South Australian Recreational Fishing Survey 2007/08

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1. DEDICATION

I wish to dedicate this report to the late Marie Rampe and Micky West, two integral members of the research team who sadly passed away while the survey was being undertaken. Their professional work during the screening and telephone-diary components of the survey substantially contributed to the overall success of the survey.

The table below lists the acronyms used in this report.

Acronym	Full Title
ABS	Australian Bureau of Statistics
CL	Confidence Limit
ERP	Estimated Resident Population
FRDC	Fisheries Research and Development Corporation
KI	Kangaroo Island
NRIFS	National Recreational and Indigenous Fishing Survey
NRFS	National Recreational Fishing Survey (2000/01) of residents in each state
NRM	Natural Resources Management
PIRSA	Primary Industries and Resources South Australia
PSU	Primary Sampling Unit
SA	South Australia
SARDI	South Australian Research and Development Institute
SD	Statistical Division
SSU	Secondary Sampling Unit
TAFI	Tasmanian Aquaculture and Fisheries Institute
UTas	University of Tasmania

2. EXECUTIVE SUMMARY

This study represents the second state-wide assessment of recreational fishing in South Australia (SA). Conducted in 2007/08, it provided statistically robust estimates of a) the state-wide and regional participation levels and demographics of SA residents who recreationally fished in SA, and b) their fishing effort and catches (harvested and released), especially for 12 key species. As a similar survey using the same methods was carried out in 2000/01, this report also compares the results of the two surveys.

The 2007/08 survey consisted of three parts:
a) a telephone interview screening survey of 7 140 randomly chosen households, to ascertain participation and the demographics of recreational fishers in the 12 months prior to October 2007; followed by a 12 month telephone survey of 1 310 fishing households to monitor their catches (numbers of harvested and released fish) and fishing effort between November 2007 and October 2008;

b) marine on-site interview surveys and a logbook program for marine and freshwater fishers were carried out to collect representative information on harvested lengths and weights of key species, for later expansion to total harvest weights;

c) at the completion of the 12 month survey, two short surveys were carried out; one, to measure the additional fishing effort from originally, non-intending fishers, and secondly, to determine the attitudes and motivation of the previously surveyed fishing households.

Extremely high response rates were achieved across all survey components (89 – 98%). All survey results were expanded to the July 2007 resident population benchmarks. Estimates of all parameters with associated levels of precision were generated using a Fisheries Research and Development Corporation (FRDC) funded statistical package (R language) developed by University of Tasmania (UTas). The main results from the 2007/08 survey include:

1. Resident participation and demographics

- In the 12 months prior to October 2007, an estimated 236 463 SA residents, aged 5 years or older, fished at least once, representing a participation rate of 16.2% of the SA population.

- By region, the highest participation rate (40.5%) occurred for residents of the generally rural Eyre Statistical Division (SD), and the lowest (13.6%) for those residing in the most urban Adelaide SD;
- Recreational fishing was more popular among males (23%) than females (9.5%).
- By age, highest participation rates (29.5% males; 14.8% females) occurred with the youngest age group surveyed (5 – 14yrs) and the lowest (14.9% males; 2.6% females) among the oldest (60 years or more) age group. However, the greatest number of recreational fishers occurred in the 30 – 44 year age group.

2. Fishing Effort

- SA residents expended an estimated 1.05 million fisher days of effort in SA.
- Line fishing (with bait or lures) was the predominant method used (81.3% of total fisher days), followed by rock lobster pots/crab nets (14.7%), hand-held gear (2.7%) and the remaining 1.3% included diving, recreational gill nets and surface dab netting.
- Most (87%) fishing effort occurred in marine waters, including estuaries, inshore and offshore waters. Regionally, fishing effort was highest in Gulf St. Vincent and Kangaroo Island (KI) waters (42% of all effort), with effort diminishing with greater distance from the Adelaide metropolitan area. Spencer Gulf accounted for 27%, West Coast 11% and the South East waters 7%. For freshwater activity (13%), the vast majority occurred in the River Murray.
- Overall, fishing effort was equally distributed between boat-based (50.8%) and shore-based (49.2%) fishing platforms.
- The survey indicated that 20% of South Australian recreational fishers accounted for 44% of the total effort in 2007/08. This highlights the potential for a relatively small proportion of the recreational fisher population to have a substantial impact and suggests that minor changes in participation within this part of the fishery could have significant implications for total recreational effort (and catch).

3. Catch (total, harvested and released numbers)

- A total of 98 individual species or species groups were reported by recreational fishers as being caught during 2007/08, translating to over 6.5 million marine finfish, 3.3 million marine shellfish (crustaceans, molluscs) and almost 400 000 freshwater fish/yabbies.

- The release rates varied considerably with the different species, ranging from very high rates (> 70%) for Mulloway, Snapper and Murray Cod, to very low rates (< 10%) for Southern Calamari.

4. Comparison between the 2000/01 and 2007/08 surveys

- Participation and demographics The estimated number of SA resident recreational fishers decreased substantially from 317 223 (23.3% participation rate) in 2000 to 236 463 (16.2%) in 2007, with a pronounced decrease (38.2%) amongst younger age groups (5 – 29 years), whereas the participation rates were quite stable amongst the older age groups (45 year or older).
- Fishing effort The number of fisher days decreased by 42% from 1.8 million in 2000/01 to 1.01 million in 2007/08. The percentage decline was greater with increasing distance from the Adelaide SD and was most pronounced in the freshwater regions of the state. There was a much greater decrease for shore-based effort (55.9%), than for boat-based fishing (18%).

5. Catches of key species

King George Whiting Total numbers caught decreased by 36% from 2.8 million to 1.8 million fish, with release rates increasing slightly from 27% to just above 30%. In 2007/08 the estimated recreational harvest (1.25 million fish or 324 tonnes) was close to half (49.6%) of the total harvest weight;

Snapper Total numbers of Snapper caught increased by 17% from 333 000 to 384 000 fish, with similarly very high release rates in both years (74%). The recreational harvest (97 000 fish or 177 tonnes) comprised 19.3% of the total harvest weight;

Southern Garfish Total numbers caught decreased by 33% from 1.5 million to 1.0 million fish, with the release rate increasing slightly from 13% to 19%. The recreational harvest (808 000 fish or 75 tonnes) comprised 20.5% of the total harvest weight;

Southern Calamari Total numbers caught decreased by 49% from 970 000 to 490 000. The recreational harvest (484 000 or 206 tonnes) was 40.5% of the total harvest weight;

Blue Swimmer Crab Total numbers caught increased by 20% from 1.56 million to 1.88 million crabs, with the release rate increasing from 33% to 39%. The

recreational harvest (1.14 million or 284 tonnes) was 29.8% of the total harvest weight;

Southern Rocklobster Total numbers decreased by 12% from 120 000 to 106 000 lobsters, however, release rate increased from 29% to 55%. The recreational harvest (48 000 or 60 tonnes) was 2.5% of the total harvest weight;

Mulloway Total numbers decreased by 13% from 78 000 to 68 000 fish; however, release rates increased from 68% to 86%. The recreational harvest (10 000 fish or 62 tonnes) was 61.7% of the total harvest weight;

Blacklip Abalone and Greenlip Abalone Total numbers caught (combined species) decreased by 78% from 26 000 to over 6 500 abalone. The recreational harvest of abalone (5 000 fish or 2.3 tonnes) was 0.3% of the total harvest weight;

Pipi (Goolwa cockle) The numbers of recreational fishers fishing for Pipi was low in both survey years, and so determining catch trends for this species is not possible. The most recent estimate of the recreational harvest (306 000 Pipi or 5 tonnes) was 0.8% of the total harvest weight;

Golden Perch Total numbers caught decreased by 63% from 249 000 to 91 000 fish, and the release rate decreased slightly from 64% to 57%. The recreational harvest (40 000 fish or 46 tonnes) was 28.4% of the total harvest; and

Murray Cod Sample sizes of SA recreational fishers fishing for Murray Cod was low in both survey years, and so discussion of catch trends is tenuous. It appears that there has been little change in the total numbers of fish caught; however, release rates have increased from 48% to 72%. The recreational harvest of Murray Cod comprised the total harvest for this species.

The potential reasons for the between-survey differences of levels of participation, catch and effort may include a number of social factors determining the motivations of recreational fishers, such as decreasing leisure time for fishing and ethical decisions not to fish. It was clearly seen that most of the decrease in participation occurred with younger recreational fishers, whereas the number of older fishers was quite stable. Implications of these results for future surveys and the management of the SA recreational fishery are also discussed.

3. INTRODUCTION

3.1 Background

Recreational fishers collectively harvest significant proportions of the total catch for a number of key species caught in SA (Status Report on SA Fisheries; PIRSA, 2006). The need for statistically robust estimates of their catches is now crucial in allocating resource shares between sectors, as well as assessing the biological sustainability for each fishery and managing the state's aquatic resources under the *Fisheries Management Act 2007*. Regular estimates of the recreational take are needed, and therefore, there is a need to develop cost-effective methods to collect such information in a timely manner.

The methods developed for surveying recreational fishers differ significantly from those used for commercial fishers who report on their fishing activities by way of compulsory logbooks. This latter method would clearly be cost-prohibitive to undertake for every recreational fisher in the state. During the late 1990s, a telephone-diary survey method was developed in Australia to estimate total non-commercial catch and effort for national, state-wide or large regional areas (Lyle *et al.* 2002) and was implemented in a national survey during 2000/01, called the National Recreational and Indigenous Fishing Survey (NRIFS 2000/01; Henry and Lyle, 2003). The recreational fishing component of the national survey is referred to as the NRFS and detailed additional results for SA are reported in Jones and Doonan (2005). The same method has been used here for the SA 2007/08 recreational fishing survey. This survey was designed primarily to provide up-to-date annual estimates of the participation rates of recreational SA resident fishers, their fishing effort and the harvested and released numbers of 12 key species for use in stock assessment and management plans. This report focuses on these estimates. Additional information was collected on other fishing activities during the survey period, including fishing effort directed at key species and fishers' attitudes to fishing-related issues and their awareness of recreational fishing regulations. These latter sets of information will be reported at a later date.

3.2 Objectives

The primary objectives of the survey were:

1. To determine the participation rate in recreational fishing throughout SA by SA residents and to profile the demographic characteristics of these recreational fishers;

2. To quantify the catch and effort of the South Australian recreational fishing sector, with special reference to 12 key species, namely:

    a. King George Whiting (*Sillaginodes punctata*);
    b. Snapper (*Pagrus auratus*);
    c. Southern Garfish (*Hyporhamphus melanochir*);
    d. Southern Calamari (*Sepioteuthis australis*);
    e. Blue Swimmer Crab (*Portunus pelagicus*);
    f. Southern Rocklobster (*Jasus edwardsii*);
    g. Mulloway (*Argyrosomus hololepidotus*);
    h. Blacklip Abalone (*Haliotis rubra*) and Greenlip Abalone (*H. laevigata*);
    i. Pipi (*Donax* spp.);
    j. Golden Perch (*Macquaria ambigua*); and
    k. Murray Cod (*Maccullochella* spp.).

3. To assess attitudes and awareness of recreational fishers in terms of various fisheries-related issues.

3.3 Report Structure Acknowledgment

The 2007/08 SA Survey employed an almost identical method to a state-wide survey that was conducted in Tasmania at the same time. Given the common objectives of the two studies, significant benefits were realised through collaborative work in survey development and implementation strategies. Yet, despite the many similarities, important components of the surveys were tailored to the different needs of the two states.

Development and application of the statistical software ultimately used to analyse the data from the surveys was undertaken by specialist TAFI/UTas staff under a separate project, primarily funded by the FRDC.

The similarities between the two studies also led to benefits in report preparation, whereby much of the structure and content of the SA report has been adapted from

the Tasmanian report, with permission of the authors (Lyle *et al*. 2009). The contribution of the Tasmanian team to the entire analysis and reporting phase is therefore gratefully acknowledged.

This report is partitioned into sections. The introduction at Section 3 outlines the background for the reasons and objectives of the survey, and the structure of the report. Section 4 provides comprehensive information on the survey methods employed, as well as to how the databases were managed and data analysed. Section 5 provides detailed information on the sample and response profiles for each component of the survey.

Sections 6 to 8 provide state-wide and regional estimates on participation, fishing effort and catches for all species, expanded to reflect all SA residents, aged 5 years or older, who recreationally fished in this state. In section 9, the expanded catch (total, harvested and released numbers and harvested weights) for the 12 key species are detailed on a regional and platform basis.

As this survey was the second of its kind in SA, and which used the same survey methods, Section 10 is devoted to a comparison of estimates obtained from the two surveys (2000/01 and 2007/08). Finally, Section 11 summarises all estimates from both surveys, discusses potential reasons for the variations, and provides advice on the direction for future surveys of this nature, especially for the key and other regulated species caught by recreational fishers in this state. It also indicates how the information can be used for future management of the recreational fishery in this state.

4. SURVEY METHODS AND ANALYSIS

The primary data collection was based on a telephone-diary approach, an off-site method developed to provide cost-effective data over large spatial scales, such as for the entire state. A detailed description of the telephone-diary design philosophy and method is provided in Lyle *et al*. (2002) and Henry and Lyle (2003). Detailed interviewing procedures, definitions and materials for the screening and diary surveys are contained in two interviewer manuals (West and Jones, 2007a; b). Data analysis procedures are described in detail by Stark *et al.* (in prep) and have been undertaken using the statistical computing language R (R Development Core Team, 2009). An overview of the survey methodology and data analysis is provided in this section.

4.1 Survey Scope

The survey encompassed the private dwelling resident population of SA aged five years and older, and their recreational fishing activity. In this context, recreational fishing was defined broadly as the capture or attempted capture of aquatic animals in SA waters (freshwater, estuarine and marine) other than for commercial purposes. In addition to line fishing, all other recreational fishing techniques and harvesting activities were included, namely the use of rock lobster pots, crab and fish nets, spears, diving and hand collection.

Unlike the 2000/01 survey, fishing activities by non-residents in SA and by SA residents in other states of Australia were not included. Also, by design, fishing-related economic activity was not assessed.

4.2 Survey Methods

4.2.1 Survey Overview

The telephone-diary method involves a multi-phase survey design, the principal components being an initial screening phase to gather profiling information from a sample of the population and a subsequent, intensive phase, in which respondents provide detailed catch and effort information over a 12 month period. In this second phase, respondents are encouraged to use a simple diary to record key fishing data and are contacted regularly by survey interviewers, who are responsible for collecting the information. The underlying design philosophy is focussed on minimizing respondent burden and maximizing response and data quality.

Additional survey components included a non-intending fisher follow-up survey and an attitudinal/'wash-up' survey among diarists. The non-intending fisher follow-up

survey involved a sample of households that had indicated at screening they were unlikely to do any recreational fishing during the diary period. This component was designed to identify and account for ‘unexpected fishing’ that may have occurred during the diary period. Motivation, awareness and attitudes to fishing-related matters were assessed for diary participants at the end of the diary period in a 'wash-up' survey. All the above survey components were conducted by specialist telephone interviewers of Kewagama Research.

On-site (creel) surveys were also conducted primarily to determine the size distribution of common marine species. These surveys were conducted in parallel to the diary survey by field staff specifically recruited, trained and managed by PIRSA. For freshwater species, size distribution information was obtained through a modest angler logbook program.

All survey components were conducted on a voluntary basis and in accordance with relevant state and national privacy legislation. All information collected through the study has been treated as strictly confidential and will be used for statistical purposes only. The relationships of all survey components are depicted in Figure 1.

4.2.2 Screening Survey

The primary role of the screening survey interview was to assess fishing participation and profiling information for all household members, as well as establishing eligibility to participate in the subsequent diary survey phase. Profiling information is important not only to characterize the sample population but also to examine issues relating to representation and response.

The screening interview involved a structured questionnaire and was conducted by telephone with a random sample of South Australian households. The 'White Pages' directory provided the sample frame, with obvious business numbers, non-private dwellings and multiple listings removed. For each selected telephone number, the suburb was also noted enabling the selection to be assigned to a Local Government Area (LGA) and SD. Stratified random sampling was undertaken with a higher sampling rate for the non-metropolitan SDs and a lower sampling rate for the Adelaide SD. Within each SD, care was taken to ensure that the proportional breakdown of the sample at the LGA level aligned to the known proportion of households based on ABS data. In addition to landline numbers, 4% of selected listings were represented by mobile-only numbers. In order to minimise non-contacts at least 15 calls were made to each live telephone number. Disconnected numbers, business and facsimile numbers were treated as sample loss and not replaced.

The screening survey was conducted during September and October 2007; with several sampling 'waves' employed to achieve pre-determined targets of households participating in the diary survey (a minimum of 150 households per stratum, see further discussion in Section 5.1).

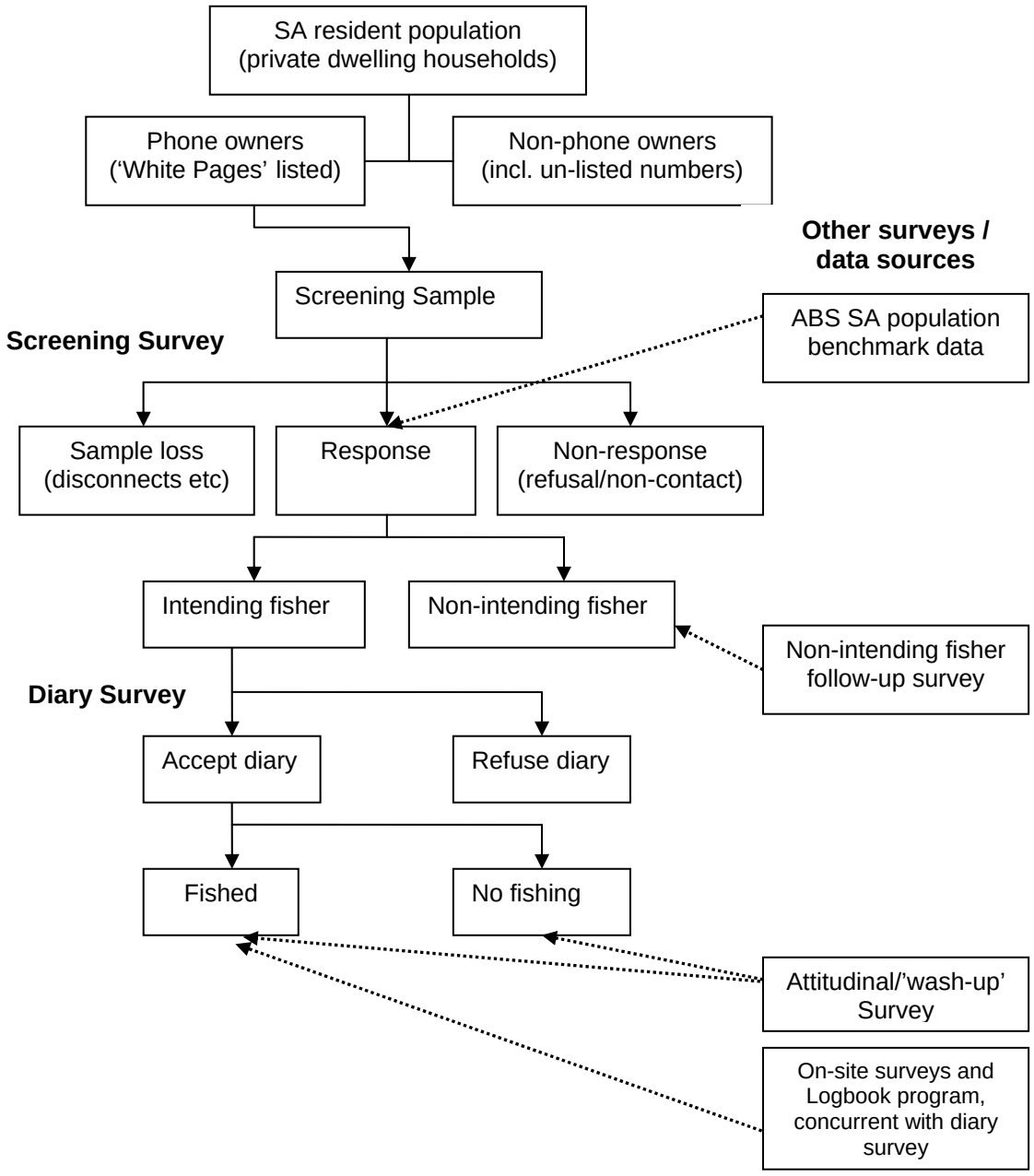


Figure 1: Diagrammatic representation of the 2007/08 SA Recreational Fishing Survey.

Within each responding household, the demographic profiles (age group and gender) of all usual residents was obtained, along with involvement in recreational fishing

over the previous 12 months and likelihood (expectation) of doing any recreational fishing in the following 12-months for residents aged 5 years or older. All respondents reporting fishing activity during the 12 months prior to interview were asked whether they had fished in fresh and/or saltwater, fished interstate and to estimate how many days they had fished in the previous 12 months. This latter detail was used as an index of avidity, rather than a direct or accurate measure of prior fishing activity, with fishers broadly classified as infrequent, occasional and regular based on the number of days reported. Previous and intending fishers were also asked whether they were members of fishing clubs or associations and ethnicity was established based on languages other than English spoken at home. Boat ownership was also established for all households, regardless of whether they were fishers or not.

All households in which at least one member (regardless of prior fishing history) expressed a likelihood of going fishing during the following 12 months were considered eligible for the second (diary survey) phase of the study.

4.2.3 Telephone Diary Survey

All households identified as eligible for the diary survey were invited to participate in this phase of the study. Fishing activity of all household members aged 5 years and older was monitored between November 2007 and October 2008, inclusive. However, additional information was collected for October 2007 in terms of any fishing activities targeting Southern Rocklobster and Snapper. For Southern Rocklobster, this provided a whole season assessment for the Southern Zone (October 2007 through to May 2008) and for Snapper, important information as to the levels of catch and effort in the lead-up to the annual season closure in November each year. These results have not been included in this report (which focuses on a 12 month assessment), but will be analysed and reviewed separately.

The approach taken in this diary survey differs from conventional angler diary surveys in two important ways. Firstly, the diary is employed more as a ‘memory jogger’ than a logbook and secondly, responsibility for data collection rests with survey interviewers and not diarists. Typically, conventional diary survey response rates are low and data quality can suffer in terms of completeness, generality and consistency. Since the burden of maintaining the diary rests with the respondent, instructions may be misinterpreted and data may be incomplete or ambiguous. The need to periodically remind respondents to submit documentation creates a further

problem, whereby information that has not been diarised must be collected on the basis of recall, if at all.

By contrast, this telephone-diary approach (a form of panel survey), effectively transfers the burden of data collection from the respondent to the survey interviewer. Data collection is undertaken by brief telephone interview where trained interviewers record details of any fishing activity since the last contact. The level of fishing activity determines the frequency of such contact but, as a general rule, respondents are called at least once a month even if no fishing is planned. Thus, any fishing activity not recorded in the diary is still collected over the phone shortly after it occurred, minimising the effects of recall bias on data accuracy.

After receiving the diary kit, data requirements are explained to respondents in a brief interview and the next contact arranged. Respondents are encouraged to record basic information in their diaries, such as date, location, start and finish times, and catch and release numbers. More detailed data, such as target species, fishing method, fishing platform (boat or shore), water body type (river, lake, estuary, coastal, offshore, etc), and reasons for release, for each individual fishing event are collected and recorded during the telephone interview. Interviewers are able to immediately clarify ambiguities and ensure completeness of information, thus providing for greater data quality and utility. For example, fishing effort can be apportioned between target fisheries, methods, fishing platform, and so on.

4.2.4 Non-intending Fisher Follow-up Survey

The objective of the non-intending fisher follow-up survey component is to account for those persons who may have unexpectedly 'dropped-in' to the fishery, providing symmetry for those persons who unexpectedly 'dropped-out' of the fishery, the latter group identified as diarists who, despite indicating an expectation to fish in the diary period, did not actually do so.

A random sample of households, which at screening had indicated no intention to go fishing during the diary period (i.e. not eligible for the diary survey), was re-contacted shortly after the diary period in late 2008. Whether any fishing had occurred during the diary period was established in a brief interview, with particular care to identify whether a change had occurred in the household (e.g. telephone number re-allocated) and that individual household members were the same as those at screening. Further details were collected from those households in which fishing was reported, including demographic profile (age group and gender), whether individual members had fished in SA and/or interstate, in salt and/or freshwater, estimated

number of days fished during the 12 months of the diary period and whether key species were caught and kept. Respondents who were identified as not being residents of the household at the time of screening were excluded from the analysis.

4.2.5 Attitudinal/Wash-up Survey

This survey was conducted with diarists at the end of the diary period and was designed to assess a range of information, including fisher motivations, attitudes to/opinions on various fishing-related issues and awareness of fishing regulations. All such information was obtained from the main/key fisher in the household, aged 15 years or older. The survey also confirmed with respondents the completeness of data for each household member, whether they had reported fishing or not. The results of this survey will be reported separately.

4.2.6 On-site Surveys and Logbook Program

The following is a summary of the on-site survey and logbook program components, with complete details provided in a separate report (Jones, 2007).

On-site surveys covering most of the SA marine coastline were conducted at key boat-ramps, jetties/breakwaters and selected beach fishing sites over a 12 month period closely aligned to the diary survey (October 2007 to September 2008). The primary objective of these surveys was to collect representative size frequency information for key species and to reveal any differences in terms of season, region, fishing platform and fishing method. This information was used to estimate the mean size and weight for each key species and in combination with harvest estimates (numbers) from the telephone/diary survey, has enabled comparison to commercial catch statistics on a total weight basis.

