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THE RECREATIONAL FISHERY FOR WEST COAST ROCK LOBSTER *JASUS LALANDII* IN SOUTH AFRICA

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The recreational fishery for West Coast rock lobster *Jasus lalandii* in South Africa was studied using a multi-stage telephone interview of permit holders over the 1991/92 to 1994/95 fishing seasons. Recreational catch information, based on permit sales only, are presented for the 1995/96 fishing season. Permit sales increased by 30% from 1991/92 to 1995/96, with a marked increase in 1992/93. The majority of the recreational permit holders were males (80%) between the ages of 25 and 49 years (68%), who were resident in areas close to the resource. Most of the permit holders (74%) fished throughout the season (as opposed to holidays only), mainly (70%) over weekends. Diving and the use of hoopnets from powered boats were the most popular methods of capture, with shore-based methods and the use of hoopnets from rowing boats of lesser importance. The bulk of the recreational catch was landed within the first three months of the start of the season (by the end of January), which was consistent with the trend in permit sales. The total recreational catch of rock lobster increased from 159 tons in 1991/92 to 469 tons in 1992/93, probably because of an increase in the length of the season and a decrease in the minimum legal size limit, and was estimated at 379 tons for the 1995/96 season. The total recreational catch, as a percentage of the commercial Total Allowable Catch, increased from 7% in 1991/92 to 21% in the 1992/93 season and was estimated at 25% in 1995/96.

West Coast rock lobster *Jasus lalandii* are distributed from about 23°S, just north of Walvis Bay in Namibia, to about 28°S, near East London on the South African east coast. However, commercial densities are encountered only along the west coast of southern Africa from about 25°S to Cape Point (34°22´S) in South Africa (Pollock 1986). The earliest records of human exploitation have been established from remains found in Khoi-San caves and middens, which date back to the early Holocene, some 10 000 years ago (Buchanan 1988). Commercial exploitation of the resource only started in the late nineteenth century. Historical records show that collection of rock lobster has been an important subsistence and/or recreational activity for communities along the west and south-west coasts of South Africa. Nevertheless, very little information on any aspects of this fishing sector is available, a worldwide problem in spiny lobster fisheries. The dearth of published material in the scientific literature is evidence of the difficulty in obtaining accurate information on the recreational component of lobster fisheries.

The regulations governing the exploitation of West Coast rock lobster in 1933 were the same for commercial and recreational fishermen. They included a minimum size limit of 89 mm carapace length (*CL*) and a ban on the retention of lobster in a soft shell state or females in berry. In 1961, the regulations for commercial and recreational fishermen were separated. A bag limit of five lobsters per day was enforced for persons diving from the shore, for which no permit was required. However, a diver operating from shore could also collect lobsters on behalf of other persons (for their own use), in quantities not exceeding 15 lobsters per diver per day, if a free permit was obtained. No lobster caught for own use, or on behalf of others, could be sold or offered for sale. No bag limits for recreational hoopnet fishing were in place at that time.

In 1973, the regulations governing recreational rock lobster fishing (Regulation 34, Sea Fisheries Act of 1973) were revised to include a minimum legal size of 89 mm *CL*, a bag limit of five lobsters per person per day, a prohibition on fishing between sunset and sunrise and sanctioned methods of capture. These methods included the use of hoopnets from boats not licensed to catch lobster commercially, the use of hoopnets and scoop nets from the shore, as well as diving without the use of artificial breathing apparatus other than a snorkel. Lobster caught for own use could not be sold or offered for sale.

A permit requirement for recreational fishing for rock lobster was introduced at the start of the 1983/84 fishing season. The permit, costing R10, was initially restricted to persons over the age of 16 years, but this was later amended to include those older than 12 years of age. Permit holders were obliged to have the permit in their possession at all times when lobster fishing. All the restrictions in place prior to the 1983/84 season were retained and

