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Western rock lobster mail surveys of
licensed recreational fishers 1986/87 to 1998/99

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Abstract

Information on the catch, effort and fishing characteristics of recreational rock lobster fishers has been collected in Western Australia (WA) since 1986, by an annual mail survey of a randomly selected sample of rock lobster licence holders. Over the period 1986-1999, the number of licensed recreational rock lobster fishers in WA has approximately doubled, from 15,249 (1987/88) to 32,768 (1998/99), and the estimated catch has nearly tripled, from 219 tonnes (1987/88) to 626 tonnes (1998/99). These estimates have not attempted to take into account illegal catches.

Of those who do fish, approximately 65% of recreational rock lobster licence holders exclusively use pots, 28% exclusively dive, 6% both dive and use pots and fewer than 1% use other methods to catch lobsters. Approximately 25% of rock lobster licence holders do not utilise their licences.

The mean number of rock lobsters caught per fisher per day varied from season to season, depending on the recruitment into the fishery in any particular year. Daily individual catches depend on whether potting or diving is the fishing method used. Pot fishers (1.0-1.5 rock lobsters per day) were consistently less successful at catching rock lobsters than divers (1.5-2.2 lobsters per day). Pot fishers were more active, fishing for approximately 30 days per year, compared with divers, who fish for an average of approximately 12 days per year.

The 1999 mail survey of recreational rock lobster fishers was broader in content than the surveys conducted in other years and allowed a more in-depth analysis than has previously been possible. It showed that 44% of rock lobster licence holders live in the Perth metropolitan area. High numbers of licence holders were also recorded as being resident in centres close to, but outside of, the metropolitan area, as well as in the cities of Geraldton, Bunbury and Mandurah. By comparison, the distribution of centres where licence holders fished was dispersed between Busselton and Kalbarri, with Rottnest Island, the greater Perth metropolitan area, Jurien Bay and Geraldton regions being the most favoured recreational lobster fishing centres.

Pot and diver rock lobster fishers tend to fish in similar depths, with 60% of the diving and potting done in depths of less than 10 m. Less than 5% of time was spent in depths over 20 m. Comparisons of the estimated commercial and recreational rock lobster landings have been made for different regions. The result is very variable from year to year and region to region, however, the important Perth metropolitan and Rottnest Island areas are shown to have a recreational catch approximating 25% of the commercial catch in those areas. This increases to around 70% when catch comparisons between the commercial and recreational sectors are made for depths shallower than 10 fathoms (18 m). Overall, the total catch made by recreational lobster fishers in the 1998/99 season is estimated to be approximately 5% of the commercial catch.

The 1999 survey questioned fishers on details relating to their age, years of fishing experience, boat ownership, ownership of electronic and other fishing aids, type of pot used and more. The majority of respondents (90%) were male. Pot fishers (average age 46 years) generally tended to be older than divers (average age 36 years). Most fishers (93%) either owned or had access to boats, which were generally in the size range of 3-6 m. Ownership of echo sounders was high (nearly 40% owned black and white and around 15% owned colour echo sounders), as was ownership of GPS (approximately 30% of respondents owned GPS). These data will form baseline information for tracking future changes in the demographic composition of recreational rock lobster fishers and their efficiency using various fishing aids.

1.0 Introduction

Rock lobster fishing is a popular recreational pastime in a number of lobster-producing countries. The current total catch made by this sector in those countries which have attempted to measure the formal recreational rock lobster catch is of the order of 2,000 tonnes (Melville-Smith *et al.*, in press). However, this figure excludes catches made by subsistence and traditional fishers, which can be difficult to separate from those of recreational fishers. Were these to be included, the total global catch would undoubtedly be very much larger.

Recreational fishers have had a long history of exploiting rock lobsters off the Western Australian coast. The vast majority of recreational lobster fishing effort is directed at western rock lobster (*Panulirus cygnus*), which is commonly found between Augusta and Carnarvon (Figure 1), although occasional western rock lobsters are taken outside this range. Most of the recreational lobster catch in the southern part of the state consists of the southern rock lobster (*Jasus edwardsii*), and in the northern areas of tropical species such as ornate rock lobster (*Panulirus ornatus*), painted rock lobster (*Panulirus versicolor*), two-spined rock lobster (*Panulirus penicillatus*) and occasional specimens of *Panulirus polyphagus*, *Panulirus homarus* and *Panulirus longipes*.

Lobster fisheries in Western Australia have been regulated for many years, with limited entry being introduced in 1963. Recreational fishers need to hold a recreational lobster fishing licence, renewed annually, and pot fishers are restricted to the use of two pots per licence holder at any time. Divers are permitted to use SCUBA and hookah and may use a noose or crook to assist them in catching lobsters. In addition to these commonly used methods, one other legal lobster fishing method, which is occasionally used by a small number of fishers, is to collect lobsters from inshore reefs on low tide at night using torches. Regardless of fishing method, all licence holders are restricted to a fishing season from mid-November to the end of June, a bag limit of eight lobsters per licence holder per day and a maximum of 16 lobsters per boat per day. Additionally, there are minimum size limitations for the different species and regulations precluding the taking of egg-bearing females and those in breeding condition.

First estimates of the size of the recreational fisher lobster catch were made in the late 1970s by Norton (1981). The creel survey undertaken put the catch in the 1977/78 season at around 174 tonnes, or 1.6% of the commercial catch at the time. A telephone survey of the Western Australian general public was undertaken in 1987 (Australian Bureau of Statistics 1989), but the terms of reference of that survey were too wide to provide much detail about recreational lobster fishing in the State. More recent data (Chubb and Melville-Smith 1996, Melville-

Smith and Caputi 1996) suggested that the recreational lobster catch in Western Australia had increased since Norton's (1981) survey and in the 1990s had reached around 400-800 tonnes, or 4-6% of the commercial catch.

A general amateur fisherman's licence to harvest lobsters, prawns and fish caught with gill nets was introduced in Western Australia in 1932. In 1986, the amateur fisherman's licence was changed to species-specific licences, one of which was for rock lobsters. A recreational rock lobster licence enables the holder to harvest any such species occurring on the Western Australian coast.

In the 1986/87 season (the same season that specific recreational fishing lobster licences were introduced), a mail survey aimed at estimating the seasonal lobster catch was initiated. This survey has been conducted each season since its introduction and this report is a summary of the data that have been collected by these surveys over that time.

The production of this report is timely, in that currently there are proposals in Western Australia to reach agreement between recreational and commercial lobster fishers (through the Rock Lobster Industry Advisory Committee Resource Sharing Sub-Committee) as to the appropriate levels of exploitation for the two groups.

2.0 Methods

Licences can be purchased by recreational fishers in Western Australia at any time during the year, but can only be used during the seven-and-a-half-month lobster fishing season which extends from 15 November through to 30 June each year. The season applies to all species of rock lobster, though painted or green tropical lobsters may be taken all year round north of latitude 21°44'S. A month prior to expiry of a licence, a renewal form is automatically generated and sent out to the licence holder offering the fisher the opportunity to renew the old licence. Many of the surveys conducted in the early years of this study (prior to the 1995/96 survey) made use of the annual posted renewal notification which occurred before the start of the season as a way of sending survey forms out to fishers. While the questions asked in recreational fishing lobster licence survey forms have remained similar in all but the most recent season (Appendices 1 and 2), the proportion of licence holders surveyed and the methods used to optimise survey return rates have varied (Table 1).

Only in the 1988/89 season were survey forms mailed to all licence holders. In other seasons, a sub-sample of licence holders was surveyed. Prior to 1995/96, those chosen to receive survey forms were randomly selected according to the number of their licence renewal. For example, if it was decided that 10% of licence holders should receive a recreational lobster licence survey form, then every tenth lobster licence renewal would have been mailed out with such a renewal form. Starting from the 1995/96 season, a nominated quantity of licence holders has been randomly selected at the end of the fishing season from the recreational lobster licence database. These people have had the survey form mailed to them and have been encouraged to return the completed questionnaire by a post-free provision, a service provided since the initial survey in 1986/87.

The proportion of licence holders utilising their licences in a season, and whether each person utilising a licence fished for lobsters by diving, potting or some other method, was calculated directly from responses to the questionnaire. Standard errors associated with these proportions

were estimated using the formula described in Berenson and Levine (1996), incorporating a finite population correction factor,

$$se = \sqrt{\frac{\theta(1-\theta)}{n}} \sqrt{\frac{N-n}{N-1}}$$

where θ is the participation rate (of utilising the licence and then of diving, potting or fishing by other methods);

N is the population size (total number of licence holders, total number of dive, pot or other fishers); and

n is the sample size (number of respondents, number of respondents diving, potting or fishing by other methods).

The standard errors associated with the proportion of divers, potters or fishers may be slightly underestimated due to the population size, N , being an estimated number for this calculation, as opposed to a known number.

The approximate upper and lower limits for the 95% confidence interval were then calculated as

$$\text{lower} \approx \theta - 1.96\sqrt{se}$$

$$\text{upper} \approx \theta + 1.96\sqrt{se}$$

The number of lobsters caught and the number of days fished were taken directly from the questionnaire (Appendices 1 and 2) and the means calculated. It was found that the distributions of catch and days fished were highly skewed, which prevented calculation of confidence intervals using standard methods which assume normality. These statistics were therefore calculated using bootstrap methods as outlined in Efron and Tibshirani (1993). S-plus was used to generate 1000 independent bootstrap samples of size n , each sample drawn randomly with replacement from the n values in the original data set. For each of the bootstrap samples the mean was calculated and then the total mean of all bootstrap replicates was found. To define the 95% confidence intervals, the bias-corrected and accelerated (BC_a) percentiles of the bootstrap distribution of the means were used (Efron and Tibshirani 1993). The bootstrap estimates of the standard errors were also recorded and were used to calculate the 95% confidence intervals of the total weight of lobsters per year.

The estimated weight of lobsters landed by recreational fishers per year (W) was calculated by

$$W = (N)*(L)*(0.5)$$

where N is the mean number of lobsters caught per fisher per season;

L is the total number of licence holders estimated (based on the sub-sample surveyed) to have fished by potting, diving, or another method; and

0.5 is the estimated mean weight in kg of a recreationally caught western rock lobster. This figure is based on the approximate weight of an 81 mm carapace length western rock lobster, which was the mean size of lobster measured in the course of the 1996/97 survey of recreational fishers between Augusta and Kalbarri (Sumner, pers. comm.).

An indication of the residential spread of recreational rock lobster licence holders in the State was obtained from the postal codes on the addresses supplied by fishers at the time of purchasing their licences.

The annual mail surveys were not designed to estimate the recreational catch on a regional basis. However, respondents were asked to nominate three areas in which they did most of their lobster fishing in order of frequency visited. Postal codes were allocated to those fishing areas and the recreational lobster catch was analysed by region, making the assumption that respondents had spent all their time fishing and had made their entire catch of lobsters at the fishing site that topped their list.

Most of the recreational lobster catch is made in waters shallower than 20 m and it was therefore felt to be of value to present the recreational catch as a proportion both of the estimated weight of the total commercial lobster catch and of the estimated catch from waters less than 10 fathoms (~18 m). The commercial lobster catch was estimated using catch and effort data which are supplied by fishers as a licence condition. Catch estimates were apportioned into regions, and into depths less than 18 m and greater than 18 m, using detailed voluntary log book information supplied by approximately one-third of the commercial lobster fishing fleet.

The main objective of this study has been to examine recreational lobster fishing patterns by way of catch and fishing effort. A number of additional questions relating to management and compliance issues were asked of licence holders surveyed in 1999 (see survey form, Appendix 2). Responses to those questions dealing with management issues have been analysed and, using Chi-squared tests, tested for independence of response according to whether the respondent was a pot or dive fisher or a non-user. Responses relating to compliance issues will be reported elsewhere (Stewart & McKinlay, 2000).

3.0 Results

3.1 Fishing and mail survey participation rates

The exact number of survey forms sent to recreational rock lobster licence holders in any season was not recorded prior to the 1995/96 season, apart from the 1988/89 season in which all licence holders were surveyed. Accordingly, it has not been possible to establish the percentage return rate of survey forms in most of the early seasons. The 36% return rate in the 1988/89 season has been assumed to have been typical of the response rates in all years prior to the 1995/96 season. Changes to the mail-out procedure combined with incentives encouraging return of the survey forms have made it difficult to establish any one single reason for the improved participation rate since 1997/98 (Table 1).

In the years when survey forms were sent out with licence renewals, there was no record of whether or not the survey form and licence renewal reached the licence holder. Since the introduction of a specific mail-out, a proportion of survey forms have been returned 'address unknown'. In the last two years these returned forms have been recorded (2.3% and 2.8% of total forms returned), and their number has been excluded from the survey sample size leading to the effective number of fishers surveyed (Table 2).

Licence sales have doubled over the 13-year period covered by this survey (Table 2). Sales showed particularly strong growth between 1987/88 and 1988/89 (48%), 1990/91 and 1991/92 (14%), and 1996/97 and 1998/99 (36%), but were relatively steady in the periods between these seasons (Figure 2, Table 2). These increases in licence sales were generally associated with increases in lobster abundance. The proportion of fishers who utilised

their licences each year has remained reasonably consistent at around 70-76% over the course of the mail survey, but was particularly high (83%) in the 1986/87 and 1997/98 seasons (Figure 3, Table 2).

Of those respondents who have reported fishing since postal surveys first commenced in 1986, around 55-70% have indicated that they used only pots to catch their lobsters (Figure 3). This category of fisher has slowly decreased over time, however the proportion of respondents who indicated that they only dived for lobsters has increased over the course of the survey from around 20% to around 35% (Figure 3). Approximately 5-10 % of respondents each season indicated that they both dived and used pots to catch lobsters (Figure 3, Table 2), and this category of fisher also has been increasing slowly. A very small group (usually less than 1% of respondents) indicated that they caught lobsters by methods other than pot fishing or diving, for example by reef walking (Table 2).

3.2 Sample demographic composition

Only in the 1998/99 season was there a concerted effort to collect demographic information for lobster licence holders, such as the age structure of fishers, their lobster fishing experience, boat ownership. etc. (see survey form in Appendix 2). It was found that 90% of recreational rock lobster fishers are male. Data from the 1998/99 survey have shown a normal age distribution for male fishers (mean age 43 years), but a distribution skewed towards the older age categories for females (mean age 45 years, Figure 4). As might be expected, the age distribution of those fishers who dive for lobsters is skewed towards younger people (mean age 36 years, Figure 5), while the age distribution of those fishing for lobsters with pots is normal (mean age 46 years, Figure 5).

Statistics also were collected in the 1998/99 season on the number of fishers who either owned or had access to a boat, the size of the boat, and any fishing aids on the boat. Of those who fished in this season, 93% of pot fishers either owned or had access to a boat, compared with 77% of divers. The majority of fishers used boats of 3-6 m in length (Figure 6) and had one or more kinds of equipment that could have improved their efficiency in catching lobsters, such as echo sounders, GPS, viewing buckets or pot winches (Figure 7). Ownership of echo sounders was particularly high (nearly 40% owned black and white and around 15% owned colour echo sounders), as was ownership of GPS (approximately 30% of respondents owned GPS) (Figure 7).

The distribution of years of lobster fishing experience was similar for both recreational pot and dive fishers, with the majority having had five or fewer years and only a small number of those participating in either method having had more than 10 years of experience (Figure 8).

3.3 General catch and fishing effort

Analysis of fishing activity by fishers using the two main fishing methods showed that pot fishers were far more active than divers, with pot fishers using their licences on average 30 days a season compared with diver usage of approximately 12 days per season. The mean number of days fished by these two methods has remained relatively constant over the 13-year period covered by the survey, with the highest usage being recorded for the 1998/99 season (Figure 9, Table 2). The peak period of fishing activity, as gauged by the 1998/99 season survey, is in the early part of the season for both potting and diving, and gradually declines each month after December until the season finishes in June (Figure 10). The number of days fished for November is low since the season commences in the middle of this month. Only

15% of divers fish more than 20 days per season (i.e. 85% of fished less than 20 days) (Figure 11), although approximately 50% of pot fishers fish in excess of 20 days per season. Data from the 1998/99 survey show that the vast majority of recreational pot fishers use either plastic or batten pots (Figure 12).