Other objectives of the on-site surveys included indicative information on the proportions of fishers from interstate/overseas and for SA residents, their home postcode and home phone ownership status in terms of whether they were 'White Pages' listed or not. By design, this information has not been used to adjust or calibrate the results from the telephone-diary survey (e.g. for fishing activity by interstate or un-listed residents), however some discussion of these results has been included in this report. More detailed review of this information is the subject of further analysis.

The on-site surveys were necessarily conducted in daylight hours only and for certain species such as Snapper and Mulloway, additional information for night fishing

activity was obtained through the logbook program (discussed below) and also from specialist anglers identified in the telephone-diary survey.

The ultimate survey methods and sampling frameworks for these surveys were determined after extensive 'mining' of the previous NRFS database (described in Jones, 2007). During this development work, it was also established that size frequency information for the various freshwater species could not be cost-effectively obtained through a conventional on-site survey design. This was due to the massive number of potential sites involved and in the case of Murray Cod, the comparatively rare harvest incidence.

Accordingly, a recreational fisher logbook program was developed and employed for specialist freshwater (and marine) fishers recruited from fishing clubs and other networking sources (e.g. the PIRSA Fisheries web-site and the 2007 SA Boat Show).

4.3 Data Management

4.3.1 Telephone Survey Components

In early 2008, a relational database management system was developed by TAFI using Microsoft Access according to the model described in Finney and Lyle (2000) for processing the screening and diary surveys. Other modules were later developed for the attitudinal/'wash-up' survey and non-intending fisher follow-up survey and incorporated into the overall database. All data entry for these surveys was undertaken by Kewagama Research, along with an array of manual and computer-based editing to optimise data quality. This editing was undertaken progressively and any errors, omissions or ambiguities in the data were referred to interviewing staff who in turn, re-contacted respondents where necessary. At the completion of the study, the edited database was provided to UTas for incorporation into the analysis package.

4.3.2 On-site Surveys and Logbook Program

Separate Microsoft Access databases were developed by PIRSA Fisheries for (a) the marine on-site survey (RecFishSurvey.09.01.16.mdb), (b) the marine log-book (M&E_LogBook.09.01.21.mdb) and (c) the freshwater logbook programs (FW_LogBook.09.01.16.mdb). All data were entered and edited by PIRSA Fisheries staff and again, incomplete or ambiguous forms were referred back to the interviewers or the logbook recorders. On completion of the survey, tables generated from the access databases were copied to Microsoft Excel spreadsheets for later

analyses including calculation of average and total harvested weights of species (derived from total numbers of harvested fish estimated from the analysis package).

4.4 Data analysis

Data analysis for the population survey components was based on single stage cluster sampling, with the household representing the primary sampling unit (PSU) and residents within the household, the secondary sampling unit (SSU). In determining household and individual expansion factors, an integrated procedure was applied to non-response adjustment and calibration against population benchmarks, taking account of household size and demographics. Adjustments for non-response at screening were primarily based on fishing propensity, determined amongst households that refused to complete the screening interview, but at least answered the question about whether household members had fished or not in the previous 12 months. Calibration relied on ABS - estimated resident population (ERP) data for SA as at July 2007. Using diary phase uptake and completion rates for eligible households, further non-response adjustment was applied to expansion factors in calculating catch and effort information. This adjustment was made sensitive to the avidity classification for the household (the maximum avidity index for a member of the household determined at screening).

Not all eligible fishers actually fished during the diary period and these in effect represented unexpected 'drop-outs' from the fishery. In order to take account of unexpected 'drop-ins' to the fishery, a final adjustment was necessary and was based on the non-intending fisher follow-up survey. This adjustment was made sensitive to the avidity index reported for 'drop-ins' and region of residence (stratum). A full account of the analytical process is provided in Stark *et al*. (in prep).

Unless otherwise indicated, parameter estimates provided in this report are based on expanded data, scaled-up to represent the population rather than the sample from which they were derived.

As a consequence of surveying a sub-sample rather than the entire population of fishers, all parameter estimates have some associated statistical uncertainty, i.e. the estimates may differ from those that would have been produced had the entire population been included in the survey. This uncertainty is often expressed in terms of standard error or relative standard error. However, to assist in reviewing the precision of survey results, 95% confidence limits (95% CL) have been routinely included in the report, in addition to the relevant population-based estimates. The 95% CL is calculated as the product of 1.96 and the SE for a given estimate and is

shown as the lower and upper range, where there is a 95% chance that the true estimate will fall.

Readers should therefore consider such precision in reviewing the results. For completeness, all estimates within the data tables have been routinely included, regardless of the confidence limits involved. However, where the lower/upper range of the 95% CL represents a decrease/increase of greater than 80% of the estimate concerned, such cases have been annotated accordingly.

4.5 Regions

4.5.1 Sampling Regions

Initial household selection (i.e. telephone number) was based on a stratified random sample design using the seven ABS SD as strata: Adelaide; Outer Adelaide; Yorke and Lower North; Murray Lands; South East; Eyre; and Northern (Figure 2). In describing household and population characteristics, data have been analysed at stratum (SD) and state levels.

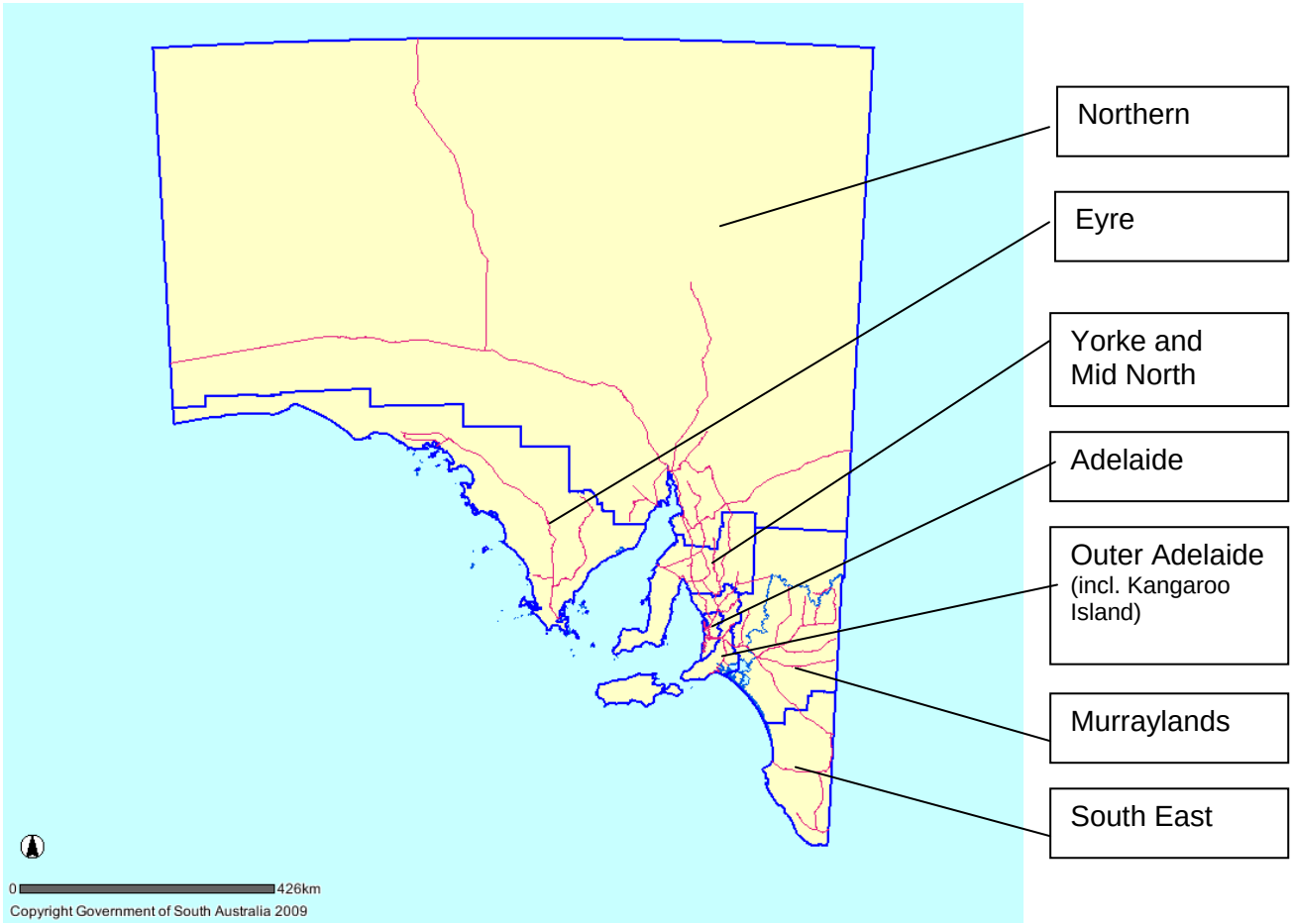


Figure 2: Map of South Australia showing survey strata – Australian Bureau of Statistics, Statistical Divisions.

4.5.2 Fishing regions

During the diary survey, interviewers classified the location of each fishing activity into one of thirty five fishing regions, as employed in the previous NRFS (Henry and Lyle, 2003). However, unlike the NRFS, the reported fishing location was routinely recorded in the database, both as a validation tool and to provide added flexibility in ongoing analysis work. For example, in Fishing Region 3 (West Coast, Figure 3), several locations such as Baird Bay and Venus Bay emerged with high reporting levels in the diary survey, to the extent that separate 'mini-regions' can be created in later analysis. By contrast, for certain purposes of this report, Fishing Regions have been amalgamated. For example, the Northern Zone for Southern Rocklobster is defined as region codes 1 - 21, with the Southern Zone embracing codes 22 - 25. For most of the key marine species, their catches are summarised into major areas: (West Coast: Regions 1 - 6, Northern Spencer Gulf: Regions 8 - 10; Southern Spencer Gulf: Regions 7, 11 and 12; Gulf St. Vincent and Kangaroo Island: Regions 13 - 21; and the South East: Regions 22 - 25. For the key freshwater species, estimates are available for each of the fishing regions in the River Murray system (Regions 26 - 29), however, the poor level of precision in each of the remaining inland waters regions, due to low sample sizes of fishers surveyed, requires the need to amalgamate the data for these regions.

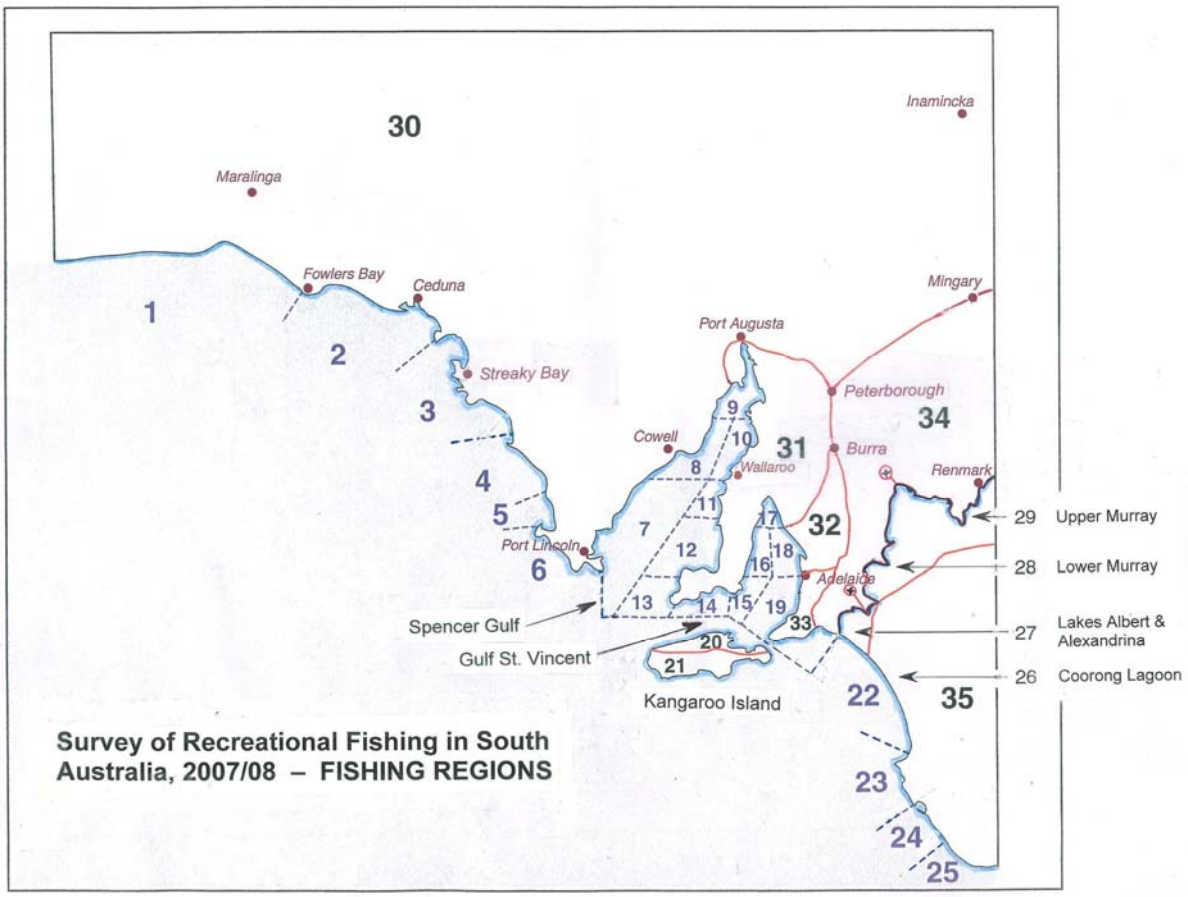


Figure 3: Map of South Australia showing the locations of 35 regions used for reporting fishing activities – coastal and inland fishing regions.

Other fishing location information was also collected in the diary survey in terms of water-body type: marine waters > or < 5kms from the coastline; estuarine/brackish waters; freshwater rivers; and freshwater lakes/dams, public or private. Although results based on this variable have not been included in this report, in combination with fishing regions, significant potential exists for further analysis work.

4.6 Fishing effort

Fishing information was collected on an 'event' basis, where an event was defined as a discrete fishing episode and the actual household member(s) involved in the event were recorded. Separate fishing events were defined where there was a change in fishing region or water body type, target species or fishing method. In this way, a day's fishing trip could comprise more than one event. For example, where a fisher gathers bait prior to fishing for King George Whiting, both the bait gathering and the subsequent fishing were considered to be separate events, since the effort expended in the capture of bait cannot be attributed to the capture of any King George Whiting and vice versa. Similarly, the use of passive fishing gear, such as rock lobster pots

or crab nets, whilst line fishing was recorded as separate fishing events. The delineation of fishing activity in this manner provided an ability to analyse effort (and catch) on the basis of fishing method and target species/fishery. Furthermore, three measures of effort can be analysed, namely fishing days (i.e. separate days in which some form of fishing was undertaken), fishing events and hours fished.

It should be noted that person-based effort has been calculated for this report. For active fishing methods such as line fishing and dive harvesting this is clearly appropriate, but where shared or joint activities occurred, such as fishing with rock lobster pots or crab nets, this can over-estimate effort. In such instances, effort was calculated as the number of rock lobster pots/nets used divided by the number of persons who participated in the fishing activity on a given day, providing an effort measure based on the number of person pot/net days of effort.

4.7 Fishing methods

A variety of discrete fishing/harvesting methods were accounted for in the diary survey including: line fishing (bait, lures or both); traditional rock lobster pots; other passive traps/nets (e.g. hoop nets); dab/scoop nets; other active nets; recreational gillnets; spear fishing (diving); other diving (snorkelling and scuba/surface air); surface spearing; raking; and hand-collecting. For results in this report, the methods have been appropriately amalgamated (e.g. all forms of line fishing). However, the potential remains for separate analysis of these and other discrete methods.

4.8 Catch

A Species Identification Guide (including clear colour images) was carefully developed and provided to all diarists to optimise the accuracy of species identification in the survey. A key factor here is that the resolution required for individual species must recognise the identification capabilities of fishers, on a lowest-common-denominator basis. Although excellent reporting accuracy can be achieved at the species level in many instances (confirmed through on-site surveys - Lyle and Campbell 1999; Lyle *et al*. 2002), species groupings were required where fishers could not routinely delineate particular species – even with the aid of the guide and interviewer assistance. For example, for species such as leatherjackets, a generic/common species from the group was included in the guide and only species group information was collected. However, for the various whiting species (King George, yellowfin, weedy etc.), their distinctions were clearly depicted in the guide and separate data were collected for each.

Catches were reported as numbers kept or harvested and numbers released or discarded by individual species or species group. Using information provided by the on-site surveys and logbook program, expanded estimates of harvested numbers were converted to weights.

5. SAMPLE AND RESPONSE PROFILES

5.1 Screening survey

Table 1 provides details of the total number of (private-dwelling) households by stratum in SA as at July 2007 (based on ABS ERP data); together with sample sizes for the screening survey and sample loss/response profiles. As noted previously, all sampling was undertaken without replacement. Accordingly, cases of sample loss (e.g. disconnected numbers, fax/email lines) effectively reduced the total gross sample of 7 140 households to a net sample of 6 230, of which 5 541 households (88.9%) fully responded to the screening survey. Response rates were largely consistent across all strata. Overall, information on recreational fishing and demographic profiling was collected for 12 493 persons aged 5 or older.

Table 1: South Australian private dwelling population (number of households), sample size, and sample loss/response profiles for the screening survey, by stratum (Statistical Division).

Statistical Division	Total households	Initial sample	Sample loss	Net sample	Non-response	Full response	Response rate
Adelaide	464,695	2,920	433	2,487	333	2,154	86.6%
Outer Adelaide	50,653	850	88	762	71	691	90.7%
Yorke and Lower North	19,181	540	57	483	35	448	92.8%
Murraylands	27,920	851	110	741	72	669	90.3%
South East	25,708	640	63	577	40	537	93.1%
Eyre	13,814	450	53	397	42	355	89.4%
Northern	31,569	889	106	783	96	687	87.7%
Total	633,540	7,140	910	6,230	689	5,541	88.9%

Among the 910 cases of sample loss (Table 1), the vast majority (748) referred to disconnected telephone numbers, i.e. numbers that remained disconnected for the two month period of the screening survey. Other forms of sample loss were: 55 business only numbers; 56 permanent fax/email lines; 28 out-of-scope dwellings (e.g. holiday homes); and 23 others (mainly non-functioning/'dead' phone lines).

Non-responding households (689 in Table 1) accounted for 11.1% of the net sample and are dissected as follows: 108 full refusals (1.7%); 238 partial refusals (3.8%), i.e. where some, but not all answers were provided; 305 full non-contacts (4.9%), despite at least 15 effective calls over the two month period; and 38 due to language/communication difficulties (0.6%).

5.2 Diary survey

In the development phase of the diary survey, minimum targets were determined for the number of households to participate in the diary survey by stratum. This strategy was devised after detailed 'mining' of the previous NRFS database to achieve optimum cost-effectiveness in the diary survey data. For the smaller strata, where many residents tend to only fish locally, a minimum of 150 households per stratum was established, ranging up to 350 households for the Adelaide stratum, where the large population is known to fish both locally and further afield.

Table 2 summarises response profiles for the diary survey, with 1 392 households (25.1% of the full response group at screening) identified as having at least one resident with an intention to do some recreational fishing during the diary period (November 2007 to October 2008). Of these eligible households, 1 310 (94.1%) agreed to take part in the diary survey and among these, 1 261 (96.3%, or 90.6% among eligible households) fully responded, representing 3 385 persons aged 5 years and older. Importantly, among the 49 households failing to complete the diary survey (after commencing), only 7 actually declined to continue, 8 were non-contacts and the remaining 34 were 'untraceable' cases of disconnected phone numbers or re-locations.

Table 2: Household response profiles for the diary survey by stratum (Statistical Division).

Statistical Division	Full response at screening	Eligible for diary survey	Diary survey uptake	Uptake rate	Diary survey completed	Completion rate (among uptake)	Completion rate (among eligibles)
Adelaide	2,154	376	352	93.6%	341	96.9%	90.7%
Outer Adelaide	691	178	168	94.4%	163	97.0%	91.6%
Yorke and Lower North	448	159	152	95.6%	146	96.1%	91.8%
Murray Lands	669	177	172	97.2%	166	96.5%	93.8%
South East	537	166	153	92.2%	143	93.5%	86.1%
Eyre	355	174	161	92.5%	159	98.8%	91.4%
Northern	687	162	152	93.8%	143	94.1%	88.3%
Total	5,541	1,392	1,310	94.1%	1,261	96.3%	90.6%

Among those completing the diary survey, 1 009 households (80%) reported some fishing activity during the 12 month period, by 1 785 fishers aged 5 years and older and a total of 12 180 person-based fishing events.

By comparison with other general population telephone surveys and traditional mail-back diary studies, the response rates achieved in this study are exceptionally high

and represent an important indicator in terms of the overall performance of the survey method (see Section 10.1).

5.3 Non-intending fisher follow-up survey

A sample of 1 250 households for the follow-up survey was randomly selected on a proportional-to-size basis by stratum, from the 4 149 fully responding households at screening that indicated no intention to fish in the diary period. This relatively high sampling intensity (30%) was determined after detailed modelling, to provide appropriate statistical strength in assessing the levels of unexpected fishing activity (the 'drop-ins', as discussed previously in Section 4.2.4).

Of the 1 250 households in the gross sample, 102 cases of sample loss were encountered (virtually all being disconnected numbers), resulting in a net sample of 1 148 households. Among these, 1 105 households fully responded to the survey (96.3% of the net sample), with negligible variation by stratum. The non-responding households (43 or 3.7% of the net sample) are dissected as follows: 17 full refusals (1.5%), 5 partial refusals (0.4%), 18 non-contacts (1.6%); and 3 due to language/communication difficulties (0.3%).

Among the 1 105 fully responding households, 26 were identified as entirely different households from the original screening, resulting in 1 079 households for assessment of unexpected fishing activity. Among these, 61 households (5.7%) reported fishing activity in SA during the diary period, by 89 fishers aged 5 years and older – conforming to the 'drop-in' component for adjustment of the diary survey results.

5.4 Attitudinal/'wash-up' survey

Although the results of the attitudinal/'wash-up' survey will be reported separately, sampling details and response profiles have been included here for completeness. By design, all 1 261 households completing the diary survey were included in the sample, with a quite detailed questionnaire for those that fished in the diary period and an abbreviated version for non-fisher households. No sample loss was encountered and 1 233 households fully responded to the survey (97.8%). Consistent response rates were achieved by stratum and also for the fisher and non-fisher households.

The non-responding households (28 or 2.2% of the sample) are dissected as follows: 4 full refusals (0.3%), 2 partial refusals (0.2%), and 22 non-contacts (1.7%), including 15 cases where the household moved interstate or overseas during the diary period. Although these latter households were correctly classified as fully responding for the

diary period (in terms of their fishing activity in SA), it was decided to effectively exclude them from the 'wash-up' survey, due to contact/tracking difficulties.

5.5 On-site surveys

The sampling plan for the on-site surveys was designed to provide cost-effective and representative size frequency data for the key marine species. Complete details of the survey are provided in Jones (2007) and the following is a summary of the sampling structure and response profiles (see Table 3).

On-site interviews were confined to daylight hours only, but sampling was conducted on both weekdays and weekend/public holidays. Along the SA coastline, a total of 156 individual fishing sites (boat ramps, jetties and breakwaters, beaches etc.) were sampled during the 12 months, for a total of 505 sampling days/visits (a mean of > 3 visits per site). A total of 2 459 fishing parties were approached for interview, with 2 380 fully responding (96.8%). Largely consistent response rates were achieved by region and again, this represents an excellent outcome by any measure.

The non-responding fishing parties (79 or 3.2% of all attempted interviews) comprised 48 full refusals (2%) and 31 partial refusals (1.3%). However, in a small number of cases, language/communication difficulties were also a contributing factor.

The 2 380 fully responding interviews represented 5 005 fishers and measurements were obtained for a total of 25 038 individual marine fish and other species.

For all on-site interviews, additional questions were asked to assess residential location (home postcode for SA residents vs. interstate or overseas) and for SA residents whether they had a "White Pages" listed home telephone or not. These questions were asked of one fisher in each party (the primary respondent, if more than one) to provide indicative information in terms of these coverage issues.

Among the 2 380 interviews, 145 respondents (6.1%) were interstate/overseas visitors to SA, with the remaining 2 235 (93.9%) being SA residents. Among the SA residents, 1 883 respondents (84.3%) reported having a "White Pages' listed home phone. At the time of the NRFS, 81% of households nationally (and 80% in SA) were assessed as being "White Pages" listed through data obtained from digital telephone directories. Since then, such directories have become illegal and reliable estimates of listed households are currently not available.

Table 3: Summary of sampling structure and response profiles for the marine on-site surveys, by coastal region and fishing platform/site type.

Coastal region	Fishing platform/Site Type	No. of sites	No. of sampling days[1]	No. of interviews attempted	Non-response	Full response	Response rate
West Coast	Boat ramps	10	64	464	11	453	97.6%
	Jetties, breakwaters	7	11	24	0	24	100.0%
	Natural shore	4	3	15	0	15	100.0%
Spencer Gulf	Boat ramps	17	82	422	4	418	99.1%
	Jetties, breakwaters	14	47	176	5	171	97.2%
	Natural shore	8	12	9	0	9	100.0%
Gulf St. Vincent	Boat ramps	21	80	400	25	375	93.8%
	Jetties, breakwaters	18	81	417	25	392	94.0%
	Natural shore	19	38	47	3	44	93.6%
Kangaroo Island (KI)	Boat ramps	5	18	63	2	61	96.8%
	Jetties, breakwaters	4	9	27	0	27	100.0%
	Natural shore	3	1	2	0	2	100.0%
Coorong Lagoon	Boat ramps	2	8	21	0	21	100.0%
	Jetties, breakwaters	1	1	2	0	2	100.0%
	Natural shore	1	1	2	0	2	100.0%
South East Coast	Boat ramps	12	39	177	3	174	98.3%
	Jetties, breakwaters	6	8	35	1	34	97.1%
	Natural shore	4	7	156	0	156	100.0%
Total		156	505	2,459	79	2,380	96.8%

[1] includes individual days/dates where multiple sites were sampled, e.g. the three natural shore sites on KI.

