

# Experimental results from the fourth Queensland recreational fishing diary program (2005)





# **Experimental results from the fourth Queensland recreational fishing diary program (2005)**

**Kirrily McInnes**

The Department of Primary Industries and Fisheries (DPI&F) seeks to maximise the economic potential of Queensland's primary industries on a sustainable basis.

© The State of Queensland, Department of Primary Industries and Fisheries, 2008.

Except as permitted by the *Copyright Act 1968*, no part of the work may in any form or by any electronic, mechanical, photocopying, recording, or any other means be reproduced, stored in a retrieval system or be broadcast or transmitted without the prior written permission of DPI&F. The information contained herein is subject to change without notice. The copyright owner shall not be liable for technical or other errors or omissions contained herein. The reader/user accepts all risks and responsibility for losses, damages, costs and other consequences resulting directly or indirectly from using this information.

Enquiries about reproduction, including downloading or printing the web version, should be directed to [ipcu@dpi.qld.gov.au](mailto:ipcu@dpi.qld.gov.au) or telephone +61 7 3225 1398.

# Acknowledgments

The Recreational Fisheries Information System (RFISH) survey program is funded by the Private Pleasure Vessel Levee (PPV) and has received guidance from the members of the Recreational Fisheries Information Coordination Committee (RFICC) since 1995. Members of RFICC at the time of the 2005 survey included David Bateman (SUNFISH), Bill Sawynok (Australian National Sportfishing Association), Ray Joyce (Charter Vessel Association), Todd Kelly (Environmental Protection Agency), Jim Higgs, Len Olyott, Kirrily McInnes and Malcolm Dunning (DPI&F) and Darren Cameron (Great Barrier Reef Marine Park Authority).

Thank you to the following people for their assistance in different areas: Meg Leslie for administration support, Cerise Lind, Glenda McMahon, Deb MacManus, Melinda Larsen, Glynis Fowler, logbook staff who assisted with data entry and Len Olyott and Malcolm Dunning for providing advice and constructive criticism.

The South Australian Bureau of Statistics Statistical Consultancy Unit—in particular Ben Smith—conducted the expansion process from raw diary information to final catch and variance estimates.

A special thank you must also be extended to Queensland households who participated in the initial screening telephone survey and the anglers who volunteered to maintain a diary of their fishing activities throughout the 2005 calendar year. Without their commitment to the management of Queensland's fisheries resources, none of this monitoring would have been possible.

# Contents

<b>Acknowledgments</b>	<b>iii</b>
<b>List of tables</b>	<b>v</b>
<b>List of figures</b>	<b>v</b>
<b>Executive summary</b>	<b>vi</b>
<b>Introduction</b>	<b>1</b>
<b>Survey design and methodology</b>	<b>2</b>
Background to Queensland RFISH survey	2
Telephone survey	2
Diary phase	2
Diary phase implementation	2
<b>Expansion of diary data to population estimates</b>	<b>4</b>
Response rates—quarterly progressive changes	4
Scaling factors procedures	4
Catch estimation procedures	5
<b>Results</b>	<b>9</b>
Interpretations of catch estimates and associated error terms	9
Total catch	9
Finfish catches	11
Saltwater finfish catch estimates	11
Freshwater finfish catch estimates	23
Invertebrate catch estimates	26
<b>Allocating unspecified catches</b>	<b>29</b>
Mackerel	29
Whiting	30
Crab	30
<b>Discussion</b>	<b>31</b>
<b>References</b>	<b>32</b>
<b>Appendix 1</b>	<b>33</b>

## List of tables

Table 1.	Quarterly summary of different types of respondents to the RFISH diary programs	4
Table 2.	Quarterly estimation procedures used to calculate the number of trips conducted by anglers in the RFISH diary program	7
Table 3.	Quarterly procedures used to estimate the species catch by recreational anglers in the angler diary program	8
Table 4.	List of species and species groups that have been used to produce total catch, harvest and release numbers	8
Table 5.	Estimated statewide total catch, harvest and release of fish and crabs calculated from the 1997, 1999, 2002 and 2005 RFISH diary rounds	10
Table 6.	Estimated statewide saltwater fish catch, harvest and release and associated standard error and relative standard error terms from the 1997, 1999, 2002 and 2005 RFISH diary rounds	11
Table 7.	Estimated statewide freshwater fish catch, harvest and release figures and associated standard error and relative standard error terms from the 1997, 1999, 2002 and 2005 RFISH diary surveys	23
Table 8.	Estimated statewide invertebrate catch, harvest and release and associated standard error and relative standard error terms from the 1997, 1999, 2002 and 2005 RFISH diary surveys	26
Table 9.	Species composition of the 5 major identified mackerel species reported in RFISH diary rounds used to allocate the unspecified component of RFISH catch estimates in each diary year	29
Table 10.	Species composition of the 2 major identified whiting species reported in RFISH diary rounds used to allocate the unspecified component of RFISH catch estimates in each diary year	30
Table 11.	Species composition of the identified crab species reported in RFISH diary rounds used to allocate the unspecified component of RFISH catch estimates in each diary year	31

## List of figures

Figure 1.	Overview of the flow of events during the 2005 RFISH diary round (n = number of participants)	3
Figure 2.	Statistical areas used to determine area of residence of anglers in the RFISH telephone and diary surveys	5

# Executive summary

This report provides a summary of the catch, release and harvest data obtained in the fourth Queensland statewide recreational fisheries program. The information was collected as part of the Recreational Fisheries Information System (RFISH) program, which was developed in 1995 to provide managers, policy makers, industry and researchers with catch estimates for the Queensland recreational fishery to enhance the management of Queensland's fisheries resources.

To calculate the catch estimates, fishing participation rates collected using a random telephone survey of the Queensland population were combined with catch estimates volunteer fishers provided through a 12-month diary program. The diary participants identified during the random telephone survey provided information on where they fished, what they caught and released, how long they spent fishing and their method of fishing. Over 5000 anglers participated in the 2005 diary program to provide information relating to their fishing activities (McInnes 2006).

Since participation rates were first collected (1996), we have seen a steady decline in the percentage of the Queensland population who can be described as 'fishers'—28.1% of the Queensland population in 1996, 26.1% in 1998, 24.6% in 2001 and 20.6% in 2004. This represents a decline in numbers from 882 200 (1996) Queensland resident fishers to 733 400 (2004). As this was the fourth estimate of statewide catch data, this report takes the opportunity to look at trends in catch, harvest and release between 1997 and 2005.

The results from the 2005 diary survey produced similar estimates to the 1997, 1999 and 2002 surveys, with an estimated 50 million fish and crabs captured by Queensland resident anglers during the year. The total estimate for 2005 shows an increase of over 4 million fish, crabs and invertebrates; however, it must be noted that throughout the 2005 diary program considerable effort was made to include all species of fish and invertebrates caught for bait purposes. The catch estimate of bait, compared to the 2002 figures, has increased by over 10 million fish and invertebrates; this number clearly distorts the total catch figures.

For some species the recreational catch is higher than the current commercial fisheries harvest. This again highlights the need for regular monitoring of the recreational fishery as it results in significant removal of fisheries resources from both marine and freshwater environments (Higgs et al. 2007)

The RFISH information has been used in sustainability reports submitted to the Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) as a requirement of the *Environment Protection and Biodiversity Conservation Act 1999*.

Although only in the early stages of operation at the time of writing this report, the RFISH program has begun to concentrate on providing better estimates of recreational catches and increasing its efforts at a regional scale to meet the requirements set by DEWHA. The RFISH program has been refined to include interviews of anglers at boat ramps and other shore-based locations to obtain more localised catch and effort information. At the time of writing this report around 15 bus route pilot surveys were being conducted by the RFISH program between Tweed Heads and Tewantin.



# Introduction

An accurate estimate of total fisheries production is one of the fundamental information requirements for the management of fish stocks worldwide; however, published fisheries production figures generally only account for commercial fisheries landings that are collected using a range of traditional data collection strategies, including census logbooks and sampling techniques. Most countries do not include estimates of recreational fisheries production because either the information does not exist or the information does not exist in a format directly comparable with the commercial production figures (Higgs et al. 2007).

The National Recreational and Indigenous Fishing Survey (NRIFS), which was conducted in 2000–01, provided a perspective of the importance of Queensland’s recreational fishery in relation to other state and territory recreational fisheries. The NRIFS indicated Queensland had the second highest number of households containing an active recreational fisher and their estimates suggested that Queensland was ranked third behind New South Wales and Victoria in terms of numbers of active fishers (Henry & Lyle 2003).

In response to the growing awareness of including recreational catch estimates into the fisheries management planning process, the Queensland Government initiated a statewide longitudinal sampling program to collect information relating to recreational fisheries. The development phases of the Recreational Fisheries Information System (RFISH) commenced in 1995 with the establishment of a recreational fisheries information coordination committee (RFICC) to oversee the development and implementation of a range of survey and sampling techniques that provide an ongoing monitoring tool for Queensland’s recreational fishery.

RFICC contained members from a range of government agencies with a variety of skills and experience in conducting recreational fishing surveys. Other members included resource managers and policy makers, as well as members from peak recreational and commercial fishing groups who could provide the field based experience to develop the most appropriate survey methodology for monitoring trends in Queensland’s recreational fishery (Higgs et al. 2007).

RFICC oversaw a series of workshops and interviews held around Queensland in 1995 and early 1996 that were designed to gather information about Queensland’s recreational fishery and seek input into the design of a statewide survey. It soon became clear that because of the geographic size of Queensland, an offsite survey would be required to gather information on a statewide scale. RFICC recommended that a statewide telephone survey, followed by a diary program, should form the cornerstone of recreational fisheries data collection for Queensland (Higgs, Olyott & McInnes 2007).

The diary and telephone survey programs have both undergone only slight modifications to enable direct comparison between surveys. Random telephone surveys were conducted in 1996, 1998, 2001 and 2004 to obtain fishing participation information and also to recruit around 5000 volunteers to participate in the diary programs. Diary programs were completed in 1997, 1999, 2002 and 2005.

This report summarises the methods used during the 2005 diary survey and compares the results with estimates for key species from the three earlier surveys. Electronic files are attached to this document to provide additional species catch summaries for each of the 15 areas used to cover the state in the RFISH diary program. In order to account for anglers’ inability to accurately allocate catches to a particular species, an attempt to allocate unspecified catches of mackerel, whiting and crabs to a particular species has also been provided. This helps determine the best estimate of total catches for key species (Higgs et al. 2007).

**Note: While the Queensland-level relative standard errors (RSEs) are reasonable across species, the majority of region-level RSEs for species represent high cautions. An estimate that has a RSE of between 25% and 50% should be used with caution and an estimate that has a RSE greater than 50% is considered too unreliable for general use (Szigetvari 2006).**

# Survey design and methods

## Background to Queensland RFISH survey

The diary survey recommended by RFICC was based on the multi-stage sampling method employed to produce New Zealand's first national survey of recreational fishing (Bradford 1998). The telephone survey was used to determine the levels of fishing participation and demographic characteristics of Queensland resident anglers (McInnes 2006). The telephone survey was also used to select volunteers to maintain a diary of their fishing activities for a 12-month period following the telephone survey.

### Telephone survey

Anglers to be included in the diary program were selected from a statewide telephone survey conducted in November and December 2004. Telephone numbers were selected randomly in each of 15 statistical areas covering the state and households were contacted by Roy Morgan Research Pty Ltd—the service provider used to conduct all earlier surveys. This ensured additional confidence in the consistency of the survey's implementation, and also ensured trends identified were actual trends in the angling population and not an artefact of using different service providers.

Households were asked a series of questions and an angler was randomly drawn from the household and asked to participate in the diary program. Full details of the results of the four statewide telephone surveys conducted to date can be found in the 2004 RFISH telephone report (McInnes 2006).