The number of lobsters caught by pot and diver fishers has fluctuated between seasons (Figure 13, Table 2). The trend over the survey period has been the same for both fishing methods and the peaks and troughs have followed seasons of high and low landings respectively in the commercial fishery (Table 2). It is clear, therefore, that the number of lobsters caught per season by recreational fishers is strongly related to inter-annual differences in recruitment to the fishery. The number of lobsters caught per season by pot fishers was shown to be considerably larger than the seasonal catches made by divers (Figure 13, Table 2). This difference is largely a result of pot fishers generally being more active than divers (Figure 9).

The actual number of lobsters caught per season by pot and diver licensed fishers is shown for all seasons combined in Figure 14. Half of all divers catch fewer than 13 lobsters per season and half of all pot fishers catch fewer than 21 lobsters per season (Figure 14), but a small proportion (less than 10%) of divers land between 50 and 200 per season and a similar proportion of pot fishers land between 90 and 300 per season (Figure 14).

Catch per unit effort, expressed as number of lobsters caught per day, has generally shown similar year-to-year trends for both fishing methods (Figure 15, Table 2). These inter-annual differences in catch rate are in line with inter-annual differences in the size of catches made by the commercial fishery (Table 2) and are a reflection of the size of recruitment into the fishery in any particular season. Divers have been shown to have a consistently higher daily catch rate than pot fishers (Figure 15, Table 2).

The estimated total recreational fishing catch has followed similar year-to-year fluctuations in size as those recorded for the commercial fishery (Figure 16, Table 2). These trends reflect inter-annual changes in recruitment to the fishery. A second, and from a management viewpoint more important, outcome from the surveys has been the gradual increase in the size of the recreational fishing catch as a proportion of the commercial catch (Figure 16, Table 2). The major explanation for this is considered to be the increase in numbers of recreational fishers participating in this pastime.

3.4 Regional and depth-specific catch and effort

The geographic spread of all Western Australians who purchased recreational rock lobster licences in the 1998/99 fishing season, and of the 3990 who were randomly selected for that season's survey, is summarised according to their places of residence in Figure 17 and Table 3. These results show, as might be expected, that the bulk of licensed recreational lobster fishers tends to be concentrated around Perth and to a lesser extent Geraldton, Mandurah and Bunbury (Table 3). Approximately 0.4% of those who purchased licences in 1998/99 were from States outside of Western Australia. International visitors (2) made an insignificant contribution to recreational lobster licence sales (Table 3). The locations in which those licence holders resident in Western Australia reported fishing in the 1998/99 season are provided in Table 3 and Figure 18. As noted earlier (see section 2.0), the survey form (Appendix 2) provided space for three possible fishing location options and requested that respondents provide their choices of lobster fishing locations according to frequency visited. The majority of respondents (76%) provided only a single fishing location, with 17%

providing two locations and 7% providing three fishing locations. The geographical distribution of locations fished in 1998/99 (Table 3, Figure 18), is based on all the areas (first, second and third choices) that were recorded by survey respondents.

Although the vast majority of lobster licence holders were resident in and around Perth, that was not the choice of fishing location for most fishers. Compared with the residential distribution of licence holders, highly disproportionate fishing activity was recorded at Rottnest Island (the surrounding waters of which are legislated as a recreational-only rock lobster fishing area) and coastal stretches from Wanneroo to Lancelin and Jurien Bay (Table 3, Figure 18).

The proportion of the recreational catch taken by divers and pot fishers respectively was not the same for all regions (Table 4 and Figure 19). The annual surveys, with the possible exception of the 1998/99 survey, were not designed to separate the recreational catch and effort into different regions. As a consequence, the assumption has had to be made that a respondent's total catch was made at his or her first choice in fishing location (question 10, Appendix 2). This assumption, combined with the question of accuracy due to the relatively small sample sizes in some cases, needs to be borne in mind when viewing the data. Figure 19, which should be considered as a time series rather than individual seasons in isolation, does provide a useful indication of trends since the late 1980s within the recreational dive and pot fisheries. It is clear, for example, that most recreational diving for lobsters has taken place in the Metropolitan and Rottnest regions and southwards, and in particular in the South West Coast region. It is also apparent that the bulk of the recreational catch (approximately 90%) is spread over the coast between Geraldton and Mandurah (South Metropolitan).

Although there are trends in the contribution that has been made by pot and dive fishers (Figure 19), the seasonal fluctuations have masked these overall trends. Ignoring some of the outlying data points, it would appear that the proportion of the total Western Australian recreational western rock lobster catch taken by divers has increased in the Metropolitan and Rottnest regions and that the proportion taken by pot fishers has decreased in the North West Coast and Geraldton regions (Figure 19).

The estimated recreational catch as a proportion of the estimated total commercial catch is presented in the Dongara, Geraldton and Kalbarri regions in Figure 20 and in the Metropolitan, Northern and Southern regions in Figure 21. As noted above, large seasonal variations in regional recreational catch estimates attributable to particular areas have made interpretation of trends difficult. However, setting this complication aside, there would seem to have been either no obvious change in recreational/ commercial catch share over time (e.g. Dongara, Northern, and Metropolitan including Rottnest Island, Figures 20 and 21), or an increase in the recreational share (e.g. Kalbarri, Geraldton, Southern, Figures 20 and 21).

Data from the 1998/99 survey have shown that the majority of recreational fishing takes place in depths of less than 10 m and that over 90% of fishing effort by both pot and dive fishers is spent in depths less than 20 m (Figure 22). Because of the tendency for recreational fishers to concentrate their fishing in shallower waters, it was considered useful to compare recreational catches with commercial catches made in depths less than 10 fathoms (18 m) (Figures 23 and 24). While the overall trend is similar to the comparisons for all depths (Figures 20 and 21), the proportion of the commercial catch taken by recreational fishers is considerably larger. In some years the estimated catch made in the Metropolitan region (including Rottnest Island)

by the recreational sector has been equivalent to that made in similar depths by the commercial sector (Figure 24).

3.5 Management issues

The responses by recreational lobster licence holders to questions relating to four different management issues have been presented in Tables 6-9. The opinions of the different categories of fisher were shown by Chi-squared tests to be significantly different (see *p*-values, Tables 6-9). The combined results for the different categories (in the last column of each table) therefore need to be viewed with caution.

Most respondents (80-90%) considered that the current management arrangements of two pots per person, eight lobsters per day and 76/77 mm size limit were 'about right' (Tables 6-8). In Table 9, there was a clear aversion by most fishers to the use of spears for lobster fishing. Use of a shepherd's crook was the only fishing method, currently legal in Western Australia, to be rejected by the majority of fishers in all categories. Interestingly, while there was acceptance for pot fishing by all user groups, there was less enthusiasm for diving, particularly using hookah, as a lobster fishing method by other groups.

3.6 Other rock lobster species

The prime objective of the recreational lobster mail surveys was to obtain data on the fishery for western rock lobsters. Data that were collected for southern and tropical lobsters were incidental and in most seasons the numbers of fishers who recorded fishing for these species were too low to give an acceptable level of precision. Based on responses recorded over the 13-year period that the survey has been in operation, only around 2% of lobster licence holders target either tropical or southern lobster species, and these licence holders are split approximately equally between those targeting the two types of lobster. Those fishing for tropical lobster species were largely divers, but in the case of southern lobsters there was an almost equal split over the years between divers and potters. A reliable account of total catch could not be made from these surveys, however, the recreational catch reported for tropical or southern lobsters in Western Australia would appear to be less than 10 tonnes each season.

4.0 Discussion

The mail survey response rates that have been inferred from this study for earlier years and recorded in recent times are typical of return rates for surveys from interest groups. Davies (1995) has suggested that return rates for questionnaires from interest groups range from 20 to 60 per cent, though there are mail surveys of recreational fishers reported in the literature with much higher response rates (e.g. 79.4% response rate for a mail survey of recreational crab trap licence holders in Louisiana, USA, Guillory 1998). Good response rates, particularly in the latter years of the western rock lobster surveys, probably reflect a combination of recreational fisher interest in surveys dealing with their sport and tenacity on the part of the originators of the survey. The apparent interest in the survey by lobster fishers may indicate that respondents have given more considered answers to the questions than they might have to surveys in which they had less interest.

We are aware that, as shown by Fisher (1996), non-respondents to mail surveys could have a different demographic profile and fishing characteristics to respondents and hence cause a bias in the results. However, the trends that have been presented in this report have not shown any

obvious deviations since the near-doubling of survey response rates recorded in the 1997/98 and 1998/99 seasons. Additionally, limited follow-up telephone surveys (Chubb in 1988/89, unpub. data, and Melville-Smith in 1996/97, unpub. data, and 1997/98, unpub. data,) have shown similar proportions of fishers to non-fishers as were recorded by the mail surveys. A separate study is currently under way utilising the 1998/99 survey data to establish what effect a greater survey response rate might have had on the demographic make-up of survey respondents, respondent fishing activity, fishing method, catch rates and ultimately the survey catch estimate for recreational fishers.

The increases in recreational lobster licence sales in the 1988/89, 1991/92, 1997/98 and 1998/99 seasons all appeared to be associated with exceptionally strong year classes of lobsters entering the fishery around those years. However, the timing of the increase in licence sales was different in each case. In 1988/89 the 48% increase in licence sales was associated with the second year of a very large commercial catch (Table 2). In 1991/92 and 1998/99, the increases in licence sales of 11% and 14% respectively were associated with the first year of a large commercial catch (Table 2), and finally in 1997/98 the 20% increase in licence sales was associated with the year preceding a particularly large commercial catch (Table 2). It would seem therefore that increases in licence sales are associated with good recruitment into the fishery. This is now being reinforced by media reports of catch forecasts, something which did not occur in earlier years.

Closer examination of the data have shown that correlations between increases in recreational licence sales and large increases in total landings made by the commercial fishery are not straightforward. For example, the 20% increase in licence sales in 1997/98 occurred in a season in which the overall catch made by the commercial fishery increased by only 6% over the previous season (Table 2). Closer examination of the data have however shown that in the southern part of the fishery, which includes the bulk of recreational lobster licence holders, the commercial catch increased by 14%. In particular the commercial 'whites' lobster catch, which forms the major part of the catch made in the key recreational lobster fishing months of November and December, increased by 22% in 1997/98. Thus if there is a correlation, increases in licence sales may be more dependent on fluctuations in lobster availability in the recreationally important southern region of the fishery than on coast-wide increases in abundance. The ability to predict the recreational lobster catch ahead of time is the subject of a separate study which is ongoing.

The size of the recreational rock lobster fisher survey, and consequently the number of returns, has been very variable over the years. Low numbers of respondents, particularly in the 1990/91 and 1991/92 fishing seasons and to a lesser extent in the 1992/93 and 1994/95 seasons, have led to the estimates for those years being less precise than others. It is possible, for example, that the sharp deviation in the proportions of recreational pot fishers and divers in 1990/91 and 1991/92 (Figure 3) is a result of the relatively small survey sample size in those years.

There are indications of a long-term positive trend in the proportion of recreational lobster divers compared with potters, a trend which has become particularly noticeable over the last four fishing seasons (Table 2, Figure 3). These apparent changes are hard to explain without data describing the demographic characteristics of licence holders in all years. Data for the 1998/99 survey showed that recreational divers were predominantly younger than those using

pots. The inference is, therefore, that the increase in the proportion of recreational lobster divers over the survey period (Figure 3) would indicate greater participation in this sport in recent years by younger Western Australians.

These recreational lobster catch estimates are the best available indications of the total catch made by this sector. It is well known (see for example Essig and Holliday 1991 and Cowx 1991) that mail surveys of recreational fishers suffer from uncertainties associated with non-responses from a proportion of those surveyed, as well as biases associated with recall memory and angling prestige and enthusiasm. These biases generally would be expected to overestimate the recreational catch, because non-respondents to recreational fisher surveys generally are considered to be less active fishers than respondents (Brown and Wilkins 1978) and long recall periods typically result in overestimates (Brown 1991). The overestimates that might result from prestige and enthusiasm are self-explanatory.

We accept that it is possible that some or all of these biases may have influenced the catch estimates. However, regardless of whether this influence was positive or negative, these factors would not have been likely to have influenced the generally increasing proportion of the available lobster catch that is being taken by the recreational sector.

In a survey which involved interviewing recreational lobster fishers on beaches and at boat ramps in the 1988/89 season, Chubb (unpub. data) found that daily lobster catches made by recreational fishers tended to be substantially higher than the mean daily catch estimated from mail survey results. The same study (Chubb, unpub.) combined differences between beach and mail survey catches with information from enforcement transgressions and developed a correction factor for the western rock lobster mail survey. This involved raising the total recreational catch estimated from the mail survey by 65%. These raised survey figures have been used in previously published material dealing with the Western Australian lobster mail surveys (e.g. Chubb and Melville-Smith 1996, Melville-Smith and Caputi 1996).

More recent data collected at boat ramps in the 1996/97 season (Sumner and Williamson 1999) have shown daily lobster catch rates (1.5 lobsters per licence holder) to be very close to those estimated by this survey in the same season (1.3 and 1.8 lobsters per licence holder per day for pot fishers and divers respectively).

In the light of research showing that mail surveys tend to overestimate recreational catches, as well as the similarity between catch rate results obtained by Sumner and Williamson (1999) and those obtained for the 1996/97 season in this report, it was considered inappropriate to continue applying the 65% correction factor to the survey results in the way that it has been applied in the past. Consequently, the recreational catch estimates for all seasons in this report are lower than those that have been published for this fishery in recent times (e.g. Chubb and Melville-Smith 1996, Fisheries WA 1999).

Subsequent to 1987/88 there has been an increasingly effective education programme aimed at improving compliance by recreational fishers. This is believed to have had a significant effect on the opinions of fishers towards regulations, and as a result it is considered that illegal activity by this sector has decreased. No attempt has been made in this report, to account for the recreational catch that might have possibly been made by fishers understating their catch or undertaking illegal activities.

Considerable interest has been shown by representatives of both recreational and commercial resource management groups in quantifying recreational rock lobster fishing activity on a regional basis. This recreational rock lobster mail survey was never designed to produce such detailed output, but given the interest in the subject an attempt has been made to satisfy these requirements (see Figures 18, 19, 20, 21, 23 and 24). It should be noted that, while overall trends in these figures are useful, caution should be exercised in drawing conclusions from short time periods, particularly in the less popular recreational rock lobster fishing regions. The popularity of recreational rock lobster fishing in the different regions (based on 1998/99 survey results) can be gauged by reading Tables 4 and 5 in conjunction with Table 2.

It is notable that the increase in the proportion of the rock lobster catch taken by recreational fishers compared with commercial fishers has not been confined to any one region on the coast (Figures 20, 21, 23 and 24). It is perhaps surprising that, despite population growth in Perth and surrounds over the last decade, the Perth Metropolitan and Rottnest Island region has shown less obvious signs of an increase in recreational:commercial catch proportion than other regions (Figures 20, 21, 23 and 24).

The commercial western rock lobster fishery is managed by well-enforced input controls and has been considered to be fully exploited for some years (e.g. Brown *et al.* 1994). Management measures which have been introduced over time have seen the number of pots in use in the commercial fishery decrease from 75,000 (1987/88) to 56,800 (1998/99) over the period covered by survey data presented in this report. It is believed that improvements in gear technology and efficiency over this same period have to a large extent offset the impact of these pot reductions (Brown *et al.* 1995, Fernandez *et al.* 1997, Anderton 1999).

This study has shown that recreational rock lobster fishing has been growing rapidly over the same period that has seen pot reductions in the commercial fishery, with recreational landings increasing from around 2% of the commercial catch to nearly 5%. It is clear that whereas some years back the impact of this sector could have been ignored, this may no longer be the case. While the potential management implications of an increasing recreational catch are beyond the scope of this document, the study has provided data that will permit combined recreational and commercial management plans to be developed in the future.

