



**Project: Developing a cost effective state wide expenditure survey method to measure the economic contribution of the recreational fishing sector in NSW.**



**Final Report to the NSW Recreational Fishing Licence Trust,  
NSW Department of Primary Industry, November 2013**



**The Australian National Centre for Ocean Resources and Security (ANCORS), University of Wollongong**, is Australia's only multidisciplinary university-based centre dedicated to research, education and training on ocean law, maritime security and natural marine resource management providing policy development advice and other support services to government agencies in Australia and the wider Asia-Pacific region, as well as to regional and international organizations and ocean-related industry.

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**Cover photo** by Alistair McIlgorm. An angler enjoying estuary flathead fishing- South Coast, NSW.

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## Headline results

### Expenditure on Recreational Fishing in NSW

The expenditure of an estimated 773,000 adult anglers in NSW in 2012 was:

- \$1.625bn on travel for recreational fishing trips, fishing tackle and boat-related items.

This included \$186.1m of expenditure by Interstate visiting fishers. The total expenditure translated into the following impacts in the NSW economy:

- \$3.42bn of economic output;
- \$1.625bn added value;
- \$877.3m household income; and
- 14,254 full time equivalent (FTE) jobs.

The economic output for recreational fishing in all NSW was \$3.42bn with an associated employment of 14,254 equivalent full time jobs. These jobs are in the retail trade sector, hospitality, personal and other services and in the transport and storage sector. The value added was \$1.625bn, which is 0.36% of estimated gross state product in NSW. Household income from recreational fishing was \$877.3m in retail, finance and insurance, hospitality, professional and technical services and the wholesale trade sectors.

### Regional estimates

Based on survey data, anglers spent \$501.96 million, \$511.65 million, \$360.86 million, \$251.40 million in the NSW North Coast, Sydney, NSW South Coast and NSW Inland regions respectively. The economic impacts of recreational fishing on the respective regions are as follows:

Region	North Coast	Sydney	South Coast	Inland	All NSW
Output (\$m)	734.65	1,002.86	395.22	353.81	3,420.35
Value added (\$m)	353.55	491.56	184.17	149.85	1,625.61
Household income (\$m)	168.75	288.88	87.60	73.50	877.28
Employment (no.)	3,320	3,944	1,808	1,539	14,254

In terms of regional output, valued added, household income and full time equivalent employment, the absolute economic impacts of recreational fishing expenditure were the highest in Sydney, followed by NSW North Coast, NSW South Coast and NSW Inland.

However, in relative terms, economic impacts (as percentage of total income and employment impacts in the respective regions) were the highest in NSW South Coast (1.67- 2.12%), followed by NSW North Coast (0.81-0.98%), NSW Inland (0.30-0.38%) and Sydney (0.25-0.28%). These relative disparities reflect the large size of Sydney and NSW Inland economies and smaller size of NSW North Coast and NSW South Coast economies.

## Executive summary

This study estimated the expenditure of recreational fishers (RFs) in NSW and its economic impact in NSW and in different regions of the state.

The study confirmed that there are approximately 905,048 anglers in NSW of whom 773,000 are adults over 18 years of age. Of these adults, our survey found 65% held a Recreational Fishing Licence (RFL) and 35% were concession and pension holders that did not require a licence.

The study utilized a telephone survey to interview RFs about their activity and expenditures by two different methods. The first survey method used a traditional screening survey to locate RFs among the general population and then interview them. The second used a sample of anglers from the RFL data base records and interviewed these fishers also. Both survey approaches subdivided NSW into the study areas of Sydney, North coast, South coast and Inland NSW. The results from the two methods were compared to determine if just the RFL data base could be used for surveys of the angling population, thereby reducing or obviating the need for the more expensive screening survey method.

Past recreational fishing surveys in NSW and across Australia were compared which indicated several methodological differences in the past decade among catch and effort surveys and expenditure surveys. The survey conducted for the present study used a recall survey method, as opposed to more expensive longitudinal diary methods.

Two waves of fieldwork surveying were undertaken in April and September 2012. A computer aided telephone interview (CATI) system was used to make screening calls through its regional random dialling facility to locate households containing at least one person who had fished in the previous 6 months. When RFs were located by the screening calls they were asked to take part in a survey about recreational fishing. The CATI telephone system required more calls to “white page” numbers than envisaged to locate the target number of RF households, with up to 50% being dead numbers. There was a surprising high refusal rate with only 48% of the RFs identified choosing to complete the survey. This may have led to non respondent bias and have impacted the representativeness of the screening survey responses. Fieldworkers reported some interviewees were suspicious the survey was “checking up on licences” which may have discouraged responses.

Analysis of the 2010 RFL records for the second survey confirmed that fisher contact details for the majority of electronic records on the NSW Government Licencing Service (GLS) database were for 1 and 3 year licences. The 3 day and 1 month licences sold manually were not migrated onto the GLS data base, but stored manually by NSW DPI. Nevertheless the sample of RFL licence holders accounted for the fewer 3 day and 1 month licence holder records in the total database. The survey method made telephone calls to these known RFL holders, was more successful in locating fishers than the screening survey, and had a much lower refusal rate of 27%.

### Sample results

Survey personnel asked fishers to recall their previous 6 months of fishing activity in terms of trips and days fished, and fishing expenditures from their last trip, including fishing tackle. Major boat related expenditures were recalled for the previous 12 months. The survey results for April and September fieldwork waves were compared statistically and did not differ significantly in terms of fishing activity for either trips or days fished. Fishing trips per annum and average days fished were significantly higher for anglers contacted via the random screening survey compared with those from the RFL database. Days fished by licensed and unlicensed fishers were not significantly different, but unlicensed fishers were found to make significantly more trips than licensed fishers.

Questions on trip activity indicated that 54% of Saltwater (SW) fishers and 67% of Fresh water (FW) fishers, fished less than 5 trips a year, the average SW trips being 8.75 trips, FW 3.8 trips and 10.7 trips per annum when combined. The length of fishing trips averaged between 1.4 and 1.6 days. A finding that influenced average days fished was that 3% of anglers fished over 40 trips per year – a relatively high proportion of such avid anglers. Overall, anglers fished an average of 14.6 days. The total combined sample showed that 38% of fishers fished less than 5 days a year while 6% of anglers fished in excess of 40 days per annum.

All respondents provided expenditure estimates on their last trip. The average fisher spent \$154.05 on fishing trip related items, including car travel of \$69.74. A further \$71.20 was spent on tackle and boat fuel per trip, totalling an expenditure per angler of \$225.24 per trip.

The annual fishing related boat expenditure on average in NSW was \$768.15 per angler, with a high range. Average daily trip expenditures in SW and FW were similar, but boat expenditure for SW fishers (\$956.18 per annum), exceeded that of FW anglers (\$365.15), no doubt due to marine fishing craft typically being larger and more costly.

The expenditure patterns of NSW anglers were investigated by multiple regression and cluster analysis to identify the drivers of RF expenditure.

Multiple regression analysis identified two significant expenditure drivers to be the holding of an RFL and number of SW fishing trips taken. It also indicated that distance travelled was a significant part of trip expenditure. Fishing tackle expenditure was correlated with income, but boat expenditure was related to both the number of SW fishing trips per annum and household income.

The cluster analysis revealed an overall picture of groups of “ordinary” fishers (approximately 85%) with low levels of activity, in which household income levels may differ (half lower, half higher); secondly, a group of dedicated anglers (approximately 12%), who are frequent fishers and have high expenditure, and thirdly, a highly avid fishing group (less than 3%), with very high fishing activity and high to very high expenditure.

The results confirm the only previous examination of the socio-economic characteristics of RFs in NSW by Dominion (2003) – that recreational fishing is a pastime enjoyed by a diverse range of people, with a range of levels of enthusiasm, crossing the entire socio-economic spectrum.

### **Estimating state-wide expenditure**

Total state expenditure on recreational fishing was estimated using the available RF household and population data, the estimates of trips made, amounts spent per trip on tackle and annual expenditures on boats. The sample expansion was based on ABS household data and survey responses.

A problem in recreational fishing studies is the skewedness in the distribution of trip activity, which declines exponentially with the increasing number of trips made. This strongly influences the distribution of total expenditure estimates. The annual expenditure by anglers is highly variable.

Total state-wide recreational fishing expenditure can be calculated as a mean value. The study was also able to estimate a distribution around the mean estimate by use of a Monte Carlo simulation model. This generated a range around the total predicted expenditure estimates with a probability and cumulative probability for each possible level of RF state expenditure.

### **State wide expenditure results**

State-wide expenditure on recreational fishing in NSW was estimated at \$1.626bn per year, including \$186m by Interstate visitors (i.e. \$1.439bn from NSW residents). The simulation model predicted that this mean of \$1.626bn has predicted 5% and 95% confidence intervals of \$0.896bn to \$3.136bn. The probability distribution reflects the skewedness of the trip frequency distribution, as the mean is not the most probable value, but reflects the higher expenditures of the long 'tail' of more avid anglers. The predictions derived from the model explain how some RF expenditure studies can estimate high estimates, without realising their achievement is improbable.

State-wide total expenditure is much higher for SW fishers (\$1.4bn) than for FW (\$0.266bn), with SW expenditure being 86% of all expenditure and FW, 14%.

Initial estimates of expenditures indicate that anglers living in Sydney account for 56% of total NSW expenditure, North coast 19%, South coast 6%, Inland 8% and interstate visitors 11%. These expenditures are adapted in the regional analysis in Chapter 5 to take account of expenditures on trips into other regions.

### **Regional economic impacts**

To estimate the economic impacts of recreational fishing on NSW North Coast, NSW South Coast, Sydney and NSW Inland regions, as well as for NSW as a whole, Western Research Institute (WRI) used the 2011-12 Simulating Impacts on Regional Economies (SIRE) input-output model of the respective regions and NSW as a whole. Economic impacts were provided in terms of output, value added, household income and full time equivalent (FTE) employment.

Results were adjusted to account for expenditure in the regions becoming, \$501.96 million, \$511.65 million, \$360.86 million, and \$251.40 million in NSW North Coast, Sydney, NSW South Coast and NSW Inland regions respectively.

The economic impacts of recreational fishing on the respective regions are as follows:

Region	North Coast	Sydney	South Coast	Inland	All NSW
Output (\$m)	734.65	1,002.86	395.22	353.81	3,420.35
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The economic output for recreational fishing in all NSW is \$3.42bn generating associated employment of 14,254 equivalent full time jobs. These jobs are in the retail trade sector, hospitality, personal and other services and in the transport and storage sector.

The value added is \$1.625bn, which is 0.36% of estimated gross state product in NSW. Household income from recreational fishing is \$877.3m in the retail sector, finance and insurance, hospitality, professional and technical services and the wholesale trade sector.

In terms of regional output, valued added, household income and FTE employment, the absolute economic impacts of recreational fishing were the highest in Sydney, followed by NSW North Coast, NSW South Coast and NSW Inland. However, in relative terms, economic impacts (as percentage of total impacts – income and employment, in the respective regions) were the highest in NSW South Coast (1.67- 2.12%), followed by NSW North Coast (0.81-0.98%), NSW Inland (0.30-0.38%) and Sydney (0.25- 0.28%). These relative disparities reflect the large size of Sydney and NSW Inland economies and smaller size of NSW North Coast and NSW South Coast economies.

#### **Developing a cost effective approach to expenditure surveys**

The project examined the requirement for ongoing expenditure surveys and how these might be met in a cost effective fashion. The study recognises that the RFL data base can be used to reduce survey costs, but recommends that additional consideration needs to be given to how to use this data base for representative estimates before fully adopting RFL based surveys to the exclusion of screening surveys. The project also examines the requirement for minimum reliable sample sizes that may apply to future surveys and how this can reduce costs.

A large-scale expenditure survey every 5 years is recommended with either annual or biennial updates between main surveys. The simulation model used here could assist with adjusting estimates between main surveys. An additional smaller survey could be made in year three if a need-to-update data was evident.

In conclusion, a full state-wide survey using the RFL data base to sample 1,000 anglers in major regions is recommended every 5 years, with an option of updating results by indexing annually or bi-ennially and considering a smaller survey (250 state wide or 500 for regions) in year three also.

The economic impact analysis can follow the five year survey pattern and can be adjusted between surveys. Simulation modelling can also be used to provide an improved understanding of the uncertainty surrounding expenditure estimates and may be used to confirm estimates between main surveys also.

## 1. Introduction

This project was undertaken to achieve the following objective: *“The project will evaluate the economic expenditure and contribution of the recreational fishing sector in NSW and determine the most cost effective approach for future expenditure surveys” (RTF project application)*<sup>1</sup>.

The expenditure of recreational fishers in NSW was previously estimated by Dominion Consulting (2003) and in the economic report of the national survey (Campbell and Murphy 2005).

This study reports the recreational expenditure and economic impacts for all of NSW and for the four main regions in NSW: Sydney, North Coast, South Coast and Inland NSW. The expenditure of interstate recreational fishers in NSW is also estimated.

The regional economic significance of the recreational fisher (RF) expenditure in the NSW state economy has not previously been measured. Regional economic impact analysis enables the direct and indirect benefits derived from recreational fishing expenditure to be determined and the associated employment estimated in NSW.

The report also examines the options for future expenditure surveys of RFs, investigating the most cost effective way to gain regular accurate expenditure and economic impact information on recreational fishing activity in NSW. This will include how to most effectively use the sampling frame available via the recreational fishing licence. Changes in communication technology in the last decade may also have impacted the traditional approaches to recreational fishing surveys and as yet new web based and social media approaches are relatively untested.

The study commenced by examining recent approaches to measuring recreational fishing expenditure in Australia and some relevant international expenditure surveys, such as used in the United States, which may indicate international best practice.

The use of expenditure data is a baseline measure of economic activity reflecting the dollars spent on going fishing and on fishing equipment on an annual basis. The expenditure of anglers is similar to an expenditure on any other sport or leisure in the economy and we can use regional economic approaches to determine the contribution and impacts of that expenditure in the NSW state economy. In contrast to expenditure surveys, studies of the “economic value” of recreational fishing, seek to determine the value of access to fishers, over and above what they pay to go fishing (Cunningham et al 1985; Galeano et al. 2004; Rolfe and Prayaga 2007).

Estimating state-wide expenditure and regional economic activity in different areas of the state can reveal differences in regional impacts and clarify the relationship between recreational fishing activity, associated expenditure and its benefits to the state economy.

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<sup>1</sup> Project title: *“Developing a cost effective state wide expenditure survey method to measure the economic contribution of the recreational fishing sector in NSW.”* NSW Recreational Fishing Trusts - contract L92.

### 1.1 Past recreational fishing expenditure studies and NSW

Past recreational fishing expenditure surveys have used slightly different methodologies depending on the objectives of the study. The general pattern in expenditure surveys is to use a field survey method, such as face to face or telephone interviews, to contact and survey fishers, asking questions about fishing activity, and the costs of the activity on a trip or annual basis (McIlgorm and Pepperell 1999; Dominion 2001 and 2003; Campbell and Murphy 2005; Gentner 2008). The method usually involves recall of past fishing events over a prior fishing period, usually 12 months, or the keeping of a diary to log fishing activity on an ongoing basis (Gentner 2008).

Expenditure surveys in different states of Australia prior to the year 2000 were reviewed in McIlgorm and Pepperell (1999). The National Survey in 2001 estimated the number of recreational fishers nationally, their fishing activity and their catch using a national telephone based screening survey to identify recreational fishing households. Cooperating anglers then responded to monthly telephone contacts via a diary based method (Henry and Lyle 2003). Respondents also recorded expenditure over a 12 month period and enabled expenditure estimates to be produced as an additional component of the main national survey, which was designed to measure catch (Campbell and Murphy 2005).

Campbell and Murphy (2005) estimated from the data collected in the National Survey that total national recreational fishing expenditure in 2001 was \$1.86bn, of which \$554m (30.7%) occurred in NSW<sup>2</sup>. Importantly, these estimates did not include several categories of ancillary trip expenditure, such as food consumed while on a fishing trip, eating out and entertainment (which were included in the current study) and were therefore conservative estimates of expenditure on all items due to fishing.

In NSW, a series of regional expenditure surveys using telephone and face to face survey methods was carried out by Dominion Consulting for the 1999-2004 period (Dominion 2001 and 2003; McIlgorm et al. 2005). These studies also produced estimates of regional economic impact of recreational fishing in the regional areas being surveyed.

Other studies have provided estimates of national retail and wholesale expenditure for the fishing tackle sector across Australia (Dominion, 2003 and 2005). In 2004, \$601m of fishing tackle was sold nationally by retailers<sup>3</sup> (Dominion 2005). However retail and wholesale tackle sales data are supply side estimates and are only part of the estimated total annual expenditures of recreational fishers on this activity.

#### *Non-NSW*

Recently in other states of Australia several recreational fishing expenditure studies have been conducted. Ernst and Young (2009) conducted an economic survey of recreational fishing in Victoria

<sup>2</sup> Using consumer price index adjustment of 1.38 (2001-2012) from ABS (2012), these estimates in 2012 terms would be \$2.56bn nationally and \$765m in NSW.

<sup>3</sup> The National Survey estimated tackle and bait expenditure by anglers nationally at \$223m in 2000-01 (Campbell and Murphy 2005). There has not been an attempt to reconcile actual industry tackle sales with such expenditure survey results.

using an internet based method to sample 1,000 persons and interview 200 anglers, with economic modelling estimates of the economic contribution of the sector. In that study, the estimated number of fishers in Victoria were 720,000, compared with a previous estimates of 550,000, which resulted in a substantial increase in the total estimated state expenditure on recreational fishing. The study raised questions about estimates of fisher populations used for expanding expenditure estimates?; the age groups included in the survey? (under 18s etc.); the distribution of fishing trip activity?; and the variation in angler expenditure levels?

Using internet-based surveys is a new area requiring assurances of representative expansion to state wide estimates. There is the potential to overestimate recreational fishing expenditures if avidity biases are not controlled. Survey design decisions all influence the accuracy of estimates of fishing activity and hence total expenditure. Another study by Ernst and Young (2011) of the Murray Darling Basin raised similar concerns about over-estimation of expenditure due to a high RF population estimate and the ensuing assumed distribution of trip frequency and expenditures, applying a sensitivity analysis which only partially addressed the issue.

