directly associated with fishing or fishers in some way, and were therefore counted and interviewed as part of another list. In total, then, 15 processors, accounting for 62.6 per cent of the catch handled in Tasmania in 1999/2000, were formally interviewed.

Second, of the 323 entitlements commercially to fish for rock lobster in Tasmania, a contact list of 295 entities was prepared by treating holders of multiple entitlements as a single entity. This treatment proved to be conservative as Dr Linda Eaton has since calculated that there were 239 single licence holding entities in 1999/2000, the fishing year in which the databases used in the research in this report were generated. (More than one individual was often involved in each licence, some formally and some 'silently'.) As a starting point, these 295 entitlement holding entities were each posted a letter introducing the research, inviting participation and noting that a port visit would be undertaken in their vicinity, at which time they would be contacted again with the aim of arranging a formal interview (Appendix 5). Recipients of this letter were also encouraged to contact researchers before and/or after port visits. Moreover, recipients were asked to inform anyone in the industry of the study who was not an entitlement holder who might be interested in participating in the research. Researchers' contact details were given in the letter. General notice of the research was also made in *Fishing Today*, a periodical of the Tasmanian Fishing Industry Council (TFIC). (TFIC is the peak fishing industry body and represents all sectors of the commercial fishing industry in Tasmania; it has approximately 1000 members.)

Various strategies were then used to approach entities on the list of entitlement holders. First, for each port outside the greater Hobart area, entitlement holders with a postal

address in the port were posted notice of imminent port visitation (Appendix 6). A letter was sent approximately one week before researchers' arrival. It stated that attempts would be made to contact the entitlement holder by telephone on the Sunday evening before arrival on Monday, with the aim of arranging a formal interview. Table 15 indicates the ports and areas that were visited.

Table 15. Ports and areas visited as part of the research

Bicheno	Smithton
Bridport	St Helens
Esperance	Stanley
Flinders Island	Strahan
King Island	Tasman Peninsula
Launceston	Triabunna

Each port visit lasted approximately seven days. During this time, attempts were made to contact and interview all entitlement holders. Attempts were also made to contact and interview all those in the port licensed to handle rock lobster. Moreover, it was important to the research that all types of participant in the industry be included. With no databases of boat drivers, deck hands, lessees, recent leavers and so on either reliable, up-to-date or extant, the methods of word-of-mouth and so-called dockside intercept (Gatewood and McCay, 1990) were used to identify and contact industry participants not on either the entitlement holders or licensed rock lobster handlers lists. Word-of-mouth is a type of cascade or snowball sampling method. In this research, it worked two ways. First, as those on the lists were contacted and interviewed, they were asked about others in the industry who were not either entitlement holders or licensed handlers of rock lobster. In this way, researchers were alerted to the existence of, and often given contact details for, boat drivers, lessees, shipwrights, recent leavers and so on. In addition, fishers with long experience in the industry who had recently retired were sought for possible interview due to the insight they might bring to issues such as longer-term stock decline and the impact of the introduction of various technologies. Second, news of researchers' visit often spread about the port, resulting in a number of industry participants approaching researchers, either in person or by telephone, to be interviewed.

In all cases, the preferred method of establishing contact by researchers was by telephone to arrange an in person interview. Telephone contact gave possible participants a low-key opportunity to decline to be interviewed; the opportunity to arrange a time and a place for formal interview that suited them; did not interrupt possible participants at work; and gave participants time to prepare for the interview, if any preparation was necessary. Much telephone contact was established at night when many participants had finished work and were either at home or were on the boat at anchor.

Telephone contact was not always possible, however, and dockside intercept was used in every port as a method of contacting those inaccessible by any other means. Dockside intercept simply involved visiting the dock at a time when fish folk were likely to be present. Such visits were made both with a view to meeting specific individuals as well as more generally to observe and contact any people possibly associated with the industry of whom researchers were unaware. Within a few days of

beginning a port visit, therefore, three lists were actually being worked from, a list of entitlement holders, a licensed rock lobster handlers list, and a list being compiled from the knowledge of participants interviewed of people in the industry not on either of these lists. Thus, by the end of a port visit, many people associated with boats in the port had been contacted and interviewed.

As research was being undertaken from the University of Tasmania's Hobart campus, ports in the greater Hobart area were visited more frequently. These 'ports' primarily consisted of Hobart's docks, the Domain slip yard dock, Margate and Kettering. In these cases, a second letter was not sent. Instead, a two-pronged telephone and dockside intercept method was used to contact participants in the industry. Hobart's docks, principally Victoria Dock, were visited approximately once per week over a number of months. Whichever commercial rock lobster boats were in port were approached, their skippers sought, the project introduced and often an interview conducted on the spot. If nobody was present on or around the boat, or the skipper was unavailable, the name of the boat was recorded, checked against a rough list of boats' owners and the owner, most of whom were also operators, was telephoned that evening with the aim of arranging a formal interview. Permission to board a boat, interview a deck hand and so on was always first sought from the boat's skipper.

The same method was used for the Domain slip yard dock in Hobart. Ports in the Channel area south of Hobart, mainly Margate and Kettering, were visited less frequently. Entitlement holders with a postal address in the Channel were contacted by telephone, and in most cases an interview was either conducted or arranged. Interviews usually involved visiting either the boat or the home of the entitlement holder. While in the vicinity, the local port was checked and any boats present were approached and their skippers sought. As for ports outside greater Hobart, industry participants not on the two DPIWE lists used were inquired after and any contact details were followed up. Outside the Channel, entitlement holders in greater Hobart not directly involved in fishing were telephoned and a formal interview requested and usually conducted or arranged. It is worth noting that the greatest number of licence holders and non-day fishers, who were harder to contact and interview, resided in greater Hobart.

In all interviews, Tasmania-wide, participants were asked about impacts of the introduction of quota management on their local community. Any leads given, such as regarding local marine engineers, shipwrights, ship chandlers and so on were then visited and the impact of quota management discussed. Talk of reduced employment for boat drivers and deck hands was checked with the local Centrelink office. In smaller, more areally discrete port communities, strategic community administrators such as council clerks or planners were interviewed regarding any changes attributable to the introduction of quota management.

By these methods, 247 formal interviews were conducted with participants from all sectors of the Tasmanian commercial rock lobster industry. More than one industry participant was involved in many of these interviews, for example in the capacity of a fisher's partner, who was also a participant in the industry. Formal interviews therefore included 312 people in the industry. In addition to formal interviews, many informal conversations were conducted. Thus, approximately 350 people in the industry were directly involved in the research in some way. However, a number of participants, there is no way of knowing how many, did not participate in the research. As in the case for the number of participants in the industry, only some numbers of non-

participants can be ascertained. Apart from those who communicated that they did not wish to be involved in the research, who numbered less than five, 84 or 28.4 per cent of the list of 295 entitlement holding entities were not contactable in person. (They had, however, received at least one letter introducing the research, requesting their participation and providing researchers' contact details.) Some of these entities were away fishing when their port was visited, the telephone numbers and residential addresses of others were not known, and some were simply not home when telephoned or not at their boat when visited.

Before discussing non-inclusion regarding other types of industry participant, it is noted that non-participation by the 84 entitlement holders could be expected to include more fishers than non-fishers. Without being able to contact those not included in the research in person, it is not possible to compile a profile of this group. However, 58 of this group had a boat attached to their entitlement, approximately the same proportion as in the group of 211 entitlement holding entities that did participate in the research.

There is no way of knowing the extent of non-inclusion among types of industry participant other than entitlement holders and handlers of rock lobster. Despite an accurate and up-to-date mailing list, it was not possible in person to include 28.4 per cent of entitlement holders. Non-inclusion in groups for which no list exists is likely to be greater. With limited resources and in many instances no available lists, however, non-inclusion was difficult to avoid.

Whether or not "putting things into numbers" is possible clearly depends on the state of the network.

There are some possible implications of the method used being non-random. Apart from those away or who declined to participate, all those on the two formal lists were interviewed. Entitlement holders and licensed rock lobster handlers were generally more familiar with government and research paperwork and processes, and were more stable in terms of continuity of occupation than some other participant types in the industry. They were also more likely to be interested in participating in social research into an industry in which they considered themselves to be stakeholders. Those on the informal list of a port's industry participants such as deck hands, boat drivers, those who had recently left the fishery and so on were less likely to be available, contactable or interested. For example, skippers themselves were at times unsure of the whereabouts of their deck hand(s) in port; many of those on the informal list were likely to be away fishing; and a number of those who had left the fishery had left the port and/or were difficult to contact. Consequently, though every attempt was made to flesh out the informal list, contact with individuals on this list was likely not as successful as with those on the entitlement holders and licensed rock lobster handlers lists. This is not to say that boat drivers, deck hands, lessees, recent leavers and so on were not interviewed, only that compared with those on the two formal lists they are probably not as well represented in the sample. In the sense, then, of failing to contact as many of those on the informal as on the formal list, the research is possibly skewed. Information received, however, is not distorted and remains valid. Similarly, in the sense of having two axes, a formal and an informal, one of which may be more fully represented, the research is possibly biased. It is not, however, prejudiced. The issue, therefore, is more one of possibly disproportionate weighting.

While the proportions of industry participants by type in the sample would most likely

not match those extant in the industry, there is no way of accurately determining either the extent of the industry or the dimensions of all industry participant types. Thus, though readers should note the possible issue of disproportionate weighting regarding information used to produce this report, weights cannot be calculated with any precision.

Two approaches to this issue are possible. First, information could be made random. If actual proportions of industry participant types were known, then information could be normalised or fitted to this standard. This standardisation would most likely involve the loss of some information as over-represented types were culled to fit real industry proportions. As noted, however, a reliable industry standard by proportion of participant type does not exist. An *ex post* randomising exercise is therefore not possible. The approach taken, then, is to make readers aware of the issue of weighting, i.e. of the possible representation in the sample of proportions of participant types that may not agree with actual industry proportions; to display the breakdown of participants in the sample by type; and thereby to enable readers to assess the issue in the context of their knowledge of the industry.

Given that statistics in this report are descriptive not inferential and that the volume of information generated is large and relates to a major part of the industry, it is considered that the issue of weighting is not strong. Readers, however, should note that statistics have been derived from a sample in which the issue of possibly disproportionate weighting exists. Care therefore needs to be exercised when interpreting any statistics due to issues internal to the sample. Generalising statistics from the sample to the industry is not attempted in this report.

It makes no sense to try to quantify or to reduce behaviour to variables and functions under all circumstances. On the other hand, it is silly to reject all quantification. The choice of method obeys no epistemological imperative, since it is entirely dictated by the state of the network.

Two orders of quantification are considered in this chapter: first, quantification regarding issues of method such as population and sample sizes, and proportions; and, second, statistics derived from information through particular techniques. The former has been discussed above and the latter is discussed below; in this section, the issue of working with words is discussed.

It was chosen to generate information for this assessment not with existing databases but directly with participants in the industry. As part of the overall project a fleet dynamics model of changes due to the introduction of quota management has been generated from catch and effort data. This model is extremely useful, but it largely operates at a scale, that of the fleet, and in a language, that of numbers, removed from individual participants in the industry. Analysis in this report is also partly undertaken at the sample-wide scale. Generation of information, however, took place in person with the individuals concerned, and largely involved the use of words. Research occurred, therefore, not with a database from which meaning needed to be calculated and imputed, the effort being largely the researcher's, but with individuals who were interested in establishing meaning with the researcher.

In this report, an epistemological movement is traced from numbers, through words and, in some cases, back to numbers. Epistemology, or *how* knowledge is constructed,

starts with some basic numbers that give dimension to the industry and to the research, discussed above, namely population, sample and proportions. The concern in this section is to outline some subsequent issues involved in generating information with participants in the form of words, and then analysing this information. Analysis for this report combined numbers and words, or the sample-wide scale with the individual. This approach was taken due to the state of the network, i.e. the Tasmanian commercial rock lobster industry. This network is not a database or a population of rock lobster but the people who make up the industry. (Scientists, fishery managers and politicians could also be considered part of the industry-network, though they were not formally included in the research.) Just to count these people would be to ignore the ability of individuals to speak, and in this way to participate in meaning-formation with researchers. Being able to talk directly with individuals making up a sample of the Tasmanian commercial rock lobster industry, however, raises its own set of issues, which are discussed before analysis of information is outlined.

Simplifying Giddens' (1993) double hermeneutic, before a researcher and the first participant have even met, both have been and are party to a number of skilled background performances. Apart from general social skills, the researcher brings a host of institutional devices such as theories, methods and techniques to research. That observation is theory-laden is now well accepted in the philosophy of science. Participants, on the other hand, bring their understandings of their circumstances to an interview. In social science, then, the researcher interprets circumstances that are pre-interpreted and related by participants. Thus, any account is interpretation-laden, both that of the participant and doubly so that of the researcher. Moreover, the skilled research performance in which both researcher and participant engage includes at least two kinds of question. The first is explicit and involves the researcher inquiring after the knowledge of the participant; and to ask the right question requires that the researcher already knows much about the area of interest. The second kind of question is often implicit and occurs on the part of the participant in the form of 'why ask?' This question points to the context in which research takes place. Context can have a bearing, not just on 'why answer?', but on 'what answer'. In this study, it was often important that questions were largely devised and were being asked by social researchers from the University of Tasmania who were perceived by participants as being impartial in the matter of what was for some still a highly-charged issue, namely quota management.

These considerations are all part of the double hermeneutic, which receives a further twist in, particularly, social science. Having decided to treat participants' knowledges ostensibly, i.e. to assume, unless given reason, that participants speak a truth as they see it or, in other words, that they are relating something real to them, these knowledges are represented in the conceptual framework and language of a science. This representation may then be taken and used by participants to change aspects of their behaviour, involving both words and deeds. The circumstances understood by the researcher in the first instance can thus be changed as part of this reflexive process.

An example of the operation of this reflexive process in this study are the two issues of individuals attempting to buy into the fishery as fishers, and a longer-term vision for the fishery. Mid-way through the research, these two issues were being mentioned in similar ways by such a large proportion of participants that a decision was taken to inform the industry of their general significance. Even if these issues had not been

raised by participants in later research, they had already appeared with sufficient strength to warrant disclosure. That participants maintained that these issues needed to be addressed urgently contributed to the decision to raise them publicly. Discussions were held with fishery biologists and managers, a representation was made to the Minister's Rock Lobster Fishery Advisory Committee, and presentations were given to the Tasmanian Rock Lobster Fisherman's Association (TRLFA) and the Professional Fishermen's Association of Tasmania (PFAT) outlining the issues of financial barriers and difficulties faced by fishers attempting to buy into the fishery, and the need to develop a formal, longer-term vision for the fishery. The language in which these issues were made public and the importance attached to them almost immediately began folding into the industry. Formally, the TRLFA began developing a scheme to assist 'rookie' fishers into the fishery, both financially and with the assistance of the practical knowledge of experienced older fishers. The TRLFA also began an initiative to develop a broadly based, longer-term vision for the industry. Informally, following public disclosure of these two issues, interviews began to include some of researchers' own language being used by participants for their own purposes. Mention of TRLFA initiatives also occurred. The alacrity with which the industry moved to address these two issues, however, justified having raised them mid-way through the research. In some ways, researchers only acted as ciphers for issues that were already well understood by the industry but had not yet been generally identified and 'officially' expressed. Bearing the double hermeneutic in mind, discussed next is the semi-structuring of words and meaning that is the interview process itself.

If the network standardises itself then one is bound to count and calculate. If it is divergent and reversible, then excessive simplification (and quantification) will betray the state of the network, and it is better just to tell a story!

To recap thus far, it is difficult to standardise the Tasmanian commercial rock lobster industry. Neither its boundaries nor the dimensions of its participant types can be ascertained. The sample derived represents a partial stabilisation of the industry, one in which the issue of disproportionate weighting is possibly problematic for the calculation of statistics descriptive of the sample. Care needs to be exercised when considering these statistics. No attempt is made to generalise findings from the sample to the industry as a whole. The divergence and openness of the industry makes generalisation difficult if not impossible. Statistics presented are still useful, but they need to be considered in light of problems encountered trying to demarcate the industry, define particular types within it, and 'measure' the extent or proportion of each participant type. In other words, this metrology, due to the undelineable and dynamic state of the industry, is inherently unstable. There is, however, another way to use the information generated in which its coverage and amount are important.

Confidence exists that all participant types in the industry are represented in the 350 participants involved in the sample. Discussion of issues relating to each type and the range of positions within each type is enhanced by the fact that many people were included in the research from all sectors in the industry. Consequently, though, for example, it may be uncertain, regarding the sample, to what extent the proportion of owner-operators compared with lessees agrees with that in the industry, an undeniable empiric is that 130 owner-operators and 21 lessees were interviewed. Just to take the lessees, it is better that 21 were interviewed than, for example, three. With 21 interviewed, many of the issues relevant to lessees as well as the range of positions

within this participant type can more confidently be discerned.

Social impact assessments are woven with words. They are the outcomes of a weaving of words and meanings between researcher and participant in which the semi-structured interview is central. The bulk of participants in the research were formally interviewed; i.e. they were approached via letter and/or telephone, were requested an interview and an interview was either then conducted or arranged. Where possible, and with permission, interviews were audiotape recorded on microcassette. In this way, approximately 150 interviews were 'taped'. The intention was to transcribe interviews for fine-grained analysis with word mapping computer software. Such was the number of tapes, however, that the project's resources could not accommodate the time or cost of transcription. The hope is that funding will be attained in future to transcribe and analyse these tapes, which have been catalogued and given to the Tasmanian Aquaculture and Fisheries Institute (TAFI). Fortunately, detailed notes were taken during interviews and these were used to compile the data matrix from which much of the statistical material in this report has been derived. A different interview schedule was used for each of the broad participant types: boat drivers; processors; investor; deck hands and those who left the fishery (Appendix 4 [bottom] and 7). These schedules were used as a guide to structure each interview. They also served as a checklist at the end of an interview to ensure that all relevant questions had been covered. Interviews, however, were very much *semi*-structured; i.e. often researchers were barely into the introduction of the project before participants began talking about quota management. At times, it was all researchers could do to keep up with participants as they, in effect, ranged across interview schedules in orders largely directed by them.

There is no such thing as a standard interview. Inevitably, participants re-order interview schedules and choose to answer questions in their own way. Interviews occurred in a variety of settings including participant's homes, on their boats, on docks, in pubs and coffee shops and at researchers' place of accommodation. As noted, interviews often involved more than one person with, for example, some participants' partners or skippers' deck hands contributing to many interviews. Such cases were often something of an acknowledgement of the wider human unit involved with the fishing boat. It was more common for skippers to include their usually onshore partner in such a unit, but in a number of cases, deck hands were brought into the interview as well or instead. Informal conversations were held away from the tape recorder and interview folder, in two ways. First, some participants were more comfortable simply 'having a chat' about quota management. Second, researchers were rarely 'off duty' on a port visit or, indeed, in Hobart and a number of extempore exchanges were had with industry participants in pubs, shops and elsewhere as word circulated about researchers' presence, or inquiries were made as to what business researchers had in town. Moreover, dockside intercept often resulted in as many informal conversations as formal interviews as participants talked freely about quota management 'on the spot' but sometimes did not wish to undertake or arrange a formal interview.

Such, perhaps, is the informal character of the industry. This informality included a wide range of personalities. Researchers were almost continually struck by differences between industry participants. Researchers had been told that the industry was replete with ‘characters’ but were unprepared for the level of engagement and interest stimulated by the people of the industry. Perhaps it is the interplay of freedom and responsibility in rock lobster fishing that attracts and results in individuals with the scope and confidence to ‘be themselves’. At any rate, researchers were impressed by the forthright openness and even-mindedness of many in the industry across a wide range of types and circumstances. Having noted the engaging diversity of the industry, participants shared similarities as well as exhibited differences. For example, many participants were practicing commercial rock lobster fishers. As such, there were aspects of fishing that many shared, for example having a particular piece of technology. Exactly how such technology was used, however, could differ between fishers.

While the major focus of research was to generate information for a social impact assessment of the introduction of quota management, two further lines of inquiry were requested by fishery biologists to assist longitudinal fishery assessment. First, the uptake and use of technology by fishers, particularly GPS and plotters, was of interest regarding possible increases in ‘fishing power’ (Brown *et al.*, 1995; Fernandez *et al.*, 1997). Many fishers had the use of a GPS and plotter in common, but *when* they began using these, and *how* they used them often differed. One output from the project has been to provide fishery biologists, part of the project team, with a list of dates of when individual fishers began using GPS and plotters. This information can be analysed to calculate what effect this technology might have had on catch rates (Appendix 3). Ways in which fishers use GPS and plotters, however, are many and need to be related in words.

Second, as noted, fishery biologists were interested in any changes in fleet dynamics due to the introduction of quota management. Questions about possible shifts in locations, depths and times of fishing were therefore included in the interview schedule for practicing fishers to supplement analysis of DPIWE databases developed from catch returns (Chapter 5.2). Fishery biologists surmised that, with catch limited, fishers would concentrate on catching more red rock lobster inshore and in winter, when such rock lobster fetched a higher beach price.

Though no interview with a practicing fisher could be considered standard, researchers would try to begin questions by inquiring after a potted ‘history’ of the operator in the fishery. How the operator entered the fishery, whether anyone else in their family fished commercially at the time, how they learned to catch rock lobster and so on were used to introduce the participant to the interview procedure. Information from these questions also provide an insight into lineages, both within and between generations, running through the fishery. Questions then turned to matters of technology and fleet dynamics, discussed above. Following these, questions aimed at generating information relevant to social impact assessment of the introduction of quota management were asked. Broadly, these questions ranged over the participant’s past and present circumstances, future intentions, any local community impacts, and any suggested changes to the operation of quota management. Information generated by these questions is used to make up the bulk of this report. In addition, however, fishery managers requested that a number of present management issues be raised. Thus,

issues such as the possible extension of MPAs, commercial rock lobster fishing in September, increasing the maximum number of pots allowed per boat to 60 and possibly zoning the fishery in some way were raised towards the end of many interviews. Some issues arose after research had commenced; they were not therefore raised by participants in earlier interviews. Finally, the reliability of fishers' catch returns prior to quota management and the possibility of a fisher, on retirement, sharing his or her personal fishing records with fishery biologists were discussed. (A list of those fishers who stated that they would be prepared, on retirement and provided the fisher did not hand his or her personal fishing records on to a practicing fisher, to share these with fishery biologists has been provided to TAFI.)

Each actor is relatively unpredictable, because any translation is constantly being undone.

Interviews took on average one-and-a-half hours to complete, though some were shorter while others took half a day. Participants appeared very much to appreciate the opportunity to talk confidentially in person, and often one-to-one, with an independent social researcher about those aspects of quota management that concerned them. When all formal questions had been considered, participants were asked if they had anything else to add, usually resulting in summary re-statement rather than the introduction of any new material. The interview schedules, therefore, can be considered to be reasonably comprehensive.

Interview schedules contain questions that were asked of nearly every participant in their type. All questions, however, were not always answered. Some questions were not relevant to the participant concerned, while others were evaded. A number of participants viewed the research, indeed any form of bureaucracy, with suspicion. Consequently, while most participants were happy to contribute their views, some were less prepared to give too many details about themselves or their operation. While not all questions were answered by all participants, many answers, comments, opinions and so on did not pertain to any particular question. In other words, interviews generated both solicited and unsolicited information. This outcome is important because it makes a difference to how the information is considered. This difference is discussed below.

In this section, the point is made that the interview schedules, or researchers' attempt to get participants to fit their knowledge into a research pro forma, often only partly worked. The unpredictability of participants meant that schedules had to be adapted to individual interview situations. The results of each interview, therefore, are different both in the sense of producing different answers to the same questions, and through different combinations of questions being answered, eschewed, perfunctorily treated and so on, as well as through different tangents being taken. In other words, interview schedules were constantly being undone by subtle participants empowered to take or leave questions, address questions in whichever order they chose, to ask us questions, to be as loquacious or taciturn as they liked, to opine on other issues and so on. Certainly, researchers were in a position to pose set questions, but participants were giving freely of their time and deserved to have their style of response respected. To try and force a participant to stick rigidly to an interview schedule can undermine rapport and fluidity often necessary regarding in person dialogue.

Participants were also unpredictable, both in the sense of routinely presenting themselves in ways that confounded any snapshot translation as well as regarding future uncertainties. Many participants talked about future uncertainties with which they saw themselves as being confronted. These included a range from, for example, macros such as interest rates or the AU\$ to micros such as separation from a partner. Few participants were sure exactly how they would act in the medium-term. Things stated during an interview may, quite simply, not transpire, and the picture painted of the sample in this report is already in the process of unravelling.

Difference everywhere complicates this report. Differences between participants and places are manifold. General circumstances in the industry can easily change and an individual can take action in a number of different ways. *Prediction* is fraught with uncertainty due to changes likely in general circumstances, a situation the invocation of *ceteris paribus* is meant to address. In *ceteris paribus* cases, however, *projection* is often undone by the provisionality with which individuals view their forecast behaviour, often couching their future in terms of options. Finally, *probability* is extremely difficult to calculate in a complex open system.

What, then, is the value of our report regarding the future? One answer lies in an antonym of difference, namely repetition. For as much as the future is unknown, much of it is also familiar. The value of our report is therefore twofold. First, it provides some indication of continuity as well as change. Participants were as able to identify future certainties, as they were uncertainties. Some future outcomes in the industry can also be stated with certainty, for example that many owner-operators will retire in the next ten years. However, no knowledge is ever complete. The industry will always be managed in an environment the knowledge of which is imperfect, especially regarding the future. The issue concerns the dimensions of what is known. In this report, not only is the stock of knowledge about the industry added to, that knowledge is taken into new areas regarding the socioeconomics of the industry. Decisions regarding the industry might then be based on more diverse rather than less information. Without good information, much management tends to be reactive. One common comment from participants was that the introduction of quota management appeared to have been a reaction to stock decline, without due consideration of many of quota management's possible socioeconomic outcomes. Such consideration, however, is difficult without available information. With such information available, decision-making can be better informed and perhaps also more forward-thinking. As noted, results from the research regarding the difficult financial positions of fishers attempting to buy into the fishery, and the lack of a longer-term vision for the industry, are already resulting in initiatives that involve considering the industry's future. This outcome is part of the second way in which this report is useful; i.e. by informing present deliberations, aspects of this work may become part of the future of the industry. In this sense, this report or translation is a concrescence occurring within the industry (Latour, 1999).

Research was conducted during the 2000/2001 quota year. The amount of information generated between March 2000 and February 2001 was large. A full 12 months were dedicated to familiarising researchers with the viewpoints of many individuals in the industry. However, a wealth of information from each individual runs the risk of becoming an undifferentiated mass when put together with others in the sample. From having been researchers working at the level of the individual industry participant, the next task was to begin to move from the particular to the general; or, in other words, to

move from the individual participant to the sample-wide scale. Apart from the background utilisation of a conceptual framework and various bodies of academic literature, effort is often made in social science to move from the idiographic to the nomothetic, i.e. to shift scales from the individual to a sample. Generalisation to the industry is not made in this report, for reasons set out above. Focus, however, does shift between the individual and the sample. This shifting is achieved through the use of certain technologies and techniques. These are often developed specifically by and for use in the sciences. It is not that some statistical techniques or pieces of computer software are not applicable outside the sciences, but that much time, effort and resources often need to be dedicated to their use. In short, much science is a slow process. It is rare, for example, that an attempt to interview hundreds of participants individually over a 12 month period will be made. It is rarer still for three months then to be spent entering information into a piece of computer software. Neither does the process of report production usually take six months. One reason for the slowness of science, apart from wishing to achieve a particular sample size and transparent and impartial reporting procedures, is that it takes time to shift scales. For example, for this report 12 months was taken to interview 312 participants, the bulk of whom were interviewed individually. These interviews provide a detailed idiography of a major sample of the industry. To shift from the scale of the individual to the sample, three months data entry was required to produce a matrix through which the sample could be treated nomothetically. In other words, each interview was painstakingly entered into the data handling computer software package SPSS. It took, approximately, as long to enter the data from one interview as it did to conduct that interview. In this way, a data matrix of the sample was constructed. Interviews were entered one-to-247 down the vertical axis of the matrix, while the particulars of each interview were recorded along the horizontal. A wide range of data were included, from basic details such as sex, approximate age and so on to the coding of complex viewpoints, resulting in 195 variables along the horizontal axis. Once entered, data from the interviews could be computed. For example, statistics descriptive of the sample, such as that in 135 interviews participants were in favour of quota management, could be produced. Data could also be manipulated to cross-tabulate views on increasing the TACC, for example, with area fished. Combinations in which data could be viewed were almost endless, and the matrix is in no way fully explored in this report. Another output from this project, therefore, is the data matrix itself, which has been provided to TAFI for possible further use in the future.

A difference between solicited and unsolicited responses was noted above. In some ways, this difference is a key that unlocks the movement between the individual and the sample-wide scales, or between words and numbers, in this report. Put simply, when the data matrix is viewed as a whole, there are areas 'thick' with data and there are patches where little data appears. This patchwork largely reflects solicited as opposed to unsolicited responses. For example, as noted, all participants were asked whether they, at the time of interview, supported or opposed quota management. Three kinds of entry were used to translate responses into the matrix: 'pro', 'anti' and '?'. The '?' indicates the fact that all responses had more to them than simply a one-word answer. Many participants qualified their position regarding quota management, for example stating how their view had changed over time or referring to some areas of the fishery but not others. Some participants were so finely balanced about the issue that it was impossible to judge them to be either for or against quota management, hence the '?'. A clear position, however, was discernable for most participants. The point here is that

the nuances of these positions are lost if all that is recorded is ‘pro’, ‘anti’ or ‘?’. To recover these nuances the issue needs to be addressed more fully in words.

Nonetheless, a sample-wide statistic can be produced regarding responses solicited to the question ‘for or against quota management?’. In other words, this data column or variable in the matrix is largely full of solicited responses, from which a meaningful statistic can be produced. Though the statistic is only a trace of the material that informed it, it is declarative, and tells us something in summary about the sample. Solicited responses to other kinds of question, however, were often not so easily categorised or coded. Some questions did not receive a large response across the sample due to their sensitivity, for example regarding any debt being serviced. Consequently, not all questions resulted in the facile production of a statistic. It is, however, important in all instances that statistics are supplemented with words descriptive of the response category.

Here, then, the only fruitful – indeed intelligible – method is that of literary description.

Rarely are statistics of great use regarding unsolicited responses. In only a minority of categories were unsolicited responses sufficiently large to warrant statistical treatment. Unsolicited responses, however, can carry weight, though this weight can be hard to quantify. It may be important that a comment was made without the presence of a direct question. For example, most participants’ ‘pro’ or ‘anti’ position regarding quota management is known, not so much because they would have talked about the issue, or in the language of ‘pro’ or ‘anti’, but because they were directly asked the question ‘for or against quota management?’ and their response was then entered into a data matrix according to the language of ‘pro’ or ‘anti’. On the other hand, that a direct question was not asked, for example, about the trajectory of the commercial rock lobster fishery broadly following that of the commercial abalone fishery means that in the 51 interviews in which an unfavourable view of this trajectory was expressed a particularly strongly held or possibly more widely existing opinion may be in evidence. This difference between solicited and unsolicited responses is raised for readers’ information. The difference exists in nearly any interview, as it is simply not possible to ask all questions that a participant might consider relevant. Once interviewing of industry participants had commenced in earnest, following trial interviews as part of researchers’ first port visit, no change was made to interview schedules so that any distinction between solicited and any unsolicited responses was consistent. As noted, interview schedules are provided in Appendix 4 in order that topics discussed in the report may be distinguished as having been raised by participants or solicited by researchers.

Such description multiplies points of view to form a polyphonic narrative.

In categories where only a few entries appear, working with words as well as numbers is perhaps most important. As noted, even where statistics are meaningful, words remain important to recovering much of the subtlety employed by participants. When only a few entries exist in a category, statistics tell us to ignore these data compared with categories with more entries. The substance of any entry, however, is rarely amenable to statistical treatment. A response category with a few entries, relating to an unsolicited topic, ought not be considered meaningless simply because of its low statistical value. Apart from situations where the aim is to identify areas of possible improvement through low value scores, statistically, low scores mean low value.

Value, however, can be determined in ways other than statistically. For example, few participants distinguished between investing in the industry, in the form of a boat, as opposed to investing in the market for entitlements and quota units. The few that did, however, raised an important distinction between real and fictitious capital. This, in turn, led to exploring sections of the political economy literature to gain further insight into the workings of capital in the industry. Thus, as a way of understanding what many participants were expressing, regarding investment trends in the industry, these few entries introduced a useful way of conceptualising the Tasmanian commercial rock lobster industry. In short, though statistically insignificant, these few entries were conceptually significant.

Throughout this report, the aim is to use both numbers and words. Considerable effort has been expended producing a data matrix of the sample. This matrix is used, where appropriate, statistically to describe the sample. At the same time, however, we are concerned to distribute the narrative over as many voices (polyphony) as possible. Consequently, at times lengthy assessment of bald statistics is provided. It is thus intended that readers can appreciate both what was said, as well as how many participants said what. 'How many' is as important as 'what' in many circumstances, but it has been argued in this chapter that numbers and words are not mutually exclusive. That many participants said X can still benefit from qualification with words. That few participants said Y can also be important, but does not disqualify Y from consideration. It may be that Y was the most sagacious or useful observation or suggestion made in the entire 12 months. Admittedly, research is selectively reported. Selection is unavoidable. The intention is that with both numbers and words used, readers are provided sufficient material adequately to inform their own understandings of the Tasmanian commercial rock lobster industry.

7.3 Interview Derived Data Matrix

7.3.1 Introduction

- In this chapter, data largely derived from 247 formal interviews are introduced. Information from these interviews has been entered into a data matrix for purpose of analysis. In this data matrix, the 247 interviews or cases are arranged down the vertical axis, while variables from each case are entered across the horizontal. In total, 195 variables are included in the data matrix. They fall into eight broad areas:
- description of participants' operations;
- fleet dynamics;
- perceived positives of the introduction of quota management;
- perceived negatives of the introduction of quota management;
- changes made due to the introduction of quota management;

- views on possible policy initiatives;
- future intentions; and
- any perceived impacts on the local community.

The data matrix constitutes a kind of map of the research material. This map can be collated in many more ways than presented in this report. The data matrix has therefore been made available to fishery biologists for possible further analysis.

It is noted that a 'before and after' assessment of the introduction of quota management is somewhat problematic. Apart from a tendency to view industry as exogenous to researchers and managers (Braun and Castree, 1998), a before and after assessment has an element of temporal artificiality. For example, in the case of the Tasmanian commercial rock lobster fishery it is not possible to treat the years leading up to the introduction of quota management as if they were free of anticipation and manipulation by fishers and managers alike. Thus, though March 1 1998 is the date on which quota management was introduced in the fishery, and is at times used in this report as a convenient organising device, many pre-quota management histories, positions and contentions fold into this date that have significant bearing on trajectories under quota management. In other words, though largely beyond the purview of this report, the political regulation of the fishery needs also to be borne in mind when considering the period surrounding the above date-event.

7.3.2 Description of the sample

7.3.2.1 *Number of participants*

As noted, 247 formal interviews were conducted with a variety of types of industry participant between March 2000 and February 2001. More than one participant was involved in a number of these interviews. Consequently, 247 interviews represent 312 participants, the majority of participants additional to 247 being participants' partners.

7.3.2.2 *Age profile*

Consistent with observations in interviews that the Tasmanian commercial rock lobster fleet was 'aging', both in terms of participants and boats, over 60 per cent of interviews included participants in either the 40-49 or 50-59 deciles. Those considered by many interviewed to be 'young' participants in the industry were commonly aged in the 30-39 decile (participants were aged in this decile in approximately 20 per cent of interviews). Outside these three deciles, participation dropped away sharply, particularly towards the younger end of the age profile of the interviews. Thus, while nearly 10 per cent of interviews included participants in their 60s or 70s, only approximately six per cent included teenagers and participants in their 20s. As noted in Chapter 7.3.2, there is a number of possible lacunae in the sample, especially including the participant types 'leavers' and 'deck hands', and it is possible that those in the industry under 30 years of age are also under-represented. However, there is no easy way of checking this possibility, and low number of interview participants under 30 years of age needs to be considered in light of a concern raised many times during

interviews that there was a dearth of ‘young’ participants in the industry.

The age profile of ‘skippers’ in the industry at present shows a ‘deficit’ of fishers in the 20-39 years age group (97 skippers) compared with the 40-59 years age group (140 skippers) (Figure 43).

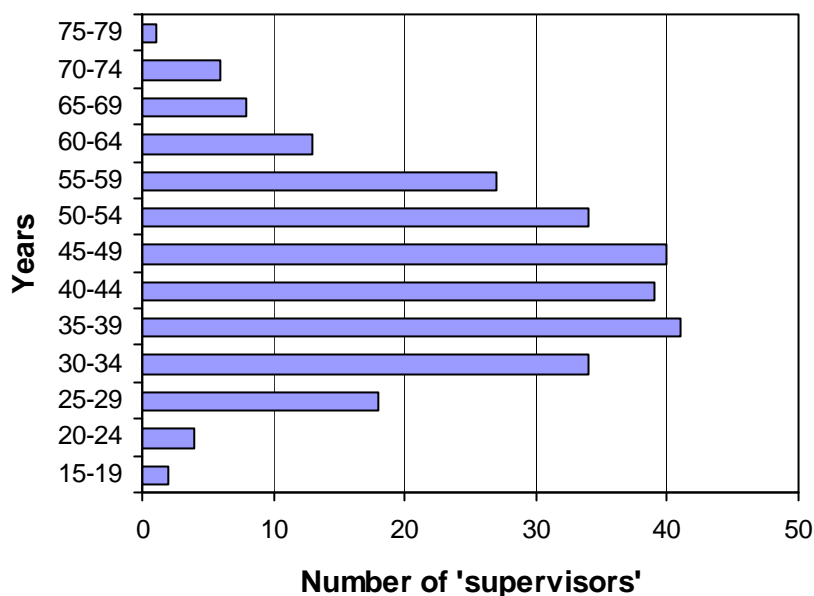


Figure 43. Age profile of ‘supervisors’ in the Tasmanian commercial rock lobster fishery, August 2001
Source: DPIWE

Given that, from the DPIWE databases used, only 34 skippers could be identified as being the sons of existing or erstwhile fishers in the industry, there may be a requirement for ‘new blood’ in the fishery. However, in 64 or 25.9 per cent of interviews, participants mentioned that their son fished in the Tasmanian commercial rock lobster fleet as either a deck hand or a skipper, giving a greater indication of important family lineages in the fishery.

Approximately 50 per cent of boats in the fishery are owner-operated at present (Gardner *et al.*, 2001). The age profile of ‘owners’ of entitlements and units in the industry suggests that the majority of these owner-operators are ‘older’ fishers, many nearing retirement (Figure 44).

For example, in the 20-39 years age group there are 47 entitlement ‘holders’, while in the 40-59 years age group there are 168. Depending on the inclination and ability of ‘younger’ fishers to buy into the fishery in the form of an entitlement and units, the proportion of owner-operators in the fishery may decline in future. Clearly, decisions made concerning the desirable number of boats in the fishery and the ‘rightful’ status of those driving them will affect the definition of such issues in the fishery.

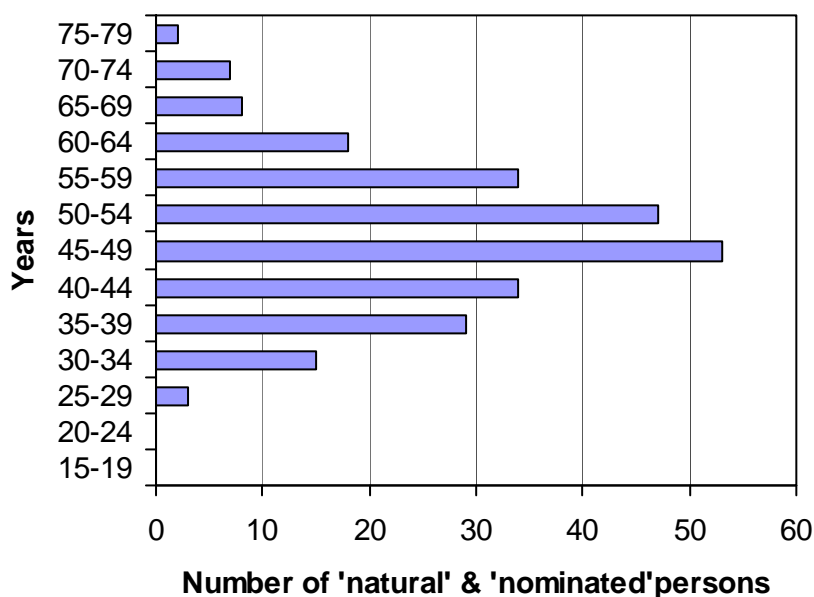


Figure 44. Age profile of 'natural' and 'nominated' persons with entitlements in the Tasmanian commercial rock lobster fishery, August 2001

Source: DPIWE

7.3.2.3 Sex profile

Females were exclusively involved in 14 or 5.6 per cent of interviews. An additional approximately 50 females were involved in interviews in the capacities of participants' partners, daughters and mothers. In these ways over one-quarter of interviews included females. The roles of women in fishing on boats, as partners, book-keepers, onshore organisers, protagonists, mothers and so on are often overlooked in fisheries research, but the Tasmanian commercial rock lobster fishery is undeniably male-oriented, particularly on the water, and the sample reflects this orientation.

7.3.2.4 Types of participant

Types of participant in the sample are as follows:

Table 16. Sample by participant types

	No. of interviews	Per cent
Tasmanian owner-operators	116	46.96
Lessees	21	8.50
Investors	15	6.07
Mainland owner-operators	14	5.66
Processors	14	5.66
Retired fisher-owners	14	5.66
Deck hands	10	4.04
Fathers & sons	9	3.64
Drivers	7	2.83
Owner-fishers*	7	2.83
Ex-fisher owners^	6	2.42
Leavers	4	1.61

Retired & sold	4	1.61
Brokers	2	0.80
Inheritors	2	0.80
Mothers & sons	2	0.80
Totals	247	99.89

* not fishing in the Tasmanian commercial rock lobster fishery but in another fishery or fisheries

^ undertaking another occupation

The first point to note is that 179 or 72.4 per cent of interviews involved participants who were directly occupied in the Tasmanian commercial rock lobster fishery on the water in some capacity at time of interview. Second, given that approximately half the boats in the Tasmanian commercial rock lobster fishery were owner-operated in the 1999/2000 fishing year (Gardner *et al.*, 2001), it is not surprising that 52.63 per cent of interviews were with owner-operators of some kind. As noted in Chapter 7.3.2, the databases available with which participants were contacted also influenced this figure. Entitlement holders are arguably over-represented in the sample, and analysis needs to be considered with this in mind. More important, perhaps, is the issue of under-representation, particularly regarding leavers, deck hands and possibly also boat drivers. In the case of leavers, the number refers to those who considered themselves to have been forced out of the fishery by the introduction of quota management. In other words, the introduction of quota management left them with no recognised stake or, they maintained, opportunity in the fishery. Many other participants, however, also 'left' the fishery, i.e. stopped fishing commercially for rock lobster, through various forms of retirement and effort shift, and are therefore classified elsewhere. The low number of 'leavers' is therefore as much a product of classification as it is of the difficulty of accessing those who, when quota management was introduced, had their entitlements recalled by fisher-owners to supplement these fishers' allocated catch. In the system of classification used in this report, a number of participants could have been classified as more than one type. Overlap therefore occurs between a number of types, inflating some such as owner-operators and deflating others such as lessees.

The low number of deck hands in the sample also requires clarification. First, in addition to deck hands interviewed individually, a number of deck hands were included in interviews with their 'bosses'. Although not ideal, it often proved difficult to access deck hands separately. Second, a number of father and son operations included discussion both with and about the present deck hand would-be owner-operator inheritor. Finally, much information regarding deck hands was gained from 'skippers' interviewed. With locating and interviewing deck hands often difficult, due to the nature of the occupation, the social relations between skippers and deck hands, and employment trends in the industry under quota management, these means provide acceptable purchase on many of the changing circumstances confronting deck hands. Given more time and resources, however, more deck hands could profitably have been interviewed.

Many of these points apply also to 'boat drivers'; i.e. those who are paid to catch rock lobster commercially using another's boat, entitlement and units. Boat drivers do more than just pilot the boat, often provisioning it, organising a deck hand, deciding when, where and how to fish and so on. The type classification 'boat driver' is therefore used to distinguish this group amongst all those 'skipping' boats in the fishery, which include owner-operators for example, and is in no way meant pejoratively. Like many deck hands, boat drivers were often most likely to be fishing when ports were visited,

though they tended to be less itinerant than deck hands when in port. It is unfortunate that DPIWE did not have a usable database of ‘skippers’, now available, operating in time for the research undertaken for this report. Though much direct and indirect information regarding boat drivers was obtained through interview, a possibly large proportion of boat drivers, like deck hands, is missing from the sample. Though sufficient boat drivers and deck hands were interviewed to reveal many of the issues involved, statistically their partial absences need to be noted.

7.3.2.5 Location of participants when interviewed

The main database used to contact participants was a mailing list of entitlement holders, discussed in Chapter 7.2. It was assumed that entitlement holders represented fishers and that location of participant(s) when interviewed indicated area fished. From interview data, both surrogates proved adequate in the majority of cases. A geographic distribution of entitlement holders immediately prior to this study is given in Gardner (1999) (Table 17).

Table 17. Regional distribution of commercial rock lobster entitlements, November 1999

	No. of entitlements	Per cent
Greater Hobart	93	29.52
St Helens	30	9.52
King Island	22	6.98
Bicheno	19	6.03
North-west coast	28	8.88
Greater Launceston	26	8.25
Triabunna	18	5.71
Victoria	27	8.57
Esperance	7	2.22
Flinders Island	6	1.90
Strahan	9	2.85
Tasman Peninsula	10	3.17
South Australia	14	4.44
Queensland	3	0.95
New South Wales	2	0.63
Western Australia	1	0.31
Totals	315	99.93

Source: Adapted from Gardner (1999)

The geographic distribution of the 247 interviews used in this report approximately matches that in Gardner (1999) (Table 18).

There are only four major disparities between the regional distribution in Gardner (1999) and that of the sample discussed in this report, for Flinders Island and Esperance in Tasmania, and for South Australia and Victoria. Regarding the first two disparities, these are explicable on the basis of a declining number of entitlement holders but an increase in lessees on Flinders Island, and boundary differences between Gardner (1999) and this report in the case of Esperance. Boundary differences are introduced in the data matrix used in this report for reason of confidentiality. The second two disparities are explicable partly on the basis of the low absolute numbers involved, which are also declining, and partly due to difficulties contacting entitlement holders in South Australia and Victoria.

Table 18. Regional distribution of places of interview, March 2000 to February 2001

	No. of interviews	Per cent
Greater Hobart	61	24.7
St Helens	19	7.6
King Island	13	5.3
Bicheno	16	6.5
North-west coast	19	7.6
Greater Launceston	20	8.1
Triabunna	16	6.5
Victoria	15	6.1
Esperance	13	5.2
Flinders Island	12	4.9
Strahan	10	4.0
Tasman Peninsula	10	4.0
South Australia	6	2.4
Queensland	1	0.4
New South Wales	2	0.8
Not applicable	14	5.7
Totals	247	99.8

7.3.2.6 Occupational histories

Participants discussed their occupational histories in 181 or 73.2 per cent of the 247 interviews. Of this subset, in 109 interviews, or 44.1 per cent of the sample, participants' only occupational history was in fishing. In 37 of these 109 interviews, or 14.9 per cent of the sample, participants' only occupational history was in commercial rock lobster fishing.

In interviews in which participants had entered the Tasmanian commercial rock lobster fishery from another fishery, the most common avenue was from the Tasmanian commercial abalone fishery. Two temporal 'waves' of entrant are discernable. First, prior to the introduction of quota management in the abalone industry from the early 1990s, a number of those interviewed had worked as divers before shifting into putatively less exacting commercial rock lobster fishing. Second, following the introduction of quota management in the Tasmanian commercial rock lobster fishery in 1998, a number of those with investment and/or fishing experience in the abalone fishery moved to invest and/or fish in the rock lobster fishery.

Non-fishing related avenues into the Tasmanian commercial rock lobster fishery can similarly be considered as two temporal waves. First, many of those entering the fishery as operators up until the early 1990s did so from trades, the army or from a farm that provided either skills relating to commercial rock lobster fishing, such as boat building, a retirement or redundancy package, or a saleable asset or collateral with which to make a start. Second, once the introduction of quota management became a possibility and then a reality in the Tasmanian commercial rock lobster fishery, entrants to the fishery as investors with backgrounds in business, financial advice, bank management, the law, accounting and so on began to appear. Thus, a general shift is evident from 'blue collar' financial entry prior to the early 1990s to 'white collar' financial entry after this period. This is not to say that blue collar entry has ceased, only that it has declined both in terms of number of entrants as well as in number of pots or quota units afforded. There is detectable, then, a general trend from

occupational to investment opportunity determined in part by increasing wealth being required to enter the fishery, such has been escalation in the capital values of entitlements and quota units. At present, only two avenues into the fishery as an 'owner' are certain, inheritance or access to substantial finance with a view to longer-term investment. Decisions taken in the next half-dozen years will in part determine whether the avenue of hard work in the fishery is closed off completely. These trends are largely coterminous with the period surrounding the introduction of quota management in the Tasmanian commercial rock lobster fishery.

7.3.2.7 Lineage

No information regarding lineage in the industry was forthcoming in 106 or 42.9 per cent of interviews. In 49 or 19.8 per cent of interviews participants stated that nobody in their family had been involved in the industry prior to their entry. These two groupings leave 92 or 37.2 per cent of interviews in which participants indicated lineage in the industry. In 62 or 25.1 per cent of interviews, participants stated that their father had worked in the industry; in ten interviews grandfathers were noted to have been involved. In 23 or 9.3 per cent of interviews, a participant's brother(s) also worked in the industry.

Presented in this way, these figures do not adequately convey a sense of the often inter-generational networks of kith and kin existing in the industry. While by no means the only way to enter and operate in the industry, networks of family and friends bind multiple operations in a number of ports around Tasmania. It was not part of the brief for this study to compile an oral history of the industry, and confidentiality limits discussion of these networks in this report, but in many places around Tasmania family 'dynasties' exist that often include more than one boat and span more than one generation. Some of the industry's most experienced fishers come from such families. Commercial rock lobster fishing has long been a full-time occupation for a number of members of these families and a major part of the livelihoods of many of the remainder. These families have known much hard, isolated and at times dangerous work and much fishery knowledge is sedimented in them.

A component of the so-called overcapitalisation said to be evident in the industry at the scale of the fleet prior to the introduction of quota management involved many of these families fishing harder, often in additional and/or larger boats, and providing more to their often extensive network of members. Though anybody who takes a rock lobster, either recreationally or commercially, arguably contributes to stock decline, in absolute numbers those who catch most stand to lose most due to the introduction of catch limitation, depending on the allocation method used to distribute any TAC. The method used to allocate the TACC in the Tasmanian commercial rock lobster fishery was equal-per-pot with, by the fourth fishing year under quota management, no account being taken of different catch histories. Catch history varying among fishers is broadly indicative of different types of operation. This egalitarian approach to distribution, though simple to implement and administer, largely ignored the utilitarian aspect of distributive justice, allocating catch equally but reducing it disproportionately across operations. In other words, differential use and return from a pot was largely ignored in favour of an equal unit of allocation. Thus, those who caught more with their pots were cut back to a procrustean allocation, the only ways to catch above this being to buy or lease more quota units. Some of the above families had prepared for the possible

introduction of quota management by purchasing additional pots, or units as these became under quota management, but many had not. Consequently, when quota management was introduced some of the industry's largest catchers from some of the industry's most 'traditional' fishing families were substantially catch reduced. Adjustment for many of these families has been 'painful' involving, for some, leaving the industry, for others scaling down their operations, while others have invested heavily to, as they put it, 'stay in the industry', i.e. continue to fish as well as they know how. In 25 or 10.1 per cent of interviews, participants stated that quota management had particularly disadvantaged traditional fishing families. A less disproportionate method of catch reduction would have affected these families less substantially, as the small, three year phase out, transitional catch history component attested.

With the organic capital component of the industry, i.e. rock lobster, arguably on track towards sustainability, and the fictitious capital component, i.e. entitlements and units, having approximately doubled in value since the introduction of quota management, it is perhaps time to consider the longer-term real, i.e. principally boats, and human capital components of the industry. Boats are an approximate proxy for employment in the industry and it needs to be considered by industry how many boats are appropriate and who is financially most able to maintain and replace them given redistribution of income since the introduction of quota management. Human capital is arguably the most undervalued asset in the industry. Willingness and qualification to fish, and ability to catch, are just some of the attributes needed to ensure that rock lobster are caught commercially in Tasmania. At present, willingness and ability, both financial and in terms of skill, to maintain boats is also required. Many networks of kith and kin in the Tasmanian commercial rock lobster fishery substantially 'train' participants, build and maintain boats, and harbour and transmit years of accreted experience and knowledge regarding the wiles required to catch rock lobster, in these ways subsidising entry of new generations of commercial rock lobster fishers to the industry. With many existing owner-operators approaching retirement and a dearth of young fishers in the industry, those willing and able to catch rock lobster commercially need to be recognised as important assets. In conclusion, it is important to ensure that operators in the fishery continue to have adequate incentive to catch rock lobster, often leasing significant numbers of quota units as well as purchasing these from owners in the process, in the quota managed Tasmanian commercial rock lobster fishery.

7.3.2.8 Diversification

Participants were asked if their commercial activities were in any way diversified regarding other fisheries or other areas. In 78 or 31.6 per cent of interviews, participants stated that their commercial activities were not diversified; i.e. involvement in the Tasmanian rock lobster industry was their only form of commercial activity. Many older fishers, however, lamented the passing of times when fishing effort was seasonally spread across a number of different fisheries. A combination of stock depression in some fisheries, escalating average beach prices in others, changes in fisheries regulations, and growing competition resulted in increasing specialisation by many fishers, a trend well established by the early 1990s. Specialisation in commercial rock lobster fishing appears to have occurred for a number of reasons. First, the fishery was perceived by some not to be as physically exacting as a number of other fisheries. Second, overfishing in fisheries such as scallop resulted in fishing effort being shifted into the comparatively stock abundant rock lobster fishery. Stocks in the rock lobster

fishery proved to be more robust than in many other fisheries partly due to the mode of juvenile recruitment and the design of the pots used to catch rock lobster. Unlike many types of dredges or nets, there is no evidence that pots used to catch rock lobster significantly disturb resource habitat. Escape gaps appear to minimise catch of undersized rock lobster and bycatch (Frusher and Gibson, 1997). Return of out-of-season rock lobster is possible without harm and some of the small amount of bycatch (e.g. draughtboard shark) is also returned to the water unharmed. Moreover, like hooks, rock lobster pots involve some discretion on the part of the resource as to whether bait is taken, and capture is not guaranteed. In other words, use of a catch instrument that requires a fugitive resource to take bait and then is not fully capture effective, escape from pots by rock lobster being possible with impunity, has meant that stocks have not been overfished to the extent of some other species fished with dredges or nets. Thus, effort was gradually concentrated in more stock abundant fisheries such as rock lobster, both in the forms of additional boats and in existing diversified rock lobster fishers expending more of their fishing effort on catching rock lobster.

The third apparent reason specialisation has occurred in the Tasmanian commercial rock lobster fishery is that the uptake of new technology in the fishery, principally colour sounders in the 1980s and GPS and plotters in the 1990s, meant that rock lobster grounds were easier to locate and return to. The uptake of GPS and plotters, particularly, enabled the fishing of new ground in the offshore rock lobster fishery (Appendix 3). Fourth, from approximately 1990 the development of Asian markets for live rock lobster meant that the average beach price rose significantly, from around AU\$10 per kilogram in the mid-1980s (Bear, 1987) to about AU\$30 per kilogram by the mid-1990s. In winter during the 1990s the beach price could rise to over AU\$50 per kilogram. In short, rock lobster became, with abalone, Tasmania's primary 'money fish', offering higher returns than for other commercial species. Fifth, also from approximately 1990, speculation regarding possible management change to address falling catch per unit effort (CPUE) in the fishery, measured in kilograms of rock lobster taken legally per potlift, resulted in some fishers beginning to concentrate effort in their preferred fishery, rock lobster, in anticipation of catch history being considered in some way. Finally, as CPUE declined, competition for rock lobster intensified with more fishers expending as much effort as possible in a catch unlimited 'race' for rock lobster.

A number of these factors were changed by the introduction of quota management. With catch limited by quota management, one possibility was that fishers would activate latent effort in other fisheries. Interview data revealed that this possibility only eventuated to a limited degree. First, many fishers did not possess licences in other commercial fisheries and were not prepared to lease or buy these, the expense involved and lack of experience in other fisheries being two reasons given. Other fishers mentioned having some time previously handed licences in alternative fisheries back to management authorities, not wishing to pay the annual fee, due to lack of use, or having licences annulled for failing to meet 'use it or lose it' or some such other provision. Still others sold, where possible, licences in alternative fisheries.

Second, some of the main reasons that many fishers concentrated their effort in the rock lobster fishery have not substantially altered regarding alternative fisheries, namely alternative fisheries being harder to fish for less catch and lower financial return. Many fishers interviewed preferred either to fish less for rock lobster or to buy or lease

additional rock lobster quota units than to gear up for another fishery. Third, many fisheries alternative to rock lobster were themselves facing various forms of management change, lending uncertainty to their status in the opinion of many fishers.

Some effort shift into other fisheries, however, did occur as a result of the introduction of quota management, though latent effort in alternative fisheries remains in the Tasmanian commercial rock lobster fleet. Of participation in other fisheries by those interviewed fishing in the Tasmanian commercial rock lobster fishery, participation in the Tasmanian commercial abalone fishery is something of a unique category. First, the abalone fishery is also quota managed, thus rendering effort shift largely irrelevant in terms of possible overfishing. Second, participation in both fisheries occurred in three different ways: first, contract diving as a source of finance and experience to assist and/or supplement participation in the relatively affordable, in terms of paying off an entitlement and quota units, commercial rock lobster fishery; second, fishing for rock lobster as a sideline to an established owner-operation in the abalone fishery; and, third, developing a possible avenue for 'retirement' into the less physically exacting rock lobster fishery, either for the owner-operator in the abalone fishery or for his or her son. Effort shift was therefore into the rock lobster fishery from abalone rather than vice versa.