5.0 Acknowledgments

We acknowledge the contribution made by Dr Chris Chubb and the Technical Officers who assisted him in organising and conducting mail surveys of recreational lobster fishers up until December 1995. Dr Nick Caputi was responsible for some of the early survey data analyses and has assisted us with some survey design advice. Mr Dave Murphy, Ms Emily Stewart and Ms Kelly Jacoby are thanked for their technical support and for co-ordinating the design and mail-out of the recreational lobster mail survey in more recent years. Dr Rod Bertelsen provided us with advice on how he and his colleagues run the Florida Fisheries Department recreational lobster mail survey and those exchanges gave us tips on ways to improve our survey design. We are particularly grateful to Drs Nick Caputi, Chris Chubb and Mervi Kangas, Jim Penn and Messrs John McKinlay and Neil Sumner, who provided very useful comments on earlier drafts of this report. Also to Ms Fran Head and Ms Kelly Jacoby for editorial comment.

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Figure 1 Major centres of the Western Australian coast between Augusta and Carnarvon, where the vast majority of recreational lobster fishing effort is directed at western rock lobster (*Panulirus cygnus*).

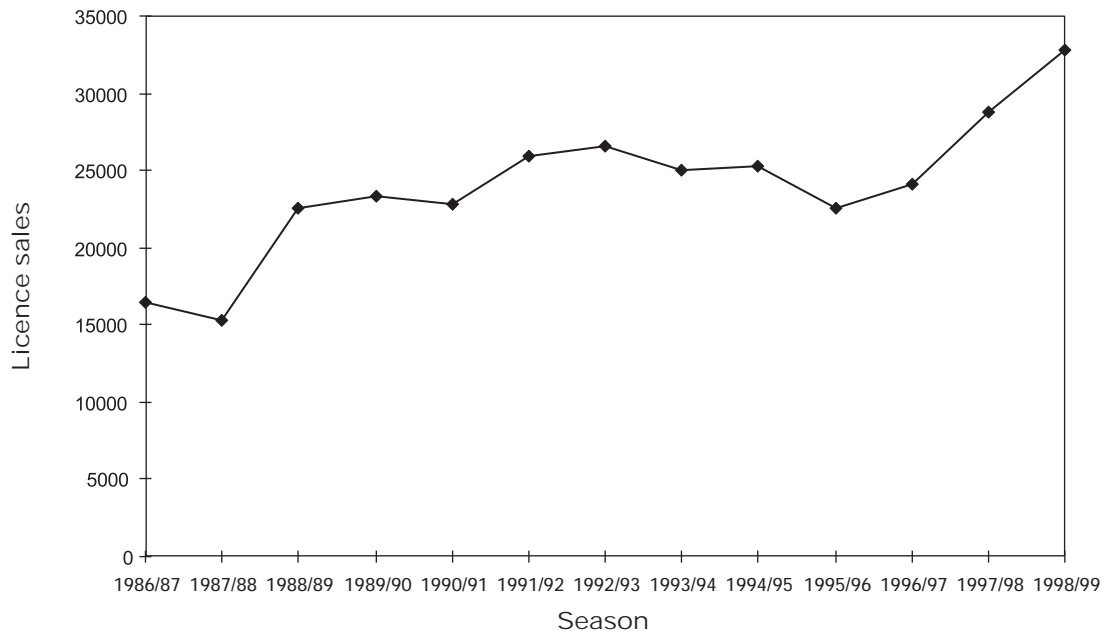


Figure 2 Trends in the number of licensed recreational lobster fishers.

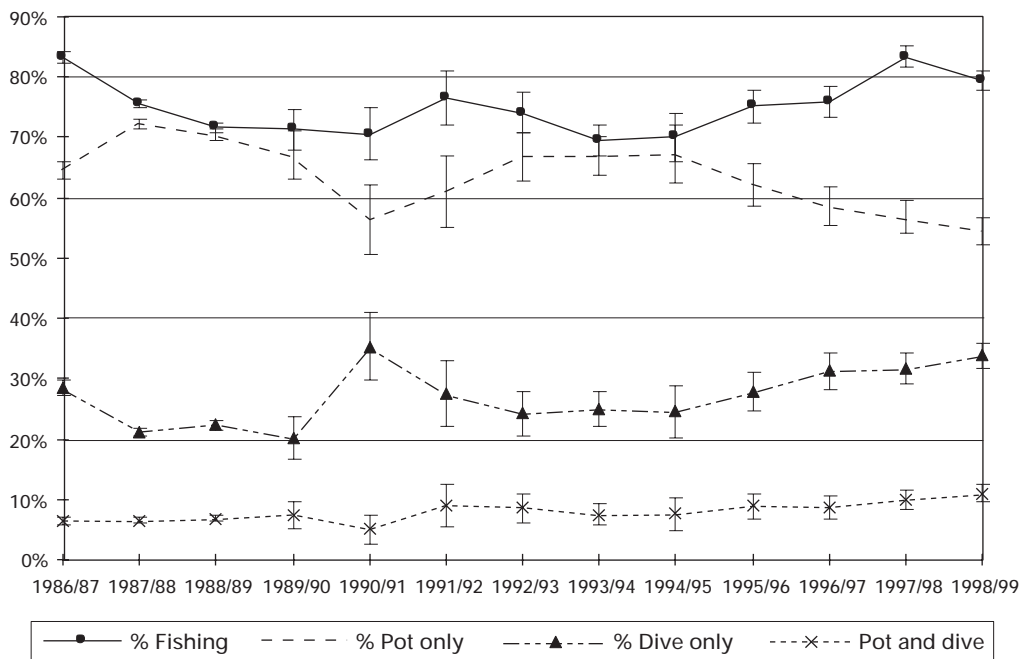


Figure 3 Percentage of licensed recreational lobster fishers who utilised their licence, and percentage of actively fishing licence holders who only potted, only dived, and who both potted and dived each season.

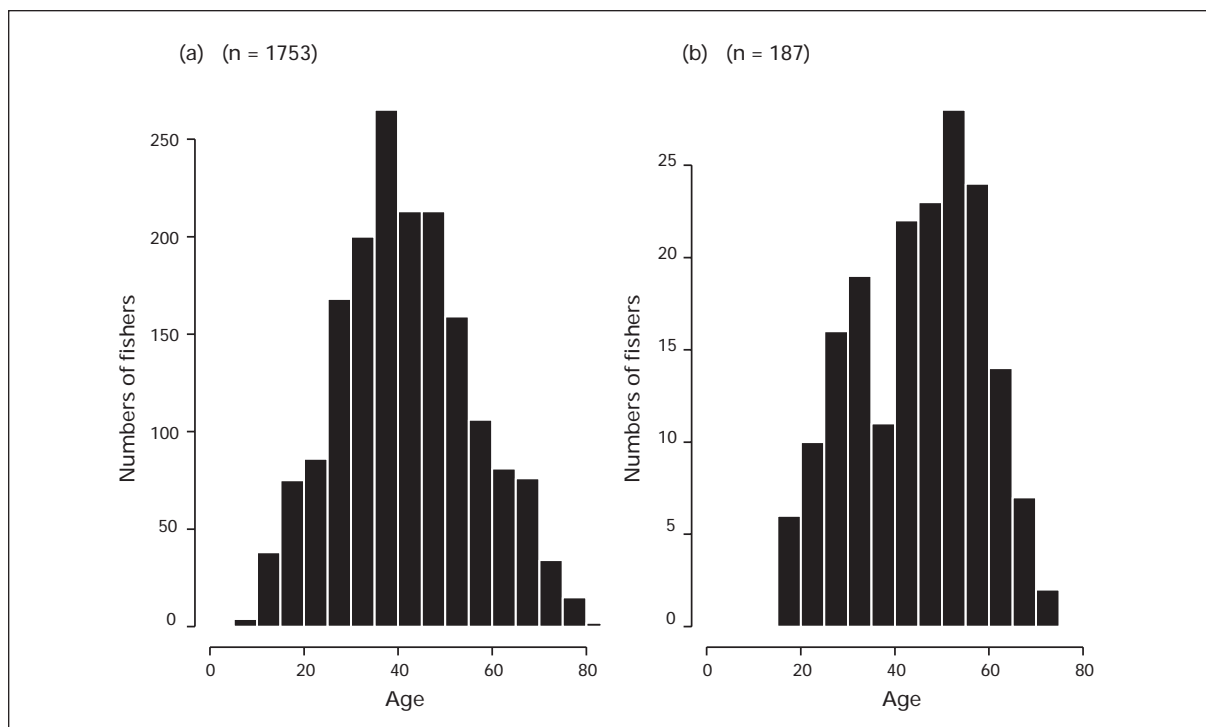


Figure 4 Age distribution of (a) male and (b) female recreational lobster fishers who reported fishing in the 1998/99 season survey.

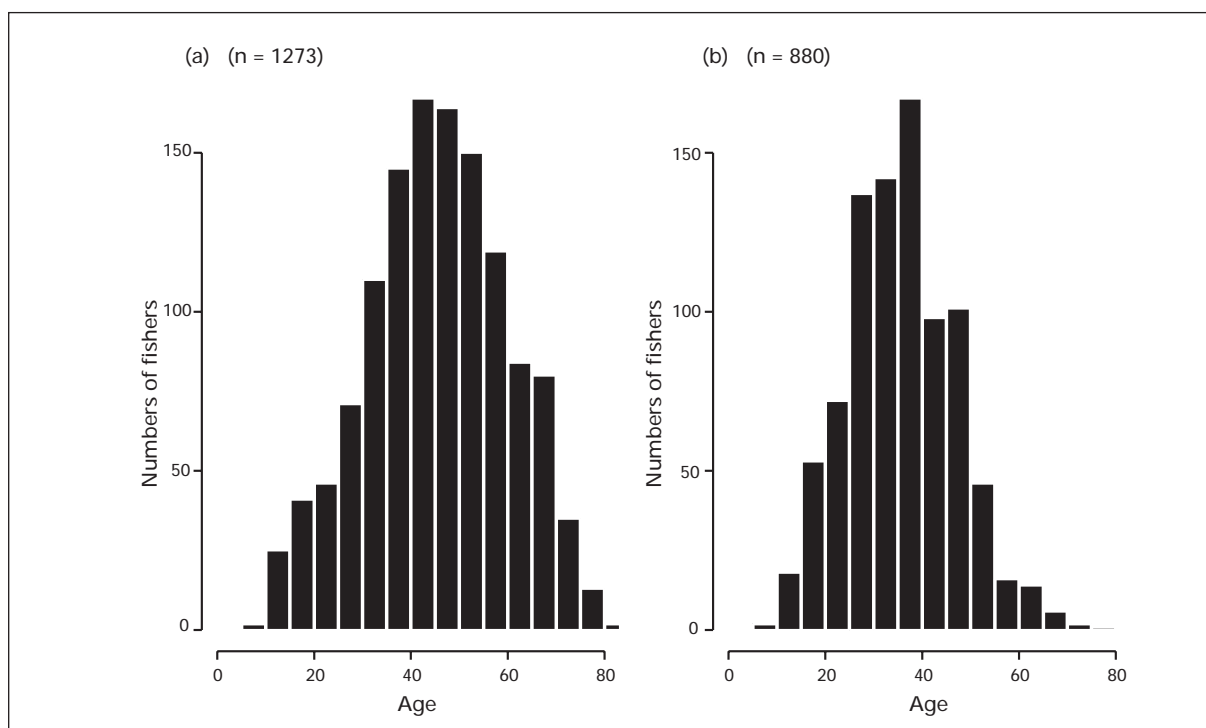


Figure 5 Age distribution of (a) pot fishers and (b) dive fishers who reported lobster fishing in the 1998/99 season survey.

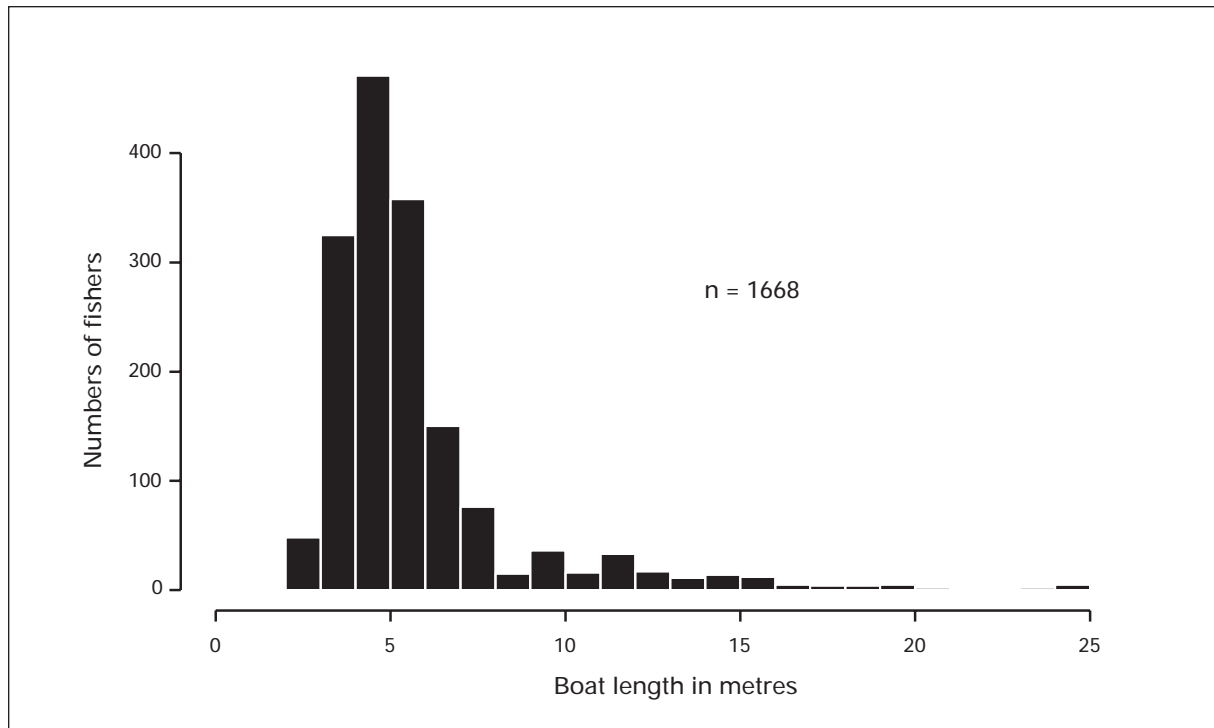


Figure 6 Number of recreational lobster fishers who reported owning, or having access to, boats of various sizes in the 1998/99 season survey.

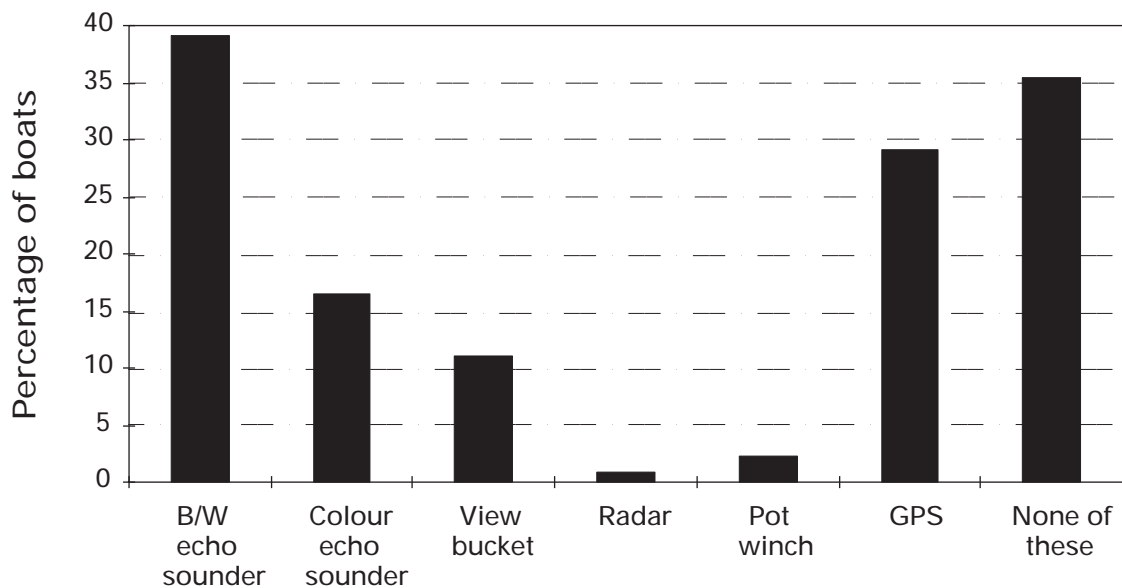


Figure 7 Percentage of boats, owned by recreational lobster fishers surveyed during the 1998/99 season survey, with equipment that might improve their ability or efficiency in catching lobsters.