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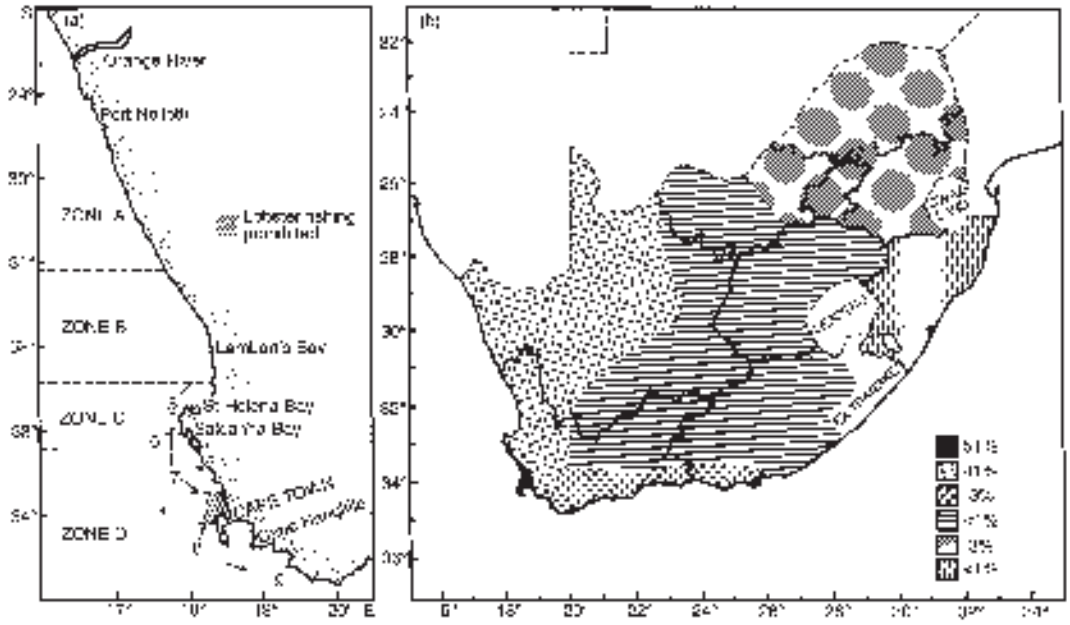

Fig. 1: The coast of South Africa, showing (a) the locations of the rock lobster recreational fishing areas (Zones A–D) and subareas (Areas 5–9) on the West Coast and (b) the percentage of permit holders resident in various geographical regions

an additional limit of 20 lobster per boat per day (notwithstanding the five per person per day bag limit) was introduced.

The permit system was discontinued during 1986 but, at public request, was reintroduced at the start of the 1988/89 season. Also, a recreational fishing season (from 15 November to 16 April) was introduced and the daily bag limit reduced from five to four lobsters per person per day. The maximum number of lobster that could be transported or accumulated at a person's place of residence at any one time was restricted to 16.

In an effort to obtain information on the quantity of lobsters being removed by the recreational fishery, the reverse side of the permits were modified in 1988 to allow for the voluntary return of catch data. The information requested included numbers caught per month and the area fished. The request for the voluntary submission of recreational catch returns met with an extremely poor response, because only 0.8% of permits were returned in the first year and even less in the following seasons.

The coast-wide decline in growth rates of rock lobster (Melville-Smith *et al*. 1995, Cockcroft and Goosen 1995) resulted in a sharp decrease in the commercial rock lobster Total Allowable Catch (*TAC*) and increased the potential for conflict between commercial and recreational fishermen. This, together with a new mathematical modelling approach that assessed the resource as a whole (i.e. recreational plus commercial), made it imperative to obtain accurate information on the recreational fishery for rock lobster (defined for purposes of this study as people in possession of recreational fishing permits). A survey to obtain this information was initiated at the start of the 1991/92 season, the results of which (until the end of 1994/95) are presented in this paper.

The aims of the study were to obtain accurate information on various aspects of the recreational fishery for rock lobster, including the volumes of lobsters removed, the spatial and temporal distribution of fishing effort and the demography of the participants.

MATERIAL AND METHODS

A multi-stage study using telephone interviews was considered to be the most effective method of achieving the stated aims. A professional survey

company (Decision Surveys International Pty Ltd) was commissioned to conduct the surveys which covered the 1991/92 to 1994/95 recreational fishing seasons (Table I).

The survey company was supplied with rock lobster permits, which contained the following information for each permit holder: name; identity number; residential address; telephone number and the place of purchase. These were then numbered and used as the sample population from which each stage was drawn. The sample for each stage (which included a set of alternative options for cases when the original selection was not available) was selected using computer-generated random numbers from the total number of permits purchased up to the two weeks prior to commencement of that stage. The total pool from which each stage was drawn therefore became progressively larger during each consecutive stage. The number of stages and the number of interviews per stage are summarized in Table I.

The fishing areas or zones as defined in this study (Fig. 1) are the same as those used for the commercial fishery for rock lobster, with the exception of the Area 9, east of Cape Hangklip, where no commercial fishing is permitted.

