Taking a closer look at Boating, Fishing and Fish in the GBR: Implications for policies

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Abstract

Declining fish stocks for some species in some parts of the world are at least partially attributable to commercial and recreational fishing activities. The commercial fishing sector is often thought to be the largest harvester of fish stocks, but the recreational fishing sector can also place significant strain on resources.

Recreational fishing is very popular activity in Queensland and on the GBR but there are some specific deficiencies in current knowledge about the recreational fishing sector. We thus set out to improve our knowledge about boating and fishing, about catch-and-release (C&R), and about the 'value' of fish to recreational fishers. We did this by analysing data collected from 656 households and 404 boaters at boat-ramps in the Townsville region in a variety of different ways.

We found that (a) there are different 'drivers' of fishing and boating; (b) the factors influencing the probability of keeping at least one fish were different from those influencing total annual keep; (c) estimates of the monetary value of fish generated from models which considered expected catch, were significantly lower than those which considered actual catch; and that (d) the value of total expected catch (mean expected catch*mean value of expected fish = approx. $27AUS) was generally much less than total outlays for a trip (approx. $63AUS).

This research highlights the importance of disaggregating the fishing/boating experience if wishing to learn more about drivers of behaviour. It also highlights the fact that in this part of the GBR, the holistic recreational fishing trip/experience is worth far more than the fish itself. As such, it seems that anglers may view C&R policies or tighter bag limits (which would have a relatively small impact on the value of the fishing trip) more favourably than policies which ban or restrict fishing activities at different times or locations.

Introduction

Declining fish stocks in some parts of the world and for some species are at least partially attributable to commercial and recreational fishing activities and are major concern for fisheries managers. In Queensland (QLD) – adjacent to the Great Barrier Reef (GBR), recreational fishing is a very popular activity: approximately 700,000 people (17% of QLD's population aged 5 years and older) went recreational fishing, crabbing or prawning in the 12 months prior to July 2010 (Taylor et al., 2012; DAFF, 2012).

There is a large body of literature on recreational fishing, but there are some specific deficiencies in current knowledge. Specifically: most existing studies do not differentiate between:
- the boating and fishing experience[1]; or between
- the characteristics of those who are most likely to keep or release a fish and the characteristics of those who keep most fish (those who place greatest strain on the resource)[2].

Moreover, most recreational fishing demand and valuation studies use historical or actual catch -*ex post* measures -rather than anticipated (*ex ante*) catch in their models[3].

The aim of this study was to improve our knowledge and understanding of recreational fishing sector with several specific objectives:
1. To determine if the key drivers of boating, fishing, boat-based fishing, and land-based fishing are similar or different.
2. To look at Catch and. Release (C&R) behaviours comparing the determinants of the keep/release decision with determinants of the total number of fish kept annually; and
3. To differentiate between expected and actual recreational catch and to investigate the drivers of expected (*ex-ante*) and actual (*ex-post*) catches; and to estimate and compare the marginal value (MV)[4] of fish, using *ex post* and *ex ante* constructs

As such, we sought to generate information about the characteristics of boaters, boat and land-based fishers; the characteristics of anglers who are likely to keep most fish annually (and who are thus likely to contribute to fishing pressure in this part of the world); and about the 'value' of fish to anglers in the northern part of the GBR.

Methods

To meet this aim we collected data about fishing and boating trips and other social and demographic variables in two separate but related studies: one targeting households and one targeting boaters and fishers at boat-ramps. Our study site was Townsville – a large population centre adjacent to the GBR which is one of the high growth coastal regions in QLD (ABS, 2010), which has the second highest number of (registered) recreational boats (GBRMPA, 2012) (see Figure 1) in QLD, and which was predicted by Economic Associates (2011) to have the largest increase in boat registrations of any GBR area in the next 20 years. It also falls in the area with

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[1] Blamey & Hundloe, 1993; Morey et al., 1991; KPMG, 2000; Asafu-Adjaye et al., 2005; Bilgic & Florkowski, 2007; Prayaga et al., 2010; Rolfe et al., 2011
[2] Grambsch & Fisher, 1991; Sutton & Ditton, 2001; Sutton, 2001, 2003; Wallmo & Gentner, 2008
[3] Morey et al., 1991; Zhang et al., 2003; Haab et al., 2008; Carter & Liese, 2010; Bingham et al., 2011; Gao & Hailu, 2012; Raguragavan et al., 2010
[4] Marginal value of a recreational fish is "the amount a fisher would be willing to forgo in order to increase the catch per trip by one fish' (Lal et al., 1992, p. 38)

highest probability of recreational fishing usage (GBRMPA, 2010) and provides access to a variety of fish species in marine and freshwater environments (DAFF, 2010)[5]. As such the region offers itself as an ideal case study, since results are likely to be of use to be of immediate interest to regional policy makers.