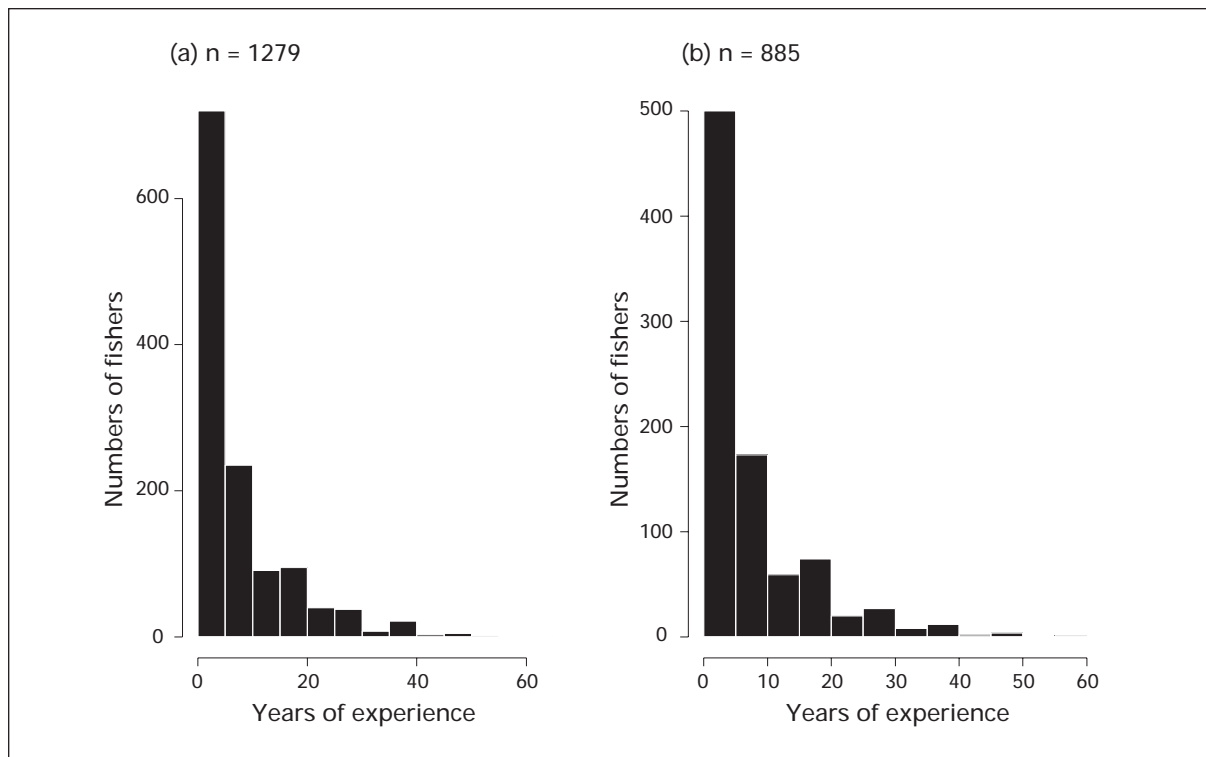


Figure 8 Years of recreational lobster fishing experience recorded by (a) pot and (b) dive fishers who reported fishing in the 1998/99 season survey.

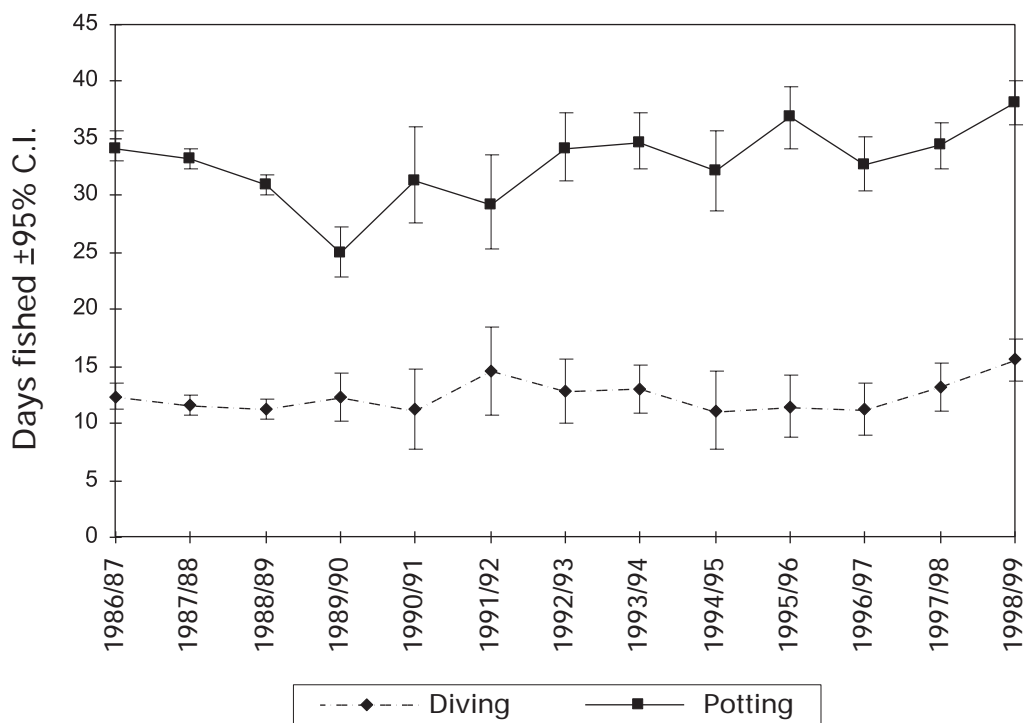


Figure 9 Number of days fished per season by recreational lobster licence holders using pots and diving.

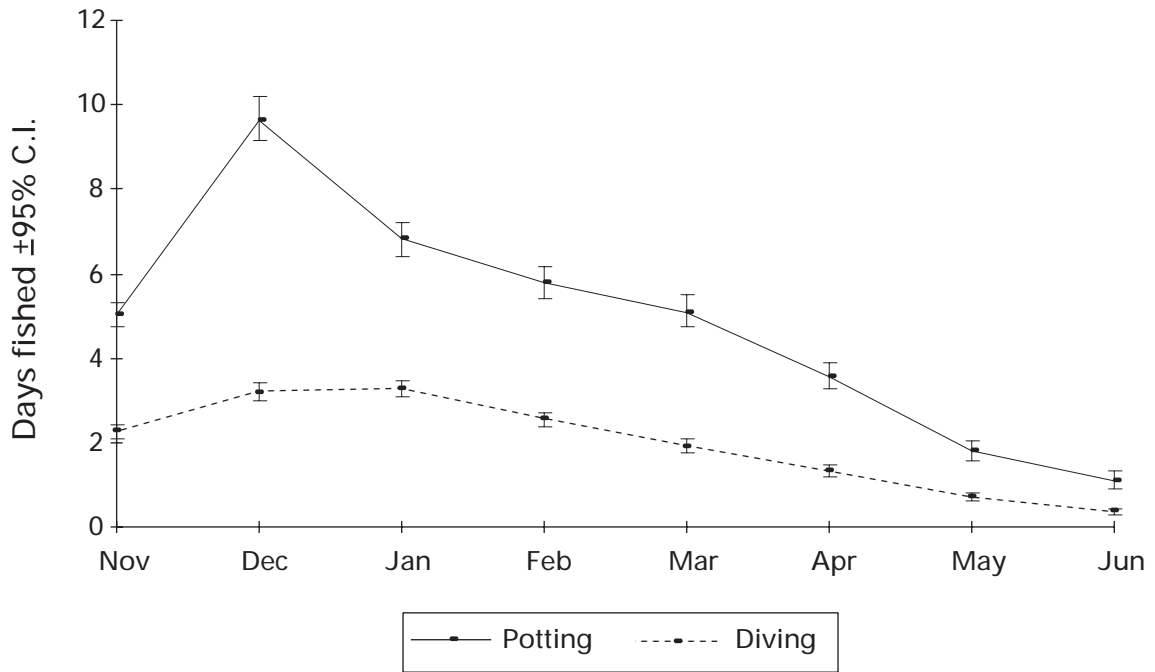


Figure 10 Average number of days fished per month by recreational lobster pot and dive fishers who reported fishing in the 1998/99 survey.

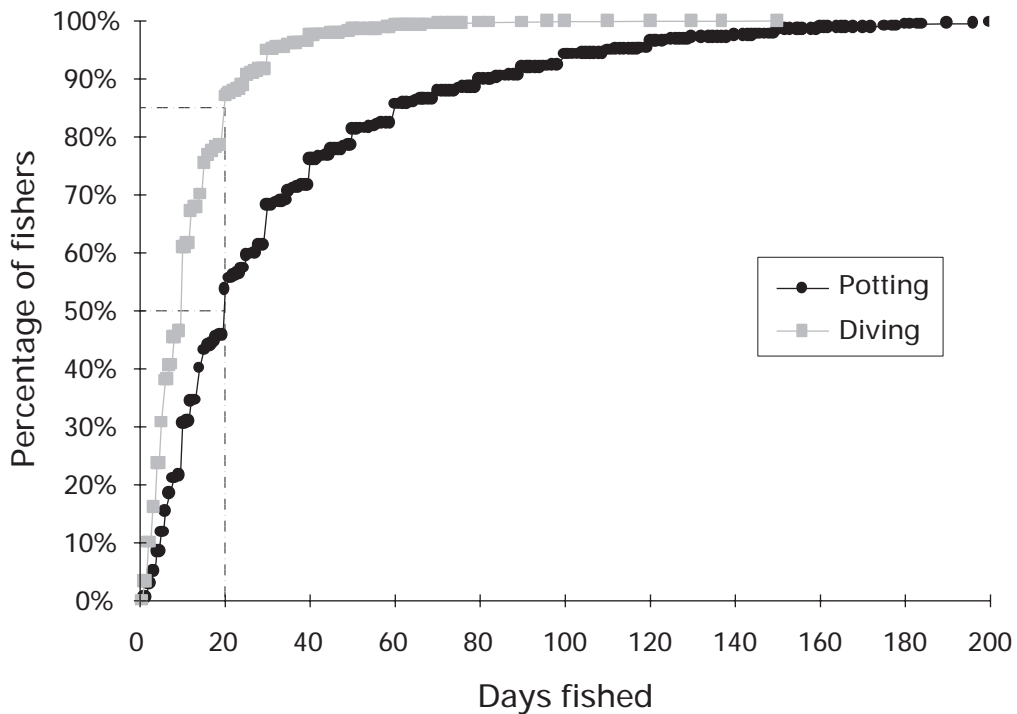


Figure 11 Number of days per season on which pot fishers and divers used their recreational lobster fishing licence to catch lobsters, expressed as a cumulative percentage of all licence holders who fished over the seasons 1986/87 to 1998/99.

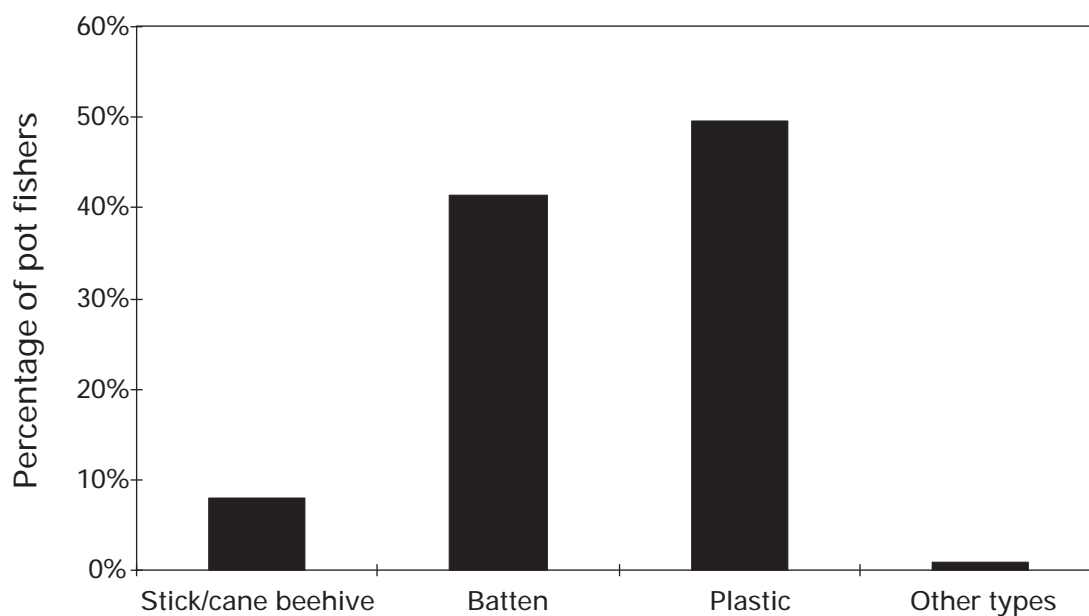


Figure 12 Frequency of usage of different pot types by recreational lobster pot fishers who reported fishing in the 1998/99 season survey.

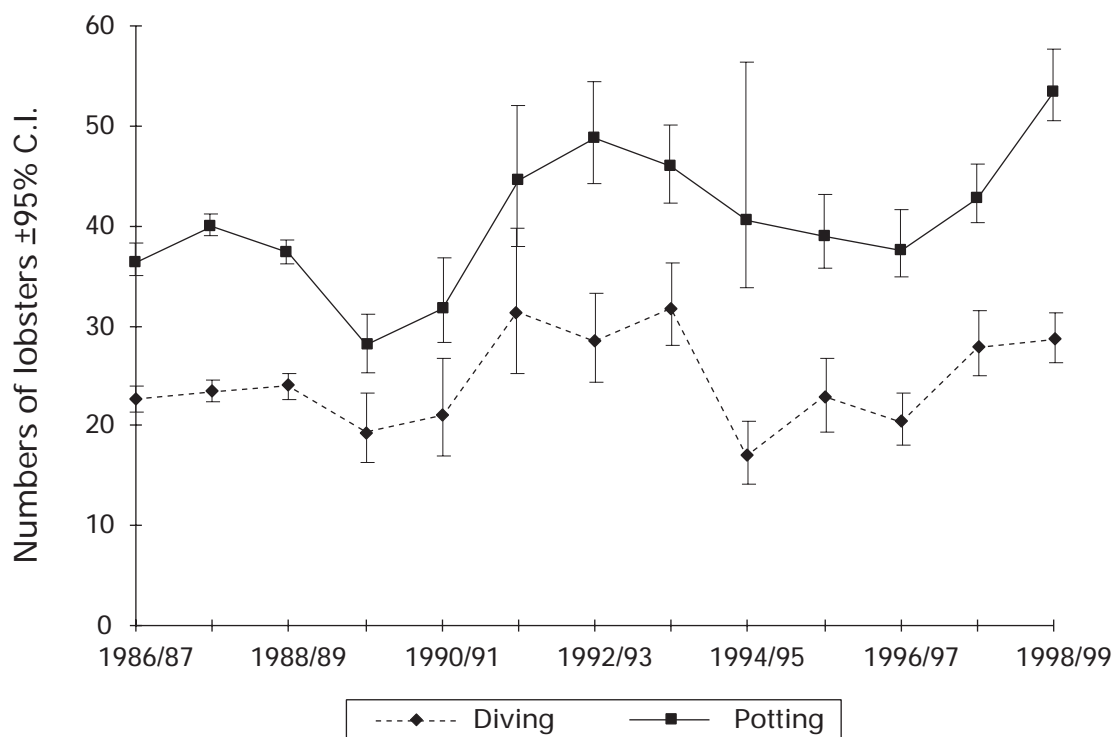


Figure 13 Mean number of lobsters caught per year by divers and pot fishers who utilised their recreational lobster fishing licences.