The total number of rock lobsters removed during each season was calculated by summing the totals calculated for each stage of the survey. The total rock lobsters removed per stage was calculated by muliplying the number of permits applicable to that stage by the average number of lobsters taken out per person during that stage. In the 1991/92 survey, the number of lobsters removed per stage was calculated using the number of permits sold up to two weeks prior to the commencement of that stage.

In 1992/93 and subsequent surveys, an improvement to this method was introduced to accommodate those people taking out permits during that stage (i.e. after the "two weeks prior" cut-off point). However, those permit holders could not be given the same weighting because they did not have the full two-week period for fishing. For example, if interviewing (relating to fishing activity from 11–24 January) took place on 25 January, then those with permits up to and including 11 January were eligible to take lobsters during that period. However, there was likely to be additional fishing activity by those taking out permits within this period (i.e. people taking out permits between 12 and 23 January), but this activity could not be given the same weighting because the full two-week fishing period was not available. To compensate for this, permit sales figures were taken at an

Table I: Comparative summary of research approach and sample details for the four seasons under study, 1991/92–1994/95

Parameter	Season			
	1991/92	1992/93	1993/94	1994/95
Total sample size and number of stages and sample size	700 interviews, i.e. 7 stages, each comrising 100 interviews	1 190 interviews i.e. 17 stages, each comprising 70 interviews	980 interviews, i.e. 14 stages, each comprising 70 interviews	700 interviews, i.e. 10 stages, each comprising 70 interviews
Rock lobster season	15 November 1991–15 April 1992 (5 months)	1 November 1992–30 June 1993 (8 months)	15 November 1993– 31 May 1994 (6.5 months)	15 November 1994–31 May 1995 (6.5 months)
Extent of seasonal coverage	Coverage of selected two-week periods throughout the season, with estimates for remaining periods	Full coverage of two-week periods throughout the season	Full coverage of two-week periods hrough-out the season	Full coverage of all two-week periods for the first half of the season. Coverage of one two-week period per 4 to 5 week period for the rest of the season, with estimates where necessary
Method of sample	Random start number with fixed interval technique	Random number selection	Random number selection	Random number selection
Volume that calculations were based on	"Past two weeks'' method	Modified "past two weeks" method	Modified "past two weeks'' method	Modified "past two weeks" method (but with estimates for two-week periods not covered)
Mass per rock lobster applied (g)	380	345	345	345

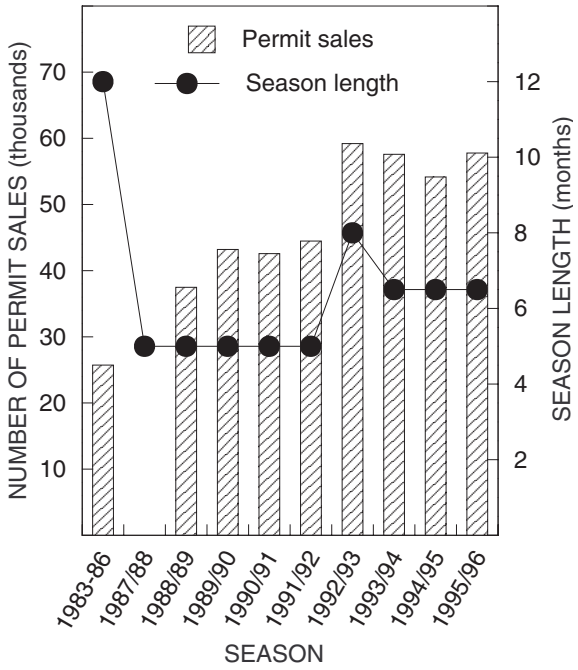

Fig. 2: Rock lobster recreational season length and the numbers of recreational fishing permits sold per season

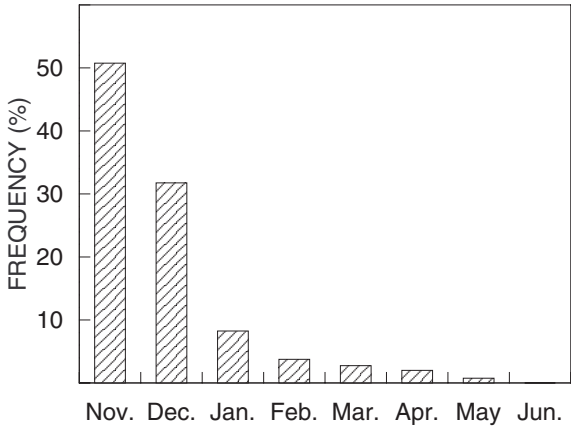

Fig. 3: Rock lobster recreational fishing permits sold per month as a percentage of the total seasonal sales (1991/92–1994/95 data combined)

average level (for the above example, 17 January was used as a cut-off point). The volume per stage for that example was calculated as: (total number of permits issued to the end of December+17/31×total January permits)×average number of lobsters caught per person during that stage. This is referred to as the "modified past two weeks" method in Table I.