The fishery into which a number of those interviewed had most noticeably shifted their effort was giant crab. Effort shift into the Tasmanian commercial giant crab fishery also requires qualification. The giant crab fishery, on the edge of the continental shelf, was largely pioneered by offshore rock lobster fishers using colour sounders, GPS and plotters, and large steel pots. Mounting concerns that this little researched fishery was being overfished resulted in the fishery being closed while research was undertaken. Quota management was introduced in the giant crab fishery in 1999. When the giant crab fishery was re-opened it was with a TACC of 100 tonnes, substantially lower than previous unlimited catch per fishing year, as well as with depressed beach prices. Effort therefore shifted back into the giant crab fishery only slowly as beach prices gradually recovered. Many of those fishing for giant crab, however, do not catch as many kilograms per fishing year as prior to the introduction of quota management in the giant crab fishery. Thus, while a number of rock lobster fishers are involved in the giant crab fishery, this number is lower and often for fewer kilograms per operation than before the fishery was temporarily closed. Those without significant catch history in the giant crab fishery prior to quota management were allocated 500 kilograms per fishing year, an amount few maintained was worthwhile 'gearing up' to fish. Neither were these kilograms worth leasing or selling until beach prices began to recover. At present, however, a number of specialist offshore rock lobster fishers, primarily, are consolidating their participation in the giant crab fishery, though with a TACC of 100 tonnes per fishing year this fishery is little more than supplementary to a small number of large, i.e. usually longer than 50 foot, boats' operations.

A number of those interviewed had licences to fish in other commercial fisheries that they considered, as things stood, to be effectively useless. Those with 500 kilograms of giant crab quota per fishing year, noted above, were in this category for a period, while many of those with scallop entitlements keenly felt the virtual closure of Tasmania's scallop beds. Shark were maintained not to be as numerous since the introduction of netting, and couta, squid and tuna were considered to be unreliable. Stripey trumpeter were commercially fished at times by a number of, especially younger, fishers

interviewed, while fishing for wrasse, garfish and morwong also occurred in an effort to bolster incomes. On the whole, however, many rock lobster fishers interviewed did not consider the effort to be worth the return in many alternative fisheries. Indeed, those interviewed who caught some or all of their bait as a cost saving measure were in a minority. A combination of reasonably priced frozen bait, unreliable numbers of bait fish and increased feeding on netted fish by seals meant that usually only the most cost sensitive operators caught their own bait. Little charter fishing was undertaken by commercial rock lobster fishers interviewed, and only a handful of fishers also fished commercially for rock lobster in either the eastern or western zones of the Victorian fishery. The most common commercial activity outside fishing among those interviewed was farming.

7.3.3 Perceived Positives of the Introduction of Quota Management

7.3.3.1 Introduction

In this chapter, positive outcomes in whole or in part attributed to the introduction of quota management by participants in interviews are discussed (Table 19). The number recorded in Table 19 is for those interviews in which the positive listed was mentioned. These data were principally in response to two general questions, the first asking participants to state any positives that they perceived to be due to the introduction of quota management, and the second inquiring after any negative impacts. Answers ranged across scales from an individual's operation and perspective, through perceived fleet effects, to impacts on all sectors of the industry.

A total of 41 positives were mentioned compared with 61 negative impacts. This difference in number is possibly due to a combination of at least three factors. First, there may be more negative than positive effects associated with the introduction of quota management. Second, participants may have been more concerned to discuss negative than positive effects. Third, an aspect of social impact assessment focuses on those types of participant for whom, and ways in which, change has been negative, with a view to improving the operation of any new system. Care also needs to be taken, however, to discuss the perceived positive effects of any management change. Each positive mentioned regarding quota management is discussed below, starting with that mentioned in the most number of interviews (Table 19).

7.3.3.2 Good for rock lobster stocks

Participants stated that the introduction of quota management had proved to have a positive effect on rock lobster stocks in 109 or 44.1 per cent of interviews. As noted, information in the data matrix has been standardised and many positives therefore require some explanation.

This positive needs to be considered in the context of contention regarding stock decline concerning some grounds in the fishery, questions in respect of the reliability of fishers' catch returns, the temporal and spatial coverage of research for stock assessment mentioned in six or 2.4 per cent of interviews, and many fishers' opinion

that stocks fluctuated naturally in longer-term cycles. Thus, there are three possible reasons why quota management was not mentioned as having had a positive effect on stocks in 55.9 per cent of interviews. First, the impact of quota management on stocks was not high on a participant's list of *personal* positive or negative effects. In such cases, a direct question concerning the participant's opinion of the effect of quota management on stocks might have produced a greater response in the affirmative. One indication that this could have occurred is that no statements to the effect that quota management was a negative factor concerning stocks were forthcoming, though some specific areas in the inshore day fishery were mentioned in 13 per cent of interviews, discussed below, as being fished more since quota management's introduction. Second, a number of fishers were of the opinion that stocks would continue to fluctuate naturally. Third, many fishers interviewed considered that it was simply too early to tell if quota management was having any influence on stocks.

Table 19. Ranking from highest to lowest number of interviews in which any perceived positive of the introduction of quota management was mentioned

Positive	No. of interviews in which mentioned
Good for rock lobster stocks	109
Fewer boats on the water	100
Boats out of the fishery	78
A fishery for future generations	71
Gains in the capital values of entitlements and units	69
More time off	55
Greater choice regarding when to fish	49
No negatives (only positives)	49
Worthwhile leasing quota units out	43
'Greedy' & short-sighted fishing largely stopped	35
'More fish in the pots'	23
Acted in the interests of the industry	22
More time with family	20
Retirement bonus	19
Only fish in fine weather	18
Fishery safer	18
Beach price 'flattened' over the fishing year	14
Fish high beach price	14
Allowed 25 per cent more pots	14
More time at home	12
Sustainable industry (stocks and investment)	10
Overpotting largely stopped	8
Pay less tax	8
Effort capped (escalating overfishing stopped)	7
Wasteful fishing largely stopped	7
Transferability of entitlements and units	5
Total catch capped	5
Know what going to earn each fishing year	4
Able to retire with dignity	4
Subleasing	4
Easier to police	4
Can plan fishing year better	3
Know what everyone is catching	3
'Cash fish' sales largely stopped	2

Competitive fishing largely stopped	2
Catch returns more reliable	1
Fill in catch returns daily	1
System more simple	1
Overcapitalisation stopped	1
Allocation	1
Entitlement attract value separate to units	1

Those who maintained that quota management was having a positive effect on rock lobster stocks were in three broad categories. The first category included participants in interviews who considered that quota management had indeed reduced effort and catch in the fishery. Rock lobster were therefore being 'left in the water' compared with effort and catch prior to quota management. The logic expressed was that this 'no take' component under quota management had to be having a positive effect on stocks. On this view, however, quota management may only be slowing stock decline, not stabilising or rebuilding stocks.

Second, a number of participants maintained that quota management had arrested stock decline; i.e. stocks were no longer diminishing under quota management. Whether stocks were rebuilding, though, had yet to be proven. Increase in catch per unit effort (CPUE), for example, could as much be cyclic stock abundance or due to reduction in number of boats as it could be due to quota management.

Third, the majority of those stating that quota management had exerted a positive influence on rock lobster stocks were of the opinion that stocks were rebuilding in many areas around Tasmania. The offshore overnight fishery, particularly off the west coast, was considered to have experienced the greatest decrease in fishing. In noting any positive effect on stocks, however, many participants stressed differences between the rock lobster resource and its habitat around Tasmania, the most basic being between increasing fishing pressure in the inshore day fishery off the east coast and decreasing fishing pressure in the offshore overnight fishery off the west coast of Tasmania. Growth rate and size differences were also commonly held to be evident between rock lobster off the north compared with the south coast of Tasmania. In many interviews, regardless of any mention of an effect of quota management on stocks, participants emphasised that the fishery was part of an extremely complex ecosystem that may include waters from off Western Australia to New Zealand. The time frame required to appreciate trends or cycles in the fishery was considered to be similarly extensive. In short, for many participants interviewed it would not be certain for some time whether quota management was resulting in stock recovery. Many participants, too, emphasised that recent good fishing years off especially the northeast coast of Tasmania were unrelated to the introduction of quota management, being due instead to good puerulus settlement in the mid-1990s. Some of these participants were convinced that a bust side to this localised boom was inevitable.

In conclusion, in no interviews was it reported that 'the fish had gone bad'. On the contrary, reports were that 'the fish are good' in all areas around Tasmania due to a combination of less fishing off the west coast and good fishing off the east coast. These reports are corroborated by increases in CPUE, measured in kilograms per potlift, in the 1999/2000 fishing year compared with both reference years and 1998/1999 (Gardner *et al.*, 2001). Concern regarding the possible end of legal size

maturation of a large pre-quota management juvenile rock lobster settlement year off the east coast, noted above, and the effect of effort concentration in the inshore day fishery off the east coast fail to outweigh reports of stock abundance elsewhere. On balance, according to data from the interviews, quota management appeared to be 'good' for stocks, though some areal fine-tuning is arguably worth considering.

7.3.3.3 *Fewer boats on the water*

In 100 or 40.5 per cent of interviews, participants, principally fishers, stated that one positive to arise from quota management was that often fewer boats were fishing around them. Many participants reported that prior to quota management, put simply, more boats were fishing more often. In the years immediately preceding quota management over 320 boats vied with each other in a catch unlimited fishery (Gardner *et al.*, 2001). Against the backdrop of an average beach price of AU\$30 per kilogram and what many fishers considered to be a declining resource, competition intensified in the final years of 'open slather' fishing. Few fishers held that they could afford to take many breaks from fishing as, depending on whether quota management was introduced, they had either to catch their share of a diminishing resource or they had to make the most of what catch unlimited fishing remained. If they did not do so, then most considered that others would. Moreover, it was possible that quota management would be allocated according to some form of catch history and this further encouraged some operators to increase their fishing effort. Some boats stopped fishing only for the worst weather, for season closures or to change crews. More boats fishing more often meant more competition. Many fishers felt compelled to be on the water and, once fishing, also felt pressured by other boats as fishers sometimes shot (i.e. set pots) among each others gear. A number of those interviewed stated that such circumstances detracted from their enjoyment of fishing, though the financial returns in a catch unlimited fishery were often good.

Since the introduction of quota management, the fleet has decreased in number by over 75 boats, or nearly one-quarter (Gardner *et al.*, 2001; Dr Linda Eaton pers. comm. 2001). Of those boats remaining, just over 50 per cent are fishing less than prior to quota management. Fewer boats in the fleet and a reduction in many boats' days at sea have meant that competition between fishers has in many places decreased, though rivalry among fishers persists. Moreover, for many fishers interviewed, allocated catch has resulted in less pressure to be at sea. If, prior to quota management, fishers keenly felt the competitive presence of both those they could not see when in port and those around them when fishing, boats out of the fleet, less time fishing and an allocated share of the TACC reduced much of the built up urgency associated with fishing. In short, for many fishers, allocated catch meant peace of mind. 'With quota I know my fish are there' was a common sentiment. That is, 'my' rock lobster to catch or, *a fortiori* under quota management, to lease out or sell in the form of a quasi-privatised entitlement to access attached units of rock lobster. Compared with a pre-quota management catch unlimited 'race for fish', in many interviews participants stated that catch allocation had relieved competitive pressure considerably and resulted in a more relaxed atmosphere in which to fish. With the ambience less agonistic, some fishers were happy to be fishing and catching less, claiming in 8 or 3.2 per cent of interviews that by paying less tax their earnings were not significantly reduced.

Consequently, for many remaining in the fishery, the practice of fishing was more

enjoyable following the introduction of quota management, though with two major exceptions: first, fishers who had not been in a position to be allocated quota; and, second, fishers who had been substantially catch reduced. In other words, those most likely to be enjoying their fishing more under quota management were those comfortable with their allocation and/or the servicing of any debt entered into to secure their allocation. For many fishers interviewed 'forced' to service high levels of debt incurred purchasing quota units, or to disburse large amounts of their gross income per fishing year leasing in quota units, fishing itself may have been less competitive and rock lobster easier to catch but financial pressures and security issues had mounted significantly due to the introduction of quota management.

7.3.3.4 Boats out of the fishery

In 78 or 31.6 per cent of interviews, participants stated that a positive effect of quota management was that boats in the fishing fleet had reduced in number. As in the positive discussed immediately above, for fishers remaining in the fleet this reduction meant, put simply, fewer boats fishing. A combination of reduction in total catch and number of boats in the fishery, and a 'cyclic' upturn in stocks off the east coast of Tasmania meant that in 23 or 9.3 per cent of interviews, participants stated that there appeared to be 'more fish in the pots' under quota management. Loads or 'jags' of rock lobster were therefore being caught more quickly. This fact notwithstanding, fishing conditions in terms of competitive pressure between fishers were largely improved by a reduction in the number of boats in the fleet. Not all those quitting the fishery, however, were entirely happy to be leaving. A number of those 'retiring' from the fishery, 'golden handshake' or not, considered that they had been 'forced' to retire by catch reduction due to allocation, and/or rule and administration changes that they perceived to be unfathomable. A number of lessees exited the fishery due to difficulty obtaining an entitlement or unwillingness to fish for reduced net returns as the cost of leasing in quota units approximately doubled between 1998 and 2001. Thus, improved fishing conditions in the form of less competition due to the introduction of quota management was in some respects at the cost of dislocating those without the necessary resources to secure a place in the fishery under the changing conditions associated with the new system. Those departing without entitlements and quota units did so without 'compensation' from either the market or the Tasmanian government.

'Fleet' is a collective noun, but in terms of operation and outlook fishers in the Tasmanian commercial rock lobster fleet are highly individualistic. Though many firm friendships exist and many forms of assistance are evident between fishers, including some selfless and brave acts when required, operators largely stand alone in respect of catch and viability. Cooperative fishing or processing ventures are largely non-existent in the Tasmanian commercial rock lobster industry. On the whole, each operator is responsible for her or his fishing and operational economics. Moreover, fleet unity is undermined by the legacy of heightened pre-quota management competition. In short, there are approximately 245 'bosses' in the present fleet of approximately 245 boats, though some drivers of others' boats are arguably less independent. Though grounds exist for commonality, agreement between independent and heterogeneous operators is difficult to reach. Disagreement, however, is not solely a matter of differences between individuals. Different individuals operate in different size boats and practice different styles of fishing off different parts of the Tasmanian coast. Given the many combinations of these differences, it is perhaps not surprising that fishers find much to

disagree about. They continue generally to share, though, the environment, the occupation and the culture of Tasmanian commercial rock lobster fishing, and they share these respects in distinction from the rest of us.

So it is that, for some fishers, a boat out of the industry is less the loss of a colleague and more the loss of a competitor. Though boats and fishers disappear, the quota units once used by them find their way through various distributions and intermediaries to remaining boats in the fleet to become part of trends disagreeable to many fishers. Though a fisher may consider the exit of a boat from another port, or even locally, to be in her or his best interests, he or she may on the other hand criticise the increase of investors in the industry or the encouragement of larger operators in the fishery. The industry is replete with such paradoxes as individuals shift scales between the micro and the macro. 'Boats out of the fishery', for example, can reduce competition for individual fishers but result in an increase in the role of investors. It can also operate as a positive at the scale of the fleet according to efficiency arguments. The argument was made in some interviews that the Tasmanian commercial rock lobster fleet prior to quota management was overcapitalised, resulting in rent dissipation. In short, it was maintained that too many boats were being used to catch the rock lobster available. Capping effort and catch below pre-quota management levels resulted in some boats being catch reduced and some boats leaving the fishery. At the scale of the fleet, as the number of boats continues to fall while the TACC remains at approximately 1500 tonnes per fishing year the fleet may be considered to be fishing more efficiently. This outcome, for a number of those interviewed, principally investors, was considered to be positive, though no agreement existed as to how many boats the fleet should fall to, or if any intervention in this decline should be considered (this is despite number of licences, as a proxy for boats, being a trigger point in the management plan).

This macro scale economic efficiency argument is open to question in the case of the Tasmanian commercial rock lobster industry. First, at the scale of the fleet, no greater efficiency may yet have been achieved. For example, assuming total catch before quota management to be approximately 2000 tonnes per fishing year – summing official and unrecorded catch, estimation of unrecorded catch being based on interviews with fishers and processors – the TACC represents a reduction in catch of about one-quarter. Number of boats in the Tasmanian commercial rock lobster fleet has, since quota management, declined by approximately the same percentage. In other words, many operators leaving the fishery, for example those catch reduced, may not have been the least efficient, and many operators at the lower end of the catch range – the least efficient operators according to proponents of larger boats – were allocated more quota units. In short, the Tasmanian commercial rock lobster fleet may arguably be yet to experience any major efficiency gains. Certain individuals may well be operating more efficiently, but the fleet might only be approaching pre-quota management efficiency levels. Arguably, too many large catchers left the fishery and others cut back their fishing to allocated levels for this not to be the case.

Second, efficiency gains are usually at the expense of losses of some kind. Depending on whether social effectiveness is considered in fishery assessment, maximising efficiency may not be in the best interests of various people and places in the fishery. If those 'losing' outweigh or are unacceptably at the expense of those making efficiency gains then efficiency maximising may be questioned, both politically and economically regarding sundry externalities. Thus far, many of the efficiency gains of

a number of individuals are simply higher lease returns to rent seeking investors. These returns are being increased as much due to willingness to pay as to increased operational efficiency. Bid-price is, of course, elastic, and a combination of declining margins and efficiency gains contributed to the lease price of quota units doubling between 1998 and 2001 as individual fishers desperate for quota units were forced to pay the rising rate in a competitive market. The surplus value at present represented by a return of AU\$14 per kilogram per fishing year for leasing quota units out is being appropriated not by the Tasmanian government but by private investors, with licence fees constituting just over 10 per cent of this figure. With number of boats in the fishery declining and the lease price of quota units continuing to increase, the goal of maximum efficiency for the fleet could perhaps be tempered by social effectiveness. Arguments about the adequacy of the royalty at present is a different issue, licence fees weighing differently on fishers compared with investors; in other words, the issue of efficiency should not be considered separate to that of distribution (Copes, 1994).

Third, macro efficiency arguments are undermined if differences in economies of scale and scope in the fleet are admitted. Once allowed, no uniform efficiency maximising model-type boat can be postulated regarding the Tasmanian commercial rock lobster fleet. There are instead different types of boat operating at different economies of scale fishing in different areas – involving different economies of scope – off different parts of the Tasmanian coast. The Tasmanian commercial rock lobster fleet is made up of a variety of boats with vessels ranging from 30-odd foot traditional wooden single-handed ‘cray’ boats, often plying the inshore day fishery, to 60-odd foot modern steel multi-purpose fishing boats, with a crew of three, concentrating on the offshore overnight fishery. In between there are many variations of operation, often adapted to fishing in distinctly different local areas. In light of such requisite diversity, to posit that the only logic of efficiency worth pursuing in the Tasmanian commercial rock lobster fishery is to encourage a fleet of 125 large boats is a macro arrogation and a micro nonsense.

Fourth, fishers also differ regarding ownership of entitlements and quota units, lessees owning neither while many owner-operators catch all the rock lobster they wish to without having to lease in quota units. There is, then, a difference between the self-determined efficiency of an owner-operator and the competitive efficiency of a lessee. Within limits, an owner-operator can, with exclusive quota units, choose to be as efficient as he or she pleases. No such choice is available to lessees as they must compete for quota units in a market that includes not just other lessees but owner-operators in a position to out-bid them due to the ‘subsidy’ represented, in the context of their operation, by their own quota units. In short, as a goal, maximising fleet efficiency is undermined by there being no level fishery in terms of either fishing conditions or operators.

7.3.3.5 A fishery for future generations

In 71 or 28.7 per cent of interviews, participants stated that the introduction of quota management had been concerned to ensure the sustainability of the resource. The longer quota management operated, the more confident participants were in its efficacy in this regard. In other words, rock lobster stocks, the keystone of the industry, had

been managed from a position of decline due to overfishing to one of sustainable fishing and stock rebuilding. Many participants maintained that this position held for some areas of the fishery more than others but, on the whole, in the 71 interviews discussed here participants considered that quota management had ‘got it right’ in respect of biological sustainability. The cap on *effort* provided by quota management was stated to be a positive factor in 7 or 2.8 per cent of interviews, while the fact that total *catch* was capped was specifically mentioned in five or two per cent of interviews.

As noted, observations regarding positives and negatives associated with quota management are in response to two general rather than specific questions. Participants’ responses therefore tend to concern those most important to them rather than all those known to them. Thus, that a ‘fishery for future generations’ was mentioned in 71 interviews was not specifically solicited. The primary focus in the research was on people in the industry not the resource. The issue of the biological sustainability of the resource is largely the preserve of fishery biologists, who may wish to question fishers specifically about this issue. One aim in the research for this report was to encourage people to speak and prioritise for themselves, and then to explore the positives and negatives that arose.

‘A fishery for future generations’ is standardised shorthand, not for biological sustainability, but for the opinion that the fishery, through quota management, was ‘on the right track’ towards ensuring a resource for fishers in the future. It was less a pronouncement on the fishery in the present as in the future. Neither was this opinion concerned with particular conditions but with the general concept of sustainability. Thus, concerns over possibly biologically unsustainable fishing in the inshore day fishery, a declining number of boats in the fishery, and rising financial hurdles for younger fishers could all be bracketed as having been addressed in the future *en route* to sustainability.

Many participants, however, were more subtle or less sanguine than this last sentence suggests. Though in all 71 of the interviews discussed here participants maintained that in general quota management had ‘fixed the fish’, in terms of social sustainability concerns were often raised regarding who would be fishing for rock lobster in the future, how many would be fishing and under what social relations of production. In other words, confidence existed of there being rock lobster to catch in the future, but doubt was often expressed over whether a present deck hand, for example, could afford to buy into the fishery and, indeed, if smaller boats would continue to operate in the fishery.

It is a truism that timing of birth matters, but just as important are “profound links among generations ... [that] are the cement of social cohesion and continuity ... [I]ndividual life choices in time and space [need] to be placed in contexts of entitlements and opportunities that affected, and affect, those choices” (McDaniel, 2001). In the last decade, management systems, markets, capital values and so on have all changed significantly in the Tasmanian commercial rock lobster industry. Possibilities and constraints could be very different depending on when a participant entered the industry. As the industry continues to change, decisions made by individuals and regarding the fishery will influence the conditions under which new participants operate in the fishery. For example, relations between fathers and sons, and owner-operators and deck hands, and decisions regarding entitlements and quota units will affect the transition between the present generation of the fishery and the

next. A number of participants interviewed, though confident about the long-term future of the resource, feared for the fishery as they knew it. In their view, the cultural emulsifier of the fishery in the forms of family and local fishing was threatened by the escalating capital values of entitlements and quota units, concentration of ownership of these, declining number of boats in the fishery and so on. For these participants, such developments did not make for a positive future for the fishery. A number of participants made the point that intergenerational transfers did not just involve wealth but that, importantly, knowledge and culture were also passed on. Much experience and understanding were considered to be needed to know exactly where and when to fish for rock lobster.

Biological sustainability requires that those catching rock lobster do not do so at the expense of future generations. Biological sustainability has arguably been achieved in the Tasmanian commercial rock lobster fishery. Significant financial gains, however, are at present being made at the expense of especially the emerging generation of commercial rock lobster fishers. The number as well as the conditions of participation of these fishers are declining, with implications for fishing families, localities, culture and knowledge. In short, in a number of the 71 interviews discussed here, participants questioned the nature of the “transitional gains trap” (Copes, 1986, 1997) into which the next generation of fishers, particularly, was steaming. As one participant put it, “the fish’ll be ok, but I don’t know about the fishermen”. For many participants the ‘don’t know’ in this quotation is apposite, some stressing that decisions regarding issues facing the industry at present require careful consideration regarding effects in the future, while others preferred to let the circumstances of tomorrow look after themselves.

Finally, the concept of ensuring a resource for use by yet to be specified future generations shifts not only scales, from the particular to the general, and temporal frames but is also informed by the normative rhetoric of sustainability. The abstract purchase of sustainability needs to be qualified and assessed to be working in local places and local times before making any concrete claims regarding future generations. As noted, quota management in the Tasmanian commercial rock lobster industry arguably requires some biological and social fine-tuning, with a vision for the industry being particularly important to the latter, before action in the interests of future generations can clearly be taken. In conclusion, however, for the participants discussed here a significant positive of quota management was that the resource was guaranteed for the future, regardless of the conditions under which it would be accessed.

7.3.3.6 Gains in the capital values of entitlements and quota units

One effect of quota management has been approximately to double the value of a ‘pot’, or quota unit as it became. Immediately prior to the introduction of quota management, a pot was valued at approximately AU\$12,000. By 2001 a quota unit was fetching approximately AU\$24,000.

An unintended consequence of quota management was the attraction of value to entitlements. Without a separate value pre-quota management, by 2001 entitlements were being valued independently of attached quota units at approximately AU\$50,000.

By 2001, leasing out the 143 kilograms of rock lobster per quota unit per fishing year

returned approximately AU\$14 per kilogram, double that received in 1998.

Finally, so-called 'blank' pots, i.e. legal pots the quota units of which had been leased out to an operation already fishing with its maximum number of pots, were able to be leased out to an operation fishing with less than its maximum number of pots at approximately AU\$200 per pot per fishing year.

Thus, to own and *use*, an entitlement and quota units in 2001 approximately grossed the same amount as prior to quota management, i.e. at a rate of approximately AU\$30 per kilogram, though unrealised capital gain had approximately doubled. If *exchanging* an entitlement and quota units, however, in either a sale or a lease arrangement, gross returns had increased by approximately 100 per cent since the introduction of quota management. For many of those owners not fishing therefore gains in the capital values of entitlements and quota units were a major positive effect of quota management, mentioned in 69 or 27.9 per cent of interviews. The transferability aspect of entitlements – long pre-dating quota management – and quota units was stated to be a specific positive in five or two per cent of interviews. If, in terms of sustainability, one aim of quota management was to ensure a longer-term investment market, or not to devalue existing licences, then this was clearly achieved. In 10 or four per cent of interviews, participants stated that sustainability under quota management was a positive outcome in terms of both stocks and the longer-term investment horizon. The market for entitlements and quota units had proved, not just to be sustainable in terms of confidence in the longer-term future of the resource and industry, but to be bullish in the form of value appreciation. In terms of activity, leasing out quota units flourished, but sales appeared to slow somewhat as the adjustment period following the introduction of quota management drew to a close; i.e. owner-operators who wished to purchase additional quota units at the time of quota management's introduction have, on the whole, now done so. More recently, smaller tranches of units appeared to be selling, rather than whole packages, with the effect of further increasing prices.

Three main types of participant perceived gains in the capital values of entitlements and quota units to be a positive effect of quota management. First, investors' principal motive for purchasing entitlements and quota units was to receive a better than average return on capital. As noted, gross recurrent return through leasing out quota units, and capital gain both doubled between 1998 and 2001, exceeding many investors' expectations. At present, as in 1998, the purchase of a quota unit could be expected to gross an approximately 8.3 per cent return per fishing year. This return is calculated on the value of a quota unit rather than on its cost. Fishery managers estimate return after payment of licence fees to be between 6 and 6.5 per cent. Second, some of those retiring from the fishery were little short of incredulous regarding the 'golden handshake' they received by dint of capital gain on their entitlements and quota units. In 19 or 7.7 per cent of interviews, participants stated that escalation in the values of entitlements and quota units had provided them with a substantial retirement bonus or 'superannuation' package. A number retiring from the fishery had acquired a licence before the introduction of capital gains tax in the mid-1980s. Some retiring fishers, however, preferred to lease out their quota units and wait to recoup the full extent of escalating capital gain. Still others entered into an arrangement with their son running the operation. In four or 1.6 per cent of interviews, participants stated that escalation of values and prices regarding entitlements and quota units associated with the introduction of quota management had provided them with a 'respectful' retirement

from fishing that enabled them to live with dignity. In 64 or 25.9 per cent of interviews, for example, participants stated that their only form of 'superannuation' was their boat and licence.

Third, a number of owner-operators were also pleased with the effect of the introduction of quota management on the capital values of entitlements and quota units. Owner-operators were bifocal in that they 'owned' an investment at the same time as they operated as fishers. The 'owner' side of this bifocality often viewed capital gains on entitlements and quota units as positive, though realisation of these may be problematic intergenerationally in terms of the conditions on which a son took on the operation. More clear-cut was the flexibility afforded owner-operators by escalating lease price in that under quota management it was increasingly worth considering leasing out quota units rather than fishing them (note that boats are discounted from this consideration, being assumed to be fully owned). Indeed, as a positive in its own right, 'worthwhile leasing quota units out' was mentioned in 43 or 17.4 per cent of interviews. A number of owner-operators interviewed calculated that net returns from fishing quota units were similar to those from leasing them out. As a fall-back position in case of illness, for example, this similarity was perceived positively. Leasing out quota units may also release a boat to participate in another fishery, though some owner-operators claimed that they could earn a higher net return tying their boat up and leasing out their quota units. This possibility precipitated some serious deliberation by some owner-operators as to the value of continuing to fish their quota units. A number of participants interviewed considered the market to have been over-stimulated when net returns from leasing out quota units began to exceed those from fishing them, even for many fully paid-up owner-operators. The balance tipped further away from fishing the more quota units an operator leased in. The flexibility afforded owner-operators by escalating lease price therefore was double-edged. Escalating lease price worked in favour of owner-operators in a position to consider leasing out quota units, but against those wishing to lease these in. For operators having to lease in a large proportion of their catch, especially full lessees, the margins involved could be slight indeed. To state the obvious, the more operators owned both in total and as a proportion of their operation, the better placed they were; but, less obviously, under quota management escalating rent return and capital gain increasingly meant for many owner-operators that the less they fished, the better off they were financially. Increasingly under quota management gains were made by 'owners' – a combination of investors and ex-fishers – at the expense of operators. Some of those interviewed who had left the fishery, having owned little, had done so simply because a 'shore job' paid better. Shore jobs were also rarely as difficult, dangerous or isolated from family as could be the case in commercial rock lobster fishing in Tasmania. Opportunity costs vary between individuals, thus affecting this scenario, but it is increasingly the case that two classes of participant are emerging in the Tasmanian commercial rock lobster industry, 'haves' and 'have nots', or owners of entitlements and quota units and non-owners. Wealth is distributed along these lines increasingly in favour of non-fishing owners.

In conclusion, increasing financial gains are being made in the Tasmanian commercial rock lobster industry. The question is 'by and from whom?' Put simply, non-fishing owners stand to gain most, while non-owning fishers stand to gain least. In other words, what is a positive for some retiring from the fishery may well be a negative for others attempting to enter it. The Tasmanian commercial rock lobster industry may need some fine-tuning in this regard. The following quote from an owner-operator

catches some of the tensions between self and industry, ownership and use, and so on that need to be considered regarding the escalating values of entitlements and quota units.

Quota suits me now, really. But I still say that it's not good for the industry ... Nobody really wants to see it run by bloody millionaires ... This is what used to make me mad when they [fishery managers] were discussing this quota system. They couldn't seem to gather that it wasn't good for the industry. They couldn't get it in their heads. Some of the fellas [fishers] couldn't either. They just wanted quota. Some of the quota blokes here, you couldn't talk to them. They wouldn't consider anything else but quota. Like one bloke here, he was that quota conscious it was unreal. And when quota come in, he never went to sea, didn't catch a fish. Sold his boat. Got about ten or twelve grand for them [quota units]. Now what good was he to the bloody industry? And whoever bought them, its like shares, they're just speculators (Owner-operator, 2000).

7.3.3.7 More time off

In 55 or 22.3 per cent of interviews, participants, principally fishers, stated that more time off was a positive outcome of quota management. As noted, fishing intensity peaked in the fishing years prior to the introduction of quota management as approximately 320 boats 'raced for fish'. Commercial rock lobster fishing licences were limited but catch per licence was not. For many participants, catch allocation and reduction in the number of boats under quota management meant both less and easier fishing. Regardless of whether time off was considered to have been 'forced' by quota management or was more discretionary, for example choosing to lease out some quota units and fish less, few of those interviewed begrudged time off. Most had 'plenty of other things to do', though some noted that when they were not fishing they had less cash flow, or that they would prefer to be fishing. Others had additional occupational interests to which to devote their time, such as farming.

In 20 or 8.1 per cent of interviews, participants mentioned that more time off under quota management meant that they could spend more time with their family. Given that fishing is traditionally hard on families, both partners and children, this is a significant positive outcome. Those working most in the industry, however, tended to be younger fishers leasing in quota units, the very individuals most likely to have young families. In 12 or 4.9 per cent of interviews, participants stated that more time off under quota management meant that they could spend more time at home. More time off, however, was largely a luxury afforded to owners of entitlements and quota units, extreme cases being where entire fishing years were taken off while a boat driver was employed or quota units were leased out. For brokers and those leasing in quota units, globe trotting quota unit owners could prove difficult to contact to sign necessary paperwork, thus holding up fishing. It is not entirely a case, however, of to the owners the spoils as nearly all fishers interviewed considered that they had some increased degree of self-determination regarding if and when they took any time off fishing. Competition for rock lobster had declined in many areas and fishers were confident that their allocated tonnage existed to be caught. Though some individuals had powerful endogenous reasons to take little time off, the exogenous factor of racing other fishers as well as stock decline had been mitigated by quota management.

7.3.3.8 *Greater choice regarding when to fish*

In 49 or 19.8 per cent of interviews, participants stated that the introduction of quota management had positively resulted in greater discretion over the timing of their fishing. As in the subsection above, allocated catch and reduced competition for rock lobster meant that many owner-operators were in a position to adjust their fishing effort to suit the amount and times they wished to fish. There are many factors that influence when a fisher may wish to be fishing, and these vary in application and combination between individuals. Some operators winding down their fishing near retirement, for example, chose to lease out some of their quota units and fish less. Others chose to fish around the change between financial years. Still others worked around the change between quota fishing years, delaying some fishing until the final month of a quota fishing year in expectation of lower prices to lease in units.

In 18 or 7.3 per cent of interviews, participants stated that they no longer worked in as bad weather as they had done pre-quota management. Also in 18 interviews, participants maintained that fishers were less likely to ignore safety issues. (Care needs to be taken here to distinguish competition between fishers from pressures specific to an operation.)

With the ‘race for fish’ largely over under quota management, a number of fishers maintained that quality and price had become more important elements influencing their fishing. Broadly, many fishers chose to concentrate their fishing in either winter or summer. Particularly during the so-called ‘new shellers’ period around November, rock lobster were likely to be caught in greater numbers than in winter. Beach prices, however, were usually low, approximately AU\$25 per kilogram, during the new shellers. Beach prices peaked in winter at approximately AU\$50 per kilogram. Reasoning varied, but some fishers maintained that it was more economic to catch rock lobster quickly, though for a lower beach price. Other fishers, however, considered greater net return to result catching rock lobster more slowly but for a higher beach price in winter, beach price being important in both cases. In 14 or 5.7 per cent of interviews, participants stated that one of the positives of quota management was that, given that CPUE was increasing due in part to catch being capped, there was more scope to plan fishing around high beach prices. Often, some combination of these two approaches was adopted depending on different styles of fishing, trends in the beach price, whether and where rock lobster were ‘running’ and so on.

Concentrating fishing in either summer or winter was a gamble of sorts. Fishers catching much of their rock lobster quickly in summer gambled mostly on summer beach prices, while fishers aiming to catch more of their rock lobster in winter gambled mostly on being able to catch sufficient rock lobster. In four or 1.6 per cent of interviews, participants stated that one positive effect of quota management was that they knew approximately what they would earn in the coming fishing year, while in three or 1.2 per cent of interviews, participants perceived quota management to have enabled them better to plan both their financial and their fishing year by dint of allocated catch and reduced competition. Moreover, the quota fishing year is begun in March and ends in February. Thus, fishers not catching much rock lobster over winter due to choice, weather, luck, ability, etc. still have the best part of the fishing year ahead of them in terms of catch.

In conclusion, the main point is that many of those interviewed maintained that the

competitive bind in which they were caught pre-quota management had been loosened, thus freeing them to adjust their fishing according to whichever factor they considered to be important.

7.3.3.9 *No negatives (only positives)*

In 49 or 19.8 per cent of interviews, participants considered there to have been no negative outcomes from the introduction of quota management. Compared with the 27 interviews in which participants held there to have been no positive outcomes from quota management, some sense of the proportion of each extreme can be gained. When summed, 'no negatives' plus 'no positives' equals 76 interviews. 'No negatives' makes up 64.4 per cent of these 76 interviews, while 'no positives' makes up 35.5 per cent. In more interviews, then, participants were one-eyed in favour of quota management than against it.

In the lead-up to the introduction of quota management various levels of support for the proposal were surveyed. Just over 50 per cent support for some form of quota management was held by fishery managers to exist in 1993. A petition in support of quota management signed by 67 per cent of licence holders was produced in 1997. As noted, interviews conducted as part of the research for this report included participants in the industry in addition to licence holders, though licence holders are possibly somewhat over-represented in the sample. In its third year of operation, it was at times difficult for participants to pronounce themselves to be unequivocally 'for' or 'against' quota management (Table 20).

Table 20. Number of interviews in which participants were either 'for', 'against' or 'unable to classify' regarding quota management.

	No. of interviews	Per cent
'For'	135	54.6
'Against'	61	24.6
Unable to classify	49	19.8
Not stated	2	0.8
Totals	247	99.8

In close to 20 per cent of interviews, participants considered there to be a combination of positives and negatives regarding the new system. In approximately one-quarter of interviews, however, participants had no difficulty in declaring themselves to be 'against' quota management, while in nearly 55 per cent of interviews participants were in favour of quota management. Those maintaining there to be no positives associated with the introduction of quota management are discussed below. Those maintaining there to be no negatives associated with quota management likewise view the system from their own vantage point. As noted, that 'something had to be done' to avert stock decline was agreed by most participants in the industry. Whether that 'something' be pot reduction, a changed regime of season closures, quota management or some other mechanism, however, was open to conjecture. Moreover, once quota management was confirmed as the favoured approach, opinions differed as to how quota might be allocated. Put simply, with quota management in its fourth year of operation, the positions of many participants in the industry are a combination of, among other things,

history, timing, preparation and allocation. History refers to the type of, particularly, fishing operation, principally size of catch per fishing year. Timing refers to when participants entered the industry, and preparation to what degree participants prepared for a possible management change. It is noted that for many participants who bought more pots in the lead-up to quota management, this strategy would also have applied in the event of pot reduction.

Finally, allocation refers to the method, 100 per cent equal-per-pot in the fourth year of quota management, of distributing quota among licence holders. As noted, equal-per-pot allocation related to the pre-quota management catch of fishers differently. In a heterogeneous fleet of catchers, some were substantially catch reduced, the catch of others was largely unchanged, while still others were allocated more than they had been catching prior to quota management. The 49 interviews in which participants considered there to have been no negatives from the introduction of quota management represent many of the ‘winners’ from this allocation process. There were fewer losers in terms of allocation and a number of these have left the industry and could not be contacted. Even so, in 43 or 17.4 per cent of interviews, participants mentioned equal-per-pot allocation as being a negative aspect of quota management.

Significantly, however, the figures in Table 20 are an extension of summary opinion beyond just licence holders, though it bears reiterating that licence holders are arguably over-represented somewhat in the sample. From the sample, support for quota management is clearly in the majority. This support is as much based on financial gain as on improved operating conditions or stock recovery. The 61 interviews in which participants were opposed to quota management are less cases of ‘sour grapes’ than indicative of the extent of the need to ‘fine-tune’ aspects of the operation of quota management so that the system works better for more concerned. Two types of participant in particular could be considered to require assistance of some kind, namely recent and aspiring owner-operators and those substantially catch reduced. Importantly, any fine-tuning of the system should not be to the detriment of any participants. However, if there exist possible Pareto superior (Buchanan, 1985) adjustments that could be made to the system, for instance by way of some form of zoning, then these are worth exploring.

7.3.3.10 ‘Greedy’ and short-sighted fishing largely stopped

In 35 or 14.2 per cent of interviews, participants stated that the introduction of quota management had altered the ‘logic’ of the fishery so that an avaricious, short-term catch maximisation approach no longer applied. This positive overlaps with two others, namely ‘overpotting largely stopped’, mentioned in 8 or 3.2 per cent of interviews, and ‘wasteful fishing largely stopped’, mentioned in 7 or 2.8 per cent of interviews. Prior to quota management the fishery was regulated through a number of so-called ‘input controls’. These included season, size, licence and pot limits. There was, however, no limit on fishers’ catch. Within these limits, if more money was needed, more rock lobster could be caught, some participants interviewed referring to the pre-quota management fishery as a ‘handybank’, the closing of this being a negative effect of quota management for some participants. A heady brew of competition between boats, individual greed and fear for rock lobster to catch meant that many fishers did not consider longer-term consequences of their overfishing. Most fishers agreed that, collectively, the fishery was being overfished, but input controls prior to

quota management contributed to this stock irrational practice at the scale of the individual operator. Many competitive advantages, be they physical, technological, illegal, etc., could be translated into increased fishing effort, with a view to greater returns. Against the backdrop of declining stocks, it only took a few pace-setters to impel many in the fleet to increase their fishing effort in an attempt to keep up. Many may not have wished to race fellow fishers but, in the context of falling CPUE pre-quota management, many fishers maintained that they had little choice but to race against declining stocks, if only to maintain their level of catch. In this way, competition as much as greed appeared slowly to be exhausting the fishery.

Regarding wasteful fishing, reports are that prior to quota management a number of fishers in the offshore overnight fishery, especially, risked catch overloading. Tonnes of dead rock lobster, jettisoned over the side of the boat, were occasionally the result. With catch limited under quota management, emphasis shifted somewhat from catch volume to quality, as evidenced by few cases of substantial numbers of 'dead fish' in a load being reported by participants in interviews. Many fishers only remaining concern regarding the quality of rock lobster under quota management was allowing fishing in September when many rock lobster in southern Tasmanian waters were soft-shelled and easily damaged.

It is more difficult to gauge a trend regarding the practice of overpotting due to it being illegal. New penalties introduced as part of the change to quota management considerably raised the stakes associated with this practice. (It is noted that penalties could have been restructured at any time independently of quota management.) Consequently, the culturally accepted practice of carrying a few extra pots largely disappeared under quota management. By 'culturally accepted' it is not meant that every fisher carried extra pots, only that most would turn a blind eye to those carrying a few more. Harsher new penalties, however, were not principally designed to address this kind of overpotting but to combat the less common practice of running extra 'fleets' of gear. By 'fleets' of gear is meant that in addition to their legal 40 pots, for example, fishers would work another 40 and, according to some reports, 80 pots. Fishing offshore, often out of sight of the coast, with the aids of a GPS and plotter to relocate gear, overpotting was unlikely to be detected. In a catch unlimited fishery returning an average beach price of AU\$30 per kilogram and within a management system that recognised rock lobster as legal once in a boat's well, provided they were size and in season, incentive to overpot existed. The introduction of quota management changed neither the likelihood of detecting overpotting nor the average beach price, but it limited catch, stiffened penalties and introduced a recording system that required all rock lobster to be documented, from fisher to table, to be legal. Where, prior to quota management, boosting catch by overpotting limited the illegality to gear in the water and crew on the boats, large-scale 'quota busting' through any means requires a chain of complicity that includes processors and so on as a rock lobster without associated quota paperwork remains illegal to point of consumption. Thus, overpotting was not addressed directly via quota management, rather the frame within which it appealed was changed, reducing the incentive to practice it. Overpotting may still occur in the interest of efficiency but detection, though unlikely, is possible, penalties are now greater and the effort required just to increase efficiency, not catch per fishing year, is simply not worth the trouble according to many participants interviewed.

Under quota management, therefore, many participants maintained that greed was

capped with effort, competition had relaxed, loads of 'dead fish' were uncommon and overpotting lacked substantial incentive, risked stiffer penalties and had largely been discontinued as a consequence. All of these outcomes were held to be unequivocally positive. Less so was the decline in 'cash fish' sales under quota management. In only two or 0.8 per cent of interviews did participants mention a decline in cash fish sales under quota management as a positive effect of the introduction of quota management. This low number may be because cash fish sales have not declined under quota management. There is no way of checking participants' reports, but in 18 or 7.3 per cent of interviews, participants stated that they no longer sold rock lobster for cash, something they bemoaned, and that they considered that this practice had largely stopped under quota management. By 'cash fish' is meant the sale of rock lobster to either processors or others, the returns from which count as undeclared income.

It is noted that cash fish sales were in decline prior to quota management due to higher beach prices made possible by the advent of Asian markets for live rock lobster. Quite simply, a local cash fish sale of, for example, AU\$20 per kilogram was a poor return compared with a possible 'official' AU\$50 per kilogram beach price in winter. However, in summers previous to quota management, particularly around Christmas and New Year, with beach prices often approximately AU\$25 per kilogram, cash fish sales continued to occur. Prior to quota management, cash fish sales were a different order illegality to those mentioned above; i.e. rock lobster were most often legally caught, were of legal size and legally in the possession of the fisher concerned, but they were not declared as part of the sold catch to avoid paying income tax. Tax avoidance being something of a national pastime, cash fish sales were not considered to be serious breaches of either the law or fishery mores, unlike the taking of undersized rock lobster for example. Indeed, cash fish sales played an important part in boosting the margins of many fishers and processors, being the 'cream on the cake' according to some. They also contributed to the 'unofficial' catch of the fleet per fishing year. There is no way of knowing the extent of unofficial catches, but the history of the fishery includes both illegal, i.e. undersize or out of season, and undeclared rock lobster in many fishing years. As noted, a common estimate of real, i.e. official plus unofficial, catches immediately pre-quota management was 2000 tonnes per fishing year (in 25 or 10.1 per cent of interviews, participants stated that the total was significantly greater than officially recorded).

It was reported in interviews that the illegal take had declined by the 1990s, but that undeclared cash fish sales were still common, at least for part of the year. A number of fishers stated that they sold rock lobster for cash not primarily to processors but to members of the community. Family, friends, acquaintances, businesses and so on all benefited. In terms of the consumption by Tasmanians of rock lobster taken from the Tasmanian fishery, in the opinion of some fishers cash fish sales constituted a part of the commercial sector's community role and outreach, particularly those rock lobster that were donated to local causes for raffle or sale. With much rock lobster caught in the Tasmanian fishery fetching an average beach price of AU\$30 per kilogram by the mid-1990s, its local affordability declined. Some fishers maintained that cash fish sales and donations were two ways that many Tasmanians could avail themselves of what had become an expensive export item.

As noted, under quota management every legal rock lobster was required to be documented, virtually the entire length of the commodity chain, and stiff new penalties

accompanied the Act introducing the change in system. Rather than at some point cheating Federal income tax obligations prior to quota management, not declaring legal size and season rock lobster under quota management was at any point in contravention of the requirements of the Tasmanian government. In short, the risk of being caught and the penalties involved under quota management were both greater. Consequently, a number of fishers interviewed stated that they no longer considered it worthwhile either to donate rock lobster or to sell rock lobster for cash. Thus, the cream on some fishers' cake effectively disappeared, with remaining margins causing a few to contemplate retirement. The cream of the cake of some local causes was also said to have disappeared. In the eyes of a number of those interviewed, the shortfall of cash fish sales deprived some Tasmanians of an item of affordable local seafood, though some participants reported that a portion of this shortfall had been offset by an increase in cash fish sales by recreational fishers. Finally, the inability to sell a rock lobster cheaply and easily to inquiring tourists under quota management was noted by many fishers, discussed below.

In 46 or 18.6 per cent of interviews, therefore, participants maintained there to be fewer illegalities occurring in the fishery. Quota management and the new penalties structure associated with it had dampened illegalities to the extent that in six or 2.4 per cent of interviews, participants suggested that policing of the commercial rock lobster fishery ought to be shifted off the water, where it was largely ineffective and no longer required, more on to shore where documentation was relatively easily checked. (This latter point pertaining to quota management being easier to police was considered to be a positive outcome in four or 1.6 per cent of interviews.) Others, however, held that a strong police presence on the water was still required, and may become more so in the future.

In 10 or 4 per cent of interviews, participants stated that more policing was required in the fishery. This opinion was based on the view that incentive existed for lessees, particularly, to bust quota. The view was that lessees on tight margins had much to gain and little to lose. In 21 or 8.5 per cent of interviews, participants stated that there was a greater likelihood of lessees acting illegally under quota management. This view, however, was rarely corroborated by lessees interviewed. Many lessees made the point that, contrary to the views of some in the industry, they did in fact take a long-term view of their rock lobster fishing and they had, and intended further to invest in the industry.

The tendency of some in the industry to treat lessees as second class participants and de facto offenders needs to be balanced by consideration of lessees' investment in and contribution to the industry. A key here is to appreciate that there are more ways to invest in the industry than just financially, and there are more things in which to invest than simply entitlements and quota units. Lessees have already stepped a number of rungs up the ladder into owner-operation in the industry. They have usually spent substantial time as a deck hand and often also as a boat driver. They have invested sea time and effort to qualify, study for and satisfy requirements for a 'skippers ticket'. Many lessees also bring a boat, a substantial investment in real capital that has to be maintained, with them to work. This investment may not be specific to the fishery, but experience and knowledge in the forms of the records of retired fishers, understanding of exactly when to fish for rock lobster, and skill in terms of how best to bait, shoot and pull pots under what conditions are specific to the Tasmanian commercial rock lobster fishery. Lessees also know how to stay alive in the fishery and are willing to put themselves in positions where they may have to apply such knowledge. Seamanship is also required to access some of the more difficult and treacherous inshore grounds in the fishery.

For many lessees, commercial rock lobster fishing in Tasmania is an investment in a way of life, one that they hope to buy into further if the opportunity arises. With just over 50 per cent of boats in the Tasmanian commercial rock lobster fleet being owner-operated (Gardner *et al.*, 2001), as noted, lessees and boat drivers clearly contribute much in the forms of catch and income to the industry. In short, lessees, especially, are undervalued assets in the Tasmanian commercial rock lobster industry, as well as being important parts of the cultural fabric and collective knowledge of the fishery. In the context of a declining number of boats in the fishery, with many older owner-operators still to retire, fishers willing and able to lease in, catch and perhaps purchase quota units may become increasingly precious commodities. The expectations of and opportunities for lessees will be crucial to the future make up of the fishery. That younger fishers, often in the form of lessees, are prepared to make the industry their career and way of life should be encouraged. They are the fishers of tomorrow, and many participants interviewed maintained that younger fishers needed and deserved the incentive of being able to purchase, if they so desired, an entitlement and quota units in the industry in which they worked. One reason given for this view was that a fleet in which the majority of fishers were owner-operators was considered more likely to comply with fishery regulations and self-police than one in which owner-operators were in a decreasing minority. The possible future co-management of the fishery was also held by a number of those interviewed to require a major proportion of the fleet to be owner-operators. A vision for the place of younger fishers in the industry, as for number of boats in the fleet, would help put these issues in longer-term context.

7.3.3.11 Acted in the interests of the industry

In 22 or 8.9 per cent of interviews, participants stated that one positive of quota management was that action had been taken in the interests of the industry as a whole. In other words, the macro scale of the industry was the primary focus rather than the micro scale of the individual. Action was claimed to have been facilitated by this industry-scale focus, it being required to over-ride micro conflicts operating to confound any outcome. Consensus was impossible in the face of the competing interests of individuals, many of whom acted in a dilatory or oppositional way

regarding the quota management proposal. Fishery biologists and most fishers agreed that stocks were declining; as noted, there was widespread acknowledgement by industry that ‘something had to be done’. What should be done, however, and, once quota management had been proposed, by what method units should be allocated provided much ground for disagreement. With the aim being to reduce effort and catch, it was inevitable that some fishers would be catch reduced. Who and by how much were two of the major sticking points, indicating preferences for different methods of control as well as allocation.

As the industry began to fracture over what should be done, the issue moved from the area of biology, through socioeconomics, to politics. In a heterogeneous industry, differently placed individuals, acting entirely rationally in their own interests, arrived at different positions. These positions came in conflict and eventually polarised and were strategised organisationally and politically. The interests of the resource and even individuals were in some ways overtaken by what became portrayed as an industry and ultimately parliamentary political zero-sum contest. With the industry in such a highly-charged state, fishery managers did well simply to orchestrate an outcome. Even with an allocation method that favoured a majority of licence holders it was a close run result.

In principal, then, one answer to a question implicit in the title to this subsection, namely ‘who acted?’, is fishery managers, though clearly a collective including individuals from the Minister to members of the TRLFA was involved. A similar position is taken in this report to that in Williamson *et al.* (1998). Simply put, the resource needed to be given foremost consideration. If stocks continued to decline, the industry would eventually collapse. Quota management of some kind was proposed by fishery managers as being the only sure way to cap legal catch. (Clearly in this report, considerable faith is being placed in fishery assessments.)

One aim in this report is to identify some of the costs at which the introduction of quota management was gained, with a view to fine-tuning the system to work better in the interests of all concerned. For many, the politics are now largely behind them and attention has turned to how best to operate in the new system. This report is based on research at the socio-economic scale of the individual. It is at this scale that the costs and benefits of quota management are most clearly evident. Studies such as this attest to a concern to develop quota management in directions that are more sensitive to local and individual circumstances. With quota management in place, fishery managers are interested to mitigate any negative effects on individuals. That fishery managers ‘acted in the interests of the industry’ therefore means that action was required due to stock decline and was inflected through a highly political process. Some winners from this process may wish to distance themselves from negative impacts on individuals. The focus at present, however, is on *acting* to identify and consider the positions of individuals disadvantaged by quota management.

7.3.3.12 Beach price ‘flattened’ over the fishing year

In 14 or 5.7 per cent of interviews, participants stated that a positive effect of quota management was that the beach price for rock lobster appeared to have a lesser range than prior to quota management. In the lead-up to quota management, the rock lobster fishing year started in November around the new shellers. The fishery had been closed in October and, with competition intense, virtually every boat went fishing on the first day of the new fishing year, weather permitting. With every boat fishing in the period in which rock lobster were easiest to catch the holding capacity of processors was filled to the limit, oversupply then 'crashing' the beach price to below AU\$25 per kilogram. In winter, on the other hand, many fishers took a month off as catching was 'slow' and some of the worst weather occurred. As supply lessened the beach price increased to, at times, greater than AU\$50 per kilogram.

As noted, with catch capped and boats leaving the fishery under quota management, competition relaxed. Neither did every boat fish the new shellers nor put to sea the first day of the quota fishing year in March. Many fishers interviewed no longer felt pressure to fish every day possible and preferred to wait for weather and a beach price that suited them. Consequently, the proportion of rock lobster landed in the new shellers declined (Gardner *et al.*, 2001) and the beach price rarely fell far below AU\$27 per kilogram. However, with more fishers hoping to maximise return on allocated catch by fishing in winter, many fishers interviewed stated that a higher proportion of the TACC was being caught over winter months compared with monthly distribution of total catch prior to quota management. With a more reliable supply of rock lobster in winter, the beach price rarely rose above AU\$50 per kilogram. (Following completion of research for this report, however, the winter of 2001 did see beach prices over AU\$50 per kilogram due, perhaps, to a weakening AU\$ compared with various Asian currencies; this development in some way obviates participants comments in six or 2.4 per cent of interviews that a negative effect of quota management was that winter beach prices had been somewhat depressed.) In short, supply of rock lobster was more even under quota management and the range of the beach price over the fishing year contracted as a result. On the whole, fishers' average beach prices did not alter significantly due to the introduction of quota management, remaining around AU\$30 per kilogram. Though fishers would have liked to see the beach price over AU\$50 per kilogram in winter, overall both fishers and processors were pleased that supply had evened somewhat and that the swing in beach price over the fishing year had shortened.

A lower beach price limit of AU\$27 per kilogram operated for both fishers and processors. Many fishers maintained that, *ceteris paribus*, it was not worth catching rock lobster for less than AU\$27 per kilogram, while for processors cooking rock lobster for the domestic market, this price was the maximum they could afford to pay and remain competitive with imported product. Rock lobster purchased for more than AU\$27 per kilogram were exported live to Asian markets. These two economies coincided to set a lower summer beach price sufficient to keep fishers catching and processors cooking rock lobster. Most processors, however, were no longer structured to cook much rock lobster. Since the development of high paying Asian markets for live rock lobster, most processors had restructured their operations to tank much of their rock lobster awaiting live transport. Those that have not, stop buying rock lobster once the beach price rose above AU\$27 per kilogram, concentrating instead on processing other species.

Little formal market research has been conducted regarding live rock lobster exported

to Asia. This is one area a number of participants considered that more work was needed. The relationship between demand and price in China, for example, is not well known. It is probable, however, that wholesalers in Asia know much about the relationship between supply and beach price in the Tasmanian commercial rock lobster fishery. What combination of supply, demand and expediency drives beach price in the Tasmanian commercial rock lobster fishery is, at this stage, not known. What is clear is that ability to pay over AU\$50 per kilogram exists and that price swings are one way that those in the commodity chain with capacity to hold live rock lobster and await a rise in price, profit in addition to operational economies. 'Buy low and sell high' is an age-old mercantilist's maxim. A reliable approximately AU\$20 per kilogram price movement in the Tasmanian commercial rock lobster industry per fishing year, from AU\$27 to AU\$47, provides the opportunity to exploit any upward movement in price. Consequently, holding tanks work both to keep rock lobster alive for export and to benefit financially from any upturn in price further along the commodity chain. Most processors, therefore, and a small number of fishers have invested in holding tanks, the capacity of some processors being greater than 25 tonnes. Other fishers will sometimes hold rock lobster in the well of their boat or in caufs (cages in the water) in hope of a rise in price. Most fishers, however, prefer to sell their rock lobster at the end of each trip and absolve themselves of responsibility for keeping rock lobster alive, as well as of the risk of falling prices. Many fishers in the Tasmanian commercial rock lobster fleet are simply not gamblers on beach price. Some enjoy attempting to play processors off against one another in the hope of increasing their margin, but many loyally sell to one often local buyer. Trying to predict price movements from the deck of a fishing boat is difficult, and many theories were ventured as to what drove prices, including collusion and manipulation by processors. Fishers found it difficult to see far along the commodity chain, but a number of processors were plainly agents for wholesalers in Asia. In terms of knowledge and control of the rock lobster commodity chain, some wholesalers in Asia appear to be well vertically integrated. From interviews, higher average beach prices were mostly achieved by fishers selling closer to Melbourne, for example on King Island or in Portland, or by those targeting quality inshore red rock lobster weighing around 1.5 kilograms, than by 'ringing around the buyers'.

In conclusion, for many fishers the positive aspect of the movement in beach price 'flattening' over the fishing year was that it had remained 'strong', i.e. rarely lower than AU\$27 per kilogram, at the bottom of the price cycle in summer. Certainly, higher winter prices would have been appreciated, but these had been sufficient to maintain average beach prices and did not impact as strongly on the viability of an individual trip. Finally, it is noted that a practice that appeared to be more common prior to the research period, namely different or 'split' beach prices according to colour and/or size, had altered sufficiently to have participants in only five, or two per cent of interviews, mention this as a negative aspect of QM. Split prices had been unpopular with fishers and few processors continued this practice as a result. Robust, inshore red rock lobster weighing approximately 1.5 kilograms, however, were still preferred by processors and largely abandoning split price was due to a combination of fishers becoming increasingly aware of and targeting these 'money fish', fishers mixing their loads more, and an emerging 'all around' price between the split.

7.3.3.13 Allowed 25 per cent more pots

In 14 or 5.7 per cent of interviews, participants stated that being allowed to fish with 25 per cent more pots was a positive outcome of quota management. Again, the point is made that any particular positive was mentioned by participants in interviews in response to a generic question. Thus, often only those positives at the forefront of participants' minds were possibly evinced. If a specific question had been asked concerning, for example, allowing 25 per cent more pots on boats the positive response may well have been greater. As its negative, discussed below, was also specifically unsolicited these responses can be compared in both number and substance for an assessment of the issue as reported largely unprompted by participants.