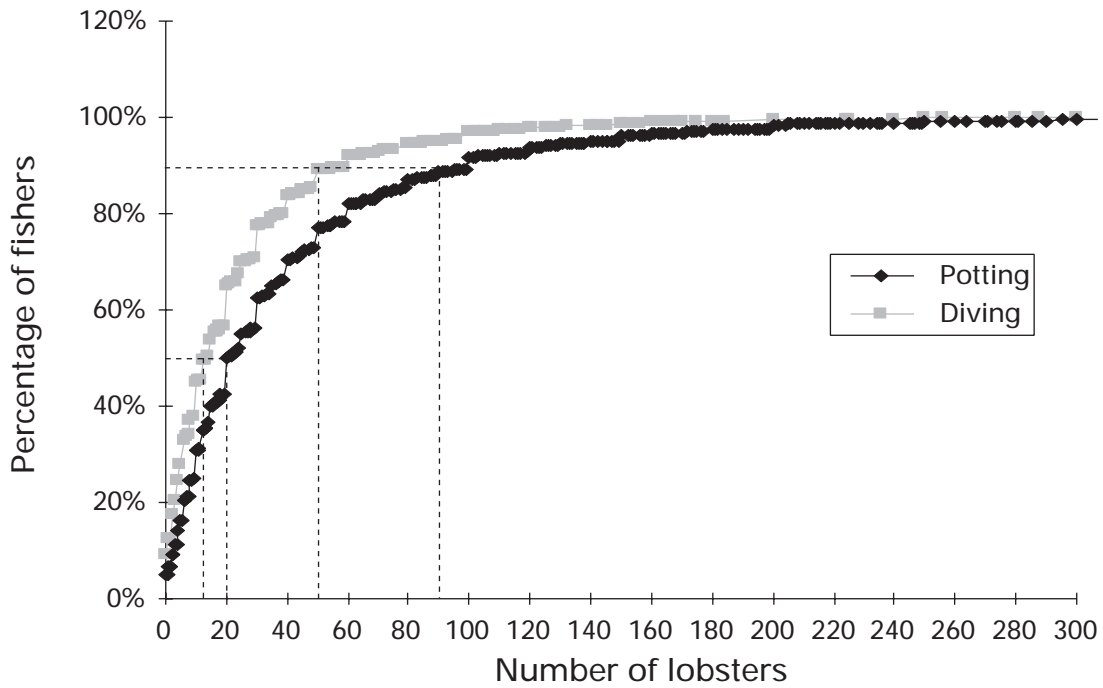


Figure 14 Number of lobsters caught per season by pot fishers and divers who utilised their recreational lobster fishing licence to catch lobsters, expressed as a cumulative percentage of all licence holders who dived over the seasons 1986/87 to 1998/99.

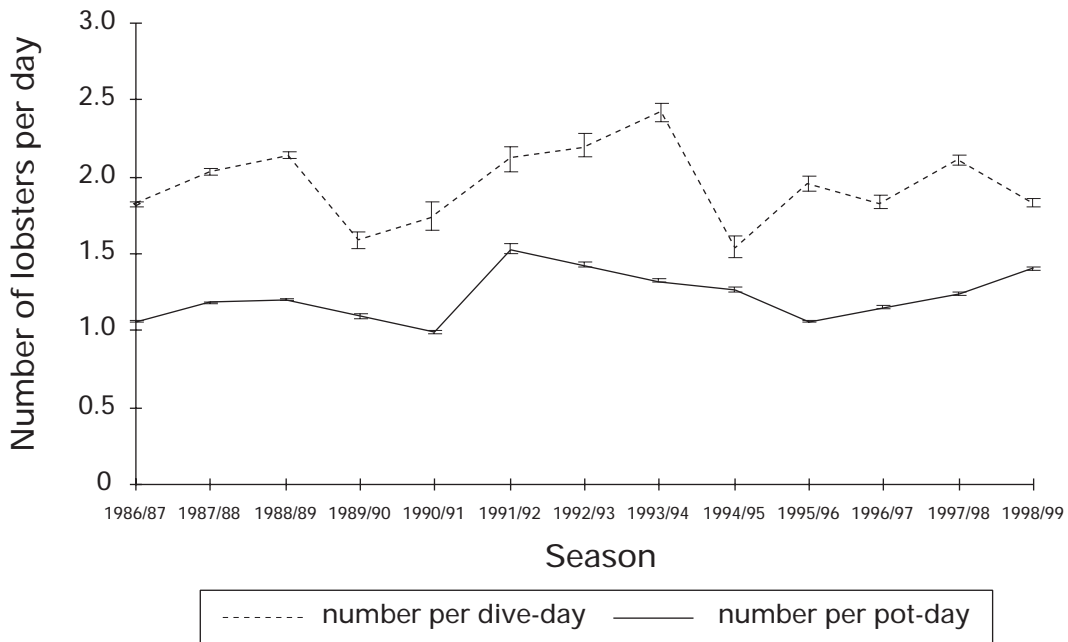


Figure 15 Mean number of lobsters caught per day by divers and pot fishers who utilised their lobster recreational fishing licences.

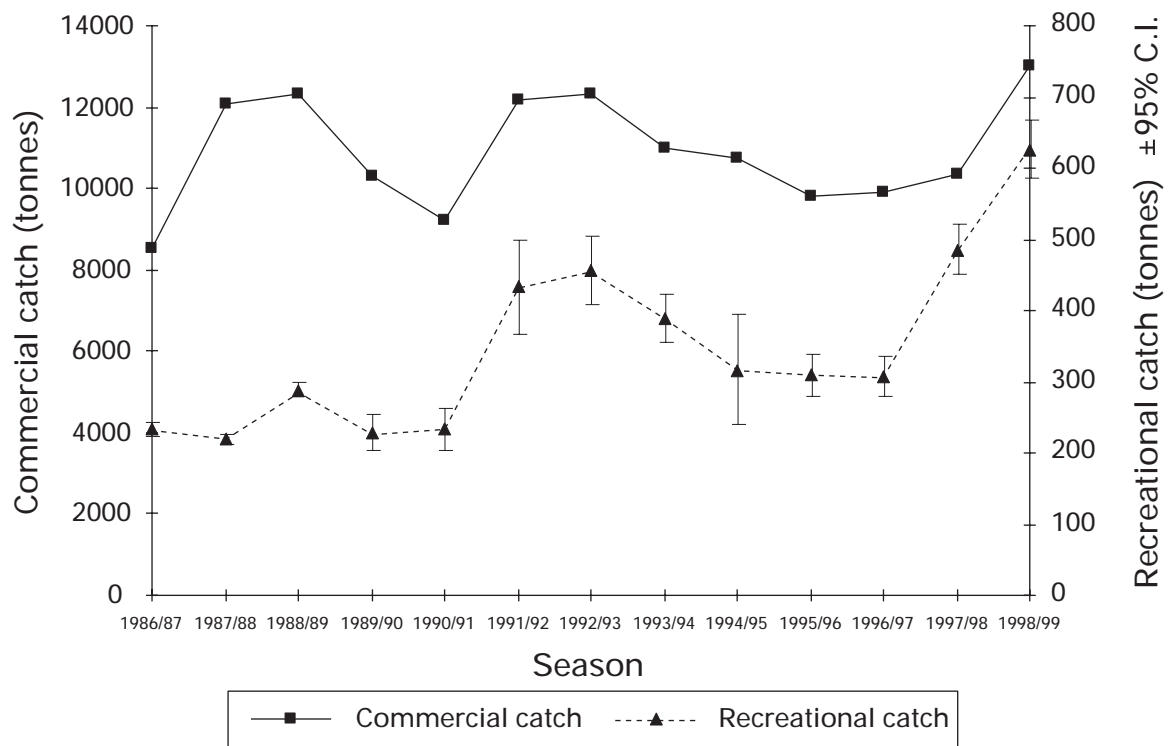


Figure 16 Comparison of the estimated total seasonal commercial and recreational fisher lobster catches between 1986/87 and 1998/99.

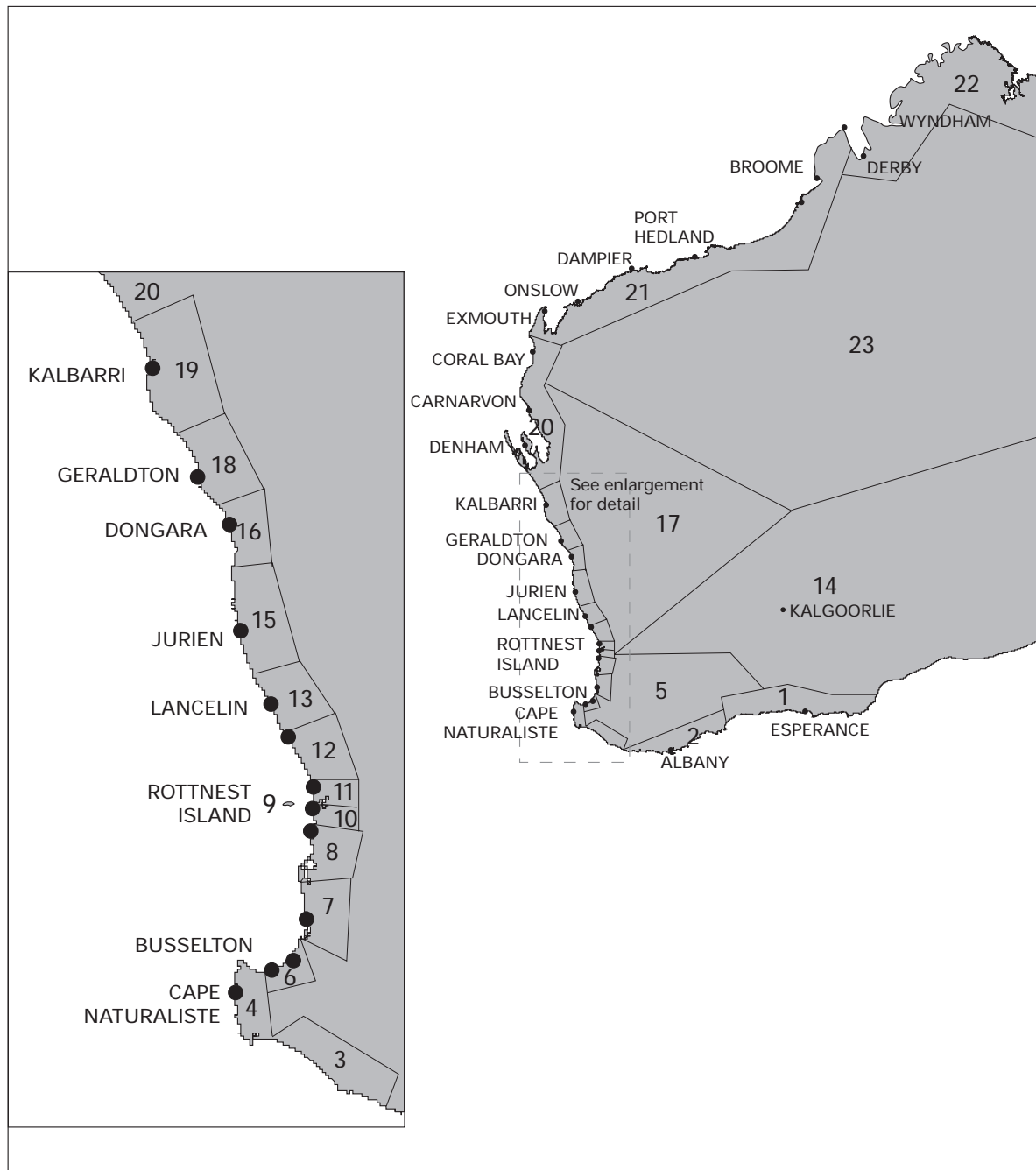


Figure 17 Western Australian regional divisions (1-23) which have been used in this study to report on recreational lobster licence holder residency and fishing activity.

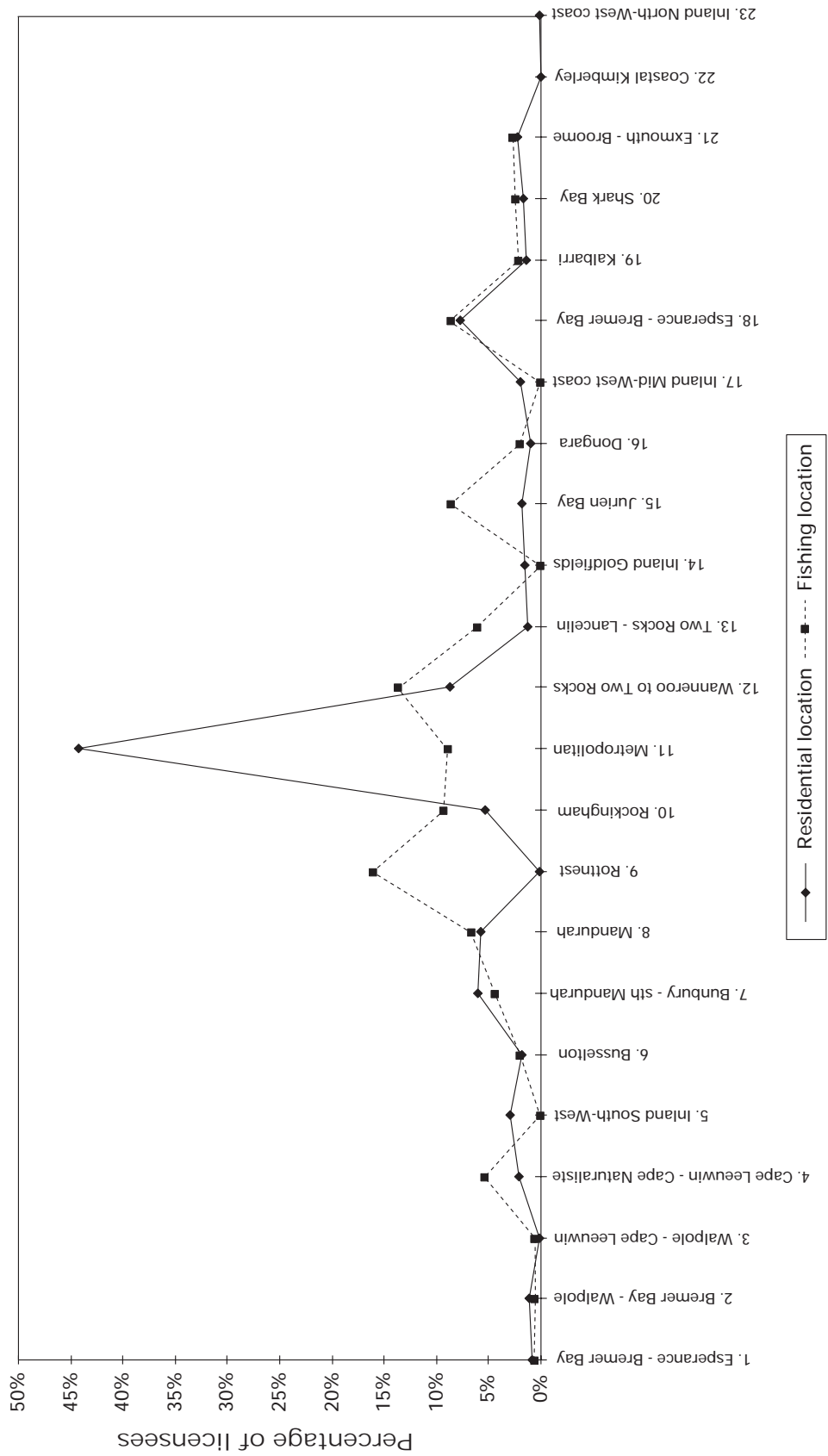


Figure 18 Geographical distribution of Western Australian recreational lobster licenses according to place of residence and recorded fishing locations. All data relates to the 4,000 fishers selected for the 1998/99 survey.