#### *International studies*

International best practice can most likely be seen in the five-yearly series of NOAA/NMFS National recreational fishing Expenditure Surveys in the US. These have generated estimates of the economic contribution of recreational fishing activity in a series dating back to the 1970s (Steinback et al., 2004; Gentner and Steinback, 2008).

The NOAA-NMFS survey has always been based on the Marine Recreational Information Program (MRIP) which is combines two different survey approaches to estimated catch and effort. These are an intercept survey at major boat ramps and a cross-checking telephone survey of anglers in coastal households over a year, asking anglers to recall activities over the previous two month period (Gentner 2008; Gentner and Steinback 2008). Expenditure on some fishing related items are collected by phone, but a mail survey has also been used to collect “durable expenditures”, such as boats and fishing gear, since 2006 (Gentner and Steinback 2008).

The latest national US RF expenditure survey was commenced in 2011 (NOAA 2011) to measure the contribution that saltwater RF expenditure makes to the US economy, particularly in terms of employment. That study found that:

*“Recent estimates indicate there are approximately 12 million saltwater recreational anglers taking about 85 million trips a year. Combined, expenditures total \$31 billion dollars, representing an \$82 billion dollar impact and supporting half a million jobs”* NMFS (2012).

These US studies illustrate the economic impacts of recreational fishing expenditure in the wider economy. Our objective is to make this information available in NSW, where the current economic contribution and economic impact of recreational fishing needs to be determined and be available in the public arena.

## **1.2 Comparing expenditure survey methods**

Any comparison of methods has to recognise that objectives in economic and expenditure studies of RFs vary. In this study we are comparing expenditure by recreational fishers and not any associated non market values.

The measure of recreational fishing total expenditure is the product of the number of fishers, their fishing activity and their expenditures in the activity annually. Experience in the ABS and in previous RF surveys indicates that household expenditure should be incorporated in the generation of state-wide estimates, where each household will have one or more anglers and trip expenses are “household” related (Henry and Lyle 2003; Campbell and Murphy 2005).

While national data for the general population is available from the Australian Bureau of Statistics (ABS), we require sampling of the general population to determine what proportion have been recreational fishing in the study period. A random telephone survey to screen the population was used to locate recreational fishers.

Each study has to decide how it will structure samples and find those to interview. The telephone screening survey of the whole general population is used to identify households with RFs (Henry and Lyle 2003). However many fishers are below 19 years of age, or may not have a phone. The fisher in a household can be recalled and surveyed with a re-call method or engaged in a diary based method, or a postal survey (Gentner 2008). This survey approach has generally sought to obtain a random sample of respondents who are recreational fishers.

Asking recreational fishers to recall their fishing activity is a low cost single interview event, but has inherent risks of non-response, re-call and other biases, such as avidity bias where too large a proportion of the most active fishers are interviewed (Johnson 1999). There is likely less recall bias when a combination of survey methods are used (Gentner 2008).

Fishing activity can be measured as days fished, which is an effort measure in recreational fishing catch surveys, but also as a number of fishing-related trips taken per annum. The number of trips is the basis of expenditure estimates that vary with activity, though less frequent large expenditures, such as capital boat expenditures and maintenance must also be incorporated into annual costs. Trip related expenses reflect travel, most of which is road travel, accommodation and food and consumables expenditure for the fisher and their accompanying party. Expenditure on small items of fishing tackle, bait and fishing consumables are also trip related. Expenditure on capital items such as boats, motors and trailers is estimated on an annual basis and is often reduced pro rata for non recreational fishing use, measuring only the capital attributable to recreational fishing activity.

## **1.3 Activity results from past studies**

In Australia, there have been numerous catch and effort surveys of recreational fishers and these have focused on estimating fishing effort measured in days fished. Prior to 2000, McIlgorm and

Pepperell (1999) identified 5 recreational fishing studies across Australia which estimated average number of days fished per angler per annum at between 12.5 and 15 days.

Since the introduction of the monthly fishing diary system in the National Survey 2001, other catch and effort surveys covering individual states or territories have also used this method. The estimated average number of days fished per year per angler by this method has averaged 6.13 days nationally and 6.0 days in NSW (Henry and Lyle 2003), 4.5 days for South Australia (Jones 2009) and 4.0 days in Queensland (Taylor et al 2011).

Past studies of recreational fishing expenditure have differed in methodologies used and in categories of expenditures collected, and have not generally followed the catch and effort diary approach. Activity and expenditure is seen as being trip related, where a fishing trip may extend for one or more days. In comparing the expenditure recall surveys of the past decade with the catch and effort studies, a two layer view of 'days fished per annum' becomes evident. Surveys designed to measure catch and effort indicate estimates of average days fished at circa 6 days per annum (see above). On the other hand, in surveys specifically estimating expenditure, estimated days fished per angler have been higher: for example 13.9 days per annum in NSW (Dominion 2001), 12 days and 14 days per annum (McIlgorm et al. 2005). Ernst and Young (2009 and 2011) estimated 14 *trips* per annum, in which case, number of days fished would be in excess of this.

These two approaches of expenditure surveys asking interviewees to recall expenditures in the past year versus the monthly catch and effort diary of the National Survey, still need to be reconciled in Australia. The US NOAA's approach with two different survey types may have some benefits to offer future research in NSW.

#### **1.4 Discussion**

Expenditure surveys currently face significant issues in terms of their methodology, particularly due to changes in telecommunications, internet technology, and the licensing of fishers, all of which potentially alter the capacity to access a non biased random sample of individual or household expenditures that can be appropriately expanded into accurate state-wide expenditure and economic impact estimates. This was noted in the US in circa 2008 and is why the US methodology post 2006 has been more complex (Gentner and Steinback 2008).

The change in communications technology is particularly seen in telephone based methods where since 2000, increasing use of mobile phones has impacted use of "white pages" home phone lines (ACMA 2013). Likewise the number of households opting to be ex-directory or not to take unsolicited calls due to privacy concerns and regulations has increased. The telephone based survey industry has adapted to these changes, which are on-going, but we are all in a large scale technology transition process that impacts survey design and methodology (ACMA 2013).

The internet has potential appeal as a survey vehicle for expenditure surveys, but the same issues of gaining a random sample, i.e. participant selection with possible avidity and non respondent biases

and re-call bias are major issues. The “sample” is unlikely to be representative of the whole population. For example currently older fishers would not be as open to internet surveying or social media use for surveys, as younger fishers.

The introduction of a general RFL in some states now means that approximately 60-70% of all fishers in those states are licence holders. The availability of contact details for NSW RFL holders has led this project to examine whether the random screening survey to detect fishers, which is the most expensive part of traditional surveying, can be substituted by ‘captive’ RFL data base survey approaches to estimate state-wide recreational fishing expenditure. However, if, for example, licence holders fish more frequently than non licence holders, will there be a possible avidity bias if only licence holders are surveyed? (Gentner 2008). We therefore need to investigate what conditions are required to use the RFL data base appropriately and thereby, to hopefully reduce the need for expensive screening surveys.

Another aim of the study is to investigate possible behavioural issues arising from the existence of the recreational fishing licence. For example, are licence holders and non-licence holders significantly different across a range of recreational fishing activities or socio-economic characteristics? The possible benefits of using recreational licence records as the basis for less expensive expenditure surveys in the future is a key element of this study.

Infrequent studies of recreational fishing expenditure are separated in time and often rely on varying methods and sample sizes, resulting in variable accuracy. The NSW recreational sector would be better served by more frequent updating of measures of the contribution of the sector to the economy. This requires investigation of more cost effective recreational fishing expenditure survey strategies. Questions such as “how many anglers do we need to interview?”, are addressed in this study, and a future expenditure survey strategy is proposed.

Other surveying issues arise in attempting to address more specific issues on activity in the sector. For example, is the size of a survey sample for all recreational fishers sufficient to estimate the expenditure of particular groups of fishers, such as those using recreational charter boat services state wide? Fishers using charter vessels may not be sufficiently captured in the sample sizes possible under cost constraints since such activities are likely “rare events” among NSW’s estimated 773,000 adult fishers. An alternative direct sampling of the NSW commercial charter boat fishery has been recommended and will be reported in another project (Dominion in prep.).

In this study, we examined past expenditure surveys in Chapter 1 and details of the expenditure survey approach, methods and survey instruments used in the current study in Chapter 2. Chapter 3 reports the results of the survey and Chapter 4 develops NSW state expenditure estimates. Chapter 5 reports the state-wide regional economic impacts of recreational fishing expenditure and employment estimates. Chapter 6 completes the study proposing cost effective surveying of expenditure for the future.

## 2. The NSW Recreational Fishing Expenditure survey –objectives, data and methods

### 2.1 Objectives

The first objective of the expenditure survey project is to provide the recreational fishing sector in NSW with an up to date profile and estimate of recreational fishing expenditure. This will require sampling the known population of RFs for their fishing activity and expenditure patterns. Part of this objective is to gain an understanding of the regional patterns of recreational fishing activity, expenditure and economic impact in all of NSW and each of the four regions:

- **Sydney** - (ABS SD region)
- **North coast** - (ABS, Hunter, Mid North Coast, Richmond- Tweed SD regions )
- **South coast** - (ABS, Illawarra and Lower South Coast SD and SDD regions ) and
- **Inland NSW**- (ABS, Central west, Far west, Murray, Murrumbidgee, Northern, North Western SD regions and Queanbeyan, Snowy and southern Table and SSD regions) ABS (2011).

Expenditure of interstate anglers in NSW is also considered.

The NSW RFL has been in place for the past decade but it is unknown if this has altered recreational fishing activity and expenditure by anglers. It is also an objective of this study to investigate how the RFL database may be used in expenditure survey sampling, potentially reducing the need for more expensive screening surveys of the general population to locate recreational fishers.

### 2.2 Data available

#### 2.2.1 Population and household data for NSW

Data on the population and number of households in the study regions of NSW is available from the Australian Bureau of Statistics (ABS). Table 1 indicates the relative populations (aged between 19 and 75 years old) of the relevant statistical divisions (SD) for the areas in the study<sup>4</sup>.

**Table 1:** The ABS population and household data on the NSW study area (ABS2011).

Area	Population 2010 (>18-75)	% by region	Households	% by region	Rec Fishers/ HH
<b>Sydney</b>	3,160,897	63.3%	1,376,583	55.7%	2.30
<b>North coast</b>	835,229	16.7%	570,688	23.1%	1.46
<b>South coast</b>	350,750	7.0%	207,195	8.4%	1.69
<b>Inland</b>	649,564	13.0%	315,987	12.8%	2.06
<b>Total</b>	<b>4,996,461</b>	100%	<b>2,470,453</b>	100.0%	<b>2.02</b>

<sup>4</sup> SDs are now part of the ABS geographic area system, replacing SD and SSD in 2011. The four study areas use the component data for reach SD area. Note: South coast is actually the coastal SSDs, other South coast Inland SSDs being grouped with the Inland category.

In Table 1 Sydney is seen to have the largest percentage of state population and households, followed by North Coast, Inland and South Coast. The variability of the relationship between population and households is evident with Sydney having more persons per household (2.3), compared with rural regions (1.46 to 2.06).

### 2.2.2 The RFL data system records

Recreational fishing licences are sold electronically as well as manually using a licence agent system. The NSW RFL data system has been moving from predominantly the manual system when the state wide licence was first introduced in 2001, to an increasing proportion of electronically recorded licence records held in the centralised NSW Government Licensing Service (GLS) ([www.licence.nsw.gov.au](http://www.licence.nsw.gov.au)). Manual licence sales data is stored by NSW Department of Primary Industries (NSW DPI). Therefore for the year 2010, the RF licence sales records available to this study, were either RFL sales recorded electronically in the GLS, or records of the number of licences sold manually through agents.

The licence sales by agents (without an electronic terminal) are recorded manually in licence books, and sales records for all licences are submitted to NSW DPI in a monthly reconciliation process. Contact details of fishers for three day and one month licences are stored manually by NSW DPI (i.e. not entered onto the GLS). The distribution of the different types of licences recorded on the GLS, means that in the 2010 data download obtained for the project in 2012, there were fewer 3 day or 1 month licence records than would be expected from total licence sales. The downloaded GLS data therefore under-represents 1 month and 3 day licences, as there were only 27% of the total sales of these licence types entered on the GLS<sup>5</sup>. The numbers of RFL licence holders in 2010-11 are estimated in Table 2.

**Table 2:** The estimated sales of different types of licence in the 2010-11 period (Source: DPI).

RFL sales 2010-11 only sources)		Data base in 2010-11 from which sample taken.		Comment
Duration	Total	Duration	Total	
3 day	174,783	3 day	48,732	electronic entries
1 month	73,648	1 month	22,114	electronic entries
1 year	150,678	1 year	246,329	active at time of sample
3 year	81,621	3 year	265,987	3 year active at time of sample
<b>Total sales</b>	<b>480,730</b>		<b>583,162</b>	<b>Total</b>
5% non compliance	24,037			
plus non licenced	268,118			
<b>Sub-total</b>	<b>772,884</b>			
Fishers 5-19 yrs (17.1%)	132,163			
<b>Total</b>	<b>905,048</b>			

<sup>5</sup> In the period July 2010-June 2011, DPI records non GLS records as a percentage of total sales and renewals: 3 day 72%; 1month 73%; 1year 49%; 3 year 16%. Most 3 year records are on the GLS, half of the 1 year and only 27% of 3 day and 1 month licences in that time period. .

Table 2 reports the estimates numbers of 3 day, 1 month, 1 year and 3 year RFL sold in 2010-11. We use this information to assist in the estimation of the total number of fishers in NSW.

The number of licence sales can be adjusted to include non-compliant fishers (assumed to be 5% of licence holders) and the 35% of fishers not requiring a licence (as estimated in McIlgorm et al. 2005 and confirmed later in this study), plus young fishers 5 to 19 years old (17.1% of the population ABS 2011). Using these figures, a total of 905,048 anglers is conservatively estimated. This total also includes interstate anglers buying licences in NSW. The RFL data in the GLS system does not have any information on non-licence holders, but does record NSW licence holders who reside in other States.

The current estimate of 905,048 is less than previous NSW DPI and National Survey estimates of close to 1 million fishers (DPI pers. comm., Henry and Lyle 2003). Other studies have noted a possible decline in recreational fishing participation since the 2001 National Survey (Jones 2008), as the method here is based on licence sales with several assumed adjustments, so should not be taken as a definitive participation estimate. We chose to use the ABS household data for survey expansions.

## 2.3 Methods

The methods we used had to be able to facilitate estimation of the total expenditure of recreational fishers state-wide. Sampling approaches were therefore designed to enable total estimates to be developed from the samples taken.

### 2.3.1 Sampling

We used two survey sampling approaches for the study:

(a) **Telephone household screening survey to identify households with a RF.** A random screening survey using the home phones of 4,000 households in the general population was proposed to identify 800 anglers. Each angler identified was then asked to complete an 8 minute survey of fishing-related activity and expenditure.

(b) **RFL database to contact known anglers (licence holders).** A survey sample of 750 licence holders from the RFL database was proposed to provide 500 completed 8 minute surveys of RFL holders.

### 2.3.2 Preparations for the fieldwork sampling survey

Ethics approval, was required through the University system to conduct the survey. Due to privacy and ethical issues the fieldwork did not call “children”, i.e. those under 19 years of age. Those fishers over 18 years of age are either licensed, or are concession holders due to having a pension or disability.

A range of issues was considered in the fieldwork design.

**a) Field work survey method**

In the last two decades in Australia there has been a move away from postal surveys, with face to face interviews, diary keeping, phone and mobile phone and internet methods being used. After considering the task we chose a telephone survey method to contact the desired audience within budget limits. The telephone survey field work was undertaken by IRIS Research, a telephone surveying, marketing and research business.

The market research company conducted two telephone surveys using (a) a whole population database for the random household calls and (b) RFL licence data base records supplied from NSW DPI.

Random telephone screening surveys use survey industry databases of household telephone numbers in different regions of NSW. The household phone survey enables the survey sample results to be related to ABS census data for the population in NSW which is essential to the process of estimating total and regional expenditure and economic impacts of recreational fishing. The screening survey response rates contributed to sample expansions. The screening survey results include non-licence holders and can be compared with the responses of RFL holders.

For the RFL database records, calls to the angler's home phone or stated mobile phone number was the contact method. Calls to a mobile phone number recorded on the RFL database assumes the holder resides in the postcode area of their physical address in the licence record.

**b) Minimising biases and seasonal effects in the survey**

Commonly, recreational fishing surveys use a single interview of fishers asking the respondent to recall fishing activity, trips and expenditure in the "past year" or "past 12 months".

The responses may be affected by the season in which fishers are asked for information. In this study, a sample of anglers was interviewed in late March 2012, pre-Easter<sup>6</sup>, asking them about their activity and expenditure in the previous six month period, that is, since the previous September 2011. The second wave of interviews in September 2012 asked another different set of respondents to recall fishing activity and expenditure since the previous April, which included Easter. The results were used to test for seasonal differences in angler activity and angler expenditure. For capital expenditure items such as boats, respondents were asked to recall their purchases in the past year.

The desire to enquire about seasonality ran some risks in asking to recall the past six months activity accurately, as responses may also include recall and other biases (Gentner 2008). The questionnaire initially asked participants to recall the last six months and then the past year, which may have presumed too much of the respondent's memory in a limited telephone interview.

**c) Demographics of fisher groups**

The survey was designed to investigate the different demographic clusters of anglers in NSW and their associated expenditures. For example, identifying angler groups such as single fishers, friends

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<sup>6</sup> Easter was 6<sup>th</sup>-9th April in 2012

fishing, married and middle aged, and retired fisher groups, would assist in understanding the recreational fishing behaviour of these groups. Other socio-economic variables like income and age may also impact recreational fishing expenditure.

This group approach of identifying different “clusters” is used in the Tourism research literature (e.g. grey nomads, pompadours, young family groups etc.), and could assist future recreational fishing expenditure research in NSW. The survey results will be analysed and the statistically different fisher groups in NSW identified. This will improve management’s understanding of the differences in recreational fishing groups in NSW.

### **2.3.3 Discussion**

Usually in telephone survey methods, a screening survey of the whole population is required to locate the 10%-20% of households (depending on the region) in the general population that have a RF living there (Henry and Lyle 2003; McIlgorm et al 2005). This is the expensive part of any telephone survey requiring perhaps ten or more calls to contact one fisher. However the random sample from the screening survey of households can be aligned with the available ABS information on households in NSW and so the total number of RFs in households in NSW can be estimated.