The most important questions asked during the telephone interviews conducted during the surveys are listed in the Appendix.

Although the telephone survey did not cover the 1995/96 season, the permit sales and estimates of total recreational catch (based on those sales and the average number of lobsters caught per permit holder over the previous two seasons) for this period are presented for comparison.

RESULTS

The numbers of rock lobster permits issued per season increased markedly from 44 469 in 1991/92 to 59 202 in 1992/93, but declined slightly to 57 778 in 1995/96 (Fig. 2). The number of permits sold in 1991/92 was consistent with the numbers sold in the three years prior to the study period.

Information gained from permits

Analysis of the data obtained from the permits revealed similar trends in the four recreational fishing seasons, and consequently those data were combined.

A breakdown of rock lobster permit sales on a monthly basis (all seasons combined) indicated that, on average, >50% of the total number issued were purchased by the end of November, the month in which the season opened, and >30% in December. Approximately 90% of the total number of permits issued in a recreational season had been purchased by the end of January (Fig. 3).

The majority of the permit holders (92%) were resident in the area which included the Cape Peninsula, Boland, West Coast and western Karoo/Namaqualand. The Cape Peninsula area alone contained 51% of all permit holders. Only 3% of permit holders were residents of Gauteng (the old Transvaal), and a similar percentage of permit holders resided between Bredasdorp, Oudtshoorn and Port Elizabeth. Only 1% of permit holders were resident in Walvis Bay and <1% were resident along the East Coast (Fig. 1).

As might be expected, virtually all the permits were purchased in the area which included the Cape Penin-sula, Boland, West Coast and western Karoo/Namaqualand; only 1% were bought elsewhere. Most permits were issued at Cape Town

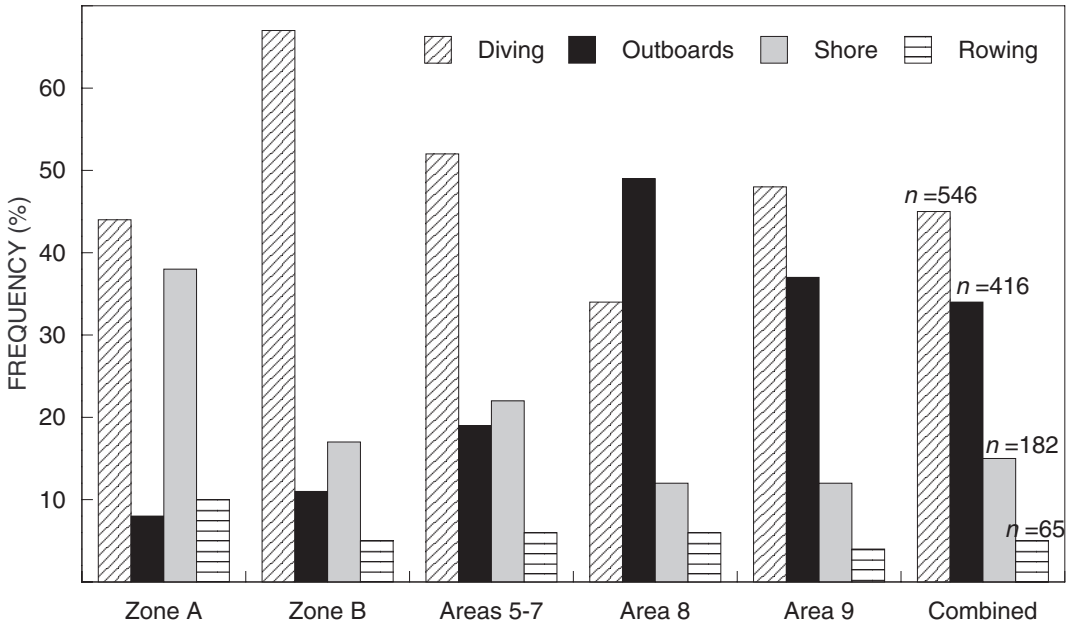

Fig. 4: Frequency of the fishing methods used by the rock lobster recreational fishing sector in each fishing area and in all areas combined (1991/92–1994/95 data combined)

(26%), Bellville (16%) and Simonstown (11%), and the remainder were purchased at Somerset West/Strand (8%), Hermanus (6%) and Stellenbosch (4%).