The household survey
In the first survey, data were collected from a random selection of householders (irrespective of fishing/boating activity). We sent out 2120 questionnaires; 656 valid responses were received; 173 letters were returned due to incorrect address or person moving away or deceased. The overall response rate was thus 33.7%.

Forty four per cent of respondents were male. The average age was about 54 years. 18.4% of the respondents were born and had lived all their life in Townsville. Approximately one third of respondents had moved to the region within the last 10 years. One quarter of respondents were professionals and nearly one third had an annual household income $100,000 and above. The majority of respondents (79%) had been fishing at least once in their life and 54.2% had been fishing within the previous two years. This is consistent with Rolfe et al. (2011) who collected the data from coastal cities between Cairns and Bundaberg and found that 42% of surveyed households went fishing/boating over the last 2 years.

Of those who had been fishing within the last two years, 63.3% were males and 45.4% were boat owners. Approximately 73% of respondents had been recreational boating in the last 12 months. Thirty three per cent of anglers said that fishing was part of their culture or family tradition and 34% said that fishing was their most important recreational activity (see Figure 2). Males preferred to fish with friends; females preferred to fish with family. The majority (62.8%) were relatively infrequent fishers; only 7.8% went fishing at least once each week during the previous two years (see Figure 3). Only 5% were highly consumptive orientated (see Figure 4). The most targeted species were coral trout, barramundi and mackerel.
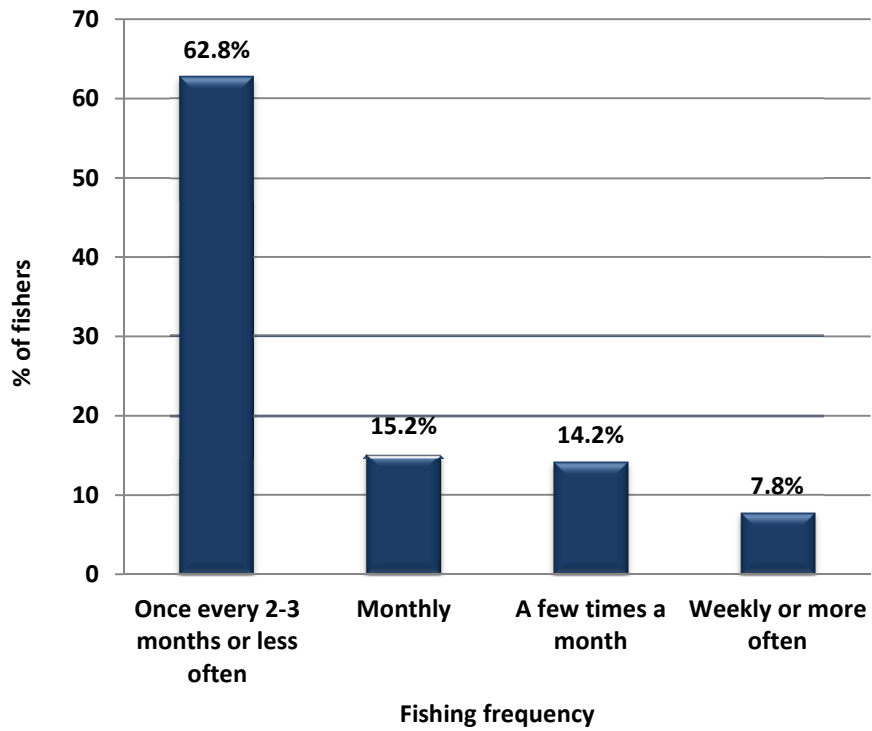
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[5] According to the DAFF (2010) residents of Townsville region mainly fish in coastal waters, boat fishing is more popular than shore fishing and most fishing occurs in marine waters.
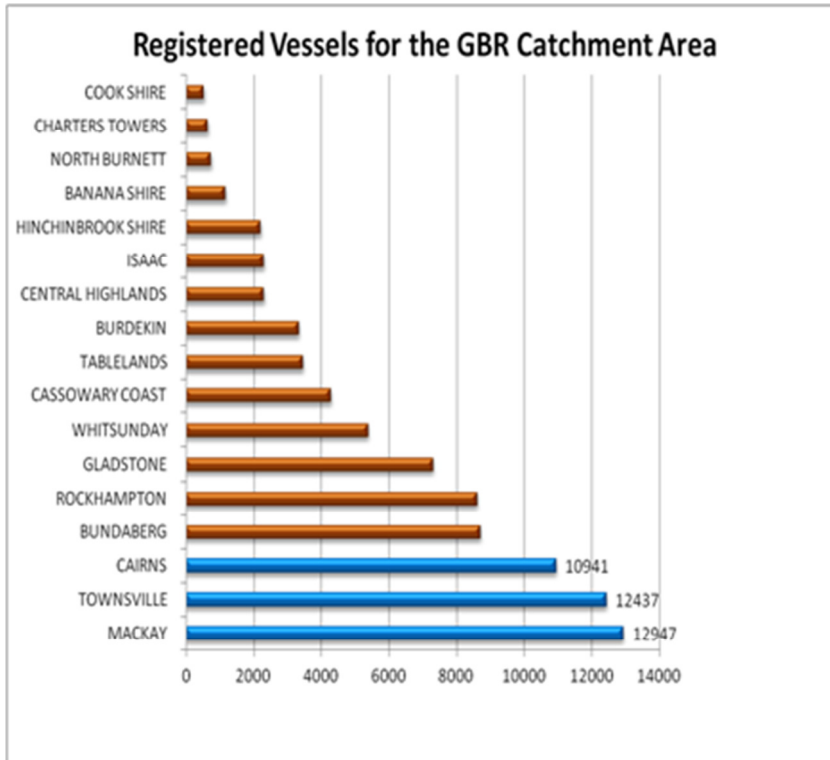
Figure 1 Registered vessels for the GBR catchment area December 2011
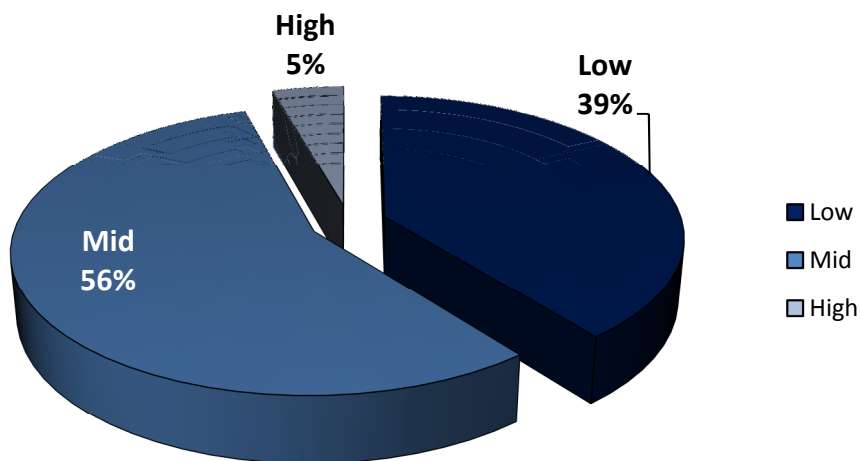(Source: GBRMPA, 2012)
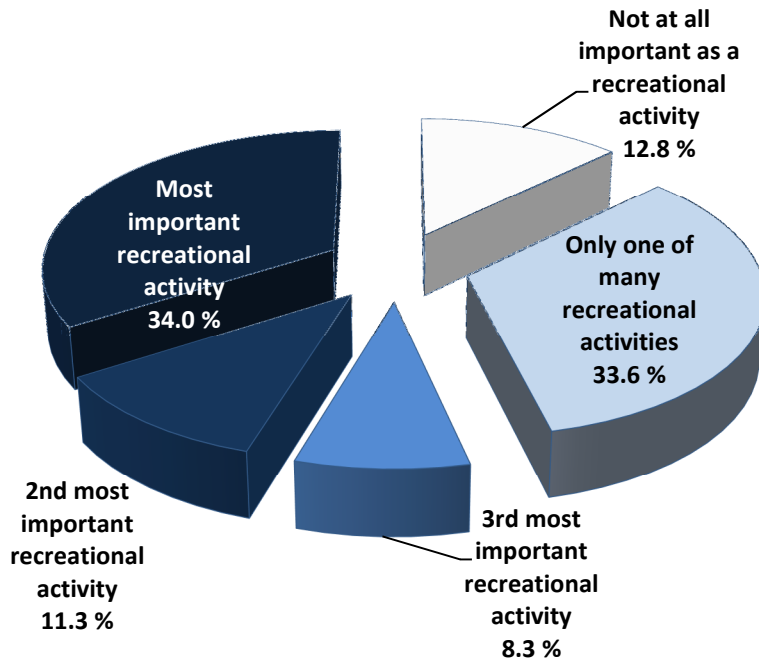
Figure 2 Proportion of respondents by level of commitment to recreational fishing