The available RFL sales data and historical database of licence holders in NSW can also be used to estimate the total number of recreational fishers. The use of the RFL data base for a survey of expenditure excludes exempted anglers, such as those who are 18 years and younger, and concession card holders, such as pensioners. An estimated two-thirds of the NSW fishing population over 18 years old have a RFL (Dominion Consulting, 2003; McIlgorm et al. 2005) as one third are concession holders and pensioners and are exempted.

RFL contact details were available under a confidentiality agreement with NSW DPI that protected licence holder identity, but made their telephone contacts available to the project’s market research company under DPI and University ethics and research privacy protocols.

Given the above, two different estimates of the total number of RFs state wide can be made. One via the screening survey results combined with ABS household data, and the second by use of the direct sales records of the RFL with some adjustments for unlicensed, concession holders and young anglers. Our preference was to use the general population household based approach within the ABS data system.

### **2.4 Estimating the total expenditure by fishers**

The total state expenditure by RFs is a function of the number of trips taken per individual angler and the expenditure per trip. However expenditures can vary from travel expenses, food and accommodation, to small trip-related fishing tackle and equipment expenditures, to other larger annual equipment expenditures, such as boats. We separated the expenditures into:

- a) **Fishing trip related expenditure** on a range of expenses (*accommodation, eating out, other food and drink, shopping, car travel<sup>7</sup>, non-car travel, sports, tours, poker machines, pub expenses, other expenses*). Trip expenditure can be annualised by expanding by the number of trips per annum.
- b) **Expenditure on small equipment** on the last trip (*rods, tackle, bait, boat hire, boat fuel, charter fees, recreational fishing clothes, camping gear and other related purchases*); and
- c) **Annual expenditure on larger boat equipment** (*boat licence, boat maintenance, boat insurance, mooring expenses, boat equipment, and major purchase expenditure on new boat or major boat repair in last year*). This includes capital purchases in the year of the survey.

Trip related expenditure per household was investigated by asking fishers about their last Saltwater (SW) or Freshwater (FW) trip and their expenditures for both the angler and accompanying persons. The trips SW (or FW) per annum were then related to the total trips per annum state-wide in SW (or FW), so the total annual recreational fishing expenditure for SW (or FW) could be calculated.

Minor equipment expenditure is considered to be trip related, whereas expenditures on major purchases, such as boats and motors, are annual expenses. Although maintenance and expenditure on repairs are expenses that can increase with activity, maintenance is also included fixed expenditures, such as annual over hauls and replacing boat motors. Capital expenditure on new boats is a distinct and significant expenditure category.

#### **Sectors not covered by the survey**

*The Charter sector-* The state-wide expenditure survey included questions on anglers' use of commercial charter services, but it is unknown if we can identify and determine the value of expenditure in the entire recreational fishing Charter sector given the sample size in the study. If it is a "rare event", then the Charter sector would need to be surveyed separately, such as a direct Charter business survey or client survey approach (Dominion in prep.). "Rare events" challenge the capacity of a sample to capture the event in a representative and statistically robust fashion.

*The fish guiding sector-* RFs may choose to hire a guide and interview participants were asked to about this expenditure. Again if this is a rare event, the sample size here may have inadequately captured the value of the sector. This may also apply to other recreational fishing tourism operations.

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<sup>7</sup> This included travel expenditure for which ATO rates per km were imputed depending on the engine size for the kilometres (km) stated in the questionnaire i.e. cubic capacity (cc) of the car for outward and return legs of the trip.

### 3. Survey results

This section presents the results of the survey fieldwork in preparation for their use in the expansions to estimate total state activity and expenditure, as developed in Chapter 4. We compare the activity and expenditure results from screening the general population to identify recreational fishers, with the more direct use of the database records of known RFL holders.

#### 3.1 The fieldwork results - Details of sampling and completed interviews

We sampled two populations, consisting of:

- 1) persons who indicated they were fishers (a proportion of which were not licence holders), located by a random screening survey of the total population; and
- 2) licence holders recorded on the RFL data base.

The survey fieldwork agency contacted and completed a total of 1,235 interviews, 613 in March and 622 in September 2012 and the data are summarised in Table 3a.

**Table 3a:** The number of surveys completed in fieldwork for both survey approaches.

Fieldwork	From screening survey	Survey of RFL holders	Total
Mar-12	292	321	<b>613</b>
Sep-12	312	310	<b>622</b>
<b>Total</b>	<b>604</b>	<b>631</b>	<b>1,235</b>

The random screening survey identified and completed interviews with 604 fishers all over 18 years old, of which 213 (35%) were adult concession holders, or pensioners not requiring a licence. Table 3b presents details of the interviews identifying the survey results for fishers identified through holding a RFL or via the random screening survey.

IRIS Research undertook two sets of fieldwork telephone survey calls in April and September 2012. Each fieldwork event involved the random screening survey of the total population to locate recreational fishers as well as survey calls to fishers holding licences on the RFL database. Table 3b shows the survey response profiles. For the screening survey:

- The Gross sample is the initial sample of white page telephone numbers;
- The net sample is the gross sample less the dead/disconnected numbers, and numbers of non private dwellings/ businesses and faxes and modems; and
- The net sample is represented by the non-contactable households, the households with no fishers and households with fishers, subdivided into full responses and refusals, which included incomplete interviews.

**Table 3b:** The response profile of the screening survey and the RFL surveys and the two waves of interviews within each (After Henry and Lyle 2003).

Screening Sample	Wave 1	%	Wave 2	%	RFL Sample	Wave 1	%	Wave 2	%
Gross sample	13,896	100%	27,796	100%	Gross sample	2,014	100%	2,706	100%
Sample loss	6,336	46%	14,078	51%	Sample loss	1,114	55%	1,569	58%
Net Sample	7,560	100%	13,718	100%	Net Sample	900	100%	1,137	100%
<i>represented by:</i>					<i>represented by:</i>				
Non-fishing households:	4,116	54%	6,938	51%	Non-fishing households:		n/a		
Full response	292	4%	312	2%	Full response	321	36%	310	27%
Refusals	327	4%	520	4%	Refusals	94	10%	90	8%
Non contacts	2,825	37%	5,948	43%	Non contacts	485	54%	737	65%
% response	327	53%	312	38%	% response	321	77.3%	310	77.5%
% refusals	292	47%	520	63%	% refusals	94	22.7%	90	22.5%
Interview approaches	619		832		Interview approaches	415		400	
RFs as % of households		13.1%		10.7%					

In Table 3b (left hand side), both waves of the screening survey of the general population recorded between 46% and 51% of sample loss due to dead/disconnected numbers, and numbers of non private dwellings/ businesses and faxes and modems. As a result, for the second wave, a greater number of initial telephone numbers were selected, and fewer call backs made in order to complete the desired sample sizes within budget. This difficulty in contacts may be due to changes in the general white pages telephone data base information, as increasingly people use other forms of telephony such as mobiles and internet/ VOIP systems. There have also been several developments in privacy legislation with more people choosing not to receive unsolicited calls, or using ex-directory numbers. In 2000, 80% of households were assumed to have a land line phone (Henry and Lyle 2003), but this has since declined (ACMA 2013) and mobile phone use has dramatically increased among those under 40 years old<sup>8</sup>.

Of the total net sample, 37% and 43% were not contactable numbers, despite repeated ringing (up to five times in wave 1 and two times in wave 2). Another 54% and 51% of the net sample of households contained non fishers, and 8% and 6% contained someone who had been fishing in the last six months. RFs who had fished in the last six months were present in 13.1% and 10.7% of all the households successfully contacted. This is in line with expectations, but there was reluctance among a significant number of these anglers to complete the survey interview, indicated by refusal rates of 47% and 63%. This was unexpected, but anecdotal information from interview staff indicated that

<sup>8</sup> A recent report by ACMA (2013) indicates that “..while over 90 per cent of Australian adults continue to use both fixed-line phones and mobile phones and largely see them as complementary services, Australians are increasingly turning to mobile technology to make their voice calls”. “Older Australians more commonly adhere to fixed-line technology for voice communication. Ninety-six per cent of those aged 65–69 maintain a fixed-line service, in contrast to 75 per cent of 18 to 24-year-olds. Among 18 to 24-year-olds living in share households, this number drops to 60 per cent”. “Emerging technologies such as VoIP are yet to be adopted by Australians at mainstream levels” (ACMA 2013).

numbers of people opted not to be interviewed because they felt that “the RFL is intrusive”, “revenue raising”, and the survey was a way for authorities “to find out if they had a current fishing licence”.

Table 3b (right hand side) reports the fieldwork response profile for the RFL database contacts. In the survey of RFL holders issues also arose with respect to contacting existing RFs. This was mainly due to data base records being valid only up to or 2010 and by 2012, up to 55% of numbers were found to be dead. Of course, it is also likely that some telephone numbers may not have been stated accurately at the time of licence issue.

Of the second RFL sample survey method, 54% and 27% in waves 1 and 2 respectively were not contactable numbers, in spite of repeated ringing up to five times in waves 1 and 2. Unlike the screening survey all of the households sampled should have contained fishers. The survey completion rate was high among angler contacted, with 77% taking part in the both waves of the RFL survey.

The numbers of people surveyed, as shown in Table 4, have to be considered against the populations in each of the study areas. There was a planned under sampling in the case of Sydney, where population is highest (and where the proportions of anglers is lowest) and an oversampling in the NSW North Coast and Inland areas where populations are less. This enabled sufficient responses to be gathered for each region in the study, but required re-weighting of regional results by regional ratios of population in some uses of the sample data later in the study.

**Table 4:** The number of interviews for the licence and the random screening survey by region of NSW conducted in March and September 2012.

<b>Licence survey</b>	<b>Region</b>	<b>March</b>	<b>Sept</b>	<b>Total</b>	
	<b>Sydney</b>	94	91	185	
	<b>North coast</b>	81	69	150	
	<b>South coast</b>	30	30	60	
	<b>Inland</b>	63	58	121	
	<b>Interstate</b>	53	62	115	
	<b>All NSW</b>	<b>321</b>	<b>310</b>	<b>631</b>	
<b>Random survey</b>	<b>Sydney</b>	50	75	125	
	<b>North coast</b>	86	78	164	
	<b>South coast</b>	23	9	32	
	<b>Inland</b>	33	37	70	
	<b>Licenced</b>	<b>192</b>	<b>199</b>	<b>391</b>	64.7%
	<b>Sydney</b>	21	35	56	
	<b>North coast</b>	46	47	93	
	<b>South coast</b>	14	11	25	
	<b>Inland</b>	19	20	39	
	<b>Unlicenced</b>	<b>100</b>	<b>113</b>	<b>213</b>	35.3%
	<b>Rnd</b>	<b>292</b>	<b>312</b>	<b>604</b>	
<b>All NSW</b>	<b>613</b>	<b>622</b>	<b>1236</b>		

Table 4 indicates that in the random sample, 64.7% of fishers had licences and 35.3% had not.

### 3.2 Fishing activity from the survey samples

Fishers were asked to recall their fishing activity and their fishing-related expenditure over three time periods:

- their last six months of fishing activity;
- their last fishing trip together with the expenditure involved on that trip; and
- their major boat expenditures in the last year.

Rather than asking fishers at one point in time to recall details of activity and expenditure over a full year (and therefore to try and reduce ‘telescoping bias’), two waves of field work interviews were run six months apart. In March 2012 and September 2012 field samples, fishers were asked about their last six months of fishing activity (this was also designed to enable any seasonality to be assessed). Recalling days fished and expenditure over the previous year is known to include recall bias and often a telescoping of memory. Although six months is shorter than a year, it may be that there is a telescoping of the memory in respect of recalling past events and hence an unknown component of “recall bias” in 6 months also. In annualising results from two different fishers recalling the last six months, any bias will be compounded.

Section 1.3 examined activity estimates from past RFE surveys in Australia and the differences between methodologies. The recreational fishing activity levels expressed as trips per annum, or days fished per annum, point to the potential for recall surveys to overestimate activity in the desired period. The six month recall results were compared with previous annual trip and fishing activity estimates in NSW and on the basis of conservatism, were treated as being equivalent to bias-adjusted annual results. The estimates of anglers when asked about their last 6 months of activity appear to be less constrained, than when recalling over the past year<sup>9</sup>. In other words, it appears there was a strong tendency to ‘telescope’ to the last 12 months.

This is illustrative of the significant methodological divide between annual recall surveys and other shorter term activity log approaches. When the cost of diary surveys is prohibitive, as is often the case, annual recall is preferred for expenditure estimation and adjustments for recall bias applied. Not applying adjustment for bias will lead to over estimates of activity and expenditure.

#### 3.2.1 Recreational fishing trips

Anglers were asked to recall the number of SW and FW trips in the past six months and also to recall details of their last trip. A trip can be just a day and may well be for many fishers who live close to their usual fishing place, but can, of course, be many days. In each case, this would be known since they were asked the duration of their last trip in days. Figure 1a plots the numerical frequency of trips in the past year.

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<sup>9</sup> Total activity estimates may have been more constrained if the same anglers had been called again, or preferably in shorter 2 month periods as in the NOAA survey (Gentner 2008).

**Figure 1a:** The numerical frequency of trips per annum for Saltwater and Freshwater fishing trips.

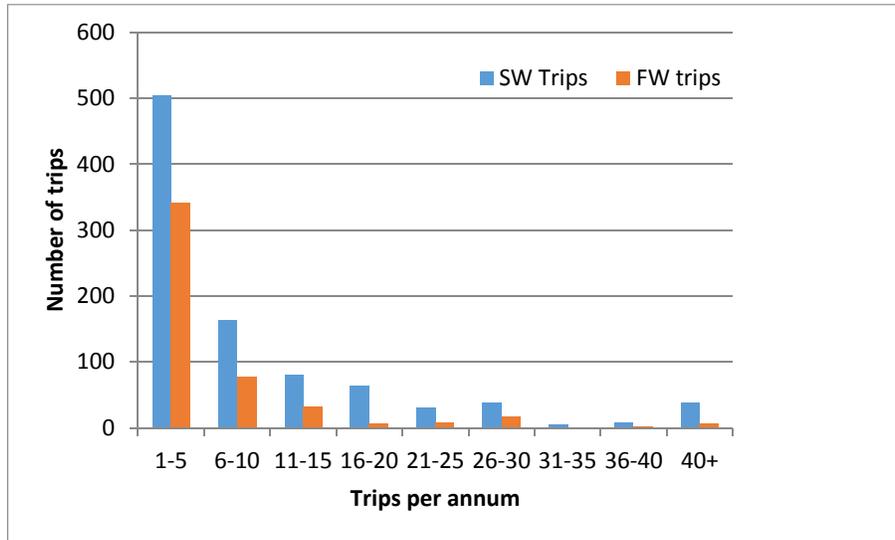
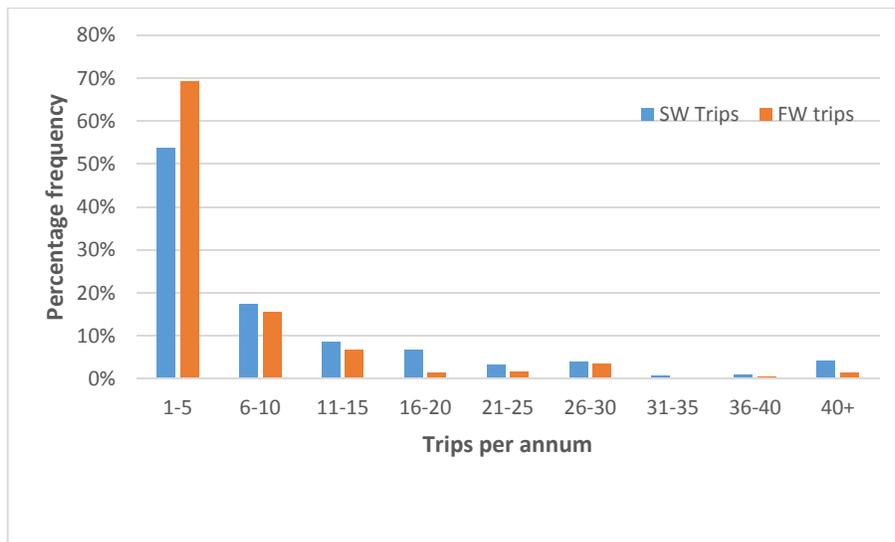


Figure 1b shows that 54% of all SW anglers and 67% of all FW anglers fished 5 trips or less per year. The average number of trips per angler was SW 8.75 (standard deviation (s.d.) 14.5) and FW 3.8 (s.d. 8.6), or 10.7 (s.d. 15.3) trips for all fishing. The declining exponential nature of the trips per annum distribution is evident, although there were 3% of trips by avid anglers who reported in excess of 40 trips per annum. This distribution is highly skewed to the left and strongly influences calculation of total expenditure estimates.

**Figure 1b:** The percentage frequency of Saltwater and Freshwater fishing trips per annum.



Anglers were also asked about days fished in SW and FW. The relationship between trips and days fished for 631 RL holders is reported in Table 5.

**Table 5:** The days, trips and length of trip for RFL Holders sampled (n= 613)

Type of fishing day	Days	Trips	Days/trip	% of trip time fished
SW days	6,112	4,189	1.46	81.7%
FW days	2,407	1,536	1.57	86.6%

The RFL survey sampled 631 fishers who fished 8,470 days, an average of 13.4 days per year. Proportionally, 72% of days fished were in SW and 28% in FW. Table 5 shows that the average fishing trip was 1.46 days in SW and 1.57 days in FW, of which over 80% of time was time fished in both environments.

### 3.2.2 Recreational fishing days

Previous catch and effort surveys have expanded data based on days fished. Days fished are presented on an annual basis in a frequency chart in Figure 2a and as percentage frequency chart in Figure 2b.