Demographic profile data indicate that 80% of permit holders were male and that 59% were Afrikaans speaking. English-speaking permit holders constituted 40%, and other language groups 1%, of the total permit holders. The majority (39%) of permit holders were 35–49 years old, with 29% aged 25–34 years.

Information gained from interviews

Throughout the study period, approximately 60% of the original sample selections were interviewed, whereas the remainder constituted the substitute or alternative choices. Refusal to participate in the survey accounted for <2% of the substitutions.

The respondents who claimed to have taken out rock lobster permits for the previous season (Question 12a) increased from 68% in 1991/92 to 77% in 1994/95. The respondents who claimed also to have permits to collect abalone (Question 2) increased slighty from 44% in 1991/92 to 55% in 1994/95. The response to Question 3 indicated that 95% of permit holders collected their own lobsters. The remainder, made up mostly of females (80%), used their permit for transport only, which is illegal.

The response to Question 8 (only asked of respondents who used their permits to catch rock lobster personally) showed that diving was the most popular fishing technique employed in all areas except Area 8 (the Cape Peninsula), where hoopnets deployed from outboard-motor-powered boats was the most popular method (Fig. 4). Overall (all seasons and areas combined), diving was the most popular fishing method (45%) and hoopnet fishing from motor-powered boats was the next most important (34%). Catching lobsters from the shore (e.g. using bait bags and hoopnets) and from a rowing boat (using hoopnets) were the least popular fishing methods (15% and 5% respectively). However, these percentages change when only the respondents holding both rock lobster and abalone permits are considered. As might be expected, diving was the fishing method employed by the majority of this group (68%), whereas hoopnet fishing from boats was preferred by 22%. By contrast, hoopnets from powered boats was used by 40% of the group holding only a lobster permit and only 27% preferred to dive.

The response to questions relating to fishing period revealed similar trends in the four recreational fishing seasons. The majority of respondents (74%) fished throughout the season, whereas 26% fished

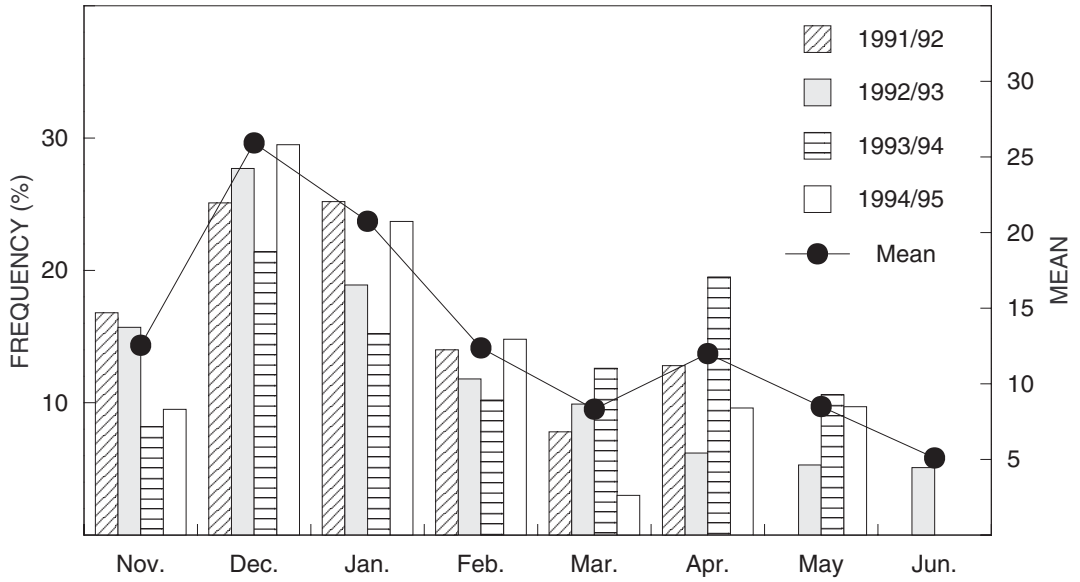

Fig. 5: Monthly frequency of the total rock lobster recreational catches taken in each season during the present study

only during their annual holiday (Question 9a). If the response to that question is linked to the month of permit purchase (Fig. 3), it is clear that the respondents who purchased permits in the early part of the season (October/November) were more emphatic about fishing throughout the season.