There were only limited changes to the interview used by the service provider during the survey. These changes included changes to reflect the inclusion of the Queensland Fisheries Management Authority into the Queensland Fisheries Service. In the final round of the survey the Department of Primary Industries became the Department of Primary Industries and Fisheries (DPI&F). Changes also included the collection of email addresses, and the inclusion of a question to clarify which contact phone number was the most appropriate for future contacts.

### Diary phase

Earlier surveys had identified that quarterly phone calls, in addition to letters and newsletters, were required to remind anglers to return their fishing information at the end of the quarter. Follow-up calls were made to all anglers who had not provided written information for the quarter. Diarists were asked for information on the number of fishing trips they had made in the quarter and reminded to complete and return the diary entries. The estimated number of trips recalled by telephone respondents was compared to the actual number of reported trips returned after the follow-up call, providing an estimate of the approximate level of recall bias over the three-month period. This information was then used to correct the recalled number of trips per quarter for people that were contacted during the telephone follow-up calls but did not return diary entries for fishing trips.

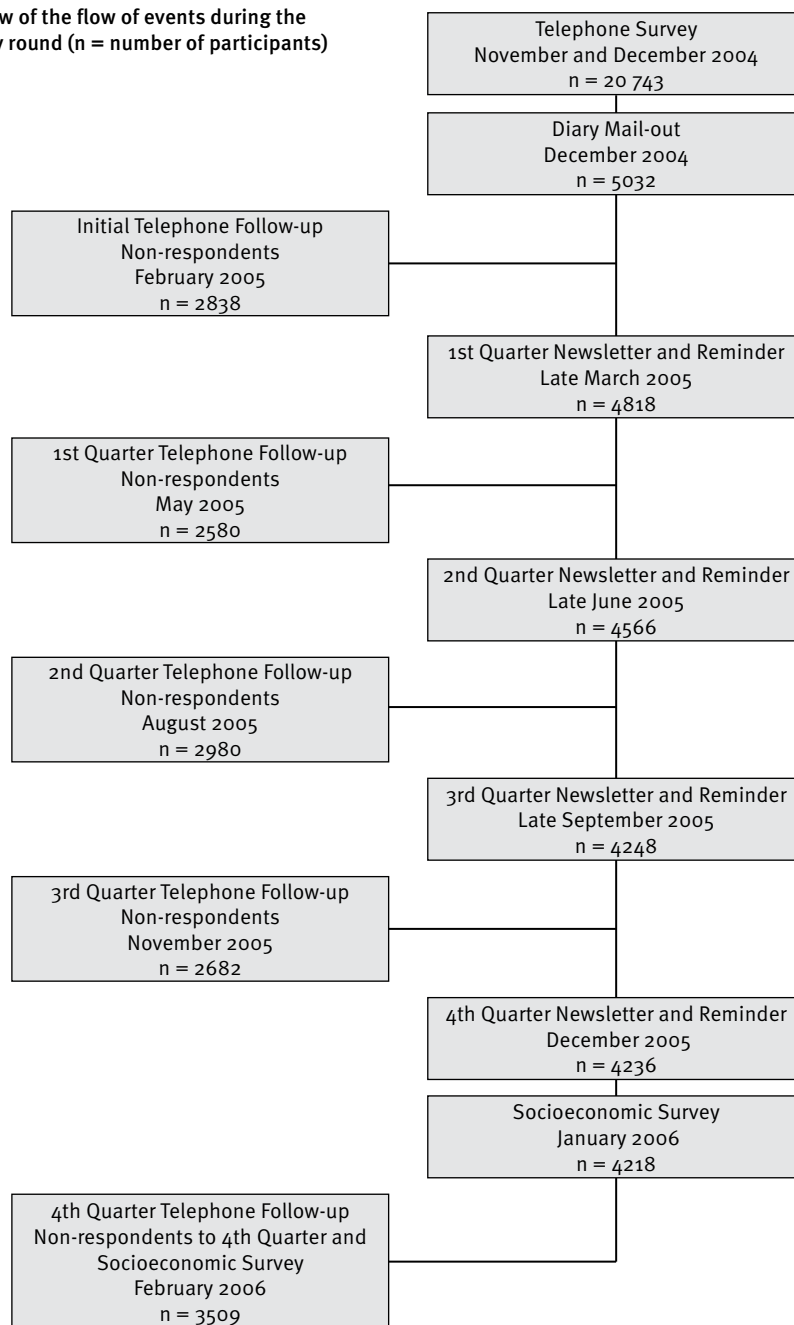
### Diary phase implementation

As with the earlier diary rounds, quarterly newsletters were distributed to all anglers just prior to the conclusion of each quarter to remind them to complete their fishing activity forms and to return them to DPI&F. Attempts were made to contact non-respondents to determine the number of times they had fished during the quarter, and also to prompt anglers to return completed diary sheets of their fishing activities.

A summary of the timing and the magnitude of follow-up events is provided in Figure 1. For those anglers that provided completed trip forms after a telephone follow-up call, the number of trips reported during the telephone conversation was compared with the number of trips reported through the diary round. This information was then used in Step 2 of the procedure used to calculate fishing effort.

Of the 6075 anglers identified during the telephone survey, 5032 anglers (83%) agreed to maintain a diary of their fishing activities. Anglers were then sent a diary containing instructions and a newsletter reiterating the importance of the program and the need to obtain information from everyone—irrespective of how frequently they fished. A letter to diary participants was used as a quarterly reminder for anglers to return their completed trip records or quarterly summary sheets indicating they had not been fishing for the quarter. Anglers who did not return their quarterly summary sheets were contacted by the telephone survey agent. The survey agent requested this quarterly information together with an estimate of the number of times the angler had been fishing in the quarter.

**Figure 1. Overview of the flow of events during the 2005 RFISH diary round (n = number of participants)**



# Expansion of diary data to population estimates

## Response rates—quarterly progressive changes

Offsite self-completion surveys are commonly characterised by low response rates and increasing respondent fatigue as the programs progress (Brown 1991; Pollock et al. 1994). The diary phase of the RFISH statewide surveys have shown consistent patterns of decreasing participation as the diary year progresses (Table 1). Increasing levels of feedback to respondents through newsletters and telephone contact, and incentives such as random prize draws, calendars, fish identification charts and rulers, helped maintain the proportion of anglers who provided diary or telephone effort estimates.

Table 1. Quarterly summary of different types of respondents to the RFISH diary programs

Analysis Step	Respondent type	Quarter 1				Quarter 2			
		1997	1999	2002	2005	1997	1999	2002	2005
1	Fully respondent	2210	2270	3045	2831	2027	2063	2742	2425
2	Phone only (number of trips provided)	1128	999	1557	1006	1291	1026	1676	864
3	Phone (fished—number of trips not provided)	26	42	19	2	30	26	11	2
Initial number of participants		5022	4506	5022	5032				
Analysis Step	Respondent type	Quarter 3				Quarter 4			
		1997	1999	2002	2005	1997	1999	2002	2005
1	Fully respondent	1473	1824	2394	2205	1585	1525	2101	1677
2	Phone only (number of trips provided)	1302	1045	1547	877	987	970	1522	1088
3	Phone (fished—number of trips not provided)	59	19	26	11	28	22	51	5
Initial number of participants									

## Scaling factors procedures

Recreational fishing participation rate information collected during the 2004 RFISH telephone survey (McInnes 2006) was used to estimate the number of anglers in six age and two gender categories for each of the 15 statistical areas covering the state.

Each diary participant was categorised in an age, gender and area of residence demographic category. These participants were then allocated a scaling factor or 'weighting' to scale them—and other anglers within the same age, gender and area of residence category—to the estimated total number of anglers within that category and area of residence. These weightings were then used to expand the data recorded by diary participants to the total recreational fishing population.

Weightings were recalculated at the end of each quarter to account for people who dropped out of the diary program. Some categories were clumped to maintain six or more active participants in each cell, with the collapsing occurring upwards across age groups within sex and area of residence cells (i.e. if there were only five female diarists aged 15–19 years in a region, then their details were merged into the 20–29 year-old female category in the same region).

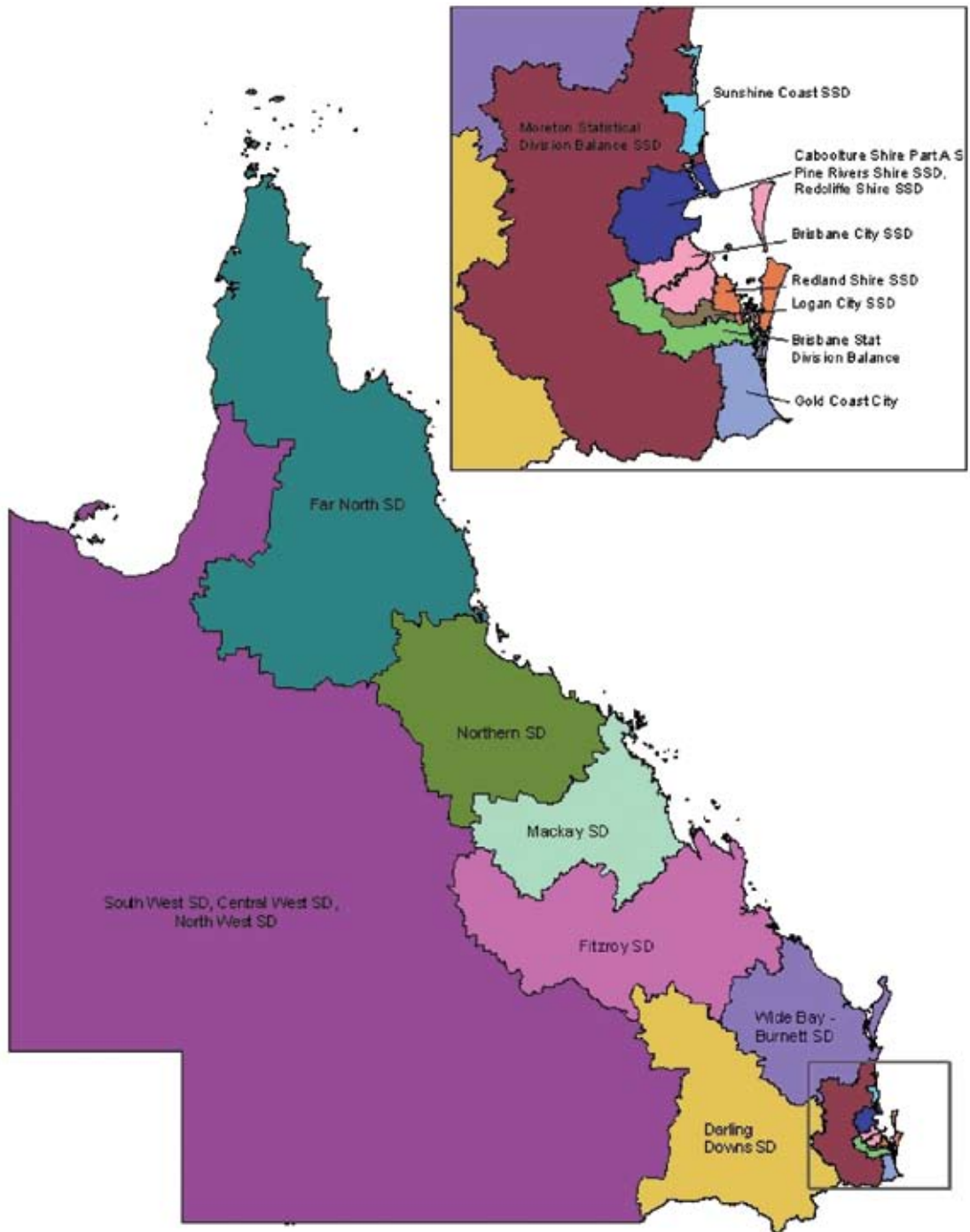


Figure 2. Statistical areas used to determine area of residence of anglers in the RFISH telephone and diary surveys

### Catch estimation procedures

The South Australian branch of the Australian Bureau of Statistics Consultancy Services (ABSCS) conducted a variety of statistical procedures to calculate the catch estimates and associated error terms for each of the diary programs on behalf of DPI&F. Table 2 outlines the procedures used by the ABSCS to account for the range of non-response categories encountered during the expansion of catch details for the randomly selected sample to the estimated population catch.