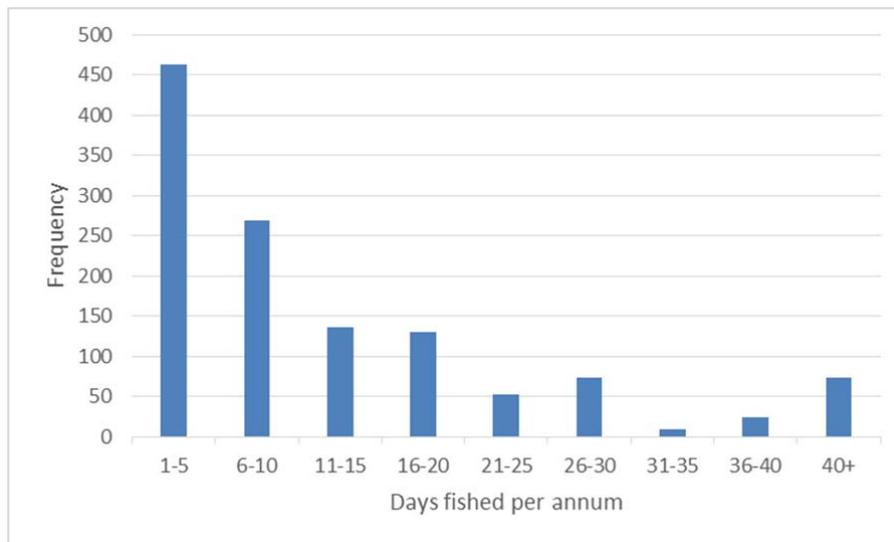
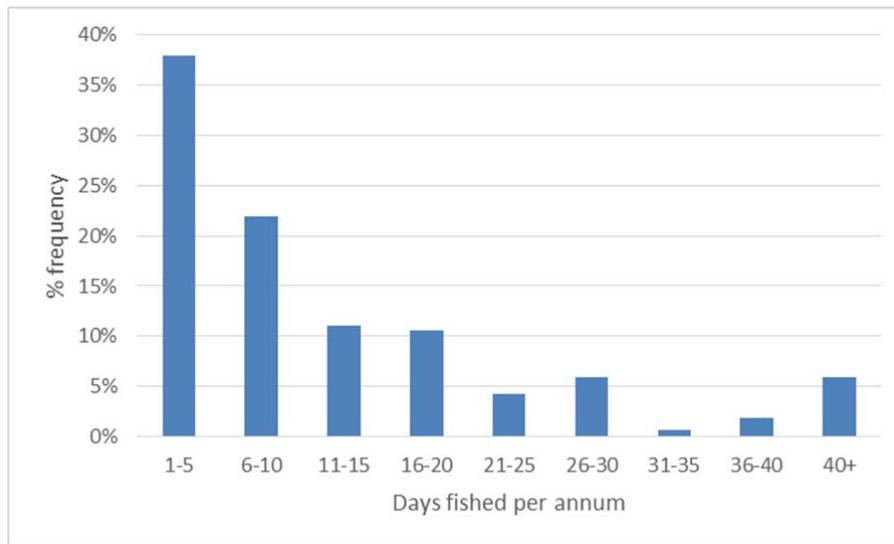
**Figure 2a:** The frequency of days fished by all fishers. (Average 14.6 days, sd. 18.6 days, n=1,231).

Figure 2a and 2b indicate that 38% of all anglers sampled fished 5 or less days per year, but also that 6% of all anglers fished more than 40 days a year, the latter often referred to as avid anglers. The average days fished are 14.6 days and given the previous estimate of 773,000 adult anglers in NSW, this translates in to an estimated 11.6 million days fished in 2012.

These activity distributions in samples are important. The 36% of days below 5 days a year was less than the 67% of the national survey (conducted in 2001). In contrast, that survey also showed that just 1% of anglers fished more than 40 days in the previous year (Henry and Lyle 2003).

**Figure 2b:** The percentage frequency of days fished.

In the present study, this is partially explained by possible under sampling of 3 day and 1 month licence holders, though the random survey should not have been affected in this way. On the other hand, the present study may well have sampled a higher proportion of avid fishers in the RFL data base. The third possibility is that angler behaviour in NSW has altered (on average) in the 12 years since the national survey, perhaps influenced by the introduction of the RFL.

### 3.3 Comparisons between methods and samples

Statistical t-tests were used to compare the trips per angler and average days fished per angler between seasonal samples, random and RFL database surveys and between licensed and unlicensed recreational fishers.

#### ***a) Are there seasonal differences in fishing activity?***

There is no previous literature on seasonal levels of fishing effort in NSW, but we might expect to see less days fished and fishing trips in the April to September “winter” period since this period does not include Christmas. However t tests revealed there was no statistically significant difference in either the average days fished, or trips per fisher, across all observations between the April and the September samples. This may be partially explained by respondents to the September survey recalling significant fishing activity at Easter time as part of “winter” activity.

#### ***b) Are the random survey method and the RFL data base method results different?***

The t tests for trips indicate that those fishers in the random survey, which included both licence holders and non licence holders, fished significantly more trips per year (12.5 v 9.06 trips,  $t=3.95$ ) than fishers sampled from the RFL database. This also applied to days fished with those in the random survey fishing significantly more days (15.5 v 13.4 days,  $t=2.08$ ).

**c) Are there differences between licenced and unlicenced fishers?**

Do licensed anglers fish more than unlicensed fishers? When all samples are considered, the average days fished estimates show no significant difference between licensed and unlicensed fishers. However non-licence holders made significantly more fishing trips than licence holders (12.8 trips v 10.3,  $t = 2.24$ ).

**3.4 Discussion of the sampling and activity results**

On the basis of these results, the average activity per angler whether measured in trips made or days fished, does not appear to be significantly different between seasons. This result supports the prospect of sampling recreational fishers at any time of the year, asking them to recall their activity in the last year.

Fishers sampled randomly through the “white pages” made significantly more fishing trips and fished on more days per annum than RFL holders. Similarly those fishers contacted at random not holding licenses were found to fish a similar number of days to licence holders, but made significantly more trips per annum. This somewhat counter intuitive result (we might expect licence holders to be more avid) is nevertheless consistent with concession holders and pensioners being available to take more occasional fishing trips than the general working population might.

It may also be related to the relatively high number of fishers found to have made more than 40 trips per year, skewing the activity profile. Where one sample is chosen at random and the other comes from a database of known recreational fishers, we may expect some avidity bias in the latter (Johnson 1999). However this is not what we found, indicating that opportunity to go fishing among non licence holders may enable them to fish more frequently than licence holders, though this assumes we have no significant biases in the survey analysis. For example ACMA (2013) states that CATI surveys, as used in our random screening survey, “*may be biased towards those who normally stay at home (e.g., older or retired people, or those whose occupation is home duties)*”. This may indicate that those who responded had more time to go fishing than across the whole NSW population.

*Non response bias and the screening survey*

The most common non-response bias is “unit non-response” which “*takes place when a randomly sampled individual cannot be contacted or refuses to participate in a survey*” (Ritz 2013). Mohadjer et al. explain “*There is always a potential for item nonresponse bias whenever sample persons who did not participate in the survey have somewhat different characteristics than those who did.*”

In our random screening survey we had:

- Sample losses: approximately 50% of dead numbers, and the potential for unit non response bias. Do those interviewees with land line numbers differ from those who have moved or changed telephones in the past few years? Privacy conditions precluded contacting non respondents to investigate further. Socio-economically, those moving away from landlines may be younger, in the working population, or may have different incomes? An argument can be made either way and the extent of any bias remains unknown;

- Non contactable household- It is unlikely these non contactable numbers for non-RF households or RF households would differ, unless they were out fishing!;
- Refusals: Why did so many people who identified themselves as having fished in the past six months refuse to complete a short fishing interview? Reasons include the dislike of surveys intruding into their home and privacy, not having the time, or other general perceptions. Those who completed the interview may be keener on fishing, more avid and some not completing it because they consider their level of fishing to be trivial. There was also the indication from surveyors of fear or mistrust that the call was checking up on their licence status. In the random survey those who may have had a licence for 3 days or 1 month in the previous six month period, may not have had one at the time of the call, and may have felt vulnerable. However approximately one third of all fishers are concession holders, reducing this possible vulnerability impact.

In the area of survey refusals, there seems to be more potential for non-response bias in the comparability of those who completed the survey with those who refused. This cannot be directly checked with non respondents due to privacy constraints. Other independent indicators could be used comparing “...the distribution of respondents in the survey with associated distributions coming from other independent surveys” (Mohadjer et al. 1994). We are able to compare the surveys given their two different approaches.

In the random screening survey, over half of the identified fishers did not complete the survey. We can test for evidence of a response bias by comparing RFL licence holders who replied to the random survey with RLF licence holders contacted directly in the other survey. A t-test indicated that the mean days fished for the random RFL group (n=391) were significantly higher than the direct RFL (n=631) survey results (15.8 v 13.4, t=2.11) significant at the 5% and 2% levels. This is indicative of a possible response bias, as more active RFL holders appear more likely to have participated in the random screening survey interviews than other less avid licence holders. Previous adjustments made to the data (section 3.2), reduced the risk to final estimates from this and other likely biases.

#### *Bias and the survey of RFL holders*

The RFL survey also recorded significant levels of dead numbers, although a much lower rate of refusals. The survey fieldwork team were able to ask to speak to the licence holder by name and this may have contributed to higher completion rates. Any bias in the RFL survey may then be between responses by different licence holders. Those holding 3 year licences may have significantly different fishing activities, expenditures or preferences to 1 year or 1 month and 3 day licence holders? Anecdotal evidence suggests some fishers buy several 3 day licences through the year and this may contribute to a form of “double counting” in any comparative analysis of licences. The scale of this behaviour is unknown and does not assist us in developing a sampling approach that may draw on a representative cross section of the four licence types. Further enquiries of non respondents was not pursued due to privacy constraints.

### 3.4 Estimation of recreational fishing expenditure per angler

Recreational fishing expenditure can be split into different categories, as explained previously:

- a) *Trip related expenditure* on a range of expenses. Trip expenditure can be annualised by expanding by the number of trips per annum.
- b) *Expenditure on small equipment and expenses* on the last trip; and
- c) *Annual expenditure on larger boat equipment*. This includes capital purchases in the year of the survey<sup>10</sup>.

All respondents in each area were asked about trip expenditures by all anglers in their household – which averaged 2.02 anglers per household (see Table 7 later in report). The estimated expenditures per angler per trip are reported in Table 6a,b,c, but state-wide estimates in the next chapter are based on household data.

Table 6a summarises the average RF expenditure per trip for all NSW fishers (both SW and FW) in each region for both fishing trip expenses and tackle. Table 6b reports the average SW RF expenditure per trip for all NSW regions on both fishing trip expenses and tackle. Table 6c shows the average trip expenditures for FW anglers. Table 6d shows the annual expenditure on boat expenditure for all NSW anglers, SW and FW anglers combined.

In Table 6a,b &c the results include fishers from Interstate who hold a NSW RFL, but their major boat and motor purchases are not assumed to have been made in NSW (Table 6d black squares).

The results in Table 6a confirm that all fishers (both SW and FW) spend 68% of trip expenses on the fishing trip and just under 32% on equipment and fishing expenses. Car travel is the major trip expense \$69.74 (31% of total trip expense, accommodation \$ 32.67 (15%) and food/drink eating out \$35.94 (16%) also, while fishing rods and tackle, hooks/lines and bait/berley \$38.91(18%) and boat fuel \$16.50 (7%) are the other major trip expenses.

In Table 6b the costs of SW anglers are shown and Table 5c for FW. Table 6b&c show that each group had similar average expenditures per fishing trip (SW - \$222.82 and FW - \$230.24). Car travel expenses are higher for FW fishers \$90.79/ day versus \$59.55/day SW, but boat fuel for SW is \$19.64/ day versus FW \$10.09/day.

Table 6d shows that the annual NSW fisher's average boat expenses per angler were \$768 p.a. for all NSW, or broken down, \$856 for SW and \$365 for FW fishers. Boat purchase values for SW fishers were much higher than for FW fishers which reflected the lower capital expenditure on small tinnies for creeks, dams and impoundments, as opposed to offshore marine vessels. The comparisons are for the major form of fishing activity with 21% of fishers in our survey sample fishing a combination of both SW and FW in a given year.

<sup>10</sup> Expenditure on fishing boats and larger capital items was reduced by 30%, to reflect non recreational fishing use.

**Table 6a:** The average RF expenditure per trip for all NSW RFs in all NSW. Last column is the percentage of total spend in the All NSW total trip.

Data in Aus \$	Sydney	North coast	South Coast	Inland	Interstate	All NSW	% of total spend per trip
Car travel (both ways)	\$ 68.74	\$ 43.76	\$ 46.50	\$ 98.71	\$ 130.60	\$ 69.74	31%
Accommodation	\$ 39.98	\$ 22.16	\$ 21.12	\$ 29.67	\$ 64.24	\$ 32.67	15%
Eating out	\$ 14.78	\$ 7.33	\$ 11.32	\$ 15.72	\$ 28.20	\$ 13.42	6%
Other food and drink	\$ 20.04	\$ 14.20	\$ 21.21	\$ 28.81	\$ 48.57	\$ 22.52	10%
Shopping (souvenir,magazines,videos)	\$ 4.19	\$ 1.55	\$ 1.20	\$ 6.07	\$ 9.47	\$ 3.87	2%
Travel-other than by car	\$ 3.54	\$ 0.53	\$ 3.25	\$ 0.40	\$ -	\$ 1.60	1%
Sports	\$ 0.27	\$ 0.18	\$ -	\$ 0.34	\$ 4.78	\$ 0.65	0%
Tours	\$ 0.96	\$ 0.07	\$ 1.54	\$ 1.00	\$ 0.22	\$ 0.66	0%
Poker machines	\$ 1.74	\$ 0.95	\$ 0.77	\$ 1.24	\$ 5.04	\$ 1.60	1%
Pub	\$ 6.51	\$ 3.47	\$ 5.65	\$ 6.18	\$ 15.54	\$ 6.21	3%
Anything else?	\$ 1.94	\$ 0.44	\$ 0.68	\$ 1.34	\$ 1.52	\$ 1.17	1%
<b>Expenditure per trip</b>	<b>\$ 162.59</b>	<b>\$ 94.60</b>	<b>\$ 113.07</b>	<b>\$ 189.46</b>	<b>\$ 308.11</b>	<b>\$ 154.05</b>	<b>68%</b>
	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
Major fishing tackle (rods, reel)	\$ 25.61	\$ 14.91	\$ 10.09	\$ 27.56	\$ 8.26	\$ 19.37	9%
Minor fishing tackle (hooks lines etc)	\$ 11.06	\$ 8.81	\$ 7.13	\$ 15.05	\$ 21.01	\$ 11.62	5%
Bait/berley	\$ 10.43	\$ 5.59	\$ 6.24	\$ 8.20	\$ 9.38	\$ 7.92	4%
Boat hire	\$ 6.71	\$ 0.05	\$ 0.90	\$ 1.39	\$ 0.78	\$ 2.42	1%
Boat fuel	\$ 20.54	\$ 13.07	\$ 6.83	\$ 11.80	\$ 35.31	\$ 16.52	7%
Charter and fishing guide fees	\$ 6.47	\$ 3.01	\$ 0.43	\$ 0.98	\$ 1.09	\$ 3.23	1%
Fishing clothes/apparel(waders etc)	\$ 2.63	\$ 1.77	\$ 2.76	\$ 3.39	\$ 1.43	\$ 2.39	1%
Camping equipment	\$ 1.75	\$ 7.35	\$ 3.09	\$ 7.90	\$ 4.00	\$ 5.08	2%
Other fishing expenses	\$ 2.40	\$ 2.83	\$ 1.44	\$ 3.28	\$ 3.93	\$ 2.76	1%
<b>Equipment per trip</b>	<b>\$ 87.47</b>	<b>\$ 57.26</b>	<b>\$ 38.90</b>	<b>\$ 79.39</b>	<b>\$ 85.20</b>	<b>\$ 71.20</b>	<b>32%</b>
<b>Total spend per trip</b>	<b>\$ 250.07</b>	<b>\$ 151.85</b>	<b>\$ 151.97</b>	<b>\$ 268.85</b>	<b>\$ 393.31</b>	<b>\$ 225.24</b>	<b>100%</b>

**Table 6b:** The average RF expenditure per SW trips for RFs anglers in all NSW. Last column is the percentage of All NSW total.

Data in Aus \$	Sydney	North coast	South Coast	Inland	Interstate	All NSW	% of total spend per trip
Car travel (both ways)	\$ 61.68	\$ 36.59	\$ 39.15	\$ 171.53	\$ 126.37	\$ 59.55	27%
Accommodation	\$ 40.63	\$ 21.82	\$ 21.70	\$ 63.25	\$ 109.59	\$ 35.47	16%
Eating out	\$ 14.54	\$ 7.82	\$ 11.51	\$ 41.95	\$ 58.38	\$ 15.39	7%
Other food and drink	\$ 19.88	\$ 12.84	\$ 23.21	\$ 28.34	\$ 62.74	\$ 20.00	9%
Shopping (souvenir,magazines,videos)	\$ 4.47	\$ 1.64	\$ 1.15	\$ 16.20	\$ 21.57	\$ 4.50	2%
Travel-other than by car	\$ 4.21	\$ 0.34	\$ 3.65	\$ 1.02	\$ -	\$ 2.19	1%
Sports	\$ 0.33	\$ 0.10	\$ -	\$ 1.31	\$ 5.81	\$ 0.51	0%
Tours	\$ 1.13	\$ 0.09	\$ 1.73	\$ 2.80	\$ -	\$ 0.86	0%
Poker machines	\$ 1.87	\$ 1.12	\$ 0.68	\$ 1.44	\$ 8.65	\$ 1.70	1%
Pub	\$ 6.94	\$ 3.71	\$ 6.12	\$ 10.95	\$ 21.49	\$ 6.49	3%
Anything else?	\$ 2.29	\$ 0.46	\$ 0.77	\$ -	\$ 4.05	\$ 1.29	1%
<b>Expenditure per trip</b>	<b>\$ 157.87</b>	<b>\$ 86.47</b>	<b>\$ 109.47</b>	<b>\$ 338.80</b>	<b>\$ 418.07</b>	<b>\$ 147.81</b>	<b>66%</b>
Major fishing tackle (rods, reel)	\$ 27.03	\$ 15.09	\$ 11.36	\$ 22.46	\$ 5.41	\$ 19.05	9%
Minor fishing tackle (hooks lines etc)	\$ 12.03	\$ 7.42	\$ 7.47	\$ 10.87	\$ 30.10	\$ 10.35	5%
Bait/berley	\$ 11.83	\$ 6.33	\$ 6.56	\$ 12.42	\$ 11.16	\$ 8.99	4%
Boat hire	\$ 8.16	\$ -	\$ 1.01	\$ 4.75	\$ 2.43	\$ 3.52	2%
Boat fuel	\$ 23.09	\$ 13.80	\$ 7.37	\$ 19.03	\$ 79.46	\$ 19.64	9%
Charter and fishing guide fees	\$ 7.88	\$ 3.70	\$ 0.48	\$ 1.69	\$ 3.38	\$ 4.65	2%
Fishing clothes/apparel(waders etc)	\$ 3.02	\$ 1.95	\$ 3.10	\$ 2.70	\$ -	\$ 2.45	1%
Camping equipment	\$ 2.13	\$ 6.31	\$ 0.48	\$ 9.36	\$ 0.27	\$ 4.02	2%
Other fishing expenses	\$ 2.52	\$ 2.75	\$ 1.61	\$ 2.34	\$ 2.23	\$ 2.47	1%
<b>Equipment per trip</b>	<b>\$ 97.50</b>	<b>\$ 57.21</b>	<b>\$ 39.43</b>	<b>\$ 85.62</b>	<b>\$ 134.44</b>	<b>\$ 75.01</b>	<b>34%</b>
<b>Total spend per trip</b>	<b>\$ 255.37</b>	<b>\$ 143.67</b>	<b>\$ 148.90</b>	<b>\$ 424.42</b>	<b>\$ 552.51</b>	<b>\$ 222.82</b>	<b>100%</b>

**Table 6c:** The average RF expenditure per FW trip for RFs anglers in all NSW. Last column is the percentage of All NSW total.