As noted, one argument prior to quota management was that the fleet needed to be encouraged to be more efficient. With catch capped under quota management, minimising costs was one way to maximise net return on catch, the other being to maximise price. Provided more pots could legally be carried on a boat, allowing operators to fish with more pots enabled them to catch rock lobster more quickly. Saving time may save money, for example on fuel and food, but the principal gain is being able to fish more, by leasing in additional quota units for example, in the time saved, thus increasing turnover. (Alternatively, some other occupation could be undertaken in the time saved.) Thus, allowing more pots on boats, up to a maximum of 50 pots, had the consequences of achieving some cost savings – though there would be no saving on bait or, depending on how crew was paid, on remuneration – and, more importantly, of making it possible to do more fishing. Put simply, more pots on a boat could translate into more potlifts in a fishing year, more rock lobster caught and greater gross returns. With only so much TACC to go around, however, more pots could also encourage some operations to catch more rock lobster, with possible implications for number and size of boats in the fleet.

An issue current during the research period was whether to increase the maximum number of pots allowed to be carried on a boat from 50 to 60. Unsolicited, in 57 or 23 per cent of interviews, participants gave an opinion on this possibility. In 7 or 12.2 per cent of these 57 interviews, participants agreed with the possible increase, while in 50 or 87.7 per cent of the 57 interviews participants disagreed with it. The major concern regarding the possible increase, in the view of most of those against it, was that it moved the fleet further in the direction of, put simply, a smaller number of big boats. Many fishers could understand the logic, from the point of view of some larger operators, of wanting more pots. Implications for the fleet, however, were dubious. Reduced level of employment, employee status of operators, poor pay and conditions, quiescent ports and so on were common concerns raised regarding a 'big boat' fishing fleet. Moreover, some fishers maintained that allowing 50 pots on boats, let alone 60, simply made more work for deck hands, and that safety was also an issue in relation to fatigue, racing incoming bad weather and so on.

Number of pots on boats is an example of an issue in the fishery that cannot be easily resolved on a 'one regulation for all' basis. Possibly raising the TACC and opening the season in September are two other such issues, discussed below. The fishery is made up of different sizes and types of operation, as well as stocks that vary according to abundance, growth rate, size and so on. Allowing fishers to increase the number of pots with which they fish effects fleet dynamics. For example, faced with a reduced catch, instead of leasing in large amounts of quota units, many owner-operators decided

to gear their operations around their own units. To maximise their income, therefore, fishers needed to minimise their costs. More pots helped to catch rock lobster more quickly. Just as important, however, was less 'steaming' time getting to and/or searching for new fishing grounds. Many fishers therefore localised their operation, stuck close to their home port and only fished grounds well known to them. (One possible negative of localisation is reduced exploratory fishing both in terms of fishers discovering new grounds and broadening their fishing experience, this latter meaning for some younger fishers that there is no longer sufficient economic margin in the fishery for a slow learning curve or long apprenticeship.) Many boats remaining in the fishery have contracted their fishing in terms of catch, effort and geography, the result being more pots in some areas. In other words, at the same time that catch and effort were reduced on a Tasmania-wide scale, they were locally concentrated, principally in the inshore day fishery.

Thus, a catch-reduced 40 pot fisher could upgrade his or her boat to 50 pots and, as an additional income-maximising measure, fish the winter, closer to home when rock lobster were harder to catch but fetched a high beach price. In the inshore day fishery, many fishers argued that the 25 per cent increase in pots had put more pressure on grounds that were already congested prior to quota management. In the offshore overnight fishery, however, pots and indeed boats were few and far between. The TACC is set below pre-quota management legal catch levels, but areas in the fishery most in need of a reduction in fishing effort are arguably being fished more, while areas with some of the most abundant stocks pre-quota management are fished less. In other words, the difference in stock levels between the day and the overnight fisheries is possibly increasing; i.e. quota management may be working well in areas in which it is least required and not working well in areas in which stock decline had provided the rationale for its introduction.

Until the Tasmanian commercial rock lobster fishery is managed as a number of different areas that are fished by a fleet of varying operations, some of which fish in one area while others fish across areas, one rule for all will most likely work in only some places and for only some operations. Management arguably needs to shift scales from the fishery-wide to more areally and operationally discrete local areas that take account of differences within the fishery. Regarding 60 pots possibly being allowed on boats, a case can be made in its favour in the offshore overnight fishery, particularly off the west coast of Tasmania. No such case exists, however, in the inshore day fishery off the east coast. A management mechanism that distinguishes between these areas is worth considering.

In conclusion, being allowed to carry 25 per cent more pots was considered to be a positive resulting from quota management by a number of those interviewed. Many in the fleet had taken up the opportunity presented, at times compelled by others doing so. Increasing pots on boats by 25 per cent offered marginal cost savings to individual operators. It could also reduce time budgets regarding fishing, giving individuals the choice of catching more rock lobster, fishing for other species, pursuing another occupation, doing more boat maintenance themselves, taking more time off and so on. As to the effect on the fleet in terms of number and size of boats, any effect may or may not be a concern depending on a vision for the fishery. Regarding any effect itself, a 25 per cent increase in pots is only one of many variables influencing the economies of operations. It has rarely proved a false economy to those fishers taking advantage of it.

Incentive is given to gearing and sometimes trading up, contributing to the ability of the fleet to take up the catching capacity of boats leaving the fishery. As additional effort may need to be encouraged in the context of a shrinking fleet, increasing gear offers greater financial incentive and therefore possible efficacy than relying on operators with latent effort increasing their fishing time. The effect on the declining number of boats in the fishery, falling level of employment and so on, however, is a possibly compounding one.

7.3.4 Perceived Negatives of the Introduction of Quota Management

It may be observed that an academic interest in *social* impacts frequently finds its origin in a concern for negative impacts on vulnerable or disadvantaged population groups. This concern is addressed by the findings of this [report], where the social impacts identified most often have a negative connotation with respect to the welfare of the economically weaker stakeholder groups in the fishery. The strength and direction of opinions in this matter no doubt will vary with the value judgements of the beholders. It will also be influenced by their assessment of indirect consequences of the impacts, which may or may not be discounted because they are remote in place or time. No attempt will be made to discuss or argue the merits of conflicting opinions that would emerge from any attempt to evaluate the extent of negativity of the impacts identified in the [report] (Copes, 1997).

7.3.4.1 Introduction

In this chapter, negative outcomes in whole or in part attributed to the introduction of quota management by participants in interviews are discussed (Table 21).

Table 21. Ranking from highest to lowest number of interviews in which any perceived negative of the introduction of quota management was mentioned

Negative	No. of interviews in which mentioned
Declining prospects for recent and aspiring owner-operators	132
Investors increasing	81
Uncertainty	76
Reduced margin	70
A 25 per cent increase in pots	67
Increase in price to lease in quota units	59
Reduced employment	52
Difficult for lessees	50
Reduced allocated catch and income	44
Allocation method	43
New recording requirements	40
Inshore day fishery concentration	32
Fishers turned into labour	31
Anti-work	30
Lack of security	30
Increased business pressure	29
No positives (only negatives)	27
Hard on 'traditional' families	25
Increase in price to purchase a pot	23

Necessary to lease in	22
Lack of operational diversity	22
Trade in blank pots	20
Necessary to go into debt	19
TACC set too low	18
End of cash fish cream	18
Reduced cash flow	18
More time off	18
Owner oriented	16
Hindered relations with tourists	16
Subleasing	14
Transitional gains trap dilemma	9
Can split licences	8
Policing	8
<i>Fait accompli</i>	7
Interference where none needed	7
Less time with family	7
Requirement to pay lease price up front	7
Fishery biological research flawed	6
No high winter beach price	6
Depressed the local community	5
Split price for rock lobster	5
Transparency	5
TRLFA levy	5
Three rock lobster per trip	5
Reduced exploratory fishing	4
Fishing more	4
Winter fishing	4
Can't fish bills	4
Stamp duty	4
Poor marketing	3
Reduced camaraderie	3
Less time off	3
That any catch history was included	2
Hard on deck hands	2
Fishers turned into capitalists	2
Community rock lobster	2
Boat drivers	2
Processors	2
Disenfranchisement	1
Transferability	1
Brokers	1

Each negative mentioned regarding quota management is discussed below, starting with that mentioned in the most number of interviews.

7.3.4.2 *Declining prospects for recent and aspiring owner-operators*

In 132 or 53.4 per cent of interviews, participants stated that financial requirements to enter and operate in the Tasmanian commercial rock lobster fishery had increased to the point where younger fishers without access to substantial wealth found it difficult to purchase any combination of a boat, entitlement and quota units and 'make it pay'. For example, in 2000/2001, a deck hand contemplating entry to the fishery as an owner-

operator, assuming he or she had a “skippers’ ticket”, needed a boat, an entitlement and a minimum of five quota units in his or her name. This package required an outlay of approximately AU\$225,000, not including stamp duty, bank fees and so on. A minimum of 15 quota units was required to catch rock lobster commercially, so any new entrant also needed to lease in at least 10 quota units. A new entrant could then catch approximately 2.1 tonnes of rock lobster in a season, and expect to gross about AU\$64,000. Subtract from this amount AU\$12 per kilogram for ten quota units and approximately AU\$12 per kilogram for operating costs and a new entrant is left with about AU\$22,000 with which to make interest payments. Given that these approximate calculations are conservative, a new entrant will be lucky to break-even for his or her season’s labour. Some of those interviewed who had or were attempting to enter the fishery as owner-operators believed that they only slipped further into debt through the attempt.

The major variable cost for new entrants was operating expenses and it was possible for those with high catch rates to make money. This ability, however, was rare and even new entrants with high catch rates were not left with sufficient finance at the end of a season to buy many more quota units themselves.

The introduction of quota management in 1998 was not the sole cause of declining prospects for recent and aspiring owner-operators. It was, however, a contributing factor. The introduction of quota management was the culmination of many factors and expediencies. Individual transferable licences, limited in number, were introduced in 1967 (Winstanley, 1973; Storey, 1998). During the 1990s, fishery managers and those anticipating benefit from quota management argued and agitated for its introduction. In some ways, quota management was a long telegraphed change in system. By the time research was being conducted for a socioeconomic profile of the industry in 1997, reported in Williamson *et al.* (1998), licences had increased in value from approximately AU\$4000 per pot in the early 1990s to approximately AU\$12,000 per pot. Many in the industry were clearly preparing for change, and rules pertaining to existing licences were altered to facilitate adjustment prior to the introduction of quota management. What was being forecast was the addition of quota (units) to existing limited individual and transferable licences.

Unitisation, however, also meant commoditisation and marketisation. A market for trade in licences existed prior to the introduction of quota management but entitlement to access the resource did not have any specified unit attached. A licensed fisher was unlimited regarding catch. Quota management created a TACC which was allocated according to kilograms per pot, or unit as these became known, attached to entitlements to fish. A new market for limited quota units was thus brought into being. An owner could fish quota units directly, or lease or sell these to someone who would then, presumably, catch them. The point here is that units could be circulated in a market that brought together ‘haves’ and ‘have nots’, often through the intermediation of brokers and/or processors. With competition for quota units, both value and price were almost certain to be bid up.

If ‘have nots’ in a market place are not homogeneous, then ability to pay may be variable. In short, those with access to more wealth are able to out-bid those with access to less. Many fishers contemplating working their way off the deck of a boat into the wheelhouse as owner-operators bring little more to the market for entitlements and quota units than their labour. These fishers risk being out-bid by those needing to

borrow less, who already own a boat, and/or who have an existing holding with which to subsidise a supplementary outlay. With the market place being open access, capital can bid labour out into a separate market in which labour is hired to crew boats and catch units owned by a range of types including investor syndicates.

Transition to such a situation is arguably underway in the Tasmanian commercial rock lobster industry. Many participants interviewed considered that owner-operation in the industry was already only accessible through substantial wealth or inheritance. Indeed, in 93 or 37.7 per cent of interviews, participants stated that some form of assistance was required for younger fishers attempting or considering entering the fishery as owner-operators. (A range of assistance was suggested including concessional finance, reduced or waived government charges such as stamp duty and licence fees, and creating quota units to be used to assist recent and aspiring owner-operators.) At present market rates, a number of those interviewed maintained that, especially in the shorter-term, working for a wage in the industry, or in another industry, was more financially sensible than buying into the rock lobster fishery as an owner-operator. Some younger fishers with the option of a trade had taken this option and left the industry.

In 47 or 19 per cent of interviews, participants said that they knew younger fishers who would bring a boat into the fishery if this was administratively and financially possible. 'Administratively' refers to the somewhat separate issue of gaining access to a commercial rock lobster fishing entitlement to lease. As noted, an unintended consequence of quota management was that entitlements attracted a value separate to quota units, approximately AU\$50,000 in 2000/2001. Consequently, virtually no entitlement has been handed in by those not fishing them. Neither, however, are all entitlements leased out as owners are reluctant under the new penalties structure to put their entitlement at risk with a younger fisher who has neither a substantial reputation nor an ownership stake in the fishery. Instead, often only quota units are leased out and entitlements are left 'on the shelf' until such time as they might be sold. Not all non-fishing owners withhold their entitlement from lease in this way but many do. Thus, even if a younger fisher wishes to bring a boat into the fishery as a lessee, he or she can find it difficult to obtain an entitlement to lease that would make this possible. Simply issuing entitlements would be complicated, among other things, by the fact that some participants had invested in purchasing these. *One way of making more entitlements available for lease could be to change the existing penalty structure so that owners' entitlements are not put at risk by any act of a lessee. If more boats were to be considered to be desirable in the industry then this measure could possibly be of assistance.*

Only 'possibly', however, because removing this administrative hurdle still leaves the question of whether entry as a base-level owner-operator is a financially viable proposition. (By 'base level' is meant an aspiring owner-operator who brings little more than his or her labour to a set of full market rate transactions, collateral first being required to access the finance needed to labour in the fishery as a purchaser.) The answer to this question given by many participants interviewed was 'break-even viability only'; i.e. no net return to the fisher. Those only leasing in, i.e. owning their boat, may be in a somewhat better short-term financial situation, but often not greatly. To translate the slight margins involved into significant net returns requires catching large tonnages of rock lobster, which involves much work and an ability to catch rock

lobster rare in the fishery. For those usually family operations capable, buying additional boats to lease in and catch more rock lobster provides greater net return in the shorter-term than attempting to purchase entitlements and quota units. Even so, however, the effect of ratcheting lease price is being felt.

Having two boats in the industry, fishing the west coast and leasing quota, we feel like taxi drivers. Over 50 per cent of quota leased comes from mainland investors. Our main concern is when quota was first introduced the price was \$7.00 a kilogram; now we are paying up to \$14.00 a kilogram. We feel the investors have pushed the price up. If this trend continues, we will be forced to downsize (Lessee, 2000).

Not all those leasing in, however, are doing so at the full market rate. It is noted that in 65 or 26.3 per cent of interviews, participants stated that they operated by virtue of submarket rate transactions with either fishers or ex-fishers, or family members. Without such so-called 'fair' deals, many participants maintained that it would not be financially worthwhile fishing. That the number of boats in the Tasmanian commercial rock lobster fleet has not fallen further is partly due to such fair dealing. This is evidenced by contact with a number of lessees in both the 2000/2001 and 2001/2002 quota years. These lessees telephoned to make known the impact of an increase in lease price between quota years on their operation. Thus, two interviews were conducted, one when these lessees had been fishing by dint of a fair deal, and one under circumstances surrounding an increase in lease price. In short, while the price to lease in quota units was at or below AU\$10 per kilogram these operators were viable. Once the lease price was increased to AU\$12 per kilogram or greater, the margin involved was considered to prohibit fishing. One operator left the fishery unemployed, another shifted effort into a different fishery, still others paid the going rate and took an anticipated drop in net return, the beach price being important in this regard. The following quote reveals something of the price difference leasing in before compared with after the introduction of quota management.

I am no longer in the industry due to the *quota*! In 1995 I paid \$700 per pot. In March 2000 the owner of the lease I was using was asking \$2220 per pot for a 30 pot quota. Therefore, it was unviable for me to carry on. I am now unemployed and doing part-time work (Leaver, 2001).

Such cases raise issues of lack of security of price and of entitlements and quota units for those leasing in, but they primarily indicate the emphasis on gross return to quota holders at the expense of lessees. Moreover, operators have to adjust to any price increases in diesel, bait, insurance and so on. In 50 or 20.2 per cent of interviews, participants considered that quota management had made financial circumstances particularly difficult for lessees.

An aspiring entrant to the fishery as a base-level owner-operator faces a number of disadvantages, lack of wealth being only the most obvious. Lack of time to learn how to catch rock lobster competitively is another. A new 'skipper' is in competition not just with other fishers with more experience but with a balance sheet the costs and returns on which are largely geared around established owner-operators supplementing their holdings by leasing in quota units. The cost of not learning quickly how to catch rock lobster competitively is not a long apprenticeship but lack of viability.

Lack of security pertains not just to price and entitlements and quota units but also to debt loadings and family. High levels of debt expose new base-level owner-operators to high levels of risk concerning inability to fish due to illness, mechanical failure and so on. With money tight and families young, the demands can be considerable and a number of families are riven by the strain of both income and parental absence. Prospects for aspiring owner-operators continue to decline as values and prices associated with entitlements and quota units in the Tasmanian commercial rock lobster industry continue to climb. The marketable unit introduced by quota management has contributed to this situation.

7.3.4.3 Investors increasing

In 81 or 32.8 per cent of interviews, participants stated that a negative outcome of the introduction of quota management was the fillip provided to ‘investors’. The type ‘investor’ requires some clarification. By ‘investor’ participants rarely meant simply any owner of entitlements and quota units not fishing in the Tasmanian commercial rock lobster industry. Ex-fishers, for example, were often excluded from the type, though they were recognised to be owners and no longer operators. Ex-fishers were from ‘inside’ the fishery, having worked in it, and were most likely to be involved in what ‘fair’ submarket transitions were occurring from one generation to the next, often involving a son. Ex-fishers understood the fishery, so the argument went, appreciated the hard work, isolation and occasional danger involved, and were considered to be concerned to ensure that the fishery continued to exist in the future in the interests of, among others, the men and women who would work in it.

Not all ex-fishers, however, inclined to this view. A number of participants distinguished ex-fishers who were concerned for the future of the industry and were prepared to enter into a ‘fair’ deal with an operator, from those who were not. The latter were said to be selfish. Having profited from their time in the fishery through a combination of hard work and serendipity, they were now considered to be squeezing the full market lease price out of fellow fishers and to be prepared to sell their entitlement and quota units to the highest bidder, most likely an investor. This was one common dichotomy mentioned regarding ex-fishers, namely between the selfish individualist and the fair-dealing collectivist, the former being considered to be no better than investors. This dichotomy overlaps with another common dualism regarding this issue, intimated above, namely that between industry insiders compared with outsiders. Individualist ex-fishers were maintained to have forsaken the fishery in that they neither operated in it any longer, had any empathy for those who continued to operate in it nor cared about the future of the fishery. They could not care, so the argument went, because they insisted on the full market rate for their entitlement and quota units despite knowledge of the difficulties this could cause existing and aspiring operators. Such knowledge regarding costs and margins was said to derive from their own time fishing. This knowledge, however, was not always either current or complete. Some ex-fishers, for example, leased or sold their entitlement and quota units through a broker, who provided a perhaps necessary buffer between them and the conditions of production of their return. Others maintained that the economics of operating in the fishery had always been difficult and that nobody had provided *them* any ‘breaks’ or assistance. These facts are not in question. The issue is less one of the relative difficulty of operating over time than one of the undeniable advantage of owning, and disadvantage of not owning, at present given that management change has

in part increased the value of holdings.

Individualist ex-fishers taking a 'hard' economic line were considered by a number of those interviewed to be outside the fishery in a way similar to owners who had never fished in the industry, this latter type being considered by many participants to be 'investors'. Certainly, individuals in both groups often used brokers to secure maximum financial return. It needs to be noted, however, that owners who had never fished in the industry need not pursue maximum financial return via a broker. Indeed, a number of owners interviewed who had never fished in the industry had entered into 'fair' arrangements with operators involving submarket rates over periods of longer than one year. In this way, it was maintained that both parties enjoyed a reasonable return and viewed their relationship or partnership as one of mutual reliance in the longer-term.

Since the introduction of quota management, demand for quota units to lease in has satisfied supply, but with number of boats in the fishery continuing to decline demand may weaken, particularly when many of those retiring add their quota units to the lease pool. Some owners have recognised that fishers willing and able to lease in quota units could become scarce assets. Viewed in this way, a fair, longer-term relationship with a lessee is therefore a kind of investment in future catches and returns. Such owners thus consider that they have an interest in the economic viability of the lessee in the short-term and agree to a rate that reflects this interest. In this way, some owners who have never fished in the industry could be considered, economically at least, to be getting inside and appreciating operating conditions in the fishery.

This kind of investor indicates a further dichotomy between those with a short-term, one quota year outlook and those taking a longer-term view. Under quota management, stocks may arguably be being fished sustainably, but the economics for some operators and aspirants may not be sustainable. As some owner-operators' subsidies via their own holdings and any efficiency gains bid up the elastic lease price for quota units, owners can choose whether to capitalise short-term or to curb their rent-seeking in the interest of ensuring longer-term demand. Like the choice relating to self versus industry, owners are free to choose where to position themselves. However, broader socioeconomic interests in the fishery and a concern for the future direction of the fishery are both important, and government as well as industry need to beware of exhausting the real, i.e. boats and equipment, and human capital components of the fishery as much as they are concerned for the resource itself and the values of entitlements and quota units.

[T]he abandonment of any debate about socio-economic goals is both undesirable and impossible. The lack of such an ongoing dialogue creates a void in higher values and aspirations. In the modern, commercial epoch, such a vacuum is likely to be filled instead by a base individualistic ethic of monetary and material gain (Hodgson, 1999).

A category that also applies both to owners who have fished in the industry and those who have not is that of owners acting in the interests of their son, as well as themselves. Most obviously, many owners who are fishers and ex-fishers with sons in the industry are managing their holding to the benefit of both themselves and their son(s). For

example, a 'fair' lease price may be set that pays the paternal owner a reasonable 'superannuation' but that also provides the son with a reasonable net income. This is one way out of the transitional gains trap dilemma between blood and money mentioned in nine or 3.6 per cent of interviews. This family-based costs-plus approach is clearly different to insisting on a set return on capital through a broker.

Some owners who have never fished have also become involved in the industry on behalf of their fisher son. Intergenerational transfers within a family are therefore not always of the fisher-to-fisher variety. Many owners who have never fished, however, are involved not for their son fishing in the industry but solely for financial gain. On the whole, investors of this kind who bought into the industry over the 1990s had some knowledge of the workings and outcomes of quota managed fisheries elsewhere, and may have investments in these, particularly regarding the abalone fishery in Tasmania and the southern zone rock lobster fishery in South Australia. Lack of certified single unit ownership in the Tasmanian commercial rock lobster industry has not deterred these investors, though many advocate this development. It is noted that the absence of certified single unit ownership was reported to be functioning as a deterrent to some investor participation in the industry. Though a number of investor syndicates exist, some participants interviewed stated that they had experienced difficulties convincing investors unfamiliar with ITQs of their security. At present, all beneficial interests are not always recorded on entitlements. Thus, units are not sufficiently assignable for some investors to commit funds. Neither is it possible to own just one quota unit, a minimum of five being required to be attached to an entitlement. It is claimed that certified single unit ownership, similar to that in the abalone industry, would make quota both a more secure and affordable investment, though beneficial interests can at present fund the purchase of a single quota unit attached to another's holding. Certified single unit ownership may provide more security, but the affordability claim is questionable. Five quota units will most likely eventually cost more to purchase than at present due to an increase in the price of a single unit due to enlarged demand. For example, salient points regarding the Tasmanian commercial abalone fishery in 2000/2001 were that: quota units of abalone had been separated from entitlements to fish; single unit ownership was allowed; an entitlement to dive for abalone was worth approximately AU\$200,000; one quota unit of abalone (800 kilograms) was worth approximately AU\$320,000; contract divers were paid as little as AU\$2.50 per kilogram to dive for abalone; the average beach price for abalone was AU\$50 per kilogram; and the majority of quota units of abalone in Tasmania was controlled by a few large stakeholders. Careful consideration needs to be given to the balance of interests between state and market, and rights and rules in the Tasmanian commercial rock lobster industry. Certified single unit ownership could possibly make the purchase of multiple units in the industry still more difficult for recent and aspiring operators than at present.

As noted, investors have been present in the Tasmanian commercial rock lobster industry since at least the early 1990s. Defining investors can be problematic. This problematic notwithstanding, in many interviews it was maintained that 'outside' investors should never have been admitted to the industry though – and one of a number of paradoxes present in interviews – many of those voicing this opinion were prepared to receive increased returns due in part to investors' participation in the industry. Investors were often convenient scapegoats for outcomes that were to the benefit of many present and former fishers in the industry. Nonetheless, that investors

as a proportion of owners will increase in future is a concern held by many participants interviewed.

I believe the bull is by the tail. The more you pursue property rights, the higher the price of pots will go. The more secure you make your investment, the more attractive it looks to investors. The industry is lost because one piece of legislation is missing from the start. That is, you must be an operator to 'own' a licence. This would keep investors away from all fisheries and keep money in Tasmania (Participant, 2001).

Much depends on what current and ex-fisher owners choose to do with their entitlements and quota units; i.e. whether to lease and sell these into the fishery at 'fair' rates or to lease and sell them out at full market rates. A collective, longer-term vision for the fishery that includes concern to encourage younger fishers, together with mechanisms to facilitate this concern such as assistance packages or trust funds, would help provide direction for decisions faced by these participants.

7.3.4.4 *Uncertainty*

In 76 or 30.7 per cent of interviews, participants stated that uncertainty, both in the lead-up to and following quota management was a negative effect of its introduction (Table 22).

Table 22. Uncertainties under quota management

Uncertainty	No. of interviews in which mentioned
Increasing licence fees and possible resource rent	27
Next generation of fishers	23
Beach price and AU\$	13
Interest rates	10
Operating costs	9
Lease price	8
Own employment in the industry	6
Declining margins to cover major work on boat	4
Price of entitlements and quota units	4
Rock lobster stocks off the east coast of Tasmania	2

Clearly, not all these uncertainties are due to quota management. More than half, however, are either directly related to the introduction of quota management or have been exacerbated by quota management. Heading the list is uncertainty regarding licence fees, mentioned in 27 of the 76 interviews discussed in this subsection. This uncertainty related to increases in fees since the introduction of quota management, and the extent of this trend in future. Four main concerns were raised in respect of possible further increases in fees. First, participants were not convinced that they were receiving value for money from existing fees. A clear account of the expenditure of fees would allay uncertainty in this regard. Second, the lack of discretion regarding some components of licence 'fees', such as payments to TFIC and the TRLFA, disgruntled some participants.

Third, operating margins in the fishery were said to be declining such that any increase

in fees was not considered affordable. The average beach price of most fishers had not altered since before the introduction of quota management, while many operating costs had increased, fees among them. On average, fees constituted a deduction of approximately five per cent of operators' gross income, or made up approximately ten per cent of their operating costs (i.e. approximately AU\$1.50 per kilogram of rock lobster taken). For fishers leasing in quota units, especially, the doubling of the lease price, one of the most elastic price movements since the introduction of quota management, was particularly burdensome. Consequently, many operators maintained that no margin existed to increase fees any further as much surplus value made in the fishery was being absorbed by sundry costs, already well to the detriment of operators' net returns, a common comment being that 'you can't get blood from a stone'.

Fourth, the possibility of a resource rent, in addition to fees, being levied by the Tasmanian government was similarly viewed as 'trawling for money' where none existed. Many participants were concerned to make the point that any resource rent, as for any increase in fees, would directly impact negatively on operators' economic viability which, for many, was already borderline. Particularly for operators leasing in a large proportion of their quota units, there was said simply to be 'no fat left'. Much of this had been appropriated by those leasing out quota units, and the taxing of such transactions would most likely be problematic.

Not surprisingly, given concern for declining prospects for recent and aspiring owner-operators, noted above, the existence and operating conditions of the next generation of Tasmanian commercial rock lobster fishers were uncertainties mentioned in 23 of the 76 interviews discussed in this subsection. Not only was an expectation of affordable entry to the fishery as an owner-operator considered to be reasonable, but fishers were needed to catch the TACC as well as to lease in and purchase available entitlements and quota units. A decision regarding a minimum number of boats in the fishery was said to be important to the future amalgam of boat types and opportunities.

Many remaining uncertainties related to possible movements in various rates. The rates at which the AU\$ was trading relative to currencies in, particularly, Asian countries, the rates at which quota units were leased, rock lobster were purchased, interest was changed, entitlements and quota units were sold and so on could all affect participants in the Tasmanian commercial rock lobster industry in one way or another. Clearly, most Australians were affected by movements in interest rates and the international performance of the AU\$, but these could have particular implications for some in the Tasmanian commercial rock lobster industry. For example, for those borrowing large amounts of capital to purchase entitlements and quota units, interest rates could have a significant impact. Some participants were quite simply taking the risk that interest rates would not increase markedly in the medium-term. (A number of participants recalled interest rates of approximately 20 per cent in the late 1980s and that these had been hard for many in the industry.) Many operators on slight margins, too, hoped for no major break down in the medium-term as the costs in time and money outlaid and in income foregone would be difficult to bear. The prices of leasing in quota units and of purchasing entitlements and quota units were widely considered to be inflated, but few participants were prepared to predict where price escalation would stop. As prices approached those in the southern zone rock lobster fishery in South Australia, however, some participants considered that peaks were imminent. Clearly, *ceteris paribus*, as lease price increases so the margins of operators leasing in are affected, as noted, while

the price of purchasing entitlements and quota units, together with interest rates, affects levels of debt and repayments. As noted, entry to the fishery as a base-level owner-operator is already only a break-even proposition for some lessees, and further increases in prices to lease in and to purchase entitlements and quota units would only send such a proposition into the red according to a number of those interviewed. As an example, the following calculations were provided by a participant.

<i>Purchasing costs</i>			
52 units @ \$25,000 p/u	\$1,300,000	With 35 units	\$875,000
Vessel	<u>200,000</u>		<u>125,000</u>
Total	1,500,000		1,000,000
Interest @ 8%	120,000		\$80,000
<i>Running costs</i>			
Wages skipper	40,000		40,000
Wages crew	30,000		nil
Licence fees	11,000		8,000
Fuel	10,000		5,000
Bait	10,000		5,000
Insurance & survey	6,000		4,000
Rep. & maint.	<u>12,000</u>		<u>7,000</u>
Total	<u>119,000</u>		<u>69,000</u>
	239,000		149,000
7.5 t @ \$30 per kg	225,000	5 t @ \$30	150,000
7.5 t @ \$33 per kg	247,000	5 t @ \$33	165,000

Note that food is not included in running costs. Similar scenarios were repeated, though not often in such detail, in many interviews. They underline the fact that substantial wealth is now required to enter the fishery as an owner-operator and that base-level entrants as owner-operators must be satisfied working largely for the lifestyle of commercial rock lobster fishing. They also underline that many fishers in the industry who had taken on a large debt to purchase quota units or lease in a significant number of quota units are operating on considerably slimmer margins than prior to quota management. They are therefore less flexible regarding price movements and less able to contribute to any form of resource rent. Moreover, all in the industry are geared around an average beach price of approximately AU\$30 per kilogram. Thus, a final uncertainty raised regarded the beach price and the future state of connections to and the conditions of markets for live rock lobster in Asia. Should, for some reason, these markets prove more difficult to access or begin to return lower prices, the viability of many in the Tasmanian commercial rock lobster industry would be further pressured.

In conclusion, margins for some in the Tasmanian commercial rock lobster industry have become so finely balanced in terms of viability, compared with other opportunities, that anything more than the slightest perturbation threatens their continued participation. 'Uncertainty' is therefore something of a euphemism for worry and stress associated with the 'business' side of the industry; i.e. not with biological sustainability regarding the resource but with economic viability. This aspect of uncertainty is due less to fishers' ability to catch rock lobster and more to the timing and circumstances of their entry and participation in a changing set of economic conditions. Concern regarding economic viability, and many of the rate movements discussed above, apply both to owners and operators, each of whom guard their margins as best they can. ('Owners' and 'operators' are used to convey the extent of a range that includes a variety of owner-operators.) On the whole, however, it is owners who have benefited at the expense of operators under quota management, and the decision regarding whether to withdraw capital from the industry, to be invested elsewhere for a higher rate of return for example, is clearly different to that of whether to withdraw labour. This difference is between the realisation of capital compared with the realisation of possible unemployment. The Tasmanian commercial rock lobster industry is part of a wider economic environment that is largely beyond its control, but the experiences of 'haves' and 'have nots' within the industry are different, and fishery management can affect the impact of externalities on each group by attending to their relative positions.

7.3.5.1 Reduced margin

In 70 or 28.3 per cent of interviews, participants stated that a negative effect of the introduction of quota management was a reduction in their profit margin. This effect was noted primarily by operators of some kind and compared with their situation prior to quota management, though many 'investors' did note an increase in licence fees. Unrelated to quota management, a major cost increase that affected all operators was in the price of diesel fuel. Increases in both licence fees and diesel reduced the margins of operators, but they were not the principal reductions concerning participants in the 70 interviews discussed in this subsection. As well as increases in a number of existing costs, many operators were also absorbing the financial impact of what most considered to be two imposts directly associated with the introduction of quota management. For those operators deciding either to service debt required to purchase quota units and/or to outlay earnings to lease in quota units, both these disbursements served to decrease their margin or net return per unit of labour. A number of operators maintained that without catch reduction due to quota management expenditure on neither debt servicing nor lease cost would be necessary. In 22 or 8.9 per cent of interviews, participants stated that a negative aspect of quota management was that they found it necessary to lease in quota units, and in 19 or 7.6 per cent of interviews, it was stated that having to go into debt was a negative outcome. Thus, though they may have been catching approximately the same amount of rock lobster as prior to quota management – in some cases more, where possible – these operators stated that they were taking home significantly less money. Same legal catch for lower net return was an equation not appreciated by any of these operators. They were clearly fishing for a reduced margin of profit.

For operators fishing their own quota units who were allocated approximately what they had been catching before quota management (some operators were allocated more), no major change in operating costs and therefore in profit margin was experienced. Certainly, licence fees, diesel and some other expenses had increased somewhat but, significantly, no new outlays were required and average beach prices remained approximately at pre-quota management levels. Margins were therefore being influenced by some inflation of existing costs, not substantially by any new costs. To catch more than allocated, however, required the purchase or lease of quota units, both of which often involved a return to an external party on interest bearing capital. Interest payments to a financial institution or lease payments to an owner of quota units affected operators' profit margins, though often this affect was attenuated by accounting practices regarding taxation. Together, increases in many existing costs and for some operators the addition of new costs, in the context of an average beach price that was largely unchanged, meant that net returns for a given amount of labour were in many cases lower for many under quota management. Margins therefore moved closer to break-even and reduced catch for many fishers, discussed below, meant that often both less fishing was being done and less money was being taken home from that fishing which was occurring.

One variable cost in the operating equation being labour, fishers' net incomes often had to be reduced to account for fixed or less negotiable costs such as licence fees, diesel, interest rates and the cost of leasing in quota units. Reduced net income for one group of participants in the fishery, however, translated into increased gross returns for another. Though the Tasmanian government, some provedores and financial institutions were also beneficiaries, the principal gains were made by those leasing out quota units. This situation clearly raises the issue of distribution of earnings in the industry. In the first year of quota management, units cost approximately AU\$7 per kilogram to lease in and approximately AU\$12,000 to purchase. As noted, by the fourth year of quota management's operation these costs had approximately doubled, while fishers' average beach prices remained approximately stable. Gross return from the TACC therefore did not change markedly over this period, totalling somewhere around AU\$45 million per quota management fishing year. New and increasing costs, however, meant that the distribution of this return was altered. Put simply, a kilogram of rock lobster caught in the Tasmanian commercial rock lobster fishery in the 2000/2001 quota management fishing year on average received a beach price of AU\$30 per kilogram, of which those leasing out quota units received on average AU\$12 per kilogram. This represents a significant redistribution of income from operators to owners, often via brokers and/or processors. Any decrease in the percentage of owner-operators in the Tasmanian commercial rock lobster fleet, at present just over 50 per cent, will most likely increase this gross redistribution, and any further increase in the price at which quota units are leased out will increase income transfers from individual operators to owners.

It is important to note here differences in the forms of capital involved in these transfers. In short, operating capital, i.e. real and human capital, is being discounted in the interest of owned capital, i.e. fictitious capital. In other words, boats and fishers are receiving less maintenance, repair and replacement while entitlements and quota units continue to attract interest and gain value. Yet boats and fishers are vital links between fictitious and organic capital, namely rock lobster. Investment is required to ensure that both boats and fishers are available and able to catch the TACC. According to a

number of participants interviewed, as the number of boats in the fishery continues to fall, both the infrastructure and knowledge required to catch rock lobster commercially are being depreciated. Many remaining fishers maintain that replacing their current boat is beyond them financially, that maintenance is limited to that required to keep the boat in survey and that they see few prospects for recent and aspiring owner-operators in the fishery. With the financial drain on operators increasing, a question being asked is ‘who will replace, not just the fishers of today, but many of their boats?’ In short, longer-term replacement costs such as these are not being taken into account in the present system of dispensation. A number of participants interviewed held that with operators’ ability to provide the future real and human capital requirements of the fishery curtailed by management fiat and short-sighted market economics, the Tasmanian government and owners of entitlements and quota units needed to be prepared to share responsibility for meeting these perhaps imminent exigencies. No global *deus ex machina* in the forms of emerging private fishing fleets, large scale portfolio investment or vertical integration through processors that may meet these future requirements yet appear likely in the Tasmanian commercial rock lobster industry. At present, most operators and owners are Tasmanian, as is management of the fishery. In the short-term at least, ways of meeting these requirements will most likely have to be found by local interests including fishers, investors and the Tasmanian government. Future dispensations may prove crucial in this regard.

7.3.5.2 A 25 per cent increase in pots

In 67 or 27.1 per cent of interviews, participants stated that a negative outcome of the introduction of quota management was allowing 25 per cent more pots on boats that, according to survey, could carry additional pots, up to a maximum of 50. Some aspects of this outcome were discussed above (see also the separate report entitled *Interview derived fleet dynamics comparing before with after the introduction of quota management in the Tasmanian commercial rock lobster fishery*). A 25 per cent increase in pots on some boats did not mean that the number of legal pots in the commercial fishery was increased from 10,507. Instead, this increase was a means whereby boats could carry pots, the quota units of which were caught by other pots, which would otherwise be ‘on the shelf’. For many participants, allowing 25 per cent more pots on boats contradicted the concern for stock decline that was purportedly propelling quota management. Put simply, ‘why encourage a reduction in the number of boats in the fishery but allow those remaining to carry more pots?’ This is not the place to discuss the macro logic of this approach. The micro outcome, however, was clear. Around a number of ports in which few boats had left the fishery and many boats carried an increased number of pots there was reported to be more pots in the water in the vicinity than prior to quota management. For example, it was estimated that the commercial rock lobster fleet working out of Bicheno was carrying approximately 130 extra pots than before quota management. No matter generally that boats were leaving the Tasmanian commercial rock lobster fishery, those boats that congregated in an area often had more pots with which to fish. Thus, under quota management, if the same number or more boats were fishing in an area there could be more pots being used. Even if fewer boats were fishing in an area, additional pots could bring the number in the water up to pre-quota management levels.

The inshore day fishery was reported to be most affected by the increase in pots allowed on boats. Many areas off Tasmania's east coast were at times more pot congested under quota management. The inshore day fishery off Currie and that off the north-west coast of Tasmania around Bluff Hill Point down to Temma were also reported to have more pots in the water than prior to quota management. These areas were also at times frequented by many recreational rock lobster fishers. Areas in the overnight fishery in which boats were at times concentrated also had greater numbers of pots being used in them. Though the overnight fishery was less affected by pot congestion than the inshore day fishery, areas such as around Babel Island in the north-east and around Port Davey in the south-west were said to be sometimes 'choked' with pots under quota management.

A difference between pot congestion before and after the introduction of quota management, however, is in soak time. Many fishers interviewed reported that they were fishing less under quota management, for example due to a combination of catch reduction and being allowed to fish with more pots. Thus, though at times pot congestion was greater under quota management, for example in good weather or in the new shellers period, it was generally more sporadic. This observation applied particularly to the overnight fishery. The inshore day fishery, however, had in places experienced an increase in number of boats fishing in winter due to contraction of effort closer to home port by catch reduced boats, some of which carried 50 pots. Reasoning in such cases was that, with more pots, the likelihood of catching high priced rock lobster in winter was greater, but that only trips of an hour or so out of a boat's home port for a single night shot should be made to minimise operating expenses. Thus, in 32 or 13 per cent of interviews, participants noted that fishing appeared to be concentrated in the inshore day fishery, especially in winter, and that more pots were evident in the water as a result. This eventuality was viewed negatively due both to increasing competition for fishing ground and because stocks in the inshore day fishery were considered to be most in need of a reduction in fishing.

Linked with concern regarding the 25 per cent increase in pots was opinion that trade in 'blank' pots was a negative outcome of the introduction of quota management, stated in 20 or 8.1 per cent of interviews. 'Blank' pots are legal pots the quota units of which are caught by another operator. Trade in blank pots enabled some operators to fish with more pots than they had quota units. In 8 or 3.2 per cent of interviews, participants stated that the splitting of pots from quota units in this way should not be possible. Some participants in these interviews were concerned that more pots should not be in the water, while others did not wish to pay approximately AU\$200 per blank pot per fishing year. These latter fishers claimed that the logic of a total pot limit in the fishery was removed by quota management and that all boats should be allowed to carry the number of pots allowed by survey at no cost.

A somewhat separate issue relating to these eight interviews is that a number of participants in these eight interviews maintained that the integrity of licences should not have been allowed to be compromised through splitting them in any way. In other words, that a licence neither should be split according to entitlement, unit or pot nor should units be added to or subtracted from licences. Thus, a licence would be infrangible and tradable only as a complete package. The reasoning behind this view was partly nostalgic and partly in the interests of simplicity and price restraint. Many participants interviewed recognised the false economy of increasingly demarcating and

unitising licences putatively with the aim of increasing affordability. Access to an entitlement and five quota units, a single quota unit to add to an existing licence or to blank pots was made possible by demarcation and unitisation, but reassembling a licence thus split would most likely cost more than if it had remained intact. Those concerned about the increase in the price of purchasing quota units, mentioned in 23 or 9.3 per cent of interviews, were of the view that splitting licences more effectively inflated prices beyond the reach of many fishers than made the components of licences available. In other words, for many fishers, price inflation soon rendered accessibility moot, any window of affordability quickly closing. Beyond the short-term, demarcation and unitisation only increased the height of the financial hurdle confronting a fisher aspiring to assemble a licence package from scratch. The superior bidding power of those with existing wealth or licences soon recast the scale and for some even the possibility of pursuing their ambition of owner-operation.

7.3.5.3 Increase in the price to lease in quota units

In 59 or 23.9 per cent of interviews, participants mentioned increase in the price to lease in quota units as being a negative effect of quota management. The creation of a TACC, quota units and a market for these by the introduction of quota management has been discussed above, as has a doubling of the lease price between 1998 and 2001. In short, lease price adjusts to ability and willingness to pay, capitalising on the demand of superior operating economies to bid up price. Superior operating economies can be due to ownership of a boat and licence package, high catching, efficiency gains or more generally due to an increase in beach price. Regardless, if a fisher wants and can afford to pay more to lease in quota units than another then the superior price prevails. This price must then at least be matched by other fishers, there often being little choice involved if quota units are to be leased in.

Differently placed operators in terms of ownership, however, also often have different economies of scale and scope. Ability to pay is not equal due to many factors other than efficiency, different proportions of ownership being the most obvious. Lease price, however, disregards differences between operators. Some fishers simply own more than others, or catch different amounts to others because they fish in a different size boat or in a different part of the fishery to others. In other words, the fishery is made up of many different operators with many different operating economies partly due to historical accident, partly regarding time of entry and ownership, and partly due to differences in the nature of fishing off different parts of Tasmania.

The inshore day fishery off the north-west coast of Tasmania, for example, is fished very differently compared with the offshore overnight fishery off the south coast. Boats vary from being planing to displacement hull, the geology of the bottom is different, depth fished is different, weather conditions differ, growth rate and size of rock lobster are different and so on. In short, different economies exist for fishers in each area, in part determined by adaptation of fishing to local conditions. A standard size boat does not exist in the fishery because the Tasmanian commercial rock lobster fishery is not a fishery with standard conditions. Operating economies in one part of the fishery regarding one size of boat in the fleet may not apply elsewhere in the fishery or fleet. If all grounds in the fishery are to be fished then different operations and economies need to be admitted.

Some fishers are being out-bid for quota units to lease in not because they are inefficient operators but because they own less with which to subsidise the lease in side of their operation. Paradoxically, these fishers often need to lease in quota units more than those who can out-bid them. The operating costs of a 35 foot single handed traditional wooden 'cray' boat fishing the inshore day fishery off the east coast are simply not comparable to those of a 55 foot multiple-handed multi-purpose steel boat fishing the offshore overnight fishery off the west coast of Tasmania. Labour and fuel costs alone are different. Prior to quota management, a 55 foot boat carried approximately one-third more pots than a 35 foot boat but the major part of its competitive economy was in catching often more than twice as many rock lobster. Higher catch was principally due to working more isolated and exposed areas where stocks were more abundant. Catch reduction significantly affected the high catch component of the competitive economies of larger boats, and put many of them in a position in which four choices were faced: leave the fishery; fish with a smaller boat; buy more quota units; or lease in quota units. The latter two options usually involved making either interest or lease payments. For a number of these operators, insufficient kilograms were allowed to be caught per quota unit to make their type of fishing worthwhile. This logic applied less to smaller boats, many of which had lower catch rates and were not catch reduced by quota management. Larger boats were often most catch reduced and fished with the highest operating costs, thus leaving those larger boats that stayed in the fishery less well placed to subsidise leasing in quota units with the owned component of their operation as well as needing to pay to access units containing fewer rock lobster than their operational costs were geared around.

A number of larger boat fishers interviewed stated that leasing in quota units was, for them, a break-even proposition undertaken only to keep the boat and crew working. In other words, only the need for cash flow meant that these fishers leased in quota units. In 18 or 7.2 per cent of interviews, participants stated that reduced cash flow was a negative outcome of quota management. Others preferred to fish what rock lobster quota units they owned and then to shift their effort into alternative fisheries such as giant crab.

The point here is that less catch-reduced boats, or those not catch-reduced at all, fishing with lower operating costs and/or fishing a higher proportion of their own quota units were positioned to out-bid large boat 'dinosaurs'. Far from the future of the fishery being with large boats, many of those interviewed considered that the increase in lease price would make these boats extinct, there being too few kilograms of rock lobster in a unit to cover these boats' operating costs. Few operators have the resources to build new large boats or to replace existing engines with more efficient models. The industry, however, arguably needs some large boats to fish the offshore overnight fishery as well as other fisheries such as giant crab and perhaps scallop. As the number of boats in the fleet continues to decline, boats that fish with large amounts of leased quota units may also become more important both to catching the TACC and providing a return to owners of quota units, the number of which who do not fish is increasing. Already, some investors in the industry, taking a longer-term view than just one quota year, are entering into arrangements with those leasing in their quota units along the lines of 'catch more, pay less' and 'catch longer, pay less'; i.e. lease price is reduced if all units are leased in over a period of time greater than one quota year. Such longer-term relationships between owners and operators may become increasingly important to ensuring that owners' quota units are caught. On the whole, however, such

understandings are rare and many owners continue to press for the highest lease price possible. Extinction of too many fishers, however, may have undesirable consequences for owners if unfishable quota units result.

7.3.5.4 *Reduced employment*

In 52 or 21.1 per cent of interviews, participants mentioned less employment in the industry as a negative outcome of quota management. As noted, since the introduction of quota management, approximately 75 boats have left the fishery. Some fishers have retired, others have changed occupation, while still others have shifted their effort into alternative fisheries, sometimes in other states of Australia such as South Australia and Victoria in the case of rock lobster and Queensland in the case of Tuna for example. This number, then, approximately equates to 75 fewer places for 'skippers' in the fishery, assuming those departed to have been full-time rock lobster fishers. Places for deck hands on departed boats are also no longer available in the fishery. Assuming there to have been 0.867 deck hands per boat leaving the fishery (Williamson *et al.*, 1998), approximately 65 fewer places for deck hands exist in the fishery at present compared with the fishing year prior to quota management. Thus, approximately 140 places in the forms of skippers and deck hands are no longer available in the industry due to the departure of approximately 75 boats.

Moreover, employment on many of the approximately 245 boats remaining in the fishery has altered. In general, for many remaining 'skippers', hours worked, catch and income are all less, while for many deck hands there are fewer places, hours worked and reduced income. Of concern here, for the moment, is the impact of quota management on the employment conditions of deck hands. Information on deck hands from the interviews revealed that those operations reducing employment of deck hands outweighed those increasing the employment of deck hands. Conservatively, approximately 183 boats, or three-quarters of the 245 boat fleet, were in some way covered by the research. Of these 183 boats, those increasing their employment of deck hands accounted for an additional 27.5 full-time equivalent positions. Those decreasing their employment of deck hands, however, accounted for a reduction in employment of 49.7 full-time equivalent positions. Thus, 22.2 fewer full-time equivalent positions for deck hands were available on these 183 boats in the 2000/2001 quota management year compared with the fishing year prior to quota management. This brings the number of fewer positions in the industry to approximately 162. Extrapolating to the 62 boats in the fishery not covered by the research produces a further loss of 7.5 full-time equivalent deck hand positions, thus bringing the total approximately to 169.

For a number of the 153.4 full-time equivalent deck hand positions calculated to be on the 183 boats covered by the research, the hours worked, income earned and rate of remuneration also changed under quota management. For example, though in 67 interviews participants stated that deck hands were being paid at the same rate, in ten interviews it was reported that more days had been worked, more rock lobster caught and therefore more money made by deck hands prior to quota management. With the allocated catch of many operators reduced, unless additional quota units were purchased or leased in then 15 per cent of the beach price grossed per fishing year, a common remunerative arrangement for many deck hands, translated into reduced income. In operations where additional quota units were leased in, it was common

practice to deduct lease cost from gross return before calculating percentage remuneration, this being reported to be the case in 28 or 11.3 per cent of interviews. When other negative outcomes such as paying deck hands a wage instead of a 'percentage of the catch', reduced percentage of the catch paid to deck hands, reduced work and income, and unemployment are considered then disadvantage to deck hands due to quota management was reported in 38 or 15.3 per cent of interviews. Finally, due to many operators fishing with more pots, the work load of many deck hands increased per shot under quota management.

Approximately three fewer boat drivers employed regarding the 183 boats covered by the research brings total loss of positions in the fishery under quota management approximately to 172, with one more driver's position being unavailable when extrapolating to the remainder of the fleet, bringing the total to 173. Employment in the processing sector of the industry also fell under quota management. A total of 52.5 full-time equivalent positions was calculated to exist in the processing sector in the 2000/2001 quota year. Comparing this number with those in Williamson *et al.* (1998), approximately 11 fewer full-time equivalent positions were evident under quota management. This number brings the total reduction of full-time equivalent positions in the industry under quota management to approximately 184.

The aims of reducing effort, catch and number of boats in the fishery could arguably not have avoided such a consequence. For a number of those interviewed, however, this approach was considered to be anti-work, mentioned in 30 or 12.1 per cent of interviews, both in terms of fewer jobs and less work for many of those remaining in the industry. Indeed, in 18 or 7.2 per cent of interviews, participants considered time off from fishing to be a negative impact of quota management.

The burden of employment loss fell largely on the 'have nots' in the industry, while some of those 'have nots' remaining paradoxically worked more often and/or harder due to fishing more to maintain net income, 'dropping' a deck hand, handling more pots and so on. Certainly, there are degrees of 'haves' and 'have nots', but loss and/or intensification of both part and full-time employment have generally not affected owner-operators allocated close to what they were catching prior to quota management. Mostly, it has been those heavily catch reduced under quota management, those in precarious employment such as deck hands and lessees, and those attempting entry to or expansion in the fishery as owner-operators who have experienced reduced and/or intensified employment.

7.3.5.5 *Reduced allocated catch and income*

In 44 or 17.8 per cent of interviews, participants stated that catch reduction due to allocation had substantially reduced their income. By 'catch reduction' is meant catch allocated to the fisher and does not include catch through leasing in quota units. There are therefore two main ways in which reduced allocated catch and income applied. The first is a straightforward case of a fisher catching no more than allocated. Catch being less than prior to quota management, *ceteris paribus*, income declined with catch. The second way involved a fisher catching more than pre-quota management but for reduced net return. This is possible due to the existence of two rates of return under quota management, that associated with a fisher catching her or his own quota units, fully paid for, and that from catching quota units being purchased or leased in.

Clearly, disbursements on interest on monies owed vary according to amount borrowed, interest rates and so on, as does the lease price between parties and over time. These variations notwithstanding, however, disbursements on interest and lease costs can impinge significantly on net returns compared with those from a fisher's own quota units. For example, a fisher interviewed in 1997 as part of research for a socioeconomic profile of the fishery prior to quota management (Williamson *et al.*, 1998) was at that time single handing a 36 foot wooden boat with 27 pots and catching approximately 6.5 tonnes of rock lobster per fishing year. Between 1997 and 2000 this fisher's average beach price per fishing year was unchanged at AU\$32 per kilogram. When quota management was introduced in 1998, this fisher purchased a 46 foot boat, activated five pots 'on the shelf' pre-quota management and purchased another eight pots for AU\$12,000 each to take his total number of pots to 40. He also leased in at least ten pots per quota year to work the maximum 50 pots off his boat; at time of interview in 2000 he was leasing in 22 quota units at AU\$13 per kilogram.

Under quota management, this fisher was catching between eight and nine tonnes of rock lobster per quota year, and employing a deck hand to help him do so. This fisher had followed the advice of those who counselled 'get big or get out' regarding quota management. He was fishing, catching and grossing more than prior to quota management but his net return was less. New costs under quota management such as servicing an approximately AU\$100,000 debt, incurred later in life and for which he mortgaged his house, the cost of leasing in quota units and paying a percentage to a deck hand were added to increases in licence fees, diesel and so on. Taken together, these costs eroded his net return per quota year to an amount less than that earned pre-quota management. (This situation could well change as he reduces his debt.) Moreover, the concern he attached to organising his operation, the financial risk to which he considered he had exposed his family and the necessity of catching between eight and nine tonnes of rock lobster meant that he was "bloody hating" his fishing. In short, this fisher maintained that he had enjoyed his fishing more, was less financially pressured and had a superior net return as a smaller single handing operator prior to quota management.

If this fisher had not altered his operation, however, he faced the prospect of fishing for approximately one-third fewer rock lobster due to equal-per-pot catch reduction. Various commitments, such as his children's schooling, meant that his existing net income needed approximately to be maintained. To do so entailed increasing his catch by approximately two tonnes of rock lobster per quota year, involving the additional costs outlined above. Thus, from where this fisher had stood on the eve of quota management, if he did nothing he faced a drop in allocated catch of approximately two tonnes and an attendant drop in income, or he needed to increase his catch by two tonnes approximately to maintain his net return. He wondered aloud in 2000 whether he would have preferred tightening his belt to further bending his back. He was of the opinion that gearing an operation solely around its own quota units, if a reduction in income was possible, was preferable to purchasing and leasing in additional quota units in terms of both job satisfaction and rate of return. Those fishers not catch reduced were in such a fortunate position. On the other hand, many operators were not as well placed as he in terms of owning a boat and an entitlement, the number of quota units owned, amount borrowed, number of quota units leased in and so on. Depending on how much an operation caught pre-quota management and what proportion of catch under quota management was owned, rather than being purchased or leased in, the rates

of return varied between operations. For those catch reduced due to equal-per-pot allocation a decision needed to be made between maintaining rate of return but experiencing a decrease in income, or maintaining net income but at a less favourable rate of return. The choice, in other words, was simple: less money or more work? Many fishers were simply not in a position under quota management to make the same amount of money from the same amount of work. For many participants in the 44 interviews discussed in this subsection, this choice proved to be invidious.

7.3.5.6 *New recording requirements*

In 40 or 16.1 per cent of interviews, participants stated that new recording requirements as part of quota management had a negative impact on them in some way. As noted, the requirement that rock lobster have accompanying documentation from fisher to point of final sale, in combination with stiffer penalties, meant that the practice of undeclared 'cash fish' sales was largely abandoned. Whereas prior to quota management as much as one-fifth of the fleet's catch per fishing year may have been undeclared, this proportion was reportedly substantially lower under quota management. For a number of fishers interviewed, therefore, new recording requirements under quota management meant no more cash fish 'cream', the absence of this 'bonus' being sufficient to have some fishers contemplate retirement. In 18 or 7.2 per cent of interviews, for example, participants stated that a negative outcome of quota management was an end to cash fish sales.

A further reason to consider 'early' retirement according to some fishers was new 'paperwork' itself. Requirement that fishing logs be completed daily, reportedly complex forms and the literacy levels of some fishers meant that a number of operators found new recording requirements onerous. On the whole, however, participants stated that they were getting used to new requirements, that officers at DPIWE were helpful and that form changes had eliminated some of the duplication involved. A number of participants requested, now they were becoming familiar with new recording requirements, that these not be changed for a period.

On the positive side of new recording requirements, one fisher stated that they forced him to be disciplined about completing his fishing logs, while others considered that catch returns were more reliable due to new requirements. Reliability was improved in two ways: first, completing catch returns daily was an *aide-mémoire*; and, second, amount of rock lobster caught was central to the metrology of quota management and any incorrect amount risked significant penalty. A number of participants considered that in some ways new recording requirements were more transparent under quota management as 'everyone knows what everyone else is catching'. On the other hand, though transparency was only partial, even partial transparency was for some undesirably open, particularly to the scrutiny of processors. Participants considering transparency to be positive were in part curious to ascertain how long other fishers took to catch their quota but, more importantly, were able to assure themselves that little more than the TACC was being taken.

Though catch returns were considered to be more reliable under quota management, particularly concerning amount and time of catch, falsification was reported to continue

to occur regarding location and depth of catch and incidental mortality. There is no way of ascertaining the prevalence of such falsification but participants reported that some discrepant information was still recorded by a number of fishers. Incidental mortality, on the other hand, was often simply not recorded. Reasons given for falsification varied. Some fishers were simply anti-authoritarian, others semi-literate, some found recording tedious, while others were suspicious of the uses to which their information might be put, as well as of its confidentiality. This said, however, most participants were of the opinion that data fouling was primarily of concern pre-quota management and that catch returns under quota management were for the most part reliable.