Step 1 was applied to all anglers who returned trip information at the end of a particular quarter and assumed that the trip information received was representative of all fishing activities conducted by that individual during the quarter.

Step 2 was applied to people who only provided an estimate of their fishing events during the quarterly non-respondent follow-up calls (Figure 1). Several imputations were applied to the event information provided to account for observed differences between recalled information provided over the telephone, and diary information returned to DPI&F following a reminder call to anglers. These differences are assumed to be related to recall bias, prestige bias, or telescoping of trips into the recall period in question.

Step 3 was applied to the small number of anglers contacted during the telephone follow-up who claimed they went fishing during the quarter but refused to say how often.

Step 4 was applied to people identified during the diary responses and/or telephone follow-ups as anglers who had not been fishing during the 12-month diary period. Those anglers who indicated that they had fished during the initial telephone screening survey were assumed to have left the Queensland fishing population and were replaced by other anglers entering the fishery with the same characteristics. Fishing characteristics of this group were modelled to remove the overestimation of fishing trips anglers reported during the telephone survey when compared to their actual trips reported during the diary program.

A series of hierarchical steps were used in the estimation of the number of fish caught by individual anglers (Table 3). These steps assume that the best estimate of fish catch will be approximated by other anglers in the same age by sex by region cells. An overview of the procedures used to calculate the variance estimates for the catch estimates is presented in Table 2.

**Table 2. Quarterly estimation procedures used to calculate the number of trips conducted by anglers in the RFISH diary program**

Step	Procedure
1	Number of trips was unchanged for anglers who had provided diary information for the quarter.
2	For anglers who provided an estimate of the number of trips they had conducted during telephone follow-up calls, but did not provide diary returns. The number of trips was modelled using the following procedures: <ul style="list-style-type: none"> <li>• If the number of trips reported on the telephone was between 1 and 10, the number of trips was calculated as <math>\text{Trips} = 1.14247 + 0.57301 \times (\text{trips reported in the phone follow-up})</math>.</li> <li>• If the number of trips reported on the telephone was greater than 10, the number of trips was calculated as <math>\text{Trips} = 6.89155 + 0.11401 \times (\text{trips reported in the phone follow-up})</math>.</li> </ul>
3	For anglers who claimed on the telephone they went fishing during the quarter, but did not provide an estimate of the number of trips, the following calculations were made: <ul style="list-style-type: none"> <li>• The number of trips was taken as the average of Step 1 and Step 2.</li> </ul>
4	For anglers who did not fish during 2005 (but were assumed to be replaced by people with the same fishing characteristics), the following modelling was used to estimate the number of trips conducted: <ul style="list-style-type: none"> <li>• If the number of trips reported in the initial 2004 telephone survey was less than or equal to 30, then the number of trips was calculated as <math>\text{Trips} = 3.28158 + 0.46680 \times (\text{trips reported in the initial telephone survey})</math>.</li> <li>• If the number of trips reported in the initial telephone survey was greater than 30 then the number of trips was calculated as <math>\text{Trips} = 18.93295 + 0.03593 \times (\text{trips reported in the initial telephone survey})</math>.</li> </ul>

Table 3. Quarterly procedures used to estimate the species catch by recreational anglers in the angler diary program

Step	Procedure
1	Number of each species is unchanged for anglers who provided diary information for the quarter.
2	For anglers that provided an estimate of the number of trips they had conducted during telephone follow-up calls but did not provide diary returns. The number of species caught was derived by: <ul style="list-style-type: none"> <li>• multiplying their imputed number of trips by the average per trip catch of diary participants (Step 1) in the age by sex by region cell.</li> </ul>
3	For anglers who claimed on the telephone they went fishing during the quarter, but did not provide an estimate of the number of trips, the number of species caught was derived by: <ul style="list-style-type: none"> <li>• multiplying their imputed number of trips by the average catch per trip of diary participants (Steps 1 and 2) in the age by sex by region cell.</li> </ul>
4	For anglers who did not fish during the period of the logbook program (but were assumed to be replaced by anglers with the same fishing characteristics), the following modelling was used to estimate the number of each species caught was derived by: <ul style="list-style-type: none"> <li>• multiplying their imputed number of trips by the average catch per trip of diary participants (Steps 1, 2 and 3) in the age by sex by region cell.</li> </ul>

Table 4. List of species and species groups that have been used to produce total catch, harvest and release numbers

1997 species categories	1999 species categories	2002 species categories	2005 species categories	Species included
Australian bass	Australian bass	Australian bass	Australian bass	<i>Macquaria novemaculeata</i>
		Bait*	Bait*	Species only identified as bait or mullet, herring, garfish, pike, sardines, slimy mackerel, hardyheads, and scad. Also invertebrates including worms, saltwater yabbies and pippies.
			Bait (excluding saltwater yabbies)	Bait as listed above but excluding saltwater yabbies ( <i>Trypaea australiensis</i> )
		Banded grunter	Banded grunter	<i>Amniataba percoides</i>
Barramundi	Barramundi	Barramundi	Barramundi	<i>Lates calcarifer</i>
Bream	Bream	Bream	Bream	Family Sparidae (excluding <i>Pagrus auratus</i> )
Catfish	Catfish	Catfish (total)	Catfish (total)	Eel-tailed (family Plotosidae) and fork-tailed (family Ariidae)
		Catfish (eel-tailed)	Catfish (eel-tailed)	Eel-tailed (family Plotosidae)
		Catfish (other)	Catfish (other)	Fork-tailed (family Ariidae)
			Cobia	<i>Rachycentron canadum</i>
Cod	Cod	Cod	Cod	Family Serranidae
Coral trout	Coral trout	Coral trout	Coral trout	<i>Plectropomus</i> spp. and <i>Variola</i> spp.
Crab	Crab (unspecified)	Crab (unspecified)	Crab (unspecified)	
	Crab (blue swimmer/sand)	Crab (blue swimmer/sand)	Crab (blue swimmer/sand)	<i>Portunus pelagicus</i>
	Crab (mud)	Crab (mud)	Crab (mud)	<i>Scylla serrata</i>
	Crab (spanner)	Crab (spanner)	Crab (spanner)	<i>Ranina ranina</i>
	Crab (other)	Crab (other)	Crab (other)	Three-spot crab ( <i>P. sanguinolentus</i> ), Coral crab ( <i>Charybdis cruciata</i> )
			Dart	<i>Trachinotus</i> spp.
		European carp	European carp	<i>Cyprinus carpio</i>
			Fingermark	<i>Lutjanus johnii</i>
Flathead	Flathead	Flathead	Flathead	<i>Platycephalus</i> spp.

1997 species categories	1999 species categories	2002 species categories	2005 species categories	Species included
Freshwater crayfish	Freshwater crayfish	Freshwater crayfish	Freshwater crayfish	<i>Cherax</i> spp.
			Garfish	Family Hemiramphidae
			Grass emperor	<i>Lethrinus laticaudis</i>
		Grunter/javelinfinh	Grunter/javelinfinh	Family Haemulidae
		Hussar	Hussar	<i>Lutjanus adetii</i> and <i>L. vitta</i>
Mackerel	Mackerel (unspecified)	Mackerel (unspecified)	Mackerel (unspecified)	<i>Scomberomorus</i> spp.
	Mackerel (Spanish)	Mackerel (Spanish)	Mackerel (Spanish)	<i>S. commerson</i>
	Mackerel (grey)	Mackerel (grey)	Mackerel (grey)	<i>S. semifasciatus</i>
	Mackerel (spotted)	Mackerel (spotted)	Mackerel (spotted)	<i>S. munroi</i>
	Mackerel (school)	Mackerel (school)	Mackerel (school)	<i>S. queenslandicus</i>
	Mackerel (shark)	Mackerel (shark)	Mackerel (shark)	<i>Grammatorcynus bicarinatus</i>
			Kingfish/ samsonfish/ amberjack	Family Rachycentridae ( <i>Seriola lalandi</i> , <i>S. hippos</i> and <i>S. dumerili</i> )
	Mangrove jack	Mangrove jack	Mangrove jack	<i>Lutjanus argentimaculatus</i>
			Moses perch	<i>Lutjanus russelli</i>
		Mullet	Mullet	<i>Mugilidae</i> spp.
		Murray cod	Murray cod	<i>Maccullochella peelii peelii</i>
		Nannygai	Nannygai	<i>Lutjanus erythropterus</i> and <i>L. malabaricus</i>
		Parrotfish/Tuskfish	Parrotfish/Tuskfish	<i>Choerodon</i> spp.
	Pearl perch	Pearl perch	Pearl perch	<i>Glaucosoma scapulare</i>
Prawns	Prawns	Prawns	Prawns	Family Penaeidae
			Queenfish	<i>Scomberoides</i> spp.
			Rays	Family Dasyatidae
			Redclaw	<i>Cherax quadricarinatus</i>
		Red emperor	Red emperor	<i>Lutjanus sebae</i>
	Redthroat emperor	Redthroat emperor	Redthroat emperor	<i>Lethrinus miniatus</i>
			Saltwater yabbies	<i>Trypaea australiensis</i>
		Shark	Shark	Sharks and rays in 2002 but sharks (Elasmobranchii) only in 2005
		Silver grunter	Silver grunter	<i>Mesopristes argenteus</i>
			Silver perch	<i>Bidyanus bidyanus</i>
		Sooty grunter	Sooty grunter	<i>Hephaestus fulliginosus</i>
Southern snapper	Southern snapper	Southern snapper	Southern snapper	<i>Pagrus auratus</i>
			Spangled emperor	<i>Lethrinus nebulosus</i>
Spangled perch	Spangled perch	Spangled perch	Spangled perch	<i>Leiopotherapon unicolor</i>
			Stripey	<i>Lutjanus carponotatus</i>
Sweetlip/emperor	Sweetlip/emperor	Sweetlip/emperor	Sweetlip/emperor	Family Lethrinidae
Tailor	Tailor	Tailor	Tailor	<i>Pomatomus saltatrix</i>
		Threadfin salmon	Threadfin salmon	Blue threadfin ( <i>Eleutheronema tetradactylum</i> ) and king threadfin ( <i>Polydactylus macrochir</i> )



1997 species categories	1999 species categories	2002 species categories	2005 species categories	Species included
		Tilapia	Tilapia	<i>Tilapia mariae</i> and <i>Oreochromis mossambicus</i>
Trevally	Trevally	Trevally	Trevally	Family Carangidae
			Tuna	Family Scombridae (tribes Sardini and Thunnini)
Tropical snappers	Tropical snappers	Tropical snappers	Tropical snappers	Family Lutjanidae <i>Lutjanus sebae</i>
		Squid		Family Loliginidae
Whiting	Whiting (unspecified)	Whiting (unspecified)	Whiting (unspecified)	Family Sillaginidae
	Whiting (sand/summer and golden)	Whiting (sand/summer and golden)	Whiting (sand/summer and golden)	<i>Sillago ciliata</i> and <i>S. analis</i>
	Whiting (winter/diver)	Whiting (winter/diver)	Whiting (winter/diver)	<i>Sillago maculata</i>
Yellowbelly	Yellowbelly	Yellowbelly	Yellowbelly	<i>Macquaria ambigua</i>
Others	Others	Others	Others	Total catch excluding the catch of species groups in this table
Total	Total	Total	Total	Total catch excluding prawns, which are measured in kilograms

## Results

### Interpretations of catch estimates and associated error terms

The following results contain estimates from the 1997, 1999, 2002 and 2005 RFISH diary program for a range of key species and species families. Catch estimates are presented on a statewide basis. Regional details, based on an angler's area of residence, are provided on the attached compact disc.