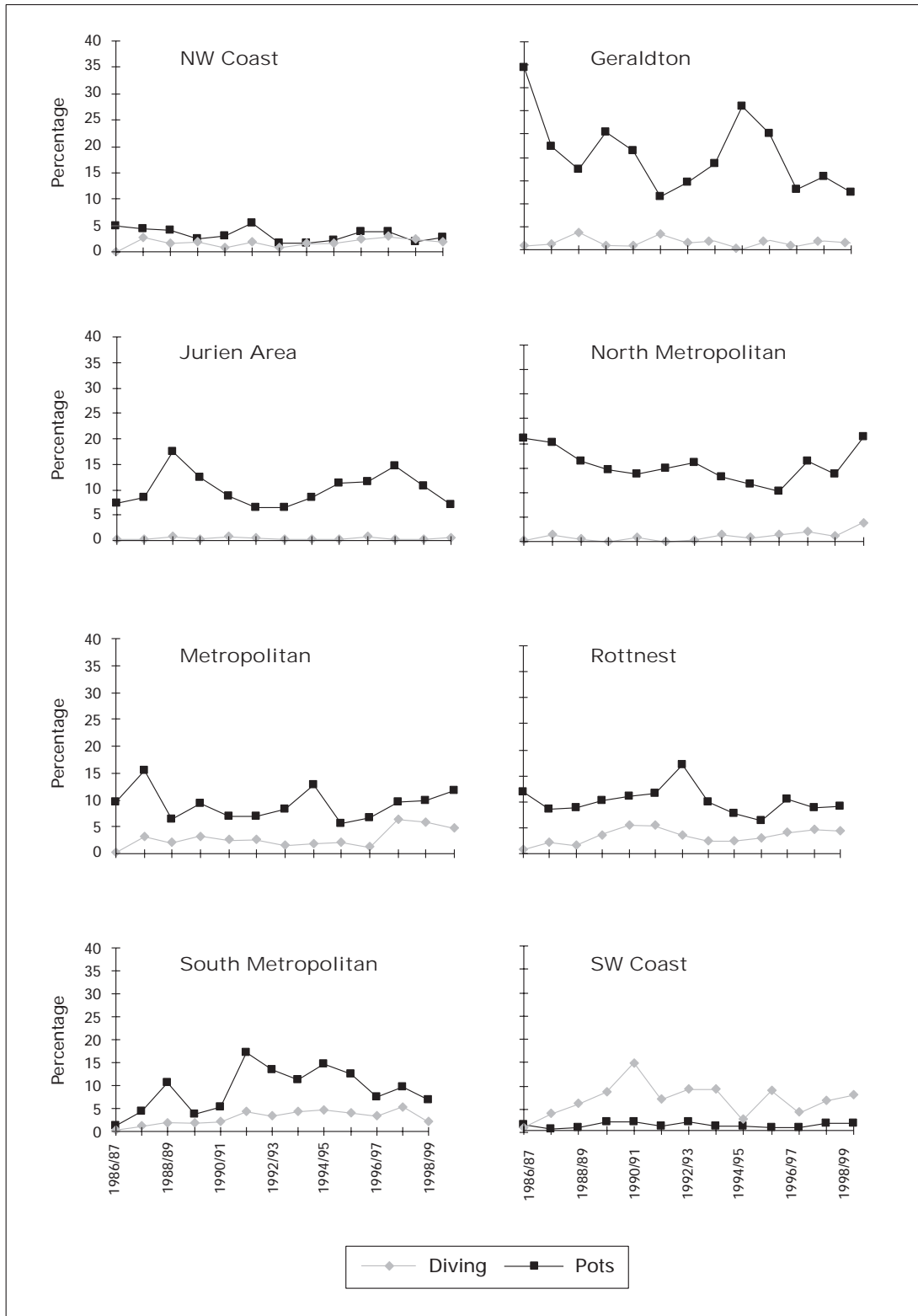


Figure 19 Seasonal comparisons of the proportions of the total recreational lobster catch taken by divers and pot fishers in eight regions of the Western Australian coast. The areas which are included in each of the eight regions are defined in Table 4.

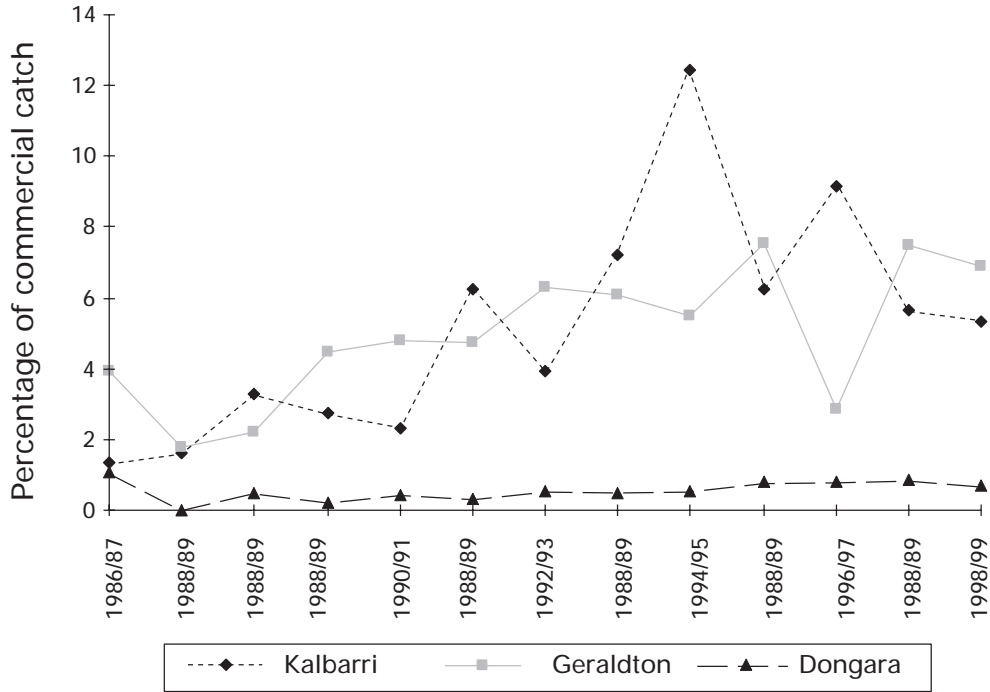


Figure 20 The estimated recreational catch as a proportion of the estimated total commercial catch in the Dongara, Geraldton and Kalbarri regions. The boundaries for the three regions which are included for this figure are outlined in Table 5.

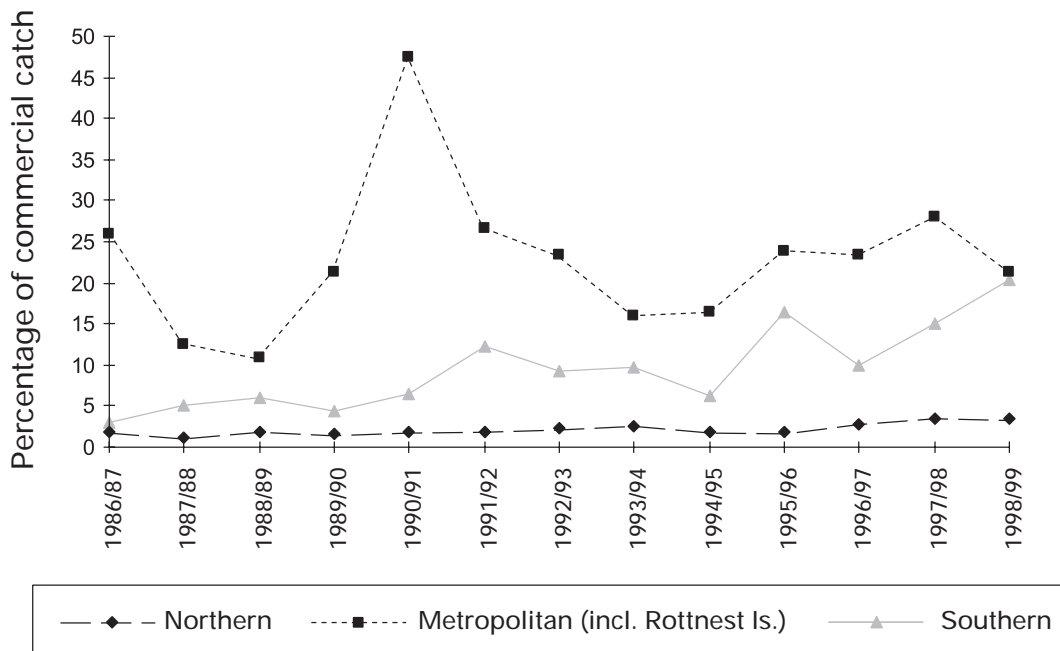


Figure 21 The estimated recreational catch as a proportion of the estimated total commercial catch in the Perth Metropolitan, Northern and Southern regions. The boundaries of the three regions which are included for this figure are outlined in Table 5.

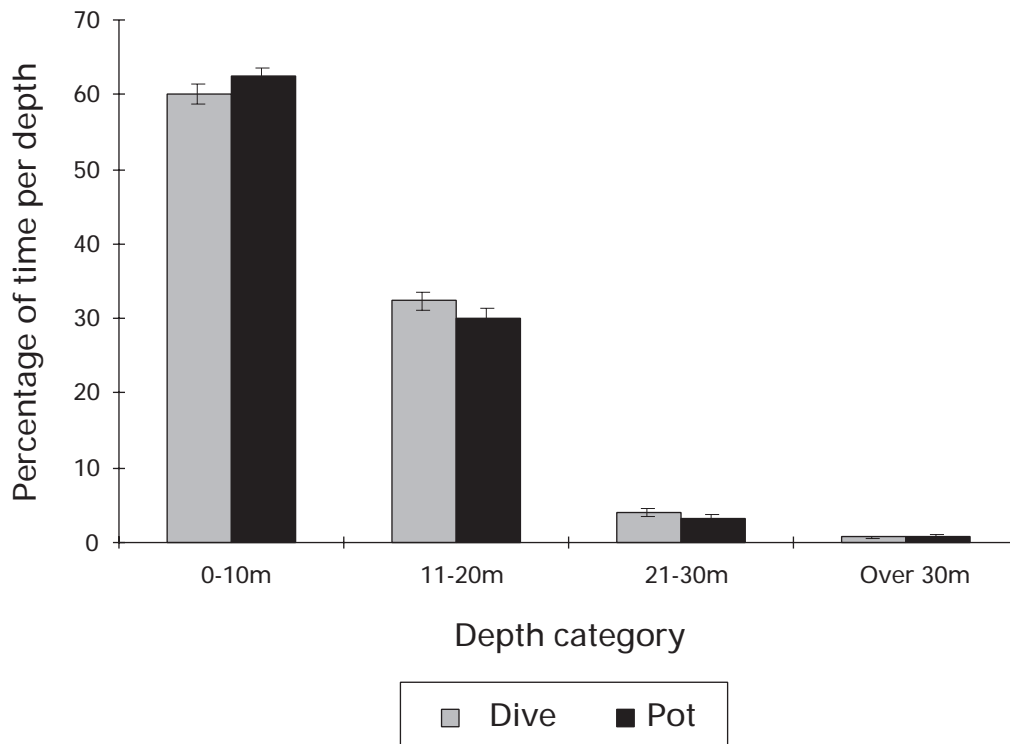


Figure 22 Average time spent in four different depth zones by recreational lobster divers and pot fishers. Data expressed as a percentage of those who reported fishing in the 1998/99 season survey.

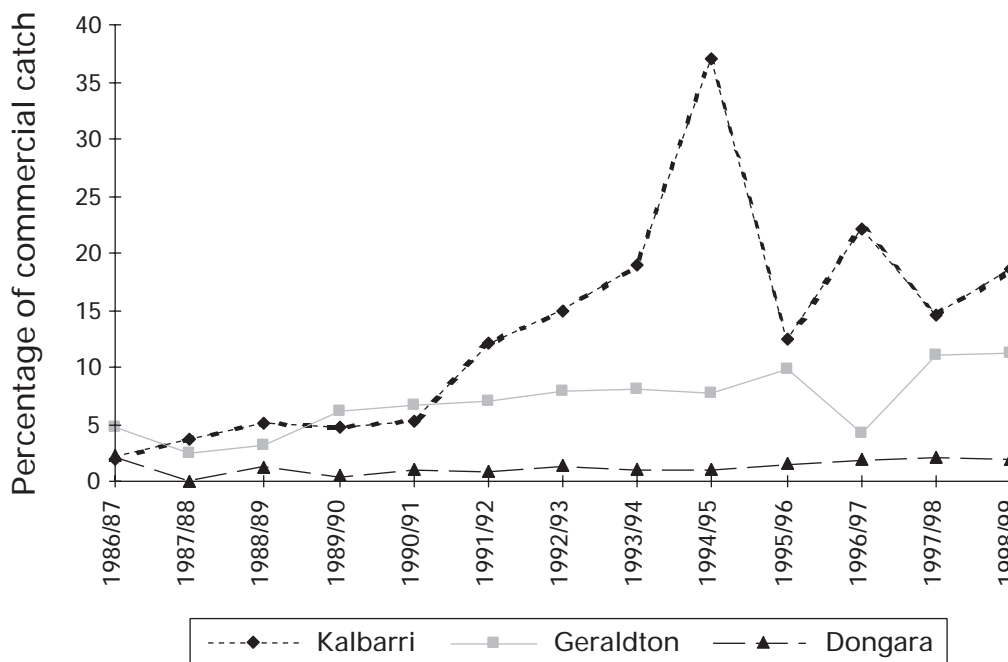


Figure 23 The estimated recreational catch as a proportion of the estimated commercial catch from depths less than 10 fathoms in the Dongara, Geraldton and Kalbarri regions. The boundaries for the three regions which are included for this figure are outlined in Table 5.

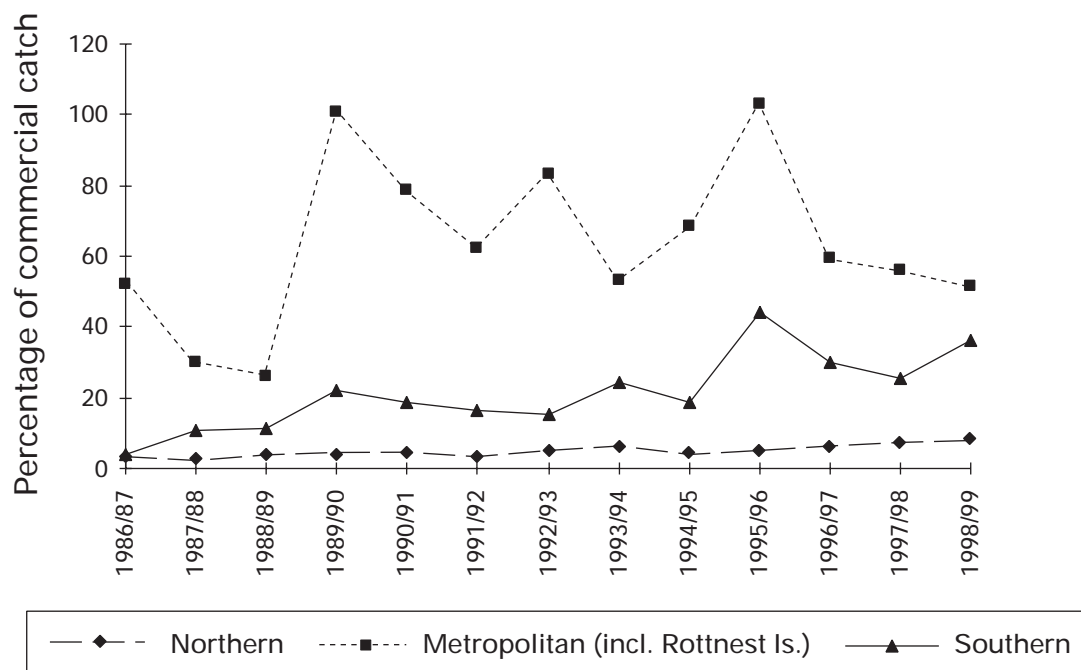


Figure 24 The estimated recreational catch as a proportion of the estimated commercial catch from depths less than 10 fathoms in the Perth Metropolitan, Northern and Southern regions. The boundaries for the three regions which are included for this figure are outlined in Table 5.