Figure Error! No text of specified style in document. Proportion of respondents by frequency of fishing trips

Consumptive orientation %

Figure 4 The proportion of the respondents in each category

Boat ramp survey

Data for this survey were collected between April 2011 and March 2012 during on-site interviews at two the most popular public boat ramps in the Townsville region during week days, weekends, public and school holidays (so as to ensure a good variety of respondents). In the pre-fishing (boat ramp) survey we collected information about the planned trip including: primary reason for going on the trip, expected duration and destination, species targeted, expected catch and keep, familiarity with fishing sites, cost of the trip and boat ownership. This was done to ensure that expectations were genuine *ex ante* measures. In the follow-up telephone survey, we sought additional information about actual duration and destination of the trip, the number and species of fish caught and kept, age, gender, fishing experience and frequency, consumptive orientation and commitment to fishing, level of education, occupation, employment status and household income. The participants were also asked how many times they had fished on reefs, shoals, offshore islands, bays, estuaries, creeks and freshwater in the last 12 months.

In total 428 people were asked to participate in the boat ramp survey. 404 agreed to participate to the pre-trip survey; 366 also participated in the follow-up. The response rate was thus 94% for the 1st part of the survey was and 91% for the follow-up.

The overall sample was dominated by males (82.4%). Approximately 3% of participants had not been fishing in the last two years while 13.8% were very frequent fishers - weekly or more often (see Figure 5). Of those who had been fishing within the last two years 71.8% were boat owners and half were targeting a particular species (e.g. Barramundi, or Mackerel). 15.2% of recreational anglers expected their catch to be zero and 20.6% of anglers expected not to keep any fish at all on this particular trip. Just over 40% of all anglers reported zero catches during this trip (see Figure 6).
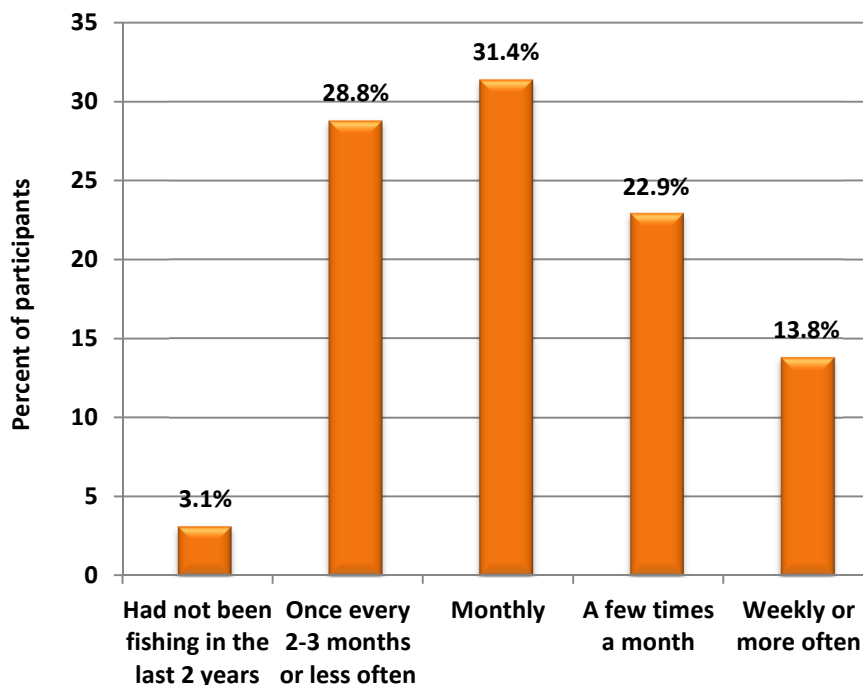
Figure 5 The distribution of the frequency of fishing trips
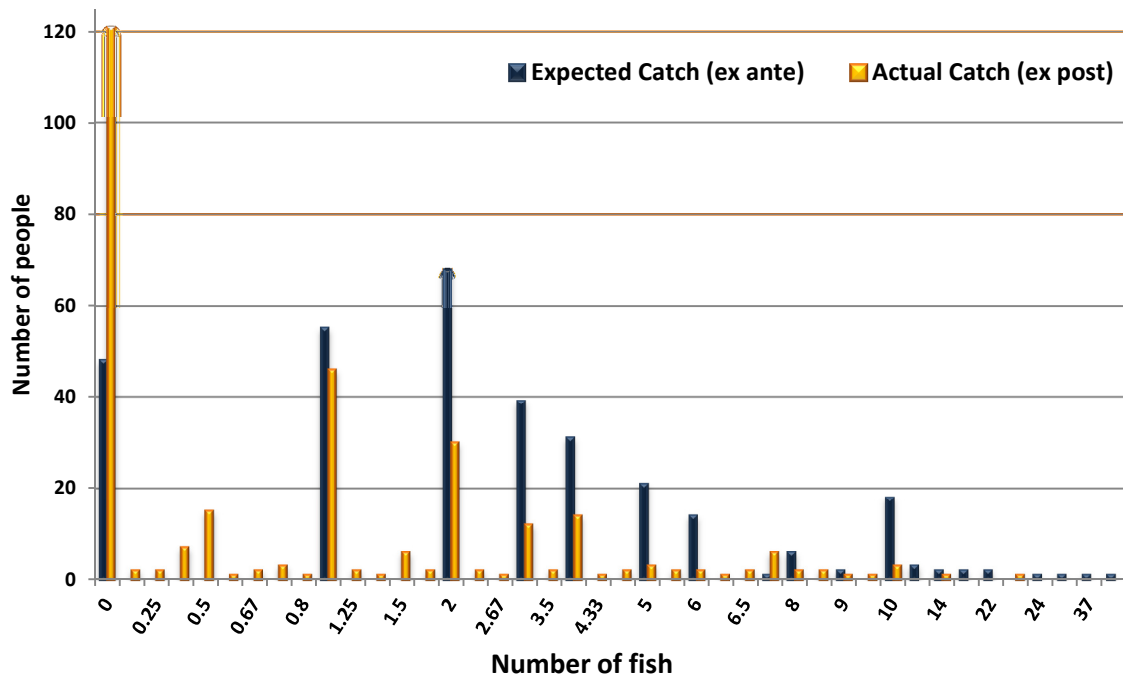
Figure 6 *Ex ante* and *ex post* catches

Results and Discussion

Objective 1

We used our household data in a two-step (hurdle) model to examine the probability of participation in boating and fishing trips and the frequency of trips (Farr et al., in review[a]). We found that there were differences in determinants (see Table 1) implying different demand curves for these activities. Our results suggest that one needs to look at these activities separately if wishing to obtain information for use in the design of monitoring programs, policy and/or for developing monitoring and enforcement strategies relating to fishing and boating.