For whiting, mackerel and crab species, the following section also includes an estimate of the allocation of unspecified mackerel, whiting and crab catches into different species groups within a broader taxonomic group.

### Total catch

The 'total catch' estimate for Queensland's recreational fishery has increased with each of the surveys conducted. The total catch estimate for 2005 comprised 54.5 million fish, crabs and invertebrates (excluding prawns). This estimate is up from earlier estimates of 50.4 million (2002), 48.4 million (1999) and 46.1 million (1997) (Table 5).

To some extent, these increases are related to a greater emphasis—through educational material provided throughout the second, third and, in particular, the fourth survey—for anglers to report their captures of 'bait species' (including saltwater yabbies, worms and other invertebrates).

Bait species accounted for 13% of the estimated total catch in 2002; in 2005 the percentage was closer to 32%. This must be noted when comparing total catch figures across the four surveys. The proportion of the total catch harvested was 47% (1997), 49% (1999), 48% (2002) and 56% (2005) for the annual surveys which equates to harvest estimates of 21.7, 23.7, 24.5 and 30.4 million fish, crabs and invertebrates.

Table 5. Estimated statewide total catch, harvest and release of fish and crabs calculated from the 1997, 1999, 2002 and 2005 RFISH diary rounds

Year	Fate	Estimate	Standard error	Relative standard error (%)
1997	Catch	46 147 000	1 040 000	2.3
1999	Catch	48 438 000	2 442 000	5.0
2002	Catch	50 379 000	1 850 000	3.7
2005	Catch	54 512 000	2 135 000	3.9
1997	Harvest	21 687 000	596 000	6.2
1999	Harvest	23 674 000	1 471 000	5.0
2002	Harvest	24 076 000	1 196 000	2.8
2005	Harvest	30 424 000	1 293 000	4.2
1997	Release	24 461 000	557 000	2.3
1999	Release	24 763 000	1 260 000	5.1
2002	Release	26 303 000	847 000	3.2
2005	Release	24 088 000	1 054 000	4.4

## Finfish catches

Finfish account for a substantial proportion of the catch, harvest and release of Queensland recreational fishers. This section is divided into two main sections, which provide a statewide overview of the fish species captured predominantly in saltwater and those captured predominantly in freshwater environments. The species are listed alphabetically based on their common name, or the common name for the major taxonomic group to which they belong.

## Saltwater finfish catch estimates

Table 6. Estimated statewide saltwater fish catch, harvest and release and associated standard error and relative standard error terms from the 1997, 1999, 2002 and 2005 RFISH diary rounds

Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
2002	Bait	Catch	6 589 000	887 000	13.5
2002	Bait	Harvest	5 968 000	869 000	14.6
2002	Bait	Release	621 000	83 000	13.4
2005	Bait (excl. saltwater yabbies)*	Catch	17 415 000	1 138 000	6.5
2005	Bait (excl. saltwater yabbies)*	Harvest	14 716 000	894 000	6.1
2005	Bait (excl. saltwater yabbies)*	Release	2 699 000	378 000	14.0

Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
1997	Barramundi	Catch	294 000	31 000	10.4
1999	Barramundi	Catch	435 000	62 000	14.4
2002	Barramundi	Catch	268 000	21 000	8.0
2005	Barramundi	Catch	191 000	19 000	10.2
1997	Barramundi	Harvest	70 000	5 000	8.4
1999	Barramundi	Harvest	120 000	17 000	14.3
2002	Barramundi	Harvest	64 000	6 000	9.7
2005	Barramundi	Harvest	51 000	6 000	12.5
1997	Barramundi	Release	225 000	28 000	12.5
1999	Barramundi	Release	315 000	47 000	15.2
2002	Barramundi	Release	203 000	17 000	8.5
2005	Barramundi	Release	140 000	16 000	11.3
1997	Bream	Catch	7 788 000	234 000	3.0
1999	Bream	Catch	6 630 000	376 000	5.7
2002	Bream	Catch	6 390 000	258 000	4.1
2005	Bream	Catch	5 074 000	245 000	4.8
1997	Bream	Harvest	2 707 000	92 000	3.4
1999	Bream	Harvest	2 644 000	198 000	7.5
2002	Bream	Harvest	2 104 000	115 000	5.5
2005	Bream	Harvest	1 877 000	116 000	6.2
1997	Bream	Release	5 081 000	167 000	3.3
1999	Bream	Release	3 986 000	206 000	5.2
2002	Bream	Release	4 286 000	169 000	3.9
2005	Bream	Release	3 197 000	150 000	4.7
2005	Cobia	Catch	52 000	8 000	14.7
2005	Cobia	Harvest	31 000	4 000	13.7
2005	Cobia	Release	21 000	5 000	22.0
1997	Cod	Catch	1 276 000	50 000	3.9
1999	Cod	Catch	1 203 000	85 000	7.2
2002	Cod	Catch	1 514 000	89 000	5.9
2005	Cod	Catch	1 360 000	76 000	5.6
1997	Cod	Harvest	558 000	29 000	5.2
1999	Cod	Harvest	569 000	42 000	7.5
2002	Cod	Harvest	559 000	33 000	5.9
2005	Cod	Harvest	374 000	22 000	5.8
1997	Cod	Release	718 000	29 000	4.0
1999	Cod	Release	633 000	48 000	7.6
2002	Cod	Release	955 000	66 000	6.9
2005	Cod	Release	986 000	61 000	6.2

Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
1997	Coral trout	Catch	552 000	38 000	6.9
1999	Coral trout	Catch	589 000	59 000	10.0
2002	Coral trout	Catch	629 000	49 000	7.8
2005	Coral trout	Catch	386 000	33 000	8.7
1997	Coral trout	Harvest	306 000	26 000	8.4
1999	Coral trout	Harvest	329 000	31 000	9.6
2002	Coral trout	Harvest	332 000	26 000	8.1
2005	Coral trout	Harvest	196 000	16 000	8.3
1997	Coral trout	Release	246 000	17 000	7.1
1999	Coral trout	Release	259 000	31 000	12.1
2002	Coral trout	Release	297 000	25 000	8.5
2005	Coral trout	Release	190 000	20 000	10.5
1999	Dart	Catch	1 646 000	184 000	11.2
2002	Dart	Catch	1 440 000	123 000	8.6
2005	Dart	Catch	1 530 000	146 000	9.6
1999	Dart	Harvest	818 000	120 000	14.6
2002	Dart	Harvest	623 000	62 000	9.9
2005	Dart	Harvest	612 000	61 000	10.0
1999	Dart	Release	828 000	87 000	10.5
2002	Dart	Release	817 000	87 000	10.7
2005	Dart	Release	917 000	95 000	10.4
2005	Fingermark	Catch	143 000	15 000	10.2
2005	Fingermark	Harvest	33 000	4000	11.0
2005	Fingermark	Release	111 000	13 000	11.9
1997	Flathead	Catch	1 625 000	71 000	4.3
1999	Flathead	Catch	1 179 000	59 000	5.0
2002	Flathead	Catch	1 446 000	83 000	5.8
2005	Flathead	Catch	1 065 000	50 000	4.7
1997	Flathead	Harvest	788 000	39 000	4.9
1999	Flathead	Harvest	669 000	38 000	5.6
2002	Flathead	Harvest	566 000	31 000	5.4
2005	Flathead	Harvest	415 000	23 000	5.6
1997	Flathead	Release	837 000	40 000	4.8
1999	Flathead	Release	510 000	29 000	5.7
2002	Flathead	Release	881 000	58 000	6.6
2005	Flathead	Release	649 000	33 000	5.0
2005	Garfish	Catch	530 000	155 000	29.3
2005	Garfish	Harvest	494 000	148 000	30.0
2005	Garfish	Release	36 000	9000	24.4
2005	Grass emperor	Catch	412 000	46 000	11.2
2005	Grass emperor	Harvest	153 000	23 000	15.4
2005	Grass emperor	Release	259 000	30 000	11.4

Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
2002	Grunter	Catch	656 000	68 000	1.4
2005	Grunter	Catch	783 000	70 000	9.0
2002	Grunter	Harvest	215 000	24 000	1.3
2005	Grunter	Harvest	209 000	18 000	8.7
2002	Grunter	Release	442 000	48 000	1.4
2005	Grunter	Release	574 000	58 000	10.0
2002	Hussar	Catch	194 000	24 000	12.5
2005	Hussar	Catch	318 000	31 000	9.8
2002	Hussar	Harvest	116 000	18 000	15.4
2005	Hussar	Harvest	111 000	12 000	10.7
2002	Hussar	Release	78 000	12 000	15.4
2005	Hussar	Release	207 000	24 000	11.4
2005	Kingfish/samson fish/ amberjack	Catch	41 000	8000	19.2
2005	Kingfish/samson fish/ amberjack	Harvest	24 000	4000	14.9
2005	Kingfish/samson fish/ amberjack	Release	18 000	6000	32.0
1997	Mackerel (total)	Catch	538 000	35 000	6.5
1999	Mackerel (total)	Catch	385 000	34 000	8.8
2002	Mackerel (total)	Catch	343 000	27 000	7.9
2005	Mackerel (total)	Catch	488 000	39 000	7.9
1997	Mackerel (total)	Harvest	413 000	29 000	6.9
1999	Mackerel (total)	Harvest	288 000	28 000	10.0
2002	Mackerel (total)	Harvest	234 000	19 000	8.3
2005	Mackerel (total)	Harvest	301 000	20 000	6.8
1997	Mackerel (total)	Release	125 000	12 000	9.3
1999	Mackerel (total)	Release	96 000	11 000	12.3
2002	Mackerel (total)	Release	109 000	10 000	9.7
2005	Mackerel (total)	Release	187 000	23 000	12.2
1997	Mackerel (unspecified)	Catch	538 000	35 000	6.5
1999	Mackerel (unspecified)	Catch	92 000	20 000	21.4
2002	Mackerel (unspecified)	Catch	140 000	16 000	11.4
2005	Mackerel (unspecified)	Catch	91 000	11 000	12.4
1997	Mackerel (unspecified)	Harvest	413 000	29 000	6.9
1999	Mackerel (unspecified)	Harvest	74 000	17 000	22.9
2002	Mackerel (unspecified)	Harvest	96 000	12 000	12.4
2005	Mackerel (unspecified)	Harvest	50 000	6000	11.2
1997	Mackerel (unspecified)	Release	125 000	12 000	9.3
1999	Mackerel (unspecified)	Release	18 000	5000	27.5
2002	Mackerel (unspecified)	Release	44 000	6000	14.1
2005	Mackerel (unspecified)	Release	41 000	8000	19.4

Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
1997	Mackerel (grey)	Catch	(10 000)		
1999	Mackerel (grey)	Catch	6400 (1840)	2000	38.9
2002	Mackerel (grey)	Catch	2300 (1400)	800	33.2
2005	Mackerel (grey)	Catch	12 200 (2800)	2000	16.5
1997	Mackerel (grey)	Harvest	(9000)		
1999	Mackerel (grey)	Harvest	4900 (1700)	2000	41.9
2002	Mackerel (grey)	Harvest	1500 (1300)	600	38.5
2005	Mackerel (grey)	Harvest	9800 (1900)	1800	18.0
1997	Mackerel (grey)	Release	(2000)		
1999	Mackerel (grey)	Release	1500 (470)	600	39.3
2002	Mackerel (grey)	Release	800 (480)	400	50.8
2005	Mackerel (grey)	Release	2400 (650)	700	27.5
1997	Mackerel (school)	Catch	(135 000)		
1999	Mackerel (school)	Catch	96 000 (30 200)	18 000	18.7
2002	Mackerel (school)	Catch	68 000 (46 900)	12 000	17.1
2005	Mackerel (school)	Catch	200 000 (46 000)	27 000	13.5
1997	Mackerel (school)	Harvest	(79 000)		
1999	Mackerel (school)	Harvest	65 000 (22 000)	15 000	23.4
2002	Mackerel (school)	Harvest	40 000 (28 000)	8 000	19.0
2005	Mackerel (school)	Harvest	110 000 (22 000)	12 000	10.8
1997	Mackerel (school)	Release	(60 000)		
1999	Mackerel (school)	Release	30 000 (7000)	7 000	23.6
2002	Mackerel (school)	Release	28 000 (19 000)	6 000	19.9
2005	Mackerel (school)	Release	89 000 (25 000)	17 000	19.4

Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
1997	Mackerel (shark)	Catch	(9000)		
1999	Mackerel (shark)	Catch	1800 (600)	600	34.3
2002	Mackerel (shark)	Catch	8000 (5000)	1 000	16.5
2005	Mackerel (shark)	Catch	8000 (2000)	2 000	29.8
1997	Mackerel (shark)	Harvest	(6000)		
1999	Mackerel (shark)	Harvest	1600 (500)	600	37.7
2002	Mackerel (shark)	Harvest	6000 (4000)	1 000	18.1
2005	Mackerel (shark)	Harvest	5000 (1000)	1 000	26.8
1997	Mackerel (shark)	Release	(3000)		
1999	Mackerel (shark)	Release	200 (50)	100	57.6
2002	Mackerel (shark)	Release	2000 (1000)	600	30.8
2005	Mackerel (shark)	Release	3000 (1000)	1000	43.9
1997	Mackerel (Spanish)	Catch	(63 000)		
1999	Mackerel (Spanish)	Catch	82 000 (26 000)	13 000	15.1
2002	Mackerel (Spanish)	Catch	51 000 (35 000)	6000	11.9
2005	Mackerel (Spanish)	Catch	64 000 14 000	9000	14.5
1997	Mackerel (Spanish)	Harvest	(55 000)		
1999	Mackerel (Spanish)	Harvest	56 000 (19 000)	10 000	17.8
2002	Mackerel (Spanish)	Harvest	38 000 (26 000)	5000	11.9
2005	Mackerel (Spanish)	Harvest	45 000 (9000)	6000	12.5
1997	Mackerel (Spanish)	Release	7000		
1999	Mackerel (Spanish)	Release	26 000 (6000)	6000	22.1
2002	Mackerel (Spanish)	Release	13 000 (9000)	3000	21.3
2005	Mackerel (Spanish)	Release	19 000 (5000)	5000	28.8

Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
1997	Mackerel (spotted)	Catch	(321 000)		
1999	Mackerel (spotted)	Catch	107 000 (34 000)	14 000	13.5
2002	Mackerel (spotted)	Catch	74 000 (51 000)	10 000	13.9
2005	Mackerel (spotted)	Catch	113 000 (26 000)	14 000	12.0
1997	Mackerel (spotted)	Harvest	(264 000)		
1999	Mackerel (spotted)	Harvest	87 000 (30 000)	12 000	13.9
2002	Mackerel (spotted)	Harvest	53 000 (37 000)	7000	14.0
2005	Mackerel (spotted)	Harvest	80 000 (16 000)	9000	11.7
1997	Mackerel (spotted)	Release	(54 000)		
1999	Mackerel (spotted)	Release	20 000 (5000)	4000	18.0
2002	Mackerel (spotted)	Release	21 000 (14 000)	5000	21.1
2005	Mackerel (spotted)	Release	33 000 (9000)	6000	19.2
1999	Mangrove jack	Catch	238 000	28 000	11.6
2002	Mangrove jack	Catch	244 000	40 000	16.4
2005	Mangrove jack	Catch	173 000	17 000	9.9
1999	Mangrove jack	Harvest	117 000	12 000	10.0
2002	Mangrove jack	Harvest	107 000	12 000	11.6
2005	Mangrove jack	Harvest	77 000	8000	10.0
1999	Mangrove jack	Release	121 000	18 000	15.1
2002	Mangrove jack	Release	137 000	29 000	21.4
2005	Mangrove jack	Release	96 000	11 000	11.9
2005	Moses perch	Catch	504 000	37 000	7.4
2005	Moses perch	Harvest	71 000	9000	12.4
2005	Moses perch	Release	433 000	34 000	7.8
2002	Mullet	Catch	2 300 000	448 000	19.3
2005	Mullet	Catch	2 200 000	178 000	8.1
2002	Mullet	Harvest	2 213 000	446 000	20.1
2005	Mullet	Harvest	1 844 000	152 000	8.3
2002	Mullet	Release	104 000	19 000	18.0
2005	Mullet	Release	355 000	47 000	13.3
2002	Nannygai	Catch	213 000	30 000	14.1
2005	Nannygai	Catch	340 000	109 000	32.0
2002	Nannygai	Harvest	104 000	18 000	17.0
2005	Nannygai	Harvest	124 000	45 000	36.7
2002	Nannygai	Release	109 000	21 000	19.3
2005	Nannygai	Release	215 000	64 000	29.8



Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
1997	Other	Catch	7 004 000	209 000	3.0
1999	Other	Catch	9 176 000	1058 000	11.5
2002	Other	Catch	2 361 000	110 000	4.7
2005	Other	Catch	2 700 000	276 000	10.2
1997	Other	Harvest	2 929 000	101 000	3.5
1999	Other	Harvest	3 736 000	442 000	11.8
2002	Other	Harvest	719 000	43 000	6.0
2005	Other	Harvest	907 000	93 000	10.3
1997	Other	Release	4 075 000	153 000	3.8
1999	Other	Release	5 440 000	727 000	13.4
2002	Other	Release	1 642 000	83 000	5.0
2005	Other	Release	1 793 000	247 000	13.8
1999	Pearl perch	Catch	109 000	24 000	21.8
2002	Pearl perch	Catch	74 000	10 000	13.9
2005	Pearl perch	Catch	356 000	50 000	14.2
1999	Pearl perch	Harvest	65 000	12 000	18.1
2002	Pearl perch	Harvest	42 000	6000	13.8
2005	Pearl perch	Harvest	148 000	19 000	13.2
1999	Pearl perch	Release	44 000	14 000	31.1
2002	Pearl perch	Release	32 000	5000	16.6
2005	Pearl perch	Release	208 000	33 000	15.9
2005	Queenfish	Catch	38 000	4000	9.5
2005	Queenfish	Harvest	16 000	2000	12.3
2005	Queenfish	Release	22 000	3000	12.4
2005	Rays	Catch	237 000	17 000	7.2
2005	Rays	Harvest	14 000	3000	20.5
2005	Rays	Release	223 000	17 000	7.4
2002	Red emperor	Catch	288 000	29 000	10.0
2005	Red emperor	Catch	299 000	33 000	10.9
2002	Red emperor	Harvest	88 000	8000	9.3
2005	Red emperor	Harvest	52 000	8000	16.0
2002	Red emperor	Release	200 000	25 000	12.4
2005	Red emperor	Release	247 000	28 000	11.4
1999	Redthroat emperor	Catch	338 000	46 000	13.7
2002	Redthroat emperor	Catch	314 000	37 000	11.6
2005	Redthroat emperor	Catch	203 000	28 000	13.6
1999	Redthroat emperor	Harvest	171 000	22 000	12.6
2002	Redthroat emperor	Harvest	155 000	19 000	11.9
2005	Redthroat emperor	Harvest	89 000	11 000	12.1
1999	Redthroat emperor	Release	166 000	27 000	16.3
2002	Redthroat emperor	Release	159 000	20 000	12.6
2005	Redthroat emperor	Release	114 000	19 000	16.2

Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
2002	Threadfin salmon	Catch	201 000	21 000	10.5
2005	Threadfin salmon	Catch	205 000	23 000	11.3
2002	Threadfin salmon	Harvest	123 000	14 000	11.8
2005	Threadfin salmon	Harvest	123 000	15 000	12.0
2002	Threadfin salmon	Release	79 000	9 000	12.0
2005	Threadfin salmon	Release	82 000	14 000	16.7
2005	Saltwater yabbies	Catch	7 743 000	640 000	8.3
2005	Saltwater yabbies	Harvest	6 531 000	514 000	7.9
2005	Saltwater yabbies	Release	1 211 000	165 000	13.6
2005	Shark	Catch	182 000	16 000	8.8
2005	Shark	Harvest	29 000	4 000	13.8
2005	Shark	Release	153 000	14 000	9.3
2002	Shark and rays	Catch	548 000	37 000	6.9
2002	Shark and rays	Harvest	59 000	6 000	10.8
2002	Shark and rays	Release	488 000	34 000	7.1
1997	Snapper (squire)	Catch	1 327 000	91 000	6.9
1999	Snapper (squire)	Catch	1 284 000	115 000	9.0
2002	Snapper (squire)	Catch	1 253 000	82 000	6.6
2005	Snapper (squire)	Catch	1 218 000	100 00	8.2
1997	Snapper (squire)	Harvest	577 000	49 000	8.6
1999	Snapper (squire)	Harvest	527 000	54 000	10.4
2002	Snapper (squire)	Harvest	296 000	22 000	7.6
2005	Snapper (squire)	Harvest	328 000	32 000	9.7
1997	Snapper (squire)	Release	750 000	50 000	6.7
1999	Snapper (squire)	Release	757 000	70 000	9.2
2002	Snapper (squire)	Release	957 000	70 000	7.3
2005	Snapper (squire)	Release	891 000	73 000	8.2
2005	Spangled emperor	Catch	51 000	9 000	17.1
2005	Spangled emperor	Harvest	31 000	6 000	19.5
2005	Spangled emperor	Release	20 000	3 000	16.8
2005	Stripey	Catch	254 000	25 000	9.9
2005	Stripey	Harvest	90 000	12 000	13.5
2005	Stripey	Release	164 000	18 000	11.0

Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
1997	Sweetlip (total)	Catch	1 487 000	68 000	4.6
1999	Sweetlip (total)	Catch	1 850 000	133 000	7.2
2002	Sweetlip (total)	Catch	1 493 000	140 000	9.4
2005	Sweetlip (total)	Catch	1 266 000	75 000	5.9
1997	Sweetlip (total)	Harvest	719 000	36 000	4.9
1999	Sweetlip (total)	Harvest	861 000	68 000	7.9
2002	Sweetlip (total)	Harvest	639 000	57 000	8.9
2005	Sweetlip (total)	Harvest	518 000	35 000	6.9
1997	Sweetlip (total)	Release	768 000	41 000	5.4
1999	Sweetlip (total)	Release	989 000	87 000	8.8
2002	Sweetlip (total)	Release	854 000	91 000	10.6
2005	Sweetlip (total)	Release	748 000	48 000	6.5
2005	Sweetlip (unspecified)	Catch	491 000	36 000	7.4
2005	Sweetlip (unspecified)	Harvest	197 000	16 000	8.1
2005	Sweetlip (unspecified)	Release	294 000	25 000	8.6
2005	Sweetlip (other)	Catch	153 000	21 000	13.4
2005	Sweetlip (other)	Harvest	64 000	10 000	15.9
2005	Sweetlip (other)	Release	89 000	14 000	15.2
1997	Tailor	Catch	1 564 000	103 000	6.6
1999	Tailor	Catch	862 000	90 000	10.5
2002	Tailor	Catch	1 058 000	79 000	7.5
2005	Tailor	Catch	738 000	67 000	9.1
1997	Tailor	Harvest	1 230 000	79 000	6.5
1999	Tailor	Harvest	628 000	68 000	10.9
2002	Tailor	Harvest	698 000	58 000	8.4
2005	Tailor	Harvest	497 000	48 000	9.7
1997	Tailor	Release	334 000	35 000	10.4
1999	Tailor	Release	234 000	31 000	13.3
2002	Tailor	Release	360 000	28 000	7.9
2005	Tailor	Release	241 000	24 000	10.1
2002	Threadfin salmon	Catch	201 000	21 000	10.5
2005	Threadfin salmon	Catch	205 000	23 000	11.3
2002	Threadfin salmon	Harvest	123 000	14 000	11.8
2005	Threadfin salmon	Harvest	123 000	15 000	12.0
2002	Threadfin salmon	Release	79 000	9 000	12.0
2005	Threadfin salmon	Release	82 000	14 000	16.7

Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
1997	Trevally	Catch	1 948 000	113 000	5.8
1999	Trevally	Catch	2 262 000	197 000	8.7
2002	Trevally	Catch	1 977 000	134 000	6.8
2005	Trevally	Catch	1 992 000	154 000	7.7
1997	Trevally	Harvest	780 000	50 000	6.4
1999	Trevally	Harvest	1 136 000	127 000	11.2
2002	Trevally	Harvest	844 000	66 000	7.8
2005	Trevally	Harvest	814 000	48 000	9.7
1997	Trevally	Release	1 168 000	80 000	6.9
1999	Trevally	Release	1 126 000	94 000	8.4
2002	Trevally	Release	1 133 000	96 000	8.5
2005	Trevally	Release	1 178 000	100 000	8.5
1997	Tropical snappers	Catch	1 837 000	74 000	4.0
1999	Tropical snappers	Catch	1 914 000	122 000	6.4
2002	Tropical snappers	Catch	1 929 000	111 000	5.8
2005	Tropical snappers	Catch	2 240 000	153 000	6.8
1997	Tropical snappers	Harvest	720 000	33 000	4.6
1999	Tropical snappers	Harvest	894 000	68 000	7.6
2002	Tropical snappers	Harvest	676 000	46 000	6.8
2005	Tropical snappers	Harvest	630 000	60 000	9.5
1997	Tropical snappers	Release	1 117 000	56 000	5.0
1999	Tropical snappers	Release	1 020 000	66 000	6.5
2002	Tropical snappers	Release	1 252 000	79 000	6.3
2005	Tropical snappers	Release	1 610 000	103 000	6.4
2005	Tuna	Catch	117 000	18 000	15.7
2005	Tuna	Harvest	56 000	7 000	11.8
2005	Tuna	Release	61 000	15 000	24.8
2002	Tuskfish	Catch	619 000	53 000	8.6
2005	Tuskfish	Catch	355 000	33 000	9.2
2002	Tuskfish	Harvest	276 000	19 000	6.7
2005	Tuskfish	Harvest	155 000	14 000	8.9
2002	Tuskfish	Release	343 000	41 000	12.0
2005	Tuskfish	Release	199 000	22 000	10.9

Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
1997	Whiting (total)	Catch	11 650 000	609 000	5.2
1999	Whiting (total)	Catch	10 714 000	911 000	8.5
2002	Whiting (total)	Catch	11 007 000	586 000	5.3
2005	Whiting (total)	Catch	8 635 000	559 000	6.5
1997	Whiting (total)	Harvest	7 433 000	461 000	6.2
1999	Whiting (total)	Harvest	7 080 000	740 000	10.5
2002	Whiting (total)	Harvest	6 332 000	403 000	6.4
2005	Whiting (total)	Harvest	5 427 000	437 000	8.1
1997	Whiting (total)	Release	4 218 000	196 000	4.7
1999	Whiting (total)	Release	3 634 000	280 000	7.7
2002	Whiting (total)	Release	4 675 000	231 000	5.0
2005	Whiting (total)	Release	3 208 000	192 000	6.0
1997	Whiting (unspecified)	Catch*	11 650 000	609 000	5.2
1999	Whiting (unspecified)	Catch	4 976 000	320 000	6.4
2002	Whiting (unspecified)	Catch	6 994 000	410 000	5.9
2005	Whiting (unspecified)	Catch	4 245 000	280 000	6.6
1997	Whiting (unspecified)	Harvest*	7 433 000	461 000	6.2
1999	Whiting (unspecified)	Harvest	2 758 000	212 000	7.7
2002	Whiting (unspecified)	Harvest	3 797 000	268 000	7.1
2005	Whiting (unspecified)	Harvest	2 266 000	166 000	7.3
1997	Whiting (unspecified)	Release*	4 218 000	196 000	4.7
1999	Whiting (unspecified)	Release	2 217 000	160 000	7.2
2002	Whiting (unspecified)	Release	3 196 000	177 000	5.5
2005	Whiting (unspecified)	Release	1 980 000	133 000	6.7
1997	Whiting (summer)	Catch	(2 014 000)		
1999	Whiting (summer)	Catch	1 552 000 (1 346 000)	386 000	24.9
2002	Whiting (summer)	Catch	1 874 000 (3 267 000)	158 000	8.5
2005	Whiting (summer)	Catch	1 528 000 (1 550 000)	158 000	10.3
1997	Whiting (summer)	Harvest	(925 000)		
1999	Whiting (summer)	Harvest	925 000 (590 000)	292 000	31.6
2002	Whiting (summer)	Harvest	784 000 (1 175 000)	70 000	8.9
2005	Whiting (summer)	Harvest	806 000 (615 000)	96 000	11.9
1997	Whiting (summer)	Release	(1 956 000)		
1999	Whiting (summer)	Release	627 000 (982 000)	103 000	16.4
2002	Whiting (summer)	Release	1 090 000 (2 357 000)	97 000	9.0
2005	Whiting (summer)	Release	723 000 (1 175 000)	81 000	11.3

Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
1997	Whiting (winter)	Catch	(9 619 000)		
1997	Whiting (winter)	Catch	(9 619 000)		
1999	Whiting (winter)	Catch	4 185 000 (3 630 000)	710 000	17.0
2002	Whiting (winter)	Catch	2 138 000 (3 727 000)	270 000	12.6
2005	Whiting (winter)	Catch	2 658 000 (2 695 000)	373 000	14.0
1997	Whiting (winter)	Harvest	(6 504 000)		
1999	Whiting (winter)	Harvest	3 396 000 (2 168 000)	611 000	18.0
2002	Whiting (winter)	Harvest	1 750 000 (2 622 000)	224 000	12.8
2005	Whiting (winter)	Harvest	2 163 000 (1 651 000)	323 000	14.9
1997	Whiting (winter)	Release	(2 582 000)		
1999	Whiting (winter)	Release	789 000 (1 235 000)	174 000	22.2
2002	Whiting (winter)	Release	388 000 (839 000)	53 000	13.8
2005	Whiting (winter)	Release	495 000 (804 000)	73 000	14.8

\* See Table 4 for included species

#### Notes:

Numbers in parenthesis indicates allocated unspecified catches

Anglers often reported capture of 'bait' or 'bait fish' in their diary. Estimates of bait harvest were first included into the 2002 diary round to address management concerns about the self-collection of bait using cast nets and other manual methods. In addition to unspecified bait or bait fish, a range of taxa were included in the bait estimate. These included mullet species, herring, garfish, saltwater yabbies (nippers), pike, sardines, silver biddies and sprats.

An estimated total catch of approximately 6.5 million bait species was recorded for 2002 (Higgs et al. 2007). Bait estimates were once again collected in 2005. More than 14.7 million bait species were caught, although this time the estimate did not include saltwater yabbies (total catch of 7.7 million), which were included in a separate estimate.

The bait estimate in 2005 was considerably higher than in 2002; however, it must be noted that in 2005 more emphasis was placed on educating anglers to include all fish and invertebrates captured for bait.

Bait species accounted for 13% of the estimated total catch in 2002. In 2005 the percentage was closer to 32%. This must be noted when comparing total catch figures across the four surveys.

## Freshwater finfish species

Table 7. Estimated statewide freshwater fish catch, harvest and release figures and associated standard error and relative standard error terms from the 1997, 1999, 2002 and 2005 RFISH diary surveys

Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
1997	Australian bass	Catch	583 000	56 000	9.6
1999	Australian bass	Catch	506 000	129 000	25.7
2002	Australian bass	Catch	604 000	66 000	11.0
2005	Australian bass	Catch	460 000	64 000	14.0
1997	Australian bass	Harvest	73 000	7000	10.1
1999	Australian bass	Harvest	63 000	9000	15.2
2002	Australian bass	Harvest	106 000	10 000	10.2
2005	Australian bass	Harvest	45 000	6000	13.3
1997	Australian bass	Release	510 000	51 000	9.9
1999	Australian bass	Release	442 000	126 000	28.5
2002	Australian bass	Release	497 000	60 000	12.2
2005	Australian bass	Release	415 000	62 000	14.9
2002	Banded grunter	Catch	48 000	12 000	25.8
2005	Banded grunter	Catch	14 000	4000	29.1
2002	Banded grunter	Harvest	16 000	5000	32.6
2005	Banded grunter	Harvest	7000	2000	32.5
2002	Banded grunter	Release	32 000	8000	24.3
2005	Banded grunter	Release	7000	2000	31.3
1997	Catfish (total)	Catch	1 431 000	58 000	4.0
1999	Catfish (total)	Catch	1 254 000	122 000	9.7
2002	Catfish (total)	Catch	1 380 000		
2005	Catfish (total)	Catch	591 000	66 000	11.2
1997	Catfish (total)	Harvest	474 000	28 000	5.9
1999	Catfish (total)	Harvest	398 000	60 000	15.2
2002	Catfish (total)	Harvest	457 000		
2005	Catfish (total)	Harvest	90 000	13 000	14.3
1997	Catfish (total)	Release	957 000	44 000	4.7
1999	Catfish (total)	Release	856 000	99 000	11.5
2002	Catfish (total)	Release	922 000		
2005	Catfish (total)	Release	501 000	64 000	12.7
2002	Catfish (eel-tailed)	Catch	255 000	30 000	11.9
2005	Catfish (eel-tailed)	Catch	23 000	4000	18.4
2002	Catfish (eel-tailed)	Harvest	120 000	23 000	18.8
2005	Catfish (eel-tailed)	Harvest	6000	2000	26.4
2002	Catfish (eel-tailed)	Release	135 000	13 000	9.8
2005	Catfish (eel-tailed)	Release	18 000	4000	20.8

Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
2002	Catfish (other)	Catch	1 125 000	103 000	9.1
2005	Catfish (other)	Catch	568 000	66 000	11.6
2002	Catfish (other)	Harvest	337 000	76 000	22.4
2005	Catfish (other)	Harvest	84 000	13 000	15.2
2002	Catfish (other)	Release	788 000	58 000	7.3
2005	Catfish (other)	Release	483 000	64 000	13.1
2002	European carp	Catch	107 000	33 000	30.8
2005	European carp	Catch	54 000	17 000	31.1
2002	European carp	Harvest	104 000	33 000	31.8
2005	European carp	Harvest	35 000	6 000	16.7
2002	European carp	Release	4 000	1 000	36.7
2005	European carp	Release	18 000	12 000	63.9
2002	Murray cod	Catch	39 000	6 000	15.3
2005	Murray cod	Catch	16 000	4 000	24.1
2002	Murray cod	Harvest	12 000	2 000	16.0
2005	Murray cod	Harvest	4 000	1 000	22.0
2002	Murray cod	Release	27 000	5 000	17.6
2005	Murray cod	Release	12 000	3 000	26.9
2005	Silver perch	Catch	72 000	18 000	25.4
2005	Silver perch	Harvest	16 000	3 000	19.5
2005	Silver perch	Release	56 000	16 000	27.8
2002	Sooty grunter	Catch	148 000	21 000	13.9
2005	Sooty grunter	Catch	57 000	21 000	37.0
2002	Sooty grunter	Harvest	27 000	5 000	16.6
2005	Sooty grunter	Harvest	4 000	1 000	31.7
2002	Sooty grunter	Release	121 000	18 000	14.5
2005	Sooty grunter	Release	53 000	21 000	39.5
1997	Spangled perch	Catch	489 000	63 000	12.8
1999	Spangled perch	Catch	331 000	45 000	13.6
2002	Spangled perch	Catch	170 000	34 000	20.0
2005	Spangled perch	Catch	109 000	31 000	28.9
1997	Spangled perch	Harvest	91 000	14 000	15.0
1999	Spangled perch	Harvest	59 000	14 000	23.7
2002	Spangled perch	Harvest	18 000	4 000	24.5
2005	Spangled perch	Harvest	16 000	6 000	36.7
1997	Spangled perch	Release	398 000	52 000	13.1
1999	Spangled perch	Release	272 000	35 000	12.9
2002	Spangled perch	Release	152 000	33 000	21.8
2005	Spangled perch	Release	93 000	29 000	30.8



Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
2002	Tilapia	Catch	55 000	30 000	53.7
2005	Tilapia	Catch	6000	3000	42.5
2002	Tilapia	Harvest	53 000	30 000	55.8
2005	Tilapia	Harvest	6000	3000	42.5
2002	Tilapia	Release	2000	1000	60.0
2005	Tilapia	Release	0	0	0
1997	Yellowbelly	Catch	895 000	45 000	5.0
1999	Yellowbelly	Catch	697 000	58 000	8.4
2002	Yellowbelly	Catch	652 000	57 000	8.8
2005	Yellowbelly	Catch	540 000	120 000	22.2
1997	Yellowbelly	Harvest	447 000	23 000	5.3
1999	Yellowbelly	Harvest	383 000	30 000	8.1
2002	Yellowbelly	Harvest	357 000	32 000	9.1
2005	Yellowbelly	Harvest	214 000	34 000	16.0
1997	Yellowbelly	Release	449 000	27 000	6.1
1999	Yellowbelly	Release	314 000	34 000	11.1
2002	Yellowbelly	Release	295 000	32 000	11.1
2005	Yellowbelly	Release	326 000	90 000	27.7

## Invertebrate catches

Table 8. Estimated statewide invertebrate catch, harvest and release and associated standard error and relative standard error terms from the 1997, 1999, 2002 and 2005 RFISH diary surveys

Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
1997	Crab (total)	Catch	3 800 000	137 000	3.6
1999	Crab (total)	Catch	5 435 000	344 000	6.3
2002	Crab (total)	Catch	6 127 000	357 000	5.8
2005	Crab (total)	Catch	4 653 000	334 000	7.2
1997	Crab (total)	Harvest	1 257 000	83 000	5.4
1999	Crab (total)	Harvest	1 720 000	125 000	7.3
2002	Crab (total)	Harvest	1 562 000	49 000	3.9
2005	Crab (total)	Harvest	1 410 000	117 000	8.3
1997	Crab (total)	Release	2 544 000	99 000	3.9
1999	Crab (total)	Release	3 714 000	234 000	6.3
2002	Crab (total)	Release	4 565 000	283 000	6.2
2005	Crab (total)	Release	3 243 000	237 000	7.3
1997	Crab (unspecified)	Catch	3 800 000	137 000	3.6
1999	Crab (unspecified)	Catch	597 000	68 000	11.5
2002	Crab (unspecified)	Catch	725 000	82 000	11.4
2005	Crab (unspecified)	Catch	437 000	61 000	13.9
1997	Crab (unspecified)	Harvest	1 257 000	49 000	5.4
1999	Crab (unspecified)	Harvest	177 000	22 000	12.7
2002	Crab (unspecified)	Harvest	183 000	21 000	11.6
2005	Crab (unspecified)	Harvest	103 000	16 000	15.3
1997	Crab (unspecified)	Release	2 544 000	99 000	3.9
1999	Crab (unspecified)	Release	420 000	49 000	11.8
2002	Crab (unspecified)	Release	541 000	64 000	11.9
2005	Crab (unspecified)	Release	334 000	50 000	14.9
1997	Crab (mud)	Catch	(2 238 000)		
1999	Crab (mud)	Catch	3 512 000 (433 000)	249 000	7.1
2002	Crab (mud)	Catch	3 880 000 (521 000)	277 000	7.1
2005	Crab (mud)	Catch	2 763 000 (314 000)	205 000	7.4
1997	Crab (mud)	Harvest	(802 000)		
1999	Crab (mud)	Harvest	993 000 (114 000)	68 000	6.9
2002	Crab (mud)	Harvest	873 000 (116 000)	55 000	6.3
2005	Crab (mud)	Harvest	638 000 (61 000)	43 000	6.8
1997	Crab (mud)	Release	(1 600 000)		
1999	Crab (mud)	Release	2 518 000 (321 000)	189 000	7.5
2002	Crab (mud)	Release	3 006 000 (404 000)	229 000	7.6

Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
2005	Crab (mud)	Release	2 125 000 (256 000)	167 000	7.9
1997	Crab (blue swimmer)	Catch	(1 486 000)		
1999	Crab (blue swimmer)	Catch	1 129 000 (139 000)	151 000	13.5
2002	Crab (blue swimmer)	Catch	1 487 000 (200 000)	154 000	10.4
2005	Crab (blue swimmer)	Catch	1 074 000 (122 000)	132 000	12.3
1997	Crab (blue swimmer)	Harvest	(723 000)		
1999	Crab (blue swimmer)	Harvest	471 000 (54 000)	72 000	15.4
2002	Crab (blue swimmer)	Harvest	485 000 (64 000)	40 000	8.3
2005	Crab (blue swimmer)	Harvest	433 000 (42 000)	62 388	14.4
1997	Crab (blue swimmer)	Release	(1 601 000)		
1999	Crab (blue swimmer)	Release	657 000 (84 000)	87 000	13.3
2002	Crab (blue swimmer)	Release	1 001 000 (135 000)	117 000	11.7
2005	Crab (blue swimmer)	Release	640 000 (77 000)	74 000	11.6
1997	Crab (spanner)	Catch	(68 000)		
1999	Crab (spanner)	Catch	196 000 (24 000)	81 000	41.4
2002	Crab (spanner)	Catch	27 000 (4000)	17 000	62.4
2005	Crab (spanner)	Catch	13 000 (4000)	7178	55.6
1997	Crab (spanner)	Harvest	(34 000)		
1999	Crab (spanner)	Harvest	78 000 (9000)	34 000	44.4
2002	Crab (spanner)	Harvest	14 000 (2000)	9000	65.2
2005	Crab (spanner)	Harvest	8 520 (1000)	4 894	57.4
1997	Crab (spanner)	Release	(41 000)		
1999	Crab (spanner)	Release	117 000 (15 000)	47 000	40.1
2002	Crab (spanner)	Release	13 000 (2000)	8000	63.1
2005	Crab (spanner)	Release	4000 (500)	2000	53.4
1997	Freshwater crayfish	Catch	680 000	101 000	14.8
1999	Freshwater crayfish	Catch	2 316 000	636 000	27.5
2002	Freshwater crayfish	Catch	1 448 000	219 000	15.1
1997	Freshwater crayfish	Harvest	492 000	71 000	14.5
1999	Freshwater crayfish	Harvest	1 885 000	607 000	32.2
2002	Freshwater crayfish	Harvest	1 004 000	161 000	16.0

Year	Species	Fate	Estimate	Standard error	Relative standard error (%)
1997	Freshwater crayfish	Release	188 000	37 000	19.6
1999	Freshwater crayfish	Release	431 000	124 000	28.7
2002	Freshwater crayfish	Release	443 000	82 000	18.5
1999	Prawns	Catch	77 000	14 000	17.8
2002	Prawns	Catch	136 000	16 000	11.9
2005	Prawns	Catch	213 000	22 000	10.4
1999	Prawns	Harvest	70 000	13 000	18.0
2002	Prawns	Harvest	132 000	16 000	12.2
2005	Prawns	Harvest	200 000	21 000	10.7
1999	Prawns	Release	7000	2000	30.9
2002	Prawns	Release	4000	2000	48.4
2005	Prawns	Release	12 000	3000	23.1
2005	Redclaw	Catch	1 077 000	150 000	13.9
2005	Redclaw	Harvest	763 000	104 000	13.6
2005	Redclaw	Release	314 000	53 000	16.9
2002	Squid	Catch	47 500	17 000	35.4
2005	Squid	Catch	196 500	37 556	19.1
2002	Squid	Harvest	45 500	17 000	36.9
2005	Squid	Harvest	194 600	37 539	19.3
2002	Squid	Release	2000	700	35.8
2005	Squid	Release	1900	730	40.3

**Notes:**

Numbers in parenthesis indicates allocated unspecified catches

# Allocating unspecified catches

## Mackerel

Estimates for species within the ‘mackerel’ catch have been separated for the last three surveys. In the first survey the entire mackerel catch was reported as ‘unspecified mackerel’. To produce a more accurate estimate of the individual species catches within the ‘mackerel’ catch estimates, ‘unspecified mackerel’ catches were allocated to individual species based on the composition presented in Table 9. This assumes anglers who did not allocate their mackerel catches to a particular species have the same catch characteristics as anglers who did allocate their catches to a particular species.

Due to considerable attempts to educate diarists on accurately identifying mackerel to a species level, in 2005 only 19% of the mackerel catch was recorded as ‘unspecified mackerel’ and were therefore reallocated. To allocate catch to a particular species, totals of identified species (i.e. Spanish, spotted, school, shark and grey mackerel) were added together and this total was then divided by the total for the individual species. This percentage was then multiplied by the total in the unspecified mackerel category.

Table 9. Species composition of the five major identified mackerel species reported in RFISH diary rounds used to allocate the unspecified component of RFISH catch estimates in each diary year

Species	Total catch (%)				Total harvest (%)				Total release (%)			
	1997	1999	2002	2005	1997	1999	2002	2005	1997	1999	2002	2005
Spanish	11.8	28.0	25.1	16.0	13.3	26.1	27.2	18.0	5.6	33.2	20.1	12.7
Spotted	59.7	36.5	36.5	28.5	64.0	40.6	38.2	32.0	43.2	25.6	32.5	22.5
School	25.0	32.8	33.5	50.3	19.2	30.3	28.8	44.0	47.7	38.4	43.3	61.1
Shark	1.6	0.7	3.9	2.1	1.4	0.7	4.4	2.0	2.3	0.3	3.1	2.1
Grey	1.9	2.0	1.0	3.1	2.1	2.3	1.4	3.9	1.2	2.6	1.1	1.6

## Whiting

### Whiting (family Sillaginidae)

Whiting species within the family Sillaginidae continue to numerically dominate the Queensland recreational fishery catch with a total catch in 2005 of just over 8.6 million fish. This estimate is, however, lower than earlier estimates of 11.0 million (2002), 10.7 million (1999) and 11.65 million (1997). As ‘unspecified whiting’ catch makes up around 50% of the total whiting catch, the last three surveys have attempted to allocate the ‘unspecified whiting’ catch to either summer or winter whiting total catches using the same method applied to mackerel.

- **Winter whiting (*Sillago maculata*)**

Winter whiting estimates—based on catches identified to a species level by anglers in the 1999, 2002 and 2005 diary programs—suggest that catches decreased from 4.2 million fish in 1999 to 2.1 million fish in 2002, slightly rising again to 2.7 million fish in 2005. Corresponding harvest rates increased from 81% (3.4 million fish in 1999) to 86% (1.8 million fish in 2002) and fell again in 2005 to 81% (2.2 million fish) of the total catch of winter whiting.