Regarding the reliability of catch returns pre-quota management, in 41 or 16.5 per cent of interviews, participants stated that a number of catch returns were not to be trusted. Much catch was simply not recorded. Much catch that was recorded was either deliberately, perfunctorily or desultorily false. Some fishers kept two sets of records, one correct set as an aid to their fishing and a 'cooked' set for the 'authorities'. With no requirement to complete catch returns daily prior to quota management, many fishers did not do so for months and sometimes years at a time. When pressed to provide catch returns, stories were related of enlisting the help of children to 'fill in the boxes' or of completing a year's catch returns from memory on the spot when renewing a licence. Again, there is no way of ascertaining the extent of falsification of catch returns prior to quota management but the practice reportedly occurred. On the other hand, by no means all catch returns submitted were false. Any use of data from pre-quota management catch returns needs to bear falsification in mind and develop an appropriate margin of error. Some assistance in arriving at such a margin may be provided by the fact that in 25 or 10.1 per cent of interviews participants maintained that the actual catch of the fleet was considerably more than officially stated. The average figure quoted for actual total catch of the fleet in the years immediately prior to quota management was 2000 tonnes per fishing year.

7.3.5.7 Fishers turned into labour

Property was to be an aid to creative work, not an alternative to it ... [I]n modern economic conditions ownership is not active, but passive, ... to most of those who own property today it is not a means of work but an instrument for the acquisition of gain or the exercise of power, and ... there is no guarantee that gain bears any relation to service, or power to responsibility (Tawney, 1982).

In 31 or 12.5 per cent of interviews, participants resented the situation under quota management that they had to do the labour of others. This situation is different to working for someone for a wage. Many in the industry, including lessees, clearly considered themselves to be their own boss. A number of lessees, for example, owned a boat, employed a deck hand and decided how many quota units to lease in, and when and where to fish. This sense of independence was greater the more an operator owned, up to the point of full discretion enjoyed by those owner-operators who owed nothing on their operation and were comfortably catching their own quota units. Many among this latter group considered that they answered to nobody. Self-determination was highly valued in the sense of having invested much hard work and determination in the fishery to be in a position amenable to the independent of spirit.

The introduction of quota management changed the outlooks of both recent and aspiring owner-operators as well as of many established owner-operators in the fishery. In between the two extremes of an aspiring owner-operator and an existing owner-operator substantially catch reduced by equal-per-pot allocation leasing in the majority of his or her catch are many variations. The point is that all operators apart from those catching only their own quota units, fully paid for, catch rock lobster 'owned' by others not catching them, i.e. they do the labour of others. How keenly this labour is felt depends, among other things, on the margin involved for the fisher, dictated in part by the lease price. As lease price approximately doubled between 1998 and 2001 to AU\$14 per kilogram, so the return to those not fishing has increased at the expense of those leasing. There is often little margin involved for lessees. There is also an incipient move away from a contract lease price to a percentage of the beach price. This move would further decrease returns to the fisher by including any possible increase in average beach price in a fishing year in lease price calculations.

Up until now, most of the leased quota has been on a per kilo for dollars basis. But recently there seems to be a new trend as we have been approached to work for a percentage of the selling price, allowing us just a good wage after expenses, and the licence holder a larger return (Lessee, 2001).

Consequently, many fishers interviewed leasing in quota units said that they were beginning to feel that they were simply doing the work of investors. Fishers were not doing the bidding of investors but many were paying the highest bid price to lease in quota units.

Purchasing quota units, on the other hand, no matter how difficult, was rarely considered in the same light. Paying a financial institution interest and principal was part of purchasing a stake in the industry, whereas disbursements to rent-seeking investors were said to be 'money down the drain'. Discussion in this subsection is more concerned with leasing in than purchasing quota units.

For many fishers, becoming labour worked differently depending on whether an element of self-determination had been lost or was unlikely to be gained. In the former case, a number of fishers who were well placed in terms of self-determination under one system found it necessary under another to rely on paying to access quota units. As noted, quota management created both a unit that could be traded and market demand for that unit. The latter was assured by the catch of some of the fleet's highest catchers being reduced by approximately three-quarters by equal-per-pot allocation. The issue of whether such operators should have prepared for this possibility by purchasing additional entitlements and quota units is largely irrelevant; the requirement is to address the effect. Moreover, minimum owning requirements (an entitlement and five quota units) and operating requirements (15 quota units) ensured that aspiring owner-operators could afford to buy into the fishery, at 1998 prices at least, but would most likely need to lease in quota units to fish in it. As noted, with the values of entitlements and quota units doubling by 2001, the ability to purchase a minimum holding in the fishery is increasingly in question for those without access to substantial wealth.

Regarding established owner-operators prior to quota management, a number of these were moved from a position of being independent operators to one in which they were

dependent on leasing in quota units from someone not fishing them. The decline in self-determination, the bargaining involved and the outlay required were all resented. A number interviewed stated that this put them in an approximately dependent position with a financial institution or an owner of quota units that they had not experienced for many years. Indeed, some had entered fishing in the first instance to avoid being beholden to others. To have to pay, later in life, to do the labour of others where once they had operated independently deeply rankled many established owner-operators leasing in quota units.

The phrase 'later in life' in the preceding sentence implicitly raises the position of those earlier in their working life in the fishery. This situation is not so much one of transformative regression as of stultified progression. Where once an avenue existed for deck hands in the fishery to work their way into owner-operation, as noted, this avenue is at present being closed to those without access to substantial wealth due to the escalating values of entitlements and quota units. This, by now, is a familiar refrain in this report. Purchasing entitlements and quota units has become a 'millionaires game' as those with wealth or existing holdings outbid those with little more to offer than their labour. Labour, however, is still required in the fishery, but it is increasingly that of the lessee and the boat driver as the prospect of owner-operation fast diminishes.

A question to be answered in the fishery is whether lessees will continue to operate with their ambition thwarted. At the moment in the fishery, lessees present themselves with qualifications, experience and often a boat to those leasing out quota units. A number of lessees interviewed considered that they would be better placed financially if they simply drove a boat for a wage. They persisted with the supposedly more independent practice of owning and running a boat in part because of the platform this may one day provide for owner-operation in the industry. With it increasingly obvious that, short of 'winning Tattsлото', owner-operation in future would most likely be through inheritance only, the responsibility and expense of owning and maintaining a boat may shift from lessees to owners. Though owning a boat is important to many fishers, and also provides the ability to participate in other fisheries, boats no longer attract the bulk of the value in the fishery compared with entitlements and quota units. Boats, however, remain considerable costs in terms of purchase and upkeep. These costs are at present not being borne by many non-fishing owners, who also profit *gratis* from much accumulated knowledge in the industry. Should non-fishing owners and/or the Tasmanian government have to contribute to the training of fishers to catch rock lobster commercially as well as to providing them with boats and equipment then returns to non-fishing owners would most likely be less attractive. Owner-operators have and will invest in real capital in the industry. Few investors have yet done so. Some lessees may not be able to afford to do so for much longer. Thus far, quota units have proved to be something of an immaculate investment for non-fishing owners with lessees bringing a suite of attributes and assets to a contract in which they agree to pay a good return for doing hard and at times dangerous work. With the number of boats in the fishery declining, many owner-operators soon to retire and boats aging, investors may soon have to contribute to the maintenance of human and real capital in the fishery as these can not be depreciated indefinitely. It is possible that in treating fishers like labour investors may produce a work-for-a-wage mentality that requires owners not operators to absorb the costs of real capital maintenance. A handful of investors in the industry have indeed begun to purchase boats, though another strategy is to cultivate a fair long-term relationship with a fisher that values willingness, ability and the material

means with which to fish. The industry is not as clear-cut as a joint-stock company. There are no straightforward demarcations between ownership, management and labour. Exactly who is managing and contributing to real and human capital maintenance, or what combination of owners, the Tasmanian government and operators is responsible, is at present an open question in the industry.

7.3.5.8 Lack of security

In 30 or 12.1 per cent of interviews, participants stated that lack of security in some form was a negative outcome of quota management. Lack of security is principally related to the negative effect of income uncertainty due to the introduction of quota management discussed above. Lack of security was mentioned by four main types of participant: investors; processors; those owning but not leasing out an entitlement; and lessees.

As noted, some participants considered that until security in the form of certified single unit ownership was provided in the Tasmanian commercial rock lobster industry those with little inside knowledge of the industry would be unlikely to risk investing in quota units.

Lack of security applied in the cases of a number of processors regarding supply of rock lobster. Under quota management, there were both less rock lobster being taken and fewer boats fishing. Competition in the processing sector of the industry was strong with a combination of approximately a dozen major operators purchasing rock lobster at any one time. Processors varied significantly regarding amount of rock lobster purchased, rock lobster as a proportion of their operation, combination of domestic and international markets, degree of vertical integration, area of operation in terms of purchase, location, number of years operating and so on. All processors interviewed held competition for rock lobster to be increasing. More precisely, competition was for boats' catch. Almost no processor owned boats. Supply therefore was not guaranteed. Processors calculated the number of regular as well as 'spot' boats with which they dealt. As number of boats in the fleet declined, pressure existed for processors to maintain their number of supplier boats. In general, two strategies were used to attempt to secure supply, one by smaller local processors and the other by larger processors purchasing Tasmania-wide, namely loyalty and subleasing respectively.

Smaller local processors, purchasing up to 70 tonnes of rock lobster per fishing year, were usually owned and managed locally by individuals who often had some previous experience in commercial rock lobster fishing. They were, in other words, embedded in the fishery both locally and culturally. They knew many local fishers and the language, lifestyle and morality of commercial rock lobster fishing. The ties between them and many local boats were personal, informal and anchored by trust. Some fishers trusted their local processor implicitly, for example not even inquiring after the going beach price when unloading their catch. In return, some local processors maintained that they shared any price benefits from holding rock lobster with the loyal fishers concerned.

With number of boats in the fleet declining, however, smaller local processors had to recruit as well as keep boats, particularly if they wished to increase the amount of rock lobster they were purchasing. Both keeping and recruiting boats were considered to be difficult due to the practice of subleasing undertaken by some larger, vertically integrated Tasmania-wide purchasing processors. These operations, too, were concerned to secure their supply, of up to 200 tonnes of rock lobster per fishing year. Local boats were insufficient to supply such amounts of rock lobster and trucks were driven to fishers in ports around Tasmania to take delivery of rock lobster. (Smaller processors rarely drove outside their local area.) Clearly, supply can be guaranteed by offering a higher price, but other means may not impact on profit margins. Larger processors were often integrated with mainland or international wholesaling interests which had the capital to secure leased quota units. These processors were often silent parties to lease arrangements between owners and fishers, providing the 'up front' funds preferred by owners. Owners were thus paid initially while fishers 'paid' the processor as rock lobster were caught, the lease cost usually being deducted from the beach price before payment. Brokers were often involved in facilitating these arrangements. Margins may at times have been added by brokers and processors – with virtually no formal paperwork existing regarding these extra-party arrangements there is little way of ascertaining these – but the principal intent was to guarantee supply. The informal expectation was that a fisher leasing in quota units through the financial agency of a processor would sell the rock lobster caught to that processor. This usually occurred, though provided the lease cost was paid, no recourse existed if a fisher did not sell to the processor concerned, save for not 'fronting' finance for the fisher again.

With many owners leasing out quota units preferring payment 'up front' and many fishers either not having the funds to do so or not wishing to obtain funds from a financial institution, the financial agency of larger processors was appreciated by both some owners and operators alike. 'Up front' payment to owners and pay-as-you-catch for fishers were simply too convenient for many to ignore. In four or 1.6 per cent of interviews, participants stated that subleasing was a positive outcome of quota management, one way around the negative of having to pay some owners 'up front' to lease in quota units, this negative being mentioned in seven or 2.8 per cent of interviews.

Those not appreciating the role being played by some larger processors in subleasing quota units were concerned either about boats being obliged to sell to larger processors or were concerned to obtain quota units themselves. In 14 or 5.6 per cent of interviews, participants stated that subleasing was a negative outcome of quota management. Some smaller processors, for example, stated that they were having to consider subleasing themselves as boats were being 'tied' to processors doing so and supply may not be maintained if this convenience was not available. Obtaining the funds to do so, however, was not always possible.

This consideration raises the issue not just of boats but of quota units to lease out being 'tied' to those sufficiently solvent to secure these with 'up front' payments. Both smaller processors and fishers who organised leasing in quota units themselves were concerned that the supply of quota units to lease in could become increasingly 'spoken for' by parties with greater financial resources that made possible superior timing rather than amount of payment. A number of fishers in pay-as-you-catch arrangements with owners considered themselves to be particularly vulnerable. There is a trend towards

arm's length arrangements between owners and lessees developing in the industry. Increasingly, entitlements are not leased out and 'up front' payments are insisted on, often through a broker. Many of those fishers leasing directly from an owner on a pay-as-you-catch basis considered that they faced the threat not just of a seemingly arbitrary increase in lease price but of a unilateral preference on the part of the licence holder for lower risk and more convenient lease arrangements available through processors.

This situation touches on a further two participant types for which some form of security was held to be lacking. The unwillingness of some owners within the penalty structure under quota management to lease out their entitlement due to it being at risk should a lessee infringe in some way has been discussed above. The situation of some lessees, however, is arguably the least secure in the industry. A number of lessees lack both security of lease price and of licence. Any quota year an owner may ask for a higher lease price or lease to a party offering more convenient arrangements such as 'up front' payments not involving an entitlement.

The lack of security of lessees was first experienced under quota management when a number had their licences recalled by fisher-owners combining licences to offset catch reduction. In fairness to many of those involved, understanding that this recalling would occur in the event of quota management being introduced was usually clear. Moreover, for many fishers so treated the issue under quota management was less one of obtaining an entitlement to lease in, experienced fishers with good reputations being differently placed to those lacking experience and a good reputation, than of escalating lease prices. In a number of interviews, participants related experiences where owners, it seemed almost capriciously, had taken up what they considered to be better offers in terms of price, risk or convenience.

Those leasing in an entitlement and quota units thus faced a three-fold lack of security compared with lower levels of insecurity for other participant types discussed in this subsection. However, displacement of lessees by those in a position to offer a better price and a lower risk, such as owner-operators leasing in, or the convenience of 'up front' payments and not having to deal with fishers, such as offered by processors through brokers, may deprive the fishery of some of those needed to lease, purchase and catch quota units of rock lobster in the future. Present halcyon economies may be being traded off against longer run negative externalities, account of which does not yet have to be taken. Fishers and their boats are linchpins in the industry, and as their numbers continue to decline thought needs to be given to ensuring that both effort and vessels are maintained at levels sufficient to be certain that the socioeconomy of the industry is moving in as sustainable a direction as the fishery is trending biologically.

Finally, lack of security was one factor contributing to what many participants referred to as increasing business pressure under quota management, mentioned in 29 or 11.7 per cent of interviews. A number of participants maintained that pressure on stocks and competition between fishers had declined under quota management but that pressure on the business side of a fishing operation had increased. Lack of security and the need to negotiate availability and price of entitlements and quota units to lease in each fishing year were two factors given for increasing business pressure. Declining margins and increasing debt loadings were others. Documentation and regulations associated with the administration of quota management were also said to be more weighty. As noted, most pressure due to lack of security was felt by 'have nots' in the industry, principally those leasing in entitlements and/or a large proportion of quota units, the availability

and/or price of which could be changed from one fishing year to the next by a party external to the operator.

7.3.5.9 *No positives (only negatives)*

In 27 or 10.9 per cent of interviews, participants held there to have been no positive outcome from the introduction of quota management. These participants represent more than a rump of disaffection with quota management. In interviews with participants 'forced out' or substantially catch reduced by quota management, individuals were even-minded in their assessment of quota management as it had affected them. Little bitterness was evident from the high political drama of 1997 when rival organisations faced each other over the proposed introduction of quota management and the method to be used to allocate quota units. For example, in only three interviews did participants consider that camaraderie in the fleet had suffered as a result of quota management. A common starting point in the interviews discussed in this subsection was that 'something had to be done' to address stock decline. (It is noted, however, that in seven or 2.8 per cent of interviews, participants maintained that the introduction of quota management was an interference where none had been needed.) This view was expressed in 42 or 17 per cent of interviews. It was usually preparatory to outlining an *operation* that was significantly disadvantaged by the introduction of quota management. The emphasis was on *operating* not on owning, leasing out or selling entitlements and quota units. These participants wished to remain fishers. Though important to many other participants, fishers and investors alike, the capital side of the quota management equation barely figured in the accounts of participants in interviews discussed in this subsection. If mentioned at all, growth in capital value counted as a negative effect of the introduction of quota management.

Some participants did not have a strong opinion regarding alternatives to quota management; their concern was to relay that between acknowledging stock decline, and the introduction of quota management events had taken a turn to their disadvantage. Others had many and varied suggestions regarding how stock decline could otherwise have been addressed, the most common being by pot reduction. Though many were pragmatically 'learning to live with' quota management, a view expressed in 17 or 6.9 per cent of interviews, they left no doubt that quota management had been 'hard' on them in terms of reduction in catch and income.

On the whole, then, most of those 'hard done by' quota management, i.e. substantially catch reduced, were adjusting to the new system, and were philosophical rather than acrimonious in recounting events surrounding its introduction. They had not, however, radically changed their opinion of quota management in light of its operation. Regarding gains in the values of entitlements and quota units, these were immaterial if fishing was to remain a priority, not only in the present but into the next generation. The doubling of the lease price of quota units therefore only meant paying double to lease these in. Some trace of the entrenching done by different organisations in the lead-up to quota management was evident, but few individuals were bloody-minded in relating their position.

The perspectives of participants in the 27 interviews discussed here should not be

dismissed as ‘sour grapes’. Their assessments of impacts on the industry are, like other participants, largely from their own positions, but their experiences of the negative effects of quota management are veritable. Broader issues such as biological sustainability and impacts on communities, for example, are often ambiguous. In short, quota management was intended to reduce effort and catch, and boats out of the fishery, many fishers catch reduced, jobs lost and people displaced were some of its corollaries, a number of which are ongoing. In other words, undeniable ‘pain’ was suffered by a significant minority in the industry due to the introduction of quota management. The point here is that this pain be acknowledged as having been caused and therefore is recognised as being valid.

Quota management hit a number of participants hard, both emotionally as a contest lost and operationally as catch reduced. Fine-tuning quota management in the future entails not just ensuring local biologically sustainable outcomes but a concern to encourage those who chose to stay fishing in the industry, often at significant financial cost, particularly as reduction in number of boats may arguably have proceeded sufficiently. Again, it would assist in assessing this sufficiency if a longer-term vision for the fishery was developed that clarified aspects such as desirable number of boats in the fishery, proportion of owner-operators and so on, and made clear the principles and arguments for setting lower limits for any of these.

7.3.5.10 *Lack of operational diversity*

In 22 or 8.9 per cent of interviews, participants stated that lack of operational diversity was a negative factor under quota management. Lack of operational diversity was not caused by quota management, but quota management arguably contributed to it, the large amounts of money usually required to buy into a quota managed fishery prohibiting many operators from buying into any more than one fishery. However, this was not the main sense in which participants referred to lack of operational diversity as a negative factor under quota management. Most often, participants were demurring specialisation in fishing, representation and management. Older fishers, mostly, recalled days when they fished seasonally for cuttle, shark, rock lobster and so on under one licence, and fishers were represented by the voluntary umbrella organisation the Professional Fishermen’s Association of Tasmania. Gradually, trends in species abundance and beach prices resulted in many fishers concentrating their effort in particular fisheries and beginning to organise representation by fishery due to the different kind of fishing and issues often involved. Fishery management, too, became increasingly species specific. Limited space does not permit discussion of the rise and fall of various organisations and fisheries accompanying specialisation; the point here is that by the mid-1990s most rock lobster fishers in the fleet relied primarily on rock lobster for their income, *a fortiori* with the imminent closure of the giant crab and scallop fisheries. There being only minor overlap between the abalone and the rock lobster fisheries, rock lobster fishers were spending the majority of their fishing time in intensifying competition for a declining but still abundant resource, relative to many other fisheries, that fetched an average beach price of AU\$30 per kilogram. Two points are relevant in this subsection. First, a number of participants considered that specialisation in rock lobster fishing was responsible for overfishing and stock decline and should not have been allowed to occur. Second, a further price of specialisation was that fishers’ ability to shift effort into other fisheries, either voluntarily to take pressure off the rock lobster fishery or in adjustment to the introduction of quota

management, was reduced. In a number of cases, reduction of options regarding other fisheries accentuated difficulties adjusting to quota management through obviating effort shift. It is this last point that was most often raised in the 22 interviews discussed in this subsection. It is noted, however, that though quota management in some ways crystallised these difficulties, it did not cause specialisation.

7.3.5.11 TACC set too low

In 18 or 7.2 per cent of interviews, participants considered that the TACC had been set too low both regarding their operation and stock levels in areas where they fished. The TACC itself, however, was rarely referred to numerically in total. Instead, kilograms per pot which participants considered appropriate were usually stated. Thus, a common higher figure mentioned was 200 kilograms per pot, compared with 143 kilograms per pot in the fourth year of quota management. It was maintained that 200 kilograms per pot would achieve three possibly contradictory things. First and most obviously, owners of quota units would be allocated more kilograms per quota unit. Of particular concern here is those owner-operators significantly catch reduced by quota management, many of whom claimed they would not lease in as many quota units if the TACC was increased to 200 kilograms per pot. This situation may not just result in fewer quota units being leased in by a fisher but, according to one participant, in less rock lobster being caught, thus:

Lease in extra 5000 kg @ \$15 per kilo. Average price \$30 p. kilo
Gain to fisher \$75 000.

To gain \$75 000 without leasing fisher would only need to catch 2500 kg.

Therefore 2500 kg left in the water (Owner-operator, 2000).

Certainly, in this example less rock lobster are required “for the same financial result”, but rock lobster are neither required to be left in the water under quota management nor are reduction of effort and maintenance of income guaranteed when more money can be made for the same or more effort. This example, however, raises the question of who would catch the TACC if it was increased? If a number of fishers leasing in quota units were able to restrict their fishing to their own units for the same financial return as at present, then if the TACC was increased more quota units with more kilograms per unit would be required to be fished by fewer operators. In other words, according to this scenario, number of boats in the fleet may possibly be too low to catch an increased TACC. With a multitude of factors involved, it is difficult to ascertain the validity of such speculation. It can be said with greater certainty, however, that increasing the TACC to 200 kilograms per pot would go some way towards redressing the loss of income experienced by those leasing in quota units to increase their allowable catch closer to pre-quota management levels. Implications for leasing, lease price, effort and catch, though, are less certain.

Second, it was argued that rock lobster stocks off the west coast of Tasmania, particularly offshore, were never depleted as was claimed of those off the east coast. Under quota management, fewer boats were said to be fishing west coast stocks.

Reports were that these stocks were ‘getting a huge rest’, unnecessarily, and that many more rock lobster could be taken off the west coast. Increasing the TACC to 200 kilograms per pot would, it was argued, the previous point notwithstanding, result in stocks off the west coast being fished closer to their maximum sustainable yield.

Third, it was argued that some boats capable would shift fishing effort, in some cases back, from the east coast to the west coast to catch the extra rock lobster allocated. Implications for the fishing of east coast stocks, however, are less clear under a TACC of 200 kilograms per pot. Many fishers maintained that the inshore day fishery off the east coast was being fished to capacity under quota management and that a bust side to the pre-quota management puerulus settlement boom was inevitable. Almost no participant interviewed considered that the inshore day fishery off the east coast should be fished under a regime of 200 kilograms per pot; indeed, few participants held that the TACC should be increased at all regarding the east coast. Arguments to the effect that a combination of stock depletion and economics would result in effort shift away from the east coast under a TACC of 200 kilograms per pot ignore both the imperative of stock conservation and recovery as well as heterogeneity among fishers in terms of preference, operation and economics. Some fishers may not wish to make such a shift and would be willing to trade this preference against lower net returns. Others may lack the experience and/or the type of boat required to fish more isolated west coast stocks exposed to the ‘roaring forties’. Most importantly, however, as noted there are two major types of operational economies under quota management, one for those required to lease in quota units and one for those not having to meet this cost. Those leasing in quota units range from operations supplementing their own allocation in varying degree to those leasing in all of their quota units. Clearly, the economics of an operation having to disburse approximately AU\$12 per kilogram of rock lobster caught are going to differ from those not having to do so.

Thus, a TACC of 200 kilograms per pot regarding stocks off the east coast of Tasmania is arguably biologically irresponsible if fishing these has to become economically unsustainable before they are shifted from. It is also economically naïve given that the fleet is not homogeneous, and differently placed operators vary in their preferences and physical and financial abilities to shift their fishing effort. In short, a TACC of 200 kilograms per pot is arguably sensible off the west coast of Tasmania but questionable off the east coast. This difference underlines the in some ways micro nonsense of a single TACC for the entire fishery.

In conclusion, that a negative component of quota management was the TACC being set too low applied in some cases, notably those significantly catch reduced, and in some places, such as off the west coast of Tasmania. In other cases and places, such as off the east coast, the TACC was considered to be ‘about right’. Arguments in favour of increasing the TACC rarely applied Tasmania-wide. Some mechanism whereby incentive could be given to fishers to take more rock lobster off the west coast but no more off the east may therefore be worth considering.

7.3.5.12 Owner oriented

In 16 or 6.4 per cent of interviews, participants held what they considered to be the

owner orientation of both the introduction and the operation of quota management to be a negative factor. In the lead-up to quota management, licence holders were said to have been ensconced by government as stakeholders in the industry, acknowledged voting rights and so on. Others in the industry such as lessees, boat drivers, deck hands, etc. were maintained not to have been given similar consideration and were held effectively not to have been enfranchised. This suffrage was then said to have been approached according to the interests of smaller catchers who were in the majority. Consequently, participants in seven or 2.8 per cent of interviews claimed the introduction of quota management to have been a *fait accompli*.

As noted, the industry is arguably composed of four different types of capital, ignoring for the moment social capital in the form of families and port communities (ancillary services as well as the processing sector need also to be taken into account). Under quota management, the organic and fictitious capital components of the industry have been enhanced. In decline, however, are real and human capital, which together constitute the workhorse of the industry. According to participants in the 16 interviews discussed in this subsection, management of the industry has concentrated on the species and owner-stakeholders and passed over much of the 'plant' and labour in between. With concern about decline in number of boats and fishers increasing, redoubtable owners, hypertrophied by government, are now a lens through which any action must be considered. Thus, in pitching quota management at owners and benefiting and empowering these it is at present possibly more difficult to act on behalf of 'have nots' in the system. As concern for particularly younger operators mounts, both in terms of their number and the social relations of production surrounding them, owner orientation may distract attention from the malaise in the engine room of the industry. In other words, quota management has worked well for owners of non-productive fictitious capital but not so well for productive real and human capital, namely operators. With number of operators declining, the Tasmanian government, owners and owner-operators need to consider maintenance of the industry's productive capital at a level sufficient to lease in and possibly purchase quota units as part of catching future TACCs.

7.3.5.13 *Hindered relations with tourists*

In 16 or 6.4 per cent of interviews, participants stated that quota management had negatively affected their relationship with tourists. Part of cash fish sales prior to quota management involved, for a number of fishers, accommodating the requests of tourists to purchase rock lobster. By 'tourists' was meant anyone not known to the fisher who inquired at the dock about rock lobster for sale. Thus, Tasmanians as well as mainland and international travellers were considered under the rubric of 'tourist'. By no means all fishers sold rock lobster to tourists prior to quota management but many stated that they had done so when approached. No rock lobster fishers interviewed in any way relied on cash fish sales to tourists to sell much of their catch but many were prepared on occasion to deal with tourists.

It is noted that intra-fishing year movements in beach price over the last ten years have fortuitously coincided with trends in tourist numbers within each year. Thus, beach prices have been lowest, at approximately AU\$25 per kilogram, and rock lobster for

purchase most plentiful in summer when numbers of tourists have been greatest. At approximately AU\$50 per kilogram in winter many Australians would balk at purchasing rock lobster for consumption.

Prior to quota management, then, part of the welcome of port towns possibly included buying a 'crayfish' from a fisher at the wharf. Sites of production are attractive to tourists both from the points of view of interest and possibly purchasing product below retail price. Towns such as St Helens, Strahan and Stanley are in part sold to tourists as working fishing ports rich in the produce and character(s) of the sea. Many tourists, not surprisingly, are drawn to the wharf and harmonious transactions with rock lobster fishers were not uncommon prior to quota management. The difference between the summer beach price and the retail price for rock lobster at times being significant, dealing direct with a fisher was one way that many tourists, Tasmanians among them, could afford to access the local delicacy.

Under quota management, sale of rock lobster to tourists was not prohibited but required paperwork and procedures that many fishers found cumbersome. Consequently, few fishers continued to sell rock lobster to tourists. In terms of selling their catch, this development was of little import. In terms of relating with tourists, however, some fishers found it gauche that tourists' requests were importunate under quota management and that they required the fisher at least to refuse to deal and often to explain this position. As a result, tourists could be disaffected with the fisher, and fishers resented quota management placing them in this awkward position. Some fishers considered that such undesirable relations detracted from tourists' experience of Tasmania, were to the detriment of selling Tasmania as a friendly and appealing place to visit and contradicted much advertising of Tasmania that emphasised ports, boats, rock lobster and so on.

Processors were more likely to sell rock lobster to tourists but were fewer in number, were less visible and usually asked a higher price. A number of processors, however, did not sell rock lobster to tourists due to the 'administration' required. Many fishers and processors acknowledged that account needed to be kept of rock lobster under quota management but maintained that an easier process should be developed to facilitate good relations between an industry being used to sell Tasmania and the tourists who came into direct contact with it. Both parties involved would benefit financially and personally, and Tasmania's reputation would be polished into the bargain. For both the tourism and the rock lobster industries, consideration should be given in this regard. Finally, consideration may also need to be given to the part played by the commercial rock lobster industry in the character of individual ports. As noted, this character is often used to sell some places to tourists and should the number of boats in the Tasmanian commercial rock lobster fleet continue to fall, the visibility of the largest fishery in Tasmania in terms of boats may suffer, with possible implications for the marketing of a number of coastal towns. A fleet comprising small, medium and large boats that totals approximately 225 may be important not just to fishing a number of different economies of scale and scope and maintaining employment opportunities, but also to the character of places such as Strahan, Victoria Dock in Hobart, and St Helens.

7.3.5.14 Policing

In 8 or 3.2 per cent of interviews, participants mentioned policing as a negative factor under quota management. Comments regarding quota management being easier to police were discussed above. Participants in the eight interviews discussed in this subsection were concerned with what they perceived to be 'petty' policing under quota management. This policing related both to new regulations in respect of quota management as well as to longer-standing regulations. Whether it be regarding familiar regulations concerning identification of pot buoys or dinghies, for example, or in relation to regulations introduced with quota management with which both fishers and authorities were less experienced, such as leaving port reports, a number of participants stated that heavy-handed or unreasonable policing of minor gear related or procedural infringements reduced cooperation between fishers and authorities. Minor infringements attracted small fines and penalty points. Neither the fine nor any penalty points involved, however, were the major concern for participants. Instead, participants considered their treatment by police to have been prejudiced by an attitude that all fishers were criminals. They also found the resulting mark on their record and slight on their reputation to be ignominious. Upholding the letter of the law was held not always to be necessary as an explanation and warning were maintained often to be more appropriate. For example, where part of identification marks had disappeared or was unreadable, notice to remedy this situation was considered to be sufficient and amiable policing. When quota management regulations were being trialled and familiarisation not yet complete, patience, explanation and flexibility were said to be necessary.

In cases where regulations were rigidly enforced, at times by police unfamiliar with rock lobster fishing, compliance usually resulted but cooperation with authorities in future was less likely. For example, exasperated fishers did not always distinguish between police and fishery biologists, both of whom were included in the rub of authority. Where police had not been considerate of minor lapses or misunderstandings concerning regulations, little consideration was given to involvement in the various sampling and tagging programs of fishery biologists.

Police would most likely be familiar with objections such as these raised by some participants, objections being in some ways part of the job. Moreover, not a large number of cases is being discussed here and relations between fishers and police were reported by most participants to be good. So-called 'petty' policing, however, can unwittingly harm relations between fishers and biologists. This outcome could be avoided if police were required to issue a warning to any fisher, or processor, infringing in a minor way for the first time, thus removing any inconsistencies in policing in such cases. In this way, the wheels of cooperation linking participants in the industry with police and fishery biologists, though with generally few squeaks, could be better oiled.

7.3.5.15 Less time with family

In seven or 2.8 per cent of interviews, participants stated that less time was being spent at home with their often young family under quota management and that this was an undesirable outcome. This negative is related to those interviews in which participants said that they were fishing more (four interviews) and had less time off (three interviews) under quota management, both of these outcomes also being considered to be negative. Only a small minority of operators increased their fishing under quota management. This increase could be associated with four main strategies. First, somewhat unrelated to quota management, the trajectory of a 'younger' fisher could

involve fishing and catching more as capabilities improved, capacities were increased and so on. Second, an operation may catch less under quota management but an individual involved with it fish more. With catch limited under quota management and many fishers focusing on cost reduction, a number of participants ceased employing a part or full-time boat driver and fished more themselves. Third, as noted, some fishers subscribed to the logic of ‘get big or get out’ and purchased and leased in quota units to catch more than they had prior to quota management, though their net return may not have increased as a result. Fourth, somewhat related to the first strategy, a number of ‘young guns’ gearing up in the fishery took a high volume lease in approach to quota units, buying boats to fish full-time in preference to purchasing quota units. With number of boats in the fishery declining and younger fishers finding it increasingly difficult to buy into the industry as owner-operators, fewer fishers but more lessees may be required to work harder to catch the TACC.

Taken together, fishers pursuing these strategies were fishing more under quota management, having less time off and spending less time at home with their often young families. Whether cost minimising or fishing a higher volume under quota management, many of these fishers felt in varying degrees forced by quota management to be fishing more. Like those operators who felt compelled to fish more in the winter to maximise gross returns, noted in four interviews to be a negative outcome of quota management, having to minimise costs, increase holdings or fish a high volume for a worthwhile margin were not without alternatives but were the most rational strategies available under quota management according to those practicing them. Available alternatives were considered to be either economically inferior or culturally unacceptable. One cost of this predominantly economic rationalism, however, was social, measured in the intensification of labour and increased time away from family. Participants discussed in this subsection gestured towards the tyranny of rationalism by one standard, the economic, in one sphere, the market. Individuals, families, communities and the Tasmanian government were all in different ways subordinate to this logic and had less room to manoeuvre as a result of unitisation and marketisation associated with the introduction of quota management. This observation may well not apply to those with a sufficient ownership stake in the industry, but individuals, families, communities and so on need to be valued for the long-term as much as short-term market economics are considered in the management of the fishery.

7.3.6 Comments Regarding Various Past, Present and Possible Policies

7.3.6.1 Introduction

Comments regarding seven particular past, present and possible policies are discussed in this chapter. All except marine protected areas (MPAs) are solely the preserve of the Tasmanian Government. MPAs were recognised to be as much a Federal Government initiative, that also had global links. Comments were unsolicited, thus giving something of an indication of what was on the collective mind of the 2000/2001 quota year sample in relation to various policies. The policies raised by participants, in order of number of interviews in which they were mentioned, were as follows:

Table 23. Past, present and possible policies raised by participants by number of interviews in which raised

	No. interviews in which raised
Zoning	79
To open or close September?	73
Sixty pots	58
MPAs	54
Double night shooting	25
Equal size measure	18
Aquaculture	13

It is emphasised that discussion in this chapter is only indicative of industry opinion, in two senses. First, only a sample of the industry is being considered. Second, without having asked a direct question regarding any of these policies, what was forthcoming can only be considered the most immediate policy concerns raised by participants. That an opinion about aquaculture trials in respect of rock lobster was volunteered in only 13 interviews, for example, should not be taken to mean that it was of no concern to participants in 234 interviews, only that it was not raised. In other words, aquaculture was of sufficient concern to be mentioned unprompted in 13 interviews, leaving opinion in remaining interviews unknown.

A comprehensive examination of particular past, present and possible policies was beyond the time-budget of interviews. Consequently, discussion in this chapter represents the tips of icebergs the form of which would require detailed questioning, repeated across the industry, to ascertain. These indications are given as they are, at least, available. A cut off point of ten interviews was used to separate policies more frequently mentioned from those less frequently mentioned. Discussion proceeds from comments made in the most to the least number of interviews.

7.3.6.2 Zoning

As noted, the possible policy of in some way zoning the Tasmanian commercial rock lobster fishery was raised in 79 or 31.9 per cent of interviews (Table 24).

Table 24. Positions on zoning

	No. of interviews	Per cent
No mention	168	68.0
What involve?	23	9.3
Perhaps	10	4.0
No	24	9.7
Yes	22	8.9
Totals	247	100.0

In other words, zoning was not mentioned in 168 or 68 per cent of interviews. In the nearly one-third of interviews in which zoning was mentioned, in 33 or 41.7 per cent of these interviews, participants were unsure about zoning, in two senses. First, in approximately two-thirds of these 33 interviews, participants did not consider there to be a consistent understanding of what might be entailed by zoning. This lack of consistency was in part due to the unwillingness of some participants in the industry even to talk about the possibility of zoning. Zoning was therefore whispered around

the industry, lest fishery managers be encouraged by open discussion. Zoning of the Tasmanian commercial abalone fishery, east-west, had been introduced in 2000. A number of participants maintained that fishery managers were inclined to zone the Tasmanian commercial rock lobster fishery in some way. Lack of willingness to talk about zoning, however, meant that few specifics had been raised regarding the possibility. There was therefore understandable confusion regarding what might be meant by zoning. For a number of fishers, zoning meant being restricted to areas or being allocated quota in areas in which they did not want to fish. These meanings, however, did not draw their substance from the views of fishery managers or biologists. Both of these groups were prepared to consider zoning, but had made no public comment on any possible initiative and were sensitive to the opinions of many fishers in the industry. In the absence of such comment, some fishers assumed the emergence of a draconian scheme or extrapolated undesirable aspects from zoned fisheries elsewhere. This absence was, in other words, fertile ground for misapprehension.

That in 23 interviews participants stated that no clear understanding existed about how the fishery might be zoned is cause for concern regarding both the terms and tenor of discussion. Without clear guidelines, some participants stated that they were unsure whether they supported or opposed zoning, while others erred on the side of caution and opposed the loosely defined concept. Discussion was stalled, tending towards the negative, for want of detail regarding any rationale and mechanism for zoning the fishery. Given that many fishers were dubious regarding any change, lack of open and focused discussion only encouraged postulation of management conspiracy. Initiative would be required from fishery managers to advance discussion. Thus, for many participants in the 33 interviews from whom support or opposition to zoning could not clearly be discerned, the attitude was one of 'it depends'; 'wait and see', that is, until a discussion paper or draft proposal was prepared by fishery managers and circulated.

Confusion about what was meant by zoning, and opposition in some ways subsequent to this confusion, should not be underestimated. Not talking about zoning was a holding action employed by some participants. Clearly, the task ahead of fishery managers, should they wish to move in the direction of zoning, would be to convince industry that many different forms of zoning exist and that one might be developed to work for the benefit of both stocks and operators in the Tasmanian commercial rock lobster fishery. Encouragement could be taken in this regard from the fact that in 22 or 27.8 per cent of the 79 interviews discussed in this section, participants were prepared in principle to support the concept of zoning. Many fishers agreed that there were important differences between areas in the fishery. Stock abundance was held to vary east-west, rock lobster growth rate and size north-south, rock lobster colour and stock characteristics inshore-offshore and so on. Management of the Tasmanian commercial rock lobster fishery as a single zone made little sense regarding some issues such as raising the TACC (possible in some areas, mainly off the west coast, but not others, mainly off the east coast), allowing a maximum of 60 pots on boats (possible in some areas offshore but not inshore) and opening the season in September (possible in the north-west). Contention about such issues in the industry would most likely continue due to the concerns of operators fishing in areas with different habitats and stock conditions. According to some operators, managing the fishery as a composite of a number of distinct but related zones was implicitly sensible. The difficult question was how to zone the fishery to the benefit of both stocks and operators.

To some fishers, zoning was a mechanism worth exploring to tackle such issues as relieving fishing pressure on stocks in the inshore day fishery off the east coast, encouraging more boats again to visit ports such as Strahan and Currie, and redressing some of the considerable reductions in catch and income experienced by some large catchers due to the introduction of quota management. In other words, zoning could be one mechanism whereby stocks in the offshore overnight fishery off the west coast could be fished closer to their maximum sustainable yield, some ports in the western half of Tasmania could experience more visiting boats and some fishers could operate more effectively in terms of both effort and net return. The requirement is satisfactorily to discharge two general objections commonly raised by fishers regarding zoning: that fishers would be allocated quota units in zones in which they did not want to fish; and, conversely, that fishers would not have the flexibility to 'follow the fish' into whichever zone rock lobster were 'running'.

A key word in the preceding sentence is 'flexibility'. Many fishers' apprehensions regarding zoning stem from concerns about the process of policy formation as well as from the orientation of zoning in respect of fishers' self-determination. In other words, fishers feared that zoning would simply be prescriptively imposed; i.e. that they would, without legitimate consultation, be geographically restricted in some way. As noted, a first step in allaying this fear would be to produce a draft proposal or discussion paper for industry consideration.

As early as possible in the consideration of any zoning initiative, development needs to involve and take into account the interests of industry. One common industry concern is that fishers not be restricted in any way. Any zoning initiative therefore needs not to limit fishers but to increase their range of choices by offering them incentive to consider spatially shifting their effort. In short, carrots not sticks should be used. If incentives *additional* to the existing system were to be used, then lines on the water would not exist for those choosing to operate only within the existing system. The existing system would not be changed, therefore, but supplemented. Those wishing to avail themselves of any incentive further to the existing system would be required to do so under only one proviso additional to quota management at present, that they catch any extra quota units in the western half of the fishery, for example. Thus, any zoning would only operate regarding a specific additional incentive, not in relation to baseline quota management arrangements as they exist at present.

In some respects, zoning already exists regarding the fishery in that the Tasmanian commercial rock lobster fishery is areally distinct from Victorian waters. Zones also existed in the fishery in the past in the case of the north-west being open to fishing in September. A key is to manage any internal zones so that fishers can for the most part cross any line with impunity. In other words, if fishers were to nominate to be part of an incentive system that was geographically specific then this would be at their discretion. Participation would not be dictated by management injunction but would be voluntary. Each fisher's share of any incentive offered might be determined in part by number of participants.

It would be important that any zoning mechanism be simple to operate and comprehend as well as easy to police. Initially at least, only two zones could be considered, an east and a west. In this way, 'lines on the water' would apply only regarding any incentive instrument additional to current quota management arrangements and would involve only two intra-fishery zones.

It is worthwhile reiterating that many fishers do not wish to have quota units allocated to them that they have to catch in an area in which they do not want to fish, and that freedom of movement to fish around Tasmania is highly valued. In other words, the geographic self-determination that fishers at present enjoy should not be diminished in any way by zoning. As noted, a starting point would therefore be not to alter any aspect of existing arrangements but to add an option to them. A further ability, for example, would be to catch rock lobster additional to the existing TACC. The requirement, however, would be that this additional catch be taken from areas capable of sustaining more fishing, for example off the west coast. One aim would be to provide incentive for some operators to shift their fishing back from the east to the west coast.

Ideally, if this approach was adopted some fishing effort would shift from the at present heavily fished east coast inshore day fishery to the healthier west coast overnight fishery. To repeat, zoning would only apply to quota units additional to the present TACC; it would not apply to those fishers who did not wish to alter the geography of their fishing. All fishers would be free to choose to nominate for and fish additional quota units off the west coast. Some fishers would not have to alter their fishing pattern to do so. Present west coast fishers would be important to catching additional tonnage but, by dint of the location of their fishing, they would not be involved in any spatial effort shift from the east to the west coast. There is no guarantee that some fishers would shift their effort from east to west, or that they would also catch a sizable proportion of their baseline quota units off the west coast in addition to any supplementary quota. From interviews, however, it is reasonable to assume that effort shift would occur, with a consequent relieving of some fishing pressure off the east coast. This assumption is based on a number of fishers stating that should their operating economies be boosted by additional quota it would again be economically viable for them to fish more isolated areas suited to their boat and experience. Alternatively, for example, it could be required that for every one supplementary west coast kilogram allocated to a fisher one baseline kilogram also had to be fished off the west coast, thus further encouraging effort shift away from the east coast. Any such secondary measures would only need to be considered once any supplementary quota mechanism was in place and its effect was known.

The intention would be that fishers with the ability to shift in some cases back into the west coast overnight fishery would be the prime movers. Effort would thus better match stocks as larger east coast boats with experience off the west coast quit fishing the east coast inshore day fishery, especially in winter, and in some cases again fished the west coast overnight fishery, in some cases offshore. With some commercial fishing pressure taken off stocks in the east coast inshore day fishery, biomass in the eastern zone would in theory rebuild more quickly. Geographically, the outcome would be a fishery in which stocks, effort and catch were more evenly and sustainably matched, with the result of a higher total catch. Importantly, too, fishers would have more choice regarding the types, amounts and locations of their fishing.

In conclusion, possibly zoning the fishery as suggested here is clearly only couched in general terms. Most obviously, there exists an inshore overnight fishery off the west coast that needs to be considered in any simple two zone model. The specifics of discussing the possibility, developing the mechanism and so on would emerge as management and industry together assessed the rationale and applicability of zoning in

the Tasmanian commercial rock lobster fishery. Zoning is raised here as a possible mechanism to address the two socio-economic issues under quota management of a decline in visiting boats to ports in western Tasmania, and the ‘pain’ experienced by some large catchers due to reduction in allocated catch. In addition, the dilemma of it being possible to raise the TACC in some areas but questionable in others could be resolved. However, fishers’ objections and underlying misgivings regarding zoning would first have to be addressed. The approach sketched above is intended to propitiate fishers’ concerns by leaving present allocation and single zonation unchanged but offer an additional non-transferable tonnage off the west coast each quota year for which fishers could nominate. Thus, fishers would not be allocated units in a zone in which they did not wish to fish and would continue to be free to ‘follow the fish’ wherever rock lobster were ‘running’.

In short, incentive-based zoning along the lines proposed would grant fishers an additional choice. It is perhaps, time to address zoning directly in the Tasmanian commercial rock lobster fishery. Direct treatment of zoning would involve the preparation by fishery managers of a draft proposal for circulation among industry outlining the arguments for and against zoning as well as how any mechanism might operate. Discussion would include possibly finding the fishery unsuited to zoning and removing this policy from further consideration. It would also need to consider how monitoring of compliance might be undertaken. In other words, discussion of zoning could benefit from being brought into the open and focused around a draft proposal. A draft proposal could at least help to clarify the issue of zoning. In this way, many fears raised by participants may be seen to be groundless.

7.3.6.3 *To open or to close September?*

As noted, comment was made regarding the opening or closing of the season for commercial rock lobster fishing in September in 73 or 29.5 per cent of interviews (Table 25).

Table 25. Positions on opening or closing September

	No. of interviews	Per cent
No mention	174	70.4
Close	58	23.4
Open	15	6.0
Totals	247	99.8

Different dates within September were at times specified but the general issue was the taking of ‘soft fish’ that were not sufficiently robust for live transport. Rock lobster that have recently shelled are more active in searching for food than at other times of their cycle and fishing usually returns higher catches during the ‘new shellers’ period as a result. It was commonly expressed in the fishery that rock lobster began shelling sometime in September and were usually sufficiently hard shelled to be worthwhile catching by November. Difficulties arose, however, because this general pattern did not apply in all areas of the fishery, could vary from year to year and overlapped with the end of high winter beach prices for rock lobster. Once fishing for rock lobster began in November and supply was plentiful the beach price fell to approximately half

the winter price. Operators were understandably keen to fish the high winter beach price for as long as possible.

In waters off the north-west coast of Tasmania, including King Island, rock lobster were said to be hard shelled in September. The fishery had formerly been zoned in September to exclude the north-west from closure (Gardner and Frusher, 2000). With many other rock lobster fisheries closed in September, the beach price remained high; the opening of the South Australian southern zone rock lobster fishery in October being possibly the only regional price dampener until November. Apart from those fishing in the north-west of Tasmania who wished September to be open, some fishers were tempted to extend the open season as far into September as possible in other areas of the fishery and gamble on a late shelling. Others were prepared to catch soft shelled rock lobster if processors would purchase them. Some processors cooking rock lobster for the domestic market were prepared to do so. That catching late shellers was lucrative or new shellers 'easy' were sufficient temptations for some fishers. Many fishers, however, maintained that, except in the north-west, all of September and October needed to be closed for the shells of rock lobster to be given time to harden.

That comment was made concerning fishing in September in 73 interviews was in part due to fishing in September having recently been allowed. Many fishers were opposed to opening September and did not fish in this month, preferring to undertake maintenance on their boat or have a holiday, as was 'traditional'. Such fishers were principally responsible for the 58 interviews in which participants opposed the opening of the commercial rock lobster fishing season in September. As noted, in favour of the initiative was a number of operators who fished off the north-west coast of Tasmania where rock lobster were hard shelled, as well as some participants who held that if a market existed for soft shelled rock lobster then it should be allowed to be supplied. According to other fishers, however, this latter 'let the processors decide' attitude ignored the possibly high level of incidental mortality involved handling soft shelled rock lobster among both those taken and those returned. A number of fishers maintained that dead soft shelled rock lobster in September deprived the fishery of hard shelled rock lobster in November and beyond.

Given that in many areas legal size allows rock lobster that are sexually mature but still growing to be targeted, the fishery faces the shelling issue recurrently. In the north-west, growth rates are such that many rock lobster shell more than once a year. Thus, the approximately synchronised annual shelling that occurs elsewhere in the fishery does not affect the north-west as markedly, though October is one of the shelling periods and has therefore traditionally been closed. In conclusion, the issue of whether to close the fishery in September again underlines difficulties associated with managing a heterogeneous fishery as a single zone. Arguments exist for closing September in some areas but not in others. Consensus does not appear to be possible concerning one rule for the entire fishery regarding fishing in September. Without some form of zoning, compromise is impossible and the fishery swings between closing *or* opening September; i.e. it is not possible to have September *both* open (in some areas) *and* closed (in others). Certainly, issues such as concentration of fishing effort in the spatio-temporal window opened by zoning would need to be considered, but a more sophisticated mechanism than 'one rule for all the fishery' is required if the September issue is to escape the binary logic of either/or. A both/and mechanism regarding the fishery offered by zoning is admittedly more complex, but offers a more subtle tool

with which geographically to fine-tune quota management in the interests of both stocks and operators. With zoning, differences between stocks and operators, instead of being overridden, can be taken into account. Zoning arguably offers an areally discrete way of opening the commercial rock lobster fishing season in September. As noted, zoning also offers an areally discrete way of increasing the TACC as well as of allowing a maximum of 60 pots on boats surveyed to carry this number.

7.3.6.4 Sixty pots

The possibility of raising the maximum number of pots allowed on a boat from 50 to 60 did not attract comment in over three-quarters of the interviews (Table 26).

Table 26. Positions on sixty pots

	No. of interviews	Per cent
No mention	189	76.5
No	50	20.2
Yes	8	3.2
Totals	247	99.9

In most of the 58 or 23.4 per cent of interviews in which comment was made, participants were opposed to ‘sixty pots’. Two main reasons were given for this opposition. First, there was concern that areas in the inshore day fishery off especially the east coast were already congested with pots. It was held that an additional ten pots on some boats and possibly a *pro rata* proportional increase on others would only add to this congestion. This concern points again to the need to treat the fishery as being spatially differentiated. For example, few participants considered 60 pots to be a concern in the offshore overnight fishery off particularly the west coast.

Second, a number of participants did not wish to see any further encouragement of ‘big’ boats in the fishery. As noted, comments regarding big boats in the fishery alternated between viewing these as operationally profligate dinosaurs to being the scale economy future of the fishery. Between these two extremes, most participants acknowledged that some big boats were needed to fish especially the offshore overnight fishery, as well as to operate in other fisheries such as giant crab and possibly scallop. What was not widely countenanced was that the future of the fishery lay entirely with a small number of big boats. Though this scenario may deliver some larger scale operational efficiencies and offer administrative simplicity, it was not considered by many participants to be in the best interests of either the fishery in terms of maximum sustainable exploitation of various stocks or in the industry in terms of employment, opportunities, local ports and so on. Moreover, quota management had encouraged a shift in the focus of fishing from volume to quality. Allocation had been conservative and prices to access quota units inflationary meaning that volume was expensive to obtain. Maximising financial return on allocated catch through geographic and temporal changes in fishing as well as through minimising costs was the approach taken by many operators. Fewer operators leased in large amounts of quota to volume fish. There existed a view in the industry, however, that management was tendentious regarding a big boat fishery. As many fishers were opposed to this tendency, they were suspicious of any initiative that appeared to promote it. Certainly, management of the

fishery under quota had emphasised reducing the number of boats in the fleet. However, no indication of wishing to move the fleet away from a combination of small, medium and large boats had been forthcoming from management. Indeed, concern that the number of boats in the fleet not fall below approximately 220 was evident in the management plan.

Not surprisingly, vocal advocates for a big boat fishery were some big boat fishers and investors, both of whom based the case for a big boat fishery on efficiency grounds. The questionable nature of macro scale economic efficiency arguments was discussed in Chapter 7.3.4. At the scale of the individual operation, some participants indicated that operators should be allowed to use sufficient number of pots to enable them to begin pulling the first pot of a shot immediately following shooting the last. Not surprisingly, many participants opposed the intensification of labour and the larger scale operations implicit in such a suggestion. Allowing a maximum of 60 pots on those boats surveyed to carry them was considered to be continuation of a trend in this direction begun by increasing the maximum number of pots from 40 to 50. Many participants simply did not believe that larger operations would spend less time fishing due to catching rock lobster more quickly with 60 pots. It was commonly maintained in the 50 interviews in which participants were opposed to 60 pots that larger operations would purchase or lease in additional quota units for which to fish in the time saved.

There were also concerns raised associated with 60 pots regarding the practice of double night shooting, safety and increasing work loads of deck hands. Double night shooting is discussed below, but potlifts in some areas stood to be increased by a further 20 per cent, in addition to their doubling by double night shooting, if maximum number of pots was increased from 50 to 60. Safety was also questioned concerning longer time being required to pull gear in the event of an approaching storm. Fatigue, too, especially for deck hands, was also mentioned as a factor impinging on safety.

In conclusion, development of a vision for the fishery, that included a minimum number of boats, would help clarify the issue of increasing the maximum number of pots to 60. More participants may be prepared to 'vote' for 60 pots if it was made clear that no plans for a big boat fishery were behind the proposal. More sophisticated still would be to consider zoning the fishery in some way that would allow more pots to be used in the offshore overnight fishery, particularly off the west coast, but not in the more congested inshore day fishery. This form of zoning would be less straightforward to introduce, but it has obvious benefits should it possibly be developed to the satisfaction of operators. Again, zoning is possibly a key that could unlock a number of adjustments that would move the fishery closer to Pareto optimality (a Pareto superior opportunity could be said to exist if the operating conditions of a fisher could be improved without detriment to a fisher for whom an initiative is not relevant).

7.3.6.5 MPAs

That comment was made regarding the Tasmanian component of the proposed national representative system of marine protected areas (MPAs) in 54 or 21.8 per cent of interviews was in part due to timing (Table 27).

The interview period in part coincided with public consultation regarding this initiative.

Consequently, many participants were concerned to raise the emerging issue of MPAs, though MPAs were of only indirect relevance to the study. It is noted that this coincidence did not occur until approximately half way through the interview period. Participants may have commented on the initiative in more than 54 interviews had the two processes commenced at the same time.

Table 27. Positions on MPAs

	No. of interviews	Per cent
No mention	193	78.1
No	35	14.2
Undecided	12	4.9
Yes	7	2.8
Totals	247	100.0

In only seven interviews were MPAs, additional to those already in place in Tasmania, supported. In 12 interviews, participants stated that it was unclear exactly what was intended by the initiative and that until a formal proposal was forthcoming they would reserve their judgement. In 35 interviews, participants were clearly opposed to more MPAs. Many participants in these interviews considered that MPAs were being imposed on Tasmania *ex cathedra* from global environmental fora via the agency of Environment Australia, leaving the Tasmanian Government with the difficult task of implementation.

Thus, according to a number of participants, the initiative was something of an unspecified foregone conclusion. Not surprisingly, many of its nuances were lost in the unknown of its general protagonism. Answers to questions such as ‘why MPAs?’, ‘which areas?’ and ‘under what conditions?’ were not often heard in an atmosphere highly charged with suspicion, prejudice and fractious group dynamics. The option of multiple use MPAs that included access by operators participating in low impact quota managed commercial fisheries such as rock lobster and abalone, when conveyed to participants, often clarified the initiative somewhat. More temperate discussion usually ensued, though until it was made official that category six MPAs were proposed for Tasmania many participants maintained their opposition to the initiative. Similar to suspicion of zoning, some participants were of the view that MPAs should be opposed under any conditions as they were the thin end of a wedge that would inhibit fishers. That netting stood to be banned in MPAs was also a concern to a number of participants, though the majority was in agreement that this should occur.

7.3.6.6 *Double night shooting*

Comment on double night shooting was made in 25 or 10.1 per cent of interviews, predominantly in opposition to the practice (Table 28).

Table 28. Positions on double night shooting

	No. of interviews	Per cent
No mention	222	89.9
No	21	8.5
Yes	4	1.6
Totals	247	100.0

Most fishers have one night shot for rock lobster. This usually involves setting the pots in daylight, leaving them overnight and pulling them at dawn. Interpolated with this pattern, double night shooting involves pulling and re-setting pots at some time during the night. During long winter nights, especially, some fishers manage to triple night shoot. In effect, double night shooting fishes twice for rock lobster overnight. The curfew on double night shooting was lifted when quota management was introduced, the aim being to allow fishers to increase their operating efficiency. Especially inshore, rock lobster are more active in search of food under the cover afforded by darkness from predators. It is possible that concentrating fishing at night takes more rock lobster from an area than would otherwise be the case. This is perhaps in part what a number of participants meant by the comment that double night shooting ‘turns day fish into night fish’. In other words, stock in an area is fished down to a point where lack of competition means that rock lobster are not required to forage in more exposed daylight hours. The subject of speculation was the effect of lights powered by 240 volt generator sets on rock lobster on the bottom as well as on those caught and returned. Some fishers maintained that these lights made rock lobster less likely to venture in daylight.

As noted, reasoning for double night shooting centred around efficiency. More potlifts in the period in which rock lobster were most active often resulted in catching quota units more quickly. With many operators focusing on minimising costs and quota management meant to be ensuring that total catch was sustainable, double night shooting was said by some to be irrelevant regarding stocks and necessary for operational efficiency. Those opposing double night shooting, however, were concerned not with total catch but with local stocks. Double night shooting was considered to be responsible for ‘fishing out’ certain areas, not just in terms of making rock lobster day shy but in taking more from a local area than it could sustain in the short-term. Moreover, double night shooting was held to be a concern regarding fisher fatigue and possibly therefore safety at sea, and also cast suspicion among the fleet due to the opportunity that existed for those double night shooting to interfere with the pots of those who were not doing so.

Finally, a number of participants were concerned about the impact of powerful lights on sea birds. Some birds were reportedly attracted to lights and ran into these, being killed or maimed in the process. Little research has been done regarding the effects of double night shooting on rock lobster and more was said to be needed by a number of participants. Research into the effects of lights on sea birds would also be informative. Given the depth of concern expressed by some participants, the issue of double night shooting could become more contentious in the fishery in future, and more research into the effects of the practice would be prudent.