Data in Aus \$	Sydney	North coast	South Coast	Inland	Interstate	All NSW	% of total spend per trip
Car travel (both ways)	\$ 101.44	\$ 74.98	\$ 105.33	\$ 73.58	\$ 132.61	\$ 90.79	39%
Accommodation	\$ 36.96	\$ 23.63	\$ 16.54	\$ 18.08	\$ 42.72	\$ 26.89	12%
Eating out	\$ 15.91	\$ 5.17	\$ 9.81	\$ 6.67	\$ 13.88	\$ 9.37	4%
Other food and drink	\$ 20.77	\$ 20.14	\$ 5.19	\$ 28.97	\$ 41.85	\$ 27.71	12%
Shopping (souvenir,magazines,videos)	\$ 2.87	\$ 1.18	\$ 1.54	\$ 2.58	\$ 3.89	\$ 2.58	1%
Travel-other than by car	\$ 0.39	\$ 1.38	\$ -	\$ 0.18	\$ -	\$ 0.40	0%
Sports	\$ -	\$ 0.53	\$ -	\$ -	\$ 4.29	\$ 0.93	0%
Tours	\$ 0.15	\$ -	\$ -	\$ 0.38	\$ 0.32	\$ 0.25	0%
Poker machines	\$ 1.15	\$ 0.20	\$ 1.54	\$ 1.17	\$ 3.33	\$ 1.41	1%
Pub	\$ 4.54	\$ 2.45	\$ 1.92	\$ 4.54	\$ 12.72	\$ 5.65	2%
Anything else?	\$ 0.31	\$ 0.33	\$ -	\$ 1.80	\$ 0.32	\$ 0.94	0%
<b>Expenditure per trip</b>	<b>\$ 184.48</b>	<b>\$ 130.00</b>	<b>\$ 141.87</b>	<b>\$ 137.94</b>	<b>\$ 255.95</b>	<b>\$ 166.91</b>	<b>72%</b>
Major fishing tackle (rods, reel)	\$ 19.03	\$ 14.14	\$ -	\$ 29.33	\$ 9.62	\$ 20.02	9%
Minor fishing tackle (hooks lines etc)	\$ 6.58	\$ 14.82	\$ 4.42	\$ 16.49	\$ 16.69	\$ 14.23	6%
Bait/berley	\$ 3.98	\$ 2.38	\$ 3.69	\$ 6.74	\$ 8.53	\$ 5.72	2%
Boat hire	\$ -	\$ 0.26	\$ -	\$ 0.23	\$ -	\$ 0.15	0%
Boat fuel	\$ 8.77	\$ 9.88	\$ 2.50	\$ 9.30	\$ 14.37	\$ 10.09	4%
Charter and fishing guide fees	\$ -	\$ -	\$ -	\$ 0.73	\$ -	\$ 0.31	0%
Fishing clothes/apparel(waders etc)	\$ 0.85	\$ 0.97	\$ -	\$ 3.63	\$ 2.12	\$ 2.27	1%
Camping equipment	\$ -	\$ 11.84	\$ 23.92	\$ 7.39	\$ 5.77	\$ 7.26	3%
Other fishing expenses	\$ 1.84	\$ 3.19	\$ 0.08	\$ 3.60	\$ 4.74	\$ 3.35	1%
<b>Equipment per trip</b>	<b>\$ 41.05</b>	<b>\$ 57.49</b>	<b>\$ 34.62</b>	<b>\$ 77.24</b>	<b>\$ 61.84</b>	<b>\$ 63.32</b>	<b>28%</b>
<b>Total spend per trip</b>	<b>\$ 225.53</b>	<b>\$ 187.49</b>	<b>\$ 176.48</b>	<b>\$ 215.18</b>	<b>\$ 317.79</b>	<b>\$ 230.24</b>	<b>100%</b>

**Table 6d:** The average RF expenditure per annum on larger boat items for SW and FW anglers in regions and all NSW. (nb: Table 6a,b,c are per trip and Table 6d is per angler per annum).

Data in Aus \$	Sydney	North coast	South Coast	Inland	Interstate	All NSW	% of total spend per trip
<b>All NSW</b>							
Boat licence/registration	\$ 71.15	\$ 46.58	\$ 44.07	\$ 58.15	\$ 85.46	\$ 59.40	8%
Boat maintenance	\$ 292.48	\$ 144.97	\$ 96.55	\$ 79.35	\$ 179.17	\$ 175.04	23%
Boat insurance	\$ 75.19	\$ 45.74	\$ 30.06	\$ 41.45	\$ 103.18	\$ 57.54	7%
Marine mooring fees	\$ 76.15	\$ 19.40	\$ 1.92	\$ 1.22	\$ 26.09	\$ 31.79	4%
Boat equipment (safety etc)	\$ 151.75	\$ 76.37	\$ 31.75	\$ 54.52	\$ 60.15	\$ 88.88	12%
Boat purchase or motor repair	\$ 234.37	\$ 256.76	\$ 258.65	\$ 97.40	\$ -	\$ 355.50	46%
<b>Annual boat expenditure</b>	<b>\$ 901.09</b>	<b>\$ 589.82</b>	<b>\$ 463.00</b>	<b>\$ 332.08</b>	<b>\$ 454.05</b>	<b>\$ 768.15</b>	<b>100%</b>
<b>Saltwater</b>							
Boat licence/registration	\$ 73.40	\$ 47.51	\$ 35.83	\$ 60.03	\$ 133.72	\$ 60.14	6%
Boat maintenance	\$ 322.21	\$ 158.80	\$ 98.05	\$ 53.56	\$ 283.92	\$ 208.29	22%
Boat insurance	\$ 80.32	\$ 50.68	\$ 30.02	\$ 39.60	\$ 198.24	\$ 64.58	7%
Marine mooring fees	\$ 87.65	\$ 23.85	\$ 2.16	\$ 0.30	\$ 81.08	\$ 45.05	5%
Boat equipment (safety etc)	\$ 174.07	\$ 78.00	\$ 34.28	\$ 75.08	\$ 92.30	\$ 107.64	11%
Boat purchase or motor repair	\$ 304.50	\$ 352.50	\$ 300.00	\$ 406.00	\$ -	\$ 470.50	49%
<b>Annual boat expenditure</b>	<b>\$ 1,042.14</b>	<b>\$ 711.34</b>	<b>\$ 500.35</b>	<b>\$ 634.56</b>	<b>\$ 789.26</b>	<b>\$ 956.18</b>	<b>100%</b>
<b>Freshwater</b>							
Boat licence/registration	\$ 60.73	\$ 42.55	\$ 110.00	\$ 57.50	\$ 62.56	\$ 57.87	16%
Boat maintenance	\$ 155.23	\$ 84.74	\$ 84.54	\$ 88.30	\$ 129.49	\$ 106.32	29%
Boat insurance	\$ 51.54	\$ 24.21	\$ 30.38	\$ 42.09	\$ 58.09	\$ 42.97	12%
Marine mooring fees	\$ 23.08	\$ -	\$ -	\$ 1.55	\$ -	\$ 4.39	1%
Boat equipment (safety etc)	\$ 48.77	\$ 69.30	\$ 11.54	\$ 47.38	\$ 44.90	\$ 50.11	14%
Boat purchase or motor repair	\$ 50.00	\$ 31.50	\$ 184.00	\$ 53.50	\$ -	\$ 103.50	28%
<b>Annual boat expenditure</b>	<b>\$ 389.35</b>	<b>\$ 252.30</b>	<b>\$ 420.46</b>	<b>\$ 290.32</b>	<b>\$ 295.04</b>	<b>\$ 365.15</b>	<b>100%</b>

In Table 6a the higher travel costs of some regional residents, such as Sydney anglers, Inland and interstate fishers were evident. The trip expenditure of Inland and interstate SW anglers was significantly higher than for resident NSW anglers due to car travel, accommodation, food and other trip expenses, presumably to the coast (Table 6b). Table 6c shows that FW expenditure per trip was highest for interstate fishers (e.g. Victorians traveling to southern NSW) and Sydney and South Coast RFs had high travel costs travelling to desirable FW fishing locations (e.g. Snowy mountains etc. Dominion 2001 and 2002).

### **The socio-economics of recreational fisher expenditure in NSW**

The survey samples were analysed to identify some of the socio-economic drivers of RF expenditure in NSW. The samples combined to give 1,235 observations of RF expenditure and the survey included a range of other variables. Both multiple regression analysis and a cluster analysis enables the statistically significant variables determining angler expenditure to be identified and estimated as reported in Appendices 1 and 2 respectively.

#### ***Multiple regression results***

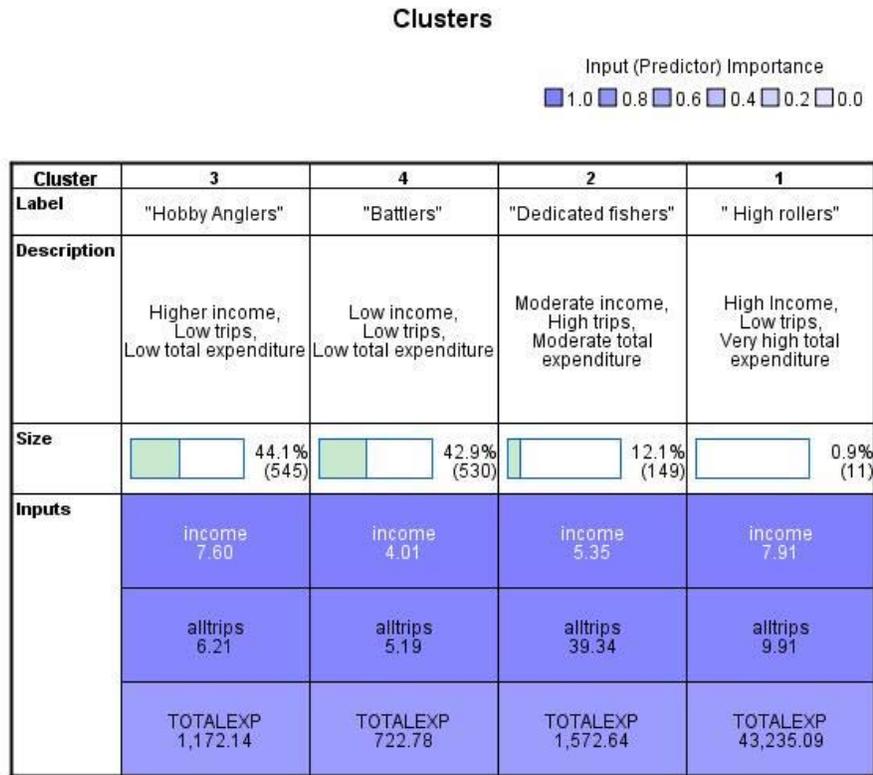
In Appendix 1 results reveal that Total recreational fishing expenditure is driven by licence status (licence holders spending more), number of SW trips per annum and the level of household income. Age, sex and regional location were found not to be statistically significant in determining total RF expenditure.

Trip expenditure was driven by licence holders and number of SW trips. Trip expenditure was further examined and was significantly influenced by licence holders, SW and FW days fished and the distance travelled on the last trip. Fishing Tackle expenditure was found to be determined by income, rather than number of trips. Expenditure on boats was driven by both number of SW trips and the level of RF household income.

#### ***Cluster analysis results***

The expenditure of NSW RFs was also subjected to “cluster analysis” to see the significant socio-economic characteristics of fisher groups as reported in Appendix 2 and in Figure 3 below. The cluster analyses for expenditure on fishing trips, tackle and boat expenditure are reported in Appendix 2.

**Figure 3:** A cluster analysis of RF total expenditure showing the groups of significantly different clusters of anglers identified.



In Figure 3 there are four significantly different cluster groups. The characteristics of the four groups are under the “description” row and the authors have put a label to characterise each group. Between Figure 3 and Appendix 2, the overall picture is of groups of “ordinary” fishers (approximately 85%) with low levels of fishing activity, in which household income levels may differ (half lower, half higher); secondly a group of dedicated anglers (approximately 12%), who have high fishing activity and expenditure, and finally a highly avid fishing group (less than 3%), with very high fishing activity and high to very high expenditure.

The results confirm the only previous examination of the socio-economic characteristics of RFs in NSW by Dominion (2003), which showed that recreational fishing is a past time involving a diverse range of people, has great variety in activity levels and crosses the entire socio-economic spectrum.

## 4. State-wide and regional expenditure estimates

### 4.1 Estimating total expenditure

This chapter describes the estimation of the total recreational fishing expenditure for RFs in NSW and in its regions. Total recreational fishing expenditure is the product of three variables:

**a) Number of recreational fishers or RF households (HH)**

We use three approaches to estimate the total RF population in NSW by use of:

- 1) Random telephone survey and ABS Household data and population data;
  - 2) The RFL data base; and
  - 3) Use of the screening sample and the ABS data on Households. Use of the screening survey of the general population to estimate total number of fishers<sup>11</sup> via ABS population data.
- b) **Fishing trip activity:** fishing trip activity estimates are obtained from the telephone survey; and
- c) **Recreational fishing expenditure:** information on the expenditure per trip and annual expenditures on equipment is obtained from the telephone survey.

The product of these variables will enable us to estimate the total state-wide recreational fishing expenditure. Expenditure is also estimated for each state region considered. Saltwater and freshwater fishing are considered separately in the state estimates through asking respondents about the trip intention.

### 4.2 Expanding the sample of fishers and expenditure

Total expenditure estimates are based on travel and fishing equipment expenses per trip, and estimates of expenditure on boat capital items. These are summed to give an annual total expenditure estimate. However the estimates for the angler survey need to be expanded to give state wide estimates. These expansions are described in Box 1 below.

**Box 1:** Explanation of key expansions.

The expansion method adapts the method used in the National Survey (Henry and Lyle 2003). The number of fisher households (FHH) was estimated as follows for each region:

$$\text{No. of fisher Household (est.)} = \text{No. Households in Population (ABS)} * \frac{\text{No. of Fisher HH (sample)}}{\text{No. of HH (sample)}}$$

Example: How many recreational fishers would these households include?

$$\text{No. of Fishers 19 to 75 yrs (est.)} = \text{Mean No. fishers per HH (sample)} * \text{No. of fisher Household (est.)}$$

$$776,496 = 2.02 * 383,921 \text{ (see Table 7)}$$

RF HH are distributed proportionally across regions by household, and recreational fishers by regional population.

<sup>11</sup> Recreational Fishers under 19 years of age are not included and need to be added if the total population figure is for all anglers. The activity and expenditure estimates are based on ages 19-75 only.

Information on NSW State and Regional Households by Local Government Area (LGA) were accessed (ABS 2011). The data were aggregated by the larger SD ABS regions (e.g. Sydney, North coast, Inland, and SDD, South Coast area). These identified the number of households in each of the study regions as reported in Table 7.

**Table 7:** The “total households” in each of the NSW study regions based on LGA data ABS (2011). Households with recreational fishers are estimated for each study region.

Area	Population 2010 (>18-75)	Households	HH with RF	Rec Fishers /HH	RF by region
<b>Sydney</b>	3,160,897	1,376,583	213,934	2.30	491,232
<b>North coast</b>	835,229	570,688	88,690	1.46	129,802
<b>South coast</b>	350,750	207,195	32,200	1.69	54,510
<b>Inland</b>	649,564	315,987	49,107	2.06	100,948
<b>Total</b>	<b>4,996,461</b>	<b>2,470,453</b>	<b>383,931</b>	<b>2.02</b>	<b>776,496</b>

The RF household responses for anglers’ trip frequency, and trip expenditure, were multiplied to produce estimates of state-wide and regional expenditure.

### 4.3 State-wide expenditure estimates

The estimation of total expenditure for samples of recreational anglers and its expansion to regional, state-wide and national estimates has depended on traditional statistical methods, estimating the total from means of the component distributions. However, while the number of households is reasonably well estimated, the frequency distribution of fishing trips is highly skewed to the left (see Figure 1a).

The estimates of total state expenditure on recreational fishing involve multiplying the following variables:

- 1) Estimate of RF households - the ABS has reliable estimates of households for which RF households can be identified;
- 2) Estimate of trips - anglers state the number of trips per annum; and
- 3) Estimate of the trip and tackle expenditure on their last trip and their capital expenditure in the last year.

Total expenditure is the product of these variables. Total expenditure can be estimated as a mean value with confidence intervals. Here, we used the 1,237 observations in the RF sample weighting the results in respect of regional populations as follows:

- a) Total annual expenditure per angler household = (( $\$$  travel expenses per trip +  $\$$  tackle expenses per trip) \* number of trips) + (annual capital expenditure per angler household);
- b) Total annual expenditure in NSW = total number of anglers households \* total annual expenditure per angler household.