Overall, most repondents (70%) confined their fishing activities mainly to weekends, whereas the remainder did as much fishing during the week as they did over weekends (Question 9b). There was a small, but consistent, increase in the percentage of respondents who claimed to fish throughout the week (26 to 33%). There was little difference in the fishing methods most commonly used by the "weekend only" and the "throughout the week" groups, with diving and hoopnetting from powered boats being most popular.

An approximate breakdown of rock lobster landings by month (the periods covered by the surveys did not always fall into discrete months) during the recreational fishing season indicates that the bulk of the catch was landed in the early part of the season (Fig. 5). On average, about 60% of the total recreational catch is landed by the end of January. The minor increase in landings during April can be associated with fishing during the Easter holidays.

The bulk (71%) of the recreational catch (all seasons combined) was made in the South-Western Cape, in Areas 8 (37%) and 9 (34%, Fig. 6). When the relative contributions of the catches are considered on a seasonal basis in those two areas (Fig. 7), the proportion of the catch in Area 9 increased from 19% in 1991/92 to 44% in 1994/95, whereas the proportion in Area 8 decreased from 49 to 40% over the same period. The relative contributions of the other areas (Zone A to Areas 5–7) also decreased slightly over the study period.

The average number of lobsters landed per permit holder in each season increased from 9 in 1991/92 to 23 in 1992/93, and decreased to 18 in 1994/95 (Table II). A value of 19 (the mean of the 1993/94 and 1994/95 seasons) was used as an estimate of the average number of lobsters caught per permit holder for 1995/96. The total mass of lobsters landed by the recreational sector each season (Table II) showed a marked increase from 159 tons in 1991/92 to 469 tons in 1992/93. This was followed by a gradual decrease to 391 and 336 tons in 1993/94 and 1994/95 respectively. The total recreational catch for 1995/96 was estimated at 379 tons. Although the 1991/92 values are not directly comparable to the other seasons, because of the slight change in methodology introduced in 1992/93, more than three times the numbers and 2.6 times the mass of lobsters were caught in 1992/93 than in 1991/92. The slight discrepancy between numbers and mass reflects the differences in the mean mass per lobster used, which is a result of the change in size limit.

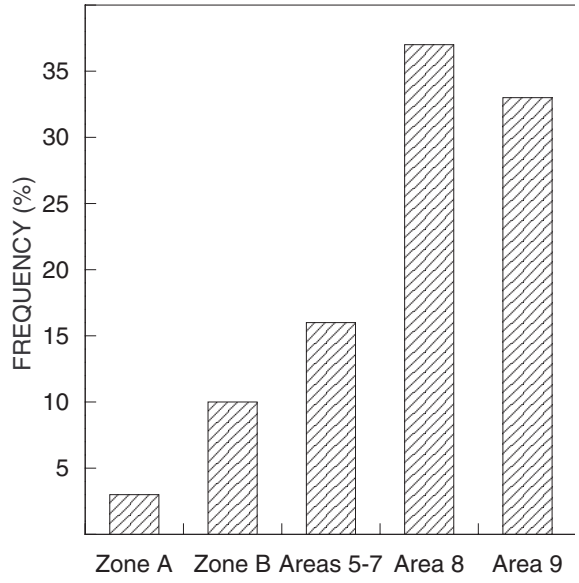

Fig. 6: Frequency of the total rock lobster recreational catch landed in each fishing area (all seasons combined)

The response to Question 12 by permit holders who held permits for the previous season clearly indicated that the 1992/93 season was regarded as the "best" season (all areas combined) during the study period (Table III). A similar opinion was given by permit holders in Areas 8 and 9. Respondents in Area 9 were more positive about the 1993/94 and 1994/95 seasons than those in Area 8.