For these reasons, therefore, most participants in the 25 interviews discussed in this

section were opposed to double night shooting. As the practice was mentioned unprompted, however, those not in favour of it were more likely to be represented.

7.3.6.7 Equal size measure

Comment that the legal size for female rock lobster should be brought back up to the male size was made in 18 or 7.3 per cent of interviews (Table 29).

Table 29. Positions on equal size

	No. of interviews	Per cent
No mention	229	92.7
Yes	18	7.3
Totals	247	100.0

This comment was made predominantly by older fishers who recalled the impact of lowering the female size in 1966 (Winstanley, 1973) on catches and stocks. This is not the place to discuss the rationale for lowering the female size or arguments for raising it back up to the male size. The point is that on grounds of simplicity and stocks a number of fishers with long experience in the industry held that consideration should be given to raising the female size. In some ways, this is an old debate, which like the suggestion that ‘stunted’ rock lobster be moved from southern to grow in northern waters, largely lacks currency under a system of output control. It does, however, indicate a further difference underlining the difficulty of managing the fishery as a single zone. Put simply, rock lobster grow faster and larger in northern than in southern waters. There is evidence that large numbers of female rock lobster reach sexual maturity but not legal size in southern waters, and legal size before sexual maturity in northern waters. There is therefore a *prima facie* case for different legal size in northern waters compared with southern waters. This simplicity, though, is complicated by incomplete knowledge regarding the long-term *ex ante* effect of legal size on stock profiles, the link between egg production and stocks, number of males required to fertilise what number of females and so on. Research into these and other questions is ongoing and care is required before considering any adjustment of legal size. Zoning the fishery north-south, however, appears to be worth considering as the regulation regarding single male and female sizes applied across the fishery is a patent nonsense according to some fishers. This view is based on there being undersize mature rock lobster that can not be taken from southern waters, and size juvenile rock lobster that can be taken from waters in the north of the fishery.

7.3.6.8 Aquaculture

As noted, experiments regarding the possible aquaculture of rock lobster received comment in only 13 or 5.2 per cent of interviews, predominantly in the negative (Table 30).

Table 30. Positions on aquaculture

	No. of interviews	Per cent
No mention	234	94.7
No	11	4.5
Yes	2	0.8
Totals	247	100.0

This number is due, first, to no direct question regarding aquaculture being asked and, second, to there being a clear distinction in the view of many participants between socioeconomic research in the wild commercial rock lobster fishery and the aquaculture initiative. Informally, however, there is in the Tasmanian commercial rock lobster industry an abiding suspicion of the aquaculture initiative. This is not the place to rehearse the many issues held by participants in the wild fishery regarding the possible aquaculture of rock lobster. The initiative is only recent and there remain a number of unknowns that need to be researched before definite answers can be given regarding its viability as well as its relationship with the wild fishery in terms of sourcing puerulus, returning rock lobster, marketing and so on. The point here is that, as with zoning and MPAs, much work is required to convince a sceptical Tasmanian commercial wild rock lobster industry of the merit of these initiatives.

7.3.7 Effects of Quota Management on Ports

7.3.7.1 Introduction

Much of this report is devoted to detailing the impact of the introduction of quota management on individuals. Interviews with individuals are the basic building blocks. The decision to construct an understanding of the industry from its smallest possible unit, that of the individual participant, means that presentation favours the micro scale. This decision was based on experience gained in Williamson *et al.* (1998). In this work it was found that assessment of the industry at more macro scales was difficult. Local ports and fleets could be distinguished, but whether a local fleet could be considered to be in any way homogeneous, or a local fishing community in any way cohesive, was confounded by differences between operations. Similarities between operators also existed, but cases were evident where, for example, an individual lived on the east coast, tied his or her boat up in a Channel port south of Hobart, and fished primarily off the west coast. Living or leaving a boat in a particular *place* therefore may give little indication of an *individual operator's* pattern of fishing, expenditure and so on.

Moreover, exploration of local multipliers in Williamson *et al.* (1998) found the pursuit of these to be problematic in the case of the Tasmanian commercial rock lobster industry. Put simply, the drop in the bucket was often too small to be clearly registered. For example, marine products constituted 1.7 per cent of Tasmania's gross state product (GSP) in 1996/97 (ABS, 1999; DPIWE, 1999). Rock lobster made up 28 per cent of these marine products, or approximately 0.5 per cent of Tasmania's GSP. Even with this figure being concentrated in some ports, in no place was commercial

rock lobster industry activity sufficiently strong to generate a 'pulse' that was noticeable at the scale of the local general community.

Had this pulse been detectable, however, the change in magnitude being sought was small. Adjustment not collapse of the industry was being assessed and detecting the effects of an approximately 20 per cent reduction in economic activity in an already faint pulse at the scale of the local general community proved beyond detection. In Strahan, for instance, general population was increasing due to an industry structure in which tourism and aquaculture were 'booming'. This activity effectively masked any Strahan-wide effects of a downturn in the commercial rock lobster industry. In other words, often when leads from fishers were followed, regarding putative impacts of the introduction of quota management, into the general community, the ebullient context of the connection rendered any impact largely inconsequential at the scale of the local general community. For a general business, for example, a connection with the Tasmanian commercial rock lobster industry often existed but was insignificant when the size or growth of other trade, or degree of diversification of the business concerned, were considered.

No areally discrete dedicated rock lobster ports and associated general communities and infrastructure exist in Tasmania in which the socioeconomic impact of the introduction of quota management can be isolated and measured (see Jacob *et al.*, 2001 for difficulties associated with defining fishing dependent communities, both the definitions of community and dependency being problematic). At one end of the spectrum are small local fleets anchored in places with diverse industry structures, such as Strahan, while at the other the largest concentration of rock lobster boats is in Hobart, Tasmania's capital city. Nowhere does the Tasmanian commercial rock lobster industry stand out so that its flow on effects can be ascertained in any straightforward way. Moreover, for the most part in Tasmania

fishing communities are unincorporated. Essentially, this means that the community is not available as a unit of analysis because there are no census or other agency data available (Jacob *et al.*, 2001: 20).

Work was done with the ABS as part of Williamson *et al.* (1998) in an attempt to separate data for rock lobster fishers from the 1996 census. Some data were available but in an insufficient number of cases to be useful. With the experience of Williamson *et al.* (1998) in mind, therefore, it was decided to focus on the impacts of quota management at the scale of the individual industry participant rather than to attempt to paint a general place-based picture in which the number of individuals involved in the industry was insufficient to be readily appreciated. Having said this, once individual building blocks are available in the form of industry participants these can be aggregated and treated at larger scales. One way of doing so is typologically, but another is spatially, not from the perspective of diluting local industry by dropping it into a strong local general community compound but in terms of the geographic distribution of the Tasmanian commercial rock lobster industry. In other words, it may be problematic locally to establish clear links between a fleet and the general community but the fleet itself is identifiable and has port infrastructure and fishing families, perhaps in part constituting a local fishing community, associated with it.

It is a matter therefore of ascertaining an appropriate scale at which to assess social impacts. Locally, the community-wide scale is probably too large and/or diverse to

display these. Thus, the geographies of local fleets, ports and families are discussed in this chapter, rather than making an attempt to multiply impacts of quota management up scales at which it is difficult to notice them. The approach is generally to discuss this geography using local examples. The unit discussed is that of the port, including a fleet, infrastructure, individuals and families directly involved in commercial rock lobster fishing, variously linked, embedded in some way in a local general community. Port and community are largely incommensurable in terms of population, employment and expenditure. Importantly, however, they may be closely linked regarding diversity, identity, “character” (Jacob *et al.*, 2001) and so on.

7.3.7.2 *Effects common in all ports*

Difficulty detailing impacts at the level of the local general community was also noted by many research participants. In 123 or nearly half the interviews, participants either made no comment regarding any local impacts of quota management at the general community scale or could state nothing particular. In only five interviews did participants state that the introduction of quota management had negatively affected the local community. Moreover, in 12 or 9.6 per cent of the remaining 124 interviews, participants stated that there had been no noticeable change in the general community in their local area.

There was, however, a clear distinction made between the local general community and the local fleet. The local fleet was associated with port infrastructure, fishers and their families, and employment. Together, these were one of the many elements that made up the local general community’s industry structure, economy and infrastructure, elements that perhaps appeared insignificant at the scale of the wider community. To those directly involved with the fleet, however, changes due to the introduction of quota management were evident and important. In other words, local indirect or secondary links between the Tasmanian commercial rock lobster industry and communities were nowhere vital to the viability of a general enterprise or service, let alone communities themselves, but many primary links were crucial to individuals directly involved in the industry. It is direct links at the scale of the port that are discussed here.

It is helpful to note that a local *fleet* may have ‘home’ and ‘away’ boats, i.e. boats that fish locally and those that fish significant distances away involving other ports, as well as boats that combine ‘home’ and ‘away’ fishing. A local *port* may have both local and visiting boats.

Before specifying differences between ports, however, effects of quota management at the level of the general community common in every port are discussed.

Two negative effects of quota management that were noted by a number of participants to be related at the scale of the general community were the regulation that only three rock lobster could be taken off the boat, not deducted from quota, for personal consumption per trip and that, consequently, the contribution of rock lobster by fishers to community causes had declined. Put simply, with little rock lobster available from the commercial sector outside quota, less rock lobster circulated through local

communities from this source. Whereas prior to quota management rock lobster were often available either gratis or at cost to those wishing to obtain them from the commercial sector via informal networks, or were donated to local charities, school raffles and so on, these circulations were curtailed by quota management. Apart from being especially parsimonious for operations that undertook long trips, a number of participants resented their largess being restricted by this regulation. Having to say 'no' regarding the provision of rock lobster to local acquaintances and causes was considered both awkward and potentially injurious in respect of local relationships. Moreover, reports were that curtailed local supply from the commercial sector encouraged black market supply by recreational fishers.

Not surprisingly, with the size of the Tasmanian commercial rock lobster fleet declining by over 70 boats since the introduction of quota management, few ports experienced an increase in the size of their fleet. Just as important, perhaps, regarding local onshore activity relating to the commercial rock lobster industry, research revealed only one new boat being built in the 2000/2001 quota year. If a 'new' boat was required, and many participants maintained that given the tightening of finances under quota management the existing boat would 'have to do', then a second-hand boat was purchased, there being something of a surplus of these in part due to the number of fishers leaving the fishery. Many operators stated that their net returns were lower under quota management, due to reduction in allocated catch and/or the escalating impost of leasing in quota units, and that any spare finance was spent not on their boat but instead on purchasing quota units.

In the context of the local community, as well as in the context of the fishing industry more generally, reduced demand for new boats is often a small or only contributing negative effect. That a boat builder no longer works in a local community may be of little consequence to levels of population or general infrastructure, and less activity in the commercial rock lobster industry may not have contributed as much to this loss as the collapse of the scallop fishery, for example. The latter points towards the general downturn in many areas of the wild commercial fishing industry since the 1980s in Tasmania. Fisheries such as scallop, orange roughie and shark have all 'boomed' and 'busted'. With their declines have gone many boats and 'fish factories', as well as much employment. Moreover, live processing of a substantial proportion of what is at present taken from Tasmanian waters requires less labour than tailing, splitting, filleting and so on. Downward adjustment in the commercial rock lobster industry was not necessarily a major cause of a general downturn in the fishing industry in a port such as Bridport, but neither has it been possible for industry activity to stop this occurring. The micro result of a boat builder no longer working in an area may be difficult to detect at larger scales as well as hard aetiologically to determine, but the fact remains that few new boats are being financed and/or built by participants in the Tasmanian commercial rock lobster industry. This indicates not just there being less employment and money available locally, as well as reduced local diversity and industry robustness, but that the industry's future real capital requirements, i.e. regarding boats and equipment, may not at present be receiving investment. As value continues to shift away from real capital, i.e. boats, and human capital, i.e. fishers, in the industry to fictitious capital in the forms of entitlements and quota units, operational externalities such as boat building are being neglected. Neglect of such externalities has both onshore and future effects. Put simply, at present surplus value is being appropriated from many operators and ports with the result that future requirements in

the forms of boats and fishers are being starved of investment.

Under quota management, every commercial rock lobster fishing port in Tasmania has experienced, to a greater or lesser degree, effects of reduced effort. Before discussing these effects, it is reiterated that downward adjustment in the Tasmanian commercial rock lobster fishery has on the whole reversed stock decline and that as a result a future increase in the TACC may be possible in some areas. Prior to the introduction of quota management, the requirement was that in the interest of bioeconomic sustainability total catch be limited in the fishery in some way. Limiting catch meant limiting effort in the fishery, expressed in terms of reduction in number of boats, not pots. Fewer boats has meant less direct employment. Figures associated with direct employment loss due to the introduction of quota management were discussed above. Indirect figures are more difficult to quantify. For example, one kind of enterprise commonly mentioned by participants as possibly being affected by quota management was marine engineering. Marine engineering enterprises contacted had indeed noticed effects due to the introduction of quota management. These enterprises, however, undertook not just marine but general engineering. Downturn in business associated with fishing was offset, for example, by diversifying into agricultural engineering. Moreover, this downturn was ascribed as much to the collapse of the scallop fishery as to downward adjustment in the commercial rock lobster fishery. Approximately 240 boats remain in the Tasmanian commercial rock lobster industry fishing a sustainable resource and these boats need to get specialist engineering and mechanical work done for reasons of survey and insurance. In addition, a tendency to fish more in winter has in some cases meant more breakages. For a number of marine engineers, mechanics and shipwrights therefore there may have been slightly less work associated with the commercial rock lobster industry but what work remained appeared reliable, was spread more conveniently over the year and, according to some, could be expected to increase as aging boats required more maintenance and new boats eventually had to be built. Ship chandlers similarly relied on more than the commercial rock lobster industry for business and, as noted, the industry was not collapsing but adjusting to a bioeconomically sustainable level of fishing.

Thus, it is difficult to arrive at a figure for reduced indirect employment in these areas. Few enterprises relied exclusively on business from the commercial rock lobster industry and, though this business may have declined somewhat it had not disappeared. Diversification by enterprises was also often possible and had in some cases occurred.

With reduced effort, catch and boats in the Tasmanian commercial rock lobster fishery, however, many participants noted that ‘things’ were, in their opinion, ‘quieter’ in the local community. Some had the time or inclination, perhaps, to notice such things. However, such things, though reasonable to assume from within the industry, were often at times difficult to substantiate outside it. Certainly, a case existed for ports in a number of places to be considered to be ‘flatter’ due to quota management, but this rarely translated into noticeable wider community effects. As noted, the ripples were too small and the pond too large and varying for many impacts on individuals in the industry to be detectable in the local general community.

At the scale of the local port and fleet themselves, however, impacts were more obvious. The impact receiving most comment concerned reduction in employment for deck hands. In terms of employment loss, deck hands fared poorly under quota management. In short, all boats need drivers, but not necessarily deck hands. With

minimising costs a focus under quota management, some of those in a position to reduce or dispense with their use of a deck hand did so. Such labour cost saving was additional to positions lost due to boats exiting the fishery.

Biological sustainability is arguably foundational to socioeconomic sustainability, but deck hands bore the brunt of both reduced employment and intensified labour as the fishery adjusted to reduced effort and catch. Fewer positions and entry opportunities existed for deck hands in the restructured Tasmanian commercial rock lobster fleet, and the work in those positions, though often involving fewer days at sea, was frequently harder due to there being more pots and/or less hands involved. In the opinion of many participants, therefore, quota management had been especially ‘hard’ on deck hands and ‘fewer positions for deck hands’ was the most common local community effect mentioned relating both to loss of deck hands from the industry and lack of opportunity for young people to enter the fishery.

Moreover, as turnover of both rock lobster and money declined due to the introduction of quota management, some employment networks involving kith and kin in the industry contracted, in a number of cases resulting in work having to be found outside the industry. In addition, in a number of interviews, fishers stated that decline in income had meant that their partner had taken up employment, usually in a non-fishing related job. A further effect of reduced effort in the commercial rock lobster fishery was the implication of fewer boats for ports’ infrastructure. For example, as the number of boats in a port declined, in part due to downward adjustment in the commercial rock lobster industry, the possibility existed that Marine and Safety Tasmania (MAST) might review the upkeep of a port’s wharf infrastructure with the possibility that sections of or the entire wharf may not be renovated up to commercial fishing standard. Moreover, the number of both port-based and/or visiting boats could fall below a level required to sustain a local processor, with the ability to sell and tank rock lobster locally therefore being lost, as occurred in Strahan.

In conclusion, effects of reduced effort in the commercial rock lobster fishery were experienced in many ports in Tasmania. For reason of bioeconomic sustainability, fewer rock lobster needed to be taken, meaning reduced gross fleet effort, product, income, number of boats, employment, infrastructure, processors and so on. Few ports escaped these effects – which were, as noted, dampenings rather than collapses – but some ports experienced them more than others. Next, geographic groupings of ports in the Tasmanian commercial rock lobster fishery are discussed.

7.3.7.3 The experiences of ports under quota management

It is difficult areally to classify ports in the Tasmanian commercial rock lobster fishery according to effects of quota management. It can be difficult, also, to ascertain which is a boat’s ‘home’ port given the Tasmania-wide nature of some operations. There are, however, differences between the experiences of ports.

Interview data indicated a tendency for boats to fish closer to home ports. If a line is drawn separating eastern from western ports through West Head at the mouth of the Tamar River and South East Cape, the majority of ports are in the more sheltered eastern half of Tasmania (Table 31).

Table 31. Number of ports in eastern and western Tasmania, and Victoria in the 1997/98 pre-quota year

	No. ports	Per cent
Eastern Tas.	31	60.7
Western Tas.	13	25.4
Victoria	7	13.7
Totals	44	99.8

NB: 'Port' meaning any officially recorded unloading point; figures are approximate
Source: DPIWE

Assessing impacts of quota management on the geography of ports in the commercial rock lobster fishery begins with this 1997/98 pattern, i.e. with the majority of ports in the eastern half of Tasmania. There is therefore more choice of unloading point in eastern compared with western Tasmania, perhaps spreading unloadings in the east more than in the west. If every boat that unloaded rock lobster in a port is given the same value, one, regardless of number of times unloaded or number of ports in which unloaded, then when number of boats through each port is summed it can be seen that the majority of boats unloaded their catch through ports in the eastern half of Tasmania in the 1997/98 pre-quota year (Table 32).

Table 32. Number of boats unloading in each port in eastern and western Tasmania, and Victoria in the 1997/98 pre-quota year

	Boats-through-ports	Per cent
Eastern Tas.	509	68.4
Western Tas.	206	27.6
Victoria	29	3.8
Totals	744	99.8

NB: Figures are approximate
Source: DPIWE

The largest difference between percentages for number of ports (Table 31) and number of boats unloading in each port (Table 32) is for Victoria. In Victoria, Portland dominated boats-through-ports figures, number of landings and kilograms of rock lobster unloaded in 1997/98; the six other ports were used, but little in comparison. Thus, seven Victorian ports had a low total boats-through-ports figure relative to other areas due to there being only one major port in the group. As noted, boats landing rock lobster in more than one port are counted in more than one port, and boats landing rock lobster are given the same value in a port regardless of how many times they unloaded in that port in a fishing year.

The ports and boats-through-ports percentages for western Tasmania in 1997/98 were approximately equivalent, while eastern Tasmania had a higher boats-through-ports percentage than for ports, indicating a preference by operators for more numerous

eastern ports. Total number of landings in 1997/98, however, reveals a variation of this pattern. As a percentage of the total, landings in western Tasmania were higher than percentages of both ports and boats-through-ports in the region (Table 33).

Table 33. Landings in the 1997/98 pre-quota year

	Landings	Per cent
Eastern Tas.	2713	63.5
Western Tas.	1457	34.1
Victoria	99	2.3
Totals	4269	99.8

NB: Figures are approximate
Source: DPIWE

An even higher percentage is recorded for kilograms of rock lobster unloaded in western Tasmania (Table 34).

Table 34. Kilograms of rock lobster unloaded in the 1997/98 pre-quota year

	Kilograms	Per cent
Eastern Tas.	954533	57.3
Western Tas.	622811	37.4
Victoria	87215	5.2
Totals	1664559	99.9

NB: Figures are approximate
Source: DPIWE

Thus, approximately one-quarter of ports used to unload rock lobster in 1997/98 were in western Tasmania, while the region accounted for 27.6 per cent of total boats-through-ports, 34.1 per cent of total number of landings, and 37.4 per cent of total kilograms unloaded. The percentages for number of landings and kilograms unloaded in eastern Tasmania, on the other hand, were lower than for the percentage of boats-through-ports. The starting point, therefore, for assessing impacts of quota management on the geography of ports in the Tasmanian commercial rock lobster fishery is one at which ports and boats appear generally to favour eastern Tasmania, but number of landings and kilograms unloaded are apparently greater in western Tasmania.

This broad 1997/98 pre-quota year pattern needs to be fine-scaled to understand differences between ports and operations underlying this general pattern, as well as to assess impacts of quota management at the scale of individual ports. For example, data from the 1997/98 pre-quota year show that the port of Strahan on the west coast of Tasmania had more kilograms unloaded than any other port associated with the fishery. By the 2000/2001 quota year, in the context of reduced landings in most ports due to catch reduction under quota management, Strahan had slipped three places in the ranking of ports by landed catch (Table 35).

Table 35. Kilograms of rock lobster landed in Strahan in the 2000/2001 quota year

	Kilograms	% of total catch	% change since 1997/98	Chg rank 1997-2000
Strahan	115380	7.7	-39.6	-3

NB: Figures are approximate
Source: DPIWE

There is therefore a story to be told regarding the experience under quota management of the port of Strahan, as well as of a number of other ports in the fishery. These experiences are not always appreciable at the scale of the east/west division discussed above. Though this division is not without its uses, it cannot be expected to reveal much of the finer-grained detail associated with the experiences of individual ports under quota management.

As noted, background to port-scale impact assessment is reduced fishing effort and catch due to the introduction of quota management. Depending at which scale this reduction is considered it can appear to have occurred ‘across the board’, i.e. for ports to have shared in reduced activity approximately equally. This is ostensibly the case according to the pattern produced by the macro east/west division. In terms of percentages, the macro-scale division of the fishery east/west reveals little difference between 1997/98 and 2000/2001 (Table 36).

Adjustment to an official approximately ten per cent reduction in catch appears largely to have been spread evenly across the fishery at this scale. According to these figures, ports in western Tasmania are indicated to have fared slightly better under quota management than those in eastern Tasmania; and ports in Victoria appear to have fared worst. The case of Strahan cited above, however, suggests that a more micro focus is required to appreciate that adjustment has not been as even as shown at the macro east/west scale, both for reasons of differences between the experiences of ports and the somewhat arbitrary boundary drawn between east and west.

Put simply, important differences in the fishery operate at a scale smaller than a macro east/west division. Some of these differences can begin to be appreciated by fine-scaling ports involved in the fishery into eleven regions (Table 37).

The reason for analysing ports by region, as well as individually below, is that some regions include a cluster of ports that local fishers move between, for example the Channel region, while other regions have less choice regarding where to unload. It can therefore be useful to consider the Channel as a region as well as individually to analyse the experience of ports within it.

The analysis recognises a difference between a bona fide port and an unloading point. A bona fide port usually has associated wharf facilities, a slipway, a marine engineer, a ship chandler and so on, as well as a ‘home’ fleet of five or more boats, and is contiguous with a local settlement with general stores, a school, and other community infrastructure. A designated unloading point is simply a convenient location for rock lobster to be brought ashore and has few of the facilities associated with bona fide ports. An official unloading point, for example, may be close to where a fisher or a number of fishers have residences. Note, too, that when both ports and unloading points are referred to, the term ‘ports’ is used, as in boats-through-ports.

Table 36. Percentages of ports, boats-through-ports, number of landings and kilograms unloaded according to an east/west/Victoria division of the fishery for the 1997/98 pre-quota and 2000/2001 quota years

	Ports	BTP*	Landings	Kilograms
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	1997	2000	1997	2000	1997	2000	1997	2000
West	25.4	27.2	27.6	29.2	34.1	38.4	37.4	39.2
Vic.	13.7	11.3	3.8	2.5	2.3	1.5	5.2	4.7
East	60.7	61.3	68.4	68.1	63.5	60.0	57.3	56.0
Totals	99.8	99.8	99.8	99.8	99.8	99.9	99.9	99.9

* Boats-through-ports

NB: 'Port' meaning an officially designated unloading point used by an operator; figures are approximate

Source: DPIWE

Table 37. Ports and unloading points associated with the Tasmanian commercial rock lobster fishery by region

Regions	Ports	Unloading Points
Channel	Hobart, Kettering, Margate	Woodbridge
Far South	Dover	Cygnets, Recherche Bay, Southport
Flinders Island	Lady Barron	Killiecrankie, North East River, Palana
King Island	Currie	Grassy
Mid East	Bicheno, St Helens,	Binalong Bay, Coles Bay
Mid North		Beauty Point, Bridport, George Town
NNW	Stanley	Smithton, Wynyard
Tasman Peninsula		Dunalley, Eaglehawk Neck, Nubeena, Port
Victoria	Apollo Bay, Port Welshpool, Portland, Queenscliff, San	
West	Strahan	Granville Harbour
WNW		Bluff Hill Point, Couta Rocks, Nelson Bay,

Source: DPIWE

Categorising a rock lobster landing place as either a port or an unloading point can be difficult, but regions such as the Mid East and the Channel are well served with ports, while regions such as the WNW and the West have few bona fide ports. This pattern is partly topographic and population oriented. Fewer safe anchorages and population centres exist on the west coast of Tasmania compared with the more sheltered east coast. Rock lobster stocks, however, have arguably been less heavily fished and are more abundant off the west than the east coast of Tasmania. Thus, where boats are unloading – something of a proxy for a number of boats' 'home' port and where visiting boats are generally fishing – indicates a twofold tale of stocks and ports.

Before discussing boats-through-ports by the ten Tasmanian regions, however, it is reiterated that fishing off the east coast of Tasmania has improved since the introduction of quota management, particularly in the north-east, due to the growing into legal size of a major pre-quota management puerulus settlement. Fleet dynamics may well alter if stocks off the east coast produce lower catches. It is also noted that the presence of five ports in Victoria underline the somewhat special case that is participation in the Tasmanian commercial rock lobster fishery by operators based in Victoria. The Victorian 'region' of the industry is therefore discussed next before considering boats-through-ports by Tasmanian regions.

7.3.7.4 The Victorian 'region'

To begin with, Victorian ports associated with the Tasmanian commercial rock lobster industry are outside the areal jurisdiction of the fishery. Neither were unloading points visited during research, unlike Tasmanian ports. Interviews with industry participants based in Victorian ports were, for the most part, conducted by telephone.

In the 1997/98 pre-quota year, the Victorian region was dominated by Portland (Table 38).

Data regarding kilograms unloaded cannot be provided at individual port level for reason of confidentiality. Nearly half the boats-through-ports in the Victorian region, two-thirds of total landings and 86 per cent of the region's kilograms unloaded were in Portland in the 1997/98 pre-quota year. By the 2000/2001 quota year, Portland's dominance of the region had declined somewhat. It was, however, still the major port through which over 60 per cent of rock lobster was unloaded in the region.

Table 38. Victorian region by port, 1997/98 and 2000/2001

	Boats-through-port			Landings			Kilograms		
	1997	2000	%Ch	1997	2000	%Chg	1997	2000	%Chg
Apollo Bay	4	2	-50.0	7	4	-42.9			-29.0
Port Welshpool	3	3	0.0	10	14	40.0			186.1
Portland	11	4	-63.6	52	22	-57.7			-37.7
Queenscliffe	2	3	50.0	3	13	333.3			506.6
San Remo	3	3	0.0	6	5	-16.7			-27.4
Region Total	23	15	-34.8	78	58	-25.6	81687	71066	-13.0
All Ports	744	588	-21.0	4269	3700	-13.3	1664559	1489507	-10.5

NB: Figures are approximate

Source: DPIWE

Care needs to be taken in assessing trends regarding individual ports in the Victorian region due to the small number of boats involved but, overall, the region had nearly 35 per cent fewer boats-through-ports, over one-quarter fewer total landings and 13 per cent fewer kilograms unloaded in 2000/2001 compared with 1997/98. Given the small number of boats involved, the fortunes of individual Tasmanian commercial rock lobster fishery port-fleets rest on the experiences and decisions of only a few operators. There is less than a handful of boats involved in the Tasmanian commercial rock lobster fishery in each port associated with the fishery in the Victorian region. In other words, there is not a substantial local Tasmanian commercial rock lobster fishery fleet in any port in the Victorian region. Moreover, what boats were involved in the Tasmanian commercial rock lobster fishery were small in number compared with other boats in Victorian ports. Even in Portland, the fortunes of local operators were insignificant at the scales of the larger local fishing fleet and population centre. The type of rock lobster fishing predominantly done by operators from Portland was in big boats working the offshore overnight fishery off the north-west and west coasts of Tasmania. Estimates by interview participants were that, prior to quota management, seven-to-eight such boats worked out of Portland in the Tasmanian commercial rock lobster fishery. By time of interviews in 2000, only two-to-three boats remained operating in the Tasmanian commercial rock lobster fishery. These operators ran

newer fuel efficient big boats relative to others in the fishery. They traded off the large distances travelled in their fishing against cheaper prices to purchase diesel and bait, for example, and higher beach prices available on mainland Australia through Portland. In preference to leasing in quota units, they supplemented their allocation by participating in the Tasmanian giant crab fishery. Tasmanian-based boats in the Tasmanian commercial rock lobster fishery rarely visited Portland.

The introduction of quota management resulted in approximately five big boats based in Portland leaving the Tasmanian commercial rock lobster fishery. Their departure was noted not just through interviewing some of these, as well as those fishers remaining in the industry in Portland, but by participants in other places, principally King Island, where these boats had called, as well as those who operated where these boats had primarily fished. Those operators remaining in Portland stated that competition for an abundant resource in the offshore overnight fishery off the west coast had declined considerably under quota management.

The impact of quota management in the population centre of Portland was not significant. Portland has a population of approximately 12,000 people, an aluminium smelter, facilities for exporting wool and grain through the only deep sea port between Adelaide and Port Phillip, a fertilizer manufacturer and so on. Portland also has other fishing activity in rock lobster in western zone Victoria, as well as boats participating in shark, abalone and deep sea trawl fisheries. Thus, though the effect of quota management on the Portland-based Tasmanian commercial rock lobster fleet was dramatic at the scale of that fleet and noticeable in the fishery, the impact on Portland itself was negligible.

7.3.7.5 Boats-through-ports by Tasmanian regions

Boats-through-ports fell in all but two regions between the 1997/98 pre-quota year and the 2000/2001 quota year (Table 39).

Context for the above regions is provided by a 21 per cent drop in boats-through-ports across all ports between the 1997/98 pre-quota year and the 2000/2001 quota year. Apart from the Tasman Peninsula and the WNW, no significant changes in rank were experienced between 1997/98 and 2000/2001. Boats-through-ports in these areas were partly attributable to the accessibility of the Tasman Peninsula, and a tendency in the WNW for 'home' boats to unload locally more under quota management. The single-figure percentage drop for the NNW is mainly due to boats being attracted to the processor in Stanley.

Table 39. Highest to lowest ranked regions by boats-through-ports for the 2000/2001 quota year

	BTP# 2000/2001	%	% Change 1997	Rank Change
Channel	123	20.9	-21.7	0
Mid East	109	18.5	-21.6	0
Far South	80	13.6	-22.3	0
King Island	61	10.3	-11.6	0
NNW	59	10.0	-6.3	0

Tas. Peninsula	42	7.1	0.0	+2
West	34	5.7	-44.3	-1
Flinders Island	32	5.4	-25.6	-1
WNW	16	2.7	45.5	+2
Victoria	15	2.5	-34.8	-1
Mid North	10	1.7	-16.7	-1
All ports*	588	98.4	-21.0	

Boats-through-port

* Totals for all ports. These totals would disagree with subtotals, if they were calculated for the above table, as 15 minor ports and unloading points were not recorded in both 1997/98 and 2000/2001 and were therefore omitted from the above comparison.

NB: Figures are approximate

Source: DPIWE

The top three regions for boats-through-ports were the Channel, the Mid East and the Far South, all arguably in the eastern half of Tasmania. The influence of Tasmania's capital city, Hobart, is evident in the south-east. Under quota management, an increasing number of entitlement holders do not fish and an increasing number of operators are fishing less. Participants not fishing as well as time not fishing therefore are becoming more important in the industry. Both non-fishing industry participants and industry participants fishing less prefer to spend less time in isolated fishing ports in western Tasmania than in ports in eastern Tasmania, especially Hobart which is arguably Tasmania's most cosmopolitan and best serviced population centre. If ports and unloading points from Triabunna to Recherche Bay are included in the area of greater Hobart, 46.4 per cent of boats-through-ports were in this area. As noted, the largest group of entitlement holders reside in greater Hobart, and the area includes seven ports, six unloading points, multiple slipping facilities, marine engineers, ship chandlers and so on, as well as a plethora of general provedores and the full range of community infrastructure associated with a capital city, quality schooling being particularly important to a number of interview participants. Moreover, local fishing grounds off the south-east coast as well as grounds off the east and especially the south and south-west coasts are close to greater Hobart. Rock lobster reputedly grow more slowly and are smaller in colder southern waters but, particularly in the new shellers period in November, are usually catchable in large quantities. Approximately one-quarter of the TACC was taken off the south and south-west coasts of Tasmania in the 1998/99 quota year (Gardner, 1999).

The Mid East includes the largest port in terms of commercial rock lobster industry activity on the east coast of Tasmania, St Helens. Indeed, more rock lobster were unloaded in St Helens in 2000/2001 than in any other port associated with the fishery. Once across its bar-way, St Helens provides safe anchorage and ample facilities for a large fleet of commercial rock lobster boats. The weather and sea conditions off St Helens are amongst the most clement in Tasmania and make possible more days at sea than in many other regions of the fishery. St Helens therefore attracts both 'home' and visiting boats which use it as a base to access fishing grounds off much of the north-east of Tasmania. Approximately nine per cent of the TACC was taken in the Mid East region of the fishery in the 1998/99 quota year (Gardner, 1999). Catch rates in the Mid East, however, are among the lowest in the fishery (Gardner *et al.*, 2001), and little volume fishing is possible. Thus, local operation in the region is suited to day fishing, with perhaps more day fishing being done out of Bicheno than any other port in

Tasmania.

Like the top three regions in terms of boats-through-ports, King Island did not change its ranking between the pre-quota year of 1997/98 and the quota year of 2000/2001. Unlike the Channel, the Mid East and the Far South, however, reduction in boats-through-ports for King Island was only approximately half that of the total for all ports. In other words, the top three regions experienced reductions in boats-through-ports approximate to that for all ports, but King Island fared somewhat better than this 21 per cent reduction. Without going into detail here, 'home' boats on King Island are generally based in the port of Currie which has a wide range of marine and general services and goods, while visiting boats frequent Grassy which offers good unloading but few marine and general facilities. Both number of 'home' and number of visiting boats in Currie have fallen under quota management, though number of 'home' boats was said in interviews to have declined less than number of visiting boats. In Grassy, however, number of visiting boats, according to unloadings, has increased. Many of these visiting boats are attracted by the higher beach prices available on King Island. Rock lobster in northern Tasmanian waters grow faster and larger than off southern Tasmania and more 'premium' size and quality approximately 1.5 kilogram red rock lobster are available to be caught in the King Island region as a result. Over 20 per cent of the TACC was taken from grounds off the north-west coast of Tasmania in the 1998/99 quota year (Gardner, 1999). These rock lobster are preferred by, particularly, the Chinese market for live 'banquet fish', and higher beach prices are therefore often paid for them. Rock lobster are purchased by agents of Melbourne-based processors who fly rock lobster live to Melbourne for tanking awaiting export. Few visiting boats, however, reprovision on King Island as most goods and services are cheaper elsewhere. Consequently, the unloading port of Grassy is all that is required by many visiting boats, and is also often closer than Currie to where visiting boats have been fishing off the north-west coast of Tasmania. Thus, the north-west is a fishing location favoured by many operators focusing on catching quality rock lobster under quota management. However, with more time between trips for many operators due to catch reduction, King Island is used by many visiting boats to unload rock lobster only, reprovisioning, repair and so on being undertaken as part of longer home and family port breaks between fishing trips.

The first region slipping a place in rankings by boats-through-ports between 1997/98 and 2000/2001 is the West. It is also the region which experienced the greatest percentage drop in boats-through-ports. The West region consistently has the highest catch rates in the fishery (Gardner *et al.*, 2001). Approximately 24 per cent of the TACC was caught in the West region in the 1998/99 quota year (Gardner, 1999). Only 7.8 per cent of the TACC, however, was unloaded in Strahan in the 2000/2001 quota year. Figures for the West are almost entirely made up by Strahan. From interviews in 2000, the number of operators based in Strahan was approximately the same as in 1997/98 when participants in the industry were interviewed as part of Williamson *et al.* (1998), i.e. just under double figures. The decrease in boats-through-port of 27 between 1997/98 and 2000/2001 in the West region therefore is predominantly made up of visiting boats no longer frequenting Strahan. Some former visiting boats have left the fishery, others no longer fish in the region, while others fish in the West but no longer reprovision and/or unload there. When effort and catch were unlimited, many boats from all regions volume fished abundant stocks off the west coast, compared with the east coast, for extended periods. This practice usually required unloading and

reprovisioning in Strahan. Considering boats-through-Strahan by boats unloading ten or more times, boats unloading between four and nine times, and boats unloading between one and three times, it can be seen that a lesser decline has been experienced in Strahan in the category of boats unloading between one and three times than for categories of boats with higher numbers of unloadings (Table 40).

Table 40. Absolute numbers and percentage change between 1997/98 and 2000/2001 for boats-through-port by number of unloadings for the top 15 ports (ports listed alphabetically)

	1-3 unloadings		4-9 unloadings		10- unloadings		All boats	
	Nos	% chg	Nos	% chg	Nos	% chg	Nos	% chg
Bicheno	10-2	-80.0	11-3	-72.7	11-16	45.5	32-21	-34.4
Currie	9-6	-33.3	14-7	-50.0	24-19	-20.8	47-32	-31.9
Dover	40-38	-5.0	18-6	-66.7	9-7	-22.2	67-51	-23.9
Grassy	7-15	114.3	11-9	-18.2	4-5	25.0	22-29	31.8
Hobart	24-13	-45.8	14-11	-21.4	2-1	-50.0	40-25	-37.5
Kettering	25-28	12.0	15-8	-46.7	3-2	-33.3	43-38	-11.6
Lady Barron	13-10	-23.1	8-2	-75.0	5-5	0.0	26-17	-34.6
Margate	34-18	-47.1	16-17	6.3	8-6	-25.0	58-41	-29.3
Portland	4-2	-50.0	7-1	-85.7	0-1	100.0	11-4	-63.6
Southport	24-19	-20.8	5-6	20.0	5-2	-60.0	34-27	-20.6
St Helens	16-17	6.3	20-14	-30.0	20-19	-5.0	56-50	-10.7
Stanley	19-22	15.8	24-18	-25.0	5-11	120.0	48-51	6.3
Strahan	25-17	-32.0	19-8	-57.9	15-8	-46.7	59-33	-44.1
Triabunna	7-14	100.0	17-2	-88.2	11-12	9.1	35-28	-20.0
Woodbridge	11-15	36.4	5-3	-40.0	0-1	100.0	16-19	18.8

NB: Some low absolute numbers; figures are approximate

Source: DPIWE

An interpretation of this pattern suggested by data from interviews is that many of the big boats that left the industry under quota management fished for much of the year out of Strahan, returning home to their families during season closures, for maintenance and so on. Put simply, most big boats, prior to effort and catch being limited by quota management, were likely to spend time volume fishing off the west coast, not just as a one or two unloadings trip but for an extended stint.

It is reasonable to assume that the eight boats unloading ten or more times in Strahan in the 2000/2001 quota year were operations based permanently in Strahan, i.e. were 'home' or local rather than visiting boats. Those boats no longer in this category for Strahan have either left the fishery or no longer visit Strahan, or fish in the region and visit Strahan less and therefore appear in categories for boats unloading less than ten times per quota year. The category of boats unloading between four and nine times per quota year also experienced a reduction in the 2000/2001 quota year compared with the 1997/98 pre-quota year, from 19 down to eight boats, a decline of 57.9 per cent. As noted, the category experiencing the lowest percentage decrease was for boats unloading between one and three times per year. It is in this category that boats unloading in Strahan were most prominent in the 2000/2001 quota year, being more than double the other two categories combined. It is reasonable to assume that all were visiting boats. It appears, therefore, from what occurred in Strahan between the 1997/98 pre-quota year and the 2000/2001 quota year that fewer boats were fishing off the west coast of Tasmania, that many boats fishing off the west coast were doing so

less, and that additional to a 'home' fleet of boats that was largely unchanged in number but was fishing and catching less under quota management, boats that visited Strahan had changed from extended stint to discrete trip fishing. In other words, instead of fishing off the west coast for a number of trips out of Strahan, requiring reprovisioning in Strahan, under quota management many visiting boats fishing in the region returned to 'home' ports elsewhere at the end of each fishing trip, regardless of whether or not rock lobster were unloaded in Strahan. One reason for this change in pattern is that for many operators fishing was less continuous under quota management. A TACC set at a level below total catch prior to quota management meant that fishers no longer raced each other as intensely for rock lobster. Reduced catch for many fishers meant that they did not spend as many days at sea and, conversely, that they spent more days at home. Many fishers preferred to spend more time between trips at home with their families. Discrete trips that started and ended in 'home' ports were therefore favoured over operating out of another port for an extended stint.

Thus, additional to boats no longer unloading in Strahan across all categories, boats in each category visiting Strahan to unload appear to shift one category to the left in Table 40. In short, boats operating out of Strahan for extended stints have largely disappeared under quota management. Remaining boats-through-Strahan are either local boats, many of which are fishing less, or visiting boats making only occasional trips to Strahan due to being catch reduced and/or fishing closer to 'home' ports elsewhere in the interest of cost minimisation. For example, prior to quota management much of the fleet on King Island would fish the new shellers period off the west coast, frequently unloading in Strahan. Under quota management, few boats in the King Island fleet fish in the West region, not just due to reasons of catch reduction and cost minimisation but for price maximisation. Fishing in the West region was attractive to visiting boats because of the quantity of rock lobster available to be caught. The usually smaller rock lobster, however, often taken from deep water grounds, were for the most part neither premium size nor quality, in terms of either colour or ability to survive live transport in good condition. Some processors were wary of taking such rock lobster, especially in September when rock lobster could be soft-shelled, for which lower beach prices were often paid.

As noted, with catch limited under quota management, focus shifted in the fishery from higher expenditure volume fishing to cost minimisation and price maximisation centering around quality rock lobster. For King Island fishers, this new focus meant fishing closer to King Island where their inshore local knowledge was greatest, the quality of their often reduced total catch was likely to be higher, and beach prices were better. The same logic applied in many other regions of the fishery, though not often to the same extent as on King Island. For processors 'exporting' live rock lobster, quality was valued and local inshore hard-shelled red rock lobster weighing between one and two kilograms were those most sought. Fishers with good inshore local knowledge in the West region, predominantly based in Strahan, could catch loads containing sufficient proportions of such quality rock lobster to satisfy many processors. Visiting boats, however, were likely to be fishing more abundant but lower grade rock lobster on deeper grounds. This kind of fishing made less economic sense in a catch reduced environment and many operators therefore chose to fish locally more, increase quality and reduce costs rather than volume fish off the west coast.

Under quota management, reduced amount of rock lobster unloaded in Strahan,

additional to its often lower quality, made local processing unattractive. Neither were some processors prepared to drive to Strahan to pick up rock lobster. Closure of the local processing facility and a limited number of processors willing to pick up rock lobster in Strahan also made the port less attractive to visiting boats.

Trends in boats-through-ports in the Flinders Island region are, as in the West region, complex. The region has three unloading points and one port, Lady Barron. Lady Barron receives over half the boats-through-ports in the region. Approximately one-eighth of the TACC was caught in the Flinders Island region in 1998/99 (Gardner, 1999). Flinders Island has only a handful of owner-operators but a number of lessees and drivers that brings the total of 'home' boats in the region to just under ten. These boats are split between Lady Barron and Killiecrankie. Flinders Island is discussed in more detail below, but on the whole 'home' boats in the region fished less, caught less and owned less under quota management. This last reduction refers to change in 'ownership' status for a number of fishers on Flinders Island in the form of selling their entitlement and quota units and then leasing or driving themselves back into the fishery. Owner-operators were not strongly represented in the Flinders Island region 'home' fleet prior to quota management, but by 2000/2001 numbered just two, there being more licence holders in the region leasing licences out or employing a driver than commercial rock lobster fishing full-time.

The major reduction in boats-through-ports between the 1997/98 pre-quota year and the 2000/2001 quota year was experienced in Lady Barron. Combinations of effort, catch and ownership status may have changed for a number of 'home' boats on Flinders Island, but most remained commercial rock lobster fishing in some capacity in 2000/2001. Thus, the number of boats unloading ten or more times in Lady Barron was unchanged between 1997/98 and 2000/2001 (Table 39). Like Strahan, the major reduction in boats-through-port for Lady Barron was in the category of boats unloading between four and nine times per year. Noting that across all ports in the fishery there was a 21 per cent reduction in boats-through-ports between 1997/98 and 2000/2001, the Flinders Island region experienced a reduction of 25.6 per cent in boats-through-ports and Lady Barron a reduction of 34.6 per cent, the bulk of which was in the category of boats unloading between four and nine times per year. Number of boats fishing for extended stints out of Lady Barron therefore appeared to have declined under quota management. Of visiting boats, it is those fishing in the region for extended stints that are most likely to reprovision and repair on Flinders Island. Interviews revealed that with improved fishing in the region from the 1999/2000 quota year, Flinders Island was attracting more visiting boats than prior to quota management. (Sizeable puerulus settlement in the Flinders Island region in the mid-1990s has been noted above as contributing to improved fishing under quota management [Gardner *et al.* 2001].) Some visiting boats were attracted by reports that rock lobster were 'running' in the north-east, while some were developing experience and catch history in the region in anticipation of a possible move to zoning the fishery according to past areal fishing patterns. The point here, however, is that many of these boats neither unloaded nor reprovisioned on Flinders Island, preferring to visit the area on trips from other ports that offered a greater range of services and goods and often higher beach prices, such as St Helens. Thus, the surrogate of boats-through-ports by number of unloadings does not include those boats that may fish in an area but not unload there. Reports of an increase in the number of commercial rock lobster fishing boats frequenting fishing grounds around Babel Island off the east coast of Flinders Island at certain times of the

year, therefore, do not translate into an increase in boats-through-Lady Barron. Unloadings, then, need to be treated with caution as a proxy for port activity, and even more so regarding fishing activity, as they provide only a partial signal.

Interviews revealed commercial rock lobster fishing not recorded by unloadings in the region occurring around Flinders Island. As noted, catch reduced fishing under quota management made quality rock lobster a greater consideration, and these were abundant in the north-east relative to other areas off the east coast of Tasmania. Catch rates in the north-east, for example, were higher than elsewhere off the east coast (Gardner *et al.*, 2001). Some operators therefore were attracted to Flinders Island, but not to volume fish, thus making extended stints and multiple unloadings in the region less likely. With less fishing by many operators under quota management, more time was often taken between trips and many fishers wished to spend this in their 'home' port with their families, as well as for convenience regarding maintenance. Moreover, away from Babel Island, much of the rock lobster fishing around Flinders Island is strongly tide affected and not all visiting operators find such conditions suited to their kind of fishing. In combination, boats spending extended stints fishing out of 'away' ports such as Lady Barron and Strahan have declined in number under quota management. Put simply, under quota management there are fewer boats, more local fishing, and travelling boats are away for shorter periods of time and are tied up more than prior to quota management. For ports such as Lady Barron and Strahan, with decline in boats visiting for extended stints has gone unloading, furlough and reprovisioning activity that supplemented activity by their 'home' fleets.

In summary, fewer boats in the fleet and changed temporal and spatial fishing patterns under quota management have meant that visiting boats spending extended stints fishing out of 'isolated' ports such as Lady Barron, Strahan and Currie have declined in number. A number of those operators who preferred to volume fish in these ports' regions prior to quota management have left the fishery. Many remaining operators are fishing less and taking longer breaks in their 'home' ports between trips, and many operators are fishing locally more. Taken together, these trends mean that boats that operate away from their 'home' port for months at a time are fewer under quota management. Indeed, in the 2000/2001 quota year approximately 63 per cent of boats unloaded in ports in only one of the four coastal quarter regions of Tasmania, the north-west, north-east, south-west and south-east. Many of the boats continuing to travel to fish in other regions either do not unload there, for example regarding the Flinders Island region, or unload but do not reprovision there, such as in Grassy. And the fewer boats unloading 'away' do so less. One way to encourage more extended visiting boat stints out of ports such as Strahan and Currie, especially, would be to make available more rock lobster to be caught in these regions. The effervescence that many participants indicated had gone out of these ports, made flat by quota management, might then return in the forms of more rock lobster unloaded and increased local trade, additional to that of 'home' fleets, associated with reprovisioning and repair by boats again visiting 'away' ports as part of fishing in other regions for extended stints. There can be, however, no absolute guarantee that increased fishing in this way would generate more activity in particular local ports.

7.3.7.6 Landings by region

There was a 13.3 per cent reduction in number of landings for all ports between the

1997/98 pre-quota year and the quota year of 2000/2001. Major changes in ranking between 1997/98 and 2000/2001 were experienced by the West region, which had a 47.8 per cent reduction in landings, the NNW region, which had a 7.2 per cent reduction in landings, and the WNW region, which had a 217.6 per cent increase in landings (Table 41).

Table 41. Number of landings in the 2000/2001 quota year

	Landings 2000/2001	%	% Change 1997	Rank Change
Mid East	952	25.7	-11.4	0
King Island	600	16.2	-1.8	+1
Channel	481	13.0	-22.0	-1
NNW	320	8.6	-7.2	+3
Far South	289	7.8	-29.0	-1
WNW	289	7.8	217.6	+4
Tas. Peninsula	254	6.8	-3.0	+1
West	209	5.6	-47.8	-3
Flinders Island	193	5.2	-25.2	-1
Victoria	58	1.5	-25.6	+1
Mid North	37	1.0	-9.8	+1
All ports*	3700	99.2	-13.3	

* Totals for all ports. These totals would disagree with subtotals, if they were calculated for the above table, as 15 minor ports and unloading points were not recorded in both 1997/98 and 2000/2001 and were therefore omitted from the above comparison.

NB: Figures are approximate

Source: DPIWE

Discussing the West region first, as noted the port of Strahan dominates the region and experienced a decrease in boats-through-port between 1997/98 and 2000/2001 of 44.1 per cent. Not surprisingly, perhaps, number of landings in Strahan also declined, by 47.2 per cent. In the context of reduced effort, catch and number of boats in the fishery, fewer boats were fishing in the West region. Many boats visiting the region in the 2000/2001 quota year were doing so for discrete trips rather than for extended stints, and unloading rock lobster direct to processing facilities in Strahan was not possible. Strahan is discussed in more detail below.

The increase in ranking by the NNW region gives an indication of where some of Strahan's landings may have shifted to between 1997/98 and 2000/2001. The NNW region is dominated by the port of Stanley. Activity in the commercial rock lobster industry in Stanley centres around a single processor and a single fishing company. Both of these operations increased their participation in the industry between 1997/98 and 2000/2001.

Discussing the processing operation first, by 2000/2001 it had closed its facility in Strahan, was purchasing approximately 200 tonnes of rock lobster per quota year and had developed 'subleasing' arrangements between a number of fishers and quota owners. In these arrangements, 'up front' finance was provided by the processor to lease in quota units on behalf of a fisher who paid for these when rock lobster were sold, usually to the processor concerned. Consequently, though the processor was prepared to drive to pick up rock lobster, unloading activity by this processor increased in Stanley. With a number of operators fishing the north-west due to the abundance of

quality rock lobster to be caught in the region compared with some other regions of the fishery, Stanley was not inconveniently located for many fishers.

Second, the fishing company in Stanley began participating in the commercial rock lobster industry in earnest due to the temporary closure of the giant crab fishery. This closure approximately coincided with the introduction of quota management. By the 2000/2001 quota year, this diversified, multi-vessel fishing company included rock lobster as one of its staple catches. It processed its catch itself and unloadings in Stanley increased as a result of its increased rock lobster fishing and local processing. Taken together, increased activity in the commercial rock lobster industry by these two enterprises, i.e. the local processor and the local fishing company, caused boats-through-port to increase by 6.3 per cent and number of landings to increase by 14.6 per cent in Stanley between 1997/98 and 2000/2001. The other port in the region, Smithton, declined in boats-through-port and landings between 1997/98 and 2000/2001, from approximately 20 per cent of the region's total to approximately five per cent, and a number of boats no longer unloading in Smithton shifting to Stanley.

Increase in ranking by landings for the WNW region between 1997/98 and 2000/2001 is one of the clearest examples in the fishery of 'home' boats unloading locally more. The WNW region includes primarily planing hull reef and beach unloading points from Bluff Hill Point down to Temma. Under quota management, 'home' boats rarely fish out of the region. Most local operators abandoned volume fishing trips away from the region, instead day fishing locally 'full-time' for higher quality rock lobster. Many local operators were substantially catch reduced under quota management and therefore travelled less and single handed their boats to minimise costs. With quality inshore red rock lobster averaging around 1.5 kilograms as likely to be caught locally as elsewhere, there was little reason for local operators to venture far to catch their reduced allocation. Deeper water rock lobster fishing in the region was also good and mixed loads were possible. Further offshore in the region are some of the better deep water grounds in the fishery, though boats fishing these rarely come into contact with those fishing closer inshore and do not unload in the region.

Thus, landings increased in number in the WNW due to 'home' boats unloading locally more. Fishers may also unload their caufs more often as they are present to respond to more movements in price. Also, a number of visiting boats have been attracted to the region to fish at varying times, from Launceston as well as from greater Hobart, though by no means all unload in the WNW. Combined, these trends resulted in boats-through-ports in the region increasing by 45.5 per cent between 1997/98 and 2000/2001, and landings increasing by 217.6 per cent. The unloading points themselves consist of little more than beach and reef access to the open sea, backed by a number of 'shacks' in some of which a number of fishers reside semi-permanently. Most local fishers have family homes in Smithton or its surrounds. In other words, few port facilities, specialist tradespeople or general community infrastructure are available without travelling to Smithton, though specialist tradespeople can visit the unloading points.

7.3.7.7 Kilograms unloaded by region

Official catch was reduced in the fishery by approximately 10.5 per cent by the introduction of quota management. As noted, reduction in actual catch may have been

greater than this percentage when undeclared catch in 1997/98 is considered. There is no way, however, of ascertaining the amount of undeclared catch, though many in the industry consider that actual catch approached 2000 tonnes in 1997/98. For the purpose of providing context here, reduction in declared catch is sufficient. Bear in mind, however, that comparing declared catch under quota management with declared catch pre-quota management most likely includes substantial undeclared catch prior to quota management. Thus, as most participants agreed that undeclared catch was small under quota management compared with pre-quota management, actual reductions between 1997/98 and 2000/2001 may be greater, and increases less than indicated.

Having discussed landings, those regions faring well under quota management in terms of increasing unloaded catch are somewhat predictable. The WNW and the NNW increased their rankings according to catch between 1997/98 and 2000/2001 by three and two places respectively (Table 42).

Clearly, the Mid East region and the Channel region have fleets that consist of a large proportion of boats that fish in other regions but unload in 'home' ports in the Mid East and in the Channel. The WNW approached doubling catch unloaded, while the NNW increased catch unloaded by over one-quarter. In terms of where much of this catch is processed, an enterprise in Smithton and one in Stanley are the major buyers. The processor in Stanley is something of a magnet in its own right, due to the large tonnage purchased by it and its involvement in subleasing, and Stanley is little steaming time from some of the better grounds in the fishery. The NNW gives immediate access to such grounds, particularly inshore.

Regions slipping places in ranking by kilograms unloaded between 1997/98 and 2000/2001 were Flinders Island and the West region, which fell three and two places respectively. The West, predominantly Strahan, experienced a greater percentage reduction in kilograms unloaded, 40.4 per cent, than Flinders Island, 38.2 per cent. Lady Barron is the major port on Flinders Island. Lady Barron experienced a 43.6 per cent reduction in kilograms unloaded, while Strahan experienced a 39.6 per cent reduction in kilograms unloaded. In tonnes, Strahan's reduction was three times that of Lady Barron's. For both ports, 'home' boats were fishing and catching less under quota management, and fewer boats were visiting for extended stints of fishing, unloading and provisioning. Another way of perceiving this latter trend is that ports in which visiting boats made up a substantial component of commercial rock lobster industry activity prior to quota management fared worst under quota management. Next, the decline of 'away' ports under quota management is discussed in more detail.

Table 42. Kilograms of rock lobster unloaded for the 2000/2001 quota year

	Kilograms 2000/2001	%	% Change 1997	Rank Change
Mid East	304 837	20.4	-3.3	0
Channel	237 559	15.9	-13.9	0
King Island	222 593	14.9	-9.5	0
NNW	171 947	11.5	27.4	+2
Far South	153 316	10.2	-11.5	0
West	117 173	7.8	-40.4	-2
WNW	71 362	4.7	95.4	+3

Victoria	71 066	4.7	-13.0	0
Tas. Peninsula	58 716	3.9	-5.7	0
Flinders Island	56 918	3.8	-38.2	-3
Mid North	18 052	1.2	-10.6	0
All ports*	1489 507	99.0	-10.5	

* Totals for all ports. These totals would disagree with subtotals, if they were calculated for the above table, as 15 minor ports and unloading points were not recorded in both 1997/98 and 2000/2001 and were therefore omitted from the above comparison.