5.6 Logbook Program

At the commencement of the program, a total of 122 recreational fishers were initially provided with fishing logbooks. Of these, 75 were provided marine logbooks, 41 with freshwater logbooks, and 6 with both logbooks. Over the 12 month period (aligning to the telephone-diary survey), 67 fishers provided data on their fishing activities, comprising 46 (61.3 %) of the marine fishers, 17 (41.5%) freshwater fishers, and 4 (66.7%) marine and freshwater fishers. Information was provided for a total of 1 140 fishing trips (including night fishing activity), comprising 854 in marine waters along the SA coastline and 286 in freshwater (predominantly the River Murray). Measurements were provided for a total of 14 968 individual fish and other species, comprising 13 639 for the marine species and 1 329 for freshwater species. Additionally, measurements of 871 Snapper and 39 Mulloway were provided by selected respondents who participated in the telephone-diary survey.

6. FISHER CHARACTERISTICS

The following results are based on information derived from the screening survey of SA residents and are expanded, with non-response adjustment, to represent the resident household population of SA.

6.1 Numbers of fishers and participation rates

An estimated 236 463 (± 17 003) SA residents aged 5 years or older fished at least once in the 12 months prior to October 2007 (Figure 4A; Appendix 1A).

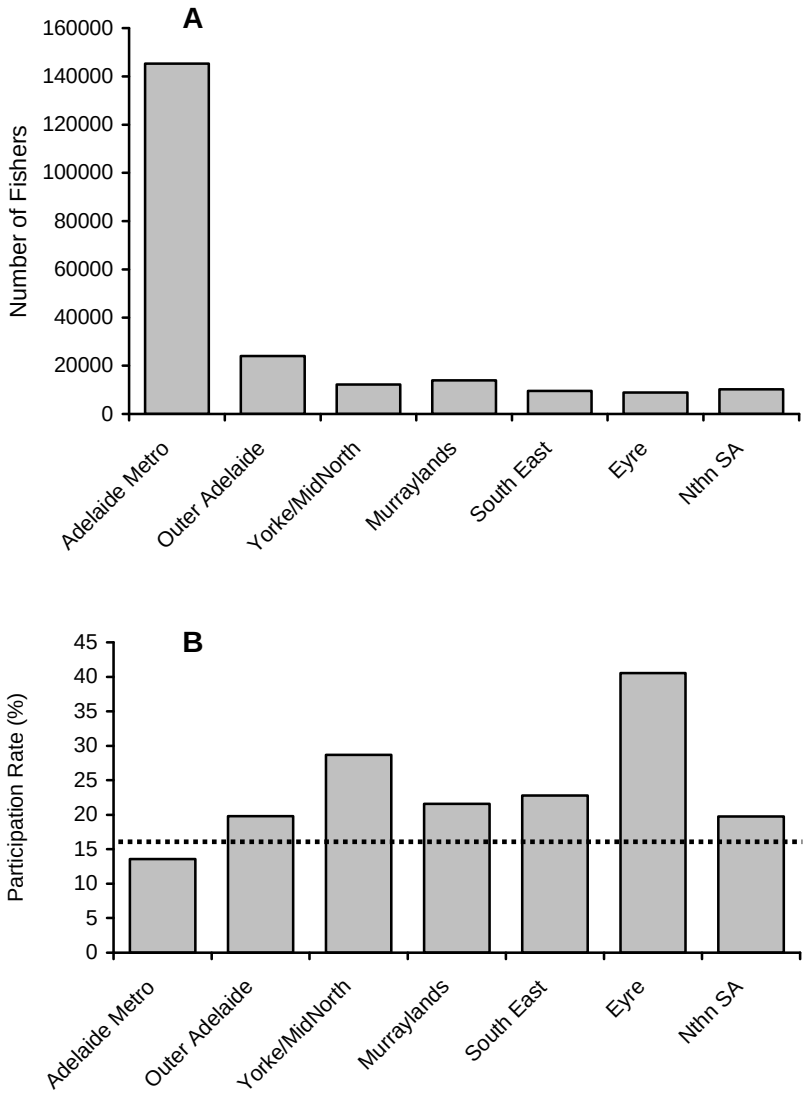


Figure 4: Fishing participation in the 12 months prior to October 2007 by Statistical Division for persons aged 5 or older: A) number of fishers; and B) proportion (%) of the resident population. The dotted line represents the participation rate for SA.

Fishers residing in the Adelaide metropolitan stratum represented the greatest number of the state's fishers (145 269; 61.4% of the state-wide number of fishers), with the outer Adelaide stratum the next highest (24 066; 10.2%) (Figure 4A). The other five strata (considered to be generally more rural), totalled 67 126 fishers (28.4%). The participation rate (proportion of the state's resident population) in SA was 16.2%, regional participation rates varied considerably between 13.6% for Adelaide SD up to 40.5% for Eyre SD (Figure 4B).

6.2 Age and gender

Recreational fishing was more popular amongst males, with 23.0% of the male and 9.5% of the female resident population in SA aged 5 or older participating in recreational fishing in the 12 months prior to October 2007 (Appendix 1B). By numbers, more than twice as many males (166 292) than females (70 170) did some recreational fishing. The predominance of males by number and participation rate was evident across all age groups (Figure 5A) and by SD (Appendix 1B). Although the highest numbers of fishers were in the 30 – 44 year old age group (41 160 males and 19 181 females), the highest participation rates occurred in the 5 – 14 year old age group (29.5 % males and 14.8 % females) (Figure 5B; Appendix 1B).

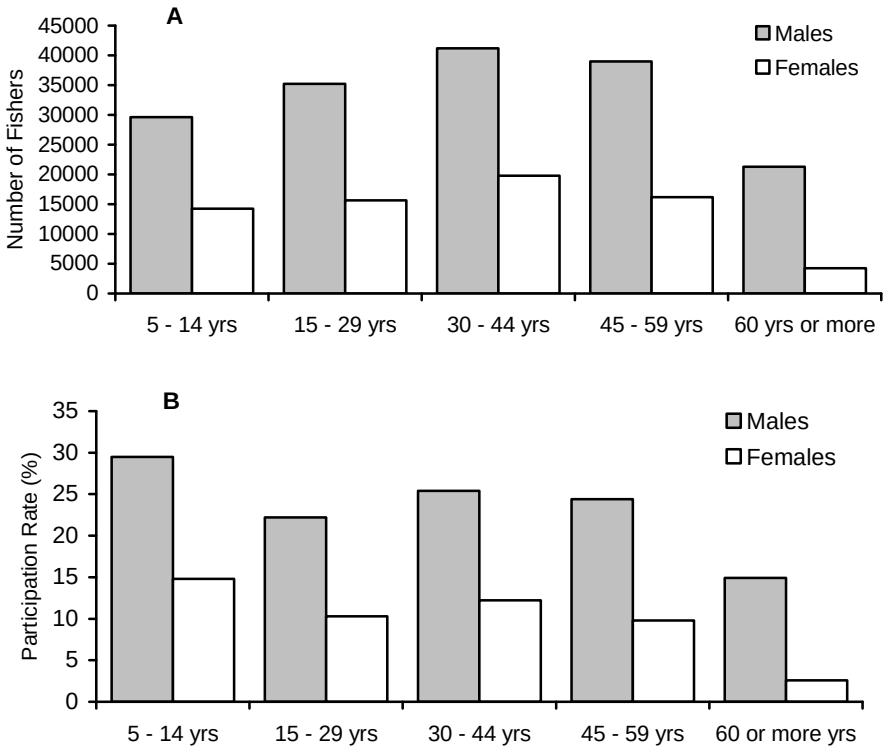


Figure 5: Fishing participation in the 12 months prior to October 2007 by age group and gender by SA residents aged 5 years or older: A) number of fishers; and B) proportion (%) of the resident population.

7. FISHING EFFORT

Fishing effort is used to describe the pressure applied to a resource by fishers and to derive (with catch data) indices of resource abundance and fishing success. The response of fish populations to variations in fishing effort represents an important foundation for stock assessment.

For the purposes of this report, only effort undertaken by SA residents in SA waters was considered. Effort can be described in several ways, i.e. on the basis of fisher days (regardless of time fished on the day), hours fished, or events (as defined in this study). For this report, the primary measure of effort used is fisher day, noting that fisher days of effort can be disaggregated by fishing region, fishing platform and/or method of capture.

Based on reported activity by diarists, with appropriate non-response and 'drop-out' and 'drop-in' adjustments, it was estimated that overall 215 972 (± 18 157) South Australians fished between November 2007 and October 2008. This represents a small decrease (8.7%) over the estimated number of persons who fished in the 12 months prior to this period (236 463).

In terms of effort, SA residents accounted for over 1 054 200 (± 113 302) days fished.

7.1 Days fished by fisher

In recreational fisheries, most fishers typically do relatively little fishing (and catch few fish); while at the other extreme, relatively few fishers are very active and contribute disproportionately to the overall effort (and catch). The distribution is, therefore, characteristically skewed. Consistent with this general observation close to half (46%) of all fishers (just above 99 000 persons) fished three or fewer days over the survey period, while almost 3% (more than 6 000 persons) fished 20 or more days (Figure 6). The average number of days fished per fisher was 4.5 for the survey period.

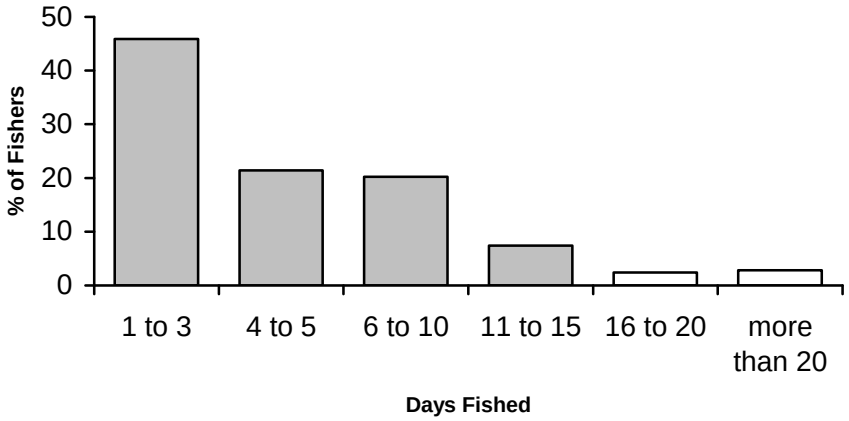


Figure 6: Frequency distribution (%) of number of days fished during the survey period by 215 972 recreational fishers (SA residents).

The impact of individual fishers on total fishing effort was examined by ranking fishers based on annual fishing effort (days fished) and then calculating the effect of progressively adding a fisher's effort to the total (Figure 7). From this relationship it was evident that 80% of the fishers accounted for 56% of the fishing effort, or conversely, 20% of the fishers accounted for 44% of the total effort. This clearly highlights the potential for a relatively small proportion of the recreational fisher population to exert a substantial impact in terms of effort (and catch); suggesting that minor shifts in the dynamics of participation (based on activity levels) at the upper end of the fishery will have significant implications on effort (and catch) levels.

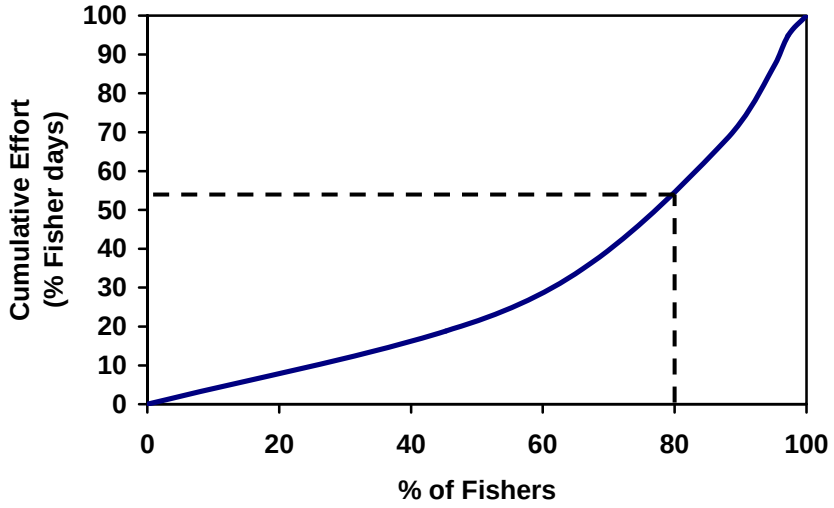


Figure 7: Relationship between the number of fishers and their cumulative fishing effort (% days fished) for SA residents aged 5 or older in SA during 2007/08. Dotted lines indicate that 80% of the total number of fishers accounted for approximately 55%.

7.2 Fishing method

Line fishing (including the use of bait, artificial lures and jigs and unattended lines) represented the primary recreational fishing activity, occurring on 81.3% of all fishing days of effort during 2007/08 (Table 4). Overall, line fishing accounted for 936 641 fisher days or 3 525 044 hours, implying an average of 3.8 hours per day. Rock lobster pot/crab net fishing were the second most important methods accounting for 14.7% of fisher days, followed by various hand collection methods (rakes/tongs, hand gathering and surface spears) (2.7%), dab netting (0.6%), diving (0.6%) and finally gill/drag netting (0.1%).

Table 4: Proportion (%) of fishing effort (no. of fisher days with 95% CL) according to method of capture.

Method of Capture	No. of fisher days	95 % C.L. (+/-)	% of total effort
Line	936,641	53,358	81.3
Rock lobster pots/crab nets	169,819	16,742	14.7
Hand (rakes/tongs, gathering, spears)	31,053	5,480	2.7
Dab netting	7,053	2,506	0.6
Diving	6,567	2,005	0.6
Gill/drag nets	1,028	505	0.1
Total	**1,152,161**	**80,596**	**100.0**

7.3 Fishing region

A significant majority (87%) of the state's total fishing (fisher days) was expended in marine waters, with effort most focused in Gulf St. Vincent and KI waters (42%), followed by Spencer Gulf (27%) (Figure 8). Fishing effort in the freshwater regions of the state (13% of total effort) mainly occurred in the River Murray (Appendix 2). A detailed dissection of fishing effort for the 35 discrete fishing regions employed in the survey is provided in Appendix 2 and is discussed below.

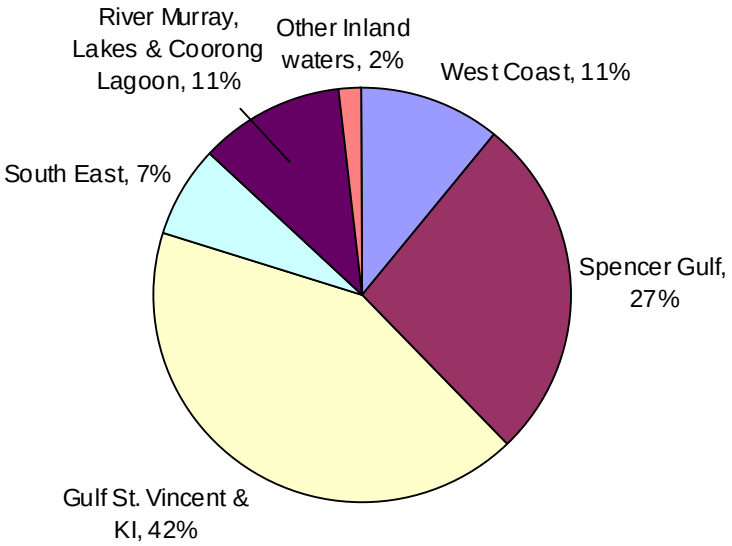


Figure 8: Percentage of fishing effort (fisher days) undertaken by SA residents during the period of the survey 2007/08, according to the major fishing regions of the state.

Within Gulf St. Vincent and KI, highest effort levels were recorded for waters adjacent to the Adelaide metropolitan and Fleurieu coastlines (Fishing Regions 18 and 19), with lowest effort occurring off the south coast of KI (Region 21). In Spencer Gulf, highest effort levels were recorded for the south eastern coast of this gulf (Regions 11 and 12 - Moonta Bay to south of Corny Point) and similarly in northern Spencer Gulf (Regions 9 and 10). The lowest effort in Spencer Gulf occurred off the central western region of this gulf (Region 8). The third most significant area for fishing effort was off the west coast of the state with Coffin Bay (Region 5) attracting the most effort, and secondly, similar levels for the far west coast (Region 2 - Ceduna/Smoky Bay and Region 3 - Streaky Bay to Venus Bay). Lowest effort for the west coast occurred in the waters south of Coffin Bay (Region 6). Although relatively low, fishing effort was more evenly spread throughout the south-east coastal waters, but highest effort for this region occurred in Region 25 (Port MacDonnell) and Region 23 (Kingston/Robe). Lowest effort occurred off the Coorong Beach (Region 22).

For the freshwater regions of the state, highest effort occurred in the lower reaches of the River Murray (Region 28 – Wellington to Morgan), and the second most important region as the upper Murray (Region 29 – Morgan to the border with the eastern states). All other freshwater regions of the state (including the Coorong Lagoon) attracted significantly lower fishing effort compared with the two Murray regions (Appendix 2).

7.4 Fishing platform

Throughout the state, similar levels of fishing effort (fisher days) were expended by boat-based (543 271 fisher days; 50.8%) and shore-based (526 160 fisher days; 49.2%) fishers. The vast majority of boat-based fishing effort (512 549 fisher days; 47.9% of total effort) was undertaken by SA residents using their own boats, with hire boat (e.g. self drive) accounting for 6 355 fisher days (0.6%) and charter boats (24 367 fisher days (2.3%) (Figure 9). Almost all the hire boat effort occurred in the River Murray (e.g. houseboats), and the majority of the charter boat effort was expended in Gulf St. Vincent and KI and Spencer Gulf.

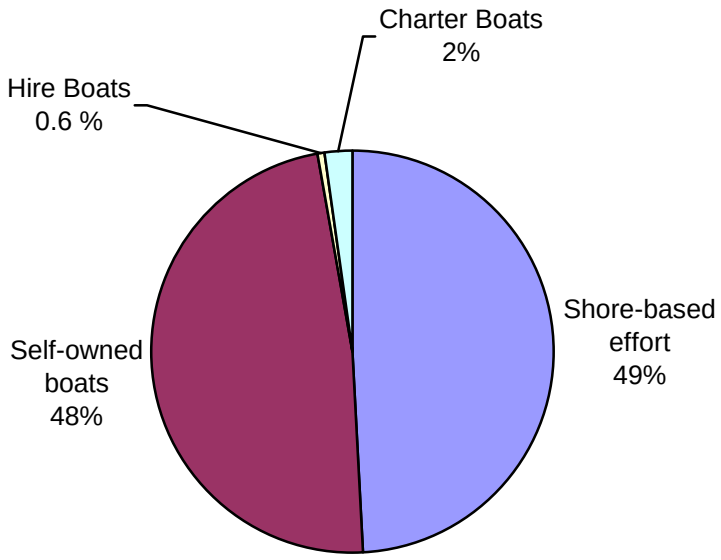


Figure 9: Percentage of fishing effort (fisher-days) expended by SA resident fishers by fishing platform, with special emphasis on boat fishing effort.

8. CATCH

SA resident fishers caught a diverse range of finfish, crustaceans, molluscs and other animals, with a total of 98 individual species or species groups reported. Species identification issues are discussed in Section 4.8.

8.1 Total catch, harvested and released numbers

In recreational fisheries, catches can be divided into harvested (retained) and released (discarded) components. The harvested component may be used for a range of purposes including human or pet consumption or bait, whereas fish may be released because of regulations (size and bag limits, seasonal or area closures), ethical reasons, undesirability of species, or sport fishing, where catch-and-release is practiced. A detailed analysis of usage patterns for harvested species and reasons for release will be provided in Part 2 of this report.

During the survey period, an estimated 10 126 192 finfish, crustaceans, molluscs and other animals were caught by SA residents fishing in SA. Of these, a total of 6 509 366 (64.3%) were harvested and 3 673 630 (36.5%) were released. Tables 5, 6 and 7 provide the annual estimates for the marine finfish, marine shellfish and freshwater species, respectively.

Table 5: Estimated annual catch (total, harvested and released numbers) and release rates (%) of marine finfish species, by SA residents aged 5 years or older in 2007/08.

Common Name	Total number caught	95% CL (+/-)	Harvested numbers	95% CL (+/-)	Released numbers	95% CL (+/-)	Release Rate (%)
Australian Herring	865,864	225,124	598,774	152,304	267,090	93,037	30.8
Western Australian Salmon	474,717	105,457	303,307	71,895	171,410	48,475	36.1
Bight redfish	38,751	27,040	25,050	16,860	13,700	11,913	35.4
Bream, black	158,917	63,148	19,971	8,842	138,946	58,206	87.4
Flathead	73,119	24,991	38,873	13,610	34,246	16,531	46.8
Flounder	1,774	1,260	1,249*	1,107*	526*	612*	29.6
Southern Garfish	1,001,653	357,912	807,743	290,296	193,910	86,075	19.4
Groper, western blue	1,847*	1,627*	714*	942*	1,133*	1,252*	61.3
Morwong, blue	1,420	964	1,150	774	271*	440*	19.1
Mullet	263,940	96,407	151,654	52,712	112,286	59,722	46.3
Mulloway	68,038	47,201	10,171	6,219	57,868	43,667	85.1
Samsonfish	467*	519*	467*	519*	0	0	0
Shark, gummy	6,414	2,850	4,443	2,242	1,971*	1,650*	30.7
Shark, school	2,084	1,226	1,278	770	806*	696*	38.7
Snapper	384,077	118,117	97,010	29,165	287,067	103,464	74.7
Snook	163,008	91,307	121,663	66,803	41,345	28,110	25.4
Sweep	68,915	23,453	32,979	12,385	35,936	15,255	52.1
Trevally	67,903	24,253	39,889	15,182	28,014	13,575	41.3
Tuna	5,413*	5,845*	2,425*	2,558*	2,988*	3,512*	55.2
Whiting, King George	1,797,148	354,491	1,249,079	259,316	548,069	122,165	30.5
Whiting, yellowfin	99,179	47,652	71,120	38,637	28,058	12,664	28.3
Yellowtail kingfish	4,825*	4,567*	3,925*	4,141*	900*	1,086*	18.6
Non-regulated marine finfish**	955,976	n.a.	278,262	n.a.	676,373	n.a.	70.9
Total marine finfish	**6,505,449**	**n.a.**	**3,861,196**	**n.a.**	**2,642,913**	**n.a.**	**40.6**

Table 6: Estimated annual catch (total, harvested and released numbers) and release rates (%) of marine shellfish species, by SA residents aged 5 years or older in 2007/08.

Common Name	Total number caught	95% CL (+/-)	Harvested numbers	95% CL (+/-)	Released numbers	95% CL (+/-)	Release Rate (%)
Blacklip Abalone	1,907	1,474	1,685	1,303	222*	308*	11.6
Greenlip Abalone	4,689	3,352	3,462	2,221	1,227	1,325	26.2
Cockle (mud cockle)	112,319*	109,333*	91,994*	80,091*	20,325*	37,124*	18.1
Blue Swimmer Crab	1,876,490	385,297	1,144,837	268,749	731,653	160,107	39.0
Crabs - sand	65,975	39,090	28,634*	25,202*	37,341	26,887	56.6
Cuttlefish	7,710	5,957	6,159*	5,745*	1,551*	1,574*	20.1
Pipi (Goolwa cockle)	312,479*	312,228*	306,107*	309,909*	6,371*	12,450*	2.1
Razor fish	148,593	74,396	148,593	74,396	0	0	0
Southern Rocklobster	106,483	54,423	47,875	20,331	58,608	36,148	55.0
Scallops	107,333	85,193	98,290*	82,583*	9,044*	11,199*	8.4
Southern Calamary	492,736	133,325	484,456	130,881	8,281*	11,209*	1.7
Non-regulated shellfish**	51,173	n.a.	46,532	n.a.	4,641	n.a.	9.1
Total marine shellfish	**3,287,887**	**n.a.**	**2,408,624**	**n.a.**	**879,264**	**n.a.**	**26.7**

Table 7: Estimated annual catch (total, harvested and released numbers) and release rates (%) of freshwater species, by SA residents aged 5 years or older in 2007/08.

Common Name	Total number caught	95% CL (+/-)	Harvested numbers	95% CL (+/-)	Released numbers	95% CL (+/-)	Release Rate (%)
European Carp	130,928	56,893	129,012	56,787	1,916	3,724	1.5
Catfish - freshwater	2,350	1,779	259*	500*	2,091	1,680	89.0
Murray Cod	1,853*	1,691*	507*	971*	1,346	1,384	72.6
Golden Perch (callop)	91,530	36,870	39,861	16,027	51,669	22,773	56.5
Perch, redfin	7,161	3,477	5,216	2,458	1,945	1,799	27.2
Perch, silver	26,067	14,318	1,840*	2,360*	24,227	13,773	92.9
Yabbies, freshwater	61,535*	54,919*	46,565*	47,895*	14,970	16,754	24.3
Other freshwater species **	11,432	n.a.	8,143	n.a.	3,289	0	28.8
Total freshwater species	**332,856**	**n.a.**	**239,546**	**n.a.**	**151,453**	**n.a.**	**30.5**

* denotes cases where the +/- 95% CL is greater than 80% of the original estimate
** a complete listing of non-regulated species is provided in Appendix 3
n.a. 95% CL have not been estimated for the combined non-regulated species in each group, and the total species for each of the three groups.