This traditional approach gives a point estimate, but does not provide any information on the probability of different expenditure levels around the mean. This requires a simulation approach.

Table 8a shows that the estimated expenditure by all NSW resident RFs in 2012 was \$1.439bn<sup>12</sup>, with an additional \$186.1m being spent by interstate fishers, making a total estimated expenditure by recreational fishers in NSW of \$1.625bn in the year 2012.

Considering regional expenditures, total recreational fishing expenditure was highest by Sydney anglers - \$903m (56% of all expenditure in NSW), followed by the North coast anglers - \$300.8m (19%) and inter-state anglers - \$ 186m (11%). Total expenditure for South Coast anglers was \$101.8m (6%) and for Inland anglers, \$130.8m (8%)<sup>13</sup>.

Expenditure on fishing trips was \$793m, or 49% of all recreational fishing expenditure in NSW. Of this, \$402m (25%) was spent on fishing equipment, tackle and fuel and \$430m (26%) was spent on annual capital expenditures such as boats and maintenance. Expenditure on SW fishing was estimated at \$1,415m (87%) and on FW fishing at \$231m (13% of total recreational fishing expenditure in NSW).

Table 8b shows the costs within each category:

- Within trip expenditure (49% of total expenditure), car travel \$326m (20.1% of total annual expenditure), accommodation, \$185.9m (11.4%) and food and eating out, \$188m (11.5%);
- Expenditure on fishing equipment and expenses \$402.5m (24.6%) was made up of \$164.5m (10.2%) on major and minor tackle, and \$102.7m (6.3%) on boat fuel; and
- Annual boat expenditure \$430.5m (26%), of which \$122.5m (7.5%) was maintenance and boat purchase or motor repair \$143.6m (8.8%).

<sup>12</sup> This estimate is the same as the mean value produced by the simulation shown later in this chapter. It is then adjusted for Interstate expenditure.

<sup>13</sup> In Chapter 5 the regional economic analysis adapts these data to reflect the expenditure made in other regions away from home residence.

**Table 8a:** Estimates of the total RF expenditure for different areas of NSW and including interstate angler expenditure to give all RF expenditure in NSW.

Expenditure category	Sydney	North coast	South coast	Inland	All NSW	Inter-state	Total expend in NSW	% total expend in NSW
<b>Trip spend</b>	383,906,879	136,686,958	57,862,828	74,849,484	653,306,149	139,478,487	<b>792,784,637</b>	49%
<b>\$ fishing equip</b>	222,891,110	85,965,049	20,624,384	31,116,970	360,597,513	41,975,664	<b>402,573,177</b>	25%
<b>Total annual boat expenditure</b>	296,326,795	81,222,395	23,393,975	24,877,516	425,820,681	4,691,465	<b>430,512,146</b>	26%
<b>Totals</b>	<b>903,124,785</b>	<b>303,874,402</b>	<b>101,881,187</b>	<b>130,843,970</b>	<b>1,439,724,343</b>	<b>186,145,616</b>	<b>1,625,869,959</b>	<b>100%</b>
<b>% of total expend in NSW</b>	56%	19%	6%	8%	89%	11%	100%	
Saltwater	840,749,912	267,431,019	99,200,573	51,715,617	1,259,097,121	140,675,487	1,415,280,961	<b>87%</b>
Freshwater	62,374,873	36,443,383	2,680,614	79,128,353	180,627,222	45,469,052	231,775,451	<b>14%</b>
SW expenditure as % of Total	<b>93%</b>	<b>88%</b>	<b>97%</b>	<b>40%</b>	<b>87%</b>	<b>84%</b>	<b>87%</b>	

NSW RF expenditure survey-2012

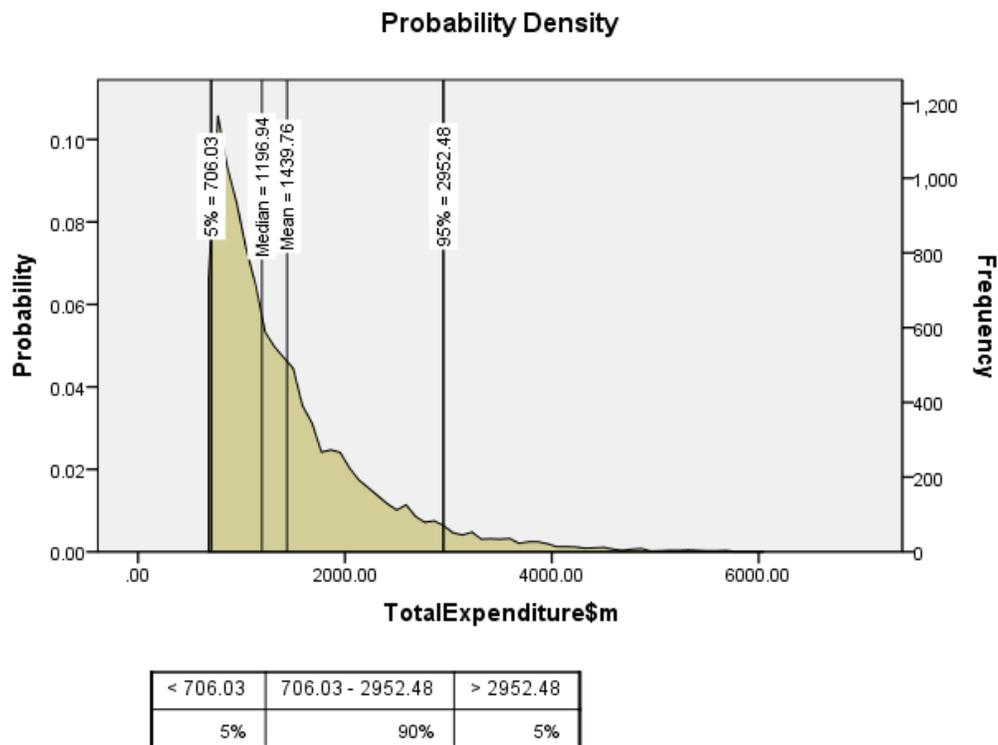
**Table 8b:** Estimates of the total RF expenditure for different areas of NSW and including interstate angler expenditure to give all RF expenditure in NSW.

Data in Aus \$	Sydney	North coast	South coast	Inland	All NSW	Interstate	Total expend in NSW	% of Total expend in NSW
<b>Expenditure category</b>								
Car travel (both ways)	155,752,824	61,047,851	21,250,669	38,966,591	277,017,934	49,755,399	326,773,333	20.1%
Accommodation	96,655,736	32,991,275	11,321,758	11,775,540	152,744,309	33,155,541	185,899,850	11.4%
Eating out	35,118,007	11,287,702	6,019,080	6,283,701	58,708,491	16,433,282	75,141,772	4.6%
Other food and drink	47,830,881	20,416,270	11,974,310	11,255,861	91,477,322	21,385,714	112,863,036	6.9%
Shopping (souvenir,magazines,videos)	10,396,840	2,377,682	609,238	2,427,428	15,811,187	5,900,718	21,711,905	1.3%
Travel-other than by car	9,328,498	675,596	1,876,003	157,968	12,038,065	-	12,038,065	0.7%
Sports	730,303	214,569	-	136,952	1,081,824	2,038,576	3,120,401	0.2%
Tours	2,517,279	121,080	888,633	400,483	3,927,475	44,318	3,971,793	0.2%
Poker machines	4,337,423	1,534,429	364,864	485,304	6,722,021	2,611,177	9,333,198	0.6%
Pub	16,147,653	5,352,108	3,163,325	2,442,584	27,105,670	7,101,506	34,207,176	2.1%
Anything else?	5,091,436	668,396	394,948	517,073	6,671,852	1,052,256	7,724,108	0.5%
<b>Trip spend</b>	<b>383,906,879</b>	<b>136,686,958</b>	<b>57,862,828</b>	<b>74,849,484</b>	<b>653,306,149</b>	<b>139,478,487</b>	<b>792,784,637</b>	<b>48.8%</b>
Major fishing tackle (rods, reel)	63,209,459	22,456,502	5,830,420	10,743,744	102,240,126	2,673,467	104,913,593	6.5%
Minor fishing tackle (hooks lines etc)	27,752,247	12,319,663	3,884,279	5,859,337	49,815,525	9,792,034	59,607,560	3.7%
Bait/berley	26,800,952	8,839,913	3,407,290	3,225,829	42,273,984	3,954,942	46,228,926	2.8%
Boat hire	17,933,756	42,708	518,369	561,815	19,056,649	604,762	19,661,412	1.2%
Boat fuel	52,493,364	20,044,184	3,811,422	4,649,308	80,998,277	21,742,806	102,741,083	6.3%
Charter and fishing guide fees	17,310,929	4,944,101	246,843	386,149	22,888,022	839,948	23,727,969	1.5%
Fishing clothes/apparel(waders etc)	6,799,431	2,766,227	1,592,134	1,322,337	12,480,129	292,501	12,772,630	0.8%
Camping equipment	4,689,522	10,357,115	508,333	3,093,322	18,648,291	864,926	19,513,218	1.2%
Other fishing expenses	5,901,451	4,194,635	825,295	1,275,129	12,196,509	1,210,277	13,406,786	0.8%
<b>\$ fishing equip</b>	<b>222,891,110</b>	<b>85,965,049</b>	<b>20,624,384</b>	<b>31,116,970</b>	<b>360,597,513</b>	<b>41,975,664</b>	<b>402,573,177</b>	<b>24.8%</b>
Boat licence/registration	22,369,127	6,037,457	1,817,922	4,154,611	34,379,117	4,691,465	39,070,582	2.4%
Boat maintenance	93,188,042	18,809,323	4,588,346	5,925,940	122,511,651	-	122,511,651	7.5%
Boat insurance	23,806,199	5,935,399	1,413,005	2,990,204	34,144,806	-	34,144,806	2.1%
Marine mooring fees	24,487,619	2,521,793	97,904	96,275	27,203,591	-	27,203,591	1.7%
Boat equipment (safety etc)	48,762,545	9,898,735	1,571,861	3,725,061	63,958,201	-	63,958,201	3.9%
Boat purchase or motor repair	83,713,264	38,019,687	13,904,937	7,985,426	143,623,314	-	143,623,314	8.8%
<b>Total annual boat expenditure</b>	<b>296,326,795</b>	<b>81,222,395</b>	<b>23,393,975</b>	<b>24,877,516</b>	<b>425,820,681</b>	<b>4,691,465</b>	<b>430,512,146</b>	<b>26.5%</b>
<b>Totals</b>	<b>903,124,785</b>	<b>303,874,402</b>	<b>101,881,187</b>	<b>130,843,970</b>	<b>1,439,724,343</b>	<b>186,145,616</b>	<b>1,625,869,959</b>	<b>100.0%</b>
Saltwater	840,749,912	267,431,019	99,200,573	51,715,617	1,259,097,121	140,675,487	1,399,772,608	86.1%
Freshwater	62,374,873	36,443,383	2,680,614	79,128,353	180,627,222	45,469,052	226,096,274	13.9%
SW expenditure as % of Total	<b>93%</b>	<b>88%</b>	<b>97%</b>	<b>40%</b>	<b>87%</b>	<b>76%</b>	<b>86%</b>	
<b>Region as % of total expenditure</b>	<b>56%</b>	<b>19%</b>	<b>6%</b>	<b>8%</b>		<b>11%</b>		<b>100%</b>

#### 4.4 A probabilistic simulation approach to the estimation of total state recreational fishing expenditure

Simulation enabled us to estimate the probability of different outcomes from the existing data. The original sample was weighted by numbers of regional households to account for the under sampling of Sydney and the over sampling of the North Coast in the original survey data. The sample was analysed using the SPSS v21 Monte Carlo Simulation model (IBM Corp. 2012). This routine produced up to 100,000 repeat runs of the predicted values of total RF state expenditure to give the probability of different expenditure totals as shown in Figure 5a. The cumulative probability is shown in Figure 5b.

**Figure 5a:** The probability of total expenditure by NSW anglers 2012.



These initial probability estimates showed that the mean total state-wide expenditure was \$1,473m with 5% and 95% confidence estimates of \$706m and \$2,952m. The median value as \$1,196m, reflecting the skewedness of the distribution.

The estimate of expenditure in NSW by interstate anglers of \$186.1m has also to be added. The final total NSW estimate of expenditure on recreational fishing was therefore \$1,625m with 5% and 95% confidence estimates of \$892m-\$3,136m<sup>14</sup>.

<sup>14</sup> For simplicity, this assumes the distribution of the interstate results are the same as all NSW.

**Figure 5b:** The cumulative probability of total expenditure by NSW anglers 2012.

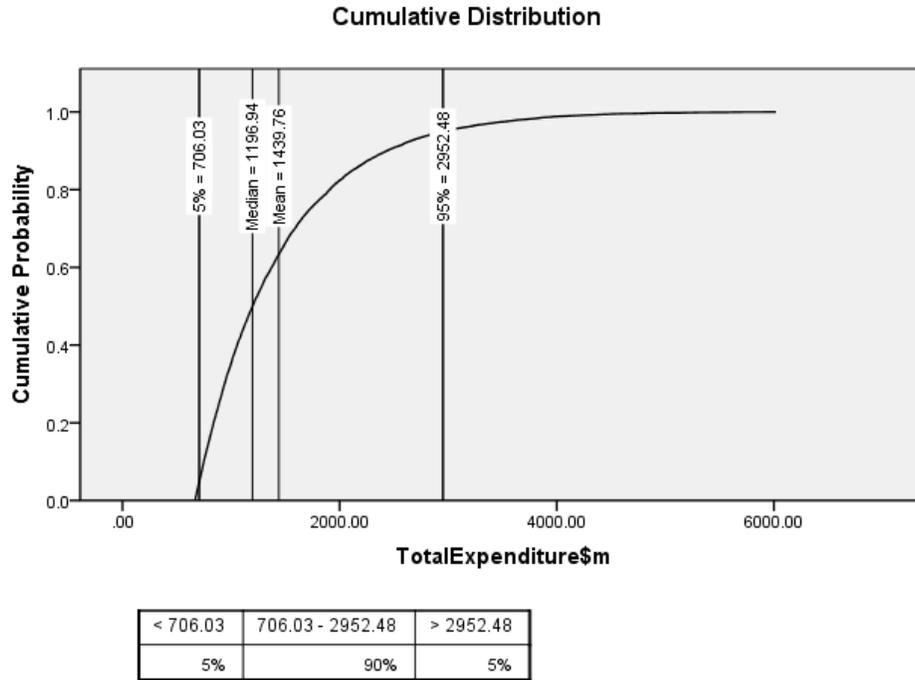


Figure 5a and 5b indicate how the skewed distribution of trips per year by anglers and the highly annual variable expenditure make the predicted adjusted distribution from \$892m-\$3,136m, around an adjusted mean \$1.625m, and an adjusted median of \$1,382m. The mean has a 0.045 probability of being achieved, whereas lower total expenditure estimates have higher probability (Figure 5a). The skewedness gives a threshold minimum expenditure level and a “trailing tail” on the right hand side, reflecting less probable high expenditure estimates.

Figure 5b indicates that the mean would have a cumulative probability of 65%. This shows the higher total expenditure estimates on the right hand side of Figure 5a, are pulling the mean to the right. This is why we have to be careful in RF sampling, and estimation of recreational activity and expenditure. This also may explain why fishers of differing avidity and expenditure levels have considerably different opinions on total expenditure in the sector. A fisher with higher activity and expenditure would estimate a state wide total at the right hand side of Figure 5a, but while high total expenditure is possible, it is highly improbable.

**4.5 Discussion**

The estimated total expenditures reported in Table 8a and 8b indicate a statewide expenditure by NSW recreational fishers and interstate anglers on items directly related to fishing of \$1,625m.

The expansions to develop the final estimates took account of the differences between SW and FW expenditure and activity and each was expanded separately. Expenditure on FW fishing contributed 14% of total expenditure, considerably less than the 28% of days fished reported in the sample (Table 5), reflecting some trip and capital expenditure differences between SW and FW fishers.

By region, the results indicate that recreational fishing expenditure by Sydney anglers \$903.1m (56% of total state recreational fishing expenditure), while North coast has \$303.8m (9%), Interstate anglers \$186.1 (11%), Inland \$130.8m (8%) and South coast \$101.8 (6%). The survey method estimated regional expenditures from interviews with fishers in their home region. The regional economic impacts adjusts these and produced estimates of recreational fishing expenditure and its economic impacts across all of NSW and its main regions.

There is just the previous national survey study for comparison of results. The 2012 expenditure estimate adjusted from the Campbell and Murphy (2005) national survey 2001 study is \$765m. This is within the confidence intervals predicted by the current study's simulation approach.

Another comparison is to deduct the trip expenditures for food and entertainment from the current study's results, to be comparable to Campbell and Murphy's assumptions giving an estimate up to \$1.36bn<sup>15</sup>. The difference in expenditure estimates<sup>16</sup> is primarily related to the survey methods used and the different estimates of fishery activity, the current study being higher. Though the number of adults fishing may have reduced since 2001, NSW has now a sizeable established recreational fishing licence holder population and expenditures per angler are higher than a decade ago.

Under the telephone survey interview and recall method used, the current results were conservative for this methodological approach. This study has pointed to the highly skewed nature of the trip activity among the RF population and the highly variable levels of expenditure among recreational fishers in NSW. The use of a probabilistic simulation in this study has illustrated the difficulties in estimation of total RF expenditure and the wide distribution around the mean. The adequate inclusion, and possible over-inclusion of avid fishers, are sampling problems under any of existing methodologies.

The sample size and hence a higher survey cost, is part of the remedy. Further examination of the US multi-method approach may be merited (Gentner 2009), though this is a large scale national expensive survey exercise. The project results in this study are proposed as being reasonable under the methodologies available within funding constraints, and are part of a proposed ongoing expenditure survey strategy in NSW, as outlined in Chapter 6.

<sup>15</sup> There may also be differences in the treatment of capital attributable to RF, definitions of maintenance and capital expenditure on motors and boats and other differences between the two studies. These may likely lower this estimate.