NB: Figures are approximate

Source: DPIWE

7.3.7.8 The decline of 'away' ports under quota management

Increased catch between 1997/98 and 2000/2001 in the only three *unloading points* in the top 15 ports by kilograms unloaded in 2000/2001, Southport, Woodbridge and Grassy, includes visiting boats that do not require goods and services available in a bona fide port in these unloading points' regions. (Only three *ports* increased catch unloaded between 1997/98 and 2000/2001, Stanley, St Helens and Bicheno.) (Tables 43 and 44)

Table 43. Kilograms of rock lobster unloaded in the top 16 ports, 1997/98

	Kilograms	Percentage of total catch
Strahan	191078	11.5
Currie	176245	10.6
St Helens	162102	9.7
Dover	127283	7.6
Stanley	114361	6.9
Margate	105120	6.3
Kettering	83240	5.0
Triabunna	74761	4.5
Portland	70295	4.2
Grassy	69829	4.2
Bicheno	65658	3.9
Lady Barron	61298	3.7
Hobart	57005	3.4
Southport	45454	2.7
Woodbridge	30569	1.8
Nubeena	29479	1.8
Totals	1463777	87.9

NB: Only ports with a boats-through-ports figure greater than nine were used for reason of confidentiality regarding operators; figures are approximate

Source: DPIWE

Table 44. Kilograms of rock lobster unloaded in the top 15 ports, 2000/2001

	Kilograms	% of total catch	% change since 1997/98	Rank 1997-2000
St Helens	170400	11.4	5.1	+2
Stanley	162831	10.9	42.4	+3
Currie	148319	10.0	-15.8	-1

Strahan	115380	7.7	-39.6	-3
Dover	107341	7.2	-15.7	-1
Margate	97616	6.6	-7.1	0
Grassy	74274	5.0	6.4	+3
Bicheno	67033	4.5	2.1	+3
Triabunna	62156	4.2	-16.9	-1
Kettering	59837	4.0	-28.1	-3
Southport	45734	3.1	0.6	+3
Hobart	42512	2.9	-25.4	0
Woodbridge	37594	2.5	23.0	+1
Lady Barron	34552	2.3	-43.6	-3
Totals	1225579	82.2		

NB: Only ports with a boats-through-ports figure greater than nine were used for reason of confidentiality regarding operators, thus accounting for the blank row in the above table; figures are approximate

Source: DPIWE

This trend requires some explication. Note, however, that care needs to be exercised due to two fishing years only being compared as well as due to low absolute numbers of boats being considered in some ports. Low absolute numbers of boats combined with a range in kilograms unloaded per boat from approximately two to twenty tonnes mean that change by a single large operator can have a major statistical effect. For this reason, aggregate figures for the top 15 ports will be discussed regarding boats-through-ports. The issue of only two fishing years being compared is, on the one hand, relevant in that situations can easily be changed at the scale of a port and within one year by developments unrelated to quota management. Moreover, as noted, change in behaviour by a large operator can statistically turn the fortunes of some ports. A recent example is the wharf at Southport which was declared unfit for heavy loads during the 2001/2002 quota year. This will most likely affect the figures for boats-through-port, number of landings and catch unloaded not just for Southport but also for Dover, the next closest port to south coast fishing grounds. Consideration of data for the ten years between and including 1991/92 and 2000/2001 would help separate changes coinciding with the introduction of quota management from those before and after the first quota management year in 1998/99. Hampering this task were data compatibility difficulties, limited resources and the realisation that many effects were not restricted to the first quota management year. Lead-in anticipation effects as well as long-run *ex post* adjustments were both noted during interviews. In many cases, impacts of the introduction of quota management were not specific just to 1998/99. Given that limited resources meant that only a before and an after fishing year were analysed in detail, the third quota management fishing year was chosen to compare with the final pre-quota management fishing year as it overlapped with interviews and contained more long-term adjustments than previous quota management fishing years. Ideally, however, a detailed ten year analysis would have been undertaken, though the resources required and the resulting report would most likely have been considerably larger than for this project.

Thus, not just any two years are being compared. As noted, 1997/98 is the final pre-quota fishing year, while 2000/2001 is the third fishing year under quota management, sufficient time for much adjustment to be substantially in process and apparent. In other words, a before and after social impact assessment of the introduction of quota

management is being conducted, and the two fishing years used coincide with interviews with industry participants concerning this change. Longer-term background trends in effort, catch, number of boats and so on can be found in recent fishery assessment reports. As noted, however, many small scale differences between 1997/98 and 2000/2001 may not be attributable to quota management, though effects can be direct as well as indirect and are not always easy to ascribe. For example, to what extent might an approximately 20 per cent reduction in boats-through-Southport between 1997/98 and 2000/2001 bear on MAST's deliberations regarding whether to renovate the Southport wharf?

To obviate possible interference by individual events or operators with local quota management effects, therefore, aggregation of figures for the top 15 ports is undertaken below. First, however, comment is briefly made on each of the six top 15 ports that increased kilograms unloaded between 1997/98 and 2000/2001, Bicheno, Grassy, Southport, Stanley, St Helens and Woodbridge. The ports involved, as distinct from unloading points, in order of highest to lowest percentage increase in kilograms unloaded, were Stanley, St Helens and Bicheno. As noted, commercial rock lobster industry activity in Stanley has been boosted by increased participation by the processor and the fishing company based in Stanley. St Helens had only approximately 10 per cent fewer boats-through-port in 2000/2001 compared with 1997/98, and a number of high catching itinerant boats prior to quota management unloaded more often in St Helens under quota management, thus increasing catch unloaded in the port. Boats-through-Bicheno fell by 34.3 per cent between 1997/98 and 2000/2001. Boats-through-port lost, however, all unloaded between one and nine times per fishing year. Boats-through-Bicheno unloading ten or more times increased from eleven to 16 boats. Number of landings and kilograms unloaded therefore increased in Bicheno, by 14 per cent and just over two per cent respectively. Bicheno is one of the prime examples in the fishery of boats operating out of their 'home' port more, fishing 'away' less and, when fishing away, doing so as a discrete trip that may involve unloading in another port but not reprovisioning and so on, extended stints out of away ports being less common under quota management. Boats returning 'home' from an 'away' trip often fished their way 'home', thus arriving 'home' with a load of rock lobster.

As noted, in all three unloading points in the top 15 ports the number of kilograms unloaded increased between 1997/98 and 2000/2001. The highest increase was in Woodbridge. Woodbridge is something of a halfway unloading point between processors in the Channel region and boats fishing off the south coast. Moreover, Woodbridge was a favoured unloading point for many boats in recent summers due to these being unusually warm. More precisely, water temperatures in the Channel and the Derwent River rose sufficiently in summer possibly to stress loads of live rock lobster. Many boats returning to 'home' ports in the Channel region in summer therefore preferred to unload in Woodbridge before encountering warmer water or exposing live rock lobster to warmer water for long periods. Unloadings in Woodbridge by month appear to confirm this pattern in that three-quarters of total kilograms in the 1999/2000 quota year were unloaded in the summer months of November to February (DPIWE), compared with just over half of the TACC being unloaded in these months for the entire fishery (Gardner *et al.*, 2001). It is reasonable to assume that more boats unloading in Woodbridge were based in 'home' ports in the Channel region as visiting boats fishing off the south coast were as likely to unload in Southport as to travel up to Woodbridge. Moreover, required specification of actual

unloading point under quota management meant that Woodbridge was being identified particularly in every instance, whereas prior to quota management general reference to any port in the Channel region, especially the closest port of Kettering, sufficed for purpose of recording requirements.

Many of the factors discussed for Woodbridge do not apply strongly in either Grassy or Southport. Loose specification of unloading point prior to quota management may apply in Grassy and Southport, and avoiding warmer water up the Channel by unloading in Southport may occur, but arguably not to the same extent as in Woodbridge. A factor that may influence unloadings in Grassy is that boats leaving Tasmanian for Victorian waters are, under quota management, first required to report at an unloading point in Tasmania. Boats returning to Victoria did so via King Island at times, and some took the opportunity to unload there. However, given that many Victorian boats return to their 'home' port with a load of rock lobster to sell at an often higher beach price than available in Tasmania, unloading in Grassy en route 'home' was not common practice.

Specificities apply in each of the top 15 ports. Aggregate boats-through-ports for the top 15 ports, however, reveals a clear trend. As noted, boats-through-ports fell for all ports by 156 or 21 per cent between 1997/98 and 2000/2001. Boats-through-ports for the top 15 ports fell by 128 or 21.5 per cent, 82 per cent of the decrease in boats-through-ports for all ports. For the top 15 ports, boats-through-ports declined in the boats unloading between one and three times category by 32 or 11.9 per cent. Boats-through-ports decreased in the boats unloading ten times or more category by seven or 5.7 per cent. In the boats unloading between four and nine times category, however, boats-through-ports for the top 15 ports by kilograms unloaded fell by 89 or 43.6 per cent between 1997/98 and 2000/2001. In other words, of total fewer boats-through-ports for the top 15 ports, nearly 70 per cent were in the category of boats unloading between four and nine times; or, the percentage of boats-through-ports in this category declined by nearly ten per cent between 1997/98 and 2000/2001 from 34.2 per cent to 24.6 per cent. Noting that there are fewer boats in the fleet, greater percentages are fishing out of the one 'home' port, as represented by the category of boats unloading in a port ten or more times, and/or visiting 'away' ports for discrete trips, represented by the category of boats unloading in a port between one and three times. These trends, as well as decline in boats fishing for extended stints out of 'away' ports under quota management, can perhaps be better appreciated through the example of a particular port. Next, therefore, trends in boats-through-Strahan between 1997/98 and 2000/2001 are examined in detail.

7.3.7.9 Individual boats-through-Strahan

In this subsection, individual boats-through-Strahan are discussed to illuminate circumstances surrounding the fact that nearly 70 per cent of the reduction in boats-through-the top 15 ports between 1997/98 and 2000/2001 was in the category of boats unloading between four and nine times. As the port perhaps most significantly affected by the introduction of quota management, Strahan has some answers to what operational behaviour this fact might represent.

The first point to note is that when all ports are considered, not just the top 15, 82 per cent of the total reduction in boats-through-ports between 1997/98 and 2000/2001 was

in the category of boats unloading between four and nine times (Table 45).

Table 45. Reduction in boats-through-ports for Strahan and for all ports by categories of unloadings, 1997/98 and 2000/2001

	Strahan		All Ports	
	No.	%	No.	%
1-3	-8	30.7	-27	17.3
4-9	-11	42.3	-128	82.0
10-	-7	26.9	-1	0.6
Totals	-26	99.9	-156	99.9

NB: Figures are approximate
Source: DPIWE

Thus, trends noted above apply *a fortiori* across all ports. Boats-through-ports for all ports fell by 156 or 20.9 per cent between 1997/98 and 2000/2001. A decrease in boats-through-ports for all ports of approximately one-fifth is not surprising given that number of boats in the fishery fell by approximately one-quarter. The difference between these two declines suggests that less 'away' fishing is being done under quota management.

Boats-through-ports for all ports decreased by 17.3 per cent in the category of boats unloading between one and three times. Boats-through-ports for all ports decreased by 82 per cent in the category of boats unloading between four and nine times. Boats-through-ports in the category of boats unloading ten or more times fell by only 0.6 per cent between 1997/98 and 2000/2001. The question to be addressed therefore is not just composed of why so much of the decline in boats-through-ports was in the category of boats unloading between four and nine times, but why so little was in the category of boats unloading ten or more times.

Strahan's reduction in boats-through-ports of 26 or 44.1 per cent between 1997/98 and 2000/2001 provides some answers to both parts of this question. The first point to note is that reduction in boats-through-ports has not been spread evenly among categories, just as it has not been spread evenly among ports (Table 46).

Table 46. Absolute numbers and percentage change 1997/98 and 2000/2001 for boats-through-ports by categories of unloadings for Strahan and for all ports

	1-3 Unloadings		4-9 Unloadings		10- Unloadings		All boats	
	Nos	%	Nos	%	Nos	%	Nos	%
Strahan	25-17	-32.0	19-8	-57.9	15-8	-46.7	59-33	-44.1
All Ports	336-309	-8.0	263-135	-48.6	145-144	-0.6	744-588	-20.9

NB: Figures are approximate
Source: DPIWE

In an homogenous fishery it could be expected that the one-fifth reduction in boats-

through-ports be experienced equally in all ports and across all categories. This has not occurred. In Strahan, for example, a greater than 20 per cent decrease in boats-through-port was experienced in all categories between 1997/98 and 2000/2001, the largest being 57.9 per cent in the category of boats unloading between four and nine times per fishing year.

That boats-through-Strahan in the boats unloading ten or more times category fell by 46.7 per cent suggests three principal possibilities: first, that boats-through-Strahan fished less under quota management; second, that boats unloading in Strahan in 1997/98 unloaded elsewhere in 2000/2001; and, third, that some boats unloading in Strahan in 1997/98 had left the fishery. A boat-by-boat breakdown of boats-through-Strahan in 1997/98 and 2000/2001 lends weight to each of these three possibilities (see Tables 46 and 50 below). Conversely, trends in boats-through-ports for a number of east coast ports reveal increases or only small decreases in boats unloading ten or more times per fishing year. Given that the fleet declined in number fishery-wide by approximately 75 boats between 1997/98 and 2000/2001, shifts in activity associated with boats are clearly occurring between ports. Shifts between Strahan and other ports in the fishery between 1997/98 and 2000/2001 indicate some of the main trends in the fishery and are discussed next.

It is reiterated that there exists a number of difficulties with data relating to boats-through-ports, landings and catch unloaded in 1997/98 and 2000/2001. First, comparing 1997/98 with 2000/2001 raises compatibility issues regarding specification of landing place and different recording requirements and systems. Second, boats are different units from fishers, the latter being able to change boats, employ drivers and so on. Third, unloading is one form of behaviour only and may not be related to area fished.

These data are the best available. Their use, however, needs to bear the above difficulties in mind. As noted, there were 59 boats-through-Strahan in the pre-quota year 1997/98 (Table 47).

Table 47. Individual boats-through-Strahan in 1997/98 and those same boats in 2000/2001

Strahan unloads 1997/98	'Home' port 1997/98	Main Strahan 'away' port 1997/98 & no. unloads	'Home' port 2000/2001	Strahan unloads 2000/2001
23	Strahan		Dover	
22	Strahan		Left fishery	
22	Strahan		Strahan	10
18	Strahan		Strahan	23
15	Strahan		Strahan	19
15	Strahan		Strahan	14
15	Strahan		Bridport	
15	Strahan		Grassy	
15	Strahan		Left fishery	
14	Strahan		Bicheno	
14	Strahan		Strahan	20
12	Strahan	Dover (1)	Strahan	12
11	Strahan	Kettering (3)	Bicheno	
10	Strahan	Stanley (1)	Strahan	4
10	Strahan	Dover (1)	Margate	1
9	Hobart		Dover	
9	Strahan	Woodbridge (3)	Devonport	
7	Stanley		Stanley	
7	Strahan	Dover (3)	Southport	
7	Strahan	St Helens (5)	Left fishery	
6	Strahan	Kettering (3)	Left fishery	
6	Strahan	Stanley (1)	Left fishery	
5	Strahan	Hobart (4)	Hobart	
5	Strahan	Hobart (4)	Hobart	
5	Hobart		Hobart	4
5	Strahan	Dover (3)	Left fishery	
5	Bicheno		Bicheno	6
5	Currie		Currie	
5	Stanley		Couta Rocks	1
4	Stanley		Strahan	9
4	Currie		Currie	
4	Hobart		Currie	
4	Kettering		Hobart	
4	Dover		Stanley	
3	Nubeena		Kettering	
3	Strahan		St Helens	2
3	Dover		Dover	2
3	Kettering		Margate	
3	Southport		Hobart	2
2	Margate		Margate	
2	St Helens		St Helens	
2	Margate		Left fishery	
2	Currie		Left fishery	
2	Nubeena		Dover	1
1	Currie		Lady Barron	

1	Smithton	Southport
1	Currie	Stanley
1	Hobart	Left fishery
1	Currie	Currie
1	Stanley	Left fishery
1	Currie	Stanley
1	Stanley	Stanley
1	Temma	Left fishery
1	Dover	Left fishery
1	Stanley	Stanley 2
1	Stanley	Left fishery
1	Temma	Temma
1	Currie	Currie
1	Currie	Left fishery

NB: 'Home' port is that in which the highest number of a boat's kilograms of rock lobster were unloaded; for ports in which a boat unloaded an equal number of times, that port in which the highest number of kilograms was unloaded is listed first; figures are approximate

Source: DPIWE

Boats unloading between one and three times constituted 42.3 per cent of boats-through-Strahan in 1997/98. By the 2000/2001 quota year, boats in this category made up more than half of Strahan's boats-through-port, 51.5 per cent. On the other hand, boats unloading between four and nine times constituted 32.2 per cent of boats-through-Strahan in 1997/98, but less than one-quarter of Strahan's boats-through-port in 2000/2001, 24.2 per cent. Given that boats-through-Strahan decreased from 59 to 33 between 1997/98 and 2000/2001, two questions arise: 'where have 26 boats-through-Strahan gone?'; and 'why have the proportions of these categories changed?'. Considering boats-through-Strahan by 'home' port, 24 boats-through-Strahan were based in Strahan in 1997/98; i.e. greater than half these boats' unloadings were in Strahan in 1997/98 (Table 48).

Table 48. Boats-through-Strahan by 'home' port, 1997/98

'Home' port	No.
Strahan	24
Currie	9
Stanley	7
Hobart	4
Dover	3
Kettering	2
Margate	2
Nubeena	2
Temma	2
Bicheno	1
Southport	1
Smithton	1
St Helens	1

NB: Figures are approximate

Source: DPIWE

Thus, 35 or nearly 60 per cent of boats-through-Strahan were visiting boats in 1997/98. Over 54 per cent of visiting boats were from the north-west of the fishery in 1997/98, principally Currie and Stanley. Exactly 40 per cent of visiting boats were from the south-east of the fishery, mainly Hobart and Dover. Only two visiting boats were from the north-east of the fishery, one from Bicheno and one from St Helens. Care needs to be taken, however, with the 'home' port figure for Strahan. As noted, from interviews in 1997 as part of Williamson *et al.* (1998) it is known that less than ten of these so-called home boats were actually based in Strahan with their families. At least 14 of these 24 boats were actually based elsewhere in Tasmania, especially in the south-east, or in Victoria in terms of place of residence, location of families and so on. Regarding much unloading, reprovisioning and so on, however, they operated out of Strahan for the majority of their fishing time.

Data from the 2000/2001 quota year make it possible to trace something of the histories of these 59 1997/98 pre-quota year boats-through-Strahan (Table 49).

The first point to note is that 14 or approximately 23 per cent of boats-through-Strahan in 1997/98 were no longer operating in the fishery in 2000/2001. This figure is in line with reduction in boats-through-ports for all ports between 1997/98 and 2000/2001. Eight of the 59 boats-through-Strahan in 1997/98 were still based in Strahan in 2000/2001. This figure agrees with the number of operators residing in Strahan according to interviews in 1997 and 2000. Eight of the 59 boats-through-Strahan in 1997/98 were still visiting Strahan to unload in 2000/2001. Together, however, these eight visiting boats unloaded 15 fewer times in Strahan in 2000/2001 compared with 1997/98. With these boats thus accounted for, i.e. 14 boats no longer in the fishery, eight boats still based in Strahan and eight boats still visiting Strahan, approximately half of the 59 boats-through-Strahan in 1997/98 no longer unloaded in Strahan in 2000/2001, as either a 'home' or a visiting boat.

Table 49. Position of 1997/98 boats-through-Strahan in 2000/2001

Position	No.
Left the fishery	14
Strahan still 'home' port	8
Still visiting Strahan	8
No longer unloading in Strahan, 'home' port is:	
Currie	5
Stanley	5
Dover	3
Hobart	3
Bicheno	2
Margate	2
Southport	2
Bridport	1
Devonport	1
Grassy	1
Kettering	1
Lady Barron	1
St Helens	1
Temma	1

NB: Figures are approximate
Source: DPIWE

It is repeated that this comparison is by individual boat. In other words, a boat is identified as having unloaded in Strahan in 1997/98 and its unloading profile is directly compared with that for 2000/2001. Thus, it is apparent that 29 boats-through-Strahan in 1997/98 either changed 'home' port from Strahan or unloaded exclusively in or closer to their 'home' port elsewhere. In these ways, unloadings primarily shifted from Strahan to ports such as Currie and Stanley in the north-west and Dover and Hobart in the south-east. Contraction as much as shift is what appears to have occurred here. Ten boats no longer unloading in Strahan were concentrating their unloadings in their 1997/98 'home' port. A further six boats were concentrating their unloadings in the quarter-region of their 1997/98 'home' port, i.e. the north-west, north-east or south-east. Nine boats for which Strahan was their major port in terms of unloadings in 1997/98 did not unload in Strahan at all in 2000/2001.

In 2000/2001, therefore, the boats-through-Strahan picture was significantly different to that in 1997/98 (Table 50).

To begin with, as noted there were 26 or 44 per cent fewer boats-through-Strahan in 2000/2001 compared with 1997/98. If more than 50 per cent of unloadings in Strahan qualifies Strahan as a boat's 'home' port, then 14 boats-through-Strahan were based in Strahan in 2000/2001. As noted, however, less than ten operators and their families actually lived in Strahan. That only eight of Strahan's 1997/98 'home' boats had not changed this status in 2000/2001 indicates that, while some boats shifted away from Strahan, others moved into the port, though in lesser number. However, before discussing boats unloading in Strahan in 2000/2001 but not in 1997/98, comparing the 'home' ports of boats visiting Strahan to unload in 1997/98 with 2000/2001, 73.6 per cent fewer boats visited Strahan from the north-west and 21.4 per cent from the south-east quarters of the fishery. The reduction in the north-west was principally boats no longer visiting Strahan from Currie on King Island. Boats from the north-west quarter fished closer to 'home' ports under quota management for reasons of superior stock quality, cost minimisation, stronger processor demand and higher beach prices than available out of Strahan. The substantially smaller reduction in boats unloading in Strahan based in the south-east quarter of the fishery between 1997/98 and 2000/2001 compared with the north-west is attributable mainly to boats new in the fishery, or more commonly new to Strahan, being based in the south-east (Table 51).

Table 50. Boats-through-Strahan by 'home' port, 2000/2001

'Home' port	No.
Strahan	14
Margate	4
Stanley	4
Kettering	3
Dover	2
Hobart	2
Bicheno	1
Couta Rocks	1
Queenscliffe	1
St Helens	1

NB: Figures are approximate

Source: DPIWE

Table 51. Individual boats-through-Strahan in 2000/2001 and those same boats in 1997/98

Strahan unloadings 2000/2001	'Home' port 2000/2001	Main Strahan 'away' port 2000/2001 & no. unloadings	'Home' port 1997/98	Strahan unloadings 1997/98
23	Strahan	Currie (3)	Strahan	18
20	Strahan		Strahan	14
19	Strahan	Dover (2)	Strahan	15
14	Strahan		Strahan	15
12	Strahan	Hobart (1)	Strahan	12
11	Strahan		Triabunna	
10	Strahan	Stanley (1)	Dover	
10	Strahan		Strahan	22
9	Strahan	Stanley (8)	Strahan	4
9	Strahan	Kettering (4)	St Helens	
8	Strahan	Bicheno (3)	Smithton	
7	Stanley		New boat	
6	Strahan		Lady Barron	
6	Bicheno		Bicheno	5
4	Strahan	George Town (4)	Strahan	10
4	Hobart		Hobart	5
3	Strahan	Dover (2)	Currie	
2	Margate		Hobart	
2	St Helens		Strahan	3
2	Kettering		Kettering	
2	Stanley		Stanley	1
2	Dover		Dover	
2	Margate		Dover	
2	Hobart		Southport	3
2	Kettering		New boat	
1	Stanley		Kettering	
1	Queenscliffe		New boat	
1	Margate		Strahan	10
1	Margate		Margate	
1	Kettering		Woodbridge	
1	Stanley		Stanley	
1	Dover		Nubeena	2
1	Couta Rocks		Stanley	5

NB: For ports in which a boat unloaded an equal number of times, that port in which the highest number of kilograms was unloaded is listed first; figures are approximate

Source: DPIWE

Just under half of boats-through-Strahan in 2000/2001 were either not in the fishery (three boats) or did not unload in Strahan in 1997/98. Of the 13 boats-through-Strahan in 2000/2001 that did not unload in Strahan in 1997/98, eight were based in the south-east quarter of the fishery. Boats from the south-east quarter of the fishery were more likely to visit Strahan than boats from the north-west as there was little difference in stock quality and beach prices between the south-east and Strahan. This left only cost minimisation and fewer processors prepared to travel to Strahan to pick up rock lobster as reasons accentuated by quota management for boats based in the south-east not to visit Strahan. Stock abundance in the West region was sufficient to compensate for

these disadvantages, compared with major disadvantages of quality and beach price differences for operators in the north-west considering visiting Strahan under quota management.

Approaching two-thirds of the 16 new visiting boats to Strahan in 2000/2001 only unloaded between one and three times. With volume being perhaps the main reason to visit the West region and many operators catch reduced under quota management, fewer operators based themselves out of Strahan for extended stints. Instead, catch was unloaded in Strahan by a number of visiting boats but 'home' ports were returned to for longer breaks between trips than prior to quota management, for reprovisioning and so on. Only 37.5 per cent of the 16 new visiting boats to Strahan in 2000/2001 unloaded four or more times.

As noted, 43 boats that unloaded in Strahan in 1997/98 no longer did so in 2000/2001. Of these 43 boats, 14 had left the fishery and 29 unloaded exclusively elsewhere. The point here is that 51.2 per cent of boats no longer unloading in Strahan in 2000/2001 had unloaded four or more times in 1997/98. In the context of Strahan losing 43 boats but gaining 16, Strahan lost 22 boats that had unloaded four or more times in 1997/98 but gained only six such boats in 2000/2001. In other words, 48.8 per cent of boats no longer unloading in Strahan in 2000/2001 had done so between one and three times in 1997/98, compared with 62.5 per cent of new visiting boats in this category in 2000/2001.

Put simply, Strahan lost more 'home' boats and boats fishing out of Strahan for extended stints than it did discrete trip visiting boats between 1997/98 and 2000/2001. Strahan thus lost many boats volume fishing, unloading, reprovisioning and so on in the West region. Many fewer than half the boats lost by Strahan were replaced by new visiting boats, and the clear majority of new visiting boats unloaded between one and three times only in 2000/2001. For many operators, quota was not allocated in amounts, or was available at a price, that made concerted volume fishing in the West region worthwhile. Moreover, higher beach prices were often available elsewhere. A number of operators therefore abandoned fishing in the West region altogether, or did not unload in Strahan, or conducted only the sporadic unloadings required to make up any volume in their allocated tonnage. For many operators cost minimisation meant provisioning, fishing, maintaining, repairing and so on exclusively out of their 'home' port where such activities were easier to organise, were cheaper and were convenient to their residences and families. (It was sometimes cheaper, too, for boats in isolated ports to steam to specialist centres than to pay to import particular services.) More time between trips under quota management was a chance for more 'home' port activity for many fishers, involving more time with partners and children, more do-it-yourself work on the boat, and more time to pursue non-fishing related activities or opportunities. In 'home' ports, too, boats could be watched and only one set of port fees paid.

'Home' ports therefore made economic as well as onshore lifestyle-related sense. Fishing intensity was reduced for many operators as the 'race for fish' had largely been ended by quota management. Only 1500 tonnes of rock lobster were allowed to be caught by the fleet, for which less fishing was required. For many fishers, particularly owner-operators, this meant 'taking it easy' and enjoying their fishing more, as well as having more time at home. For many operators, there was simply not the capacity available under quota management to spend any or much time volume fishing in the West region. A trip or two, perhaps unloading in Strahan, was all that was required to

'take the worry' out of not catching sufficient quota at 'home'. With the advantage of volume fishing reduced by quota management, the West region's disadvantages in terms of lower quality rock lobster, Strahan's processing difficulties and lower beach prices, high expense associated with any reprovisioning or repair, isolation from family and so on meant that fewer fishers visited Strahan in 2000/2001, and that those who did unload in Strahan did so less. As noted, encouragement of more boats to visit Strahan for extended stints in numbers approaching those pre-quota management may be assisted by some form of volume-based incentive. New boats may also be attracted to the fishery and/or make their 'home' in Strahan in this way. Additional west coast quota supplementary to the Tasmania-wide TACC could be worth consideration in this regard, provided stock assessment allowed.

In conclusion, as noted nearly 63 per cent of boats unloaded in only one of Tasmania's four quarter regions in 2000/2001 (Table 52).

The fleet was approximately 25 per cent larger in 1997/98, but the percentage of boats unloading in only one quarter region was almost the same in 2000/2001. Close similarity between percentages for boats unloading in two quarter regions between 1997/98 and 2000/2001 is also evident. Where the two fishing years begin to diverge suggests some changes in the fleet regarding 'away' fishing, i.e. boats unloading in ports other than their 'home' ports, under quota management. The trend is not one of a lower percentage of boats 'away' fishing under quota management, rather it involves a reduction in how far as well as how often 'away' fishing is undertaken. No boat was identified as having unloaded in all four quarter regions of the fishery in 2000/2001 (Strahan is included in the south-west quarter). This agrees with interview data which suggest that few 'circumnavigations' of the fishery are conducted under quota management. In the case of Strahan, many fewer boats visited the port to unload from the north in 2000/2001 compared with 1997/98; i.e. from the King Island, the WNW and the NNW regions. The number of boats visiting Strahan from the south fell by less, but those visiting Strahan in 2000/2001 did not unload as often.

Table 52. Boats by number of quarter regions in which unloaded, 1997/98 and 2000/2001

No. quarter regions in which unloaded	1997/98		2000/2001	
	Count	Percentage	Count	Percentage
One	206	62.2	153	62.9
Two	95	28.7	69	28.3
Three	25	7.5	21	8.6
Four	5	1.5	0	0
Totals	331	99.9	243	99.8

NB: Figures are approximate

Source: DPIWE

Moreover, interview data suggest that some boats fishing off the west coast steamed home with their loads, or to a port in which a better beach price was available, rather than unload in Strahan. Fresh water in Macquarie Harbour meant that visiting Strahan but not unloading was not an option. Thus, Strahan experienced a three-factor reduction in boats-through-port under quota management in that many boats were travelling away shorter distances and therefore did not reach Strahan, many boats were travelling away less often and many boats were unloading away less. For example, a number of boats stopped visiting Strahan from Currie, while many southern boats

unloaded only a few times in Strahan, and a number did not unload in Strahan though they in part fished off the west-south-west coast. 'Home' ports elsewhere offered a greater range of processors, often better beach prices and cheaper reprovisioning. They also offered logistically easier and cheaper maintenance and repair, and family, many fishers having more time to spend in their 'home' port due to catch reduction under quota management. Reduced catch for a number of Strahan's 'home' boats meant still fewer unloadings.

However, volume fishing had not entirely disappeared under quota management, particularly among lessees. Approximately 1500 tonnes is still caught by commercial fishers each quota year and much fishing continues to occur off the west coast where stocks and catch rates are among the best in the fishery. As the only port on the west coast, Strahan continues to attract commercial rock lobster industry activity. However, for reasons of increasing the yield from the fishery, possibly assisting some of those operators most catch reduced by quota management and possibly increasing commercial rock lobster industry activity in some isolated ports a mechanism such as supplementary west coast quota is worth considering. Next, each of the ten Tasmanian regions is discussed in more detail regarding individual ports and unloading points.

7.3.7.10 Intra-region breakdowns

Fine-scaling the fishery by ten Tasmanian regions provides greater geographic purchase on the fishery than does a basic east/west division. Closer inspection of each region reveals that a region is often dominated by a single port. Comparing trends in boats-through-ports, number of landings and catch unloaded for the dominant port or ports in a region can reveal something about the types of operations based in or visiting the region. Moreover, comparing ports in a region makes possible further insight into differences in the fishery. In some ways, ports more than regions are the important analytical geographic units in the fishery. In this section, trends in ports are combined with interview data to complete the spatial breakdown of the fishery. The Victorian region was discussed separately above. Tasmanian regions are discussed alphabetically, beginning with the Channel.

The Channel region

The first point to note about the Channel region is that it includes the port of Hobart in Tasmania's capital city. Second, many boats based in the region have a somewhat similar fishing pattern, i.e. they undertake trips longer than a day to fish 'local' grounds off the south coast of Tasmania. Choice of unloading point and/or 'home' port, which is great in south-east Tasmania, has as much to do with how far operators are prepared to steam and where they live as with the kind of fishing operation.

The region accounted for over one-fifth of boats-through-ports in the 2000/2001 quota year, a drop in absolute number of over 20 per cent from the 1997/98 pre-quota year (Table 53).

Table 53. The Channel region by ports and unloading point, 1997/98 and 2000/2001

	Boats-through-port	No. of landings	Kilograms unloaded
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Effects of ITQ Change

	1997	2000	%Chg	1997	2000	%Chg	1997	2000	%Chg
Hobart	40	25	-37.5	148	100	-32.4			-25.4
Kettering	43	38	-11.6	168	121	-28.0			-28.1
Margate	58	41	-29.3	257	211	-17.9			-7.1
Woodbridge	16	19	18.8	44	49	11.4			23.0
Region Total	157	123	-21.7	617	481	-22.0	275934	237559	-13.9
All Ports	744	588	-21.0	4269	3700	-13.3	1664559	1489507	-10.5
Percentages	21.1	20.9		14.4	13.0		16.5	15.9	

NB: Totals for all ports include ports occurring in only one of the two fishing years; some low absolute numbers; figures are approximate

Source: DPIWE

This drop was similar to that for all ports. That less fishing was being conducted by the approximately 20 per cent fewer boats unloading in the region is indicated by a 22 per cent decrease in number of landings between 1997/98 and 2000/2001, a significantly greater decrease than for all ports. The Channel region accounted for 13 per cent of landings in the fishery in the 2000/2001 quota year compared with nearly 21 per cent of boats-through-ports. The trend in kilograms unloaded, however, suggests that fishing has not been reduced as far as indicated by the figure for number of landings. The region accounted for nearly 16 per cent of the TACC in 2000/2001, a drop in absolute number of nearly 14 per cent from 1997/98. This drop is higher than that for all ports, but by only 3.4 per cent.

Thus, the Channel region has fared worse than figures for all ports, but perhaps not to the extent suggested by its large drop in number of landings. This drop is in part explained by the kinds of fishing operations frequenting the region. First, little day fishing is done in the Channel region, and a propensity to fish for longer trips translates to fewer landings. Second, ports in the region experience some of the activity associated with the new shellers period in November. Prior to quota management, this period was fished by most operators in the fishery, many of whom would travel to fish off the south coast and would perhaps unload in the Channel region. Rock lobster 'ran' off the south coast during the 'new shellers' period more than in other areas of the fishery. Under quota management, however, the new shellers period, while still important, diminished somewhat in priority as quality not quantity fishing became a focus in a catch reduced environment. Put simply, fewer boats existed in the fishery to target the southern new shellers run; not as many fishers were prepared to travel out of their local fishing region to participate in the southern new shellers run as the quality of rock lobster was at times questionable, often a costly trip was involved in terms of time as well as distance and the beach price was usually at its lowest in the new shellers period; and many boats that did participate in the southern new shellers run under quota management did not fish as much of the period as prior to quota management, preferring to stop catching rock lobster if the beach price fell below a certain level. Though commercial rock lobster industry activity associated with visiting boats during the new shellers period was greater in the Far South region, it was also arguably present in the Channel, particularly prior to quota management. Visiting boats that wished to reprovision or repair were especially likely to visit a Channel port, ports in the Channel being well placed regarding such activities. However, such activities were more based on extended stints and with these being replaced somewhat by discrete trips, visits to ports in the Channel region also declined due to the changing nature of visiting boat fishing.

That fewer boats were visiting the Channel and that the pattern of many of those continuing to visit had changed under quota management is supported by the boats-through-ports figures for the region, considered by three categories of unloadings per boat. Hobart's boats-through-port figure in the category of one-to-three unloadings fell by 45.8 per cent between 1997/98 and 2000/2001, while that for Margate fell by 47.1 per cent (Table 40). Boats-through-ports in this category had constituted approximately 60 per cent of each port's total boats-through-port in the 1997/98 pre-quota year. In the 2000/2001 quota year they made up 52 per cent of Hobart's and 43.9 per cent of Margate's total boats-through-port figures. These two ports are furthest from 'local' south coast fishing grounds. As noted, under quota management fewer visiting boats fishing these grounds were more likely to be undertaking shorter trips away from east or west coast 'home' ports than to be spending an extended stint in the south. They were therefore likely to look to unload but not to re-provision in the south. Consequently, ports closer to the fishing grounds but not as well placed for re-provisioning were preferred. Ports in the Far South region were therefore visited, but Woodbridge arguably also continued to attract some visiting boat activity. Woodbridge, for example, increased its number of boats-through-port in the one-to-three unloadings category by 36.4 per cent between 1997/98 and 2000/2001. The figure for Kettering increased by 12 per cent, but this was as much due to Channel boats fishing less under quota management and therefore shifting recording categories into one-to-three unloadings per boat as it was due to any increase in visiting boats. Boats based in the Channel region, perhaps more than in any other region of the fishery, had four landing places from which to choose separated by little distance. Consequently, a number of boats unloaded in more than one of these landing places, some boats using all four in a fishing year. In this way, unloadings tended to be spread across the four landing places in the Channel region somewhat more than in other regions in the fishery. Trends in categories of boats unloading fewer than ten times therefore include boats based in the Channel region as these were somewhat less likely to concentrate unloadings in one landing place.

Thus, the percentage of Woodbridge's boats-through-port in the category of boats unloading between one and three times increased from 68.7 per cent in 1997/98 to 78.9 per cent in 2000/2001, while Kettering's increased from 58.1 per cent to 73.6 per cent. Care needs to be taken here, however, as boats may be unloading in Woodbridge and Kettering during summer months to avoid warm water further up the Channel and in the Derwent River. In recent fishing years, including 2000/2001, a number of operators have been concerned to unload before steaming too far up the D'Entrecasteaux Channel. This practice applies both to local and to visiting boats. Consequently, the figures for Woodbridge, especially, could be influenced by local boats unloading during summer on their way to their 'home' port further up the Channel. Unloadings in Woodbridge per month show that this tendency increased slightly in February between 1997/98 and 2000/2001 (Figure 45).

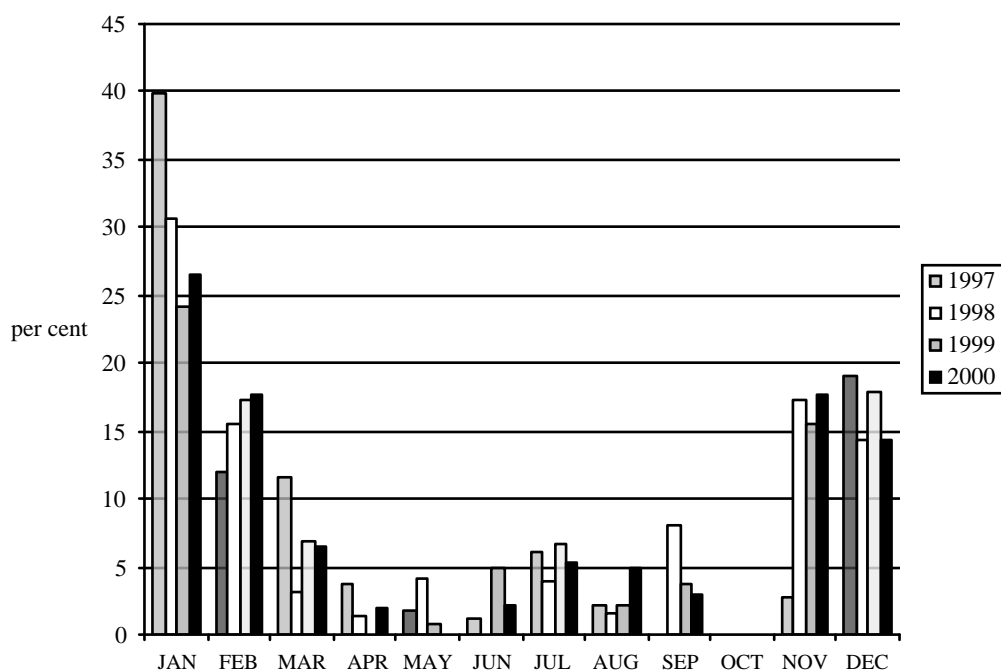


Figure 45. Percentage unloadings per month for Woodbridge, 1997-2000

NB: Figures are approximate

Source: DPIWE

Figures for Woodbridge and Kettering can therefore partly be explained by a combination of processors preferring to drive locally to pick up rock lobster, ports in the Far South being considerably longer drives in comparison; more unloadings in summer due to more rock lobster being caught in summer coupled with concern regarding warm water up the Channel and in the Derwent River; less extended stint fishing and more discrete trip fishing; and, especially in Kettering's case, Channel boats fishing less and therefore shifting recording categories from four-to-nine to one-to-three unloadings per boat. Without inspection of records for individual boats, which was largely beyond the resources of the research, fuller explanation of these trends is not ventured.

As noted, Woodbridge is an unloading point not a port. The three ports in the Channel region have fared somewhat differently from one another under quota management. Kettering has lost or had substantially catch reduced some big catching 'home' boats, as reflected in its greater percentage reduction in landings and catch unloaded compared with boats-through-port. Average number of kilograms unloaded per boat per fishing year in Kettering decreased by 18.6 per cent between 1997/98 and 2000/2001, and average number of landings per boat also declined. Margate, on the other hand, has largely maintained the size of its 'home' fleet, which has mitigated its loss of visiting boats. Average number of kilograms unloaded per boat per fishing year in Margate increased by 31.3 per cent between 1997/98 and 2000/2001, and average number of landings per boat also rose. In general, a 'home' boat contributes more landings and catch to a port than does a visiting boat. Though Margate declined nearly 30 per cent in boats-through-port between 1997/98 and 2000/2001, most of this decline was visiting boats. Landings therefore fell by under 18 per cent and catch unloaded decreased by just over seven per cent. In contrast, Kettering declined by only 11.6 per

cent regarding boats-through-port, but this decline was almost entirely made up of 'home' boats. Landings and catch therefore each fell by approximately 28 per cent. Hobart performed somewhere between Margate and Kettering. It, too, lost visiting boats, but it did not lose many 'home' boats. Average number of kilograms unloaded per boat per fishing year in Hobart increased by 19.2 per cent between 1997/98 and 2000/2001, and average number of landings per boat also rose. As a result, Hobart's decline in catch was less than its decline in landings which was, in turn, less than its decline in boats-through-port; all of which, however, were greater than the respective figures for all ports.

A comment common in interviews was that the Channel region was 'quieter' under quota management. It was particularly difficult for participants to exemplify this observation in Hobart due to the size of the population centre in which commercial rock lobster industry activity is embedded. In some respects, too, Margate, Kettering and Woodbridge are encompassed by Tasmania's capital city which in many instances confounds the identification of any secondary effects of quota management. Margate was considered to be the port least worst off under quota management in the Channel region, while Kettering was often held to have been the hardest hit. Participants measured a port more by 'home' than by visiting boats.

Balancing the undoubted quietness in the ports in the Channel in the opinion of many participants was the long-term sustainable presence of the industry in the region. Care needs to be taken, also, not to consider commercial rock lobster industry activity under the name of 'Hobart', 'Margate' or 'Kettering', etc., to be synonymous with an entire port or place. Hobart and Kettering, in particular, are diversified ports in which commercial rock lobster industry activity adds variety and character but is arguably not necessary to their existence. In some ways, reduction in commercial rock lobster industry activity was least in Margate where, perhaps, any major reduction would have been noticed most. Margate is principally a commercial fishing port in which the rock lobster industry is a significant presence. The township and surrounds of Margate, however, are in many ways more closely linked with Hobart, as one of greater Hobart's rural-residential areas, than with the port. Major reduction in commercial rock lobster industry activity would therefore have had a significant effect in the port of Margate, but arguably not have impacted significantly in the area that shares its name. As noted, however, only a minor reduction in commercial rock lobster industry activity occurred in Margate. A number of operators preferred to base their boat in a dedicated commercial fishing port rather than to compete with merchant shipping, ferries, tourists, recreational vessels associated with marinas and so on.

The Far South region

Proximity to rock lobster grounds off the south coast of Tasmania, frequented by many fishers during the new shellers period in November, has an even greater influence in the Far South region than in the Channel. Boats-through-ports and kilograms unloaded in the Far South region declined by similar percentages to those for all ports between 1997/98 and 2000/2001 (Table 54).

Table 54. The Far South region by port and unloading points, 1997/98 and 2000/2001.

	Boats-through-port			No. of landings			Kilograms unloaded		
	1997	2000	%Chg	1997	2000	%Chg	1997	2000	%Chg
Cygnat	1	1	0.0	1	2	100.0			-40.7
Dover	67	51	-23.9	276	183	-33.7			-15.7
Recherché Bay	1	1	0.0	3	1	-66.7			-67.7
Southport	34	27	-20.6	127	103	-18.9			0.6
Region Total	103	80	-22.3	407	289	-29.0	173280	153316	-11.5
All Ports	744	588	-21.0	4269	3700	-13.3	1664559	1489507	-10.5
Percentages	13.8	13.6		9.5	7.8		10.4	10.2	

NB: Totals for all ports include ports occurring in only one of the two fishing years; some low absolute numbers; figures are approximate

Source: DPIWE

Number of landings, however, declined by nearly 30 per cent in the Far South compared with 13.3 per cent for all ports. These figures indicate that many boats visiting the region unload a low number of large catches. This pattern is consistent with what many of those interviewed considered to be predominantly the kind of fishing in the region in the new shellers period under quota management. In other words, the new shellers were still being fished off the south coast of Tasmania under quota management, but with less intensity than prior to quota management. Intensity has decreased in two ways. First, fewer boats are involved, in line with reduction in number of boats across the fishery. Second, still fewer unloadings are evident, suggesting that boats fishing and unloading in the region are doing so less. Both many local boats are fishing less and significantly fewer boats are visiting the region for extended stints. (By 'local' boats here is meant boats based in the Far South and the Channel regions.) Thus, while many boats continue to visit the Far South for a few new shellers trips, not many of these boats stay as long as they did prior to quota management; i.e. they unload once or twice and then return to a 'home' port elsewhere to break from fishing, to reprovision and to fish in their local region.

The Far South accounted for 13.6 per cent of all boats-through-ports in the 2000/2001 quota year, 10.2 per cent of the TACC unloaded, and 7.8 per cent of total landings. Percentage of total landings was the only one of the three variables to change significantly between 1997/98 and 2000/2001. The Far South region accounted for 9.5 per cent of total landings in 1997/98. Interviews indicated fewer 'home' as well as visiting boats under quota management and fewer sellers to the local processor in Dover. Interviews also revealed involvement in the aquaculture industry by some participants, for example through towing fish pens, due to lack of employment opportunity in the commercial rock lobster industry. Figures for the two main landings places in the region, the port of Dover and the unloading point of Southport, support these observations. Between them, Dover and Southport accounted for 78 boats-through-ports in the 2000/2001 quota year, a decrease of 22.7 per cent from the 101 boats-through-ports in the 1997/98 pre-quota year. Only seven of the boats in this 23 boats-through-ports decline unloaded between one and three times in 1997/98. In Dover alone, 12 of the decrease in boats-through-port unloaded between four and nine times, while five fewer boats were evident in the ten or more unloadings category for both Dover and Southport. Dover fared worse than Southport according to boats-through-port, number of landings and catch unloaded. While some big catchers still operated out of Dover, and some large catches were still unloaded, fewer visiting boats

fished for extended stints out of Dover, which had an impact in terms of reduced reprovisioning, repair and maintenance activity and so on. Major purchases and work were often done closer to Hobart, but reprovisioning and minor work and maintenance were possible in Dover. With less of these being done under quota management, commercial rock lobster industry activity in Dover was considered by a number of interview participants to be 'quieter', but 'fish farming', tourism and terrestrial farming activity ensured that the general port and town were largely unaffected by some reduction in commercial rock lobster industry activity. Somewhat similar to Flinders Island, the Far South is in population decline. Population in the Dover locality fell by 7.6 per cent between the 1991 and 1996 censuses, from 521 people to 481 (ABS, 1996). Moreover, the unemployment rate in the Dover locality was significantly higher than that for Tasmania, especially in the 15 to 24 year age group (26.2 per cent compared with 19.6 per cent for Tasmania). Decline in any industry present in the locality is negative in these respects. Like many rural localities struggling to maintain population, trade, services and employment levels in Tasmania reduction of activity in the commercial rock lobster industry may be only one of a number of possible small cuts but it does result in fewer local opportunities. Impacts of a reduction in commercial rock lobster industry activity may be difficult to measure but when included with reductions in other industries can result in palpable local decline. No negative impact should be taken lightly therefore.

In the case of decline in activity in the commercial rock lobster industry, however, the glass can also be perceived to be half full; more precisely regarding the Far South region, approximately four-fifths full. In other words, if prior to quota management the commercial rock lobster industry was on track towards bioeconomic collapse due to unsustainable fishing, then quota management can be seen to have ensured the long-term presence of the industry in the region. Some reduction in industry activity in the shorter-term is clearly preferable to no reduction but probable longer-term collapse.

Both 'home' and visiting boat activity in the commercial rock lobster industry declined in Dover under quota management. Percentage decrease in kilograms unloaded was less than for boats-through-port and landings, indicating that boats continuing to unload in Dover were landing some large catches. As noted, many of these catches were in the new shellers period when the local processor was prepared to take quantity rather than quality rock lobster. The local processing enterprise concentrated on cooking rock lobster purchased for a beach price of less than AU\$28 per kilogram for the domestic market during the new shellers period. Depending on the beach price, at least as many operators considered that catching large quantities of rock lobster quickly in the new shellers achieved approximately similar returns to catching rock lobster slowly over winter. Many operators therefore continued to fish off the south coast in November, but not as many as prior to quota management and many operators did not fish the entire period. This latter prudence was primarily due to catch reduction which had many operators 'fishing the price' as much as fishing for rock lobster themselves. With the quota year in place until the end of February, few fishers caught all their quota in November during the lowest beach price period of the quota year. The winter leading into the new shellers may also have resulted in some large catches for those fishing which, while often lucrative, left them with less rock lobster to catch in November. With many operators fishing more in winter under quota management this situation was not uncommon.

This brief discussion of the quantity/quality/price trade-off does not do justice to the range of approaches involved, and ignores the possibility of leasing in quota units. The main point here is that fewer boats fished as much in the new shellers period as when the season began in November prior to quota management. Previous to quota management, volume fishing 'crashed' the beach price in November. Lower prices were acceptable as effort and catch were not capped, operators being able to fish both when beach prices offered only modest returns as well as when beach prices increased. With catch limited under quota management, operators' fishing was often reduced and more consideration was necessary regarding when in a quota year fishing might most profitably be undertaken.

Given that nearly three-quarters of boats-through-Dover unloaded between one and three times in 2000/2001, compared with approximately 60 per cent in 1997/98, commercial rock lobster industry activity in the port appears to be increasingly reliant on new shellers volume fishing by visiting boats. Boats fishing the new shellers in the region under quota management were more likely to visit Dover as part of discrete trips rather than operating out of the port for extended stints that required the purchase and use of goods and services associated with the port. And if Dover was being perceived and used more as an unloading point than a port under quota management, then Southport could be preferred as an unloading point due to it being closer to south coast fishing grounds, particularly if rock lobster were not being taken by the local processor. In Southport catches were unloaded into the waiting trucks of processors, and boats were quickly back at sea fishing and/or returning to their 'home' port. Indeed, kilograms unloaded in Southport increased by 0.6 per cent between 1997/98 and 2000/2001, though both number of landings and boats-through-Southport fell. Clearly, some big catches were being unloaded in Southport by boats that required only an unloading point. Average landings per boat-through-Southport in 2000/2001 was virtually identical to that in 1997/98, 3.7 and 3.8 respectively. Average kilograms per landing, however, increased by nearly one-quarter.

Finally, too much should not be made of differences between Southport and Dover. As for a number of ports in the Channel region, there is a large amount of commercial rock lobster boat 'traffic' steaming past Southport and Dover and landing places tend to be used interchangeably. Clearly, however, under quota management the unloading points of Southport and Woodbridge were being preferred to ports such as Dover and Kettering.

The Flinders Island region

Flinders Island has been discussed above and is therefore touched on only briefly in this section. As noted, Lady Barron is the only port on Flinders Island. Nearly all rock lobster landed on southern Flinders Island are unloaded in Lady Barron. Lady Barron also attracts the bulk of visiting boats to Flinders Island. Rock lobster are landed on northern Flinders Island through three unloading points, Killiecrankie, North East River and Palana. Killiecrankie is the largest of these unloading points in terms of kilograms unloaded. Comparing percentage boats-through-ports, number of landings and kilograms unloaded for Flinders Island with those for all ports, reduction in boats-through-ports is similar and Flinders Island experienced more of a reduction in landings relative to all ports. The major difference, however, is the 38.2 per cent reduction in

kilograms unloaded for Flinders Island compared with 10.5 per cent for all ports between 1997/98 and 2000/2001 (Table 55).

Table 55. The Flinders Island region by port and unloading points, 1997/98 and 2000/2001

	Boats-through-port			No. of landings			Kilograms unloaded		
	1997	2000	%Chg	1997	2000	%Chg	1997	2000	%Chg
Killiecrankie	9	9	0.0	57	69	21.1			-17.6
Lady Barron	26	17	-34.6	153	100	-34.6			-43.6
North East	5	3	-40.0	41	13	-68.3			-76.2
Palana	3	3	0.0	7	11	57.1			269.5
Region Total	43	32	-25.6	258	193	-25.2	92151	56918	-38.2
All Ports	744	588	-21.0	4269	3700	-13.3	1664559	1489507	-10.5
Percentages	5.7	5.4		6.0	5.2		5.5	3.8	

NB: Totals for all ports include ports occurring in only one of the two fishing years; some low absolute numbers; figures are approximate

Source: DPIWE

Flinders Island accounted for 5.4 per cent of all boats-through-ports in the 2000/2001 quota year and 5.2 per cent of total landings, but only 3.8 per cent of the TACC unloaded (5.5 per cent of the total commercial catch had been unloaded on Flinders Island in 1997/98). Clearly, fewer boats-through-ports landed smaller loads on Flinders Island in 2000/2001 compared with 1997/98. For example, Lady Barron experienced a 75 per cent decrease in boats-through-port in the category of boats unloading between four and nine times per fishing year between 1997/98 and 2000/2001. While average landings per boat in Lady Barron remained at 5.9 per fishing year, average kilograms unloaded per landing fell by 13.7 per cent. A number of fishers continuing to unload on Flinders Island under quota management had fewer rock lobster to take due to catch reduction and, as noted, a number of operators fish in the region but unload elsewhere. These figures indicate, and data from interviews support the proposition that a number of boats no longer unloading in Lady Barron in 2000/2001 had unloaded large catches in the port in 1997/98.

Fewer boats unloading less on Flinders Island meant less commercial rock lobster industry activity and employment on Flinders Island. Flinders Island is in population decline. The population of Flinders Island fell by 3.8 per cent between 1991 and 2000, to 944 (ABS, 2001). Less work for deck hands, with the local marine engineer and with local processors was evident from interviews in 2000. Though not marked and difficult to quantify due to the often informal and casual status of 'fringe' commercial rock lobster industry employment, this reduction added its weight to general difficulties related to the mainly primary industry structure of Flinders Island and the at times precarious nature of links on and off Flinders Island. The three local processors on Flinders Island, particularly, noticed reduced kilograms unloaded on Flinders Island under quota management. Competition for rock lobster to process on Flinders Island was strong. One processor experimented with subleasing in an attempt to guarantee supply. Furthermore, difficulties with regular air links off Flinders Island meant chartering a plane to transport rock lobster to mainland Australia. Contraction of supply and transport logistics difficulties both made business problematic in the over-catered Flinders Island processing sector. How much longer three processors could remain in operation was an open question. In 2000, two were more part- than full-time.

Like many on Flinders Island, diversification into other industries was evident by both processors and some fishers. With no industry booming on Flinders Island, multiple interests were believed by many to be required to make a living. For those in the commercial rock lobster industry, farming and tourism were two industries into which many branched. In short, it was not always easy making a living on Flinders Island, and the introduction of quota management did not help in this regard. Some left the industry, while others tightened their belts. For a number of participants, however, quota management at least meant that an industry belt existed to be tightened.

According to many participants, stocks had improved in the north-east due to a major puerulus recruitment event in the mid-1990s. Many visiting boats fishing in the north-east, however, did not unload on Flinders Island. That Flinders Island was smaller in terms of population and infrastructure and could not offer an attractive beach price were not in any major part due to quota management.

There are many differences between Flinders Island and King Island, most important in the context of this study perhaps being in tonnes unloaded and flight connections with mainland Australia. King Island, with its more abundant local stocks, larger 'home' fleet and reliable links with processors in Melbourne is discussed next. As noted, however, in both Lady Barron and Currie local 'home' fleets were still evident under quota management, but extended stint visiting boats were significantly fewer. Visiting boats just unloaded in Grassy on King Island, and often not at all on Flinders Island, despite fishing in the region.

The King Island region

As noted, King Island has two ports, Currie on its west coast and Grassy on its south east coast. The experience of each port under quota management has been different (Table 56).

Table 56. The King Island region by ports, 1997/98 and 2000/2001

	Boats-through-port			No. of landings			Kilograms unloaded		
	1997	2000	%Chg	1997	2000	%Chg	1997	2000	%Chg
Currie	47	32	-31.9	480	460	-4.2			-15.8
Grassy	22	29	31.8	131	140	6.9			6.4
Region Total	69	61	-11.6	611	600	-1.8	246074	222593	-9.5
All Ports	744	588	-21.0	4269	3700	-13.3	1664559	1489507	-10.5
Percentages	9.2	10.3		14.3	16.2		14.7	14.9	

NB: Totals for all ports include ports occurring in only one of the two fishing years; some low absolute numbers; figures are approximate

Source: DPIWE

King Island accounted for 10.3 per cent of all boats-through-ports in the 2000/2001 quota year, 16.2 per cent of total landings and 14.9 per cent of the TACC unloaded. The use of Grassy as an unloading point more than as a port under quota management is underlined by boats-through-Grassy increasing in the category of boats unloading between one and three times from seven to 15 boats between 1997/98 and 2000/2001. A number of boats unloading in Grassy were based in Currie, but more than half the

boats unloading between one and three times in Grassy were not based on King Island.

Currie has long been the main port for commercial rock lobster boats based on King Island. Between 1997/98 and 2000/2001, the 'home' fleet in Currie of approximately 25 boats has remained largely stable, while Grassy's considerably smaller 'home' fleet has dwindled to only a handful of boats. These trends in each port are as much influenced by concentration of population and services in Currie, following the closure of the scheelite mine in Grassy, as they are by quota management. Consequently, interview participants stated that both the Grassy township itself and 'home' fleet commercial rock lobster industry activity were 'very quiet' under quota management. The increase in visiting boats unloading in Grassy had little impact on the town as few of these reprovisioned in Grassy. Currie was a more likely location for reprovisioning, though a number of visiting boats did not reprovision on King Island at all.

Supermarkets, hotels, hardware, a marine engineer and so on were all available in Currie. Grassy's principal attractions were, first, that it was King Island's closest safe anchorage to much good rock lobster ground lying off south-west King Island and the north-west of the Tasmanian mainland. Second, King Island's superior beach prices compared with mainland Tasmania could be accessed through Grassy. Melbourne processors had agents on King Island who purchased the bulk of the approximately 225 tonnes of rock lobster unloaded on King Island each fishing year. Rock lobster were loaded live on either chartered planes or the airlines operating regular services between King Island and Melbourne. Once in Melbourne, most rock lobster were tanked awaiting export. A combination of quality rock lobster available from grounds proximate to King Island, little tanking of rock lobster being done on King Island and reliable links with Melbourne processors in relation to which King Island was geographically well located meant that beach prices were usually dollars higher on King Island than elsewhere in the fishery. It made doubly good economic sense therefore to fish in the north-west and to unload on King Island in terms of both quality rock lobster and a high beach price. As noted, however, lower volumes fished under quota management resulted in discrete trips 'away' fishing rather than extended stints, and many visiting boats to King Island only unloaded on King Island before fishing their way 'home'. Grassy more than adequately served this unloading purpose and was also more conveniently located than Currie to 'home' ports south of King Island. Grassy was also a less crowded and scrutinised port than Currie. A number of boats based in Victorian ports also unloaded in Grassy.