An estimated 6.51 million marine finfish were caught by SA recreational fishers during 2007/08, with around 85% of this catch, comprising regulated species (Table 5). King George Whiting and Southern Garfish were the two most commonly caught species, with each having more than 1 million caught (approximately 1.8 and 1.0 million, respectively). In descending order, Australian Herring, Western Australian Salmon and Snapper were the next most numerous species caught. In terms of harvested numbers, a total of almost 3.9 million finfish were retained, with King George Whiting, Southern Garfish and Australian Herring comprising a significant proportion (almost 69%) of the harvest. Release rates varied widely according to species, and are discussed below (see Table 8).

For the marine shellfish, an estimated total catch of about 3.3 million animals were taken by recreational fishers, with Blue Swimmer Crab (57.1%) and Southern Calamari (15%) and Pipi (9.5%) being the three most numerous species taken (Table 6). Indeed, for all the species reported during this survey, the Blue Swimmer Crab

was the most commonly caught species (around 1.9 million). The order of importance of numbers harvested for these species was similar to that for total catch.

Finally, for the freshwater species, an estimated total of 332 856 finfish and other species were caught, with European Carp (39.3%), Golden Perch (27.5%) and freshwater yabbies (18.5%) being the three most numerous species taken (Table 7). The order of importance of numbers harvested was similar to that for the total catch.

Overall, a total of 2.64 million marine finfish, 0.88 million marine shellfish species and 0.1 million freshwater species were released (Tables 5, 6 & 7). Highest release rates (> 70%) were reported for black bream, Mulloway, Murray Cod, Snapper and the two freshwater species fully protected in the River Murray (i.e. freshwater catfish and silver perch), whereas lowest release rates (< 10%) were reported for Samsonfish, razor fish, Southern Calamari, scallops, Pipi, and the noxious species, European Carp. The results on release rates are summarised in Table 8 which shows a continuum from those species rarely released (i.e. mainly harvested) to those almost exclusively released.

Table 8: Summary table indicating groupings based on the proportion of the recreational catch for regulated species that was released by fishers during 2007/08.

Released **Harvested**

Proportion Released				
> 70%	**51 – 70%**	**31 – 50%**	**10 – 30%**	**< 10%**
Black Bream	Western blue groper	Western Australian Salmon	Australian Herring	Samsonfish
Mulloway	Sweep	Bight redfish	Flounder	Blacklip Abalone
Snapper	Tuna	Flathead	Southern Garfish	Pipi (Goolwa cockle)
Freshwater catfish	Sand crabs	Mullet	Blue morwong	Razor fish
Murray Cod	Southern Rocklobster	School shark	Gummy shark	Scallops
Silver Perch	Golden Perch	Trevally	Snook	Southern Calamari
		Blue Swimmer Crab	King George Whiting	European Carp
				Freshwater yabbies

8.2 Harvest Weights

Catch information reported during the diary survey was based on numbers rather than weight or size (length) since these latter parameters tend to be less reliably estimated when self-reported by recreational fishers and also represent an added burden for diarists generally. However, the weight of the recreational harvest is of particular importance to resource managers, scientists, the fishing community (commercial and recreational) and other stakeholder groups with an interest in the

aquatic environment. Commercial production is generally reported in terms of weight (PIRSA, 2006).

It is possible to approximate the recreational harvest by multiplying the numbers caught by average weight of the harvested species. However, reliable assessment and estimation of average weights needs to account for varying size (and age) over different spatial and temporal scales and also in terms of fishing platform, method of capture or the relative skills of recreational fishers.

The sampling design and effort required to obtain representative size compositions of harvested fish is considerable, especially with such large and diverse environments in SA. Various details of the on-site surveys and logbook program are summarised in Sections 4 and 5 of this report, with more complete information (including length/weight relationships) provided in Jones (2007).

In terms of recreational harvest weights (Table 9), a number of species emerge as significant, with King George Whiting, Snapper, Blue Swimmer Crab, Southern Calamari, European Carp all exceeding 100 tonnes. Also, the conversion of harvested numbers to harvest weights has an impact on the relative importance of some species, for example, Snapper (177 tonnes), the tunas (44 tonnes) and, possibly yellowtail kingfish (100 tonnes). By contrast, reduced ranking occurred for smaller species, included Southern Garfish (75 tonnes), Mullet (28 tonnes) and Pipi (5 tonnes).

The provision of harvest weights for selected species enabled comparison with commercial production levels and has relevance for stock assessment and management, including issues relating to resource sharing and allocation. For a number of regulated species in the marine finfish, marine shellfish and freshwater groups, the recreational harvest either equalled or exceeded commercial production for species such as King George Whiting (50% of the total harvest), Mulloway (62%) and Murray Cod (100%). Others comprised substantial minorities of total harvest such as Snapper and Southern Garfish (each about 20%), Blue Swimmer Crab (30%), Southern Calamari (41%) and Golden Perch (28%), whilst others were relatively low (i.e. abalone (0.2%), Pipi (0.8%) and Southern Rocklobster (about 3%)).

Table 9: Annual harvest (numbers), average weight (kg), estimated harvest weight (kg, live wt) and % of total harvest for key and other regulated species taken by SA recreational fishers in SA during 2007/08, based on SA residents aged 5 years or older, compared with the commercial harvest for 2007/08.

Common name	Harvest numbers	Mean Live Weight (kg)	Estimated rec. harvest (kg) and % total harvest	SA Commercial harvest (kg, live wt)
Whiting, King George	1,249,079	0.259	324,268 (49.6 %)	330,074
Garfish	807,743	0.093	74,823 20.5%	290,143
Australian herring	598,774	0.155	93,037 (43.3%)	122,012
Australian salmon	303,307	0.301	91,302 (45.0%)	111,632
Mullet	151,654	0.182	27,601 (10.1%)	245,243
Snook	121,663	0.68	82,741 (50.3)	81,856
Snapper	97,010	1.82	177,551 (19.3%	742,721
Whiting, yellowfin	71,120	0.325	23,114 (22.0%)	81,904
Trevally	39,889	0.292	11,648 (52.7%)	10,475
Flathead	38,873	0.473	18,387 (88 %)	2,518
Sweep	32,979	0.261	8,698 (87.4%)	1,249
Bight redfish, nannygai	25,050	0.61	15,281 (84 %)	3,186
Bream, black	19,971	0.293	5,852 (49.4)	5,519
Mulloway	10,171	2.02 (Coorong Lagoon) 10.03 (marine)	61,683 (61.7%)	38,332
Shark, gummy	4,443	4.198	18,652 (16.2%)	98,206
Kingfish, yellowtail	3,925*	25.625	100,578	n.a.
Tuna, SBT, YFT, albacore	2,425*	18.215	44,171 (100%)	0
Shark, school	1,278	7.421	9,484 (44.4%)	11,884
Flounder	1,249	0.203	254 (11.2%)	2,020
Morwong, blue	1,150	1.087	1,250 (45.5%)	1,495
Groper, western blue	714*	11.0[A]	7,854 (96.8%)	256
Samson fish	467*	21.7[A]	10,134	n.a.
Crabs, blue swimmer	1,144,837	0.248	283,687 (29.8%)	668,446
Southern calamary	484,456	0.426	206,196 (40.5%)	303,158
Goolwa pipis	306,107*	0.016	4,959 (0.8%)	607,250
Razor fish	148,593	1.0[A]	148,593 (94.5%)	8,599
Scallops	98,290*	0.049	4,816	n.a.
Cockles, mud	91,994*	0.011[A]	1,012 (0.3%)	319,587
Southern rock lobster	47,875	1.254	60,035 (2.6%)	2,309,000
Crabs, sand	28,634*	0.388	11,110 (15.1%)	62,707
Cuttlefish	6,159*	0.237	1,460 (18.6%)	6,394
Abalone - greenlip	3,462	0.474	1,690 (0.4%)	408,800
Abalone - blacklip	1,685	0.394	658 (0.1%)	474,900
Carp, European	129,012	2.345	302,529 (29.8%)	713,000
Yabbies, freshwater	46,565	0.083	3,865	n.a.
Perch, golden (callop)	39,861	1.001	46,492 (28.4%)	117,060
Perch, redfin	5,216	0.367	1,914 (6.2%)	28,875
Perch, silver	1,840*	0.158[A]	291 (100%)	0
Murray cod	507*	4.164	2,111 (100%)	0
Catfish, freshwater	259*	0.328[A]	85 (100%)	0

n.a. commercial harvest is from less than 5 licence holders
* denotes cases where the +/- 95% CL is greater than 80% of the original estimate
A: Average weights based on limited empirical data, “best-guess” estimates.

9. KEY SPECIES

In this section, annual catch estimates (incl. harvest and release) for the 12 key species are disaggregated in terms of regional distribution, fishing platform and method of capture. Expanded catch information has been graphically presented here as estimates and in tables with associated 95% CL's in Appendix 4.

9.1 King George Whiting (*Sillaginodes punctatus*)

An estimated 1 797 148 (± 354 491) King George Whiting were caught by SA residents throughout SA in 2007/08, with 1 249 079 (± 259 316) of these harvested and 548 069 (± 122 165) released representing a release rate of 30.5% (Table 5A; Appendix 4A).

King George Whiting was the most frequently caught marine finfish species that was caught in SA by recreational fishers, with highest total and harvested numbers in Spencer Gulf, followed by Gulf St. Vincent and KI and West Coast (Figures 10A and B). By contrast, all three major regions (West Coast, Spencer Gulf and Gulf St. Vincent and KI) reported similar numbers of fish released (Figure 10C). The highest proportion of the harvest weight occurred in Spencer Gulf (Figure 10D). Numbers and harvested weight of King George Whiting caught in the South East waters were consistently low (1%).

Virtually all the King George Whiting caught by SA recreational fishers were taken with baited or lure-attached lines, with only a minute proportion (0.04%) taken by spear fishing.

Boat fishers harvested and released larger numbers of King George Whiting compared with those by shore fishers (Figure 11), although relatively higher release rates were reported by shore fishers (49.3%) than by boat fishers (29.2%).

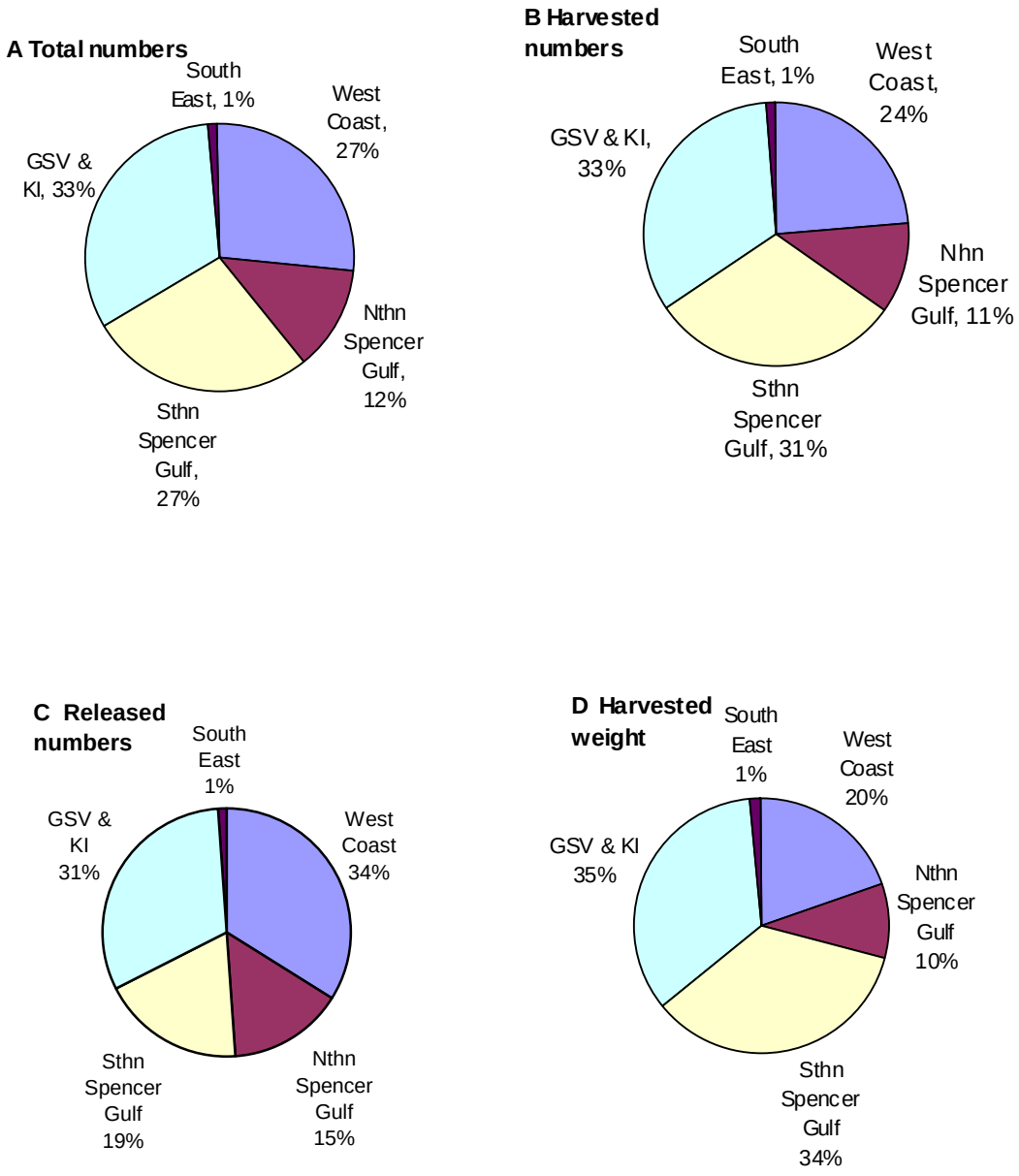


Figure 10: Regional proportional (%) catches of King George Whiting in SA by recreational fishers, aged 5 years or older; A: Total numbers; B: Harvested numbers; C: Released numbers and D: Harvested weight (kg, live wt).

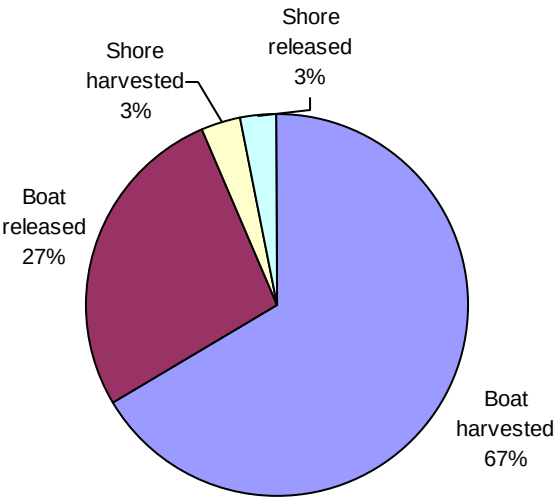


Figure 11: Proportion (%) of King George Whiting (numbers) harvested or released by boat or shore-based SA recreational fishers.

9.2 Snapper (*Pagrus auratus*)

An estimated 384 077 (± 118 117) Snapper were caught by SA residents throughout South Australia in 2007/08, with 97 010 (± 29 165) of these harvested and 287 067 (± 103 464) released representing a release rate of 74.7 % (Table 5A; Appendix 4B). Snapper were caught in all marine waters of the state (Figure 12), with high numbers (total, harvested and released) taken in the Gulfs, and most significantly in Gulf St. Vincent and KI (Figures 12A, B and C). Because the average size of harvested Snapper in Spencer Gulf was higher than for Gulf St. Vincent and KI, the proportion of the harvested weight taken in Spencer Gulf, was the highest of all areas (Figure 12D).

Line fishing (bait or lure) was the main method of capture (99.6%), with the remainder (0.4%) taken by spear fishing. Boat-based fishers dominated the numbers of Snapper harvested or released (Figure 13).

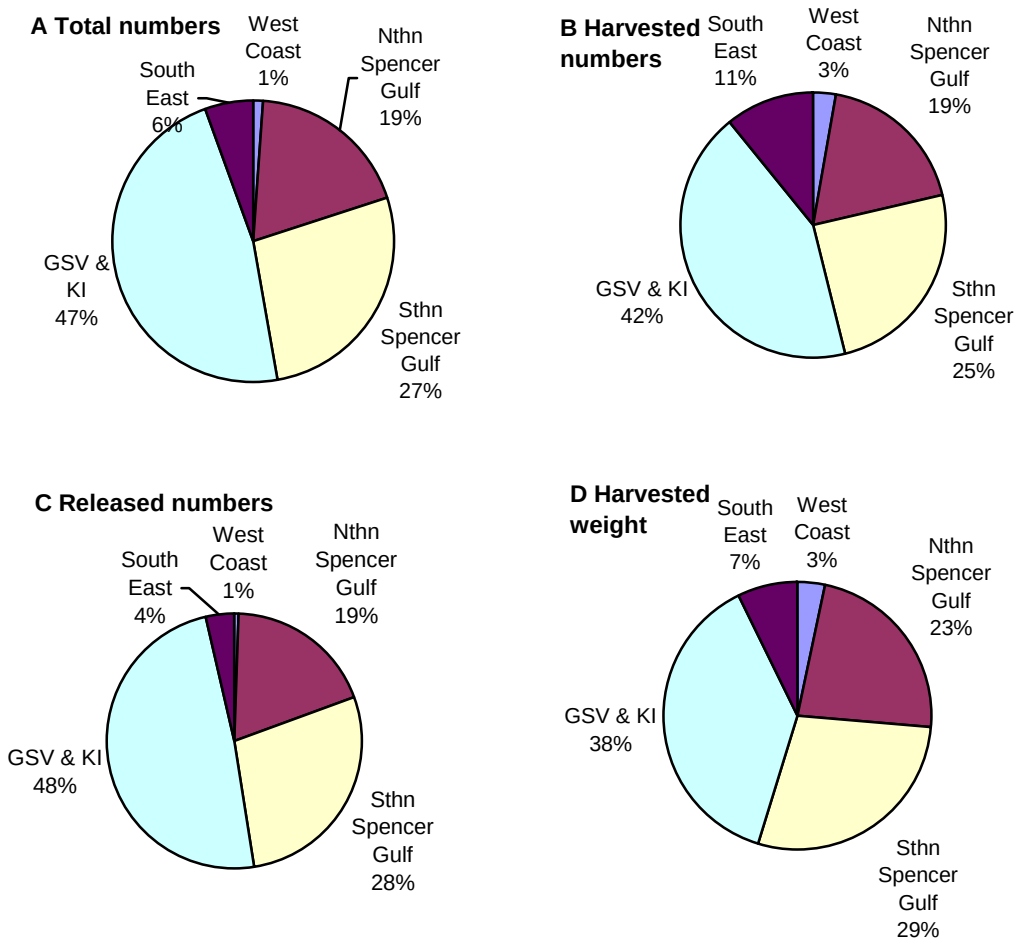


Figure 12: Regional proportional (%) catches of Snapper in SA by recreational fishers, aged 5 years or older; A: Total numbers; B: Harvested numbers; C: Released numbers and D: Harvested weight (kg, live wt).

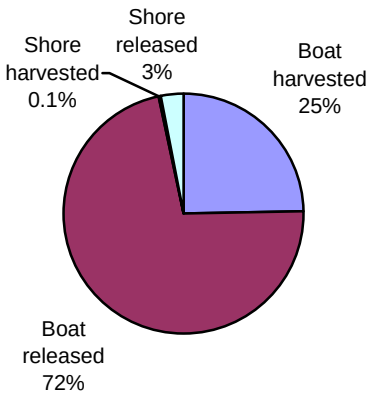


Figure 13: Proportion (%) of Snapper (numbers) harvested or released by boat or shore-based SA recreational fishers.

9.3 Southern Garfish (*Hyporhamphus melanochir*)

An estimated 1 001 653 (± 357 912) Southern Garfish were caught by SA residents throughout South Australia in 2007/08, with 807 743 (± 290 296) of these harvested and 193 910 (± 86 075) released, representing a release rate of 19.4% (Table 5A; Appendix 4C). The highest numbers of Southern Garfish (total and harvested) were taken in Spencer Gulf with Gulf St. Vincent and KI the second most important area (Figures 14A and B). Despite different average weights of Southern Garfish by area, the proportions of harvest weight were largely similar to the harvested numbers by area (Figures 14B and D).

Line fishing for Southern Garfish was the predominant method (88.4%) and the remainder almost exclusively taken by surface dab netting (11.6%). Line fishers released relatively more Southern Garfish (95.5%) compared with those by dab netters.

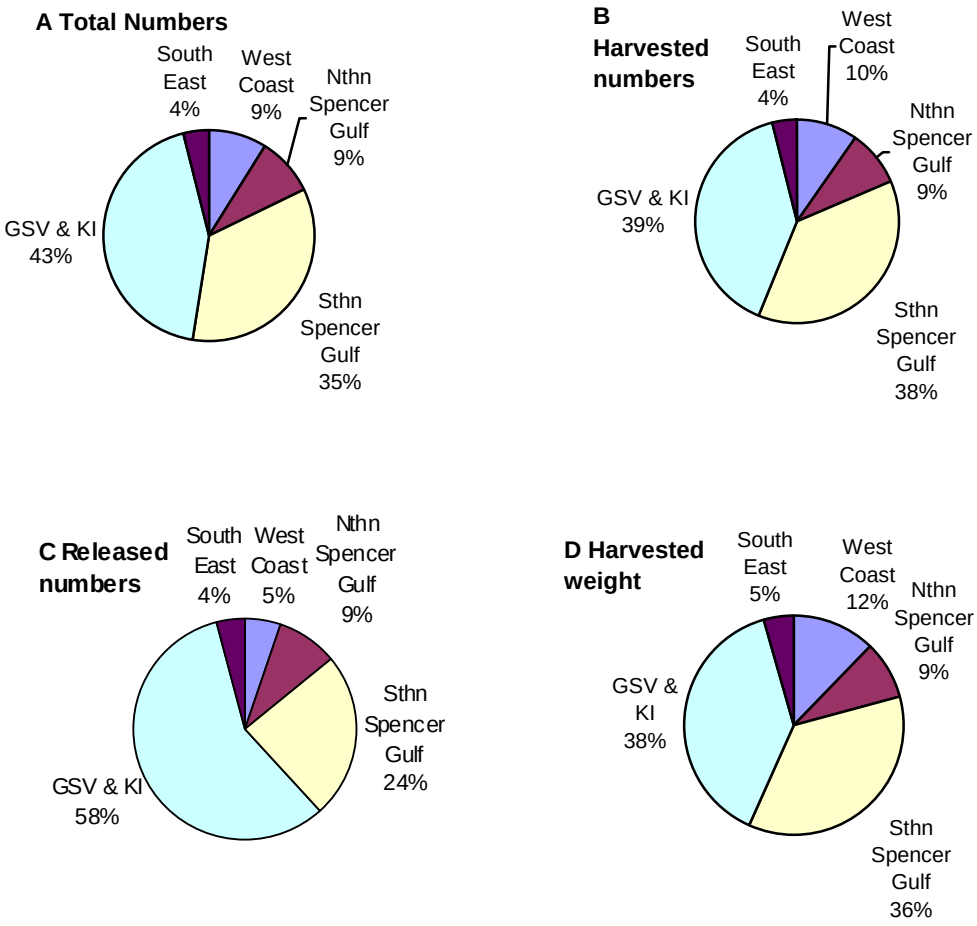


Figure 14: Regional proportional (%) catches of Southern Garfish in SA by recreational fishers, aged 5 years or older; A: Total numbers; B: Harvested numbers; C: Released numbers and D: Harvested weight (kg, live wt).

Most Southern Garfish were taken by boat fishers (90%), and relatively low numbers released by both boat and shore based fishers (Figure 15).

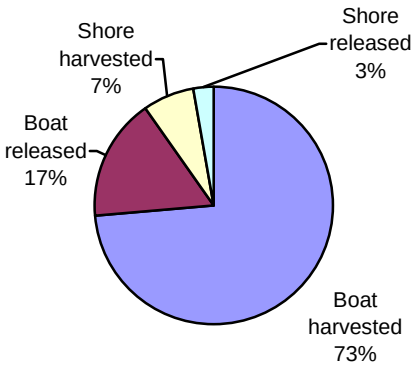


Figure 15: Proportion (%) of Southern Garfish (numbers) harvested or released by boat or shore-based SA recreational fishers.

9.4 Southern Calamari (*Sepioteuthis australis*)

An estimated 492 736 (± 133 325) Southern Calamari were caught by SA residents throughout South Australia in 2007/08, with 484 456 (± 130 881) of these harvested and 8 281 (± 11 209) released, resulting in a release rate of 1.7 % (Table 5B; Appendix 4D). The total catch of Southern Calamari was predominantly harvested, with consistently low release rate in all areas (Appendix 4D). Both the total numbers caught and the harvested weights were dominated by catches in Gulf St. Vincent and KI and Spencer Gulf (Figures 14A and B).

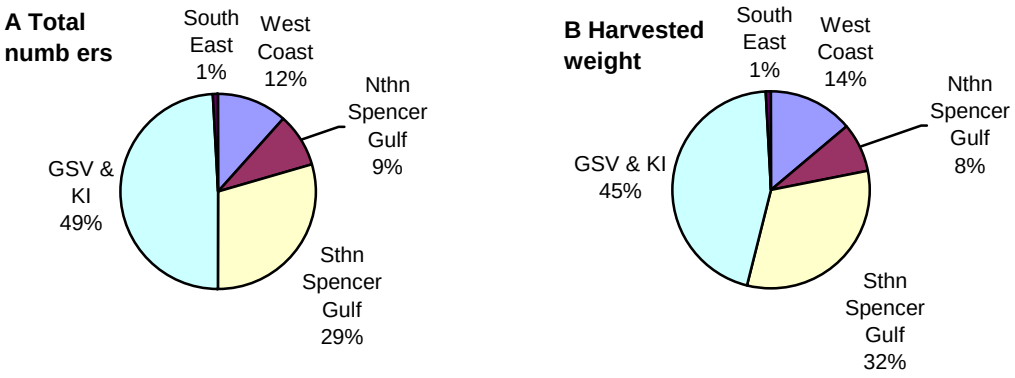


Figure 16: Regional proportional (%) catches of Southern Calamari in SA by recreational fishers, aged 5 years or older; A: Total numbers and B: Harvested weight (kg, live wt).