8.0 Tables

Table 1 Incentive schemes employed to encourage participation in completing the surveys by recreational fishers and improve survey response rates between the 1995/96 and 1998/99 seasons.

Prior to 1994/95	<p><i>Survey type:</i> Standard <i>Survey return rates:</i> ~36% <i>Incentive scheme employed:</i> Survey dispatched with licence renewal. No incentives offered to encourage returns Letter requesting cooperation.</p>
1995/96	<p><i>Survey type:</i> Standard <i>Survey return rates:</i> 31% <i>Incentive scheme employed:</i> Letter requesting cooperation. Prizes: \$500 first prize and 20 free rock lobster licences as consolation prizes for winners drawn randomly from those returning survey forms.</p>
1996/97	<p><i>Survey type:</i> Standard <i>Survey return rates:</i> 38% <i>Incentive scheme employed:</i> Letter requesting cooperation. Prizes: \$500 first prize and 20 free rock lobster licences as consolation prizes for winners drawn randomly from those returning survey forms.</p>
1997/98	<p><i>Survey type:</i> Standard <i>Survey return rates:</i> 63% <i>Incentive scheme employed:</i> Letter requesting cooperation. Reminder postcard. Prizes: \$500 first, \$200 second and \$100 third prize drawn randomly from those returning survey forms.</p>
1998/99	<p><i>Survey type:</i> Standard <i>Survey return rates:</i> 63% <i>Incentive scheme employed:</i> Letter requesting cooperation. Reminder postcard. Prizes: \$500 first, \$200 second and \$100 third prize drawn randomly from those returning survey forms. Second survey form sent out with letter requesting cooperation. Second set of three \$100 prizes drawn randomly from those returning forms.</p>

Table 2 Summary of recreational rock lobster catch and effort statistics by fishing method.

	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Licence sales	16484	15249	22529	23374	22777	25907	26580	25079	25258	22592	24047	28776	32768
% fishing	83%	76%	73%	71%	71%	77%	74%	70%	70%	75%	76%	83%	80%
Total fishing	13748	11528	16131	16666	16081	19819	19696	17430	17681	16989	18252	23999	26051
se	82	48	90	397	516	595	447	339	498	313	299	266	257
% potting only	65%	72%	70%	67%	56%	61%	67%	67%	67%	62%	59%	57%	54%
Total potting only	8871	8331	11372	11178	9074	12107	13157	11680	11899	10567	10683	13636	14190
se	96	43	77	348	472	599	413	288	427	305	300	324	283
% diving only	28%	21%	22%	20%	35%	28%	24%	25%	25%	28%	31%	32%	34%
Total diving only	3907	2427	3595	3354	5680	5474	4771	4353	4353	4751	5713	7598	8826
se	91	39	70	297	455	549	376	265	392	282	282	304	269
% pot and dive	6%	7%	7%	7%	5%	9%	9%	8%	8%	9%	9%	10%	11%
Total potting & diving	886	756	1097	1220	803	1773	1684	1308	1339	1503	1578	2389	2876
se	49	24	42	193	207	351	245	161	241	178	171	196	178
% other*	1%	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%	1%	1%
Total other*	53	37	35	47	0	0	54	35	59	74	107	164	109
se*	16	6	9	48	0	0	56	34	64	52	61	71	27
Days fished per year													
Potting	34.15	33.26	30.90	24.91	31.22	29.11	34.06	34.59	32.11	36.84	32.61	34.47	38.08
se	0.78	0.51	0.51	1.40	2.54	2.54	1.81	1.51	2.19	1.67	1.46	1.23	1.16
Diving	12.38	11.54	11.23	12.32	11.26	14.48	12.85	13.03	11.11	11.52	11.26	13.15	15.61
se	0.32	0.25	0.26	1.04	0.99	1.44	1.16	0.80	1.11	0.66	0.64	0.59	0.53
Number caught per year													
Potting	36.38	39.84	3723	28.15	31.64	44.48	48.80	45.86	40.44	38.95	37.45	42.75	53.47
se	0.99	0.69	0.70	1.79	2.44	4.22	3.06	2.44	5.95	2.18	2.06	1.81	2.24
Diving	22.59	23.57	24.04	19.31	21.14	31.34	28.56	31.76	17.06	22.81	20.51	27.86	28.61
se	0.80	0.70	0.78	2.10	2.90	4.21	2.66	2.48	1.96	2.21	1.59	2.01	1.42
Number caught per day													
Pots	1.06	1.18	1.20	1.09	0.99	1.53	1.43	1.32	1.27	1.06	1.15	1.24	1.40
Diving	1.82	2.03	2.14	1.59	1.74	2.12	2.21	2.43	1.53	1.97	1.83	2.11	1.83
Recreational catch (tonnes)													
Pots	17780	180.96	231.81	181.56	161.54	316.03	362.36	298.15	267.77	237.23	232.74	345.75	456.92
se	4.83	3.71	4.34	11.53	12.43	29.98	22.74	15.85	39.38	13.25	12.79	14.61	19.10
Diving	54.66	37.77	56.42	46.18	70.88	116.46	92.81	89.96	48.56	72.08	74.87	139.74	169.30
se	1.94	1.12	1.84	5.02	9.71	15.65	8.65	7.02	5.58	6.97	5.80	10.06	8.41
Total	232.46	218.73	288.23	227.74	232.42	432.49	455.17	388.11	316.33	309.31	307.61	485.49	626.22
se	5.21	3.31	4.71	12.57	15.77	33.81	24.33	17.34	39.78	14.98	14.04	17.74	20.87
Professional catch (tonnes)													
Total catch	8529	12066	12312	10298	9220	12164	12303	11011	10764	9786	9901	10463	13008
Rec. as % of prof. catch	2.73%	1.81%	2.34%	2.21%	2.52%	3.56%	3.70%	3.52%	2.94%	3.16%	3.11%	4.64%	4.81%
Number surveyed			22529	1000						3000	3000	2441	3888
Respondents	4185	8457	8171	690	397	336	663	1112	528	932	1128	1530	2448
% response			36.27%	69.00%						31%	38%	63%	63%

*Subject to error due to small sample sizes

Table 3 Breakdown by area (a) nationally and (b) within Western Australia, of residential area and fishing area for recreational rock lobster licence holders. The map code on this table corresponds to Figure 17.

(a)

Residential distribution Locality	Population Number	4000 Number
<i>Australia</i>		
Western Australia	32628	3990
South Australia	14	3
Tasmania	1	
Victoria	41	1
New South Wales	44	4
Queensland	31	2
Northern Territory	7	
<i>Overseas</i>		
Japan	1	
UK	1	

(b)

Map Code	Area Description	Residential area		Fishing area			
		Population Number	%	3990 Number	%	4000 Number	%
1	Esperance to just east of Bremer Bay	282	0.86	22	0.55	13	0.67
2	Bremer Bay to just east of Walpole	353	1.08	45	1.13	13	0.67
3	Walpole to just south of Cape Leeuwin	55	0.17	7	0.18	15	0.77
4	Cape Leeuwin to Cape Naturaliste	704	2.16	89	2.23	136	7.01
5	Inland South-West	970	2.97	123	3.08	0	0.00
6	Busselton Area	608	1.86	80	2.01	51	2.63
7	Bunbury to just south of Mandurah	1992	6.11	234	5.86	111	5.72
8	Mandurah	1871	5.73	207	5.19	168	8.66
9	Rottnest	48	0.15	2	0.05	407	20.98
10	Rockingham	1736	5.32	192	4.81	235	12.11
11	Metropolitan	14424	44.21	1843	46.19	224	11.55
12	Wanneroo to Two Rocks	2851	8.74	320	8.02	344	17.73
13	just north of Two Rocks to Lancelin	400	1.23	50	1.25	152	7.84
14	Inland Goldfields	496	1.52	58	1.45	0	0.00
15	Jurien Bay	590	1.81	77	1.93	218	11.24
16	Dongara	300	0.92	43	1.08	50	2.58
17	Inland Mid-West	622	1.91	72	1.80	0	0.00
18	Geraldton	2506	7.68	308	7.72	217	11.19
19	Kalbarri	440	1.35	54	1.35	52	2.68
20	Shark Bay	572	1.75	71	1.78	62	3.20
21	Exmouth to Broome	745	2.28	88	2.21	69	3.56
22	Coastal Kimberley	9	0.03	1	0.03	0	0.00
23	Inland North-West	54	0.17	4	0.10	0	0.00

Table 4 The areas included in each of the eight regions corresponding to Figure 19.

Region	Areas included	Map Codes
NW Coast	Kalbarri northwards	19-22
Geraldton	South of Kalbarri to Cliff Head	16 & 18
Jurien Area	South of Cliff Head to Lancelin	15
North Metropolitan	Lancelin to Wanneroo	12 & 13
Metropolitan	Wanneroo to Rockingham	10 & 11
Rottnest	Rottnest	9
South Metropolitan	South of Rockingham to Mandurah	8
SW Coast	Mandurah southwards	1-4 & 6-8

Table 5 The areas included in each of the regions corresponding to Figures 20, 21, 23 and 24.

Commercial Zone	Region	Areas included
B	Kalbarri	Kalbarri
	Geraldton	South of Kalbarri to north of Dongara
	Dongara	Dongara to Leeman
C	Northern	Greenhead to Two Rocks
	Metropolitan	Wanneroo to Mandurah, Rottnest
	Southern	Mandurah to Cape Leeuwin

Table 6 Breakdown of licence holders' responses to the question regarding the current limit of two pots per person (expressed as a percentage).

	Pot fishers	Dive fishers	Pot & dive	Non-users	All
Too low	13.52	10.86	13.02	14.2	12.88
About right	85.81	78.73	85.12	82.3	83.10
Too high	0.29	2.41	0.93	0.6	1.00
Don't know	0.38	7.99	0.93	2.9	3.00

p = 0

Table 7 Breakdown of licence holders' responses to the question regarding the current bag limit of 8 lobsters per day (expressed as a percentage).

	Pot fishers	Dive fishers	Pot & dive	Non-users	All
Too low	4.0	6.0	9.3	5.0	5.3
About right	87.3	79.9	81.5	81.4	83.6
Too high	8.3	13.6	8.8	12.3	10.6
Don't know	0.4	0.5	0.5	1.3	0.6

p < 0.001

Table 8 Breakdown of licence holders' responses to the question regarding the current legal size limit (expressed as a percentage).

	Pot fishers	Dive fishers	Pot & dive	Non-users	All
Too small	2.8	7.9	5.6	5.1	4.9
About right	90.5	85.7	88.4	88.2	88.5
Too large	4.3	2.0	2.3	0.2	2.7
No limit	0.0	0.3	0.5	0.4	0.2
Don't know	2.4	4.1	3.3	6.1	3.7

p < 0.001


Table 9 Licence holders' responses to the question regarding how recreational lobster fishers should be able to catch lobsters (expressed as a percentage).

	Pot fishers	Dive fishers	Pot & dive	Non-users	All
Free-diving*	70.4	92.4	92.6	71.7	78.6
SCUBA*	40.0	89.2	89.4	53.7	60.6
Pots*	98.1	88.5	99.1	91.2	94.2
Hookah*	24.4	65.8	62.0	33.3	40.8
Spear	2.7	2.7	5.1	4.4	3.3
Loops*	48.5	86.0	88.9	53.3	63.3
Shepherd's crook*	25.2	47.7	46.3	31.9	34.6

* Denotes significant difference in response between the different types of fishers (p < 0.05)

9.0 Appendices

APPENDIX 1: Mail survey form typical of those sent out to rock lobster recreational fisher licence holders over the period 1986 to 1998



FISHERIES
WESTERN AUSTRALIA

Recreational rock lobster fishing survey

1997/98 season

Please complete and return to
W.A. Marine Research Laboratories
PO Box 20, North Beach, 6020
Enquiries (08) 9246 8482 / (08) 9246 8444

Assist us by filling in this survey form and put yourself in line for a prize

1. Contact phone no. (to verify any entries below)

Name

Address

Post Code

2. Did you fish for rock lobsters between 15 November 1997 and 30 June 1998 (please tick Yes or No below)

Yes If you answered yes, please complete this survey and return it to us.

No If you answered no, you can stop here, but **please still return** the survey form to us.

All these questions refer to you as a single licence holder - please fill out one form for one licence.

3. What **METHODS** did you use to fish for rock lobsters last season? (please tick)

4. How many lobster **POTS** did you pull each day you went fishing?

5. During which **MONTHS** did you fish for rock lobsters? (tick more than one if appropriate)

6. **WHEN** did you do most of your fishing for rock lobster? (tick more than one if appropriate)

7. On how many **DAYS** during the season did you go fishing for rock lobsters? (your best estimate of the total number for each method)

8. What was the total number of **LEGAL SIZE WESTERN** rock lobsters you caught during the season? (your best estimate)

9. **WHERE** did you do most of your fishing? (list locality or town with [1] being the most often fished. Indicate which fishing methods you used in each area)

10. Total number of **TROPICAL** (green or painted) or **SOUTHERN** rock lobsters caught this season?

Pots	Diving	Other	If other, please describe.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>


Week-ends	Week-days	School Holidays	Annual Holidays
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

By using pots?	By diving?	By other methods?
<input style="width: 50px;" type="text"/>	<input style="width: 50px;" type="text"/>	<input style="width: 50px;" type="text"/>

By using pots?	By diving?	By other methods?
<input style="width: 50px;" type="text"/>	<input style="width: 50px;" type="text"/>	<input style="width: 50px;" type="text"/>

[1] Town/locality	postcode	Pots	Diving	Other
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
[2] Town/locality	postcode	Pots	Diving	Other
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
[3] Town/locality	postcode	Pots	Diving	Other
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

By using pots?	By diving?	By other methods?
<input style="width: 50px;" type="text"/>	<input style="width: 50px;" type="text"/>	<input style="width: 50px;" type="text"/>
Tropical?	Southern?	
<input type="checkbox"/>	<input type="checkbox"/>	



Space for any further comments you'd like to make is provided overleaf

RLSurv98.p65

Comments (optional)

Fold 1

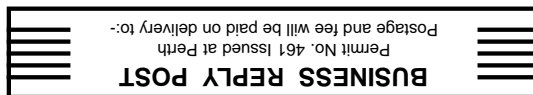
Postage is Paid.

Fold the form to show the return address - staple or tape the page and mail it.

Thank you for your input into the survey.

Fold 2

Rock Lobster Research
Western Australian Marine Research Laboratories
PO Box 20
NORTH BEACH WA 6020



No postage stamp required if
posted in Australia

O.H.M.S.