A number of boats visiting King Island that had fished for extended stints out of Currie prior to quota management therefore shifted to discrete trip fishing, unloading in Grassy. In terms of the geography of beach prices, as well placed as King Island was regarding high beach prices, some operators left King Island altogether, especially Currie, and based themselves in higher paying ports in Victoria which were also often cheaper to run a boat from due to having lower priced goods and services. With less fishing being done by many operators under quota management, these operators took the opportunity to move residence to mainland Australia, from where many had originated, but still fish in the King Island region.

If Grassy increased in visiting boat activity between 1997/98 and 2000/2001 but decreased in 'home' boat activity, the former contributing less to the local economy, Currie in some ways experienced the opposite of this trend. Currie declined in visiting boat activity but retained most of its 'home' fleet. Prior to quota management, Currie's

'home' fleet was greater than five times that of Grassy's, and the bulk of Currie's 'home' fleet remained in 2000/2001, as indicated by the 19 boats unloading in Currie ten or more times in 2000/2001. Moreover, for Grassy, boats-through-port may have increased by 31.8 per cent, but landings only rose by 6.9 per cent and kilograms unloaded by 6.4 per cent. Grassy experienced more boats-through-port under quota management, but these boats did not unload often. Thus, though average kilograms per landing did not change markedly in Grassy between 1997/98 and 2000/2001, average landings per boat and average kilograms unloaded per boat both fell, from six to 4.8 landings and from 3.1 to 2.5 tonnes respectively.

The opposite was the case in Currie. Average landings rose from 10.2 to 14.4 and average kilograms unloaded per boat increased from 3.7 to 4.6 tonnes. This difference is indicative not just of different amounts of commercial rock lobster industry activity in Currie compared with Grassy, but of different types of commercial rock lobster fishing being undertaken out of the two ports. Predating quota management, day fishing has taken place out of Currie for a number of years. Both the grounds off Currie are suited to day fishing and the port and township cater for day fishing in terms of port facilities and services, and general goods and community infrastructure. In general, many boats based in Currie day fish or steam to the north-west of King Island to fish, compared with boats fishing off the south-west of King Island using Grassy. Prior to quota management, however, by no means all boats based in Currie day fished, and a number of boats both operated out of Currie as well as an 'away' port for periods of time in the fishing year. For example, as noted, prior to quota management, Strahan was frequented by a number of Currie-based boats during the new shellers period in November. Under quota management, a number of operators contracted their fishing to be based solely in Currie, some day fishing exclusively. Ports such as Strahan were not visited under quota management, and some boats shifted from Grassy to Currie as King Island became something of a one 'home' port island. Increased Currie-based fishing by boats-through-Currie is indicated by a drop in boats-through-Currie of 31.9 per cent between 1997/98 and 2000/2001 but only a 4.2 per cent decrease in number of landings. With more lower volume day fishing out of Currie under quota management, kilograms unloaded in Currie fell by 15.8 per cent between 1997/98 and 2000/2001, approximately half way between the percentage decrease in boats-through-port and that for number of landings.

Thus, the commercial rock lobster industry remained a strong presence in Currie, though industry activity in the port was dampened to a greater degree than for averages for all ports regarding boats-through-ports and kilograms unloaded. Where Grassy was pronounced by many of those interviewed to be 'very quiet' in terms of 'home' boat activity, despite increased visiting boat activity, Currie was said to be 'quieter' than prior to quota management due to approximately half-a-dozen fewer 'home' boats and many fewer visiting boats. In some respects, Grassy had become more of an unloading point under quota management, while Currie had become more of a 'home' port, somewhat similar to trends in each population centre as much general cargo continued to be shipped through Grassy but most townsfolk preferred to live in Currie following the closure of the scheelite mine in Grassy.

When considering Currie and Grassy together, King Island fared better than percentage declines for all ports by boats-through-ports, number of landings and kilograms unloaded. On the strengths of stock abundance and quality, and high beach prices,

King Island continues to host a sizeable 'home' fleet, in Currie, and to attract visiting boats, mainly to Grassy. That Currie and Grassy have polarised somewhat under quota management, as port and unloading point respectively, and that visiting boats tend only to unload is due in part to less fishing being possible under quota management. The positive side of a TACC, however, is a sustainable industry presence on King Island. In future, though, if more rock lobster were made available to be taken and more fishing was required to catch these, then visiting boats may tarry on King Island, thus docking in Currie and leading some local operators with transport on King Island again to frequent the more commodious port of Grassy. Again, the proviso is that stock assessment makes possible such a course of action.

The Mid East region

The Mid East region encompasses much of Tasmania's east coast, from the port of St Helens in its north to the port of Triabunna in its south. In between these two ports is the port of Bicheno, and the region also includes two unloading points, Binalong Bay and Coles Bay. A number of boats based in St Helens are likely to fish up to and including Flinders Island, while some boats in Triabunna are likely to fish the south coast and further west. Boats based in Bicheno are more likely exclusively to fish off the east coast. In the context of average reductions for all ports, trends in the Mid East between 1997/98 and 2000/2001 are similar reductions in boats-through-ports and number of landings, but a lower reduction in kilograms unloaded (Table 57).

Table 57. The Mid East region by ports and unloading points, 1997/98 and 2000/2001

	Boats-through-port			No. of landings			Kilograms unloaded		
	1997	2000	%Chg	1997	2000	%Chg	1997	2000	%Chg
Bicheno	32	21	-34.4	250	285	14.0			2.1
Binalong Bay	3	5	66.7	15	8	-46.7			15.8
Coles Bay	13	5	-61.5	44	8	-81.8			-72.6
St Helens	56	50	-10.7	473	428	-9.5			5.1
Triabunna	35	28	-20.0	293	223	-23.9			-16.9
Region Total	139	109	-21.6	1075	952	-11.4	315368	304837	-3.3
All Ports	744	588	-21.0	4269	3700	-13.3	1664559	1489507	-10.5
Percentages	18.6	18.5		25.1	25.7		18.9	20.4	

NB: Totals for all ports include ports occurring in only one of the two fishing years; some low absolute numbers; figures are approximate

Source: DPIWE

The Mid East region accounted for 18.5 per cent of all boats-through-ports in the 2000/2001 quota year, 25.7 per cent of total landings and 20.4 per cent of the TACC unloaded (the Mid East accounted for just under 19 per cent of the total commercial catch unloaded in 1997/98). As noted, all ports experienced a reduction in boats-through-ports of approximately one-fifth, but only a 13.3 per cent reduction in number of landings. Boats remaining in the fleet were clearly landing rock lobster more often than prior to quota management. In 1997/98 average landing per boat was 5.7, compared with 6.2 in 2000/2001. Kilograms unloaded per landing also increased between 1997/98 and 2000/2001, from 389 to 402 kilograms, while unloadings per boat

increased from approximately 2.2 to 2.5 tonnes. As noted, figures for kilograms unloaded, especially, should be treated with caution due to undeclared catch prior to quota management in the order of 15 per cent above official figures. Thus, the 13.2 per cent increase in catch per boat could indicate previously undeclared catch being declared under quota management. However, the general trends are clearer regarding boats-through-ports and number of landings. While comparing pre- with quota management years regarding kilograms unloaded is complicated by possibly large differences in undeclared catch, ports can be compared within a fishing year, though even here care is required. Thus, it can be said that the Mid East region fared similarly to average reductions for all ports regarding boats-through-ports and number of landings, but better in terms of reduction in kilograms unloaded compared with all ports. One reason for this difference is that ports in the Mid East, particularly Bicheno, despite receiving fewer visiting boats, experienced a number of larger catching operators fishing out of their 'home' port more often under quota management, thus boosting landings and catch in the port. Each port in the region experienced a variation of this trend and is discussed individually, beginning with Bicheno.

Bicheno

Bicheno perhaps best exemplifies the above trend. Bicheno experienced a 34.4 per cent decrease in boats-through-port, but a 14 per cent increase in number of landings and a 2.1 per cent increase in kilograms unloaded between 1997/98 and 2000/2001. Boats-through-Bicheno decreased by 80 per cent in the category of boats unloading between one and three times, and 72.2 per cent in the category of boats unloading between four and nine times. Together, these two categories accounted for 16 fewer boats-through-Bicheno between 1997/98 and 2000/2001. Clearly, then, there were fewer visiting boats making up Bicheno boats-through-port figure under quota management. In the category of boats unloading ten or more times, however, boats-through-Bicheno increased by 45.5 per cent from 11 to 16 boats. Thus, by 2000/2001 boats in this category made up more than three-quarters of boats-through-Bicheno. In the context of many interview participants considering there to have been little noticeable change in Bicheno due to quota management, Bicheno's 'home' fleet appeared to have increased marginally in terms of number of boats. Boats leaving Bicheno had been more than balanced by others operating out of the port for the first time or more often under quota management. As noted, with numbers of local boats similar pre- and under quota management but 25 per cent more pots allowed on boats surveyed to carry them, up to 50 pots, many interview participants held there to be at times upwards of 100 more pots in the water on local grounds off Bicheno.

Clearly, more boats were day fishing out of Bicheno more often under quota management. For example, in 1997/98 average landings per boat in Bicheno was 7.8, compared with 13.6 in 2000/2001. Day fishers tend to unload more often than overnight fishers as they are often in a position to be more responsive to movements in beach price at the same time as hedging their bets regarding future price movements by selling only part of their catch at a time. Average kilograms per landing in Bicheno fell slightly between 1997/98 and 2000/2001, but kilograms per boat increased by more than 50 per cent. A combination of immediately accessible local grounds, local processors, good fishing from 1999/2000 due to a sizeable mid-1990s puerulus settlement event, and increased quality and cost sensitivity caused by catch reduction under quota management meant that reduced allocated catch was, in the view of a

number of operators, best taken economically day fishing for quality inshore red rock lobster out of Bicheno, especially in the winter.

The two processors in Bicheno do not act as significant drawcards for boats outside the area in the way that the processor does in Stanley. The smaller processor principally buys from local boats, while the larger has agents in other parts of Tasmania and drives to pick up much of its tonnage. Their location in Bicheno, however, is undeniably convenient for local operators.

In summary, under quota management Bicheno receives fewer visiting boats and experiences fewer 'home' boats fishing 'away' from the port. Fewer boats leave the area, and those that do, fish away for shorter periods. Boats-through-Bicheno have become more localised as most boats concentrate their fishing in the area. Less visiting boats to Bicheno and less visiting of other ports by boats from Bicheno are the two sides of less travelling in a catch reduced environment under quota management.

St Helens

It is worthwhile reiterating that unloading may not indicate either where fishing or where residing. Unloading is simply the best quantitative surrogate available that represents some level of port activity. Moreover, choice regarding a port in which to unload varies around Tasmania. Many boats in the south-east unload in a number of different ports in the quarter region. More locally, boats working around the Tasman Peninsula, Flinders Island or King Island can unload in a number of different local landing places in a fishing year. For this reason, coast of operation was given above. The point regarding the Mid East region is that Bicheno had largely become a 'home' port, but St Helens continued to receive visiting boats under quota management. Once across its occasionally treacherous bar-way, both local and visiting boats are attracted to St Helens due to its sheltered and spacious wharf facilities, its slipways and marine engineer, and the general goods and services that are associated with a large population centre. St Helens also has a local processor. In contrast, Bicheno is not well sheltered from the north-east, has little wharf area, is not well provided regarding boat maintenance and repair, and lacks a wide range of general goods and services. Not surprisingly, perhaps, boats travelling the east coast largely by-pass Bicheno in favour of St Helens, and Bicheno-based boats may also visit St Helens for intermittent maintenance or repair.

In short, St Helens is the major port in the north-east. Boats fishing south towards Bicheno and north to Flinders Island, as well as boats travelling the east coast, make use of St Helens. In addition, a number of St Helens based boats fish further a field, off the south, the west and the north-west coasts of Tasmania. Consequently, boats-through-St Helens fell by only six or 10.7 per cent between 1997/98 and 2000/2001. Number of landings declined by approximately the same percentage, 9.5. Kilograms unloaded, however, increased in St Helens between 1997/98 and 2000/2001 by 5.1 per cent. From interviews it is known that a number of operators, both lessees, retiring owner-operators and those relocating, left the St Helens fleet between 1997/98 and 2000/2001. Number of boats-through-St Helens in the category of boats unloading ten or more times, however, fell by only one boat between 1997/98 and 2000/2001. Moreover, boats-through-St Helens in the category of boats unloading between one and three times, most likely visiting boats, increased by one boat. The question therefore arises 'where did St Helens' 'new' boats in the ten or more unloadings category come

from?'. Two answers are that they came from other ports or in the form of new entrants to the fishery. A third answer is that, as also happened in Bicheno, some operators based in St Helens but who had also fished 'away' prior to quota management contracted their fishing to their 'home' port under quota management. Their unloadings in St Helens thus increased from being in the category of boats unloading between four and nine times to boats unloading ten or more times. This shift in categories is partly indicated by boats-through-St Helens in the boats unloading between four and nine times category declining by 30 per cent between 1997/98 and 2000/2001, from 20 to 14 boats. The figures for individual boats-through-Strahan alone, discussed above, show five boats contracting their fishing to the north-east, two in Bicheno and one each in St Helens, Lady Barron and Bridport. Comparing the 20 boats in the category of boats unloading between four and nine times in St Helens in 1997/98 with each boat's unloading geography in 2000/2001 reveals seven boats still unloading in St Helens. Five of these boats had shifted into the category of boats unloading ten or more times. These five boats were no longer unloading in southern ports such as Margate and Kettering; but ports such as Lady Barron, Stanley, Grassy and, as noted, Strahan were also no longer visited. Volume fishing in the south of the fishery, especially in the new shellers period, or off the west coast was no longer a feature of these boats' fishing activity. Sufficient quality rock lobster could be unloaded in St Helens to make up limited catch, and local winter fishing was both inexpensive and coincided with the highest beach prices in the fishing year, provided an operator could catch quantities of rock lobster at this time. Substantial 'away' fishing was still undertaken from St Helens, but boats did not fish 'away' as long, and returned to St Helens to unload more often.

For a number of fishers, winter fishing was something of a new gamble under quota management. Many operators considered 'their' rock lobster to be extant under quota management. The gamble was not whether their quota existed and would be caught, but when rock lobster should be taken. Fishers had long gambled on beach price. Fishing in some winter months, however, was for a number of operators a new experience. Combinations of conventional wisdom regarding rock lobster not running, time off from fishing for maintenance or a holiday and so on meant that some winter months were not fished by many operators prior to quota management. Catches were considered to be of insufficient quantity to make fishing worthwhile at these times. Winter months were also the coldest, had the least hours of daylight and often experienced the worst weather. Traditionally, therefore, most fishers took at least one winter month off. With catch limited under quota management, a number of fishers gambled on weather and reputedly pot shy rock lobster to fish high winter beach prices more than they had prior to quota management. With volume less of an issue, local knowledge, prudence and economy were all maximised by fishing out of an operator's 'home' port. Hence, ports such as St Helens and Bicheno experienced more winter fishing locally than prior to quota management as boats that may not have fished as much at 'home' or may have fished 'away' stayed 'home' to work the winter, often day fishing. This tendency was assisted in the north-east by more clement and safer winter weather in the area and improved fishing from 1999/2000. The quota year starting in March also meant that a poor year's fishing over winter could be made good over spring and summer when rock lobster were easier to catch.

Thus, in Bicheno number of landings rose but kilograms per unloading fell as more fishing was done for fewer rock lobster over winter. That some large catching boats-through-St Helens were unloading more in the port is evidenced by average kilograms of rock lobster unloaded per boat increasing by 17.7 per cent between 1997/98 and 2000/2001. Average kilograms per unloading increased by 16.3 per cent in St Helens between 1997/98 and 2000/2001, indicating that less day fishing was done out of the port compared with Bicheno, something supported by data from interviews. Boats unloading at the landing point of Binalong Bay just north-east of St Helens were for the most part day fishing, with more large catching boats doing so in 2000/2001 than in 1997/98.

In summary, St Helens remained the principal port in the north-east of the fishery under quota management. Indeed, in 2000/2001 more kilograms of rock lobster were unloaded in St Helens than in any other port associated with the fishery. St Helens' 'home' boats tended to unload more in the port and St Helens continued to attract visiting boats. St Helens' role as something of a main base for fishing in the north-east was confirmed by many of its 'home' boats concentrating their fishing in the area as well as by boats travelling the east coast visiting to unload. That St Helens had approximately ten per cent fewer boats-through-port and landings in 2000/2001 than in 1997/98 but an increase in kilograms unloaded of 5.1 per cent is evidence of more fishing being done out of the port by a range of operators that included some large catchers. This trend is supported by data from interviews which suggest that many operators are fishing locally more than prior to quota management. Much catch, however, was still being taken from outside the Mid East region by boats based in St Helens, but these boats were fishing their way 'home' from fewer and shorter trips and unloading in St Helens more often under quota management. Thus, St Helens experienced less activity in terms of boats-through-port and number of landings, though it fared better than average percentage reductions for all ports in these respects, but more activity in the form of boats-through-St Helens unloading more rock lobster than before the introduction of quota management. These trends point to St Helens having a more locally focused 'home' fleet under quota management that includes some large catchers as well as to St Helens receiving much visiting boat traffic, en route to and from Flinders Island especially. As noted, localisation includes both boats fishing and unloading locally more as well as boats fishing 'away' less, i.e. for discrete trips rather than for extended stints, but fishing their way 'home' to unload in St Helens more. As noted, too, that stocks in the north-east have improved following a major mid-1990s puerulus recruitment event has made possible more fishing in the region. Any 'bust' side to this 'boom' may have implications for fleet dynamics in the north-east, particularly, but also in other areas of the fishery.

Triabunna

The port of Triabunna includes participants in the commercial rock lobster industry who live in Orford. In some respects, Triabunna exemplifies difficulties in associating 'home' port by majority of unloadings with either where fished or where domiciled. Interviews revealed operators who fished out of Triabunna but lived hundreds of kilometres away, as well as operators who lived and sometimes unloaded in Triabunna but fished off the south and west coasts. Moreover, the Dunalley Canal makes the south-east more accessible to boats based in Triabunna, as well as Triabunna more accessible to boats based in the south-east. That Triabunna is classified as part of the

Mid East region is therefore somewhat arbitrary, as is the case for Dunalley regarding the Tasman Peninsula. In general, however, boats based in Triabunna are likely to fish from Maria Island north up to and including the Freycinet Peninsula, while boats based in Dunalley are likely to fish from Maria Island south down to and including the Tasman Peninsula.

Boats-through-Triabunna fell by a similar percentage to that for all ports between 1997/98 and 2000/2001. Number of landings in Triabunna decreased by approximately the same percentage as for boats-through-Triabunna, indicating that the proportion of boats day fishing out of the port was no greater than prior to quota management. For example, average landings per boat in Triabunna dropped from 8.4 in 1997/98 to 8.0 in 2000/2001, while average kilograms unloaded per landing and per boat both only increased slightly. These slight increases help to explain why kilograms unloaded in Triabunna did not decline as far in percentage as boats-through-port and number of landings.

Triabunna approximately maintained number of boats unloading ten or more times between 1997/98 and 2000/2001. Boats unloading between four and nine times in Triabunna between 1997/98 and 2000/2001 fell by 88.2 per cent, from 17 boats to two. Six of these 17 boats shifted into the ten or more unloadings category in Triabunna, indicating that they were unloading 'away' less often under quota management. Four left the fishery and three no longer unloaded in Triabunna. Boats unloading in Triabunna between one and three times doubled between 1997/98 and 2000/2001, from seven to 14 boats. Four of these 14 boats had unloaded in Triabunna four or more times in 1997/98, indicating a tendency for boats to visit and unload in Triabunna less under quota management. This tendency is supported by data for unloadings by coast. As noted, ports in Tasmania can be considered by quarter region. The south-east quarter region in 1997/98 had a number of boats that unloaded in ports proximate to rock lobster grounds off the south coast, such as Dover and Kettering, as well as in Triabunna. In 2000/2001, fewer boats exhibited this pattern, indicating both that southern boats were less likely to unload in Triabunna and that Triabunna-based boats were less likely to unload in southern ports under quota management. This tendency is also consistent with data from interviews which suggest that operators were fishing locally more under quota management. One answer, then, to the question 'where did 15 boats in the four to nine unloadings category in Triabunna shift between 1997/98 and 2000/2001?' is into higher and lower categories of unloadings in Triabunna. Those shifting into the higher category were unloading locally more, while those shifting into the lower category were based elsewhere and visiting Triabunna less.

In other words, boats unloading between four and nine times in a port in 1997/98 could be either 'home' or visiting boats, i.e. itinerant boats based in the port or visiting the port. Itinerant boats tended to be larger catchers, and many were catch reduced by quota management. Such operators then faced a number of choices. First, to purchase and/or lease in additional quota units and catch as much rock lobster as prior to quota management. Few fishers were in the financial position to do so to the extent required. Second, to contract fishing and unloadings entirely to their local area and port. Third, to continue to fish both at 'home' and 'away' but less so, thus involving shorter trips 'away' and likely more 'home' unloadings due to abandoning extended stint 'away' fishing. For many operators, the requirement of somewhat regular cash flow, as well as fishers targeting winter beach prices but catching more slowly as a result, meant that

fishing was still spread over the year.

Thus, ignoring boats leaving or entering the fishery, three scenarios were likely for boats in a port unloading between four and nine times in 1997/98. First, that no change would be evident, regardless of whether they were 'home' or visiting itinerant boats. This scenario did not often eventuate under quota management. Second, that visiting itinerant boats would no longer unload in the port or would do so less often, thus either disappearing from unloadings in the port or shifting into the category of boats unloading between one and three times per fishing year. Third, that 'home' itinerant boats would stop fishing and unloading 'away' altogether and become exclusively 'home' boats. Fourth, that 'home' itinerant boats would continue at times to fish 'away' but would do so less, thus unloading more at 'home' as more fishing was done at 'home' and/or shorter discrete trips 'away' were undertaken involving more unloading at 'home' on their completion. Both these latter two scenarios were likely to shift boats into the ten or more unloadings category in their 'home' port. A combination of these scenarios resulted in Triabunna's dramatic decrease in boats unloading between four and nine times between 1997/98 and 2000/2001.

However, somewhat accentuating part of this pattern were developments concerning the wharf at Coles Bay. Prior to quota management, a number of Triabunna-based boats fishing off the Freycinet Peninsula at times unloaded in Coles Bay rather than steam to Triabunna. Change in status of the wharf at Coles Bay, though, meant that most of these unloadings shifted to wharves at Triabunna which were oriented towards commercial fishing. Wharfage was also minimised in this way. Thus, commercial rock lobster industry activity through the unloading point of Coles Bay declined significantly, indirectly associated with the area's increasing focus on tourism. Triabunna, on the other hand, was well sheltered, had sizeable wharf areas, a slipway, a local boat builder, a processor's agent, a processor, hardware, a supermarket and community infrastructure that went with a large population centre. In other words, Triabunna catered well to the requirements of the local commercial rock lobster industry.

Interviews revealed that Triabunna's 'home' fleet declined slightly between 1997/98 and 2000/2001. In terms of activity, 'home' boats leaving were nearly made up for by a number of 'home' boats unloading locally more, but a decrease in 'home' boats was noticeable. Quantitative data show that visiting boats unloaded in Triabunna less than prior to quota management. Thus, Triabunna maintained boats-through-port in the category of boats unloading ten or more times, and increased boats-through-port in the category of boats unloading between one and three times. It did so, however, largely at the expense of boats unloading between four and nine times as 'home' boats in this category unloaded locally more and shifted up a category and visiting boats in this category either ceased unloading in Triabunna or unloaded in Triabunna less, thus shifting down a category. Triabunna's gains in the upper and lower categories in part drew from and therefore could not compensate for a 15 boat or 88.2 per cent decline in boats-through-port unloading between four and nine times. Consequently, though Triabunna still has a sizeable 'home' fleet with a number of boats unloading locally more, and still attracts visiting boats under quota management, the lack of boats unloading around half-a-dozen times in Triabunna was primarily responsible for percentage declines for boats-through-port, landings and kilograms unloaded greater than those for all ports. In some respects, one impact on fleet dynamics can be readily

appreciated in Triabunna through the 'hole' in the category of boats unloading between four and nine times made by the introduction of quota management. Many boats in this category in 1997/98 that were still fishing in 2000/2001 either unloaded exclusively at 'home' or unloaded 'away' less, most likely reprovisioning at 'home'. If boats unloading between four and nine times were in some way considered to be the 'cream on the cake' in terms of port activity then catch reduction associated with quota management has dampened many of those ports that relied on such itinerant half-a-dozen unloadings boats.

The Mid North region

The Mid North region primarily consists of the ports of Bridport and Launceston. Most boats unloading in Beauty Point and George Town land their catch before steaming up the Tamar River to Launceston. The Tamar River has both fresh water and pollution-related concerns regarding the health of rock lobster being transported live in boats' wells. Though care needs to be taken due to the low absolute numbers involved, as a region the Mid North fared reasonably well under quota management compared with percentage reductions for boats-through-ports, landings and kilograms unloaded for all ports (Table 58).

Table 58. The Mid North region by port and unloading points, 1997/98 and 2000/2001

	Boats-through-port			No. of landings			Kilograms unloaded		
	1997	2000	%Chg	1997	2000	%Chg	1997	2000	%Chg
Beauty Point	2	3	50.0	2	3	50.0			14.2
Bridport	9	3	-66.7	38	19	-50.0			-59.2
George Town	1	4	300.0	1	15	1400.0			2136.2
Region Total	12	10	-16.7	41	37	-9.8	20196	18052	-10.6
All Ports	744	588	-21.0	4269	3700	-13.3	1664559	1489507	-10.5
Percentages	1.6	1.7		0.9	1.0		1.2	1.2	

NB: Totals for all ports include ports occurring in only one of the two fishing years; some low absolute numbers; figures are approximate

Source: DPIWE

The Mid North region accounted for only 1.7 per cent of all boats-through-ports in the 2000/2001 quota year, one per cent of total landings and 1.2 per cent of the TACC unloaded. Commercial rock lobster industry activity has declined in the Mid North, but approximately in line with those for all ports. In the context, then, of reduction in commercial rock lobster industry activity similar to that for all ports due to catch reduction associated with quota management, a shift in activity from Bridport to Launceston is discernable. In some respects, this shift is related to the longer-term decline of general fishing industry activity in Bridport. Stock depleted or closed fisheries, increased live fish export, the closure of the 'fish factory' in Bridport, fewer boats being built and so on resulted in significantly less general fishing industry activity before the introduction of quota management. By the time quota management was introduced in 1998, commercial rock lobster industry activity constituted most of what remained of commercial fishing industry activity in Bridport. Bridport has long been tide-affected and once its location regarding eastern Bass Strait became less

important, due to the decline of various fisheries and the use of Little Musselroe Bay as an unloading point by some rock lobster fishers, the port itself was less attractive. Moreover, ports that were part of larger population centres such as Launceston and St Helens offered more facilities for fishers and their families. Consequently, shifts in two directions were detectable from Bridport by boats in the commercial rock lobster industry, east to the unloading point of Little Musselroe Bay and west to Launceston. Operators unloading in Little Musselroe Bay continued at times to use Bridport to secure their boat near their place of residence. However, operators shifting to Launceston tended also to move their place of residence to Launceston.

Bridport had no boats-through-port that unloaded ten or more times in either 1997/98 or 2000/2001. Bridport was part of a network of north-eastern ports prior to quota management that included Lady Barron and St Helens. A number of boats fishing in the north-east would unload in Bridport when convenient to where they were fishing or in the direction in which they were travelling. With less fishing and travelling under quota management, Bridport was dropped substantially out of the north-eastern port network, which largely contracted to St Helens. Much of the fishing in Banks Strait is strongly tide-affected. Fishing in this area requires considerable local knowledge. With easier fishing possible elsewhere and many operators catch reduced, visiting boats, of which there were generally fewer and which travelled less under quota management, mostly did not fish in the Banks Strait area. As operators with the local knowledge and skills to fish areas such as Banks Strait left the fishery or shifted elsewhere they were rarely replaced by new operators. Consequently, in 2000/2001 boats-through-Bridport, number of landings and kilograms unloaded in Bridport had all declined by over 50 per cent compared with 1997/98.

The decline of fishing industry activity in Bridport, for which quota management in the commercial rock lobster industry accounts for only part, meant that the port became less attractive as either a 'home' or an 'away' port. A small handful of boats remained in the area in 2000/2001, but ports elsewhere were preferred bases or unloading points. One such preferred port was Launceston. Like Bridport, little rock lobster 'bottom' exists near Launceston and day fishing is not commercially possible full-time. Launceston is, however, Tasmania's second largest city and offers good port and general facilities. Boats operating out of Launceston travel east or west to access rock lobster grounds. Boats travelling west to fish, for example in the WNW region, often unloaded away from Launceston, for example in Stanley. Boats travelling east to fish, for example around the Furneaux Group, were more likely to unload in 'Launceston' as Bridport was no longer a significant 'home' port. Buyers of rock lobster existed in Launceston and a number of processors were prepared to travel to Launceston to pick up rock lobster. Launceston's principal attraction, however, was as a sheltered and well provided port in a city offering many of the facilities important to families, such as matriculation colleges. The port was not central to rock lobster grounds, rather it was central to a major population centre. Launceston was therefore a good 'home' port in the forms of provisioning, maintenance, repair, family requirements and so on. Like Hobart, however, overnight trips were required to access most rock lobster grounds, distances operators were prepared to travel to access the facilities available in these major coastal population centres. In other words, they preferred their fishing to be somewhat isolated, instead of their families being removed from the benefits of living in one of Tasmania's two largest cities.

The Mid North is the smallest of the regions discussed measured by kilograms unloaded. The presence of the commercial rock lobster industry in Launceston is small compared with that in Hobart in terms of number of boats and visibility. Commercial rock lobster boats at times largely take up Victoria Dock in Hobart and are arguably an important part of the portscape close to the heart of the city. The commercial rock lobster industry does not contribute as significantly to the character of Launceston. Fewer boats are involved and the port is somewhat distant from the city centre. As in Hobart, it is difficult to measure the economic effect of the commercial rock lobster industry in a large population centre such as Launceston, but commercial rock lobster boats are not as important to the image of Launceston as they are in Hobart.

The port of Bridport is now largely quiescent compared with the early 1990s. A number of fisheries have either declined, been closed or had quota management introduced and, as noted, few boats are at present being built in the commercial rock lobster fishery or any other fishery. Bridport was at one time a centre of boat building activity and, though this capacity remains, less activity is evident. What few commercial boats continue to operate out of Bridport share the port with the ferry to Flinders Island and the recreational sector. Decline in fishing industry activity, however, has been more than offset by activity in the retirement, tourism and terrestrial farming industries, particularly the former two. For example, the population of Bridport increased by 5.9 per cent between the 1991 and 1996 censuses, from 1165 to 1234 people (ABS, 1996). This increase is contrary to a general trend in rural Tasmania of population decline. That Bridport is becoming a popular location for retirees is indicated by 19.9 per cent of Bridport's population being aged 65 or more in 1996, compared with 12.3 per cent of Tasmania's population (the ratio of families with dependents to lone person households in Bridport was approximately 1:1 in 1996, compared with 1:0.67 for Tasmania). The unemployment rate in Bridport was 3.2 percentage points below that for Tasmania in 1996. Moreover, Bridport increasingly attracts tourists, and its population peaks in summer at the height of the tourist season. In addition, many Tasmanians, particularly from Launceston, holiday in Bridport in summer in shacks and other accommodation. In short, the character of Bridport may be changing due to decline in general fishing industry activity largely pre-dating that associated with the introduction of quota management, but the town itself is not in decline.

The NNW region

A number of aspects relating to the NNW have already been discussed. The region is dominated by the port of Stanley which is primarily made up of a processor, a fishing company and a number of commercial rock lobster fishers (Table 59).

The NNW region accounted for ten per cent of all boats-through-ports in the 2000/2001 quota year, 8.6 per cent of total landings and 11.5 per cent of the TACC unloaded (the NNW accounted for just over eight per cent of the total commercial catch unloaded in 1997/98). Smithton is in some respects on the border of the NNW and WNW regions. Locationally, it lies on the NNW coast but much of what commercial rock lobster industry activity occurs in Smithton was associated with fishing off the WNW coast; a number of boats shifted from Smithton to Stanley between 1997/98 and 2000/2001. Occasional unloadings in Wynyard were simply convenient for the fishers who lived in

the township.

Table 59. The NNW region by ports and unloading point, 1997/98 and 2000/2001

	Boats-through-port			No. of landings			Kilograms unloaded		
	1997	2000	%Chg	1997	2000	%Chg	1997	2000	%Chg
Smithton	13	4	-69.2	77	13	-83.1			-85.6
Stanley	48	51	6.3	261	299	14.6			42.4
Wynyard	2	4	100.0	7	8	14.3			244.4
Region Total	63	59	-6.3	345	320	-7.2	134961	171947	27.4
All Ports	744	588	-21.0	4269	3700	-13.3	1664559	1489507	-10.5
Percentages	8.4	10.0		8.0	8.6		8.1	11.5	

NB: Totals for all ports include ports occurring in only one of the two fishing years; some low absolute numbers; figures are approximate

Source: DPIWE

By 2000/2001, in terms of commercial rock lobster industry activity, Stanley had become a still larger feature of the NNW region than in 1997/98. Three main factors were involved in the continued ascendance of Stanley in the region. First, as noted a number of boats moved from the waning port of Smithton to the waxing port of Stanley. Second, the fishing company in Stanley shifted into rock lobster fishing in earnest due to the temporary closure of the giant crab fishery. Third, the processor in Stanley purchased approximately 200 tonnes of rock lobster per quota year, in part by subleasing quota units for fishers. Thus, Stanley attracted more boats-through-port and experienced more landings. Moreover, Stanley increased its kilograms unloaded by 42.4 per cent between 1997/98 and 2000/2001. As noted, some of this increase was at the expense of Smithton, but by no means all. Notable when categorising boats by number of coasts on which unloaded in 2000/2001 compared with 1997/98, was the number of boats that predominantly unloaded in regions other than the NNW, particularly in the south-east, that also unloaded a number of times in Stanley. For example, nearly 80 per cent of boats-through-Stanley unloaded between one and nine times in 2000/2001. Interviews revealed that Stanley did not have a sizeable 'home' fleet. For example, only 11 of the 51 boats-through-Stanley unloaded ten or more times in 2000/2001. The vast majority of boats-through-Stanley were therefore visiting boats.

Drawing these visiting boats to Stanley was a combination of the local processor and good fishing grounds off the north-west coast. The processor in Stanley was adequately located to take deliveries from boats fishing these grounds. It did not have to drive large distances to pick up rock lobster, perhaps through local agents, as some other processors less well located regarding volume producing rock lobster grounds were required to do.

There were, however, a number of options for operators fishing in the north-west regarding the sale of their catch. Melbourne-based processors were accessible through King Island, there was a local processor in Smithton, processors were accessible by road or by steaming 'home' with a load of rock lobster. The processor in Stanley, though, was favoured by many fishers, not just because it offered conveniently located and reliable purchase of virtually any amount of rock lobster at any time, but because sublease arrangements existed involving many fishers, the processor and owners of

quota units, often via the agency of brokers. It was understood that, at the going price, the fisher would sell rock lobster caught as part of leased quota units to the processor that had provided 'up front' payment to a quota owner on behalf of the fisher. Some interview participants maintained that it was required that the fisher also sell rock lobster to the processor caught as part of the fisher's own quota units. However, evidence regarding the nature of often informal understandings between processors and fishers is mixed. For example, some participants stated that fishers did not always sell to processors providing finance to lease in quota units.

Relationships between processors and fishers were complex. Clearly, processors were concerned to guarantee supply at a reasonable price. Fishers, in turn, were interested to secure the highest price possible. Different fishers related with processors through varying combinations of business and mateship, and different ranges of transactions were evident involving rock lobster, bait, finance and so on, some of which were formal, but many of which were informal and involved various kinds of payment. The point here is that the processor in Stanley purchased approximately 200 tonnes of rock lobster in 2000/2001. To guarantee supply without offering a higher price, the processor paid a number of quota owners 'up front' to lease in units and required payment from the fishers involved when the rock lobster caught were purchased by the processor. The processor in Stanley dealt with approximately 160 boats in the commercial rock lobster fleet in 2000/2001. Approximately 30 of these 160 boats dealt exclusively with this processor. An estimated 50 per cent the processor's trade was secured through pay-as-you-go arrangements, involving a 'float' of approximately AU\$250,000. Whether any margin was added in the process could not be ascertained but some margin was likely, *a fortiori* considering that brokers were often involved. Commonly, the lease cost was deducted by the processor from the sale price of the rock lobster, but fishers were ostensibly free to sell to another processor provided the sublessee was paid.

A number of fishers considered such arrangements to be convenient. Fishers wishing to lease in rock lobster but lacking the funds to do so, and not wishing to organise the often substantial amounts required through a financial institution, were prepared to operate via the intermediary of a processor-sublessee and pay for leasing in quota units when rock lobster were sold. Such fishers tended to be large catchers. Lessee-operators generally needed to catch large tonnages of leased quota units for fishing to be economically viable. Owner-operators leasing in quota units were often those whose reduced allocated catch, compared with their catch prior to quota management, was caught with considerable fishing time in the quota year still remaining. A number of both these types of fishers wishing to lease in quota units entered into subleasing arrangements with processors such as in Stanley. Many quota owners preferred not to deal direct with fishers as payment was often not available 'up front'. Processors, often via brokers, offered the attraction of 'up front' payment. With a number of large catchers leasing in quota units through the processor in Stanley, not just more boats-through-port and landings were experienced in Stanley but, as noted, kilograms unloaded increased considerably. For example, average landings per boat in Stanley only increased from 5.4 in 1997/98 to 5.9 in 2000/2001, but average kilograms unloaded per boat increased by 34 per cent, and average kilograms unloaded per landing increased by 24.2 per cent.

Clearly, the processor in Stanley was something of a magnet attracting commercial rock lobster industry activity. One way to influence the location of commercial rock lobster industry activity, therefore, may be through the processing sector. Stanley, however, like Bridport had experienced a decline in general fishing industry activity before the introduction of quota management. Stock depletion in fisheries such as shark and scallop, and live fish export had reduced much of the labour employed by the local 'fish factory' by the time quota management was introduced in 1998. By this time only catch in the rock lobster fishery continued to be landed in Stanley in any quantity. Other fishing industry activity in Stanley had fallen away considerably. Stanley was said in interviews to be 'quieter' and to be relying more heavily on tourism and traditional terrestrial farming activity as a result. Less work was available on boats and processing catch, and there was less business associated with the fishing industry. This downturn in general fishing industry activity in Stanley, associated with principally the finfish and scallop sectors, was part of a general decline in the fishing industry in these sectors around Tasmania, and occurred in Stanley despite a slight increase in activity associated with the commercial rock lobster industry. For example, approximately 80 per cent of the Stanley processor's trade was rock lobster, approximately 80 per cent of which was exported live to China. Live export required considerably less labour compared with cooking and tailing rock lobster. Stanley, then, was caught between two pincers that forced activity from the fishing industry generally, less catch being landed in Stanley across all fisheries and less labour being required to process what catch was landed. The commercial rock lobster industry was not part of the first pincer, but it was part of the second.

It was in terms of less employment that reduced fishing industry activity in Stanley was noted by many participants interviewed. Smithton, not Stanley, was the major population and service centre in the region. Boats-through-Stanley in the commercial rock lobster industry were attracted by either the processor or the fishing company, not local provisioning outlets. Despite experiencing few boats-through-port under quota management, Smithton continued to experience commercial rock lobster industry activity in the form of a processor and operators from the WNW, Stanley and visiting boats reprovisioning.

Thus, though general fishing industry activity in Stanley was noticeably lower in terms of employment than when the cannery in Stanley was in full operation, commercial rock lobster industry activity continued to be a feature of the town. Stanley had a major processor, a small core of 'home' boats, many visiting boats to the port and a fishing company that operated and maintained a number of boats in the industry as well as catered to tourist trade. That visiting boats unloaded but largely did not reprovision in Stanley was for the most part due to Stanley's small size limiting it to only modest local provedores. Smithton is only a short drive or steam from Stanley, and there is no record of boats reprovisioning but not unloading in Smithton. Stanley is in part favoured by the processor and fishing company due to infrastructural inertia. Much of the infrastructure involved in their activities is expensive to build and existing processing facilities are attractive, as is also the case in some other parts of Tasmania.

On balance, and noting that variables discussed for each region do not qualitatively take into account individual cases, a number of which include significant catch reduction, commercial rock lobster industry activity appeared to increase slightly in the NNW region under quota management. Boats-through-ports and number of landings

declined by only 6.3 per cent and 7.2 per cent respectively, while kilograms unloaded increased by 27.4 per cent. Reasons for this performance include the drawcards of abundant stocks in the north-west and a major processor in Stanley, particularly regarding visiting boats, the fishing company in Stanley increasing its commercial rock lobster fishing, and 'home' boats unloading locally more. This last trend is particularly noticeable in the WNW region, involving the processors in both Smithton and Stanley, discussed below. Though a number of local operators were catch reduced by quota management and visiting boats do not have as great a socioeconomic impact as 'home' boats, the NNW region clearly fared better than many other regions under quota management. The emphasis, however, was on visiting boats attracted by local stocks and processor demand, not so much on 'home' boats catching more rock lobster, though they may unload locally more. Thus, the experience of an individual local operator could be one of catch reduction but more unloading locally due to less 'away' fishing. It is difficult socioeconomically to quantify a difference locally between a 'home' boat unloading at 'home' more but less overall, common under quota management, and a 'home' boat unloading locally less but more overall, common prior to quota management. What can be said about the NNW region is that under quota management it experienced both localised and 'away' fishing, by 'home' and visiting boats respectively, and that the commercial rock lobster industry was a continuing presence that may have altered somewhat in nature but was still identifiable in extent similar to prior to quota management. Differences between a regional experience based on unloadings and those of individual operators are discussed in more detail regarding the WNW region below where onshore dampening of the commercial rock lobster industry is evident despite more local offshore fishing and unloading activity.

The Tasman Peninsula region

Consideration of the Tasman Peninsula region is complicated by two factors. First, Dunalley is included. As noted, Dunalley is a passage point for commercial rock lobster boats travelling between the east and south-east coasts. Dunalley also has a number of 'home' boats, a number of which day fish for much of the fishing year. It is problematic to include Dunalley in either the Mid East, the Channel or the Tasman Peninsula regions. From interviews, operators based in Dunalley appeared to fish towards and around the Tasman Peninsula more than elsewhere, thus justifying inclusion in the Tasman Peninsula region. Dunalley-based fishers, however, also fish up the east coast, as well as have the option of fishing down towards the south coast. Moreover, given that Dunalley is only an approximately 45 minute drive from Hobart, operators of boats based in Dunalley may not live in the town.

Second, recording of unloadings in Pirates Bay and Eaglehawk Neck changed between 1997/98 and 2000/2001. Pirates Bay and Eaglehawk Neck were recorded separately in 1997/98, but under quota management just Eaglehawk Neck is recorded. Figures for Pirates Bay in 1997/98 have been included with those for Eaglehawk Neck. Pirates Bay does not appear as an unloading point in 2000/2001. While most combined figures for Eaglehawk Neck in 1997/98 are reliable, average landings per boat, kilograms unloaded per boat and kilograms unloaded per landing are only approximate.

With these two caveats in mind, boats-through-ports, number of landings and kilograms unloaded for the Tasman Peninsula region declined by lower percentages than for all ports (Table 60).

Table 60. The Tasman Peninsula region by ports and unloading points, 1997/98 and 2000/2001

	Boats-through-port			No. of landings			Kilograms unloaded		
	1997	2000	%Chg	1997	2000	%Chg	1997	2000	%Chg
Dunalley	11	13	18.2	41	80	95.1			47.7
Eaglehawk	9	8	-11.1	74	67	-9.4			26.5
Nubeena	14	9	-35.7	102	71	-30.4			-27.8
Port Arthur	8	12	50.0	45	36	-20.0			-18.3
Region Total	42	42	0.0	262	254	-3.0	62279	58716	-5.7
All Ports	744	588	-21.0	4269	3700	-13.3	1664559	1489507	-10.5
Percentages	5.6	7.1		6.1	6.8		3.7	3.9	

NB: Totals for all ports include ports occurring in only one of the two fishing years; some low absolute numbers; figures are approximate

Source: DPIWE

The Tasman Peninsula region accounted for 7.1 per cent of all boats-through-ports in the 2000/2001 quota year, 6.8 per cent of total landings and 3.9 per cent of the TACC unloaded. The region experienced the same number of boats-through-ports in 2000/2001 as in 1997/98, only eight less landings and approximately 3.5 fewer tonnes unloaded. As a region, then, the trend for the Tasman Peninsula has been one of a minor decline in commercial rock lobster industry activity. However, the experiences of each of the two ports and unloading points in the region have been markedly different. Proceeding alphabetically, Dunalley had only two more boats-through-port in 2000/2001 compared with 1997/98, but its number of landings almost doubled and its kilograms unloaded increased by nearly 50 per cent. These figures as well as interview data suggest that boats fishing out of Dunalley were fishing locally more, often day fishing, in 2000/2001 than in 1997/98. For example, average landings per boat increased in Dunalley from 3.7 to 6.2 and average kilograms unloaded per landing decreased by approximately one-quarter between these two fishing years. With average kilograms unloaded per boat increasing by nearly one-quarter, however, Dunalley experienced the increase in kilograms unloaded noted above. In some respects, the position of the commercial rock lobster fishery against the background of declining activity in the fishing industry around Tasmania more generally, noted above regarding Stanley and Bridport, is exemplified in Dunalley. The commercial rock lobster fishery is largely all that remains of a once diversified fishing port. The former cannery overlooking the wharf is now an antiques café and the processor in Dunalley buys only a few rock lobster for sale locally.

Kilograms unloaded in Eaglehawk Neck increased by over one-quarter between 1997/98 and 2000/2001. This increase was despite experiencing one fewer boat-through-port and seven fewer landings. Clearly, boats-through-Eaglehawk Neck were landing larger loads in 2000/2001. Average kilograms unloaded in Eaglehawk Neck per landing increased by approximately one-quarter between 1997/98 and 2000/2001. Some larger catchers were unloading more often in Eaglehawk Neck than prior to quota management, but were not necessarily day fishing. Interview data suggest that larger catchers had bigger boats with wells that could hold more rock lobster as well as that some larger catchers spent periods fishing offshore or on discrete trips away to catch tonnages, to be unloaded at Eaglehawk Neck, not as readily available locally inshore.

Nubeena has 'home' boats that operate either locally, often day fishing, or travel away to fish up the east coast or to fish the south and/or west coasts. Boats-through-Nubeena, number of landings and kilograms unloaded all decreased by approximately 30 per cent between 1997/98 and 2000/2001. Average landings per boat, average kilograms unloaded per boat and average kilograms unloaded per landing all increased slightly in Nubeena, indicating a tendency for boats unloading in the port to be doing so more often and, perhaps, to be fishing locally more. However, Nubeena lost four boats unloading between four and nine times in 2000/2001 compared with 1997/98. This loss was due both to boats leaving the fishery and to less 'away' fishing being done by many operators under quota management. Thus, as a number of boats in the Tasman Peninsula region unload locally more, so too do many boats based in ports in other regions. Though perhaps declining somewhat prior to quota management due to overfishing, fishing off the Tasman Peninsula, particularly off Tasman Island, was popular with a number of boats based in the south-east and as far up the east coast as St Helens. Some of these boats unloaded in Nubeena. Under quota management, this 'traffic' largely fell away as fewer visiting boats fished the area, and those that continued to visit did so less often. Thus, as in a number of other ports under quota management, in the context of fewer boats-through-port, some boats that unloaded between four and nine times in 1997/98 were 'home' and 'away' boats that stayed 'home' in 2000/2001 and therefore unloaded in Nubeena ten or more times. Other boats were visiting boats that either stopped visiting the area and unloading in Nubeena or did so less often, thus only unloading between one and three times. In these ways, Nubeena became more of a 'home' port, receiving fewer visiting boats than prior to quota management.

In 2000/2001, only one boat unloaded in Port Arthur ten or more times. Interview data, too, indicate that only one boat operated out of Port Arthur 'full-time' in 2000/2001. Only two boats unloaded ten or more times in Port Arthur in 1997/98. Boats-through-Port Arthur, however, increased by 50 per cent between 1997/98 and 2000/2001. This increase was entirely made up of boats unloading between one and three times, the number of which rose from four to nine. However, despite boats-through-Port Arthur increasing by 50 per cent, number of landings fell by 20 per cent and kilograms unloaded fell by 18.3 per cent. Average kilograms unloaded per boat fell by approximately 45 per cent. Visiting boats unloading in Port Arthur were either local to the Tasman Peninsula or were among the fewer visiting boats to the region. Port Arthur was an unloading point convenient to stocks in Maingon Bay and around Tasman Island, but was hardly used as a 'home' port due to its location in the Port Arthur historic site.

Apart from a number of individuals being catch reduced by quota management, the main regional social impact mentioned by participants interviewed was there being less work for deck hands under quota management. Moreover, some long-standing fishing families were based in the region and there was concern that the industry could no longer offer a career, not just to local young hopefuls, but to more than one son or grandson in a traditional fishing family. Concerns such as these, as well as trends such as unloading locally more and less unloading by visiting boats, were common throughout the commercial rock lobster industry under quota management.

The West region

The commercial rock lobster industry in the West region is comprised almost entirely of activity in the port of Strahan. Granville Harbour was used by only one operator in the commercial rock lobster industry in 2000/2001, a day fisher. Granville Harbour is not discussed individually for reason of confidentiality. Given that Strahan was presented at length above, no further discussion of the West region is undertaken in this subsection.

The WNW region

The WNW region has been discussed in part above. The region includes unloading points from Bluff Hill Point down to Temma. Much of the fishing done by operators based in the region involves fast, planing hull boats. These are used to exploit better early morning weather to pull and reset pots before returning to the shelter of small reef harbours. Boats may also be towed above the high water mark across short beaches. The landing places in the WNW region are unloading points not ports. On the whole, they are only associated with a settlement of shacks. Operators of boats usually own and reside in a shack for periods at a time. Most operators also have a permanent home elsewhere, such as in Smithton in the NNW region. Most goods are purchased in Smithton, and much major work on boats requires either travelling to a well provided port in terms of maintenance and repair facilities and expertise, or bringing a specialist into the region. Travelling to specialised facilities and tradespeople is often less expensive than importing these.

As noted, there are links in the commercial rock lobster industry between the WNW region and Smithton in the NNW region. A number of fishers' families live in Smithton, most goods and services are purchased in Smithton and many fishers sell rock lobster to the processor in Smithton. Fishers based in the WNW also sell to the processor in Stanley. The processor in Smithton purchases a smaller amount of rock lobster per quota year, approximately 70 tonnes compared with approximately 200 tonnes purchased by the processor in Stanley, but a greater percentage is purchased from local fishers, predominantly operators in the WNW region. Both processors run trucks to pick up rock lobster from fishers unloading in the WNW. 'Unloading' in the region usually involves removing rock lobster from caufs rather than from boats' wells, operators towing boats across beaches, especially, having to leave their rock lobster in the water until being picked up by a processor.

Bearing in mind the low absolute numbers involved, commercial rock lobster industry activity in the WNW region exhibited some dramatic changes in 2000/2001 compared with 1997/98 (Table 61).

Table 61. The WNW region by unloading points, 1997/98 and 2000/2001

	Boats-through-port			No. of landings			Kilograms unloaded		
	1997	2000	%Chg	1997	2000	%Chg	1997	2000	%Chg
Bluff Hill Point	2	3	50.0	24	42	75.0			168.6
Couta Rocks	3	7	133.3	18	106	488.9			113.7
Nelson Bay	1	2	100.0	1	47	4600.0			1762.4
Temma	5	4	-20.0	48	94	95.8			16.5
Region Total	11	16	45.5	91	289	217.6	36527	71362	95.4
All Ports	744	588	-21.0	4269	3700	-13.3	1664559	1489507	-10.5
Percentages	1.4	2.7		2.1	7.8		2.1	4.7	

NB: Totals for all ports include ports occurring in only one of the two fishing years; some low absolute numbers; figures are approximate

Source: DPIWE

The WNW region accounted for 2.7 per cent of all boats-through-ports in the 2000/2001 quota year, 7.8 per cent of total landings and 4.7 per cent of the TACC unloaded. Boats-through-ports in the WNW region increased by five or 45.5 per cent between 1997/98 and 2000/2001. This increase, however, does not indicate how markedly boats-through-ports had increased their number of unloadings in the WNW. For example, in 1997/98 three or 27.2 per cent of boats-through-ports unloaded ten or more times. In 2000/2001, 12 or 75 per cent of boats-through-ports unloaded ten or more times. Thus, number of landings in the WNW region increased by nearly 200 or 217.6 per cent. With more boats landing rock lobster in the region more often, catch unloaded in the WNW nearly doubled between 1997/98 and 2000/2001. Consequently, average number of landings per boat increased in all unloading points in the WNW region, average kilograms unloaded per boat increased in three of the four unloading points, and average kilograms unloaded per landing decreased in three of the four unloading points between 1997/98 and 2000/2001. That average number of landings per boat more than doubled in three of the four unloading points indicates that boats based in the WNW region were unloading 'away' less, unloading locally more and primarily day fishing. Few boats-through-ports in the region were visiting boats due to the unsuitability of displacement hulls regarding much of the shelter available, with the possible exception of Couta Rocks, and the lack of accessible goods and services onshore. Interviews, however, revealed boats fishing but not unloading in the region due to the quality rock lobster available, particularly inshore. Like some boats based in Currie on King Island, a number of 'home' boats in the WNW region no longer unloaded in Strahan under quota management. Instead, operators, often catch reduced, unloaded in the WNW, day fishing in the region largely inshore, as without more quota units volume fishing further south was economically unattractive.

This trend points to a paradox operating at different scales in the WNW. A number of fishers based in the region were catch reduced by quota management and responded by abandoning 'away' fishing, day fishing and unloading locally more and shifting from fishing with a deck hand to single handing. Thus, though they fished and caught less overall, they concentrated more of their effort and catch on local grounds, principally inshore. They reprovisioned locally more, i.e. in Smithton, but they earned less and therefore stopped employing a deck hand and did more maintenance and repair work on their boats themselves.

This paradox of the individual compared with the regional scale indicates why so many industry participants interviewed throughout Tasmania mentioned lack of visiting boats and less employment, mainly for deck hands, as the two most noticeable social impacts of quota management. As many individual operators contracted their fishing locally and sought ways to reduce the labour cost of the enterprise, effort and expenditure outside local fishing grounds and the core financial unit were minimised, resulting in much visiting boat and local employment 'cream' disappearing. Many 'home' boats were fishing and therefore spending locally more but many ports received fewer visiting boats, and local expenditure by 'home' boats was structured to minimise outlays on crew and maintenance and repair by maximising do-it-yourself. Single handing and do-it-yourself boat maintenance and repair cost primarily time, something many operators had in surplus under quota management.

In summary, the WNW region in some respects highlights a number of apparent contradictions under quota management. Noting that boats-through-ports decreased for all ports by 21 per cent, number of landings by 13.3 per cent and kilograms unloaded by 10.5 per cent between 1997/98 and 2000/2001, according to these benchmarks the WNW region fared exceptionally well under quota management as boats stayed 'home' to fish. However, fishing pressure on local stocks, particularly quality inshore rock lobster, was thereby increased. Moreover, though 'home' boats were present more in the local area, they were often fishing less than prior to quota management, which translated into their being absent from 'away' ports. Cost minimisation also often meant that they were absent from the local labour market by ceasing to employ a deck hand. Thus, shortening of fishing ranges and tightening of financial belts under quota management could result in more 'home' unloading and provisioning but in less expenditure on employment, maintenance and repair, and house and family due to the catch and income of many operators being reduced by quota management.

In summary, with catch and income limited under quota management, many operators contracted to their local fishing grounds and relied more on the resource of their own labour. In these ways, commercial rock lobster industry activity could in some cases increase in a 'home' port, but the reach of the industry to 'away' ports and into the local economy was in many instances truncated. The WNW region had a number of single handing 'home' boats in 2000/2001 that had been double handing 'home' and 'away' boats in 1997/98. Both the geographies and the economies of these boats were less extensive in 2000/2001. Increased commercial rock lobster industry activity in the WNW was, then, due to contraction by individual operators not expansion. Areal concentration at the scale of this region resulted in increased boats-through-ports, landings and kilograms unloaded, but these increases hide catch reduction of individual operators, reduced visitation of ports in other regions, less local employment and so on. 'Home' boats are worth more to individual ports in terms of commercial rock lobster industry activity, but 'away' boats spread the wealth of the fishery further by involving more ports as well as labour in the form of deck hands. As noted, if a mechanism could be developed to encourage boats to fish abundant west coast stocks more, for example by offering supplementary west coast quota units, then the number of boats 'away' fishing could be expected to increase. In this way, more value could be extracted from the fishery, some fishing pressure could be taken off inshore stocks proximate to 'home' ports and industry activity could be increased in the form of visiting boats as well as in local labour markets. If these outcomes are thought to be worth pursuing, then such a mechanism merits consideration.

7.3.8 Performance Indicators

Opportunity is taken in this chapter to discuss the relevance of performance indicators in the Tasmanian commercial rock lobster industry. It is not intended in this chapter to suggest points on trend lines regarding variables in the industry at which particular courses of action should be taken. The setting of any such points is the preserve of appropriate management bodies such as the Minister's Rock Lobster Fishery Advisory Committee. Such bodies bring together representatives from all sectors of the industry to consider information and issues relating to the fishery. Courses of action, should any such 'trigger' points be reached, need also to be decided by such bodies.

It is information and issues that reports such as this can contribute for consideration. One summary way of presenting information and issues regarding the industry is through performance indicators. Performance indicators are variables that reveal something of how an aspect of the industry is changing over time. In other words, performance indicators are time-series data for key or available industry variables. As such, relevant variables need to be identified, data relating to these recorded and trends in these data presented. Once trend lines are established, management bodies may set projected points at which prescribed courses of action may be taken, or at which the variable or indicator concerned is subject to more detailed consideration. Before this can occur, however, the variables to be considered need to be identified.

A number of performance indicators are already in use in the Tasmanian commercial rock lobster industry (Table 62). Varying degrees of formality attach to existing performance indicators. For example, in this report number of boats in the fishery in the 2000/2001 quota year was calculated to be approximately 243. Number of boats in the 1997/98 pre-quota year was calculated to be approximately 331. Thus, approximately 88 fewer boats, or 26.5 per cent, were apparent in the fishery in 2000/2001 compared with 1997/98. Fishery managers, TAFI, the TRLFA and so on have their own calculations and understandings of number of boats in the fishery. With a clear trend line downward established, however, there is talk in the industry of a trigger point being set. The figure at which a trigger point might be set appears to be somewhere within the range of 225 and 200 commercial boats active in the fishery. What this trigger point would represent, however, varies among industry participants. For some, it would represent a point below which the number of boats in the industry should not be allowed to fall. Thus, action to prevent such an occurrence may be required before the trigger point is reached. In this way, the point would act more as a floor than a trigger. For others, the trigger point would signal action to affect the trend concerned. For still others, the trigger point would indicate that detailed consideration was required regarding the implications of the trend identified. Closer monitoring of the trend and development of a policy regarding it would then be required.