<sup>16</sup> (\$1,360m-\$765m=\$595m in 2012 terms)

## 5. Regional economic impact estimates

This chapter of the report was compiled by Western Research Institute (WRI). WRI received the output of this survey in terms of expenditure of respondents, and based on this output modelled the economic impacts of recreational fishing on the NSW economy and defined sub-regions. Input-output modelling has been employed to derive the relevant economic models and the impacts.

### 5.1 Methodology

The methodology used to prepare this report included:

#### *Determination of the boundaries of the regions to be used in table construction.*

In consultation with the ANCORS, the decision was made to construct input-output tables for the NSW North Coast, NSW South Coast, NSW Inland and Sydney regions, as well as NSW as a whole. Each region was defined by aggregating statistical areas at level 4, 3 or 2 or combination thereof. This allowed the formulation of regions and economies that best represented the regions of interest. Specifically, data from statistical areas at level 3 of ABS Statistical Geography Standard (rather than at larger statistical areas at level 4) was used in the construction of tables for the NSW North Coast, and data from statistical areas at level 2 was used in the construction of tables for the NSW South Coast. The table construction for Sydney region was based on the data from statistical areas at level 4, while tables for NSW Inland region was based on the data from statistical areas at different levels (2, 3 and 4). Detailed information on statistical areas is provided in WRI (2013).

#### *Construction of tables*

The input-output tables developed for this project were derived from the latest national table produced by the Australian Bureau of Statistics (ABS). That table provides a detailed picture of the structure of the economy of Australia for the year 2008-09. A series of steps were undertaken to update the table to 2011-12. Further information from the State Accounts (ABS Cat. No. 5220.0), labour force data from the 2011 Census and the quarterly labour force survey (ABS Cat. No. 6291.0.55.003) were used to develop a state table for New South Wales at 2011-2012. This was then regionalised to reflect the respective regional economies of NSW North Coast, NSW South Coast, NSW Inland and Sydney. Further details of the procedures used in the development of a regional input-output table are provided in WRI (2013).

### 5.2 Economic impact analysis

The economic impacts were modelled as a final demand impact (that calculates the impacts measured by output, value added, household income and employment across all sectors in response to changes in industry final demands) using the 2011-12 Simulating Impacts on Regional Economies (SIRE) input-output model of NSW North Coast, NSW South Coast, NSW Inland, Sydney and NSW as a whole. The SIRE model is superior to standard input-output models, as it provides for non-linear relationships between variables and is based on empirically derived (rather than assumed) coefficients. In terms of

robustness of results it is comparable with computable general equilibrium (CGE) models, whilst minimising data requirements. See WRI (2013) for a detailed description of the SIRE input-output model.

The impacts of recreational fishing expenditure on the NSW North Coast, NSW South Coast, NSW Inland and Sydney regions, as well as NSW as a whole have been provided in terms of:

- Output which is the value of goods and services that are produced within an establishment that become available for use outside that establishment, plus any goods and services produced for the organisation's own final use. Output is equal to total revenue plus any internal consumption.
- Value added which is equal to gross output minus intermediate inputs. Value added is equivalent to the contribution to gross regional product (the local equivalent of gross domestic product).
- Household Income which measures the benefit received by regional households from economic activity. It typically refers to compensation of employees but can also include income in return for other forms of productive activity.
- Employment, which refers to full-time equivalent (FTE) employment, is a measure of the total level of staff resources used. The FTE of a full-time staff member is equal to 1.0. The FTE of a part-time worker will be a fraction of this depending on the relative number of hours worked.

### **5.3 The Economic Impact of Recreational Fishing on the Regional Economies of NSW.**

The economic impact due to recreational fishing was modelled as follows:

- The expenditure survey conducted by ANCORS did not capture the location of expenditure, just the origin (postcode) of the respondent. Therefore, in the absence of location data, an assumption was made that the total expenditure by interstate visitors (\$186.14 million) who make expenditures on recreational fishing whilst staying in NSW should be distributed evenly across four NSW regions (i.e. 25% of total interstate expenditure pertaining to each NSW region);
- Likewise, it was assumed that expenditure pertaining to the NSW North Coast, NSW South Coast and NSW Inland regions was made in these regions (e.g. those respondents who indicated living in the NSW North Coast partake in recreational fishing in the NSW North Coast and not in other areas, thereby ensuring that the money spent on recreational fishing remains in the NSW North Coast region);

- For those respondents who indicated living in Sydney, an assumption was made that 51.5% of them partake in fishing in Sydney, with the remaining 48.5% fishing in the rest of NSW in the following proportions: NSW North Coast – 34.6%, NSW South Coast – 48.5%, and NSW Inland – 16.9% (Dominion 2002 and 2004);
- Since anglers in each of the regions make expenditure on items that may not be produced in the region but that are imported from the rest of NSW, the regional recreational fishing expenditure was split into local and imported components using a location quotients matrix. This way WRI ensured that only local expenditure generated economic impacts in the respective region. For NSW as a whole, an assumption was made that all products that anglers purchase are produced within the state, and therefore no separation of local and imported components was performed. The economic impacts of recreational fishing on NSW were modelled using total recreational fishing expenditure in NSW.
- In order to ensure consistency of the input-output modelling procedure, the expenditure data was allocated in the input-output table to the industries (typically manufacturing industries) where the relevant expenditure items were produced, and was then converted to basic prices. See WRI (2013) for further details on sectoral allocations.
- A final demand analysis in SIRE was performed and economic impacts on NSW North Coast, NSW South Coast, NSW Inland and Sydney, as well as NSW as a whole were derived.

The impacts of recreational fishing on the economies of the NSW North Coast, NSW South Coast, NSW Inland and Sydney regions are outlined in the Table 9.

**Table 9:** Regional expenditure and economic impacts on regional economies

Region	North Coast	Sydney	South Coast	Inland
Expenditure by postcode (\$m)	303.87	903.12	101.88	130.84
Reclassified expenditure (\$m)	501.96	511.65	360.86	251.4
Output (\$m)	734.65	1,002.86	395.22	353.81
Value added (\$m)	353.55	491.56	184.17	149.85
Household income (\$m)	168.75	288.88	87.6	73.5
Employment (no.)	3,320	3,944	1,808	1,539

**NSW North Coast**

Overall, when flow-on effects are taken into account, recreational fishing contributes the following to the economy of NSW North Coast:

- 3,320 FTE jobs, including 667 in the retail trade sector, 573 in the hospitality sector, 349 in the personal and other services sector, and 174 in the transport and storage sector;
- \$168.75 million in household income with 13.4 percent being in the retail trade sector, 11.2 percent being in the hospitality sector, 7.6 percent being in the public administration sector, 7.2 percent being in the personal and other services sector, and 5.7 percent being in the transport and storage sector;
- \$353.55 million in industry value added, representing 0.81 percent of total regional value added of the NSW North Coast region; and
- \$734.65 million in output.

For the North Coast, recreational fishing will contribute 0.98 percent of FTE employment in the region when flow-on effects are taken into account as well as 0.84 percent of household income and 0.7 percent of the estimated gross regional product of the NSW North Coast region.

**NSW South Coast**

Overall, when flow-on effects are taken into account, the recreational fishing contributes the following to the economy of NSW South Coast:

- 1,808 FTE jobs, including 420 in the hospitality sector, 284 in the retail trade sector, 236 in the personal and other services sector, 117 in the transport and storage sector, and 106 in the public administration sector;
- \$87.60 million in household income with 15.2 percent being in the hospitality sector, 10.9 percent being in the retail trade sector, 9.3 percent being in the public administration sector, 8.6 percent being in the personal and other services sector, and 7.7 percent being in the transport and storage sector;
- \$184.16 million in industry value added, representing 1.67 percent of total regional value added of the NSW South Coast region; and
- \$395.22 million in output.

For the South Coast, recreational fishing will contribute 2.12 percent of FTE employment in the region when flow-on effects are taken into account as well as 1.73 percent of household income and 1.43 percent of the estimated gross regional product of the NSW South Coast region.

### NSW Inland

Overall, when flow-on effects are taken into account, the recreational fishing contributes the following to the economy of NSW Inland:

- 1,539 FTE jobs, including 289 in the hospitality sector, 288 in the retail trade sector, 148 in the personal and other services sector, and 138 in the agriculture sector;
- \$73.50 million in household income with 13.4 percent being in the retail trade sector, 13.1 percent being in the hospitality sector, 7.4 percent being in the personal and other services sector, 7.0 percent being in the public administration sector, and 6.8 percent being in the transport and storage sector;
- \$149.85 million in industry value added, representing 0.30 percent of total regional value added of the NSW Inland region; and
- \$353.81 million in output.

Recreational fishing will contribute 0.38 percent of FTE employment in the NSW Inland region when flow-on effects are taken into account as well as 0.32 percent of household income and 0.26 percent of the estimated gross regional product of the NSW Inland region.

### Sydney

Overall, when flow-on effects are taken into account, the recreational fishing contributes the following to the economy of Sydney:

- 3,944 FTE jobs, including 741 in the retail trade sector, 450 in the hospitality sector, 366 in the personal and other services sector, and 310 in the professional and technical services sector;
- \$288.88 million in household income with 16.2 percent being in the finance and insurance sector, 11.3 percent being in the retail trade sector, 8.3 percent being in the professional and technical services sector, 7.7 percent being in the wholesale trade sector, and 6.3 percent being in the hospitality sector;
- \$491.56 million in industry value added, representing 0.25 percent of the total regional value added of Sydney; and
- \$1,002.86 million in output.

For the Sydney region, recreational fishing will contribute 0.28 percent of FTE employment when flow-on effects are taken into account as well as 0.25 percent of household income and 0.22 percent of the estimated gross regional product of Sydney.

### NSW State economy

The impacts of recreational fishing on the state economy of the NSW are outlined in the Table 10.

**Table 10:** NSW expenditure and economic impacts on NSW

Item	Estimate
NSW Expenditure by postcode (\$m)	1,439.72
Total interstate expenditure (\$ m)	186.15
NSW Reclassified expenditure (\$m)	1,625.87
Output (\$m)	3,420.35
Value added (\$m)	1,625.61
Household income (\$m)	877.28
Employment (thousand)	14,254

### NSW Economy

Overall, when flow-on effects are taken into account, the recreational fishing contributes the following to the economy of NSW:

- 14,254 FTE jobs, including 2,730 in the retail trade sector, 2,123 in the hospitality sector, 1,389 in the personal and other services sector, and 951 in the transport and storage sector;
- \$877.28 million in household income with 12.2 percent being in the retail trade, 11.4 percent being in the finance and insurance sector, 8.8 percent being in the hospitality sector, 7.2 percent being in the professional and technical services sector, and 6.5 percent being in the wholesale trade sector;
- \$1,625.61 million in industry value added, representing 0.36 percent of the estimated gross state product of the NSW; and
- \$3,420.35 million in output.

Overall, recreational fishing will contribute 0.46 percent of FTE employment in the NSW when flow-on effects are taken into account as well as 0.41 percent of household income and 0.40 percent of total regional value added.

## **5.4 Conclusion**

The recreational fishing expenditure and economic impact of recreational fishing on NSW and respective regions were substantial in absolute terms, but uneven across regions.

The expenditure based on place of residence was the highest in Sydney, followed by NSW North Coast, NSW Inland and NSW South Coast. The reallocated expenditure (i.e. actual expenditure made in the region) was still the highest in Sydney (but substantially lower than postcode expenditure), followed by expenditure in NSW North Coast, NSW South Coast and NSW Inland.

In terms of output, valued added, household income and FTE employment, the absolute economic impacts of recreational fishing were the highest in Sydney, followed by NSW North Coast, NSW South Coast and NSW Inland. However, in relative terms, economic impacts (as percentage of total in the respective regions) were the highest in NSW South Coast (1.67- 2.12%), followed by NSW North Coast (0.81-0.98%), NSW Inland (0.30-0.38%) and Sydney (0.25-0.28%). These relative disparities reflect the large size of Sydney and NSW Inland economies and smaller size of NSW North Coast and NSW South Coast economies.

## 6. Developing a cost effective approach to expenditure surveys

There have been several reoccurring issues in obtaining information on recreational fishing expenditure in NSW. The first is the lack of a series of expenditure surveys, the past ones not occurring as part of an on-going consistent strategy. The second issue is the lack of a known survey method which is repeatable and can be compared with past surveys. In both of these issues, the recurrent cost of such surveys has been unknown also.

### 6.1 The objectives of an recreational fishing expenditure survey

Any survey is designed towards its objectives. In developing a cost effective regular approach to recreational fishing expenditure surveys there has to be some design decisions made in respect of the information required. For example: A state-wide expenditure estimate may be required every two years to track and promote the value of the sector. This could include a state-wide estimate of regional economic impact. Further disaggregation by area or other variables will increase cost.

### 6.2 Sampling, data issues and findings

This study has considered how the use of the RFL database reduced the cost of expenditure surveys which have traditionally used expensive random screening surveys to locate recreational fishers.

**Finding 1:** The current study has found that there is no statistically significant difference between seasonal samples. Consequently, we **recommend** an annual survey event, being mindful of its timing relative to Christmas, January and Easter which may be periods when fishers are not at home.

The RFs identified through a random screening survey process were found to make more fishing trips and fish more days than the sample of RFs contacted through the RFL database (noting that both samples include licence holders). However in further comparisons of days fished per angler between licenced and unlicensed fishers, no significant difference was found. On the other hand, unlicensed fishers were found to undertake significantly more fishing trips than licence holders, though this relates to trip events and not necessarily to higher average expenditure – in other words, unlicensed fishers may make more, but shorter trips to nearby destinations compared with licensed fishers.

**Finding 2:** The RFL database can be used to sample anglers for expenditure surveys, providing certain conditions are met in terms of the different numbers of licences holders that are sampled<sup>17</sup>.

### 6.3 What sample size is required?

The size of a sample in statistics is important. If the sample is too small there is then the risk that the null hypothesis is wrongly rejected (ATS 2010). The size of a sample is also related to the probability level at

<sup>17</sup> A ratio of 3 day, 1 month, 1 year and 3 year licence holder records is recommended. The weighting would be easier for the annual and 3 year licence holders, as 3 day and monthly licence holder can be repeat licence purchasers in a given year.

which the variable is seen to be significantly different from zero e.g. 95%, (5%), or 99% (1%) levels of significance. The dispersion of the distribution of the variable being examined is also important and this is captured in the standard error of the variable.

In statistics these issues are brought together in statistical “power analysis” where the minimum size of a sample can be tested both prior to, and even after statistical surveys, to see if the sample size is adequate. “*The power is the probability of detecting an effect, presuming it is actually there*” (ATS 2010).

#### *Sample size estimation*

In this section of the report we investigate how reducing the sample size to the minimum required number of interviews can reduce the cost of an expenditure survey. The decision regarding the target sample size for the survey has to be balanced between the levels of significance chosen for testing (1%, 5%) and the standard error that is acceptable for the intended variables, which is often related to the estimated value called the relative standard error (RSE)<sup>18</sup>.

Table 11 shows a range of sample sizes derived for different scenarios using the ABS calculator facility at NSS (2013). There are the two scenarios for random surveys (cases 1-4) and two for surveys from a population base of known participants (case 5-6).

**Table 11:** Indication of the required sample sizes under different sampling and risk scenarios, including sampling of the RFL database.

Case number	1	2	3	4	5	6
Sample type	Random sampling				Non random	
Statistical input	All NSW Population	All NSW Population	All NSW Population	South coast	RFL -1	RFL-2
Confidence Level:	99%	95%	95%	95%	95%	95%
Population Size:	4,996,500	4,996,500	4,996,500	350,750	480,700	480,700
Proportion:	0.5	0.5	0.15	0.25	0.6	0.6
Confidence Interval:	0.05	0.05	0.0294	0.05	0.05	0.05
Upper	0.55	0.55	0.1794	0.3	0.65	0.65
Lower	0.45	0.45	0.1206	0.2	0.55	0.55
Standard Error	0.025	0.025	0.015	0.025	0.03	0.045
Relative Standard Error (%)	5.0%	5.0%	10.0%	10.0%	5.0%	7.5%
Sample Size:	339	196	567	300	267	119

<sup>18</sup> The RSE is the standard error expressed as a percentage of the estimate.

In Table 11, cases 1 and 2 show the general sampling results when the confidence level is either 99% or 95% and the proportion is 0.5, (i.e. where “the expected proportion of the population to have the attribute that you are estimating from your survey” (NSS 2013). These data are often quoted, but given that RFs are more difficult to locate than a one in two assumption (proportion 0.5), case 3 assumes a 15% proportion for RFs and requires a sample size of 567 with a relative standard error (RSE) of 10%. Reducing the sampling area to the South Coast (case 4) raises the chances of locating RFs (proportion 0.25) and would require 300 observations at an RSE of 10%. The sampling model assumes a random population.

We also apply the model to the non-random scenarios from the RFL data base. Here cases 5 and 6 are RFL records and hence not as random as the whole NSW population. We use the model to estimate possible minimum sample sizes when using the RFL data base population. Assuming that the proportion is 0.6, an RSE of 5% requires a sample of 267 and an RSE of 7.5%, a sample size of 119. In the experience of the authors the last sample size (119) is low, given the variation in our results. We recommend no less than 250 completed surveys as a minimum sample size for state-wide estimates. If four NSW regions are included, a minimum total of 500 completed surveys would be required and be should be larger if possible.

The review of samples has shown that there is a trade off in accuracy of estimates with the number of interviews undertaken. For example in the case 3 random survey in Table 11, the RSE is 10% and reducing this to 7.5% for case 3 would increase the sample size from 576 to 1,008, or for 5% to 2,226. The incidence of locating RFs has cost implications for surveying and this is why the careful use of the RFL data base is attractive.

**Finding 3a:** A main state-wide survey using the RFL data base to sample 1,000 anglers in major regions is recommended every 5 years, with an option of updating results by indexing annually or bi-ennially and/or considering a smaller survey (250 state wide or 500 for regions) in year three also.

**Finding 3b:** The economic impact analysis can follow the five year survey pattern and can be adjusted between surveys. Simulation modelling can also be used to provide an improved understanding of the uncertainty surrounding expenditure estimates and may be used to confirm estimates between main surveys also.

#### **6.4 Discussion - Scoping a recreational fishing expenditure survey strategy for NSW**

A recreational fishing expenditure survey strategy would aim to undertake a substantial survey every 5 years and run smaller annual, or biennial, updating exercises between these periods.