APPENDIX 2: Mail survey form sent out to rock lobster recreational fisher licence holders in 1999



Recreational Rock Lobster Fishing Survey: 1998/99 Season

FISHERIES
WESTERN AUSTRALIA

Participating in this survey will put you in the running to win one of three cash prizes:
1st prize \$500, 2nd prize \$200, 3rd prize \$100

Please complete and return (**free postage**) to:
W.A. Marine Research Laboratories
PO Box 20, North Beach, 6020
Enquires: (08) 9246 8482 or (08) 9246 8444

Please note that all information supplied will be treated as strictly confidential

<p>1. Contact details in case we need to verify any information you provide. We will also contact you if you win a prize.</p> <p>2. How are you licensed to fish for rock lobster? (tick one) <input type="checkbox"/> Rock lobster licence only <input type="checkbox"/> Umbrella licence (all recreational fisheries)</p> <p>3. What is your age? -----</p> <p>4. What is your gender? Male <input type="checkbox"/> Female <input type="checkbox"/></p> <p>5. What is the main language spoken at home? -----</p>	<p>Name: _____ Ph: _____</p> <p>Home address: _____</p> <p style="text-align: right;">Postcode: _____</p> <hr/> <p>6. What is your highest level of education? (circle one) a) Below Year 12 b) Year 12 c) Apprenticeship or TAFE certificate d) Tertiary</p> <p>7. Did you fish for rock lobster between 15 November 1998 and 30 June 1999? (tick Yes or No).</p> <p>YES <input type="checkbox"/> If you answered Yes, please go to question 8, complete this survey, and return it to us.</p> <p>NO <input type="checkbox"/> If you answered No, please skip ahead to Q21, complete the survey, and return the form to us.</p>
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All the questions refer to you as a single licence holder - please fill out one form for one licence.

<p>8. What methods did you use to fish for rock lobsters last season? (please tick) Pots <input type="checkbox"/> Diving <input type="checkbox"/> Other <input type="checkbox"/> If Other, please describe: -----</p> <p>9. Please indicate the approximate number of days you fished for rock lobster in each month using the following methods:</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th></th> <th>Pots</th> <th>Diving</th> <th>Other</th> </tr> </thead> <tbody> <tr><td>Nov '98</td><td>---</td><td>---</td><td>---</td></tr> <tr><td>Dec '98</td><td>---</td><td>---</td><td>---</td></tr> <tr><td>Jan '99</td><td>---</td><td>---</td><td>---</td></tr> <tr><td>Feb '99</td><td>---</td><td>---</td><td>---</td></tr> <tr><td>Mar '99</td><td>---</td><td>---</td><td>---</td></tr> <tr><td>Apr '99</td><td>---</td><td>---</td><td>---</td></tr> <tr><td>May '99</td><td>---</td><td>---</td><td>---</td></tr> <tr><td>Jun '99</td><td>---</td><td>---</td><td>---</td></tr> </tbody> </table>		Pots	Diving	Other	Nov '98	---	---	---	Dec '98	---	---	---	Jan '99	---	---	---	Feb '99	---	---	---	Mar '99	---	---	---	Apr '99	---	---	---	May '99	---	---	---	Jun '99	---	---	---	<p>10. Where did you do most of your fishing? (list locality or town with [1] being the most often fished). Please note the number of days fished using each method.</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <th>[1]</th> <th>Town/Locality</th> <th>Postcode</th> </tr> <tr> <td>-----</td> <td>-----</td> <td>-----</td> </tr> <tr> <td></td> <td colspan="2" style="text-align: right;">(if known)</td> </tr> <tr> <td colspan="3">Number of days fished at locality:</td> </tr> <tr> <td></td> <td><i>Pots</i></td> <td><i>Diving</i> <i>Other</i></td> </tr> <tr> <td>-----</td> <td>-----</td> <td>-----</td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <th>[2]</th> <th>Town/Locality</th> <th>Postcode</th> </tr> <tr> <td>-----</td> <td>-----</td> <td>-----</td> </tr> <tr> <td></td> <td colspan="2" style="text-align: right;">(if known)</td> </tr> <tr> <td colspan="3">Number of days fished at locality:</td> </tr> <tr> <td></td> <td><i>Pots</i></td> <td><i>Diving</i> <i>Other</i></td> </tr> <tr> <td>-----</td> <td>-----</td> <td>-----</td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <th>[3]</th> <th>Town/Locality</th> <th>Postcode</th> </tr> <tr> <td>-----</td> <td>-----</td> <td>-----</td> </tr> <tr> <td></td> <td colspan="2" style="text-align: right;">(if known)</td> </tr> <tr> <td colspan="3">Number of days fished at locality:</td> </tr> <tr> <td></td> <td><i>Pots</i></td> <td><i>Diving</i> <i>Other</i></td> </tr> <tr> <td>-----</td> <td>-----</td> <td>-----</td> </tr> </table>	[1]	Town/Locality	Postcode	-----	-----	-----		(if known)		Number of days fished at locality:				<i>Pots</i>	<i>Diving</i> <i>Other</i>	-----	-----	-----	[2]	Town/Locality	Postcode	-----	-----	-----		(if known)		Number of days fished at locality:				<i>Pots</i>	<i>Diving</i> <i>Other</i>	-----	-----	-----	[3]	Town/Locality	Postcode	-----	-----	-----		(if known)		Number of days fished at locality:				<i>Pots</i>	<i>Diving</i> <i>Other</i>	-----	-----	-----	<p>11. If you used pots, how many lobster pots did you typically pull each day you went fishing? -----</p> <p>12. When did you do most of your fishing for rock lobster? (tick more than one if appropriate) Weekends <input type="checkbox"/> Weekdays <input type="checkbox"/> School Holidays <input type="checkbox"/> Annual Holidays <input type="checkbox"/></p> <p>13. What was the total number of legal size western rock lobster you caught during the season? (your best estimate) By using pots ----- By diving ----- By other methods -----</p> <p>14. Please indicate the number of legal size tropical (green/painted) or southern rock lobster caught during the season:</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th></th> <th>Lobster</th> <th>Pots</th> <th>Diving</th> <th>Other</th> </tr> </thead> <tbody> <tr> <td>Tropical</td> <td>---</td> <td>---</td> <td>---</td> <td>---</td> </tr> <tr> <td>Southern</td> <td>---</td> <td>---</td> <td>---</td> <td>---</td> </tr> </tbody> </table>		Lobster	Pots	Diving	Other	Tropical	---	---	---	---	Southern	---	---	---	---
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APPENDIX 2 (continued)

<p>15. Do you own (or have regular access to) a boat? (tick one) Yes <input type="checkbox"/> No <input type="checkbox"/> Go to Q16 Skip to Q18</p> <p>16. What is the length of the boat in metres? _____ m</p> <p>17. Please tick the equipment you used: (tick more than one if appropriate)</p> <p>B/W Echo Sounder <input type="checkbox"/> Colour Echo Sounder <input type="checkbox"/> View Bucket <input type="checkbox"/> Radar <input type="checkbox"/> Pot Winch <input type="checkbox"/> GPS <input type="checkbox"/> None of the above <input type="checkbox"/></p> <p>18. In what depth range did you dive for rock lobster last season?</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Depth</th> <th style="width: 50%;">Percentage of Time Diving</th> </tr> </thead> <tbody> <tr> <td>0-10 m</td> <td>-----</td> </tr> <tr> <td>11-20 m</td> <td>-----</td> </tr> <tr> <td>21-30 m</td> <td>-----</td> </tr> <tr> <td>Below 30 m</td> <td>-----</td> </tr> <tr> <td>Didn't dive</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </tbody> </table> <p>19. In what depth range did you fish for rock lobster using pots last season?</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Depth</th> <th style="width: 50%;">Percentage of Time Potting</th> </tr> </thead> <tbody> <tr> <td>0-10 m</td> <td>-----</td> </tr> <tr> <td>11-20 m</td> <td>-----</td> </tr> <tr> <td>21-30 m</td> <td>-----</td> </tr> <tr> <td>Below 30 m</td> <td>-----</td> </tr> <tr> <td>Didn't pot fish</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </tbody> </table> <p>20. Please tick the type(s) of pots you used when fishing for lobster last season: (tick more than one if appropriate)</p> <p>Stick/cane beehive <input type="checkbox"/> Batten pots <input type="checkbox"/> Plastic pots <input type="checkbox"/> Don't use pots <input type="checkbox"/> Other _____ <small>(please specify)</small></p> <p>21. For how many years have you participated in the recreational rock lobster fishery? _____</p> <p>22. Consider the following statement: "Fisheries management is effective in conserving rock lobster stocks". Do you: (circle one answer only)</p> <p>a) Strongly agree b) Agree c) Not sure d) Disagree e) Strongly disagree</p>	Depth	Percentage of Time Diving	0-10 m	-----	11-20 m	-----	21-30 m	-----	Below 30 m	-----	Didn't dive	<input type="checkbox"/>	Depth	Percentage of Time Potting	0-10 m	-----	11-20 m	-----	21-30 m	-----	Below 30 m	-----	Didn't pot fish	<input type="checkbox"/>	<p>23. In your experience, how fair do you think fisheries officers are in dealing with infringements that they find. As far as you know, do they treat people: (circle one)</p> <p>a) Always fairly b) Sometimes fairly c) Never fairly d) Don't know, no contact with fisheries officers.</p> <p>24. Consider the following statement: "Recreational rock lobster fishers generally abide by fisheries regulations". Do you: (circle one answer only)</p> <p>a) Strongly agree b) Agree c) Not sure d) Disagree e) Strongly disagree</p> <p>25. Please indicate the number of contacts you had with fisheries personnel while fishing for rock lobster in the last season: (circle one, but if greater than 1 contact please write number)</p> <p>i) Fisheries officers: a) None b) Seen only c) 1 contact d) More than 1 contact _____ e) Did not fish last season</p> <p>ii) Volunteer fisheries liaison officers (VFLO's): a) None b) Seen only c) 1 contact d) More than 1 contact _____ e) Did not fish last season</p> <p>[Note: VFLO's are recreational fishers who donate their time to educate other fishers about conservation and fish management. They usually wear distinctive yellow shirts and hats].</p> <p>26. How many times in total (over all your fishing years) have you come into contact with a fisheries officer (not a VFLO) while fishing for rock lobster? _____</p> <p>27. Consider the following statement: "Commercial rock lobster fishers generally abide by fisheries regulations". Do you: (circle one answer only)</p> <p>a) Strongly agree b) Agree c) Not sure d) Disagree e) Strongly disagree</p>	<p>28. The current pot limit is 2 for recreational fishers. Do you think this number is: (circle one)</p> <p>a) Too low b) About right c) Too high d) Don't know</p> <p>29. The current bag limit is 8 lobsters per day for recreational fishers. Do you think this number is: (circle one)</p> <p>a) Too low b) About right c) Too high d) Don't know</p> <p>30. In your experience, what percentage of recreational fishers do you think regularly sell some or all of their catch? (circle one)</p> <p>a) 0% b) 1-2% c) 3-5% d) 6-10% e) More than 10% f) Don't know</p> <p>31. In your experience, what percentage of recreational fishers do you think illegally pull other recreational fishers' pots? (circle one)</p> <p>a) 0% b) 1-2% c) 3-5% d) 6-10% e) More than 10% f) Don't know</p> <p>32. In your experience, what percentage of recreational fishers do you think illegally pull commercial fishers' pots? (circle one)</p> <p>a) 0% b) 1-2% c) 3-5% d) 6-10% e) More than 10% f) Don't know</p> <p>33. In your experience, what percentage of commercial fishers do you think illegally pull recreational fishers' pots? (circle one)</p> <p>a) 0% b) 1-2% c) 3-5% d) 6-10% e) More than 10% f) Don't know</p>
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Didn't pot fish	<input type="checkbox"/>																									

APPENDIX 2 (continued)

<p>34. What evidence have you seen of illegal pot pulling in the rock lobster fishery? a) None b) Heard rumours it occurs c) Occasionally witnessed it d) Regularly witnessed it</p> <p>35. If you see a recreational fisher breaking the rules, what would you do? (circle one answer only): a) Do nothing, but feel bad about it. b) Report the illegal activity c) Talk to the person directly d) Ignore it e) Don't know</p> <p>36. What percentage of recreational fishers do you think illegally keep undersized lobster? (circle one) a) 0% b) 1-2% c) 3-5% d) 6-10% e) More than 10% f) Don't know</p> <p>37. In your usual fishing area, how many times do you think you could break the size regulations without getting caught by fisheries officers? -----</p> <p>38. What is your understanding of the minimum size rules for taking western rock lobster? (tick more than 1 box if appropriate) <input type="checkbox"/> 76 mm, 15 Nov-30 Jun <input type="checkbox"/> 76 mm, 1 Feb-30 Jun <input type="checkbox"/> 77 mm, 15 Nov-30 Jun <input type="checkbox"/> 77 mm, 15 Nov-31 Jan <input type="checkbox"/> Don't know</p> <p>39. What percentage of days fished do you usually catch your daily bag limit for Western rock lobster? (circle one) a) less than 20% b) 20-40% c) 41-60% d) 61-80% e) More than 80% f) Don't know</p> <p>40. In your experience, what percentage of recreational fishers do you think fish out of season? (circle one) a) 0% b) 1-2% c) 3-5% d) 6-10% e) More than 10% f) Don't know</p>	<p>41. What size fine do you think would be imposed on someone convicted of being in possession of 6 undersized lobster as a first offence? (circle one) a) \$200 to \$500 b) \$500 to \$1000 c) \$1000 to \$2000 d) \$2000 to \$3000 e) More than \$3000 f) Don't know</p> <p>42. How much do think someone should be fined if they are caught with 6 undersized lobster (and have no previous convictions)? \$ -----</p> <p>43. Among recreational rock lobster fishers you know, how would you describe their attitude towards fishers who keep undersized lobster? Would they think the practice is: (circle one) a) Very wrong b) Basically wrong, but OK every so often c) Fine if you can get away with it d) Don't know</p> <p>44. How should recreational rock lobster fishers be able to catch lobster: (tick those appropriate)</p> <p>Free-diving <input type="checkbox"/> SCUBA <input type="checkbox"/> Pots <input type="checkbox"/> Hookah <input type="checkbox"/> Spear <input type="checkbox"/> Loops <input type="checkbox"/> Shepherd's crook <input type="checkbox"/> Other ----- (please specify)</p> <p>45. Consider the statement: "It doesn't hurt to keep lobsters if they are just undersize". Do you: (circle one) a) Strongly agree b) Agree c) Not sure d) Disagree e) Strongly disagree</p> <p>46. Do you think the current legal size for western rock lobster is: (circle one) a) Too small b) About right c) Too large d) Shouldn't be a limit e) Don't know</p>	<p>47. Fishers tell us that the following issues are considered important in the recreational rock lobster fishery. Please number these according to the priority Fisheries Officers should give each issue (1 for highest priority, 8 for lowest priority).</p> <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Issue</th> <th style="text-align: left;">Priority</th> </tr> </thead> <tbody> <tr> <td>Divers poaching rock lobsters from pots</td> <td>---</td> </tr> <tr> <td>Education</td> <td>---</td> </tr> <tr> <td>Undersize lobsters</td> <td>---</td> </tr> <tr> <td>Illegal pot-pulling of recreation pots by recreational fishers</td> <td>---</td> </tr> <tr> <td>Oversize female lobster</td> <td>---</td> </tr> <tr> <td>Over-potting</td> <td>---</td> </tr> <tr> <td>Illegal pot-pulling of recreation pots by commercial fishers</td> <td>---</td> </tr> <tr> <td>Mature female lobster</td> <td>---</td> </tr> <tr> <td>Bag limits</td> <td>---</td> </tr> </tbody> </table> <p>48. Are there any issues you feel are important which were not listed in Q47? </p> <p style="text-align: center;"><i>Thankyou for taking the time to complete this survey</i></p>	Issue	Priority	Divers poaching rock lobsters from pots	---	Education	---	Undersize lobsters	---	Illegal pot-pulling of recreation pots by recreational fishers	---	Oversize female lobster	---	Over-potting	---	Illegal pot-pulling of recreation pots by commercial fishers	---	Mature female lobster	---	Bag limits	---
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Comments (optional)

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Thank you for taking the time to participate in this survey.

Fold 2

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