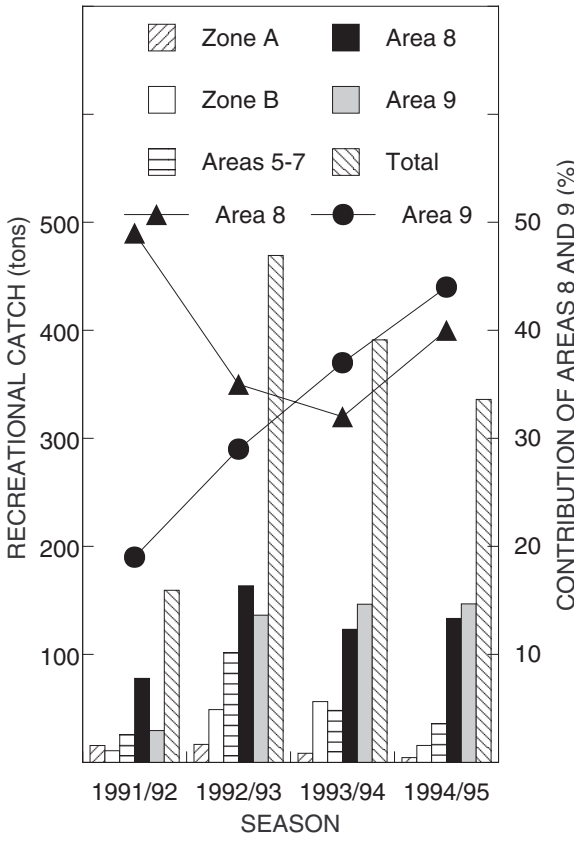

Fig. 7: Rock lobster recreational catch per season for each fishing area and the relative contribution of Areas 8 and 9 to the total catch during the study period

Table II: Summary of recreational rock lobster catches during the study period

Parameter	Season				
	1991/92	1992/93	1993/94	1994/95	1995/96
Number of permits sold	44 469	59 202	57 590	54 160	57 778
Number of rock lobster caught (95% confidence limits)	419 286	1 360 166 (1 100 146–1 620 186)	1 133 731 (1 004 161–1 263 301)	973 963 (839 764–1 108 163)	1 097 782*
Average number of rock caught (95% confidence limits)	9	23	20	18	19*
Mass (tons) of rock lobster caught (95% confidence limits)	159	469 (379–558)	391 (346–435)	336 (289–382)	379*
Mass as a percentage of the commercial *TAC*	6.6	21.3	17.7	16.8	25*

* Estimated on permit sales and the mean of the last two years "average number of rock lobster per permit"

Table III: The response of permit-holders to Question 12b (comparing current season with the previous season) for all areas combined and for Area 8 and 9

Parameter	Frequency (%)											
	1991/92 as "current" compared to 1990/91			1992/93 as "current" compared to 1991/92			1993/94 as "current" compared to 1992/93			1994/95 as "current" compared to 1993/94		
	All areas combined	Area 8	Area 9	All areas combined	Area 8	Area 9 combined	All areas	Area 8	Area 9 combined	All areas	Area 8	Area 9
Current season better	18	20	20	47	61	61	21	13	27	22	27	47
Current season worse	57	60	40	18	13	15	39	49	34	33	29	24
About the same	21	13	30	17	13	18	21	25	28	20	27	22
Cannot compare	–	–	–	–	–	–	8	6	3	6	9	1
Do not know/no answer	4	7	10	18	13	6	11	7	8	16	10	6

DISCUSSION

Accurate information on the recreational component of spiny lobster fisheries is usually extremely difficult to obtain and in most cases involves a degree of voluntary cooperation between researchers and sport/recreational fishermen. A variety of methods has been used to assess the impact of recreational fishing. These include direct monitoring of catches by recreational fishermen themselves (MacDonald 1987), controlled harvesting experiments (Davis 1977), diving surveys (Blonder *et al.* 1992), personal and telephone interviews (Davis and Dodrill 1989), postal surveys and questionnaires (Davis and Dodrill 1989, Chubb and Melville-Smith 1996), compulsory or voluntary catch returns (Tomalin 1993, Chubb and Melville-Smith 1996) and the use of the Delphi technique (Zuboy 1981). The uniqueness of each recreational fishery for rock lobster precludes a comparison of the effectiveness of the methods used to assess them. However, the telephone interview approach used here has been the most successful technique to date for obtaining information on the West Coast rock lobster recreational fishing sector. The general consistency obtained in responses to certain questions and the generally high level of cooperation throughout the study period (S. Brook, Decision Surveys International, pers. comm.) is an indication that the results obtained are a good reflection of the real situation.

Permit sale figures prior to the start of this study were fairly consistent and ranged between 37 477 (1988/89) and 43 205 (1990/91). The 33% increase in the sale of recreational permits in the 1992/93 season (compared to the previous season) was a direct result of the increased recreational season length (from five months in 1991/92 to eight months in 1992/93), combined with the reduction of the legal minimum size for recreationally caught lobsters from 89 to 80 mm *CL* during that period. However, despite the reduction to 6.5 months (19%) in the season length in 1993/94, the number of permits sold only decreased by 2.7% and remained at that level throughout the remainder of the study. The early date of permit purchase and the fact that the bulk of the recreational catch is usually landed by the end of January indicate that recreational fishermen attempt to take advantage of the more favourable early summer weather and fishing conditions (rock lobsters are more catchable early in the season). This period also coincides with the annual summer holiday. The majority of rock lobster recreational permit holders (77% in 1994/95) commented that they had taken out a permit the previous season and therefore could be

regarded as experienced fishermen.