We found that the boat owners and relatively young people are likely to participate in boating, boat fishing, or land-based fishing at least once in the last 12 months (see Table 1). This is consistent with previous research findings (Bilgic and Florkowski, 2007; Floyd et al., 2006). We also found that frequent boaters differ from frequent fishers. The most frequent boaters are long term residents, people who are not single and people with annual household incomes below $100,000 AUS. This later finding consistent with the results from previous studies (Gillig et al., 2000). These are the variables that the Great Barrier Reef Marine Park Authority (GBRMPA) should monitor when making decisions associated with recreational boating. The most frequent fishers are long term residents, people who are not employed as clerical or administrative worker and people who live in the outer suburbs. Older people go land-based fishing more frequently than younger people (who are more apt to go boat-fishing) this was confirmed by other researchers (Walsh et al., 1992; Bilgic and Florkowski, 2007). As people grow older it seems that they are inclined to reduce their number of boat and boat-fishing trips – instead taking more frequent land-based fishing trips. Our research also suggests that an aging population may decrease boating and boat-fishing participation but could increase the number of land-based fishing trips. However, whether or not more frequent fishing trips (be they land or boat based) directly translates into more pressure on fish stocks, remains to be seen – since not everyone who goes fishing catches a fish, and not everyone who catches a fish, chooses to keep it.

Table 1   Determinants of the probability of participation and frequency of trips

Determinants that increase the probability of <u>participation</u> in boating and fishing trips

a boating trip (fishing and no fishing)	a boat-based fishing trip	a land-based fishing trip
Boat ownership (+)	Boat ownership (+)	Boat ownership (+)
Age (-)	Age (-)	Age (-)
	Clerical worker (+)	Clerical worker (+)
Migrant to Townsville region in the last 10 years (+)	Migrant to Townsville region in the last 10 years (+)	
Single (+)	Single (+)	
Distance to boat ramp (-)	Distance to boat ramp (-)	
	Income > $100,000 (-)	

Determinants that increase <u>the frequency of participation</u> in boating and fishing

A boating trips (fishing and no fishing)	A boat-based fishing trip	A land-based fishing trip
Migrant to Townsville region in the last 10 years (-)	Migrant to Townsville region in the last 10 years (-)	
Single (-)		
	Clerical worker (-)	
Income > $100,000 (-)	Distance to boat ramp (+)	
		Age (+)

Our research findings indicate that recent migrants fish less often than long term residents do. Even though the coastal population growing rapidly, a number of surveys and recreational fishing studies report a decrease in the proportion of local residents who are fishing in the GBR (Higgs & McInnes, 2003; AEC Group, 2005; Sutton, 2006; Young & Temperton, 2007; Taylor et al., 2012) our research indicates that this decline in participation may be occurring because the new migrants to the area simply don't fish as often as those who have lived here a long time (i.e. it is not a drop in participation rate of long-term residents, but a drop in participation overall because the new people are less apt to fish). Females are more likely to be employed as clerical workers than males, so the statistical significance of the 'clerical worker dummy' may be picking up a gender effect.
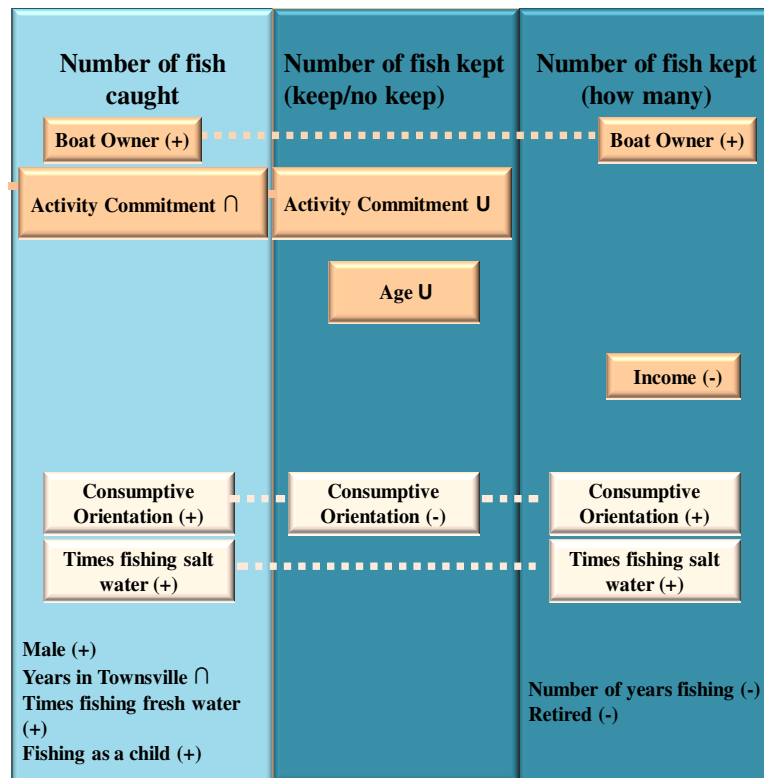
Objective 2