In the future the 5 year survey could either:

- Follow past screening survey approaches of all RFs and compare results with a sample of RFL holders as in the current study; or
- Use a weighted selection of 3 day, 1 month, 1 year and 3 year licence holder contacts to enable a representative sample to be expanded to state-wide totals.

Before being able to categorically recommend the sole use of the RFL database only approach, we would require more information on the inter-relationship between the random screening survey and the use of and RFL data base records. The current NSW catch and effort survey study may also provide information on this relationship (J. Murphy DPI, pers. comm.).

As per Finding 2, we recommend further comparisons of the random screening survey approach to all fishers, with use of the RFL holders' data as in the current study. Use of the RFL database alone should be confirmed by other research on the relationship between all fishers and those who are licensed.

In the years between the five year main surveys, the survey results from the initial survey could be upgraded annually (or bi-ennially), by sampling several variables that could be used to index the changes in the state wide expenditure estimates. For example, any changes detected in RF participation or activity, state population, or change in licence sales could inform activity estimates. Information on recreational fishing expenditure could be influenced by annual changes in price levels as measured by the consumer price index (c.p.i.) and any information available from industry about retail fishing gear prices, such as those related to exchange rate variations which would impact expenditure on fishing gear. Many of these indices of economic conditions are monitored by the Australian Fishing Tackle Association and could be referred to.

The simulation modelling approach used in the current study could be re-run annually/biennially with these activity and expenditure indices included and updated annual estimates produced. The reoccurrence of another survey in year 5 means there would be a cross check on the indexing of the previous survey.

The choice of 5 years for the main survey is arbitrary and could be 3 years, particularly if other catch and effort surveys are indicating significant changes in participation rates in NSW, or there is evidence of changes in other states. Leaving a main survey for more than 5 years is not recommended, as the public awareness of the sector's economic contribution and associated regional benefits will reduce, giving the sector less public profile.

## **6.5 Conclusions**

The recreational fishing sector in NSW wishes to have more regular studies of angler expenditure and its importance to the economy. The RFL data base can be used for sampling the recreational fishing population, reducing the costs of fieldwork surveys, if several conditions are followed. The frequency of

the different licence durations needs to be chosen, so as not to move away from sampling a representative cross section of anglers of all different activity levels, and possibly having over or under emphasis of avid anglers.

A main state-wide survey using the RFL data base to sample 1,000 anglers in major regions is recommended every 5 years, with an option of updating results by indexing annually or bi-ennially and considering a smaller survey (250 state wide or 500 for regions) in year three also. The economic impact analysis can follow the five year survey pattern and can be adjusted between surveys. Simulation modelling can also be used to provide an improved understanding of the uncertainty surrounding expenditure estimates and may be used to confirm estimates between main surveys also.

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## Appendix 1: What determines recreational fisher expenditure in NSW?

Linear multiple regression was used to determine the variables which are statistically significant in determining total expenditure, trip expenditures, tackle expenditure and boat expenditure. A range of variables available from the interviews, such as licence holder, age, regional location, situation, household and male/female were able to be tested for their statistical significance in relation to RF expenditures.

### Total expenditure

The significant determinants of total expenditure were found to be income, trips per annum and licensed fishers who have a marginally greater total spend than unlicensed fishers. Trips in SW were a significantly higher contributor to total expenditure than days fished in FW, probably related to higher capital boat expenditure by marine fishers. Licensed fishers, who are generally in the workforce, were found to have marginally greater total expenditure than unlicensed fishers, but only at a 10% level of significance (see A1-Table 1). Other variables such as age, region, situation, household and male/female were not significantly different from zero at the 5% level of significance.

**A1- Table 1:** Regressions results for Total Expenditure.

Model		Coefficients <sup>a</sup>			t	Sig.
		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta		
1	(Constant)	-1137.559	475.354		-2.393	.017
	LIC10	558.821	314.755	.050	1.775	.076
	swtrips	43.064	12.240	.099	3.518	.000
	income	332.455	73.522	.128	4.522	.000

a. Dependent Variable: TOTALEXP

### Trip expenditure

Determinants of total trip expenditure were found to be number of SW trips per annum, with licence holders spending more on trips (see A1-Table 2a) were not significantly different from zero at the 5% level of significance.

**A1- Table 2a:** Regressions results for Trip Expenditure.

Coefficients <sup>a</sup>						
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
1	(Constant)	953.678	185.885		5.130	.000
	LIC10	623.065	232.860	.076	2.676	.008
	swtrips	36.235	9.133	.113	3.967	.000

a. Dependent Variable: TRIPSPEND

The trip expense will also be related to the days fished, which is correlated with the number of trips taken annually. In A1-Table 2b the model was altered to include days fished and kilometres travelled. Days fished in SW and FW, the number of kilometres travelled and being a licence holder were all significant variables in determining trip expenditure.

**A1- Table 2b:** Regressions results for Trip Expenditure, with SW and FW days fished.

Coefficients <sup>a</sup>						
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
1	(Constant)	151.158	190.606		.793	.428
	LIC10	599.485	223.599	.073	2.681	.007
	SWDAYS	83.015	7.460	.304	11.128	.000
	FWDAY	50.750	14.523	.096	3.494	.000
	kmsa	2.109	1.034	.057	2.039	.042

a. Dependent Variable: TRIPSPEND

This result is a reminder of the significant expenditure made by many anglers on road travel.

**Tackle expenditure**

Regression results reveal that Tackle expenditure is determined primarily by household income levels (see A1-Table 3). Other variables such as age, licencing, region, freshwater days, family situation, household and male/female were not significantly different from zero at the 5% level of significance.

**A1- Table 3:** Regressions results for Tackle Expenditure.

Coefficients <sup>a</sup>						
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
1	(Constant)	39.960	26.312		1.519	.129
	income	17.264	4.263	.115	4.049	.000

a. Dependent Variable: Total Tackle

### Boat capital expenditure

The regressions show that number of SW trips and household income levels are the determinants of Boat capital expenditure (A1- Table 4), other variables not being significantly different from zero.

**A1- Table 4:** Regressions results for Boat Capital Expenditure.

Coefficients <sup>a</sup>						
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
1	(Constant)	-1175.462	444.221		-2.646	.008
	swtrips	44.403	11.767	.106	3.774	.000
	income	309.987	70.336	.124	4.407	.000

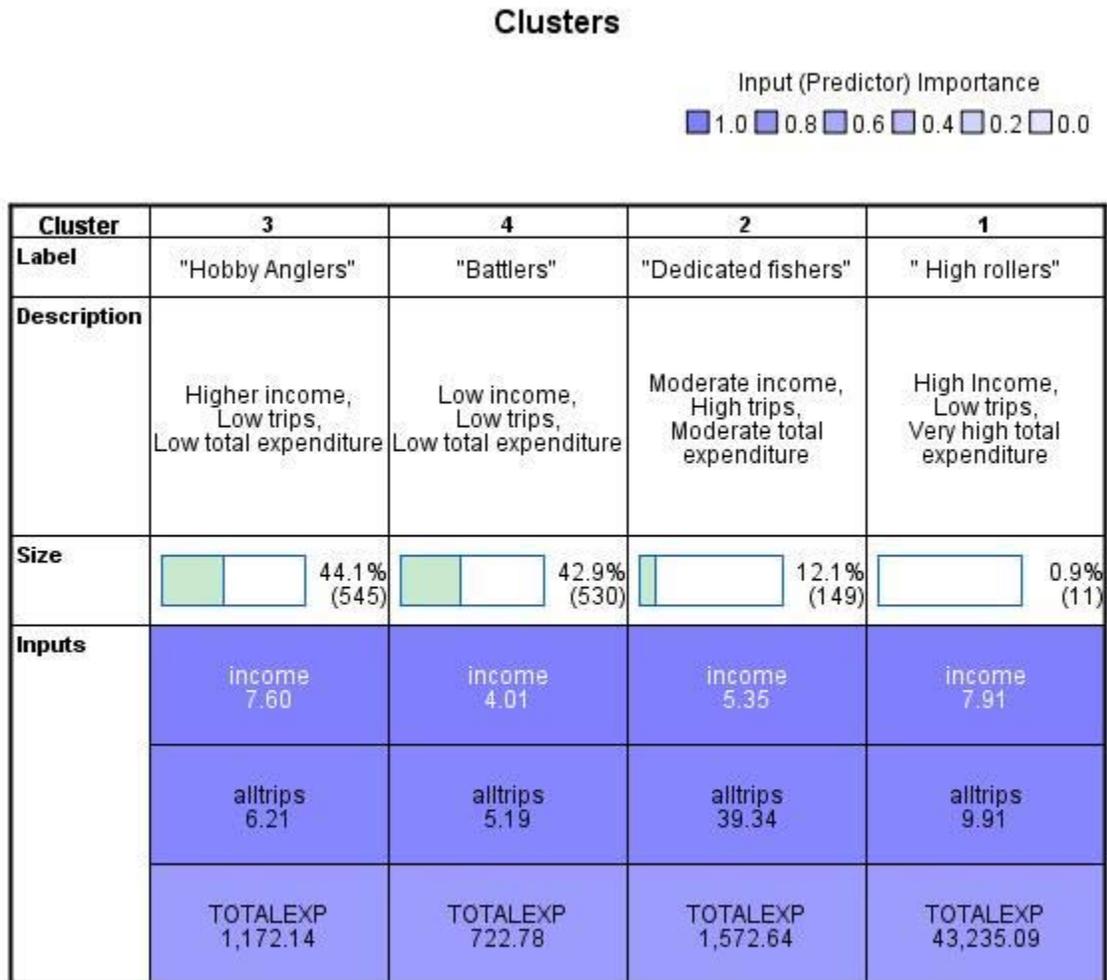
a. Dependent Variable: TOTALCAP

## Appendix 2: Socio- economic groups and RFs in NSW – a cluster analysis.

Cluster analysis enables researchers to let the data determine how many statistically significant groups (called “clusters”), there are in the given data set. In the previous regressions we found that income<sup>19</sup> and SW days fished were significant in predicting angler expenditure. Cluster analysis can show r patterns among groups of RFs in NSW. Labels to characterise groups have been added.

### Total expenditure

**A2-Figure 1:** RF Clusters in total expenditure.

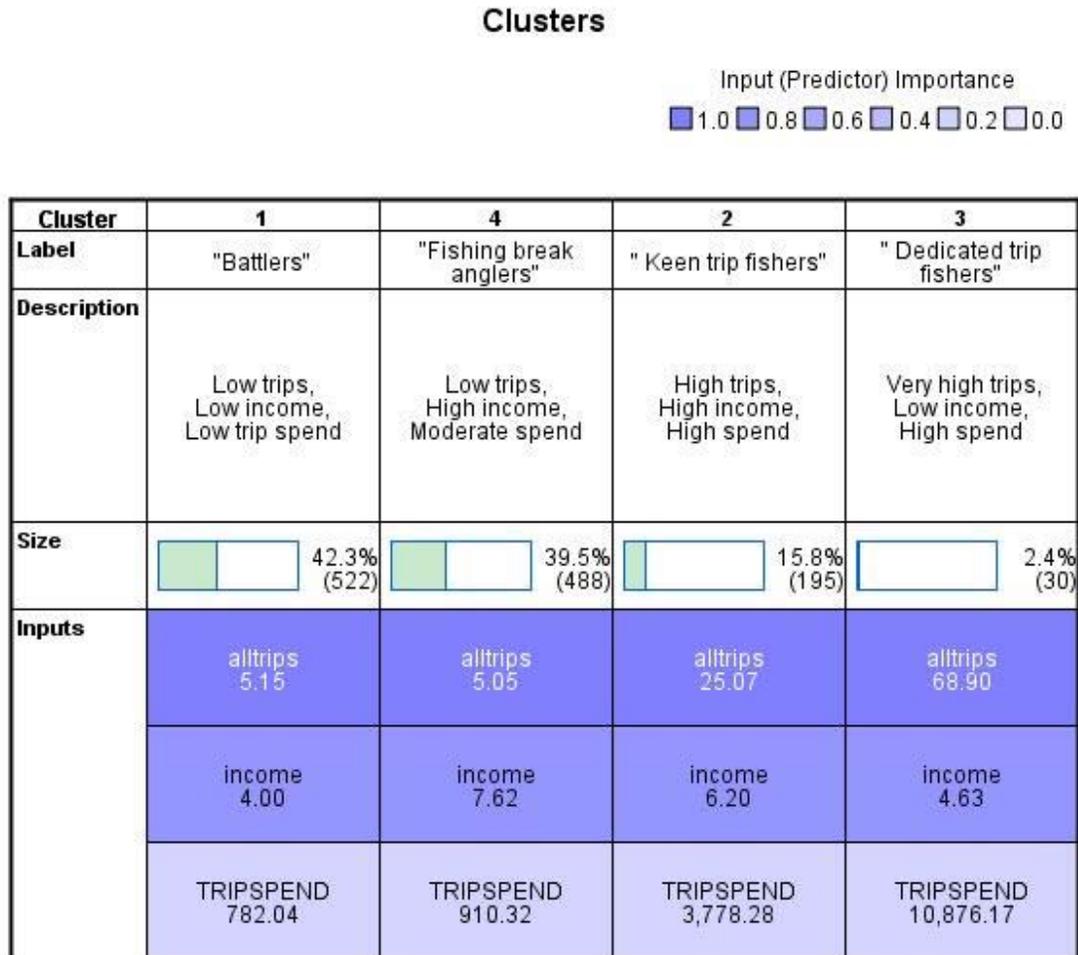


<sup>19</sup> Household income is in the following numerical bands 1-Under \$20,000; 2- \$20,000 to \$29,999; 3- \$30,000 to \$39,999; 4-\$40,000 to \$59,999; 5-\$60,000 to \$79,999; 6-\$80,000 to \$99,999; 7- \$100,000 to \$119,999; 8- \$120,000 to \$140,000; 9- \$140,000+

In A2-Figure 1 the cluster analysis of the data shows that total expenditure has income and trips per annum as strongest predictor of total expenditure, but there are 4 statistically significant clusters as described. The authors have added a label to describe the group characteristics which are given in the description.

**Trip expenditure**

**A2-Figure 2:** RF Clusters in trip expenditure

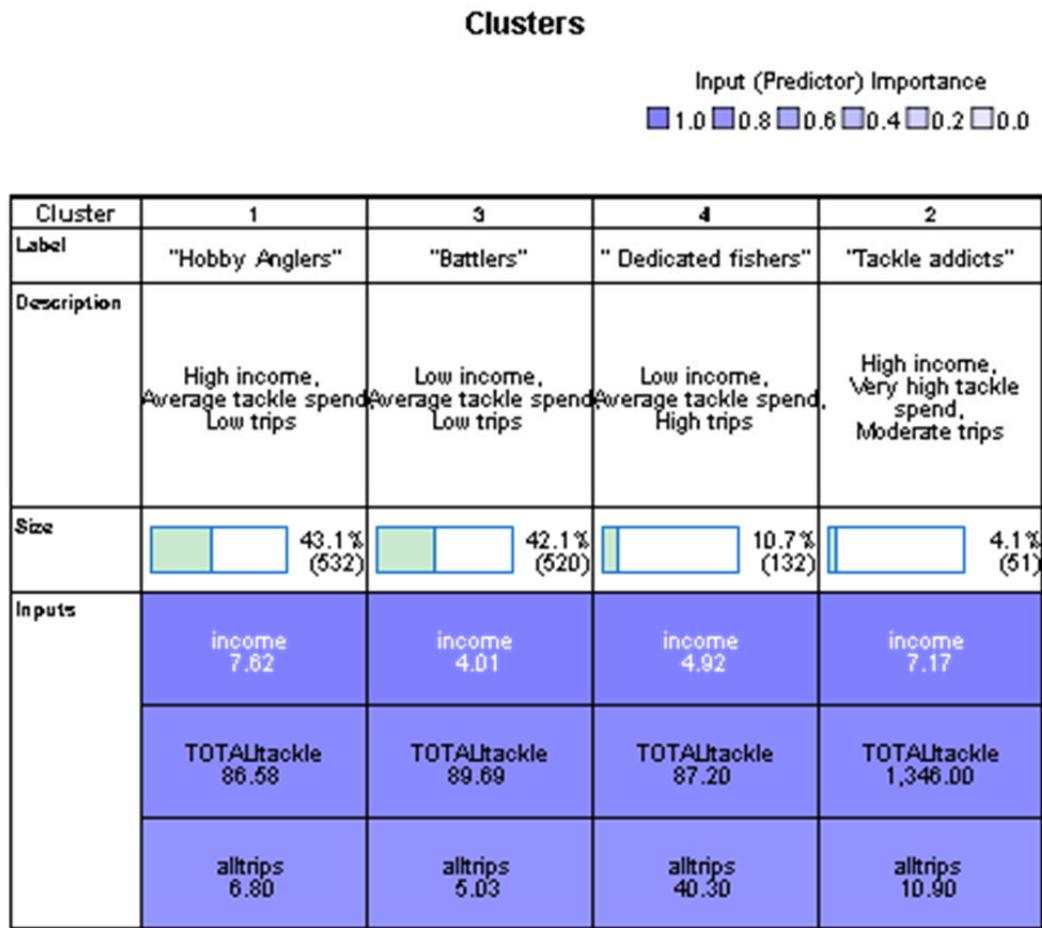


Trips and secondly income are the strongest predictors of trip expenditure. Examining trip expenditure leads to 4 distinct clusters. We see clusters 2 and 3 (18.2%) have high trip expenditures. Some 81.8% of the population have low trip expenditure, with one low income (“battlers”) and one higher income group (“Fishing break anglers”).

**Tackle expenditure**

Tackle expenditure is most strongly predicted by income and is less trip related than expected. There is a cluster of 4% of higher income fishers who have very high tackle expenditure (“Tackle addicts!”).

**A2-Figure 3:** RF Clusters in tackle expenditure



Tackle expenditure forms into 4 clusters with 85.2% of fishers fishing few trips and spending low amounts on tackle, irrespective of income.

**Capital boat expenditure**

In A2 Figure 4, firstly trips and then secondly income are the strongest predictors of expenditure on boats. The highest boat expenditure is associated with 2.3% of fishers doing many trips, but also with the 13.8% of dedicated fishers.

**A2-Figure 4:** RF Clusters in capital boat expenditure