The demographic information obtained directly from the permits clearly shows that most recreational fishermen are males (80%) between the ages of 25 and 49 years (68%), who are resident in areas close to the resource. This is at odds with the popular belief that people from outside the main fishing areas, e.g. holidaymakers, are responsible for a large proportion of the annual recreational catch.

Diving and the use of hoopnets from motor-powered boats were the most popular and consistent capture methods used by local recreational fishermen during this study. In the recreational lobster fishery for *Panulirus cygnus* in Western Australia, pots (traps) deployed from boats are used by 75–80% of recreational permit holders, with the remainder diving (SCUBA) for their catch (Chubb and Melville-Smith 1996).

The increased season length, coupled with the increased availability of lobsters as a result of the decrease in minimum size, is clearly reflected in the total recreational catch. The catch, as a percentage of the commercial *TAC*, increased substantially between 1991/92 and 1992/93 and reached an estimated 25% in the 1995/96 season. By comparison, the recreational catch of *P. cygnus* in Western Australia usually varies between 3 and 6.5% of commercial catches (Melville-Smith, Western Australian Marine Research Laboratories, unpublished data), and was 5.9% of the commercial catches in 1993/94 (Chubb and Melville-Smith 1996).

The marked increase observed in the relative contribution in the total recreational catch east of Cape Hangklip (Area 9), from 19% in 1991/92 to 44% in 1994/95, implied an increased abundance of lobsters in that region over that period. This finding is supported by the generally positive outlook of the recreational fishermen utilizing that area, as well as from diving observations made there during regular abalone research surveys by the Sea Fisheries Research Institute. Predation by increased numbers of lobster has been postulated as the cause for the decreased abundance of urchins east of Cape Hangklip, with possible negative effects on abalone recruitment survival (Tarr *et al.* 1996). Although no commercial fishing is allowed east of Cape Hangklip, it is noteworthy that the relative contribution of the adjacent area (Area 8) to the commercial *TAC* increased from 29 to 47% over the study period. Combined, Areas 8 and 9 contributed >80% of the total recreational catch made in the 1994/95 season.

Information from this study has been included in the size-based models used for setting appropriate commercial *TAC*s for the rock lobster resource (Bergh and Johnston 1992, Johnston 1995). The study also provides information that would be applicable for informed decision-making toward sound management of the recreational sector of this fishery. Continuation of the survey, coupled with a comprehensive ground truthing exercise, should permit the monitoring of further developments within the recreational fishery.

ACKNOWLEDGEMENTS

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APPENDIX

Summary of main questions asked during the telephone surveys

1. Is it correct that you personally have a permit for rock lobster? _____
2. Do you personally have a permit for abalone? _____
3. Thinking of rock lobster, do you personally catch, or only transport rock lobster? _____
4. Did you go out to catch/transport rock lobster in the last two weeks? _____
5. In the last two weeks, i.e. from (date) to (date), how many times did you go to catch/transport rock lobster? ____
6. In total, how many rock lobster did you catch/transport in the last two weeks? _____
7. At or near which resort was most of your rock lobster caught in the last two weeks? _____
8. There are different methods of rock lobster fishing. Which of the following do you personally do?
   - Dive for rock lobster _____
   - Catch rock lobster with hoopnets from a small rowing boat/dinghy _____
   - Catch rock lobster with hoopnets from a small rowing boat/dinghy with an outboard motor ____
   - Catch rock lobster from the shore _____
   - Use other methods _____
9. For each pair of statements, which one statement most applies to you?
   - I actually do all or most of my catching/transporting during my annual holiday. _____
   - I catch/transport rock lobster throughout the season and not my annual holiday. _____
   - My rock lobster catching/transporting is mainly over weekends. _____
   - Overall, I do about as much catching/transporting of rock lobster over the week as I do over weekends _____
10. How many rock lobster do you think that you are likely to catch/transport over the whole season? _____
11. Thinking of all the rock lobster you caught during the season, where did you catch the most? _____

12a What about the previous season (dates): did you have a permit for the season? _____

b If "yes" would you say that the catching of rock lobster for the current season was better than for last season, or the current season was worse than last season. _____