We used a subset of the household data (that relating to people who had been fishing at least once within the previous two years) within two different models to learn more about Catch-and-Release (C&R) (Farr et al., in review[b]). The first model looked at the total number of fish caught over the year and second model looked at the total number of fish kept (harvested) over the year. The negative binomial and a two-step (Zero-Inflated Negative Binomial) specifications were used respectively in accordance with the nature of the dependant variables.

The results show that the determinants of total annual catch and total annual keep are different (see Figure 7). The big 'catchers' are more likely to be a male, to have gone fishing as a child, to fish in fresh water and to be a long term resident (although the quadratic relationship indicates that they do it up to the point and then their catch declines as they grow older). In contrast, the big 'keepers' are boat owners, highly consumptively orientated, frequent salt water fishers, less experienced, non-retirees and those with a household income of less than $100,000 per annum. In other words, frequent fishers and big 'catchers' are not necessarily big 'keepers'.

The determinants of the probability of keeping at least one fish and the total annual keep are also different. Those wishing to use C&R as a management tool needs to ensure that their background studies consider total annual keep rather than only focusing on the probability of keeping. Failure to differentiate between them may generate misleading results (e.g. in the GBR failure to do so would mean that managers could be duped into monitoring factors such as age, and commitment (and might misinterpret consumptive orientation), rather than other factors such as boat ownership, income, fishing experience and retirement status).

Figure 7 Determinant of total recreational catch and keep per year

∩ - coefficients **+/-**

∪ - coefficients **-/+**

Objective 3

We used data collected from the boat ramp (and associated follow-up) surveys to estimate the value of catching or keeping fish for recreational anglers. In doing so, we developed and compared two different models – one looking at determinants of expected, *ex ante* catch; the other looking at *ex post* catch (Farr et al., in review[c]). Our analysis indicated that (at least in this part of the GBR and for this particular sample) the determinants of *ex ante* and *ex post* recreational catch are different. Expectations are largely driven by motivations (e.g. importance of fishing for fun and for eating) but the personal variables – such as consumptive orientation, years fishing and gender – have greater influence on outcomes (*ex post* catch). Both the economics and the psychology literature seems to agree that one should use *ex ante* constructs if trying to predict behaviours. Resource managers and researchers should thus use *ex ante* (rather than *ex post*, as is the norm) constructs if trying to predict behaviours and these differences should send warnings to those who instead use *ex post* constructs. So those interested in predicting behaviours may need to pay greater attention to motivations, and somewhat less attention to socio-demographics.

We also used a Hedonic Trip Price model to estimate and compare the marginal value (MV) of fish, using *ex post* and *ex ante* measures of recreational catch. Our marginal, *ex ante* 'value' estimates were much lower than *ex post* 'values' ($7 and $22 AUS respectively) – a result likely to be driven by differences between expected and actual catches. These values were significantly less than an average price of the trip $63. So clearly the fishing trip is not only about 'fish' but also about fishing experience. Our research also establishes that approximately 50 % of caught fish released in this particular region which is consistent with the results of 2010 Statewide Recreational Fishing Survey (Taylor et al., 2012).

Conclusions/Take Home Messages

We found that (a) there are different 'drivers' of fishing and boating; (b) the factors influencing the total annual catch, the probability of keeping at least one fish and the total annual keep are also different; (c) estimates of the monetary value of fish generated from models which considered expected catch, were significantly lower than those which considered actual catch; and that (d) the value of total expected catch (mean expected catch*mean value of expected fish = approx. $27AUS) was generally much less than total outlays for a trip (approx. $63AUS).

This research highlights the importance of disaggregating the fishing/boating experience if wishing to learn more about drivers of behaviour. It also highlights the fact that in this part of the GBR, the holistic recreational fishing trip/experience is worth far more than the fish itself. As such, it seems that anglers may view C&R policies or tighter bag limits (which would have a relatively small impact on the value of the fishing trip) more favourably than policies which ban or restrict fishing activities at different times or locations.

Acknowledgments

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