Almost all Southern Calamari were taken by recreational fishers using squid jigs (99.8%), with very small numbers taken by spear-fishing or crab nets. Boat-based fishers accounted for the majority of calamari harvested, over twice the number by shore-based fishers (Figure 17).

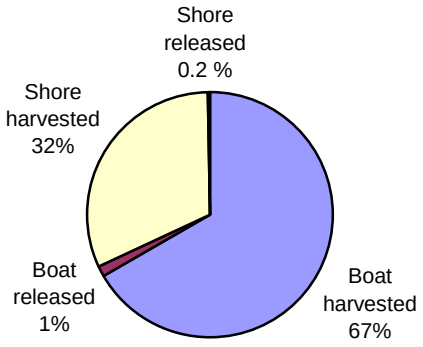


Figure 17: Proportion (%) of Southern Calamari (numbers) harvested or released by boat or shore-based SA recreational fishers.

9.5 Blue Swimmer Crab (*Portunus pelagicus*)

An estimated 1 876 490 (± 385 297) Blue Swimmer Crabs were caught by SA residents throughout SA in 2007/08, with 1 144 837 (± 268 749) harvested and 731 653 (± 160 107) released representing a release rate of 39.0 % (Table 5B; Appendix 5E). Highest total, harvested and released numbers were reported from Gulf St. Vincent and KI, followed by Spencer Gulf, with a small minority from the West Coast (Figures 18A, B and C); however, due to higher average weights for Blue Swimmer Crab, the proportion of harvest weights in Spencer Gulf sightly exceeded the Gulf St. Vincent and KI estimate (Figure 18D).

In contrast to many finfish species, Blue Swimmer Crabs were taken by a large range of methods of capture (Figures 19A and B). Highest harvested and released numbers were taken by crab nets (hoop or drop nets), with hand-held crab rakes the second most important method. Blue Swimmer Crabs are often taken on baited lines, and this was the third most significant method. Less significant methods included surface dab netting, diving and spearing. Release rate by fishers using handheld rakes was higher than for other methods, thereby raising their proportion of released catch (Figure 19B).

A majority of the total catch of Blue Swimmer Crab (64%) was taken by boat-based fishers with higher release rates for shore-based fishers (Figure 20).

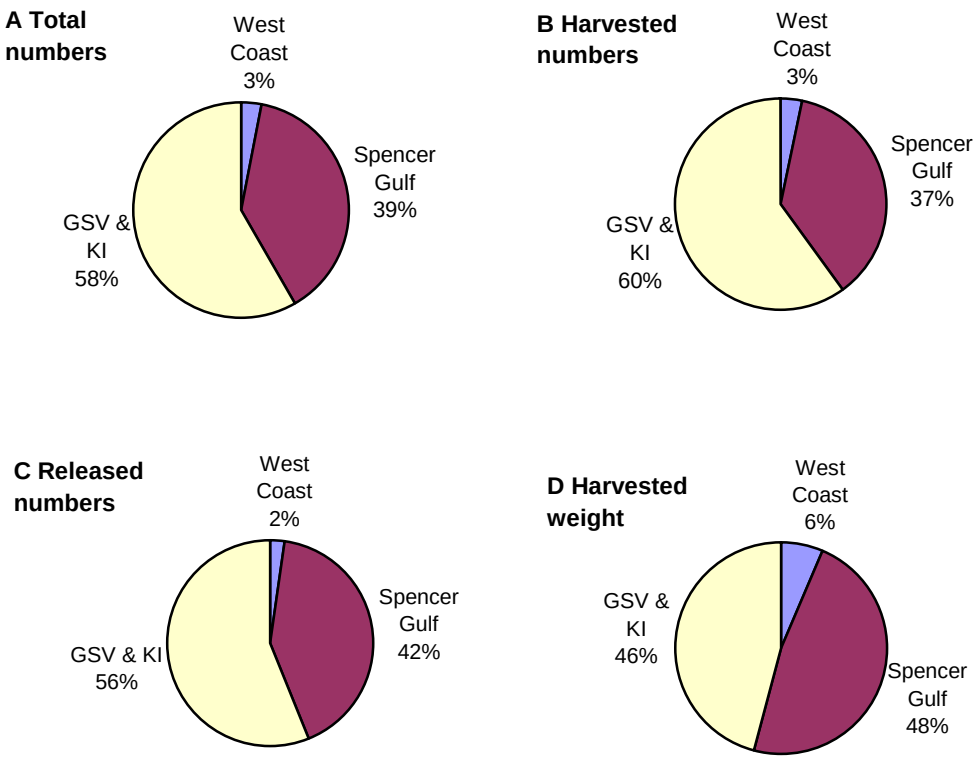


Figure 18: Regional proportional (%) catches of Blue Swimmer Crab by SA recreational fishers, aged 5 years or older; A: Total numbers; B: Harvested numbers; C: Released numbers and D: Harvested weight (kg, live wt).

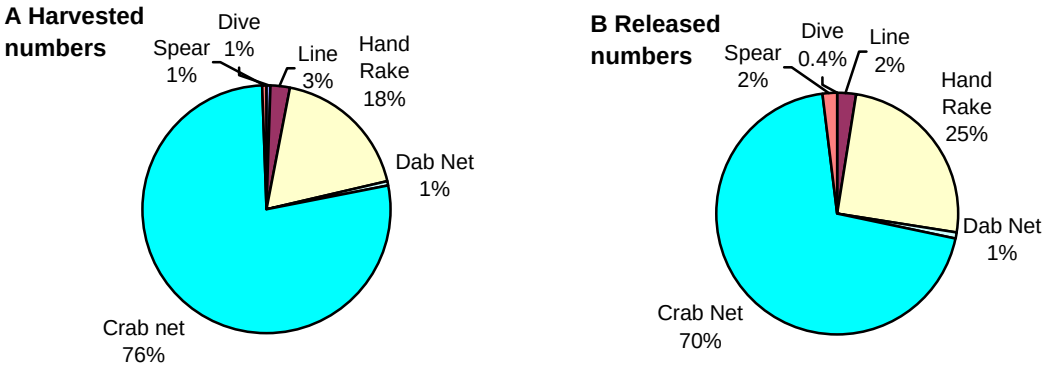


Figure 19: Proportion (%) catches of Blue Swimmer Crab by the different methods of capture by SA recreational fishers, aged 5 yrs or older; (A) Harvested numbers and (B) Released numbers.

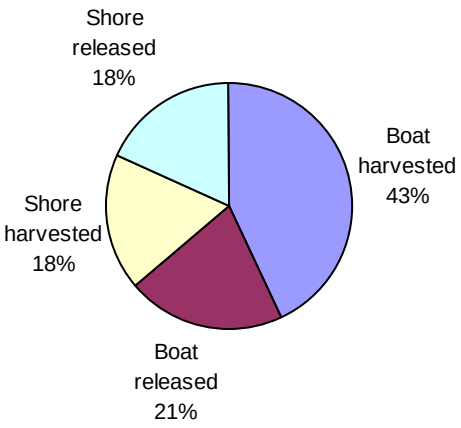


Figure 20: Proportion (%) of the Blue Swimmer Crab catch (numbers) harvested or released by boat or shore-based SA recreational fishers.

9.6 Southern Rocklobster (*Jasus edwardsii*)

An estimated 106 483 (± 54 423) Southern Rocklobster were caught by SA residents throughout SA in 2007/08, with 47 875 (± 20 331) of these harvested and 58 608 (± 36 148) released, representing a release rate of 55.0% (Table 5B; Appendix 4F).

The catches of Southern Rocklobster are reported here according to the two management zones. The Southern Zone is defined as Regions 22 – 25 and the Northern Zone covers the remainder of the SA coast. Higher total, harvested and released numbers and harvested weights were taken in the Southern Zone (Figures 21A, B, C and D; Appendix 4F). Higher release rates were reported in the Southern Zone (56.6%), compared with those from the Northern Zone (30.2%).

Rock lobster pots/nets were the main method of capture (96%) with various diving methods accounting for the remainder (Figure 22). The proportion taken by rock lobster pots, as opposed to drop nets is the subject of further analysis, however, the on-site surveys indicated that drop nets comprised a very small proportion of the total harvest.

The majority of the total Southern Rocklobster catch was taken by boat-based fishing (75%) with similar release rates for boat-based (54.7%) and shore-based fishers (56.1%).

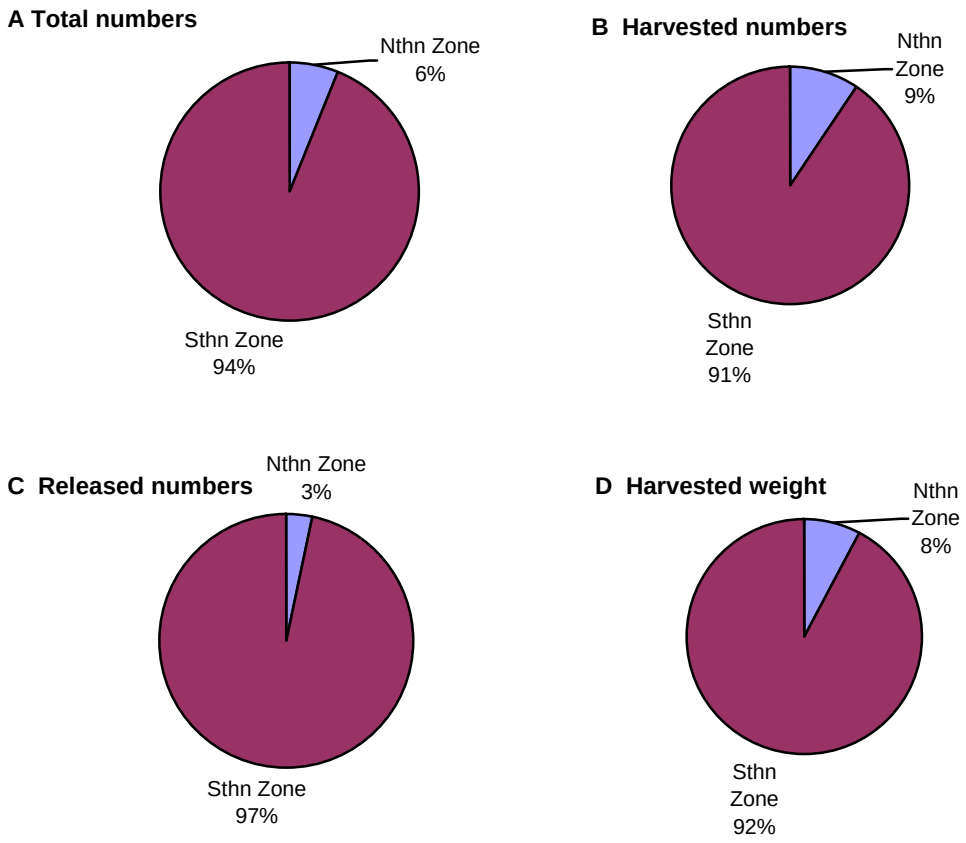


Figure 21: Regional proportional (%) catches of Southern Rocklobster in SA by recreational fishers, aged 5 years or older; A: Total numbers; B: Harvested numbers; C: Released numbers and D: Harvested weight (kg, live wt).

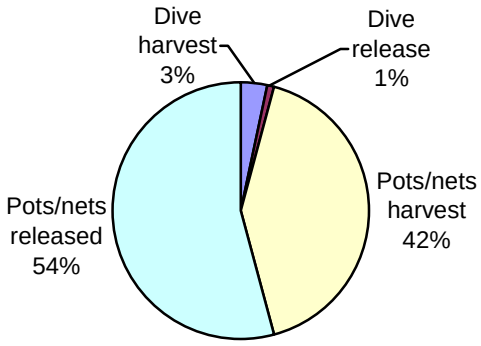


Figure 22: Proportion (%) of the harvested and released catch of Southern Rocklobster taken by the different methods of capture by SA recreational fishers, aged 5 yrs or more.

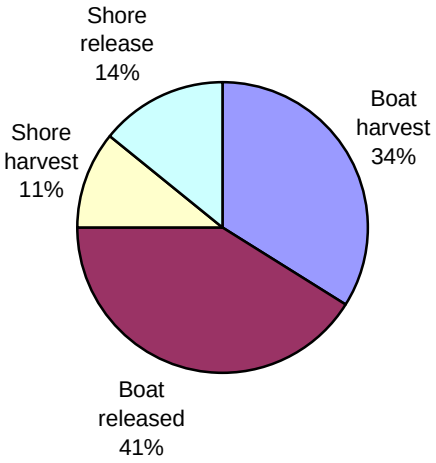


Figure 23: Proportion (%) of Southern Rocklobster (numbers), harvested or released by boat or shore-based SA recreational fishers.

9.7 Mulloway (*Argyrosomus hololepidotus*)

An estimated 68 038 (± 47 201) Mulloway were caught by SA residents throughout South Australia in 2007/08, with 10 171 (± 6 219) of these harvested and 57 868 (± 43 667) released, representing a release rate of 85.1 % (Table 5A; Appendix 4G). Mulloway were reportedly taken by recreational fishers throughout much of inshore waters of SA, and most significantly within the Coorong Lagoon (Figures 24A, B and C). In most regions, significantly more Mulloway were released than harvested (Appendix 4G). Because of the lower minimum size limit applied to Mulloway within the Coorong Lagoon, and despite the highest numbers harvested there, highest proportions of the total harvest weight occurred in other coastal areas (Figure 24D).

The vast majority of Mulloway were caught by line, fishing with bait or lures (Figure 25) and in largely equal proportions by boat and shore-based fishers (Figure 26).

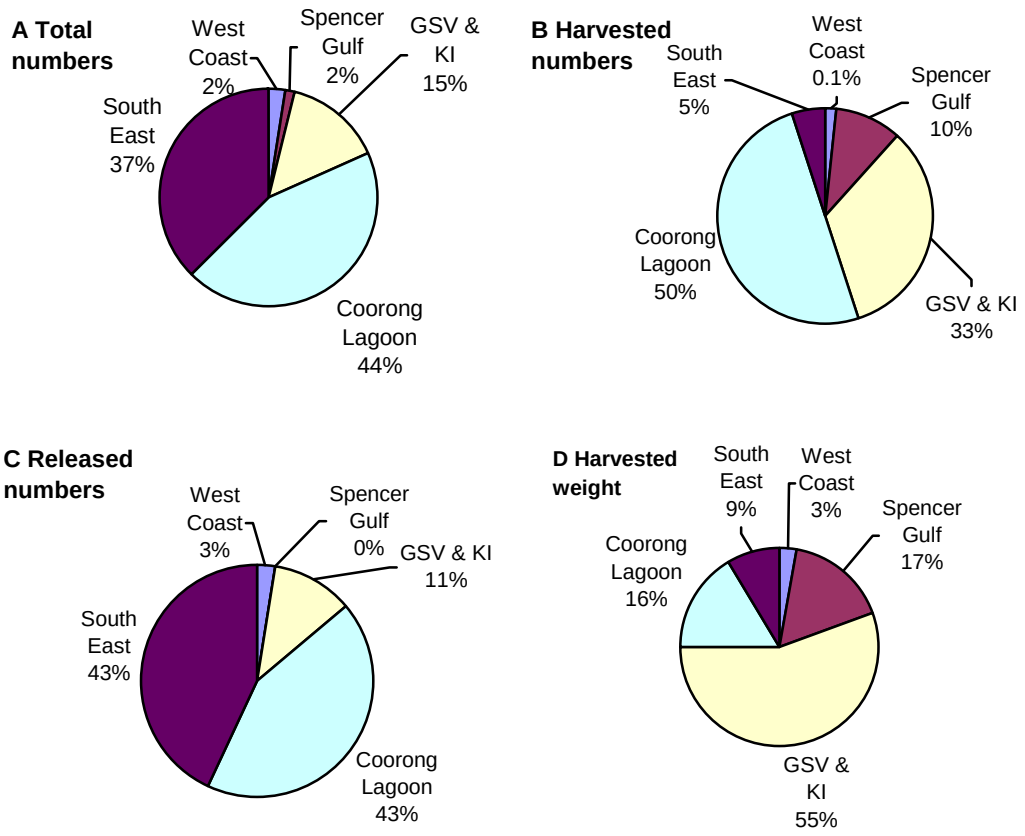


Figure 24: Regional proportional (%) catches of Mulloway in SA by recreational fishers, aged 5 years or older; a: Total numbers; B: Harvested numbers; C: Released numbers and D: Harvested weight (kg, live wt).

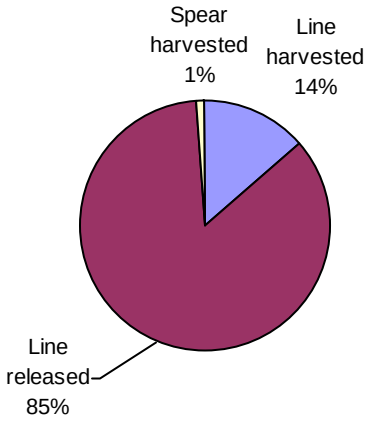


Figure 25: Proportion (%) of the harvested and released catch of Mulloway taken by the different methods of capture by SA recreational fishers, aged 5 yrs or more.

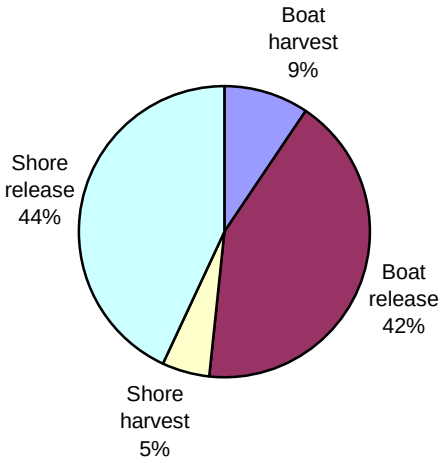


Figure 26: Proportion (%) of Mulloway (numbers) harvested or released by boat or shore-based SA recreational fishers.

9.8 Blacklip Abalone (*Haliotis rubra*) and Greenlip Abalone (*H. laevigata*)

An estimated 1 907 (± 1 474) Blacklip Abalone and 4 689 (± 3 352) Greenlip Abalone were caught by SA residents throughout South Australia in 2007/08. Of these, 1 685 (± 1 303) Blacklip Abalone and 3 462 (± 2 221) Greenlip Abalone were harvested and 222 (± 308) Blacklip Abalone and 1 772 (± 1 325) Greenlip Abalone were released, representing release rates of 11.6% and 26.2%, respectively (Table 5B; Appendix 4H).

Despite the small numbers and associated precision the catch estimates for these two key species have been disaggregated for completeness. The three management zones are: Western Zone (Fishing Regions 1 – 7); Central Zone (Regions 8 – 21); Southern Zone (Regions 22 – 25).

Highest total, harvested and released numbers and harvest weights were consistently reported for Greenlip Abalone for the Western Zone (Figures 27A, B, C and D). Blacklip Abalone were harvested in all three management zones, whereas Greenlip Abalone were only reported from the Western and Central Zones.

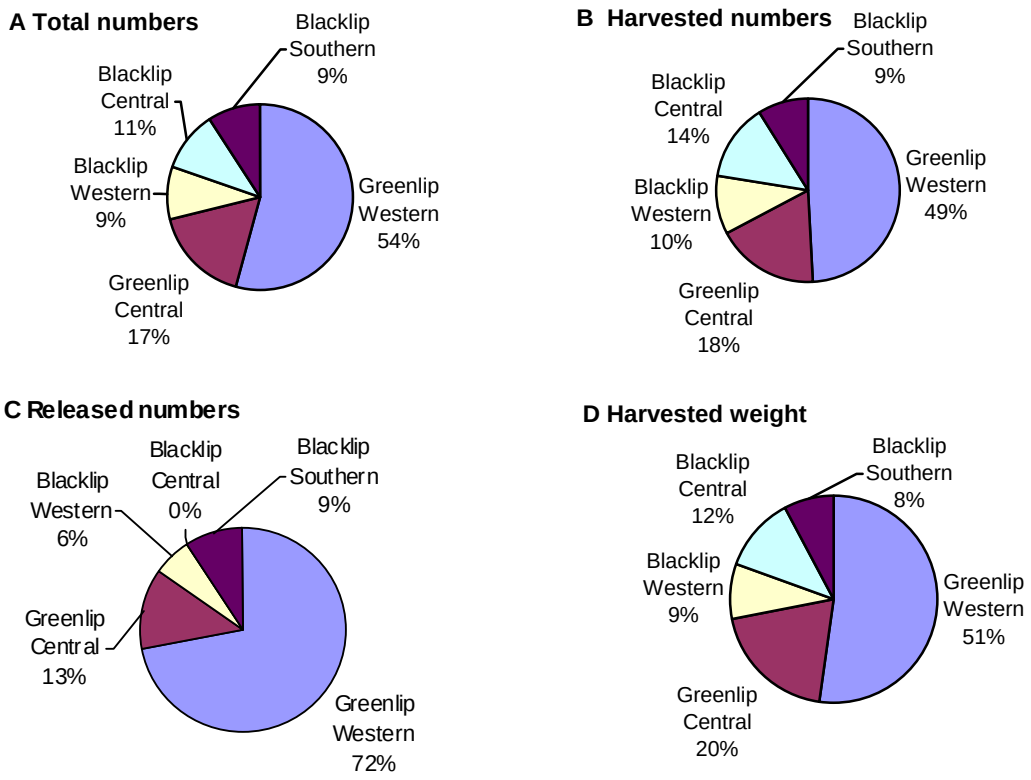


Figure 27: Regional proportion (%) catches of Greenlip Abalone and Blacklip Abalone in SA by recreational fishers, aged 5 years or older; A: Total numbers; B: Harvested numbers; C: Released numbers and D: Harvested weight (kg, live wt).

Greenlip Abalone were solely harvested by diving, whereas Blacklip Abalone were harvested by hand gathering from sub-tidal reefs (28%) and the remainder by diving. Divers either operated from boats or the shore to harvest both species (Figure 28A and B). Similar numbers of Greenlip Abalone were taken by boat and shore-based divers (Figure 28A), whereas, the majority of Blacklip Abalone were gathered by shore-based divers or hand-gatherers (Figure 28B).

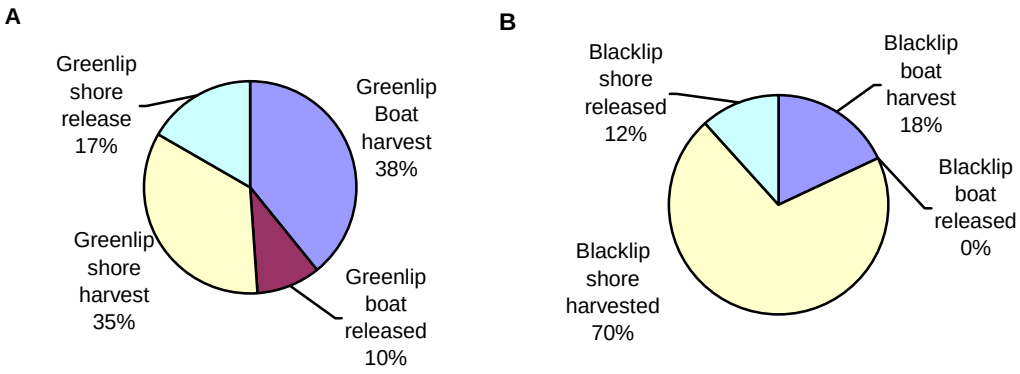


Figure 28: Proportion (%) of A: Greenlip Abalone and B: Blacklip Abalone harvested or released numbers by boat or shore-based SA recreational fishers.

9.9 Pipi (*Donax* spp.)

Throughout the state, an estimated 312 479 (± 312 228) Pipi (Goolwa cockle) were caught by SA residents in 2007/08 with 306 107 (± 309 909) harvested and 6 371 (± 12 450) released, representing a release rate of 2.1% (Table 5B; Appendix 4I). This species of intertidal surf clam was almost solely taken by hand-gatherers operating along the Goolwa Beach (Fishing Region 19) with only small quantities harvested from the shore in Fishing Regions 6 and 22. It should be noted that the estimates of total, harvested and released numbers for Pipi lack precision (95% CL are > 80%), principally due to the low sample size of fishers in the diary survey.

9.10 Golden Perch (*Macquaria ambigua*)

An estimated 91 530 (± 36 870) Golden Perch (callop) were caught by SA residents in 2007/08 with 39 861 (± 16 027) of these harvested and 51 669 (± 22 773) released, repenting a release rate of 56.5% (Table 5C; Appendix 4J). Golden Perch were taken primarily within the River Murray, with small numbers from the Lakes (Alexandrina & Albert) and the waters in the Lake Eyre basin. Highest total, harvested and released numbers were reported from the lower section of the River Murray (Fishing Region 28 - Wellington to Morgan), and the second most important fishing region was the upper River Murray (Fishing Region 29 - upstream from Morgan) (Figures 29A, B, C and D; Appendix 4J).