There are therefore a number of issues associated with even the most obvious and accepted variable in the fishery. Most basically, there is not agreement as to what exactly the variable 'number of boats in the fishery' represents or indicates. Is it an efficiency measure or a socioeconomic measure? Is decline in number of commercial boats active in the fishery a good or a bad development? Should the fishery be allowed to restructure along the lines of there being fewer but larger operators? Questions such as these are yet to be answered in the industry. Next, differences in calculations arise influencing exactly how many boats participants consider are actually active in the fishery. There is agreement that number of boats in the fishery has declined, but from

what number to what number, and with what implications are less than clear.

Table 62. Present and possible performance indicators regarding the Tasmanian commercial rock lobster fishery

	Rationale	Data source	How often
No. of boats (real capital)	Work platforms of the industry; fleet of various length boats necessary to maximising yield from all parts of the fishery; onshore unloading, reprovisioning, maintenance, repair and replacement activity; employment; and career opportunities	Catch returns (DPIWE)	Update every fishing year
Percentage of boats owner-operated	Fleet traditionally owner-operated; regulatory compliance arguably greater, co-management arguably facilitated and sustainable fishing practices arguably more likely by owner-operator stakeholders; greater retention of value in Tasmania	Licensing data and catch returns (DPIWE)	Update every fishing year
Geography of licence holders (concentrating in Hobart)	Indicative of centralisation of ownership; indicative of increased proportion of licence ownership by non-operators; and indicative of declining 'rural' 'home' fleets	Licensing data and catch returns (DPIWE)	Update every fishing year
Boats-through-ports (by landing)	Indicative of 'home' and visiting boat activity by port; geography of boat-related activity; long-term monitoring of use of ports possible; possible (de)centralisation measure re activity; average kilograms unloaded per landing and per boat also useful re local activity level	Catch returns (DPIWE)	Update every fishing year
No. of processors	The greater the number of processors purchasing more than ten tonnes of rock lobster per fishing year, the less likely oligopoly	Licensing data and receipts (DPIWE)	Update every fishing year
Boats by length and geography of catch	Size-class distribution of boats according to where fished is indicative of trends in types of boats as well as in fleet dynamics; various types of boat and areas fished may be important to maximising yield from the fishery	Catch returns (DPIWE)	Update every fishing year
Age distribution of 'skippers' (human capital)	Monitor number of leavers, size of pre-retirement cohort, and number of new entrants to the fishery; may assist planning for future human capital requirements of the fishery	Licensing data (DPIWE)	Update every fishing year
Percentage of quota units (sub)leased	Indication of extent of lease economies, both onshore and on the water; monitoring of subleasing regarding possibly anti-competitive behaviour	Licensing data (DPIWE)	Update every fishing year
Social impact assessment	Provide background detail regarding performance indicators and issues in the industry	Social research	Every five years, coincide with new management plan

Perhaps, if nothing else, a trigger point could be used to initiate wide-ranging debate in the industry as to what a trend means, with a view to arriving at agreement as to what, if anything, ought to be done about it. According to Montaigne, however, “no wind helps him who does not know to what port he sails”. Without a vision for the Tasmanian commercial rock lobster industry, performance indicators are of little more than interest value unless there is a clear and accepted understanding as to where certain trends are taking the industry, whether this direction is desirable as well as where the industry wants to be. There needs to be an industry view on the favourability of any destination if points *en route* are to be identified at which the direction might be influenced. In short, the rationale underlying performance indicators and trigger points is crucial to their identification and setting, as well as to any response to them. Put simply, so what if number of boats falls below 200, percentage of boats owner-operated drops under 50 or concentration of owners of commercial rock lobster licences continues in Hobart? Why examine these variables in the first place? If the industry is concerned to remain predominantly owner-operated, would like to be decentralised or would prefer to have a fleet of varying boat lengths, as well as types of operators, numbering over 225 then such aims need to be clearly stated. How the industry would like to look in 2020, for example, is important to what directions are tracked, for what reasons and with what proposed courses of action should steering of the industry be required.

Thus, the three variables which are at present monitored in some way in the industry – number of boats, percentage of owner-operators and ‘concentration’ of licence owners according both to entities as well as geographically – are largely divorced from any vision for the industry. This is because no broadly-based, longer-term vision for the industry at present exists. A draft vision currently being developed by the TRLFA may prove to be an important initiative. Once finalised and accepted by all sectors of the industry, it could help in the identification of performance indicators, the establishment of trigger points and so on.

Other variables for which trend lines could be monitored have been discussed in this report. Data detailing the ‘aging’ of the populations of both fishers and licence owners have been presented. Clearly, the industry needs to ensure that operators are entering the fishery in order that the TACC continues to be caught, quota units continue to be leased and so on.

Boats-through-ports data were calculated that show something of change in the regional distribution of industry activity. Again, monitoring trend lines in this variable would need to have a point. Knowing that a number of isolated ports are experiencing less visiting boat activity under quota management is largely useless without a position regarding the desirability or otherwise of such a trend. A policy might then be developed on the basis of such information. Regarding boats-through-ports, ideally a boat-by-boat breakdown for each port would be undertaken every quota year. Resources would need to be allocated to such a task.

Further variables that could be used as possible performance indicators, with associated trigger points, may require additional kinds of data to be recorded and/or calculated. For example, the proportion of quota units being subleased each quota year is a variable that could be monitored. At present, however, no record is made of this practice. Moreover, as types in the fishery, lessees and owner-operators need to be more closely analysed. Definitions of both types are needed which are sufficiently flexible to

convey the range of operators within each type. Trends associated with each subtype could then be monitored. Again, however, the rationale for dedicating additional resources to undertake such monitoring needs to be spelt out.

Finally, performance indicators and trigger points are summary devices that miss much of the detail of the industry. They are no substitute for in-depth social research. As stated in the introduction, socioeconomic performance indicators, and trigger points especially, are ‘fuzzy’; i.e. their specification is an often contentious industry-political process. Discussion of socioeconomic characteristics occurs throughout this report. A number of these characteristics could be monitored in future and used as performance indicators. Background provided by this report, however, is important to filling out the partial picture provided by performance indicators. It is important, too, that a future picture of the industry is developed in the form of a vision that broadly guides the industry’s year-by-year performance. In other words, this report is now something of an historic document. In time, such work needs to be repeated, but in the short-term it is through steps taken to identify and define relevant variables regarding performance indication, to collect data appropriate to these variables, to calculate and present trends, to set trigger points, to develop policies associated with trigger points and to project a longer-term future for the industry that ‘progress’ will be measured and influenced. Much work remains to be done.

7.3.9 Conclusion

The title of the overarching project of which this social impact assessment has been one part is *Impact of management change to an individual transferable quota system in the Tasmanian rock lobster fishery*. A key phrase in this title is *individual transferable quota* (ITQ). In fact, referring to the change in management system in 1998, this phrase is something of a misnomer. Introduced in 1998 was quota management, the ‘I’ and the ‘T’ having been in existence in the industry since 1967 (Winstanley, 1973). In effect, then, quota management was introduced into a system in which licences were already limited, allocated to individuals in perpetuity and were transferable. Thus the I and T component of the individual transferable quota management system was in fact carried over from the pre-quota management system.

Since quota, several aspects, particularly the value of fishing units has escalated rapidly, however it is worth noting that the current value of fishing units in Tasmania is no greater than either other quota or non-quoted rock lobster fisheries elsewhere in Australia. (It is worth noting that a number of the consequences associated with quota management discussed in this report have also occurred generally in other commercial rock lobster fisheries in Australia. After considering the availability of stocks (i.e. lobsters) the ‘I’ and the ‘T’ are foundational to value appreciation is indicated by the Western Australian commercial rock lobster fishery having licences trading at similar prices to those in quota managed fisheries in South Australia and Tasmania.)

A number of the changes discussed in this social impact assessment, particularly those regarding escalation in the value of entitlements and quota units, are not entirely ascribable to the introduction of quota management in 1998. In other words, quota management was introduced into a system in process which had a history and context that influenced the impact of the most recent management change. Quota management added to increases in the value of entitlements and quota units (formerly pots), but it

did not cause licences to come into being, to be limited, tradeable or to attract value. Quota management introduced a unit, a market for this unit and a certain type of participant (i.e. 'quota investors', which was a concern for a number of interview participants) to the industry. In other words, quota management segmented the licence package and added value to it, but it did not create this licence package in the first instance. Although it can be argued that the licence package was already segmented as pots could be added (to a maximum limit depending on vessel capacity) and deleted, the value of adding a pot was uncertain. Prior to quota, a fisher would expect to catch more by increasing his pot holdings but the extent was unknown. After quota, a pot was worth the equivalent of 143kgs of lobsters and thus had a finite value. Quota management, then, ought not bear the full weight of escalation in the value of entitlements and quota units. In name, however, 'quota' is shorthand and commonly used in the industry to summarise such developments. Whereas in this report 'quota management' is deliberately used to exclude consideration of the 'I' and the 'T' from changes introduced in 1998. However, in the industry the understanding of the 'I' and the 'T' is largely absent. This absence is partly due to the long-term existence of these conditions, such that they appear to be an almost natural aspect of the industry. Thus, 'quota' can be invoked to account for the entirety of a number of developments in the industry, regardless of the fact that it has only recently contributed to but not caused these. In other words, in considering this report the knowledge of a number of provenances in the industry needs to be borne in mind.

Concerning the introduction of quota management in 1998 itself, the vast majority of 'industry', i.e. licence holders, had acknowledged that 'something' had to be done to arrest stock decline. While a lesser majority 'voted' for the introduction of quota management, alternative options involving input controls (e.g. pot buyback, pot reductions) would arguably have also resulted in a decline in the number of vessels operating in the fishery. However, whether the same group of persons/vessels would have been affected, as under quota management is not known.

It is clear that there are more older than younger 'skippers' in the Tasmanian commercial rock lobster fishery. Many older skippers are nearing retirement, while there are few signs that it is financially possible for aspiring skippers to enter the fishery as owner-operators. (Profit margins for many of those leasing quota units are minimal.) Given that an average apprenticeship in the Tasmanian commercial rock lobster fishery of five years is considered to be required by interview participants, it is possible that human capital and knowledge in the fishery is running down. Moreover, while the proportion of owner-operators in the fishery is just over 50 per cent at present, due in part to a number of owner-operators having consolidated their licenses at the expense of lessees, this proportion could fall in future. Thought should therefore be given to assisting young fishers into the industry, both financially as well as through some form of mentorship.

The onshore geographic distribution of industry activity, though concentrated in the greater Hobart area, is also considerably decentralised. That is, while many fishers are based in or around Hobart, the remainder is spread around Tasmania. Although no rural coastal towns in Tasmania are economically dependent on commercial rock lobster fishing, any decline in activity and employment in places such as Flinders Island exacerbates already declining employment opportunities and infrastructure needs.

A total of 41 positive aspects regarding quota management were noted. The majority of positive responses related to improvement in rock lobster stocks, reduction in the number of boats and an end to the ‘race for fish’. Reduction in number of boats was likely under any restructuring of the fishery to reduce effort. Many fishers considered that ‘their fish were there’ and that they had more choice regarding when to fish under quota management.

A total of 61 negative impacts of quota management were noted. The majority of these related to an escalation in the value of entitlements and quota units. This escalation operated against aspiring owner operators and favoured investors. Moreover, leased quota units were only marginally profitable. Many fishers purchasing or leasing quota units went into debt to do so. Reduction in the number of boats and therefore in employment and increased pressure on inshore rock lobster stocks were also negative impacts commonly raised.

Fishers and their boats are linchpins in the industry, and as their numbers continue to decline thought needs to be given to ensuring that both effort and vessels are maintained at levels sufficient to be certain that the socioeconomy of the industry is moving in as sustainable a direction as the fishery is trending biologically. A fleet comprising small, medium and large boats that totals approximately 225 may be important not just to fishing a number of different economies of scale and scope and maintaining employment opportunities, but also to the character of places such as Strahan, Victoria Dock in Hobart, and St Helens.

Reduction in the size of the fishing fleet through any management change was always going to reduce activity in ports. However, quota management – more specifically the allocation mechanism associated with it – affected ports/regions differently. Both the number of ‘home’ vessels operating out of a port and the number of visitations to ports declined. The West region suffered hardest in terms of reduction in economic activity due to the provisioning and maintenance of boats. Ports that had few ‘home’ based vessels lost economic activity as vessels’ away trips declined in number. This trend also affected employment associated with the industry, especially regarding deckhands.

Zoning was the main unsolicited issue raised by interview participants. No clear mandate was evident either in favour of or against zoning. There was considerable uncertainty about zoning, as no formal proposal existed. ‘Wharf-talk’ and rumour therefore prevailed. It was commonly acknowledged, however, that both socioeconomic and biological reasons existed in favour of a management framework that considered the Tasmanian commercial rock lobster fishery to be made up of a number of different regional sub-fisheries.

An argument for zoning emerged during the interviews and, while there are many possibilities, an option based on incentive was presented as a possible starting position for discussion. As early as possible in the consideration of any zoning initiative, development needs to involve and take into account the interests of industry. One common industry concern is that fishers not be restricted in any way. Any zoning initiative therefore needs not to limit fishers but to increase their range of choices by offering them incentive to consider spatially shifting their effort. In short, carrots not sticks should be used. If incentives *additional* to the existing system were to be used, then lines on the water would not exist for those choosing to operate only within the existing system. The existing system would not be changed, therefore, but

supplemented. Those wishing to avail themselves of any incentive further to the existing system would be required to do so under only one proviso additional to quota management at present, that they catch any extra quota units in the western half of the fishery, for example. Thus, any zoning would only operate regarding a specific additional incentive, not in relation to baseline quota management arrangements as they exist at present.

A series of performance indicators has been developed to monitor the main issues raised in this report. This report represents a comprehensive baseline and understanding of the social position of the fishery around the commencement of quota management. It is from this baseline that future trends can be monitored. Such monitoring, however, is of little value unless a position regarding the future direction of the fishery is developed. It would be against this future direction that trends would be seen as either positive or negative.

During the latter part of this study, initial results prompted the TRLFA to begin to develop a vision for the industry. At the time of writing, this development is still in progress and support for this vision is being sought from the Tasmanian Government. For the community of Tasmania, it needs to be recognised that the value of the rock lobster fishery extends beyond the annual beach price of AU\$50 million. Fishers, their boats and their regional distribution are essential components of Tasmania's socioeconomic and cultural profile and their sustainability is as important as the biological sustainability of the resource.

8. Benefits

Both the Government and the Industry will benefit from the new fleet dynamics model created during this study. This model is used to predict the movement of the fishing fleet in forward projects. The rock lobster fisheries advisory committee uses the forward projections to recommend a TACC to the Minister. As the new fleet dynamics model better captures the movement of the fleet between fishery assessment regions, future projects are considered to be more robust. This new model has been incorporated into the stock assessment process.

There had been concern from both scalefish fishers and managers that the introduction of quota in the rock lobster fishery was going to result in increased effort in scalefish fisheries. As rock lobster fishers were capped in the amount of lobster that could be caught, there was the potential to redirect effort into other fisheries once an individual's quota had been caught. This report demonstrated that this has not happened and that there is less effort directed at scalefish as there are now fewer boats fishing in the rock lobster fishery and the amount of scalefish activity per rock lobster fishing vessel has remained static.

The socio-economic component of the study provides a number of benefits to the Industry, Government and Community. Firstly, the qualitative responses by fishers as to how their fishing behaviour had changed since the introduction of quota, established hypotheses that were then explored quantitatively using the commercial catch and effort data. These analyses were then incorporated into the fleet dynamics model or directly into the fishery assessment report to demonstrate changes in catch rates that were unrelated to changes in lobster abundance. A simple example is the statement by industry that they now fish in shallower water to capture premium quality red lobsters than in deeper water prior to quota. Analysis of the logbook data confirmed both the shift to shallower waters and also those catch rates in shallower water are lower than in deeper water. Thus, the decline in catch rates seen in the fishery assessment area where this was most prevalent is due to this change in fishing pattern. The benefits of this combined socio-economic and mathematical interpretation are that both Industry and Government accept the outcome, and that industry has greater acceptance of the stock assessment process and appreciates how valuable their qualitative input is. The assessment document has an industry issues section that is expected to highlight fishers' understanding of the dynamics of their fishery from the 'hands-on, at sea' perspective.

Secondly, the major benefit from the socio-economic study was due to the comprehensive nature of the research. As almost all fishers were contacted, it was possible to obtain an Industry wide view of issues and also to pass on information about the science and management to a 'grass roots' audience. The Industry wide view raised a number of issues about the future of the industry, which prompted the Industry to develop a vision for their future. An example is the push by Industry to investigate ways where young fishers will have an opportunity to enter the fishery. The escalation in the value of licences since the introduction of quota has made it virtually impossible for deckhands to work their way up into the fishery. The rock lobster industry vision document is a major benefit to Government, Industry and the community as it enables

management decision to be appraised against a future rather than a 'knee-jerk' reaction to a short-term problem.

A third and more surprising outcome of the socio-economic study was the misinformation that many 'grass-roots' industry participants had of the roles of management and science. Many fishers were unaware that management and assessment were independent, and that had input at both the management (through the fishery advisory committee) and research (through the research advisory group) of their fishery. Despite numerous articles in the fishing industries magazine *Fishing Today* and discussions with Industry representatives, there was confusion by several fishers about how research projects benefited their industry. An example is this study, while fishers felt that this was the first time they were being consulted and the 'best thing' the government has ever done, they were surprised to find that it was proposed and managed by scientists ("who don't know nothing"). The improved understanding by Industry through this comprehensive interview process will aid in the co-management processes being forged between Government and Industry.

Finally, the socio-economic study produced a series of socio-economic performance indicators that are under consideration for inclusion into the next management plan. These performance indicators will provide a mechanism by which management can bench mark socio-economic changes in the fishery against management decision and general fishery trends.

9. Further development

Data extraction routines and model development undertaken in this project will form the basis of future fleet dynamic models. However, there was insufficient data to create a full post-quota fleet dynamics model. This report recommends that a review of the fleet dynamics model be undertaken in 2003/4 when 5 years of post-quota data is available.

Trends identified in this study will be monitored in each forthcoming assessment to determine if further management is required. For example, if the decline in fishing offshore waters is exacerbated then a management decision may be required to optimise the harvest potential of this component of the resource. Similarly, there was uncertainty about the value of zoning the fishery. Further work on informing industry of the advantages and disadvantages of zoning is required before it is progressed as an issue.

The study was undertaken immediately after introduction of the individual transferable quota management system (ITQMS) to determine if there were any immediate impacts that would affect management of this fishery as well as other fisheries. A repeat socio-economic study will be required in approximately 5 years time to determine the medium term impacts and report on trends identified in this project. This project will also enable the socio-economic performance indicators to be appraised and, if necessary, revised.

10. Planned outcomes

Three main outcomes were identified with this project:

- 1) To improve assessment model outputs by having a harvest strategy evaluation tool that accurately reflected the dynamics of the fishery. Such an improvement was expected to provide greater certainty in future predictions and thus contribute to improving sustainable management.

The introduction of quota was expected to have a substantial impact on the behaviour of fishers. Both the qualitative and quantitative information obtained from this project identified a number of variables that had changed over recent times. While quota had accelerated these changes, this report demonstrated that most of the changes had begun to occur prior to quota implementation. A fleet dynamics model based solely on the post-quota data was not robust enough due to the small amount of data. A new model based on a longer time set (10 years) was developed that is an improvement over the existing model and thus provides greater confidence in the harvest strategy evaluation component of the Tasmanian rock lobster assessment model. This component is used for comparing different harvest scenarios and these are reported to the Fishery Advisory Committee who informs the Minister of the most favoured option.

- 2) To determine the impact that the implementation of quota on the rock lobster fleet had on other fisheries for which rock lobster fishers had endorsements.

Results demonstrated that there had been no increased impact on 'other' fisheries. In most cases the average amount of fishing per rock lobster vessel since the introduction of quota was similar to pre-quota levels. However, the reduced number of vessels now operating in the fishery has resulted in overall lower effort per fishery. It was recognised that effort creep could be marginal and a review of effort in these 'other' fisheries will be undertaken in future reviews of the impact of quota.

- 3) To provide socio-economic performance indicators by which the fishery could be assessed during routine fishery assessments.

In determining a series of socio-economic performance indicators, the authors recognised that costs associated with obtaining data from interviews with all of Industry was prohibitive. Performance indicators were therefore design around data that was readily accessible through catch return and licensing information. These performance indicators have been presented to the Government and the Crustacean Fishery Advisory Committee for consideration in the current review of the rock lobster fishery management plan.

The comprehensive study undertaken during this project is the most detailed of any fishery in Australia and provides a baseline from which future socio-economic change can be measured. The value of this study, which brought a true industry consensus to the assessment and management tables, was enormous. Industry and Government

viewed the benefits as exceptional value for money. It has been suggested by both parties that a similar study be undertaken every 5 years and aligned with review of the management plan.

11. Conclusion

Objective 1. To assess the response (fleet dynamics) of rock lobster fishers to changes in management, including any change in the rules which fishers used to influence their fishing decisions prior to and after quota implementation.

To evaluate future harvest strategies for a fishery (e.g. different quota allocations in future years) or predict the impact of a change in the current harvest amount (e.g. increase or decrease in allocated quota) it is necessary to understand the dynamics of the fishing activity. For example, if the catch rates improved by 15% in a certain region of the fishery, will the rest of the fleet respond by moving to this region to fish? In such a scenario the biomass and associated performance indicators for the region that has the improved catch rates will depend on how much extra effort is expended in the region. Similarly, assessment of all other regions will depend on how much fishing effort has been removed from each region. Clearly understanding how the fleet responds to variables such as catch rate and beach price are crucial for accurately predicting the impact of changing the current harvest strategy or evaluating future changes.

The Tasmanian rock lobster fishery is assessed in eight regions. These regions are necessary as the biology of lobsters, especially their growth and reproduction vary substantially between these regions. Even within each of these broad regions, there are substantial differences in catch rates related to depth and time of year (catchability). Understanding the behaviour of the fishing fleet is necessary for assessing each of these regions.

The rock lobster assessment model captures the dynamics of the fishing fleet through a fleet dynamics sub-model. The current sub-model, developed prior to the implementation of the ITQMS, was based on the movement of the fleet from 1990 to 1995. With the change to an ITQMS there are expected to be substantial changes in way that fishers operate. Under the ITQMS, fishers maximise their profits by maximising the unit return per lobster. Prior to the ITQMS, profits were maximised by maximising the catch obtained through the fishing season. This change in profit maximisation strategy was expected to result in substantial changes in fishing strategies. Some of the drivers that would be expected to affect the behaviour of fishers would include the following. Doubling of the beach price between the start and end of the fishing season, the decline in catchability of lobsters between the start and end of the fishing season, and the differences in the beach price of lobsters based on size and colour.

To determine what changes in fisher's behaviour were occurring in the fishery since the implementation of the ITQMS, we used a two pronged attack. Firstly, a comprehensive survey of fishers provided qualitative data on changes that they had noted. This qualitative data was then used as a hypothesis that was tested using the quantitative

catch and effort logbook data. This approach proved successful, as most of the changes being noted by fishers were apparent when the logbook data was analysed. However there were several changes that fishers recorded that were not apparent in the logbook data. These changes have been noted for future reference, as the magnitude of the change may have been too small to produce a significant result. In these cases, it was the minority of the fishing fleet that spoke about these changes. It is also possible that the scale of analysis of the logbook data (i.e. 30 X 30 nautical mile blocks that fishers use to record their catch) may be too large to identify this initial change in fishers behaviour.

These changes in fisher's behaviour formed the basis on which to re-appraise the fleet dynamics sub-model for the fishery. Although rate of changes in the dynamics of the fleet had increased since the implementation of the ITQMS, there was insufficient data to obtain a robust model. As most of the changes had begun to occur prior to introduction of the ITQMS, a sub-model based on 10 years data (1990-2000) was found to be a substantial improvement on the existing sub-model.

Objective 2. To evaluate the impacts (catch and effort) of rock lobster fishers on other fisheries prior to and post quota implementation.

The ITQMS provides each licensed fisher with a set allocation of the total allowable commercial catch (TACC). The allocation of quota was based on a 'per pot basis' across the fishing fleet. This resulted in a number of vessels having an allocation of quota less than what they had traditionally caught. Most lobster fishing vessels have entitlements to fish in other fisheries that are less regulated. Thus, there was the potential to divert considerable effort into other fisheries that may not be able to handle such an increase.

At the time of introduction of the ITQMS, the giant crab fishery was seen as the ideal candidate to receive this additional effort. However, the concern for this fishery was so great that the Government implemented a 9-month closure of the fishery while it implemented an ITQMS for this fishery. While the giant crab fishery was no longer an option for redirection of fishing effort out of the rock lobster fishery, several of the larger fishers whom had experienced substantial reductions in catch with the implementation of the ITQMS in the lobster fishery, brought into the giant crab fishery. Several other larger fishers that had experienced substantial reductions either sold or leased their quota and moved interstate to operate in new fisheries (e.g. East Coast tuna fishery).

In anticipation of quota, many fishers had purchased additional rock lobster licences that they were leasing to other fishers. With the implementation of the ITQMS, these licences were consolidated onto fewer vessels. This resulted in a reduction in the rock lobster fishing fleet of nearly 25%. As the endorsements to fish in other fisheries were attached to the licence, these endorsements were now on fewer fishing vessels.

Analysis of the catch rates of the remaining rock lobster vessels demonstrated that they had not changed with the implementation of the ITQMS. However, with fewer vessels now fishing, the overall catch by the rock lobster industry is smaller than prior to quota. Thus the implementation of an ITQMS in the Tasmanian rock lobster fishery has resulted in less overall effort being diverted into other State fisheries.

Objective 3. To determine socio-economic changes associated with implementation of quota management and establish performance indicators relevant to managing the fishery.

Managing a fishery is as much about resource management as it is about managing the operatives in the fishery. As many fishing industries are based out of rural coastal ports, these industries can have important socio-economic impact on these towns. The collapse of the West Atlantic cod fishery has had catastrophic socio-economic impacts on most of Canada's towns on its eastern seaboard.

The Tasmanian rock lobster fishery has an annual beach price of between \$50 and \$60 million. The fishery is the backbone of the Tasmanian fishing fleet and has vessels and families based in most of Tasmania's coastal rural towns.

The change in management of the fishery from an effort-regulated fishery to an ITQ managed fishery is expected to impact on the fishing fleet. A moratorium has been implemented in the USA on the use of quota as a fisheries management tool as a quota managed fishery were seen to favour big investors and companies at the expense of smaller owner operators.

Incorporation of a series of socio-economic performance indicators in the annual fishery assessment was considered an appropriate measure to monitor socio-economic impacts. In addition to providing these indicators, it was also necessary to determine a baseline from which change could be monitored.

This project undertook the ambitious task of trying to interview all participants involved in the Tasmanian rock lobster fishery. Inevitably, a few participants 'slipped through the net'. Nevertheless, it is most comprehensive socio-economic study undertaken on a major Australian commercial fishery and, to our knowledge, the largest socio-economic study addressing the initial impact of introducing a ITQMS. This detailed report lists all the issues raised by fishers about the ITQMS. From these discussions a baseline has been established against which future studies can monitor developments. Such studies would need to be infrequent (e.g. 5 to 10 years) due to the commitment of time and labour. Performance indicators to monitor change on a more frequent basis would be required and these would need to use information that does not require interviewing the fishing industry. As such, eight performance indicators have been presented to Government and Industry based on data available from either licensing information or catch and effort returns.

These indicators or a subset of are to be considered for incorporation into the new fishery management plans that were to be finalised by the end of this project. However, these plans are still being drafted.

12. Acknowledgements

We would like to take this opportunity to acknowledge the openness and interest with which a range, more than wide enough to have us looking forward to the next interview, of industry participants responded to the research. Participants were generous and considered with their time, views and hospitality. Time and again we were welcomed and fed. Time and again interviews ran into hours as interesting people talked openly about their lives, fishing and quota management. Offers to take a trip fishing were many, and we regret that limited time meant that only two such offers could be accepted, a four day trip south of Bruny Island and for a morning off Bicheno. Thanks are extended to all participants; this study could not have proceeded without them.

Kate Hodgson extracted the 'other species' data and Wes Ford, Gary Leonard and Hiliary Revil helped speed up the input of rock lobster catch records into the DPIWE Integrated Catch and Effort database. This enabled a more timely analysis of the post-quota data.

Craig Mackinnon helped in the review and formatting of this report.

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14. Appendix 1 – Intellectual Property

No intellectual property was generated through the project that requires protecting.

15. Appendix 2 – Staff

Staff that have participated in this project are:

Dr Stewart Frusher (Senior Research Fellow)

Dr Matt Bradshaw (Research Fellow)

Dr Linda Eaton (Research Fellow)

Dr Malcolm Haddon (Associate Professor)

Dr Les Wood (Associate Professor)

16. Appendix 3 – Use of GPS and Plotters in the Tasmanian Commercial Rock Lobster Industry

Introduction

One of the reasons given for the introduction of quota management was declining rock lobster stocks. Prior to quota management, fishery assessment, based both on research and fishers' catch returns, indicated that the rock lobster biomass was in longer-term decline. This indication was supported by anecdotal evidence from fishers whose experience pre-dated that of reliable catch and effort data and fishery research. These indications meant that the bioeconomic sustainability of contemporary fishing practices was questionable. Three different sources – research, catch returns and fishers – concurred that 'something needed to be done' to avert the possible bioeconomic collapse of the fishery.

Among a number of possible options, quota management was introduced in the fishery in March 1998. Indications since are that rock lobster stocks are rebuilding (Gardner *et al.*, 2001). However, the data sets on which such indications are based – research, catch returns and fishers – are 'fuzzy'. First, research is resource-limited and provides only partial geographic and temporal coverage of the fishery. Second, catch returns, particularly prior to quota management, are not fully reliable. A combination of low literacy levels and interest, and falsification of both amount and area fished, mean that many fishers' catch returns do not reflect actual effort and catch. Before quota management began being discussed as an option for the fishery, many fishers were suspicious of supplying 'authorities' with catch data that some fishers viewed as commercially sensitive. Misreporting was a common response in such circumstances. Under reporting for purpose of taxation was also a common practice. On the other hand, once quota management was under consideration, some fishers who believed allocation by catch history to be likely began over-reporting their catches. In summary, in X interviews, participants expressed the view that the catch returns of some fishers, sometimes including their own, were 'not worth the paper they're written on'. Third, anecdotal evidence from fishers was coloured by each's position in the fishery. In short, though the general trend of stock decline was discernable in each source, the error bands associated with each were arguably wide.

Further complicating this picture was the putative influence on 'fishing power' (Brown *et al.*, 1995; Fernandez, 1997) by technology, particularly the uptake by most fishers of GPS and plotters. Many fishers maintained that this technology was 'hard on the fish' and made possible higher catches than would otherwise have occurred. If so, this increase in fishing power might need to be considered regarding declining catch rates indicated by fishers' catch returns. One aim of the social research in this FRDC funded project was to provide fishery biologists with data that would help them to clarify the influence of GPS and plotters on catch rates. Meeting this aim principally involved asking fishers if they used a GPS and plotter, when they began using a GPS, how they used a GPS and plotter, and whether a GPS and plotter changed the way they fished.

Two outputs are provided from this line of questioning. First, a list of fishers by name has been provided to fishery biologists with the date fishers began fishing with a GPS. (Fishery biologists part of this project are bound by the same confidentiality protocols as its social researchers.) These data will enable fishery biologists to compare a fisher's catch returns before and after his or her uptake of a GPS. Year of uptake of a plotter was not recorded. Plotters were believed by many fishers interviewed to make the use of a GPS easier, but not more locationally effective. Year of uptake of a GPS may be followed by a familiarisation period during which fishers experiment with its use before settling on a preferred or optimal utility for their particular fishing operation.

Differential use leads to the second output, namely discussion in this report, based on interview data, of some of the different ways fishers use a GPS and plotter. How fishers use this most recent technology is in some ways as important as when they began using it to understanding possible spatial and temporal effects of GPS and plotters on RL stocks. The remainder of this report is structured around a number of distinctions, the first of which is between fishers who use a GPS and plotter and fishers who do not. (It needs to be noted that some fishers can change their style of RL fishing, and would therefore be present in a number of the distinctions made below. In other words, distinctions are meant to be taken heuristically.)

Fishers not using a GPS and plotter

Examining fishers not using a GPS and plotter reveals as much about the applicability of this technology to different types of rock lobster fishing as it does about the different ages and inclinations of various fishers. To begin, X fishers interviewed did not use a GPS in their fishing. Such fishers tended to be over the age of forty. Care needs to be taken, however, in ascribing non-use of GPS and plotters to age-related technophobia; i.e. older fishers having learnt how to fish without GPS and plotters and seeing no need to change. As much as non-use of GPS and plotters may be related to age, it more closely correlates with type of fishing, and length of experience in the fishery. In short, from interview data, fishers not using GPS and plotters fished almost exclusively inshore. Many also 'day fished', rarely overnighting on their boat. Finally, GPS and plotters are not cheap to purchase and some fishers with tight financial margins viewed them as an unnecessary expense.

In all parts of the fishery, 'knowing your bottom' is achieved by a combination of sounder, marks and experience. Methods of recording marks are the main difference between those fishing with and those fishing without GPS and plotters. For fishers without GPS and plotters, it is common to record a mark by eye, mind and/or hand. Inshore, lines of sight usually exist by which fishers can locate themselves on the water above the bottom below them. Some memorise these 'marks', while others record them by hand in personal fishing logs. (By 'inshore' is meant fishing in less than forty fathoms both off the deck of boats and from boats' dinghies.) These characteristics are suited to 'day fishing' where fishers leave port before dawn to pull their night shot on sunrise, reset their gear and return home, often before lunchtime. Inshore fishing, however, is not limited to day fishing close to a fisher's place of residence on land. A number of fishers interviewed had 'local knowledge' of inshore bottom the fishing of which required overnighting on a boat.

Attaining inshore local knowledge can take much time in the covering and recording of ground. Once learnt, good local knowledge is sufficient, inshore, to return to known rock lobster bottom. A long working lifetime's experience in the fishery is often involved in compiling such knowledge and, though not always as locationally accurate, or as efficient a learning process as with a GPS and plotter, good fishers without this technology can more than hold their own inshore. Their advantage is because finding and returning to rock lobster ground inshore usually involves developing experience in the most important variable of all, knowing *when* rock lobster are likely to pot, discussed below.

The next distinction discussed is between those who have always fished with a GPS and plotter and those who introduced this technology to pre-existing fishing practices.

Fishers adding a GPS and plotter to pre-existing fishing operations

Many fishers with long experience in the fishery *have* taken up using GPS and plotters. Clearly, this technology has some utility regarding their fishing. As a means of recording marks, GPS and plotters are both accurate and easy to use compared with radar. Prior to GPS and plotters, many fishers had taken to using satellite navigators because of their superiority to radar. Radar operates off a reliable fix on land from the boat and does not work well in fishing areas off low profile shorelines or prone to large swells. The further from shore fishing is being undertaken, the less accurate sight marks become. While an accuracy of metres with a GPS and plotter is no great advantage close inshore, compared with lines of sight, it is of considerable assistance further offshore. The recording of marks by keypad and in computer memory is also easier, once learnt, and less fallible than human memory and hand recording. Moreover, information on GPS and plotters can be linked with automatic piloting systems which can then navigate obstacles to grounds with maximum efficiency and minimum attention. GPS and plotters, then, contributed to more precise and safer navigation by fishers.

Another area in which GPS and plotters supplemented an existing practice was in the sharing or poaching of marks. Fishers had long helped kith and/or kin by sharing their marks, and the locations of other boats fishing were almost always noted. GPS and plotters made both the recording and transfer of locational information easier, via computer disk, and this technology also facilitated the marking of others' fishing locations, if desired. A number of fishers interviewed did not fish some grounds known to them when other rock lobster boats were in sight, it being easy for another boat to 'see' them on radar and to plot their position using GPS.

A common year in which many fishers began using a GPS was 1991. Of those for whom the question was relevant in the sample (X), Y began using a GPS in 1991. For those entering the fishery as skippers after 1991, many have always fished with a GPS. A number of fishers interviewed stated that they would not go to sea without one, and many boats had two GPS and plotters, often a legacy of upgrading, in case of malfunction. Many older fishers viewed this level of dependency on GPS and plotters with suspicion. They emphasised that though GPS and plotters positioned the boat accurately, there was no substitute for knowing when to fish a particular piece of ground. In other words, GPS and plotters could provide a shortcut to local knowledge, especially if an experienced fisher's marks could be obtained or poached, but they did

not tell a fisher *when* to fish them.

A common comment regarding GPS and plotters was that they were more efficient, in two senses. First, they reduced steaming time locating grounds and gear, particularly offshore, in poor visibility, at night or in areas with strong tides. Second, they enabled fishers quickly to construct a map of rock lobster grounds in localities in which they fished. By making possible the accurate location of their own and other boats, as well as the importation of other fishers' marks via disk, GPS and plotters obviated the need to memorise or hand record marks, and enrolled more boats in the collective exercise of building up a personal map of local rock lobster fishing grounds. In other words, according to many fishers interviewed, GPS and plotters were an assistance in fishing, but they were not decisive in determining catch.

Many fishers believed that GPS and plotters could help make poor mariners better ones in terms of navigational efficiency, location and safety, but they could not make them better rock lobster fishers. Many other factors besides knowing the location of rock lobster were involved in being able to catch them. For example, one of the oldest pieces of technology on a rock lobster boat is the pot. The range of ways in which this technology was employed by different fishers was surprisingly large. Material out of which pots were made differed, and the size and weight of pots also varied. Moreover, practices associated with pots differed. Type and amount of bait used varied, some fishers used bait savers and some did not, number of skewers used and their placement differed, skewers could be made out of wood or steel, some fishers did not use skewers, and so on. Differences related both to variation in fishing conditions around Tasmania as well as to differences between fishers' approaches to catching rock lobster.

In various combinations, these differences add up to a wide range of possible practices before baited pots have even been shot over the side of the boat. Discerning ground and shooting pots also vary between individual fishers. Variation centres around perhaps the most important but intangible and in many ways inscrutable variable of all, deciding or knowing when rock lobster are most likely to 'pot'. The simple answer is when they are hungry. In reality, a complex of factors contributes to the likelihood or otherwise of actually catching rock lobster in economically viable quantities. In addition to those above, other factors include aspects of rock lobster biology and behaviour, both of which vary between different areas of Tasmanian waters, environmental conditions such as swell, tide, the lunar cycle and water temperature, the biology and behaviour of other species and so on. In short, some claim that to be a good fisher it is necessary to be able to 'think like a rock lobster' or to 'put yourself in their environment'.

GPS and plotters can accurately position a fisher in the right place, provided the mark corresponds with known rock lobster bottom, but exactly how and when rock lobster are then fished takes years of experience and trial-and-error fine-tuning to optimise chances of a good catch. An 'apprenticeship' of five years skippering was believed by many of those interviewed to be required reliably to catch rock lobster in economic quantities; and most fishers maintained that they never stopped learning how to catch them. GPS and plotters could help a good fisher operate more efficiently, but they could not turn poor fishers into good ones, or inexperienced young fishers into experienced older ones. With GPS and plotters, young fishers were perhaps better mariners, but their becoming better fishers was still very much an open question. Ultimately, their seamanship and ability to catch rock lobster would depend on the

acumen with which they learnt to 'read the fish', including the complex and dynamic system in which rock lobster lived.

Effectiveness as distinct from efficiency

Regarding their fishing, a number of fishers stated in interviews that GPS and plotters assisted them to operate more efficiently but did not help them to catch more rock lobster. Comments such as GPS and plotters 'don't put fish in your pots' or 'don't round fish up for you' were common. In terms of efficiency, GPS and plotters contributed to cost savings in fuel, for example, as less steaming was done searching for grounds and gear. More fishing time may also have been made possible, but GPS and plotters did not significantly change where or the way in which a number of interview participants fished. The catch rates of such fishers, therefore, are less likely to have been influenced by GPS and plotters. Such fishers used GPS and plotters principally as a navigational aid for reasons of ease and efficiency, but did not avail themselves of the opportunity presented by GPS and plotters to help explore the bottom.

Other fishers, however, stated that GPS and plotters did change the way they fished. A number of fishers interviewed stated that they used GPS and plotters, in combination with a sounder, to grid-map the extent of grounds fished by them. Many expressed surprise at the actual size of grounds, which some had fished for many years prior to GPS, once they had been grid-mapped. What was thought to be a small patch of ground could be revealed with the aid of a GPS and plotter to be of far greater extent. Prior to GPS and plotters, many fishers had been able approximately to locate a given patch of ground, but had no way of accurately mapping where they were actually shooting. The further offshore, the more difficult it became to ascertain location. Grounds were known to exist, but their dimensions were unclear; how yesterday's shot related with today's involved an element of guesswork. Consequently, what was considered to be sufficient distance between shots was often large, and much of the bottom was not fished. GPS and plotters enabled fishers precisely to plot their shots. Each shot could be positioned in such a way as neither to fish ground already shot nor to miss any ground. The edges of grounds could also be plotted, and all bottom within the area methodically grid-mapped and shot. In this way, the full extent of a particular piece of rock lobster ground, long detectable by sounder, could be mapped and systematically grid-fished. Before GPS and plotters, such thorough exploration and exploitation of other than close inshore rock lobster ground was simply not possible. GPS and plotters also cemented the practice, begun with sounders, of shooting pots individually rather than in lines, though this practice may still be employed by some fishers offshore.

The grid-mapping of grounds is one of the uses of GPS and plotters that many of those interviewed believed to be 'hard on the fish'. It may also have had an influence on some fishers' catch rates. The next distinction considered, between inshore and offshore fishing, is the one most likely, in combination with GPS and plotters, to have had an influence on catch rates.

Offshore rock lobster fishing

For some commercial rock lobster fishers, GPS and plotters made possible what was

little short of a revolution in offshore fishing. 'Wide' of the coast, frequently out of sight of land, ascertaining location within metres, prior to the introduction of GPS and plotters, was difficult, time-consuming and often impossible. Certainly, navigation was feasible and rock lobster fishing did occur offshore before GPS and plotters as finding grounds, which were large in many places, was usually not difficult. Returning to grounds and gear, however, could be hit-and-miss. Much steaming time and expense could be spent searching for flags indicating the whereabouts of gear, particularly in rough weather conditions. Previous to GPS and plotters, the low chance of returning to particularly good offshore grounds and lost fishing time and gear meant that offshore grounds were only fished part-time and around periods of good weather. Good weather windows, however, were often only small, and large boats (usually greater than 50 feet in length) were needed to overnight at sea and work in frequently difficult weather conditions.

Prior to 1991, many fishers had little interest in upgrading their boat and equipment to subject themselves to the rigours and uncertainties of offshore rock lobster fishing. By 1991, however, many fishers were installing GPS on their boats. From the early 1990s, too, the average beach price for rock lobster began to rise due to the development of Asian markets for live seafood. Technological accuracy and financial incentive both now existed regarding offshore grounds. These grounds carried many more rock lobster than much inshore bottom, which had been both longer and was harder fished. Some fishers began fishing offshore full-time, shooting often previously unexplored and even undiscovered and unfished grounds. Many of these fishers also pioneered a giant crab fishery, these crustaceans living on the edge of the continental shelf.

In effect, a lucrative, almost entirely new and in many ways specialised type of rock lobster fishing emerged. Large, virtually all-weather boats became more numerous, and heavier often steel pots were used by many fishers working offshore. Two deck hands were often required to handle this larger and heavier gear. Investment in, and the overheads of, such operations were large, and high catches and good beach prices were needed to support the economics of this new scale of fishing in the Tasmanian commercial rock lobster fishery. This, in effect, spatial fix for declining catch rates elsewhere in the fishery, however, was most likely only a short-term solution. As significant effort began to be shifted into the offshore fishery, both biologists and fishers feared that offshore rock lobster stocks, too, would soon begin to show appreciable signs of decline. Moreover, the rate of incidental mortality for rock lobster caught offshore was considered to be high. Rock lobster, often white in colour, were being taken from depths greater than 60 fathoms and were less amenable to the trials of fishing, holding and live transport.

A further issue was that opportunities for illegalities were greater fishing offshore with a GPS and plotter. Higher costs involved in this type of fishing made any practice that might increase catch tempting. Offshore fishing often occurred out of sight of land and other boats, making it possible to work more pots than allocated. Many fishers interviewed talked of boats working two and three sets of gear. Over-potting was more difficult without a GPS and plotter because, to catch rock lobster, pots require soak time. Detection, therefore, was a simple matter of arithmetic, i.e. of police locating pot buoys and lines, pulling them and counting the number of pots. Pots needed to be marked on the surface for the fisher to be able to find them. GPS and plotters, however, made it possible to return to often black pot buoys sunk below the surface of

the water. Without knowing the pot's exact location, detection of any illegal gear was almost impossible. As in the case of unreliable catch returns, it can be stated from interview data that such illegalities were practiced, but no quantification of such practices is possible. Both need to be borne in mind, however, when considering fishers' catch rates and the influence of technology uptake in the form of GPS and plotters prior to the introduction of quota management.

The methodical exploration and exploitation of offshore rock lobster grounds were considerably expedited by GPS and plotters. Without this technology, the accuracy required to return to grounds and gear was simply not available. As offshore grounds were, from approximately 1991, being systematically fished for the first time, the catch rates of fishers undertaking such fishing might be expected to have increased. A final distinction facilitated by GPS and plotters, discussed next, is in some ways symptomatic of escalating fishing effort in a catch unlimited race for fish, namely between those fishers having more than one night shot and those continuing with the 'traditional' single night shot.

Fishers multiple night shooting

Perhaps not surprisingly, many fishers prepared to take up the use of GPS and plotters, shift their effort into offshore grounds and alter their fishing operations accordingly, were part of a group of fishers that took up the practice of having multiple night shots. Rock lobster are wary of predators and are therefore often more active at night, though at depths at which little light penetrates, such as in the offshore fishery, they may be active at any time. Offshore, fishing operations began to take on the characteristics of a 24-hour-a-day enterprise. Catching large numbers of rock lobster quickly was one aim offshore and as much fishing as possible was fitted into good weather windows and seasonal increases in rock lobster feeding activity such as in the 'new shellers' period in November. Crews worked around the clock with very little sleep between shots. Clearly, lights powered by 240 volt generator sets primarily made possible fishing at night, but it was GPS and plotters that got fishers sufficiently close to pot buoys to come within range of boats' lights. Two night shots became common practice offshore, and some fishers fitted three and even four shots into long winter nights. GPS and plotters and 240 volt lights made rock lobster fishing into nearly a continuous operation, limited only by fatigue, season closures and the worst of weather.

Not all fishers, however, took up the opportunity presented by new technology to intensify their fishing in this way. Instead, some shifted their effort from a day shot and one night shot, to two night shots. As stocks declined, so-called 'day fish' became more scarce, particularly inshore, and fishers began relying exclusively on fishing at night. As noted, some fishers contracted their effort to one night shot per day, pulling their pots at dawn, setting them again and retiring for the day. No GPS and plotters or 240 volt lights were required for this type of 'day fishing'. Other fishers, however, took the opportunity afforded by GPS and plotters and 240 volt lights to shift their two shots in a 24 hour period from one day and one night shot, to two night shots. Particularly regarding inshore fishing, so-called 'double night shots' increased fishing effort in the period in which rock lobster were most active searching for food. Catches were, therefore, likely to be greater. Not all fishers, however, were in favour of this practice and instead shot their pots inshore for their night shot and offshore for their day shot. Fishers' concerns regarding double night shots were twofold. First, stocks

were being fished down more effectively with the result that in some areas of the inshore fishery virtually no day fish were evident. In the language of many fishers, double night shooting was 'turning day fish into night fish'. In other words, with little competition for food, rock lobster were remaining ensconced during the riskier part of the day and foraging only at night. Second, some fishers did not like the opportunity presented to those double night shooting to 'shake' or pull and strip the pots of those not doing so.

At any rate, GPS and plotters, in combination with 240 volt lights, largely made it possible to fish through the night when rock lobster were most likely to be searching for food under cover of darkness. This is another sense in which GPS and plotters were considered by many of those interviewed to be 'hard on the fish'. Multiple night shooting therefore is a further reason why the catch rates of fishers might be influenced by taking up a GPS and plotter.

Conclusion

Focusing exclusively on technology can lead to ignoring the decisive role of fishers in any catch rate equation. Technology is largely inert unless actuated by human beings, and the human factor in rock lobster fishing is both important and variable. As noted, interview participants maintained that it took years to graduate to catching rock lobster for good financial return and that there was a considerable range of catch-ability among those who fished. In X interviews, participants stated that experience in the fishery was an important factor in fishing success, many older fishers seeming to have learnt much that younger fishers were still working out. Moreover, the set up costs in the Tasmanian commercial rock lobster fishery, compared with abalone, were believed to be high, both in terms of boat and equipment as well as in experience required to catch rock lobster. In other words, many of those interviewed considered boats and particularly skippers to be undervalued assets in the Tasmanian commercial rock lobster fishery and that fishery managers could not afford to ignore the crucial role played by good skippers, who were declining in number due to retirement, in the various markets and economies involved in catching the TACC. The fact that few new skippers were entering the fishery due to financial barriers was therefore believed to be cause for concern.

Though GPS and plotters have possibly influenced catch rates in the Tasmanian commercial rock lobster fishery through facilitating a number of different fishing practices, discussed above, this technology in no way diminishes the importance of fishers, particularly skippers, at the heart of the technology platform that is a rock lobster boat. The people employing the technology need to be taken into account as much as the technology itself as, quite simply, it remains the case in the Tasmanian commercial rock lobster fishery that new fishers are more important than new technology. In short, no fishing is possible without new fishers. The same cannot be said of new technology. Moreover, fishing is dependent on replacement of old technology such as boats. While it is important, therefore, to understand the influence of new technology, this should not be at the expense of either human or old technology variables, both of which have arguably greater bearing on catch rates in the Tasmanian commercial rock lobster fishery than GPS and plotters.

17. Appendix 4 – Example of interview schedule



Impact of management change to a QMS in the Tasmanian rock lobster fishery: technology & fleet dynamics



How/when did you first start fishing for rock lobster (self-starter, family), transition deckhand-skipper-own boat (upgraded?)-licence holder (\$, no. pots, additions–why), qualifications, (<i>years</i>)?	
Where did you fish then (generally, areas, depth: any supporting <i>records</i> , date and place– <i>later</i>) (Nov. vs March)?	
Have there been many technological changes since you started fishing, which have been most helpful in your fishing (how), what year did you first begin using: synthetic ropes; buoys; hydraulic pot lifter; tipper; echo sounder (fish-finder)–b&w, colour, bottom lock; sonar (vertical, forward, side-scanner); sat. nav.; GPS; plotter; etc.? (Est. % better fisher) (Any supporting <i>records–later</i>)	
How, if at all, did any of these technologies change where and/or when you fished (areas, depths–month ,no. shots)?	
What other fishing licences have you/do you hold (use them, why hand them in)?	
What were the circumstances surrounding your licence(s)/boat/catch etc. in the season before the introduction of a QMS (employees, how pay)?	
What are the circumstances surrounding your licence(s)/boat/catch/quota etc. now (employees,pay, debt)	
Do you lease any extra quota (from/to others, \$), how easy is this (what does it cost you to catch a kg of rock lobster)?	
What was your position on a QMS before its introduction, has this changed (job satisfaction)?	
What do you consider to have been the major positive impacts of a QMS if any (e.g. from personal experience)?	
What do you consider to have been the major negative impacts of a QMS if any (e.g. from personal experience)?	
How and why have your fishing patterns changed, if at all, with the introduction of a QMS (when fish [price maximisation], where fish [inshore, out wide – colour, high-grading], size [split price], what legal fish, if any, are you putting back, shots, trip length, no. days fished, etc.)?	
To whom do you sell your rock lobster (arrangement, ave beach price, where land rock lobster, hold anywhere, etc.)?	
What do you do, if anything, if you catch your quota with time to spare before the end of the rock lobster season (how long does it take to catch your quota)?	

When you're not fishing for rock lobster, what **other activities** do you undertake (fish other species, farming, tourism, leisure, etc.)?

--

Are you considering **investing** in other fishing licences or buying/leasing more rock lobster quota?

--

What do you **plan** to do with your licence(s)?

--

Has the change to quota management of the rock lobster fishery altered the local **community** in which you operate (how, e.g.), (which is **home port**, how long/attached)?

--

If fishery managers were to **alter** any aspect of the QMS, what do you believe it should be (max. holdings, seasons, etc.)?

--

What is your position regarding **MPAs**?

--

Subsidy, reliability, zoning.

Records

Deckhands:

How long have you been fishing?

--

How did you start fishing?

--

How are you paid?

--

Has quota made a difference to your situation (% catch versus wage, relationship with skipper, etc.)?

--

What are your intentions (possible to buy in, etc.)?

--

18. Appendix 5 – Letter sent to entitlement holding entities introducing research



Tasmanian Aquaculture
& Fisheries Institute
University of Tasmania



School of Geography &
Environmental Studies

Dear licence holder

You may be aware that in 1997/98 a socioeconomic profile of the Tasmanian rock lobster industry, prior to the introduction of a quota management system, was conducted by Sandra Williamson, Les Wood and Matt Bradshaw at the School of Geography and Environmental Studies at the University of Tasmania. This coming rock lobster season, from March 2000 to February 2001, we will again be undertaking a socioeconomic profile of the Tasmanian rock lobster industry. The aim is to provide an independent report on the socioeconomic aspects of the change to quota management.

Crucial to this report are the knowledge and opinions of those in the Tasmanian rock lobster industry. It is anticipated that we will take between six to 12 months to talk with as many licence holders, quota holders, skippers, processors, family members, etc. as we can. Though you may not have been involved in the shorter 1997/98 study, we are keen to talk with you as part of this larger follow-up study. We would also like to talk with people who have left or retired from the industry, either before or after the introduction of quota management and also those who left many years ago.

Sometime during the coming months we will contact you to see if you would be agreeable to talking with us face-to-face at a time and a place most convenient for you. We are interested in talking with you about your history in the industry and your experience of the change to quota management.

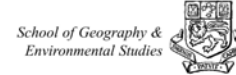
Not everyone who might like to speak with us may receive this or any other notice. Please pass on our contact details to anyone you believe might wish to participate in our study, especially those who have left or retired from the industry, either recently or many years ago. Neither do you need to wait for us to contact you. Feel free to contact us at any time; all communication will be treated in the strictest confidence.

Looking forward to speaking with you

Matt Bradshaw and Les Wood

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Telephone (03) 6226 2205
Facsimile (03) 6226 2989
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19. Appendix 6 – Letter to entitlement holders indicting port visitation



(DATE)

(ADDRESS)

Dear (FIRST NAME)

You may be aware that in 1997/98 a socioeconomic profile of the Tasmanian rock lobster industry, prior to the introduction of a quota management system, was conducted by Sandra Williamson, Les Wood and Matt Bradshaw at the School of Geography and Environmental Studies at the University of Tasmania. This rock lobster season, from March 2000 to February 2001, we are again undertaking a socioeconomic profile of the Tasmanian rock lobster industry. The aim is to provide an independent report on the socioeconomic aspects of the change to quota management.

Crucial to this report are the knowledge and opinions of those in the Tasmanian rock lobster industry. It is anticipated that we will take between six to 12 months to talk with as many licence holders, skippers, processors, family members, etc. as we can. (Though you were not involved in the shorter 1997/98 study, we are keen to talk with you as part of this larger follow-up study.)

We will be visiting (PLACE) from (DATE) to (DATE). We are interested in talking with you about your history in the industry as well as about your experience of the change to quota management. We will endeavour to contact you by telephone before our visit to see if you are agreeable to arranging a time for us to come and discuss how the change to quota management has affected you, your fishing operation, your family and your local community.

Finally, not everyone who might like to speak with us may receive this or any other notice. Please pass on our contact details to anyone you believe might wish to participate in our study, especially those who have left or retired from the industry, either recently or many years ago. Neither do you need to wait for us to contact you. Feel free to contact us at any time; all communication will be treated in the strictest confidence.

Looking forward to speaking with you

Matt Bradshaw

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20. Appendix 7 – Interview schedule used for specific participant types



Impact of management change to a QMS in the Tasmanian rock lobster fishery: processors of rock lobster



How many tonnes of rock lobster do you process in a season?	
What percentage of your business is processing rock lobster?	
How many people do you employ processing rock lobster (in and out of season [casual], FT, PT, permanent, temporary, etc.)?	
Do you 'own' any commercial rock lobster fishing licences or lease any quota units (what do you do with these)?	
How many rock lobster fishers do you buy from?	
How many rock lobster fishers are regular suppliers and how many are spot suppliers (any long-term arrangements, formal, informal, etc.)?	
How many suppliers are local rock lobster fishers and how many are from elsewhere?	
What proportion of rock lobster do you purchase locally and what proportion do you purchase elsewhere (trucks, drivers, etc.)?	
What was your average beach price paid last season?	
What was your average selling price for rock lobster last season?	
Where are your major markets for rock lobster (live, cooked, tailed-domestic versus export, proportions)?	
Has the change to quota management of the rock lobster fishery altered anything in your operation ?	
Has the change to quota management of the rock lobster fishery in any way altered the local community in which you operate?	
What do you consider to have been the major positive impacts of quota, if any (e.g. from personal experience)?	
What do you consider to have been the major negative impacts of quota, if any (e.g. from personal experience)?	
If fishery managers were to alter any aspect of the QMS, what do you believe it should be?	



Impact of management change to a QMS in the Tasmanian rock lobster fishery: investors in rock lobster licences



How long have you owned a rock lobster licence?	
Are you an ex-rock lobster fisher?	
Why did you buy a rock lobster licence?	
How did you identify the investment opportunity of a rock lobster licence?	
To whom do you lease your licence/units/pots?	
Do you lease yourself or do you use a broker (contacts in the industry [ex-fisher, lease to kith and kin] vs few [investor, lease to stranger via broker], also fishers to other fishers)?	
Have you had any difficulties leasing?	
Have you invested in any other fisheries?	
What is your opinion of QM (pre- and post-QM)?	
Positives, negatives and suggested changes re QM?	
Do you intend to buy more licences/units?	
What do you intend to do with your rock lobster licence longer-term?	
Other issues: \$12 kg re margins, investors in industry (vs owner-operation), concentration of ownership, capitalisation of licences (re new entrants)?	



Impact of management change to a QMS in the Tasmanian rock lobster fishery: exited fishery post-quota



Why did you leave the fishery?

What are you doing now?

Have any of your fishing skills transferred to your occupation at present?

What, if any, re-training have you undertaken?

Has your income been affected by your leaving the fishery?

Has your standard of living been altered in any way by your leaving the fishery?

What is your current level of job satisfaction compared with when you were fishing?