Allocating the ‘unspecified whiting’ estimates based on the species composition of identified catches in Table 10 suggests winter whiting catches were approximately 9.6 million fish in 1997, 8.0 million in 1999, 6.0 million in 2002 and 5.4 million fish in 2005. This equates to a harvest rate of 71% in 1999, 75% in 2002 and 71% in 2005 for winter whiting.

- **Summer whiting (*Sillago ciliata* and *S. analis*)**

Summer whiting are regularly taken from the shore on the mainland or the sand islands adjacent to the South East Queensland coast.

Summer whiting estimates—based on catches identified to a species level by anglers in the diary programs—suggest that catches increased from 1.6 million fish in 1999 to 1.9 million fish in 2002, then decreased to 1.5 million fish in 2005. Harvest rates decreased from 60% (925 000 fish) in 1999 to 42% (784 000 fish) in 2002 increasing again to 53% (805 563) in 2005. Released estimates increased significantly from 627 000 fish in 1999 to 1.1 million fish in 2002 and then decreased to 722 706 in 2005.

Allocating the ‘unspecified whiting’ estimates based on the species composition of identified catches in Table 10 suggests that summer whiting catches were approximately 2 million, 2.8 million, 5.1 million and 3.1 million fish, with harvest estimates of approximately 925 000, 1.5 million, 2 million and 1.4 million fish.

Table 10. Species composition of the two major identified whiting species reported in RFISH diary rounds used to allocate the unspecified component of RFISH catch estimates in each diary year

Species	Total catch (%)				Total harvest (%)				Total release (%)			
	1997	1999	2002	2005	1997	1999	2002	2005	1997	1999	2002	2005
Winter	83.0	72.9	53.3	63.5	87.0	78.6	69.1	72.9	61.0	55.7	26.3	40.6
Summer	17.0	27.1	46.7	36.5	12.0	21.4	30.9	27.1	38.0	44.3	73.7	59.4

## Crab

### Crabs (total)

Crab catch estimates increased significantly until the recent 2005 catch estimate. Catch estimates in the first three diary rounds increased steadily—3.8 million crabs in 1997, 5.4 million in 1999 and 6.1 million crabs in 2002. In 2005 the estimate of total crabs caught decreased to 3.8 million crabs. Harvest numbers for 2005 (1 million) were considerably lower than earlier estimates (1.6 million, 1.7 million and 1.3 million crabs). Rates of release in 1997 and 1999 were similar, 67% and 68% respectively, but in the last two diary rounds, 2002 and 2005, release rates have increased to 75% and 72% respectively.

The catch composition of ‘crab’ species for the last three surveys were consistent, with mud crabs representing almost 75% of the total catch, 66% of the harvest and 75% of the total release (Table 11). These figures are all consistently higher than the 1997 estimate when blue swimmer crab catches were more prevalent.

Table 11. Species composition of the identified crab species reported in RFISH diary rounds used to allocate the unspecified component of RFISH catch estimates in each diary year

Species	Total catch (%)				Total harvest (%)				Total release (%)			
	1997	1999	2002	2005	1997	1999	2002	2005	1997	1999	2002	2005
Mud	58.9	72.6	71.8	71.8	51.4	64.4	63.4	59.1	62.9	76.5	74.7	76.7
Blue swimmer	39.1	23.3	27.5	27.9	46.3	30.5	35.2	40.1	35.3	20.0	24.9	23.1
Spanner	1.8	4.1	0.5	0.3	2.2	5.1	1.0	0.8	1.6	3.6	0.3	0.2

- **Crab (unspecified)**

As there was no attempt to allocate crab catches to individual species categories in the 1997 survey, the entire catch of 3.8 million crabs was included in the ‘unspecified crab’ category. With the introduction of species estimates from 1999 onwards, the estimated total catch of crabs that could not be allocated to a particular species was 597 000 in 1999, 725 000 in 2002 and 437 420 in 2005. The proportion of unspecified crabs released was 70% in 1999, 75% in 2002 and 76% in 2005, representing 420 000, 541 000 and 333 940 crabs respectively.

## Discussion

Results from the 2005 RFISH diary survey have made a fourth point in tracking significant changes in the catch and release characteristics of recreationally important species, like coral trout and other reef species, which have undergone some form of management intervention since the inception of the first statewide diary survey. These trends provide resource managers and decision makers with quantitative evidence about the effectiveness of new management arrangements.

Estimates in this report are used extensively in the compilation of stock assessments, ecological assessments and annual status reports. In recent times, the estimates have been used as an indicator to the Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) on the status of the recreational fishery as a requirement of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

As expected with the prolonged drought conditions experienced in Queensland since the 2002 diary survey, we have seen major changes in the catch characteristics of freshwater species such as Australian bass. As access to freshwater fishing environments has become even more restricted since the 2005 survey, further decreases in catch would be expected in any future surveys.

One of the major issues with self-completed diary programs is the accuracy of species identification by anglers (Henry & Lyle 2003; Pollock *et al.* 1994). This is particularly relevant in Queensland because of the large diversity of species caught. Historically, anglers have had difficulty identifying species within the mackerel, whiting, trevally and flathead families. These issues can only be resolved to any degree of confidence by a concerted field-based survey of angler’s catches. In 2007–08 the DPI&F recreational fishing program diverged from the biannual telephone/diary survey to regional boat ramp surveys in order to reduce reliance on recreational anglers identifying species within certain families of fish.

At the time of writing this report, DPI&F were conducting a volunteer diary program asking recreational anglers to keep a diary of their fishing activities for 12 months. This is the first time DPI&F has asked for volunteers to join the diary program (rather than conducting random telephone interviews throughout the state to invite participants into the diary program). Volunteers have been sourced by various methods (flyers in boat registration notices, flyers at tackle shops and fishing and tackle shows, media articles and staff at boat ramp surveys conducted by DPI&F).

The 2005 survey increased the number of species that weighted information was obtained for. This survey included a combined catch figure for kingfish/samsonfish/ amberjack and an individual weighted catch for cobia, spangled emperor, tuna species, grass emperor, fingermark, stripeys and silver perch. Improvements were made to the survey analysis by increasing certain species breakdowns so that the recreational catch of some species included in the *Fisheries (coral reef fin fish) management plan 2003* and the *Annual status report 2005 Queensland rocky reef finfish fishery* could be monitored more effectively.

Future improvements to another diary program and subsequent catch analysis could include recent work on released fish mortality. There is some concern that the mortality rates of some released rocky reef fish, particularly snapper, amberjack, teraglin jew and samsonfish, may be quite high because of their susceptibility to barotrauma. By obtaining an estimate of the number of released fish that survive could provide a more accurate estimate of the harvest figures for some species.

Further enhancements of the analysis of the RFISH survey information will include a comparison with commercial catch information. These comparisons have been made in a number of stock assessments where an indicative average weight for the recreational fishery has been used to convert catch numbers into a weight for comparison with commercial catch statistics. Recent introduction of requirements for commercial fishers operating in the coral reef finfish fishery and the Spanish mackerel fishery to report the number and weight of fish landed will enable a direct comparison with recreational fishery figures. This will enhance the ability to produce accurate stock assessments based on the number of fish removed from the fishery.

## References

- Bradford, E 1998, *National marine recreational fishing survey 1996: scaling the diary survey to give the total recreational harvest*, Technical report 17 prepared by National Institute of Water and Atmospheric Research, Wellington.
- Brown, TL 1991, 'Use and abuse of mail surveys in fisheries management', *Papers of American Fisheries Society Symposium*, vol. 12, pp. 255–61.
- Henry, GW & Lyle, JM 2003, *The national recreational and Indigenous fishing survey*, Final Report Series No. 48 for FRDC Project 99/158. 18, New South Wales Fisheries, Cronulla, NSW.
- Higgs, JB 1999, *Experimental catch estimates for Queensland residents*. RFISH technical report no. 2: results from the 1997 diary round, Queensland Fisheries Management Authority.
- Higgs, JB 2001, *Catch estimates for Queensland residents*. RFISH technical report no. 3: results from the 1999 diary round, Queensland Fisheries Service.
- Higgs, JB, Olyott L & McInnes, K 2007, *Experimental results from the third statewide recreational fishing information system diary program (2002)*, DPI&F, Brisbane.
- McInnes, K 2006, *2004 biennial recreational fishing telephone survey of Queensland residents*, DPI&F, Brisbane.
- Pollock, KH, Jones, CM, Brown, T 1994, 'Angler survey methods and their application in fisheries management', *American Fisheries Society Special Publication*, no. 25.
- Szigetvari (nee James), Caitlin 2006, *Frame investigation for future recreational fishing surveys (RFISH)*, DPI&F internal report, DPI&F, Brisbane.



# Appendix 1

## Variance estimation procedures—Caitlin Szigetvari (nee James)

The variance estimators used are derived by treating the sample design as two phase, (the first phase being stratified random sample stratified by age, sex and region), the second phase introducing fishing/non-fishing strata within the age, sex and region strata. The formula used is adapted from (9.4.14) on page 353 of *Model assisted sampling* (Sarndal et al. 1992)—also refer to pages 333 and 334 of *Sampling techniques* (Cochran 1977). Earlier reports (Higgs 1999; Higgs 2001) reported variance estimates that were calculated on a quarterly basis and then summed to obtain annual estimates. This is only a valid way of calculating variances if the samples from each quarter are independent. Since we mostly have common samples (taking into account non-response) in all four quarters, these samples are not independent.

It is reasonable to assume that an angler catching many fish in one quarter will also catch many fish in the next quarter and so on. For this reason it is not correct to assume that each quarter's sample is independent of the others. The mathematically correct method of calculating the variances in this situation is to calculate the covariance terms between all quarters. The problem with this method is purely a computational one—that is, with 15 regions and a Queensland total (16) and four quarters with covariances needed between each quarter (6) for each type of fish and the total (178), we would need to calculate a total of 17 088 ( $16 \times 6 \times 178$ ) covariance terms.

Another method is to aggregate the four quarters of data for each angler together to get annual data, and then calculate the variance based on this aggregate data. This method has the problem that not all anglers responded in all quarters, meaning we would be unable to calculate annual aggregates for these anglers.

The decision was made not to calculate all the covariance terms, but instead to simulate the effects of calculating the variances incorrectly and therefore determine a factor that could correct for this error. To do this, variances were calculated in two different ways. Both methods were calculated using the same data, containing anglers who had responded in some way in all four quarters.

1. Using these data, variances were calculated for all four quarters individually and summed (the previous method).
2. The data from all four quarters were aggregated to form annual data and the variance calculated. In order to calculate these annual variances it was necessary to decide on one quarter to use for strata and values of the benchmark and sample size. The values from the third quarter were chosen as this was approximately the middle of the range of response rates over the year.

Using these two methods, two different variances were calculated to represent the annual variance. These two variances, after converting to standard errors, were then used to produce a correction factor to use to produce the final standard errors. The variances are then calculated individually for each quarter, this time based on all samples, aggregated and the correction factor applied.

Upon applying the factors, the results were investigated and it was noticed that some of the excessively large resultant RSEs had large factors applied to them. A more in-depth look revealed that some of these RSEs were in region by fish groups that only had contributions to variance from one quarter. In this case the covariance terms between quarters should be zero and hence the factor should be exactly 1. The reason for the factor being a number greater (or in some cases less than) 1 was due to using strata, benchmark and sample sizes from quarter 3. If the particular region by fish category only had contributors from quarter 1 or 2 for variance, then the numbers of sample would be greater in the quarter by quarter method than in the annual method. This would result in the factor being greater than 1 and vice versa for quarter 4. To correct this, all correction factors from region by fish categories with variance contributions from only one quarter were set to 1.

The change in the method of variance calculation is in the form of a factor which is applied to the variances to correct for the variances being calculated individually, then aggregated. This factor is manually set to 1 when the variance for a particular region by fish is only coming from one quarter.