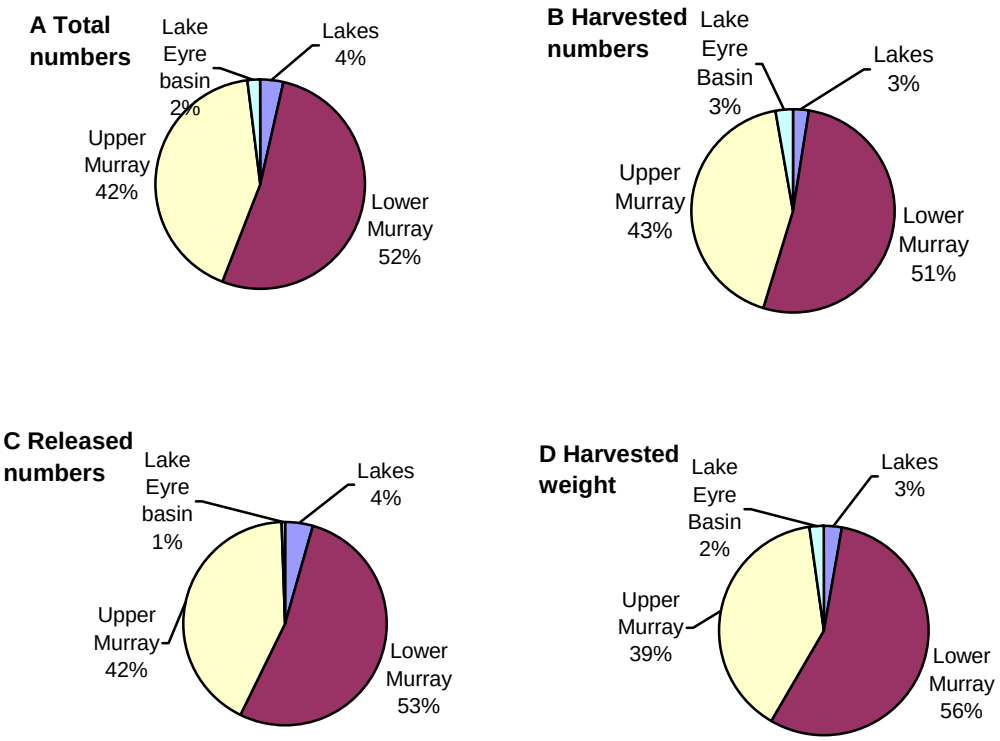


Figure 29: Regional proportional (%) catches of Golden Perch (callop) in SA by recreational fishers, aged 5 years or older; A: Total numbers; B: Harvested numbers; C: Released numbers and D: Harvested weight (kg, live wt).

Golden Perch were almost solely caught from lines (baited or lures), with a negligible proportion (0.2%) reported to be harvested using lift nets. A majority of the total catch was taken by boat-based fishers, with slightly higher release rates among shore-based fishers (Figure 30).

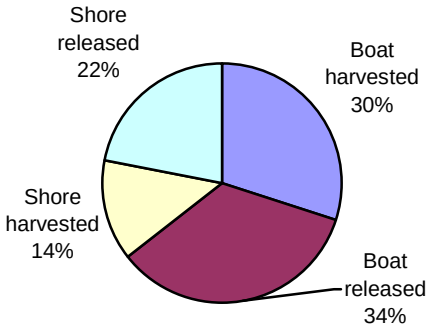


Figure 30: Proportion (%) of Golden Perch harvested or released by boat or shore-based SA recreational fishers.

9.11 Murray Cod (*Maccullochella* spp.)

Low sample numbers both of diarists reporting that they were fishing for Murray Cod as well as low numbers of harvested Murray Cod that were measured, resulted in low levels of precision for all estimates (numbers and harvest weights) for this species, and the figures provided should only be considered as indicative.

An estimated 1 853 (± 1 691) Murray Cod were reported to have been caught by SA recreational fishers in 2007/08, with 507 (± 971) harvested and 1 346 (± 1 384) released, representing a release rate of 72.7% (Table 5C; Appendix 4K). The lower River Murray (Fishing Region 28) was the only region where a harvest was reported, with only releases occurring in the upper River Murray (Region 29) and other inland waters of the state (Region 32) and none for the Lakes (Region 27) (Figure 31A; Appendix 4K). No Murray Cod were reportedly caught in the Lakes region (Region 27). Slightly higher total numbers were caught by boat fishers than shore based fishers (Figure 31B), and line fishing was the only method of capture.

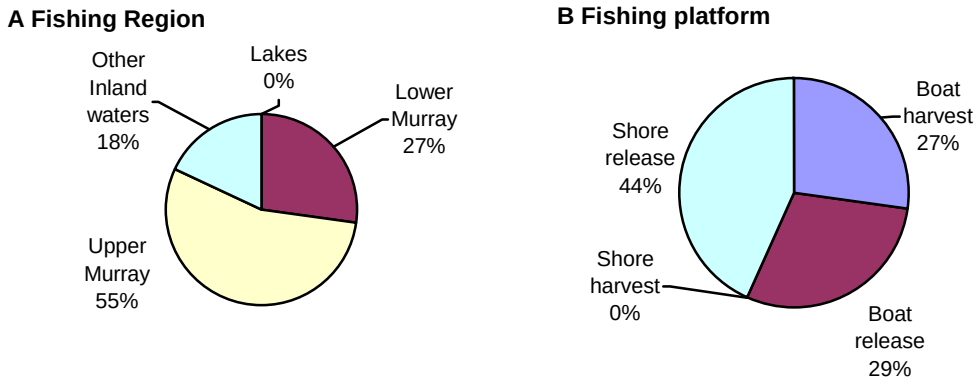


Figure 31: Proportion (%) of Murray Cod (numbers) caught by A: Fishing region, and B: Fishing platform, by SA recreational fishers during 2007/08.

10. COMPARISON WITH THE 2000/01 NRFS SURVEY

In this section, data from the SA component of the 2000/01 NRIFS are compared with the present results to examine changes in the fishery that may have occurred since that time. While the 2000/01 NRFS survey data have been reported previously by Henry and Lyle (2003) and in more detail by Jones and Doonan (2005) for SA, the current assessment has involved a complete re-analysis of the 2000/01 data using the statistical protocols developed for the present study. Previous analyses also included fishing activity in SA by non-residents; therefore the re-analysed estimates may not align with previously published data. In relation to comparability with the analysis of the 2007/08 data, the only difference has been in how the fisher 'drop-in' adjustment has been implemented. Although the national survey included a non-intending fisher follow-up component, the sample size was insufficient to allow a robust adjustment to be made, as undertaken for the present survey. For the re-analysis, equilibrium has been assumed, whereby fishers who 'dropped out' of the fishery were considered to be replaced by counterparts who 'dropped in', such that the participation rate and fisher characteristics determined at screening were applied to the diary period. Apart from this issue, the application of consistent methodology and analytical procedures means that the two data sets can be validly compared to identify trends in the fishery.

10.1 Response profiles

The response profiles for the screening and diary surveys for 2007/08 are fully discussed in Sections 5.1 and 5.2 of this report. These household profiles are compared with those for the 2000/01 SA survey (Table 10). The profiles show that in 2007/08, the sampling of potential recreational fishers was boosted by more than 2 300 households, in order to overcome the predicted lower participation rates in the more urban regions of the state.

Table 10: Response profiles of households participating in the screening and diary surveys in 2000/01 and 2007/08, based on the net sample (total gross sample less sample loss).

SAMPLE (Households)	2000/01	2007/08
Gross Sample	5,090	7,410
Sample loss (e.g. disconnects, business numbers)	668	910
Net sample	4,422	6,230
SCREENING SURVEY		
Full Response	3,785	5,541
Non-response (full and partial refusals, non-contacts, language difficulties)	637	689
% Response	85.6	88.9
DIARY SURVEY		
Eligible Households	1,451	1,392
Diary Uptake	1,308	1,310
Diary Completion	1,220	1,261
% Uptake	90.1	94.1
% Completion	93.3	96.3
% Response (among Eligibles)	84.1	90.6
No. Fished during diary survey	1,032	1,009
% Fished (among Completions)	84.6	80.1

The excellent response rate achieved for the screening survey in 2007/08 (88.9%) represents an improvement over the 2000/01 results and is largely attributable to interviewer skill. Similarly, response profiles for all aspects of the diary survey in 2007/08 were higher than for the 2000/01 diary survey. Despite the higher number of households sampled in 2007/08, compared with 2000/01, the final number of households who were eligible for the diary survey was slightly lower in 2007 (1 392) compared with 2000 (1 451). However, the number of survey participants who completed the latest diary survey (1 261) was marginally higher than in the 2000/01 survey (1 220) and the proportion of households who fished during the survey period decreased from 84.6 % in 2000/01 to 80.1% in 2007/08. The average number of fishing events per fisher also dropped from 8.6 to 7.0. These latter decreases are consistent with changes discussed in the remainder of this section.

10.2 Fisher Characteristics

10.2.1 Participation rates

In 2000 an estimated 317 223 (± 24 665) South Australian residents aged 5 or older fished at least once in the previous 12 months (Appendix 5A), whereas by 2007 this number had fallen to 236 463 (± 17 003) persons, representing a 25.7% decrease. When expressed as participation rates (i.e. proportion of the resident population), the decrease from 23.4% in 2000 declining to 16.1% in 2007 is proportionally greater (31.2%), due to population growth during the period.

Compared with 2000, there were fewer estimated fishers and lower participation rates in each of the SDs (Figures 32A and B). In both years, the numbers of fishers was notably highest in the mostly urban Adelaide SD; however, its participation rates were the lowest in both years. The Eyre SD was the region with the lowest numbers

of resident fishers; however, its participation rates were highest. The decrease in participation rate was the highest for the Murraylands SD (36.3% to 21.5%), followed by the Northern SA SD (32.2% to 19.8%).

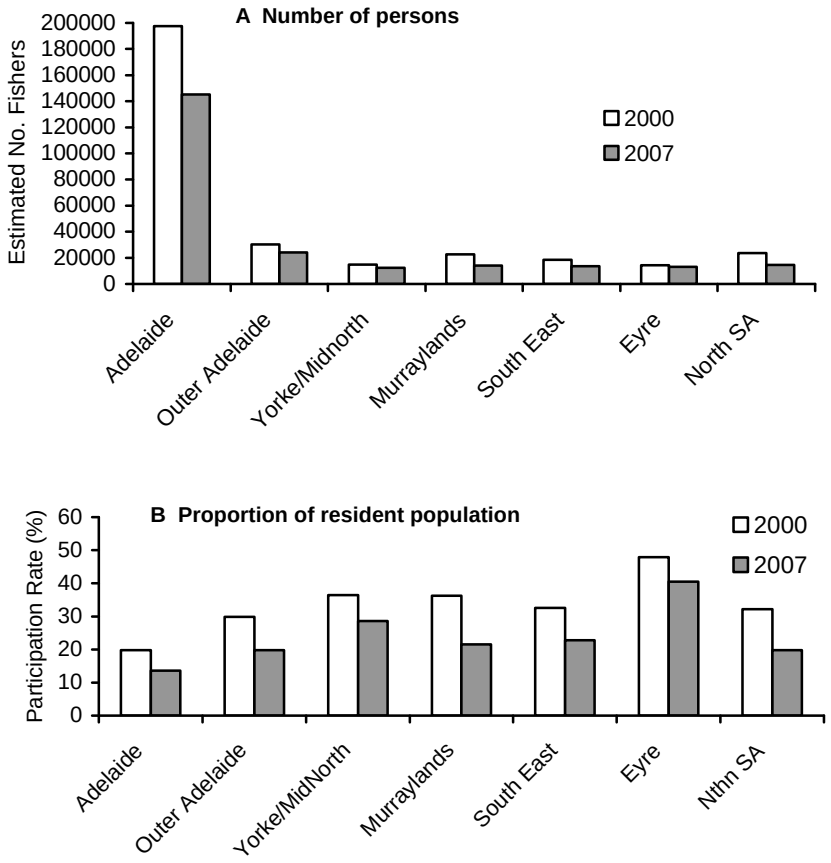


Figure 32: Fishing participation in the 12 months prior to May 2000 or October 2007 by Statistical Division for persons aged 5 or older; A: Number of persons and B: Proportion (%) of the resident population.

10.2.2 Age and gender

In absolute terms, the decline in participation was more pronounced amongst females, from 106 343 in 2000 to 70 170 in 2007 (a 34% decease), than for males from 210 781 in 2000 to 166 295 in 2007 (21% lower). When expressed as participation rates, more pronounced decreases emerge among females from 15.4% in 2000 to 9.5% in 2007 (a 38.3% decrease), and for males, 31.7% in 2000 to 23.0% in 2007 (27.4% lower).

Based on age, the younger age groups dominated participation in 2000 and 2007, with the middle age group (30 – 44 years) accounting for the greatest number of fishers in both years (Figure 33A). Despite higher participation rates in both years the younger age groups accounted for the greatest decreases in participation rates

from 2000 to 2007, with the older age groups (> 45 years) relatively stable (Figure 33B).

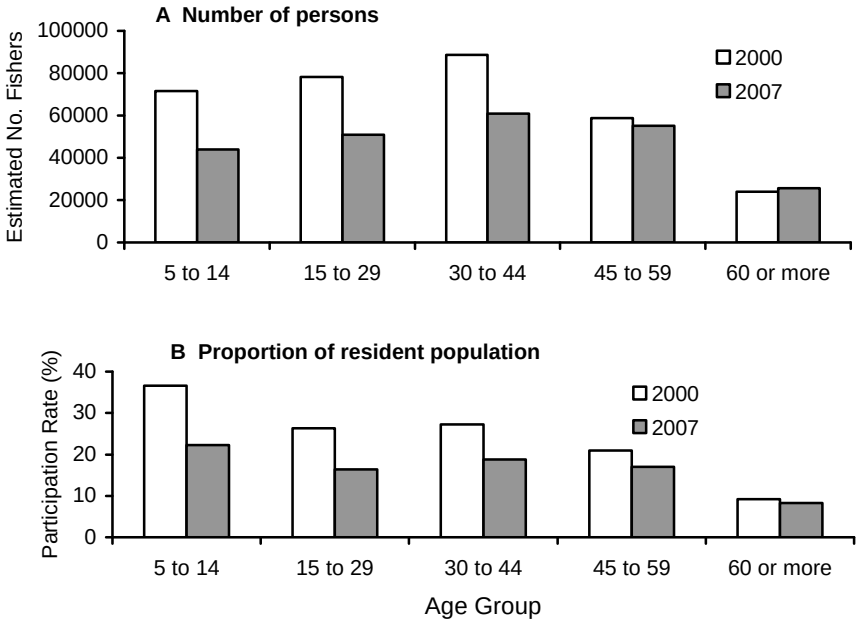


Figure 33: Fishing participation by age group for SA residents aged 5 or older for 2000 and 2007; A: Number of persons and B: Proportion (%) of the resident population.

10.2.3 Participation rate trend since 1983

Two previous surveys on recreational fishing participation in SA were undertaken prior to 2000. The first one, done in 1982/83 was undertaken by the (then) SA Department of Recreation and Tourism, in conjunction with the ABS (Philipson *et al*. 1986). This face-to-face survey of 0.5% of the SA residents included questions relating to whether they went recreational fishing, where and how many times in each quarter of 1982/83. However, the survey only interviewed recreational fishers aged 10 years or more. Since the grouping of survey respondents by age in this survey was inconsistent with later surveys, it has only been possible to compare the estimates for recreational fishers aged 15 years or older for the 1982/83, 2000 and 2007 surveys.

In the 1982/83, during the quarter when numbers of recreational fishers were at their highest (autumn, 1982), an estimated 244 602 SA residents fished, which represented a participation rate of 24.4% of the SA population at the time. This is considered a minimum as it does not take into account additional SA residents who only fished in other quarters of that year. Using the same age criterion, there were an estimated 249 646 fishers in 2000 and 192 598 in 2007, representing participation rates of 21.5% and 15.2%, respectively.

A second survey on recreational fishing participation was done in 1997. In the first week of February, 1997, the Marketing Research Centre of the University of South Australia undertook a survey of recreational fishing in South Australia for the then PISA Fisheries. The objectives and method of the 1997 survey were similar to those of the two most recent surveys (2000/01 & 2007/08), except that catches and levels of fishing effort were not estimated (Cierpicki *et al*,1997). To obtain participation estimates, more than 1 110 households were randomly selected from the electronic white pages for metropolitan and country SA. One member of each household aged 16 years or more was interviewed using a telephone administered questionnaire by accredited interviewers. All answers to the questionnaire related to the interviewee's 12 month recall of information, and the data obtained from the survey were expanded to the SA population based on the 1995 census. The survey estimated that a total of 453 000 (± 54 000) SA residents aged 5 years or more, had fished recreationally in the 12 months prior to Feb, 1997. This represented 31 % of the SA population (28% from the metropolitan and 47% from the SA country). Although these estimates are substantially higher than those for the 2000 and 2007 surveys, the 1997 survey results should only be regarded as indicative, as, a) SA population growth between 1995 and the year of the survey in 1997 was not taken into account; b) it is uncertain from the 1997 report as to how non-responses were surveyed to allow for these types of biases, and finally, c) the 1997 data have not been re-analysed using the recently developed statistical package that has been used on the 2000 and 2007 data-sets.

Therefore, an inspection of the time series of participation rates in recreational fishing in South Australia between 1982 and 2007, suggests that there has been a steady decrease in this parameter of recreational fishing activity over this period.,

10.3 Fishing effort

In 2000/01, SA residents aged 5 years and older expended an estimated 1 834 962 (± 242 583) fisher days of effort in SA (Appendix 6), compared with 1 054 200 (± 113 302) fisher days in 2007/08, representing a 42.5% decrease (Appendix 2. The decline in effort was 43% for marine waters (Fishing Regions 1 – 25) and 57.7% for freshwater (Fishing Regions 26 – 35) (Figure 34A). However, a substantially greater decrease occurred in shore-based effort (55.9%) than for boat-based fishing (18.3%) (Figure 34B).

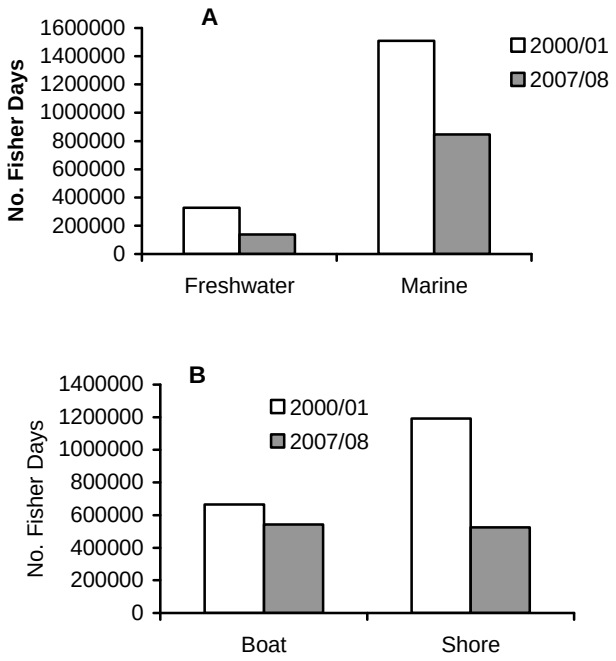


Figure 34: Comparison of estimated fishing effort (fisher days) of SA residents aged 5 years or older who fished in SA during 2000/01 and 2007/08; A: based on type of water body and B: based on fishing platform.

Fishing effort for all methods of capture declined from 2000/01 to 2007/08, but especially in line fishing, which was the predominant method in both years (Figure 35).

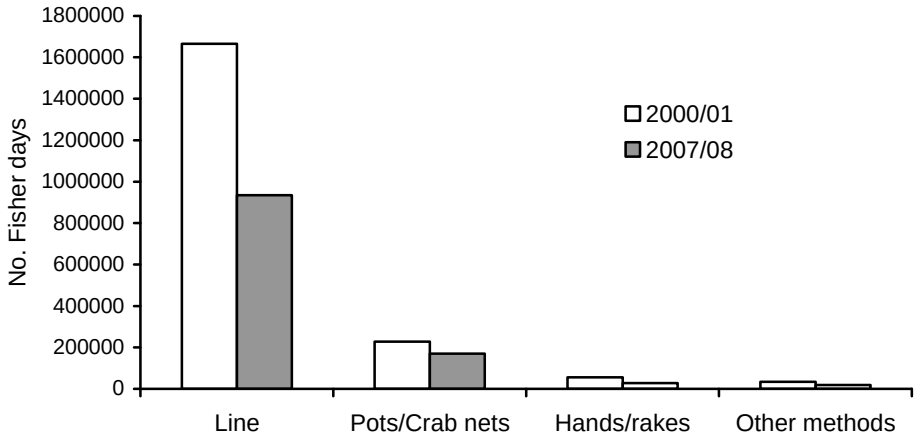


Figure 35: Comparison of fishing effort (fisher days) by fishing method for SA residents aged 5 or older who fished in SA during 2000/01 and 2007/08.

Regionally, the number of fisher days declined in 2007/08 across all major areas (Figure 36); however, the proportional decline varied for the 35 individual fishing regions (see Appendix 6). Fishing effort declined by 50% or more in all major areas, with the exception of Spencer Gulf (39.1%) and Gulf St. Vincent and KI (32.7%) (Figure 36).

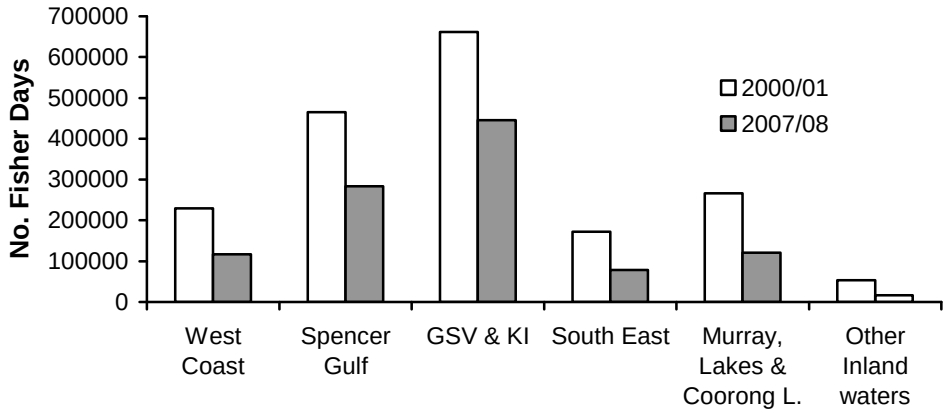


Figure 36: Comparison of fishing effort (fisher days) in major fishing regions for SA residents, aged 5 or older in SA in 2000/01 and 2007/08.

10.4 Catch

Re-analysed catch data[1] for 2000/01 are provided in Tables 9A, B and C, as a comparison with Tables 5A, B and C for the 2007/08 information. Although considerable variation occurred in catch estimates between the two studies for certain species, the significance of this needs to be considered in terms of estimate precision (as assessed by 95% CLs).

An estimated 12.25 million marine finfish were caught by SA recreational fishers during 2000/01 (Table 11), compared with 6.52 million in 2007/08. Australian Herring, King George Whiting and Southern Garfish, in combination, comprised 62.2% of the total (7.62 million) in 2000/01, and other species of significance in order of descending importance included Western Australian Salmon (857 441 or 7.0%), Mullet (573 381 or 4.7%), Snapper (332 978 or 2.7%) and Black Bream (221 850 or 1.8%). While King George Whiting and Southern Garfish also dominated the catches in 2007/08, the catch of Australian Herring was substantially lower, to become the third ranked marine finfish species.

An estimated total of 4.89 million marine shellfish and other marine non-finfish species were taken in 2000/01, compared with 3.29 million in 2007/08. In 2000/01, Blue Swimmer Crab, Pipi and Southern Calamari made up 77.1% of the total catch (Table 12), and in 2007/08, their combined contribution increased to 81.6%. However, with the exception of Blue Swimmer Crab, the total catch of Pipi and Southern Calamari were lower in 2007/08.

[1] Using the improved analytical technique discussed on page 57.

For the freshwater species, there was a significant decrease in the catch in 2007/08 compared with 2000/01, principally regarding Yabbies, European Carp and Golden Perch (Table 13).

Table 11: Estimated annual catch (total, harvested and released numbers) and proportion (%) released for marine finfish species, by SA residents aged 5 years or older during 2000/01[2].

Common Name	Total Number caught	95% CL (+/-)	Harvested numbers	95% CL (+/-)	Released Numbers	95% CL	Release Rate (%)
Australian Herring	3,280,467	844,788	2,535,404	676,588	745,063	243,414	22.7
Western Australian Salmon	857,441	338,030	643,886	264,689	213,555	115,197	24.9
Bight redfish	68,783	30,864	42,409	24,121	26,375	13,494	38.3
Bream, black	221,850	135,095	82,007	67,426	139,843	74,647	63.0
Flathead	98,202	55,882	57,077	31,203	41,126	26,493	41.9
Flounder	2,755	1,775	2,551	1,739	204*	363*	7.4
Southern Garfish	1,504,912	514,133	1,305,275	437,315	199,637	99,492	13.3
Groper, western blue	130*	452*	48*	382*	82*	116*	63.1
Morwong, blue	1,691*	2,285*	1,691*	2,287*	0	0	0
Mullet	573,381	291,532	384,631	204,263	188,750	119,074	15.5
Mulloway	78,561	36,101	24,933	16,299	53,628	27,122	68.3
Samsonfish	61*	123*	61*	123*	0	0	0
Shark, gummy	7,525	4,406	3,876	2,391	3,648*	3,627*	48.5
Shark, school	540*	774*	540*	774*	0	0	0
Snapper	332,978	120,703	85,951	39,785	247,027	90,656	74.2
Snook	153,181	63,733	142,737	61,399	10,444	7,191	6.8
Sweep	108,254	49,086	56,226	22,634	52,028	30,398	48.1
Trevally	86,952	45,790	60,297	28,161	26,655*	23,412*	30.7
Tuna	6,165*	6,864*	3,386*	3,030*	2,778*	5,206	44.9
King George Whiting	2,836,250	681,186	2,068,549	532,918	767,701	216,774	27.1
Whiting, yellowfin	325,982*	264,245	252,697*	233,283*	73,285	43,802	22.5
Yellowtail kingfish	8,938*	9,943*	6,551*	9,490*	2,387*	2,634	26.7
Non-regulated marine finfish**	1,780,858	n.a.	788,265	n.a.	992,593	n.a.	55.7
Total marine finfish	**12,251,070**		**8,519650**		**3,731,420**		**30.5**

Table 12: Estimated annual catch (total, harvested and released numbers) and proportion (%) released for marine shellfish species, by SA residents aged 5 years or older during 2000/01.

Common Name	Total number caught	95% CL (+/-)	Harvested numbers	95% CL (+/-)	Released Numbers	95% CL	Release Rate (%)
Blacklip Abalone	9,586*	9,139*	9,285*	9,122*	300*	570	3.1
Greenlip Abalone	16,379*	25,448*	7,745*	9,459*	8,634*	16,340	52.7
Cockle (mud cockle)	304,329*	373,686*	304,329*	373,686*	0	0	0
Blue Swimmer Crab	1,568,311	490,398	1,055,101	342,488	513,210	186,888	32.7
Crabs, sand	160,573	82,389	74,656	49,020	85,916	46,054	53.5
Cuttlefish	36,118	20,711	29,111	15,927	7,007*	7,253	19.4
Pipi (Goolwa cockle)	1,237,758*	1,414,473*	1,004,839*	1,010,760*	232,918*	466,286	18.8
Razor fish	347,031	176,567	343,548	176,184	3,484*	6,652	1.0
Southern Rocklobster	120,163	57,199	85,776	42,405	34,387	23,471	28.6
Scallops	56,242*	85,732*	39,816*	60,076*	16,426*	25,670	29.2
Southern Calamari	967,878	427,223	955,229	426,937	12,649	6,415	1.3
Non-regulated marine shellfish species **	68,202	n.a.	63,297	n.a.	4,905	n.a.	7.2
Total, marine shellfish	**4,892,570**		**3,972,700**		**919,870**		**18.8**

[2] Refer to p 68 of Jones and Doonan (2005) for explanation of weights v numbers

Table 13: Estimated annual catch (total, harvested and released numbers) and proportion (%) released for freshwater species by SA residents aged 5 years or older during 2000/01.

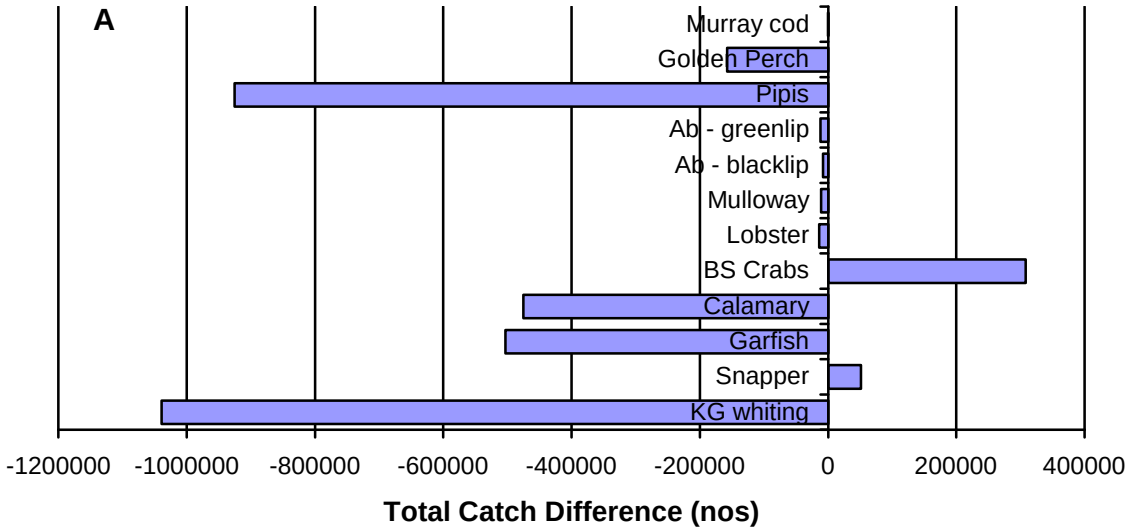
Common Name	Total number caught	95% CL	Harvested numbers	95% CL	Released Numbers	95% CL	% Release Rate
European Carp	469,416	146,122	453,511	141,566	15,905*	23,055	3.4
Catfish, freshwater	4,265*	4,077*	822*	1,333*	3,444*	3,851	80.8
Murray Cod	1,938*	1,831*	1,012*	1,427*	927*	1,088	47.8
Golden Perch (callop)	249,107	86,846	89,001	27,665	160,106	66,070	64.3
Perch, redfin	92,648	65,544	41,487	30,339	51,162	40,384	55.2
Perch, silver	3,910*	4,704*	1,320*	3,616*	2,589*	3,005	66.2
Yabbies, freshwater	822,051	345,579	739,326	330,777	82,726*	75,476	10.1
Other freshwater species **	1,517,837	n.a.	1,267,777	n.a.	250,060	n.a.	28.8
Total, all freshwater species	**3,161,172**	**n.a.**	**2,594,254**	**n.a.**	**566,918**	**n.a.**	**26.3**

* denotes cases where the +/- 95% CL is greater than 80% of the original estimate
** other freshwater species and non-regulated marine species are listed in Appendix 7.
n.a. estimates of 95% CLs for the combined non-regulated marine species and other freshwater species are not available, and so 95% CLs for the totals for each species group have not been estimated.

Comparison of total and harvested catch data for 2000/01 and 2007/08 have been summarised for the key species in Figures 37A and B. The most conspicuous changes in total numbers caught occurred for King George Whiting, Pipi, Southern Garfish and Southern Calamari (all decreased in 2007/08 from that in 2000/01), and an increase for Blue Swimmer Crab. A minor increase in the number of Snapper caught in 2007/08 was also reported, but as for other species (e.g. Pipi especially), the precision of these estimates precludes a conclusion of significant change.

The changes in harvested numbers for most of the key species were not as pronounced (Figure 37B), as in the total catch results, and is a direct function of higher release rates for many of the key species in 2007/08 (Tables 5 - 7 and 11 - 13).

Since the 2000/01 survey, a number of changes to regulations used to manage recreational fishing in this state have taken place, including raising minimum size limits (King George Whiting, Southern Garfish), reducing personal bag limits (King George Whiting, large Mulloway, Pipi), seasonal closure extensions for Snapper and Murray Cod, and a reduction in the maximum size limit for Murray Cod. All these changes may have influenced release rates, along with inter-annual variation in recruitment to the each fishery. However, without regular monitoring of the recreational fishery, the extent of such effects cannot be assessed.



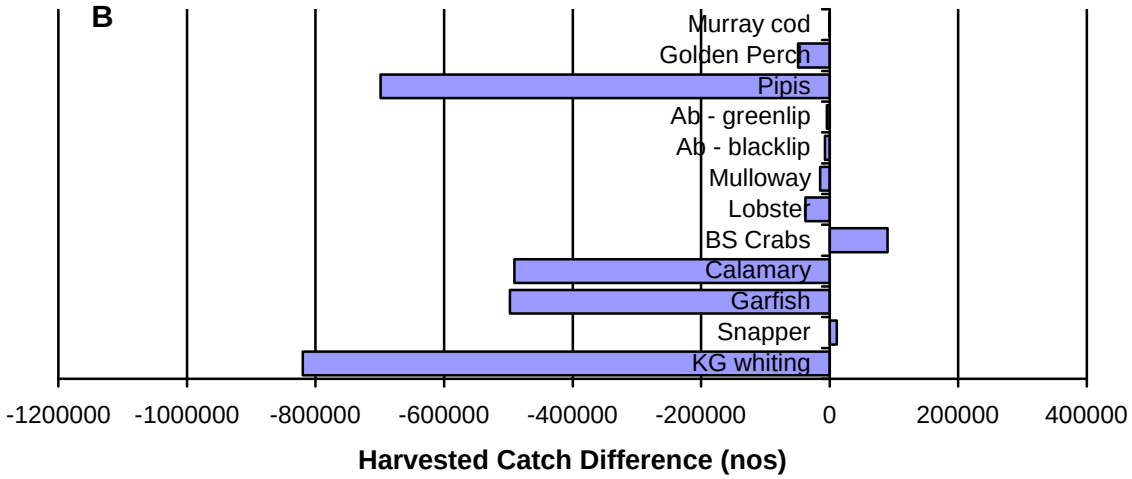


Figure 37: Differences in A: total catch numbers and B; harvested catch numbers of key species between 2007/08 and 2000/01 for South Australian residents aged 5 years or older. (Negative figures mean decrease in catches from 2000/01 to 2007/08.

11. DISCUSSION

The 2007/08 survey of the SA Recreational Fishery is the second state-wide assessment of this fishery. It has provided researchers and fishery managers with estimates and accompanying 95% CLs of: a) the participation and demographic profiles of SA recreational fishers; and b) their fishing effort and catches (harvested and released numbers and harvest weights), with special emphasis on regional information for the 12 key managed species. This report compared the results from this survey with those obtained from a survey using the same method, undertaken in 2000/01 (Section 10).

This section now discusses; a) the potential reasons for the differences between recreational fishing activity in the two years, b) how the results can be validated using independent information; c) potential methods on how the survey design, and hence, precision of the estimates, can be improved, d) the impact of interstate/overseas residents on the recreational fishery in this state and finally, e) how this information can be used for the future management of the recreational fishery.

11.1 Changes in participation, participation rates and fishing effort

In the 12 months prior to October, 2007 a total of 236 463 SA residents recreationally fished at least once in this state, representing 16.2% of the SA resident population. The 2000/01 survey showed a substantially higher level of participation (317 223 SA residents) and participation rate (23.3%). Thus, participation by SA residents in recreational fishing appears to be decreasing both in absolute and relative terms. Similar trends have been observed elsewhere in the western world (e.g. Queensland (Sutton *et al.* 2009) and Canada (Hofmann, 2008)). The reasons for these decreases include a number of social factors determining the motivations of recreational fishers. Sutton *et al.* (2009) suggests that decreasing leisure time for fishing (i.e. more time spent on work or family-related activities) is one of the drivers. This also appears to be the case for South Australians (the results of the attitudinal component of the 2007/08 survey will be included in a later report). It was clearly seen that most of the decrease in participation occurred with younger recreational fishers, whereas the number of older fishers was quite stable. This may be related to the gradually ageing population of South Australians (ABS, 2008); however, further social research directed at the younger age groups, investigating their ethical decisions in not fishing, may assist in explaining these changes in participation. This type of research is important to undertake, not only on a state-wide, but also regional basis.

The decrease in fishing effort from 1.8 million fisher days in 2000/01 to 1.01 million in 2007/08, with a proportionally higher rate of decrease for shore-based fishers compared to boat-based ones, may partly be explained by the decrease in participation. However, several external factors, especially operating for the shore-based fishery, may also influence the decrease. These factors include the low water levels in SA freshwater regions (especially the lower River Murray, the Adelaide streams and private farm dams) that prevailed throughout the 2007/08 survey period. This may have reduced access for recreational fishers to their known fishing sites. This is supported from the observation that the percentage decrease in effort in the freshwater regions of the state since 2000/01 was greater than for the marine fishing regions (Figure 36).

11.2 Validation of estimates from large surveys

In the future, it is important to develop a direct validation method to compare estimates with those obtained from such a large survey; however, direct validation of such estimates is difficult to undertake. The marine on-site surveys and logbook program done in conjunction with the 2007/08 diary survey, were not designed to provide accurate estimates of recreational participation and catch and effort. Indeed, the costs would have been far too prohibitive. However, as the relative number of interviews of recreational fishers in each marine region (Table 3) are similar to the relative spatial distribution of fishing effort estimated from the diary survey (Figure 36), this provides some indicative confidence in the spatial variation in the relative estimates of fishing effort derived from the diary survey. Direct validation may be more achievable in the future with a more intensive on-site survey in one of the regions done at the same time as the more extensive telephone-diary survey.

There are a number of ways that the present estimates can be indirectly validated (compared) through inspection of other recreational or commercial catch or effort data collected independently. In SA, there are two recreationally important fisheries that are managed using gear registrations. Therefore, a cost-effectively selected number of recreational fishers can regularly be monitored. Firstly, the South Australian licensed recreational Charter Boat Fishery has been in place since 2005 (Presser and Mavrakis, 2005). This requires licensed operators to fill out trip logs which report on their catch and effort. As most of the charter boat trips cover single day operations, the total number of client trips occurring between November 2007 and October 2008, were found to be of a similar magnitude (approximately 21000; Knight (in prep) to the number of fisher days estimated in this survey (24000; Section 7.4), thus providing a suitable direct means to validate the charter boat fishery catch

and effort. Secondly, as recreational fishers are required to register rock lobster pot gear with PIRSA Fisheries, data collected in surveys of this fishery (Currie *et al*. 2006) can also be used to compare the estimates of recreational Southern Rocklobster obtained from our broader surveys of 2000/01 and 2007/08. Although, to date, there has been no simultaneous surveys, the 2000/01 estimate of rock lobster pot harvested numbers of 99 000 lobsters (Jones and Doonan, 2005) compares favourably with the 2001/02 estimate of 105 000 (± 3 700) lobsters harvested from pots (Venema *et al*. 2003).

Commercial catch and effort information may also be used to validate differences in catch estimates from the 2000/01 and 2007/08 recreational fishing surveys. For example, some investigation is needed to explain the substantial decrease in Australian Herring catch from 3.3 million fish in 2000/01 to 0.8 million in 2007/08. Inspection of the South Australian commercial Marine Scalefish Fishery catch and catch rate trends reported for Australian Herring (Fowler *et al*. 2008) indicate that in 2007/08, catch and catch per unit effort were at almost record low levels since 1983/84, and they were also substantially lower than for 2000/01. Such agreement between the two fisheries, provides confidence in the recreational fishing estimates for this species.

11.3 Improving the precision of species catch estimates

For most of the key and regulated species, the estimates for total, harvested or released numbers show an acceptable level of precision (i.e. the 95% CL is < 80% of the estimate) (Tables 5 and 9). However, there were some species that were reported rarely by the fishers who were diarists (i.e. for less than 30 events) including Pipi, Murray Cod and iconic game species, such as the tunas, Yellowtail Kingfish, Samsonfish and some shark species. In these situations, other survey methods directed at these species will need to be undertaken to improve their estimate precision. A registry of fishers who target these species, or suitably designed face-to-face surveys along the Goolwa Beach monitoring the recreational Pipi harvest during the open season would greatly assist.

Where there are limited administrative means to directly select/invite recreational fishers into a screening survey, the survey method described in this report will remain the most cost-effective means to provide statistically robust estimates of recreational fishing activities. The high skills of the experienced phone interviewers that greatly contributed to the excellent response rates achieved in all parts of this survey, provide confidence in the data quality. However, with the observed declining

numbers and rates of participation now measured here in the South Australian recreational fishery, there will be a continual need to upwardly adjust sample sizes of the resident SA population for each new screening survey. This is likely to increase the overall costs of undertaking future large-scale surveys. Where a registry of recreational fishers is available, the expected cost of reaching an active fisher by telephone has shown to be much cheaper, than for an active fisher in an un-registered recreational fishery (Ashford *et al.* 2009).

11.4 Interstate component of recreational fishing in South Australia

By design, the 2007/08 assessment of the SA recreational fishery does not include any estimates of catch and effort by interstate residents or overseas visitors. The 2000/01 survey estimated that around 5% of the total fishing effort was derived from interstate residents, and in the marine on-site surveys in 2007/08 showed similar indicative results.

11.5 Use of these estimates for future management of the recreational fishery and resource allocation decisions

The SA recreational fishery is traditionally managed by minimum / maximum size limits and personal daily bag and boat limits. Future analysis of the survey databases can potentially be used to determine the effectiveness of these management tools. For example, we have observed slight upward shifts in the release rates of several of the key species, following the introduction of higher minimum size limits since 2001 (i.e. King George Whiting and Southern Garfish) and a higher release rate for Mulloway following a reduction in the bag limit for large Mulloway from marine waters. The reasons for their release will be further analysed and discussed in a later report.

This survey of recreational fishing was primarily directed to provide harvest weights to inform management of the key recreationally caught species. This has been achieved for most of the key species, as the on-site surveys provided statistically robust regional estimates of regional average weights, for expansion to harvest weights. In similarity with the estimates of harvested numbers for some species, the precision of estimates for average weights was low (e.g. Murray Cod). For other more commonly caught species, such as Snapper, which can potentially exhibit a wide length, and therefore weight, range of harvested fish within a region or by different sectors within the recreational fishery, the calculation of overall average weight is particularly complex. The SA commercial Snapper fishery currently reports

their catches in terms of both numbers of fish and landed weights (Fowler et al, 2008).

Finally, by any measure, the 2007/08 study has been highly successful and provides optimum performance standards for research of this kind. While this report contains quite detailed results from the study, substantial potential also exists for on-going interrogation of the survey database. Indeed, more detailed results will be provided in future, including the opinions, attitudes and awareness of fishers in terms of various fisheries-related issues. Also, the data will be incorporated into age-based stock assessment models for key species, which currently have detailed data on the catch and effort from the commercial sector of the fishery.

12. ACKNOWLEDGEMENTS

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More than 100 recreational fishers participated in the marine and freshwater logbook programs, and I am grateful for the valuable information they provided on their recreational fishing activities. The data on the sizes of fish landed during three major SA fishing competitions during the survey period provided additional information, and I wish to thank Phill Stone (National Snapper Fishing Championship), Peter Cooper (Kingston Surf Fishing Competition) for allowing our survey teams to utilise the data collected during or after these competitions.

The statistics team at the Department of Mathematics, UTas and Drs. Simon Wotherspoon and Kate Stark, are gratefully acknowledged for their work in developing and applying the statistical package to analyse the final database. I would also like to thank Dr. Sean Tracey (TAFI) with his development of the telephone survey database and the Fish Identification Booklet.

Dr. Jeremy Lyle (TAFI) greatly assisted with his expertise and advice throughout the project and especially in terms of the structure and content of this report. Indeed, major components of the report (principally the methodology) have been adapted from the report for the recent Tasmanian Survey (Lyle *et al. 2009*), which effectively employed the same methodology as the SA Survey. Laurie West provided very valuable advice and comments on the draft report, and Drs Tony Fowler and Rowan Chick (SARDI Aquatic Sciences) peer reviewed the final draft report.

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Finally, the excellent cooperation from the many thousands of South Australian recreational fishers who voluntarily provided their fishing details during the telephone and on-site surveys. The exceptional response rates achieved in the study have greatly enhanced the quality and utility of the survey results.

13. REFERENCES

Australian Bureau of Statistics (2008) South Australia's ageing population and the labour force. ABS Report 1345.4 – SA Stats, 2008. Website: http://www.abs.gov.au/AUSSTATS. Accessed: October 27, 2009.

Ashford, J.R., Jones, C.M. and Fegley, L. (2009) A licence registry improves sampling efficiency for a marine recreational survey. Transactions of the American Fisheries Society 138: 984 – 89.

Cierpicki, S., Riquier, C. and Kennedy, R. (1997) South Australian Recreational Fishing Survey 1997. SA Fisheries Management Series. Paper No. 25, 23 pp.

Currie, D.R., Sorokin, S.J. and Ward, T.M. (2006) Survey of recreational rock lobster fishing in South Australia during 2004/05. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Research Report Series No. 123. 28 pp.

Finney, K, and Lyle, J.M. (2000) Data management strategy for the national recreational and indigenous fishing survey. In:SDWG: Development of the National Recreational and Indigenous Fishing Survey. Final Report to FRDC. Project No. 98/169.

Fowler, A.J., McGarvey, R., Steer, M.A. and Feenstra, J.E. (2008). The SA Marine Scalefish Stock Status Report. Report to PIRSA. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Research Report Series No. 321, 29 pp.

Henry, G.W. and Lyle, J.M. (2003) The National Recreational and Indigenous Fishing Survey. FRDC Project No. 99/158, Final Report. 188 pp.

Hofmann, N. (2008) Gone fishing: A profile of recreational fishing in Canada. Statistics Canada. Website: http://www.statcan.gc.ca/pub/16-002-x/2008002/article/10622-eng.htm. 6 pp. Accessed: October 13, 2009.

Jones, K. and Doonan, A. (2005) 2000-01 National Recreational and Indigenous Fishing Survey. South Australian Information. SA Fisheries Management Series Paper No. 46, 99 pp.

Jones, K. (2007) Survey of Recreational Fishing in South Australia – 2007/08. On-site Interview Surveys and Recreational Log Books. Sampling methodology, guidelines for interviewers and length:weight relationships for all retained species. Nov, 2007. PIRSA Fisheries Unpublished Report. 42 pp.

Knight, M.A. (in prep) South Australian charter boat fishery report 2009. SARDI Research Report Series.

Lyle, J.M. and Campbell,, D.A. (1999) Species and size composition of recreational catches with particular reference to licenced fishing methods. Tasmanian Aquaculture and Fisheries Institute. Final Report to MRFAC, 46 pp.

Lyle, J.M., Coleman, A.P.M., West, L., Campbell, D. and Henry, G.W. (2002) New large-scale methods for evaluating sport fisheries. In: Pitcher, T.J. and Hollingworth, C.E. (Editors). Recreational Fisheries: Ecological, Economic and Social Evaluation. pp 207 – 26. Blackwell Science, Oxford, UK.

Lyle, J.M., Tracey,S.R., Stark, K.E., Wotherspoon,S (2009) 2007/08 Survey of Recreational Fishing in Tasmania. TAFI report, 97 pp.

Lyle, J.M., Stark, K. and Wotherspoon, S. (in review). Developing an analytical module for large- scale recreational fishery data based on phone/diary survey methodology. FRDC Project 2007/064. Final Report.

Lyle, J.M., Stark, K. and Wotherspoon, S. (in prep.) Recfish. Manual for using an R-based analytical package to estimate recreational catch and effort in large regional surveys. (Draft manual, 89 pp.)

Philipson, M., Byrne, J. and Rohan, G. (1986) Participation in recreational fishing in South Australia. Fish. Res. Pap. Dep. Fish. (S.Aust.) No. 16, 33 pp.

Presser, J. and Mavrakis, V. (2005) Management Plan for the South Australian Recreational Charter Boat Fishery. SA Fisheries Management Series Paper No. 43, 22 pp.

PIRSA (2006) South Australian Fisheries Resources. Current Status and Recent Trends 2006. SA Fisheries Management Series Paper No. 49, 94 pp.

R Development Core Team (2009) An introduction to R. Notes on R: A Programming Environment for Data, Analysis and Graphics. Version 2.9.0. (2009-04-17). 94 pp.

Sutton, S., Dew, K. and Higgs, J. (2009) Why do people drop out of recreational fishing? A study of lapsed fishers from Queensland, Australia. Fisheries, 34 (9), 443 – 52.

Venema, S., Boxall, V. and Ward, T.W. (2003) Survey of the recreational rock lobster fishery in South Australia, during 2001/02. Final Rep. to PIRSA Fisheries Policy Group. SARDI Aquatic Sciences, Adelaide, 42 pp.

West, L. and Jones, K. (2007a) Survey of Recreational Fishing in South Australia – 2007/08. Interviewer Manual, Part 1. Screening Survey. Unpublished Report PIRSA & Kewagama Research. 30 pp. and 3 appendices

West, L. and Jones, K. (2007b) Survey of Recreational Fishing in South Australia – 2007/08. Interviewer Manual, Part 1. Diary Survey. Unpublished Report PIRSA & Kewagama Research. 27 pp, and 9 appendices.

Appendix 1A: Estimated number of SA resident recreational fishers, aged 5 years or older, who fished in SA during 2007/08, by gender, age group and Statistical Division (SD).

Gender: Females

SD / Age Group	5 to 14	15 to 29	30 to 44	45 to 59	60 or older	Total
Adelaide	7,463	10,434	12,401	9,368	1,990	41,656
Outer Adelaide	2,011	1,121	2,056	1,505	584	7,277
Yorke/MidNorth	846	823	680	1,288	507	4,144
Murraylands	1,057	747	1,215	1,179	464	4,662
South East	873	859	1,116	889	253	3,990
Eyre	850	862	1,092	1,127	248	4,179
Nthn SA	1,132	825	1,251	838	216	4,262
Total SA	**14,232**	**15,671**	**19,810**	**16,194**	**4,262**	**70,170**

Gender: Males

SD / Age Group	5 to 14	15 to 29	30 to 44	45 to 59	60 or older	Total
Adelaide	18,143	24,498	24,220	24,353	12,399	103,613
Outer Adelaide	3,512	2,739	5,167	3,454	1,917	16,789
Yorke/MidNorth	1,067	1,470	1,410	2,280	1,846	8,073
Murraylands	1,900	1,658	2,123	2,149	1,393	9,223
South East	1,527	1,415	3,214	2,130	1,302	9,588
Eyre	1,542	1,548	2,507	2,147	1,097	8,841
Nthn SA	1,943	1,861	2,519	2,485	1,358	10,166
Total SA	**29,634**	**35,189**	**41,160**	**38,997**	**21,312**	**166,293**

Appendix 1B: Estimated participation rate (% of resident population) of SA resident recreational fishers, aged 5 years or older, who fished in SA during 2000/01, by gender, age group and Statistical Division (SD).

Gender: Females

SD / Age Group	5 to 14	15 to 29	30 to 44	45 to 59	60 or older	Total
Adelaide	11.1	8.8	10.3	7.7	1.6	7.6
Outer Adelaide	22.8	11.2	15.2	10.5	4.2	12.0
Yorke/MidNorth	29.6	27.8	17.2	25.6	8.1	19.7
Murraylands	22.0	13.8	18.3	16.3	6.2	14.8
South East	19.1	15.3	16.9	13.7	4.1	13.6
Eyre	34.9	30.3	32.5	31.7	7.4	26.8
Nthn SA	20.6	12.0	15.9	11.0	2.9	12.1
Total SA	**14.8**	**10.3**	**12.2**	**9.8**	**2.6**	**9.5**

Gender: Males

SD / Age Group	5 to 14	15 to 29	30 to 44	45 to 59	60 or older	Total
Adelaide	26.0	20.2	20.2	21.6	12.4	19.8
Outer Adelaide	37.6	25.0	40.8	23.6	14.4	27.6
Yorke/MidNorth	35.3	44.1	36.7	43.9	29.9	37.4
Murraylands	38.9	27.8	30.5	28.0	18.8	28.1
South-East	32.4	23.2	47.1	30.5	23.3	31.7
Eyre	58.2	49.7	70.4	54.8	33.1	53.4
Nthn SA	32.8	25.0	29.9	29.5	18.3	27.0
Total SA	**29.5**	**22.2**	**25.4**	**24.4**	**14.9**	**23.0**

Appendix 2: Regional numbers of SA resident recreational fishers and the number of days these fishers spent fishing in 2007/08 (see Fig. 3 for location of all fishing regions).

Fishing Region	No. Fishers	95 % C.L. (+/-)	No. days fished	95 % C.L. (+/-)
1	1,128*	1,074	5,223*	5,276
2	6,622	2,366	30,433	11,105
3	5,950	2,413	30,915	15,586
4	3,241*	2,860	7,172	4,790
5	12,242	4,547	41,584	18,351
6	522*	608	1,794*	2,699
7	15,244	4,592	47,936	14,422
8	4,763	2,452	13,872	7,401
9	14,451	2,958	46,735	10,486
10	19,082	5,263	45,280	15,509
11	21,636	6,213	72,091	26,991
12	18,191	6,002	57,355	22,679
13	3,289	1,842	7,759	4,900
14	10,689	5,071	27,953	15,898
15	10,289	4,069	30,363	14,473
16	22,609	6,766	71,473	29,055
17	13,758	4,663	31,217	14,676
18	47,170	10,627	113,414	32,242
19	47,777	9,775	130,146	38,332
20	8,394	3,734	27,885	12,395
21	2,796	3,009	4,858	4,222
22	3,034	1,219	10,670	6,105
23	6,725	2,150	25,196	9,467
24	3,820	1,396	18,024	10,996
25	4,139	1,560	24,484	12,052
26	7,121	3,095	11,164	4,518
27	904*	815	1,677*	1,478
28	20,785	5,453	61,487	19,792
29	13,336	3,663	46,962	17,701
30	482*	404	963*	815
31	33*	63	65*	125
32	3,480	2,707	4,261	3,263
33	1,943*	1,923	3,273*	4,069
34	383*	490	2,210*	2,993
35	3,089	1,872	5,881	3,675

* denotes cases where the +/- 95% CL is greater than 80% of the original estimate

Appendix 3: The estimated total, harvested and released numbers of other species caught by SA recreational fishers in SA in 2007/08, and release rates.

Common Name	Total number caught	95% CL (+/-)	Harvested numbers	95% CL (+/-)	Released numbers	95% CL (+/-)	Release Rate (%)
Barracouta	5,310*	4,879	3,165*	4,043	2,145*	2,066	40.4
Catfish	565*	769	0	0	565*	769	100.0
Cod, other marine	98,551	29,838	13,260	6,688	85,291	28,932	86.5
Cod, red rock	29,328	20,345	3,012*	2,976	26,315	18,027	89.7
Cowfish	38*	74	0	0	38*	74	100.0
Dolphinfish (mahi mahi)	57*	117	57*	117	0	0	0
Drummer, silver	1,622*	2,170	239*	398	1,382*	2,138	85.2
Eel, conger	95*	149	0	0	95*	149	100.0
Elephant fish	485*	564	368*	542	117*	159	24.1
Fish ID, unknown	2,537*	3,550	13*	30	2,523*	3,550	99.4
Fish, other	6,856*	9,001	4,671*	8,838	2,185	1,655	31.9
Gemfish	59*	111	59*	111	0	0	0
Gurnard	2,858*	2,826	390*	424	1,133*	1,259	39.6
Hapuku	59*	111	59*	111	0	0	0
Harlequin fish	240*	413	240*	413	0	0	0
Knifejaw	468*	683	468*	683	0	0	0
Leatherjacket	133,016	44,943	49,292	16,805	83,723	37,936	62.9
Ling	447*	522	107*	206	340*	490	76.1
Luderick / zebrafish	15,364*	17,974	742*	1,143	14,622*	17,800	95.2
Mackerel, blue	43,193	30,162	21,774	11,674	21,419*	26,811	49.6
Mackerel, scad	17,804*	20,431	7,375*	13,273	10,429*	15,515	58.6
Morwong, dusky	236*	397	200*	391	35*	66	14.8
Morwong, jackass	3,417*	4,723	3,417*	4,723	0	0	0
Mullet, red	57,574	22,665	18,752	10,530	38,822	17,170	67.4
Old wife	1,901*	2,884	0	0	1,901*	2,884	100.0
Perch, ocean	121*	235	121*	235	0	0	0
Rays / skates	18,082	9,423	559*	661	17,524	9,364	96.9
Sergeant baker	440*	563	73*	119	366*	541	83.2
Shark, dogfish	9,624	8,132	1,152*	1,896	8,472*	7,717	88.0
Shark, hammerhead	179*	250	69*	97	109*	180	60.9
Shark, mako	59*	111	59*	111	0	0	0
Shark, other	555*	895	32*	62	523*	893	94.2
Shark. port jackson	12,018	5,336	116*	159	11,902	5,334	99.0
Shark, whaler	2,152*	1,772	1,730*	1727	422*	384	19.6
Shark, wobbegong	251*	310	211*	300	40*	76	15.9
Silverbiddy	717*	1,399	0	0	717*	1,399	100.0
Toadfish	142,638	44,527	3,178*	3,201	139,460	44,100	97.8
Trevalla, blue-eye	262*	406	262*	406	0	0	0
Trumpeter, other	117*	245	0	0	117*	245	100.0
Trumpeter, striped	249,851	78,908	97,111	32,234	152,740	58,278	61.1
Whiting, school	32,607	17,113	22,271	15,182	10,335	5,909	31.9
Whiting, weedy	39,486	17,393	18,323	10,051	21,163	11,427	53.6
Wrasse, blue-throated	23,934	12,514	5,247*	4,923	18,687	11,401	78.1
Wrasse, unspecified	803*	1,398	88*	165	716*	1,388	89.2
Total, non-regulated marine finfish	**955,976**	**n.a.**	**278,262**	**n.a.**	**676,373**	**n.a.**	**70.9**
Crab. Other	4,091*	3,651*	1,195*	1,043	2,896*	3,334	70.8
Nonfish, other	117*	227*	117*	227	0	0	0
Octopus	1,537*	1,374*	273*	321	1,264*	1,339	82.2
Prawns	2,851*	5,452*	2,851*	5,452	0	0	0
Squid, arrow	2,000	1,516	2,000	1,516	0	0	0
Worms, beach	4,713*	8,347*	4,713*	8,347	0	0	0
Worms, other	3,209*	6,034*	3,209*	6,034	0	0	0
Yabbies, nippers	32,655*	50,616*	32,174*	49,737	481*	915	1.5
Total, non-regulated marine shellfish	**51,173**	**n.a.**	**46,532**	**n.a.**	**4,641**	**n.a.**	**9.1**
Bream, bony	197*	373	0	0	197*	373	100.0
Shrimp/Macrobrachium	10,131*	17,159	8,143*	13,895	1,988*	3,275	19.6
Perch, spangled	281*	546	0	0	281*	546	100.0
Trout	823*	1,558	0	0	823*	1,558	100.0
Total, other freshwater species	**11,432**	**n.a.**	**8,143**	**n.a.**	**3,289**	**n.a.**	**28.7**

* denotes cases where the +/- 95% CL is greater than 80% of the original estimate

Appendix 4: Regional total, harvested and released catch estimates, with 95% CL for the 12 key species.

A: King George Whiting.

Fishing Region	Total Number caught	95% CL (+/-)	Harvested numbers	95% CL (+/-)	Released numbers	95% CL (+/-)	Release Rate (%)
West Coast	484,380	145,148	298,569	88,480	185,811	66,313	38.4
Nthn Spencer Gulf	217,336	77,224	135,563	56,916	81,773	27,583	37.6
Sthn Spencer Gulf	487,151	190,616	385,034	158,827	102,117	43,463	21.0
Gulf St. Vincent & KI	588,428	227,464	416,252	154,328	172,176	85,613	29.3
South East SA	19,853	11,844	13,662	9,677	6,191*	5,102	31.2
Total SA	**1,797,148**	**354,491**	**1,249,079**	**259,316**	**548,069**	**122,165**	**30.5**

B: Snapper

Fishing Region	Total Number caught	95% CL (+/-)	Harvested numbers	95% CL (+/-)	Released numbers	95% CL (+/-)	Release Rate (%)
West Coast	4,542	3,420	2,692	1,840	1,849*	1,860	40.7
Nthn Spencer Gulf	72,105	55,578	17,998	7,595	54,107*	54,578	75.0
Sthn Spencer Gulf	104,370	58,604	24,048	14,026	80,322	48,926	77.0
Gulf St. Vincent & KI	181,893	83,574	41,805	23,114	140,087	71,585	77.0
South East SA	21,168*	17,979	10,467	7,944	10,701*	10,582	50.6
Total SA	**384,077**	**118,117**	**97,010**	**29,165**	**287,067**	**103,464**	**74.7**

C: Southern Garfish

Fishing Region	Total Number caught	9 % CL (+/-)	Harvested numbers	95% CL (+/-)	Released numbers	95% CL (+/-)	Release Rate (%)
West Coast	88,957	68,255	78,781	33,108	10,176	7,350	11.4
Nthn Spencer Gulf	87,992	49,114	70,993	20,013	16,999*	14,061	19.3
Sthn Spencer Gulf	348,983	276,050	302,509	120,448	46,474*	43,771	13.3
Gulf St. Vincent & KI	434,069	206,306	323,296	74,618	110,772	71,330	25.5
Coorong Lagoon	2,420	n.a.	1,226	n.a.	1,194	n.a.	49.3
South East SA	39,233	28,075	30,938	10,566	8,295*	9,569	21.1
Total SA	**1,001,653**	**357,912**	**807,743**	**290,296**	**193,910**	**86,075**	**19.4**

D: Southern Calamari

Fishing Region	Total Number caught	95% CL (+/-)	Harvested numbers	95% CL (+/-)	Released numbers	95% CL (+/-)	Release Rate (%)
West Coast	57,113*	76,344	57,113*	76,344	0	0	0
Nthn Spencer Gulf	43,760	16,574	43,578	16,535	181*	288	0.4
Sthn Spencer Gulf	145,345	61,238	138,651	56,080	6,693*	11,120	4.6
Gulf St. Vincent & KI	242,614	83,447	241,208	83,190	1,406*	1,384	0.6
South East SA	3,906*	3,663	3,906*	3,663	0	0	0
Total SA	**492,236**	**133,325**	**484,456**	**130,881**	**8,281***	**11,209***	**1.7**

E: Blue Swimmer Crab

Fishing Region	Total Number caught	95% CL (+/-)	Harvested numbers	95% CL (+/-)	Released numbers	95% CL (+/-)	Release Rate (%)
West Coast	55,606	31,672	39,604	25,035	16,002	9,708	28.8
Spencer Gulf	724,100	178,409	419,592	101,828	304,508	93,682	42.1
Gulf St. Vincent & KI	1,094,434	334,062	685,640	245,321	408,795	125,397	37.4
Coorong Lagoon	**2,349**	**n.a.**	**0**	**0**	**2,349**	**n.a.**	**100.0**
Total SA	**1,876,490**	**385,297**	**1,144,837**	**268,749**	**731,653**	**160,107**	**39.0**

F: Southern Rocklobster

Fishing Region	Total Number caught	95% CL (+/-)	Harvested numbers	95% CL (+/-)	Released numbers	95% CL (+/-)	Release Rate (%)
Northern Zone	6,472	6,380	4,517*	4,265	1,955*	2,164	30.2
Southern Zone	100,011	54,047	43,359	19,878	56,653	36,084	56.6
Total SA	**106,483**	**54,423**	**47,875**	**20,331**	**58,608**	**36,148**	**55.0**

G: Mulloway

Fishing Region	Total Number caught	95% CL (+/-)	Harvested numbers	95% CL (+/-)	Released numbers	95% CL (+/-)	Release Rate (%)
West Coast	1,632*	2,031	167*	220	1,465*	2,019	89.8
Spencer Gulf	1,029*	1,531	1,029*	1,531	0	0	0
Gulf St. Vincent & KI.	9,906*	8,448	3,388*	2,909	6,518*	6,009	65.8
Coorong Lagoon	30,049*	42,575	5,066*	5,245	24,983*	39,180	83.1
South East SA	25,423	17,207	522*	404	24,901	17,027	97.9
Total SA	**68,038**	**47,201**	**10,171**	**6,219**	**57,868**	**43,667**	**85.1**

H: Blacklip Abalone and Greenlip Abalone.

Blacklip Abalone

Fishing Region	Total Number caught	95% CL (+/-)	Harvested numbers	95% CL (+/-)	Released numbers	95% CL (+/-)	Release Rate (%)
Western Zone	610*	647	521*	515	89*	176	14.6
Central Zone	701*	1,017	701*	1,017	0	0	0
Southern Zone	596*	849	463*	633	133*	253	22.3
Total SA	**1,907**	**1,474**	**1,685***	**1,303**	**222***	**308***	**11.6**

Greenlip Abalone

Fishing Region	Total Number caught	95% CL (+/-)	Harvested numbers	95% CL (+/-)	Released numbers	95% CL (+/-)	Release Rate (%)
Western Zone	3,564*	3,150	2,528	1,997	1,037*	1,276	29.1
Central Zone	1,124*	1,121	934*	970	190*	352	16.9
Southern Zone	0	0	0	0	0	0	-
Total SA	**4,689**	**3,352**	**3,462**	**2,221**	**1,772**	**1,325**	**26.2**

I: Pipi

Fishing Region	Total Number caught	95% CL (+/-)	Harvested numbers	95% CL (+/-)	Released numbers	95% CL (+/-)	Release Rate (%)
West Coast	2,720	n.a.	2,720	n.a.	0	0	0
Spencer Gulf	0	0	0	0	0	0	-
Gulf St. Vincent and KI**	295,269	n.a.	288,898	n.a.	6,371	12,450	2.2
South East SA	14,490	n.a.	14,490	n.a.	0	0	0
Total SA	**312,479**	**312,228***	**306,107***	**309,909***	**6,371***	**12,450***	**2.1**

** Goolwa Beach (within Fishing Region 19), only reported site in Gulf St. Vincent and KI.

J: Golden Perch (callop)

Fishing Region	Total Number caught	95 % C.L. (+/-)	Harvested numbers	95 % CL (+/-)	Released numbers	95% CL (+/-)	Release Rate (%)
Lakes	3,243*	4,163	1,035*	1,746	2,208*	2,781	68.1
Lower River Murray	47,925	27,832	20,769	12,775	27,156	16,495	56.7
Upper River Murray	38,487	19,631	16,947	7,248	21,540	13,406	55.2
Lake Eyre Basin	1,875	1,254	1,109	784	766*	890	52.8
Total SA	**91,530**	**36,870**	**39,861**	**16,027**	**51,669**	**22,773**	**56.5**

K: Murray Cod

Fishing Region	Total Number caught	95 % C.L. (+/-)	Harvested numbers	95 % CL (+/-)	Released numbers	95% CL (+/-)	Release Rate (%)
Lakes	0	0	0	0	0	0	-
Lower River Murray	507*	972	507*	971	0	0	0
Upper river Murray	1,014*	813	0	0	1,014*	813	100.0
Other Inland waters	333*	647	0	0	332*	647	100.0
Total SA	**1,853***	**1,691**	**507***	**971**	**1,346***	**1,384**	**72.7**

Appendix 5A: Estimated number of SA resident recreational fishers, aged 5 years or older, who fished in SA during 2000/01, by gender, age group and Statistical Division (SD).

Gender: Females

SD / Age Group	5 to 14	15 to 29	30 to 44	45 to 59	60 or older	Total
Adelaide	18,137	15,551	18,080	9,624	1,993	63,385
Outer Adelaide	2,931	2,550	2,943	1,723	372	10,519
Yorke/MidNorth	1,193	1,191	1,600	681	353	5,018
Murraylands	1,745	2,124	1,904	1,771	482	8,026
South East	1,589	1,284	1,807	916	268	5,864
Eyre	1,303	1,205	1,607	1,002	332	5,449
Nthn SA	2,515	1,994	1,560	1,644	370	8,083
Total SA	**29,413**	**25,899**	**29,501**	**17,362**	**4,168**	**106,343**

Gender: Males

SD / Age Group	5 to 14	15 to 29	30 to 44	45 to 59	60 or older	Total
Adelaide	25,047	33,723	35,374	23,730	11,104	128,978
Outer Adelaide	3,944	3,782	5,383	4,759	1,360	19,228
Yorke/MidNorth	2,124	1,814	2,656	1,862	1,687	10,143
Murraylands	2,790	3,560	3,774	3,055	1,530	14,709
South East	2,591	3,459	3,604	2,356	908	12,918
Eyre	1,712	1,920	2,347	2,095	1,083	9,157
Nthn SA	3,281	3,598	4,753	2,825	1,191	15,648
Total SA	**41,489**	**51,856**	**57,891**	**40,782**	**18,863**	**210,781**

Appendix 5B: Estimated participation rate (% of resident population) of SA resident recreational fishers, aged 5 years or older, who fished in SA during 2000/01, by gender, age group and Statistical Division (SD).

Gender: Females

SD / Age Group	5 to 14	15 to 29	30 to 44	45 to 59	60 or older	Total
Adelaide	27.2	13.8	14.9	9.2	1.9	12.4
Outer Adelaide	37.1	29.2	23.3	16.1	3.6	20.9
Yorke/MidNorth	38.1	40.4	35.3	15.4	6.7	24.8
Murraylands	36.3	38.4	26.5	27.5	7.6	26.3
South East	34.7	22.4	26.0	16.6	5.0	20.8
Eyre	49.6	43.8	44.3	33.5	11.7	36.7
Nthn SA	41.0	26.6	17.7	23.7	5.8	22.6
Total SA	**30.7**	**17.7**	**17.9**	**12.2**	**3.0**	**15.4**

Gender: Males

SD / Age Group	5 to 14	15 to 29	30 to 44	45 to 59	60 or older	Total
Adelaide	36.3	29.4	30.6	24.0	13.3	26.8
Outer Adelaide	46.1	40.8	44.8	43.7	14.3	38.3
Yorke/MidNorth	63.3	55.8	60.2	42.0	32.9	49.3
Murraylands	53.1	57.2	50.5	44.4	26.1	46.4
South East	52.2	58.0	50.4	40.0	18.9	44.9
Eyre	61.9	63.9	62.1	66.7	40.2	59.2
Nthn SA	48.0	46.4	50.7	38.6	19.6	41.9
Total SA	**41.2**	**35.5**	**36.2**	**29.6**	**16.0**	**31.7**

Appendix 6: Regional numbers of SA resident recreational fishers and the number of days these fishers spent fishing in 2000/01 (see Figure 3 for locations of fishing regions).

Fishing Region	No. Fishers	95% CL (+/-)	No. days fished	95% CL (+/-)
1	910*	766	1,815*	2,146
2	10,229	6,723	46,674*	37,940
3	13,404	6,237	52,713	29,326
4	3,355	1,809	17,741*	14,618
5	18,377	7,354	106,713	74,715
6	2,513	1,860	3,953	2,677
7	28,258	4,592	108,361	36,870
8	9,161	3,730	26,021	12,207
9	20,624	4,302	83,739	28,763
10	25,443	7,440	78,690	34,092
11	29,509	12,540	106,541	52,779
12	23,173	8,457	61,932	25,311
13	4,551	3,016	9,097	6,801
14	14,255	6,701	36,179	19,821
15	8,630	3,961	31,204	17,861
16	23,765	9,316	88,130	48,518
17	16,740	9,092	33,951	22,820
18	89,123	20,429	225,067	64,096
19	72,676	18,687	199,666	37,252
20	7,736	4,171	30,117	23,126
21	3,257*	2,611	8,264*	7,070
22	14,613	8,751	24,659	11,946
23	14,907	6,123	59,319	26,991
24	8,753	3,957	35,021	20,529
25	11,304	3,261	53,209	22,773
26	3,164	2,442	4,525*	3,977
27	3,191*	3,289	3,682*	3,420
28	43,966	15,210	137,700	82,884
29	40,484	10,214	120,060	33,455
30	2,245	1,403	4,855	3,369
31	4,286*	3,785	9,359*	10,165
32	5,205	2,652	7,968	4,929
33	14,994	9,290	20,152	13,324
34	2,029	1,539	3,198*	2,754
35	6,430	3,013	8,255	6,286

* denotes cases where the +/- 95% CL is greater than 80% of the original estimate

Appendix 7: The estimated total, harvested and released numbers of other species, caught by SA recreational fishers in SA in 2000/01, and release rates (%).

Common Name	Total number caught	95% CL (+/-)	Harvested numbers	95% CL (+/-)	Released numbers	95% CL (+/-)	Release Rate (%)
Barracouta	6,904*	10,731	1,125*	1,358	5,780*	9,535	83.7
Catfish	2,456*	2,634	401	517	2,055*	2,548	83.7
other marine	54,289	25,417	10,305	9,949	43,984	21,815	40.2
Cowfish	842*	1,623	12	96	830*	1,621	98.6
Dolphinfish (mahi mahi)	25*	165	25*	84	0	0	0
Drummer, silver	1,893*	3,710	814*	935	1,079*	1,654	57.0
Eel, conger	47*	94	47	94	0	0	0
Fish ID, unknown	6,780*	6,346	213*	406	6,567*	6,335	96.9
Fish, other	3,575*	6,633	3,575*	6,633	0	0	0
Gurnard	4,017*	2,840	3,013*	2,675	1,005*	958	25.0
Hapuku	36*	71	36*	71	0	0	0
Harlequin fish	194*	367	194*	367	0	0	0
Knifejaw	677*	1,323	677*	1,323	0	0	0
Leatherjacket	368,651	136,806	146,152	58,051	222,499	53,980	60.4
Ling	915*	1,513	158*	253	765*	1,266	83.6
Luderick / zebrafish	6,098*	6,893	3,138*	3,536	2,960*	3,420	48.5
Mackerel, blue	48,101	34,723	30,655	23,044	17,447*	18,201	36.3
Mackerel, scad	14,453	6,682	2,554*	2,146	4,820*	5,018	33.3
Morwong, dusky	2,358*	2,842	1,320*	1,815	1,038*	1,292	44.0
Mullet, red	155,017	66,785	101,211	52,693	53,806	21,709	34.7
Old wife	3,077*	3,738	1,305*	1,835	1,772*	2,001	57.6
Rays / skates	41,524	16,703	14,237	8,169	27,287	11,554	65.7
Sergeant baker	2,213*	4,169	2,215*	4,169	0	0	0
Shark, dogfish	16,369*	29,474	371*	443	15,998*	29,463	97.9
Shark, hammerhead	31*	59	31*	59	0	0	0
Shark. port jackson	8,988	5,349	623*	953	8,365	5,092	93.1
Shark, whaler	313*	598	104*	200	209*	398	66.8
Shark, wobbegong	661*	1,027	69*	149	592*	1,017	89.6
Silverbiddy	1,011*	1,707	0	0	1,011*	1,707	100.0
Toadfish	81,612	60,331	15,778*	10,598	65,834	53,424	80.7
Trumpeter, striped	635,257	203,156	294,206	141.365	341,051	128,707	53.7
Whiting, school	14,677*	17,109	11,953*	13,548	2,724*	4,190	18.6
Whiting, weedy	121,303	63,232	48,827	26,813	72,476	53,073	59.7
Wrasse, unspecified	183,573*	63,869	64,760*	36,472	118,812*	49,757	64.7
Total, non-regulated marine finfish	**1,780,880**	**n.a.**	**760,114**	**n.a.**	**1,020,766**	**n.a.**	**57.3**
Crab. Other	1,309*	1,680*	142*	474	1,166*	1,613	89.1
Nonfish, other	33*	65*	33*	65	0	0	0
Octopus	1,609	1,278*	939*	694	670*	1,031	41.6
Prawns	13,961*	27,350*	13,961*	27,350	0	0	0
Worms, beach	28,080*	47,510*	28,080*	47,510	0	0	0
Worms, other	20,143*	36,591*	20,144*	36,591	0	0	0
Yabbies, nippers	3,067*	5,719*	0	0	3,067*	5,719*	100.0
Total, non-regulated marine shellfish	**68,202**	**n.a.**	**63,299**	**n.a.**	**4,903**	**n.a.**	**7.2**
Bream, bony	698*	1,266	169*	766	529*	1,009	75.8
Shrimp/Macrobrachium	1,509,813	699,232	1,266,783	544,478	243,030*	212,946	16.1
Trout	7,326*	12,411	825*	1,327	6,501*	12,340	88.7
Total, other freshwater species	**1,517,837**	**n.a.**	**1,267,777**	**n.a.**	**250,060**	**n.a.**	**16.5**

* denotes cases where the +/- 95% CL is greater than 80% of the original estimate